100 Introduction

FDOT Design Manual

PURPOSE:

This ***Florida Department of Transportation (FDOT) Design Manual (FDM)*** sets forth geometric and other design criteria, as well as procedures, for all new construction, reconstruction, and resurfacing projects on the State Highway System and the National Highway System. The information contained herein applies to the preparation of contract plans for roadways and structures.

AUTHORITY:

Sections 20.23(3)(a) and 334.048(3), Florida Statutes.

SCOPE:

This procedure impacts anyone preparing roadway and structures construction plans for the Department.

PROCEDURE:

The criteria in this manual represent requirements for the State Highway System which must be met for the design of FDOT projects unless approved Design Exceptions or Design Variations are obtained in accordance with procedures outlined in this manual.

Roadway and structures design is primarily a matter of sound application of acceptable engineering criteria and standards. While the criteria contained in this manual provide a basis for uniform design practice for typical roadway design situations, precise standards which would apply to individual situations must rely on good engineering practice and analyses.

Special requirements for Non-Conventional Projects, e.g., Design-Build Projects and all Non-Design-Bid-Build Public-Private-Partnership Projects, may be shown in a “Modification for Non-Conventional Projects” box as shown in the following example:

Modification for Non-Conventional Projects:
Delete the last three paragraphs above and see the RFP:

These boxes are located at the beginning of the chapter or after a section, paragraph or table which is to be modified. The requirements listed within these boxes are only applicable to Non-Conventional Projects.

The Author of a Request for Proposal (RFP) for a Non-Conventional project must use the standard boilerplate language as a starting point in developing RFPs on all Department Design-Build projects. ***Section V*** of the ***Design-Build Boilerplate*** establishes Department, FHWA and AASHTO criteria, procedures, guidelines, and design codes that serve as design constraints to be used in the performance of the work. The governing regulations list in ***Section V*** cannot be modified without the approval of the State Construction Office. The standard boilerplate language is available at the FDOT Construction Office website:

https://www.fdot.gov/construction/DesignBuild/DBDocuments/DBDocsMain.shtm

Pre-scoping questions have been developed to aid in the establishment of project constraints and requirements to be included in the RFP. The Pre-scoping questions can be found at:

https://www.fdot.gov/construction/DesignBuild/DBRules/DBRulesMain.shtm

Situations will exist where these criteria will not apply. The inappropriate use of and adherence to these criteria does not exempt the engineer from the professional responsibility of developing an appropriate design. The engineer is responsible for identifying those criteria which may not apply to a particular design, and for obtaining the necessary Design Exception or Design Variation to achieve proper design.

1. ORGANIZATION

The ***FDM*** is a three-part manual. ***Part 1*** contains development and processes, ***Part 2*** contains design criteria, and ***Part 9*** contains material concerning the preparation and assembly of model-centric plans. Parts 3 through 8 are reserved for future use.

2. DISTRIBUTION

This document is available electronically on the FDM web page:

https://www.fdot.gov/roadway/fdm/

FDM users can register to receive notification of updates and ***Roadway Design Bulletins*** online through the Department's Contact Management Database at:

https://fdotewp1.dot.state.fl.us/ContactManagement/Utilities/login.aspx

For information on updates and ***Roadway Design Bulletins***, contact:
Roadway Design Office, Mail Station 32
Telephone (850) 414-4310
FAX Number (850) 414-5261

https://www.fdot.gov/roadway/

3. REVISIONS AND UPDATES

FDM users are encouraged to submit comments and suggestions for changes to the manual to the State Roadway Design Office. When ideas or suggestions are received, they will be reviewed by appropriate Roadway or Structures Design staff in a timely manner and will be coordinated with other offices affected by the proposed change. Items warranting immediate change will be made with the approval of the State Roadway Design Engineer and/or State Structures Design Engineer in the form of a ***Design Bulletin***.

Roadway Design Bulletins are numbered based on the two-digit calendar year and bulletin number (YY- ##). Notices are sent to all users who are registered to receive notifications for ***Roadway Design Bulletins*** and updates to the ***FDM***. Design Bulletins affecting the ***FDM*** will remain effective until either:

1. An official manual revision is published; or
2. The ***Design Bulletin*** is made void.

Roadway Design Bulletins are posted online at:

https://www.fdot.gov/roadway/bulletin/

Structures design issues, which are subject to modification and revision, will be processed in coordination with the State Structures Design Office. See the ***Structures Manual*** for more information on this process.

Proposed revisions are distributed in draft form to each District's Roadway Design Engineer or Structures Design Engineer. These experienced engineers provide the necessary technical and practical input on how the revision will potentially affect their District's operations and customers. Periodically, these engineers meet collectively with the State Roadway Design Office or the State Structures Design Office to discuss comments on the proposed revisions. Proposed revisions with comments are then presented to the District Design Engineers (DDE) for review and comment. Once the comments are addressed, the Florida FHWA Division Office is given the opportunity to review the revisions as per the Department's Stewardship Agreement with FHWA.

The State Roadway Design Office will also coordinate proposed revisions or additions with affected offices within the Central Office. Substantive revisions that result in policy change may be coordinated with the Executive Committee for adoption.

Revisions and updates are adopted or rejected by the State Roadway Design Engineer (for Roadway Design issues) or the State Structures Design Engineer (for Structures Design issues). Requirements mandated by FHWA or State Rules will be coordinated with the DDEs and affected offices within the Central Office and are considered compulsory.

Notification of the adopted revisions and addenda will be distributed to registered users of the manual through the Department's Contact Management Database.

4. DEVELOPMENTAL DESIGN CRITERIA

Developmental Design Criteria (***DDC***) provides a process for the Department to develop future ***FDM*** criteria for new or innovative design concepts and technologies.

A Design Memorandum will be released to notify the Districts of the initial availability of each ***DDC***.

The ***DDC*** is published separately from the ***FDM***; however, they will be listed with hyperlinks to the ***DDC*** on the ***FDM*** webpage along with the ***FDM*** chapters.

A Central Office Monitor (Monitor) is assigned to each ***DDC***. The Monitor oversees the development of the criteria, monitors the use of the ***DDC*** on projects, and makes revisions and updates as needed.

The ***DDC*** must be used to the extent practicable on projects containing the applicable design elements; however, must not adversely affect the production schedule. Determination of applicability versus project schedule is at the discretion of the District Design Engineer. Include the Monitor as a lead reviewer in the Electronic Review Comments (ERC) system when the ***DDC*** is used.

The Department's Design Variation process is not applicable to ***DDC.*** When requesting deviations from ***DDC***, designers must contact the assigned Monitor to obtain written approval. Written approvals for deviations will be used by the Monitor to further develop ***DDC*** language. Designers are not required to submit written documentation when requesting deviations. The sole purpose of this process is to aid the Monitor in understanding the challenges faced by designers in following the ***DDC.***

Revisions to ***DDC*** may be made by the Department at any time and the last revision date will be noted within each chapter. Revisions to ***DDC*** are not retroactive for projects where the design effort for applicable design elements is substantially complete as determined by the District Design Engineer.

Modification for Non-Conventional Projects:
Delete item 4 above and see the RFP.

TRAINING:

None required.

FORMS:

All forms related to this manual are found in ***FDM 103***.

102 Glossary of Terms

102.1 General

The following definitions used in the FDOT Design Manual (FDM) are assigned for consistency of understanding and interpretation of the processes and criteria contained within. These definitions may not be consistent with AASHTO, MUTCD, NCHRP, or other documents referenced in this manual. When definition of terms conflict with other FDOT manuals, use the definitions provided in this chapter.

102.2 FDM Definitions

Access Classification

A classification of a roadway that determines the standards to apply to the design of medians, median openings, connections, and signal spacing. See ***FDM 201*** for additional information.

AADT

Annual Average Daily Traffic (AADT) is the total volume of vehicle traffic of a roadway for a year divided by 365 days.

Area Designation (Rural, Urban, Urbanized)

Rural: Places outside the boundaries of concentrated populations that accommodate higher speeds, longer trip lengths and freedom of movement, and are relatively free of street and highway networks.

Urban: A geographic region comprising as a minimum the area inside the United States Bureau of the Census boundary of an urban place with a population of 5,000 or more persons, expanded to include adjacent developed areas as provided for by Federal Highway Administration (FHWA) regulations. The FHWA Urban Boundary maps are available online at:

https://www.fdot.gov/roadway/BufferMaps/Default.shtm

Urbanized: A geographic region comprising as a minimum the area inside an urban place of 50,000 or more persons, as designated by the United States Bureau of the Census, expanded to include adjacent developed areas as provided for by Federal Highway Administration regulations. Urban areas with a population of fewer than 50,000 persons which are located within the expanded boundary of an urbanized area are not separately recognized.

As-Built Plans

The Contract Plans after construction is completed, all revisions including those occurring during construction, have been included and with the title on the key sheet changed to Final Plans.

Blended Transitions

Blended transitions are areas where the elevation of a roadway and a sidewalk, or shared use path, are the same along the width of a pedestrian crossing. Blended transitions can vary in geometrics. For flush shoulder roadways, blended transitions are the portion of the sidewalk, or shared use path, that meets the traveled way, bicycle lane, or paved shoulder. For curbed roadways, blended transitions are elevation transitions of the roadway such as a raised crosswalk, raised intersection, or depressed corner. Detectable warnings must be placed in the same locations as that of a curb ramp.

Bicycle Way

Any road, path, or way which by law is open to bicycle travel, regardless of whether such facilities are signed and marked for the preferential use by bicyclists or are to be shared with other transportation modes. Examples include bicycle lanes, paved shoulders, shared use paths, and traffic lanes.

C-D Road

Collector-Distributor Roads are limited access roadways provided within a single interchange, or continuously through two or more interchanges on a freeway segment. They provide access to and from the freeway and reduce and control the number of ingress and egress points on the through freeway. They are similar to continuous frontage roads except that access to abutting property is not permitted.

Context Classification

Description of the land use and transportation context where a roadway is found. Roadways are designed to match the characteristics and demands defined by the appropriate Context Classification criteria. See ***FDM 200*** for additional information.

Control Vehicle

An infrequent vehicle allowed to encroach into adjacent lanes, curbs, and sidewalks of intersections or driveways when making turning movements. Geometric design of intersections and driveways are based on the design vehicle.

Conventional Project

Projects for which the preparation of the contract documents is a 'stand-alone' effort resulting in Plans, Specifications and Estimates (PS&E) package that is advertised for a Construction Contract. These projects are often referred to as "design-bid-build" projects.

Crash Analyses

Summaries, crash rates, or other formatted reports that are developed using crash data.

Crash Data

Crash data at FDOT is the Florida Traffic Crash Report (FTCR) data received from the Florida Department of Highway Safety and Motor Vehicles (FLHSMV) with additional information from FDOT, such as location coordinates and coding for first point of impact position on the roadway.

Commentary: The State Safety Office (SSO) completes fatal and serious injury (KA) crash location review within days of receipt of the information, and the data is immediately available for use. All available data in the Signal Four Analytics (S4A) data base ~~Crash Analysis Reporting (CAR) system~~ within the recommended review period should be incorporated into a project's analysis.

The FDOT SSO adds information during the crash location processing and the crash data is updated continuously as data is received. This includes verified data and completed data sets.

Verified data refers to crash data that has been processed and reviewed by the FDOT staff in the SSO. Data that have been verified is tied to location coordinates on the public roadways and can be reported from the S4A data base ~~CAR system~~, the SSOGis Query Tool, or other FDOT crash data portals. Preliminary data for all crashes is available in the S4A data base. This S4A data should be used to supplement crash analyses and is available in coordination with the District Safety Office.

A completed data set, which may also be called "finalized" data, at FDOT refers to the completion of the location processing and review for a specific calendar year of crash data. The SSO completes the review of crashes on the State Highway System (SHS) for a given year and follows that completion by running the annual crash rate analyses in the ~~CAR~~ S4A system. These annual steps produce the Average Crash Rates and the High Crash listings.

Crash Reports or Crash Report Documents:

Original Florida Traffic Crash Report (FTCR) form documents in .TIFF or.PDF format as received from FLHSMV. These are the documents filed by law enforcement when reporting crashes.

Design Speed

A principal design control that regulates the selection of many of the project standards and criteria used for design. There are three categories of Design Speed:

> **High Speed:** Design Speeds 50 mph and greater.
>
> **Low Speed:** Design Speeds of 45 mph and less.
>
> **Very Low Speed**: Design Speeds 35 mph and less.

Design Vehicle

Vehicles with representative weight, dimensions, and operating characteristics used to establish highway design controls for accommodating vehicles of designated classes. The design vehicle is the largest frequent user of a given roadway; see ***FDM 201.6***.

Functional Classification

The grouping of streets and highways into classes, or systems, according to the character of service they are intended to provide.

> **Arterial:** Divided or undivided roadways that provide continuous routes which serve through traffic, high-traffic volumes, and long average trip lengths. Arterials include expressways without full control of access, US numbered highways and principal state roads that connect cities and towns. Arterials are further classified by context.

Collector: Divided or undivided roadway which serves to link arterials with local roads or major traffic generators. They serve as transition link between mobility needs and land use needs. Collectors may include minor state roads, major county roads, and major urban and suburban streets. Collectors on the SHS are further classified by context.

Freeway: The terms Freeway, Interstate, Toll Road, and Expressway are often used synonymously when establishing criteria within this manual. A Freeway is a divided highway that provides full control of access (i.e., Limited Access) and is intended for long distance trips. Interstate is a federally-funded network of freeways that must meet national design criteria and operational standards. Toll Road is a general term for any road that requires the user to pay to use all or a portion of the road. Expressways are freeways situated in major metropolitan areas with primary service for commuters; and may or may not be tolled. Movement of traffic, free of interference and conflicts, is of primary importance for these types of facilities. Essential elements include medians, grade separations, interchanges, and, in some cases, collector-distributor roads and frontage roads. Freeways may be further classified as rural, urban, or urbanized.

Grade Separation
A crossing of two roadways, or a roadway with a railroad or pedestrian pathway, at different levels.

Highway
A highway is a high-speed roadway (divided or undivided) intended for travel between destinations like cities and towns.

Intersection
Intersection types can be categorized by intersection basic type, functional classification, control type, area type, or a combination of these classifiers, depending on the element of design.

Lanes

Auxiliary Lane: The designated widths of roadway pavement marked to separate speed change, turning, passing, and weaving maneuvers from through traffic. They may also provide short capacity segments.

Bicycle Lane: A bicycle lane (bike lane) is a portion of a curbed roadway which has been designated by striping and special pavement markings for use by bicyclists.

Express Lane: An express lane is a type of managed travel lane physically separated from general use lanes, or general toll lanes, within a roadway corridor. Express lanes use dynamic pricing through electronic tolling in which toll amounts are set based on traffic conditions.

General Use Lane: Any untolled traffic lane that is not set aside for a specific purpose such as Express lanes.

HOV Lane: Special designated travel lanes reserved for high occupancy vehicles (HOV); e.g. buses and carpool vehicles. They may be adjacent to general use lanes or separated.

Travel Lane: A travel lane is the designated portion of a roadway intended to carry motorized through traffic. Generally, travel lanes equate to the basic number of lanes for a facility; e.g. 4-lane divided highway has 4 travel lanes.

Traffic Lane: The term traffic lane may be used synonymously with traveled way in this manual. See definition for traveled way.

Local Agency Funding Agreement (LFA)

An agreement used when Local Agencies provide funds to the Department for a specific project, often that are not on the State Highway System. The conveyance of funds and work to be accomplished are documented with a signed Local Agency Funding Agreement. The Agreement typically includes provisions for additional funding for contingency. These Agreements must be coordinated through the Comptroller's office and is covered by procedure locally funded agreements (non-PTO) – financial provisions and processing **(Topic Number: 350-020-300-n)**.

Local Road

Roadways which provide high access to abutting property, low average traffic volumes, and short average trip lengths. Local roads may include minor county roads, minor urban and suburban subdivision streets, and graded or unimproved roads.

Low Volume and High Volume

Certain operating characteristics and driver expectancy on highways. Standards for these controls are based on area type and are given in ***Table 102.1.1***.

Table 102.1.1 AADT Thresholds for Low and High-Volume Roadways

Facility	Urban		Rural	
	Low Volume AADT	High Volume AADT	Low Volume AADT	High Volume AADT
Freeway				
4-Lane Facility	57,000	69,000	46,000	56,000
6-Lane Facility	86,000	103,000	69,000	83,000
8-Lane Facility	114,000	138,000	92,000	111,000
Arterial				
2-Lane Facility	16,000	20,000	9,000	14,000
4-Lane Facility	37,000	43,000	38,000	47,000
6-Lane Facility	55,000	64,000	58,000	71,000
8-Lane Facility	69,000	80,000	--	--
Collector				
2-Lane Facility	11,000	16,000	8,000	13,000
4-Lane Facility	37,000	45,000	30,000	38,000
LOW VOLUME ROADWAYS: Design Year AADT is ≤ low volume AADTs shown. **HIGH VOLUME ROADWAYS:** Design Year AADT is ≥ high volume AADTs shown.				

Maintenance Agreement

An agreement with a Local Agency for the maintenance responsibilities of a federally funded project. This agreement is required for construction projects let by FDOT for work not on the State Highway System and must be obtained prior to the authorization for construction of the project.

Match Existing

This term is used when the construction of a proposed element (e.g., roadway, sidewalk, striping) may need to be adjusted at the termini to harmonize with the existing element to which it is connected. For Resurfacing Projects, this term is used when the existing pavement cross slopes are not intentionally modified or changed (i.e., applicable to constant depth milling and resurfacing).

Micromobility Device

A range of small, lightweight vehicles (typically less than 36” wide and 50 lbs.) operated by users personally at speeds between 15 mph and 28 mph. Micromobility devices include, but are not limited to, electric scooters, electric skateboards, and electric pedal assisted (pedelec) bicycles.

Paratransit

Comparable transportation service required by the American with Disabilities Act (ADA) for individuals with disabilities who are unable to use fixed route transportation systems. The specific requirements and parameters for this service, including eligibility and service requirements, are contained in 49 CFR Part 37, Subpart F.

Pedestrian Access Route

A continuous and unobstructed path of travel provided for individuals with disabilities within or coinciding with a pedestrian way.

Pedestrian Way

A space for pedestrian travel separated from traffic lanes. Sidewalks, shared use paths, footpaths and shoulders are pedestrian ways; however, footpaths and shoulders are not Pedestrian Access Routes, since they lack specific improvements or provisions to accommodate persons using mobility aids.

Projects of Division Interest (PoDI)

PoDIs are projects that have an elevated risk, contain elements of higher risk, or present a meaningful opportunity for FHWA involvement to enhance meeting program or project objectives. Project selection is risk-based. Stewardship and oversight activities will be directed toward addressing identified risks. This may include retaining certain project approvals, where permissible, or directing stewardship or oversight activities to a specific phrase or element of the project. Additional information is included in ***FDM 128***.

Production Date

The committed completion date for final plans (as described in ***FDM 301.2.5***) and Certifications (e.g., utilities, permits, R/W, environmental). Marks the date that the project is ready for the Plans, Specifications, and Estimates (PS&E) Submittal(s).

Ramp

A turning roadway that connects a Freeway to a crossing roadway within an interchange. The components of a ramp are a terminal at each leg and a connecting road. The geometry of the connecting road ramp usually involves some curvature and a grade.

Roadway

Roadways consist of prepared surfaces (asphalt or concrete pavement) for use by vehicles, including shoulders and adjacent bicycle lanes. A divided roadway provides a separation between opposing traffic lanes.

Safe System

The Safe System approach aims to eliminate fatalities and serious injuries of all users of the transportation system through a holistic model of multiple elements working together to safeguard against tragic crash outcomes.

Commentary: There are five elements of the Safe System: Safe Road Users, Safe Vehicles, Safe Speeds, Safe Roads, and Post-Crash Care. Each element is inter-related and weaknesses in one element may be compensated with strengths in another.

The criteria within the ***FDM*** *have been developed with the Safe System approach in-mind as related to Safe Speeds and Safe Roads. The term "Safe System" may not be specifically mentioned; however, it is inherent within the criteria and important to keep in mind when making engineering decisions to vary from the criteria.*

The Safe System approach begins with a foundational acknowledgement that transportation system users, as humans, will inevitably make mistakes. These mistakes may lead to crashes on our transportation facilities. FDOTs Target Zero goal is to eliminate fatal and serious injuries.

To achieve zero fatalities and serious injuries, crash forces induced on the human body must be kept below the tolerable limits. When designing and operating the transportation system, it is critical to manage crash kinetic energy. Human error is to be expected; therefore, the transportation infrastructure should be designed and operated to eliminate fatalities and serious injuries. This may be achieved by first reducing the risk of error and secondly, when crashes do occur, to maintain *collision forces on the human body within tolerable levels by managing speed and crash angles to reduce injury severity.*

The following are six foundational principles for understanding and applying the Safe System approach:

- ***Fatalities and serious injuries are unacceptable*** *– While no crashes are desirable, the Safe System approach emphasizes a focus on crashes resulting in fatal and serious injuries. Regardless of road users' socio-economic backgrounds, their abilities, and the modes of transportation they use, no one should experience fatal or serious injuries when using the transportation system.*

- ***Humans make mistakes*** *– Road users will inevitably make mistakes, and those mistakes can lead to crashes. The Safe System approach expects the transportation system be planned, designed, and operated to be forgiving of inevitable human error, so that fatal and serious injury outcomes are unlikely to occur.*

- ***Humans are vulnerable*** *– Humans have a limited ability to tolerate the energy involved in crash impacts. Although the exchange of kinetic energy in collisions among vehicles, objects, and road users has multiple determinants, applying the Safe System approach involves managing the kinetic energy of crashes to avoid fatal and serious injury outcomes.*

- ***Responsibility is shared*** *– All stakeholders (transportation system users and managers, vehicle manufacturers, emergency responders, etc.) must work collaboratively to ensure that crashes do not lead to fatal or serious injuries.*

- ***Safety is proactive*** *– Proactive and data-driven tools should be used to identify and mitigate latent risks in the system, rather than waiting for crashes to occur and reacting afterwards.*

- ***Redundancy is crucial*** *– Reducing the risk of severe crash outcomes requires all parts of the system be strengthened so that if one element fails, the others protect transportation system users.*

Shoulder Break

Point of intersection of the shoulder slope plane and the embankment or ditch slope plane; i.e., where the full-width shoulder slope of 0.05 or 0.06 “breaks” to a front slope of 1:X.

Strategic Intermodal System (SIS)

A transportation system comprised of facilities and services of statewide and interregional significance, including appropriate components of all modes. The highway component includes all designated SIS Highway Corridors, Emerging SIS Highway Corridors, SIS Intermodal Connectors, and Emerging SIS Highway Intermodal Connectors.

Streets

The local system which provides direct access to residential neighborhoods and business districts, connects these areas to the higher order road systems and offers the highest access to abutting property; sometimes deliberately discouraging through-traffic movement and high speeds.

Traveled Way

The traveled way is the portion of the roadway for the movement of vehicles, exclusive of shoulders and bicycle lanes. The traveled way includes travel lanes and auxiliary lanes.

Truck Traffic

Truck traffic is sometimes used as a qualifying control. Truck traffic is expressed as a percent of the AADT or daily count (24 hr).

Turnpike Projects

Projects within the Turnpike system as defined by FS 338.221(6), 2021:

> *"'Turnpike system' means those limited access toll highways and associated feeder roads and other structures, appurtenances, or rights previously designated, acquired, or constructed pursuant to the Florida Turnpike Enterprise Law and such other additional Turnpike projects as may be acquired or constructed as approved by the Legislature."*

103 Standard Forms

103.1 General

This chapter contains fillable portable document format (PDF) of the standard forms found in the FDOT Design Manual (***FDM***). The form number assigned to each form corresponds to the ***FDM*** chapter in which it is discussed. Refer to the related chapter for instruction on the use of each form.

Form 110

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

PROPRIETARY PRODUCT CERTIFICATION

To: ______________________________________ Date: ____________________
District or Turnpike Design Engineer

Financial Project ID: ____________________
Federal Aid Number: ____________________
Project Name: ____
State Road Number: ____________________ Co. / Sec. / Sub.: ____________________
Begin Project MP: ____________________ End Project MP: ____________________

Attach justification and supporting documents.
Mark the appropriate certification (below):

"I, ____________________, ____________________, of the ____________________,
Print Name of Initiator Position Title Name of Agency
do hereby certify that the following condition(s) apply. Mark appropriately:

- ☐ *that this patented or proprietary item is most compatible with existing highway facilities;*
- ☐ *that this patented or proprietary item provides greater flexibility with existing and/or future highway facilities;*
- ☐ *that this patented or proprietary item fosters innovation in highway transportation technology;*
- ☐ *that this patented or proprietary item satisfies Build America/Buy America (BABA) requirements;*
- ☐ *that this patented or proprietary item is included as FDOT Approved Products Listing (APL) Number ____________;*
- ☐ *that no equally suitable alternative exists for this patented or proprietary item."*

______________________________, ______________________________
Signature Date

For Department Use Only

"I, ______________________________________, ____________________________,
Print Name, District/Turnpike Design Engineer *Signature*

of the Florida Department of Transportation, do hereby approve this certification request made in accordance with the policies and procedures of the Department. Mark appropriately:

- ☐ *that this patented or proprietary item is most compatible with existing highway facilities;*
- ☐ *that this patented or proprietary item provides greater flexibility with existing and/or future highway facilities;*
- ☐ *that this patented or proprietary item fosters innovation in highway transportation technology;*
- ☐ *that this patented or proprietary item satisfies Build America / Buy America (BABA) requirements;*
- ☐ *that this patented or proprietary item is included as FDOT Approved Products Listing (APL) Number ___________;*
- ☐ *that no equally suitable alternative exists for this patented or proprietary item."*

Identify any conditions and limitations:

____, ____________________________________
Signature *Date*

Bridge Development Report Submittal Checklist

Project Name ____

Financial Project ID ______________________________________

FA No. ____________________

Projects of Division Interest Yes ☐ No ☐

NHS Yes ☐ No ☐

Date ______________________ FDOT Project Manager ______________________

	ITEMS	STATUS[b]
(1)	Typical Sections for Roadway and Bridge[a]……………….	Select Status
(2)	Roadway Plans in Vicinity of Bridge[a]……………………..	Select Status
(3)	Maintenance of Traffic Requirements[a]………………….	Select Status
(4)	Bridge Hydraulics Report[c]………………………………..	Select Status
(5)	Geotechnical Report[c]……………………………………..	Status Select
(6)	Bridge Corrosion Environmental Report[c]……………….	Status Select
(7)	GRS Abutments Feasibility Assessment[d]………………	Select Status
(8)	Precast Feasibility Assessment………………………..	Select Status
(9)	Existing Bridge Plans…………………………………….	Select Status
(10)	Existing Bridge Inspection Report……………………….	Status Select
(11)	Existing Bridge Load Rating……………………………..	Status Select
(12)	Wildlife Connectivity………………………………………..	Select Status
(13)	Utility Requirements………………………………………..	Select Status
(14)	Railroad Requirements…………………………………..	Select Status
(15)	Retaining Wall and Bulkhead Requirements……………..	Select Status
(16)	Lighting Requirements……………………………………..	Select Status
(17)	ADA Access Requirements………………………………..	Select Status
(18)	Other…………………………………………………….	Select Status

(a) Must be approved by District before BDR submittal.
(b) Select appropriate status: Provided, Not Applicable, Comments Attached
(c) See approval requirements for these documents in ***FDM 121***.
(d) GRS = Geosynthetic Reinforced Soil

Standard Peer Review Certification Letter

Florida Department of Transportation
District ____

Attn: ____

Reference: **Independent Peer Review Category 2 Structures**
Financial Project ID: ________________
Federal Aid Number: ________________
Contract Number: __________________

Submittal: **90% Bridge ________________________ Plans**
Submittal __________________________
Bridge Number(s): __________________

Dear ___________________________________,

Pursuant to the requirements of the Contract Documents, ______________________________ hereby certifies that an independent peer review of the above-referenced submittal has been conducted in accordance with ***FDM 121*** and all other governing regulations. Component plans that were included in the peer review are as follows:

____
____
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____
____
____

Outstanding / Unresolved Comments and Issues:

Certification Statement:
I certify that the component plans listed in this letter have been verified by independent review and are in compliance with all requirements presented in the Contract Documents. Independent Peer Review comments and comment resolutions have been included in this submittal under separate cover.

I have also attached a current copy of the Firm's Independent Peer Review Prequalification Letter issued by the Department with the "Approved Rates" Section redacted.

Please do not hesitate to contact me if you have any questions.

Name of Independent Peer Review Firm ________________________

Name of Independent Peer Reviewer ________________________

Title ________________________

Signature ________________________

Florida Professional Engineer Lic. No. ________________________

Certification Letter

Florida Department of Transportation
District _____

____

Attn: ____

Reference: **Independent Peer Review Category 2 Structures**
Financial Project ID: ___________________
Federal Aid Number: __________________
Contract Number: ____________________

Submittal: **Final Bridge ________________________ Plans**
Submittal __________________________
Bridge Number(s): ___________________

Dear____,

Pursuant to the requirements of the Contract Documents, ______________________________ hereby certifies that an independent peer review of the above-referenced submittal has been conducted in accordance with ***FDM 121*** and all other governing regulations. Component plans that were included in the peer review are as follows:

____
____
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____
____
____

Certification Statement:

I certify that the component plans listed in this letter have been verified by independent review, that all review comments have been adequately resolved, and that the plans are in compliance with all Department and FHWA requirements presented in the Contract Documents.

I have been provided with all 90% Department or Department Representative Electronic Review Comments (ERC). I certify that I have reviewed the comments and have considered these concerns in the Independent Peer Review. See attached 90% ERC comments.

I have also attached a current copy of the Firm's Independent Peer Review Prequalification Letter issued by the Department with the “Approval Rates” section redacted.

Please do not hesitate to contact me if you have any questions.

Name of Independent Peer Review Firm ______________________

Name of Independent Peer Reviewer ______________________

Title ______________________

Florida Professional Engineer Lic. No. ______________________

[Insert Signature, Date and Seal here.]

Name of IPR Quality Assurance Manager ______________________

Title ______________________

Florida Professional Engineer Lic. No. ______________________

[Insert Signature, Date and Seal here.]

Independent Department Review Certification Letter

Florida Department of Transportation
District ____

Attn: ____

Reference: **Independent Department Review Category 2 Structures**
Financial Project ID: ________________
Federal Aid Number: ________________
Contract Number: ________________

Submittal: **90% Bridge ______________________ Plans**
Submittal ______________________
Bridge Number(s): ________________

Dear ________________________________,

Pursuant to the requirements of the Contract Documents, ____________________________ hereby certifies that an Independent Department Review of the above-referenced submittal has been conducted in accordance with ***FDM 121*** and all other governing regulations. Component plans that were included in the Independent Department Review are as follows:

____
____
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Outstanding / Unresolved Comments and Issues:

Certification Statement:

I certify that the component plans listed in this letter have been verified by independent review and are in compliance with all requirements presented in the Contract Documents. Independent Department Review comments and comment resolutions have been included in this submittal under separate cover.

Please do not hesitate to contact me if you have any questions.

Name of Independent Department Review Firm ______________________

Name of Independent Department Reviewer ________________________

Title ____

Signature ____

Florida Professional Engineer Lic. No. ____________________________

Independent Department Review Certification Letter

Florida Department of Transportation
District _____

____

Attn: ____

Reference: Independent Department Review Category 2 Structures
Financial Project ID: ________________________
Federal Aid Number: ________________________
Contract Number: ________________________

Submittal: Final Bridge ____________________________ Plans
Submittal
Bridge Number(s): ________________________

Dear ______________________________________,

Pursuant to the requirements of the Contract Documents, ____________________________ hereby certifies that an Independent Department Review of the above-referenced submittal has been conducted in accordance with ***FDM 121*** and all other governing regulations. Component plans that were included in the Independent Department Review are as follows:

____
____
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Certification Statement:

I certify that the component plans listed in this letter have been verified by independent review, that all review comments have been adequately resolved, and that the plans are in compliance with all Department and FHWA requirements presented in the Contract Documents.

I have been provided with all 90% Department or Department Representative Electronic Review Comments (ERC). I certify that I have reviewed the comments and have considered these concerns in the Independent Department Review. See attached 90% ERC comments.

Please do not hesitate to contact me if you have any questions.

Name of Independent Department Review Firm ____________________

____

Name of Independent Department Reviewer ____________________

Title ____

Florida Professional Engineer Lic. No. __________________________

[Insert Signature, Date and Seal here.]

Name of IPR Quality Assurance Manager ____________________

Title ____________________

Florida Professional Engineer Lic. No. ____________________

[Insert Signature, Date and Seal here.]

Submittal/Approval Letter

To:______________________________ Date:____________________

District or Turnpike Design Engineer

Financial Project ID: ____________ New Const. ☐ RRR ☐ Other __________ ☐

Federal Aid Number: ____________

Project Name: ______________________________

State Road Number: ____________ Co./Sec./Sub. ____________

Begin Project MP: ____________ End Project MP: ____________

FHWA Project of Division Interest: Yes ☐ No ☐

Request for: Design Exception ☐ Design Variation ☐ Design Variation Memorandum ☐

Community Aesthetic Feature: Conceptual ☐ Final ☐

Re-submittal: Yes ☐ No ☐ Original Ref# ______ - ______ - ______

Requested for the following element(s):

☐ Design Speed	☐ Lane Width	☐ Shoulder Width	☐ Cross Slope
☐ Design Loading Structural Capacity	☐ Vertical Clearance	☐ Maximum Grade	☐ Stopping Sight Distance
☐ Superelevation	☐ Horizontal Curve Radius	☐ Other ____________	

Recommended by:

____________________ Date __________

Name:

Responsible Professional Engineer or Landscape Architect (Landscape-Only Projects)

Approvals:

____________________Date __________

Name:

District or Turnpike Design Engineer

____________________Date __________

Name:

District Structures Design Engineer

____________________Date __________

Name:

State Roadway Design Engineer

____________________Date __________

Name:

State Structures Design Engineer

____________________Date __________

Name:

Chief Engineer

____________________Date __________

Name:

FHWA Division Administrator

Project Design Variation Memorandum Form 122-B

To: ______________________ Date:____________________________________
District or Turnpike Design Engineer

Financial Project ID: _____________ New Const. ☐ RRR ☐ Other ___________ ☐

Design Speed: ___________ Posted Speed: ___________ Context Classification: _______

Federal Aid Number: _____________

Project Name: ______________________________________

State Road Number: _____________ Co./Sec./Sub. _____________

Begin Project MP: _____________ End Project MP: _____________

Other Project Information: ________________________________

Request for: Design Variation

For District Use Only

Design Element	MP: Beg-End	Existing	Proposed	Required	Attr. Crashes	Approved	Denied	Addl. Docum.
1. ___________	_________	______	______	______	☐	☐	☐	☐

Justification: ____

____

____

____

Design Element	MP: Beg-End	Existing	Proposed	Required	Attr. Crashes	Approved	Denied	Addl. Docum.
2. ___________	_________	______	______	______	☐	☐	☐	☐

Justification:____

____

____

____

Design Element	MP: Beg-End	Existing	Proposed	Required	Attr. Crashes	Approved	Denied	Addl. Docum.
3. ___________	_________	______	______	______	☐	☐	☐	☐

Justification: ____

____

____

____

Design Element	MP: Beg-End	Existing	Proposed	Required	Attr. Crashes	Approved	Denied	Addl. Docum.
4. ____________	__________	_______	_______	_______	☐	☐	☐	☐

Justification: ____

____

____

____

Design Element	MP: Beg-End	Existing	Proposed	Required	Attr. Crashes	Approved	Denied	Addl. Docum.
5. ____________	__________	_______	_______	_______	☐	☐	☐	☐

Justification: ____

____

____

____

Design Element	MP: Beg-End	Existing	Proposed	Required	Attr. Crashes	Approved	Denied	Addl. Docum.
6. ____________	__________	_______	_______	_______	☐	☐	☐	☐

Justification: ____

____

____

____

Appendices: Yes ☐ No ☐

If yes, list appendices in order: ____

____

____

Recommended by:

______________________________ Date ____________
Name:
Responsible Professional Engineer or Landscape Architect (Landscape-Only Projects) (Seal)

Approvals:

____________________________________Date ____________
Name:
District or Turnpike Traffic Operations Engineer

____________________________________Date ____________
Name:
District or Turnpike Design Engineer

Initial Meeting And Methodology Checklist

The Applicant should prepare the following list of items to discuss at the initial meeting. The District Review Team may require the Applicant to address these items in the Concept Report.

Project Information

- ☐ Project Location, Limits, and Length
- ☐ Project Purpose
- ☐ Conceptual plan (including transitions to and from the lane repurposing section)
- ☐ Existing and long-range future AADT (the latter based on historical growth and the regional travel demand model)
- ☐ Environmental and utilities impacts
- ☐ Consistency of the proposed project with the applicable Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Transit Development Plan (TDP), comprehensive plan, master plans, visions, and Complete Streets initiatives
- ☐ Status of the roadway as an Evacuation Route, and freight route
- ☐ Project limits are within or proposed to be part of Strategic Intermodal System (SIS)
- ☐ Status of the roadway as a major transit corridor per the LRTP or TDP
- ☐ Proposed use(s) for the right-of-way after lanes are eliminated (e.g., widened sidewalks, bicycle lanes, landscaping, on-street parking, transit lanes)
- ☐ Impact on bicycle/pedestrian infrastructure and connectivity
- ☐ Impact on parking
- ☐ Impact on transit routes, stop locations (including appropriateness of turn radii and lane widths), include total number of stops and routes in the area.
- ☐ Existing right-of-way width and any proposed changes to the right-of-way width
- ☐ Anticipated changes in jurisdictional responsibility for ownership or maintenance of the roadway
- ☐ Existing and anticipated changes in functional classification
- ☐ Existing and anticipated changes to access management classification
- ☐ Jurisdiction(s) in which the Project is Located
- ☐ Proposed Change in Lane Configuration
- ☐ Project Schedule
- ☐ Existing and anticipated context classification
- ☐ Public Involvement, agency outreach and endorsement
- ☐ Existing design and posted speeds
- ☐ Existing and future typical section
- ☐ Target speed with anticipated changes in posted speed limits and design speeds
- ☐ Need for design variations or design exceptions
- ☐ Plan for obtaining input and review from businesses, residents, and other stakeholders
- ☐ Plan for receiving endorsement from elected officials
- ☐ Funding source and cost estimates
- ☐ Size of impact area-parallel and cross streets
- ☐ Potential implementation strategy and partner commitments
- ☐ Impact on School crossing locations and midblock crossing
- ☐ Need to add, remove, or modify traffic signals
- ☐ Existing or proposed roundabouts
- ☐ Near and long-range multimodal level of service (LOS) and queuing analysis for intersections and segments in the impact area under build and no-build scenario
- ☐ Mitigation to address the significant adverse impact on state roads and regional transportation system
- ☐ Crash data summary and analysis for the segments and intersections within the project limits
- ☐ Case-specific special considerations to be determined (e.g., railroad crossing improvements)

Lane Repurposing Initial Notice To Central Office

To: ______________________ From: ______________________ Date: ____________
Systems Management Administrator *District Lane Repurposing Coordinator*

The intent of this notice is to inform Central Office that District ________________ has received a request for lane repurposing on the State Highway System.

PROJECT INFORMATION
State Road and Project Location: ____
Roadway ID: ____________________ Project Limits (MP): from __________ to __________
Roadway ID: ____________________ Project Limits (MP): from __________ to __________
Context Classification: ________________ Access Management Classification: ___________
Applicant: ____
Project Description: ____
____
____

Proposed Change in Cross Section: From ______________ lanes to ______________ lanes

☐ SIS ☐ NHS

ACTIONS AND OUTCOMES TO DATE
District staff participated in a meeting with ____ on ________________ to formally commence the lane repurposing review process. At that meeting, District staff provided an overview of the lane repurposing review process and the Applicant shared initial information about the lane repurposing project. The District determined the specific review process and analysis methodology for the lane repurposing request

NEXT STEPS
The Applicant will submit a Draft Concept Report (containing a proposed typical section) as the lane repurposing review process proceeds. If the District reviewers find the Draft Concept Report acceptable, the Applicant submits a formal Application Package (including the Final Concept Report) to the District. If the Application Package is complete and acceptable, the lane repurposing request will be approved at the District level. The Final Application Package along with signed Form-C will be sent to Central Office for final approval.

Concurrences:

________________________________ Date: ________________
District Planning and Environmental Administrator

________________________________ Date: ________________
District Design Engineer

________________________________ Date: ________________
District Traffic Operations Engineer

Lane Repurposing Final Review And Approval Notice To Central Office

The intent of this notice is to inform Central Office that District _________________ has completed the review for the following lane repurposing project on the State Highway System.

PROJECT INFORMATION
State Road and Project Location:____

____

Roadway ID: _____________ Project Limits (MP): From ______________to _______________
Roadway ID: _____________ Project Limits (MP): From ______________to _______________
Context Classification: ____________ Access Management Classification: ________________
Existing Posted Speed: __________ Proposed Posted Speed: __________
Design Speed: __________ Target Speed: ____________
Transit facilities (stops and routes): ☐ Yes ☐ No
Applicant: ____

Project Description: ____

____

____

Proposed Change in Cross Section: From _______________ lanes to _______________ lanes

☐ SIS ☐ NHS

Attachments: ☐ Concept Report ☐ Plan views ☐ Typical sections

District Concurrences:

___________________________________ Date: _______________________
District Planning and Environmental Administrator

___________________________________ Date: _______________________
District Design Engineer

___________________________________ Date: _______________________
District Traffic Operations Engineer

Central Office Concurrence:

___________________________________ Date: _______________________
Chief Planner

Final Approval:

___________________________________ Date: _______________________
Chief Engineer

Design Plans Phase Review

DATE: _____________

TO: _____________________

FROM: ___ COPIES: _____________

SUBJECT: Response to _____________ Phase Review

REF: Financial Project ID ____________________________
FA Project Number ____________________________
County ____________________________

APPROVED:

____
Responsible Professional Eng.
(Name of Consultant Firm)

* As appropriate

CONCURRENCE:

____
* District Design Engineer
* District Structures Design Engineer
* District Project Management Engineer

Design Plans Component Review

DATE: _____________

TO: ______________________

FROM: ___ COPIES: _____________

SUBJECT: Response to _____________ Component Review

REF: Financial Project ID _____________________________
FA Project Number _____________________________
County _____________________________

APPROVED:

____
Responsible Professional Eng.
(Name of Consultant Firm)

* As appropriate

CONCURRENCE:

____
* District Design Engineer
* District Structures Design Engineer
* District Project Management Engineer

Special Provisions

DATE: _____________

TO: _____________________

FROM: ___ COPIES: _____________

SUBJECT: Response to _____________ Component Review

REF: Financial Project ID ____________________________
FA Project Number ____________________________
County ____________________________

APPROVED:

____
Responsible Professional Eng.
(Name of Consultant Firm)

* As appropriate

CONCURRENCE:

____
* District Design Engineer
* District Structures Design Engineer
* District Project Management Engineer

18 KIP Equivalent Single Axle Loads (ESAL)

Financial Project ID __________________

State Road No. __________________

County __________________

I have reviewed the 18 KIP Equivalent Single Axle Loads to be used for pavement design on this project. I hereby attest that these have been developed in accordance with the FDOT ***Project Traffic Forecasting Procedure*** using historical traffic data and other available information.

____
Name

____
Signature

____
Title

____
Organizational Unit

____
Date

Project Traffic

Financial Project ID _________________

State Road No. _________________

County _________________

I have reviewed the Project Traffic to be used for design on this project. I hereby attest that it has been developed in accordance with the FDOT ***Project Traffic Forecasting Procedure*** using historical traffic data and other available information.

____
Name

____
Signature

____
Title

____
Organizational Unit

____
Date

Sample Local Agency Maintenance Agreement
For Work Performed by the Department
Sheet 1 of 3

Financial Project ID: ___________________

Federal Aid No. ______________________

Local Agency: ________________________

Project Description: ___________________

____

Bridge No.: __________________________

MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into on this __________ day of _______, 20 ____, by and between the STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION (hereinafter called “DEPARTMENT”), and _____________________, Florida (hereinafter called “LOCAL AGENCY”);

WITNESSETH:

WHEREAS, the DEPARTMENT is preparing to undertake a project within the LOCAL AGENCY and LOCAL AGENCY identified and known to the parties by Financial Project I.D. ___________________which will be of benefit to the LOCAL AGENCY; and

WHEREAS, approval of federal aid necessary to the project requires agreement by the LOCAL AGENCY to maintain the project;

NOW, THEREFORE, in consideration of the premises, the parties hereby agree as follows:

1. The DEPARTMENT will undertake the project and obtain approval of the Federal Highway Administration for federal participation.

2. Upon completion and acceptance, the LOCAL AGENCY will assume responsibility for maintenance of the project and will conduct such maintenance in accordance with approved state standards.

3. To the extent permitted by law, LOCAL AGENCY must indemnify, defend, and hold harmless the DEPARTMENT and all of its officers, agents, and employees from any claim, loss, damage, cost, charge, or expense arising out of any act, error, omission or negligent act by LOCAL AGENCY, its agents, or employees, during the performance of the Agreement, except that neither LOCAL AGENCY, its agents, or its employees will be liable under this paragraph for any claim, loss, damage, cost, charge, or expense arising out of any act, error, omission, or negligent act by the DEPARTMENT or any of its officers, agents, or employees during the performance of the Agreement**.** Nothing herein must waive the rights of sovereign immunity of either party.

Sample Local Agency Maintenance Agreement
For Work Performed by the Department

Sheet 2 of 3

4. In the event there are cost overruns, supplemental agreements (specifically incurred in the areas located off the State Highway System), and or liquidated damages not eligible to be paid for by federal funds due to the Federal Highway Administration determining that said costs are non-participating costs, the LOCAL AGENCY must be responsible for one hundred percent (100%) of the funds required to make up the shortfall not paid by federal funds. The Project is off of the “State Highway System,” therefore, in accordance with ***Section 339.08(1), Florida Statutes***, State funding cannot be used for payments of non- participating costs on this Project. (Examples of non-participating items could be fishing piers; premium costs due to design or CEI errors or omissions; material or equipment called in for the plans but not used in the construction, as referenced in the Federal Aid Policy Guide 23, ***CFR Section 635.120***).

    a. Should such shortfalls occur, due to a determination that said costs are non-participating, the LOCAL AGENCY agrees to provide, without delay, a deposit within fourteen (14) calendar days of notification from the Department, to ensure that cash on deposit with the Department is sufficient to fully fund the shortfall. The Department must notify the LOCAL AGENCY as soon as it becomes apparent there is a shortfall; however, failure of the Department to so notify the LOCAL AGENCY must not relieve the LOCAL AGENCY its obligation to pay for its full participation of non-participating costs during the Project and on final accounting, as provided herein below. If the LOCAL AGENCY cannot provide the deposit within fourteen (14) days, a letter must be submitted to and approved by the Department’s project manager indicating when the deposit will be made. The LOCAL AGENCY understands the request and approval of the additional time could delay the project, and additional non-participating costs may be incurred due to the delay of the project.

5. The DEPARTMENT intends to have its final and complete accounting of all costs incurred in connection with the work performed hereunder within three hundred sixty days (360) of final payment to the Contractor. The Department considers the Project complete when the final payment has been made to the Contractor, not when the construction work is complete. All non-participating Project cost records and accounts must be subject to audit by a representative of the LOCAL AGENCY for a period of three (3) years after final close out of the Project. The LOCAL AGENCY will be notified of the final non-participating cost of the project. Both parties agree that in the event the final accounting of total non-participating costs pursuant to the terms of this Agreement is less than the total deposits to date, a refund of the excess

will be made by the Department to the LOCAL AGENCY. If the final accounting is not performed within three hundred and sixty (360) days, the LOCAL AGENCY is not relieved from its obligation to pay.

6. In the event the final accounting of total non-participating costs are greater than the total deposits to date, the LOCAL AGENCY will pay the additional amount within forty (40) calendar days from the date of the invoice from the Department. The LOCAL AGENCY agrees to pay interest at a rate as established pursuant to Section 55.03, Florida Statutes, on any invoice not paid within forty (40) calendar days until the invoice is paid.

7. Any payment of funds under this Agreement provision will be made directly to the Department for deposit.

IN WITNESS WHEREOF, the parties hereto have set their hands and seals on the day and year first above written.

___________________________,	STATE OF FLORIDA
LOCAL AGENCY OFFICIAL	DEPARTMENT OF TRANSPORTATION
By: ____________________________	By: ____________________________
Title: ___________________________	District Secretary
___________________________ (Type Name)	
ATTEST:	ATTEST:
______________________________ Clerk (Seal)	______________________________ Executive Secretary (Seal)
LEGAL APPROVAL:	LEGAL APPROVAL:
______________________________ LOCAL AGENCY Attorney	______________________________ Senior Attorney
______________________________ (Type Name)	

Items of Work Checklist

DATE: ____

TO: ________________________, District Specifications

FROM: ________________________, Project Manager

COPIES TO:

SUBJECT: ITEMS OF WORK

Financial Project ID: ________________________(GOES WITH ________________________)

County (Section): ________________________

* Project Description: ________________________

The plans package for the above referenced project includes the following items of work to be performed:

- ☐ Milling & Resurfacing
- ☐ Base Work
- ☐ Shoulder Treatment
- ☐ Drainage Improvements
- ☐ Curb & Gutter
- ☐ Traffic Signals
- ☐ Lighting
- ☐ Other (Please Specify)
- ☐ Highway Signing
- ☐ Guardrail
- ☐ Landscaping
- ☐ Box or Three-sided Culverts
- ☐ Bridges
- ☐ MSE Walls
- ☐ Sidewalks/Shared Use Path

Please include the county, project description and all items of work that apply in the *Intent and Scope* so they may be added to the advertisement description.

* The project description should only include the road number and the limits or location of the project.

Record Shop Drawing Transmittal

Date ________________________

TO: ____

FROM: ____

(Final Review Office)

PROJECT NAME ____

FINANCIAL PROJECT ID ___________________________________

FEDERAL AID PROJECT NO. ________________________________

CONTRACT ID NUMBER ____________________________________

COUNTY (SECTION) ______________________________________

STATE ROAD NUMBER _____________________________________

BRIDGE NUMBER ____

CONTRACTOR ____

ENGINEER OF RECORD _____________________________________

We are transmitting herewith the following Record Shop Drawings for archiving:

1. ______________________________________
2. ______________________________________
3. ______________________________________
4. ______________________________________
5. ______________________________________
6. ______________________________________

For the Final Review Office: __________________________________ ____________

(Signature) (Date)

For the Receiving Office: __________________________________ ____________

(Signature) (Date)

Layer 3 Switch Worksheet

Chassis Based Switches					
Number of Management Blades					
Backplane Capacity					
Number of Copper Ports					
Protocol Requirements					
Number Fiber Ports #1		Fiber Port Speed			
Number Fiber Ports #2		Fiber Port Speed			
Number Fiber Ports #3		Fiber Port Speed			
Number Power Supplies		Voltage (AC/DC)			
Optics Needed					
	Optic #1	Optic #2	Optic #3	Optic #4	Optic #5
# Required					
Speed Requirement					
Distance Required					
Require OEM					

Stack Aggregation Switches					
Number of Fiber Ports					
Number of Copper Ports					
Protocol Requirements					
Number Power Supplies		Voltage (AC/DC)			
Optics Needed					
	Optic #1	Optic #2	Optic #3	Optic #4	Optic #5
# Required					
Speed Requirement					
Distance Required					
Require OEM					

Transportation Management Plan (TMP) Form

Responsible Professional Engineer:________________________________

FDOT Project Manager:____

State Road: ____

Project Location: ____

Roadway ID: ____

Project Limits (MP): From ____________________ to _________________

Project Description: ____

____

Financial Project ID: _____________ New Const.☐ RRR☐ Other _____________☐

Federal Aid Number. ______________

FHWA Projects of Division Interest Yes ☐ No ☐

In accordance with the requirements of the FDOT Design Manual (FDM) Chapter 240, the following items determine the scope and need of a Transportation Management Plan (TMP). Complete the following checklist and provide brief descriptions of the items included, as appropriate.

Indicate if the project meets one or both of the following qualifying conditions as “significant project”:

- ☐ A project that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts.
- ☐ All Interstate system projects within the boundaries of a designated Transportation Management Area (TMA) that occupy a location for more than three days with either intermittent or continuous lane closures.

If either or both above qualifying conditions are met, indicate compliance with the following documents in development of a TMP for the Project:

- ☐ ***FDOT Design Manual***
- ☐ ***FDOT Standard Plans***
- ☐ ***FDOT Standard Specifications for Road and Bridge Construction***
- ☐ ***FDOT Basis of Estimates Manual***
- ☐ ***Manual on Uniform Traffic Control Devices for Streets and Highways, (MUTCD), Part VI***

- ☐ ***Policy on Geometric Design of Highways and Streets, AASHTO***
- ☐ ***Roadside Design Guide, AASHTO, Chapter 9***
- ☐ ***FDOT Accessing Transit Handbook, Chapter 4.6.***
- ☐ ***AASHTO Guide for the Development of Bicycle Facilities, 4th Edition, Chapter 7***

TMP Components:

Indicate that the following TMP Components have been addressed on the project:

- ☐ **Temporary Traffic Control Plan (TTCP)**
  - ☐ **Work Zone Speed Established**

    Speed Reduction Required (Y/N)

    If Yes, is the "*Work Zone Speed less than Existing Posted Speed*" documentation completed (Y/N)
  - ☐ **Lane Closure Analysis**

    If included, was the *"Lane Closure Analysis Worksheet"* and any restrictions requiring approval completed (Y/N)
  - ☐ **Traffic Pacing**

    If included, was the *"Traffic Pacing Worksheet"* completed (Y/N)
  - ☐ **Portable Changeable Message Signs**

    If included, was the *"Portable Changeable Message Sign Worksheet"* completed (Y/N)
  - ☐ **Bicycle, Pedestrian, and Transit Accommodations**
  - ☐ **Railroads**

    Was the District Railroad Coordinator consulted (Y/N)
  - ☐ **Utilities**

    Was the District Utility Coordinator consulted (Y/N)
  - ☐ **Signals**

    Was the District Traffic Operations Engineer consulted (Y/N)
  - ☐ **Speed and Law Enforcement Officer**

    Was the District Construction Office consulted or any usage requiring approval completed (Y/N)

☐ **Transportation Operations Plan (TOP):**

Briefly describe TOP components included on the project. If a comprehensive plan has been prepared, indicate below, and attach.

TOP Description:

☐ **Public Information Plan (PIP):**

Briefly describe PIP components included on the project. If a comprehensive plan has been prepared, indicate below, and attach.

PIP Description:

Portable Changeable Message Signs Worksheet

Location of board: ____

Used: from __________at ________

to __________at ________

Message programmed by: ____

MESSAGE 1

____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____

MESSAGE 2

____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____

____ ____ ____ ____ ____ ____ ____ ____

Timing:

Message 1 will run: _____ seconds.

Message 2 will run: _____ seconds.

Standard Abbreviations For Use On Changeable Message Signs

Standard abbreviations easily understood are:

WORD	ABBREV.	WORD	ABBREV.
Boulevard	BLVD	Normal	NORM
Center	CNTR	Parking	PKING
Crossing	XING	Pedestrian	PED
Crosswalk	XWALK	Road	RD
Emergency	EMER	Service	SERV
Entrance, Enter	ENT	Shoulder	SHLDR
Expressway	EXPWY	Slippery	SLIP
Freeway	FRWY, FWY	Speed	SPD
Highway	HWY	Traffic	TRAF
Information	INFO	Travelers	TRVLRS
Left	LFT	Warning	WARN
Maintenance	MAINT		

Other abbreviations are easily understood whenever they appear in conjunction with a particular word commonly associated with it. These words and abbreviations are as follows:

WORD	ABBREV.	PROMPT
Access	ACCS	Road
Ahead	AHD	Fog*
Blocked	BLKD	Lane*
Bridge	BRDG	[Name]*
Chemical	CHEM	Spill
Construction	CONST	Ahead
Exit	EX, EXT	Next*
Express	EXP	Lane
Hazardous	HAZ	Driving
Interstate	I	[Number]
Major	MAJ	Accident
Mile	MI	[Number]*
Minor	MNR	Accident
Minute(s)	MIN	[Number]*
Oversized	OVRSZ	Load
Prepare	PREP	To Stop
Pavement	PVMT	Wet*
Quality	QLTY	Air*
Route	RT	Best*
Turnpike	TRNPK	[Name]*
Vehicle	VEH	Stalled*
Cardinal Directions	N, E, S, W	[Number]
Upper, Lower	UPR, LWR	Level

*** = Prompt word given first**

The following abbreviations are understood with a **prompt** word by about 75% of the drivers. These abbreviations may require some public education prior to usage.

WORD	**ABBREV.**	**PROMPT**
Condition	COND	Traffic*
Congested	CONG	Traffic
Downtown	DWNTN	Traffic
Frontage	FRNTG	Road
Local	LOC	Traffic
Northbound	N-BND	Traffic
Roadwork	RDWK	Ahead [Distance]
Temporary	TEMP	Route
Township	TWNNSHP	Limits

*** = Prompt word given first**

Certain abbreviations are prone to inviting confusion because another word is abbreviated or could be abbreviated in the same way. **DO NOT USE THESE ABBREVIATIONS:**

ABBREV.	**INTENDED WORD**	**WORD ERRONEOUSLY GIVEN**
WRNG	Warning	Wrong
ACC	Accident	Access (Road)
DLY	Delay	Daily
LT	Light (Traffic)	Left
STAD	Stadium	Standard
L	Left	Lane (Merge)
PARK	Parking	Park
RED	Reduce	Red
POLL	Pollution (Index)	Poll
FDR	Feeder	Federal
LOC	Local	Location
TEMP	Temporary	Temperature
CLRS	Clears	Color

104 Public Involvement

104.1 General

FDOT's policy on ***Public Involvement, Topic No. 000-525-050*** states:

"It is the policy of the Florida Department of Transportation (Department) to use every possible opportunity to engage with and involve the public that leads to community-based decisions when planning, designing, constructing, and maintaining transportation facilities and services to meet the State's transportation needs. The participation of the public is an integral part of the transportation process and results in

- Early and continuous opportunities for public input
- Consideration of public needs and preferences
- Informed decisions through collaborative efforts
- Mutual understanding and trust between the Department and its partners

The Department will promote public involvement, engagement opportunities and information exchange activities in all functional areas using various techniques adapted to the audience, local area conditions, and project requirements."

Detailed information on Public Involvement activities and requirements can be found in the ***Metropolitan Planning Organization (MPO) Program Management Handbook, Chapter 6;*** the ***Project Development and Environment Manual (PD&E Manual) Part 1, Chapter 11*** and the ***Public Involvement Handbook***.

Typically, when a project reaches the design phase, many of the project commitments and community issues have already been identified. However, there are times when design alternatives need to be reevaluated to determine their community impacts. Any commitments made in previous phases are communicated to designers, who are responsible for carrying them out. If constraints arise that require design changes that affect FDOT's ability to meet commitments, then the process would require follow-up with the affected community. In such cases, additional public involvement and community impact assessment may be necessary to address public concerns.

Projects may have the following potential community impacts that are not identified until the design phase:

(1) Impacts on public safety, including people with disabilities

(2) School crossings or other areas of high pedestrian activity

(3) Aesthetic features such as landscaping or tree replacement

(4) Medians or access changes

(5) Intersections and driveways, including audible signalized intersections

(6) Accessibility of corridor businesses and neighborhoods

(7) Significant improvements to bicycle, pedestrian, and transit facilities

(8) Lighting

(9) Maintenance of Traffic

(10) Railroad crossings

(11) Location and extent of storm water management facilities

104.2 Public Information and Outreach

Start developing and implementing a public information and outreach campaign when the design phase begins. Ongoing monitoring throughout the life of the project will be necessary. The following steps should be used when planning and implementing a public information and outreach campaign.

(1) **Determine appropriate size and nature**. The size and nature of a public information and outreach effort is determined by the characteristics of a project, its location, and the anticipated impacts. Address the size and duration of the project, the amount of delay anticipated, special traffic and safety conditions such as heavy truck traffic, changes to bicycle and pedestrian routes and facilities, and disruptions to other modes and key facilities such as airports, stadiums, and hospitals.

(2) **Identify resources**. Typically, public information and outreach spending is included in the project budget. In addition, the Department may need to tap existing resources, such as an operating 511 system and the Lane Closure Information System (LCIS) and leverage external resources such as free media coverage.

(3) **Identify partners**. Working with a range of partners to design and implement an information and outreach campaign will strengthen the strategies employed and may reduce the costs and resources. Partners may include state and local

agencies, law enforcement, major employers, business and neighborhood associations, and local clubs and advocacy groups.

(4) **Identify target audiences**. Identifying target audiences is a key in developing an effective communication strategy. This determines the types of messages that should be conveyed and the best method of communicating those messages.

(5) **Develop the message(s)**. The messages communicated should provide project information to maintain safety and minimize delay and should indicate that the agency cares about the traveling public, including transit riders, pedestrians, cyclists, and motorists. More specific messages might include details of the work zone, travel times through the work zone, alerts regarding the need for cyclists to share or control a travel lane and alternate routes and modes of transportation.

(6) **Determine communication strategies**. How information is communicated will depend on the audiences, the messages to be conveyed, and the campaign budget. The ***Public Involvement Handbook*** discusses a wide range of strategies for communicating information about a project.

(7) **Determine communication timing**. Begin public information and outreach before work commences to develop partnerships and inform the public about the project, its anticipated impacts, and additional sources of ongoing project information. Early contact and coordination with bicycle groups (such as Metropolitan Planning Organization Bicycle/Pedestrian Advisory Committees or bike clubs) helps mitigate friction.

104.3 Community Awareness Plan (CAP)

The CAP identifies and documents the notification method to project stakeholders of potential impacts of a proposed construction project. Project stakeholders typically include local governments, law enforcement, affected property owners, tenants, and the public. The CAP establishes and maintains a strategy for early, meaningful, and continuous public involvement during the design and construction phases. Specifically, the intent of the CAP is to develop an approach to achieve the following objectives:

(1) Resolve controversial issues during the design phase.

(2) Develop and maintain stakeholder support for the project.

At a minimum, the CAP should include the following elements:

(1) **Project Description:** Identify the project background, existing conditions, and proposed project scope. Include special features or amenities to be included in the project when describing the scope of work.

(2) **Description of the Community:** Describe the area surrounding the project limits and properties that might be affected. Include special demographic data that would assist in determining the need for translation services or bilingual staff at a public meeting.

(3) **Potential Controversial Issues:** Identify community issues or concerns. Some level of controversy can be expected from the following: access changes, driveway modifications, parking removal, right-of-way acquisition, new signalized intersections, landscaping changes or removal, loss of aesthetic feature, safety issues identified by law enforcement, or temporary construction impacts (e.g., lane closures, detours).

(4) **Special Commitments:** List commitments made prior to or during the design phase.

(5) **Traffic Control and Access Impacts:**

(a) Temporary Traffic Control Plan – Describe the temporary traffic control plan, including lane closures, night work, or detours. Identify special community events that must be considered.

(b) Access Impacts – Describe temporary or permanent access changes, including driveway modifications.

(c) Construction Schedule – Identify when construction activities are expected to begin.

(d) Preliminary Contract Time – Include an estimate of the contract duration.

(6) **CAP Level:** Identify the public involvement level and justify the level selected.

(7) **Identification of Project Stakeholders:** List the property owners, tenants, elected and appointed officials, local, state, and federal agency representatives, law enforcement, and interested organizations.

(8) **Proposed Public Involvement Notification Methods and Activities During Design:** Describe the outreach efforts to conduct during the design phase, the anticipated schedule, and how the public will be notified.

(9) **Proposed Public Involvement Notification Methods and Activities During Construction:** Provide a timeline of public involvement activities for the construction phase.

104.3.1 CAP Levels

FDOT CAP Guidelines for all design and construction projects identify four levels of public involvement based on the type of project:

Level 1: Project is noncontroversial, causes negligible accessibility impacts, and causes minimal traffic disruption.

Level 2: Project has general public acceptance, little impact on accessibility or traffic, and a moderate degree of traffic disruption. Examples include urban resurfacing, bridge repair projects, and other construction activities that may require lane closures.

Level 3: Project may be controversial, will significantly impact traffic flow, or will significantly affect accessibility to properties (temporary or permanent). Examples are parking removal, median openings or closures, access management issues, traffic signal removal, roadway widening, major reconstruction, and projects including detours.

Level 4: Project involves road widening or major reconstruction, bridge widening or replacement, new interchange, or closures (temporary or permanent) of the roadway, ramps, bridges, or railroad crossings.

104.4 Recommended Activities

A public information and outreach campaign involves communicating with road users, the general public, area residences and businesses, and appropriate public entities about a road project and its implications for safety and mobility.

104.4.1 Design Activities

The District Public Information Officer (PIO) should also have final approval of informational documents intended for public distribution.

Typical activities corresponding to the CAP level are provided as follows:

CAP Level 1

(1) Provide Phase II plans to city, county officials, and staff to solicit comments and concurrence.

CAP Level 2, 3, 4

(1) When requested, provide presentation(s) to city, MPO, County Commission, legislators and community groups regarding design, impact, and construction status.

(2) Provide plans for all phase reviews to city, county officials, and staff to solicit comments and concurrence.

(3) Provide plans for all phase reviews to maintenance, construction, and appropriate Operations Center.

(4) Following Phase II review:

(a) Send Notice of Access Impact (driveway closures/modifications) to affected property owners. If done by mass mailing, all proposed access revisions must be clearly stated in the mailing.

(b) Project Information Workshop(s) with city and county staff, law enforcement, elected officials, property owners, and interested public to solicit comments. Mass mailing of invitation or project flyers are typically coordinated by the Department Project Manager and the District PIO.

104.4.2 Construction Activities

Typical activities corresponding to the level type are provided as follows:

CAP Level 1, 2, 3, 4

(1) Two to four weeks prior to beginning construction activities, conduct a mass mailing of project information with construction dates and specific traffic impact information. Project flyers are typically coordinated by the Construction Project Manager and the District PIO.

(2) One week prior to beginning construction activities, include information regarding the project start date, pertinent project information and specific traffic impacts in the District PIO's Weekly Traffic Report (news release).

(3) Throughout the construction phase, include specific traffic impacts in the District PIO's Weekly Traffic Report (news release). It is the Construction Project Manager's responsibility to provide the District PIO with this information in a timely manner to meet media deadlines.

CAP Level 2, 3, 4

(1) After Letting, conduct a 'Hand Off' meeting including representatives from Design, Construction, Utilities, Traffic Operations and Maintenance. This meeting is typically scheduled by the Design Project Manager.

(2) When requested, provide presentations to city and county officials, legislators, community groups and property owners regarding project status, as needed or requested.

CAP Level 3, 4

(1) During the development of Scope of Services for C.E.I., determine if a consultant PIO is required for the project. This decision will be made by the Design Project Manager, Construction Project Manager, and the District PIO. The District PIO should be involved in writing Requests for Proposals and Scopes of Services language that pertain to contracting with community involvement and public information consultants.

(2) For project websites, Construction staff typically maintains the website in accordance with the Project Website Guidelines.

104.5 Combined PD&E and Design Projects

For projects that overlap the PD&E and Design phases, prepare a Public Involvement Plan (PIP) in accordance with ***Part 1**, **Chapter 11*** of the ***PD&E Manual***. At the conclusion of the PD&E phase, update the PIP to include the following:

(1) Summary of community concerns and issues

(2) List of special commitments

(3) Summary of the Temporary Traffic Control Plan

(4) Description of access impacts

(5) Construction schedule

(6) Estimated construction duration

(7) Proposed public involvement activities during construction

104.6 Noise and Perimeter Walls

See ***FDM 264.4*** for Public Involvement requirements for noise and perimeter walls.

105 Aesthetic Design

105.1 General

Merriam-Webster defines aesthetic as "*pleasing in appearance; beautiful*." Aesthetics has to do with human perception of whether places or objects are beautiful or ugly; elegant or tasteless; elaborate or plain. It is difficult to define aesthetics because it is a subjective topic. However, humans can generally arrive at a consensus of what is "pleasing in appearance."

Successful implementation of aesthetics can be summarized in a quote by Alvar Aalto: "Beauty is the harmony of function and form." In the design of transportation facilities, the roadway should blend with its physical and social environment.

Aesthetic design should achieve a balance between form, function, color, texture, durability, and cost. It is important that designers be sensitive to the aesthetic implications of their work and also to their personal aesthetic capabilities and limitations.

Florida's beauty is a combination of the natural and built environment; credited with attracting millions to visit, invest, live, and work here. Transportation facilities are the largest, most visited, and most visible land use in Florida; the largest public spaces in most communities. Quality transportation design should not diminish the visual quality of a place and the experience of being there.

105.2 Aesthetic Design

Aesthetics is an integral part of the transportation design process and should not require additional tasks. Aesthetic designs are not an afterthought to embellish or provide adornments, frills, decorations, or add-ons to cover ugly parts. Affordable, biddable, constructible, and maintainable designs can artfully respond to the Department's and communities' safety, mobility, and aesthetic ideals. Even when there are no known aesthetic issues or when a project is minor, transportation facilities must not be ugly and detract from Florida's beauty.

It is important to achieve a balance between form, function, color, texture, durability, and cost in the design of transportation facilities. Implementation of aesthetic prinicipals in transportation design involves the balanced combination and implementation of the following elements:

- Form
- Scale
- Proportion
- Location
- Materials
- Color
- Perspective
- Context
- Viewsheds
- Durability
- Orientation
- Aspect
- Exposure
- Lightness, darkness, shade, shadow, and reflection

The placement of transportation elements (e.g., signs, signal control boxes, handrails) should be carefully considered during design. It may be possible to strategically place these items to avoid disturbing a scenic view.

105.3 Policies

Constitution of the State of Florida, Article II, Section 7(A):

> "It shall be the policy of the state to conserve and protect its natural resources and scenic beauty."

Section 334.044 (26) Florida Statutes:

> "The department shall have the powers and duties to...conserve the natural roadside growth and scenery; and to provide for the implementation and maintenance of roadside conservation, enhancement, and stabilization programs."

Aesthetic effects and roadway design considerations are discussed in the ***PD&E Manual (Topic No. 650-000-001), Part 2, Chapter 5 and the FDOT Drainage Manual section 5.4.4.2 Detention and Retention Ponds***.

105.4 Guidelines

Integrating aesthetics into transportation projects accomplish the following:

(1) Support safety, mobility, and enjoyment of all users, and can be integrated with functional elements.

(2) Provide facilities that are compatible with the surrounding natural and built environment, based on the context of the roadway; e.g., the urban scale, surrounding architecture, forests, farms, parks, neighborhoods, landscape, community features, water bodies, views, and vistas.

(3) Avoid, minimize, and mitigate insensitive solutions that detract from Florida's beauty.

(4) Coordinated to provide a clear sense of order, clarity, and continuity.

(5) Use materials and design solutions sensitive to scale, form, materials, color, pattern, texture, and architectural style of existing and proposed elements.

(6) Address maintenance needs and responsibilities.

Roadways should blend into the landscape, avoiding large cuts and fills into the existing terrain. Horizontal and vertical alignment should be coordinated so that a driver has an opportunity to gain a sense of the local environment. Combinations of horizontal and crest vertical curves and broken-back curves should be avoided. Excessively long tangent sections become monotonous. Curvature or other features should be added to maintain drivers' interest and awareness.

Vistas of exceptional beauty should be accentuated by the roadway geometrics. Ideally, such vistas should be on the outside of horizontal curves, without excessive roadside appurtenances and signs to clutter the view. Consider the view from, and the view of the transportation facility.

Preferred design solutions may require additional right of way (R/W). Aesthetics is an acceptable design objective. The Department has a wide discretion to select the amount and location of the property to be acquired. Courts can inquire whether the Department has adequately considered alternatives, costs, environmental factors, long-range planning, and safety. As long as these factors are adequately considered, courts generally are not authorized to substitute their design judgment for that of Department unless the Department acts illegally in bad faith or abuses its discretion.

Often, the most attractive and elegant design solution can be low cost or no cost and add little or no time to the project schedule.

105.5 Process

Although beauty is subjective, two or more people can usually find consensus on what is attractive or beautiful and what is not. Seek and use the opinions of others to inform the final design.

Consideration of aesthetics begins early and is as integral to the design process as safety and mobility. Within the time and budget available, identify and build on opportunities to improve the project aesthetics.

Visualize and evaluate each design element as it will appear from the road, the sidewalk, the bike lane, and from adjacent properties; day and night. Visualize how the element will appear after ten or more years of weather, minimal care, and typical use.

105.6 Safety and Scenic Beauty

General principles of aesthetic design include form, scale, order, and proportion. Due to the need for uniformity in roadway design, there is often a lack of contrast and variety. This can contribute to driver monotony, a real safety concern. By integrating aesthetic design principles throughout the design process, the need for uniformity can be balanced with the need for variety and interest.

106 Exempt Public Documents

106.1 General

This chapter describes the Department's policy concerning the distribution of sensitive documents used in the design and construction of structures.

106.2 Exempt Documents

In an effort to protect Florida's transportation infrastructure, the 2002 Legislature enacted ***Section 119.071(3)(b), Florida Statute (F.S.)***, which provides that building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout and structural elements of a building, arena, stadium, water treatment facility, or other structure owned or operated by an agency are exempt from the requirements of Florida's Public Records Law.

Therefore, plans, blueprints, schematic drawings and diagrams of structures owned by the Department are exempt from the public records provisions of ***Chapter 119, F.S.*** This exemption includes draft, preliminary and final documents and includes paper, electronic, and other formats.

106.3 Distribution of Exempt Documents

Procedure 050-020-026 ***(Distribution of Exempt Documents Concerning Department Structures and Confidential and Exempt Security System Plans)*** describes the process for the distribution of documents deemed as Exempt Documents.

For the purpose of ***Procedure 050-020-026***, the term "structure" includes bridges and culverts with an opening of more than 20 feet between undercopings of abutments or spring lines of arches or extreme ends of openings for multiple boxes, and those other bridges subject to safety inspection under ***Section 335.074, F.S.*** A roadway is not otherwise a structure.

Entities or persons outside the Department requesting or receiving copies of any portion of plans or other documents considered Exempt Documents must complete a request form (***Form No. 050-020-26***). The entity or person receiving the Exempt Documents must maintain the exempt status of the Exempt Documents. This procedure applies to all Department internal or contracted staff who have access to such Exempt Documents in their Department work.

110 Initial Engineering Design Process

110.1 General

This chapter discusses the engineering design process which begins with the approval of the Project Location and Design Concept Acceptance and ends with the construction letting. It may include an update process when the construction plans and specifications are ready and on hold in the district and require revising to make them contract ready. Throughout this design process, quality control will be performed by those responsible for the engineering design and plans preparation activities.

The engineering and design activities and the schedules depend on the type of project and the required effort to accomplish the desired objectives. There are three basic types of projects:

(1) **New Construction -** A highway or bridge project along a new corridor on new horizontal and vertical alignments.

(2) **Add Lanes and Reconstruction -** A highway project along an existing facility to add lanes, widen or replace bridges, or improve intersections to improve capacity, safety, or operation.

(3) **Other Projects -** May include Resurfacing, Restoration and Rehabilitation (RRR), operational improvements, safety enhancements, or improvements to extend the service life of an existing highway or bridge. These projects generally do not require a PD&E phase. The scopes are so varied that it is difficult to define them, except project by project. They can vary in magnitude from installing highway lighting for enhanced safety or resurfacing pavement to extend the service life, to minor lane and shoulder widening, bridge rail modification or intersection improvements. These projects may also include transit facilities, bike paths, sidewalks, and landscaping.

Figure 110.1.1 shows the major activities included in the initial engineering design process.

Figure 110.1.1 Major Activities – Initial Engineering Process

Review & Confirm:
... Project objectives/scope
... PD&E study preferred alternative
... Typical section data accuracy
... Environmental evaluation
... PD&E commitments (e.g., noise barriers, pond sites)
... Budget (WP) & staff-hour estimates
... Schedule & production dates
... Approvals & authorizations

Prepare, Document & Approve:
1. Typical section standards
2. Design controls - speed, design period, vehicle, traffic volumes, LOS, access class & function, bike & pedestrian LOS, ADA
3. Design project standards & assumptions, Pavement Type Selection

Compare & Confirm:
... Project design standards vs. R/W
... PD&E preferred alternative vs. standards
... Design controls vs. standards
... Objectives & scope vs. standards
... Documentation & approval

Field Review and Verify:
... Adequacy of survey data
... Updates required
... Transfer survey data to design files
... Adequacy of R/W survey data

Surveyor signs off on location files

Review, Confirm & Approve:
... Alignment and topo in CADD
... Alignment vs. standards
... New alignments
... Design Exceptions & Design Variations

Initiate utility contact

Review & Establish Needs:
... Environmental issues
… PD&E and Environmental commitments (i.e., Noise barrier locations, etc.)
... Landscape
... Aesthetics
... Retention/outfalls
... Permits, mitigation, R/W field review

Develop:
... Preliminary project layout: grades, superelevation rates, transitions, vertical curves, geometry calculations

1

1

Review:
... Grades vs. soil data vs. Base Clearance Water Elevation
... Clearances above and below
... Existing drainage structure size used on existing facility vs. grades
... Existing landscape condition

Develop:
... Existing ground cross sections
... Approval of alignment & grades along project, computations
... Soil data on existing ground cross sections
... Utility locations & potential conflicts
... Landscape locations & potential conflicts

Develop:
... Roadway cross section templates
... Special ditch profiles
... Check impact on utilities
... Check impact on existing vegetation
... Drainage outfalls

Develop:
... Geometric layout - intersections, interchanges, transitions & connections
... Verify and confirm access management design
... Confirm bike, pedestrian, transit & ADA needs vs. project standards
… Noise barrier geometry
... Landscape Plan and Tree Disposition

Field Review:
... All preliminary engineering activities & decisions
... Approvals documented

Finalize:
... Alignments, grades, geometry, reports
Begin:
... R/W requirements, Summary of Pay Items

Review & Confirm:
... Preliminary project design report
... Project objectives/scope
... Project design controls/standards
... Environmental issues/permits
... Budget, staff-hour estimate & production dates
... Engineering support data & services

To Final Engineering Design

110.2 Initial Engineering Design

Generally, the initial engineering process should accomplish or complete the following activities:

(1) Completely and fully define and document the objectives of the project and the scope of activities to accomplish them. This will almost always require an on-site review.

(2) Document the surrounding context as it relates to aesthetics and accommodating trees (existing and proposed) and other long-lived plants.

(3) Develop and document a realistic staff-hour estimate and production schedule to accomplish the scope of activities identified.

(4) Coordinate with the District Interchange Review Coordinator to determine if a re-evaluation of the approved Interchange Access Request (IAR) is necessary. The Interchange Access Request Users Guide (***IARUG***) provides the requirements for performing a re-evaluation of the Interchange Access Request (IAR).

(5) Establish and document the design controls, criteria, assumptions, project design standards, Design Exceptions, and Design Variations. Significant changes to previously approved PD&E concept may result in a re-evaluation of the Environmental Document. Discuss with the District Environmental Management Office.

(6) Review Project Commitment Record (PCR) that was completed during PD&E and identify all prior PD&E commitments that will be addressed during design; e.g., the need to design and locate noise barriers (with insertion loss calculations), special pond site requirements, landscape or aesthetic considerations, pedestrian and bicycle commitments, access commitments, wildlife management commitments, wetland issues, transit issues, and resilience commitments.

(7) Identify and document additional engineering, data gathering, and support services.

(8) Determine and document the structural design requirements.

(9) Determine and document if R/W is required.

(10) Establish and document the review procedure and number of submittals, if different from guidelines provided in this manual.

(11) Establish preliminary geometry, grades, and cross sections.

(12) Identify and implement needed public involvement activities. See ***FDM 104***.

(13) Develop Pavement Type Selection Report based on FDOT ***Pavement Type Selection Manual*** ***(Topic No. 625-010-005)***.

(14) Identify seasonal high water and base clearance water elevations and determine base clearance.

(15) Identify locations of potential hydroplaning risk and develop mitigation strategies to reduce risk and aid in the development of the Typical Section Package.

~~(15)~~(16) Identify where resilience measures should be considered to address changing conditions over the design life of the project and determine if there is a need to develop strategies to avoid, mitigate, or eliminate impacts in the project scope.

If a PD&E phase has been completed, some of the activities listed above may have been performed to varying levels during that phase. The information contained in the preliminary engineering report should be considered as the starting point for the initial engineering phase. When there was no PD&E phase, the initial engineering design activities must establish the project scope, controls, criteria, and standards, data gathering requirements, right of way (R/W) needs, and major design elements necessary to determine that the project is viable and R/W can be cleared.

110.3 Scope, Objectives, Schedule, and Budget

The Department's project manager is responsible for the development, review and approval of the project objectives, scope of work, and schedule in accordance with the ***Project Management Guide***. They must also verify that required funds are in the work program.

The project objectives and scope are best confirmed and completed by:

(1) Reviewing the PD&E study recommendations, conclusions, and commitments including any safety needs.

(2) Review, select, and prioritize any of the overlapping safety improvement projects identified in the Department's Safety Needs Dashboard with coordination and approval of the District Traffic Operations Engineer and/or District Safety Administrator.

(3) Performing a field review of the project with the project manager and personnel from appropriate FDOT offices, such as Roadway Design, Traffic Operations, Safety, Right of Way, Utilities, Landscape, Survey, Maintenance, and Construction.

(4) Requesting a review of the draft scope of services activities by FDOT offices, such as Maintenance, Construction, Design, Traffic Operations, Access Management, Public Transportation, Pedestrian and Bicycle, and Environmental Management.

(5) Developing the scope of services sufficient to advertise for professional services. After the scope of services is completed and approved, the schedule and budget may be confirmed and updated by the engineer/project manager and approved by the appropriate district manager. The scope of services should anticipate and include:

   (a) The most cost-effective methods that may be used in Subsurface Utility Engineering (SUE) for locating subsurface anomalies, structures, buried fiber optic cable, and utilities.

   (b) Opportunities to accommodate existing trees, proposed trees, and other long-lived plants.

After consultant selection or in-house assignment, the designer or consultant should review and confirm the scope of services.

110.4 Project Design Controls and Standards

Selection of appropriate project design controls and standards ensure that the facility will function safely at the level desired and expected by motorists, pedestrians, and cyclists. The Engineer of Record (EOR) is responsible for establishing project design controls and standards to be used in the development of the construction plans. Place documentation for the selected project design controls and standards in Project Documentation (see ***FDM 111.7***).

The design controls as addressed in this manual include:

- design speed
- design vehicle
- design period
- traffic volumes
- level of service
- functional classification
- access classification
- context classification

Other factors that control the selection of project design controls and standards include right of way constraints, utility conflicts, and preservation of large trees.

The Preliminary Engineering Report (PER) or project concept report may include some of the project design controls and standards to be used on the project. These design parameters should be reviewed, confirmed as valid and consistent with the overall corridor or system, and documented.

See ***FDM 201.5*** for information on selecting the appropriate design speed for the project.

Either a Design Exception or Design Variation, as described in ***FDM 122***, must be obtained when selected project design controls and standards do not meet Department's criteria.

110.4.1 Sole Sourced Products or Processes

Sole sourcing products or processes occur~~s~~ when the EOR specifies a proprietary product or process within the construction contract documents which results in the exclusion of other products or processes that may perform the same or similar function. Sole sourcing must be justified by the EOR, reviewed by District and Central Office Technical Experts, and approved by the District Design Engineer with the **Proprietary Product Certification (*Form 110*)**. Identify these features as early in the design process as possible and provide the approved justification prior to the Phase III submittal.

When the Local Agency requests to use a limited list of products, use the Local Agency List described in ***FDM 115.4***. Use sole sourcing only when a single product is acceptable.

Provide justifications that factually and technically support the sole sourcing of the proprietary product or process. Address why sole sourcing is reasonable and necessary to fulfill the project's needs, as well as why similar products do not meet the project's needs. Complete the Sole Sourcing Approval along with supporting documents and justification as needed in the PSEE module. The State Product Evaluation Administrator will verify the Approved Product List (APL) number, and/or invite the manufacturer to apply for listing on the APL.

Upon approval of Sole Sourced Product, update the Contract Documents, including approved modifications to specifications and any necessary pay item requests.

110.5 Support Services

Review information or support services that have been provided to determine the completeness and currency of data used in previous studies/reports.

Technical data required for the design of a roadway project can be available from various sources, such as:

(1) Surveys - design, topographical, aerial, drainage, right of way location, soil, utilities

(2) Traffic Data

(3) Pavement Design

(4) Environmental Documents (including Noise Study Report and wildlife connectivity recommendations)

(5) Original Plans

(6) Crash Data

(7) Roadway Characteristics Inventory (RCI)

(8) As-Built Drawings

(9) Intelligent Transportation Systems Facility Management (ITSFM) Documentation

During the design process, the project will require coordination with different sections or offices. When engineering decisions, information, or other support services are required from FDOT functional areas, it is the project manager's responsibility to coordinate and facilitate the request and expedite a timely response. The functional areas include but are not limited to:

(1) Planning and Programs

(2) Surveying and Mapping

(3) Traffic Design

(4) Geotechnical

(5) Drainage

(6) Maintenance

(7) Construction

(8) Utilities

(9) Estimates and Specifications

(10) Right of Way

(11) FHWA

(12) Value Engineering

(13) Traffic Operations

(14) Environmental Management

(15) Access Management

(16) Structures

(17) Safety

(18) Plans Review

(19) Public Transportation

(20) Landscape Architecture

(21) Tolls Design

(22) Intelligent Transportation Systems

(23) Lighting / Electrical

(24) Architecture

(25) Materials

(26) Turnpike Concepts

(27) Central Office

(28) Program Management

110.5.1 Project Aviation Requirements

Federal regulations exist to protect the national airspace system and must be considered when planning, designing and constructing a Department project. The Department must comply with the requirements of ***Title 14 Code of Federal Regulations (CFR), Part 77*** (***14 CFR, Part 77)*** regarding the construction or alteration of existing or proposed permanent and temporary structures.

Place the FAA Determination in accordance with ***FDM 111.7.2.12***.

110.5.1.1 Required Coordination

Responsibility for complying with ***14 CFR, Part 77*** ultimately rests with the Department. However, the responsibility for filing FAA notifications rests with the Engineer of Record. The FAA notification process is a complex and lengthy process; therefore, coordinate with both of the following as early as possible in the initial phases of the project for assistance:

District Aviation Coordinator	and	Airspace and Land Use Manger Aviation and Spaceports Office ***https://www.fdot.gov/aviation/***

110.5.1.2 FAA Notification Guidelines

The FAA provides a ***Notice Criteria Tool*** via the Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) website (***https://oeaaa.faa.gov/***). Unless exempt from filing notice per ***14 CFR, Part 77***, this tool must be used to determine if the construction activity or alteration requires notice to the FAA.

If notice is required, use ***FAA Form 7460-1, "Notice of Proposed Construction or Alteration"***. ***Form 7460-1*** should be submitted electronically through the FAA's Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) website:

https://oeaaa.faa.gov/

The website allows filing multiple "points" in a matrix on a single ***Form 7460-1***. Early submission is recommended to avoid required design changes or delays in letting or construction.

Submission of ***Form 7460-1*** will result in the FAA issuing a Determination whether the obstruction constitutes a hazard to air navigation in accordance with ***14 CFR, Part 77***. Construction may not commence until the FAA issues a Determination. If the obstruction is determined to be a hazard, the construction may not proceed according to ***Chapter 333, F.S.***

FAA Emergency Notification:

Emergency notifications are rarely granted. In such a case, the required notification may be sent by telephone or any expeditious means to the nearest FAA Flight Service Station, and within 5 days thereafter, a completed copy of the ***FAA Form 7460-1***, must be submitted to the FAA Southern Regional Office in Atlanta.

110.5.2 Projects Involving Existing Bridges

Coordinate with appropriate offices and functional areas on projects that involve existing bridges as described below.

110.5.2.1 Projects Involving Steel Bridges

For all projects that involve the repair, repainting or replacement of a steel bridge, the Design Project Manager must contact the State Corrosion Engineer in the State Materials Office and the District Contamination Impact Coordinator (DCIC) to determine if the bridge contains lead or other hazardous elements. The State Corrosion Engineer and DCIC will furnish a Modified Special Provision for disposition of the lead based paint waste for that particular project.

The Design Project Manager must provide the Modified Special Provision to the Engineer of Record who is preparing the contract plans and specifications. The Engineer of Record must ensure that the project specifications include Modified Special Provision and that they prohibit the use of lead based paint. A mandatory pre-bid conference is not required unless special conditions exist and the district determines one is needed.

110.5.2.2 Projects Involving Bridges with Asbestos-Containing Materials

There may be asbestos-containing materials (ACM) used in bridges. Projects involving bridges that are to be either partially or fully demolished or renovated require an asbestos survey to be conducted by a licensed Asbestos Consultant. This should be completed as early in the project as possible to determine the nature and extent of ACM and if abatement is required. Some bridge elements potentially containing asbestos include (but are not limited to) the following:

(1) Tender House Roof Materials (e.g., felts, flashings, mastics)

(2) Tender House Floor Materials (e.g., tiles, sheet flooring, mastics)

(3) Tender House Wall Materials (e.g., drywall muds, joint compounds)

(4) Tender House Window Materials (e.g., caulks, gaskets)

(5) Bridge Equipment Materials (e.g., gaskets, packings, linings, insulation)

(6) MSE Wall Gaskets

(7) Beam/Deck Bearing Pads

(8) Asbestos-cement pipes (e.g., scuppers)

(9) Bascule Bridge Machinery Brake Pads

(10) Troweled-on or Sprayed-on Decorative Coatings

110.5.2.3 Projects Involving Bridge Demolition

At or before the 30% plans phase, the Department will determine if it has a need for the debris resulting from the demolition of a bridge. If no such need exists, and in response to ***Section 1805, SAFETEA-LU Legislation,*** the Department is then required to notify local, State and Federal government agencies of the availability of the bridge debris for their beneficial use (use as shore erosion control or stabilization, ecosystem restoration, and marine habitat restoration). For any projects that involve the complete demolition of a bridge, the Design Project Manager is required to notify these agencies of the availability of the resulting debris. The Bridge Development Report (BDR)/30% Structure Plans (see ***FDM 121***) will include the approximate volume of debris and the estimated timeframe in which the material will be available.

The Design Project Manager must coordinate with the receiving agency and the District Construction Engineer to develop a Joint Project Agreement. The receiving agency will be responsible for all additional costs associated with the processing, delivery, placement, and use of the material. The following items must be determined in order for the Joint Project Agreement to be developed:

(1) The volume of raw (unprocessed) debris (a more detailed quantity than original estimate).

(2) The estimated timeframe for the debris availability.

(3) The location of the receiving agency’s staging/storage site to which the raw debris is to be delivered. Any further work involving processing and final placement of the material is expected to be the responsibility of the receiving agency and not part of the FDOT's contract for bridge demolition.

(4) An estimated cost to transport the debris to that site. This estimate will be the amount the receiving agency must pay the FDOT.

Once this information is determined, the contract plans will include the instructions for the delivery of the debris.

If no agency expresses interest in the debris material, then the material will be disposed of in accordance with FDOT Specifications.

Requirements for the original notification to agencies (including a sample Notification Letter) and the resulting Joint Project Agreement are found on the ***Project Management*** website.

The demolition of bridges with ACM requires that Asbestos Abatement Plans be developed by a licensed Asbestos Consultant. ***FDM 110.5.2.2*** and the ***Construction Project Administration Manual*** (***CPAM***), ***Section 10.4*** contain additional requirements for projects involving demolition of bridges with ACM.

110.5.2.4 Local Roadways on Department-owned Bridges

Evaluate Department-owned bridges that carry local roadways over Department Right-of-Way to ensure compliance with the requirements of the ***FDM*** and ***Structures Design Guidelines (SDG)***. Include needed retrofits or other improvements (e.g., traffic railings, guardrail transitions, pier protection) in the project scope.

110.5.3 Projects Involving Bridges Over Navigable Water

For projects involving bridges over navigable water, the Design Project Manager must provide the District Structures Maintenance Engineer (DSME) sufficient notification prior to engaging in any action in, on, or around the bridge(s). This includes any field reviews involving persons conducting activities that may be perceived as suspicious (e.g., parking on the bridge, repeated viewing from a boat or other vehicle, carrying cameras and other electronic equipment like a GPS, etc.). This will allow the DSME to notify the U.S. Coast Guard prior to such activities taking place.

110.5.4 Wildlife Connectivity

Wildlife connectivity features include new or modified structures; e.g. bridges, bridges with shelves, specially designed culverts, enlarged culverts, or drainage culverts. Exclusionary devices such as fencing, walls or other barriers may be included to funnel wildlife to a crossing. Disciplines that may be involved in this effort include Structures, Roadway, Drainage, Environmental Management, Permitting, Right of Way, and Utilities.

Wildlife connectivity needs are usually identified during the PD&E study. However, coordinate with the District Environmental Management Office and District Permit Office early in the design phase for determination of the type, size and other parameters for the wildlife crossing feature. For further guidance on wildlife connectivity refer to the ***FDOT Wildlife Crossing Guidelines***, commitments section of the Environmental Document, and any other documentation regarding the wildlife connectivity related to the project.

In the event that wildlife connectivity needs are not identified until after the design process has begun, immediately start the coordination process with the District Environmental Management Office and District Permit Office.

110.5.5 Interstate Projects Affecting Logo Structures

Determine if the construction activities on Interstate mainline or ramp projects may impact logo sign structures. Any affected logo structures must be identified so those logo structures can be properly addressed in the plans. Once the affected logo structures are identified, the designer must coordinate with the State Outdoor Advertising and Logo Manager, the Logo Program Contractor, and the District Traffic Operations Office to determine if the logo structures need to be relocated or redesigned during construction. Through this coordination, the following questions must be answered:

(1) Will the construction activities require the relocation of any logo structures during construction?

(2) Where will the logo structures be reinstalled?

(3) Will an upgrade of the sign panel, support or foundation of the affected logo structure be required?

The disposition (e.g., relocate, furnish & install) of affected logo structures must be addressed in the plans and paid for as specified in the ***Basis of Estimates Manual***.

Refer to the Logo Sign Program web page for additional information:

https://www.fdot.gov/rightofway/LogoSignProgram.shtm

110.5.6 Products and Source of Supply

The Buy America provisions are included in the Build America, Buy America Act (BABA). All projects must comply with the BABA provisions, established in ***Public Law No. 117-58,* §§ 70901-52 and 23 CFR 635.410**. BABA requirements are covered in ***FDOT Standard Specifications, Section 6***. The allowable levels of foreign steel or iron, and contractor certification requirements are identified in ***Specification 6-5.2***.

For BABA requirements, the term “Federal funds” is not limited to Federal Highway Administration (FHWA) funds or construction projects with a federal project number. Some state or local funds may have originated with other federal funding programs. Therefore, all FDOT projects will be subject to the same BABA requirements regardless of funding sources.

BABA includes items on construction projects that will remain in place as part of the permanent installation. Exceptions exist for temporary products and manufactured products, as identified on the APL.

While ***Specification 6-5.2*** applies to contractors, designers also have a responsibility to ensure BABA is met. When BABA is not met, project funding may be affected. The design engineer of record must perform sufficient research to ensure these requirements are met.

This research is necessary when the plans include the following:

(1) Non-standard or special grade steel components and shapes.

(2) Proprietary products not on the APL.

(3) Sole sourced products not on the APL.

(4) Special machinery with steel or iron components.

(5) Heavy sections of steel sheet pile wall.

It is not necessary to conduct such research for the following:

(1) Standard domestic steel beams and shapes of standard grades as shown on the National Steel Bridge Alliance (NSBA) website.

(2) Standard concrete reinforcing steel sizes and grades.

(3) Standard steel drainage pipe sizes and gages.

(4) Items included on the APL that are domestically sourced.

(5) Items covered in the ***Standard Plans*** including:

- (a) Standard mast arm assemblies.
- (b) Standard steel guardrail, posts, and end treatments.
- (c) Standard drainage grates.
- (d) Standard steel fences.
- (e) Standard steel sign supports and structures.

For iron or steel products, if it is determined that the product being proposed is not manufactured in the United States, then the Designer must determine if the estimated costs of such foreign steel or iron is within the thresholds stated in the specification. If the costs exceed such threshold, the Designer must explore alternatives that utilize domestic steel or iron, or seek a waiver from FHWA. Generally, it is preferred to select a different engineering solution utilizing domestic products.

For all other products, if it is determined that the product being proposed is not manufactured in the United States, then the Designer must explore alternatives that utilize domestic products, or seek a waiver. Contact the State Product Evaluation Administrator for assistance. Generally, it is preferred to select a different engineering solution utilizing domestic products.

Product Evaluation will assist Designers with inviting manufacturers to submit documentation for APL listing.

Should a waiver become necessary, it must be obtained before the contract letting to ensure federal funding is not jeopardized. Submit BABA waiver requests to the Central Office for concurrence by the Directors of Design and Construction and notify the Office of Work Program of the requests. Upon concurrence, requests will then be forwarded to the FHWA Florida Division Office for approval and coordinated with the FHWA headquarters in Washington, D.C. for further concurrence. Originals will be returned to the District by the Central Office. These issues must be identified early in the plans preparation process.

110.5.7 Traffic Monitoring Sites

One or more traffic monitoring sites should be considered for addition to each construction project which has a type of work consistent with the construction of such sites. Examples of compatible work types include traffic signals, resurfacing, reconstruction, and other work that involves either pavement surfaces or electrical systems. Inquiries about monitoring sites should be addressed to the Traffic Data Section Manager of the Traffic Data & Analytics Office, Office of Planning.

110.5.8 Fire Suppression Systems

The Department has determined that the details for standpipes, valves and hydrants that have been used on past projects for fire suppression systems located within traffic railings and roadway barriers present significant snag hazards for errant vehicles and thus are not crashworthy. The Department has also determined that there is insufficient justification for incorporating fire suppression systems into, on or attached to traffic railings and roadway barriers in an attempt to improve safety during an extreme event, (e.g. a vehicle fire).

FDOT owned fire suppression systems are not allowed on bridges, retaining walls or limited access facilities unless they are approved by the Chief Engineer due to special circumstances. Commonly occurring traffic related incidents will not be considered as special circumstances or as justification for the installation of any fire suppression system.

If an FDOT fire suppression system is approved, agreements must be executed with a local agency to bear all installation costs, repair costs and maintenance functions.

Any fire suppression system that is not owned by FDOT is defined by ***Section 337.401, (F.S.)*** as a utility and is not to be issued a utility permit unless approved by the Chief Engineer in accordance with ***Rule 14-46.001, Florida Administrative Code*** and the Utility Accommodation Manual.

110.5.9 Trees, Landscape, and Landscape Irrigation Systems

Consistent with Department policy, determine how the project can be designed to accommodate existing desirable trees and proposed trees. Determine if commitments have been made to preserve or provide trees, landscape, or landscape irrigation systems. Determine if a landscape project is programmed or proposed as a component or standalone by the Department or a local agency.

The District Landscape Architect will determine the level of preservation, tree relocation, or invasive species eradication involved. Projects that impact desirable trees typically require Selective Clearing and Grubbing plans (see ***FDM 229*** and ***924***).

Coordinate with the District Landscape Architect to determine the following:

- Whether design alternatives could reduce impacts to existing vegetation.
- Whether existing trees will be saved or relocated (if avoidance is not an option). This will determine the prioritization of the level of required funding.

110.5.10 Projects Involving Trails

For projects involving trails (e.g., Florida National Scenic Trail, SUN Trail, bike routes, etc.) intersecting or along the right-of-way, coordinate with the trail owner to ensure the use of the trail is not interrupted during construction.

110.5.11 Resilience

FDOT's Resilient State Transportation Policy (000-525-053) states the following: "Resilience includes the ability of the transportation system to adapt to changing conditions and prepare for, withstand, and recover from disruption." For projects with a PD&E Phase, document any resilience commitment(s) described in the Project Commitment Record (PCR) in the Project Suite Enterprise Edition (PSEE) Resilience Tracker Module. The PCR is maintained within the commitment section of the

Environmental Document within Office of Environmental Management's SWEPT (Statewide Environmental Project Tracker) application. For all other projects, document resilience measure(s) to be considered during the design phase in the PSEE Resilience Tracker Module as defined from the initial engineering process as described in ***FDM 110.2***.

The Design PM should update the Resilience Tracker module to reflect the status of resilience measures implementation on the project throughout the design process as necessary.

110.6 Preliminary Geometry

To establish geometry, the following activities should be accomplished or near completion:

(1) Supporting data such as surveys, traffic, and pavement evaluation data.

(2) Typical sections and pavement design.

(3) Standards, Design Variations, and Design Exceptions.

(4) PD&E commitments addressed.

(5) Need for R/W phase addressed.

(6) Utility initial contact and survey data.

(7) Transit initial contact and facility location.

The initial engineering design activities to establish the preliminary project plans are:

(1) Set and calculate the horizontal alignment.

(2) Set the proposed profile grade lines.

(3) Develop preliminary cross sections at selected intervals or control locations.

(4) Develop preliminary layout of roadway, intersections, interchanges, transitions, and connections.

(5) Field review all proposed preliminary engineering layout and decisions for conflicts, R/W needs, connections, updates, and additional needs.

The initial engineering review is used to obtain confirmation and approval of the objectives, scope, standards, decisions, and assumptions to be used as the basis for the engineering and design.

The above activities should result in the following:

(1) Structures can now be given the horizontal and vertical alignment and clearance requirements for bridges.

(2) R/W Engineering can be furnished with mainline R/W requirements for the project.

(3) Plan-profile sheets can be clipped.

(4) Traffic plans development can be initiated.

(5) Cross sections, grades, and alignments, as required, can be provided to the drainage section.

(6) Work sheets, as needed, can be provided to the permits section for initial evaluation.

(7) Utility/Agency Owners (UAOs) can be provided plans, profiles and cross sections as required to identify/verify and designate their existing utilities as well as indicate proposed installations.

(8) The list of pay items can be loaded into Designer Interface by identifying the items of work involved at this stage of design.

(9) The need for noise barriers has been confirmed and locations established.

(10) Subsurface work can be performed free of conflicts with underground FDOT infrastructure.

111 Final Engineering Design Process

111.1 General

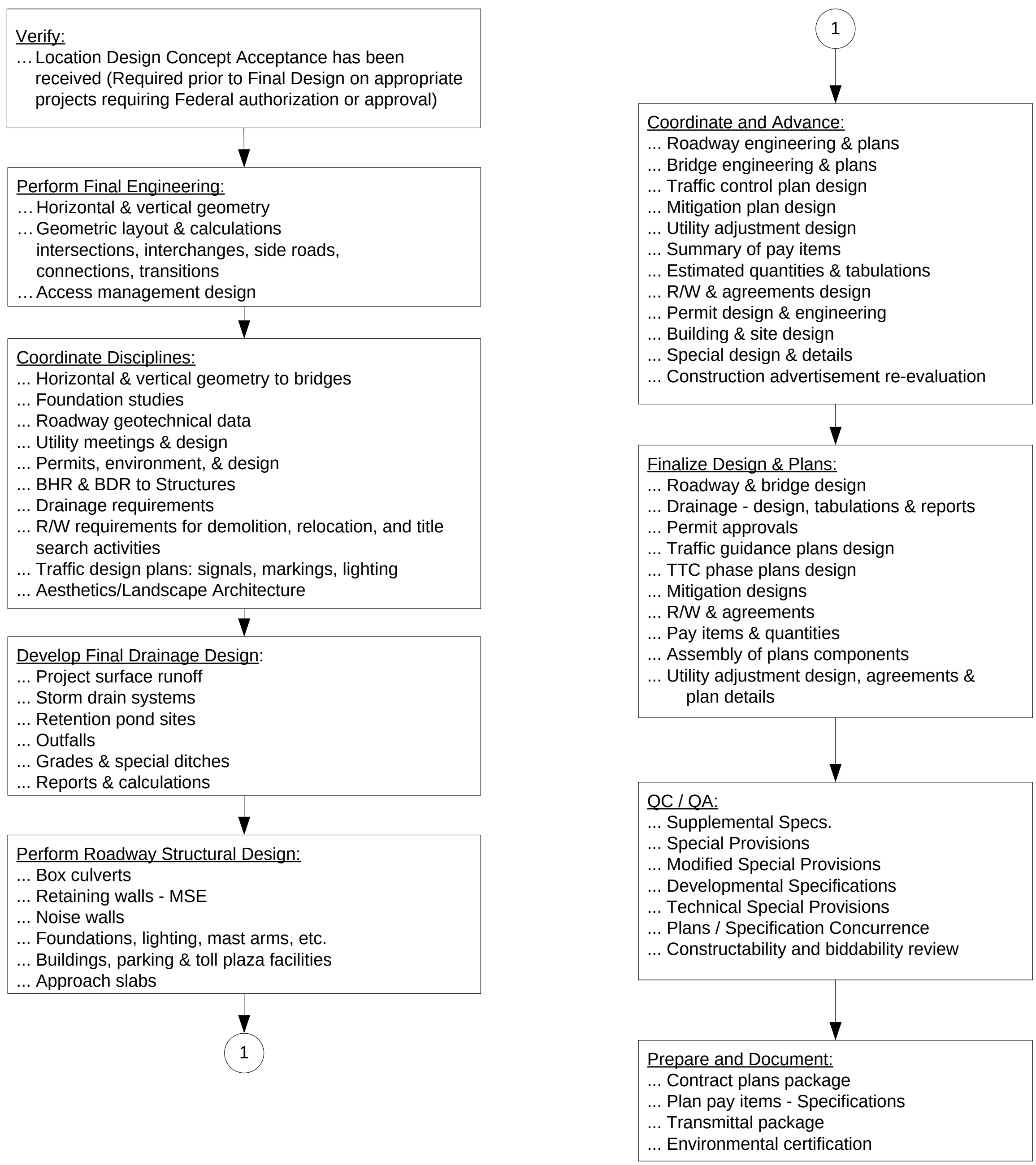
The final engineering design process follows the initial engineering design process and review. The primary objective of the final engineering design phase is to prepare contract plans and specifications that can be used to bid and construct the project with a minimum number of field changes, delays, and cost overruns.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: The primary objective of the final engineering design phase is to prepare contract plans and specifications sufficient to meet the contract requirements.

On projects requiring Federal authorization where the Design Phase and the PD&E Phase overlap, the Department must receive Location Design Concept Acceptance (LDCA), prior to acceptance of the Phase II submittal (prior to advancing into Final Design). To advance past Phase II coordinate with the Environmental Management Office who will work with FHWA (see ***Part 1, Chapter 4*** of the ***PD&E Manual***). The Design Project Manager must coordinate with the PD&E Project Manager, and the District Environmental Management Office to ensure that that the Department has received LDCA for the project. The Design Project Manager will need to convey this information to the district federal aid staff in the District Work Program Office. ***Figure 111.1.1*** shows the major activities included in the final engineering design process.

Modification for Non-Conventional Projects:
Delete the first two sentences of the above paragraph and replace with the following: On projects requiring Federal authorization where the Design Phase and the PD&E Phase overlap, the Department must receive Location Design Concept Acceptance (LDCA), prior to release of the final RFP.

Figure 111.1.1 Major Activities – Final Engineering Design Process



111.2 Final Engineering Design

The Engineer of Record (EOR) and Design Project Manager must coordinate activities to ensure that the quality, accuracy, and appropriate decisions go into the performance of each step. The project quality control should include a plan-do-check routine for each set of activities or operations.

The major design activities include, but are not limited to, the following:

(1) Pavement design

(2) Drainage design

(3) Structural (bridge) design

(4) Structural (roadway) design

(5) Roadway design including access management, earthwork, selective clearing and grubbing, geometrics, ADA

(6) Traffic plans design including signing, marking, signals, lighting

(7) Utility adjustment design

(8) Permit preparation design including ponds, mitigation

(9) Temporary Traffic control plans (work zone) design

(10) R/W requirements design

(11) Building and site design including landscaping, ADA, transit

(12) Estimates and Quantities preparation

(13) Specifications and special provisions

(14) Landscape design including accommodating existing and proposed vegetation.

(15) Noise barrier design

Modification for Non-Conventional Projects:
Delete item 12 above.

111.2.1 Work Program Administration (WPA) System

Project stationing information is to be checked and entered into the Work Program Administration (WPA) system during final engineering design. This information is important for tying construction records, such as material coring, sampling and testing to other databases. The information is entered by stations, which are related to roadway mile post for later information retrieval.

The begin and end stations, and station equations are entered into the WP50 computer screen under FM on the FDOT CL/SUPERSESSION Main Menu for each WPA location. After logging onto SUPERSESS, the WP50 designees enter on FM (Financial Management System). On the FM Main Menu, press ENTER: 3 for WPA (Work Program Administration). On WPA Main Menu, press ENTER: 25 for WP50 (Station Definition).

Update access to WP50 screen is granted through the Work Program Development Office in Tallahassee. Listed below are the important edit and browse features:

(1) Only enter FM Item Segment number on the top line.

(2) The RDWYLOC sequence number displays on the top line of the screen and on the first line of the header information. It's entered on the top line to retrieve a particular location.

(3) The transaction type “00” is entered on the top line to browse station equation information for that RDWYLOC. The transaction type “02” is entered on the top line to update station equation information for that RDWYLOC. The transaction type “99” is entered on the top line to erase station equation information for that RDWYLOC.

(4) Press the F8 key will forward from one RDWYLOC to the next RDWYLOC on the same Item Segment number. Press ENTER key to update or delete data on the screen depending on the transaction type but will not page forward.

(5) Press F3 key will take the user to the FM main menu while press F15 key will take the user back to the SUPERSESS main menu.

After entering the station information, it is important to verify the milepost limits in WPA are still accurate. This can be accomplished by reviewing the WP50 computer screen.

If the project length has changed, the District Work Program Office should be advised to correct the mileposts.

111.3 Contract Plans and BIM Files

The products of the engineering design activities are component sets of contract plans. The major component sets may include:

(1) Roadway

(2) Signing and Pavement Marking

(3) Signalization

(4) Intelligent Transportation Systems (ITS)

(5) Lighting

(6) Landscape

(7) Architectural Plans

(8) Structures Plans

(9) Toll Facilities

Each Utility Work by Highway Contractor Agreement may have a separate phase for each Financial Project Identification Number (FPID). The plan set for each agreement is placed in the back of the contract plans set under the associated FPID.

Modification for Non-Conventional Projects:
Delete the two sentences above and see the RFP.

These component sets, the specifications package, and the pay items list with calculated quantities are assembled and packaged as the construction contract letting documents.

Modification for Non-Conventional Projects:
Delete the sentence above and replace with the following: These component sets and the specifications package are assembled and packaged as the construction contract documents.

BIM files are signed and sealed 2D or 3D CADD files that are included with the contract plans. See ***FDOT CADD Manual***, ***Section 5.16*** for instruction on the development of BIM files.

111.4 Standard Specifications and Special Provisions

The EOR must develop engineering designs that can be constructed, controlled, measured and paid for under the current ***Standard Specifications***.

In the event the work required is not covered by the Standard Specifications or the supplements and special provisions thereto, the EOR must develop a Modified Special Provision (MSP) or Technical Special Provision (TSP) to be made part of the Specifications Package for the project.

See ***FDM 901.3*** for phase submittal requirements.

The approval process for MSPs and TSPs are different, described as follows:

111.4.1 Modified Special Provision

MSPs are used to modify Standard Specifications language to reflect specific project needs not addressed in the applicable Standard Specifications eBook. These should be submitted to the District Specification Engineer as early as practical, but not later than Phase III submittal. After the District Specification Engineer concurs with the changes, the MSP will be forwarded to the State Specifications Engineer for their approval. There is often collaboration between District, Central Office, and the designer prior to approval by the State Specifications Engineer.

111.4.2 Technical Special Provision

TSPs are used for specific elements of construction not covered within the ***Standard Specifications eBook***.

TSPs describe:

- The work to be performed,
- requisite materials,
- construction or installation requirements, and
- measurement and pay item information.

TSPs should be developed and entered into Electronic Review Comments (ERC) as early as practical, but not later than Phase III submittal. ~~TSPs are not to be loaded into ERC with phase submittal documents (i.e., keep these reviews separate).~~

District Specifications and Estimates Office reviewers, and appropriate technical discipline reviewers will provide comments through ERC. The State Program Management Office may assist the district with the review of a TSP, when requested. After the TSP ERC comments have been reconciled, the District Specifications Office will coordinate the required legal review with the (District/Department) General Counsel. After receiving concurrence from the General Council, District Specifications Office will approve the TSP.

In the event the need for a TSP is identified later than Phase III, coordinate with the District Specifications Office to expedite the approvals and concurrence by (District/Department) General Counsel.

Instruction on the preparation of Specification Packages can be found in the ***Specifications Handbook***.

111.5 Pay Items and Summaries of Quantities

Pay Items and Summaries of Quantities are provided in the Estimated Quantities Report (see ***FDM 902***).

Modification for Non-Conventional Projects:
Delete ***FDM 111.5***.

111.6 PS&E Submittal Package

A Plans, Specifications, and Estimates (PS&E) submittal package consists of the final Plans, Specifications, and Estimates, along with any other contract and transmittal documents. ***FDM 131*** provides further guidance on the contents of the transmittal.

Modification for Non-Conventional Projects:
Delete ***FDM 111.6***.

111.7 Project Documentation

The submittal of project documentation is required for all projects. Place required project documents in Project Suite Enterprise Edition (PSEE) within the Design Development Documentation (DDD) Module concurrent with the second PS&E submittal. Place only final documents in this folder structure; do not submit working files or draft documents. Standard file format is PDF; however, an Excel spreadsheet may be placed in the folder structure if protected to prohibit changes.

When the PSEE module is fully populated and no additional plan changes are expected, the Department will lock the Design Development Documentation Module, typically not later than the project advertisement date. Project managers do not inherit the ability to modify the status of the DDD module within the project. This permission is controlled by the district wide permission “Manage Design Documentation Module Status,” and each district should have a policy of how this permission is assigned.

Place PD&E documents in the Office of Environmental Management’s SWEPT (Statewide Environmental Project Tracker) application.

111.7.1 File Naming Convention

Although the filename is limited to 240 characters, the number of characters used should not exceed 48. Filename is not to contain spaces or special characters (!@#$%^&*+). Filenames are not case sensitive; however, the use of uppercase letters to begin each word in the filename is encouraged. Recommended filenames for submitted documents are provided in ***Table 111.7.1.***

Additional document description may be provided using a hyphen before the identifying information, for example:

- TempRetainingWallDesignCalculations-TempRetWall2
- DesignVariation-Sidewalk
- StructuresGeotechReport-MSERetWall
- RoadwayGeotechReport-PondSoilSurvey

111.7.2 Documents

Include the list of documents contained in ***Table 111.7.1*** when the document must be produced to support the development of the contract plans. Include other final supporting documents, reports, or calculations not listed in this table if applicable.

Include any correspondence (e.g., memorandums, meeting minutes, emails) when design decisions are expressed. Assemble a single PDF that contains all applicable documents pertaining to the subject in chronological order. Include document subject in the name using a hyphen (e.g., Correspondence-GreenBikeLanes.pdf).

Table 111.7.1 – Document Summary Table

PSEE Folder	Document Type	Document	File Name
APPROVALS	ICE Report	ICE Report	ICEReport
	Variations-Exceptions	Design Variation Package	DesignVariation
		Design Exception Package	DesignException
		Design Memorandum	DesignMemo
		Project Design Variation Memorandum	ProjectDesignVariationMemo
	Approval Docs	Project Correspondance	Correspondance
		Lane Repurposing Approval	LaneRepurposingApproval
		Federal Aviation Administration (FAA) Determination	FAADetermination
		Intersection Number Request Form	IntersectionNumberRequestForm
		Contract Time Memorandum	ContractTimeMemo
		Permit Exemption Letter	PermitExemptionLetter
		Structure Number Request Form	StructureNumberRequestForm
		Value Engineering Report	ValueEngineeringReport
ROADWAY	Typical Section Package	Typical Section Package	TypicalSectionPackage
	Pavement Design Report	Pavement Design Report	PavementDesignReport
	Roadway Docs	AutoTurn Analysis	AutoTurnAnalysis
		Superelevation Analysis	SuperelevationAnalysis
		Cross Slope Evaluation	CrossSlopeEvaluation
		Barrier Length of Need Analysis	LengthofNeedAnalysis
		Sight Distance Analysis	SightDistanceAnalysis
		Lane Closure Analysis	LaneClosureAnalysis

Table 111.7.1 – Document Summary Table Cont.

PSEE Folder	Document Type	Document	File Name
ROADWAY	Roadway Docs	Work Zone Speed Study	WorkZoneSpeedStudy
		Summary of Pay Items Report	SummaryPayItemsReport
		Cross Section Sheet	CrossSectionSheet
		Transportation Management Plan	TransportationManagementPlan
		Project KMZ File	ProjectKMZFile
		ADA Assessment Report	ADA-AssessmentReport
		Roadway Safety Assessment Report	RoadwaySafetyAssessmentReport
		Roadway Operational Assessment Report	RoadwayOperationalAssessmentReport
		Existing Roadway Characteristics Assessment Report	ERCAR
		Community Awareness Plan	CommunityAwarenessPlan
		Express Lanes Separation Treatment Selection Memo	ELSeparationTreatmentSelectionMemo
DRAINAGE	Drainage Docs	Location Hydraulics Report	LocationHydraulicsReport
		Bridge Hydraulics Report	BridgeHydraulicsReport
		Pond Siting Report	PondSitingReport
		Drainage Report	DrainageReport
		Base Clearance Water Evaluation Report	BaseClearanceWaterEvaluation
		Pipe Inspection Report	PipeInspectionReport

Table 111.7.1 – Document Summary Table Cont.

PSEE Folder	Document Type	Document	File Name
SandPM	SandPM Docs	Attachment to Barrier Calculations	AttachmentToBarrierCalculations
		Multi-Post Sign Report	MultiPostSignReport
		Concept Signing Plan	ConceptSigningPlan
SIGNALS	Signals Docs	Sub-Surface Utility Location Form (mast arm location)	SubSurfaceUtilityLocationForm
SIGNALS ITS	Signals Docs ITS Docs	Signal Warrant Report	SignalWarrantReport
		Signal Analysis Report	SignalAnalysisReport
		ITS Concept of Operations	ITSConceptOfOperations
ITS	ITS Docs	ITS Power Design Analysis Report	ITSPowerDesignAnalysis
		Express Lanes Systems Engineering Management Plan	ELSystemEngineeringManagementPlan
		Express Lanes Concept of Operations	ELConceptOfOperations
LIGHTING	Lighting Docs	Voltage Drop Calculations	VoltageDropCalculations
		Lighting Justification Report	LightingJustificationReport
		Lighting Design Analysis Report	LightingDesignAnalysisReport
		Intersection Lighting Retrofit Report	IntersectionLightingRetrofitReport
		Lighting Agency Coordination	LightingAgencyCoordination

Table 111.7.1 – Document Summary Table Cont.

PSEE Folder	Document Type	Document	File Name
LANDSCAPE	Landscape Docs	Landscape Maintenance Plan	LandscapeMaintenancePlan
		Landscape Maintenance Cost Estimate	LandscapeMaintenanceCostEstimate
		Irrigation Feasibility Report	IrrigationFeasibilityReport
		Landscape Opportunity Plan	LandscapeOpportunityPlan

Table 111.7.1 – Document Summary Table Cont.

PSEE Folder	Document Type	Document	File Name
STRUCTURES	Structures Docs	Bridge Structure Design Calculations	BridgeStructureDesignCalculations
		Temporary Detour Bridge Calculations	TempDetourBridgeCalculations
		Bridge Load Rating Report	BridgeLoadRatingReport
		Temporary Retaining Wall Design Calculations	TempRetainingWallDesignCalculations
		Temporary Shoring Design Calculations	TempShoringDesignCalculations
		Retaining Wall Design Calculations	RetainingWallDesignCalculations
		Overhead Sign Structure	OverheadSignStructureDesignCalculations
		Mast Arm Design Calculations	MastArmDesignCalculations
		Box Culvert Design Calculations	BoxCulvertDesignCalculations
		High Mast Lighting Design Calculations	HighMastLightingDesignCalculations
		Ancillary Structures Report	AncillaryStructuresReport
		Bridge Development Report	BridgeDevelopmentReport

Table 111.7.1 – Document Summary Table Cont.

PSEE Folder	Document Type	Document	File Name
TOLLS	Tolls Docs	Toll Siting Technical Memorandum	TollSitingTechMemo
		Express Lanes Diagrams and Concept Plans	ELDiagramsAndConceptPlans
		Tolls Mechanical Design Analysis	TollMechanicalDAR (required for Toll Equipment Buildings Only)
		Tolls Structural Design Analysis Report	TollStructuralDAR
		Tolls Gantry Design Analysis Report	TollGantryDAR
		Tolls Power Design Analysis Report	TollPowerDAR
		GTR Deviations	GRTDev_XX
ARCHTECTURAL	Architect Docs	Electrical Calculations	ElectricalCalculations
		Mechanical Calculations	MechanicalCalculations

Table 111.7.1 – Document Summary Table Cont.

PSEE Folder	Document Type	Document	File Name
ARCHTECTURAL	Architect Docs	Plumbing Calculations	PlumbingCalculations
		Structural Calculations	StructuralCalculations
		Water Feature Hydraulic Calculations	WaterFeatureHydraulicCalculations
		Civil Site Design Documentation	CivilSiteDesignDocumentation
		Electrical Design Analysis Report	ElectricalDesignAnalysisReport
		Mechanical Design Analysis Report	MechanicalDesignAnalysisReport
GEOTECH	Geotech Docs	Roadway Geotechnical Report	RoadwayGeotechReport
		Sign Structure Geotechnical Report	SignStructureGeotechReport
		Signal Structure Geotechnical Report	SignalStructureGeotechReport
		ITS Geotechnical Report	ITSGeotechReport
		Lighting Geotechnical Report	LightingGeotechReport
		Structures Geotechnical Report	StructuresGeotechReport
		Architectural Geotechnical Investigation Report	ArchitecturalGeotechInvestigationReport

112 Update Engineering Design Process

112.1 General

An update engineering design process is required when nine months or more has elapsed since final contract Plans, Specifications, and Estimates (PS&E) package was completed. The requirements of the update process depend on:

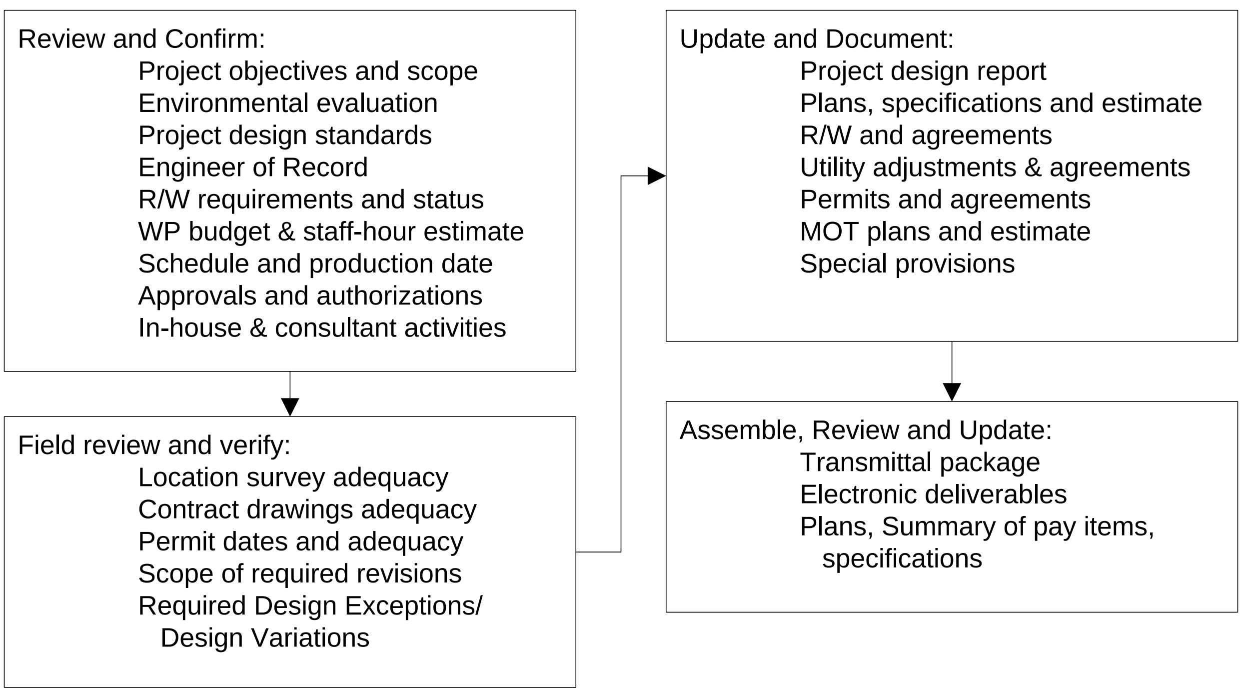
(1) Type of project

(2) Adequacy and appropriateness of the original design controls and standards

(3) Original scope and objectives.

Determining the extent of the update process, as shown in ***Figure 112.1.1***, requires input from both engineering and management.

Figure 112.1.1 Major Activities - Update Engineering Design Process



112.2 Design Update Review and Decision Process

Conduct an engineering review of the PS&E package and supporting documents to determine the activities required to update the package and get it ready for letting.

(1) Review and compare the original project objectives, scope, and standards with current corridor conditions, as well as growth rate and patterns, to determine if the project design is still valid.

(2) Review and compare the original environmental evaluations and commitments against current requirements.

(3) Review and compare the permit date and terms against current requirements.

(4) Review R/W certifications and agreements and confirm the status of documents.

(5) Compare the component plans and BIM files against current requirements, including ***Standard Plans***, ***Standard Specifications***, ***Basis of Estimates***, and design criteria.

(6) Review agreements with outside entities such as Utility Agency/Owners (UAOs), maintaining agencies and local agencies to determine if the agreements are still valid.

(7) Resubmit Design Exceptions and Design Variations with updated documentation based on current data and conditions.

If it is determined that engineering updates are required, the scope, staff-hour estimate, schedule, cost estimate, and other activities described in ***FDM 110*** should be followed to the extent necessary to define the scope and schedule for the update process.

112.3 Updating Engineering Design and Documents

The actual engineering design activities necessary to update the PS&E package will vary from project to project. Develop a fully defined scope of work to determine resources and schedule needed for the update. Fully describe the required activities in the professional services contract if one is to be used.

All reports, calculations, assumptions, and engineering decisions that support changes to the component plans, BIM files, specifications, or other documents must be sealed by the Engineer of Record (EOR) updating the PS&E package. Changes to the component plans and BIM files are approved by the EOR, and require concurrence by the District Design Engineer, District Structures Design Engineer, or District Consultant Project Management Engineer, as appropriate for the type of change. Updated documentation of approvals and concurrences must be in the project file.

112.4 Revised PS&E Package

In addition to the required engineering changes, the contract transmittal package must be reviewed and updated to current status.

(1) All component plans and BIM files are made current and sealed.

(2) Specifications and special provisions are made current and sealed.

(3) The CADD.zip or BIM.zip file is made current.

(4) The Estimated Quantities Report is made current and sealed.

(5) The contract file is made current.

113 Right of Way Requirements

113.1 General

To assist the roadway designer's understanding of Right of Way (R/W) requirements, which must be addressed during the project development and design phases of projects, the following terms are briefly defined as an introduction.

Right of Way is real property or an interest therein, donated or acquired by purchase or condemnation, to accommodate transportation improvements. Fee simple is the strongest interest available to the Department and is sought for most permanent highway facilities. When improvements are designed which will fall outside of the existing R/W boundaries, additional lands must be identified and acquired. All necessary Right of Way and easements must be in Department ownership prior to advertisement of the project for letting.

Limited Access R/W is purchased for facilities such as Interstate and Expressways. This limits public access to interchange connection-points designed with entrance and exit ramps and limits access to motorized vehicular traffic. Pedestrians and bicycles are restricted in the interest of traffic capacity and safety.

Controlled Access R/W is acquired for the remaining State Highway System. This allows the general public and landowners along the corridors reasonable access, but in a controlled pattern that will facilitate the movement of through traffic.

Perpetual Easements grant a right of use over, under or through the property of another. They are used when permanent structures or improvements are to be constructed and maintained on parcels where acquisition of fee title would be impractical; e.g., sight triangles or drainage facilities. Condemnation powers may be utilized to acquire Perpetual Easements.

Temporary Easements (a temporary right of use over, under or through the property of another) are used when it is necessary to temporarily occupy a parcel for a specific purpose such as construction of improvements requisite of the project, construction of temporary detours, stock piling materials or parking equipment. A Temporary Easement may also be necessary when it is determined that reestablishing access causes a compensable impact to the use of the abutting land or causes a safety issue due to a change in grade. No improvement which requires maintenance by the Department beyond the term of the easement can be constructed on a temporary easement.

License Agreements are used to gain access to adjoining properties for sloping, grading, tying in, harmonizing, and reconnecting existing features of the licensor's property with the highway improvements to be constructed. This work is for the benefit of the property owner. The Department does not compensate for license agreements. If the owner refuses to execute the agreement, the Department will not perform the work outside of Department Right of Way.

Licenses are included here as real property interests for convenience, but they are not real property interests. A license, with respect to real property, is a privilege to go on the premises for a certain purpose but does not vest any title in the licensee.

The most economical means of constructing the project should always be the objective. The designer must design the highway facility within the existing R/W, obtain a license agreement, or request acquisition of R/W to accommodate project elements.

113.2 Procedures for Establishing Right of Way Requirements

The procedures for addressing R/W requirements require engineering analyses, economic comparisons, and professional judgments. Consultation with the District R/W Surveyor and District R/W Manager is required. One excellent method of providing the consultation is the "R/W Partnering" concept with all parties that have a vested interest participating in the decision-making process.

Alternate design studies will be required in many locations to determine if additional R/W should be purchased, a retaining wall constructed, or modified slopes and barrier system should be considered. A reasonable estimate of R/W costs or damages expected must be obtained from the R/W Office in order to make such a design study. Alternate construction methods may be shown on the plans as preferred and alternate methods.

113.2.1 Open Cut and Fill Roadway Sections

R/W requirements along the project boundaries are dictated by the actual construction limits plus a reasonable maintenance buffer. The roadway cut and fill slopes, drainage ditch slopes and other construction elements are used to define the construction limits, which are generally shown on the roadway cross sections. R/W requirements are determined by reviewing the plotted cross sections after the roadway and drainage design elements have been established and major revisions are highly unlikely.

A joint field review of the proposed R/W is strongly encouraged and should be conducted at this point. The design details and the property information must be reviewed by the designer, personnel from the R/W Office and the R/W Mapping Office. This review should be scheduled during the Phase II design process as defined in this manual and should address such issues as:

(1) Will additional R/W be required for project access, maintenance of the facility, or transit facility needs? Check pond sites, high embankment slopes, bridges, outfalls, canals, and similar sites.

(2) Can acquisitions be avoided or design modified to avoid substantial damages to remainder property or businesses? Examples include designing retaining walls or by adjusting slopes or grades to reduce the difference in elevation between the remainder and the project grade at the R/W line.

(3) Can the roadway grades be revised or connections relocated so access to the remainders can be constructed without damaging the use of the remainder, thereby minimizing or avoiding severance and business damages caused by altering the access?

(4) Can drainage facilities (e.g., outfalls, ponds, ditches) be maintained without additional R/W space? Can uneconomic remainders be used for stormwater treatment?

(5) Has consideration been given to joint use ponds (including golf course ponds) and/or regional treatment facilities?

(6) Check the suitability and cost effectiveness of storm water treatment facilities and the status of permit approval.

(7) What types of legal instruments are likely to be required to secure the appropriate property rights for the project?

(8) Review the status of R/W activities by others in the project area. Avoid multiple acquisitions from the same owner at ramp terminals, intersections and by future FDOT projects.

(9) Check for potentials of hazardous materials, "4F" parcels, utility easements, landlocked remainders, and parcels, which could be eliminated.

(10) Check for acquisitions involving existing treatment systems which could be mitigated within the FDOT system.

(11) Discuss the possibility of advance acquisition of any parcel where development is imminent.

(12) Check for incidental work which will fall outside of R/W such as trenching, wall forms, or equipment maneuvering space.

(13) Check for availability of offsite property owned by FDOT which could be used for mitigation sites.

(14) Discuss status of any R/W being claimed by maintenance pursuant to ***Section 95.361, F.S.*** (Maintenance Statute).

113.2.2 Curbed Roadway Sections

Establishing R/W requirements for curbed roadway sections will generally follow very similar procedures as the open roadway section projects. The analysis and decision making is complicated by more property owners, generally higher property values, businesses, and more complex access management problems.

The roadway and drainage design must be developed to a point where all major elements of the project (including transit facilities, signalization poles, lighting poles and overhead sign foundations) are firmly fixed. On projects with sidewalks and driveway connections, the design elements can be accurately established only if proper survey data has been obtained for the designer's use. Profile elevations along the proposed R/W line and back of sidewalk and half-sections or profiles at each driveway location should be obtained as a minimum standard practice.

The design engineer must perform the design work required to establish the project profile grades and the back of sidewalk grades to minimize the grade differences at the R/W line. Areas of superelevation must be analyzed very carefully. Split profile grades or other design strategies may be required to accommodate the proposed construction of the facility within minimum R/W limits.

The developed drainage and roadway design elements should be plotted on the plan sheets and the cross sections, which will establish the preliminary R/W requirements along the project boundaries as indicated by the construction limits. A good quality control review and a joint review with R/W appraisers and R/W Mapping personnel at this time will assist in determining the final R/W requirements. The same issues listed earlier in these procedures should be addressed.

113.2.3 Access Management

Access to the Department's facilities is an important element of the design and R/W determination procedures. Follow the Access Management Rules (14-96 and 14-97) and the procedures and directives adopted (***Topic Numbers 625-010-020*** and ***625-010-021***) to implement the objectives of those rules. Identification of access and median opening location in relation to individual parcels should be completed before appraisal.

The following activities should be accomplished by the Designer:

(1) The access classification of the roadway segment and the connection category of the driveways must be determined. The designer must be aware of the nature, type, frequency of trips and number of vehicles utilizing the driveway.

(2) The designer must make a determination as to which driveways are in conformance, which are to be maintained, which are to be closed and which are to be modified to bring them into compliance.

(3) The designer must obtain sufficient field survey data to establish the highway grades, horizontal alignment, and the existing ground elevations in the vicinity of the driveway location. The data necessary to accurately design the driveway connection and determine an acceptable tie-in with the existing surface should be obtained as a minimum.

(4) The designer should develop the most economical driveway design which will conform to the standards and the requirements of the access management objectives. Alternate designs and locations may be required to meet the property needs. Generally, the best option can be reached by negotiating with the property owner and/or tenant in a give and take atmosphere; however, Right of Way must take the lead in such negotiations.

Driveway connections must be addressed in consultation with R/W personnel. This fact should not be overlooked on projects, such as resurfacing, on which there may not be any other R/W requirements. R/W related decisions to be made about driveway connections, probably on a case-by-case basis, include:

(1) License Agreements (LA) are used where restoration of the driveway connection is not necessary to project construction or maintenance of the finished facility. The LA allows the Department entry to the property at no cost in order to harmonize and reestablish the driveway connection. Refusal of the property owner to execute the LA does not unduly affect construction of the project. If refusal would adversely affect the construction of the project, then a Temporary Construction Easement should be used and the engineer should be prepared to testify in court as to necessity.

(2) In the situation where a team consisting of the engineer, the R/W Mapper, the District Right of Way Manager (DRWM), and Legal (or their designees) decides that (1) harmonization and restoration of the driveway connection is likely to cause a diminution in the use of the property, and (2) no taking for the benefit of the project is necessary, then the DRWM must decide on the appropriate method of compensating the property owner, whether by a TCE or some other means.

(3) The Office of R/W will see that the proper instruments are executed to enter onto the property for purposes of construction and to compensate the owner for damages, if any are due. If other acquisition of that property is proposed, these instruments should include the entry and compensation, if any, for the driveway.

(4) If there is no acquisition from a property, yet the property owner feels their property has been negatively affected by a project, the property owner can negotiate or claim damages through the inverse condemnation process.

(5) Design should always, in their consultation with R/W personnel, make a determination if a fee taking or permanent easement is in the public interest to protect the facility. If a permanent easement will protect the facility and still give the owner some utility in the easement area, this may reduce the severance and business damages incurred.

113.2.4 Procedures for Decision Making

To assist in the decision process related to R/W requirements and instruments to be used, the following guidelines from the Office of Right of Way may be used during the joint review process. Close coordination with the District Right of Way Office and the Office of General Counsel is required during this decision-making process.

A License Agreement is the default method for driveway harmonization; use of a Temporary Construction Easement must be justified in terms of project integrity, cost or potential impact of the project on the property.

(1) License agreements should be used only if the following conditions can be met:

  (a) The improvements or changes contemplated have no compensable impact to the use of the property, and are for the sole benefit of the property owner; and

  (b) None of the improvements are required for the construction, operation and maintenance of the transportation facility and removal of or change to the improvements will not be detrimental to the facility.

(2) Temporary Easements should be used under the following conditions:

  (a) When it is necessary to temporarily occupy a parcel for a specific purpose such as construction of improvements requisite of the project, construction of temporary detours, stockpiling materials or parking equipment;

  (b) When it is determined that reestablishing access creates a compensable impact to the use of the abutting land;

  (c) Where grading, tying-in, harmonizing, and/or connecting an access point is required to maintain the safety and design of the facility;

  (d) The contemplated improvements or uses of the property owner's land are required only during the period of construction of the transportation facility;

  (e) Removal or alteration of the improvements to the property owner’s land subsequent to construction would not be detrimental to the facility; and,

(f) After construction is complete, there will be no need for periodic re-entry onto the property by the Department for maintenance or other purposes.

(3) Fee Simple R/W purchase should be used when the following conditions exist:

(a) The planned improvements to the property owner's land are required as a part of construction of the transportation facility;

(b) The improvement on that land must remain in place as a part of the facility; and,

(c) Periodic re-entry to the property is required for maintenance or repair.

Perpetual Easements may be considered as an alternative to fee simple purchase in the R/W process if the owner may continue to enjoy some benefits of the property without impairing the Department's use and the total acquisition costs to the Department are less than the cost of acquiring fee.

113.2.5 Transmittal of Right of Way Requirements

R/W requirements should be finalized before transmitting them to the R/W Mapping Office for preparation of R/W maps. All R/W requirement transmittals should be in writing and clearly indicate in the memo and on the plans which parcels have been finalized and which parcels are still pending. An effort should be made to transmit final R/W requirements in usable segments. Priority should be given to the major, expensive, or complex acquisitions that are going to require more time to acquire and complete the relocation of the occupants. Advanced design effort and final R/W requirement determination may expedite meeting production ready dates. It is desirable to transmit requirements as early as possible in the plans development.

All R/W requirements that are firm (primarily mainline construction limits) should be transmitted by Phase II. All other requirements that generally involve more detailed design completion (e.g., outfalls, pond locations, corner clips, access needs) must be submitted by the Phase III stage completion of the roadway design plans.

All R/W requirements must be transmitted by the completion of the Phase III roadway design plans.

113.3 Process for Establishing Right of Way Requirements

Establishing Right of Way requirements is a design process but requires close coordination with other functions that have input to the project development and design of the project.

The Engineer of Record is responsible and must ensure that representatives from the appropriate functional areas are involved in the determination process. They must also ensure that a review of the final R/W requirements is performed. The "R/W Partnering" concept is an excellent method of ensuring that the proper consultation and input is received.

Generally, the R/W needs-determination will involve Roadway, Bridge and Drainage Design, Permits, Utilities, R/W appraisers, R/W Mapping and Legal functions. On consultant designed projects, the Department project manager's role as lead coordinator is especially critical (See ***Figure 113.3.1***).

113.3.1 New or Major Reconstruction Projects

These projects generally have Project Development and Environmental (PD&E) activities and Right of Way activities identified in the Work Program.

The project development process must address R/W requirements and perform sufficient preliminary engineering design to obtain preliminary cost estimates from the R/W Office. This may require that the PD&E consultant or in-house scope of services include work such as:

(1) Preliminary roadway grades & geometric design.

(2) Conceptual Drainage design and layout.

(3) Analysis of major access management issues.

(4) R/W Survey, property lines and limited topography.

(5) R/W Mapping and property research activities.

(6) Preliminary R/W cost estimates work.

(7) Analysis of the transit, pedestrian/bicycle R/W needs.

This early identification of potential R/W requirements, approximate costs and work effort to complete R/W activities will greatly improve both cost estimates and schedules of projects. Also, involving R/W mapping and appraisers will assist in developing better project alternatives.

R/W requirements identified during the project development phase should not be considered firmly set. The R/W Office cannot be requested to begin R/W mapping or appraisal activities based on these requirements, without extraordinary efforts by the designer to support the acquisition process as in advance acquisition.

113.3.2 Reconstruction Projects with Anticipated Right of Way Requirements

These projects may not have a formal PD& E study, but they were determined during Work Program development to require some R/W acquisition. Most projects will require some environmental re-evaluation effort and all projects should have some preliminary engineering to better define objectives, scope, and R/W requirements. The following general process, as it relates to R/W requirements should be established by design:

PHASE I

(1) R/W Mapping will provide preliminary maps showing properties and all existing R/W lines for the project. These should be requested by the designer or by the Department project manager, on consultant projects.

(2) The roadway designer will define project horizontal and vertical alignment and relate the existing R/W lines to the project as necessary to set R/W limits.

PHASE II

(1) The roadway designer will identify proposed R/W requirements as indicated by the completed design details such as the following:

    (a) Limits of construction slopes for roadway and bridges

    (b) Cross section elements, transit facilities, ditches, curb returns and sidewalks

    (c) Driveway and street connections

(2) The drainage designer will identify proposed R/W requirements as indicated by the completed drainage features, which may include:

    (a) Retention or Detention Ponds

    (b) Mitigation of environmental issues

    (c) Drainage outfalls, sediment basins

    The designer will review all proposed R/W requirements with the R/W Mapping Office. This should be performed during the Phase II design activities in order to make decisions on how each parcel of proposed R/W will be acquired. These decisions will impact which design approach is taken. The issues to be discussed and decisions to be considered are detailed in ***FDM 113.2***.

(3) As R/W requirements are determined, the information is furnished to the R/W Mapping Office by memo documenting clearly which R/W is final and which is pending. The R/W Mapping Office will use only the final requirements transmitted to prepare R/W maps. See ***FDM 113.2.5***.

PHASE III

(1) By the completion of Phase III design, all R/W requirements will be identified and transmitted to the R/W Mapping Office.

(2) After transmittal of final R/W requirements to the R/W Mapping Office, design changes that affect R/W must be coordinated with the R/W Mapping Office, in a timely manner.

The R/W shown on the roadway plans must be in exact agreement with the R/W Maps.

It is essential that close coordination be maintained with R/W personnel in order to ensure that design changes affecting R/W are transmitted promptly.

113.3.3 Projects without an Identified Right of Way Phase

Many improvements to highway projects are intended to be accomplished within the existing R/W. The widening or widening and resurfacing projects are examples. Such projects must be evaluated very carefully and very early in the roadway design process.

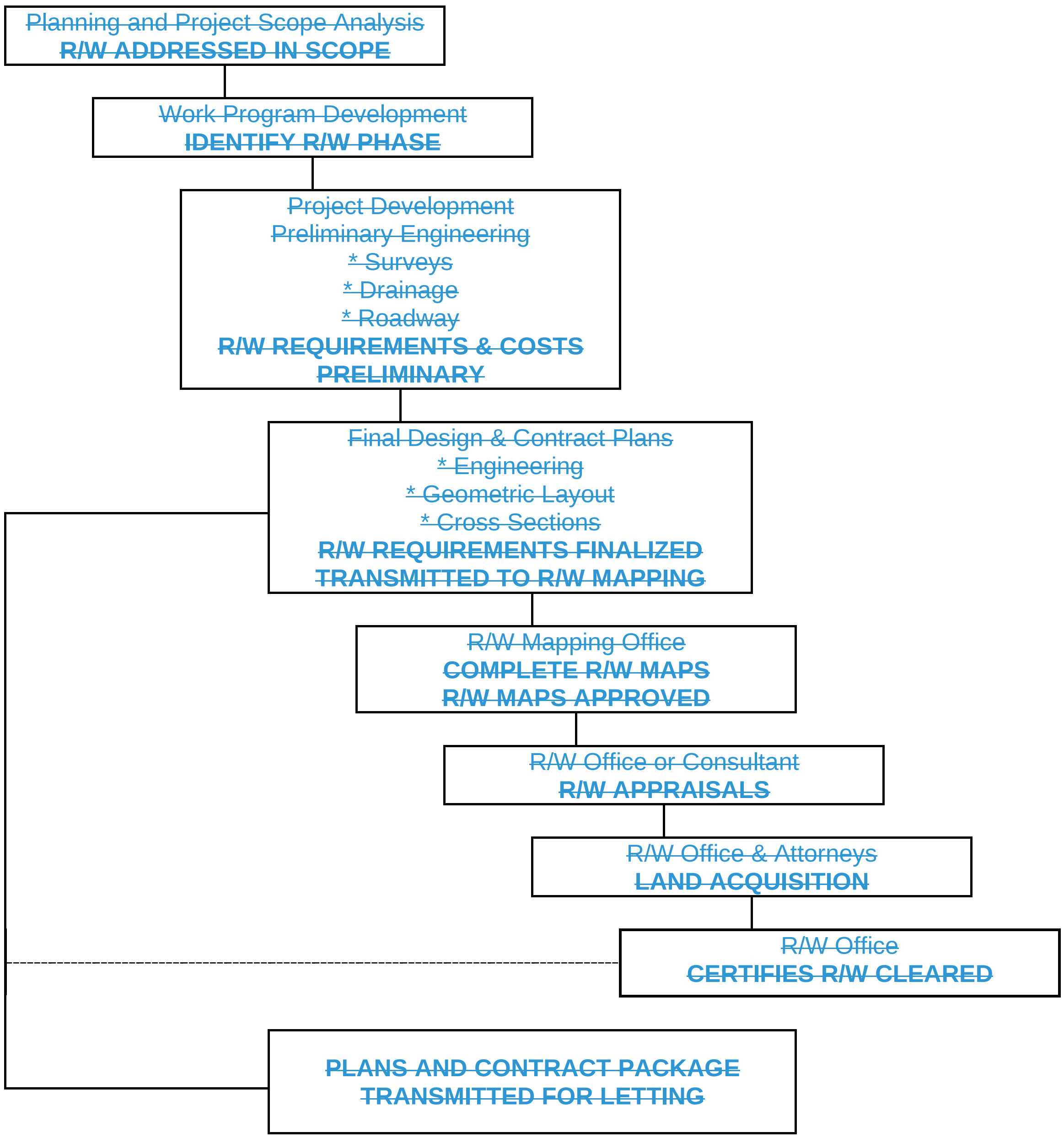
The addition of R/W requirements can have a tremendous impact on the schedule and on the anticipated costs of a highway improvement project. R/W Mapping should be consulted on all projects to ensure that the proposed construction lies completely within the existing R/W and no Trustees of the Internal Improvement Trust Fund parcels or maintenance surveys are required.

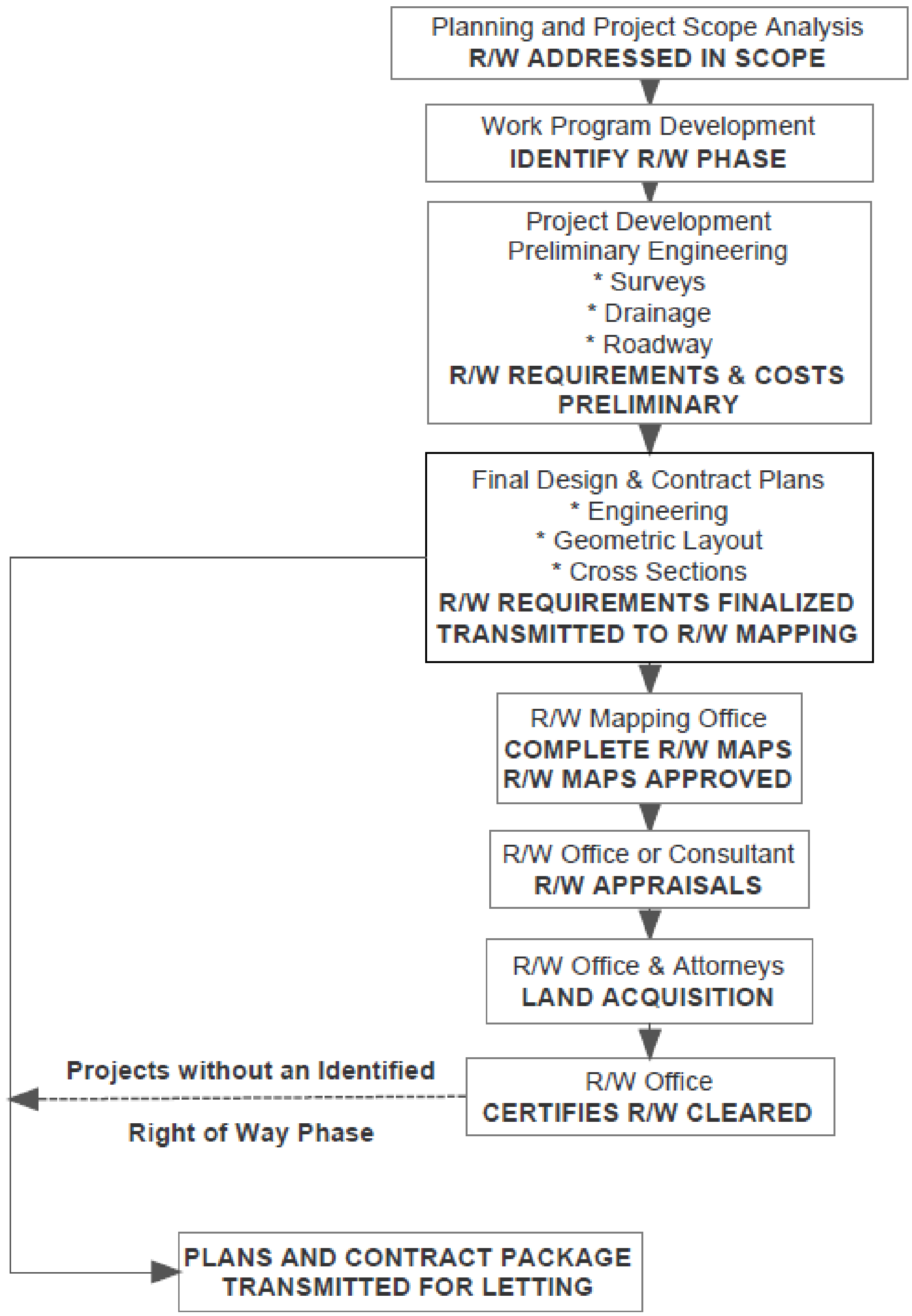
For all projects determined to be completely within existing R/W the Department project manager or District R/W Surveyor as appropriate, must notify the District R/W Manager, in writing, that no R/W is required. This notification will serve as the basis for the District R/W Manager's certification that all necessary R/W is available for construction.

If unanticipated R/W requirements are identified during design, the production management staff, and the R/W Mapping Office should be notified as soon as the requirements are determined. The production management staff will then give direction as to continuing with the design and acquisition. If acquisition continues, it will follow the previously discussed procedures.

Figure 113.3.1 Right of Way Requirements Generalized Process Flow Diagram

(Each function must have well defined written procedures for the development, quality control, coordination, and regular exchange of product evaluation.)




Planning and Project Scope Analysis
R/W ADDRESSED IN SCOPE
Work Program Development
IDENTIFY R/W PHASE
Project Development
Preliminary Engineering
* Surveys
* Drainage
* Roadway
R/W REQUIREMENTS & COSTS PRELIMINARY
Final Design & Contract Plans
* Engineering
* Geometric Layout
* Cross Sections
R/W REQUIREMENTS FINALIZED
TRANSMITTED TO R/W MAPPING
R/W Mapping Office
COMPLETE R/W MAPS
R/W MAPS APPROVED
R/W Office or Consultant
R/W APPRAISALS
R/W Office & Attorneys
LAND ACQUISITION
Projects without an Identified
Right of Way Phase
R/W Office
CERTIFIES R/W CLEARED
PLANS AND CONTRACT PACKAGE
TRANSMITTED FOR LETTING

114 Resurfacing, Restoration, and Rehabilitation (RRR)

114.1 General

Resurfacing, restoration, and rehabilitation (RRR) work is defined as work undertaken to extend the service life of an existing highway and enhance highway safety for all modes of travel. This includes the placement of additional surface materials and other work necessary to return an existing roadway to a condition of structural and functional adequacy. This chapter contains processes and requirements specific to RRR projects necessary to evaluate existing roadways for safety and performance.

The District Safety Engineer and District Safety Administrator must be involved in determining safety needs. Target Speed must be established early in the design process to assist with meeting safety objectives.

114.1.1 Improvements in RRR Projects

RRR projects must meet ***FDM Part 2*** criteria and requirements. In addition, the following must be included in the scope for each RRR project:

(1) Provide improvements recommended by the Safety Assessment described in FDM 114.3.2.2.

(2) Pavement Resurfacing/Rehabilitation.

(3) Modifications necessary to comply with the ***FDM*** requirements associated with the Americans with Disabilities Act (ADA).

(4) Provide paved shoulders.

(5) Improvements to roadside barriers and guardrail necessary to meet minimum standards.

(6) Improvements to bridge rails necessary to meet minimum standards.

(7) Provide Traffic Signal Mast Arms within the mast arm policy area (see ***FDM 232.8***) where existing strain poles require replacement/relocation.

114.1.2 SIS Facilities

Projects on controlled access SIS Corridor and Connector facilities should be designed using new construction criteria. RRR criteria may be applied on a project to the extent permitted by the Action Plan for that corridor, consistent with the schedule for phased improvements to bring the facility up to new construction criteria. For controlled SIS Corridors and Connectors with no Action Plan, RRR criteria may be applied if minimum design speed criteria shown in ***FDM 201*** are met, or a Design Variation or Design Exception for design speed is approved.

114.1.3 Interstate, Expressway, and Freeway Resurfacing

The processes and requirements contained in this chapter are applicable for Interstate, Expressway, and Freeway (i.e., LA Facility) resurfacing projects.

114.1.4 Pavement Only Projects and Ride Only Projects

Pavement Only Projects (POPs) are also known as “Maintenance Resurfacing Projects.” They include milling and resurfacing to restore the functional condition of the pavement but are not intended to increase the structural capacity. For POP pavement design requirements, refer to Chapter 7 of the ***Flexible Pavement Design Manual***.

Ride Only Projects are those where the existing pavement is in good structural condition but is deficient in ride due to the presence of irregularities such as manholes, utility valves, or utility tie-in patches in the wheel path. These projects may entail either an entire resurfacing of the project limits, or spot resurfacing of damaged areas. The intent of Ride Only Projects is to correct the ride deficiency rating.

This chapter does not apply to projects programmed as POPs or Ride Only Projects other than meeting ADA curb ramp and detectable warning requirements. Work Program Instructions, Chapter 27, states that POP projects cannot be on the “high crash list.”

114.2 Planning and Programming RRR Projects

The principal objectives of a RRR project are intended to extend the service life and provide for the needs of the roadway through the next resurfacing cycle, which include:

(1) To preserve or extend the service life of the existing pavement.

(2) To improve multi-modal capacity (without adding continuous through lanes).

(3) To improve multi-modal operating characteristics.

(4) To provide safety modifications that support the Safe System approach (see ***FDM 102*** for definition.)

(5) To provide, to the extent practicable, for expected transportation needs in the corridor based on context classification changes over time.

RRR projects are typically identified and programmed based on projections of deficient pavement condition and are funded under the Department's Pavement Resurfacing program. Districts are tasked with meeting assigned lane mile resurfacing targets. Resurfacing funds are allocated annually to each District based on an estimated cost per lane mile. The amount allocated includes funds necessary for pavement resurfacing, rehabilitation, minor reconstruction, and pavement milling and recycling. Refer to ***Part III, Chapter 27, Resurfacing***, of the ***Work Program Instructions*** for funding resurfacing projects.

Due to limitations on resurfacing funds, improvements other than those necessary to address a safety need or to meet design criteria must be carefully considered before inclusion in the project scope. To ensure that the safety needs of the project are addressed, to the extent feasible, coordination with the District Safety Engineer and District Safety Administrator should be done at the time of scoping. Coordinate early with the DSE and DSA to balance the safety needs, available time and resources to accomplish the RRR and safety needs objectives.

Identify potential modifications to meet anticipated future conditions during the context classification review as part of scoping. This will typically include reviewing local and District plans (e.g., bicycle facilities plan, corridor studies, sector plans, etc.) for desired pedestrian, bicycle, and transit facilities along the project corridor to identify opportunities for improvement as part of the RRR project.

114.2.1 Right of Way (R/W) Acquisition

RRR projects do not typically involve R/W acquisition; however, review RRR projects to determine if additional R/W is required to meet project needs. Conditions that may warrant R/W acquisition include:

(1) Providing pedestrian, bicycle, or transit facilities

(2) Speed management countermeasures

(3) Correcting substandard roadway elements

(4) Meeting access management requirements

(5) Providing new or improved drainage conveyance or treatment facilities

(6) Making intersection improvements (see ***FDM 212*** for conventional intersection criteria and guidance, and ***FDM 213*** for roundabout criteria and guidance)

When R/W acquisition is warranted, the design should be expedited to determine actual R/W requirements. Coordinate the requirements with the District Right of Way Office.

114.2.2 Survey Guidelines

Types of survey work typically included in RRR Projects are as follows:

(1) Mill and resurface only, EOP to EOP, no other improvements [Level 1].

(2) Resurface with trench widening (Roadway only) [Level 1 if lump sum excavation].

(3) Resurface adding turn lanes (spot improvements) [Level 2].

(4) Resurface adding shoulder pavement [Level 2].

(5) Combination of numbers 2-4 [Level 2].

(6) Resurface with access management [Level 2]

(7) Resurface with pedestrian, bicycle, and transit facility improvements [Level 2].

(8) Resurface with cross slope or superelevation correction [Level 2].

(9) Add shoulder pavement only [Level 2 or 3].

(10) (E) Extend drainage structures [Level 3].

(11) (E) Guardrail, end treatments, (safety) [Level 2].

(12) (E) Side drain closure; mitered ends [Level 3].

(13) Intersection improvements [Minor = Level 2; Major = Level 3].

(14) (E) Correct horizontal or vertical alignment [Level 3].

(15) (E) ADA compliance [Level 2].

(16) Approaches to structures [Level 4].

(17) RRR with R/W acquisition [Level 3].

(E) = Element of an item

114.2.2.1 Minimum Levels of Survey Effort

(1) **LEVEL 1**

Review by District Surveyor to check for Public Land Corners. Check sections for cross slope at 1000 feet in tangents. For curves, check 50 feet before PC, at PC, 50 and 100 feet after PC and at middle of curve or 300-foot intervals. (Reverse at PT). May use assumed datum if approved by the District Location Surveyor and the Project Manager/Designer. The cross sections will have a common benchmark elevation throughout the curve. In other words, do not assume an elevation at the centerline of the highway for each cross section. A minimum of two (2) benchmarks should be set off of the highway near the R/W Line and may be on assumed elevations or NAVD 88 datum. If the surveyor elects to use temporary assumed benchmarks, they must last throughout the life of construction and cannot be set in trees, power poles or concrete monuments. Establish begin and end points of project and reference.

(2) **LEVEL 2**

Minor spot improvements such as turn lane at existing crossover or turn lane on 2-lane. No additional R/W required. Where R/W is adequate, establish horizontal and vertical control in the improvement area. May use assumed vertical datum if approved by the District Location Surveyor and the Project Manager/Designer. The cross sections will have a common benchmark elevation throughout the curve. In other words, do not assume an elevation at the centerline of the highway for each cross section. A minimum of two (2) benchmarks should be set off of the highway near the R/W Line and may be based on assumed elevations or NAVD 88 datum. If the surveyor elects to use temporary assumed benchmarks, they must last throughout the life of construction and cannot be set in trees, power poles or concrete monuments. If R/W is constrained, re-establish existing R/W line. Level 1 required throughout other portions of project. Cross section level to be determined by Project Manager/Designer with input from the District Location Surveyor and Resident Engineer. TOPO with supplemental cross sections or elevations in area(s) of deficient criteria or proposed improvement(s). Reference control points outside R/W. Subsurface utility locates if required.

(3) **LEVEL 3**

Continuous improvements through length of project such as widening or paved shoulder; or major spot improvements (structure replacement; major intersection improvement). May require R/W purchase. Horizontal Control baseline, centerline, or network. Vertical Control on NAVD 88. TOPO with supplemental elevations (limits to be determined). Digital Terrain Model (DTM) at specified locations. R/W Control Survey and Maps (if R/W purchased). Subsurface utility locates.

(4) **LEVEL 4**

Full Digital Terrain Model (DTM) and TOPO for entire project.

114.2.3 Public Involvement

Contact the District Public Information Office for information regarding public involvement on RRR projects.

114.3 RRR Design Process

The RRR design process is a team effort that requires familiarity with processes, guidance, criteria, and standards for planning, design, safety, traffic engineering, traffic operations, and maintenance. To ensure all needs are addressed, perform the assessments described in ***FDM 114.3.1*** through ***114.3.11*** below.

114.3.1 Assessment of Design Controls

Set design controls in accordance with ***FDM 201***. Target Speed must be established early in the project development to set the design controls.

114.3.2 Assessment of Existing Conditions

Before beginning design of the project, perform office and field reviews to assess current conditions. The assessment includes both physical conditions, operating conditions, and related local plans and projects.

114.3.2.1 Office Reviews

Review old plan sets, as-built drawings, Straight Line Diagrams, and other historical records to assess many of the existing conditions. Review and identify the project-level Context Classification for any related plans or conditions that could affect the goals of the project.

The existing conditions assessment should include:

(1) Horizontal and vertical geometrics, including intersections.

(2) Existing Typical Section elements.

(3) Radius, length, and superelevation of curves.

(4) Shoulder treatments and side slopes.

(5) Drainage features, including cross drains and drainage structures. Evaluate District Drainage and Maintenance reported drainage issues.

(6) Clear zone or lateral offset, and shielding devices

(7) Location and design of intersections including opportunities for alternative intersection designs where they may improve bicycle and pedestrian safety.

(8) Pavement cross slope and superelevation data.

(9) Pedestrian, bicycle, and transit facilities.

(10) ADA compliant features.

(11) Operating Conditions, including:

  (a) A summary of posted speeds on the project.

  (b) Conditions attributable to current control of access.

  (c) Operational issues along the corridor (e.g., signal timing, detection failure, red light running, queue build-up, speeding, and split failures).

(12) Planning Office review of district and local plans, major permits or projects relating to the project area.

114.3.2.2 Safety Assessment

Perform a safety assessment, resulting in written recommendations. The safety assessment should include:

(1) Evaluation of safety needs identified and documented through the ***Safety Assessment Dashboard***. The Safety Assessment Dashboard is an internal FDOT application accessible only to specific FDOT positions. Coordinate with the District Traffic Safety Engineer to obtain information from the dashboard.

(2) Evaluation of proactive safety countermeasures supporting the Safe System approach.

(3) Identification of significant crash locations, with:

  (a) Determination of possible causes, and

  (b) Recommended modifications, mitigation measures, implementation of speed management techniques, or other safety countermeasures.

(4) Review of correspondence files for letters of public concern.

(5) Review of historic crash and travel statistics.

(6) Identification of safety and mobility measures such as filling pedestrian facility gaps, providing adequate crossing opportunities, correcting deficiencies of bicycle facilities, and improving connectivity of bicycle facilities.

The safety assessment along with written recommendations must be submitted to the District Safety Engineer and District Safety Administrator.

114.3.2.3 Field Reviews

Perform a field review to observe and verify physical, operational and safety conditions including those identified during the office review and safety assessment.

The field review must:

(1) Verify geometric and physical conditions by observing the following:

  (a) Pavement condition including distressed pavement or depressions that may indicate pavement or base failure

  (b) Alignment

  (c) Cross slope and superelevation

  (d) Lane width

(e) Traffic control markings and signs

(f) Side slopes and clear zones

(g) Shoulder type and width

(h) Intersection and bridge elements

(i) Sight distances

(j) Drainage (including erosion or siltation issues)

(k) Highway appurtenances

(l) ADA features

(m) Transit stops

(n) Pedestrian facility connectivity and identification of pedestrian facility gaps and substandard conditions.

(o) Pedestrian and bicycle crossing locations

(p) Bicycle facility connectivity and identification of bicycle facility gaps and substandard conditions.

(q) Nighttime review to observe lighting along corridor, intersections, and mid-block crosswalks.

(r) Signalization

(s) No-passing zone (see ***FDM 230***)

(2) Verify the following operating conditions:

(a) Verify posted regulatory speeds and posted advisory speeds.

(b) Observe reported and suspected problem areas (e.g., signal timing, pedestrian detection, signal head placement).

(c) Evaluate access features.

(3) Verify safety conditions by observing the following:

(a) Known crash locations.

(b) Indicators of lane departure or other unsafe operations (e.g., tire marks on walls or curb, tire tracks on front slope, tire marks encroaching on pedestrian areas, damaged drainage inlet top within curb return, guardrail repairs).

(c) Evidence of informal pedestrian movement paths or improper crossing.

114.3.2.4 Identified Improvements

Coordinate with the District Project Manager, District Design Engineer, District Safety Engineer, and District Safety Administrator for safety related issues with identified improvements necessary to correct deficiencies. Crash analysis should include an examination of needs identified through the ***Safety Assessment Dashboard*** and the identification of proactive countermeasures in support of the Safe System approach.

Identified improvements may include:

(1) Remove, relocate, or make crashworthy roadside obstacles.

(2) Remove unwarranted guardrail.

(3) Upgrade or replace nonstandard guardrail, end treatments and crash cushions.

(4) Replace or retrofit obsolete bridge rails.

(5) Improve side slopes; slope flattening/stabilizing.

(6) Correct shoulder drop-off.

(7) Provide or widen paved shoulders.

(8) Correct pavement cross slope and superelevation.

(9) Provide side drain safety modifications.

(10) Increase sight distance at intersections.

(11) Improve pavement markings.

(12) Improve pavement drainage.

(13) Provide new or replace deficient sidewalks.

(14) Provide transit stops.

(15) Provide new or upgrade existing pedestrian crossings (e.g., midblock crossings, bulb-outs, raised crosswalks, refuge islands).

(16) Provide new or upgrade existing bicycle facilities (e.g., keyholes, conflict markings).

(17) Upgrade railroad crossing approaches.

(18) Provide or upgrade signalization (e.g., leading pedestrian intervals, pedestrian signals, automatic recall, push-button locations, midblock pedestrian signals).

(19) Provide or upgrade lighting.

(20) Upgrade signing and other traffic control devices (e.g., Rapid Rectangular Flashing Beacons, Pedestrian Hybrid Beacons).

(21) Provide or upgrade curb cuts, ramps, and other ADA features.

(22) Reconstruct or close driveways to comply with Access Management standards.

(23) Adjusting corridor speeds to reflect changing development conditions or safety needs (see ***FDM 201.5.1*** for Target Speed on RRR projects).

114.3.2.5 Design Exceptions and Design Variations

Existing features not meeting RRR criteria require processing of a Design Exception or Design Variation for the feature to remain. Refer to ***FDM 122*** for the Design Exception and Design Variation procedures. See also, ***FDM 114.1.1***.

114.3.2.6 Design Documentation

Include in the design file all documentation that substantiates the design process and decisions made. Documentation may include the following information:

(1) A short paragraph which states the overall project purpose. Factors such as principal reason for the project, anticipated project cost, principal work type, general R/W needs or provisions, and any special project priorities are appropriately addressed here.

(2) Documents that detail the existing conditions on the project. Findings of office reviews, field reviews and surveys are assembled here, to document existing geometric and roadside features, operating conditions, traffic volumes, posted speeds, existing pavement markings, signing, and safety. A brief overall summary of findings is recommended.

(3) Document the selected standards based on project intent and conditions.

(4) A summary of safety issues that have been identified for the project and recommended solutions.

(5) Reviews of the project design for safety improvements, documenting what was finally accomplished or ruled out of the project subsequent to the scope of work having been completed.

(6) Those items in the original scope of work for the project which cannot be reasonably accomplished and must be removed or delayed.

114.3.3 Intersections

Evaluate intersections to determine if a traffic engineering study is needed. The following items should be considered:

(1) Traffic Signal Mast Arms or single point attachment span wires within the mast arm policy area where existing strain poles require replacement/relocation. See ***FDM 232.8*** for information on mast arm policy.

(2) Addition of right and left turning lanes.

(3) Realignment of intersection.

(4) Adequate turning radii for left and right turning lanes.

(5) Use of channelization to reduce excessive areas of conflict at large intersections.

(6) Placement of crosswalks as related to sidewalks and stop bars.

(7) Locations of pedestrian, bicycle, and transit facilities.

(8) Need and potential for protected intersection.

(9) Locations of utilities, signal poles, controller cabinets, lighting poles and drainage structures as related to sidewalks and curb ramps.

(10) Warrants for traffic control systems.

(11) Addition of signal backplates where it would not require structural modifications to mast arms or span wire systems. See ***Traffic Engineering Manual (TEM)***, ***Section 3.9*** for use of flexible backplates where needed.

(12) History of angle crashes or observed red-light running.

(13) Addition of auxiliary heads where it would not require structural modifications to mast arms or span wire systems.

(14) Installation of buried conduit for future traffic control systems.

(15) Lighting for intersection illumination.

(16) Adequate line of sight.

(17) ADA needs.

Include corrective measures in projects having T-intersections with overrepresented crash histories or other evidence of safety or operational problems.

When there are proposed changes in intersection control, a roundabout alternative must be considered. See ***FDM 213*** for additional information.

The additional cost associated with improvements requested by local governments that exceed the Department’s criteria should be paid for by the local government making the request (e.g., installation of mast arm signal supports in areas beyond the mast arm policy area).

114.3.4 Drainage

Conduct a site visit to evaluate the physical condition of the existing drainage system and to determine if hydraulic and/or safety improvements are needed. In addition to the site visit, contact the local maintenance office to coordinate these findings and to discuss the drainage history along the section of roadway to be resurfaced. If drainage improvements are warranted, perform the required hydraulic analysis to determine the most cost-effective repair strategy to restore the design intent of the existing drainage system. When siltation is noted during site review, follow the pipe inspection criteria in the ***Drainage Manual***, Chapter 3. The ***Drainage Manual*** ***(Topic No. 625-040-002)*** contains design criteria and methods which provide guidance in formulating suitable drainage features, either through modification or replacement.

See ***FDM 215*** for roadside safety requirements of drainage features.

Consult with drainage and environmental permit specialists when the roadway modifications impact existing ditch cross sectional area, storage and infiltration or increase discharge rates and volumes. Stormwater management, using retention or detention storage, may be required to mitigate for water quality, rate, and volume changes associated with the proposed roadway improvements. The drainage specialist must perform the drainage analysis to determine if improvements are required and must provide the necessary drainage design, flood data information, and all information required to obtain the necessary environmental permits.

114.3.5 Pedestrian, Bicyclist, and Transit

Coordinate with the District Pedestrian/Bicycle Coordinator, the District Modal Development Office, and, as needed, the District Safety Engineer and/or District Safety Administrator when deficiencies in bicycle, pedestrian, or transit facilities are identified during the field review or project development.

114.3.6 At-grade Railroad Crossing

Federal-aid projects must be reviewed to determine if a railroad-highway grade crossing is in or near the limits of the project. If such railroad-highway grade crossing exists, see ***FDM 220*** for requirements.

Review physical and operational characteristics of at-grade railroad crossings for compliance with minimum standards. Discuss identified deficiencies with the District Railroad Coordinator. Resurfacing funds must not be used where the primary purpose is to improve an at-grade railroad crossing.

114.3.7 Lighting

Lighting features must meet the requirements of ***FDM 231***.

Lighting may be installed at specific locations to reduce the effects of ambient light conditions or to improve safety at the following locations:

(1) Busy or high crash intersections or areas

(2) Transit stops.

(3) Channelized intersections.

(4) Car pool parking lots.

(5) Pedestrian and bicycle crossings.

(6) Ramp terminals.

(7) Roundabouts

(8) Midblock Crossings

Coordinate project needs with the District Lighting Engineer.

114.3.8 Signals, Signing, and Pavement Markings

Signal features must meet the requirements of ***FDM 212*** and ***FDM 232***.

Signing and Pavement Marking features must meet the requirements contained in ***FDM 230***. Review and adjust no-passing zone locations as needed on 2-lane roadways in accordance with ***Manual on Uniform Traffic Studies (MUTS)*****, Chapter 11**.

Coordinate project needs with the District Traffic Operations Engineer.

114.3.9 Bridge Structures

See ***FDM 260.9*** for information on evaluating existing bridge structures.

Review bridges in sufficient detail to clearly establish cost effective and appropriate improvements to be included in the project. RRR program funds can be used only for minor bridge improvements; e.g., rail retrofits, ADA improvements.

Bridges that require substantial improvements, or replacement, should be programmed with the appropriate bridge program funds.

114.3.9.1 Pier Protection

The requirements for Pier Protection are outlined in ***FDM 215.***

114.3.10 Roadside Safety Hardware

See ***FDM 215*** for RRR requirements of Roadside Safety Hardware.

114.3.11 Sign, Signal, Lighting, and ITS Support Structures

See ***FDM 261.7*** for information on evaluating ancillary structures.

115 Standard Plans and Standard Specifications

115.1 General

This chapter describes the relationship between the plans development process, the ***Standard Plans for Road and Bridge Construction (Standard Plans)***, and the ***Standard Specifications for Road and Bridge Construction (Standard Specifications)***.

115.1.1 Effective Dates

The ***Standard Plans*** are published annually and are effective based on construction letting dates. The effective dates for each version are provided on the ***Standard Plans*** website. Identify the governing version for each project in accordance with ***FDM 910***. See the ***Structures Detailing Manual*** for additional requirements for bridges.

The ***Standard Specifications*** are published annually and are effective based on construction letting dates.

Modification for Non-Conventional Projects:
Delete ***FDM 115.1.1*** and see the RFP for the governing ***Standard Plans*** and ***Standard Specifications***.

115.2 Standard Plans

The ***Standard Plans*** (formerly referred to as the ***Design Standards***) are standard construction details that are published as sets of Indexes. The ***Standard Plans*** provide consistent designs and details for the preparation of construction contract documents.

Standard Plans are developed with consideration for durability, maintainability, and broad applicability. However, they may not be suitable for use on all projects or site conditions. The Engineer of Record (EOR) must determine the appropriate application of Standard Plans for each project.

The ***Standard Plans*** comprise the latest and best practices of the Department as follows:

(1) Are in compliance with:

 (a) Department criteria, policy, preferences, and specifications,

 (b) ***AASHTO*** publications.

 (c) Federal laws and regulations.

 (d) ***Basis of Estimates***, Approved Products List, and Construction Specification consistency and coordination.

(2) Provide detail clarity and are based on proven designs with considerations for constructability and long-term maintenance.

(3) Reserve structural capacity; redundancy of design.

(4) Clarify material usage.

(5) Promote contractor familiarity.

(6) Standardize formwork for concrete components.

Incorporate the ***Standard Plans*** as appropriate unless a need to develop project-specific designs is documented. Place documentation in the Project Documentation folder; see ***FDM 111.7***.

The ***Standard Plans*** may be supplemented or amended by one or more of the following:

- ***Standard Plans Errata***
- ***Standard Plans Revisions***
- ***Standard Plans Interim Revisions***
- ***Developmental Standard Plans***
- ***Modifications to Standard Plans***
- ***Standard Plans Instructions***
- ***Data Tables***

115.2.1 Standard Plans Errata

The Errata process implements minor changes to the ***Standard Plans*** before the next regularly scheduled version is published (i.e., out-of-cycle). These changes do not affect cost or implementation of the Index (e.g., correcting editorial or typographical errors). Errata are published on the ***Standard Plans*** website next to the Index.

115.2.2 Standard Plans Revisions

Standard Plans revisions are implemented with the regularly scheduled annual version (i.e., in-cycle). These revisions may include additions, updates, corrections, clarifications, or deletions to the ***Standard Plans***. Documentation of ***Standard Plans*** revisions is posted in Revision History sheets on the ***Standard Plans*** website.

115.2.3 Standard Plans Interim Revisions

Standard Plans Interim Revisions (*SPIR*) are changes requiring implementation before the regularly scheduled version of the ***Standard Plans*** is published (i.e., out-of-cycle). The **SPIR** is posted on the website with the version of the ***Standard Plans*** that is specifically affected. Interim revisions are typically incorporated into the proceeding annual publication.

SPIRs are made effective through the release of a ***Design Bulletin***, which includes the revised Index and implementation requirements. When a **SPIR** is applicable to a project, it must be referenced in accordance with ***FDM 910***.

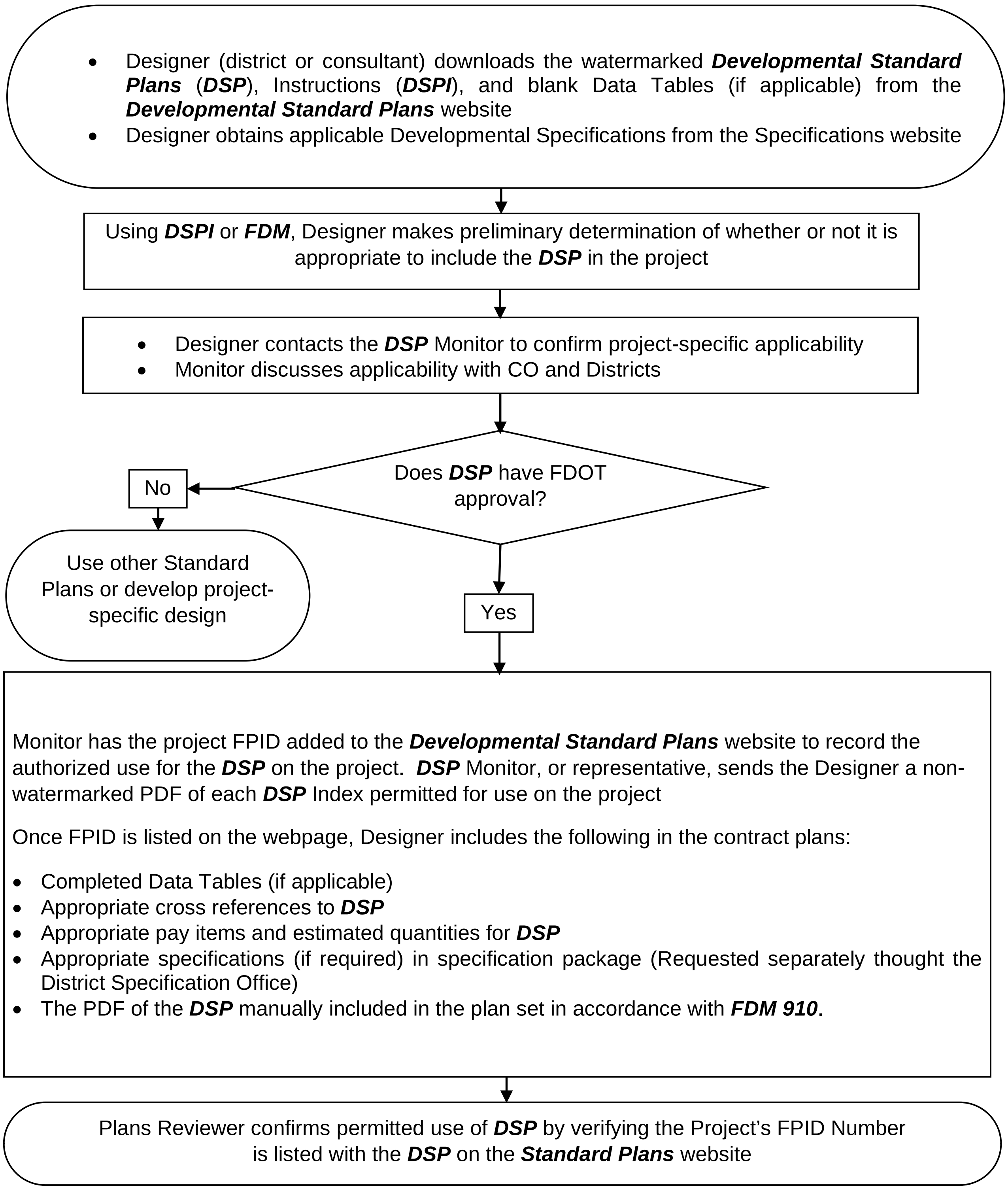
115.2.4 Developmental Standard Plans

Developmental Standard Plans integrate new or innovative concepts into the ***Standard Plans***. A Central Office Monitor is assigned to each ***Developmental Standard Plan***. The Central Office Monitor oversees the development of the Index, monitors the usage process, and makes changes as needed. The use of a ***Developmental Standard Plan*** requires the approval of the Central Office Monitor.

Developmental Standard Plans are typically released with a ***Design Bulletin*** or as part of criteria included within the ***FDM***.

Follow the process illustrated in ***Figure 115.2.1*** when seeking approval to use a Developmental Index. When a project-specific use has been approved by the Central Office Monitor, the project's FPID number is listed on the ***Developmental Standard Plans*** website with the appropriate Developmental Index. Include the Developmental Index in the project plans in accordance with ***FDM 910***.

Figure 115.2.1 Developmental Standard Plans Usage Process



115.2.5 Modifications to Standard Plans

Modifications to Standard Plans may be needed if the ***Standard Plans*** do not meet a project specific need. When this occurs, modifications of a ***Standard Plan*** requires the approval of the District Design Engineer. To facilitate the process, CADD files are available on the ***Standard Plans*** website. When ***Modifications to Standard Plans*** are needed, the modifications must be performed under the direct supervision of a Florida Licensed Professional Engineer and one of the following methods must be used:

(1) **Method 1:** Produce a new project-specific drawing using the details within the CADD files as a guide or template. No reference to the related ***Standard Plan*** is called out in the plans. The details in the plans which were created from the CADD files cease to be a Standard and the engineer responsible for the modifications to the drawings becomes the EOR for the application of the entire design.

(2) **Method 2:** Modify the details and notes within the CADD files for the project-specific requirements. No reference to the related ***Standard Plan*** is called out in the plans. The plans must clearly depict evidence that modifications have been made to the original ***Standard Plan*** to avoid any confusion. It may be appropriate to place a plan note indicating that the details are based on modifications to the original ***Standard Plan***. The details in the plans which were created from the CADD file cease to be a Standard and the engineer responsible for the modifications to the drawings becomes the EOR for the application of the entire design, including the applicability and correctness of the unaltered portions of the CADD file.

(3) **Method 3:** If the required modifications are minor (e.g., modifications to reinforcing, changes to specific sectional details, or accommodations for unique design elements), use the CADD file to create details showing the modifications to the ***Standard Plans*** on a separate sheet in the plans. Include a reference to the related ***Standard Plans*** in the Index of Sheets. Place the modified details in the plans on a sheet entitled, *"Modifications to Standard Plans, Index ### - ###"*. The engineer responsible for the modifications to the ***Standard Plan*** becomes the EOR for the details on this sheet and for effects the modification has on other components within the ***Standard Plans***.

115.2.6 Standard Plans Instructions

The ***Standard Plans Instructions (SPIs)*** provides instructions for incorporating the ***Standard Plans*** into the Contract Plans. ***SPIs*** include design criteria, usage limitations, plan content requirements, and pay item information. ***SPIs*** may also provide examples and sample drawings.

Instructions are organized by ***Standard Plans*** Index number and included on the ***Standard Plans*** website adjacent to the associated Index. Some instructions apply to an entire series of Indexes. Instructions for the Indexes in each respective series are included in the instructions for the lead Index of the series.

It is the responsibility of the EOR using these instructions to determine the applicability of an Index in the design of a project. The inappropriate use of and adherence to these instructions does not exempt the engineer from the responsibility of developing an appropriate design.

115.2.7 Data Tables

Many ***Standard Plans*** require Data Tables that must be completed and included in the plans. The Data Tables provide information that supplements or completes individual ***Standard Plans***. The Data Tables are presented as CADD Cells and are included with the FDOT CADD Software. Modifications of these tables are discouraged.

Current Data Tables can be found on the ***Standard Plans website*** (under "Supporting Documents") when they are not available in the FDOT CADD Software.

Data Tables include a "Table Date" in the upper right corner of each table, and they may include a "Notes Date" for each set of corresponding notes. "Table Date" or "Notes Date" reflect the latest modification of the CADD cell and are not to be changed or deleted. Compare the "Table Date" or "Notes Date" with the ***SPI*** to confirm that the current Data Table is being used.

115.2.8 Local Agency Standards and Details

Local agency standards are permitted on off-system projects for items requested by the local maintaining agencies that differ from the Department's ***Standard Plans***. Use only local agency standards developed by a Florida Licensed Professional Engineer. Usage of local agency standards requires approval of the District Design Engineer.

Use one of the following methods to incorporate local agency standards and details into the Contract Plans:

A. Include as ***Modifications to Standards Plans***, as described above.

B. Add project-specific details and notes based on the local agencies standard into the Contract Plans. The engineer responsible for including these details and notes in the Contract Plans becomes the EOR for the application of the entire design. This option should only be used for items completely independent of the Department's ***Standard Plans***.

C. Attach the local agencies standard(s) (without modification) in the Contract Plans. Only include the standard(s) specific to the project. Insert the local agency standard(s) into the Contract Plans in accordance with the requirements for ***Developmental Standard Plans*** provided in ***FDM 910***. Reference the agency standards where required using plan notes or callouts.

Consider the need for a Modified Special Provision or Technical Special Provision where the local agency standards conflict with, or are not addressed by, the FDOT ***Standard Specifications***. Coordinate the need for project-specific pay items with the District Specifications Office.

115.3 Standard Specifications

The governing Specifications for a project include the ***Standard Specifications*** and any revisions thereto. These revisions typically take the form of Special Provisions, Supplemental Specifications, Modified Special Provisions (MSPs), Technical Special Provisions (TSPs), and Developmental Specifications. Revisions to the ***Standard Specifications*** are compiled into the ***Specifications Package***, which is part of the contract documents.

The process of compiling and formatting the ***Specifications Package*** is described in the Department's ***Specification Package Preparation Procedure*** (***Topic No.: 630-010-005***) and the ***Specifications Handbook***. These documents also include the definitions of the various components and an explanation of the roles and responsibilities of the different individuals involved (e.g., EOR, District, Central Office).

The governing ***Standard Specifications*** for every project must be identified in the plans in accordance with ***FDM 910***.

These publications are available on the State Specification Office website at: ***https://www.fdot.gov/programmanagement/PackagePreparation/Default.shtm***

115.4 Approved Products List (APL) for Local Agency

The local agency may request to use a limited list of products that are a subset of the Department's APL. When requested, include ***Special Provision 6-1.3.1.1*** in the Specifications Package. The Local Agency List will be posted on a separate tab in ***PATH*** and be maintained by the Product Evaluation Office, with coordination between the local agency and the responsible offices.

116 Alternative Intersection and Interchange Review

116.1 General

Alternative Intersection evaluations are governed by the Intersection Control Evaluation process. See the ***Intersection Control Evaluation (ICE) Manual*** for requirements at the following web address:

https://www.fdot.gov/traffic/TrafficServices/Intersection_Operations.shtm

See ***FDM 901*** for Alternative Intersection and Interchange phase submittal requirements.

Alternative intersections and interchanges provide a fresh approach to addressing congestion and safety concerns on the State Highway System. They are typically more complex than conventional designs and there is little guidance available to designers. For these reasons, all proposed Alternative Intersection and Interchange designs require a detailed review early and throughout the design process.

Configurations subject to this detailed review are listed as follows:

- Roundabout
- Median U-Turn (MUT)
- Restricted Crossing U-Turn (RCUT)
- Jug Handle
- Displaced Left Turn
- Continuous Green-T
- Quadrant Roadway
- Diverging Diamond Interchange (DDI)

Include Alternative Intersection and Interchange Review Packages in the Phase I Submittal. Designate a representative of the State Roadway Design Office as a Lead Reviewer for all phases in ERC.

117 Monitor Existing Structures

117.1 General

Monitor Existing Structures includes settlement, vibration, and groundwater monitoring of existing structures during construction as described in ***Standard Specifications, Section 108***. Monitor Existing Structures pay item numbers are lump sum; see the ***Basis of Estimates Manual*** for additional information.

For Department (in-house) design projects, the Department PM should work with appropriate district staff to identify and determine the structures that are to be monitored.

For Consultant design projects, the Consultant PM is to provide to the Department PM a list of structures that warrant consideration for monitoring. The Department PM will work with appropriate district staff to make a final determination of the structures that are to be included.

117.2 Inspection and Settlement Monitoring

Inspection and settlement monitoring (pay item 108-1) is primarily used to mitigate the risk for damage occurring to an existing structure due to settlement of the foundation. Structures considered for settlement monitoring typically include buildings, bridges, retaining walls, and other facilities such as historic features or swimming pools. This pay item is typically not used for Department owned structures, but should be considered for existing bridges for bridge widening projects.

If a determination is made to monitor an existing structure, include pay item 108-1 in the Estimated Quantities (EQ) Report in the Summary of Lump Sum Items table.

117.2.1 Miscellaneous Structures

Activities that may cause harm to existing structures include the construction of foundations for mast arm signal poles, strain poles, cantilever signs, overhead truss signs, high mast lighting, and ITS poles.

Because ***108-2.1*** of the ***Standard Specifications, Section 108,*** does not provide prescribed distances for Miscellaneous Structures, all structures that are to be monitored must be listed in a pay item note on the General Notes sheet; see ***FDM 117.5***.

117.2.2 Structures Other Than Miscellaneous Structures

Activities that may cause harm to existing structures include the excavation of deep foundations, extraction of existing piles, sheet piling and temporary casing installations, and pile driving operations associated with bridge or retaining wall construction.

MSE walls and bridges founded on short piles, shallow foundations, or timber pile foundations are vulnerable to these operations.

Structures that are to be monitored that are beyond the distances specified in the ***Standard Specifications***, ***Section 108***, must be listed in a pay item note on the General Notes sheet; see ***FDM 117.5***.

117.2.3 Roadway Compaction Operations

Activities that may cause harm to existing structures include embankment and asphalt vibratory compaction.

Do not include inspection and settlement monitoring (pay item 108-1) for roadway compaction operations when a note is included in the plans requiring non-vibratory compaction mode near any structure recommended for monitoring.

Structures that are to be monitored that are beyond the distances specified in the ***Standard Specifications***, ***Section 108***, must be listed in a pay item note on the General Notes sheet; see ***FDM 117.5***. It is typically not necessary to monitor structures beyond the distances specified in the ***Standard Specifications, Section 108***.

117.3 Vibration Monitoring

Vibration monitoring (pay item 108-2) is primarily used to mitigate the risk for interfering with the intended use of an existing structure. Structures considered for vibration monitoring typically include buildings in which sensitive business operations are conducted: e.g., eye surgery, medical treatments, rehabilitation operations, recording and broadcasting operations, places of worship, antique shops, or museums.

This pay item is not typically used for residential properties, storage facilities, retail and grocery stores, warehouse and distribution centers, or other similar structures where sensitive business operations are not conducted. This pay item should not typically be used for Department owned structures.

Activities that may warrant vibration monitoring include pile driving, sheet pile and casing installation, and embankment and asphalt vibratory compaction.

Do not include vibration monitoring (pay item 108-2) for embankment and asphalt compaction operations when the risk of interfering with the intended use of a structure is mitigated by including a note in the plans that:

(1) Restricts hours of construction activities (to non-business hours).

(2) Requires non-vibratory compaction mode.

If a determination is made to monitor an existing structure, include pay item 108-2 in the EQ Report in the Summary of Lump Sum Items table. Because ***Standard Specifications, Section 108,*** does not provide prescribed distances for Vibration Monitoring, all structures that are to be monitored must be listed in a pay item note on the General Notes sheet; see ***FDM 117.5***.

117.4 Groundwater Monitoring

Dewatering operations has the potential for lowering the groundwater elevation in or above compressible soils supporting a structure which can cause that structure to settle. Groundwater monitoring for this purpose is not common and is to be used only when concurred with by the District Geotechnical Engineer.

If a determination is made to monitor an existing structure, include pay item 108-3 in the EQ Report in the Summary of Lump Sum Items table. Because ***Standard Specifications, Section 108,*** does not provide prescribed distances for Groundwater Monitoring, structures that are to be monitored must be listed in a pay item note on the General Notes sheet; see ***FDM 117.5***.

117.5 Pay Item Notes

The following are examples of pay item notes. Notes are included in the plans only when ***Standard Specifications, Section 108,*** does not provide prescribed distances, or when a structure is beyond the prescribed distances.

108-1 In addition to the requirements of ***Standard Specifications, Section 108***, provide Inspection and Settlement Monitoring for the following structures:

- Church located at 3750 County Road 220 during pile driving operations.
- Historic cemetery stone archway entrance located at Sta. 1327+60 Lt. during foundation construction for mast arm signal pole.
- Existing I-95 Bridge over NW 6th Ave, piers 1 through 6, during pile driving operations for bridge widening.

108-2 Provide Vibration Monitoring for the Walk-in Medical Clinic located at 3326 Byron Road during pile driving operations.

108-3 Provide Groundwater Monitoring for the commercial building located at Sta. 840+25 Rt. during dewatering operations.

120 Design Submittals

120.1 General

The design process will require various submittals to transfer technical information and decisions between the Engineer of Record (EOR), Department personnel, and functional areas. The Department Project Manager is responsible for the adequacy of the submittals or requests and for the coordination of reviews between the Department and the EOR. Each district office head (including Construction and Maintenance) should assume direct responsibility for assigning reviewers and meeting the review schedules. The contract scope of work should list the information to be furnished by FDOT functional areas and submittals (number and type) required of the EOR.

During the design process, various items of information may be required from different sections or departments. ***Figure 120.1.1,*** shown on the following page, is a partial list of functional areas with typical submittals and requests. Plans phase submittals include component plans and BIM files.

Figure 120.1.1 List of Requests and Contacts
Sheet 1 of 2

A) Planning

Request pavement design (18 Kip ESAL)
Request project traffic data
Request turning movements for intersections
Request updates of project traffic data (as needed)
Request Context Classification
Railroad contact (Phase I and III)
Plans transmittal letter data (railroad)
Notification that projects is in vicinity of a traffic monitoring site

B) Traffic Plans/Traffic Operations

Request turns and counts for intersection design
Notification that projects include milling
Signing & pavement marking plans (Phase I, II, III)
Traffic signal plans (Phase I, II, III) & signal warrant
Lighting plans (Phase I, II) & justification report
Pedestrian and bicycle project traffic
Safety/crash analysis and recommendations
Operational and capacity review of design plans

C) Geotechnical

Request pavement design soil information
Request roadway soil survey
Soils data
Request foundation investigations
Request dynaflect testing
Phase III review if unsuitable soils exist.
Soils and foundation recommendations
PH and soils resistivity for culvert material selection
Request pavement composition and milling recommendations
Review if any changes are made in alignment, grade, or typical section.
Bridge Geotechnical Report

D) Surveying and Mapping

Request survey

E) Drainage

Request grade and high-water review
Conceptual drainage plan & assumptions
Bridge Hydraulics Report
Request drainage design
Request final drainage review
Permit review
Stormwater Runoff Control Concept

F) Maintenance

Pavement design comments
Phase I Plans review & response
Phase II Plans review & response
Phase III Plans review & response

G) Construction

Pavement design comments
Phase I Plans review & response
Phase II Plans review (constructability) & response
Phase III Plans review (biddability) & response
Submit traffic control plan request
Contract time

H) R/W Surveying and Mapping

Submit title search request
Request existing Right of Way maps
Transmit Right of Way requirements
Final Right of Way check
Plans transmittal letter data

I) Utilities

Preliminary (First) contact (Phase I)
Pre-Design conference and contact (Phase II)
Final contact (Phase III)
Horizontal and vertical verification of utilities
Plans transmittal letter data (utilities)
Number of sets of final prints for utility companies

Figure 120.1.1 List of Requests and Contacts
Sheet 2 of 2

J) Estimates and Specifications
Preliminary estimate (LRE)
Preliminary estimate (Phase I)
Preliminary estimate (Phase II)
Preliminary estimate (Phase III)
Complete estimate (Phase IV)

K) Right of Way Department
Project schedule updates as needed
R/W estimates as needed
Pre-Proposal appraisal conference
Field questions from R/W agents as needed
Plans transmittal letter data
Phase I Plans Review (by Appraiser)
Phase II Plans Review (by Appraiser)
Phase III Plans Review (by Appraiser)
Phase IV Plans Review (by Appraiser)

L) FHWA (if Project of Division Interest (PoDI)
Phase I Plans review & response
Phase II Plans review & response
Phase III Plans review & response
Phase IV Plans review & response
Submit for typical section approval
Submit for pavement design approval
Submit Design Exception request letters
R/W review

M) Value Engineering ($25,000,000+)
Phase I & II reviews

120.2 Design Documentation Submittals

Certain engineering processes require the submittal of information to specific Department personnel for the purpose of making timely decisions and confirming project objectives. Submittals will take place as these activities are completed so that issues do not go unresolved before subsequent activities begin. The following are submittals that should take place during initial engineering. Ideally these engineering type submittals are done in lieu of traditional phase plans reviews.

120.2.1 Field Survey Data

Evaluate the following typical field survey data for sufficient breadth and accuracy to complete the proposed design. Bring deficiencies to the attention of the Department.

(1) Design location survey data including horizontal and vertical control, alignments, reference points, utilities, natural and manmade features, and topography or general shape of the terrain.

(2) Digitized aerial survey data, especially for large areas such as drainage maps. Drainage design survey data from site inspection and historical records.

(3) Right of Way and related property (land) survey data, including property owners and acreage.

(4) Geotechnical studies and foundation and soils report, including physical properties and classifications of soils, together with recommendations related to foundations, pavement, and drainage design.

(5) Bridge data sheet surveys, channel alignment survey data, and bathymetric data.

120.2.2 Traffic Data

In the development of roadway plans, traffic data is used to justify:

- Number of through lanes,
- Geometric improvements to intersections,
- Traffic signal timings, and
- Pavement design.

The number of through lanes is usually determined during the project development phase, based on Annual Average Daily Traffic (AADT) and factors included in the typical section. Vehicular traffic data shown on the plans Typical Section sheet includes:

- AADT for the following:
  - Current Year (refers to when the traffic data is collected),
  - Opening Year (as defined in the FDOT Project Traffic Forecasting Handbook), and
  - Design Year (as defined in the FDOT Project Traffic Forecasting Handbook)
- Design hour factor (K is the Department's Standard "K" factor as defined in the FDOT Traffic Forecasting Handbook),
- Directional distribution (D is the percent of two-way peak-hour traffic that occurs in the peak direction), and
- Truck factors (T is the percent that trucks constitute of vehicular traffic) for the peak hour and a 24-hour period.

The source and methods used to produce this data must be documented.

120.2.2.1 Traffic Counts

Intersection improvements and signal timings require additional information on turning volumes. The ***FDOT Project Traffic Forecasting Procedure*** ***(Topic No.: 525-030-120)*** describes the input data required, explains the procedure to forecast turning volumes, and provides examples. A Project Traffic Report will be required. Traffic counts provide input on the number of motor vehicles, bicycles and pedestrians using an intersection. At proposed (non-existing) major intersections, turning volumes are estimated using transportation planning models or other means. Forecasts provide designers the information required to determine the need for turning lanes, turning bay length, signal timings, and pedestrian crossings. Also, the designer establishes Right of Way requirements based on documented needs to satisfy design year volumes.

120.2.2.2 18-kip Equivalent Single Axle Loads (ESAL)

In pavement design, the designer requires AADT forecasts for the year a project opens to traffic and for the design year. AADT, together with percent trucks (24-hour period) and other factors used by the Department, provides information on the pavement loadings (18kip ESAL) used in pavement design. The FDOT Project Traffic Forecasting Procedure provides additional information.

120.2.3 Typical Section Package

The purpose of the typical section package is to establish and document the following:

(1) Project Controls

(2) Typical Section Elements

- Lanes (width and cross slope)
- Curbs (for curbed roadways)
- Median (for divided roadways)
- Shoulders (paved and unpaved)
- Front and back side slopes, including roadside ditches
- Border and clear zone
- Bicycle and pedestrian facilities.

(3) Traffic Data

(4) Potential Design Variations and Design Exceptions related to the typical section.

Prepare a typical section package for projects that alter cross section elements and for resurfacing projects. The typical section package must be prepared and sealed by the EOR. The 11” x 17” report format is available in the FDOT CADD Software for the development of typical section packages.

The Typical Section Package consists of a cover sheet and proposed typical section sheet(s). See ***Exhibit 120-1*** for an example of a cover sheet and ***Exhibits 120-2*** through ***120-4*** for examples of typical section sheets.

120.2.3.1 Approval Process

The completed Typical Section Package is signed and sealed by the Engineer of Record (EOR) with concurrence from the following as needed:~~. Concurrence signatures must be obtained prior to sealing (typically obtained using DocuSign), including:~~

- District Design Engineer: design, posted, and target speeds and typical section
- District Traffic Operations Engineer: design, posted, and target speeds
- FHWA Transportation Engineer: typical section
- District Structures Engineer: bridge typical section elements
- District ISD Manager: Context Classification and target speed

Projects with PD&E Phase:

The typical section package is prepared by the PD&E EOR as part of the Project Development & Environment (PD&E) process. The Typical Section Package is processed after the preferred alternative is selected. Include a copy of the approved Typical Section Package as part of the PD&E Final Preliminary Engineering Report.

Projects without PD&E Phase:

For projects that do not contain a PD&E phase, or if significant changes occurred during the design process, a Typical Section Package is prepared by the Design EOR. The Typical Section Package should be approved by the Department prior to the Phase II plans submittal.

120.2.3.2 Cover Sheet

The Cover Sheet contains the following:

(1) Project Identification: Place the Financial Project ID number(s) immediately under the heading "TYPICAL SECTION PACKAGE" at the top of the sheet. When the project involves Federal funds, place the words "(Federal Funds)" under the Financial Project ID. Place the county name and roadway section number associated with the Straight-Line Diagrams under the Financial Project ID or “(Federal Funds)”. Include a description of work type under the state road number.

(2) Project Work Limits and Features as explained in ***FDM 910.2.2***.

(3) Project Location: Show a small-scale state map at the upper right portion of the Cover Sheet and indicate with leader line the general location of the project within the state.

(4) PD&E or Design EOR Signature Block: See ***FDM 130*** for requirements.

(5) Sheet Index: Provide an index of sheets listing all sheets contained in the package that the EOR is responsible for.

(6) Typical Section Concurrence: Concurrence from the District Design Engineer for all typical sections is required. Other concurrence signatures may be included:

   (a) District Structures Design Engineer for bridge typical sections

   (b) County or City Engineer for local roadway typical sections.

   (c) Concurrence of the typical section elements by the FHWA Transportation Engineer is required on Projects of Division Interest (PoDI). Refer to ***FDM 128*** for additional information concerning PoDIs.

(7) Design Speed and Posted Speed Concurrence: The District Design Engineer and District Traffic Operations Engineer will discuss and agree to the posted speed. The selected design speed will be jointly approved by the District Design Engineer and the District Traffic Operations Engineer with a declaration that the posted speed is not expected to exceed the selected design speed.

(8) Context Classification Concurrence: Context classification is determined by FDOT district staff on all projects. Coordinate with the FDOT Project Manager to obtain context classification(s). Concurrence from the District Intermodal Systems Development (ISD) Manager or Planning and Environmental Management Administrator for the context classification assigned to each typical section is required.

(9) Target Speed Concurrence: The District Design Engineer, District Traffic Operations Engineer, and District Intermodal Systems Development Manager will discuss and agree to the Target Speed.

120.2.3.3 Typical Section Sheet

The Typical Section sheet contains a data box that provides the Project Controls, and the cross-section view showing the proposed typical section. Provide a Typical Section sheet for each proposed typical section. The only gaps between the begin and end Project Limits should be Project Exceptions. Other than the primary State Road typical section, additional typical sections may be required for the following conditions:

- A change in the number of through lanes, or a change in Project Controls
- Change in facility type (e.g., flush shoulder roadway to curbed roadway)
- Intersecting roadways when significant work length is required
- Toll sites (ramp and mainline) representing the required 100 feet of loop pavement underneath the toll gantry.
- New, widened, or modified bridges.

Project Controls:

Indicate Project Controls that apply to the typical section being shown as follows:

(1) Context Classification: Indicate the applicable context classification.

(2) Functional Classification: Indicate the type of facility.

(3) Highway System: Indicate the applicable highway system(s) for the roadway.

(4) Access Classification: Indicate the degree of access for the roadway.

(5) Criteria: Indicate the type of construction.

(6) Potential Exceptions and Variations: List non-compliant typical section elements related to the typical section.

When the typical section limits contain one or more applicable project control, list each project control with the limits to which it applies. This is an acceptable practice only when changes in project control do not affect the typical section elements being shown.

Typical Section:

Display the proposed typical section in the center of the cross-section view panel. The FDOT CADD Software provides typical section templets that can be modified to reflect the conditions of a particular project. Typical sections are not created to scale, but the horizontal dimensions should be proportionate.

Show all required typical section information contained in ***FDM 913.2,*** except:

(1) Show and label Border Width (required only for new construction and reconstruction projects) and Clear Zone (required only for flush shoulder roadway).

(2) Do not include Typical Section Notes and Details.

(3) Do not include Partial Sections.

(4)

~~(3)~~ Do not include pavement construction dimensions and labels.

Place below each typical section the name of roadway and station or Mile Post (MP) Limits. Assumed beginning MP or station (e.g., MP 0.000 at point of intersection) may be used for local roads.

Provide the following Traffic Data on the lower left portion of the plan view panel:

(a) Current Year and AADT

(b) Estimated Opening Year and AADT

(c) Estimated Design Year and AADT

(d) K, D, T (24-hour) factors.

(e) Design Hour T factor

(f) Design Speed, Posted Speed, Target Speed

Exhibit 120-1: Typical Section Package

Exhibit 120-2: Typical Section Package

Exhibit 120-3: Typical Section Package

Exhibit 120-4: Typical Section Package

120.2.4 Preliminary Drainage Design

On projects where the drainage design is a critical element the following items should require a preliminary submittal:

(1) Determination of water elevations affecting the roadway grade. These include base clearance water elevations and design flood elevations.

(2) Pond Siting Report.

(3) Documentation of preliminary drainage coordination with permitting agencies

(4) Information that is essential to proper evaluation of drainage design concepts such as seasonal high ground water, soil types, existing cross drain peak design stages, historical pavement failure, floodplain elevation, present water elevations, and drainage areas.

(5) Documentation of coordination with the Landscape Architect and District Maintenance Engineer regarding aesthetics, including the accommodation of existing and proposed trees, particularly where additional R/W or Design Exceptions or Design Variations may be required.

120.2.5 Preliminary Geometry and Grades

On projects where connections to the facility make grades a critical element, back of sidewalk profiles, project profile grades, determination of water elevations affecting the roadway grade, and driveway and side street geometry should require a preliminary submittal. The Department may require the designer to present the project geometry and grade to a geometry and grade technical review team to encourage productive dialogue and proper communication regarding these design issues. If a bridge exists within the project limits, the early input of the structural designer as to approach grades and clearance needs should be coordinated to ensure proper bridge design.

120.2.6 Preliminary Traffic Control Plan

On projects where the traffic control plan is a critical element the following items should require a preliminary submittal.

(1) Typical sections of each construction phase with information that is essential to proper evaluation of each construction phase; e.g., location and nature of proper construction drainage; regulatory speed; location of work zone; proposed traffic control devices; number, width and location of maintained traffic; maximum drop-off; maintenance of existing lighting.

(2) Documentation addressing possible innovative construction techniques; e.g., need for temporary detours, hazardous material excavation, temporary structures.

(3) Documentation of coordination with the local community; e.g., city and county transportation engineers, businesses, police, hospitals, civic centers or arena operations, fire department, schools, mass transit.

(4) When a temporary bridge is used, the designer must coordinate with the State Bridge Evaluation Engineer in Tallahassee (Office of Maintenance) to ensure that a detour route for overweight vehicles is included in the plans. If no detour route is available, the temporary bridge may have to be designed to support multi-trip overweight vehicles.

120.2.7 Pavement Selection and Design

The pavement selection and design should be completed as early in the process as possible. The Rigid and Flexible Pavement Design Manuals are available through ***Pavement Management Publications***.

The final version (non-signed and sealed) of the Pavement Design Package should be submitted and reviewed prior to submitting the Phase II plans. The Phase II plans submittal should incorporate the resolution of comments from the final version Pavement Design Package review. The signed and sealed Pavement Design Package should be approved by the Department prior to the Phase III plans submittal.

120.2.8 Preliminary Utilities

On projects where utility coordination is a critical element, the following early involvement activities should be required.

(1) Prior to Phase I plans submittal, early involvement can be obtained by coordinating a review of the utility information in the topographic survey. This review may be accomplished by distribution of the topographic survey to all Utility Agency/Owners (UAOs) through the District Utility Office for mark-ups and confirmation of existing facilities.

(2) Once the designer has reviewed the early topographic survey mark-ups a meeting should be held with the UAOs, District Utility Office and the designer to discuss errors, omissions, and future plans of the utilities already identified within the corridor. This will allow the designer the ability to prioritize which utilities will ultimately impact the design.

120.3 Structures Submittals

Structures design elements go through decision-making reviews at various stages of the design as listed below:

120.3.1 Coordination of Structural Design - (Bridges and Retaining Walls)

Requests for structural design should include roadway plan and profile sheets showing horizontal and vertical alignment and cross sections within 500 feet of each end of the bridge or ends of retaining walls. Horizontal curvature that is on or near the end of the bridge or retaining wall must be shown. Nonstandard superelevation transition details or other special profiles must be included if any part or all of the transition is on the bridge or wall. The approved proposed typical section is required.

Provisions for access to property near the end of bridges and adjustments to avoid costly Right of Way takings should be resolved.

120.3.2 Bridges

Bridge design begins when the Phase I bridge geotechnical report is complete and proceeds on a schedule which allows simultaneous review of the final (90%) bridge plans and the Phase III roadway plans. All structures design work is coordinated through the District Structures Design Engineer or the State Structures Design Office in the Central Office, depending on the category or complexity of the structure. Determine the typical section of the facility crossing, the horizontal and vertical clearance requirements, and the profile grades prior to beginning structures design. For complete details and requirements for structural designs and plans preparation, the reader is referred to ***FDM 121*** and the Structures Detailing Manual issued by the State Structures Design Office.

Generally, the completion and review of bridge designs are accomplished in the following phases:

(1) BDR/30% Structures Plans

(2) 60% Substructure Submittal / 60% Structures Plans

(3) 90% Structures Plans

(4) 100% Structures Plans

These reviews should be coordinated with the phase reviews of the roadway plans. Submit the latest set of structural plans with the Phase II roadway plans submittal. This joint submittal at Phase II roadway plans review is to ensure that roadway and bridge structures plans are consistent; i.e., widths, superelevation transitions, vertical and horizontal alignment, and work zone traffic control agree. The precise number and type of plans submittals depends on the complexity of the design and the sensitivity of the project. Each submittal must include written responses to the comments received on the previous submittal.

Modification for Non-Conventional Projects:
Delete ***FDM 120.3.2*** above and replace with the following: **120.3.2 Bridges** For bridge submittal requirements see RFP and ***FDM 121.***

120.3.3 Other Structural Submittals and Reviews

In addition to bridge plans, structures plans may include retaining walls, sheet piling, noise barriers, box or three-sided culverts, pedestrian overpasses, temporary bridges, and special structural appurtenances. Special structural appurtenances that include transit related furnishings and amenities would require review by the local transit agency.

For projects where bridges and other structures plans are involved, preliminary and final plan submittals (usually along with bridge plans) should be handled according to the instructions for structures plans submittals covered in ***FDM 121*** and ***FDM 262***.

For projects where retaining walls are required along with roadway plans (no bridge in the project), follow the procedure outlined in ***FDM 262***. The submittal of detailed control plans should occur as early in the design process as possible.

120.4 Plans Phase Reviews

The number of submittals and phase reviews is determined on a project-by-project basis and defined in the scope. Submittals allow functional areas to review the development of the project as contained in the scope.

Formal plans phase review requirements are covered in the District Quality Control Plan. Reviews should include Department personnel that can assist in making timely decisions and confirm that the requirements have been met for their discipline. Reviews are driven by the engineering process and occur when input or a decision is needed. Some of these activities are discussed in ***FDM 120.2***. Reviews are complete when the comments from all the various offices have been resolved and have been documented as required in ***FDM 128***.

Constructability and biddability reviews by the District Construction Office will be included at appropriate stages of the phase review process. Procedures for these reviews are provided in the ***Construction Project Administration Manual***.

Minor projects, such as resurfacing, typically have two plans phase reviews. The two reviews consist of a decision-making phase review on the scope and intent of the project and a final plans phase review for constructability and biddability. One of these will be an on-site review.

On complex projects plans phase reviews may be required at the Phase I, II and III stages and a final check at Phase IV. Two on-site reviews are typically required with one of these held early in the initial engineering phase.

FDM 901.3 outlines, in detail, the sequence for contract plans preparation and assembly required by the several design phase submittals. Also included in the chapter is information required to be presented on various plan sheets included with each submittal.

When the plans are in compliance with all phase review requirements and are considered final, they are to be submitted in accordance with the process described in ***FDM 131***.

Modification for Non-Conventional Projects:
Delete ***FDM 120.4*** above and replace with the following: **120.4 Plans Phase Reviews** ***FDM 901.3.1*** outlines, in detail, the sequence for contract plans preparation and assembly required by the design phase submittals.

120.4.1 Review of Non-Department-Owned Projects

Perform a Department review of those portions of non-Department-owned projects located on Department-owned Right of Way, regardless of funding source or owner. Perform the review to the same extent as reviews for Department projects to assure compliance with the Department's design criteria. See ***FDM 121.18*** and ***FDM 121.12*** for review requirements of non-Department-owned projects containing a structure located on, under or over Department-owned Right of Way.

121 Bridge Project Development

121.1 General

Structural designs for new construction are developed under the direction of the Structures Design Office (SDO) and the District Structures Design Offices (DSDO).

Designs are to be developed in accordance with:

- This manual
- The ***Structures Manual*** ***(Topic No. 625-020-018)***
- The ***Standard Plans*** ***(Topic No. 625-010-003)***
- The ***AASHTO-LRFD Bridge Design Specifications*** as referenced in the ***Structures Manual***
- Applicable FHWA Directives
- Other criteria as specified by the Department

Structural designs for repair or rehabilitation of bridges are generally developed under the direction of the District Structures Maintenance Engineer (DSME) and may not include all the submittal types discussed in this chapter.

Modification for Non-Conventional Projects:
Delete the above paragraph.

Structure designs for other agencies or authorities such as the Jacksonville Transportation Authority or various Expressway Authorities may meet the Department's criteria or additional criteria as specified by the authority.

For projects involving bridges over navigable water, notify the DSME a minimum of 90 days prior to engaging in any action in, on, or around the bridge. Refer to ***FDM 110.5.3*** for further information.

121.2 Organization

The SDO is a subdivision of the Office of Design under the direction of the Chief Engineer and the Assistant Secretary for Engineering and Operations. The SDO is under the direction of the State Structures Design Engineer (SSDE). Each District, including the

Turnpike, has a staff of structural design engineers that comprise the DSDO, and which is under the direction of the District Structures Design Engineer (DSDE).

121.3 Definitions

All structures are grouped into the following two categories based upon design difficulty, structural complexity, type of construction materials used and history of use in Florida.

121.3.1 Category 1 Structures

The following structure types are classified as Category 1 Structures:

(1) Box or three-sided culverts

(2) Bridges with simple or continuous span reinforced concrete slab superstructures

(3) Bridges with prestressed concrete slab superstructures

(4) Bridges with simple span non-post-tensioned concrete beam or concrete girder superstructures with cast in place decks

(5) Widenings for the structure types listed above

(6) Prefabricated steel truss pedestrian bridges meeting the Category 1 conditions of ***FDM 266.4***

(7) Retaining walls

(8) Roadway signing, signalization, and lighting supports

(9) Overhead sign structures and toll gantries

(10) Noise walls and perimeter walls

121.3.2 Category 2 Structures

All structure types not listed above are classified as Category 2 Structures unless exempted by the SDO. In addition to, or in lieu of, the criteria listed above, a structure is classified as a Category 2 Structure when any of the following are present:

(1) Bridge substructures containing any of the following:

 (a) Post-tensioned components

 (b) Straddle piers

 (c) Integral caps

 (d) Mildly reinforced pier column with net sustained tension on the extreme fiber under permanent service loads in the final condition

(2) Bridges designed for vessel collision or bridges with superstructures subject to application of wave loads

(3) Bridges with non-redundant foundations, micropiles, or auger cast piles

(4) Any component designed using Fiber Reinforced Polymer (FRP) composite materials except components in the ***Standard Plans*** that include FRP composite materials

(5) Braided underpass structures where the beams or flat slab superstructure element is not oriented parallel to traffic of the overlying roadway and a portion of the superstructure and substructure extends beyond the limits of the overlying traffic barriers

(6) Design concepts, components, elements, details, or construction techniques not normally used by Florida DOT including but not limited to:

 (a) New bridge types

 (b) New materials used to construct bridge components

 (c) New bridge construction methods

 (d) Non-standard or unusual bridge component-to-component configurations and connection details

 (e) Department issued ***Developmental Standard Plans*** or modified versions of Developmental Design Standards

 (f) Items not covered by the Department's ***Standard Specifications***

 (g) All atypical precast structural elements (The following are not considered to be atypical: AASHTO Beams, and precast elements included in the ***Standard Plans***.)

(h) Prefabricated Bridge Elements and Systems (PBES) not meeting all requirements of Chapter 25 of the ***Structures Detailing Manual***

The Department supports the use of accelerated project construction techniques including the expanded use of precast/prefabricated bridge elements and systems as a way to reduce costs, construction time, and user impacts; however, the use of precast/prefabricated bridge elements can create long term durability and quality issues depending on the details utilized. Therefore, the designs and details for these elements must be approved by the Department prior to use.

Modification for Non-Conventional Projects:
Items listed in numbers 4 through 6 above are not allowed unless they are specifically permitted in the RFP or unless they are submitted and approved during the Alternative Technical Concept (ATC) process.

121.4 Abbreviations and Acronyms Used in Structures Design

Terminology used in the area of Structures Design is often written in the form of abbreviations or acronyms. Following is a list of acronyms frequently encountered in this manual and in other references used in structures design and include those commonly used for offices, organizations, materials, systems, features, equipment, conditions, and expertise:

AASHTO	***American Association of State Highway and Transportation Officials***
ACI	***American Concrete Institute***
ACIA	***Assigned Commercial Inspection Agency***
ADA	***Americans with Disabilities Act***
AISC	***American Institute of Steel Construction***
ANSI	***American National Standards Institute***
APL	***Approved Products List***
AREMA	***American Railway Engineering and Maintenance Association***
ASTM	***American Society for Testing and Materials***
AWS	***American Welding Society***
BBS	***Bulletin Board System***
BDR	***Bridge Development Report***
BHR	***Bridge Hydraulics Report***
BHRS	***Bridge Hydraulics Recommendation Sheet***
CADD	***Computer Aided Design and Drafting***
CEI	***Construction Engineering and Inspection***

C.I.P. (C-I-P)	***Cast-in-Place (Concrete)***
CSIP	***Cost Savings Initiative Proposal***
CPAM	***Construction Project Administration Manual***
CVN	***Charpy V-Notch (Impact Testing)***
DSDE	***District Structures Design Engineer***
DSDO	***District Structures Design Office***
DSME	***District Structures Maintenance Engineer***
EOR	***Engineer of Record***
FDOT	***Florida Department of Transportation***
FHWA	***Federal Highway Administration***
GRS	***Geosynthetic Reinforced Soil***
LRS	***Low-relaxation Strands***
LRFD	***Load and Resistance Factor Design***
MHW	***Mean High Water***
MSE	***Mechanically Stabilized Earth (Walls)***
MUTCD	***Manual on Uniform Traffic Control Devices***
NBR	***Nominal Bearing Resistance***
NHS	***National Highway System***
NHW	***Normal High Water***
NOAA	***National Oceanic and Atmospheric Administration***
OEM	***Office of Environmental Management***
OIS	***Office of Information Systems***
OSHA	***Occupational Safety and Health Administration***
PDA	***Pile Driving Analyzer***
PD&E	***Project Development and Environment***
PPD	***Plans Production Date***
RDR	***Required Driving Resistance***
RFP	***Request For Proposal***
SDO	***Structures Design Office***
SIP (S-I-P)	***Stay-in-Place (Forms)***
SRS	***Stress-relieved Strands***
SSDE	***State Structures Design Engineer***
TAG	***Technical Advisory Group (SDO and DSDEs)***
TFE (PTFE)	***Polytetrafluoroethylene (Teflon)***
TRB	***Transportation Research Board***
TTCP	***Temporary Traffic Control Plans***
UBC	***Ultimate Bearing Capacity***
UV	***Ultraviolet***

121.5 Responsibility

The DSDO has total project development and review responsibility for projects involving Category 1 Structures. The SDO has total project development and review responsibility for projects involving Category 2 Structures. This responsibility for Category 2 Structures extends to widening and rehabilitation projects and repairs of bridge components that qualify the structure as a Category 2 Structure. For large projects with multiple bridges, review responsibilities will be coordinated between the DSDO and the SDO based on the category of the individual bridge, workload demands and project make-up.

The District Project Manager must coordinate with the DSDE who will review and concur with the bridge aspect of all projects during the PD&E process in accordance with ***Part 2, Chapter 3*** of the ***PD&E Manual***.

The DSDE or the SSDE, as appropriate, must concur/approve all bridge related work after location design approval is granted.

To assure a uniform approach to a project, the Engineer of Record must coordinate with the appropriate structures design office (i.e., DSDO or SDO) to discuss structures related phase review comments and get concurrence on how to proceed.

Modification for Non-Conventional Projects:

Delete ***FDM 121.5*** and replace with the following:

121.5 Responsibility

Submit RFP's on those projects where it is anticipated that Category 2 bridges will be designed and constructed to the SSDE for review and approval. Submit RFP's on those projects where it is anticipated that Category 1 bridges will be designed and constructed to the DSDE for review and approval.

The DSDO has total component structure plan review responsibility for projects involving Category 1 Structures. The SDO has total component structure plan review responsibility for projects involving Category 2 Structures. This responsibility for Category 2 Structures extends to widening and rehabilitation projects and repairs of bridge components that qualify the structure as a Category 2 Structure. The DSDE or the SSDE, as appropriate, determine when structure component plans should be "Released for Construction."

The District Project Manager must coordinate with the DSDE who will review and concur with the bridge aspect of all projects during the PD&E process in accordance with ***Part 2, Chapter 3*** of the ***PD&E Manual***.

121.6 Projects of Division Interest

See ***FDM 128*** for FHWA requirements.

121.7 Bridge Project Development

The following sections will define, clarify, and list the information necessary to produce an acceptable and reproducible set of contract documents (special provisions, bridge contract drawings) ready for advertisement and construction.

Bridge project development normally includes five phases of development. The first phase of development, bridge analysis, occurs during the Project Development and Environment (PD&E) process. After location design approval is granted, the second phase, Bridge Development Report/30% Structures Plans, is initiated. After approval of the BDR, the final phases of work will begin. The third phase is the 60% Structures Plans that consists of the substructure foundation submittal for all projects and 60% Structures Plans for most Category 2 Structures. The fourth phase includes the 90% Structures Plans and specifications. The fifth phase includes the 100% Structures Plans and specifications. For efficiency, one engineering firm (one design team) should be responsible for the BDR and the final plans and specifications.

For Category 2 bridges and some Category 1 bridges, step negotiations are suggested. Step negotiations are desirable because the final bridge type cannot be determined until the BDR is complete. Utilizing this scenario, the first step of the negotiations would include the BDR/30% Structures Plans. After submittal of the BDR/30% Structures Plans, negotiations for final three phases of work (60% Structures Plans, 90% Structures Plans and 100% Structures Plans) would begin. Negotiations should not be finalized until the BDR/30% Structures Plans are approved by the DSDO or the SDO as appropriate.

Modification for Non-Conventional Projects:

Delete ***FDM 121.7*** and replace with the following:

121.7 Bridge Project Development

Bridge project development normally includes four phases of development. The first phase of development, bridge analysis, occurs during the Project Development and Environment (PD&E) process**.** The second phase includes the development of the bridge related project constraints based on project specific requirements and development of the bridge concept plans for inclusion into the RFP. A series of pre-scoping questions has been compiled and are available on the Office of Construction website to aid in the development of project specific constraints. Depending on the complexity of the project and at the discretion of the Department, this second phase may include a Bridge Feasibility Assessment for the purpose of developing the structures concept plans. The third phase involves the project procurement process. See ***Procurement and Administration Procedure (Topic No. 625-020-010)*** for specific requirements. The fourth phase includes component structure plan reviews in accordance with the requirements of the RFP.

121.8 Bridge Analysis

121.8.1 General

The Bridge Analysis is performed during the PD&E phase by qualified bridge engineers. The findings of the bridge analysis must be approved by the District Structures Design Office or the State Structures Design Office, as applicable, in accordance with the responsible review authority specified in ***FDM 121.5***. The function of the bridge analysis is to determine the general attributes for the recommended bridge. The specific attributes of the bridge will be defined in the BDR.

For bridges over water, a location Hydraulics Report will be prepared in conjunction with the bridge analysis. General site geotechnical knowledge is also required (usually from existing bridge plans) or, in some cases, it may be desirable to obtain borings.

121.8.2 Contents

The bridge analysis provides conceptual guidance for the bridge design consultant. Conceptual guidance on how the bridge should fit into the uniqueness of the site should be provided. Bridge design and structure type should be left to the design team in the later phases of work. Include the following in the bridge analysis:

(1) Environmental and site considerations, including the need for wildlife connectivity (see ***FDM 110.5.4***).

(2) Vertical and horizontal clearances (existing and proposed).

(3) Load Rating of existing bridge if any portion is retained.

~~(3)~~(4) Evaluation of the fatigue limit state per the ***AASHTO LRFD Bridge Design Specifications*** for existing steel bridges if any portion is retained. If the Fatigue II load combination for finite life applies, calculate an approximate remaining fatigue life for the bridge per ***SDG 7.3.8*** and determine if replacement should be recommended.

~~(4)~~(5) Disposition of existing structure. (Final disposition of demolished bridge debris will depend on whether or not a local, State or Federal agency has agreed to receive the debris. See ***FDM 110.5.2.3***).

~~(5)~~(6) Vertical and horizontal geometry.

~~(6)~~(7) Typical section.

~~(7)~~(8) Conceptual ship/barge impact data (sample of recreational and commercial traffic).

~~(8)~~(9) Identification of historical significance of bridge and surrounding structures.

~~(9)~~(10) Aesthetic level for bridge and bridge approaches.

~~(10)~~(11) Location Hydraulics Report.

~~(11)~~(12) Bridge deck drainage considerations.

~~(12)~~(13) Stream bottom profile.

~~(13)~~(14) Conceptual geotechnical data.

~~(14)~~(15) For sites with movable bridge options, a life cycle cost comparison will be prepared and compared to fixed bridge options (Ref: ***AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual, 2nd Edition***).

~~(15)~~(16) Phase Construction Impacts.

~~(16)~~(17) Construction time.

121.9 Bridge Development Report (BDR)/30% Structures Plans

The BDR is intended to be a tool in selecting the optimal bridge type and to establish all the basic parameters that will affect the work done in the Design and Plans Preparation phase. Initiate the BDR after location design approval (For those sites not requiring location design approval, a categorical exclusion will be required before initiation of the BDR). Include the Phase I Geotechnical Report and the Bridge Hydraulic Report with the submittal containing the BDR. For some projects, the 30% Structures Plans will be included as an appendix to the BDR. See ***FDM 121.9.9***.

The work necessary to prepare the BDR is determined on a case-by-case basis and depends upon the bridge's complexity and other factors as described below:

(1) Considering the site constraints of the crossing (vertical and horizontal clearance requirements, etc.), the optimal bridge type may be evident for some simple Category 1 Structures without comparing various bridge types and an abbreviated BDR that requires less effort may be appropriate. In certain cases, the BDR may simply document the reasons for the bridge type selected.

(2) An abbreviated BDR will usually be appropriate for widenings; however, in some cases a thorough evaluation of viable structural possibilities and economical options may be required to determine if replacement of the bridge would be more appropriate than widening. Factors to consider when determining the BDR effort for widenings include, but are not limited to, the following:

  (a) Load rating,

  (b) Condition of the existing bridge,

  (c) History of structural problems,

  (d) Clearance limitations in the widened configuration,

  (e) Historical significance (see ***FDM 121.9.5***), and

  (f) Sites where there has been a record of serious flooding or scouring.

  See ***Section 7.1.1*** of the ***Structures Design Guidelines*** for load rating considerations to be included in the BDR recommendations.

(3) For all other situations, including all new Category 2 Structures and major widenings of Category 2 Structures, the BDR will consider all viable bridge types and alternatives. See ***Section 7.2*** of the ***Structures Design Guidelines*** for definitions of minor and major widenings.

The District Structures Design Engineer will make the final determination on the scope of work necessary to prepare a BDR.

Once approved, the BDR will define the continuing work by the Engineer of Record (EOR). It is mandatory that the EOR obtain and coordinate the information and requirements of the offices and engineering disciplines whose input is essential to the preparation of an effective BDR. Changes to the parameters after the BDR is approved could result in schedule delays and supplemental agreements; therefore, it is critical that District Offices, FHWA (if involved), the SDO and other involved agencies recognize the purpose and importance of the BDR. The BDR phase of work will contain sufficient detail for the justification of the proposed bridge type. The BDR is developed from information outlined on the Bridge Development Report Submittal Checklist shown in ***FDM 103***, ***Form 121-A***. This information is often provided by others; however, the EOR is responsible for ensuring that all of the information is adequate and appropriate. If the data is not sufficient, the EOR must obtain the required information before the BDR can be completed and submitted.

When alternate designs are considered, consistency between the alternates is essential in ensuring equitable competition and optimum cost-effectiveness. This consistency includes uniformity of design criteria, material requirements and development of unit costs.

The BDR should contain only supportable and defendable statements. Subjective opinions or unsubstantiated statements are not acceptable. All arguments are to be clearly and logically defensible with calculations, sketches, or other technical data.

121.9.1 Contents

The major items to be considered in the BDR are:

(1) General: The bridge length, height and pier locations are subject to vertical and horizontal design clearance requirements such as those for clear zone, navigation, wildlife connectivity, and hydrology. After these considerations are met, span lengths are governed by economics and aesthetic considerations. Superstructure depths (grade separation structures in particular) are to be kept to the minimum that is consistent with good engineering practice. Recommended span/depth ratios for steel superstructures are shown in AASHTO.

The length of the bridge will be affected by:

(a) Opening required by the Bridge Hydraulic Report.

(b) Environmental Considerations, including wildlife connectivity (see ***FDM 110.5.4***).

(c) Railroad clearances and cross sections.

(d) Width of waterway or width of cross section of roadway being spanned including the use of retaining walls, or fender systems.

(2) Statical System: Address the economic and engineering advantages of both simple span and continuous spans.

(3) Superstructure: Some superstructure types that could be considered are prestressed concrete girders, inverted-tee sections, reinforced or prestressed concrete slabs, steel rolled sections or plate girders, steel or concrete box girders, and post tensioned slabs, bulb-tees, or boxes.

(4) Substructures: Some substructure types that could be considered are pile bents and multi-column or hammerhead piers. Variations of column shapes may be appropriate for aesthetic or economical requirements.

(5) Foundations: Some foundation types that could be considered are steel and concrete piles, drilled shafts, geosynthetic reinforced soil (GRS) abutments and spread footings. Assess GRS abutments to determine feasibility for all new bridges. If GRS abutments are determined not to be the most suitable alternative for the project, provide a statement in the BDR indicating so and the reasons why (e.g., sinkhole-prone area or differential settlement limit exceeded).

(6) Vessel Collision: Vessel collision forces will often have a major effect on the structural configuration and overall economics. See vessel collision requirements in the ***Structures Design Guidelines***.

(7) Scour: The 100 year and 500 year predicted scour elevations will often have a major effect on the foundation design. See the foundations and geotechnical requirements in the ***Structures Design Guidelines***.

(8) Temporary Traffic Control: Show how traffic will be maintained during construction for each of the bridge alternates considered. Assess the impacts of the traffic carried on the structures as well as under the structures being constructed. Consider all major overhead work items such as bridge demolition and girder placement. Show stability towers locations, phased construction sequences, girder splice locations, for each alternate being considered. Compare traffic user impacts for each of the alternates.

(See ***FDM 240.4*** for additional requirements)

(9) Precast Feasibility Assessment: Investigate the use of either partial or full precast bridge alternate(s) with the specific purpose of accelerating bridge construction and reducing user impacts. As part of this investigation:

(a) Conduct a feasibility assessment responding to questions similar to those listed in ***FDM 121.19***.

(b) Based on responses to the feasibility questions, explain whether a precast alternate should be considered an advantage on the project or what site constraints, economic impacts, or other factors (e.g., haul distance from precast yard, project variability) precluded or limited its application. If precasting is determined not to be applicable for the project, provide a statement in the BDR indicating so and the reasons why. This statement fulfills the requirements of this section.

(c) Only if precasting is found to be viable, evaluate preliminary precast alternates and associated MOT schemes against conventional methods using the assessment matrix and referenced links given in ***FDM 121.19***. Provide enough detail in the preliminary evaluation in order to estimate total direct and indirect costs. Indirect costs, typically referred to as road user costs, include fuel use and man-hour losses resulting from detours, anticipated traffic flow reduction, and reduced speed limits. Determine indirect costs using the Department's software at the following link:

(d) ***http://infonet.dot.state.fl.us/tlconstruction/SchedulingEng/AddSoftwareScheduling.htm***

(e) At this stage, a meeting with the District Structures Design Engineer is recommended to discuss the preliminary evaluation and cost estimates before finalizing the alternates for inclusion in the BDR.

(f) See ***Chapter 25*** of the ***Structures Detailing Manual*** for design considerations as it relates to Prefabricated Bridge Elements and Systems (PBES).

(g) Report the estimated total direct costs and estimated total indirect costs, as well as the sum of both, for *each* alternate as three separate dollar amounts in a summary table in the same section as the completed assessment matrix (see ***Table 121.19.2***).

Providing both the direct and indirect costs of the project in the BDR enables Department management to make informed decisions to maximize construction dollars while at the same time minimizing construction time and economic impacts to Florida's traveling public.

Also, demonstrate in the BDR text that consideration was given to identify and employ other innovative techniques aimed at reducing costs, shortening project delivery time, enhancing safety during construction, and protecting the environment.

(10) Quantity estimates: For minor bridges rough quantities (such as reinforcing steel based on weight per volume of concrete) may be sufficient. For major and complex bridges, the degree of accuracy may require more exact calculations keeping in mind that the intent is to establish relative and equitable costs between alternates and not necessarily to require the accuracy of the Final Estimate. For major and complex structures, it may be necessary to develop unit costs from an analysis of fabrication, storage, delivery, and erection costs of the different components. Provide calculated debris volume quantities for projects involving the demolition of bridges.

(11) Unit costs: Data available from the Department or contractors and suppliers should be used to arrive at unit costs. Record the sources of all price data for later reference. Base cost should be obtained from the ***BDR Estimating Section*** of the ***Structures Manual***.

(12) Develop cost curves: For each alternative establish the most economical span arrangement, i.e., minimum combined superstructure and substructure cost.

(13) Retaining Wall Study: If retaining walls are present, include a retaining wall study in the BDR. This study will conform to the work as specified in ***FDM 262*** and the ***Structures Manual***.

(14) Movable Bridges: Include information in the BDR on the type of equipment for the machinery and electrical drive systems, together with a general description of the control system to be utilized. Include a written description and preliminary layouts of system components. Utilize acronyms and terminology as defined in ***AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual, 2nd Edition***.

(15) Bicycle and Pedestrian Facilities: Describe in the BDR the facilities to be provided and the means to be used to comply with ADA requirements. Describe the pedestrian railing and fencing to be provided. See ***FDM 222, 223,*** and ***224***.

For rehabilitation project plans, include the BDR stage in the plans and written descriptions of those system components to be modified from the existing configuration, along with plans of the existing configuration. Submittal of information described in the previous paragraph is not required unless the electrical and mechanical configuration is modified from the existing configuration.

121.9.2 Format

~~The report is to use standard, letter-size pages with any larger sheets or drawings folded to fit the report size.~~ Present ~~T~~the report ~~is to be neatly written and the contents presented~~ in a logical sequence with narrative, as required, to explain the section contents. Provide an Executive Summary to compare the relative features and costs of the alternates considered and recommend alternate(s) to be carried forward into the Final Structures Plans Preparation phase.

The BDR is to be as self-contained as possible by including all arguments that establish, justify, support, or prove the conclusions. It is acceptable to refer to other documents that will be included in the final submittal package; however, include any documentation that will help emphasize a point, support a statement, or clarify a conclusion. Such documentation may include drawings, clear and concise views, or other such illustrated information.

Address construction time requirements in the BDR and the effect that components, systems, site constraints and conditions, or other site characteristics or criteria have upon the construction time, whether additive or deductive.

121.9.3 Aesthetics

(1) General: Integrate three basic elements in any bridge design: efficiency, economy, and elegance. Regardless of size and location, the quality of the structure, its aesthetic attributes and the resulting impact on its surroundings is to be carefully considered. Achieving the desired results involves:

(a) Full integration of the three basic elements listed previously.

(b) The EOR's willingness to accept the challenge and opportunity presented. A successful bridge design will then be elegant or aesthetically pleasing in and of itself and will be compatible with the site by proper attention to form, shapes, and proportions. Attention to details is of primary importance in achieving a continuity of line and form. Use the rule of "form following function."

Consider the totality of the structure as well as its individual components and the environment of its surroundings. A disregard for continuity or lack of attention to detail can negate the best intent. Formulas cannot be established; however, ACI's ***Aesthetic Considerations for Concrete Bridges*** and TRB's ***Bridge Aesthetics Around the World,*** as well as authors such as David P. Billington can guide the designer. A book developed by the Maryland Department of Transportation entitled ***Aesthetic Bridges*** provides excellent guidance. In bridge aesthetics the designer is dealing with the basic structure itself; not with enhancement, additions, or other superficial touches. The EOR is expected to be well read on the subject of bridge aesthetics and committed to fulfilling both the structural and aesthetic needs of the site.

The challenge differs for major and minor structures. Indeed, the challenge may be greater the smaller the project. Major structures, because of their longer spans, taller piers, or curving geometry often offer inherent opportunities not available for minor bridges.

Some basic guidelines where aesthetics may play a more important role are:

(a) Bridges highly visible to large numbers of users (maritime and motorists).

(b) Bridges located in or adjacent to parks, recreational areas, or other major public gathering points.

(c) Pedestrian bridges.

(d) Bridges in urban areas in or adjacent to commercial and residential areas.

(e) Multi-bridge projects, such as interchanges, or corridors should attain conformity of theme and unifying appearance. Avoid abrupt changes in structural features.

Considering these guidelines, the District will determine the level of aesthetic effort warranted on a project early in its development. When significant aesthetic expense is proposed, such as is the case with Level Three (Level of Aesthetics), Federally funded projects require legitimate written justification.

(2) Levels of Aesthetics:

Normally the District will establish one of the following three general levels of aesthetic consideration and effort at each structure's site:

(a) **Level One:** Consists of cosmetic improvements to conventional Department bridge types, such as the use of color pigments in the concrete, texturing the surfaces, modifications to fascia walls, beams, and surfaces, or more pleasing shapes for columns and caps.

(b) **Level Two:** The emphasis is on full integration of efficiency, economy and elegance in all bridge components and the structure as a whole. Consideration should be given to structural systems that are inherently more pleasing, such as hammerhead or "T" shaped piers, oval or polygonal shaped columns, integral caps, piers in lieu of bents, smooth transitions at superstructure depth change locations, box-type superstructures, concealed drainpipes, conduits, and utilities.

(c) **Level Three:** The emphasis in this level applies more to the overall aesthetics when passing through or under an interchange or at other sites such as historic or highly urbanized areas where landscaping or unique neighborhood features are to be considered. The bridge itself must comply with Level Two requirements. This level of work may require, at the District's option, a sub-consultant (architect to consider adjacent building styles, and landscape themes) with the necessary expertise and credentials to perform the desired work.

These aesthetic levels are not exclusive. For example, where the EOR believes a specific landscape feature might significantly enhance bridge site elegance, even on a Level 1 design, the recommendation should be offered for the Department's consideration. For aesthetic Levels 2 and 3, public input into this issue may be appropriate. The EOR may recommend particular public involvement to the Department for consideration, or the district might specify such efforts at specific times during the BDR and final plan development phase of the project.

Include a summary of aesthetic considerations for the structure and the site in the BDR. The summary consists of sketches or drawings of recommended treatment as well as the options considered in the aesthetic study but not recommended as appropriate. Also include an estimate of cost to implement the recommended aesthetic treatment in the summary.

The default condition for new steel bridges is uncoated weathering steel where site conditions permit (See ***SDG 1.3.2***). Use an Inorganic Zinc Coating System where site conditions preclude uncoated weathering steel and may be used elsewhere with approval of the Chief Engineer. Use of a High-Performance Coating System to any extent for Steel bridges requires written approval from the Chief Engineer.

121.9.4 Construction and Maintenance Considerations

Evaluate all viable structure concepts for constructability. Consider items such as member sizes, handling, fabricating, and transporting members as well as maintenance of traffic, construction staging, equipment access, equipment requirements. Perform a special evaluation to insure against potential problems that may occur in obtaining permits and equipment to transport long and heavy members from point of manufacture to the project site. Contact the Department's Road Use Permits Office for questions concerning the feasibility of transporting long and heavy structural components. Also, take into account considerations for future maintenance inspection in the structure's design. Include those considerations described in ***FDM 121.15*** and the requirements of the ***Structures Manual***. All special construction and maintenance requirements should be identified and appropriately considered in any concepts recommended for design. A design is able to be inspected properly when it permits safe inspector access to all portions of the structure using equipment available to District Structures Maintenance personnel.

121.9.5 Historical Significance Considerations

When an older bridge is considered for rehabilitation or replacement, the Environmental Management Office will evaluate the historical significance of the structure. A structure may be historically significant due to some of the following characteristics:

(1) The structure may be an historic example in the development of engineering.

(2) The crossing may be historically significant.

(3) The bridge may be associated with an historical property or area.

(4) The bridge might be associated with significant events or circumstances.

(5) National Register of Historic Places or on a state or local historical register. If it is determined that the structure is historically significant, then the project should be developed to preserve the historic character of the structure.

121.9.6 Bridge Security

Perform a refined evaluation of all new Category 2 bridges identified in a PD&E study as critical, landmark or signature bridges to determine if anti-terrorist countermeasures are to be included as part of the design. Contact the SDO and the State Maintenance Office for guidance and assistance. Minimize the bridge vulnerability through alternative designs developed in the BDR. Design countermeasures to minimize the effectiveness of explosives. Minimize vulnerability to shape charges and vehicle bombs. Maximize the use of structural redundancy and continuity to limit structural damage.

Countermeasures designed into the bridge alternatives must meet one or more of the following objectives:

(1) Protect structure from blast effects,

(2) Maximizing explosive standoff distance,

(3) Denial of access,

(4) Minimizing time-on-target,

(5) Selective protection of the structural integrity of key members, or

(6) Structural redundancy.

Use one or more of the following countermeasure strategies in the design:

(1) Deter attacks by the possibility of exposure, capture or failure of the attacker due to visible countermeasures,

(2) Detect potential attacks before they occur and provide the appropriate response force,

(3) Defend the bridge by delaying and distancing the attacker from the bridge and protecting the bridge from the effects of weapons, fire and vehicle and vessel impacts, or

(4) Design the bridge to minimize the potential effects of Weapons of Mass Destruction (WMDs) and conventional explosives, fire and vehicle and vessel impacts.

Structural members that are fracture critical or are cable stays, cable stay pylons, hollow boxes, single columns, twin wall columns and thin wall columns require design modification to reduce the potential impact of explosions. Access into cable stay pylons, box superstructures and movable bridge machinery require heavy doors with secure lock systems. Bridges with essential communication utilities and or gas lines require the design to minimize risk to the utility.

121.9.7 Alternative Designs

The use of alternative designs for some larger or complex projects may result in more competitive bids and lower costs. Accordingly, the EOR is to evaluate benefits from alternatives for the particular structure being developed and provide a recommendation for or against preparing alternative designs. Support the alternative designs recommended by the evaluations included in the BDR. As a guide, consider the following in evaluating justification for alternative designs:

(1) Alternative designs are to be considered for all structures that cost more than $25 Million and a difference in alternate material (steel versus concrete) construction costs that are within twice the cost of producing the alternate plans. For example, alternative designs would be warranted if the additional preliminary engineering cost for final plans preparation is $1.5 million per alternate and the difference between the construction cost estimates utilizing the Department estimating practices in the BDR was less than $3 million.

(2) For bridges that cost less than $25 million consider alternative designs when project issues reflect possible advantages (i.e., TTCP, A+B) from competitive bids.

(3) For bridges estimated to cost more than $10 million consider evaluation of alternative designs whenever a unique design concept is proposed until such time that a bid history is established for the unique design.

(4) Projects containing multiple bridges with a reasonable mixture of concrete and steel designs do not require alternate designs.

Steel box structures and steel plate girders should be evaluated including the differences in corrosion potential. Box Girders are preferred over plate girders when located in extremely aggressive environments.

121.9.8 Conclusions and Recommendations

With due consideration for all applicable data, the engineer is required to recommend the final bridge design system for the site. Thorough justification for the selection will be presented which examines each element of data, and the total estimated construction cost of the recommended design must be indicated in the BDR.

The following sections will define, clarify, and list the information necessary to produce an acceptable and reproducible set of contract documents (special provisions, bridge contract drawings) ready for advertisement and construction. The production of a bridge project commences with the Bridge Development Report (BDR) and ends with complete Contract Documents.

121.9.9 30% Structures Plans

The consultant's scope of services should clearly state at what point the 30% plans are to be submitted. The 30% Structures Plans may be submitted with the Bridge Development Report. If the 30% Structures Plans are submitted separately, the BDR is required to contain enough information and drawings to depict the information needed to properly determine the type, size and location of the bridge.

The 30% Structures Plans should show the following applicable information, as a minimum:

(1) General Notes Sheet: As many general notes as possible should be included on this sheet at this stage. Add subsequent notes, when necessary, as the design progresses (for example of General Notes, see ***Chapter 5*** of the ***Structures Detailing Manual***).

(2) Plan and Elevation Sheet: provide contents as required by the Structures Detailing Manual.

(3) Substructures: For end bents, piers, or intermediate bents, show substructure elements and sizes including all deviations from the typical dimensions, foundation type including element spacing and the arrangement of piles or drilled shafts.

(4) Superstructure: Include cross section showing lanes, shoulders, railings, slab thickness, beam type and spacing and web depth for steel girders. If applicable, show geometric changes in shapes of various components. Also show construction phases and maintenance of traffic data, outline of the existing structure and portions to be removed, and utilities (existing and proposed as available).

(5) Retaining Walls: Submit preliminary control drawings when proprietary or standard cast-in-place walls are proposed. Include control drawings for all critical temporary walls.

(6) Bridge Hydraulics Recommendation Sheet.

(7) Report of core borings.

(8) Proposed construction sequence and methods indicate construction easements and methods of construction access.

(9) Preliminary aesthetic details.

(10) Preliminary post-tensioning layouts.

(11) Preliminary foundation layouts and pile/shaft data table.

(12) Sidewalks: If provided, show preliminary accessible elements.

(13) Any other special details required by the Engineer or details which are not normally used on Department projects.

In addition to these requirements, the following items will be included for moveable bridges: preliminary electrical and mechanical equipment layouts in plan and elevation, submarine cable routing, and single line electrical diagrams including service voltage. Rough size all equipment and submit the supporting calculations.

Include requests for Design Exceptions and Design Variations for structural design criteria in the 30% Structures Plans Submittal. Design Exceptions and Design Variations are required to be approved in accordance with ***FDM 122*** with concurrence of the DSDO or SDO as appropriate.

Modification for Non-Conventional Projects:
Delete ***FDM 121.9*** and replace with the following. **121.9 Bridge Feasibility Assessment/Structures Concept Plans** At the discretion of the Department, a Bridge Feasibility Assessment may be necessary during the RFP development phase for the purpose of developing the structures concept plans. When required, the assessment must target specific critical bridge components to ensure that the preliminary information presented in the concept plans can meet all of the project constraints depicted in the RFP. For aesthetic and wildlife connectivity requirements, see RFP.

121.10 Bridge Development Report (BDR) Submittal Checklist

The Bridge Development Report (BDR) Submittal Checklist (***FDM 103, Form 121-A***) contains a list of the key supporting elements that are required for the preparation, submittal, and review of a BDR. Include this Checklist with the BDR when submitted for review. The BDR Checklist consists of the following items:

(1) Typical Sections for Roadway and Bridge:

The approved typical sections for both the bridge and roadway are required.

(2) Roadway Plans:

Preliminary roadway plans covering the bridge vicinity are required.

(3) Maintenance of Traffic Requirements:

Show the number of required lanes and the lane widths of all affected roadways in the Maintenance of Traffic Plan.

(4) Bridge Hydraulics Report and Bridge Hydraulics Recommendation Sheet:

Prepare the Bridge Hydraulics Report (BHR) and Bridge Hydraulics Recommendation Sheet (BHRS) in accordance with the ***Drainage Manual***. Concurrence of the BHR by the District Drainage Engineer with the District Structures Design Engineer for Category 1 Structures and State Structures Design Engineer for Category 2 Structures is required.

(5) Geotechnical Report:

Prepare the Bridge Geotechnical Report (Phase I) in accordance with Chapter 3 of the ***Structures Design Guidelines*** and the Department's ***Soils and Foundation Handbook***. Document a thorough investigation of all viable foundation types for the bridge and retaining walls. Concurrence of the District Geotechnical Engineer is required for Category 1 Structures and of both the State and District Geotechnical Engineers for Category 2 Structures.

(6) Bridge Corrosion Environment Report:

Prepare a Bridge Corrosion Report to determine the environmental classifications for the structure in accordance with the ***Structures Design Guidelines*** and receive approval from the District Materials Office.

(7) Geosynthetic Reinforced Soil (GRS) Feasibility Assessment:

Assess GRS abutments to determine feasibility for all new bridges.

(8) Precast Feasibility Assessment:

Investigate the use of either partial or full precast prefabricated bridge alternate(s) with the specific purpose of accelerating bridge construction and reducing user impacts.

(9) Existing Bridge Plans:

A set of prints of the existing (preferably as-built) bridge plans should be included for replacement structures and widenings. This is of particular importance for widenings and phase construction. These plans are not usually necessary for completely separate alignments or new interchanges unless the existing structures either will be used for new construction activities or will infringe upon the Contractor's allowed work zone.

(10) Existing Bridge Inspection Report:

A copy of the latest existing Bridge Inspection Report and Structures Inventory and Appraisal Form is required for all widenings and rehabilitations and may be required for new structures. Identify the existing paint system(s) on all significant metal elements of existing structures. Clearly delineate the presence of lead-based paint and asbestos.

(11) Existing Bridge Load Rating:

A copy of the latest existing Bridge Load Rating is required for all widenings and rehabilitations.

(12) Wildlife Connectivity:

Describe the decision to include or exclude wildlife connectivity features into the design. The discussion for excluding a wildlife connectivity feature should summarize coordination with the Environmental Management or Permit office (or may be an attached summary memo from one of these offices). The discussion for including wildlife connectivity should refer to the ***Wildlife Crossing Guidelines***, commitments made during PD&E and any other documentation regarding the wildlife connectivity related to the bridge (or may be an attached summary memo from the Environmental Management or Permit office).

(13) Utility Requirements:

Identify proposed utility attachments to the structure as well as all existing and proposed utilities in the vicinity of the structure. Follow the requirements of the Department's ***Utility Accommodation Manual*** regarding attachments to the structure.

(14) Railroad Requirements:

Identify existing and future railroad requirements. This will include all clearances and crash wall or other construction parameters. Include copies of correspondence with the Railroad Agency.

(15) Retaining Wall and Bulkhead Requirement:

Identify permanent and temporary retaining wall requirements and show the proposed type of wall. Also identify the type, location, and extent of temporary walls to accommodate phased construction and maintenance of traffic.

For water crossings where erosion and wave action are anticipated, identify the type, location, and extent of bulkhead production. Include the proposed tie-back and anchor system in the submittal.

(16) Lighting Requirements:

Identify proposed lighting on or under the structure.

(17) ADA Access Requirements:

Identify ADA access requirements that affect the structure.

(18) Other:

Modification for Non-Conventional Projects:
Delete ***FDM 121.10***.

121.11 Final Plans and Specifications Preparation

121.11.1 General

Within this phase of work, for both Category 1 and 2 Structures, there are three phases of work; viz., 60% Substructure submittal or 60% Structure Plans, 90% Structure Plans and 100% Structures Plans and Specifications. For projects where preapproved proprietary wall systems cannot be used and fully designed proprietary wall plans are required, submit approved control drawings to the appropriate proprietary wall companies as soon as possible and no later than the 60% substructure submittal. Send a copy of this submission to the DSDO or SDO as appropriate.

At any time during the project development, the reviewer may require submittal of design calculations. All Electronic Review Comments (ERC) must be resolved to the Department's satisfaction prior to submitting the next phase submittal of the project.

121.11.2 60% Substructure Submittal / 60% Structures Plans

This submittal phase is divided into two distinct parts; viz., the 60% Substructure Submittal (required for all projects) and the 60% Structures Plans for Category 2 Structures and some Category 1 Structures.

(1) 60% Substructure Submittal:

This submittal is required for every project and should be made a part of the 60% Structures Plans phase when that phase is part of the project. The submission is only a partial plans set. The purpose of this submittal is to communicate essential project information to the Geotechnical and Hydraulic Engineers so that all remaining calculations can be performed using actual structural shapes, loads, and dimensions. Plan sheets required for this submittal include: Plan & Elevation, Bridge Hydraulics Recommendation Sheet, Boring Logs, Foundation layout, Substructure Plans, and draft technical specifications.

60% Substructure Submittal Contents:

(a) Foundation Layouts

(b) Foundation Installation Notes

(c) Pile/Drilled Shaft Installation Table

(d) Footing Concrete Outlines (All Variations)

(e) Pier Concrete Outline (All Variations)

(f) Wall Plans - Control Drawings

(g) Pile Details

(h) Lateral Stability Analysis Completed

(i) Phase II Geotechnical Report

(j) Draft Technical Specifications

(k) Reinforcement of Footing and Column

(l) Post-Tensioning Details

(m) Plan and Elevation Sheet

(n) Bridge Hydraulics Recommendation Sheet

(o) Boring Logs

(2) 60% Structures Plans:

When a 60% Structures Plans submittal is required, all comments from earlier reviews will have been resolved. At this phase, the design should be 90% complete and the plans, 60% complete. In addition to the documents required for the 60% Substructure Submittal, the 60% Structures include the following details as applicable in the plans: final concrete outlines of all individual components, major reinforcing steel, final post-tensioning layouts, steel box/I-girder details, segmental concrete box details, bearing details, seismic details, details of congested areas, details of unique features, accessible pedestrian facilities details, and other details as required. For moveable bridges the following additional information is required: electrical calculations (for generator size, service voltage drop, short circuit, service size, automatic transfer switch), single line diagram showing equipment sizes and utilities, conduit and wire sizes, panelboard schedules, and light fixture schedules.

121.11.3 90% Structures Plans

Upon approval of the BDR/30% Structures Plans or 60% Structures Plans, as applicable, 90% Structures Plans begin. At this stage of plans development, the EOR will have resolved the 30% and 60% Structures Plans review comments and developed the plans for completion. The design and plan production is required to be 100% complete. This submittal will include prints of the completed plans, Estimated Quantities Report, design calculations, Final Phase II Geotechnical Report, Addendums to Hydraulic Report and, if appropriate, Technical Special Provisions. No sheet or detail should be missing at this stage.

121.11.4 100% Structures Plans and Specifications

After resolution of the 90% Structures Plan comments, the EOR will make all authorized changes necessary to complete the plans and Technical Special Provisions. The EOR will provide a list of all changes made to the Plans or Specifications that were not directly related to the 90% Structures Plans review comments. The intent is to help minimize the Department's review time and to help the Department's review office to focus on only those new items or details proposed by the EOR. This will, in turn, help to expedite the project's authorization.

The 100% Structures Plans submittal is divided into two distinct phases. First, plans and technical special provisions are submitted 30 days prior to the District's Plans Production Date. Second, once notified by the Department, the plans and all other documents are submitted to the District.

Within the 30-day period allotted, the EOR will receive notification either of additional changes/corrections to be made or to submit the Final Plans as they are. If at any time during the 30-day period the EOR finds additional changes/corrections that should be made, the structures design office responsible for plans approval (either the DSDO) or the SDO as appropriate) is required to be notified for discussion and resolution.

Once all changes/corrections are made, or if no changes/corrections are necessary, the EOR will submit all work to the District prior to or on the Plans Production Date. Submittal of this stage of the work will include the plans, sealed in accordance with ***FDM 130***, sealed Technical Special Provisions (if required), and Estimated Quantities Report.

Modification for Non-Conventional Projects:
Delete ***FDM 121.11***. See the RFP for plans submittal requirements.

121.12 Independent Peer Review of Bridges

An Independent Peer Review (IPR) is used to validate the design of structures or portions thereof as defined below. The designated IPR firm will have no involvement with the project other than conducting the IPR and is required to be pre-qualified in accordance with ***Rule 14-75 of the Florida Administrative Code***. The responsible independent peer review engineer or the IPR Quality Assurance Manager must be on the Department's list of consultant qualifying engineer personnel (as a P.E. Qualifier) for the specific Group 4 work type.

(1) The Department may require an IPR for conventional projects. Consult with the SDO when determining the need for such reviews. Consideration of when to require an IPR include, but is not limited to, the following:

(a) The introduction of new complex details or structure types.

(b) Work being performed that is outside the normal structure type designed by the selected consultant.

(c) Structures using complex details within standard bridge types (e.g., integral piers, straddle piers, complex or unusual geometry~~skewed superstructures~~).

Modification for Non-Conventional Projects:
Delete item (1) above and replace with the following: (1) An Independent Department Review (IDR) ***(FDM 103, Forms 121-D & 121-E)*** is required for all Category 2 Structures. When a firm is designated by the Department to conduct the IDR, the firm will not be a party to the contract with, or perform work for, the Design-Build Firm/Joint Venture.

(2) An IPR is required for Cost Savings Initiatives involving Category 2 Structures. The IPR function must be performed by a single independent engineering firm other than the engineer responsible for the design. The IPR must include:

(a) The superstructure and substructure for bridges consisting of Category 2 superstructures.

(b) Only the substructure for bridges where the superstructure is Category 1, but the substructure is Category 2.

(c) The superstructure and substructure for bridges designed for vessel collision. The IPR must include all spans or continuous units subject to vessel collision.

(d) The superstructure and substructure on bridges for which the superstructure is subject to application of wave loads. The IPR must include all spans or continuous units for which the superstructure is subject to application of wave loads.

(3) An IPR is required for the following structures and components of non-Department-owned projects constructed within, under or over State Road right-of-way, regardless of funding source:

(a) Category 1 (excluding miscellaneous structures) or Category 2 Structures

(b) Existing bridge retrofits and modifications regardless of bridge category

(c) Bridge cladding components and attachments

The peer review is intended to be a comprehensive, thorough independent verification of the original work. An independent peer review is not simply a check of the EOR's plans and calculations; it is an independent verification of the complete design, including but not limited to an evaluation of all nodal forces, using different programs and independent processes than what was used by the EOR. In addition, all independent peer reviews must include but are not limited to the independent confirmation of the following when applicable:

(1) Compatibility of bridge geometry with roadway geometrics including typical sections, horizontal alignment, and vertical alignment. Minimum lateral offsets and vertical clearance requirements.

(2) Compatibility of construction phasing with Traffic Control Plans.

(3) Conflicts with underground and overhead utilities.

(4) Compliance with AASHTO, Department and FHWA design requirements.

(5) Conformity to Department Standard Plans.

(6) Structural Analysis Methodology, design assumptions, and independent confirmation of design results including verification of the design thru all phases of construction.*

(7) Global and local analyses including nodal forces, considering all structural members, connections/nodes and boundary conditions consistent with the structure type.*

(8) Design results/recommendations (independent verification of the design).*

(9) Completeness and accuracy of bridge plans.

(10) Technical Special Provisions and Modified Special Provisions where necessary.

(11) Constructability assessment limited to looking at fatal flaws in design approach.

* When Category 2 elements are designed with software using refined analyses (e.g., Grid, Finite Element Method), the peer review consultant is required to verify the design results by a different program/method.

In addition to the requirements of ***FDM 121.11.3*** and ***121.11.4***, include the following documents with plan submittals requiring an independent peer review:

(1) 90% Plan Submittals

  (a) A tabulated list of all review comments from the independent review engineer and responses from the originator of the design.

  (b) A standard peer review certification letter following the format presented in ***Form 121-B*** (see ***FDM 103***) signed by the independent review engineer. All outstanding/unresolved comments and issues presented in this letter are required to be resolved and implemented prior to the 100% plan submittal.

  (c) A copy of the Department-issued Professional Services Qualification Letter, Part 1, containing the Work Types in which the independent PEER review firm has been qualified to work. The DSDE, for Category 1 bridge projects, or the SSDE, for Category 2 bridge projects, will confirm with the Procurement Office the independent PEER review firm's prequalification status of the appropriate Work Type.

  (d) Independent peer review calculations conforming to the requirements of ***FDM 121.13.2***.

(2) 100% Plan Submittals

  (a) A certification letter following the format presented in ***Form 121-C*** (see ***FDM 103***) signed and sealed by the independent review engineer stating that all review comments have been adequately addressed and that the design is in compliance with all Department and FHWA requirements.

  (b) A copy of the Department-issued Professional Services Qualification Letter, Part 1, containing the Work Types in which the independent PEER review firm has been qualified to work. The DSDE, for Category 1 bridge projects, or the SSDE, for Category 2 bridge projects, will confirm with the Procurement Office the independent PEER review firm's prequalification status of the appropriate Work Type.

  (c) Independent peer review calculations conforming to the requirements of ***FDM 121.13.2***.

Modification for Non-Conventional Projects:
Delete items (1) and (2) above.

121.13 Assembly of Plans and Calculations

121.13.1 Plans Assembly

Consult the ***Structures Detailing Manual*** for plans assembly, materials, content of plans, and other drafting information.

121.13.2 Calculations Assembly

The requirements herein are applicable to calculations submitted to the Department. All calculation submittals must be complete, understandable, and organized. Submit calculations as a high-quality PDF report, wherein any scanned pages have a minimum 300 dpi and 75% quality compression~~, with all major chapters delineated with bookmark links~~, and include the following:

(1) Cover page listing project information and Engineer of Record

(2) ~~Table of contents listing a~~All design sections and sub-sections ~~with page numbering~~delineated with bookmark links.

(3) Comment Tracking Log listing all current and previous comments from the Department (including all Department Representatives) with responses to date, at the time of submission.

(4) Detailed narrative of the design methodology, including a summary of all applicable design criteria (e.g., specifications and references, loads and load combinations, software and versions used for each component design, geotechnical considerations, modeling considerations for elastic/inelastic behavior, how results from one program were utilized in another, etc.).

(5) Supporting design assumptions and associated commentary

(6) Relevant software input and output

(7) Member or component governing force effect and section capacity

(8) Refined analyses shall include visual graphics of the structural model(s), loading diagrams, and results

Category 2 Structures require extensive analysis and design documentation due to their inherent complexity. The following are typical requirements for concrete and steel Category 2 Structures to be addressed in the calculations submittal and modified as necessary for each structure type. Other types of bridge structures such as cable stay, suspension, arch, truss, moveable, FRP, bridges using Prefabricated Bridge Element Systems, etc. shall include similar information.

(1) General

(a) General project overview and description

(b) Describe purpose of submittal

(c) Document all unique or non-standard details pertinent to the calculations submittal

(d) Design Specifications. List all relevant design specifications and References used during the design, including the date and edition for each.

(e) Redundancy and Operational Importance

(f) Bridge target service life

(g) Analysis Software. Name, version number and provide a description of the programs.

(h) Properties for each material considered in the analysis and design, including but not limited to yield strength, tensile strength, compression strength, modulus of elasticity, thermal coefficient, Poisson's ratio, etc.

(2) Geometry

(a) Horizontal alignment

(b) Vertical alignment

(c) Horizontal and vertical clearances

(d) Finish Grade Elevations

(e) Substructure elevations

(3) Loads and Load Combinations

(a) Document all loads and load combinations considered in the analysis and design.

(4) Structural Analysis Models

At a minimum, provide the following sections for any structural model to document the assumptions:

(a) Overview of Model

i. Diagram of what components are included in the model stiffness

ii. Element and node numbering

iii. Tendon/Cable Layouts

iv. Tendon/Cable Stressing Forces

(b) Boundary condition assumptions for all structural components

i. Connection between superstructure and substructure

ii. Connection between substructure and foundation

iii. Connection between foundation and soil

(c) Basic model assumptions

i. Cross-sectional information

ii. Effective Flange Width

iii. FEM element types used

(d) Construction stages with sequence and descriptions

(e) Loading diagrams or sketches to clearly document magnitude and direction of loading.

(f) Non-linear analysis assumptions

i. Geometric non-linearity

ii. Material non-linearity

(5) Structural Analysis Software Results

Structural analysis software outputs should be limited to pertinent results and document the following minimum requirements:

(a) Force effects for each element

(b) Envelope of Forces and Stresses for applicable Load Combinations

(6) Component Design Calculations

The calculations shall provide the governing loading combinations and section capacities for the structural elements and connections for critical stages during construction and the design life of the bridge listed as follows:

(a) Superstructure

(b) Substructure

(c) Foundation

(d) Miscellaneous (bearings, expansion joints, etc.)

(7) Appendices

Provide additional documentation used as a basis of design assumptions for the submittal. Examples include wind-tunnel testing reports, pertinent design related correspondence, side studies, sensitivity analyses, etc.

121.14 Plans Submittal

121.14.1 Schedule

The District Project Manager is responsible for establishing the schedule of submittals with input from the EOR and either the DSDE for Category 1 or Structures Design Office for Category 2 projects.

121.14.2 Submittal Schedule

(1) BDR/30% Structures Plans

(2) 60% Substructure Submittal/60% Structures Plans

(3) 90% Structures Plans

(4) 100% Structures Plans

Modification for Non-Conventional Projects:
Delete ***FDM 121.14.1*** and ***121.14.2***. See the RFP for requirements.

121.14.3 Summary of Phase Submittals

Submittals made at various stages of project development are required to conform to a uniform standard of completeness for each phase. Use ***Table 121.14.1*** to prepare deliverables for each stage of project development for fixed bridges. Use ***Table 121.14.1*** and ***Table 121.14.2*** to prepare deliverables for each stage of project development for moveable bridges.

Table 121.14.1 and ***Table 121.14.2*** give a listing of specific structure plan sheets to be submitted at Bridge Development Report, 30%, 60%, 90% and 100% Plans stage. For specific sheet content requirements, see ***Structures Detailing Manual Examples for Design-Bid-Build Projects***. For sheets not covered by specific example, see general description below for required level of completion.

(1) **Preliminary (P):** Basic shapes, geometry and layout of specified members are shown. Rebar and elevations are not required for Preliminary submittals. For example, the outline drawing of an end bent with complete dimensions including stationing, beam, and pedestal layout but without pile layout dimensions or rebar.

(2) **Substantially Complete (S):** Shapes, geometry and layout have been finalized. Design is 90% complete with most rebar, plate sizes, bolt patterns, concrete strengths finalized and incorporated into the plans. For example, an end bent drawing with rebar, complete dimensions, pile, and beam layout but without elevations.

(3) **Complete but Subject to Change (C):** The design, drawings and details are complete for the specified component. Only reviewer-initiated changes should be expected at this level. For example, an end bent drawing would be complete, including all rebar callouts, elevations, dimensions.

(4) **Final (F):** All drawings and designs are complete. No changes are expected at this level. Plans are ready to be signed and sealed by the EOR.

Modification for Non-Conventional Projects:

Delete ***FDM 121.14.3*** and replace with the following:

121.14.3 Design-Build Technical Proposal and Component Plan Submittals

Component Plan Submittals are required to conform to a uniform standard of completeness for each submittal. Use ***Table 121.14.3*** to prepare deliverables for each component submittals for fixed bridges. Use ***Table 121.14.3*** and ***Table 121.14.4*** to prepare deliverables for component submittals for moveable bridges. Unless otherwise shown in the RFP, Technical Proposals are required to include the requirements of ***Table 121.14.3*** and ***Table 121.14.4***.

Submit component submittals per ***Table 121.14.3*** and ***Table 121.14.4*** (e.g., foundation, substructure, and superstructure) for each bridge. Partial submittals of individual elements within a bridge (e.g., End Bent 1, Pier 3, I-girder details) are not permitted.

Table 121.14.3 and ***Table 121.14.4*** give a listing of specific structure plan sheets to be submitted at Technical Proposal, 90% and Final Plans stage. For specific sheet content requirements, see ***Structures Detailing Manual Examples for Non-Conventional Projects***. For sheets not covered by specific example, see general description below for required level of completion.

(1) **Preliminary (P):** Basic shapes, geometry and layout of specified members are shown. Rebar and elevations are not required for Preliminary submittals. For example, the outline drawing of an end bent with complete dimensions including stationing, beam and pedestal layout but without pile layout dimensions or rebar.

(2) **Substantially Complete (S):** Shapes, geometry and layout have been finalized. Design is 90% complete with most rebar, plate sizes, bolt patterns, concrete strengths finalized and incorporated into the plans. For example, an end bent drawing with rebar, complete dimensions, pile and beam layout but without elevations.

(3) **Complete but Subject to Change (C):** The design, drawings and details are complete for the specified component. Only reviewer-initiated changes should be expected at this level. For example, an end bent drawing would be complete, including all rebar callouts, elevations, and dimensions.

(4) **Final (F):** All drawings and designs are complete. No changes are expected at this level. Plans are ready to be signed and sealed by the EOR.

Table 121.14.1 Summary of Phase Submittals

Provide the sheets listed as applicable based on structure type.

ITEM	BDR	30%	60% Substr. Submittal	60% Structures Plans*	90%	100%
Cover Sheet		P	S	S	C	F
Key Sheet		P	S	S	C	F
Sheet Index		P	S	S	C	F
General Notes		P	S	S	C	F
Standard Plans Index Sheets					F	F
Surface Finish Details			S	S	C	F
Riprap Details			S	S	C	F
Slope Protection Details			S	S	C	F
Plan and Elevation	S	S	C	C	C	F
Typical Section	S	S	C	C	C	F
Hydraulics Recommendation	P	P	S	S	C	F
Construction Sequence	S	S		C	C	F
Borings		C	C	C	C	F
Foundation Layout		S	S	S	C	F
Pile/Shaft Data Table		P	S	S	C	F
End Bent		P	S	S	C	F
End Bent Details			S	S	C	F
Wing Wall Details			S	S	C	F
Pier	P	P	S	S	C	F
Pier Details		P	S	S	C	F
Footing		P	S	S	C	F
Intermediate Bent	P	P	S	S	C	F
Intermediate Bent Details			S	S	C	F
Drilled Shaft Details		P	S	S	C	F
Finish Grade Elevations				C	C	F
Camber/Build-up/Deflection Diagrams				C	C	F
Framing Plan		P		S	C	F
Superstructure Plan				S	C	F
Superstructure Details				S	C	F
Erection Sequence	P	P	S	S	C	F
P/S Beam Data Tables				S	C	F
Cross Frames/Diaphragm Details				S	C	F
Steel Girder Details		P		S	C	F
P/T Systems		P		S	C	F
Bearing Details				S	C	F
Expansion Joint Details				S	C	F
Approach Slab Details				S	C	F
Reinforcing Bar List					C	F
Conduit and Inspection Lighting Details				P	C	F
Vermin Guard				S	C	F
Wall Control Drawings		P***	S	S	C	F
Wall Details		P	S	S	C	F
Temporary Critical Wall Drawings	P	P	S	S	C	F
Wall Data Tables			S	S	C	F
Temp. Bridge Plan and Elevation			P	P	C	F
Temp. Bridge Foundation Layout			P	P	C	F

Table 121.14.1 Summary of Phase Submittals (continued)

Provide the sheets listed as applicable based on structure type.

ITEM	BDR	30%	60% Substr. Submittal	60% Structures Plans*	90%	100%
Segment Joint Coordinates/Deck Elev.				S	C	F
Segment Layout		P		S	C	F
Typical Segment Dimensions	P	P		C	C	F
Typical Segment Reinforcing				S	C	F
Pier Segment Dimensions	P	P		C	C	F
Pier Segment Reinforcing **				S	C	F
Abutment Segment Dimensions	P	P		C	C	F
Abutment Segment Reinforcing **				S	C	F
Expansion Joint Segment Dimensions		P		S	C	F
Expansion Joint Segment Reinforcing **				S	C	F
Deviation Segment Dimensions		P		C	C	F
Deviation Segment Reinforcing **				S	C	F
Post Tensioning Layout		P		C	C	F
P/T Details	P	P		S	C	F
Transverse P/T Details		P		C	C	F
Bulkhead Details		P		S	C	F
Drainage Layout		P		S	C	F
Drainage Details		P		S	C	F
Load Rating Summary Sheet					C	F
Developmental Standard Plans		C	C	C	F	F
Existing Bridge Plans		F ‡‡	F ‡‡	F ‡‡	F	F

Status Key:
P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
***** – 60% Structures Plan submittals are required for all Category 2 and some Category 1 bridges. See ***FDM 121.11.2*** for additional information
****** – May require integrated drawings
*** – Control Plans only showing geometry, stationing, and offsets
‡ – Where required for project
‡‡ – Widenings and projects with phased construction

Table 121.14.2 Summary of Phase Submittals - Movable Bridges

For approach span requirements, see ***Table 121.14.1***.

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Bascule Pier Notes		P	S	C	F
Bascule Span Elevation	P	S	S	C	F
Leaf Clearance Diagrams		P	S	C	F
Bridge Railing Clearance Diagrams		P	S	C	F
Bascule Pier North Elevation View	P	S	S	C	F
Bascule Pier South Elevation View	P	S	S	C	F
Bascule Pier East Elevation View	P	S	S	C	F
Bascule Pier West Elevation View	P	S	S	C	F
Bascule Pier Deck Plan	P	S	S	C	F
Bascule Pier Deck Elevations	P	S	S	C	F
Bascule Pier Trunnion Level Plan	P	S	S	C	F
Bascule Pier Machinery Level Plan	P	S	S	C	F
Bascule Pier Pit Plan	P	S	S	C	F
Bascule Pier Footing Plan	P	S	S	C	F
Bascule Pier Longitudinal Sections	P	S	S	C	F
Bascule Pier Transverse Sections	P	S	S	C	F
Bascule Pier Railing Details			P	C	F
Bascule Pier Stair Details			P	C	F
Bascule Pier Trunnion Access Platform Details	‡	‡	S	C	F
Bascule Pier Finger Joints			P	C	F
Bascule Pier Deck Level Reinforcing			P	C	F
Bascule Pier Trunnion Level Reinforcing			P	C	F
Bascule Pier Machinery Level Reinforcing			P	C	F
Bascule Pier Pit Reinforcing			P	C	F
Bascule Pier Footing Reinforcing			P	C	F
Bascule Pier North Elevation Reinforcing			P	C	F
Bascule Pier South Elevation Reinforcing			P	C	F
Bascule Pier East Elevation Reinforcing			P	C	F
Bascule Pier West Elevation Reinforcing			P	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Bascule Pier Longitudinal Section Reinforcing			P	C	F
Bascule Pier Transverse Section Reinforcing			P	C	F
Bascule Pier Reinforcing Bar List			P	C	F
Control House General Notes			P	C	F
Control house Reflected Ceiling Plan			P	C	F
Control House Access Bridge Dimensions	‡	‡	S	C	F
Control House Access Bridge Reinforcing	‡	‡	S	C	F
Control House Access Bridge Bar List	‡	‡	S	C	F
Control Tower Floor Plans	P	S	S	C	F
Control Tower Sections	P	S	S	C	F
Control Tower Reinforcing Plans			P	C	F
Control Tower Reinforcing Elevations			P	C	F
Control Tower Section Reinforcing			P	C	F
Control Tower Bar List			P	C	F
Control Tower Schedules			P	C	F
Control Tower Elevations	P	S	S	C	F
Control Tower Building Sections			P	C	F
Control Tower Details			P	C	F
Control Tower Stair Plans			P	C	F
Control Tower Stair Sections			P	C	F
Control Tower Roof			P	C	F
Control Tower Door and Window Types and Details			P	C	F
Control Tower Architectural Details			P	C	F
Control Tower HVAC Notes			P	C	F
Control Tower HVAC and Plumbing Floor Plans			P	C	F
Control Tower HVAC and Plumbing Elevations			P	C	F
Bascule Leaf Notes			S	C	F
Bascule Leaf Framing Plan and Longitudinal Section	P	S	S	C	F
Bascule Leaf Transverse Sections at Floorbeams	P	S	S	C	F
Bascule Leaf Transverse Sections at Trunnion	P	S	S	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Bascule Leaf Transverse Sections at Counterweight Girders	P	S	S	C	F
Main Girder Elevation	P	S	S	C	F
Main Girder Details			P	C	F
Main Girder Web Geometry and Camber Details			P	C	F
Main Girder Force Diagrams			P	C	F
Main Girder Reaction Influence Lines			P	C	F
Main Girder Moment Influence Lines			P	C	F
Floorbeam Details			P	C	F
Counterweight Girder Details			P	C	F
Stringer Details			P	C	F
Lateral Bracing Details			P	C	F
Counterweight Bracing Plan and Details			P	C	F
Counterweight Bracing Sections and Details			P	C	F
Counterweight Plan			P	C	F
Counterweight Longitudinal Sections			P	C	F
Counterweight Transverse Sections			P	C	F
Counterweight Details and Reinforcing Bar List			P	C	F
Bridge Deck Panel Layout			P	C	F
Bridge Deck Panel Sections			P	C	F
Bridge Deck Panel Details			P	C	F
Armored Joint Details			P	C	F
Span Lock Housing Details			P	C	F
Bascule Leaf Jacking Details and Notes			P	C	F
Mechanical General Notes		P	S	C	F
Mechanical Equipment Schedules		P	S	C	F
Drive Machinery Layout		P	S	C	F
Machinery Support Details			S	C	F
Trunnion Assembly Details		P	S	C	F
Open Gearing Details		P	S	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Rack/Rack Frames and Rack Pinion Details		P	S	C	F
Mechanical Bearing Details		P	S	C	F
Drive Hydraulic Cylinders Details		P	S	C	F
Hydraulic System Layout/Piping Details		P	S	C	F
Hydraulic Cylinder Support Assemblies		P	S	C	F
Hydraulic System Details		P	S	C	F
Live Load Shoe Details		P	S	C	F
Centering Device Details			S	C	F
Span Lock Assembly Details		P	S	C	F
Control Tower – Control Console and Operator's Visualization Geometry Analysis Including CCTV Locations		P	S	C	F
Electrical General Notes		P	S	C	F
Electrical Site Plan		P	S	C	F
Conduit Riser Diagram		P	S	C	F
Single Line Diagram		P	S	C	F
Electrical Symbol Legend		P	S	C	F
Lighting and Equipment Plan (Including Control Tower Lighting, Fire Detection and Lighting Panel Schedules)		P	S	C	F
Lightning Protection, Bonding, and Grounding Plan		P	S	C	F
Navigation Lighting Plan		P	S	C	F
Communication Equipment Plan		P	S	C	F
Control Panel Details		P	S	C	F
Control Console Details		P	S	C	F
Block Diagram of Operating Sequence Control System Architecture Diagram		P P	S S	C C	F F
Schematic Diagrams of all Control Systems and Interlocks		P	S	C	F
Control System I/O Points		P	S	C	F
Ladder Logic for PLC			P	C	F
Submarine Cable/Submarine Cable Termination Cabinet Details		P	S	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Fire and Security Panel Schematic Diagram		P	C	C	F
CCTV Plan and Elevation		P	C	C	F
Limit Switch Development		P	C	C	F
Conduit and Cable Schedule		P	C	C	F
Electrical Equipment Layout - Including but not limited to Generators, Motors, Control Console, Control Panels, and Motor Control Center.		P	C	C	F
CCTV Layout			P	S	F

Status Key:

P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
***** – 60% Structures Plan submittals are required for all movable bridges. See ***FDM 121.11.2*** for additional information
‡ – Where required for project

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals

Provide the sheets listed as applicable based structure type.

Foundation Submittal

ITEM	Technical Proposal	90%	Final
Cover Sheet		C	F
Key Sheet		C	F
Sheet Index		C	F
General Notes	S	C	F
Standard Plans Index Sheets		F	F
Surface Finish Details		C	F
Riprap Details		C	F
Slope Protection Details		C	F
Plan and Elevation	P	C	F
Typical Section	P	C	F
Hydraulics Recommendation	P	C	F
Construction Sequence	P	C	F
Borings		C	F
Foundation Layout	P	C	F
Pile/Shaft Data Table		C	F
Drilled Shaft Details		C	F
Temp. Bridge Foundation Layout	P	C	F
Existing Bridge Plans		F‡‡	F
Foundation Related Temporary Critical Wall Drawings	P	C	F
Include in all submittals additional details and backup information necessary to substantiate the loading on the foundations. Include a copy of the Geotechnical Report in all submittals. ‡‡ – Widenings and projects with phased construction 90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals (Continued)

Provide the sheets listed as applicable based structure type.

Substructure Submittal

ITEM	Technical Proposal	90%	Final
End Bent	P	C	F
End Bent Details		C	F
Wing Wall Details		C	F
Pier	P	C	F
Pier Details		C	F
Footing	P	C	F
Intermediate Bent	P	C	F
Intermediate Bent Details		C	F
Reinforcing Bar List		C	F
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals (Continued)

Provide the sheets listed as applicable based structure type.

Superstructure Submittal

ITEM	Technical Proposal	90%	Final
Finish Grade Elevations		C	F
Camber/Build-up/Deflection Diagrams		C	F
Framing Plan		C	F
Superstructure Plan		C	F
Superstructure Details		C	F
Erection Sequence	P‡	C	F
P/S Beam Data Tables		C	F
Cross Frames/Diaphragm Details		C	F
Steel Girder Details	P	C	F
P/T Systems	P	C	F
Bearing Details		C	F
Expansion Joint Details		C	F
Approach Slab Details		C	F
Reinforcing Bar List		C	F
Conduit and Inspection Lighting Details		C	F
Vermin Guard		C	F
Wall Control Drawings	P	C	F
Wall Details		C	F
Non-Foundation Related Temporary Critical Wall Drawings	P	C	F
Wall Data Tables		C	F
Temp. Bridge Plan and Elevation	P	C	F
Segment Joint Coordinates/Deck Elev.		C	F
Segment Layout	P	C	F
Typical Segment Dimensions	P	C	F
Typical Segment Reinforcing		C	F
Pier Segment Dimensions	P	C	F
Pier Segment Reinforcing **		C	F
Abutment Segment Dimensions	P	C	F
Abutment Segment Reinforcing **		C	F
Expansion Joint Segment Dimensions	P	C	F
Expansion Joint Segment Reinforcing **		C	F
Deviation Segment Dimensions	P	C	F
Deviation Segment Reinforcing **		C	F
Post Tensioning Layout	P	C	F

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals (Continued)

Provide the sheets listed as applicable based structure type.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
P/T Details	P	C	F
Transverse P/T Details		C	F
Bulkhead Details		C	F
Drainage Layout		C	F
Drainage Details		C	F
Load Rating Summary Sheet		C	F
Developmental Standard Plans		F	F
Existing Bridge Plans		F‡‡	F
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Status Key:

P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
****** – May require integrated drawings
‡ – For geometrically constrained sites, show temporary stability towers in the vicinity of the underlying roadways consistent with the Traffic Control Plans. Also show temporary stability towers within navigable waterways.
‡‡ – Widenings and projects with phased construction

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges

For approach span and foundation submittal requirements see ***Table 121.14.3***.

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Substructure Submittal

ITEM	Technical Proposal	90%	Final
Bascule Pier Notes		C	F
Bascule Span Elevation	P	C	F
Leaf Clearance Diagrams		C	F
Bridge Railing Clearance Diagrams		C	F
Bascule Pier North Elevation View	P	C	F
Bascule Pier South Elevation View	P	C	F
Bascule Pier East Elevation View	P	C	F
Bascule Pier West Elevation View	P	C	F
Bascule Pier Deck Plan	P	C	F
Bascule Pier Deck Elevations	P	C	F
Bascule Pier Trunnion Level Plan	P	C	F
Bascule Pier Machinery Level Plan	P	C	F
Bascule Pier Pit Plan	P	C	F
Bascule Pier Footing Plan	P	C	F
Bascule Pier Longitudinal Sections	P	C	F
Bascule Pier Transverse Sections	P	C	F
Bascule Pier Railing Details		C	F
Bascule Pier Stair Details		C	F
Bascule Pier Trunnion Access Platform Details	‡	C	F
Bascule Pier Finger Joints		C	F
Bascule Pier Deck Level Reinforcing		C	F
Bascule Pier Trunnion Level Reinforcing		C	F
Bascule Pier Machinery Level Reinforcing		C	F
Bascule Pier Pit Reinforcing		C	F
Bascule Pier Footing Reinforcing		C	F
Bascule Pier North Elevation Reinforcing		C	F
Bascule Pier South Elevation Reinforcing		C	F
Bascule Pier East Elevation Reinforcing		C	F
Bascule Pier West Elevation Reinforcing		C	F
Bascule Pier Longitudinal Section Reinforcing		C	F
Bascule Pier Transverse Section Reinforcing		C	F
Bascule Pier Reinforcing Bar List		C	F
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal

ITEM	Technical Proposal	90%	Final
Control House General Notes		C	F
Control house Reflected Ceiling Plan		C	F
Control House Access Bridge Dimensions	‡	C	F
Control House Access Bridge Reinforcing		C	F
Control House Access Bridge Bar List		C	F
Control Tower Floor Plans	P	C	F
Control Tower Sections	P	C	F
Control Tower Reinforcing Plans		C	F
Control Tower Reinforcing Elevations		C	F
Control Tower Section Reinforcing		C	F
Control Tower Bar List		C	F
Control Tower Schedules		C	F
Control Tower Elevations	P	C	F
Control Tower Building Sections		C	F
Control Tower Details		C	F
Control Tower Stair Plans		C	F
Control Tower Stair Sections		C	F
Control Tower Roof		C	F
Control Tower Door and Window Types and Details		C	F
Control Tower Architectural Details		C	F
Control Tower HVAC Notes		C	F
Control Tower HVAC and Plumbing Floor Plans		C	F
Control Tower HVAC and Plumbing Elevations		C	F
Bascule Leaf Notes		C	F
Bascule Leaf Framing Plan and Longitudinal Section	P	C	F

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
Bascule Leaf Transverse Sections at Floorbeams	P	C	F
Bascule Leaf Transverse Sections at Trunnion	P	C	F
Bascule Leaf Transverse Sections at Counterweight Girders	P	C	F
Main Girder Elevation	P	C	F
Main Girder Details		C	F
Main Girder Web Geometry and Camber Details		C	F
Main Girder Force Diagrams		C	F
Main Girder Reaction Influence Lines		C	F
Main Girder Moment Influence Lines		C	F
Floorbeam Details		C	F
Counterweight Girder Details		C	F
Stringer Details		C	F
Lateral Bracing Details		C	F
Counterweight Bracing Plan and Details		C	F
Counterweight Bracing Sections and Details		C	F
Counterweight Plan		C	F
Counterweight Longitudinal Sections		C	F
Counterweight Transverse Sections		C	F
Counterweight Details and Reinforcing Bar List		C	F
Bridge Deck Panel Layout		C	F
Bridge Deck Panel Sections		C	F
Bridge Deck Panel Details		C	F
Armored Joint Details		C	F
Span Lock Housing Details		C	F
Bascule Leaf Jacking Details and Notes		C	F
Mechanical General Notes	P	C	F
Mechanical Equipment Schedules	P	C	F
Drive Machinery Layout	P	C	F
Machinery Support Details		C	F

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
Trunnion Assembly Details	P	C	F
Open Gearing Details	P	C	F
Rack/Rack Frames and Rack Pinion Details	P	C	F
Mechanical Bearing Details	P	C	F
Drive Hydraulic Cylinders Details	P	C	F
Hydraulic System Layout/Piping Details	P	C	F
Hydraulic Cylinder Support Assemblies	P	C	F
Hydraulic System Details	P	C	F
Live Load Shoe Details	P	C	F
Centering Device Details		C	F
Span Lock Assembly Details	P	C	F
Control Tower – Control Console and Operator's Visualization Geometry Analysis Including CCTV Locations	P	C	F
Electrical General Notes	P	C	F
Electrical Site Plan	P	C	F
Conduit Riser Diagram	P	C	F
Single Line Diagram	P	C	F
Electrical Symbol Legend	P	C	F
Lighting and Equipment Plan (Including Control Tower Lighting, Fire Detection and Lighting Panel Schedules)	P	C	F
Lightning Protection, Bonding, and Grounding Plan	P	C	F
Navigation Lighting Plan	P	C	F
Communication Equipment Plan	P	C	F
Control Panel Details	P	C	F
Control Console Details	P	C	F
Block Diagram of Operating Sequence	P	C	F
Control System Architecture Diagram	P	C	F
Schematic Diagrams of all Control Systems and Interlocks	P	C	F

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
Control System I/O Points	P	C	F
Ladder Logic for PLC		C	F
Submarine Cable/Submarine Cable Termination Cabinet Details	P	C	F
Fire and Security Panel Schematic Diagram	P	C	F
CCTV Plan and Elevation	P	C	F
Limit Switch Development	P	C	F
Conduit and Cable Schedule	P	C	F
Electrical Equipment Layout - Including but not limited to Generators, Motors, Control Console, Control Panels, and Motor Control Center.	P	C	F
CCTV Layout		S	F

Status Key:

P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
‡ – Where required for project.

121.15 Review for Constructability and Maintainability

121.15.1 Purpose

The purpose of this review is to provide reasonable and practical use of fabrication and construction techniques and equipment without overloading and overstressing components, provide for proper material handling and transportation, provide safe maintenance of traffic, and provide an appropriate construction sequence. Additionally, provide features which will retard bridge deterioration, permit reasonable access to all parts of the bridge for inspection and performance evaluation and provide features to facilitate replacement of damaged and deteriorated bridge components.

121.15.2 Responsibility

For Category 1 and 2 Structures, it will be the responsibility of the District Project Manager, or his/her designee, to coordinate a review of both the 30% and 90% Structures Plans submittals by the appropriate District Construction and Maintenance personnel for constructability and maintainability. For Category 1 Structures, technical issues will be resolved to the satisfaction of the appropriate DSDE. For Category 2 Structures, technical issues will be resolved to the satisfaction of the SDO.

The Construction and Maintenance Offices should be given adequate time to perform these reviews. All comments from these reviews will be addressed prior to the next submittal and its subsequent review.

Modification for Non-Conventional Projects:
Delete ***FDM 121.15*** and see the RFP for requirements.

121.16 Review for Biddability

121.16.1 Purpose

To prevent construction problems, the District Construction Office will review the plans to make certain the plans are clearly understandable and contain all pertinent notes. During the biddability review, the Construction Office will check for the interface with the roadway segment of the project, utility agreements and environmental permits.

121.16.2 Responsibility

For Category 1 and 2 Structures, it will be the responsibility of the District Project Manager to coordinate a review of the 90% Structures Plan submittal. This review should occur at the same time as the Phase III Plans submittal for the roadway segments of the project.

Additionally, for Category 2 Structures, it will be the responsibility of the SDO to coordinate a review of the 90% Structures Plans submittal.

The Construction Offices should be given adequate time to perform these reviews. All comments from these reviews are required to be addressed prior to the 100% Structures Plans Stage submittal.

Modification for Non-Conventional Projects:
Delete ***FDM 121.16***.

121.17 Bridge Load Rating

For new bridges the Engineer of Record is required to load rate the bridge(s) and submit the calculations with the 90% plan submittal.

Prior to developing the scope-of-work for bridge widening or rehabilitation projects, the Department or their consultant will determine the suitability of the bridge project using the load rating. If the existing load rating is inaccurate or was performed using older methods (e.g., load factor), perform a new load rating using the procedures outlined in the ***Structures Manual, Volume 1 - Structures Design Guidelines, Chapter 7***. Submit load rating calculations for the entire structure (existing and new) with the 90% plan submittal for the project.

Modification for Non-Conventional Projects:
Delete ***FDM 121.17*** and see the RFP for requirements.

121.18 Review of Non-Department-Owned Projects (New Construction)

Portions of transportation projects on, under or over a Department-owned right-of-way, regardless of funding source or owner, will be subject to review by the Department. FHWA review will be required whenever a privately funded or LAP structure crosses over an interstate route, or when such work otherwise affects such a route; i.e., lane closures, access, R/W changes. The extent of the Department and FHWA review is that:

(1) Plans will meet all current clearance requirements (vertical and horizontal).

(2) Review and approve the maintenance of traffic scheme for construction.

(3) Securely fasten all attachments to the structure over the highway.

(4) Design will be sealed by a licensed professional engineer employed by a Department prequalified engineering firm.

(5) Designs will be in accordance with applicable Department publications.

(6) Plans will meet all District permit requirements and procedures.

(7) Submit to FHWA for approval only projects over or affecting a NHS facility.

(8) Department review for these structures will be performed by the DSDO for Category 1 and the SDO for Category 2 Structures. Structural reviews will be performed to the same extent as reviews performed on Department projects to assure compliance with the Department's design criteria.

121.19 Precast Alternate Development

Modification for Non-Conventional Projects:
Delete ***FDM 121.19***.

121.19.1 Precast Feasibility Assessment Questions:

Several negative responses to the following questions may indicate precasting is not feasible for the project. In this case, provide a statement in the BDR stating that precasting is not feasible and indicate the reasons why in order to satisfy the requirements of ***FDM 121.9.1, #9.***

(1) Will precasting reduce traffic impacts? Factors may include: average traffic volumes being affected, detour lengths and durations, lane reductions and duration.

(2) Is this structure likely to be on the critical path for construction of the project or is this structure on a hurricane evacuation route which requires accelerated delivery?

(3) Is the size of the project large enough to benefit from economy of scale, assembly line construction processes, and is it large enough to capitalize on a construction learning curve?

(4) Is precasting practical given the project aesthetics when component lifting weights are considered?

(5) Is precasting practical given project variability? Factors may include: formwork reuse, multiple construction methods and steps, and variable equipment requirements.

(6) Does the project site have space within FDOT R/W to use as a near-site casting yard and can precast elements be hauled from likely near-site casting yard locations to the site?

(7) Can precast elements be hauled from likely off-site prestressed yard locations to the site?

(8) Are the lifting weights practical given the assumed equipment, construction access, and construction methods?

(9) Can connection details be developed with the following characteristics:

(a) Durable?

(b) Easily inspected during construction?

(c) Accommodates shaft/pile placement tolerances?

(d) Accommodates fit up?

(e) Accommodates differential camber (full-depth deck panels)?

121.19.2 Assessment Matrix

Table 121.19.1 is a tool that may be used in documenting the decision-making process for evaluation of precast construction versus conventional cast-in-place construction. ***Table 121.19.2*** is a sample Alternate Cost Summary Table indicating how to summarize the component cost estimates and their sum.

Table 121.19.1 Sample Assessment Matrix

- example values in italics -		PRECAST		CONVENTIONAL	
Selection Factor	**Factor Weight (%)**	**Score *(0 to 5)***	**Weighted Score***	**Score *(0 to 5)***	**Weighted Score***
Total Direct Costs	*40*	*4*	*160*	*5*	*200*
Total Indirect Costs	*10*	*5*	*50*	*4*	*40*
Factor 3 - *Constructability*	*25*	*3*	*75*	*4*	*100*
Factor 4 – *Traffic Impacts*	*0*				
Factor 5 - *Construction Duration*	*0*				
Factor 6 - *Durability*	*0*				
Factor 7 – *Environmental Impacts*	*10*	*5*	*50*	*2*	*20*
Factor 8– *Aesthetics*	*15*	*5*	*75*	*3*	*45*
Factor 9 – *Other*	*0*				
Factor 10 – *Other*	*0*				
TOTAL ($\sum$ Factor Weights = 100%)	***100***		***410***		***405***
TOTAL (Excluding Indirect Cost Factor)**	*90*		*360*		*365*

*Weighted Score = Factor Weight x Score **See following explanation, Instructions “6.”

121.19.3 Assessment Matrix Instructions

(1) **List Selection Factors** to be used to evaluate the applicability of alternates to meet the goals of the project. Factors are project specific and always include Total Direct Costs and Total Indirect Costs (road user costs) and may include some of the following: Constructability, Traffic Impacts (e.g., Maintenance of Traffic, Detours, Traffic Delays), Construction Duration, Durability, Environmental Impacts, and Aesthetics. Include other Factors as required to capture any unique project characteristics that are not otherwise addressed. Note that as many or as few criteria may be used in the assessment matrix as deemed appropriate by the designer; though, a sufficient number of Selection Factors (i.e., criteria) are required to provide a thorough evaluation of the alternates being considered to meet the objectives of the project. When choosing selection factors and applying factor weights avoid double counting benefits. For instance, indirect costs and traffic impacts may be related selection factors.

Costs of precast versus conventional may be affected by:

(a) Savings associated with labor rates and insurance costs for reduced time working from a barge on a large water project.

(b) Savings associated with structural efficiencies resulting from precasting (e.g., composite dead loads in the case of shored deck casting).

(c) Savings associated with simultaneous substructure and superstructure component construction.

(d) Savings associated with increased productivity rates of precasting.

(2) **Construct** a two-dimensional table allowing one row for each Selection Factor and two columns for each alternate, one for Score and one for Weighted Score.

(3) **Factor Weights** to distinguish the level of importance of each criterion relative to the other criteria in achieving the project objectives. Weighting the various factors will usually require Department/District input. Distribute the Factor Weights such that their sum is equal to 100%.

(4) **Score** the relative difference between alternates. Range of scores can vary for a given project (e.g., 0 to 5 or 0 to 10). Scoring may be accomplished by a committee and then the average score for each Selection Factor entered into the matrix.

(5) **Calculate** the Weighted Score by multiplying the Factor Weight by Score for each alternate.

(6) **Total** the Weighted Score columns: (1) Provide the absolute total of each column, which includes the Indirect Costs Score and, (2) Provide the column total ***excluding*** the contribution from the "Total Indirect Costs." It is useful for management to

compare the impacts, both relative and in hard dollar amounts, of indirect costs on bridge construction projects when making their decisions. *The column with the largest total weighted score theoretically indicates the alternate which most closely meets the project objectives as implicated by the matrix construct.*

Table 121.19.2 Sample Alternate Cost Summary

Alternate	Direct Costs* ($)	Indirect Costs**							Sum: Direct + ∑Indirect ($)
		Lane Closures		Detour Time		Facility Closure		∑Indirect ($)	
		Days (#)	$/Day	Days (#)	$/Day	Days (#)	$/Day		
Precast 1									
Precast 2									
Conventional 1									
Conventional 2									

***** In calculation of Direct Costs, give specific consideration to factors that will:

(1) Increase the cost of the bridge, as necessary to accommodate:

(a) Self-propelled modular transporters (SPMTs)

(b) Large capacity cranes

(c) Special erection equipment

(d) Casting yard setup

(2) Decrease the cost of the bridge, as necessary to accommodate:

(a) Reduced labor rates (e.g., work from barges)

(b) Reduced maintenance of traffic (MOT) work restrictions

(c) Reduced worker compensation insurance rates (e.g., work from barges)

(d) Increased production rates due to assembly line processes.

(e) Increased production rates due to multiple crews working simultaneously

****** Use engineering judgment and knowledge of construction processes to estimate the number of days required for each lane closure, detour, or facility closure for each alternate. Coordinate this estimate with the preliminary construction schedule and MOT scheme.

121.19.4 Referenced Links

(1) Connection Details for Prefabricated Bridge Elements and Systems
https://www.fhwa.dot.gov/bridge/prefab/if09010/

(2) Manual on Use of Self-Propelled Modular Transporters to Remove and Replace Bridges
https://www.fhwa.dot.gov/bridge/pubs/07022/

(3) Framework for Decision-Making
https://www.fhwa.dot.gov/bridge/prefab/framework.cfm

(4) Prefabricated Bridge Elements and Systems Cost Study: Accelerated Bridge Construction Success Stories
https://www.fhwa.dot.gov/bridge/prefab/successstories/091104/index.cfm

(5) FDOT RUC (Road User Cost) software *(only available through infonet)*
http://infonet.dot.state.fl.us/tlconstruction/SchedulingEng/AddSoftwareScheduling.htm

122 Design Exceptions and Design Variations

122.1 General

The Department's design criteria and standards contained in the FDOT Design Manual are usually within the desirable ranges established by AASHTO. The values given have been accepted by the Federal Highway Administration (FHWA) and govern the design process. When it becomes necessary to deviate from the Department's criteria, early documentation and approval are required. There are two approval processes used by designers: Design Exceptions and Design Variations.

A Design Exception or Design Variation is required when the Department's criteria are not met. This requirement applies to all entities affecting planning, design, construction, and maintenance.

For RRR projects, see also ***FDM 114.1.1***.

122.1.1 Safety Improvement Projects

For safety improvement projects developed to solely address documented safety problems, only the elements identified under the scope of work for the safety improvement project are subject to these approval processes. Existing non-compliant features~~,~~ within the limits of a safety improvement project do not require approval to remain~~,~~ if the project does not create a non-compliant condition. For these projects, all Design Variations and Design Exceptions applicable to the project scope must be approved prior to the beginning of the design phase.

122.1.2 Drainage Projects

For drainage projects, only elements identified in the scope of services for the drainage project are subject to these approval processes. The existing features, within the limits of the drainage project that do not meet design criteria, do not require approval to remain (if the project does not create a nonconforming condition).

122.1.3 Maintenance Projects

Maintenance Resurfacing, Ride Only (a.k.a., Ride Rehabilitation) and Skid Hazard Projects do not require Design Exceptions or Design Variations other than for ADA curb ramp requirements. If compliance with ADA curb ramp requirements is determined to be technically infeasible, documentation as a Design Variation is required. Maintenance Resurfacing Projects can only be programmed on routes that meet the requirements identified in ***Chapter 27*** of the ***Work Program Instructions***.

122.1.4 Landscape Projects

For Landscape-only projects, intersection sight distance Design Variations may be processed by the Responsible Landscape Architect of Record. For design projects with landscaping, intersection sight distance Design Variations must be processed by a Professional Engineer. In cases where intersection sight distance falls below stopping sight distance, a Design Exception for stopping sight distance must be processed by the respective professional according to the above guidelines.

122.2 Identification

Identify the proper approval process as early as possible in the Planning and Design phases to allow time to research alternatives and begin the analysis and documentation activities. Identification should be done during the PD&E process for major projects and the scope development process for minor projects. Approval must be obtained no later than Phase I design submittal.

122.2.1 Design Exceptions

Design Exceptions are required when existing or proposed design elements do not meet both the Department's governing criteria and AASHTO's new construction criteria for the Controlling Design Elements.

The 10 Controlling Design Elements for high-speed (Design Speed ≥ 50 mph) roadways and limited access ramps (all design speeds) are:

(1) Design Speed
(2) Lane Width
(3) Shoulder Width
(4) Horizontal Curve Radius
(5) Superelevation Rate
(6) Stopping Sight Distance
(7) Maximum Grade
(8) Cross Slope
(9) Vertical Clearance
(10) Design Loading Structural Capacity

The two Controlling Design Elements for low speed (Design Speed < 50 mph) roadways are:

(1) Design Speed
(2) Design Loading Structural Capacity

FDM 122.5 provides AASHTO's minimum requirements for the above elements.

122.2.2 Design Variations

Design Variations are required when existing or proposed design elements do not meet the Department's criteria.

There are 2 methods to document Design Variations:

- Formal Design Variation
- Project Design Variation Memorandum

A **Formal Design Variation** is used for any of the following design elements:

(1) Controlling Design Elements
(2) American with Disabilities Act (ADA)
(3) Design elements requiring signature by individual or office noted in ***FDM 122.7.4***.

A **Project Design Variation Memorandum (*Form 122-B*)** is used to document all Non-Controlling Design elements for projects that do not meet Department criteria and for design elements that are not included in the above list for Formal Design Variations. This document is a stand-alone document prepared by the Engineer of Record and approved by the District Design Engineer and the District Traffic Operations Engineer (as needed).

This form should be submitted early in the design process, as certain items may require more extensive review.

When additional documentation is requested on a **Project Design Variation Memorandum (*Form 122-B*)**, a Formal Design Variation is required for re-submittal of those elements.

When additional design elements arise on a project following approval of the initial Project Design Variation Memorandum, the Memorandum can be appended for approval of the additional elements. An alternative option would be to submit the Design Variation in an additional Project Memorandum.

122.3 Justification for Approval

Sufficient detail and explanation must be provided to those reviewing the request to justify approval. Develop a detailed justification showing good engineering judgement when allowing a design element to remain that does not meet these requirements. At some point, this justification may be used to defend design decisions made by the Department and the designer. All deviations from Department criteria and standards must be uniquely identified, located, and justified; no blanket approvals are given.

Examples of valid justifications are as follows:

(1) The required criteria are not applicable to the site-specific conditions.

(2) The project can be as safe by not following the criteria.

(3) The environmental or community needs prohibit meeting criteria.

In some instances, the required criteria may be impractical, and the proposed design wisely balances all design impacts. The impacts that may be associated with this level of justification are:

(1) Safety and Operational performance

(2) Level of Service

(3) Right of Way impacts

(4) Community impacts

(5) Environmental impacts

(6) Costs

(7) Usability by all modes of transportation

(8) Long term and cumulative effects on adjacent sections of roadway

The justification should not be developed solely on the basis that:

(1) The Department can save money,

(2) The Department can save time, or

(3) The proposed design is similar to other designs.

122.3.1 Approval Process

Project Design Variation Memorandums, Formal Design Variations, and Design Exceptions should be approved by the Department prior to the Phase II plans submittal.

122.4 Documentation for Approval

Supporting documentation that is generated during the approval process is to accompany each submittal. The level of detail for Design Exceptions and Design Variations should be commensurate with the complexity of the design element and the relevance of information to engineering decisions.

Design Exceptions and **Formal Design Variations** should include the following documentation:

(1) Submittal/Approval Letter (***Form 122-A***, see ***FDM 103)***

(2) Project Description: general project information, location map, context classification, existing roadway characteristics, project limits (mileposts), county section number, work mix, objectives, and obstacles. Include any associated or future limitations that exist as a result of public or legal commitments.

(3) Project Schedule and Lifespan: Provide (1) the Plans Production date, and (2) the Letting date for the project. Explain why the proposed Design Exception/Variation is either a temporary or permanent condition. Include any future work planned or programmed to address the condition.

(4) Exception/Variation Description:

  (a) Specific design criteria that will not be met (provide criteria values from both AASHTO and FDOT). Detailed explanation of why the criteria or standard cannot be complied with or is not applicable. Description of the proposed value and why it is appropriate.

  (b) A plan view, plan sheet, or aerial photo of the location, showing the design speed, posted speed, target speed, right of way lines, and property lines of adjacent property. A photo of the area of the deficiency.

(c) Typical section or cross-section of the location.

(d) The milepost and station location (including left/right side).

(5) Alternative Designs Considered: meeting Department criteria, meeting AASHTO criteria, partial correction, and the no-build (existing) condition.

(6) Impacts of the Exception/Variation to:

(a) Safety Performance:

i. Review and evaluation of the most recent 5 years of crash data from the current date of analysis.

~~i.~~ii. A ~~-~~summary listing of the crashes reviewed with crash report numbers is acceptable for documentation. However, if specific crash reports are necessary for clarity, personal information must be redacted from the crash reports per ***F.S. 316.066***.

~~ii.~~iii. Description of the anticipated impact on safety, long and short-term effects. Description of any anticipated cumulative effects.

~~iii.~~iv. For non-existing or proposed conditions, a comparison of the predicted or expected crash frequency should be included along with a discussion of the 5-year crash history. Some resources that are available for this comparison include:

1. Highway Safety Manual (HSM)

2. Interactive Highway Safety Design Model (IHSDM)

3. Enhanced Interchange Safety Analysis Tool (iSATe)

4. Roadside Safety Analysis Program (RSAP)

(b) Operational Performance:

i. Description of the anticipated impact on operations, long and short-term effects. Description of any anticipated cumulative effects.

ii. Traffic information: Design Year AADT and 24-hour truck volume.

iii. Compatibility of the design with adjacent sections of roadway.

iv. Effects on capacity (proposed criteria vs. AASHTO) using an acceptable capacity analysis procedure and calculate reduction for design year, level of service.

(c) Right of Way

(d) Community

(e) Environment

(f) Usability by all modes of transportation

(7) Costs: Description of the anticipated costs associated with the Design Exception or Variation. Provide a Benefit-Cost (B/C) ratio, where applicable.

(8) Mitigation Measures: Description and explanation of practical mitigation measures or alternatives that were considered and selected treatments implemented on the project.

(9) Summary and Conclusions

A ***Project Design Variation Memorandum*** should include the following documentation, which may be presented in the format of succinct bullets:

(1) Submittal/Approval Memo (***Form 122-B***, see ***FDM 103***).

(2) Design criteria versus proposed criteria.

(3) Review of crash history on the project related to the design element.

(4) Abbreviated justification for the proposed criteria.

For Lateral Offset Design Variations, provide a tabulation of stations (or mileposts) and lateral offsets for aboveground fixed objects.

~~Additional information can be found on the ***Crash Location Verification Status Dashboard***.~~

122.5 AASHTO Controlling Elements

AASHTO criteria, required documentation, and mitigation strategies for the controlling elements is provided in the following sections. Detailed discussions on criteria and mitigation are provided in the ***AASHTO Green Book: A Policy on Geometric Design of Highways and Streets, 2018,*** and the ***FHWA Guide: Mitigation Strategies for Design Exceptions, July 2007.*** The AASHTO criteria provided are in no way intended to replace Department design criteria.

The criteria used for determining Design Exceptions on Interstate projects must be based on AASHTO's ***A Policy on Design Standards Interstate System 2016***.

122.5.1 Design Speed

122.5.1.1 AASHTO Criteria

Table 122.5.1 AASHTO Design Speed (Minimum)

Type Facility	Other Factors	Design Speed (mph)	AASHTO
Interstate	Urban Rural	50 70	DSIS pg. 3[(1)]
Freeways	Urban Rural	50 50	pg. 8-2
Urban Arterials	Major Other	20 15	pg. 2-26 pg. 2-27
Rural Arterials	Rolling terrain Level terrain Rural Town	50 50 20	pg. 7-3
Urban Collectors	Suburban Urban Urban-core	35 30 25	pg. 6-13
Rural Collectors	Level ADT < 400 ADT 400 - 2000 ADT > 2000 Rolling ADT < 400 ADT 400 - 2000 ADT > 2000	40 50 60 30 40 50	pg. 6-3, Table 6-1
Ramps	Highway Design Speeds (mph) 30 35 40 45 50 55 60 65 70	 15 20 20 25 25 30 30 30 35	pg. 10-105, Table 10-1
Loop Ramps	Minimum	20	pg. 10-106
Connections	Direct Semi-Direct	40 30	pg. 10-106

Notes:
(1) DSIS = AASHTO's *A Policy on Design Standards Interstate System* (January 2016).

122.5.1.2 Documentation

Provide the length of section with reduced design speed compared to the overall length of the project. Include any existing or proposed measures used within the transitions to adjacent roadway sections having higher or lower design (or operating) speeds.

122.5.1.3 Mitigation

A potential mitigation strategy is to use cross-sectional elements to reduce operating speeds to the design speed.

122.5.2 Lane Width

122.5.2.1 AASHTO Criteria

Table 122.5.2 AASHTO Lane Width (Minimum)

Type Facility	Lane Width (feet)	AASHTO
Freeway (including Auxiliary)	12	pg. 8-3, 10-90, DSIS pg.4 (1)
Rural Arterial	11	pg. 7-7, Table 7-3
Rural Town	10	Pg. 7-15
Urban Arterial	10	pg. 7-39
Urban Collector	10	pg. 6-16
Rural Collector	10	pg. 6-6, Table 6-5
Low Speed	10	pg. 4-9
Residential	9	pg. 4-10
Auxiliary (Non-Freeway)	10	pp. 4-9
Continuous TWLTL	10	pg. 4-10

Notes:
(1) DSIS = AASHTO's *A Policy on Design Standards Interstate System* (January 2016).

122.5.2.2 Documentation

Provide locations of alternative routes that meet criteria and a proposal for handling drainage. Include a typical section or plan of the proposed signing and pavement markings associated with the lane width exception.

122.5.2.3 Mitigation

Potential mitigation strategies for lane width are:

(1) Select optimal combination of lane and shoulder widths based on site characteristics to optimize safety and operations by distributing available cross-sectional width

(2) Signing to provide advanced warning of lane width reduction

(3) To improve the ability to stay within the lane:

  (a) Wide, recessed, or raised pavement markings

  (b) Delineators

  (c) Object Markers

  (d) Tubular Markers

  (e) Lighting

  (f) Audible and vibratory treatment, (See ***FDM 210.4.6*** for arterials and collectors. See ***FDM 211.4.4*** for LA Facilities.)

(4) To improve the ability to recover if the driver leaves the lane:

  (a) Paved or partially paved shoulders

  (b) Safety edge treatment

(5) To reduce crash severity if the driver leaves the roadway (See ***FDM 215***):

  (a) Remove or relocate fixed objects

  (b) Traversable slopes

  (c) Breakaway safety hardware

  (d) Shield fixed objects and steep slopes

122.5.3 Shoulder Width

122.5.3.1 AASHTO Criteria

Table 122.5.3 AASHTO Shoulder Widths (Minimum)

Type Facility	Other Factors	Median or Left (feet)	Right (feet)	AASHTO
Freeway	4 lanes	4 paved	10 paved	pg. 8-3
	≥ 6 lanes	10 paved	10 paved	pg. 8-3
Rural Arterial	ADT > 2000		8	pg. 7-7, Table 7-3
	ADT 400-2000		6	
	ADT < 400		4	
	4 lane Divided	4 paved	8	pg. 7-16
	6+ lane Divided	8	8	
Urban Arterial	Low Type (Gravel, Other)		2	pg. 4-12
	High Type (Asphalt, Conc.)		10	
	Heavily Traveled/High Speed/High Trucks		10	
Rural & Urban Collector	ADT > 2000		6	pg. 6-6, Table 6-5
	ADT 400-2000		4	
	ADT < 400		2	

Table 122.5.4 AASHTO Bridge Widths (Minimum)

Type Facility	Other Factors	Bridge Widths		AASHTO
Freeway	New Bridges	Approach Roadway Width		pg. 8-5
Rural Arterial	New Bridges (Short)	Approach Roadway Width		pg. 7-9
	New Bridges (Long) (> 200 ft.)	Travel Lanes + 4 ft. each side		
Urban Arterial	New and Existing Bridges (Short)	Curb to curb width of street		pg. 7-50
	New and Existing Bridges (Long) without shoulders or parking on arterial	Curb to curb width of street		
	New and Existing Bridges (Long) with shoulders or parking on arterial	Travel Lanes + 4 ft. each side		pg. 7-51
Type Facility	**Other Factors**	**Bridge Widths**		**AASHTO**
		New or Reconstruction	**To Remain**	
Rural and Urban Collector	ADT Under 400	Traveled Way + 2 ft. each side (1)	22 ft. (2)	pg. 6-8 Table 6-6,
	ADT 400-2000	Traveled Way + 4 ft. each side(1),(3)	24 ft. (2)	
	ADT > 2000	Approach Roadway Width (1),(3)	28 ft. (2)	

Notes:

(1) If the approach roadway has paved shoulders, then the surfaced width must be carried across the bridge.

(2) Bridges longer than 100 ft. are to be analyzed individually.

(3) For bridges > 100 ft. in length, the minimum bridge width of traveled way plus 3 ft. on each side is acceptable.

122.5.3.2 Documentation

Provide a proposal to address stalled vehicles, enforcement activities, emergency operations, and drainage in the documentation for the exception.

122.5.3.3 Mitigation

Potential mitigation strategies for shoulder width are:

(1) Select optimal combination of lane and shoulder width based on site characteristics to optimize safety and operations by distributing available cross-sectional width

(2) Signing to provide advanced warning of lane width reduction

(3) To improve the ability to stay within the lane:

- (a) Wide, recessed or raised pavement markings
- (b) Delineators
- (c) Object Markers
- (d) Lighting
- (e) Audible and vibratory treatment, (See ***FDM 210.4.6*** for arterials and collectors. See ***FDM 211.4.4*** for LA Facilities.)

(4) To improve the ability to recover if the driver leaves the lane:

- (a) Paved or partially paved shoulders
- (b) Safety edge treatment

(5) To reduce crash severity if driver leaves the roadway (See ***FDM 215***):

- (a) Remove or relocate fixed objects
- (b) Traversable slopes
- (c) Breakaway safety hardware
- (d) Shield fixed objects and steep slopes

122.5.4 Horizontal Curve Radius

122.5.4.1 AASHTO Criteria

Table 122.5.5 AASHTO Horizontal Alignment

Minimum Radius (feet) with Superelevation (page 3-34, 3-35, Table 3-7)

Type Facility	Super-elevation e-max	Minimum Curve Radius (feet) for Design Speed (mph)											
		15	20	25	30	35	40	45	50	55	60	65	70
Rural Highway and High-Speed Urban Street	0.04	42	86	154	250	371	533	711	926	1190	1500	---	---
	0.06	39	81	144	231	340	485	643	833	1060	1330	1660	2040
	0.08	38	76	134	214	314	444	587	758	960	1200	1480	1810
	0.10	36	72	126	200	292	410	540	694	877	1090	1340	1630
	0.12	34	68	119	188	272	381	500	641	807	1000	1220	1480

Minimum Radius (feet) for Section with Normal Cross Slope (page 3-47, Table 3-11)

Type Facility	Minimum Curve Radius (feet) for Design Speed (mph)											
	15	20	25	30	35	40	45	50	55	60	65	70
Freeway, Arterial, and Collector	947	1680	2420	3320	4350	5520	6830	8280	9890	11700	13100	14700

Minimum Radius (feet) for Intersection Curves (2001 AASHTO, page 201, Exh. 3-43)

Design Speed (mph)	10	15	20	25	30	35	40	45
Minimum Radius (feet)	25	50	90	150	230	310	430	540
Assumed Minimum Superelevation Rate	0.02	0.02	0.02	0.04	0.06	0.08	0.09	0.10

122.5.4.2 Documentation

No additional documentation beyond what is covered in ***FDM 122.4*** is required.

122.5.4.3 Mitigation

Potential mitigation strategies for horizontal curve radius are:

(1) To provide advanced warning:
   (a) Signing
   (b) Pavement marking messages
   (c) Dynamic curve warning systems
(2) To provide delineation:
   (a) Chevrons
   (b) Delineators
   (c) Tubular Markers
   (d) Linear Barrier Delineators
(3) To improve the ability to stay within the lane:
   (a) Widen the roadway
   (b) Skid-resistant pavement
   (c) Enhanced pavement markings
   (d) Lighting
   (e) Audible and vibratory treatment, (See ***FDM 210.4.6*** for arterials and collectors. See ***FDM 211.4.4*** for LA Facilities.)
(4) To improve the ability to recover if driver leaves the lane:
   (a) Paved or partially paved shoulders
   (b) Safety edge
(5) To reduce the crash severity if driver leaves the roadway (See ***FDM 215***):
   (a) Remove or relocate fixed objects
   (b) Traversable slopes
   (c) Breakaway safety hardware
   (d) Shield fixed objects and steep slopes

122.5.5 Superelevation Rate

122.5.5.1 AASHTO Criteria

Table 122.5.6 AASHTO Superelevation (Maximum)

Type Facility	Superelevation Rate	AASHTO
Highways (Rural)	12%	pg. 3-32
Urban	6%	pg. 3-32
Urban: Low Speed w/severe constraints	None	pg. 3-31
Ramps and Turning Roadways at Intersections	10%	pg. 9-83

Note:
(1) Maximum Superelevation is pro-rated value (based upon radius) from rate tables cited above.

122.5.5.2 Documentation

Provide side friction factors for each curve at the PC, Midpoint, and PT of the curve, and at the location of maximum provided superelevation. For multi-lane facilities, provide values for each lane. Use the following equation:

$$f = \frac{V^2 - 15Re}{V^2e + 15R}$$

where: f = Side Friction Factor

V = Design Speed (mph)

R = Radius (feet)

e = Superelevation (ft/ft) at the station evaluated

122.5.5.3 Mitigation

Potential mitigation strategies for superelevation rate exceptions are:

(1) To provide advanced warning:

   (a) Signing

   (b) Pavement marking messages

   (c) Dynamic curve warning systems

(2) To provide delineation:

   (a) Chevrons

   (b) Linear Barrier Delineators

   (c) Tubular Markers

(3) To improve the ability to stay within the lane:

   (a) Widen the roadway

   (b) Skid-resistant pavement

   (c) Enhanced pavement markings

   (d) Lighting

   (e) Audible and vibratory treatment, (See ***FDM 210.4.6*** for arterials and collectors. See ***FDM 211.4.4*** for LA Facilities.)

(4) To improve the ability to recover if driver leaves the lane:

   (a) Paved or partially paved shoulders

   (b) Safety edge

(5) To reduce the crash severity if driver leaves the roadway: (See ***FDM 215***)

   (a) Remove or relocate fixed objects

   (b) Traversable slopes

   (c) Breakaway safety hardware

   (d) Shield fixed objects and steep slopes

122.5.6 Stopping Sight Distance

122.5.6.1 AASHTO Criteria

Table 122.5.7 AASHTO Stopping Sight Distance (Minimum)
(AASHTO page 3-4, Table 3-1)

	Design Speed (mph)											
	15	20	25	30	35	40	45	50	55	60	65	70
Stopping Sight Distance (feet) Computed for Design	80	115	155	200	250	305	360	425	495	570	645	730

Table 122.5.8 AASHTO Vertical Alignment
(AASHTO Table 3-35, Table 3-37, and Table 6-3, and based on a 2' object height)

Design Speed (mph)	Minimum K Value for Vertical Curves	
	Crest	Sag
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64
45	61	79
50	84	96
55	114	115
60	151	136
65	193	157
70	247	181

Note:
(1) Rate of vertical curvature, K, is the length of curve per percent algebraic difference of the intersecting grades. (K = L/A)

Table 122.5.9 AASHTO Minimum Passing Sight Distance (AASHTO page 3-11, Table 3-4)

	Design Speed (mph)										
	20	25	30	35	40	45	50	55	60	65	70
Passing Sight Distance (feet)	400	450	500	550	600	700	800	900	1000	1100	1200

122.5.6.2 Documentation

Provide profiles in the area of vertical alignment related Design Exception or Design Variations for stopping sight distance. Provide plan views with sight triangles for horizontal stopping sight distance evaluations.

122.5.6.3 Mitigation

Potential mitigation strategies for stopping sight distance are:

(1) To mitigate sight distance restrictions
- (a) Signing and speed advisory plaques (crest vertical curves)
- (b) Lighting
- (c) Adjust placement of lane within the roadway cross section (horizontal)
- (d) Cross-sectional elements to manage speed

(2) To improve the ability to avoid crashes:
- (a) Cross-sectional elements
- (b) Wider clear recovery area

(3) To improve driver awareness on approach to intersections:
- (a) Advance warning signs
- (b) Dynamic warning signs
- (c) Larger or additional STOP/YIELD signs
- (d) Intersection lighting

122.5.7 Maximum Grade

122.5.7.1 AASHTO Criteria

Table 122.5.10 AASHTO Grades (Maximum)

Type Facility	Type Terrain	Grades (%) for Design Speed (mph)											AASHTO
		20	25	30	35	40	45	50	55	60	65	70	
Freeway [(1)]	Level	---	---	---	---	---	---	4	4	3	3	3	pg. 8-5,
	Rolling	---	---	---	---	---	---	5	5	4	4	4	Table 8-1
Rural Arterial	Level	5	5	5	5	5	5	4	4	3	3	3	pg. 7-6,
	Rolling	8	8	7	7	6	6	5	5	4	4	4	Table 7-2
Urban Arterial:	Level	8	7	7	7	7	6	6	5	5	---	---	pg. 7-38,
	Rolling	10	10	9	8	8	7	7	6	6	---	---	Table 7-4a
Rural Collector[(2)]	Level	7	7	7	7	7	7	6	6	5	---	---	pg. 6-4,
	Rolling	10	10	9	9	8	8	7	7	6	---	---	Table 6-2
Urban Collector[(2)]	Level	9	9	9	9	9	8	7	7	6	---	---	pg. 6-15,
	Rolling	12	12	11	10	10	9	8	8	7	---	---	Table 6-7

Notes:

(1) Grades one percent steeper than the values shown may be used in urban areas.

(2) Short lengths of grade in rural and urban areas, such as grades less than 500 ft. in length, one-way downgrades, and grades on low-volume rural and urban collectors may be up to 2 percent steeper than the grades shown above.

122.5.7.2 Documentation

No additional documentation beyond what is in ***FDM 122.4*** is required.

122.5.7.3 Mitigation

Potential mitigation strategies for maximum grade are:

(1) Signing to provide advanced warning

(2) To improve ability to stay within the lane:

   (a) Enhanced pavement markings

   (b) Delineators

   (c) Tubular Markers

   (d) Audible and vibratory treatment, (See ***FDM 210.4.6*** for arterials and collectors. See ***FDM 211.4.4*** for LA Facilities.)

(3) To improve ability to recover if driver leaves the roadway (See ***FDM 215***):

   (a) Paved or partially paved shoulders

   (b) Safety edge

   (c) Remove or relocate fixed objects

   (d) Traversable slopes

   (e) Breakaway safety hardware

   (f) Shield fixed objects

122.5.8 Cross Slope

122.5.8.1 AASHTO Criteria

Table 122.5.11 AASHTO Cross Slope

Type Facility	Other Factors	Minimum	Maximum	AASHTO
Freeways	---	0.015	0.025 (1)	pg. 8-3
Arterials	Rural Urban	0.015 0.015	0.02 0.03	pg. 7-6 pg. 7-38
Divided Highways	---	0.015	0.02 (1)	pg. 7-15
Collectors	Rural Urban	0.015 0.015	0.02 0.03	pg. 6-4 pg. 6-15
Shoulders	Paved Gravel Turf	0.02 0.04 0.06	0.06 0.06 0.08	pg. 4-13 pg. 4-13 pg. 4-13

Note:
(1) Values given are for up to two lanes in one direction. Additional outside lanes may have cross slopes of 0.03.

122.5.8.2 Documentation

Provide a proposal for handling drainage and details on how the cross-slope impacts intersections.

122.5.8.3 Mitigation

Potential mitigation strategies for deficient cross slope are:

(1) Signing to provide warning of slick pavement

(2) To improve surface friction:

 (a) Pavement grooving (PCC Pavement)

 (b) Open-graded friction courses (HMA pavement)

(3) To improve drainage:

 (a) Transverse pavement grooving (PCC Pavement)

(b) Open-graded friction courses (HMA pavement)

(c) Pavement edge drains

(d) Modified shoulder cross slope to mitigate cross-slope break on the high side of superelevated curves.

122.5.9 Vertical Clearance

122.5.9.1 AASHTO Criteria

Table 122.5.12 AASHTO Vertical Clearance (Minimum)

Type Facility		Vertical Clearance (feet)[2]	AASHTO
Freeways		16 [(1),(4)]	pg. 8-5, 10-24
Arterials (New Structures):	Rural Urban	16 [(1)] 16 [(1)]	pg. 7-9, 10-24 pg. 7-51, 10-24
Arterials (Existing Structures):	Rural Urban	14 14	pg. 7-9, 10-24 pg. 7-51, 10-24
Other Highways		14	pg. 5-9, 8-5
Sign Trusses		17	pg. 7-9,51, 8-5
Pedestrian Overpass		17	pg. 7-9,51, 8-5
Tunnels:	Freeways Other Highways	16 14	pg. 4-62 pg. 4-62
Railroads		23 [(3)]	pg. 10-25

Notes:

(1) 14 feet allowed in highly developed urban areas if alternate route has 16 feet.

(2) An allowance of 6 inches should be added to vertical clearance to accommodate future resurfacing.

(3) See ***FDM 220.3.4*** and the latest version of ***American Railway Engineering and Maintenance-of-Way Association (AREMA)*** guidelines, or the design office of the high-speed rail line of interest for specific high-speed guidelines and specifications. Over Electrified Railroad, the minimum vertical clearance is 24 feet 3 inches. (See ***Topic No. 000-725-003: South Florida Rail Corridor Clearance***.)

(4) Design Exceptions to the 16-ft vertical clearance standard on rural Interstate routes or on a single Interstate route through urban areas must be coordinated with Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) as described in ***FDM 122.5.9.2***.

122.5.9.2 Documentation

A written evaluation of the vertical clearance deficiency and recommendation by the State Office of Maintenance is required and should be attached to all Vertical Clearance Variations and Exceptions.

Provide locations of alternative routes that meet criteria.

For Interstate Projects, the District is responsible for completing an ***Interstate Vertical Clearance Exception Coordination*** form, for Design Exceptions to vertical clearance requirements above interstate facilities (mainlines and ramps). The District will submit the form to the Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) via e-mail for approval, copying the FHWA Florida Division. Allow for 10 working days after SDDCTEA receipt for action before requesting notification of disposition (via email or fax). A copy of the approval must be provided with the Design Exception. A request for coordination must take place before the District Design Engineer can recommend the Design Exception.

122.5.9.3 Mitigation

Potential mitigation strategies for vertical clearance are:

(1) Signing to provide advance warning

(2) To prevent impacts with low structures:

  (a) Alternate routes

  (b) Large vehicle restrictions.

  (c) Bridge Jacking may be a consideration to address bridges with minor deficiencies.

122.5.10 Design Loading Structural Capacity

122.5.10.1 AASHTO Criteria

Table 122.5.13 AASHTO Structural Capacity (Minimum Loadings)

Type Facility	AASHTO
Freeways, Arterials, and Collectors	See *AASHTO LRFD* for minimum loadings.

122.5.10.2 Documentation

(1) Load rating calculations for the affected structure.

(2) Verification of safe load-carrying capacity (load rating) for State unrestricted legal loads or routine permit loads.

(3) Verification of Federal legal loads for bridges and tunnels on the Interstate.

(4) A written evaluation and recommendation by the Office of Maintenance.

122.5.10.3 Mitigation

Potential mitigation strategies for design loading structural capacity are determined on a case-by-case basis.

122.6 Crash Analysis

For areas with crash histories or when a benefit to cost analysis is required, provide a time value analysis between the benefit to society (quantified in dollars) and the costs to society (quantified in dollars) over the life of the Design Exception. The benefit to society is quantified by the savings associated with the projected reduction in crashes. The cost to society is a summary of the construction, operation, maintenance, and other costs anticipated over the life of the project. The Discount (interest) rate to be utilized in benefit/cost analysis is 4%.

Both Historical (HCM) and Predictive (RSAP and HSM) methods are acceptable for performance of a benefit/cost analysis. Perform the analysis early in the design process.

In accordance with the Department's ***Highway Safety Manual Implementation Policy (Topic No. 000-500-001)***, "the transportation analyst is encouraged to use the Highway Safety Manual (HSM) methods, where applicable, to measure safety benefits from proposed improvements."

122.6.1 Historical Crash Method (HCM)

This method can be used for sites with a crash history. The historical crash analysis for Design Exceptions and Design Variations includes a review of crashes from within ~~the FDOT Crash Analysis Reporting (CAR) system database and~~ the ~~SIGNAL FOUR~~Signal Four Analytics ~~ANALYTICS~~ (~~SFA~~S4A) system database. Department approval is required for access to the data within these systems and can be obtained through the D~~d~~istrict O~~o~~ffices.

~~The FDOT CAR system~~SFA S4A ~~database includes verified crash data for all fatal and serious injury (KA) crashes typically up to the current date and for all crash types (KABCO) available up to 2018 (latest completed data set).~~The S4A database includes all currently available crash data for all severity types (KABCO) and all location verified statuses (i.e. verified as well as preliminary.) These crashes should be included in all HCM analyses. ~~The Signal Four database includes all crash types (KABCO) up to the current date and should be used to supplement the crashes reported from the FDOT CAR system database to establish a complete dataset of crashes over the analysis period. Due to the overlap of crash data within the two systems, proper vetting of the dataset is required to ensure that crashes are not duplicated within the analysis~~.

The B/C (benefit/cost) ratio is the ratio of the estimated annual reduction in crash costs to the estimated annual increase in combined construction and maintenance costs. The annualized conversion will show whether the projected expenditure of funds for the crash benefit will exceed the direct cost for the improvement.

The HCM uses the ***Highway Safety Improvement Program Guideline (HSIPG)*** cost per crash by facility type in ***Table 122.6.1*** to estimate benefit to society, while the cost to society is estimated by the expected cost of right of way, construction, and maintenance.

Table 122.6.1 FDOT Average Crash Costs by Facility Type

Type Facility	Divided Roadway			Undivided Roadway		
	Urban	Suburban	Rural	Urban	Suburban	Rural
2-3 Lanes	$107,732	$201,527	$355,183	$124,618	$267,397	$523,727
4-5 Lanes	$123,406	$225,315	$473,637	$112,896	$190,276	n/a
6+ Lanes	$123,598	$166,258	$451,492	$41,650	n/a	n/a
Interstate	$153,130	n/a	$327,385	n/a	n/a	n/a
Turnpike	$139,221	n/a	$304,397	n/a	n/a	n/a

Notes:

(1) Average Cost/Crash: **$159,093**

(2) The above values were derived from 2015 through 2019 traffic crash and injury severity data for crashes on state roads in Florida using the formulation described in *FHWA Technical Advisory "Motor Vehicle Accident Costs", T7570.2, dated October 31, 1994. Base costs derived* from a memorandum from USDOT: "*Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in the U.S. Department of Transportation Analyses*", dated August 8, 2016 updating the value of life saved from $9.4 million to $9.6 million for 2015 data with a growth factor applied to increase the base cost to $9.7 million

in the current analyses. Costs are computed for the actively state-maintained State Highway System (SHS) only.

(3) Link to ***Revised Departmental Guidance 2013***

When utilizing predictive methods or crash severity distributions for analysis, the following crash severity level costs should be used:

Table 122.6.2 FDOT KABCO Crash Costs

Crash Severity	Comprehensive Crash Cost
Fatal (K)	$10,890,000
Severe Injury (A)	$888,030
Moderate Injury (B)	$180,180
Minor Injury (C)	$103,950
Property Damage Only (O)	$7,700

Note:

(1) Source: Florida Department of Transportation State Safety Office's Crash Analysis Reporting (CAR) System, analysis years 2015 through 2019. Published by FDOT State Safety Office on 2/23/2022.

122.6.2 Roadside Safety Analysis Program (RSAP)

This method complements the ***AASHTO Roadside Design Guide***, dated June 2011. When hazards cannot be removed or relocated, designers need to determine if a safety device, such as a guardrail or a crash cushion, is warranted to protect motorists from the roadside obstacle. This method can be used to perform a benefit/cost analysis comparing a potential safety treatment with the existing or baseline conditions (i.e., the do-nothing option) or alternative safety treatments. Based on the input of information available to the user (e.g., offsets, traffic, slopes, crash history, traffic accident severity levels), the program will offer results which can be used in comparing design alternatives.

122.6.3 Highway Safety Manual

The ***AASHTO Highway Safety Manual (HSM)*** provides analytical tools and techniques for quantifying the potential effects on crashes as a result of decisions made in planning, design, operations, and maintenance. The new techniques and knowledge in the HSM reflect the evolution in safety analysis from descriptive (historical) methods to quantitative, predictive analyses. In the ***HSM***, crash frequency is the fundamental basis for safety analysis and is used to reduce crashes and severities through the selection of alternative treatments.

The ***HSM*** includes Safety Performance Functions (SPFs) for many roadway segment and intersection applications. SPFs are equations used to estimate or predict the expected average crash frequency per year at a location as a function of traffic volume and roadway characteristics. Adjust SPFs to local conditions by applying calibration factors shown in ***Table 122.6.3***. The use of HSMSPF and Crash Modification Factors (CMF), with an Empirical Bayes (EB) adjustment, provides research-based solutions for use in Benefit/Cost comparisons. Crash distributions presented in ***Table 122.6.4*** and KABCO costs as specified in ***Table 122.6.2*** should be used in determining benefits from an ***HSM*** analysis.

Table 122.6.3 HSM Calibration Factors for Florida

Type Facility		Abbreviation	Calibration Factor (Cx)
FDOT Roadway Calibration Factors			
Rural	2-lane Undivided	R2U	1.00
	4-lane Divided	R4D	0.68
Urban	2-lane Undivided	U2U	1.02
	3-lane with a Center Two-Way Left Turn Lane	U32LT	1.04
	4-lane Undivided	U4U	0.73
	4-lane Divided	U4D	1.63
	5-lane with a Center Two-Way Left Turn Lane	U52LT	0.70
FDOT Intersection Calibration Factors			
Rural	2-lane 3-Leg Stop-Controlled	RTL3ST	1.27
	2-lane 4-Leg Stop-Controlled	RTL4ST	0.74
	2-lane 4-Leg Signalized	RTL4SG	0.92
	Multilane 3-Leg Stop-Controlled	RML3ST	2.20
	Multilane 4-Leg Stop-Controlled	RML4ST	1.64
	Multilane 4-Leg Signalized	RML4SG	0.45
Urban	3-Leg Stop-Controlled Intersection	USA3ST	1.14
	4-Leg Stop-Controlled Intersection	USA4ST	1.87

	3-Leg Signalized w/o Ped. CMFs	USA3SG w/o Ped.	2.58
	3-Leg Signalized w/ Ped. CMFs	USA3SG w/ Ped.	2.50
	4-Leg Signalized	USA4SG	2.27

Table 122.6.4 HSM Crash Distribution for Florida

Type Facility		Abbreviation	K	A	B	C	O
Rural Roadways	2-lane Undivided	R2U	0.028	0.094	0.181	0.187	0.509
	4-lane Undivided	R4U	0.033	0.093	0.164	0.186	0.524
	4-lane Divided	R4D	0.028	0.090	0.187	0.196	0.499
Urban & Suburban Arterials	2-lane Undivided	U2U	0.009	0.050	0.150	0.224	0.567
	3-lane TWLTL	U32LT	N/A				
	4-lane Undivided	U4U	0.004	0.031	0.110	0.204	0.650
	4-lane Divided	U4D	0.008	0.046	0.142	0.234	0.571
	5-lane TWLTL	U52LT	N/A				
Freeways	Rural		0.017	0.065	0.143	0.163	0.612
	Urban		0.006	0.035	0.113	0.206	0.641
	Ramps		0.004	0.032	0.107	0.210	0.647
All	All Roadways and Ramps		0.007	0.041	0.124	0.217	0.611

Notes:
K – Fatality
A - Incapacitating Injury
B - Non-incapacitating Injury
C - Possible (or minor) Injury
O - Property Damage Only

Data Source: Florida Department of Transportation, State Safety Office's Crash Analysis Reporting (CAR) database, analysis years 2015 through 2019. Publishing by FDOT State Safety Office on 2/23/2022.

Tools and spreadsheets for use with these analytical methods have been developed and are available on the following websites:

https://safety.fhwa.dot.gov/rsdp/hsm.aspx

https://www.fdot.gov/roadway/QA/Tools.shtm

122.7 Design Approval Request

122.7.1 Submittal Package

The submittal package for a Design Exception or a Design Variation will include the same items. However, the required documentation and necessary level of detail will vary depending on the design element being evaluated (as described in ***FDM 122.4***). The Design Exception or Design Variation submittal package is to include the following items:

(1) Submittal/Approval Letter (cover letter): ***Form 122-A*** (see ***FDM 103***).

(2) Signed and Sealed Report: The signed and sealed documents including all required documentation and justification (see ***FDM 122.4*** for documentation requirements). Multiple design elements and signed and sealed reports may be included in one submittal package.

(3) Appendices (as needed): Include any support documentation to facilitate an understanding of the report. Supplemental documents do not alter the sealed analysis or design.

Sign and seal the report in accordance with ***FDM 130***. A Submittal/Approval Letter (***Form 122–A,*** see ***FDM 103***) is to be attached to the Signed and Sealed Report and submitted to the District or Turnpike Design Engineer. The District or Turnpike Design Engineer then approves or denies the request and notifies the Responsible Engineer. When further approvals are required, the District or Turnpike Design Engineer will forward the Submittal/Approval Letter and Sealed Report to the State Roadway Design Office.

122.7.2 Design Exception Approval

The request will be reviewed by the State Roadway Design Engineer and may be forwarded for approval to the Chief Engineer, the State Structures Design Engineer, the Planning Office, and FHWA, as appropriate.

Each request will be reviewed on a case-by-case basis and approved on its merits. When approval is obtained, the State Roadway Design Office will email the disposition to the District or Turnpike Design Engineer along with the signed Submittal/Approval Letter. The State Roadway Design Office will keep an electronic copy filed under the assigned reference number.

When a request is denied, the State Roadway Design Office will notify the District or Turnpike Design Engineer of the disposition. Denied requests can be resubmitted when all deficiencies, noted in the denial notification, have been addressed. This may require only a new Submittal/Approval Letter if the Sealed Report does not need to be amended; however, if the Sealed Report requires revision, a new Sealed Report and attached Submittal/Approval Letter must be submitted.

Documentation requirements for Design Exceptions are in ***FDM 122.4***.

122.7.3 Design Variation Approval

Design Variations are typically approved at the District level; however, there are specific elements requiring Central Office approval noted in ***FDM 122.7.4*** (see ***Table 122.7.1***). Design Variations requiring Central Office approval must follow the processes in ***FDM 122.7.2***.

Design Variations approved at the District level may be submitted as either a Formal Design Variation or a Design Variation Memorandum for approval by the District or Turnpike Design Engineer.

Documentation requirements for Design Variations (both Formal and Memorandums) are in ***FDM 122.4***.

122.7.4 Signature Requirements

Obtain all required approvals as described in this section. Approvals from multiple individuals may be required for certain issues. The Director of Design must resolve any approval authority issues if conflicting objectives arise. Approval signatures are required by the following Department and FHWA personnel as specified:

Chief Engineer:

(1) Design Exceptions for Design Speed on SIS facilities, following review by the Chief Planner.

(2) Design Variations for Design Speed on SIS facilities, following review by the Chief Planner.

(3) Design Variations for omission of Emergency Shoulder Use (ESU) evacuation requirements for any phase of construction.

(4) Design Variation for Shared Use Paths in LA R/W not meeting the criteria in ***FDM 224.1.1***, following review by the Chief Planner.

(5) Design Exceptions or Variations involving lateral offsets or vertical clearances for railroads not meeting the requirements of ***Rule 14-57 F.A.C***. or the clearance

criteria for the South Florida Rail Corridor (***Topic No. 000-725-003 - South Florida Rail Corridor Clearance Policy for 25 KV service***).

(6) Design Variations for Non-Standard Use of Shoulders. (e.g., Bus on Shoulder Projects, Part-Time Shoulder Use, Hard Shoulder Running, etc.)

(7) Design Exceptions for Paved Shoulder Width on Interstate and Turnpike Facilities.

(8) Design Variations to not install a Railroad Dynamic Envelope (RDE).

FHWA Division Administrator:

(1) Design Exceptions on Projects of Division Interest (PoDIs).

District (or Turnpike) Design Engineer:

(1) Design Exceptions

(2) Design Variations

State Roadway Design Engineer:

(1) Design Exceptions for elements other than Design Loading Structural Capacity.

(2) Design Variations involving the use of fencing around stormwater management facilities.

(3) Design Exceptions or Variations involving lateral offsets or vertical clearances for railroads not meeting the requirements of ***Rule 14-57 F.A.C***. or the clearance criteria for the South Florida Rail Corridor (***Topic No. 000-725-003 - South Florida Rail Corridor Clearance Policy for 25 KV service***).

State Structures Design Engineer:

(1) Design Exceptions for Design Loading Structural Capacity of bridges and Vertical Clearance impacting Category 1 and 2 bridge structures.

(2) Design Variations for Design Loading Structural Capacity of bridges and Vertical Clearance impacting Category 2 structures.

(3) Design Variations for Design Loading Structural Capacity due to deficient load ratings impacting both Category 1 and 2 bridge structures.

(4) Design Variations for Traffic Railing impacting Category 1 and 2 bridge structures.

(5) Design Exceptions or Variations involving lateral offsets or vertical clearances for railroads not meeting the requirements of ***Rule 14-57 F.A.C***. or the clearance criteria for the South Florida Rail Corridor (***Topic No. 000-725-003 - South Florida Rail Corridor Clearance Policy for 25 KV service***).

(6) Design Variations for noise walls on bridges and retaining walls.

District (or Turnpike) Structures Design Engineer:

(1) Design Exceptions for Design Loading Structural Capacity of all structural items and Vertical Clearance impacting Category 1 and 2 bridge structures.

(2) Design Variations for Design Loading Structural Capacity of all structural items and Vertical Clearance impacting Category 1 bridge structures.

Table 122.7.1 Central Office Approvals

Design Element	State Roadway Design Engineer	State Structures Design Engineer	Chief Planner	Chief Engineer
	Approval	Approval	Review	Approval
Design Speed Exception	X			
Design Speed Exception-SIS	X		X	X
Design Speed Variation-SIS			X	X
Design Variation: ESU Omission during Construction				X
Design Variation: Shared Use Path in LA R/W			X	X
Design Variation: Non-Standard Shoulder Use				X
Design Variations to not install an RDE				X
Lane Width Exception	X			
Shoulder Width Exception	X			
Paved Shoulder Width Exception (Interstate and Turnpike)	X			X
Maximum Grade Exception	X			
Cross Slope Exception	X			
Superelevation Rate Exception	X			
Horizontal Curve Radius Exception	X			
Stopping Sight Distance Exception	X			
Design Variation: Traffic Railing (Category 1 and 2 Structures)		X		
Design Variation: Fencing on Traffic Railing between pedestrians and travel lanes on LA Facilities		X		
Design Variation: Crossovers on Limited Access Facilities	X			
Design Variation: Patterned Pavement Technical Special Provisions	X			
Design Variation: Use of fencing around stormwater management facilities	X			

Table 122.7.1 Central Office Approvals (Cont.)

Design Element	State Roadway Design Engineer	State Structures Design Engineer	Chief Planner	Chief Engineer
	Approval	Approval	Review	Approval
Design Loading Structural Capacity				
-Design Exception for Bridges		X		
-Design Variation: Category 2 Structures		X		
-Design Variation: Deficient Load Ratings (Category 1 and 2 Structures)		X		
-Design Variation: Noise walls on bridges and retaining walls		X		
Vertical Clearance Exception				
- Non-Bridge Items	X			
- Bridge Structures (Category 1 and 2)	X	X		
-RR-South Fla Rail Corridor	X	X		X
Vertical Clearance Variation				
-Category 2 Structures		X		
-RR-South Fla Rail Corridor	X	X		X
Lateral Offset Variation				
-Category 1 and 2 Structures	X			
-RR-South Fla Rail Corridor	X	X		X

123 Engineering Design Estimate Process

123.1 General

The construction cost estimate (Authorization Estimate) is one of the last activities performed during the design phase. Use the following items to develop a construction cost estimate:

(1) The contract plans set, including all component sets; e.g., structures, architectural.

(2) The specifications, including the supplemental specifications and technical special provisions.

(3) The Standard Plans referenced on the key sheet of the contract plans.

(4) The current ***Basis of Estimates Manual***.

(5) Estimated Quantities Report

Modification for Non-Conventional Projects:
Delete ***FDM 123.1*** and replace with the following: **123.1 General** The construction cost estimate (Authorization Estimate) is one of the last activities performed on design projects prior to beginning the procurement process. Use the following items to develop a construction cost estimate: (1) The Concept Plans including a Estimated Quantities Report, if available; (2) The Request for Proposal.

123.2 Basis of Estimates

The ***Standard Specifications*** establish the method of measurement, basis of payment, and pay items for work specified for road and bridge construction. The ***Basis of Estimates Manual*** contains design aids, notes, the pay item structure, a list of currently open pay items, and computation information to aid the engineer in preparing the cost estimate.

Pay items for the various categories of construction work should be identified as those components are completed. For example, pay items for base and pavement work may be identified as the pavement design is completed; signal pay items may be identified as the signal design is completed. The engineer doing the design and specifications should be knowledgeable about what work is to be done and which pay items are needed.

Use the ***Basis of Estimates Manual*** to identify pay items on all types of projects, e.g., resurfacing, widening, safety, bridge. If any work on a project is not covered by existing specifications, then a technical special provision and possibly a new pay item description, unit of measure, and basis of payment may be required. If a desired pay item is not available, contact the FDOT Project Manager or District Estimates Office for assistance. Additional details for requesting pay items are available in ***Chapter 6*** of the ***Basis of Estimates Manual***.

Modification for Non-Conventional Projects:
Delete ***FDM 123.2***.

123.3 Designer Interface for AASHTOWare Project Preconstruction™ (formerly Trns•port)

The Designer Interface, available through the Program Management Office webpage via the Webgate login, is used to build categories and to add pay items and quantities to categories. Contact the District Estimates Office for more information.

Modification for Non-Conventional Projects:
Delete ***FDM 123.3*** and replace with the following: **123.3 Designer Interface for AASHTOWare Project Preconstruction™ (formerly Trns•port)** Use the ***Basis of Estimates Manual*** to select the design-build pay items.

123.4 Estimated Quantities

123.4.1 Compiling and Reporting Quantities

See ***FDM 902*** for information on compiling and reporting quantities. See the ***Basis of Estimates Manual*** for further details. Place detailed documentation on calculations in the project's Calculations folder and included in the CADD_[FPID].ZIP file with the Final Plans Submittal. See the ***CADD Manual*** for details.

123.4.1.1 Plan Quantity

The Department's current practice is to provide for final payment under the plan quantity concept for a large number of commonly used items. Refer to the ***Standard Specifications*** to determine if an item is paid by plan quantity. This concept requires that the estimated quantities be calculated and documented as accurately as possible. Do not include contingencies in the quantity calculation for plan quantity pay items. The designer is responsible for the final pay quantity for all plan quantity items.

123.4.1.2 Final Measurement Concept

The designer is responsible to estimate a quantity for all final measure items. Because there are many variables associated with these items, the final pay quantity will be determined by measurements performed in the field when the item is being used or constructed.

123.4.2 Breakdown of Quantities

Pay item quantities are loaded into the Designer Interface system by category, to reflect the work shown in each design group. When incidental work from one design group is included in the component plans for another group, the pay items must continue to be loaded in the appropriate category for the work to be completed. When a contract contains more than one Financial Project ID, pay item quantities for each project are loaded separately. The Estimated Quantities Report must show separate quantities for each project. Only the Summary of Pay Items run from the Department's WebGate Reporting menu will show the project totals, as well as the combined proposal/contract total. Additional information is available in ***Chapter 9*** of the ***Basis of Estimates Manual***.

123.5 Contract Time

Contract duration is the time required for the complete construction of the contract. Pay items measured per day need an accurate estimate of construction duration. Before completion of the design project, the plans package is submitted to the District Construction Office scheduling engineer for establishing the contract duration. Large complex projects should have the desired contract duration established earlier in the design process.

Modification for Non-Conventional Projects:
Delete ***FDM 123.5.***

123.6 Alternative Contracting Practices

The Construction Office web page defines various contracting techniques used by the Department (***https://www.fdot.gov/construction/AltContract/AltContract.shtm***). When alternative contracting is called for by the Department, coordinate the PS&E preparation with the FDOT Project Manager.

Modification for Non-Conventional Projects:
Delete the previous paragraph and replace with the following: The Construction Office web page defines various contracting techniques used by the Department (***https://www.fdot.gov/construction/AltContract/AltContract.shtm***). When design-build contracting method is called for by the Department, coordinate the estimate preparation with the FDOT Project Manager.

124 QA/QC Management Plan

124.1 General

Quality Assurance (QA) and Quality Control (QC) are two processes used by Consultants and Department (in-house) designers to ensure that deliverables are complete, orderly, correct, and appropriate for the intended purposes. The quality of the deliverable must meet or exceed industry standards; i.e., "Due Diligence" ("Due or Ordinary Care").

Quality Control (QC) is the process of checking, reviewing, and revising deliverables to comply with Department requirements. Quality Assurance (QA) is enforcing and verifying that quality control procedures have been established and performed.

This chapter describes the Department's QA/QC Management Plan for the development of deliverables. A deliverable is any professional service document (e.g., Plans, Specifications, Reports, Building Information Modeling (BIM) files) where the final version of the product is signed and sealed.

124.2 Quality Control Plan

A Quality Control Plan establishes the review procedures that are to be performed on each deliverable. The Quality Control Plan includes the following elements:

- QA/QC Staffing Plan
- Review procedures for each deliverable type (e.g., reports, plans, BIM files)
- Certificate of Compliance

A project-specific Quality Control Plan is not required for Department (in-house) design projects; however, these projects must follow the procedures outlined in this chapter.

Consultant design projects must either:

(1) Develop a project-specific Quality Control Plan acceptable to the Department. The Quality Control Plan is completed and accepted before any design efforts begin; typically, within 20 days after Notice to Proceed.

(2) Adopt the Quality Control Plan requirements outlined in ***FDM 124*** by submitting a declaration email to the Department PM. Attach the proposed QA/QC Staffing Plan to the declaration email for approval. With this option, the prime consultant is responsible for ensuring that subconsultants also adhere to the procedures outlined in this chapter.

124.2.1 QA/QC Staffing Plan

The QA/QC Staffing Plan contains a list of required deliverables and associated discipline area. The plan must identify the following staff:

- Engineer of Record (EOR) (professional that will sign and seal the document)
- Lead Technical Professional
- Quality Control (QC) Reviewer
- Quality Assurance (QA) Manager
- BIM Manager

Include the above information for the entire design team; i.e., include information for Geotechnical, Landscaping, Survey and Mapping, Environmental, and Utility staff.

The Lead Technical Professional is the professional responsible for the development of the deliverable, which is often the Engineer of Record.

The QC Reviewer must have equal or higher level of qualification as the Lead Technical Professional and must not be involved in the development of the deliverable.

The BIM Manager is responsible for coordinating and conducting Interdisciplinary Reviews of consolidated BIM content. The BIM Manager should be familiar with developing and delivering BIM content.

Whenever staffing changes are necessary on consultant design projects, provide the Department PM an updated staffing plan for approval prior to making staff changes. Include resumes for the replacement staff and the staff being replaced.

An example of a QA/QC Staffing Plan is shown in ***Table 124.2.1***.

124.2.2 BIM Review Technology

List the software that will be used for conducting BIM Reviews in the Quality Control Plan. When determining the Digital Review Process to be followed, consider the entire project team's needs and capabilities. More than one solution may be necessary to conduct and document a comprehensive BIM Review.

Examples of BIM Review technologies to consider:

- Cloud collaboration technology: Many forward-thinking technologies are available for collaborative BIM Reviews (e.g., iTwin Design Review, BIM 360, Revizto, PlanGrid, etc..).

- Native design software technology: The software used to develop the model is also acceptable for conducting BIM Reviews (e.g., OpenRoads Designer, Civil 3D, etc..).

- Augmented Reality/Virtual Reality/Mixed Reality (AR/VR/MR) technology: May be considered when an immersive experience is warranted when conducting BIM Reviews (e.g., HoloLens, Google Glass, Oculus, etc...).

Table 124.2.1 Example QA/QC Staffing Plan

Element/Task	Deliverable	Lead Tech. Professional	QC Reviewer
General (PM: Luke S. Walker, PE) (QA Mgr.: Dew Wright, PE) (BIM Mgr.: Tye Down, PE)			
Project Schedule	Schedule	Luke S. Walker, PE	Dep Abillaba, PE
Quality Assurance	Quality Control Plan	Luke S. Walker, PE	Dep Abillaba, PE
Roadway (Rdwy EOR: Luke S. Walker, PE) (Drg EOR: Flow Fast, PE) (TTCP EOR: Lan Solo, PE)			
Variations/Exceptions	Sidewalk Variation	Luke S. Walker, PE	Dep Abillaba, PE
Typical Section	Typical Section Package	Luke S. Walker, PE	Dep Abillaba, PE
Pavement Design	Pavement Design Package	Luke S. Walker, PE	Dep Abillaba, PE
Project Control	Roadway Plans	Chad Bane, PE	Anna King, PSM
Roadway Design	Roadway Plans	Chad Bane, PE	Dep Abillaba, PE
	BIM files	Mora d' Minbas, E.I.	Sabrina Ren, PE
Temp Traffic Control	Roadway Plans	Lan Solo, PE	Luke S. Walker, PE
Drainage Design	Roadway Plans	Flow Fast, PE	Dep Abillaba, PE
Quantity Computations	QTDSRD files	Mora d' Minbas, E.I.	Sabrina Ren, PE
	EQ Report / AASHTOWare	Luke S. Walker, PE	Dep Abillaba, PE
Specifications, TSP	Specifications Package	Luke S. Walker, PE	Dep Abillaba, PE
Signing & Pavement Marking (EOR: Tara Full, PE)			
Signing Design	S&PM Plans	Tara Full, PE	Luke S. Walker, PE
Pavt Marking Design	S&PM Plans	Tara Full, PE	Luke S. Walker, PE
Quantity Computations	EQ Report	Chad Bane, PE	Luke S. Walker, PE
Survey and Mapping (SOR: Anna King, PSM)			
Design Survey	Survey Files	Anna King, PSM	Bob Afett, PSM
Terr Mobile LiDAR	SURVRD01.dgn file	Anna King, PSM	Bob Afett, PSM

124.3 QC Review Procedures for Plans and Documents

This check and back check review process is performed by the applicable design group (in-house design units or consultants) before the deliverable is submitted for the Department's ERC Review. The Quality Control Review may be conducted on either a printed paper copy or a PDF of the deliverable.

A formal and documented Quality Control Review is to be performed on all draft and final Reports, Documents and Plans where the final deliverable is signed and sealed. The project schedule must allocate time to complete this review prior to submittal date; typically, one to three weeks (depending upon complexity of the deliverable).

The plan set or document that has completed the Quality Control Review is referred to as the "QC Document". Documents that contain multidisciplinary information must show documentation of all applicable discipline reviews. For a paper review, scan the QC Document to PDF.

For consultant design projects, the QC Document must be included with the submittal of any deliverable in which the final PDF document is to be signed and sealed; e.g., Typical Section Package, Pavement Design Package, Specifications Package, Plans (all phase submittals), Lighting Justification Report.

For all projects, the Department PM must place the QC Document in the project file.

124.3.1 5-Step Review Process

The 5-step review described in this section pertains to a review of a paper print of the QC Document. It is expected that minor differences to the 5-step review process described will occur based on office or business adopted practices; however, each of the five steps must be carried out.

A color scheme other than the one described in this section may be used. Specify the colors used within the QC stamp.

Step 1 – Origination

The Lead Technical Professional assembles the review document and applies a QC Stamp to the cover of a bound set of documents or to individual sheets, if unbound. The QC Stamp may be digitally generated. An example of a QC Stamp is shown in ***Figure 124.3.1***.

The Lead Technical Professional enters a description for the QC Document in the block provided (e.g., Phase II Plans, Draft Typical Section Package). By initialing and dating the Origination block, The Lead Technical Professional affirms that the documents are ready for checking.

Figure 124.3.1 Example QC Stamp

QC Stamp Submittal:		
Step	By	Date
Origination		
Checked Correct - Yellow Highlight Change - Red Comments		
Concurrence Agree - Green Check No change - Green 'X'		
Changes Made Green Highlight		
Changes Verified Blue Check		

Step 2 – Checking

The QC Reviewer checks the QC Document:

- Yellow highlight is used to identify the elements of the document that are deemed to be acceptable. Items not checked are not to be highlighted.
- Red mark is used to identify the elements of the document that are deemed to be in error or are questionable (i.e., provide comments).

Black pen (or similar) is used to perform interim manual calculations or make notes for reference on the document.

By initialing and dating the Checked block, the QC Reviewer affirms the completion of the checking process.

Step 3 – Concurrence

The Lead Technical Professional indicates agreement with the suggested change by placing a green check mark by the QC comment. This affirms that this change is to be made. The Lead Professional indicates disagreement with the suggested change by placing a green "X" mark over the QC comment. This affirms that this change is not to be made. This is done only after the Lead Professional has discussed the comment with the QC Reviewer and they reach this conclusion together. Clarification of comment resolution may be provided near the QC comment using blue ink.

By initialing and dating the Concurrence block, the Lead Professional affirms completion of this Concurrence step.

Step 4 – Changes Made

The Lead Professional makes the agreed-upon changes and uses green highlight to identify that the change has been made.

By initialing and dating the Changes Made block, the Lead Professional affirms that all agreed-upon changes have been made.

Step 5 – Changes Verified

The QC Reviewer verifies that comments have been appropriately interpreted and addressed by placing a blue check by the QC comment. The QC Reviewer will coordinate any unresolved issues with the Lead Professional for final resolution, and Step 4 will be repeated when necessary.

By initialing and dating the Changes Verified block, the QC Reviewer affirms that all agreed-upon changes have been verified.

124.3.2 Electronic Review Process

When conducting a Quality Control Review within a PDF document, use an electronic comment review, resolution, and documentation process mimicking the 5-Step Review Process. Place the QC Stamp only on the first sheet of the QC Document. **Bluebeam©** offers a collaborative approach to performing digital QC reviews and is recommended for multidiscipline reviews; other software applications may be used that provide similar workflow.

124.4 QC Review Procedures for BIM Files

A formal Quality Control Review, as outlined in this chapter, must be conducted on project BIM files that are signed and sealed. It is recommended that other CADD files provided to the Department follow these requirements as well.

Conduct and document BIM Reviews using a digital review process. For more information regarding BIM development and BIM.zip deliverable expectations, refer to the ***FDOT CADD Manual***; ***Sections 5.16 Modeling Standards*** and ***8.4.7 BIM ZIP File***.

QC comments made during the phase submittal BIM Reviews must be documented in a QC Summary Report and submitted with each phase submittal. Spreadsheet tables are an acceptable format.

The Department categorizes BIM Reviews as:

- Developmental Reviews
- Design Analysis Reviews
- Interdisciplinary Reviews.

124.4.1 Developmental Reviews

Developmental Reviews are typically conducted by the QC Reviewer for each discipline, and have three focus areas:

(1) Conformance: BIM adheres to CADD standards

(2) Completeness: BIM meets the project scoped expectations

(3) Consistency: BIM files are accurate relative to each other.

124.4.1.1 Conformance

Development Reviews are conducted to check the BIM for conformance, verifying that the BIM elements adhere to the standards defined in the ***FDOT CADD Manual***.

Checking conformance at developmental milestones minimizes the impact of deficiencies (i.e., when the roadway geometries are initially created, when the drainage network is initially developed).

Example of Conformance checks include the following:

- Do the files adhere to CADD standard compliance using the QC Project Inspector and Project Validator tools?
- Are the files based on the correct seed files?
- Are the files and folders named properly?
- Are elements assigned the correct level/layer, color, line-style, and weight?
- Are elements assigned the correct feature definitions/styles, material types and data attributions?
- Do the files have the correct geographic coordinate system defined?
- Is the corridor frequency interval appropriate to account for context classification, tangent/curves, intersections, and critical station expectations?

124.4.1.2 Completeness

Development Reviews are conducted to check the BIM for completeness, verifying that all required existing and proposed elements are developed to the minimum Level of Development (LOD). The Completeness check is conducted prior to each phased delivery. The Completeness check conducted on completed files should verify that "work" elements (aka., scratch elements) have been removed from the BIM files.

Level of Development (LOD) is the degree to which the elements contained in the BIM file are detailed. See ***FDOT CADD Manual***; **Section 5.16.6** for LOD definitions.

124.4.1.3 Consistency

Development Reviews are conducted to check the BIM for consistency, verifying that the project elements are consistent across the various types of data formats (e.g., dwg/dgn, xml, i-model). Disparities between equivalent data indicates that one of the files is inaccurate.

Example of Consistency checks include the following:

- Is the alignment data provided in xml format consistent with the 2D planimetric design in pdf format?
- Are 3D proposed breaklines in dwg/dgn format consistent with the 2D planimetric design in pdf format?

- Are 3D proposed breaklines in dwg/dgn format consistent with the 3D final graded surface provided in xml format?
- Are summary of quantity design files (QTDSRD file) consistent with 2D representation of the planimetric design in pdf format?

124.4.2 Design Analysis Reviews

Design Analysis Reviews are conducted to check that the BIM adheres to design criteria, is void of design flaws, and comply with Department requirements. These reviews are conducted by the discipline QC Reviewers prior to each phase delivery.

Many design flaws are identified in the review of the Plans, however, reviews within the BIM further enhance the reviewer's ability to identify unsuitable conditions, such as:

- Trapped stormwater runoff
- Vertical or horizontal clearance issues
- Undesirable intersection, side road or driveway geometrics or profile
- Constructability issues associated with deep excavations
- Adherence to ADA requirements

The Design Analysis Review should also include checks to ensure that the BIM reflects the data contained in project reports (e.g., Typical Section Package, Pavement Design Package, No Passing Zone Study, Drainage Report, Bridge Hydraulics Report, Geotechnical Report)

124.4.3 Interdisciplinary Reviews

Interdisciplinary Review are conducted to check the interaction between the BIM content developed by each discipline. These reviews are typically coordinated by the BIM Manager prior to each phase submittal.

The primary purpose of the Interdisciplinary Reviews is to identify conflicts or inconsistences between the various discipline designs, such as:

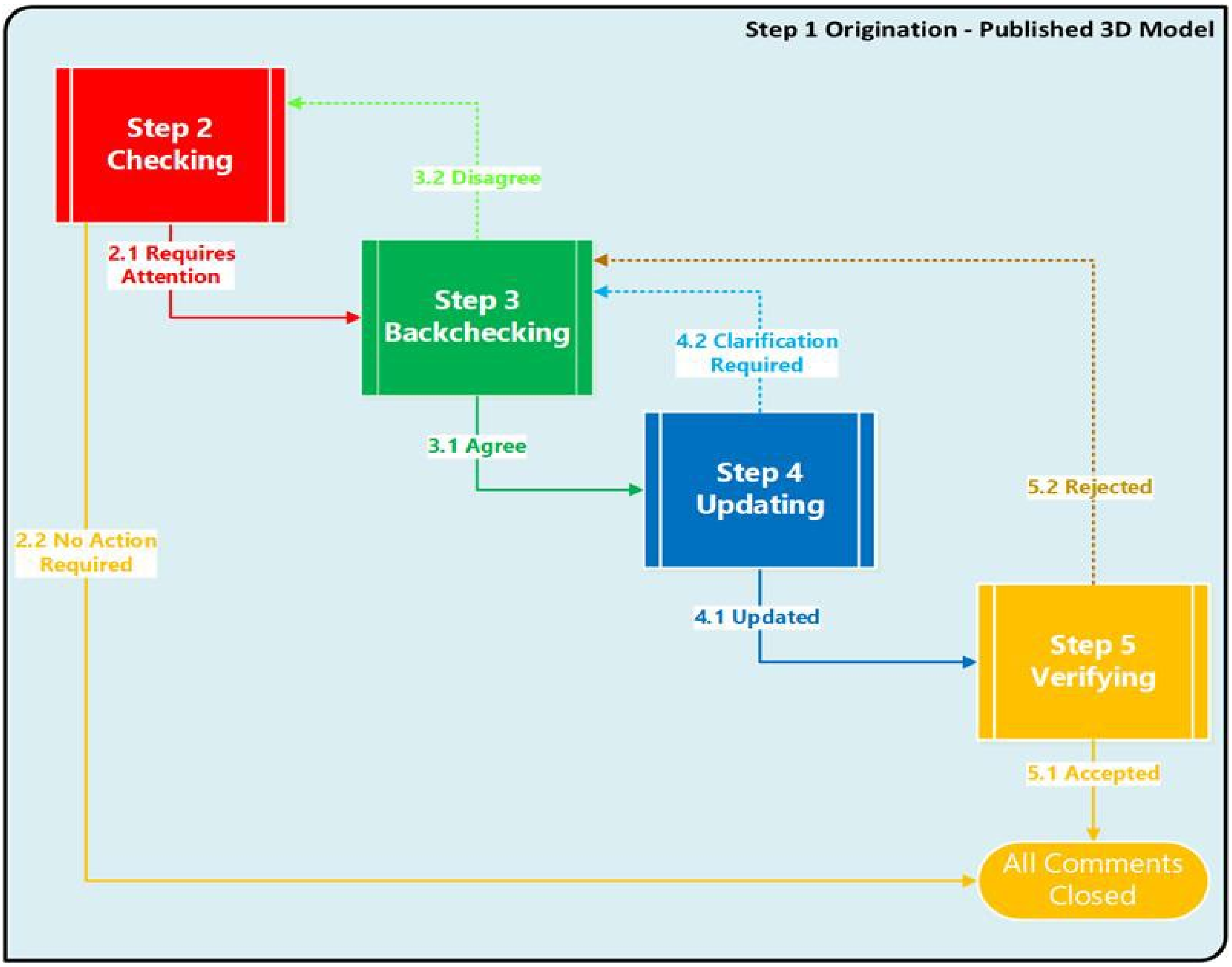
- Are drainage inlet elevations set properly relative to curbs, ditches, and ponds?
- Are Clearing and Grubbing limits appropriate for all disciplines?
- Are multiple elements occupying the same physical space?

- Are high mast lighting, mast arm, and overhead sign locations clear from obstructions and standing water (final and TTC phases).
- Are minimum pipe cover expectations met?
- Does landscaping provide required sight distance for sideroads and driveways?
- Does the roadway pavement cross slope match the bridge deck cross slope?

124.4.4 Digital Review Process

This section describes a Digital Review Process used to conduct reviews of the BIM content. This process follows the basic QC steps shown in ***Figure 124.4.1***. It is expected the process used by the designer will have minor differences from the Digital Review Process described here; however, each of the steps (Origination, Checking, Backchecking, Updating and Verifying) must be carried out.

Figure 124.4.1 QC Review Steps



To manage the Digital Reviews expected during design development, develop a BIM Review Log. The review log should be submitted with each phase submittal of the BIM files. An example of a BIM Review Log is shown in ***Table 124.4.1***.

Table 124.4.1 Example BIM Review Log

Review Description	Reviewer	Developmental Review			Design Analysis Review	Inter-disciplinary Review
		Conform.	Complete.	Consist.		
Initial Geometrics	Sabrina Ren, PE	12/10/2020			12/12/2020	
Existing Utilities	Sabrina Ren, PE	2/14/2021			2/15/2020	
Phase I BIM	Tye Down, PE	3/25/2021	3/27/2021	3/28/2021	3/28/2021	3/29/2021
Initial Drainage	Dep Abillaba, PE	4/20/2021			4/21/2021	
Final Geometrics	Sabrina Ren, PE	4/26/2021			4/28/2021	
Phase II BIM	Tye Down, PE	8/9/2021	8/10/2021	8/12/2021	8/13/2021	8/15/2021
QTDSRD files	Sabrina Ren, PE					
Final Drainage	Dep Abillaba, PE					
Phase III BIM	Tye Down, PE					
Phase IV BIM	Tye Down, PE					
Final BIM	Tye Down, PE					

Use a status scheme common to many review applications to track each comment through the review process. A status scheme other than the one described in this section may be used; however, it must mimic the intent of the Digital Review Process.

QC Summary Report should include the following information for each comment:

- Unique ID Number
- Name and Role of Originator
- Name and Role of Reviewer
- Date and Review Type (Developmental, Design Analysis, or Interdisciplinary)
- Comment Status
- Comment Response
- Communication Log (e.g., discussion, decisions, directions)

Step 1 – Origination

Each BIM review conducted, as documented by the BIM Review Log, begins with the Originator notifying the Reviewer that the BIM is locked down and ready for review. The BIM Manager often assists with the coordination of this step.

Step 2 – Checking

The Reviewer will check the BIM and create comments with the comment status of:

(a) "Requires Attention" (associated color is red) – Indicates that the QC Comment is ready for Backchecking.

(b) "No Action Required" (associated color is yellow) – Indicates that the QC Comment is informational note in the model that does not require further action.

When the review is completed, the Reviewer should request necessary clarification and discuss the QC Comments with the Originator.

Step 3 – Backchecking

The Originator responds to the QC Comments and changes the comment status of "Requires Attention" to:

(a) "Agree" (associated color is green) – Indicates that revisions will be made to resolve the QC Comment.

(b) "Disagree" (associated color is red) – Indicates that the Reviewer and Originator have determined that no change is required (STET).

Step 4 – Updating

The Original oversees revisions for QC Comments with the "Agree" and changes the comment status to:

(a) "Updated" (associated color is Blue) – Indicates that the BIM has been revised.

(b) "Clarification Required" (associated color is Light Blue) – Indicates that additional information or discussion with the Reviewer is required.

Step 5 – Verifying

The Reviewer determines that the QC Comment has been appropriately interpreted and addressed, and changes the “Updated” comment status to:

(a) “Accepted” (associated color is yellow) – Indicates that the QC Comment has been resolved and no further action is required.

(b) “Rejected (associated color is red) – Indicates that the QC Comment requires further action to fully resolve.

124.5 Certificate of Compliance

For consultant produced deliverables, the firm’s designated person for overseeing quality control activities (e.g., Quality Control Officer, Quality Assurance Manager) must review and certify that established quality control procedures have been performed. The purpose of the Certificate of Compliance is to attest that the level of effort used to complete the quality control review adheres to industry standards.

Coordinate requirements for the Certificate of Compliance with the Department PM.

124.6 Independent Peer Review

An independent peer review is supplemental to the Quality Control Review and is performed on selected consultant projects. This review is conducted by an independent team of qualified reviewers on specific design elements or portions of a project. Members of the independent peer review team are not assigned to the same organizational unit that managed and produced the project.

124.7 Field Review

A field review (A.K.A. Plans-in-Hand Review) is supplemental to the Quality Control Review. The review is held at the project site for the purpose of verifying the compatibility of the design with the field conditions encountered during construction. A record of the field review includes the following:

- Date and time.
- List of attendees.
- Documented site conditions and observations; may include marked up plan sheets, photographs or any other method deemed appropriate.

For consultant projects, provide the Department PM with a copy of the review record.

125 Quality Assurance

125.1 General

This chapter describes the planned and coordinated evaluation procedures conducted by FDOT Districts and the Central Office for the purpose of verifying and enforcing that established requirements are being met. Evaluation procedures ensure compliant and consistent performance by the districts and central office units that implement transportation programs.

Section 20.23(3)(a), Florida Statutes (***F.S.***), requires the establishment of departmental policies, rules, procedures, and standards.

Section 334.048, F.S. states the Legislative intent with respect to the Central Office role in the Department's management accountability and monitoring systems, including corrective actions when appropriate.

125.2 District Quality Assurance Activities

Districts must conduct Quality Assurance (QA) Audits on consultant prepared plans and documents to verify that a Quality Control (QC) review was performed for each deliverable (see ***FDM 124***). To complete the requirements of the QA Audit, districts must verify that the completed QC document demonstrates that the review procedures were completed, e.g., QC check prints, Bluebeam, or Adobe QC PDF file, 3D-CADD file check list and notes.

Districts must also verify that the Certificate of Compliance was provided (see ***FDM 124.5~~2.3~~***).

125.2.1 Electronic Review Comment (ERC) Reviews

ERC Reviews are conducted by the Department utilizing the ERC system in accordance with ***FDOT Electronic Review Comments (ERC) System User Manual***. The ERC system is an application used to track the review process (comments and responses) for project submittals in a database. The purpose of an ERC Review is to assure that the submitted documents meet Department requirements.

Documents are uploaded into the ERC system only after the required quality control procedures have been performed. It is expected that comments associated with poor quality work are minimal; the focus of the ERC Review is to validate that the designs and reports are acceptable to the Department.

Discipline experts (reviewers of the document) are assigned through the ERC system, along with the required due date for providing comments. All comments must be adequately addressed before closing out the ERC Review.

125.3 Central Office Quality Assurance Review (QAR) Program

The Office of Design (Central Office) has a formal Quality Assurance Review (QAR) Program which is led by the Office of Design QAR Program Manager. The Office of Design evaluates the District Design Offices for compliance with Department policies, procedures, and manuals through this program.

The Office of Design QAR Program is conducted by Central Office staff; typically, by Roadway Design, Structures Design, and Production Support offices, but may include other offices as necessary. The overall goal of the QAR Program is to achieve an objective assessment on the Department's performance in following established requirements.

The Office of Design QAR Program consists of:

(1) Development and adoption of an annual QAR Plan

(2) Conducting QARs on various topics (which cover specific requirements contained within Policies, Procedures, and Manuals) and reporting the findings to the districts and other stakeholders, accomplished through the development and distribution of a QAR Memorandum

(3) Annual QAR Plan Summary Report

125.3.1 QAR Plan Development

Annual QAR Plans are developed based on Fiscal Year, i.e., the FY 19/20 QAR Plan begins July 1, 2019 and completed by June 30, 2020. An example of a QAR Plan is shown in ***Exhibit 125-1***.

The development and adoption of a QAR Plan occurs between February and April preceding the fiscal year that the plan will cover.

125.3.1.1 FY QAR Plan Development Meeting

For planning the upcoming fiscal year's QAR activities, the Office of Design QAR Plan Development Meeting is held in early February and is led by the Office of Design QAR Program Manager. Representatives from the Roadway Design, Structures Design and Production Support offices attend the QAR Plan Development Meeting; staff from other FDOT offices and FHWA may also be in attendance. Agenda topics discussed at this meeting include:

(1) Status of current fiscal year QAR Plan

(2) QAR Topics to be considered for the upcoming fiscal year QAR Plan, based on the following priorities:

- (a) Safety concerns
- (b) Construction issues
- (c) Conformance with new, changed, or existing departmental policies, rules, procedures, and standards
- (d) Non-compliance or needed improvement identified on previous QARs
- (e) Opportunities to streamline processes and apply innovation

(3) Cycle period to complete QARs for all districts. The following general practice applies, based on complexity of QAR and available resources:

- (a) For each QAR topic identified, the established practice is to complete the reviews for all districts in a single fiscal year; however, a two or three-year cycle may be appropriate for topics requiring extensive evaluations, or on-going Department programs; e.g., ADA, Pavement Design.
- (b) Typically, QARs are conducted on contract documents, or design processes that were completed in the fiscal year preceding the fiscal year of the QAR Plan. Each project will be evaluated for compliance based on the manuals, policies, and procedures in place at the time the document or design was completed.
- (c) QAR evaluations should be conducted in the 1^{st} (July-September), 2^{nd} (October-December), and 3^{rd} (January-March) quarters of each fiscal year QAR Plan.
- (d) The Final QAR Memorandum is to be completed and distributed by the end of the quarter following the quarter in which the QAR evaluation was performed; e.g., Final QAR Memorandum is distributed by December 31st for a QAR conducted in the 1^{st} quarter.

(4) Assess QAR topics for future fiscal year plans; typically, a one to two-year look ahead.

125.3.1.2 DRAFT FY QAR Plan

QAR representatives from the Roadway Design, Structures Design, and Production Support offices reconvene in early March to complete the DRAFT FY QAR Plan. The focus of this meeting is to select the proposed QAR Topics to be included in the plan.

To complete the DRAFT FY QAR Plan, the following information is identified:

(1) **Office Unit** – Unit responsible for conducting the QAR.

(2) **QAR Leader** – Individual who will take the lead in conducting the QAR.

(3) **Authority** – Department policy, rule, procedure, or standard governing the QAR Topic.

(4) **QAR Topic/Purpose**

  (a) **Topic**: The area or subject of the planned QAR evaluation.

  (b) **Purpose**: The QAR objective and specific requirements being evaluated.

(5) **QAR Cycle** – The fiscal year quarter in which the QAR will begin. The FY QAR Plan should not subject any district to excessive reviews within the planned year, or within a single quarter.

125.3.1.3 FY QAR Plan Adoption

The DRAFT FY QAR Plan is presented to the District Design Engineers (DDE), District Consultant Project Management Engineers (DCPME), and FHWA in early April. Following the presentation, districts have two weeks to request additional information as to the intent of the QAR Topic or suggest changes to the QAR Cycle.

The FY QAR Plan is formally adopted in early May.

125.3.2 Conducting a QAR

Conducting a QAR involves the following activities:

(1) Conducting a QAR Kick-off Meeting

(2) Evaluation of projects for compliance with the QAR purpose statement

(3) Documenting the findings in a Draft QAR Memorandum

(4) Resolution of Findings

(5) Distribution of Final QAR Memorandum

Depending on complexity, a QAR may be conducted by remote review, district visit, or a combination of the two methods. Conducting a QAR involves Central Office and district staff working together to complete the review activities.

125.3.2.1 QAR Kick-off Meeting

The QAR Leader should contact the appropriate district staff at the beginning of the quarter in which the QAR is to be conducted to schedule the QAR kick-off meeting. The QAR Kick-off meeting agenda should include the following:

(1) QAR topic and purpose

(2) Identification of Central Office and district staff that will participate in the QAR

(3) Proposed schedule

(4) Selected projects to be evaluated and the best method for obtaining the data.

(5) Agree-upon date to complete the gathering of the required information.

125.3.2.2 Evaluation of Projects

Central Office staff will evaluate district documentation in accordance with the QAR purpose statement. Evaluation of provided documents is typically conducted through office reviews; however, a field review or district visit may be appropriate.

The findings should be tabulated with a clear indication that the project was in full compliance, compliant with opportunity for improvement, partial compliance, or non-compliance. An explanation as to what triggered any partially or non-compliance determination is to be provided.

Project evaluations should be completed by the end of the quarter in which the QAR is to be conducted. The findings of the QAR are documented within a draft QAR Memorandum which is shared with the district.

125.3.2.3 QAR Memorandum

A district-specific QAR Memorandum is to be developed for each QAR Topic. The memorandum contains the following sections:

(1) Executive Summary

(2) Projects Selected for Review

(3) Evaluation Method (Optional)

(4) Findings

(5) Observations (Optional)

(6) Recommendations

Executive Summary

This section should be succinct (1-3 paragraphs) and should not extend to a 2nd page.

(1) First paragraph should state which design office conducted the review (include other offices if it was a joint review) and the quarter in which the review took place. Include the names of the Central Office and district key staff that participated in the review.

(2) Second paragraph should provide the stated purpose of the review; e.g., “The specific purpose of this QAR was to verify inclusion of applicable documents in the required E&O file.”

(3) Last paragraph should provide the results of the evaluation by indicating that the district was in full compliance, compliant with opportunity for improvement, partial compliance, or non-compliance.

Projects Selected for Review

This section should provide a description of how the projects were selected to be included in the QAR.

(1) First paragraph should describe the general project attributes that qualified it for inclusion of the QAR evaluation, e.g., “This QAR included projects with a letting date between July 1, 2017 and June 30, 2018 and proposed a new or extended bridge culvert. Eight projects were identified that met these parameters”.

(2) Subsequent paragraphs should include discussion on why projects were added or subtracted from the list to be evaluated.

(3) Last paragraph should state the number of projects that were selected for evaluation.

Evaluation Method (Optional)

This optional section is used to provide a description of the process used to evaluate the compliance of selected projects.

Findings

This section should indicate how the district performed overall and whether the projects met the stated requirements. At a minimum, this section should include:

(1) First paragraph should begin with “The following table provides a summary of the findings for each project evaluated as part of this QAR.” The table may be omitted if there were only one or two projects identified.

(2) Flexibility in content and format of tabulated findings should be exercised to clearly convey the information. Only include information that is the basis for why the district did or did not comply with requirements along with statements about what was missing or incomplete. Do not include comments concerning the quality of the document or submittal.

(3) Subsequent paragraphs should include discussion concerning the assessment of specific projects if additional information would help to clarify findings.

Observations (Optional)

This optional section is used to provide comments concerning faults or best practices in district processes, quality of project deliverables, or any other topic that may have contributed to the findings. It may include discussion on benefits of compliance (improved safety and operational performance or cost savings) and missed opportunities identified through the QAR.

Recommendations

This section should list actions the district should consider for improving compliance with the stated requirements. Include suggested participation in training opportunities directly related to the QAR Purpose. This section may also include recommendations for Central Office improvements (e.g., new, improved or additional training, clarification to departmental policies, rules, procedures and standards).

125.3.2.4 Resolution of Findings

The Draft QAR Memorandum is shared with district staff involved in the QAR, followed by a discussion of findings and recommendations. The resolution of findings is typically face-to-face to assure open dialog between Central Office and district staff. Video conference or teleconference may be used in lieu of face-to-face meeting when deemed appropriate.

125.3.2.5 Distribution of Final QAR Memorandum

The memorandum is finalized after agreed-upon edits from the resolution of findings have been made. The Final QAR Memorandum is typically sent from the manager of the Roadway Design, Structures Design, or Production Support office, as appropriate.

The memorandum is addressed to the District Secretary, with the following recipients copied:

(1) Director, Office of Design

(2) District Director of Transportation Development

(3) District Design Engineer

(4) Office of Design QAR Program Manager

(5) FHWA Design Program Manager

(6) FHWA Quality Assurance Manager

~~125.3.2.6 Quality Management Dashboard~~

~~Quality Management Dashboard (QMD) is a Department enterprise application that is used to store QAR information. The QAR Leader will upload QAR findings and recommendations into the QMD after the Final QAR Memorandum is distributed.~~

125.3.3 QAR Summary Report

When all the district QAR Memorandums have been completed on a QAR topic, the QAR Leader will summarize findings for that QAR topic in a QAR Summary Report. This report should be no more than one page and is not intended to repeat the individual district QAR Memorandums. This report will summarize recommendations, action items, lessons learned, and best practices identified through that year's QARs for that QAR topic. The QAR Leader will submit this QAR Summary Report to the Office of Design QAR Program Manager prior to June 30th.

The Office of Design QAR Program Manager will compile the individual QAR Summary Reports into a Summary of Recommendations and Action Items Report that should be provided to FHWA no later than August 31st of each year.

The Office of Design QAR Program Manager maintains a library of the Annual QAR Plans, QAR Memorandums, QAR Summary Reports, and a QAR Findings Log.

Exhibit 125-1: Example QAR Plan

126 Lane Repurposing Projects

Modification for Non-Conventional Projects:
Delete ***FDM 126***.

126.1 General

Lane repurposing projects (a.k.a., "road diets", "lane elimination", or "lane reduction") are intended to reduce the number of travel lanes to achieve systemic improvements. Generally, the purpose of these projects is to reconfigure the existing cross section to enhance other uses and travel modes. Lane repurposing projects typically contribute to the economic development, livability, and vitality of a community. The recovered travelled way can be used to accommodate other uses such as separated bicycle lanes, buffered bicycle lanes, improving existing sidewalks, adding sidewalks, landscaping, on-street parking, bulb-outs, traffic calming, transit, and pedestrian refuge islands marked with crosswalks. Guidance on the development and review processes for repurposing lanes on the State Highway System (SHS) is provided in the Department's ***FDOT Lane Repurposing Guidebook*****.**

A local government entity (e.g., municipality, county, Metropolitan Planning Organization (MPO), Transportation Planning Organization (TPO)) or the Department can submit a request for the repurposing of travel lanes on the SHS. A private entity may only submit a request through a local government entity. Proposed lane repurposing projects may be part of a larger community vision. With sufficient advanced planning, lane repurposing projects are often done in conjunction with Resurfacing, Restoration and Rehabilitation (RRR) projects. It is preferred that lane repurposing projects be identified ahead of time through a planning exercise such as a district area wide multimodal mobility plan, community vision plan, or downtown redevelopment plan.

If the project has a PD&E phase, the requirements of this chapter are followed during the PD&E study prior to the selection of a preferred alternative. See ***Part 1, Chapter 2*** of the ***PD&E Manual*** for additional information.

126.2 Requirements

Lane repurposing projects must comply with AASHTO and Department design criteria. A Design Exception or Design Variation is required when an existing or proposed design element does not comply with the governing criteria. See ***FDM 122*** for information on Design Exceptions and Design Variations.

Lane repurposing projects should be consistent with the Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), and Transit Development Plan (TDP).

Analyze impacts of a lane repurposing project with consideration for the following:

- Utilities
- Access management
- Businesses
- Traffic operations
- Safety
- Pedestrian and bicyclist activities
- Transit and freight routes
- Environmental impacts
- Evacuation routes
- Emergency responders
- Functional classification
- Context classification
- Landscaping (shade or architectural)
- Speed (target, design and posted)
- Traffic impact due to diversion to parallel routes

Four-lane undivided roadways with AADT ≤ 20,000 are typically good candidates for a lane repurposing (e.g., converting to a two-lane, two-way road with a center-left-turn-lane). However, projects are evaluated for lane repurposing feasibility on a case-by-case basis.

If exclusive bus lanes/business access & transit (BAT) lanes are proposed in the lane repurposing project, coordinate with Office of Modal Development/Public Transit and local transit agency.

In addition to impacts of lane repurposing projects, conduct public involvement activities in accordance with the ***Public Involvement Handbook***.

126.2.1 Federal-Aid Projects

Follow the National Environmental Policy Act (NEPA) for lane repurposing projects that use federal funding.

126.2.2 Roadway Functional Reclassification

A lane repurposing project can potentially change the functional classification of a roadway, which could affect planning, funding eligibility, traffic analyses, project prioritization, and state and federal reporting requirements.

A request for a change in functional classification requires review and approval by the Department and FHWA. Approval is typically requested during the preliminary review process. More information is provided in the Department's ***Urban Boundary and Functional Classification*** Handbook. This handbook can be found at the FDOT Transportation Data and Analytics website:

https://www.fdot.gov/statistics/tsopubs.shtm.

A proposed change in functional classification of a roadway on the National Highway System (NHS) requires coordination between the Department, local officials, and FHWA.

126.3 Application Process

The application process consists of three main steps: coordination between Applicant and the District, a preliminary review and approval by District, and the final review and approval by Central Office (CO). ***FDM 103*** includes the ***Forms 126-A***, ***B***, and ***C*** that are utilized during this process. ***Form 126-A*** is used as guidance for project meetings, reports and methodology, ***Form 126-B*** establishes the initial notification to CO Systems Implementation Office (SIO) and ***Form 126-C*** confirms the final review and approval from CO.

126.3.1 Project Initiation

(1) The applicant submits the lane repurposing request to the District Lane Repurposing Coordinator.

(2) The applicant submits required information in the Initial Meeting and Methodology Checklist (***Form 126-A***) to the district prior to the initial meeting.

(3) The District Lane Repurposing Coordinator schedules the initial meeting to discuss the proposed lane repurposing project with the District Review Team, which includes the following district offices:

    (a) Planning

    (b) Environmental Management

(c) Modal Development

(d) Design

(e) Safety

(f) Traffic Operations

(4) The applicant attends this initial meeting to discuss the process and requirements of the lane repurposing request.

(5) The District Lane Repurposing Coordinator submits the initial notification to Central Office Systems Implementation Office (SIO). This will include:

(a) Initial Meeting and Methodology Checklist (***Form 126-A***)

(b) Meeting Minutes

(c) Initial Notice to Central Office (***Form 126-B***), with concurrence from the District Planning and Environmental Administrator, District Design Engineer and District Traffic Operations Engineer.

126.3.2 District Preliminary Review

The District Preliminary Review is as follows:

(1) The applicant will submit a draft concept report containing a proposed typical section to the District Lane Repurposing Coordinator for review.

(2) The District Lane Repurposing Coordinator will coordinate the review of the project and concept report with the District Review Team.

After District reviewer's acceptance, a Final Concept Report must be submitted along with ***Form 126-C*** and signed at the District level to CO for review. The District Lane Repurposing Coordinator will work closely with CO staff during this review phase.

126.3.3 Central Office Final Review and Approval

The Final Review and Approval process is as follows:

(1) The District Lane Repurposing Coordinator submits the Final Review and Approval Notice to Central Office Systems Implementation Office (***Form 126-C***), signed by the District Planning and Environmental Administrator, the District Design Engineer, and the District Traffic Operations Engineer, along with the Final Concept Report.

(2) The Systems Implementation Office coordinates the review of the lane repurposing request with the different offices in Central Office (e.g., Design, Traffic Engineering and Operations) and obtains concurrence from the Chief Planner.

(3) The Systems Implementation Office submits the lane repurposing request for obtaining the final approval or denial to the Chief Engineer. The Chief Engineer has the final authority to approve, deny or object (with comments) to the lane repurposing request.

(4) The Systems Implementation Office submits notification to the District Lane Repurposing Coordinator of the Chief Engineer's decision.

   (a) Approved: application process is complete.

   (b) Denied: includes an explanation for the denial.

   (c) Objection with comments: the applicant may resubmit the lane repurposing proposal to the District once the comments have been addressed. The resubmittal must include an updated concept report and signed ***Form 126-C*** (included in ***FDM 103***).

127 Community Aesthetic Features

127.1 General

A Community Aesthetic Feature (CAF) is an enhancement installed within the Department's right of way to represent or reflect the surrounding community's identity, culture, and values. A CAF may also enhance the sense of place through which a highway passes.

A CAF placed within FDOT Right of Way (R/W) or attached to an FDOT structure or facility must be approved by the Department. These features are designed, maintained, and paid for by a local governmental agency. A CAF is typically constructed by the sponsoring entity but may be included as part of a Department project.

The ***Community Aesthetic Feature Agreement*** (***Form Number 625-010-10***) must be executed by the local governmental entity and the Department prior to any construction within the Department's R/W. This agreement provides for the removal and/or relocation of the CAF at the local governmental entity's expense should it not be maintained by the local governmental entity, or if the Department needs the R/W for transportation purposes. A Deposit, Performance Bond, or Letter of Credit is required as part of the ***Community Aesthetic Feature Agreement***. A waiver of the Deposit, Performance Bond or Letter of Credit is allowed for certain minor installations as indicated within the CAF agreement.

See ***F.S. 334.187*** for Bond and Letter of Credit requirements.

Final plans for placing a CAF within the Department's R/W must be accompanied by a resolution of the local governmental entity indicating their full financial responsibility for the feature's design, construction, and maintenance during its lifespan. The resolution must indicate the office or position title (e.g., Mayor, City Manager) within the local agency with approval authority to execute the CAF agreement.

127.2 Requirements

A CAF must meet the Department's requirements governing safety, access, and maintenance of the highway. A CAF is classified in the following categories:

(1) Public Art (Stand Alone or Affixed)

(2) Local ID Markers (Stand Alone or Affixed)

While there are some criteria unique to each category, all CAFs must meet the following requirements:

(1) Except where parking is available, select a site and lay out the site plan to deter drivers from stopping within the roadway. If drivers are expected to stop or park, provide for parking in the plan. If public access is available, Department Standards and Specifications must be met, including ADA requirements. Prohibit public access to the CAF when located within limited access R/W.

(2) The feature must not contain any signs as defined in the ***2009 Manual on Uniform Traffic Control Devices (MUTCD), Part 1, Chapter 1A.13***, traffic control features, auditory devices, reflective surfaces, flashing lights, moving parts or moving illumination.

(3) The feature must not contain any advertising per the ***MUTCD*** and ***23 C.F.R., 1.23*** which prohibits advertising on, or commercial use of the R/W. Commercial advertising on state R/W is also prohibited by ***Chapter 479, Florida Statutes***, including charitable, fraternal, religious, or political signs, symbols, logos, banners, web links, or any other such devices. Governmental seals or logos are permitted as part of a Local ID Marker.

(4) Lighting of the feature must not be directed at motorists, bicyclists or pedestrians. For roadway and intersection lighting criteria see ***FDM 231.*** When located near an airport, the feature must not create a hazard as defined by ***Section 333.01(3), F.S.***

(5) In absence of feature lighting, messages or text included on Local ID Markers must be retroreflective. Decorative or accent lighting must not include any strobe effects, flashing lights, moving parts, or moving illumination.

(6) CAF installations that are visible from the Interstate mainline, require FHWA approval.

(7) Do not install Public Art or Local ID Markers in both the median and roadside at a given location. Median placements are allowed on roadways with restricted right of way or restricted roadside conditions.

(8) CAFs within the median of a limited access facility are prohibited.

(9) One Stand-Alone feature will be allowed per mainline interchange approach (for a maximum of two installations). The local governmental entity must select one site from amongst the ramp and the mainline, along the outside of a ramp, or the area inside a loop ramp.

(10) The feature must meet applicable building codes and design criteria for similar structures or landscaping placed adjacent to the highway's R/W, including wind loading commensurate with highway signs in the area.

(11) The feature must not cause adverse impacts or create public controversy related to any of the following:

(a) Property access

(b) Air quality

(c) Noise

(d) Water quality

(e) Wetlands

(f) Floodplain encroachments

(g) Imperiled, endangered, or threatened species or their critical habitat

(h) Historical resources

(12) The CAF, including amenities like landscape or fencing, must not obstruct signs or interfere with a sight distance, sight triangle, or permitted view zone (billboards).

(13) The CAF final design must be signed and sealed by a responsible professional licensed in Florida, excluding art wraps.

(14) Attachments to fencing on structures is not permitted.

127.2.1 Public Art (Stand-Alone)

Additional requirements for Public Art (Stand-Alone) are as follows:

(1) All roadways

(a) The location must be outside the appropriate lateral offset or clear zone as defined in ***FDM Table 215.2.3*** and ***215.2.4,*** .and should be as close to the right of way line as practical.

(b) The structure may not display messages with text or contain any words or alpha-numeric characters.

(c) The artist's insignia may be inscribed or etched on a small plaque affixed to the artwork or placed on the artwork itself. The insignia must not be visible from the roadway so as to avoid distraction to drivers or bicyclists.

(d) The object's highest point must not be greater in elevation than 25 feet above the nearest point of the traveled way.

(2) Curbed roadways

The feature may be placed within the median of curbed roadways, where:

(a) The Design Speed is less than or equal to 45 mph, and

(b) The R/W or roadside is restricted, and

(c) A minimum 4-foot offset from the face of curb is provided.

127.2.2 Public Art (Affixed)

Additional requirements for Public Art (Affixed) are as follows:

(1) The feature may not display any messages with text or contain any words or alpha-numeric characters.

(2) The artist's insignia may be inscribed or etched on a small plaque affixed to the artwork or placed on the artwork itself. The insignia must not be visible from the roadway so as to avoid distraction to drivers or bicyclists.

(3) For bridges, the feature must not reduce the vertical clearance over the roadway.

(4) For art wraps affixed to roadside features:

(a) Do not obstruct traffic control cabinet vents or access panels with the art wrap.

(b) Art wrap themes can be approved for general use by a local government entity.

(c) A CAF Agreement will be required for these features.

(d) Any maintaining agency, other than a local government, must coordinate approvals and maintenance through the appropriate local government entity.

(e) Official seals or logos representing the local governmental entity are permitted. Alpha-numeric characters are allowed if they are part of official seals or logos. Seals or logos must be less than 200 square inches each. Only one seal or logo per face is permitted.

(f) Maps on traffic control cabinet wraps are not permitted to face the roadway.

(g) A Deposit, Bond, or Letter of Credit is not required for art wraps on traffic control cabinets.

(h) The DDE should coordinate with the District Traffic Operations Office during the review process for traffic control cabinet wraps.

127.2.3 Local ID Marker (Stand-Alone)

Additional requirements for a Local ID Marker (Stand-Alone) are as follows:

(1) All roadways:

(a) Local ID Markers are intended to represent the geographic boundary for a county, municipality, sovereign nation, or unincorporated area. The Markers should be located in close proximity to the actual geographic boundary of that area. Remove existing standard geographic boundary guide signs, and unofficial signs or structures, at or near the location.

(b) Local ID Markers for an unincorporated or community area must provide a map, or sufficient enough description to clearly designate the geographic boundary of the area. Also provide documentation of approval of such boundary by the local governing authority.

(c) The location must be outside the appropriate clear zone and lateral offset as defined in ***FDM 215.2.3*** and ***215.2.4*** and should be as close to the R/W line as practical.

(d) The structure may contain text such as the name of the municipality, county, or community area (as defined in ***Chapter 14-51.041, F.A.C.)*** with a short phrase or message. Text such as "Exiting" or "Leaving" are prohibited.

(e) The object's highest point must not be greater in elevation than 25 feet above the nearest point of the roadway.

(2) Curbed roadways:

The feature may be placed within the median of curbed roadways, where:

(a) The Design Speed is less than or equal to 45 mph, and

(b) The R/W or roadside is restricted, and

(c) A minimum 4-foot offset from the face of curb is provided.

(3) Limited Access Facilities:

(a) Provide a minimum 50-foot offset (100-foot preferred) from the edge of the traveled way, whether guardrail is present or not. The 50-foot to 100-foot lateral offset will help to minimize driver distraction and reduce the likelihood that vertical structures will become storm debris blown across the roadway.

(b) Letter height must not exceed four feet.

(c) Short phrases or messages are prohibited.

127.2.4 Local ID Marker (Affixed)

Additional requirements for a Local ID Marker (Affixed) are as follows:

(1) All roadways:

  (a) The feature may contain text such as the name of the municipality, county, or community area (as defined in ***Chapter 14-51.041(2)(c), F.A.C.***) with a short phrase. Text such as "Exiting" or "Leaving" are prohibited.

  (b) For bridges, the feature must not reduce the vertical clearance over the roadway.

(2) Limited Access Facilities:

  (a) Letter height must not exceed four feet.

  (b) Short phrases or messages are prohibited.

127.3 Approval Process

The application process is conducted in two phases, the Concept Phase and the Final Phase.

When any of the requirements in ***FDM 127.2*** are not met, a Design Variation must be approved by the District Secretary.

127.3.1 Concept Phase

The Concept Phase includes District coordination with the applicant to ensure:

(1) The appropriate Community Aesthetic Feature category is selected,

(2) The corresponding requirements are achievable and acceptable, and

(3) The conditions of the ***Community Aesthetic Feature Agreement*** are acceptable.

The local agency will submit a concept drawing and documentation to the District Office. The concept submittal must include a ***Submittal/Approval Letter***, which can be found in ***FDM 103, Form 122-A***. The ***Submittal/Approval Letter*** is to be signed by a representative of the requesting entity, the District Design Engineer (or Turnpike Design Engineer), and the District Secretary.

Upon review by the District Design Engineer and the District Secretary, conceptual approval may be granted. If the concept and proposed Design Variations are deemed acceptable, the signed ***Submittal/Approval Letter***, indicating conceptual approval, will be returned to the local agency.

For applications involving the Interstate System, the District should coordinate with the FHWA District Transportation Engineer.

The package submitted to the District Office for conceptual approval must include the following:

(1) The designation of the feature category.

(2) A conceptual drawing/rendering showing the top, front, and side views of the feature with labeled dimensions, material designations including connections, proposed lighting configuration, and any alpha-numeric characters.

(3) A draft site plan and cross section view dimensioning the location of the feature in relationship to the edge of traveled way and the R/W.

(4) The design speed of all adjacent roadways.

(5) A citation of the Governing Design Standards (or Governing Standard Plans), criteria, and building code to which the feature will be designed.

(6) If the feature is to be affixed to a bridge:

    (a) Identify the bridge owner.

    (b) Declare what the impact is to the bridge loading.

(7) For Local ID Markers, include a site map or provide a dimension from the jurisdictional boundary associated with the marker.

(8) The Signature/Approval Letter signed by the applicant.

127.3.2 Final Phase

The Final Phase includes the preparation and review of all final documents. The local agency will submit the ***Submittal/Approval Letter*** and final documents for approval to the District Design Office. The District Secretary will review the application and either grant approval to place the feature or deny the submittal with comments.

The package submitted to the District Design Office for final approval must include the following:

(1) Site Plans, including a Traffic Control Plan if temporary maintenance of traffic will be required to place and/ or maintain the feature.

(2) Structural Plans including a wind load analysis.

(3) Local Governmental Entity Resolution.

(4) Design Variations for any requirements in ***FDM 127.2*** that are not met.

(5) ***Community Aesthetic Feature Agreement*** signed by the local governmental entity.

(6) ***Signature/Approval Letter*** signed by the applicant.

Upon receiving final approval by the District Design Engineer (or Turnpike Design Engineer), the District Secretary, and, if applicable, FHWA, the District will notify the local governmental entity that placement of the feature may proceed. The final approval is valid for one year, at which time the local governmental entity may request an extension from the District.

127.4 Place Name Signs

Customized Place Name Signs are considered Local ID Markers which are addressed in ***FDM 127.2.3*** and ***127.2.4***.

The placement of Place Name Signs within FDOT R/W is regulated by the Department. Requirements for Place Name Signs within FDOT R/W are located in ***Rule Chapter 14-51, F.A.C., Part IV Place Name Signs***.

All signs placed within the Department's R/W must meet the requirements contained in the ***MUTCD, Part 2***. Signs for general information, services, tourist destinations, and recreational/cultural interest areas all have specific chapters in the ***MUTCD***, which specify color, size and lettering requirements. Destination signs are classified in the ***MUTCD*** as Guide Signs.

127.5 Blue Star Memorial Markers and Flag Poles

Blue Star Memorial Markers and Flag Poles are not considered Community Aesthetic Features and are not covered by this chapter. These markers are managed through the Local FDOT Maintenance and Traffic Operations offices.

128 Federal-Aid Project Certification

128.1 General

The Florida Department of Transportation (FDOT) has a Stewardship and Oversight Agreement with the Federal Highway Administration (FHWA) setting forth the respective roles, responsibilities, and accountability of FDOT and FHWA in the administration of Federal-aid highway funds. See ***FHWA-FDOT Stewardship and Oversight Agreement, Topic No. 700-000-005*** and ***Title 23 United States Code 106 (23 USC 106)***. Under this agreement, FHWA grants to FDOT general responsibilities and approvals for design, plans, specifications, estimates, contract awards, contract administration, and project inspections on Federal-aid highway projects except for those projects FHWA and FDOT used the risk-based approach to select as projects of Division Interest" (PoDI), and as discussed in ***FDM 128.2***. For those projects that FDOT has oversight responsibility, FDOT will act on FHWA's behalf by complying with all applicable FHWA policies, regulations, ***Title 23 USC***, and ***non-Title 23 USC*** requirements. Notwithstanding this, FHWA may become involved with any Federal-aid project and retains overall responsibility for all aspects of Federal-aid programs. As such, FHWA has full access to and the legal authority to review any aspect or record of any Federal-aid project at any time. In accordance with ***Title 2 Code of Federal Regulations Part 200*** (***2 CFR Part 200***), records will be retained for a minimum of three years or until litigation, claims or audit findings initiated before the three-year period have been resolved.

Modification for Non-Conventional Projects:
Delete the second sentence of the above paragraph and replace with the following: See ***FHWA-FDOT Stewardship and Oversight Agreement, Topic No. 700-000-005, Title 23 United States Code 106 (23 USC 106),*** and ***Title 23 Code of Federal Regulations 636 (23 CFR 636)***.

128.2 Selection of Federal-Aid Projects

In accordance with the Stewardship and Oversight Agreement, annually in July, FHWA and FDOT will use risk-based approach to negotiate which new projects will be selected as Projects of Division Interest (PoDI). The FHWA Transportation Engineer will coordinate the project selection with their assigned FDOT District Office. Ideally, the projects will be selected from projects listed in the Statewide Transportation Improvement Program (STIP) to be approved by FHWA the following October 1st, and will include projects selected from all four years of the STIP. The projects selected should be on the Federal-aid system to primarily include the Interstate and National Highway System (NHS) routes, but non-NHS projects can be selected. The projects should be selected considering the factors below:

(1) All major projects as defined by FHWA's major project criteria (cost ≥ $500 million)

(2) Controversial and Congressional interest Projects

(3) Demonstration (demo) and pilot projects

(4) Interstate projects:

- (a) With Design Exceptions to the 10 controlling criteria
- (b) For new or modified access points
- (c) For major reconstruction and widening

(5) Projects utilizing innovative contracting methods (e.g., design build, public-private partnerships)

(6) Special Experimental Projects (SEP):

- (a) Projects requiring SEP-14 approval for alternative contracting methods
- (b) Projects requiring SEP-15 approval for public-private partnerships

(7) Unusually complex or controversial projects

(8) Major unique and/or unusual structures

(9) A priority focus for projects on the NHS

(10) A desire to have a mix in project size and scope

All federally funded projects must comply with applicable ***non-Title 23 U.S.C.*** requirements which include, but are not limited to:

(1) National Environmental Policy Act (NEPA) of 1969 pursuant to 40 C.F.R. Parts 1500 - 1508, 23 C.F.R. Section 771 and Section 6002 of SAFETEA-LU

(2) Section 4 (f) of the DOT Act of 1966

(3) Clean Air Act Amendments of 1990

(4) Civil Rights Act of 1964

(5) Civil Rights approvals

(6) Disadvantaged Business Enterprise Program (DBE)

(7) Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970

(8) Hardship acquisition and protecting buying

(9) Americans with Disabilities Act/Section 504 Rehabilitation Act of 1973

(10) Davis-Bacon wage rates

(11) Waiver for Buy America requirements

(12) SEP-14/SEP15 contracting methods

(13) Executive Orders

(14) FHWA Guidance and technical advisories

(15) Addition/modification of access points to the Interstate (Interchange, locked gate access points, median crossovers for construction)

(16) Project by project obligation of federal funds

(17) Modifications to Federal-aid project agreements

(18) Final Vouchers

128.3 FDOT Responsibilities

The final design documents, reports and plans for projects not selected as PoDI will be developed in accordance with all applicable Department manuals, guidelines and procedures, and in compliance with all applicable Federal Statutes, Regulations, Executive Orders, and FHWA Directives and Standards. The Department is responsible for assuring that all appropriate criteria have been adhered to, and for documenting its findings in lieu of FHWA reviews. Several of the major areas and the method to be used by the Department to document the acceptability of various final design activities in place of an FHWA review and approval are:

(1) Typical Section Package:

The typical section package should be prepared as described in ***FDM 120.2.3*** and ***120.3.2***. Concurrence by the District Design Engineer documents the acceptability of the package. Concurrence from the District Structures Design Engineer may also be required on unusual bridge typical sections.

(2) Pavement Design Package:

The pavement design is developed and approved by the responsible professional engineer in accordance with Department pavement design procedures. Concurrence from the District Design Engineer is required to document the acceptability of the package in lieu of FHWA review and concurrence.

(3) Bridge Hydraulics Report:

The hydraulics report is developed and approved by the responsible professional engineer in accordance with appropriate design standards. Concurrence from the District Drainage Engineer is required to document the acceptability of the package in lieu of FHWA review and concurrence.

(4) Bridge Development Report:

The bridge development report is developed and approved by the responsible professional engineer in accordance with appropriate design standards. Concurrence from the District Design, Structures Design, or Project Management Engineer is required to document the acceptability of the report in lieu of FHWA review and concurrence.

Modification for Non-Conventional Projects:
Delete item (4).

(5) Design Plans Phase Reviews:

Plan reviews should be conducted as described in ***FDM 120***. Concurrence in the resolution of phase review comments from the District Design, Structures Design, or Project Management Engineer is required to document the acceptability of the reviews in lieu of FHWA review and concurrence. (See ***Form 128-A, in FDM 103***)

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: Plan reviews will be conducted as described in ***FDM 901***. (See ***Form 128-B***, in ***FDM 103***)

(6) Design Exceptions:

Design Exceptions on projects not selected as PoDI require approval and concurrence as described in ***FDM 122***.

(7) Special Provisions:

Special provisions, which include project specific and technical special provisions, will be developed and approved by the responsible professional engineer. Concurrence from the District Specifications Engineer is required to document the acceptability of the special provisions in lieu of FHWA review and concurrence. (See ***Form 128-C***, in ***FDM 103***)

(8) Plans, Specifications, and Estimates:

The Plans, Specifications, and Estimates (PS&E) Package and contract file will be emailed to Central Office Final Plans section as described in ***FDM 131***. The District Director of Transportation Development will certify that the design and PS&E Package has been prepared according to the appropriate certification procedures. The date of this certification will be noted on the Transmittal of PS&E Package. The Transmittal will also identify the individuals that reviewed the Plans Package, Specification Package, and Authorization Estimate, and the dates of their respective reviews. The Department's official estimate will be prepared by the District Estimates Office.

Modification for Non-Conventional Projects:
Delete Item 8.

(9) Authorization to Advertise:

The PS&E Package must be approved by the Specifications and Estimates Office prior to requesting FHWA authorization for construction to advertise. The Contract File Package (consisting of the documents listed on the Contract File Index completed by the district), FHWA Summary Sheet, Cost Estimate, Right of Way Certification. Utility Certification, Environmental Certification and Railroad Certification Agreement (if applicable), along with confirmation of the PS&E approval will be reviewed by the appropriate district and central offices and by the Federal Aid Management Office prior to submittal of the federal authorization request.

Modification for Non-Conventional Projects:
Delete Item 9 and replace with the following: (9) Use of Federal Funds on Design-Build Projects The District Design-Build team approves the Design Criteria Package before the release of the ***Final Request for Proposal*** to the Design-Build Firms. The Design-Build authorization request should be processed immediately upon notice of receipt of package approval. Upon receipt of the approved FHWA authorization, District Federal-Aid Coordinators should notify the District Design-Build firm so that the RFPs and Design Criteria packages can be distributed. See ***Chapter 7.1*** of the ***Procurement and Administration Procedure (Topic No. 625-020-010)*** procedure.

(10) Revisions:

Revisions to the PS&E Package will be processed as described in ***FDM 132***. Concurrence from the District Design, Structures Design, or Project Management Engineer is required to document the acceptability of the revision in lieu of FHWA review and concurrence.

Modification for Non-Conventional Projects:
Delete Item 10.

In special cases where programs or projects are developed in the Central Office, an appropriate Central Office Manager will provide any necessary concurrences in lieu of a District Manager.

Modification for Non-Conventional Projects:
Delete the above paragraph.

(11) Environmental Review:

Pursuant to ***Title 23 U.S.C., Chapter 3, Section 327 and the Memorandum of Understanding (MOU)*** executed on December 14, 2016, the Department had assumed FHWA's responsibilities under the National Environmental Policy Act (NEPA) for highway projects on the State Highway System (SHS) and Local Agency Program (LAP) projects off the SHS. Based on this MOU, the Department responsibilities include environmental review, interagency consultation, and other activities pertaining to the review or approval of NEPA actions. The Department is the Lead Federal Agency for highway projects, and approval authority is held by the State Office of Environmental Management. (OEM).

128.4 Certification Documentation and Reviews

FHWA will perform periodic reviews of projects developed under the Stewardship and Oversight Agreement and may have access to review project phases and records at any time. Adequate documentation throughout the design phase is critical. All approvals and concurrences outlined in the previous section must be sufficiently documented. A complete, well-organized design project file should be able to support a compliance review. All correspondence and documents must include the Federal-aid project number. The Quality Assurance procedures described in ***FDM 125*** will be used by the Central Office to monitor district compliance with the certification requirements.

128.5 Certification Statement

A Federal-aid project certification statement by the District Director of Transportation Development for each project is no longer required; however, Districts are responsible for ensuring that all Federal-aid requirements are met as described in this chapter.

130 Signing and Sealing Documents

130.1 General

The act of signing, dating, and sealing contract component plans, BIM files, specifications, reports, or other documents is collectively referred to as signing and sealing.

This chapter provides the Department's requirements for signing and sealing plans and documents in conformance with ***Florida Statutes (F.S.)*** and ***Florida Administrative Code (F.A.C.)***. The Laws and Rules referenced in this chapter are primarily those governing Professional Engineers. Other licensed professionals that are required to sign and seal plans or documents are to follow the Laws and Rules applicable to their profession.

It is the licensee's responsibility to comply with the signing and sealing requirements applicable to their profession's Laws and Rules. It is the District's responsibility to verify that documents are signed, sealed and transmitted in accordance with this chapter.

130.2 Signing and Sealing Contract Plans

The transmitted contract plans signed and sealed by the responsible professional(s) become the Record Set. Every sheet of the Record Set must be signed and sealed, except for the following sheets that may be appended to the contract plans set:

- Existing Bridge Plans,
- ***Developmental Standard Plans***, and
- Plans that are prepared by an employee of a Utility or other employees exempted under ***Section 471.003, F.S.***, except as follows.
    - o Utility plans that modify or detail attachments to a bridge or other structure belonging to the Department must sign and seal the sheets affecting such bridge or structure.
    - o Plans prepared by nonexempt parties for a Utility must be signed and sealed.

Every sheet of the Record Set must include a title block that contains information for the professional engineer that will sign and seal the sheet, showing:

(1) The name, address, and license number of the engineer, or

(2) If practicing through a duly authorized engineering business, the name and license number of the engineer, and the name and address of the engineering business, or

(3) If employed by a local, State or Federal agency, the name and license number of the engineer, and the name and address of the agency.

A non-engineering licensed professional that will sign and seal the sheet must show similar information in the title block related to their profession.

130.2.1 Digital Signing and Sealing

Digital Delivery is the standard method of electronically transmitting contract documents to the Department. This includes the creation of Portable Document Format (PDF) files of contract plans and specifications, which are signed and sealed with a Digital Signature. The ***CADD Manual*** defines the type of digital certificate to be used for Digital Signature. A representation of the professional's seal next to the Digital Signature Appearance is required for Contract Plans.

Place the following OFFICIAL RECORD note on each plan sheet that is digitally signed and sealed:

> "THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C."

For standard size (11"x17") plan sheets, the OFFICIAL RECORD note appears along the right edge of the plan sheet just outside the border. For large format (24"x36", 36"x48" or 36"x72") plan sheets, the OFFICIAL RECORD note appears in the information block located in the bottom right portion of the sheet.

The rule number referenced in the note above applies to the engineering professional that is signing and sealing the sheet. A non-engineering licensed professional should use the rule number that applies to their profession:

- Surveyors, Rule 5J-17.062, F.A.C.
- Geologists, Rule 61G16-2.005, F.A.C.
- Landscape Architects, Rule 61G10-11.011, F.A.C.
- Architects, Rule 61G1-16.005, F.A.C.

Electronically transmit the Contract Plans as individual signed and sealed PDFs of component plans. The list of component plans for Digital Delivery is comprised of the following:

(1) Roadway Plans

(2) Signing and Pavement Marking Plans

(3) Signalization Plans

(4) Intelligent Transportation System (ITS) Plans

(5) Lighting Plans

(6) Landscape Plans

(7) Architectural Plans

(8) Structures Plans

(9) Toll Facilities Plans

The component plans listed above may require insertion of sheets that were prepared early in, or prior to the design process ("early works"). The following early plan sheets may be contained in a separate signed and sealed PDF that is to be included as part of the Contract Plans:

GR-# Soil Survey and Report of Core Borings

TR-# Tree Survey

UTV-# Verified Utility Locate

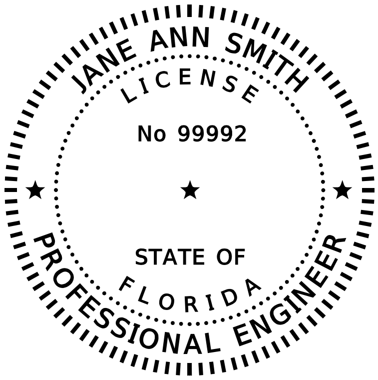
No other plans sheets than those listed above are to be submitted separate from the component plans, except for manually signed and sealed documents as discussed in ***FDM 130.2.2***.

See ***FDM 910*** for instruction on how to show early plan sheets on the Key Sheet.

130.2.1.1 Single Digital Signature

Component plans that will be signed and sealed by a single professional (signatory) may place a signature block, as shown in ***Figure 130.2.1***, on the component Key Sheet in lieu of using a Signature Sheet. Listing the sheets contained in the PDF to be signed and sealed is not required.

Figure 130.2.1 Signature Block



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

Jane Ann Smith
2018.06.25 16:52:48 -04'00'

ON THE DATE ADJACENT TO THE SEAL

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

ROADWAY DESIGN ENGINEERS, INC.
123 MAIN STREET
TALLAHASSEE, FL 32301
JANE ANN SMITH, P.E. NO. 99992

130.2.1.2 Multiple Digital Signatures

A Signature Sheet is required for component plans that will be signed and sealed by more than one professional. See ***FDM 910*** for Signature Sheet requirements.

130.2.2 Manual Signing and Sealing

Digital Delivery is the standard practice for signing and sealing, and transmittal of contract documents. Transmittal of contract documents that have been manually signed and sealed is only accepted when Digital Delivery is not possible. The following approval is required for acceptance of manually signed and sealed documents:

(1) District Plans, Specifications, and Estimates (PS&E) Engineer for District Lettings.

(2) State Final Plans Engineer for Central Office Lettings.

The district is to receive one set of manually signed and sealed contract documents to be retained as the record set. Place a note on the first sheet of the documents and scan into a pdf file. The note is to read: “This is a scanned copy of the original signed and sealed document”. Use the scanned pdf file for the Letting process.

If the scanned pdf are sheets that are to be included with a component of the Contract Plans, follow the process for “early works”, see ***FDM 130.2.1***.

The requirements for manually signing and sealing are covered in the Laws and Rules for each licensee's profession. Do not include the note along the right edge of plan sheets that is used when documents are digitally signed and sealed.

130.3 Signing and Sealing Other Documents

Other documents to be signed and sealed include reports, calculations, specifications, and criteria packages, used in the development of design plans. Sign and seal Specifications Packages in accordance with the ***Specifications Handbook***.

130.3.1 Digital Signing and Sealing

Signing and sealing PDF documents with a Digital Signature is the standard practice. Place a signature block on the first sheet of the PDF document. A representation of the professional's seal next to the Digital Signature Appearance is optional for other documents.

When including a representation of the professional's seal, use the signature block as shown in ***Figure 130.2.1***.

When omitting a representation of the professional's seal, use the following signature block:

[NAME], State of Florida, Professional Engineer, License No. [NUMBER] This item has been digitally signed and sealed by [NAME] on the date indicated here. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

130.4 Signing and Sealing BIM Files

BIM files are signed and sealed 2D or 3D CADD files that are included with the contract plans. BIM files are listed in a manifest that is placed on the Signature Sheet within the component plans to which the files apply. Each listed file has a unique hash code that identifies the CADD file being signed and sealed. See ***FDM Exhibit 910.4*** for an example of a BIM file manifest.

FDOT ***CADD Manual***, ***Section 8.4*** Project Deliverables, outlines the steps to complete this process. A training webinar can be found at the following link: ***BIM S&S Procedure***.

130.5 Signing and Sealing Revisions

~~Modification for Non-Conventional Projects~~
~~Delete the first sentence of the above paragraph and replace with the following:~~ ~~Design revisions are modifications to the plans submittal after it has been stamped Released for Construction.~~

Design revisions are modifications to the PS&E Submittal after it has been accepted by Central Office Final Plans. Revisions made after the award of the contract are referred to as post-let revisions. Revisions should be prepared by the same professional that Signed and Sealed the plan sheet contained in the Record Set or the original document. When it is necessary to have revisions signed and sealed by a different professional, provide exculpatory language defining the professional’s limits of responsibility.

Modification for Non-Conventional Projects
Delete the first sentence of the above paragraph and replace with the following: Design revisions are modifications to the plans submittal after it has been stamped Released for Construction.

130.5.1 Contract Plans Set

Prepare design revisions as outlined in ***FDM 132***. Sign and seal the revision package PDF in accordance with ***FDM 130.2***.

Prepare post-let revisions as outlined in ***FDM 132*** and ***Chapter 5*** of the ***Construction Project Administration Manual (CPAM)***. Sign and seal the revision package PDF in accordance with ***FDM 130.2***.

130.5.2 Specifications

Prepare a Supplemental Specifications Package when it becomes necessary to revise either the Specifications Package or a previous Supplemental Specifications Package. Sign and seal the Supplemental Specifications Package in accordance with the ***Specifications Handbook.***

130.5.3 Other Design Documents

Sign and seal each revised sheet and place immediately behind the cover sheet of the original signed and sealed document.

130.6 Support Documents

Engineering decisions are often made on the basis of support documents furnished by non-engineering staff or offices. Two support documents that require certification that they were prepared in accordance with Department procedures are shown in ***Form 130-A*** and ***Form 130-B***; see ***FDM 103*** for forms.

131 Plans Processing

131.1 General

This chapter describes the critical activities required to process the contract plans, specifications and estimate for letting. It identifies the transmittal forms, certifications and other documents prepared by the District and the various offices involved in processing a Plans, Specifications & Estimates (PS&E) submittal package.

This chapter also outlines the steps to resubmit a project that has been withdrawn from letting.

Projects must be electronically delivered in Digital Delivery format in accordance with ***FDM 130*** and the ***CADD Manual***.

Other specific requirements for processing the electronic delivery, including information on the Electronic Delivery software, can be found in the ***CADD Manual***.

131.1.1 Definitions

(1) **Contract Documents:** Contract Documents are treated as one instrument which includes all the following:

(a) Advertisement for Proposal, Proposal, Certification as to Publication and Notice of Advertisement for Proposal,

(b) Appointment of Agent by Non-resident Contractors,

(c) Non-collusion Affidavit,

(d) Warranty Concerning Solicitation of the Contract by Others,

(e) Resolution of Award of Contract,

(f) Executed Form of Contract,

(g) Contract Bond,

(h) Standard Specifications and Plans (including revisions thereto issued during advertisement),

(i) Supplemental Specifications Package,

(j) Required Insurance(s) and,

(k) Addenda, or other information mailed or otherwise transmitted to the prospective bidders prior to the receipt of bids, work orders, and supplemental agreements.

Modification for Non-Conventional Projects:
Delete ***FDM 131.1.1*** item (1) and replace with the following: (1) Contract Documents**:** Contract Documents are treated as one instrument which includes all the following: (a) Advertisement, Request for Proposal (RFP), (b) Technical and Price Proposal, (c) Certification as to Publication and Notice of Advertisement for Proposal, Appointment of Agent by Nonresident Contractors, (d) Non-collusion Affidavit, (e) Warranty Concerning Solicitation of the Contract by Others, (f) Resolution of Award of Contract, (g) Executed Form of Contract, (h) Contract Bond, (i) Design Liability Insurance, (j) Standard Specifications and Plans (including revisions thereto issued during construction), (k) Addenda, written statements or transcripts or minutes of oral representation by Design-Build Firm made at oral presentations, or other information mailed or otherwise transmitted to the prospective bidders prior to the receipt of bids, work orders and supplemental agreements, whether or not set forth at length in the form of contract.

(2) **Plans:** Plans include 2D Contract Plans Set(s) and 3D Build Information Model (BIM) files. Plans show the location, character, dimensions, and details of the work.

(3) **Final Plans:** Plans are considered final after changes noted during the Phase IV submittal review are completed and verified.

(4) **Mandatory Specification Revision:** A required change to the Specifications, Design Standards, or other contract documents, caused by changes in Federal Regulations, State Statutes, Rules, safety improvements, technological changes,

or omissions and implemented on a time-critical schedule, effective with a specific letting month and year.

(5) **Plans, Specifications, and Estimates (PS&E) Submittal Package:** For Contract Class 1 (Central Office Letting) this package is transmitted by the District Final Plans Office to State Program Management Office, Final Plans section, or to District Contracts Office for letting. For Contract Class 7 (District Letting) this package is transmitted by the District Plans, Specifications, and Estimates office(s) to District Contracts Office for letting. The package consists of signed and sealed Final Plans and BIM.zip, Specification Package, the Estimated Quantities Report, and other contract and transmittal documents. PS&E Submittals are numbered consecutively, and re-submittals are required until the project is accepted by the District Program Management Office.

(6) **Authorization Estimate:** The Authorization Estimate is a report generated by the Design Quantities and Estimates (DQE) that is automatically saved to a server for access by authorized users. The Authorization Estimate must be posted to the server no later than the PS&E Transmittal Date.

(7) **Production Date:** The committed completion date for Final Plans, Specifications Package, and certifications (e.g., utilities, permits, R/W, environmental); these documents must be ready for compilation into the Contract File Index.

(8) **PS&E Phase:** The plans processing period between Phase IV plans and delivery of PS&E Package to State Program Management Office, Final Plans section, or to District Contracts Office.

(9) **PS&E Review(s):** Review(s) consisting of the Final Plans, Specifications and Estimate along with any other contract and transmittal documents.

(10) **PS&E Transmittal Date:** The committed date for the transmittal of the PS&E Submittal Package to State Program Management Office, Final Plans section, or to District Contracts Office.

(11) **Supplemental Specifications Package:** A signed and sealed document modifying the Specifications Package after construction contract advertisement.

131.2 District Plans Processing

There are plans processing activities that occur in the Districts prior to submitting the PS&E Submittal Package to State Program Management Office, Final Plans section, or to District Contracts Office. The schedule for these activities vary by District; contact the District Final Plans Office for specific requirements.

Review of contract documents during the PS&E Phase often require modifications to the plans, specifications, or quantities. It is considered a Plan Change when modifications are made prior to the District Estimates Office changing the AASHTOWare Project Preconstruction (PrP) Workflow/Phase or Central Office acceptance of the PS&E Submittal Package.

Plan Changes include modifications, deletions, or addition of data on individual sheets, or adding and deleting entire sheets. Plan Changes also include modifications, deletions, or addition of data to BIM files. Plan Changes are not Plan Revisions (as described ***FDM 132***); therefore, do not note Plan Changes in the Revision Block on the sheets.

131.2.1 Authorization Estimate

The Authorization Estimate (used for budgeting construction dollars in the Work Program) is one of the last activities performed during the design phase. Using the final quantities loaded into AASHTOWare Project Preconstruction™ by the EOR, District Estimates Office will adjust unit prices (when appropriate). The District Estimator typically considers the following items when adjusting costs:

- Order of magnitude of the quantity (exceeding high or low)
- Availability of materials
- Accessibility to project location
- Complexity of work, or Traffic Control Plan
- Specialty work or materials
- Contract time restrictions

When finalized, post the Authorization Estimate to the server. Posting must be no later than PS&E Transmittal Date.

131.2.2 Processing the PS&E Submittal Package

District Final Plans Office initiates the collection and processing of PS&E Submittal documents using the PS&E Module within Project Suite Enterprise Edition (PSEE). When the PS&E Submittal package is complete and ready for submission, control of the PSEE model will be transferred to the appropriate office. Transfer control of the PS&E Module no later than the PS&E Transmittal Date to:

- State Program Management Office, Final Plans section, or
- District Contracts Office for district-let projects

Upon receiving control of the PS&E Module, the appropriate office (indicated above) will check the package for completeness. If incomplete, the District Final Plans Office is notified to provide a corrected submittal.

Transfer control of the AASHTOWare Project Preconstruction™ (PrP) project files to the State Program Management Office, Final Plans section when transferring control of the PS&E Module.

131.2.2.1 Transmittal Memo

The Transmittal Memo provides project information to assist with plans processing, and to certify that required approvals have been received. The Transmittal Memo is populated within the PS&E Module. Update the Transmittal Memo whenever information changes due to project updates.

131.2.2.2 Revisions to PS&E Submittal Package

Revisions are modifications to the PS&E Submittal Package after it has been accepted by State Program Management Office, Final Plans section, or District Contracts Office. See ***FDM 132*** for information on revisions to the PS&E Submittal Package.

131.2.2.3 Re-submittal of Withdrawn Projects

Modification for Non-Conventional Projects:
Delete ***FDM 131.2.2.3***.

When a District withdraws the PS&E Submittal Package for major revisions before the letting, the project must be resubmitted as a new PS&E Submittal Package with all required components. Show the new Proposal/Contract ID number on the Key Sheet(s).

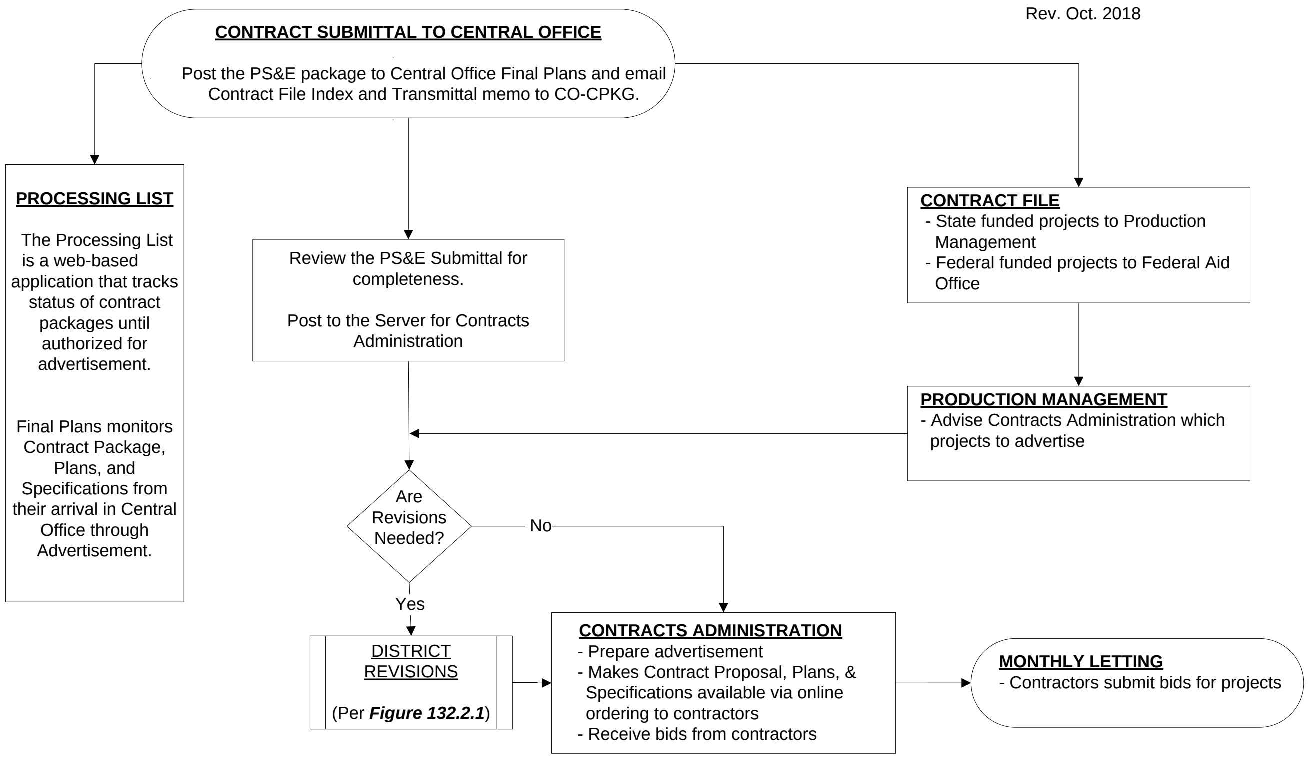
Project documents in Central Office from the previous submittal will be deleted. A project withdrawn for a period of nine months or longer will be updated according to the process outlined in ***FDM 112***.

Districts must coordinate with Central Office Production Management or District Contract Administration to reschedule a letting.

131.3 Central Office Plans Processing

Figure 131.3.1 illustrates the Central Office activities for processing the contract documents for Letting.

Figure 131.3.1 Plans Processing for Central Office Letting



131.4 Re-advertised and Reissued Process

A re-advertised and reissued PS&E Package occurs when a PS&E Package has been advertised/withdrawn or moved beyond advertisement. For a re-advertised and reissued PS&E Package, the Specification Package is to be revised to the current Specifications workbook. The word "REISSUED" precedes the Specifications Package date, as applicable throughout the document.

131.5 Letting Date Changes

The process for changing letting dates depends on the advertisement status of the project.

131.5.1 Before Advertisement

Districts send an email notification of the letting date change to CO-CPKG. Request access to AASHTOWare if the AASHTOWare transfer has occurred. The Project deliverables then become a new submittal with the new letting date.

131.5.2 After Advertisement

For letting date changes from the district, the letting date in the embedded transmittal form will update automatically when Work Program changes the letting date in PSEE.

For letting date changes under a new Specification Workbook and new Standard Plans publication, the Project deliverables must be brought up to date with these new standards. This will require a Plans Revision and an updated Specifications Package. The updated Specifications Package must be listed on the revision memo. Pay items should be checked and updated as necessary for validity with the new date.

132 PS&E Submittal Package Revisions

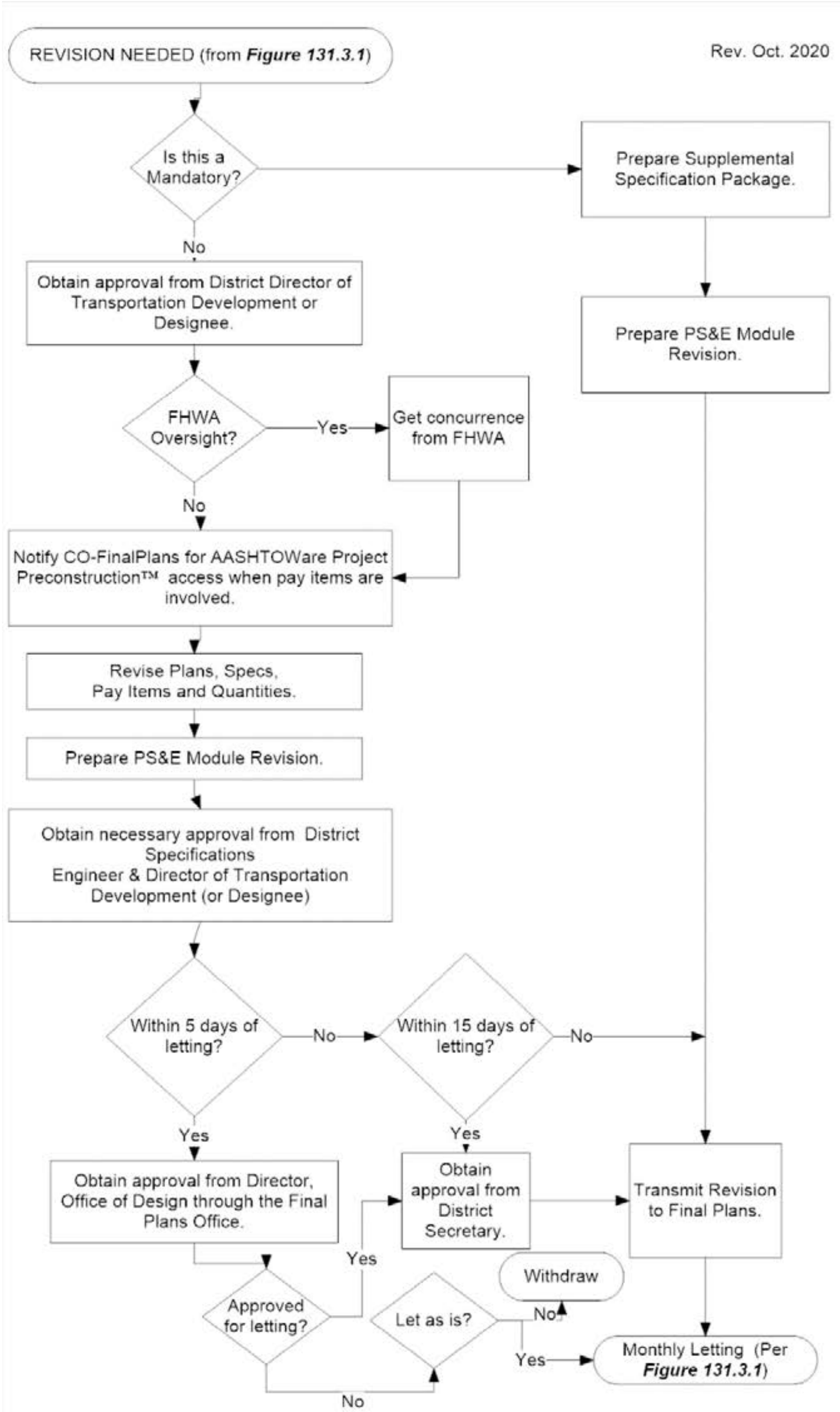
132.1 General

A PS&E Revision Package is required when modifications to plans, specifications, or estimates are made after the PS&E Submittal Package has been accepted by the State Program Management Office, Final Plans section or District Contracts Office. ***Figure 132.1.1*** illustrates the flow for processing a Revision Package.

The responsible professional Signs and Seals each revised document in accordance with the requirements of ***FDM 130***. If the original professional engineer is not available to prepare a revision and is replaced by a new one, an additional signature sheet should be created listing the sheets containing the revisions they are responsible for.

Other specific requirements for processing the electronic delivery, including information on the Electronic Delivery software, can be found in the ***CADD Manual***.

Figure 132.1.1 Processing Revision Packages



132.2 Plans Revisions

Assign a unique numbered symbol (e.g., a numbered triangle) to each revision made to the Contract Plans. Begin the revision numbering with "1" and number subsequent revisions sequentially. Place the numbered symbol next to the revision on the sheet. Provide the date, numbered symbol, and a brief description of the revision in the Revision Block on each modified plan sheet.

When adding a sheet, the new sheet may be numbered with alphabetic suffix (e.g., 22A, 22B, 22C). Place the revision date, numbered symbol for the revision, and the description "Added Sheet" in the Revision Block of the new plan sheet. Revise the Index of Plan Sheets on the Key Sheet to include the new sheet.

When deleting a sheet, the sheet numbers for the following sheets remain unchanged. Place the revision date, numbered symbol for the revision, and the description "Deleted Sheet" in the Revision Block of the deleted plan sheet. Revise the Index of Plan Sheets on the Key Sheet to indicate the deleted sheet.

See ***FDM 910*** for instructions on recording a revision on the Key Sheet. Submit each revised component of the Contract Plans as an individual PDF with an appendix REV and the revision number, for example:

- 43177035201-PLANS-01-ROADWAY-REV01
- 43177035201-PLANS-02-SIGNINGMARKING-REV01
- 43177035201-PLANS-03-SIGNALIZATION-REV01

Submit a BIM.zip or CADD.zip file that contains CADD files that have been modified to create the plans PDFs. Use the same appendix (e.g., 43177035201-CADD-REV01) when naming the zip file.

132.3 Supplemental Specifications Package

District Specifications Engineer (or designee) must review the Contract Plans revisions for any effect on the specifications. When changes to the Specifications Package are necessary, prepare a Supplemental Specifications Package in accordance with the requirements of the ***Specifications Handbook***. The completed Supplemental Specifications Package must be submitted with an appendix SUPP and the revision number (e.g., 43177035201-SPECS-SUPP01).

132.3.1 Mandatory Specification Revisions

Mandatory Specification Revisions issued from Central Office will be processed as a Supplemental Specifications Package. Revision Memo approvals are not required for Mandatory Specification Revisions, unless additional revisions are included in the package.

132.4 EQ Report Revisions

Any revision to the Estimated Quantities (EQ) Report will require the report to be generated in its entirety, including quantities for components that did not require a change. Use the same appendix (e.g., 43177035201-ESTIMATES-QUANTITIES-REV01) when naming the EQ Report pdf file.

To create the modified EQ Report, the Calculations Folder within the CADD folder structure must be updated to include only the latest summary tables. Include the updated Calculations Folder in submitted BIM.zip or CADD.zip file.

Place a revision block (see ***Figure 132.4.1***) on the EQ Report signature page and indicate pay item numbers and quantities that were revised. Each subsequent resubmittal of the EQ Report will add to the previous revision block so that a complete history of changes is provided. When numerous changes are necessary, the revision block made be placed on its own sheets directly behind the cover sheet.

Figure 132.4.1 Example Revision Block

Revisions		Pay Item		Quantity	
Number	**Date**	**Number**	**Add/Del/Rev**	**Old**	**New**
REV01	2/9/21	425-5-1	Add		16.000
		425-6	Add		34.000
		1644-800	Add		1.000
REV02	2/19/21	102-71-16	REV	288.000	329.000
		102-89-1	REV	2.000	4.000

When access to AASHTOWare Project Preconstruction™ is required to make pay item number or quantity revisions, send a request for access to the State Program Management Office, Final Plans section (CO-FINALPLANS). The district will then be granted access for a period not to exceed 2 business days. Access will not be given within 10 days of advertisement.

132.5 Revision Memo

Process revision packages using the PS&E Module within Project Suite Enterprise Edition (PSEE). All revisions to the PS&E Package require a completed Revision Memo providing a Revision Number and describing modifications. Record the revision date for each revised sheet, using the date shown in the revision block on the sheet.

When the revision package is complete and ready for submission, control of the PS&E Module will be transferred to the appropriate office (see ***FDM 131.2.1***). The receiving office will check the revisions for completeness.

If information on the Transmittal Memo changes due to Project updates, the Transmittal Memo must be updated within the PS&E Module whether it is a formal Revision or not.

132.5.1 Required Approvals

Several approvals are required to process a revision:

(1) Obtain concurrence from the District Director of Transportation Development (or designee). Concurrence may be in the form of an email that includes a summary of the revision or a signed Revision Memo.

(2) In accordance with the Stewardship and Oversight Agreement or the project-specific Project of Division Interest (PoDI), obtain an email concurrence from FHWA prior to making revisions or requesting access to the AASHTOWare Project Preconstruction™. Include the name of the FHWA contact and the concurrence date on the Revision Memo. Major changes to plans or specifications on PoDI Projects made during the advertising period will require the FHWA Division Administrator's approval prior to issuing addenda. Major changes increase the project cost (>$50,000), alter project termini, change the character of the project, or modify scope of the work.

(3) Approval from the District Secretary is required on the Revision Memo if the revision is submitted within 15 working days of the letting. Approval can be documented by uploading an email approval to PS&E Module "Supporting Documentation Section".

(4) Approval from the Director of the Office of Design is required if the revision is submitted within five working days of the letting. Since there is no assurance that all prospective contractors will get these documents on time to be considered in their bids, approval for a revision within five working days of the letting is uncommon. If approval is not granted, the project will either be let as is, or be withdrawn from letting. Withdrawing or moving the project to a later letting after advertisement requires approval by the District Secretary and the Chief Engineer.

133 Retention of Electronic Documents

133.1 General

The documents and files created throughout the life of a project must be retained in electronic format. There are several different storage systems used for retaining these records. See ***Figure 133.1.1***. As-built documents that are to be scanned for electronic storage should meet both requirements of the ***Construction Project Administration Manual (CPAM), Section 5.12*** and the ***Transportation Technology User's Manual*** (***FDOT Procedure No. 325-000-002***).

Figure 133.1.1 Storage of Electronic Documents

Active VAULT	**Archive VAULT**	**Electronic Data Management System (EDMS)** Legal Records for Department of State Requirements – **Image files (PDF Version 1.7 or TIF) only.** For information on Specific Document Types stored in each Group contact the Responsible Office			
		DESIGN EDMS	**CONTRACT EDMS**	**CONSTRUCTION EDMS**	**STRUCTURES MANAGEMENT EDMS**
File management system for in-house CADD file check in/out. Allows for multiple users to work on same files. Working files only. Can be used during Construction Phase to prepare As-Built Plans.	Electronic Vault for Storage of electronically signed, or digital delivery files For Storage of: - Project CD - Plans and Specs CD - Revisions CD - Cat II Bridge As-Built Files Files stored in the PEDDS Database cannot be written.	<u>Design Records</u> <u>Groups</u> Architectural Community Involvement Drainage Environmental Permits Estimates FDOT Publications Geotechnical/Materials Landscaping Lighting Product Evaluation Project Management Rdwy Design Documentation **Does not include Plans** Roadway Resource Library Specifications Structures Structures Resource Library Tolls Facilities Traffic Design Utility Agreements **NOTE: Contract Plans are not stored in the Design EDMS.**	<u>Contract Records</u> <u>Groups</u> Construction Contracts: - Amendments - Bid Blank - Certificate of Insurance - Contract - Federal Aid Contract - Provisions - Permits - Pertinent Pages - Proposal - Special Provisions - Specifications - Supplemental Specifications - Utility Work Schedule - Wage Rate Supporting Construction Contract Documents: - Award Letter - Correspondence - Daily Diaries - Execution Letter - Final Estimates Package Work Progress **NOTE: Contract Plans are not stored in the Contracts EDMS.**	<u>Construction Records</u> <u>Groups</u> Claims Compliance Contract Changes Includes Design Errors and Omissions, Field SA/Work Orders, and SA/Change Orders Contract Documents As-Built Plans Daily Diary Estimates Final Estimates General Correspondence Job Correspondence Material Sampling and Reporting Pre-Letting Includes Design Correspondence Quality Assurance/Quality Control Service Contracts Working Drawing Transmittals Structure Sublet Work Time Correspondence Unpaid Bills Utility	<u>Maintenance Records</u> <u>Groups</u> Bridge Plans and Specifications Bridge Record Bridge Working Drawings Correspondence Geotechnical High Mast Record Sign Record Structural Calculations - As-Bid Plans - As-Built Plans - Repair As-Bid Plans - Repair As-Built Plans - Widening As-Bid Plans - Widening As-Built Plans

140 Lump Sum Projects

Modification for Non-Conventional Projects:
Delete ***FDM 140***.

140.1 General

The purpose of Lump Sum projects is to reduce the costs of contract administration associated with quantity, verification, and measurement. This contracting technique requires the Contractor to submit a lump sum price to complete a project as opposed to bidding on individual pay items. The Contractor will be provided a set of bid documents (plans, specifications) and will develop a Lump Sum bid for all work specified in the contract drawings.

The decision to use the Lump Sum Contracting Technique on a project should be made by the District Design Engineer in consultation with the District Construction Engineer. Lump Sum Projects should be identified during the scope development process, rather than during or after the design process. Conversion of partially complete plans and completed “plans on the shelf” that were originally developed as conventional bid item type projects to the Lump Sum Technique may require significant rework and is generally not recommended.

The contingency pay item is recommended on a Lump Sum project. This tool is used to compensate the Contractor for any additional work requested, which is not covered in the contract documents. District Construction should be consulted for the contingency amount.

140.2 Project Selection

Lump Sum contracting should be used on simple projects. “Simple” is defined by the work activity, not by the project cost. “Simple” projects are:

(1) Projects with a well-defined scope for all parties (Design and Construction)

(2) Projects with low risk of unforeseen conditions (i.e., projects that do not involve such things as significant underground utilities, earthwork variations, underground drainage pipes, bricks under pavement in urban areas)

(3) Projects with low possibility for change during all phases of work – Design and Construction (i.e., limited possibilities for added driveways, median modifications due to developments, or changes due to political involvement)

Examples of projects that may be good Lump Sum contracting candidates:

(1) Bridge painting

(2) Bridge projects

(3) Fencing

(4) Guardrail

(5) Minor Intersection improvements (with known utilities)

(6) Landscaping

(7) Lighting

(8) Mill/Resurface (including Interstate) without complex overbuild requirements

(9) Minor road widening

(10) Sidewalks

(11) Signing

(12) Signalization

Examples of projects that may not be good Lump Sum contracting candidates are listed below. Use of Lump Sum contracting on these type projects requires written approval by the State Roadway Design Engineer:

(1) Urban construction/reconstruction

(2) Rehabilitation of movable bridges

(3) Projects with subsoil earthwork

(4) Concrete pavement rehabilitation projects

(5) Major bridge rehabilitation/repair projects where there are many unknown quantities

(6) JPA Projects with local agency funds

140.3 Plans Preparation

Plan content should conform to the requirements of ***Part 3 or Part 9,*** subject to the guidance provided herein. Designers should detail plans, either by detailed drawings or plan notes, to clearly describe the work to be performed by the contractor. Notes and requirements must provide specific direction and details that can be properly bid on by the Contractor; avoid notes containing “as directed by the Engineer”.

The following are some of the desired elements in a set of Lump Sum plans:

(1) Typical Sections.

(2) Milling, resurfacing and overbuild details to show any cross-slope corrections, including existing pavement cross slope information.

(3) Document quantities for all work to be performed on the project by location in the Estimated Quantities Report.

(4) Plan sheets to accurately depict existing conditions and detail all work to be performed by contractor. (i.e., show all limits of milling and resurfacing, pipe installations, limits of sod when different from typical section, all concrete work, guardrail removal/installation).

(5) Details of work not covered by typical section or the ***Standard Plans*** (e.g., curb and gutter installation, traffic separator limits, special curb ramps, modifications to storm inlets).

(6) Cross sections when shoulder break is moved. When cross sections are provided, earthwork columns should not be used.

(7) Anticipated pile tip/drilled shaft elevations on bridge projects. Note: This is the predicted elevation to achieve axial capacity and satisfy all other design requirements and is usually deeper than the minimum tip elevation shown for piles.

140.4 Preliminary Estimate

For a single project (one FPID number), load the pay item for Lump Sum (Alternative Bidding, 999-2) and the Initial Contingency Amount (Do Not Bid) Pay item (999-25) into Designer Interface for AASHTOWare Project™ Preconstruction under the project's FPID number. Load the detailed pay items and quantities that make up the Lump Sum Project scope of work into the Designer Interface system under a duplicate project number created using the FPID number appended with the designation, "LS" (Ex. 12345678901LS). The pay items and quantities are loaded by category to reflect the work shown in each design group.

For a strung project (multiple FPID numbers), load the Lump Sum and Initial Contingency Amount pay item into the Designer Interface system for each FPID number. Load the detailed pay items and quantities for each FPID number into the Designer Interface system under the respective duplicate project number (i.e., Do not load all pay item and quantity information into one FPID number).

Detailed pay items and quantities that make up the Lump Sum Project scope of work will be loaded into a duplicate project from the one to be advertised. Pay items and quantities are loaded into the Designer Interface system by category to reflect the work shown in each design group. Contact the Project Manager for specific requirements.

140.5 Specifications

The Design Project Manager will provide an “Items of Work” checklist to the District Specifications Office. This checklist is ***Form 140-A***, which is found in ***FDM 103***. The Specifications Office will include the work items identified on the checklist in the “Intent and Scope” in the Specifications Package. The checklist must include, as a minimum, the major work items shown in the sample included with these guidelines.

Lump Sum Projects require Special Provisions that modify the first nine articles of the Standard Specifications. These Special Provisions are in the Specifications Workbook and must be included as part of the Specifications package.

Article 9-2 of the Special Provisions for Lump Sum Projects must be completed with predetermined unit prices for asphalt materials, concrete, and base when applicable. These unit prices will serve as a basis for calculating pay reductions for deficiencies accepted by the Project Engineer. In the case of asphalt overbuild, the predetermined unit price for the material used for overbuild will serve as a basis for pay adjustments for thicknesses that differ from the thickness shown in the plans. All predetermined unit prices should be based on an analysis of similar type projects let in the District and the District wide average of projects let within the six months prior to the letting date of the project.

For projects including bridges, Article 9-2 of the Special Provisions for Lump Sum Projects must be completed with predetermined unit prices for piling and drilled shafts as applicable. These unit prices will serve as a basis for pay adjustments for the actual quantities installed as additions or deletions from the individual element lengths shown in the plans. All predetermined unit prices should be based on an analysis of similar type projects let in the District and the Districtwide average of projects let within the six months prior to the letting date of the project.

140.6 Contracts Administration

Contracts Administration will include the information provided in the Specifications Package “Intent and Scope” in the job advertisement. This information can be used by the contractors/subcontractors to determine what type of work is contained in the project, in lieu of a list of pay items.

140.7 Construction Contract Administration

Monthly payments will be made based on a payout schedule mutually agreed upon by the Department and the Contractor. The payout schedule will include only major tasks similar to what has been used on design-build projects.

Lump Sum contracts are not fixed price. Changed conditions, extra work and unforeseen work must be negotiated and resolved with the Contractor utilizing Supplemental Agreements and Work Orders on Contingency Supplemental Agreements.

Construction inspection personnel should not be required to document quantities except for asphalt and other items subject to pay adjustments (items with predetermined unit prices). Measurement and completion of “Final” Estimated Quantities Report is not required. Focus should be on inspection and achieving a quality final product. For example, the Project Engineer will not be concerned with how many square yards of sod it takes or the number of miles of final striping. The Project Engineer will be charged with ensuring that the sod, striping, embankment, and pipe meets the lines and grades of the plans and specifications.

140.8 Materials Sampling and Testing

The Laboratory Information Management System (LIMS) relies on the pay items identified in AASHTOWare Project Preconstruction™ (formerly TRNS*PORT), which are populated via the Designer Interface, to generate a Job Guide Schedule based on the ***Sampling, Testing and Reporting Guide (STRG)***. On Lump Sum projects, since there is no detailed pay item list to identify the various types of work, LIMS will output a generic Job Guide Schedule. Some materials will not actually be used depending on the project scope. Personnel should use the Job Guide Schedule entries applicable to their project and input sample data and field test results into LIMS system in accordance with standard procedures. Materials not included on the Job Guide Schedule will be accepted in accordance with ***Section 6*** of the ***Standard Specifications*** and other pertinent contract documents.

150 Consultant Priority Matrices

150.1 General

Following the completion of the project design phase, the EOR will continue to be available to assist the CEI through the completion of construction of the project. The ***Construction Project Administration Manual*** **(*CPAM*)** defines the terms, methods, and processes that the Department and Construction Consultant personnel use to administer construction contracts, including engaging the EOR for various reasons. Specifically, ***CPAM, Section 8.11*** includes a Request For Information (RFI) Priority Matrix and Escalation Matrix. The RFI Priority Matrix is used to determine the required RFI response time for CEI and Design, and the Escalation Matrix will expedite decisions by escalating issues to the next level when not resolved within the RFI response time.

151 Revision Packages

151.1 General

This chapter outlines the process for the development and delivery of revision packages. A revision package is created when the engineering design is changed, and associated documents are modified. There are two types of revision packages:

(1) Post-let revisions for Design-Bid-Build

(2) Post-stamped revisions for Design-Build Projects

151.2 Post-Let Revisions

Post-let revisions occur after the project has been awarded for construction. It is the responsibility of the Department's Design Project Manager (PM) to process the required revision package, including any necessary reviews (typically conducted using ERC). The process used to develop and deliver a plans revision package to Construction is as follows:

(1) The Department identifies the need for a modification and notifies the EOR.

(2) The EOR develops the draft revision package and delivers it to the Design PM.

(3) The Design PM is responsible for ensuring that appropriate Department review is conducted.

(4) When all comments and issues are resolved, the EOR will submit a final signed and sealed revision package to the Design PM. Include a Revision Memo that summarizes the changes made to the contract document in the revision package.

(5) The Design PM uploads the revision package into the PSEE Design Documentation module.

(6) The Design PM notifies the Construction PM that the revision is available.

(7) The Design PM delivers the modified CADD files to the District CADD Manager to be included in the Vault Archive.

151.2.1 Post-Let Revision Package

For revision files contained within the revision package, use the original file name with a suffix "-REV##" (see ***CADD Manual***, Chapter 8). For example, the third revision to a Roadway component is named:

fpid-PLANS -03-ROADWAY-REV03.PDF

Begin the revision package numbering with "1" and number subsequent packages sequentially. For projects which have been revised pre-award, begin the numbering where the pre-award numbering left off. For large complex projects, when requested by the Department, number revision packages by addendum issuance to easily differentiate changes for work order/supplemental agreement processing. In this case, a shape other than a triangle may be utilized.

A revision package is a ZIP file that contains the following documents, as applicable:

- Revision Memo
- Signed and sealed pdf plan sheets
- CADD.zip or BIM.zip
- Specifications (TSPs, MSPs)
- Estimated Quantities

151.2.1.1 PDF Plan Sheets

Revised plan sheets are placed in a single pdf file for each component affected by the change(s). Each component pdf file contains only those sheets that have been modified.

For naming the component pdf file(s), use the original file name with a suffix "-REV##". For example, the pdf file name for a third revision to the Roadway component is named:

fpid-PLANS -03-ROADWAY-REV01.PDF

Revise pdf plan sheets as follows:

(1) Revise CADD and BIM files to reflect the required changes or modifications. Add new files or sheets as required.

(2) "Cloud" revisions in a conspicuous manner within the CADD sheet files. "Cloud" only the latest revisions, i.e., don't "cloud" previous revisions to the sheet.

(3) Place the revision number within a unique symbol (e.g., a numbered triangle) beside the "clouded" revision.

(4) Place the revision date, corresponding numbered symbol for the revision, and a brief description of the revision in the sheet Revision Block.

(5) If an entire sheet is being deleted, place a circle and strike ( ) through the entire drawing area and include the deleted sheet in the component pdf file as a revised sheet. Note the deleted sheet on the Key Sheet Index of Sheets.

Create component pdf file(s) containing all affected plan sheets. Forward updated CADD.zip or BIM.zip to District CADD Manager for inclusion in Vault Archive.

151.2.1.2 CADD Files

Provide a CADD.zip or BIM.zip that includes all CADD files that were modified due to the revision. Include the BIM file manifest on the Signature Sheet when signing and sealing a revised BIM file. Indicate in the manifest the BIM file being submitted, the revision package number, and a thorough description of the modifications made to the file.

151.2.1.3 Specifications

When a MSP or TSP must be included in the revision package, develop the special provision in accordance with the Specifications Handbook.

151.2.1.4 Estimated Quantities

Include only updated estimated quantities Summary Tables (Excel files) associated with the design modifications in the revision package. Provide a summary of changes for revised pay item numbers and quantities. The Estimated Quantities (EQ) Report will not be regenerated during the construction phase.

151.3 Post-Stamped Revisions

Post-stamped revisions occur after “Released for Construction” stamping has been completed and are typically initiated by the Design Build Firm. The revision package consists of signed and sealed pdf plan sheets and BIM files for the affected plans component(s).

See ***FDM 151.2.1.1*** and ***FDM 151.2.1.2*** for the procedures to modify these documents.

Department’s Project Manager enters the draft package into ERC for review by the appropriate discipline reviewers and recommendation for stamping. When all ERC comments/issues are resolved, the Department’s Project Manager will initial, date, and stamp each revised sheet as “Released for Construction.

152 Shop Drawing Submittals

152.1 Introduction

While the Contract Plans and Specifications (including Supplemental and Special Provisions) define the overall nature of the project, Shop Drawing submittal is the accepted method of approving a specific element of the work while allowing flexibility in the Contractor's means and methods. The Contract Plans and Special Provisions for the project are to identify the requirements for submittal of Shop Drawings.

Shop Drawing submittals must meet or exceed the quality level of previously approved submittals of a similar nature and be complete enough to allow for fabrication of an item without referencing any other document.

A Shop Drawing submittal for structural bridge components (e.g., steel girders, non-standard precast/prestressed beams) typically include plan and elevation views denoting the placement of a component in the structure.

Unless explicitly stated, definitions shown referencing the Standard Specifications are the same for the Design-Build Division I Specifications:

(1) **Shop Drawings:** See Specifications.

(2) **Engineer:** See Specifications.

(3) **Engineer of Record (EOR):** See Specifications.

Modification for Non-Conventional Projects:
Delete **Engineer of Record (EOR)** definition and replace with the following: (3) **Engineer of Record (EOR)**: See Design-Build Specifications.

(4) **Contractor's Engineer of Record:** See Specifications.

(5) **Specialty Engineer:** See Specifications.

(6) **Consultant:** The Professional Engineer or Engineering Firm, or the Architect or Architectural Firm, licensed in the State of Florida and under contract to the Department to perform professional services. The consultant may be the Engineer or Architect of Record or may provide services through and be subcontracted to the Engineer or Architect of Record.

(7) **Architect of Record:** The Architect or Architectural Firm registered in the State of Florida that performs services for the Department in connection with the design and construction of buildings.

Modification for Non-Conventional Projects:
Delete **Architect of Record** definition and replace with the following: (7) **Architect of Record**: The Architect or Architectural Firm registered in the State of Florida that performs services for the Design-Build Firm in connection with the design and construction of buildings.

(8) **"Ballooning"**: The Contractor's use of minimum 1/16 inch wide lines to "balloon" or "cloud" (encircle) notes or details on drawings, and design calculations, in order to explicitly and prominently call out any deviations from the Contract Plans or Specifications. The EOR may also use "ballooning" to make note of any limitations to their submittal review and disposition of Shop Drawings.

(9) **Record Shop Drawings**: The Department's official record copy of all Shop Drawings, correspondence/ transmittal files and submittal activity record (logbook).

(10) **FDOT Shop Drawing Review Office**: The office or other Department entity responsible for performing the Department's review, record keeping, disposition and distribution of Shop Drawings to other disciplines within the district for review as well as distribution back to the project personnel. This office is normally the District Structures Design Office.

(11) **Final Review Office**: FDOT Shop Drawing Review Office or the EOR performing the final review and making final distribution of shop drawings which have been reviewed.

(12) **Demolition of Bridges with Continuous Beams or Girders Affecting Public Safety**: See Specifications.

(13) **Construction Works Affecting Public Safety**: See Specifications.

Modification for Non-Conventional Projects:
Expand the list above with the following: (14) **Design-Build Firm:** See Design-Build Specifications.

152.2 Shop Drawing Submittals Not Required

Material certifications, welding procedures, paint procedures and concrete mix designs are typically submitted by the Contractor to the Engineer (CEI) who forwards the certifications to the State Materials Engineer in Gainesville. These items do not need to be submitted to the FDOT Shop Drawing Review Office for review and approval. For non-standard items, the Engineer (CEI) will typically request approval by the EOR regarding applicability. Material certification for items on the Approved Product List (APL) is typically submitted by the Contractor to the Engineer (CEI).

152.3 Contractor Information Required

A Shop Drawing submittal that omits any of the minimum requirements listed in ***Standard Specifications*, *Section 5-1*** must be returned for resubmittal.

Modification for Non-Conventional Projects:
Delete ***FDM 152.3*** and see RFP for Shop Drawing requirements.

152.4 Submittals Requiring a Specialty Engineer or Contractor's Engineer of Record

When required, the Specialty Engineer or Contractor's Engineer of Record must provide a signed and sealed Shop Drawing submittal. The signed and sealed Shop Drawings will be retained by the Department as the official, Record Shop Drawing.

Signed and sealed Shop Drawing submittals by a Specialty Engineer or Contractor's Engineer of Record typically include signed and sealed drawings and calculations.

152.5 Transmittal of Submittals

Submittal of Shop Drawings must be made by the project Contractor to the designated parties, as applicable. Submittals will not be accepted from a subcontractor or fabricator. Subcontractors and fabricators are encouraged to contact the appropriate FDOT Shop Drawing Review Office for guidance.

Figures 152.11.1 thru ***152.11.3*** shown in ***FDM 152.11*** illustrate the flow of submittals during the review process. Use electronic delivery to transmit submittals between parties.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: ***Figure 152.11.4*** shows the flow of critical temporary works shop drawings affecting public safety including erection manuals and erection plans. ***Figure 152.11.4*** also shows the flow of demolition plans of a bridge with continuous beams or girders where one span within the unit is over traffic. Use electronic delivery to transmit submittals between parties. ***Figure 152.11.5*** shows the flow of all other shop drawing submittals. Use electronic delivery to transmit submittals between parties. See RFP for transmittal and submittal review requirements.

The Special Provisions for the project may denote the number of drawings to be submitted and the procedure to be followed. Furthermore, the office to which the Contractor must transmit ~~his~~ the submittal and the procedure to be followed may also be defined during the preconstruction conference for the project.

152.5.1 Requirements for Department EOR

On projects where the EOR is Department in-house staff, transmit submittals to the FDOT Shop Drawing Review Office or as directed at the project's preconstruction conference. The FDOT Shop Drawing Review Office is the principal contact group and "clearing house" for all construction submittals and information desired by the Contractor regarding structural, mechanical, or electrical items.

The EOR must perform a thorough review of the shop drawings, implement a QA/QC Plan, provide a QA/QC check print to the Department, and ensure that all components depicted in the shop drawings are being constructed/fabricated in accordance with the RFC Plans and other Contract Documents. The shop drawing stamp (e.g., "APPROVED" or "APPROVED AS NOTED") must include language that states that the shop drawing was reviewed in accordance with ***FDM 152*** and with the Contract.

Modification for Non-Conventional Projects:
Delete ***FDM 152.5.1*** and replace with the following: **152.5.1 Review Requirements for EOR**

The EOR must perform a thorough review of the shop drawings, implement a QA/QC Plan, provide a QA/QC check print to the Department, and ensure that all components depicted in the shop drawings are being constructed/fabricated in accordance with the RFC Plans and other Contract Documents. The shop drawing stamp (e.g. "APPROVED" or "APPROVED AS NOTED") must include language that states that the shop drawing was reviewed in accordance with ***FDM 152*** and with the Contract.

152.5.2 Requirements for Consultant EOR (Full Services)

152.5.2.1 Review by Engineer of Record Only

On projects where the EOR is a Consultant to the Department and has been retained by the Department to review construction items without follow-up review by the Department, the Consultant will assume the responsibility of the owner's agent. The reviewing consultant is encouraged to communicate with fabricators, contractors, specialty engineers and the FDOT Shop Drawing Review Office to clarify concerns before returning the submittal to the Contractor. The reviewing consultant must also contact the Department's Structures Office if unsure of the Department's position on certain issues during the review. Where possible, mark all necessary requirements on the shop drawing sheet and stamp "APPROVED AS NOTED" instead of requiring a resubmittal. The Contractor will transmit the submittals directly to the Consultant (unless otherwise noted below). Upon receipt of the submittal, the Consultant must do the following:

- perform the review~~,~~
- note any comments on the sheets~~,~~
- indicate ~~his~~ disposition by stamping the sheets as described hereinafter ~~and~~
- make distribution as described hereinafter~~.~~

The original submittal forms the official Record Shop Drawing submittal and must be sent by the EOR to the Department at the end of the project.

152.5.2.2 Review by Engineer of Record and the Department

On projects where the EOR is a Consultant to the Department and has been retained by the Department to review construction items, submittals (unless otherwise noted below) must be transmitted by the Contractor directly to the Consultant. Upon receipt of the submittal, the Consultant must perform the review, note any comments on the sheets, indicate ~~his~~ the Consultant's disposition by stamping the sheets as described hereinafter, and transmit the sheets to the FDOT Shop Drawing Review Office for review and distribution. When submittals require a Specialty Engineer, the original submittal forms the official~~,~~. Record Shop Drawing submittal and must be retained by the Department. Upon completion of ~~his~~ this review, the Consultant must:

- transfer ~~his~~ their comments to the sealed sheets,
- indicate ~~his~~ their disposition
- and transmit ~~them~~ the comments to the Department as described above.

Modification for Non-Conventional Projects:
Delete ***FDM 152.5.2*** and replace with the following: **152.5.2 Review Requirements for Shop Drawings Affecting Public Safety** The EOR must perform a thorough review of the shop drawings, implement a QA/QC Plan, provide a QA/QC check print to the Department, and ensure that all components depicted in the shop drawing are being constructed, fabricated, or demolished in accordance with the RFC Plans and other Contract Documents. An Independent Peer Review must be performed for all critical temporary works shop drawings, erection manuals, and erection plans affecting public safety. This includes demolition plans of a bridge with continuous beams or girders where one span within the unit is over traffic. This review is a comprehensive independent verification of the design of the structural elements depicted in the shop drawing. The Independent Peer Review cannot be performed by the originator of the shop drawing and must be completed by either the EOR or by an Independent Peer Reviewer. The Independent Peer Review must follow one of the processes below (depending on who performs the Review): • The EOR performs the Independent Peer Review: The EOR will apply the shop drawing stamp (e.g., "APPROVED" or "APPROVED AS NOTED") and must include a signed and sealed certification letter stating that an Independent Peer Review was performed in accordance with ***FDM 152*** and with the Contract. The certification letter must clearly state which components (e.g., temporary works) were reviewed. • An Independent Peer Reviewer performs the Independent Peer Review: The EOR will apply the shop drawing stamp (e.g., "APPROVED" or "APPROVED AS NOTED") and include a statement that the shop drawing was reviewed in accordance with ***FDM 152*** and with the Contract, but an Independent Peer Review was not performed. Then, an Independent Peer Reviewer qualified under ***Florida Administrative Code***, ***Rule 14-75*** (in the Work Group for the

structure being constructed, fabricated, or demolished) must perform the Independent Peer Review. The Independent Peer Reviewer must sign and seal a certification letter stating that an Independent Peer Review was performed in accordance with ***FDM 152*** and with the Contract. The certification letter must clearly state which components (e.g., temporary works) were reviewed.

152.5.3 Requirements for Consultant EOR (Design Services Only)

On projects where the EOR is a Consultant to the Department but has not been retained by the Department to review construction items, the contractor will transmit submittals (unless otherwise noted below) directly to the FDOT Shop Drawing Review Office or as directed at the project's preconstruction conference.

Modification for Non-Conventional Projects:
Delete ***FDM 152.5.3.***

152.5.4 Requirements for Architectural or Building Structures

Submittals related to Architectural or Building Structures, such as Rest Areas, Picnic Pavilions, Offices and Warehouses, must be made according to the requirements of the Architectural Services Group, Production Support Office, Florida Department of Transportation, 605 Suwannee Street, MS 40, Tallahassee, FL 32399-0450, Phone (850) 414-4378.

152.5.5 Requirements for Roadway Submittal Items

Distribute all submittals related to roadway plans such as attenuators and non-standard drainage structures (except bridge items such as poles and bracket arms, or as noted below) in accordance with the ***Construction Project Administration Manual*** for the component involved or as otherwise directed at the project's preconstruction conference. Submittals related to bridge items must be transmitted to the Department as previously described in this section.

152.5.6 Requirements for Overhead Sign Structures and Nonstandard Miscellaneous Structures

Transmit submittals concerning overhead sign structures and non-standard miscellaneous structures as previously described in this section.

152.5.7 Miscellaneous Requirements and Assistance

Items not specified above or for which questions may arise regarding submittal requirements, the Contractor should be advised to contact the appropriate FDOT Shop Drawing Review Office. Regardless of submittal type, a letter of transmittal must always accompany a submittal.

152.6 Disposition of Submittals

The approval or disapproval of submittals by the Reviewer must be indicated by one of the following designations: "APPROVED" (no further action required), "APPROVED AS NOTED" (make corrections noted - no further submittal required), "RESUBMIT" (make corrections noted and resubmit for approval; or insufficient data submitted in order to perform a complete review), or "NOT APPROVED" (rejected - do not resubmit the concept or component as submitted).

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: The approval or disapproval of submittals by the EOR must be indicated by one of the following designations: "APPROVED" (no further action required), "APPROVED AS NOTED" (make corrections noted - no further submittal required), "RESUBMIT" (make corrections noted and resubmit for approval; or insufficient data submitted in order to perform a complete review), or "NOT APPROVED" (rejected - do not resubmit the concept or component as submitted). Only shop drawings that have been "APPROVED", or "APPROVED AS NOTED" must be submitted to the Department for review. Submit copies of QA/QC shop drawing check prints to the CEI along with the shop drawing. The Department must stamp the drawings “RELEASE FOR CONSTRUCTION”, “RELEASE FOR CONSTRUCTION AS NOTED”, OR "RESUBMIT". Where possible, mark all necessary requirements on the shop drawing sheet and stamp “RELEASE FOR CONSTRUCTION AS NOTED” instead of requiring a resubmittal.

Indicate the disposition designation on each and every drawing sheet, or on the cover sheet of calculations, by the use of an electronic, red-colored stamp. The electronic stamp size must not exceed 3” high by 3” wide, but 1 ½” high by 3” wide stamp is preferred. Stamps must identify the approving groups, such as the EOR-Consultant, the Department's Verification Inspection Consultant and Department personnel, and the date. All notations or corrections made on the approval prints must be consistently marked on all drawings.

All Consultants reviewing submittals must red ink stamp and initial each item as noted above with the firm's appropriate stamp. When the EOR is a Consultant, and when a Sub-consultant is retained to assist in the submittal review, the EOR must signify disposition of the submittal as noted above with the EOR’s firm's appropriate stamp prior to distribution or prior to transmitting it to the Department. In this event it is the EOR's prerogative to also require a disposition stamp by the Sub-consultant.

When the EOR receives a submittal that is not in accordance with the requirements of this chapter, the Contractor will be advised to resubmit with the corrections or additions necessary.

Disposition of Shop Drawing submittals by the EOR for construction and erection equipment including beams and winches, launch gantry, erection trusses, forms, falsework, midspan and longitudinal closures, lifting devices, temporary bearing fixity devices, cranes, form travelers, segment carrying equipment and stability devices must be either "NOT APPROVED" if deemed to be unacceptable or, if acceptable, must be "APPROVED AS NOTED" with the following note included on the submittal drawings:

> "Drawings are acceptable for coordination with, relationship to, and effects upon the permanent bridge; but have not been reviewed for self-adequacy. Adequacy and intended function remain the sole responsibility of the Contractor."

Unless considered as Construction Affecting Public Safety, the EOR is not responsible for accepting or reviewing calculations or drawings pertaining to construction formwork. These documents should normally be submitted to the Engineer (CEI) or, in the event they are erroneously transmitted to the EOR, should be immediately rerouted to the Engineer (CEI).

On projects when the EOR is a Consultant to the Department and the Department will also be reviewing shop drawings, the Department will perform a second confirmation review of the submittal. Upon receipt of the Consultant’s reviewed submittal, the Department will stamp the submittal with the disposition as noted above. The primary purposes of the Department's review include: conformance with FDOT policy and standards; uniformity of disposition with similar submittals; accuracy and completeness of the Consultant's review; and attention to specific details or areas of work that have experienced recurring problems during fabrication or construction.

When the Specialty Engineer or Contractor's Engineer of Record is required by the Contract Plans and specifications to perform a portion of the design of the project, the EOR must confirm that:

(1) The Specialty Engineer or Contractor's Engineer of Record is prequalified with the Department as such to design and prepare the submittal.

(2) The Shop Drawings are correctly signed and sealed by the Specialty Engineer or Contractor's Engineer of Record.

(3) The Specialty Engineer or Contractor's Engineer of Record understands the intent of the design and utilizes the correct specified criteria.

(4) The configuration set forth in the submittal is consistent with that of the Contract Documents.

(5) The Specialty Engineer or Contractor's Engineer of Record's methods, assumptions and approach to the design are in keeping with accepted engineering practices.

(6) The Specialty Engineer or Contractor's Engineer of Record's design does not contain any gross inadequacies that would jeopardize or threaten public safety.

Figures 152.11.1 through ***152.11.3*** shown in ***FDM 152.11*** illustrate the submittal and distributional flow of a shop drawing transmittal. When the Department concurs with the Consultant's review and disposition of the submittal, the Department will stamp and distribute the submittal including a record copy for the Consultant.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: ***Figures 152.11.4*** and ***152.11.5*** show the submittal and distributional flow of a shop drawing transmittal. When the Department concurs with the Design-Build Firm's EOR review and disposition of the submittal, the Department will stamp and distribute the submittal.

152.6.1 Minor Modifications

The submittal will be processed when notations not involving design decisions are added, modified, or deleted and when the disposition of the submittal remains unchanged or changed only in accordance with ***Table 152.6.1***:

Table 152.6.1 FDOT Changes to Minor Modifications

From	To
Approved	Approved as Noted
Approved as Noted	Approved
Resubmit	Not Approved
Not Approved	Resubmit

In this event, the Department will notify the Consultant of the modifications, document the notification in the project's shop drawing file, process and distribute the submittal and furnish the Consultant with a copy.

Modification for Non-Conventional Projects:

Delete ***FDM 152.6.1*** and replace with the following:

152.6.1 Minor Modifications

The submittal will be processed when notations not involving design decisions are added, modified, or deleted and when the disposition of the submittal remains unchanged or changed only in accordance with the following ***Table 152.6.1***:

Table 152.6.1 FDOT Changes to Minor Modifications

From	To
Approved	Released for Construction as Noted
Approved as Noted	Released for Construction

In this event, the Department will notify the Design-Build Firm of the modifications, document the notification in the project's shop drawing file, process and furnish the Design-Build Firm with a copy.

152.6.2 Major Modifications

The submittal will be returned to the Consultant for re-review when notations involving significant design decisions must be added, deleted, or modified, when the submittal's review is deemed by the Department to be incomplete or require significantly more work. The Department will notify the Consultant and document the notification in accordance with ***Table 152.6.2***. The submittal will be returned to the Consultant for re-review and return to the Department.

Table 152.6.2 FDOT Changes to Major Modifications

From	To
Approved or Approved as Noted	Not Approved or Resubmit
Not Approved or Resubmit	Approved or Approved as Noted

Modification for Non-Conventional Projects:

Delete ***FDM 152.6.2*** and replace with the following:

152.6.2 Major Modifications

The submittal will be returned to the Design-Build Firm for re-review when notations involving significant design decisions must be added, deleted or modified, when the submittal's review is deemed by the Department to be incomplete or require significantly more work. The Department will notify the Design-Build Firm and document the notification in accordance with ***Table 152.6.2***. The submittal will be returned to the Design-Build Firm for re-review and return to the Department.

Table 152.6.2 FDOT Changes to Major Modifications

From	To
Approved or Approved as Noted	Resubmit

152.7 Distribution of Submittals

Figures 152.11.1 thru ***152.11.3*** shown in ***FDM 152.11*** illustrate the submittal and distributional flow of shop drawings for reviews performed by Consultant EORs without FDOT review, reviews performed by Consultant EOR with FDOT review, and reviews performed by FDOT only. In the case of reviews performed by Consultant EORs and FDOT, the Consultant must transmit Shop Drawings to the appropriate FDOT Shop Drawing Review Office.

When precast/prestressed concrete components are involved, copies of the Shop Drawings are to be submitted to the Department's District Prestress Engineer and the State Materials Office (Gainesville). When structural steel components are involved, copies of the Shop Drawings are to be submitted to the Department's Verification Inspection Consultant.

When the Department is reviewing shop drawings and a submittal is denied ("RESUBMIT" or "NOT APPROVED"), distribution of the submittal must be made to the FDOT Shop Drawing Review Office's File and the Contractor only, with a copy of the transmittal letter to the Engineer (CEI).

Modification for Non-Conventional Projects:

Delete ***FDM 152.7*** and replace with the following.

152.7 Distribution of Submittals

Figure 152.11.4 shows the submittal and shop drawing flow diagram for design-build projects. The Contractor submits Shop Drawings to the Engineer (CEI).
When precast/prestressed concrete components are involved, copies of the Shop Drawings are submitted to the Department's District Prestress Engineer and the State Materials Office (Gainesville). When structural steel components are involved, copies of the Shop Drawings are submitted to the Department's Verification Inspection Consultant.

152.8 Review of Prequalified Joint Welding Procedures

In accordance with ***Section 11.2*** of the ***Materials Manual,*** the approval of all joint welding procedures specification (WPS) will be the responsibility of the Department's Verification Inspection Consultant. The State Materials Office maintains the list of the approved WPS which may be used on all future projects by the fabricator who developed them, until their expiration. A list of the approved WPSs will be provided with the submittal of the Shop Drawings. The EOR may elect to review these documents. Shop drawings depicting plate sizes, types of welds, weld designations, weld sizes and grades of materials will continue to be reviewed by the EOR.

152.9 Submittal Activity Record (Logbook)

The Final Review Office is responsible for maintaining a Submittal Activity Record (Logbook) on each project reviewed by the office. Update the logbook each day that any Shop Drawing submittal activity occurs. Enter the following minimum data in the logbook for each submittal:

(1) Financial Project ID and State Project Number (if assigned).

(2) Submittal Number.

(3) Description of Submittal.

(4) Number of Sheets in the Submittal.

(5) Number of Pages of Calculations, in Reports, in Manuals.

(6) Date Transmitted by Contractor to the EOR.

(7) Date Transmitted by EOR (when EOR is not the final reviewer) to the Final Review Office.

(8) Date Distributed by the Final Review Office to the Contractor.

(9) Disposition as either "A" (Approved), "AN" (Approved as Noted), "R" (Resubmit) or "NA" (Not Approved).

The Logbook is an historical record of the activity devoted to an individual submittal as well as that for the project as a whole. It can serve as a verification of review time, to respond to inquiries of a particular submittal's status and as a record of manpower effort to aid in estimating and allocating future workload.

152.10 Archiving Record Shop Drawings

Upon completion and acceptance of a construction project by the Department (usually by receipt of a written Notice of Acceptance), the Final Review Office, within thirty (30) days, will transmit the Record Shop Drawings to the appropriate offices, as dictated by practice in the District in which the project is located. The Record Shop Drawings may include some or all of the following documents:

(1) Shop Drawings (including all relevant data as set forth in the Specifications)

(2) Project Files of Shop Drawing transmittal letters.

(3) Submittal Activity Record

The Final Review Office must complete the Record Shop Drawing Transmittal (see ***Form 152-A***, located in ***FDM 103***), and transmit copies, along with the Record Shop Drawings described above, to the appropriate office. The Record Shop Drawing Transmittal describes all the Record Shop Drawing documents being transmitted.

The Submittal Activity Record (logbook) is intended to serve as the listing of all Shop Drawings transmitted. Other transmitted material such as project files and samples should be listed individually on the Transmittal shown in ***Form 152-A***.

Upon receipt of the Record Shop Drawings, the offices receiving the transmittal will verify the documents and material transmitted, sign and date the Record Shop Drawing Transmittal, and return a copy to the Final Review Office.

The Final Review Office will maintain a file of Record Shop Drawing Transmittals (***Form 152-A***) for future reference and use. Once the signed copy of the Record Shop Drawing

Transmittal is received, the Final Review Office's initially retained Record Shop Drawing Transmittal may be discarded.

152.11 Shop Drawing Flow Diagrams

Figures 152.11.1 through ***152.11.5*** show the submittal and distributional flow of shop drawings for reviews.

Figure 152.11.1 Shop Drawing Flow Diagram for Reviews with Consultant EORs without FDOT Review

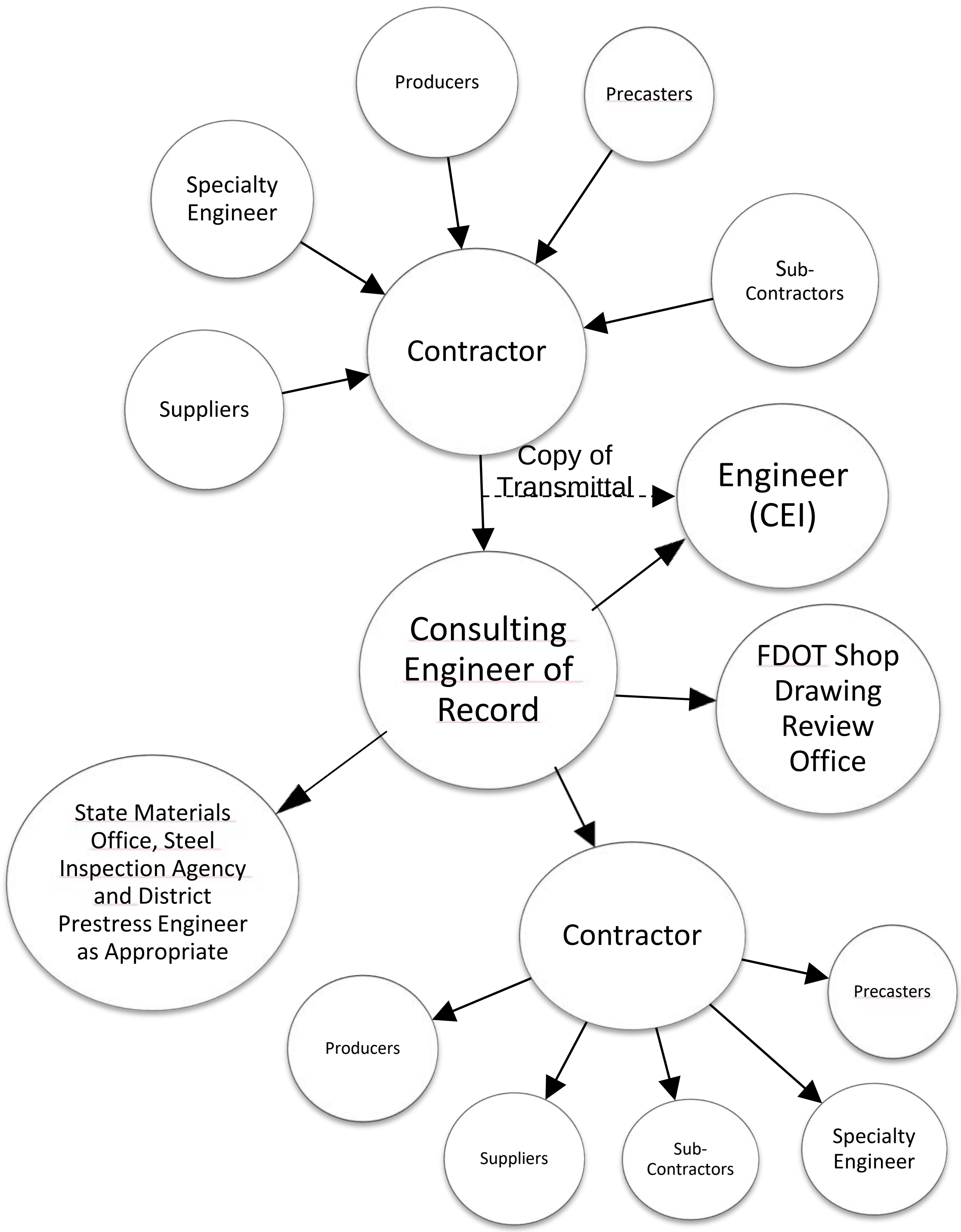


Figure 152.11.2 Shop Drawing Flow Diagram for Performed by Consultant EOR with FDOT Review

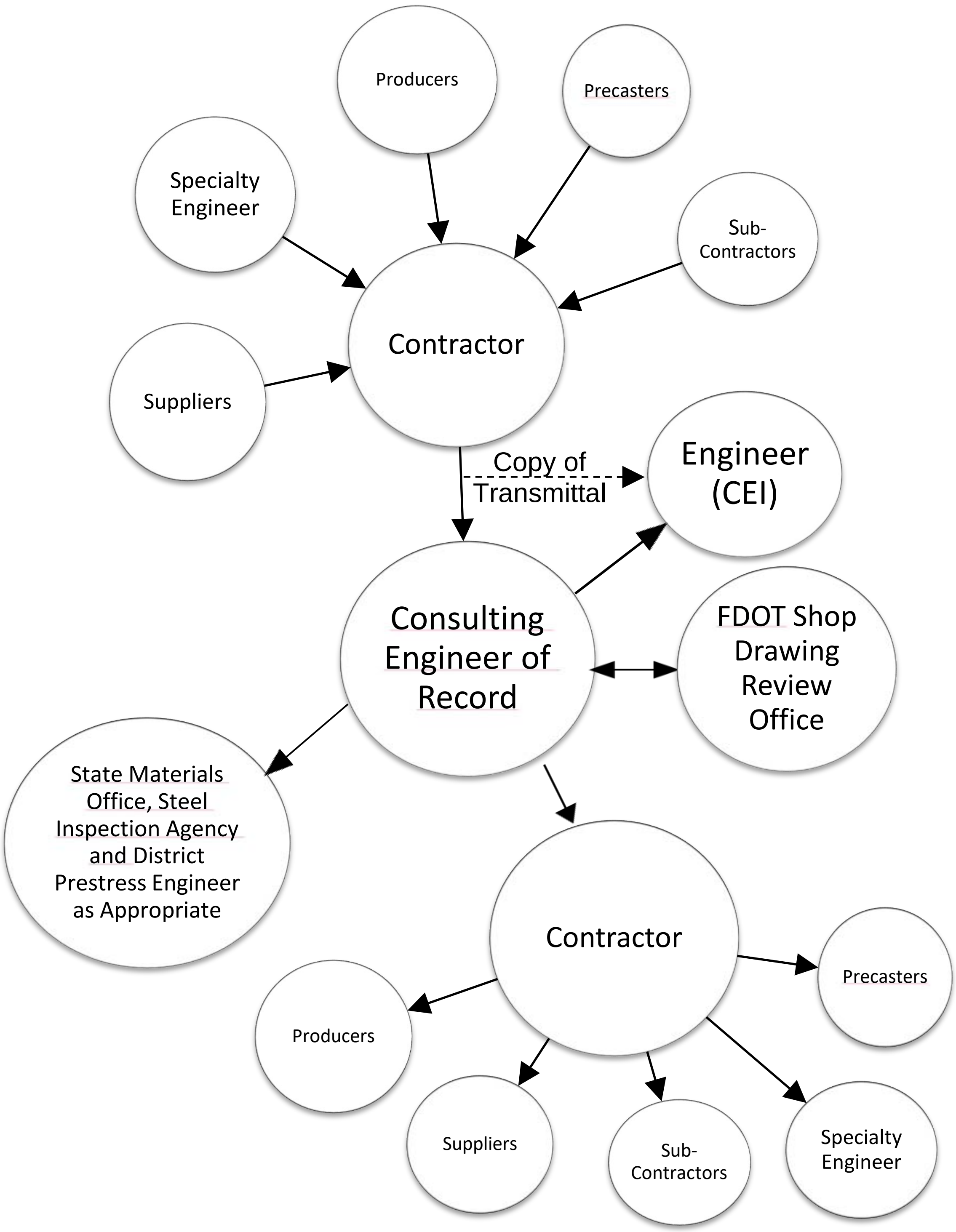


Figure 152.11.3 Shop Drawing Flow Diagram for Reviews Performed by FDOT Only

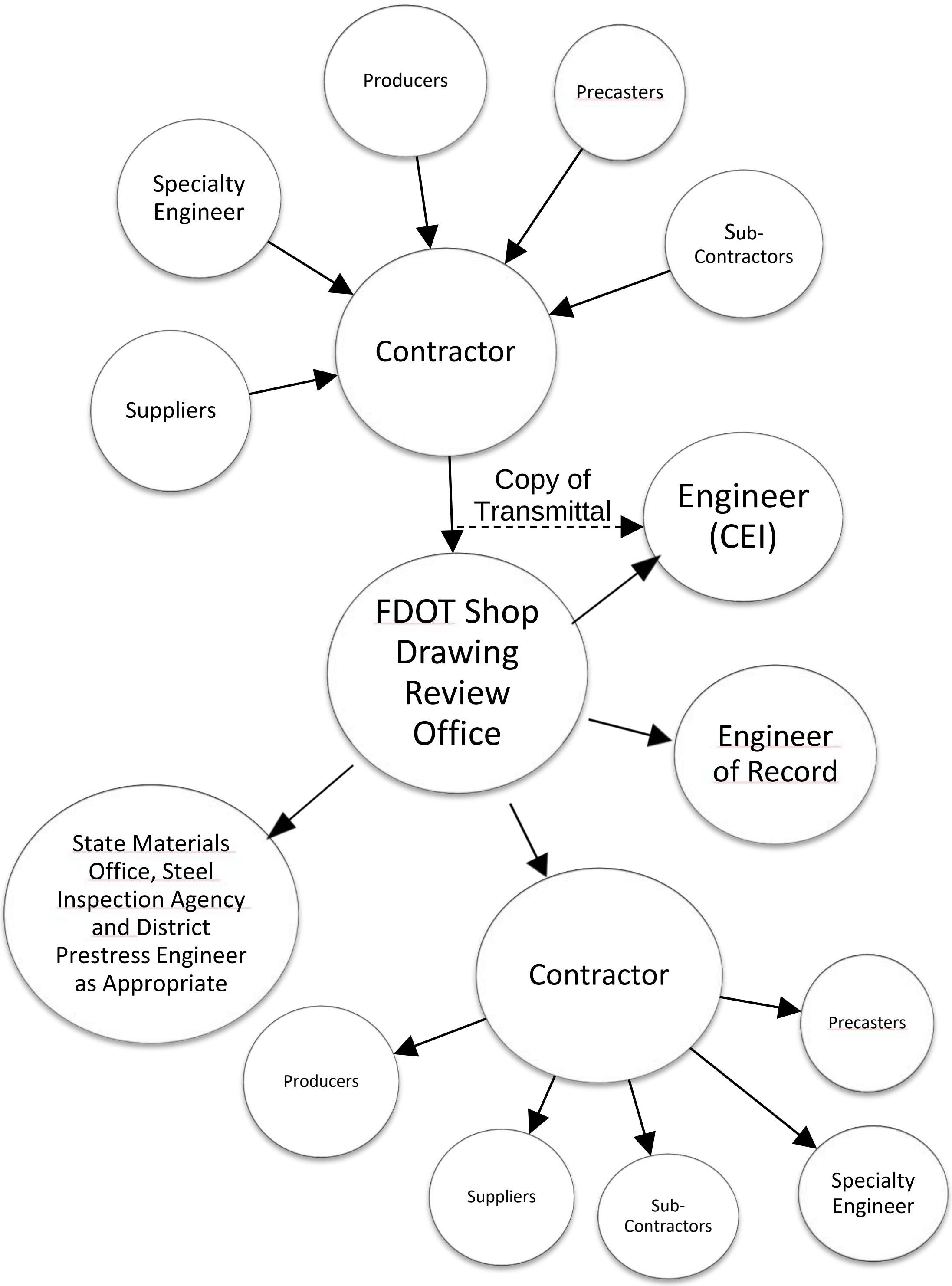


Figure 152.11.4 Shop Drawing Flow Diagram for Design-Build Project- Shop Drawings Affecting Public Safety

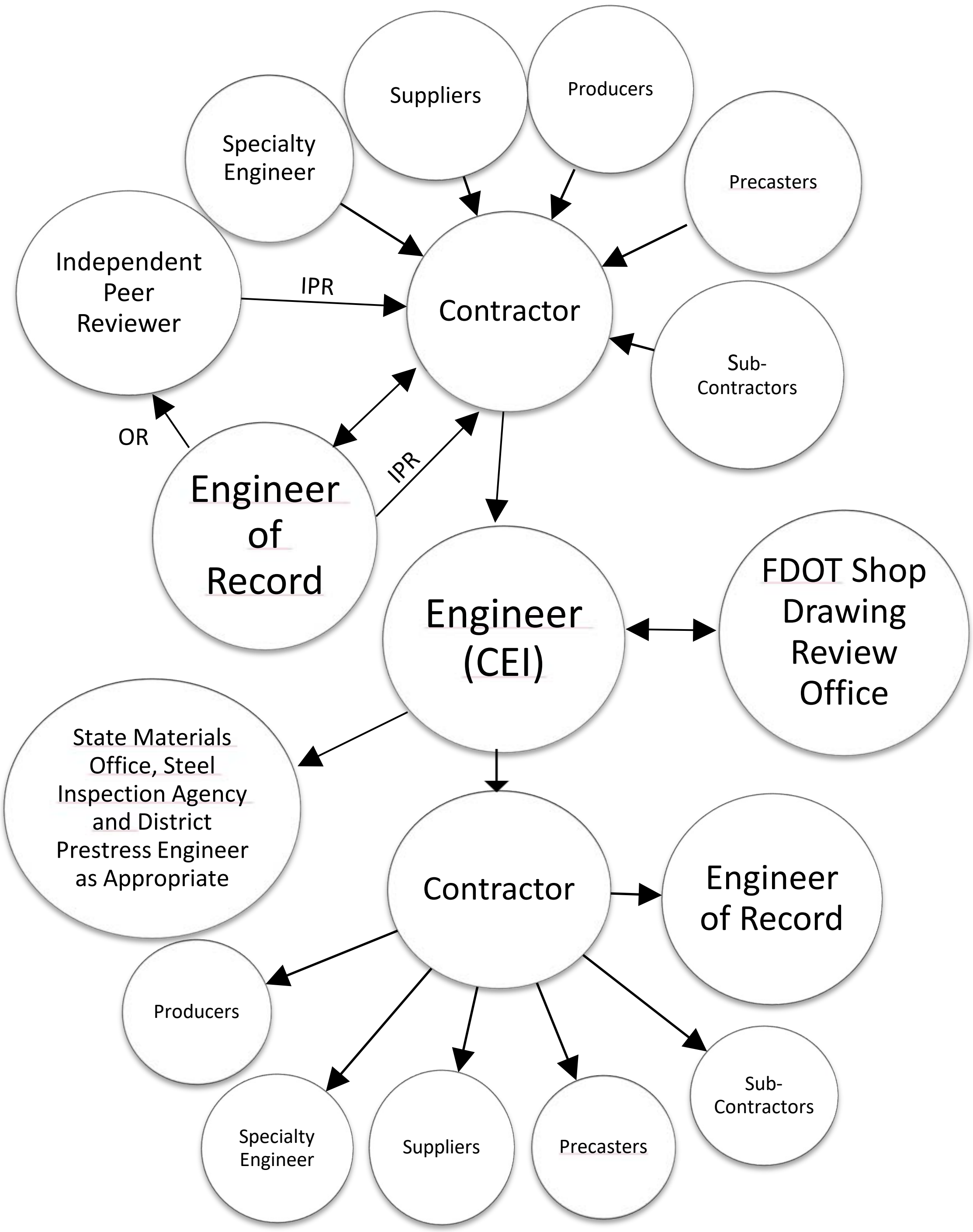
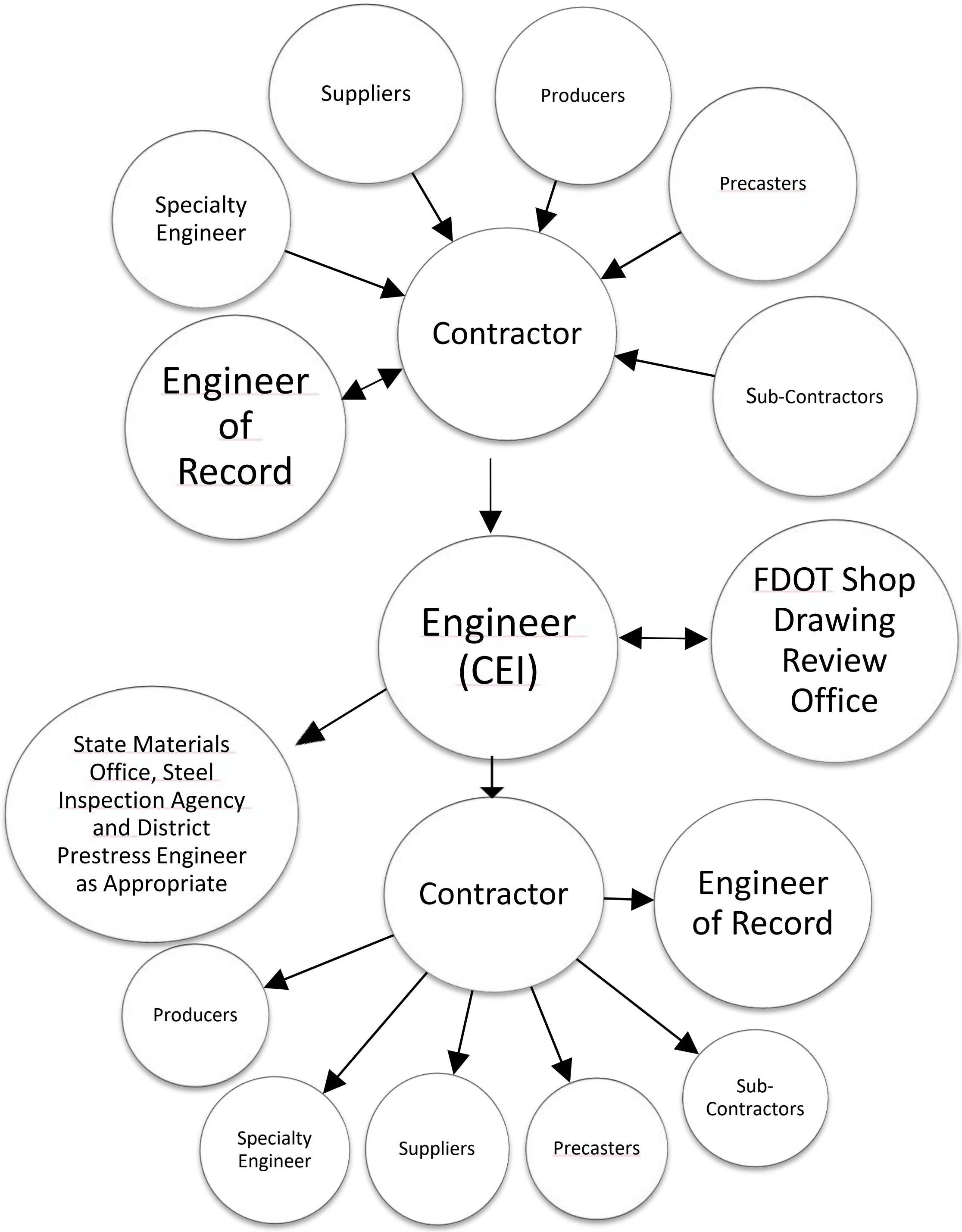


Figure 152.11.5 Shop Drawing Flow Diagram for Design-Build Projects-Shop Drawings Not Affecting Public Safety



200 Context Based Design

200.1 General

Designs for highway and bridge projects are based on established design controls for the various elements of the project such as width of roadway, side slopes, horizontal and vertical alignment, drainage considerations and intersecting roads.

The design criteria presented in this manual are based on:

- Functional Class
- Design Speed
- Context Class

200.2 Highway Functional Classification

Functional classification is the grouping of highways by the character of service and connectivity they provide. The ***AASHTO*** publication ***A Policy on Geometric Design of Highways and Streets*** presents an excellent discussion on highway functional classifications. ***Table 200.2.1*** summarizes the primary characteristics of each functional classification.

Table 200.2.1 Design Types

Functional Classification	Primary Characteristics
Limited Access Facilities	• Limited access • Through traffic movements • Primary freight routes • Guided by FHWA Design Standards
Principal Arterial	• Through traffic movements • Longer distance traffic movements • Primary freight routes
Minor Arterial	• Connections between local areas and network principal arterials • Connections for through traffic between arterial roads • Access to public transit and through movements • Pedestrian and bike movements
Collector	• Carry traffic with trips ending in a specific area • Access to commercial and residential centers • Access to public transportation • Pedestrian and bicycle movements
Local Roads	• Direct property access—residential and commercial • Pedestrian and bicycle movements

This manual provides design criteria for roads on the State Highway System (SHS) based on the following functional classification groups:

(1) Limited Access (LA) Facilities (Interstate, Freeways, and Expressways)

(2) Arterials and Collectors

The ***Florida Greenbook*** provides criteria for local roads.

200.3 Design Speed

See ***FDM 201*** for discussion on Design Speed.

200.4 Context Classification

Projects are uniquely planned and designed to be in harmony with the surrounding land use characteristics and the intended uses of the roadway. To this end, a context classification system comprising eight context classifications has been adopted. ***Table 200.4.1*** describes the context classifications that will determine key design criteria elements for arterials and collectors.

Criteria for LA Facilities are independent of the adjacent land uses; therefore, context classifications shown in ***Table 200.4.1*** do not apply to these facilities.

Additional information on context classifications and guidance on the determination of the context classification is provided in the ***FDOT Context Classification Guide***.

Contact the District Complete Streets Coordinator to obtain the appropriate context classification for project roadway segments.

Table 200.4.1 Context Classifications

Context Classification		Description of Adjacent Land Use
C1	**Natural**	Lands preserved in a natural or wilderness condition, including lands unsuitable for settlement due to natural conditions.
C2	**Rural**	Sparsely settled lands; may include agricultural land, grassland, woodland, and wetlands.
C2T	**Rural Town**	Small concentrations of developed areas immediately surrounded by rural and natural areas; includes many historic towns.
C3R	**Suburban Residential**	Mostly residential uses within large blocks and a disconnected/sparse roadway network.
C3C	**Suburban Commercial**	Mostly non-residential uses with large building footprints and large parking lots. Buildings are within large blocks and a disconnected/sparse roadway network.
C4	**Urban General**	Mix of uses set within small blocks with a well-connected roadway network. May extend long distances. The roadway network usually connects to residential neighborhoods immediately along the corridor or behind the uses fronting the roadway.
C5	**Urban Center**	Mix of uses set within small blocks with a well-connected roadway network. Typically concentrated around a few blocks and identified as part of the community, town, or city of a civic or economic center.
C6	**Urban Core**	Areas with the highest densities and with building heights typically greater than four floors within FDOT classified Large Urbanized Areas (population >1,000,000). Many are regional centers and destinations. Buildings have mixed uses, are built up to the roadway, and are within a well-connected roadway network.

201 Design Controls

201.1 General

Designs for highway and bridge projects are based on established design controls for the various elements of the project such as width of roadway, side slopes, horizontal and vertical alignment, drainage considerations and intersecting roads. Selection of the appropriate criteria and standards is influenced by traffic volume and composition, desired levels of service, functional classification, terrain features, context classification, and environmental considerations.

The identification of applicable design controls is needed to achieve:

(1) Optimum safety.

(2) Desired capacity and Level of Service.

(3) Design consistency.

(4) Cost effective designs.

201.1.1 Capacity and Level of Service

The AASHTO publication ***A Policy on Geometric Design of Highways and Streets***, the Transportation Research Board ***Highway Capacity Manual***, and FDOT's ***Quality/Level of Service (Q/LOS) Handbook*** provide detailed analysis and calculation procedures used in determining the number and configuration of lanes required and the resulting levels of service provided. As illustrated in those texts the following factors greatly influence capacity and Level of Service:

- Roadway gradients and roadside developments
- Number, spacing, and types of crossings and intersections
- Traffic volumes and composition
- Signalization progression and interconnectivity

Design of signalized intersections should ensure an adequate Level of Service through the design year of the facility, especially when right of way acquisition is being considered. The capacity of an at-grade arterial or collector is primarily controlled by its ability to move traffic through signalized intersections, rather than the mid-block through lane capacity.

Use the operational analysis methods in the Highway Capacity Manual for design of signalized intersections. Information or assumptions on basic intersection geometrics, lane utilization, and movement-specific traffic volumes are provided by the designer. The primary output of the operational analysis method is Level of Service and delay at a signalized intersection; however, this method can be used to determine geometric requirements, signal timing, or service flow volumes.

Signal timing is interactive with geometric design. Changes to geometrics, such as adding a turn lane, must consider changes to the signal timing simultaneously. Department-approved software, including the Highway Capacity Software, should be used to simulate the operation of independent or interconnected signals. Output from these programs can be used for the analysis and evaluation of proposed designs.

201.1.2 Design Consistency

Design consistency is achieved when the geometric features of the roadway are consistent with the operational characteristics expected by the driver. Design consistency alleviates driver uncertainty and inappropriate driver response. Following the criteria contained in this manual will assure design consistency; however, special attention should be given at locations where sudden changes in Design Speed, alignment or cross section occur, and in the development of intersection designs.

Roadways may traverse through a variety of context classifications. As the context changes, the Design Speed for the roadway will also change. Changes in Design Speed may also occur based on FDOT policy or to conform to operational or geometric conditions. Consistent signing and pavement marking designs in transition areas is an important aspect in meeting driver expectancy. See ***FDM 201.5*** for information on Design Speed.

Two examples of sudden change in cross section are where a narrow bridge exists and when the number of travel lanes increase or decrease. The FDOT ***Standard Plans*** provide guidance on accepted practices in these areas. Changes in the cross section may also occur when there is a change in the context classification.

Critical design elements that affect design consistency, driver expectancy, and vehicular operation include:

- Horizontal and vertical alignment
- Embankments, slopes, and guardrail applications
- Bridge width and roadway shoulders
- Pavement crown, cross slope, and superelevation

- Signing and delineation
- Placement of signal, lighting, and utility poles

201.2 Context Classification

Context classification is a design control that determines key design criteria elements for arterials and collectors. Criteria for LA Facilities are independent of the adjacent land uses; therefore, context classifications do not apply to these facilities and they are assigned the code “LA” for “Limited Access” where a context classification is required, such as in the Roadway Characteristics Inventory. However, where a limited access facility connects to the non-limited access state road system, the context classification of the non-limited access facility must be considered to provide a context-appropriate transition between access classifications. Each state road has been assigned a context classification, and this information can be obtained from the District Complete Streets Coordinator. The following is a list of the Department’s adopted context classifications:

- C1 – Natural
- C2 – Rural
- C2T – Rural Town
- C3R – Suburban Residential
- C3C – Suburban Commercial
- C4 – Urban General
- C5 – Urban Center
- C6 – Urban Core

Additional information on context classification is included in ***FDM 200***. Contact the District Complete Streets Coordinator to obtain the appropriate context classification for project roadway segments.

201.3 Traffic and Design Year

To provide for an interconnected transportation system that insures the mobility of people and goods, designs should satisfy capacity needs at an acceptable level of service through the design year. Forecasted traffic demand and volume are used to establish the number of travel and turn lanes, turn lane storage, signal timing, and right of way requirements. Forecasted traffic should account for anticipated future land use development.

The design year is the year for which the proposed improvement is designed. The FDOT ***Project Traffic Forecasting Handbook*** states that the design year is usually 20 years from the Opening Year, but design period may range in years from the present to 20 years depending on the project type.

Design year period typically used on FDOT projects are as follows:

- 20 years for new construction and reconstruction projects
- 15 years for lighting projects
- 10 years for signalization projects
- 10 years for improvements included with RRR projects
- 0-10 years for safety and operational improvements

Traffic forecasting is also used in pavement design to determine the vehicular loadings on the pavement. The proposed pavement design must provide structural strength through the pavement's service life. Refer to the FDOT ***Pavement Design Manuals*** for guidance on selecting an appropriate design period for flexible and rigid pavements.

Traffic forecasts are developed during the Project Development and Environmental (PD&E) study of a project. A Project Traffic Analysis Report is generally required. When a PD&E study is not conducted, traffic forecasts must be prepared early in the design phase. Project traffic used for design must be attested to by completing ***Form 130b***, located in ***FDM 103***.

Traffic data used for design includes:

(1) AADT for the current year, opening year and design year.

(2) Existing hourly traffic volumes over minimum of 24-hour period, including peak hour turning movements and pedestrian counts.

(3) Directional distribution factor (D).

(4) Standard K factor (K).

(5) Truck factors (T) for daily and peak hour.

(6) Design Speed and proposed Posted Speed.

(7) Design vehicle for geometric design.

(8) Peak turning movements at signalized and problem intersections and major traffic generators.

(9) Movements for future traffic generators that are scheduled during the service life should be considered.

201.4 Access Management

Regulation of access is necessary to preserve the functional integrity of the State Highway System and to promote the safe and efficient movement of people and goods within the state. Under ***Florida Statutes 335.18***, the Legislature authorized FDOT to develop rules to administer the "State Highway System Access Management Act". These are ***Rule 14-96*** and ***Rule 14-97***; see ***Tables 201.4.1, 201.4.2*** and ***201.4.3***. Designs are to comply with the statute, the rules, adopted procedures and directives, and the district program.

Table 201.4.1 Rule 14-97 - Freeway Interchange Spacing

Access Class	Area Type	Segment Location	Interchange Spacing (miles)
1	Area Type 1	CBD & CBD Fringe For Cities In Urbanized Areas	1.0
	Area Type 2	Existing Urbanized Areas Other Than Area Type 1	2.0
	Area Type 3	Transitioning Urbanized Areas, and Urban Areas Other Than Area Type 1 or 2	3.0
	Area Type 4	Rural Areas	6.0

Table 201.4.2 Rule 14-97 - Arterial Access Classifications & Standards

Access Class	Median Type	Connection Spacing (feet)		Median Opening Spacing (feet)		Signal Spacing (feet)
		>45 mph	≤45 mph	Directional	Full	
2	Restrictive with Service Roads	1320	660	1320	2640	2640
3	Restrictive	660	440	1320	2640	2640
4	Non-Restrictive	660	440			2640
5	Restrictive	440	245	660	2640 >45 mph 1320 ≤ 45 mph	
6	Non-Restrictive	440	245			1320
7	Both Median Types	125		330	660	1320

Notes:

(1) "Restrictive" physically prevent vehicle crossing.

(2) "Non-Restrictive" allow turns across at any point.

(3) Speeds shown in this table are posted speeds.

~~Connection Spacing Near~~ Interchange Ramp Areas~~s~~:

Connections ~~and median openings located within 1,320 feet of~~within the interchange ramp~~s~~ area require the following spacing from the end of the ramp taper ~~(measured from the ramp furthest from the interchange)~~:

- 440 feet ≤ 45 mph
- 660 feet > 45 mph
- 1,320 feet on Access Class 2 Facilities > 45 mph

Median openings within the interchange ramp area require the following standard distance from the end of the ramp taper:

- 2,640 feet for full median opening
- 1,320 feet for directional median opening

Table 201.4.3 Rule 14-97 - Interim Access Management Standards

Posted Speed (mph)	Connection Spacing (feet)	Median Opening Spacing (feet)	

		Directional	Full	Signal Spacing (feet)
35 mph or less	245	660	1320	1320
36 - 45 mph	440	660	1320	1320
Over 45 mph	660	1320	2640	1320

In addition, FDOT adopted the ***Median Opening and Access Management Decision Process (Topic No. 625-010-021)***, which further defines the principles and processes for FDOT to implement the Access Management Statute and Rules.

Each district has established an Access Management Review Committee to guide actions in access management and median decisions through all FDOT's processes. Various district offices are responsible for driveway permit connections and administering other parts of the program.

Each roadway on the State Highway System is assigned an access classification which determines what roadway features and access connection modifications are appropriate to adhere to the program.

During the PD&E phase, a conceptual access management plan is prepared for the preferred alternative. Access management issues are addressed in the Preliminary Engineering Report. Designs are to implement access management decisions and commitments made during the PD&E phase.

For projects that did not go through a PD&E phase, access connections within the project limits are to be evaluated for compliance with the assigned access classification. Driveways, signal, and median opening spacing should be considered in the analysis of safety and operational problems. Modifications or closures to access may be the solution in certain cases.

Rule 14-97.003(3)(b) gives FDOT the authority to alter, relocate or replace connections in order to meet current FDOT standards.

Rule 14-96.011 allows FDOT to revoke a permit *"…if the connection causes a safety or operational problem on the State Highway System substantiated by an engineering study…".*

Rule 14-97.003(3)(b) provides guidance on the treatment of existing features in the highway improvement process:

> *"Existing lawful connections, median openings, and signals are not required to meet the access management standards. Existing access management features will generally be allowed to remain in place, but shall be brought into conformance with access management standards when significant change occurs or as changes to the roadway design allow."*

Where revisions are necessary due to operational or safety problems, it may not be possible to upgrade a median opening or driveway connection to the current standards because of existing conditions or constraints. In these cases, provide the best solution, based on good engineering practice.

Median Opening and Access Management Decision Process (Topic No. 625-010-021) requires the following:

(1) Any significant change to driveway access will be shown in the plans or the driveway will be replaced in the same location, width and configuration (number of lanes).

(2) Access design and impacts to a right of way acquisition parcel should be determined prior to the right of way phase.

(3) Changes to access details or decisions must be coordinated with District Right of Way and General Counsel's offices in addition to the Access Management Review Committee.

Properties that abut a roadway on the State Highway System has a right to reasonable access to the roadway. A means of reasonable access cannot be denied except on the basis of safety and operational concerns as provided in ***Section 335.184, Florida Statutes***. Nothing in ***Section 335.184*** limits FDOT's authority to restrict the operational characteristics of a particular means of access. Service roads provide reasonable access.

It should be noted that if there are any conflicts between this manual and the statute and rules, the statute and rules will govern.

201.5 Design Speed

Design Speed is a principal design control that regulates the selection of many of the project standards and criteria used for design. The selection of an appropriate Design Speed must consider many factors. The AASHTO publication, ***A Policy on Geometric Design of Highways and Streets***, has a thorough discussion on Design Speed.

There are three categories of Design Speed:

High Speed: Design Speeds 50 mph and greater.

Low Speed: Design Speeds of 45 mph and less.

Very Low Speed: Design Speeds 35 mph and less.

201.5.1 Design Speed Selection

Design Speed should be selected early in the design process and should reflect the Target Speed (see below). Select a context-appropriate Design Speed to attain a desired degree of safety, mobility, and efficiency. Where the initial recommended Target Speed value is not feasible to attain in a single project, the Target Speed should be as close to the initial Target Speed values as can be achieved within the constraints of the project. Adjust both the Design Speed and Target Speed as appropriate to achieve a single value appropriate to the project. Select Design Speeds in increments of 5 mph.

Target Speed is the highest speed at which vehicles should operate on a thoroughfare in a specific context, consistent with the level of multi-modal activity generated by adjacent land uses, to provide both mobility for motor vehicles and a supportive environment for pedestrians, bicyclists, and public transit users. Determine appropriate Target Speed for all non-limited access projects where a Design Speed is also required. The Target Speed must:

- Be within the range of Design Speeds for the context classification (see ***Table 201.5.1***)
- Reflect the needs of safety, quality of life, and economic development of the corridor; and
- Be established by a team that includes, but is not limited to, Design, Traffic Operations, Safety, Planning, and Program Management offices.

It is expected that initial Target Speed values may be modified during project scoping to achieve the Target Speed as additional information is gathered and project scoping decisions are made. See the ***FDOT Context Classification Guide*** for more information about determining appropriate Target Speed.

In general, the Target Speed for C1 and C2 roadways should be on the higher end of the Design Speed range, with justification provided for lower speeds. In C2T through C6, consider starting with Target Speeds on the lower end of the range with justification provided for higher speeds.

It is considered a best practice to provide initial Target Speed values as part of the Context Classification determination. These initial values can be an effective starting point for the establishment of the Target Speed. For RRR projects where the initial Target Speed value is below the existing Design Speed or Posted Speed Limit, see ***FDM 202*** for Speed Management techniques to better align the Design Speed with Target Speed. In many cases, the Design Speed and the initial Target Speed values may both need to be changed to arrive at a Target Speed appropriate for the project.

*Commentary: The 85th-percentile observed speed is a starting point when traffic engineers conduct a speed study for setting speed limits (see the **FDOT Speed Zoning Manual** for more information, if desired.). The 85th percentile speed should be considered when selecting the Target Speed, but the Target Speed does not have to match the 85th-percentile speed.*

In many cases, speed management is required because the existing 85th-percentile speed is too high for current conditions, so setting Target Speed equal to the existing 85th-percentile speed would fail to accomplish the speed management objectives. The primary value of knowing the existing 85th percentile speed is to understand the potential magnitude of speed management interventions that may be required to achieve a selected Target Speed. Large speed reductions of more than 10 mph, for instance, may need to be approached incrementally over several projects, rather than achieved at once on a single project.

The District Design Engineer (DDE) and the District Traffic Operations Engineer (DTOE) jointly approve the selected Design and Posted Speeds. This approval is a declaration that the Posted Speed will not exceed the selected Design Speed. This is to be documented on the Typical Section Package as described in ***FDM 120.2.3***.

Table 201.5.1 provides an allowable range of mainline Design Speeds on the State Highway System. ***Table 201.5.2*** provides the minimum Design Speeds allowed on ramps.

Modification for Non-Conventional Projects:
See RFP for Design Speed and Target Speed.

Table 201.5.1 Design Speed

Limited Access Facilities (Interstates, Freeways, and Expressways)		
Area	**Allowable Range (mph)**	**SIS Minimum (mph)**
Rural and Urban	70	70
Urbanized	50-70	60
Arterials and Collectors		
Context Classification	**Allowable Range (mph)**	**SIS Minimum (mph)**
C1 Natural	55-70	65
C2 Rural	55-70	65
C2T Rural Town	25-45	40
C3 Suburban	35-55	50
C4 Urban General	25-45	45
C5 Urban Center	25-35	-
C6 Urban Core	25-30	-

Notes:

(1) SIS Minimum Design Speed may be reduced to 35 mph for C2T Context Classification when appropriate design elements are included to support the 35-mph speed, such as on-street parking.

(2) SIS Minimum Design Speed may be reduced to 45 mph for curbed roadways within C3 Context Classification.

(3) For SIS facilities on the State Highway System, a selected Design Speed less than the SIS Minimum Design Speed requires a Design Variation as outlined in ***SIS Procedure (Topic No. 525-030-260)***.

(4) For SIS facilities not on the State Highway System, a selected Design Speed less than the SIS Minimum Design Speed may be approved by the District Design Engineer following a review by the District Planning (Intermodal Systems Development) Manager.

(5) SIS minimum Design Speed may be reduced to 30 mph for C2T, C3, and C4 for facilities with a transit route.

Table 201.5.2 Ramp Design Speeds

Ramp Connection Type	Minimum Design Speed (mph)
Loops and Semi-Direct	30
Outer Cloverleaf	35
Intermediate Portions of Long Ramps	40
Direct Connection	50

Express Lane Direct Connections:

(1) Design Speeds higher than the minimum shown above should be used when practical. A Design Speed of 60 mph is desirable.

(2) Design Variations for Design Speed will not be approved for Express Lane Direct Connections with a Design Speed below 40 mph.

201.5.1.1 Collector-Distributor Roads

The Design Speed for collector-distributor roads must not be more than 10 mph below the Design Speed of the primary facility when direct ingress or egress to the Limited Access facility is provided. C-D road segments more than one intersection away from a LA facility should be assigned a Target Speed in accordance with their context classification.

201.5.1.2 Express Lanes

Express lanes Design Speed will be the same Design Speed as the adjacent general use lanes or general toll lanes in roadways that have buffer and wide buffer separation. In cases of barrier and grade separation the Design Speed can be equal to or greater than that of the adjacent general use lanes or general toll lanes, but never less than the general use lanes or general toll lanes. Minimum ramp Design Speeds for Express Lanes ramps are included in ***Table 201.5.2***.

201.5.2 Post-Construction Speed Study

The District Traffic Operations Engineer (DTOE) typically conducts a speed investigation within one year after a new construction or reconstruction project is completed. A change in Posted Speed limit may be proposed based on engineering and traffic investigations described in the Department's ***Manual on Speed Zoning for Highways, Roads and Streets in Florida*** (a.k.a. ***Speed Zoning Manual***).

When a speed study indicates that a higher Posted Speed is warranted, a modification of Posted Speed limit may be made under the authority of the District Traffic Operations Engineer (per the Traffic Regulation Approval Process, ***FDOT Procedure No. 750-010-011***).

To assign a Posted Speed higher than the Design Speed, the DTOE, working with the District Design Engineer (DDE) must process a Design Exception or Design Variation for each design element that does not meet the criteria for the higher speed.

Further explanation on how Posted Speed limits are developed can also be found on the State Traffic Operations web page:

https://www.fdot.gov/traffic/FAQs/

201.5.3 RRR Projects

Select a Design Speed consistent with the Target Speed (see ***FDM 201.5.1***), context classification of the roadway and project scope. The Design Speed used for a RRR project must be no higher than the Design Speed used in the original design of the highway.

When the Posted Speed is greater than the Design Speed used in the original design of the highway:

(1) Process a Design Variation or Design Exception for each design element that does not meet the criteria for the higher Posted Speed. Refer to Design Variations and Design Exceptions that were processed when the higher Posted Speed was implemented.

(2) Use criteria based on the Posted Speed:

  (a) when correcting a specific highway feature that has a significant crash history

  (b) for any new highway feature

(3) For replacement of highway features, use criteria based on the Posted Speed to the greatest extent possible, but not less than the Design Speed.

When the Design Speed used in the original design of the highway is higher than the existing Posted Speed, the Design Speed may be reduced to match the existing Posted Speed, as long as the values in ***Table 201.5.1*** are still met. Speed management strategies (per ***FDM 202***) should be used in conjunction with reduction of Design Speed. No Design Variation is required to lower the Design Speed to match the existing Posted Speed.

Include Design Speed, Target Speed, Design Variations, and Design Exceptions in the Typical Section Package. See ***FDM 120.2.3***.

If the existing Design Speed or Posted Speed meets AASHTO's criteria but is not within the allowable range shown in ***Table 201.5.1***, a Design Variation is not required to maintain the existing Design or Posted Speed. When Posted Speed exceeds the allowable range, roadway elements that encourage lower operating speeds should be included with the project. See ***FDM 202*** for examples of roadway elements that encourage lower operating speeds.

201.6 Design Vehicle

The Design Vehicle is the largest vehicle that is accommodated without encroachment on to curbs (when present) or into adjacent travel lanes. The type of Design Vehicle is influenced by the functional and context classification of a roadway, the role of the roadway in the network, and the land uses served.

The selected Design Vehicle affects:

- Horizontal and vertical alignments
- Lane widths and lane assignments
- Roundabout inscribed circle diameter
- Intersection turning radii and sight distance
- Auxiliary lane storage length, and acceleration and deceleration lengths

When considering dual left turn or right turn lanes, the Design Vehicle should generally be considered as turning simultaneously with a passenger car.

AASHTO's A Policy on Geometric Design of Highways and Streets provides general guidance on the selection of a design vehicle. ***AASHTO*** also provides the dimensions and turning characteristics for a variety of standard design vehicles; e.g., P, SU, WB-40, WB-62.

Florida Statutes allow truck-trailer combinations that are similar to the AASHTO WB-62 Interstate Semitrailer with some slight modifications. This modified WB-62 design vehicle is defined as the Florida Interstate Semitrailer (WB-62FL) and is often used as the design vehicle on the SHS. In addition, the Florida's Turnpike and other truck routes allow tandem tractor trailers. Use the AASHTO WB-109D as the design vehicle for tandem truck routes.

201.6.1 Control Vehicle

The Control Vehicle is one that is infrequent and is accommodated by allowing:

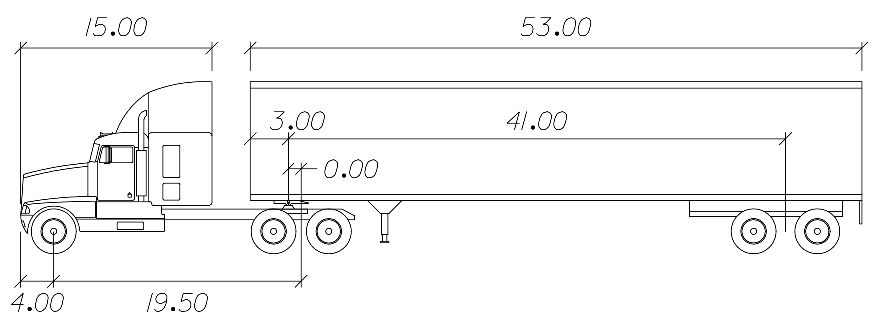
- Encroachment into opposing lanes if no raised median is present
- Minor encroachment on to curbs and areas within the curb return if no critical infrastructure such as traffic signal poles are present.

Control Vehicles may be appropriate at intersections for curbed roadways within C4, C5 and C6 context classifications. When considering U-turns, the Control Vehicle may be used as the Design Vehicle.

201.6.2 WB-62FL

When designing for a WB-62FL at intersections, the design elements (e.g., control radii, return radii) can be based on the criteria tables and figures in ***AASHTO*** for a WB-62. In addition, when designing features for complex or constrained intersections (e.g., roundabouts, multi-lane turns, directional median openings, ramps) the geometric design elements should be checked against the turning movement of a WB-62FL. The Florida Interstate Semitrailer WB-62FL is illustrated in ***Figure 201.6.1***.

Figure 201.6.1 WB-62FL



WB-62FL feet

Tractor Width :	8.00	Lock to Lock Time:	6.00 seconds
Trailer Width :	8.50	Steering Angle :	28.40 degrees
Tractor Track:	8.00	Articulating Angle:	70.00 degrees
Trailer Track :	8.50		

202 Speed Management

202.1 General

This chapter describes strategies that may be used to achieve desired operating speeds across all context classifications. The strategies described in this chapter are national best practices for low-speed facilities and are allowable on arterials and collectors when consistent with the context classification of the roadway.

The ***FDM*** recognizes a range of design speeds for each context classification. For very low speed conditions (35 mph or less) the context classification design speed range indicates the upper end of desirable operating speeds. For instance, the design speed range for C4 is 30-45 mph, but in conditions where on-street parking is present, a 35 mph or lower design speed should be used. Additionally, when the current design speed of a roadway exceeds the allowable range for the context classification or exceeds the target speed for conditions within the roadway, the strategies described in this chapter can be used to achieve a lower operating speed.

202.1.1 Lane Repurposing Projects

Lane repurposing projects (a.k.a., "road diets") are intended to reconfigure the existing cross section to allow other uses. This type of project typically does not move existing curbs, but with the removal of a travel lane(s) may provide space to implement the speed management strategies discussed in this chapter. Lane repurposing alone is not a speed management strategy but is included here to facilitate the use of other strategies.

See ***FDM 126*** for information on lane repurposing projects.

202.2 Speed Management Concepts

Low speed areas will typically have characteristics where conventional controls, such as centerline horizontal curvature, have limited applicability, such as:

- C6, C5 and C2T segments, which may be only a few blocks long and may already be built out, with limited possibility for roadway realignment
- C4 and C3 segments which are only a few blocks long and where reconstruction is not planned (such as a RRR project)
- Any project where interventions are part of a RRR project rather than a reconstruction or realignment, so curb lines are assumed to be fixed.

The strategies shown in ***Table 202.3.1*** are intended to be implemented on RRR projects but may also be incorporated into New Construction or Reconstruction projects. For new construction or reconstruction projects, provide a centerline curvature to support the desired lower speed, in addition to the other techniques described in this chapter. Shorter segments with smaller curve radii will generally yield better results, compared to applying speed management strategies to a facility originally designed for high speeds. In town centers, respecting the existing or proposed street grid will help provide frequent intersections for speed management as well as circulation for traffic and pedestrians.

Table 202.3.1 indicates the appropriate context classification, Target Speed range, and potential techniques that may be applicable to achieve the indicated Target Speed. The strategies shown in this table are not exhaustive. Creativity, judgment, and experience in the use of low-speed strategies are encouraged. Successful strategies typically incorporate one or more of the following speed management concepts:

- **Enclosure**: Enclosure is the sense that the roadway is contained in an “outside room” rather than in a limitless expanse of space. Drivers’ sense of speed is enhanced by providing a frame of reference in this space. The same sense of enclosure that provides a comfortable pedestrian experience also helps drivers remain aware of their travel speed. Street trees, buildings close to the street, parked cars, and terminated vistas help to keep drivers aware of how fast they are traveling. This feedback system is an important element of speed management.
- **Engagement**: Engagement is the visual and audial input connecting the driver with the surrounding environment. Low speed facilities utilize engagement to help bring awareness to the driver resulting in lower operating speeds. As the cognitive load on a driver’s decision-making increases, drivers need more time for processing and will manage their speed accordingly. Uncertainty is one element of engagement – the potential of an opening car door, for instance, alerts drivers to drive more cautiously. On-street parking and proximity of other moving vehicles in a narrow-lane are important elements of engagement, as are architectural detail, shop windows, and even the presence of pedestrians.
- **Deflection:** Deflection is the horizontal or vertical movement of the driver from the intended path of travel. Deflection is used to command a driver’s attention and manage speeds. Being a physical sensation, deflection is the most visceral and powerful of the speed management strategies. Whereas enclosure and engagement rely in part on psychology, deflection relies primarily on physics. Examples include roundabouts, splitter medians (horizontal deflection), and raised intersections (vertical deflection). Deflection may not be appropriate if they hinder truck or emergency service vehicle access.

202.2.1 Target Speed

Target Speed is the highest speed at which vehicles should operate on a thoroughfare in a specific context, consistent with the level of multi-modal activity generated by adjacent land uses, to provide both mobility for motor vehicles and a supportive environment for pedestrians, bicyclists, and public transit users.

References:

- **FHWA webpage: *https://www.fhwa.dot.gov/planning/css/design/controls/factsheet3_ite.cfm***
- ***Speed Zoning Manual 9.4***
- ***FDOT Context Classification Guide*** (July 2020)

Ideally, the Target Speed, Posted Speed, and Design Speed should all be the same where speeds are 45 mph or less. However, Design Speed and Posted Speed will often take time to change and may even need to be changed over the course of several projects. Target Speed can be set immediately and serves as the "target or goal" for Design Speed and Posted Speed on a project. Establish a Target Speed for any non-limited access project where a design speed is also required, per ***FDM 201.5.1***. ***Table 202.3.1*** indicates the speed management strategies that should be used to achieve a desired Target Speed. The district planning office should include a recommended Target Speed along with other documentation of the Context Classification for a project.

The Design Speed of the roadway should be changed to match the Target Speed per ***FDM 201***. Recognizing this may have to occur incrementally depending on the magnitude of the difference between the current Design Speed and the Target Speed, adjust both the Target Speed and Design Speed during initial scoping if needed, based on project needs and constraints. See ***FDM 201*** for information on Design Speed and changes in Design Speed on RRR projects. Speed studies per the Speed Zoning Manual should be conducted as well to determine if the Target Speed strategies are working and to reset the Posted Speed as the operating speeds change over time.

202.3 Speed Management Strategies

When selecting appropriate strategies from ***Table 202.3.1***, consider:

- context classification
- desired operationg speed
- community vision
- multimodal needs (safety, operations)
- design and emergency vehicles
- access management

Descriptions of each speed management strategy are provided in the following sections of this chapter. Typically, the strategies provided in ***Table 202.3.1*** are most effective when several are used together. Use existing conditions to the greatest extent possible to support speed management. In particular, existing street grids with short blocks and frequent intersections represent excellent speed management opportunities already in place. Accentuate and use such opportunities where they exist.

202.3.1 Roundabouts

Roundabouts are effective as a transition from a higher speed context to a lower speed context. On the State Highway System (SHS), modern roundabouts are standard, but smaller roundabouts (sometimes referred to as “mini-roundabouts”) may be appropriate in contexts where operating speeds of 25 mph or less are desired. See ***FDM 213*** for roundabout design criteria.

When used in series, roundabouts can help maintain a low-speed condition as an alternative to vertical deflection, stop signs, or traffic signalization. To limit the potential of drivers accelerating between roundabouts in series, spacing should not exceed one mile on low-speed roadways and half-mile on very low speed roadways.

202.3.2 On-Street Parking

In addition to providing parking supply and separating pedestrians from the travel lane, on-street parking can be used to manage speeds when the parking lane is located directly adjacent to the travel lane. For best effect, the parking lane should be of the standard size for the type of parking used (parallel or reverse angle), and the travel lane should be of the minimum width that will accommodate the design vehicle. Effective speed management can be achieved by maximizing the engagement between the parking lane and the travel lane. Where parking is used for speed management, avoid the following:

- Installing a bicycle lane between the parking lane and the travel lane
- Travel lanes wider than 11 feet.

Consider providing additional strategies such as curb extensions, and shorts blocks, with on street parking.

See ***FDM 210.2.3*** for on-street parking design criteria.

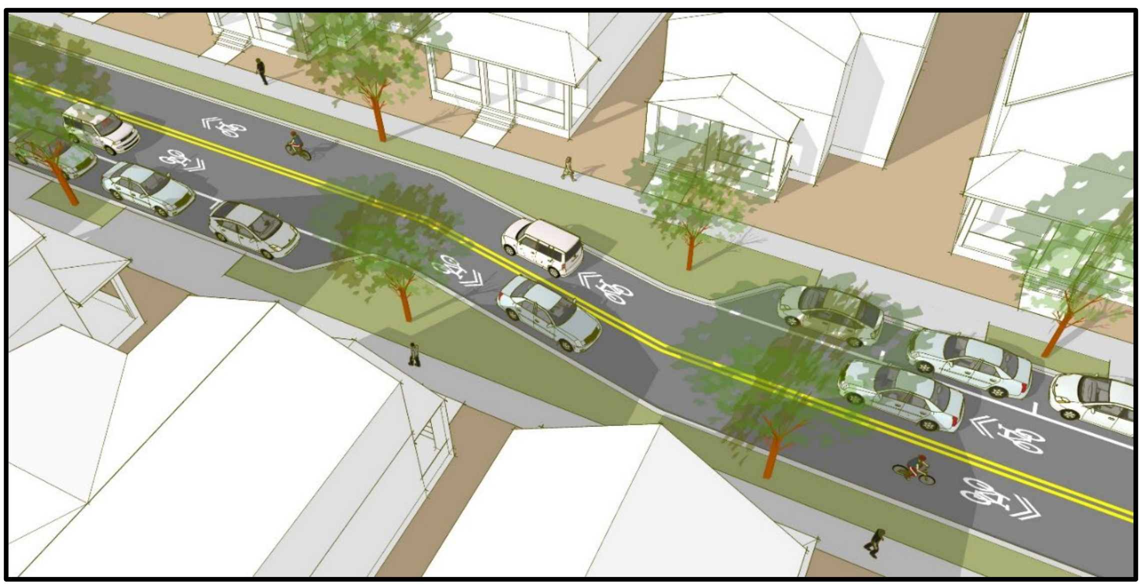
202.3.3 Chicanes

A chicane is a very low speed treatment using deflection of the roadway centerline to achieve horizontal deflection within existing curb. Chicanes place vertical barriers (e.g., curbs, on-street parking) to require vehicle operators to make frequent horizontal movements. To be effective, the chicane deflection should be the width of a parking lane or no less than half of the travel lane width. Transition distance between chicanes is typically 100 feet or more.

An example of a chicane strategy is the placement of on-street parking on alternating sides of the street. This alternating on-street parking pattern may be placed from one block to the next, or within a single block (depending on block length and transition distances). This creates a centerline shift, as illustrated in ***Figure 202.3.1***.

To accommodate a WB-62FL Design Vehicle, chicanes should not be shorter than one block. For smaller trucks, buses and emergency vehicles, chicanes should not be shorter than half a-block.

Figure 202.3.1 Concept Sketch - Midblock Chicane



202.3.4 Lane Narrowing

Use of narrow lanes (less than 12') alone has limited effect on operating speeds. This effect can, however, enhance engagement as traffic volumes increase. The visible narrowing of travel lanes may be used as a transition device to clearly indicate a change in context. For instance, narrowing two 12-foot lanes to two 11-foot or 10-foot lanes by shifting the lane lines slightly and introducing a hatch in the newly created edge space has been shown to alert drivers of a change in condition or context. To maximize effectiveness, lane narrowing should be used in conjunction with other low speed strategies (e.g., introduction of parking, creation of a median, beginning a chicane).

See ***FDM 210.2*** for lane width criteria on the SHS.

202.3.5 Horizontal Deflection

Horizontal deflection is the redirection of the driver in the horizontal plane through the introduction of a curve, splitter island, or other redirection device. Horizontal deflection is the operating principle behind roundabouts and chicane treatments. Designers may conceive additional ways to introduce horizontal deflection using these same principles.

FDM 210.8.1 has criteria for horizontal deflection of tangent sections of roadway. ***FDM 212.7*** provides criteria for horizontal deflection through intersections.

202.3.6 Street Trees

To be most effective as a speed management strategy, street trees should be close to the roadway and should form a continuous "wall" effect. When used this way, the street trees reinforce a sense of enclosure. As with most of these strategies, street trees along the roadway will be more effective when used in conjunction with other strategies. For speed management purposes, designers are encouraged to use street trees whenever possible.

FDM 212.11 and ***FDM 215.2.4*** provide criteria on the placement of street trees. The installation of street trees may require a maintenance agreement with local agency.

202.3.7 Short Blocks

Short blocks of 500 feet or less manage speed by limiting driver acceleration distance between intersections. If used in conjunction with marked crosswalks, short blocks also create engagement. Accentuate the presence of the short blocks to reinforce low-speed and pedestrian-supportive contexts. Creation and enforcement of short blocks can take many forms, from the control of intersections on physically short blocks to the simulation of short blocks achieved by introducing midblock crossings on longer block segments. On reconstruction projects, preserve existing short block networks wherever possible, particularly in established town centers with an existing street grid.

Where physical short blocks already exist, such as most C6 and C5 contexts and many C4 and C2T contexts, consider marking crosswalks at unsignalized intersections to reinforce the presence of the short blocks; see ***FDM 222.2.3.1*** and ***Traffic Engineering Manual (TEM) 5.2*** for criteria on marking unsignalized crosswalks. This concept is illustrated in ***Figure 202.3.2***.

Where physical short blocks do not exist, installation of mid-block crossings can be used to simulate the short-block effect, as illustrated in ***Figure 202.3.3***.

Figure 202.3.2 Concept Sketch – Mark Crossings to Emphasize Short Blocks

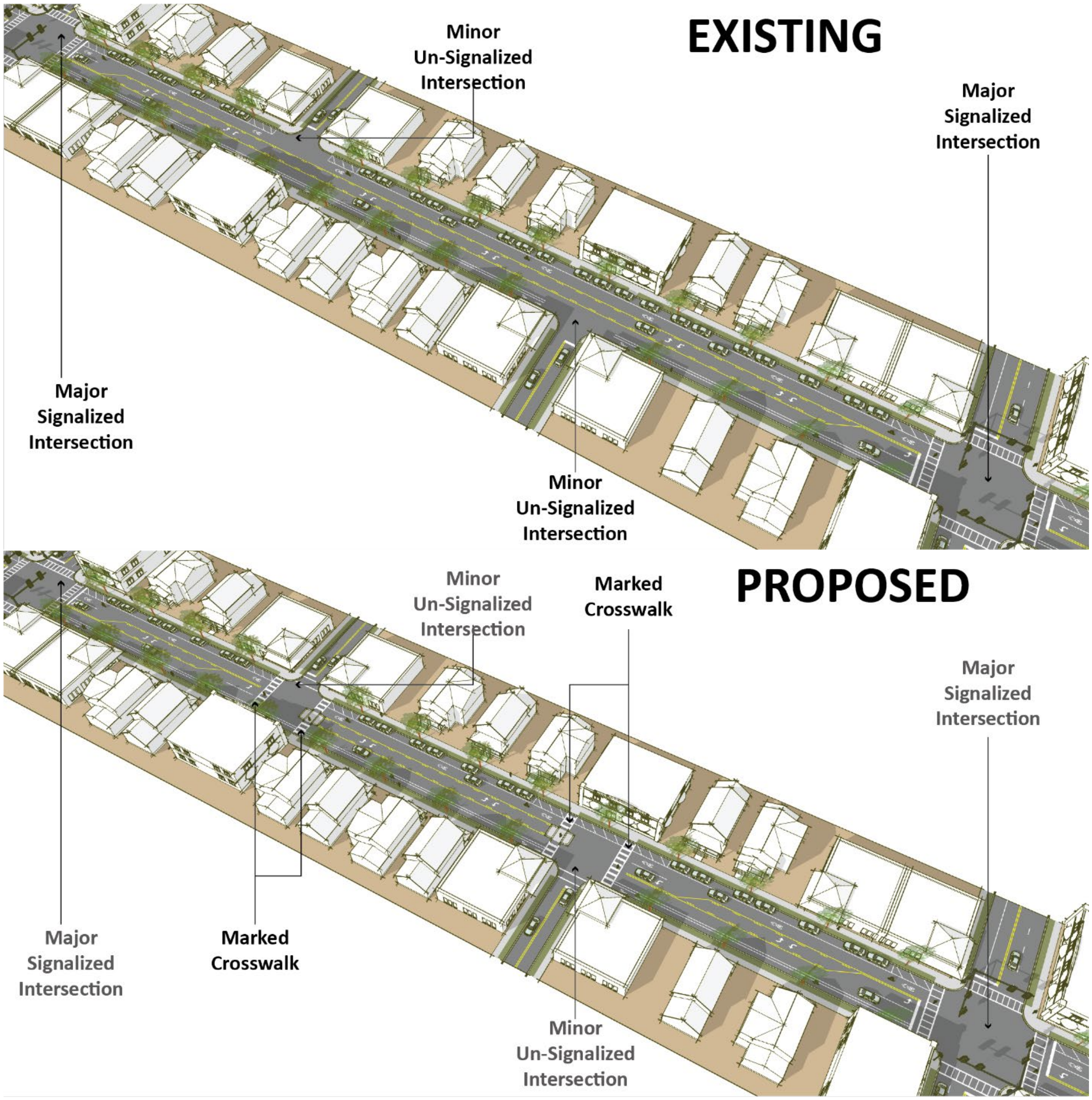
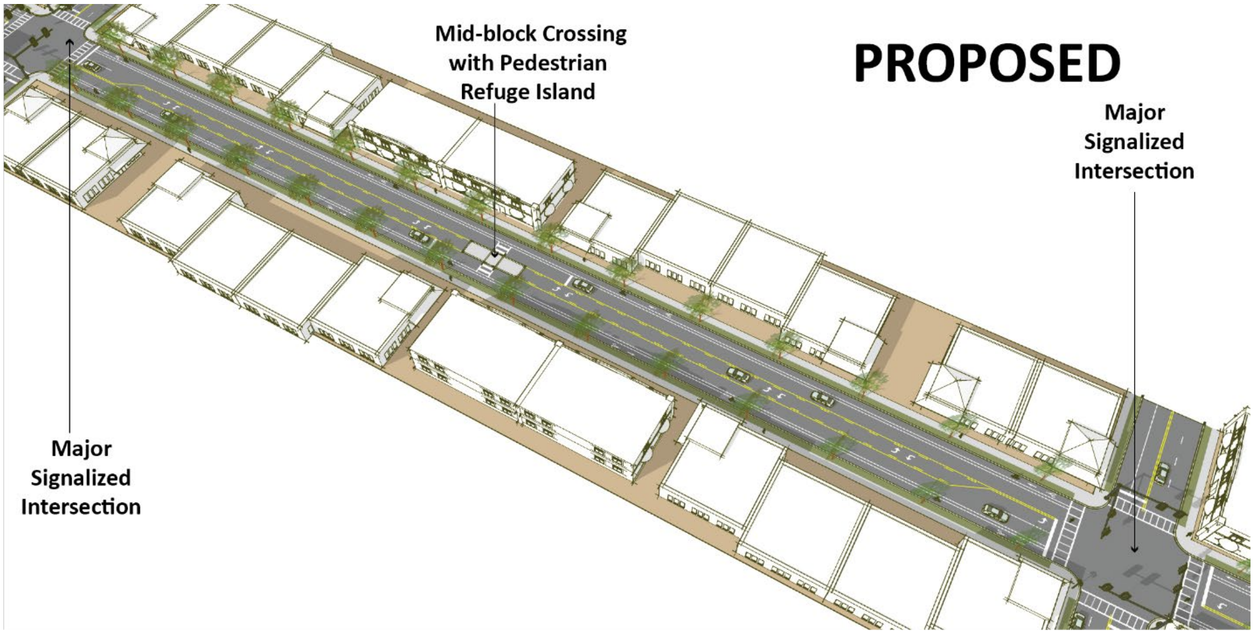


Figure 202.3.3 Concept Sketch- Add a Midblock Crossing to Long Block



202.3.8 Vertical Deflection

Like horizontal deflection, vertical deflection is a proven technique for speed management. When deflection is proposed, coordinate with local public works and emergency services to ensure emergency vehicle access will not be adversely affected.

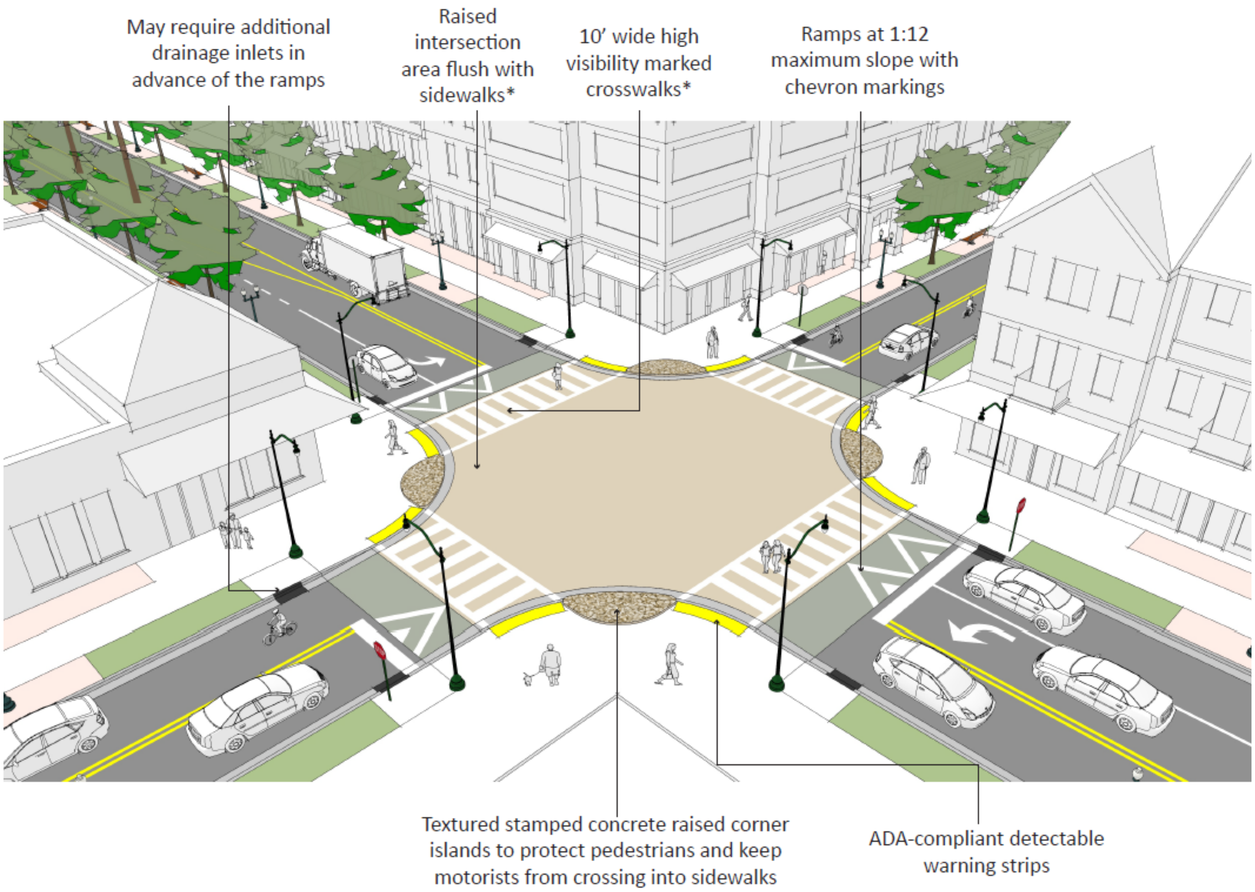
Speed tables and raised intersections may be considered only for Target Speeds of ~~25~~ 30 mph or less. Create speed tables by modifying the details in ***Developmental Standard Plan D520-030*** for Raised Crosswalks. Extend the raised crosswalk surface to a width greater than or equal to the axle spacing of the Design Vehicle and omit the crosswalk marking, unless the speed table is also serving as a raised crosswalk.

Raised intersections are site specific and must be designed to meet the needs of each individual intersection. ***Figure 202.3.4*** shows a concept drawing of a simple raised intersection indicating critical design considerations. Design more complex intersections with additional lanes or signalization using the same considerations. Mark all legs of vertically-deflected intersections, either raised or with adjacent raised crosswalks, using special emphasis crosswalk markings.

Raised crosswalks may be considered at mid-block crossings for Target Speeds of 30 mph or less. Raised crosswalks are not allowed at intersections within the turning path of the design vehicle. ~~Vertical deflection at intersections can be achieved by utilizing~~

~~raised intersections.~~ For more information on raised crosswalks, see the ***Developmental Standard Plans D520-030***.

Figure 202.3.4 Concept Sketch - Raised Intersection



*Note: Recommend raised intersection pavement and crosswalks be patterned and colored for increased visibility. Pattern and color should be coordinated with Department and local agencies.

202.3.9 Speed Feedback Signs

Speed feedback signs are a traffic operations strategy that is effective in helping to enforce school zone Posted Speeds. However, this strategy may also require active participation by law enforcement.

The signs provide immediate feedback to drivers when the Posted Speed is exceeded, which may help to reduce unintentional speeding. They are most effective at managing operating speeds for short distances (about 1,000 feet) following the sign and when combined with other measures such as high emphasis crosswalk markings and islands. Coordinate with the District Traffic Operations Engineer on the use of this device.

202.3.10 Posted Speed Pavement Marking

Posted Speed markings placed directly on the pavement adjacent to Posted Speed signs, reinforce a change in Posted Speed (e.g., at transition areas, on approach to a pedestrian crossing). This strategy should be considered when a Posted Speed reduction may be unexpected (e.g., transition from a C1 or C2 context to a C2T context, an approach to a pedestrian crossing in a rural area, or a transition from a low-speed to a very low-speed condition). Coordinate with the District Traffic Operations Engineer on the use of Posted Speed pavement marking.

202.3.11 Islands

Islands at crossings can provide deflection as well as engagement to help manage operating speeds. Unlike continuous raised medians, islands are short sections used in specific locations. When combined with a crosswalk, the island may provide refuge for pedestrians as well as speed management. See ***FDM 210*** for island criteria.

Islands on curved roadway sections can prevent lane departures by forcing drivers to stay within the travel lane. These are especially effective in locations where drivers increase speed by overrunning the centerline striping on a shorter-radius curve.

202.3.12 Curb Extensions (Bulb-Outs)

Curb extensions are portions of the curb line extended out into the roadway to provide engagement and deflection. Curb extensions are commonly used at either end of a parking lane. They also shorten crossing distance for pedestrians and may provide space for landscaping or community aesthetic features.

Curb extensions create engagement by extending the curb line to be adjacent to the travel lane. When used at the beginning of a parking lane or as part of a chicane, the curb extension also provides deflection. In some instances, longitudinally extended bulb-outs inside the existing curb lines may be used to narrow the entire length of a roadway segment. In this case, the existing drainage system is preserved, and drainage provided through the new curb extensions to existing inlets. Curb extensions at intersections should be designed using a CADD-based vehicle turning path (e.g., AutoTurn) to verify the appropriate design and control vehicles are accommodated.

See ***FDM 222.2.6*** for curb extension criteria.

202.3.13 Rectangular Rapid Flashing Beacons and Pedestrian Hybrid Beacons

The Rectangular Rapid Flashing Beacon (RRFB) and Pedestrian Hybrid Beacon (PHB) traffic control devices are "beacons" rather than signals and consequently have a less restrictive warranting processes. When combined with marked crosswalks, they can be used to establish shorter block lengths. They may also create engagement and thereby help manage operating speeds. See ***TEM 5.2*** and coordinate with the District Traffic Operations Engineer on the application of these devices.

202.3.14 Terminated Vista

The terminated vista creates enclosure by providing an enclosed (terminated) view ahead (vista), indicating a street segment does not extend indefinitely. The terminated vista places a building, tree, artwork, or natural view in the driver's central vision to indicate that a stop or change of direction is imminent. This is illustrated in ***Figure 202.3.~~4~~5*** by an oak tree terminating the vista where the roadway bears to the left.

The terminated vista is a valued and well-understood town planning tool to create a sense of place and enclosure for pedestrians. The effect on drivers is similar. Roundabouts are a common type of terminated vista, especially where a tall vertical element is included in the center island of the roundabout. Other terminated vistas can be created at T-intersections, median splitter islands, and off-set block configurations.

Figure 202.3.45 Concept Sketch – Terminated Vista Example

Table 202.3.1 Strategies to Achieve Desired Operating Speed

Context Classification	Target Speed (mph)	Strategies																	
		Lane Repurposing	Roundabouts	On-Street Parking	Chicanes	Lane Narrowing	Horizontal Deflections	Street Trees	Short Blocks	Speed Tables	Raised Intersections	Raised Crosswalks	Speed Feedback Sign	Pedestrian Refuge Islands	Bulb-Outs	RRFBs	PHBs	Terminated Vistas	Islands in Curved Sections
C2T	40-45		X			X	X						X				X		
	35	X	X	X		X	X	X	X				X	X	X	X	X	X	
	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C3R, C3C	40-45		X			X	X						X				X		
	35	X	X			X	X						X	X	X	X	X	X	
C4	40-45		X			X	X						X				X		
	35	X	X	X		X	X	X	X				X	X	X	X	X	X	
	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C5	35	X	X	X		X	X	X	X				X	X	X	X	X	X	
	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C6	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:
1. For C1 and~~,~~ C2 (55-70 mph): Speed Management Strategies are not used on high-speed roadways. See ***FDM 202.4*** for information on transitions from high-speed to low-speed facilities.
2. For C3R~~,~~ and C3C (50-55 mph): Project-specific; see ***FDM 202.4***.

~~Table 202.3.1 Strategies to Achieve Desired Operating Speed~~

~~Context Classification~~	~~Target Speed (mph)~~	~~Strategies~~
~~C1~~	~~55-70~~	~~N/A: Speed Management Strategies are not used on high-speed roadways. See ***FDM 202.4*** for information on transitions from high-speed to low-speed facilities.~~
~~C2~~	~~55-70~~	~~N/A: Speed Management Strategies are not used on high-speed roadways. See ***FDM 202.4*** for information on transitions from high-speed to low-speed facilities.~~
~~C2T~~	~~40-45~~	~~Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, RRFBs and PHBs~~
	~~35~~	~~Techniques for 40-45 mph, plus RRFBs, On-street Parking, Street Trees, Short Blocks, Islands at Crossings, Road Diet, Bulb-outs, Terminated Vista~~
	~~30~~	~~Techniques for 35-45 mph, plus Chicanes, Islands in curved sections, Raised Crosswalks~~
	~~≤ 25~~	~~Techniques for 30-45 mph, plus Vertical DeflectionSpeed Tables and Raised Intersections~~
~~C3R, C3C~~	~~50-55~~	~~Project-specific; see ***FDM 202.4***.~~
	~~40-45~~	~~Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, RRFB and PHB~~
	~~35~~	~~Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, Islands in crossings, Road Diet, RRFB and PHB, Terminated Vista~~
~~C4~~	~~40-45~~	~~Roundabout, Lane Narrowing, Horizontal Deflection, Speed Feedback Signs, RRFB and PHB~~
	~~35~~	~~Techniques for 40-45mph plus On-Street Parking, RRFBs, Street Trees, Short Blocks, Islands at Crossings, Bulb-outs, Terminated Vista, Road Diet~~
	~~30~~	~~Techniques for 35-45 mph plus Chicanes, Islands in Curve Sections, Raised Crosswalks~~
	~~25~~	~~Techniques for 30-35 mph plus Speed Tables and Raised Intersections~~
~~C5~~	~~35~~	~~Roundabout, On-street Parking, Street Trees, Short Blocks, Speed Feedback Signs, Islands in Crossings, Road Diet, Bulb-outs, RRFB and HAWKPHB, Terminated Vista~~
	~~30~~	~~Techniques for 35 mph plus Chicanes, Island in Curve Sections, Raised Crosswalks~~

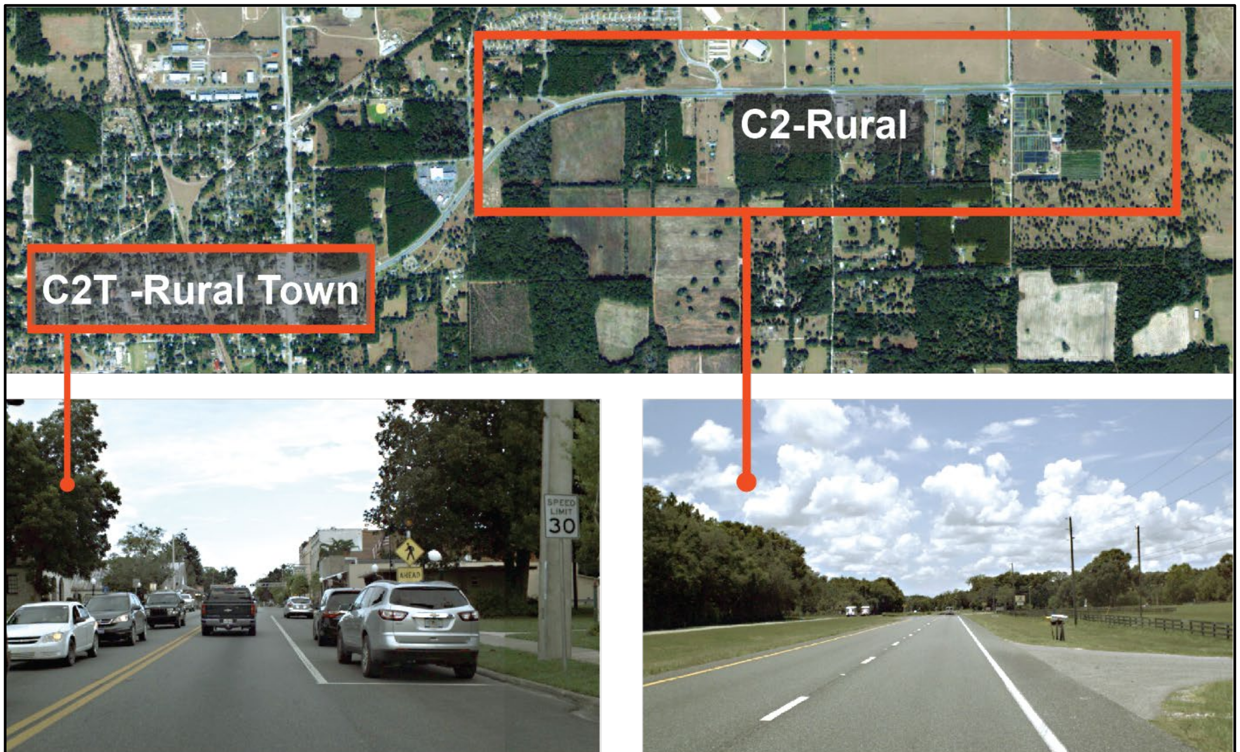
	~~25~~	~~Techniques for 30-35 mph plus Vertical Deflection~~
~~C6~~	~~30~~	~~Roundabout, On-Street Parking, Horizontal Deflection, Street Trees, Islands in Curve Sections, Road Diet, Bulb-outs, Terminated Vista, Raised Crosswalks~~
	~~25~~	~~Techniques for 30 mph plus vertical deflection~~

202.4 Transition Zones

Roadways may traverse more than one context classification. As the context changes, the design criteria for the roadway will also change. The transition from C1 (Natural) or C2 (Rural) context classification to a higher classification such as C2T (Rural Town) provides a potentially abrupt change in the recommended design speed and design users.

For example, the land use surrounding SR 26 through Newberry, Florida transitions from C2 (Rural) to C2T (Rural Town) over the course of a few blocks (see ***Figure 202.4.1***). Such conditions require a transition zone to alert drivers to the context change and to notify them to adjust their behavior and expectations accordingly. Changes in Posted Speed as part of transition zones must comply with the requirement of the ***Speed Zoning for Highways, Roads, and Streets in Florida***.

Figure 202.4.1 Example of Transition Zone (SR 26 through Newberry, FL)



Downtown Newberry, FL C2T-Rural Town

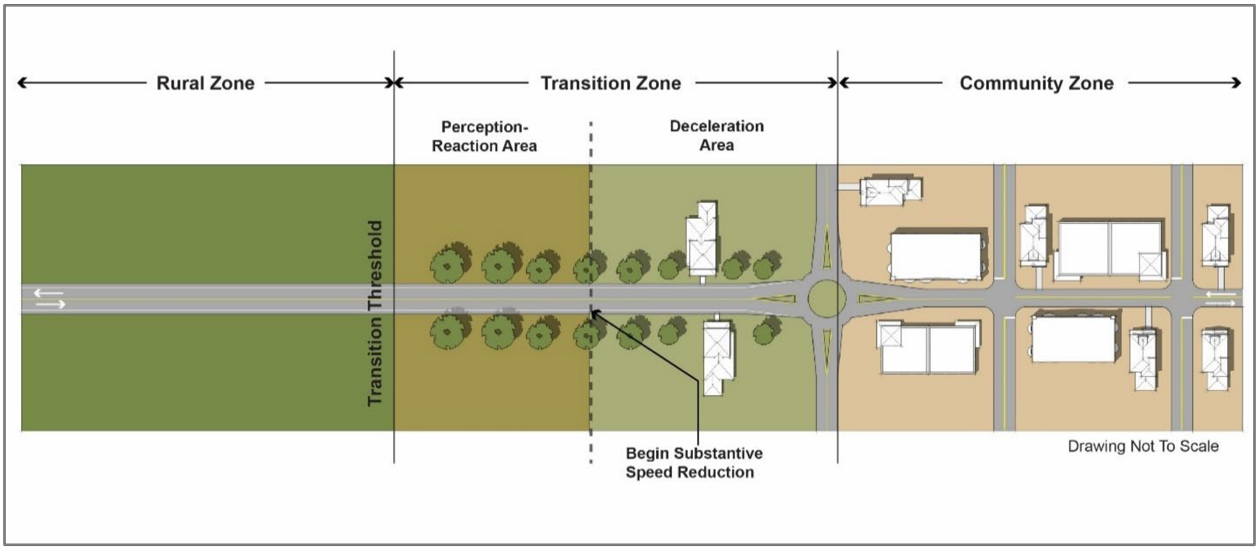
East of Downtown Newberry, FL C2-Rural

Transition zones have two distinct sections, as illustrated in ***Figure 202.4.2***:

(1) Perception-Reaction Area and

(2) Deceleration Area

Figure 202.4.2 Transition Zone from C1/C2 to C2T Context Classification



In the perception-reaction area, drivers are made aware of the need to reduce speed. This section will include visual cues to alert the driver of an upcoming deceleration. These cues may include:

- Signage, including warning signs such as “Reduced Speed Ahead” signs, or gateways signs where appropriate.
- Pavement markings: lane narrowing can be highlighted with the use of a wider outside stripe. The Posted Speed may be placed on the pavement.
- Curb changes: from flush paved shoulders to curbed roadway.
- Architectural elements such as type, location, and spacing of lighting or landscaping.

In the deceleration area, drivers are expected to slow down to an operating speed that matches the context of the community being approached. In the deceleration area, there is a noticeable change in roadway characteristics. The length of the deceleration area is a function of design speed, sight distance, and design criteria of the new context classification. Transition from a high-speed to low-speed cross section can be accomplished through a variety of features, including but not limited to:

- Horizontal deflection (e.g., splitter islands, chicanes, roundabouts)
- Lane narrowing
- Lane repurposing

- Introduction of curb and gutter
- Street enclosure through vertical landscaping
- Signage or gateway treatments, including speed feedback signs
- Posted Speed pavement markings

A combination of strategies is more effective for reducing speed. ***Figures 202.4.3*** and ***202.4.4*** provide an example of horizontal deflection and lane narrowing at the entrance of a rural town.

Figure 202.4.3 Example of a Transition Zone from 60 to 30 mph (SR 636, entrance to town of Wauchula, Florida)

Figure 202.4.4 Section Change Near Transition from 40 to 30 mph (Entrance to Wauchula, FL, showing lane narrowing)

Photo by FDOT District 1

210 Arterials and Collectors

210.1 General

Design criteria presented in this chapter apply to new construction and reconstruction projects on arterials and collectors on the State Highway System. Roadways not on the State Highway System which are impacted by these new construction and reconstruction projects should also be designed in accordance with this manual; however, districts may allow the use of the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (commonly known as the "***Florida Greenbook***").

This chapter also provides minimum criteria to be used with Resurfacing, Restoration, and Rehabilitation (RRR) projects as described in ***FDM 210.1.1***.

Facilities on the Strategic Intermodal System (SIS) are subject to special standards and criteria for number of lanes, design speed, access, and level of service. Design all SIS and Emerging SIS Highway Intermodal Connectors in accordance with the SIS criteria contained in this manual. With approval by the District Design Engineer, the ***Florida Greenbook*** may be used on SIS facilities that are not on the State Highway System.

Many design criteria are related to design speed; e.g., vertical and horizontal geometry, sight distance. The minimum design values are closely related to traffic safety and require an approved Design Exception or Design Variation when they are not met. See ***FDM 201*** for information on Design Speed. See ***FDM 122*** for information on Design Exceptions and Design Variations.

Example roadway typical sections are included in the exhibits in ***FDM 913***. Criteria regarding lanes, medians, and shoulders for bridges are illustrated in ***FDM 260.1.1.*** Subsequent sections of this chapter contain specific information and criteria regarding these and other typical section elements, as well as geometric features.

Existing project features which were constructed to meet minimum metric design criteria but are mathematically slightly less than equivalent minimum English design criteria, do not require Design Exceptions or Design Variations to remain.

210.1.1 Criteria for RRR Projects

Criteria for RRR projects provided in this chapter are the minimum values allowed for roadway and structure elements to remain on the State Highway System without obtaining a Design Exception or Design Variation (see ***FDM 122***). Existing project features are to meet new construction criteria when RRR criteria are not provided.

New features installed on RRR projects are to meet new construction criteria. However, RRR criteria may be used for establishing the minimum requirements for adding auxiliary lanes, keyhole lanes, or other minor intersection improvements with the understanding that when existing R/W is adequate, new construction criteria will be used to the maximum extent feasible.

210.1.2 Railroad-Highway Grade Crossing

If a railroad-highway grade crossing is within or near the limits of the project, and there are Federal Funds associated with the project, see ***FDM 220.2.4*** for requirements.

210.1.3 Aviation and Spaceports

If an airport or spaceport is within 10 nautical miles of the project, refer to ***FDM 110.5.1*** for requirements.

210.2 Lanes

Design criteria for lane widths and pavement slopes are given by lane type, design speed and context classification. Minimum travel, auxiliary, and two-way left-turn lane widths are provided in ***Table 210.2.1***. Refer to ***FDM 202*** for speed management information and ***FDM 211*** for ramp lane widths.

Additional traveled way width may be provided in curves on undivided 2-lane roadways to accommodate large trucks. See ***AASHTO Green Book***, ***Section 3.3.10*** for guidance and information on traveled way widening in horizontal curves.

Two-way left turn lane widths (flush median) may be used on 3-lane and 5-lane typical sections with design speeds ≤ 40 mph. On new construction projects, flush medians are to include sections of raised or restrictive median and islands to enhance vehicular, bicycle, and pedestrian safety, improve traffic efficiency, and attain the standards of the Access Management Classification of that highway system. Sections of raised or restrictive median and islands are recommended on RRR projects.

Table 210.2.1 Minimum Travel and Auxiliary Lane Widths

Context Classification		Travel (feet)			Auxiliary (feet)			Two-Way Left Turn (feet)	
		Design Speed (mph)			Design Speed (mph)			Design Speed (mph)	
		25-35	40-45	≥ 50	25-35	40-45	≥ 50	25-35	40
C1	Natural	11	11	12	11	11	12	N/A	
C2	Rural	11	11	12	11	11	12		
C2T	Rural Town	11	11	12	11	11	12	12	12
C3	Suburban	10	11	12	10	11	12	11	12
C4	Urban General	10	11	12	10	11	12	11	12
C5	Urban Center	10	11	12	10	11	12	11	12
C6	Urban Core	10	11	12	10	11	12	11	12

Notes:

Travel Lanes:

1. Minimum 11-foot travel lanes on designated freight corridors, SIS facilities, or when truck volume exceeds 10% on very low speed roadways (design speed ≤ 35 mph) (regardless of context).
2. Minimum 12-foot travel lanes on all undivided 2-lane, 2-way roadways ~~(for all context classifications and design speeds)~~. ~~However, 11-foot lanes may be used on 2-lane, 2-way curbed roadways that have adjacent buffered bicycle lanes~~However, Very Low-Speed and Low-Speed table values may be used for roadway sections with both of the following:
    a. C2T, C4, C5 or C6 context classification
    ~~a.~~b. Tangent horizontal alignment or ~~very large radius~~ curve radii large enough to accommodate the design vehicle within the travel lane in accordance with ***AASHTO Green Book, Section 3.3.10***
~~2.~~3. 10-foot travel lanes are typically provided on very low speed roadways (design speed ≤ 35 mph) but should consider wider lanes when transit is present ~~or truck volume exceeds 10%~~.
~~3.~~4. Travel lanes should not exceed 14 feet in width.

Auxiliary Lanes:

(1) Auxiliary lanes are typically the same width as the adjacent travel lane.
(2) Table values for right turn lanes may be reduced by 1 foot when a bicycle keyhole is present.
(3) Median turn lanes should not exceed 15 feet in width.
(4) For high-speed curbed roadways, 11-foot minimum lane widths are allowed for the following:
- Dual left turn lanes
- Single left turn lanes at directional median openings.

(5) For RRR Projects, 9-foot right turn lanes on very low speed roadways (design speed ≤ 35 mph) are allowed.
Two-way Left Turn Lanes:
(1) Two-way left turn lanes are typically one foot wider than the adjacent travel lanes.
(2) For RRR Projects, the values in the table may be reduced by 1-foot.

210.2.1 Bicycle Lanes

FDM 223 contains criteria for the accommodation of bicyclists.

210.2.2 Transit Facilities

Coordinate with the District Modal Development Office and local transit agency for the need for public transit facilities. ***FDM 225*** contains additional guidelines for street side bus stop facilities, location, and design.

210.2.3 On-Street Parking

On-street parking is a key element of urban contexts C6, C5, and C4, but may also be found in C2T. It provides necessary parking supply in these locations, helps manage traffic speeds, and provides separation between the sidewalk and the travel lanes. In these context zones, leave existing on-street parking in place unless local plans call for its removal. Where on-street parking is not present in C6, C5, or C4, determine whether it should be added per local plan, for speed management, or to increase available parking.

On-street parking is allowed on facilities with posted speeds of 35 mph or less. It is typically located at the outside edge of the roadway between the travel lane and the sidewalk. In C6 and C5 contexts it may sometimes be located within the median of a divided low speed urban street. Median parking provides additional parking supply as well as speed management.

On-street parking may be either parallel or angle (traditional or reverse). See ***Chapter 316, F.S.*** for laws governing parking spaces.

Standard Plans, Index 711-001 provides dimensions and additional requirements for on-street parking.

See ***FDM 223*** for bicycle accommodations on roadways with on-street parking.

Parking restrictions to assure adequate clear sight triangles are provided in ***FDM 212.11.5***.

210.2.3.1 Existing On-Street Parking

For RRR projects with existing on-street parking and a posted speed greater than 35 mph, process a single Design Variation that addresses all of the following design elements:

- Intersection Sight Distance
- Stopping Sight Distance (as applicable)
- On-street parking

The single Design Variation described above should include all affected intersections within a corridor; i.e., it is not necessary to process individual Design Variations for each location. In addition to processing a Design Variation, consider the following mitigation strategies:

- Use speed mitigation strategies described in ***FDM 202*** to achieve a target speed of 35 mph.
- When possible, provide a 2' buffer between the on-street parking spaces and the travel lane.

210.2.4 Pavement Cross Slopes

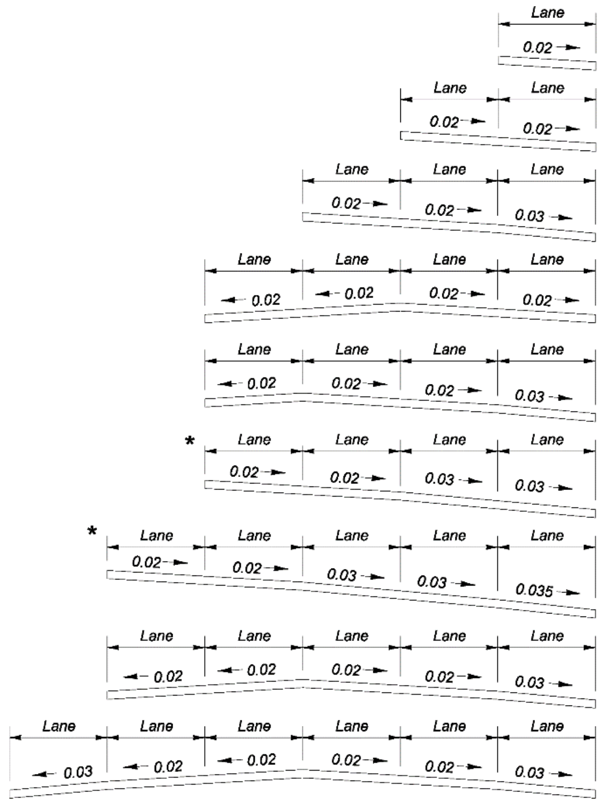
For roadways, the maximum number of travel lanes with cross slope in one direction is three lanes except as shown in ***Figure 210.2.1***, which prescribes standard pavement cross slopes. A Design Variation or a Design Exception is required when proposed pavement cross slopes do not meet the requirements shown in ***Figure 210.2.1***.

Outside auxiliary lane cross slopes must match or exceed adjacent travel lane cross slope. The outside auxiliary lane cross slope cannot exceed the values in ***Figure 210.2.1***. In superelevation transitions for separated free flow turning roadways, do not exceed the maximum algebraic differences shown in ***Table 210.2.2.***

The maximum algebraic difference in cross slope between adjacent through lanes is 0.04. The maximum algebraic difference in cross slope between a through lane and an auxiliary lane at a turning roadway terminal is given in ***Table 210.2.2***.

Cross slopes on bridges are to be on a uniform, straight-line rate, typically 0.02 (see ***FDM 260.4***). Use transitions to adjust for differences in cross slope between the approach roadway section and the required straight-line slope for bridge decks. Whenever possible the transition should be accomplished on the roadway section, outside the limits of the bridge and approach slabs. This will require detailing of the transition(s) in the roadway plans. Coordination between the Roadway, Drainage and Structures designers in the development of transitions is required to ensure compatibility and harmonizing at bridge approaches.

Figure 210.2.1 Standard Pavement Cross Slopes



All Travel Lanes One Direction

(1) These sections show only the standard slopes for adjoining travel lanes; they do not prescribe needed lanes, lane usage or typical section requirements other than lane slope. These slopes are not applicable to parabolic crowns.

(2) Maximum pavement cross slopes for tangent sections are:
   (a) 0.04 for design speeds of 45 mph or less
   (b) 0.03 for design speeds greater than 45 mph
   (c) 0.035 may only be used for 5-lanes sloped in one direction as shown above.

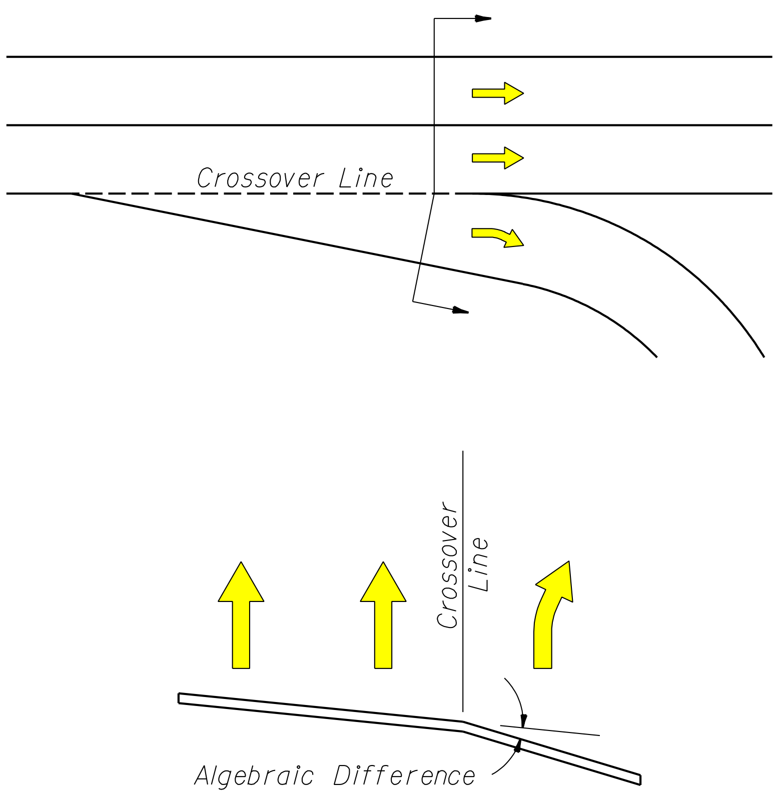
(3) The maximum change in cross slope between adjacent through lanes is 0.04.

(4) Slopes on multi-purpose lanes may be 0.03 to 0.05. Portions of multi-purpose lanes that are reserved for parking and access isles for the physically disabled are to have cross slopes not exceeding 1:50 (0.02) in all directions.

(5) 4 or 5 lanes sloped in one direction (*) may be used with design speed 65 mph or less and longitudinal grades not exceeding 5%.

Table 210.2.2 Maximum Algebraic Difference in Cross Slope at Turning Roadway Terminals

Design Speed of Exit or Entrance Curve (mph)	Maximum Algebraic Difference in Cross Slope at Crossover Line (%)
Less than 35	6.0
35 and over	5.0



210.2.4.1 RRR Criteria for Cross Slopes

Review the existing pavement and shoulder cross slopes for compliance with criteria. Field verify existing pavement and shoulder cross slopes by one of the following:

(1) Full Digital Terrain Model for the roadway width – evaluate cross slope on tangent sections at 100-foot intervals.

(2) Vehicle Mounted Scanner – prior to design, using the results of the scan, determine roadway limits where cross slope is potentially out of tolerance and request Digital Terrain Model of the roadway width for these limits. Evaluate cross slope on tangent sections at 100-foot intervals.

If cross slopes do not meet the values in ***Table 210.2.3***, additional cross sections may be required to develop cross slope correction details and estimate material quantities. Resurfaced pavement and shoulder cross slopes should meet new construction criteria. When cross slope correction is not practical, documentation in the design file is required. If existing conditions are within the allowable range shown in ***Table 210.2.3***, the term “Match Existing” may be used on the Typical Section(s) to indicate that the existing cross slope is to remain. Superelevation requirements are covered in ***FDM 210.9***.

When cross slope correction is necessary, work closely with the District Pavement Design Engineer and the District Pavement Materials Engineer to determine the appropriate method of correction. Tabulate existing cross slopes in the plans at 100-foot intervals within the limits of cross slope correction. Include cross slope correction details showing the method of correction in the plans (see examples in ***FDM 913***). Do not show cross slope correction details on the roadway cross sections. Base cross slope correction material quantities on the method of correction shown in cross slope correction details.

Table 210.2.3 RRR Criteria for Existing Roadway Cross Slopes

Facility or Feature	Standard (ft/ft)	Allowable Range (ft/ft)
Two-Lane Roads	0.020	0.015 - 0.030
Multilane Roads	0.020	0.015 - 0.040
	0.030	0.025 - 0.040
	0.035	0.030 - 0.040
Outside Shoulders	0.060	Adjacent Lane Cross Slope - 0.080
Inside Shoulders	0.050	0.020 - 0.080
Parking Lanes	0.050	0.015 - 0.050

Notes:

(1) Existing multilane curbed roadways may have outside travel or auxiliary lanes with a maximum cross slope of 0.05.

(2) Outside auxiliary lanes on flush shoulder roadways must match or exceed adjacent travel lane cross slopes with a maximum cross slope of 0.04.

(3) The maximum algebraic difference between adjacent through lanes must not exceed 0.06.

(4) When existing shoulders are to remain, the algebraic difference between the shoulder slope and adjoining roadway pavement slope must be ≤ 0.07.

(5) Parking spaces and access aisles dedicated to serving persons with disabilities must have cross slopes no steeper than 0.02 (1:50) in any direction.

Existing curbed roadways originally constructed with a parabolic crown section may be resurfaced using a series of tangents with a cross slope range from 0.015 to 0.05.

210.2.4.2 Hydroplaning Risk Analysis

The hydroplaning risk analysis predicts the water film thickness on the pavement being analyzed and the speed at which hydroplaning may occur. This information may support utilizing a non-compliant typical section when weighed against the cost of correcting pavement cross slope. For projects with design speeds of 60 mph or greater with 3 or more lanes sloped in one direction, refer to ***FDM 211*** for guidance for when a hydroplaning analysis is required and analysis procedures.

210.2.5 Lane Tapers

The minimum merging roadway transition length (L) is calculated as follows:

(1) Use $L = (W*S^2)/60$ for design speeds ≤ 40 mph

(2) Use $L = W*S$ for design speeds ≥ 45 mph

Where: L = length of taper, feet

W = width of lateral transition, feet

S = design speed, mph

Exhibit 210-1 through ***210-6*** illustrate standard roadway transitions. For conditions not addressed in these figures, use the following minimum taper lengths:

- Merging Taper = L
- Shifting Taper = L/2
- Shoulder Taper = L/3

Where an abrupt change in roadway typical (e.g., 4-lane section to a 6-lane section) a striped lane transition may be considered when all the following conditions are met:

- New pavement widths are not substantially greater than the joining pavement,
- Grade differentials are slight, and
- Future widening is expected.

210.2.6 Number of Lanes on the State Highway System

See ***Section 335.02(3)*** of the ***Florida Statutes*** for the number of lanes to be provided on the State Highway System. Nothing in this statute precludes a number of lanes in excess of ten lanes. The Department will determine the appropriate number of lanes based on traffic demand. Consideration will be given to availability of right of way and the capacity to accommodate other modes of transportation within existing rights of way.

Exceptions to ***Section 335.02(3)*** of the ***Florida Statutes*** will be addressed on a case-by-case basis, with final approval resting with the Secretary of Transportation.

Exhibit 210-1: Lane Divergence/Convergence

Exhibit 210-2: Paved Shoulder Treatment

Exhibit 210-3: 2 to 4 Lane Transitions: Left Roadway Centered

Exhibit 210-4: 4 to 2 Lane Transition: Left Roadway Centered

Exhibit 210-5: 2 to 4 Lane Transition: Right Roadway Centered

Exhibit 210-6: 4 to 2 Lane Transition: Right Roadway Centered

210.3 Medians, Islands, and Hardened Centerlines

210.3.1 Medians

Median width is expressed as the dimension between the inside edges of travel lanes. Medians perform the following functions:

- Provide separation of opposing traffic to minimize risk of head on crashes,
- Provide a recovery area for errant vehicles,
- Provide a stopping area in case of emergencies,
- Allow space for speed changes and storage of left-turning and U-turning vehicles,
- Minimize headlight glare,
- Provide width for future lanes,
- Provide pedestrian refuge,
- Control access.

Provide a raised or restrictive median (i.e., not a two-way left turn lane or centerline pavement marking) on divided roadways that have a design speed of 45 mph or greater. Median widths for divided roadways are given in ***Table 210.3.1***.

Median ditches must be designed to meet the following requirements:

- Have sufficient depth to provide positive drainage of the adjacent sub-grades. Typically, this requires a median depth of at least one foot below the sub-grade shoulder point.
- Have recoverable side slopes within the clear zone in order to facilitate the recovery of errant vehicles. See ***FDM 215*** for additional information on roadside safety.
- Have sufficient longitudinal gradient and hydraulic capacity to ensure good drainage.

See ***FDM 260.5*** for information on bridge medians.

Table 210.3.1 Median Widths

Context Classification		Curbed Roadways and Flush Shoulder Roadways (feet)		High Speed Curbed Roadways (feet)	Flush Shoulder Roadways (feet)
		Design Speed (mph)			
		25-35	40-45	50-55	≥ 50
C1	Natural	N/A	N/A	30	40
C2	Rural	N/A	N/A	30	40
C2T	Rural Town	15.5	22	N/A	N/A
C3	Suburban	22	22	30	40
C4	Urban General	15.5	22	N/A	N/A
C5	Urban Center	15.5	N/A	N/A	N/A
C6	Urban Core	15.5	N/A	N/A	N/A

Notes:

(1) On reconstruction projects where existing curb locations are fixed due to severe right of way constraints, the minimum median width may be reduced to 19.5 feet for design speeds = 45 mph, and to 15.5 feet for design speeds ≤ 40 mph.

(2) A minimum 6-foot median may be used within C5 and C6 context classifications only where left turn lanes are not expected.

(3) N/A indicates this combination of design speed and context classification is outside the intended design range and should be avoided. See ***Table 201.5.1*** for context classifications and design speed ranges.

210.3.2 Islands

An island is an area between traffic lanes that provide one or more of these primary functions:

(1) Channelization Islands: To control and direct traffic movement (usually turning) at intersections or driveways.

(2) Median Islands and Traffic Separators: To separate traffic in opposing or same direction (usually through movements), manage access points and turning movements, provide for delineation of narrow roadway medians, and provide for drainage. Typically referred to as "divisional islands" when separating traffic in opposing directions.

(3) Refuge Islands: To provide refuge for pedestrians.

Islands are generally elongated or triangular in shape and located in areas where motorized vehicle use is restricted. The placement of mast arms in channelizing islands is discouraged.

Island delineation is divided into three types:

(1) Curbing that raises the island

(2) Pavement markings or reflectorized markers placed on paved areas

(3) Pavement edges, possibly supplemented by delineators or a mounded-earth treatment beyond and adjacent to the pavement edges.

Delineation of small islands is primarily by curbs. Large, curbed islands may be sufficiently delineated by color and texture contrast of vegetative cover, mounded earth, shrubs, signs, or any combination of these. Use tubular markers at island noses as channelizing devices in addition to delineation. Curbed islands should not be used on high-speed flush shoulder roadways. Standard markings for islands are provided in the ***Standard Plans*, *Index 711-001***. See ***FDM 202*** for more information on speed management.

210.3.2.1 Channelization Islands

Islands must be large enough to command attention. Meet the following requirements when designing channelization islands:

(1) Curbed islands should have an area of 100 square feet or more, however, must not be less than:

  (a) 50 square feet for intersections within C4, C5, or C6 Context Classification

  (b) 75 square feet for intersections within C1, C2, C2T or C3 Context Classification

(2) Triangular islands should be at least 15 feet on a side, but not less than 12 feet, after rounding of corners.

(3) Side dimensions of curbed islands should not exceed 100 feet on high-speed facilities (e.g., high speed curbed roadway).

The approach and departure noses are rounded with radii of at least 3.5 feet. ***Figure 210.3.1*** illustrates a small island with a parallel offset. ***Figure 210.3.2*** illustrates a large island with a taper offset.

Approach ends of the island should be offset from the edges of the traveled way in order to funnel drivers smoothly into the desired path. The amount that a curbed island is offset from the through-traffic lane is influenced by the type of edge treatment and other factors such as island contrast, length of taper or auxiliary pavement preceding the curbed island. If a bike lane is adjacent to an island curb, no offset is needed.

Figure 210.3.1 Typical Small Curbed Island

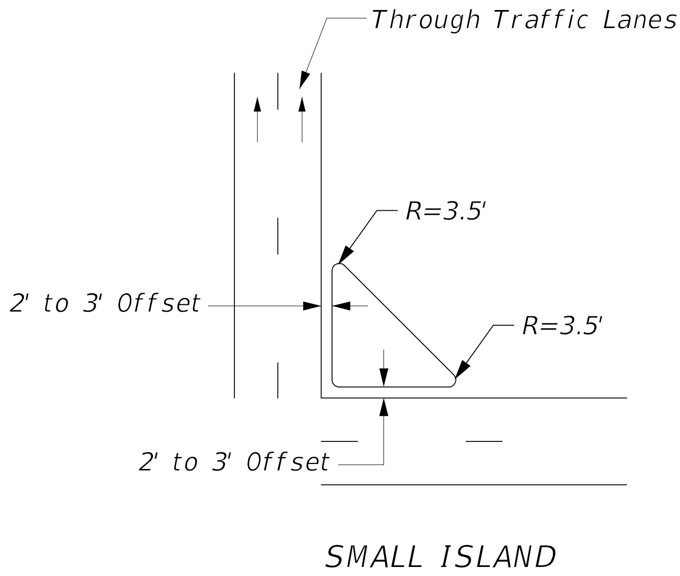
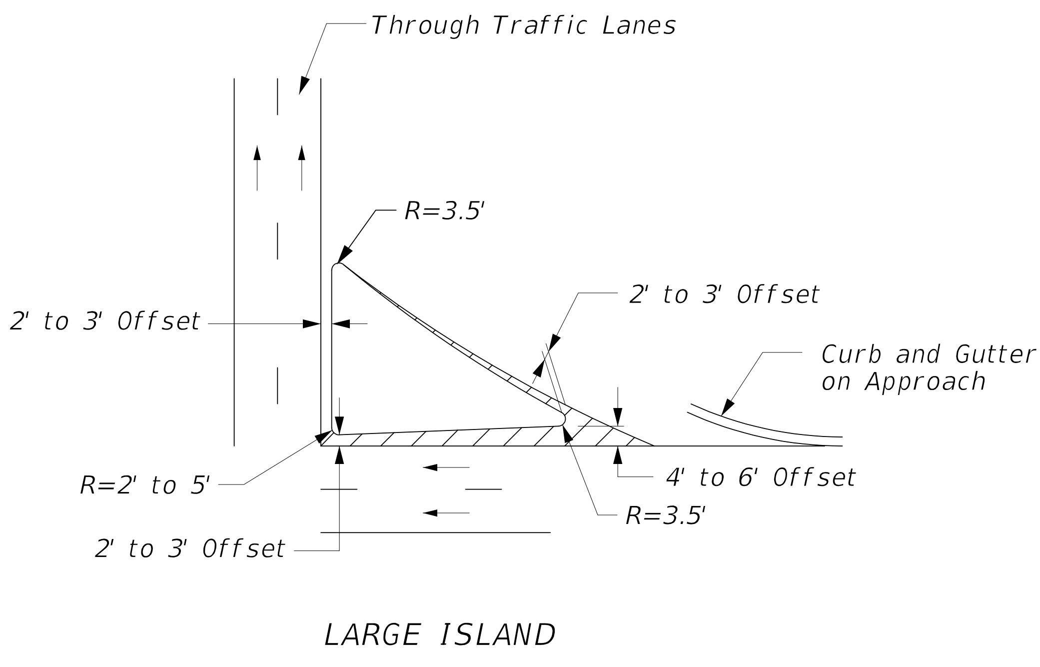


Figure 210.3.2 Typical Large Curbed Island



Where there are no curbs on the approach traveled way, the minimum offset of the edge of the curbed island to the through lane should be 1.5 to 3.5 feet. Where the approach roadway has a Type E curb, a similar curb on the island may be located at the edge of the through lane if there is sufficient length of curbed island to provide a gradual taper from the nose offset. Type F curbs should be offset from the through traveled way edge, regardless of the size of the curbed island. For intermediate and large-size islands that are uncurbed, offsets are desirable but not required. Fixed objects within the island areas must meet clear zone and lateral offset criteria found in ***FDM 215.2.3*** and ***215.2.4***.

210.3.2.2 Median Islands and Traffic Separators

Meet the following requirements when designing median islands and traffic separators:

(1) A minimum of 4 feet wide and 25 feet long. See ***FDM 223.2.4*** for width of separation for separated bicycle lanes.

(2) 100 feet or more in length is allowed on high-speed roadways when providing high visibility for the islands.

(3) Approach noses should be offset 2 to 6 feet from the through (approach) lanes to minimize impacts. Pavement markings in advance of the nose can be used to transition from the centerline to the edge of island.

(4) The shape of the island should be based on design turning paths and the island function. Curvilinear tapers comprised of parabolic or circular curves generally suffice.

(5) The length of the island should be related to the approach speed. An estimate is to use the length based on 3-second driving time to the intersection.

(6) Median islands should begin on tangent alignments and on upgrades or beyond crest vertical curves. In some cases, it is appropriate to extend a median island to avoid its introduction on a horizontal curve or within an area of limited sight distance.

(7) Approach noses must extend across the crosswalk at intersections to control left-turn speeds and encourage pedestrian use of the crosswalk. Use tubular markers as shown in the figures as channelizing devices.

 (a) For median island widths greater than or equal to 6 feet, use a refuge island. ***Figure 210.3.3*** illustrates the geometrics for curbed roadways (i.e., standard 6-foot nose extension and minimum nose extension for RRR projects).

 (b) For median island widths less than 6 feet, use hardened centerlines. See ***FDM 210.3.3*** for hardened centerlines.

Commentary: At intersections, median islands and hardened centerlines are effective at improving vehicle approach angles to the crosswalks resulting in increased visibility of the pedestrians. They are also effective in managing vehicle left-turn speeds which is in-line with the Safe System approach. These factors also provide increased confidence for pedestrians that they will be safer when crossing within the designated crosswalk.

Standard Plans*, *Index 520-020 provides detailed dimensional design for traffic separators.

See ***FDM 222.2.3.1*** for more information on crosswalks at intersections.

210.3.2.3 Refuge Islands

Refuge islands provide an area for pedestrians and bicyclists to stop before finishing the crossing of a roadway. Complex intersections can be made more navigable and midblock crossing can be facilitated with refuge islands. Refuge islands have specific design criteria to support pedestrian or bicyclist movement. See ***FDM 222*** for more information on Pedestrian Facilities.

Refuge islands must be a minimum of 6 feet wide in the dimension between the traveled ways; however, the preferred width is 8 feet or greater. For curbed roadways, this dimension is from face of curb to face of curb. Consider the refuge island's storage capacity for higher volumes of pedestrian and bicycle traffic, as well as the space needed for pedestrians or bicyclists with items such as strollers, wheelchairs, wagons, cargo bikes, box bikes, and bikes with trailers.

Provide a clear path through the island without obstruction by objects such as poles, signposts, or utility boxes. The width of the clear path through the island must be at least 5 feet to meet ADA requirements and should be equal to the width of the crosswalk. For additional requirements and information on intersection refuge islands see ***Figure 210.3.3***. See ***FDM 213.3.5*** for additional dimensional requirements for roundabout splitter islands. See ***FDM 222.2.3.2*** for more information on midblock crossings. For more information on depressed and raised sidewalks, see ***Standard Plans*, *Index 522-002***.

Refuge islands may be enhanced by low-growing landscaping of 18 inches tall or less and stormwater management features. See ***Drainage Manual*, *FDM 916*** (Drainage Structures Sheet), ~~***Drainage Manual***~~, ~~and~~ ***FDM*** ~~***228***~~ ***270*** (~~Landscape Design~~Planting Designs,) ***FDM 271*** (Irrigation Designs) and ***FDM 273*** (Landscape Maintenance Guide.)~~.~~

Examples of refuge islands at midblock crossings are shown in ***Figures 210. 3.4*** and ***210. 3.5.*** For more information on pavement markings, see ***Standard Plans*, *Index 711-001***.

FDM 212.12 provides information on the design of turning roadways with corner islands.

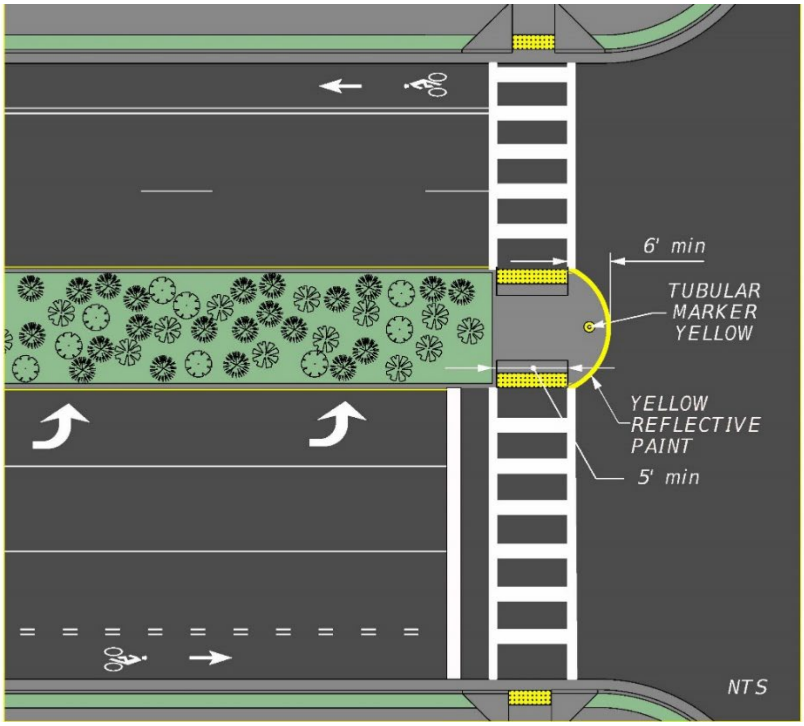
Roundabout splitter islands provide pedestrian refuge and are discussed in ***FDM 213.3.5***.

Commentary: The FDM figures depict ideal situations. Site specific conditions and RRR scenarios may require working around obstacles, such as drainage structures, that may result in final configurations different than shown in the FDM figures. For example, crosswalks may need to be angled slightly, off-set from the intersection more than is illustrated, or other modifications.

It may be necessary to assess tradeoffs between various safety measures. When doing so, approach decisions by considering which safety measure is most likely to reduce serious and fatal injury crashes. Consider prioritizing the safety measure that is most likely to reduce system kinetic energy. Look for creative solutions to work through concerns. For example, in some situations, signs or turn restrictions could help address pedestrian visibility concerns, and careful application of Design and Control Vehicle concepts could help address turning movements.

Figure 210.3.3 Intersection Refuge Island

For New and Reconstruction Projects with Raised Crossings:

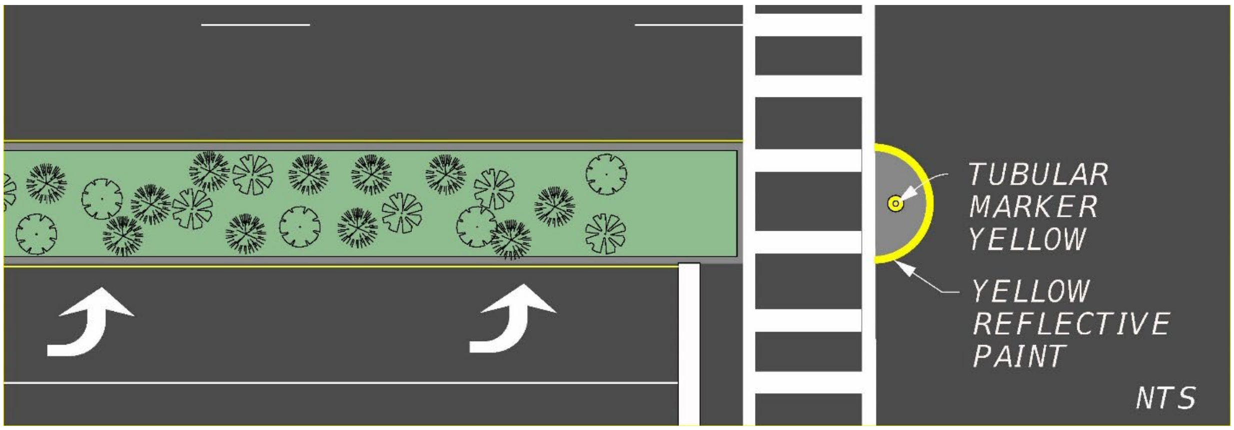


Notes:

- The median nose must be a concrete separator as shown in Standard Plan 520-020. Match the curb profile that is used for the adjacent median.

Figure 210.3.3 Intersection Refuge Island (Cont.)

For New and Reconstruction Projects with Depressed Crossings:



For RRR Projects Where Concrete Median Nose is Not Constructible in Constrained Conditions:

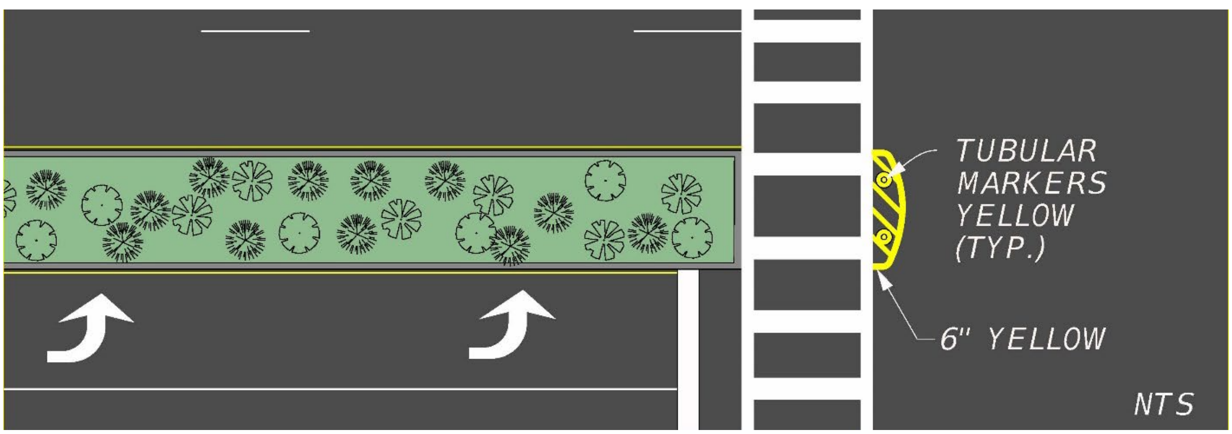


Figure 210.3.4 Midblock Refuge Island Example #1

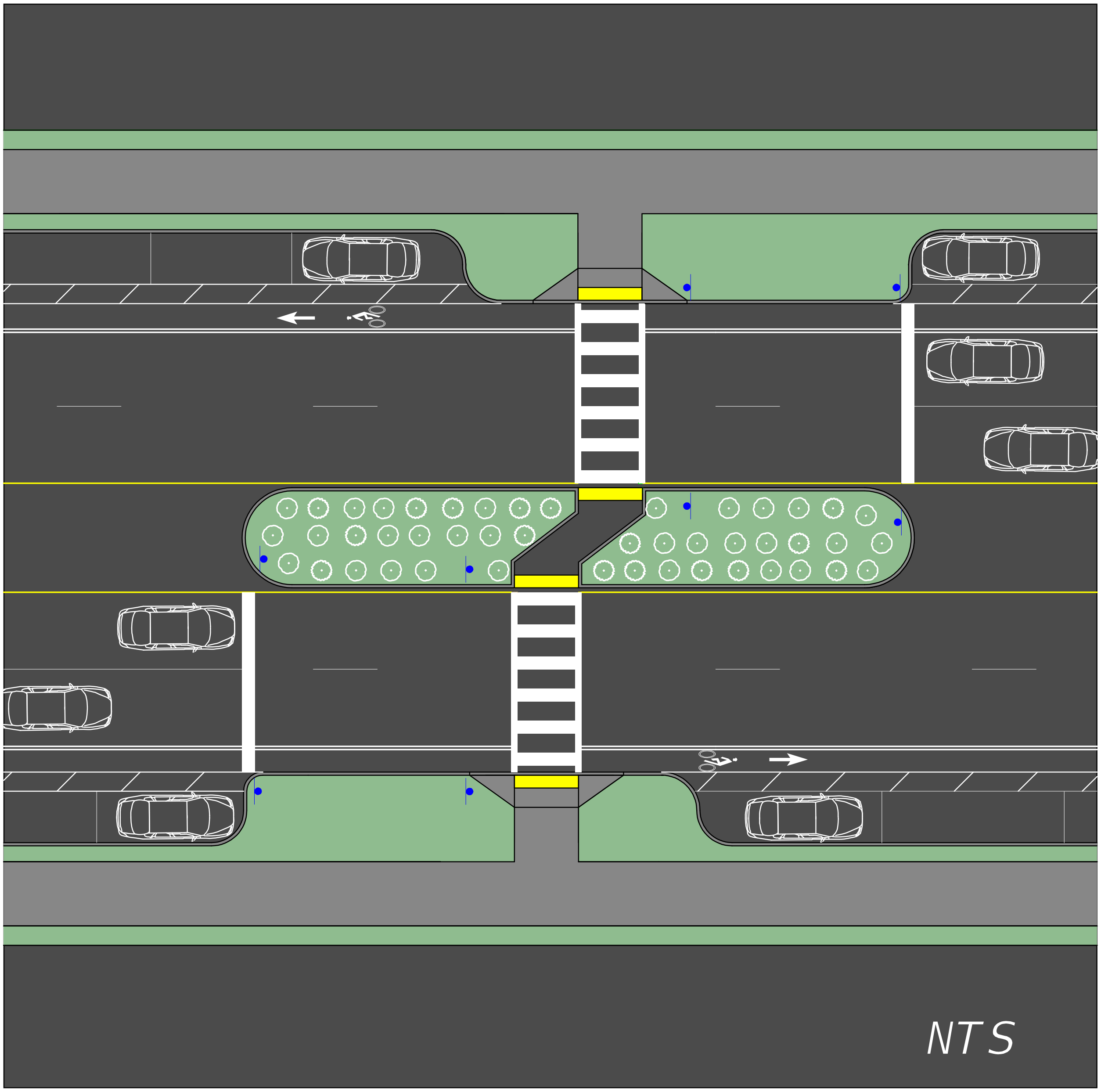
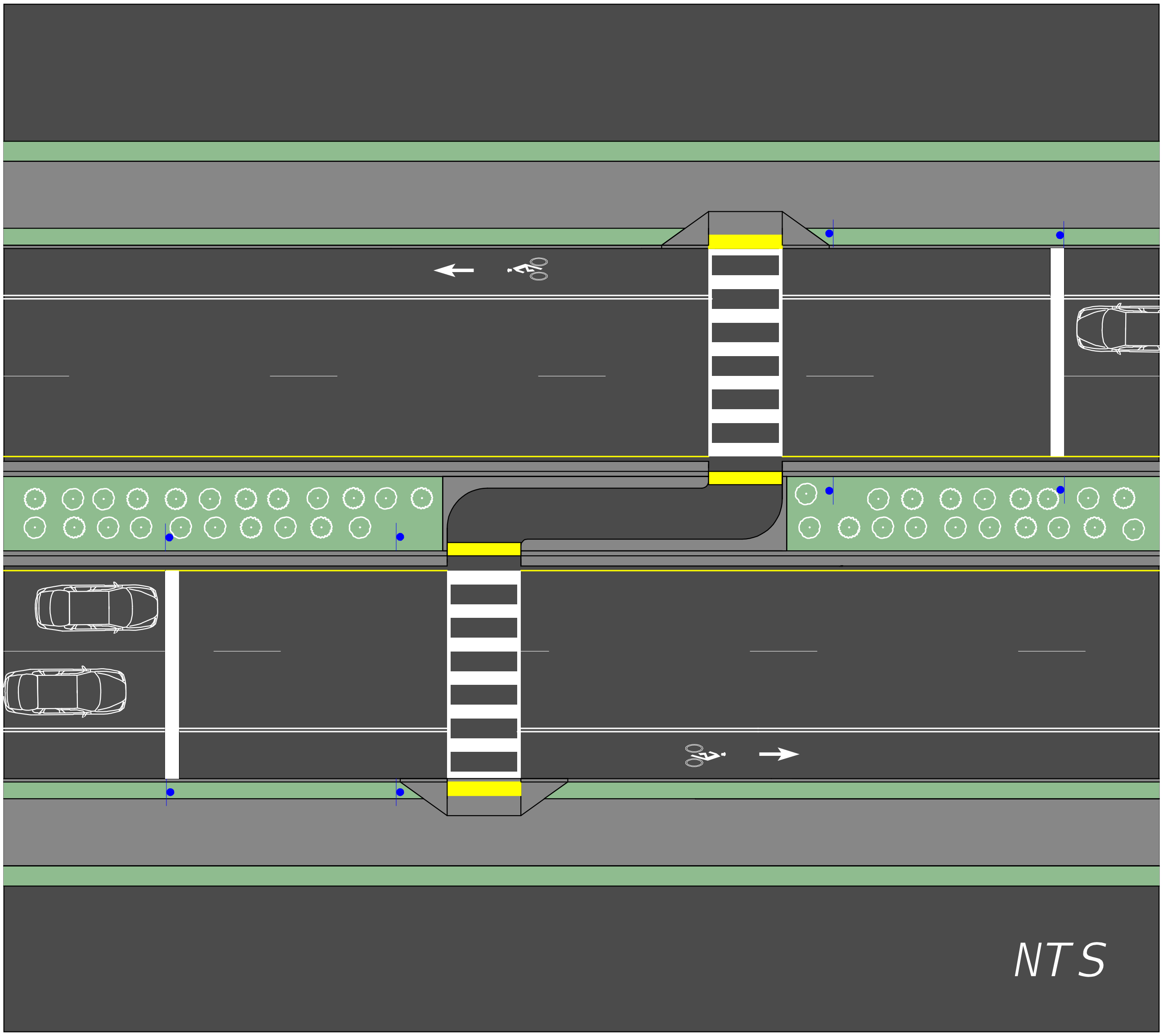


Figure 210.3.5 Midblock Refuge Island Example #2



210.3.2.4 Corner Islands

Where the inside edges of the traveled way for right turns are designed to accommodate semi-trailer combinations or where the design permits passenger vehicles to turn at speeds greater than 10 mph, the pavement area within the intersection may become excessively large and may create longer crossing paths for pedestrians. This may also occur at intersections with turning angles greater than 90 degrees. To avoid this condition, a corner channelizing island can be provided to form a separate turning roadway.

FDM 212.12 provides information on the design of turning roadways with corner islands.

210.3.3 Hardened Centerlines

Hardened Centerlines are an extension of the traffic separator or centerline past the crosswalk. Hardened Centerlines improve pedestrian safety by reducing the turning speeds of left-turning motorists and by improving their approach angle to the crosswalk to increase pedestrian visibility. See ***FDM 222*** for more information on Pedestrian Facilities.

Provide a hardened centerline where it is not possible to provide a pedestrian refuge island.

The nose extension can be no less than 2 feet long and must provide 1-foot of clear distance from the edge of the crossing traffic lane or bicycle lane. A 6-foot nose extension is preferred, but the designer can adjust the length to balance control of the left turning vehicle with the design vehicle turning path.

Where applicable, space multiple tubular markers a minimum of 2 feet and a maximum of 5 feet apart. Provide tubular markers for a minimum of 25 feet along the traffic separator or centerline approaching the crosswalk.

If tubular markers on the nose extension are not practicable to accommodate sight distance or turning radii, use a "channelizing curb" for the nose extension. Use ***Developmental Specification Dev703*** for channelizing curb. Detail channelizing curb in the plans showing the length of the nose extension as described above. Channelizing curb products are typically prefabricated in 6-foot lengths with additional length for the endcaps.

Hardened centerlines may be used with offset left turn lanes.

Figure 210.3.6 Hardened Centerline with Traffic Separator

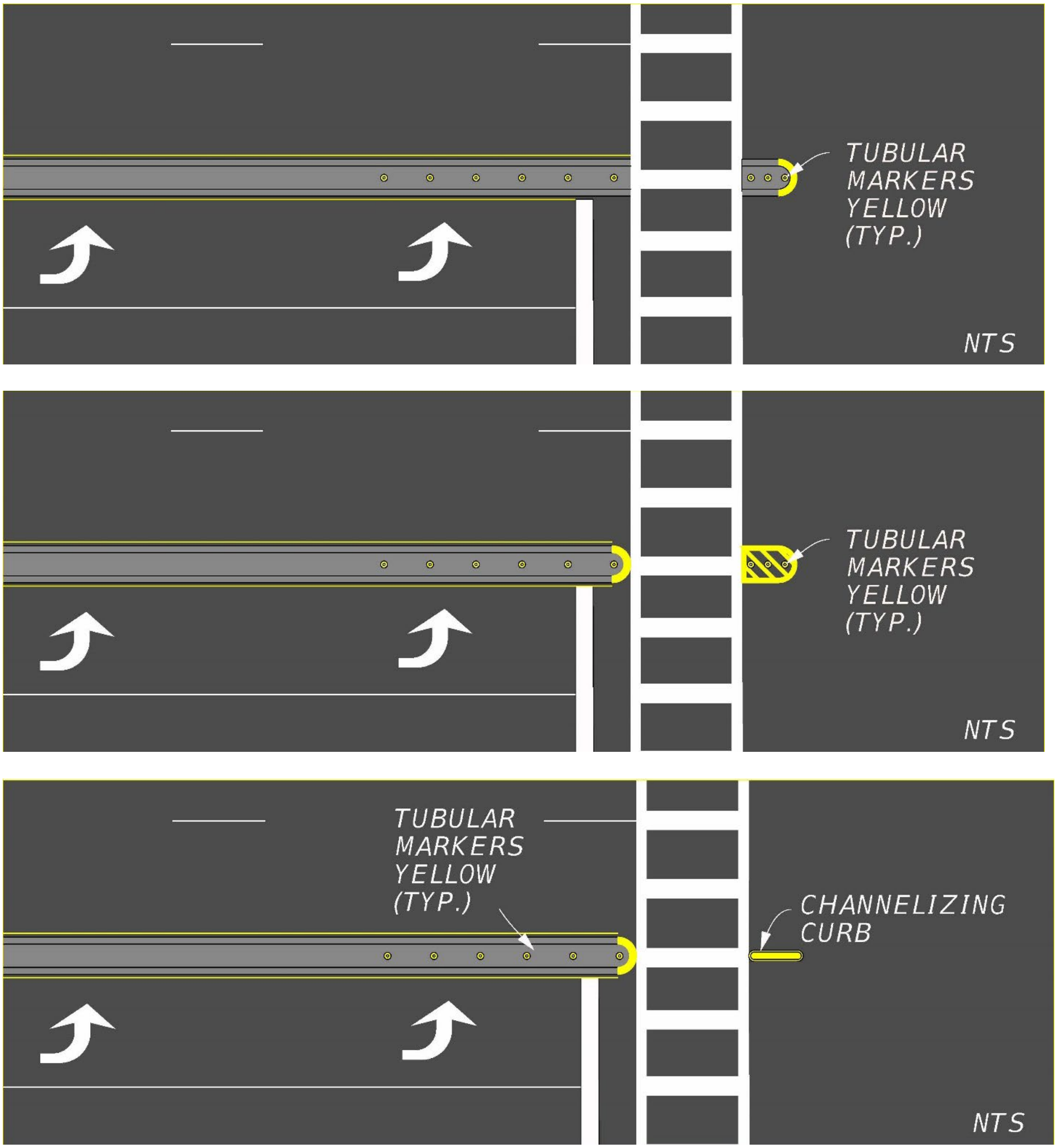
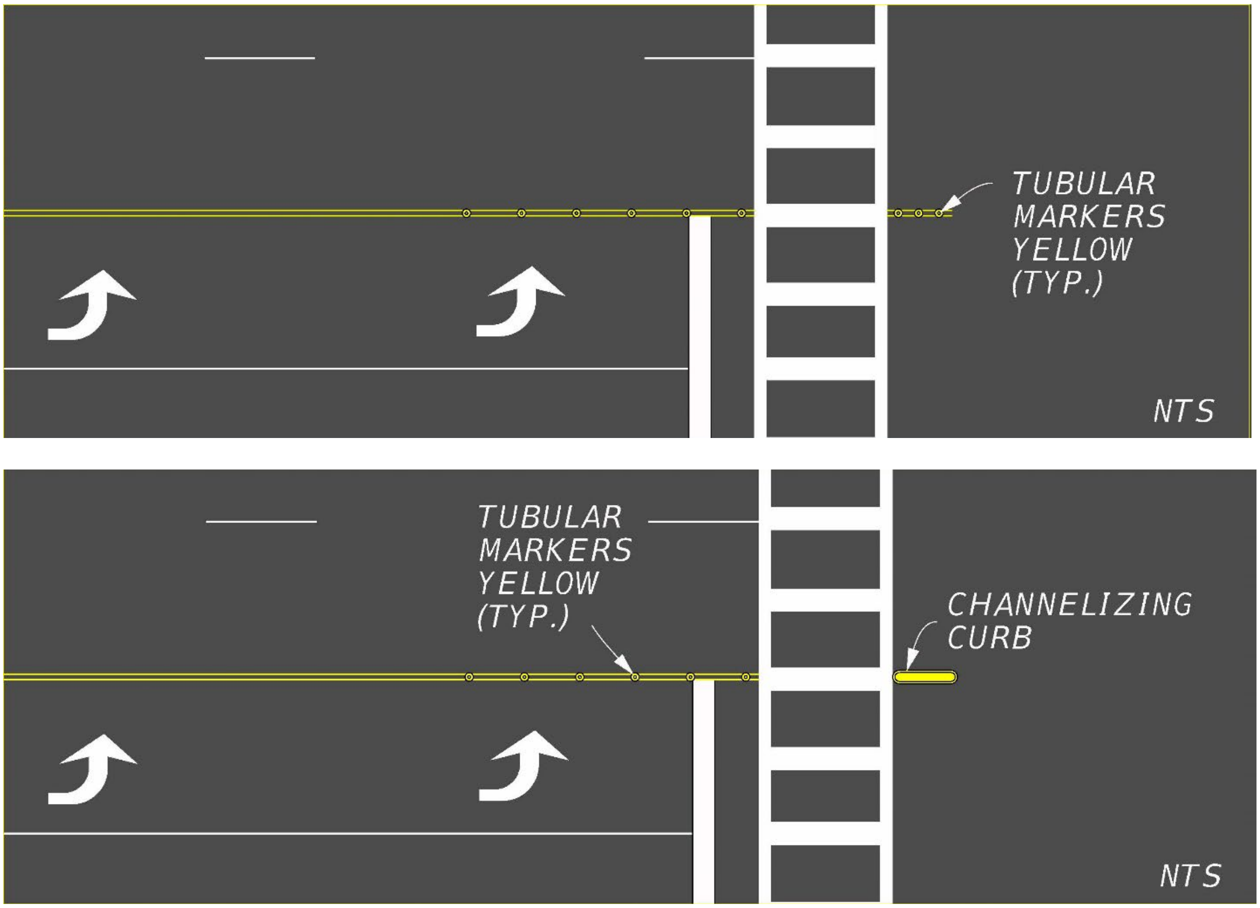


Figure 210.3.7 Hardened Centerline without Traffic Separator



210.4 Shoulders

Roadway shoulder width is measured from the edge of the traveled way to the shoulder break. A portion of the shoulder is required to be paved on all roadways on the State Highway System. A paved shoulder is the portion of the roadway contiguous with the traveled way for accommodation of errant vehicles, stopped vehicles, bicycle traffic, and emergency use.

When it is determined that the Helmeted Bicyclist Symbol and Bicycle Lane Arrow pavement markings (see ***FDM 223.2.2***) will be placed on the shoulder of a flush shoulder roadway, the paved width for Outside Shoulder without Shoulder Gutter must be 8 feet instead of the 5 feet shown in ***Table 210.4.1***.

Commentary: Paved shoulder widths greater than 5 feet and less than 8 feet are challenging to construct on flush shoulder roadways.

Standard asphalt paving machines have a main screed width of 8 feet or 10 feet (10 feet screed is most common), with 5-foot-wide extensions, connected at pivot points, on either side of the paver. The pivot points are the only locations on the paver where a cross slope break can be constructed. As such, up to a 5-foot-wide shoulder can be paved in conjunction with the adjacent travel lane. Shoulder widths that are 8-feet-wide or greater can be paved with a standard paver.

Due to these dimensional limitations of standard asphalt paving machines, constructing a paved shoulder width that is greater than 5 feet or less than 8 feet is challenging, and should be avoided when possible.

Shoulder widths for roadways are given in ***Table 210.4.1***. See ***Figure 210.4.1*** for an illustration of roadway shoulders. Refer to ***FDM 211*** for ramp shoulder widths. Refer to ***FDM 260.3*** for bridge shoulder widths.

Use shoulder gutter for the following conditions:

- On embankments higher than 20 feet
- On embankments higher than 10 feet where the longitudinal slope is greater than 2 percent
- On embankments, with slopes steeper than 1:6 for more than five feet vertically, to minimize erosion
- At bridge ends where concentrated flow from the bridge deck would run down the slope

- In areas of guardrail where embankment slopes are steeper than 1:4 and any pavement is sloped toward the embankment.

Construct roadway paved shoulders up to the railroad crossing shoulder pavement as shown in ***Standard Plans***, ***Index 830-T01***. For additional information see ***FDM 220*** and ***Standard Plans***, ***Index 509-070***.

Figure 210.4.1 Shoulder Width Identification

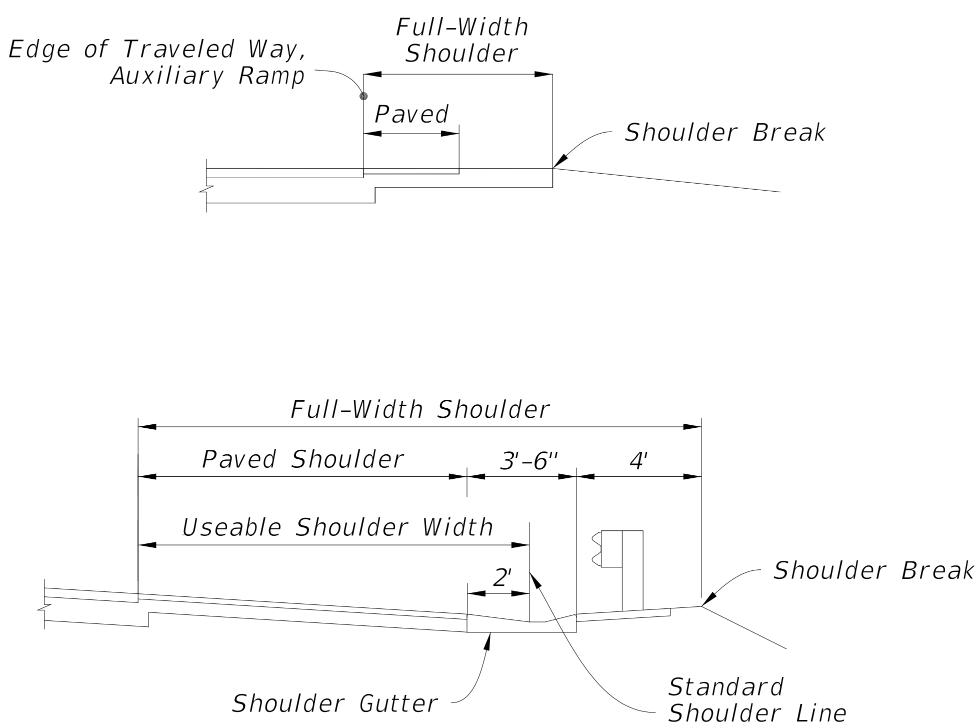


Table 210.4.1 Standard Shoulder Widths

Lane Type	# Lanes (One Direction)	Without Shoulder Gutter				With Shoulder Gutter			
		Outside		Median Or Left		Outside		Median Or Left	
		Full Width (feet)	Paved Width (feet)	Full Width (feet)	Paved Width (feet)	Full Width (feet)	Paved Width (feet)	Full Width (feet)	Paved Width (feet)
Travel Lanes	4-Lanes or more	10	5	10	4	15.5	8	15.5	8
	3-Lanes	10	5	10	4	15.5	8	15.5	8
	1-Lane & 2-Lanes	10	5	8	4	15.5	8	13.5	6
Aux. Lanes	ALL	10	5	8	4	11.5	4	11.5	4

Notes:

Without shoulder gutter:

(1) Consider 12-foot outside full width shoulder adjacent to travel lanes with high AADT or greater than 10% trucks.

(2) Consider providing a minimum 10-foot median shoulder where continuous barrier or guardrail is present.

(3) Outside shoulder widths for auxiliary lanes typically match those of the adjacent roadway; however, width may be reduced to 6-foot shoulder with 2-foot paved for right turn lanes when a bicycle keyhole is present.

(4) Pave the entire width of shoulders adjacent to concrete barriers. See ***FDM 215.4.6.1.***

(5) For RRR Projects:

(a) an existing full width shoulder of 6-foot or greater may be retained~~, and~~

(b) the following minimum existing outside paved shoulder widths may also be retained:

i. 4-foot ~~paved outside shoulder~~ adjacent to travel lane

ii. 2-foot ~~paved outside shoulder~~ adjacent to auxiliary lane

~~iii. 2-foot paved median or left shoulders adjacent to the travel and auxiliary lane.~~

(c) an existing unpaved median or left shoulder may be retained. Consider providing a 4-foot median or left paved shoulder adjacent to travel and auxiliary lanes where there are documented safety or maintenance concerns.

With shoulder gutter:

(1) Paved shoulders less than 6 feet in width with adjoining shoulder gutter must be the same type, depth, and cross slope as the roadway pavement.

(2) Shoulders must extend 4 feet beyond the back of shoulder gutter and have a 0.06 cross slope back toward the gutter.

(3) Required shoulder widths for auxiliary lanes typically match those of the adjacent roadway.

210.4.1 Shoulder Cross Slopes

The standard cross slope is 0.06 on the outside shoulder and 0.05 on the median (or left) side. ***Figure 210.4.2*** illustrates shoulder cross slopes in relationship to roadway cross slopes for normal and superelevated sections. For 5-foot (or less) paved shoulders, see ***Figure 210.4.3***. If the inside travel lane is sloping toward the median, then the inside shoulder cross slope may be increased to 0.06.

For projects constructed with concrete pavement, the first one foot of the outside shoulder is cast with the outside travel lane and will have the same cross slope (and superelevation) as the outside lane. Superelevation of the shoulder pavement is to be rotated about the outside edge of the outside slab.

For shoulder cross slope criteria on bridges see ***FDM 260.4***.

Figure 210.4.2 Shoulder Superelevation

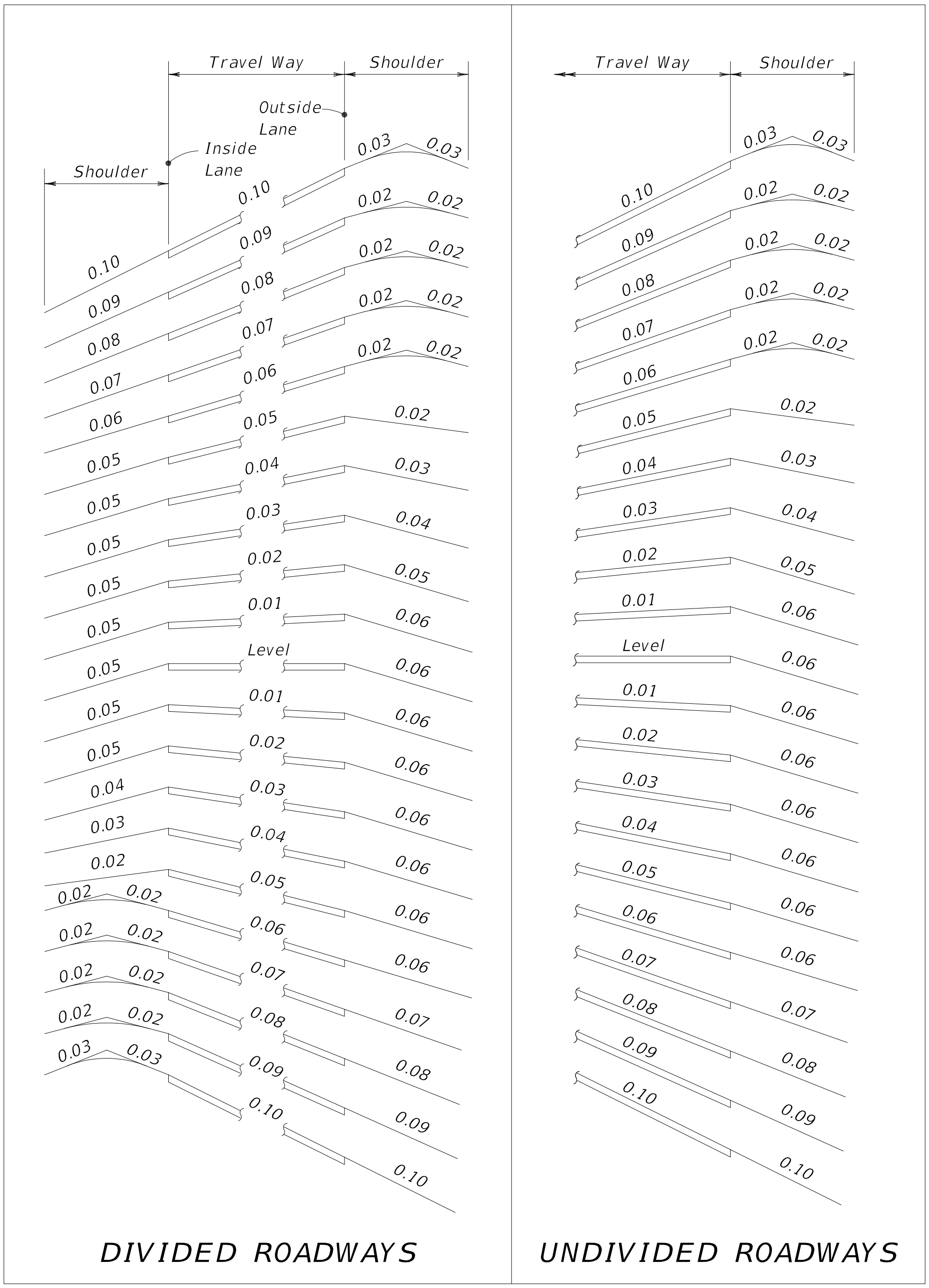
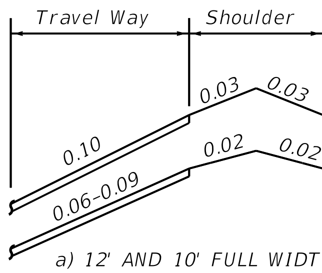
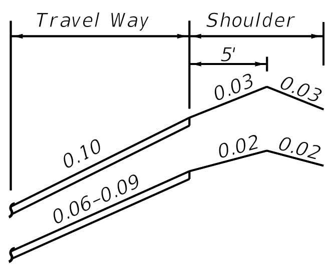


Figure 210.4.3 Special Shoulder Superelevation

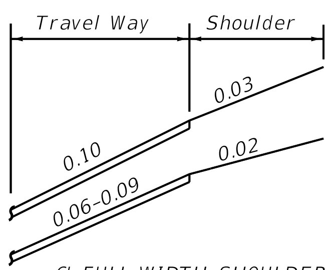


a) 12' AND 10' FULL WIDTH SHOULDERS WITH 5' OR LESS PAVED WIDTHS,

b) 8' FULL WIDTH SHOULDERS WITH 4' OR LESS PAVED WIDTHS,



8' FULL WIDTH SHOULDER WITH 5' PAVED WIDTH



6' FULL WIDTH SHOULDER WITH 5' OR LESS PAVED WIDTH

210.4.2 Typical Paving under Bridge

See ***FDM 260.7*** for requirements for paving under bridges.

210.4.3 Limits of Friction Course on Paved Shoulders

Extend friction course (closed and open graded) over the full width of the median and outside paved shoulders.

210.4.4 RRR Shoulder Treatment

Identify the shoulder treatment option in the plans when using ***Standard Plans***, ***Index 570-010***. Use Treatment I only if the shoulder is established with good soil and turf, and there is no significant shoulder erosion. Use Treatment II when an existing shoulder meets the overlay thickness requirements for Treatment I, but there is significant shoulder erosion.

210.4.5 Narrow Bridge Shoulder Warning Devices

The ***Standard Plans***, ***Index 700-106***, provides details for the shoulder treatment to be used on flush shoulder roadway approaches to a narrow bridge. This index provides standards for the placement of signing, striping, object markers and raised pavement marking (RPMs) for use at structures where the bridge shoulder width is less than the width of the useable shoulder on the approach roadway.

210.4.6 Audible and Vibratory Treatment

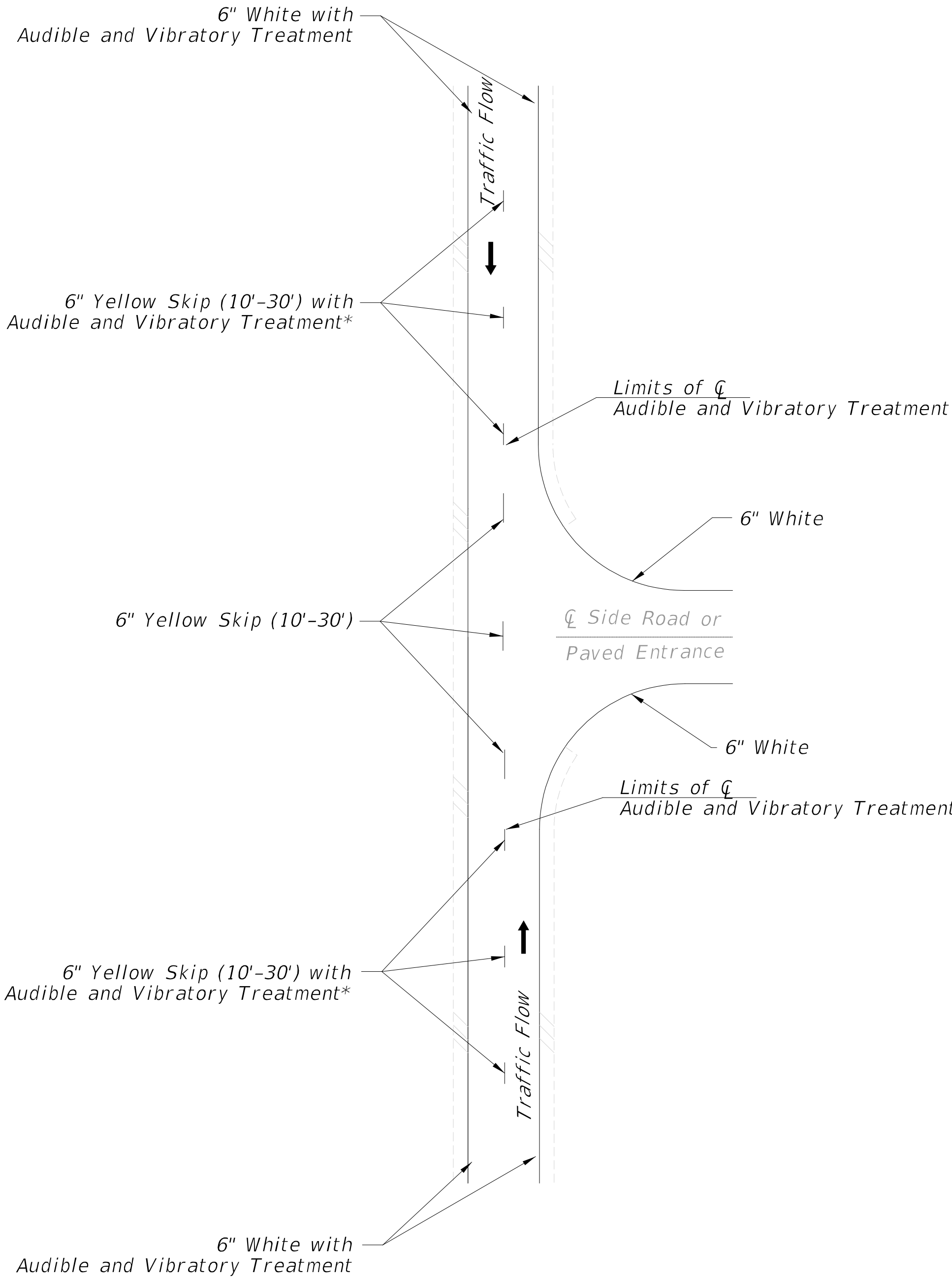
Provide audible and vibratory treatment (AVT) for edge lines and center lines on flush-shoulder roadways with a posted speed of 50 mph or greater. Do not place edge line AVTs on lanes that are less than 11 feet wide. Do not exclude sections of the project where advisory speeds are used due to restricted horizontal or vertical geometry. Do not place AVTs within the limits of crosswalks.

Use sinusoidal ground-in rumble strips on flexible pavements as shown in ***Standard Plans, Index 546-020***.

Use profiled thermoplastic on rigid pavements. Otherwise, use of profiled thermoplastic for any project including RRR, permits, push-button safety, and restriping projects must be approved by the State Roadway Design Engineer. ***Figure 210.4.4*** provides guidance for placement of AVTs. See ***FDM 940*** for information regarding plan requirements.

Ground-in rumble strips are to be quantified in the Signing and Marking Plans component set.

Figure 210.4.4 Audible and Vibratory Treatment Placement



* Since the drawing applies both Profiled Thermoplastic and Ground-in Rumble Strips, a visable line style for the Continuous Array Ground-in Rumble Strips cannot be shown here.

Figure 210.4.4 Audible and Vibratory Treatment Placement (Cont.)

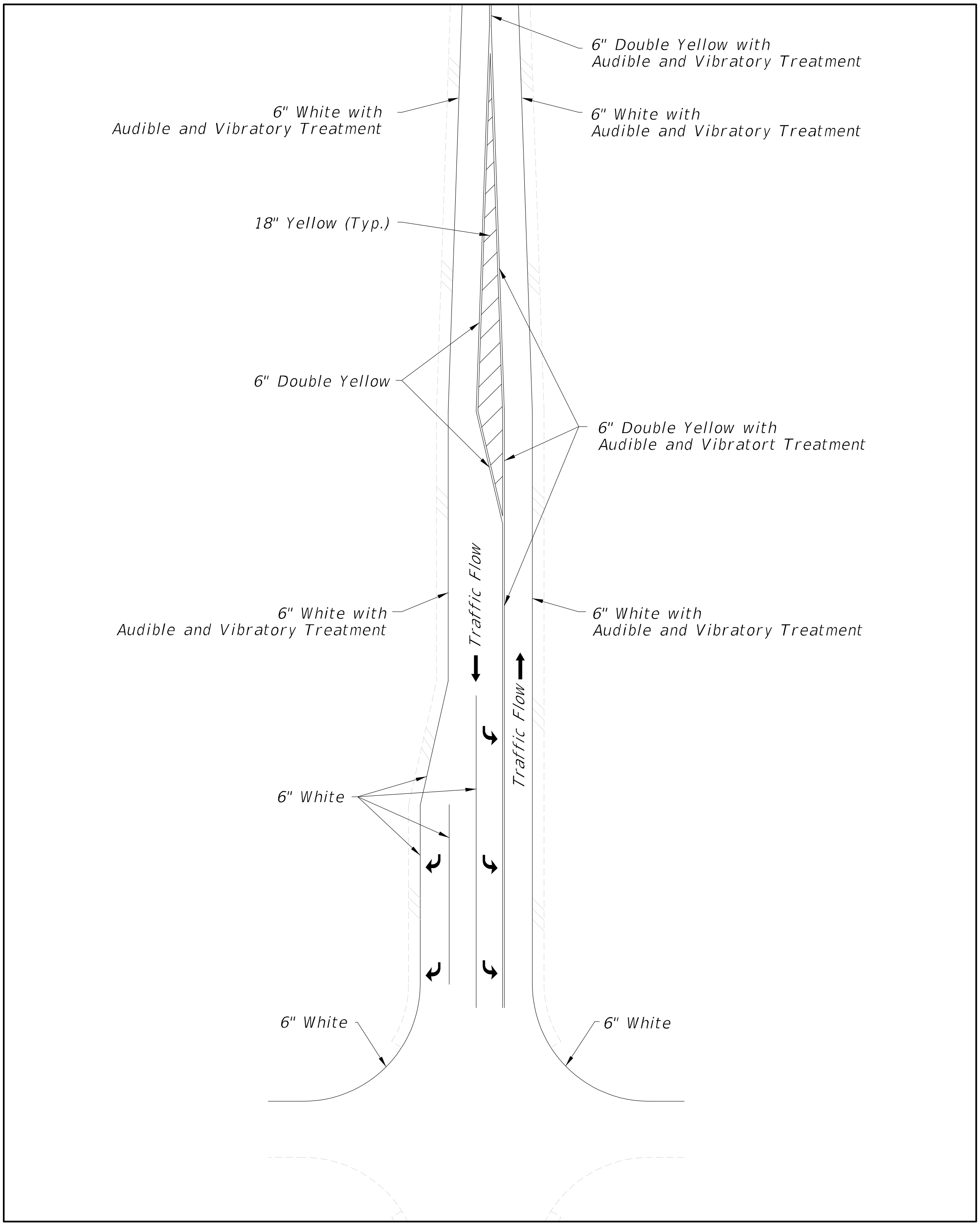


Figure 210.4.4 Audible and Vibratory Treatment Placement (Cont.)

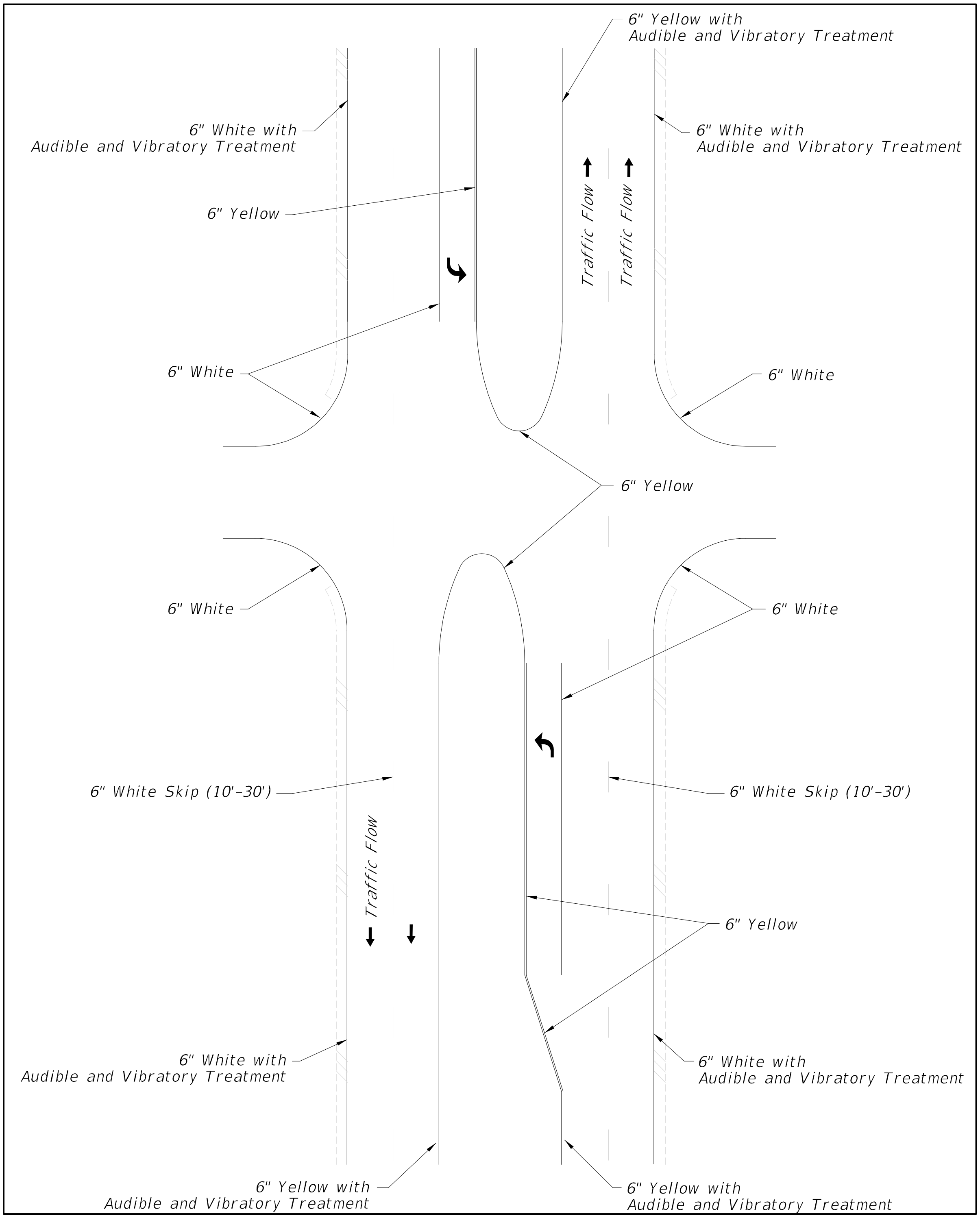


Figure 210.4.4 Audible and Vibratory Treatment Placement (Cont.)

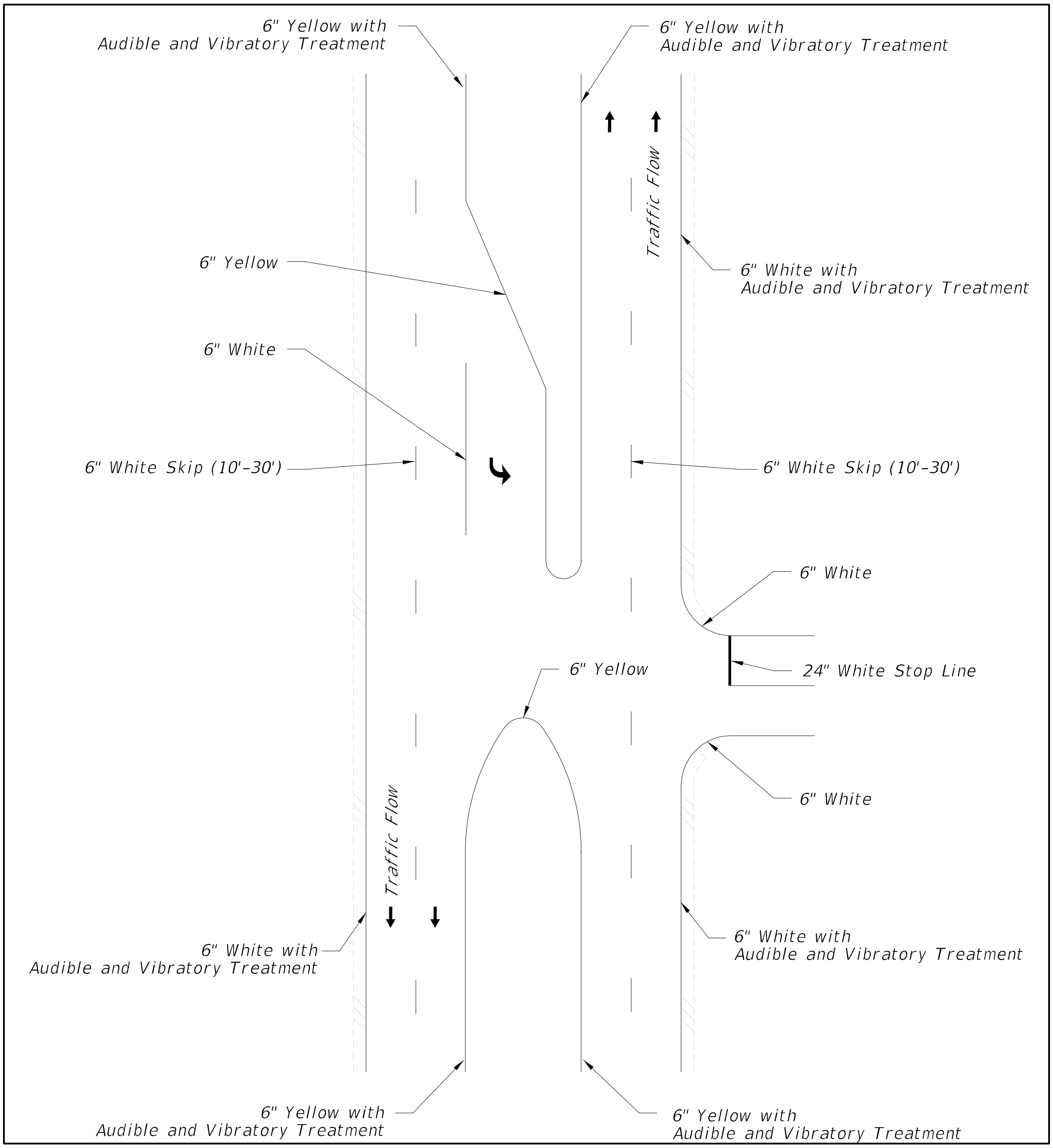
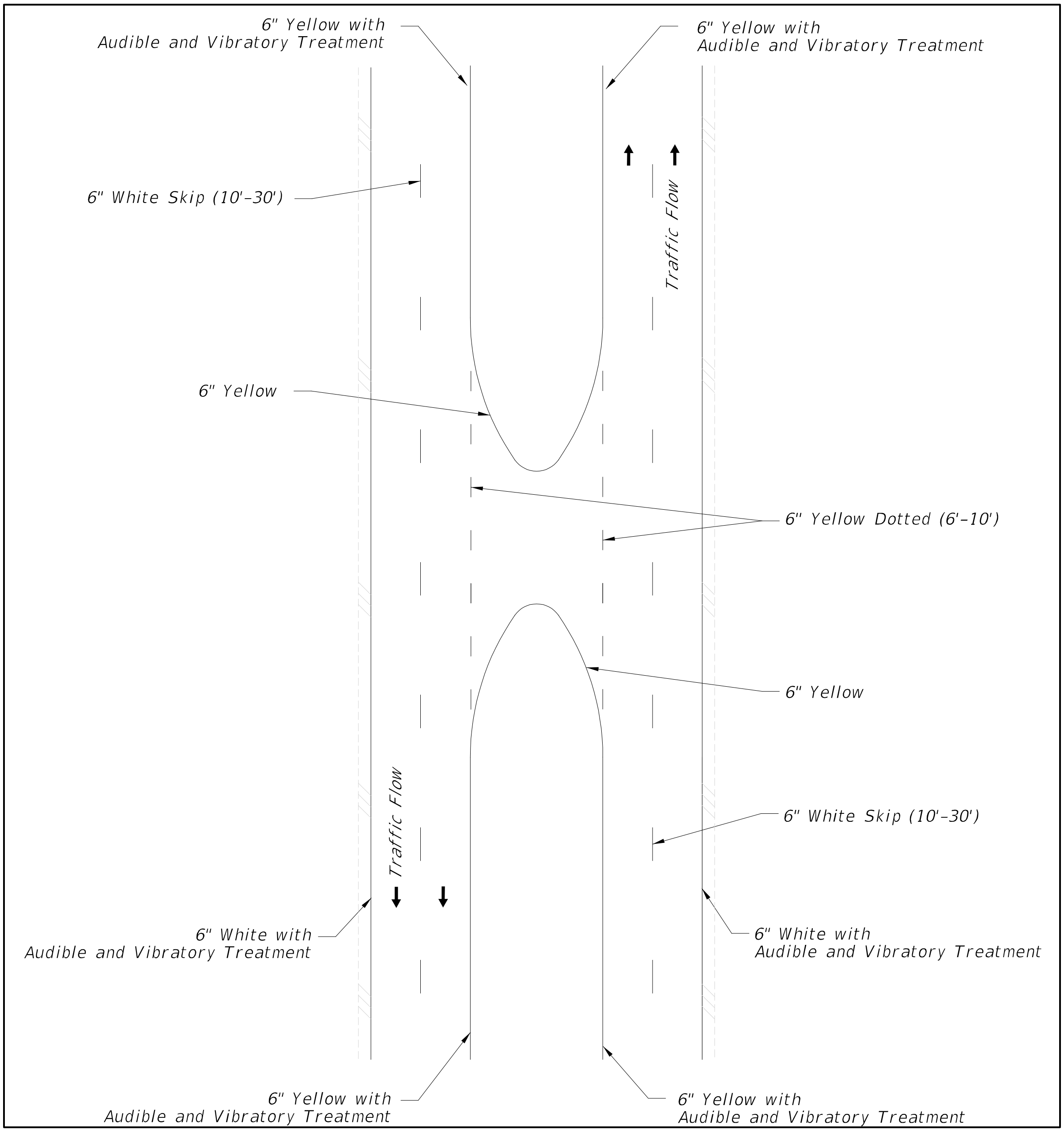


Figure 210.4.4 Audible and Vibratory Treatment Placement (Cont.)



210.5 Curbed Roadways

The term "curbed" includes all types of curbs and curb and gutter that are used on the state highway system and detailed in ***Standard Plans***, ***Index 520-001***.

The method of collecting and conveying drainage runoff and the availability of R/W determines the cross section; i.e. flush shoulder or curbed. When it is determined that a closed drainage system will be used, the selection of curb type will be based on the design speed.

Curbed roadways with design speeds of 45 mph or less, typically use Type F curb on the outside and Type E curb on the median (or left) side.

See ***FDM 215.2.7.2***, for additional information regarding curbs and their placement.

210.5.1 High-Speed Curbed Roadways

Curbs may be used on roadways where the anticipated operating speeds require a design speed of 50-55 mph and:

(1) Curbs are necessary to control drainage, or

(2) R/W is constrained

High speed curbed sections are typically used within C3 context classification and transitional areas.

High speed curbed roadways are to use Type E curb on both the median and outside. Provide an offset from the edge of the traveled way to the lip of gutter as follows:

(1) 4-foot to median curb for 4-lane roadway sections.

(2) 6.5-foot to median curb for 6-lane roadway sections.

(3) 6.5-foot to outside curb for all roadway sections.

The above median offsets are not required for left turn lanes adjacent to traffic separators or Type E curb. Outside offsets for right turn lanes may be reduced to 4.5-foot when a bicycle keyhole is provided.

210.6 Roadside Slopes

Criteria and details for roadside slopes are included in ***FDM 215***.

The following guidance is being provided to designers for consideration during project design. Additional sod requirements are provided ~~in the *FDOT Drainage Design Manual* and~~ in the ***Standard Plans**, **Indexes 570-001*** and ***571-010***.

- Sod should be considered for slopes 1:4 or steeper. For all other areas, refer to ***FDOT Drainage ~~Design~~ Manual***, Chapter 2, Table 2.5, for additional guidance on maximum velocity for each lining type.
- Sod should be used for projects with less than 10,000 square feet of disturbed area.
- Sod should be considered for narrow areas less than six feet.
- A minimum 48" of sod should be considered for back of sidewalk areas as applicable.
- Sod should be considered in areas of concentrated runoff (i.e., bottom of vertical curves, inside areas of superelevated curves, tangent sections, and outside of curves). Refer to ***Standard Plans**, **Index 570-001*** for sodding requirements.
- Refer to ***Standard Plans**, **Index 570-010*** for milling and resurfacing projects or major projects with portions of milling and resurfacing.

210.7 Border Width

Border width provides space for:

(1) Roadside design components such as signing, signals, lighting, drainage features, guardrail, fencing and clear zone, sidewalks with ADA provisions, traffic control devices, fire hydrants, storm drainage features, bus and transit features, permitted public utilities and space for aesthetic features such as sod and other landscape items.

(2) A buffer between vehicles and pedestrians,

(3) Construction and maintenance of the facility, and

(4) Permitted public utilities.

Required border width is provided in ***Table 210.7.1***. Border width is measured to the R/W line as follows:

- **Flush shoulder roadways**: from the shoulder break.
- **Curbed roadways**: from the outside edge of the pavement (lip of gutter).
- **High-speed curbed roadways**: from the outside edge of the traveled way.

Table 210.7.1 Minimum Border Width

Context Classification		Minimum Border Width (Feet)					
		Curbed and High-Speed Curbed Design Speed (mph)				Flush Shoulder Design Speed (mph)	
		25-40	45	50	55	25-45	≥ 50
C1	Natural	N/A	N/A	29	35	N/A	40
C2	Rural	N/A	N/A	29	35	N/A	40
C2T	Rural Town	12	14	N/A	N/A	33	N/A
C3	Suburban	12	14	29	35	33	40
C4	Urban General	12	14	N/A	N/A	33	N/A
C5	Urban Center	12	N/A	N/A	N/A	N/A	N/A
C6	Urban Core	14	N/A	N/A	N/A	N/A	N/A

Notes:

(1) On low-speed curbed roadways that have an adjacent bike lane, the required border width shown in the table may be reduced by 2 feet.

~~(2) On existing roadways where R/W cannot be acquired or where the decision has been made to simply maintain and preserve the facility, the absolute minimum border under these conditions is 8 feet. No Design Variation is required for this condition.~~

(2) On existing roadways:

a. When R/W is not being acquired:

i. Unmodified existing border width may remain (e.g., a resurfacing only project)

ii. Modified existing border width must not be less than 8 feet (e.g., when adding a right turn lane)

b. When R/W is being acquired, border width should meet new construction criteria shown in the table. Provide a segment of sufficient length to assure continuity.

~~(3) On existing roadways where R/W is being acquired for other reasons, the minimum border width should be that used for new construction projects; however, the minimum length of wider border width must be a segment of sufficient length to provide reasonable continuity.~~

~~(4)~~(3) N/A indicates this combination of design speed and context classification is outside the intended design range and should be avoided. See ***Table 201.5.1*** for context classifications and design speed ranges.

210.8 Horizontal Alignment

The centerline (CL) or baseline (BL) of construction defines the horizontal alignment for roadway and bridge construction. The CL or BL of construction is a series of tangents connected by horizontal curves established by the Engineer of Record (EOR). CL or BL of construction may be the same alignment as the BL of survey.

Horizontal alignment should be consistent with the anticipated operating speed and with environmental, physical, and economic constraints. Design speed is the principal factor controlling horizontal alignment.

Avoid placing horizontal curves, point of intersection (PI), and superelevation transitions within the limits of a structure or approach slabs. Placement of stationing equations within the limits of a structure should be avoided on contract plans. Such equations unnecessarily increase the probability of error in both the design and construction phase.

210.8.1 Deflections in Alignment

The point where tangents intersect is known as the PI. Avoid the use of a PI with no horizontal curve; however, there may be conditions where it is necessary (e.g., closely spaced intersections in areas with limited R/W). The maximum deflection without a horizontal curve are as follows:

- Flush shoulder and curbed roadways with design speed 40 mph and less is 2^{o}00’00”.
- Flush shoulder roadways with design speed 45 mph and greater is 0^{o}45’00”.
- Curbed roadways with design speed of 45 mph is 1^{o}00’00”.
- High speed curbed roadways with design speed 50 mph and greater is 0^{o}45’00”.

210.8.1.1 Intersections

Refer to ***FDM 212*** for information regarding deflections through intersections.

210.8.2 Horizontal Curves

A horizontal curve should not be introduced near the crest of a vertical curve. The combination of horizontal and vertical curves can negatively impact sight distance and can also greatly reduce the approaching driver's ability to perceive a horizontal curve ahead. The condition can be avoided by having the horizontal curvature lead the vertical curvature; i.e., the horizontal curve is made longer than the vertical curve.

Flatter curvature with shorter tangents is preferable to sharp curves connected by long tangents; i.e., avoid using minimum horizontal curve lengths.

Table 210.8.1 provides the horizontal curve lengths to be used in establishing the horizontal alignment. Refer to ***Table 210.8.3*** for compound curves.

Table 210.8.1 Length of Horizontal Curve

<table>
<tr><th colspan="11">Desired Length Based on Design Speed (mph)</th></tr>
<tr><th>mph</th><th>25</th><th>30</th><th>35</th><th>40</th><th>45</th><th>50</th><th>55</th><th>60</th><th>65</th><th>70</th></tr>
<tr><th>feet</th><td>400</td><td>450</td><td>525</td><td>600</td><td>675</td><td>750</td><td>825</td><td>900</td><td>975</td><td>1050</td></tr>
<tr><th colspan="6">Desired Length Based on Deflection Angle</th><td colspan="5" rowspan="3"><u>Notes:</u>
(1) The desired horizontal curve length shall be the greater of the lengths based on design speed and length based on deflection angle.
(2) When desirable horizontal curve length cannot be attained, provide the greatest attainable length possible, but not less than 400 feet.</td></tr>
<tr><th>degrees</th><th>5º</th><th>4º</th><th>3º</th><th>2º</th><th>1º</th></tr>
<tr><th>feet</th><td>500</td><td>600</td><td>700</td><td>800</td><td>900</td></tr>
</table>

210.8.2.1 Existing Horizontal Curves

Evaluate existing curves against the values shown in ***Table 210.8.2***. The review should include crash history and an on-site review for evidence of roadway departure or operational problems in the area of concern.

Table 210.8.2 Minimum Radius for Evaluation of Existing Horizontal Curves

Maximum Superelevation (e_{max})		Minimum Radius (feet)									
		Design Speed (mph)									
		25	30	35	40	45	50	55	60	65	70
0.10	SHS	160	231	323	432	559	694	881	1091	1348	1637
	RRR	120	188	276	388	521	674	849	1042	1273	1528
0.05	SHS	194	286	402	533	694	881	N/A	N/A	N/A	N/A
	RRR	140	223	332	468	637	849	N/A	N/A	N/A	N/A

Condition #1 – A horizontal curve that meets or exceeds the SHS minimum radius shown in ***Table 210.8.2*** is satisfactory unless there is a significant crash history (3 or more crashes within the most recent available 5-year location verified data) or other evidence of safety or operational problems. If problems are identified, include corrective measures in the project.

Condition #2 – A horizontal curve that is below the SHS minimum radius shown in ***Table 210.8.2*** but meets or exceeds the RRR minimum radius shown in ***Table 210.8.2*** must be reviewed for specific safety problems at the curve. If the review indicated significant operational or safety problems exist, the curve should be reconstructed. If problems are identified but reconstruction is not warranted, include corrective measures in the project.

Condition #3 – A horizontal curve that does not meet the RRR minimum radius shown in ***Table 210.8.2*** must be reconstructed or a Design Exception or Design Variation obtained. A reconstructed curve must meet the new construction values shown in ***Tables 210.8.1***, ***210.9.1***, ***210.9.2***, and ***210.9.3***.

210.8.2.2 Compound Curves

Although the use of compound curves is discouraged, there may be conditions where it is necessary. Avoid sudden changes from flat to sharp curves. For compound curves on open highways, the ratio of the flatter radius to the sharper radius is not to exceed 1.5:1. For compound curves on turning roadways and at intersections, a ratio of 2:1 may be used where the flatter radius precedes the sharper radius in the direction of travel.

The length of compound curves (arc length) for turning lanes are provided in ***Table 210.8.3***.

Table 210.8.3 Minimum Compound Curves Arc Lengths on Turning Roadways

Minimum Arc Length (feet)							
	Radius (feet)						
	100	150	200	250	300	400	≥ 500
Desirable	65	70	100	120	150	180	200
Minimum	40	50	65	85	100	120	150

Notes:

(1) Provide the desirable arc length. When the desirable length cannot be attained, provide the greatest attainable length possible, but not less than the minimum values.

210.8.2.3 Reverse Curves

Reverse curves are curves in opposite directions on a common tangent that are located in close proximity to each other. Avoid using reverse curves unless a sufficient length (see ***FDM 210.9.1***) of tangent is included between the curves to provide for superelevation transition.

210.9 Superelevation

Use a maximum superelevation rate of 0.10 on high-speed roadways. Tabulated superelevation rates for high-speed roadways are provided in ***Table 210.9.1***.

Use a maximum superelevation rate of 0.05 on low-speed roadways. Tabulated superelevation rates for low-speed roadways are provided in ***Table 210.9.2***.

Design non-limited access ramps using the arterial roadway criteria. Additional data is contained in the ***Standard Plans*****, *Index 000-510*** and ***000-511***.

Provide the following minimum lengths of full superelevation within horizontal curves:

(1) 100 feet for design speed ≤ 45 mph.

(2) 200 feet for design speeds ≥ 50 mph.

210.9.1 Superelevation Transitions

The standard superelevation transition places 80% of the transition on the tangent and 20% on the curve. Superelevation transition slope rates are provided in ***Table 210.9.3***.

In transition sections where the travel lane(s) cross slope is less than 1.5%, provide one of the following grade criteria:

(1) Maintain a minimum profile grade of 0.5%

(2) Maintain a minimum edge of pavement grade of 0.2% (0.5% for curbed roadway).

When superelevation is required for reverse curves, a suitable tangent length between the curves is determined as follows:

(1) 80% of the transition for each curve should be located on the tangent.

(2) Tangent length is equal to or greater than the sum of the two 80% distances.

(3) Where alignment constraints require an adjustment to the superelevation transition, not more than 50% of the transition may be placed on the curve.

210.9.2 RRR Criteria for Superelevation

Superelevation and transition requirements are provided in ***FDM 210.9.***

For all curves:

- If there are any crashes within the last 5 years that are attributed to superelevation, correct the superelevation rates to the new construction values provided in ***Tables 210.9.1*** and ***210.9.2***.

For Low-Speed Curves:

- If the existing superelevation rates are within 0.5% (+/-) of the new construction values in ***Table 210.9.2,*** superelevation rate correction is not required.
- If the existing superelevation rates are **not** within 0.5% (+/-) of the new construction values in ***Table 210.9.2***, correct the superelevation rates. A Design Variation is required to leave the deficient curve in place.

For High-Speed Curves and all ramps (regardless of speed):

- If the existing superelevation rates are within the range of derived values from the e_{max} = 6% and e_{max} = 12% tables in ***AASHTO A Policy on Geometric Design of***

Highways and Streets (***AASHTO Green Book***), superelevation rate correction is not required.

- If the existing superelevation rates are outside of the range of derived values from the ***AASHTO Green Book*** e_{max} = 6% and e_{max} = 12% tables, correct the superelevation rates. A Design Exception is required to leave the deficient curve in place.

210.9.2.1 Superelevation Correction

This type of work may involve variable depth milling and asphalt layers. Provide the following information in the plans:

(1) Details showing how the transition from normal cross slope to superelevation is to be achieved.

(2) A table that summarizes the estimated quantities for milling, overbuild, and structural courses will be necessary.

(3) Cross sections depicting superelevation correction for the following locations:

  (a) At the PC and at the PT.

  (b) Fifty feet before and after the PC and PT.

  (c) At 300 ft. intervals within the curve.

For curbed roadways, superelevation correction should be provided by reconstructing or adjusting the curve to accommodate overbuild. When a correction is not possible, provide other measures appropriate to improve identified safety or operational problems.

Table 210.9.1 Superelevation Rates for e_{max} = 0.10

Superelevation Rates (e_{max} =0.10) Tabulated Values										
Degree of Curve (D)	Radius R (ft.)	Design Speed (mph)								
		30	35	40	45	50	55	60	65	70
0° 15'	22,918	NC	NC	NC	NC	NC	NC	NC	NC	NC
0° 30'	11,459	NC	NC	NC	NC	NC	NC	RC	RC	RC
0° 45'	7,639	NC	NC	NC	NC	RC	RC	0.023	0.025	0.028
1° 00'	5,730	NC	NC	NC	RC	0.021	0.025	0.030	0.033	0.037
1° 15'	4,584	NC	NC	RC	0.022	0.026	0.031	0.036	0.041	0.046
1° 30'	3,820 *R_{NC}	NC	RC	0.021	0.026	0.031	0.037	0.043	0.048	0.054
2° 00'	2,865 *R_{RC}	RC	0.022	0.028	0.034	0.040	0.048	0.055	0.062	0.070
2° 30'	2,292	0.021	0.028	0.034	0.041	0.049	0.058	0.067	0.075	0.085
3° 00'	1,910	0.025	0.032	0.040	0.049	0.057	0.067	0.077	0.087	0.096
3° 30'	1,637	0.029	0.037	0.046	0.055	0.065	0.075	0.086	0.095	0.100
4° 00'	1,432	0.033	0.042	0.051	0.061	0.072	0.083	0.093	0.099	D_{max} = 3° 30'
5° 00'	1,146	0.040	0.050	0.061	0.072	0.083	0.094	0.098	D_{max} = 4° 15'	
6° 00'	955	0.046	0.058	0.070	0.082	0.092	0.099	D_{max} = 5° 15'		
7° 00'	819	0.053	0.065	0.078	0.089	0.098	D_{max} = 6° 30'			
8° 00'	716	0.058	0.071	0.084	0.095	0.100				
9° 00'	637	0.063	0.077	0.089	0.098	D_{max} = 8° 15'				
10° 00'	573	0.068	0.082	0.094	0.100					
11° 00'	521	0.072	0.086	0.097	D_{max} = 10° 15'					
12° 00'	477	0.076	0.090	0.099						
13° 00'	441	0.080	0.093	0.100						
14° 00'	409	0.083	0.096	D_{max} = 13° 15'						
15° 00'	382	0.086	0.098							
16° 00'	358	0.089	0.099							
18° 00'	318	0.093	D_{max} = 17° 45'							
20° 00'	286	0.097								
22° 00'	260	0.099								
24° 00'	239	0.100								
		D_{max} = 24° 45'								

Notes:

NC = Normal Crown (-0.02)

RC = Reverse Crown (+0.02)

R_{NC} = Minimum Radius for NC

R_{RC} = Minimum Radius for RC

(1) Rates for intermediate D's and R's are to be interpolated.

(2) Degree of Curvature (D) on high speed curbed roadways must not exceed: 2° 30' for 50 mph and 2° 00' for 55 mph.

(3) Degree of Curvature (D) on interstate must not exceed 3° 00' for 70 mph.

* NC/RC (- -) and RC/e (—) Break Points (Radius in feet)									
Break Points	Design Speed (mph)								
	30	35	40	45	50	55	60	65	70
R_{NC}	3349	4384	5560	6878	8337	9949	11709	13164	14714
R_{RC}	2471	3238	4110	5087	6171	7372	8686	9783	10955

Table 210.9.2 Superelevation Rates for e_{max} = 0.05

Superelevation Rates (e_{max} =0.05) Tabulated Values					
Degree of Curve (*D*)	Radius (R) (feet)	Design Speed (mph)			
		25-30	35	40	45
2° 00'	2,865	NC	NC	NC	NC
2° 15'	2,546				
2° 45'	2,083				NC
3° 00'	1,910				RC
3° 45'	1,528			NC	
4° 00'	1,432			RC	
4° 45'	1,206				
5° 00'	1,146		NC		
5° 15'	1,091		RC		
5° 30'	1,042				
5° 45'	996				
6° 00'	955				RC
6° 15'	917				0.022
6° 30'	881				0.024
6° 45'	849				0.027
7° 00'	819	NC			0.030
7° 15'	790	RC			0.033
7° 30'	764				0.037
7° 45'	739				0.041
8° 00'	716			RC	0.045
8° 15'	694			0.022	0.050
8° 30'	674			0.025	D_{max} = 8° 15'
8° 45'	655			0.027	
9° 00'	637			0.030	
9° 30'	603			0.034	
10° 00'	573			0.040	
10° 30'	546		RC	0.047	
11° 00'	521		0.023	D_{max} = 10° 45'	
11° 30'	498		0.026		
12° 00'	477		0.030		
13° 00'	441		0.036		
14° 00'	409	RC	0.045		
15° 00'	382	0.023	D_{max} = 14° 15'		
16° 00'	358	0.027			
17° 00'	337	0.032			
18° 00'	318	0.038			
19° 00'	302	0.043			
20° 00'	286	0.050			
		D_{max} = 20° 00'			

Notes:
(1) NC = Normal Crown (-0.02), RC = Reverse Crown (+0.02)
(2) Rates for intermediate D’s and R’s are to be interpolated.
(3) Design speeds of 25 mph are to be designed as 30 mph.

Table 210.9.3 Superelevation Transition Slope Rates

<table>
<tr><th rowspan="4"># Lanes One Direction</th><th colspan="7">Superelevation Transition Slope Rates</th></tr>
<tr><th colspan="4">e_{max} = 0.10</th><th colspan="3">e_{max} = 0.05</th></tr>
<tr><th colspan="4">Design Speed (mph)</th><th colspan="3">Design Speed (mph)</th></tr>
<tr><th>25-40</th><th>45-50</th><th>55-60</th><th>65-70</th><th>25-35</th><th>40</th><th>45</th></tr>
<tr><td>1-Lane & 2-Lane</td><td>1:175</td><td>1:200</td><td>1:225</td><td>1:250</td><td rowspan="3">1:100</td><td rowspan="3">1:125</td><td rowspan="3">1:150</td></tr>
<tr><td>3-Lane</td><td>---</td><td>1:160</td><td>1:180</td><td>1:200</td></tr>
<tr><td>4-Lane or more</td><td>---</td><td>1:150</td><td>1:170</td><td>1:190</td></tr>
</table>

Notes:

e_{max} = 0.10:

(1) The length of superelevation transition is to be determined by the relative slope rate between the travel way edge of pavement and the profile grade, except that the minimum length of transition is 100 feet.

(2) For additional information on transitions, see the ***Standard Plans***, ***Index 000-510***.

e_{max} = 0.05:

(1) The length of superelevation transition is to be determined by the relative slope rate between the travel way edge of pavement and the profile grade, except that the minimum length of transition is 50 feet for design speeds 25-35 mph and 75 feet for design speeds 40-45 mph.

(2) A slope rate of 1:125 may be used for 45 mph under restricted conditions.

(3) For additional information on transitions, see the ***Standard Plans***, ***Index 000-511***.

210.10 Vertical Alignment

The profile grade line defines the vertical alignment for roadway and bridge construction. The profile grade line is a series of tangents connected by vertical curves. For undivided highways the profile grade line is typically located at the horizontal centerline of the roadway. For divided highways a profile grade line should be established for each direction of travel.

Vertical alignments must meet criteria in the ***FDM*** to assure proper transitions, sight distances, and clearances.

210.10.1 Grades

The slope or grade of each tangent is expressed in percent rise (+) or fall (-); e.g., +2.000% or -2.000%. The maximum grades that may be used in establishing the vertical alignment is given in ***Table 210.10.1***.

Table 210.10.1 Maximum Grades

Context Classification	Maximum Grades (percent)								
	Design Speed (mph)								
	25-30	35	40	45	50	55	60	65	70
C1 Natural C2 Rural	N/A	N/A	N/A	N/A	4	4	3	3	3
C2T Rural Town C3 Suburban C4 Urban General	8	7	7	6	6	5	N/A	N/A	N/A
C5 Urban Center C6 Urban Core	8	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

(1) Maximum grade used should not exceed 4% when truck volume ≥ 10% for all context classifications.

(2) For RRR projects, when existing grades do not meet the above requirements but meet the standards in effect at the time of construction, the existing grade may remain.

(3) N/A indicates this combination of design speed and context classification is outside the intended design range and should be avoided. See ***Table 201.5.1*** for context classifications and design speed ranges.

The point where tangents intersect is known as the vertical point of intersection (VPI). When two tangent grades intersect and no vertical curve is provided, the “kink” is known as the point of intersect (PI). The maximum change in grade (i.e., algebraic change) without a vertical curve is provided in ***Table 210.10.2***.

Table 210.10.2 Maximum Change in Grade without Vertical Curve

Maximum Change In Grade Without Vertical Curve (percent)								
Design Speed (mph)								
25-30	35	40	45	50	55	60	65	70
1.00	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20

210.10.1.1 Curbed Roadway

The minimum distance between VPIs on curbed roadways is 250 feet. The minimum grade on curbed roadways is 0.30%.

210.10.2 Vertical Curves

A vertical curve must be provided when the change in grade of two intersecting tangent grades exceed the values shown in ***Table 210.10.2***. A vertical curve is identified by a curve length (L) which is equal to the product of the K value (K) and the algebraic difference in grades (A).

Table 210.10.3 provides minimum K-Values, and ***Table 210.10.4*** provides minimum vertical curve lengths.

Table 210.10.3 K Values for Vertical Curves

	Minimum K Values For Curves									
	Design Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
Sag	26	37	49	64	79	96	115	136	157	181
Crest (new const.)	19	31	47	70	98	136	185	245	313	401
Crest (RRR Criteria)	12	19	29	44	61	84	114	151	193	247

Notes:

Length, L = KA

Where: K = Rate of vertical curvature

L = Length of vertical curve, (feet)

A = Algebraic difference in grades, (percent)

(1) New Construction K values are based on an eye height of 3.5 feet and an object height of 6 inches. RRR Criteria K values are based on an eye height of 3.5 feet and an object height of 2 feet.

(2) The minimum curve length must not be less than values shown in ***Table 210.10.4***.

Table 210.10.4 Minimum Vertical Curve Lengths

	Minimum Curve Length (feet)									
	Design Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
Sag	75	90	105	120	135	200	250	300	350	400
Crest						300	350	400	450	500

210.10.2.1 RRR Criteria for Vertical Curves

Table 210.10.3 provides RRR Criteria K values to be used to check the sufficiency of existing crest vertical curves. ***2001 AASHTO Green Book*** revised its K values to reflect a 2-foot object height; FDOT has not adopted this change for new construction but these K values can be used to check existing curves. An existing crest vertical curve that does not meet the minimum RRR Criteria K value requires a Design Exception or Design Variation to remain.

When crash data indicates that an evaluation is required, consider the following:

(1) The nature of potential hazards hidden by a hill crest.

(2) The location of the hazard in relation to the portion of the highway where sight distance falls below new construction criteria.

(3) Effectiveness of other options such as relocating or correcting the hazard.

(4) Providing warning signs.

Sag vertical curves do not typically pose stopping sight distance problems. A sag vertical curve that does not meet the minimum K value in ***Table 210.10.3*** and does not have a crash history, does not require a Design Exception or Design Variation to remain.

210.10.3 Vertical Clearances

Consider the following vertical clearance requirements when developing the vertical alignment:

(1) Minimum clearances for bridge structures ~~is~~are given in ***FDM 260.6*** ***and FDM 260.8***.

(2) Minimum clearance from the bottom of the roadway base course to the Base Clearance Water Elevation is 3 feet, except as noted below. These exceptions will require a reduction in the design resilient modulus in accordance with the ***Flexible Pavement Design Manual***. Coordinate with the Pavement Design Engineer for the following facilities:

   (a) 2-lane roadways in context classification C1, C2, C2T and C3, and all ramps may be reduced to a 2-foot clearance.

   (b) Low point on ramps at crossroads may be reduced to a 1-foot clearance.

   (c) All other facilities in context classifications C4 through C6 may be reduced to a 1-foot clearance.

(3) The relationship between the pavement elevation and the Design Flood Elevation is discussed in ***Section 4.4 (3)*** of the ***FDOT Drainage Manual (Topic No. 625-040-002)***.

(4) The ***Drainage Manual, Appendix C*** lists minimum covers and maximum fill heights for all types of culverts.

(5) For utility clearances, refer to the ***Utility Accommodation Manual***.

(6) The required clearance for new overhead sign structures is 17.5 feet. This clearance is the least distance measured between the lowest point on the sign structure and the traffic lane or shoulder directly below the sign structure. For construction affecting existing overhead sign clearances, the minimum vertical clearance is 17 feet.

(7) The required clearance for new walk-in Dynamic Message Sign (DMS) structures is 19.5 feet. This clearance is the least distance measured between the lowest point on the DMS structure and the traffic lane or shoulder directly below the DMS structure. For any construction affecting existing DMS, the minimum vertical clearance is 19 feet.

(8) The required clearance for new signals on span wires, mast arms, or other structures is 17.5 feet. This clearance is the least distance measured between the lowest point on the signal structure and the traffic lane or shoulder directly below the signal structure. For any construction affecting existing signal clearances, FDOT minimum vertical clearance is 17 feet. Vertical clearances between 15 feet and 17 feet require a Design Variation. Signal clearances less than 15 feet are not allowed.

210.10.4 RRR Criteria for Vertical Alignment

Vertical alignment must be reviewed together with the horizontal alignment to assure that the necessary balance of standards is realized and that the combination is both safe and pleasing.

The alignment should be reviewed to see if the following principles are satisfied by the existing vertical alignment:

(1) The stopping sight distance provided meets or exceeds the values in ***Table 210.11.1***.

(2) Grades do not significantly affect truck operations.

(3) There are no hidden dips which could obscure traffic or hazards.

(4) Steep grades and sharp vertical curves do not exist at or near an intersection.

(5) Sufficient grades and, when necessary, special gutter grades exist to adequately drain urban projects.

(6) Adequate sight distance exists for traffic signals (e.g., beyond overpasses, etc.).

When any of the above conditions do not exist, evaluate for hazardous conditions and determine if corrective measures are warranted.

210.11 Sight Distance

The ***AASHTO Green Book*** has a thorough discussion on sight distance. Consider the following aspects of sight distances:

(1) Stopping Sight Distance: Sight distances needed for stopping, which are applicable on all highways

(2) Intersection Sight Distance: Sight distances needed by a motorist to see approaching vehicles before their line of sight is blocked by an obstruction near the intersection.

(3) Passing Sight Distance: Sight distances needed for the passing of overtaken vehicles, applicable only on two-lane highways

(4) Decision Sight Distance: Sight distances needed for decisions at complex locations (e.g., merging tapers, ramps, weaving sections)

210.11.1 Stopping Sight Distance

Stopping sight distance is defined as the distance needed for drivers to see an object on the roadway ahead and bring their vehicles to safe stop before colliding with the object. The distances are derived for various design speeds based on assumptions for driver reaction time, the braking ability of most vehicles under wet pavement conditions, and the friction provided by most pavement surfaces.

Stopping sight distance is influenced by both vertical and horizontal alignment. A roadway designed to criteria employs a horizontal, vertical alignment, and a cross section that provides at least the minimum stopping sight distance through the entire facility.

Minimum stopping sight distances are provided in ***Table 210.11.1***. Values shown in this table are based on eye height of 3.5 feet and an object height of 6 inches.

Minimum stopping sight distances greater than shown in ***Table 210.11.1*** should be considered when drivers require additional time to make decisions.

Table 210.11.1 Minimum Stopping Sight Distance

Grade (percent)		Minimum Stopping Sight Distance (feet)									
		Design Speed (mph)									
		25	30	35	40	45	50	55	60	65	70
Downgrade	≤ 2	155	200	250	305	360	425	495	570	645	730
	3	158	205	257	315	378	446	520	598	682	771
	4	160	208	261	320	385	454	530	610	696	788
	5	162	211	266	326	392	464	541	623	712	806
	6	165	215	271	333	400	474	553	638	728	825
	7	167	218	276	339	408	484	565	652	746	845
	8	170	222	281	346	417	495	579	669	765	867
	9	173	227	287	354	427	507	593	686	785	891
Upgrade	≤ 2	155	200	250	305	360	425	495	570	645	730
	3	147	190	237	289	344	405	469	538	612	690
	4	146	188	234	285	339	399	462	530	602	678
	5	144	186	231	281	335	393	456	522	593	668
	6	143	184	229	278	331	388	450	515	584	658
	7	142	182	226	275	327	383	443	508	576	648
	8	141	180	224	272	323	379	438	501	568	639
	9	139	179	222	269	320	375	433	495	561	631

210.11.2 Intersections

Information and requirements on sight distance at intersections is contained in ***FDM 212***.

210.11.3 Passing Sight Distance

Passing sight distance is the minimum distance that would enable a vehicle to pass another vehicle without interfering with oncoming vehicles traveling at the design speed. The minimum passing sight distance is sufficient only for the passing of a single or isolated vehicle.

Minimum passing sight distances for 2-lane, 2-way roadways are provided in ***Table 210.11.2***. Values shown in this table are based on eye height of 3.5 feet and an object height of 3.5 feet.

Table 210.11.2 Minimum Passing Sight Distance

	Minimum Passing Sight Distance For 2-Lane, 2-Way Roadways (feet)									
	Design Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
New Const.	900	1090	1280	1470	1625	1835	1985	2135	2285	2480
RRR	450	500	550	600	700	800	900	1000	1100	1200

The ***2011 AASHTO Green Book*** revised its passing sight distance values, and FDOT has not adopted this change for new construction. The new construction passing sight distance values in ***Table 210.11.2*** should be used to check the vertical and horizontal geometry on new alignments to provide as many passing zones as possible.

The values shown in the ***Manual on Uniform Traffic Studies (MUTS)*** are used as the warrants for placing no-passing zone pavement markings for all projects. The RRR values in ***Table 210.11.2*** should be used to verify existing pavement markings, in accordance with the No Passing Zone Study procedure included in the ***MUTS***.

210.11.4 Decision Sight Distance

The ***AASHTO Green Book***, ***Chapter 3*** provides a detailed discussion on decision sight distance.

211 Limited Access Facilities

211.1 General

This chapter includes criteria for Limited Access (LA) Facilities (tolled and non-tolled), including:

(1) Interstates

(2) Freeways

(3) Expressways

(4) Interchange ramps servicing high speed LA Facilities

(5) Collector-distributor roads (C-D) servicing high speed LA Facilities

Design Turnpike Projects in accordance with Interstate criteria unless Turnpike Project criteria is provided.

Managed lanes design is an iterative process best performed in a collaborative environment involving various disciplines (e.g., managed lanes planning, PD&E, construction, maintenance, traffic operations, transportation systems management and operations). Coordinate with the Turnpike Toll Systems and Tolls Design Offices in Phase I of the design process. An explanation of the process and considerations is given in the ***FDOT Managed Lanes Guidebook***.

Many design criteria are related to design speed (e.g., vertical and horizontal geometry, sight distance). When the minimum design values are not met, an approved Design Exception or Design Variation is required. See ***FDM 201.5*** for information on Design Speed. See ***FDM 122*** for information on Design Exceptions and Design Variations.

The following manuals and documents provide additional information for the design of LA Facilities:

- ***General Tolling Requirements (GTR)*** -Use this document for design criteria and requirements for tolling on Turnpike and Non-Turnpike projects.
- ***AASHTO's A Policy on Geometric Design of Highways and Streets (AASHTO Green Book)***
- ***A Policy on Design Standards – Interstate System, 2016 Edition (AASHTO)***
- ***FDOT Managed Lanes Guidebook***
- ***Traffic Engineering Manual (TEM)*** - This manual is used to supplement the ***Manual on Uniform Traffic Control Devices (MUTCD)***'s standards and

guidelines with Florida specific signs and pavement markings used on the State Highway System by the Department's Traffic Operations Offices.

Example roadway typical sections are included in the exhibits in ***FDM 913***. Criteria regarding lanes, medians, and shoulders for bridges are illustrated in ***FDM 260.1.1.*** Subsequent sections of this chapter contain specific information and criteria regarding these and other typical section elements, as well as geometric features.

Existing project features which were constructed to meet minimum metric design criteria but are mathematically slightly less than equivalent minimum English design criteria, do not require Design Exceptions or Design Variations to remain. On reconstruction projects, every effort should be made to use current criteria and standards.

Specific requirements for toll site design (e.g., toll siting, toll facility demolition/renovation, toll facility site, toll facility building, and toll facility gantry) are given in the ***General Tolling Requirements (GTR)***.

211.1.1 Interstate Resurfacing Projects

Interstate resurfacing projects that do not meet the criteria in this chapter may use the AASHTO interstate standards that were in effect at the time of original construction or inclusion into the interstate system for the following elements.

- Horizontal alignment
- Vertical alignment
- Median width
- Traveled way width
- Shoulder width

Place documentation in Project Suite Enterprise Edition (PSEE) within the Design Development Documentation Module.

211.2 Travel Lanes and Auxiliary Lanes

Provide 12-foot travel lanes and auxiliary lanes on LA Facilities.

211.2.1 Ramps

On tangent sections, provide a 15-foot traveled way for one-lane ramps and 24-foot traveled way for two-lane ramps. Provide a 36-foot traveled way for three-lane ramps and 12-feet for each additional lane for ramps with more than three lanes.

Consider providing a greater lane width for one-lane ramps where accommodation of future resurfacing is a factor.

Ramp widths in other areas such as terminals are controlled by the curvature and the vehicle type selected as the design control. Minimum ramp widths for turning roadways are given in ***Table 211.2.1***. Typical details for ramp terminals are provided in the ***Standard Plans***, ***Index 000-525.***

Table 211.2.1 Minimum Ramp Widths - Turning Roadways

Radius To Inside of Curve (ft.)	Minimum Ramp Width (ft.)		
	1-Lane		2-Lane
	Case I-C Traveled Way Width	Case II-B Traveled Way Width + Outside Paved Shoulder Width	Case III-A Traveled Way Width
	One–lane, one-way operation – no provision for passing a stalled vehicle	One-lane, one-way operation – with provision for passing a stalled vehicle	Two-lane operation – either one-way or two-way
50	23	26	29
75	20	23	27
100	18	22	26
150	17	21	24
200	16	20	24
300	15	20	24
400	15	19	24
≥ 500	15	19	24
Notes:			

(1) For case application, see ***AASHTO Green Book.***

   (a) Case I - Bus and combination trucks govern design.

   (b) Case II - SU vehicles govern design, some consideration for semitrailer combination trucks.

   (c) Case III – P vehicles govern design, some consideration for SU trucks.

(2) ***AASHTO*** adjustments do not apply.

211.2.2 Pavement Cross Slopes

For roadways, the maximum number of travel lanes with cross slope in one direction is three lanes except as shown in ***Figure 211.2.1***, which prescribes standard pavement cross slopes. A Design Variation or a Design Exception is required when proposed pavement cross slopes do not meet the requirements shown in ***Figure 211.2.1***.

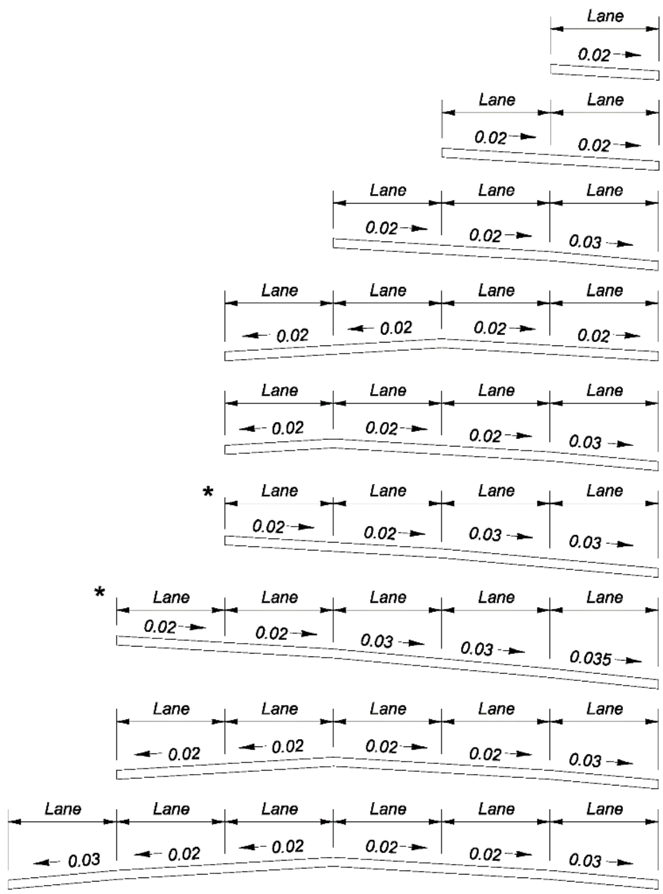
Outside auxiliary lane cross slopes must match or exceed adjacent travel lane cross slope. The auxiliary lane cross slope cannot exceed the values in ***Figure 211.2.1***. In superelevation transitions, do not exceed the maximum algebraic differences shown in ***Table 211.2.2***.

The maximum algebraic difference in cross slope between adjacent through lanes is 0.04. The maximum algebraic difference in cross slope between a through lane and an auxiliary lane at a turning roadway terminal is given in ***Table 211.2.2***.

Cross slopes on bridges are to be on a uniform, straight-line rate, typically 0.02 (See ***FDM 260.4***). Use transitions to adjust for differences in cross slope between the approach roadway section and the required straight-line slope for bridge decks. Whenever possible the transition should be accomplished on the roadway section, outside the limits of the bridge and approach slabs. This will require detailing of the transition(s) in the roadway plans. Coordination between the Roadway, Drainage and Structures designers in the development of transitions is required to ensure compatibility and harmonizing at bridge approaches.

For shoulder cross slope transitions at bridge approaches, use adjacent travel lane transition rate where feasible. The minimum length of transition is 100 feet.

Figure 211.2.1 Standard Pavement Cross Slopes



All Travel Lanes One Direction

Notes:

(1) These sections show only the standard slopes for adjoining travel lanes; they do not prescribe needed lanes, lane usage or typical section requirements other than lane slope.

(2) Maximum pavement cross slopes for tangent sections are:

(a) 0.03 for design speeds greater than 45 mph

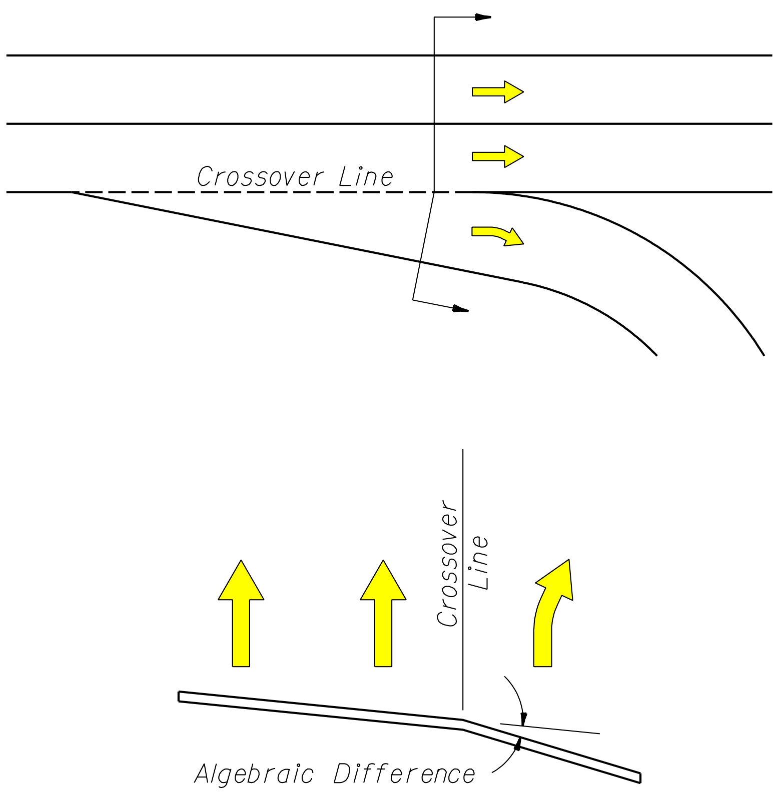
(b) 0.035 may only be used for 5-lanes sloped in one direction as shown above.

(3) The maximum change in cross slope between adjacent through lanes is 0.04.

(4) 4 or 5 lanes sloped in one direction (*) may be used with design speed 65 mph or less and longitudinal grades not exceeding 5%.

Table 211.2.2 Maximum Algebraic Difference in Cross Slope at Turning Roadway Terminals

Design Speed of Exit or Entrance Curve (mph)	Maximum Algebraic Difference in Cross Slope at Crossover Line (%)
Less than 35	6.0
35 and over	5.0



211.2.2.1 Existing Pavement Cross Slopes

Review the existing pavement and shoulder cross slopes for compliance with criteria. Field verify existing pavement and shoulder cross slopes by one of the following:

(1) Full Digital Terrain Model for the roadway width – evaluate cross slope on tangent sections at 100-foot intervals.

(2) Vehicle Mounted Scanner – prior to design, using the results of the scan, determine roadway limits where cross slope is potentially out of tolerance and request Digital Terrain Model of the roadway width for these limits. Evaluate cross slope on tangent sections at 100-foot intervals.

If cross slopes do not meet the values in ***Table 211.2.3***, additional cross sections may be required by the designer to develop cross slope correction details and estimate material quantities. Resurfaced pavement and shoulder cross slopes should meet new construction criteria. When cross slope correction is not practical, documentation in the design file is required. If existing conditions are within the allowable range shown in ***Table 211.2.3***, the term “Match Existing” may be used on the Typical Section(s) to indicate that the existing cross slope is to remain. Superelevation requirements are covered in ***FDM 211.8***.

When cross slope correction is necessary, work closely with the District Pavement Design Engineer and the District Bituminous Engineer to determine the appropriate method of correction. Tabulate existing cross slopes in the plans at 100-foot intervals within the limits of cross slope correction. Include cross slope correction details showing the method of correction in the plans (see examples in ***FDM 913***). Do not show cross slope correction details on the roadway cross sections. Base cross slope correction material quantities on the method of correction shown in cross slope correction details.

Table 211.2.3 Allowable Range for Existing Pavement Cross Slopes

Facility or Feature	Standard (ft./ft.)	Allowable Range (ft./ft.)
Travel Lanes	0.02	0.015 - 0.025
Travel Lanes	0.03	0.025 - 0.035
Outside Shoulder	0.06	Adjacent Lane Cross Slope - 0.080
Median (left) Shoulder	0.05	0.020 - 0.080

Notes:

(1) Standard cross slope (0.02 or 0.03) as designated in ***Figure 211.2.1***.

(2) The algebraic difference in cross slope between adjacent travel lanes must not exceed 0.04. The maximum algebraic difference in cross slope between a through lane and an auxiliary lane at a turning roadway terminal must meet ***Table 211.2.2***.

(3) When existing shoulders are to remain, the algebraic difference between the shoulder slope and adjoining roadway pavement slope must be ≤ 0.07.

(4) Outside auxiliary lanes must match or exceed adjacent travel lane cross slopes with a maximum cross slope of 0.035.

211.2.3 Hydroplaning Risk Analysis

The hydroplaning risk analysis predicts the water film thickness on the pavement being analyzed and the speed at which hydroplaning may theoretically occur. This information may support utilizing a non-compliant typical section when weighed against the cost of correcting pavement cross slope.

A hydroplaning analysis is required for projects with the following:

Additional contributing pavement (ex: managed lane buffer, paved shoulder, paved gore, auxiliary lane, etc.) is added to the standard pavement cross slope sections shown in ***Figure 211.2.1***.

Superelevated sections as outlined in ***Table 211.2.4***.

Ungrooved bridge decks that exceed the requirements outlined above. Grooved bridge decks do not require an analysis.

Include hydroplaning calculations in the hydroplaning analysis. Where a risk is identified, provide a risk evaluation in report format that includes identification and benefit-cost analysis of mitigating strategies. Submit the preliminary analysis with the 15% line and grade or Draft Typical Section Package (whichever is submitted first). Provide a final recommendation in conjunction with the Final Typical Section Package.

Table 211.2.4 Hydroplaning Analysis Requirements in Superelevated Sections

Project Type	Number of Lanes Draining in One Direction		
	Less Than 3 Lanes	3 Lanes	More Than 3 Lanes
Capacity Improvements & New Alignments	Not required	Only when superelevation of lowest lane is less than 3% or when there have been 2 or more wet weather crashes within the available 5-year crash data	Always required
RRR	Not required	Only required when there have been 2 or more wet weather crashes within the available 5-year crash data	

Notes:

(1) Wet weather crashes attributable to hydroplaning conditions.

For bridge transitions, evaluate mitigating strategies such as shortening transitions and staggering the cross slope transitions prior to evaluating more costly solutions (i.e. bridge replacement and pavement type changes that require additional design details and a benefit-cost analysis.)

Use the HP Program and the Design Guidance: Hydroplaning Risk Analysis to perform hydroplaning risk analysis. The Hydroplaning Tools can be downloaded under Design Aids at:

https://www.fdot.gov/roadway/drainage/hydroplaning

211.2.4 Roadway Transitions

The minimum merging roadway transition length (L) is calculated as follows:

(1) Use L = WS for design speeds ≥ 45 mph

(2) Use $L = WS^2/60$ for design speeds ≤ 40 mph

Where: L = length of taper, feet

W = width of lateral transition, feet

S = design speed, mph

Exhibits 210-1 through ***210-6*** illustrate standard roadway transitions. For conditions not addressed in these figures, use the following:

(1) Merging Taper = L

(2) Shifting Taper = L/2

(3) Shoulder Taper = L/3

Where an abrupt change in roadway typical (e.g., 4-lane section to a 6-lane section) a striped lane transition may be considered when all the following conditions are met:

- New pavement widths are not substantially greater than the joining pavement,
- Grade differentials are slight, and
- Future widening is expected.

211.2.5 Number of Lanes on the State Highway System

See ***Section 335.02(3)*** of the ***Florida Statutes*** for the number of lanes to be provided on the State Highway System. Nothing in this statute precludes a number of lanes in excess of ten lanes. The Department will determine the appropriate number of lanes based on traffic demand. Consideration will be given to availability of right of way and the capacity to accommodate other modes of transportation within existing rights of way.

Topic No.: 525-030-020a Capacity Improvement Alternatives is the Department policy to assist in the identification of the most appropriate option for widening projects on all LA Facilities on the State Highway System (SHS). This policy applies to the Interstate System and to Florida's Turnpike Enterprise facilities.

211.3 Medians

Median width is the distance between the inside (median) edge of the travel lane of each roadway. Required median widths are given in ***Table 211.3.1***.

Median ditches must be designed to meet the following requirements:

- Have sufficient depth to provide positive drainage of the adjacent subgrades. Typically, this requires a median depth of at least one foot below the subgrade shoulder point.
- Have recoverable side slopes within the clear zone in order to facilitate the recovery of errant vehicles. See ***FDM 215*** for additional information on roadside safety.
- Have sufficient longitudinal gradient and hydraulic capacity to ensure good drainage.

Table 211.3.1 Minimum Median Widths

Facility Type		Minimum Median Width (ft.)
Interstate, Without Barrier		64
Freeway and Expressway, Without Barrier	Design Speed ≥ 60 mph	60
	Design Speed < 60 mph	40
All, With Barrier		26

Notes:

(1) For Interstate (without barrier), provide an 88-foot median width when future lanes are planned.

Facilities that have the ability to be expanded for additional capacity in the future will be designed to accommodate that future expansion. For example, a 4-lane high-speed facility that has the potential to expand to a 6-lane facility (without managed lanes) may be designed with a 50-foot median with barrier (e.g. guardrail, high tension cable barrier) instead of the required 60-foot median. A 50-foot median will accommodate a future 2-foot concrete median barrier, two 12-foot travel lanes and two 12-foot shoulders.

211.3.1 Bridge Median

See ***FDM 260.5*** for information on bridge medians.

211.3.2 Median Crossovers

This section addresses permanent median crossovers (i.e., median openings). The criteria in this section does not apply to contra-flow crossovers placed for facilitating hurricane evacuation, nor does it apply to temporary construction crossovers.

Permanent crossovers are necessary to avoid excessive travel distances for emergency vehicles, law enforcement vehicles, and maintenance vehicles. Provide median crossovers only when there is a documented request and need for such a feature; however, they are to be limited in number and strategically located. The District Design Engineer (DDE) and the District Traffic Operations Engineer (DTOE) jointly approve the location of median openings.

The following ***AASHTO Green Book*** crossover recommendations have been adopted by the Department as requirements for permanent crossovers:

(1) Not spaced closer than 3 miles apart.

(2) Located only in areas with above-minimum stopping sight distance and without superelevated curves.

(3) Not located within 1,500 feet of the end of a speed-change taper (of a ramp or facility widening/narrowing) or any structure (bridge, overpassing facility or overhead sign).

(4) Not located where the median width is less than 25 feet.

Crossover locations that do not meet the above criteria require approval by the State Roadway Design Engineer. Non-conforming crossovers on Interstate facilities require approval by the State Roadway Design Engineer and Federal Highway Administration (FHWA).

The following additional FDOT criteria are also requirements for permanent crossovers:

(1) Not located within 1.5 miles of any interchange.

(2) Not located where the median width is less than 40 feet.

(3) Not located in urban areas

(4) Where continuous median barrier is present, openings for crossovers should not be greater than 5 miles apart between Interchanges.

Typical layouts for the design of median crossovers are provided in ***Exhibits 211-1*** and ***211-2***. These typical layouts may not cover all situations, but are provided as a guide for developing site-specific designs. Designs should accommodate the types of emergency vehicles expected to use the crossover. Law enforcement vehicles and typical ambulance sized vehicles can usually be easily accommodated. The typical layouts illustrated in the exhibits accommodate a SU design vehicle. To the extent practical, designs should accommodate larger emergency response vehicles such as fire trucks. This may require obtaining information from local emergency responders on the size and configuration of vehicles used. Except where median widths are wider than normal, fire trucks and other larger vehicles will likely not be able to make U-turns without encroaching or crossing travel lanes. As a minimum, designs should provide for the necessary minimum radii and width to allow the largest design vehicle to enter the crossover and stop as close to perpendicular to traffic as practical. All designs should be tested by superimposing the turning path of the design vehicle to insure the crossover will operate as expected.

On Interstate facilities, the FHWA directs that median shoulders approaching the crossover utilize the standard shoulder width, or existing shoulder width. FHWA advocates that the safety benefits derived by making the crossovers appear less conspicuous outweigh the benefits obtained by providing paved shoulders to accommodate acceleration and deceleration lanes for emergency vehicles, law enforcement, or other authorized vehicles.

The profile of the crossover is to conform as close as practical with travel way shoulder slopes and median side slopes so that the crossover is inconspicuous as possible to traffic. The paved width of the crossover should not be any wider than that necessary to provide for the largest design vehicle. Shoulder width for the crossover should be 8 feet minimum. Side slopes of the crossover (parallel with the mainline travel way) are to be 1:10 or flatter. However, side slopes may be transitioned to match the slope of a pipe culvert safety end treatment where a culvert crossing underneath the crossover is necessary to provide for proper median drainage.

For each proposed location, determine drainage requirements and make appropriate provisions. The drainage culvert shown in the exhibits are for example only. Either a mitered end section (1:4) or preferably a u-endwall with grate (1:6) should be used for culverts parallel with the mainline. In some cases existing median ditches are shallow and there will be minimal clearances available for even small size culverts.

Provide a pavement design equivalent to a Limited Access shoulder pavement (i.e., 12-inch Stabilized Subgrade, Base Group 1, and 1.5 inch Structural Course).

A "No U-turn" sign (R3-4) with an "Official Use Only" plaque (FTP-65-06) is required for permanent crossovers. To improve nighttime visibility for approaching emergency responders, yellow RPMs are installed on the outside yellow edge line in advance of the crossover. See ***Standard Plans***, ***Index 706-001*** for RPM placement.

Florida Administrative Code, Rule 14-97, Section 14-97.003(3) (Access Control Classification System and Access Management Standards) regulates the location of driveway connections and median openings in interchange areas on arterial roads. This standard should be applied in accordance with the District procedures for implementing the Rule, and should not be confused with minimum requirements for LA R/W.

211.3.2.1 Existing Crossovers

On reconstruction and resurfacing projects, evaluate the location of existing crossovers for conformance to the above criteria. For those locations that do not meet the criterion in ***FDM 211.3***, do one of the following:

(1) Remove or relocate crossover as a part of the project

(2) Crossover locations that do not meet the ***AASHTO Green Book*** criteria require approval by the State Roadway Design Engineer to remain. Non-conforming crossovers on Interstate facilities require approval by the State Roadway Design Engineer and Federal Highway Administration (FHWA) to remain.

(3) Crossover locations that meet the ***AASHTO Green Book*** criteria, but do not meet additional FDOT criteria require approval by the District Design Engineer to remain.

211.3.3 Managed Lanes Separation

Managed lanes are always separated from the general use lanes~~ or general toll lanes~~. Median openings and crossovers are prohibited within managed lanes.

There are ~~four~~ five types of managed lanes separation treatments:

(1) Barrier separation; see ***Figure 211.3.1***

(2) Buffer separation with tubular markers; see ***Figure 211.3.2***

(3) Wide buffer separation; see ***Figure 211.3.3***

(4) Grade separation; see ***Figure 211.3.4***

~~(4)~~(5) Buffer separation with pavement marking; see ***Figure 211.3.5***

The minimum standard buffer width for the buffer separation is 4 feet. Any variation from a 4-foot-buffer width must be approved by the District Design Engineer. Install tubular markers per the ***TEM***, Chapter 4. Use barrier separation or grade separation when implementing a reversible managed lane system. See the ***FDOT Managed Lanes Guidebook*** for ~~For~~ factors to consider~~for~~ in determining separation type~~, please refer to the Managed Lanes Guidebook~~.

The maximum spacing and placement of tubular markers is provided in the ***TEM***. If, based on operational and safety analysis, the EOR or the district wishes to increase the maximum allowable spacing, a Design Variation must be approved by the Chief Engineer.

When a wide buffer separation is selected, the buffer may include a grassed median or pavement. Paved wide buffers should be no more than 12 feet wide.

Figure 211.3.1 Managed Lanes Barrier Separation Typical Section

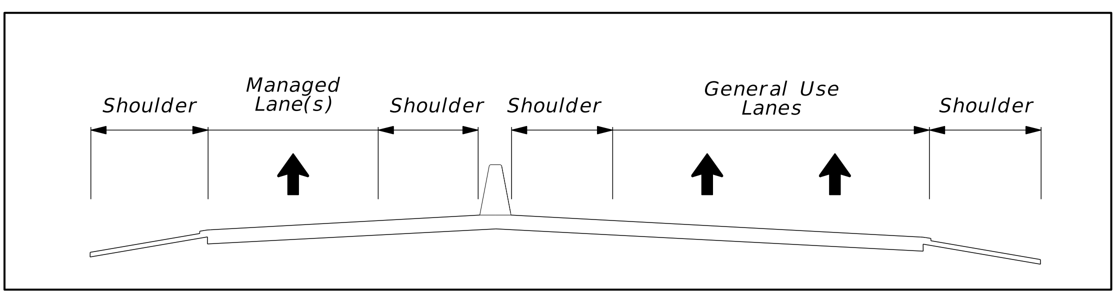


Figure 211.3.2 Managed Lanes Buffer Separation with Tubular Marker Typical Section

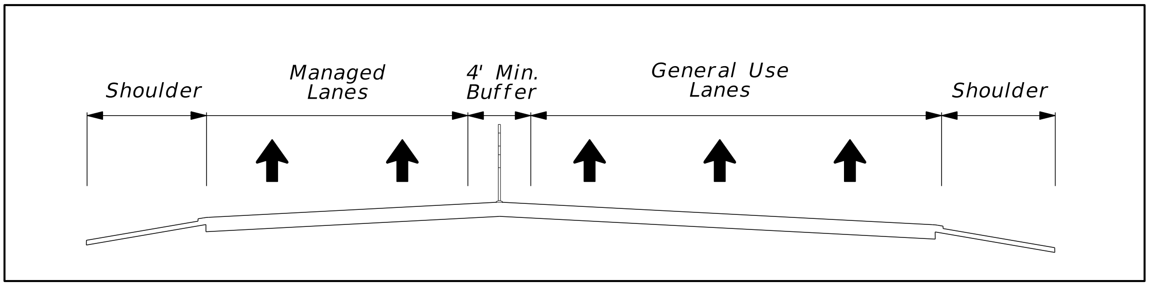


Figure 211.3.3 Managed Lanes Wide Buffer Separation Typical Section

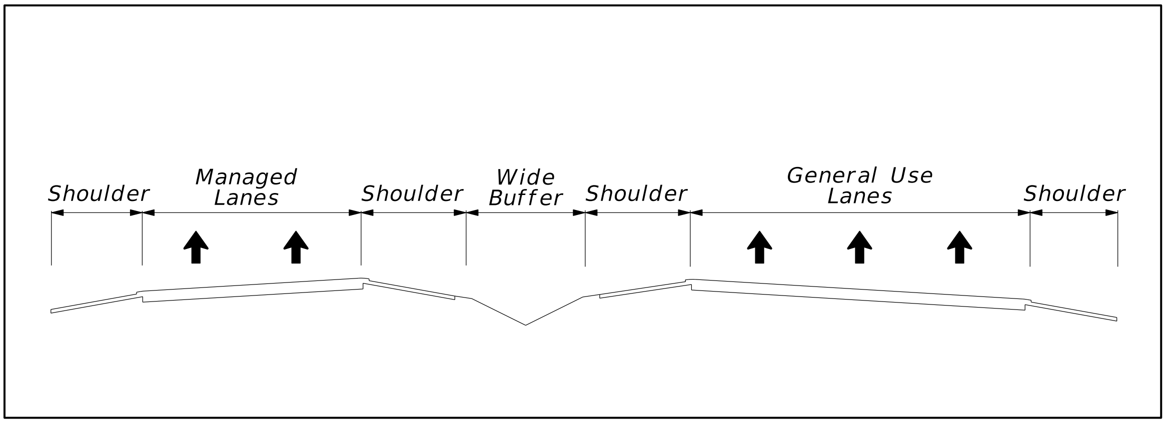


Figure 211.3.4 Managed Lanes Grade Separation Typical Section

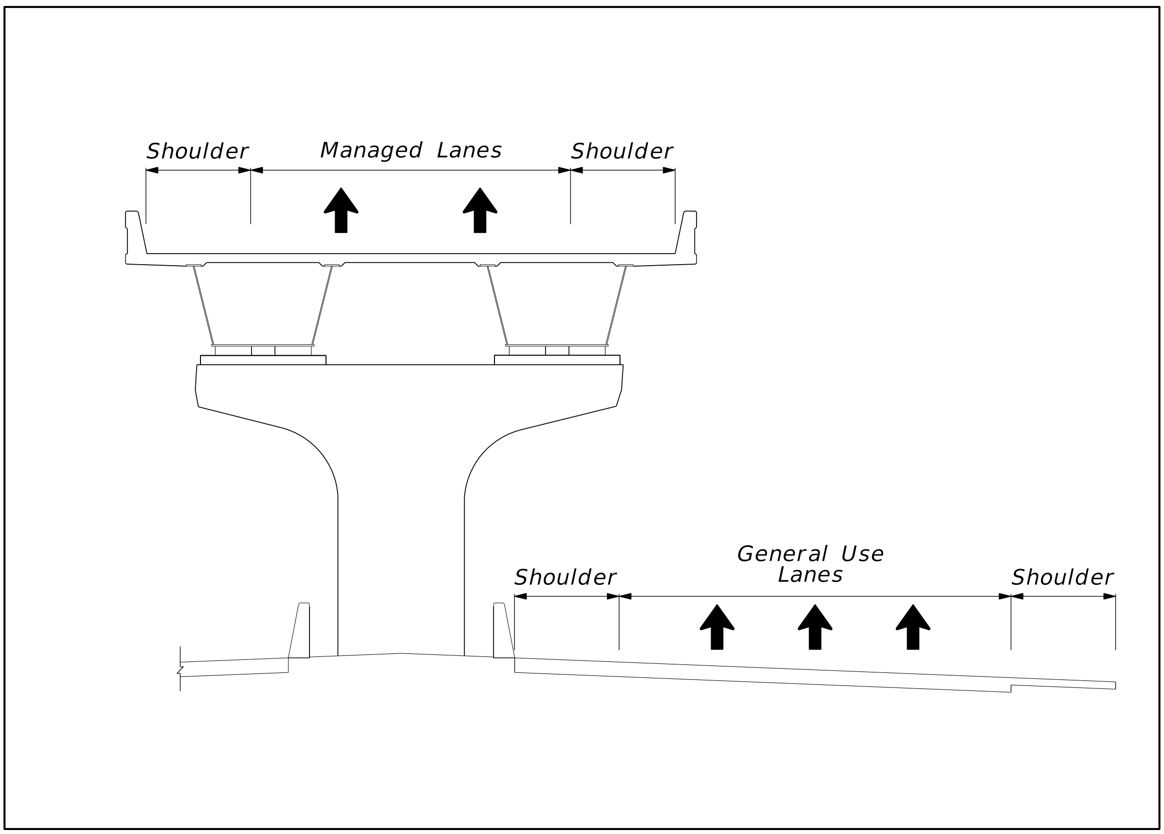


Figure 211.3.5 Managed Lanes Buffer Separation with Pavement Marking Typical Section

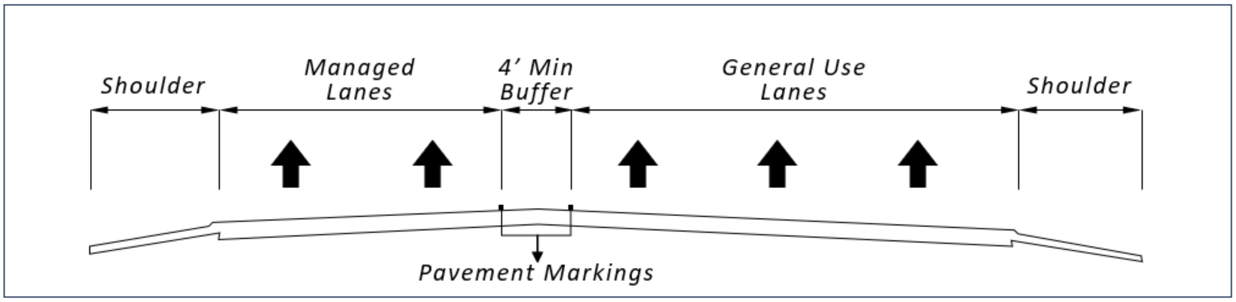


Exhibit 211-1: Crossovers On Limited Access Facilities

Exhibit 211-2: Median Barrier Opening For Crossovers On Limited Access Facilities

211.4 Shoulders

Roadway shoulder width is measured from the edge of the traveled way to the shoulder break. A portion of the shoulder is required to be paved. Minimum shoulder widths and paved widths are given in ***Table 211.4.1***.

Use shoulder gutter for the following conditions:

- On embankments higher than 20 feet
- On embankments higher than 10 feet where the longitudinal slope is greater than 2 percent
- On embankments, with slopes steeper than 1:6 for more than five feet vertically, to minimize erosion
- At bridge ends where concentrated flow from the bridge deck otherwise would run down the slope
- In areas of guardrail where embankment slopes are steeper than 1:4 and any pavement is sloped toward the embankment.

Refer to ***FDM 260.3*** for bridge shoulder widths.

See ***General Tolling Requirements (GTR)*** for paved shoulder requirements at tolling locations.

211.4.1 Managed Lanes Shoulders

The required width for managed lanes shoulders depends on the type of separation between the managed lanes and the general use lanes ~~or general toll lanes~~. When retrofitting managed lanes in constrained conditions, shoulder widths in ***Table 211.4.1*** may not be achievable without a Design Variation or Design Exception. Consult the ***Highway Safety Manual*** on safety tradeoffs when narrowing shoulder widths.

Table 211.4.1 Minimum Shoulder Widths

~~Minimum Shoulder Width (ft.)~~									
Lane Type	# Lanes (One Direction)	Without Shoulder Gutter (feet)~~ft.)~~				With Shoulder Gutter (feet)~~ft.)~~			
		Outside or Right		Median Or Left On Divided Roadways		Outside or Right		Median Or Left On Divided Roadways	
		Full Width	Paved Width	Full Width	Paved Width	Full Width	Paved Width	Full Width	Paved Width
Travel Lanes	2-Lane	12	10	8	4	15.5	8	13.5	6
	3-Lane or more	12	10	12	10	15.5	8	15.5	8
Managed Lanes	1-Lane	12	12	12	12	17.5	10	17.5	10
	2-Lane	12	12	12	12	17.5	10	17.5	10
Ramps	1-Lane ~~Ramp~~	6	4	6	2	11.5	4	11.5	4
	2-Lane ~~Ramp~~ Non-Interstate	10	8	8	4	15.5	8	13.5	6
	2-Lane ~~Ramp~~ Interstate	12	10	8	4	15.5	8	13.5	6
	3-Lane or more ~~Ramp~~	12	10	12	10	15.5	8	15.5	8
C-D Roads	1-Lane	6	4	6	2	11.5	4	11.5	4
	2-Lane	12	10	8	4	15.5	8	13.5	6
	3-Lane or more	12	10	12	10	15.5	8	15.5	8
Aux. Lanes	ALL	12	10	8	4	15.5	8	11.5	4

Notes:

Without shoulder gutter:

(1) For Florida's Turnpike projects with 3-Lanes or more in One Direction, provide 12-foot inside and outside paved width shoulders adjacent to travel lanes with High Volume AADT or greater than 10% trucks.

(2) For all other LA Facilities, consider 12-foot outside paved width shoulders adjacent to travel lanes with High Volume AADT or greater than 10% trucks.

(3) Pave the entire width of shoulders adjacent to concrete barriers. See ***FDM 215.4.6.1***

With shoulder gutter:

(1) Ramp shoulder pavement less than 6 feet in width that adjoins shoulder gutter must match the type, depth, and cross slope of the ramp travel lane.

211.4.2 Shoulder Cross Slopes

The standard cross slope is 0.06 on the outside shoulder and 0.05 on the median (or left) side for all roadway and ramp sections. ***Figure 211.4.1*** illustrates shoulder cross slopes in relationship to roadway cross slopes for normal and superelevated sections. For 5-foot (or less) paved shoulders, see ***Figure 211.4.2***. When the inside travel lane is sloping toward the median, the inside shoulder cross slope may be increased to 0.06.

For projects constructed with concrete pavement, the first one foot of the outside shoulder is cast with the outside travel lane and will have the same cross slope (and superelevation) as the outside lane. Superelevation of the shoulder pavement is to be rotated about the outside edge of the outside slab.

Figure 211.4.1 Shoulder Superelevation

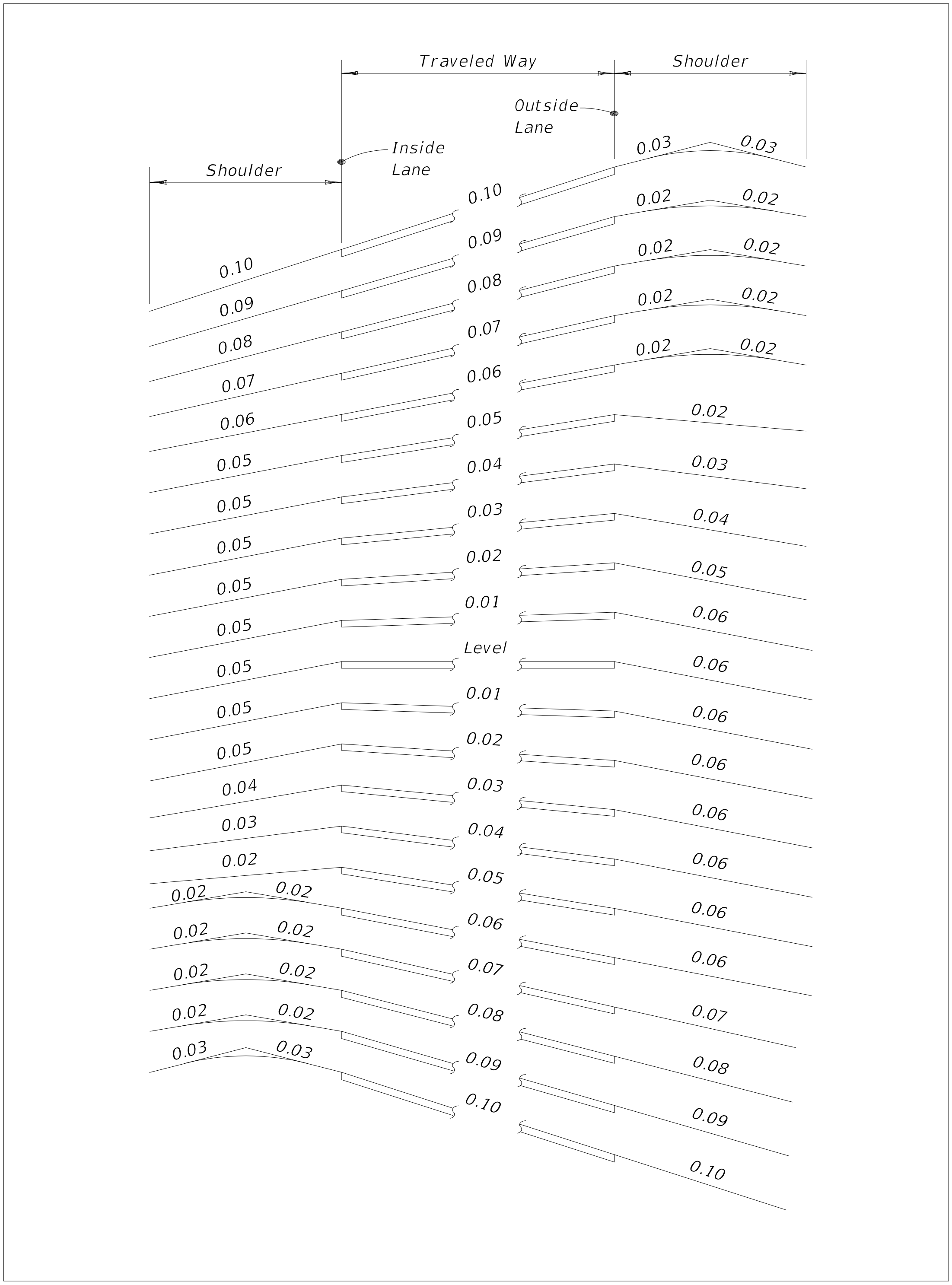
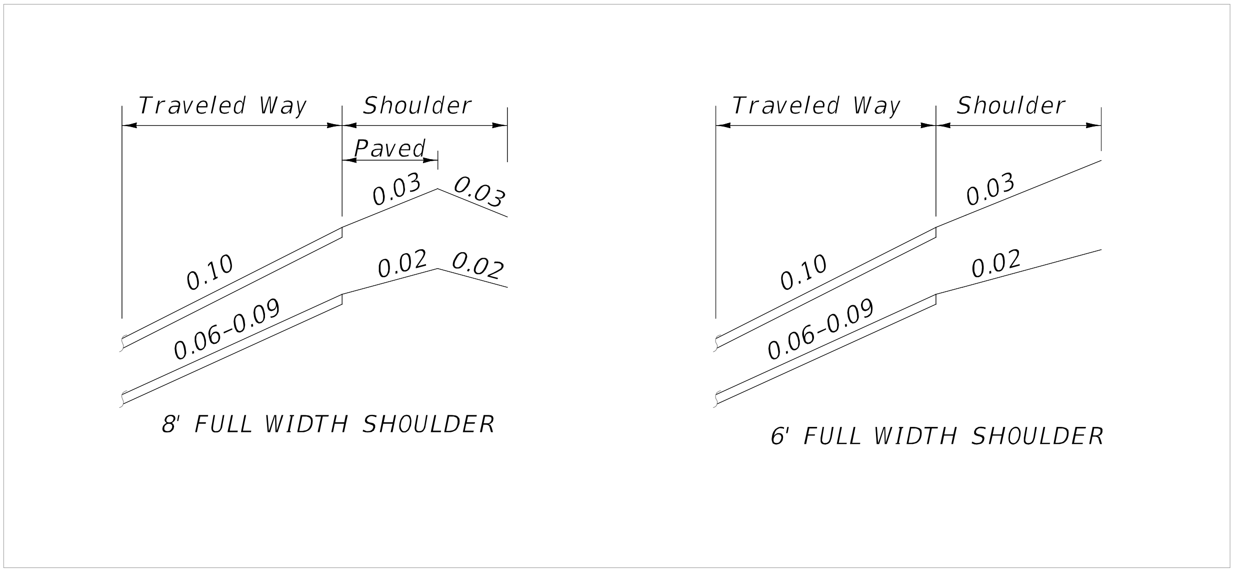


Figure 211.4.2 Special Ramp Shoulder Superelevation



211.4.2.1 Shoulder Rocking

When a minimum 0.3% longitudinal gutter grade cannot be maintained using uniform shoulder cross slopes then shoulder rocking may be used to achieve positive drainage. The cross slope for shoulders may be varied from minimum 0.03 (not flatter than adjacent lane) to a maximum 0.06 in tangent sections. The design must maintain balance between inlet spacing and flat shoulder cross slopes. To achieve a minimum distance of 100 feet between the high and low points, a 0.24% minimum longitudinal gutter grade may be used.

~~Designs adjacent to a single-slope barrier wall must maintain the minimum height required by the ***Standard Plans***. Designs adjacent to an F-Shape concrete barrier wall must maintain the gutter profile within the 3-inch vertical face of the wall and a minimum height required by the ***Standard Plans***.~~

For shoulder rocking designed in conjunction with new single-slope concrete barriers, see the ***Standard Plans Instructions*** for ***Index 521-001***.

Where existing F-Shape barriers are being used, the varying shoulder surface may intersect the barrier face within the lower 3-inch vertical portion (a.k.a., the reveal). F-Shape barriers must remain embedded in the pavement at least 1 inch deep at all locations.

For outside shoulder rocking, use one of the three options below to meet minimum spread criteria. Options 1 and 2 are preferred. Consider Option 3 only when the first two options are not feasible, as determined by the District Roadway Design and Drainage Engineers.

Option 1: Use concrete barrier ~~wall~~ with inlets to collect storm water.

Option 2: Use guardrail with shoulder gutter and inlets to collect storm water.

Option 3: Use guardrail in conjunction with a permanent turf reinforcement mat in fill sections with a front slope steeper than 1:4 (maximum slope of 1:2) and maximum height of 10 feet. Shear stress calculations are required to be submitted for the design/selection of the permanent turf reinforcement mat.

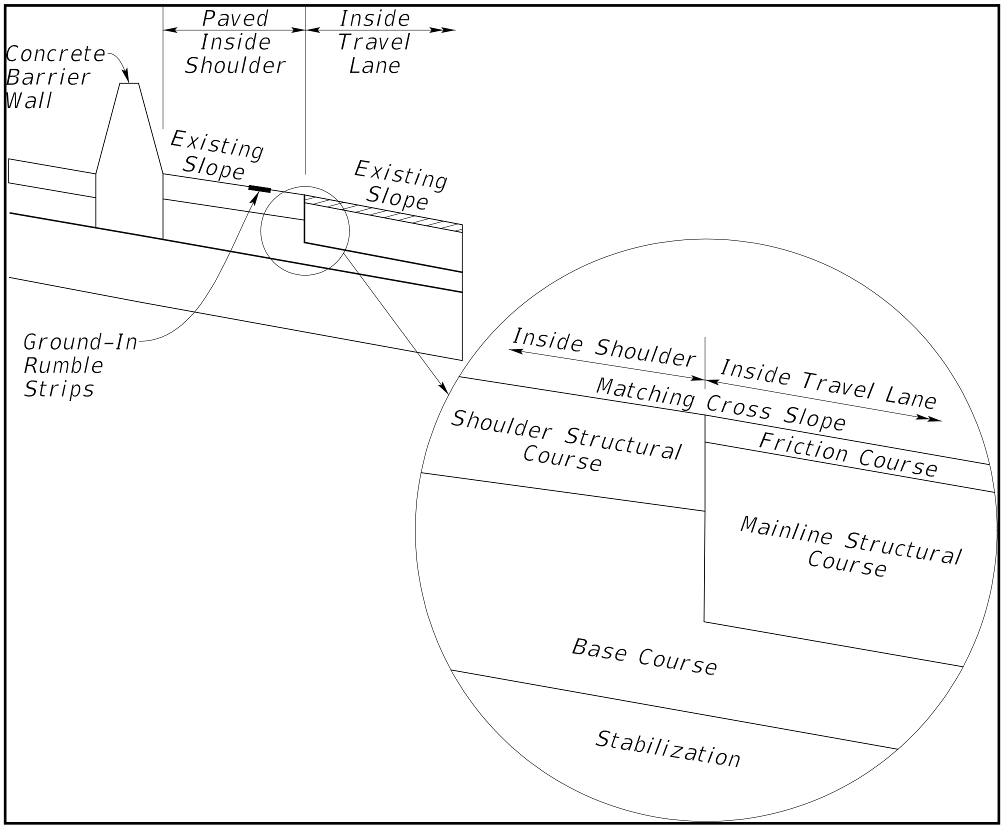
See ***FDM 915*** for shoulder rocking gutter profile plan requirements.

211.4.3 Limits of Friction Course on Paved Shoulders

Extend the friction course 8 inches onto both the median and outside paved shoulders of roadways.

For locations where median barrier wall is continuous and shoulder slopes toward the travel lane, construct the inside shoulder pavement flush with the friction course placed on the adjacent travel lane. This will address any concerns for trapping water on the shoulder as demonstrated in ***Figure 211.4.3***.

Figure 211.4.3 Flush Shoulder Pavement



211.4.4 Audible and Vibratory Treatment

Audible and vibratory treatments provide a lane departure warning. Include either ground-in rumble strips or profiled thermoplastic audible and vibratory treatment on LA Facilities.

211.4.4.1 Ground-in Rumble Strips

Use ground-in rumble strips on mainline flexible pavement shoulders in accordance with ***Standard Plans***, ***Index 546-010***. Use the skip array on both inside and outside shoulders. Use the continuous array in advance of bridge ends for a distance of 1,000 feet or back to the gore recovery area for mainline interchange bridges. ***Figure 211.4.4*** provides guidance for placement of ground-in rumble strips.

Exclude ground-in rumble strips at the following locations:

(1) On bridges, terminate at the approach slab joint.

(2) At mainline toll sites within the toll loop pavement area.

(3) On All Electronic Tolling (AET) facilities within the tolling area as defined in the ***General Tolling Requirements (GTR)***.

(4) On outside shoulders of entrance ramp terminals, terminate at the point of the physical gore and resume at the end of the acceleration lane taper.

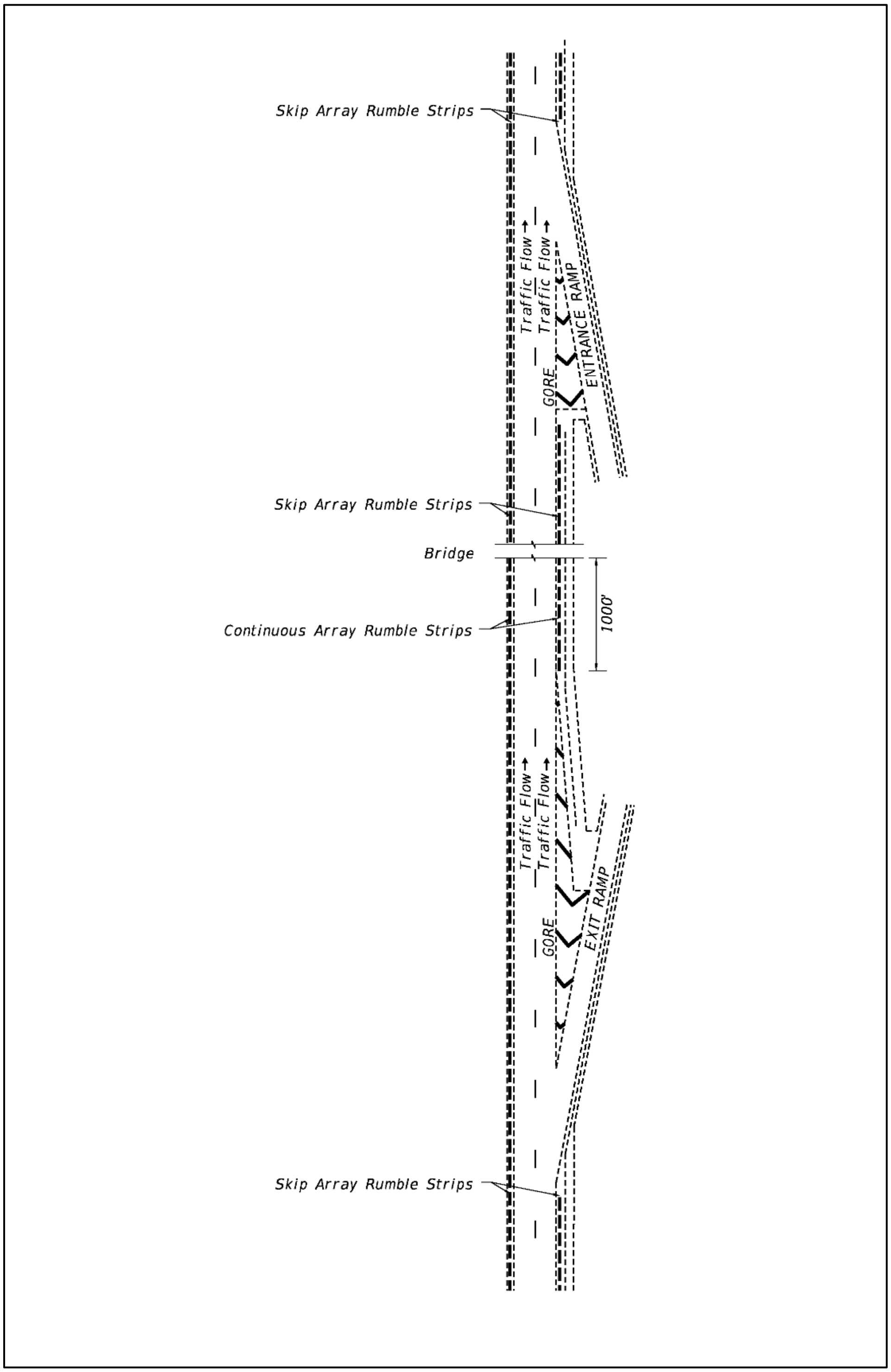
(5) On outside shoulders of exit ramp terminals, terminate at the start of the deceleration lane taper, and resume at the point of the physical gore.

(6) On either side of median crossover openings, terminate within 400 feet.

211.4.4.2 Profiled Thermoplastic

Use profiled thermoplastic for inside and outside edge line pavement markings on roadways with rigid pavement shoulders.

Figure 211.4.4 Placement of Ground-In Rumble Strips



211.4.5 Emergency Refuge Areas

Consider including Emergency Refuge Areas (ERAs) in areas where additional shoulder widths are deemed necessary (e.g., law enforcement, vehicle refuge). Coordinate with Traffic Operations, Maintenance, and Law Enforcement to determine if ERAs would be appropriate for the roadway facility.

For managed lanes projects, consider ERAs where deemed necessary in coordination with Traffic Operations, Maintenance, and Law Enforcement. Coordinate with the Turnpike Toll Systems and Tolls Design Offices during Phase I of the design process. For managed lanes in constrained conditions, a staggered shoulder may be designed to allow storage of disabled or damaged vehicles.

211.4.6 Emergency Shoulder Use (ESU)

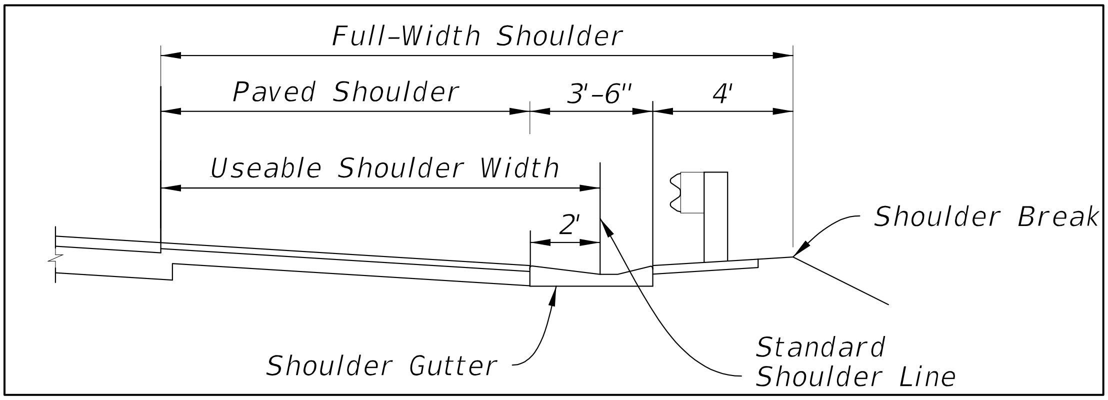
Emergency Shoulder Use (ESU) increases traffic capacity for hurricane evacuations by using existing paved shoulders as temporary travel lanes. ESU is typically implemented on evacuation routes as follows:

- On median shoulder when median paved shoulder width is at least 10 feet, or
- On outside shoulder when median paved shoulder width is less than 10 feet.

ESU evacuation routes are listed at:
https://www.fdot.gov/emergencymanagement/esu/

Provide a minimum of 10-foot paved shoulder that is useable for travel on ESU routes identified on the Department's Emergency Management website. A portion of the shoulder gutter (when present) may be included in the useable 10-foot width; see ***Figure 211.4.5***.

Figure 211.4.5 Useable Shoulder Width with Shoulder Gutter



On resurfacing projects where paved or usable shoulder widths are less than 10 feet, do one of the following:

- Provide shoulder modifications to allow for acceptable ESU usage, or
- Identify a future project that will provide the required shoulder modifications.

Locate median barrier in accordance with ***FDM 215***. When possible, do not locate median barrier adjacent to the shoulder identified for ESU evacuation.

See ***FDM 240.2.1.1*** for ESU requirements during construction.

211.4.7 Use of Curb

Type F Curb may be used in areas with design speeds 45 mph or less. Type E Curb may be used in areas with design speeds 55 mph or less. This applies to both median and outside shoulder locations. All curb is prohibited in areas with design speeds greater than 55 mph.

211.4.7.1 Existing Curb

There are infrequent sections of curbed roadways in combination with guardrail on LA Facilities. When there is no crash history associated with these applications, the curb may remain when approved by the District Design Engineer (DDE). Approval by DDE is documented through the development of the Typical Section Package.

211.5 Roadside Slopes

Side slopes within the clear zone are typically 1:6 or flatter. When site conditions require the use of steeper slopes, refer to new construction criteria included in ***FDM 215***.

See ***FDM 210.6*** for Roadside Slope requirements.

211.6 Border Width

For new construction the required border width is 94-feet, which is measured from the outside edge of traveled way to the R/W line. This width may be reduced in the area of a crossroad terminal, as long as the design meets the requirements for clear zone, lateral offsets, drainage, and maintenance access.

Fencing, or in special cases, walls or barriers are to contain LA Facilities. These treatments are to be continuous and appropriate for each location. Treatment height and type may vary under special conditions. The treatment is typically placed at or near the LA R/W line, but location may be adjusted based on site-specific conditions (e.g., ponds, trees, bridges). Placement information and additional data is provided in ***Standard Plans, Indexes 550-001***, ***550-002***, and ***550-004***.

211.6.1 Border Width on Reconstruction & Resurfacing Projects

For reconstruction and resurfacing projects where additional R/W will not be acquired, a Design Variation is not required when the following minimum border width is met:

(1) The border width accommodates:

  (a) Roadside design components such as signing, drainage features, guardrail, fencing and clear zone

  (b) The construction and maintenance of the facility

  (c) Permitted public utilities

(2) Along ramps and mainline lanes where roadside barriers are used and thus clear zone is not applicable, the minimum border width from the back of a barrier or retaining wall must be 10 feet if maintenance vehicles have sufficient access from public R/W that is contiguous and unimpeded to the facility.

(3) If the maintenance access is not continuous along a barrier or wall, and thus maintenance vehicles and equipment would need to turn around, then a sufficient

turnaround area must be provided that is acceptable and approved by Maintenance.

(4) Maintenance accessibility includes the ability for equipment and vehicles to maneuver around obstacles including fences, lights, signs, side slopes and ponds.

211.7 Horizontal Alignment

The centerline (CL) or baseline (BL) of construction defines the horizontal alignment for roadway and bridge construction. The CL or BL construction is a series of tangents connected by horizontal curves established by the Engineer of Record (EOR). CL or BL construction is often the same alignment as the BL of survey.

Horizontal alignment should be consistent with the anticipated operating speed and with environmental, physical, and economic constraints. Design speed is the principal factor controlling horizontal alignment.

Avoid placing horizontal curves, points of intersection (PI) and superelevation transitions within the limits of a structure or approach slabs. Placement of stationing equations within the limits of a structure should be avoided on contract plans. Such equations unnecessarily increase the probability of error in both the design and construction phase.

211.7.1 Deflections in Alignment

The point where tangents intersect is known as the point of intersection (PI). Avoid the use of a PI with no horizontal curve; however, there may be conditions where it is necessary. The maximum deflection along the mainline and ramps without a horizontal curve are as follows:

- Design speed ≤ 40 mph is $2^{o}00'00''$.
- Design speed ≥ 45 mph is $0^{o}45'00''$.

211.7.2 Horizontal Curves

A horizontal curve should not be introduced near the crest of a vertical curve. The combination of horizontal and vertical curves can greatly reduce sight distance; i.e., hide the horizontal curve from the approaching driver. The condition can be avoided by having the horizontal curvature lead the vertical curvature; i.e., the horizontal curve is made longer than the vertical curve.

Flatter curvature with shorter tangents is preferable to sharp curves connected by long tangents; i.e., avoid using minimum horizontal curve lengths. Avoid long tangents followed by sharp curves.

Table 211.7.1 provides the desirable horizontal curve lengths to be used in establishing the horizontal alignment. Desirable curve lengths for interstate, freeways and expressways are based on 30-times the design speed (30V), where V = design speed in mph. Desired curve lengths for low-speed ramps are based on 15-times the design speed (15V), and high-speed ramps are based on 30V.

Table 211.7.1 Length of Horizontal Curve

Length Of Horizontal Curve (ft.)										
Interstate, Freeway and Expressways based on Design Speed (mph)										
	25	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**
Desirable	N/A	N/A	N/A	N/A	N/A	1500	1650	1800	1950	2100
Minimum	N/A	N/A	N/A	N/A	N/A	750	825	900	975	1050
Ramps based on Design Speed (mph)										
	25	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**
Desirable	400	450	525	600	675	1500	1650	1800	1950	2100
Minimum	400	400	400	400	400	750	825	900	975	1050
Notes: Provide the desirable length; however, when desired length cannot be attained, provide the greatest length possible, but not less than the minimum.										

211.8 Superelevation

The criteria contained in ***FDM 210.9*** is applicable for Interstates, Freeways, and Expressways. The RRR criteria contained in ***FDM 210.9.2*** applies to Limited Access resurfacing projects.

Superelevation rates of 0.10 maximum are required on high speed LA Facilities, except for the portion of a ramp that adjoins an arterial. For the portion of a ramp that adjoins to an arterial, match the superelevation rate of the arterial. The terminal and the area abutting the LA Facility is controlled by Limited Access criteria and must be designed for 0.10 maximum superelevation rate.

211.9 Vertical Alignment

The profile grade line defines the vertical alignment for roadway and bridge construction. The profile grade line is a series of tangents connected by vertical curves. For undivided highways the profile grade line is typically located at the horizontal centerline of the roadway. For divided highways a profile grade line should be established for each direction of travel.

Meeting vertical alignment criteria assures proper transitions, sight distances, and clearances.

LA facilities play a critical role during hurricane evacuation and re-entry in the aftermath. Designing the mainline travel lanes to be above the 100-year flood plain elevation (established by FEMA or other pertinent studies) is a requirement on Florida's Turnpike Facilities and should be considered for all LA facilities. See ***FDM 210.10.3*** for all other vertical clearance requirements.

Minimum vertical clearances for bridges structures is given in ***FDM 260.6***.

211.9.1 Grades

The slope or grade of each tangent is expressed in percent rise (+) or fall (-); e.g., +2.000% or -2.000%. The maximum grades that may be used in establishing the vertical alignment in given in ***Table 211.9.1***.

Table 211.9.1 Maximum Grades

Facility Type	Maximum Grades (percent)									
	Design Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
LA Facilities	N/A	N/A	N/A	N/A	N/A	4	4	3	3	3
Ramps	7	7	6	6	5	5	4	4	3	3

Notes:

(1) For roadways with significant (10% or more) heavy truck traffic the maximum grade used should not exceed 4%.

(2) For resurfacing projects, when existing grades do not meet the above requirements but meet the standards in effect at the time of construction, the existing grade may remain.

For new construction or when the vertical profile is being significantly modified, the desired minimum profile grade is 0.5%; 0.3% is the minimum when 0.5% cannot be achieved. When practicable, develop roadway profiles to avoid the need for shoulder rocking, with consideration for future widening and resurfacing.

The point where tangents intersect is known as the vertical point of intersection (VPI). When two tangent grades intersect and no vertical curve is provided, the “kink” is known as the point of intersect (PI). The maximum change in grade (i.e., algebraic change) without a vertical curve is provided in ***Table 210.10.2***.

211.9.2 Vertical Curves

A vertical curve must be provided when the change in grade of two intersecting tangent grades exceed the values shown in ***Table 210.10.2***. A vertical curve is identified by a curve length (L) which is equal to the product of the K value (K) and the algebraic difference in grades (A).

Tables 211.9.2 and ***211.9.3*** contain vertical alignment criteria for Interstates, Freeways, Expressways, and ramps.

Table 211.9.2 K Values for Vertical Curves

Type of Curve	Minimum K Values for Vertical Curves									
	Design Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
Interstate										
Sag	N/A					115	136	157	181	206
Crest (New Construction)	N/A					185	245	313	401	506
Crest (Resurfacing)	N/A					114	151	193	247	312
Freeway and Expressways										
Sag	N/A					96	115	136	157	181
Crest (New Construction)	N/A					136	185	245	313	401
Crest (Resurfacing)	N/A					84	114	151	193	247
Ramps										
Sag	26	37	49	64	79	96	115	136	157	181
Crest (New Construction)	19	31	47	70	98	136	185	245	313	401
Crest (Resurfacing)	12	19	29	44	61	84	114	151	193	247

Notes:
Length, L = KA
Where: K = Rate of vertical curvature (a.k.a., K value)
L = Length of vertical curve, (feet)
A = Algebraic difference in grades, (percent)

(1) New construction K values are based on an eye height of 3.5 feet and an object height of 6 inches. Resurfacing K values are based on an eye height of 3.5 feet and an object height of 2 feet.

(2) The minimum curve length must not be less than values shown in ***Table 211.9.3***.

(3) Vertical curves within a system interchange are to use K values based on the higher system.

(4) Use interstate, freeway, or expressway K values on vertical curves located within the ramp terminal area. Ramp vertical curve K values are used for ramps outside of the ramp terminal area.

Table 211.9.3 Minimum Vertical Curve Length

Type of Curve	Curve Length (ft.)									
	Design Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
Interstate, Freeway and Expressways										
Sag	N/A					800				
Crest (Open Highway)	N/A					1,000				
Crest (Within Interchanges)	N/A					1,800				
Ramps										
Sag	75	90	105	120	135	200	250	300	350	400
Crest						300	350	400	450	500

211.10 Sight Distance

The ***AASHTO Greenbook*** has a thorough discussion on sight distance. Consider the following aspects of sight distances:

(1) Stopping Sight Distance: Sight distances needed for stopping, which are applicable on all highways

(2) Decision Sight Distance: Sight distances needed for decisions at complex locations (e.g., merging tapers, ramps, weaving sections)

211.10.1 Stopping Sight Distance

Stopping sight distance criteria is provided in ***Tables 211.10.1*** and ***211.10.2***.

Table 211.10.1 Minimum Stopping Sight Distance for Interstate

Grade (percent)		Minimum Stopping Sight Distance (ft.)				
		Design Speed				
		50	55	60	65	70
Downgrade	≤ 2	495	570	645	730	820
	3	516	595	673	767	861
	4	524	605	685	781	878
	5	534	616	698	797	896
	6	544	628	713	813	915
	7	554	640	727	831	935
	8	565	654	744	850	957
	9	577	668	761	870	981
Upgrade	≤ 2	495	570	645	730	820
	3	475	544	613	697	780
	4	469	537	605	687	768
	5	463	531	597	678	758
	6	458	525	590	669	748
	7	453	518	583	661	738
	8	449	513	576	653	729
	9	445	508	570	646	721

~~211.10.2 Decision Sight Distance~~

~~The ***AASHTO Green Book, Chapter 3*** provides a detailed discussion on decision sight distance.~~

Table 211.10.2 Minimum Stopping Sight Distance for Freeways, Expressways, and Ramps

Grade (percent)		Minimum Stopping Sight Distance (ft.)									
		Design Speed (mph)									
		25	30	35	40	45	50	55	60	65	70
Downgrade	≤ 2	155	200	250	305	360	425	495	570	645	730
	3	158	205	257	315	378	446	520	598	682	771
	4	160	208	261	320	385	454	530	610	696	788
	5	162	211	266	326	392	464	541	623	712	806
	6	165	215	271	333	400	474	553	638	728	825
	7	167	218	276	339	408	484	565	652	746	845
	8	170	222	281	346	417	495	579	669	765	867
	9	173	227	287	354	427	507	593	686	785	891
Upgrade	≤ 2	155	200	250	305	360	425	495	570	645	730
	3	147	190	237	289	344	405	469	538	612	690
	4	146	188	234	285	339	399	462	530	602	678
	5	144	186	231	281	335	393	456	522	593	668
	6	143	184	229	278	331	388	450	515	584	658
	7	142	182	226	275	327	383	443	508	576	648
	8	141	180	224	272	323	379	438	501	568	639
	9	139	179	222	269	320	375	433	495	561	631

211.10.2 Decision Sight Distance

The ***AASHTO Green Book, Chapter 3*** provides a detailed discussion on decision sight distance.

The geometric design developed for LA Facilities considers locations where decision sight distance is critical such as interchanges, toll facilities, lane drops, and managed lanes ingress/egress locations. Decision sight distance requirements are in ***AASHTO Green Book, Section 3.2.3***. If it is not practical to provide decision sight distance at these locations, or if relocation of the critical decision points is not feasible, special attention will be given to the use of suitable traffic control devices for providing advance warning of the sub-standard condition.

Do not place managed lane ingress or egress within the limits of a Design Variation or Design Exception processed for sight distance.

211.11 Structures

Refer to ***FDM 260*** for information on bridge structures.

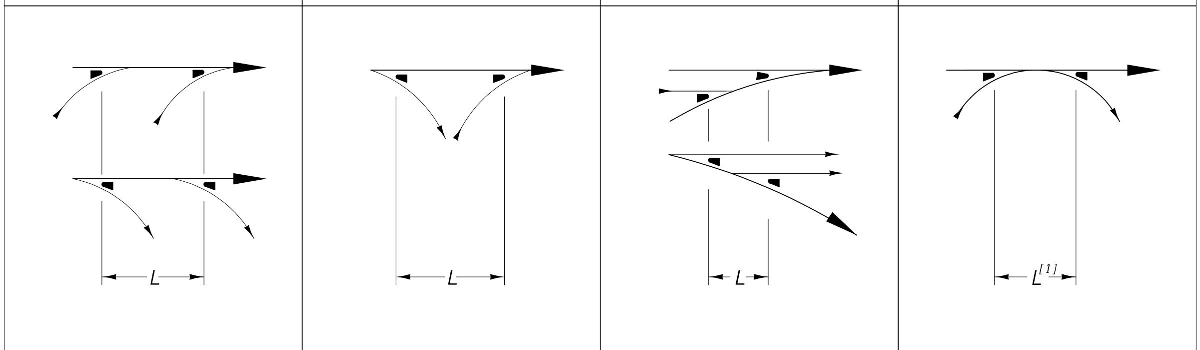
211.12 Interchange and Ramp Spacing

Interchange spacing is measured along the freeway or interstate centerline between the centerlines of the crossroads. Refer to ***FDM 201.4*** for the minimum spacing between adjacent interchanges.

In urban areas, spacing less than one mile may be used with C-D roads or grade-separated (braided) ramps.

The spacing between interchanges may also be dependent on the ramp connection spacing. The minimum connection spacing between the painted noses of adjacent ramps is provided in ***Figure 211.12.1***. Additional information on interchanges is in ***AASHTO Green Book, Chapter 10***.

Figure 211.12.1 Ramp Connection Spacing



On-On or Off-Off		Off-On		Turning Roadways		On-Off (Weaving)		
LA Facility	C-D Road	LA Facility	C-D Road	System Interchange [2]	Service Interchange [3]	A	B or C	D
1,000 ft.	800 ft.	500 ft.	400 ft.	800 ft.	600 ft.	2,000 ft.	1,600 ft.	1,000 ft.

Painted Nose (see Figure 211.13.1)

L = Minimum distance in feet from painted nose to painted nose (See figure 211.13.1)
A Between two interchanges connected to a LA Facility: a system interchange[2] and a service interchange[3].
B Between two interchanges connected to a C-D Road: a system interchange[2] and a service interchange[3].
C Between two interchanges connected to a LA Facility: both service interchanges[3].
D Between two interchanges connected to a C-D Road: both service interchanges[3].

Notes:

These values are based on operational experience, need for flexibility, and signing. Check them in accordance with the procedures outlined in the Highway Capacity Manual and use the larger value.

[1] With justification, these values may be reduced for cloverleaf ramps.
[2] A system interchange is a LA Facility-to-LA Facility interchange.
[3] A service interchange is a LA Facility-to-local road interchange.

Ref: Figure 10-70, 2018 AASHTO Green Book

211.12.1 Weaving Sections

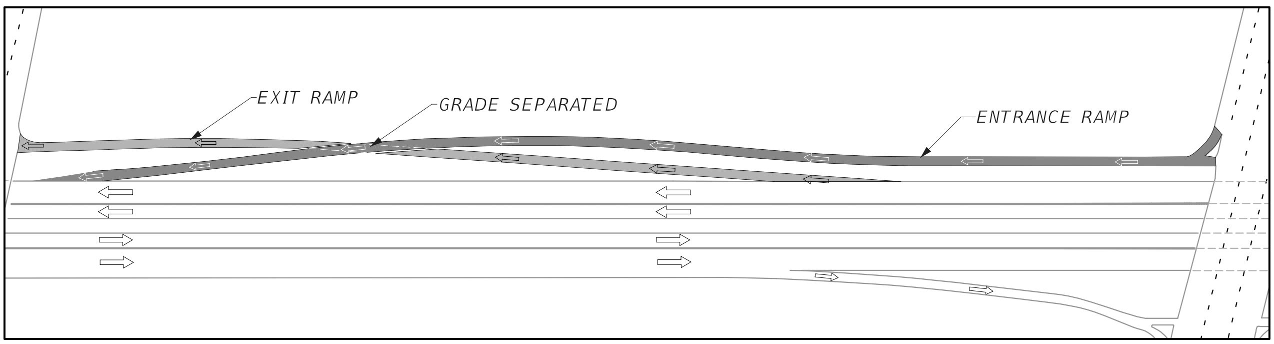
Weaving sections are defined in ***2018 AASHTO Green Book, Section 2.4***.

When an entrance is followed by an exit, the minimum distance between gore noses is governed by weaving considerations per the procedure outlined in the ***Highway Capacity Manual (HCM)***. On-off Weaving is illustrated in ***Figure 211.12.1***. If the minimum weaving distance cannot be provided, replace the weaving maneuver with physical separation; e.g., grade separation or barrier. For more information regarding barriers, refer to ***FDM 215***.

211.12.1.1 Braided Ramps

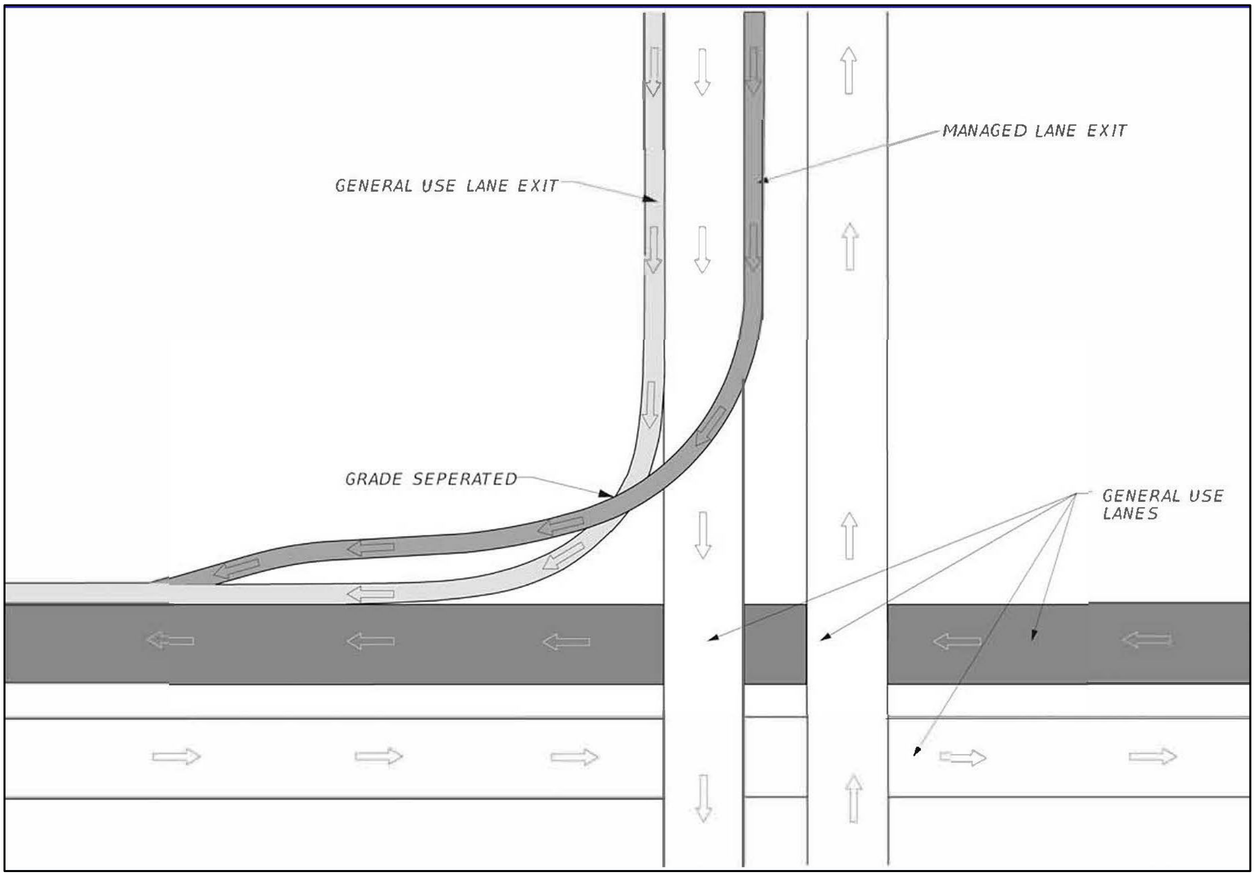
Ramps that are grade-separated and cross over one another are known as braided ramps. They are typically used to achieve the required ramp spacing by converting the on-off connection into an off-on connection. An example of braided ramps is shown in ***Figure 211.12.2***. These configurations are used on a limited basis because of the large cost typically associated with them.

Figure 211.12.2 Braided Ramp Configuration



When combining general use lane or general toll lane exits and managed lane exits in a braided ramp configuration, the managed lane exit merges on the right side of the general use lanes ~~or general toll lanes~~ as illustrated in ***Figure 211.12.3***. Operational analysis determines the actual lane configuration. Refer to ***Traffic Analysis Handbook*** and ***Interchange Access Request User's Guide*** for guidance on analysis requirements.

Figure 211.12.3 Braided Managed Lane and General Use Lane Exits



211.12.2 Interchange Connections

When a series of interchanges are closely spaced, attention must be given to the uniformity of interchange patterns and to lane balance. Refer to the concepts discussed in the ***2018 AASHTO Green Book, Section 10.9.5***. Auxiliary lanes may be required to conform to lane balance requirements.

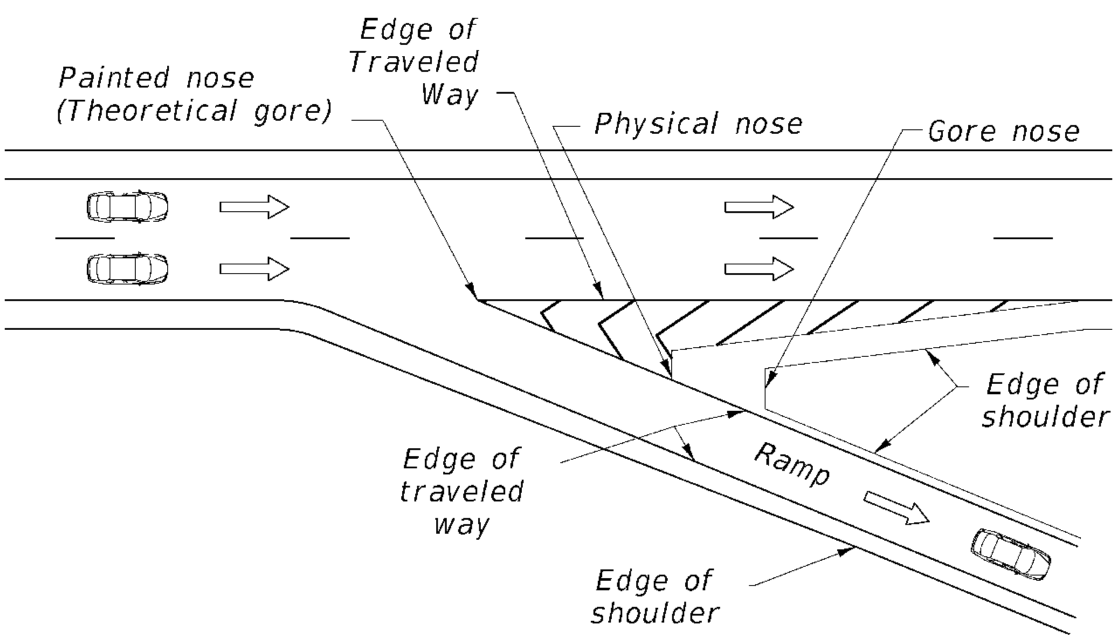
Successive auxiliary lanes less than 1,500 feet apart are prohibited. Auxiliary lanes may continue through an interchange to avoid this condition.

211.13 Ramp Terminals

Taper type and parallel type ramp terminals can be used to enter and exit a LA Facility. The selection of either a parallel or taper type depends on the geometrics and anticipated traffic conditions of the highway as well as the roadway that connects to the ramp. Design speed of entrance and exit ramps for LA Facilities should be gradually decreased from the LA mainline design speed to the design speed of the ramp. The minimum ramp speed used to design the first curve adjacent to the LA mainline is 20 mph below the LA mainline design speed. The preferred ramp type is parallel. Use of taper type ramp terminals must be approved by District Design Engineer. Existing tapered ramps that are not being altered by construction may remain in place.

Typical geometric configuration for the taper and parallel types are depicted in ***Standard Plans*** ***Index 000-525***. ***Figure 211.13.1*** illustrates a basic configuration and terminology used when designing ramp terminals. The taper and parallel type ramp terminals are discussed in the paragraphs below.

Figure 211.13.1 Ramp Gore

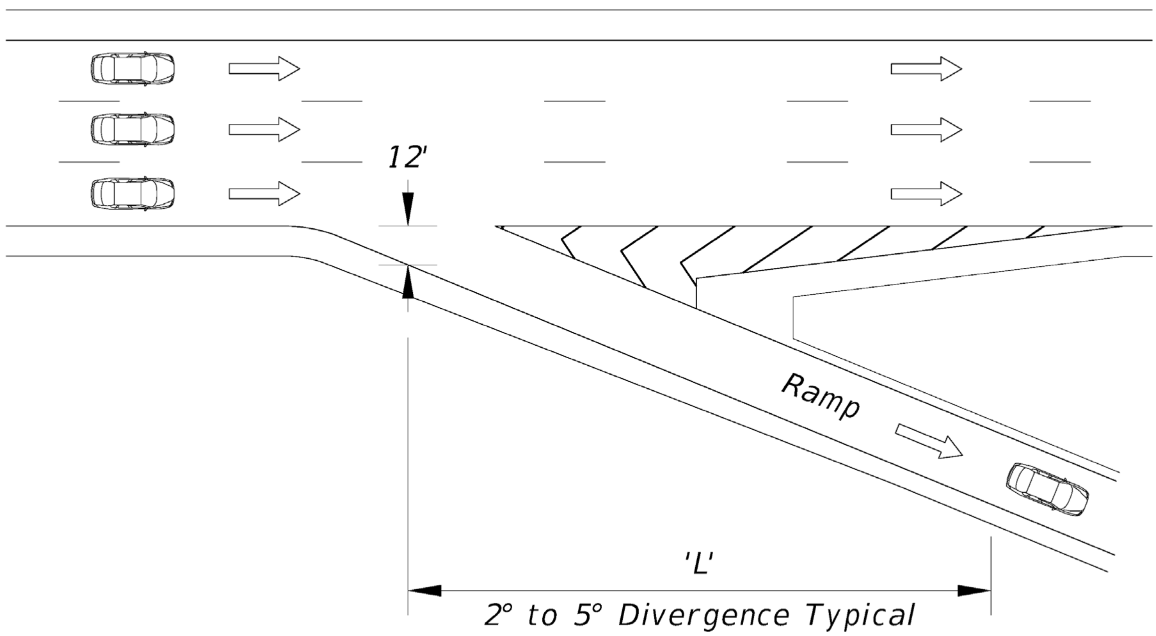


Taper Type Exit Ramp Terminals

For single lane taper type exit terminal, the recommended divergence angle is ±4 degrees. The speed change can be achieved off the traveled way as the exiting vehicle moves along the taper onto the ramp proper. The length available for deceleration (L) should be measured from a point where the right edge of the tapered wedge is about 12 ft from the right edge of the right through lane to the point of initial curvature or the first horizontal curve on the exit ramp. The taper type ramp terminal is not to be used where a minimum of 50 mph design speed cannot be maintained. For such ramps, parallel deceleration lanes must be used in place of tapers with lengths set according to AASHTO. For additional information, see the *AASHTO Green Book*.

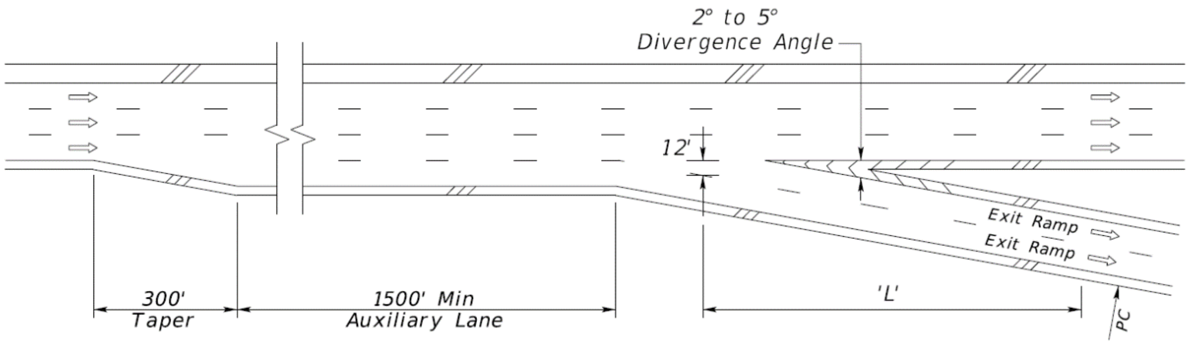
Figure 211.13.2 below shows a typical design for a taper type exit terminal.

Figure 211.13.2 Taper Type Exit Ramp Terminal



For two-lane exit type ramp terminals, it is usually appropriate to develop an auxiliary lane upstream from the exit. A length of 1,500 ft is recommended to develop the full capacity of a two-lane exit. As with single lane exits, attention should be given to obtaining the appropriate deceleration distance between the exit and first horizontal curve on the ramp. The length available for safe deceleration (L) on a two-lane taper type exit is measured from a point where the right edge of the tapered wedge along the left or inside exit lane is about 12 ft from the right edge of the right through lane. This is to ensure that any extent of the auxiliary lane is not used to determine length needed for safe deceleration, since vehicles using the left exit lane would be entering the ramp at LA mainline speed. See ***Figure 211.13.1***. Typical design for two-lane taper type exit terminals is shown in ***Figure 211.13.3*** below.

Figure 211.13.3 Two-Lane Taper Type Exit Ramp Terminal



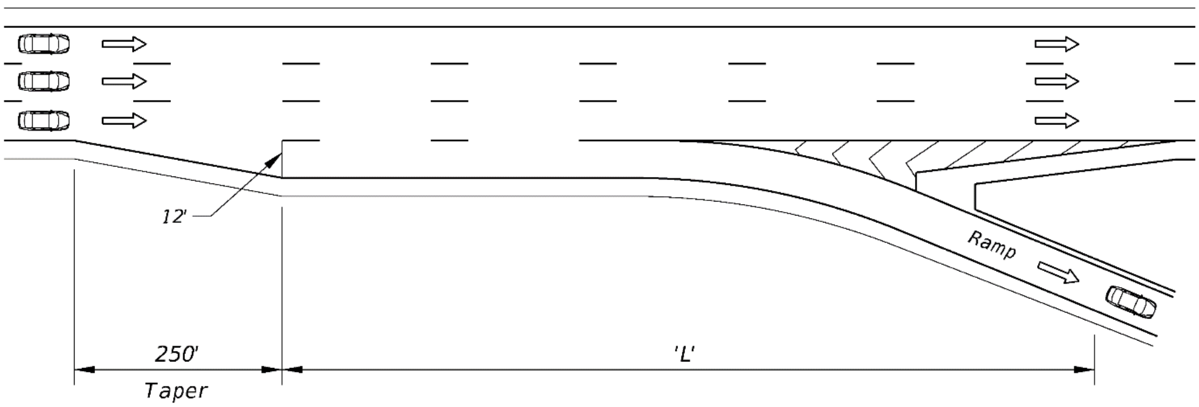
Parallel Type Exit Ramp Terminals

A single lane parallel type exit terminal usually begins with a taper, followed by an added lane that is parallel to the LA mainline traveled way. The parallel type exit terminal should be used when:

- the exit is partially hidden over the crest of vertical curve and
- when turning roadway speed is less than 60% of the through roadway speed.

In cases that have limited sight distance and close connections to a signal-controlled arterial, parallel type terminals should be used to allow for sufficient deceleration. The length available for deceleration (L) should be measured from the point where the added lane attains a 12-ft width to the point where the alignment of the ramp roadway departs from the alignment of the freeway. Lengths of at least 800 ft are desirable. The taper portion of a parallel type deceleration lane should have a taper of 15:1 to 25:1. For additional information, see the ***AASHTO Green Book***. ***Figure 211.13.4*** shows a typical design for a parallel type exit terminal.

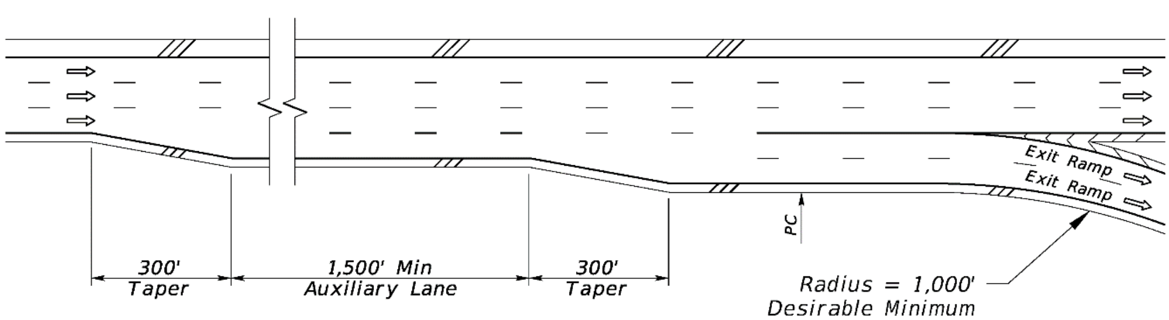
Figure 211.13.4 Parallel Design Type Exit Ramp Terminal



For two-lane exit type ramp terminals, it is usually appropriate to add an auxiliary lane upstream from the exit. A length of 1,500 ft is recommended to develop the full capacity of a two-lane exit. As with single lane exits, attention should be given to obtaining the appropriate deceleration distance between the exit and first horizontal curve on the ramp. See ***Table 211.3.1***. The operation for a two-lane parallel type exit is different from the taper type in that vehicles in the outer through lane of the LA mainline must move two lanes to the right to use the right lane of the ramp. The total length from the beginning of the first taper to the point where the ramp traveled way departs from the right-hand through lane of the LA mainline range from 2,500 ft to 3,500 ft depending on the turning volumes thresholds provided in the ***AASHTO Green Book***. This is to ensure that any extent of the auxiliary lane is not used to determine length needed for safe deceleration, since vehicles using the left or inside lane would be entering the ramp at LA mainline speed.

Typical design for two-lane parallel type exit terminals is shown in ***Figure 211.13.5*** below.

Figure 211.13.5 Two-Lane Parallel Design Type Exit Ramp Terminal



Minimum Deceleration Lengths

Minimum deceleration lengths (L) for various combinations of design speeds for the LA mainline and for the ramp roadway for both taper type and parallel type exit terminals are given in ***Table 211.13.1*** below. Grade adjustments are given in the ***AASHTO Green Book***.

Table 211.13.1 Minimum Deceleration Lengths (L) for Taper and Parallel Type Exit Terminals

Deceleration Length (ft.) for Design Speed of Exit Curve (mph)									
LA Mainline Design Speed	Stop Condition (0)	15	20	25	30	35	40	45	50
30	235	200	170	140	-	-	-	-	-
35	280	250	210	185	150	-	-	-	-
40	320	295	265	235	185	155	-	-	-
45	385	350	325	295	250	220	-	-	-
50	435	405	385	355	315	285	225	175	-
55	480	455	440	410	380	350	285	235	-
60	530	500	480	460	430	405	350	300	240
65	570	540	520	500	470	440	390	340	280
70	615	590	570	550	520	490	440	390	340

Source: 2018 AASHTO Green Book, Table 10-6

Entrance Type Ramp Terminals

The taper type entrance usually operates smoothly for volumes up to and including the design capacity of merging areas. The parallel type entrance terminal should be used when a bridge is located within the merging lane and when turning roadway speed is less than 60% of LA mainline speed. At entrance ramps on an ascending grade, the portion of the ramp intended for acceleration and the ramp terminal should closely parallel the through roadway profile to permit entering drivers to have a clear view of the through road ahead.

The length of the acceleration lane for taper and parallel type entrance ramp terminals is determined by the ***AASHTO Green Book.***

The taper type ramp terminal is not to be used where a minimum of 50 mph design speed cannot be maintained.

The parallel type entrance terminal should be used when a bridge is located within the merging lane and when turning roadway speed is less than 60% of LA mainline speed. The length of the acceleration lane is determined by ***2018 AASHTO Green Book, Table 10-4***.

The parallel type exit terminal should be used when the exit is partially hidden over the crest of vertical curve and when turning roadway speed is less than 60% of the LA mainline speed. The length of the deceleration lane is determined by ***2018 AASHTO Green Book, Table 10-6***.

The selection of either a parallel or taper type depends on the geometrics and anticipated traffic conditions of the LA mainline as well as the roadway that the ramp is connecting to. In cases that have limited sight distance and close connections to a signal-controlled arterial, parallel type terminals should be used to allow for sufficient deceleration. For additional information, see the ***2018 AASHTO Green Book, Section 10.9.6***.

At entrance ramps on an ascending grade, the portion of the ramp intended for acceleration and the ramp terminal should closely parallel the LA mainline profile to permit entering drivers to have a clear view of the LA mainline ahead.

Design speed of entrance and exit ramps for LA Facilities should be gradually decreased from the LA mainline design speed to the design speed of the ramp. The minimum speed used to design the first curve adjacent to the LA mainline is 20 mph below the design speed of the LA mainline.

Figure 211.13.1 illustrates a basic configuration and terminology used when designing ramp terminals.

211.14 Managed Lanes Access Points and Access Types

The design of managed lanes access points is based on major origin and destination patterns, the location of toll facilities, and the location of existing interchanges with the general use ~~or general toll~~ lanes. The operational analysis associated with managed lanes access points is performed using the methodology in the Highway Capacity Manual and/or microsimulation. Refer to ***Traffic Analysis Handbook*** and ***Interchange Access Request User's Guide*** for guidance on analysis requirements.

Perform an operational analysis to determine the required length of the weave segment that will accommodate the weave demand. Base the analysis on 1000 feet per lane change weaving length (See ***Exhibits 211-3*** to ***211-6***). Adjust the weave segment length as needed based on the analysis. Perform a safety analysis as required in the ***Interchange Access Request User's Guide***.

An access point serves one of three uses:

(1) Point of entry to the managed lanes

(2) Intermediate point of entry/ingress or exit/egress

(3) Termination of managed lanes

When determining the point of entry and the termination of managed lanes, consideration is given to future phased implementation plans for the corridor depicted in the ultimate managed lanes diagram. Avoid temporary access points.

Avoid locating a managed lanes access point in the same weaving area as other highway weaving movements (i.e., interchange on-ramps, interchange off-ramps, or auxiliary lanes). Access points are located to provide the required weave length between the managed lanes and general use lanes ~~or general toll lanes~~. If placed closer than the required minimum weave length, additional traffic control devices are added to prohibit vehicles from cutting across traffic to get into the managed lane or get out to the interchange exit.

Traffic operational analyses must demonstrate that queuing from vehicles exiting the managed lanes to the general use lanes ~~or general toll lanes~~ will not encroach on the managed lanes.

Refer to ***Section 2.42*** of the ***TEM*** for guidelines on managed lanes entrance/ingress and exit/egress signs and signing sequence.

211.14.1 Managed Lanes Access Types

On Florida's managed lanes, the following types of access are used:

- Slip Ramps
- Weave Lanes
- Weave Zones
- Direct Connect
- Continuous Access

Slip ramps, weave lanes, and weave zones on the Interstate do not require an interchange access request. A weave lane or weave zone is used in constrained conditions for intermediate ingress and egress points and requires approval of the District Design Engineer. Continuous access is prohibited for use with express lanes and may require increased enforcement.

Direct connect ramps are used for system-to-system connection between managed lanes facilities, toll facilities, major arterials, park-and-ride facilities, and transit facilities. Direct connect ramps on the Interstate require an interchange access request (Refer to the ***Interchange Access Request User's Guide***.) Refer to the ***Managed Lanes Guidebook*** for further information.

Standard geometric details are shown in ***Exhibits 211-3*** through ***211-8***. The associated signing and pavement marking requirements at ingress and egress locations are shown in ***Exhibits 211-9*** through ***211-12***.

Exhibit 211-3: Begin Managed Lanes Typical Ingress For Managed Lanes With Buffer Separation

Exhibit 211-4: End Managed Lanes Typical Egress For Managed Lanes With Buffer Separation

Exhibit 211-5: Slip Ramp Typical Ingress & Egress For Managed Lanes With Buffer Separation

Exhibit 211-6: Weave Sections Typical Ingress & Egress For Managed Lanes With Buffer Separation

Exhibit 211-7: Managed Lanes Entrance Terminal Configurations

Exhibit 211-8: Managed Lanes Exit Terminal Configurations

Exhibit 211-9: Managed Lanes Typical Pavement Markings For Slip Ramp Ingress & Egress

Exhibit 211-10: Managed Lanes Typical Pavement Markings For Weave Sections Ingress & Egress

Exhibit 211-11: Managed Lanes Typical Pavement Markings For Begin Managed Lanes

Exhibit 211-12: Managed Lanes Typical Pavement Markings For End Managed Lanes

211.15 Limited Access Right of Way

The following criteria will be used in establishing Limited Access limits along crossroads at interchanges. LA R/W will end at the same station for both sides of the crossroad based on the greatest distance from the LA facility.~~:~~

(1) Extend the LA R/W along the crossroad 1,320 feet measured from the end of the taper of the ramp furthest from the interchange. See ***Florida Administrative Code, Rule 14-97*** for additional information.

~~(1)~~(2) In constrained conditions, ~~F~~for rural interchanges, LA R/W will extend along the crossroad as far as the first intersection with an arterial road or a minimum distance of 300 feet beyond the end of the acceleration or deceleration taper. Where no taper is used, the LA R/W will extend a minimum distance of 300 feet beyond the radius point of the return. ~~LA R/W will end at the same station for both sides of the crossroad based on the greatest distance from the LA facility.~~

~~(2)~~(3) In constrained conditions, f~~F~~or interchanges in urban areas, the criteria given above will apply except that the LA R/W will end a minimum of 100 feet beyond the end of taper or the radius point of the return.

~~(3) Extend LA R/W for queue spillback on the arterial within interchanges of arterials and LA facilities.~~

~~(4) For unsymmetrical interchanges such as half-diamonds and partial clover leafs, the LA R/W along the crossroad on that side having no ramp will extend to a point opposite that point controlled by the ramp.~~

~~(5)~~(4) Extend LA R/W along crossroads overpassing LA facilities (no interchange) 200 feet from the LA facility R/W line. This distance may be reduced or omitted if the crossroad profile provides adequate sight distance for existing or proposed driveways. The fence is generally tied into the crossroad structure end bent unless required along the crossroad.

Any reduction in the 300 feet rural and 100 feet urban minimum values shown above for LA R/W limits must be approved by FHWA for interstate projects and by the District Design Engineer for non-interstate facilities.

211.16 Maintenance Access

Accommodation of access for maintenance is integral to the roadway typical section on LA facilities. Specific requirements for the area immediately adjacent to toll sites is contained within the ***General Tolling Requirements (GTR)***. Requirements for access through various roadside safety devices is contained within ***FDM 215***.

Along ramps and mainline lanes where roadside barriers are used, the minimum border width from the back of a barrier or retaining wall is 10 feet. Provide sufficient access from public R/W that is contiguous and unimpeded to the LA facility for maintenance vehicles.

If the maintenance access is not continuous along a barrier or wall, and thus maintenance vehicles and equipment would need to turn around, then a sufficient turnaround area must be provided that is acceptable and approved by the District Maintenance Engineer.

Maintenance accessibility includes the ability for equipment and vehicles to maneuver around obstacles including fences, lights, signs, side slopes, and ponds.

The maximum continuous length of a guardrail or barrier wall run along the outside of the roadway is 2,500 feet between end terminals. An access opening must be provided when long guardrail or barrier wall runs are broken up. Coordinate with the District Maintenance Engineer and District ITS Design Engineer on the final access location points to meet the needs of maintenance and operations. The preferred typical detail for roadside guardrail access openings is depicted in the ***Standard Plans* Instructions (SPI) for Index 536-001**.

211.17 Roadway and Bridge Approach Slab Evaluation

Resurfacing Projects – Perform a qualitative evaluation for approach slabs throughout the limits of the project to ensure they are providing a smooth transition to the bridge. When deficiencies are identified, summarize the potential underlying causes, and provide a recommendation for correcting the deficiencies.

Capacity Improvement Projects – Perform the same qualitative evaluation as required for the resurfacing projects and include in the design documentation submitted with the preliminary geometry and grade submittal. Existing bridges and approach slabs that are scheduled for complete reconstruction do not need to be evaluated for corrective measures.

211.18 Interchange Areas Bicycle and Pedestrian Facilities

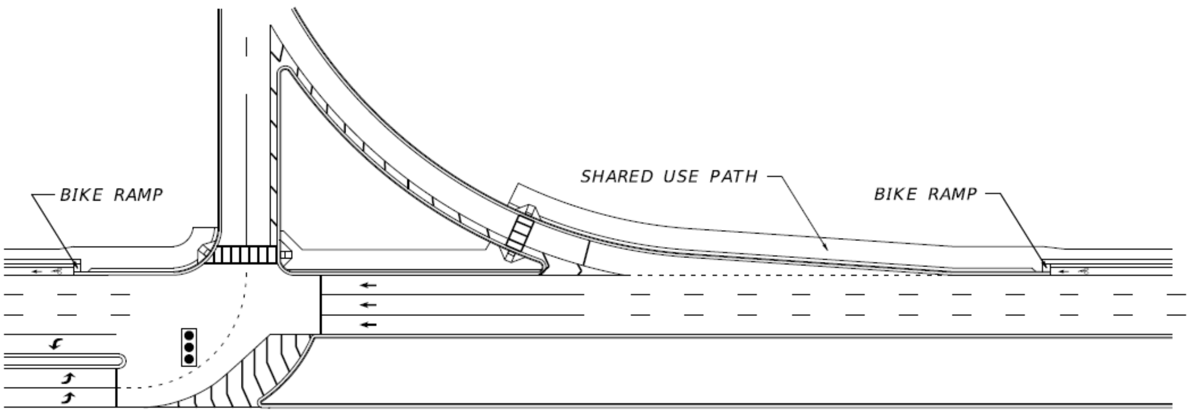
Provide a shared use path to move pedestrians and bicyclists through interchange locations where pedestrian and bicycle facilities are required. See ***FDM 224*** for the types of shared use paths and associated criteria for each. For existing interchanges where a shared use path cannot be provided, a design variation is not required.

The shared use path can be continuous through the entire influence area of the interchange or can be used only at ramp intersection locations. A continuous path through the entire interchange is preferred but may not always be feasible. See the ***Interchange Access Request User's Guide*** to determine if an Interchange Access Request (IAR) or break in Limited Access R/W is required.

211.18.1 Bicycle Ramps

Connect bicycle lanes to the shared use path using bicycle ramps (***FDM 223.2.6***). Terminate bicycle lanes at the approach to the interchange and resume the bicycle lane at the far side of the interchange. A conceptual layout of entry and exit bicycle ramps to a shared use path from a bicycle lane is provided in ***Figure 211.18.1***. See ***FDM 230*** and the ***TEM*** for additional information on pavement marking and signing.

Figure 211.18.1 Conceptual Layout of Bicycle Ramps at Interchange Areas



For existing interchanges where a bicycle ramp cannot be provided, a design variation is not required. Consider any of the following mitigation strategies, in addition to the required keyhole lane, where there is not an option lane:

- Provide an "exit ramp" from the bicycle lane to a sidewalk and an "entry ramp" from the sidewalk to the bicycle lane.
- Provide supplemental green markings within the keyhole lane. See FDM 223 for information on bicycle facilities.
- Add speed management strategies to lower speeds through the conflict area. See FDM 202 on Speed Management.

Where there is an option lane, discontinue the bicycle lane on the approach to the interchange and resume at the far side of the interchange.

211.18.2 Refuge Island at Ramp Intersections

Design corner channelization islands as refuge islands that meet the criteria in ***FDM 210.3.2.3***.

211.18.3 Intersection Angle with Crossroad

Provide an intersecting angle consistent with intersection design criteria in ***FDM 212***.

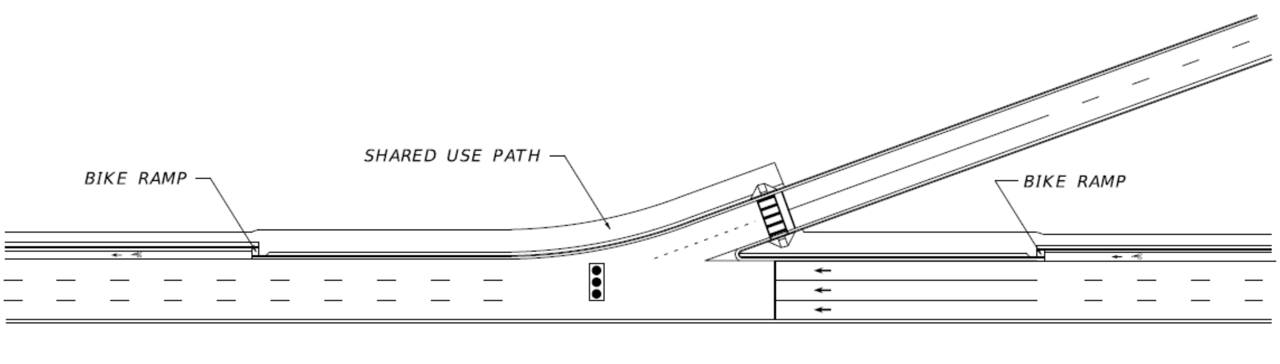
When the intersecting angle cannot be between 75 to 90 degrees, process a design variation, and consider the following mitigation strategies:

- Signalize the free-flowing or yield on/off-ramp movement or
- Provide a pedestrian signal or Rectangular Rapid-Flashing Beacon (RRFB) for the pedestrian crossing. For the criteria of a RRFB, please refer to ***TEM 5.2.5.2***.

A conceptual layout of a low-angle ramp intersection with mitigation strategies is provided in ***Figure 211.18.2***.

For existing interchanges, a Design Variation is only required when the mitigation strategies are not met. Existing ramp configuration does not require a Design Variation on RRR projects.

Figure 211.18.2 Example of Mitigation for Low-Angle Ramp



211.18.4 Signing and Pavement Markings

See ***FDM 230.6*** for typical signing and pavement markings for bicycle and pedestrian facilities through interchange areas.

212 Intersections

212.1 General

This chapter provides design criteria and guidance for the geometric layout of at-grade conventional intersections. Conventional intersections include 3-leg (T), 4-leg, and Multi-leg (5 or more legs).

Multi-leg conventional intersections should be avoided. Alternatives to existing multi-leg intersections include:

(1) Converting to a roundabout.

(2) Converting one or more legs to a one-way operation

(3) Reconfiguring or realigning the intersection to create separate intersections, each with no more than four legs.

See ***FDM 201*** for design vehicle selection and design speed requirements.

See ***FDM 210*** for lane width, median width, island dimensions, and deflection angle requirements.

See ***FDM 222*** for requirements concerning pedestrian facilities and ***FDM 223*** for bicycle facilities.

212.1.1 Alternative Intersections

Alternative intersection design is a key component of upgrading our transportation facilities and improving the mobility and safety of all road users. These innovative designs are becoming more common as increasing traffic demand exceed the limitations of traditional intersection solutions.

Alternative intersections offer the potential to improve safety and reduce delay at lower cost and with fewer impacts than traditional solutions such as adding lanes or grade separation. Three of the more common alternative intersection types are:

- Displaced Left Turn (a.k.a. Continuous Flow Intersection)
- Restricted Crossing U-Turn (RCUT)
- Median U-Turn (MUT)

The FHWA has published comprehensive informational guides for alternative intersections which include guidance on how to plan, design, construct, and operate them. The following links provide access to these guides: ***FHWA Alternative Designs*** and ***Alternative Intersections/Interchanges: Informational Report (AIIR).***

These types of alternate intersection designs should be coordinated with the Central Office Roadway Design.

212.1.2 Intersection Control Evaluation

Intersection Control Evaluation (ICE) is a process to determine the most effective intersection configuration for a specified project. Through ICE, multiple alternative and conventional intersection configurations are compared to one another based on safety, operations, cost, and environmental impacts. The ICE procedure provides a transparent and consistent approach to intersection alternatives selection and provides documentation to support decisions made.

ICE policy and procedure is published on the FDOT Traffic Engineering and Operations Office website at the following Link: ***Manual on Intersection Control Evaluation***.

212.2 Intersection Control

Conventional intersections utilize one of four control types; yield, stop, all-way stop and signal.

212.2.1 Yield Control

Certain channelized movements at intersections and interchanges, and all approaches to roundabouts are often yield controlled. Refer to the ***Manual on Uniform Traffic Control Devices*** (***MUTCD)*** for information on the locations where yield control traffic control devices may be appropriate.

212.2.2 Stop Control

Stop-controlled intersections have one or more legs of the intersection controlled by a "STOP" sign (R1-1).

Intersections with stop control are a common, low-cost control, which require the traffic on the minor roadway to stop before entering the major roadway. It is used where application of the normal R/W rule is not appropriate for certain approaches at the intersection.

To meet the requirements for the assigned access classification, or where U-turn opportunities exist within a corridor, consider limiting stop controlled minor roads or driveways to “right-in, right-out” only.

212.2.3 All-Way Stop Control

For an all-way stop intersection, traffic approaching it from all directions is required to stop before proceeding through the intersection. An all-way stop may have multiple approaches and typically marked with a supplemental signing stating the number of approaches.

All-way stop control is most effective at the intersection of low-speed, 2-lane roadways not exceeding 1,400 vehicles during the peak hour. All-way stop control should not be used on multilane highways. Guidance for consideration of the application of all-way stop control is provided in the ***MUTCD***.

All-way stop control may be used as an interim measure when a traffic signal or roundabout is warranted, but the installation is delayed.

212.2.4 Signal Control

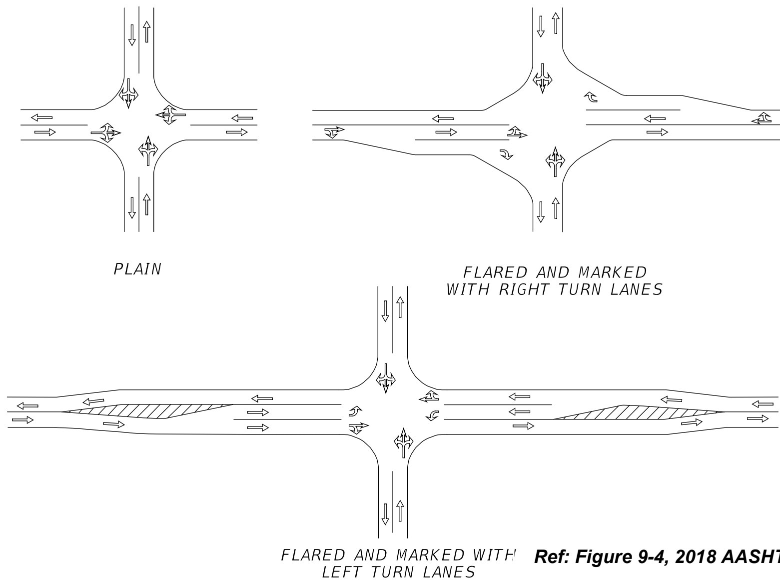
Signalization provides an orderly and predictable movement of motorized and non-motorized traffic throughout the highway transportation system. It also provides guidance and warnings to ensure the safe and informed operation of the traffic stream.

Refer to ***FDM 232*** for design criteria for signalization.

212.3 Intersection Types

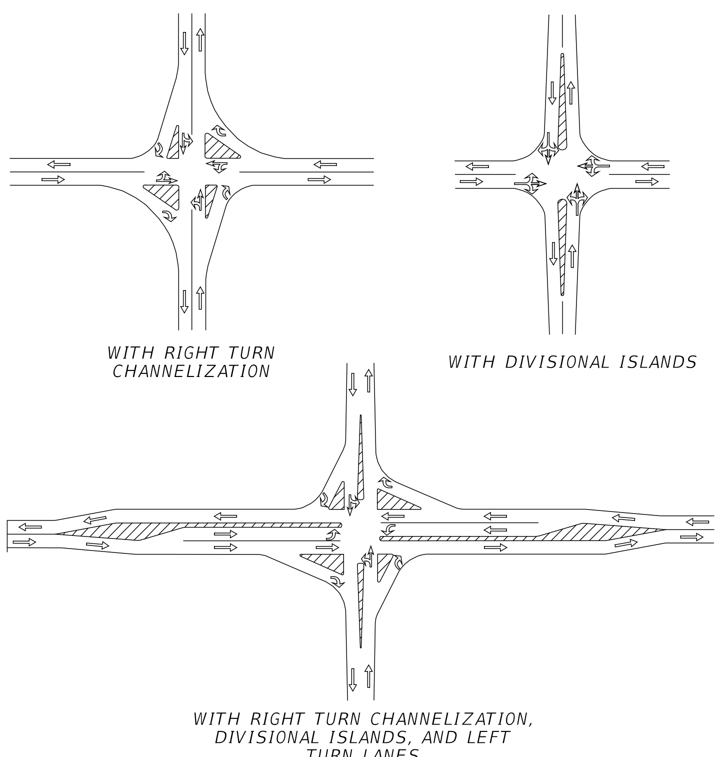
Conventional intersection configurations include flared and channelized intersections (divided and undivided). Flared intersections are illustrated in ***Figure 212.3.1*** and channelized intersections in ***Figure 212.3.2.*** See ***FDM 210.3*** for median and island requirements.

Figure 212.3.1 Flared Intersections



***Ref: Figure 9-4, 2018 AASHTO** Green Book*

Figure 212.3.2 Channelized Intersections



Ref: Figure 9-8, 2018 AASHTO Green Book

212.4 Intersection Functional Area

The functional area of an intersection extends in both directions including auxiliary lanes and their associated channelization. This is illustrated in ***Figures 212.4.1*** and ***212.4.2***.

The functional area on the approach to an intersection or driveway consists of three basic elements:

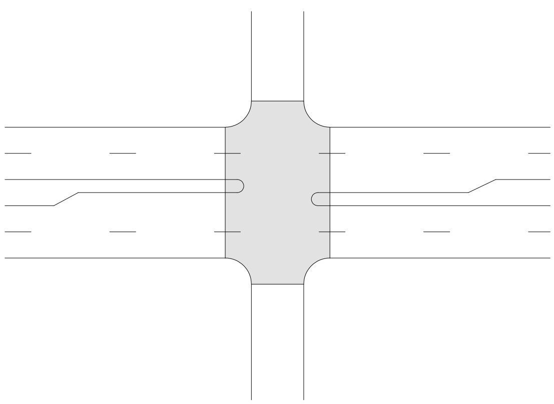
(1) Perception-reaction-decision distance

(2) Maneuver distance

(3) Queue-storage distance (see ***FDM 212.14.2***)

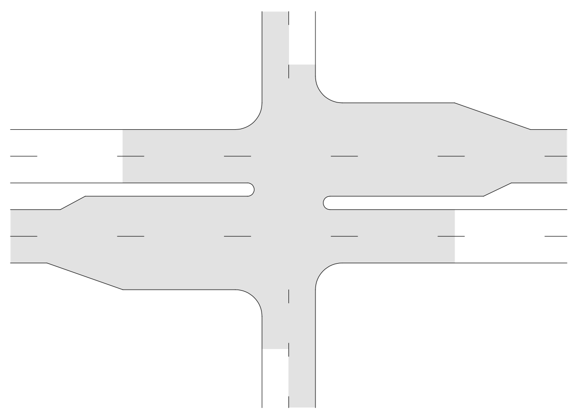
These elements are shown in ***Figure 212.4.3***. The maneuver distance includes the length needed for both braking and lane changing when there is a left or right turning lane. In the absence of turn lanes, the maneuver distance is the distance to brake to a comfortable stop. The storage length includes the most distant extent of any intersection-related queue expected to occur during the design period.

Figure 212.4.1
Physical Definition



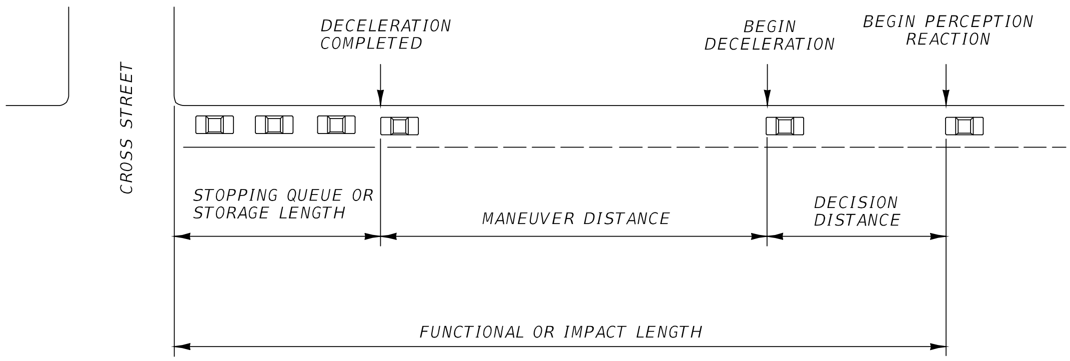
Ref: Figure 9-2, 2018 AASHTO Green Book

Figure 212.4.2
Functional Definition



Ref: Figure 9-2, 2018 AASHTO Green Book

Figure 212.4.3 Elements of the Functional Area



Ref: Figure 9-3, 2018 AASHTO Green Book

212.5 Intersection Angle

The intersection angle between two roadways has a significant influence on the safety and operation of an intersection. Intersection angles are to be as close to 90 degrees as practical. Intersection angles less than 75 degrees should be avoided for the following reasons:

(1) Heavy skew angles increase the intersection crossing length, exposing vehicles, pedestrians, and cyclists to conflicting traffic streams for longer periods of time. This is of particular concern at stop-controlled approaches on high-speed facilities.

(2) The road user's sight angle to the crossing leg becomes restricted due to the skew, making it difficult to see conflicting vehicles and to perceive safe crossing gaps.

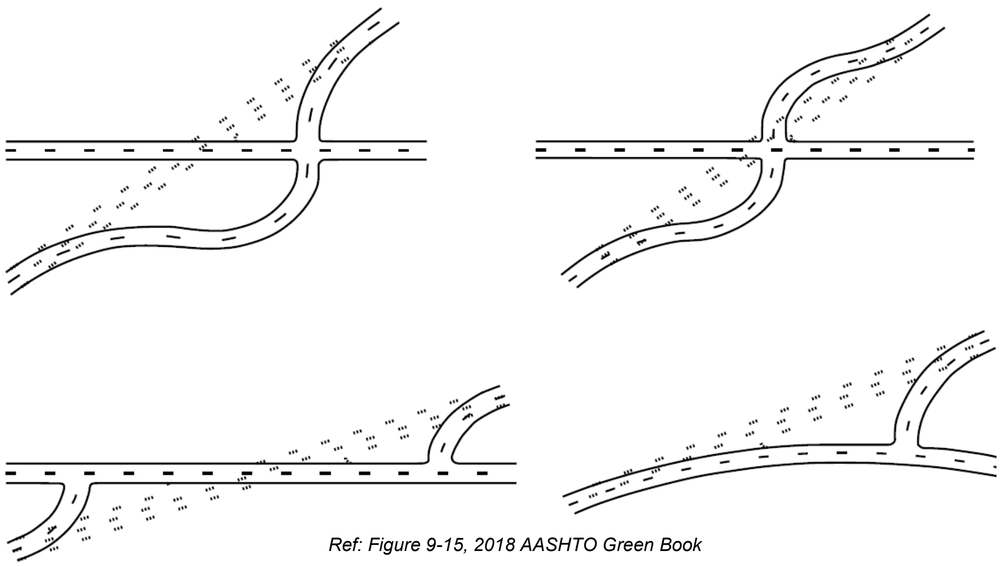
(3) Turning movements are difficult because of the skew. Additional pavement may be necessary to accommodate the turning of large trucks.

(4) Turning movements or positioning may be confusing and require additional channelization.

(5) Increased open pavement areas of highly skewed intersections increase construction and maintenance costs.

Evaluate intersections with severe skew angles and crash histories for geometric improvements as shown in ***Figure 212.5.1***. A high incidence of right-angle crashes is an indicator that improvements may be justified.

Figure 212.5.1 Intersection Reconfigurations



Ref: Figure 9-15, 2018 AASHTO Green Book

212.6 Lane Tapers

Standard taper lengths for auxiliary lanes are given in ***FDM 212.14***. Taper length is based on the following equations:

(1) Merging Taper (L):

(a) For design speeds ≤ 40 mph: $L = (W*S^2)/60$

(b) For design speeds ≥ 45 mph: $L = W*S$

Where: L = Taper length (feet)
W = Width of offset (feet)
S = Design speed (mph)

(2) Shifting Taper is equal to Merging Taper (L) / 2.

Minimum deceleration lengths are illustrated in ***Exhibit 212-1***. Additional information on lane transitions (add or drop) are provided in ***Exhibits 212-2*** and ***212-3***.

Exhibit 212-1: Median Turn Lanes Minimum Deceleration Lengths

Exhibit 212-2: Lane Transitions: 4-Lane Roadways

Exhibit 212-3: Lane Transitions: 2-Lane Roadways

212.7 Lane Shifts

Lane shifts through intersections should meet the requirements for non-merging conditions. Pavement markings should be used through the intersection to provide positive guidance to the motorist. The shifting taper length is controlled by the size of the intersection and the deflection angle. Although deflections through intersections are discouraged, there may be conditions where they are necessary.

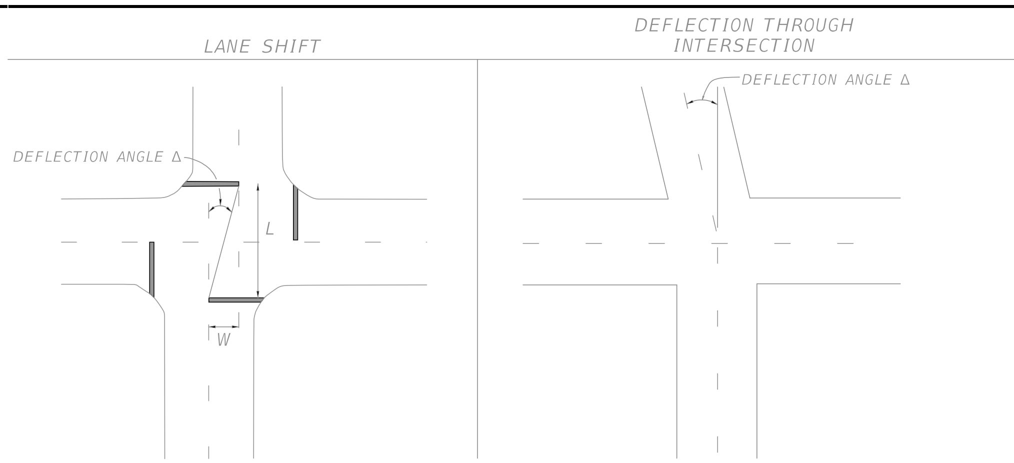
The maximum deflection angles at intersections to be used in establishing the horizontal alignment are given in ***Table 212.7.1***.

Table 212.7.1 Maximum Deflection Angle Through Intersection

Maximum Deflection Angle Through Intersection (DM)					
Design Speed (mph)					
≤ 20	25	30	35	40	45
16° 00'	11° 00'	8° 00'	6° 00'	5° 00'	3° 00'

Notes:

Deflection angle used is not to cause a lane shift (W) of more than 6 feet from stop bar to stop bar.



212.8 Profile Grades

The profile grade line defines the vertical alignment for construction. The grade line of the mainline road is typically carried through the intersection and the minor crossroad (or cross street) is adjusted to it. This design involves a transition in the crown of the crossroad to an inclined cross section at its junction with the mainline road, as illustrated in ***Figure 212.8.1***.

The break in the crossroad profile at the center of the intersection should be accomplished with a vertical curve.

Vertical alignments at or near intersections should provide traffic lanes that are:

(1) Clearly visible and understandable to drivers for any desired direction of travel,

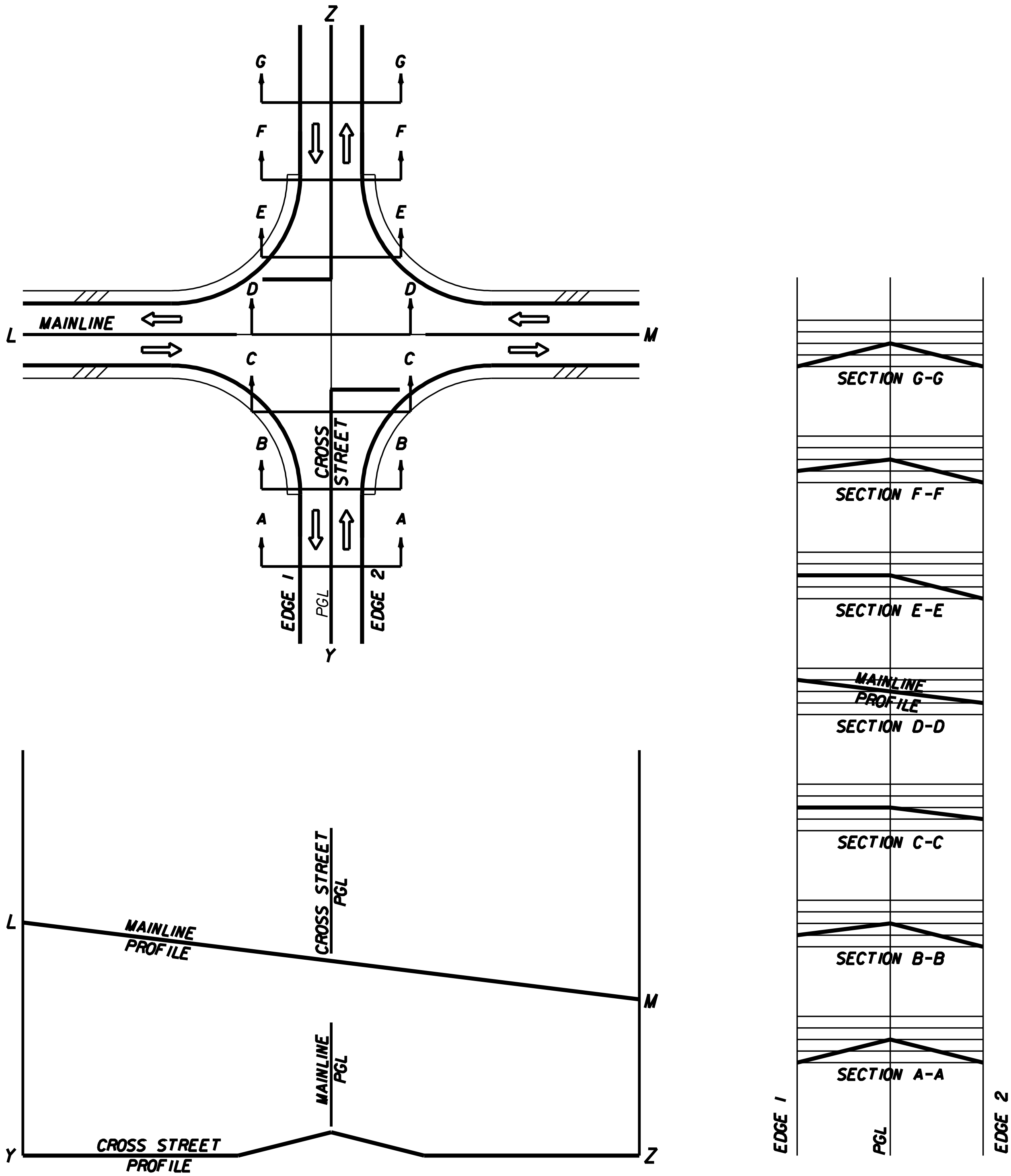
(2) Free from sudden appearance of potential conflicts, and

(3) Consistent in design with the portions of the highway just traveled.

Steep grades at intersections may increase or decrease stopping or acceleration distance. Avoid grades in excess of 3% on intersecting roads in the vicinity of the intersection. Where conditions make such designs impractical, grades should not exceed 6%.

Provide adequate sight distance along both intersecting roads and across their included corners, even where one or both intersecting roads are on vertical curves. The gradients of intersecting roads should be as flat as practical on those sections that are to be used for storage of stopped vehicles.

Figure 212.8.1 Cross Street Intersection Transition



212.8.1 Special Profiles

Special profiles for certain roadway elements may be necessary to ensure a safe, efficient, well-drained and smooth roadway system. Elements that may require special profiles include pavement edges or gutter flow lines at street intersections, profile grade lines, intersection plateaus, curb returns, and special superelevation details. Special profiles are developed at close intervals and large scale to clearly identify all construction details of these elements.

212.8.2 Plateauing

In some instances, it is desirable for the crossroad to receive the same profile considerations as the mainline road. To provide this "equal treatment", with respect to profile, a technique commonly known as intersection plateauing is applied. Plateauing refers to flattening of the intersection and the transition of both roadway profiles and cross slopes on the intersection approaches.

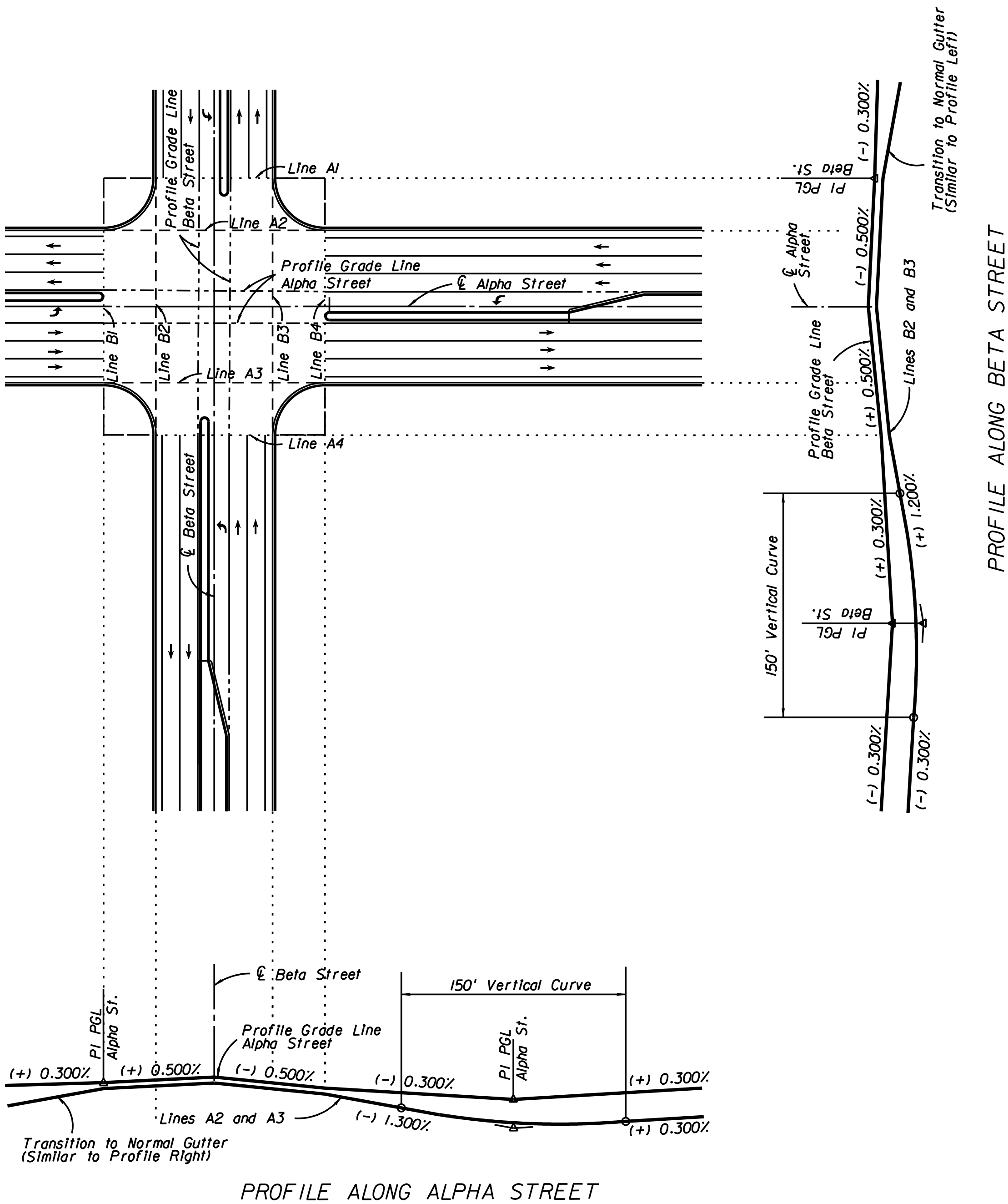
Provide a profile combination that provides a smooth transition and adequate drainage when applying intersection plateauing. Transition slope rates are to meet the values provided in ***Table 212.8.1***; however, the minimum length of cross slope transition is 50 feet for design speeds less than or equal to 35 mph and 75 feet for design speeds of 40 mph or greater.

An example of a plateaued intersection is illustrated in ***Figure 212.8.2***.

Table 212.8.1 Slope Rates for Intersection Approaches

Design Speed (mph)	Slope Ratio
25-35	1:100
40	1:125
45-50	1:150
55-60	1:170
65-70	1:190

Figure 212.8.2 Example of Plateaued Intersection



212.9 Median Openings

Locate and design median openings to meet traffic requirements in accordance with the access management plan for the facility. See ***FDM 201.4*** for more information on access management plans and decision making.

See ***FDM 210.3*** for additional requirements for medians at intersections**.**

The following conditions may require additional median width:

- accommodation for trees (provide space above and below ground for growth)
- offset turn lanes
- directional median openings
- dual and triple left turn lanes

The overall length of a full median opening is typically the same width as the intersecting road (including shoulders) which is sufficient to accommodate the swept path of left turning vehicles. Median functions and minimum widths are provided in ***Table 212.9.1***.

For un-signalized intersections, median openings should not be longer than the required length to avoid multiple vehicles attempting to stop within the opening.

Table 212.9.1 Minimum Median Width

Median Function	Minimum Width (feet)
Separation of opposing traffic	4
Provision for pedestrian refuge	6
Provision for storage of left-turning vehicles	See ***Table 210.3.1***
Provision for protection of vehicles crossing through lanes	22
Provision for U-turns, left turn lane to outside lanes	30
Provision for Dual Left Turn Lanes and U Turns	42

The control radius refers to a radius that must be considered in establishing the location of median or traffic separator ends on divided highways and the stop bar on undivided highways. Provide this radius for left-turn movements when appropriate.

Design guidance on minimum edge-of-traveled-way design for various design vehicles is provided in ***FDM 212.12.1***.

For the central part of the turn the use of compound curves is not necessary and the use of simple curves is satisfactory. ***Table 212.9.2*** provides control radii for minimum-speed turns (10 to 15 mph) that can be used for establishing the location of the median ends.

Table 212.9.2 Control Radii for Minimum Speed Turns

Design Vehicles Accommodated	Control Radius (feet)			
	50 (40 min)	60 (50 min)	75	130
Predominant	P	SU-30	SU-40, WB-40	WB-62FL
Occasional	SU-30	SU-40, WB-40	WB-62	WB-67

212.9.1 U-Turns

Median width should accommodate passenger vehicle (P) left-turn and U-turn maneuvers. If adequate median width does not exist for accommodating U-turns, then consider adding extra pavement width such as a taper or additional shoulder width. See ***FDM 210.3*** for information on median width criteria.

In cases where U-turn traffic volumes are high, consider the use of jug handles, loop designs, or indirect left turn designs.

212.10 Stopping Sight Distance

See ***FDM 210.11.1*** for stopping sight distance requirements.

212.11 Clear Sight Triangles

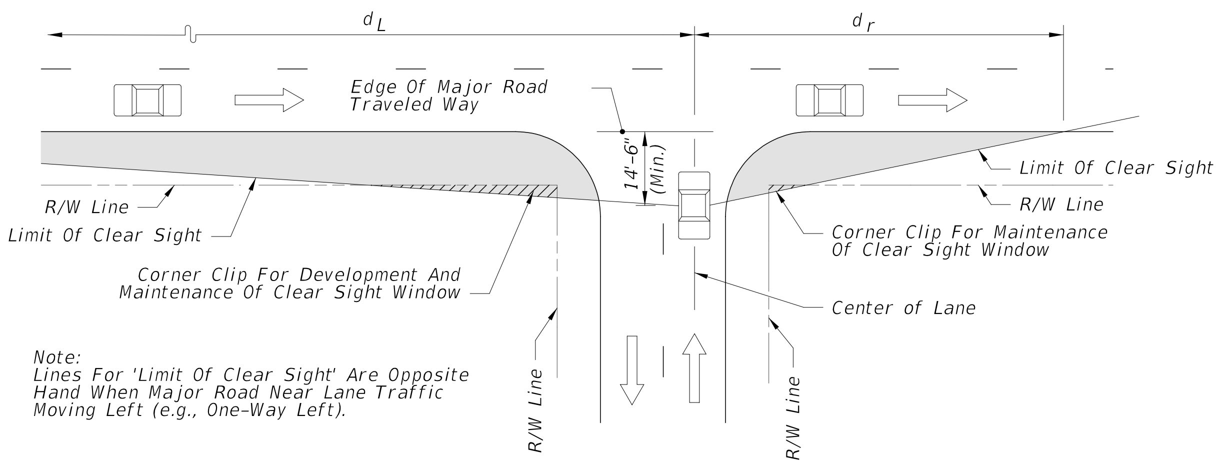
Establish clear sight triangles to assure that drivers are provided a sufficient view of the intersecting highway to identify gaps in traffic and decide when it is safe to proceed. Document the analysis of sight distance for all intersections.

Clear sight triangles are the areas along intersection approach legs and across their common corners that should be clear of visual hindrances. Dimensions of clear sight triangles are based on design speed, design vehicle, and the type of traffic control used at the intersection.

212.11.1 Stop Control (AASHTO Case B)

Figure 212.11.1 illustrates clear sight triangles for intersections and driveways.

Figure 212.11.1 Clear Sight Triangles



The minimum driver-eye setback of 14.5 feet from the edge of the traveled way may be adjusted on any intersection leg only when justified by a documented, site-specific field study of vehicle stopping position and driver-eye position.

Exhibits 212-4 through ***212-7*** provide intersection sight distances for stop-controlled intersections. The tables in the exhibits provide sight distance values for Passenger vehicles, Single Unit (SU) Trucks, and Combination vehicles for design speeds ranging from 30 mph to 65 mph. Intersection sight distance based on Passenger vehicles is suitable for most intersections; however, consider the values for SU Vehicles or Combination vehicles for intersections with high truck volumes.

The following guidance applies to ***Exhibits 212-4*** through ***212-7***:

(1) Limitations

(a) The exhibits apply to intersections in all context classifications with stop control or flashing beacon control.

(b) The exhibits apply only to intersections with intersecting angles between 60°and 120°, and where vertical and horizontal curves are not present.

(2) Dimensions

(a) Sight distance (d) is measured from the center of the entrance lane of the crossroad to the center of the near approach lane (right or left) of the highway.

(b) Distances 'd_L' and 'd_r' are measured from the centerline of the entrance lane of the crossroad to a point on the edge of the near side outer traffic lane on the highway.

(c) Distance 'd_m' is measured from the centerline of the entrance lane of the crossroad to a point on the median clear zone limit or horizontal clearance limit for the far side road of the highway.

(3) Vertical limits

(a) Provide a clear sight window throughout the limits of all intersection sight triangles.

(b) Provide a clear line of sight between vehicles at intersection stop locations and vehicles on the highway throughout the limits of all intersection sight triangles.

(c) The reference datum between roadways is 3'-6" above respective pavements since observations are made in both directions along the line of sight.

Exhibit 212-4: Intersection Sight Distance: 2-Lane Undivided

Exhibit 212-5: Intersection Sight Distance: 4-Lane Undivided

Exhibit 212-6: Intersection Sight Distance: 4-Lane Divided

Exhibit 212-7: Intersection Sight Distance: 6-Lane Divided

212.11.2 All-Way Stop Control (AASHTO Case E)

Provide clear sight lines on each of the approach legs for all-way stop controlled intersections.

212.11.3 Signal Control (AASHTO Case D)

For signalized intersections incorporate the following:

(1) Develop sight distances based on AASHTO 'Case D-Intersections with Signal Control'.

(2) The first vehicle stopped on any approach leg is visible to the driver of the first vehicle stopped on each of the other approach legs.

(3) For permissive left turns provide sufficient sight distance for left turning vehicles to select gaps in oncoming traffic and complete left turns.

(4) If a traffic signal is to be placed on two-way flashing operation (i.e., flashing yellow on the major road approaches and flashing red on the minor road approaches) under off peak or nighttime conditions, then provide the appropriate departure sight triangles for AASHTO Case B (Stop Control on the Minor Road).

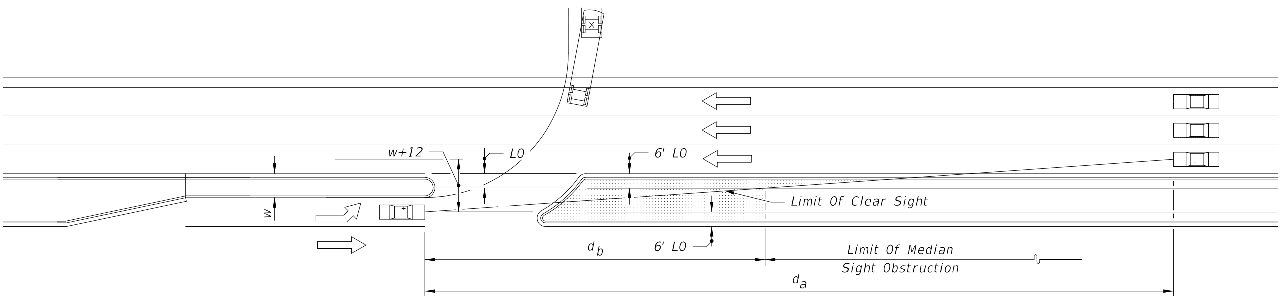
(5) If right turns on red are permitted from any approach leg, then provide the appropriate departure sight triangle to the left for AASHTO Case B above.

212.11.4 Left Turn from Highway (AASHTO Case F)

Provide sufficient sight distance to accommodate a left turn maneuver for locations where left turns across opposing traffic are permitted. ***Table 212.11.1*** provides clear sight distance values for left turn from highway.

For additional information on determining the sight distance refer to Chapter 9 of AASHTO's ***A Policy on Geometric Design of Highways and Streets***.

Table 212.11.1 Sight Distance for Left Turn from Highway



Design Speed (mph)	d_a (feet)								
	1 Lane Crossed			2 Lane Crossed			3 Lane Crossed		
	P	SU	Comb.	P	SU	Comb.	P	SU	Comb.
25	205	240	280	225	265	305	240	290	330
30	245	290	330	265	320	365	290	350	395
35	285	335	385	310	370	425	335	410	460
40	325	385	440	355	425	485	385	465	525
45	365	430	495	400	475	545	430	525	590

Notes:

(1) Provide a lateral offset (LO) of 6' as shown in the diagram above. d_b may be determined by the equation $d_b = d_a (w/(w+12))$. For roadways with non-restricted conditions, d_a and d_b should be based on the geometry for the left turn storage and on clear zone widths.

(2) For wide medians where the turning vehicle can approach the through lane at or near 90°, use d values from tables in ***Exhibits 212-6*** and ***212-7***. (The clear sight line origin is assumed to be 14.5 feet from the edge of the near travel lane.

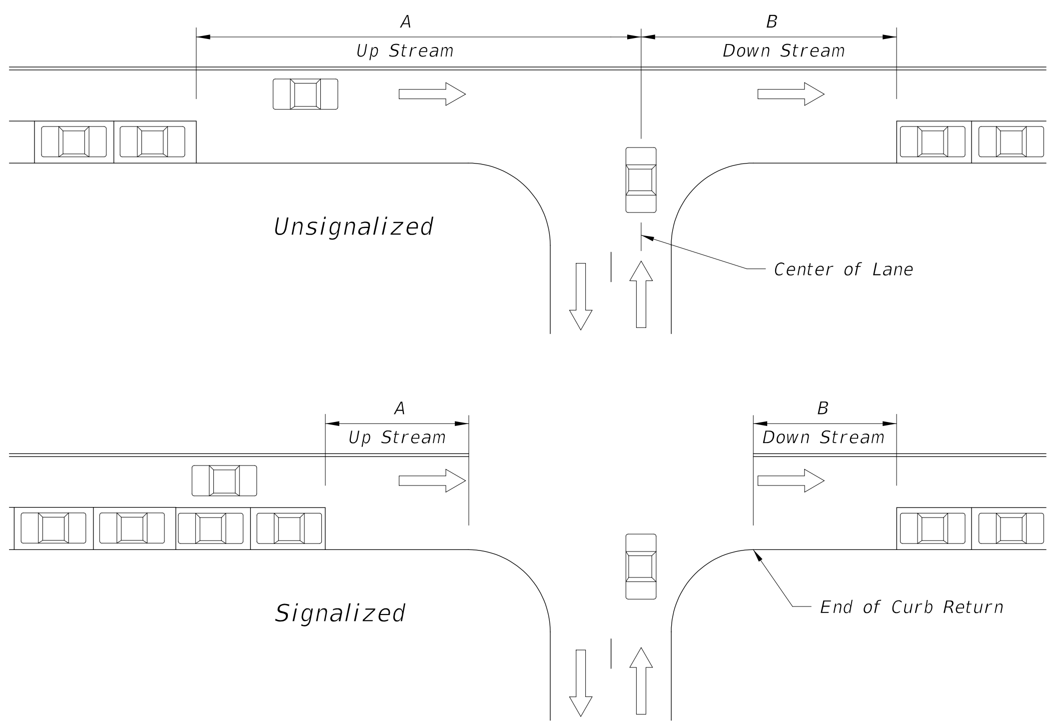
212.11.5 On-Street Parking

Table 212.11.2 provides parking restrictions for intersections, including mid-block crossings and roundabout approaches. For additional information, see the following:

- ***FDM 210.2.3*** for additional information concerning on-street parking.
- ***FDM 222.2.6*** for information concerning curb extensions (bulb-outs).
- ***Chapter 316, Florida Statutes*** (***F.S.***), for laws governing parking spaces.

Table 212.11.2 Parking Restrictions for Driveways and Intersections

Control Type	Posted Speed (mph)	A - Up Stream (ft)	B – Down Stream (ft)	
			2-Lane	4-Lane or more
Unsignalized	< 35	90	60	45
	35	105	70	50
Signalized	< 35	30	30	30
	35	50	50	50



Notes:

(1) For entrances to one-way streets, the downstream restriction (B) may be reduced to 20 feet.

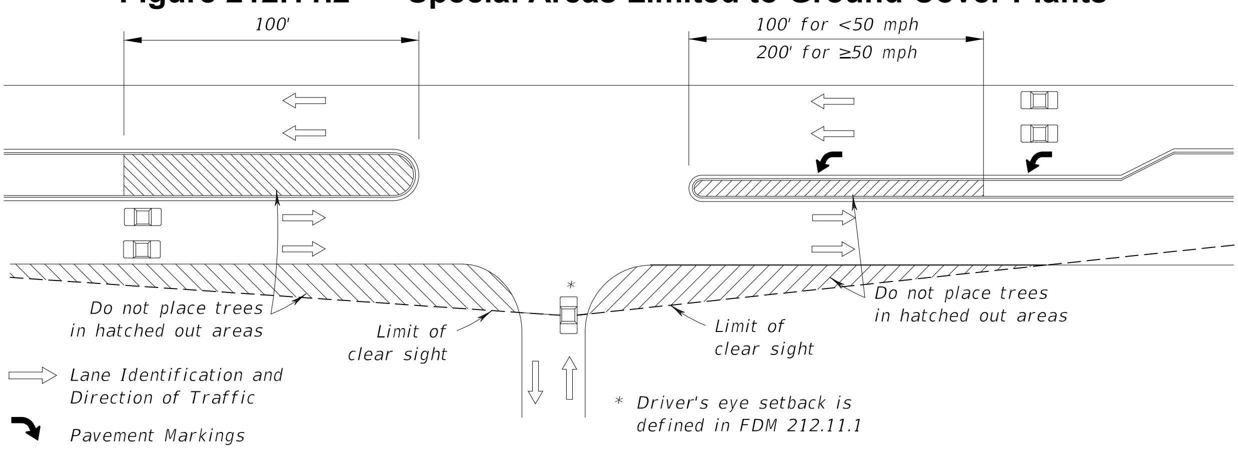
(2) Do not place parking within 20 feet of a marked crosswalk.

212.11.6 Trees and Vegetation

Intersections should be designed to accommodate the placement of trees and other desired vegetation (e.g., ground cover plants, trunked plants) in C2T, C3C, C4, C5, and C6 context classifications while still maintaining clear sight triangles. Ground cover plants are naturally low-growing plants with a maximum mature height of ≤ 18 inches. Trunked plants are those with a mature trunk diameter of 4 inches or less (measured 6 inches above the ground).

Maintain clear sight triangles for all approaches. Do not place trees within the hatched-out areas as shown in ***Figure 212.11.2***. The hatched-out areas are for ground cover plants only. Coordinate with the Project Landscape Architect for the placement of vegetation and the necessary space above and below ground for tree growth that will maintain clear sight triangles.

Figure 212.11.2 Special Areas Limited to Ground Cover Plants

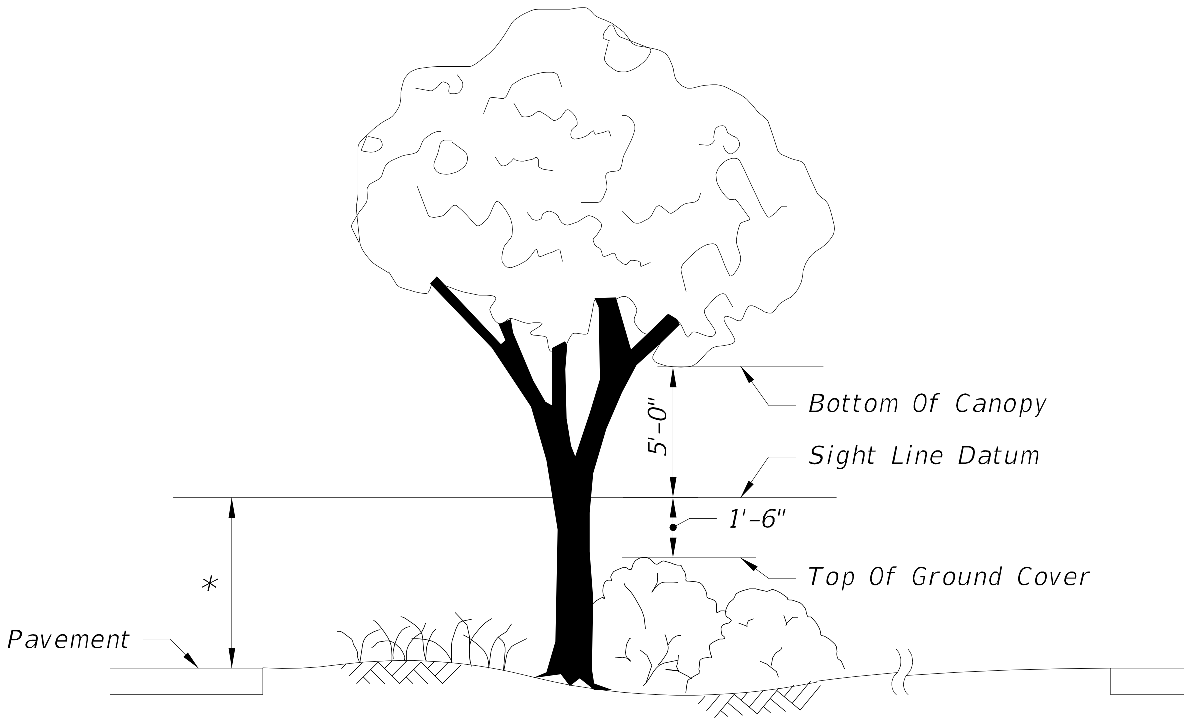


Where left turns from the major road are permitted, do not locate trees within the distance d_b shown in ***Table 212.11.1*** (see ***FDM 212.11.4***) and not less than the distances shown in ***Figure 212.11.2*** and the spacings in ***Table 212.11.3*** as applicable.

212.11.6.1 Clear Sight Window Concept

The clear sight window concept may provide opportunities for vegetation within the limits of intersection sight triangles. This concept is illustrated in ***Figure 212.11.3.*** This detail provides the required vertical clear sight limits with respect to the sight line datum. Do not place trees within the hatched-out areas as shown in ***Figure 212.11.2*** (even if using the clear sight window concept). The hatched-out areas are for ground cover plants only.

Figure 212.11.3 Window Detail



* Since observations are made in both directions, the line-of-sight datum between roadways is 3.5 feet above both pavements.

The horizontal limits of the window are defined by clear sight triangles. Within the limits of clear sight triangles, the following restrictions apply:

- Canopy of trees and trunked plants must be at least 5 feet above the sight line datum.

- The top of the ground cover plants must be at least 1.5 feet below the sight line datum.

See ***FDM*** ~~***228.2(2)(a)***~~***270*** for additional information about plant selection and placement. Enforcing these limits provides a clear line of sight for approaches to an intersection.

When trees are located in the median of a divided roadway and fall within the limits of a clear sight triangle, conform to ***Table 212.11.3*** for tree size and spacing. Spacing values for trees with diameter of 11 inches or less were derived assuming a maximum 6-foot-wide shadow band on a vehicle at the stop bar location when viewed by a mainline driver beginning at sight distance 'd'. This is illustrated in ***Figure 212.11.4***. Spacing values for trees with diameter greater than 11 inches and less than or equal to 18 inches were derived assuming a 2 second full view of the vehicle at the stop bar when viewed by the mainline driver beginning at sight distance ‘d’. (See ***Figure 212.11.5***).

Table 212.11.3 Minimum Tree Spacing

Design Speed (mph)	Minimum Tree Spacing (Center-to-Center of Trunk) (feet)	
	4” < Tree Diameter ≤ 11”	11” < Tree Diameter ≤ 18”
25	20	75
30	25	90
35	30	105
40	35	120
45	40	135
50	50	150
55	55	165
60	60	180

Notes:

(1) Size and spacing are based on the following conditions:

(a) A single line of trees in the median parallel to but not necessarily collinear with the centerline.

(b) A straight approaching mainline and intersection angle between 60° and 120°.

(c) Space trees with 4” < Dia. ≤ 11” intermixed with trees with 11” < Dia. ≤ 18” based on trees with 11” < Dia. ≤ 18”.

(2) Detail tree size, spacing, and location in the plans for any other conditions.

(3) Trunked Plants may be placed on 20-foot centers.

Figure 212.11.4 Shadow Diagram

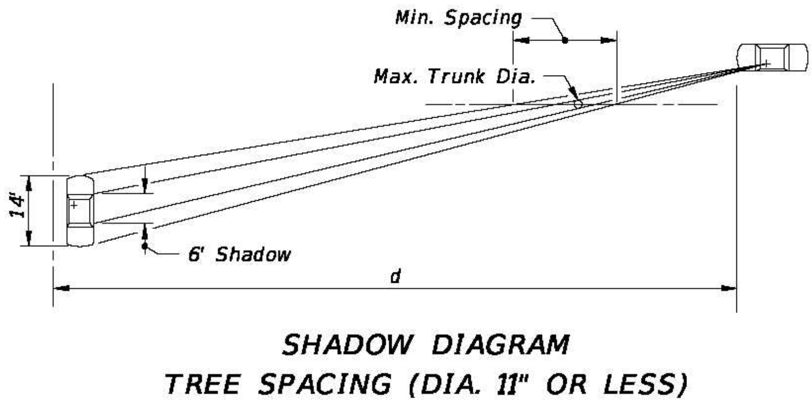
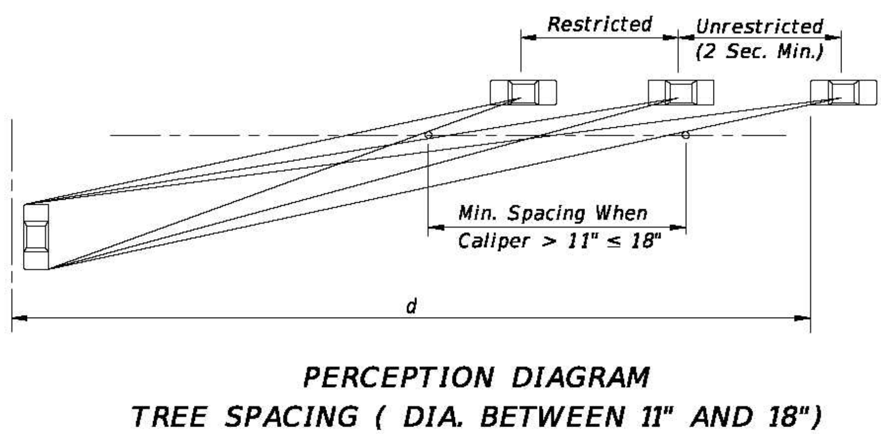


Figure 212.11.5 Perception Diagram



212.12 Turning Roadways

Turning roadways are typically designed for use by right-turning traffic at intersections. There are three types of right-turning roadways:

- edge-of-traveled-way design
- design with a corner triangular island
- free-flow design using a simple radius or compound radii

The turning radii and the pavement cross slopes for free-flow right turns are functions of design speed and design vehicle.

212.12.1 Edge-of-Traveled-Way Design

When selected design vehicle is to be accommodated within minimum space, corner radii should be based on the required turning path.

Table 212.12.1 provides simple curve radii with and without tapers. ***Table 212.12.2*** provides symmetric and asymmetric three centered compound curve radii for a range of design vehicles. These values provide the minimum turning paths attainable at design speeds of 10 mph and less.

Figure 212.12.1 demonstrates the angle of turn for use in these tables.

The minimum edge-of-traveled-way values provided in these tables are based on the assumption that the vehicle is properly positioned within the traffic lane at the beginning and end of the turn (2 feet from the edge-of-traveled-way on the tangents approaching and leaving the intersection curve). Such designs follow closely the inner wheel path of the selected design vehicle, with a clearance of 2 feet or more throughout most of the turn, and with a clearance at no point less than 9 inches. Differences in the inner paths of vehicles turning left and right are not sufficient to be significant in design. For this reason, these edge designs also apply to left-turn maneuvers, such as a left turn by a vehicle leaving a divided highway at a very low speed.

Figure 212.12.1 Turn Angle for Turning Roadway Designs

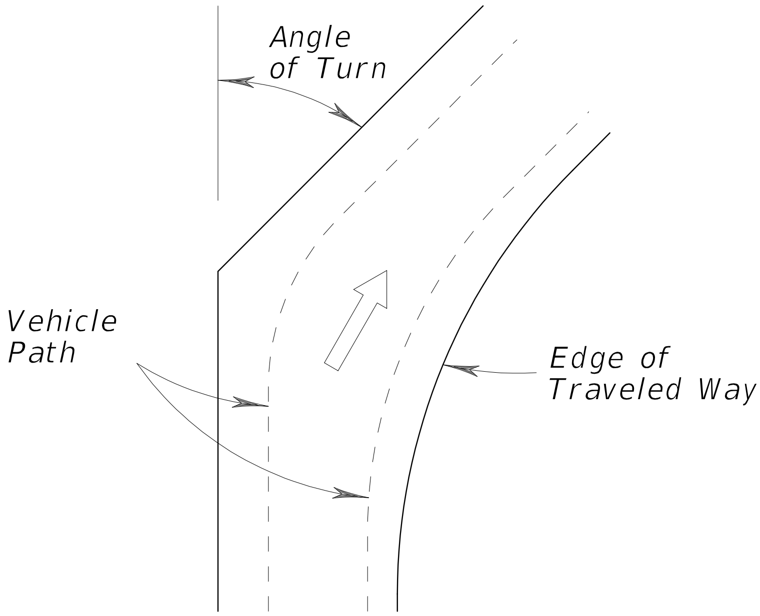


Table 212.12.1 Edge-of-Traveled-Way, Simple Curve Radii

Angle of Turn (degrees)	Design Vehicle	Simple Curve Radius (feet)	Simple Curve Radius with Taper		
			Radius (feet)	Offset (feet)	Taper H:V
30	P	60	----	----	----
	SU-30	100	----	----	----
	SU-40	140	----	----	----
	WB-40	150	----	----	----
	WB-62	360	220	3.0	15:1
	WB-62FL	380	220	3.0	15:1
	WB-67	380	220	3.0	15:1
	WB-92D	365	190	3.0	15:1
	WB-100T	260	125	3.0	15:1
	WB-109D	475	260	3.5	20:1
45	P	50	----	----	----
	SU-30	75	----	----	----
	SU-40	115	----	----	----
	WB-40	120	----	----	----
	WB-62	230	145	4.0	15:1
	WB-62FL	250	145	4.5	15:1
	WB-67	250	145	4.5	15:1
	WB-92D	270	145	4.0	15:1
	WB-100T	200	115	2.5	15:1
	WB-109D	----	200	4.5	20:1
60	P	40	----	----	----
	SU-30	60	----	----	----
	SU-40	100	----	----	----
	WB-40	90	----	----	----
	WB-62	170	140	4.0	15:1
	WB-62FL	200	140	4.5	15:1
	WB-67	200	140	4.5	15:1
	WB-92B	230	120	5.0	15:1
	WB-100T	150	95	2.5	15:1
	WB-109D	----	180	4.5	20:1

Table 212.12.1 Edge-of-Traveled-Way, Simple Curve Radii, cont.

Angle of Turn (degrees)	Design Vehicle	Simple Curve Radius (feet)	Simple Curve Radius with Taper		
			Radius (feet)	Offset (feet)	Taper H:V
75	P	35	25	2.0	10:1
	SU-30	55	45	2.0	10:1
	SU-40	90	60	2.0	10:1
	WB-40	----	60	2.0	15:1
	WB-62	----	145	4.0	20:1
	WB-62FL	----	145	4.0	20:1
	WB-67	----	145	4.5	20:1
	WB-92D	----	110	5.0	15:1
	WB-100T	----	85	3.0	15:1
	WB-109D	----	140	5.5	20:1
90	P	30	20	2.5	10:1
	SU-30	50	40	2.0	10:1
	SU-40	80	45	4.0	10:1
	WB-40	----	45	4.0	10:1
	WB-62	----	120	4.5	30:1
	WB-62FL	----	125	4.5	30:1
	WB-67	----	125	4.5	30:1
	WB-92D	----	95	6.0	10:1
	WB-100T	----	85	2.5	15:1
	WB-109D	----	115	2.9	15:1
105	P	----	20	2.5	8:1
	SU-30	----	35	3.0	10:1
	SU-40	----	45	4.0	10:1
	WB-40	----	40	4.0	10:1
	WB-62	----	115	3.0	15:1
	WB-62FL	----	115	3.0	15:1
	WB-67	----	115	3.0	15:1
	WB-92B	----	80	8.0	10:1
	WB-100T	----	75	3.0	15:1
	WB-109D	----	90	9.2	20:1

Table 212.12.1 Edge-of-Traveled-Way, Simple Curve Radii, cont.

Angle of Turn (degrees)	Design Vehicle	Simple Curve Radius (feet)	Simple Curve Radius with Taper		
			Radius (feet)	Offset (feet)	Taper H:V
120	P	----	20	2.0	10:1
	SU-30	----	30	3.0	10:1
	SU-40	----	35	6.0	8:1
	WB-40	----	35	5.0	8:1
	WB-62	----	100	5.0	15:1
	WB-62FL	----	105	5.2	15:1
	WB-67	----	105	5.2	15:1
	WB-92D	----	80	7.0	10:1
	WB-100T	----	65	3.5	15:1
	WB-109D	----	85	9.2	20:1
135	P	----	20	1.5	10:1
	SU-30	----	30	4.0	10:1
	SU-40	----	40	4.0	8:1
	WB-40	----	30	8.0	15:1
	WB-62	----	80	5.0	20:1
	WB-62FL	----	85	5.2	20:1
	WB-67	----	85	5.2	20:1
	WB-92D	----	75	7.3	10:1
	WB-100T	----	65	5.5	15:1
	WB-109D	----	85	8.5	20:1
150	P	----	18	2.0	10:1
	SU-30	----	30	4.0	8:1
	SU-40	----	35	7.0	8:1
	WB-40	----	30	6.0	8:1
	WB-62	----	60	10.0	10:1
	WB-62FL	----	65	10.2	10:1
	WB-67	----	65	10.2	10:1
	WB-92B	----	65	11.0	10:1
	WB-100T	----	65	7.3	10:1
	WB-109D	----	65	15.1	10:1

Table 212.12.1 Edge-of-Traveled-Way, Simple Curve Radii, cont.

Angle of Turn (degrees)	Design Vehicle	Simple Curve Radius (feet)	Simple Curve Radius with Taper		
			Radius (feet)	Offset (feet)	Taper H:V
180	P	----	15	0.5	20:1
	SU-30	----	30	1.5	10:1
	SU-40	----	35	6.4	10:1
	WB-40	----	20	9.5	5:1
	WB-62	----	55	10.0	15:1
	WB-62FL	----	55	13.8	10:1
	WB-67	----	55	13.8	10:1
	WB-92D	----	55	16.8	10:1
	WB-100T	----	55	10.2	10:1
	WB-109D	----	55	20.0	10:1

Table 212.12.2 Edge-of-Traveled-Way, 3-Centered Compound Curves

Angle of Turn (degrees)	Design Vehicle	3-Centered Compound Curve			
		Curve Radii (ft)	Symmetric Offset (ft)	Curve Radii (ft)	Asymmetric (ft)
30	P	----	----	----	----
	SU-30	----	----	----	----
	SU-40	----	----	----	----
	WB-40	----	----	----	----
	WB-62	----	----	----	----
	WB-62FL	460-175-460	4.0	300-175-550	2.0-4.5
	WB-67	460-175-460	4.0	300-175-550	2.0-4.5
	WB-92D	550-155-550	4.0	200-150-500	2.0-6.0
	WB-100T	220-80-220	4.5	200-80-300	2.5-5.0
	WB-109D	550-250-550	5.0	250-200-650	1.5-7.0

Table 212.12.2 Edge-of-Traveled-Way, 3-Centered Compound Curves, cont.

Angle of Turn (degrees)	Design Vehicle	3-Centered Compound Curve			
		Curve Radii (ft)	Symmetric Offset (ft)	Curve Radii (ft)	Asymmetric (ft)
45	P	----	----	----	----
	SU-30	----	----	----	----
	SU-40	----	----	----	----
	WB-40	----	----	----	----
	WB-62	460-240-460	2.0	120-140-500	3.0-8.5
	WB-62FL	460-175-460	4.0	250-125-600	1.0-6.0
	WB-67	460-175-460	4.0	250-125-600	1.0-6.0
	WB-92D	525-155-525	5.0	200-140-500	1.5-6.0
	WB-100T	250-80-250	4.5	200-80-300	2.5-5.5
	WB-109D	550-200-550	5.0	200-170-650	1.5-7.0
60	P	----	----	----	----
	SU-30	----	----	----	----
	SU-40	----	----	----	----
	WB-40	----	----	----	----
	WB-62	400-100-400	15.0	110-100-220	10.0-12.5
	WB-62FL	400-100-400	8.0	250-125-600	1.0-6.0
	WB-67	400-100-400	8.0	250-125-600	1.0-6.0
	WB-92D	480-110-480	6.0	150-110-500	3.0-9.0
	WB-100T	250-80-250	4.5	200-80-300	2.0-5.5
	WB-109D	650-150-650	5.5	200-140-600	1.5-8.0
75	P	100-25-100	2.0	----	----
	SU-30	120-45-120	2.0	----	----
	SU-40	200-35-200	5.0	60-45-200	1.0-4.5
	WB-40	120-45-120	5.0	120-45-195	2.0-6.5
	WB-62	440-75-440	15.0	140-100-540	5.0-12.0
	WB-62FL	420-75-420	10.0	200-80-600	1.0-10.0
	WB-67	420-75-420	10.0	200-80-600	1.0-10.0
	WB-92B	500-95-500	7.0	150-100-500	1.0-8.0
	WB-100T	250-80-250	4.5	100-80-300	1.5-5.0
	WB-109D	700-125-700	6.5	150-110-550	1.5-11.5

Table 212.12.2 Edge-of-Traveled-Way, 3-Centered Compound Curves, cont.

Angle of Turn (degrees)	Design Vehicle	3-Centered Compound Curve			
		Curve Radii (ft)	Symmetric Offset (ft)	Curve Radii (ft)	Asymmetric (ft)
90	P	100-20-100	2.5	----	----
	SU-30	120-40-120	2.0	----	----
	SU-40	200-30-200	7.0	60-45-200	1.0-4.5
	WB-40	120-40-120	5.0	120-40-200	2.0-6.5
	WB-62	400-70-400	10.0	160-70-360	6.0-10.0
	WB-62FL	440-65-440	10.0	200-70-600	1.0-11.0
	WB-67	440-65-440	10.0	200-70-600	1.0-11.0
	WB-92D	470-75-470	10.0	150-90-500	1.5-8.5
	WB-100T	250-70-250	4.5	200-70-300	1.0-5.0
	WB-109D	700-110-700	6.5	100-95-550	2.0-11.5
105	P	100-20-100	2.5	----	----
	SU-30	100-35-100	3.0	----	----
	SU-40	200-35-200	6.0	60-40-190	1.5-6.0
	WB-40	100-35-100	5.0	100-55-200	2.0-8.0
	WB-62	520-50-520	15.0	360-75-600	4.0-10.5
	WB-62FL	500-50-500	13.0	200-65-600	1.0-11.0
	WB-67	500-50-500	13.0	200-65-600	1.0-11.0
	WB-92D	500-80-500	8.0	150-80-500	2.0-10.0
	WB-100T	250-60-250	5.0	100-60-300	1.5-6.0
	WB-109D	700-95-700	8.0	150-80-500	3.0-15.0
120	P	100-20-100	2.0	----	----
	SU-30	100-30-100	3.0	----	----
	SU-40	200-35-200	6.0	60-40-190	1.5-5.0
	WB-40	120-30-120	6.0	100-30-180	2.0-9.0
	WB-62	520-70-520	10.0	80-55-520	24.0-17.0
	WB-62FL	550-45-550	15.0	200-60-600	2.0-12.5
	WB-67	550-45-550	15.0	200-60-600	2.0-12.5
	WB-92D	500-70-500	10.0	150-70-450	3.0-10.5
	WB-100T	250-60-250	5.0	100-60-300	1.5-6.0
	WB-109D	700-85-700	9.0	150-70-500	7.0-17.4

Table 212.12.2 Edge-of-Traveled-Way, 3-Centered Compound Curves, cont.

Angle of Turn (degrees)	Design Vehicle	3-Centered Compound Curve		3-Centered Compound Curve	
		Curve Radii (ft)	Symmetric Offset (ft)	Curve Radii (ft)	Asymmetric (ft)
135	P	100-20-100	1.5	----	----
	SU-30	100-30-100	4.0	----	----
	SU-40	200-40-200	4.0	60-40-180	1.5-5.0
	WB-40	120-30-120	6.5	100-25-180	3.0-13.0
	WB-62	600-60-600	12.0	100-60-640	14.0-7.0
	WB-62FL	550-45-550	16.0	200-60-600	2.0-12.5
	WB-67	550-45-550	16.0	200-60-600	2.0-12.5
	WB-92D	450-70-450	9.0	150-65-450	7.0-13.5
	WB-100T	250-60-250	5.5	100-60-300	2.5-7.0
	WB-109D	700-70-700	12.5	150-65-500	14.0-18.4
150	P	75-20-75	2.0	----	----
	SU-30	100-30-100	4.0	----	----
	SU-40	200-35-200	6.5	60-40-200	1.0-4.5
	WB-40	100-30-100	6.0	90-25-160	1.0-12.0
	WB-62	480-55-480	15.0	140-60-560	8.0-10.0
	WB-62FL	550-45-550	19.0	200-55-600	7.0-16.4
	WB-67	550-45-550	19.0	200-55-600	7.0-16.4
	WB-92D	350-60-350	15.0	120-65-450	6.0-13.0
	WB-100T	250-60-250	7.0	100-60-300	5.0-8.0
	WB-109D	700-65-700	15.0	200-65-500	9.0-18.4
180	P	50-15-50	0.5	----	----
	SU-30	100-30-100	1.5	----	----
	SU-40	150-35-150	6.2	50-35-130	5.5-7.0
	WB-40	100-20-100	9.5	85-20-150	6.0-13.0
	WB-62	800-45-800	20.0	100-55-900	15.0-15.0
	WB-62FL	600-45-600	20.5	100-55-400	6.0-15.0
	WB-67	600-45-600	20.5	100-55-400	6.0-15.0
	WB-92B	400-55-400	16.8	120-60-400	9.0-14.5
	WB-100T	250-55-250	9.5	100-55-300	8.5-10.5
	WB-109D	700-55-700	20.0	200-60-500	10.0-21.0

For curbed intersections, the effective turning radius must be considered in addition to the actual curb radius. As shown in ***Figure 212.12.2***, where a parking lane (or bike lane) is present, the vehicle turn is offset from the edge of the roadway by the width of the parking lane or bike lane, creating an "effective turning radius" that is larger than the physical curb radius. Where there is no parking lane or bike lane, the corner radius and effective turning radius are the same. To minimize pedestrian crossing distance, designers should provide the shortest curb radius possible or provide bulbouts within the effective turning radius area. The corner radii should follow the guidance in ***Table 212.12.3***, and accommodate the following:

- The control vehicle, design vehicle, and design speed for each street
- Available R/W
- Angle of turn between intersection legs
- Presence of on-street parking or a bike lane
- The width and number of lanes on the intersecting street

Figure 212.12.2 Actual Curb Radius Vs Effective Radius

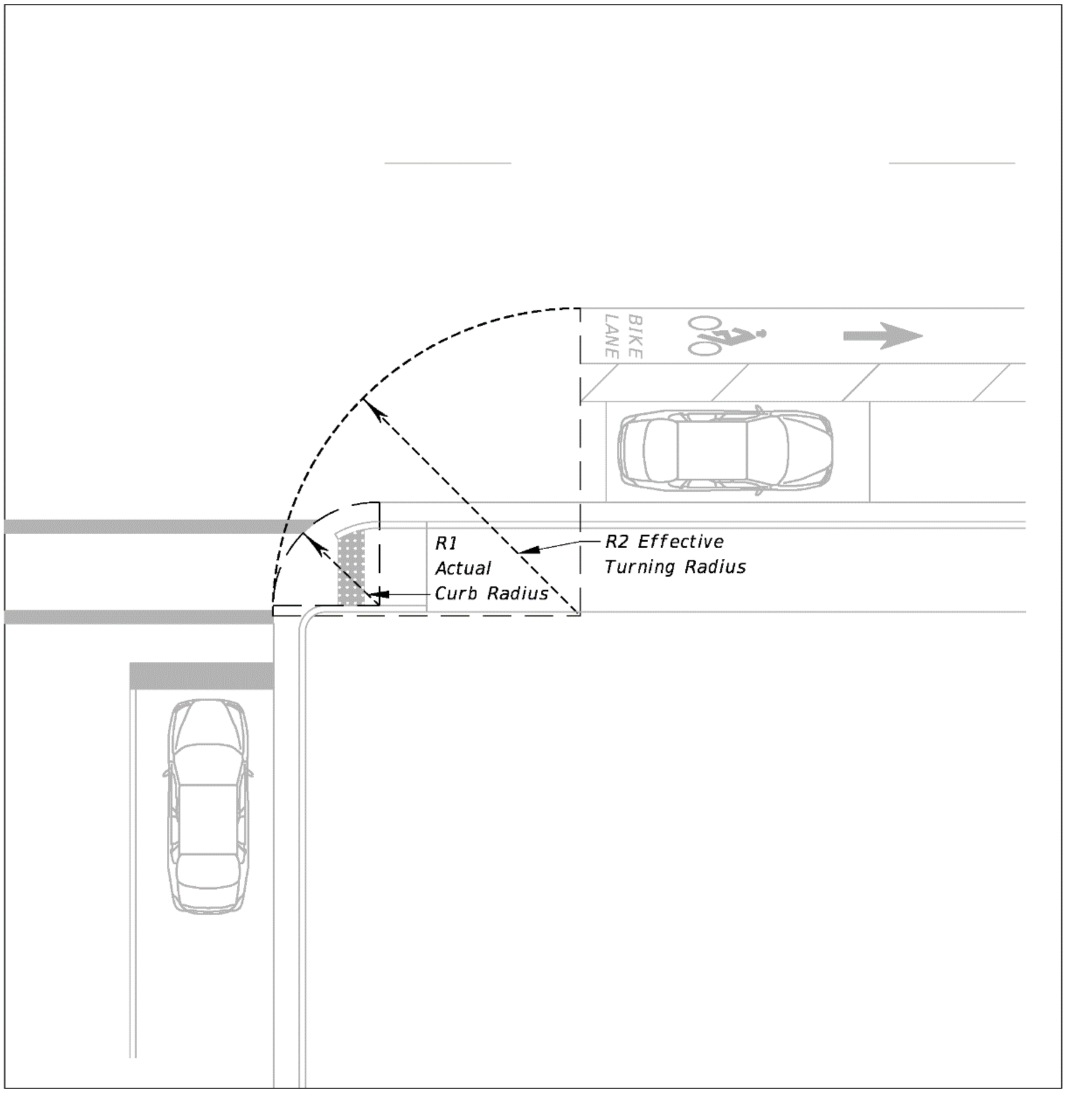


Table 212.12.3 Recommended Corner Radii

R1 Actual Curb Radius (ft)	R2 Effective Turning Radius (ft)	Operational Characteristics
5-30	**25 - 30**	P vehicles and SU vehicles with minor lane encroachment
5-40	**40**	P vehicles, SU vehicles, and WB-40 vehicles with minor encroachment
5-50	**50**	All vehicles up to WB-40

Notes:

(1) Table 212.12.3 assumes perpendicular intersections. For skewed intersections, establish radius using AutoTurn or turning templates.

(2) Confirm the actual curb radius using AutoTurn or turn templates.

Guidelines for corner radii in C4, C5, and C6 context classification without on-street parking or a bike lane are as follows:

(1) Radii of 15 to 25 feet are adequate for passenger vehicles. These radii are suitable for minor cross streets where there is little occasion for trucks to turn and at major intersections where there are parking lanes;

(2) Radii of 25 feet or more should be provided at minor cross streets on new construction or reconstruction projects;

(3) Radii of 30 feet or more should be provided at minor cross streets where practical so that an occasional truck can turn without too much encroachment;

(4) Radii of 40 feet or more or preferably three-centered curves or simple curves with tapers to fit the paths of large truck combinations, should be provided where such combinations or buses turn frequently. Where speed reductions would cause problems, larger radii should be considered; and,

(5) Curb radii should be coordinated with crosswalk distances or special designs should be used to make crosswalks efficient for all pedestrians. Where larger radii are used, an intermediate refuge or median island is desirable or crosswalks may need to be offset so that crosswalk distances are not excessive. See ***FDM 210.3*** for addtional information on islands.

212.12.2 Turning Roadways with Corner Islands

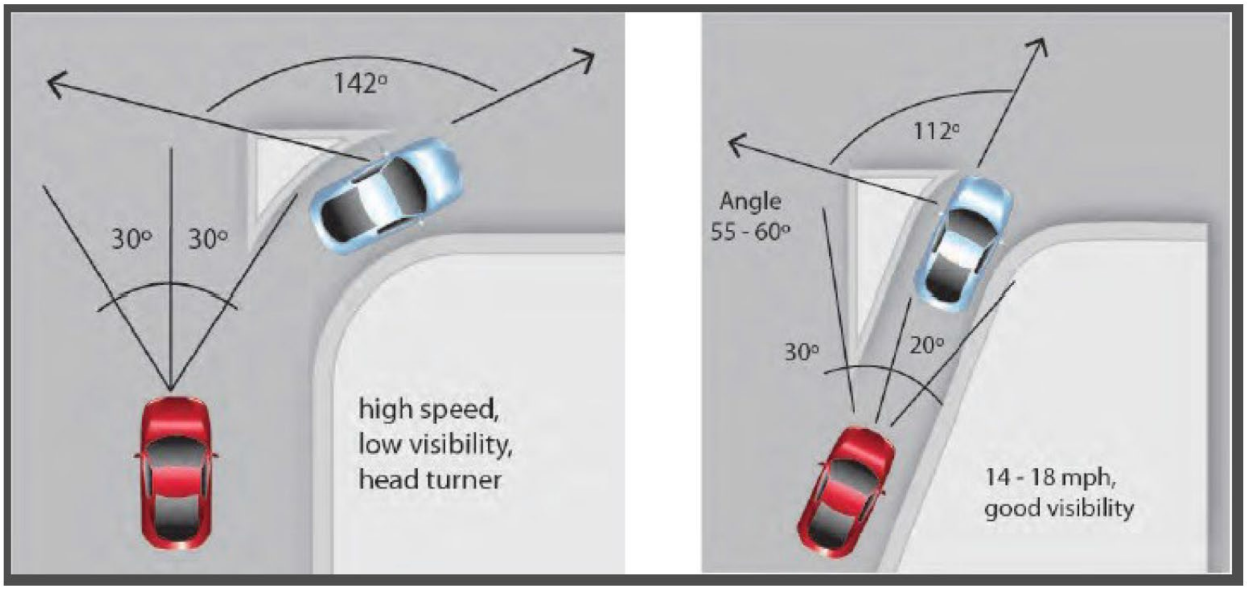
Consider providing a corner island at an intersection where paved areas are excessively large or do not establish proper channelization of traffic. Corner islands can provide delineation for through and turning traffic. In addition, corner islands shorten crosswalks and give pedestrians and bicyclists a refuge area. See ***FDM 210.3.2*** for island requirements.

Channelized right turn lanes can be designed with a flat or near perpendicular angle of entry to the cross street (see ***Figure 212.12.3***). The flat angle of entry is most appropriate for higher speed turning movements with no pedestrian accommodations. Large turning radii and angles of entry into the cross street allow higher turning speeds, reduced traffic delays, and the turning movement of large trucks. The higher speeds, angle of entry and large radii adversely impacts pedestrian safety at the crosswalk.

The near perpendicular angle of entry is preferred where pedestrian facilities are provided. Tight turning radii and angles of entry into the cross street accommodate the following:

- Slower turning speeds,
- Reduced cross walk length,
- Improved pedestrian visibility,
- Improved sight distance
- Decreased angle of driver head turning
- Reduced right-of-way impacts.

Figure 212.12.3 Channelized Right Turn Lanes



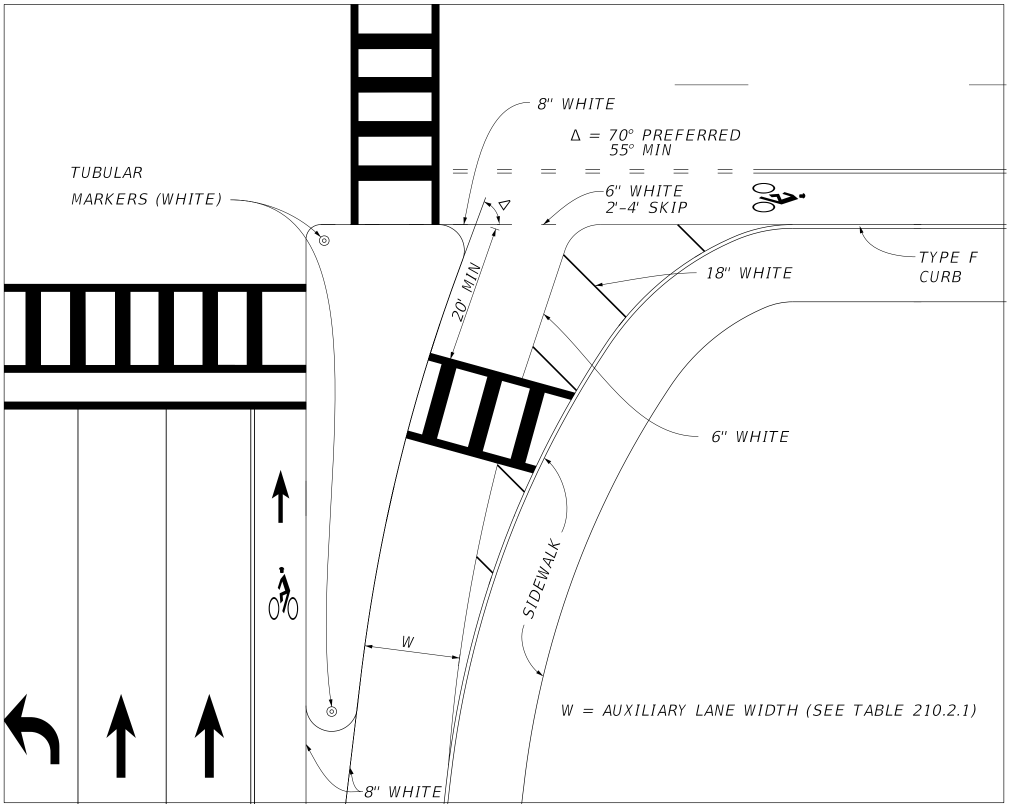
Ref: Figure 9-19, 2018 AASHTO *Green Book*

Consider the near perpendicular right turn lane design in ***Figure 212.12.4*** when the following conditions are met:

- Context Classification C2T, C3, C4, C5 and C6
- Low speed roadway (design speeds 45 mph and less)
- Pedestrian traffic is expected
- No acceleration lane is provided

This design includes the previously mentioned benefits to passenger cars and pedestrians with stripping and a scalene triangle shaped corner island. An approaching deceleration lane is preferred to provide vehicles additional time to stop for crossing pedestrians. The crosswalk is set back 20 feet minimum from the end of the island to allow room for a passenger car to wait for a gap in traffic with out blocking the crosswalk. As shown in ***Figure 212.12.4***, the outside curb radii can be designed to accommodate over tracking of large vehicles such as single-unit trucks, transit, or Florida Interstate Semi-trailers (WB-62FL).

Figure 212.12.4 Near Perpendicular Right Turn Lane



212.12.3 Mountable Truck Aprons

Truck aprons are used to manage the turning movements of vehicles where pedestrian or bicycle facilities are present. A truck apron is a mountable portion of an intersection designed to:

- Manage the turning speed of passenger vehicles
- Accommodate the turning movements of large trucks
- Minimize instances of off tracking over street corners when making turns
- Reduce risks to bicyclists and pedestrians.

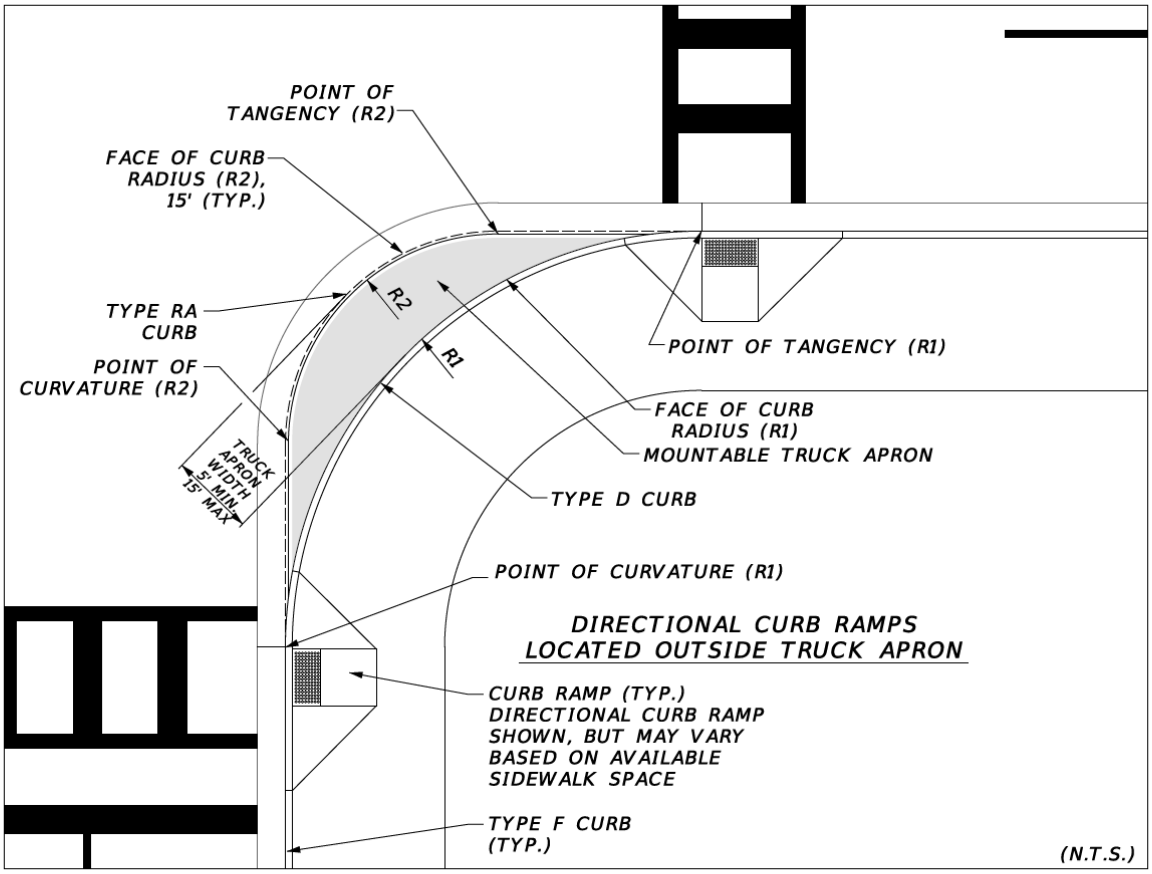
Design a mountable truck apron by either of these methods:

- Attach to a full height curb and allow water to flow along the apron's outer edge.
- Separate from the full height curb to allow water to flow along the curb's edge.

See ***Figure 212.12.5*** for additional details.

Locate all traffic equipment, bicycle features, and pedestrian features (e.g., detectable warning surfaces, bicycle stop bars, curb ramps, etc.) behind the mountable surface area. Design of a mountable truck apron at intersections should incorporate Type RA curbs. See ***FDM 213.3.8*** for additional truck apron requirements. Cross slopes shown in ***Figure 213.3.2*** may be adjusted based on intersection site conditions.

Figure 212.12.5 Mountable Truck Apron



212.12.~~3~~4 Free-Flow Design

Provide superelevation on free flow turning roadways. An important part of the design on some intersections is the design of a free-flow alignment for turns. Ease and smoothness of operation can result when the free flow turning roadway is designed with compound curves preceded by a deceleration lane. Turning radii and pavement cross slope for free flow right turns at speeds greater than 10 mph are a function of the design speed and design vehicle. In general, the design speed of the turning roadway should be equal to, or within 10 to 20 mph less than the through roadway design speed.

It is desirable to provide as much superelevation as practical on intersection curves, particularly where the intersection curve is sharp and on a downgrade. However, the short curvature and short lengths of turning roadways often prevents the development of a desirable rate of superelevation. ***Table 212.12.4*** provides the minimum superelevation rates in relation to design speed. The wide variation in likely speeds on intersection curves precludes the need for precision, so only the minimum superelevation rate is given for each design speed and intersection curve radius.

Table 212.12.4 Superelevation Rates for Turning Roadways

	Design Speed (mph)							
	10	15	20	25	30	35	40	45
Minimum Superelevation Rate	NC	NC	0.02	0.04	0.06	0.08	0.09	0.10
Minimum Radius (feet)	25	50	90	150	230	310	430	540

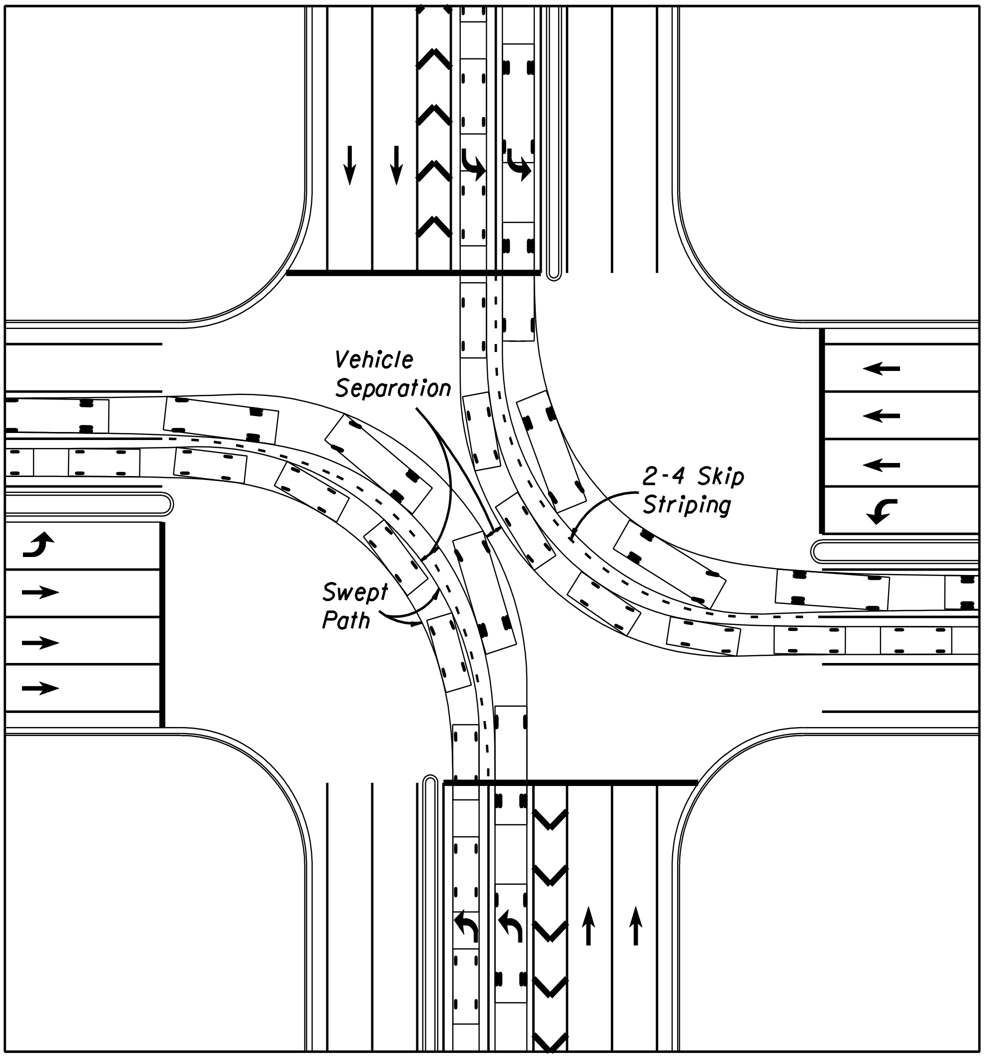
See ***FDM 210.9*** for additional superelevation criteria.

212.12.45 Dual and Triple Left Turns

Double and triple turn lanes require turning radii that will accommodate the selected design vehicles turning simultaneously. The radius of curvature in combination with the track width of the design vehicles will establish the required width within the turn. Lane lines (i.e., guidelines) and width requirements should be determined by plotting the swept paths of the selected design vehicles. For preliminary layout of intersection geometry, use the swept path of the design vehicle on the inside turning lane to locate the median nose and crosswalk on the crossing street (at the receiving point of the left turn).

Design of dual turns should accommodate a SU-40 vehicle and a P vehicle turning simultaneously, as illustrated in ***Figure 212.12.~~5~~6***.

Figure 212.12.~~5~~6 P and SU Design Vehicles Turning Simultaneously



Design of triple left turns should accommodate a WB-62FL (outside lane), a SU-40 (center or inside lane), and a P vehicle (center or inside lane) turning simultaneously.

Establish control radius for the inside turning lane based on the guidance in ***FDM 212.14.5*** and ***Table 212.9.2***. Establish the inside edge of the outer lane by providing a minimum 4-foot separation between swept paths of the selected design vehicles traveling in the same direction. Except for turns with large radii, the inside edge of the outer lane will not be concentric with the selected control radius. Radius for the inside edge of the outer turn lane should be determined by analysis of the plotted swept path of the design vehicles.

Provide minimum 8-foot separation between vehicles traveling in opposing direction. Separation may be less than 8 feet when:

(1) Turning paths are highly visible and speeds are low, or

(2) Signal left turn phases are not concurrent for the opposing directions.

212.13 Islands

See ***FDM 210.3*** for island criteria.

212.14 Auxiliary Lanes

The primary function of auxiliary lanes at intersections is to accommodate speed changes, storage and maneuvering of turning traffic. The length of the auxiliary lanes is the sum of the deceleration length, queue length and approach end taper. Pavement marking requirements for auxiliary lanes are included in ***Standard Plans, Index 711-001***.

212.14.1 Deceleration Length

The required total deceleration length is that needed for a safe and comfortable stop from the design speed of the highway. See ***Exhibit 212-1*** for minimum deceleration lengths (including taper) for left turn lanes.

Right turn lane tapers and lengths are identical to left turn lanes under stop control conditions. Right turn lane tapers and lengths are site-specific for free-flow or yield conditions.

212.14.2 Queue Length

The queue length provided should be based on a traffic study.

For low volume intersections where a traffic study is not justified, a minimum 50-foot queue length (2 vehicles) should be provided for C1, C2, and C3R context classifications. A minimum 100-foot queue length (4 vehicles) should be provided in C2T, C3C, C4, C5, and C6 context classifications. Locations with over 10% truck traffic should accommodate at least one car and one truck.

For queue lengths at signalized intersections, refer to ***FDM 232.2***.

212.14.3 Approach End Taper

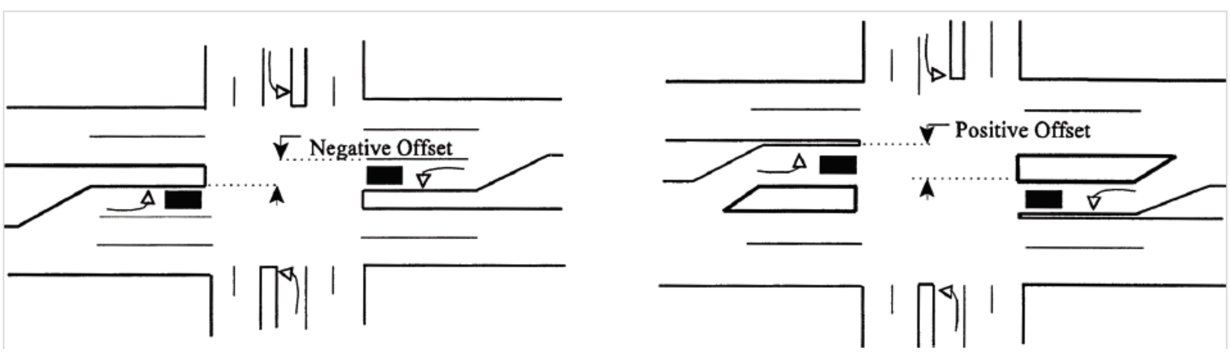
The length of approach end tapers is 50 feet for a single turn lane and 100 feet for two or more turn lanes, as shown ***Exhibit 212-1***. These taper lengths apply to all design speeds.

212.14.4 Offset Left Turn Lanes

The alignment of opposing left-turn lanes and the horizontal and vertical curvature on the approaches are the principal geometric design elements that determine how much sight distance is available to a left-turning driver. Vehicles queuing in opposing left-turn lanes restrict each other's view of oncoming traffic in the through lanes. The level of restricted view depends on the alignment of opposing left-turn lanes with respect to each other and the type of vehicles in the opposing queue.

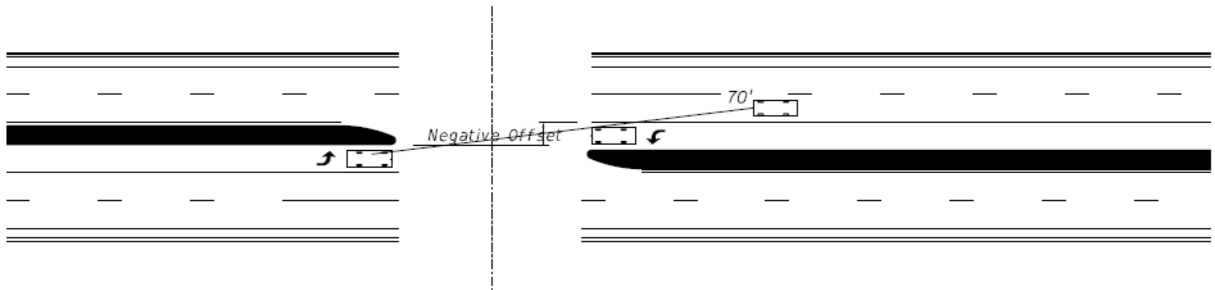
The offset distance is defined as the distance between the left edge of the turn lane and the right edge of the opposing turn lane. If the offset distance is to the left of the turn lane it is considered a negative offset, and if it is to the right of turn lane it is considered a positive offset, as illustrated in ***Figure 212.14.1***.

Figure 212.14.1 Negative and Positive Offset Left Turns



The conventional method of designing left turn lanes is to place the left turn lanes adjacent to the through lanes. This design creates a negative offset which restricts the sight distance of the left-turning driver's view of oncoming traffic when another vehicle is in the opposing turn lane. ***Figure 212.14.2*** indicates the negative offset when the conventional design is used.

Figure 212.14.2 Opposing Left Turns (22' Median with Negative 10' Offset)

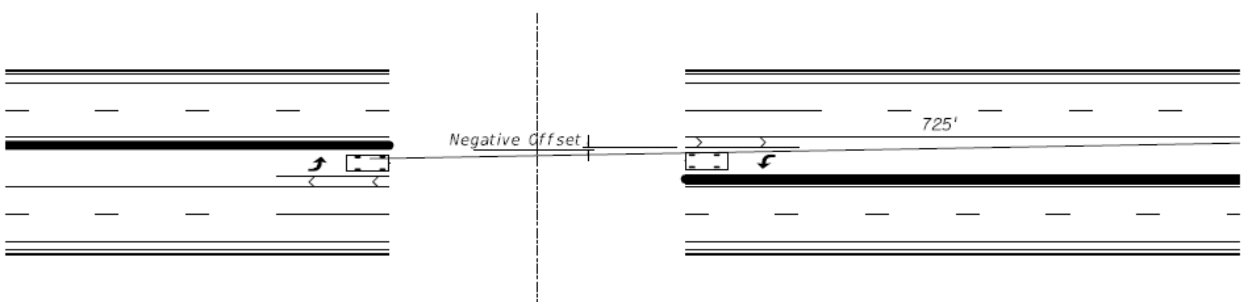


On curbed roadway designs, offset left-turn lanes should be used with median widths greater than 18 feet. A 4-foot traffic separator should be used when possible to channelize the left turn and provide separation from opposing traffic.

Consider offset left-turn lanes at C1, C2, and C3R context classification intersections with high turning movements. For median widths 30 feet or less, use a parallel offset left-turn lane. Stripe the area between the offset left-turn lane and the traffic lane where vehicles are moving in the same direction. For medians wider than 30 feet, consider a tapered offset left-turn lane. An offset left is illustrated in ***Figure 212.14.3***.

2018 AASHTO Green Book Figure 9-41 illustrates the design of parallel and tapered left turn lanes.

Figure 212.14.3 Typical Opposing Left Turns (22' Median with Negative 1' Offset)



At locations where the full offset distances cannot be obtained, it is recommended that the minimum offset distances shown in ***Table 212.14.1*** be provided to achieve minimum required sight distances according to design speed. It is recommended that the "Opposing Truck" values be used where the opposing left-turn traffic includes a moderate to heavy volume of large trucks.

Table 212.14.1 Minimum Offset Distances for Left-Turn Lanes

Design Speed (mph)	Minimum Offset (feet)	
	Opposing Car	Opposing Truck
≤ 30	1.0	3.0
35	1.5	3.5
40 - 45	2.0	4.0
50 - 55	2.5	4.5
60 - 65	3.0	4.5
70	3.0	5.0

212.14.5 Directional Median Openings

Directional (channelized) median openings are designed to accommodate left-turn movements from the through roadway and prevent or discourage left-turn and crossing movements by traffic from a side road or driveway. Directional median openings are to be provided in accordance with the access management plan for the roadway.

The design of a directional median opening must accommodate the swept path of the predominant design vehicle. Channelization may be achieved using a combination of traffic separators, islands, and tubular markers. See ***FDM 210*** for additional information on islands. See ***Standard Plans***, ***Index 520-020*** for standard details for 4 feet, 6 feet and 8.5 feet wide traffic separators. See ***FDM 230.2.7*** for additional information on tubular markers.

Typical layouts for directional median openings for high-speed roadways with 40-feet-wide medians are provided in ***Exhibits 212-8***, ***212-9*** and ***212-10***. Type E curb and raised islands in conjunction with the minimum offsets shown in these figures may be used on high-speed roadways for directional median openings.

Exhibit 212-8: Directional Median Opening: SU & WB-40 Parallel

Exhibit 212-9: Directional Median Opening: WB-62 Parallel

Exhibit 212-10: Directional Median Opening: SU & WB-40 Tapered

213 Modern Roundabouts

213.1 General

This chapter provides design criteria for the geometric layout of modern roundabouts. The criteria contained in the FDM are supplemented by guidance provided in the ***National Cooperative Highway Research Program (NCHRP) Report 672, Roundabouts: An Informational Guide***.

Only single-lane and two-lane modern roundabouts are to be constructed on the SHS. Partial three-lane roundabouts may be acceptable under certain conditions.

Exhibit 213-1 illustrates the elements of a modern roundabout that are discussed in this chapter.

213.1.1 Roundabout Evaluation

Roundabout evaluation is governed by the Intersection Control Evaluation process. See the ***Intersection Control Evaluation (ICE) Manual*** for requirements at the following web address:

https://www.fdot.gov/traffic/TrafficServices/Intersection_Operations.shtm

Exhibit 213-1: Design Details

213.2 Operational Analysis

Use the methodology in the current edition of the ***Highway Capacity Manual (HCM)*** when conducting a roundabout operational analysis. Two commonly used software packages consistent with the ***HCM*** are HCS and SIDRA. When SIDRA is used, run the analysis in ***HCM*** mode to be consistent with ***HCM*** methodology. For more information on HCS and SIDRA, see ***Traffic Analysis Handbook***, ***Chapter 6***.

To optimize safety and operation performance, provide only the lanes that are warranted through the traffic operational analysis. Inclusion of unwarranted approach, circulatory or by-pass lanes increases complexity and conflict points. Provide roundabout designs that are simplistic and have pavement widths based on necessity.

Use 20-year design traffic volumes for roundabout design.

213.2.1 Stage Construction

Consider stage construction when traffic operational analysis indicates that a multi-lane roundabout will be required in the design year (20-year design life), but a single-lane roundabout would provide acceptable service for 10 to 15 years (1^{st} resurfacing cycle). Having more lanes than what is warranted in the early years will have a negative effect on safety and operational performance.

When it is determined that staged construction will be utilized, develop the ultimate design first to assure all right-of-way needs for the ultimate project are identified. Then develop the initial design that allows for expansion in the future with minimal “throw-away” work.

213.3 Geometric Design

It is important to develop roadway geometry that encourages drivers to gradually slow down as they approach the roundabout. Roundabout design features that influence vehicular approach speeds include:

(1) Prominent landscaping in the central island serves to increase visibility of the central island and provides a visual queue to approaching drivers that they are entering a low-speed environment. Roadway approach geometry should work with the landscaping to limit line of sight beyond what is necessary to meet intersection sight distance requirements. See ***NCHRP Report 672, 6.7.3*** for additional information.

(2) Raised splitter islands and roadside curb provide visual ques to establish a speed transition zone. Lengthening this transition zone on high-speed facilities can be an effective strategy for slowing down traffic prior to entering a roundabout.

(3) Geometric features (e.g., inscribed circle diameter (ICD), lane width, entry width, curb locations) introduce deflection and curvature into the driver's path and is the most effective way to slow vehicles down to a safe entry speed.

Typical ranges are as follows:

(a) Single-lane Roundabout ICD: 120' to 160' with 140' as a good starting point

(b) Two-lane Roundabout ICD: 160' to 200' with 180' as a good starting point

A chicane is a series of curves that requires the driver to turn slightly right and then slightly left while approaching the roundabout entry. Chicaning should not be excessive but used only to the extent necessary to establish the splitter island and create an offset left alignment.

Tangent segments between reverse curves:

- Provides a smooth natural path for drivers
- Improves the alignment of the approach with the receiving circulatory roadway
- Aids and assists truck drivers in navigating the roundabout

Tangent segments between reverse curves are required for high-speed approaches as discussed in the ***FDM 213.3.1***. For low-speed approaches, 50 foot desirable and 25 foot minimum tangent segments are required between reverse curves (i.e., avoid back to back reverse curves).

213.3.1 High-Speed Approach Geometry

Exhibit 213-2 illustrates the Department's desired geometry for a high-speed two-lane undivided highway approaching a single-lane roundabout. High-speed approach geometry uses a series of three curves upstream of the roundabout with successively smaller radii separated by tangent segments. The general approach demonstrated can be applied to high-speed two-lane roundabouts as well.

The approach roadway alignment contains three curves labeled AR1, AR2, and AR3. The Department criteria for minimum curve length on open roadway (400 feet) does not apply within the functional area of the intersection. See ***FDM 212.4*** for more information on intersection functional area.

AR1

The first curve encountered by the driver as they approach the roundabout is AR1. This curve to the right has the largest radius of the three and is intended to alert the driver that they are approaching a roundabout and need to slow down. This curve also initiates separation between the opposing traffic lanes allowing for the development of the splitter island. The PC of AR1 demarks the area of influence of the intersection. The radius of AR1 is based on the design speed of the approach leg and is determined by using ***AASHTO Greenbook 2011 Equation 3-8***. Assuming normal crown, the superelevation rate (e_{max}) is 2%. Side friction factors are dependent on speed and are determined using ***AASHTO Greenbook 2011 Figure 3-6***.

AR1 is typically not necessary for divided highway approaches because separation between opposing traffic lanes is already established.

AR2

The second curve approaching the roundabout is AR2. This curve to the left aligns the approach roadway centerline to the left of the roundabout center (offset left). An offset left design allows for proper deflection and speed control. When entering AR2, it is assumed that the driver has decelerated 15-20 mph from the vehicle’s approach speed.

Since the curve is to the left and the roadway cross slope is normal crown, the superelevation rate used to calculate AR2 is -2%.

AR3

The final curve entering the roundabout is AR3. This curve to the right guides the driver into the circulatory roadway. AR3 radius is typically between 75 and 100 feet and is determined through the fastest path analysis. At this point it is assumed that the driver has decelerated to an operating speed between 20 and 25 mph.

Tangent Segments

Provide a tangent segment between AR1 and AR2 not less than 100 feet. Provide a tangent segment between AR2 and AR3 not less than 50 feet.

Exhibit 213-2: High Speed Approach Detail

213.3.2 Alignment of Approach Lane

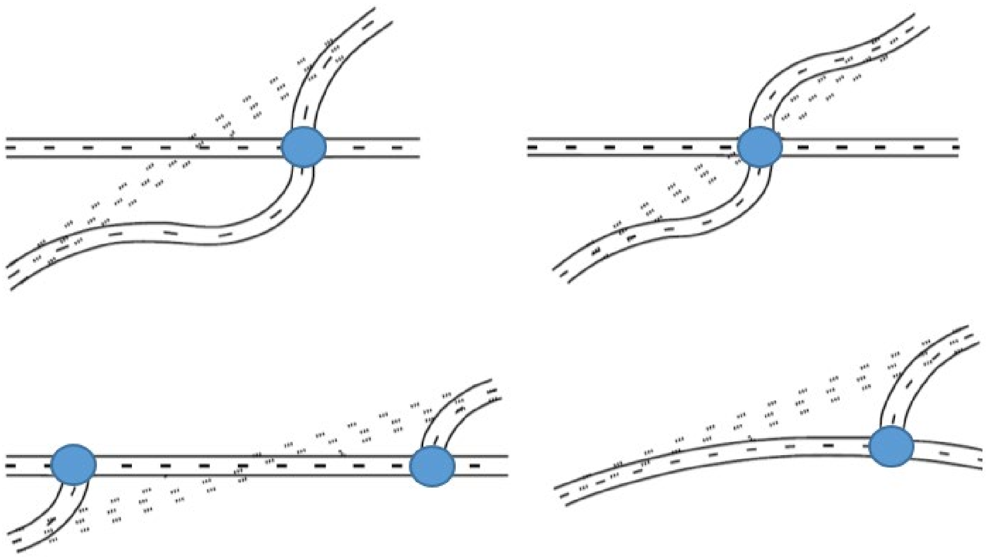
The alignment of the approach affects the amount of deflection (speed control) that is achieved, the ability to accommodate the design vehicle, and the visibility angles to adjacent legs. The optimal alignment is generally governed by the size and position of the roundabout relative to its approaches.

An offset left alignment is typically preferred as it increases the deflection achieved at the entry to improve speed control and is easier to remove path overlap for multilane entries.

213.3.3 Angle Between Approach Legs

The intersection angle between two roadways has a significant influence on the geometrics and operation of a roundabout. Intersection angles are to be as close to 90 degrees as practical. Consider realigning the approach legs of minor roads when the intersection angle is less than 75 degrees; ***Figure 213.3.1*** illustrates realignment configurations.

Figure 213.3.1 Realignment Configurations



213.3.4 Roadway Profiles

The profile grade of the roadways carried through the influence area of the intersection should be as flat as practical to allow the circulatory roadway pavement to slope to the outside. See ***FDM 213.3.7*** for cross slope requirements.

213.3.5 Splitter Islands

Splitter islands generally extend upstream of the yield line to the point at which entering drivers are expected to begin decelerating comfortably. ***Exhibit 213-1*** provides details for splitter islands. Splitter islands are to use Type E curb or Type I traffic separator.

Locate the crosswalk approximately 20-feet upstream from the yield line. Minimum width for the raised splitter island at crosswalks is 6-foot (between curb faces). The minimum crosswalk width in the splitter island is 10-feet. These dimensions ensure the provision of a pedestrian refuge area within the splitter island.

Minimum length of the splitter island is based on the design speed of the approach leg, as follows:

- 50-foot for design speed 35 mph or less; 100-foot desirable
- 100-foot for design speed 45 mph or less

- 200-foot for design speed 50 mph or greater

Extend the splitter island beyond the PT of the exit curve to discourage exiting traffic from crossing into the path of approaching traffic.

213.3.6 Approach Roadway Width

The width of the roadway at locations with curb on both sides needs to accommodate the design vehicle and be a minimum 15-feet face to face.

213.3.7 Circulatory Roadway

The width of the circulatory roadway is determined from the number of entry lanes and the turning requirements of the design vehicle. Provide only the minimum width necessary to serve the required lane configuration. Typically accommodate a bus without use of the truck apron.

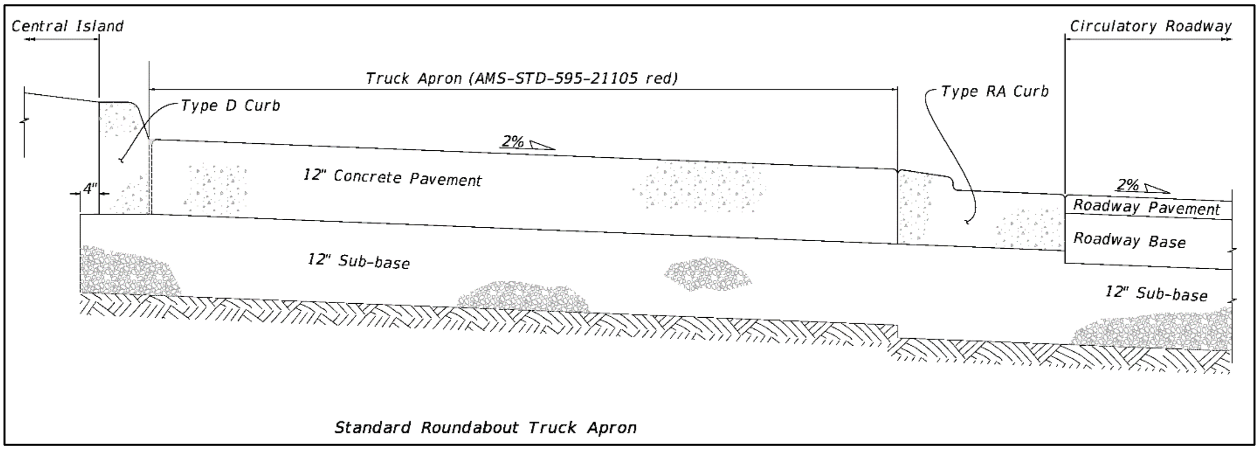
Circulatory roadway lane widths of multilane roundabout do not need to be consistent and typically range from 12-feet to 18-feet. The outside lane is typically larger to provide additional space for the design vehicle and reduce entry and exit path overlap.

Slope the circulatory roadway away from the central island at 2%, 1% minimum.

213.3.8 Truck Apron

Use the standard truck apron design illustrated in ***Figure 213.3.2***. Indicate in the plans that the roundabout truck apron is to be red in color that closely matches AMS-STD-595-21105 red.

Figure 213.3.2 Standard Truck Apron Design

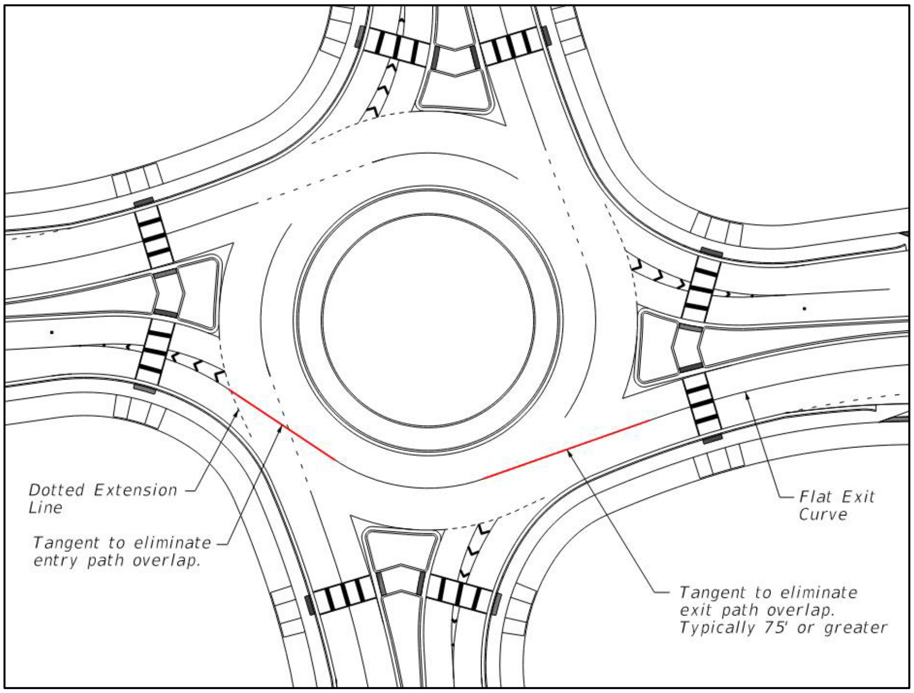


213.4 Path Overlap

The natural path of a vehicle is the path it will take based on the speed and orientation imposed by the roundabout geometry. Path overlap on multi-lane roundabouts occurs when the natural paths of vehicles in adjacent lanes overlap or cross one another; i.e., geometry leads vehicles into the wrong lane. It occurs at entries where the geometry of the right-hand lane tends to lead vehicles into the left-hand circulatory lane. Aligning the approach lanes with the receiving lanes in the circulatory roadway helps drivers maintain their natural trajectory upon entry and significantly reduces potential for path overlap. To reduce path overlap at multi-lane entries, provide a tangent segment between the right-hand entry lane and the circulatory roadway as shown in ***Figure 213.4.1***. Extend the tangent segment beyond the dotted extension line at the entry to assure proper alignment of vehicles prior to entering the circulatory roadway.

Path overlap can also occur at multi-lane exits where the geometry or pavement marking tends to lead vehicles from the left-hand circulatory lane into the right-hand exit lane. To reduce path overlap at multi-lane exits, provide a tangent segment between the circulatory roadway and receiving lane as shown in ***Figure 213.4.1***. ~~Flattening the~~ Providing a flat exit radius also helps drivers maintain their natural trajectory upon ~~existing~~ exiting and significantly reduces potential for path overlap. The potential for increased speeds associated with a flatter exit ~~radius~~ design should be ~~taken into consideration~~considered when crosswalks are provided.

Figure 213.4.1 Tangents for Path Overlap



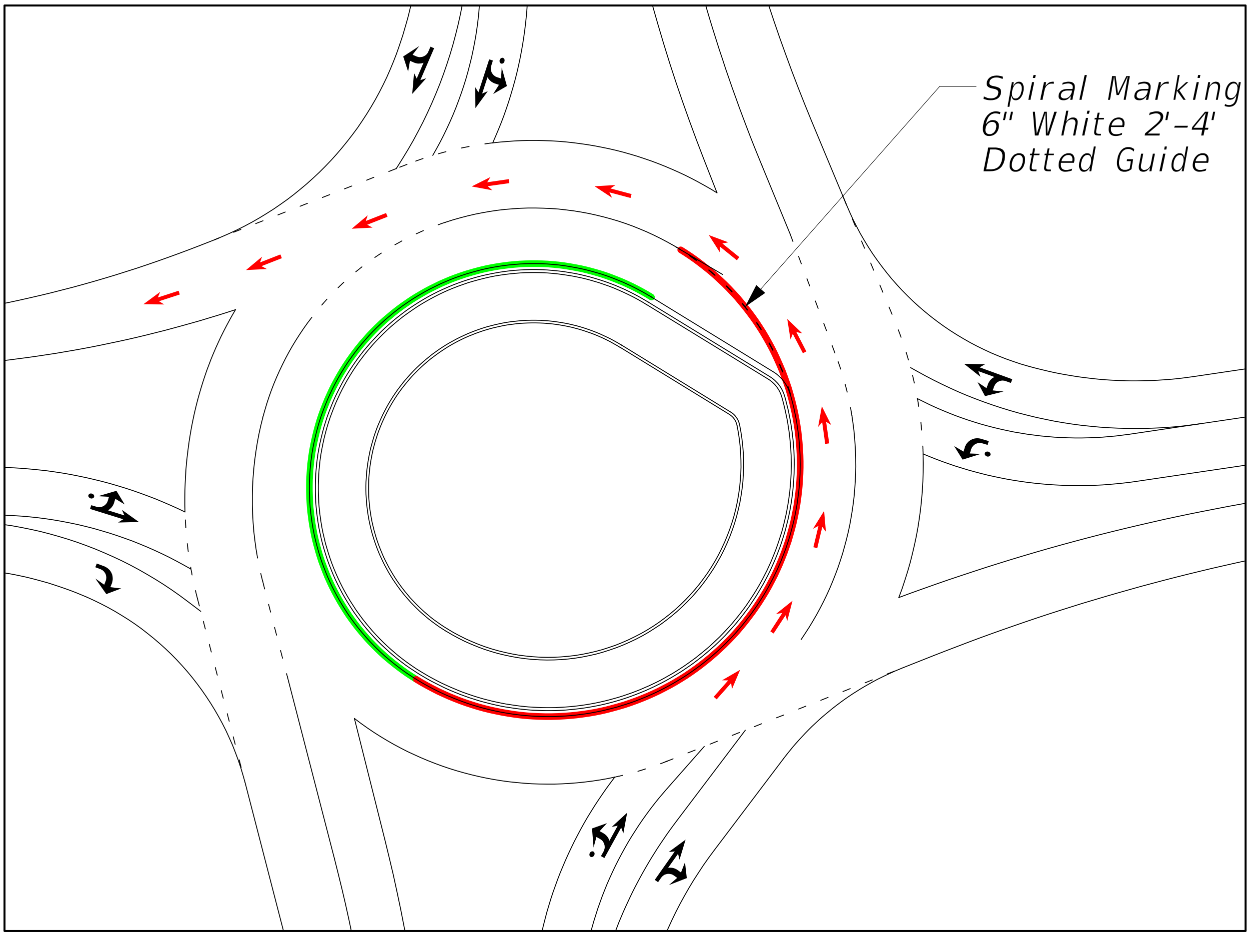
213.5 Spiral Transitions

Spiral transitions are necessary for multi-lane roundabouts when the lane configuration includes exclusive left turn lanes. ~~A s~~Spiral transitions ~~is~~ are used to guide drivers into the appropriate lane for their desired exit. Drivers that enter the roundabout on the inside lane are pushed to the outside lane allowing them access to their desired exit without the need for a lane change. ~~within the circulatory roadway to exit; avoiding potential lane changing within the circulatory roadway.~~ Inclusion of ~~left turn only~~ exclusive left turn lanes and transition spirals complicate the design and should only be provided if warranted through traffic operational analysis.

Figure 213.5.1 illustrates the inclusion of a spiral transition with a lane configuration that includes two circulatory lanes and a single exit lane. The spiral geometry is developed by connecting two semi-circles with different diameters as indicated by the green and red arcs. The smaller diameter (green) represents the inside edge of travel lane adjacent to the truck apron and the larger diameter (red) is equal to smaller diameter plus the width of the inside travel lane. The spiral transition allows for the left turning movement as indicated by the red arrows. Also shown in the figure is the required spiral transition pavement marking.

The central island should be developed (shaped) using curb to enforce the spiral geometry. Use of striping to create the spiral geometry should be avoided.

Figure 213.5.1 Spiral Transition



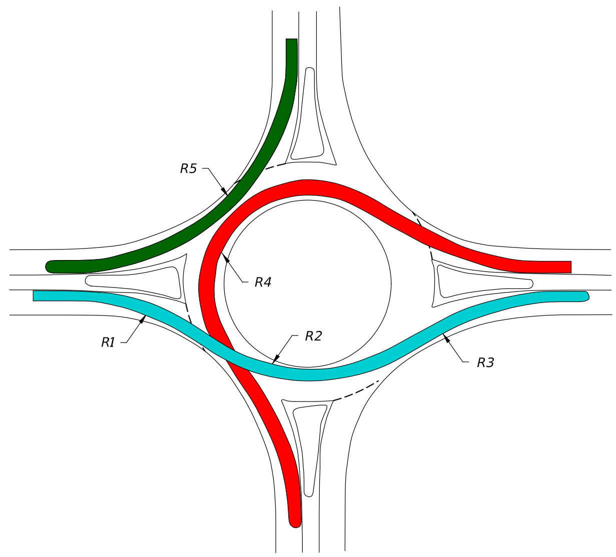
213.6 Fastest Path

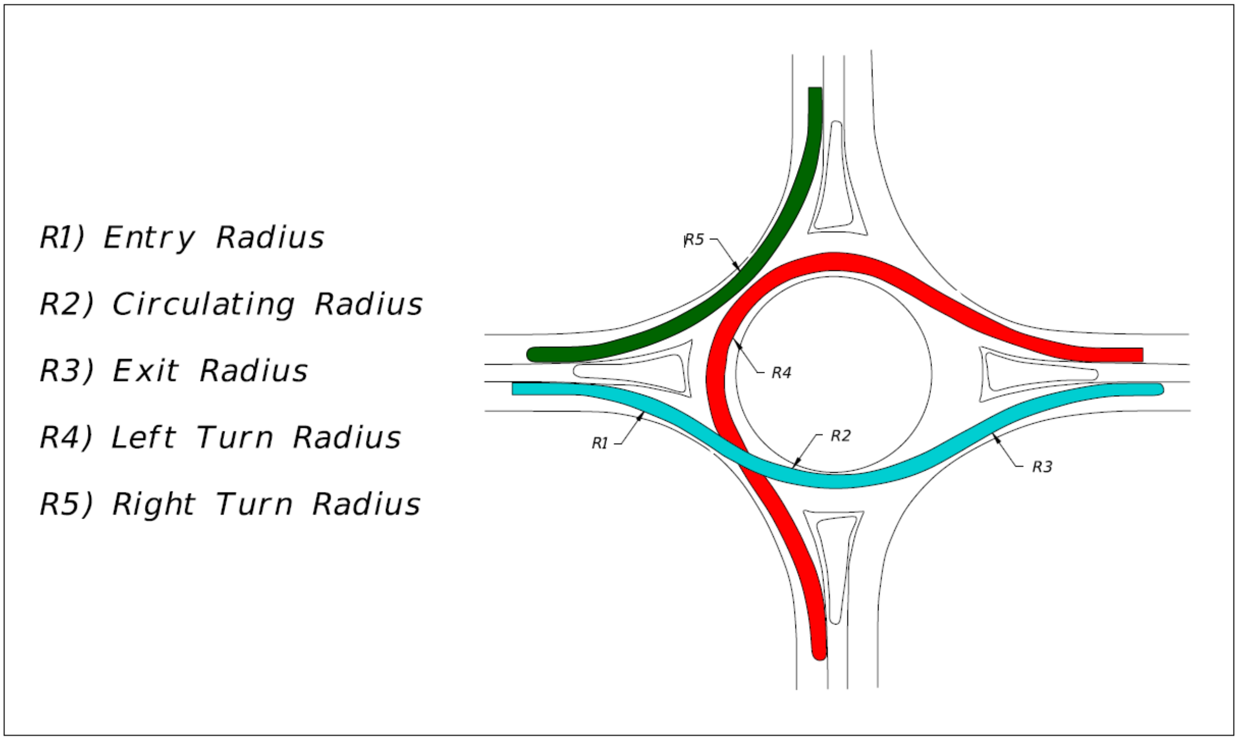
Controlling speeds for vehicles entering and traveling through roundabouts is a critical design objective that significantly impacts the safety and comfort of all users. A well-designed roundabout reduces vehicle speeds upon entry and encourages consistency in the relative speeds between conflicting traffic streams. The effectiveness of speed control within a roundabout can be determined by conducting a fastest path performance check.

The fastest path is defined as the radius (R1, R2, R3, R4 and R5) that provides the smoothest and flattest path possible for a single vehicle (assumed 6 feet wide) traversing the roundabout. The fastest path does not consider lane markings when determining the vehicles path; i.e., drivers will run over striping and use all available pavement. Fastest path movements are shown in ***Figure 213.6.1*** and are as follows:

Figure 213.6.1 Fastest Path Curves

- ~~R1 – Entry Radius~~
- ~~R2 – Circulating Radius~~
- ~~R3 – Exit Radius~~
- ~~R4 – Left Turn Radius~~
- ~~R5 – Right Turn Radius~~





Fastest path speeds must adhere to the following;

- R1 and R5 entry speeds are not to exceed 25 mph for single-lane entries and 30 mph for multi-lane entries.
- R2 and R4 circulating speeds should be no more than 15 mph less than the entry speed.
- R3 exit speeds requires engineering judgement to balance the competing objectives of accommodating the design vehicle and providing a safe environment for pedestrians using the crosswalk.

The fastest path for the through movement (R1, R2, and R3) is illustrated in ***Figure 213.6.~~1~~2***. The fastest path for the right turn movement (R5) is illustrated in ***Figure 213.6.~~2~~3***. Centerline of vehicle path is drawn with a 5-foot offset from face of curb, or a 3-foot offset from the painted edge line

Figure 213.6.~~1~~2 Fastest Path for Through Movement

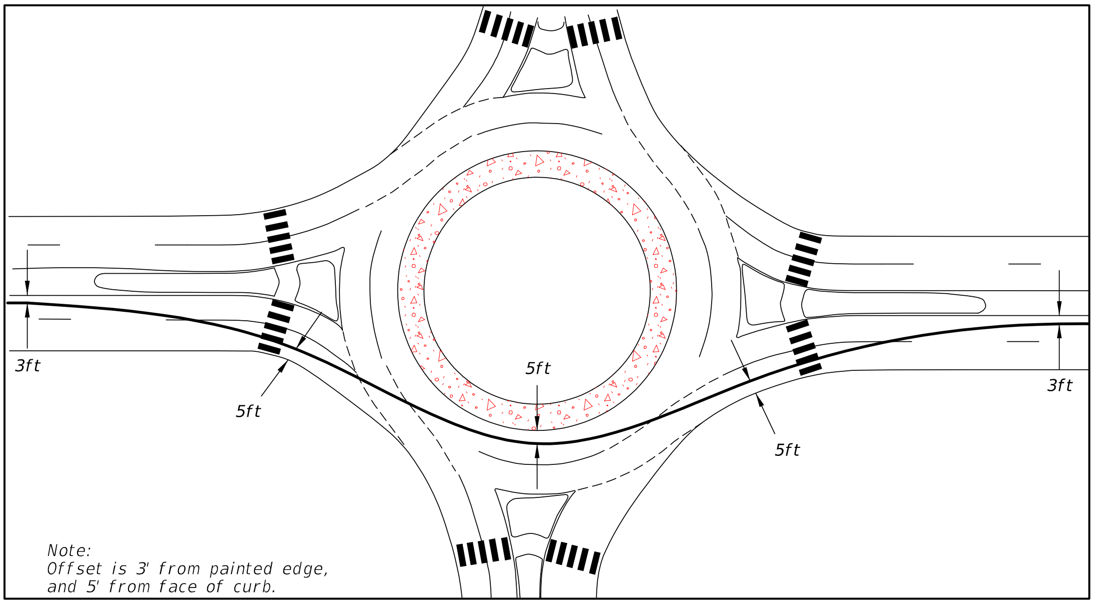
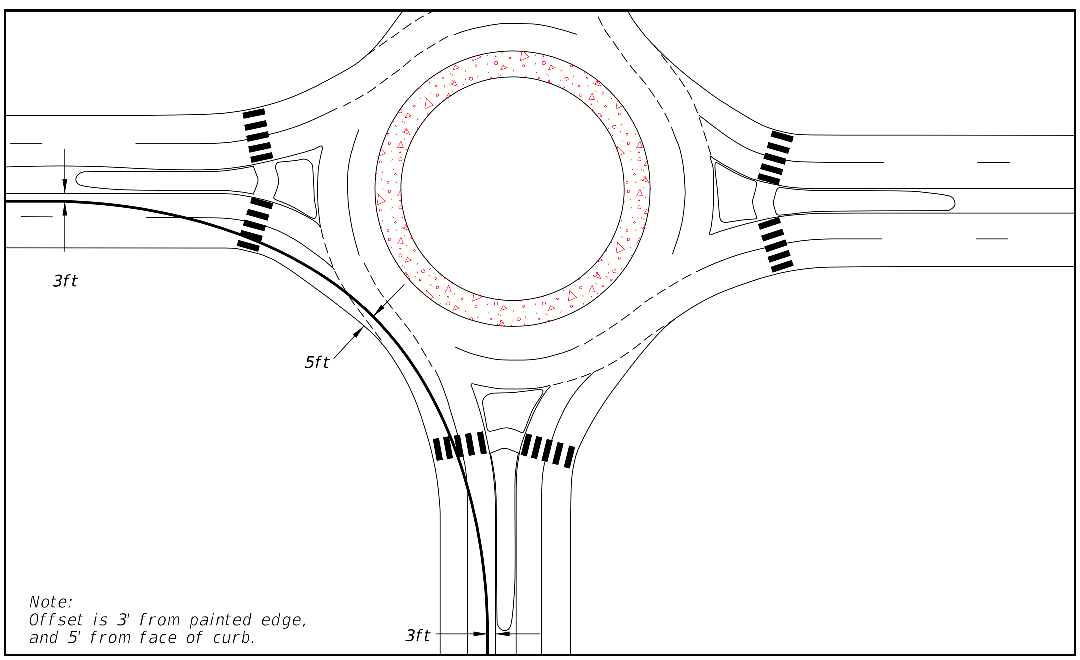


Figure 213.6.~~2~~3 Fastest Path for Right Turn Movement



213.6.1 Fastest Path Methodology

A CADD-based procedure for conducting fastest path analysis has been adopted by the Department and can be downloaded from the ***FDM*** web page. For consistency, this step-by-step procedure should be followed when determining R1, R2, R3, R4, and R5.

Calculated speeds for R1, R3 and R5 are based on NCHRP 672 equation 6-1 with a pavement slope of +2%.

Calculated speeds for R2 and R4 are based on NCHRP 672 equation 6-2 with a pavement slope of -2%.

A spread sheet has been developed to assist with these calculations and can be downloaded from the ***FDM*** web page.

213.7 Design Vehicle Accommodation (Swept Path)

Roundabouts typically accommodate a WB-62FL design vehicle for the through movements on the SHS. A smaller design vehicle may be appropriate for turning movements connecting off-system roads. See ***FDM 201.6*** for additional information on design vehicle.

Swept path diagrams assure that there is adequate pavement to accommodate the maneuvers of the design vehicle through the roundabout without over-tracking the curb. AUTOTURN is a CADD-based vehicle turning path program that is often used to determine the swept path of the design vehicle.

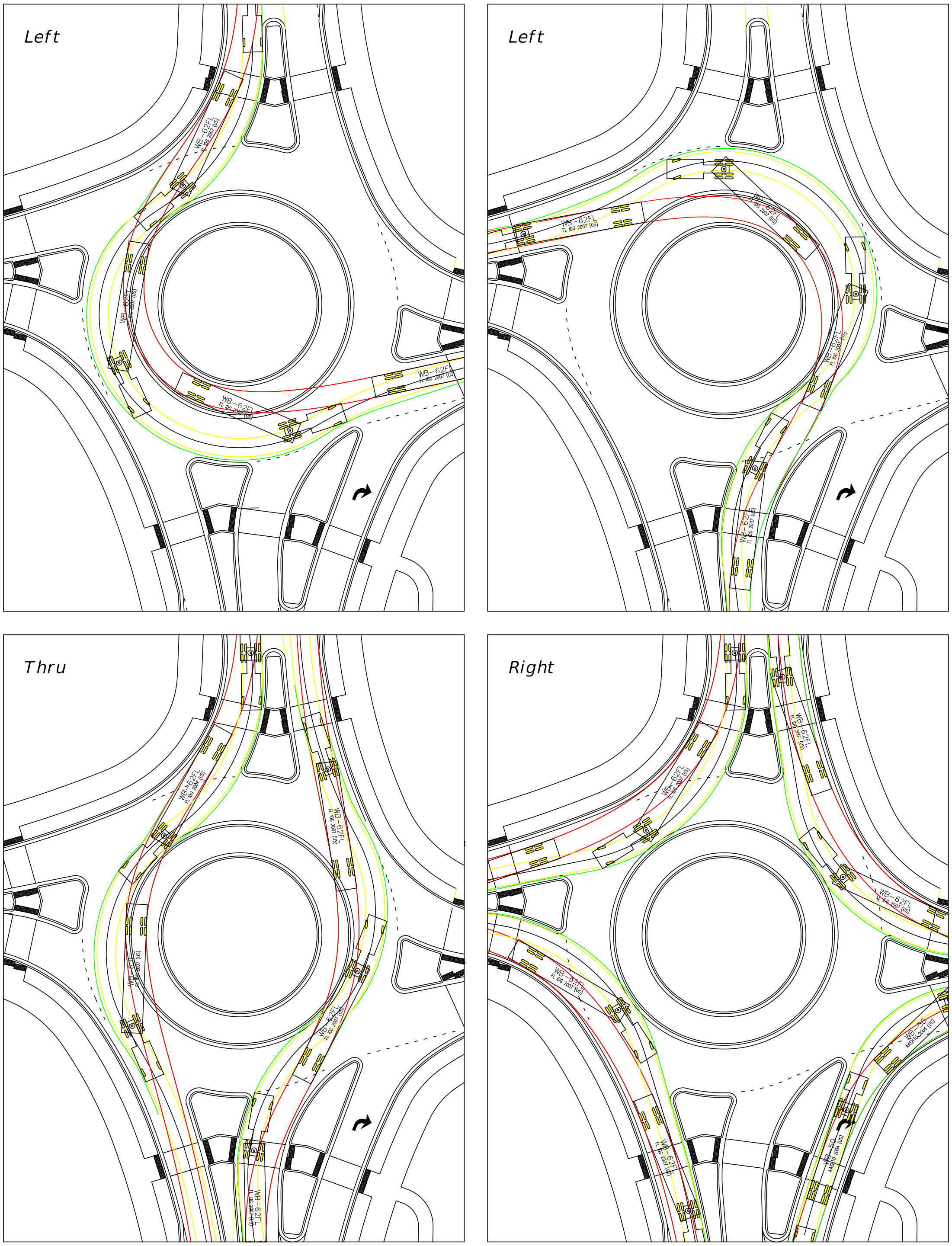
Provide swept path diagrams for the design vehicle for all turning movements. Develop travel paths using continuous smooth spline curve alignments representative of travel paths experienced in the field.

Provide a minimum 1.5-foot offset from the face of curb to the design vehicle's tire track.

213.7.1 Single-Lane Roundabout

The swept path design vehicle is required to stay within the travel lane and is prohibited from encroaching onto the splitter island, central island, or outside gutter pans. The truck trailer is permitted to mount the RA curb and use the truck apron. ***Figure 213.7.1*** illustrates a WB-62FL design vehicle swept paths for a single-lane roundabout.

Figure 213.7.1 WB-62FL Swept Paths: Single Lane Roundabout



213.7.2 Two-Lane Roundabout

Provide adequate pavement area for the simultaneous passage of the design vehicle and a passenger vehicle through the roundabout and for turning movements. The design vehicle must stay within the travel lanes without encroaching onto the inside or outside gutters. The truck trailer is permitted to mount the RA curb and use the truck apron. Develop swept path diagrams for all turning movements in the following combinations:

- Design vehicle in the outside lane and passenger vehicle in the inside lane
- Design vehicle in the inside lane and passenger vehicle in the outside lane

It is acceptable for the design vehicle path to encroach into the adjacent travel lane within the circulatory roadway when there is sufficient space for the passenger vehicle plus two feet of clearance between the two vehicles.

Use a painted gore when providing in-~~-~~lane truck accommodations~~es~~ on multilane entries. Typical ~~lane widths range from 11 to~~multi-lane approaches include two 12-~~feet~~foot lanes ~~with a~~separated by a ~~4~~ 6- to ~~6~~7-foot painted gore, as shown in ***EXHIBIT 213-1***.

When truck volume is very low, consider allowing the truck-trailer to command both lanes to complete the maneuver.

213.7.3 Exit Radius

An exit radius of 300 to 400 feet should be provided to create a smoother vehicular path and better truck accommodation. Use engineering judgement to balance the competing objectives of accommodating the design vehicle and providing a safe environment for pedestrians. Provide flat exit geometry when no pedestrian facilities are present.

213.8 Bicycle and Pedestrian Accommodation

Exhibit 213-1 provides standard details for pedestrian and bicycle facilities.

213.8.1 Pedestrian Facilities

When there are existing or planned pedestrian facilities on the approach roadways, the following requirements apply:

(1) Provide sidewalk widths in accordance with ***FDM 222,*** or consistent with approach sidewalk widths. When bicycle ramps are provided, the desired sidewalk width is 10 feet, but not be less than 8 feet.

(2) A 5-foot set-back from back of curb to sidewalk is desired; typically not less than 2 feet.

(3) Provide crosswalks at every approach leg.

(a) Provide curb ramps and detectable warning surfaces consistent with ***FDM 222*** and ***Standard Plans, Index 522-002***.

(b) Orient crosswalks perpendicular to the roadway to minimize pedestrian crossing distance.

(c) Provide a pedestrian refuge area within the splitter island meeting the requirements of ***FDM 213.3.5***.

(d) Provide pedestrian crosswalk lighting in accordance with ***FDM 231***.

213.8.2 Bicycle Facilities

~~Do not carry bicycle lanes through the roundabout.~~

~~Inclusion of bicycle ramps is required for multi-lane roundabouts and is optional for single-lane roundabouts. Terminate bicycle lanes or shoulders as illustrated in ***Exhibit 213-1***.~~

~~***Figure 213.8.1*** illustrates the geometrics for a bicycle ramp when a utility strip of at least 5-feet is present. The desired angle between the ramp and the roadway ranges from 20 to 25 degrees; however, angle is not to exceed 35 degrees.~~

~~***Figure 213.8.2*** illustrates the geometrics for a bicycle ramp when sidewalk on the approach leg is adjacent to, or near the back of curb.~~

~~Place Directional Tactile Walking Surface Indicator (a.k.a., Directional Indicator) at the top of the bicycle ramp to provide a tactile cue for visually impaired pedestrians to continue down the sidewalk. Do not place detectable warning surfaces on the bicycle ramp. See Developmental Specification ***Dev528*** and Developmental Standard Plans (DSP) ***Index D528-001*** for additional requirements.~~

There are several types of on-road and physically separated bicycle facilities available to accommodate bicycle travel as discussed in ***FDM 223***. The following paragraphs outline the requirements for bicycle facilities at roundabouts.

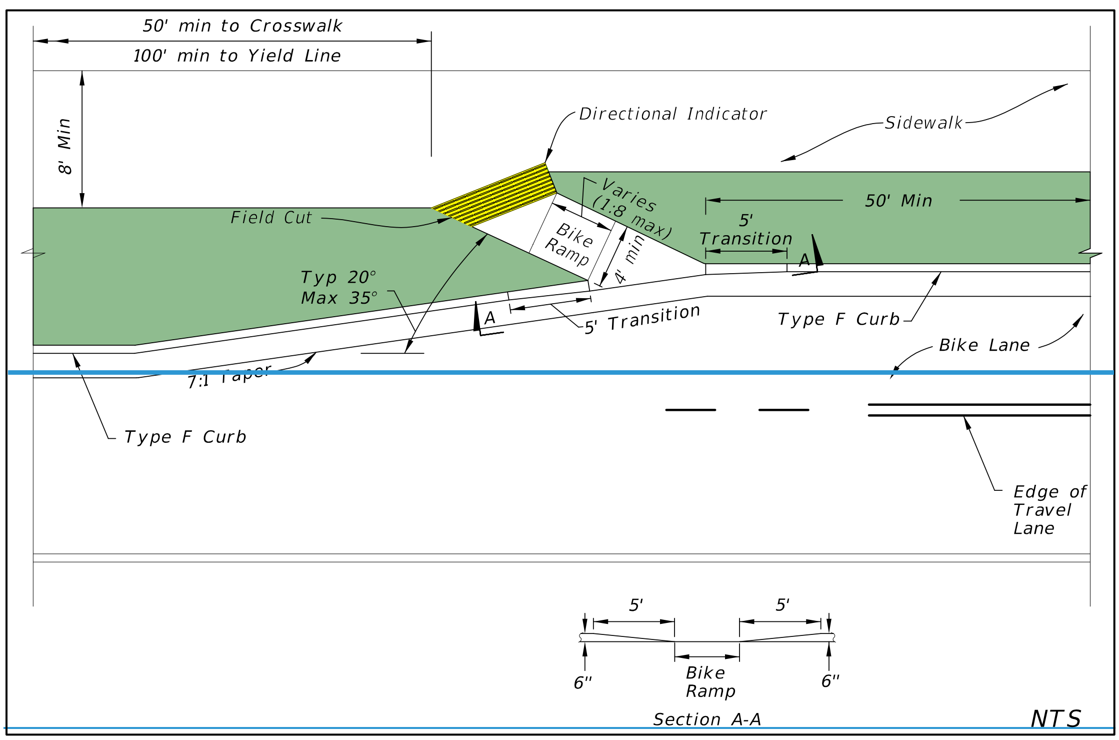
On-road bicycle facilities: On-road bicycle facilities include bicycle lanes and paved shoulders. Terminate on-road bicycle facilities at the upstream end of the roundabout and resume them at the downstream end as shown in ***Figure 213.10.1***. Locate termination points close to the roundabout where vehicular speeds are slow. Provide physically separated bicycle facilities with bike ramps at multi-lane roundabouts. This allows cyclists the option to either use the physically separated facility to cross the intersection or enter the travel lane and use the circulatory roadway to cross. Physically separated bike facilities with bike ramps are optional for single lane roundabouts.

Physically separated bicycle facilities: Physically separated bicycle facilities include separated bike lanes, sidewalk level separated bike lanes, and shared use paths. Physically separated facilities should be continuous around the intersection, parallel to the curb ,line and follow the contours of the circular intersection. ***Figure 213.10.1*** shows a typical design for a separated bike lane. Details for sidewalk level separated bike lanes and shared use paths are similar.

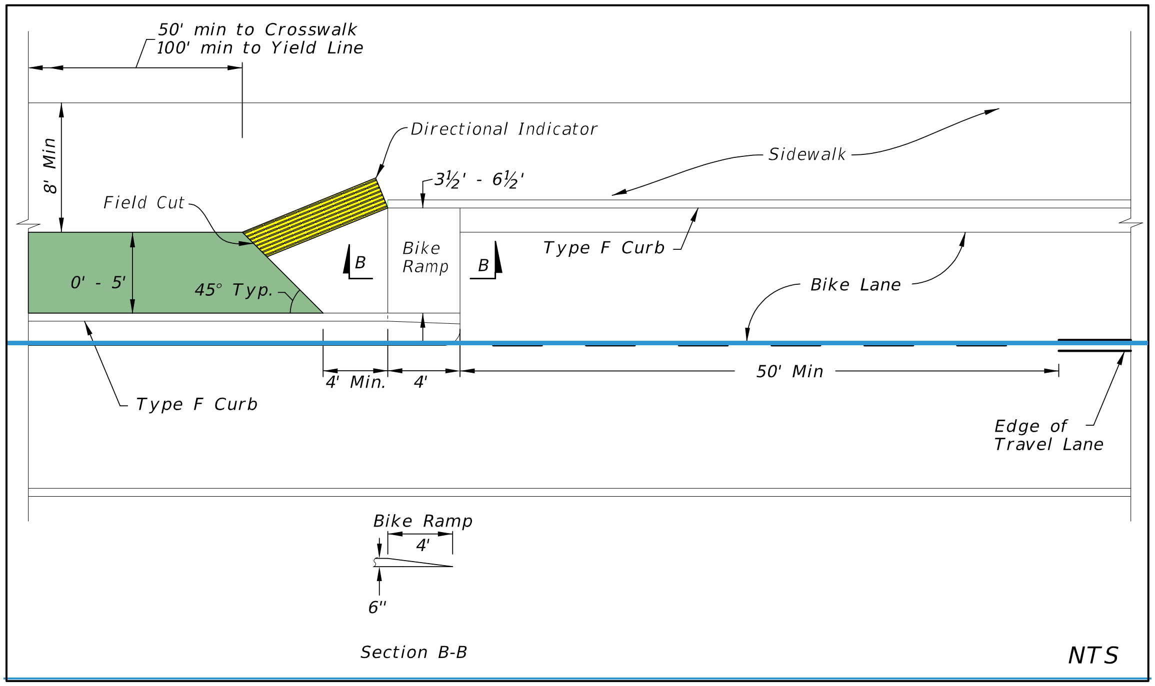
Separation techniques for physically separated bicycle facilities are covered in ***FDM 223***.

Provide bike ramps at multi-lane roundabouts to allow cyclists on the roadway the option to use the physically separated bike facility to cross the intersection or to stay on the roadway and use the circulatory roadway to cross. Bike ramps are optional for single lane roundabouts.

Design bike ramps in accordance with ***FDM 223.2.5***.



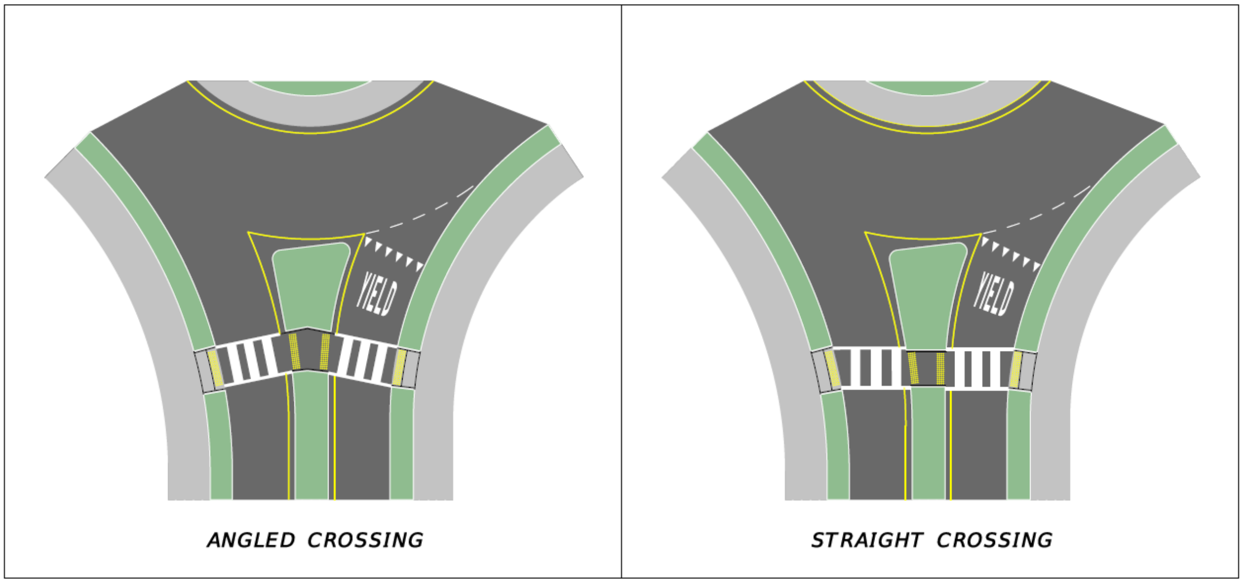
~~Figure 213.8.2 Straight Bicycle Ramp~~



213.8.3 Pedestrian Crossings

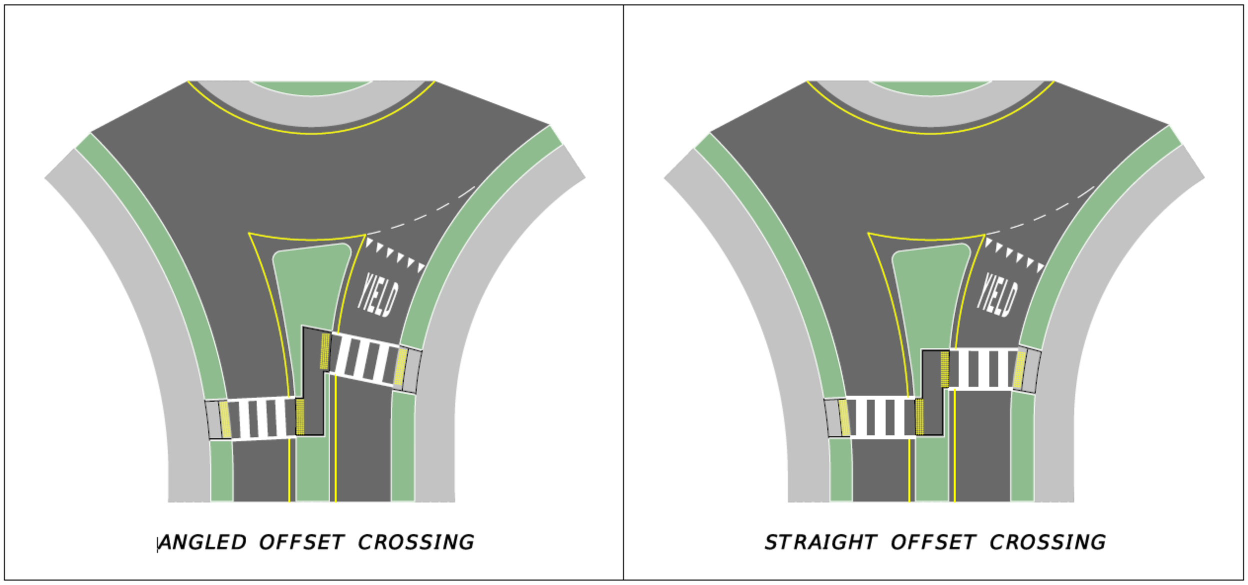
- Angled Crossings - Angled crossings are the preferred configuration because they minimize pedestrian crossing distance. When developing Angled Crossings, place each leg of the crosswalk perpendicular to the outside curb of the entry and exit lanes and locate the angle point near the center of the splitter island. (See ***Figure 213.8.1*** for angled crossings)
- Straight Crossings – Straight crossings are used when providing continuity of a major multi-use path. For Straight Crossings, place the entire crosswalk perpendicular to the centerline of the approach roadway. *(See* ***Figure 213.8.1*** for straight crossings*)*

Figure 213.8.1~~3~~ Angled and Straight Crossings



- Offset Crossings - Offset crossings ***(Figure 213.8.2)*** are used at multi-lane roundabouts where supplemental crossing treatments such as Pedestrian Hybrid Beacons or Rectangular Rapid Flashing Beacons are proposed. When developing offset crossings, locate the approach lane crosswalk 20 feet from the outside of the ICD and the exiting lane crosswalk 50 feet from the outside of the ICD. This design is intentionally opposite the similar "Z-Crossing" found at midblock locations. The longer distance at the exit allows for a 2-car queue between the crosswalk and roundabout.

Figure 213.8.24 Offset Crossings



213.9 Landscaping

Create a mounded central island that slopes upward from the truck apron using a slope no flatter than 1:10 and no steeper than 1:6. Provide varying height trees and plants in the central island to enhance driver recognition of the roundabout upon approach. On large roundabout center islands, varying heights, and uneven slopes can increase visual awareness of the roundabout and enhance aesthetics.

Provide quality space above and below ground for trees and other desirable vegetation to grow. Do not construct roundabout center islands on existing road pavement and base. Assure that the soil conditions will support the health and growth of selected trees and plants. Place trees and palms near the center of the central island, and not less than 6 feet from the face of Type D curb. Place shrubs in a simple arrangement to help increase visual awareness of the roundabout.

Coordinate the landscape design in the early stages of plans development to assure that landscaping will be fully integrated into the roundabout design.

Additional information regarding roundabout landscaping is in Chapter 9 of ***NCHRP 672***.

213.9.1 Plant Selection

Select a diverse, low maintenance mix of ***Florida Friendly*** plant species. Select trees 6-foot in height or taller when installed; palm trees 12-foot or taller. The use of native tree species is encouraged. Select shrubs that will recover or regenerate naturally after mechanical damage. Select trees and plants with a variety of height, color, form, and texture. Select trees that will continue to grow in value, after establishment, without routine irrigation.

Plants placed in splitter islands must not exceed 18-inches in height, at full maturity; i.e., do not encroach on sight distance requirements.

If more decorative plantings are requested by local agency or groups, a maintenance agreement should be obtained.

213.10 Signing and Pavement Markings

Well-designed signing and pavement markings will enhance safety and traffic operations by clarifying the rules of the road and proper lane assignments to drivers as they navigate through the roundabout.

Use the standard left-turn arrow with a circular dot on the left-most lane of the approach to multi-lane roundabouts as shown in ***Standard Plans, Index 711-001***. Use standard arrows within the circulatory roadway.

Follow the details presented in ***Exhibits 213-3, 213-4, 213-5, and Figure 213.10.1*** when developing roundabout signing and pavement marking plans to promote consistency throughout the state.

~~Use the standard left-turn arrow with a circular dot on the left-most lane of the approach to multi-lane roundabouts as shown in ***Standard Plans, Index 711-001***. Use standard arrows within the circulatory roadway.~~

Figure 213.10.1 shows roundabout signs and pavement markings with the bicycle lane. There are options for green or no green color pavement markings depending on the location and conditions. Green-colored pavement is permitted for use with Interim Approval from FHWA. This figure also identifies features that should be included in the design of street crossings.

Additional measures may be needed to induce yielding to bicyclists and pedestrians at crossing locations of multilane roundabouts or roundabouts where exit geometry may prompt faster exiting speeds and reduced chances of yielding by motorists. Consider devices such as a Rapid Flashing Beacon or a Pedestrian Hybrid Beacon.

Figure 213.10.1 Roundabout S&PM with Separated Bicycle Lane

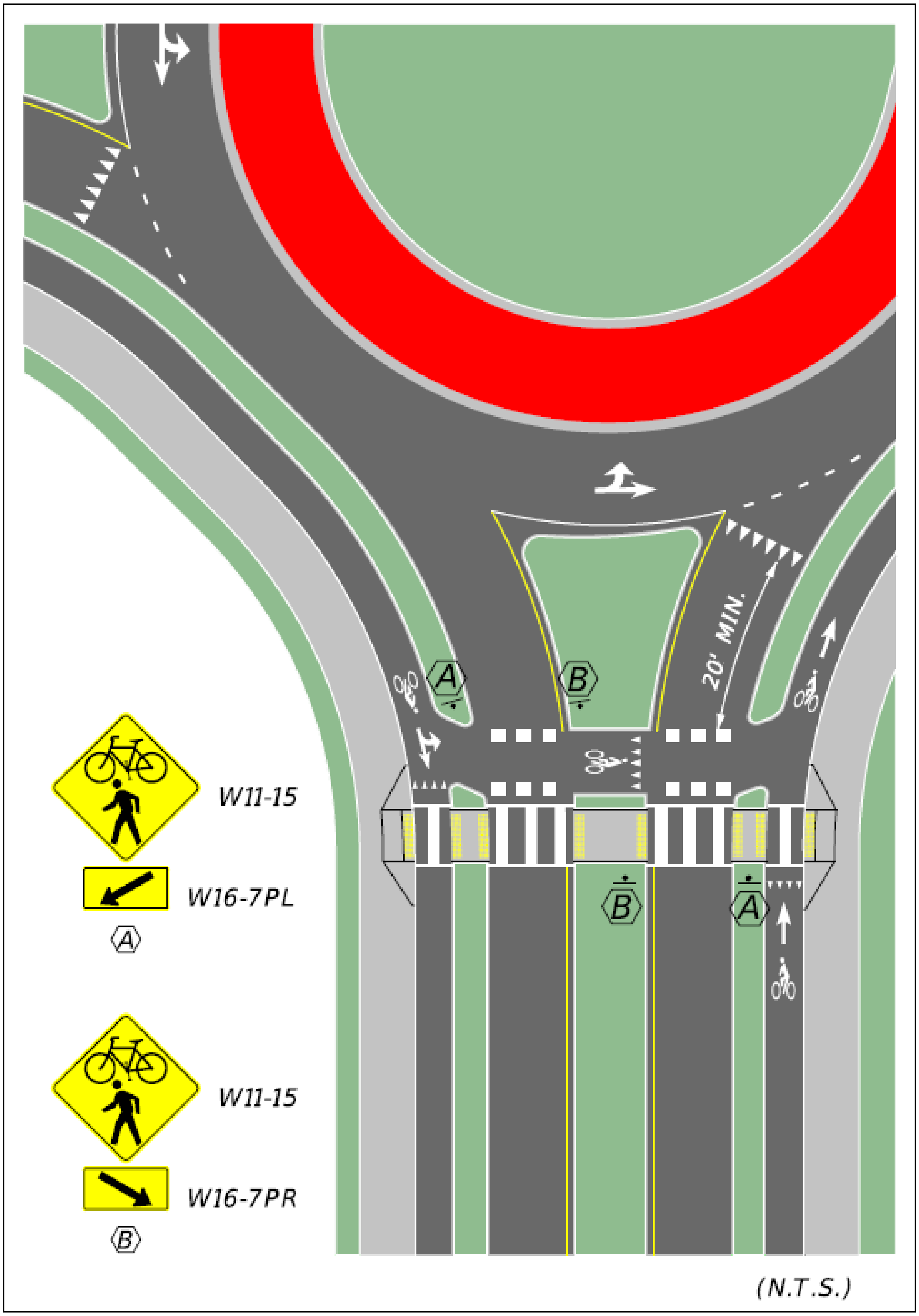


Exhibit 213-3: Roundabout S&PM

Exhibit 213-4: Roundabout S&PM

Exhibit 213-5: Roundabout S&PM

213.11 Lighting

Nighttime illumination of roundabouts is required. Provide a minimum 1.5 foot-candles on the roadway surface within the circulatory roadway and at least 200 feet in advance of the splitter islands.

See ***FDM 231.3.3*** for additional lighting requirements when pedestrian facilities are provided.

213.12 Community Aesthetic Features

Communities commonly desire to place public art or other large aesthetic objects within the central island. These types of features are acceptable provided that:

- Objects are located outside the required sight triangles,
- Not less than 6 feet from the inside edge of the truck apron, and
- Approval is granted through the process outlined in ***FDM 127***.

Fountains, or other water spraying features are not permitted.

214 Driveways

214.1 General

This chapter provides driveway design criteria and requirements for connections to the State Highway System. The ***FDOT Access Management Guidebook*** provides further guidance and information on driveways and medians. For additional information and definitions, including Connection Categories, and requirements for obtaining access to the State Highway System, refer to:

- ***Florida Administrative Code (F.A.C.)***, ***Rule 14-96 (State Highway Connection Permits)*** and
- ***Rule 14-97, F.A.C. (State Highway System Access Control Classification System and Access Management Standards)***.

This criteria applies to new construction, reconstruction, and Resurfacing, Restoration and Rehabilitation (RRR) projects. New Construction criteria must be met for new and reconstruction projects, and for proposed improvements included within RRR projects. For RRR Projects, unaltered driveways that are not in compliance with the new construction criteria in this chapter, ***Standard Plans,*** or ADA requirements are not required to be reconstructed.

The terms “driveway”, “connection”, and “turnout” are used in various FDOT manuals, handbooks, and guides. A driveway is an access constructed within a public R/W connecting a public road with adjacent property. The intent is to provide vehicular access in a manner that will not cause the blocking of any sidewalk, border area, or roadway. The term “connection” encompasses a driveway or side road and its appurtenances:

- islands,
- separators,
- transition tapers,
- auxiliary lanes,
- travel way flares,
- drainage pipes and structures,
- crossovers,
- sidewalks,
- curb cut ramps,
- signing,
- pavement marking,
- required signalization,
- maintenance of traffic or
- other means of access to or from controlled access facilities.

The term “turnout” is typically used to describe the portion of the driveway or side road adjoining the outer roadway (maintained or constructed by the Department). The terms “driveway” and “connection” are used in this chapter.

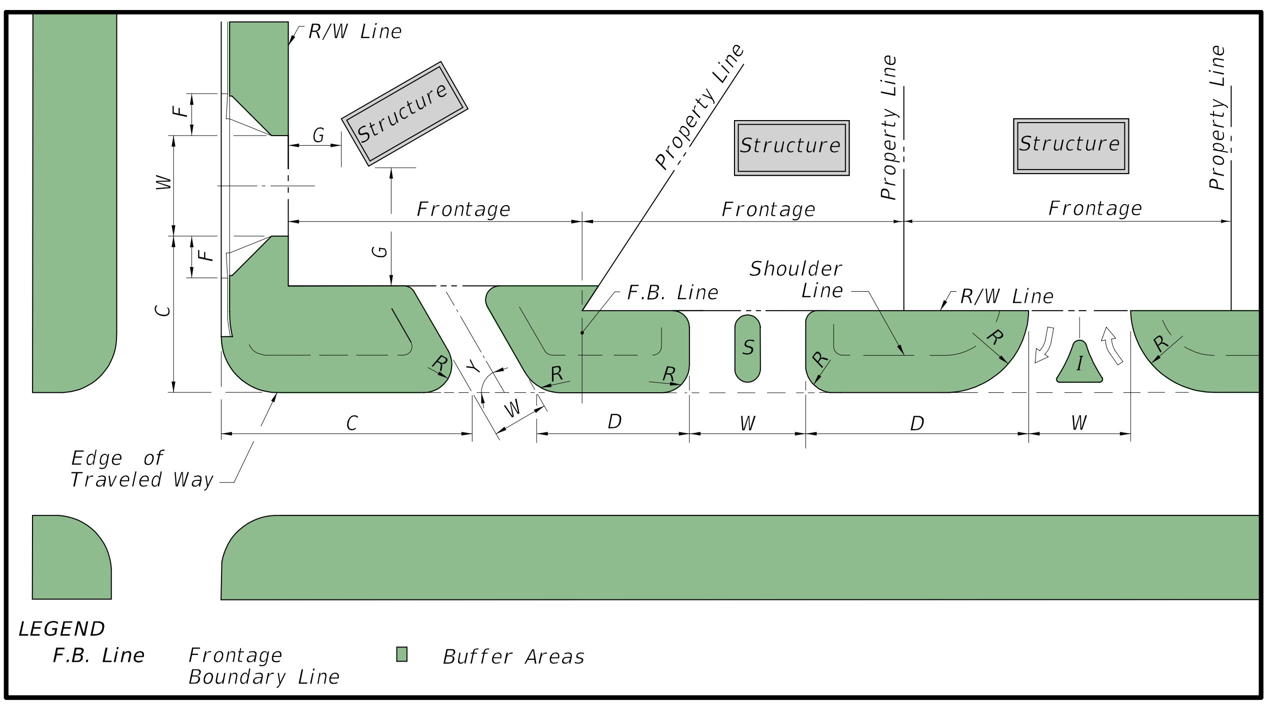
Driveways should be located and designed to improve the mobility and safety of all road users. The location and design of the connection must consider potential users, context classification, access classification, and site conditions.

This Chapter includes considerations and requirements for the design of driveways defined as Connection Categories A, B, C, or D (see ***FDM 214.1.1***). Connection Categories E, F and G (i.e., traffic volume >4,000 trips/day) are designed as Intersections in accordance with ***FDM 212***. Side road intersection design, with possible auxiliary lanes and channelization, may be necessary for Connection Category C and D.

214.1.1 Driveway Terminology

Figure 214.1.1 provides a schematic of typical driveway types and the associated terminology. The terms shown in this section are standard terms or variables used within this chapter.

Figure 214.1.1 Driveway Terminology



Radius (R) – The radial dimension of curved driveway entry or exit

Flare (F) – The total length of angled approach/exit at the edge of roadway for a flared driveway

Driveway Connection Width (W) – Effective width of the driveway, measured between the left edge and the right edge of driveway.

Driveway Connection Spacing (D) – Spacing between driveways from the projected edge line of each driveway (see connection spacing in ***Tables 201.4.2*** and ***201.4.3***)

Corner Clearance (C) – Distance from an intersection, measured from the projected closest edge line of the intersecting roadway to a driveway projected edge line (see connection spacing in ***Tables 201.4.2*** and ***201.4.3***)

Angle (Y) – Angle of the driveway between the driveway centerline and the roadway edge of traveled way.

Setback (G) – Distance from the R/W line to the closest permanent structure

Driveway Location – Position of driveway in relation to other traffic features such as intersections, neighboring driveways, median openings, and interchanges

Driveway Length – Distance needed into the site to transition vehicles to the internal circulation system of the site.

Driveway Traffic Separator (S) – Linear islands or raised medians used to separate traffic movements on the driveway.

Channelization Island (I) – Used to facilitate right turns and discourage left turn movements on the driveway.

Connection (Driveway) Category (A through D) are defined as follows:

- A – 1-20 trips/day or 1-5 trips/hour.
- B – 21-600 trips/day or 6-60 trips/hour.
- C – 601-1,200 trips/day or 61-120 trips/hour.
- D – 1,201-4,000 trips/day or 121-400 trips/hour.

Design driveways based on the context classification, expected volume of multimodal traffic, and expected mix of traffic, and design vehicle. See the ***FDOT Access Management Guidebook*** for descriptions of these categories.

214.1.2 Evaluation of Existing Driveways

Evaluate existing driveways to ensure the design properly balances safety, accessibility, and mobility. The following existing roadway elements play a role in locating driveways on roadway improvement projects:

- Medians
- Median openings
- Adjacent driveways
- Traffic signals
- Adjacent highway features
- Adjacent intersection

Perform a corridor analysis to determine if existing connections, median openings, and signal spacing are in conformance or can be brought into conformance with Department standards. See ***FDM 201.4*** for Access Management requirements.

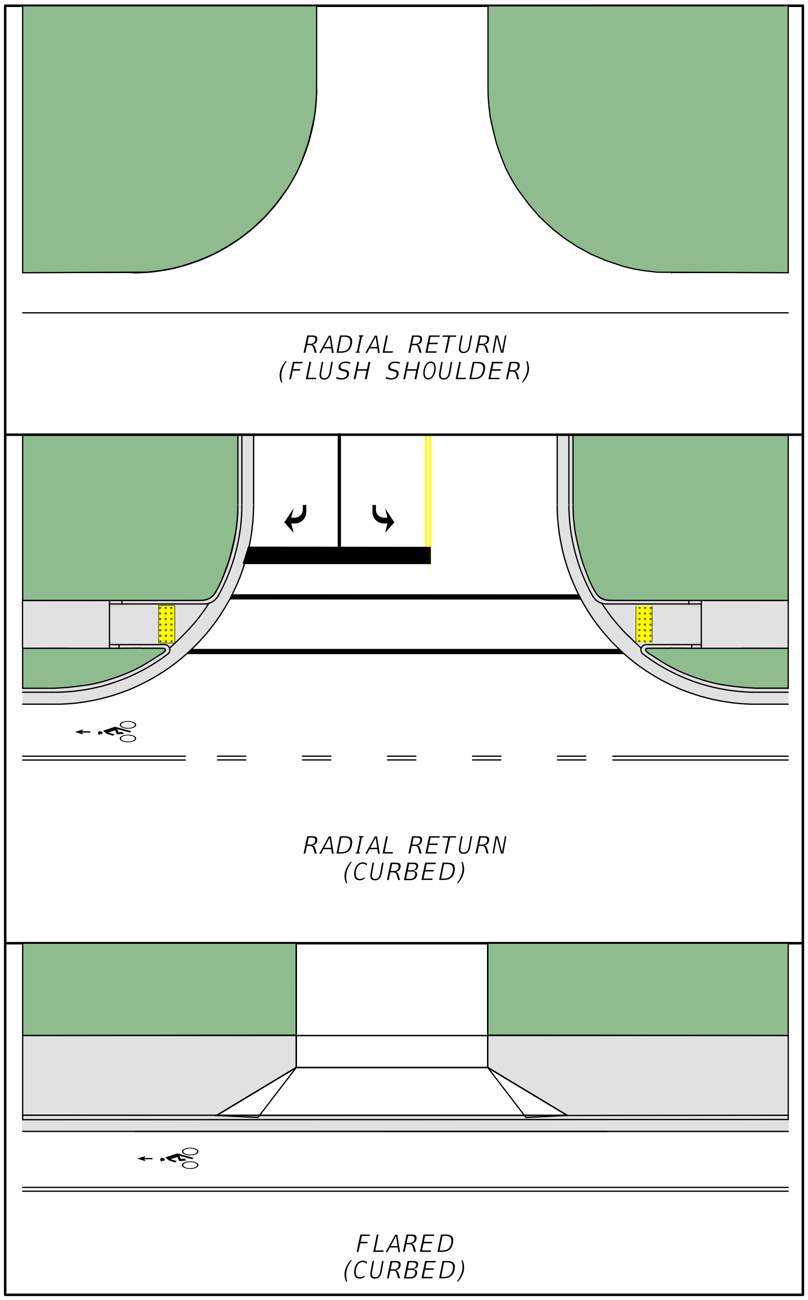
Each district has an **Access Management Review Committee** (AMRC)~~,~~ to provide guidance on access management and median decisions. The AMRC also~~to~~ reviews deviations from connection and median opening spacing standards not resolved during the District's staff level review~~, deviations from spacing standards of more than 10% for full median openings~~. The AMRC members are appointed by the District Secretary and consists of head level positions within the District. ~~AMRCs in the districts provide guidance on access management and median decisions.~~ Interested persons may also appear before the AMRC during the project development stage. (See ***Section 335.181(2), Florida Statutes*** and ***Rule 14-96.002(25), F.A.C.***).

When a connection is proposed to be modified as part of a Department project, notice of the Department's intended action will be provided to the property owner pursuant to ***Rule 14-96.011(2), Florida Administrative Code***. Property owners have the right to request an administrative hearing. If a hearing is requested, the Department will offer to schedule a meeting on site to consider documents, reports, or studies obtained by the property owner with regards to safety and operational concerns.

214.2 Flared and Radial Return Designs

Driveway connections on the State Highway System use either a flared or a radial return design. Examples of each type are shown in ***Figure 214.2.1***.

Figure 214.2.1 Flared and Radial Return Driveway Examples



Determine the type of driveway needed based on roadway type (curbed or flush shoulder) and driveway traffic volumes. Flared driveways are used on curbed roadways where driveway traffic does not exceed 600 trips per day or 60 trips per hour (i.e., Connection Categories A and B) as shown in ***Table 214.2.1***. Radial return designs are used on all flush shoulder roadways and on curbed roadways with driveway traffic greater than 600 trips per day (i.e., Connection Category C and D).

Provide radial returns for driveways requiring or having a specified median opening with left turn storage and served directly by that opening.

Table 214.2.1 Flared or Radial Driveway

Element Description	Connection Category		
	A	B	C and D
		2-Way	2-Way
Curbed Roadways	Flared	Flared	Radius
Flush Shoulder Roadways	Radius	Radius	Radius

Notes:

(1) Connection Categories A, B, C, and D are defined in ***FDM 214.1.1***.

(2) Small radii may be used in lieu of flares for curbed roadways with Category B Connections when approved by the Department.

Modification for Non-Conventional Projects:
Delete note 2 from ***Table 214.2.1*** and see RFP for requirements.

Flared or radial return design determines driveway entry and exit speeds and turning movements. Larger radius or flare allows for quicker and more efficient vehicle access in contexts where motor vehicle movement is a priority. This reduces interference with traffic on the major roadway. Pedestrians may be impacted due to larger driveway openings (e.g., higher vehicle entry speeds and increased pedestrian crossing times), which are undesirable in contexts where pedestrians and speed management are a priority.

Consider the following to determine which type of driveway is needed:

- Design Speed, Posted Speed and Target Speed of roadway
- Driveway traffic volume
- Entry and exit movements (e.g., one-way, two-way, right-in/right-out)
- Available R/W
- Design Vehicle
- Context Classification
- Pedestrian Needs
- Bicyclist Needs

A CADD-based vehicle turning path program (e.g., AUTOTURN) is often used to determine the driveway type and dimensions for the appropriate design vehicle.

Requirements for driveway profiles connected to curbed or flush shoulder roadways are provided in ***FDM 214.4***.

For additional information and details on flared driveways see ***Standard Plans*, *Index 522-003*** and for paved radial driveways see ***Standard Plans*, *Index 330-001***.

214.3 Driveway Horizontal Geometry

Driveway horizontal geometry should be consistent with the context classification, roadway type (curbed or flush shoulder), driveway traffic volumes, driveway design vehicle, and access classification. This section contains the following design elements for driveway horizontal geometry:

- Radius
- Driveway Width
- Angle of Driveway
- Driveway Traffic Separator and Channelization Island
- Driveway Length
- Driveway Location

Each driveway element listed above is further discussed in the subsequent sections. ***Table 214.3.1*** contains driveway dimensions for the horizontal geometry elements. This table also provides the requirements for the elements in ***Figure 214.1.1***.

Table 214.3.1 Driveway Dimensions

Element	Description	Connection Category		
		A	B	C and D
			2-Way	2-Way
Curbed Roadways				
W	Connection Width	12' Min 24' Max	24' Min 36' Max	24' Min 36' Max
F	Flare (Drop Curb)	10' Min	10' Min	N/A
R	Radial Returns (Radius)	N/A	See Note 3	25' Min 50' Std 75' Max
Y	Angle of Driveway	60°- 90°	60°- 90°	60°- 90°
S	Driveway Traffic Separator or Median	N/A	4'-22' Wide	4'-22' Wide
G	Setback	12' Min., All categories.		
C & D	Corner Clearance and Driveway Connection Spacing	See connection spacing in ***Tables 201.4.2*** and ***201.4.3***		
Flush Shoulder Roadways				
W	Connection Width	12' Min 24' Max	24' Min 36' Max	24' Min 36' Max
F	Flare (Drop Curb)	N/A	N/A	N/A
R	Radial Returns (Radius)	15' Min 25' Std 50' Max	25' Min 50' Std 75' Max	25' Min 50' Std (Or 3-Centered Curves)
Y	Angle of Driveway	60°- 90°	60°- 90°	60°- 90°
S	Driveway Traffic Separator or Median	N/A	4'-22' Wide	4'-22' Wide
G	Setback	12' Min., All categories.		
C & D	Corner Clearance and Driveway Connection Spacing	See connection spacing in ***Tables 201.4.2*** and ***201.4.3***		

Notes:

(1) Connection Categories A, B, C, and D are defined in ***FDM 214.1.1***.
(2) 2-Way refers to one entry movement and one exit movement; i.e., not exclusive left or right turn lanes on the connection.
(3) Small radii may be used in lieu of flares for curbed roadways in Connection Category B when approved by the Department.
(4) The Angle of Driveway for Connection Category A may be reduced with approval by the local Operations/Maintenance Engineer.
(5) Design criteria for channelization islands (I) is found in ***FDM 210.3***.

Radial Returns (Radius):

(6) Provide the minimum radius for low-speed roadways with driveway design vehicle of a passenger car.
(7) Provide the standard radius for high-speed roadways or driveway with large design vehicles (e.g., SU-30).
(8) Consider providing the maximum radius or compound curve for high-speed roadways or driveway with large design vehicle (e.g., WB-62).

Modification for Non-Conventional Projects:
Delete notes 3 and 4 from ***Table 214.3.1*** and see RFP for requirements.

214.3.1 Radius

Design criteria for radial return driveways are given by road type (curbed or flush shoulder roadways) and connection category. A range of return radii (minimum, standard, and maximum) is provided in ***Table 214.3.1***.

The minimum radii will reduce the distance for pedestrians to cross the driveway. See ***FDM 214.7*** for additional pedestrian requirements.

Use 50-foot radii for driveways intended for daily accommodation of vehicles exceeding 30 feet in length. Provide the following as necessary for safe turning movements where large numbers of multi-unit vehicles will use the connection:

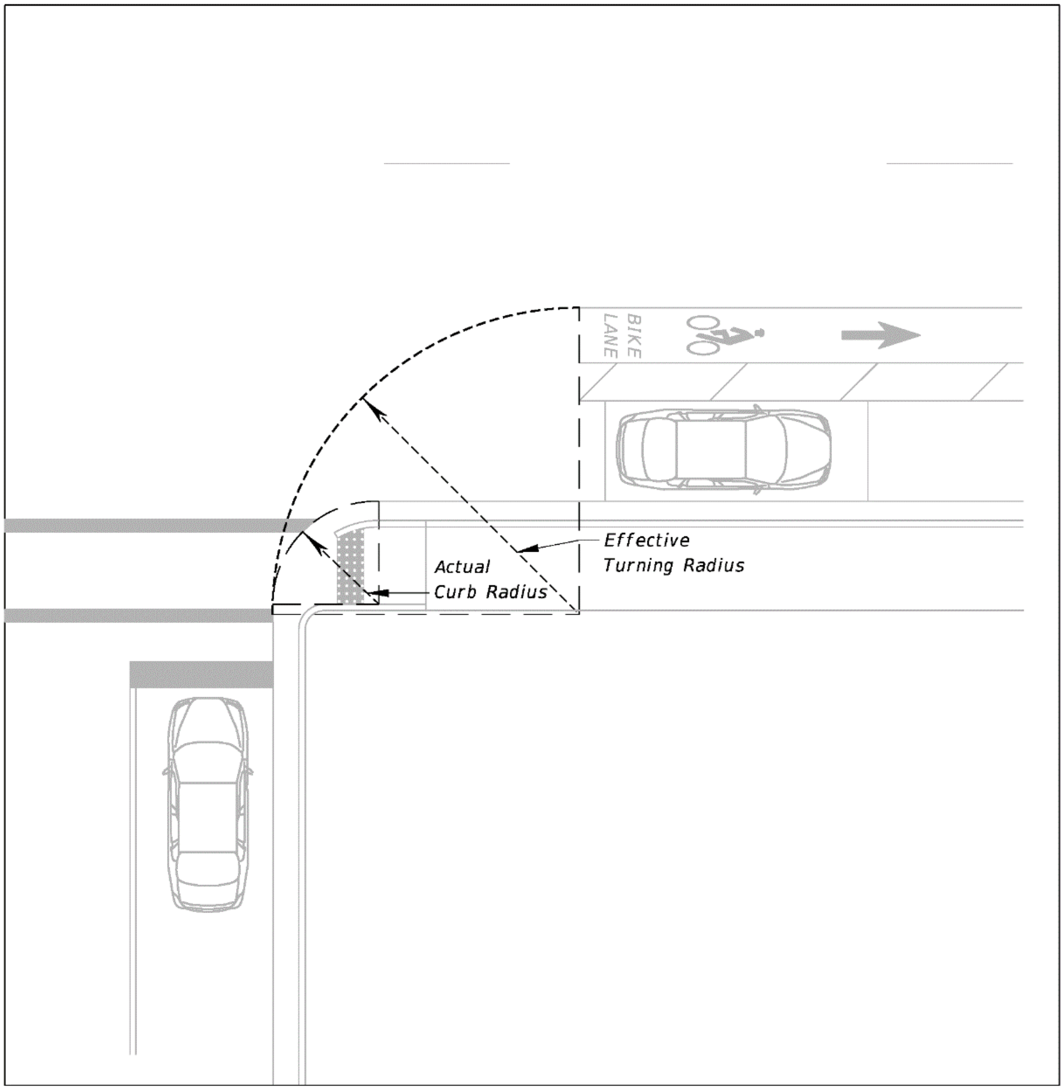
- Increased connection width
- Increased radii
- Auxiliary lanes
- Tapers
- Lane flares
- Separators
- Islands

214.3.1.1 Effective Turning Radius for Right Turns

The effective turning radius is the minimum radius needed to enter or exit a driveway, as illustrated in ***Figure 214.3.1***. Additional pavement adjacent to the travel lane (e.g., on-street parking, bike lane, bus bay) will result in the following:

- Increase the effective turning radius for the design vehicle
- The radial return radius (curb radius) may be reduced
- The ability to use a larger design vehicle

Figure 214.3.1 Effective Driveway Radius



214.3.1.2 Designing for Trucks and Other Large Vehicles

Determine the appropriate design vehicle for each driveway. Driveways designed for large vehicle (i.e. truck and bus) movements may impact other users. The following may result when using larger driveway dimensions for truck movements:

- Some confusion for passenger car drivers
- Increased pedestrian and bicyclist exposure to vehicles

Chapter 4 in the ***FDOT Access Management Guidebook*** provides additional guidance for designing for large vehicles.

The Department will determine if an auxiliary lane is needed for safe turning movements when large numbers of multi-unit vehicles ~~will~~ use the connection. *See* ***FDM 214.5*** for more information on exclusive right turn lanes.

214.3.2 Driveway Width

Design criteria for driveway widths are given by Connection Category (A – D) and type of roadway (curbed or flush shoulder). Minimum and maximum driveway widths are provided in ***Table 214.3.1***. Design driveway widths based on the design vehicle and number of lanes. Consider increasing driveway width above maximum values when large numbers of multi-unit vehicles will use the connection. The Department will determine if the maximum driveway width is insufficient for safe turning movements.

Modification for Non-Conventional Projects:
Delete last sentence in above paragraph and see RFP for requirements.

Design one-way connections to eliminate unpermitted movements.

When more than two lanes in the driveway connection are required, the 36-foot maximum width may be increased to relieve interference between entering and exiting traffic which adversely affects traffic flow. These cases require documented site-specific study and design.

Consider providing pavement markings to guide drivers exiting or entering a driveway.

214.3.3 Angle of Driveway

The angle of driveway (Y) influences safety and operation of the driveway. It is to be as close to 90 degrees as practical. Design values for angle of driveway are in ***Table 214.3.1***. Angles of driveways at the lower end of the allowable range should be avoided for the following reasons:

(1) Heavy skew angles increase the driveway crossing length, exposing vehicles, pedestrians, and cyclists to conflicting traffic streams for longer periods of time.

(2) The road user's sight angle to the crossing leg becomes restricted due to the skew, making it difficult to see conflicting vehicles and to perceive safe crossing gaps.

(3) Turning movements are difficult because of the skew. Additional pavement may be necessary to accommodate the turning of large trucks.

(4) Turning movements or positioning may be confusing and require additional channelization.

(5) Increased open pavement areas of highly skewed driveways increase construction and maintenance costs.

214.3.4 Driveway Traffic Separator and Channelization Island

Width requirements for driveway traffic separators are provided in ***Table 214.3.1***. For triangular channelization islands, see ***FDM 210.3*** for criteria and information.

214.3.5 Driveway Length

Driveway length is measured from the edge of roadway traffic lane or bicycle lane to the first conflict point; including the distance to the R/W and the setback (G) to a structure. The setback to a structure is measured from the R/W line to the structure as shown in ***Figure 214.1.1*** (see ***Table 214.3.1*** for minimum requirements).

Driveway length and size must accommodate all vehicular queuing, maneuvering, and parking beyond the R/W line. Except for vehicles stopping to enter the highway, the portion of the driveway within the Department R/W must be used only for moving vehicles entering or leaving the highway.

The term driveway length as used in this manual may also be referred to as throat length in other manuals.

214.3.6 Driveway Location

Driveway locations impact the safety and operation of the roadway. Closely spaced driveways increase conflict points and may impede the movement of traffic. Refer to the ***2018 AASHTO Green Book, Section 9.11.6*** for additional information. Consider the location of driveways in relation to the following:

- Signalized intersections
- Un-signalized connections
- Alternative intersections
- Limited Access interchange ramps

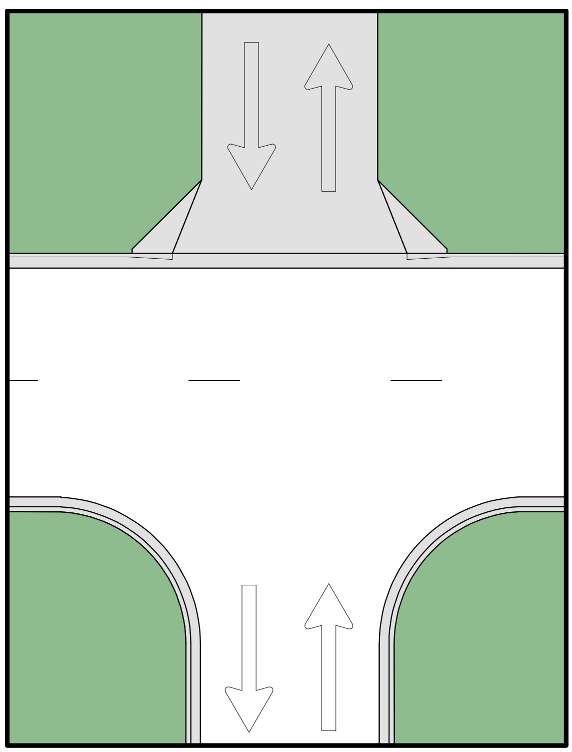
Requirements for driveway spacing and corner clearance are provided in ***FDM 201.4*** (connection spacing in ***Tables 201.4.2*** and ***201.4.3***) and shown in ***Figure 214.1.1***. In addition to corner clearance requirements, driveways should be located outside of the functional areas of adjacent intersections, where practical. The functional area of an intersection is defined in ***FDM 212.4***.

See the following for driveway distances to interchange areas and alternative intersections in ***Figure 214.3.3***:

- ***FDM 214.3.6.2*** for d1 values
- Connection spacing in ***Tables 201.4.2*** and ***201.4.3*** for d2 requirements

Align corresponding connection through lanes where a driveway is intended to align with a connection across the highway as shown in ***Figure 214.3.2***.

Figure 214.3.2 Aligned Through Lanes



214.3.6.1 Roundabouts

Providing driveway access to a roundabout may be considered only when there are no other reasonable alternatives. Driveways introduce conflict to roundabout operations and increase the likelihood of wrong-way movements. Direct driveway connections must meet the following:

- Design Connection Category B, C, and D driveways as a roadway approach leg, including a splitter island.
- Connection Category A driveways are only allowed on single-lane, low-volume roundabouts. Design Connection Category A driveways as flared connections to provide a visual indication that they are not roadways.
- Provide a means for vehicles to enter the roundabout moving forward; i.e., not backing out of the driveway. This is more critical for Connection Category A driveways where unfamiliar drivers may need to turn around in the driveway.
- Meet the required intersection sight distance (see ***FDM 212***).

See ***FDM 213*** for roundabout criteria and information.

For driveway distances to roundabouts, see ***Figure 214.3.3.***

214.3.6.2 Interchange Areas

Access Management on a crossroad at an interchange is critical for the efficient operation of an interchange. Provide adequate connection spacing along the crossroad at an interchange for the following:

- To minimize spillback on the ramp and crossroad approaches to the ramp terminal
- Provide adequate distance for crossroad weaving
- Provide space for merging maneuvers
- Provide space for storage of turning vehicles at access connections on the crossroad

Arterial or collector roadways within 1,320 feet of interchange ramps are areas of special concern (see ***Figure 214.3.3***). ***Florida Administrative Code, Rule 14-97*** requires that the first full median opening ~~shall~~ be at least 2,640 feet as measured from the end of the taper of the off ramp. The first driveway connection following minimum driveway spacing from the ramp taper furthest from the interchange must be as follows:

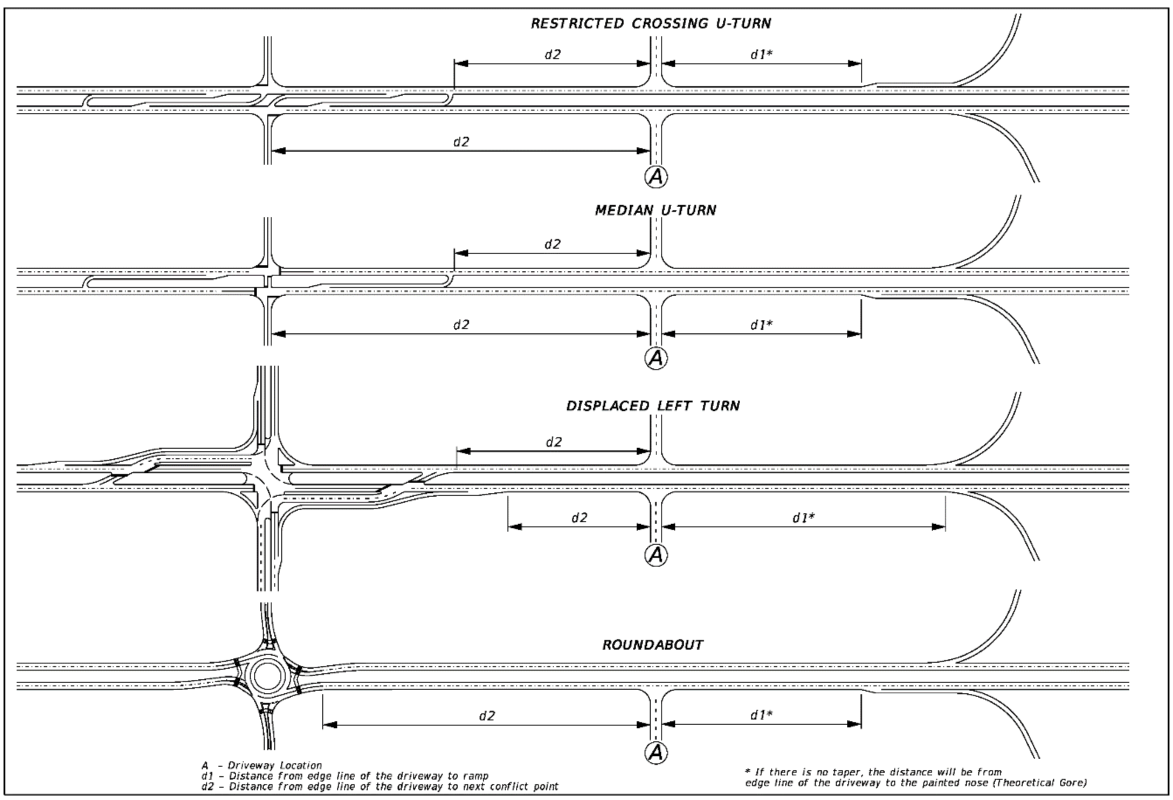
- 440 feet on roadways with posted speeds ≤ 45 mph

- 660 feet on roadways with posted speeds ~~≥~~ > 45~~50~~ mph
- 1,320 feet on Access Class 2 Facilities with posted speeds ~~≥~~ > 45~~50~~ mph

~~Thelisted in this section, refer to the speed limit~~ For interchanges with speed changes between the ramp tapers, the posted speed is based on the roadway outside the interchange area. These requirements should be applied in accordance with District procedures for implementing the Rule, and should not be confused with the minimum requirements for limited access R/W. See ***FDM 211.15*** for limited access R/W minimum requirements.

For driveway locations in interchange areas ~~-~~see ***Figure 214.3.3***.

Figure 214.3.3 Driveway Locations at Interchange Areas and Alternative Intersections



214.4 Driveway Vertical Geometry

The driveway profile defines the vertical geometry for constructing a driveway. The following will impact the design of driveway profiles:

- Roadway type (curbed or flush shoulder)
- Context classification
- Commercial or residential use
- Drainage accommodation
- Utility considerations
- Design speed of roadway (affects steepness of driveway)
- Design vehicle
- Available R/W

Design driveway grades with the following maximum values:

- 10% for commercial
- 28% for residential

Design driveways to avoid ponding and erosion. Drainage requirements are in Chapters 2 and 3 of the ***FDOT Drainage Manual***.

214.4.1 Driveway Profile on Curbed Roadways

Requirements for driveway profiles connected to curbed roadways are provided in ***Figure 214.4.2, Table 214.4.1,*** and ***FDM 113.2.2***.

To provide the standard sidewalk width, shared use path width, or crossing through the driveway, consider shortening the driveway apron with the appropriate flared driveway. See ***FDM 214.7*** for more information on pedestrian accommodations for driveways.

Slopes and lengths of flared driveways depend on roadway geometry, design vehicles, sidewalk width, shared use path width, and available R/W.

*Commentary: Driveways can serve as a vertical deflection speed management tool, see **FDM 202** for more information on Speed Management. Requiring motorists to slow down before entering the driveway may increase safety for pedestrians.*

Flared driveways are classified as General, Marginal, or Adverse and are described as follows:

General Applications

These can accommodate representative standard passenger vehicles, and general applications can also accommodate representative standard trucks, vans, buses, and recreational vehicles operating under normal crown and superelevation conditions. Standard pavement cross slopes and superelevation tables are provided in ***FDM 210***.

Marginal Applications

These can cause overhang drag for a fully loaded representative standard passenger vehicle when the driveway is located on the low side of a fully-superelevated roadway.

Adverse Applications

These can cause vehicles to drag or slow down and are typically used on very low speed (design speed ≤ 35 mph) roadways. This application's slopes can cause overhang drag for representative standard passenger vehicles under fully loaded conditions. The steeper slopes can impede traffic flow by causing drivers leaving the roadway to excessively slow or pause.

Figure 214.4.1 illustrates a comparison between each application. Details for these applications are provided in ***Standard Plans*, *Index 522-003***.

Flared driveways may not accommodate vehicles with low beds, undercarriage, or appendage features. Use site-specific flare designs or Connection Category C and D designs for these vehicles.

Projects that require the reconstruction of an existing commercial driveway may exceed 10% grade when both of the following conditions are met:

- Documentation that an adverse roadway operational or safety impact would not result from the proposed grade is provided; and,
- Approval by District Design Engineer is obtained.

Modification for Non-Conventional Projects:
Delete the above paragraph and see RFP for requirements.

NCHRP Report 659, Guide for the Geometric Design of Driveways contains additional driveway profile information and guidance.

Figure 214.4.1 Comparison of Applications for Flared Driveway Connection

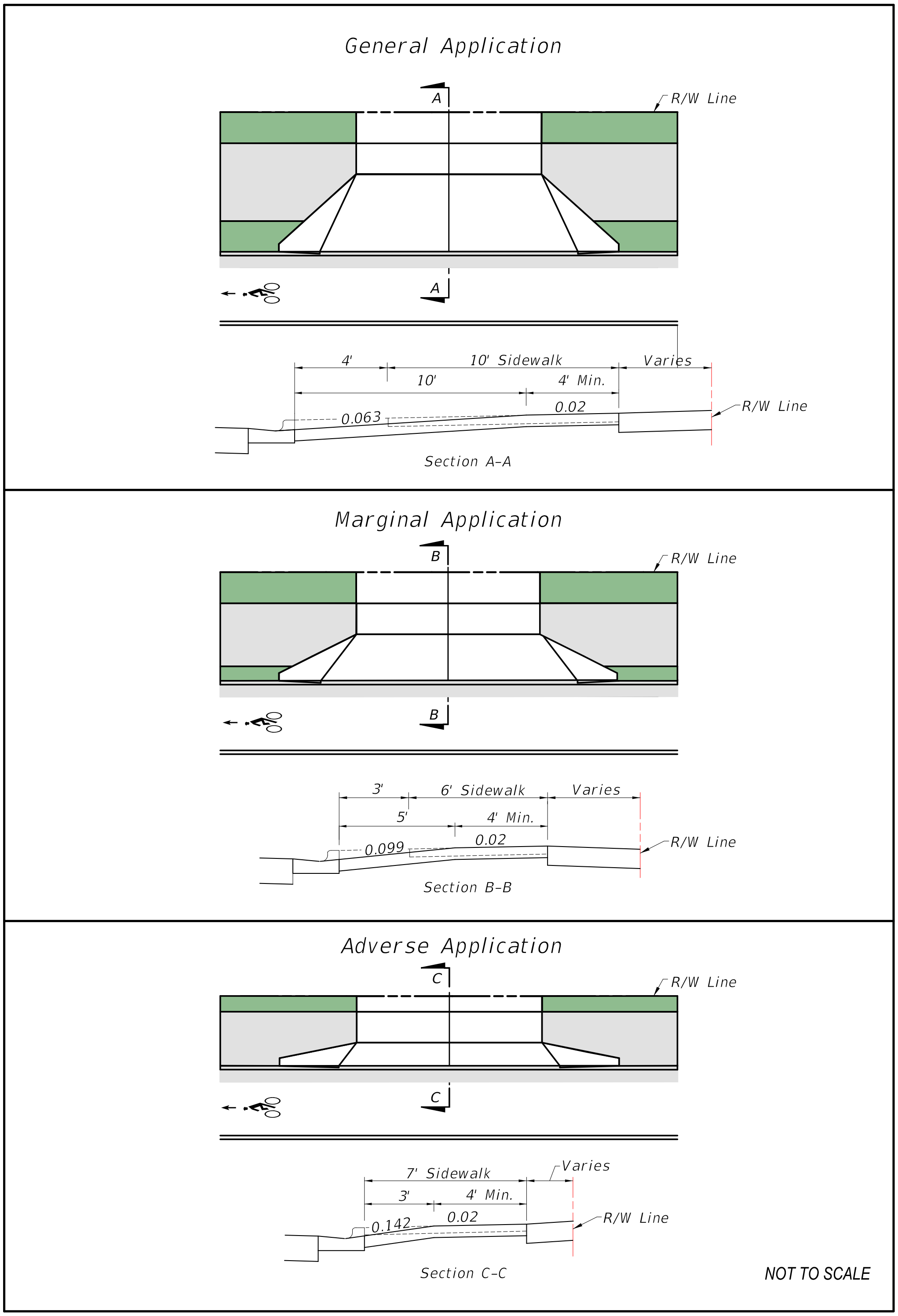
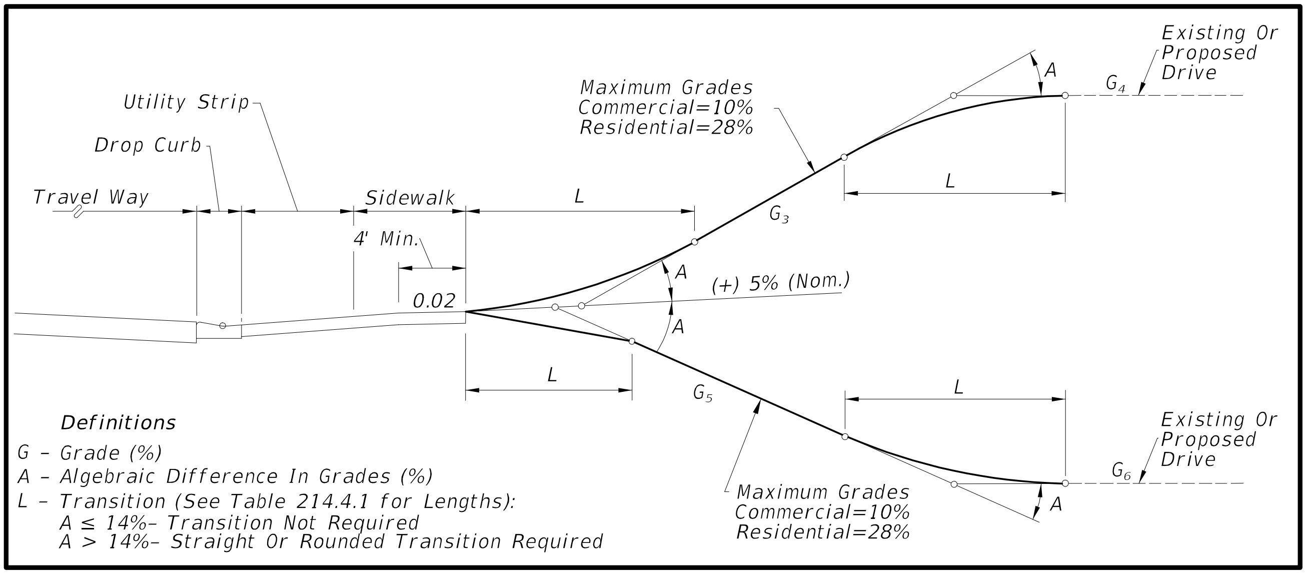


Figure 214.4.2 Curbed Roadway Driveway Profiles



214.4.2 Driveway Profile on Flush Shoulder Roadways

Requirements for driveway profiles connected to flush shoulder roadways are provided in ***Figure 214.4.3*** and ***Table 214.4.1***. Two profile options are included in ***Figure 214.4.3***. Option 1 is intended for locations where roadway, driveway taper, and auxiliary lane stormwater runoff volumes are relatively large. Option 2 is intended for locations where the runoff volumes are relatively small or there is no roadside ditch.

Slope or crown the transition (L) nearest the roadway to direct stormwater runoff to the roadside ditch.

Provide driveway profile grades adjacent to superelevated roadways (see G2 in ***Figure 214.4.3***) with the slopes and break-overs shown in ***Figure 214.4.4***.

Figure 214.4.3 Flush Shoulder Roadway Driveway Profiles

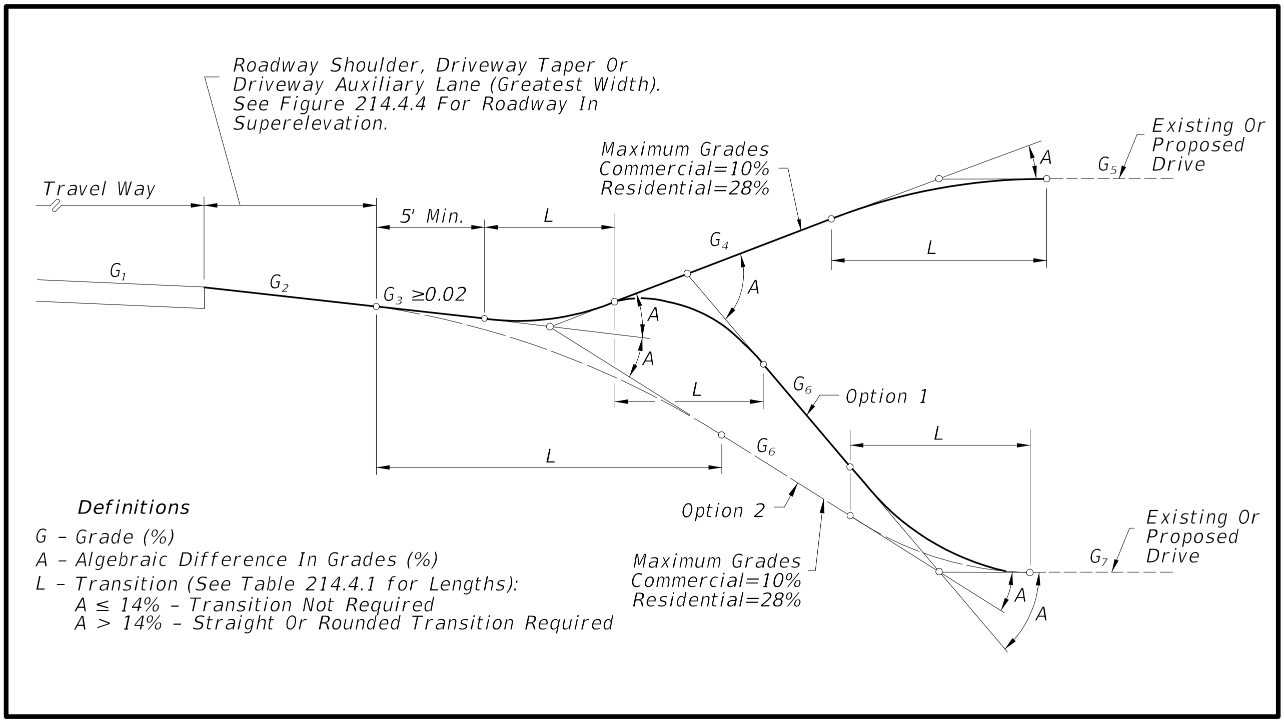
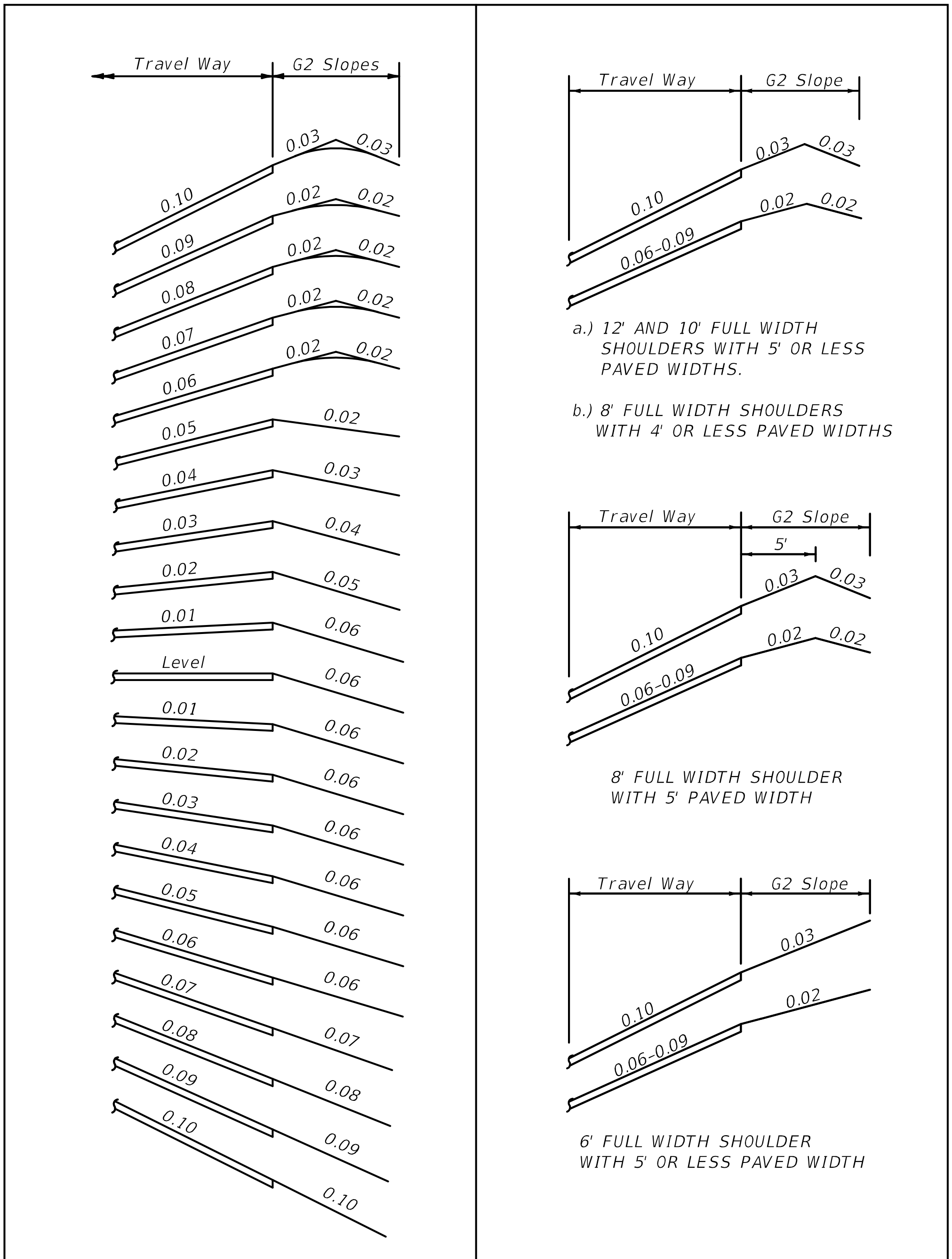


Figure 214.4.4 Driveway Slope for Flush Shoulder Roadway in Superelevation



SEE FIGURE 214.4.3 FOR G2 SLOPES ON FLUSH SHOULDER ROADWAY DRIVEWAY PROFILES

Table 214.4.1 Typical Driveway Profile Transition Lengths

A	Lengths (L) (Feet)							
	Crests				Sags			
	Straight		Rounded		Straight		Rounded	
	Desirable	Minimum	Desirable	Minimum	Desirable	Minimum	Desirable	Minimum
6-13%	3	0	5	0	3	0	5	0
14%	3	0	10	0	3	0	10	0
15%	3	2.5	10	3	5	3	10	5
16%	5	3	10	4	6	4	10	6
17%	6	3.5	10	5	8	5	10	7
18%	6	4	10	6	9	6	10	8
19%	7	4.5	10	7	11	7	12	9
20%	8	5	11	8	12	8	13	10
21%	9	5.5	12	9	13	8.5	14	11
22%	10	6	13	10	14	9	16	12
23%	10	6.5	14	10.5	14	9.5	16	12.5
24%	11	7	15	11	15	10	17	13
25%	12	7.5	15	11.5	16	10.5	18	13.5
26%	12	8	16	12	17	11	18	14
27%	13	8.5	17	12.5	17	11.5	19	14.5
28%	14	9	17	13	18	12	20	15
29%	N/A	N/A	22	14	N/A	N/A	21	17
30-31%	N/A	N/A	23	15	N/A	N/A	22	18
32-33%	N/A	N/A	24	16	N/A	N/A	23	20
34-36%	N/A	N/A	26	17	N/A	N/A	25	21
37-38%	N/A	N/A	27	18	N/A	N/A	26	22
39-41%	N/A	N/A	29	19	N/A	N/A	28	24
42-43%	N/A	N/A	30	20	N/A	N/A	29	25
44-46%	N/A	N/A	32	21	N/A	N/A	31	26
47-48%	N/A	N/A	33	22	N/A	N/A	32	27
49-51%	N/A	N/A	34	23	N/A	N/A	34	28
52-54%	N/A	N/A	36	24	N/A	N/A	35	30
55-56%	N/A	N/A	37	25	N/A	N/A	36	31

Notes:

(1) Rounded: The following types of curvature may be selected: circular, parabolic, or spline.
(2) Provide the desirable length. When the desirable length cannot be attained, provide the greatest attainable length possible, but not less than the minimum values.

214.5 Right-Turn Lanes

Exclusive right-turn lanes at unsignalized driveways can be used to reduce rear-end collisions, increase capacity, and reduce differentials in speed. Vehicles can wait in a right-turn lane for pedestrians to cross the driveway without impeding the flow of through traffic. Consider right-turn lanes into driveways with high peak hour right-turn volumes on high-speed roadways.

Design right-turn lanes according to ***FDM 212.14***.

214.6 Sight Distance at Driveways

Provide intersection sight distance (per ***FDM 212.11***) on roadways with design speeds of 40 mph and higher. When intersection sight distance cannot be met on very low speed (design speed ≤ 35 mph) roadways, provide the greatest sight distance possible, but not less than minimum stopping sight distance values in ***FDM 210.11.1***.

214.7 Pedestrian Accommodations for Driveways

Provide the following at radial or flared return driveways where a pedestrian facility (i.e., sidewalk, shared use path) is required:

- The same width of pedestrian facility across the driveway as the pedestrian facility adjoining the driveway to the greatest extent possible, with a minimum 4-foot-wide crossing for sidewalks and minimum 8-foot-wide crossing for shared use paths.
- Crossings with a maximum cross slope of 2% for flared and unsignalized radial driveways. See ***FDM 214.4*** and ***Standard Plans, Index 522-003*** for information on the selection of flared driveway applications

Commentary: Crossing widths of 5 feet or greater will allow a more accessible connection to the pedestrian facility.

Additional requirements for radial driveway crosswalks are in ***FDM 222.2.3***. Additional requirements for pedestrian facilities are in ***FDM 222*** and the ***Standard Plans, Indexes 522-001*** and ***522-002***.

214.8 Permitting

New or modified driveways associated with new or expanded developments must be permitted in accordance with the ***Rule 14-96***, ***F.A.C.*** Permitted or grandfathered connections modified as part of a Department construction project, and not due to a significant change (as defined in Rule 14-96, F.A.C.), do not require a permit.

The ***FDOT Drainage Manual*** and ***FDOT Drainage Connection Permit Handbook*** provides information on National Pollutant Discharge Elimination System (NPDES) requirements.

The ***FDOT One Stop Permitting*** website has additional information and online permit application.

215 Roadside Safety

215.1 General

This Chapter contains roadside safety design criteria for new construction, reconstruction, and Resurfacing, Restoration and Rehabilitation (RRR) projects. New Construction criteria must be met for new and reconstruction projects, and for improvements included with RRR projects.

The design criteria contained in ***FDM 210*** and ***FDM 211*** has been developed to minimize the probability that a vehicle will depart the roadway. Design elements that affect roadside safety include horizontal alignment, superelevation, vertical alignment, drainage design, sight distance, lane widths, pavement, pavement markings, cross slopes, median widths, shoulders, and lighting.

The evaluation of Roadside Safety design elements is necessary to address the occasional errant vehicle that does depart the roadway. These design elements include roadside geometries, lateral offsets to potential hazards, and the use of shielding.

The ***AASHTO Roadside Design Guide*** **(*AASHTO RDG*)** provides the foundation for the development of specific criteria contained in this Chapter and the ***Standard Plans***.

215.1.1 RRR Criteria

Criteria for RRR projects provided in this chapter are the minimum values allowed for roadside elements to remain on arterials and collectors without obtaining a Design Exception or Design Variation (see ***FDM 122***).

Criteria for RRR projects provided in this chapter may be used for establishing the minimum requirements for adding auxiliary lanes, keyhole lanes, or providing minor intersection improvements with the understanding that when existing right of way (R/W) is adequate, new construction criteria will be used.

Do not apply RRR criteria in this chapter to resurfacing projects on Limited Access (LA) Facilities.

215.2 Roadside Features

215.2.1 Roadside Geometry

Roadside geometry refers to the terrain features (slopes) that a vehicle will encounter when departing a roadway. The components of roadside geometry include front slopes, back slopes, and transverse slopes.

215.2.2 Roadside Slope Classification

Roadside Slopes include areas located beyond the edge of the traffic lane as shown in ***Figures 215.2.2*** and ***215.2.3***. These areas are divided into the following classifications:

(1) Traversable Slope – Smooth terrain, unobstructed by fixed objects:

  (a) Recoverable Traversable Slope, 1:4 or flatter

  (b) Non-Recoverable Traversable Slope, 1:3 or flatter and steeper than 1:4

(2) Non-Traversable Slope – Rough terrain, obstructed, or slopes steeper than 1:3

215.2.3 Clear Zone Concept

The following provides the definition of the Clear Zone Concept using the slope classifications above. These slope classifications are considered the standard for effective roadside safety design in the ***AASHTO RDG***. However, in some cases the Department's roadside slope requirements supersede these values. For Roadside Slope Criteria, see ***FDM 215.2.6***.

Providing a sufficient amount of Recoverable Slope adjacent to the roadway provides an opportunity for an errant vehicle to safely recover. The amount of recoverable area provided beyond the traveled way is defined as the clear zone and includes shoulders and bike lanes. The clear zone must be free of roadside hazards, as defined in ***FDM 215.3***.

Traversable Back Slopes 1:3 or flatter may be located within the clear zone.

A clear zone width must be provided so that the sum of all Recoverable Slopes is equal to or greater than the required clear zone width obtained from ***Table 215.2.1***. Clear zone widths may be widened based on crash history and horizontal curvature; see ***AASHTO RDG**, **Section 3.1***. Clear zone concepts are illustrated in ***Figure 215.2.1*** and ***Figure 215.2.2***.

Figure 215.2.1 Clear Zone Plan View

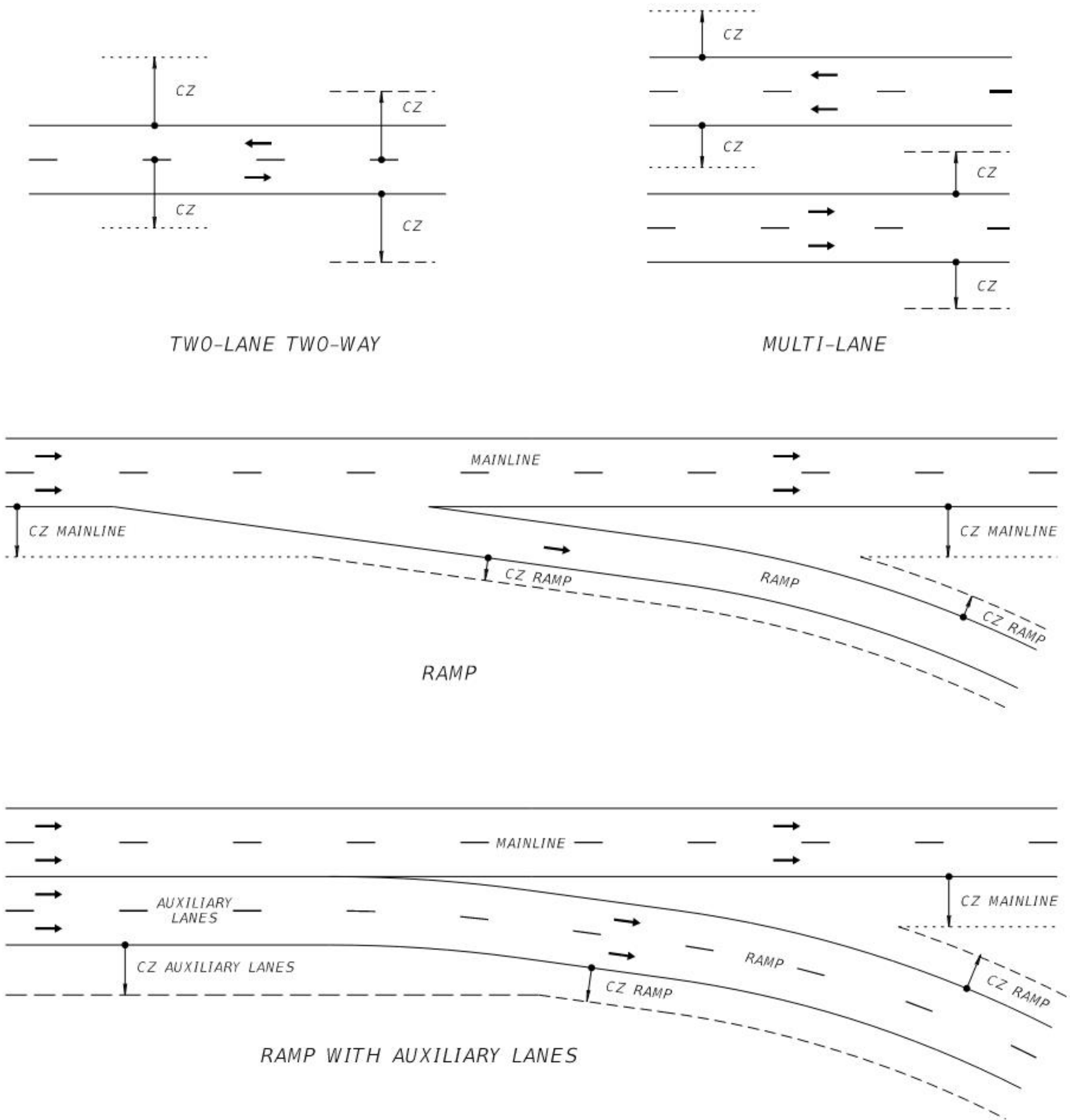
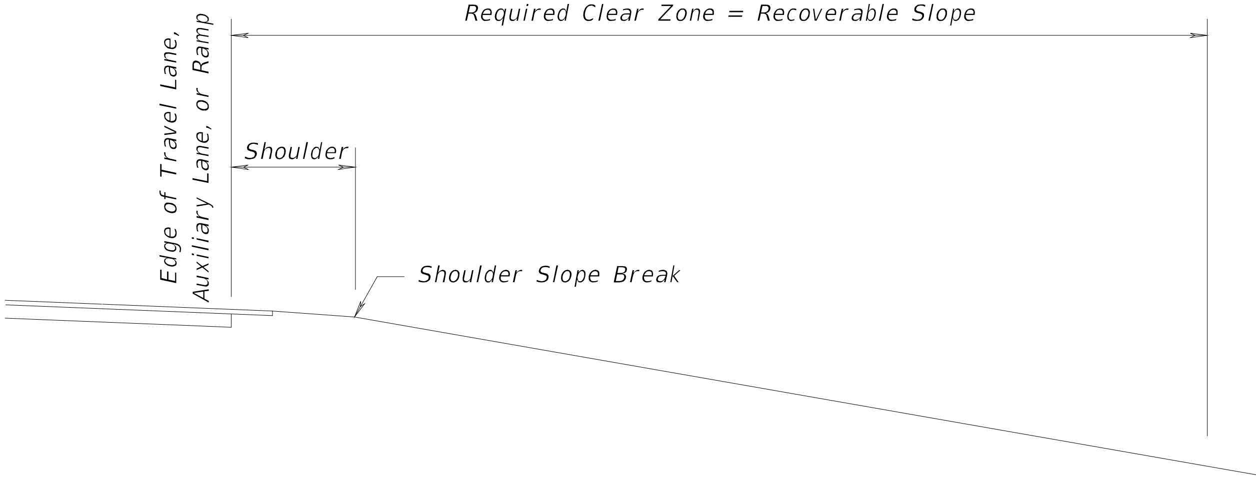


Figure 215.2.2 Clear Zone Concept



When a Traversable Non-Recoverable Slope is present within the clear zone, extend the clear zone width until the amount of Recoverable Slope equals the required clear zone width obtained from ***Table 215.2.1***. The additional width provided beyond the Traversable Non-Recoverable Slope is known as the Clear Run-out Area and is illustrated in ***Figure 215.2.3.*** Provide a 10-foot minimum width for the Clear Run-out Area where R/W allows.

Figure 215.2.3 Adjusted Clear Zone Concept

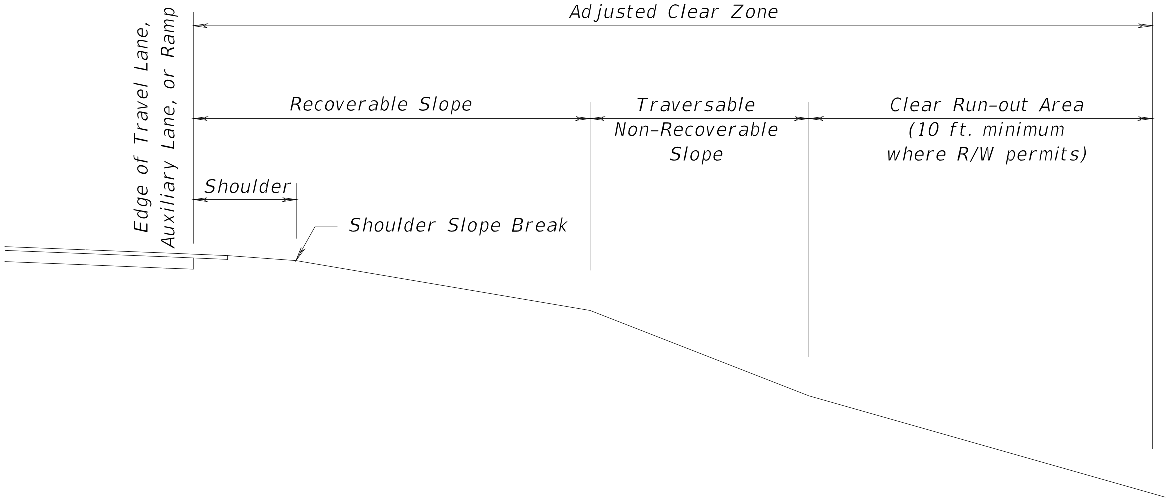


Table 215.2.1 Clear Zone Width Requirements

	Design Speed (mph)						
	≤ 30	35	40	45	50	55	≥ 60
Clear Zone Width for New Construction							
Travel Lanes & Multilane Ramps	12 feet	14 feet	18 feet	24 feet	24 feet	30 feet	36 feet
Auxiliary Lanes & Single Lane Ramps	10 feet	10 feet	10 feet	14 feet	14 feet	18 feet	24 feet
Clear Zone Width for RRR Projects							
Travel Lanes & Multilane Ramps	6 feet	6 feet	6 feet	14 feet	18 feet	18 feet	18 feet
Auxiliary Lanes & Single Lane Ramps	6 feet	6 feet	6 feet	8 feet	8 feet	8 feet	8 feet

Clear zone widths for work zones are provided in ***Standard Plans*, *Index 102-600*.**

215.2.4 Lateral Offset

Lateral offset is the distance from a specified point on the roadway to a roadside hazard. Lateral offset to the roadside hazard is measured as follows:

- Curbed roadways: from face of curb.
- Flush shoulder and high-speed curbed roadways: from outside edge of traveled way.

Lateral offsets apply to all roadways and are determined based on the following:

- Type of facility (i.e., flush shoulder or curbed roadway)
- Design speed
- Design Element
- Project Type (i.e., New Construction, RRR)

Flush shoulder roadways typically have sufficient R/W, to provide the required clear zone widths. Therefore, minimum lateral offset for these roadways is based on maintaining a clear roadside for errant vehicles to recover (i.e., maintaining clear zone width provided in ***Table 215.2.1***).

Lateral offsets for curbed roadways should be based on clear zone criteria; however, curbed roadways typically do not have sufficient R/W to provide the required clear zone widths. Therefore, minimum lateral offset on these roadways is based on offset needed for normal operation of the roadway.

At times, it may be necessary to place poles (e.g., signal, light, sign) within the sidewalk. Refer to ***FDM 222.2*** for minimum unobstructed sidewalk width requirements.

Table 215.2.2 provides minimum lateral offset criteria for roadside features and roadside hazards typically encountered and considered functionally necessary for normal operation of the roadway (e.g., signing, lighting, utilities). For crashworthy objects, meet or exceed the minimum lateral offset criteria provided in ***Table 215.2.2***. Locate objects that are not crashworthy as close to the R/W line as practical and no closer than the minimum lateral offset criteria provided.

When a roadside hazard is placed behind a barrier that is justified for other reasons, the minimum lateral offset to the object equals the setback requirements (deflection distance) of the barrier, see ***FDM 215.4.6***. Refer to ***FDM 215.5*** for permissible attachments to barriers.

When determining minimum lateral offset for bridge piers and abutments, coordinate with vertical clearance requirements found in ***FDM 210.10.3***. When shielding is used, refer to setbacks to barriers in ***FDM 215.4.6*** and ***FDM 210.10.3***.

Table 215.2.2 Minimum Lateral Offset Criteria

<table>
<tr><th colspan="2" rowspan="4">Design Element</th><th colspan="4">Curbed Roadways</th><th rowspan="4">High Speed Curbed and Flush Shoulder Roadway</th></tr>
<tr><th colspan="2">New Construction</th><th colspan="2">RRR</th></tr>
<tr><th colspan="4">Design Speed</th></tr>
<tr><th>25-35 mph</th><th>40-45 mph</th><th>25-35 mph</th><th>40-45 mph</th></tr>
<tr><td rowspan="3">Light Poles</td><td rowspan="2">Conventional</td><td colspan="5">Do not locate in Medians, except in conjunction with barriers that are justified for other reasons. See FDM 215.2.9.</td></tr>
<tr><td>1.5 feet</td><td>4.0 feet</td><td>1.5 feet</td><td>1.5 feet</td><td>20 feet from Travel Lane,
14 feet from Auxiliary Lane, or
Clear Zone width,
whichever is less</td></tr>
<tr><td>High Mast</td><td colspan="5">Outside Clear Zone</td></tr>
<tr><td colspan="2" rowspan="2">Signal Poles and Controller Cabinets</td><td colspan="5">Do not locate in Medians, except for PHB in accordance with FDM 215.2.9.</td></tr>
<tr><td>1.5 feet</td><td>4.0 feet</td><td>1.5 feet</td><td>1.5 feet</td><td>Outside Clear Zone</td></tr>
<tr><td colspan="2">Traffic Infraction Detectors</td><td colspan="5">For placement and installation specifications, refer to the State Traffic Engineering and Operations Office web page:
http://www.fdot.gov/traffic/</td></tr>
<tr><td rowspan="4">ITS Poles and Related Items</td><td rowspan="2">Pole & Other Aboveground Fixed Objects</td><td colspan="5">Do not locate in Medians, except in conjunction with barriers that are justified for other reasons. See FDM 215.2.9.</td></tr>
<tr><td>1.5 feet</td><td>4.0 feet</td><td>1.5 feet</td><td>4.0 feet</td><td>Outside Clear Zone</td></tr>
<tr><td>Equipment Shelters and Towers</td><td colspan="5">Do not locate within the limited access right of way,</td></tr>
<tr><td>Breakaway Objects</td><td>1.5 feet</td><td>4.0 feet</td><td>1.5 feet</td><td>4.0 feet</td><td>As Close to R/W As Possible</td></tr>
<tr><td rowspan="2">Traffic Control Signs</td><td>Single and Multi-Column</td><td colspan="5">Locate in accordance with Standard Plans.</td></tr>
<tr><td>Overhead Sign Structures (Includes DMS)</td><td colspan="5">Outside Clear Zone</td></tr>
<tr><td rowspan="2">Trees</td><td rowspan="2">Where the diameter is or is expected to be > 4 inches measured 6 inches above the ground</td><td>1.5 feet</td><td>4.0 feet</td><td>1.5 feet</td><td>1.5 feet</td><td>Outside Clear Zone</td></tr>
<tr><td colspan="5">RRR Projects:
(1) Meet New Construction criteria for new plantings.</td></tr>
</table>

Table 215.2.2 Minimum Lateral Offset Criteria (cont.)

Design Element		Curbed Roadways				High Speed Curbed and Flush Shoulder Roadway
		New Construction		RRR		
		Design Speed				
		25-35 mph	40-45 mph	25-35 mph	40-45 mph	
Aboveground Utilities (See *FDM 215.2.8*)	**Existing Utilities**	1.5 feet	4.0 feet	1.5 feet	4.0 feet	Outside Clear Zone
	New or Relocated Utilities	4.0 feet				Outside Clear Zone
	RRR Projects: Existing aboveground utilities are not required to be relocated unless one of the following applies: • The edge of traveled way is being moved closer to the aboveground utility; e.g., addition of an auxiliary lane, or • They have been hit 3 times in 5 years.					
Railroad Grade Crossing Traffic Control Device		Locate in accordance with ***Standard Plans*, *Index 509-100*** and ***Index 509-070***				
Roadways Overpassing Railroads		For Horizontal Clearances where roadways overpass railroads refer to ***FDM 220***.				
Canal and Drop-off Hazards		See ***FDM 215.3***				
Bridge Piers and Abutments (See ***FDM 215.4.5.4*** for Pier Protection criteria and ***Figures 260.6.3*** & ***260.6.4***)		The greater of the following: • Inside or Outside Travel Lane: 16 feet from Edge of Travel Lane • Outside Auxiliary Lane: 4 feet from Face of Curb • Inside Auxiliary Lane (Median): 6 feet from Edge of Auxiliary Lane				Outside Clear Zone
		RRR Projects:		1.5 feet	4.0 feet	
Drainage Structures (e.g., wingwalls, endwalls, flared end sections)		Refer to the FDOT Drainage Manual				
Mailboxes		Locate in accordance with ***Standard Plans*, *Index 110-200***				
Bus Benches and Transit Shelters		Locate in accordance with ***Rule Chapter 14-20.003, Florida Administrative Code (F.A.C.)***. Transit bus benches must be located in accordance with ***Rule Chapter 14-20.0032, F.A.C.***				
Pedestrian Railing		4.0 feet			Outside Clear Zone	
Bicycle/Micromobility Parking		See ***FDM 223.5***				

215.2.5 Control Zones for RRR Projects

Control Zones apply only to RRR projects and do not include aboveground utilities.

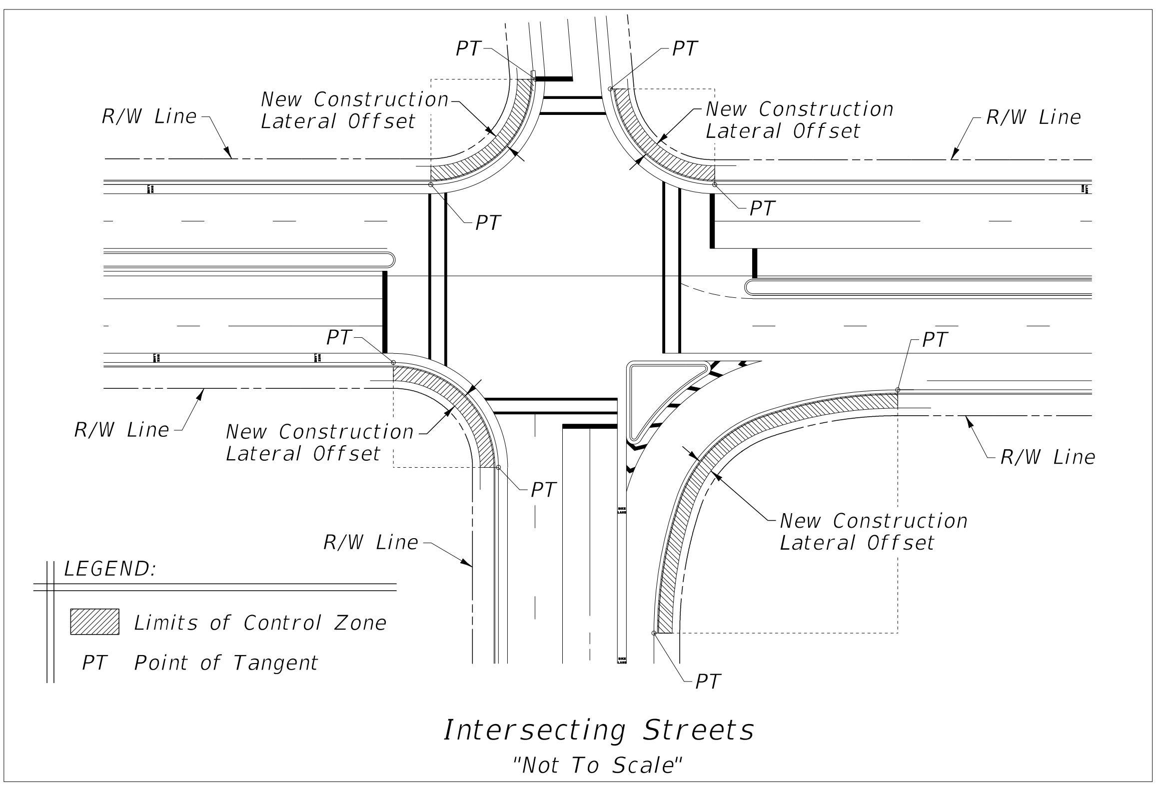
Control Zones are high-risk areas where roadway departures occur with greater frequency resulting in increased risk of impact with roadside hazards. To address this condition, lateral offset and clear zone width requirements in Control Zones are to be based on New Construction criteria. A Control Zone violation is when RRR lateral offset requirements are met, but New Construction criteria is not. Process a Design Variation for Control Zone violations.

Control Zones include the following locations:

(1) A location where an aboveground object has been hit 3 times or more in the last 5 years.

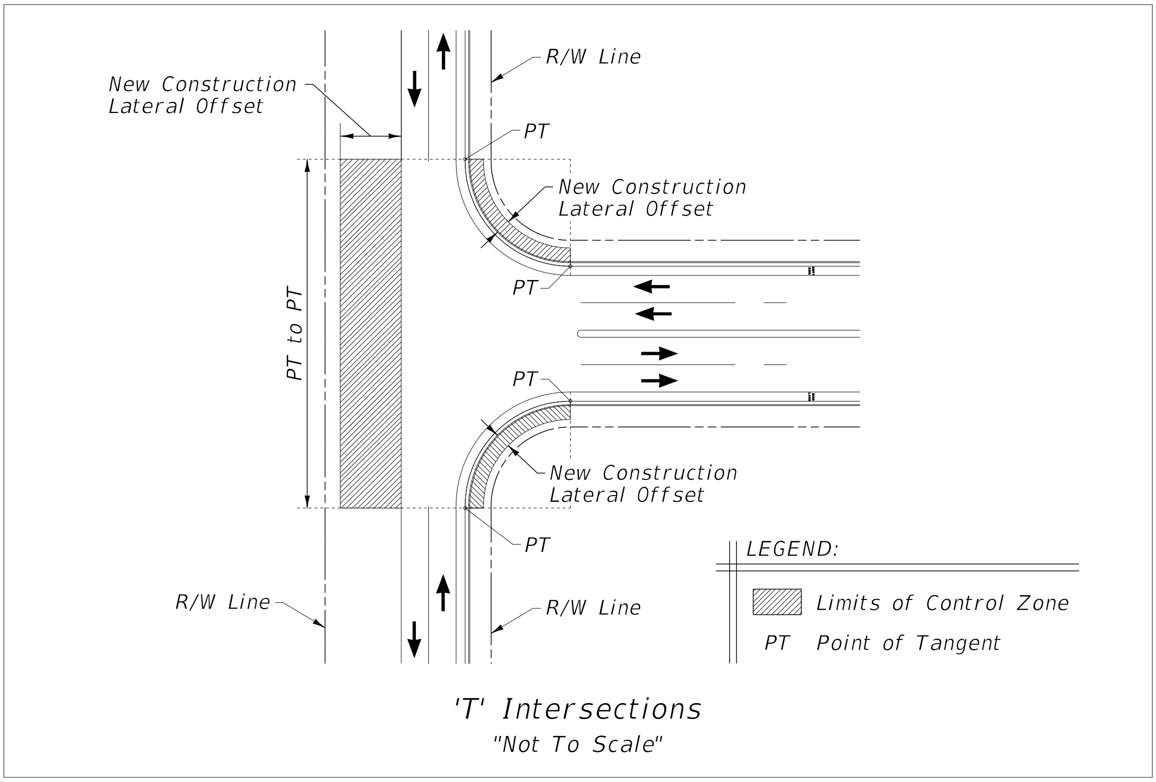
(2) Intersection Radii – Within the New Construction lateral offset of the return radii of an intersecting street from begin point of tangent (PT) to end point of tangent (PT), see ***Figure 215.2.4***.

Figure 215.2.4 Intersection Radii



(3) 'T' Intersection – On the non-intersection side of 'T' intersections within the area directly across and between each radii return point of tangent (PT) extended to the New Construction lateral offset, see ***Figure 215.2.5.***

Figure 215.2.5 'T' Intersection



(4) Right Turn Deceleration – Within the New Construction lateral offset for a length of 100 feet measured downstream from the beginning of the full width lane, see Figure 215.2.6 for right turn deceleration lane on a tangent. For right turn deceleration lane constructed with a reverse curve the beginning of the Control Zone starts at the point of intersection (PI), see ***Figure 215.2.7***.

(5) Merge Section – Within the New Construction lateral offset for a length of 100 feet measured downstream from the beginning of the taper of a skewed merge section. See Figure 215.2.8 for merge section constructed on a tangent. For merge section constructed with a reverse curve the beginning of the Control Zone starts at the point of intersection (PI), see ***Figure 215.2.9.***

(6) Service Facility (i.e., alley way or easement) Driveway – For a distance of 3 feet from a driveway flare within the new construction lateral offset distance at the intersection of a dedicated intersecting service facility, see ***Figure 215.2.10***.

Figure 215.2.6 Right Turn Deceleration with Tangent

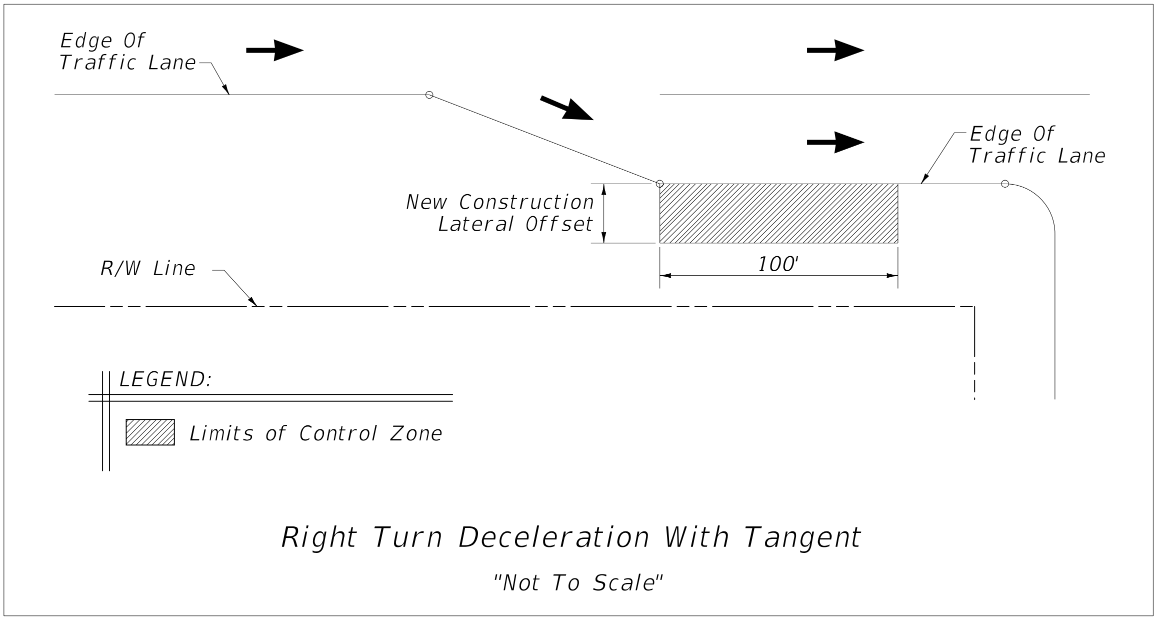


Figure 215.2.7 Right Turn Deceleration with Reverse Curve

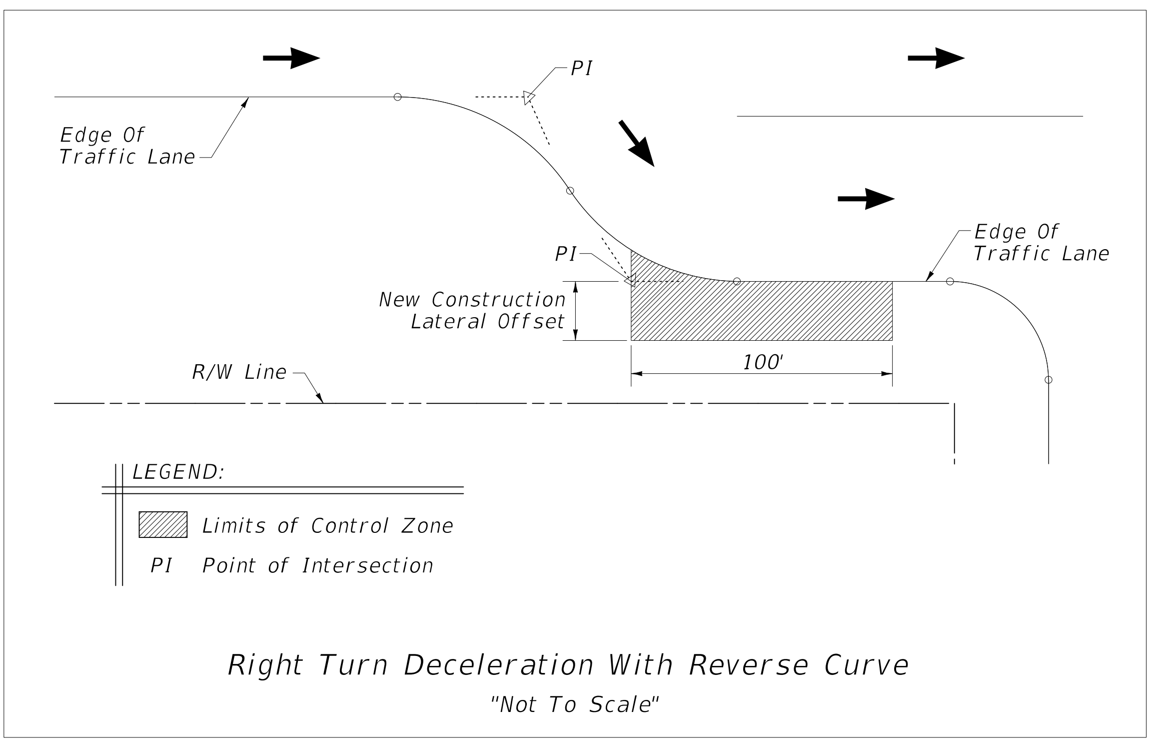


Figure 215.2.8 Merge Section with Tangent

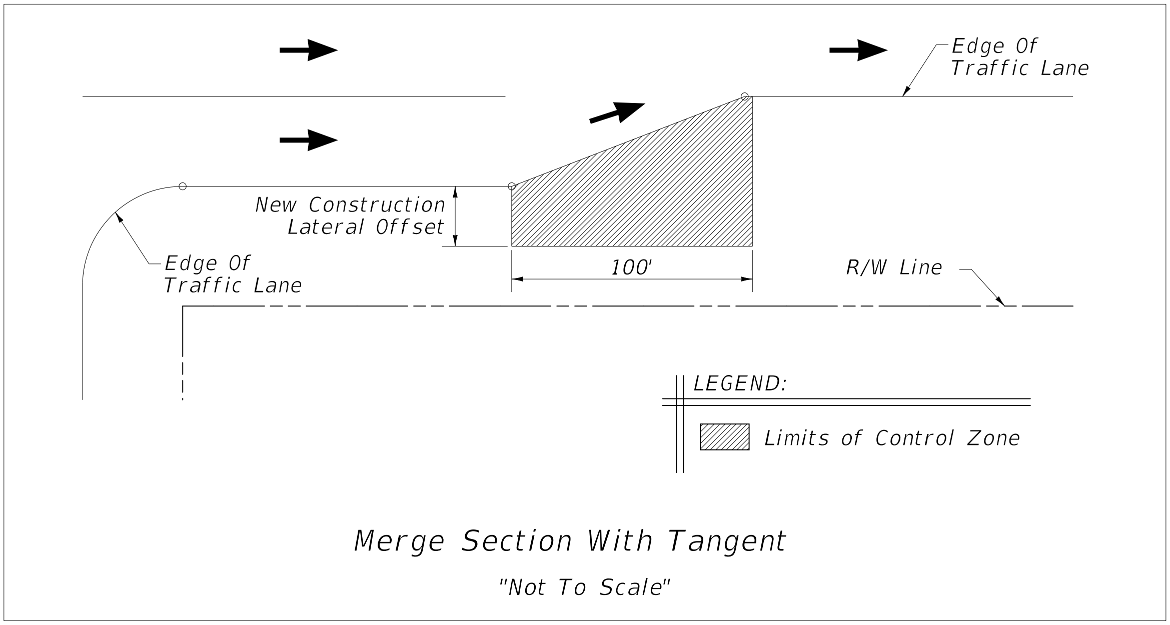


Figure 215.2.9 Merge Section with Reverse Curve

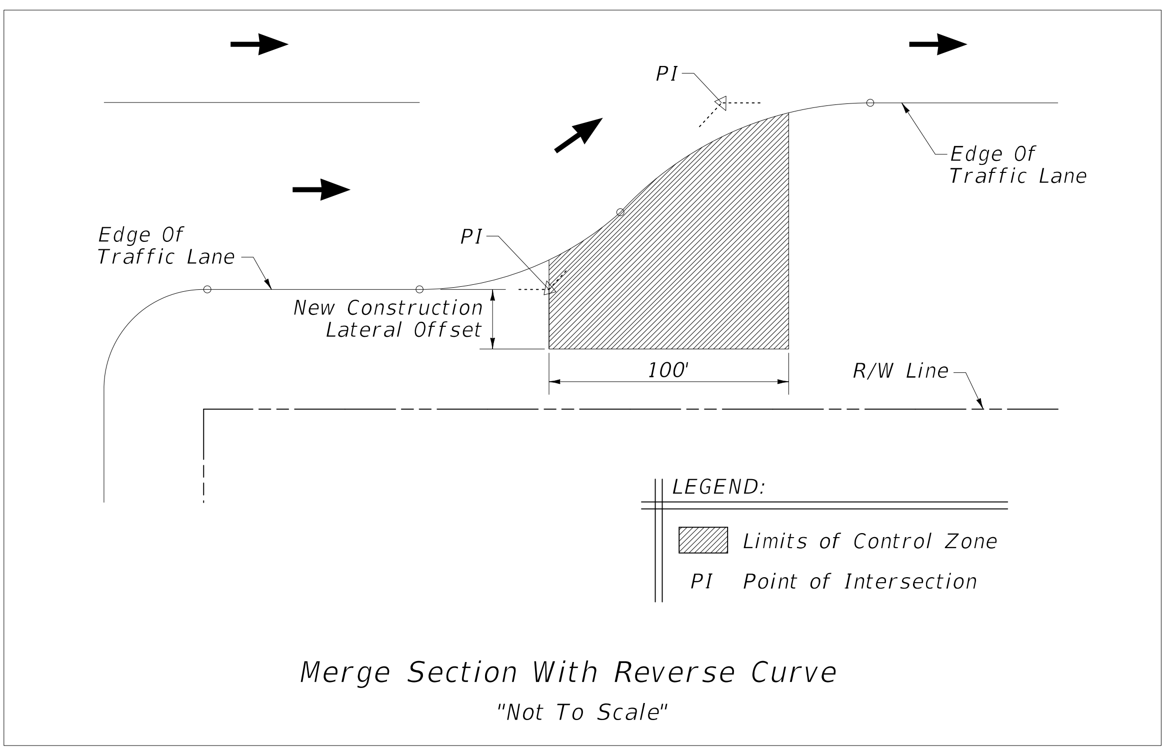
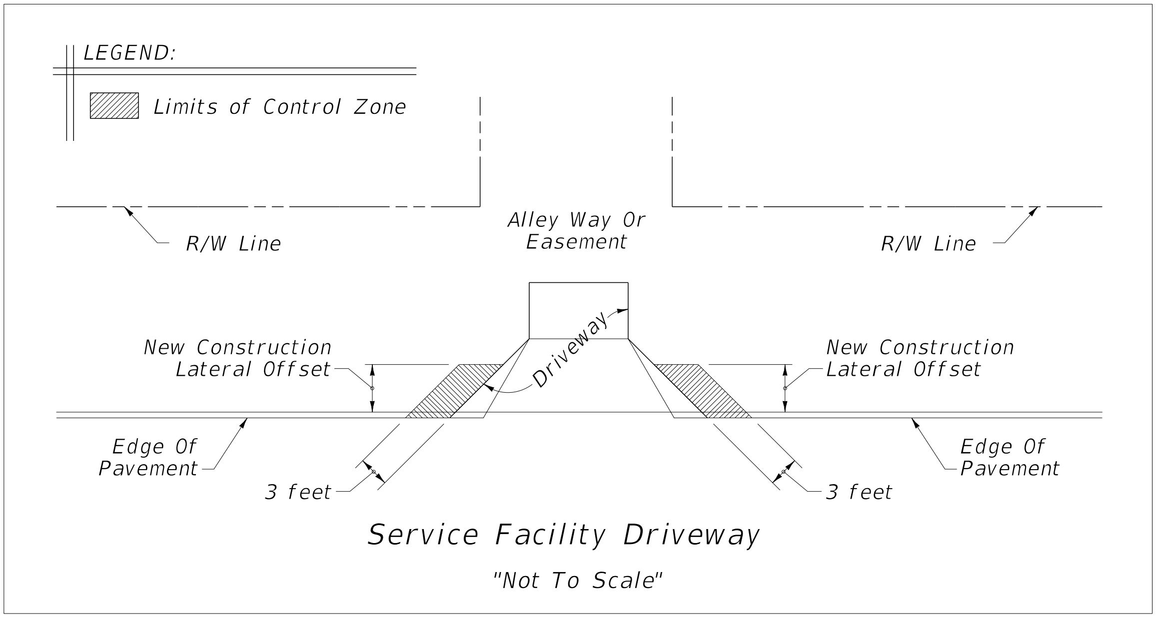
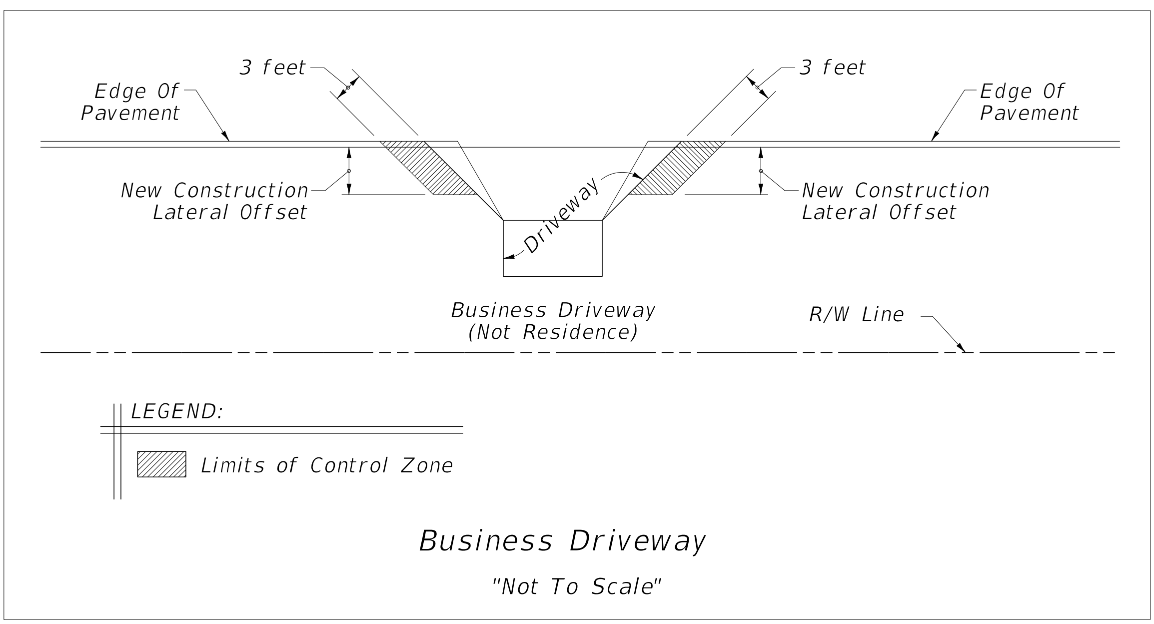


Figure 215.2.10 Service Facility Driveway



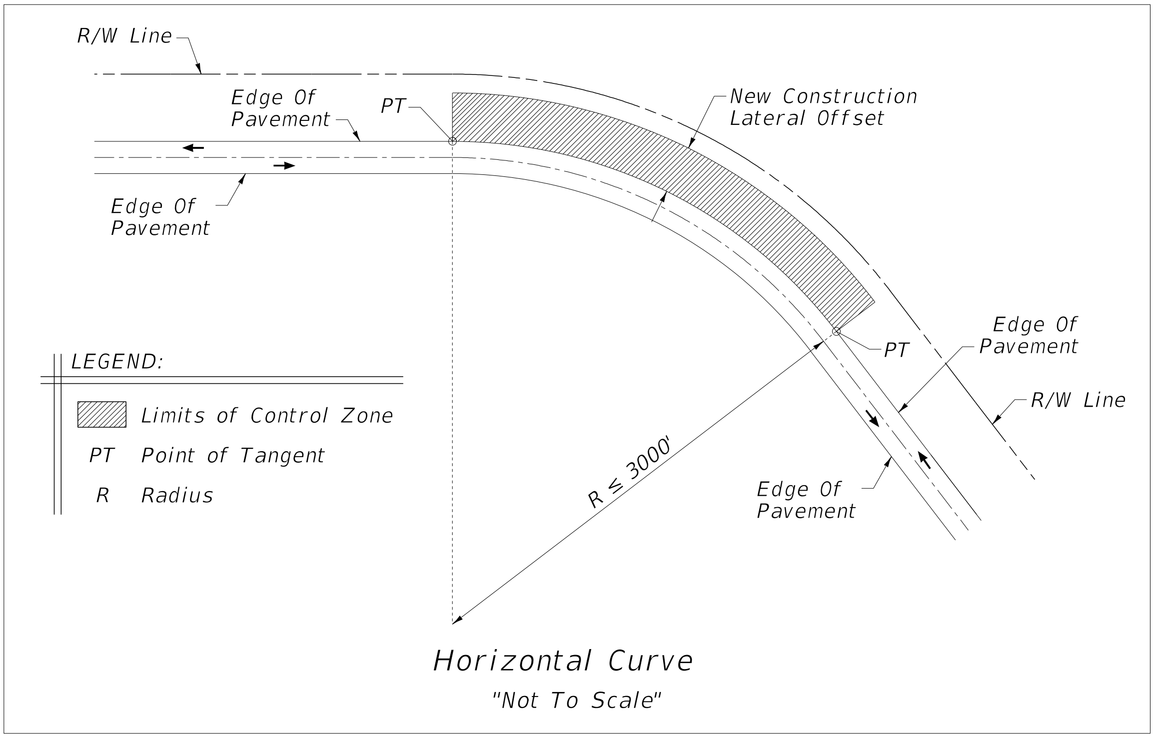
(7) Business (i.e., non-residential) Driveway – For a distance of 3 feet from a driveway flare within the new construction lateral offset distance at the entrance turnout for use other than a private residence, see ***Figure 215.2.11***.

Figure 215.2.11 Business Driveway



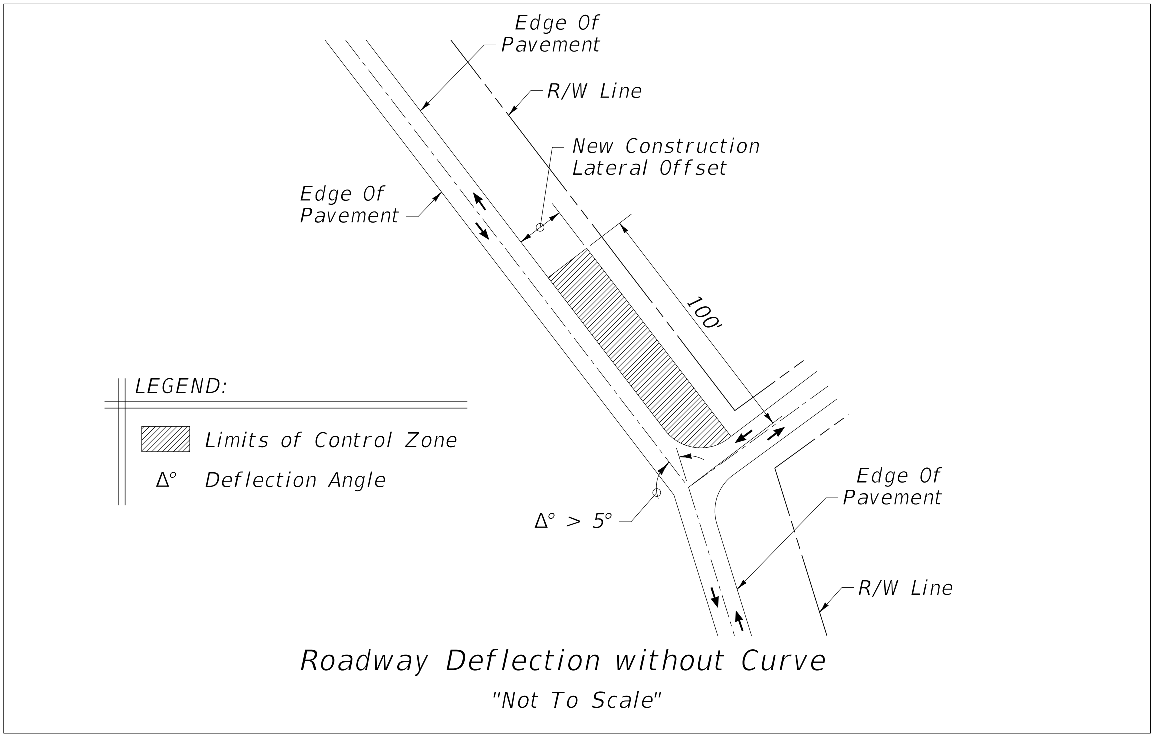
(8) Horizontal Curves – Within the New Construction lateral offset in the outside area of a curve when the posted speed is greater than 35 mph and the curve radius is 3000 feet or less, see ***Figure 215.2.12***.

Figure 215.2.12 Horizontal Curve



(9) Roadway Deflection without Curves – Within the New Construction lateral offset of roadway alignments with a deflection (kink) of more than 5 degrees for a distance of 100 feet from the point of intersection of the deflection, see ***Figure 215.2.13***.

Figure 215.2.13 Roadway Deflection without Curve



215.2.6 Roadside Slope Criteria

Roadside slopes consist of front slopes, back slopes, and transverse slopes. Roadside slope criteria is provided in ***Table 215.2.3***. See ***FDM 210.6*** for additional roadside slope information. See ***FDM 262.1*** for additional retaining wall maintenance information.

For sod or turf slopes steeper than 1:3:

- Consider the associated long term erosion control and maintenance costs.
- Slopes higher than 20 feet, provide a 10-foot-wide maintenance berm (1:10 or flatter) at the top and toe.
- Slopes higher than 35 feet, provide a 10-foot-wide maintenance berm (1:10 or flatter) at the top and toe. Include intermediate berm(s) so that the spacing between berms does not exceed 35 feet. Coordinate with the District Drainage, Maintenance, and Landscape Architect’s Offices.

For slopes steeper than 1:2 obtain concurrence from the District Geotech Engineer and District Maintenance Engineer.

Table 215.2.3 Roadside Slope Criteria

Type of Slope	Flush Shoulder and High Speed Curbed		Curbed	
	Height of Fill (feet)	Rate	Height of Fill (feet)	Rate
Front Slope	0 – 5	1:6	0-6	1:2 or to suit property owner, not flatter than 1:6.
	5 – 10	1:6 to edge of Clear Zone, then 1:4	> 6	1:3 or to suit property owner, not flatter than 1:6.
	10 – 20	1:6 to edge of Clear Zone, then 1:3		
	> 20	1:2 with guardrail		
Back Slope	All	1:4 or 1:3 with a standard width trapezoidal ditch and 1:6 front slope	All	1:2 or to suit property owner. Not flatter than 1:6.
Transverse Slope	All	1:10 or flatter (freeway & Interstate) 1:4 (others)	All	1:4

Notes:

(1) Height of fill is the vertical distance from the edge of the outside travel lane to the toe of front slope.

215.2.6.1 RRR Evaluation of Existing Roadside Slope

Existing roadside slope, and new slopes included with a RRR project, must meet the criteria provided in ***Table 215.2.3***, except for the following:

(1) Front Slopes:

(a) For constrained conditions, new slopes at 1:4 may be constructed within the clear zone. New slopes steeper than 1:4 require a Design Variation.

(b) Existing 1:3 or flatter slopes within the clear zone may remain.

(c) Flattening slopes of 1:3 or steeper at locations where run-off-the-road type crashes are likely to occur (e.g., on the outsides of horizontal curves) should be evaluated.

(d) Existing front slopes steeper than 1:3 within the clear zone should be evaluated for shielding.

(2) Back Slopes:

(a) For constrained conditions, new slopes at 1:3 may be constructed within the clear zone. New slopes steeper than 1:3 require a Design Variation.

(b) Existing 1:2 or flatter slopes may remain.

(c) Existing back slopes steeper than 1:3 within the clear zone should be evaluated for shielding.

RRR lateral offset and clear zone requirements must be met when the above criteria are applied.

Modification for Non-Conventional Projects:
Delete ***FDM 215.2.6.1*** and see RFP for requirements.

215.2.7 Drainage Features

Drainage features in close proximity to travel lanes are often necessary. These features include ditches, curbs, and drainage structures (e.g., transverse/parallel pipes, culverts, endwalls, wingwalls, and inlets). Evaluate the placement of these features as part of roadside safety design. Refer to the ***Drainage Manual*** for information regarding hydraulic design.

Consider the future maintenance of the facility when evaluating the design of roadside topography and drainage features. Routine maintenance or repairs necessary for the continued function of the drainage feature may lead to long-term expenses and disruption to traffic flow.

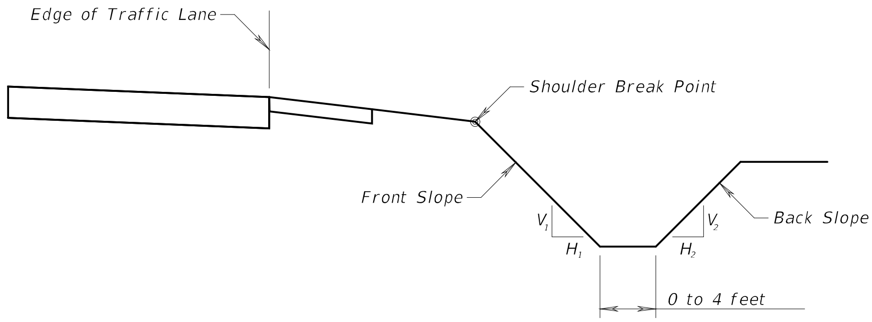
215.2.7.1 Roadside Ditches

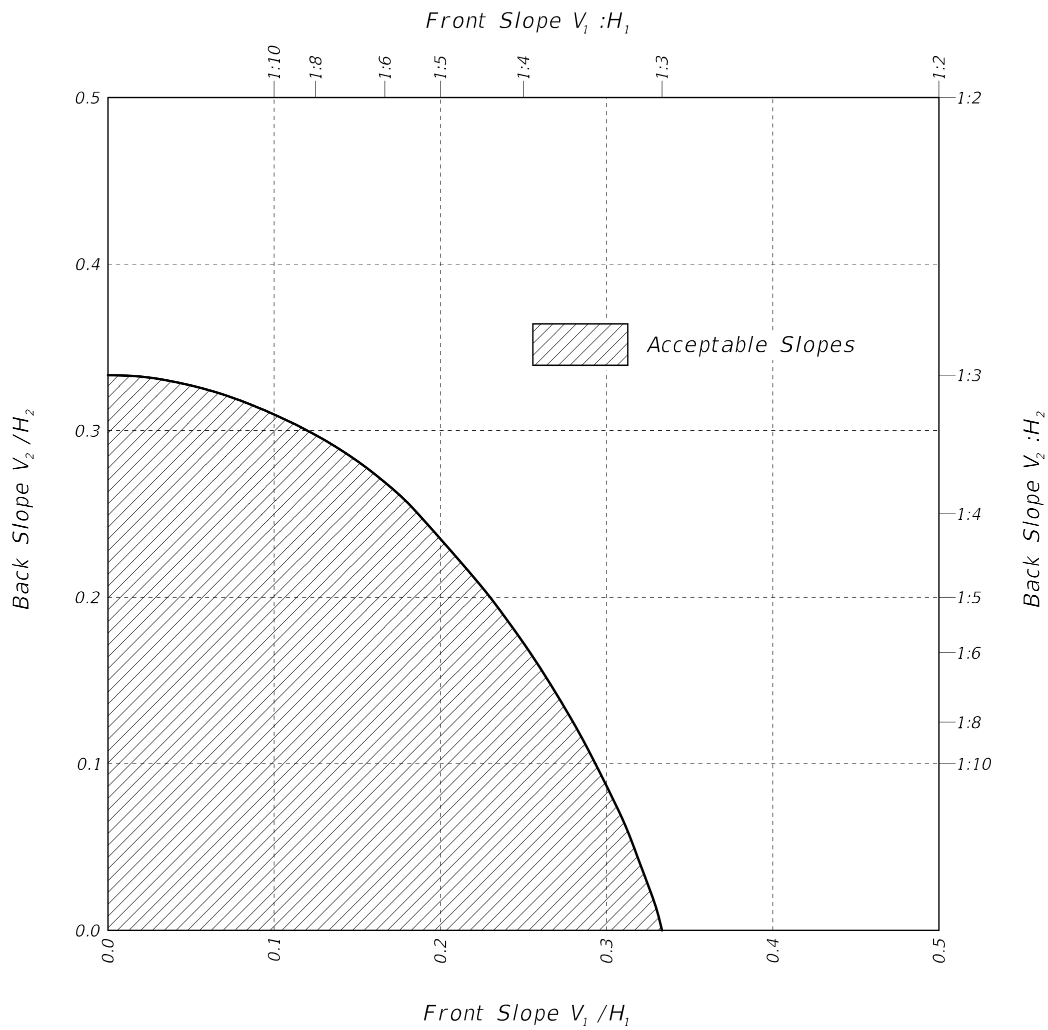
Acceptable cross section slope criteria for roadside ditches within the clear zone is provided in ***Figures 215.2.14*** and ***215.2.15***. These roadside ditch configurations are considered traversable, as described in the ***AASHTO RDG***. Adjusted clear zone widths may be required for Non-Recoverable Slopes located within the clear zone (i.e., slopes steeper than 1:4 but flatter than 1:3, see ***FDM 215.2.3***). The application of the ditch cross section slopes must be coordinated with Roadside Slope Criteria included in ***FDM 215.2.6***.

The ***Drainage Manual, Chapter 2*** requires a minimum ditch bottom width of 5 feet to accommodate mitered end sections and maintenance mowers. Refer to the ***Drainage***

Manual for V-bottom ditch limitations. When a ditch bottom width of less than 5 feet is approved by the District Drainage Engineer the slope criteria provided in ***Figures 215.2.14*** and ***215.2.15*** may be used.

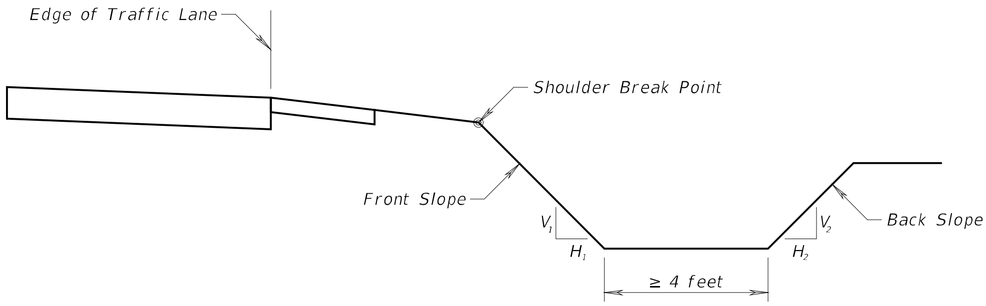
Figure 215.2.14 Roadside Ditches – Bottom Width 0 to < 4 feet

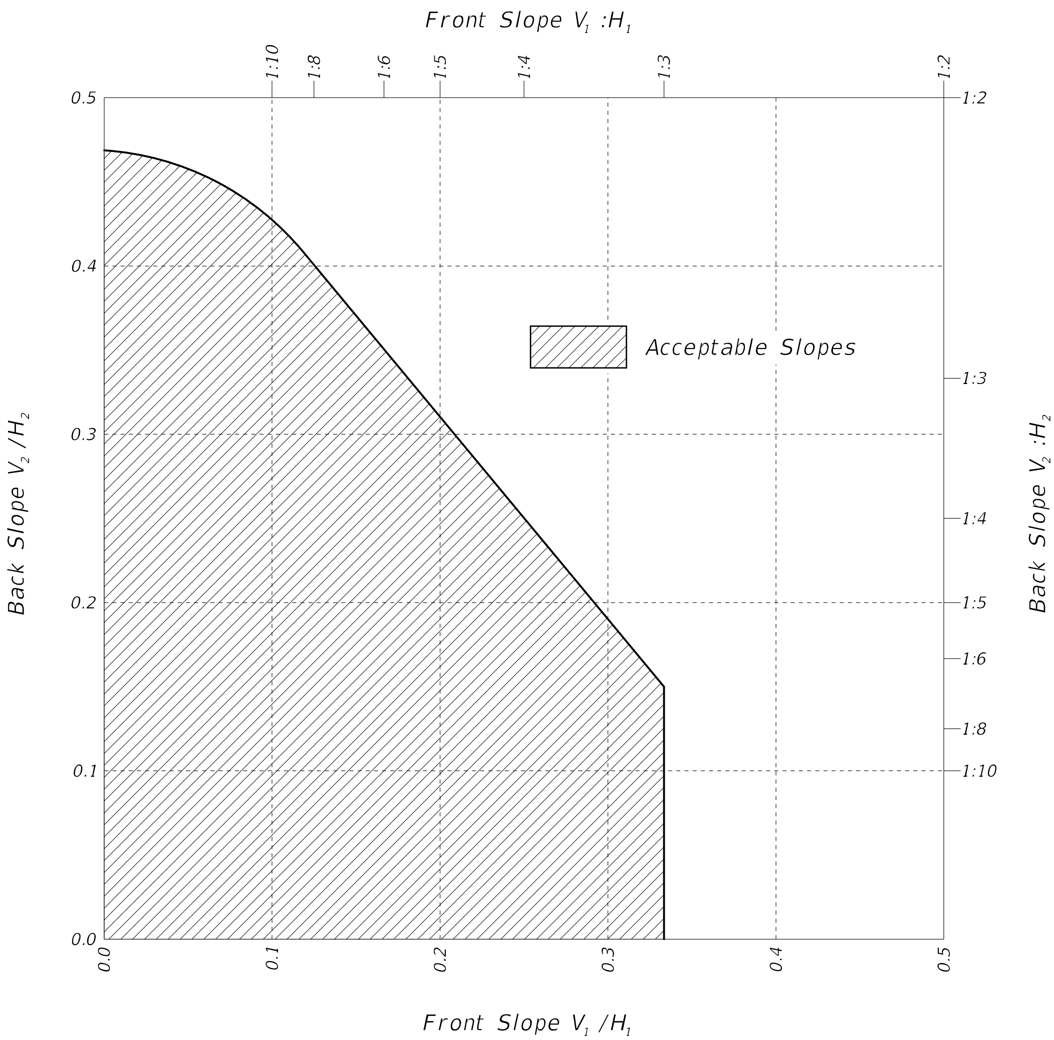




Ref: Figure 3-6, 2011 AASHTO Roadside Design Guide, 4th Edition

Figure 215.2.15 Roadside Ditches – Bottom Width ≥ 4 feet





Ref: Figure 3-6, 2011 AASHTO Roadside Design Guide, 4th Edition

215.2.7.2 Curbs, Medians, and Islands

See ***FDM 210.5*** for information concerning curbed roadways.

Curb has no redirection capability; therefore, do not use curb to mitigate clear zone violations. The addition of curb for the sole purpose of achieving Lateral Offset Criteria is prohibited.

Refer to the ***FDM 210.3*** and ***Standard Plans, Index 520-020*** (Traffic Separators) for additional information concerning medians and islands.

A bridge mounted traffic separator is to match geometrically with adjacent roadway traffic separator or the face of curb. Design separators in accordance with the ***Structures Design Guidelines***, and ***Standard Plans, Index 520-020.***

Shoulder Gutter is frequently used along roadway fill sections and bridge approaches to prevent excessive runoff down embankment slopes. Refer to the ***FDM 210.4*** and ***211.4*** for Shoulder Gutter requirements.

215.2.7.3 Drainage Structures

Drainage structures located along the roadside must provide a traversable design or be located outside the required clear zone. Drainage designs typically contain curb inlets, ditch bottom inlets, endwalls, wingwalls, headwalls, flared end sections or mitered end sections. If not adequately designed or properly located, these features may create hazardous conditions for vehicles. For detailed background information concerning traversable designs, refer to the ***AASHTO RDG***.

Details for drainage structures and end treatments are provided in ***Standard Plans Index 425 and 430 Series***. These drainage features have the potential for conflict with a vehicle either departing the roadway or within a commonly traversed section of a roadway. Refer to the ***Drainage Manual*** for standard drainage structures which are permitted within the clear zone.

215.2.7.4 RRR Evaluation of Existing Drainage Features

Evaluate existing drainage structures and end treatments located within the clear zone to determine if they present a hazardous condition and if modification or relocation is necessary. Based on a review of the crash history, modify, or relocate any drainage structures impacted three times in five years.

New drainage features included with a RRR projects must provide a traversable design or be located outside the required clear zone.

215.2.8 Aboveground Utilities

Utility Agency/Owners (UAOs) are cities, counties, utility companies, homeowner associations, private citizens, or businesses organized under the laws of Florida with permission and/or rights to have their aboveground utilities within the Department's R/W. Where aboveground utilities are more than 4 inches above the grade and are not accepted by FDOT as crashworthy they are considered roadside hazards. The below criteria are designed to minimize conflicts between roadside safety requirements and the privilege and rights the UAOs may have. Consult with the District Utilities Office to determine any limitations to the Department's authority to affect the below requirements.

New and existing aboveground utilities are to meet the following requirements:

(1) Not within the median,

(2) Outside the new construction lateral offsets in ***Table 215.2.2***, and

(3) As close to the R/W as practical. Aboveground utilities are considered to be as close to the right of way as practical when the location does not cause the utility to do any of the following:

- (a) encroach onto private property
- (b) violate National Electrical Safety Codes
- (c) violate State or Federal codes/regulations
- (d) conflict with other existing overhead or underground facilities
- (e) require encroachments onto private property to trim trees
- (f) requires the utility to remove trees
- (g) takes individual poles out of alignment with existing pole lines

When the requirements above cannot be met, aboveground utilities may be placed behind Department-approved barriers, allowing for barrier deflection.

215.2.9 Signing, Lighting, Traffic Signals, Intelligent Transportation Systems (ITS), and Other Similar Roadside Features

Locate devices in accordance with the minimum lateral offset criteria provided in ***Table 215.2.2*** and the following:

- Signing – ***FDM 230***
- Lighting – ***FDM 231***
- Traffic Signals – ***FDM 232***
- ITS – ***FDM 233***

These features are not required to meet minimum lateral offset criteria when installed behind a traffic barrier, provided:

(1) The barrier was justified for other reasons, and

(2) The device is located within the barrier's Length of Need (See ***FDM 215.4.6***).

Post-mounted sign supports and conventional light poles must be breakaway as defined in the ***AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*** and the ***AASHTO RDG.*** Post-mounted supports must be of an acceptable and crashworthy design as detailed in the ***Standard Plans***.

Light poles or traffic signals in the median may become hazardous flying objects to vehicles in an opposing lane when struck. Do not place overhead sign structure (cantilever or truss) supports, conventional light poles, or traffic signal mast arm supports in the median, except in conjunction with barriers that are justified for other reasons. See ***FDM 231.1*** for additional limitations on placing lighting in the median.

Overhead structural supports for a Pedestrian Hybrid Beacon (PHB) may be placed in the median at midblock crossings if it is not possible to place elsewhere. Place the supports near the center of the median to the greatest extent practicable, while meeting the minimum lateral offsets in ***Table 215.2.2***.

Do not locate high mast lighting poles in gore areas within the runout length as defined in the ***AASHTO RDG, Section 5.6.4***.

215.2.10 Enhanced Highway Signing Assemblies

Enhanced highway signing assemblies installed in accordance with ***Standard Plans, Index 700-120*** are considered crashworthy and are permitted within the clear zone.

Locate in accordance with the lateral offset criteria provided in ***Index 700-101***. Other ground mounted flashing beacon assemblies located within clear zone must be either crash tested or located behind a barrier that has been justified for other reasons. Flashing beacon assemblies that are mounted on mast arms are exempt from this requirement.

215.2.11 Breakaway Devices

The criteria for breakaway supports is covered in the ***AASHTO RDG, Chapter 4***. Breakaway devices are designed to be impacted at normal bumper heights with vehicles traveling along relatively flat level ground. If impacted at a significantly higher point the breakaway mechanism may not function as designed resulting in non-activation or improper fracturing of the device. For this reason, do not locate breakaway supports in ditches or along slopes steeper than 1:6.

215.3 Roadside Hazards

215.3.1 Aboveground Hazards

An aboveground hazard is anything within the clear zone that is greater than 4 inches in height and is firm and unyielding or doesn't meet breakaway criteria. Evaluate the location of temporary and permanent aboveground hazards and ensure that their placement is in accordance with the lateral offset and clear zone requirements of ***FDM 215.2***.

Curbs are not an aboveground hazard when utilized in accordance with ***FDM 210.5***.

215.3.1.1 Work Zone Aboveground Hazards

Aboveground hazards in work zones are considered part of the “work area” and treated with appropriate work zone traffic procedures included in the ***Standard Plans*, *Index 102 Series***. During non-working hours, place aboveground hazards (e.g., objects, materials, equipment) outside clear zone widths for work zones, or behind a barrier.

215.3.2 Canal Hazards

A canal hazard is defined as an open ditch parallel to the roadway for a minimum distance of 1000 feet and with a seasonal water depth in excess of 3 feet for extended periods of time (i.e., 24 hours or more).

Minimal lateral offsets for canal hazards exceed standard clear zone width criteria. Canal hazard lateral offsets are measured from the edge of travel lane, auxiliary lane or ramp to the top of the canal side slope nearest the road. These ~~M~~minimum required distances are illustrated in ***Figures 215.3.1*** and ***215.3.2*** and summarized as follows:

- Not less than 60 feet for flush shoulder and curbed roadways with design speeds of 50 mph or greater.
- Not less than 50 feet for flush shoulder roadways with design speeds of 45 mph or less.
- Not less than 40 feet for curbed roadways with design speeds of 45 mph or less.

When new canal or roadway alignment is required, provide distances greater than those above to accommodate future widening of the roadway.

On fill sections, provide a flat berm (1:10 or flatter slope) no less than 20 feet in width between the toe of the roadway front slope and the top of the canal side slope nearest the roadway.

When the slope between the roadway and the "extended period of time" water surface is 1:6 or flatter, the minimum distance can be measured from the edge of the travel lane, auxiliary lane, or ramp to the "extended period of time" water surface, and a berm is not required.

In sections with ditch cuts, provide a minimum of 20 feet between the toe of the front slope and the top of the canal side slope nearest the roadway.

Shield the canal hazard with an approved roadside barrier when the required minimum lateral offset cannot be met. Use ~~using~~ the following offset criteria:

- Locate the barrier as far from the traveled way as practical and outside of the clear zone where possible.
- Locate guardrail no closer than 6 feet from the canal front slope.
- Locate High Tension Cable Barrier no closer than 15 feet from the canal front slope.

If the above offset criteria would locate the barrier within the clear zone, instead follow the offset requirements of ***FDM 215.4.6.1.***

Figure 215.3.1 Lateral Offset Criteria for Canal Hazards on Flush Shoulder and High-Speed Curbed Roadways

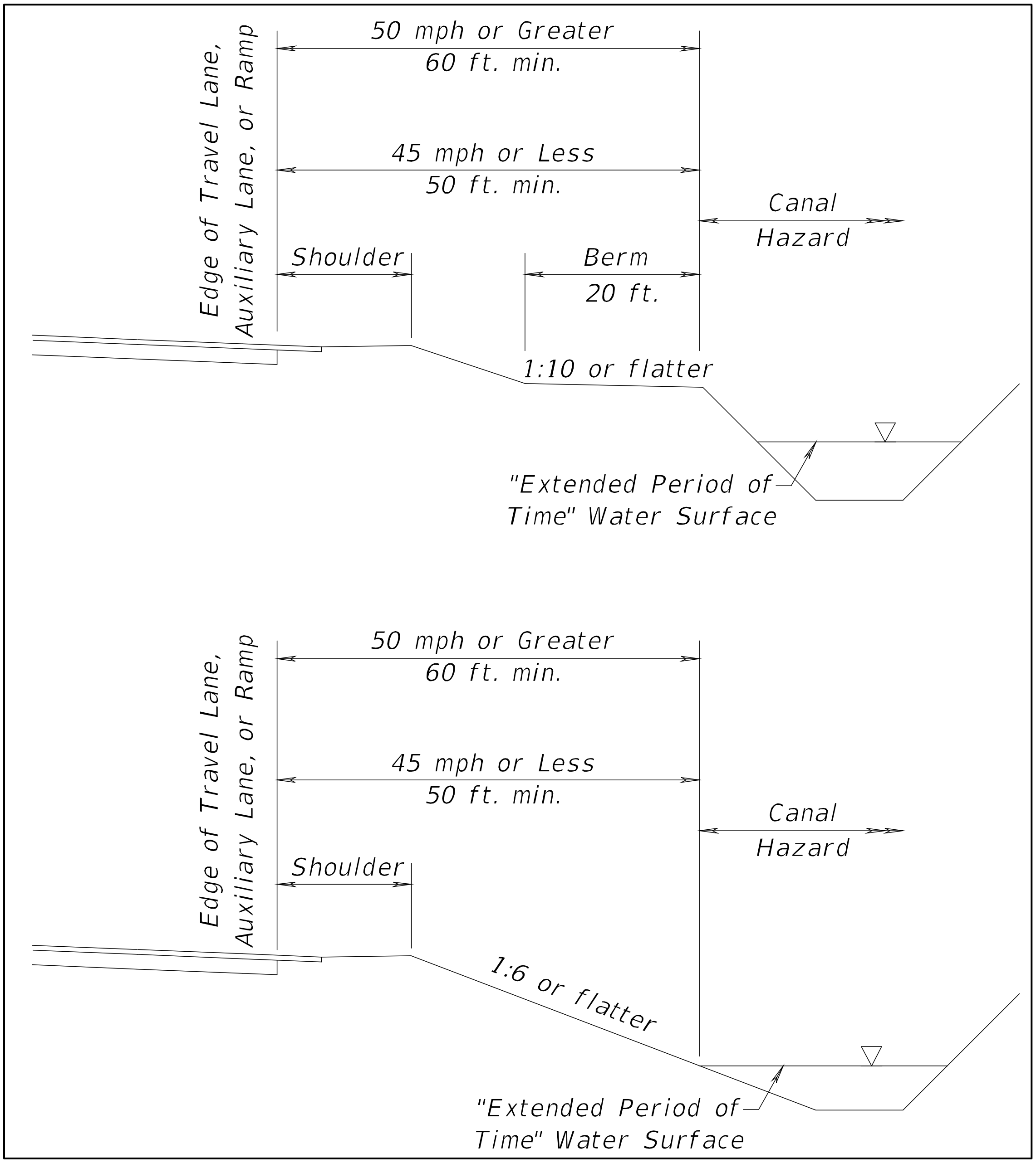
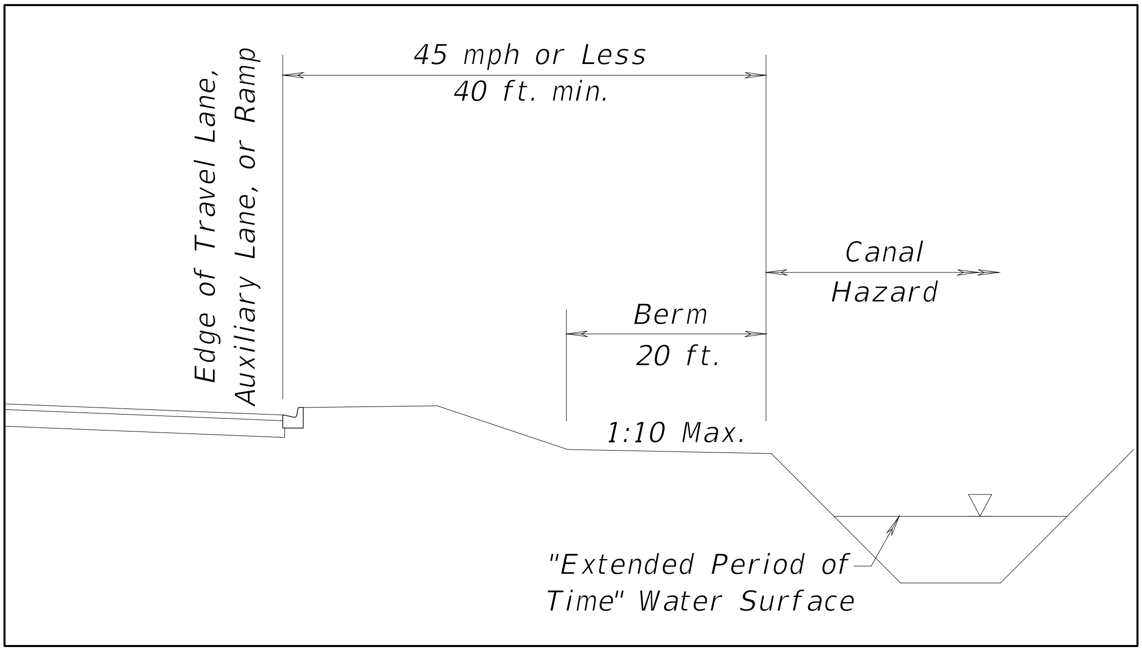


Figure 215.3.2 Lateral Offset Criteria for Canal Hazards on Curbed Roadways



215.3.3 Drop-off Hazard

Drop-off hazards are defined as steep or abrupt downward slopes that can be perilous to vehicle occupants, pedestrians, and cyclists. Shield any drop-off determined to be a hazard using the following guidelines:

(1) Any vertical faced structure (e.g., retaining wall, wing-wall) located within the clear zone

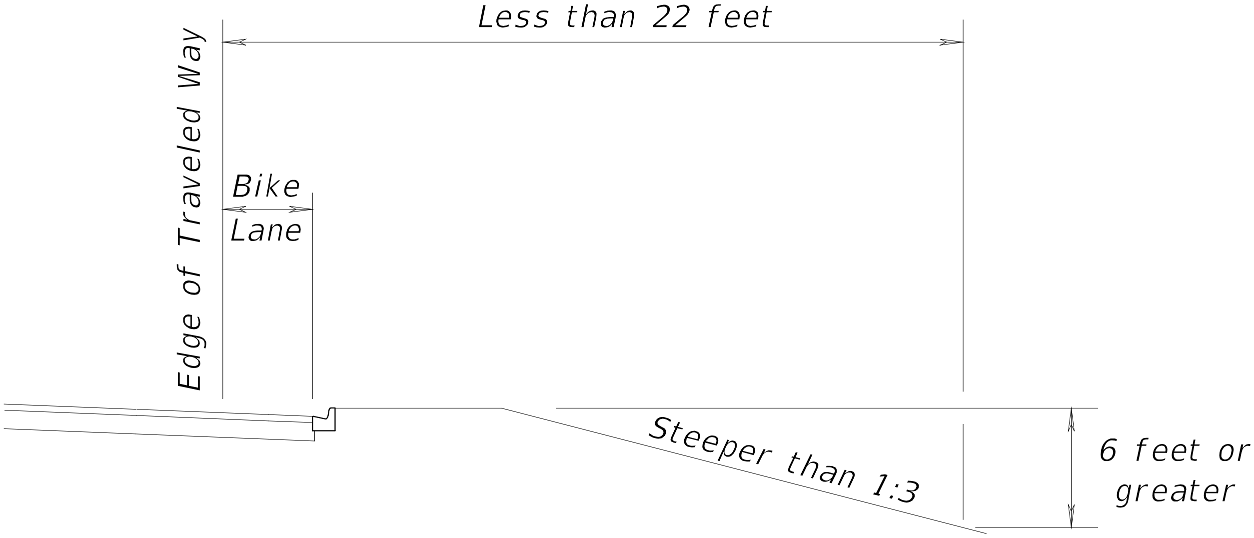
(2) For flush shoulder and high-speed curbed roadways, a drop-off of 6 feet or more with a slope steeper than 1:3 located within the clear zone

(3) For low-speed curbed roadways, a drop-off of 6 feet or greater with a slope steeper than 1:3 located within 22 feet of the traveled way (See ***Figure 215.3.3***).

(4) A drop-off that has had 3 crashes within a 5-year period. Five years of crash data for a particular site can be obtained from the Safety Office.

For drop-off hazards for pedestrians, see ***FDM 222.4*** and ***FDM 224.15***.

Figure 215.3.3 Drop-off Hazard on Low-Speed Curbed Roadways



215.3.3.1 Work Zone Drop-offs

For drop-off criteria in work zones see ***Standard Plans*, *Index 102-600***. Anticipate drop-offs that are likely to occur during construction and provide the appropriate shielding. In locations where shielding is not practical, such as areas with numerous driveways, add a plan note requiring a return to acceptable conditions by the end of each day's construction period.

215.3.4 Additional Hazard Considerations

Engineering judgment should be used when evaluating hazardous conditions, and should consider; roadway geometry, proximity to facility or building, level of activity, and traffic conditions and operations. These conditions may include:

(1) Bridge piers that are not designed for vehicle impact loads,

(2) Bicycle and pedestrian facilities,

(3) Residential buildings, schools, businesses, and

(4) The presence of personnel in work zones.

Requirements for Bridge Pier Protection are provided in ***FDM 215.4.5.4***.

Considerations regarding Positive Protection in Work Zones are provided in ***FDM 215.4.9***.

215.4 Longitudinal Barriers, Barrier Transitions, End Treatments & Crash Cushions

Roadside barriers, transitions, end treatments (trailing anchorages and approach terminals), and crash cushions must be full-scale crash tested in accordance with either:

(1) **NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features** (NCHRP 350), or

(2) **AASHTO Manual for Assessing Safety Hardware, 2016 (MASH)**.

Bridge Traffic Railings must be evaluated and designed in accordance with the ***Structures Design Guidelines*** (***SDG***).

The criteria for crash testing specified in ***NCHRP 350*** and ***MASH*** provides six Test Levels (TL-1 thru TL-6) for the evaluation of roadside hardware suitability with consideration for vehicle type, mass, speed, and impact angle. Each Test Level provides an increasing level of service in ascending numerical order. For additional information regarding appropriate application of Test Levels for Barrier Type Selection refer to ***FDM 215.4.5*** and the ***AASHTO RDG***.

Barriers, transitions, and end treatments consist of both proprietary and non-proprietary devices. Non-proprietary/Standardized devices are detailed in the ***Standard Plans***. Proprietary products are included on the ***APL***. These devices address the majority of roadside needs on the State Highway System.

Non-standard roadside hardware (i.e. devices not included in either the ***Standard Plans*** or the ***APL***) may sometimes be needed to address unique situations, but are not permitted without prior approval by the Structures Design Office (SDO) for traffic railings (e.g., bridges, noise walls, wall copings), or the Roadway Design Office (RDO) for other roadside hardware. For additional information on the use of Non-Standard Roadside Safety Hardware refer to ***FDM 215.8***.

215.4.1 Longitudinal Barriers

215.4.1.1 Flexible Barrier

Flexible Barrier systems provide the least severe impact conditions with the greatest deflections. The only Department-approved flexible barrier system is High Tension Cable Barrier (HTCB) and is currently available for implementation through the Departments ***Developmental Standard Plans*** process. Detailed information on the usage requirements and design criteria of HTCB can be found on the Department's Website (***https://www.fdot.gov/design/standardplans/***), which includes the following:

- ***Developmental Standard Plans Instructions, D540-001***
- ***Developmental Standard Plans, Index D540-001***
- ***Developmental Specification, Dev540***

When considering the use of a ***Developmental Standard Plans Index***, review the ***Developmental Standard Plans Usage Process*** included in ***FDM 115.***

215.4.1.2 Semi-Rigid Barrier

The Department's Semi-Rigid Barrier is W-Beam Guardrail per ***Standard Plans***, ***Index 536-001*** and ***536-002.*** The available options for W-Beam Guardrail are:

- General, TL-3 Guardrail – Post spacing at 6'-3" (TL-3, MASH)
- Low-Speed, TL-2 Guardrail – Post spacing at 12'-6" (TL-2, MASH)

W-Beam Guardrail, with a rail height of 2'-1" to center of panel and midspan splices, was developed based on the ***31" Midwest Guardrail System*** (***MGS***). Compatible proprietary components may be referred by the 31" height.

General, TL-3 Guardrail may be used for all design speeds; however, installations on roadways with Design Speeds > 45 mph must have a minimum length of 75 feet, unless attached to a permanent rigid barrier.

Low-Speed, TL-2 Guardrail is limited to use on flush shoulder roadways with Design Speeds ≤ 45 mph.

Installations of W-Beam Guardrail with 8-in offset blocks on wood or steel posts are detailed in ***Standard Plans***, ***Index 536-001***. W-Beam guardrail may also be installed at a reduced post spacing (i.e., less than 6'-3") to reduce deflection of the system. Reduced post spacing may be used for all design speeds in accordance with spacing and setback requirements provided in ***Table 215.4.2***.

The use of Thrie-Beam Guardrail panels is restricted to Thrie-Beam Retrofits (e.g., Metal Traffic Railings) and Barrier Transitions only.

215.4.1.3 Rigid Barrier

Rigid Barriers are assumed to exhibit no deflection under impact conditions; however, crash severity will likely be the highest of all barrier options. Rigid barrier includes Concrete Barriers and Traffic Railings. Concrete barriers are included for roadway applications and Traffic Railings are designed for structural applications (e.g., bridges, noise walls, wall copings).

Align Rigid Barrier parallel to adjacent traffic lanes; this orientation may vary by the maximum taper rates given in the ***Standard Plans Instructions*** for ***Index 521-001***.

Modifications to Rigid Barriers require approval from Office of Design (SDO or RDO). Modifications may include the following:

- Reinforcement details
- Surface treatments
- Material substitutions
- Geometric discontinuities along the length of the barrier
- Non-standardized attachments that do not meet the requirements of either this manual or ***SDG***
- Non-standardized and unfilled pockets or blockouts
- End transition details
- Traffic face geometry

Rigid Barriers include the following:

(1) Single-Slope Concrete Barriers (roadside applications):

(a) Median – ***Standard Plans***, ***Index 521-001*** (TL-4, MASH)

(b) Shoulder – ***Standard Plans***, ***Index 521-001*** (TL-4, MASH)

(c) Curb & Gutter - ***Standard Plans***, ***Index 521-001*** (TL-2, MASH)

(d) Retaining Wall Shielding – ***Standard Plans***, ***Index 521-001*** (TL-4, MASH)

(e) Pier Protection – ***Standard Plans***, ***Index 521-002*** (TL-5, MASH)

(2) Traffic Railings (bridges, noise walls, and wall copings):

(a) Bridges – ***Standard Plans***, ***Index 521-422 thru 521-427*** (TL-4, MASH) and ***Index 428*** (TL-5, MASH)

(b) Thrie-Beam Retrofits – ***Standard Plans***, ***Index 460-470 thru 460-476*** (TL-3, MASH) and ***Index 460-477*** (TL-2, MASH)

(c) Vertical Face Retrofits – ***Standard Plans***, ***Index 521-480 thru 521-484*** (TL-3, MASH)

Note: Use Tapered End Transition, ***Standard Plans, Index 521-484***, for Design Speed ≤ 40 mph only. Not permitted within the clear zone of approaching traffic unless site-specific justification is provided and approved by the District Design Engineer.

(d) Noise Wall – ***Standard Plans***, ***Index 521-509 thru 521-515*** (TL-4, MASH) (TL-5 option available from Structures Design Office)

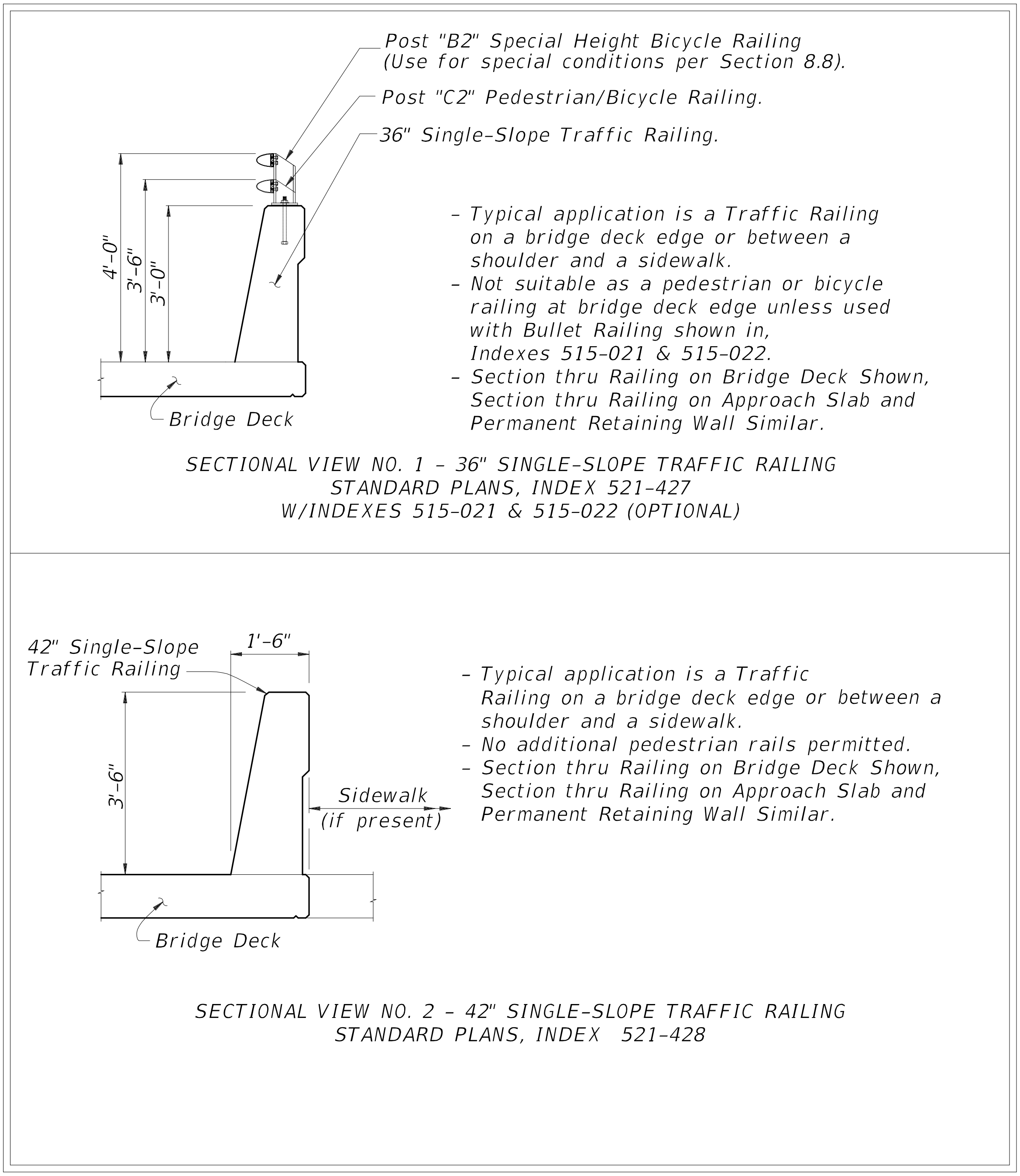
(e) Wall Coping – ***Standard Plans***, ***Index 521-610*** (36” Single-Slope and 42” Vertical, TL-4, MASH)***, 521-611*** (36” Single-Slope and 42” Vertical (FRP), TL-4, MASH)***, and 521-620*** (42” Single-Slope, TL-5, MASH)

Design bridge railings in accordance with the ***SDG.*** Superseded FDOT Standard New Jersey Shape and F-Shape Traffic Railings conforming to the designs shown in ***Standard Plans Instructions*** for ***Index 536-002****, “A Historical Compilation of Superseded Florida Department of Transportation ‘Structures Standard Drawings’ for ‘F’ and ‘New Jersey’ Shape Structure Mounted Traffic Railings"*, are both structurally and functionally adequate for TL-3 MASH.

For information regarding existing traffic railings, see ***FDM 215.7.4***.

Details and typical applications of standard bridge railings are provided in ***Figures 215.4.1 – 215.4.10***. Refer to ***FDM 222.4*** for details of pedestrian/bicycle railings and fencing.

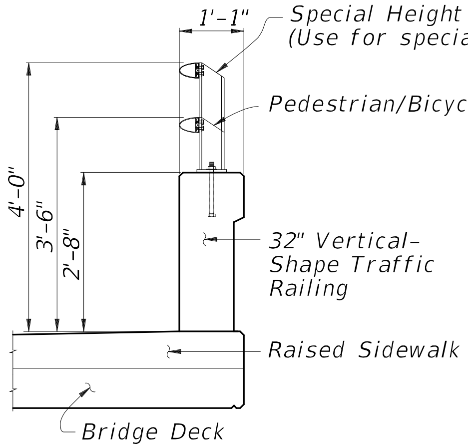
Figure 215.4.1 Bridge Traffic Railings – Single Slope Railings



SECTIONAL VIEW NO. 1 – 36" SINGLE-SLOPE TRAFFIC RAILING
STANDARD PLANS, INDEX 521-427
W/INDEXES 515-021 & 515-022 (OPTIONAL)

SECTIONAL VIEW NO. 2 – 42" SINGLE-SLOPE TRAFFIC RAILING
STANDARD PLANS, INDEX 521-428

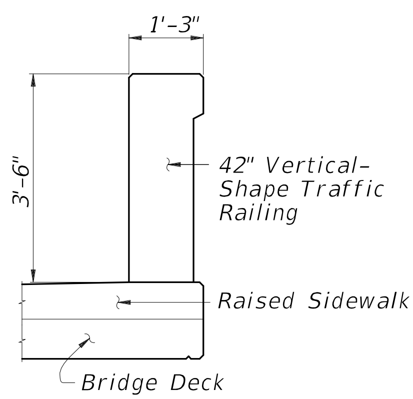
Figure 215.4.2 Bridge Traffic Railings – Vertical Shapes



- Typical application is a bridge deck edge Traffic Railing at the back of a raised sidewalk, design speed ≤ 45 mph or as a pedestrian railing behind a Traffic Railing (without a raised sidewalk See Sectional View No 10).
- Section thru Railing on Bridge Deck Shown, Section thru Railing on Approach Slab and Permanent Retaining Wall Similar.

SECTIONAL VIEW NO. 3 - 32" VERTICAL-SHAPE TRAFFIC RAILING
STANDARD PLANS, INDEX 521-423
W/INDEXES 515-021 & 515-022 (OPTIONAL)

- Typical application is a bridge deck edge Traffic Railing at the back of a raised sidewalk, design speed ≤ 45 mph or as a pedestrian railing behind a Traffic Railing (without a raised sidewalk).
- No additional pedestrian rails permitted.
- Section thru Railing on Bridge Deck Shown, Section thru Railing on Approach Slab and Permanent Retaining Wall Similar.



SECTIONAL VIEW NO. 4 - 42" VERTICAL SHAPE TRAFFIC RAILING
STANDARD PLANS, INDEX 521-422

Figure 215.4.3 Bridge Traffic Railings – Other Shapes

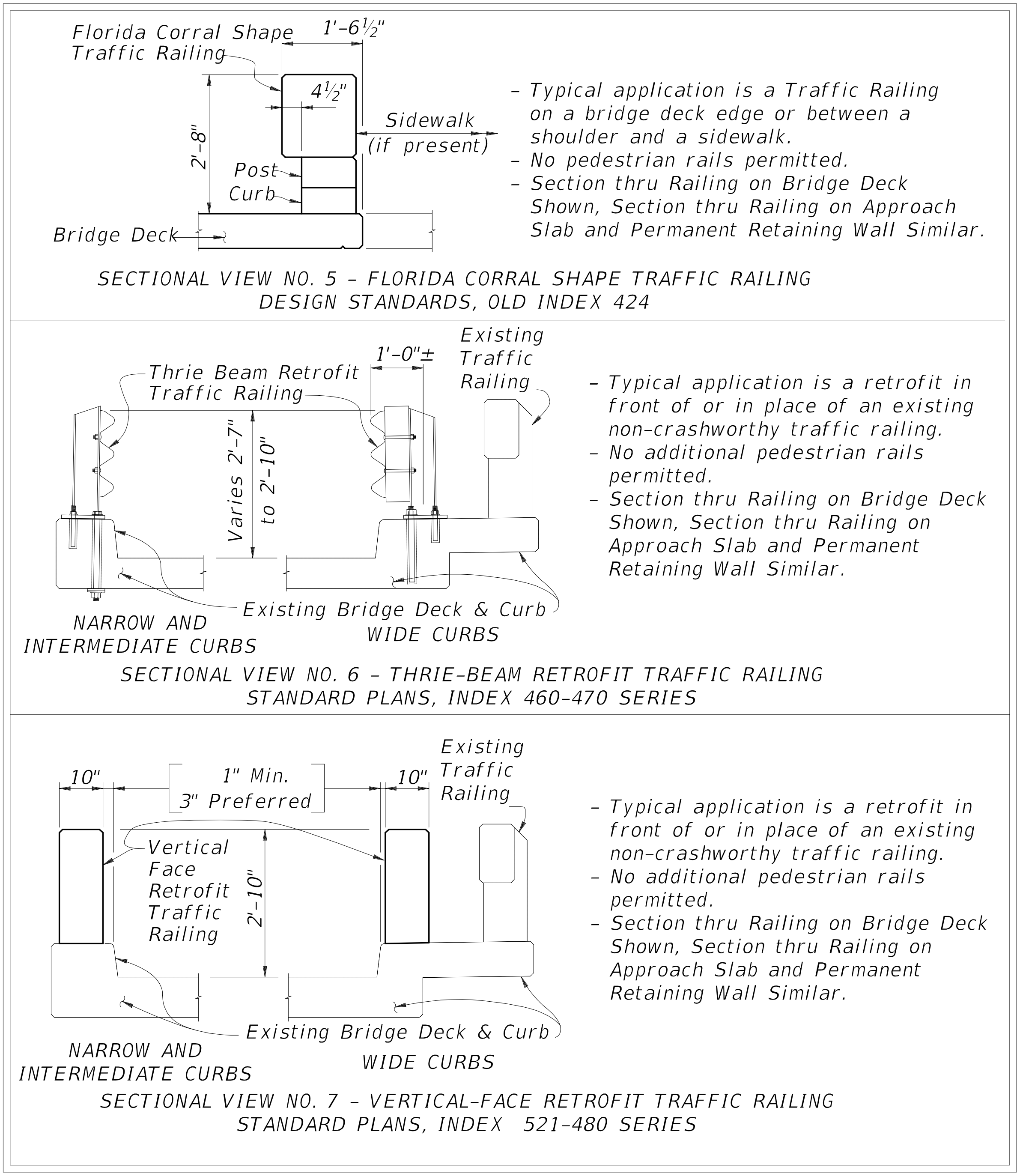
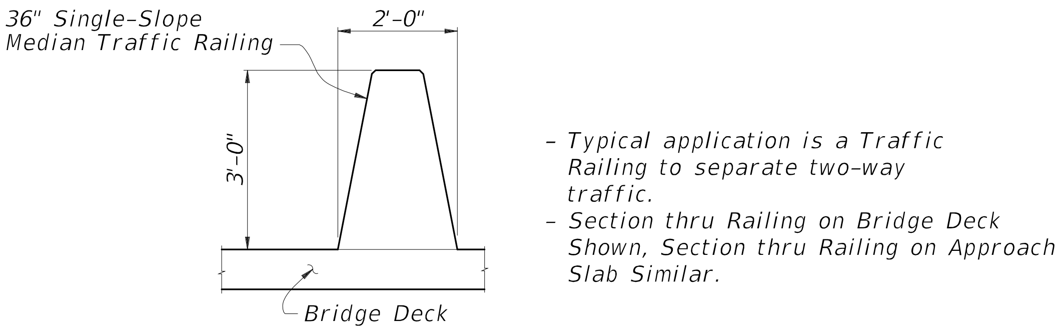
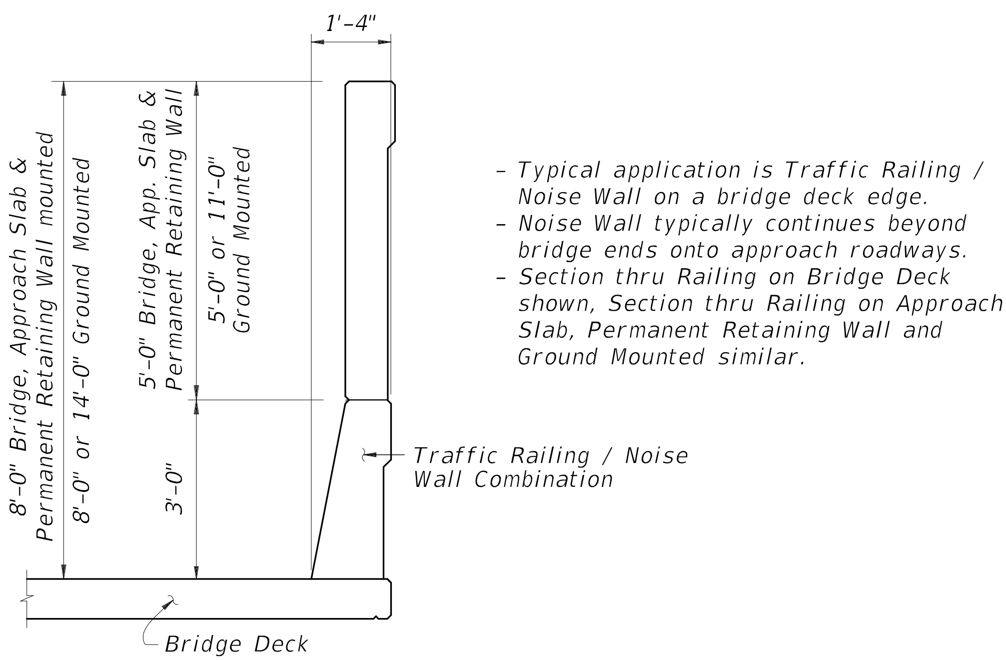


Figure 215.4.4 Bridge Traffic Railings – Median Traffic Railing and Traffic Railing/Noise Wall Combination



SECTIONAL VIEW NO. 8 - 36" SINGLE-SLOPE MEDIAN TRAFFIC RAILING
STANDARD PLANS, INDEX 521-426



SECTIONAL VIEW NO. 9 - 8' & 14' TRAFFIC RAILING / NOISE WALL
STANDARD PLANS, INDEXES 521-509 THRU 521-515

215.4.1.4 Temporary Barriers

Temporary Barriers are used in work zones to protect motorists and as Positive Protection to safeguard construction workers while construction actives are taking place. General information about the application of Temporary Barriers can be found in ***Standard Plans***, ***Index 102-100***. For information about the use of Temporary Barriers with bicycle or pedestrian temporary traffic control, see ***FDM 240.***

Temporary Barriers are installed in either 'Anchored' or 'Free-standing' conditions based on the barrier type and needed setback distance. See the Installation Data table provided in ***Standard Plans***, ***Index 102-100*** for the lateral offset and setback distance requirements.

Temporary Barriers include the following:

(1) Low Profile Barrier – ***Standard Plans***, ***Index 102-120*** (TL-2, MASH)

(2) Type K Barrier – ***Standard Plans***, ***Index 102-110*** (TL-3, NCHRP 350 and MASH)

(3) Proprietary Temporary Barrier – See ***APL*** (TL-3, NCHRP 350 and MASH)

Low Profile Barriers are required for Work Zone Speeds of ≤ 45 mph where temporary barrier is needed within 100 feet of an intersection, residential driveway or business entrance. Use of other barriers is not permitted at these locations due to sight distance limitations. Low Profile Barrier can be used on bridges where no drop-off is present. Transitions from Low Profile Barrier to other temporary barriers within a run of barrier (i.e., from begin length of need to end length of need) is not permitted.

Type K Barrier is a portable concrete barrier which has the capability of being anchored (i.e., staked or bolted) to limit deflections or installed in a free-standing configuration. See ***Standard Plans***, ***Index 102-110*** for specific requirements for the use of Type K Temporary Concrete Barrier Refer to ***Standard Plans***, ***Index 102-110*** for details on transitioning between the Type K Temporary Concrete Barrier on bridges and other concrete barrier systems on the adjoining roadway.

Proprietary Steel Barriers (anchored only), Water Filled Barriers (free-standing only) and portable concrete barriers (free-standing or anchored) must be used in accordance with the Vendor drawings on the ***APL***. To allow for the use of ***APL*** devices refer to temporary barrier the Plans as either 'Anchored' or 'Free-standing', unless specific limitations are required. Proprietary steel barriers listed on the ***APL*** are anchored to limit deflections; however, barrier heights and drainage performance may limit some systems.

Anchored (bolted) temporary barriers are not permitted on bridge superstructures that contain post-tensioned tendons within the concrete deck (top flange of concrete box girders) or on bridge superstructures consisting of longitudinally prestressed, transversely post-tensioned, solid, or voided concrete slab units.

If Flexible (HTCB, ***Index D540-001***) or Semi-Rigid (Guardrail, ***Index 536-001***) barrier is used in a temporary configuration or allowed to remain during a portion of the Temporary Traffic Control (TTC) Plan, requirements for the permanent application of barrier must be met (e.g., grading, deflection space, offset from Edge of Traveled Ways).

215.4.2 End Treatments

Non-crashworthy longitudinal barrier ends are hazards for approach direction when terminated within the clear zone. Crashworthy end treatments for each barrier type (i.e., flexible, semi-rigid, and rigid) are provided in the ***Standard Plans***.

Flexible barrier end treatments are vendor specific. For additional information regarding the end treatment of HTCB, refer to ***Developmental Standard Plans***, ***Index D540-001***, as referenced above.

215.4.2.1 Guardrail End Treatments

Guardrail end treatments are necessary to provide crashworthy ends for approaches and anchorage of the guardrail system. For the guardrail to provide adequate redirective capabilities during a vehicle impact, anchorage of the system is needed for tensile (ribbon) strength to develop in the guardrail panels. Approach terminals provide both anchorage of the guardrail system and a crashworthy approach. End treatments for guardrail are categorized as follows:

(1) Approach Terminals – required for guardrail ends within the clear zone of approaching traffic. Guardrail approach terminals must be a proprietary device listed on the ***APL***. MASH compliant approach terminals are required for new installations. For additional information, see ***Standard Plans***, ***Index 536-001***. Approach terminals are classified by the following:

   (a) Test Level:

      i. TL-2 (Design Speeds ≤ 45 mph)

      ii. TL-3 (All Design Speeds)

   (b) Connection Type:

      i. Single-Faced (crashworthy on one side)

      ii. Double-Faced (crashworthy on both sides)

(2) Crash Cushions – See ***FDM 215.4.3*** and ***Standard Plans***, ***Index 544-001***.

(3) Trailing Anchorages – required for anchoring of the trailing ends of guardrail. Trailing anchorages are non-crashworthy as an approach end treatment and are not permitted as a guardrail end treatment on the approach end within the clear zone, unless shielded by another run of barrier. The trailing anchorage is detailed in the ***Standard Plans, Index 536-001***.

215.4.2.2 Rigid Barrier End Treatments

Terminate rigid barrier by either transitioning into another barrier system (e.g., guardrail), or by shielding with a crash cushion. Details and requirements are provided in the ***Standard Plans***.

Sloped concrete end treatment using a vertical height transition, detailed in ***Standard Plans***, ***Index 521-001***, are not permitted within the clear zone of approaching traffic lanes. With sufficient justification the District Design Engineer may grant approval for use of this end treatment within clear zone for very low design speeds (35 mph and less), and only when no other more crashworthy solution is available.

Treatment of the trailing end of rigid barriers is not required unless additional hazards exist beyond the rigid barrier or the barrier is within the clear zone of opposing traffic.

215.4.2.3 Temporary Barrier End Treatments

The required treatments for exposed ends of temporary barriers are:

(1) Connecting to an existing barrier (smooth, structural connections are required - Refer to ***Standard Plans***, ***Indexes 102-100*** and ***102-110***, or the ***APL***);

(2) Shield end with a crash cushion as detailed in the ***Standard Plans*** or ***APL*** for the specific type of temporary barrier (i.e. Temporary Concrete, Steel, or Water Filled); or,

(3) Flaring outside of the Work Zone clear zone (See ***Standard Plans, Index 102-600***)

No modifications to the end treatments included in the ***Standard Plans*** or ***APL*** are permitted. Special conditions may require end treatments other than those included above. If this occurs, consult the State Roadway Design Office (RDO***)*** and provide special details in the Plans.

215.4.3 Crash Cushions

Crash cushions (impact attenuators) are used to protect motorists from the exposed ends of barriers, fixed objects, and other hazards within the clear zone. They are energy absorbing devices that may be redirective non-gating, or non-redirective gating. Crash cushions are classified based on Test Level, as shown for each system on their respective ***APL*** drawings.

The design of a crash cushion system must not create a hazard to opposing traffic. ***APL*** drawings provide details for transitions for optional barrier types with and without bi-directional traffic.

An impacting vehicle should strike the systems at normal height, with the vehicle's suspension system neither collapsed nor extended. Therefore, the terrain surrounding crash cushions must be flat (1:10 or flatter) in advance of and along the entire design length of the system Curb placement in the approach area of crash cushions is only permitted where project constraints prevent usage of flush shoulders or alternative barrier configurations.

215.4.3.1 Permanent Crash Cushions

Permanent crash cushions must be redirective non-gating. Standard details of systems for typical installations shielding concrete barrier wall ends and guardrail ends can be found on the ***APL*** under ***Section 544***. In addition, some of these systems have standard details for shielding wide hazards. For applications not covered in the ***APL*** drawings, crash cushion vendors normally provide design assistance for their systems. Special designs must be detailed in the Plans and based on meeting the performance criteria for the established design speed of the facility (i.e., barrier system Test Level). For additional information, see ***Standard Plans***, ***Index 544-001***.

215.4.3.2 Temporary Crash Cushions

Two types of temporary crash cushions are permitted;

- Redirective non-gating crash cushions
- Non-redirective gating crash cushions

Redirective crash cushions will shield hazards by redirecting errant vehicles impacting the side of the crash cushion and decelerate errant vehicles from a direct, in-line impact at the terminus of the crash cushion by absorbing the energy.

Gating crash cushions are designed to decelerate errant vehicles from a direct, in-line impact at the terminus of the crash cushion by absorbing the energy but provide no redirective capabilities for side impacts. Use of gating crash cushions require approval from the State Roadway Design Office (RDO). Gating cushions may be appropriate on low-speed facilities and in work zones with higher speeds where only low impact angle hits are expected. An adequate clear runout area must be provided beyond a gating crash cushion (between the departure line and the clear zone). Plan details for site specific design are required.

Approved temporary crash cushions for use on Department contracts are listed on the ***APL*** under ***Section 102***. Sand barrel gating systems are not permitted.

Anchored (bolted) temporary crash cushions are not permitted on bridge superstructures that contain post-tensioned tendons within the concrete deck (top flange of concrete box girders) or on bridge superstructures consisting of longitudinally prestressed, transversely post-tensioned, solid, or voided concrete slab units.

215.4.4 Barrier Transitions

Guardrail transitions are necessary, whenever standard W-Beam guardrail converges with rigid barriers. Guardrail transitions must include sound structural connections, nested panels, and additional posts for increased stiffness. Use the guardrail transitions included in the ***Standard Plans*** as follows:

(1) General, Guardrail Approach Transition Connection to Rigid Barrier – ***Index 536-001*** (Single or Double Faced Guardrail, TL-3, MASH), Approved for all Design Speeds

(2) Low Speed, Guardrail Approach Transition Connection to Rigid Barrier – ***Index 536-001*** (Single Faced Guardrail only, TL-2, MASH), Only approved for Design Speeds ≤ 45 mph

(3) Trailing End Transition Connection to Rigid Barrier – ***Index 536-001*** (Test Level N/A), Approved for all Design Speeds.

Various other barrier transitions are detailed throughout the ***Standard Plans*** and ***APL*** drawings for transitions from temporary barriers to permanent rigid barriers and transitions from variable height/shape rigid barriers.

215.4.5 Barrier Type Selection

Consider the following factors when determining the appropriate barrier type:

(1) Barrier Placement requirements (see ***FDM 215.4.6***)

(2) Traffic characteristics (e.g., volume, percent trucks)

(3) Site characteristics (e.g., terrain, alignment, geometry, access facility type, access locations, design speed)

(4) Expected frequency of impacts

(5) Initial and replacement/repair costs

(6) Ease of maintenance

(7) Exposure of workers when conducting repairs/maintenance

(8) Aesthetics

For additional information about considerations for barrier selections refer to the ***AASHTO RDG***. Document barrier type selection decisions and warrants.

215.4.5.1 Longitudinal Barrier Selection

There are three options for longitudinal barrier; HTCB, W-Beam Guardrail, and Rigid Barrier. ***Table 215.4.1*** provides guidance regarding roadway barrier type selection.

Specific requirements for the selection of HTCB are provided in the ***Standard Plans Instructions*** for ***Index D540-001***.

Refer to the ***SDG*** for barrier type and test level selection of Traffic Railings.

Table 215.4.1 Roadway Barrier Type Selection

Barrier Type	Deflection Space Requirement (feet)	Order of Bias: Initial Cost	Order of Bias: Vehicle Impact Severity	Order of Bias: Maintenance Cost	Test Level	Design Vehicles
HTCB	12	LOW	LOW	HIGH	TL-4 (NCHRP 350)	Passenger Car, Pickup Truck, & Single-Unit Truck
W-Beam Guardrail	5	↓	↓	↑	TL-2 & TL-3 (MASH)	Passenger Car & Pickup Truck
Rigid Barrier	0	HIGH	HIGH	LOW	TL-3, TL-4 & TL-5 (MASH)	Passenger Car, Pickup Truck, Single-Unit Truck & Tractor-Van Trailer

215.4.5.2 End Treatment Selection

Select end treatments in accordance with ***FDM 215.4.2***, the ***Standard Plans*** and the ***Standard Plans Instructions*** for each applicable barrier type.

215.4.5.3 Crash Cushion Selection

Various types of energy absorbing devices eligible for use on Department projects as crash cushions can be found on the ***APL***. Detailed information about these systems is provided in the ***Standard Plans***, ***APL***, and in each manufacturer's publications. Each system has unique physical and functional characteristics.

For permanent crash cushion applications, indicate in the Plans the requirements for each given location in accordance with ***Standard Plans***, ***Index 544-001***, and ***FDM 902***, including the:

(1) Location (station and side),

(2) Barrier system (concrete barrier wall or guardrail),

(3) Design length,

(4) Design speed,

(5) Crash test level, and

(6) Hazard width and length restriction.

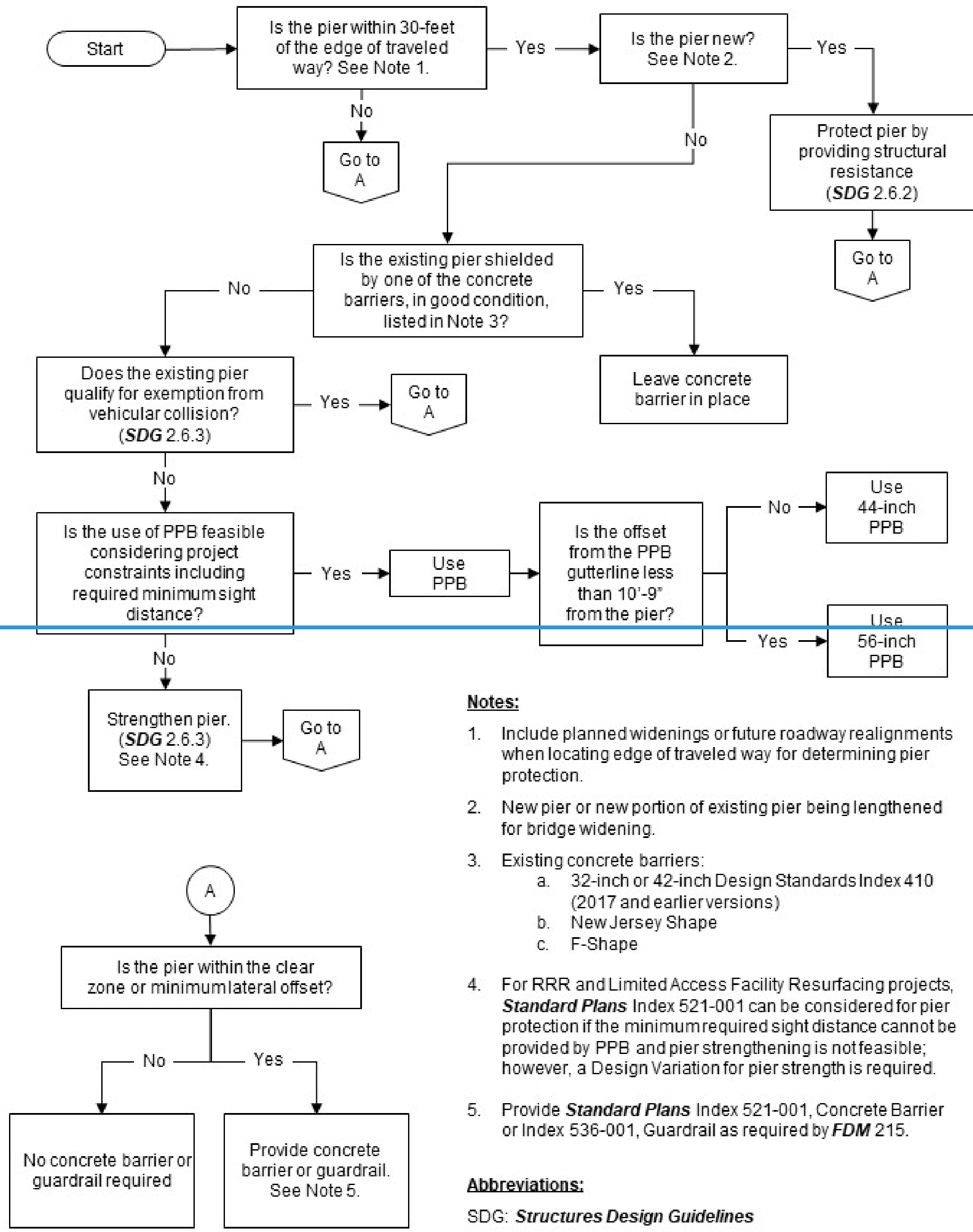
Site characteristics and economics dominate crash cushion selection considerations. Some crash cushion systems are relatively low in initial cost, but usually must be completely replaced when struck, so are more appropriate in locations with a low likelihood of collision. There are a number of other systems that have higher initial costs but can be repaired after collisions relatively quickly and inexpensively, so are more appropriate where frequent collisions are anticipated. The ability of maintenance forces to perform routine maintenance and to place a crashed system back into service quickly should be a major consideration. Do not use crash cushions that require stocking unusual and expensive parts or those that are complex to replace.

215.4.5.4 Pier Protection

In addition to consideration for bridge piers as hazards to vehicle occupant safety, consideration must also be given to protection of bridge piers from vehicular collision. The ***AASHTO LRFD Bridge Design Specifications*** refer to the protection of bridge piers from vehicular collision as Protection of Structures; however, protection of bridge piers is also commonly referred to as Pier Protection. Coordinate with the Structural Engineer of Record to determine if Pier Protection is required.

The process for selection of Pier Protection is presented in ***Figure 215.4.5*** (Pier Protection Selection Flowchart). The flowchart is only intended as a visual aid for selection of Pier Protection. Refer to ***SDG 2.6*** for the Department's design policy for Pier Protection.

Figure 215.4.5 Pier Protection Selection Flowchart



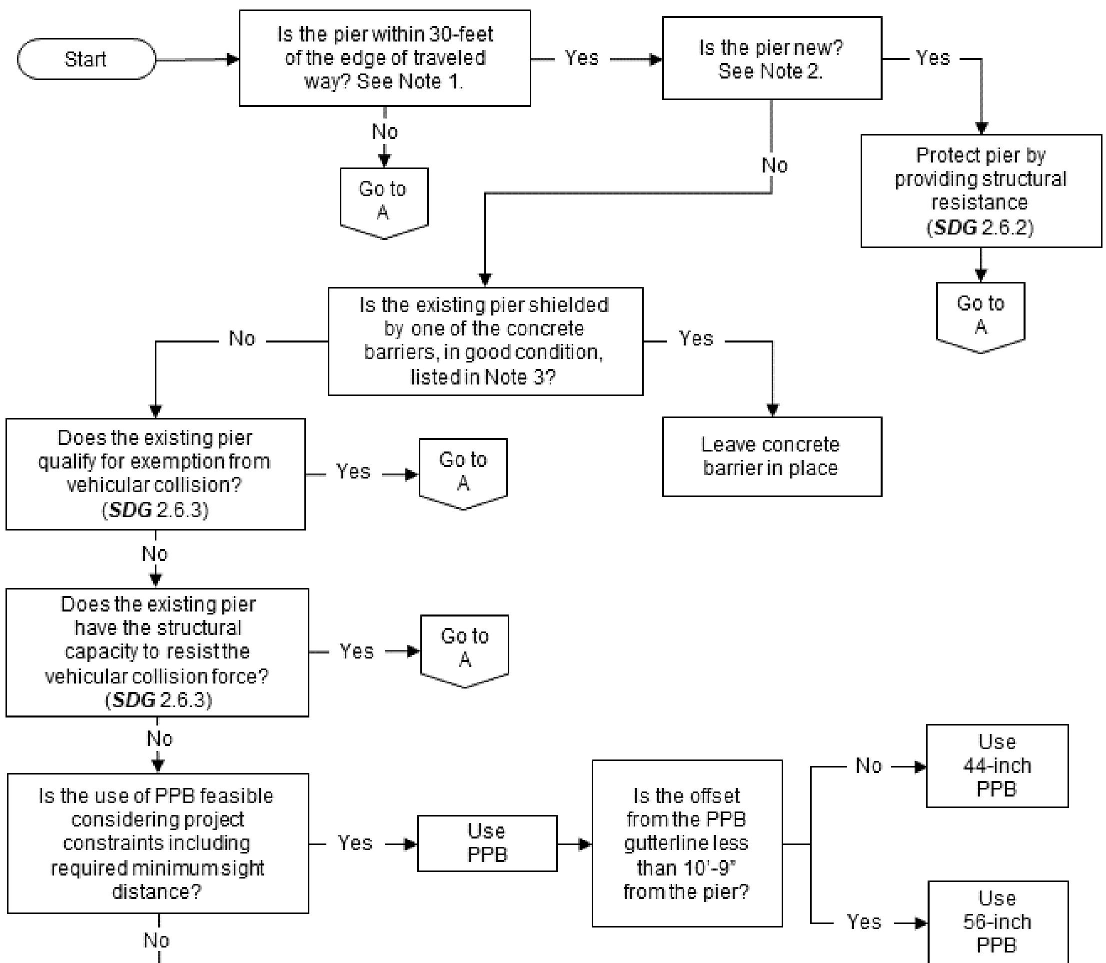
Notes:

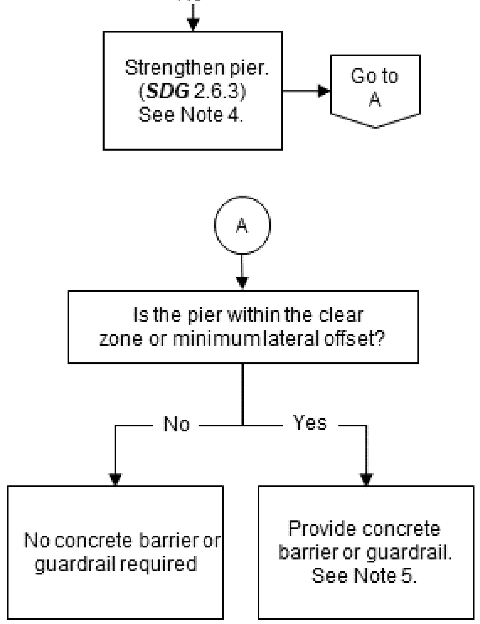
1. Include planned widenings or future roadway realignments when locating edge of traveled way for determining pier protection.
2. New pier or new portion of existing pier being lengthened for bridge widening.
3. Existing concrete barriers:
   a. 32-inch or 42-inch Design Standards Index 410 (2017 and earlier versions)
   b. New Jersey Shape
   c. F-Shape
4. For RRR and Limited Access Facility Resurfacing projects, ***Standard Plans*** Index 521-001 can be considered for pier protection if the minimum required sight distance cannot be provided by PPB and pier strengthening is not feasible; however, a Design Variation for pier strength is required.
5. Provide ***Standard Plans*** Index 521-001, Concrete Barrier or Index 536-001, Guardrail as required by ***FDM*** 215.

Abbreviations:

SDG: ***Structures Design Guidelines***

PPB: ***Standard Plans*** Index 521-002, Pier Protection Barrier





Notes:

1. Include planned widenings or future roadway realignments when locating edge of traveled way for determining pier protection.
2. New pier or new portion of existing pier being lengthened for bridge widening.
3. Existing concrete barriers:
    a. 32-inch or 42-inch Design Standards Index 410 (2017 and earlier versions)
    b. New Jersey Shape
    c. F-Shape
4. For RRR and Limited Access Facility Resurfacing projects, ***Standard Plans*** Index 521-001 can be considered for pier protection if the minimum required sight distance cannot be provided by PPB and pier strengthening is not feasible; however, a Design Variation for pier strength is required.
5. Provide ***Standard Plans*** Index 521-001, Concrete Barrier or Index 536-001, Guardrail as required by ***FDM*** 215.

Abbreviations:

SDG: ***Structures Design Guidelines***

PPB: ***Standard Plans*** Index 521-002, Pier Protection Barrier

215.4.6 Barrier Placement

The primary design factors associated with barrier placement are:

(1) Lateral Offset from the Edge of Traveled Way,

(2) Deflection Space Tolerance,

(3) Terrain Effects,

(4) Length of Need,

(5) Space for End Treatments, and

(6) Outside Shoulder or Median Application

215.4.6.1 Barrier Offset

Place W-Beam Guardrail and Rigid Barriers at the offsets described below. See ***Developmental Standard Plans Instructions*** for ***Index D540-001*** for the barrier placement requirements for HTCB.

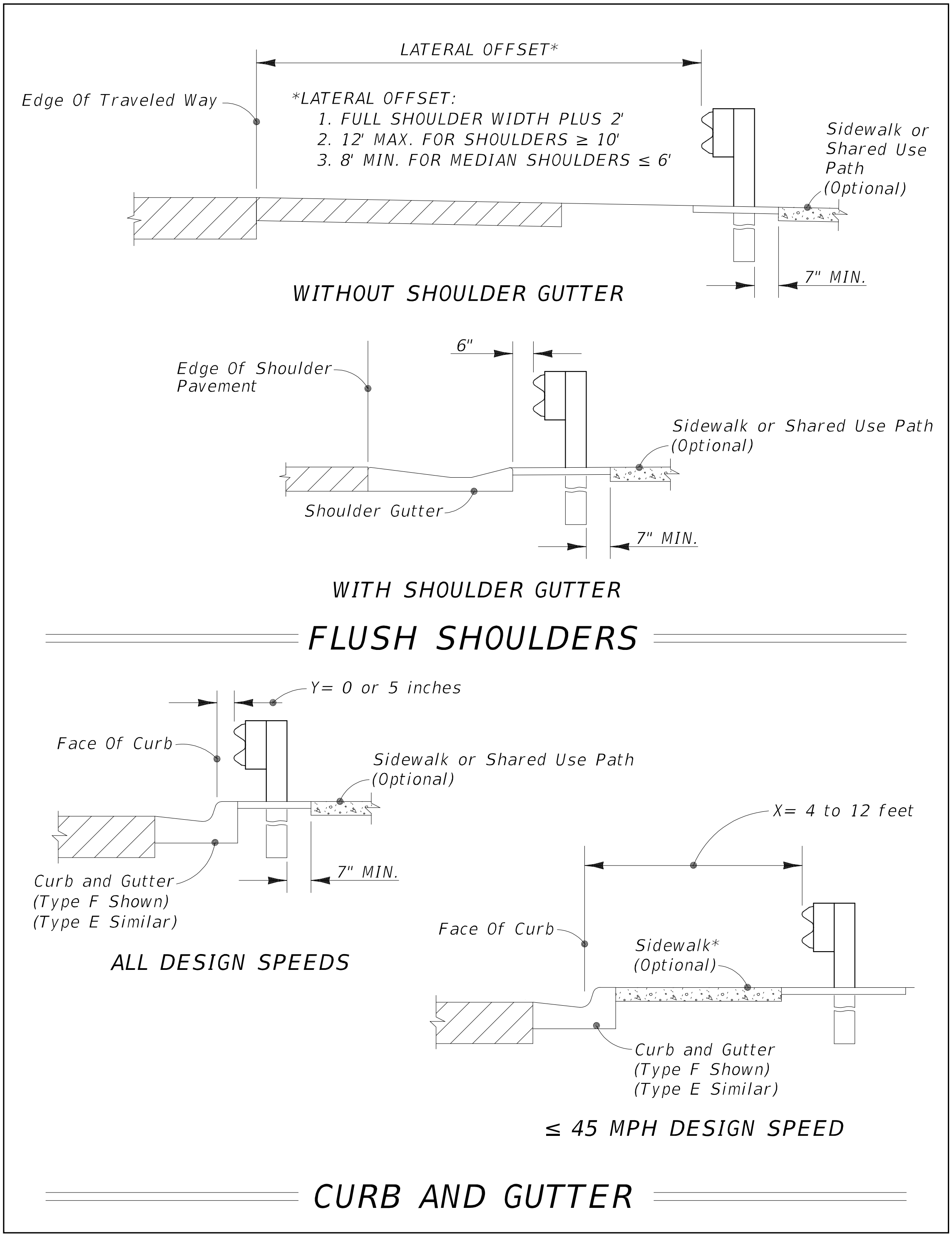
Requirements for guardrail offsets are illustrated in ***Figure 215.4.6***.

For flush shoulder roadways, the standard offset for W-Beam Guardrail, measured from the Edge of Traveled Way to the face of guardrail, is the full shoulder width plus 2 feet, not to exceed 12 feet. The 12-foot offset limit for guardrail is established to reduce the potential for impacts where the vehicle is behaving significantly different than the crash tested conditions (i.e. non-tracking, fish-tailing, excessive approach angle, etc.). Guardrail offsets greater than 12 feet require site-specific justification in accordance with ***FDM 215.4.7***, unless the condition is based on requirements of the ***Standard Plans***, ***FDM 215.4.6.4*** for ***Median Barrier, FDM 215.3.2*** for ***Canal Hazards,*** or ***shoulder gutter segments***. For shoulder gutter segments only, guardrail may be placed with a 14-foot offset to accommodate a 12-foot useable shoulder width.

Note: Consider exceeding the 12-foot offset limit where required to avoid guardrail post conflicts with structures or utilities. This is preferred over the use of encased or special guardrail posts. If the 12-foot offset limit is exceeded, provide site-specific justification per above and extend the shoulder grading to maintain the requirements of ***FDM 215.4.6.2***. When curb is present, the preferred configuration is to place the face of guardrail at 5 inches behind the face of curb. For design speeds ≤ 45 mph, the face of guardrail may also be placed between 4 feet and 12 feet behind the face of curb.

Rigid Barrier is typically used when there are barrier deflection or right-of-way limitations. For flush shoulder roadways, the general offset for Rigid Barrier, measured from the Edge of Traveled way to the barrier gutter line, is the full shoulder width. This offset may vary where differing barrier placement is justified for site-specific conditions (e.g., barrier taper across median, alignment for shielding bridge piers or sign supports, or coordination with drainage structures). Extend adjacent shoulder pavement to close gaps between the nearest paved shoulder and the rigid barrier. Follow additional offset requirements for specific conditions shown in the ***Standard Plans***. Rigid Barrier, with the exception of F-Shape or Single-Slope barriers with a height less than 42”, may be used in combination with curbs, and provide an acceptable alternative to the areas excluded for guardrail use in ***Figure 215.4.6***.

Figure 215.4.6 Lateral Offset to Guardrail



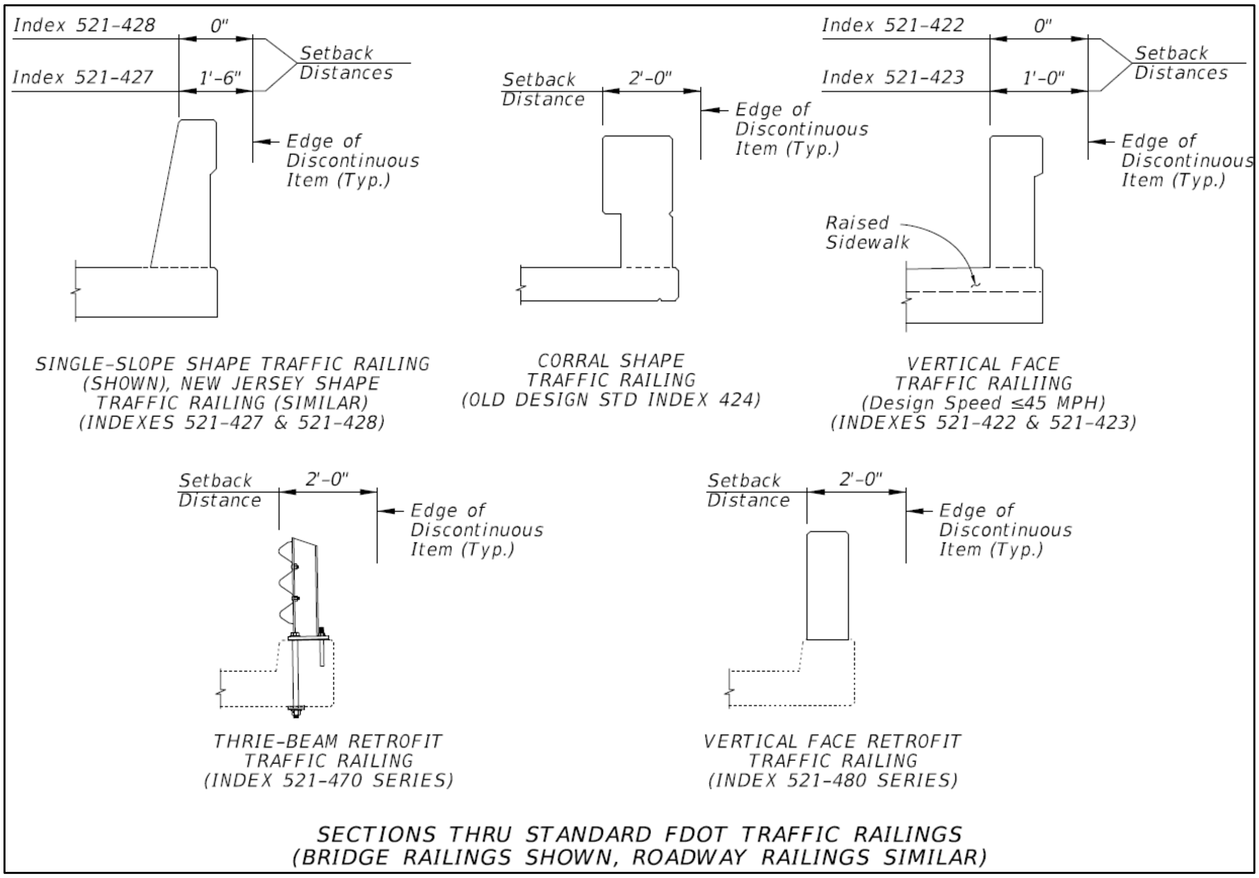
In addition to travel lane lateral offset considerations, an adequate setback must be provided behind the barrier to ensure proper function. Setback is the distance between the face of the barrier and the aboveground hazard behind the barrier. For flexible and semi-rigid barriers, the setback is based on deflection tolerances and is required to prevent the barrier from contacting aboveground hazards or breakaway devices.

For rigid barriers, the setback is required to keep the area above and behind the barrier face free of obstructions that could penetrate or damage the vehicle compartment. This requirement is based on the “Zone of Intrusion” concept as described in the ***AASHTO RDG***. ***Table 215.4.2*** provides the Setback requirements for FDOT standard barriers. Additionally, ***Figure 215.4.7*** includes setback distances to rigid barriers for discontinuous elements. Setback requirements for discontinuous items apply to discrete features, such as piers, poles, or sign supports. Apply continuous item setback requirements to other features. See ***SDG*** ***6.7*** for additional bridge railing and setback requirements. These requirements do not apply to devices detailed in the ***Standard Plans*** as attachments to rigid barriers (e.g., pedestrian/bicycle bullet railing, bridge fencing, traffic railing/noise wall combinations).

Table 215.4.2 Minimum Barrier Setback
(Measured from the face of the barrier, as shown in *Figure 215.4.7*)

Barrier Type	Setback Distance
Flexible Barrier	
High Tension Cable Barrier (HTCB)	12 feet, 0 inches
Semi-Rigid Barrier	
W-Beam with Post Spacing @ 6 feet, 3 inches (TL-3)	5 feet, 0 inches
W-Beam with Post Spacing @ 12 feet, 6 inches (TL-2)	5 feet, 0 inches
W-Beam with Post Spacing @ 3 feet, 1.5 inches (½ Spacing)	3 feet, 10 inches
W-Beam with Post Spacing @ 1 foot, 6.75 inches (¼ Spacing)	3 feet, 2 inches
Nested W-Beams with Post Spacing @ 3 feet, 1.5 inches (½ Spacing)	3 feet, 0 inches
Nested W-Beams with Post Spacing @ 1 foot, 6.75 inches (¼ Spacing)	2 feet, 8 inches
Deep Post W-Beam installed on 1:2 Slope Break with Post Spacing @ 6 feet, 3 inches (TL-3)	5 feet, 6 inches
Rigid-Barrier	
Concrete Barrier < 40” Height (Design Speeds ≤ 45 MPH)	0 feet, 0 inches
Concrete Barrier < 40” Height (Design Speeds > 45 MPH) Non-crash Tested Continuous or Discontinuous Items	1 foot, 6 inches
Concrete Barrier ≥ 40” Height	0 feet, 0 inches
Bridge Traffic Railing Non-crash Tested Continuous Items Non-crash Tested Discontinuous Items	 5 feet, 0 inches See ***Figure 215.4.7***
Temporary Barriers	
See “Setback Distance” of applicable ***Standard Plans***, ***Index*** or ***APL*** drawing.	

Figure 215.4.7 Setback Distances for Discontinuous Elements



Noise Wall/Traffic Railing combinations located within the setback distance must be crash tested to or accepted as TL-4 under ***MASH***. Other continuous items (e.g., glare screens and fences) located within this setback distance must be crash tested to or accepted as TL-3 under ***NCHRP 350*** or ***MASH***.

Back-to-back railings on separated parallel or adjacent bridges are exempt from the bridge traffic railing setback requirements of ***Table 215.4.2***, provided the back face of the higher bridge railing is smooth and continuous with no attachments (e.g., sign supports, pedestals, bullet rails, etc.).

See ***FDM 215.5*** for additional information regarding discontinuous attachments to rigid barriers.

215.4.6.2 Grading Requirement

The terrain effects between the traveled way and a barrier can have a significant impact on whether or not a barrier will perform as intended. Proper grading around a barrier will ensure that as a vehicle approaches a barrier its suspension is not dramatically affected, causing the vehicle to underride or override a barrier.

Install barriers on slopes 1:10 or flatter. Continue the 1:10 slope a minimum 2 feet beyond the barrier (i.e., from either the guardrail post or rigid barrier) before providing a slope break.

With approval of the District Design Engineer and where conditions are constrained, the Deep Post guardrail option may be used in lieu of providing a 2-feet setback to the slope break point. Coordinate the use of the Deep Post guardrail option with the District Drainage Engineer and District Maintenance Engineer. See Deep Post details in ***Standard Plans***, ***Index 536-001*** "Slope Break Condition".

Proper grading around crashworthy end treatments is essential to assure the device performs as intended. Grading requirements are shown in the ***Standard Plans***.

For superelevated roadway sections, a maximum 7% algebraic difference is permitted between the travel lanes and shoulder in advance of barriers. See ***FDM 215.4.6.5*** for temporary barrier requirements in superelevated roadway sections.

215.4.6.3 Length of Need

Length of need is used to determine the required placement of barrier, relative to hazards. Use the requirements provided in the ***Standard Plans Instructions*** or the ***Standard Plans*** to establish length of need for each barrier type.

Length of need is dependent on:

(1) Barrier type

(2) Design speed

(3) Offset distance to the face of the barrier

(4) The lesser distance to either the back of the hazard or the clear zone limit

On new construction and reconstruction projects, use clear zone width requirements for new construction in the length of need calculations. For existing hazards on RRR projects, new barrier installations may be designed using RRR clear zone width requirements for length of need calculations. See ***Table 215.2.1.***

When existing project constraints prevent placement of barrier for the full length of need required, place the barrier to the greatest extent possible within the available space. Examples of existing project constraints include canals, side streets, driveways, and railroad crossings. Provide site-specific justification for not meeting the required length of need.

Extend the trailing end of barriers downstream, relative to hazards, in accordance with the ***Standard Plans Instructions***. For Concrete Barrier and Bridge Traffic Railing, see the ***Standard Plans Instructions*** for ***Index 521-001***.

215.4.6.4 Continuous Median Barriers

Continuous median barriers are used to mitigate median crossover crashes (i.e., reduce the number of vehicles that might enter opposing lanes of traffic after traversing a median).

Locate continuous median barrier in accordance with guidelines included in the ***AASHTO RDG, Section 6.6*** and in accordance the ***Standard Plans***.

In locations where a continuous median barrier is present, the length of a barrier opening should be minimized. As shown in ***FDM Exhibit 211-3***, the barrier ends on each side of the opening should be offset. Provide crashworthy end treatments or crash cushions to shield the barrier ends when the ends are within the clear zone and fall within the departure angle used to set length of need. Provide crashworthy end treatments or crash cushions when the angle between barrier ends is less than 30 degrees, measured from the direction of mainline travel.

The preferred barrier option for continuous median barrier is High Tension Cable Barrier (HTCB), provided the requirements of the ***Developmental Standard Plans Instructions*** for ***Index D540-001*** can be met. Evaluate other barrier options when the deflection and placement requirements for HTCB cannot be met.

Include Rub Rail on double faced w-beam guardrail installations as shown in ***Standard Plans, Index 536-001***. Based on the full shoulder width as shown in ***Figure 215.4.6***, locate double faced w-beam guardrail at a lateral offset of between 8 feet and 12 feet from the edge of traveled way. For medians with cross slopes of 1:6 of flatter, locate the barrier closest to the traveled way with the most likelihood or history of lane departure (e.g., outside of horizontal curves and sections with outside merge lanes). If median cross slopes greater than 1:6 exist, and HTCB is not feasible, install w-beam guardrail along both sides of the median or consider a grade separated (bifurcated) median with a concrete barrier.

Use concrete median barrier when the barrier offset requirements for flexible or semi-rigid barrier cannot be met or a higher test level barrier is justified. Implement concrete median barrier in accordance with ***Standard Plans*, *Index 521-001***.

215.4.6.5 Requirements for Culverts

Roadside barriers placed at a culvert (i.e., box culvert, bridge culvert, or three-sided culvert) should be either W-Beam Guardrail or Bridge Traffic Railing. See ***Chapter 6*** of the ***Structures Design Guidelines*** for more information regarding bridge traffic railings.

W-Beam Guardrail is the preferred barrier option, provided the grading, post embedment and length of need requirements can be met. A minimum of 4 feet of fill must be provided over the culvert for adequate post embedment and performance. If there is less than 4 feet of fill over the culvert, utilize one of the following options:

(1) Culverts with total overall widths ≤ 5 feet: use W-Beam Guardrail with a post layout that straddles the outside of the culvert using standard post spacing of 6'-3".

(2) Culverts with total overall width between 5 feet and 20 feet: use shortened W-Beam guardrail posts (e.g., Encased Post for Shallow Mount). See ***Standard Plans*, *Index 536-001***.

(3) Culverts with total overall width > 20 feet: use a project specific designed metal traffic railing similar to the Thrie-Beam Retrofit barriers (i.e., thrie-beam railing attached directly to the culvert headwall), see the ***Standard Plans*, *Index 460 Series***. Designers should note that the locations of the first and last posts are critical. Headwalls must be a minimum of 18 inches wide and the base plate must be located so that it is located at least 12 inches away from any construction joint or free end of the concrete headwall.

Placement of base plates and bolts in the top slab of the culvert barrel should be avoided because they are difficult to repair and maintain, the necessary anchor embedment lengths are problematic to obtain, and they are potentially damaging to the top of the culvert barrel.

Concrete rigid barrier or bridge traffic railing is typically not used due to the short length of culverts, unless continued along the roadway for other reasons.

215.4.6.6 Temporary Barriers

Installation instructions and flare rates are given in ***Standard Plans***, ***Indexes 102-100***, ***102-110***, ***102-120*** and ***102-600***.

A temporary or permanent pavement surface with a maximum cross slope of 1:10 is required when a temporary barrier is used. Refer to ***Standard Plans***, ***Index 102-100*** for setback distance and asphalt pad requirements.

Show or note the location of temporary barriers in the Temporary Traffic Control (TTC) Plans. Also provide a Work Area Access Plan for projects with work zones shielded with a barrier. For additional information regarding TTC Plans, refer to ***FDM 240***.

The presence of barriers on both shoulders may eliminate any effective shoulder width or refuge area. The effective shoulder width is required to ensure an area is available for both disabled vehicles during normal traffic conditions and access for emergency responders during stopped conditions. Therefore, on interstate, freeway, and expressway projects requiring barriers on both sides of the work zone traveled way, provide a minimum 10-foot lateral offset from the edge of the traveled way to the barrier on at least one side of the roadway. Providing refuge to the outside is preferred. For conditions with more than three lanes in one direction, consider a 10-foot lateral offset on both sides of the roadway. See also, ***FDM 211.4.6*** for Emergency Shoulder Use (ESU) requirements. Existing bridges and grade-separated approaches that are not along an ESU evacuation route need not be widened to meet this requirement. Consider providing this 10-foot lateral offset on arterials and collectors. For all other applications, provide the minimum lateral offset required per ***Standard Plans***, ***Index 102-100***.

When using existing barrier during a temporary traffic control operation or when 2-way traffic is placed on a facility that is normally one-way, the existing permanent or temporary barriers must be modified as necessary to ensure their proper crashworthiness during the temporary situation. This will include eliminating non-crashworthy end treatments, snag points or other protrusions normally angled away or hidden from approaching vehicles.

Existing permanent barriers used during temporary traffic control operations must meet grading, offset, and setback (i.e., deflection space) requirements for the permanent installation.

Temporary barriers, as defined in ***FDM 215.4.1.4***, located in superelevated roadway sections must be installed on the same roadway cross slope as the travel lanes (i.e., no slope break in advance of the barrier).

215.4.7 Warrants for Roadside Barriers

The installation of roadside barriers presents a hazard in and of itself, and as such, requires an analysis for whether or not the installation of a barrier presents a greater risk than the feature it is intended to shield. The analysis should be completed using the ***Roadside Safety Analysis Program*** (***RSAP***) or in accordance with the ***AASHTO Highway Safety Manual*** (***HSM***). Refer to ***FDM 122.6*** for guidance on evaluating the benefits of shielding using ***RSAP*** or the ***HSM***.

Roadside barriers are recommended when hazards exist within the clear zone and do not meet minimum Lateral Offset, hazards cannot be cost effectively eliminated or corrected, and collisions with the hazards are more serious than collisions with the barriers.

The following conditions within the clear zone are considered more hazardous than a roadside barrier and preclude the requirement for **RSAP** or **HSM** analysis:

(1) Drop-off Hazards, as defined in ***FDM 215.3.3***.

(2) Bridge piers, abutments and railing ends.

(3) Non-traversable culverts, pipes and headwalls.

(4) Non-traversable parallel or perpendicular ditches and canals.

(5) Canals, ponds and other bodies of water.

(6) Parallel retaining walls with protrusions or other potential snagging features.

(7) Retaining walls at an approach angle with the edge of pavement larger than 7 degrees (1:8).

(8) Non-breakaway sign or luminaire supports.

(9) Trees greater than 4 inches in diameter measured 6 inches above the ground.

(10) Utility poles.

(11) Weaving Sections, as defined in ***FDM 211.12.1***.

215.4.7.1 Treatment of Roadside Hazards

If a hazard, including slopes steeper than 1:3, is present within the clear zone, eliminate or shield the hazard, except when any of the following apply:

- Longitudinal barrier or crash cushion would be a greater hazard than the hazard to be shielded
- The likelihood of striking the hazard is negligible

- The expense of shielding the hazard outweighs the benefits in terms of crash reduction as determined through the use of ***RSAP*** or ***HSM*** analyses.

If crash data or safety reports indicate that treatment of the hazard will result in fewer or less severe crashes, implement one of the following treatments, in order of priority:

(1) Eliminate the hazard.

(a) Remove the hazard.

(b) Relocate the hazard outside the clear zone.

(c) Make the hazard traversable or crashworthy.

(2) Shield the hazard with a longitudinal barrier or crash cushion.

215.4.8 Warrants for Median Barrier

Provide a median barrier on LA Facilities when:

(1) Reconstruction reduces the median width to less than what is required for the facility. Deviation from this criteria is not permitted. An ***RSAP*** or ***HSM*** analysis may be used to evaluate barrier alternatives and supplement the following requirements.

(2) One or more crossover crashes have occurred in the most recent 5-year period within the limits of 1 mile in advance of the exit ramp gore to 1 mile beyond the entrance ramp gore. The District may require shielding outside these areas after reviewing the most recent 5-year crash history.

On divided arterial and collector projects with design speed greater than 45 mph, review the most recent 5-year crash history for crossover crashes to determine if shielding with a median barrier is warranted. Consider alignment, sight distance, median width and frequency of median openings when evaluating the facility.

215.4.9 Positive Protection in Work Zones

For locations where work zone traffic barriers (i.e., Temporary Barriers) are required, refer to ***Standard Plans***, ***Index 102-600***. Work zone traffic barriers have four specific functions:

(1) Protect traffic from entering work areas (e.g., excavations or material storage sites).

(2) Provide positive protection for workers.

(3) Separate two-way traffic.

(4) Protect construction such as false work for bridges and other exposed objects.

Anticipate when and where barriers will be needed and include this information and the quantities on the Plans. Consider positive protection devices in work zone situations that place workers at increased risk from vehicular traffic, and where positive protection devices offer the highest potential for increased safety for workers and road users, such as:

(1) Work zones that provide workers no means of escape from vehicular traffic (e.g., tunnels, bridges).

(2) Long duration work zones (two weeks or more at the same location) resulting in substantial worker exposure to vehicular traffic.

(3) Projects with anticipated Work Zone speeds greater than 45 mph, especially when combined with high traffic volumes.

(4) Work operations that place workers close to travel lanes open to traffic.

(5) Roadside hazards (e.g., drop-offs, unfinished bridge decks) that will remain in place overnight or longer.

Modification for Non-Conventional Projects:
Delete the first sentence of the above paragraph and see RFP for requirements.

215.4.9.1 RRR Evaluation of Shielding in Work Zones

Temporary shielding is not required on RRR projects where existing aboveground objects or drop-offs are located within the “Clear Zone Widths for Work Zones” (See ***Standard Plans, Index 102-600)*** when both of the following conditions are met:

- Existing aboveground objects and drop-offs will remain unshielded in the permanent condition

- The lateral offset to the existing aboveground objects or drop-offs will be the same during construction

215.5 Attachments to Barriers

Allowable attachments to flexible or semi-rigid barriers (discontinuous or continuous) are detailed in the ***Standard Plans***.

Use ***Standard Plans***, ***Index 700-012*** for signs attached to rigid barrier. ***Standard Plans***, ***Index 700-013*** can only be used to mount permanent signs to non-median rigid barriers when there is insufficient space for ***Standard Plans***, ***Index 700-012*** and the sign is critical to safety.

Design and detail attachments to rigid barriers in accordance with ***SDG*** ***1.9***. Provide setback distances as shown in ***Table 215.4.2*** and ***Figure 215.4.7*** to non-crash tested discontinuous items (e.g., light poles, sign supports, traffic signal controller boxes, flood gauges) that are attached to or behind rigid barriers located along the outside shoulder. Discontinuous items located within these setback distances must be crash tested to or accepted as TL-3, at a minimum, under ***NCHRP 350*** or ***MASH*** as attachments to traffic railings.

For continuous items attached to rigid barriers, refer to the requirements of ***FDM 215.4.6.1***.

Fender access ladders are exempt from these requirements. Sign panels may be placed within the given setback distances, however the setback to the sign support must be increased to assure sign panels do not extend past the top inside face of the traffic railing.

215.5.1 Median Barrier Attachments

215.5.1.1 Light Poles and Sign Supports

Use ***Standard Plans***, ***Index 715-002*** for light poles installed in conjunction with concrete median barriers or traffic railings. Overhead sign supports may be located on rigid barriers within the median to reduce span or cantilever lengths and provide more cost-effective designs. When placing overhead sign supports on rigid barriers within the median, project specific details that supplement ***Standard Plans***, ***Index 521-001*** (e.g., foundation and reinforcement details) are required to be shown in the Plans.

Single column sign supports mounted on rigid barriers within the median are permitted only when requirements for sign visibility cannot be met by placing the sign supports on the outside of the shoulder barrier or beyond the shoulder. If single column sign supports must be mounted on a median traffic railing, utilize ***Standard Plans***, ***Index 700-013***. The signs listed in ***FDM 230.2.5*** are the only permanent signs that may be used with ***Standard Plans***, ***Index 700-013***.

These requirements also apply to attachments made to back-to-back outside shoulder rigid barriers that are located so close together that the required setback distances cannot be provided for both barriers. The bridge traffic railings and supporting decks shown in ***Figure 215.4.7*** that are located back-to-back are exempt from these requirements.

215.5.1.2 Opaque Visual Barrier

Opaque Visual Barrier is used on top of median concrete barrier and traffic railing to reduce headlight glare from opposing traffic lanes. Opaque Visual Barrier may be considered on LA Facilities that have glare issues when the facility has high-traffic volumes and a separation between opposing traffic lanes of 26 feet or less.

When Opaque Visual Barrier is used, a minimum shoulder width of 4 feet is required on both sides of the median concrete barrier or traffic railing.

Standard Plans**, Index 521-010* and the associated ***Standard Plans Instructions provide additional information.

215.5.2 Existing Attachments to Barriers and Traffic Railings

Evaluate existing rigid barrier attachments on a case-by-case basis to ensure they are installed in accordance with the ***FDM*** and ***Standard Plans***, ***Indexes 700-012***, ***700-013***, or ***715-002***. Remove existing attachments not meeting these requirements.

215.5.3 Temporary Attachments to Barriers

Standard Plans, ***Index 700-012 or Index 700-013*** may be used for temporary work zone signs when the application of ***Standard Plans***, ***Index 102-600*** cannot be achieved. Use ***Standard Plans**, Index 700-012* only when mounting to the top of the barrier/railing places the sign panel closer than 2 feet from the traveled way.

For additional information on the design of temporary lighting in combination with temporary barrier, refer to ***FDM 240.4.2.13***.

215.6 Surface Finishes

Class 5 coatings, tints or stains may be applied to roadway concrete barrier walls in order to be compatible with the treatment of bridge or retaining wall mounted traffic railings or for corridor uniformity. Approval by the District Design Engineer is required for the use of Class 5 coatings, tints, or stains. Abrupt changes of aesthetic treatment of barriers, railings, or parapets from a bridge to a roadway should be avoided. See ***SDG***, ***Section 1.4.5*** for the policy on bridge, noise wall and retaining wall surface finishes.

The Department will cover the cost for coating, tints or stains on roadway concrete barriers only as described above. If a Local Maintaining Agency desires a roadway concrete barrier with coatings, tints or stains and the concrete barrier does not qualify for such treatment as determined by the Department, the barrier may be treated with approval by the District Secretary. The Local Maintaining Agency must provide the additional construction funding for the coatings, tints, or stains and must commit to cover the associated maintenance costs for the service life of the barrier.

215.7 Existing Barrier Systems

When barrier systems are present on a project for which reconstruction of the roadside is not required, the existing barrier should be evaluated to determine if the barrier meets current structural, functional, and crashworthy requirements. Remove or replace any barrier installation which is found to be non-crashworthy or crash tested prior to ***NCHRP 350*** test criteria. The evaluation should consider the following:

(1) Warrants for the barrier. See ***FDM 215.4.4***.

(2) Length of need.

(3) Guardrail panel height.

(4) Offset at terminal end.

(5) Clear deflection distance between the barrier and the shielded object.

(6) Placement with respect to the traveled way, or face of curb.

(7) Placement on the proper slope.

(8) Clear recovery area behind gating end terminals.

(9) Overall condition of the barrier system.

(10) Post type and spacing.

In addition to the above evaluation requirements, existing roadside safety hardware must comply with the requirements of the following Sections.

215.7.1 Resetting Guardrail

For installations of guardrail where the barrier is determined to be deficient or requires relocating due to other work, but otherwise determined to consist of panels in good condition, the guardrail may be reset. If the guardrail system is determined to be non-reusable, remove, and replace with new guardrail. Refer to ***Standard Specification 538*** for additional information on reusable and non-reusable guardrail components.

When resetting existing guardrail, the guardrail will be reinstalled as ***31” Guardrail*** reusing existing guardrail panels and posts (steel only) as shown in the current ***Standard Plans**, **Index 536-001***. This resetting requires panels be reinstalled with the panel splices located at the midspan; therefore, consideration must be given to the effect this will have on the overall system length and if adjustments to the Begin/End Guardrail Station are needed.

Guardrail approach transition connections to rigid barrier, approach terminals, and trailing anchorages must be replaced with new hardware, panels, and posts when resetting guardrail.

215.7.2 Existing Longitudinal Roadway Barriers

Existing longitudinal guardrail sections that do not conform to ***31” Guardrail*** must be upgraded or replaced, with the following exceptions:

(1) ***27” Guardrail*** – Existing W-Beam guardrail installations installed to a 1’-9” mounting height (27” top height), meeting the requirements of the ***2013 Design Standards*** with regards to delineation, height, deflection distance, grading, mounting hardware, length of need, and consisting of crashworthy end treatments tested to at least ***NCHRP 350***, is acceptable and allowed to remain in place.

(2) ***Thrie-Beam Guardrail*** – Existing Thrie-Beam guardrail meeting the installation requirements of ***2013 Design Standards*** and consisting of crashworthy end treatments tested to at least ***NCHRP 350***, is acceptable and allowed to remain in place.

(3) ***Steel Blocks*** – Existing ***27” Guardrail*** constructed with steel blocks, which is not being evaluated for upgrading according to the criteria above, may remain in place for projects with Design Speeds ≤ 45 mph.

Replacing or resetting existing ***27” Guardrail*** to meet the ***31” Guardrail*** mounting height requirement is at the discretion of the District. Typically, if 50% or more of an existing run of ***27” Guardrail*** is affected or if the existing installation is extended by 50% or more, the entire run should be replaced or reset with ***31” Guardrail***. The required clear deflection distances for ***31” Guardrail*** are greater than the requirements for ***27” Guardrail*** and should be considered when resetting guardrail to the new height.

Modification for Non-Conventional Projects:
Delete the last paragraph and see RFP for requirements.

Existing concrete barriers conforming to the current ***Standard Plans***, ***Index 521-001***, F-Shape, New Jersey shape barriers, and approved vertical faced concrete barriers may remain in place. Other concrete barrier shapes must be replaced.

Replacements and new installations must conform to the current ***Standard Plans***.

See ***FDM 215.4.5.4*** and ***SDG, Section 2.6***, for barrier requirements for Pier Protection.

215.7.3 Existing End Treatments & Crash Cushions

Evaluate end treatments to ensure adequate length of need is provided and meet crashworthiness requirements. Remove or replace end treatments and crash cushions which are found to be non-crashworthy or crash tested prior to ***NCHRP 350*** test criteria. Existing guardrail end treatments must be upgraded or replaced unless they conform to one of the systems identified on the ***APL***, the current ***Standard Plans***, or the ***2013 Design Standards***.

Replacements and new installations must conform to the current ***Standard Plans***.

215.7.4 Existing Bridge Traffic Railing

Evaluate bridge traffic and pedestrian railings for conformance to current ***FDM*** criteria and ***Standard Plans*** whenever improvements are made to a bridge or its approach roadway. For non-compliant bridge railings:

(1) Retrofit bridge railing to bring them up to current standards, or

(2) Replace bridge railing, or

(3) Process a Design Variation, provided that a subsequent project that will remedy this condition is scheduled within a reasonable time.

See ***SDG*** 6.7 for traffic railing requirements, and ***SDG*** 6.8 and the following for pedestrian railing requirements.

Remove existing fences that are not in compliance with ***Standard Plans, Indexes 550-010*** or ***550-011***, and existing pedestrian railings that are mounted on existing traffic railings located between the shoulder and the sidewalk (a.k.a. "inboard" traffic railings). Replace or retrofit the existing pedestrian railing or fence rather than completely removing it if there is a documented issue of traffic incidents involving pedestrians (at the site before installation of the existing pedestrian railing or fence on the inboard traffic railing) that would likely reoccur if the existing installation were to be removed. Use ***Standard Plans, Indexes 550-010*** or ***550-011***, or another crashworthy pedestrian railing or fence that is compatible with the traffic railing, as appropriate. Retrofit existing bullet-type railings that are to remain on inboard traffic railings and that do not have the bullet railing member(s) oriented towards the traffic side of the railing to match ***Standard Plans***, ***Index 515-021***.

Retrofit existing installations of ***Standard Plans***, ***Index 515-021***, and other similar bullet-type railings, to include rail splice assemblies and tapered end transitions as shown on ***Standard Plans**, **Index 515-022*** if they are not present. Retrofit the ends of other existing crashworthy traffic railing mounted pedestrian railings to include a similar tapered end transition, or other appropriate approach end transition, if one is not present.

215.7.5 Existing Guardrail to Bridge Railing Transitions

Existing guardrail to bridge traffic railing approach and trailing end transition connections must be upgraded or replaced unless they conform to one of the following systems:

(1) For approach ends of existing standard New Jersey Shape, F-Shape, and Single-Slope bridge traffic railings:

  (a) The nested Thrie-Beam approach transition shown as in the current ***Standard Plans*** or the ***2013 Design Standards***, ***Index 400***.

  (b) For retrofitted installations, the appropriate nested Thrie-Beam transition shown in the current ***Standard Plans*** or the ***2013 Design Standards***, ***Index 402***.

  (c) For a design speed ≤ 45 mph the nested w-beam approach transition shown as ***Detail J*** in the ***1998 Roadway and Traffic Design Standards***, ***Index 400***, Sheet 7 of 21. This detail is also shown in the ***2000 Roadway and Traffic Design Standards***, ***Index 401***, Sheet 1 of 9.

(2) For approach ends of existing bridge traffic railing retrofits constructed in accordance with the ***1987 through 2000 Roadway and Traffic Design Standards**, **Index 401**, Schemes 1 and 19, "Concrete Safety Barrier"*:

  (a) The appropriate nested Thrie-Beam transition shown in ***Standard Plans***, ***Index 536-002***.

  (b) For design speeds ≤ 45 mph the w-beam approach transition shown as ***Detail J*** in the ***1987 Roadway and Traffic Design Standards***, ***Index 400***, Sheet 9 of 13, upgraded as shown in the ***2013 Design Standards***, ***Index 403*** by the installation of a nested section of W-beam guardrail, additional guardrail posts and offset blocks and a transition block if a curb is not present beyond the bridge end.

  (c) For design speeds ≤ 45 mph the nested W-beam approach transition shown as ***Detail J*** in the ***1998 Roadway and Traffic Design Standards*** Sheet 7 of

21, upgraded as shown in the ***2013 Design Standards***, ***Index 403*** by the installation of a transition block if a curb is not present beyond the bridge end.

(3) For trailing ends of existing bridge traffic railing retrofits constructed in accordance with the ***1987 through 2000 Roadway and Traffic Design Standards**, **Index 401**, *Schemes 1 and 19, “Concrete Safety Barrier”:*

(a) In the absence of additional hazards on the trailing end, no end treatment is required.

(b) When additional hazards are present on the trailing end, a w-beam trailing end treatment as shown in ***Standard Plans***, ***Index 536-001***.

(4) For approach ends of existing structurally continuous Post and Beam bridge traffic railings that are not being retrofitted per ***FDM 215.7.4***:

(a) A custom designed nested Thrie-Beam approach transition based on the current ***Standard Plans***, ***Index 536-001***.

(b) A nested Thrie-Beam approach transition based on the current ***Standard Plans***, ***Indexes 536-002***, ***521-404*** or ***521-405***.

(c) A custom designed nested Thrie-Beam approach transition based on the ***1987*** through ***2000 Roadway and Traffic Design Standards**, **Index 401**, *Scheme 29.*

(5) For trailing ends of existing structurally continuous Post and Beam bridge traffic railings that are not being retrofitted, per ***FDM 215.7.4***:

(a) In the absence of additional hazards on the trailing end, no end treatment is required.

(b) When additional hazards are present on the trailing end, a w-beam trailing end treatment as shown in the current ***Standard Plans***, ***Index 536-001*** or the ***1987*** through ***2000 Roadway and Traffic Design Standards***, ***Index 401***.

(c) When additional hazards are present on the trailing end, a custom designed nested Thrie-Beam approach transition based on any design listed in No. 4 above.

(6) For trailing ends of existing standard New Jersey Shape, F-Shape, and Single-Slope traffic railings:

(a) The w-beam to Special End Shoe connection shown in the 1980 through FY2016-17 Design Standards, Index 410.

Guardrail replacements and new installations connecting to standard New Jersey Shape F-Shape, and Single-Slope bridge traffic railings must conform to the current ***Standard Plans***, ***Index 536-001***. For guardrail retrofits connecting to existing bridge traffic railings, see the current ***Standard Plans***, ***Indexes 536-002*** or ***460-477*** and their associated ***Standard Plans Instructions***.

Guardrail replacements, retrofits and new installations connecting to structurally continuous post and beam bridge traffic railings must conform to ***Standard Plans***, ***Indexes 521-404*** or ***521-405*** and their ***Standard Plans Instructions***. See the ***Standard Plans Instructions*** for details of structurally continuous post and beam traffic railings.

215.8 Non-Standard Roadside Safety Hardware

The use of Non-Standard Roadside Safety Hardware must be approved by the State Roadway Design Office (RDO). Roadside Safety hardware that is not listed on the ***APL*** and not shown in the ***Standard Plans*** is considered Non-Standard. The ***APL*** includes proprietary devices and products that have been evaluated for compliance with FDOT ***Standard Specifications*** and the ***Standard Plans***. The majority of proprietary roadside safety hardware eligible for use on the State Highway System are identified on the ***APL***. However, the devices included on the ***APL*** may not cover every roadside safety application. Unique situations will sometimes require unique devices. Examples of available devices that are not covered by the ***APL*** include but are not limited to barrier wall gates, aesthetic guardrail, temporary steel barriers, and crashworthy stop gates. When the need arises for a unique crashworthy device not included on the ***APL***, carefully investigate the applicability of the device for the situation, as well as the crash performance characteristics of the device. For some of these devices, the State Roadway Design Office (RDO) may have information and be of assistance in establishing the appropriateness of the device for a given situation.

Provide the following documentation when requesting the approval of a device not included in the ***Standard Plans*** or ***APL***:

(1) FHWA, Federal-Aid Reimbursement Eligibility Letter

(2) Crash Test Reports, including review of test results. Performance characteristics must be reviewed, including post impact vehicle behavior and post impact test article deflection, and debris scatter.

(3) Compatibility with adjacent and/or connecting standard roadside safety devices.

(4) Maintenance requirements and characteristics, including coordination with the District Maintenance Office.

(5) For devices such as barrier gates, operational plans, and training as appropriate.

Project specific plan details, technical special provisions (TSP), and method of payment will be required and must be coordinated with the appropriate Department Offices.

Other barrier designs may be required by specific site conditions. Site specific conditions are identified and detailed in the plans.

216 Earthwork

216.1 General

Earthwork is a generic term for all items of work, materials and operations required to construct the excavated areas and the embankments of a project.

FDOT Specifications ***Sections 110***, ***120***, and ***125*** define the terms, method of measurement, basis of payment, and pay items associated with earthwork.

Earthwork on a highway project generally consists of:

- **Clearing and Grubbing** – Removal of existing pavement to prepare the area for proposed construction. See ***Standard Specifications*** ***Section 110*** for additional requirements.
- **Embankment –** Compacted fill material needed to construct the roadway. See ***Standard Specifications*** ***Section 120*** for additional requirements.
- **Regular Excavation –** See ***Standard Specifications*** ***Section 120*** for additional requirements.
- **Subsoil Excavation –** See ***Standard Specifications*** ***Section 120*** for additional requirements.
- **Excavation for Structures and Pipe –** See ***Standard Specifications*** ***Section 125*** for additional requirements.

The roadbed is constructed by excavating soil from cut sections and placing soil as embankments in fill sections. A summary of the most common cut and fill sections are described in this chapter.

216.2 Classification of Soils

The Department uses a system of soil classification that places materials into groups and subgroups based on soil fraction, liquid limit, and plasticity index. This classification determines if and where the materials may be placed or left in their existing position on a project. The soils survey, testing and classification of materials must be performed by a qualified geotechnical laboratory. The plans will include the information about the soil classification on the soil survey sheet and by showing the boring data soil boxes on the cross-section sheets. If it is determined that an organic or plastic material must be removed below the finished graded surface, the lower limits of removal of organic or plastic material will be shown to determine the area and volume of subsoil excavation.

216.3 Cross Sections

The details of cut and fill of earthwork are shown on the cross sections. The cross sections of the existing surface are usually obtained by location field survey or photogrammetry. The finished profile grades, typical section details, pavement design details, superelevation and horizontal alignments are used in combination to develop the finished surface at each location where an existing cross section was obtained or generated. Sometimes it is advisable to develop and plot intermediate cross sections or half-sections to accurately determine quantities.

Cross sections cannot be finalized until late in the design process. However, preliminary cross section surfaces, developed early in the design process, can assist the designer in establishing many of the other design elements such as guardrail, shoulder gutter, inlets, and special ditch grades. Preliminary cross sections are also used in performing the Soils Survey. Cross section surfaces should be plotted as soon as the alignment, profile grades and typical section details are established.

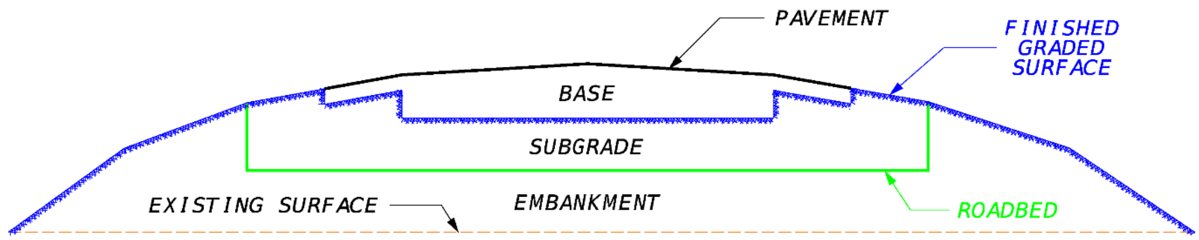
For guidance see ***FDM 905***.

216.4 Earthwork Pay Items

Standard Specifications, ***Sections 120*** and ***125*** define the terms, method of measure, basis of payment, and pay items associated with earthwork. Two terms that are relevant to quantifying earthwork pay items are: existing surface and finished graded surface. The existing surface is defined as the contour of existing natural topography. The finished graded surface (illustrated in ***Figure 216.4.1***) is defined as the contour of the finished side slopes, unpaved shoulders, and the bottom of the roadway base and shoulder base for flexible or rigid pavement.

Figures 216.4.2 through 216.4.5 illustrates cut and fill limits and details. Additional criteria and earthwork details are found in the ***Standard Plans, Indexes 120-001, 120-002,*** and ***160-001***.

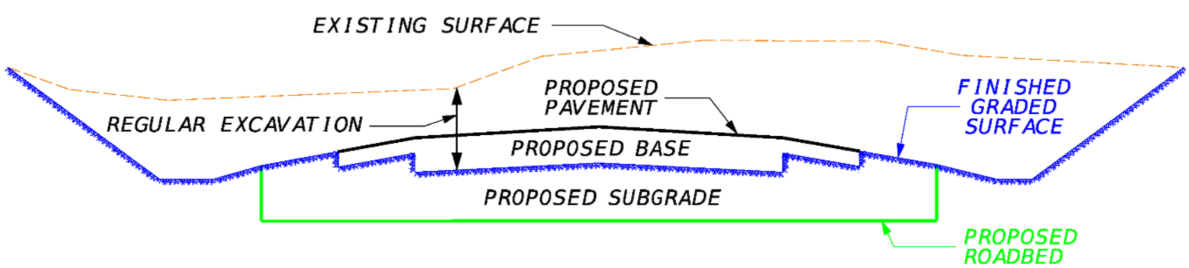
Figure 216.4.1 Finished Graded Surface



Projects are constructed over natural topography (Case I) or over existing roadbeds (Case II). Project may also have sections where both Case I and Case II apply.

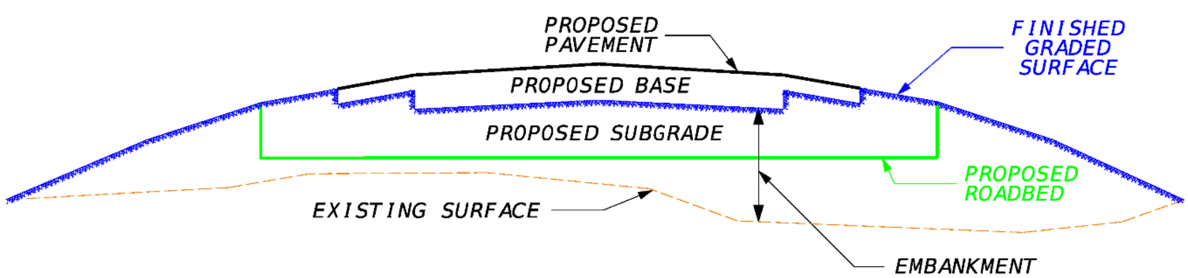
For Case I projects, calculate the Excavation quantities from the existing surface to the finished graded surface.

Figure 216.4.2 Case I Excavation



Calculate the Embankment quantities from the existing surface to the finished graded surface.

Figure 216.4.3 Case I Embankment



Case II projects may or may not include the removal of existing base material or removal of existing concrete pavement. According to ***Standard Specification*** ***120-4.2***:

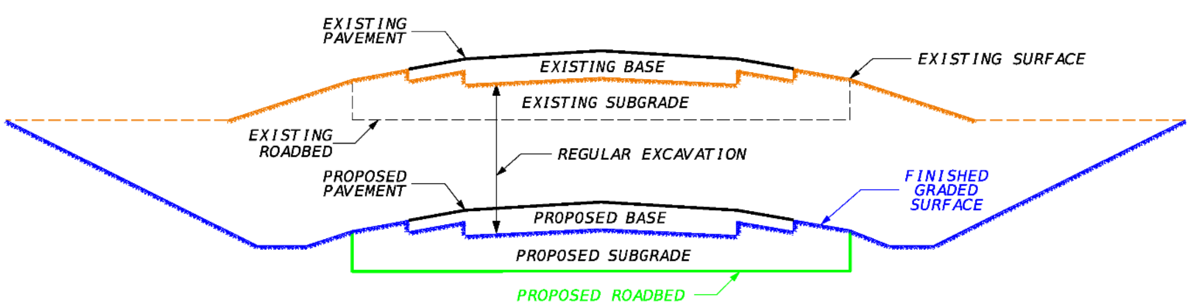
- Only the asphalt on existing flexible pavement roadways will be removed (not base material) unless shown in the Plans; and,

- Existing concrete pavement is only to be removed when called for in the Plans.

Coordinate with the District Pavement Materials Office (DPMO) to determine if removal of existing flexible pavement base or concrete pavement is required. If the existing flexible pavement base or the existing concrete pavement are to be removed, this must be indicated in the Plans and included in the Clearing and Grubbing pay items.

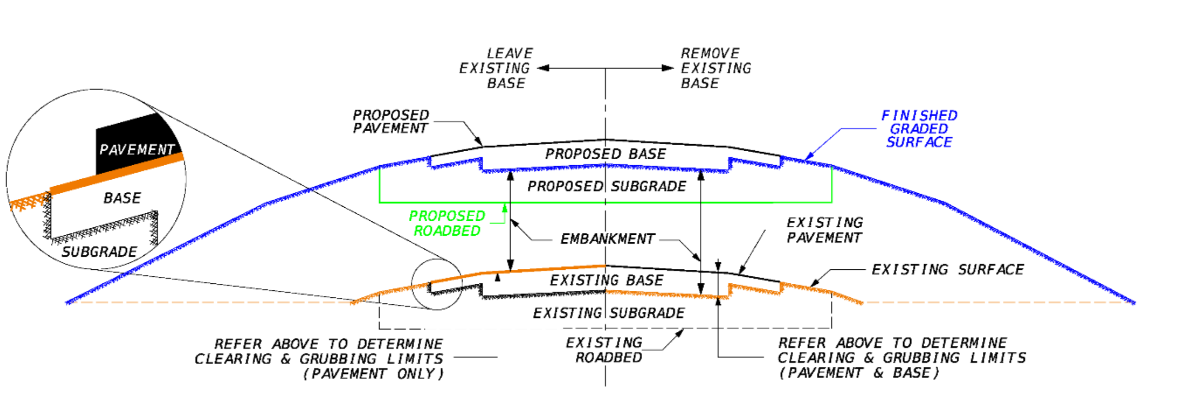
Calculate the Excavation quantities for a new roadway as shown in ***Figure 216.4.4***. For Case II projects, calculate the Excavation quantities from the existing surface to the finished graded surface of the new road; or if concrete pavement removal is called for in the plans, the calculation is taken from the bottom of the existing concrete to the finished graded surface of the new road.

Figure 216.4.4 Case II Excavation



Calculate the embankment quantities for a new roadway as shown in ***Figure 216.4.5***. Calculate the Embankment from the top of the existing base to the finished graded surface of the new road (***Figure 216.4.5*** Left) or, if the base removal is called for in the plans, calculate the Embankment from the bottom of the existing surface (finish graded surface) to the finished graded surface of the new road (***Figure 216.4.5*** Right). If concrete pavement removal is called for in the plans, the calculation is taken from the bottom of the existing concrete to the finished graded surface of the new road.

Figure 216.4.5 Case II Embankment



216.4.1 Regular Excavation

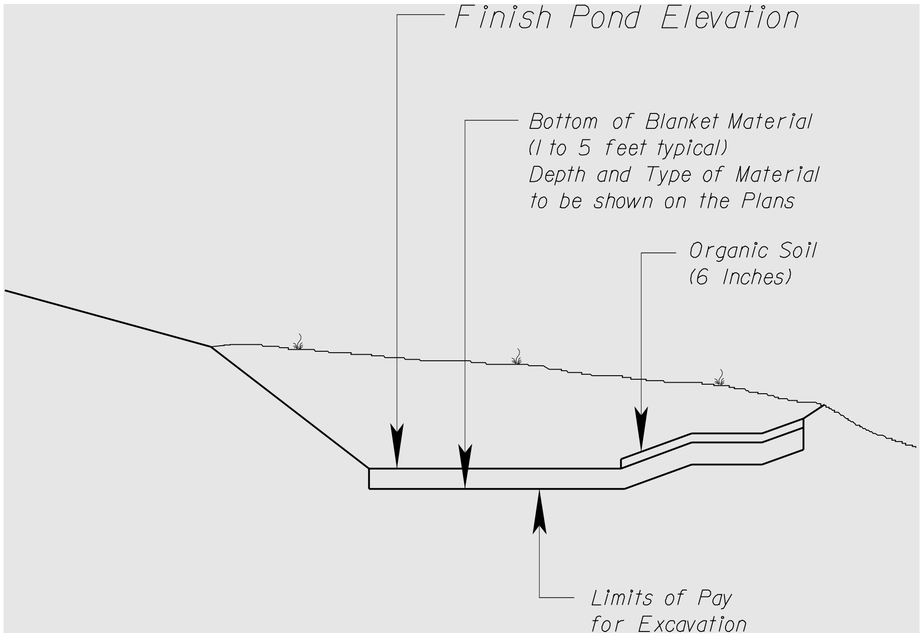
Regular excavation is the most general classification of earthwork excavation. Regular excavation consists of the excavation and the utilization or disposal of all materials necessary for the construction of the roadway, ditches, channel changes, etc., except for removal of existing pavement as defined in ***Standard Specifications*** ***Section 110***. When Lateral Ditch or Channel excavation pay items are not called for in the plans, the total quantity of all excavation must be paid for as Regular Excavation.

216.4.1.1 Stormwater Treatment Ponds

Retention or detention areas that require considerable excavation should be summarized separately and added to the Regular Excavation. This is especially important if there is a large quantity and the area is removed from the project by some distance.

Some environmental permits now require that the plans call for excavating additional depth below the finish elevation of the bottom of a pond or ditch. They also require that the area of extra depth be replaced with “blanket material” that will either allow for percolation or not allow for percolation as required by the permit. ***Figure 216.4.6*** shows the limits of pay for excavation in this situation. The depth and type of fill material must be identified in the plans.

Figure 216.4.6 Pond Surface



216.4.1.2 Regular Excavation (RRR Projects Only)

The pay item for Regular Excavation (RRR Projects Only) Lump Sum is used on resurfacing (RRR) projects that meet the following conditions:

(1) There are limited or no cross sections on the project.

(2) Existing typical sections are reasonably consistent throughout the project.

(3) If utility adjustments are a consideration on the project, the designer will need to be sure that sufficient data is available to allow the utility to be relocated or adjusted.

(4) There are no right of way requirements on the project.

(5) There is no change in the existing horizontal or vertical alignment.

(6) There are no major special ditches on the project.

(7) There are no major intersection modifications.

(8) Show quantity of Excavation in Summary of Earthwork but pay for as 1 Lump Sum.

Regular Excavation (RRR Projects Only) - Lump Sum may be used on intersection improvements and minor widening projects if they comply with the same conditions listed above.

Earthwork will be paid for as Borrow Excavation (Truck Measure) and Regular Excavation (RRR Projects Only) – Lump Sum. The designer will calculate these quantities based on information obtained from the field and the proposed typical section. The designer must conduct a thorough field review to ensure existing field conditions are accurately reflected in earthwork estimates.

216.4.2 Subsoil Excavation

Subsoil Excavation is defined in ***Standard Specification* Section 120-2.3**.

The soils investigation survey documents the organic or plastic material found on the project. Likewise, the cross sections and the earthwork calculations must use the lower limits of removal of organic or plastic material in determining the quantities for Subsoil Excavation.

Where future widening of the roadway is anticipated, specify the limits of removal necessary to accommodate the future widening.

At some locations the complete removal of organic or soft soils may not be practical due to the depth. Review the subsoil excavation with the Geotechnical Engineer of Record and where constructability concerns exist, consult with the District Geotechnical Engineer to review design alternatives. If a geosynthetic reinforced design is selected, refer to ***FDM 263*** for plan content and design requirements. Additional information concerning geotechnical design can be found in the ***Soils and Foundations Handbook***.

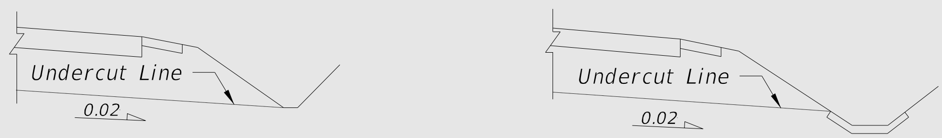
Where subsoil excavation is required due to plastic soils, ensure that adequate drainage of the pavement subgrade is provided. ***Figure 216.4.7*** illustrates the required excavation undercut line (i.e., grade and extent of excavation bottom) for flush shoulder roadways. To accommodate normal undercuts, the side ditches should be at least 3.5 feet below the shoulder break.

For curbed roadways, additional subsoil excavation may be needed beyond that shown in ***Figure 216.4.7*** or underdrains must be installed in accordance with ***Standard Plans*, Index 120-002**. Coordinate the removal of plastic materials with the Drainage Engineer of Record, as it may affect various drainage design elements including the profile grade of the ditch bottoms.

The embankment quantities (areas and volumes) may be checked by calculating the areas and volumes required to fill the excavated areas created by subsoil removal. See example given in ***Figure 216.4.8***.

Do not include the payment for subsoil excavation in the pay quantities for other items no matter how small the subsoil quantity.

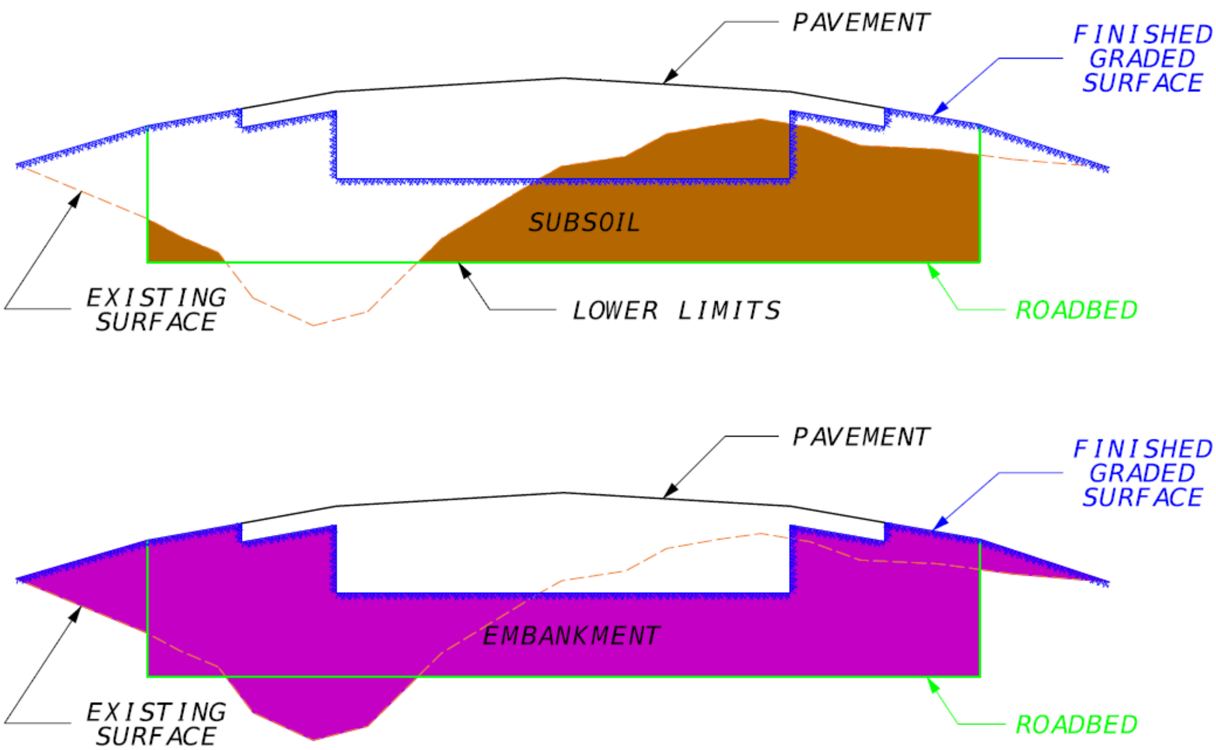
Figure 216.4.7 Undercut Detail of Plastic Material with Relation to Side Ditches



At locations where plastic material is being removed, the side ditches must be at least as deep as the undercut line to allow subgrade soils to drain.

Where paved side ditches are used in areas of removal of plastic material, the top of the ditch pavement must be below the undercut line.

Figure 216.4.8 Excavation and Embankment



Embankment (fill) or Regular Excavation (cut) should be used in conjunction with the pay item Subsoil Excavation. Both Embankment and Regular Excavation are plan quantity items. The quantities are based on the line and grades shown in the plans and would allow construction personnel to field verify the quantities of material used on a project. Subsoil Excavation is a field measure item, and the final pay quantity will be determined by cross section taken when the removal of the material is completed.

216.4.3 Lateral Ditch Excavation

Excavation required to construct inlet and outlet ditches at structures, changes in channels of streams and ditches parallel to the right of way, but separated from the roadway surface, may be designated by the designer as Lateral Ditch Excavation.

On projects with very little of this type of excavation, this earthwork is usually included in the Regular Excavation. If there is a significant amount of Lateral Ditch Excavation, it should be detailed, calculated, and summarized separately in the Summary of Earthwork.

Quantities for ***Excavation for Structures and Pipe*** must not be included in the quantities for Lateral Ditch or other excavation pay items.

216.4.4 Channel Excavation

The pay item for Channel Excavation consists of the excavation and satisfactory disposal of all material from the limits of the channel as shown in the plans. This work is generally called for by the plans and has lines, grades, typical sections, and other details shown for excavating a channel change or a major modification to an existing channel or stream. This work may be significantly different from regular excavation or lateral ditch excavation, requiring draglines, barges, or other special equipment. It is typically detailed, calculated, and summarized separately.

216.4.5 Borrow Excavation (Truck Measure)

The pay item for Borrow Excavation (Truck Measure) is only used on projects with limited or no cross sections. It is used to indicate that the contractor is to furnish earthwork material from areas provided by him and generally outside the project limits. This could include material with a specific minimum bearing value for building up existing shoulders, when appropriate for the project.

Evaluate the availability of borrow material within the project right of way and conduct an earthwork balance assessment, prior to Phase III. Evaluate any accessibility, drainage, geotechnical, environmental, or environmental restrictions that would affect the determination of available earthwork.

When the designer chooses the method of payment as Borrow Excavation (Truck Measure), a fill adjustment must be made to the net total fill material calculated from the plans to allow for handling. An additional adjustment (truck) is added to obtain a representative volume of material required. This is not a plan quantity item, but it is very important that a realistic determination of quantities be calculated by the designer.

216.4.6 Embankment

Embankment includes placing material, as described in ***FDM 216.4***, or above the lower limits of removal of organic or plastic material, as applicable, to the bottom of the proposed roadbed. Refer to ***FDM 210.4*** and ***211.4*** for additional requirements for shoulder gutters.

216.5 Earthwork Quantities

Earthwork quantities are typically calculated using surface to surface calculation within the model. For more information, see the ***CADD 3D Modeling Course Guide*** and ***Basis of Estimates***.

Earthwork quantities may be checked by the method of average end areas:

$$\textbf{CUBIC YARDS} = \frac{\textbf{EA1 + EA2}}{\textbf{2}} \textbf{ X LENGTH / 27}$$

216.5.1 Variation in Quantities

When detailing and determining earthwork quantities, use the most probable base option within the optional base group. A plan note should also be shown in the plans stating which option was used for plotting the cross sections and calculating the earthwork quantities (see ***FDM 902***).

216.6 Summary of Earthwork

A subtotal for each group (e.g., mainline, side street, pond) should be shown in the Summary of Earthwork for each earthwork operation (subsoil excavation, regular excavation, and embankment). This summary should be shown on the Summary of Earthwork in the Estimated Quantities Report. See ***FDM 902*** for information on Estimated Quantities Report. Specify and quantify material necessary to meet the drainage design requirements, such as select material beneath swales, on fill, and ponds designed to percolate runoff.

See Chapter 8 of the ***BOE*** for examples of Summary of Earthwork.

D217 Diverging Diamond Interchanges

D217.1 General

The Developmental Design Criteria for diverging diamond interchanges can be found on the ***FDM Webpage*** at ***Developmental Design Criteria***.

See ***FDM 100*** for more information and procedure for Developmental Design Criteria.

220 Railroads

220.1 General

This chapter provides requirements for highway-railroad crossings on the State Highway System.

220.1.1 Railroad Companies

State-owned rail corridors include the Central Florida Rail Corridor and South Florida Rail Corridor.

Railroad companies currently operating in the state of Florida include:

(1) CSX Transportation, Incorporated

(2) Norfolk Southern Corporation

(3) Florida East Coast Railway Company

Short line railroad companies and terminal switching companies also operate in the state of Florida.

220.1.2 Work Near or Within Railroad R/W

A flagger must be present while any work within railroad R/W is being performed. Railroad companies often impose additional requirements as deemed necessary.

When roadway improvements are adjacent, near, above, or below the railroad R/W, there is potential for impacts to the railroad during construction or for construction materials and equipment to foul the tracks.

220.1.3 Required Coordination

Coordinate projects within or near railroad R/W as follows:

(1) New at-grade railroad crossings must be permitted in accordance with ***Section 335.141, Florida Statutes (F.S.)***. Early coordination with the Central Office is required concerning the Rail Crossing Opening/Closure Program.

(2) Coordinate the design of traffic control devices with the District Rail Coordinator who will then coordinate with the railroad company. Warning devices that are on within railroad R/W or interact with trains are installed by the railroad company.

(3) Coordinate with the District Traffic Operations Engineer to determine if a preemptive system is required.

(4) Coordinate with the Department's Central Office Freight and Multimodal Operations Office to determine if a highway-railroad at grade crossing is located within a designated Quiet Zone.

(5) Coordinate with the District Rail Coordinator when a waiver is being considered for standard lateral offset requirements for structures; see ***FDM 220.3.2***.

Some railroads may require an increase in Railroad Protective Liability Insurance greater than what is provided in the ***Standard Specifications***. The District Specifications Engineer and the District Rail Coordinator will develop a Modified Special Provision and submit it through the Central Specifications Office for special processing. For projects involving CSX Railroad use Special Provision SP0071303.

Modification for Non-Conventional Projects:
Delete ***FDM 220.1.3*** and see RFP for requirements.

220.2 Highway–Railroad At-Grade Crossing

The roadway should cross the railroad at an angle of or near 90 degrees.

Selection of the warning devices to be used is a function of the geometrics of highway-railroad at-grade crossing (e.g., alignment, profile, sight distance, cross section of both the roadway and the railroad), available R/W, and proximity to signalized intersections.

A highway-railroad at-grade crossing with a high-profiled vertical geometry is considered a "hump crossing" and can adversely affect the safety and operations of road users, posing a risk of low-clearance vehicles and trailers (e.g., low-profile vehicles, vehicles with long wheelbase, "lowboy" towing trailers) becoming stuck on the tracks. A hump crossing is defined as an at-grade crossing not meeting the dimensions and description of the detail entitled, "*Vertical Roadway Alignment Through A Railroad Crossings*" contained in ***Standard Plans***, ***Index 830-T01***.

Ensure all new construction and reconstruction at-grade crossings are in accordance with ***Standard Plans***, ***Index 830-T01***. For existing humped crossings to remain, install a Low Ground Clearance Grade Crossing (MUTCD W10-5) warning sign with LOW GROUND CLEARANCE (W10-5P) plaque.

Design considerations are discussed in the ***Florida Greenbook*** and the ***AASHTO Green Book***.

220.2.1 Traffic Control Devices

Traffic control devices (both roadway and pedestrian) for highway-railroad at-grade crossings consist primarily of signs, pavement markings, flashing light signals, and automatic gates. Consider the following when designing these devices:

(1) Roadway type

(2) Volume of vehicular traffic

(3) Volume of railroad traffic

(4) Speed of vehicular traffic

(5) Volume of pedestrian and bicycle traffic

(6) Crash data

(7) Geometrics of the crossing

Evaluate highway-railroad at-grade crossings and any of the following as a network to avoid blocking the crossing:

- Stop condition
- Roundabout
- Reduction in the number of lanes

Standards and criteria for design, placement, installment and operation of traffic control devices are located in the ***Manual on Uniform Traffic Control Devices (MUTCD),*** the Department's ***Standard Plans***, and ***Rule 14-57.013, Florida Administrative Code (F.A.C.)***.

When warning signs or signals are used in advance of a highway-railroad at grade crossing, they must be placed so as not to obstruct the view of the crossing signals.

220.2.1.1 Signing and Pavement Markings

Exhibits 220-1 through ***220-4*** provide typical signing and pavement markings for Active Grade Crossings. Refer to the ***MUTCD*** for definitions and signing and pavement markings at Passive Grade Crossings.

Do not place turning movement lane-use pavement markings on the upstream approach between the railroad crossing pavement message and the tracks.

Where intersections occur between the W10-1 sign shown in ***Exhibits 220-1*** through ***220-4*** and the tracks, place an additional W10-1 sign between the intersection and the railroad gate.

Include Railroad Dynamic Envelope (RDE) pavement markings at Active and Passive Grade Crossings on:

- State Roads,
- State-owned rails, and
- State-owned property.

Design Variations to not install an RDE are to be approved by the Chief Engineer.

The determination of slightly or significantly skewed railroad crossing is at the discretion of the EOR.

Detail RDE pavement markings in the Plans in accordance with ***Standard Plans, Index 711-001*** and the details shown in ***Exhibits 220-1*** through ***220-4***. Ensure the details in the plans include the following:

(1) Orient RDE pavement markings:

(a) In the direction of the travel lanes at all approaches upstream of the crossing (i.e., transverse to the travel lanes).

i. For slightly skewed railroads extend the RDE markings transverse across all lanes, as shown in ***Exhibits 220-2*** and ***220-3***.

ii. For significantly skewed railroads, step the RDE markings transverse across each lane, as shown in ***Exhibit 220-4***.

(b) Along the railroad (i.e., parallel to the railroad tracks) for areas between tracks and downstream of the crossing.

(c) To maximize the visibility of the RDE pattern for both the upstream and downstream sides of the track. Locate markings in a manner to ensure the “X” pattern is identifiable to the motorists and bicyclists and centered in the lanes to the extent practicable.

(2) Place RDE markings through the foul area as shown in ***Exhibits 220-3*** and ***220-4***. If the railroad owner will not allow the RDE markings through the foul area, or the substrate material will not provide an appropriate bonding surface for the markings, keep the RDE markings outside of the railroad’s foul area as shown in ***Exhibits 220-1*** and ***220-2***.

(3) Replace all skip lane lines with solid lines for the following distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance “A” plus 15 feet. For Distance “A”, see table in ***Exhibit 220-1***.

(4) Continue solid longitudinal edge line, lane line, and centerline markings through the RDE pattern, maintaining a 9-inch clear space between the RDE pattern and the longitudinal lane lines or gore areas.

(5) Refurbish all existing longitudinal lane lines, edge lines, and centerlines to remain in-place for the following minimum distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance “A” plus 15 feet. For Distance “A”, see table in ***Exhibit 220-1***.

(6) Place RPMs at 10’ maximum on center for the following distance: From stop bar to stop bar of each approach excluding the foul area, then upstream and downstream for a Distance “A” plus 15 feet. For Distance “A”, see table in ***Exhibit 220-1***.

(7) For conditions where multiple tracks are configured non-parallel to each other, maintain the typical RDE pattern and fill the gap between the tracks, as necessary.

(8) RDE markings must not interfere with any pedestrian crosswalk.

(9) Consider extending the RDE markings beyond any railroad gates to reduce potential for railroad gates to close on top of stopped vehicles.

Consider the following additional provisions for Active and Passive Grade Crossings:

- For significantly skewed angles, corridor highway lighting for the following minimum distance: From stop bar to stop bar of each approach, then upstream and downstream for a Distance “A” plus 15 feet. For Distance “A”, see table in ***Exhibit 220-1***.

- For significantly skewed angles, curves, and intersections directly adjacent to crossings, consider using additional channelization techniques for the roadway alignment. Some channelization techniques include Internally Illuminated RPMs and Tubular Markers. When crest vertical curves impede the visibility of RPMs, Tubular Markers should be used.
- Consider excluding downstream RDE pattern when traffic queuing is not expected.
- Consider the use of through lane-use arrows. For turn lanes, a route shield may be used in conjunction with the through lane-use arrow.
- Remove all existing traffic control signs and pavement markings (e.g., turning signs and turning arrow lane-use pavement markings) from the upstream approach that may lead to driver confusion on the correct turning point for downstream turning movements.
- Ensure placement of all signs allow a clear sight line to all rail signal flasher units. Sight line distance requirements vary by rail company. Consult with the operating railroad for project-specific determination of sight line distance.

For pavement marking material selection, see ***FDM 230***.
For side roads with Active and Passive Grade Crossings within 100 feet of the edge of traveled way, include W10-2, W10-3 or W10-4 signs on the mainline state road in accordance with the ***MUTCD***. Include W10-5 with W10-5P as described above in ***FDM 220.2***.

Exhibit 220-1: Railroad Crossing At Two-Lane Roadway

Exhibit 220-2: Railroad Crossing At Multilane Roadway

Exhibit 220-3: Railroad Crossing At Urban Multilane Roadway With Turn Lane

Exhibit 220-4: Railroad Crossing With Significant Skew To The Roadway

220.2.1.2 Preemption

Highway-railroad at grade crossings may require preemption of traffic signals where signalized highway intersections are in close proximity to a railroad crossing. Preemption requires the railroad and traffic signal control equipment to be interconnected with the traffic signal preempted to operate in a special control mode when trains are approaching. Preemption is required for any of the following conditions:

(1) Traffic Signal is within 200 ft of a highway-railroad at-grade crossing

(2) Highway traffic queues have the potential for extending across a nearby railroad crossing, or

(3) Highway traffic backed up from a nearby downstream railroad crossing could interfere with signalized highway intersections. A study to determine the need for preemption is required for a traffic signal within 500ft of a highway-railroad at-grade crossing

220.2.2 Surfaces

The roadway travel lanes at a highway-railroad at-grade crossing should be constructed for a suitable length with all-weather surfacing. A roadway section equal to the current or proposed cross section of the approach roadway, including any existing or proposed pedestrian walkways, should be carried through the railroad crossing. The railroad crossing surface itself should have a riding quality equivalent to that of the approach roadway. When selecting the type of crossing and the material to be used in its construction, consideration should be given to the character and volume of traffic using the roadway.

220.2.3 Quiet Zones

An at-grade railroad crossing within a designated Quiet Zone must comply with the ***Code of Federal Regulations (C.F.R.), Part 222*** and the ***Standard Plans, Index 509-070***. Quiet Zone means a segment of a rail line that includes public highway-railroad crossings at which locomotive horns are not routinely sounded.

A public highway-railroad at-grade crossing within a Quiet Zone should be equipped with a Supplemental Safety Measure identified in ***C.F.R., Part 222, Appendix A***. Allowable measures include:

(1) Gates with medians, or channelization using Type IV concrete traffic separators or Type F curb and gutter. Use of temporary channelization devices is not permitted.

(2) Four quadrant gate and three quadrant gates systems

(3) One-way streets with gates

(4) Permanent crossing closures

The railroad crossing should be evaluated to determine if driveways, minor side streets, or turn lanes in close proximity to the crossing require an additional gate.

220.2.4 Railroad Crossing Near or Within Project Limits

Review Federal-aid projects to determine if a railroad-highway at-grade crossing is within the limits of or near the terminus of the project. If such crossing exists, the project must be upgraded to meet the latest ***MUTCD*** requirements in accordance ***Title 23 United States Code (U.S.C.), Chapter 1, Section 109(e)*** and ***C.F.R. 646.214(b)***. These requirements are located in ***Chapter 8*** of the ***MUTCD***. "Near the terminus" is defined as being either of the following:

(1) If the project begins or ends between the crossing and the MUTCD-mandated advanced placement distance for the advanced (railroad) warning sign. See ***MUTCD, Table 2C-4*** (Condition B, column "0" mph) for this distance.

(2) An intersection traffic signal within the project is connected to the crossing's flashing light signal and gate.

220.2.5 Bicycle and Pedestrian Facilities

Extend proposed or existing sidewalks, bike lanes or shared use paths through the rail crossing. See ***FDM 222.2.4*** for additional information.

When a new bicycle or pedestrian crossing is added to an existing roadway, it is considered a new crossing if it is separated from the roadway. See ***FDM 220.1.3*** for information on coordinating new crossings.

220.3 Grade Separated Highway- Railroad Crossing

For railroad crossing over a roadway, the bridge must be designed to carry railway loadings in conformance with the ***American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering***. See ***FDM 260.6*** for required vertical clearances between the facilities.

Coordinate the following with the governing railroad company:

- Clearances, Geometrics and Utilities
- Provisions for future tracks
- Maintenance road requirements for off-track equipment
- Need for, and location of crash walls

The railroad company's review and approval is based on the completed Bridge Development Report (BDR)/30% Structures Plans.

Prepare the Structures Plans in accordance with the criteria obtained from the railroad company, the ***Structures Manual***, the ***Standard Plans***, and this manual.

Figure 220.3.1 illustrates the dimensions that are to be obtained from or approved by the railroad company before preparing the BDR/30% Structures Plans.

220.3.1 Bridge Width

For railroad over roadway crossing, the railroad bridge typical section is based on project requirements. For roadway over railroad crossings, see ***FDM 210*** for information on highway typical sections.

220.3.2 Lateral Offset to Face of Structure

For a roadway over a railroad crossing, measure lateral offset in accordance with ***Figure 220.3.1*** and ***Table 220.3.1***. The railroad company may accept a waiver from standard lateral offset requirements for the widening or replacement of existing bridges.

Lateral offset is measured from the centerline of outside track to the face of pier cap, bent cap, or any other adjacent structure. Minimum lateral offsets are shown in ***Table 220.3.1***.

Figure 220.3.1 Track Section

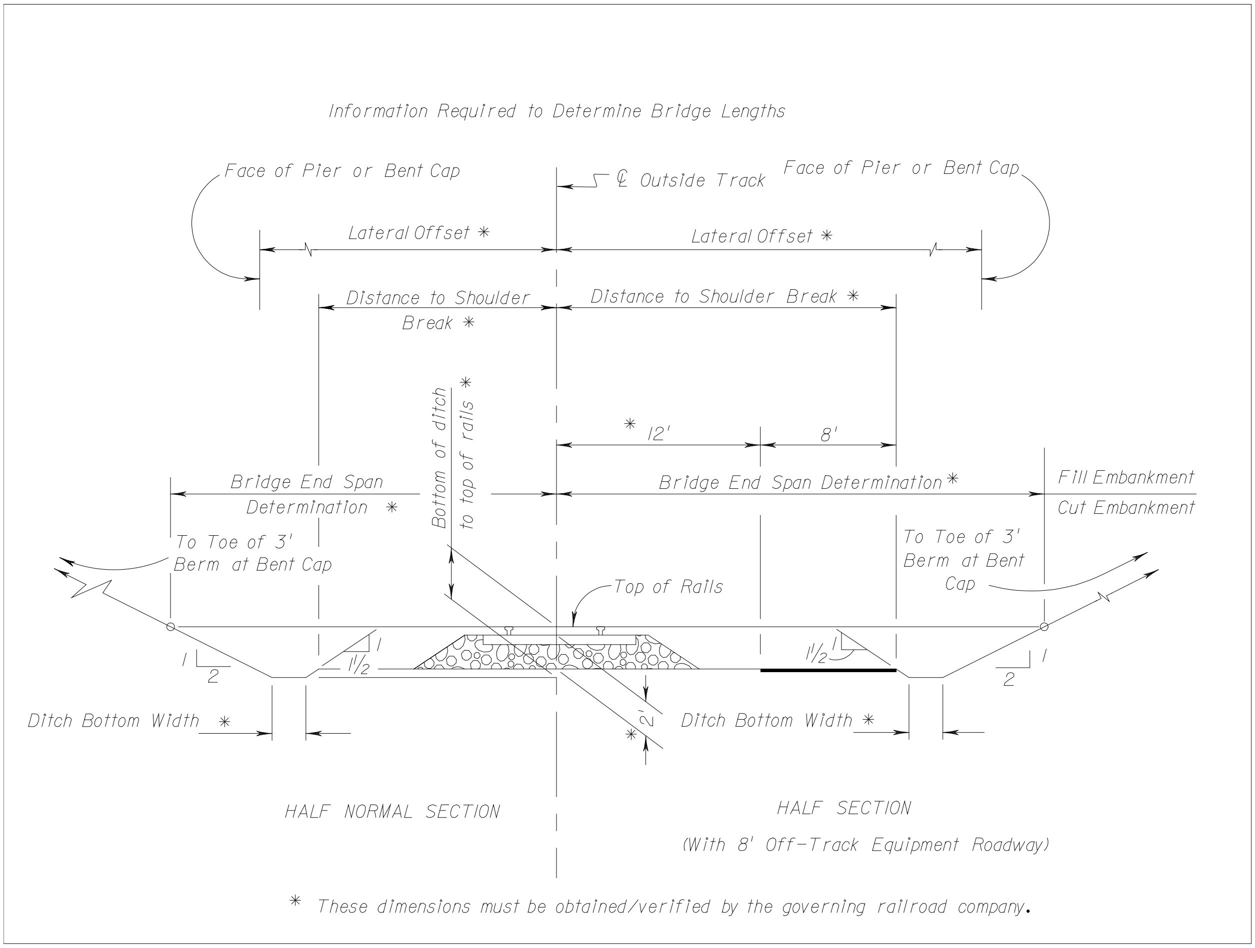


Table 220.3.1 Lateral Offsets for Railroads

Minimum Clearance Requirements	Normal Section	With 8 ft. Required Clearance for Off-Track Equip.	Temporary Falsework Opening
With Crash Walls*	18 ft.	22 ft.	10 ft.
Without Crash Walls	25 ft.	25 ft.	N/A

* See the ***Structures Design Guidelines, Section 2.6~~.7~~*** for crash wall requirements.

Provide an additional 8-ft. clearance for off-track equipment only when requested by the railroad company.

220.3.2.1 Adjustments for Track Geometry

Increase the minimum lateral offset by a rate of 1.5 inches for each degree of curvature when the track is on a curve.

Increase the minimum lateral offset on the inside of the curve by 3.5 inches horizontally per inch of superelevation when the track is superelevated.

Meet lateral offset requirements found in the ***AREMA Manual for Railway Engineering*** for extremely short radius curves.

220.3.2.2 Adjustments for Physical Obstructions

Columns or piles should be kept out of the ditch to prevent obstruction of drainage. Provide adequate lateral offset to avoid the need for crash walls unless extenuating circumstances dictate otherwise.

Figure 220.3.1 shows horizontal dimensions from the centerline of track to the points of intersection of a horizontal plane at the rail elevation with the embankment slope. This criteria may be used to establish the preliminary bridge length which normally is also the length of bridge eligible for FHWA participation; however, surrounding topography, hydraulic conditions, and economic or structural considerations may warrant a decrease or an increase of these dimensions.

220.3.2.3 Required Foundation Clearances

Place edges of footings no closer than 11 feet from centerline of the track to provide adequate room for sheeting.

220.3.3 Crash Walls

See the ***Structures Design Guidelines*** for crash wall requirements.

220.3.4 Special Considerations

Projects may include any of the following special considerations:

(1) Shoring and Cribbing requirements during construction should be accounted for in the preparation of the preliminary plans to assure compliance with required

clearances. Anything within the railroad R/W (e.g., cofferdams, footings, excavation) requires coordination with the District Rail Coordinator for approval by the railroad company.

(2) Overpasses for electrified railroads may require protection screens.

(3) Substructure supports may be located between adjacent tracks or an outside track and the off-track equipment road.

(4) Convey drainage from the bridge above the railroad away from the railroad R/W. Open scuppers are to be no closer than 25 feet to the centerline of the nearest track.

(5) The District Rail Coordinator must be contacted to see if there are any other requirements when constructing in or near their R/W.

(6) Additional consideration should be given to any utilities that may be located within the railroad R/W

220.3.5 Widening of Existing Bridge over Railroad

The requirements for widening an existing roadway or pedestrian bridge over railroad are as follows:

(1) If existing horizontal or vertical clearances are less than those required for a new structure, the design of the new portion of the structure is not to encroach into the existing clearances.

(2) Minimum vertical clearance should take into account the track grade and the cross slope of the bridge superstructure. It is desirable to widen on the ascending side of the bridge cross slope.

(3) Minimum lateral offset should take into account future changes to track geometry, physical obstructions or foundation clearances.

(4) Temporary construction vertical clearances less than 22 feet and lateral offsets less than 10 feet must be approved by the railroad company. It may not be possible to reduce already restricted vertical clearances on high volume rail lines.

(5) Meet drainage design requirements for new bridges when widened approach fills are necessary.

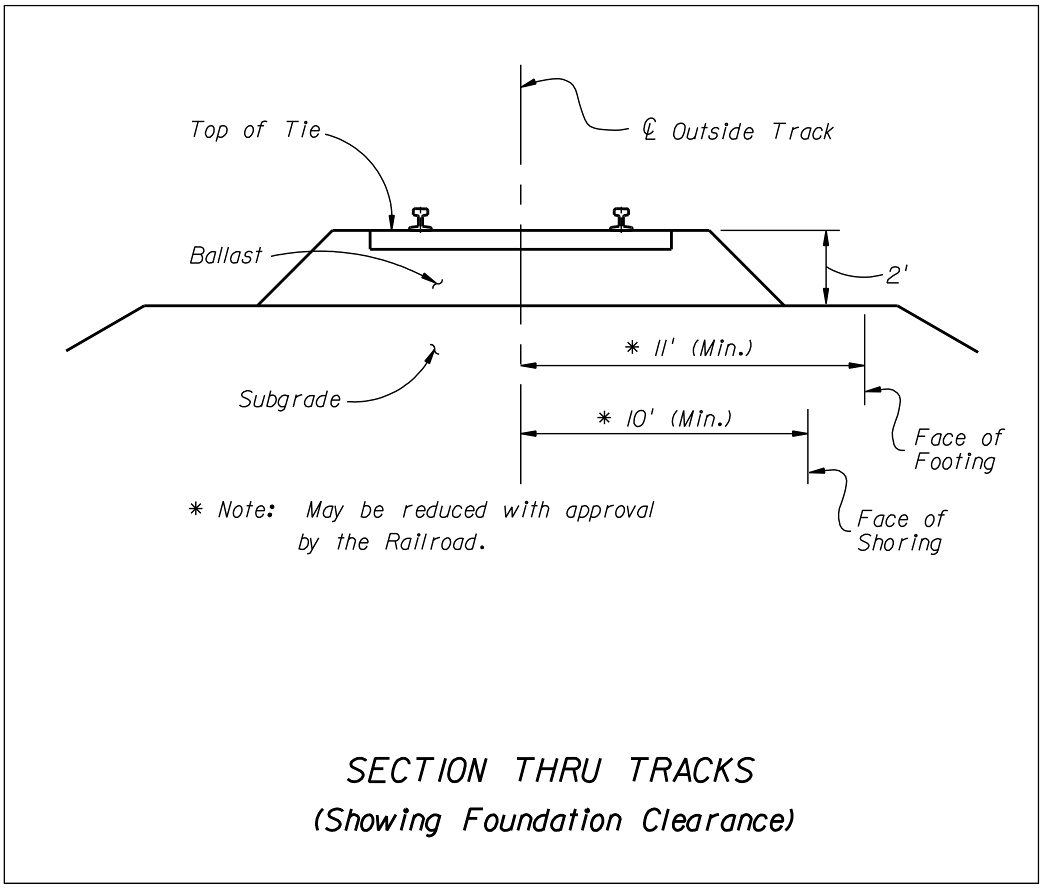
(6) Evaluate the need for crash wall protection ~~if new substructures provide less than 25 feet lateral offset from center line of track~~ in accordance with~~.~~ ***SDG 2.6***.

(7) If the existing railroad is in a cut section, special considered should be given to the length, depth, and type material of the existing cut section.

(8) In cases where demolition of the existing structure is required for attachment of the new structure over the railroad's tracks, a method of debris collection should be provided so as not to encroach within the railroad R/W.

Provide a cross section at a right angle to the centerline of the track where the centerline of bridge intersects the centerline of track in the BDR/30% Structures Plans. Where the substructure is not parallel to the track, or the track is curved, provide a section perpendicular to the centerline of the track at each substructure end.

Figure 220.3.2 Section Thru Tracks



221 Utilities

221.1 General

Identify necessary utility work (e.g., installation, removal, relocation, de-energizing, deactivation, or adjustment of utilities) that is required to construct the project. Obtain agreements or orders to schedule the identified work. Assist the Department with Utility Agency/Owner (UAO) coordination throughout the design process.

Utility work is necessary where:

(1) Working room is needed for construction

(2) Clearances are needed to comply with Department requirements

(3) Occupational Safety and Health Administration (OSHA) (***29 CFR Part 1926***) restricts crane operations

(4) National Electric Safety Code (NESC), or other regulations are violated.

(5) Construction equipment may damage utilities

(6) Utilities are within areas of excavation.

When evaluating the use of design features that reduce or avoid utility conflicts, consider savings in construction time and the total associated savings for the FDOT project and the utilities.

Additional guidance for accommodating utilities within Department R/W are given in the AASHTO publications ***A Guide for Accommodating Utilities within Highway Right-of-Way*** and ***A Policy on Geometric Design of Highways and Streets*** and in the TRB publication ***Policies for Accommodation of Utilities on Highway Rights-of-Way***.

221.2 Utility Work Schedules and Agreements

Certify the project in accordance with the ***Utility Work Agreements and Certification Letter***. With assistance from the District Utilities Office and the Office of General Counsel, obtain the following:

- ***Utility Work Schedules (Form 710-010-05)***
- Relocation agreements
- Required payments to or by the Department for utility work

When an agreement cannot be obtained, coordinate with the District Utilities Office and the Office of General Counsel to pursue any needed order to relocate.

Modification for Non-Conventional Projects:
Delete ***FDM 221.2*** above and see RFP for requirements.

221.3 Subsurface Utility Locates

Coordinate with the District Utility Office to determine the locations and quality levels needed. Quality levels are defined in Section 3.6 of the ***Survey and Mapping Handbook***. The UAOs may be requested to provide locate information as required by Section 5.2 of the ***2017 Utility Accommodation Manual***.

Obtain quality level "QL A" locate information when proposed construction operations are within 3' of utilities and verified information is needed to make confident design decisions. The decision to proceed to construction without obtaining quality level "QL A" locate information must be further coordinated with district construction personnel and the UAO.

222 Pedestrian Facilities

222.1 General

This chapter provides the minimum criteria to be used for the design of pedestrian facilities on the State Highway System. The term "pedestrian" used in this chapter includes any person traveling on foot or in a wheelchair. Pedestrians should be expected on all of Florida's state roadways except where restricted on Limited Access (LA) facilities.

Process a Design Variation when the design criteria for pedestrian facilities in this manual are not met. Reference the following conditions that support not providing a pedestrian facility in the Design Variation documentation:

(1) The establishment of pedestrian facilities would be contrary to public safety.

(2) The cost of providing pedestrian facilities would be excessively disproportionate to the need or probable use.

(3) The presence of other available means for pedestrian traffic. Other available means should meet the following requirements:

  (a) Meet the design criteria for pedestrian facilities on state roadways.

  (b) Provide access to the same services, origination and destination sites, and transit connections as the project corridor.

  (c) Not result in a significant increase in travel time or trip length, exposure to motorized traffic, or substantial elevation changes.

  (d) Provide appropriate locations to cross limited access, arterial or collector roadways, or railroad corridors.

222.1.1 Americans With Disabilities Act (ADA)

In addition to the criteria presented in the ***FDM*** and Department's ***Standard Plans***, the following documents provide Americans with Disabilities Act (ADA) guidance in the design of pedestrian facilities in public R/W:

- ***United States Department of Justice 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design***
- ***United States Department of Transportation 2006 ADA Standards for Transportation Facilities***.

- ***Florida Accessibility Code*** contains **ADA** requirements for accessibility to sites, facilities, buildings, and elements by individuals with disabilities.

222.2 Pedestrian Facilities

Pedestrian facilities are features or elements used to support pedestrian travel. Pedestrian facilities may include the following:

- Sidewalks
- Curb ramps and blended transitions
- Crosswalks
- At-grade railroad crossings
- Refuge islands
- Curb extensions
- Pedestrian signals
- Public transit loading zones
- Pedestrian bridges
- Shared use paths
- Street furniture

Pedestrian safety can be enhanced through the following measures:

(1) Maintaining a smooth, clean walking surface, free of obstructions.

(2) Responsive and appropriate traffic control devices, consistent with guidance in the ***Manual on Uniform Traffic Control Devices (MUTCD)***, including providing pedestrian-oriented directional signage.

(3) Sidewalks and other pedestrian walkways are continuous, and termini connect to existing sidewalk, pedestrian crossing, or access point.

(4) Providing adequate lighting.

222.2.1 Sidewalk

Sidewalk is a continuous concrete pedestrian walkway as depicted in ***Standard Plans Index 522-001***.

Provide sidewalk on all curbed roadways, except where prohibited by ***Section 316.130 (18), Florida Statute (F.S).*** The inclusion of sidewalk on short isolated sections of curbed roadway is not required when:

- Within C1 and C2 context classification, and
- There are no pedestrian facilities leading to, or from the location.

Provide sidewalk on high speed curbed and flush shoulder roadways within C2T, C3C~~R~~, C4, C5 or C6 context classification; and within C1, C2 or C3R~~C~~ where the demand for use is demonstrated.

For high speed curbed and flush shoulder roadways, place sidewalk in the following order of desirability:

(1) As near the R/W line as possible.

(2) Outside of the clear zone.

(3) Five feet beyond the limits of the full width shoulder.

(4) At the limits of the full width shoulder.

Sidewalk on flush shoulder roadways is not to be constructed directly adjacent to the roadway or shoulder pavement. Nearing intersections, the sidewalk should be transitioned as necessary to provide a more functional crossing location that also meets driver expectation. Further guidance on the placement of stop or yield lines and crosswalks is provided in the ***MUTCD*, *Part 3*** and ***Standard Plans* *711-001.***

Continue sidewalk across bridge structures when sidewalk is provided on the approach roadway. Also provide sidewalk on new bridges where sidewalk or shared use path is not present along the roadway but may be included with a future project.

Sidewalk should be constructed on both sides of the roadway; however, if sidewalk is constructed on only one side, provide reasonable pedestrian access to destinations (e.g., transit stops, homes, places of work, stores, schools, post offices, libraries, parks) on the opposite side.

For RRR Projects, other than meeting detectable warning and curb ramp requirements, unaltered sidewalks that are not in compliance with ***FDM*** criteria, ***Standard Plans***, or ADA requirements are not required to be reconstructed.

222.2.1.1 Sidewalk Width

The standard sidewalk width varies by context classification as shown in ***Table 222.2.1***.

Table 222.2.1 Standard Sidewalk Widths

Context Classification		Sidewalk Width (feet)
C1	Natural	5
C2	Rural	5
C2T	Rural Town	6
C3	Suburban	6
C4	Urban General	6
C5	Urban Center	10
C6	Urban Core	12

Notes:

(1) For C2T, C3 and C4, sidewalk width may be increased up to 8 feet when the demand is demonstrated.

(2) For C5 and C6, when standard sidewalk width cannot be attained, provide the greatest attainable width possible, but not less than 6 feet.

(3) For RRR projects, unaltered sidewalk with width 4 feet or greater may be retained within any context classification.

(4) See ***FDM 260.2.2*** for sidewalk width requirements on bridges.

See ***FDM 214*** for information on sidewalks across driveways.

Provide the following minimum unobstructed sidewalk width (excluding the width of the curb) when there is no practical alternative to placing a pole within the sidewalk:

- 36 inches for aboveground utilities. This 36-inch width may be reduced to 32 inches, not exceeding 24 inches in length, when there is no practical alternative available to avoid an obstruction.
- 48 inches for signal, light, sign poles

When used for plantings and street furniture, the area between the back of curb and the sidewalk should be 5 feet or greater in width. Consider providing treewells in areas where on-street parking is provided.

Appropriate types of street furniture may vary based on frequency and density of pedestrian activity. Street furniture must allow for minimum sidewalk width and vertical clearance as required in this section and ***FDM 222.2.1.2***.

Refer to ***FDM 223.5*** for information on bicycle parking amenities and ***FDM 225*** for information on public transit facilities as related to use of sidewalk space.

222.2.1.2 Vertical Clearance

Provide a minimum 7-foot vertical clearance over the entire walking surface. See ***FDM 260.6*** for pedestrian bridge vertical clearance requirements.

222.2.1.3 Grades and Cross Slope

When sidewalk is adjacent to the roadway (i.e., located back of curb or consistent separation from curb), sidewalk grades may mirror the roadway profile. When sidewalk is not adjacent to a traveled way, sidewalk grades are not to exceed 5%, unless accessible ramps are provided.

There should be enough sidewalk cross slope to allow for adequate drainage; however, to comply with ADA requirements, the maximum cross slope is 2%. A clear 1-foot wide graded area with a maximum 1:6 slope should be provided adjacent to the sidewalk. Edge drop-offs should be avoided. When drop-offs cannot be avoided and lie within 2 feet of the edge of sidewalk, they should be shielded as discussed in ***FDM 222.4***.

222.2.2 Curb Ramps and Blended Transitions

Standard Plans, Index 522-002 provides requirements and details for curb ramps and landings that are compliant with Americans with Disabilities Act Standards for Transportation Facilities.

A continuous accessible pedestrian route, including curb ramps and blended transitions (e.g., depressed corners, raised street crossings, flush roadway connections) are required along sidewalks and shared use paths. Provide curb ramps to be the same width as the sidewalk where practicable. Additional information, nomenclature, requirements, and details for curb ramps and landings are provided in the ***Standard Plans, Index 522-002***.

Alpha-identifications have been provided in Index 522-002 for the various curb ramp options (e.g., CR-A, CR-B, etc.) to facilitate ease of callouts in the Plans. Use the curb ramp options as follows:

- Curb Ramps CR-A, CR-B & CR-C are for use where ramp and landing depths are not restricted.
- Curb Ramps CR-D, CR-E, CR-F, CR-G and CR-H are for linear pedestrian traffic.
- Curb Ramps CR-K and CR-L are for use where ramp and landing depths are restricted.

Include sidewalk curb ramps at the following locations:

- All intersections and driveways with curbed returns. Include a landing at the top of each ramp.
- On curbed roadways between intersections where a crosswalk has been established.

Pull boxes, manholes (and other utility covers), and other types of existing surface features in the location of a proposed curb ramp or detectable warning should be relocated. When relocation is not feasible, adjust the feature to meet the ADA requirements for surfaces (including the provision of a nonslip top surface, and adjustment to be flush with and at the same slope as the adjacent surface).

Curb ramps should be in line with the crossing and must provide a maximum slope of 1:12 (8.3 percent). At intersections where more than one road is crossed, provide curb ramps at both ends of each crossing. Crossings are required to meet the same grade and cross slope requirements as sidewalks. Where criteria for maximum cross slope cannot be met, process a Design Variation and provide the minimum attainable cross slope. When following the profile grade of the roadway, curb ramp slopes should not exceed 15 feet in length.

Provide transition slopes (flared sides) where a pedestrian circulation path crosses the curb ramp. The maximum slope of transition slopes is 1:10, measured parallel with and adjacent to the curb line.

When altering an existing pedestrian facility and conditions preclude the construction of a curb ramp slope of 1:12, provide a slope from 1:12 to 1:10 with a maximum rise of 6 inches.

Provide a landing at all pedestrian pushbutton locations. The landing must provide a clear area of 30 inches by 48 inches directly in front of the pedestrian pushbutton to allow persons using a wheeled mobility device to actuate the button while remaining stationary. Horizontally center the 48-inch dimension on the pushbutton.

When compliance with Department curb ramp requirements is determined to be technically infeasible (i.e., no engineering solution is available), a Design Variation is required. This may occur where existing right of way is inadequate and where conflicts may occur with existing features which cannot be feasibly relocated or adjusted (e.g., drainage inlets, signal poles, pull and junction boxes, etc.).

222.2.2.1 Driveways

See ***FDM 214*** for additional information on pedestrian accommodations at driveways.

New and reconstructed driveways are to be in compliance with ***Standard Plans*****, *Index 330-001 and 522-003***.

For RRR Projects, unaltered driveways that are not in compliance with ***Standard Plans*** or ADA requirements are not required to be reconstructed.

222.2.3 Crosswalks

Crosswalks are marked paths where pedestrians can safely cross a roadway. Marking of crosswalks helps drivers better identify the intersection and guides pedestrians to the best crossing location.

Use Special Emphasis crosswalk markings for all marked crosswalks except the following. Use standard crosswalk markings at marked stop-controlled intersection approaches.

Coordinate with the District Traffic Operations Office on proposed new marked crosswalks. For new and existing crosswalks, meet criteria and guidelines in ***Traffic Engineering Manual (TEM), Section 5.2.***

TEM* *5.2 also contains criteria and guidelines on additional treatments including signals, signing, pavement markings and other treatments at midblock and unsignalized intersections.

For crosswalk signing and pavement markings, see ***FDM 230***, ***MUTCD***, and ***Standard Plans*****, *Index 711-001***.

The maximum cross slope for crosswalks is 2%. For crosswalks located at signalized intersections, midblock, or driveways, cross slope may exceed 2% but not greater than 5%.

School Zone crosswalks have additional criteria for signing and pavement markings. For requirements for school signs and markings, see ***The Manual on Speed Zoning for Highways, Roads and Streets in Florida*, Chapter 15**.

222.2.3.1 Intersections

Provide crosswalk markings for all legs of a signalized intersection unless there is a documented, project-specific justification not to do so (e.g., physical constraints, safety concern).

When separated right-turn lanes are used, place crosswalks so that an approaching motorist has a clear view of the pedestrian, and the crossing distance is minimized. See ***TEM* *2.44*** for signing criteria.

Coordinate with the District Traffic Operations Office for new marked crosswalks at unsignalized intersection locations and meet the criteria and guidelines identified in ***TEM 5.2***.

*Commentary: Marked crosswalks at an uncontrolled location may be supplemented with other treatments such as beacons, signals, curb extensions, raised medians, raised traffic islands, and enhanced overhead lighting. See **TEM 5.2** for a complete and updated list of these types of treatments.*

Additional countermeasure treatments are recommended at locations where any of the following conditions exist:

(1) Where posted speeds are greater than 35 mph,

(2) On a roadway with 4 or more lanes without a raised median or raised traffic island that has an ADT of 12,000 or greater, or

(3) On a roadway with 4 or more lanes with a raised median or raised traffic island that has or is projected to have (within 5 years) an ADT of 15,000 or greater.

As roadway volumes, speeds, and number of travel lanes increase, marked crosswalks are best used in conjunction with other countermeasure treatments.

For controlled intersections with six-lane divided roadways or crossing distances exceeding 80 feet, consider installing a two-stage pedestrian crossing with median refuge island. See ***FDM 210*** for more information on Intersection Refuge Islands and Hardened Centerlines.

222.2.3.2 Midblock

Midblock crosswalks are used to supplement pedestrian crossings in areas between intersections.

Provide illumination for both new and existing midblock crosswalks in accordance with ***FDM 231***.

An engineering study is required for all new Midblock Crosswalks. Follow the procedure and guidelines identified in ***TEM 5.2***.

Midblock crosswalks are not recommended at locations where any of the following exist:

(1) The distance from the crosswalk to the nearest intersection (or crossing location) is less than 300 feet.

(2) The crossing distance exceeds 60 feet (unless a median or a crossing island is provided).

(3) The sight distance for both the pedestrian and motorist is not adequate.

(4) The crosswalk cross slope (roadway profile) exceeds 5%.

(5) The crosswalk grade (roadway cross slope) exceeds normal crown.

See ***Figures 210.3.4*** and ***210.3.5*** for examples of midblock crossings with refuge islands. Refer to ***FDM 230.6*** for information on pavement markings and midblock crossings.

If site conditions are identified that would obstruct the placement of a midblock crosswalk, include additional features in the design to remedy these conditions. Features like overhead signing can help alert motorists and be used to light the crossing. Curb extensions or bulb-outs can improve sight distance and decrease the crossing distance. Adjustment of the profile on the roadway crossing may be required to improve the cross slope of the crosswalk.

The sidewalk median crossing through a raised median will be either depressed or raised, depending on the median width between the backs of curbs (W), as follows:

(1) Depressed Sidewalk when $W \leq 16$ feet

(2) Raised Sidewalk when $W > 16$ feet

See ***Exhibit 222-1*** for more information.

Exhibit 222-1: Median Crossings

222.2.4 At-Grade Railroad Crossings

Provide an ADA accessible route for pedestrians at railroad crossings by extending proposed or existing sidewalks or shared use paths through the rail crossing. The surface of the crossing must be:

- Firm, stable and slip resistant,
- Level and flush with the top of rail at the outer edges of the rails, and
- Area between the rails aligns with the top of rail.

Place detectable warnings on each side of the railroad crossing as detailed in ***Standard Plans*, Index 522-002**.

The edge of the detectable warning nearest the rail crossing is to be located between 6 and 15 feet from the centerline of the nearest rail. Where gates are provided, detectable warnings are to be placed a minimum of 4 feet from the side of the gates opposite the rail.

An audible device, such as a bell, is used in conjunction with the traffic control signals, if traffic control signals are in operation at a crossing that is used by pedestrians or bicyclists. Additional information is located in the ***MUTCD*** regarding additional signals, signs, or pedestrian gates and designing crossings for shared use paths.

Flangeway gaps are necessary to allow the passage of train wheel flanges; however, they pose a potential hazard to pedestrians who use wheelchairs because the gaps can entrap the wheelchair casters. A maximum flangeway gap is required for all at-grade pedestrian rail crossings of 2½" for all non-freight rail track and 3" for freight rail track.

222.2.5 Refuge Islands

See ***FDM 210.3*** for information on refuge islands.

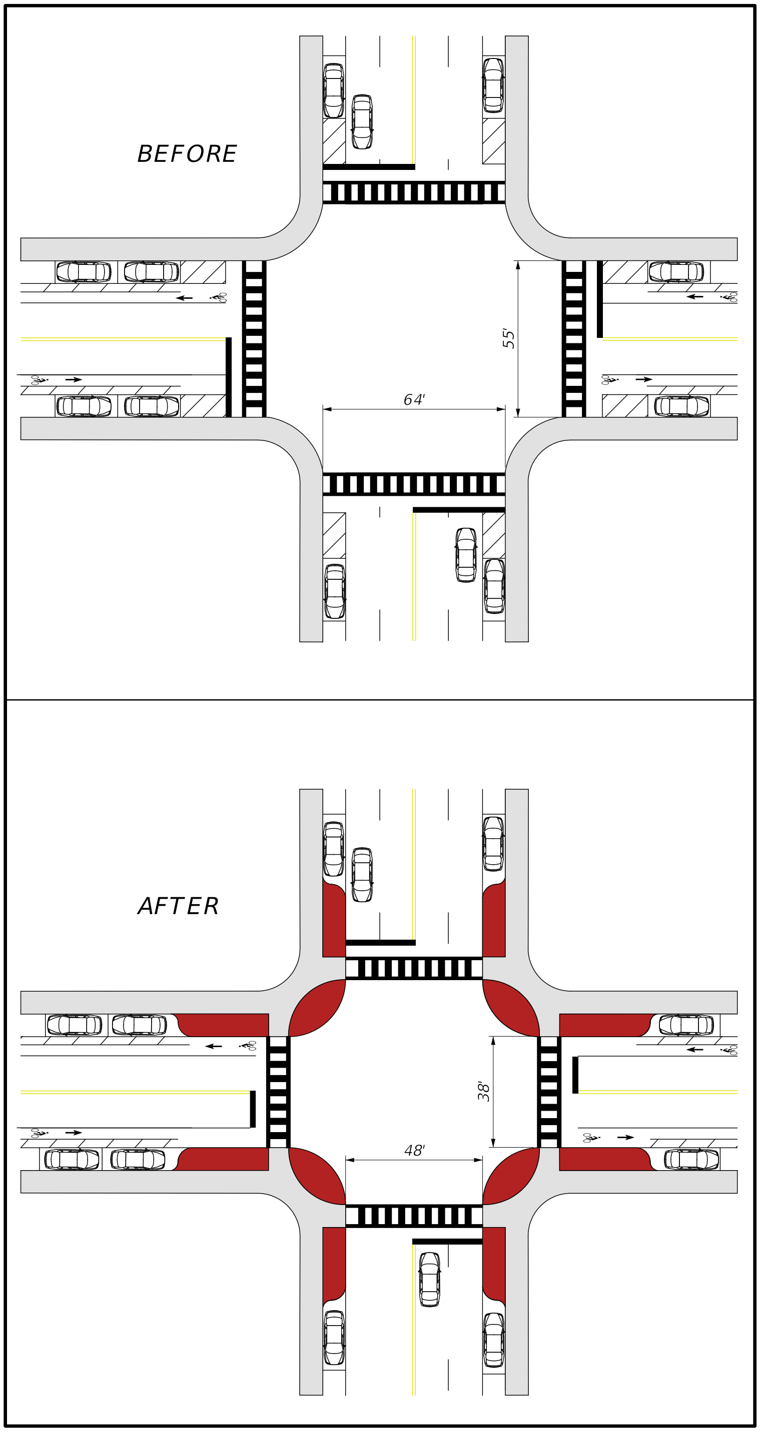
222.2.6 Curb Extensions (Bulb-Outs)

Consider the use of curb extensions (a.k.a., bulb-outs) in conjunction with on-street parking at intersections or midblock locations where there is a crosswalk, provided there is adequate width for existing traffic movements. Curb extensions shorten the crossing distance, and provide additional space at intersections, allowing pedestrians to see and be seen before entering a crosswalk.

The design of curb extensions must take into consideration the needs of transit, emergency vehicles, commercial trucks, drainage, and bicyclists.

Consult with District drainage staff on drainage accommodations for the curb extension during Phase I of the design. See the ***Drainage Design Guide*** and ***Figure 222.2.1***.

Figure 222.2.1 Curb Extension



222.2.7 Pedestrian Signals

See ***FDM 232.6*** for information on pedestrian signals. Pedestrian detector assemblies and pedestrian control signals are detailed in the ***Standard Plans***, ***Indexes 653-001*** and ***665-001***

222.2.8 Public Transit Loading Zones

See ***FDM 225*** for information on public transit facilities. Provide a minimum 5-foot-wide sidewalk connecting transit stops to sidewalk or shared use paths.

Coordination with the following may be required to determine the optimum location of boarding and alighting areas, transit shelters and bus bays:

- District Pedestrian and Bicycle Coordinator
- District Modal Development Office Coordinator
- District ADA Coordinator
- District Public Transportation staff
- Local public transit provider

222.2.9 Pedestrian Bridges

See ***FDM 266*** for information on pedestrian bridges.

222.2.10 Shared Use Paths

See ***FDM 224*** for information on shared use paths.

222.2.11 Street Furniture

Street furniture may include benches, lighting fixtures, transit shelters, and bicycle parking. These items may be placed within the R/W under certain conditions. Ensure items do not obstruct sight distance or visibility of pedestrians at crosswalks. Do not use street furniture on curb extensions.

Refer to ***FDM 223.5*** for information on bicycle parking amenities, and ***FDM 225*** for information on public transit facilities. Appropriate types of street furniture may vary based on frequency and density of pedestrian activity. Street furniture must allow for minimum sidewalk width and meet lateral offset requirements identified in ***FDM 222.2.1.1*** and ***222.2.1.2***.

222.3 Detectable Warnings

Detectable warnings are a distinctive surface pattern of domes detectable by cane or underfoot that alert people with vision impairments of their approach to street crossings. Install detectable warnings to cover the full width of the walking surface and 2 feet deep. They are required on sidewalks at the following locations:

- Curb ramps and transition areas at street crossings
- Pedestrian refuge islands where there is one or more of the following:
  - Change in surface texture
  - Change in elevation (e.g., curb ramp)
  - Change in horizontal alignment of the path within the refuge island
  - Two-stage crossings
- Pedestrian at-grade railroad crossings
- Commercial driveways with a stop sign, yield sign, or traffic signal
- Boarding and alighting areas adjacent to the roadway at bus stops where there is an at-grade connection to the roadway
- Edges of railroad boarding platforms not protected by screens or guards

Detectable warnings should not be placed where sidewalk intersects urban flared driveways or on sidewalks that run continuously through residential driveways. Do not place detectable warnings on transition slopes or over grade breaks. Further guidance on detectable warnings is provided in ***Standard Plans, Index 522-002***.

222.4 Pedestrian Drop-off Hazards and Railings

A pedestrian drop-off hazard is a steep or abrupt downward slope that can be hazardous to pedestrians.

There are two pedestrian drop-off hazard conditions defined in ***Figure 222.4.1***. Additionally, depending on the height of a slope and the severity of the conditions beyond, cases other than those shown in ***Figure 222.4.1*** may also be considered a pedestrian drop-off hazard.

When the pedestrian drop-off hazard cannot be eliminated, consider the following:

(1) Fencing is typically used in C1 and C2 context classifications, and on shared use paths and trails.

(2) Railing is typically used in C2T, C3, C4, C5, and C6 context classifications, and at locations attaching to bridge rail or along sidewalks.

  (a) Pedestrian/Bicycle Railings (***Standard Plans*, *Index 515-021*** through ***515-062)*** are adequate for shielding all drop-offs but are generally intended for use on drop-offs greater than 60 inches.

  (b) Pipe Guiderail (***Standard Plans*, *Indexes 515-070*** and ***515-080***) is adequate for shielding drop-offs which are 60 inches or less.

  (c) Along continuous sections where the drop-off varies above and below the 60-inch threshold, for uniformity the engineer may consider using only one of the railing types adequate for shielding all drop-offs.

  (d) Pedestrian/Bicycle Railings and Pipe Guiderail are non-crashworthy and are not to be placed within:

    i. Lateral offset requirement for curbed roadways, or

    ii. Clear zone for high-speed curbed and flush-shoulder roadways.

(3) Maintain driver's line of sight at intersections and driveways.

The standard height for Pedestrian/Bicycle Railing is 42 inches. Provide a 48-inch-tall Pedestrian/Bicycle Railing when all three of the following conditions exist:

(1) Bicyclists are permitted to travel within 3 feet of the railing.

(2) The path is on a downward grade steeper than 5%.

(3) There is a horizontal curve having a radius less than that specified for the design speed of the bicycle facility. Taller railing should not extend more than 20 feet beyond the point of tangency of the horizontal curve.

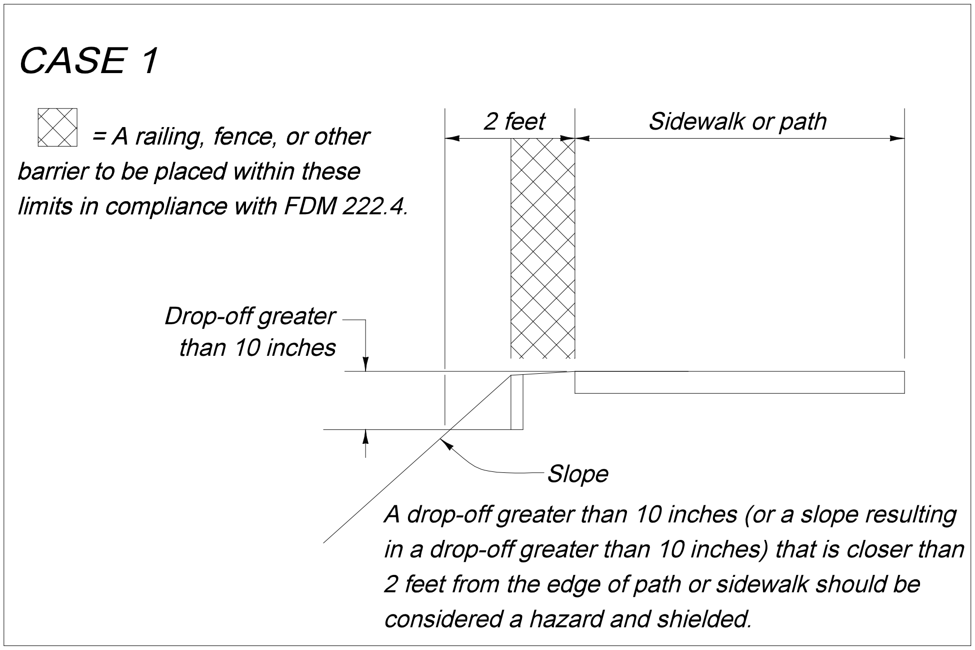
Pedestrian railings are not required where W-beam guardrail is installed at the back of the sidewalk or shared use path.

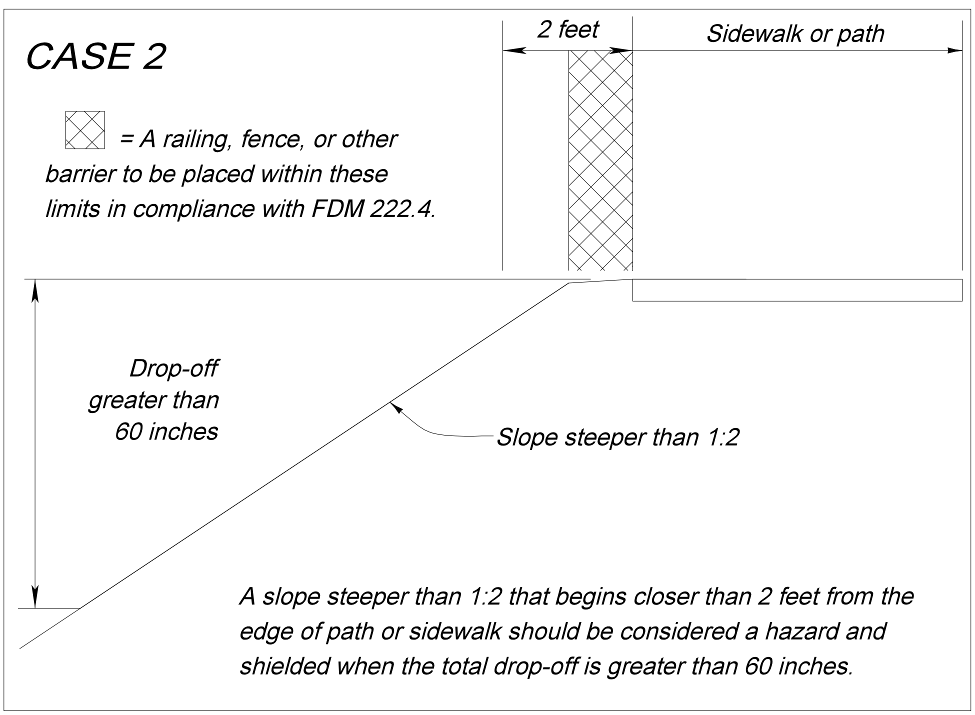
Pedestrian/Bicycle railings (42 inches in height) are not required where traffic railings separate the vehicular traffic from the pedestrian or bicycle facility.

Where Pedestrian/Bicycle Railing is used, the Department will cover the cost only for standard galvanized steel or standard aluminum railing. If the Local Agency desires a painted railing, they are required to provide the additional funding and commit to cover the maintenance cost.

The Department will cover the cost of the standard Infill Panel Types shown in the ***Standard Plans***. If the Local Agency desires a railing having Custom Infill Panels which increases the cost over standard infill panels, they are required to provide the additional funding to cover this initial premium cost. In addition, a maintenance agreement will be needed to address the responsibilities associated with maintaining Custom Infill Panels.

Figure 222.4.1 Drop-Off Hazards for Pedestrians





222.4.1 Bridge Pedestrian Railings and Fences

Details and typical applications of various crashworthy pedestrian/bicycle bridge railings and fencing are provided in ***Figures 222.4.2 – 222.4.8***. The installation of fencing on traffic railing between sidewalk or shared use paths and travel lanes on LA facilities must be approved by the State Structures Design Engineer.

The Engineer should work with the District to determine when an enclosed fencing option is warranted.

Figure 222.4.2 Bridge Railing – Pedestrian/Bicycle Railing

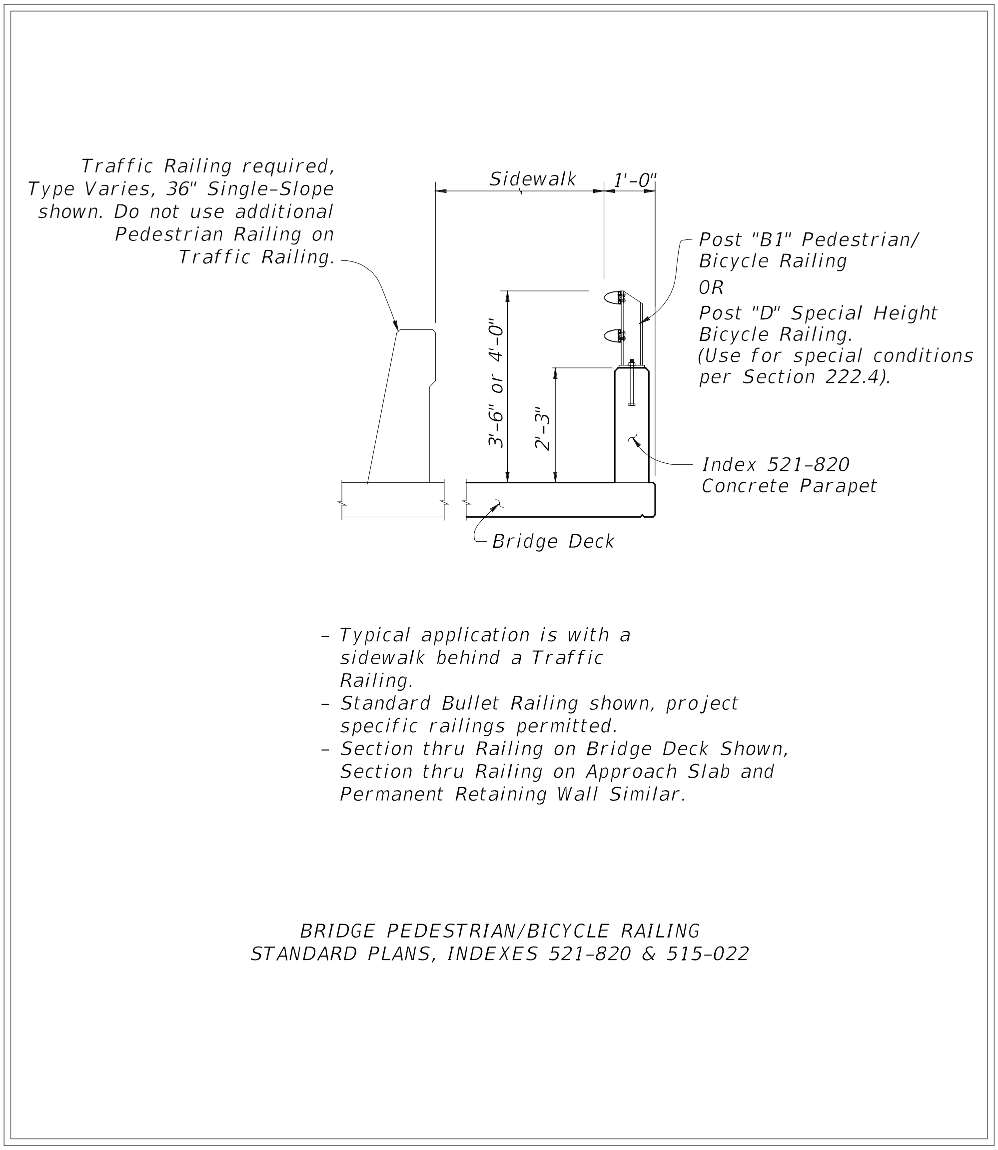
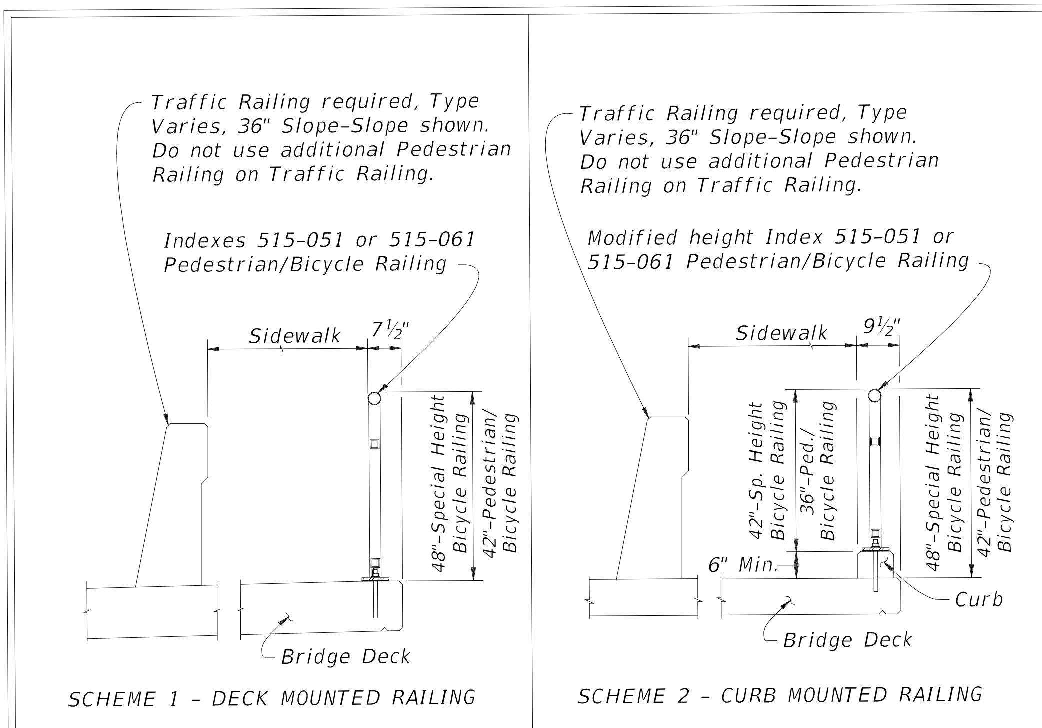


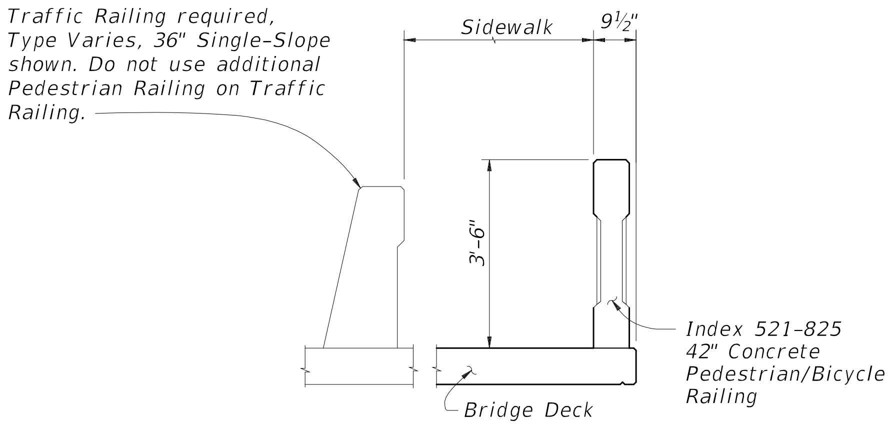
Figure 222.4.3 Bridge Railing – Pedestrian/Bicycle Railing



- Typical application is with a sidewalk behind a Traffic Railing.
- Standard railing shown, project specific railings permitted.
- Section thru Railing on Bridge Deck Shown, Section thru Railing on Approach Slab and Permanent Retaining Wall Similar.

BRIDGE PEDESTRIAN/BICYCLE RAILING
STANDARD PLANS, INDEXES 515-051 & 515-061

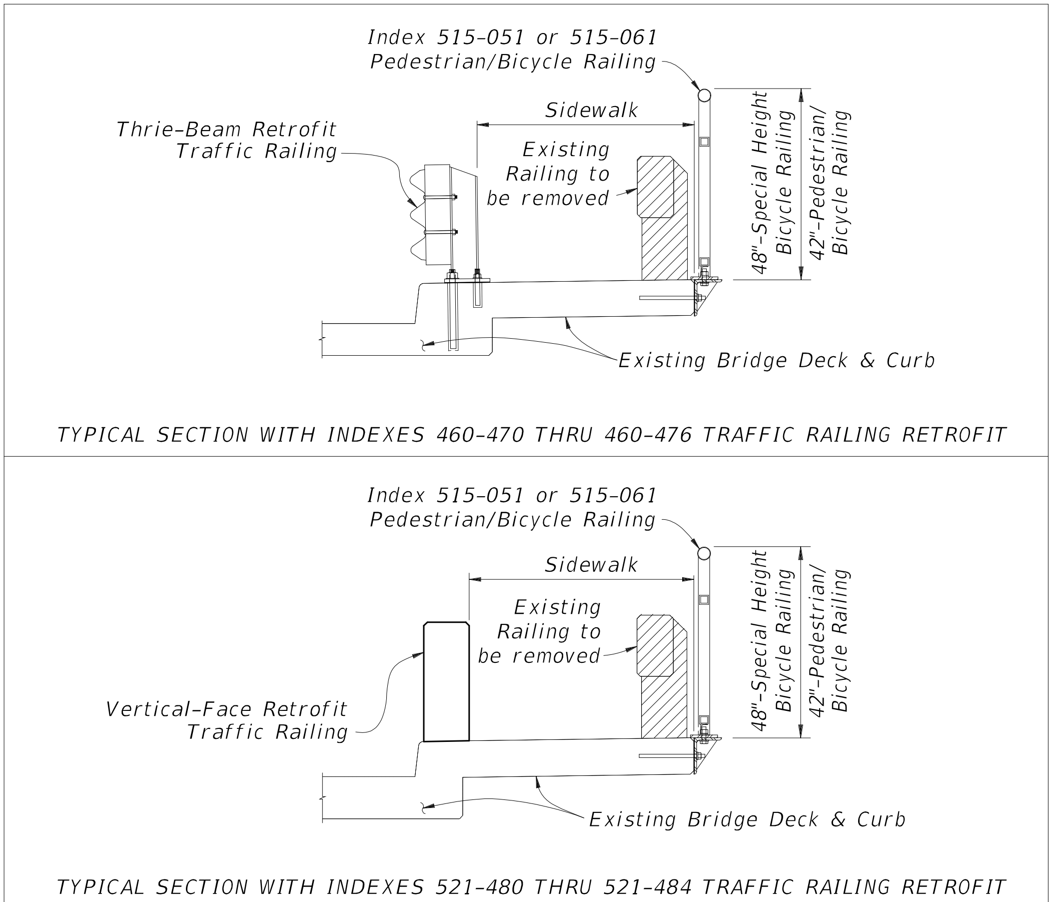
Figure 222.4.4 Bridge Railing – Pedestrian/Bicycle Railing



- Typical application is with a sidewalk behind a Traffic Railing.
- Section thru Railing on Bridge Deck Shown, Section thru Railing on Approach Slab and Permanent Retaining Wall Similar.

PEDESTRIAN/BICYCLE RAILING
STANDARD PLANS, INDEX 521-825

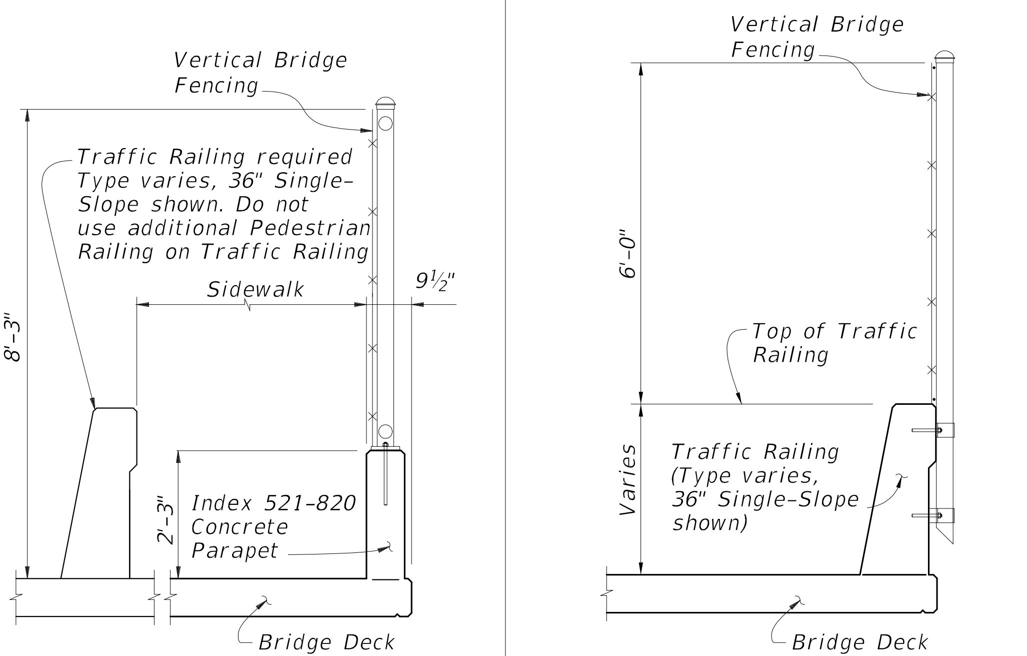
Figure 222.4.5 Bridge Railing and Pedestrian/Bicycle Railing Retrofit



- Typical application is a retrofit in combination with a Traffic Railing retrofit (Indexes 460-470 & 521-480 shown, other Traffic Railing retrofits similar).
- No additional pedestrian rails permitted on Traffic Railing.
- Section thru Railing on Bridge Deck shown, Section thru Railing on Approach Slab and Permanent Retaining Wall similar.

BRIDGE PEDESTRIAN/BICYCLE RETROFIT RAILING
STANDARD PLANS, INDEXES 515-051 & 515-061

Figure 222.4.6 Bridge Railing and Bridge Parapet Fencing



TYPICAL SECTION ON
CONCRETE PARAPET WITH INDEX 550-010

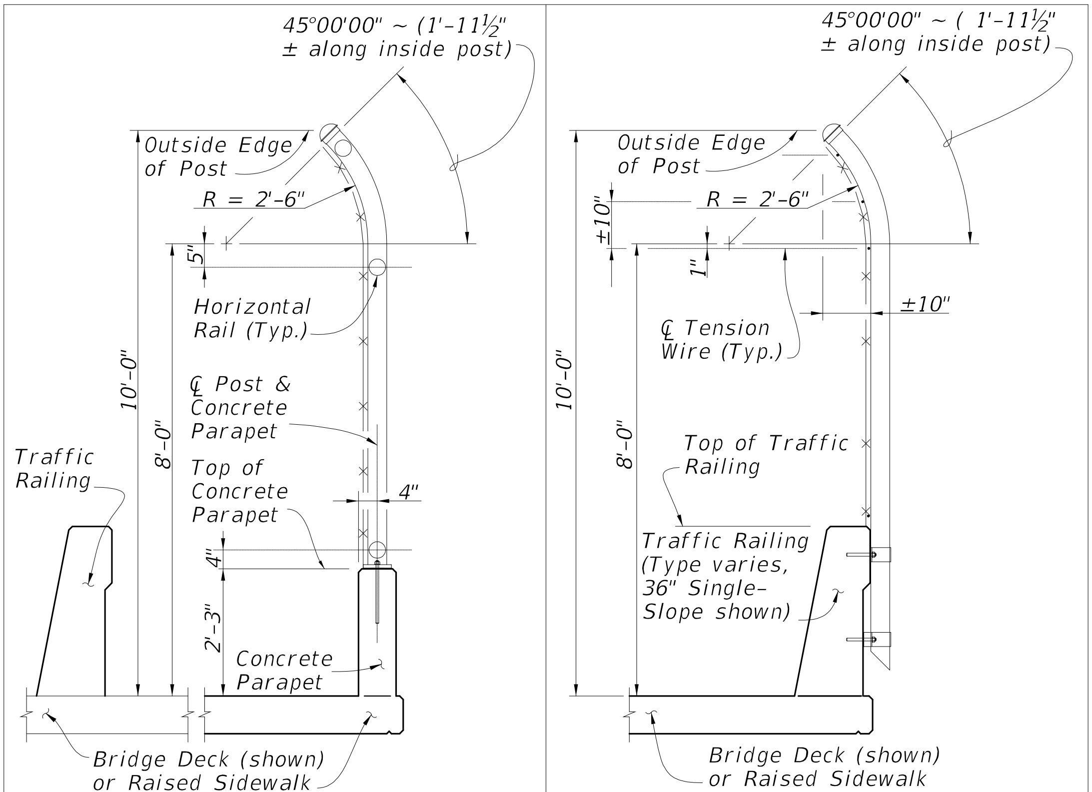
- At the direction of the District, use *Standard Plans*, Index 550-010, where there are reoccurring incidents of debris being thrown or dropped over bridge railings onto traffic or railroad tracks below.
- Section thru Fence and Parapet on Bridge Deck shown. Section thru Fence and Parapet on Approach Slab and Pemanent Retaining Wall similar.

TYPICAL SECTION ON TRAFFIC
RAILING BARRIER WITH INDEX 550-010

- At the direction of the District, use *Standard Plans*, Index 550-010, where there are reoccurring incidents of debris being thrown or dropped over bridge railings onto traffic or railroad tracks below.
- Section thru Fence and Railing on Bridge Deck shown. Section thru Fence and Railing on Approach Slab and Pemanent Retaining Wall similar.

VERTICAL BRIDGE FENCING
STANDARD PLANS, INDEX 550-010

Figure 222.4.7 Curved Bridge Fencing



TYPICAL SECTION ON CONCRETE PARAPET WITH INDEX 550-011

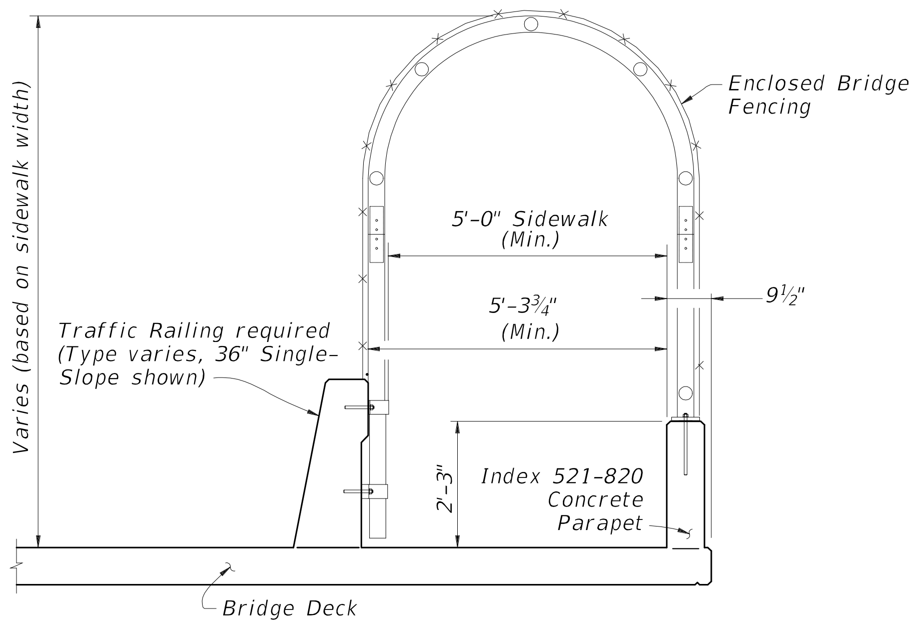
- At the direction of the District, use **Standard Plans, Index 550-011,** where there are reoccurring incidents of debris being thrown or dropped over bridge railings onto traffic or railroad tracks below.
- Section thru Fence and Parapet on Bridge Deck shown. Section thru Fence and Parapet on Approach Slab and Pemanent Retaining Wall similar.

TYPICAL SECTION ON TRAFFIC RAILING BARRIER WITH INDEX 550-013

- At the direction of the District, use **Standard Plans, Index 550-013,** where there are reoccurring incidents of debris being thrown or dropped over bridge railings onto traffic or railroad tracks below.
- Section thru Fence and Railing on Bridge Deck shown. Section thru Fence and Railing on Approach Slab and Pemanent Retaining Wall similar.

CURVED BRIDGE FENCING
STANDARD PLANS, INDEXES 550-011 & 550-013

Figure 222.4.8 Bridge Railing – Enclosed Fencing



- *At the direction of the District, use* Standard Plans, Index 550-012 *when a Traffic Railing, sidewalk and parapet exists on a bridge and when Pedestrian Traffic from schools, residential neighborhoods, playgrounds and recreational facilities is encountered. The Engineer should work with the District to determine when the enclosed fencing option is warranted.*
- *Section thru Fence, Parapet and Traffic Railing on Bridge Deck shown, Section thru Fence, Parapet and Traffic Railing on Approach Slab and Permanent Retaining Wall similar.*

ENCLOSED BRIDGE FENCING
STANDARD PLANS, INDEX 550-012

222.4.2 Pedestrian Railings on RRR Projects

For RRR projects, existing pedestrian railings and pipe guiderail should be removed that are within:

- Required lateral offset for curbed roadways, or
- Inside clear zone for high speed curbed and flush shoulder roadways

If there was a documented issue of traffic incidents involving pedestrians prior to the installation of the existing pedestrian railing or pipe guiderail that would likely reoccur, implement one of the following treatments, in order of priority:

(1) Eliminate the hazard and remove the pedestrian railings and pipe guiderail, or

(2) Allow the railing to remain.

222.5 Movable Bridge Pedestrian Gates

Refer to ***Structures Design Guidelines (SDG)***, Chapter 8 for movable bridge pedestrian safety design requirements.

223 Bicycle Facilities

223.1 General

This chapter provides the minimum criteria to be used for the design of bicycle facilities on the State Highway System (SHS).

Provide a bicycle facility on all roadways on the SHS, except where its establishment would be contrary to public safety; e.g., limited access facilities as defined by ***FDM 211***. The various methods of providing bicycle facilities are discussed in ***FDM 223.2***.

Bicycle safety can be enhanced through the following measures:

(1) Maintaining a smooth, clean riding surface, free of obstructions. This includes ensuring drainage inlets and utility covers that cannot be moved out of the travel way are flush with grade, well seated, and use bicycle-compatible inlets, grates and covers.

(2) Responsive and appropriate traffic control devices, consistent with guidance in the ***Manual on Uniform Traffic Control Devices*** (***MUTCD***), including providing bicycle oriented directional signage.

(3) Providing adequate lighting.

(4) Developing and maintaining a district bicycle facility plan to assign proposed bicycle facility types through a consistent and efficient process and ensure the following:

    (a) Integration of FDOT bicycle facilities with local and regional bicycle transportation systems

    (b) The direct use of more complex facility types in a cost-effective and efficient manner.

(5) For more design guidance regarding bicycle facilities on arterials and collectors, refer to ***FHWA Separated Bike Lane Planning and Design Guide*** and ***AASHTO Guide for the Development of Bicycle Facilities***.

Process a Design Variation when a bicycle facility cannot be provided or when criteria contained within this chapter are not met.

223.2 Bicycle Facilities

A bicycle facility accommodates bicycle travel. Bicycle facilities play an important role in supporting bicycle travel.

Bicycle facilities include the following:

- Bicycle lanes
- Keyhole lanes
- Intersection Bicycle Box and Two-Stage Bicycle Turn Box
- Paved shoulders
- Shared use paths
- Separated bicycle lanes
- Bicycle ramps

223.2.1 Bicycle Lanes

Bicycle lanes are a portion of a ~~curbed~~ roadway designated for the exclusive use of bicyclists. Bicycle lanes are designated by a bicycle symbol pavement marking in accordance with ***Standard Plans*, *Index 711-002*** and the ***MUTCD***, and illustrated in ***Exhibits 223-1*** through ***223-3***. Bicycle lane signs and plaques may be used in accordance with the ***MUTCD*** when high levels of bicycle traffic exist or are anticipated.

Bicycle lanes can be used on ~~curbed~~ roadways with a design speed ≤ 45 mph. However, it is best practice to consider other types of facilities for design speeds greater than 30 mph, such as a separated bicycle lane or shared use path.

Mark paved shoulders as bicycle lanes when all the following are met:

(1) Design speed ≤ 45 mph,

(2) Shoulder width ≥ 5-foot,

(3) Within C2T, C4, C5, C6, C3C context classification, or within C3R when demand is demonstrated, and

~~(1)~~(4) Shared use path or separated bicycle lanes are not present along corridor.

Bicycle lanes are one-way facilities and carry bicycle traffic in the same direction as adjacent motor vehicle traffic. On one-way streets, bicycle lanes should typically be placed on the right side of the street. A bicycle lane on the left side of the street can be considered if it will substantially reduce the number of potential conflicts, such as those caused by frequent bus traffic, heavy right-turn movements, high-turnover parking lanes, or if there is a significant number of left-turning bicyclists.

223.2.1.1 Bicycle Lane Width

The width of the bicycle lane is measured from the edge of travel lane to the edge of pavement. For new construction projects when a bicycle lane has been selected as the bicycle facility, a 7-foot buffered bicycle lane is the standard. A buffered bicycle lane has a double-6-inch white edge line separating the bicycle lane and the adjacent travel lane.

Buffered bicycle lanes are depicted in ***Exhibit 223-1***. A buffered bicycle lane should not exceed 7 feet in width (including the buffer). Any additional pavement width that results from restricting the buffered bicycle lane to 7 feet should be applied to the outside travel lane.

For projects where a bicycle lane is needed and it is not practical to move the existing curb (e.g., RRR), the width of the bicycle lane depends on the width of the available roadway pavement. For these types of projects, the options in the order of priority are:

(1) 7-foot buffered bicycle lane

(2) 6-foot buffered bicycle lane

(3) 5-foot bicycle lane

(4) 4-foot bicycle lane

Do not place a ~~4-foot~~ bicycle lane with less than 5 feet of width adjacent to a 10-foot traffic lane.

When roadway pavement is continuous to the face of guardrail or barrier, the minimum bicycle lane width is 5 feet. See ***FDM 223.2.1.3*** when the bicycle lane is adjacent to a right-turn lane or bus bay.

223.2.1.2 Pavement Markings and Signage

Bicycle lane pavement marking symbols are illustrated in ***Exhibit 223-1***. Use the following guidance in determining the appropriate placement of bicycle lane markings:

(1) At an intersection approach, transition the buffer lane striping to a double 6-inch-wide stripe using a 2'- 4' dotted pattern 150 feet in advance of the intersection to provide sufficient distance for an automobile or truck to merge into the bicycle lane before turning right.

(2) Provide continuous lane striping past low-volume and residential driveways.

(3) Place a Helmeted Bicyclist Symbol and Bicycle Lane Arrow (per ***Standard Plans*, *Index 711-002***) in the following locations:

(a) The beginning of a bicycle lane

(b) The far side of major intersections

(c) Prior to and within the keyhole lane

(4) The maximum spacing of the Helmeted Bicyclist Symbol and Bicycle Lane Arrow is 1,320 feet.

Provide "Bike Lane Ahead" and "Bike Lane End" signage in accordance with the ***MUTCD***.

See ***FDM 230.3.1.3*** for information on placing markings on concrete surfaces.

223.2.1.3 Keyhole Lanes

A keyhole lane is a bicycle lane that is placed between a through lane and the adjacent right-~~-~~turn lane, merge lane, bus bay, or parking lane.

To reduce conflicts between motorists and bicyclists, consider transitioning a bicycle lane to an adjacent separated bicycle lane, shared use path, or urban side path prior to and through the conflict area. Keyhole lanes are not required where a separated bicycle lane is provided.

Provide a keyhole lane on curbed roadways that have a bicycle lane approaching ~~the intersection~~a right-turn lane, merge lane, bus bay, or parking lane. On curbed roadways that do not have a bicycle lane approaching ~~the~~an intersection with a right-turn lane, consider providing a 17-foot right-turn lane for development of future bicycle facilities.

Provide a keyhole lane on flush shoulder roadways of any design speed where the approaching or departing paved shoulder is of at least 4 feet in width.

Provide a 7-foot buffered keyhole lane on curbed roadways; however, when 7 feet is not obtainable, provide the greatest keyhole lane width possible, but not less than 5 feet. The keyhole lane should match the width of the shoulder on flush shoulder and high-speed curbed roadways, but not less than 5 feet.

See ***FDM 223.4*** for bicycle lane design criteria when adjacent to on-street parking.

Include Helmeted Bicyclist Symbol and Bicycle Lane Arrow pavement markings in the keyhole lane. Keyhole lanes are illustrated in ***Exhibit 223-2***.

For RRR projects, a keyhole lane should be provided except on projects that have inadequate R/W or utility conflicts.

223.2.1.4 Green-Colored Pavement Markings

Green-colored pavement markings may be used when the need to enhance the conspicuity of bicycle-vehicular conflict areas is demonstrated. The Federal Highway Administration (FHWA) has issued an Interim Approval (IA.14) for the use of green-colored pavement in marked bicycle lanes, extensions of bicycle lanes through intersections, and other bicycle-vehicular conflict areas. FDOT has received permission from FHWA for use of green-colored pavement on the SHS. The Interim Approval may be found at the following website:

https://mutcd.fhwa.dot.gov/resources/interim_approval/ia14/index.htm

Bicycle-vehicular conflict areas are illustrated in ***Exhibit 223-3,*** and include:

(1) Bicycle lane crosses a vehicular right turn lane

(a) Separate right-turn lane

(b) Dropped lane transitioning into a right-turn lane

(c) Free-flow channelized right-turn lane, such as at an interchange: lane addition or merge lane

(2) Bicycle lane adjacent to a dedicated bus bay

(3) Intersection Bicycle Boxes, see ***FDM 223.2.1.5***

(4) Two-Stage Bicycle Turn Boxes, see ***FDM 223.2.1.5***

Green-colored pavement markings supplement the required bicycle lane pavement markings and are not to be used as a substitute for such markings.

The use of green-colored pavement markings requires the approval of the District Design Engineer through Project Suite’s Design Approval Request Process. The approval must be obtained during Phase I of Design. The addition of green-colored pavement markings to bicycle lanes per these criteria do not require a local agency maintenance agreement. For placement on existing pavement, contact the State Materials Office for additional placement requirements.

Use the following guidance in the placement of green-colored pavement markings for bicycle lanes:

(1) When it is used in conjunction with white dotted lines, such as when extending a bicycle lane across a right turn lane or access to a bus bay, the transverse-colored marking must match the 2'- 4' white dotted line pattern of the bicycle lane extension.

(2) Start the green-colored pavement as a solid pattern 50 feet in advance of the dotted striping, match the 2'- 4' dotted through the conflict area, and then resume the solid color for 50 feet after the conflict area, unless such an extent is interrupted by a stop bar, an intersection curb radius or bicycle lane marking.

Include quantities in accordance with the ***Basis of Estimates Manual***. Load these quantities into the Designer Interface in the Signing and Pavement Marking Category.

Projects using green-colored pavement markings, the EOR must submit either a GIS (a.k.a., shapefile or geodatabase) or CADD (e.g., dsgnsp.dgn, dsgnsp.dwg) file(s) depicting the location(s) of these markings. Submit the required files via email to ***CO-CIMGIS@dot.state.fl.us*** and copy the State Bicycle Pedestrian Coordinator.

Additional details on the file format can be found in the ***CADD Manual*** and at the following website: ***https://www.fdot.gov/gis/bim/green-pavement***.

223.2.1.5 Intersection Bicycle Box and Two-Stage Bicycle Turn Box

The Federal Highway Administration (FHWA) has issued Interim Approvals (IA), for the use of intersection bicycle boxes (***IA.18***) and two-stage bicycle turn boxes (***IA.20***). FDOT has received permission from FHWA for use of these markings on the SHS.

Intersection bicycle boxes increase the visibility of stopped bicycle traffic at an intersection and help group together bicyclists to clear intersections more quickly. Two-stage bicycle turn boxes provide another option for bicyclists to make a left turn at an intersection.

The use of intersection bicycle boxes or two-stage bicycle turn boxes may be considered only at signalized intersections. Should it be determined there are safety concerns with the IA's device or application and the IA is terminated, the device must be removed and the site restored to its previous condition.

Intersection bicycle boxes are to meet the requirements in ***IA.18*** and comply with all of the following conditions:

- 'Right turn on red' is prohibited
- The left turn signal is protective
- All approaches to the intersection have a posted speed no greater than 35 mph

- Bicycle detection is provided if detection is required to actuate the signal or the signals are not timed
- There is a bicycle lane or bicycle keyhole preceding the bicycle box
- There is no more than one through lane on the approach to the bicycle box
- There is a receiving bicycle facility (bicycle lane or paved shoulder) on the opposite side of the intersection

Two-stage bicycle turn boxes are used only in conjunction with bicycle lanes. They must meet the requirements in ***IA.20*** and comply with all of the following conditions:

- 'Right turn on red' is prohibited
- All approaches to the intersection have a posted speed no greater than 45 mph
- Bicycle detection is provided if detection is required to actuate the signal or the signals are not timed

It is recommended that an educational program be developed to accompany the installation of bicycle boxes or two-stage bicycle turn boxes.

The use of intersection bicycle boxes or two-stage bicycle turn boxes require the approval of the State Roadway Design Engineer.

223.2.2 Paved Shoulders

A paved shoulder is the portion of the roadway contiguous with the traveled way for accommodation of errant vehicles, stopped vehicles, bicycle traffic, and emergency use. A paved shoulder must be a minimum width of 4 feet to serve as a bicycle facility.

See ***FDM 223.2.1*** for criteria on marking a paved shoulder as a bicycle lane.

See ***FDM 210.4*** for additional information on paved shoulder requirements.

When audible and vibratory treatment is used adjacent to a paved shoulder that serves as a bicycle facility, see ***FDM 210.4.6***.

~~223.2.2.1 Marked Shoulders~~

~~A paved shoulder that has the Helmeted Bicyclist Symbol and Bicycle Lane Arrow pavement markings (see ***FDM 223.2.1.2***) is referred to as a "marked shoulder".~~

~~Paved shoulders should be marked only when all the following are met:~~

~~(1) Design speed ≤ 45 mph,~~

~~(2) Shoulder width ≥ 5-foot,~~

~~(3) Within C4, C5, C6 context classification, or within C3 when demand is demonstrated, and~~

~~(4) Shared use path is not present along corridor.~~

223.2.3 Shared Use Paths

A shared use path may be substituted for a bicycle lane when the roadway design speed is 35 mph or greater and all the following conditions are met:

- Context classification C1, C2, or C3,
- Separation can be maintained between bicycle and motorized traffic through intersections, and
- Conflict points are minimal and mitigated.

An Urban Side Path, which is a category of shared used path, may be substituted for a bicycle lane when the roadway design speed is 35 mph or less and the following conditions are met:

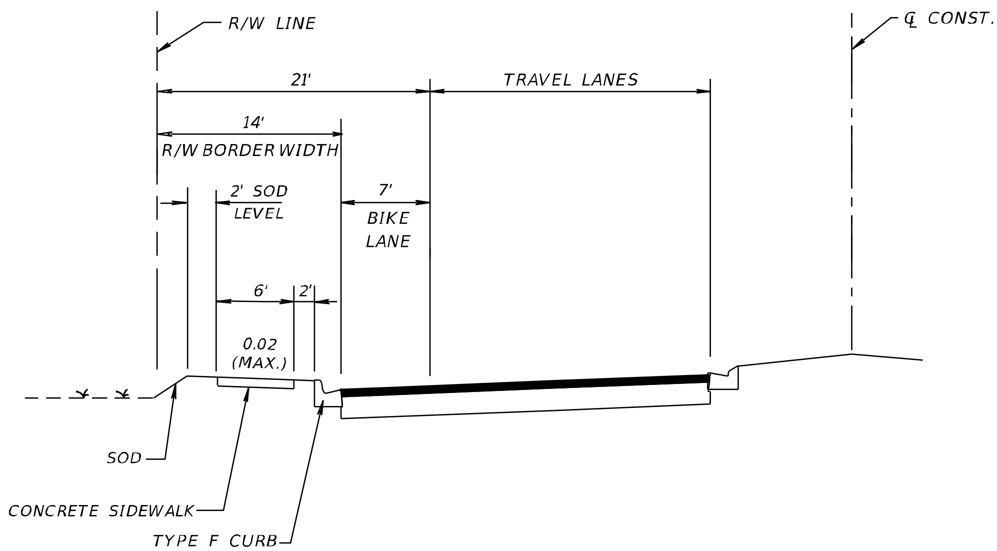
- Context Classification of C2T, C4, C5, and C6
- The adjacent roadway is curbed

As shown in ***Figure 223.2.1***, in some cases it may be possible to fit a shared use path into the same space required for a sidewalk and buffered bicycle lane. Process a Design Variation for signs placed within the path horizontal and vertical clearance envelope (see ***FDM 224.7*** and ***224.8***) or roadway lateral offset (see ***FDM 215*** and ***Standard Plans***). In other cases, additional width may be required. It is preferable to plan for shared use paths and separated bicycle lanes ahead of time by reflecting them in a district bicycle facility plan.

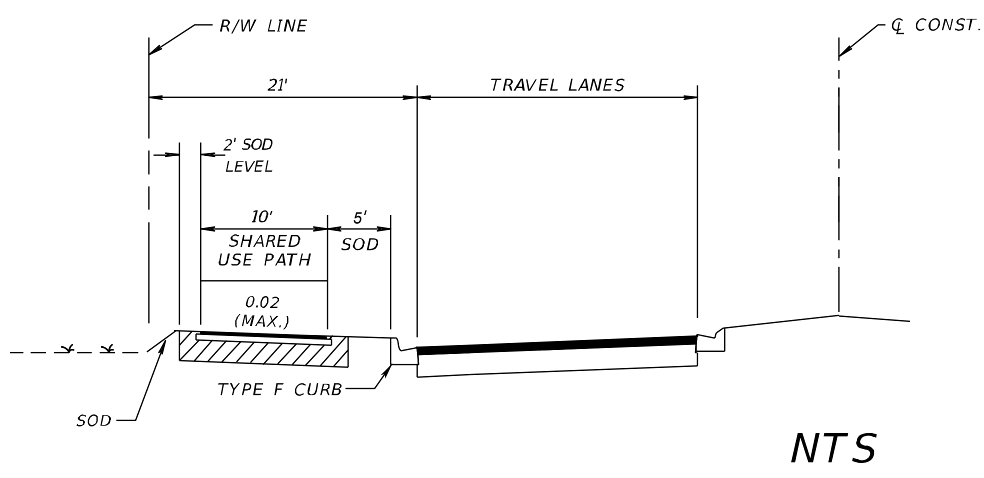
See ***FDM 224*** for shared use path design criteria.

Figure 223.2.1 Bicycle Lane and Shared Use Path Examples

Bicycle Lane and Sidewalk Example



Shared Use Path Example



223.2.4 Separated Bicycle Lanes (SBL)

Separated bicycle ~~facilities~~ lanes are one-way or two-way bicycle lanes that are adjacent to and physically separated from the vehicular travel lane. Bicyclists in these facilities are separated from vehicular traffic.

A separated bicycle lane may be used when all the following conditions are met:

- Minimum required combined width of the separator and separated bicycle lane can be obtained,
- Separation can be maintained between bicycle and motorized traffic through intersections, and
- Conflict points are minimal and mitigated. Cyclists should be given priority at the driveway and side street crossings.

A separated bicycle lane should be considered when street level bicycle facility transitions are needed for interchange ramp and intersection approaches. See ***FDM 223.2.6*** for criteria for transitioning between elevations and ***FDM 211.18*** for ramp crossing criteria.

Use the criteria contained in ***FDM 223.2.4*** in conjunction with the ***FHWA Separated Bike Lane Planning and Design Guide*** to plan and design separated bicycle lanes on the State Highway System.

223.2.4.1 Type of Separation

Tubular markers, islands, on-street parking, and rigid barriers may be used as forms of separation for the appropriate design speeds as follows:

- 35 mph or less: Tubular markers, traffic separators, islands, rigid barriers, or on-street parking. For separated bicycle lanes adjacent to on-street parking, use an island (see ***Figure 223.2.2***).
- 40-45 mph: ~~Medianst~~Traffic separator, islands, or rigid barriers

Use curb types for separated bicycle lanes as shown in ***FDM 223.2.5***. Other forms of separation require approval from the State Roadway Design Engineer.

223.2.4.2 Sidewalk Level Separated Bicycle Lanes

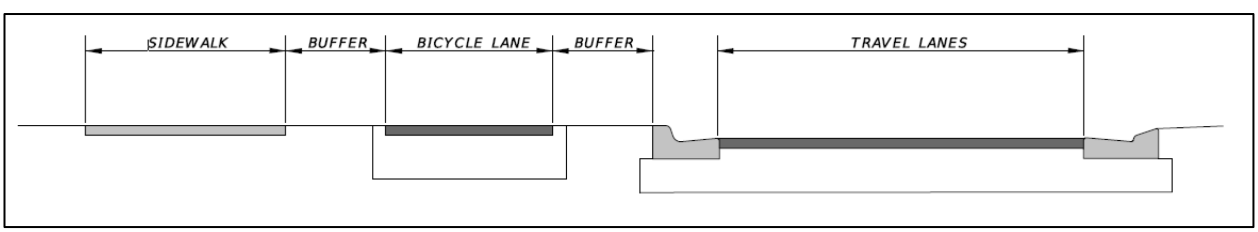
Sidewalk level separated bicycle lanes (sidewalk level SBLs), also known as raised bicycle lanes, are exclusive bicycle facilities located at sidewalk level directly adjacent to the roadway,

Use the following criteria when designing sidewalk level SBLs:

- In C2T, C4, C5, or C6 where design speed is 35 mph or less, use urban side path criteria per FDM 224 for the following elements. In other conditions, use Shared Use Path criteria for these elements.
    - Horizontal Clearance
    - Vertical Clearance
    - Design Speed
    - Horizontal Alignment
    - Separation from Roadway
    - Longitudinal Grades
    - Cross Slopes
- Follow the width criteria in ***Table 223.2.1***
- When adjacent to a sidewalk, provide a 2-foot detectable buffer (e.g. grass strip or textured pavement) between the sidewalk and separated bicycle lane. A 1-foot detectable buffer may be used in constrained conditions.

A sidewalk level bike lane does not substitute for a sidewalk, where a sidewalk is required. See ***Figure 223.2.2*** for example of a sidewalk level bike lane.

Figure 223.2.2 Example of Sidewalk Level Bicycle Lane

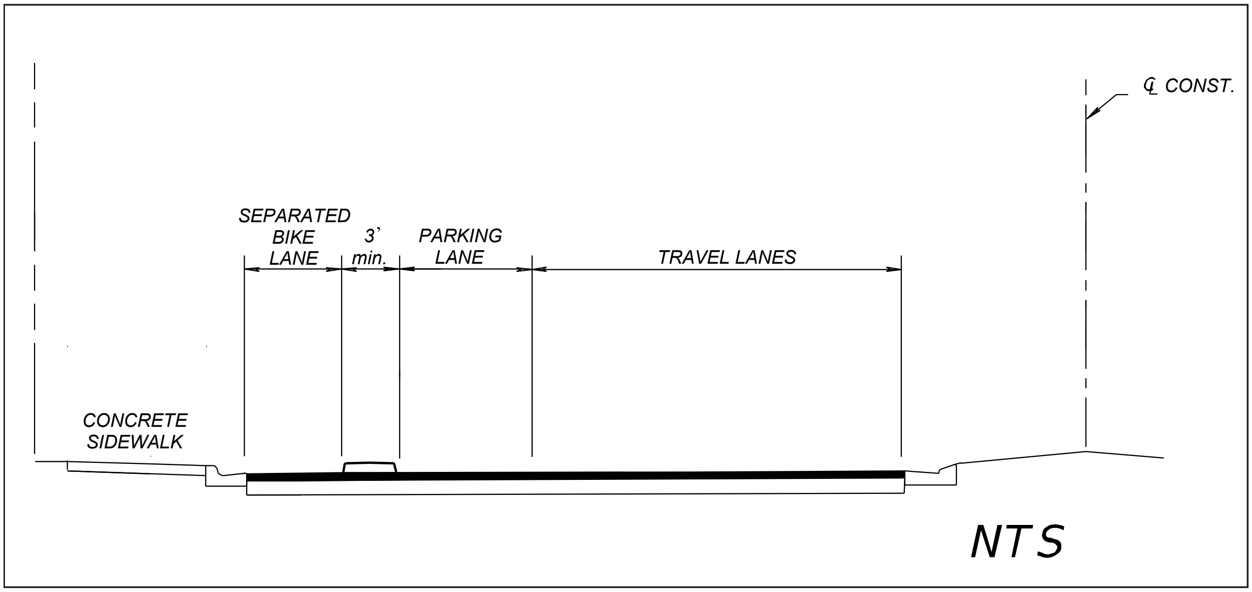


223.2.4.~~2~~3 Width of Separation

The widths of separation are as follows:

- 3 feet minimum if adjacent to on-street parking. See ***Figure 223.2.~~2~~ 3*** for more information.
- If adjacent to travel lanes:
  - 35 mph or less: 6 feet preferred, 3 feet minimum unless using tubular markers or islands, then 2 feet minimum
  - 40 to 45 mph: 8 feet preferred, 3 feet minimum.

Figure 223.2.~~2~~3 On-Street Parking Minimal Separation



223.2.4.~~3~~ 4 Separated Bicycle Lane Widths

Use wider lanes where higher volumes are expected.

~~The lane widths for separated bicycle facilities are as follows:~~

- ~~Two-Way facilities: 12 feet preferred, 10 feet minimum~~
- ~~One-Way facilities: 7 feet preferred, 6 feet minimum~~

The preferred lane width for one-way separated bicycle facilities is 7 feet. For two-way facilities, the preferred lane width is 12 feet.

Use the following minimum separated bicycle lane widths in **Table 223.2.1** along one-way and two-way separated bicycle lane facilities under constrained conditions:

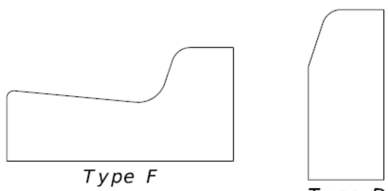
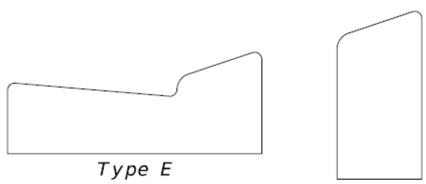
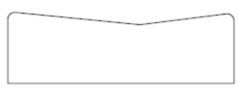
Table 223.2.1 Minimum Separated Bicycle Lane Widths

One-Way Facility	Width (feet)
Between drop curbs, types E or B curbs, at sidewalk level, or adjacent to one type F or D curb	5
Between two type F or D curbs	6
Two-Way Facility	**Width (feet)**
Between drop curbs, types E or B curbs, or at sidewalk level	8
Adjacent to one type F or D curb	9
Between two type F or D curbs	10
Notes: (1) A continuous barrier is treated the same as a type F or D curb	

223.2.5 Separated Bicycle Lane (SBL) Curb Types

Selecting the appropriate curb type is important when designing separated bicycle lanes and street buffer zones. Increased risks of bicycle wheel or pedal strikes and crashes can be influenced by the curb type. The curb angle and curb height can have an impact when exiting the bicycle lane, accessing parking, and determining risk of encroachment by motor vehicles. ***Figure 223.2.4*** illustrates and describes curb types used for separated bicycle lanes.

Figure 223.2.4 SBL Curb Types

Curb Types	Description
	Types F and D Curbs assist in channelizing bicycles, but wheels or pedals could strike the curb.
	Types E and B curbs also assist in channelizing bicycles, reduces pedal strikes, and provide easier access to the sidewalk for dismounting.
 See References: FDOT Standard Plan-Index 520-001, 520-002 FDOT Drainage Manual-Table 3.2	Drop Curbs are designed with a forgiving angle that minimizes pedal strikes but consumes more cross section width that could be used for the bicycle lane or a buffer. The curbs also allow safer exit from the bicycle lane, without impeding fellow bicyclists. However, the curb can be encroached by motor vehicles and bicycles. (N.T.S)

223.2.~~4~~5.~~4~~ ~~6~~1 Pavement Markings

Pavement markings used for separated bicycle facilities must conform to the ***MUTCD***, ***Traffic Engineering Manual (TEM)***, or ***FDM 230***. Markings that do not conform to any of these manuals require approval by the State Roadway Design Engineer and State Traffic Operations Engineer.

223.2.~~4~~5.~~5~~ 2 Intersections and Driveways

Chapter 5 of the ***FHWA Separated Bike Lane Planning and Design Guide*** includes typical designs to address the following:

- Facility connections at intersections,
- Side streets and driveways, and
- Traffic operation tools such as bicycle signal faces and signal phasing.

See the ***TEM*** for more information on traffic operation tools.

Maintain separation between bicycle and motorized traffic through intersections (e.g., do not use mixing zones and keyhole lanes).

Minimize turning conflicts through access management. Cyclist should have priority at the driveway and side street crossings that remain.

223.2.~~5~~6 Bicycle Ramps

Use bicycle ramps when connecting on-street bicycle facilities to sidewalk level ~~s~~SBLs or shared use paths on curbed roadways.

Figure 223.2.5 illustrates the geometrics for a bicycle ramp when a utility strip of at least 5-feet is present. The desired angle between the ramp and the roadway ranges from 20 to 25 degrees; however, the angle is not to exceed 35 degrees.

Figure 223.2.6 illustrates the geometrics for a bicycle ramp when the sidewalk on the approach leg is adjacent to, or near the back of curb.

Place a Directional Tactile Walking Surface Indicator (a.k.a., Directional Indicator) at the top of the bicycle ramp to provide a tactile cue for visually impaired pedestrians to continue down the sidewalk or shared use path. Do not place detectable warning surfaces on the bicycle ramp. See ***Developmental Specification Dev528*** and ***Developmental Standard Plans (DSP) Index D528-001*** for additional requirements. Do not include a Directional Indicator when connecting an on-street bicycle facility to a sidewalk level SBL.

Figure 223.2.5 Angled Bicycle Ramp

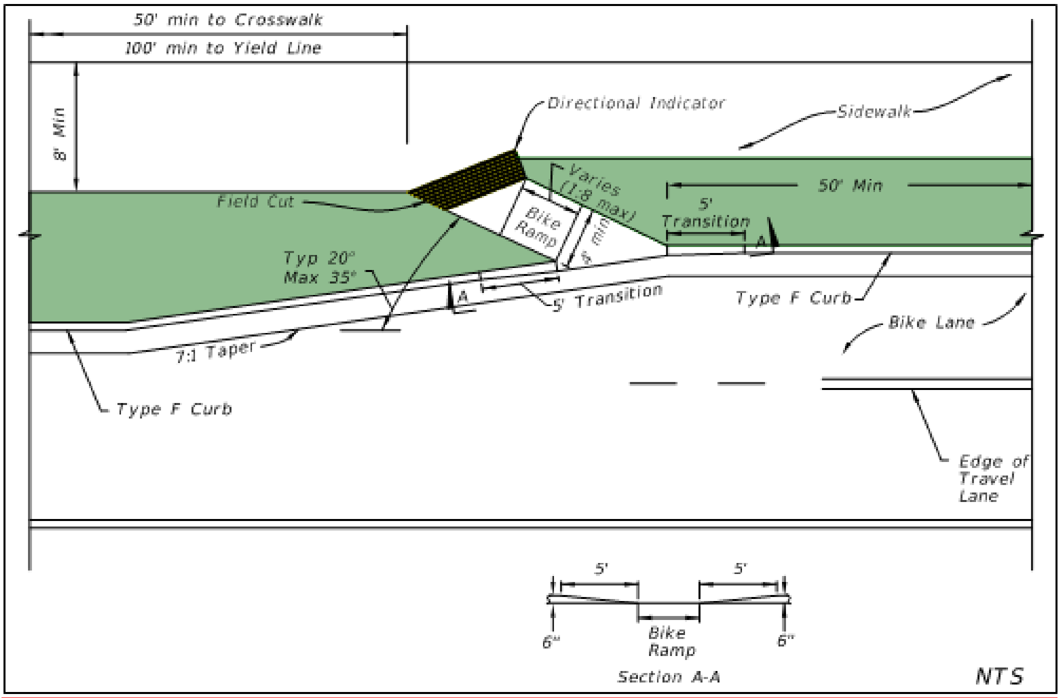


Figure 223.2.6 Straight Bicycle Ramp

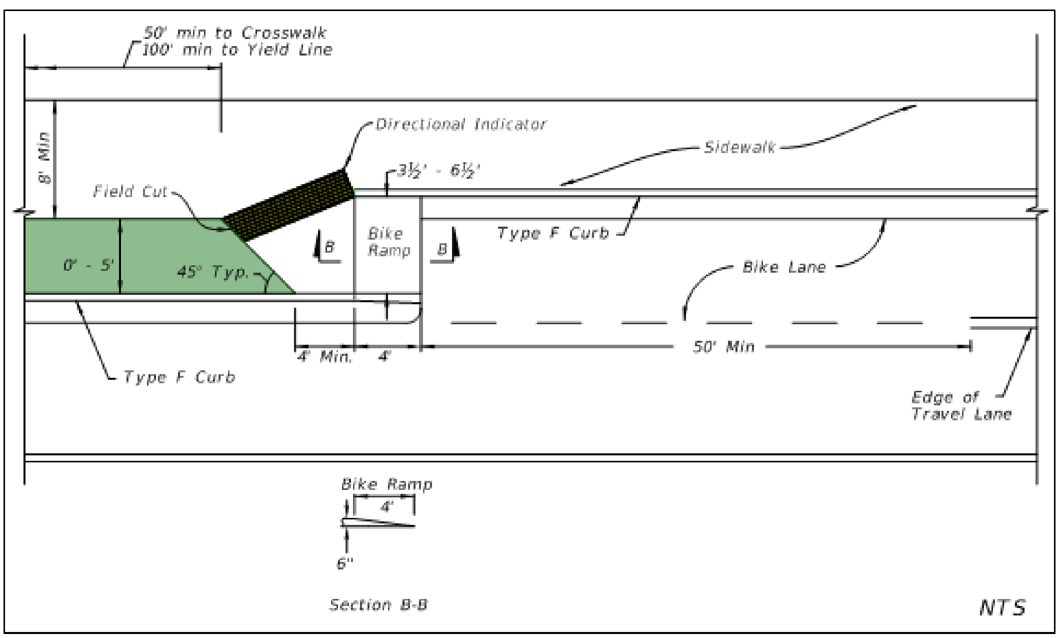


Exhibit 223-1: Bicycle Lane Typical Pavt Marking

Exhibit 223-2: Typical Keyhole Lanes

Exhibit 223-3: Green-Colored Bicycle Lanes

223.3 Shared Lane Markings (Sharrows)

Shared lane markings, or "Sharrows" are optional pavement markings used to indicate a shared environment for bicycles and motor vehicles. Sharrows are used where it is not practical to provide a bicycle facility, and any of the following conditions exist:

(1) With on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle.

(2) To fill a gap in an otherwise continuous bicycle facility, generally for a short distance.

(3) As part of an approved temporary traffic control plan, see ***FDM 240***.

Streets with low traffic volumes and low traffic speeds are better suited to a travel environment where bicycle and motor vehicle traffic are mixed. Do not use Sharrows in the following conditions:

- Roadways with a posted speed greater than 35 mph
- On shared use paths
- Within a right turn lane

Place Sharrows in the center of the travel lane. This placement provides guidance to bicyclists to "command the lane" which discourages motorists from passing too closely. This placement also informs drivers that cyclists are entitled to ride in the center of the lane for their safety. To effectively convey this message, place Sharrows immediately after intersections and at a maximum spacing of 250 feet.

223.4 On-Street Parking

Roadways with on-street parking must provide room to cyclists to minimize impacts related to close proximity of parked vehicles (e.g., door zone avoidance). The following treatments are required for roadways with on-street parking:

- Parallel Parking:
  - Provide a 4-foot bicycle lane adjacent to the travel lane with a 3-foot buffer between the parallel parking lane and bicycle lane, per ***Exhibit 223-1***.
  - Provide a shared lane marking in place of a bicycle facility when there is less than 7 feet available for the bicycle lane and buffer.
- Angle Parking:
  - Use a shared lane marking in place of a bicycle facility.

223.5 Bicycle Parking Amenities

Appropriately placed bicycle and micromobility parking supports those who choose to use the bicycle or micromobility devices (devices) as their mode of transportation. Bicycle and micromobility parking facilities are ~~,~~ installed and maintained by local agencies and require approval of the District Design Engineer when ~~,~~ on FDOT R/W. ~~require the approval of the District Design Engineer.~~

~~Consider the following for the p~~Locate and design~~lacement of~~ bicycle and micromobility device parking facilities so that:

- Sidewalk-level f~~F~~acilities meet the following lateral offset requirements based on roadway design speed ~~and do not interfere with pedestrian facilities~~
    - ≤35 mph: 1.5 ft
    - ≥40 mph: 4 ft
- On-street facilities are no closer than 1.5 feet to the traveled way
- When parked, the device ~~must~~ fits completely within the parking area (i.e. not extend into the travel lane) and does not interfere with pedestrian facilities
- Racks provide two points of support to the device
- ~~Racks are no closer than 1.5 feet to the traveled way the bicycledevice from two locations to prevent it from falling over~~

Consider the following:

- ~~Bicycle s~~Shelters are desirable for long-term ~~bicycle~~ device parking and for shielding ~~bicycles~~ devices from inclement weather conditions
- ~~Bicycle l~~Lockers can provide a secure place to store and~~a bicycle by~~ prevent~~ing~~ access when closed

When on-street parking is being used to create bicycle and micromobility device parking as seen in ***Figure 223.5.1*** and ***Figure 223.5.2:***

- Use only where vehicular on-street parking is also allowed per ***FDM 210.2.3***
- Parking should be flush with the bicycle lane or accessible by a mountable curb
- Vertical ground-mounted objects (i.e. tubular markers) may also be used for motor vehicle and bicycle parking separation

~~See ***AASHTO's 2012 Guide for the Development of Bicycle Facilities, Section 6.3.1*** for site-specific guidance for bicycle racks.~~

Figure 223.5.1 illustrates on-street bicycle parking at midblock and ***Figure 223.5.2*** illustrates on-street bicycle parking at an intersection.

Figure 223.5.1 On-Street Bicycle Parking (Midblock)

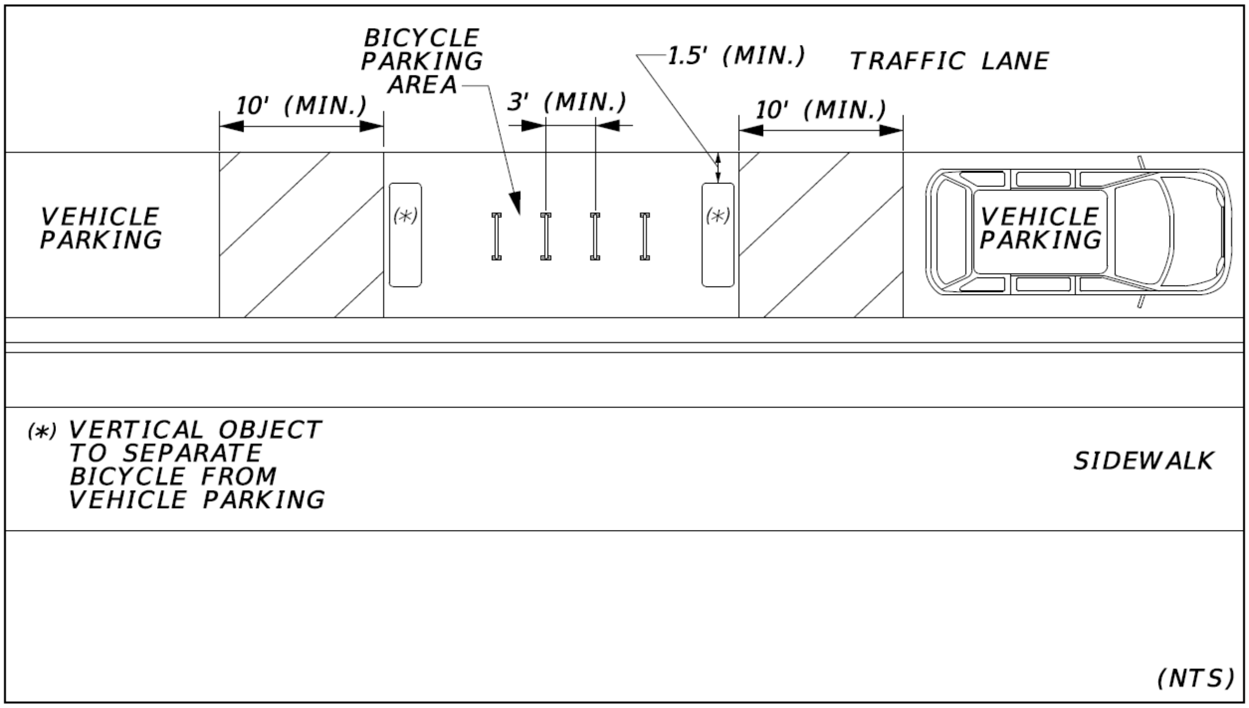
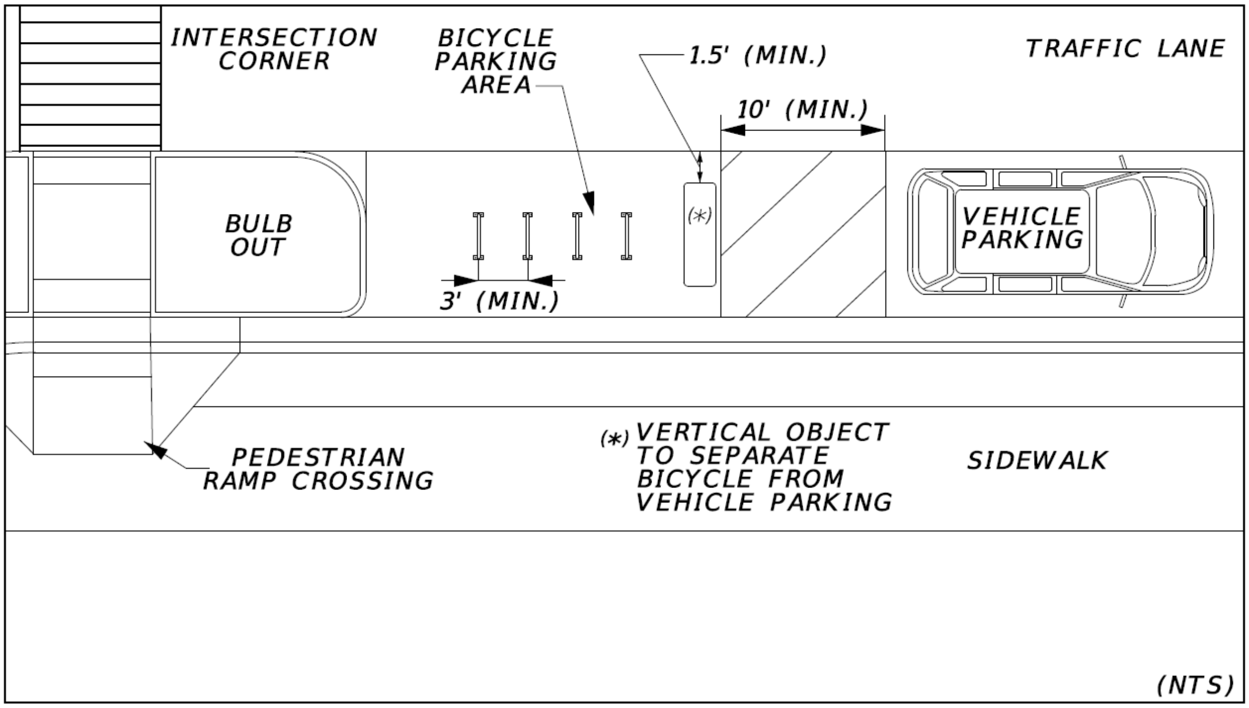


Figure 223.5.2 On-Street Bicycle Parking (Intersection)



See ***AASHTO's 2012 Guide for the Development of Bicycle Facilities, Section 6.3.1*** for site-specific guidance for bicycle racks.

223.6 Bicycle Route System

Bicycle routes include roadways or shared use paths designated through signage, pavement markings or mapping. They provide directional and distance information, and aid bicyclists in wayfinding, especially in complex urban locations or along established long distance bicycle routes.

Follow the signing guidance in the ***MUTCD*, *Part 9*** when including information directing bicyclists around temporary interruptions in a route. Do not terminate bicycle routes at a barrier.

The decision whether to provide a bicycle route system should be based on the suitability of the particular roadway or shared use path for bicycle travel and the need for wayfinding information. Evaluations of suitability should include roadway width, volume, speed, and types of traffic, parking conditions, grade, sight distance, and connectivity to services, significant destinations, and local transit or regional transportation hubs. Other considerations include location and condition of drainage grates, railroad crossings, pavement surface, signals responsive to bicycles, and maintenance schedules.

223.6.1 U.S. Bicycle Route System

The U.S. Bicycle Route (USBR) System is a network of bicycle routes that span multiple states and are of national or regional significance. These routes are nominated for national designation by State Departments of Transportation (DOTs) and designated and catalogued by the ***American Association of State Highway and Transportation Officials (AASHTO)***.

The **National Corridor Plan** shows existing and proposed U.S. Bicycle Routes within the United States. Florida has three U.S. Bicycle Routes:

- U.S. Bicycle Route 1
- U.S. Bicycle Route 90
- U.S. Bicycle Route 15

Florida has adopted a policy entitled **U.S. Numbered Bicycle Routes, Topic No. 000-525-060-a** in support of the national route system.

223.6.1.1 Determining a U.S. Bicycle Route

The District Bicycle Pedestrian Coordinator(s), with assistance from the State Bicycle Pedestrian Coordinator, will conduct the following:

- Assess and evaluate possible routes and select the most appropriate alternative.
- Acquire written support from federal, state, or local agencies that have jurisdiction over the route or surrounding area, including the following:
  - Road authorities
  - Municipal governments
  - Departments of natural resources
  - Tribes
  - Parks and recreation
  - Federal land agencies; e.g., U.S. Forest Service, Bureau of Land Management, National Park Service

- Secure letter of concurrence from adjacent state (Alabama or Georgia). When these states ask Florida for concurrence of a proposed route, the letter will be signed by the appropriate District Secretary.
- Prepare and submit the AASHTO application. Provide turn-by-turn instructions, map, state letter of concurrence, and written support from road owners. Also include discussion of economic benefits, liability, and signage for the route. The application is to be signed by FDOT Secretary.

Table 223.6.1 provides criteria that can be used to evaluate route options. Route options are scored on a scale from 3 (fulfills selection criteria) to 0 (does not contribute to meeting selection criteria). “N/A” may be used when the criteria does not apply.

Table 223.6.1 U.S. Bicycle Route Criteria

Macro Criteria	3	2	1	0	NA
Within USBR corridor, with an emphasis on intrinsic scenic and cultural qualities of the corridor itself.					
Access to scenic, cultural, historical, and recreational destinations. (May not be directly on route but are nearby.)					
Links major metropolitan areas to connect bicyclists to transportation hubs or major attractions.					
Reasonable direct route in connecting cities or attractions along the corridor.					
Supports natural connections between adjoining states.					
Includes or intersects existing or planned bicycle routes that are suitable for travel by touring bicycles.					
Micro Criteria	**3**	**2**	**1**	**0**	**NA**
Meets acceptable design criteria for on-road facilities and shared use paths.					
Utilizes already established and successful routes or paths					
Easy to follow with limited turns; is well marked or has easily identified permanent landmarks to enable navigation.					
Connects to at least one neighboring state's USBR, suitable roadway, bicycle route, or trail system.					
Access to food, water and overnight accommodations (including camping) at appropriate intervals (40-60 miles).					
Access to restaurants, libraries, retail shops and bicycle shops (parts and repair).					
Regularly scheduled ferry service for crossing water bodies. An alternate route should be identified when service may not be available.					
Topography is relatively easy for bicyclists; i.e., avoids extreme climbs.					
Total					

224 Shared Use Paths

224.1 General

Shared use paths are paved facilities physically separated from motorized vehicular traffic by an open space or barrier and are either within the highway right of way or an independent right of way. The term, "shared use path", as used in this manual is synonymous with trails, multiuse trails, or other similar terms used in other Department manuals.

Shared use paths are used by bicyclists, pedestrians, skaters, runners, and others. Since shared use paths serve as pedestrian facilities, they must comply with Americans with Disabilities Act (ADA) standards. In addition to the requirements of this manual for accessible pedestrian facilities, the bicycle's operating characteristics govern the design of shared use paths.

It is preferable to plan for shared use paths ahead of time by including them in a district bicycle facility plan. There should be a commitment to provide path continuity with other bikeways throughout the corridor. Ensure adequate access to local streets and other facilities along the path.

A shared use path may substitute for the following:

Sidewalk in locations where sidewalk is required (See ***FDM 222.2.1***)

Bicycle lanes on roads with a design speed of 35 mph or greater (See ***FDM 223.2.1***)

For RRR projects, other than meeting detectable warning and curb ramp requirements, unaltered shared use paths that are not in compliance with ***FDM*** criteria or ADA standards are not required to be reconstructed.

An Urban Side Path is a category of shared use paths that may be used in C2T, C4, C5 and C6 context classifications where the design speed of the adjacent roadway is 35 mph or less. In C5 or C6 context classifications, Urban Side Paths placed adjacent to the roadway must be provided with a separate sidewalk to accommodate increased pedestrian demand in these context classifications.

The Urban Side Path users and motorists in adjacent travel lanes will be traveling more slowly in C2T, C4, C5, and C6 context classifications, compared to the rural and suburban locations of conventional Shared Use Paths. In addition, because they are associated with curbed roadways, Urban Side Paths will be vertically separated from the roadway, further distinguishing them from conventional Shared Use Paths. The slower travel speeds and vertical separation allow the use of design criteria differing from a standard Shared Use Path. The slower travel speeds are due to speed management concepts inherent to the urban environment (e.g., enclosure, engagement, and deflection). See ***FDM 202*** for more information on speed management.

A shared use path may not be the best solution for all conditions. Use a separated bike lane with a sidewalk per ***FDM 223*** and ***FDM 222*** in Context Classifications C2T, C4, C5, or C6 when:

(1) Non-motorist volumes are expected to be high, or

(2) There may be high numbers of more vulnerable users such as elderly or people with disabilities.

224.1.1 Shared Use Path Within Department Limited Access Right of Way

Exposing vulnerable road users to high-speed traffic is undesirable; therefore, shared use paths located parallel to Limited Access (LA) Facility travel lanes are not permitted within LA right of way (R/W). However, a shared use path on causeways or bridges that span navigable waterways may be considered when the path is shielded from the high-speed traffic using a barrier or traffic railing.

It is the Department's intention to facilitate interconnectivity with other existing or planned shared use paths (trails) as identified by the Florida Greenways and Trails Council in accordance with ***Chapter 260, Florida Statutes*** "Florida's Greenways and Trail Act". To support Florida's shared use path (trail) network, crossing the Department's LA R/W at an existing roadway, or on a new separated overpass or underpass, will be considered.

Shared use paths that cross LA R/W must meet the following criteria:

(1) The shared use path is available for public use and includes a fence or wall to prevent access to the LA Facility travel lanes.

(2) Local Agency Agreements must be obtained to assign ownership, maintenance, and management; responsibilities, including:

   (a) Lighting

   (b) Fencing or barriers

   (c) Security gates

   (d) Signing

   (e) Amenities

(3) At-grade crossings are permitted only at interchange ramp terminals and signalized crosswalks.

(4) A proposed overpass crossing (i.e., bridge structure spanning LA R/W) must not be within two miles of an existing or proposed shared use path crossing of the same LA Facility. A proposed overpass must:

(5) Accommodate future widening of the LA Facility,

(6) Span the LA R/W with minimal piers, and

(7) Provide abutments outside of clear zone.

(8) A proposed underpass crossing (i.e., shared use path adjacent to roadway or waterway under LA Facility bridge) must meet minimum vertical clearance as defined in ***FDM 224.8***. A proposed underpass must remain free from standing water up to and including the 10-year storm event.

Design Variations for the above criteria must be approved by the Chief Engineer, following a review by the Chief Planner.

224.1.2 Public Transit Loading Zones

See ***FDM 225*** for information on Public Transportation Facilities. Provide a minimum 5-foot-wide sidewalk connecting transit stops to shared use paths.

Coordination with the following may be required to determine the optimum location of boarding and alighting areas, transit shelters, and bus bays:

(1) District Pedestrian/Bicycle Coordinator

(2) District Modal Development Office Coordinator

(3) District ADA Coordinator

(4) District Public Transportation staff

(5) Local public transit provider(s)

224.1.3 At-grade Railroad Crossings

See ***FDM 222.2.4*** for information on at-grade railroad crossings.

224.1.4 Conflict Points

Special attention should be paid to minimizing and managing conflict points along shared use paths. See ***FDM 223.2.4.5*** for more information.

224.1.5 Cyclists Enter and Exit Paths

Design Shared Use Path entry and exit points to allow cyclists to enter and exit without riding against traffic. See ***FDM 223.2.4.5*** for more information.

224.2 Curb Ramps

Provide curb ramps to be the same width as the path. At locations where the path narrows from the typical width, warning signs or pavement markings in conformance with the ***MUTCD*** should be used. Refer to ***FDM 222.2.2*** for specific design criteria for curb ramps.

224.3 Detectable Warnings

Provide detectable warnings in accordance with ***FDM 222.3***.

224.4 Widths

The appropriate paved width for a two-directional shared use path is dependent upon context, volume and mix of users. Widths range from a minimum 10 feet to 14 feet, with a standard width of 12-feet. SUN Trail network facilities that are less than 12-feet require approval by the Chief Planner. For shared use paths not in the SUN Trail network:

(1) 10-feet wide may be used where there is limited R/W.

(2) Short 8-feet wide sections may be used in constrained conditions.

Consider the accommodation of emergency and maintenance vehicles or management of steep grades when selecting the width of the path.

FHWA's Shared Use Path Level of Service Calculator may be used as a guide in determining appropriate width.

224.4.1 Tunnel and Bridge Widths

Clear width for tunnels is the width of the shared use path plus four feet. The geometrics and lighting requirements should be discussed with the Department Project Manager and the District Pedestrian/Bicycle Coordinator.

Clear width for standalone pedestrian & bicycle Bridges can be found in ***FDM 266.3***.

Clear width for shared use paths on vehicular bridges is the width of the approach facility plus four feet (2-foot wide on each side). The minimum clear width is 12 feet under constrained conditions.

224.5 Cross Slopes

To meet ADA requirements, the maximum cross slope on shared use paths is 2%.

Use a 75-foot distance to transition from -2% to 2% or from 2% to -2% when it is desired to change the slope direction of the path. Consider the potential for ponding water when proposing a slope transition.

224.6 Longitudinal Grades

When a shared use path is adjacent to the roadway (i.e., follows the roadway profile), shared use path grades may mirror the roadway profile. When a shared use path is not adjacent to a traveled way, shared use path grades are not to exceed 5%, unless accessible ramps are provided. Maximum ramp slopes are 8.33% and can have a maximum rise of 30 inches, with a level landing at least 60 inches in length.

Grades greater than 5% cause difficulties for many path users including bicyclists. ***Table 224.6.1*** provides maximum grades and distances for areas in which the terrain makes it necessary to use steeper grades on short sections.

Table 224.6.1 Maximum Grade Lengths

Longitudinal Grade (%)	Maximum Length (feet)
6	800
7	400
8	300
9	200
10	100
11+	50

Notes:

(1) When using a longer grade, consider adding 4 to 6 feet of additional width to the path to allow a bicyclist to dismount and walk their bicycle.

(2) Clear distances and sight distances should be adjusted to accommodate longer grades.

Refer to ***FDM 224.11*** for controls on grade changes.

224.7 Horizontal Clearance

Provide a 4-foot clear area adjacent to both sides of the path, including placement of signs. Maintain a 2-foot-wide graded area with a maximum 1:6 slope adjacent to both sides of the path. For restricted conditions, bridge abutments, sign columns, fencing and railing may be located within 4 feet of the edge of pavement.

For Urban Side Paths, the following criteria reflect the lower design speed. Provide a minimum 2-foot buffer area adjacent to both sides of the path, including placement of signs. Signs, plantings, or other items must be located outside of the 2-foot buffer. Maintain a graded area with a maximum 1:6 slope adjacent to both sides of the path within the 2-foot minimum buffer area.

Horizontal clearance on standalone pedestrian & bicycle bridges, shared use paths alongside or on vehicular bridges, and tunnels is accounted for in the required clear widths as described in ***FDM 224.4.1***.

See ***FDM 224.15*** for information concerning drop-off hazards.

See ***Figure 224.8.1*** where horizontal clearance is “H”.

224.8 Vertical Clearance

Provide a 10-foot vertical clearance from the lowest edge of an overhead obstruction to any portion of the path under the obstruction. An 8-foot clearance is allowed for overhead signs and for other overhead obstructions under constrained conditions.

A 12-foot vertical clearance is desirable for:

(1) Accommodation of equestrians or maintenance and emergency vehicles.

(2) Underpasses and tunnels.

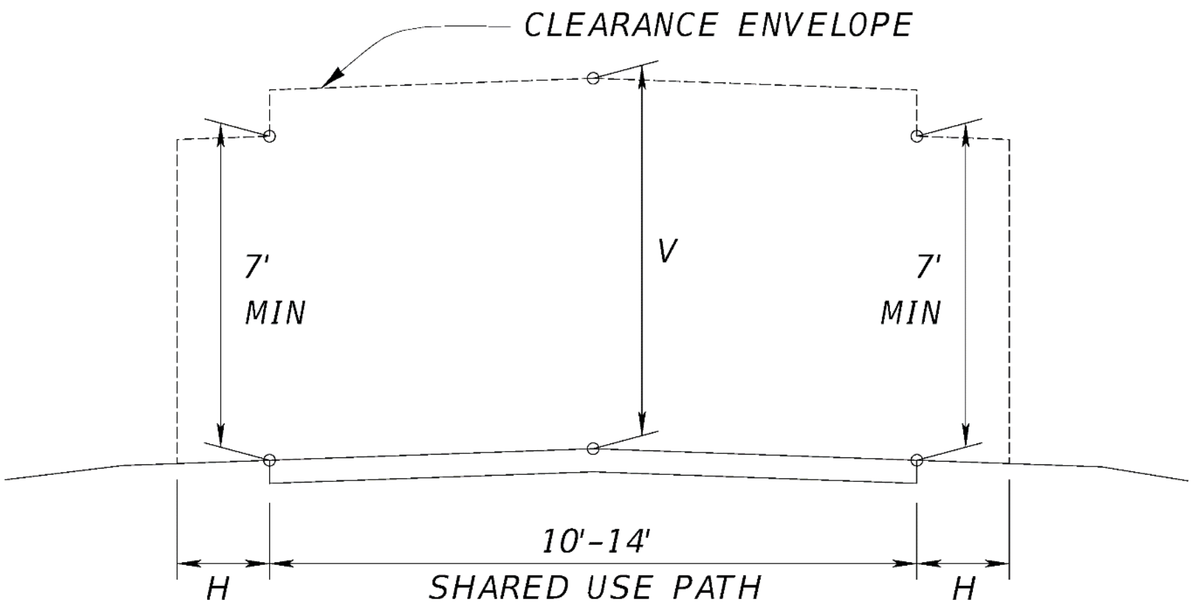
(3) SUN Trail.

Minimum clearances for bridge structures are given in ***FDM 260.6***.

Existing elements that provide a minimum 8-foot vertical clearance are not required to be corrected to the clearances listed above.

See ***Figure 224.8.1*** where vertical clearance is “V”.

Figure 224.8.1 Shared Use Path Horizontal and Vertical Clearance Envelope



224.9 Design Speed

Use a design speed of 18 mph for paths with longitudinal grades ≤ 4%. Use a design speed of 30 mph for paths with downhill longitudinal grades greater than 4%. For Urban Side Paths use a design speed of 10 mph.

224.10 Horizontal Alignment

224.10.1 Minimum Radii

The minimum centerline radius of curvature for a shared use path is provided in ***Table 224.10.1***.

Table 224.10.1 Minimum Radius Horizontal Curves on Shared Use Paths

Design Speed (mph)	Maximum Cross Slope (%)	Minimum Radius (feet)
10	2	20
10	-2	22
18	+2	74
18	-2	86
30	+2	261
30	-2	316

Notes:

(1) For paths with two-way traffic use minimum radius given for cross slope of -2%

(2) Positive (+) cross slopes represent pavement sloped to the inside of horizontal curves. Negative (-) cross slopes slope toward the outside of horizontal curves.

224.10.2 Stopping Sight Distance

The minimum stopping sight distances for a shared use path are provided in ***Table 224.10.2.*** Further information on calculating the minimum stopping sight distances may be found in the ***AASHTO*** ***Guide for the Development of Bicycle Facilities, 2012***.

Table 224.10.2 Minimum Stopping Sight Distances

Minimum Stopping Sight Distance (feet)															
Design Speed	Grades														
	Downhill								Uphill						
	9%	8%	7%	6%	5%	4%	3%	Flat	3%	4%	5%	6%	7%	8%	9%
10 mph	84	78	74	70	67	64	62	58	54	53	53	52	51	51	50
18 mph	Use 30 mph Values					156	149	134	123	120	118	115	113	111	109
30 mph	539	485	444	410	383	Use 18 mph Values									
Notes: Stopping sight distance based on an object height of 0.0 feet and an eye height of 4.5 feet															

224.11 Vertical Alignment

The minimum length of vertical curve necessary to provide minimum stopping sight distance at various speeds on crest vertical curves is selected by using the formula listed below:

When $S > L$: $L = 2S - (900 / A)$ L = Min. Length of Vertical Curve (ft.)

A = Algebraic Grade Difference (%)

When $S < L$: $L = AS^2 / 900$ S = Stopping Sight Distance (ft.)

224.12 Separation from Roadway

Place as close to the R/W line as possible or outside the clear zone. At a minimum, provide a separation between the shared use path and the roadway. This demonstrates to both path users and motorists that the shared use path is a separate facility. Minimum separation is as follows:

- On flush shoulder roadways with design speed 45 mph or less, the edge of the path is to be at least 5 feet from the edge of the paved shoulder.
- On flush shoulder roadways with design speed 50 mph or greater, the edge of the path is to be at least 5 feet from the shoulder break (see ***FDM 210.4***).

- On curbed roadways, the edge of the path is to be at least 5 feet from the face of curb, with consideration of other roadside obstructions (e.g., signs and light poles).

Where the minimum separation cannot be obtained:

- Consider installation of a pedestrian channelization fence at speeds of 45 mph or less to limit incursion of path users onto the roadway.

- Consider installation of a crashworthy barrier at speeds greater than 45 mph to limit incursion of motorists onto the path, although this type of barrier can be used at lower speeds as well.

For Urban Side Paths, place as close to the R/W line as possible, but no closer than 2 feet from the back of curb. Do not place Urban Side Paths adjacent to uncurbed roadways.

Commentary: Criteria provided are minimum values only. As motorist speeds increase, the amount of separation between the traveled way and path should also increase to manage the level of traffic stress for path users.

224.13 Lighting

Lighting for shared use paths is important and should be considered where riding at night is expected, such as paths serving college students or commuters. Lighting should also be considered through underpasses or tunnels. Lighting standards are provided in ***Table 231.2.1***.

224.14 Signing, Pavement Marking, and Signalization

The ***Standard Plans*** and the ***MUTCD*** provide guidance and requirements for signage, pavement markings and signals for shared use paths. Signs on shared use paths should follow the dimensions provided in ***Table 9B-1 Bicycle Sign and Plaque Sizes, MUTCD***.

224.15 Drop-off Hazards

Drop-off hazards are steep or abrupt slopes adjacent to the path that can be perilous to pedestrians and cyclists. There are two cases that require shielding as shown in ***Figure 224.15.1***. Depending on the depth of the drop-off and severity of the conditions below, shielding may be necessary for conditions other than cases 1 or 2.

Consider the following when determining the feasibility of shielding other drop-off hazards for protecting pedestrians and cyclists:

(1) The engineer should consult the District Bicycle/Pedestrian Coordinator or Trail Coordinator.

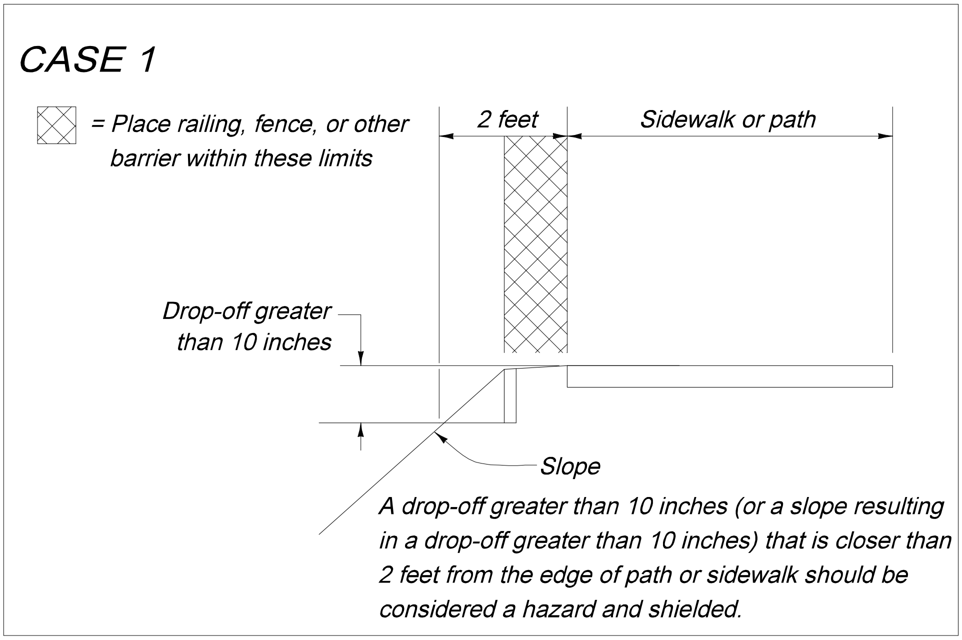
(2) Installing fencing or railings are two ways to shield the drop-offs. Fencing is generally intended for use in rural areas along paths and trails. Railing is generally intended for urbanized areas, locations attaching to bridge rail or along concrete walkways. Pedestrian/Bicycle Railings (***Standard Plans*, Index 515 Series**) are adequate for shielding all drop-offs but are generally intended for use on drop-offs greater than 60 inches. Pipe Guiderail (***Standard Plans*, Index 515-070** and ***515-080***) is adequate for shielding drop-offs which are 60 inches or less.

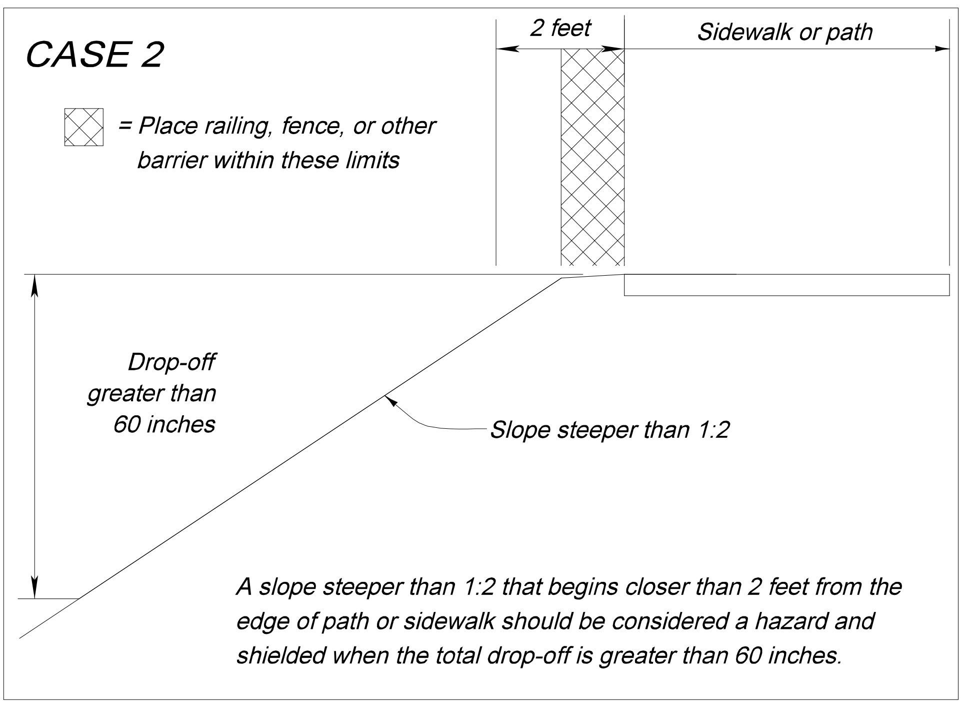
(3) Along continuous sections where the drop-off varies above and below the 60-inch threshold, for uniformity the engineer may consider using only one of the railing types adequate for shielding all drop-offs.

(4) Railing or fencing near intersections or driveways could obstruct the driver's line of sight. To reduce the need for railings, as a sidewalk or shared use path approaches an intersection, consider extending cross drains and side drains to minimize drop-offs.

(5) The installation of fencing, railing, or pipe guardrail presents a hazard in and of itself. Evaluate whether or not the installation of these devices present a greater risk than the drop-off or other condition it is intended to shield.

Figure 224.15.1 Drop-Off Hazards for Pedestrians and Bicyclists





224.16 Path Railings

Requirements for railings and fences are discussed in ***FDM 222.4***.

224.17 Typical Sections

Example typical sections are provided in ***FDM 913***.

224.17.1 Pavement Design

See the ***FDOT Pavement Management website*** for guidance on pavement requirements.

Provide a pavement design equivalent to standard shoulder pavement:

(1) 12-inch Stabilized Subgrade

(2) Base Group 1

(3) 1.5-inch Structural Course.

224.18 Shade Considerations

Shade along shared use paths is desired. Consider shade from landscaping and shade from architectural sources such as buildings, pavilions, and shade sails.

To maximize shade and minimize costs:

(1) Begin coordination between the designer, project manager, utilities, district landscape architect, and maintaining agency for the landscaping during Phase I of the design.

(2) Choose an alignment of the path that can capitalize on shade from existing and proposed trees or architectural sources.

For more information on shade from Landscape Design, refer to ***FDM ~~228~~270, FDM 944*** and ***Work Program Instructions Part 3, Chapter 16***.

225 Public Transit Facilities

225.1 General

Curbside and street-side transit facilities for bus stops should be considered in the roadway design process when a project includes a public transit route.

The Department's ***Accessing Transit: Version III, 2013 Design Handbook for Florida Bus Passenger Facilities*** provides guidance relating to provisions for curb-side and street-side facilities. Refer to ***FDM 215*** for criteria on the placement of shelters and benches. Coordination with the District Modal Development Office and local public transit provider(s) is necessary in developing the plans.

Additional guidance on the design of transit facilities is available in the 2014 AASHTO publication, ***A Guide for Geometric Design of Transit Facilities on Highways and Streets, 1st Edition***. This guide provides a comprehensive reference of current practice in the geometric design of transit facilities on streets and highways, including:

- Local buses, express buses, and bus rapid transit operating in mixed traffic
- Dedicated bus lanes, and high-occupancy vehicle lanes
- Bus-only roads within street and freeway environments
- Streetcars and Light Rail Transit running in mixed traffic and transit lanes, and within medians along arterial roadways

The AASHTO guide is intended for use by public agencies, practitioners, and developers in need of basic information about planning, locating, sizing, designing, and implementing transit facilities along roadways.

225.2 Boarding and Alighting Areas

Boarding and alighting areas help to create an accessible bus stop by providing a raised platform that is compatible with a bus that kneels or extends a ramp. A boarding and alighting area must have a firm, stable, and slip-resistant surface with a minimum clear length of 8 feet (measured perpendicular to the curb or roadway edge), and a minimum clear width of 5 feet (measured parallel to the roadway). Firm, stable, and slip resistant boarding and alighting areas are required if amenities such as benches or shelters are added to a bus stop. Boarding and alighting areas are not required at bus stops on flush shoulder roadways where only a bus stop sign is provided. Coordinate with the appropriate public transit provider(s) to determine compatibility with equipment and transit vehicles.

The slope of the boarding and alighting area parallel to the roadway should be the same as the roadway. For drainage purposes, a maximum slope of 1:50 (2%) (measured perpendicular to the roadway) is allowed.

On flush shoulder roadways, the boarding and alighting area should be constructed at the shoulder break to create an accessible bus stop, as shown in ***Figures 225.2.1*** and ***225.2.2***. The boarding and alighting area may be placed at the edge of shoulder pavement on roadways with a posted speed of 45 mph or less. The raised area provides a landing that is compatible with a bus that kneels or extends a ramp with a slope of 1:6 or less. Bus stops should be located in close proximity to existing intersections, and with sidewalk access. The boarding and alighting area is to:

(1) Use a Type E curb and gutter (5” curb height)

(2) Be connected to the sidewalk along the roadway or to the roadway when no sidewalk is present

Provide a sidewalk and/or ramp that is a minimum of 5 feet wide with a maximum slope of 1:12 for the boarding and alighting area. A detectable warning is required where a sidewalk associated with a boarding and alighting area connects to the roadway at grade. Except for the area adjacent to the 5-inch curb, the areas surrounding the boarding and alighting area are to be flush with the adjacent shoulder and side slopes and designed to be traversable by errant vehicles. On the upstream side of the landing, a maximum slope of 1:12 should be provided, and may be grass or a hardened surface. The boarding and alighting area (and ramp and level landing if needed) are to be constructed with 6-inch thick concrete.

Figure 225.2.1 Accessible Boarding and Alighting Area for Flush Shoulder Roadways with Connection to Sidewalk

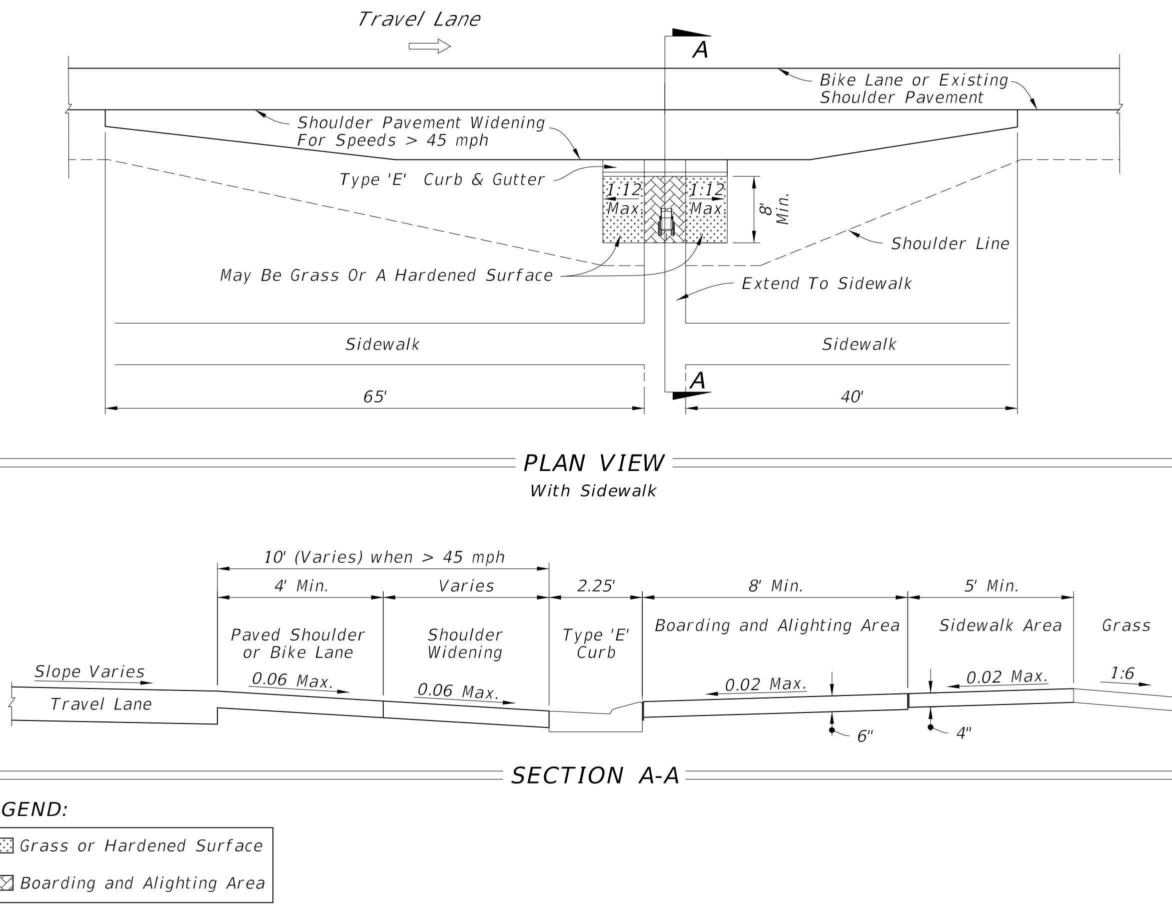
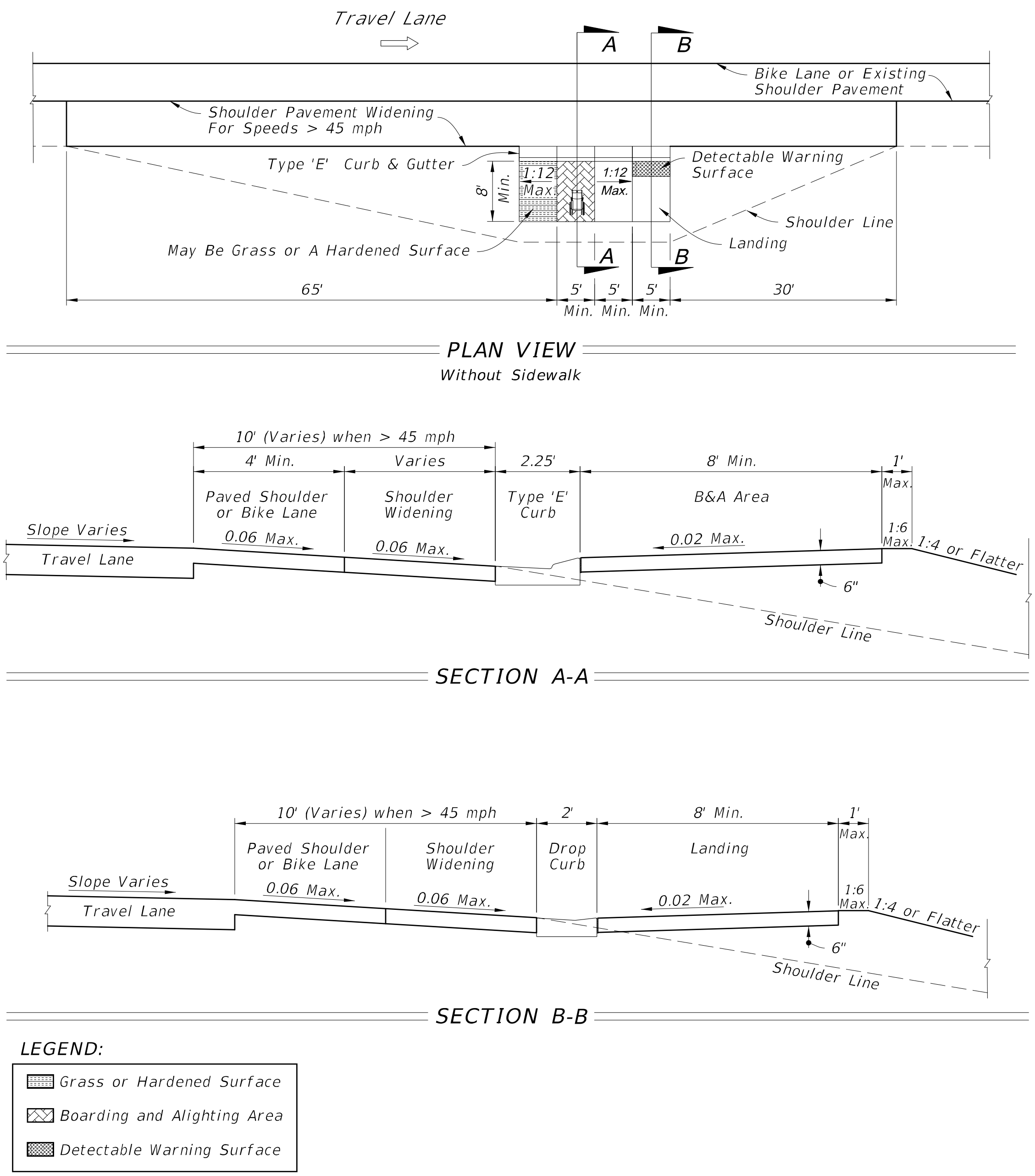


Figure 225.2.2 Accessible Boarding and Alighting Area for Flush Shoulder Roadways with Connection to Roadway



225.3 Street-Side Facilities

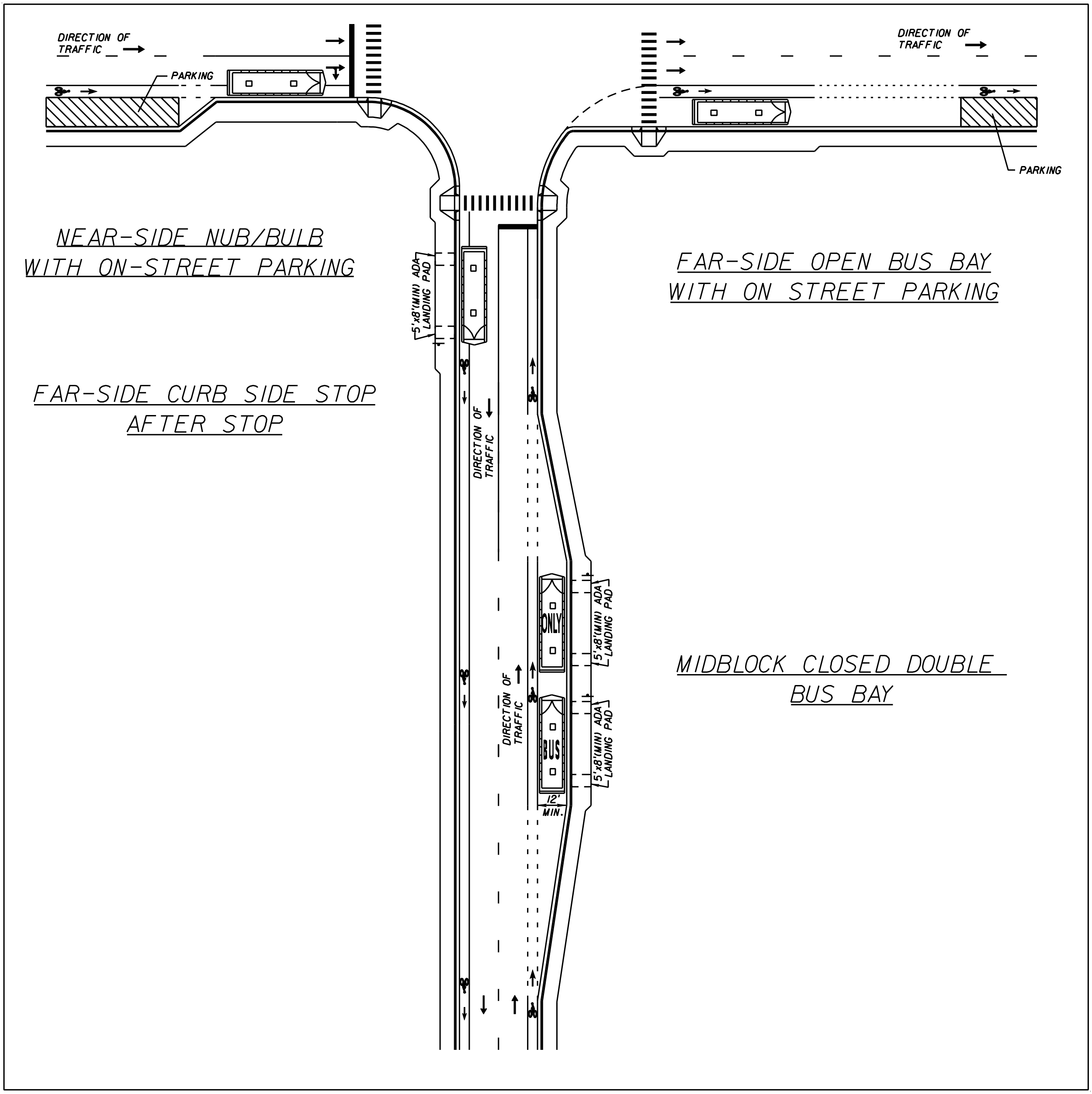
Bus stop locations can be categorized as far-side, near-side and midblock stops. Bus stops may be designed with a bus bay or pullout to allow buses to pick up and discharge passengers in an area outside of the travel lane. This design feature allows traffic to flow freely without the obstruction of stopped buses. See ***Figure 225.3.1*** for typical details for the bus stop and bus bay categories. ***Chapter 2*** of the ***Accessing Transit Handbook*** provides additional information for each facility. The greater distance placed between waiting passengers and the travel lane increases safety at a stop.

Bus bays are encouraged on roadways with posted speeds 45 MPH and greater. A high frequency of crashes involving buses is a good indicator for the need of a bus bay. Bus bays are classified as closed, open or bulbs. Illustrations for various bus bay configurations are provided in the ***Accessing Transit Handbook***.

Coordinate bus bay designs with applicable transit agencies to determine the site specific needs. In locations where the traffic volumes exceed 1,000 vehicles per hour per lane, it is difficult to maneuver the bus into the bay and back into the travel lane. Incorporating an acceleration distance, signal priority, or a far-side (rather than near-side or midblock) placement, are potential solutions when traffic volumes exceed 1,000 vehicles per hour per lane.

The total length of the bus bay should allow room for an entrance taper, a stopping area, and an exit taper as a minimum. However, in some cases it may be appropriate to consider providing acceleration and deceleration lanes depending on the volume and speed of the through traffic. This decision should be based upon site specific conditions. ***Accessing Transit Handbook*** provides detailed bus bay dimensions for consideration when right of way is unlimited and access points are limited.

Figure 225.3.1 Bus Stop and Bus Bay Categories



225.4 Exclusive Transit Running Ways

The Department's ***Typical Sections for Exclusive Transit Running Ways*** is a guide which provides a starting point for designing exclusive transit running ways. Case-by-case evaluation of sites and corridors is essential in producing design drawings that are feasible and effective.

This guide presents conceptual typical sections for exclusive transit running ways that may see application in Florida. Typical section elements, general dimensions, analysis considerations, and intersection operations considerations are discussed in the guide for the following scenarios:

- Concurrent flow curb bus lanes
- Concurrent flow median bus lanes
- Contraflow bus lane on a one-way street
- Contraflow bus lane on a two-way street
- At-grade two-way busway on a two-way street
- At-grade reversible one-lane median busway on a two-way street
- At-grade exclusive busway in roadway R/W
- At-grade exclusive busway in separate R/W
- Exclusive bus street
- Shoulder-running bus lanes on an uninterrupted flow highway.

226 Patterned Pavement and Architectural Pavers

226.1 General

Alternative paving treatments, such as patterned pavement and architectural pavers meeting ***Standard Specifications***, may be used for enhancing aesthetics and appearance when requested by a local community, and when the conditions and restrictions provided in this section are met. Patterned pavement treatments are covered under ***Section 523*** of the ***Standard Specifications*** and are surface markings applied either as an overlay to the pavement surface or imprinted in the pavement surface. Architectural pavers are covered under ***Section 526*** of the ***Standard Specifications*** and consist of brick pavers or concrete pavers placed on specially prepared bedding material.

These alternative pavement treatments are purely aesthetic treatments and are not considered to be traffic control devices. Use of either of these treatments is highly restricted as stated below. Even when all conditions and restrictions are met, any decision to use these treatments should consider that there may be potential adverse impacts to the traveling public as well as potential long term maintenance problems. Architectural pavers have been found to create significant ride-ability problems even on low-speed roadways. Therefore, architectural pavers are prohibited within the traveled way on the State Highway System. Properly installed patterned pavement treatments do not significantly affect ride-ability; however, their use is also restricted since they are not likely to sustain their friction and wear characteristics for the full life of typical roadway pavement.

These paving treatments involve additional construction and maintenance costs not associated with typical roadway pavement. Therefore, obtain the appropriate agreements with the local maintaining agency. The additional funding for construction and assumption of responsibility for regular inspection and maintenance of the pavement treatment are to be provided by the local maintaining agency. In cases where existing alternative pavement is being removed as part of a Department project, replacement of such pavement is to adhere to the requirements in this chapter regardless of the circumstances of the original installation and maintenance. Maintenance agreements for installations within the traveled way on the State Highway System are to include the provisions outlined in ***FDM 226.4.1*** for the duration of the installation.

226.2 Design Variations

Design Variations to any of the requirements in this chapter are to be approved by the District Design Engineer.

226.3 Architectural Pavers

When architectural pavers are used, identify the location, type, pattern, shape and color in the plans. In addition, identify the project specific details and requirements for edge restraints, bedding material thickness, and base and sub-base materials and thicknesses, as appropriate in the plans, which are to be signed and sealed by a licensed Florida Professional Engineer. The following restrictions apply to the use of architectural pavers:

(1) May not be used on the traveled way of the State Highway System.

(2) May be used on local side streets (with a design speed of 35 mph or less), non-traffic medians and islands, curb extensions, sidewalks, borders, and other areas not subject to vehicle traffic.

(3) Meet ADA requirements in areas subject to pedestrian traffic. See ***Public Rights of Way Accessibility Guidelines (PROWAG)*** ***R301.5 and R301.7*** and ***Americans with Disabilities Act Accessibility Guidelines (ADAAG)*** ***302*** and ***303*** for surface requirements.

226.4 Patterned Pavement

When patterned pavement treatments are used, identify the location, patterned type (brick, stone, etc.), and surface color in the plans. Product brands, colors and patterns may be specified in the plans as long as the brand is listed on the ***Approved Products List (APL)*** at the time of use if requested by the local agency funding and maintain these treatments. The following restrictions apply to the use of pattern pavement:

- Use on the traveled way of the State Highway System is restricted to areas within marked pedestrian crosswalks where the design speed is 45 mph or less; however, patterned pavement cannot be used on pedestrian crosswalks across limited access roadway ramps. Use on pedestrian crosswalks with heavy truck traffic turning movements (≥ 10% trucks) should be avoided.

- The pavement to which the treatment is applied is required to be of the same pavement type as, and continuous with, the adjoining pavement. For example, replacing flexible pavement with rigid patterned pavement within the limits of a crosswalk where the abutting pavement is to remain flexible pavement will likely result in pavement joint problems and adverse impacts to rideability. This type treatment is therefore not permitted. Replacing flexible pavement with rigid pavement for an entire intersection including crosswalks may be permitted with a Technical Special Provision submitted to the State Roadway Design Engineer for approval.

- The initial treatment cannot be applied to any State Highway whose asphalt pavement surface is older than 5 years.

- May be used in areas not subject to vehicle traffic such as median islands, curb extensions, sidewalks, and landscaping borders.

- Meet ADA requirements in areas subject to pedestrian traffic. See ***PROWAG* R301.5 and R301.7** and ***ADAAG* 302 and 303** for surface requirements.

226.4.1 Maintenance Memorandum of Agreement

Prior to the installation of patterned pavement crosswalks in intersections on the State Highway System, a Maintenance Memorandum of Agreement is required to be entered into with the local government agency requesting this aesthetic enhancement to the project. This agreement is filed with the District Maintenance Office. This Agreement requires the local government agency to acknowledge that the installation and maintenance of patterned pavement is the total responsibility of the local agency, including contracting for friction testing with a qualified firm.

“Maintenance” of all patterned pavement crosswalks in these Agreements is to be defined, as a minimum, to include its frictional characteristics and integrity as follows:

- Evaluate all lanes of each patterned crosswalk for surface friction within 60 days of project acceptance by the Department. Conduct the friction test using either a locked wheel tester in accordance with ***FM 5-592*** (***Florida Test Method for Friction Measuring Protocol for Patterned Pavements***) or a Dynamic Friction Tester in accordance with ***ASTM E1911***. ***FM 5-592*** can be accessed at the following link:

  http://www.fdot.gov/materials/administration/resources/library/publications/fstm/methods/fm5-592.pdf

  The initial friction resistance must be at least 35 obtained at 40 mph with a ribbed tire test (FN40R) or equivalent. Failure to achieve this minimum resistance will require all deficient crosswalk areas to be removed to their full extent (lane-by-lane) and replaced with the same product installed initially. If the Department determines that more than 50% of the lanes in the intersection require replacement, the entire intersection installation may be reconstructed with a different product on the ***APL*** or replaced with conventional pavement.

- Approximately one year after project acceptance and every two years thereafter and for the life of the adjacent pavement, only the outside traffic lane areas of each patterned crosswalk must be tested for friction resistance in accordance with

ASTM E274 or ***ASTM E1911***. Friction resistance must, at a minimum, have a FN40R value of 35 (or equivalent).

- Send the results of all friction tests to the District's Warranty Coordinator with a cover letter either certifying that the crosswalks comply with the minimum friction criteria or stating what remedial action will be taken to restore the friction.
- Failure to achieve the minimum resistance requires all lanes of the crosswalk to be friction tested to determine the extent of the deficiency. All deficient areas must be removed to their full extent (lane-by-lane) and replaced with the same product installed initially. If the Department determines that more than 50% of the lanes in the intersection require replacement, the entire intersection installation may be reconstructed with a different product on the APL or replaced with conventional pavement.
- When remedial action is required in accordance with the above requirements, the local agency must complete all necessary repairs at its own expense within 90 days of the date when the deficiency was identified. No more than two full depth patterned pavement repairs can be made to an area without first resurfacing the underlying pavement to 1" minimum depth.
- The Department will not be responsible for replacing the treatment following any construction activities in the vicinity of the treatment.
- Should the local agency fail to satisfactorily perform any required remedial work in accordance with this agreement, the Department reserves the right to replace the patterned pavement with conventional pavement (matching the adjacent pavement) and bill the local agency for this cost.

230 Signing and Pavement Marking

230.1 General

Traffic control devices are necessary to help ensure highway safety. Traffic control devices provide for an orderly and predictable movement of motorized and non-motorized traffic throughout the highway transportation system. They also provide guidance and warnings to ensure the safe and informed operation of individual elements of the traffic stream. The design and layout of signs and pavement markings should complement the basic highway design.

FHWA's ***Manual on Uniform Traffic Control Devices (MUTCD)*** contains detailed information of all standard highway signs and pavement marking messages. Each sign is identified by a unique designation. Signs and pavement markings not included in the ***MUTCD*** or in the ***Standard Plans*** are to be detailed in the plans. Sign and pavement marking design must comply with ***Standard Specifications***, ***Standard Plans***, ***TEM***, ***MUTS***, and the ***MUTCD.***

Examples of typical signing and pavement marking configurations are included in ***FDM 230.6***.

230.1.1 Structural Supports

AASHTO's ***LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*** and ***FDOT Modifications to LRFDLTS-1*** provide structural design criteria.

Refer to ***FDM 261*** for information regarding structural support requirements. Refer to ***FDM 940*** for information regarding plan requirements.

230.1.2 School Zones

The Department's ***Manual on Speed Zoning for Highways, Roads and Streets in Florida*** (a.k.a., ***Speed Zoning Manual***)***, Chapter 15,*** provides school zone signing and pavement marking requirements.

Public or private elementary, middle schools (Jr. High), and federally funded facilities providing a full-time educational program are to comply with the pavement markings, signs, and other traffic control devices referenced in the ***Speed Zoning Manual***. The use of these devices at high schools must be justified by an engineering study.

Standard Plans, ***Index 700-120*** provides details relating to enhanced highway signing assemblies.

230.1.3 Vertical Clearance

See ***FDM 210.10.3*** for vertical clearance requirements for sign structures.

230.2 Signing

230.2.1 Sign Placement

Refer to the ***MUTCD***, ***Standard Plans***, and ***FDM 215*** for acceptable sign locations. Provide a four-foot clear width, not including the width of curb, when a sign is located within a sidewalk.

230.2.1.1 Advance Guide Signs for Limited Access Facilities

Use physical gore as the point of reference to measure distance for advance guide sign messages when the physical gore and theoretical gore are separated by no more than 500 feet.

230.2.2 Overhead Signs on Limited Access Facilities

Section 2A.17 of the ***MUTCD*** lists thirteen optional conditions where overhead signs have value on limited access facilities. Signs are to be ground mounted except at locations required by the ***MUTCD*** or noted below:

Use overhead exit direction signs when any of the following conditions exists:

(1) Interchange Spacing ≤ 3 Miles

(2) Left Exit

(3) Three or More Through Lanes

Use overhead advance guide signs when any of the following conditions exists:

(1) Interchange Spacing ≤ 3 Miles

(2) Left Exit

(3) Limited access facility to limited access facility Interchange (1/2 mile and 2 mile, 1 mile required by ***MUTCD***)

This criteria is not intended to restrict the use of overhead signs where there is insufficient space for post mounted signs or where there is restricted sight distance.

Place overhead advance guide signs over the shoulder with the edge of the sign aligned with the edge of the traveled way unless otherwise shown in the ***MUTCD***. Place overhead exit signs over the ramp traffic lane(s). If a barrier is present to shield another hazard, place the upright behind the barrier with proper setback for barrier performance.

230.2.3 Local Street Names on Guide Signs

Standard practice is to use route numbers on guide signs to designate roadways. When the local name for a roadway is more familiar than the route number, the local street name may be used as supplemental information to route numbers. The decision to use a local name should be coordinated with the District Traffic Operations Engineer.

230.2.4 External Lighting of Overhead Signs

Provide external lighting of overhead signs only for the following conditions:

(1) Horizontal curves with radii of 880 feet or less in rural context classifications.

(2) Horizontal curves with radii of 2,500 feet or less in urban context classifications.

(3) In sag vertical curves with a K value of 60 or less for all context classifications.

Show sign lighting requirements on the Guide Sign Worksheet when sign lighting is required. Include sign lighting calculations in the Lighting Design Analysis Report.

To eliminate the use of lighting on existing overhead sign structures, confirm all panels on the structure utilize Type XI sheeting. All panels not utilizing Type XI sheeting must be overlaid with Type XI sheeting or replaced with new panels utilizing Type XI sheeting prior to elimination of the lighting.

See ***FDM 231.2*** for sign lighting criteria.

230.2.5 Signs on Barriers and Traffic Railings

For information regarding attachments to bridge traffic railings, concrete median barrier walls, or concrete shoulder barrier walls, refer to ***FDM 215.5***.

Utilize ***Standard Plans, Index 700-013*** when attaching the following permanent sign supports to a median traffic railing:

(1) No U-Turns (R3-4) w/ Official Use Only

(2) Left Lane Ends (W9-1)

(3) Lane Ends Merge Right (W9-2)

(4) Merge Symbol (W4-2)

(5) Warning, Regulatory, or Advisory Speed signs used as a countermeasure or mitigation for safety conditions

(6) Shoulder Use Signs

No other permanent signs are to be attached to median traffic railings. ***Standard Plans, Index 700-013*** may be used for temporary or work zone signs when ***Standard Plans, Index 102-600*** cannot accommodate post mounted signs within existing conditions.

230.2.6 Signing for Temporary Bridges with Steel Decks

Place “Slippery When Wet” signs (W8-5) in advance of temporary bridges with steel decks. Refer to ***TEM***, ***Section 2.1***

230.2.7 Object Markers and Delineators

An object marker is used to mark obstructions within or adjacent to the roadway. The ***MUTCD*** describes four object markers and how they are to be used. A Type 1 (style OM1-3 only) or Type 3 (all styles) object marker is used to mark obstructions within the roadway. A Type 2 (style OM2-2V only) or Type 3 (all styles) object marker is used to mark obstructions adjacent to the roadway. A Type 4 (style OM4-3 only) object marker (end-of-roadway marker) is used to alert users of the end of the road.

A delineator is a guidance device rather than a warning device. The ***MUTCD*** and ***Standard Plans, Index 711-003*** illustrate the use of delineators along the edge of limited access traffic lanes and interchange ramps. A delineator may be a flexible or a nonflexible type. District maintenance offices generally have a preference on which should be specified.

Modification for Non-Conventional Projects:
Delete the last sentence of the above paragraph and see RFP for requirements.

230.2.8 Tubular Markers

Tubular markers are the Department's standard device for the purpose of channelization. The color of tubular markers must be the same color as the pavement marking that they emphasize. They are typically used for channelization at the following locations unless signing (e.g., R4-7 or R4-8) is otherwise required:

(1) Multilane intersections where additional visibility is required for the marking of an island,

(2) Marking median openings,

(3) Nose of traffic separators,

(4) Where the island is obstructed due to crest vertical curves,

(5) Intersections where the alignment thru the intersection is not straight,

(6) Hardened center lines,

(7) To preclude lane changing where it is not practicable to provide a barrier (e.g. managed lanes, separated bicycle lanes, acceleration lanes), and

(8) To restrict vehicle movements and control turning speeds.

230.2.9 Enhanced Highway Signing Assemblies

Flashing beacons, highlighted signs, and electronic speed feedback signs may be used to increase the conspicuity of warning and regulatory signs.

For school signing requirements, see ***Chapter 15*** of the ***Speed Zoning for Highways, Roads, and Streets in Florida***.

Typical applications with these enhancements are shown in ***Standard Plans*, *Index 700-120***.

230.2.10 Internally Illuminated Street Name Signs

Do not exceed nine feet in width for an internally illuminated street name sign. For span wire systems, the sign is to be mounted to the strain poles. On mast arm supports, the sign may be mounted to the support or to the arm. When mounted to the arm, the distance between the upright and the near side edge of the sign is not to exceed ten feet.

Design the street name sign in accordance with the ***TEM*, *Section 2.2***. Utilize the following text attributes in order of preference:

(1) 10-inch upper case with 8-inch lower case, Type EM font

(2) 10-inch upper case with 8-inch lower case, Type E font

(3) 8-inch upper case with 6-inch lower case, Type EM font

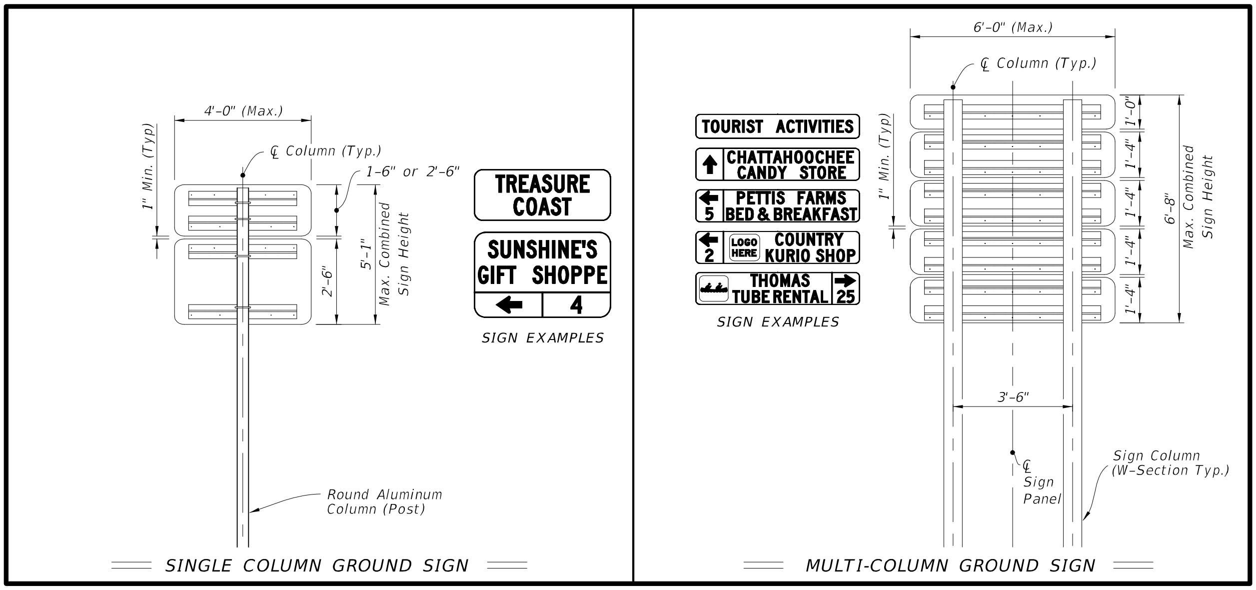
(4) 8-inch upper case with 6-inch lower case, Type E font

230.2.11 Tourist-Oriented Directional Signs

Tourist-Oriented Directional Signs are guide sign assemblies with individual panels displaying the identity and directional information for a business, service, or activity facilities. These panels are unique in size, content, and have specific criteria for that must comply with ***Rule 14-51, Florida Administrative Code*** and ***MUTCD***, ***Chapter 2K***.

Maximum sign panel dimensions for single and multi-column ground-mounted signs are shown in ***Figure 230.2.1***. Place Tourist-Oriented Directional Signs in accordance with ***Standard Plans*, *Index 700-101***.

Figure 230.2.1 Tourist-Oriented Directional Sign Panel Dimensions



230.2.12 Florida National Scenic Trail Signs

Provide signage and pavement markings as shown in ***Exhibit 230-b*** at all locations where the Florida National Scenic Trail crosses along the SHS.

Use RS-034 signs to guide the public to designated trailhead parking when available and adjacent to the crossing.

230.3 Pavement Markings

The ***MUTCD*** was adopted by the Department as the uniform system of traffic control for use on the streets and highways of the State. This action was in compliance with ***Chapter 316.0745*** of the ***Florida Statutes***. The ***MUTCD*** is the national standard, and its requirements must be met, as a minimum, on all roads in the State. Where Department manuals indicate criteria which is more stringent than the ***MUTCD***, Department criteria is to be followed. See ***FDM 220*** for signing and pavement marking requirements for at-grade railroad crossings.

230.3.1 Selection of Pavement Marking Material

For new pavement markings, use ***Table 230.3.1***, as a guide to assist in selecting the appropriate pavement marking material. For any given pavement marking application, the table indicates allowable materials for three different substrates as follows: asphalt pavement (A), concrete pavement (C), and concrete bridge deck (B). The table also indicates when black contrast is required on new pavement surfaces. For existing asphalt surfaces, contact the District Maintenance Engineer to determine if black contrast is required.

Once the pavement marking material is selected from ***Table 230.3.1***, verify the project meets the criteria discussed in ***FDM 230.3.1.1*** through ***230.3.1.5***.

For maintaining existing pavement markings, consider the existing pavement condition and coordinate with the District Maintenance Engineer. Possible options for consideration include:

- Refurbishment Thermoplastic
- Hot Spray Thermoplastic
- Durable Paint

Remove existing pavement markings and apply new pavement marking in accordance with ***Table 230.3.1.***

Table 230.3.1 Pavement Marking Material Selection

Pavement Marking Category	Pavement Marking Application	Color	Material Options: Hot-Applied Standard Thermoplastic	Material Options: Permanent Tape	Material Options: Preformed Thermoplastic	Material Options: Two Reactive Components	Material Options: Durable Paint	Black Contrast** ~~Required **~~
Longitudinal Solid Lines	~~Longitudinal~~ Solid Lines	White	A C	c ~~C~~ B		~~A C~~a c		a C B***
		Yellow	A C	c~~C~~ B		~~A C~~a c		
Longitudinal Skip and~~/~~ Dotted Lines	~~Longitudinal~~ Skip Lines (10-30 Skip)	White	A	C B		~~A~~a		a C B ~~**~~
		Yellow	A	C B		a~~A~~		
	Dotted Extension Lines (6-10)	White	A	C B		a~~A~~		a C B ~~**~~
		Yellow	A	C B		a~~A~~		
		White	A	C B		a~~A~~		a C B ~~**~~

			-					
	Dotted ~~Extension~~ Lines (3-9)	Yellow	A -	C B		a~~A~~		
	Dotted ~~Extension~~Guide Lines (2-4)	White	A -		C B	a~~A~~		a C B **
		Yellow	A -		C B	a~~A~~		
~~Transverse~~ **Markings Other Than Longitudinal Lines ~~Messages and Symbols~~**	**Diagonal Cross Hatch**	White	A C B -		a ~~C~~ ~~B~~c b			
		Yellow	A C B -		a ~~C~~ ~~B~~c b			
	Chevrons		A C B -		a ~~C~~ ~~B~~c b			
	Stop Lines		A -		a C B			a C B **
	Yield Lines (Shark's T~~t~~ee~~oo~~th)		A -		a C B			~~C B~~ a C B**
	Standard and Special Emphasis Crosswalk Transverse Lines-12" ~~Special Emphasis Crosswalk Longitudinal Bars- 24"~~		A ~~A~~		a ~~A~~ C B			a C B
	Special Emphasis Crosswalk Longitudinal Bars- 24"~~Standard and Special Emphasis Crosswalk Transverse Lines-12"~~	White ~~White~~	~~A~~ ~~a~~		A C B			a C B
	Railroad Dynamic Envelope		-		A C B			a C B **
	~~Text~~ Messages and Symbols		A -		~~A~~a C B			a C B **
	Lane Use Arrows		A -		~~A~~a C B			a C B ~~B~~ **
	Ramp Exit Numbers		-		A C B			A C B **
	Bicycle Markings (arrows, ~~(~~sSymbols, m ~~M~~essages)		-		A C B			a C B **
	Shared Use Path Markings (arrows, s~~S~~ymbols, m~~M~~essages)		-		A C B			a C B **
	Wrong Way Arrows		A -		~~A~~a C B			a C B **
	Route Shields	Multi-color	-		A C B			a C B **
Curb Delineation	**Island Nose**	Yellow	-				A C B	
Legend:	Options:							

	Preferred (in caps): A = Asphalt Pavement C = Concrete Pavement B = Concrete Bridge Deck **Allowed (lowercase): a = Asphalt Pavement c = Concrete Pavement b = Concrete Bridge Deck**

* Two Reactive Components requires approval by District Maintenance Engineer and District Construction Engineer
** For existing asphalt surfaces, contact the District Maintenance Engineer to determine if contrast is required.
*** Use black contrast for longitudinal solid white lane lines. Do not use contrast on solid edge lines.

230.3.1.1 Longitudinal Solid Lines

The following applies to Longitudinal Solid Line material selection:

- For ~~a~~Asphalt ~~s~~Surfaces:
  - Hot-Applied Standard Thermoplastic is the ~~default~~ preferred option~~material for this application~~.
  - Two Reactive Components may be used ~~may be used at the discretion of~~if approved by the District Maintenance Engineer and District Construction Engineer.
  - For existing asphalt surfaces, contact the District Maintenance Engineer to determine if black contrast is required.
- For ~~c~~Concrete ~~s~~Surfaces:
  - Hot-Applied Standard Thermoplastic is the preferred ~~default material for this application~~option.
  - ~~Consider the use of~~ Permanent Tape may be used with the understanding that the cost is significantly higher. ~~where equipment mobilization for Hot Applied Thermoplastic is not feasible.~~
  - Two Reactive Components may be used if approved by the District Maintenance Engineer and District Construction Engineer.~~at the discretion of the District Maintenance Engineer.~~
  - Use black contrast consistent with ***Standard Plans*** ***Index 711-001*** for longitudinal solid white lane lines. Do not use contrast on solid edge lines.
- For Concrete Bridge Deck Surfaces:
  - Use Permanent Tape.

- Use black contrast consistent with ***Standard Plans*** ***Index 711-001*** for longitudinal solid white lane lines. Do not use contrast on solid edge lines.

230.3.1.2 Longitudinal Skip and ~~/~~Dotted Lines

The following applies to Longitudinal Skip Line (10-30), Dotted Extension Line (6-10), and Dotted ~~Extension~~ Line (3-9) material selection:

- For Asphalt Surfaces:
  - Hot-Applied Standard Thermoplastic is the ~~default material for this application~~preferred option.
  - Two Reactive Components may be used if approved by the District Maintenance Engineer and District Construction Engineer.~~at the discretion of the District Maintenance Engineer.~~
  - For existing asphalt surfaces, contact the District Maintenance Engineer to determine if black contrast is required.
- For Concrete and Concrete Bridge Deck Surfaces:
  - Use Permanent Tape
  - Use black contrast consistent with ***Standard Plans Index 711-001*** for longitudinal skip and dotted lines.

The following applies to Dotted ~~Extension~~ Guide Line (2-4) material selection:

- For Asphalt Surfaces:
  - Use Hot-Applied Standard Thermoplastic ~~-~~if black contrast is not required.~~is the default material for this application.~~
  - Use Preformed Thermoplastic if black contrast is required. Use black contrast consistent with ***Standard Plans Index 711-001*** for longitudinal dotted lines.
  - Two Reactive Components ~~-~~may be used if approved by the District Maintenance Engineer and District Construction Engineer.~~at the discretion of the District Maintenance Engineer.~~
- For Concrete and Concrete Bridge Deck Surfaces:

- Use Preformed Thermoplastic~~.~~ with black contrast consistent with ***Standard Plans Index 711-001*** for longitudinal dotted lines.

~~Use contrast consistent with ***Standard Plans Index 711-001*** for all skip/dotted lines requiring contrast.~~

230.3.1.3 Markings Other Than Longitudinal~~Transverse Markings~~ Lines

The following applies to Diagonal Cross Hatch and Chevron material selection:

- For Asphalt, Concrete, and Concrete Bridge Deck ~~s~~Surfaces:
  - ~~Use Hot-Applied Standard Thermoplastic.~~
- ~~For Concrete and Concrete Bridge Deck Surfaces:~~
  - Hot-Applied Standard Thermoplastic is the ~~default material for this application~~preferred option.
  - Preformed Thermoplastic may be used with the understanding that the cost is significantly higher.
  - ~~Consider the use of Preformed Thermoplastic where quantities are small and equipment mobilization for Hot Applied Standard Thermoplastic is not feasible.~~

The following applies to Stop Line, Yield Line, ~~and~~ 12-inch Transverse Line at standard and special emphasis crosswalks, Message, Lane Use Arrow, and Wrong Way Arrow material selection:

- For Asphalt Surfaces:
  - ~~Use~~ Hot-Applied Standard Thermoplastic is the preferred option if black contrast is not required.
  - For existing asphalt surfaces, contact the District Maintenance Engineer to determine if black contrast is required. Use Preformed Thermoplastic with black contrast if black contrast is required.
- For Concrete and Concrete Bridge Deck Surfaces:
  - Use Preformed Thermoplastic with black contrast.

The following applies to 24-inch Longitudinal Bars at special emphasis crosswalks material selection:

- For Asphalt Surfaces
    - Preformed Thermoplastic is the ~~default material for this application~~preferred option.
    - ~~Hot- aApplied High Friction Thermoplastic is a contractor's option to Preformed Thermoplastic and should not be called out in the plans.~~
    - For existing asphalt surfaces, contact the District Maintenance Engineer to determine if black contrast is required. Use Preformed Thermoplastic with black contrast if black contrast is required.
- For Concrete and Concrete Bridge Deck Surfaces:
    - Use Preformed Thermoplastic with black contrast.

The following applies to Railroad Dynamic Envelope, Bicycle Markings (includes arrows, symbols, and messages), Shared Use Path Markings (includes arrows, symbols, and messages), and Route shields ~~M~~material selection:

- For Asphalt Surfaces~~, Concrete, and Concrete Bridge Deck Surfaces~~:
    - Use Preformed Thermoplastic.
    - For existing asphalt surfaces, contact the District Maintenance Engineer to determine if black contrast is required. Use Preformed Thermoplastic with black contrast if black contrast is required.
- For Concrete and Concrete Bridge Deck Surfaces
    - ~~Use Preformed Thermoplastic.~~Use Preformed Thermoplastic with black contrast.

The following applies to Ramp Exit Number material selection:

- For Asphalt, Concrete, and Bridge Deck Surfaces
    - Use Preformed Thermoplastic with black contrast.

Provide the following ~~where~~ black contrast ~~is required for transverse~~for M~~m~~arkings Other Than Longitudinal Lines and include details in the plans:

- Special Emphasis Crosswalk 24-inch Longitudinal Bars: Provide 4-inch-wide black contrast border on both sides of longitudinal bars.

- Yield Lines (Shark's ~~t~~Teeth~~oo~~): Provide black contrast block with a minimum of 1.5 inches from the yield line perimeter to the edges of the block.
- Stop Lines: Provide 4-inch-wide black contrast border on both sides of stop line.
- Railroad Dynamic Envelope: Provide 4-inch-wide black contrast border on both sides of each 12-inch-wide line.

Lane Use Arrows, Wrong Way Arrows, Messages, Symbols, and Bicycle Markings (includes arrows, symbols, and messages) with design speed of 45 MPH and less – Provide 1.5-inch minimum black contrast border adjacent to the perimeter of the pavement marking.

- (includes arrows, symbols, and messages) with design speed greater than 45 MPH – Provide black contrast block with a minimum of 1.5 inches from the pavement marking perimeter to the edges of the block.
- Intricate Symbols - For intricate symbols such as the Helmeted Bicyclist Symbol, use black contrast block for all design speeds.

~~230.3.1.4 Messages and Symbols~~

~~The following applies to Text Message, Lane Use Arrow, and Wrong Way Arrow material selection:~~

~~For Asphalt Surfaces~~

~~Hot-Applied Standard Thermoplastic is the default material for this application.~~

~~Use Preformed Thermoplastic when black contrast is required. Consider the use of Preformed Thermoplastic where quantities are small and equipment mobilization for Hot Applied Standard Thermoplastic is not feasible.~~

~~For Concrete and Concrete Bridge Deck Surfaces:~~

~~Use Preformed Thermoplastic.~~

~~For Ramp Exit Numbers, Bicycle Markings, Shared Use Path Markings, and Route shields use Preformed Thermoplastic for asphalt, concrete, and bridge deck surface.~~

~~Provide the following for message and symbol markings requiring contrast and include details in the plans:~~

~~Lane Use Arrows, Wrong Way Arrows, Messages, and Symbols with design speed of 45 MPH and less – Provide 1.5-inch minimum black contrast border adjacent to the perimeter of the pavement marking.~~

- ~~Lane Use Arrows, Wrong Way Arrows, Messages, and Symbols with design speed greater than 45 MPH – Provide black contrast block with a minimum of 1.5 inches from the pavement marking perimeter to the edges of the block.~~
- ~~Intricate Symbols - For intricate symbols such as the Helmeted Bicyclist Symbol, use black contrast block for all design speeds.~~

230.3.1.4~~5~~ Curb Delineation

Use Durable Paint for curb delineation at island noses.

230.3.2 Pavement Marking Maintenance

Two standard methods to extend the life of existing pavement markings are the application of Refurbishment Thermoplastic and Hot Spray Thermoplastic. These applications are often used when existing pavement markings no longer meet specification requirements, and the anticipated service life of the pavement is approximately 3 years or greater. Refurbishment Thermoplastic and Hot Spray Thermoplastic are discussed in the following sub-sections.

Use of Durable Paint is an option for asphalt pavement where the longer service life of Refurbishment Thermoplastic is not required. Durable Paint should not be used in areas opened to traffic due to the prolonged cure time of approximately 20 minutes. Prior to use, contact the District Maintenance Engineer to determine if use of Durable Paint is recommended.

230.3.2.1 Refurbishment Thermoplastic

Refurbishment Thermoplastic is the placement of new hot-applied thermoplastic material on top of existing pavement markings at a minimum thickness of 0.06 inches (60 mils). On concrete riding surfaces (i.e., concrete pavement and bridge deck surfaces) with existing Permanent Tape pavement markings, remove and replace in accordance with ***Table 230.3.1***.

Consider the following when contemplating the use of refurbishment markings:

- Remaining service life of the pavement
- Thickness and conditions of existing markings
- Traffic volumes
- Cost of markings
- Other special requirements such as contrast needs or ground-in rumble strip installation

Coordinate with the District Maintenance Engineer to determine if Refurbishment Thermoplastic is appropriate. If Refurbishment Thermoplastic cannot be applied without exceeding the maximum thickness of 0.150 inches (150 mils), use Hot Spray Thermoplastic, or remove the existing markings before placing Hot-Applied Standard Thermoplastic markings. When contemplating use of Refurbishment Thermoplastic, consider an anticipated service life of 3-5~~2-4~~ years. Refer to ***Standard Specification 711*** for additional information on Standard and Refurbishment Thermoplastic.

230.3.2.2 Hot Spray Thermoplastic

Hot Spray Thermoplastic is the application of a minimum 0.04-inch (40 mil) application of Hot Spray Thermoplastic material on existing longitudinal pavement markings.

Use of Hot Spray Thermoplastic may be conducive in the following circumstances:

- Existing audible or vibratory pavement markings need to have retroreflectivity restored.
- Resurfacing is scheduled within 2-4 years
- Refurbishment Thermoplastic would result in excessive pavement marking thickness and the removal and replacement with Standard Thermoplastic is cost prohibitive.
- Condition of the existing pavement has deteriorated such that removal and replacement is not an option as it would cause greater damage to the existing pavement.

230.3.3 No-Passing Zones

Follow the procedures contained in the ***MUTS*** for determining the limits of no-passing zones.

Limits of pavement markings for no-passing zones will be established by one of the following methods:

(1) On projects where existing roadway conditions (vertical and horizontal alignments) are to remain unaltered by construction, the no-passing zones study will be accomplished as part of the design phase. The limits of the no-passing zones will be shown on the plans.

(2) On projects with new or altered vertical and horizontal alignments, limits for no-passing zones will be established during construction. The required traffic study and field determination of limits will be performed by the designer during post design. Sufficient time must be included to accomplish the required field operations without delaying or interfering with the construction process.

For 2-Lane, 2-way roadways, a no-passing zone study should be conducted if any of the following conditions apply subsequent to the last roadway resurfacing project:

(1) Newly constructed intersections

(2) Multiple new residential or commercial driveway connections

(3) New sight distance obstructions due to vegetation, tree growth or buildings

(4) History of wrong way/head-on crashes or observations/complaints of near misses

230.3.4 Work Zone Pavement Markings

Use Standard Paint for work zone markings on asphalt and concrete pavement. The performance of Standard Paint has been evaluated by the Department for a period of 6 months.

Consider using Durable Paint or Refurbishment Thermoplastic when a work zone phase is expected to last for more than a year under heavy traffic volumes. The performance of Durable Paint has been evaluated by the Department for a period of 18 months.

Use Removable Tape for transitions on the final structural course or dense-graded friction course. Removable Tape may be used for other markings to avoid the removal of paint and scaring of final surface. Do not use Removable Tape for application durations of more than 6 months. Do not use Removable Tape on open-graded friction course.

Use contrast consistent with ***Standard Plans*** ***Index 711-001*** for solid white lane lines. Do not use contrast on solid edge lines.

230.3.5 Raised Pavement Markers (RPMs)

Retroreflective RPMs, Class B, are the standard type of RPM.

Internally illuminated RPMs are similar to retroreflective RPMs but are internally illuminated with LEDs. Internally illuminated RPMs may be used in lieu of retroreflective RPMs to enhance delineation and driver awareness as a mitigation strategy for substandard conditions as defined in the ***TEM*, *Section 4.6***.

Place all RPMs in accordance with the ***Standard Plans*, *Index 706-001*** and the ***MUTCD***.

230.4 Wrong-Way Signs and Pavement Markings

Deploy the enhanced signing and pavement markings in this section to improve positive guidance, to minimize driver confusion, and to reduce wrong-way movements. The height of WRONG WAY (R5-1a) signs must be in accordance with ***Standard Plans*, *Index 700-101***. Include red retroreflective strips on DO NOT ENTER (R5-1) and static WRONG WAY (R5-1a) sign columns in accordance with the ***MUTCD* *2A.21***. Include white retroreflective strips on ONE WAY (R6-1) sign columns in ***Exhibits 230-5, 230-6, and 230-7*** in accordance with the ***MUTCD* *2A.21***. These wrong-way prohibitive signs and pavement markings are used to enhance driver awareness. They are in addition to other required signs and pavement markings that are not shown in exhibits.

230.4.1 Exit Ramp Intersections

The standard for signing and pavement marking and advanced countermeasure installation at exit ramp intersections are illustrated in ***Exhibits 230-1a*** and ***230-1b***. The description of the layouts are as follows:

(1) Include MUTCD "optional" signs; second DO NOT ENTER (R5-1), second WRONG WAY (R5-1a), and ONE WAY (R6-1) signs.

(2) Include NO RIGHT TURN (R3-1) and COMBINATION U-TURN & LEFT TURN PROHIBITION (R3-18) signs.

(3) Use 42 inches by 30 inches WRONG WAY (R5-1a) signs.

(4) Modify distances between signs and detectors as appropriate for multi-lane ramps.

(5) Include yellow 2'-4' dotted guideline striping on left edge line and white dotted guideline striping on right edge or lane line for left turns between ramps entrances/exits and cross-streets.

(6) Include retroreflective yellow paint on ramp median nose where applicable. Include RPMs on ramp median nose in accordance with ***Standard Plans*, Index 706-001**.

(7) Include a straight arrow and route interstate shield pavement marking in left-turn lanes extending from the far-side ramp intersection through the near-side ramp intersection to prevent premature left turns. Refer to ***TEM***, ***Section 4.2.4*** "Route Shields for Wrong-Way Treatment" for additional information.

(8) Include a straight arrow and ONLY pavement message in outside lane approaching the ramp exit.

(9) Coordinate with the District Traffic Operations Engineer (DTOE) to determine if a wrong-way vehicle detection system and a pair Light-emitting Diode (LED) Highlighted WRONG WAY (R5-1a) signs are required. If the DTOE determines they are required, install as illustrated in ***Exhibits 230-1a and 230-1b***. The Highlighted Sign assembly may be solar powered or AC powered. If powered by AC, provide a power service assembly, conduits, and power conductors from the Highlighted Sign to the local cabinet. The Highlighted Sign must be integrated back to the District's Traffic Management Center (TMC). Connectivity between the Highlighted Sign and the TMC may be provided by either fiber optic or wireless communications. If fiber optic communications are used, include the fiber optic cable, conduit, and transmission equipment. If wireless communications are used, include the antenna and communication devices.

Modification for Non-Conventional Projects:
Delete item (9) above and see the RFP.

230.4.2 Diverging Diamond Intersections

Signing of Diverging Diamond Intersections is an evolving practice and not explicitly addressed in the MUTCD, however typical signing and pavement markings at diverging diamond crossovers and exit ramp intersections are illustrated in ***Exhibit 230-2*** and described as follows:

(1) Include DO NOT ENTER (R5-1), WRONG WAY (R5-1a), and ONE WAY (R6-1) signs.

(2) Include NO RIGHT TURN (R3-1), NO LEFT TURN (R3-2), and COMBINATION U-TURN & LEFT TURN PROHIBITION (R3-18) signs.

(3) Include KEEP RIGHT (R4-7), KEEP LEFT (R4-8), and OBJECT MARKER (OM3) signs.

(4) Use 42 inches by 30 inches WRONG WAY (R5-1a) signs.

(5) Include white 2’-4’ dotted guideline striping for through movements at the crossover location turns as well as at ramp entrances/exits.

(6) Include retroreflective yellow paint on crossover and ramp median nose where applicable. Include RPMs on ramp median nose in accordance with ***Standard Plans*, Index 706-001**.

(7) Include a straight arrow pavement marking in all through lanes for the crossover maneuver in both directions on the downstream side of the crossover intersections.

(8) Include Wrong-Way Arrow pavement markings in all through lanes for the crossover maneuver in both directions on the upstream side of crossover intersections.

(9) Include route interstate shield pavement marking in the left turn lane(s) prior to and after the crossover intersection. Refer to TEM, Section 4.2.4 “Route Shields for Wrong-Way Treatment” for additional information.

(10) Include a left turn arrow and ONLY pavement message in exclusive left turn lanes approaching ramp entrances.

See ***FDM D217*** for more information on Diverging Diamond Interchanges.

230.4.3 Divided Arterials and Collectors

Provide Wrong-Way Arrow pavement markings at unsignalized intersections with median widths of 20 feet or greater.

Provide DO NOT ENTER (R5-1) signs and WRONG WAY (R5-1a) signs at unsignalized intersections with median nose widths of 30 feet or greater. Orient each sign face at 45 degrees toward the connection it is intended to regulate. For median nose widths less than 30 feet, the median DO NOT ENTER (R5-1) and WRONG WAY (R5-1a) signs are optional. Place each sign as close to the wrong-way roadway as possible while meeting the placement criteria of ***Standard Plans*, Index 700-101**.

See ***Exhibits 230-3*** and ***230-4*** for recommended configurations of Wrong-Way Arrow pavement markings, DO NOT ENTER (R5-1) signs, and WRONG WAY (R5-1a) signs.

Commentary: For median nose widths less than 30 feet, median DO NOT ENTER (R5-1) and WRONG WAY (R5-1a) signs should only be considered in high-risk locations (as described below). If placed in these narrower medians, ensure details in the plans clearly specify 45-degree rotation of each sign toward the wrong way movements to reduce visibility to those making proper turning movements.

At intersections with positive offset left-turns, use DO NOT ENTER (R5-1) signs with dimensions of 48 inches by 48 inches. See ***FDM 212.14.4*** for further information on offset left turn lanes.

For Context Classifications C1, C2, C3C, and C4 place Wrong-Way Arrow pavement markings in all lanes prior to unsignalized, stop-controlled connection (i.e., side streets, commercial driveways, or driveways). Space Wrong-Way Arrow pavement markings no closer than 300 feet. For all other Context Classifications, consider placing Wrong-Way Arrow pavement markings as described above where high-risk locations are present.

Coordinate with the District Traffic Operations Engineer (DTOE) to evaluate high-risk locations using factors such as land-use, presence of lighting, history of impaired driving, crash history, and an over-represented population of licensed drivers 25 or younger and 65 or older. Determination of high-risk locations is at the discretion of the DTOE.

At intermediate ends of medians, consider the use of KEEP RIGHT (R4-7) sign for median nose widths less than 30 feet.

230.4.4 One-Way Pairs and Divided Arterials/Collectors with One-Way Egress

One-Way Egress is a condition where a two-way or one-way side street, commercial driveway, or driveway connects to a one-way arterial/collector or divided arterial/collector without a median opening.

See ***Exhibit 230-5*** for recommended configurations.

Place a ONE WAY (R6-1) sign at signalized and unsignalized, stop-controlled connection (i.e., side streets, commercial driveways, or driveways) with one-way egress. ONE WAY (R6-1) sign shall be placed on far side median or shoulder depending on facility type.

At driveways controlled by a non-signalized traffic control device with one-way egress, place a RIGHT TURN ARROW (FTP-55R-06) sign or a LEFT TURN ARROW (FTP-55L-06) sign below the STOP (R1-1) sign. Verify this sign has not already been installed by District driveway permit. At side street connections, place a Mandatory Lane Control (R3-5) sign below the STOP (R1-1) sign.

For Context Classifications C1, C2, C3C, and C4 place Wrong-Way Arrow pavement markings in all lanes prior to signalized and unsignalized, stop-controlled connection (i.e., side streets, commercial driveways, or driveways) with one-way egress. Space Wrong-Way Arrow pavement markings no closer than 300 feet. For all other Context Classifications, consider placing Wrong-Way Arrow pavement markings as described above where high-risk locations are present. Coordinate with the District Traffic Operations Engineer (DTOE) to evaluate high-risk locations using factors such as land-use, presence of lighting, history of impaired driving, crash history, and an over-represented population of licensed drivers 65 and older. Determination of high-risk locations is at the discretion of the DTOE.

230.4.5 Undivided One-Way Streets

For two-way street approaches, place the following signs and pavement markings as illustrated in ***Exhibit 230-6***:

(1) Place the corresponding turn prohibition (R3 Series) symbolic sign on the right-hand side of the approach street.

(2) Place DO NOT ENTER (R5-1) signs on both sides of the one-way street.

(3) Place Wrong-Way Arrow pavement markings in all lanes upstream of side street.

(4) Add turn and through lane-use arrow on approaches to the one-way street.

(5) For one-way approaches, place the following signs and pavement markings as illustrated in ***Exhibit 230-7***:

(6) Place the corresponding turn prohibition (R3 Series) symbolic sign. Where overhead structures exist, consider placement of a secondary turn prohibition sign over the lane or closest to the direction it is prohibiting.

(7) Place DO NOT ENTER (R5-1) signs on both sides of the one-way street.

(8) Place Wrong-Way Arrow pavement markings in all lanes prior to the side street.

230.4.6 Two-Way Signalized Intersections

Provide the following signing and pavement markings as illustrated in ***Exhibit 230-8*** for intersections serving two-way traffic where the distance from the side street stop bar to the arterial receiving lane meets or exceeds 60 ft:

(1) Place yellow 2’-4’ dotted guide center line for left turn movement onto a two-way state route.

(2) Where design or conditions deem it appropriate to provide enhanced positive guidance for the driver, include yellow 2’-4’ dotted guide center line for left turn movement off the state route.

(3) For multiple left turn lanes, place white 2’-4’ dotted guideline for right edge or lane line. For single left turn lane, white 2’-4’ dotted guideline may be provided on right edge line.

If a two-way street crosses a one-way street at a signalized intersection, the criteria of ***FDM 230.4.5*** applies.

Exhibit 230-1a: Standard Signing and Pavement Marking at Exit Ramp Intersections

Exhibit 230-1b: Typical Layout for Partial Cloverleaf/Trumpet Exit Ramp Intersections

Exhibit 230-2: Typical Layout for Diverging Diamond Interchange Exit Ramp and Crossover

Exhibit 230-3: Wrong-Way Signing and Pavement Marking at 4-Leg Intersections Along Divided Arterials/Collectors

Exhibit 230-4: Wrong-Way Signing and Pavement Marking at 3-Leg Intersections Along Divided Arterials/Collectors

Exhibit 230-5: One-Way Pairs and Divided Arterials/Collectors with One-Way Egress

Exhibit 230-6: Typical Two-Way Approach to Undivided One-Way Street

Exhibit 230-7: Typical One-Way Approach to Undivided One-Way Street

Exhibit 230-8: Typical Dotted Line Markings to Extend Center Line and Lane Line Markings into Signalized Intersection

230.5 Signing and Pavement Marking Coordination

Coordination with other offices and agencies is a very important aspect of signing and pavement marking design. The offices discussed in this section are those that are typically involved in developing signing and marking plans; however, there may be other offices or agencies involved.

The District Utilities Engineer provides the coordination between the designer and the various utilities. The Utilities Section may assist in identifying or verifying conflicts with overhead and underground utilities. The District Utilities Engineer should be contacted as early in the design phase as possible.

The Structures EOR provides the design of the sign structure and foundation for overhead cantilever and overhead truss sign assemblies. The Structures EOR should be contacted early in the design phase to allow adequate time for coordination with the Geotechnical Engineer in obtaining the necessary soils information.

Contact the State Outdoor Advertising and Logo Manager on any project affecting business logo structures. Refer to ***FDM 110.5.5*** for requirements and additional information.

230.6 Typical Signing and Pavement Marking Configurations

The following sub-sections describe standard signing and pavement marking applications for midblock crosswalks, Florida scenic trails, median openings along divided arterials/collectors, roadway transitions, stop controlled intersections along divided arterials/collectors, and residential and minor street terminations.

230.6.1 Midblock Crosswalks

Typical signing and pavement markings for stop controlled and signal controlled midblock crosswalks are illustrated in ***Exhibit 230-9*** and described as follows:

(1) Include PEDESTRIAN TRAFFIC (W11-2), DIAGONAL ARROW (W16-7p), AHEAD (W16-9p), and STOP HERE FOR PEDESTRIANS (R1-5p) signs

(2) Include 24” white stop line placed 40 feet plus or minus 10 feet in advance of the marked crosswalk.

(3) Include 6” solid white lane lines 100 feet in length upstream of each approach and terminating at the stop line.

(4) Include special emphasis crosswalk markings consistent with ***Standard Plans, Index 711-001***.

230.6.2 Florida Scenic Trails

Typical signing and pavement markings for Florida Scenic Trails are illustrated in ***Exhibit 230-10*** and described as follows:

(1) Include FLORIDA NATIONAL SCENIC TRAIL 1000 FEET, PEDESTRIAN CROSSING (W11-2), DIAGONAL ARROW (W16-7p), and AHEAD (W16-9p) signs.

(2) Include FLORIDA NATIONAL SCENIC TRAIL, TRAIL MARKER, and HIKING TRAIL (RS-068) signs.

(3) Include special emphasis crosswalk markings consistent with ***Standard Plans, Index 711-001***.

230.6.3 4-Leg Stop Controlled Intersections Along Divided Arterials/Collectors

Typical signing and pavement markings for stop controlled median openings along divided highways are illustrated in ***Exhibit 230-11*** and described as follows:

(1) Include DIVIDED HIGHWAY CROSSING (R6-3), STOP (R1-1), and ONE WAY (R6-1) signs.

(2) Include YIELD (R1-2) and ONE WAY (R6-1) signs in the median when the median nose width is 30 feet or greater.

(3) Divided highway signs (R6-3) may be on the same structure with the STOP and ONE WAY signs or on a separate structure.

(4) See the ***MUTCD*** and ***Standard Plans*, Index 711-001** for additional pavement marking details.

(5) See ***FDM 230.4*** for Wrong-Way signs and pavement markings.

230.6.4 3-Leg Stop Controlled Intersections Along Divided Arterials/Collectors

Typical signing and pavement markings for 3-leg stop controlled intersections along divided arterials/collectors are illustrated in ***Exhibit 230-12*** and described as follows:

(1) Include DIVIDED HIGHWAY CROSSING (R6-3a), STOP (R1-1), and ONE WAY (R6-1) signs.

(2) Include YIELD (R1-2) and ONE WAY (R6-1) signs in the median when the median nose width is 30 feet or greater.

(3) Include OBJECT MARKER (OM1-3) as shown and in accordance with ***Specification 705*** and ***Standard Plans*, Index 700-010**.

(4) See the ***MUTCD*** and ***Standard Plans*, Index 711-001** for additional pavement marking details.

(5) Provide sheeting on signs and object markers in accordance with ***Specification 993***.

(6) See ***FDM 230.4*** for Wrong-Way signs and pavement markings.

230.6.5 Residential and Minor Street Terminations

Typical signing and pavement markings for residential and minor street terminations are illustrated in ***Exhibit 230-13*** and described as follows:

(1) For minor street terminations, include STOP (R1-1), LARGE ARROW (W1-6), and TWO DIRECTIONAL LARGE ARROW (W1-7), signs. Include OBJECT MARKER (OM1-3) as shown and in accordance with ***Specification 705*** and ***Standard Plans*, Index 700-010**.

(2) For residential street terminations, include DEAD END (W14-1) sign. Include OBJECT MARKER (OM4-3) as shown and in accordance with ***Specification 705*** and ***Standard Plans*, Index 700-010**.

230.6.6 Roadway Transitions (2 Lane Undivided to 4 Lane Divided)

Typical signing and pavement markings for roadway transitions from 2-lane undivided to 4-lane divided are illustrated in ***Exhibit 230-14*** and described as follows:

(1) Include DIVIDED HIGHWAY (W6-1), DIVIDED HIGHWAY ENDS (W6-2), TWO WAY TRAFFIC (W6-3), DO NOT ENTER (R5-1), KEEP RIGHT (R4-7) and LANE ENDS (W4-2) signs.

(2) For left roadway centered on existing roadway scheme, include LANE ENDS MERGE LEFT (W9-2L), and RIGHT LANE ENDS (W9-1) signs.

(3) For right roadway centered on existing roadway scheme, include LANES ENDS MERGE RIGHT (W9-2R), and LEFT LANE ENDS (W9-1L) signs.

230.6.7 Channelized Turn Lanes

Typical signing and pavement markings for channelized turn lanes are illustrated in ***Exhibit 230-15*** and described as follows:

(1) Include STOP (R1-1) sign.

(2) For yielding right turn lanes include YIELD (R1-2) sign.

(3) Include right or left turn lane arrows as applicable.

230.6.8 Toll Route Markers

Typical signing and pavement markings for toll routes are illustrated in ***Exhibit 230-16a*** to ***16c*** and described as follows:

(4) Use toll route marker sign panel on the toll mainline.

(5) Use the Toll Auxiliary Sign in combination with the toll route marker on side streets leading to the toll mainline.

(6) On numbered routes, use the Toll Route Shield without the additional Toll Auxiliary Sign.

The width of cardinal direction sign, directional arrow auxiliary sign, or other auxiliary sign in the route marker assembly must match the width of the parent route marker sign.

The signs and markers can be found in the ***Department's Sign Library***.

230.6.9 Bicycle and Pedestrian Facilities at Interchanges

Typical signing and pavement markings for bicycle and pedestrian facilities through interchange areas are illustrated in ***Exhibits 230-17a*** and ***230-17b.*** Use the signs below to alert and direct motorists, pedestrians, and bicycles through the interchange area:

(1) Place COMBINED BICYCLE/PEDESTRIAN WARNING (W11-15) sign and AHEAD (W16-9P) plaque to alert motorists of the upcoming pedestrian crossing.

(2) Place STOP HERE FOR PEDESTRIANS (R1-5b) sign at stop line to indicate where motorists must stop for pedestrians.

(3) Place PEDESTRIAN WARNING (W11-15) sign and DOWN ARROW (W16-7P) plaque to indicate the pedestrian and bicycle crosswalk location.

(4) Place NO TURN ON RED (R10-11a) sign if a traffic signal controls the intersection.

Use other signs and pavement markings per the ***TEM*** and ***MUTCD*** if needed, based on the design of the interchange. Criteria for the design of bicycle and pedestrian facilities through interchanges is found in ***FDM 211***.

The signs and pavement markings can be found in the ***Department's Sign Library***.

Exhibit 230-9: Typical Signing and Pavement Markings for Midblock Crosswalks

Exhibit 230-10: Typical Signing and Pavement Markings for Florida Scenic Trails

Exhibit 230-11: Typical Signing and Pavement Markings at 4-Leg Stop Controlled Intersections Along Divided Arterials/Collectors

Exhibit 230-12: Typical Signing and Pavement Markings at 3-Leg Stop Controlled Intersections Along Divided Highways

Exhibit 230-13: Typical Signing and Pavement Markings for Residential and Minor Street Terminations

Exhibit 230-14: Typical Signing and Pavement Markings for Roadway Transitions (2 Lane Undivided to 4 Lane Divided)

Exhibit 230-15: Typical Pavement Markings for Channelized Turn Lanes

Exhibit 230-16a: All Electric Tolling Connecting Roadways Typical Signing Layout

Exhibit 230-16b: All Electric Tolling Entrance / Exit Ramp Typical Signing Layout

Exhibit 230-16c: All Electric Tolling Mainline Toll Typical Signing Layout

Exhibit 230-17a: Bicycle and Pedestrian Facilities through Interchange Typical Signing and Pavement Marking Layout

Exhibit 230-17b: Bicycle and Pedestrian Facilities at Low-Angle Interchange Ramp Signing and Pavement Marking Layout

231 Lighting

231.1 General

Roadway lighting benefits the traveling public by improving nighttime visibility of roadway geometry, vehicles, pedestrians, and obstructions. The design and layout of lighting should complement the basic highway design and must comply with the requirements of ***FDM 215*** for roadside safety.

Locate light poles between the right of way line and the outside edge of curbs or shoulders as applicable. Light poles are permitted in the median only when lighting from the outside cannot meet the criteria shown in ***Table 231.2.1*** without being supplemented by median lighting. Additionally, light poles placed in medians must be mounted on or behind barriers per the requirements in ***FDM 215.2.9*** and ***Standard Plans, Index 715-002***.

This chapter provides the process and criteria to be used in the development of lighting designs on the SHS. The design and installation of these lighting systems must comply with the National Electrical Code (NEC) unless otherwise specified by the Department.

231.1.1 Design Luminaires

Use only luminaires listed on the Department's ***Approved Products List*** (***APL***) for the corresponding usage cases. Obtain photometric information from manufacturers to use in the lighting design and resulting design luminaire selection. Include the design luminaire information with the Lighting Plans per the requirements of ***FDM 943***.

Where practical, use consistent luminaire models with the same input/output properties per new lighting location (e.g., per corridor, intersection, interchange, sidewalk, etc.).

231.1.2 Structural Supports

AASHTO's LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and the ***FDOT Modifications to LRFDLTS-1*** provide structural design criteria.

Refer to ***FDM 261*** for information regarding structural support requirements. Refer to ***FDM 943*** for information regarding Lighting Plans requirements.

231.1.3 Attachments to Barriers

Refer to ***FDM 215*** for information regarding proposed attachments to bridge traffic railings, concrete median barrier walls, concrete shoulder barrier walls or the evaluation of existing attachments.

231.1.4 Voltage Drop Criteria

When determining conductor sizes for lighting electrical circuits, the maximum allowable voltage drop, measured from the power company's transformer through the last device on any one circuit, must not exceed 5%.

The NEC's additional voltage drop criteria for the individual evaluation of feeders and circuit branches may be considered at the District's discretion.

231.1.5 Grounding

The grounding requirements for lighting systems, as shown in the ***Standard Plans*** are as follows:

(1) Install 20' of ground rod at each conventional height light pole and at each pull box.

(2) Install 40' of ground rod at each electrical service point.

(3) At each high mast pole, install an array of 6 ground rods 20' in length, as shown in the ***Standard Plans**, **Index 715-010***.

The above lengths of ground rod will be installed at each pole, pull box and service point, and the cost will be incidental to the unit or assembly being installed.

231.2 Design Criteria

Use the illuminance method for nighttime light level design. The design values for light levels given by the ***AASHTO Roadway Lighting Design Guide*** are maintained values. These maintained values have been adjusted for Department assigned light loss and maintenance factors , and they are provided in ***Table 231.2.1*** as required light level criteria.

The ***AASHTO Roadway Lighting Design Guide*** permits either the illuminance technique or the luminance technique to be used in the design of highway lighting. The luminance technique requires a complex design process and knowledge of the reflective characteristics of the pavement surface used. These reflective characteristics change as the pavement ages and with variations in weather conditions. It is for these reasons that the luminance technique is not used for nighttime light level design. As a result, direct illumination methods must be used in design software for general roadway lighting. The radiosity or reflectance of surfaces is not required in the analysis.

For the differing daytime bridge underdeck analysis requirements, see ***FDM 231.3.6.2.***

Conventional lighting generally includes the basic fixtures for roadside placement that are used for the majority of roadway lighting cases, excluding the specialized fixtures used for high mast, underdeck, sidewalk, shared used path, and sign lighting.

Luminaire tilt is defined in ***Standard Plans, Index 715-001***. Luminaires may be tilted up to the following:

(1) 5 degrees for limited access facilities, excluding undivided segments and ramps

(2) 15 degrees for weigh stations, agricultural stations, and rest areas

Light poles installed within the clear zone must be breakaway or shielded by an approved barrier unless they are bridge or barrier mounted. Where practical, avoid placing unshielded light poles at locations where distracted or errant drivers may have a greater tendency for roadway departures (e.g., downstream of lane drops, shoulder narrowing, or gore areas). See ***FDM 215*** for additional information on roadside safety design.

Pole setback is the horizontal distance from the edge of the travel lane to the pole. Mounting Height is defined below.

Lighting Values:

Meet the requirements of ***Table 231.2.1*** as directed throughout this chapter. The listed illumination levels must be met or exceeded. Beyond this requirement, use illumination levels that are as low as practical.

~~The average Vertical Foot Candle (V.F.C.) illumination levels must not exceed the requirement shown by more than 10%. If the V.F.C. requirement for a given location type is shown as "N/A", then~~For corridor lighting, the average Horizontal Foot Candle (H.F.C.) requirements of ***Table 231.2.1*** ~~governs and~~ must not be exceeded by more than 10%.

Where corridor lighting areas adjoin different areas with higher illumination requirements, the corridor lighting may exceed its illumination requirement only in the portion where light spill from the adjacent brighter area is unavoidable. These short segments may be excluded from the lighting value checks only as necessary to transition between differing requirements.

Table 231.2.1 Lighting Values

Roadway Classification	Illumination Level Average Foot Candle		Illumination Uniformity Ratios		Veiling Luminance Ratio
Or Location Type	**Horizontal (H.F.C.)**	**Vertical (V.F.C.)**	**Avg./Min.**	**Max./Min.**	**$L_{V(MAX)}/L_{AVG}$**
Corridor Lighting					
Limited Access Facilities	1.5	N/A	4:1 or Less	10:1 or Less	0.3:1 or Less
Major Arterials	1.5				
Arterial Lighting Retrofit	1.0-1.5				
Other Roadways	1.0				
High Mast Lighting					
All Roadway Classifications	0.8-1.0	N/A	3:1 or Less	10:1 or Less	N/A
Signalized Intersection and Roundabout Lighting					
New or Reconstruction	3.0 Std. 1.5 Min.	1.5 Std. 1.2 Min.	4:1 or Less	10:1 or Less	N/A
Intersection Lighting Retrofit	1.5 Std. 1.0 Min.	1.5 Std. 1.0 Min.			
Isolated Lighting	1.0-1.5	1.0-1.5			
Unsignalized Intersection Lighting					
All Project Types	1.0-1.5	~~1.5 Std. 1.0 Min.~~ 1.0-1.5	4:1 or Less	10:1 or Less	N/A
Midblock Crosswalk Lighting					
Low Ambient Luminance	N/A	1.5	N/A	N/A	N/A
Medium & High Ambient Luminance		2.3			
Sidewalks and Shared Use Paths					
Facilities Separated from the Roadway	2.5	N/A	4:1 or Less	10:1 or Less	N/A
Sign Lighting					
Low Ambient Luminance	5-10	N/A	N/A	6:1	N/A
Medium Ambient Luminance	10-20				

High Ambient Luminance	20-40				
Rest Area Lighting					
All Roadways and Parking Areas	1.5	N/A	4:1 or Less	10:1 or Less	N/A

Table 231.2.1 Lighting Values cont.

Roadway Classification	Illumination Level Average Foot Candle		Illumination Uniformity Ratios		Veiling Luminance Ratio
Or Location Type	**Horizontal (H.F.C.)**	**Vertical (V.F.C.)**	**Avg./Min.**	**Max./Min.**	**$L_{V(MAX)}/L_{AVG}$**
Wildlife-Sensitive Conventional Lighting					
Limited Access Facilities	0.8-1.0	N/A	4:1 or Less	10:1 or Less	0.3:1 or Less
Arterials and Collectors	1.0-1.5	N/A			
Signalized Intersection – New	1.5-3.0	1.0	4:1 or Less	10:1 or Less	N/A
Signalized Intersection – Retrofit or Isolated	1.0-1.5	1.0.			
Midblock Crosswalk	N/A	1.0	N/A	N/A	N/A

Notes:
(1) Illumination Uniformity Ratios do not apply to V.F.C.
(2) Standard (Std.) values must be met unless doing so raises the accompanying H.F.C. or V.F.C. result in excess of double its required illumination level. For such cases, the Minimum (Min.) value may apply.
(3) Ambient luminance classifications are defined in the ***AASHTO Roadway Lighting Design Guide***.

Limited Access Facilities:

If the length of the mainline roadway between any two lighted areas is 0.5 mile or less, then that segment of the mainline must be lighted. These lighted areas may include roadway mainline segments, interchanges, service plazas, and toll facilities.

Interchanges:

For independently lighted interchanges with no connection to adjacent mainline or crossroad lighting, the lighting values for high mast lighting may be used throughout all areas, including bridge underdecks. See ***FDM 231.3.1*** for the included analysis zones and limits.

Where the mainline or crossroad corridors have a connecting lighting system adjacent to the interchange limits, continue the connecting corridor's lighting values through the interchange for consistency. Conventional and high mast style lights may work in conjunction to achieve these illumination levels. On ramps, either high mast lighting values or the corridor's lighting values may be used at the District's discretion, so long as consistent lighting value requirements are used throughout all ramps in the interchange.

For high mast lighting, the effects of elevated ramps and bridge decks must be accounted for in the design analysis, particularly when light is blocked by other raised objects (e.g., adjacent bridges, railings, signs, or miscellaneous structures). Meet the maximum illumination and uniformity ratio requirements to avoid bright spots.

Mounting Height:

Mounting height (M.H.) for conventional lighting is the vertical distance from the finished grade at the pole's base to the luminaire's light source, regardless of lateral placement of the pole.

Specify mounting heights for conventional lighting as shown in ***Standard Plans, Index 715-002***. In the photometric analysis, adjust the luminaire height to account for the difference between the finish grade elevation at the pole's base and the approximate average roadway surface elevation. In order to assume a simplified level roadway, a surface elevation tolerance of ±18" is permitted in the analysis.

The design luminaire must not exceed the maximum candela for the associated minimum mounting height per ***Table 231.2.2***.

Table 231.2.2 Minimum Mounting Heights Based on Maximum Candela

Minimum Mounting Height (ft.)	Maximum Candela of Luminaire		
	Long Distribution	Medium Distribution	Short Distribution
20 or Less	5,000	10,000	15,000
25	10,000	15,000	20,000
30	15,000	20,000	25,000
35	20,000	25,000	30,000
40	25,000	30,000	35,000
45	30,000	35,000	40,000
50	35,000	40,000	45,000

Notes:

(1) "Distribution" refers to the longitudinal distribution of the luminaire output per the Illuminating Engineering Society of North America (IESNA).

(2) "Maximum Candela" is generally provided with the manufacturer's luminaire specific "IES" file for AGi32® or similar design software.

Color Temperature:

Apply the Correlated Color Temperature (CCT) requirements of ***Table 231.2.3*** to lighting projects that are warranted for reasons other than CCT. The requirements of ***Table 231.2.3*** alone do not warrant replacement of existing luminaire installations.

Where new luminaires are added within the limits of existing lighting systems for maintenance, retrofits, or other purposes, the requirements of ***Table 231.2.3*** do not apply. Instead, match the CCT of the existing system to maintain color consistency. For new luminaires added within existing high pressure sodium systems, use 3000K or lower CCT.

For roadside facility lighting, use the same CCT as the nearest roadway lighting for consistency. Such facilities include, but are not limited to, sidewalks, shared use paths, toll sites, rest areas, and weigh stations. If roadway lighting is not visible from the roadside facility, then use 3000K or lower CCT for the roadside facility.

Where permitted per ***Table 231.2.3***, consider the use of the warmer 2700K CCT for aesthetic locations including residential areas, natural areas, historic areas, downtown districts, parks, and campuses. Additionally, the requirements of ***FDM 231.2.1*** for Environmental Lighting supersede the requirements of ***Table 231.2.3***.

Daytime underdeck lighting that is installed per the requirements of ***FDM 231.3.6.2*** must be 4000K CCT. For these locations, either 4000K CCT or the corridor values in ***Table 231.2.3*** may apply for the nighttime underdeck lighting operation phase at the District's discretion. If no daytime underdeck lighting is required, then the corridor values in ***Table 231.2.3*** apply to nighttime underdeck lighting.

Table 231.2.3 Correlated Color Temperature (CCT)

Design Speed	Context Classification	CCT
Arterials and Collectors		
≤ 35 mph	All	2700K[1] or 3000K
≤ 50mph	All	3000K
≥ 55mph	C1 & C2	3000K
≥ 55mph	C3[2]	4000K
Limited Access Facilities		
All	All	3000K

Notes:

(1) Consider use of 2700K per the description above
(2) Higher number context classifications may apply

231.2.1 Environmental Lighting

Wildlife areas of concern are identified by the District's environmental managers or permit coordinators on a project-specific basis. For lighting within these areas, follow the requirements for Wildlife-Sensitive Conventional Lighting listed in ***Table 231.2.1*** along with ***FDM 231.3.*** Where practical, use only Wildlife-Sensitive Conventional Luminaires listed on the ***APL***, and orient lighting away from the wildlife-sensitive areas per ***FDM 231.2.2***.

For consideration of sea turtle nesting beaches, the Office of Environmental Management (OEM) provides additional resources on the ***Protected Species and Habitat*** website or through the ***Florida Geographic Data Library (FGDL)*** metadata explorer. The *Data Tools for Turtle Lighting* provide GIS shape files and Google Earth™ map layers showing the areas of concern where lighting may be visible from light-sensitive sea turtle nesting beaches. For projects within these areas, coordinate with the District's environmental managers or permit coordinators to evaluate proposed lighting impacts to sea turtles on nesting beaches. Where the lighting is visible from nesting beaches, the following requirements apply.

For Wildlife-Sensitive Buffer Areas:

(1) Orient lighting away from nesting beaches to avoid direct lighting and consider light shielding, where practical.

(2) Follow criteria for Wildlife-Sensitive Conventional Lighting per ***Table 231.2.1***. Use only Wildlife-Sensitive Conventional Luminaires as listed on the ***APL***.

(3) For night-time work zone lighting within the wildlife-sensitive buffer area that will occur during sea turtle nesting season, meet the requirements of ***FDOT Standard Specifications Workbook 8-4.1***.

For Dark-Sky Buffer Areas:

(1) Follow International Dark-Sky Association recommendations where practical, including the topics of light orientation and light shielding.

(2) Use Luminaires with a 3000K CCT or lower. Use traditional luminaires as listed on the ***APL***; specify CCT in Lighting Plans.

231.2.2 Light Spill

Design lighting systems to minimize light projection beyond the right of way line. Illumination levels outside of the right of way should be as low as practical, with attention given to reducing impacts to the surrounding areas.

If wildlife areas or residential properties are within 100 feet of a luminaire, select a luminaire model that has original manufacturer's shielding options available for a potential future installation. Where residential or commercial structures are directly adjacent to luminaires, determine whether immediate shielding would prevent light from entering nearby windows and living spaces. Call for such shielding in the plans where practical.

Provide a general overview of the light spill status to coordinate mitigation decisions with the District Design Office. Provide a brief summary of these coordination efforts, including the participants and results, in the LDAR per ***FDM 231.7***. See ***FDM 231.2.1*** for additional wildlife area requirements.

231.3 Design Methodology

A lighting design analysis is required where a new system of luminaires is being installed or where luminaire locations are being changed within an existing system. This requirement includes ~~intersection~~ lighting retrofits, the general adding or moving of light poles, and the replacement of more than three consecutive luminaires on existing light pole runs for maintenance or other purposes.

Roadway Lighting:

Provide a photometric software analysis for roadway areas being illuminated throughout the project. Include a printout of the analysis in the LDAR per ***FDM 231.7***. Such printouts must be in electronic format (e.g. PDF) using 11” x 17” sheets with photometric data points that are clearly legible. The analysis results must indicate foot-candle values displayed on plan view with 1/100th accuracy (0.XX foot-candles). Where solid objects (e.g. bridges) block luminaire light contributions, a 3D graphic representation must be included that accounts for such objects. Analysis using only typical sections is not permitted.

Use the polygon method for all horizontal area photometric calculations. Establish illumination data points (i.e. calculation points) within the polygon at the following intervals:

(1) Roadway Segments – General: 15 feet longitudinally and 5 feet transversely along the roadway

(2) Roadway Segments – Beneath Bridge Underdecks: 5 feet longitudinally and 5 feet transversely along the roadway, including pedestrian ways.

(3) Signalized Intersections: 5 feet longitudinally and 5 feet transversely along the roadway.

Sign Lighting:

Provide a photometric software analysis for signs being illuminated throughout the project. The analysis must include illumination data points at a maximum 1-foot by 1-foot spacing, covering the entire sign area. Include a printout of the analysis in the LDAR per ***FDM 231.7***. Such printouts must be in electronic format (e.g. PDF), and they must have photometric data points that are clearly legible. The analysis results must indicate foot-candle values displayed with 1/100th accuracy (0.XX foot-candles).

Refer to ***RCI Features & Characteristics Handbook***, Urban Classification – Feature 124 for additional information concerning urban designations Urban 1 through Urban 5.

231.3.1 Analysis Zones

Establish independent analysis zones for each signalized intersection segment and for each roadway segment between signalized intersections. Roadway lighting for roadway segments, signalized intersection segments, and pedestrian lighting are to meet the criteria shown in ***Table 231.2.1.***

Analyze signalized intersection segments using one analysis zone bounded by the back of sidewalks and the signalized intersection stop bars on each approach. See ***FDM 231.3.2*** for additional intersection information, including vertical illumination analysis information.

The termini for each roadway segment will be either the lighting project limits, or the signalized intersection stop bars. Continue lighting through bridge underpasses using underdeck lighting per ***FDM 231.3.6.*** The boundary for each underdeck segment will be the same as the roadway corridor passing through it. The boundary of each roadway segment is described as follows:

Flush Shoulder Roadways:

(1) Analyze divided roadway segments with grassed medians or bridge supports using two analysis zones (i.e., one for each direction of travel). Each zone will be bounded by the outside and median shoulder breaks (includes full-width shoulders).

(2) Analyze multi-lane undivided roadway segments using two analysis zones (i.e., one for each direction of travel). Each zone will be bounded by the outside shoulder break and the centerline of the roadway (includes full-width shoulders).

(3) Analyze two and three lane roadway segments as one analysis zone bounded by the outside shoulder breaks (includes full-width shoulders).

Curbed Roadways:

(1) Analyze divided roadway segments with grassed medians or bridge supports using two analysis zones (i.e., one for each direction of travel). Each zone will be bounded by the back of sidewalk and the back of the median curb.

(2) Analyze multi-lane undivided roadway segments, including roadways with two-way left turn lane, using two analysis zones (i.e., one for each direction of travel). Each zone will be bounded by the back of sidewalk and the center of the roadway.

Limited Access Facilities and Interchanges:

Establish independent analysis zones for the mainline roadway segments, ramp segments, underdeck segments, and crossroad segments at interchanges.

The termini for each mainline roadway segment will be the lighting project limits. Logical termini for the other segments will be determined by the designer. The boundary for each underdeck segment will be the same as the ramp or roadway corridor passing through it. The boundary of each segment is described as follows:

(1) Analyze divided mainline roadway with grassed median or bridge supports using two analysis zones, one for each direction of travel (i.e., one zone for each direction of travel). Each zone will be bounded by the outside and median shoulder breaks (includes full-width shoulders).

(2) Analyze barrier separated mainline roadway as one analysis zone bounded by the outside shoulder breaks of each direction of travel (includes full-width shoulders).

(3) Analyze each ramp segment as one analysis zone bounded by the shoulder breaks (includes full-width shoulders). Light ramps where the connecting mainline or interchange is lighted.

(4) Analyze crossroad segments based on the criteria given above for flush shoulder or curbed roadways. Light crossroads when the connecting interchanges are lighted, following the limits below.

(5) Analyze interchanges, including the mainline, ramps, crossroads, and underdeck areas per above. For interchanges where there is no connecting crossroad lighting, extend the interchange’s crossroad lighting to the limits of the interchange ramps. For interchanges where there is no connecting mainline lighting, place the interchange’s mainline lighting within the limits of 200 feet upstream and 200 feet downstream of the exit and entrance ramps, respectively.

Rest Areas:

(1) Analyze each ramp as defined for limited access facilities above. Light all ramps connecting to rest areas.

(2) Analyze the mainline roadway as defined for limited access facilities above. Mainline lighting is required adjacent to rest areas. If there is no continuous mainline lighting adjacent to the rest area, place mainline lighting within the limits of 200 feet upstream and 200 feet downstream of the exit and entrance ramps, respectively.

(3) Analyze all paved areas and parking lots around the rest area facilities. Light these areas within limits defined at the District’s discretion.

231.3.2 Intersections

231.3.2.1 Signalized Intersections

For new or reconstructed signalized intersections within context classifications C3 through C6, provide lighting meeting the requirements of ***Table 231.2.1***. For all other signalized intersection contexts, lighting may be provided at the District's discretion. Vertical illuminance is the primary design value used to measure driver visibility of pedestrians. Research has determined that visibility of pedestrians in crosswalks at intersections is a function of the following:

(1) Background illuminance

(2) Luminaire location in relation to the approach vehicle

(3) Luminaire mounting height

(4) Distance from the luminaire to the crosswalk

(5) Photometrics of the luminaire

The vertical illuminance calculation method to be used at intersections will be the variable light meter aimed toward the driver's location. This calculation will provide the vertical illumination level of a pedestrian which the driver sees approaching the crosswalk. This type of vertical illumination calculation is outlined in the ***IESNA Design Guide for Roundabout Lighting (DG-19-08)***. When performing this calculation, the driver's location from the crosswalk must be established. Use the stopping sight distance for the nearside approach based on the posted speed of the near approach roadway. Use the stopping sight distance for the turning movement approaches based on the operating speed for each specific turning radius.

The vertical illuminance must be calculated for three movements for each intersection approach. The first is the thru movement and the near side crosswalk; the second is the right turn movement and crosswalk on the adjacent side street; and the third is the left turn movement and the crosswalk on the side street. ***Figures 231.3.1*** through ***231.3.3*** indicate each of these three movements and the corresponding crosswalk area that must be analyzed. The vertical illuminance data points are to be on a line centered in the crosswalk with a horizontal point spacing of 1.65 feet at a height of 5 feet above the pavement. The linear data points are oriented toward the approaching driver, which is different from the data points for sidewalks, where the data points are oriented parallel to the main pedestrian flow.

See ***FDM 231.3.2.1.1*** for projects where pedestrian lighting improvements are desired, but the existing intersection infrastructure will remain and be supplemented to achieve the desired improvements.

Figure 231.3.1 Vertical Illuminance Calculation for Near Side Movement

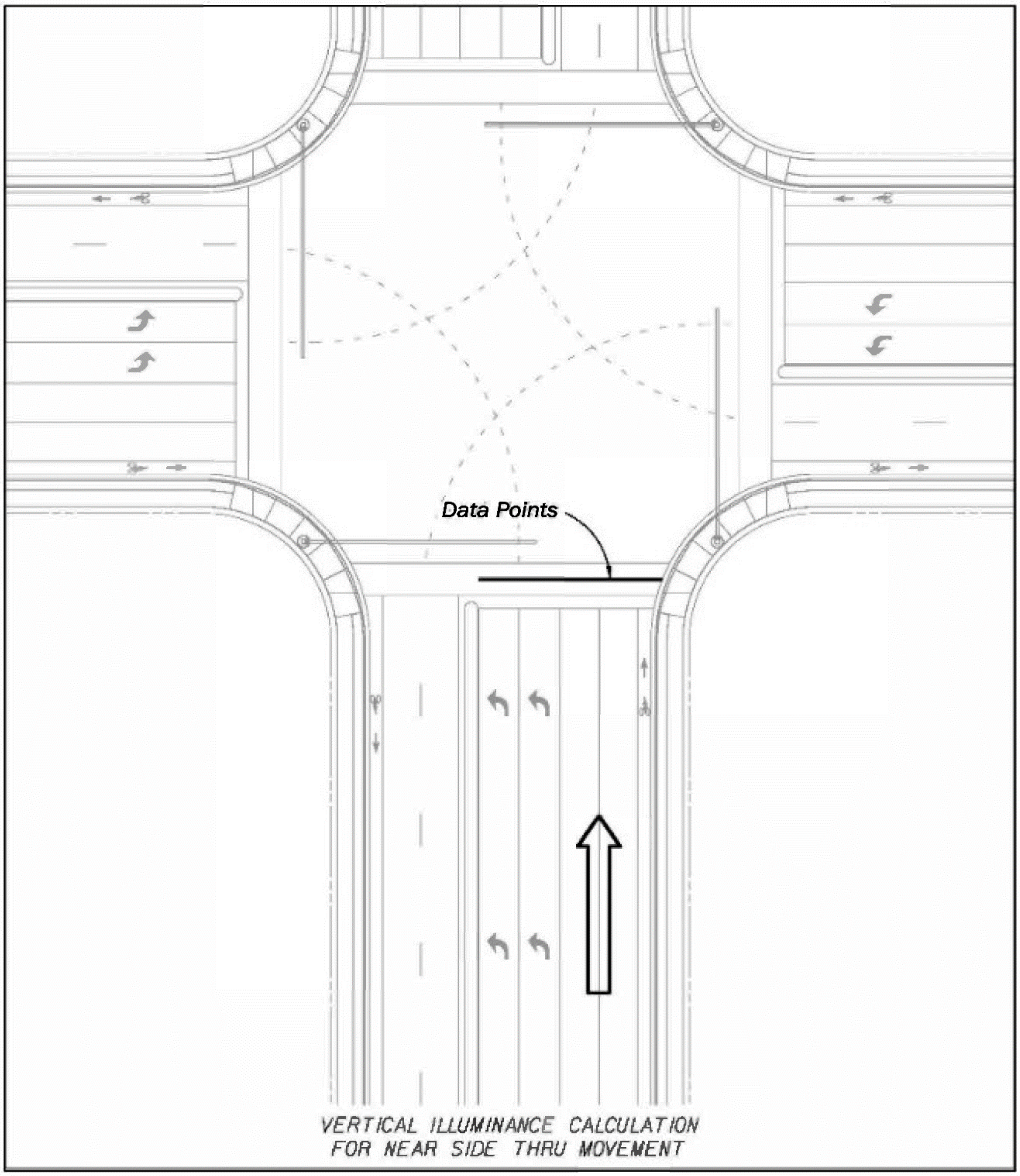
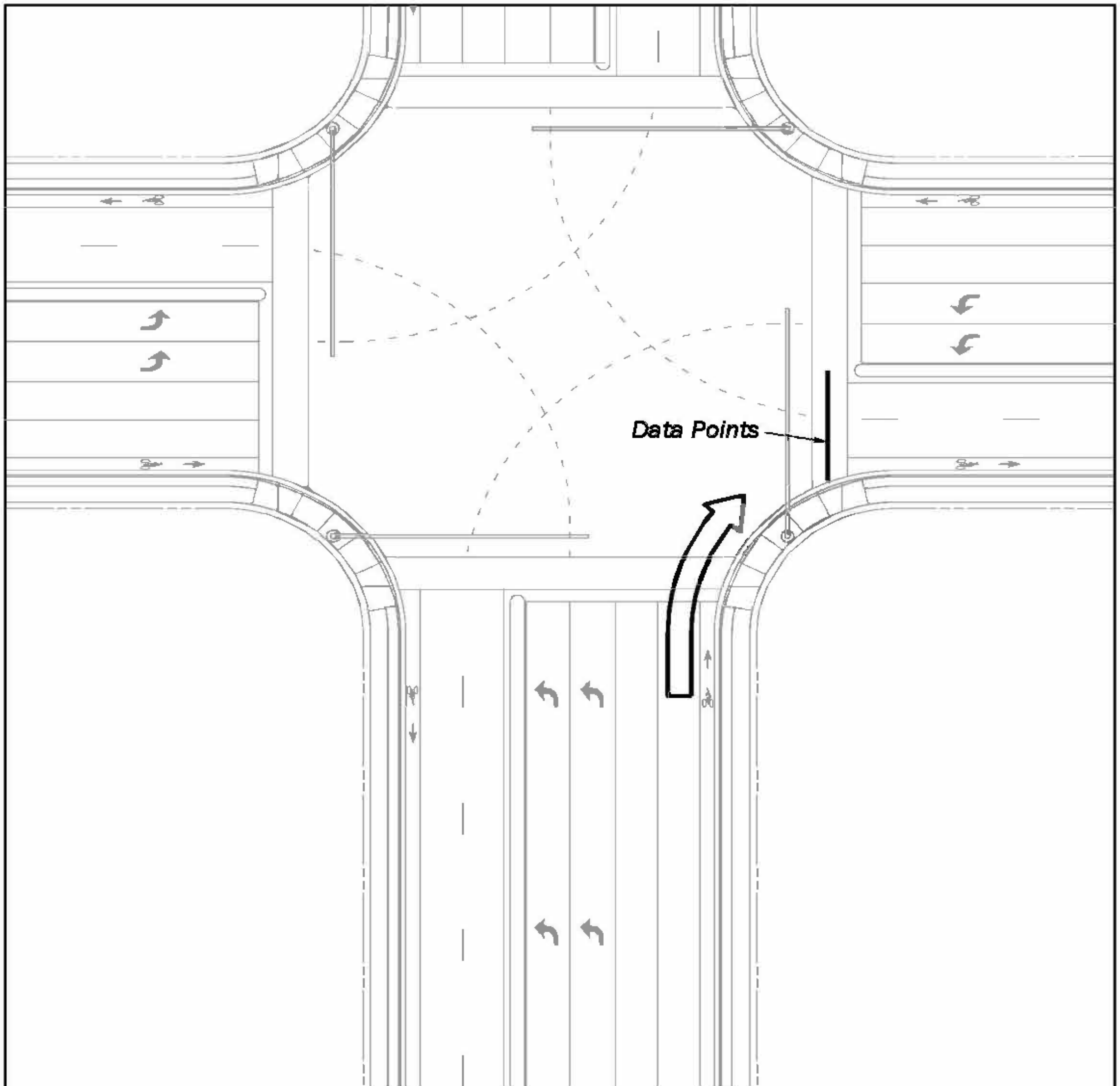


Figure 231.3.2 Vertical Illuminance Calculation for Right Turn Approach



VERTICAL ILLUMINANCE CALCULATION
FOR RIGHT TURN APPROACH

Figure 231.3.3 Vertical Illuminance Calculation for Left Turn Approach

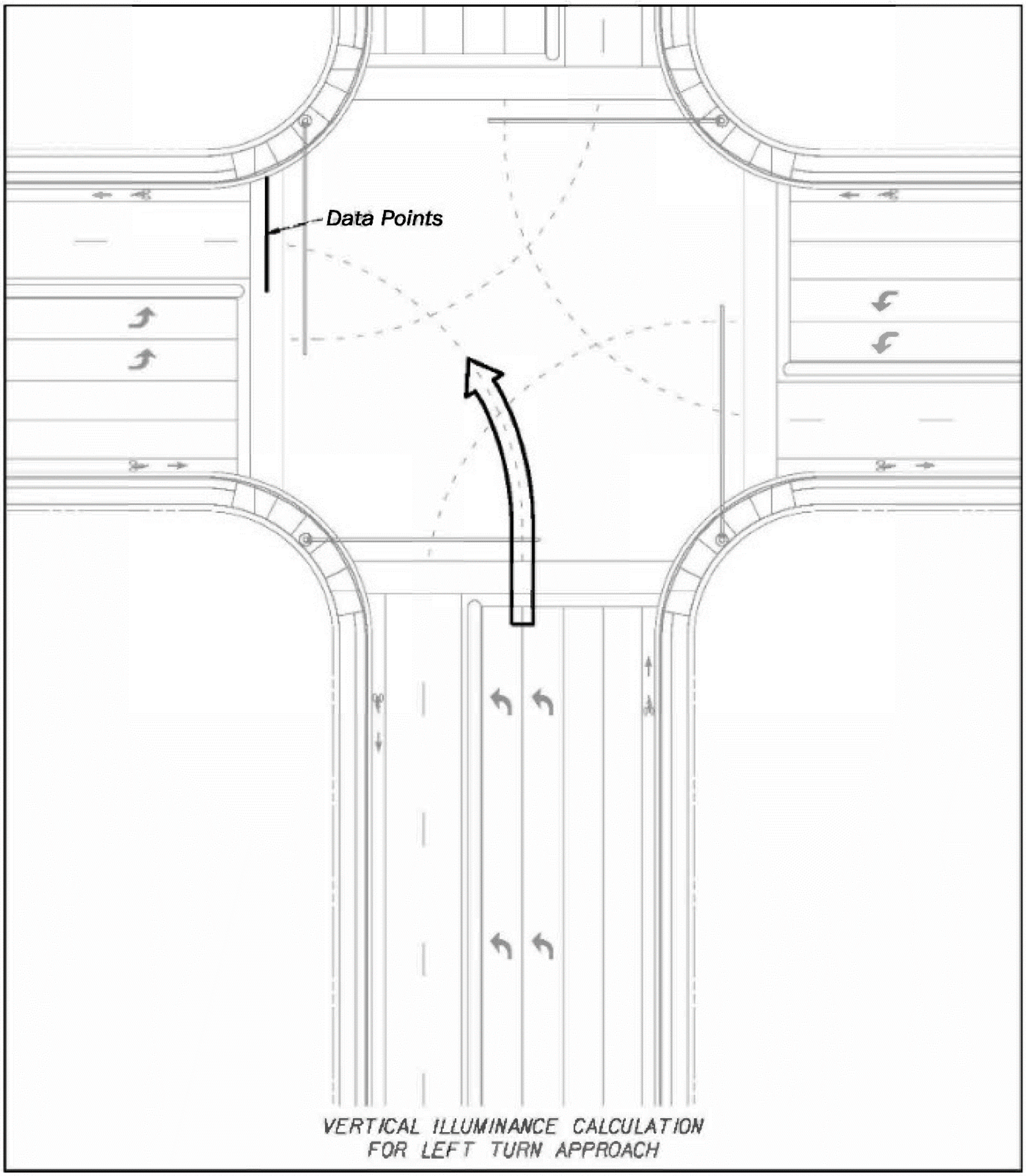
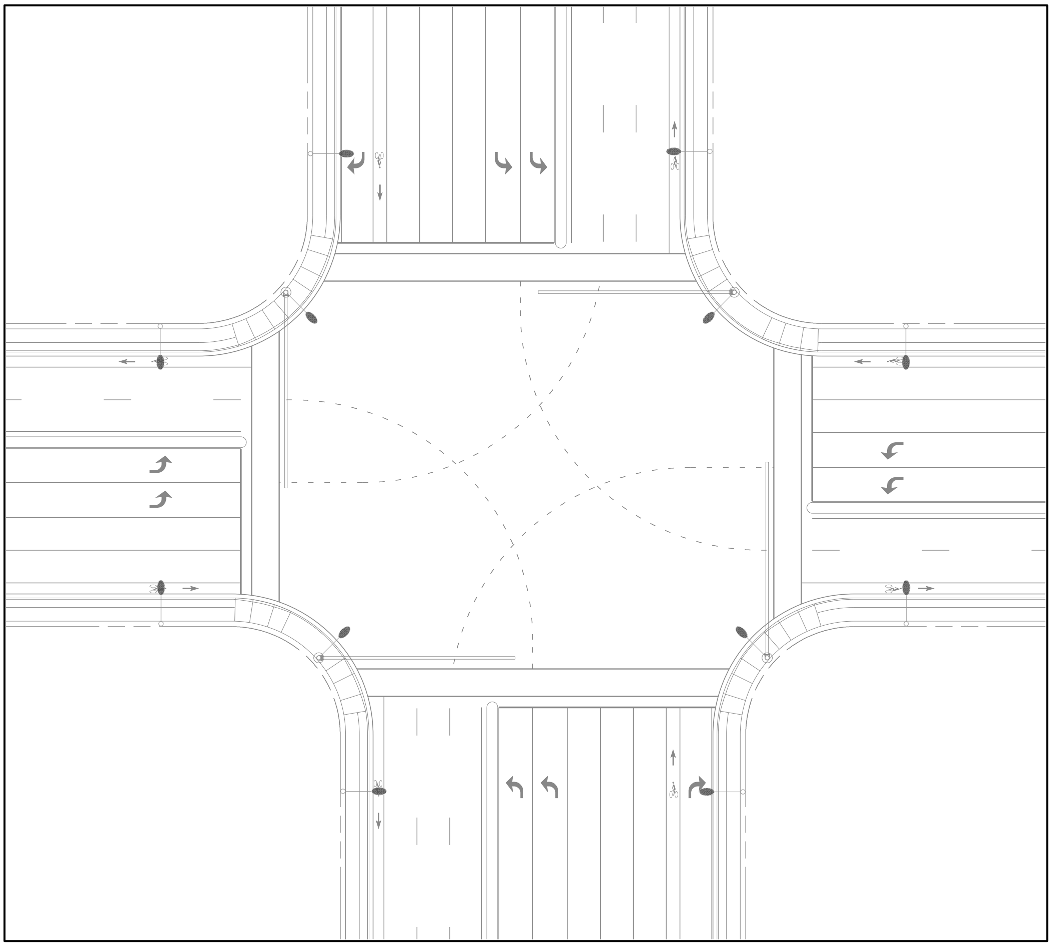


Figure 231.3.4 shows the typical lighting layout for a large intersection. The crosswalk and luminaire locations must be coordinated to optimize the vertical illumination level.

Figure 231.3.4 Typical Lighting Layout for Large Intersection



231.3.2.1.1 Intersection Lighting Retrofit

For existing signalized intersections where a full signal upgrade is not occurring, the existing infrastructure may restrict the placement of additional lighting structures necessary to meet the New and Reconstructed criteria of ***Table 231.2.1***. With these challenges considered, ***Table 231.2.1*** provides reduced illumination requirements for Intersection Lighting Retrofit designs. ~~Lighting~~ These ~~R~~retrofits provide safety benefits of improved lighting without the full reconstruction of light and signal structures.

Lighting ~~R~~retrofits should be considered for use at existing signalized intersections that have a history of nighttime pedestrian crashes. Lighting ~~R~~retrofits may be included with RRR and minor intersection improvement projects that do not include full signal reconstruction. An Intersection Lighting Retrofit operation may include replacing older luminaire types with LED luminaires, adding additional light poles, adding luminaire support arms to existing structures, and any other minor modifications needed to meet the Lighting Retrofit requirements of ***Table 231.2.1***. Lighting ~~R~~retrofits generally do not include removing or replacing existing structures such as light poles and signal structures.

For Intersection Lighting Retrofit designs, the vertical illuminance requirement of ***Table 231.2.1*** only applies to the near side ~~thru~~ movement (see ***Figure 231.3.1***).

Existing, low-mounted sidewalk lighting is generally not intended to meet the lighting requirements of ***Table 231.2.1***. To prevent increased glare, do not increase light output at existing luminaire locations with mounting heights less than 30 feet.

Independent maintenance operations that update existing fixtures to LED fixtures are not considered Intersection Lighting Retrofits for design and planning purposes.

231.3.2.1.2 Isolated Lighting Intersections

Use the Isolated Lighting requirements of ***Table 231.3.1*** for signalized intersections with no connecting lighting on approach corridors. The vertical illuminance requirement only applies to the near side movement for these designs (see ***Figure 231.3.1***).

231.3.2.2 Unsignalized Intersections

Provide lighting for unsignalized intersections consistent with any connecting corridors that meet warranting requirements of ***FDM 231.4***.

Consider adding lighting for unsignalized intersections with a history of nighttime pedestrian crashes, particularly for marked crosswalks on uncontrolled approach legs. For marked crosswalks at such intersections, the vertical illuminance requirement of ***Table 231.2.1*** is only required for the near side ~~thru~~ movement (see ***Figure 231.3.1)***.

231.3.3 Roundabouts

Provide lighting for roundabouts as required per ***FDM 213***.

The roundabout lighting criteria for new or reconstruction in ***Table 231.2.1*** applies where pedestrian features are provided. ~~Use conventional corridor lighting criteria for roundabouts where pedestrian traffic is not anticipated.~~ Calculate the vertical illuminance for crosswalks on each near side approach and for each right turn movement in accordance with the methodology outlined in ***FDM 231.3.2***. Use conventional corridor lighting criteria for roundabouts where pedestrian traffic is not anticipated.

Use the Isolated Lighting requirements of ***Table 231.3.1*** for roundabouts with no connecting lighting on approach corridors.

231.3.4 Midblock Crosswalks

Provide lighting for midblock crosswalks as required per ***FDM 222***. Where midblock crosswalks are placed to serve a facility that generates pedestrian crossings only during daylight hours, this lighting requirement may be omitted at the District's discretion.

Lighting criteria for midblock crosswalks are provided in ***Table 231.2.1***. Calculate the vertical illuminance for the crosswalk on each near side approach in accordance with the methodology outlined in ***FDM 231.3.2***. This criteria applies for stand-alone crosswalks at all locations, including entrance or exit ramps.

231.3.5 Sidewalks and Shared Use Paths

Lighting criteria for sidewalks and shared use paths are provided in ***Table 231.2.1***. These values are only intended for facilities separate from the roadway.

When sidewalk or shared use path lighting affects an adjacent roadway, then the sidewalk or shared use path illumination requirements are reduced to match those of the adjacent roadway. When such lighting is mounted below a height of 30 feet, use full cutoff luminaires with low output. Include the effects of this sidewalk or shared use path lighting when meeting the roadway's lighting requirements in ***Table 231.2.1***, including the veiling luminance check for glare.

231.3.6 Bridge Underdeck Lighting

Luminaires for underdeck lighting are wall-mount fixtures that are mounted to the bridge substructure, including the piers, pier caps, end bents, or wall copings.

231.3.6.1 Nighttime Underdeck Lighting

If the roadway passing under the bridge has lighting immediately adjacent to the bridge, then bridge underdeck lighting is required to maintain continuity of the lighting system. The roadway lighting values for bridge underdeck lighting must be equal to, or an average of, the connecting roadway lighting on either side of the underpass per ***Table 231.2.1***.

If there is no adjacent roadway lighting per above, bridge underdeck lighting may still be used at the discretion of the Districts. This lighting is typically provided where frequent pedestrian traffic is expected or where changing roadway geometry and features occur. Follow the lighting value requirements of ***Table 231.2.1*** for the appropriate roadway classification or location type.

231.3.6.2 Daytime Underdeck Lighting

Daytime underdeck lighting may be required where wide bridge structures block natural sunlight from reaching the roadway below, causing rapid brightness changes that affect driver visibility. The length and geometry of the underpass area are the primary considerations for determining the need for daytime underdeck lighting and any resulting analysis.

The underpass length is the distance that a vehicle would travel underneath the bridge structure, measured along the centerline of the roadway passing under the bridge structure. Parallel bridges must be considered as one continuous structure unless the lateral distance between them is greater than 15 feet and the resulting opening is free of obstructions that would prevent daylight from reaching the roadway below.

For underpasses 80 feet long or less, daytime underdeck lighting is not required and may be used at the District’s discretion. For underpasses greater than 80 feet but less than or equal to 150 feet, underdeck lighting designed for nighttime lighting values per ***Table 231.2.1*** must be installed and run continuously throughout daytime hours. These conditions assume an overpass height of at least 15 feet above the roadway and a width of at least 40 feet.

For underpasses not meeting the above conditions, a daytime underdeck lighting analysis using ***ANSI/IES RP-22-11 Tunnel Lighting (ANSI/IES-TL)*** guidance is required as described below. At a minimum, the following procedure applies:

(1) Determine the need for daytime supplemental lighting for the underpass using methodology from the ***ANSI/IES-TL Table 2***. If the adjustment factor is zero, then no further daytime lighting underdeck analysis is required.

(2) Use the ***ANSI/IES-TL 6.4.1*** Table Method to determine the Threshold Zone Luminance requirements.

(3) Use the ***ANSI/IES-TL 6.4.3*** Reduction Curve Method to determine luminance level requirements throughout the Threshold Zone and Transition Zones as applicable. Note that if the Threshold Zone length exceeds the underpass length, then the initial Threshold Zone value may be used throughout the entire underpass.

(4) Use the ***ANSI/IES-TL 6.4.4*** methodology and ***ANSI/IES-TL Table 7*** to determine the luminance requirement for the Interior Zone, if applicable for longer underpasses.

(5) Consider all other aspects described throughout ***ANSI/IES-TL***, including non-roadway surface illumination per ***ANSI/IES-TL 6.4.6*** and flicker effects per ***ANSI/IES-TL 6.5***.

(6) Perform a daylight study using lighting simulation software capable of 3-D modeling of proposed underpasses. AGi32® or equivalent lighting software is recommended. Some considerations include luminance contributions from the sun per weather station data, material reflectance, and underpass orientation per ***ANSI/IES-TL***. Create a design that meets the above established requirements. A process framework is described below:

    (a) Create an underpass model. The model must include all light-reflecting surfaces, all openings, the roadway layout below the underpass, the bridge structures beneath underpass (e.g. columns), and any other light sources or obstacles to light.

    (b) Apply surface reflectivity characteristics. The recommended material reflectivity characteristics may be obtained from ***Table 231.3.6*** below.

    (c) Create calculation zones for the roadway(s) beneath the proposed underpass per the ***ANSI/IES TL Figure 1 and Figure 8***. Data points near the edges of the underpass may artificially inflate the luminance average, so it is recommended that those data points not be considered in the overall average luminance. Per ***ANSI/IES Table 2*** notes, daytime lighting is not required within 23 feet of the underpass entry and exit.

(d) Run daylight models and calculate average luminance values within calculation zones established per above. Site location coordinates are required for weather station data (if available). To establish if supplemental lighting is needed, a daylight module analysis must be run with the orientation of the sun at 9:00am, 12:00pm, and 3:00pm for the summer and winter solstice as well as the fall and spring equinox (12 analysis times total).

(e) If average luminance requirements per (2) thru (4) cannot be met using daylight alone per part (d), then provide supplemental wall mount luminaires beneath underpass as needed to meet the average luminance requirements per zone. Use of nighttime luminaires in conjunction with the daytime supplemental luminaires is permitted where practical. The goal is to meet the average luminance requirement using the least number of fixtures while avoiding flicker affects. Adjust and re-run the daylight plus luminaire analysis module as needed to meet the average luminance values per zone as determined above. Design and select luminaires to meet the requirement at the time of least daylight contribution.

(f) In the LDAR, provide all assumptions, conclusions, and visual representations of photometric results as produced by the lighting software.

(7) Based on the completed lighting analysis, develop underdeck lighting plans, including the following:

(a) Provide the specific locations of required design luminaires in plan, elevation, and isometric views. Show the specific baseline lumen output per location, as required by the analysis. This information must be specified along with all other design luminaire requirements per ***FDM231.1.1***, including details for the following:

For underpasses 250 feet or less, a photo sensor control may be used to switch from daytime to nighttime operation. The switch may be adjusted to occur at a timeframe after dawn and before dusk at the District’s discretion.

For underpasses greater than 250 feet, each design luminaire output must be adjustable by remote control, pre-programmed timer, and photo sensor. Each luminaire must be capable of at least 20% higher and 20% lower lumen output than the baseline determined in the analysis.

(b) Describe the expected maintenance agreement and required expertise in the Lighting Coordination document per ***FDM 231.6.*** Provide expected provisions for the lighting's future oversight, maintenance, programming, and remote adjustments as needed.

(c) Provide other applicable elements of the lighting plans per ***FDM 943,*** including the electrical system design as coordinated per ***FDM 231.6***

Table 231.3.6 Material Reflectivity

Material of Surface	Recommended Reflectivity
Concrete	0.25
Steel	0.20
Asphalt	0.38

231.3.7 Arterial Lighting Retrofit

Upgrading the luminaires on existing light poles is sometimes beneficial for arterial roadway corridors. This provides advantages of newer lighting technology without the cost of removing or replacing existing pole structures. However, using existing light pole locations also restricts the design placement of new luminaires. As such, reduced lighting values are provided in ***Table 231.3.1*** for Arterial Lighting Retrofits.

An Arterial Lighting Retrofit operation generally includes replacing older luminaire types with LED luminaires while leaving all of the existing light poles in place. Where practical, a limited number of light poles may be added or removed as needed to meet the design requirements. Do not reduce illumination levels from the existing condition. Any existing sidewalk illumination must be maintained or increased.

Use Arterial Lighting Retrofits at the discretion of the District Traffic Design Engineer. Consider if increased light levels from an all-new light pole system may instead be appropriate based on past safety performance.

231.4 Lighting Justification

The Department follows the warrants for lighting of corridors and interchanges established by ***AASHTO***. The warrants are based on benefit-cost ratios determined from the Average Daily Traffic (ADT), the ratio of night to day crashes, initial cost, and maintenance.

Interchanges that are not on the interstate highway system will require a warrant analysis. A benefit-cost ratio of 2.0 or greater is the threshold for lighting usage at these interchanges.

Interchanges that are on the interstate highway system must all be lighted to assure consistency and to meet driver expectations. A warrant analysis is still required for funding evaluation and information, but it will not be used as the determining factor for lighting usage at these interchanges.

A lighting justification must be completed in accordance with ***Manual on Uniform Traffic Studies (MUTS), Chapter 14***.

231.5 Existing Lighting During Construction

The maintenance of existing lighting will be the responsibility of the contractor only if the lighting is affected by the construction. The contractor is not expected to replace lamps and pole knockdowns or to repair wiring if these problems are not caused by the construction work.

The plans are to specify the scope of the contractor's responsibility for the maintenance of existing lighting.

231.6 Lighting Design Coordination

Agency Coordination Document:

Contact applicable local construction, power, and maintaining agencies to confirm roles of lighting stakeholders. Prior to developing the Lighting Plans, create a document entitled "Lighting Agency Coordination", and include the following information:

(1) Project ID, roadway name, and limits

(2) Lighting designer or EOR

(3) Local agencies and personnel contacted

(4) List of local agency requirements, including structural, electrical, and aesthetic requirements that will substitute for FDOT requirements

(5) Lighting EOR that will accept the above local agency requirements as an equivalent substitute for FDOT requirements

(6) A brief summary of expected operating and maintenance agreement, including responsible parties and term lengths

Include "Lighting Agency Coordination" document with the project documentation. All local agency requirements listed must later be included with the details or notes of the Lighting Plans. The "Lighting Agency Coordination" document may be updated as design work progresses, but the latest version must be saved and included with the project documentation.

General Coordination:

Contact the District Utilities Engineer when the pole locations are set and the electrical load has been determined. The designer should coordinate with the utility company providing power on the preferred location for the electrical service.

Coordinate with the Drainage Section to assure that high water tables, stormwater retention areas, or other water bodies will not be a problem with the proposed location of light poles and the light pole pull boxes.

Coordinate locations of lighting equipment and conduits with other utilities and systems, including ITS, traffic signal, or toll site equipment layouts. In general, check light poles, pull boxes, and lighting circuit equipment to avoid physical conflicts or interference with ITS and toll site functions.

Coordinate locations of lighting equipment and conduits on bridge structures with the bridge structural designer. Include light and conduit locations, and attachment details in the plans. Refer to ***Structures Design Guidelines***, ***Section 1.9*** for details and restrictions related to bridge attachments.

Typically, the District Maintenance Engineer in conjunction with the District Utilities Engineer obtains the required maintenance agreements. The designer should coordinate with these offices to ensure that this activity is either underway or scheduled.

Any lighting project, especially high mast, adjacent to or in the vicinity of an airport, may present a potential conflict. For poles located within 3 miles of airports, check coordinates of light pole structures with the FAA website tool to determine if further filing and coordination with the FAA is necessary.

Modification for Non-Conventional Projects:
Delete ***FDM 231.6*** and replace with the following: **231.6 Lighting Project Coordination** The Lighting Engineer of Record is responsible for all necessary coordination.

231.7 Lighting Design Analysis Report

Prepare a Lighting Design Analysis Report (LDAR) that provides a photometric analysis for all lighted areas, including each intersection segment, mainline segment, ramp segment, interchange area, and structure with underdeck lighting. These designs, including horizontal and vertical illumination analyses, should be shown on separate photometric plan sheets. For additional analysis and formatting details, see ***FDM 231.2*** and ***231.3*** along with corresponding sections above.

Provide a summary statement on cost-effectiveness of the lighting design. In general, the system with the largest pole spacing that meets design requirements and avoids detrimental light spill will be the most cost-effective design. Also, provide information for at least three luminaire models/manufacturers considered, and explain why the final design luminaire was chosen based on cost-effectiveness.

Provide voltage drop calculations, load analysis calculations for each branch circuit, and lighting calculations for each lighting system.

Include the Lighting Agency Coordination document per ***FDM 231.6.*** If applicable, include the FAA coordination documents per ***FDM 231.6*** Include the light spill coordination summary per ***FDM 231.2.2***.

For LDAR components, provide sufficient detail in print format (e.g., PDF) so that reviewers do not require compatible design software to check inputs and results of calculations.

232 Signalization

232.1 General

Signalization provides an orderly and predictable movement of motorized and non-motorized traffic throughout the highway transportation system. They also provide guidance and warnings to ensure the safe and informed operation of the traffic stream.

The design and layout of signals should complement the basic highway design and comply with:

- ***Standard Specifications***,
- ***Standard Plans***,
- ***Traffic Engineering Manual (TEM)***,
- ***Structures Manual (Volume 3)***,
- ***Manual on Uniform Traffic Studies (MUTS)***,
- ***National Electrical Code (NEC)***, and
- ***Manual on Uniform Traffic Control Devices (MUTCD)***.

The criteria presented in the following sections supplement the ***MUTCD***.

232.1.1 Structural Supports

AASHTO's LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and the ***FDOT Modifications to LRFDLTS-1*** provide structural design criteria.

Refer to ***FDM 261*** for information regarding structural support requirements. Refer to ***FDM 941*** for information regarding plan requirements.

232.1.2 Attachments to Barriers

Refer to ***FDM 215*** for information regarding proposed attachments to bridge traffic railings, concrete median barrier walls, concrete shoulder barrier walls or the evaluation of existing attachments.

232.1.3 Certification and Specialty Items

Traffic control signals and devices installed in Florida must be certified by the Department. The State Traffic Engineering Research Laboratory (located in Tallahassee) is responsible for certifying all traffic control equipment. If requiring new equipment types or types not typically used, contact the State Traffic Engineering Office to determine the certification status of the equipment. Noncertified equipment cannot be used.

232.1.4 LED Light Sources

The Light Emitting Diode (LED) is the standard light source for all signal indications.

232.1.5 Retroreflective Signal Backplates

Install retroreflective signal backplates on traffic signals for all approaches.

Provide rigid retroreflective backplates for all new signal structures. Flexible retroreflective backplates may be used on existing signal structures in accordance with ***TEM*, *Section 3.9***.

232.1.6 Signal Heads for Through Lanes

Place a three-section head over the center of each lane for approaches of two or more lanes. When a single left turn lane is provided, a five-section cluster can serve as one of the indications required for the inside through lane.

232.1.7 Vertical Clearance

See ***FDM 210.10.3*** for vertical clearance requirements.

232.2 Lane Configuration

The engineer responsible for the traffic signal design may be asked to verify the number and configuration of traffic lanes required for an intersection to function properly when signalized. For this calculation use the Design Hourly Volume (DHV) based on the Department's Standard K factor and not a peak to daily (P/D) ratio based on a 24-hour count.

The K, D, and T factors convert the two-way AADT volumes to a one-way DHV. This is appropriate for the total approach movements. The AM and PM peak turning movement counts on each approach should be addressed individually. Current turning movement counts should be taken to determine the percentage of turns for each approach. Apply the percentages to the DHV for each approach volume to determine the turning volumes that should be used for the turn lane design calculations. Compare the turning volumes to the movement counts supplied by Planning. Use the greater of the two values for the design of turn lanes. Contact the District Planning Office to determine if recent counts are available and also if any use changes are planned which would require adjustments to the turn percentages found in the current counts.

Storage lanes for left turns can affect the capacity and safety of intersections. The storage length of a left turn lane is a critical design element. The queue of left turn vehicles in a storage lane of inadequate length may extend into the through lanes. The result is loss of capacity for the through lanes. The queue of through vehicles may also extend beyond the entrance of a short-left turn storage lane, blocking access to the storage lane. Either case results in a less efficient operation of the intersection and may cause last minute lane changes, thereby increasing the possibility of conflicts.

Turn lanes should comply with ***FDM 212***. The available queue length provided should be based on a traffic study.

The factors to determine the length of a left turn storage lane are:

(1) The design year volume for the peak hour (see discussion above).

(2) An estimate for the number of cycles per hour.

NOTE: If the cycle length increases, the length of the storage for the same traffic also increases.

(3) The signal phasing and timing.

There are several techniques used to determine necessary storage length. The following are suggested guidelines for left turn lanes:

(1) Where protected left turn phasing is provided, an exclusive turn lane should be provided.

(2) Left turn lanes should be provided when turn volumes exceed 100 vehicles per hour (VPH) and may be considered for lesser volumes if space permits.

(3) For signalized intersections, the following formula may be used, assuming an average vehicle length of 25 feet.

$$Q = \frac{(2.0)(DHV)(25)}{N}$$

Where:

Q = design length for left turn storage in ft.

DHV = left turn volume during design peak hour, in VPH.

N = number of cycles per hour for peak hour, use N = 30 as default.

Note: Computer programs, such as ***TRANSYT-7F*** and ***Synchro*** are used to develop signal phasing and timing. One of the outputs of these programs is the queue length. For projects where traffic signal timing is included as a part of the project, the output of these programs should be considered in determining storage length.

Where peak hour truck traffic is 10% or more, use vehicle length of one passenger car and one truck.

(4) Where left turn volumes exceed 300 vph, a double left turn should be considered.

(5) When right of way has already been purchased, and the designer has to choose between a long wide grass median or a long left turn lane, the storage length for the left turn should be as long as practical without hindering other access.

Right turn lanes are provided for many of the same reasons as left turn lanes. Right turns are, however, generally made more efficiently than left turns. Right turn storage lanes should be considered when right turn volume exceeds 300 vph and the adjacent through volume also exceeds 300 vehicles per hour per lane (vphpl). The introduction of right turn lanes can impact pedestrian crossing distances at signalized intersections; therefore, additional analysis may be required to weigh the impacts of increased pavement width and signal operations.

232.3 Left Turn Treatments

Follow the guidelines given below when determining signal treatments for left turns. For detailed information, see the ***TEM***, ***Section 3.2***.

(1) Single Turn Lane

(a) Protected/Permissive Phasing

Option #1: A five-section cluster or a separate turn signal head may be used for this location. If a separate turn signal head is used, it should be positioned over the center of the left turn lane. If a five-section cluster is used, it should be installed over the lane line between the left turn lane and through lane. The five-section cluster can serve as one of the two indications required for the through traffic.

Option #2: A flashing yellow arrow signal indication may be used. A study conducted by the National Cooperative Highway Research Program determined that drivers had fewer crashes with flashing yellow left-turn arrows than with traditional yield-on-green signal configurations. A flashing yellow arrow must use a separate four section head positioned over the center of the left turn lane.

(b) Protected Phasing

A separate signal head for the left turn lane with red, yellow and green arrow indications should be positioned over the center of the left turn lane.

(2) Dual Turn Lanes – Use only protected phasing; i.e. permissive movements will not be allowed. A single three-section head with red, yellow, and green arrow indications should be centered over each turn lane. These heads are in addition to the dual indications required for the through movement.

(3) Separated Turn and Through Lanes – Guidance for signal operation of separated left turn and through lanes is found in the ***TEM***, ***Section 3.2***.

(4) Single Lane Approach on Stem of "T" – A minimum of two three-section heads are required.

(5) Two Approach Lanes on Stem of "T"

Option #1: The approach may display two three-section heads with circular indications on all sections.

Option #2: The approach may display a five-section cluster in conjunction with a three-section head. If the lanes are exclusive left and right turn lanes, then the five-section cluster should be placed over the center of the lane line and the three-section head over the major movement lane. If one of the lanes is a shared left and right lane, then the five-section cluster should be placed over the center of this lane and the three-section head over the center of the other lane.

Option #3: The approach may display two three-section heads for the major movement and a single three-section head for the secondary movement.

(6) Three Approach lanes on Stem of "T"

Option #1: The approach may display two three-section heads for the major movement and one for the secondary movement (Exclusive left and right turn lanes).

Option #2: The approach may display a five-section cluster in conjunction with a three-section head (exclusive left and right turn lanes). The five-section cluster should be placed over the center of the lane line separating the left turn lane(s) from the right turn lane(s). The three-section head should be placed over the other lane line to provide dual indication for the major movement.

Option #3: When the middle lane is a shared left and right turn lane, then a five-section cluster should be placed over the center of this lane and a three-section head placed over each of the other two lanes. Each head must contain green and yellow arrow indications in this situation.

Modification for Non-Conventional Projects:
Add the following sentence: (7) Coordinate requirements with the local maintaining agency.

NOTE:

(1) For all cases, the approach must display "dual indications". This means that there will be at least two heads with identical indications on the major approach. For example, if a green arrow is displayed on one head of the major movement or approach then a green arrow must be displayed on the second head.

(2) The same signal display option should be used throughout an urban area to provide consistency in display to the motorist.

(3) The use of advance and/or overhead lane use signs should be used as a supplement to pavement arrows on stems of signalized "T" intersections.

232.4 Controller Assemblies

The lateral offset requirements for signal poles and controller cabinets are given in ***FDM 215***. Final location of these devices must be based on the safety of the motorist, visibility of the signal heads, ADA requirements, and access by maintenance.

(1) Controller Timings:

The development of controller timings is a basic part of traffic signal design. Signal controller timing plans must be signed and sealed by a licensed Professional Engineer.

Traffic signal timings and settings are developed and designed for a specific intersection location. The settings must respond to all users at the intersection and meet objectives defined by the policies of the responsible Maintaining Agency.

Coordinate with the responsible Maintaining Agency to verify that traffic signal cabinets, controllers, assemblies, and standards are compatible with the agency's needs and are synchronized accordingly. The signal timings for the Yellow change and all red clearance intervals must be in accordance with the ***TEM***, ***Section 3.6***.

Traffic signal designs on state and local roadways must include initial timings of all controllers in the plans set. If the responsible agency decides to implement different timings than the ones in the plan set, it must insure they were prepared under the supervision of a licensed Professional Engineer.

(2) Future Intersection Expansion:

Any planned intersection improvements should be considered in the signal design. The controller type, cabinet type, and the number of load switches are examples of design features that may be affected by future intersection improvements. The signal design engineer must determine if the current design should include capabilities for future improvements.

(3) Upgrade of Existing Controller Assemblies:

Replace or expand existing controller assemblies when an upgrade is required. Minor expansions include the addition of load switches, new controller timings, or new controller unit provided the cabinet is properly wired. Major expansions include cabinet rewiring or any work requiring the removal of the cabinet back panel. Contact the District Traffic Operations Engineer before making the decision to expand or replace an existing controller assembly.

232.5 Vehicle Detection

Detection technology types commonly used with signal design include inductive loops installed in pavement and video (camera) or microwave sensors mounted on the pole or mast arm supports. Inductive loop detection is generally used with asphalt pavement, and video detection with concrete pavement or bridge structures. Coordinate with the District Transportation Systems Management and Operations (TSM&O) Engineer to determine the preferred detection technology that will serve the needs of the District and maintaining agency.

(1) Inductive Loop Detection:

The traffic signal design is to identify the placement of loops for each intersection. Vehicle detection loops are detailed in the ***Standard Plans***, ***Index 660-001*** and are suitable for most locations. ***Index 600-001*** allows for minor modifications in size and placement of the loops when required by site conditions.

(2) Video Vehicle Detection System (VVDS):

VVDS uses a camera to detect vehicle presence. The traffic signal design is to identify the placement of cameras for each intersection.

(3) Microwave Vehicle Detection System (MVDS):

MVDS uses an FCC-certified, low-power microwave radar signal (sensors) to detect vehicle presence within a detection zone. These systems establish wired or cellular communication with the agency responsible for system operation and maintenance. This allows for remote configuration and monitoring.

232.6 Pedestrian Detection and Control Signal

The standard for detecting the presence of a pedestrian is the Pedestrian Pushbutton Detector. Pedestrian detector assemblies and pedestrian control signals are detailed in the ***Standard Plans***, ***Index 653-001*** and ***Index 665-001***. Pedestrian detection systems are listed on the Department's Approved Product List (***APL***).

Use the countdown pedestrian signal assembly on projects that include pedestrian-controlled signal installations. Refer to the ***TEM, Chapter 3***, for additional information on pedestrian signal installation and operation.

Orient pushbutton with the face parallel to the crosswalk to be used (i.e. parallel to the crossing direction). See ***Standard Plans, Index 665-001*** for additional orientation guidance.

232.6.1 Accessible Pedestrian Signal Feature

Where pedestrian facilities are provided, include provisions (e.g., conduit, conductors, signal cables) needed for future use of Accessible Pedestrian Signal (APS) devices on all new and reconstructed signalized intersections and signalized midblock crossing locations.

See ***TEM* 3.7** for installation and operation criteria of Accessible Pedestrian Signals on the State Highway System.

232.7 Signal Preemption

Determine if there is a requirement for signal preemption; e.g., close proximity to fire station or railroad crossing. Refer to the ***FDOT Procedure for Signalization Pre-Emption Design Standards*** (***FDOT Procedure 750-030-002***) for additional information on the conditions for which preemption is required or should be considered. Coordinate all signal preemption requirements with the local maintaining agency.

232.8 Mast Arm Supports

Utilize an underground communication cable infrastructure for those signals operating as part of an advanced traffic management system on these designated corridors.

Orient mast arm signal structures approximately 90° to approach traffic; i.e., mast arms diagonal to traffic are not allowed.

Signs on mast arms will be restricted to required regulatory and street name signs.

232.8.1 Mast Arm Policy

Provide mast arms in accordance with the following criteria for new signals installed on the State Highway System:

(1) Intersections within the ***Mast Arm Boundary Map***, as defined by the State Traffic Engineering Office Implementation Guidelines (aka mast arm policy area):

Signals are to be supported by galvanized mast arms, with the signal head(s) rigidly attached to the mast arm. When it is impractical to use a mast arm or overhead rigid structure within the ***Mast Arm Boundary Map***, a two point span wire assembly with adjustable hangers must be used and a Design Variation must be approved in accordance with ***FDM 122***. The Department will install and maintain mast arm installations only with galvanized finish. If the Local Maintaining Agency wants a painted finish, see coating requirements for ancillary structures in ***FDM 261.1***.

Modification for Non-Conventional Projects:
Delete the last three sentences of the above paragraph and see RFP for requirements.

(2) Signalized Intersections outside the ***Mast Arm Boundary Map***:

Signals along all corridors outside the ***Mast Arm Boundary Map*** must be supported by two-point span wire assemblies with adjustable hangers. If the Local Maintaining Agency prefers a mast arm, they must provide funding for the increase in construction cost., and if the requested mast arm is to be painted, see coating requirements for ancillary structures in ***FDM 261.1***.

Modification for Non-Conventional Projects:
Delete the last sentence of the above paragraph and see RFP for requirements.

232.9 Span Wire Assemblies

Use either perpendicular spans, box spans or drop box spans for all traffic signal span wire assemblies. Signs on span wires will be restricted to required regulatory signs.

Diagonal span assemblies may be used for flashing beacon installations. A Design Variation is required for any other diagonal installation. The Design Variation must be signed by both the District Design Engineer and the District Traffic Operations Engineer.

232.10 Traffic Signal Project Coordination

Coordination with other offices and agencies is an important aspect of project design. The offices discussed in this section are normally involved in signal projects, however there may be others.

Roadway Design – Typically, the designer of a signal project receives the base sheets for design and any required cross sections from the roadway designer. Base sheets may be created from existing plans when the signal project is not part of an active roadway design project.

Utilities - The District Utilities Engineer provides the coordination between the designer and the various utilities that may be involved in the project. The Utilities Section may assist in identifying or verifying conflicts with overhead and underground utilities. The designer should coordinate with the utility company providing power on the preferred location for the electrical service.

Structures Design - The Structures Engineer of Record provides the design of the traffic signal mast arms and strain poles, including the design of the foundation. The Structures Engineer of Record should be contacted early in the design phase to allow adequate time for coordination with the Geotechnical Engineer in obtaining the necessary soils information.

Coordinate locations and attachments of traffic signals and conduits on bridge structures with the bridge structural designer. Include traffic signal and conduit locations and attachment details in the plans. Refer to ***Structures Design Guidelines***, ***Section 1.9*** for details and restrictions related to bridge attachments.

Pedestrian and Bicycle Coordinator - The District Bicycle and Pedestrian Coordinator should be consulted to assure that all potential pedestrian and bicyclist concerns have been considered.

232.11 Traffic Signal System Power Design

Traffic signal systems typically operate at 120 volts alternating current (AC) from the commercial utility service provider. Refer to ***Section 233.3*** for power source design considerations. The following subsections describe the power calculations at the traffic signal intersection.

232.11.1 Power Load Requirements

The total power requirement for any traffic signal system site is the sum of the power of all components within the cabinet as well as all the components outside of the cabinet.

Assume all equipment is in continuous operation.

232.11.2 Voltage Drop

Perform voltage drop calculations for the following conductors.

(1) Conductors from the utility service provider meter to the traffic signal cabinet:

- (a) Measure the distance between the meter and the traffic signal cabinet.
- (b) Determine the conductor size for a maximum of 5% voltage drop.
- (c) Voltage drop mitigation strategies may include use of larger conductors or higher service voltage.
- (d) Minimum conductor size is 6 American Wire Gauge (AWG).

(2) Conductors from the traffic signal cabinet to the traffic signal head:

- (a) Measure the distance between the traffic signal cabinet and the farthest traffic signal head.
- (b) Determine the conductor size for a maximum of 5% voltage drop.
- (c) Voltage drop mitigation strategies may include use of larger conductors.
- (d) Minimum conductor size is 14 AWG.

Perform traffic signal system electrical design in accordance with the National Electric Code for traffic signal system equipment electrical designs, including voltage drop calculations, load requirements, electrical device sizing and grounding.

233 Intelligent Transportation Systems (ITS)

233.1 General

Intelligent Transportation Systems (ITS) criteria provided in this chapter applies to the placement and installation of ITS devices and systems along Florida's roadways including Limited Access (LA) facilities, arterials, and express lanes.

The design and layout of ITS facilities should complement the basic highway design and comply with current versions of the following:

- ***Standard Specifications***
- ***Standard Plans***
- ***Traffic Engineering Manual (TEM)***
- ***Structures Manual***
- ***Highway Beautification Policy***
- ***Manual on Uniform Traffic Studies (MUTS)***
- ***AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals***
- ***Manual on Uniform Traffic Control Devices (MUTCD)***
- ***Intelligent Transportation System Integration Guide Book***
- ***National Electric Code (NEC)***
- ***National Fire Protection Association (NFPA)***
- ***Title 23 Code of Federal Regulation (CFR), Part 940***
- ***Title 47 CFR, Part 90***
- ***Title 47 CFR, Part 95L***

Additional information related to the design of ITS facilities is found in the following locations of the ***FDM***:

- ***FDM 215*** – lateral offset requirements for poles, sign structures, field cabinets, and communication hubs for deployments. Deployment refers to existing and new ITS facilities and infrastructure.
- ***FDM 221*** – utility coordination
- ***FDM 261*** – structural support requirements

- ***FDM 942*** – ITS Plans content and requirements

The Statewide Systems Engineering Management Plan and various systems engineering templates (e.g., Concept of Operations) are found on the following web site:

https://www.fdot.gov/traffic/ITS/Projects_Deploy/SEMP.shtm

233.1.1 Railroad-Highway Grade Crossing Near or Within Project Limits

Federal-aid projects with a railroad-highway grade crossing near or within the project limits should refer to ***FDM 220.2.4***.

233.1.2 Attachments to Barriers

Refer to ***FDM 215*** for information regarding proposed attachments to bridge traffic railings, concrete median barrier walls, concrete shoulder barrier walls or the evaluation of existing attachments.

233.1.3 ITS Device Approval and Compatibility

ITS devices are traffic control devices that follow approval requirements discussed in ***FDM 232.1.3***.

Incorporate features and functions that allow interoperability with other ITS deployments throughout the region and state including existing Transportation Management Center (TMC) hardware and software. Examples of design characteristics that promote interoperability include:

- Systems and products based on open architectures and standards.
- Systems and products that are scalable and nonproprietary.
- Compatibility with the Department's SunGuide® Software directly or via support of one or more of its related Interface Control Documents (ICD).
- Compatibility with the local agency central system software, as applicable.
- Systems on the Department's Approved Products List (***APL***), Innovative Products List (***IPL***), or proprietary products. Refer to ***FDM 110.4.1*** for more information on proprietary products.
- Compatibility with existing or legacy systems and networks.

- Develop technical special provisions (TSPs) or modified special provisions (MSPs) in accordance with the Department's ***Specification Handbook***.

233.2 ITS Design Criteria

ITS devices and systems gather, analyze, and distribute real-time information to improve the safety, efficiency, mobility, security, and integration of transportation systems. Various ITS technologies have strengths and limitations for collecting, analyzing, and disseminating information. Select ITS devices for the appropriate application.

Many ITS devices require specific placement and configuration requirements for the equipment to perform properly. Consider the following for the design of these devices:

(1) Life cycle expectancy for continued operations and maintenance.

(2) Value engineering for installation and maintenance of the design.

(3) Environmental impacts.

(4) Technologies for commercial vehicle operations.

(5) Technologies for connected vehicles.

(6) Accommodations for future expansion.

(7) Utility and landscaping impacts.

233.2.1 Title 23 CFR, Part 940

ITS projects must comply with the requirements specified in the ***Guidelines for the Implementation of Part 940 in Florida*** (Topic No. 750-040-003). This is to ensure compliance with ***Code of Federal Regulations (CFR) Chapter 23 Part 940 Section 940.11*** and Department requirements.

233.2.2 Maintenance Considerations

Consider the following for maintenance access:

- Provide a minimum 4-foot clear area around the ITS pole for maintenance of the camera lowering device.
- Avoid ITS equipment near areas susceptible to vegetation overgrowth, swales, or wetlands.
- Avoid installing equipment in medians.

- Provide a leveling platform and railing system (handrail) to protect from any drop-off hazards and/or slopes steeper than 1:2.
- Place ITS equipment behind existing or proposed guardrails, as required in ***FDM 215.2.4***.
- Provide space to pull over on the shoulder to access the equipment.

233.3 ITS Power Design

ITS systems typically operate on 120 volts alternating current (AC) from the commercial utility service provider. Some systems operate using a low voltage (60 volts or less) direct current (DC) power source, facilitating battery and solar power options. Do not use 600-volt step-up electrical systems. Do not exceed 480 volts for ITS systems. Consider the following for power designs:

- Existing and future loads.
- Expected power consumption duty cycle.
- The time during which the system must operate.

Include a Remote Power Management Unit (RPMU) within each ITS field cabinet.

233.3.1 Power Source Design and Placement

Power service availability is an essential element to ITS design. The power service location is the demarcation point between the Department and the commercial utility service provider. In many cases, the power service is a new power service pole located immediately inside the R/W.

Identify the location of power service and design the power service cable routing from the power service to the field device cabinet. Include the device stations and offsets for proposed power service locations in the plans.

Power service locations are typically located within a half-mile of the ITS devices served. Consult with the commercial utility service provider to select optimal power service locations for power service routing greater than a half-mile.

Identify underground and above-ground obstacles (e.g., buried utilities, structure foundations, retaining walls, guardrail) between proposed ITS devices and the power services. These obstacles may affect the location of proposed ITS devices, the choice of power service points, or the routing for the power service conductors.

233.3.2 Local Backup and Alternative Power Sources

Provide Uninterruptible Power Supply (UPS) to prevent failure of normal operations for mission critical systems. Mission critical systems are systems that are critical to the daily operation of the Transportation Management Center (TMC) (e.g., master hubs, certain local hubs, detectors, cameras, signs, tolling systems, express lanes) as defined by the District ITS/Transportation Systems Management & Operations (TSM&O) Engineer.

Solar or wind power sources may be an option for some ITS applications. Consider the geographical and topographic features that affect sunlight or wind exposure, size of site, and protection from maintenance operations (e.g., mowing).

An electrical distribution system may be necessary in rural areas where commercial electric service is not readily available. Design the electrical distribution system in accordance with ***NEC*** requirements. Consider voltage and amperage needs of the equipment along the distribution system. Different combinations of voltage, conductor size, step-up, step-down, and isolation transformers may be used to design a system that is cost effective to construct and maintain. Coordinate with the District ITS/TSM&O Engineer to determine additional electrical capacity needs.

233.3.3 Application for Electric Service

Proposed service points for new power service installations require approval by the commercial utility service provider. This approval should be coordinated with the Department and the commercial utility service provider early in the design process.

The approval of proposed service points for new power service installations include the following steps:

(1) Determine the following:

    (a) Availability of service at any location.

    (b) Commercial utility service provider’s standard type of service for the load to be served.

    (c) Designated point of delivery (prior to confirmation with the commercial utility service).

(2) Request that the proposed service points be verified and approved by the commercial utility service provider.

(3) (Optional) Hold a coordination meeting in the field with the commercial utility service provider representative.

(4) (Optional) Designer to obtain a written agreement with the commercial utility service provider for agreed upon service locations.

In most locations, the secondary distribution system provides service(s) at standard voltages.

233.3.4 Power Design Requirements

Key design steps for an ITS device deployment electric power system are:

(1) Determine the total power requirement based on anticipated peak equipment loads determined in accordance with ***FDM 233.3.5***.

(2) Select a suitable power source based on availability.

(3) Determine transformer requirements (step-down, step-up, or isolation), where applicable. The need for transformers may be based on voltage and power loss calculations.

(4) Balance the device electrical loads to achieve a uniform and efficient power distribution design.

(5) Separate power service meter to be provided for ITS infrastructure

Locate a power disconnect switch within a convenient distance from the device service enclosure. For example, the power to operate a Dynamic Message Sign (DMS) may be fed from a nearby DMS service enclosure, and a power disconnect switch is typically installed outside of the service enclosure. Step-up and step-down transformers must include a minimum of two 2.5% full capacity below normal taps and two 2.5% above normal taps on the primary side.

233.3.5 Power Load Requirements

The total power requirement for any deployed device or deployment site is the sum of the power requirements of the following:

- Heating Ventilation and Air Conditioning (HVAC).
- Cabinet components (lights, fans, UPS).
- Devices not powered through the UPS.
- Convenience outlets.
- Future device loads.

Assume all equipment is in continuous operation. Provide 20% spare load capacity in every ITS field cabinet (excluding DMS loads). In addition, provide for a 15A load at 120V at the end of every circuit.

233.3.6 Voltage Drop

Perform voltage drop calculations for ITS devices with the following considerations:

- Ability of the ITS device to operate above or below the nominal voltage.
- Distance from the power source to the ITS device.

Voltage drop mitigation strategies may include use of larger power conductors or higher service voltage.

Meet ***NEC*** code for ITS equipment electrical designs, including voltage drop calculations, load requirements, electrical device sizing (e.g., switches, isolators, bus bars, surge protective devices), and grounding.

233.3.7 Installation of Power Cable

Install power cables in separate conduits and pull boxes from communications cables. Design for the maximum duct fill ratio in accordance with ***NEC, Chapter 9***.

233.3.8 Grounding and Lightning Protection

Include provisions for grounding and lightning protection. Examples of techniques for grounding and lightning protection include the following:

- Proper bonding and installation of grounding rods and grounding conductors.
- Air terminals.
- Surge Protective Devices (SPDs).

Standard Plans, Index 700-090 contains additional information on grounding and lightning protection for DMS signs.

Existing geological and other physical characteristics (e.g., rock formations, underground utilities, gravel deposits, soil types, and resistivity, groundwater) affect the design or layout of grounding systems. Include in the plans relevant subsurface data at the proposed installation locations (e.g., soil resistivity measurements).

Place the grounding arrays such that grounding paths from the down cable to the primary electrode are as straight as possible. Provide details in the plans related to grounding and cable routing for each device.

Determine grounding and SPD placement and overall system design based on project-specific needs and the following:

- Follow ***NFPA 780 (Standard for the Installation of Lightning Protection Systems)***, ***Underwriters Laboratories*** (***UL***) ***UL-1449***, and the ***NEC***.
- Place SPD equipment so that grounding connections are as short and straight as possible.
- Avoid bending conductor routes.
- Provide physical separation between low-voltage and high-voltage signal paths.
- Avoid routing unprotected wires or grounding wires parallel or adjacent to the protected wiring.

233.3.9 Emergency Generator Power Systems (Generators)

Generators provide temporary power when commercial AC power is interrupted. Their use is associated with mission critical ITS applications (as described in ***FDM 233.3.2***).

Permanent generators are required for applications that cannot tolerate a short duration outage. Supplement with a UPS or battery system to provide continuous power service during the start-up cycle of the generator.

Include a connection and proper receptacles to accommodate a portable generator for applications that can tolerate a short duration outage of a few hours.

233.3.9.1 Generator Design Requirements

Sizing a generator depends on design load (including future device loading) and power factor. Consider run time requirements and future load expansion in the generator design. Identify and design specific critical load circuits to be powered by the generator when commercial power fails.

Use Liquefied Petroleum Gas (LPG) as the fuel type for permanent generator designs. The preferred storage technique for LPG is in-ground (buried) tank. Obtain approval from the District ITS/TSM&O Engineer to use fuel alternatives. Design permanent generators to provide a minimum of 48-hours of run time at full (rated) load. Meet the minimum requirements in ***NFPA 58 (Liquefied Petroleum Gas Code)*** for generator designs.

For permanent generators, provide a generator pad with a minimum clearance of 30 inches around the generator and fuel tank. Provide pad design details with adequate information such as reinforcing, concrete class type/strength, and installation notes.

Install a manual transfer switch for all generator installations and also include an automatic transfer switch for permanent generator installations. The automatic transfer switch must provide emergency power in less than 15 seconds and permit full manual override control for testing and maintenance.

Install a remote monitor and control appliance for permanent generators. Connect to a network management system to monitor the status of permanent generators and allow remote operations and testing capabilities. Coordinate with the District ITS/TSM&O Engineer for connections to a network management system.

233.3.10 DC Power Plant (48 Volt)

DC power plants protect ITS devices from potential disruptions, such as high-switching voltages, transients, lightning strikes, harmonic distortion, and interference from other equipment.

Include DC power plants where ITS applications require isolation from the AC power grid utility service provider. Connect the DC power plant to the facility grounding system.

233.3.10.1 Battery Types

Use Valve Regulated Lead-Acid (VRLA) batteries for mission critical ITS applications (as described in ***FDM 233.3.2***).

Consider a large form factor lithium battery (e.g., Lithium Iron Phosphate) if a site has a unique battery size limitation.

Provide proper ventilation for specified battery system.

Do not use flooded type lead-acid batteries.

233.3.10.2 Battery Sizing

Size battery systems to support all the following:

- Present design load plus load expansion safety margin (typically 25%).
- Anticipated future load expansion.
- Minimum run time requirements of the DC power plant load.

Evaluate the present design load for the maximum instantaneous DC current requirements and the average DC current requirements.

Size VRLA battery systems such that the battery cells do not discharge below 50% of their rated capacity.

233.3.10.3 Battery Interconnects

Provide a circuit breaker disconnect and a low voltage disconnect for battery systems.

233.3.10.4 Battery Charging Systems

Match the battery charging system to the battery type and size to avoid unnecessary damage to battery cells. Battery charging systems may include multiple rectifiers for load sharing and redundancy.

233.3.10.5 Battery Monitoring System

Provide a battery monitoring system to monitor the condition of each battery or cell. Specify a monitoring system that identifies a thermal runaway event in the battery system and provides information to the charging system. This allows the charging system to lower the rectifier float voltage to limit the current or shutdown the battery system. Connect the battery monitoring system to the network to permit remote reporting.

233.3.10.6 DC Power Plant Load Distribution

Equip DC power load circuits with circuit breaker panels or fuses. Circuit breakers and fuses may be inherent to the DC power plant or part of a stand-alone fused alarm panel to distribute the DC power to load circuits. The panels may be networked to permit remote monitoring.

233.3.10.7 DC Power Plant Wiring

Specify stranded insulated wire with sufficient gauge to carry the required current in the DC power plant. Specify red insulation for source wiring (e.g., -48 VDC) and black insulation for the return (0 V).

233.3.10.8 Battery Installation

Large DC power plants and battery systems installed on flooring, may require a structural analysis to determine the load bearing capacity. Coordinate with the FDOT Project Manager to determine if structural analysis is required.

Design for the weight of large DC power plants and batteries to be evenly distributed to minimize surface or floor load.

233.4 ITS Support Infrastructure

ITS support infrastructure includes:

- Conduits infrastructure
- Pull, slice, and junction boxes
- Utility designation (e.g., power, communications)
- Fiber optic network cables and connections
- Poles and structures
- Camera lowering devices

Coordinate the grading of all foundations to ensure elevation of cabinet bases are above grade. Consider the following:

- Sight obstructions with landscaping and other structures
- Temporary Traffic Control functionality
- Drainage or flooding concerns
- Constructability
- Access for future maintenance

233.4.1 Conduit Infrastructure

Specify the conduit color, inner duct type, size, and quantity of the conduit system in the Plans. Coordinate with the District ITS/TSM&O Engineer to ensure conduit colors and sizes synchronize with existing conduit subsystem. Obtain approval from the District ITS/TSM&O Engineer and District Structures Engineer to utilize bridge-mounted or barrier-wall-embedded conduit for fiber/electric service wires.

Design the conduit system in accordance with the following:

- Conduit runs are to be as straight as possible
- Joints and bends in the conduit system are to meet minimum bending radius of the fiber optic cable as defined in ***Standard Specifications***, ***Section 633***
- Place conduit along the edge of R/W as much as possible to avoid future widening conflicts
- Avoid placing conduits:
    - Within terrain steeper than 1:4 slope
    - Near endangered species habitats, chronic wet areas, landscaping, drainage features, and existing or proposed roadside features (e.g., guardrail)
    - Near underground utilities and lighting conductors
    - Behind noise walls
- Provide maintenance access to the conduit and pull or splice boxes
- Minimize the number of directional borings. If there are two directional bore sections, less than 100 feet apart, then consider using a continuous directional bore.
- Minimize road crossings. When road or ramp crossing is necessary, locate and route the conduit crossing in a manner that minimizes the length to cross the road. Place conduit perpendicular (shortest distance) to the roadway or ramp to the greatest extent practicable.
- Include only one fiber cable in each fiber optic backbone conduit. Do not collocate fiber cables inside the same backbone conduit. Obtain approval from the District ITS/TSM&O Engineer to place multiple fiber optic cables in conduits with lateral fiber optic cable drops. Ensure conduits meet NEC conduit fill ratio requirements.

Provide callouts and notes in the plans indicating existing conduit infrastructure that will be removed or abandoned in the project. Note existing underground conduit identified in the plans for removal as incidental to clearing and grubbing.

If existing conduit is to be abandoned and remain in place, include fiber optic cable removal in plans, so that it is apparent that the conduit has been abandoned.

233.4.2 Pull, Splice, and Junction Boxes

The top of pull, splice, and junction boxes should be placed a minimum of 2 feet above the appropriate drainage feature elevation. Coordinate with the Drainage Design Engineer to confirm these structures and their associated components are placed above the appropriate elevation as follows:

• Treatment Swales – Weir Elevation

• Conveyance Ditches – Normal Depth

• Stormwater Ponds – Design Storm Peak Stage

• Floodplain Compensation or Other Systems – Seasonal High-~~-~~Water Level

Provide the applicable elevation in the component-specific cross-sections and typical cross-sections.~~Provide access points using pull, splice, or junction boxes. Minimum requirements for placement of access points are as follows:~~

- ~~Provide at-grade access to fiber optic cables housed within conduit systems.~~
- ~~Provide assist points to aid in fiber optic cable installation.~~
- ~~Provide protection for the fiber optic cable.~~
- ~~Provide space for storing cable slack/coils and splice enclosures.~~
- ~~Provide space for entry, routing, and slack fiber storage for pull boxes and splice boxes. Fiber optic cable slack requirements are provided in ***Standard Specifications, Section 633***.~~

~~Access points are required at the following locations:~~

- ~~As provided in ***Standard Specifications, Section 635***.~~
- ~~Planned or future splice locations.~~
- ~~On each side of:~~
  - ~~A railroad crossing.~~
  - ~~A roadway crossing, except for narrow roadways, such as ramps.~~

~~Splice boxes must be used for access points on fiber optic cable backbone routes or for device drop. Pull boxes can only be used for access points when the conduit system extends from the backbone to the ITS field devices.~~

~~***Standard Plans, Index 634-002*** includes information for aerial interconnect, and ***Index 635-001*** includes information for pull and splice box details.~~

233.4.3 Fiber Optic Cable Designating System

The fiber optic cable designating system provides visual indication of the underground fiber optic conduit or cable system. Provide appropriate fiber optic cable locating and marking per ***Standard Specifications*** ***633***.

233.5 Fiber Optics and Network Design

Design network facilities based on specific project needs with the following information:

- General network topology.
- Facility diagrams illustrating conduit routes.
- Network diagrams, including communication hub details.
- External network connections and demarcation points.
- Fiber block diagram to show switches, field devices, and physical network connectivity.

Include Special Provision ***SP0071101-Tolls*** in the contract documents when there are existing power or communication cables that transmit toll system information near areas where work is to be performed. Refer to the ***General Tolling Requirements (GTR)*** for specific ITS requirements related to toll facility design.

233.5.1 Fiber Optic Cable

Fiber optic cable is utilized in the Department’s statewide network infrastructure to provide data and device control communications between ITS field devices, Transportation Management Centers (TMCs) and other identified stakeholder facilities.

Requirements for fiber optic cable are as follows:

- Design for single mode fiber strands.
- Define fiber optic cable backbone, drop buffer tube, and strand color requirements.
- Use 12 fibers as a minimum when lateral fiber optic cable drops to ITS field cabinets. Use 24 fibers as a minimum when lateral fiber optic cable drops to local ITS hubs with Layer 3 switches.

- Use 144 single-mode fibers as a minimum for fiber optic cable backbone in new systems.

233.5.1.1 Splices, Terminations, and Connection Hardware

Plans must provide the following:

- Splice points and splice diagrams.
- Interconnect fiber strands, origination, and destination points.
- Minimum link loss budget; including line, splice, and termination losses
- Reserve loss budget for future splicing and cable deterioration. Budget for future loss to equal one-half of the total decibels of the circuit or 10 decibels, whichever is greater.
- Splice enclosures to protect all fiber splices within splice trays. Number and size of splice trays and enclosures are based on the number of fibers involved in the splicing diagram at each splice location.
- Existing fiber optic cables and the location of the nearest full splices in the existing cables, including distance in each direction.
- Termination of fiber optic cables using a Fiber Patch Panel (FPP). Terminate single-mode fiber optic cable in the FPP or use pre-terminated FPP connectors.
- When the project work necessitates a break in the fiber cable, include provisions regarding allowable downtime. Provide any temporary splice drawings required during construction.

233.6 ITS Poles and Structures

Consider the following to locate and select ITS poles and structures:

- Existing ITS infrastructure, roadway features, device type (match existing), and environment.
- Road geometry, static signs spacing, lightning protection, underground utilities, and drainage infrastructure.
- Aesthetics, conflict avoidance, and line of sight issues.
- Soil boring information for the foundation design of the structures.
- Co-locating ITS devices to minimize the number of poles and structures.

- Pole type for each ITS device (e.g., pre-stressed concrete, steel) and structure type (e.g., cantilever, full-span, mid-span).

233.6.1 Camera Lowering Device

Provide a lowering device for pole-mounted cameras with mounting heights greater than 45 feet or where height impedes access via maintenance truck.

Design external conduit for housing the cables, mounting box hardware at the top of the structure, and component details required for installation (e.g., air terminal, guide wire) for a lowering device to be attached to an existing pole or similar structure.

Orient the lowering device to prevent an operator from standing directly beneath the equipment while it is being lowered.

233.7 ITS Enclosures

ITS enclosures include ITS field cabinets, small equipment cabinets, and equipment shelters. Each of these cabinets require an analysis for design, usage, and placement.

233.7.1 ITS Cabinets

Placement of ITS cabinets is based on the safety of the motorist, visibility of roadside devices, and safety of maintenance staff. Mount the ITS cabinets on concrete pads, structures, or poles. Do not place cabinets in flood-prone areas or wetlands. Place ground mounted DMS cabinets based on the DMS type. Cabinet mounting details are shown in ***Standard Plans*, *Index 676-010***.

Size the cabinet to accommodate equipment to be installed, ease of access, anticipated future equipment (e.g., connected vehicle roadside unit in-cabinet equipment), and proper ventilation. All cabinets within a project corridor should have a consistent layout for the interior by functionality. Orientate the cabinet such that the maintenance technician is facing oncoming traffic when accessing the cabinet. Show cabinet orientation and door swings in the plans.

Provide one power and one communication entry conduit for each cabinet, at minimum. Include additional conduit entries as required for the equipment to be housed. Include spare conduits in the cabinet for future expansion.

Provide maintenance service slabs in accordance with ***Standard Plans*, *Index 676-010***.

Consider mitigation strategies to prevent drop-off hazards from maintenance service slabs. Modifications to grading surrounding the maintenance service slab is preferred to the extent practicable. The use of retaining walls and railings should be limited to safety concerns in coordination with district ITS maintenance. If a railing is used, extend maintenance slab to provide a minimum of three feet, six inches of clear space beyond all sides of the ITS pole and cabinet constrained by the railing.

Coordinate with district ITS maintenance for deficiencies and other safety concerns at existing maintenance slab locations. If field reviews and documented safety concerns warrant refurbishment or replacement of any deficient maintenance slabs, seek approval from District ITS/TSM&O Engineer to make provisions in the plans to address the deficiencies.

233.7.2 Small Equipment Enclosures

Small equipment enclosures include structure- or pole-mounted cabinets (e.g., National Electrical Manufacturers Association (NEMA) 3R). These may be used in lieu of ITS field cabinets in locations that require minimal equipment to be housed. Small equipment enclosures may be connected to another ITS site, which houses the Ethernet switch and other ITS components. When locating the small equipment enclosure, consider the allowable power and communication loss per ***IEEE 802.3ab*** to District network speed requirements.

233.7.3 Equipment Shelter

Co-location of master hub equipment in existing FDOT-owned microwave tower buildings may be used in-lieu of new equipment shelters. Coordinate with the District ITS/TSM&O Engineer and the State Traffic Engineering and Operations Office's ITS Communications division to determine if co-location is possible.

If co-location is not possible, provide the following information in the equipment shelter details:

(1) Site layout
  - (a) Shelter dimensions.
  - (b) Site preparation work, clearing and grubbing, fencing, and landscape.
  - (c) Conduit and pull box installation.
  - (d) Details for grounding.

(2) Shelter layout

- (a) Details for electrical and lighting.
- (b) HVAC systems.
- (c) Back-up power systems (e.g., UPS, generator, fuel tanks).
- (d) Security features (e.g., cameras, security alarms).
- (e) Remote monitoring alarms.

(3) Equipment layout

- (a) Overhead cable trays.
- (b) Standard EIA/TIA 19-inch racks.
- (c) Demarcation punch blocks.
- (d) Patch panels.
- (e) Equipment placement within each rack.

233.8 Communication and Networking Devices

Network devices include a variety of Internet Protocol (IP)-addressable electronic equipment. This equipment is used for the collection and dissemination of video, traffic data, and other information.

Provide communication and networking devices that conform with the following:

- Network requirements and information for communication network design.
- Compatibility with existing network equipment currently in operation.
- Minimal system downtime to facilitate immediate replacement of defective or damaged units.
- Open architecture.
- Survivability and reliability.
- Redundant path and no single point of failure.

233.8.1 Managed Field Ethernet Switch (MFES) Network

Provide MFES network to avoid the following:

- Distance limitations for common Ethernet media types.

- Interference that may be induced on copper-based interconnects.
- Data size transfer limitations based on Gigabit Interface Converter (GBIC).

In the fiber network layout, provide a leap-frog configuration to support availability and optimal data transfer. Ensure no more than one DMS and no more than six CCTV devices are included on any one leap-frog circuit. Ensure that adjacent CCTV devices are on separate circuits.

233.8.2 Device Server

Include device servers when remote field devices with serial communication interfaces require connection to an Ethernet network.

Equipment that may require the use of device servers include:

(1) Traffic data and vehicle detection systems.

(2) Road Weather Information System (RWIS).

(3) Low-speed data output devices.

233.8.3 Media Converter

Media converters may be used to transition between various types of interfaces.

233.8.4 Wireless Communications System

Determine the proper wireless communications system to fit the ITS application (e.g., point-to-point, point-to-multipoint). Consider reliability, security, capital, and operational expenditures, licensed versus unlicensed radio bands, and regulatory requirements for the wireless communications system selection.

Wireless systems enable data communications through radio links.

Typical applications for point-to-point wireless communications system includes:

- Remote ITS field devices or intersections that can use a wireless connection to the nearest fiber drop point.
- Across rugged terrain and bodies of water.
- The use of fiber optics is temporarily unavailable during construction; this use must be approved by the District ITS/TSM&O Engineer.

- ITS device sites where it is difficult or cost prohibitive to install fiber optic cables.

Typical applications for point-to-multipoint wireless communications system includes:

- Land Mobile Radio push-to-talk.
- Highway Advisory Radio.
- Citizens Band (CB) Radio.

The ITS Communications division maintains the Federal Communications Commission (FCC) licenses associated with ITS wireless communications and manages assignment of new licenses. Districts using wireless communications systems to support an ITS application are encouraged to contact State Traffic Engineering and Operations Office's ITS Communications division.

Specify each component in the wireless communications system including antennas, radios, transmission lines, and connectors. Provide installation details, location, and placement of the system components. Design cable management details. Consider the length between transmit and receive equipment to attain optimum communications signal.

Design line-of-sight, throughput, frequency, availability, power levels, and path calculations for the communications design plans as follows:

- Design the communication path so that two-thirds of the Fresnel Zone is clear of any obstructions (e.g., surrounding terrain, trees, signs, buildings).
- Set throughput capacity for each radio link to transmit two times more data than the maximum data throughput.
- Analyze multipath challenges over large water bodies and within urban street canyons (created by large buildings).
- Analyze spectrum interference in the vicinity.

Wireless communications shall not be used for communication to Express Lane ITS devices.

233.8.5 Layer 3 Switch

Within the ITS network, the Layer 3 switch provides connectivity at transmission rates of 1 or 10 Gigabit per second to and from adjacent Layer 3 switches.

The Layer 3 switch includes Layer 2 capabilities, including Quality of Service (QoS), Internet Group Management Protocol (IGMP), rate limiting, security filtering, and general management. The Layer 3 switch is fully compatible and interoperable with the ITS trunk Ethernet network interface.

The Layer 3 switch is a port based VLAN, supporting VLAN tagging, meeting the requirements of IEEE 802.1Q standard.

The selection of a Layer 3 switch involves variables suited for the proper environment. Items such as dual power supplies, dual supervisor units, Layer 3 protocols, and voltage requirements are considered during the switch selection process. Items such as number and type of ports are design specific. An MSP and custom pay-item are needed for all projects requiring a Layer 3 switch.

See **Form 233-A** (located in **FDM 103**) for desired Layer 3 switches.

233.9 Traffic Data and Vehicle Detection Systems

Include the location and placement of system components and provide installation details for the cables. Design the cabling installation details.

Consider capabilities and functional limitations at each location to attain the required levels of detection accuracy as specified in ***Standard Specifications***, ***Section 660***.

Show detector types and locations on the plans to obtain traffic data such as speed, occupancy, and volume. Detector placement must conform to the following requirements:

- Cover all lanes in both directions (as a group or individually).
- Space one-third to one-half mile in urban areas (context classifications C4, C5 and C6).
- Space one mile in suburban areas (context classifications C3R and C3C).
- Space one to two-mile in rural areas (context classifications C1, C2, and C2T).
- Space one-fourth to one-third mile on express lanes.
- Place at major interchanges exit and entrance ramps.
- Place at intersection to detect vehicle presence at the stop bar, when required.

233.9.1 Loop Detectors

Do not use loop detectors on concrete pavement or on corridors with large traffic volumes of heavy vehicles. Consider using them at locations with low volumes of traffic.

233.9.2 Video Vehicle Detection Systems (VVDS)

Design considerations for VVDS include:

- Upstream versus downstream view orientation.
- Shoulder coverage to detect stalled vehicles.
- Detection zone layout to cover near and far zones.
- Roadway geometry and line of sight.
- Requirement to view VVDS images from the Transportation Management Center (TMC).
- High-contrast or low-light conditions that might interfere with VVDS data reliability.
- Maintenance requirements and impact of high winds on detector alignment and calibration.

233.9.3 Microwave Vehicle Detection Systems (MVDS)

Design considerations for MVDS include:

- Cover all lanes in both directions of travel.
- Provide offset mounting on structures.
- Avoid aiming toward steel structures.
- Align detector perpendicular to the roadway.
- Provide access for maintenance and calibration.
- Use Power over Ethernet when connecting to an ITS Field Cabinet within 330 feet.

On limited-access facilities, place MVDS devices at a maximum of 1-mile intervals for C1 and C2 context classifications and half-mile intervals for other context classifications. Additionally, place MVDS devices at all limited-access facility exit ramp locations or as directed by the District ITS/TSM&O Engineer.

Install MVDS at CCTV camera locations, if possible, to minimize costs. Install MVDS so that it does not interfere with the lowering of CCTV. Do not use roadway lighting poles or sign structures for the installation of CCTV cameras or MVDS.

233.9.4 Wireless Magnetometer Detection Systems (WMDS)

Design considerations for WMDS include:

- Determine the number and spacing of sensors based on detection requirements, e.g., three magnetometers may be required for truck parking.
- Align sensors such that they are placed in the direction of traffic flow or parking space.
- Provide access for installation, maintenance, and calibration.

233.9.5 Automatic Vehicle Identification (AVI) Systems

Design considerations for AVI systems include:

(1) Follow manufacturer's requirements for AVI sensor placement, mounting height, offset, and line of sight.

(2) Follow location and spacing based on District objectives for the AVI system. Potential locations include mid-blocks, major intersections, and locations prior to or after interchanges.

233.10 Closed-Circuit Television Systems

Closed-circuit television (CCTV) systems consist of roadside cameras, communication devices, as well as camera control and video display equipment. CCTV is located at one or more remote monitoring locations that allow surveillance of roadway and traffic conditions for traffic and incident management. Cameras are also required for visual confirmation of dynamic message signs and ramp signal operation, as well as security purposes.

Locate and place cameras to provide continuous view of general toll lanes, managed lanes, and limited-access roadways within the project corridor.

Design and placement considerations for CCTV cameras include:

- Continuous view of arterial roadways as directed by the Department.
- Coverage of roadway features including lanes, shoulders, ramps, ramp terminals, and designated emergency stopping, and crash investigation sites beyond the traveled way.
- Coverage of the master hubs, ITS cabinets, generators, and walk-in DMS. Ensure the CCTVs can view corresponding DMS clearly.

- Place cameras at interchanges to view arterial traffic.
- Place cameras for DMS verification no further than 1,000 feet from the face of the DMS with a clear line of sight within the horizontal and vertical viewing cone.
- Dedicated express lane cameras for verification must be capable of pan, tilt, and zoom (PTZ) for every DMS.
- Accommodate service and maintenance access with minimal impact to traffic.
- Utilize crash data analysis to place cameras at high-crash locations.
- Place the camera at a location with minimal vegetation obstruction within half-mile on each side.
- Identify locations for vegetation removal in the plans or propose closer spacing upon approval from the District ITS/TSM&O Engineer and District Landscape Architect.
- Locate the camera in accordance with minimum lateral offset requirements in ***FDM 215***, or place behind existing guardrail and barrier walls. Avoid introducing new guardrail and barrier walls.
- Specify camera mounting height in the plans based on specific project needs. Mount cameras a minimum of 45 feet above the highest crown elevation of the mainline roadway on limited-access facilities. Consider the following in determining the mounting height:
    - Required viewing distance.
    - Roadway geometry and lane configuration.
    - Roadway functional classification (e.g., arterial, collector, limited access facility).
    - Environmental factors (e.g., glare from the horizon, headlight glare).
    - Vertical clearance.
    - Co-location with the other ITS devices.
    - Existing and anticipated vegetation.
- Do not place cameras on lighting structures.
- Avoid placing camera poles in the bottom of ditches or in locations that would prevent maintenance.
- Consider camera life-cycle cost, including maintenance costs.
- Consider CCTV performance and bandwidth requirements, control type, use of temporary cameras, and camera housing.

Design camera housings, enclosures, lowering devices, and mounts in accordance with the ***Standard Specifications***.

Refer to ***Standard Plans*, *Index 649-020*** or ***Index 641-020*** for CCTV camera pole and foundation details. Refer to Department's ***Standard Specifications***,(Division II and III) Section 649 for Steel Pole and Section 641 for Concrete CCTV Pole.

233.11 Motorist Information Systems

Motorist Information Systems include DMS, Highway Advisory Radio (HAR), electronic display signs, and Citizens Band (CB) Radio.

233.11.1 Dynamic Message Sign (DMS)

Select the appropriate DMS type based on specific project needs. Position the DMS to be legible from the roadway based on the display characteristics of DMS technology (e.g., the vertical and horizontal viewing angles of LED displays).

Determine DMS placement based on the following requirements:

- Compatible with the message library proposed for use on the project, including text and graphics.
- Utilize DMS capable of displaying minimum character heights and line spacing per the ***MUTCD***, Section 2L.04.
- Place in advance of high crash locations and traffic bottlenecks.
- Place where sufficient space is available between the edge of travel lanes and the R/W limits, while meeting the minimum lateral offset requirements in ***FDM 215***
- Place where no conflict with underground or overhead utilities exists.
- Accommodate access for service and maintenance.
- Place along key commuter or evacuation corridors.
- Place on Interstate and Freeway facilities in advance of interchanges that offer alternate routes, and meet the requirements of ***MUTCD***, Section 2L and the following:
    - Place in advance of 1-mile exit signing.
    - Provide a minimum 800-foot spacing between existing and planned overhead static and other signs, per the ***MUTCD***. Provide increased spacing when conditions allow.

- Install walk-in DMS on support structures without static signage.
- In advance of interchanges where interstates meet to allow for advance messaging of traffic conditions on both roadways. Consider locations that are two exits before major interchanges as well as immediately prior to the interchange.
- Mount embedded DMS over or under the static sign panel or use a static sign cut-out.

- Place on arterials prior to major intersections and interchanges:
  - Approximately 1/4 to 1/2 mile in advance of major intersections or interchanges.
  - At least 600 feet from adjacent signalized intersections.
  - Where the DMS is continuously visible to motorists for 600 to 800 feet, depending on the design speed of the roadway.
  - Where no existing or planned guide signs exist within the 600-foot minimum visibility distance.
  - With minimum interference from lighting, adjacent driveways, side streets, or commercial signage.
  - Where no historical neighborhoods exist.

233.11.1.1 Express Lanes DMS

Express lanes DMS must be full-color or full-matrix DMS and conform to the following application criteria:

Table 233.11.1 DMS Characters

DMS Type		Minimum Character Size (inches)	Minimum Number of Characters Per Line	Maximum Resolution (millimeter pixel pitch)
Lane Status	LA Facility	18	18	20
	Arterial	12		
Toll Amount	LA Facility	18	7	
	Arterial	12		

233.11.2 Highway Advisory Radio (HAR)

A highway advisory radio (HAR) system is an advisory tool that informs the public of traffic- and safety-related issues. HAR systems may be installed or upgraded with the approval from the Chief Engineer. See Engineering and Operations Memorandum ***16-03***.

Include the equipment necessary for the operator to record verbal messages from onsite or remote locations, and to continually broadcast live, prerecorded, or synthesized messages from roadside transmission sites. Also, include highway signs with remotely operated flashing beacons to notify motorists of HAR broadcasts.

Refer to FCC regulations ***Title 47 CFR, Part 90.242*** for additional design requirements on travelers' information stations. Additional information on licensing issues, frequency allocation, and other specifics may be obtained by contacting the State Traffic Engineering and Operations Office's ITS Communications division.

Determine placement of a HAR installation based on specific project needs, as well as the following requirements:

- Transmission of message that can be received by motorists traveling through the broadcast zone.
- Placement on Interstate and Freeway facilities prior to interchanges that offer alternate routes.
- Placement in advance of high crash locations and traffic bottlenecks.
- Placement that accommodates access for service and maintenance.
- Placement along key commuter or evacuation corridors.
- Placement of flashing beacon signs within the HAR coverage area prior to exit signs or DMS associated with an interchange.
- Wood poles are often recommended by HAR manufacturers for antenna mounting to reduce interference that may occur with conductive poles. Install the antenna in accordance with the manufacturer's recommendations and in compliance with FCC requirements.

233.11.3 Electronic Display Signs

Place Variable Speed Limit (VSL) signs and Lane Control Signals (LCS) in accordance with:

- Locations per District requirements.
- Sign spacing per ***MUTCD*** requirements.

Specify field cabinet, support structure, power supply, and communications to support VSL and LCS installation.

233.11.4 Citizens Band (CB) Radio

The Department deploys CB radios to advise motorists (particularly commercial freight vehicles) about travel conditions and emergencies. The CB radio service operations and electronic equipment are regulated by the FCC in ***Title 47 CFR, Part 95, Subpart D***.

Operation of a remotely located CB radio station from a facility (e.g., a Transportation Management Center (TMC) where the operator is not co-located with the CB radio) requires a written waiver of the FCC rules. Contact State Traffic Engineering and Operations Office's ITS Communications division to obtain the required FCC waiver needed to remotely operate a CB radio.

233.12 Additional ITS Devices

This section includes information on other ITS devices that are TSM&O tools.

233.12.1 Road Weather Information System (RWIS)

RWIS consists of Environmental Sensor Station that incorporates multiple or single environmental sensor(s) (e.g., wind speed sensors, visibility sensors, pavement sensors) that are attached to one pole. Location of Environmental Sensor Stations should consider the following:

- Place in locations where weather observations will be the most representative of the roadway segment of interest.
- Select locations to avoid the following:
    - Effects of passing traffic (e.g., heat, wind, splash).
    - Standing water.
    - Locations where billboards, surrounding trees, or other vegetation would affect the weather measurements.

For more information on appropriate location of ESS and additional design requirements, refer to the ***FHWA's Road Weather Information System (RWIS) Environmental Sensor Station Siting Guidelines**, Publication No. FHWA-HOP-05-026*.

Identify the appropriate communication platform for the RWIS application (e.g., copper, fiber, wireless).

Licensing for using satellite-based communications is required, and it must be coordinated by the Department with the National Oceanic and Atmospheric Administration (NOAA). Coordinate the use of satellite-based systems with the State Traffic Engineering and Operations Office's ITS Communications division.

233.12.2 Ramp Metering Signals

A ramp metering signal controls the number of vehicles entering a limited-access facility to maintain steady traffic flow. Consider the following when designing ramp metering signals:

- ***MUTCD*** signalization requirements for ramp signals (e.g., design of the signal system, number of signal heads, placement beside or over the ramp).
- Distance from the stop bar to the acceleration lane to allow vehicles starting from the signal to reach highway speeds and merge safely.
- Distance from signal stop bar to the cross-street intersection to allow adequate vehicle storage at the signal.
- Add two-lane storage upstream of stop bar from cross street to store additional vehicles and not spill over cross street if ramp meter is proposed on a single lane ramp and traffic analysis warrants the need.
- Placement of stop bar and queue length detection.
- Placement of detectors to support local or central ramp signal control algorithm in use by the District.
- Signing to support signal operation.

233.12.3 Connected Vehicle Infrastructure

Connected Vehicle (CV) is an emerging TSM&O strategy that generally falls into three application categories:

- Vehicle-to-Infrastructure (V2I).

- Vehicle-to-Vehicle (V2V).
- Vehicle-to-Others (V2X).

The V2X components include pedestrians, bicyclists, personal mobile devices, aftermarket safety devices (ASDs), and any other Internet of Things (IoT). The common communications source uses 5.9 GHz Dedicated Short-Range Communication (DSRC) or cellular communications to and from Roadside Units (RSUs) and On-board Units (OBUs).

Use the following national standards when designing CV infrastructure:

- United States Department of Transportation (USDOT) ***DSRC RSU Specifications***.
- Society of Automotive Engineers (SAE) ***DSRC Message Set Dictionary***, including Basic Safety Messages (BSMs) and Traveler Information Messages (TIMs).
- USDOT ***Mapping Tool*** or LiDAR for intersection mapping.
- USDOT Architecture Reference for Cooperative and Intelligent Transportation (***ARC-IT***).
- FCC, ***Title 47 CFR***, Parts 90 and 95L.
- USDOT Security Credential Management System (***SCMS***).
- Communications requirements for Internet Protocol version 6 (***IPv6***).

Consider the following for the RSU device placement:

- Co-location of devices with new or existing ITS or signal infrastructure.
- Availability of inside cabinet space for RSU-associated equipment.
- Antenna placement location.
- Wireless coverage.

Provide the RSU locations to the State Traffic Engineering and Operations Office's ITS Communications division and the District ITS/TSM&O Engineer to file for FCC licenses for all DSRC RSUs. FCC licenses must be granted before a station transmits on any channel.

233.13 Maintenance of ITS Devices and Communications

Coordinate with District ITS/TSM&O Engineer to determine if maintenance of ITS devices and communications during a construction project is required. Considerations for uninterrupted ITS devices and communications include the following:

- Install new ITS communications network before removing the existing network.
- Use of temporary fiber that is placed outside the limits of construction.
- Use of temporary aerial fiber or wireless communications.
- Use of other public or private communications.
- Make every effort to maintain existing ITS devices and field equipment. If ITS device locations are impacted by planned construction, include temporary ITS devices.

The maintenance of ITS devices and communications plan must be approved by the District ITS/TSM&O Engineer.

240 Transportation Management Plan

240.1 General

A Transportation Management Plan (TMP) is required for minimizing activity-related traffic delay and crashes. The goal of a TMP is to reduce congestion during construction by managing traffic through the project area. For TMPs, significant projects are defined as:

(1) A project that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts.

(2) All Interstate system projects within the boundaries of a designated Transportation Management Area (TMA) that occupy a location for more than three days with either intermittent or continuous lane closures.

Significant projects may require a multi-discipline TMP team to plan, coordinate, implement, monitor, and evaluate the details of TMP elements. Depending on the project logistics, the team composition may include FHWA, local government, and business representatives.

Complete the Transportation Management Plan Form, ***Form 240*** (See ***FDM 103***). This form is required for all projects (significant or not) to document compliance with the ***CFR 23, Part 630, Subpart J***.

240.1.1 TMP Reference Documents

Comply with the following documents for the development of TMPs:

(1) ***Manual on Uniform Traffic Control Devices for Streets and Highways***, (***MUTCD***), ***Part VI***

(2) ***Policy on Geometric Design of Highways and Streets, AASHTO***

(3) ***Roadside Design Guide, AASHTO, Chapter 9***

(4) ***Standard Plans***, ***102 Series*** and ***711-002***

(5) ***FDOT Standard Specifications for Road and Bridge Construction*** (***Standard Specifications***)

(6) ***Basis of Estimates Manual***

(7) ***FDOT Accessing Transit Handbook, Chapter 4.6.***

(8) ***AASHTO Guide for the Development of Bicycle Facilities, 4th Edition, Chapter 7***

(9) ***Traffic Analysis Handbook***

240.1.2 TMP Components

A TMP consists of strategies to manage the work zone impacts of a project. The scope, content, and degree of detail will vary based upon the expected work zone impacts of the project. A TMP may include the following three components:

- Temporary Traffic Control Plan
- Transportation Operations Plan
- Public Information Plan

240.2 Temporary Traffic Control Plan

A Temporary Traffic Control Plan (TTCP) is required for all work zones within, or adjacent to highways, roads and streets as specified by Florida Statute and Federal regulations. Typical applications of some commonly encountered situations are shown in the MUTCD. Some of these typical applications have been modified by the ***Standard Plans*, *102 Series***. Most work zones will require further development of the typical applications to address project-specific conditions.

240.2.1 TTCP Details

240.2.1.1 Emergency Shoulder Use

The requirements for Emergency Shoulder Use (ESU) outlined in ***FDM 211.4.6*** must be maintained during all phases of construction. A Design Variation to omit ESU evacuation requirements for any phase of construction must be approved by the Chief Engineer.

240.2.1.2 Work Zone Speed

Work zone speed is used with the ***Standard Plans*, *102 Series***, and to select geometric elements within the project limits.

Work zone speed should be the existing posted speed. The existing posted speed is defined as the posted speed prior to the start of any work zone activity. A reduction from the existing posted speed should only be made when geometric constraints make it necessary or when implementing the Motorist Awareness System (MAS) in accordance with ***FDM 240.2.2.12*** and ***Standard Plans*, *102 Series***. Include the justification for reduction in existing posted speed in the project documentation (see ***FDM 111.7***). The TTCP and the project documentation will suffice as a traffic and engineering investigation.

A work zone speed more than 10 mph below the existing posted speed requires the approval of the District Traffic Operations Engineer, and the District Director of Transportation Operations.

A work zone speed below the minimum statutory speed for the class of facility is prohibited.

For projects with interspaced work activities (such as interstate resurfacing), locate speed reductions in proximity to those activities which merit a reduced speed, and not “blanketed” for the entire project.

240.2.1.3 Tapers

Transitions and tapers should be obvious to drivers. If sight distance is restricted (e.g., a sharp vertical or horizontal curve), the taper should begin well in advance of the view obstruction.

Temporary T~~t~~raffic C~~c~~ontrol (TTC) devices at intersections must provide sight distances for the road user to perceive potential conflicts and to traverse the intersection safely.

See the ***Standard Plans*, *102 Series*** for taper length requirements.

See ***FDM 210*** for required sight distance using the work zone speed.

240.2.1.4 Superelevation

The minimum radii where superelevation is not necessary are provided in ***Table 240.2.1.***

When superelevation is provided, specify the superelevation in accordance with ***FDM 210***.

Table 240.2.1 Minimum Radii for Normal 0.02 Cross Slopes

Minimum Radii for Normal Cross Slopes (Feet)									
Work Zone Speed (mph)									
25	30	35	40	45	50	55	60	65	70
290	430	610	820	1080	1390	1840	2400	3130	4090

For Turnpike Projects, use superelevation criteria described in ***FDM 210*** and ***211***.

240.2.1.5 Lane Widths

See ***Standard Plans, 102 Series*** for lane width requirements.

240.2.1.6 Lane Closure Analysis

Lane closure analysis is a process used to calculate the peak hour traffic volume and the restricted capacity for open road and signalized intersections. The analysis will determine if a lane closure should be allowed and the times during which a lane closure can occur without causing excessive travel delay.

Common uses for lane closures include:

- Reconstruction, rehabilitation, or resurfacing of travel lanes or shoulders
- Provide lateral offset to the work area
- Staging of construction equipment
- Bicycle and pedestrian accommodations

Many roadways have directional peak hour traffic volumes, with inbound morning traffic, and outbound afternoon traffic. A composite lane closure analysis would, in many cases, require night work or create very short allowable lane closure periods. If a lane closure analysis is calculated for inbound and outbound separately, night work may be avoided and longer lane closure periods may be allowed.

On limited access facilities, include a traffic analysis of any ramp affected by the lane closure.

When a closure of one or more lanes is necessary, provide an allowable lane closure duration of at least one ten-hour period per 24-hour work period. Approval by the State Roadway Design Engineer is required when at least one ten-hour-period per 24-hour work period cannot be provided.

A lane closure duration of more than one calendar day on limited access facilities is prohibited. If a lane closure duration of more than one calendar day on limited access facilities is unavoidable, obtain approval from the District Secretary or Turnpike Executive Director.

See ***FDM 241*** for the lane closure analysis process and worksheet example.

240.2.1.7 Traffic Pacing

Traffic pacing is a temporary traffic control technique that allows short duration work operations by pacing traffic at a slow speed upstream of the work zone. The Department frequently allows this technique for:

- Installing overhead sign structures
- Replacing sign panels
- Placing bridge beams
- Installing utility crossings

See the ***Standard Plans*** for additional traffic pacing information.

Specify traffic pacing restrictions for all multilane roadways with a work zone speed of 50 mph or greater. See ***FDM 242*** for the procedure for calculating the traffic pacing restrictions.

Obtain District Traffic Operations Engineer approval prior to adding traffic pacing into the TTCP.

For limited access roadways, include a contingency plan in the event that the construction activities last longer than the allowable pacing timeframe. This plan must note that it will only be used at the direction of the Construction Project Manager.

240.2.1.8 Detours, Diversions, and Lane Shifts

Detour: A redirection of motorized and non-motorized traffic onto an alternate route, using state roads or local (county or city) roads, to bypass the work zone.

Diversion: A redirection of motorized and non-motorized traffic onto temporary pavement adjacent to the existing or permanent roadway.

Lane Shift: The redirection of motorized and non-motorized traffic onto a different section of the permanent roadway or shoulder.

Design detours, diversions, and lane shifts in accordance with ***FDM 240.2.1.9*** and the following:

- Maintain existing shoulder width where practicable, but no less than:
  - 2 feet for limited access roadways or roadways with existing paved shoulders less than 4 feet, or
  - 4 feet (i.e., maintain bicycle facility) for all other roadways.
- For offsets to barriers and special considerations (e.g., refuge areas or emergency vehicle access), see ***FDM 215***.
- Special detours from a divided highway to an undivided condition must separate opposing traffic using either temporary barrier or temporary lane separators in accordance with the ***Standard Plans***. The use of striping, RPMs, and complementary signing, either alone or in combination is not considered acceptable for separation purposes.
- Minimize interruption of local transit operations and coordinate with emergency services.
- For diversions on high-speed multilane facilities, place cross-slope break overs on lane lines except when the lane is actively transitioning.
- Meet the requirements in ***FDM 211*** for lane cross slopes on limited access facilities.
- Pavement drop offs must be no more than 2 inches away from a lane line.
- Check spread to verify that the provided shoulder width complies with the criteria in ***Chapter 3.9.1*** of the ***FDOT Drainage Manual***.

Ramps that service tandem trucks must entirely accommodate the WB-109D truck turning radius within the longitudinal pavement markings of each lane.

In addition to the requirements above, design detours in accordance with the following:

- Detour signing must convey clear direction allowing users to safely traverse the entire detour and return to the original path of travel.
- When developing a detour, consider the type of motorized traffic being routed (e.g., vertical clearance for large vehicles). Do not route large vehicles through a U-turn.

- Consider the structural capacity of the detour pavement.
- Obtain concurrence from the local agency when detours are to utilize local roadways.
- Include truck turning templates and AutoTurn Analysis in the TTCP design documentation.

240.2.1.9 Bicycle, Pedestrian, and Transit Accommodation

Include accommodations for the following road users of all ages and abilities in the TTCP:

- Pedestrians
- Bicyclists
- Transit users

Provide accommodations on Florida National Scenic Trail and SUN Trail.

ADA requirements apply during TTC. Include provisions ~~for the disabled~~ at the same level of accessibility as the existing facility or greater. See ***Standard Specifications*, *Section 102*** and ***FDM 222, 225*** for more information.

Minimize impacts to existing bicycle, pedestrian, and transit facilities by preserving the following to the extent feasible:

- Safety and accessibility features
- Connectivity of the facilities to and through the project
- Directness of the routes

Incorporate the following requirements into the TTCP:

Design Principles for Temporary Bicycle and Pedestrian Facilities:

(1) Provide like-for-like bicycle and pedestrian facilities to the maximum extent feasible~~possible~~. When this cannot be accomplished for bicycle facilities, separate motorized traffic from bicycle traffic whenever possible. The higher the volumes of motorized traffic or percentage of truck traffic and the longer the duration of construction, the more substantial the separation should be.

Specify temporary bicycle ways that replicate the geometric characteristics of the existing bicycle way. For example, a separated bicycle facility should remain separated during construction. See ***FDM 223*** for more information on separated bicycle facilities.

(2) Phase the construction plans to ensure bicycle and pedestrian facilities are only closed when necessary. Phasing has the following advantages:

- Restricts bicycle and pedestrian network disruption to smaller segments of the project at a time
- Limits the number and use of TTC devices on a project to those areas where the bicycle and pedestrian network is currently being disrupted

See ***FDM 921*** for more information on phasing.

~~(2)~~(3) See ***Standard Plans, Series 102*** for additional information and requirements on pedestrian facilities in work zones.

~~(3)~~(4) Provide temporary barrier per ***FDM 215*** where temporary pedestrian ways divert pedestrian traffic to be immediately adjacent to vehicular traffic (e.g., a paved shoulder) or when a separated bike lane has been moved. This does not apply to temporary pedestrian ways behind curb.

~~(4)~~(5) Ensure work zones adjacent to sidewalks or temporary pedestrian ways provide separation between pedestrians and the work area.

Location of Temporary Routes for Pedestrians and Bicyclists:

(1) Do not lead pedestrians or bicyclists into direct conflicts with vehicles, equipment, or operations.

(2) Keep detour lengths and diversions as short as practicable.

(a) Detours should not create more than a 30% increase in the length of the non-motorized facility, or not longer than 0.5 miles for bicyclists or 0.25 miles for pedestrians.

(b) To minimize the detour length, consider providing a temporary mid-block crosswalk instead of detouring pedestrians to the nearest signalized intersection or existing crosswalk.

(3) The order of preference for routing:

(a) Maintain facility on the same side of the road.

i. Narrow the temporary bicycle way or temporary pedestrian way if needed.

ii. Consider closing one lane of motorized traffic to accommodate non-motorized traffic of bicycle or pedestrian facilities with high usership.

Separate motorized traffic from pedestrians by providing a temporary barrier where feasible per ***FDM 215,*** or by providing LCDs to delineate the temporary pedestrian path.

iii. If the existing bicycle facility is a shared use path or separated bike lane and separation for bicyclists, such as a temporary bike lane, is not possible, then bicyclists may be directed onto a temporary or permanent pedestrian way of a min. width of 8 feet.

iv. When the existing bike facility is a bicycle lane, marked shoulder, or paved outside shoulder 4' or greater in width, and the work zone speed is 35 mph or less, then bicyclists may be directed onto the travel lane. Provide portable changeable message signs (PCMS) letting motorists know bicyclists will be detoured onto the road, per ***FDM 243***. For example:

- Bike Facility Closed, Bicycles on Road
- Bike Detour Ahead, Bicycles on Road

(b) Diversion to the opposite side of the road. Return to original side of road as soon as possible. For two-lane two-way work within the traveled way, additional bicycle accommodations are not necessary. Standard flagging procedures allow bicyclists to use the opposite shoulder.

i. Phase the construction so bicycle or pedestrian facilities will be open on the other side of the road if facilities cannot be provided on the same side of the road.

ii. Choose crossing points with adequate stopping sight distance.

iii. If using temporary midblock crossings, meet the criteria in the ***TEM*** for permanent midblock crosswalks. Consider the use of temporary traffic signals or RRFBs with temporary midblock crossings. See ***FDM 240.2.2.8*** and the ***TEM*** for more information.

iv. Warn motorized and non-motorized traffic there are extra pedestrian or bicycle crossings through portable changeable message signs (PCMS) per ***FDM 243***. For example:

- Bike Detour Ahead, Ped Detour Ahead
- Use Caution, People Crossing Ahead
- Use Caution, Bicycle Crossing Ahead
- Use Caution, Ped Bike Crossing Ahead
- Use Caution, New Xwalks Ahead

- Use Caution, New Cross Walks
- Use Caution, New Xwalks 500 Ft

v. Facilitate left turns for bicyclists. Consider whether accommodations can be made for two-stage left turns where appropriate.

(c) Detour to another road. Return to original road and side of road as soon as possible.

i. Coordinate with the owner of the facility pedestrians or bicyclists will be detoured onto.

ii. Notify motorists on the detoured road through portable changeable message signs (PCMS) per ***FDM 243*** if there are additional crossings or if bicyclists will be detoured to a shared lane condition. Motorists may not be aware of the construction project that has caused the need for re-routing. For example:

- Bike Facility Closed, Bicycles on Road
- Bike Detour Ahead, Bicycles on Road
- Use Caution, People Crossing Ahead
- Use Caution, Bicycle Crossing Ahead
- Use Caution, Ped Bike Crossing Ahead
- Use Caution, New Ped Xing Ahead
- Use Caution, New Cross Walks
- Use Caution, New Xwalks 500 Ft

(d) Where the above options are not feasible or are cost prohibitive, consider the use of a vehicle transport service. Show accessible pickup and drop off locations in the TTCP. Coordinate with District Design Engineer and District Construction Engineer.

Transit Users:

Ensure provision is made to allow transit users to access transit stops, and to board and depart transit vehicles safely. Temporary transit access must include provisions ~~for the disabled~~ at the same level of accessibility as the existing facility or greater. See FDOT's ***Accessing Transit Handbook*** for guidance on transit stops.

240.2.1.10 Railroads

Ensure that the TTCP does not cause queuing of traffic across railroad tracks. Evaluate the signal timing, tapers, lane closures and distance to intersections as compared to projected peak traffic volumes. Evaluate the effects of the TTCP on interconnected traffic signals and railroad signals to avoid conflicting or ineffective signal controls.

240.2.1.11 Utilities

If contract utility work is anticipated in conjunction with or during the highway construction, the TTCP must account for and adequately protect all work activities. The phasing of construction activities must be compatible with the utility work. Utilities, whose work affects traffic, are required by FHWA to provide a TTCP. This requires early and effective coordination with utilities.

240.2.1.12 Existing Traffic Signals

Adjust signal heads to maintain proper position when lane shifts are necessary and determine the need for temporary vehicle detection. Coordinate required modifications to existing traffic signal operations with the District Traffic Operations Engineer and show signal adjustments in the TTCP.

Provide signal installation plans that specify the preliminary phasing and timing for each phase of construction in the TTCP. Include project specific requirements (e.g., equipment harmonization or operational responsibilities), in the Technical Special Provisions. Signal displays and location must meet ***MUTCD*** requirements.

240.2.1.13 Roadside Hazards

See ***FDM 215*** and ***Standard Plans, 102 Series*** for information on the shielding of roadside hazards.

240.2.1.14 Drop-offs in Work Zones

See ***Standard Plans, 102 Series*** for requirements related to drop-offs in work zones.

240.2.1.15 Bridge Construction

To facilitate the development of an optimal design minimizing traffic disruption and construction costs, the roadway engineer and structures engineer must collaborate with each other prior to completion of Phase I roadway plans or the Bridge Development Report (BDR), whichever is earlier. For very complex urban projects, this collaboration should begin as early as the PD&E phase of the project.

Modification for Non-Conventional Projects:
Delete ***FDM 240.2.1.15*** and replace with the following: **240.2.1.15 Bridge Construction** To facilitate the development of an optimal design minimizing traffic disruption and construction costs, collaboration between the roadway engineer and structures engineer is required.

240.2.1.16 Emergency Pull Off Area

For long-term TTC operations on Limited Access roadways, include a paved emergency pull off area when the shoulder width is reduced to less than eight feet for a distance of one mile or more. The preferred location is to the right of the outside travel lane. Coordinate these locations with the District Traffic Operations Engineer to accommodate road users and emergency personnel.

The emergency pull off area must meet the following:

- Minimum of twelve feet wide and 500 feet long
- Located every ½ to 1 mile, but not closer than ½ mile from an interchange
- Maintain the adjacent lane or paved shoulder cross slope
- Include chevron pavement markings at 60-foot spacing
- Do not locate an emergency pull off area near an ingress/egress location for the contractor.

240.2.2 Temporary Traffic Control Devices

The ***MUTCD*** contains detailed instructions on the use of traffic control devices. Special design considerations applicable to Florida are discussed in the following sections.

Temporary traffic control devices should not be placed in locations where they will block or interfere with transit stops, pedestrians, or bicycle traffic.

240.2.2.1 Signs

The following types of signs are encountered in temporary traffic control:

- Work Zone Signs
- Existing Signs

Work Zone Signs:

Work zone signs are typically post mounted in accordance with ***Standard Plans***, ***102 Series***.

Signing for the control of traffic entering and leaving work zones by way of intersecting roadways must be adequate to inform drivers, cyclists, and pedestrians of work zone conditions. At a minimum, provide a "Road Work Ahead" sign.

If the work zone interrupts the continuity of an existing bicycle or pedestrian way, then provide signs directing non-motorists alongside or around the work zone and back to the bicycle or pedestrian way.

See the ***Standard Plans***, *102 Series* for required work zone signs and placement.

Existing Signs:

Specify covering, removing, or relocating existing regulatory or warning signs that conflict with the TTCP, or to complement the work zone conditions (e.g., if a stop sign on an existing side road is needed, use the existing sign and show the location that it is to be relocated to).

Modify existing guide signs to show changes made necessary by the construction operations. If existing guide signs are to be removed during construction, make provisions for temporary guide signing. The temporary sign should be black on orange with the legend designed in accordance with ***MUTCD*** requirements for permanent guide signing.

240.2.2.2 Work Zone Pavement Markings

Specify the use of work zone pavement markings in accordance with ***FDM 230*** and ***Standard Specifications, Section 102***.

240.2.2.3 Temporary Raised Pavement Markers

Temporary Raised Pavement Markers (RPMs) are used to supplement work zone pavement markings in accordance with ***Standard Plans, 102 Series*** and ***Standard Specifications, Section 102***.

240.2.2.4 Channelizing Devices

Channelizing devices direct road users through the work zone. Specify the use of channelizing devices in accordance with the ***Standard Plans, 102 Series*** and ***Standard Specifications, Section 102***.

240.2.2.5 Pedestrian Longitudinal Channelizing Devices

Specify the use of pedestrian Longitudinal Channelizing Devices (LCDs) for the following situations:

- At each closed pedestrian way location, for the full width of the pedestrian way
- In locations where a drop-off hazard exists (see ***Standard Plans, 102 Series***)
- In locations where the active work zone is within 2 feet of the sidewalk or pedestrian walkway
- Along both sides of a temporary pedestrian way
    - Pedestrian LCDs are not required on sides where an existing or temporary barrier delineates the temporary pedestrian way.

240.2.2.6 Arrow Boards

Specify the use of arrow boards to supplement other devices for lane closures on multilane roadways. Refer to the ***MUTCD*** for further information.

240.2.2.7 Portable Changeable Message Signs

Specify the use of Portable Changeable Message Signs (PCMS) as a supplemental device to provide road users with the following information:

(1) Construction schedules

(2) Alternate routes

(3) Expected delays

(4) Detours, diversions, and lane shifts

A PCMS is not to be used to replace any required sign or other device. See ***FDM 243*** for requirements in determining the appropriate uses and messages for the PCMS.

240.2.2.8 Temporary Traffic Signals

Design and detail temporary poles and span wire assemblies for temporary traffic signals using the following criteria:

(1) Design temporary signal supports for a~~n~~ ~~80~~100-mph wind speed. See ***Structures Manual, Volume 3*** for additional requirements.

(2) See Lateral Offset Criteria in ***FDM 215*** for placement of temporary traffic signal supports.

Provide sufficient signal timing for pedestrians where a pedestrian crossing is present.

Include temporary traffic signals in the TTCP in accordance with ***FDM 240.2.1.12***.

240.2.2.9 Type III Barricades

Specify the use of type III barricades to close or partially close a roadway or ramp. Two barricades are typically used for a 12-foot-wide lane. One barricade should be used for lanes less than 12 feet in width.

240.2.2.10 Temporary Barrier

See ***Standard Plans*, 102 Series** and ***FDM 215*** for temporary barrier requirements.

240.2.2.11 Law Enforcement Officers

Law enforcement officers are used to heighten the awareness of passing vehicular traffic and to improve safety through the work zone. The following types of law enforcement officer are used in temporary traffic control:

- Speed and Law Enforcement Officer
- Traffic Control Officer

Speed and Law Enforcement Officer:

Speed and law enforcement officers are used to control the speed of motorists in the work zone. Speed and law enforcement officers should be considered for the following work zone conditions:

(1) Speed reductions

(2) Temporary barrier adjacent to through traffic

(3) Nighttime work

(4) Workers exposed to high-speed traffic

For limited access facilities, coordinate with District Construction when encountering the above criteria. Speed and law enforcement officer use on arterials and collectors requires approval from the District Director of Transportation Operations.

Traffic Control Officer:

Traffic control officers are used to increase the visibility of the work zone or work operation. Uniformed law enforcement officers are respected by motorists, cyclists, and pedestrians. Utilize traffic control officers as a supplement to traffic control devices to assist in traffic movements and provide a safer work zone.

Specify the use of traffic control officers in accordance with ***Standard Specifications*, Section 102**.

240.2.2.12 Motorist Awareness System

A Motorist Awareness System (MAS) is used to alert motorists to the presence of an active work zone and to emphasize reduced speed limits. A MAS consists of the following devices:

- Portable Regulatory Sign
- Radar Speed Display Unit

Specify the use of a MAS in accordance with ***Standard Plans* 102-613.**

For a posted speed of 65 mph or greater, reduce the work zone speed by 10 mph. For a posted speed of 60 mph, use a work zone speed of 55 mph.

Portable Regulatory Sign:

A Portable Regulatory Sign (PRS) is used to highlight the work zone speed. A portable regulatory sign consists of a speed limit sign with flashing lights mounted on a portable trailer. The flashing lights are intended to draw attention to the speed limit sign.

Radar Speed Display Unit:

A Radar Speed Display Unit (RSDU) is used to display a motorist's current speed. A radar mounted on the unit detects the speed and relays it to a LED display panel adjacent to a static speed limit sign.

240.2.2.13 Temporary Raised Rumble Strips

Temporary raised rumble strips are used to warn vehicular traffic of the upcoming work zone. Specify the use of temporary raised rumble strips when both of the following conditions occur:

- Lane closure on a two-lane, two-way roadway
- Existing posted speed prior to construction is 55 mph or greater

240.2.2.14 Temporary Lane Separator

Temporary lane separator should be used to separate opposing traffic on previously divided roadways with a work zone speed of 45 mph or less.

See ***Standard Plans*, 102 Series** for temporary lane separator details.

240.2.2.15 Temporary Highway Lighting

When practical, existing highway lighting is to remain in service during all phases of construction or until new lighting is installed and placed in service. Temporary highway lighting is not required where it is necessary to remove existing lighting before new lighting is placed in service.

Use temporary highway lighting at the District's discretion. For example, Districts may determine that temporary highway lighting is warranted for areas such as interchanges or other large roadways with complex vehicle movements. When temporary highway lighting is used, provide plans content per ***FDM 943*** and comply with the following:

(1) Meet the lighting criteria in ***Table 231.2.1,*** except that the illumination levels may be lowered to a range of 0.8 to 1.0 foot-candles at the District's discretion. Leeway may be given for lighting values given the temporary nature.

(2) Position lights as high as practical, with consideration for avoiding glare.

(3) Meet minimum lateral offset criteria in ***Table 215.2.2***.

(4) Utilize structural supports that are crashworthy or shielded by a crashworthy barrier that was installed for other purposes.

(5) Utilize structural supports that are attached to and located behind permanent or temporary concrete barriers (or traffic railings) as follows:

   (a) Do not install temporary barrier for the sole purpose of supporting or protecting the temporary lighting system.

   (b) Do not locate structural supports for temporary lighting on the back side of permanent or temporary barriers/traffic railings~~; i.e., which face away from traffic, where~~ if the back side of the barriers/traffic railings are within the work zone clear zone (per ***Standard Plans*, 102 Series**) of other traffic lanes.

   (c) Attach structural supports to the back face of temporary and permanent barriers/traffic railings using brackets that do not protrude above the top of the barrier/traffic railing.

   (d) Use undercut anchor or screw anchor systems ~~designed in accordance with *Structures Design Guidelines* Section 1.6 to~~ for attaching brackets to barriers/traffic railings. Use stainless steel or mechanically galvanized carbon steel anchors. Position anchors ~~so~~ as to avoid the reinforcing steel within the barrier/traffic railing.

(e) Design the luminaire pole, support brackets, and anchors for a~~n~~ ~~80~~100-mph wind speed.

(f) Do not design luminaire pole, support brackets and anchors for vehicular impact loads.

(g) For structural supports attached to and located behind permanent concrete barriers/traffic railings, provide a minimum setback distance from the top edge of the traffic face of the barrier/traffic railing to the traffic face of the luminaire pole in accordance with ***FDM 215***.

(h) For structural supports attached to and located behind ***Standard Plans, 102 Series*** (Type K Temporary Concrete Barriers), provide a minimum setback distance of 1'-6" from the top edge of the traffic face of the barrier to the traffic face of the luminaire pole~~, mounted behind the barrier~~. To minimize the potential for damaging reinforcing steel during the installation of the anchors, attach brackets within the middle portion, where there is large spacing between the vertical steel reinforcing bars, of the Type K Barrier Unit.

(i) Temporary lighting must only be attached to a continuously anchored Type K Temporary Concrete Barrier System.

(j) The supports attached to Type K Temporary Concrete Barrier must not encroach into the required deflection distance when the barrier is ~~protecting~~ shielding an above ground hazard.

(6) For temporary highway lighting near a wildlife area of concern (as determined by the Environmental Management Office), comply with the Wildlife-Sensitive Lighting criteria in ***FDM 231***.

240.2.2.16 Overhead Bridge Related Construction Activities

There are several overhead work activities that must be executed without traffic below. ***Table 240.2.2*** provides typical work durations for common overhead bridge related work activities. The work activity durations given in the table assume a best-case scenario in which the Contractor has optimized resources and work planning in advance to minimize traffic disruption.

Table 240.2.2 Typical Durations for Overhead Bridge Work

Work Activity	Duration
Bridge Demolition	2 to 3 days per span
Beam Placement Simple Span	30 minutes per beam
Beam Placement Continuous Steel I-Beam	60 minutes per beam
Beam Placement Continuous Steel Box Girder	90 minutes per girder, depending on the complexity of the connections
Form Placement	4 hours per lane
Deck Concrete Placement	3 hours per span
Span Sign Structure Placement	20 to 25 minutes per structure
Segment Placement from Land Based Cranes (Balanced Cantilever)	2.5 hours per segment

240.2.2.17 Temporary Structures

The use of temporary structures is often required to allow for the installation of the permanent structure. Temporary structures commonly used for the construction of highway structures include temporary stability towers and temporary sheet pile walls.

Temporary stability towers are commonly used for the erection of segmental bridges constructed in balanced cantilever, steel plate girders, and steel box girders. Temporary sheet pile walls are commonly used for the construction of pier footings or to facilitate the installation of MSE wall straps. It is important to show the location of all temporary structures in each phase of the TTCP to assure there are no conflicts. See ***FDM 215*** to determine if temporary structures must be shielded.

240.2.2.18 Temporary ACROW Bridge

When using a temporary ACROW bridge, include "Legal Weight Only" sign in accordance with ***Standard Plans*, *Index 700-102*** and ***Index 700-107***. Specify "Slippery When Wet" (W8-5) signs in advance of all temporary ACROW bridges when an asphalt overlay is not used. See ***Standard Plans*, *102 Series*** and the associated ***Standard Plans Instructions*** (***SPI 102-200 for the 300 Series and 102-201 for the 700 Series***) for more information.

For limited access facilities, the ACROW Series 700 bridging must be used. All temporary bridges require a project-specific foundation design.

Coordinate with the State Maintenance Office in a timely fashion because there is a limited quantity of Department-owned temporary ACROW bridges available.

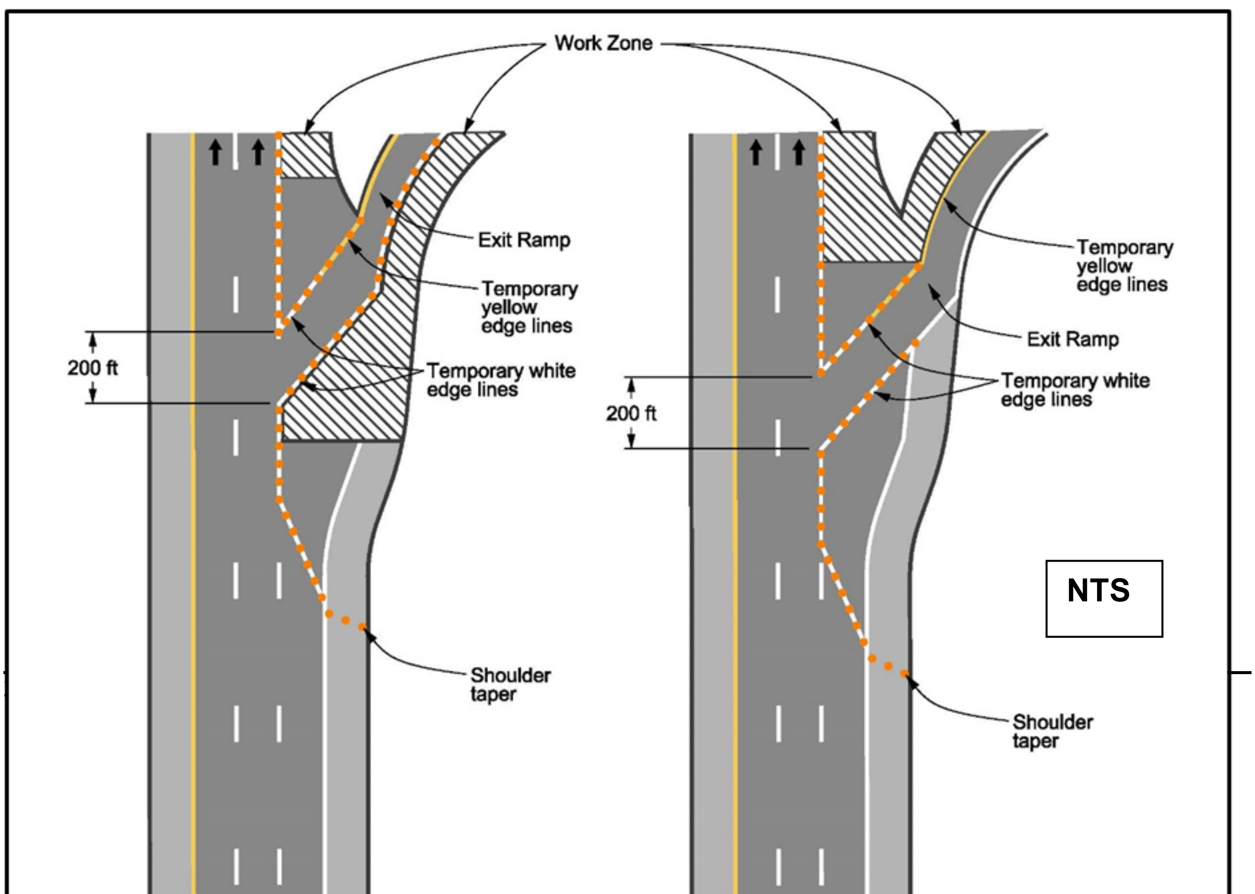
240.2.2.19 Short-Term Raised Rumble Strip Sets

In locations with existing raised rumble strip sets (e.g., intersections, approaches to horizontal curves, toll plazas), maintain or replace the raised rumble strip sets throughout construction. Provide short-term raised rumble strip sets when existing raised rumble strip sets are removed for construction activities, until the permanent raised rumble strip sets are installed. Short-term raised rumble strip sets must be installed prior to opening the road to traffic; therefore, quantities may include multiple applications due to construction phasing. Refer to ***Standard Plans***, ***Index 546-001*** and ***Standard Specifications***, ***Section 546*** for additional requirements and information.

240.2.2.20 Limited Access Exit Ramp Opening

Meet the requirements of the ***MUTCD***, ***Part 6*** for work near a limited access facility exit ramp and include a minimum ramp opening of 200 feet. See ***Figure 240.2.1***.

Figure 240.2.1 Work in the Vicinity of an Exit Ramp



240.2.2.21 Temporary Drainage

Refer to the ***FDOT*** ***Drainage Manual*** for temporary drainage criteria. Additional guidance can be found in the ***Drainage Design Guide***.

240.3 Transportation Operations Plan

The Transportation Operations Plan (TOP) contains strategies to improve mobility, work zone access, and safety. Strategies will include items such as work zone Intelligent Transportation System (ITS) components and incident management. ***Table 240.3.1*** provides common TOP items.

A TOP should be considered for significant projects, as defined in ***FDM 240.1***.

Table 240.3.1 Transportation Operations Strategies

Category			
Demand Management	**Corridor/Network Management**	**Work Zone Traffic Management**	**Safety Management and Enforcement**
Transit services improvements	Signal timing/ coordination improvements	Speed limits reduction or variable speed limits	ITS for traffic monitoring and management
Transit incentives	Temp. traffic signals	Temp. traffic signal	Transportation Management Center (TMC)
Shuttle services	Intersection improvements	Temp. barrier	Aerial surveillance
Ridesharing/ carpooling incentives	Bus turnouts	Crash Cushions	Milepost markers
Park-and-Ride promotion	Turn restrictions	Automated flagger assistance devices (AFAD)	Service patrol
HOV lanes	Truck restrictions	On-site safety training	Local detour routes
Variable work hours	Dynamic lane close system	TMP inspection team meetings	Contract support for incident management
Telecommuting	Ramp closures		Incident/emergency response plan
	Railroad crossing controls		Law enforcement
			Emergency Access, Emergency Pull Off Areas, Glare Screens

240.4 Public Information Plan

The Public Information Plan (PIP) describes how project information will be communicated to affected parties, traveling public, and project stakeholders prior to and during construction. The PIP will also describe the most efficient method of communicating this information (e.g., local media, business groups, message signs). The PIP should be integrated into the project's Community Awareness Plan (CAP) when the CAP is to include communication strategies.

A PIP should be considered for significant projects, as defined in ***FDM 240.1***.

See the following for additional information on public involvement and CAP requirements:

(1) ***FDM 104***

(2) ***Public Involvement Handbook***

(3) ***PD&E Manual***

240.5 Temporary Traffic Control Training

The Department has prescribed temporary traffic control training requirements outlined in the ***Temporary Traffic Control (Maintenance of Traffic) Training Handbook***.

241 Lane Closure Analysis

241.1 General

See ***FDM 240*** for requirements and criteria concerning lane closures.

241.2 Lane Closure Excel Program

An Excel file is available to assist in the preparation of the Lane Closure Worksheet. The program can be found at the Department's TTC Resources web page: ***TTC Resource Download Library***. The Excel worksheet is based on the methods presented in this chapter; Districts may require alternate methods.

The Excel worksheet also illustrates two examples: a widening project and a resurfacing project.

241.3 Lane Closure Symbols and Definitions

The following symbols and definitions provide detail and guidance on the variables to be entered into the Input Data Sheets. The number provided in the circle corresponds to the circled number found on the Lane Closure Worksheet in ***FDM 241.5***.

1 ATC — Actual Traffic Counts. Use current traffic counts. Traffic counts can be obtained from the Office of Planning, or you may need to get traffic counts done. The designer needs hourly traffic volumes with a total traffic volume for a 24-hour period (see ***Figure 241.7.1***).

2 P/D — Peak Traffic to Daily Traffic Ratio. Highest hourly volume divided by the total 24-hour volume. Convert the percentage to a decimal on the Lane Closure Worksheet (see ***Figure 241.7.1***).

3 D — Directional Distribution of peak hour traffic on multilane roads. This factor does not apply to a two-lane roadway converted to two-way, one-lane. The directional distribution can be obtained from the Office of Planning.

4 PSCF — Peak Season Conversion Factor. Many counties in Florida have a significant variance in seasonal traffic. Use the PSCF for the week in which the actual traffic count was conducted. The ***Transportation Statistics Office*** has tables showing Peak Season Conversion Factors for every county in Florida. These tables are found in the ***Florida Traffic***

Online mapping application by selecting "Traffic Reports" from the toolbar on the right side of the screen.

5 RTF — Remaining Traffic Factor is the percentage of traffic that will not be diverted onto other facilities during a lane closure. Convert the percentage to a decimal on the Lane Closure Worksheet. This is an estimate that the designer must make on his own, or with help from the Office of Planning. Range: 0% for all traffic diverted to 100% for none diverted.

6 G/C — Ratio of Green to Cycle Time. This factor is to be applied when lane closure is through or within 600 ft. of a signalized intersection. The Office of Traffic Engineering has timing cycles for all traffic signals.

7 V — Peak Hour Traffic Volume. The designer calculates the peak hour traffic volume by multiplying the actual traffic count, times peak to daily traffic ratio, times directional factor, times peak seasonal factor, times remaining traffic factor. This calculation will give the designer the expected traffic volume of a roadway at the anticipated time of a lane closure.

8 C — Capacity of a 2L, 4L 6L, or 8L roadway with one lane closed, and the remaining lane(s) unrestricted by lateral obstructions. The capacity of a 4L, 6L, or 8L roadway is based on lane closure in only one direction.

9 RC — Restricting Capacity of the above facilities by site specific limitations detailed in the Temporary Traffic Control plans which apply to travel lane width, lateral clearance and the work zone factor. The work zone factor only applies to two lane roadways (see the tables in ***FDM 241.6*** to obtain the Obstruction Factor and Work Zone Factor).

10 OF — Obstruction Factor which reduces the capacity of the remaining travel lane(s) by restricting one or both of the following components: Travel lane width less than 12 ft. and lateral clearance less than 6 ft. (see Obstruction Factor Table in ***FDM 241.6***).

11 WZF — Work Zone Factor (WZF) is directly proportional to the work zone length (WZL). The capacity is reduced by restricting traffic movement to a single lane while opposing traffic queues. The WZF and WZL only apply to a two lane roadway converted to two way, one lane (see the Work Zone Factor Table in ***FDM 241.6***).

12 TLW — Travel Lane Width is used to determine the obstruction factor (see the Obstruction Factor Table in ***FDM 241.6***).

13 LC Lateral Clearance is the distance from the edge of the travel lane to the obstruction. The lateral clearance is used to determine the obstruction factor (see the Obstruction Factor Table in ***FDM 241.6***).

241.4 Lane Closure Worksheet Instructions

General Instructions are as follows:

(1) ***Lane Closure Symbols and Definitions*** (see ***FDM 241.3***) provide guidance on where to find the necessary information to fill out the lane closure worksheets.

(2) Fill out the top part of the lane closure worksheet and complete the formulas to calculate the hourly percentage of traffic at which a lane closure will be permitted.

(3) Transfer the calculated percentages to the graph on the ***Lane Closures 24 Hour Counts*** (see ***Figure 241.7.1***).

(4) Draw a line across the graph representing the percentage for both open road and signalized intersections (see ***Figure 241.7.1***).

(5) Plot the hourly percentages (hourly volume divided by total volume) on the graph. Any hourly percentage extending above the restricted capacity percentage lines for open road or signalized intersections indicates the potential for excessive delays.

(6) Lane closures should be prohibited during the time periods shown to have a potential for excessive delays.

241.5 Lane Closure Worksheet

DATE: ______________________________

FINANCIAL PROJECT ID:____________________ FEDERAL AID PROJECT NO.:____________

COUNTY:______________________________ DESIGNER:__________________________

NO. EXISTING LANES:____________________ LOCATION: ________________________

SCOPE OF WORK: ____

Calculate the peak hour traffic volume (V)

V=ATC__1__X P/D__2__X D__3__X PSCF__4__X RTF__5__ =__7__

Capacity (C) of an Existing 2-Lane – Converted to 2-Way, 1-Lane = 1400 VPH
Capacity (C) of an Existing 4-Lane – Converted to 1-Way, 1-Lane = 1800 VPH
Capacity (C) of an Existing 6-Lane – Converted to 1-Way, 2-Lane = 3600 VPH
Capacity (C) of an Existing 8-Lane – Converted to 1-Way, 3-Lane = 5400 VPH

Factors restricting Capacity:

TLW __12__ LC__13__ WZL__11__ G/C__6__

Calculate the Restricted Capacity (RC) at the Lane Closure Site by multiplying the appropriate 2L, 4L, 6L, or 8L Capacity (C) from the Table above by the Obstruction Factor (OF) and the Work Zone Factor (WZF). If the Lane Closure is through or within 600 ft. of a signalized intersection, multiply the RC by the G/C Ratio.

RC (Open Road) = C__8__X OF__10__X WZF__11__ =__9__

RC (Signalized) = RC (Open Road) __9__ X G/C __6__ = __9__

If V ≤ RC, there is no restriction on Lane Closure
If V > RC, calculate the hourly percentage of ADT at which Lane Closure will be permitted

$$\text{Open Road \%} = \frac{\text{RC (Open Road) } \underline{\ 9\ }}{(\text{ATC } \underline{\ 1\ } \text{ X D } \underline{\ 3\ } \text{ X PSCF } \underline{\ 4\ } \text{ X RTF } \underline{\ 5\ })} = \underline{\qquad}\ \%$$

Signalized % = Open Road % ______ X G/C __6__ = _____ %

Plot 24 hour traffic to determine when Lane Closure permitted. (See ***Figure 241.7.1***)

NOTE: For Existing 2-Lane Roadways, D = 1.00.

Work Zone Factor (WZF) applies only to 2-Lane Roadways.

For RTF < 1.00, briefly describe alternate route ______________________________________
____
____

241.6 Lane Closure Input Data

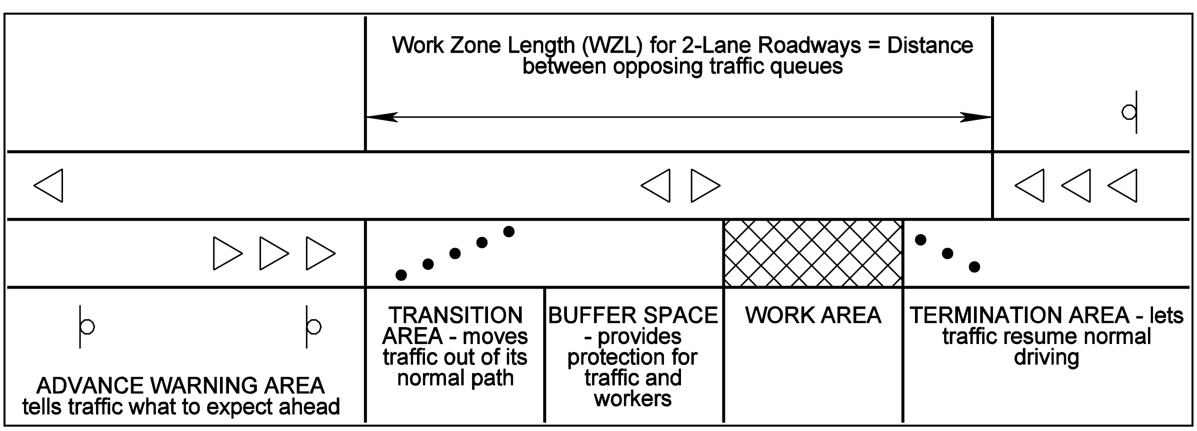
Table 241.6.1 Obstruction Factors (OF)

Lateral Clearance (LC) (feet)	Travel Lane Width (TLW) (feet)			
	12	11	10	9
6	1.00	0.96	0.90	0.80
4	0.98	0.94	0.87	0.77
2	0.94	0.90	0.83	0.72
0.0	0.86	0.82	0.75	0.65

Table 241.6.2 Work Zone Factors (WZF)

WZL (ft.)	WZF	WZL (ft.)	WZF	WZL (ft.)	WZF
200	0.99	2200	0.87	4200	0.78
400	0.97	2400	0.86	4400	0.77
600	0.96	2600	0.85	4600	0.77
800	0.95	2800	0.84	4800	0.76
1000	0.93	3000	0.83	5000	0.75
1200	0.92	3200	0.82	5200	0.75
1400	0.91	3400	0.81	5400	0.74
1600	0.90	3600	0.80	5600	0.73
1800	0.89	3800	0.80	5800	0.73
2000	0.88	4000	0.79	6000	0.72

Figure 241.6.1 Work Zone Length (WZL)



241.7 24-Hour Counts

Figure 241.7.1 24-HR Counts – Example

LANE CLOSURES

24 HOUR COUNTS

TIME	AM HOURLY VOLUME	ATC %		PM HOURLY VOLUME	ATC %
12 - 1	320	1.1		1920	6.4
1 - 2	180	0.6		1660	5.5
2 - 3	60	0.2		1620	5.4
3 - 4	50	0.2		2160	7.2
4 - 5	60	0.2		2380	7.9
5 - 6	260	0.9		2480	8.3
6 - 7	1050	3.5		1860	6.2
7 - 8	2270	7.6		1360	4.5
8 - 9	1820	6.1		1060	3.5
9 - 10	1740	5.8		850	2.8
10 - 11	1650	5.5		730	2.4
11 - 12	1920	6.4		540	1.8
			TOTAL	30,000	100

DATE

APR 19, 1998

DESIGNER

GIDDENS

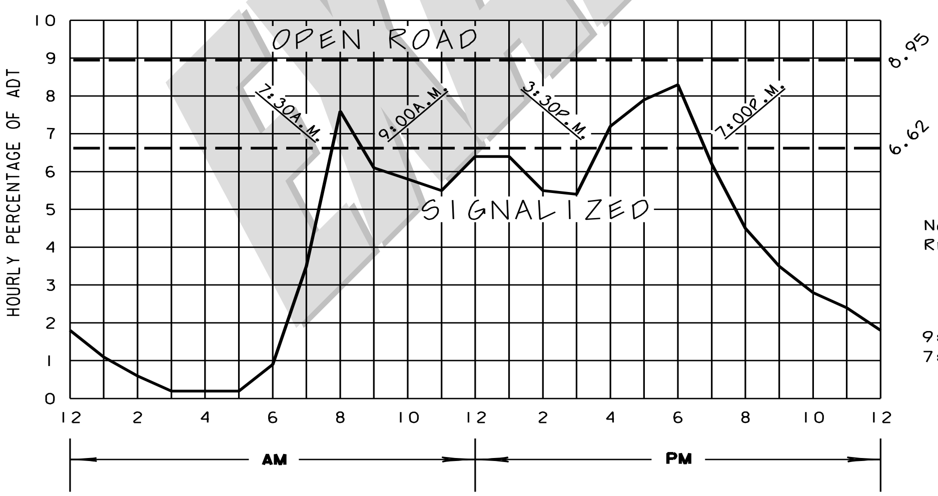
FINANCIAL PROJECT ID

123456-7-89-10

LOCATION

BUCK LAKE RD.

HOURLY VARIATION OF DAILY TRAFFIC



-CONCLUSION-

ROUND TO THE NEAREST 1/2 HOUR CONSERVATIVELY

OPEN ROAD LANE CLOSURE

NO RESTRICTION

SIGNALIZED LANE CLOSURE

9:00A.M. - 3:30P.M.
7:00P.M. - 7:30A.M.

242 Traffic Pacing Design

242.1 General

See ***FDM 240.2.1.7*** for traffic pacing requirements and criteria.

242.2 Traffic Pacing Excel Program

An Excel file is available to assist in the preparation of the Traffic Pacing Report. The program can be found at the Department's temporary traffic control resources web page: ***TTC Resource Download Library***. The Excel worksheet is based on the methods presented in this chapter; Districts may require alternate methods.

The Excel file also illustrates an example of a bridge beam replacement.

242.3 Traffic Pacing Symbols and Definitions

The following symbols and definitions provide detail and guidance on the variables to be entered into the Input Data Sheets.

AADT Annual Average Daily Traffic. In lieu of actual traffic counts, use AADT provided by the Office of Planning. Adjust the AADT to peak season hourly traffic by applying the model correction factor and the hourly distribution factors.

ATC Actual Traffic Counts. Traffic counts can be obtained from the Office of Planning or collected on the project site. The designer needs hourly traffic volumes for a 24-hour period.

C Capacity. The capacity of the roadway under free flow conditions in passenger cars per hour per lane

C = 2,400 pc/h/ln for 70 mph regulatory speed

C = 2,300 pc/h/ln for 65 mph regulatory speed

C = 2,250 pc/h/ln for 60 mph regulatory speed

C = 2,220 pc/h/ln for 55 mph regulatory speed

C = 2,150 pc/h/ln for 50 mph regulatory speed

FHV Heavy-vehicle adjustment factor. This factor is used to convert hourly traffic to equivalent passenger cars. Heavy vehicles include trucks, busses and recreational vehicles.

HDF Hourly Distribution Factors. Multiply the AADT by the HTD to obtain the traffic volume for a particular hour. The Office of Planning publishes hourly distribution factors for regions of the state.

HTD Hourly Traffic Demand in vehicles / hour. Hourly traffic volumes will be required for each hour in the analysis period. Hourly traffic volumes may be obtained from the Project Traffic Report, the Office of Planning or from field data collection. Use the most recent values available.

MOCF Model Correction Factor. The MOCF converts AADT to peak season traffic.

N Number of Lanes

Pc/h/ln Passenger cars per hour per lane. Pc/h/ln represents the traffic volume or capacity of one lane adjusted for heavy vehicles.

PSCF Peak Season Conversion Factor. The Office of Planning publishes tables with the PSCF for each county in Florida. Each county table has a PSCF for the week that the traffic counts were collected. The factor converts the ATC to Peak Season Traffic representing the highest daily traffic for the year.

P_t Percent Trucks (%).

242.4 Traffic Pacing Calculations Example

STEP 1: Calculate the hourly percentage of peak season traffic for each hour of the day (in pcphpl) and plot the 24-hour traffic percentages.

A. Calculate the Heavy Vehicle Adjustment Factor,

$$F_{HV} = 1 + \left(\frac{P_t}{100}\right) 0.5 = 1 + \left(\frac{6.71}{100}\right) 0.5 = 1.034$$

B. Using actual traffic counts calculate the hourly traffic demand (*Hour 1 shown*)

$$HTD_i = \frac{(ATC_i)(PSCF)(F_{HV})}{N}$$

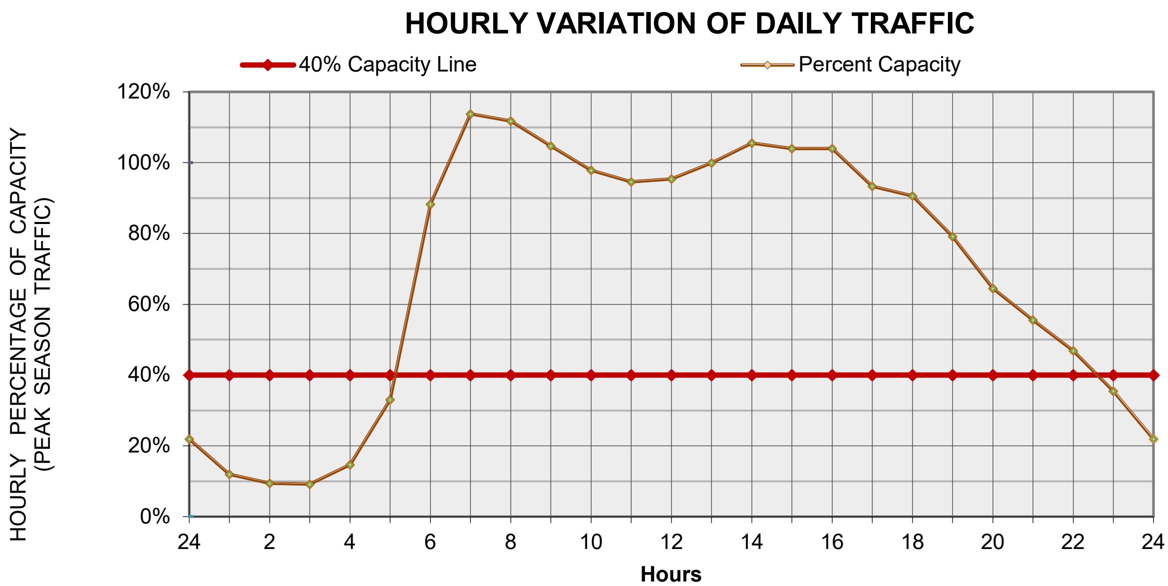
$$HTD_1 = \frac{(1406)(1.04)(1.034)}{3} = 504\, pcphpl$$

C. Calculate the percent capacity, $\%C = \frac{HTD_1}{C} \times 100$ where:

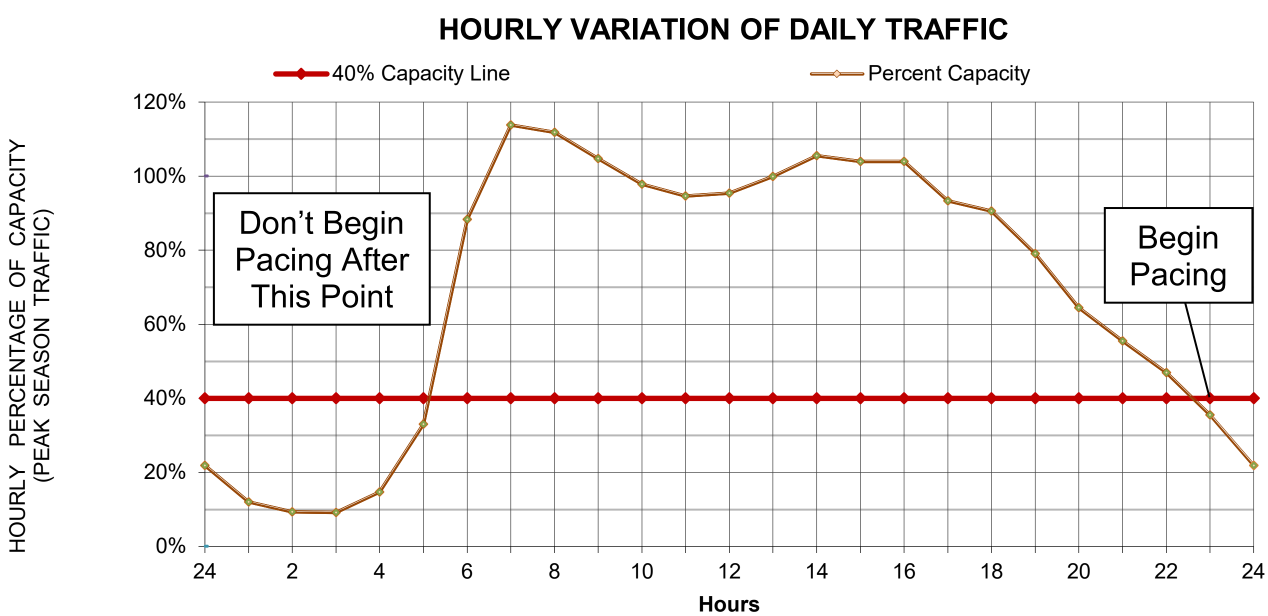
C = 2,300 pc/h/ln for 65 mph regulatory speed (*Hour 1 shown*)

$$\%C = \frac{HTD_1}{C} \times 100 = \frac{504}{2300} \times 100 = 21.9\%$$

Hour	AM Hourly Traffic Demand	Percent Capacity	Hour	PM Hourly Traffic Demand	Percent Capacity
24 - 1	504	21.90%	12-13	2193	95.40%
1 - 2	277	12.00%	13-14	2290	99.90%
2 - 3	215	9.40%	14-15	2427	105.50%
3 - 4	212	9.20%	15-16	2393	104.00%
4 - 5	338	14.70%	16-17	2368	104.00%
5 - 6	758	33.00%	17-18	2147	93.30%
6 - 7	2031	88.30%	18-19	2083	90.60%
7 - 8	2617	113.80%	19-20	1820	79.10%
8 - 9	2571	111.80%	20-21	1484	64.50%
9 -10	2408	104.70%	21-22	1277	55.50%
10-11	2249	97.80%	22-23	1078	46.90%
11-12	2174	94.60%	23-24	816	35.50%



STEP 2: Identify the traffic pacing restrictions. Leave a buffer period of one hour between the end of traffic pacing operations and the beginning of 40% capacity.



243 Portable Changeable Message Signs

243.1 General

See ***FDM 240*** for additional information concerning the use of portable changeable message signs (PCMS).

A PCMS is required for nighttime work that takes place within 4 feet of traveled way, and considered for the following conditions:

(1) Road closures

(2) Ramp closures

(3) Delays created by:

   (a) Congestion

   (b) Crashes

   (c) Lane closures

   (d) Two-way traffic on divided highway

   (e) Multiple lane closures

   (f) Unexpected shifts in alignment

243.2 PCMS Placement

The message displayed must be visible and unobstructed to a motorist in accordance with ***Standard Specification 102***.The message displayed must be installed at the following minimum distances:

(1) 900 feet on approach to construction work areas to allow for two message cycles.

(2) 500 to 800 feet in advance of potential traffic problems

(3) 0.5 to 2 miles in advance of complex traffic control schemes that require new or unusual traffic patterns.

243.3 PCMS Messages

Messages must be simple, with a minimum number of words and lines and must include no more than two displays of no more than three lines each with 8 characters per line. Provide the location and messages to be displayed in the Temporary Traffic Control (TTC) plan.

Programmed messages must provide appropriate information for the conditions likely to be encountered. Place the programmed messages in the TTC plan. Consider the following items in the development of a message:

(1) Message elements

- (a) Problem statement (where?)
- (b) Effect statement (what?)
- (c) Attention statement (who?)
- (d) Action statement (do?)

(2) Message format

- (a) Will vary depending on content
- (b) "Where" or "what" will generally lead
- (c) "Who" and "do" follow in that order
- (d) "Who" often understood from "where"

(3) Display format

- (a) Discrete, with entire message displayed at once is most desirable
- (b) Sequential is OK, 2 parts maximum
- (c) Run-on moving displays prohibited
- (d) One abbreviation per panel display desirable, two abbreviations are the maximum. Route designation is considered as one abbreviation and one word. Guidelines for abbreviations are provided on the following pages. Refer to the ***Library of Approved Safety Messages for DMS***.

243.3.1 PCMS Worksheet

See ***Figure 243.3.1*** for an illustration on the development of a PCMS Worksheet.

See ***Form 243-A*** (located in ***FDM 103***) and ***FDM 921*** for instruction on showing the worksheet information in the plans set.

Figure 243.3.1 PCMS Worksheet

Financial Project No.: 123456-7-89-10

Location of board: Westbound Buck Lake Road – Station 100+00

Used: from 01 - 01 - 01 at 6 : 00 am/pm

to 02 - 02 - 02 at 6 : 00 am/pm

Message programmed by: W. Giddens

MESSAGE 1

U	S	E					
C	A	U	T	I	O	N	

MESSAGE 2

T	R	U	C	K	S		
E	N	T	E	R	I	N	G
R	O	A	D	W	A	Y	

Timing:

Message 1 will run 10 . 00 seconds.

Message 2 will run 12 . 50 seconds.

STANDARD ABBREVIATIONS FOR USE ON PCMS

Standard abbreviations easily understood are:

WORD	ABBREV.	WORD	ABBREV.
Boulevard	BLVD	Normal	NORM
Center	CNTR	Parking	PKING
Crossing	XING	Pedestrian	PED
Crosswalk	XWALK	Road	RD
Emergency	EMER	Service	SERV
Entrance, Enter	ENT	Shoulder	SHLDR
Expressway	EXPWY	Slippery	SLIP
Freeway	FRWY, FWY	Speed	SPD
Highway	HWY	Traffic	TRAF
Information	INFO	Travelers	TRVLRS
Left	LFT	Warning	WARN
Maintenance	MAINT		

Other abbreviations are easily understood whenever they appear in conjunction with a particular word commonly associated with it. These words and abbreviations are as follows:

WORD	ABBREV.	PROMPT
Access	ACCS	Road
Ahead	AHD	Fog*
Blocked	BLKD	Lane*
Bridge	BRDG	[Name]*
Chemical	CHEM	Spill
Construction	CONST	Ahead
Exit	EX, EXT	Next*
Express	EXP	Lane
Hazardous	HAZ	Driving
Interstate	I	[Number]
Major	MAJ	Accident
Mile	MI	[Number]*
Minor	MNR	Accident
Minute(s)	MIN	[Number]*
Oversized	OVRSZ	Load
Prepare	PREP	To Stop
Pavement	PVMT	Wet*
Quality	QLTY	Air*
Route	RT	Best*
Turnpike	TRNPK	[Name]*
Vehicle	VEH	Stalled*
Cardinal Directions	N, E, S, W	[Number]

Upper, Lower	UPR, LWR	Level

* = Prompt word given first

The following abbreviations are understood with a prompt word by about 75% of the drivers. These abbreviations may require some public education prior to usage.

WORD	**ABBREV.**	**PROMPT**
Condition	COND	Traffic*
Congested	CONG	Traffic
Downtown	DWNTN	Traffic
Frontage	FRNTG	Road
Local	LOC	Traffic
Northbound	N-BND	Traffic
Roadwork	RDWK	Ahead [Distance]
Temporary	TEMP	Route
Township	TWNNSHP	Limits

* = Prompt word given first

Certain abbreviations are prone to inviting confusion because another word is abbreviated or could be abbreviated in the same way. Do not use these abbreviations:

ABBREV.	**INTENDED WORD**	**WORD ERRONEOUSLY GIVEN**
WRNG	Warning	Wrong
ACC	Accident	Access (Road)
DLY	Delay	Daily
LT	Light (Traffic)	Left
STAD	Stadium	Standard
L	Left	Lane (Merge)
PARK	Parking	Park
RED	Reduce	Red
POLL	Pollution (Index)	Poll
FDR	Feeder	Federal
LOC	Local	Location
TEMP	Temporary	Temperature
CLRS	Clears	Color

250 Hydraulic Data and Agency Permits

250.1 General

A Bridge Hydraulic Report (BHR) includes the following, as applicable:

- Bridge Hydraulics Recommendation Sheet,
- Bridge hydraulic calculations, and
- Scour calculations (prepared as specified in ***Chapter 4*** of the ***Drainage Manual***, ***Topic No. 625-040-002)***.

250.1.1 Bridge Hydraulic Recommendation Sheet (BHRS)

Prepare the Bridge Hydraulic Recommendation Sheet (BHRS) for new structures and widenings as specified in ***Chapter 4*** of the ***Drainage Manual***.

250.2 Scour Calculations

Scour calculations are required for new structures and for major widening of an existing bridge structure. See the ***Structures Design Guidelines*** for classification of major and minor widening.

Scour calculations for the widening of an existing structure will be considered by the Department on an individual basis.

Develop scour estimates using a multi-disciplinary approach involving the Hydraulics Engineer, the Geotechnical Engineer, and the Structures Design Engineer. Design bridges and bridge culverts to withstand the design flood without damage and to withstand the 500-year flood (super flood) without failure. Refer to the ***Structures Design Guidelines*** for specific foundation design steps and the ***Drainage Manual*** for policy on scour computations.

The 100-year and 500-year scour elevations are required for the design of all bridges over watercourses. In addition, the Long-Term Scour Elevation must be established for bridge structures required to meet the extreme event vessel collision load. For more information on these scour elevations see the ***Drainage Manual***.

250.2.1 Scour Design Process

Scour problems should be resolved early in the design process. The Bridge Development Report (BDR), or 30% structures plans submittal when a BDR is not required, is a means of addressing and resolving all major design issues early in the design process. The BDR (or 30% structures plans) should also define the need for scour considerations, establish the scour parameters, and arrive at possible solutions. The eight-step process is illustrated in ***Figure 250.2.1*** and described as follows:

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: Submit the scour calculations as part of the 90% foundation component plan submittal.

(1) The Drainage Design Engineer evaluates stream stability and scour potential based on all available data, assumed soil conditions, structure positioning, and foundation designs. The Drainage Design Engineer's assumptions (hydraulic, geotechnical, and structural) and design parameters should be discussed with both the Geotechnical and Structures Design Engineers. When evaluating stream stability and scour potential, the recommendations developed from FHWA's ***Hydraulic Engineering Circular (HEC)*** should be followed as well as the design requirements provided in ***Chapter 4*** of the ***Drainage Manual***. This work should be initiated during the PD&E study where changes in the alignment could affect the severity of general scour.

(2) The Geotechnical Engineer will then consider the possible alignments based on the scour potential and subsoil conditions. It may be necessary to conduct exploratory work if variability of subsoil conditions are suspected but not sufficiently defined. The results of exploratory investigations should be discussed with both the Hydraulics and Structures Design Engineer, and any previous scour assumption verified or modified.

(3) The Structures Design Engineer should provide approximate span ranges, pier configurations, and pier locations for the different alternates. In addition, possible foundation types and approximate sizes should be developed such that the Drainage Design Engineer can estimate local scour potentials. Conditions to be considered are:

(a) The extent and severity of scour along the alignment must be developed. For example, for bridges over a wide body of water, general scour could vary in extent and severity. It may be reasonable, therefore, to consider fewer foundations in the most severe areas (i.e., span the problem), or take appropriate steps to assure the structural integrity of the foundation in those locations.

(b) The pile driving resistance, which must be overcome at the time of construction, may be greater than the ultimate pile capacity at a later date due to subsequent scour activity.

(c) Likewise, design drilled shaft capacity must account for the possibility that ultimate capacity will be reduced as a result of future scour activity.

(4) The Drainage, Geotechnical, and Structures Design Engineers must develop the scour potential and rate each location and furnish the results to the District Environmental Management Office for consideration in establishing the recommended alignment(s).

(5) The preferred alignment is established by others.

(6) The Structures Design Engineer develops more detailed calculations showing possible span arrangements and types and sizes of foundations.

(7) The Drainage, Geotechnical, and Structures Design Engineers review the proposed configuration to assure that scour has been properly addressed. The Drainage Design Engineer reviews both the general and local scour potential and recommends continuation or changes.

(8) The Structures Design Engineer finalizes the configuration and proceeds with a more detailed analysis of the foundation including the anticipated pile tip elevations. The Drainage, Geotechnical, and Structures Design Engineers must review and concur. The final results are then incorporated into the BDR or 30% structures plans as applicable.

Modification for Non-Conventional Projects:
Delete the third sentence of item 8, above and replace with the following: Submit the final results as part of the 90% foundation component plan submittal.

Figure 250.2.1 Structural Plans Development

Sheet 1 of 2

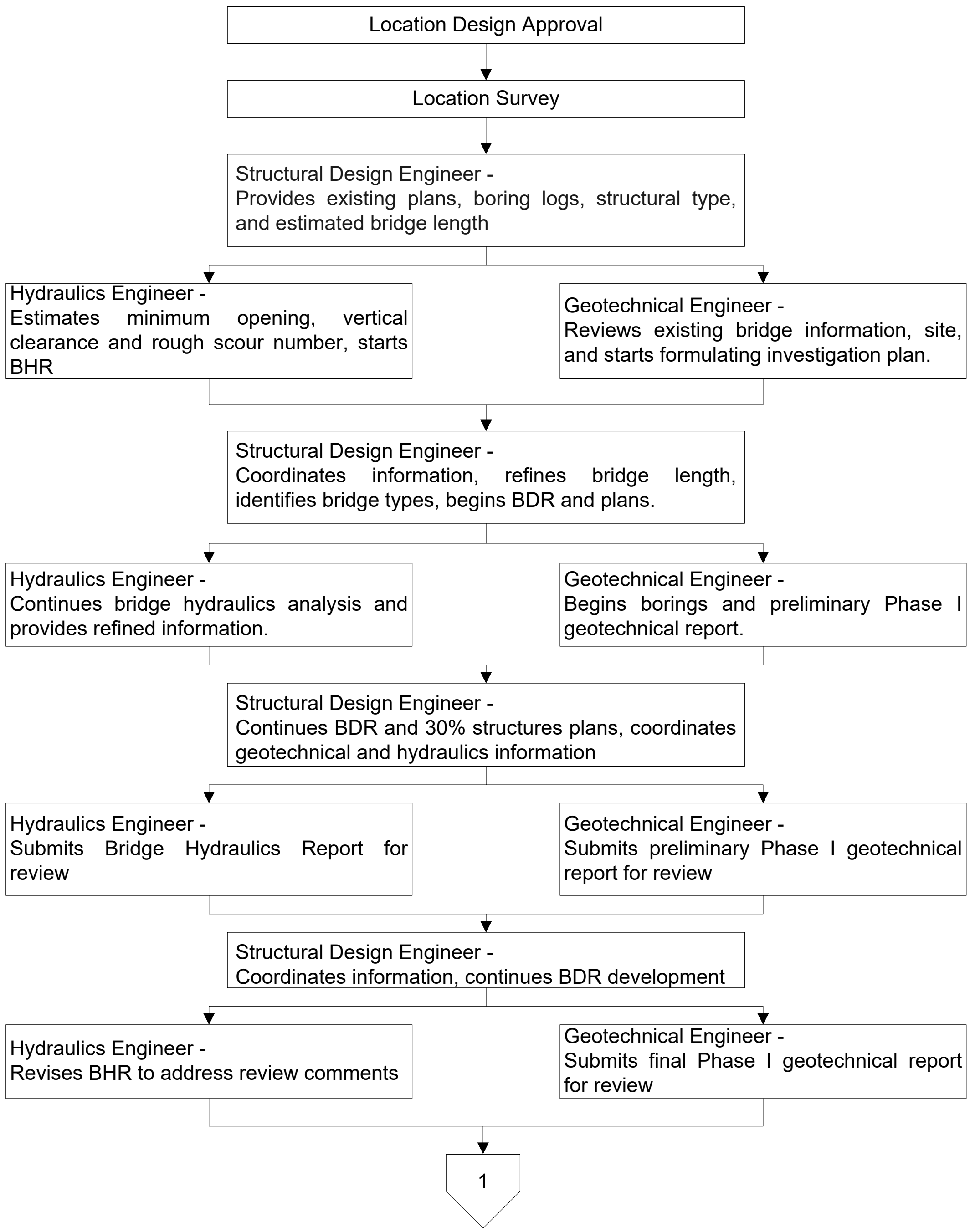
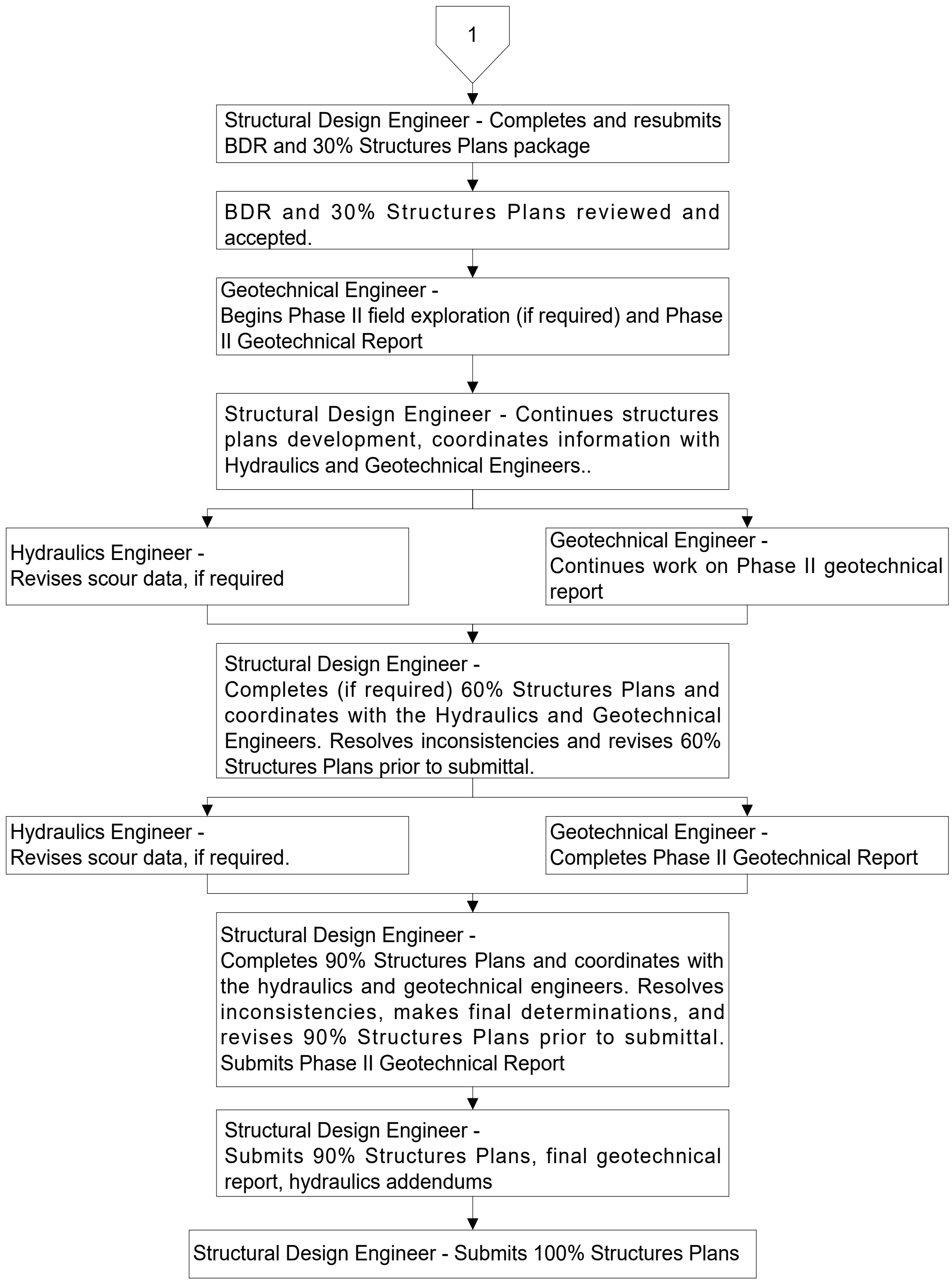


Figure 250.2.1 Structural Plans Development

Sheet 2 of 2



250.2.2 Bridge Foundation Design Process

This is a multi-discipline effort involving Geotechnical, Structures, and Hydraulics/Coastal Engineers. The process described below will often require several iterations. The foundation design must address the various scour conditions and furnish sufficient information for the Contractor to provide adequate equipment and construction procedures. These three engineering disciplines have specific responsibilities in considering scour as a step in the foundation design process.

(1) The Structures Engineer determines the preliminary design configuration of a bridge structure utilizing geotechnical and hydraulic data. The Structure Engineer also performs lateral stability evaluations for the applicable loadings described in the ***Structures Design Guidelines***, ***Section 2.12*** (***Substructure Limit States***), (do not impose arbitrary deflection limits except on movable bridges). A preliminary lateral stability analysis generally will occur during the BDR phase of the project, and a final evaluation will occur subsequent to the selection of the final configurations. The Structures Engineer must apply sound engineering judgment in comparing results obtained from scour computations with available hydrological, hydraulic, and geotechnical data to achieve a reasonable and prudent design.

Modification for Non-Conventional Projects:
Delete the third sentence of item 1, above.

(2) The Hydraulics Engineer provides the predicted scour elevation through a 100-year flood event (100-Year Scour), a 500-year flood event (500-Year Scour), and for "Long-Term Scour". "Long Term Scour" is defined and described in ***Chapter 4*** of the ***Drainage Manual***.

(3) The Geotechnical Engineer provides the nominal axial (compression and tension) capacity curves, mechanical properties of the soil, and foundation recommendations based on construction methods, pile availability, similar nearby projects, and site access.

250.2.3 Submittal Requirements

During the 30% and 90% structures plans reviews, the EOR must coordinate the reviews of the design of both the Drainage and Geotechnical Engineers to assure compliance with the results of the scour calculations. The EOR must consult with the District Structures Maintenance Engineer for scour inspection reports on existing bridges.

Modification for Non-Conventional Projects:
Delete the first sentence of the above paragraph and replace with the following: During the 90% foundation component plans submittal, the EOR must coordinate the reviews of the design of both the Drainage and Geotechnical Engineers to assure compliance with the results of the scour calculations.

250.3 Debris Accumulation

Debris accumulation on the upstream side of substructure units can significantly affect the flow of water and cause significant scour. Evaluate the type of vegetation upstream from the bridge and consider the probability of debris accumulation in establishing types and locations of substructure units. Special consideration must be given to mitigating debris accumulation on substructure units.

Debris clearance criteria are specified in ***FDM 260.8.1***.

250.4 Agency Permits

Most projects will require several permits from Federal, State and local agencies. For examples of the types of permits that may be required, see ***Part 1, Chapter 12*** of the ***Project Development and Environment Manual*** ***(PD&E Manual)***.

Modification for Non-Conventional Projects:
Delete ***FDM 250.4*** and see RFP for requirements concerning Agency Permits.

251 Stormwater Runoff Control Concept (SRCC) Development

251.1 General

A Stormwater Runoff Control Concept (SRCC) must be developed during design and is a conceptual layout of temporary sediment and erosion control Best Management Practices (BMPs). The intent of the SRCC is to provide sediment and erosion control quantities for cost estimating purposes and to offer reasonable assurances for permits obtained during design. CADD files developed for this concept will not be signed and sealed but will be included in the CADD.zip or BIM.zip. Permanent controls (such as permanent sod/turf, inlets, erosion mats, etc.) must be included in the contract plans. The Contractor is responsible for developing a project specific plan to match field conditions, project approach, and construction phasing. Implementing, installing, inspecting, and maintaining these controls are also the responsibility of the Contractor.

The SRCC should be prepared in consultation with Drainage, Construction and Environmental personnel. This concept must consider project limits, wetland locations, preservation areas, and existing and proposed terrain and drainage features. The ***Sediment and Erosion Control Manual*** provides guidance for appropriate application of BMPs. A review of the permitting agency requirements is recommended. Links to the Applicant Handbooks for each Water Management District are provided below:

Northwest Florida

Suwannee River

Southwest Florida

St. Johns River

South Florida

The amount of information provided to adequately address stormwater runoff control varies based on the complexity of a project. A concept sediment and erosion control layout may be only tabular for minor projects.

Include details for controls that are not detailed in the ***State of Florida Erosion and Sediment Control Designer and Reviewer Manual***. The details should show the work intended, where and how the control is to be placed, and any other special design details. Include a Technical Special Provision in the project specification package when required by the erosion control items of work.

260 Bridge Structures

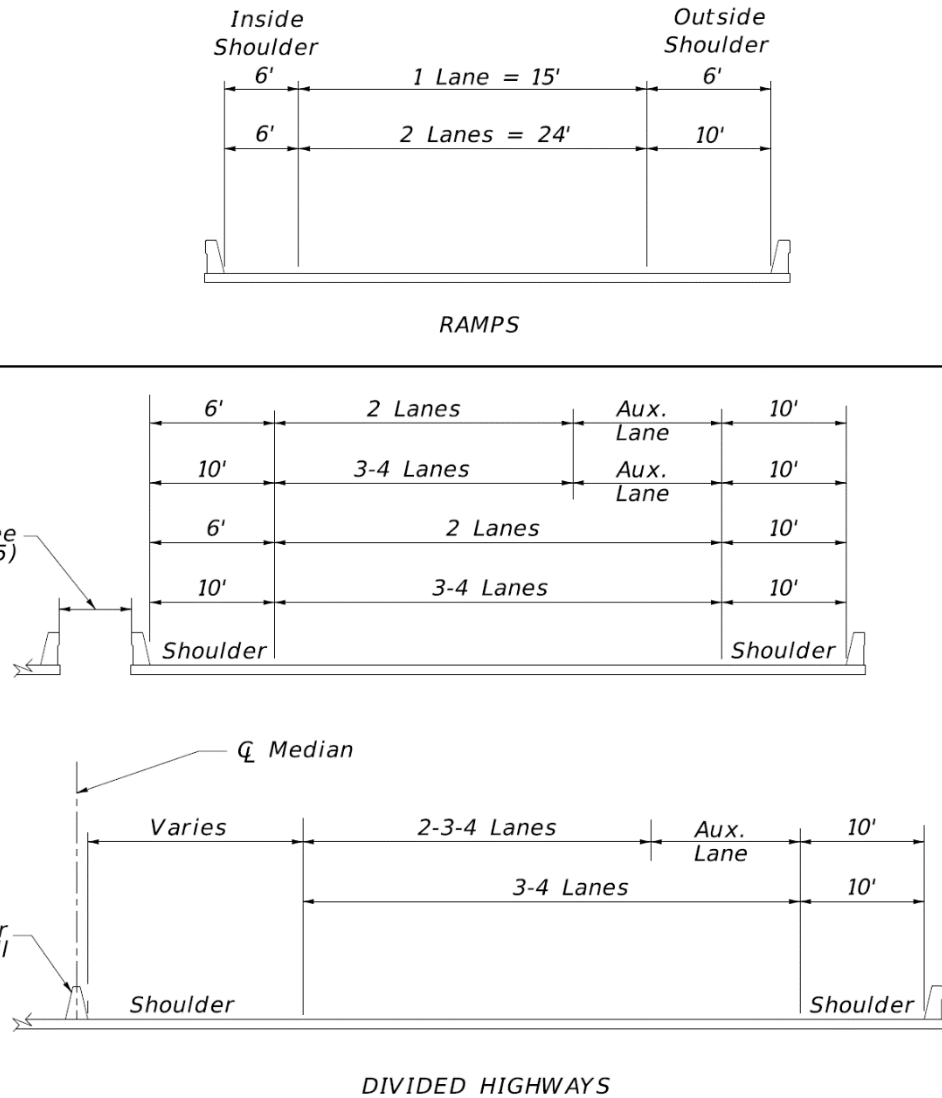
260.1 General

The design criteria presented in this chapter apply to bridge structures on arterials, collectors, and Limited Access Facilities. Criteria regarding lanes, medians, and shoulders for bridges are illustrated in ***FDM 260.1.1.*** Subsequent sections of this chapter contain specific information and criteria regarding these typical section elements, as well as geometric features.

260.1.1 Partial Bridge Sections

Criteria regarding lanes, medians, and shoulders are illustrated in the following partial bridge sections, ***Figures 260.1.1 – 260.1.4***. These figures show sections through the bridge deck. Sections through the approach slab and permanent retaining wall should match the lanes, medians, and shoulder widths in the bridge section.

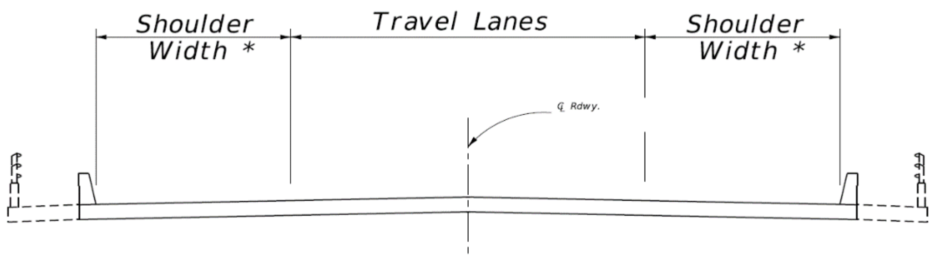
Figure 260.1.1 Partial Bridge Sections for Limited Access Facilities and Divided Arterials (4 or More Lanes) Design Speed 50 mph and Greater



Notes:
1. Minimum values may change if on horizontal curve.
2. If barrier-separated Managed Lane on approach roadway, maintain shoulder width across bridge.
3. For Turnpike Projects, maintain the approach roadway paved shoulder width on retaining walls and bridges.
4. For limited access evacuation routes, provide the minimum shoulder widths for Emergency Shoulder Use found in FDM 211.4.6.

Legend: ▯ - Appropriate barrier: Type varies, Single Slope shown. See FDM 215.

Figure 260.1.2 Bridge Section for Undivided Arterials and Collectors



CROWNED SECTION

* Shoulder Widths:
High Volume = 10'
Normal Volume = 10'
Low Volume = 8'

Legend: - Appropriate barrier: Type varies, Single Slope shown. See FDM 215.

Figure 260.1.3 Partial Bridge Sections for Curbed Arterials and Collectors Design Speed 45 mph and Less

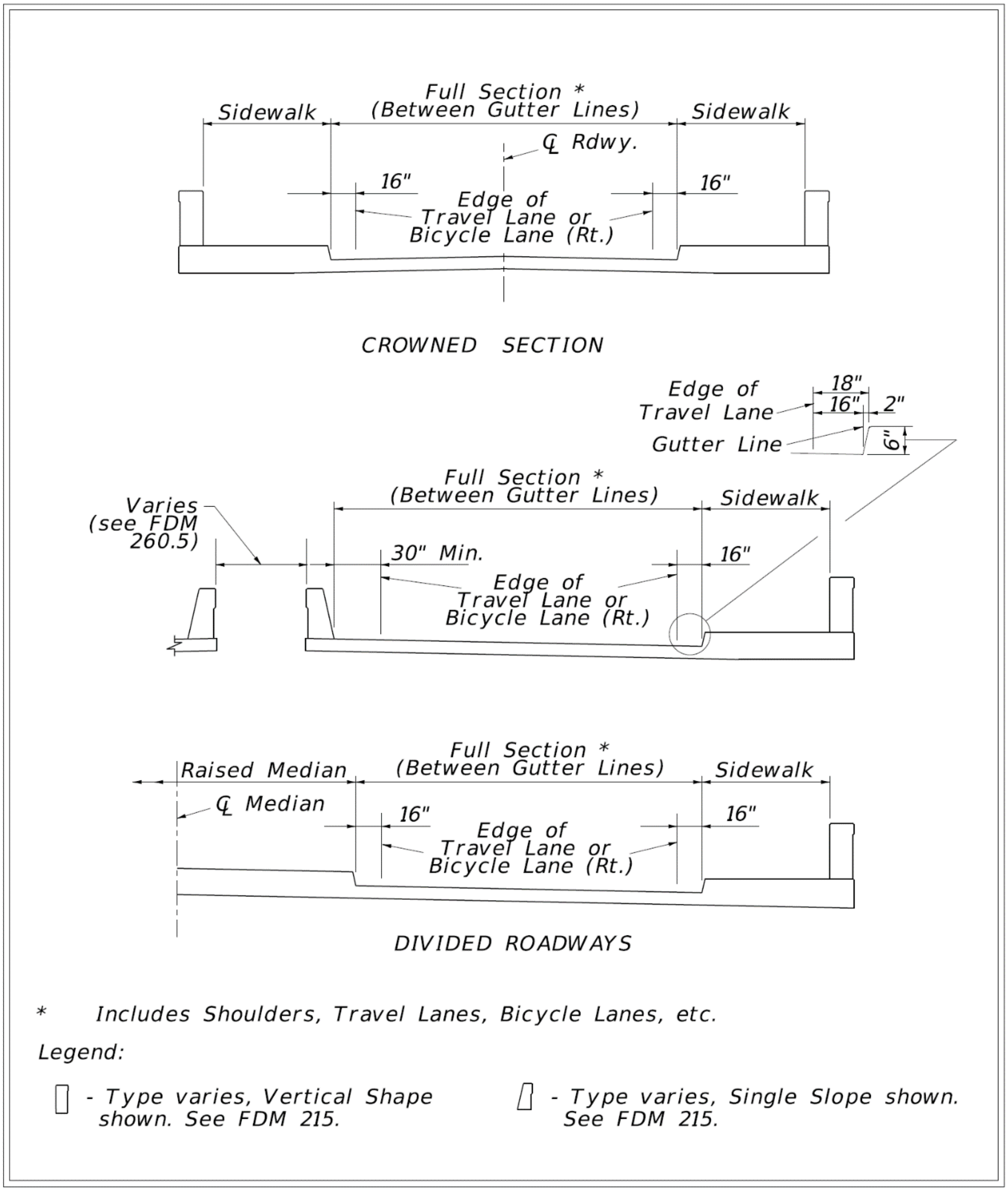
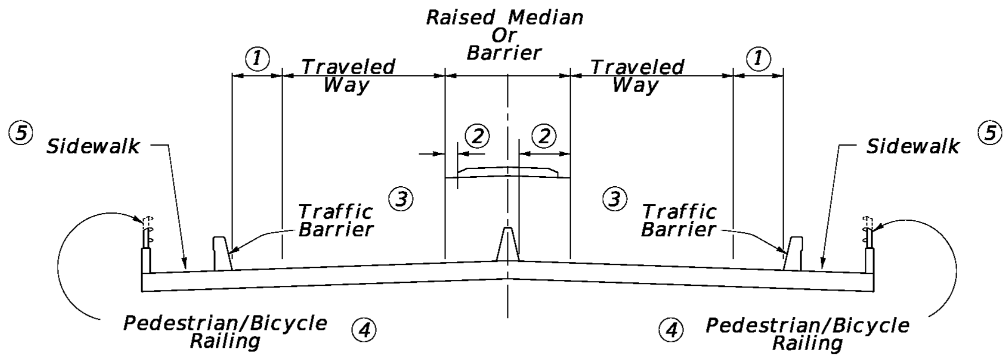


Figure 260.1.4 Bridge Section for Divided Arterials and Collectors



① *<u>Outside shoulders</u>:*
Curbing on approach roadway:
Use 2.5' minimum, 8'-4" with bike lane, 8' minimum for bridges 500' or longer or high-level bridges.
Flush shoulder on approach roadway:
Use 10' minimum.

② *<u>Median shoulders</u>:*
Raised median on bridge:
Use same offset to median as used on the approach roadway.
Median barrier on bridge:
Raised median on approach roadway:
Use 2.5' minimum, and for bridges 500' or longer or high-level bridges use 6' minimum for 2 lanes and 8' minimum for 3 or more lanes.
Flush shoulder on approach roadway:
Use 6' minimum for 2 lanes and 10' minimum for 3 or more lanes.

③ *Use traffic barrier between traveled way and sidewalk and separate pedestrian railing at back of sidewalk if heavy pedestrian traffic is anticipated or facility is near a school, or design speeds on the bridge are 50 mph or greater.*

④ *Provide pedestrian/bicycle railing as required per FDM 222.4*

⑤ *See FDM 260.2.2 for sidewalk width requirements.*

260.2 Lanes

Lane widths are to match the approach roadway lane widths.

260.2.1 Bicycle Lanes

Continue bicycle lanes on the approach roadway across the structure.

260.2.2 Sidewalk and Shared Use Paths

Continue width of sidewalk or shared use path on the approach roadway across the structure. Bridge sidewalk width may be less than the approach roadway for long bridges (greater than 100 feet), but not less than 5 feet for C1 and C2 context classification or 6 feet for all other context classifications.

Provide sidewalk on new bridges where sidewalk or shared use path is not present along the roadway but may be included with a future project.

Modification for Non-Conventional Projects:
Delete ***FDM 260.2.2*** and see RFP for requirements.

260.3 Shoulders

Figures 260.1.1 – 260.1.4 provide criteria for shoulder widths on various bridge sections. Where these widths differ from those required for roadways or ramps, decisions about the final values chosen for the project are to be coordinated between the District Roadway Design and Structures Design Offices.

On roadway alignments having 12-foot shoulders with continuous barrier walls and closely spaced bridges, a 12-foot bridge shoulder width may be considered. Bridges are considered to be closely spaced when the required length of shoulder transition (between standard width roadway and bridge shoulders) is greater than the distance between the bridges. The decision to use 12-foot bridge shoulder widths should be coordinated with the District Design Engineer.

Modification for Non-Conventional Projects:
Delete the above paragraph and see RFP for bridge shoulder width requirements.

260.4 Bridge Cross Slopes

Bridge cross slope is typically 0.02 for non-superelevated bridge deck sections. Bridges with one-way traffic have a uniform cross slope applied over all travel lanes and required shoulders. Bridges with two-way traffic may be designed with a crowned bridge deck section. This cross-slope criteria applies to all bridge decks whether of cast-in-place concrete, precast concrete, or open steel decking.

Use transitions to adjust for differences in cross slope between the approach roadway section and the required straight-line slope for bridge decks.

260.5 Bridge Median

For divided highways, the District will determine the desired distance between structures based in the following:

(1) Provide separate structures if the open space between the bridges would be 20 ft. or more.

(2) Provide single structure if the open space between the bridges would be less than 10 feet.

(3) A single structure is recommended when the open space between the bridges would be between 10 and 20 feet.

Consult with the District Structures Maintenance Engineer when the open space between the bridges would be less than 20 feet.

The inspection and maintenance capabilities of each District Office’s personnel and equipment will provide the basis for deciding on a single structure deck or twin bridges. If the total width for a single structure exceeds the capacity of district maintenance equipment, typically a 60-foot reach, twin structures may be specified and the open distance between structures determined by the practical capability of the maintenance and inspection equipment. This is particularly important for girder superstructures because those areas that cannot be reached by topside equipment might require catwalks, ladders, or other access features. Such features are to be accounted for in the initial selection of alternates as they will add to the cost of superstructures.

Design bridge railings and separators in accordance with the ***Structures Design Guidelines (SDG)***. For more information regarding bridge traffic railings, refer to ***FDM 215***.

260.6 Vertical Clearance

For roadway, pedestrian, or railroad bridge over roadway, the minimum vertical clearance is the least distance measured between the lowest bridge superstructure or substructure element and the traveled way or shoulder directly below the element.

For roadway or pedestrian bridge over railroad, the minimum vertical clearance is the least distance measured between the bottom of the superstructure and the top of the highest rail utilized.

For roadway or pedestrian bridge over High-Speed Rail Systems, see the latest version of ***American Railway Engineering and Maintenance-of-Way Association (AREMA)*** guidelines, or contact the design office of the high-speed rail line of interest.

For roadway or pedestrian bridge over electrified railroad, see FDOT's ***South Florida Rail Corridor Clearance Policy for 25 KV service (Topic No. 000-725-003)***. This provision also applies to tracks identified as candidates for future electrification.

FDOT minimum vertical clearances for new construction and RRR projects are given in ***Table 260.6.1***. New construction criteria are also illustrated in ***Figures 260.6.1*** through ***260.6.5***.

Table 260.6.1 Minimum Vertical Clearances for Bridges

<table>
<tr><th rowspan="3">Type of Crossing</th><th colspan="3">Minimum Vertical Clearance (feet)</th></tr>
<tr><th colspan="2">New Construction</th><th rowspan="2">RRR</th></tr>
<tr><th>New Bridge</th><th>Construction Affecting Existing Bridge</th></tr>
<tr><td>Roadway or Railroad bridge over Limited Access Roadway</td><td rowspan="2">16.5</td><td rowspan="2">16.0</td><td>16.0</td></tr>
<tr><td>Roadway or Railroad bridge over Arterial or Collector Roadway</td><td>14.5</td></tr>
<tr><td>Pedestrian bridge over Roadways</td><td>17.5</td><td colspan="2">17.0</td></tr>
<tr><td>Roadway or Pedestrian bridge over Railroad</td><td colspan="3">23.5</td></tr>
<tr><td>Roadway or Pedestrian bridge over Electrified Railroad</td><td colspan="3">24.25</td></tr>
</table>

Notes:

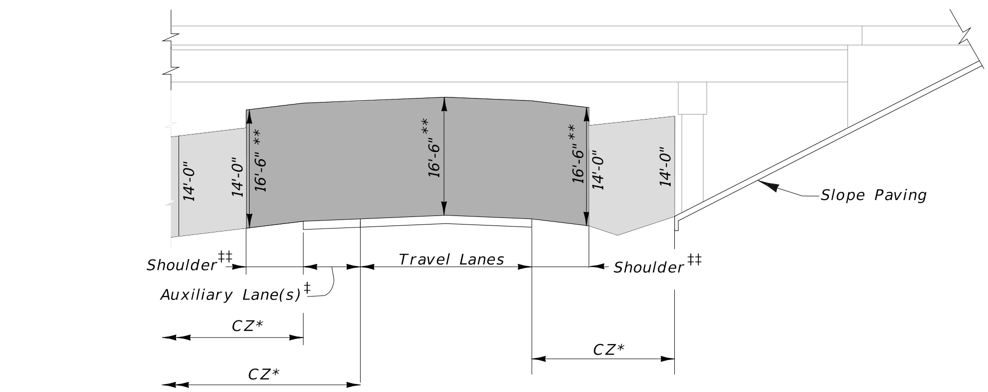
(1) For construction affecting an existing bridge (e.g., bridge widenings or resurfacing), if the proposed minimum design vertical clearance is between 16 feet and 16 feet 2 inches or if a Design Variation or Design Exception is required, place a note in the plans as shown in ***FDM 914***.

Roadway or Railroad bridge over Arterial or Collector Roadway

(1) Contact the District Structures Design Engineer for further guidance if any sway bracing members over the bridge deck have a clearance of less than 14 feet.

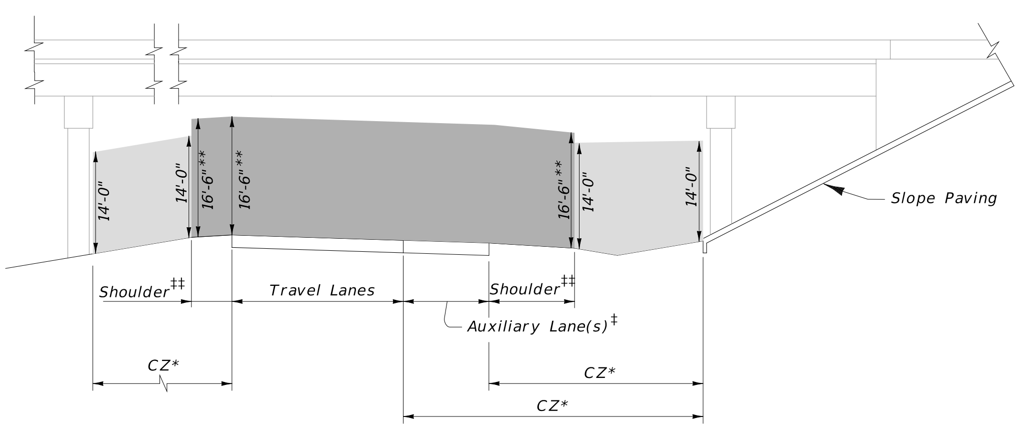
(2) ~~Contact the District Structures Design Engineer for further guidance when vertical clearance of a~~An existing bridge ~~is~~with a vertical clearance less than 14.5 feet requires a Design Variation. See ***Traffic Engineering Manual*, Section 2.6** for information on required signing and warning features.

Figure 260.6.1 Flush Shoulder Roadway



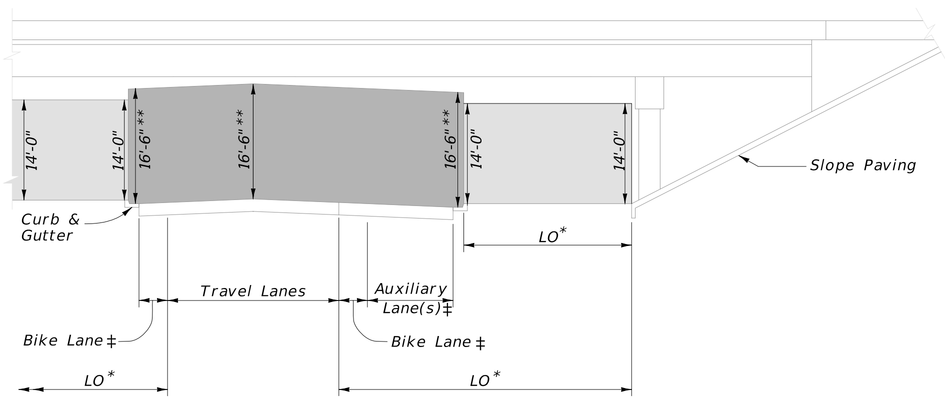
* Clear Zone (CZ) - To Pier (Shown), Face of Retaining Wall/Coping or Toe of Slope (Similar)
** See Table 260.6.1 Vertical Clearances for Bridges
‡ When present, Auxiliary Lane(s) may be located on either or both sides of Travel Lanes.
‡‡ Condition applies to median or outside shoulder.

Figure 260.6.2 Flush Shoulder Divided Roadway



* Clear Zone (CZ) - To Pier (Shown), Face of Retaining Wall/Coping or Toe of Slope (Similar)
** See Table 260.6.1 Vertical Clearances for Bridges
‡ When present, Auxiliary Lane(s) may be located on either or both sides of Travel Lanes.
‡‡ Condition applies to median or outside shoulder.

Figure 260.6.3 Curbed Roadway ≤ 45 mph

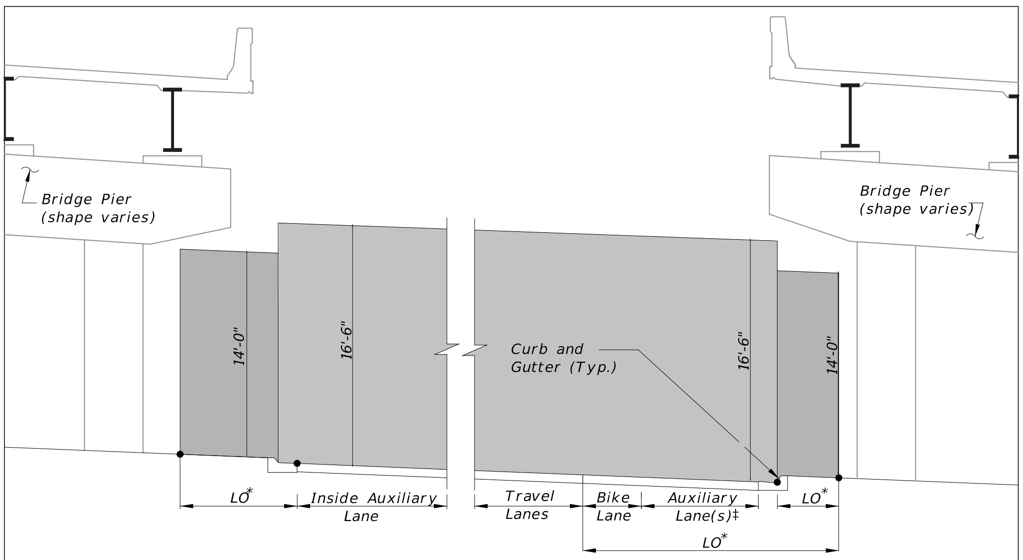


* Lateral Offset (LO) - To Pier (Shown), Face of Retaining Wall/Coping or Toe of Slope (Similar). See FDM 215, Table 215.2.2 Lateral Offset Criteria

** See Table 260.6.1 Vertical Clearances for Bridges

‡ When present, Auxiliary Lane(s) may be located on either or both sides of Travel Lanes.

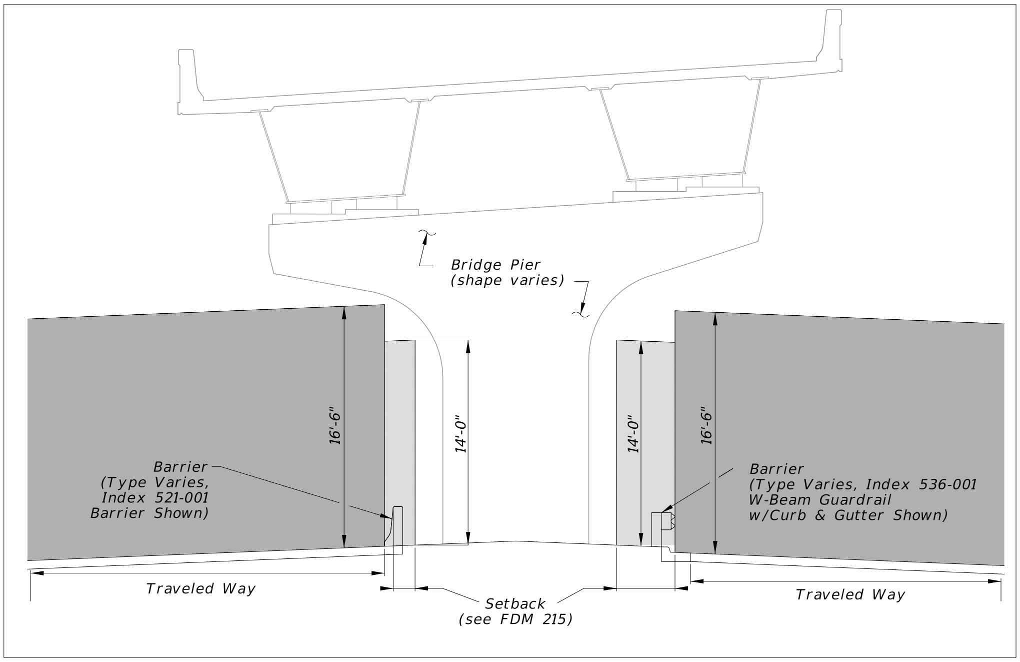
Figure 260.6.4 Curbed Roadway ≤ 45 mph – Section through Bridge



* Lateral Offset (LO) - To Pier (Shown), Face of Retaining Wall/Coping or Toe of Slope (Similar). See FDM 215, Table 215.2.2 Lateral Offset Criteria

‡ When present, Auxiliary Lane(s) may be located on either or both sides of Travel Lanes.

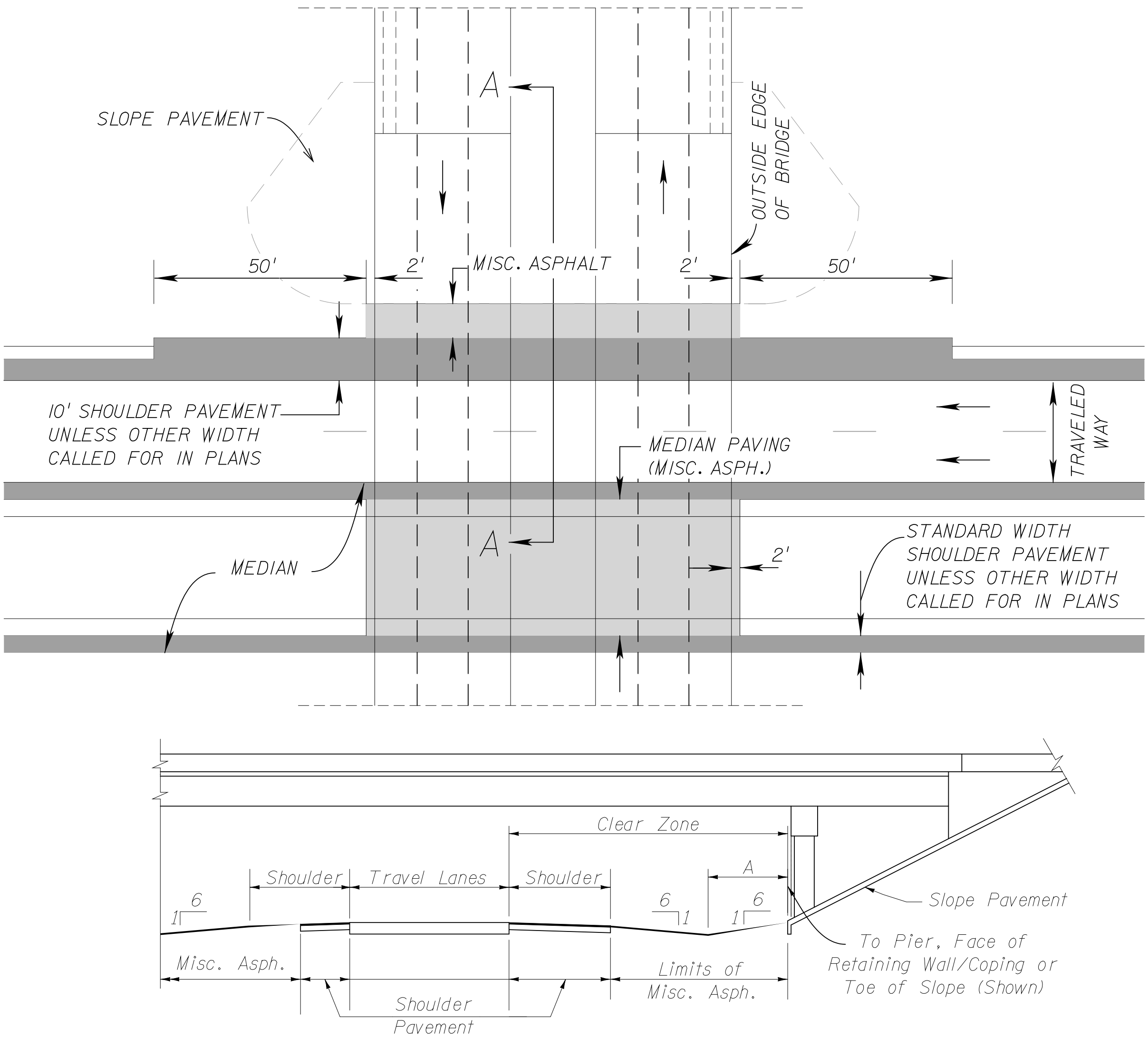
Figure 260.6.5 Curbed Roadway with Traffic Barrier



260.7 Typical Paving Under Bridge

A 10-foot paved outside shoulder under overpass bridges is recommended. In addition, miscellaneous asphalt within the median area and from the paved shoulder to the bridge slope pavement should be placed. This pavement will provide additional safety, enhance drainage, reduce maintenance, and improve appearance. Typical paving under bridges is illustrated in ***Figure 260.7.1***.

Figure 260.7.1 Typical Paving Under Bridge



SECTION A-A

FACILITY	A
Limited Access Facilities	12'
Flush Shoulder Arterials & Collectors Design Speed 50 mph or greater	8'
Flush Shoulder Arterials & Collectors Design Speed 45 mph or less	6'

260.8 Bridges Over Waterways

260.8.1 Vertical Clearance

The following criteria applies to the minimum vertical bridge clearance over water:

Environment:

For concrete superstructures classified as Moderately or Extremely Aggressive due to chloride content, material requirements are determined based on location of the superstructure relative to the splash zone. See ***SDG*** 1.3, ***SDG*** 1.4, and ***SDG*** 4.3 for more information.

For steel superstructures, obtain the minimum vertical clearance from the District Bridge Maintenance Engineer. At a minimum, steel superstructures must be located above the splash zone. See ***SDG*** 1.3 for more information.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: Steel superstructures must be located above the splash zone as defined in ***SDG*** 1.4 or as specified in the RFP.

Drainage:

The minimum vertical clearance between the design flood stage and the low member of a bridge is 2 feet. This clearance is necessary to allow the majority of debris to pass without causing damage to the structure. This requirement does not apply to culverts and bridge-culverts.

Navigation:

Provide the following minimum vertical clearance for navigational purposes:

(1) 6 feet above the Mean High Water for tidewater bays and streams

(2) 6 feet above the Normal High Water for freshwater rivers, streams, non-regulated/controlled canals, and lakes

(3) 6 feet above the control elevation for regulated/controlled lakes and canals

For bridges without a designated navigation channel, minimum vertical clearance for navigation purposes is measured from the low point of the superstructure to the water surface anywhere along the length of the bridge over the navigable water. For bridges with a designated navigation channel, minimum vertical clearance for navigation purposes is measured from the low point of the superstructure to the water surface at the edges of the designated navigation channel. Navigation lights are not considered in the vertical clearance.

Coastal Bridges:

A minimum vertical clearance of 1 foot above the 100-year design wave crest elevation including the storm surge elevation and wind setup is required for the superstructure. For bridge designs where this criterion cannot practically be met, refer to the ***FDOT Drainage Manual*, *Section 4.9.5***.

Information on the Normal High Water, control water elevation, or Mean High Water can be obtained from the appropriate Drainage Design Engineer.

Widening of existing structures which do not meet the minimum vertical clearance criteria stated above (either before or after the widening) may be justified hydraulically or economically. However, encroachment of vertical clearance criteria may be limited and is required to be approved by the agency having jurisdiction over the navigable waterway.

260.8.2 Horizontal Clearance

Provide the following minimum horizontal clearance:

(1) 10 feet for crossings subject to boat traffic.

(2) Consistent with debris conveyance needs and structure economy where no boat traffic is anticipated.

Horizontal clearance is defined as the unobstructed clear distance between piers, fender systems, culvert walls, etc. projected by the bridge normal to the flow.

260.8.3 Regulatory Agency Requirements

Vertical and horizontal clearances will also be subject to the requirements of the Coast Guard, Corps of Engineers, Water Management District, and any other regulatory agency having appropriate statutory jurisdiction or authority. Such regulatory agency requirements may exceed Department requirements.

260.9 Evaluation of Existing Bridge Structures

Each project will require a determination on the most appropriate action regarding existing structures; i.e., should bridge remain as is, be rehabilitated, or be replaced. This determination should be made as early as practical due to the potential impact to the work program. Pavement resurfacing funds can only be used for minor bridge improvements such as rail retrofits and ADA improvements. Bridges that require major improvements or replacement must be programmed with appropriate bridge program funds.

The determination of bridge improvement needs is to be supported by an engineering analysis and report. The determination is to be based on an assessment of the bridge's structural and functional adequacy. The engineering report is to include the following:

(1) Project description

(2) Operational impact evaluation

(3) Safety impact evaluation that includes a detailed review of crash history, severity, contributing factors, etc.

(4) Benefit/cost analysis

If the engineering analysis determines it is not feasible to bring the bridge into full compliance with minimum criteria, a Design Exception or Design Variation addressing the feature(s) not meeting criteria must be processed in accordance with ***FDM 122***. The engineering analysis and report should be used to support the Design Exception or Design Variation.

Review the Department's work program to see if a structure is scheduled for replacement, before determining short term improvements. Consider short term improvements that enhance safety, but may not bring the bridge into compliance, such as:

- Upgrading of connecting guardrail systems
- Approach roadway or shoulder widening
- "Narrow Bridge Ahead" signing and shoulder warning (see ***FDM 210.4.5***)

If a bridge is functionally obsolete but structurally sound, complete replacement is usually not warranted. For these structures, a full range of possible improvements should be considered to bring the structure into compliance with minimal criteria. Widening of the structure or rail retrofits are primary options. If a roadway is being programmed or considered for improvements or widening (adding lanes), consider the needs of the future structure(s).

When evaluating bridge replacement or widening, the following should be considered:

(1) Cost of replacing the existing bridge with a wider bridge designed to new bridge criteria.

(2) Cost of widening the existing bridge (if widening is practical), including life cycle costs of maintaining a widened bridge.

(3) The number of crashes that would be eliminated by replacement or widening.

(4) The hydraulic sufficiency and the risk of failure due to scour and/or ship impact as well as the consequences of failure.

260.9.1 Bridge Width

Required bridge widths for new bridge structures are illustrated in the partial bridge sections, ***Figures 260.1.1 – 260.1.4***.

Minimum existing bridge widths for arterials and collectors are provided in ***Table 260.9.1***.

See ***FDM 210.4.5*** for information concerning narrow bridge shoulder warning devices.

Bridge widening is to be in accordance with the ***Structures Design Guidelines*** and meet the geometric requirements for new construction.

Table 260.9.1 Minimum Widths for Existing Bridges

Bridge Median Treatment	Minimum Width		
	Traveled Way Width	Shoulder Width (ft)	
		Median	Outside
Undivided (AADT < 750)	Total Width of Approach Lanes	n/a	2.0
Undivided (AADT ≥ 750)	Total Width of Approach Lanes	n/a	4.0
Divided (Median Separator)	Total Width of Approach Lanes	1.5	4.0
Divided (Median Barrier Wall)	Total Width of Approach Lanes	2.5	4.0
One Way Bridges	Total Width of Approach Lanes	2.5	4.0

260.9.1.1 Interstate, Freeways and Expressways

For resurfacing projects, existing 4-lane (2-lanes in one direction) mainline bridges may remain in place without a Design Exception or Variation when all the following requirements are met:

(1) Minimum 12-foot lane widths, and

(2) Minimum 3-foot left shoulder, and

(3) Minimum 10-foot right shoulder on bridges ≤ 200 feet in length, or minimum 3-foot right shoulder on bridges > 200 feet in length.

260.9.2 Bridge Loading

See ***FDM 121.17*** for load rating requirements.

260.9.3 Pier Protection, Bridge Railing and Roadside Safety Hardware

See ***FDM 215*** for requirements.

260.9.4 Bridge Mounted Support Structures and Signs

See ***Structures Manual Volume 3 Chapter 18*** for existing bridge mounted support structures and signs.

261 Structural Supports for Signs, Signals, Lighting, ITS, and Tolling

261.1 General

The criteria for the structural design of sign, signal, lighting, ITS, and tolling support structures (aka Ancillary Structures) must be in accordance with AASHTO's ***LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals***, as modified by the ***Structures Manual, Volume 3***. Include structural details in the Plans for all sign, signal, lighting, ITS, and tolling structures. Use the ***Standard Plans*** for sign, signal, lighting, ITS, and tolling support structures, unless site conditions or other considerations require a custom design.

When a custom support structure is required, or otherwise specifically designated in the contract documents, the Engineer of Record (EOR) is responsible for the structural design including foundations and the review of the shop drawings. Details for supports attached to bridge structures must be coordinated with the bridge structural engineer and included in the plans. See ***Structures Design Guidelines***, ***Section 1.9*** and ***Structures Manual, Volume 3, Section 2.6*** for details and restrictions related to making attachments to bridges.

Sign and signal structures ~~span length~~ are limited to the following dimensions:

- ***Standard Plans, Index 700-041***, Span Sign Structure: Span Length ≤ 220 feet
- ***Index 700-040***, Cantilever Sign Structure: Cantilever Length ≤ 50 feet
- ***Indexes 700-040*** and ***700-041***, Cantilever & Span Sign Structure: Truss Depth~~:~~ ≤ 8 feet
- ***Indexes 649-030*** and ***649-031***, Standard Mast Arm Assemblies: Cantilever Length ≤ 78 feet
- ***Indexes 649-010*** or ***641-010,*** Steel or Concrete Strain Pole with Signal Cable: Span Length ≤ 250 feet

These dimensional limitations are applicable to both the designs contained within the ***Standard Plans*** and project-specific designs. Any sign or signal structure exceeding these dimensions requires a Design Variation approved with concurrence from the District Structures Design Engineer. See the applicable ***Standard Plans Instructions*** (***SPI***) for additional information on sign and signal structures.

Steel ancillary structures (highway signs, luminaires, traffic signals, ITS, and tolling) must use a galvanized coating per the ***Standard Plans***. They must not be painted or otherwise coated without written approval of the District Structures Design Engineer. If the local Maintaining Agency requests a painted or otherwise coated finish, the requesting agency is to provide the funding for the additional construction cost and be responsible for maintenance costs.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: Steel ancillary structures (highway signs, luminaires, traffic signals, ITS, and tolling) must use a galvanized coating per the ***Standard Plans*** unless specified otherwise in the RFP.

See ***FDOT Modifications to LRFD Specifications For Structural Supports For Highway Signs, Luminaires And Traffic Signals (LRFDLTS-1), Structures Manual Volume 3***, Section 2.6 for limitations on the use of bridge mounted signs.

261.2 Sign Support Structures

Use the applicable ***Standard Plans*** for the following sign support structures:

- ***Index 700-010*** Single Column Ground Signs
- ***Index 700-011*** Single Column Cantilever Ground Mounted Sign
- ***Index 700-012*** Single Post Bridge Mounted Sign Support
- ***Index 700-013*** Single Post Median Barrier Mounted Sign Support
- ***Index 700-020*** Multi-Column Ground Sign
- ***Index 700-040*** Cantilever Sign Structures (Overhead)
- ***Index 700-041*** Span Sign Structures (Overhead)

Refer to the corresponding ***Standard Plans Instruction*** (***SPI***) for design information.

For ***Standard Plans, Index 700-010*** Single Column Ground Signs, the contactor selects the appropriate pole size using the sign dimensions given in the plans and the four-step process given the standard.

Where the distance between the curb and the sidewalk restricts the use of ***Standard Plans, Index 700-020***; ***Index 700-011*** may be used.

The EOR is responsible for the design of all multi-column ground signs and overhead sign structures (including bridge mounted signs). This responsibility is for the entire sign structure, including the supports and foundations, as well as all details necessary to fabricate and erect the sign structures. The EOR is also responsible for the shop drawing review in accordance with ***FDM 152*** when sign structure shop drawings are required by the Contract Documents.

FDOT assigns identification numbers to overhead sign structures. See the ***Structures Detailing Manual*, *Chapter 2***, for instructions.

Use FDOT standard overhead sign support structures whenever possible. Only use custom (non-standard) overhead sign support structures as a last resort solution. If a custom overhead sign support structure is required:

- Provide a brief written justification for its use.
- Coordinate the proposed design and details early in the plan development process with the District Structures Design Engineer.

Modification for Non-Conventional Projects:
Delete the last sentence above and replace with the following: Use of a custom (non-standard) overhead sign structure is not permitted unless otherwise shown in the RFP.

261.3 Lighting Support Structures

Use the applicable ***Standard Plans*** for the following lighting support structures:

- ***Index 715-010*** High Mast Lighting,
- ***Index 715-002*** Standard Aluminum Lighting.

Refer to the corresponding ***SPI*** for design information.

261.4 Traffic Signal Support Structures

Use the applicable ***Standard Plans*** for the following traffic signal support structures:

- ***Index 649-010*** Steel Strain Poles,
- ***Index 641-010*** Concrete Poles,

- ***Indexes 649-030*** and ***649-031*** Mast Arm Assemblies.

Refer to the corresponding ***SPI*** for design information.

See ***FDM 232*** for determining which locations require mast arms.

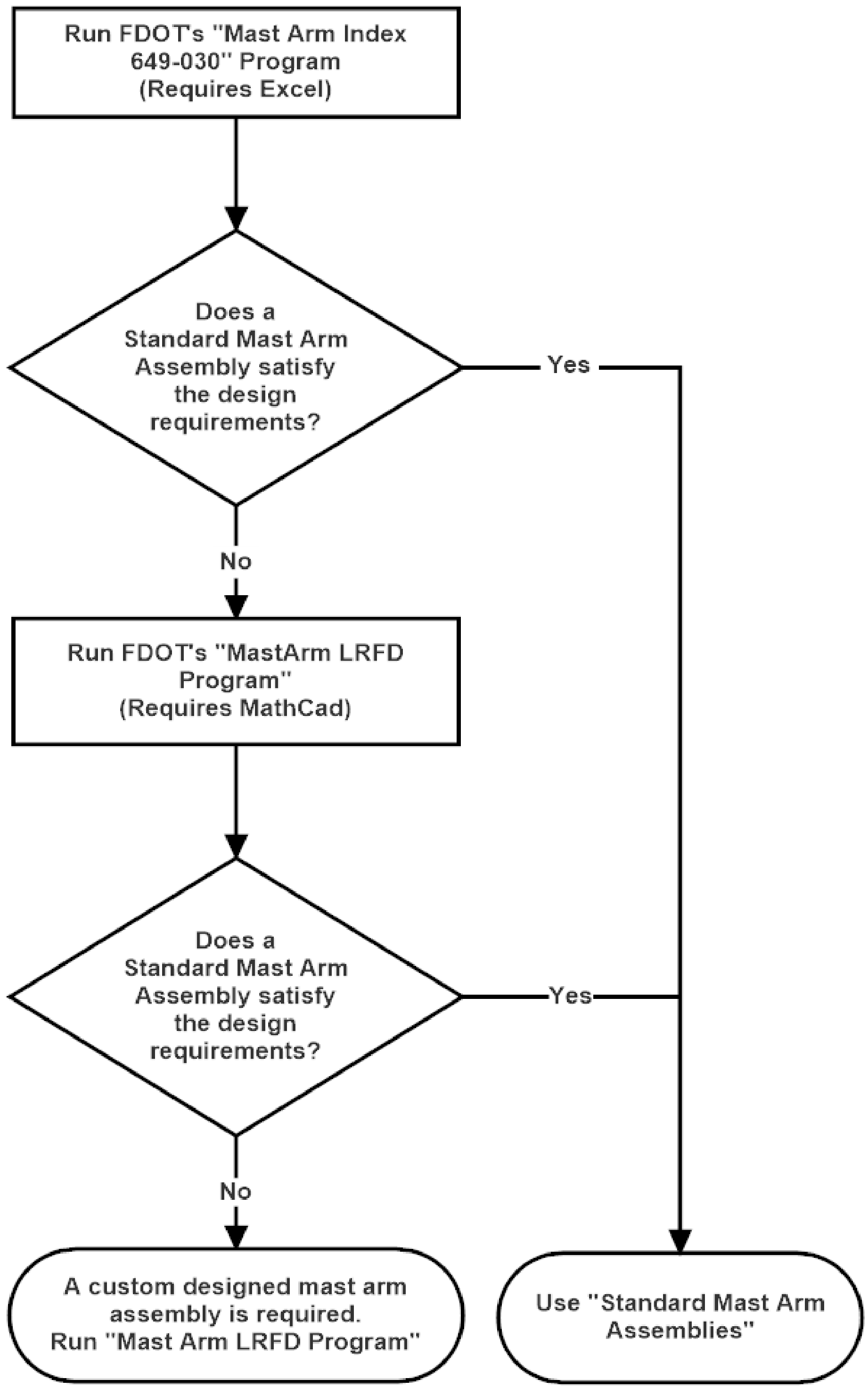
Design all structures assuming traffic signal assemblies have rigid backplates in accordance with ***FDM 232.1.5***

Span wire systems have two strain pole options, rectangular prestressed concrete and round steel. Round steel poles are typically used on longer spans where prestressed concrete poles do not have the required capacity.

For attaching Free-Swinging, Internally Illuminated Street Sign Assemblies, see ***Standard Plans Index 700-050***.

Mast Arm Assemblies may be Standard Mast Arm Signal Structures, Standard Mast Arms for Site-Specific Loadings or Custom Designs. Use the Flowchart in ***Figure 261.4.1*** to determine which type of Mast Arm design is suitable for the particular application. See ***Standard Plans, Indexes 649-030*** and ***649-031,*** and their ***SPI.***

Figure 261.4.1 Flowchart for Designing Mast Arm Assemblies



261.5 ITS Support Structures

Use the applicable ***Standard Plans*** for the following ITS support structures:

- ***Index 649-020*** Steel CCTV Poles,
- ***Index 641-020*** Concrete CCTV Poles,
- ***Indexes 700-040*** and ***700-041*** Cantilever and Span Sign Supports to support Dynamic Message Signs (DMS). For additional DMS details, see ***Standard Plans***, ***Index 700-090*** Dynamic Message Sign Walk-In.

Refer to the corresponding ***SPI*** for design information.

Refer to the ***Structures Manual, Volume 3*** for Dynamic Message Sign Structure design requirements.

261.6 Tolling Support Structures

Refer to the ***General Tolling Requirements (GTR)*** for the design of tolling support structures.

261.7 Foundations

Unique site circumstances may require the foundation variables to be modified from the foundations shown in the ***Standard Plans***. If custom designs are required, the Geotechnical Engineer must provide the soil information to be used by the EOR during the design phase of the project.

The foundation design and drawings where special foundations are required are the responsibility of the EOR. The Geotechnical Engineer must provide the EOR the following soils information (this information may be derived from the borings of other nearby structures or from roadway borings):

(1) Soil Type and SPT-N value

(2) Effective Unit Weight of the Soil

(3) Design High Water Table Level

(4) Effective Friction Angle of the Soil (if applicable)

(5) Cohesion Value (if applicable)

(6) Coefficient of Horizontal Subgrade Reaction

(7) Factored Bearing Resistance (if applicable)

Include the above soils information in the plans. Additionally, Soil Boring Data Sheets must be included in the plans, except for strain poles. This will provide the Contractor with the conditions for which the foundations were designed as compared to actual on-site conditions and establish criteria for any future analysis of the foundations.

261.8 Evaluating Existing Ancillary Structures

Evaluate existing ancillary structures within the project limits in accordance with this section to produce the Ancillary Structures Report as described below in ***FDM 261.8.4***.

When only retrofitting ‘flexible’ backplates to existing mast arm or span wire signals, see the ***Traffic Engineering Manual*** ***(TEM), Section 3.9***.

261.8.1 Condition Evaluation

Perform a Condition Evaluation for ancillary structures that have a proposed change in loading conditions or are proposed for relocation. A Condition Evaluation is a physical and functional assessment that includes inventory of attachments, damage, deterioration, or other potential defects that may cause a reduction in service life or design capacity. Coordinate with the District Structures Design Engineer (DSDE) and District Structures Maintenance Engineer (DSME) prior to performing the Condition Evaluation. Consider the findings of the Condition Evaluation and how the condition may affect the structural capacity of the ancillary structure, paying special attention to items added after initial construction and changes to the structure’s section properties. Based on the findings, determine if a detailed structural analysis is required in coordination with the DSDE.

Sources for as-built plans include ***ProDo*** (ProDo is accessible to FDOT staff only), the District Maintenance Office, and District Design Office.

261.8.2 Existing Ancillary Structures to Remain In-Place

When adding new or modifying existing attachments to existing ancillary structures, mitigation strategies should be used to reduce additional structural loading to the extent practicable. For example, some mitigation strategies could include:

- Relocating street name signs, no right turn on red signs, or other attachments to the mast arm upright or closer to the base of the arm.
- Shifting location of existing signals closer to the mast arm upright while maintaining tolerance for lane alignment

- Replacing existing rigid signal backplates with flexible backplates
- Replacing existing attachments with lighter/smaller devices that provide the same/similar function and meet MUTCD minimum requirements

261.8.2.1 Determination of need for Detailed Structural Analysis

A detailed structural analysis of an existing ancillary structure is not required for replacing attachments in-kind (e.g., same or less critical location on the structure; same or less weight or size/EPA) unless warranted by the findings of the Condition Evaluation.

A detailed structural analysis may not be required when adding, modifying, or replacing attachments as described in the following for each ancillary structure type. For these cases, provide a justification in the Ancillary Structures Report. The one-time allowance for additional loads/areas herein are for all attachments in excess of the original design configuration throughout the life of the structure.

Commentary: *In some cases, the benefit of adding safety devices to existing structures may outweigh the potential risk of structural failures during the design extreme event limit state. The Department has determined that some level of risk is acceptable to improve safety and replacement of a slightly overstressed ancillary structure based on an extreme high-wind event is not desirable.*

- **Lighting Structures:**

  Fixtures may be replaced with those having a similar Effective Projected Area (EPA, typically provided by the manufacturer) without detailed structural analysis. The total EPA of all fixtures on the structure must not increase by more than 10% above the documented design EPA (e.g., from Standard Plans Instructions, shop drawings, etc.). If the documented design EPA is not available, use the total existing fixture EPA. Otherwise, perform a detailed structural analysis as described below.

- **Service or CCTV Poles:**

  A total area for existing and proposed attachments of less than 6 square feet may be attached to the upright/vertical pole without detailed structural analysis. For standard CCTV camera support structures, see the ***Standard Plans Instructions*** for ***Index 641-020*** (Concrete CCTV Pole) and ***Index 649-020*** (Steel CCTV Pole) for additional loading allowed for future operating needs without a detailed structural analysis. Otherwise, perform a detailed structural analysis as described below.

- **Span and Cantilever Overhead Sign Structures:**

  Sign panel modifications that comply with the original design (e.g., design has already accounted for future panels) do not require a detailed structural analysis. A total area of less than 6 square feet for existing and proposed attachments (other than sign panels) may be attached without detailed structural analysis. Otherwise, perform a detailed structural analysis as described below.

- **Tolling Structures:**

  A total area of less than 6 square feet for proposed attachments (sign panels may not be attached to tolling structures) may be attached without detailed structural analysis. Otherwise, perform a detailed structural analysis as described below.

- **Strain Pole Structures:**

  Additional devices attached only to the vertical upright with a total area of less than or equal to 18 square feet and a total weight less than or equal to 145 pounds, no structural capacity analysis is required. Otherwise, perform a detailed structural analysis as described below.

  <u>Commentary</u>: *The size and weight limits of the additional devices are roughly based on the maximum allowable for internally illuminated street name signs per **Standard Specifications** **700**.*

- **Standard Mast Arm Structures:**

  A "Standard Mast Arm" support structure is one that has previously been, or is currently, included in the ***FDOT Design Standards*** or ***FDOT Standard Plans*** regardless of the publication dates. These structures should contain an Identification Tag specifying the Arm Type which can be used to determine the moment capacity of the horizontal support members. The Arm Type or Identification Tag may be noted in the Department's Bridge Management System (BrM). For structures without an Identification Tag, use the criteria below for Non-Standard Mast Arm Structures.

  <u>Commentary</u>: *The Identification Tag is typically located under the handhole cover or terminal compartment cover plate. Access to the handhole cover or terminal compartment should be coordinated with the District Maintenance Office.*

For Standard Mast Arm support structures with additional devices attached only to the vertical upright with a total area of less than or equal to 18 square feet and a total weight less than or equal to 145 pounds, no analysis is required.

*Commentary: The size and weight limits of the additional devices are roughly based on the maximum allowable for internally illuminated street name signs per **Standard Specifications** **700**.*

For Standard Mast Arm support structures with additional loading on the horizontal member that produces a flexural demand/capacity ratio less than or equal to 1.10, no further analysis is required. Use the ***FDOT*** ***Mast Arm Evaluation Program*** to determine the flexural demand/capacity ratio of the horizontal member.

For Standard Mast Arm support structures with flexural demand/capacity ratios at the base of the horizontal member greater than 1.10, perform a detailed structural analysis.

- **Non-Standard Mast Arm Structures:**

For non-standard Mast Arm structures or those without an Identification Tag, the original as-built plans should be obtained to determine the original configuration of the attachments.

For non-standard Mast Arm support structures with additional devices attached only to the vertical upright with a total area of less than or equal to 18 square feet and a total weight less than or equal to 145 pounds, no analysis is required (see Commentary above).

For non-standard Mast Arm support structures with additional loading (as compared to the configuration of the attachments in the original as-built plans) on the horizontal member that produces an increase in the moment at the base of the horizontal member of less than or equal to 10%, no further analysis is required. Use the ***FDOT*** ***Mast Arm Evaluation Program*** to determine percentage increase in moments at the base of the horizontal member.

For non-standard Mast Arm support structures with an increase in moment at the base of the horizontal member greater than 10%, perform a detailed structural analysis.

261.8.2.2 Detailed Structural Analysis

When a detailed structural analysis is required, evaluate the capacity of the structure in accordance with the ***Structures Manual**, **Volume 3, Section 18.1***. Report the Demand/Capacity (D/C) ratios, Stress Ratios (SRs), and Combined Force Interactions (CFIs). If all D/C ratios, SRs, and CFIs are less than or equal to 1.10, the existing structure may remain without processing a Design Variation or Design Exception. The DSDE must review the detailed structural analysis and provide final direction to either allow the existing structure to remain, strengthen the existing structure, or replace the structure. For projects not in a typical design-bid-build or design-build contract (e.g., permit, push-button, safety), consult the District Traffic Operations Engineer (DTOE) instead of the DSDE. Obtain concurrence from the DSME. The DSME must document the DSDEs or DTOEs decision in BrM.

Contact the DSDE for guidance on a detailed structural analysis for existing ancillary structures without plans, shop drawings, foundation depths, or design calculations.

261.8.3 Existing Ancillary Structures to be Relocated

Perform a Condition Evaluation and detailed structural analysis for all ancillary structures to be relocated.

261.8.4 Ancillary Structures Report

Produce an Ancillary Structures Report including the following:

- Listing of ancillary structures within the project limits including the proposed disposition (e.g., remain in place, relocated, replaced, removed)
- Condition Evaluation (if required)
- Justification for when a detailed structural analysis is not required
- Detailed structural analysis (if required)
- Documentation of any required remedial actions
- Other items as specified by the District

Submit the Ancillary Structures Report to the DSDE and the DSME. The Ancillary Structures Report will be stored in PSEE.

262 Retaining Walls

262.1 General

This chapter describes the procedure to be used in the development of retaining wall plans. This chapter should be used in conjunction with the ***Structures Design Guidelines (SDG)***, ***Structures Detailing Manual (SDM)***, and the applicable ***Standard Plans Instructions (SPI)***.

See ***FDM 215*** for guidance on roadside barrier requirements and ***SDG, Chapter 6*** for retaining wall mounted traffic railing requirements. See ***FDM 222*** for pedestrian and bicycle rail requirements. See ***SDG***, ***Section 1.4.5*** for the policy on retaining wall surface finishes.

Precast walls other than Mechanically Stabilized Earth (MSE) walls should be considered as an alternate when sufficient room for soil reinforcement is not available.

Standard Plans, Index 400 Series, 455 Series, 548 Series, and ***Indexes 521-600*** through ***521-640,*** contain general notes and common details for retaining walls. See the applicable ***SPI*** for information on the use of these standards.

Using the site-specific geotechnical information, the structures Engineer of Record (EOR), in cooperation with the Geotechnical Engineer, will determine the appropriate wall type and its requirements. See the ***SDG***, ***Section 3.12*** for the Permanent Retaining Wall Selection Process.

For retaining walls greater than 5 feet in height, provide a 10-foot maintenance area (1:10 or flatter) in front of the wall face with suitable access for maintenance vehicles. See ***Structures Design Guidelines (SDG)***, ***Section 3.12*** for information regarding partial height walls. See ***FDM 210.6*** for additional roadside slope information.

The following sections refer to the structures plans submittal procedure. For projects where there are no bridges, the roadway EOR must adjust the procedure as required for the roadway project.

262.2 Retaining Wall Plans Submittal Procedures

On projects with retaining wall types not listed on the APL (C-I-P wall systems, permanent concrete and steel sheet pile walls, soldier pile walls, non-proprietary precast wall systems, complex wall systems, or project specific designs), the complete wall design and details are included in the plans by the EOR.

On projects with proprietary retaining wall systems listed on the ***APL***, the EOR provides the Wall Control Drawings and the appropriate wall systems Data Tables in the plans. The EOR selects which FDOT Wall Type (see the ***SDG, Section 3.12***) is appropriate for the project and places this information in the notes associated with the Data Tables. The Contractor then selects the ***APL*** listed retaining wall system to build based on the allowable wall types shown in the notes associated with the Data Tables and on the ***Standard Plans***. Proprietary retaining walls require shop drawings in accordance with ***FDM 152***.

Proprietary retaining wall design plans are not required in the contract plans for normal wall projects (see ***FDM 262.2.2***). If the proprietary walls are two-phased, include generic details for attaching the permanent facing (second phase) to the primary reinforcement in the contract set. If spatial limitations require project specific details, or the wall is subject to unusual geometric or topographic features, include project specific details in the contract set. If the proprietary wall is experimental, it is required to have fully detailed design plans in the contract set (see ***FDM 262.2.3***).

Provide an analysis with the 60% Structures Plans Submittal meeting the requirements of ***SDG 7.8*** when an existing MSE wall with metallic soil reinforcement will be widened or modified on a construction project and the existing soil reinforcement provides resistance for the proposed configuration. For wall projects without bridges, provide the analysis with the Phase II Submittal.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: Unless otherwise shown in the RFP, provide an analysis with the 90% Submittal meeting the requirements of ***SDG*** 7.8 when an existing MSE wall with metallic soil reinforcement will be widened or modified on a construction project and the existing soil reinforcement provides resistance for the proposed configuration.

Prior to construction on projects utilizing proprietary wall systems, the contractor will submit, for approval by the EOR, shop drawings that are based on an ***APL*** listed wall system that is shown in the plans. Site-specific details for the wall construction will be included in these shop drawings.

The success of these methods for producing wall plans is highly dependent on complete, accurate and informative Control Plans. The importance of the Geotechnical Engineer's role in this scheme cannot be emphasized enough and is detailed in the ***Soils and Foundation Handbook*, Chapters 3, 8, and 9**.

The Geotechnical Engineer's wall type recommendation must be presented in a report together with the results of field and laboratory testing and the reasoning for the recommendation. For Proprietary Walls, also include the following: external stability analyses, minimum soil reinforcement length vs. wall height for external stability, recommended soil reinforcement type limitations if any (e.g., synthetic vs. steel), maximum bearing pressure for each wall height and soil reinforcement length for each different wall height (2-foot increments).

The normal failure modes to be investigated are shown in ***SDG*, Chapter 3**.

Procedures for developing retaining wall plans follow.

262.2.1 Non-Proprietary Retaining Walls

(1) Bridge Development Report (BDR) / 30% Plans:

The BDR must discuss and justify the use/non-use of non-proprietary retaining walls. If the use of these retaining walls is applicable to the site and economically justified, it may be the only design required or it may be an alternate to a proprietary design. Include Wall Control Drawings (as specified in the ***SDM*, Chapter 19**), cross sections, details and general notes in the 30% Plans submittal. Denote the location of drainage inlets, utilities, sign structures, lights, and barrier joints in the plans. See the ***SDM*, Chapter 19** for more information.

(2) 30% Plans:

The 30% Plans must be submitted for approval and development of the plans continued towards the 90% Plans submittal.

(3) 90% Plans:

The 90% Plans submittal must be further developed to include, in addition to the information required for the 30% Plans, information listed in the ***SDM*, Chapter 19**.

Modification for Non-Conventional Projects:

Delete ***FDM 262.2.1*** and replace with the following:

262.2.1 Non-Proprietary Retaining Walls

See ***SDG***, ***Section 3.12*** for wall selection requirements. Include Wall Control Drawings (as specified in the ***SDM, Chapter 19***), cross sections, complete wall details and general notes in the Component Plans submittal. Denote the location of drainage inlets, utilities, sign structures, lights and barrier joints in the plans. See the ***SDM, Chapter 19*** for more information.

262.2.2 Proprietary Wall Systems Where Full Design Details Are Not Required In Contract Plans

Preapproved Vendor Drawings for proprietary wall systems are listed on the ***APL*** and are categorized in accordance with the applicable FDOT Wall Type(s). Utilize these drawings with the applicable standard(s) and Data Tables. Do not include the Vendor Drawings in the plans.

Use the following procedure in preparing plans for wall projects.

(1) BDR/30% Plans:

Discuss and justify the use of proprietary retaining walls and FDOT Wall Types (see ***SDG, Section 3.12***) in the BDR. Provide documentation of all the site-specific geotechnical information and wall system considerations in the Retaining Wall Justification portion of the BDR. Include the Retaining Wall System Data Tables and Preliminary Wall Control Drawings with the information shown in ***SDM, Chapter 19*** for the Plan and Elevation Sheets.

(2) 60% Plans/Phase II Roadway Submittal:

For bridge projects requiring project specific details for proprietary wall systems, include the project specific details in the 60% Plans Submittal. For wall projects without bridges, project specific details must be included in the Phase II Submittal.

(3) 90% Plans/Phase II Roadway Submittal:

Include the completed Wall Control Drawings, project specific details and Data Tables in the 90% Plans Submittal.

Modification for Non-Conventional Projects:

Delete ***FDM 262.2.2*** and replace with the following:

262.2.2 Proprietary Wall Systems Where Full Design Details Are Not Required In Contract Plans

Preapproved Vendor Drawings for proprietary wall systems are listed on the ***APL*** and are categorized in accordance with the applicable FDOT Wall Type(s). Utilize these drawings with the applicable standard(s) and Data Tables. Do not include the Vendor Drawings in the plans.

Using site-specific geotechnical information, the EOR, in cooperation with the geotechnical engineer, will determine all wall system requirements. See ***SDG 3.12*** to determine appropriate FDOT Wall Type. Include Wall Control Drawings, project specific details, and Data Tables in the Component Plans submittal, as specified in the ***SDM, Chapter 19***. Denote the location of drainage inlets, utilities, sign structures, lights and barrier joints in the plans. See the ***SDM, Chapter 19*** for more information.

262.2.3 Proprietary Wall Systems Where Full Design Details Are Required In Contract Plans

The following procedure for plans preparation should be followed if the walls are required to be fully detailed in the contract plans.

(1) BDR/30% Plans:

The BDR must discuss and justify the use of proprietary retaining walls. Include Wall Control Drawings in the 30% Plans. It will not be necessary for these Plans to contain pay items; however, they must include, but not be limited to, the information listed in the ***SDM, Chapter 19***.

(2) Control Plans/Invitation Package:

The Control Plans must be reviewed by the Department and, upon approval, sent to all the appropriate wall companies. Provide a set of control plans, roadway plans and foundation report to the wall companies no later than by the 60% Plans submittal. A copy of the transmittals to the wall companies must be sent to the DSDO or SDO as appropriate. The proprietary companies must acknowledge receipt of the invitation package. If they choose to participate they must provide design plans for the retaining walls and submit the plans for review as prescribed in the invitation letter.

(3) 90% Plans:

Upon receipt of the proprietary design plans, the designer must review the design and incorporate the wall plans into the contract set. The plans from the wall companies, control plans and wall company standard drawings must constitute the 90% Plans.

Modification for Non-Conventional Projects:
Delete ***FDM 262.2.3*** and replace with the following: **262.2.3 Proprietary Wall Systems Where Full Design Details Are Required In Contract Plans** Using site-specific geotechnical information, the EOR, in cooperation with the geotechnical engineer, will determine wall system requirements. See ***SDG 3.12*** to determine appropriate FDOT Wall Type. The Design-Build EOR must coordinate with one of the vendors with approved wall drawings on the ***APL*** to prepare fully detailed project specific proprietary drawings for inclusion into the Component Plans. Include Wall Control Drawings and Data Tables (in accordance with ***SDM, Chapter 19***) in the Component Plans submittal. Denote the location of drainage inlets, utilities, sign structures, lights and barrier joints in the plans. See the ***SDM, Chapter 19*** for more information.

262.2.4 Critical Temporary Walls

A critical temporary wall is a temporary wall that is necessary to maintain the safety of the traveling public, or structural integrity of nearby structures or utilities during construction. Traffic lanes located either above or below a grade separation and within the limits shown in ***SDM, Chapter 19***, will require the design of a critical temporary wall.

On bridge projects, discuss the use of, and selected type of, critical temporary walls in the BDR.

Modification for Non-Conventional Projects:
Delete the above sentence.

Typically, critical temporary walls are either proprietary MSE walls or steel sheet pile walls. Concrete sheet piles, soldier pile walls and precast or cast-in-place concrete walls may also be used as critical temporary walls.

Critical temporary proprietary MSE walls must comply with ***Standard Plans*, *Index 548-030*** (and the applicable ***SPI***) and require generic design details in the contract plans. The plans format must be in accordance with ***FDM 262.2.2*** and ***FDM262.2.3***. Include control drawings and the completed Temporary Retaining Wall System Data Tables. Submit the final design details in the shop drawings.

If critical temporary steel sheet pile walls are used, complete the associated Data Table and include it in the plans. See the ***Structures Detailing Manual*** for more information including critical temporary wall definitions.

If other types of critical temporary walls are used, prepare the necessary details and include them in the plans.

263 Geosynthetic Design

263.1 General

This chapter provides design guidance for geosynthetic reinforced soil slopes and geosynthetic reinforced foundations over soft soils. "Geosynthetic" is a generic term for all synthetic materials used in Geotechnical engineering applications and includes geotextiles and geogrids.

Reinforced soil slopes should be utilized only when unreinforced slopes are not appropriate and retaining walls are not economical or are undesirable. ***FDM 215*** contains design criteria for the use of roadside slopes.

Reinforced foundations over soft soils should be utilized when the existing soils are too weak to support the anticipated loading without soil failure, and when excavation and replacement (or other ground modification methods) are not economical solutions.

Approved geosynthetic products are included in the ***Approved Products List*** (***APL***).

263.2 Contract Plans Content

Provide the geosynthetic application type and specific requirements to ensure the geosynthetic selected from the ***APL*** will be suitable. Refer to ***Standard Specification 985*** to determine which test values will be available for selecting the products for each application from the ***APL***.

Control drawings are required which depict the geometrics (plan and elevation view) of the area being reinforced. These designs are generic and are not based upon any one specific product or supplier; the product brand names are not shown on the plans. Design reinforced slopes using the maximum reinforcement spacing allowed. For soft soils, design the reinforcement and provide the minimum total strength required.

Include the following information in the plans:

- Required reinforcement strength based on the maximum allowed vertical spacing of these materials,
- The extent and the number of layers of geosynthetic reinforcement,
- Vertical spacing of geosynthetic reinforcement,
- Orientation of geosynthetic,

- Facing details,
- Details at special structures or obstructions,
- Typical construction sequence,
- Top and bottom elevations of the geosynthetic reinforcement layers,
- Surface treatments, and
- Any other required design parameters or limitations.

263.3 Shop Drawings and Redesigns

The contractor can choose to construct the reinforced soil structures either by: (1) using geosynthetic materials approved for the intended application in the ***APL*** meeting or exceeding the strength required in the plans and placed at or less than the spacing(s) shown in the plans, or (2) submitting an alternate design (redesign) which optimizes the use of a specific material and revises the material spacing within the limits contained in the design methodology in ***FDM 263.4****.* Redesigns may be optimized for backfill specific material properties verified prior to the redesign or based on generic properties which must be verified prior to backfill placement. All designs must meet the design methodology requirements contained in ***FDM 263.4***.

Modification for Non-Conventional Projects:
Delete the first sentence of the above paragraph and replace with the following: Construct the reinforced soil structures using geosynthetic materials approved for the intended application in the ***APL*** meeting or exceeding the strength required in the plans and placed at or less than the spacing(s) shown on the Plans.

The shop drawing reviewer must be familiar with the requirements, design and detailing of these systems. The review must consist of but not limited to the following items:

(1) Verify horizontal and vertical geometry with the contract plans.

(2) The soil reinforcement must be approved for the intended application in the ***APL***.

(3) The soil reinforcement design values do not exceed the values in the ***APL***.

(4) Verify that the material strengths and number of layers of the product selected meets or exceeds the design shown in the contract plans.

(5) Soil properties for the fill material chosen by the contractor must meet or exceed those used in the design shown in the Contract Plans.

(6) If a redesign is proposed, verify the design meets the requirements of ***FDM 263.4*** and the Contract Plans, and the soil properties for the fill material chosen by the contractor meets or exceeds those used in the redesign.

See ***Standard Specifications*** ***Section 145*** for requirements associated with Contractor initiated redesigns.

263.4 Geosynthetic Reinforcement Design Considerations

Only those geosynthetic products approved for usage on reinforced soil slopes in the ***APL*** are eligible for use on FDOT projects. Design the geosynthetic reinforced systems using comprehensive stability analyses methods that address both internal and external stability considerations by a Florida licensed Professional Engineer who specializes in Geotechnical engineering.

263.5 Geosynthetic Reinforcement Design Requirements

Use the following design guidelines and requirements for the analyses and design of geosynthetic reinforcement:

(1) **Performance:** The design resistance factors must cover all uncertainties in the assumptions for the design limit state. The resistance factors must not exceed the following:

- (a) 0.65 against pullout failure.
- (b) 0.65 against sliding of the reinforced mass.
- (c) 0.75 against external, deep-seated failure.
- (d) 0.65 against external, deep-seated failure when supporting a structure.
- (e) 0.75 against compound failure; i.e., failure through the reinforcement.
- (f) 0.75 against internal failure.
- (g) 0.75 against local bearing failure (lateral squeeze).

(2) **Nominal Tension Resistance of Reinforcement:** The maximum long-term reinforcement tensile resistance of the geosynthetic must be:

$$T_a = \frac{T_{ult}}{RF_c RF_d \, CRF}$$

Where:

T_a = The nominal long-term reinforcement tensile resistance.

T_{ult} = The ultimate strength of a geosynthetic in accordance with ***ASTM D 6637*** for the reinforcement oriented normal to the slope.

RF_c = Reduction factor for installation damage during construction for the appropriate fill material (sand or lime rock).

RF_d = Reduction factor for durability (due to Chemical or Biological degradation).

CRF = Creep reduction factor. (T_{ult}/T_{creep})

T_{creep} = Serviceability state reinforcement tensile load based on minimum 10,000-hour creep tests.

These reinforcement specific parameters can be found in the ***APL***.

For applications involving reinforcing slopes with geosynthetic, the minimum design life is 75 years.

(3) **Soil Reinforcement Interaction:** Friction reduction factors are presented as Soil-Geosynthetic Friction values in the ***APL*** for each approved geosynthetic product.

263.6 Geosynthetic Reinforcement Design Guidelines

These design guidelines are excerpted from the FHWA Publications (a) ***FHWA GEC 011*** (***FHWA-NHI-10-024*** & ***FHWA-NHI-10-025***), "***Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes-Volumes 1 & 2***", and (b) ***No. FHWA HI-95-038***, "***Geosynthetic Design and Construction Guidelines***". Designers should refer to these publications for further details.

(1) **Reinforced Slope** - see reference (a) ***FHWA GEC 011***.

Step 1. Establish the geometry and loading - see ***Figure 263.6.1***.

Step 2. Determine the engineering properties of the in-situ soils.

Step 3. Determine the properties of the reinforced fill and the retained fill.

Use the following default values for fill soil within the reinforced volume when the fill material source is not known:

For sand fill: $\varphi = 30°$, $\gamma = 105$ pcf, $c = 0$;

For crushed lime rock fill: $\varphi = 34°$, $\gamma = 115$ pcf, $c = 0$.

Step 4. Evaluate design parameters for the reinforcement.

Step 5. Check unreinforced slope stability.

Step 6. Design reinforcement to provide a stable slope.

Step 7. Check external stability and service limit state deformations.

Step 8. Evaluate requirements for subsurface and surface water runoff control.

(2) **Reinforced Foundation over Soft Soils** - see reference (b) ***FHWA HI-95-038.***

Step 1. Define embankment dimensions and loading conditions - see ***Figure 263.6.2***.

Step 2. Establish the soil profile and determine the engineering properties of the foundation soil.

Step 3. Obtain engineering properties of embankment fill materials.

Step 4. Establish appropriate resistance factors and operational settlement criteria for the embankment.

The resistance factors must not exceed the following:

(a) 0.65 against bearing failure of subsoil

(b) 0.65 against pullout failure in select soil

(c) 0.50 against pullout failure in plastic soil

(d) 0.65 against lateral spreading (sliding) of the embankment

(e) 0.75 against external, deep-seated failure at the end of construction

(f) 0.65 against external, deep-seated failure at the end of construction, when supporting a structure.

(g) 0.65 against tensile failure of the reinforcement

Settlement criteria: depends upon project requirements

Step 5. Check bearing capacity, global stability (both short and long term), and lateral spreading stability.

Step 6. The geosynthetic reinforcement should be designed for strain compatibility with the weak in-situ soil.

Based on the type of weak in-situ soil, the maximum design strain in the geosynthetic ($\varepsilon_{geosynthetic}$) is as follows:

Cohesionless soil: $\varepsilon_{geosynthetic}$ = 5%*

Cohesive soils: $\varepsilon_{geosynthetic}$ = 5%*

Peat: $\varepsilon_{geosynthetic}$ = 10%*

* For all cases, limit $\varepsilon_{geosynthetic}$ to the strain at failure minus 2.5%

Step 7. Establish geosynthetic strength requirements in the geosynthetic's longitudinal direction.

Step 8. Establish geosynthetic properties.

Step 9. Estimate magnitude and rate of embankment settlement.

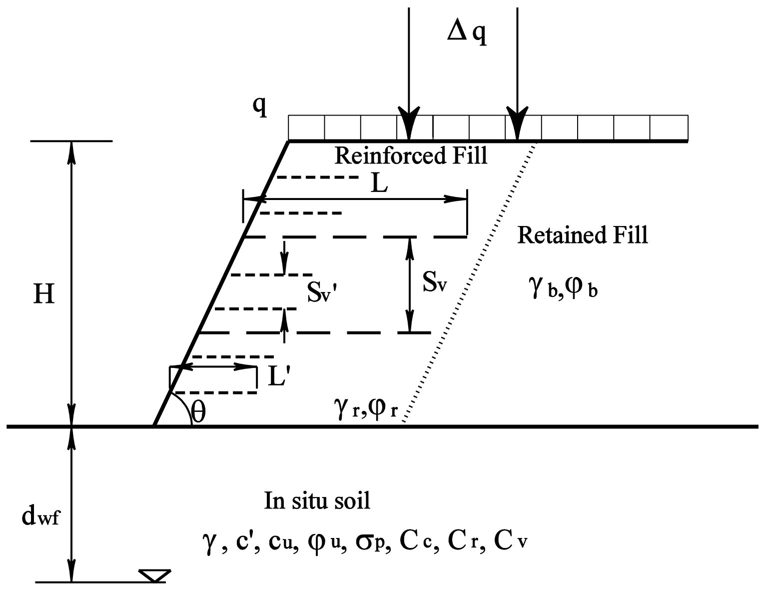
Step 10. Establish construction sequence and procedures.

Include all stages of construction. Base the analysis of each stage on the estimated strength of the subsoils at the end of the previous construction stage.

Step 11. Establish construction observation requirements.

Use instrumentation such as settlement plates, piezometers, and/or inclinometers to monitor the performance of the construction. Establish the monitoring criteria, such as the maximum rate of piezometric and/or settlement change that must occur before the next stage of construction can proceed.

Figure 263.6.1 Geosynthetic Reinforced Soil Slopes



Notations: H = slope height

θ = slope angle

L = length of primary reinforcement

L' = length of secondary reinforcement, 4' minimum

S_v = vertical spacing between primary reinforcements, 4' maximum

S_v' = vertical spacing between secondary reinforcements, 1' maximum

q = surcharge load

Δq = temporary live load

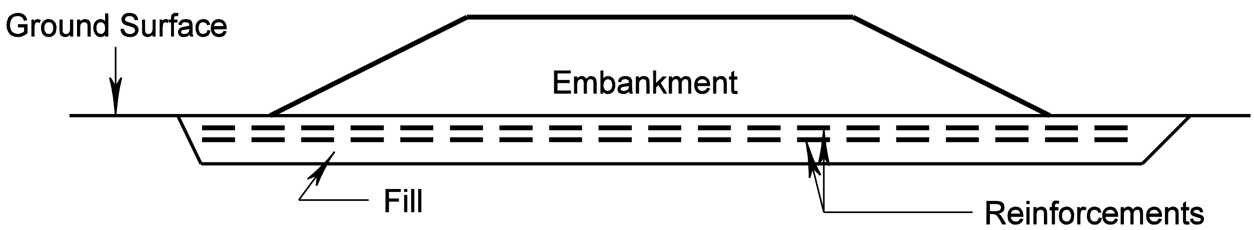
d_{wf} = depth to groundwater table in foundation

γ_r, γ_b, γ = unit weights of soils in reinforced, retained and foundation, respectively

φ_r, φ_b, φ = friction angles of soils in reinforced, retained and foundation, respectively

c', c_u = cohesion strength parameters of foundation soil

Figure 263.6.2 Geosynthetic Reinforced Foundations over Soft Soils



(1) The spacing between any two reinforcements must be 6 to 12 inches.

(2) Extend the reinforcement layer(s) below the embankment to 3 feet beyond the toe of slope or the development length required to resist pullout, whichever is longer.

(3) Additional layers of reinforcement may be added below or within the embankment.

264 Noise Walls and Perimeter Walls

264.1 General

Noise abatement measures identified as reasonable and feasible during the PD&E phase are re-evaluated during final design based on detailed design data and the public involvement process. This chapter contains the process for the final noise wall analysis, reasonableness and feasibility determinations, design and public involvement concerning noise abatement during the development of the contract plans.

This chapter also contains the process for the consideration, design, and incorporation of perimeter walls in the contract plans.

264.2 Noise Walls

Chapter 23 of the ***Code of Federal Regulations, Part 772 (23 CFR 772)*** entitled ***"Procedures for Abatement of Highway Traffic Noise and Construction Noise"*** contains the federal regulations for the assessment of traffic noise impacts and abatement on federal aid projects. ***Section 335.17*** of the ***Florida Statutes*** (***F.S.***) requires the use of ***23 CFR 772*** for traffic noise impact assessment on highway projects, regardless of funding type. The policy for abatement of traffic noise on Department projects and the requirements for assessing the noise impacts and abatement commitments are detailed in FDOT's Noise Policy (***Part 2, Chapter 18*** of the ***Project Development and Environment Manual (PD&E Manual) (Topic No. 650-000-001)***. The initial evaluation of noise impacts is made during the PD&E phase of a project. A commitment to perform a detailed noise analysis during final design to support the need for reasonable and feasible noise abatement measures on a project are included in the Noise Study Report (NSR) and summarized in the Environmental Document. Review the Environmental Document and any subsequent re-evaluations to identify all preliminary noise abatement commitments.

Noise abatement commitments made during the PD&E phase are subject to design changes made during final design, such as:

(1) Roadway profiles and horizontal alignments

(2) Typical section elements

(3) Land use changes

(4) Proposed ground elevation at noise wall locations.

PD&E assumptions are appropriate for preliminary reasonableness and feasibility assessment; however, the final determinations concerning noise abatement are based on the contract plans developed during final design. Coordinate with the District Noise Specialist in the District Environmental Management Office to ensure proper analysis and public involvement occurs. Final top of noise wall elevations should be based on modeled heights and coordinated with the District Noise Specialist.

Modification for Non-Conventional Projects:
Delete the above two paragraphs and replace with the following: See the RFP for noise wall requirements. If an Alternative Technical Concept proposes changes to the horizontal or vertical alignments depicted in the Concept Plans, any associated required changes to the noise wall locations must also be addressed. Any modifications or additions to noise wall location and height requirements depicted in the RFP must be approved by the Department based on the information from a Noise Study Report Addendum (NSR Addendum) provided by the Design-Build Firm. The Design-Build Firm must coordinate with the noise specialist in the District Environmental Management Office to ensure proper public involvement occurs during final design. Changes will trigger a re-evaluation, which must be approved by the Department.

If no feasible and reasonable noise abatement is identified in the Environmental Document or any subsequent environmental re-evaluations, no further effort is required during final design unless design changes are made that may affect noise impacts. However, it is still necessary to evaluate construction noise and vibration impacts and develop any Special Provisions to be included in the plans.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: If noise walls are not specified in the RFP, no further effort is required during final design. If design changes are proposed, a reevaluation of traffic noise and abatement reasonableness and feasibility shall be performed. Evaluate construction noise and vibration impacts and develop the necessary Special Provisions to be included in the plans.

Consider all noise receptors identified in the Environmental Document and NSR in the final design re-evaluation. Noise receptors resulting from development completed after the approval date of the Environmental Document (Date of Public Knowledge) are not to be considered, as the Department is not responsible for providing noise abatement at these sites.

During final design:

(1) Re-evaluate noise abatement identified as reasonable and feasible during the PD&E phase based on detailed design data or changes made during the development of final plans.

(2) Evaluate locations where significant design changes are likely to affect noise impacts and require consideration of additional noise abatement.

Document the final noise abatement measures for the project in a Noise Study Report Addendum (NSR Addendum).

Modification for Non-Conventional Projects:
Delete the above two paragraphs and replace with the following: If an Alternative Technical Concept is proposed to change the horizontal or vertical alignments depicted in the Concept Plans, any associated required changes to the noise wall locations must also be addressed. Any modifications/additions to noise wall location and height requirements depicted in the RFP must be evaluated for approval by the Department. See RFP for requirements.

See ***Structures Design Guidelines (SDG), Section 1.4.5*** for the policy on noise wall surface finishes.

264.2.1 Noise Study Report Addendum

The re-evaluation of preliminary noise abatement commitments during final design is documented in an NSR Addendum. The re-evaluation must be based on the final roadway geometry and the proposed noise abatement design, including noise wall type, location, dimensions, and estimated costs. The final design re-evaluation should be conducted using the latest version of the FHWA's Traffic Noise Model (TNM).

Noise abatement measures are considered when noise levels at a receptor(s) approach or exceed the noise abatement criteria or substantially exceed existing noise levels. The noise abatement criteria are listed in ***Table 264.2.1***. Approaching the criteria means within 1 dB(A) of the noise abatement criteria. A predicted increase of 15 dB(A) or more is considered substantial. Noise abatement is considered only for Activity Categories A, B, C, D and E.

The NSR Addendum should contain a description of the methodology for selecting final noise wall dimensions including any evaluation matrix used.

264.2.2 Noise Abatement Criteria

A noise wall should be both reasonable and feasible to be provided on the project.

264.2.2.1 Feasibility

Factors for noise abatement measures include both acoustic (noise reduction) and engineering considerations. The noise wall must attain a minimum acoustic insertion loss of 5 dB(A) to at least two impacted receptors. The insertion loss is defined as the level of noise reduction because of abatement.

Engineering factors to consider is the constructability of the noise wall; e.g., lane closures, sight distance, terrain changes, utilities, bridges, overpasses, access, maintenance, and drainage. Consideration should also be given to whether a noise wall can be constructed using standard construction methods and techniques.

264.2.2.2 Reasonableness

A noise wall is considered reasonable if it provides an insertion loss design goal of 7 dB(A) to at least one benefited receptor at a reasonable cost of $42,000 per benefited receptor or less. A benefited receptor is a receptor that receives a noise reduction at or above the minimum threshold of 5 dB(A) (whether impacted or not).

The cost reasonableness is calculated by multiplying the statewide average unit cost (per square foot) by the square footage of the noise wall and dividing it by the number of benefited receptors. The statewide average unit cost of noise wall to be used in determining cost reasonableness is established by the Office of Environmental Management. The statewide average unit cost of noise walls to be used in the calculation of the cost/benefited receptor is $\$30.00/ft^2$. Refer to the ***PD&E Manual*** for the latest unit cost update.

Additional costs such as required right of way, special drainage features, special bridge support and special foundations associated with the installation of a noise wall should be added to the unit cost. If these additional costs increase the cost per benefited receptor above the $42,000 limit, a determination to provide noise abatement must be made in consultation with the District Environmental Management Office, and the Office of Environmental Management (OEM), pursuant to ***Title 23 United States Code (U.S.C.), Chapter 3, Section 327*** and ***Memorandum of Understanding (MOU)*** dated December

14, 2016. Any decision to eliminate a noise wall from consideration based on the inclusion of these additional costs will require clear demonstration that the additional costs are associated only with the noise wall and cannot be mitigated by other considerations.

Do not exceed the following heights:

(1) For ground mounted noise walls use a maximum height of 22 feet. Shield non-crash tested noise walls within the clear zone.

(2) For noise walls on bridge and retaining wall structures use a maximum height of 8 feet.

(3) For ground mounted Traffic Railing/Noise Wall combinations use a maximum height of 14 feet.

Refer to the NSR prepared during the PD&E phase for the analytical results used to evaluate noise wall heights necessary to achieve minimum, desired and optimum insertion loss. The optimum noise wall height is the most cost effective in consideration of noise reduction benefits per unit cost of the noise wall. Perform a comparative analysis to evaluate an appropriate range of noise wall configurations (height, length and roadway offset). Determine the number of benefited receptors and calculate the cost per benefited receptor for each configuration evaluated. Select a noise wall configuration that can provide the insertion loss design goal (7 dB(A)) at a reasonable cost (less than $42,000 per benefited receptor). If this is not achievable, select a noise wall configuration that optimizes insertion loss per impacted receptor and cost per benefited receptor.

The height of the noise wall is measured from the ground elevation to the top of the noise wall. Tall noise walls are seldom necessary at the top of roadway embankments or berms since the elevation of the embankment contributes to the effective height of the noise wall. In addition, changes in the vertical grade of the top of the noise wall should be gradual and abrupt changes in wall heights should be avoided. Natural ground elevations at the base of the noise wall fluctuate, even in flat terrain. Therefore, provide plan details that make clear to the contractor the final top of wall elevations, post spacing and foundation step locations. See the ***Standard Plans*** ***Instructions, Index 534-200***, and ***Indexes 521-510*** thru ***521-515*** for additional design requirements. See ***LRFD Section 15*** and ***SDG***, ***Sections 3.16*** and ***3.18*** for the Noise Wall design criteria.

When an otherwise continuous noise wall is broken resulting in a horizontal separation between the wall sections, it is often necessary to overlap the wall sections to reduce insertion loss degradation. Examples of horizontal separation include:

- When the mainline noise wall is located at the right of way line, but is moved to the shoulder break at a bridge location.
- When transitioning from the mainline to a ramp at interchanges.

The overlap distance of noise walls is generally equal to four times the separation; however, an analysis by the Noise Specialist is necessary to determine the optimum overlap. Review the need or effectiveness of a noise wall in the infield area of an interchange during final design. The attenuation of ramp traffic may provide adequate insertion loss when considering the intersecting roadway's noise contribution. When selecting wall termini details, consider maintenance access, clear zone and line of sight.

Ensure the noise wall study station limits, for concrete barrier/noise walls, are extended to account for any tapers, attenuators or guardrail required during final design as required by the ***Standard Plans***. This also applies to overlapping noise wall installations. These changes may require reanalysis in an updated Noise Study Report Addendum document due to site specific geometry.

Show the location and limits (stations and offsets), including any tapers, for the traffic railing/noise walls in the contract plans.

Table 264.2.1 Noise Abatement Criteria

Noise Abatement Criteria [Hourly A-Weighted Sound Level-decibels (dB(A))]				
Activity Category	Activity Leq(h)		Evaluation location	Description of activity category
	FHWA	FDOT		
A	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	66	Exterior	Residential
C	67	66	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	-	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	-	-	Undeveloped lands that are not permitted.

Notes:

(1) Based on *Table 1 of* ***23 CFR Part 772***

(2) Activity Leq(h) criteria values are for impact determination only, and are not design standards for noise abatement measures.

(3) Activity Category B, C and E include undeveloped lands permitted for these activities.

(4) FDOT defines that a substantial noise increase occurs when the existing noise level is predicted to be exceeded by 15 decibels or more as a result of the transportation improvement project. When this occurs, the requirement for abatement consideration will be followed.

264.2.3 Final Noise Abatement Measures

Document the final noise abatement measures in the environmental re-evaluation and the NSR Addendum prior to construction advertisement. Refer to ***Part 2, Chapter 18*** of the ***PD&E Manual*** for required documentation in the NSR Addendum.

Modification for Non-Conventional Projects:
Replace the above paragraph with the following: Any modifications to noise abatement locations, noise wall types, lengths and heights must be documented in the NSR Addendum for approval by the Department prior to beginning noise wall construction.

The District Noise Specialist will verify that the noise walls shown in the contract plans comply with the final noise abatement measures included in the NSR Addendum.

The District Environmental Management Office will ensure that the final noise abatement measures are reflected in the re-evaluation of the Environmental Document and will obtain concurrence from OEM, if appropriate.

264.3 Perimeter Walls

Modification for Non-Conventional Projects:
Delete ***FDM 264.3~~1.2~~*** and replace with the following: See the RFP for perimeter wall requirements. If an Alternative Technical Concept is proposed that changes the horizontal or vertical alignments depicted in the Concept Plans, any associated required changes to the perimeter wall locations must also be addressed. Any modifications/additions to perimeter wall location requirements depicted in the RFP must be assessed by the Department based on the information provided by the Design-Build Firm and are subject to Department approval. The Design-Build Firm must coordinate with the District Environmental Management Office to ensure proper public involvement occurs during final design.

Perimeter walls provide a barrier between a highway and adjacent properties; however, they are not intended to provide any measurable noise reduction. Benefits of perimeter walls include:

(1) minimizing visual impacts,

(2) providing a visual screen when existing vegetation is removed,

(3) providing a physical separation,

(4) maintaining access control restrictions.

The initial assessment for the use of a perimeter wall would typically be performed during the PD&E phase and documented in a Perimeter Wall Justification Report (PWJR). The final decision for the use of a perimeter wall is made during final design when the conditions and cost are available for consideration. Add decisions made during final design to the PWJR by addendum. See the ***Standard Plans* Instructions, Index 534-250** design requirements. See ***LRFD Section 15*** and ***SDG*, Sections 3.16** and ***3.18*** for the design criteria

264.3.1 Consideration of Perimeter Walls

Perimeter walls may be considered:

(1) On new construction and reconstruction projects when requested by a local municipality or group of directly affected property owners. The distance from the edge of the proposed travel lane to the closest portion of the adjacent structure should be less than 150 feet; and when one or more of the following are met:

  (a) The capacity of an existing highway is expanded by adding lanes to the outside.

  (b) Horizontal and/or vertical alignment of an existing highway is significantly altered as defined in the ***PD&E Manual*** (Part 2, Chapter 18, Section 18.1.3.1 Type I Projects).

  (c) The highway project is proposed on a new alignment or location.

  (d) Existing vegetation or other visual barriers are removed.

(2) Around Department facilities (e.g., rest areas, weigh stations), to separate the facility from adjacent land uses.

Consider the following factors when determining if a requested perimeter wall would provide a benefit:

(1) Functional Classification: Perimeter walls will not be recommended on arterial roadways where multiple openings would be required to maintain access.

(2) Context Classification; e.g., dense residential, educational facilities, recreation areas. Land on which the structure is located should be immediately adjacent to the R/W.

(3) Highway traffic is visible from the adjacent properties.

(4) No new Right of Way is required to construct the wall (further consideration will be made if Department is granted an easement from adjacent properties).

(5) Constructability, safety, cost, access, drainage and utility conflicts.

(6) Cost of perimeter wall must not exceed $25,000 for each adjacent property, including the cost of utility relocation.

To assure consistent application of these guidelines, partial or complete funding from third party sources will not be accepted and no custom designs are allowed.

See ***SDG***, ***Section 3.18*** for additional limitations on where perimeter walls may be located.

264.3.2 Restrictions on Consideration of Perimeter Walls

Perimeter walls are not considered on the following conditions unless an exception is granted by the Assistant Secretary of Engineering and Operations:

(1) Retrofitting existing conditions where highway improvements are not proposed

(2) Mitigation of environmental impacts

(3) Building(s) that received a building permit after the Date of Public Knowledge

264.3.3 Local Municipality Concurrence

The Department will approach the local government during the design phase of the project to seek concurrence on the inclusion of proposed perimeter wall; including location and aesthetics. The local government will be responsible for obtaining support from the majority (simple majority) of the adjacent residents/property owners prior to construction of a perimeter wall. The local government or landowner assumes responsibility for maintenance and structural repairs of perimeter walls located on non-FDOT owned lands.

The local government or landowner will provide formal concurrence with the recommendation (resolution or letter) and a Maintenance Agreement for the perimeter wall, if applicable. Include these documents in the PWJR Addendum.

264.4 Public Involvement

Public coordination is often necessary to finalize wall locations, length and heights, color, textures, and other aesthetic features. Coordinate required public involvement activities with the District Public Involvement or Community Liaison Coordinator.

264.4.1 Noise Walls

Conduct a written survey to establish that a simple majority of the benefited receptors are in favor of the construction of the noise wall. If the public is not in favor, the Department may elect not to build the wall. The Department will make the final determination on the use of noise walls if consensus cannot be reached by a neighborhood. This survey is typically conducted during final design but may have occurred during the PD&E phase. Coordinate survey issues with the District Environmental Management Office.

Noise walls located on arterial roadways can potentially impact access. The ability to construct an effective noise wall can depend on an individual property owner's willingness to sign a right of way indenture allowing access to be cut off or modified. For these conditions, it is a general practice to obtain a written statement from each affected property owner demonstrating support for the noise wall. If an adjacent property owner declines to sign the indenture, evaluate alternative noise wall layouts to determine the effectiveness of noise abatement on the project segment. Document in the NSR Addendum that the noise wall is not feasible if the insertion loss criteria cannot be met.

264.4.2 Perimeter Walls

Coordination with the local government for the identification and design of perimeter walls may require public involvement. Public involvement may be necessary to finalize wall locations and aesthetic features, especially if there are substantial changes to conditions or previously requested needs. Coordinate required public involvement activities with the District Public Involvement or Community Liaison Coordinator.

Perimeter walls located on arterial roadways can potentially impact access. The ability to construct perimeter wall(s) can depend on an individual property owner's willingness to sign a right of way indenture allowing access to be cut off or modified. For these type projects, it is a general practice to obtain a written statement from each affected property owner demonstrating support for the perimeter wall. If an adjacent property owner(s) declines to sign the indenture the Department may elect not to build the perimeter wall. Document the final determination in the PWJR Addendum if the perimeter wall is not feasible.

264.4.3 Outdoor Advertising Signs

Section 479.25, F.S. ***"Erection of noise-attenuation barrier blocking view of sign; procedures; application"***, provides procedures and requirements for allowing permitted, conforming, lawfully erected outdoor advertising signs to be increased in height if visibility is blocked due to construction of noise walls (or "noise attenuation barriers" as referred to in the statute). The statute also provides procedures that address various coordination requirements (e.g., notification requirements, survey requirements, public hearing requirements, and approval requirements) for the involved parties. The involved parties include the Department, the local government or local jurisdiction, and the benefited receptors (or "impacted property owners" as referred to in the statute). Refer to Part 1, Chapter 11 Public Involvement, of the ***PD&E Manual*** for additional details about meeting notification requirements.

265 Reinforced Concrete Box and Three-Sided Culverts

265.1 General

The Department recognizes three types of culverts;

- Round and elliptical reinforced concrete pipe,
- Concrete box culverts (four-sided), and
- Three-sided concrete culverts.

This chapter presents the minimum requirements for concrete box culverts and three-sided concrete culverts, both of which are classified as Category 1 structures in accordance with ***FDM 121***. It is not possible to provide prescriptive requirements for all conditions, so guidance provided in this chapter is for typical designs. Each location will usually have some unique character (e.g., floods, scour, surroundings, salt water, historic character). Unique environments need to be thoroughly evaluated and all environmental requirements satisfied.

The procedure for the hydraulic analysis of culverts differs based on whether the culvert is located at a riverine or tidal crossing. Refer to ***Chapter 4*** of the ***Drainage Manual*** for the appropriate hydraulic analysis and documentation requirements.

Definitions of terms used in this chapter include the following:

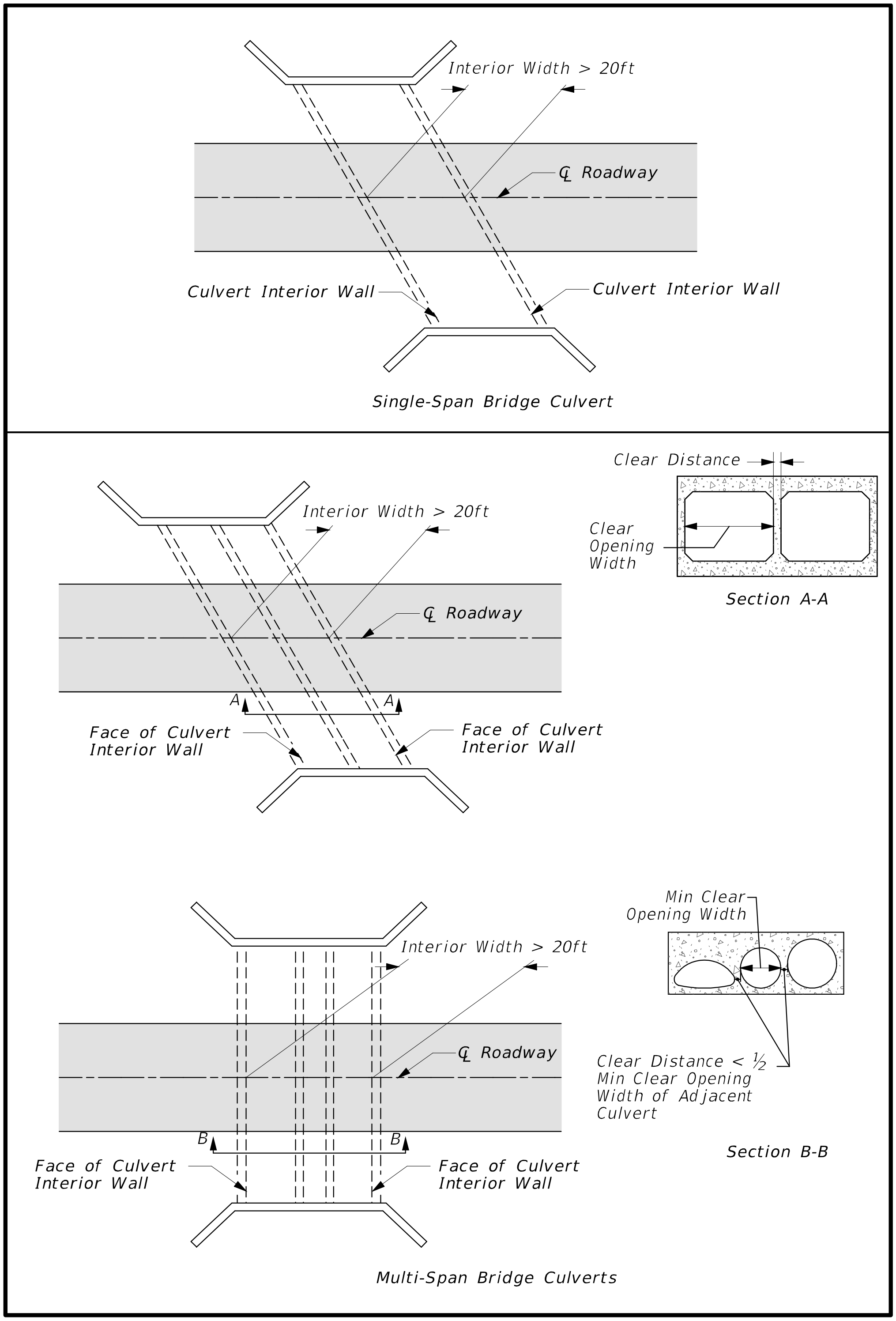
Culverts are structures under the roadway with an interior width of less than or equal to 20 feet. The interior width is measured along the centerline of the roadway from face-to-face (inside) of the extreme abutments or sidewalls.

The National Bridge Inspection Standards classify the following culverts as bridge-sized (a.k.a., bridge culverts):

- Box and three-sided culverts with a clear opening measured along the center of the roadway > 20 feet, or between the extreme ends of openings for multiple boxes.
- Also includes multiple pipes where the clear distance between openings is less than ½ of the smaller adjacent opening.

Figure 265.1.1 provides an illustration of a single-span and a multi-span bridge culvert.

Figure 265.1.1 Examples of Bridge Culverts



Concrete box culverts (four-sided) typically have rectangular cross sections. An arch or arch-topped culvert is considered a box culvert if the "sidewalls" are built monolithic with the bottom (invert) slab. Two-piece (four-sided) box culverts are permitted with a simply supported top slab, which is keyed into a monolithic three-sided bottom section. Concrete box culverts are typically used where the streambed is earth or granular soil and rock is not close enough to the streambed to directly support the structure.

Three-sided concrete culverts may be rectangular in shape or a frame with varying wall and slab thickness or an arched or arch-topped structure. These structures have separate foundations with spread footings supported by earth, rock or piles. The largest culverts are typically not boxes; rather they are frames or arches. Use of three-sided concrete culverts where rock is not at or near the streambed requires pile support for the footings or some other form of positive scour protection. Three-sided concrete culverts on spread footings may be used for railroads, wildlife crossings, bicycle/pedestrian/equestrian/golf cart paths, and other uses that do not convey water or have scour vulnerability.

Clear span is the perpendicular distance between the inside face of the sidewalls. The maximum clear span recommended for a concrete box culvert is 24 feet.

Design span for non-skewed culverts is the perpendicular distance between the centerline of the sidewalls. For culvert units with skewed ends, the design span of end sections is the distance between the centerlines of the sidewalls measured parallel to the skewed end.

265.2 Structure Type Selection

Determine the most appropriate type of short-span structure. The basic choices are a corrugated metal structure, concrete box culvert, concrete frame or arch, and a short-span bridge. While the site conditions are the primary deciding factor for structure selection, aesthetics, constructability, and economics are also very important.

Proper selection of the feasible structure alternatives is based on site and project-specific parameters, including but not limited to:

(1) Vertical and horizontal clearance requirements

(2) Available "beam" (top slab) depth

(3) Maintenance and protection of traffic requirements (e.g., phase construction)

(4) Construction constraints (e.g., water diversion requirements)

(5) Foundation requirements

(6) Environmental concerns (e.g., natural streambed)

(7) Desired aesthetic treatments (e.g., arch appearance)

(8) Geometric limitations (e.g., skew angle, right of way restrictions, utilities)

Concrete culverts are usually more expensive in initial cost than corrugated metal structures. However, concrete culverts are the preferred alternative when considering suitability to the site and life-cycle cost estimates. The advantages of concrete culverts are superior durability for most environmental conditions, greater resistance to corrosion and damage due to debris, greater hydraulic efficiency, and typically longer service life.

Concrete culverts are typically the least expensive option at sites with limited headroom. Smaller corrugated metal structures typically require a minimum height of soil cover of 2 feet and for some structures the soil cover increases to 4 feet or more depending on size and shape. Concrete culverts, frames, and arches can have the least amount of cover by placing a minimum of 3 inches of asphalt pavement directly on the top slab. Corrugated metal structures will also typically require taller structures than concrete box culverts, to provide adequate waterway area below design high water due to their arched shapes. If a corrugated metal structure is a viable option, an engineering evaluation and cost analysis should be performed in consultation with the District Drainage Engineer.

Single-cell and multi-cell concrete box culverts with barrel spans less than 15 feet, are often the most cost-effective structural solution where debris collection and aesthetics are not a major concern. Three-sided culverts may be appropriate for single spans exceeding 20 feet where scour is not a concern.

The use of a short-span bridge should be investigated before a final determination is made to use a large concrete culvert. Possible advantages of a bridge may be minimized work in the stream, speed of erection, minimized interference with the existing structure foundation, and easier phased construction. See ***FDM 121*** for procedural steps on planning short-span bridges.

265.2.1 Precast Concrete Culverts

Precasting permits efficient mass production of concrete units. The advantages often offset the cost of handling and transporting the units to the site. Precast units are often limited to certain sizes and skews due to forms, transportation, and handling concerns. Skewed units typically need more reinforcement and thicker slabs and/or sidewalls. The use of skewed units will increase the cost of the culvert due to increased fabrication costs.

Skewed end units are sometimes required to satisfy right of way constraints and/or phased construction requirements for skewed alignments. In the event they are necessary, skewed precast culvert units must be designed for the skewed-end design span. Precast manufacturers should be contacted for information on maximum skews available.

Precast culverts may occasionally need to be placed on moderate or steep grades. No maximum slope is recommended for box culverts because of the need to match the slope of the streambed. Three-sided box culverts and the frames and arches should be limited to a maximum slope of 2%. Precast manufacturers should be contacted for the maximum grade that can be fabricated if a grade larger than 2% is proposed. If matching a steeper slope is necessary, the ends of the precast units must be beveled to create vertical joints and the footings may be stepped or the length of the sidewall varied.

Provide a 2 to 4-inch gap between the walls of adjacent cells when two or more single-cell, precast concrete culverts are placed side-by-side. Fill this gap with Class NS (non-structural) concrete, non-excavatable, flowable fill or non-shrink grout.

All manufacturers must have approved precast drainage product facilities in accordance with ***Section 6.3*** of the ***Materials Manual***.

265.2.2 Concrete Box Culverts

A cast-in-place culvert must be designed and detailed in the contract plans when a concrete box culvert is selected as the appropriate structure for the site. A precast concrete box culvert alternative is permitted during construction unless specifically excluded in the contract plans. Speed of erection, maintenance of traffic, stream diversion problems, and site constraints can be minimized when utilizing precast culverts.

265.2.3 Three-Sided Concrete Culverts

There are various types of proprietary, precast concrete frames, arch topped units, and arches available. These units are typically used when larger culverts (spans ≥ 20 feet) are required. They can only be considered when scour protection is adequately provided or aesthetics are a consideration. They may be placed on spread footings with an invert slab, footings on rock, or pile-supported footings. The advantages of the precast concrete arches and frames are the same as for the precast concrete box culverts, except that longer spans (up to 48 feet) are possible.

A precast culvert should be the preferred option when a three-sided concrete culvert is selected as the appropriate structure for the site. A cast-in-place reinforced concrete foundation and the channel lining must be designed and detailed in the contract plans. The final design of the precast three-sided culvert structure and any necessary foundation modifications must be completed by the Contractor's Engineer of Record (usually the manufacturer).

Sizes of precast units that are common to more than one manufacturer should be selected. Dimensions of the sidewalls and top slab, reinforcement size and spacing should not be shown on the plans, unless necessary. If sidewall or top slab dimensions are dictated by site conditions, only show the affected dimensions, and indicate if they are minimums, maximums, or specifically required dimensions. The assumed top slab dimension used to determine fill limits should be shown in the contract plans.

Include a note in the contract plans requiring the Contractor to provide all design details not included in the contract plans. This method should result in the most economical culvert design.

265.2.3.1 Precast Arch and Arch-Topped Units

Consider the following when selecting a precast arch or arch-topped culvert:

(1) Aesthetics concerns may make the use of arch-shaped units desirable. The use of arch-shaped facade panels is not recommended, especially for hydraulic openings due to snagging of debris.

(2) The amount of skew that can be fabricated varies. Some manufacturers prefer to produce only 0° skew units. The maximum skew at which a precast unit should be fabricated is 45°. The culvert orientation to the centerline of the highway may be at a skew greater than 45°.

(3) An arch unit is preferable for a grade separation for highway vehicles or railroads when a dry conveyance environment is necessary. The arch shape eliminates any ponding problems above the culvert without special fabrication or field adjustments that would be required for flat-topped culverts.

(4) Arch units are preferred in cases where fills above the precast units exceed 20 feet.

(5) Precast arch-topped units are currently available in spans up to 48 feet.

(6) Arched units have been used as liners for old masonry or concrete arches in other States. After the construction of a pedestal wall at the base, the units are slid into place. The void between the existing arch and the liner is filled with grout installed through fittings cast into the liner units.

(7) Large arch units may be shipped in two pieces and assembled on site. Three-piece units are not permitted.

265.2.3.2 Precast Frame Units

Consider the following when selecting a precast frame (rectangular) culvert:

(1) Many of precast frame-type units can be fabricated with skew angles up to 45°. This characteristic is useful when phased construction is proposed. When used for phased construction with shallow highway pavements, no temporary shoring is needed at the phase construction joint to support the fill or pavement.

(2) Frame units provide a simpler traffic railing/headwall connection than arch-topped units.

(3) Frame units provide a hydraulic opening greater than arches of equivalent clear span when flowing full.

(4) Precast frame units can be fabricated by some manufacturers with any increment of span length up to 40 feet, although typical span length increments are 2 feet.

(5) Maximum rise of the units is normally limited to 10 feet due to shipping and handling considerations. Investigate the need for a pedestal wall when a larger rise is necessary.

265.3 Foundation Design

All structures discussed in this chapter, regardless of span and height of fill, are considered buried structures in regard to foundation design. There is no requirement for seismic analysis; however, this may change in the future as more research is completed.

For culverts with spans greater than or equal to 20 feet, foundation recommendations are provided in the Bridge Geotechnical Report (Phase I) and included in the Bridge Development Report (BDR). Foundation design parameters for culverts with spans less than 20 feet are provided by the District Geotechnical Engineer or the Department's Geotechnical Engineering consultant. Foundation recommendations and design parameters must include factored bearing resistance, predicted total and differential settlements, and any required excavation and replacement to ensure proper behavior of the foundation.

The District Geotechnical Engineer or the District Structures Design Office should be consulted to determine the proper foundation treatment.

Modification for Non-Conventional Projects:

Delete ***FDM 265.3*** above and replace with the following:

265.3 Foundation Design

All structures discussed in this chapter, regardless of span and height of fill, are considered buried structures in regard to foundation design. There is no requirement for seismic analysis. The EOR will coordinate the foundation recommendations with the geotechnical engineer for the project. Foundation design parameters must be shown in the contract plan set and will include factored bearing resistance, predicted total and differential settlements, and any required excavation and replacement to ensure proper behavior of the foundation.

265.3.1 Rock Foundations

In the unusual case where sound rock is at or near the surface of a streambed, an invert slab is not required and a three-sided culvert would generally be the appropriate structure selected. Concrete footings are either keyed or doweled into rock based on consultation with an Engineering Geologist and the District Geotechnical Engineer.

The wall height should be constant and the footing height varied when the elevation of the rock surface varies by 2 feet or less. If the variation in rock surface elevation exceeds 2 feet, the height of the culvert wall may be varied at a construction joint or at a precast segment joint. In some cases, it may be necessary to use walls of unequal heights in the same segment, but this should generally be avoided.

265.3.2 Earth or Granular Soil Foundations

In most cases a concrete culvert will not be founded on rock, so a box culvert (four-sided) with an integral invert slab should be the preferred foundation treatment. In areas of compact soil and low stream velocities, three-sided concrete culverts may be used if they have positive scour protection such as piles or channel lining with concrete-filled mattresses, gabions, or riprap rubble, and spread footings founded below the calculated scour depth. Three-sided concrete culverts located in stream beds, with spans equal to or exceeding 20 feet, must have pile supported footings when the structure is not founded on sound rock.

Concrete box culverts should never be founded partially on rock and partially on earth to avoid differential settlement. If rock is encountered in a limited area, it should be removed to a minimum depth of 12 inches below the bottom of the bottom slab and backfilled with either select granular material or crushed stone. Concrete culverts are rigid frames and do not perform well when subjected to significant differential settlement due to a redistribution of moments. All concrete box culverts should have a designed undercut and backfill. Consult the District Geotechnical Engineer to determine the depth of the undercut and type of backfill material required to prevent excessive differential settlement. Any required undercut and backfill must be shown on the plans.

A concrete box culvert can be considered if settlement is expected and the foundation material is fairly uniform. The culvert should be designed to accommodate additional dead load due to subsequent wearing surface(s) which may be needed to accommodate the settlement of the box. Precast culverts require mechanical connections between units when significant differential settlement is anticipated. ***Standard Plans***, ***Index 400-291*** provides criteria for cast-in-place link slab to satisfy this requirement when joint openings are expected to exceed 1/8 inch. The District Geotechnical Engineer or the Department's Geotechnical Engineering consultant should provide the anticipated differential settlement, which should be included in the contract plans.

If the foundation material is extremely poor and it is desirable to limit settlement, coordinate with the District Geotechnical Engineer to determine the best course of action. A typical remedy might be removal of unsuitable or unstable material and replacement with suitable material. All required remedies must be shown on the plans.

265.3.3 Three-sided Culvert Foundation Design

Provide a cast-in-place footing design in the contract plans when a three-sided structure is selected for a site. There are several types of culverts that may meet the project specifications. Determine which specific type of unit would best fit that particular application and use those vertical and horizontal reactions for design of the foundations. Consider contacting known fabricators for design reactions. If no specific type of unit is determined as most appropriate, a conservative estimate of the design reactions for all types should be used and the reactions included in the contract plans.

Modification for Non-Conventional Projects:
Delete ***FDM 265.3.3*** and replace with the following: **265.3.3 Three-sided Culvert Foundation Design** When a three-sided structure is selected for a site, the specific culvert details including the cast-in-place footing design must be included in the contract plans.

265.4 Wingwalls

A wingwall is a retaining wall placed adjacent to a culvert to retain fill and to a lesser extent direct water. Wingwalls are preferably cast-in-place, but precast wingwalls may be considered on a project-by-project basis. Wingwalls are generally designed as cantilevered retaining walls. Precast counterfort and binwalls may also be considered for design of wingwalls. Cast-in-place wingwall designs are provided by the Department's standard box culvert computer program.

Wingwall alignment is highly dependent on-site conditions and should be evaluated on a case-by-case basis. The angle(s) of the wall(s) on the upstream end should direct the water into the culvert. It is also desirable to have the top of the wall elevation above the design high water elevation to prevent overtopping of the wall.

Consider potential conflicts with R/W limits and utilities when precast wingwalls are permitted. The footprint of the footing and excavation, especially for bin type walls, can be extensive. Notes should be placed on the plans alerting the Contractor to these requirements when they exist. Due to skew or grade differences between the cast-in-place or precast culvert units and precast wingwalls, it is necessary to provide a cast-in-place closure pour between the culvert end unit and precast wingwalls. A closure pour is not required if cast-in-place wingwalls are used.

When precast wingwalls are permitted, the cost is included in the cost of the culvert barrel. No separate item is required but the estimated concrete and reinforcing steel quantities for a cast-in-place design should be included in the contract plans.

Modification for Non-Conventional Projects:

Delete ***FDM 265.4*** above and replace with the following:

265.4 Wingwalls

Precast wingwalls will only be permitted when specifically allowed in the RFP. The specific culvert details must be included in the contract plans.

265.5 Headwalls/Edge Beams

Headwalls are normally used on all culverts. In deep fills a headwall helps retain the embankment. In shallow fills the headwall may retain the roadway and provide the anchorage area for the railing system.

Headwalls should be cast-in-place and attached to precast culvert end segments in accordance with ***Standard Plans***, ***Index 400-291***. Headwalls one foot or less in height with no railing attachment for single barrel precast culverts may be precast. If a curb must be placed on a culvert without a sidewalk, the headwall must be cast-in-place to allow for the tie-in of the curb's anchor bar, unless the curb is also cast at the precast facility.

The typical maximum height of headwalls is 3 feet. Greater heights are attainable but are only used in special cases. Headwall heights greater than 2 feet above the top slab require an independent transverse analysis, which is not provided by the FDOT box culvert program.

Concrete culverts with skewed ends may require additional stiffening of the top and bottom slabs by what is most commonly called an "edge beam". An edge beam is similar to a headwall or cutoff wall. The headwall may be used to anchor metal traffic railing posts and traffic railings or retain earth fill, as well as stiffening the top slab of culverts that lose their rigid frame action as a result of having a skewed end.

When additional strength is required in the concrete edge beam, use the following criteria:

(1) If there is a 1-on-2 slope to the edge beam, it will be more economical to increase the depth of the edge beam in order to meet the required design.

(2) When the edge beam is at shoulder elevation (anchoring guard rail and traffic railing), the edge beam height should be maintained and the width of the edge beam should be increased.

265.6 Cutoff Walls

A cutoff wall is required in all culverts with invert slabs to prevent water from undermining the culvert. The cutoff wall should be a minimum 24 inches below the bottom of the invert slab or to the top of sound rock if the rock is closer. Investigate the need for deeper cutoff walls when culvert is founded on highly permeable soils or with significant hydraulic gradients. The cutoff wall may also act to stiffen the bottom slab for skewed box culverts.

Cutoff walls must always be specified at each end of the barrel. When a concrete apron is provided, show an additional cutoff wall at the end of the apron. For three-sided culverts, where the apron is made continuous with the barrel invert slab, the cutoff wall is only required at the end of the apron. The wingwall footings should have toe walls extending close to the bottom of the cutoff wall to prevent scour around the edges of the cutoff wall.

When a precast culvert is specified, the cutoff wall must be cast-in-place. The cost of the cutoff wall is included in the cost of the culvert barrel. No separate item is required but the estimated concrete and reinforcing steel quantities should be included in the contract plans.

265.7 Aprons

Box culverts can significantly increase the stream flow velocity because the concrete has a roughness coefficient significantly lower (i.e., smoother) than the streambed and banks. To dissipate this increase in energy and to prevent scour, a riprap rubble or other type of revetment apron may be required at the ends of some culverts. The District Drainage Engineer should be consulted to determine the appropriate apron requirements.

Modification for Non-Conventional Projects:
Delete the last sentence in above paragraph and see RFP for requirements.

The apron must be cast-in-place when a precast culvert is specified with a concrete apron. The cost of the apron is included in the cost of the culvert barrel. No separate item is required but the estimated concrete and reinforcing steel quantities should be included in the contract plans.

Modification for Non-Conventional Projects:
Delete the above paragraph and replace with the following: When a precast culvert is specified with a concrete apron, the apron must be cast-in-place.

265.8 Subbase Drainage

In some situations where there is low fill (< 12 inches below the base course) ***Standard Plans*, *Index 400-289*** requires additional friable base or coarse aggregate material above the top and along the sides of the culvert to eliminate maintenance problems.

265.9 Joint Waterproofing

Culverts will occasionally be used to allow the passage of things other than water, including but not limited to pedestrians, bicycles, trains, golf carts, wildlife, or farm animals. In cases where it is desirable to have a dry environment, a waterproof joint wrap should be used to cover the joints between precast culvert units or to cover the construction joints in cast-in-place culverts.

Even though a joint sealer is always placed between individual precast concrete culvert units and the units are pulled tightly together, water may seep through the joint. The minimum requirement for waterproofing these joints is to provide an external sealing band in accordance with ***ASTM C 877***, centered on the joints, covering the top slab, and then extending down the sidewalls to the footing. The purpose of the waterproofing membrane is to restrict seepage of water or migration of backfill material through the joints in the culverts and it is not intended to protect the concrete.

The external sealing band is mandatory for precast three-sided culverts under ***Section 407*** of the ***Standard Specifications*** but will need to be included as a note in the contract plans when required for box culverts.

265.10 Traffic Railings

For information regarding roadside barriers or traffic railings refer to ***FDM 215***.

265.11 Design Requirements for Concrete Culverts

Refer to the ***Chapter 3*** of the ***Structures Design Guidelines*** for design and analysis requirements.

265.12 Design Details

Provide a complete cast-in-place design in the contract plans when a box concrete culvert is proposed for a site. Standard details for concrete box culverts are provided in the ***Standard Plans, Index 400-289***. The contractor is usually permitted to substitute precast concrete box culverts for cast-in-place box culverts in accordance with ***Section 410*** of the ***Standard Specifications***. The contractor may select a standard precast box culvert design in accordance with ***Standard Plans, Index 400-292*** or provide a custom design. Design and fabrication details for precast box culverts, including calculations for custom designs, must also comply with the requirements of ***Standard Plans, Index 400-291*** and be submitted to the Engineer of Record for approval.

Provide either a complete cast-in-place design or a conceptual precast barrel design with a complete foundation and wingwall design, in the contract plans when a three-sided concrete culvert is proposed for a site. The contractor is permitted to substitute precast three-sided culverts for cast-in-place three-sided culverts in accordance with ***Section 407*** of the ***Standard Specifications***. Design and fabrication details for precast three-sided culverts, including calculations, must be submitted to the Engineer of Record for approval. Do not place wildlife shelves in hydraulic structures.

The bar designations in ***Table 265.12.1*** should be used for box culvert reinforcement:

Table 265.12.1 Bar Identification Schedule

BAR IDENTIFICATION SCHEDULE		
C.I.P. (LRFD) Index 400-289	**Precast (LRFD) Index 400-292**	**Description / Bar Location**
105	As1	Top Corner Bars
106	As1	Bottom Corner Bars
102	As2	Top Slab, inside face transverse bars
103	As3	Bottom Slab, inside face transverse bars
101	As1/As7	Top Slab, outside face transverse bars
104	As1/As8	Bottom Slab, outside face transverse bars
108	As4	Exterior wall, inside face vertical bars
105/106	As1	Exterior wall, outside face vertical bars
107	-	Interior wall, vertical bars both faces
110/111	As6/As9	Top Slab longitudinal bars (temperature reinf.)
109/112	As9	Bottom Slab longitudinal bars (temperature reinf.)
113/114		Exterior wall longitudinal bars (temperature reinf.)
115/ 116…		Interior wall longitudinal bars (temperature reinf.)
111	As5	Top Slab inside face longitudinal bars (design distribution reinforcement)

Additional reinforcing bars and designations must be added as required. No standardized bar designations are provided for three-sided culverts.

Modification for Non-Conventional Projects:
Delete ***FDM 265.12*** and replace with the following: **265.12 Design Details** Provide complete details for the proposed concrete culvert in the contract plans.

265.13 Computer Design and Analysis Programs

The Department's ***LRFD Box Culvert Program*** (Mathcad) from the Structures Design Office website is available for LRFD designs. This program analyzes monolithic single or multi-barrel box culverts with prismatic members and integral bottom slabs only. The program requires input for all member thicknesses, material properties and reinforcing area utilizing a trial and error design methodology.

Other computer programs are available for design of reinforced concrete culverts such as BOXCAR and CANDE. Generally, these other computer programs should only be used for preliminary designs or independent quality assurance checks. Consult with the State Structures Design Office before using one of these other programs in lieu of the FDOT box culvert program.

265.14 Design and Shop Drawing Approvals

The Engineer of Record for the contract plans has design and shop drawing approval authority for precast concrete box and three-sided culverts. All calculations and shop drawings require a quality assurance review for general compliance of contract requirements and for suitability of the design for the given design conditions.

Standard precast concrete box culvert designs are available in ***Standard Plans*, *Index 400-292*** for a limited number of box culvert sizes. Modification of FDOT standard box culverts or design of special size box or three-sided culverts is delegated to Contractor's Engineer of Record in accordance with the ***Section 407*** and ***Section 410*** of the ***Standard Specifications***. The Contractor is responsible for providing all design computations and details for these units.

Modification for Non-Conventional Projects:
Delete ***FDM 265.14*** and see RFP for Shop Drawing Approval requirements.

266 Bicycle and Pedestrian Bridges

266.1 General

A separate bicycle and pedestrian bridge may be necessary to provide continuity to sidewalks, bicycle lanes and shared use paths. See ***FDM 222***, ***223***, and ***224*** for information on bicycle and pedestrian facilities.

See ***Chapter 10*** of the ***Structures Design Guidelines (SDG)*** for information on pedestrian bridges.

266.2 Designer Qualifications

Engineering firms must be technically pre-qualified with the Department in the appropriate bridge design work type(s), in accordance with ***Rule 14-75, Florida Administrative Code***, when designing the following:

- Department owned pedestrian bridges
- Permitted, non-Department owned pedestrian bridges within, under or over State Road right-of-way.

For Department projects only, engineering firms must also be administratively pre-qualified (approved overhead audit) for projects greater than $500,000 total value per professional services contract. See ***Table 266.2.1*** for designer qualifications on projects with prefabricated steel truss pedestrian bridges.

Table 266.2.1 Designer Qualifications for Prefabricated Steel Truss Pedestrian Bridges

Project Type	**Category 1 per FDM 266.4?**	**Project EOR Design Firm**		**Contractor's EOR ~~Design Firm~~**	
		Role	**Prequalification**	**Role**	**Prequalification**
Department	Yes	Substructure and/or foundation design	**[T + A]** Work Type 4.1.2 - Minor Bridge Design, or other necessary work group based on substructure design	Steel truss design	**T** (Work Type 4.2.2 - Major Bridge Design - Steel)
	No	Steel truss, substructure and/or foundation design	**[T + A]** Work Type 4.2.2 - Major Bridge Design - Steel and other necessary work group based on substructure design	CSIP redesign of steel truss and any associated substructure and/or foundation design	**T** (Work Type 4.2.2 - Major Bridge Design - Steel)
Non-Department	Yes	Substructure and/or foundation design	**T** Work Type 4.1.2 - Minor Bridge Design, or other necessary work group based on substructure design	Steel truss design	**T** (Work Type 4.2.2 - Major Bridge Design - Steel)
	No	Steel truss, substructure and/or foundation design	**T** Work Type 4.2.2 - Major Bridge Design - Steel and other necessary work group based on substructure design	CSIP redesign of steel truss and any associated substructure and/or foundation design	**T** (Work Type 4.2.2 - Major Bridge Design - Steel)

Notes:

(1) See ***FDM 266.4.2*** for definitions of Project EOR Design Firm and Contractor's EOR ~~Design Firm~~.
(2) "T" = Technical prequalification required in accordance with ***Rule 14-75, Florida Administrative Code***.
(3) "T + A" = Technical and Administrative (approved overhead audit) prequalification for projects greater than $500,000 total value per professional services contract in accordance with ***Rule 14-75, Florida Administrative Code***.
(4) CSIP = Cost Savings Initiative Proposal

266.3 Design Criteria

Design bicycle and pedestrian bridges in accordance with the following criteria:

(1) Clear width for bridges is:

(a) 8-foot minimum on a pedestrian structure; 12-foot desirable

(b) 12-foot minimum on a shared use path structure; 16-foot desirable

(c) Minimum clear width is the width of the approach facility when the facility is wider than the minimums above; desirable clear width is the width of the approach facility plus four feet (2-foot-wide clear area on each side).

(2) Minimum vertical clearance under pedestrian bridges must be in accordance with ***FDM 260.6*** and ***FDM 260.8***.

(3) Account for future widening of the roadway below when determining required lateral offset (per ***FDM 215.2.4***).

(4) Ramp grades should not exceed 5%, but in no case be more than 8.33% with a maximum 30-inch rise.

(a) Provide level landings that are 5-feet long at the top and bottom portions of the ramp.

(b) Provide intermediate level landings that are 5-feet long when the ramp length results in a rise that exceeds 30-inches.

(5) Provide full-length pedestrian ADA handrails on both sides of pedestrian ramps.

(6) Consider providing stairways in addition to ramps.

(7) Provide railing and fencing options in accordance with the ***SDG, Chapter 10***..

(a) See ***FDM 222, Figures 222.4.6*** through ***222.4.8*** for vehicular fencing options.

(b) Provide full or partial screening on pedestrian bridges crossing State Road right-of-way in order to reduce the likelihood of objects being dropped or thrown onto the roadway below. See ***Figure 266.3.1*** for example of full screening.

Coordinate with District Design Engineer and local stakeholders to determine use of full screening on pedestrian bridges crossing FDOT right of way. When fencing is required, make the limits of fencing from the beginning of the approach slab at Begin Bridge to the end of approach slab at End Bridge.

(c) Pedestrian bridges on State Road right-of-way but not crossing State Road right-of-way are not required to be screened.

(d) Check with local authorities for guidance on screening for Department pedestrian bridges crossing local rights of way.

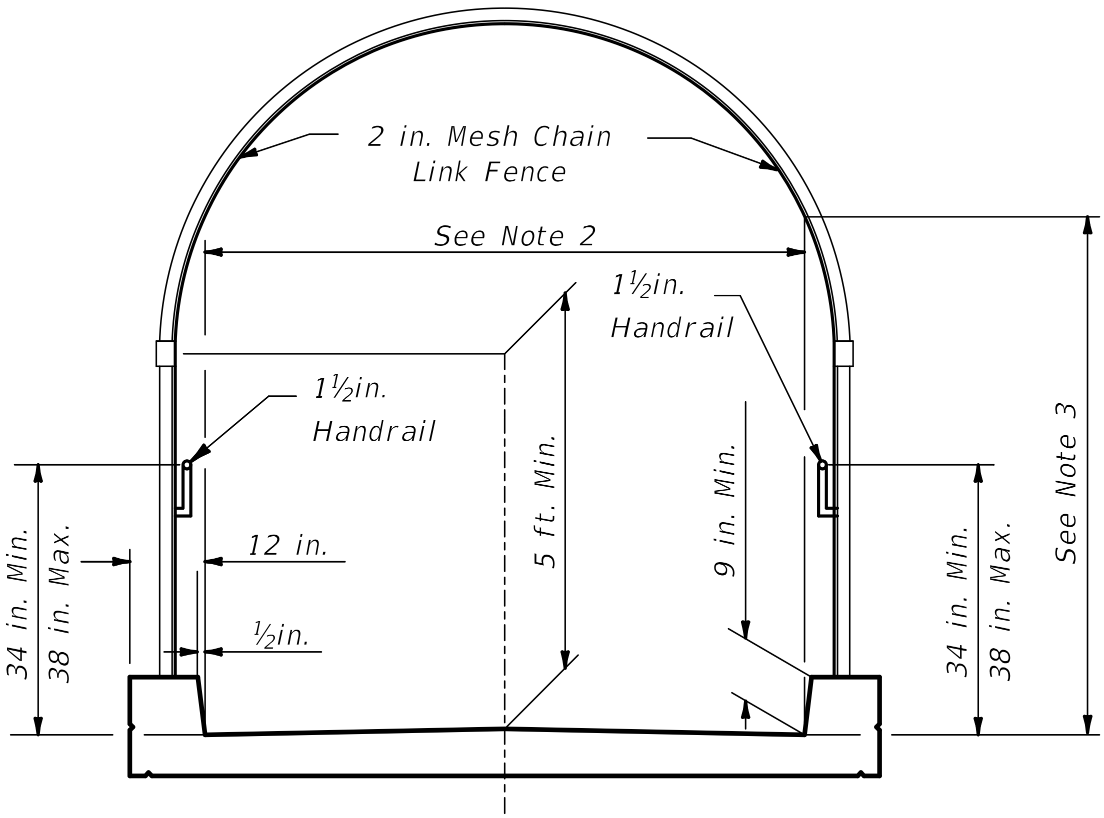
(e) The use of chain link fence on ramps of the pedestrian bridges will be determined on a project-by-project basis.

Modification for Non-Conventional Projects:
Add the following sentence: (f) When fencing is required, the limits of fencing is from the beginning of the approach slab at Begin Bridge to the end of the approach slab at End Bridge, unless otherwise indicated in the RFP.

An Independent Peer Review meeting the requirements of ***FDM 121.12*** is required for non-Department owned projects in which the pedestrian bridge is constructed within, under or over State Road right-of-way, regardless of the funding source. The Independent Peer Review must be completed, and all comments resolved prior to erecting the structure over or adjacent to traffic. Include the following note in the Plans:

> The Independent Peer Review must be completed, and all comments resolved, prior to erecting the structure over or adjacent to traffic. The term adjacent is in accordance with ***Standard Plans* Index 102-600, Table 5 – Clear Zone Widths for Work Zones**.

Figure 266.3.1 Pedestrian or Shared Use Path Bridge Typical Section



1. Pedestrian Handrails may be required. Handrails must be installed per the requirements of the Americans with Disabilities Act (ADA) Standards for Transportation Facilities.

2. For minimum clear width see FDM 266.

3. For minimum vertical clearance see FDM 222 or 224 as applicable.

266.4 Prefabricated Steel Truss Bridges

In many situations it makes good engineering and economic sense to utilize prefabricated steel truss bridges for pedestrian crossings. These bridges can be stand-alone structures or a hybrid structure with adjoining spans of other types (FIB, deck slab, steel I-girder, etc.). The provisions of this article apply only to the spans on a bridge that are comprised of prefabricated steel trusses. The term steel truss bridge as applied in this article refers only to stand-alone steel truss structures or to the steel truss spans of a hybrid bridge structure.

The following conditions must be met to use the plans development process described in ***FDM 266.4.4*** and for the prefabricated steel truss bridge to be classified as a Category 1 structure:

(1) The bridge lies within a tangent horizontal alignment.

(2) The maximum span[1] length does not exceed 200 feet measured between the centerline of bearings.

(3) The bridge width is constant.

(4) Each span[1] is simply supported (no continuity over supports)

(5) The supports have a skew angle[2] of 20° or less.

Notes:

(1) Span indicates an individual span.

(2) See the ***Structures Detailing Manual*** ***(SDM) Section 2.14*** for the definition of skew angle.

When the above conditions are not met, the plans development process described in ***FDM 266.4.4*** is not permitted, the truss span must be fully detailed in the Structures Plans, and the bridge is classified as a Category 2 structure. This requirement applies to all projects (including permits) involving Department or non-Department owned prefabricated steel truss bridges placed within, under or over State Road right-of-way, as well as Local Authority Projects developed and designed in accordance with Department policies.

Modification for Non-Conventional Projects:

Delete ***FDM 266.4*** and replace with the following:

266.4 Prefabricated Steel Truss Bridges on Department Projects

Prefabricated steel truss bridges can be stand-alone structures or a hybrid structure with adjoining spans of other types (FIB, deck slab, steel I-girder, etc.). The provisions of this article apply only to the spans on a bridge that are comprised of prefabricated steel trusses. The term steel truss bridge as applied in this article refers only to stand-alone steel truss structures or to the steel truss spans of a hybrid bridge structure.

The following conditions must be met for the prefabricated steel truss bridge to be classified as a Category 1 structure:

(1) The bridge lies within a tangent horizontal alignment.

(2) The maximum span[1] length does not exceed 200 feet measured between the centerline of bearings.

(3) The bridge width is constant.

(4) Each span[1] is simply supported (no continuity over supports)

(5) The supports have a skew angle[2] of 20 degrees or less.

Notes:

(1) Span indicates an individual span.

(2) See the ***Structures Detailing Manual*** ***(SDM) Section 2.14*** for the definition of skew angle.

See the RFP for additional requirements.

266.4.1 Qualification of Prefabricated Steel Truss Pedestrian Bridge Producers

Use prefabricated steel truss pedestrian bridges from providers included on the Department's Production Facility Listing. For information on the facility qualification process see ***Articles 11.1.5*** and ***11.1.6*** of the ***FDOT Materials Manual***.

266.4.2 Design and Detailing Responsibilities

The project Engineer of Record (EOR) is responsible for the design and detailing of the steel truss bridge substructure and foundation including end bents, piers, and pile foundations or spread footings. The project EOR is also responsible for the design and detailing of approach structures (non-steel truss bridge spans, walls, ramps, steps, approach slabs, etc.).

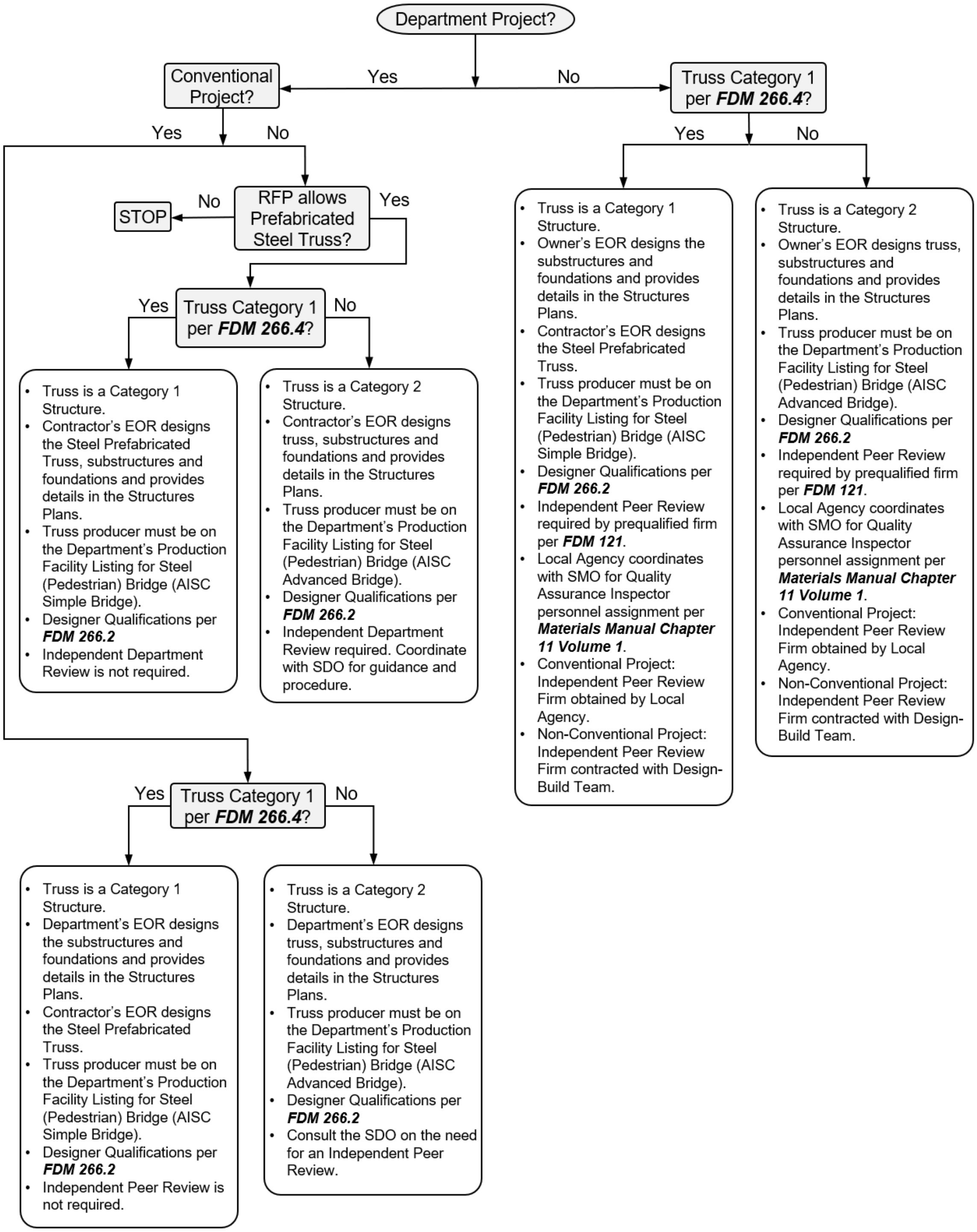
The Contractor's EOR is responsible for the design and detailing of the steel truss bridge superstructure including trusses, deck, bridge railing, floor beams, bridge joints, bearing assemblies and anchor bolts.

Modification for Non-Conventional Projects:
Delete ***FDM 266.4.2*** and replace with the following: **266.4.2 Design and Detailing Responsibilities** The Engineer of Record (EOR) is responsible for the design and detailing of the steel truss bridge foundation, substructure, and superstructure. The EOR is also responsible for design and detailing of approach structures (walls, ramps, steps, approach slabs, etc.). Include the steel truss bridge superstructure including trusses, deck, bridge railing, floor beams, bridge joints, bearing assemblies and anchor bolts as part of the appropriate phase submittal, depending on whether the steel truss bridge is considered Category 1 or Category 2 per ***FDM 121***. See the RFP for additional requirements.

266.4.3 Project Processing

Project processing of prefabricated steel truss bridges is summarized in ***Figure 266.4.1***.

Figure 266.4.1 Project Processing of Prefabricated Steel Truss Bridges Flowchart



266.4.4 Plans Development

To allow equal opportunity for all qualified pedestrian bridge producers to participate, the pedestrian bridge plans should have the flexibility to accommodate multiple alternate superstructure designs. When a prefabricated steel truss pedestrian bridge is classified as a Category 1 Structure per ***FDM 266.4***, adhere to the following procedure when developing the plans:

(1) Using ***Figures 266.4.2, 266.4.3,*** and ***266.4.4***, coordinate with the District Project Manager to select allowable truss configurations, truss member shapes, and bridge cross sections. A box truss bridge cross-section is required for spans greater than 150 feet.

If project specific aesthetic requirements warrant the use of truss configurations not included in ***Figure 266.4.2*** the project EOR can specify additional truss configurations. However, a minimum of two steel truss pedestrian bridge producers must be capable of satisfying the aesthetic requirements.

(2) Develop a Plan and Elevation sheet and Bridge Typical Section to be submitted with the BDR/30% plans.

(3) After the BDR/30% plans have been approved, send out a Prefabricated Pedestrian Bridge Invitation to Participate (ITP) to all prefabricated pedestrian steel truss bridge producers on the Department's Production Facility Listing. Send the ITP through registered mail with return receipt to confirm delivery. Contact information for all qualified producers can be found at the following web address:

https://www.fdot.gov/materials/quality/programs/qualitycontrol/materialslistings/postjuly2002.shtm

The ITP is intended to solicit qualified producers for information required to design the foundation and substructure of the steel truss pedestrian bridge. The ITP cover letter should contain the following elements with links to websites as appropriate and applicable:

(a) Introduction with brief project description

(b) Project Requirements

i. Design Specifications Requirements

ii. Construction Specifications Requirements

iii. Design Standards Requirements

iv. Bridge Typical Section

v. Allowable Truss Options

vi. Painting Requirements

vii. Pedestrian Fence/Railing Requirements

viii. Vehicular Loading Requirements

ix. Project Specific Aesthetic Requirements

x. Project Geometry including Vertical Clearance Requirements for Each Span

(c) Participation Requirements

(d) Submittal Requirements

Include the following items in the ITP package:

(e) Hard copy:

i. Invitation to Participate Cover Letter

ii. Project Location Map

iii. Plan and Elevation

iv. Bridge Typical Section and Pedestrian Fence Concept

v. Pedestrian Bridge Data Sheet

(f) Electronic files:

i. PDF file with all of the above

ii. Pedestrian Bridge Data Sheet in CADD format

For a sample Prefabricated Pedestrian Bridge ITP complete with all hard copy attachments see ***Example 266.4.1***. To aid plan development CADD cells for the Pedestrian Bridge Data Sheet and Plan and Elevation sheet (2 of 2) are available in the FDOT Structures Cell Library. For the current FDOT CADD Software downloads follow the link below:

https://www.fdot.gov/cadd/downloads/software/software.shtm

(4) Upon delivery the pedestrian bridge, producers must acknowledge receipt of the ITP package.

(5) In order to be eligible to participate in the project the pedestrian bridge producers must provide a completed Pedestrian Bridge Data Sheet as outlined in the ITP on or before the specified due date (prior to 60% plans submittal). The completed Data Sheets must be electronically signed and sealed by the pedestrian bridge producer's EOR for inclusion in the final plan set.

The project EOR assigns a unique sheet number to each data sheet. The sheet numbers will be identified with the prefix BP (e.g., BP-1, BP-2, BP-#) and the data sheets will be placed at the end of the numbered sequence of the bridge plans. This will allow the Pedestrian Bridge Data Sheets to have independent sheet numbers as plan development progresses.

(6) After all ITP responses are received the project EOR must design and detail the foundation and substructure to accommodate the superstructure designs of all eligible pedestrian bridge producers. The design must envelope the most extreme loading conditions and geometry of all alternates.

(7) A Public Interest Finding is required for Federal Aid projects when only one Interest for Participation letter is received.

Include the following notes in the plans:

(a) <u>Eligible Steel Truss Pedestrian Bridge Producers</u>

Included in this plan set are Pedestrian Bridge Data Sheets submitted by bridge producers eligible to participate in this project. Producers who failed to submit a data sheet are excluded from participation. No Cost Savings Initiative Proposal will be accepted for the truss superstructure portion of the project. Contact information for the eligible producers is included in the data sheet.

(b) <u>Shop Drawing Submittal</u>

Prior to fabrication the Contractor’s EOR must submit signed and sealed superstructure shop drawings, technical specifications, and design calculations to the Engineer for review and approval.

Figure 266.4.2 Prefabricated Pedestrian Bridge Standard Truss Configurations

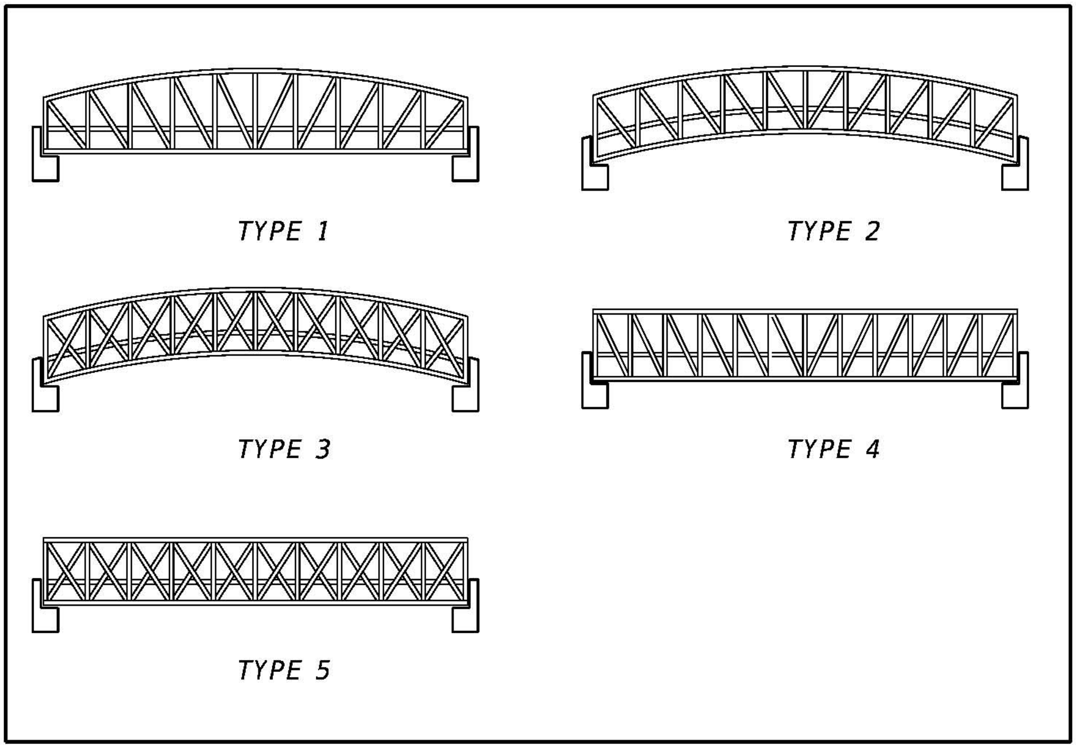


Figure 266.4.3 Prefabricated Pedestrian Bridge Standard Truss Member Shapes

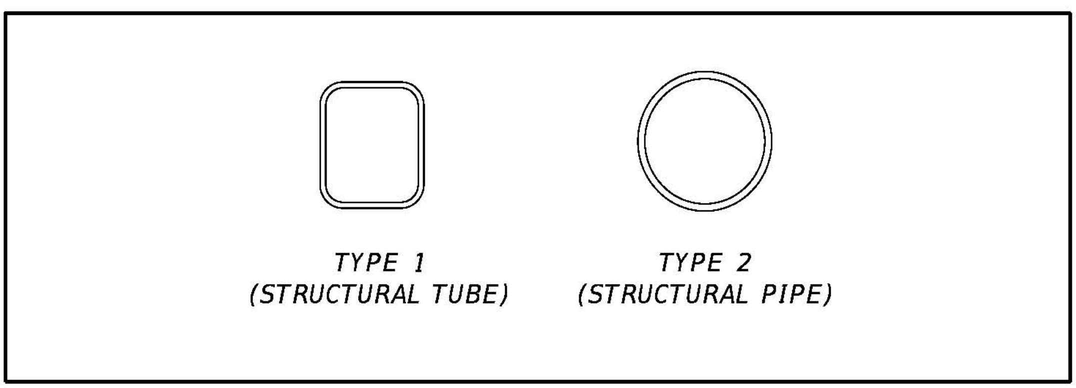
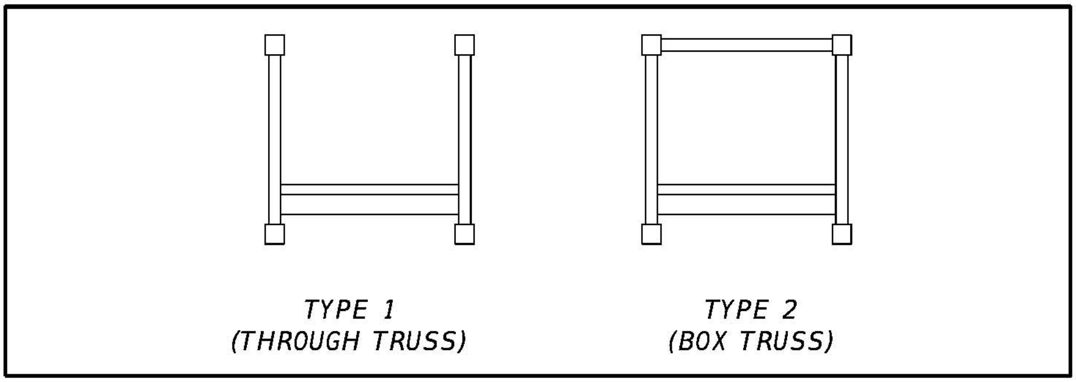


Figure 266.4.4 Prefabricated Pedestrian Standard Bridge Cross-Sections



Modification for Non-Conventional Projects:
Delete ***FDM 266.4.4*** and see the RFP for requirements.

Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans

Sheet 1 of 8

(prepare on Department letterhead)

FLORIDA DEPARTMENT OF TRANSPORTATION

DISTRICT 3

PREFABRICATED PEDESTRIAN BRIDGE

INVITATION TO PARTICIPATE

Project: CR 250 over Ruby Creek Pedestrian Bridge

Financial Project Number: 217664-1-52-01

Federal Aid Project Number(s): SF2-349-R

Date: March 15, 2011

Introduction:

The Florida Department of Transportation is currently preparing bid documents for the construction of a steel truss pedestrian bridge adjacent to County Road 250 crossing Ruby Creek in Jefferson County. The superstructure of the proposed bridge is to be provided by a steel truss pedestrian bridge producer who is prequalified to work on Department projects. This invitation to participate is being sent to all prequalified producers to solicit information needed by the project EOR to design the foundation and substructure of the proposed bridge. Enclosed are the following materials:

(1) Hard Copy
   - (a) Project location map
   - (b) Bridge Typical Section and Pedestrian Fence Concept
   - (c) Plan and Elevation (P&E) (2 sheets)
   - (d) Pedestrian Bridge Data Sheet

(2) Electronic
   - (a) PDF file with all of the above
   - (b) Pedestrian Bridge Data Sheet in CADD format

Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans
Sheet 2 of 8

Project Requirements:

(1) Design Specifications:
FDOT Structures Design Guidelines (***SDG***) ***Article 10.4***.
https://www.fdot.gov/docs/default-source/structures/structuresmanual/currentrelease_test_old/Vol1SDG.pdf

(2) Construction Specifications:
FDOT Standard Specifications for Road and Bridge Construction
https://www.fdot.gov/programmanagement/specs.shtm

(3) Standard Plans:
FDOT Standard Plans
https://www.fdot.gov/design/standardplans

(4) Allowable Truss Options: Allowable Truss options shown on P&E sheet 2 of 2 (Attached).

(5) Paint: Paint structural steel in accordance with ***Sections 560*** and ***975*** of the ***Standard Specifications***. Paint structural steel with a high performance top coat system. The color of the finish coat to be Federal Standard No. 595, Color No. 36622.

(6) Pedestrian Fence: Bridge Fence consistent with bridge rail concept and ***SDG Article 10.12***.

(7) Vehicular Loading: Vehicular Loading per ***AASHTO LRFD Guide Specifications*** for the Design of Pedestrian Bridges is not required.

(8) Geometry: For project geometry see attached P&E sheets.

Participation:

To be eligible to participate on this project pedestrian bridge producers must:

- Acknowledge receipt of this ITP
- Be on the Department's List of Qualified Fabrication Facilities.
- Submit a response to this ITP on or before June 10, 2011 to the project EOR.

Submittal:

Provide completed pedestrian bridge data sheet as follows:

- Bearing Plate Dimensions Table – for each span provide bearing dimensions as shown to the nearest 1/8th inch.

Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans

Sheet 3 of 8

- Bearing Plate Locations & Bridge Seat Elevations Table – for each substructure unit provide dimensions as shown to the nearest 1/8th inch and bridge seat elevation to the nearest 0.001 feet.
- Bridge Reactions Table – for each span provide loads as indicated to the nearest 0.1 kip.
- Company Contact Information Table – in the contact information block provide company name, address, contact person, phone number, and e-mail address.
- Florida PE Seal and Signature – provide seal and signature of Florida PE responsible for the work.

Submit response to:

John Doe, PE
XYZ Engineers, Inc.
123 East Main Street
Tampa, Florida 33607

By submitting a response to this invitation to participate the pedestrian bridge producer is agreeing to satisfy all project requirements listed above if selected.

Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans

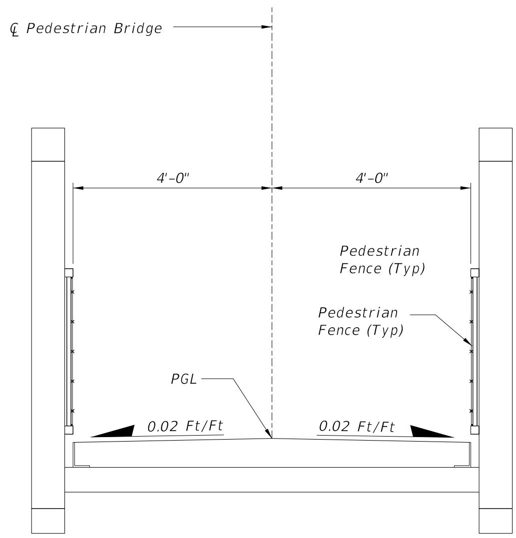
Sheet 4 of 8

LOCATION MAP

CR 250 OVER RUBY CREEK PEDESTRIAN BRIDGE
JEFFERSON COUNTY FLORIDA
FPN 217664-1-52-01

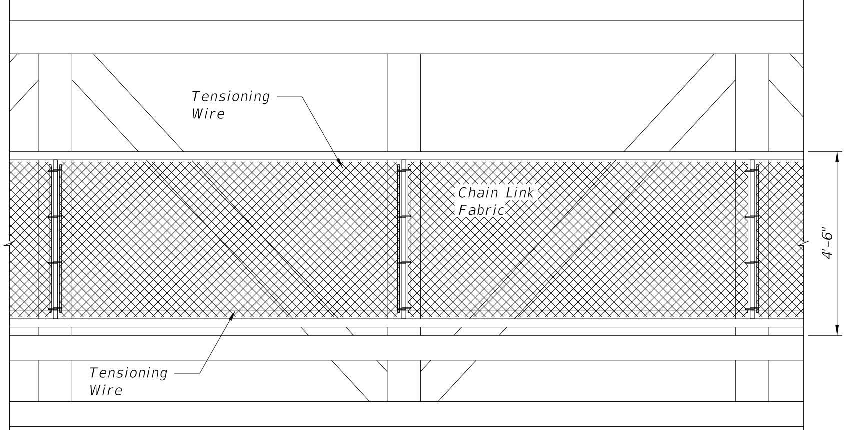
Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans

Sheet 5 of 8



BRIDGE TYPICAL SECTION

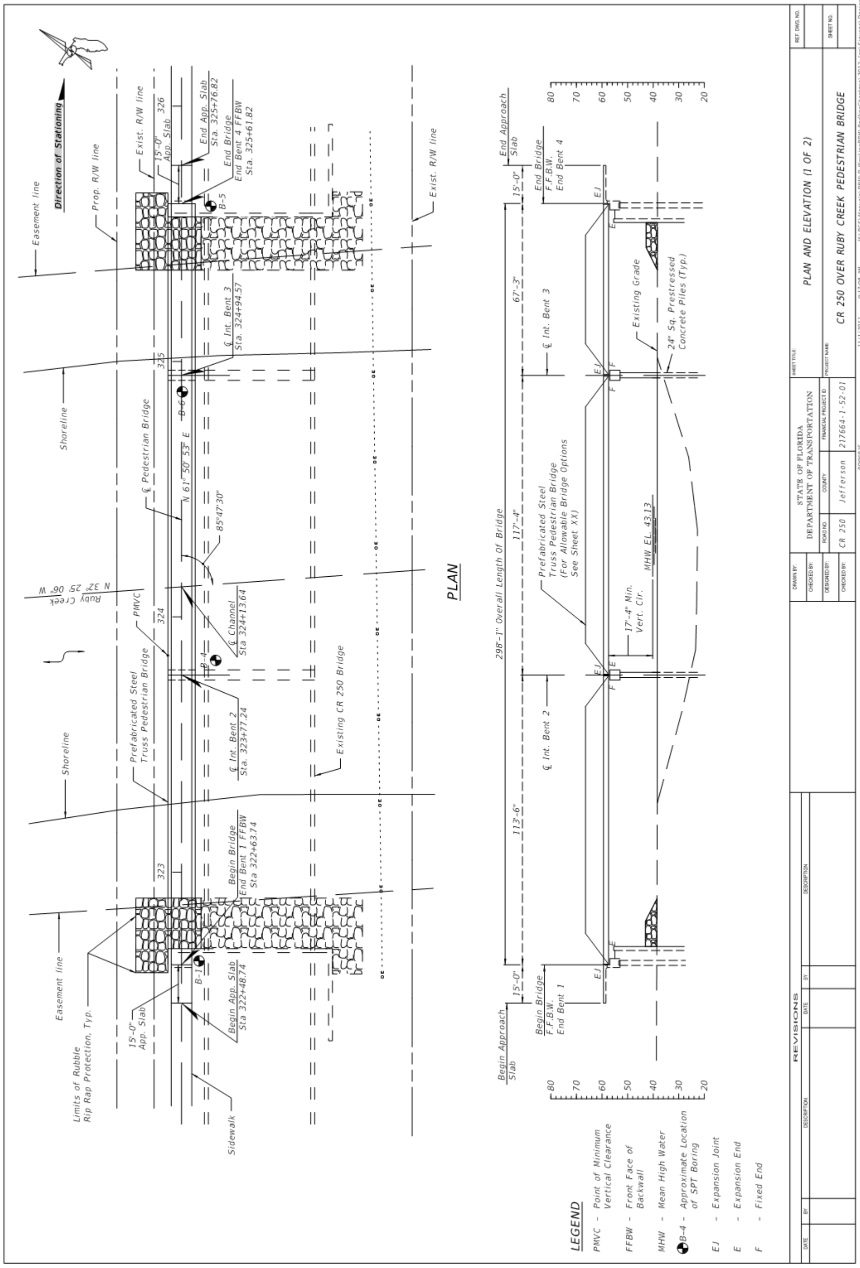
(CR 250 Over Ruby Creek Pedestrian Bridge)



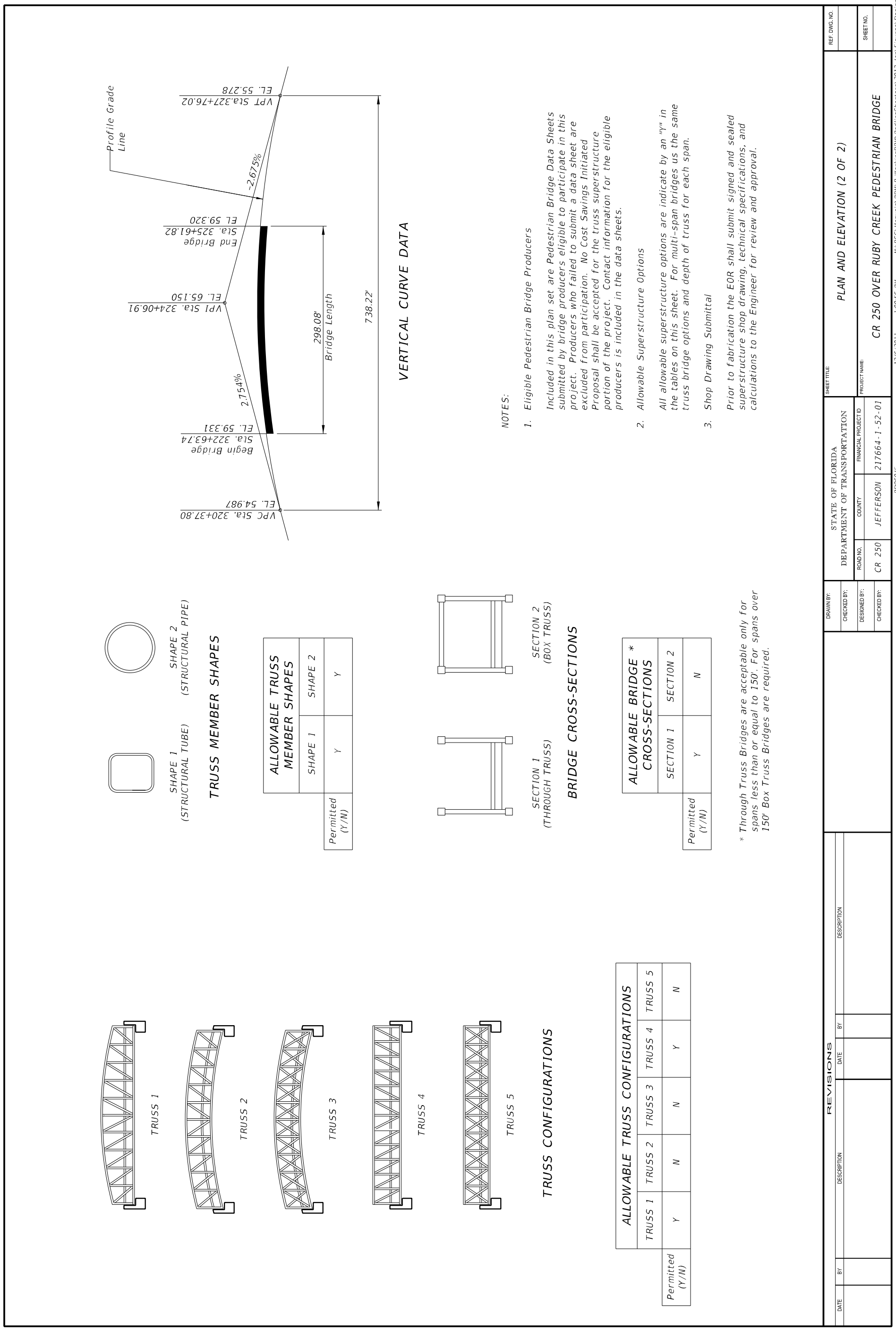
PEDESTRIAN FENCE CONCEPT

Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans

Sheet 6 of 8

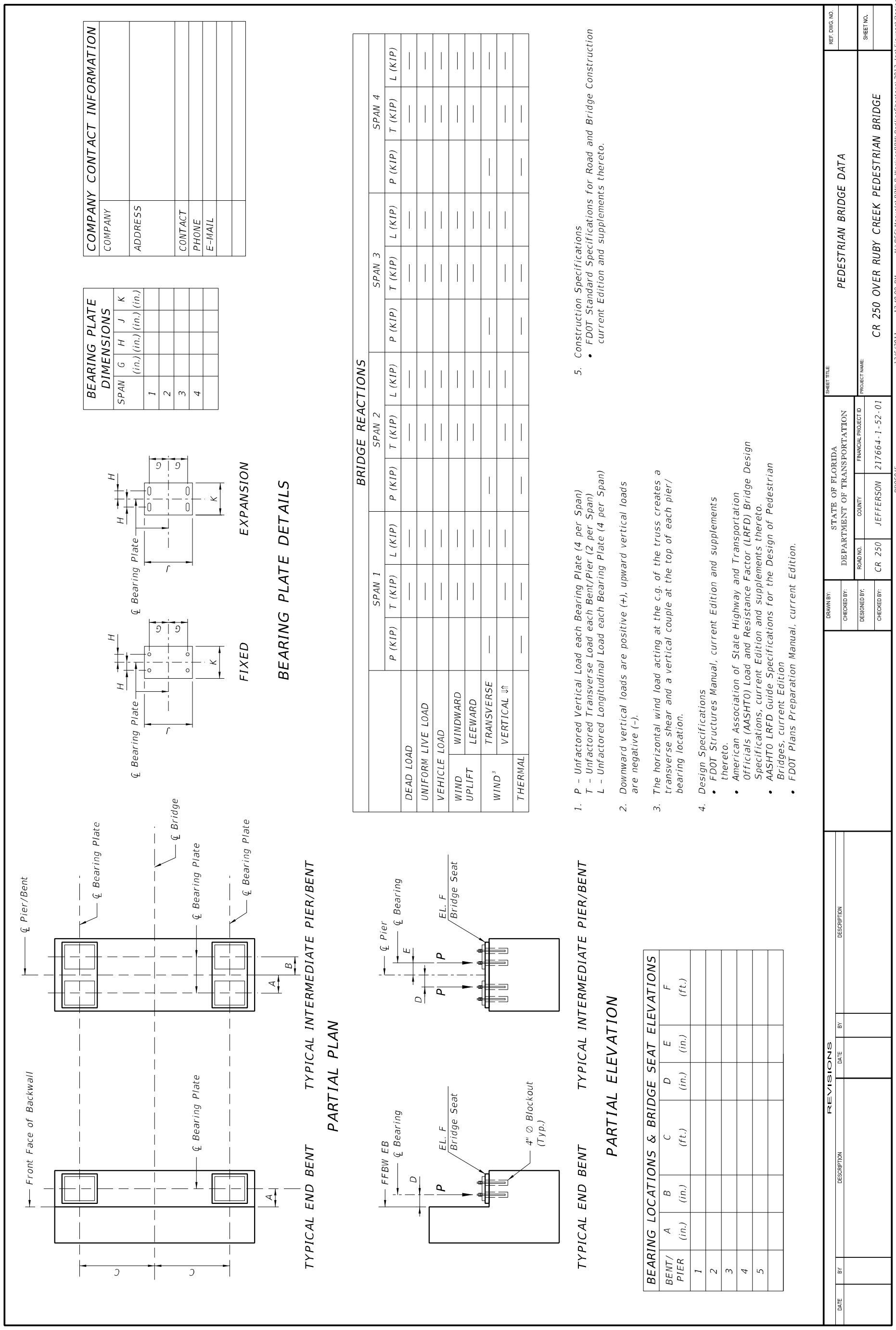


Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans
Sheet 7 of 8



Example 266.4.1 Sample Steel Truss Pedestrian Bridge Plans

Sheet 8 of 8



270 Planting Designs

270.1 General

This chapter provides the criteria and requirements for development of planting designs.

Landscape projects serve ecological, restoration, and conservation functions. Planting designs can effectively:

- Change the characteristics of the roadway corridor to encourage lower vehicle operating speeds.
- Provide shade and comfort for pedestrians.
- Preserve infrastructure from erosion.
- Support economic development.
- Enhance the aesthetic value of transportation facilities.

For Selective Clearing and Grubbing plan content refer to ***FDM 924***.

For Planting Plan content and Construction Cost Estimate refer to ***FDM 944***.

270.1.1 Maintenance Agreements

A maintenance agreement is often obtained when a local agency or group requests landscape designs that require elevated levels of care beyond the establishment period. When requested, assist the Department Project Manager in the execution of an agreement.

270.2 Planting Design Requirements

Planting designs may include:

- Protection of existing plant material to remain
- Removal or relocated plant material
- New plant material

Plants need quality space above and below ground to thrive. To ensure that quality space is provided, coordinate the Landscape Plan with other component plans.

Planting designs must comply with the following requirements:

(1) Target a combined value greater than 50% for large plants of the estimated value of all plants specified in the plans. Large plants are defined as:

    (a) Shrubs, trees, and cycads, 7 gallons or greater

    (b) Single-trunk palms

    (c) Clustering Palms, 6-foot height or greater

(2) Meet clear zone and lateral offset requirements for mature plants with diameter > 4 inches as specified in ***FDM 215***.

(3) Meet district setback requirements for the following:

    (a) Drainage Structures and Pipes

    (b) R/W Fence and Retaining Walls

    (c) Back of Guardrail, or Ditch Pavement

    (d) Concrete Bridge Embankment

    (e) Light Poles

    (f) ITS Poles and Devices

    (g) Underground Utilities

    (h) Overhead Electrical Utilities

(4) Meet sight distance requirements specified in ***FDM 210***.

(5) Meet intersection sight distance requirements specified in ***FDM 212.*** Do not use plants that will require routine maintenance to preserve sight distance.

(6) Use plants that are resistant to destructive insects and diseases, and do not rely on inoculation for survival.

(7) Preserve visibility of community aesthetic features, roadway signing and lighting, and permitted outdoor advertising signs

(8) Be compatible with above and below ground utilities. Consider plant size at maturity when selecting trees and vegetation.

(9) Not inhibit the performance and function of stormwater systems.

(10) Accommodate maintaining agency's preferences, abilities, and resources using primarily native plants that are context appropriate and locally adapted.

(11) Include a diverse mix of plants when practical.

In addition, planting design should avoid the following:

(1) The need to amend or replace existing soil.

(2) Potential damage to pavement from growing roots.

(3) Accumulation of falling debris (fruit, nuts, large leaves) on sidewalk.

270.2.1 Department-Maintained Landscapes

Coordinate the intended level of maintenance expected with the District Maintenance Office.

Landscape designs for highways that are viewed by high-speed motorists are often low maintenance. Plants selected for these areas typically do not rely on an irrigation system or fertilizer for survival. Avoid planting designs that require irrigation following plant establishment period.

Landscape designs for rest areas, toll facilities, median treatments, or other areas which will be viewed by pedestrians or slow-moving motorists may require a higher standard of care and maintenance.

Arrange trees and palms to allow for efficient mowing paths of tractors, and to maintain design intent in the case of plant mortality. Rigid geometric designs focused on repetition should not be used.

270.2.2 Roundabout Central Island

Provide varying height trees and plants in the central island to enhance driver recognition of the roundabout upon approach. Select tree species 6-foot in height or taller when installed; palm trees 12-foot or taller. Select shrubs that will recover or regenerate naturally after mechanical damage. Select trees and plants with a variety of height, color, form, and texture.

Place trees and palms near the center of the central island, and not less than 6 feet from the face of Type D curb. Place shrubs in a simple arrangement to help increase visual awareness of the roundabout.

The landscape design must be fully integrated into the roundabout design to optimize the performance of the roundabout.

270.3 Soil Enhancements

Highly disturbed soils (i.e., soils located in medians, embankments, and roundabouts) are often densely compacted, rocky, unsuitable pH levels, and infertile. These soil conditions may negatively impact plant establishment by inhibiting root growth, reducing water infiltration, and inhibiting nutrient uptake.

When possible, select plant species that can thrive in the existing or disturbed soil conditions. Soil enhancements become necessary for soil conditions that inhibit plant establishment and growth. Soil enhancements are typically limited to:

- Planting beds
- Tree or palm planting pits (typically 2-times the size of the root ball)

Excavation for amendments or replacement soil cannot occur within two feet from the back of any curb or from any structure.

270.3.1 Soil Analysis

Conduct a preliminary analysis of the existing soil conditions during analysis phase, or early in the design process to determine what plants will thrive. The preliminary analysis should include pH, soil fertility, and percolation tests. The Department may require an advanced soil analysis when preliminary analysis indicates the existing soils are not suitable for plant establishment and growth.

Provide documentation to the District Landscape Architect justifying the need for soil enhancements.

270.3.2 Soil Enhancement Selection

Select the appropriate soil enhancements based on the results of the soil analysis. There are three types of soil enhancements:

(1) Soil scarification (a.k.a., soil structural improvement) includes mechanically loosening the existing soils.

(2) Soil amendment includes mixing organic soils, inorganic soils, or minerals with the existing soils.

(3) Soil replacement with Landscape Soil. Landscape Soil material requirements are included in ***Standard Specification* 987-2.4**. Soil replacement is used only when either of the following conditions exist:

(a) Other soil enhancement types will not improve the quality of the existing soil to support establishment and vigorous growth of new or relocated plants.

(b) The District Design Engineer approves the use of Landscape Soil on a design project that has raised curbed medians, bulb-outs, sidewalk tree pits, and roundabout central islands to accommodate a subsequent landscape project.

271 Irrigation Designs

271.1 General

This chapter provides the criteria and requirements for designing irrigation systems. For Irrigation Plan content and Construction Cost Estimate refer to ***FDM 944***.

Irrigation is the application of water applied evenly on designated areas using a system of pipes and sprinkler heads. Irrigation systems are often included with landscape projects in areas where:

- Rainfall is irregular
- Healthy and robust plantings are desirable
- Plants are observed and enjoyed by pedestrians or slow-moving vehicular traffic (e.g., rest areas, toll plazas, streetscapes, roundabouts)
- Plants serve as a safety enhancement (e.g., roundabout central island, midblock crossings, median treatment)
- Access to planting area during establishment period is not practical

271.2 Irrigation System Requirements

Irrigation system designs must comply with the following requirements:

(1) Provide reliable points of connection for water and power source with sufficient capacity for system operation. Power source may be electric, solar, or battery. Water sources, in the order of preference are:

  (a) Re-use or reclaimed water

  (b) Well water (with acceptable mineral content that will not cause staining of concrete surfaces)

  (c) Potable water

  (d) Stormwater pond

(2) Provide fully automatic controllers, including the following:

  (a) Connected to a rain sensor

  (b) Programable irrigation run time based on watering restrictions, temperature, sunshine, and humidity

(c) Grounded per manufacturers recommendations

(d) Communication abilities and flow monitoring when required by district

(e) Housed in a secure cabinet (NEMA 3R) located near the power source and generally out of view of the public

(3) Use durable materials that are traffic rated and ultraviolet light resistant.

(4) Minimum 12 inches of cover from top of pipe for lateral lines and 18 inches for mainline. Size pipes to maintain a minimum working pressure at each spray head or nozzle as per manufacturer. Water flow rate in pipe not to exceed 5-feet per second without district concurrence.

(5) Provide sprinkler head-to-head coverage with uniform precipitation rate. Avoid overspray into the roadway, sidewalks, transit stops, and other similar paved areas.

(6) Compatible with the maintaining agency's preferences, abilities, and resources. Request proprietary product certification when applicable.

(7) Comply with requirements:

(a) Florida Building Code

(b) Water Management Districts

(c) Florida Administrative Code.

271.3 Landscape Irrigation Sleeves

Landscape irrigation sleeves are used in locations where a future landscape project with irrigation is planned, as determined by the District Landscape Architect. Irrigation sleeves are intended to be used on new and reconstruction projects, where there is an opportunity to install the sleeves in an open trench.

Typical installation may include under paved surfaces to connect to raised medians, roundabout central islands, or under driveways.

See ***Standard Plans***, ***Index 591-001*** for landscape irrigation sleeve installation requirements.

272 Hardscape Designs

272.1 General

This chapter provides the criteria and requirements for hardscape features.

Hardscape is any non-living structure or feature included within a landscape design. Hardscape-only projects are not landscape projects. Examples of hardscape include:

- landscape borders (e.g., stone, bricks, concrete)
- planters, fountains, or other Community Aesthetic Features
- retaining walls or sidewalk
- benches and decks
- wayfinding signage
- transit stops
- pavers for driveways, paths, plazas, or patios

See ***FDM 944*** for Hardscape Plan content and Construction Cost Estimate.

272.2 Hardscape Design Requirements

Hardscape designs must comply with the following requirements:

(1) Be compatible with a maintaining agency's preferences, abilities, and resources. Request proprietary product certification when applicable.

(2) Preserve visibility of Community Aesthetic Features, highway signing, and permitted outdoor advertising signs

(3) Be compatible with above and below ground utilities.

(4) Support community efforts for economic development, urban revitalizations, and aesthetic enhancements. See ***FDM 127*** for hardscape identified as a Community Aesthetic Feature.

(5) Meet vertical and horizontal clearance requirements for pedestrian and bicycle facilities in ***FDM 222, 223,*** and ***224***.

(6) Meet lateral offset or clear zone requirements in ***FDM 215***.

(7) Meet sight distance requirements in ***FDM 210.***

(8) Meet intersection sight distance in ***FDM 212.***

(9) Use materials that are low maintenance and durable.

(10) When possible, use recycled or recyclable materials.

(11) Comply with:

  (a) Florida Building Code

  (b) Florida Administrative Code

273 Landscape Maintenance Guide

273.1 General

This chapter provides the criteria and requirements for the Landscape Maintenance Guide. See ***FDM 944.7*** for development of Landscape Maintenance Guide sheet.

A Landscape Maintenance Guide is required for all landscape projects whether delivered as a standalone or as a component set of plans. This plan sheet describes the long-term design intent, limits of landscape maintenance, and the necessary activities for maintaining the planting and irrigation designs.

273.2 Landscape Maintenance Guide Requirements

The Landscape Maintenance Guide provides guidance to the maintaining agency on anticipated activities necessary to preserve the design intent, assure vitality of the plant material, and optimize the performance of the irrigation system. Coordinate the methods for plant care, and watering frequency for irrigation system with the maintaining agency.

Include a draft Landscape Maintenance Guide with the Phase III submittal, submit final guide with Phase IV submittal. Place the final PDF of the Landscape Maintenance Guide in the:

- Maintenance agreement when maintained by a local agency or group
- Maintenance contract when maintained by the Department.

273.2.1 Design Intent

Convey the design intent of the landscape design is intended to provide.

(1) Functional characteristics of individual plants or groups of plants may provide:
   - (a) Screen adjoining land use
   - (b) Provide shade to sidewalk or path
   - (c) Reduce stormwater velocity (erosion control)
   - (d) Maintain full foliage, or naturally appearing forest
   - (e) Reestablish natural roadside edge
   - (f) Support economic development, or enhance the esthetic value of rest areas

(g) Provide a safety enhancement (e.g., roundabout central island, midblock crossings, median treatment)

(2) Preserve required site distances, such as:

(a) Stopping and intersection sight distance

(b) Horizontal and vertical clearances near pedestrian facilities

(c) Outdoor advertising sign view zone

(d) Lateral offset and clear zone

273.2.2 Plant Vitality

Convey the maintenance activities and performance to assure continued plant vitality, such as:

(1) Plant pruning:

(a) Maintain clear trunk to X feet

(b) Maintain at height no less than X feet

(c) Maintain height no greater than X feet

(d) Maintain form and spread

(2) Fertilizer requirements (type and frequency)

(3) Watering requirements

(4) Weeding, mulch replenishment, and planting bed edging

(5) Pest and disease control

(6) Hardscape and site amenities preservation

273.2.3 Irrigation System Performance

Convey the maintenance activities for optimal performance of the irrigation system, such as:

(1) Frequency of scheduled inspections and testing requirements

(2) Requirements associated with the original design parameters, including manufacturer specifications and user manuals

(3) Zone run times based on system efficiency, precipitation rate, seasonal adjustments, and local jurisdictional restrictions

(4) Inspection and maintenance of the following:

   (a) Backflow preventer and point of connection

   (b) Water source and pressure requirements

   (c) Filters and filtration requirements

   (d) Operation of controller and sensors

   (e) Valve flow and operation

   (f) Head adjustment and spray pattern, including necessary adjustments as the landscape matures

(5) Winterization requirements (if applicable)

(6) Future audit requirements

273.3 Limits of Landscape Maintenance

Provide an illustration that defines the boundaries of maintenance activities. The illustration is typically not-to-scale and produced on a standard-format sheet (11”x17”) oriented west to east, or south to north (increasing stationing or mile post). Illustration should include the following:

(1) Use the planting plan sheets, “gray screened” and devoid of unnecessary text and labeling, in the background.

(2) Display and label the limits of maintenance shown as shaded, or hatched areas.

(3) Provide a north arrow with NTS, typically placed in the top right corner of the sheet.

(4) Label the following:

   (a) Begin and end project limits

   (b) R/W and easements

   (c) Roadway names

   (d) Outside edge of sidewalk, pavement, or other elements that define the boundary of maintenance activities

Include the limits of landscape maintenance as an exhibit to the Landscape Maintenance Guide.

273.4 Landscape Maintenance Cost Estimate

Estimate the annual cost for proposed landscape maintenance activities, including irrigation system. Consult with the District Landscape Architect and District Maintenance staff when developing the cost estimate. During design, a preliminary cost estimate allows the maintaining agency to evaluate the landscape plan and determine if revisions are necessary.

Include the cost estimate as an exhibit to the Landscape Maintenance Guide.

274 Selective Clearing and Grubbing

274.1 General

This chapter provides the criteria and requirements for Selective Clearing and Grubbing (C&G) designs. See ***FDM 924*** for development of Selective C&G Plan sheets

Selective C&G is an alternative to Standard C&G in areas outside the limits of construction (i.e., area that must be cleared for the purpose of constructing the roadway). While Standard C&G requires complete removal of all trees, stumps, roots and other such protruding vegetation, Selective C&G provides instruction for areas where existing trees and vegetation are retained.

Coordinate the determination of desired Select C&G areas with the District Landscape Architect early in the design phase. Verify that the inclusion of Select C&G activities aligns with future landscape projects or available Landscape Opportunity Plan. Also, review Project Commitments made during the PD&E phase to identify possible landscaped areas that would benefit from Select C&G activities.

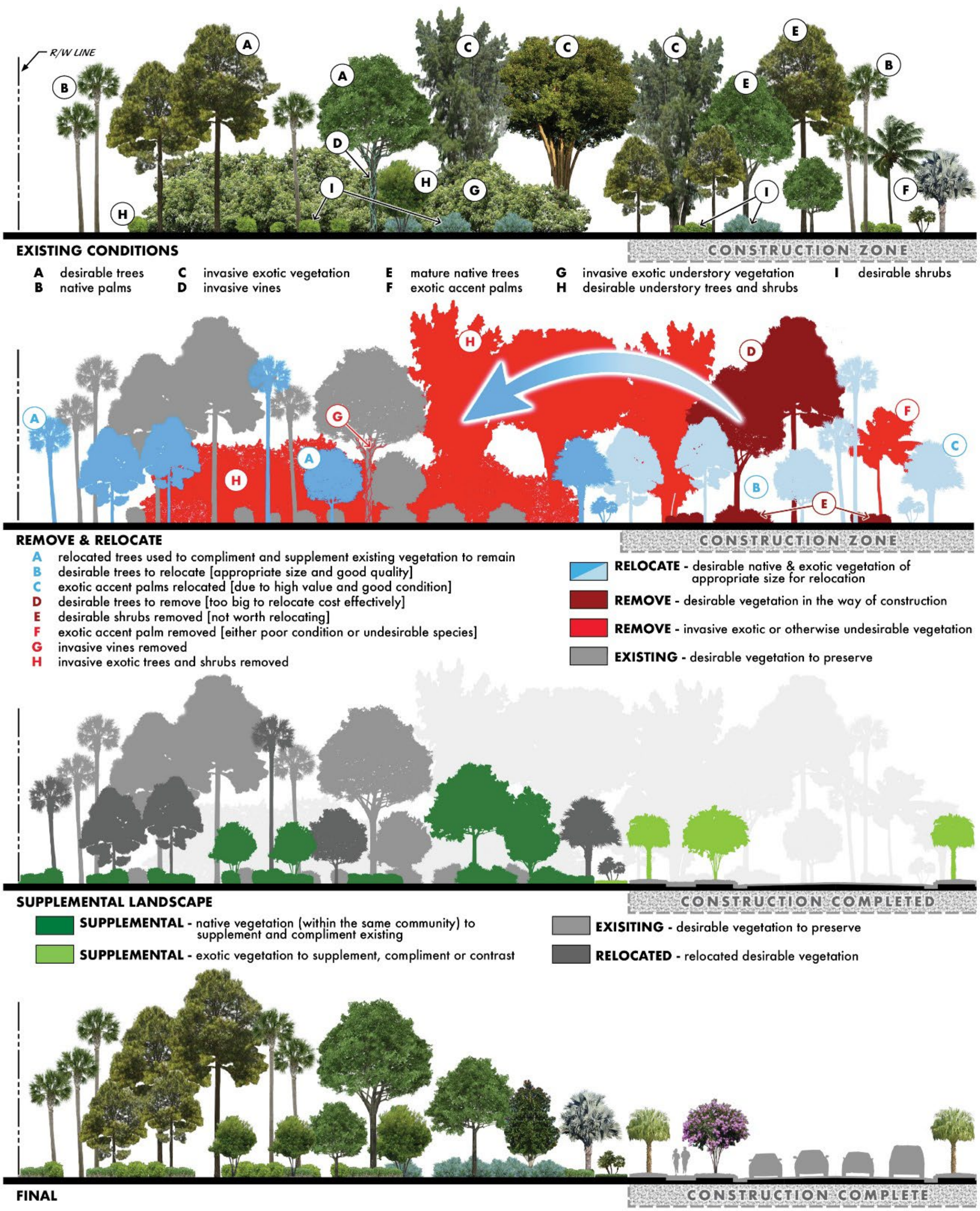
Selective C&G areas may include one or more of the following activities:

- Preservation and protection of desirable trees and vegetation
- Removal of undesirable trees and vegetation
- Installation of tree protection fencing
- Branch and root pruning
- Tree or palm relocation

Preserve and protect healthy and structurally sound trees, palms, and vegetation along transportation corridors. Removal or relocation of trees and palms should be considered only when preservation is impractical. See ***FDM 275*** for tree and palm relocation requirements.

Refer to ***Figure 274.1*** for an illustration of the Selective C&G process, including vegetation removal, preservation, relocation, and supplementing with new landscape material.

Figure 274.1 Illustration of Selective C&G Process



274.1.1 Preservation of Trees and Vegetation

Preserve natural landscapes by identifying Plant Preservation Areas within the Select C&G Plan sheets. Plant Preservation Areas are areas in which no construction activities are to occur, including the staging of materials or equipment.

Trees, palms, shrubs, grasses, wildflowers, and existing soils within Plant Preservation Areas are to be protected from construction activities. Surrounding these areas by silt fence (or other visible delineation) during the construction phase is an effective way of avoiding unintended encroachment.

Verify with the District Landscape Architect that preservation areas align with future highway landscape plans.

274.1.2 Removal of Undesirable Trees and Vegetation

Trees and vegetation that are in poor health, diseased, or listed as invasive are undesirable and should be removed. Within a designated Selective C&G area, undesirable vegetation can be removed while preserving existing desirable vegetation.

Mechanical thinning (removal) of undergrowth to improve the health and appearance of desirable trees and vegetation should also be considered. Avoid thinning dense trees and shrubbery along the R/W when this vegetation is providing a desired buffer between the roadway and adjacent residents.

When removing undesirable trees, determine if stump removal is necessary or may be left in place.

Chemical weed control, or physical removal of invasive trees and vegetation will also improve the health and appearance of remaining landscaped area. When attempting to remove invasive grass, weeds, and vines, consider the effectiveness of this treatment when adjacent properties are overrun as well, or if follow-up treatments will be necessary for complete eradication.

Category 1 plants listed by the ***Florida Exotic Pest Plant Council*** are undesirable and removed when feasible.

274.1.3 Tree Protection Fencing

Tree protection fencing is to protect the tree in its entirety, including the root system, trunk, branches, and surrounding soil from damage, compaction, and contamination. Utilize tree protection fencing for trees "selected" to remain when:

(1) Individual or groups of trees require preservation, or

(2) Individual or groups of trees have been relocated within project limits.

Place fencing around the root zone, or at minimum the dripline of trees. See ***FDOT Standard Plans***, Index 110-100 for fencing installation requirements.

274.1.4 Branch and Root Pruning

Branch pruning is the selective removal of unwanted tree branches and provides one or more of the following benefits:

- Reduce risk of damage to people or property
- Manage tree health and direction of growth
- Provide horizontal and vertical clearance for pedestrians, cyclists, or vehicles
- Improve tree structure, restore shape, or improve aesthetics

Root pruning is the process of cutting roots prior to mechanical excavation near a tree. Root pruning is necessary to minimize damage to the tree's critical root system during construction, or in preparation for tree relocation. The roots are typically sliced at the drip line of an established tree.

274.2 Selective C&G Field Assessment

A field assessment should be conducted prior to final determination on extent of Select C&G activities. The field assessment should identify the following:

(1) Opportunities for preservation, protection and enhancement of existing vegetation, and tree relocation options. Also note:

    (a) Presence of endangered plant species (***Florida Department of Agriculture Endangered Plant Species***), or invasive trees and vegetation.

    (b) Health and condition of trees and vegetation

    (c) Historically significant, or large trees or palms

(d) Completed beautification or landscape projects

(e) Vegetation buffers between project and adjacent landowners

(2) Opportunities for vegetation removal to create vistas or allow views into desirable areas such as ponds, forested areas, or other attractive transportation features.

(3) Anticipated limits of construction and the impacts on surrounding vegetation.

(4) Location of outdoor advertising signs, community aesthetic features, or other similar structures.

(5) Corridors traversing through designated Florida Scenic Highways, or conservation lands.

(6) Possible utility conflicts effecting proposed tree removal or installations.

274.2.1 Tree and Vegetation Survey

The result of the field assessment determines the course of action for Selective C&G and the extent of the Tree and Vegetation Survey.

Prepare a site inventory of all existing trees and vegetation, including species, size, and location. Coordinate with the surveyor to have trees tagged and surveyed.

A site inventory provides a record of what existed prior to construction if mitigation or replacement is warranted due to damage caused by contractor.

274.3 Selective C&G Maintenance Report

A Select C&G Maintenance Report is required when Select C&G sheets are included in the Roadway Plans.

This Select C&G Maintenance Report details the care and maintenance of preservation and Selective C&G areas. This document describes the intent of the Selective S&G activities, and arboricultural best practices.

Deliver the Select C&G Maintenance Report to the District Project Manager.

275 Tree and Palm Relocation

275.1 General

This chapter provides the criteria and requirements for relocation of trees and palms. For Tree and Palm Relocation plan content refer to ***FDM 944***.

Relocation of trees and palms require the approval of the District Landscape Architect.

Develop a root pruning and relocation plan tailored to the species being relocated. Time periods required between root pruning and relocation must be in accordance with Industry standards and ***Supplemental Specification 581***.

275.2 Relocation Considerations

When deciding to relocate a tree or palm, consider the following:

(1) Protected tree or palm species (***Florida Department of Agriculture Endangered Plant Species***), or local jurisdictional regulations.

(2) Cost effectiveness of relocation (i.e., cost and benefit of relocating existing trees versus purchasing new nursery material)

(3) Tree or palm condition (e.g., size, form, health, structure)

(4) Aesthetic, historical cultural, community, and environmental value

(5) Functional characteristics and engineering (e.g., safety considerations)

(6) Negative public perceptions regarding removal of healthy trees

(7) Overall suitability for relocating:

    (a) Desirable and disease resistant species

    (b) Survivability

    (c) Required establishment period

    (d) Impact to construction schedule

    (e) Removal, transport, or installation issues

275.3 Relocation Site Selection

For construction projects, trees or palms must be relocated to a site that is within, or near the project limits which decreases transport costs and increases the survival rate.

For maintenance-let landscape projects an off-site location may be considered when there is not sufficient space to relocate a tree on-site. Off-site relocations must meet the following requirements:

- Relocation site is within the district in which the contract is let
- Acceptable plan for care during establishment period
- A written agreement with the maintaining agency has been obtained

276 Outdoor Advertising Signs

276.1 General

This chapter provides the criteria and requirements for outdoor advertising signs.

Generally, any outdoor advertising sign structure requires a permit from FDOT. A legally erected or permitted sign establishes a protected view zone in which no plantings may encroach on the driver's line of site of the sign. When a landscape project is within or near the limits of a view zone, the landscape architect will notify the sign owner in writing (email correspondence is acceptable).

276.1.1 View Zones

In accordance with ***Chapter 479, F.S.***, the view zone begins at a point on the edge of pavement perpendicular to the nearest edge of the sign facing and continues in the direction of approaching traffic for a distance of:

- 350 feet for posted speed limits of 35 mph or less, or
- 500 feet for posted speed limits over 35 mph.

An alternate view zone is created by shifting the starting point along the edge of roadway and then adding the distances stated above. The alternate view zone can be established via the original permit application, vegetation management permit, or by written agreement (email correspondence is acceptable) between the Department and the sign owner.

Use the ***Outdoor Advertising Database*** located on the ***Outdoor Advertising*** web site to verify the permit status of permitted outdoor advertising signs located within 1,000 feet of the project limits. Search the database by county and roadway section ID to make sure all permitted signs are identified. Some permitted signs may not be erected or visible at the time of design, but still have valid view zones.

The database provides pertinent information for erected signs, including:

- Permit status (active, voided, revoked, canceled, or expired)
- View zone requirements (by statute, or alternate view agreement)
- Approved Vegetation Management Permit

For signs with a permit status of “revoked”, “cancelled”, or “expired”, contact the State Outdoor Advertising Administrator (identified on the ***Outdoor Advertising*** web site) to determine if the view zone is still valid.

276.1.2 Vegetation Management Permit

An approved ***Vegetation Management Permit Application*** allows the owner to alter, remove or install vegetation within the Department's right of way. This application may also establish an alternate view zone. The activities granted to the owner via permit may have a significant bearing on the proposed landscape project.

900 Production of NexGen Plans

900.1 General

The requirements provided in the ***FDM 900 series*** and the ***FDOT CADD Manual*** form the basis for format and assembly of the Contract Plans Set.

The ***FDM 900 series*** reflects adopted practices, processes, and procedures for plans production and delivery using Bentley's OpenRoads Designer (ORD) Edition or Autodesk Civil3D.

The ***FDM 900 series*** also provides instruction when Building Information Model (BIM) files are provided. BIM files are required for:

- All related surfaces for earthwork operations and used to determine earthwork quantities.
- All related surfaces for automated machine guidance (AMG) milling and pavement operations are anticipated.
- When appropriate, other files where the Level of Development (LOD) is considered construction ready (LOD 300 and higher).

The ***FDM 900 series*** is divided into three sections:

(1) Plans Production – This section provides general plans production information, and requirements for documents that are not delivered within a Contract Plans Set.

(2) Roadway Plans Set – This section provides specific information concerning the content of each required sheet delivered within the Roadway Plans Set.

(3) Component Plans Set – This section provides supplemental information concerning the content of a Component Plans Set.

Placing the Consultant's business logo on any plan sheet contained in the Contract Plans is prohibited.

900.1.1 Exhibits

Many chapters contain "generic" exhibits that provide examples of the plan sheets covered by that chapter. These exhibits were developed using criteria and standards in force at the time of their creation. These exhibits are not to be used as a source for criteria unless specified as such within the ***FDM*** chapter.

900.1.2 Symbols and Abbreviations

Standard symbols for Roadway Design are shown in the CADD Symbol Cell Library.

Abbreviations may be used to save space. A list of standard abbreviations is contained in the ***Standard Plans***. Minor deviations from these standard abbreviations are allowed, provided that the abbreviation used is clear and easily understood.

900.1.3 Photography

Plan sheets may use photography (aerial or other) when appropriate (e.g., for Drainage Maps, supplemental site maps, bridge repair plans).

900.2 Labeling and Dimensioning Requirements

Orient horizontal and diagonal text to read left to right. Orient vertical text to read bottom to top.

Display information and data in accordance with the following:

- **Typical Section Elements** (e.g., lane widths, shoulder widths) - in feet, typically as a whole number.
- **Cross Slopes** (e.g., pavement, shoulder surfaces, sidewalks, bridge decks) - as a decimal part of a foot vertical per foot horizontal. These cross slopes are typically rounded to two decimal places (i.e., 0.02, 0.06) but may be shown to three decimal places when required.
- **Horizontal Control Points** (e.g., survey centerline, baseline, intersections, and alignment) - in feet to 2 decimal places.
- **Vertical Control Points** (e.g., PVC, PVI, PVT) - in feet to 2 decimal places.
- **Profile Grade Elevations** - in feet to 2 decimal places.
- **Profile Grade Slope** - in percent to 3 decimal places.
- **Flow Line Elevations** - in feet to 2 decimal places.
- **Drainage Structure Elevations** (e.g., manhole tops, grate elevations) - in feet to 2 decimal places.
- **Ditch Elevations** - in feet to 1 decimal place (to nearest 0.05 when controlled by percent of grade).

- **Box or Three-sided Culvert Spans and Heights** - Show inside dimensions using “span by height” format (10 x 6 means the span is 10 feet and the height is 6 feet). In feet as a whole number for new construction; in feet to 2 decimal places for extensions of existing box culverts.
- **Alignment Bearings, Degree of Curve and Delta Angles** - in degrees, minutes, and seconds, rounded to the nearest second.
- **Slope Ratios** - in vertical to horizontal (V:H) format; e.g., 1:6, 1:4.

900.3 Sheet Borders (Sheet Print Size)

Plan sheet borders are contained in the FDOT CADD Software. There are four allowable sheet border sizes that can be selected: standard-format sheet (11”x17”) or large-format sheet (24”x36”, 36”x48”, or 36”x72”). Each ***FDM 900 series*** chapter specifies the allowable sheet border that may be used. When multiple sizes are allowed, select the size that will most efficiently display the information. ***Table 900.3.1*** provides a summary of allowable border sizes for each sheet used in the Contract Plans.

Sheet borders include an information block and revision block.

900.3.1 Project Information Block

The information block is in the lower right corner of the border. Enter the following information into the information box:

(1) Sheet Number (far right corner) – Number plan sheets in sequential order as shown in the Index of Plans Sheets that is placed on the Key Sheet.

(2) Sheet Title (immediately left of the sheet number) – This should be the same title that is shown in the Index of Plans Sheets that is placed on the Key Sheet.

(3) Project Information (immediately left of the sheet title) - This should be the same information that is shown on the Key Sheet.

  (a) State Road Number – Place the prefix “SR” before the number for clarification. When a county road is shown in the box use the prefix “CR”. The box should remain blank when the facility is neither a state nor county road. If a project Key Sheet lists multiple state roads:

    - Place all State Road Numbers in the box when there is adequate space (without reducing required font size)
    - Place “Districtwide” when there are more roadways than available space allows

(b) County

(c) Financial Project ID - On projects which have multiple Financial Project IDs, show only the lead Financial Project ID

(4) Designer Information (immediately left of the project information) – provide information for the Professional of Record that Signs and Seals the sheet, as discussed in ***FDM 130***.

900.3.2 Revision Block

Revision blocks are along the bottom of the sheet for standard (11”x17”) sheet borders

The Key Sheet and large-format sheets (24”x36”, 36”x48”, or 36”x72”) require the placement of a revision block cell on the sheet when a revision to that sheet is necessary. Place the revision block cell at the following locations:

- Bottom center on the Key Sheet
- Far right on large format plan sheets, just above the project information block

See ***FDM 132*** for required information to be placed in the revision block.

Table 900.3.1 Allowable Sheet Border Sizes

FDM	Sheet	11 x 17	24 x36	36 x 48	36 x 72
904	Landscape Opportunity	X	X	X	X
905	Cross Sections	X	X	X	X
906	Bridge Hydraulics Recommendation	X	X		
	Roadway Plans				
910	Key Sheet & Signature Sheet	X			
911	Model Management	X	X	X	X
912	PNC	X	X		
913	Typical Sections	X			
914	General Notes	X			
915	Plan-Profile	X	X	X	X
916	Drainage Structures	X	X	X	X
917	Stormwater Facilities	X	X	X	X
918	Drainage Map	X	X	X	X
919	Lateral Ditch	X	X	X	X
920	Soil Survey	X	X		
	Report of Core Borings	X	X		
921	TTC Plan	X	X	X	X
922	Misc Structures	X			
923	Utility Adj	X	X	X	X
924	Selective C&G	X	X	X	X
940	**S&PM Plans**				
	S&PM Plan Sheets	X	X	X	X
	Overhead Sign Cross Section Sheets	X	X		
	All other S&PM Sheets	X			
941	**Signal Plans**				
	Signalization Plan Sheet	X	X	X	X
	Interconnect/Communication Plan Sheet	X	X	X	X
	All other Signal Sheets	X			
942	**ITS Plans**				
	ITS Plan Sheet	X	X	X	X
	ITS Cross Section Sheet	X	X	X	X
	All other ITS Sheets	X			

Table 900.3.1 Allowable Sheet Border Sizes Con't

FDM	Sheet	11 x 17	24 x36	36 x 48	36 x 72
943	**Lighting Plans**				
	Lighting Plan Sheets	X	X	X	X
	All other Lighting Sheets	X			
944	**Landscape Plans**				
	Landscape Plan Sheets	X	X	X	X
	Landscape Detail Sheets	X			
947	**Toll Fac Plans**				
	All (excluding BHRS)	X			
948	**Utility Work by Contractor Plans**				
	UWHC Plan-Profile Sheets	X	X		
	UWHC TTC Plan Sheets	X	X		
	All other UWHC Sheets	X			

901 Sequence of Plans Preparation

901.1 General

The set of plans depicting the proposed construction work is known as the "Contract Plans Set" and is comprised of component plans that are associated with a primary work type. The contract plans set should be prepared systematically, undergoing phases of review and updates to ensure technically correct and clear plans. Additional information can be found in ***FDM 110, 111, 112,*** and ***120***. These chapters contain a comprehensive discussion of design processes and activities from initial to final engineering.

Component plans are included in the Contract Plans Set in the following order:

(1) Roadway

(2) Signing and Pavement Marking

(3) Signalization

(4) Intelligent Transportation Systems (ITS)

(5) Lighting

(6) Landscape

(7) Architectural

(8) Structures

(9) Toll Facilities

(10) Utility Work by Highway Contractor

Prepare Toll Facility Plans in accordance with the Florida's Turnpike Enterprise ***General Tolling Requirements (GTR)***. Contact the Florida's Turnpike Enterprise Project Manager to request a copy of the GTR.

901.2 Optional Line and Grade Submittal

At the discretion of the district, submit preliminary horizontal and vertical geometry depicting the proposed design at approximately mid-point between Notice to Proceed (NTP) and Phase I Plans. Include horizontal geometry for mainline roadways, ramps, cross streets, and side roads. Provide vertical geometry for mainline roadways and cross streets, and when critical to the project for ramps and side roads as well.

These sheets are typically produced using large format (24"x36", 36"x48", or 36"x72") sheets with a scale of 1" = 50' horizontal and 1" = 5' vertical.

Show base clearance water, seasonal high groundwater, and flood plain elevations in profile view.

Identify potential impacts or constraints (e.g., R/W, utilities, wetlands, existing bridge structures) on plan view.

901.2.1 Requirements

The Line and Grade sheets should address the following objectives:

(1) Check consistency with the intent and scope of the Project Concept Report

(2) Evaluate the impacts of changes to the project concept, resulting from the normal design development process as well as those due to changes in scope and the identification of adverse site conditions

(3) Verify the geometric viability of the project for the desired design speed and traffic volumes.

(4) Provide a basis for early coordination with other disciplines

(5) Provide a basis for early identification of design constraints or problems

(6) Document off-site and pavement drainage constraints, such as flood plain elevations, base clearance, and seasonal high-water table

(7) Establish design criteria specific to horizontal and vertical geometry

(8) Identify Design Variations and Design Exceptions associated with horizontal and vertical alignment.

Include supporting calculations and documentation with the Line and Grade Submittal that address the following:

- Design speed
- Lane widths
- Shoulder widths
- Bridge widths
- Base clearance
- Access management
- Aesthetics
- Landscape Opportunity
- Stopping sight distance
- Intersection sight distance
- Horizontal and vertical clearances
- Existing bridge approach slab evaluation
- Auto-turn exhibits for vehicle movements

901.3 Conventional (Design-Bid-Build) Projects

See ***FDM 120*** for design submittal requirements and guidance in preparing submittals for review by the Department. For bridge submittal requirements see ***FDM 121***.

Standard phase submittals are: Phase I, Phase II, Phase III, Phase IV, and PS&E. RRR, operational improvement, and safety improvement projects often omit some of these phase submittals.

Sheets typically required for each phase submittal and required level of completion are noted in ***Table 901.3.1***. Levels of completion are indicated as follows:

(1) Preliminary (P): Basic shapes, geometry, and information to convey the concept.

(2) Complete but Subject to Change (C): The design, drawings and details are complete. Only reviewer-initiated changes should be expected at this level.

(3) Final (F): All drawings and designs are complete. No changes are expected at this level. Plans are ready to be signed and sealed by the EOR.

Roadway sheets that support permit applications (e.g., Plan-Profile, Stormwater Facility Plan, Drainage Plan, Mitigation Plan) should be permit ready level of completion for the Phase II Submittal.

Table 901.3.1 Phase Submittals for Conventional Projects

ITEM	PHASE I	PHASE II*	PHASE III	PHASE IV
Roadway Plans Set				
Key Sheet	P	P	C	F
Signature Sheet		P	C	F
Typical Section	P	C	C	F
Model Management	C	C	C	F
Project Control	P	C	C	F
Roadway Plan-Profile	P	P	C	F
Traffic Monitoring Site		P	C	F
Drainage Structures		P	C	F
Stormwater Facility Plan		P	C	F
Drainage Map	P	P	C	F
Roadway Soil Survey		P	C	F
Temporary Traffic Control Plans	P	P	C	F
Utility Adjustments		P	C	F
Selective Clearing and Grubbing		P	C	F
Mitigation Plan	P	P	C	F
Miscellaneous Structures		P	C	F
Component Plans Set				
Signing and Pavement Marking Plans		P	C	F
Signalization Plans		P	C	F
Intelligent Transportation System (ITS) Plans		P	C	F
Lighting Plans		P	C	F
Landscape Plans	P	P	C	F
Landscape Maintenance Guide			C	F
Utility Work by Highway Contractor ~~Agreement~~ Plans			C	F
Toll Facility Plans				
Site/Civil, Architectural, and Structural	P	P	C	F
Electrical, Mechanical, and Plumbing		P	C	F
Communications and Systems		P	C	F

Status Key: P - Preliminary C - Complete but subject to change F - Final
** Projects with structures plans component must submit the latest set with the 60% roadway submittal.*

901.3.1 Phase I Submittal

Develop Phase I Plan sheets to include the following:

KEY SHEET

- All applicable Financial Project IDs
- (Federal Funds) notation, if applicable
- County Name and State Road Number
- Fiscal Year and sheet number
- Consultants name, address, and contract number, if applicable
- Department's Project Manager's Name
- List of Component Plan Sets
- Project Location URL and Work Limits
- Governing Standards and Specifications

TYPICAL SECTIONS

- Proposed typical section(s)
- R/W lines
- Special details and notes
- Traffic data

MODEL MANAGEMENT

- Complete

PROJECT CONTROL

- Benchmarks
- Reference points
- Control points

ROADWAY PLAN ~~AND~~ - PROFILE

Plan View

- Existing topography
- Existing utilities, and V_{vh} data when available.
- North arrow and scale
- Centerline of construction or baseline of survey
- Equations and exceptions
- Curve data
- Preliminary horizontal geometrics
- Existing R/W lines
- Begin & end stations for the project

- Begin & end bridge stations

Profile View

- Scale
- Appropriate existing utilities
- Preliminary profile grade line
- Equations
- Existing ground line
- Begin & end stations for the project
- Begin & end bridge stations
- Preliminary highwater elevation

DRAINAGE MAP

- Photographic (aerial) base map
- Centerline of construction or baseline of survey and stationing
- North arrow and scale
- Street names and R/W lines
- Begin & end of project stations
- Begin & end of bridges stations
- Drainage areas and flow direction
- Drainage divides and ground elevations
- Highwater information
- Existing structures and pipes with relevant information
- State, Federal, and county highway numbers
- Label existing water bodies (e.g., lakes, rivers)

TEMPORARY TRAFFIC CONTROL PLANS

- Typical section for each phase.
- Description of the phasing sequence and work involved.
- Other worksheets as necessary to convey concept and scope.

MITIGATION PLANS

- Project Specific

LANDSCAPE PLANS

- Conceptual landscape plan

TOLL FACILITY PLANS

- Site/Civil, Architectural, And Structural

901.3.2 Phase II Submittal

Typically, the work to be done during this phase is the following:

(1) Address Phase I comments.

(2) Load pay item numbers into Designer Interface for AASHTOWare Project™ Preconstruction and print a PDF of the Summary of Pay Items Report. Notify the Department Project Manager when this is completed via email with the PDF report attached.

(3) Develop Phase II Plans to include the following:

KEY SHEET

- Index of sheets including Developmental Standard Plans (if appropriate)
- Contract plans and component plans list (lead component only)

SIGNATURE SHEET

- Sections for each Professional of Record with Index of Sheets
- Image of the seals (if appropriate)

TYPICAL SECTIONS

- Complete

MODEL MANAGEMENT

- Complete

PROJECT CONTROL

- Complete

ROADWAY PLAN ~~AND~~ - PROFILE

Plan View

- Begin & end stations for construction
- Curb return numbers, station ties, and elevations
- Proposed drainage structures with pipes
- Proposed R/W lines
- Proposed side drainpipes

- Preliminary horizontal geometrics and dimensions
- Limits of wetlands

Profile View

- Final profile grades and vertical curve data
- Mainline storm drainpipes
- Special ditch gradients with DPI station and elevation
- Special gutter grades with DPI station and elevation.
- Nonstandard superelevation transition details
- Highwater elevations
- Existing utilities

TRAFFIC MONITORING SITE

- Complete

DRAINAGE STRUCTURES

- Drainage tabular information
- Vertical and horizontal scale
- Special sections at conflict points

Plan View

- Centerline of construction or baseline of construction with stationing
- All elements of roadway template and R/W lines
- Proposed drainage system with structure and pipe labeling
- Underground utilities

Profile View

- Sectional view along pipe runs with structure and pipe labeling
- Existing and proposed surface
- Underground utilities

STORMWATER FACILITY PLAN

- North arrow and scale
- Proposed baseline with stationing with ties to roadway centerline of construction or baseline of survey
- Existing topography, drainage structures, and utilities
- R/W lines
- Soil boring locations
- Fence and gate locations
- Drainage structures with structure and pipe labeling
- Stormwater facility delineation with side slopes, dimensions, and elevations
- Stormwater facility section views
- Outlet structure details and notes
- 100-year flood plain boundaries and elevations, contamination sites, delineated wetlands, and sink holes and depressions

DRAINAGE MAP

- Proposed drainage structures with structure numbers
- Proposed cross drains with pipe sizes and structure numbers
- Flow arrows along proposed ditches
- Retention and detention ponds, pond number and area size
- Bridges and bridge culverts with begin & end stations
- Flood Data Summary (if applicable)

ROADWAY SOIL SURVEY

- Soil data

TEMPORARY TRAFFIC CONTROL PLANS

- General and Phasing notes complete
- TTCP and Detour Plans mostly complete
- R/W and Utilities information

UTILITY ADJUSTMENTS

- All existing utilities highlighted
- Develop conflict matrix

SELECTIVE CLEARING AND GRUBBING

- Existing vegetation to be protected, relocated, or removed
- Project-specific notes and details

MITIGATION PLANS

- Project specific

MISCELLANEOUS STRUCTURES ~~PLANS~~

- Retaining walls (cast in place, proprietary, or temporary) if required

SIGNING AND PAVEMENT MARKING PLANS - PLAN SHEETS

- North arrow and scale
- Basic roadway geometrics
- Begin & end stations and exceptions
- Station equations
- Conflicting utilities, lighting, and drainage
- Pavement markings
- Sign locations
- Applicable pay items

SIGNING AND PAVEMENT MARKING PLANS - SIGN DETAIL SHEETS, GUIDE SIGN WORK SHEETS

- Project specific

SIGNALIZATION PLAN S~~HEET~~

- North arrow and scale
- Basic roadway geometrics
- Begin & end stations and exceptions
- Station equations
- Conflicting utilities, lighting, and drainage
- Signal pole location
- Type and location of loops
- Type and location of signal heads
- Pedestrian signal
- Location of stop bars
- Location of crosswalks
- Sheet title
- Applicable pay items

SIGNALIZATION PLANS - POLE SCHEDULE

- Pole location, number, and type
- Pole dimensions
- Pay item number and quantity
- Joint-use pole details, if applicable
- Foundation design

SIGNALIZATION PLANS - INTERCONNECT/ COMMUNICATION CABLE PLAN

- Placement of interconnect/communication cable
- Conflicting utilities, lighting, and drainage
- Other project-specific details

ITS PLANS - PLAN SHEETS

- North arrow and scale
- Basic roadway geometrics
- Begin & end stations and exceptions
- Station equations
- Conflicting utilities, lighting, and drainage
- Applicable pay items

ITS PLANS - DETAIL SHEETS

- Project specific

LIGHTING PLANS - POLE DATA AND LEGEND SHEET

- Each pole listed by number with location, arm length, mounting height, and luminaire wattage
- Design value for light intensities and uniformity ratios shown
- Legend and sheet title

LIGHTING PLANS - PLAN SHEETS

- North arrow and scale
- Baseline of construction
- Begin & end stations and equations
- Basic roadway geometrics
- Conflicting utilities, drainage, signal poles, etc.
- Sheet title
- Applicable pay items

- Pole symbols shown at correct station location and approximate offset

LIGHTING PLANS - HIGH MAST

- Project-specific foundation detail sheets
- Project-specific boring data sheets
- Conflicting utilities, drainage, and lighting

LANDSCAPE PLANS

- Complete

TOLL FACILITY PLANS

- Site/Civil, Architectural, and Structural
- Electrical, Mechanical, and Plumbing
- Communications and Systems

901.3.3 Phase III Submittal

Typically, the remaining work to be done is to:

(1) Address Phase II comments

(2) Complete all remaining Plan Sheets

(3) Complete the development of models to be contained in the BIM.zip file

(4) Complete the Estimated Quantities Report (see ***FDM 902***) and input quantities into Designer Interface for AASHTOWare Project™ Preconstruction. Submit the Estimated Quantities Report with the Phase III Submittal.

Estimate the Work Zone Traffic Control items paid for on a 'per day' basis and include them in the Estimated Quantities Report. The Department's Construction Office will perform a biddability review and will establish construction duration as a part of the Phase III review after receiving the plan set. Include this information in the Phase III review comments transmitted back to the EOR.

Utility Work by Highway Contractor (UWHC) Agreement Plans consisting of a Key Sheet and mainline plan-profile showing proposed utility horizontal and vertical locations are also to be included in the Phase III submittal.

901.3.4 Phase IV Submittal

Typically, the work to be done during this phase is the following:

(1) Address Phase III review comments

(2) Update the Work Program Administration (WPA) system (see ***FDM 111.2.1***) to reflect the project begin and end project milepost.

(3) Finalize all plan sheets, including:

   (a) Place the assigned Construction Contract Number on the Key Sheet

   (b) Update Work Zone Traffic Control pay items based on established construction duration.

(4) Finalize the models to be contained in the BIM.zip file

(5) Finalize the Estimate of Quantities Report and update quantities in Designer Interface for AASHTOWare Project™ Preconstruction. Submit the Estimated Quantities Report with the Phase IV Submittal

(6) Provide an EOR's construction cost estimate to the Department Project Manager (when requested).

After corrections noted during the Phase IV submittal review are completed and verified, the plans are referred to as Final Plans.

901.3.5 PS&E Submittal

There are two required submittals during the Plans, Specifications, and Estimates (PS&E) phase. Coordinate with the District Final Plans Office for scheduling these required submittals.

The first submittal consists of the Final Plans and BIM.zip, draft Specifications Package and Estimated Quantities Report. See the ***Specifications Handbook*** for information on preparing Specifications Packages and Supplemental Specifications Packages.

A review of the first submittal by the District Final Plans Office often require changes (e.g., pay item numbers and quantities, notes, design details). After changes to the Final Plans, Specifications Package, and Estimated Quantities Report, have been completed and verified, deliver the second submittal consisting of the following:

(1) Signed and Sealed Plans

(2) Signed and Sealed Specifications

(3) Signed and Sealed Estimated Quantities Report

(4) BIM.zip or CADD.zip file

Provide the Total Roadway Length, Total Bridge Length, and Total Project Length to the Department Project Manager (when requested).

Information on District activities during PS&E Phase is described in ***FDM 131***.

Sign and seal As-Built Plans and BIM files in accordance with ***FDM 130***.

Information on the delivery of Project Documentation is described in ***FDM 111.7***.

901.4 Non-conventional (Design-Build) Projects

The following are required submittals for Design-Build projects:

(1) Technical Proposal

(2) 60% Plans for IDR associated with Category 2 structures

(3) 90% Component Plans

(4) Final Component Plans

(5) As-Built Plans

Required level of completion for each phase submittal are noted in ***Table 901.4.1***. Levels of completion are Preliminary (P), Complete (C), and Final (F).

Table 901.4.1 Phase Submittals for Non-conventional Projects

Plan Sheet	Technical Proposal	90% Plans	Final Plans
Roadway Plans Set			
Key Sheet		C	F
Signature Sheet		C	F
Typical Section	P	C	F
Model Management		C	F
~~Project Layout~~	~~P~~	~~C~~	~~F~~
Project Control	P	C	F
Roadway Plan-Profile	P	C	F
Special Profiles		C	F
Traffic Monitoring Site	P	C	F
Drainage Structures		C	F
Stormwater Facility Plan		C	F
Drainage Map	P	C	F
Roadway Soil Survey		C	F
Temporary Traffic Control Plans	P	C	F
Utility Adjustments		C	F
Selective Clearing and Grubbing		C	F
Mitigation Plan		C	F
Miscellaneous Structures		C	F
Component Plans Set			
Signing and Pavement Marking Plans	P	C	F
Signalization Plans		C	F
Intelligent Transportation System (ITS) Plans		C	F
Lighting Plans		C	F
Landscape Plans		C	F
Utility Work by Highway Contractor ~~Agreement~~ Plans		C	F
Toll Facility Plans			
Site/Civil, Architectural, and Structural	P	C	F
Electrical, Mechanical, Plumbing, Communications, and Systems		C	F

Status Key: P - Preliminary C - Complete but subject to change F - Final

901.4.1 Discipline Phase Reviewer Requirements

There are two types of comments that may be provided during the review of submittals:

- **Response Required Comment:** These comments refer to direct violations of contract requirements and must be responded to.

- **FYI Comment:** These comments are informational, and do not require a response. Phase reviews should focus on compliance with contract requirements, however, "for information only" comments may also provide valuable feedback.

Enter comments in the Electronic Review Comments (ERC) system in the boxes labeled "Response Required Comment" or "FYI Comment". The ERC system will automatically add a statement at the end of each comment indicating "A written response is required." or "This comment is for information only. A written response is NOT required."

When providing a Response Required Comment, include the specific contract reference or requirement that is being violated, such as:

- an ***AASHTO*** provision that is being violated.
- a Governing Regulation (e.g., ***FDM, Structures Design Guidelines***) requirement that is being violated.
- a Technical Proposal commitment that is not being met.
- a Request For Proposal (RFP) requirement that is being omitted or violated.
- an omission in the plans or calculations.
- an inconsistency between the plans and calculations.
- an obvious error in math or basic engineering principles.
- an environmental commitment or permit commitment that is not being met.

The Department may provide mark-ups to support a review comment. The Department may allow the EOR to include supplemental details or revised plan sheets with their written responses, in lieu of resubmitting a component plan set.

901.4.1.1 Example of Response Required Comment

Example Comment: *The vertical curve length does not meet the minimum requirements of **Table 210.10.4** in the **FDM**. A written response is required.*

In this example, a requirement from the **FDM** is being violated. The plans must be corrected to address this situation, and a written response from the Design-Build Firm or Concessionaire is required.

Example Comment: *Calculations are consistent with two-phased post tensioning of the pier cap, but the plans indicate post-tensioning in a single phase. Update plans to be consistent with the calculations so that the cap will not be overstressed in the unloaded condition. A written response is required.*

In this example, the intent of the comment is to alert the Design-Build Firm or Concessionaire of an inconsistency between the calculations and the plans that result in the pier cap being overstressed. The plans must be corrected to address this situation, and a written response from the Design-Build Firm is required.

901.4.1.2 Example of FYI Comment

Example Comment: *The plans as submitted depict a land pier located very close to the shoreline of a major body of water and steel sheet piling are not shown along the water face of the footing. Ensure that the footing can be constructed in the dry per the requirements of the Specifications. This comment is for information only. A written response is NOT required.*

In this example, the intent of the comment is to ensure that the footing concrete is placed in the dry per the ***Standard Specifications***. Regardless of the action the Design-Build Firm or Concessionaire takes in response to the comment, the ***Standard Specifications*** requirements must be met; the reviewer is putting the Design-Build Firm or Concessionaire on notice.

901.4.2 Technical Proposal Submittal

Plan sheets contained in the Technical Proposal Submittal must adhere to the requirements of the ***FDM 900 Series***. Large-format sheets (36”x48” or 36”x72”) may be used when producing plan sheets when allowed by specific ***FDM 900*** chapters.

Do not submit CADD files with the Technical Proposal Submittal.

When required by RFP, develop Technical Proposal Submittal plan sheets to include the following:

TYPICAL SECTIONS

- Mainline and crossroad typical sections
- R/W lines
- Traffic data
- Pavement Design

PROJECT CONTROL

- Benchmarks
- Reference Points
- Control Points

ROADWAY PLAN- ~~AND~~ PROFILE PLAN VIEW

- North arrow and scale
- Baseline of survey, equations
- Curve data (including superelevation)
- Existing topography including utilities
- Preliminary horizontal geometrics and dimensions
- R/W lines (if available)
- Centerline of construction (if different from the baseline of survey)
- Begin and end stations for the project and stations of equations and exceptions
- Existing utilities
- Guide sign locations
- Limits of wetlands

ROADWAY PLAN- ~~AND~~ PROFILE PROFILE VIEW

- North arrow and scale
- Appropriate existing utilities
- Preliminary profile grade line
- Existing ground line with elevations at each end of sheet
- Begin and end stations for the project and stations of equations and exceptions

- Final profile grades and vertical curve data
- High water elevations

DRAINAGE MAP

- Drainage divides and flow direction arrows
- High water information as required
- Preliminary horizontal alignment with stationing
- State, Federal, County highway numbers (as appropriate)
- Proposed storm drain trunk line and outfall locations
- Proposed Retention/Detention Pond Location

TRAFFIC MONITORING SITE

- Project Specific

~~**PROJECT LAYOUT**~~

- ~~North arrow and scale~~
- ~~Stationing and ties~~
- ~~Ramp identification (if applicable)~~
- ~~Curve data including superelevation and design speed~~
- ~~Existing topography (if applicable)~~
- ~~Proposed R/W limits~~
- ~~Geometric dimensions (radii, offsets, widths)~~

TEMPORARY TRAFFIC CONTROL PLANS

- General and Phasing notes complete
- Preliminary TTCP and Detour Plans
- Typical section for each phase
- R/W and Utilities information

SIGNING AND PAVEMENT MARKING PLANS - SIGN DETAIL SHEETS

- Preliminary layout of multi-column and overhead guide sign worksheets

TOLL FACILITY PLANS

- Project specific
- Site/Civil
- Architectural
- Structural

901.4.3 90% Plans Component Submittal

After all comments associated with the Technical Proposal Submittal have been resolved, the required plan sheets must be completed in accordance with the ***FDM 900 Series***.

Submit CADD files with the completed plans sets for the 90% Plans Component Submittal.

901.4.4 Final Plans Component Submittal

After all comments associated with the 90% Plans Component Submittal have been resolved, the required plan sheets and CADD files must be finalized.

Submit CADD files with the final plans sets for the Final Plans Component Submittal.

901.4.5 Released for Construction Plans

After all comments associated with the Final Plans Submittal have been resolved, the EOR must submit signed and sealed plan sets and BIM files for Department approval. The Department's Project Manager will initial, date, and stamp each submittal as "Released for Construction". Only signed and sealed plans and BIM files that have been stamped "Released for Construction" by the Department's Project Manager are valid.

Submit the BIM.zip file with the Released for Construction plan sets.

Sign and seal Final Plans and BIM files in accordance with ***FDM 130***.

901.4.6 As-Built Plans

As-Built requirements are specified in the Design Build RFP. The Final As-Built Plans include all revisions and changes, both design and construction, that indicate precisely how the project was constructed.

Submit the BIM.zip or CADD.zip file with the As-Built plan sets.

Sign and seal As-Built Plans and BIM files in accordance with ***FDM 130***.

Provide Project Documentation in accordance with ***FDM 111.7***.

901.5 Alternative Intersection and Interchange Submittals

Alternative Intersection and Interchange reviews are generally required for the following configurations:

- Roundabout
- Median U-Turn (MUT)
- Restricted Crossing U-Turn (RCUT)
- Diverging Diamond Interchange (DDI)
- Jug Handle
- Displaced Left Turn
- Continuous Green-T
- Quadrant Roadway

Include Alternative Intersection and Interchange Review Packages with the Phase I Submittal and designate a representative of the State Roadway Design Office as a Lead Reviewer in ERC.

The following items are required for an Alternative Intersection and Interchange Review Package:

(1) Geometric Layout (PDF and CADD):

   (a) North Arrow and scale, Survey Baseline, equations

   (b) Significant topographic features including buildings, driveways, bridges, drainage structures, utilities, bicycle and pedestrian facilities, and transit facilities

   (c) Preliminary horizontal geometry including pavement edges, curb and gutter, traffic separators, islands, sidewalks, and curb ramps

   (d) Preliminary pavement markings including edge lines, interior lane lines, extension lines, stop bars, crosswalks, direction arrows, and gore markings

(2) Design Vehicle Turning Movements (PDF and CADD):

   (a) Design vehicle swept path diagrams for all through movements, left turn movements, and right turn movements

(3) Traffic Forecast (PDF)

   (a) Opening year and design year, a.m. and p.m., peak hour volumes for all movements through the intersection

(b) Peak hour factor

(c) Percentage of heavy vehicles

(d) Volume distribution across lanes for multi-lane entries

(4) Operational Analysis input and output (PDF)

901.5.1 Roundabouts

The following additional items are required for Roundabout Review Packages:

(1) Fastest Path Speed Checks in accordance with ***NCHRP 672 Section 6.7.1*** (PDF and CADD)

(2) Sight Distance Checks in accordance with ***NCHRP 672 Section 6.7.3*** (PDF and CADD)

901.5.2 Diverging Diamond Interchanges

The following additional items are required for Diverging Diamond Interchange Review Packages:

(1) Horizontal alignment data including baseline locations, curve data, stationing, and cardinal points (PC, PT, etc.)

(2) Vertical alignments

(3) Cross slopes

(4) Conceptual Drainage Plan

902 Estimated Quantities Report

Modification for Non-Conventional Projects:
Delete ***FDM 902*** and replace with the following: Provide a Summary of Pavement summary box with planned asphalt quantities on a General Notes sheet within the "Released for Construction" plan set. Develop and report quantities in accordance with the ***Basis of Estimates Manual***. Include documentation that supports the asphalt quantities shown in the summary box.

The Estimated Quantities (EQ) Report is required for all projects that begin the design phase starting in January 2021. The EQ Report is also required for projects being produced in OpenRoads Designer that began design prior to January 2021.

902.1 General

The EQ Report is a single PDF file that contains all pay item and quantity information for the project. The EQ Report consists of a signature page and a series of summary tables, and must be developed and delivered according to the guidelines and formats defined by:

- ***Basis of Estimates Manual***
- ***Structures Manual***
- ***CADD Manual***, Section 8.4.3
- ***FDM 902***

The FDOT Automated Quantities Training Guides provide additional instructional information.

Beginning with the Phase III submittal include the EQ Report with each required phase submittal. Submittals are to include the electronic shape files and other appropriate documentation (e.g., calculations, sketches, or spreadsheets) that support the quantities shown in the report.

For a strung project with two or more FPID numbers, develop an EQ Report for each FPID number.

For a single project with multiple FPID number sequencing, develop a single EQ Report with separate summary tables for each sequencing.

902.2 Signature Page

The signature page is typically an 11”x17” sheet (landscape). Place this page at the front of the EQ Report and include the information shown in ***Figure 902.2.1***. Show all FPID numbers on the signature page when a project has multiple funding sources.

The final EQ Report document is digitally signed and sealed only by the Department’s lead designer or lead consultant firm Engineer of Record (EOR). The page must show the Digital Signature Appearance of the EOR along with a representation of their Seal.

See ***FDM 130*** for digital Signing and Sealing requirements.

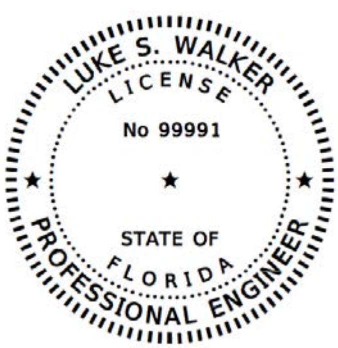
Figure 902.2.1 Signature Page Information

ESTIMATED QUANTITIES REPORT

Financial Project ID: 123456-1-52-01

Contract Number: T0000

Project Description: SR 22 (Wewa Highway), Bay County



This item has been digitally signed and sealed by:

Luke S. Walker
2020.10.14 16:52:48 – 4’00’

on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Roadway Engineers, Inc.
123 Main Street
Tallahassee, FL 32301
Luke S. Walker, P.E. No. 99991

The estimated quantities contained in this document:

1. Were developed in compliance with Florida Department of Transportation procedures, processes, and requirements.
2. Contain no known errors or omissions.
3. Match the pay item numbers and quantities in Designer Interface for AASHTOWare Project Preconstruction™.

902.3 Summary Tables

The summary tables to be used to create the EQ Report must be generated using the Quantity Takeoff Manager (QTM). The ***CADD Manual*** provides a list of summary tables that will be generated by the QTM. Do not modify the filename of the spreadsheets or format of the summary tables. Any modification to file name or format creates errors in the generated EQ Report.

Place quantity and location information into the created summary tables for those items that are not auto populated (extracted quantities from the design files). Once the Excel summary tables are fully populated use the Summary Reports Builder tool to create the EQ Report. The created report is done on 11”x17” pages (landscape) and are generally in ascending order of pay item numbers.

Each page of the report will contain only one summary table type. A continuation of a summary table onto subsequent pages may occur.

Place summary tables in the Calculations Folder within the CADD folder structure for delivery with the CADD.zip or Bim.zip file.

See ***FDM 132.5*** when a revision to the PS&E Package includes changes to the EQ Report. The Estimated Quantities (EQ) Report will not be regenerated during the construction phase. See ***FDM 151.2.1*** for post let revision requirements.

902.3.1 Designer Notes and Construction Remarks

Designer notes can be added to the summary tables prior to generating the EQ Report. The Designer Notes column is used to provide clarification on how the quantities were derived. Do not use this column to provide direction to the contractor.

Do not place any data or information in the Construction Remarks column.

902.4 EQ Report Requirements

The Department’s lead designer or lead firm Engineer of Record (EOR) is responsible for generating the EQ Report and for validating that the pay items and quantities contained in the report are the same as those loaded into Designer Interface for AASHTOWare Project™ Preconstruction.

Title the EQ Report PDF file with the FPID number followed by “-ESTIMATES-QUANTITIES.pdf” (e.g., 12345615201-ESTIMATES-QUANTITIES.pdf).

902.5 Loading Pay Item Information into Designer Interface

For the Phase II submittal the designer is typically responsible for loading only pay item numbers into Designer Interface for AASHTOWare Project™ Preconstruction. When only loading pay item numbers, create a PDF file of the Summary of Pay Item Report generated in AASHTOWare Project™ Webgate Reporting. Notify the Department Project Manager when this is completed via email with the report PDF file attached.

When including preliminary quantities at Phase II (at request of the district), create the EQ Report and include with Phase II submittal. Creating the Summary of Pay Item Report and notifying the Department Project Manager is not required.

For the Phase III submittal, and subsequent submittals, the designer is responsible for entering (or updating) pay items and quantities into Designer Interface.

902.5.1 Designer Interface Quantities Builder

When the summary tables are populated with quantities, the Designer Interface Quantities Builder tool can be used to upload pay item number and quantity information into Designer Interface for Phase III submittal and all subsequent submittals.

Only the Department's lead designer or the lead consultant firm EOR may use the quantity tool to upload pay items and quantities. Each time the export tool is used the existing Designer Interface information is over-written.

904 Landscape Opportunity Plan

904.1 General

This chapter provides the criteria and requirements for development of Landscape Opportunity Plan. These sheets are used for coordination purposes between projects, and between the various disciplines of a project. Do not place the Landscape Opportunity Plan sheets within the Contract Plans Set. Signing and sealing the Landscape Opportunity Plan is not required.

A Landscape Opportunity Plan is prepared when landscape is not part of a roadway construction project, but landscaping will be installed:

(1) Within a subsequent stand-alone landscape project.

(2) As part of a simultaneous JPA or LAP project.

(3) Within a future safety or roundabout project.

A Landscape Opportunity Plan is typically prepared during the roadway concept plan development, but when developed during the design phase should be preliminary by Phase II submittal, complete at Phase III, and final at Phase IV. Coordinate with other disciplines (e.g., Roadway, Utility, Drainage, Signage, ITS, R/W) when developing the Landscape Opportunity Plan.

Submit the completed Landscape Opportunity Plan to the Department Project Manager and District Landscape Architect. Place the completed Landscape Opportunity Plan in Project Suite Enterprise Edition (PSEE) within the Design Development Documentation Module (see ***FDM 111.7***).

See ***Exhibit 904-1*** for an example of a Landscape Opportunity Plan sheet.

904.2 Landscape Opportunity Plan Development

A Landscape Opportunity Plan identifies areas within the upcoming roadway project that should be set-aside or prepared for the future landscape project. Common areas are:

- areas requested by a municipality
- median plantings or other safety enhancements
- high-visibility areas or embankments, or areas adjacent to barriers or sound walls

- scenic highways or areas programmed for Highway Beautification Grants
- areas indicated in the District's Landscape Branding Document

904.3 Landscape Opportunity Plan Sheet

The Landscape Opportunity Plan sheet provides a plan view of the project illustrating the intent of the future landscape project. This sheet is typically produced on large format sheets (24"x36", 36"x48" or 36"x72"). Use landscape orientation regardless of sheet size selected. Use standard symbols contained in the ***CADD Manual***.

The standard horizontal scale is 1" = 100', however an alternate scale may be approved by the Project Manager.

Provide a legend, notes, and details as needed.

904.4 Required Information

Display aerial photography or available topographic surveys as gray scaled in the background. Information from a prior construction project may also be used. Display and label elements that are relevant to the future landscape design, including:

- Proposed improvements and existing elements to remain
- Existing vegetation or areas to remain undisturbed
- Wetland jurisdictional lines
- Drainage retention areas
- Utilities
- Outdoor advertising view zones

The Landscape Opportunity Plan provides requirements for the development of roadway design to support a future landscape design. Locations of landscape opportunity planting areas are typically illustrated in a bubble format which identifies various vegetation groupings in a hatched or colorized manner (e.g., "trees/palms/shrubs", "shrubs only", "buffer plantings").

The Landscape Opportunity Plan should also identify or designate the following:

(1) Essential elements of landscape design intent.

(2) Anticipated location of irrigation sleeves. See ***FDM 271.3*** for irrigation sleeve requirements.

(3) Preservation areas. Preserve existing trees and vegetation, and natural vistas to the greatest extent possible.

(4) Areas requiring soil amendments. Assure landscape areas will have soil suitable for plants viability.

(5) Areas to be set aside to accommodate future plantings considering visibility, clear zone and site distance requirements, and maintenance. Provide adequate space (both above and below ground) for plant growth. Delineate areas in bubble format and indicate as high, medium, or low priority, such as:

  (a) Areas with trees and shrubs for screening distracting views

  (b) Trees to frame desirable views

  (c) Trees and ground cover areas for stabilization of embankments

  (d) Trees to shade sidewalks

  (e) Shrubs for pedestrian channelization

(6) Use of Select Clearing and Grubbing to preserve the existing and future landscape planting areas and to relocate trees.

(7) Display applicable clear zone, horizontal clearance, setback dimensions on the plans which reflect AASHTO, FDOT, and Department guidelines for landscape installation and maintenance operations.

(8) Indicate potential areas for wildflower plantings.

(9) Objectionable and desired views.

(10) Location of Outdoor Advertising sign faces and view zones within project limits; see ***FDM 276***.

904.5 Optional Summary of Analysis

At the Districts discretion, provide a Summary of Analysis in a graphic and written format.

Exhibit 904-1: Landscape Opportunity Plan

905 Roadway Cross Sections

905.1 General

Cross sections depict the existing ground and manmade features, and proposed roadway template as sections perpendicular to the respective stations along a centerline or baseline of construction.

Cross section sheets are used to convey supplemental information during the plans phase review process. These sheets may also be used for coordination purposes (e.g., permit or utility, local agency, public meetings). These sheets are not to be placed within the Contract Plans Set. Signing and sealing these sheets is not required.

Enter a PDF of these sheets into the Electronic Review Comments (ERC) system with the Phase II and Phase III plans submittals. Include these sheets with the Phase IV ERC submittal when there are Phase III comments related to the cross sections. Provide a PDF of the cross-section sheets for coordination purposes as needed (e.g., permits, utilities, public meetings).

Place the final Cross Section sheets in Project Suite Enterprise Edition (PSEE) within the Design Development Documentation Module (see ***FDM 111.7***)

See ***Exhibit 905-1*** for an example of a Cross Section Sheet.

905.2 Sheet Set Up

This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48” or 36”x72”). Use landscape orientation regardless of sheet size selected.

Place as many cross sections on a sheet as possible using multiple columns of sections when appropriate. Create cross sections using a scale of 1” = 20' horizontal and 1” = 10’ vertical. The standard cross section interval is 50 feet. Another interval may be used when appropriate based on the type and complexity of the project.

Show cross sections with stations increasing from the bottom to the top of the sheet and multiple columns placed from the left to the right.

Cross sections for mainline, side streets, and ramps are typically shown on separate sheets within a single PDF. The order of cross sections contained in the PDF should be the mainline, side streets, then ramps.

Display the begin and end construction limits and include the name of the mainline (e.g., SR 22), side street (e.g., Easy Street), or ramp (e.g., Ramp A). Indicate exception limits (e.g., Bridge No. 770175 STA 105+20 to 109+60).

905.3 Required Information

As illustrated in ***Exhibit 905-1***, each cross section must include a background grid at the appropriate scale. Display the station for each cross section must be shown in the lower right area of the grid. Display (in feet) the horizontal offset from centerline along the bottom of the grid. Display the vertical elevation along both sides of the grid.

Each cross section must provide the following:

(1) Label the centerline or baseline of construction.

(2) Show and label R/W limits.

(3) Show existing ground lines.

(4) Show below ground portions of existing features, e.g., pavement, curb, sidewalk.

(5) Show and label parallel underground utilities. Label only the utility type (e.g., “G”, “W”); the size of pipe is not required.

(6) Show the proposed roadway template and include:

    (a) Profile grade elevation

    (b) Special ditch elevation

    (c) Pavement and sidewalk cross slope

    (d) Median and outer slope ratio

(7) Show, and label, the lower limits (undercut line) of the removal of organic or plastic material. See ***FDM 216*** and ***Standard Plans***, ***Index 120-002*** for the requirements of subsoil excavation; i.e., removal of unsuitable organic or plastic soils.

Showing parallel drainage pipes or structures is not required.

Exhibit 905-1: Cross Sections

906 Bridge Hydraulic Recommendations Sheet

906.1 General

A Bridge Hydraulic Recommendations Sheet (BHRS) is required for each proposed bridge structure; not bridge culverts. This sheet summarizes the findings and recommendations of the bridge hydraulic analysis contained within the Bridge Hydraulics Report. The BHRS consists of four sections:

(1) Plan View

(2) Profile View

(3) Location Map and Drainage Area

(4) Bridge Hydraulic Data Table

The BHRS is appended to the Bridge Hydraulics Report and included in the Structures Plans. This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”). Use landscape orientation regardless of sheet size selected.

See ***Exhibit 906-1*** for an example of a Bridge Hydraulic Recommendations sheet.

906.2 Plan View

The plan view is typically located in the upper left area of the sheet. A common horizontal scale for the plan view is 1” = 40’ or 1” = 50’.

The plan view on the BHRS is often created by referencing the CADD file that was used to create the bridge plan view for the Plan and Elevation sheet included in the Structures Plans. Do not display information and graphic data from the reference file that is not germane.

Include the following information in the plan view:

(1) Stationing, scale, and north arrow. Include the channel baseline if one was created.

(2) Label bridge begin and end station, the name of the road and the water body (e.g., St. Johns River), and R/W lines.

(3) Show contour lines (existing or proposed) with elevations, and arrows illustrating the direction of the flow through the channel opening.

(4) Show limits of abutment protection.

906.3 Profile View

The profile view is typically located in the lower left area of the sheet. Profile view must include a background grid using the same horizontal scale that was used for the plan view, and a vertical scale of 1" = 10' (typical).

The profile view on the BHRS is often created by referencing the CADD file that was used to create the bridge profile view for the Plan and Elevation sheet included in the Structures Plans. Do not display information and graphic data from the reference file that is not germane, such as labeling of grade line and vertical curve data.

Include the following information in the profile view:

(1) Show stationing along the bottom of the background grid and horizontal grid line elevations along both sides.

(2) Display the proposed bridge, low member, piers, and approaches.

(3) Label the begin and end stations for the proposed structure and indicate the Bridge Number.

(4) Dimension and label the overall bridge length, and the width of each span and approach.

(5) Label abutment locations (e.g., toe of slope).

(6) Show limits of abutment protection and label the protection type.

(7) For non-tidal crossings, indicate the Normal High Water (NHW) and Design Flood elevations. For tidal crossings, indicate the Mean High Water (MHW) and Design Flood Stage elevations.

(8) When practical, show the profile of the expected design scour (contraction and long-term scour along the entire unprotected cross section and the local scour at the intermediate piers/bents). Display local scour holes as beginning at the foundation element edges at the design scour depth and extending up at a 1:2 slope to meet the contraction or long-term scour profile.

906.4 Location Map and Drainage Area

The location map is typically located in the upper right area of the sheet. When practicable, use a scale so that the entire drainage area for the proposed structure is shown.

Any suitable graphics file may be used to create the map. A common source is the county maps in MicroStation (*.dgn) format or in Portable Document format (PDF) that can be downloaded from the ***County General Highway Maps*** web page. Place a north arrow on the right side of the map. Orient the map so that the north arrow points toward the top of the sheet.

Flag and label the bridge location as "Proposed Bridge", and provide a google maps hyperlink (e.g., ***https://goo.gl/maps/zmmkmmoLDvk***). Flag and label bridge structures located immediately upstream and downstream that affect the hydraulics of the proposed structure.

Display the drainage area boundaries using a very heavy dashed line, with the area (in acres or square miles) shown within the boundary.

906.5 Bridge Hydraulic Data Table

The Bridge Hydraulic Table consists of five sections:

(1) Existing and Proposed Structures

(2) Hydraulic Design Data

(3) Hydraulic Recommendations

(4) Scour Predictions

(5) Remarks

906.5.1 Existing and Proposed Structures

Provide information on existing and proposed structures in the following table:

Table 906.5.1 Existing Structures

(REFERENCE)		EXISTING STRUCTURES (1)	(2)	(3)	(4)	PROPOSED STRUCTURE
FOUNDATION	(1)					
OVERALL LENGTH (ft)	(2)					
SPAN LENGTH (ft)	(3)					
TYPE CONSTRUCTION	(4)					
AREA OF OPENING @ D.F. (sf)	(5)					
ELEV. LOW MEMBER (ft)	(6)					
ELEV. LOW MEMBER (ft)	(7)					

NOTES: Existing Structures - (1) structure being replaced or modified. (2), (3), and (4) are immediate upstream and downstream structures that affect the hydraulics of the proposed structure.

(1) Foundation: Describe the type of foundation (e.g., timber piles, concrete piles).

(2) Overall Length (ft): Provide the total length of the structure. The length is measured from the top of the abutment. Use the total length shown in the final plans for the proposed structure.

(3) Span Length (ft): Provide the length of the main span of the structure.

(4) Type Construction: Describe the construction material(s) used for the structure (e.g., steel, concrete, steel, and concrete).

(5) Area of Opening (ft^2) @ D.F.: Provide the area of opening below the design flood elevation at the bridge section. Subtract the pile area when pile area is significant.

(6) Bridge Width (ft): Provide the distance from outside rail to outside rail.

(7) Elev. Low Member (ft): Provide the elevation of the lowest point along the low member of the structure.

906.5.2 Hydraulic Design Data

Provide hydraulic design data for the proposed structure in the following table:

Table 906.5.2 Hydraulic Design Data

HYDRAULIC DESIGN DATA

The hydraulic data shown in this table indicate the flood discharges and water surface elevations which may be anticipated in any given year.
Engineering judgement and assumptions are necessary to determine this data with no assurance of precision.

WATER SURFACE ELEVATIONS: **(1)**	N.H.W. (Non-Tidal)	________	M.H.W. (Tidal)	________	
	CONTROL (Non-Tidal)	________	M.L.W. (Tidal)	________	
FLOOD DATA:	MAX. EVENT OF RECORD	DESIGN FLOOD	BASE FLOOD	OVERTOPPING	GREATEST FLOOD
STAGE ELEV. NAVD (ft) **(2)**	________	________	________	________	________
DISCHARGE (cfs) **(3)**	________	________	________	________	________
AVERAGE VELOCITY (f/s) **(4)**	________	________	________	________	________
EXCEEDANCE PROB. (%) **(5)**	________	________	________	________	________
FREQUENCY (yr.) **(6)**	________	________	________	________	________

NOTES:
Max. Event of Record: Maximum event recorded based on historical information (if available).
Design Flood: Utilized to assure a desired level of hydraulic performance.
Base Flood: Has a 1% chance of being exceeded in any given year (100 year frequency).
Overtopping/Greatest Flood: Only show data for event with lower return period.
Overtopping: Causes flow over the highway, watershed divide, or thru relief structures.
Greatest flood: The most severe that can be predicted where overtopping is not practicable..

(1) **Water Surface Elevations (ft):** Provide elevation of the following water surfaces at the bridge section, when applicable:

(a) N.H.W. (Non-Tidal): The Normal High Water elevation applicable only to non-tidal areas.

(b) CONTROL (Non-Tidal): Water surface elevation controlled by the operation of pump stations, dams, or other hydraulic structures. This applies only to non-tidal areas.

(c) M.H.W. (Tidal): The Mean High Water elevation applicable only to tidal areas.

(d) M.L.W. (Tidal): The Mean Low Water elevation applicable only to tidal areas.

(2) **Stage Elevation (ft):** For freshwater flow, provide stage elevation (NAVD 88 or NGVD 29) using data from hydraulic model at the approach section. For tidal flow, use the maximum elevation during the flood or ebb storm surge at the bridge. Add a remark that stage, discharge, and the velocity described in the flood data do not occur at the same time.

(3) **Discharge (cfs):** For freshwater flow, provide total discharge using data from the simulations for the design flood, base flood, overtopping flood, and/or greatest flood. For tidal flow, use the maximum discharge during the flood or ebb storm surge at the bridge. Add a remark that stage, discharge, and the velocity described in the flood data do not occur at the same time.

(4) **Average Velocity (fps):** For freshwater flow, provide average velocity using data from the simulations for the design flood, base flood, overtopping flood, and/or greatest flood. For tidal flow, use the maximum velocity during the flood or ebb storm surge at the bridge.

(5) **Exceedance Prob. (%):** Provide the probability that the conditions will be exceeded. Probability is determined as 100% times unity over the return interval (e.g., 100%*(1/100) = 1%).

(6) **Frequency (yr):** Provide the return period in years.

906.5.3 Scour Predictions

Provide scour predictions for the proposed structure in the following table:

Table 906.5.3 Scour Predictions for Proposed Structure

SCOUR PREDICTIONS FOR PROPOSED STRUCTURE				
(1) PIER INFORMATION		(2) TOTAL SCOUR ELEVATION (FT)		
NUMBERS	SIZE AND TYPE	LONG TERM SCOUR ELEVATION	WORST CASE < 100 yr. FREQ. (yr.) ______	WORST CASE < 500 yr. FREQ. (yr.) ______

(1) Pier Information: Provide the following pier information for the proposed structure:

- (a) Numbers: Pier number(s) that correspond to the pier size, type, and scour elevations.
- (b) Size and Type: Pier size and type that produce the greatest scour. If necessary, place a reference to the appropriate details of the bridge plans for clarity.

(2) Total Scour Elevation (ft): Provide the following scour information for the proposed structure:

- (a) Long-Term Scour elevation: Applicable only to structures required to meet extreme event vessel collision load. Place “N/A” when not applicable. Refer to Chapter 4 of the Drainage Design Guide for additional information on long-term scour.
- (b) Worst-Case (< 100-year) Scour Elevation: The predicted total scour elevation for the worst-case scour condition up through the scour design flood frequency. This includes aggradation or degradation, channel migration, local scour (pier and abutment) and contraction scour.
- (c) Worst-Case (< 500-year) Scour Elevation: The predicted total scour elevation for the worst-case scour condition up through the scour design check flood frequency. This includes aggradation or degradation, channel migration, local scour (pier and abutment), and contraction scour.

906.5.4 Hydraulic Recommendations

Provide hydraulic recommendations in the following table:

Table 906.5.4 Hydraulic Recommendations

HYDRAULIC RECOMMENDATIONS													
BEGIN BRIDGE STATION				END BRIDGE STATION				SKEW ANGLE BETWEEN BRIDGE AND ROADWAY					
CLEARANCE PROVIDED (ft):	(1)	NAV: HORIZ.		VERT.		ABOVE EL.		DRIFT: HORIZ.		VERT.		ABOVE EL.	
MINIMUM CLEARANCE (ft):	(2)	NAV: HORIZ.		VERT.		ABOVE EL.		DRIFT: HORIZ.		VERT.		ABOVE EL.	
ABUTMENTS :	(3)												
				BEGIN BRIDGE						END BRIDGE			
RUBBLE GRADE:													
SLOPE:													
BURIED OR NON-BURIED HORIZ. TOE:													
TOE HORIZ. DISTANCE (ft):													
LIMIT OF PROTECTION (ft):													
DECK DRAINAGE:	(4)												

(1) Clearance Provided (ft): Provide the following navigational and drift clearance information for the proposed structure:

- (a) Navigation Horizontal: The actual horizontal navigation clearance provided between fenders or piers.
- (b) Navigation Vertical: The actual vertical navigational clearance in feet provided between fenders or piers.
- (c) Navigation Above Elevation: For freshwater flow, use the elevation at the NHW elevation or control elevation. For tidal flow, use the elevation at MHW.
- (d) Drift Horizontal: The actual minimum horizontal clearance provided.
- (e) Drift Vertical: The actual minimum vertical clearance provided above the design flood elevation.
- (f) Drift Above Elevation: The design flood elevation used to determine Drift Vertical clearance. For freshwater flow, use NHW elevation or control elevation. For tidal flow, use the maximum stage associated with an average velocity of 3.3 fps through the bridge section during the flood or ebb for the storm surge for the design flood. If the maximum velocity due to the storm surge is less than 3.3 fps, use the stage associated with the maximum velocity through the bridge section.

If either of these stages causes the profile to be higher than the profile of the bridge approaches, discuss having less drift clearance and designing the structure for debris loads with the District Structures Design Office:

(2) Minimum Clearance (ft): Vertical and horizontal clearances are subject to regulatory agency requirements (e.g., Coast Guard, Corps of Engineers, Water Management District), and may exceed Department requirements. Provide the following minimum navigational and drift clearance information for the proposed structure:

(a) Navigation Horizontal: Provide a minimum 10-foot horizontal navigation clearance, or the minimum clearance specified by regulatory agency.

(b) Navigation Vertical: See ***FDM 260.8*** for information on minimum vertical clearance for navigational purposes.

(c) Drift Horizontal and Vertical: Consistent with debris conveyance needs and structure economy where no boat traffic is anticipated.

(3) Provide the following information for the begin and end bridge abutments:

(a) Rubble Grade: Provide the type of rubble to be constructed at the begin and end bridge abutments.

(b) Slope: Provide the slope of the abutments at the begin and end bridge.

(c) Non-buried or Buried Horizontal Toe: Indicate whether the toe of the abutment will be non-buried or buried when extended horizontally from the bridge. The horizontal and vertical extents should be determined using the design guidelines contained in ***HEC-23***.

(d) Toe Horizontal Distance (ft): Provide the horizontal extent of the rubble protection measured from the toe of the abutment. Refer to the Drainage Design Guide for additional information.

(e) Limit of Protection (ft): Provide the limits of protection, distance in feet measured parallel to the stationing, from the edge of the rubble protection to the begin or end bridge station. If the distance is different on each side, indicate both distances with their corresponding sides.

(4) Deck Drainage: Describe how the rainfall runoff is collected and conveyed from the proposed structure deck (e.g., scuppers, storm drain system).

906.5.5 Remarks

Provide any pertinent remarks for the proposed structure in the following table:

Table 906.5.5 Remarks

REMARKS
(1) ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88)

Include information for the 100-year design wave crest elevation in feet, including the storm surge elevation and wind setup. The vertical clearance of the superstructure must be a minimum of 1 foot above the wave crest elevation.

Exhibit 906-1: Bridge Hydraulic Recommendations

907 RFP Concept Plans

907.1 General

This Chapter provides minimum requirements for the development of RFP Concept Plans that are included as an Attachment to the Request for Proposal (***RFP***). The requirements of this chapter must be met for Adjusted Score Design-Build Projects, and Low Bid Design-Build Projects.

The requirements provided in the ***FDM 900 Series*** and the ***FDOT CADD Manual*** form the basis for format and assembly of the plans.

Additional information regarding Design-Build contracting method can be found at:

https://www.fdot.gov/construction/designbuild/design-build.shtm

907.2 Index of RFP Concept Plans

Place an index of sheets on the left side of the Key Sheet. Assemble RFP Concept Plans in the following order:

(1) Key Sheet (see ***Exhibit 907-1***)

(2) Typical Section Details

(3) Model Management

(4) Project Control

(5) Roadway Plan-Profile

(6) Stormwater Facilities

(7) Drainage Map

(8) Soil Survey

(9) Report of Core Borings

(10) Selective Clearing and Grubbing

(11) Mitigation Plan

(12) Traffic Plan (S&PM, Signalization, ITS, Lighting)

(13) ~~Landscaping~~ Landscape Plan

(14) Architectural Plan

(15) Structures Plan

(16) Utility Work by Highway Contractor

907.3 RFP Concept Plans Development

Table 907.3.1 provides the minimum information that is to be shown on each sheet of the RFP Concept Plans. Written approval is required from the District Construction Engineer and the Chief Engineer when deviating from the minimum information set forth in ***Table 907.3.1***.

Consider exceeding the minimum level of completion for higher risk elements.

Table 907.3.1 RFP Concept Plans Development

SHEET / CONTENT
KEY SHEET
Financial Project IDs
(Federal Funds) notation, if applicable
County Name and State Road
Fiscal Year and sheet number
Consultant’s name, address, and contract number, if applicable
Department’s Project Manager's name
List of Component Plan Sets
Project Location URL and Work Limits
Index of sheets including Developmental Standard Plans (when required in RFP)
Contract plans and component plans list (lead component only)
TYPICAL SECTION DETAILS
Project Specific Details
MODEL MANAGEMENT
Proposed Roadway Design and R/W Lines
Baselines
Model Information
PROJECT CONTROL
Benchmarks, Reference points, Control points
ROADWAY PLAN-PROFILE
Plan View
Existing topography including utilities
North arrow and scale
Centerline of construction or baseline of survey
Equations and exceptions
Curve data
Existing R/W lines
Begin & end stations for the project
Begin & end bridge stations
Proposed drainage structures with pipes
Proposed R/W lines
Proposed side drainpipes
Proposed geometrics
Limits of wetlands

Table 907.3.1 RFP Concept Plans Development cont'

SHEET / CONTENT
Profile View
Scale
Equations
Existing ground line
Begin & end stations for the project
Begin & end bridge stations
Highwater elevation
Final profile grades and vertical curve data
Nonstandard superelevation transition details
Highwater elevations
STORMWATER FACILITIES
North arrow and scale
Centerline of construction or baseline of survey
Existing topography, drainage structures, and utilities
R/W lines
Soil boring locations
Fence and gate locations
Drainage structures with structure and pipe labeling
Stormwater facility delineation with side slopes, dimensions, and elevations
Stormwater facility section views
Outlet structure details and notes
100-year flood plain boundaries and elevations
Contamination sites, delineated wetlands, and sink holes and depressions
DRAINAGE MAP
Photographic (aerial) base map
Centerline of construction or baseline of survey and stationing
North arrow and scale
Street names and R/W lines
Begin & end of project stations
Begin & end of bridges stations
Drainage areas and flow directions
Drainage divides and ground elevations
Highwater information
Existing structures and pipes with relevant information
State, Federal, and county highway numbers
Label existing water bodies (e.g., lakes, rivers)

Proposed drainage structures with structure numbers
Proposed cross drains with pipe sizes and structure numbers
Flow arrows along proposed ditches
Retention and detention ponds, pond number and area size
Bridges and bridge culverts with begin & end stations
Flood Data Summary (if applicable)

Table 907.3.1 RFP Concept Plans Development cont'

SHEET / CONTENT
SOIL SURVEY & REPORT OF CORE BORINGS
Soil data
TEMPORARY TRAFFIC CONTROL PLAN
Typical section for each phase
Description of the phasing sequence and work involved
Other worksheets as necessary to convey concept and scope
Detour Plans with off-site detour routing
UTILITY ADJUSTMENTS
All existing utilities highlighted with dispositions
Develop conflict matrix
General Notes sheet including any work restrictions stipulated by UAOs and limitations on relocations, protections, or adjustments
Verified utility locations (SUE data)
SELECTIVE CLEARING AND GRUBBING
Existing vegetation to be protected, relocated, or removed
Project-specific notes and details
MITIGATION PLANS
Project specific
TRAFFIC PLAN
North arrow and scale
Basic roadway geometrics
Begin & end stations and exceptions
Station equations
Conflicting utilities, lighting, and drainage
Guide sign locations with panel legends depicted
Pavement markings including stop bars and crosswalks
Signal pole locations shown at correct station location and offset
Signal head locations
ITS device locations shown at correct station location and offset
Light pole symbols shown at correct station location and offset

Table 907.3.1 RFP Concept Plans Development cont'

SHEET / CONTENT
LANDSCAPE PLAN
Contents are Project Specific
ARCHITECTURAL PLAN
Contents are Project Specific
STRUCTURES PLAN
Plan and Elevation
Substructures: For end bents, piers, or intermediate bents, show substructure elements and sizes Including all deviations from the typical dimensions, foundation type including element spacing and the arrangement of piles or drilled shafts
Superstructure: Include cross section showing lanes, shoulders, railings, slab thickness, beam type and spacing and web depth for steel girders. If applicable, show geometric changes in shapes of various components. Also show construction phases and maintenance of traffic data, outline of the existing structure and portions to be removed, and utilities (existing and proposed as available)
Retaining Walls: 1) Submit preliminary control drawings when proprietary or standard cast-in-place walls are proposed. 2) Control drawings for critical temporary walls.
Bridge Hydraulics Recommendation Sheet
Report of core borings.
Proposed construction sequence and methods indicate construction easements and methods of construction access
Aesthetic details.
Post-tensioning layouts
Foundation layouts and pile/shaft data table
Sidewalks: If provided, show preliminary accessible elements
Special details required by the Engineer or details which are not normally used on Department projects
UTILITY WORK BY HIGHWAY CONTRACTOR
Key Sheet
Mainline plan-profile showing proposed utility horizontal and vertical locations
Summary of Quantities Sheet

907.~~3~~4 RFP Concept Plans Delivery

After the RFP Concept Plans have been reviewed, District comments addressed, and plans updated, submit the following:

(1) Final RFP Concept Plans

(2) CADD.zip file

(3) Typical Section Package

(4) Toll Siting Technical Memorandum in accordance with GTR, when applicable

908 Stormwater Runoff Control Concept Worksheet

908.1 General

Stormwater Runoff Control Concept (SRCC) worksheet is provided to the Contractor to facilitate Contractor compliance with ***Standard Specifications, Section 104***. These sheets may also be used to convey supplemental information during the plans phase review process. These sheets are not to be placed within the Contract Plans Set. Signing and sealing these sheets is not required.

Enter a PDF of these sheets into the “Permits” Project CADD folder. The worksheet may be entered into the Electronic Review Comments (ERC) system with the Phase III and Phase IV plans submittals, for review by District MS4 permit coordinators and District construction staff.

See ***Exhibit 908-1*** for an example of a SRCC Worksheet.

908.2 Sheet Set Up

This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48” or 36”x72”). Use landscape orientation regardless of sheet size selected.

Use the following horizontal scales:

	Standard	Optional
Curbed Roadways	1” = 40’	1” = 50’
Flush-shoulder Roadways	1” = 50’	1” = 100’

908.3 Required Information

As illustrated in ***Exhibit 908-1***,

The worksheet must display the following:

(1) Centerline or Baseline of construction

(2) R/W limits

(3) Limits of Construction activities

(4) Overland flow drainage patterns

(5) Areas of soil disturbance

(6) Areas which will not be disturbed

(7) Locations of major structural and nonstructural controls

(8) Locations of areas where stabilizations practices are expected to occur

(9) Location of surface waters and wetlands

(10) Location of project discharge locations (to surface water or MS4)

Exhibit 908-1: SRCC Worksheet

910 Key Sheet and Signature Sheet

910.1 General

The Key Sheet is the first sheet of each contract plans. The Signature Sheet, when required, is typically the second sheet of the contract plans. Produce these sheets using standard-format plan sheets (11”x17”).

Projects are to be delivered as individual Signed and Sealed components of the Contract Plans set; e.g., Roadway Plans, Signing and Pavement Marking Plans, Structure Plans.

910.2 Key Sheet

The Key Sheet describes the project and the contents of the Contract Plans set. The Key Sheet is created using the FDOT CADD Software.

The top center of the sheet is to display “STATE OF FLORIDA, DEPARTMENT OF TRANSPORTATION” followed by the contract plans title of the component; e.g., “ROADWAY PLANS”, “LIGHTING PLANS”, “LANDSCAPE PLANS”. See ***FDM 910.2.5*** for a full list of allowable component names.

See ***Exhibit 910-1*** for an example of a Lead Key Sheet (typically Roadway Plans). See ***Exhibit 910-2*** for a Lead Key Sheet with revisions. See ***Exhibit 910-3*** for an example of a Component Key Sheet.

910.2.1 Work Program Data

Work program data is placed directly below component contract plans designation, and includes the Financial Project ID, Federal Funds designation, County name and roadway section number, and State Road number with local name.

<u>Financial Project ID</u>

The Financial Project ID is the main number identifying each individual project within the Work Program. On projects which have one Contract Plans set, but multiple Financial Project IDs, list all the Financial Project IDs on the key sheet. Show only the lead Financial Project ID in the title block on all other plan sheets.

Federal Funds

When any of the Financial Project IDs listed on the Key Sheet involves Federal funds, display the words "(Federal Funds)" directly under the list.

Do not display the words "(Federal Funds)" for projects that use only State funds, even when strung with a project that uses Federal funds.

County Name and State Roadway Section Number

Place the county name and (in parentheses) the roadway section number directly under the Financial Project ID or "(Federal Funds)". The roadway section number can be found with the ***Straight Line Diagrams*** (SDL). On projects which involve multiple counties, or multiple roadways, list all counties and associated roadway section numbers.

State Road Number and Project Description

Place the state road number and (in parentheses) the local road name directly under the county name and roadway section number. Under the state road number display a general description of work type and limits; e.g., "RRR from Crim Boulevard to Kurt Street".

910.2.2 Project Work Limits and Features

Show project work limits and features directly below the State Road number and project description. This data is reported in milepost (MP), correct to three decimals. A box is typically used as shown in ***Exhibit 910-1***, and includes the following required information:

(1) Provide a Project Location URL. The intent of the project location link is to provide a visual of the project location using the Work Program GIS. Create the full URL using a set string, with the first seven digits of the FPID number appended. For example, FPID number ***217932-1-52-01*** would display the following URL: ***https://owpbstandardmap.fdot.gov/?query=WorkProgram_Tbl15_Dissolved_2004,itemseg,2179321***.

Optional: Convert the full URL to a condensed URL using ***https://tinyurl.com/app/*** (or equivalent). The converted URL displays as ***https://tinyurl.com/367v2589***.

(2) Begin and end project MP limits for each State Road included in the project. Include Turnpike mile marker (MM) limits for Turnpike projects.

(3) Begin and end MP limits of bridge structures, including the structure number(s). Do not include bridge culverts. When an existing bridge structure is being replaced, indicate the proposed structure and not the existing.

(4) Begin and end MP limits for each Project Exception (i.e., excluded roadway limits from project)

(5) Center line MP for each railroad crossing within the limits of construction, including name of railroad and DOT/AAR crossing number.

Project work limits must be consistent with milepost information entered into the Work Program Administration (WPA) system during final design. See ***FDM 111.2.1*** for information on updating the WPA system.

910.2.3 Project Location

Show a small-scale state map at the upper right portion of the Key Sheet and indicate with leader line the general location of the project within the state.

910.2.4 Construction Contract Number and Fiscal Year

Provide the Construction Contract Number and Fiscal Year in the data block located in the lower right corner of the sheet. The Key Sheet of each component of the Contract Plans set will be numbered as the first sheet of that component.

The Construction Contract Number is typically issued late in the design process and may remain blank until provided. Show the fiscal year for which the Letting is scheduled in the "Fiscal Year" box; i.e., enter "24" in the box for a project that has a Letting date during the July 2023 to June 2024 fiscal year.

910.2.5 Contract Plans Set Components

The Contract Plans Set is typically assembled as component plans that are associated with a primary work type. List all component plans included in the Contract Plans Set in the upper left corner of the Key Sheet in the following order:

(1) Roadway

(2) Signing and Pavement Marking

(3) Signalization

(4) Intelligent Transportation Systems

(5) Lighting

(6) Landscape

(7) Architectural

(8) Structures

(9) Toll Facilities

(10) Utility Work by Highway Contractor Plans

No alterations or modifications to the component names listed above is allowed.

Roadway plans are most often the lead component of the Contract Plans set; however, another component may become the lead component when there are no roadway plans. Details and plan sheets typically found within the roadway plans, such as Temporary Traffic Control Plans, may be included in the lead component plans and numbered consecutively.

Utility Work by Highway Contractor Plans have a separate Financial Project ID and are typically treated as a strung project (see ***FDM 910.2.10***). When utility work is minimal, Utility Work by Highway Contractor Plans may be included as component plans within the Contract Plans set.

See the ***Structures Manual, Volume 2 – Structures Detailing Manual*** when Structures plans become the lead component.

910.2.6 Index of Roadway Plans

Place an index of roadway sheets on the left side of the Key Sheet below the list of component plans. Each component Key Sheet will have an index of sheets contained in that component.

Assemble Roadway Plans in the following order:

(1) Key Sheet

(2) Signature Sheet

(3) Drainage Map

(4) Typical Sections

(5) Typical Section Details

(6) Model Management

(7) Project Control

(8) General Notes

(9) Roadway Plan-~~ and ~~Profile~~s~~

(10) Traffic Monitoring Site

~~(11)~~ Special ~~Profiles~~

~~(12)~~(11) ~~Ramp Terminal~~ Details

~~(13) Intersection Details~~

~~(14) Special Details~~

~~(15)~~(12) Drainage Structures

~~(16)~~(13) ~~Roadway~~ Soil Survey

~~(17)~~(14) ~~Roadway Core Data~~Report of Core Borings

~~(18)~~(15) Verified Utility Locate

~~(19)~~(16) Temporary Traffic Control Plan~~s~~

~~(20)~~(17) Utility Adjustments

~~(21)~~(18) Selective Clearing and Grubbing

~~(22)~~(19) Miscellaneous Structures

Do not place Box Culvert plan sheets in the Roadway component plans. These sheets are to be placed in a Structure component, even when there are no bridge plans.

910.2.6.1 Early Works

Plan sets may require insertion of sheets that were prepared early, or prior to the design process. These sheets may be identified and numbered with the following prefixes:

(1) GR-# Soil Survey~~,~~ and Soil Boring Cross Sections~~, and~~ or Report of Core Borings

(2) TR-# Tree Survey

(3) UTV-# Verified Utility Locate

When submitted as early works, list these sheets below the index of plan sheets with an asterisk and a note as shown in ***Exhibit 910-1.***

No plan sheets other than those listed above are to be separated from the component plans.

910.2.7 Engineer of Record (EOR) and Project Manager

Place on the right side of the Key Sheet the following information in the order shown:

(1) Name and license number of the EOR, name, address, and phone number of the engineering business or agency where the EOR is employed. Include consultant contract number and vendor number when appropriate. For non-engineering

licensed professionals, change title to "Licensed Professional of Record", and include similar information that applies to their profession.

(2) Name of the Department's Project Manager below the EOR information. Show only the Department's Project Manager at this location, except for:

(a) When plans are prepared by the Department, the name of the Department's designer may be placed immediately below the name of the Department's Project Manager.

(b) When appropriate, the name of the GEC Project Manager may be placed immediately below the Department's Project Manager.

910.2.8 Governing Standards

Indicate the governing ***Standard Plans*** and ***Standard Specifications*** in the lower left corner of the Key Sheet as shown on ***Exhibit 910-1***.

For requirements of the Structures General Notes and inclusion of the relevant bridge related ***Standard Plans*** in the structures component plan set, see the ***Structures Detailing Manual***. For additional information on the ***Standard Plans*** and ***Standard Specifications***, see ***FDM 115***.

When ***Standard Plans*** ***Interim Revisions*** (***IRs***) are released, the engineer must determine if any ***IRs*** apply to the project and reference those applicable ***IRs*** as shown on ***Exhibit 910-1***.

910.2.8.1 Developmental Standard Plans

List ***Developmental*** ***Standard Plans*** to be included in the component plans below either the "Index of Sheets" or the early works note as shown on ***Exhibit 910-1***.

Insert ***Developmental*** ***Standard Plans*** sheets at the end of each applicable component plan set as applicable. When included in structure component plans, insert ***Developmental*** ***Standard Plans*** sheets before existing bridge plans.

910.2.9 Revisions

For information on the process and requirements for completing plan revisions:

- See ***FDM 132*** for revisions prior to Letting
- See ***FDM 151*** for revisions during construction

Show a complete record of all revisions made to a component plans set on the correlating component Key Sheet under a “REVISIONS” header located in the bottom center of the sheet. For each revision, record the revision number, the sheet numbers, and the date of the revision. Show the unique numbered symbol that corresponds to the revision number on the Revision Memo and modified plan sheets.

Show revisions to the Key Sheet in the Key Sheet Revisions block placed to the right of the “REVISIONS” header. List the revision date and a brief description of the revision. The Key Sheet Revisions block is only used to record changes to the Key Sheet other than recorded revisions under the “REVISIONS” header.

Do not show the “REVISIONS” header or the Key Sheet Revisions block on the Key Sheet until needed.

910.2.10 Strung Projects

Contract Plans sets that are independently prepared but are let in the same construction contract are referred to as strung projects. Show the strung project note only on lead component Key Sheet for each project that is being strung together. The note is shown in the top right corner above the small-scale state map as shown in ***Exhibit 910-1***. The note must contain all Financial Project IDs (lead project first) being strung together, including project numbers without contract plans.

When a federally funded project is strung with a non-federal eligible (NFE) project, the federally funded project is often the lead project.

When a federally funded project is strung with a state funded project, the entire contract becomes federalized; i.e., both the state funded project and the federally funded project must comply with all applicable federal laws, rules, and regulations related to the federalized contract. Do not put “(Federal Funds)” on the Key Sheet of a state funded project that is being strung with a federal project, even though that project has become federalized.

910.3 Signature Sheet

The Signature Sheet defines a professional’s area of responsibility for those portions of the document being digitally signed. The Signature Sheet shows the Digital Signature Appearance of the Professional(s) of Record.

When component plans are Signed and Sealed by a single licensed professional a signature block can be placed on the Key Sheet in lieu of using a Signature Sheet. When the component plans are signed by more than one licensed professional, or a BIM file manifest is required, a Signature Sheet is often needed.

See ***Exhibits 910-4*** for an example of a Signature Sheet.

910.3.1 Title Block

The Signature Sheet title block is to contain the information for the licensed professional that is responsible for the creation and content of the sheet. Do not place the Official Record note along the right edge of this sheet.

See ***FDM 130*** for digital Signing and Sealing requirements.

910.3.2 Digital Signature Placement

By placing a digital signature on the Signature Sheet of a multi-sheet plans set, the licensed professional associates their professional signature with the entire plans set. The Signature Sheet provides a Statement of Responsibility delineating the extent of the professional's responsibility and identifies the specific sheets for which the professional is accepting responsibility.

910.3.2.1 Digital Signature Appearance

A Digital Signature Appearance is the visual representation of a Digital Signature applied to a document. The Digital Signature Appearance is composed of combinations of informational fields; e.g., dates or text, and other information. The Digital Signature Appearance must include the professional's name, and the date and time of signing stamp.

910.3.2.2 Seal

The professional will include a representation of their Seal next to the Digital Signature Appearance. Seal representations are provided with the FDOT CADD Software. Each respective Board of Professional Regulation has enacted in their section of the Florida Administrative Code the requirements for the size and representation of a Seal.

910.3.2.3 Statement of Responsibility

The Statement of Responsibility is used to define the licensed professional's limits of responsibility and any exculpatory language. Place this statement below the Seal and

Digital Signature Appearance and above the sheet index. The Statement of Responsibility must indicate the applicable Rule of the Florida Administrative Code (F.A.C.).

910.3.3 Index of Sheets

List the plan sheets below the Statement of Responsibility that the licensed professional is signing and sealing. Exculpatory language should be included in cases where professionals share responsibility for content on any given sheet.

910.3.4 BIM File Manifest

The BIM file manifest is table placed below the Index of Sheets.

910.3.5 Revisions

A revision Signature Sheet is created when more than one licensed professional is required to Sign and Seal a revision package. The revision Signature Sheet is numbered using an alphabetic suffix; e.g., 2A, 2B. Only the licensed professionals required to Sign and Seal the revision are to be included on the revision Signature Sheet.

See ***Exhibit 910-5*** for an example of a revision Signature Sheet.

Exhibit 910-1: Lead ~~Original~~ Key Sheet

Exhibit 910-2: Revision Lead Key Sheet

Exhibit 910-3: Component Key Sheet

Exhibit 910-4: ~~Original~~ Signature Sheet

Exhibit 910-5: Revision Signature Sheet

911 Model Management Sheet

911.1 General

The Model Management sheet provides information for the order and naming of the models developed for the project.

The Model Management sheet is produced as a contract document and placed within the Roadway Plans. The sheet may be a standard-format plan sheet (11”x17”) or a large-format plan sheet (24x36”, 36”x48”, or 36”x72”) and may use any scale provided that the required information is clearly depicted.

The required information should be shown on a single plan sheet. Development of this sheet early in the design phase establishes an effective segmentation of the project.

See ***Exhibit 911-1*** for an illustration of the Model Management sheet.

911.2 Creation of Model Management Sheet

Display and label the centerline or baseline of construction on the sheet with station numbers close to station ticks. Include a north arrow, typically in the upper right portion.

Display proposed limits of pavement, curbs, traffic separators, sidewalks, curb ramps, and driveways. Show proposed bridges and approach slabs by simple outline. The labeling of any of these features is not required. If the topographic file is displayed, it should be gray scale. The intent is to show an outline of the proposed roadway to give context to the limits of each model segment.

Indicate the segments (portions of the centerline) that the project is broken into for the purpose of model development. Provide labeling that includes:

(1) File name of model(s) associated with a segment.

(2) Name of roadway centerline of baseline construction.

(3) Station limits contained within the model.

Exhibit 911-1: Model Management

912 Project Control

912.1 General

The Project Control sheet provides a summary of horizontal and vertical datum (i.e., reference points, benchmarks, and control points). The reported datum shown on this sheet must provide clear and sufficient information to establish horizontal and vertical control during the construction of the project. The data shown can be extracted from the project network control survey and historical control data or reflect assumed datum.

The Engineer of Record will create the Project Control sheet from data extracted from the project survey and sign and seal the Project Control sheet. These sheets are to be placed in the component plans in accordance with ***FDM 910.2***.

See ***Exhibit 912-1*** for example of a Project Control sheet.

912.2 Sheet Setup

Prepare the Project Control sheet on a standard-format sheet (11”x17”) or large-format sheet (24”x36”) . Use landscape orientation regardless of sheet size selected. Use standard symbols contained in the ***CADD Manual***.

Provide a note on the Project Control sheet that identifies horizontal and vertical datum that the survey is based on.

912.3 Reference Points

Reference points are prominent, easily located points in the terrain used to define a location of another point that is located on the baseline of survey. The purpose of reference points is to provide horizontal location to re-establish primary control points along the baseline of survey. Reference points should not be located on the baseline. Detailed descriptions of each reference point are illustrated with a sketch normally not drawn to any scale.

Place survey reference points on the Project Control sheet along the top of the sheet or where other space allows. Clearly indicate the baseline of survey and reference points, including all ties. Complete length of survey baseline between two consecutive reference points need not be shown. Clearly label each reference point, beginning at the first reference point within the limits of the project, and progressing in the direction of stationing. Reference points need not be drawn to any scale, but distances and angles shown must be proportionate.

912.4 Benchmarks

Benchmarks provide a known elevation that is used as the basis for measuring the elevation of other topographical points. When benchmarks are not used to provide horizontal control, they may be placed on the Project Control sheet along the bottom of the sheet or where other space allows. At a minimum, benchmarks are to include:

(1) Identifying name (e.g., BM No. 9)

(2) Description (e.g., nail in tree, concrete monument)

(3) Station and offset

(4) Elevation (in feet to two decimal places)

912.5 Control Points (Horizontal and Vertical Datum)

Control points provide information for the location and elevation of established monuments. Control points that provide vertical datum are also known as benchmarks.

Place the following information for the control points in a table titled Horizontal and Vertical Control:

(1) Point Name – Often identified on the stamped disk placed on the established monument.

(2) Northing and Easting – Show to three decimal places. Show Northing and Easting to the nearest foot when control point serves only as a Benchmark.

(3) Scale Factor – Show to eight decimal places.

(4) Latitude and Longitude – Show seconds to five decimal places. If control point serves only as a Benchmark show Latitude and Longitude to the nearest second.

(5) Baseline Station and Offset – Show to two decimal places.

(6) Elevation – If control point only serves as horizontal control show elevation as “N/A”.

(7) Description – Indicate the size, type, if the monument is “found” or “set” and include the monument ID number.

When this table is the sole means to convey horizontal and vertical datum, include a project sketch on the Project Control sheet that provides a visual reference for the location of the control points. The sketch normally is not to scale but must provide clarity and legibility. Include the following information on the sketch:

(1) Show the baseline of survey with stationing.

(2) Flag and label beginning and ending stations for project.

(3) Show bearings for all tangent sections, in the direction of stationing.

(4) Label PC and PT points and show horizontal curve data.

(5) Indicate graphically the location of intersecting roadways and railroads.

(6) Indicate Township, Range and Sections that the survey traverses. Show the location where section lines cross the baseline of survey.

(7) Place a north arrow and scale in a conspicuous location, typically in the upper right portion of the sheet.

Exhibit 912-1: Project Control

913 Typical Sections

913.1 General

The primary purpose of Typical Section sheets is to provide sectional depictions of the roadway, bridge, and toll site elements that illustrate "typical" conditions found between specified station or milepost limits. Typical Section sheets also provide traffic data and pavement design associated with the typical section being displayed.

The typical section design files used to create the Typical Section Package (see ***FDM 120***) should be used to prepare the Typical Section sheets.

This sheet is produced on a standard-format sheet (11"x17") provided in the FDOT CADD Software. For illustrations of various typical sections, see ***Exhibits 913-1*** to ***913-13***.

913.2 Typical Sections

Typical sections must cover the entire project limits; i.e., omit only Project Exceptions. Include the limits of typical section transitions with the typical section that begins the transition. Conditions that occur for short distances should not be shown as a separate typical section, such as turn lanes.

Include typical sections for each proposed toll site. These typical sections must represent the required 100 feet of loop pavement underneath the toll gantry, tolling equipment building, gantry, and foundation outlines.

To aid in the development of typical section depictions, the FDOT CADD Software contains templates for generic typical sections that can be modified to reflect project conditions.

Typical Section sheets should contain only one typical section. Place Typical Section sheets in the plans in the following order:

(1) Roadway mainline

(2) Bridges for projects including bridges (new or widened)

(3) Toll Sites

(4) Ramps and service roads for projects which include an interchange

(5) Intersecting roadways when significant work length is required

(6) Sideroads or streets when significant work length is required

913.2.1 Required Information

Show the road name and station (or milepost) limits below the TYPICAL SECTION header.

Typical Sections are typically not drawn to scale, but horizontal distances and slope angles shown must be proportionate. Existing typical section elements are shown as dashed lines and proposed as solid lines. Typical sections must label and dimension the following information, as applicable:

(1) Centerline or Baseline of Construction.

(2) Natural ground.

(3) Profile grade point.

(4) R/W or easements, and limits of Construction.

(5) Limits of Clearing and Grubbing (Standard and Selective).

(6) Limits of sod and turf.

(7) Total shoulder width and paved shoulder width. Label shoulder treatment on RRR projects.

(8) Travel lane width (total and individual lanes), and limits of friction course.

(9) Show median or roadside barrier when continuous (or mostly continuous) through the typical section limits.

(10) Bicycle lanes.

(11) Indicate width of existing pavement and proposed pavement on widening projects.

(12) Curb location and type (show Type E or F Curb, not the dimension).

(13) Sidewalk location and width.

(14) Cross slopes of roadway pavement, shoulder surfaces, sidewalks, and bridge decks as a decimal part of a foot vertical per foot horizontal. These cross slopes should be rounded to two decimal places, i.e., 0.02, 0.06. Three decimal places may be required for pavement cross slope.

(15) Median width and type, show slopes by ratio, vertical to horizontal, i.e., 1:4, 1:2.

(16) Roadside slopes and ditches, show slopes by ratio, vertical to horizontal.

(17) Depict pavement construction by indicating the LBR requirement and the thickness of the subgrade stabilization, subbase, or base, as well as thickness for structural course, friction course and shoulder pavement. Use 4 inches for both base extension on rural sections and for stabilization extension on curbed sections.

(18) Toll equipment building, gantry and foundation outlines.

(19) For Turnpike projects only, show and label Florida Gas Transmission (FGT). Dimension location to center of utility from the Construction Centerline or Baseline.

913.2.2 Required Notes and Details

Show the following notes and details on Typical Section sheets as applicable:

(1) For projects using Selective Clearing and Grubbing include the following note:

See Selective Clearing and Grubbing sheets for details and limits of selective clearing and grubbing.

(2) For new construction flush shoulder projects, include a Shoulder Pavement Detail (shown on ***Exhibit 913-1***) with the following note:

This area may be constructed of base material (granular only) at no additional compensation.

(3) For widening projects include the following note:

Actual width of base widening may vary due to actual existing pavement width. A uniform width base widening strip may be constructed at no additional compensation.

(4) For projects constructing ditches include the following note:

Depth and bottom width of ditch may vary.

(5) For new construction curbed roadway projects with Asphalt Base, Type B-12.5 only, indicate the asphalt curb pad on the typical section and include an Asphalt Base Curb Pad Detail.

(6) For resurfacing projects on curbed roadways where the milling depth is less than the overlay thickness, include a feathering detail with notes.

913.2.3 Partial Sections

Partial sections are used to illustrate a changed condition (e.g., ditch or drainage features, bicycle or pedestrian features, longitudinal barriers) that occur for significant limits with the typical section being shown. ***Exhibit 913-4*** demonstrates the use of a partial section.

Place partial sections on the same sheet as the typical section to which they apply.

913.3 Traffic Data

Traffic data is required only for mainline roadways and bridges, and ramps. Show the following traffic data (consistent with the data used for pavement design) below and to the left of the typical section:

(1) Current Year and AADT

(2) Estimated Opening Year and AADT (not required for skid hazard projects)

(3) Estimated Design Year and AADT (not required for skid hazard projects)

(4) K, D, T (24 hour) and T (Design Hour) factors

(5) Design Speed (do not show Posted Speed or Target Speed)

(6) Context Classification

913.4 Pavement Design

Show the approved pavement design directly below the typical section described in the order of construction as follows:

- For new construction start with Option Base Group and end with friction course.
- For resurfacing projects start with milling depth, then list the structural courses and end with friction course.

913.5 Cross Slope Correction Details

When cross slope correction is necessary, include special milling and layering details showing the method of correction in the plans.

Exhibit 913-13 provides an example of overbuild details.

Exhibit 913-1: 2-Lane Flush Shoulder

Exhibit 913-2: 4-Lane Flush Shoulder

Exhibit 913-3: 4-Lane Flush Shoulder Resurfacing

Exhibit 913-4: 4-Lane Curbed

Exhibit 913-5: 4-Lane High Speed Curbed

Exhibit 913-6: 4-Lane Limited Access Facility

Exhibit 913-7: 6-Lane Limited Access Facility

Exhibit 913-8: Ramp

Exhibit 913-9: Shared Use Path

Exhibit 913-10: Roundabout

Exhibit 913-11: Mainline Toll Gantry

Exhibit 913-12: Ramp Toll Gantry

Exhibit 913-13: Overbuild Details

914 General Notes

914.1 General

Place general notes on a 11” x 17” plan sheet available in the FDOT CADD Software. Place the General Notes sheet before the first roadway plan-profile sheet in the plans set. See ***Exhibit 914-1*** for an example of a General Notes sheet.

Many Department offices may be involved in the determination of the suitability of general or pay item notes added to the plans, however, the final acceptance of the proposed language is the responsibility of the District Specifications Office.

914.2 General Notes

General notes provide information and direction to the contractor by clarifying design details or construction practices. General notes are project-specific and must not restate, broaden or curtail requirements in the ***Standard Specifications*** or ***Standard Plans***.

General notes are not a substitute for specifications. Product and material requirements must be included in the applicable specifications. Refer to the Specifications Handbook for guidance.

914.2.1 Writing General Notes

Notes are written to the contractor and should be written as a command.

Follow the Federal Guidelines for Plain Language when writing notes and use terminology and abbreviations commonly used in the ***Standard Specifications*** and ***Standard Plans***. Other rules to follow include:

(1) Do not include “Contractor must”, “by the Contractor”, or similar phrases in notes.

(2) Use “must” instead of “shall”.

(3) Use active voice and present tense to structure the sentence as a command. “Must” is often not needed when writing in active voice.

(4) Use short sentences; i.e., be precise and concise.

(5) Omit unnecessary words such as particularly, somewhat, absolutely, actually, completely, really, quite, totally, all, utmost, and very.

(6) Avoid using “if-then” sentence structure; e.g., “If base is exposed during milling, immediately place tack coat over area.” A more correct sentence structure is: “Immediately place tack coat over any base that is exposed during milling.”

914.2.2 Required General Notes

Place the following notes on the General Notes sheet when applicable:

(1) All survey information was obtained from a licensed Florida Professional Surveyor and Mapper and utilized as supporting data in the production of design plans and for construction on subject project. The professional surveyor and mapper of record is:

{Surveyor name, P.S.M.}
{P.S.M. NO: #}
{Company Name}
{Company Address}
{Certificate of Authorization: #}

(2) The location(s) of the utilities shown in the plans (including those designated Vv, Vh and Vvh) are based on limited investigation techniques and should be considered approximate only. The verified locations/elevations apply only at the points shown. Interpolations between these points have not been verified.

(3) Utility/Agency Owners for this project include:

{List Company Name, Contact Name, and Phone Number}

Also include:

- Contact information for persons responsible for the maintenance of FDOT infrastructure such as traffic counters, lighting, signal components, and ITS.
- Transportation Data and Analytics Office when there is a traffic-monitoring site on the project or within one-half mile of the construction. The contact person is the Traffic Data Section Manager.

(4) SR XX is an Emergency Shoulder Use (ESU) route between _______ and ______. Maintain a usable shoulder during all phases of construction that can be open to ESU traffic when directed by the Department.

914.2.3 Bridge Clearance

For projects affecting an existing bridge (e.g., bridge widenings or resurfacing) that propose a minimum design vertical clearance between 16’-0” and 16'-2" or if a Design Variation or Design Exception is required, place the following general note in the plans:

When construction is complete, submit a certified survey confirming the as-built minimum vertical clearance is equal to or greater than the minimum design vertical clearance called for in the Plans.

914.3 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a Pay Item Note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.
- Clarify the purpose, uses, or requirements.

914.4 Notes to Reviewer

The use of Notes for Reviewer is optional. However, these notes are particularly useful in documenting a project’s status when the plans are to be “shelved”.

Notes for Reviewer provides relevant information to reviewers, such as:

(1) Special directives and project details.

(2) Status on utility, R/W, and permit activities that may have a bearing on the level of completion for plan sheets.

(3) Clarification on Department commitments or agreements that reviewers should be apprised of.

(4) List of Design Exceptions, Design Variations, Design Variation Memorandums being processed.

Place the Notes for Reviewer conspicuously on the General Notes sheet. Include these notes only with Phase I, Phase II and Phase III submittals.

Exhibit 914-1: General Notes

915 Roadway Plan-Profile Sheet

915.1 General

The signed and sealed Building Information Model (BIM) files contain the complete horizontal and vertical geometry definitions for the project. The Roadway Plan-Profile sheet shows a 2D representation of the design contained within the model(s). Various roadway elements such as pavement width, medians, paved shoulders, curbs, drainage elements, tapers, turn provisions, and intersecting roadways, are annotated on this sheet.

Prepare the Roadway Plan-Profile sheet using a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48”, or 36”x72”). Use landscape orientation regardless of sheet size selected.

Roadway profiles are typically provided for new construction and reconstruction projects and are shown with the plan view on the same sheet. When roadway profiles are not needed, title the sheet as Roadway Plan Sheet.

When appropriate, the plan or plan-profile sheet may utilize multi-stacking (subdividing sheet horizontally); each panel containing a roadway plan view with (when appropriate) the corresponding roadway profile directly below.

Use the following horizontal scales:

	Standard	Optional
Curbed Roadways	1” = 40’	1” = 50’
Flush-shoulder Roadways	1” = 50’	1” = 100’

See ***Exhibit 915-1*** for an example of a Roadway Plan-Profile sheet.

915.2 Roadway Plan

Display a north arrow and scale within each plan view, typically in the upper right portion.

Display roadway plan view such that the centerline of construction or baseline of construction stationing increases from left to right. Display bearings for tangent sections (in the direction of stationing) below the centerline or baseline. Display station numbers close to station ticks.

Display ~~and label~~ existing topography, including roads, streets, drives, buildings, underground and overhead utilities, walls, curbs, pavements, fences, railroads, and bridges, drainage structures and similar items, as well as streams, ponds, lakes, wooded areas, ditches, existing gasoline storage tanks within limits of topographical survey, and other physical features. Label existing features as needed to clarify design intent.

915.2.1 Required Labeling and Information

Include labeling and dimensions only to the extent necessary to convey the design intent of the improvements. Provide the following labeling and dimensions:

- Flag and station the begin and end project limits, and construction limits. Project limits should be at the beginning and the end of the full typical sections. Begin construction and end construction where construction limits are other than project limits. Transitions for maintenance of traffic and other construction work such as feathering, friction course, guardrail, drainage work, signing and marking work, and sidewalk may fall outside of the project limits but must be included within the construction limits. If plans include more than one project, identify the limits for each by Financial Project ID.
- Display station equations along centerline or baseline of construction.
- Flag and station the begin and end of project exceptions (e.g., excluded intersections, bridges).
- Indicate each type of construction classification where more than one type is involved (e.g., new construction, resurfacing, bridge work, widening, and milling). Use shading, patterning, or labeling to convey the information. Indicate the limits of pavement and grading at side street intersections. Provide a legend when shading or patterning is used.
- Display proposed curbs, traffic separators, sidewalks, curb ramps, retaining walls, and driveways. Label curbs and curb ramps indicating type. Label and dimension sidewalks, medians, and traffic separators at intervals no greater than 2,500 ft.
- Dimension traveled way along mainline at intervals no greater than 2,500 ft., or where pavement widths change. Dimension traveled way of side streets and driveways.
- Display proposed drainage system by depicting drainage pipes and French drain with a single line, and the outline of inlets, manholes, junction boxes, and outfall features (e.g., mitered end section (MES), end wall). Identify by structure number only. Do not label pipe size or length.~~Display drainage system by depicting drainage pipes and French drain with a single line, and the outline of inlets, manholes, junction boxes, and outfall features (e.g., MES, end wall). Identify by structure number only. Do not label pipe size or length~~.

- Display box culverts and three-sided culverts. Identify by structure number only. Do not label culvert size or length.
- Display and label R/W lines at intervals no greater than 2,500 ft. Display and label construction easements or license agreements.
- Display and label the limits of wetlands based on permit or regulatory requirements.
- Display and label Verified Vertical Elevation and Horizontal Location (V_{vh}) for underground utilities.
- Display and label overhead utilities indicating the line voltage. For a multi-line electrical overhead crossing, accurately show the location of each line. Show utility line height where overhead lines to may impact proposed construction.
- Identify all traffic monitoring sites in or within one-half mile of the project limits with the following notation:

  Traffic Monitoring Site Number (XXXX)

  Roadway Section Number (XXXX)

  Milepost (XX.XXX)

  Site includes vehicle detectors in roadway and pedestal, pole or base mounted cabinet, buried cable, and solar power unit on R/W. Inquiries about monitoring sites should be addressed to the Traffic Data Section Manager of the Transportation Data and Analytics Office, Office of Planning.

- When it is determined that a sectional view is helpful to convey the design intent at critical locations, display and label the sectional view near the critical location.

Projects with minor utility work or impacts may include these features on the Roadway Plan-Profile sheet.

915.2.2 Horizontal Curves

PC and PT points of horizontal curves are designated by small circles with short radial lines from these points, and PI points by a small triangle with a short section of tangent on either side. Display the following horizontal curve data on the plan view:

PI	(Station)	T	(Tangent Length)
Δ	(Delta Angle with Direction)	L	(Length of Curve)
D	(Degree of Curve)	R	(Radius Length)

PC	(Station)	e	(Superelevation Rate)
PT	(Station)		

915.2.3 Bridges and Bridge Culverts

Bridge-sized culverts (a.k.a., bridge culverts) are defined in ***FDM 265.1***. Flag and station the begin station and end station for the bridge culvert (outside wall to outside wall). Provide a bridge number and a drainage structure number for all bridge culverts.

Display proposed bridges and approach slabs by simple outline. Flag and station the begin station and end station for the bridge and for the approach slabs. Provide a bridge number for all bridges.

When appropriate, display a short section of lateral ditch/outfall centerline on the Roadway Plan-Profile sheet.

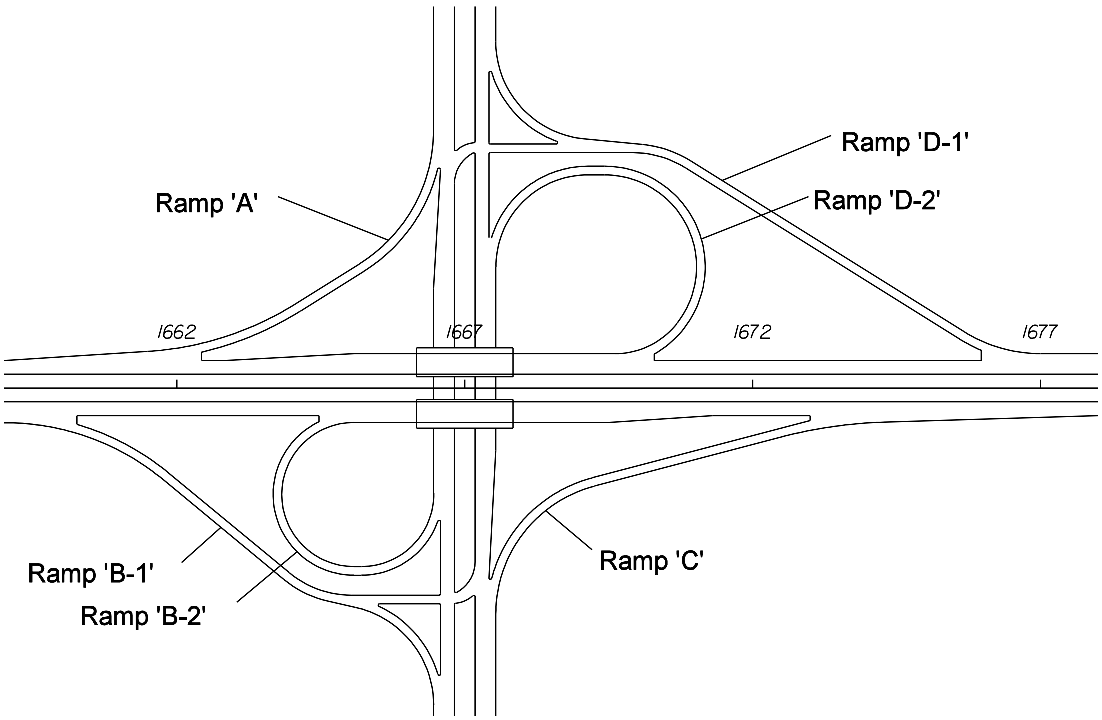
915.2.4 Interchanges

The entire interchange should be shown on one sheet using a 1" = 100' scale. With larger interchanges, consider using match lines and placing extended potions of alignment in available space on the sheet.

Display the ramp baseline of construction, typically located on the right edge of the pavement with respect to the direction of traffic. Ramp stationing should be increasing in the same direction as the project.

Identify ramps using letters or a combination of letters and numbers (e.g., Ramp A, Ramp B-1, Ramp B-2). Ramps in the first left quadrant along mainline stationing should be assigned first. Name assignments progress in a counterclockwise direction around the interchange (see ***Figure 915.2.1***). For projects with two or more interchanges, continue name assignments with the next letter and in same counterclockwise direction noted above.

Figure 915.2.1 Interchange Layout



Frontage roads should be assigned a unique alpha or numeric designation to avoid confusion with ramp nomenclature.

915.2.4.1 Ramp Terminal Details

Consider providing ramp terminal details at a scale of 1" = 40'. Ramp terminal details should be shown on the same page as the interchange.

915.3 Roadway Profile

Display roadway profiles directly below the corresponding roadway plan view. As illustrated in ***Exhibit 915-1***, each roadway profile must include a background grid at the appropriate scale. The horizontal scale and interval stationing for the roadway profile must be the same as that used for the roadway plan view. The vertical scale is typically 10% of the horizontal scale (e.g., 1” = 100’ horizontal scale would typically use a 1” = 10’ vertical scale)

Align the begin roadway profile stationing with the begin roadway plan view stationing. Display stationing along the bottom of the grid. Display the vertical elevation along both sides of the grid.

915.3.1 Required Labeling and Information

Include labeling and dimensions only to the extent necessary to convey the design intent of the improvements. Provide the following labeling and dimensions:

- Flag and station the begin and end project, and construction limits matching what is shown in the roadway plan view.
- Label percent grade for each tangent section. When two tangent grades intersect and no vertical curve is required, label the PI station and elevation.
- Flag and station the superelevated sections (see ***FDM 915.3.3***).
- Show the cross-section template of the underlying road, railroad, or waterway for bridges and box culverts along the centerline or baseline of construction. Display minimum vertical clearances for bridges.
- Display and label only transverse underground utilities.

Do not display proposed drainage pipes or inlets in the profile view.

915.3.2 Vertical Curves

Indicate vertical curve PCs and PTs by small circles and PIs by a small triangle with short sections of tangent shown on each side. Extend vertical lines from the PC and PT points and place a dimension line indicating the length of the vertical curve. The PC and PT stations and elevations must be labeled on the vertical lines.

For vertical curves, show the profile grade elevations on even stations and at appropriate intervals. Place the elevations between the dimension line and the grade line. Also, place the curve length, dimension lines and the profile grade elevations above the grade line for sag vertical curves and below the grade line for crest vertical curves. Place the dimensions and elevations reasonably near the grade line. The PI station and elevation must be noted, lettered vertically above the PI symbol for crest curves and below for sag curves.

Show the profile grade elevation of the beginning and ending station of each sheet vertically just above the grade line, except when the beginning or ending station is on a vertical curve.

915.3.3 Superelevation

Standard superelevation details shown in ***Standard Plans*, *Indexes 000-510*** and ***000-511*** may be used for projects with simple curves.

Show superelevation profiles for:

- Reverse curves
- Compound curves
- Other conditions requiring special superelevation not covered in the standards

Show complete profile grade line and edges of pavement (right and left) within the superelevation zone on the grid format. Label the begin and end superelevation stations and indicate the section in full superelevation.

915.3.4 Special Ditch Profile

Display and label special ditches and treatment swales (ditch blocks) in the profile. Show percent ditch grade and a beginning or ending ditch PI with elevation and station plus. Show ditch PI with elevation at the begin and end point of ditch blocks.

For multi-lane divided projects, three special ditch grades (right and left roadway ditches and median ditch) may occur at the same location. In such cases, it may be advantageous to:

- Show the median ditch at a convenient location on the sheet with a separate elevation datum, or
- Provide spot elevation labels in the plan view.

Depict uniform ditches of non-standard depth by a dimension line in the lower portion of the grid and label as a special ditch with location and depth or show them by flagging the DPIs at each end with station elevation and side. Standard depth ditches are not labeled.

915.3.5 Special Gutter Grades

Show special gutter grades in profile for cases where the gutter grades are not controlled by the typical section. Include prolongations of gutter profile grades across street intersections on plan-profile sheets if an inlet is not provided before the intersection.

915.3.5.1 Shoulder Rocking Gutter Profiles

Shoulder rocking is used to achieve positive drainage when a minimum 0.3% longitudinal gutter grade cannot be maintained using uniform shoulder cross slopes. Provide a gutter profile for each side of a concrete barrier wall, along with the profile of the wall top. The top of the wall profile must follow the roadway profile which will create a varied wall height between the high and low points along the gutter profile.

A special detail depicting the concrete barrier wall reveal is often provided to supplement the ***Standard Plans*** details. These profiles may be depicted in either table or graphical format on the Plan-Profile sheet.

See ***FDM 210.4.1 or FDM 211.4.1*** for more information on design requirements for shoulder rocking profiles.

915.3.6 Special Sidewalk Profiles

Display and label special sidewalk profiles when the profile grade of the proposed sidewalk is independent of the roadway profile. Sidewalk profiles are typically located at the back of the proposed sidewalk (closest to the R/W).

When special sidewalk profiles are included on the Roadway Plan-Profile sheet, indicate the location of the sidewalk profile grade line (PGL) on the typical section.

915.4 Ramp Profiles

Develop ramp profile grades along the baseline of each ramp. A profile of the edge of the pavement opposite the baseline is typically shown as well. Show ramp profiles anywhere within available space on the Roadway Plan-Profile sheet.

Use the same scales used for the Roadway Plan-Profile sheet displaying the interchange. Each ramp profile must include a background grid at the appropriate scale.

915.4.1 Spline Grade

Spline grades are used to show the interconnection and interrelation of the ramp edge of pavement with the mainline edge of pavement. Showing this profile in the plans is typically not necessary. However, if the mainline pavement is superelevated or within the superelevation transition zone, the profile can be beneficial to illustrate the design intent.

Display the spline grade elevations at intervals of 20 or 40 feet. Show elevations for the outer edge of mainline pavement and inner and outer edges of the ramp pavement at the nose areas.

Join the grades of each pavement edge by smooth splines or simple curves. Label the three grade profiles and all equality stations. Flag and label nose stations. Place the scale in proximity of the profile.

915.5 Special Profiles

Showing special profiles in the plans is typically not necessary. However, if it is determined that providing a special profile in the plans is helpful to convey the design intent, they should be shown anywhere within available space on the Roadway Plan-Profile sheet.

Standard scale used for special profiles should be 1" = 20' horizontally and 1" = 2' vertically. Each profile must include a background grid at the appropriate scale.

915.5.1 Intersections

Supplemental profiles at intersections may be necessary to define edge of pavement profiles. Include sections showing pavement surface elevations for nose points and other critical locations. Label the existing ground line and curb line per the ***CADD Manual***.

915.5.2 Curb Returns

Curb return profiles may be necessary to define the gutter flow line from the PC to the PT point of the return at an intersection.

Identify each return profile and its PC and PT stations shown. Elevations should be shown at appropriate intervals and low and high spots must be identified by location and elevation.

915.5.3 At-Grade Railroad Crossings

Supplemental profiles for at-grade railroad crossings may be necessary to define lane lines, edges of pavement, and gutter flow lines.

Exhibit 915-1: Roadway Plan-Profile

916 Drainage Structures Sheet

916.1 General

The signed and sealed Building Information Model (BIM) files contain the complete drainage system information for the project. The Drainage Structures sheet provides supplemental data and information for proposed drainage structures, including:

(1) Drainage Plan View

(2) Drainage Profiles

(3) Drainage Tabular Information

(4) Drainage Special Details and Notes

(5) Optional Materials Tabulation

The Drainage Structures sheet is produced as a contract document and placed within the Roadway Plans. This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48” or 36”x72”). Use landscape orientation regardless of sheet size selected. Sheet size selection should be based on size and extent of drainage network(s). The Drainage Structures sheet should display the complete extents of individual drainage network(s).

Use the following horizontal scales:

	Standard	Optional
Curbed Roadways	1” = 40’	1” = 50’
Flush-shoulder Roadways	1” = 50’	1” = 100’

Provide a legend for all abbreviations included in the drainage tabular information. See ***Exhibit 916-1*** for an illustration of the Drainage Structures sheet.

916.2 Drainage Plan View

The drainage plan view is typically shown in the upper half of the sheet. The purpose of this view is to highlight the storm drain network(s), cross drains, and side drains that will be shown in the profile views and included in the tabular data. The drainage plan view is not required when side drains are the only drainage structures included with the project, however side drains must be shown and labeled on roadway plan sheet, and included in the drainage tabular information.

The display limits of the drainage plan view should contain the entire proposed drainage network. If multiple drainage networks are shown or overlap, clearly indicate which network the profile and tabular information is associated with.

916.2.1 Required Information

Provide the following information in the plan view:

(1) Display the view such that the centerline of construction or baseline of survey stationing is increasing from left to right. Display station numbers close to station ticks. Include a north arrow and scale above and near the drainage plan view.

(2) Display proposed limits of pavement, curbs, traffic separators, sidewalks, curb ramps, and driveways. Show proposed bridges and approach slabs by simple outline and indicate the bridge structure number. The intent is to show an outline of the proposed roadway to give context to the location of the drainage structures. The elements of the proposed roadway should be gray scaled.

(3) Display and label existing and proposed underground utilities only where a conflict exists. Identify the underground utility as a conflict node.

(4) Display the proposed drainage system by depicting drainpipes with a single pipeline style indicating direction of flow, and the outline of inlets, manholes, junction boxes, and outfall features (e.g., MES, endwall).

(5) Display and label existing structures that are to be filled, plugged, and remain in place.

Do not display existing topography, except to the extent those elements are to be incorporated into, affected by, or accommodated by the proposed drainage system. Existing topography elements may include roads, streets, driveways, buildings, underground and overhead utilities, walls, curbs, pavements, fences, railroads, bridges, drainage structures and similar items, as well as streams, ponds, lakes, wooded areas, ditches, existing gasoline storage tanks within limits of topographical survey, and other physical features. When shown, display existing topography elements as gray scaled.

916.2.2 Structure and Pipe Numbers

Provide drainage structure numbers (w/ prefix “S”), and a pipe number (w/ prefix “P”) between structures. Include the bridge number for proposed bridge culverts. Established the structure and pipe numbers using the convention shown in ***Exhibit 916-1*** and described as follows:

(1) Storm drain networks: Assign structure numbers in ascending order along the centerline of construction or baseline of construction. Assign pipe numbers that correlate with the structure at the hydraulically upper end of pipe.

(2) Cross drains and side drains: Assign structure number in ascending order along the direction of flow (hydraulic upper end to lower end). Assign the same structure to intermediate or end structures with suffix letter (i.e., A, B, C). Assign pipe numbers to correlate with the structure at the hydraulically upper end of pipe. When there are multiple pipes associated with the cross drain or side drain include a suffix letter.

916.3 Drainage Profile

Drainage profiles are typically shown in the lower left portion of the sheet as illustrated in ***Exhibit 916-1***. Stack or space the profiles to avoid overlapping of structures or notes. Display drainage profiles from left to right, beginning with the structure at the hydraulically upper end of the system run to the outfall or structure at the hydraulically lower end. All storm drain networks and cross drains are to be shown in profile view.

Do not include profile views for side drains.

Each drainage profile must include a background grid at the appropriate scale. Use the same horizontal scale for the profile portion that is used for the plan portion. The vertical scale is typically 10% of the horizontal scale (e.g., 1” = 50’ horizontal scale would typically use a 1” = 5’ vertical scale).

916.3.1 Required Information

Drainage profiles depict vertical relationships of the drainage network or cross drain along the centerline of the pipes. Provide the following information for each drainage profile:

(1) Display drainage structures (typically depicted as rectangles) and connecting pipes. Place the outside edge of the first structure at the first vertical grid line as shown in ***Exhibit 916-1***. Assign the value of zero to the first vertical grid line; subsequent vertical grid lines reflect the true distance along the pipe system.

(2) Display and label wall zone pipes.

(3) Label drainage pipes and structure numbers.

(4) Display and label existing and proposed surfaces along centerline of pipe. Displaying surfaces past the limits of the first and last pipes is not required.

(5) Provide horizontal grid line elevations along the left side of the background grid.

(6) Display and label existing and proposed underground utilities. When appropriate, identify underground utility as a conflict node.

916.4 Drainage Tabular Information

Drainage tabular information provides necessary data for the installation of structures and pipes associated with storm drain networks, cross drains, and side drains. The drainage tabular information is typically shown on the lower right portion of the sheet and consists of four tables:

(1) Pipe Data

(2) Structures Data

(3) Endwall and MES Data

(4) Optional Materials

If there is insufficient space on the Drainage Structures sheet, the Drainage Tabular Information may be placed on a separate sheet titled “Drainage Structures Data”.

916.4.1 Pipe Data

The Pipe Data table contains the following information:

- Pipe number, length, and size
- Hydraulic upper end structure number with invert elevation
- Hydraulic lower end structure number with elevation
- Optional materials group number

916.4.2 Structures Data

The Structure Data table contains the following information for each structure:

- Structure number
- Baseline feature
- Structure location (baseline station and offset)
- Structure type and bottom dimensions
- FDOT Standard Plans (Index 400 series) Notes
- Reference point elevation
- Pipe label for each pipe entering or exiting the structure

916.4.3 Endwall and MES Data

The Endwall and MES Data table contains the following information:

- Structure number
- Baseline feature
- Structure location (baseline station and offset)
- Structure type
- Pipe invert elevation
- Structure notes

916.4.4 Optional Materials

Modification for Non-Conventional Projects:
Delete ***FDM 916.4.4*** and see ***Chapter 6*** of the ***Drainage Manual*** for Optional Material requirements.

Consider optional materials for all pipes; however, match pipe extensions and end section replacements to the existing pipe material. See the Department's ***Drainage Design Guide*** (Optional Pipe Material Chapter) for more information.

Conduct an Optional Pipe Materials Analysis and place an Optional Materials table with the Drainage Tabular Information. The Optional Materials table shows all materials allowed and indicates which material is plotted in the plans and used as the basis for pay item quantities. The Optional Materials table is to include:

- Optional Pipe Group Number
- Size(s)
- Material, thickness or class, corrugation requirements, and protective coating
- Plotted and as-built notations, and construction remarks

916.5 Drainage Special Details

Showing special horizontal or vertical details in the plans is typically not necessary. However, if it is determined that providing a special drainage detail is beneficial to conveying the design intent, the detail is typically placed in the upper right portion of the sheet but may be shown anywhere within available space on the sheet. Any scale may be used.

The following are examples of information that may be depicted:

- Clash detection results and utility clearances
- Drainage structure details (non-standard structures, pond outfall structures multiple or off-centered pipe connections to a structure wall)
- Isometric and 3D views with identifying labels

Exhibit 916-1: Drainage Structures Sheet

917 Stormwater Facilities

917.1 General

A stormwater facility is often located at the downstream end of the drainage system for the purpose of treatment and attenuation of stormwater runoff. The Stormwater Facilities sheet provides data and information for proposed stormwater facilities, including:

(1) Stormwater Facility Plan View

(2) Stormwater Facility Sectional Views

(3) Outlet Structure Details

This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48”, or 36”x72”). Use landscape orientation regardless of sheet size selected.

See ***Exhibit 917-1*** for an example of a Stormwater Facilities sheet.

917.2 Stormwater Facility Plan View

The stormwater facility plan view is typically located in the upper left area of the sheet. It is preferrable to display a stormwater facility in its entirety on a single plan sheet. A common horizontal scale for the plan view is 1” = 50’ and should not be larger than 1” = 20’.

917.2.1 Required Information

Display and label the following information in the plan view:

(1) Baseline of construction stationing (typically increasing from left to right) with station and offset ties to the project centerline of construction. Include a north arrow and scale above and near the drainage plan view.

(2) Elements of the proposed roadway, including drainage pipes and structures.

(3) Location of stormwater facility sectional views (i.e., A-A, B-B).

(4) Location of soil borings

(5) Stormwater facility delineations:

(a) Facility bottom and top (often referred to as Top of Bank). Provide Station/Offset callouts and radiuses along the Top of Bank delineation.

(b) Change of side slope (e.g., 1:2 to 1:4)

(c) Maintenance berm limits

(6) Maintenance access road, fence and gates, and R/W lines

(7) Stormwater facility drainage structures and pipes with location of outlet structure sectional views (i.e., C-C, D-D)

917.3 Stormwater Facility Sectional Views

The stormwater facility sectional views are typically located below or adjacent to the plan view. Include a minimum of two sectional views, taken in directions perpendicular to each other (as shown on ***Exhibit 917-1***). The horizontal scale should be the same as used for the stormwater facility plan view. The vertical scale is typically 4 to 5 times larger than the horizontal scale; e.g., 1" = 20' horizontal and 1" = 4' vertical.

917.3.1 Required Information

Display and label the following information in the sectional views:

- Stormwater facility bottom and top (often referred to as Top of Bank) with elevations, side slopes, and maintenance berm.
- Existing groundline, limits of clearing and grubbing, limits of sod or vegetation, and location of R/W and fence
- Symbols and elevation for Normal Highwater and Peak Design Stage.
- Soil borings

Dimension the maintenance berm, and horizontal distance between stormwater facility delineations.

917.3.2 Cross Sections

Showing cross sections of the stormwater facility in the plans is typically not necessary. However, if it is determined that the sectional views do not adequately show the design intent, cross sections may be included. Place cross sections anywhere within available space on the Stormwater Facilities sheet and include required information specified in ***FDM 917.3.1***.

917.4 Outlet Structure Details

The stormwater facility outlet structure details are typically shown adjacent to the plan view. Outlet structure information, elevations, and dimensions may be placed in a data table (as shown on ***Exhibit 917-1***) or shown and labeled directly on the outlet structure sectional views. Information, elevation, and dimensions should clearly indicate the fabrication requirement of the modified inlet and skimmers.

917.4.1 3D Isometric View

Provide a 3D isometric view of the stormwater facility outlet structure that illustrates:

- Inlet with weir and drawdown. Provide outlet structure drainage structure number.
- Outlet pipe(s), with pipe number
- Skimmer(s)
- Concrete apron

Placement of the 3D isometric view may use any scale and angle that best displays the various components of the outlet structure.

917.4.2 Sectional Views

Provide a sectional view across each outlet structure side that contains a weir or drawdown. Sectional views must provide all pertinent dimensions and elevations needed to fabricate the outlet structure and at a minimum illustrate the same elements required for the 3D isometric view. Any scale may be used that clearly conveys the requirements of the outlet structure. Elevation data may be provided in table format as shown in ***Exhibit 917-1.***

Exhibit 917-1: Stormwater Facility Sheet

918 Drainage Map

918.1 General

The Drainage Map sheet is required for new construction and reconstruction projects, and for other project types that propose significant changes to the existing hydrology and hydraulics.

The Drainage Map sheet provides an overview of the overland drainage patterns as well as the storm drain system layout and outfall locations. This sheet is used for establishing the appropriate drainage facilities during design, confirmation of overland flow patterns during construction, and for emergency response and maintenance purposes.

This sheet may be produced on a standard-format sheet (11"x17") or a large-format sheet (24"x36", 36"x48", or 36"x72"). Use landscape orientation regardless of sheet size selected.

Use the following horizontal scales:

	Standard	Optional
Closed Drainage System	1" = 200'	1" = 500'
Open Drainage System	1" = 1000'	1" = 2000'

See ***Exhibit 918-1*** for an example of a Drainage Map.

918.2 Required Information

The Drainage Map sheet must comply with the following:

(1) Use a gray-scaled photographic (aerial) base map as shown in ***Exhibit 918-1***.

(2) Display a north arrow and scale, typically in the upper right portion.

(3) Display the centerline or baseline of construction with station equations. Show stationing at an appropriate interval.

(4) Flag and station the begin and end project limits.

(5) Flag and station the begin and end of bridges and bridge culverts.

(6) Label road names and state numbers, and side street names.

(7) Display and label existing physical land features affecting drainage (e.g., lakes, streams, swamps) by name and direction of flow. Indicate if feature is an FDEP impaired water body when known. Show past highwater elevations with date of occurrence, if available, and present water elevations with date of reading.

(8) Label known landfill areas, contamination sites, and wellfield protection sites.

(9) Show drainage divides and other information (e.g., pop-off elevations, spot elevations) to indicate the overland flow of water. Show drainage areas in acres.

Use inserts to show areas that are of such magnitude that the boundaries cannot be plotted at the selected scale. Display basin or subbasin names.

(10) Display the 100-year flood plain boundaries and elevations. Display delineated wetlands. Identify sink holes and depressions.

(11) Display arrows to indicate direction of flow along proposed ditches. Show flow arrows from offsite areas at the point where stormwater would approach the FDOT R/W to be routed or controlled by FDOT. Show flow arrows from onsite areas where the flow leaves FDOT R/W.

(12) Display and label existing drainage structures with type, size, flow line elevations, flow arrows and any other pertinent data. Refer to the ***FDOT CADD Manual*** for correct symbols for existing drainage facilities.

Data relating to existing drainage structures and pipes may be compiled in a table format and placed within available space on the sheet.

(13) Display proposed drainage structures, cross drains, storm drain pipes, outfall structures and retention/detention pond locations.

(a) Label cross drains by pipe size and structure number

(b) Label structures by structure number

(c) Label ponds or treatment swales by pond number

918.2.1 Flood Data Summary Box

The Flood Data Summary box provides design discharge, base discharge, and overtopping or greatest flood discharge with corresponding stage values.

Provide the Flood Data Summary box when a new or modified cross drain or box culvert (regardless of size) is proposed, or an existing cross drain or box culvert is impacted by changes to the existing hydrology and hydraulics, and the location of the cross drain or box culvert is within the 100-year floodplain or has a history of flooding or other hydraulic problems.

If there is insufficient space on the Drainage Map sheet, or the Drainage Map is not produced, place the Flood Data Summary box on its own sheet titled “Flood Data Sheet”.

The required preformatted summary box is available within in the FDOT CADD Software. An example of a Flood Data Summary box is shown in ***Table 918.2.1***.

Table 918.2.1 Example of a Flood Data Summary Box

STRUCT. NO.	STATION	DESIGN FLOOD 2% PROB. DISCHARGE	DESIGN FLOOD 50 YR. FREQ. STAGE	BASE FLOOD 1% PROB. DISCHARGE	BASE FLOOD 100 YR. FREQ. STAGE	OVERTOPPING FLOOD DISCHARGE	OVERTOPPING FLOOD STAGE	OVERTOPPING FLOOD PROB. X	OVERTOPPING FLOOD FREQ. YR.	GREATEST FLOOD 0.2% PROB. DISCHARGE	GREATEST FLOOD 500 YR. FREQ. STAGE
CD-1	1525+40.00	15.6	34.84	17.8	34.86	--	--	--	--	30.3	34.96
CD-2	1561+00.00	39.4	38.35	44.9	38.54	65.75	39.5	0.32	314	--	--
CD-3	1679+00.00	24.0	34.60	28.0	34.73	--	--	--	--	48.0	35.36
CD-4	2257+22.00	9.0	35.77	11.0	35.77	--	--	--	--	18.0	35.81
CD-5	2283+02.75	24.0	35.70	28.0	35.90	--	--	--	--	48.0	36.87

NOTE: THE HYDRAULIC DATA IS SHOWN FOR INFORMATIONAL PURPOSES ONLY, TO INDICATE THE FLOOD DISCHARGES AND WATER SURFACE ELEVATIONS WHICH MAY BE ANTICIPATED IN ANY GIVEN YEAR. THIS DATA WAS GENERATED USING HIGHLY VARIABLE FACTORS DETERMINED BY A STUDY OF THE WATERSHED. MANY JUDGEMENTS AND ASSUMPTIONS ARE REQUIRED TO ESTABLISH THESE FACTORS. THE RESULTANT HYDRAULIC DATA IS SENSITIVE TO CHANGES, PARTICULARLY OF ANTECEDENT CONDITIONS, URBANIZATION, CHANNELIZATION, AND LAND USE. USERS OF THIS DATA ARE CAUTIONED AGAINST THE ASSUMPTION OF PRECISION WHICH CANNOT BE ATTAINED. DISCHARGES ARE IN CUBIC FEET PER SECOND AND STAGES ARE IN FEET, NGVD '88.

DEFINITIONS:

- DESIGN FLOOD: THE FLOOD SELECTED BY FOOT TO BE UTILIZED TO ASSURE A STANDARD LEVEL OF HYDRAULIC PERFORMANCE.
- BASE FLOOD: THE FLOOD HAVING A 1% CHANCE OF BEING EXCEEDED IN ANY YEAR. (100 YR. FREQUENCY)
- OVERTOPPING FLOOD: THE FLOOD WHERE FLOW OCCURS (A) OVER THE HIGHWAY, (B) OVER A WATERSHED DIVIDE, OR (C) THROUGH EMERGENCY RELIEF STRUCTURES.
- GREATEST FLOOD: THE MOST SEVERE FLOOD WHICH CAN BE PREDICTED WHERE OVERTOPPING IS NOT PRACTICABLE, NORMALLY ONE WITH A 0.2% CHANCE OF BEING EXCEEDED IN ANY YEAR (500 YR. FREQUENCY)

Exhibit 918-1: Drainage Map

919 Lateral Ditches

919.1 General

Lateral ditches are sometimes needed to convey stormwater runoff to retention areas, detention areas, or convey the discharge to an outfall point. This information may be placed on the Plan-Profile sheet or Stormwater Facilities sheet when space is available.

Lateral Ditch sheet or Outfall sheet consists of a plan view and a profile view but may also include a typical section or cross sections. These sheets may be produced on a standard-format sheet (11"x17") or a large-format sheet (24"x36", 36"x48", or 36"x72"). Use landscape orientation regardless of sheet size selected.

The standard horizontal scale for plan and profile views is 1" = 100' but may use 1" = 50' when appropriate. The vertical scale for profile view is typically 10% of the horizontal scale (e.g., 1" = 100' horizontal scale would use a 1" = 10' vertical scale).

919.2 Plan View

Display a north arrow and scale within each plan view, typically in the upper right portion.

Display the lateral ditch plan view such that the centerline or baseline of construction stationing is increasing from left to right. Display bearings for tangent sections (in the direction of stationing) below the centerline or baseline. Display station numbers close to station ticks. Display station equations along centerline or baseline.

Show R/W (or easement), alignment data, and topography. Tie the alignment of the lateral ditch to the centerline of construction.

919.2.1 Required Information

Include labeling and dimensions only to the extent necessary to convey the design intent. Provide the following labeling and dimensions as appropriate:

- Flag and station the begin and end lateral ditch or outfall construction limits.
- Display planned improvements.
- Label and dimension lateral ditch or outfall, and tie to the baseline alignment of construction.
- Display drainage pipes, inlets, manholes, box culverts, and outfall features.

- Display and label R/W lines, and construction easements or license agreements.
- Display and label the limits of wetlands based on permit or regulatory requirements.

919.3 Profile View

Display the lateral ditch profile directly below the corresponding ditch plan view. Each profile must include a background grid at the appropriate scale. Align the begin lateral ditch profile stationing with the begin lateral ditch plan view stationing. Display stationing along the bottom of the grid. Display the vertical elevation along both sides of the grid.

Display the following information:

- Existing ground line profiles
- High water elevations
- Transverse underground utilities
- Benchmark information
- Elevation datum

If storm drain construction is proposed along a lateral ditch or at an outfall, plot the proposed structures on the lateral ditch profile. Include the following information for the structures shown in the profile:

- Flow line elevations
- Structure numbers
- Pipe or culvert sizes
- Utilities (if applicable)
- Label the normal water elevation of the receiving system.

919.3.1 Required Labeling and Information

Required labeling and dimensions necessary to convey the design intent, include the following:

- Flag and station the begin and end lateral ditch.
- Label percent grade for each tangent section. When two tangent grades intersect and no vertical curve is required, label the PI station and elevation.
- Label transverse underground utilities.

919.4 Typical Section

Display a lateral ditch typical section on the Lateral Ditch sheet showing the following:

- Limits of clearing and grubbing
- R/W or easement limits
- Ditch bottom width
- Side slopes or berms

The typical section does not need to be to scale but must be dimensionally proportionate. If the width of proposed clearing and grubbing is variable, note the various widths and their respective station limits below the typical section.

919.5 Cross Sections

Showing lateral ditch cross sections in the plans is typically not necessary. However, if it is determined that providing cross sections in the plans is beneficial to show the design intent, they should be shown anywhere within available space on the Lateral Ditch sheet.

Cross sections often use a horizontal scale of 1” = 20’ and a vertical scale of 1" = 10', and display the same elements listed for typical section.

When cross sections are included on the Lateral Ditch Sheet, omit the Lateral Ditch Typical Section.

920 Soil Survey Sheet and Boring Coring Data

920.1 General

This chapter provides the requirements for the development of Soil Survey sheets and Boring Cross Sections sheets.

Place a core bore symbol on the Roadway Plan-Profile sheet at the location (station/offset) that the bore was taken. Label the symbol with the assigned bore number.

Refer to the ***FDOT Soils and Foundation Handbook*** for additional information.

920.2 Soil Survey Sheet

The Soil Survey sheet describes the various types of soils encountered within the limits of the project, including the environmental classification, mechanical properties, and recommended usage of those soils. A preformatted CADD sheet can be found in the FDOT CADD Software. This sheet is typically prepared using a standard-format sheet (11”x17”).

Assign a stratum number and provide a description of the material encountered. Include the results for the following tests (as applicable):

- Organic Content
- Moisture Content
- Sieve Analysis
- Atterberg Limits
- Corrosion Test

Assign (group) soils having the same characteristics. Include applicable notes regarding each stratum group on this sheet. Provide the date and weather conditions at the time of sampling.

Include a legend for any symbology used in the Boring Cross Section sheets.

Refer to ***Exhibit 920-1*** for an example of Soil Survey sheet and ***Exhibit 920-2*** for the Report of Core Borings.

920.3 Boring Cross Sections Sheets

Boring Cross Section sheets display the results of each core boring on a cross section at the station and offset at which the boring was taken. To create these sheets, Final Geotechnical Data must be deliverable in a xml file (3D model) generated from the FDOT

Geotechnical Data Manager (GDM) application. Cross sections are generated, inclusive of all core boring locations, in conformance with the requirements contained in ***FDM 905***. Show the core bores on the corresponding cross section as a ¼-inch wide column below the ground line. Show stratum limits at appropriate depth and assigned stratum numbers inside the column.

920.3.1 Report of Core Borings Sheets

When the Geotechnical Data is not available in a xml file (3D model), or there are only a few core borings, core boring illustrations can be shown on Report of Core Borings sheets instead of Boring Cross Section sheets.

Show the core bores as a ¼-inch wide column below the ground line with a vertical scale adjacent to the core to indicate depth. Show stratum limits at appropriate depth and assigned stratum numbers inside the column.

When there are only a few isolated cores, the soil survey data is often included on the Report of Core Borings sheet.

Exhibit 920-1: Roadway Soil Survey

Exhibit 920-2: Report of Core Borings

921 Temporary Traffic Control Plan

921.1 General

A project-specific Temporary Traffic Control Plan (TTCP) is required for all projects. The TTCP is used to communicate the requirements for conveying pedestrian, bicycle, and motorized traffic through established work zones.

This chapter provides the requirements for the development of TTCP sheets. See ***FDM 240*** for requirements of TTCP designs.

The amount of information that must be communicated depends on the complexity of the TTCP, which is defined as Level I or Level II TTCP. Regardless of level, TTCPs should not exceed four major phases.

(1) Level I TTCP - Simple construction projects, such as RRR, Minor Widening, New Alignment.

  (a) General / Phasing Notes

  (b) Phase Typical Sections

  (c) Special Details

(2) Level II TTCP – Complex construction projects, such as Major Widening or Reconstruction, Innovative Intersections (Roundabouts, Diverging Diamond Interchange) or projects requiring a diversion. This level typically includes the following sheets:

  (a) General / Phasing Notes

  (b) Phase Typical Sections

  (c) Special Details / Critical Sectional Views

  (d) TTCP Plan

  (e) Detour Plan

  (f) Temporary Signal Plan

  (g) Temporary Highway Lighting Plan

921.2 General / Phasing Notes

Place general and phase notes on standard-format sheets (11”x17”).

TTCP notes must communicate the following information (when they apply):

- Description of work to be accomplished during each phase of construction
- Project-specific requirements (e.g., school zones, hospitals, fire stations, railroads, waterborne vessels)
- Work zone speed
- Pedestrian and bicycle accommodation
- Lane closure restrictions, traffic pacing restrictions, and portable changeable message signs (PCMS) message for each phase
- Legend for traffic control devices

921.3 Phase Typical Sections

Place typical sections on standard-format sheets (11”x17”).

Typical sections must communicate the following information (when they apply):

- Defined work area limits
- Available lane widths (motor vehicle and bicycle), and shoulder widths
- Location of temporary traffic control devices
- Offset requirements

921.4 Special Details Sheet

Include Special Details to provide project-specific requirements and construction details not covered by ***Standard Plans*** or ***Standard Specifications***. Details are often used to illustrate placement of construction signs and traffic control devices when TTCP Plan sheets are not required.

Place details on the General Notes sheet, or on separate standard-format sheets (11”x17”).

921.5 Critical Sectional Views

Provide sectional views when clarification is necessary. Sectional views should provide pertinent dimensions and illustrate location of active of traffic lanes, work zone, walls or piers, and temporary barrier walls.

Place critical sectional views on TTCP Plan sheets near the location the view pertains to, or on separate standard-format sheets (11”x17”).

921.6 TTCP Plan Sheets

These sheets are typically created referencing the survey and design CADD files.

TTCP plans may be produced on standard-format sheets (11”x17”) or large-format sheets (24”x36”, 36”x48”, or 36”x72”). Use landscape orientation regardless of sheet size selected. Use levels, fonts, and line weights in accordance with the ***CADD Manual***.

A common horizontal scale for the TTCP plan sheets is 1” = 50’ for curbed roadways and 1” = 100’ for flush shoulder roadways. Another scale may be used if clarity and legibility are maintained.

TTCP plan sheets are often produced for each major phase of construction. These sheets must communicate the following information (when they apply):

- Orientation of the roadway (i.e., north arrow, stationing, road names)
- Open travel lanes, work area, geometry for lane tapers or shifts
- Placement of temporary pavement
- Placement of temporary construction signs and traffic control devices
- Temporary or permanent drainage work
- Disposition of existing sign installations (e.g., guide signs, route signs, speed limit signs)
- Pedestrian and bicycle accommodations

921.6.1 Temporary Diversions (Special Detour)

When temporary ramps, or other roadways, are necessary, provide diversion horizontal and vertical geometry. Include pavement and shoulder widths, curvature, elevations, cross slope, grades, and tapers. Also display and label required temporary drainage in the TTCP Plan sheet. Include critical sectional views as discussed in ***FDM 921.5***.

921.7 Detour Plan Sheets

Detours often use an outline (stick diagram) of the roadway network as a background and use any appropriate horizontal scale that clearly communicates the alternate routes.

Detour plans may be produced on standard-format sheets (11"x17") or a large-format sheet (24"x36", 36"x48", or 36"x72"). Use landscape orientation regardless of sheet size selected.

Detour Plan sheets must communicate the following information (when they apply):

- Orientation of the roadway (i.e., north arrow, road names, railroad, river crossing)
- Location of temporary construction and detour signs necessary to direct pedestrian, bicycle, and motorized traffic
- Location of portable changeable message signs (PCMS)
- Movement of traffic (i.e., arrows)
- Legend for traffic control devices

921.8 Temporary Signal Plan Sheets

Include Temporary Signal Plan sheets for temporary or portable signals, and for alterations to existing signals.

Temporary Signal Plan sheets may be produced on standard-format sheets (11"x17") or a large-format sheet (24"x36", 36"x48", or 36"x72"). Use landscape orientation regardless of sheet size selected.

Provide signal timing for each phase, including temporary actuation, to maintain all existing actuated or traffic responsive mode signal operations for the duration of the Contract.

Refer to ***FDM 941*** for required plan content.

921.9 Temporary Highway Lighting Plan

Temporary Lighting Plan sheets may be produced on standard-format sheets (11”x17”) or a large-format sheet (24”x36”, 36”x48”, or 36”x72”). Use landscape orientation regardless of sheet size selected.

Refer to ***FDM 943*** for required plan content.

922 Miscellaneous Structures

922.1 General

Miscellaneous Structures sheets provide details and data when the information is not provided in the ***Standard Plans*** or ***Standard Specifications***. Produce these sheets using standard-format plan sheets (11”x17”).

These sheets are typically placed in the associated component plans set. Miscellaneous structures include:

- Supports for high mast lighting, traffic mast arm, and overhead signs
- Signal strain poles
- Rest area structures or buildings
- Barrier walls (traffic or sound)
- Retaining or gravity walls
- Bridge approach slabs
- Toll facilities

For guidelines on structural detailing, refer to the ***Structures Detailing Manual***.

922.2 Retaining Walls

Non-proprietary retaining walls require design and construction details in the Structure Plans component.

Proprietary retaining walls require a set of control plan details to be included in the Structure Plans component for projects with bridges. Place the control plan details in the appropriate component plans when there are no bridge plans. Examples of control plan details are included in the ***Structures Detailing Manual***.

See ***FDM 262*** for retaining wall plans submittal procedures. See the ***Structures Manual*** for plan content requirements.

Vendor Drawings for proprietary wall systems listed on the ***APL*** are provided on the Program Management Office website.

922.3 Approach Slabs

Approach slab sheets provide details and information that are not addressed in ***Standard Plans*, Indexes 400-090** and ***400-091***.

Some roadway elements may need to be carried onto the approach slab. In these cases, clarify in the plans which elements are to be included as part of the roadway. Elements that are part of the roadway approaches to the bridge and interface with the approach slabs areas (e.g., stabilization, guardrail, earthwork, sidewalks, approach slab surfacing) are to be included and paid for in the roadway quantities.

922.4 Concrete Box Culverts

Place these sheets in a Structure Plans component, even when there are no bridge plans. In accordance with the ***Basis of Estimates*,** load pay items and quantities in the structures category.

Concrete box culverts require complete design and construction details to be included in the contract plans. Include the following minimum design details:

(1) Plan and Elevation Sheets:

(a) Plan view showing: Grid north arrow; scale bar; existing highway boundaries including existing R/W monuments; new R/W line(s) including proposed R/W monuments; culvert or bridge identification number; culvert and highway alignment; survey baseline; profile grade line; direction of stationing; stream channel alignment; stream flow direction; skew angle of the culvert relative to the centerline of roadway; stationing along the profile grade line including begin and end station of culvert (outside face of sidewalls); length of culvert; subsurface exploration locations (e.g., boring locations); culvert end treatment (e.g., headwall and wing wall orientation); scour protection; slope protection; limit of stream work; utilities; traffic railing and pedestrian/bicycle railing type.

(b) Elevation view showing: Elevation vertical scale; profile grade line and vertical data; existing stream bottom and ground line (along PGL); utilities.

(2) A longitudinal section along the culvert centerline showing: Culvert or bridge identification number; invert elevations; existing stream bottom or original ground; culvert stationing at centerline; typical highway section (including rail treatment); design earth cover height (measured from the top of the top slab to the top of pavement); limits of scour protection (including any keyways or geotextile fabric lining); channel work; culvert end treatments; utility (either attached to the fascia,

or in the embankment, traffic railing or sidewalk); wing walls; headwalls; cutoff walls; reference to the appropriate ***Standard Plans***.

(3) Data Sheets: Box Culvert Data Table and Reinforcing Bar List.

(4) Miscellaneous details showing: Construction phasing information (affects lengths of precast segments and potential need for skewed segments) including appropriate excavation support and protection systems (e.g., critical temporary walls); traffic railing details including connection details; slope and/or stream bank protection; channel section detail; culvert-end safety grate, guardrail or fencing details when applicable; removal of existing culvert(s); cofferdams or water diversion.

(5) Notes indicating: Live loading requirements (HL-93 or HS-25); hydraulic data (show 100-year design flow or the design flow used and the minimum hydraulic area perpendicular to flow below the Design High Water); environmental classification for durability; minimum concrete class and reinforcing steel grade; assumed soil weight, angle of internal friction and nominal bearing capacity; differential soil settlement height and effective length (when significant); precast culvert limitations; any special joint waterproofing requirements; restrictions for work in streams; estimated quantities.

(6) A Load Rating Summary sheet is required for box culverts classified as bridge culverts (per ***FDM 265.1***).

922.5 Three-Sided Concrete Culverts

These sheets are to be placed in a Structure Plans component, even when there are no bridge plans.

Complete footing, wingwall and channel lining designs and construction details are required for three-sided culverts. However only conceptual culvert barrel and headwall design details need to be provided. Include the following minimum design details in the plans:

(1) Plan view showing the orientation of the ends of the structure. The two most typical options for culverts on a skew are ends parallel to the centerline of the roadway (skewed ends) or ends perpendicular to the centerline of the structure (square ends). The end treatment depends upon the skew, whether it is in a fill section or at grade, the location within the R/W, conflicts with utilities, phased construction details, the alignment of the feature crossed, and other site limitations.

(2) Elevation view showing the configuration of the most appropriate type unit; e.g., frame or arch. Show any limitations on using a larger span (some manufacturers only fabricate units at fixed increments of span length, therefore showing the

limitations will allow the manufacturers to bid using special units or the next larger span length of their standard units). Show other acceptable structure types in separate partial elevation views. Show limiting spans and heights for all alternatives.

(3) No precast manufacturer should be eliminated from consideration for a given project. However, specific project requirements that may exclude some manufacturers must be identified (such as fabrication on a skew or a desired arched appearance).

(4) Complete details for a cast-in-place footing design, including design loads and assumptions for the spread footings.

(5) Complete details for cast-in-place wingwalls, including geometry and reinforcement details.

(6) Include the applicable details in ***FDM 922.4***.

(7) Place the following notes adjacent to the plan or elevation views, as applicable:

(a) The assumed foundation vertical reaction is ____ kips/ft. The assumed foundation horizontal reaction is ____ kips/ft. The Contractor must submit a revised foundation design to the Engineer if the actual loads of the supplied structure exceed these assumed values. Any revised foundation design must be included in the shop drawings and submitted for approval at the same time as the design calculations for the three-sided structure.

(b) In cases where squaring of the unit ends would create a geometric conflict with right of way, utilities, phase construction or site geometry, include the following note:

(c) Due to site restrictions, only skewed end units are acceptable.

(d) If site constraints do not eliminate the squaring of the ends, include the following note:

(e) Squared end units may be substituted for skewed end units with no change in the payment limits and no additional cost to the Department.

(f) When traffic railings are attached to skewed headwalls and site constraints do not eliminate the squaring of the ends, include the following note:

If the Contractor proposes to substitute square ends, details of the traffic railing attachment must be provided in the shop drawings and approved by the Engineer.

923 Utility Adjustments

923.1 General

Utility Adjustments sheets provide a plan view that highlights the location of existing, proposed, and relocated utilities. These sheets are used when the project corridor contains numerous utilities with significant potential for conflict or harm. Projects with minor utility work or impacts may include this information on roadway (or other component) plan sheets.

Prepare Utility Adjustment sheets on standard-format sheets (11”x17”) or a large-format sheets (24”x36”, 36”x48” or 36”x72”) using a horizontal scale of 1” = 40’, or 1” = 50’. Use landscape orientation regardless of sheet size selected.

923.1.1 Utility Notes

See ***FDM 914*** for required utility notes to be include on the General Notes sheet.

923.2 Required Information

Display a north arrow and scale within each plan view, typically in the upper right portion.

Display roadway plan view (gray scaled as background) such that the centerline of construction, or baseline of construction stationing, increases from left to right. Other proposed design elements should also be shown, such as overhead sign or mast arms. Do not display information and graphic data that is not relevant.

Display and label the following information:

(1) Display existing and proposed utilities within the project limits using lines and standard utility symbols (see the ***CADD Manual***). Though not utilities, display and label Department-owned subsurface communication (ITS) lines.

(2) Indicate the disposition of existing utilities not to remain in service (e.g., "To Be Removed", "To Be Adjusted", "To Be Relocated", "To Be Placed Out Of Service”).

(3) Indicate the utility type, Agency Owner (UAO), and size and material of existing utilities to remain in service.

(4) Display and label overhead utilities indicating the line voltage. For a multi-line electrical overhead crossing, accurately show the location of each line.

(5) Indicate field verified vertical elevation and horizontal location (V_{vh}) of existing utilities (SUE data). Leader line must point to location on plan view where field data was taken. Include the V_{vh} number shown in the Utility Verification table.

(6) Display a Utility Verification table in each view panel of the sheet that contains V_{vh} information for utilities shown in that panel. Required table information includes:

(a) V_{vh} number

(b) Utility type and owner

(c) Size and Material

(d) Location (Sta/Offset/Lt or Rt)

(e) Existing ground and top of utility elevations

If number of V_{vh} data points or required view panels are extensive, the table may be shown on separate standard-format sheets (11”x17”) titled “Utility Verification Sheets”.

Exhibit 923-1: Utility Adjustments

924 Selective Clearing and Grubbing Plans

924.1 General

This chapter provides the requirements for the development of Selective Clearing and Grubbing (C&G) Plan sheets. See ***FDM 274*** for purpose, criteria, and requirements of Selective C&G designs.

Selective C&G Plan sheets provide the data and information for existing vegetation, trees, and palms. Select C&G Plan sheets are placed in the Roadway Plans only when:

(1) Contract Plans do not include a Landscape Plans component, and

(2) The district landscape architect or manager has determined that one or more of the Select C&G activities is to be included in the Roadway Plans Set.

Selective C&G activities are as follows:

(1) Removal of undesirable trees and vegetation

(2) Preservation and protection of desirable trees and vegetation

(3) Branch and root pruning

(4) Tree relocation

When tree relocations are the only Selective C&G activity, show relocation requirements on the Select C&G Plan sheets, or include Tree Relocation Plan sheets in the Roadway Plan Set (see ***FDM 944***).

See ***Exhibit 924-1*** for an example of a Selective C&G Plan sheet. Refer to the ***CADD Manual*** for CADD standards associated with Selective C&G.

924.2 Selective C&G Plan Sheet

The Selective C&G Plan sheet provides a plan view of project indicating the location of selective clearing and grubbing activities are to be performed, and areas to be protected or preserved.

This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48”, or 36”x72”). Use landscape orientation regardless of sheet size selected. The standard horizontal scale is 1” = 100’, however an alternate scale may be approved by the Project Manager.

Display aerial photography or available topography, including R/W, roadways and driveways, buildings, underground and overhead utilities, walls, sidewalks and curbs, pavements, fencing, railroads, bridges, drainage structures and similar items that are relevant to the proposed Selective C&G activities. Display proposed roadway improvements when landscape project follows or is part of a roadway project.

Display a north arrow and scale within each plan view, typically in the upper right portion. Display existing or proposed roadway and centerline of construction or baseline of construction such that the stationing is increasing from left to right.

Display and label the following:

(1) Existing tree canopy for individual tree or tree group

(2) Trees to be relocated or removed

(3) Tree protection fencing

(4) Preservation areas

(5) Removal of undesirable vegetation

(6) Branch and root pruning

Include a legend on each sheet depicting the type of selecting clearing and grubbing activities to be performed. Provide a designation (ID) number for each tree and palm, and for each area where removal of undesirable vegetation will occur. Each tree does not need a designation number when a group of trees are to be branch pruned, but the quantity of trees to be pruned must be provided.

When a tree protection area is adjacent to a barrier (e.g., fencing, wall, guardrail, sediment barrier) the tree protection fencing that is parallel to the barrier may be omitted.

924.3 Selective C&G Detail Sheet

The notes required for selective C&G vary depending on the project. It may be desirable to provide a separate Selective C&G Detail sheet to display the notes, symbols, and details that are applicable to the project. Place Vegetation Removal Table, Root and Branch Pruning Table, and Tree Disposition Table on Selective C&G Detail sheets.

See ***Exhibit 924-2*** for an example of a Selective C&G Detail Sheet.

924.3.1 Vegetation Removal Table

Provide a Vegetation Removal Table when the project includes removal of undesirable vegetation. The table includes:

(1) Area ID number for removal area. Numbers can be based on roadway stationing numbers, quadrants, or sheet numbers.

(2) Clear and precise description of the work to be performed.

(3) Estimated percent of target species to be removed or eradicated from the area.

(4) List of primary species targeted for removal or eradication. Use species symbol.

(5) List of primary species to remain or preserve. Use species symbol.

(6) Additional information or notes concerning removal area, such as:

  (a) Florida Exotic Pest Plant Council Category I species to be removed

  (b) Estimated percent of Category I vegetative cover for each area

  (c) Additional species to target for removal or preservation

Include a species legend indicating plant species Botanical Name (common name) and symbol. Plant species symbols are typically abbreviated by the first letter of the genus and the first letter of the botanical name; e.g., Live Oak, *Quercus virginiana* is QV. Include project specific notes on the Selective C&G Detail sheet.

924.3.2 Root and Branch Pruning Table

Provide a Root and Branch Pruning Table when the project includes root or branch pruning of existing trees. The table should include the following:

(1) Tree ID number and location (e.g., station/offset, coordinates). Payment for pruning activity is per tree which requires that each tree be listed in the table.

(2) Botanical and common name of tree

(3) Clear and precise description of the work to be performed, including:

  (a) Root Pruning objects (e.g., preparation for relocation, required for construction of project)

  (b) Branch Pruning objectives (e.g., structural, aesthetics, safety, clearance)

924.3.3 Tree Disposition Table

Provide a Tree Disposition Table when existing trees and palms to be protected, relocated, or removed. Include the following in the table:

(1) Tree ID number

(2) Existing and proposed location of tree (e.g., station/offset, coordinates, site numbers).

(3) Botanical and common name of tree

(4) Diameter of tree trunk at breast height (DBH), and estimated tree height and canopy spread.

(5) Disposition of tree (e.g., “To Remain”, “To Be Protected”, “To Be Removed”, “To Be Relocated.”)

(6) Condition of the tree utilizing the International Society of Arboriculture (ISA) tree rating system (Excellent, Good, Fair, Poor, Dead). Also note issues with structure or damage.

Site-specific requirements may be included under the “Notes” column. Site-specific requirements may include:

(1) Watering schedule

(2) Fertilizer mix

(3) Fertilizer schedule

(4) Backfill or soil amendments.

(5) Root or Branch pruning and intent (structural, aesthetic, safety, etc.)

Exhibit 924-1: Selective C&G Plan

Exhibit 924-2: Selective C&G Detail

940 Signing and Pavement Marking Plans

940.1 General

This chapter provides the requirements for the development of Signing and Pavement Marking (S&PM) Plans. See ***FDM 230*** for requirements of signing and pavement marking designs.

S&PM Plans are usually a component set of plans. Projects with minimal signing and pavement marking improvements may include S&PM sheets in the Roadway Plan set.

940.1.1 Signs Mounted on Signal Installations

Place details for signs mounted on signal span wires or mast arms in the Signalization Plans set.

940.2 Key Sheet and Signature Sheet

The Key Sheet is the first sheet of S&PM Plans set. The Signature Sheet, when required, is placed behind the Key Sheet. These sheets are produced on a standard-format sheet (11”x17”) created using the FDOT CADD Software.

Follow the requirements contained in ***FDM 910*** for the development of a Key Sheet and Signature Sheet, except for the following:

<u>Index of Signing and Pavement Marking Plans</u>

(1) Key Sheet

(2) Signature Sheet

(3) General Notes

(4) S&PM Plan

(5) Guide Sign Worksheet

(6) Overhead Sign Cross Section

(7) Sign Structures Data Table

(8) Foundation Details

(9) Bridge Mounted Sign Details

(10) Report of Core Borings

S&PM Plans may require insertion of sheets that were prepared early, or prior to the design process (aka early works). See ***FDM 910.2.6.1*** for instructions on including early works sheets.

For standalone signing or pavement marking projects, include the list of Contract Plans Set even if "Signing and Pavement Marking Plans Set" is the only component.

See ***FDM 910*** for an example of a Key Sheet and Signature Sheet.

940.3 General Notes Sheet

General Notes sheets convey site-specific requirements not covered by ***Standard Plans*** or ***Standard Specifications*** Place general notes on standard-format sheets (11"x17").

940.3.1 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a Pay Item Note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.
- Clarify the purpose, uses, or requirements.

940.4 S&PM Plan Sheets

S&PM Plan sheets convey a graphic depiction, and necessary information for the installation of signs and pavement marking elements.

Produce the S&PM Plan sheet using a standard-format sheet (11"x17") or a large-format sheet (24"x36", 36"x48" or 36"x72") that are contained in the FDOT CADD Software. Use landscape orientation regardless of sheet size selected.

When appropriate, the sheet may utilize multi-stacking (subdividing sheet horizontally); each panel containing a plan view.

Use the following horizontal scales:

	Standard	Optional
Curbed Roadways	1” = 40’	1” = 50’
Flush-shoulder Roadways	1” = 50’	1” = 100’

940.4.1 Required Information

Provide the same basic information required on the Roadway Plan sheet, including roadway geometrics, project limits, street names, curb and gutter, drainage inlets, sidewalks, and R/W lines.

Show underground and overhead utilities, lighting structures, signal structures and ITS structures that may conflict with the installations of sign components. Identify potential conflicts with utilities, drainage, landscape features, sidewalks, and driveways in the plans.

Provide the following on the S&PM Plan sheet:

(1) Display a north arrow and scale within each plan view, typically in the upper right portion. Display centerline of construction or baseline of construction such that the stationing is increasing from left to right. Flag and station the begin and end of the signing and pavement marking limits.

(2) Place proposed signs at the proper locations. Display the sign face near its respective sign with a leader line connecting the sign location and sign face. Orient each sign face on the plan sheet to be read as viewed from the direction of travel along the roadway. Indicate next to each sign face the station (or mile post), pay item number, sign size, standard designation, or assigned number (if nonstandard). In addition, provide sign placement (offset) when installation may conflict with utilities, drainage, lighting, sidewalks, driveways, or landscape feature.

(3) Display existing signs in the same manner as proposed signs. Indicate next to each sign face the station (or mile post), disposition (remain, relocate, or remove), and pay item number.

(4) Display and label permanent pavement markings specifying width, color and spacing. Indicate begin and end pavement marking stations including offsets. Provide radii information and dimension lane widths at appropriate intervals or changes.

(5) Label ~~begin and end limits of~~ Ground-in Rumble Strips with the permanent pavement marking callout labels. It is not necessary to call out the array type (skip or continuous) for Arterials and Collectors.

(6) Display and label raised pavement markers and delineators specifying type, color, and spacing. Indicate begin and end of application by stations.

(7) Display and label tubular markers specifying color and spacing. Indicate begin and end of application by stations.

(8) Label field verified vertical elevation and horizontal location (V_{vh}) of existing utilities (SUE data) for overhead sign installations on the plan view. Include with label (or in summary table) the following:

  (a) V_{vh} number

  (b) Utility type and owner

  (c) Size and Material

  (d) Location (Sta/Offset/Lt or Rt)

  (e) Existing ground and top of utility elevations

940.4.2 Typical Pavement Marking Sheet

For simple projects, or sections of a project, S&PM Plan details may be conveyed using a Typical Section indicating placement of traffic markings in lieu of full plan sheets. Provide typical marking plan details for median crossovers, turn lanes, or other similar features.

Proposed and existing signs may be tabulated to convey location, disposition, and other required information.

940.5 Guide Sign Worksheet

The Guide Sign Worksheet provides information necessary for sign panel fabrication. Each proposed sign panel must be shown with a complete message layout (sign face) and supporting information, including:

- panel color, dimensions, and corner radii
- border width and color
- lettering (copy) color, height, and spacing

For multi-post signs, include number of posts needed, and the column size and length.

The Guide Sign Worksheet is produced on a standard-format sheet (11”x17”). The number of signs shown on a single sheet depends on the sign size and complexity.

Output from the ***Transoft GuidSign Program***, or a similar format may be used.

940.6 Overhead Sign Cross Section Sheets

Overhead Sign Cross Section sheet provides a sectional view of overhead signs (e.g., cantilever or span structures, bridge mounted) as viewed by approaching traffic. This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”). Use landscape orientation regardless of sheet size selected.

The cross section must be at the station of the overhead sign, and include ditches, guardrails, barrier walls, right of way lines, potentially conflicting utilities, and lane lines. Create the section using a horizontal and vertical scale of 1" = 10' or 1”-5’.

Any arrow included on the sign panel that designates a lane assignment must be located within the center 1/3 of the associated traffic lane.

Display the foundation, sign structure and panel, and cross section on a background grid. Indicate the sign number, station, direction of travel, and scale used. Dimension and label the following:

- Highest elevation of the roadway surface
- Elevation of the foundation top
- Vertical distance from highest elevation of roadway surface to bottom of sign panel
- Horizontal distance from edge of panel to center of foundation
- Horizontal distance from edge of travel lane to closest edge of foundation
- Width and height of sign panel

940.6.1 Multi-Post Sign Cross Section Sheets

Muti-post sign cross sections, though not placed in plans, are often created to:

- Support the reported column size and length data on the Guide Sign Worksheet.
- Support the planning of future overlay of the rates on Toll Schedule Signs.

When created, place final cross sections in PSEE Project Documentation module.

940.7 Sign Structures Data Table Sheet

Provide design information for the support truss, columns, and foundations on either the “Cantilever Sign Structures Data Table” or the “Span Sign Structures Data Table”. These tables should be completed by the Structures Engineer of Record (EOR).

The information shown on these sheets, along with details contained in ***Standard Plans***, ***Indexes 700-040*** and ***700-041*** provides all information necessary for sign structure fabrication and installation.

Computer programs for the design of overhead cantilever sign structures and for the design of overhead span sign structures are available. The programs were developed by the Structures Design Office and may be downloaded from the Structures Design web site.

Produce this sheet using a standard-format sheet (11”x17”).

940.8 Foundation Details Sheet

Required construction details for standard foundations are provided in ***Standard Plans***, ***Index 700-040*** and ***Index 700-041***.

Provide a Foundation Details sheet when any of the following apply:

(1) Proposing a non-standard foundation.

(2) Project soil conditions are weaker than soil conditions which the standard foundation designs are based on.

(3) Unavoidable site restrictions (e.g., limited R/W, utility conflicts)

Produce this sheet using a standard-format sheet (11”x17”).

940.9 Bridge Mounted Sign Details Sheet

The design of the attachment system for signs mounted on bridge structures is the responsibility of the Structures EOR. Include the design of the attachment system in the structures plans if bridge work is included in the project. If bridge work is not in the project, place the Bridge Mounted Sign Details sheet in the S&PM Plans.

Produce this sheet using a standard-format sheet (11”x17”).

940.10 Report of Core Borings Sheet

The Report of Core Borings sheets provide soil information for each proposed overhead sign structure. Produce this sheet using a standard-format sheet (11”x17”). See ***FDM 920*** for additional information.

The following information is required:

(1) Depiction of the boring identifying type and depth of soil strata encountered, and water level encountered. Provide boring number and location.

(2) Soil boring location map illustrating where boring was taken. Provide boring number.

(3) Soil properties and environmental classification.

941 Signalization Plans

941.1 General

This chapter provides the requirements for the development of Signalization Plans. See ***FDM 232*** for requirements of signalization designs.

Signalization Plans are usually a component set of plans. Projects with minimal signalization improvements may include signalization sheets in the Roadway Plan set.

941.1.1 Signs Mounted on Signal Installations

Place details for signs mounted on signal span wires or mast arms in the Signalization Plans.

941.1.2 Rectangular Rapid Flashing Beacons (RRFBs)

Place details for RRFBs mounted overhead or as a standalone assembly in the Signalization Plans.

941.2 Key Sheet and Signature Sheet

The Key Sheet is the first sheet in the Signalization Plans set. The Signature Sheet, when required, is placed behind the Key Sheet. These sheets are produced on a standard-format sheet (11"x17") created using the FDOT CADD Software.

Follow the requirements contained in ***FDM 910*** for the development of a Key Sheet and Signature Sheet, except for the following:

Index of Signalization Plans

(1) Key Sheet

(2) Signature Sheet

(3) General Notes

(4) Signalization Plan

(5) Interconnect/Communication Plan

(6) Mast Arm Details

(7) Foundation Details

(8) Service Point Details

(9) Internally Illuminated Street Name Signs Details

(10) Mast Arm Assemblies Data Table

(11) Report of Core Borings

Signalization Plans may require insertion of sheets that were prepared early, or prior to the design process (aka early works). See ***FDM 910.2.6.1*** for instructions on including early works sheets.

For standalone signalization projects, include the list of Contract Plans Set even if "Signalization Plans Set" is the only component.

See ***FDM 910*** for an example of a Key Sheet and Signature Sheet.

941.3 General Notes Sheet

General Notes sheets convey site-specific requirements not covered by ***Standard Plans*** or ***Standard Specifications***. Place general notes on standard-format sheet (11"x17"). See ***FDM 914*** for additional information concerning general notes.

General notes often include signal design information for the following:

- controller operations
- signal heads
- computer interface
- loop installations
- interconnect cable

941.3.1 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a pay item note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.

- Clarify the purpose, uses, or requirements.

941.3.2 Signals Legend

Place a Signals Legend (i.e., symbol and description), and other abbreviations used in Signalization Plans on the General Notes sheet, or on a separate “Signals Legend” sheet. Use symbols in accordance with the requirements of the FDOT CADD Software.

941.4 Signalization Plan Sheet

Signalization Plan sheets convey a graphic depiction, and necessary information for the installation of signals, including:

- Construction details
- Electrical circuits
- Signal phasing
- Pay item number and quantity for each element of the signal design.

Produce the Signalization Plan sheet using a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48” or 36”x72”) that are contained in the FDOT CADD Software. Using a horizontal scale of 1" = 20' or 1" = 40', select a sheet size to display complete intersections on one plan sheet. Use landscape orientation regardless of sheet size selected.

941.4.1 Required Information

Provide the same basic information required on the Roadway Plan sheet, including roadway geometrics, project limits, street names, curb and gutter, drainage inlets, sidewalks, and R/W lines.

Show underground and overhead utilities, signing structures, lighting structures, and ITS structures that may conflict with the installation of signal components. Identify potential conflicts with utilities, drainage, landscape features, sidewalks, and driveways in the plans.

Provide the following on the Signalization Plan sheet:

(1) Display a north arrow and scale within each plan view, typically in the upper right portion. Display centerline of construction or baseline of construction such that the stationing is increasing from left to right. Flag and station the begin and end of the lighting limits. Provide the bearing on each roadway approach.

(2) Signal head locations with orientation arrows and movements (movements 2 and 6 are the major streets).

(3) Details of signal heads in tabular form.

(4) Phasing diagram or signal operating plan (SOP). If the SOP conforms to the ***Standard Plans**, Index 671-001*, then a only a reference to the index is required.

(5) Signal controller timing chart.

(6) Display loop detectors, "stop bars", and pedestrian crosswalks. Indicate location and orientation of pedestrian push buttons.

(7) Identify electrical service location and routing to power source.

(8) Display signal wire signs.

(9) Identify conduits and pull boxes.

(10) Location of signal poles and span wires. Label ground and roadway crown elevations.

(11) Location of pedestrian signals. See ***Standard Plans Instructions*** for ***Index 665-001* (*SPI-665-001*)** for additional information on pedestrian detector assemble installation.

(12) Lane lines with vehicle orientation arrows and median nose locations with turning radii.

(13) Coordination unit-timing chart.

(14) Label field verified vertical elevation and horizontal location (V_{vh}) of existing utilities (SUE data) for signal pole, or mat arm installations on the plan view. Include with label (or in summary table) the following:

   (a) V_{vh} number

   (b) Utility type and owner

   (c) Size and Material

   (d) Location (Sta/Offset/Lt or Rt)

   (e) Existing ground and top of utility elevations

(15) Label signalization equipment, including applicable pay item numbers.

941.5 Interconnect/Communication Plan Sheet

Provide an Interconnect/Communication (I/C) Plan sheet when signal equipment is being coordinated with other signal installations.

Prepare the I/C Plan sheet using a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48”, or 36”x72”) that are contained in the FDOT CADD Software. Use landscape orientation regardless of sheet size selected.

Use a horizontal scale of 1" = 100' for underground cable, and 1" = 200' for aerial cable.

941.5.1 Required Information

Provide the same basic information required on the Roadway Plan sheet, including graphic display of roadway, cross streets, driveways, sidewalks, and R/W lines.

Provide the following on the I/C Plan sheet:

(1) Display a north arrow and scale within each plan view, typically in the upper right portion. Display centerline of construction or baseline of construction such that the stationing is increasing from left to right.

(2) Display and label the signal controller, I/C cable, and pull boxes or aerial junction boxes. Label must include pay item number and quantity for each I/C element.

(3) Identify signal poles, service poles, and joint-use poles to which I/C cable will be attached.

941.6 Signalization Details

Construction details for mast arm assemblies and foundations are provided in ***Standard Plans*** ***Index 649-030*** (Standard Mast Arm Assemblies) and ***Index 649-031*** (Mast Arm Assemblies).

Use signalization detail sheets to provide project-specific requirements and construction details not covered by ***Standard Plans*** or ***Standard Specifications***.

Place details on standard-format sheet (11”x17”).

FDM 941.6.1 through 942.6.4 are common details provided in plans. Other details, such as video detection, controller cabinet or service pole may be required.

941.6.1 Mast Arm Details

Provide a Mast Arm Details sheet when proposing a non-standard mast arm assembly.

941.6.2 Foundation Details

Provide a Foundation Details sheet when any of the following apply:

(1) Proposing a non-standard mast arm assembly.

(2) Project soil conditions are weaker than soil conditions which the standard foundation designs are based on.

(3) Unavoidable site restrictions (e.g., limited R/W, utility conflicts)

941.6.3 Service Point Details

Provide a one-line diagram and panel schedule for each service point. Panel schedules must include the following:

(1) Panel ratings: voltage, phases, capacity (main lugs or main circuit breaker) and short circuit current rating.

(2) Enclosure type.

(3) Neutral bus and ground bus requirements.

(4) Capacity of the circuit breakers.

(5) Circuit loads.

(6) Total and demand loads.

941.6.4 Internally Illuminated Street Signs Details

Provide an Internally Illuminated Street Signs Details sheet when proposing illuminated street signs placed on mast arm assemblies.

941.7 Mast Arm Assemblies Data Table

The Mast Arm Assembly Data Table provides necessary arm, pole, and foundation information for each mast arm assembly.

The table and required notes are available through the CADD tools.

941.8 Report of Core Borings Sheet

The Report of Core Borings sheets provide soil information for each proposed mast arm assembly. Produce this sheet using a standard-format sheet (11”x17”). See ***FDM 920*** for additional information.

The following information is required:

(1) Depiction of the boring identifying type and depth of soil strata encountered, and water level encountered. Provide boring number and location.

(2) Soil boring location map illustrating where boring was taken. Provide boring number.

(3) Soil properties and environmental classification.

942 Intelligent Transportation Systems Plans

942.1 General

This chapter provides the requirements for the development of Intelligent Transportation Systems (ITS) Plans. See ***FDM 233*** for requirements of ITS designs.

ITS plans provide construction details, electrical circuits, and other relevant data for various types of ITS systems, including:

- Freeway Management System
- Incident Management System
- Arterial Management System
- Emergency Management Systems
- Transit Management Systems
- Electronic Toll Collection or Fare Payment
- Highway Rail Intersections (under electronic surveillance)
- Regional Multimodal Traveler Information

ITS Plans are usually a component set of plans. Projects with minimal ITS improvements may include ITS sheets in either the Roadway Plans or Signalization Plans set.

942.1.1 FDOT Fiber Optic Cable

When FDOT fiber optic cable exists within the project limits, coordinate proposed improvements with the ITS and TSM&O staff within the District Traffic Operations Office.

When the fiber optic cable is buried, Include the pay item for “Fiber Optic Cable Locator” in the Estimated Quantities Report.

942.2 Key Sheet and Signature Sheet

The Key Sheet is the first sheet in the ITS Plans set. The Signature Sheet, when required, is placed behind the Key Sheet. These sheets are produced on a standard-format sheet (11”x17”) created using the FDOT CADD Software.

Follow the requirements contained in ***FDM 910*** for the development of a Key Sheet and Signature Sheet, except for the following:

Index of Intelligent Transportation Systems Plans

(1) Key Sheet

(2) Signature Sheet

(3) General Notes

(4) Legend

(5) Pole Data Table

(6) ITS Plan

(7) Dynamic Message Sign Details

(8) Highway Advisory Radio Details

(9) Video Display System Details

(10) Network Devices Details

(11) Vehicle Detection Details

(12) Service Point Details

(13) Foundation Details

(14) ITS Cross Sections

(15) Report of Core Borings

ITS Plans may require insertion of sheets that were prepared early, or prior to the design process (aka early works). See ***FDM 910.2.6.1*** for instructions on including early works sheets.

See ***FDM 910*** for an example of a Key Sheet and Signature Sheet.

942.3 General Notes Sheet

General Notes sheets convey site-specific requirements not covered by ***Standard Plans*** or ***Standard Specifications***. Place general notes on standard-format sheet (11"x17").

General notes may include:

(1) Department's contact information for the fiber optic cable route marker label.

(2) Submittal of equipment specifications or design and shop drawings proposed for the project.

(3) Required coordination.

942.3.1 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a pay item note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.
- Clarify the purpose, uses, or requirements.

942.3.2 ITS Legend

Place an ITS Legend (i.e., symbol and description), and other abbreviations used in ITS Plans on the General Notes sheet, or on a separate "ITS Legend" sheet. Use symbols in accordance with the requirements of the FDOT CADD Software.

942.4 ITS Plan Sheets

ITS Plan sheets convey a graphic depiction, and necessary information for the installation of ITS system, including:

- ITS cabinets, equipment, and devices
- Power source and electrical circuits
- Conduits and pull boxes
- Pay item number, quantity, and description for each element of the ITS installation.

Assign a unique ID name to each proposed ITS device, hub, and service point. Refer to the Standard Naming Conventions per the FDOT Intelligent Transportation System Facilities Management (ITSFM) Standards. Example of IDs include CCTV-SR91-126.2-NB-A; EPB-SR528-4.8-SB-B; FSV-SR417-52.2-WB-A.

Produce the ITS Plan sheet using a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48”, or 36”x72”) that are contained in the FDOT CADD Software. Use landscape orientation regardless of sheet size selected.

The standard horizontal scale is 1” = 100’, however an alternate scale may be approved by the Project Manager.

942.4.1 Required Information

Provide the same basic information required on the Roadway Plan sheet, including, roadway geometrics, project limits, street names, construction stationing or milepost, curb and gutter, drainage inlets, sidewalks and right of way lines. Where details normally shown on roadway plans would obscure ITS features, the details may be screened so long as the details remain plainly legible.

Aerial photography may be used as a background in lieu of topographic survey and roadway design file.

Show underground and overhead utilities, signing structures, and lighting structures that may conflict with the installation of ITS components. Identify potential conflicts with utilities, drainage, landscape features, sidewalks, and driveways in the plans.

Provide the following on the ITS Plan sheet:

(1) Display existing ITS elements and label to remain, or removed

(2) Display and label the following proposed ITS equipment with their associated ID name and pay item numbers:

- (a) Fiber optic cable, conduit, conductors, and access points.
- (b) System communication devices.
- (c) Electrical power service equipment, interconnects, and service voltage.
- (d) Grounding and transient voltage protection.
- (e) Structure-mounted or ground-mounted field cabinets for system electronics, maintenance service points, and interconnect.
- (f) Circuit numbers with load center identification.

(3) Display location and placement of ITS installations, such as

(a) Dynamic Message Sign

(b) Highway Advisory Radio

(c) Vehicle Detection Systems

(d) Video Display Systems

(4) Illustrate the cone of vision or detection zone when applicable.

(5) Label field verified vertical elevation and horizontal location (V_{vh}) of existing utilities (SUE data) for ITS installations on the plan view. Include with label (or in summary table) the following:

(a) V_{vh} number

(b) Utility type and owner

(c) Size and Material

(d) Location (Sta/Offset/Lt or Rt)

(e) Existing ground and top of utility elevations

942.4.2 Modified ITS Plan Sheets Format

Modified plans format (aka “letter type” plans) provides location of ITS devices in table format in leu of plans sheets. The table includes device ID, description, milepost (to 3 decimal places), offset from the edge of the traveled way to the aboveground ITS device installations, and a comment field. Global positioning system (GPS) coordinates can be utilized as supplemental information in the table.

The modified plans should also include the following:

(1) A cross section for devices such as DMS that require overhead structures.

(2) Number and sizes for conduit.

(3) Number of fibers for fiber optic cable.

(4) Size and numbers of pairs for twisted pair copper cables.

Aerial photographs should be furnished with the table above to provide supplementary information. The aerial plan sheets do not require R/W lines, baseline, or roadway edges to be shown. The aerial plan sheets are used as a base for the as-built plans.

942.5 ITS Details Sheet

Use a ITS Details sheets to provide project-specific requirements and construction details not covered by ***Standard Plans*** or ***Standard Specifications***.

Place details on standard-format sheet (11”x17”).

Common ITS details include:

- Fiber optic cable splices, terminations, and designating system.
- Splice Diagrams and Logical Network Diagrams
- Electrical Information (e.g., transformers and disconnect switches, panel board schedules)
- Electrical Line Diagrams and Service Details
- Cabinet Details and Wiring Diagrams
- ITS Device Mounting Details

942.5.1 Dynamic Message Sign (DMS)

Provide the following details for DMS installations:

(1) DMS Housing, including details and notes that identify type of display (monochrome, full-color, or tricolor), size of display matrix (height, width, number of lines, and number of characters per line), and type of mechanical construction (walk-in, front access, or embedded).

(2) DMS controller, cabinet, and associated electronic equipment. Include telemetry equipment details for remote sensing and control.

(3) DMS Uninterruptible Power Supply (UPS) system.

(4) DMS support structures, including external walkways, safety railings, and ladders.

(5) DMS mounting brackets and hardware.

942.5.2 Highway Advisory Radio (HAR)

Provide the following details for HAR installations:

(1) HAR operator workstation and central recording facility.

(2) HAR antennas, transmitter, and electronics.

(3) HAR support structures, signage, and beacons.

(4) HAR mounting brackets and hardware.

942.5.3 Video Display System

Provide the following details for video display system installations:

(1) Detailed structural mounting information for each color video monitor, flat panel display, and rear projection video unit in the video display system, including support structures, wall attachment methods, and the weight of each display unit

(2) Cable routing plan and diagrams, including maintenance and service points.

(3) Video display controller and operator workstations.

(4) Encoders, decoders, multiplexers, and routing equipment.

(5) Cross-sections and elevations for all modifications to existing wall systems in the TMC facility.

For the rear projection video unit mounting and installation plans, include details that illustrate stacking configuration and support design, along with a ventilation and climate control plan. Provide cable routing plans that include detailed connection diagrams for individual and stacked configurations.

942.5.4 Network Devices

Provide the following details for network devices:

(1) System diagrams illustrating network and device interconnect.

(2) General network topology.

(3) Notes regarding special configurations or options for specific devices that are required to achieve a specific system function.

942.5.5 Vehicle Detection and Traffic Data Collection

Provide the following details for vehicle detection and traffic data collection systems:

(1) Diagrams illustrating detection system interconnect.

(2) General network topology.

(3) Notes regarding any special configurations or options for specific devices that are required to achieve a specific system function.

(4) Illustrate detection zones on respective lanes. Identify lanes numerically from the inside to the outside lane.

942.5.6 Service Point Details

Provide a one-line diagram and panel schedule for each service point. Panel schedules must include the following:

(1) Panel ratings: voltage, phases, capacity (main lugs or main circuit breaker) and short circuit current rating.

(2) Enclosure type.

(3) Neutral bus and ground bus requirements.

(4) Capacity of the circuit breakers.

(5) Circuit loads.

(6) Total and demand loads.

The panel schedules must comply with the load analysis submitted as part of the ITS Power Design Analysis Report (PDAR).

Provide a Technical Special Provision (TSP) for automatic transfer switches (ATS), fuel tanks and engine generators, when a permanent ITS generator is required.

942.5.7 Foundation Details Sheet

Required construction details for mast arm foundations are provided in ***Standard Plans*, *Index 649-030*** or ***Index 649-031***.

Provide necessary construction details on a Foundation Detail sheet when either of the following apply:

(1) Proposing a non-standard mast arm assembly.

(2) Project soil conditions are weaker than soil conditions which the standard foundation designs are based on.

(3) Unavoidable site restrictions (e.g., limited R/W, utility conflicts).

942.6 ITS Cross Sections Sheet

The ITS Cross Sections sheet provides a sectional view of the installation of camera poles and other similar ITS devices as they relate to the roadway elements. The sectional view also illustrates the cone of view or detection, location of R/W, and relevant utility or drainage features.

This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”, 36”x48” or 36”x72”). Use landscape orientation regardless of sheet size selected. Follow the requirements contained in ***FDM 905*** for the development of a Cross Section sheet.

The section view must be shown at the proposed station of the ITS installation. Display, label, and dimension relevant information, such as setback, height of pole and IT device, depth of foundation and top elevation, and offset to R/W and centerline of construction.

942.7 Pole Data Table

Pole Data Table sheet provides the following information for ITS poles:

(1) ITS Devise to be mounted on the pole, and the mounting height

(2) The location of the pole (station/offset), and slope of ground at pole location

(3) Type of pole (e.g., concrete, P-III)

(4) Pole length, embedment depth, and height of pole above ground

Produce this sheet using a standard-format sheet (11”x17”).

942.8 Report of Core Borings Sheet

The Report of Core Borings sheets provide soil information for each proposed ITS pole. Produce this sheet using a standard-format sheet (11”x17”). See ***FDM 920*** for additional information.

The following information is required:

(1) Depiction of the boring identifying type and depth of soil strata encountered, and water level encountered. Provide boring number and location.

(2) Soil boring location map illustrating where boring was taken. Provide boring number.

(3) Soil properties and environmental classification.

943 Lighting Plans

943.1 General

This chapter provides the requirements for the development of Lighting Plans. See ***FDM 231*** for requirements of lighting designs.

Lighting plans are usually a component set of plans. Projects with minimal lighting improvements may include lighting sheets in the Roadway Plans set.

943.2 Key Sheet and Signature Sheet

The Key Sheet is the first sheet in the Lighting Plans set. The Signature Sheet, when required, is placed behind the Key Sheet. These sheets are produced on a standard-format sheet (11"x17") created using the FDOT CADD Software.

Follow the requirements contained in ***FDM 910*** for the development of a Key Sheet and Signature Sheet, except for the following:

Index of Lighting Plans

(1) Key Sheet

(2) Signature Sheet

(3) General Notes

(4) ~~Lighting~~ Legend

(5) Lighting Data Table

(6) Lighting Plan

(7) Pole Details

(8) Foundation Details

(9) Underdeck Lighting Details

(10) Box Girder Maintenance Lighting Details

(11) Service Point Details

(12) Report of Core Borings

Lighting plans may require insertion of sheets that were prepared early, or prior to the design process (aka early works). See ***FDM 910.2.6.1*** for instructions on including early works sheets.

See ***FDM 910*** for an example of a Key Sheet and Signature Sheet.

943.3 General Notes

General Notes sheets convey site-specific requirements not covered by ***Standard Plans*** or ***Standard Specifications***. Place general notes on standard-format sheet (11"x17"). See ***FDM 914*** for additional information concerning general notes.

General notes often include lighting design information, including:

- maintaining agency
- proximity to airport over overhead utilities
- load center location
- lighting design criteria (average illumination level, uniformity ratio, veiling luminance ratio)

943.3.1 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a pay item note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.
- Clarify the purpose, uses, or requirements.

943.3.2 Lighting Legend

A Lighting Legend provides symbols and descriptions, and other abbreviations, used in Lighting Plans. Place a Lighting Legend on the General Notes sheet, or on a separate (11"x17") "Lighting Legend" sheet. Use symbols in accordance with the requirements of the FDOT CADD Software.

Provide a unique light pole symbol and description for each different type of installation or work (e.g., ”New Light Pole Installation”, "Retrofit Existing Light Pole”, “Exiting Light Pole to Remain”).

943.4 Lighting Data Table

Place the Lighting Data Table on a standard (11”x17”) sheets. The table provides a listing of each light assembly, and includes the following information (as applicable):

- Pole Number
- Station and Offset
- Coordinates
- Roadway Setback
- Pole Owner
- Maintaining Agency
- Pole Type (Standard or other)
- Arm Length
- Quantity of Luminaires
- Luminaire Type
- Luminaire Make/Model
- Lumen Output
- IES Distribution Pattern
- Correlated Color Temperature (CCT)
- Mounting Height
- Tilt Angle
- Input Wattage
- Input Voltage
- Load Center Number
- Circuit Number
- Foundation Type
- Pay Item Number

Table must list all luminaire installations, including underdeck lighting, sign mounted luminaires, and luminaires mounted on existing utility poles.

943.5 Lighting Plan Sheets

~~Signalization~~ Lighting Plan sheets convey a graphic depiction, and necessary information for the installation of lighting, including:

- Construction details
- Light poles and luminaire installations
- Electrical circuits, conduits, and wire, pull boxes
- Load Center information

Produce the Lighting Plan sheet using a standard-format sheet (11"x17") or a large-format sheet (24"x36", 36"x48" or 36"x72") that are contained in the FDOT CADD Software. Use landscape orientation regardless of sheet size selected.

Use the following horizontal scales:

	Standard	Optional
Curbed Roadways	1" = 40'	1" = 50'
Flush-shoulder Roadways	1" = 50'	1" = 100'

943.5.1 Required Information

Provide the same basic information required on the Roadway Plan sheet, including roadway geometrics, project limits, street names, curb and gutter, drainage inlets, sidewalks, and R/W lines.

Show underground and overhead utilities, signing structures, lighting structures, and ITS structures that may conflict with the installation of lighting components. Identify potential conflicts with utilities, drainage, landscape features, sidewalks, and driveways in the plans.

Provide the following on the Lighting Plan sheet:

(1) Display a north arrow and scale within each plan view, typically in the upper right portion. Display centerline of construction or baseline of construction such that the stationing is increasing from left to right. Flag and station the begin and end of the lighting limits

(2) Display and label existing and proposed lighting features at correct location (station/offset) using symbols which represent poles, conduits, pull boxes, and underdeck luminaires.

  (a) Include pay item number, number of conduits, length of conduits, and conductor sizes when labeling conduit runs.

  (b) Include pole number, description of installation and arm length, baseline or centerline station and offset, and circuit number when label poles.

  (c) Include the estimated foundation depth as "for information only" when labeling existing high mast light poles that are to be removed.

(3) Display and label service point locations and electrical devices. Display the routing of the service feeder from the power company service pole to the load center. ***Standard Plans**, **Index 639-001*** provides details for the service point. Provide the following service point information:

  (a) Power company providing service.

  (b) Baseline or centerline station and offset.

  (c) Voltages and phases (e.g., 240/480 Volt, 3 phase).

  (d) Main or overhead breaker size.

  (e) Number of branch circuits and breaker size of each.

(4) Label field verified vertical elevation and horizontal location (V_{vh}) of existing utilities (SUE data) on the plan view. Include with label (or in summary table) the following:

  (a) V_{vh} number

  (b) Utility type and owner

  (c) Size and Material

  (d) Location (Sta/Offset/Lt or Rt)

  (e) Existing ground and top of utility elevations

943.6 Lighting Details Sheets

Required construction details for light poles and foundations are provided in ***Standard Plans**,:*

- ***Index 715-001*** (Conventional Lighting)
- ***Index 715-002*** (Standard Aluminum Lighting)
- ***Index 715-003*** (Utility Conflict Pole)

- ***Index 715-010*** (High Mast Lighting)
- ***Index 715-240*** (Maintenance Lighting for Box Girders)

Use Lighting Details sheets to provide project-specific requirements and construction details not covered by ***Standard Plans*** or ***Standard Specifications***.

Place details on standard-format sheet (11”x17”).

943.6.1 Pole Details Sheet

Provide a Pole Details sheet when proposing a non-standard light assembly.

Pole details may also include:

- Tilt angle details when luminaire is tilted
- Installation and wiring requirements
- Identification ID tag

943.6.2 Foundation Details Sheet

Provide a Foundation Details sheet when any of the following apply:

(1) Proposing a non-standard light assembly.

(2) Project soil conditions are weaker than soil conditions which the standard foundation designs are based on.

(3) Unavoidable site restrictions (e.g., limited R/W, utility conflicts).

943.6.3 Underdeck Lighting Details Sheet

Underdeck Lighting Details sheet provides the following information:

(1) The location of the embedded junction boxes, conduits and associated electrical work with standard notation to indicate the items that are incidental to the bridge.

(2) Mounting details and associated hardware needed for the installation of the underdeck luminaires.

(3) Electrical work associated with bridge mounted signs, when applicable.

943.6.4 Box Girder Maintenance Lighting Details Sheet

Box Girder Maintenance Lighting Details sheet provides the following information:

(1) The location of internal lighting, receptacles, switches, load centers, life safety devices, and wiring needed for maintenance.

(2) Quantity of each electrical item within each box girder.

(3) A panelboard schedule for the distribution panelboard and for each mini power center.

943.6.5 Service Point Details

Provide a one-line diagram and panel schedule for each service point. Panel schedules must include the following:

(1) Panel ratings: voltage, phases, capacity (main lugs or main circuit breaker) and short circuit current rating.

(2) Enclosure type.

(3) Neutral bus and ground bus requirements.

(4) Capacity of the circuit breakers.

(5) Circuit loads.

(6) Total and demand loads.

943.7 Report of Core Borings Sheet

Report of Core Borings sheets provide soil information for each proposed high-mast pole and non-standard foundations. Produce this sheet using a standard-format sheet (11”x17”). See ***FDM 920*** for additional information.

The following information is required:

(1) Depiction of the boring identifying type and depth of soil strata encountered, and water level encountered. Provide boring number and location.

(2) Soil boring location map illustrating where boring was taken. Provide boring number.

(3) Soil properties and environmental classification.

943.8 Temporary Highway Lighting Sheets

Temporary Highway Lighting is not required. See ***FDM 240*** for additional guidance for temporary highway lighting.

If included with Contract Plans, provide Temporary Highway Lighting sheets that provide the following, at a minimum:

(1) Temporary Lighting Data Table, that includes the following listed by TTC phase and stationing range:

- (a) Light pole type (e.g., standard, temporary)
- (b) Light pole spacing
- (c) Light pole offset
- (d) Foundation type (e.g., standard, barrier-mounted)

(2) Temporary Lighting Plan sheets for complex projects (i.e., typically not necessary for simple layouts)

(3) Temporary Lighting Details sheets, including barrier bracket mount details and Type K Temporary Barrier anchorage details.

Select plan sheet sizes in accordance with ***FDM*** subsections in this chapter.

944 Landscape Plans

944.1 General

The chapter provides the requirements for the development of Landscape Plans. See ***FDM 270 through 276*** for requirements of landscape designs.

Landscape Plans are most often developed as a standalone maintenance project, or occasionally as a component set of plans. Projects with minor landscaping may include landscape sheets in the Roadway Plans set.

944.1.1 Estimated Quantity Report

Prepare an Estimated Quantity (EQ) Report in accordance ***FDM 902***. Landscape quantities are determined by location identified by a site number, location description, or both. The location description can be identified as:

- “project-wide” for small projects,
- individual Landscape Plan sheets, or
- designated areas within a sheet.

Pay items categorized as small are plants less than 7-gallon container size.

Pay items categorized as large are plants 7 gallon or greater container size.

944.1.2 Landscape Construction Cost Estimate

Include a Landscape Construction Cost Estimate (typically an Excel spread sheet) at each phase submittal beginning with Phase III. The estimate provides the cost for all landscape improvements, including irrigation systems and hardscape.

Do not include the cost estimate in the construction contract documents. It is intended solely for use by the Department.

944.2 Key Sheet and Signature Sheet

The Key Sheet is the first sheet of each contract plans set. The Signature Sheet, when required, is placed behind the Key Sheet. These sheets are produced on a standard-format sheet (11”x17”) created using the FDOT CADD Software.

Follow the requirements contained in ***FDM 910*** for the development of a Key Sheet and Signature Sheet, except for the following:

Index of Landscape Plans

Assemble the Landscape Plans in the following order:

(1) Key Sheet

(2) Signature Sheet

(3) General Notes

(4) Legend

(5) Planting Plans and Details

(6) Irrigation Plans and Details

(7) Hardscape Plans and Details

(8) Temporary Traffic Control Plan

Landscape Plans may require insertion of sheets that were prepared early, or prior to the design process (aka early works). See ***FDM 910.2.6.1*** for instructions on including early works sheets.

For standalone maintenance contracts, include the list of Contract Plans Set even if "Landscape Plans Set" is the only component.

944.3 General Notes Sheet

The General Notes sheet provides site-specific requirements not covered by ***Standard Plans*** or ***Standard Specifications***. Place general notes on standard-format sheets (11"x17").

General notes may include:

- Benchmark datum
- Maintaining authority contact information
- Utility information and owners contact information
- Mowing requirements, including requirements for wildflower areas
- Planting area preparation (e.g., soil scarification and amendment requirements)

Notes are written to the contractor and should be written as a command. Do not include "Contractor must", "by the Contractor", or similar phrases in notes. Also, use "must" instead of "shall".

944.3.1 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a pay item note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.
- Clarify the purpose, uses, or requirements.

944.3.2 Plant Legend

Place a Plant Legend (e.g., plant symbol, abbreviated plant name (code), and common name), and other abbreviations used in Landscape Plans on the General Notes sheet, or on a separate "Plant Legend" sheet.

944.4 Landscape Plan Sheets

Landscape Plan sheets convey a graphic depiction, and necessary information for the installation of plant materials, irrigation systems, and hardscape elements.

Plan sheets may be produced on a standard-format sheets (11"x17") or a large-format sheet (24"x36", 36"x48" or 36"x72") that are contained in the FDOT CADD Software. Use landscape orientation regardless of sheet size selected. The standard horizontal scale is 1" = 50', however an alternate scale may be approved by the Project Manager.

Produce Details sheets using a standard-format sheet (11"x17").

For simple landscape projects, all elements of landscape design may be shown together on a single "Landscape Plan" sheet. For most landscape projects, each element of the landscape design is shown on individual sheets, as follows:

- Planting Plan
- Irrigation Plan
- Hardscape Plan

944.4.1 Planting Plan

Planting designs may be displayed on aerial photography or on available topographic surveys. Information from a prior construction project may also be used.

Display and label existing topography, including R/W, roadways and driveways, buildings, underground and overhead utilities, walls, sidewalks and curbs, fencing, guardrail, railroads, bridges, drainage structures, and other similar items that are relevant to the planting design. Existing topography elements are often displayed as “gray screened”.

Display proposed roadway improvements when landscape project follows or is part of a roadway project (e.g., edge of pavement and shoulder, sidewalks, utilities, lighting, or signal installations).

Display a north arrow and scale within each plan view, typically in the upper right portion. Display centerline of construction or baseline of construction such that the stationing is increasing from left to right. Indicate beginning and end project limits.

Display and label the following planting design information:

(1) Location of new planting areas, indicating:

  (a) Planting Area ID number for location identification in the EQ Report. This is required only when multiple areas (locations) are designated within a sheet.

  (b) Plant Symbol, abbreviated plant name (code), and number of plants, trees, or palms.

  (c) Clear trunk height for trees and palms.

  (d) Delineated mulch area with estimated cubic yard of material needed.

(2) Location and depth to improve soil structure (a.k.a., soil scarification), amend existing soil, or replace existing soil with Landscape Soil.

(3) Demonstrate the following requirements are met:

  (a) Clear Zone or Lateral Offset

  (b) Limits of clear sight (see ***FDM 212.11***)

(c) View Zone for outdoor advertising signs

(d) Setbacks from structural elements or drainage system

(4) Mowing Limits

(5) Installation of tree protection fencing

(6) Selective Clearing and Grubbing activities (remove or relocate trees, eradicate undesirable vegetation, and branch and root pruning) are often shown on the Planting Pan sheet, but can be shown on separate "Selective C&G" sheets when the work is significant. See ***FDM 924*** for Selective C&G sheet requirement.

944.4.1.1 Planting Details

Planting Details sheets provide details and information that are applicable to the project and not addressed in the ***Standard Plans*** or ***Standard Specifications***.

Construction details for tree bracing during root establishment are provided in ***Standard Plans*** ***Index 580-001***. Provide tree bracing details in the plans when ***Index 580-001*** does not apply.

944.4.2 Irrigation Plan

When separate Irrigation Plan sheets are necessary, use the planting plan sheets, "gray screened" in the background, and devoid of unnecessary text and labeling.

Display and label the location of spray heads and rotors, valves, mainlines, lateral lines, sleeves (noting the diameter sizes), controllers, water sources and points of connection, backflow preventers, and isolation valves.

944.4.2.1 Irrigation Details

Irrigation Details sheets provide details and information that are applicable to the project and not addressed in the ***Standard Plans*** or ***Standard Specifications***.

Include a legend depicting the symbology used in the irrigation plan sheets and an associative description for each entry. Additional information such as the nozzle and component schedule, irrigation zone, or pipe schedule can be included on these sheets.

944.4.3 Hardscape Plan

When separate Hardscape Plan sheets are necessary, use the planting plan sheets, "gray screened" in the background, and devoid of unnecessary text and labeling.

Display and label hardscape and site amenities; e.g., street furniture, specialty paving, tree grates, walls, planters, fountains, fences, and lighting (excluding public utility street and area lighting).

944.4.3.1 Hardscape Details

Hardscape Details sheets provide details and information that are applicable to the project and not addressed in the ***Standard Plans*** or ***Standard Specifications***.

944.5 Landscape Maintenance Guide Sheet

The Landscape Maintenance Guide sheet provides the long-term design intent, limits of landscape maintenance, and the necessary activities for maintaining the planting and irrigation designs.

See ***FDM 273*** for more information on the Landscape Maintenance Guide.

948 Utility Work by Highway Contractor (UWHC) Plans

948.1 General

Most utility adjustment work is performed by the utility owner.

On occasion the Department and utility owner enter into an agreement called "Utility Work by Highway Contractor Agreement". The agreement stipulates that the highway contractor is to construct or relocate the specified utilities in accordance with the UWHC Plans and special provisions developed by the utility owner. The agreement also establishes what costs the utility owner will reimburse the Department for the highway contractor utility work.

UWHC Plans are prepared in the same basic format as Department contract plans set components.

UWHC Plans are typically included as a strung project with a separate Estimated Quantities (EQ) Report. The EQ Report must identify which pay item quantities are reimbursable, and which are not.

When utility work is minimal, Utility Work by Highway Contractor Plans may be included as component plans within the Contract Plans set, and utility quantities included in the highway project EQ Report.

948.2 Key Sheet and Signature Sheet

The Key Sheet is the first sheet in the UWHC Plans set. The Signature Sheet, when required, is placed behind the Key Sheet. These sheets are produced on a standard-format sheet (11"x17") created using the FDOT CADD Software.

Follow the requirements contained in ***FDM 910*** for the development of a Key Sheet and Signature Sheet, except for the following:

<u>Index of Utility Work by Highway Contractor Plans</u>

(1) Key Sheet

(2) Signature Sheet

(3) General Notes~~ and Legend~~

(4) <u>Legend</u>

(5) UWHC Plan-Profile

(6) UWHC Details

(7) Cross Sections

(8) Temporary Traffic Control Plan

When utility work extends outside the highway project limits of construction note this in the work program data box on the Key Sheet.

Refer to the ***Work Program Instructions*** for guidance on the Financial Project ID phase number identification.

948.3 General Notes Sheet

General Notes sheets convey site-specific requirements not covered by ***Standard Plans*** or ***Standard Specifications***. Place general notes on standard-format sheet (11"x17").

General notes may include:

(1) The disposition and final ownership of any utility infrastructure that is to be removed as specified in the UWHC Agreement.

(2) Submittal requirements for equipment specifications, or shop drawings .

(3) Required coordination.

The Department follows the FHWA Guidelines for Plain Language. Notes are written to the contractor and should be written as a command. Do not include "Contractor will", "by the Contractor", or similar phrases in notes. Also, use "must" instead of "shall".

948.3.1 Pay Item Notes

Place pay item notes on the General Notes sheet.

Information on how quantities are determined are contained in the Estimated Quantities (EQ) Report and should not be repeated in the plans as a pay item note.

Pay item notes are used to provide unique project information not covered by basis of payment information contained in the ***Standard Specifications***, such as:

- Clarify how incidental work is to be paid for.
- Clarify the purpose, uses, or requirements.

948.3.2 UWHC Legend

Place an UWHC Legend (i.e., symbol and description), and other abbreviations used in UWHC Plans on the General Notes sheet, or on a separate “UWHC Legend” sheet. Use symbols in accordance with the requirements of the FDOT CADD Software.

948.4 UWHC Plan-Profile Sheets

UWHC Plan-Profile sheets convey a graphic depiction, and necessary information for the relocated or constructed of utilities by the highway contractor.

Produce the UWHC Plan-Profile sheet using a standard-format sheet (11”x17”) or a large-format sheet (24”x36”). Use landscape orientation regardless of sheet size selected.

A plan-profile sheet format must be utilized when any underground utility is 4'' or greater. When utility profiles are not needed, title the sheet as UWHC Plan.

Use a scale of:

- 1” = 40’ horizontal and 1” = 4’ vertical, or
- 1” = 50’ horizontal and 1” = 5’ vertical.

948.4.1 Required Information

Provide the following information in the plan view:

(1) Display a north arrow and scale within each plan view, typically in the upper right portion.

(2) Display and label centerline of construction or baseline of construction in the plan view such that the stationing is increasing from left to right. Flag and station the begin and end of the utility work limits. Display and label R/W.

(3) Display and label existing and proposed roadway profile in the profile view.

(4) Display proposed roadway improvements to give context to the location of the utility work. Show proposed bridges and approach slabs by simple outline. The elements of the proposed roadway should be gray scaled. Provide road and street names.

(5) Display and label existing and proposed utilities. Convey disposition of existing utilities (e.g., "To Be Removed", "To Be Relocated", "To Be Abandon”). Identify new utility installations (e.g., type utility and size, sleeves, valves, fire hydrants) with approximate length and station information.

(6) Display and label overhead utilities indicating the line voltage. For a multi-line electrical overhead crossing, accurately show the location of each line.

(7) Display the proposed drainage system by depicting drainpipes with a single pipeline style, and the outline of inlets, manholes, junction boxes, and outfall features (e.g., MES, endwall). Display signing structures, lighting structures, and ITS structures that may conflict with the installation of signal components

(8) Display and label existing utilities that are to be filled, plugged, and remain in place.

948.5 UWHC Cross Sections Sheet

UWHC Cross Sections sheet provides sectional views of critical utility installations. This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”). Use landscape orientation regardless of sheet size selected. Follow the requirements contained in ***FDM 905*** for the development of a Cross Section sheet.

Display and label existing and proposed utilities. Convey disposition of existing utilities and identify new utility installations.

948.6 UWHC TTC Plan Sheets

Typically, the roadway plans provide the plan details and quantities for conveying pedestrian, bicycle, and motorized traffic to allow for the utility work to be performed.

UWHC TTC (Temporary Traffic Control) Plan sheets are required when the roadway TTC Plan does not cover the utility work. This sheet may be produced on a standard-format sheet (11”x17”) or a large-format sheet (24”x36”). Use landscape orientation regardless of sheet size selected.

Include the quantities associated with the UWHC TCC Plan in the UWHG Estimated Quantities Report.