ROADWAY

PLANS PREPARATION MANUAL

DESIGN CRITERIA AND PROCESS

(METRIC)

ROADWAY DESIGN OFFICE

TALLAHASSEE, FLORIDA

1995

973

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

SUGGESTION AND COMMENTS
ROADWAY DESIGN MANUALS

FORM 625-[illegible]
ROADWAY [illegible]
[illegible]

DOCUMENT NAME:

- ☐ Plans Preparation Manual (Metric)
- ☐ Plans Preparation Manual (English)
- ☐ Roadway and Traffic Design Standards

NAME OF FIRM/ FDOT DEPARTMENT: ______________________________

ADDRESS: ______________________________

____

____

NAME OF PERSON RESPONSIBLE FOR SUGGESTIONS OR COMMENTS: ______________________________

TELEPHONE NO.: (   ) ______________________________

FAX NO.: (   ) ______________________________

SUGGESTIONS OR COMMENTS: ______________________________

____

____

____

____

____

____

____

____

(Comments or Suggestions may be attached as marked up copies of pages from the manual)

PLEASE COMPLETE THE REQUESTED INFORMATION ON A COPY OF THIS SHEET AND RETURN TO:

FLORIDA DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN OFFICE
MAIL STATION 32
605 SUWANNEE STREET
TALLAHASSEE, FLORIDA 32399-0450
ATTN: DOCUMENTS AND TRAINING

RECYCLED PAPER

TABLE OF CONTENTS

Design Criteria and Process

Chapter 1

Design Controls (Metric)

CHAPTER 1

DESIGN CONTROLS (METRIC)

1.1 General

Designs for highway and street projects are normally based on established design standards 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 standards is influenced by traffic volume and composition, desired levels of service, terrain features, roadside developments, environmental considerations and other individual characteristics

The identification of applicable design controls is basic to providing the desired level of service, optimum safety, and cost effectiveness

1.2 Traffic

The existing and design year traffic volumes, the traffic composition, directional distribution and design speed are all essential elements to the calculation of highway capacity, levels of service and pavement structural designs This traffic information must be developed and approved during the programming and Project Development and Environmental (PD&E) studies stages of each project PD&E studies may not be performed on all projects When that is the case the necessary traffic studies must be part of the design process

Preliminary capacity analyses and levels of service calculations will produce the numbers and configurations of traffic lanes required for the project

Designs shall be based upon the projected traffic volume for the expected service life of the project The pavement design manuals should be referenced for specific information on design periods Design Hourly Volume (DHV) shall be the 30th highest hour

The following traffic design information should be available to the designer prior to or very early in the design process Depending on the project, a traffic design report should be performed

1 AADT for the current year, opening year (completion of construction) and design year
2 Existing hourly traffic volumes over minimum of 24 hour period, including peak hour turning movements and pedestrian counts
3 Projected traffic growth rate
4 Directional distribution factor (D)
5 30th highest hour as percentage of AADT (K)
6 Truck percentage (T) for daily and peak hour
7 Design speed and proposed posted speed
8 Design vehicle to be provided for by the designer
9 Existing and proposed signalized intersections

10 Special or unique traffic conditions

11 Accident history and analyses within the project limits

12 Recommendations regarding parking or other traffic restrictions

1.3 Capacity and Level of Service

The AASHTO A Policy on Geometric Design of Highways and Streets and the Transportation Research Board Highway Capacity Manual provide the detailed analysis and calculation guides necessary for the number and configurations of lanes required and the resulting levels of service provided As illustrated in those texts, gradients, roadside developments, number, spacing and types of crossings and intersections, traffic volumes, and signalization patterns all greatly influence capacity and levels of services Those factors, in addition to the roadway functional classification, have a direct influence on the design speed to be adopted at the preliminary design level

When the design speed and roadway functional classification (and the resulting geometric controls) have been established, the capacity and level of service analyses will have to be checked and adjusted against the more advanced determination of those variable factors outlined above For a detailed evaluation of a roadway's level of service, a traffic operations model should be used These models rather than planning level models should also be used to evaluate the proposed designs Special attention should be given to intersection design and operation to ensure that they do not degrade the level of service on the roadway segments

1.4 Roadway Functional Classification

The AASHTO Policy on Geometric Design presents an excellent discussion on highway functional classifications Florida Statutes, Title XXVI, Chapters 334, 335 and 336 give similar definitions, and establish classifications for road design in the State of Florida

The Systems Planning Office in compliance with Rule Chapter 14-97 and the Florida Statutes has developed a comprehensive Access Management Classification system for all segments of the State Highway System The purpose is to enhance the functional integrity of the State Highway System, protect public safety and provide improved mobility of goods and people

Functional and Access Management classification and the standards required by them are predetermined controls over which the designer has little choice

These standards are minimum values and, where possible and practical, values above the minimum should be used

1.5 RRR Design

Interstate Highways and Freeways - Design standards applicable for these facilities are new construction standards, with the following exception The standards used for horizontal alignment, vertical alignment, and widths of median, traveled way and shoulders may be the AASHTO interstate standards that were in effect at the time of original construction or inclusion into the interstate system

State Highway System - Design standards applicable for the State Highway System facilities, other than interstate and freeways, are contained in this manual The chapter on Resurfacing, Restoration, and Rehabilitation (RRR) replaces the 1988 RRR Manual RRR standards are generally less restrictive than criteria for new construction

1.6 Design Consistency and Driver Expectancy

Design consistency is achieved when the geometric features of the roadway are consistent with the operational characteristics expected by the driver Inconsistencies normally relate to

- changes in design speed
- changes in cross section
- incompatibility in geometry and operational requirements

Changes in design speed may occur on a given stretch of roadway because portions of the highway were built as separate projects over an extended period of time Inconsistencies may be due to a number of factors changes in standards or DOT policy, re-classification of the facility, and lack of necessary funding

There are two major types of design inconsistencies relative to cross section These are point inconsistencies and a general incompatibility between cross section and alignment A point inconsistency may be, for example, the narrowing of lane widths, a narrow bridge, a lane drop, or a change from multi-lane section to two lanes

A cross sectional inconsistency is usually the result of upgrading a highway cross section without upgrading the alignment Sometimes pavements are widened and shoulders added on an older two lane highway The wider cross section on an old alignment might convey a conflicting message to the driver and lead to an inappropriate expectancy based on the visual aspects of the cross section, because cross section features can be more apparent than the alignment

Of course, this is not to say that widening creates unsafe conditions Widening alone can measurably improve the safety characteristics of a road, particularly on very narrow, low-volume roads Designers should, however, be aware of potential inconsistencies that frequently can be overcome with relatively low cost treatments In the case of widened roads on old alignments, pavement markings, warning signs, and delineation devices can be very helpful to the driver

Inconsistencies may also relate to incompatibility in geometric and operational requirements Occasionally elements of the design appear to have been selected for the purpose of fitting together the geometric components conveniently and economically rather than for the purpose of satisfying operational requirements An example of an inconsistency resulting from the incompatibility is a direct entry ramp which is intended to permit vehicles to enter the stream of traffic without coming to a complete stop but which, in reality, forces the vehicle to stop when a gap in the traffic stream is not immediately available

Design inconsistencies can result in driver uncertainty, an increase in response time and an increase in the probability of inappropriate driver response

Driver expectancy relates to the readiness of the driver to respond to events, situations, or the presentation of information It can be defined as an inclination, based on previous experience, to respond in a set manner to a roadway or traffic situation It should be stressed that the initial response is to the expected situation rather than the actual one

Expectancy can affect the perception and use of information In most circumstances, the expected and actual conditions are the same However, when design inconsistencies occur and a driver's expectancy is incorrect, it takes longer to respond properly, there may be no response, or the response may be inappropriate to actual conditions

There are certain elements in the design of various components of the roadway which particularly affect design consistency, driver expectancy, and vehicular operation These components include horizontal and vertical alignment, embankments and slopes, shoulders, crown and cross slope, superelevation, bridge widths, signing and delineation, guardrail and placement of utility poles or light supports

1.7 Aesthetics

Highways are built first and foremost for functional purposes, but the designer should be sensitive to how the highway will be perceived by the users Designing-in aesthetics is more than just providing for landscape plantings The roadway should blend into the landscape, avoiding large cuts and fills, and round side slopes 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 Either curvature or other features should be added to maintain drivers interest

Application of the clear zone concept discussed in the chapter on Roadside Safety will result in a clean, uncluttered and pleasing roadside Landscaping of the roadside should be considered early in the design process, so that plantings blend in with the geometric design The Landscaping chapter of this volume discusses landscape design criteria At times extra right-of-way may be obtained for treatments if the need is identified early Retention/detention ponds and other wetlands can be attractive if well-designed and placed in a location where they can be viewed from the roadway

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

"Streetscaping" techniques in urban areas include an emphasis on pedestrian accommodation, trees and other plantings, access control, careful signing, and zoning restrictions on commercial signs Parkways, and other roads specifically intended for pleasing aesthetics should be designed by a multi-disciplined team including landscape architects and planners

1.8 Access Management

Unregulated access to the State Highway System was determined to be one of the contributing factors to congestion and functional deterioration of the system Regulation of access was 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 F S 335 18, the Legislature authorized the Department to develop rules to administer the "State Highway System Access Management Act " These are Rule 14-96 and 14-97 Each district has assigned various offices the responsibility to permit connections and administer other parts of the program In order to adhere to the program, the designer must be familiar with the statute, the rules and the district program In addition to driveway connections, features such as median openings affect safe and efficient operation It is critical that the designer know what access classification has been assigned to the highway segment under design and to determine what roadway features and access connection modifications are appropriate to adhere to the program

During the development of construction plans, the designer should evaluate the access connections within the project limits Driveways and crossovers should be considered in the analysis of safety and operational problems Modifications or closures to access may be the solution in certain cases Rule 14-96 003 (3) & (4) and 14-96 015 gives the Department the authority to alter, relocate or replace connections in order to meet current Department standards Furthermore, Section 14-96 011 of the Rule allows the DOT 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 also provides guidance on the treatment of existing features in the highway improvement process

14-97 003(1)(b)

> (b) For the purpose of the interim standards for the assignment of an access classification to a segment of highway by the Department pursuant to Rule 14-97 004, permitted connections and those unpermitted connections exempted pursuant to Section 335 187(1), Florida Statutes, and existing median openings, and signals are not required to meet the interim standards of the assigned classification Such features will generally remain in place These features shall be brought into reasonable conformance with the standards of the assigned classification or the interim standards where new connection permits are granted for significant changes in property use, or as changes to the roadway design allow Applicants issued permits based on the interim standards as set forth in Rule 14-97 004 shall not have to reapply for a new permit after formal classification of the roadway segment unless significant change pursuant to Rule Chapter 14-96 and Rule 14-97 002 has occurred

Existing connections that are to remain are not required to be shown on the plans, but are to be reconstructed at their existing location in conformance to standards Those that are to be altered or closed must be detailed in the plans In some cases where revisions are necessary due to operational or safety problems, it may not be possible to totally upgrade the connection to the newest standards because of existing conditions or constraints In these cases, the designer should provide the best solution possible The designers' efforts should be coordinated with those responsible for access connection permitting in the District (i e , the District Permits Engineer) and those responsible for access management highway classification (i e , District Planning) Any changes or revocation of a connection must be made in accordance with Rule 14-96 011

Every owner of property which abuts a road on the State Highway System has a right to reasonable access to the abutting state highway but does not have a right to unregulated access to such highway A means of reasonable access cannot be denied except on the basis of safety and operational concerns as provided in s 335 184 Nothing in s 335 184 limits the Department's authority to restrict the operational characteristics of a particular means of access Service roads provide reasonable access Corner property can be given direct access by a "right-in" and/or "right-out" connection to the highway More restricted access must be supported by a study that documents safety and operational problems

It should be noted that if there are any conflicts between these guidelines and the statute and rules, the statute and rules shall govern

FLA. DOT ACCESS MANAGEMENT GUIDELINES RULE 14-97

FREEWAY INTERCHANGE SPACINGS

Access Class	Area Type	Segment Location	Interchange Spacing (kilometers)
1	AREA TYPE 1	CBD & CBD Fringe For Cities In Urbanized Areas	1 5
	AREA TYPE 2	Existing Urbanized Areas Other Than Area Type 1	3 0
	AREA TYPE 3	Transitioning Urbanized Areas And Urban Areas Other Than Area Type 1 or 2	5 0
	AREA TYPE 4	Rural Areas	10 0

ARTERIAL ACCESS MANAGEMENT CLASSIFICATIONS & STANDARDS

Access Class	Medians "Restrictive" physically prevent vehicle crossing "Non-Restrictive" allow turns across at any point	Connection Spacing (meters)		Median Opening Spacing (meters)		Signal Spacing (meters)
		>70 km/h	≤70 km/h	Directional	Full	
2	Restrictive w/Service Roads	400	200	400	800	800
3	Restrictive	200	135	400	800	800
4	Non-Restrictive	200	135			800
5	Restrictive	135	75	200	*800/400	*800/400
6	Non-Restrictive	135	75			400
7	Both Median Types	40		100	200	400

* 800 meters for >70 km/h , 400 meters for ≤70 km/h

INTERIM STANDARDS (newly constructed or transferred roads)				
Posted Speed (km/h)	Connection Spacing (meters)	Median Opening Spacing (meters)		Signal Spacing (meters)
		Directional	Full	
60 km/h or less "Special Cases"	40	100	200	400
60 km/h or less	75	200	400	400
60 61-70 km/h	130 135	200	400	400
Over 70 km/h	200	400	800	400

CORNER CLEARANCE AT INTERSECTIONS ISOLATED CORNER PROPERTIES				
Median	Position	Access Allowed	Minimum (meters)	
RESTRICTIVE	Approaching Intersection	Right In/Out	35	Class 7 & Special Cases
	Approaching Intersection	Right In Only	25	
	Departing Intersection	Right In/Out	70	40
	Departing Intersection	Right Out Only	30	
NON-RESTRICTIVE	Approaching Intersection	Full Access	70	40
	Approaching Intersection	Right In Only	30	
	Departing Intersection	Full Access	70	40
	Departing Intersection	Right Out Only	30	

Chapter 2

Roadway Design Geometrics and Criteria (Metric)

ROADWAY DESIGN CRITERIA - TABLES & FIGURES

CHAPTER 2

ROADWAY DESIGN GEOMETRICS & CRITERIA (METRIC)

2.0 General

The implementation of design criteria is outlined in the following text

1 Roadway Design Criteria The roadway design criteria presented in this manual are intended as the principal source of criteria for the design of new or major reconstruction projects on the Florida State Highway System

These criteria are presented by subject for major design elements as fixed values or a range of acceptable values as defined by qualifiers

Where design criteria appear in the Roadway and Traffic Design Standards, it will be consistent with the criteria in this manual Some criteria will remain in the other chapters of this manual until the Roadway Design Criteria section is completed When conflicts are discovered, they should be brought to the attention of the State Roadway Design Engineer for resolution

Design criteria for resurfacing, restoration, and rehabilitation (RRR) is presented in Chapter 25 of this manual and is applicable only on programmed RRR projects

2 Design Controls Design controls are characteristics and conditions that influence or regulate the selection of the criteria for project standards It is the designer's responsibility to recognize and apply those controls applicable to the project

3 Design Standards The specific values selected from the roadway design criteria become the design standards for a design project These standards will be identified and documented by the designer

4 Project Parameters The properties or specific conditions with limits which require modification of design standards within these limits The designer is responsible for establishing and documenting any project parameters and their limits, as part of the justification for deviations from project standards

Many design standard considerations are related directly to the design speed, including vertical and horizontal geometry and required sight distances The minimum design values are very closely related to traffic safety and cannot be compromised without an approved design variation See Chapter 23

2.1 Lanes

FDOT criteria for lane widths and pavement slopes are given by highway type and area, through lanes, auxiliary lanes and other special lanes Conditions and controls affecting the selection of project standards are listed in the criteria tables and figures

2 1 1 Through Lanes

Standard practice is to provide lane widths as wide as practical, up to 3 6 meters

2 1 2 Other Lane Widths

Collector-distributor lanes and auxiliary lanes for speed change, turning, storage for turning, weaving and other purposes supplementary to through-traffic movement should be of the same width as the through lanes

2 1 3 Ramp Widths

The standard single lane ramp width for the ramp proper on tangent and large radii sections is 4 5 m Ramp widths in other areas such as terminals are controlled by the curvature and the vehicle type selected as the design control The criteria presented in these tables are the FDOT full values established to satisfy these controls

2 1 4 Bicycle Lanes

On rural projects with no curb and gutter, the paved shoulder shall serve as a designated or undesignated bike lane

On urban curb and gutter projects, bike lanes may be designated or undesignated Urban resurfacing projects may include restriping to provide bike lanes by using reduced interior lanes or other lane combination widths

The district bicycle coordinator should be consulted during design to establish appropriate bike elements, if any, on a project by project basis

Chapter 8 contains additional guidelines for the accommodation of bicycles

2 1 5 Cross Slopes

The maximum number of lanes with cross slope in one direction is three lanes The algebraic difference in cross slope between adjacent through lanes should not exceed 0 04

The chapter on Roadside Safety Design and the chapter on Bicycle and Pedestrian Facilities contain additional procedures and guidelines on slope design

2 1 6 Roadway Pavement

The type of pavement usually is determined by analysis of the volume and composition of traffic, the soil conditions, the availability of materials, the initial cost and the estimated cost of maintenance

Criteria and procedures for selecting the type of pavement and the structural design of the various surfacing courses are discussed in the pavement design manuals

2 1 2 Transitions of Pavement Widths

When new pavement widths are not substantially greater than the joining pavement, grade differentials are slight and future widening is expected, striped transitions may be considered An alternative approach is an abrupt change in width, with appropriate pavement markings, reflectors and rumble strips The Roadway and Traffic Design Standards contain additional criteria and details

2.2 Medians

Median widths are given in the criteria tables and figures

2.3 Shoulders

Shoulder width, slope and superelevation criteria are provided in the criteria tables and figures It is the Department's policy that 1 5 meter paved outside shoulders are required on all new construction, reconstruction and lane addition projects for all highways except freeways

Roadway and Traffic Design Standards, Index 104, provides additional details for paved shoulders

Specific widths have also been adopted for interstate, expressway, single and double lane ramps and collector-distributor road shoulders Total shoulder widths, paved shoulder widths, widths of paved shoulder separations between through pavement edge and the near edge of any shoulder gutter are given for both right (outside) and left (inside) edges of the roadway See Shoulders in the criteria tables and figures

It is desirable to pave the median section and a 3 meter shoulder under overpass bridges and place miscellaneous asphalt from the paved shoulder to the slope pavement This pavement will provide additional safety, enhance drainage, reduce maintenance and improve appearance

2 3 1 Limits of Friction Course on Shoulders

Friction courses on limited access facilities shall be extended 0 3 meter onto both the median and outside shoulders

Friction courses should be extended the full width of the shoulder on free access highways because of bicyclist usage Terminating the friction course at the edge of travel lane or within the paved shoulder is considered to be a safety problem for bicyclists since they may cross over the drop-off

2 3 2 Shoulder Warning Devices (Rumble Strips)

The safety of freeways and other limited access facilities on the State highway system is to be enhanced by the installation of shoulder warning devices in the form of rumble strips Projects on these type facilities shall include the construction of ground-in rumble strips Several types of applications have been tested The ground-in strips provide the desired warning to the driver and consistency in application has been possible using this construction process

These ground-in strips are installed using two patterns The skip array is the standard array These are used on both inside and outside shoulders on divided highway sections The continuous array shall be constructed in advance of bridge ends for a distance of 300 meters or back to the gore recovery area for mainline interchange bridges Other areas may be specified in plans

Methods and types of application described above and in Roadway and Traffic Design Standards, Index 518, shall not be used unless concurred in by the State Roadway Design Engineer Approval will be considered only with sufficient documented justification for deviation from the standard

Roadway and Traffic Design Standards, Index 518 has been prepared to provide all needed details This index also gives standards for raised rumble strips for use at structures with less than full width shoulders and at intersections Notes for locations of raised rumble strip applications are also included on the index

2.4 Roadside Slopes

Criteria and details are included in the criteria tables and figures and in Chapter 4

2.5 Borders

Border widths on rural highways are based on drainage requirements, clear zones, maintenance and border areas

Border width requirements for urban collector and arterial highways for new construction or major modifications to existing facilities (with curb or curb and gutter), require a separate set of design controls, as discussed below

The standard border width is measured from the outside edge of the outer traffic lane to the right-of-way line Border widths are justified by some conditions such as overhead utilities, ADA requirements, pedestrian needs and connections to driveways or other access facilities FDOT's minimum standard border width is 3 0 meters

The standard sidewalk width with a grass strip adjacent to the curb is 1 5 meters When the sidewalk is adjacent to a curb, the width of the sidewalk shall be 1 8 meters

2.6 Grades

The profile grade line defines the vertical alignment for road and street construction As with other design elements, the characteristics of vertical alignment are influenced greatly by basic controls related to design speed, traffic volumes, functional classification, drainage and terrain conditions Within these basic controls, several general criteria must be considered

The Department's minimum for structure clearance over all highways is given in the criteria tables and figures Exceptions to this policy shall be permitted only when justified by extenuating circumstances and approved as a variation or exception This clearance should be increased on new facilities to allow for resurfacing

Clearance required above design high water for roadway base courses, as well as the limiting relationships between shoulder/pavement elevations vs flood elevations, are discussed in the FDOT Drainage Manual

The Roadway and Traffic Design Standards lists utility clearances and minimum covers and maximum fill heights for all types of culverts

2.7 Sight Distance

Minimum stopping and passing sight distances are given in the criteria tables and figures

2.8 Curves

2 8 1 Horizontal Curves

Design speed is the principal factor controlling horizontal alignment Several geometric standards related to design speed are very specific Other criteria cannot be defined as specifically and require that judgments be made by designers in consideration of local conditions

2 8 1 1 Supplemental Alignment Control (Mainline)

Further guidelines have been established by the Department for lengths of horizontal curves, maximum deflections without curves, redirection of through lanes at intersections and minimum transition lengths between reverse curves The criteria given are intended for use in establishing minimum lengths for both rural and urban conditions See criteria tables and figures

For small deflection angles (5° or less) curves should be suitably lengthened to avoid the distracting appearance of a kink Curves should be at least 150 m long for a central angle of 5° and the minimum increased 30 m for each 1° decrease in the central angle (270 m for a 1° central angle) This treatment may not be practical in developed or environmentally sensitive areas or for major modifications of existing facilities

For design, the aesthetic control given above should be considered where practical, but may be compromised where other considerations warrant such action Discernment of alignment changes in an urban setting is normally minimal due to the masking effects of development, traffic signs, various items of interest and similar distracting stimuli

For information on the maximum deflection without a curve, see Table 2 8 1

When superelevation is required for curves in opposite directions on a common tangent, a suitable distance is required between the curves This suitable tangent length should be determined as follows

- 80% of the transition for each curve should be located on the tangent
- The suitable tangent length is the sum of the two 80% distances, or greater
- Where alignment constraints dictate a less than desirable tangent length between curves, an adjustment of the 80/20 superelevation transition treatment is allowed (where up to 50% of the transition may be placed on the curve)

The use of compound curves in horizontal alignment should be avoided When compound curves are necessary, the radius of the flatter curve should not be more than 50% greater than the sharper curve

The length for compound curves for turning roadways when followed by a curve of one-half radius or preceded by a curve of double radius should be as shown in the table below

Length of Circular Arc (meters)

Radius (m)	30	50	60	75	100	125	≥150
Minimum length	12	15	20	25	30	35	45
Desirable length	20	20	30	35	45	55	60

2 8 1 2 Supplemental Alignment Control (Intersections)

For redirection or offset deflection of through lanes through intersections the following angular deflections may be used Curves are not required for these angular breaks However, short curves may be desirable at each end, especially if pavement markings are used through the intersection to provide positive guidance to the motorist

Design Speed (km/h)	30	40	50	60	70
Maximum deflection	16°00'	11°00'	8°00'	6°00'	3°00'

2 8 1 3 Roadway Transitions

Transition details have been developed and included in the Roadway and Traffic Design Standards Transitions on curved alignment will require special design details in the contract plans

2.8.2 Vertical Curves

Minimum lengths for crest and sag vertical curves are provided in the criteria tables and figures

2.9 Superelevation

Superelevation rates of 0 10 maximum (rural) and 0 05 maximum (urban) are used by the Department on the State Highway System Charts for these rates are in the criteria Additional data is contained in the Roadway and Traffic Design Standards, Indexes 510 and 511

The standard superelevation transition places 80% of the transition on the tangent and 20% on the curve In special situations this treatment can be adjusted to allow up to 50% of the transition to be placed on the curve

2.10 Vertical Clearance

Minimum vertical clearances are contained in the criteria tables and figures

2.11 Horizontal Clearance

Minimum horizontal clearances are contained in the criteria tables and figures

2.12 Clear Zones

Minimum clear zones are contained in the criteria tables and figures and in the Roadway and Traffic Design Standards

2.13 Intersections

Design guides and criteria presented heretofore are also applicable to the proper design of intersections

2 13 1 Circular Intersections (Roundabouts)

The circular intersection with all yield control is another design concept for the designer to consider Two critical elements of the small circular traffic pattern with a central island are as follows

- Entry is by gap acceptance by having a yield condition at all entry legs
- Speeds through the intersection are 40 km/h or less

The use of this design is best for low speed facilities Its use should be documented by a complete intersection analysis and study, including alternate types of design

All roundabout designs must be approved by the State Roadway Design Engineer

2.14 Interchanges

Design guides and criteria presented heretofore and in the Roadway and Traffic Design Standards are also applicable to the proper design of interchanges with their inherent ramps, speed change, merging and weaving lanes

2 14 1 Limited Access Limits at Interchanges

The following criteria will be used in establishing limited access limits along crossroads at interchanges

For rural interchanges, limited access will extend along the crossroad to a point 90 m minimum beyond the end of the acceleration or deceleration taper In the event these points are not opposite, the point most remote from the project will be the control and the limited access on both sides will end at that station along the crossroad Where no taper is used, the limited access will be carried to a point 90 m minimum beyond the radius point of the return In this case also, the radius point most remote from the project will control

For interchanges in urban areas, the criteria given above will apply except that the limited access will end a minimum of 30 m beyond the end of taper or the radius point of the return

In both cases of interchanges in rural and urban areas, a median cross-over may be centered no less than 15 m beyond the end of limited access except that a minimum distance of 200 m to the ramp median opening will be required In no case should access be permitted between the interchange proper and the median cross-over as established by this criteria

For partial cloverleaf, the limited access right-of-way along the cross road on that side having no ramp will extend to a point opposite that point controlled by the ramp

Special cases or exceptions to the above will have to be handled on an individual basis and must be fully supported by realistic right-of-way cost information and other pertinent data covering any recommended alternative

Limited access along crossroads overpassing (no interchange) limited access facilities shall be extended approximately 60 meters, measured from the mainline right of way line, along the crossroad The fence is generally tied into the crossroad structure end bent unless required along the crossroad

2.15 Lighting Criteria

Lighting criteria is contained in the criteria tables and figures and in Chapter 7

Introduction to Criteria Tables and Figures

In the application of the criteria in this manual, the following definitions are assigned for consistency of understanding and interpretation

1 Arterials Divided or undivided, relatively continuous routes that primarily serve through traffic, high traffic volumes, and long average trip lengths Traffic movement is of primary importance, with abutting land access of secondary importance Arterials include expressways without full control of access, US numbered routes and principal state routes May be classified as urban or rural

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

3 C-D Roads 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, 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

4 Collectors Divided or undivided routes which serve to link arterial routes with local roads or major traffic generators They serve as transition link between mobility needs and land use needs Collectors include minor state routes, major county roads, and major urban and suburban streets

5 Freeways Divided arterial highways, with full control of access Movement of traffic free of interference and conflicts is of primary importance Essential elements include medians, grade separations, interchanges, and, in some cases, collector-distributor roads and frontage roads Freeways include Interstate, toll road and expressway systems May be classified as urban or rural

6 HOV Lane Special designated widths of pavement marked to provide travel lanes for high occupancy vehicles (HOV) They may be directly adjacent to other travel lanes or separated

7 Local Roads Routes which provide high access to abutting property, low average traffic volumes, short average trip lengths and on which through traffic movements are not of primary importance Local roads include minor county roads, minor urban and suburban subdivision streets, and graded or unimproved roads

8 Rural Areas 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 Rural environments are surroundings of similar characteristics

9 Streets The local system which provides direct access to residential neighborhoods and business districts, connect 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

Note Local roads and streets are not generally a part of the State Highway System and therefore, may not be governed by the FDOT roadway design criteria,but by the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways

10 Traffic Lane The designated widths of roadway pavement marked to separate opposing traffic or vehicles traveling in the same direction Traffic lanes include through travel lanes, auxiliary lanes, turn lanes, weaving, passing, and climbing lanes They provide space for passenger cars, trucks, buses, recreational vehicles and bicycles

11 Travel Lane The designated widths of roadway pavement marked to carry through traffic and to separate it from opposing traffic or traffic occupying other traffic lanes Generally, travel lanes equate to the basic number of lanes for a facility

12 Urban Areas Places within boundaries of concentrated populations, where density of street and highway networks, travel speeds, nature and composition of vehicles and pedestrian traffic dictate street and highway characteristics that promote lower speeds, better circulation movements, more delineation and traffic guidance devices, shorter trip lengths and provisions for pedestrians and bicycles Urban environments are surroundings of similar characteristics

13 Urbanized Areas Transitional zones between rural and urban areas, with characteristics approaching or similar to urban areas

14 High Speed Descriptive term used to summarize all conditions governing the selection of Design Speeds of 90 km/h or greater

15 Low Speed Descriptive term used to summarize all conditions governing the selection of Design Speed of 80 km/h or less

16 Low Volume and High Volume Descriptive term used to describe certain operating characteristics and driver expectancy on highways Criteria for some elements are selected according to these qualifying controls Standards for these controls are given in the table on the next page

17 Truck Traffic When significant, heavy, substantial, high percent, etc truck traffic is used as a qualifying control, it shall mean 10% of the AADT or 10% of the daily count (24 hr)

STANDARDS FOR LOW AND HIGH VOLUME HIGHWAYS IN ANNUAL AVERAGE DAILY VOLUMES

HIGHWAY TYPE	LOW VOLUME AADT	HIGH VOLUME AADT
FREEWAY - URBAN		
4-LANE FACILITY	57,000	69,000
6-LANE FACILITY	86,000	103,000
8-LANE FACILITY	114,000	138,000
FREEWAY - RURAL		
4-LANE FACILITY	46,000	56,000
6-LANE FACILITY	69,000	83,000
8-LANE FACILITY	92,000	111,000
ARTERIALS - URBAN		
2-LANE FACILITY	16,000	20,000
4-LANE FACILITY	37,000	43,000
6-LANE FACILITY	55,000	64,000
8-LANE FACILITY	69,000	80,000
ARTERIALS - RURAL		
2-LANE FACILITY	9,000	14,000
4-LANE FACILITY	38,000	47,000
6-LANE FACILITY	58,000	71,000
COLLECTOR - URBAN		
2-LANE FACILITY	11,000	16,000
4-LANE FACILITY	37,000	45,000
COLLECTOR - RURAL		
2-LANE FACILITY	8,000	13,000
4-LANE FACILITY	30,000	38,000

LOW VOLUME — FACILITIES ARE HIGHWAY TYPES WITH PROJECTED DESIGN YEAR AADT VOLUME EQUAL TO OR LESS THAN THE LOW VOLUME VALUES SHOWN

HIGH VOLUME — FACILITIES ARE HIGHWAY TYPES WITH PROJECTED DESIGN YEAR AADT VOLUME EQUAL TO OR GREATER THAN THE HIGH VOLUME VALUES SHOWN

2.1 Lanes

LANE WIDTHS (METERS)						
FACILITY		THROUGH OR TRAVEL	AUXILIARY			
TYPE	AREA		SPEED CHANGE	TURNING (LT/RT/MED)	PASSING	CLIMBING
FREEWAY	Rural	3 6	3.6	—	—	3 6
	Urban	3 6	3 6	—	—	3 6
ARTERIAL	Rural	3 6	3 6	3 6[4]	3 6	3 6
	Urban	3 6[1]	3 6[1]	3 6[1 4]	3 6[1]	3 6
COLLECTOR	Rural	3 3[2]	3 3[2]	3 3[2, 4]	3 3[2, 5]	3 6
	Urban	3 3[3]	3 3[3]	3 3[3 4]	3 3[3]	3 6

1 3 3 permitted if one of these conditions exist

- R/W and existing conditions are stringent controls
- Facility operates on interrupted flow conditions
- Design speed 80 km/h or less
- Intersection capacity not adversely affected
- Truck volume 10% or less

2 3 6 lanes for all 2-lane rural

3 3 6 lanes in industrial areas when R/W is available

4 With severe R/W controls, 3 0 turning lanes may be used where speeds are 60 km/h or less and the intersection is controlled by traffic signals Median turn lanes shall not exceed 4 5

5 3 6 when truck volume more than 10%

LANE WIDTHS
Table 2.1.1

2.1 Lanes

LANE WIDTHS (METERS)					
FACILITY		SPECIAL			
TYPE	AREA	HOV[1]	BICYCLE	OFF SYSTEM DETOUR	URBAN MULTI-PURPOSE[5]
FREEWAY	Rural	3 6	—	3 3[4]	—
	Urban	3.6	—	3 3[4]	—
ARTERIAL	Rural	3 6	1.5[2]	3 3	—
	Urban	3 6	1 2[3]	3 3	2 4[6]
COLLECTOR	Rural	—	1 5[2]	3 3	—
	Urban	—	1.2[3]	3 3	2 4[6]

1 Separated or concurrent flow

2 Designated shoulder pavement

3 Designated or undesignated

4 For Interstate highway detours, at least one 3 6 lane must be provided in each direction

5 Urban multi-purpose lanes are usually used as refuge lanes but may be used for loading zones, bus stops, emergency access and other purposes Parking that adversely impacts capacity or safety is to be eliminated whenever practical Standard parking width is 2 4 m measured from lip of gutter, with a minimum width of 2 4 m measured from face of curb Portions of multi-purpose lanes that are reserved for parking and access isles for the physically handicapped shall have cross slopes not exceeding 1.50 (0.02) in all directions

6 3 0 to 3 6 lanes for commercial and transit vehicles

LANE WIDTHS
Table 2.1.2

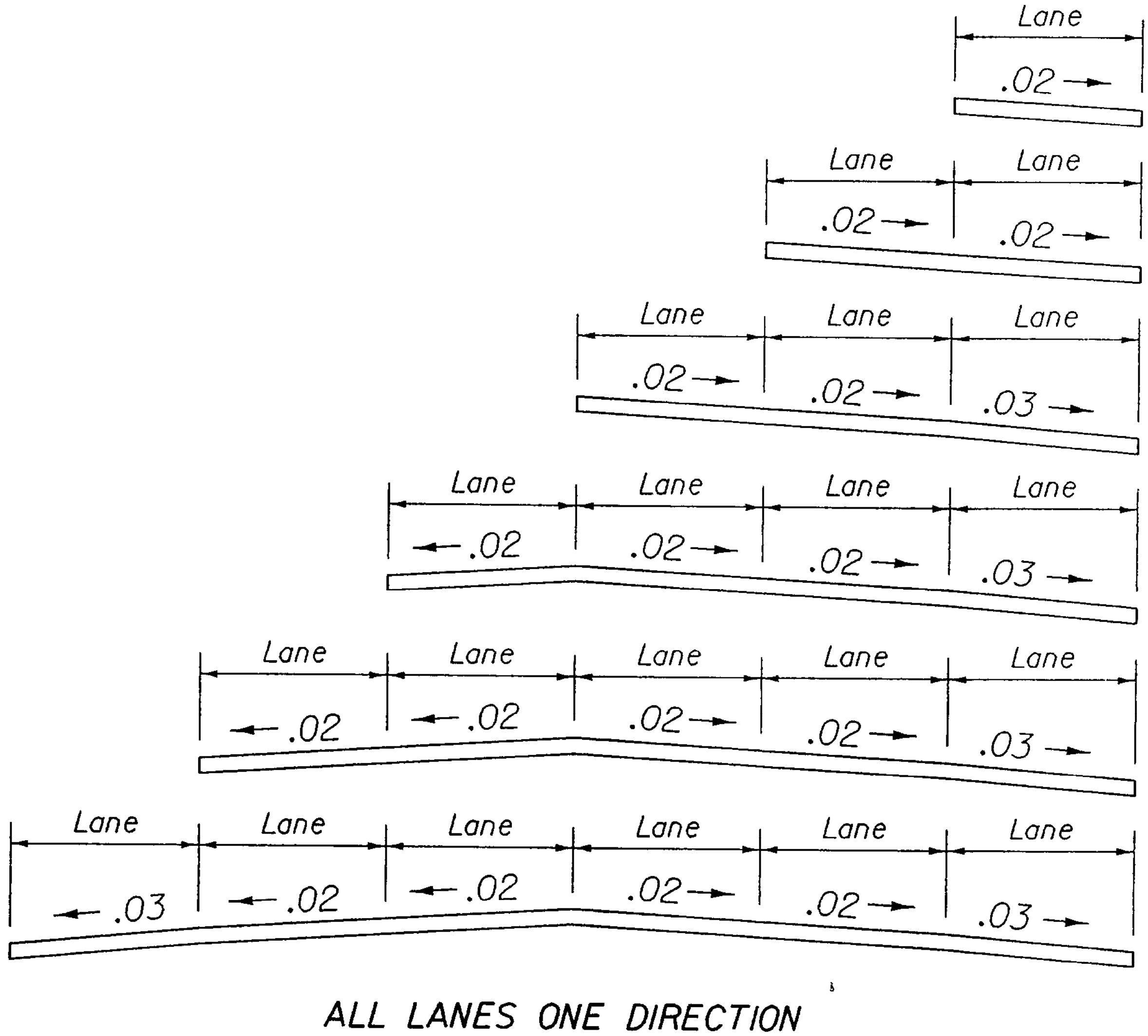
2.1 Lanes

RAMP WIDTHS RAMP PROPER (ONE WAY)			
RADIUS (Radius To Inside Of Curve)	1-LANE (All Design Vehicles)	2-LANES (P & SU Vehicles)	2-LANES (Combination-Type Vehicle And Buses)
METERS			
15 0	6 9	8 7	—
25 0	5 7	8 1	—
30 0	5 4	7 8	—
50 0	5 1	7 5	9 3
75 0	4 8	7 5	8 7
100 0	4 8	7 2	8 4
125 0	4 8	7 2	8 4
150 0+	4 5	7 2	8 4

These widths include adjustments for standard shoulder and/or curb edge of pavement treatments; no further adjustments are needed

RAMP PAVEMENT WIDTHS
Table 2.1.3

2.1 Lanes



These sections show only the standard slopes for adjoining 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

Maximum pavement cross slopes on tangent sections are·
0 04 for design speeds of 80 km/h or less
0.03 for design speeds greater than 80 km/h

The change in cross slope between adjacent through lanes shall not exceed 0.04

STANDARD PAVEMENT CROSS SLOPES
Figure 2.1.1

2.2 Medians

MEDIAN WIDTHS (METERS)	
TYPE FACILITY	WIDTH
FREEWAYS	
Interstate, Without Barrier	19.2[1]
Other Freeways, Without Barrier	
Design Speed $\geq$ 100 km/h	18 0
Design Speed < 100 km/h	12.0
All, With Barrier, All Design Speeds	7.8[2]
ARTERIALS AND COLLECTORS	
Design Speed $\geq$ 90 km/h	12.0
Design Speed < 90 km/h	6.6[3]
Paved And Painted For Left Turns	3.6[4]

1 26 4 when future lanes planned.

2 Based on 0 6 median barrier and 3.6 shoulder

3 On reconstruction projects where existing curb locations are fixed due to severe right of way constraints, the minimum width may be reduced to 6.0 for design speeds = 70 km/h, and to 5 0 for design speeds $\leq$ 60 km/h.

4. Restricted to 5-lane sections with design speeds $\leq$ 70 km/h. On reconstruction projects where existing curb locations are fixed due to severe right of way constraints, the minimum width may be reduced to 3 0. These flush medians are to include sections of raised, restrictive islands for pedestrian refuge and to conform with the "Multilane Facilities Median Policy" and the Access Management Rules.

MEDIAN WIDTHS
Table 2.2.1

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS)								SLOPES	
		WITHOUT SHOULDER GUTTER				WITH SHOULDER GUTTER				NORMAL◪	
		FULL WIDTH		PAVED WIDTH		FULL WIDTH		PAVED WIDTH			
		Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left	Outside	Median Or Left
FREEWAYS (Lanes One Way)	4-Lane Or More	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4	06	06
	3-Lane	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4		05
	2-Lane	3 6	2 4	3 0	1 2	4 7	4 1	2 4	1 8		
	HOV Lane	NA	4 2	NA	3 0	NA	NA	NA	NA	NA	05☆
	1-Lane Ramp	1 8	1 8	1 2	0 6	3 5	3 5	1 2△	1 2	06	05
	2-Lane Ramp Non-Interstate	3 0	2 4	2 4	1 2	4 7	4 1	2 4	1 8		
	2-Lane Ramp Interstate	3 6	2 4	3 0	1 2	4 7	4 1	2 4	1 8		
	C-D Road 1-Lane	1 8	1 8	1 2	0 6	3 5	3 5	1 2	1 2		
	C-D Road 2-Lane	3 6	2 4	3 0	1 2	4 7	4 1	2 4	1 8		
	C-D Road 3-Lane	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4		
	C-D Road > 3-Lane	3 6	3 6	3 0	3 0	4 7	4 7	2 4	2 4		06
	Auxiliary Lane Climbing & Weaving	3 6	NA	3 0	NA	4 7	NA	2 4	NA		NA
	Auxiliary Lane Mainline Terminal 1-Lane Ramp	2 4	NA	1 8	NA	3 5	NA	1 2	NA		NA
	2-Lane Ramp	3 6	NA	3 0	NA	4 7	NA	2 4	NA		NA
	Frontage Road	See COLLECTORS Table 2 3 4 For Local Roads And Streets See The FDOT 'Manual Of Uniform Minimum Standards For Design, Construction And Maintenance For Streets And Highways'									

◪ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

☆ 0 06 when 4 lanes or more combined

△ Shoulder pavement less than 1 8 in width and adjoining shoulder gutter shall be the same type, depth and slope as the ramp pavement

SHOULDER WIDTHS AND SLOPES

Table 2.3.1

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS) WITHOUT SHOULDER GUTTER FULL WIDTH Outside	WITHOUT SHOULDER GUTTER FULL WIDTH Median Or Left	WITHOUT SHOULDER GUTTER PAVED WIDTH ⊙ Outside	WITHOUT SHOULDER GUTTER PAVED WIDTH Median Or Left	WITH SHOULDER GUTTER FULL WIDTH Outside	WITH SHOULDER GUTTER FULL WIDTH Median Or Left	WITH SHOULDER GUTTER PAVED WIDTH Outside	WITH SHOULDER GUTTER PAVED WIDTH Median Or Left	SLOPES NORMAL ◪ Outside	SLOPES NORMAL ◪ Median Or Left
ARTERIALS Divided (Lanes One Way)	4-Lane	3 6 3 0 2.4	3 6 3 0 2.4	1 5 1 5 1 5	1 2 1 2 1 2	4 7 4 7 4 1	4 7 4 7 4 1	2 4 2 4 1 8	2 4 2 4 1 8	06	06
	3-Lane	3 6 3 0 2 4	3 6 3 0 2 4	1 5 1 5 1 5	0 0◓ 0 0◓ 0 0◓	4 7 4 7 4 1	4 7 4 7 4 1	2 4 2 4 1 8	2 4 2 4 1 8		05
	2-Lane	3 6 3 0 2 4	2 4 2 4 1 8	1 5 1 5 1 5	0 0◓ 0 0◓ 0 0◓	4 7 4 7 4 1	4 1 4 1 3 5	2 4 2 4 1 8	1 8 1 8 1 2		
	1-Lane Ramp	1 8	1 8	1 2	0 6	3 5	3 5	1 2 △	1 2		
	2-Lane Ramp	3 0	1 8	1 5	0 6	4 7	4 1	2 4	1 8		
	C-D Road 1-Lane	1 8	1 8	1 2	0 6	3 5	3 5	1 2	1 2		
	C-D Road 2-Lane	2 4	1 8	1 5	0 0	4 1	3 5	1 8	1 2		
	Auxiliary Lane Climbing And Weaving	Same As Travel Lanes	NA	Same As Travel Lanes	NA	Same As Travel Lanes	NA	Same As Travel Lanes	NA		NA
	Auxiliary Lane Mainline Terminals 1-Lane Ramp 2-Lane Ramp	2 4 3 6	NA NA	1 5 1 5	NA NA	3 5 4 7	NA NA	1 2 2 4	NA NA		NA NA
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes	Same As Travel Lanes	1 5	0 0	3 5	NA	1 2	NA		05 - 06
	Frontage Road	See COLLECTORS Table 2 3 4 For Local Roads And Streets See The FDOT 'Manual Of Uniform Minimum Standards For Design Construction And Maintenance For Streets And Highways'									

◪ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

△ Shoulder pavement less than 1 8 in width and adjoining shoulder gutter shall be the same type, depth and slope as the ramp pavement

⊙ Shoulder shall be paved full width through rail-highway at grade crossings, extending a minimum distance of 7 6 on each side of the crossing measured from the outside rail For additional information see Standard Index No 17882

◓ Paved 0 6 wide where turf is difficult to establish Paved 1 2 wide (a) in sag vertical curves 30 m minimum either side of the low point, and (b) on the low side of superelevated traffic lanes extending through the curves and approximately 90 m beyond the PC and PT

X — High Volume Highways
X — Normal Volume Highways
X — Low Volume Highways

LEGEND FOR VALUES

SHOULDER WIDTHS AND SLOPES
Table 2.3.2

2.3 Shoulders

HIGHWAY TYPE		WIDTHS (METERS)				SLOPES
		WITHOUT SHOULDER GUTTER		WITH SHOULDER GUTTER		
		FULL WIDTH	⊙ PAVED WIDTH	FULL WIDTH	PAVED WIDTH	NORMAL ◪
ARTERIALS Undivided (Lanes Two-Way)	Multi-Lane ⊕	3 6 3 0 2 4	1 5 1 5 1 5	4 7 4 7 4 1	2 4 2 4 1 8	06
	2-Lane	3 6 3 0 2 4	1 5 1 5 1 5	4 7 4 7 4 1	2 4 2 4 1 8	
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes	1 5	3 5	1 2	
	Frontage Road	See COLLECTORS Table 2 3 4 For Local Roads And Streets See The FDOT 'Manual Of Uniform Minimum Standards For Design Construction And Maintenance For Streets And Highways'				

◪ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

⊙ Shoulder shall be paved full width through rail-highway at grade crossings extending a minimum distance of 7 6 on each side of the crossing measured from the outside rail For additional information see Standard Index No 17882

⊕ All multi-lane facilities shall conform to the Department "Multilane Facilities Median Policy", Topic No 000-625-015

x — High Volume Highways
x — Normal Volume Highways
x — Low Volume Highways

LEGEND FOR VALUES

SHOULDER WIDTHS AND SLOPES
Table 2.3.3

2.3 Shoulders

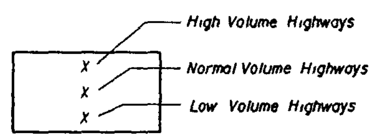
HIGHWAY TYPE		WIDTHS (METERS) WITHOUT SHOULDER GUTTER FULL WIDTH Outside	Median Or Left	PAVED WIDTH ⊙ Outside	Median Or Left	WITH SHOULDER GUTTER FULL WIDTH Outside	Median Or Left	PAVED WIDTH Outside	Median Or Left	SLOPES NORMAL ◪ Outside	Median Or Left
COLLECTORS Divided (Lanes One-Way)	3-Lane	3 6 3 0 2 4	3 6 3 0 2 4	1 5 1 5 1 5	0 0● 0 0● 0 0●	4 7 4 7 4 1	4 7 4 7 4 1	2 4 2 4 1 8	2 4 2 4 1 8	06	0[illegible]
	2-Lane	3 6 3 0 2 4	2 4 2 4 1 8	1 5 1 5 1 5	0 0● 0 0● 0 0●	4 7 4 7 4 1	4 1 4 7 3 5	2 4 2 4 1 8	1 8 1 8 1 2		
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes	Same As Travel Lanes	1 5	1 2	3 5	NA	1 2	NA		
COLLECTORS Undivided (Lanes Two-Way)	Multi-Lane ⊕	3 6 3 0 2 4		1 5 1 5 1 5		4 7 4 7 3 5		2 4 2 4 1 8		06	
	2 Lane	3 6 3 0 2 4		1 5 1 5 1 5		4 7 4 7 3 5		2 4 2 4 1 8			
	Auxiliary Lane At-Grade Intersection	Same As Travel Lanes		Same As Travel Lanes		3 5		1 2			

◪ Shoulders shall extend 1 2 back of shoulder gutter and have a 0 06 slope back toward the gutter

⊙ Shoulder shall be paved full width through rail-highway at grade crossings, extending a minimum distance of 7 6 on each side of the crossing measured from the outside rail For additional information see Standard Index No 17882

● The median shoulder may be paved 0 6 wide in areas of the State where establishing and maintaining turf is difficult however, shoulders shall be paved 1 2 wide (a) in sag vertical curves, 30 m minimum either side of the low point and (b) on the low side of superelevated traffic lanes extending through the curve and approximately 90 m beyond the PC and PT

⊕ All multi-lane facilities shall conform to the Department "Multilane Facilities Median Policy", Topic No 000-625-015

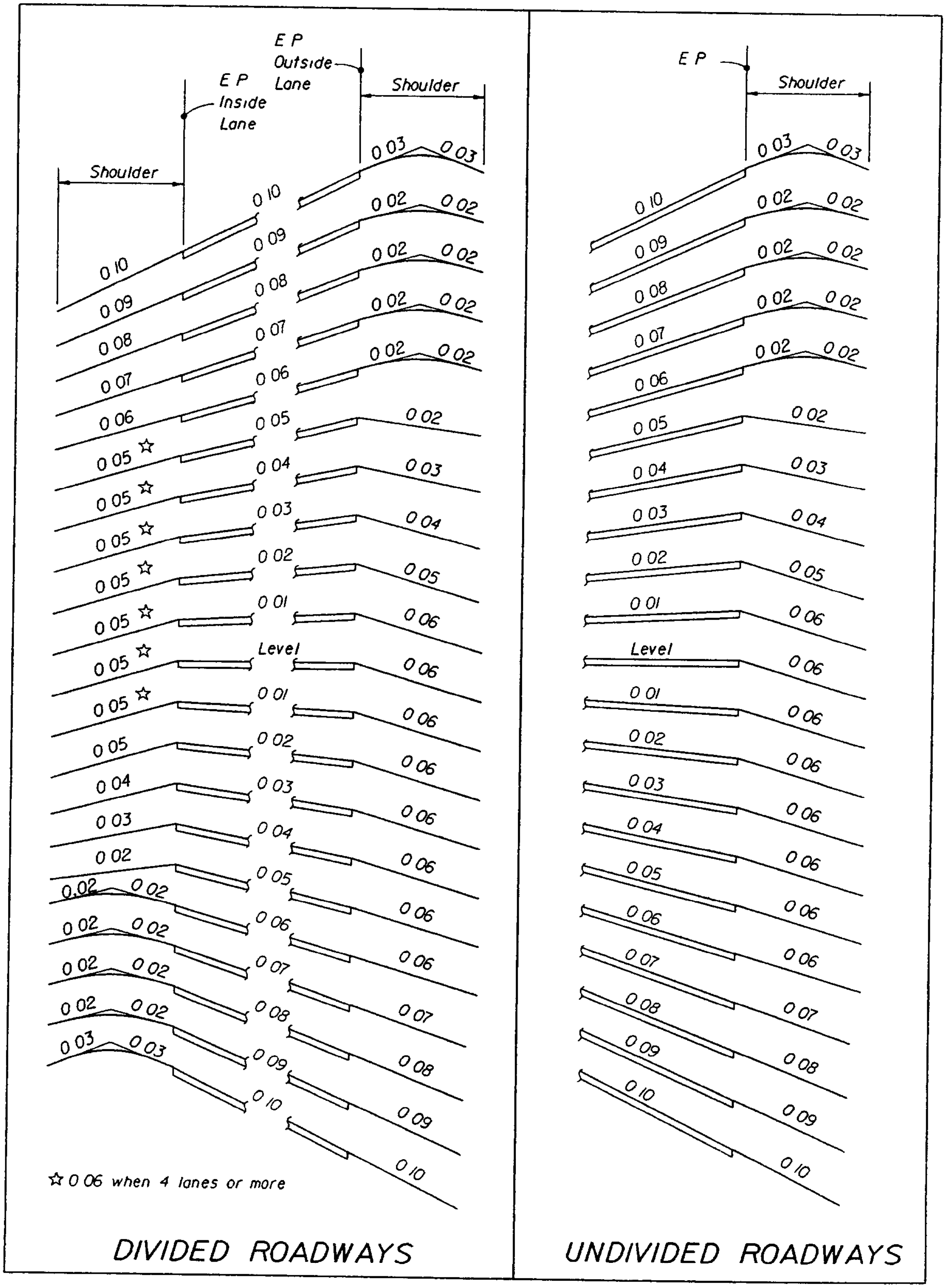


LEGEND FOR VALUES

SHOULDER WIDTHS AND SLOPES

Table 2.3.4

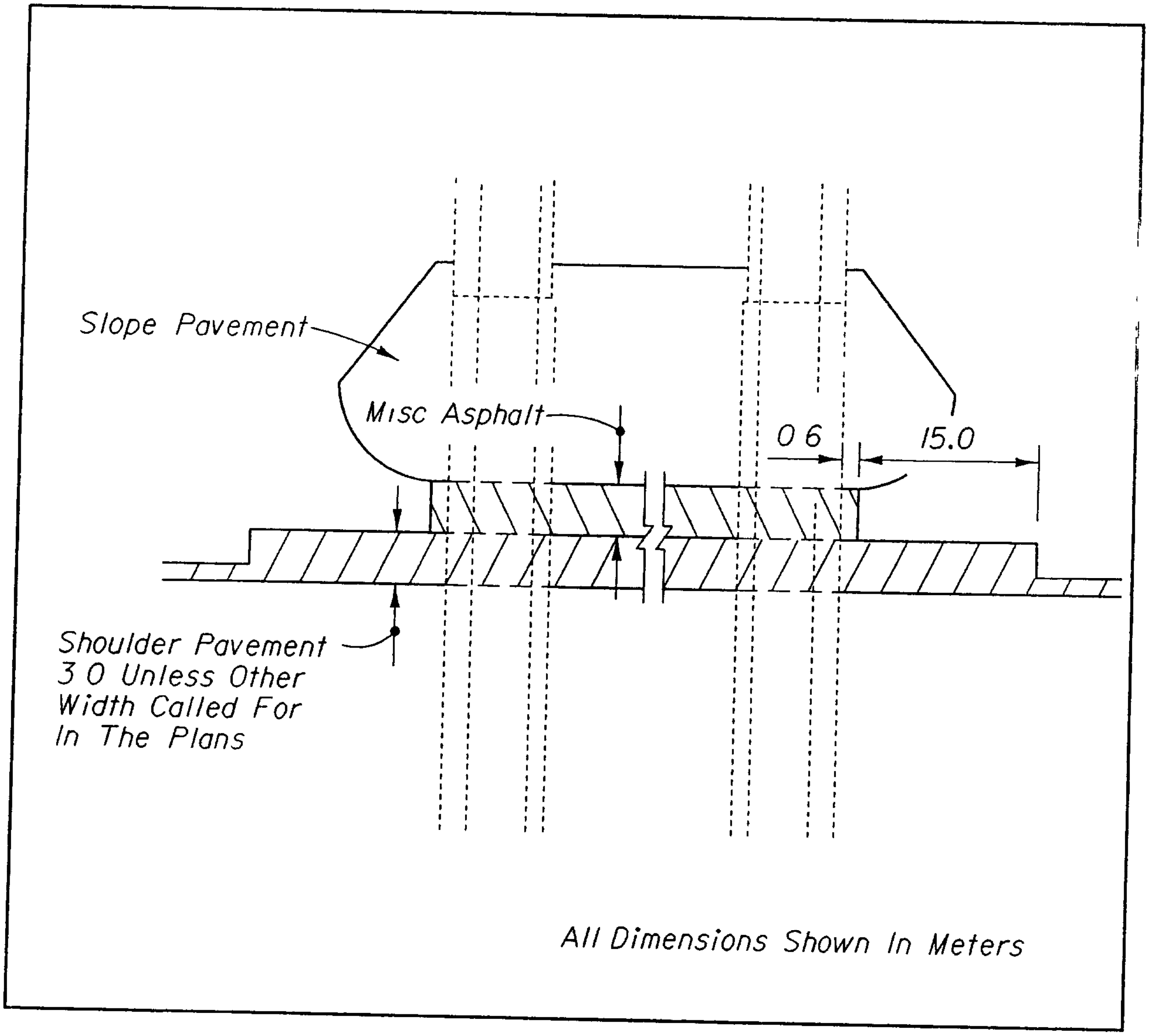
2.3 Shoulders



SHOULDER SUPERELEVATION

Figure 2.3.1

2.3 Shoulders



TYPICAL PAVING UNDER BRIDGE STRUCTURES
FOR OUTSIDE SHOULDERS
Figure 2.3.2

2.4 Roadside Slopes

TYPE OF FACILITY	RURAL & URBAN FREEWAYS, RURAL ARTERIALS AND COLLECTORS, WITH PROJECTED 20 YR ADT OF 1500 OR GREATER DESIGN SPEED 80 km/h OR GREATER		RURAL ARTERIALS AND COLLECTORS WITH PROJECTED 20 YR ADT LESS THAN 1500 AND RURAL LOCALS, URBAN ARTERIALS AND COLLECTORS WITHOUT CURB & GUTTER ALL SPEEDS		URBAN ARTERIALS AND COLLECTORS WITH CURB & GUTTER DESIGN SPEED 80 km/h OR LESS	
	Height (Meter)	Rate	Height (Meter)	Rate	Height (Meter)	Rate
Front Slope	0 0-1 5 1 5 3 0 3 0-6 0 >6 0	6 I 6 I to edge of CZ and 4 I 6 I to edge of CZ and 3 I 2 I (with guardrail)	0 0-1 5 1 5-6 0	6 I except where R/W is insufficient then 6 I to edge of CZ and 3 I will be permitted 6 I to edge of CZ and 3 I except where R/W is insufficient then 2 I will be permitted	All	2 I or to suit property owner, not flatter than 6 I R/W cost must be considered for high fill sections in urban areas
Back Slope	All	4 I or 3 I with a standard width trapezoidal ditch and 6 I front slope	All	4 I when R/W permits or 3 I	All	2 I or to suit property owner Not flatter than 6 I
Transverse Slopes	All	10 I or flatter (freeways) 4 I (others)	All	4 I	All	4 I

Roadside Slopes
Table 2.4.1

2.6 Grades

2.6.1 Criteria For Grade Datum

1 Roadway Base Clearance Above Design High Water Elevation

Freeways and rural multi-lane mainline.	0 9 m
Ramps (proper)	0 6 m
Low point on ramps at cross roads	0 3 m
Rural two-lane with design year ADT greater than 1500 VPD	0 6 m
All other facilities including urban	0 3 m

2 Bridge Vertical Clearances

See Vertical Clearances For Bridges, Table 2 10 1

2.6.2 Length Of Grade On Curb And Gutter Sections

A minimum of 75 m between VPI's

2.6.3 Grades On Curb And Gutter Sections

A minimum grade of 0 3%

See Table 2 6 1 for maximum grades

2.6 Grades

MAXIMUM GRADES IN PERCENT															
TYPE OF HIGHWAY	AREA	DESIGN SPEED (km/h)													
		FLAT TERRAIN							ROLLING TERRAIN						
		50	60	70	80	90	100	110	50	60	70	80	90	100	110
FREEWAYS (1)	Rural Urban	—	—	4	4	3	3	3	—	—	5	5	4	4	4
ARTERIALS (3)	Rural	—	5	5	4	3	3	3	—	6	6	5	4	4	4
	Urban	8	7	7	6	5	5	—	9	8	8	7	6	6	—
COLLECTORS (3)	Rural	7	7	7	6	5	5	4	9	8	8	7	6	6	5
	Urban	9	9	9	7	6	6	5	11	10	10	8	7	7	6
	Industrial (2)	4	4	4	3	3	3	—	5	5	5	4	4	4	—
FRONTAGE ROADS	Require Same Criteria As Collectors														

RAMPS	DESIGN SPEED (km/h)	< 30	40 to 50	60	70 to 80
	GRADES (%)	6 To 8	5 To 7	4 To 6	3 To 5

One-Way Descending Grades On Ramps May Be 2% Greater, In Special Cases

(1) Interstate designed to 110 km/h will be restricted to 3% maximum grade

(2) Areas with significant (10% or more) heavy truck traffic

(3) On 2-lane highways critical length of upgrades shall not be exceeded Critical lengths are those which reduce the speeds of 180 kg/kW trucks by more than 15 km/h

MAXIMUM GRADES
Table 2.6.1

DESIGN SPEED km/h	30	40	50	60	80	90	100	110
MAXIMUM CHANGE IN GRADE IN PERCENT	1 20	1 10	1 00	.80	60	50	40	20

MAXIMUM CHANGE IN GRADE WITHOUT VERTICAL CURVES
Table 2.6.2

2.7 Sight Distance

MINIMUM STOPPING SIGHT DISTANCE (METERS)
(Based on height of eye of 1.070 m and height of object 0.150 m above road surface)

Design Speed (km/h)	GRADES OF 2% OR LESS			
	FREEWAYS		ARTERIALS	COLLECTORS
	Interstate	Other		
40	- - -	- - -	- - -	45
50	- - -	- - -	60	60
60	- - -	- - -	85	80
70	- - -	110	110	100
80	- - -	140	120	120
90	170	150	145	140
100	190	175	170	150
110	225	210	200	- - -

ADJUSTMENT IN DISTANCE FOR GRADES GREATER THAN 2%

Design Speed (km/h)	INCREASE IN LENGTH FOR DOWNGRADE (METERS)							DECREASE IN LENGTH FOR UPGRADE (METERS)						
	Grades							Grades						
	3%	4%	5%	6%	7%	8%	9%	3%	4%	5%	6%	7%	8%	9%
40	3	3	3	6	6	9	9	3	3	3	3	3	3	6
50	3	6	6	9	9	12	12	3	3	3	6	6	6	6
60	6	6	9	12	15	18	20	3	6	6	6	6	9	9
70	6	9	12	15	18	25	27	6	6	6	9	9	12	12
80	9	12	18	20	25	30	- - -	6	9	9	12	12	15	- - -
90	12	15	20	25	30	35	- - -	6	9	12	12	15	15	- - -
100	15	20	27	34	40	- - -	- - -	9	12	15	15	18	- - -	- - -
110	18	25	30	40	45	- - -	- - -	12	12	15	18	20	- - -	- - -

MINIMUM STOPPING SIGHT DISTANCE
Table 2.7.1

MINIMUM PASSING SIGHT DISTANCE (METERS)
(Based on height of eye of 1.070 m and height of object 1 300 m above road surface)

Design Speed (km/h)	40	50	60	70	80	90	100
2-Lane, 2-Way Facilities	285	345	410	485	545	605	670

MINIMUM PASSING SIGHT DISTANCE
Table 2.7.2

2.8 Curves

2.8.1 Horizontal Curves

MAXIMUM DEFLECTION WITHOUT CURVE (DMS)			
TYPE FACILITY		$V \geq 70$ km/h	$V \leq 60$ km/h
Freeways		0° 45' 00"	NA
Arterials And Collectors	Without Curb & Gutter	0° 45' 00"	2° 00' 00"
	With Curb & Gutter	1° 00' 00"	2° 00' 00"
Where V = Design Speed			

MAXIMUM DEFLECTIONS WITHOUT HORIZONTAL CURVES
Table 2.8.1

LENGTH OF CURVE (METERS)	
Freeways	$6V_1$
Arterials	$3V_2$
Collectors	$3V_2$
Where V = Design Speed (km/h)	

1 When 6V cannot be attained, the greatest attainable length shall be used, but not less than 3V

2 When 3V cannot be attained, the greatest attainable length shall be used, but not less than 120 m

Curve length shall provide full superelevation within the curve of not less than 60 m (Rural) or 30 m (Urban)

LENGTH OF HORIZONTAL CURVES
Table 2.8.2

2.8 Curves

2.8.1 Horizontal Curves

MINIMUM RADIUS (m)			
Design Speed (km/h)	RURAL ENVIRONMENT (e max = 0 10) (R min)	URBAN ENVIRONMENT (e max = 0.05)	
		Without Curb And Gutter (R min)	With Curb And Gutter (R min)
40	45 0	60.0	60 0
50	75 0	99 0	99 0
60	115 0	150 0	150 0
70	160 0	215 0	215 0
80	210 0	280 0	280 0
90	275 0	376 0	——
100	360 0	493 0	——
110	455 0	636 0	——
Interstate 585 0 m Minimum Radius (Maximum Curvature) (e max = 0 10)			

MAXIMUM CURVATURE OF HORIZONTAL CURVE
(Using Limiting Values Of "e" and "f")

Table 2.8.3

MINIMUM RADIUS (m)	
Design Speed (km/h)	Radius
50	1165 0
60	1745 0
70	2330 0
80	2500.0
90	3495 0
100	3790 0
110	4350 0

MAXIMUM HORIZONTAL CURVATURE
USING NORMAL CROSS SLOPES

Table 2.8.4

2.8 Curves

2.8.2 Vertical Curves

K VALUES FOR CREST CURVES				
Design Speed km/h	FREEWAYS		ARTERIALS	COLLECTORS
	Interstate	Other		
40	—	—	5	5
50	—	—	9	9
60	—	—	18	16
70	—	30	30	25
80	—	48	36	32
90	71	56	52	48
100	90	75	70	55
110	125	110	100	—

Length, $L = KA$

Where L = Minimum Length (Meters)
K = Constant
A = Algebraic Differance In Grades, Percent

Interstates — Lengths of crest vertical curves on Interstate mainlines are not to be less than 300 m for open highways and 550 m within interchanges

Service Interchanges — K values for ramp crest vertical curves at freeway terminals are not to be less than the freeway K values K values for other ramp crest vertical curves are not to be less than arterial K values

System Interchanges — K values for all crest vertical curves on systems interchanges are not to be less than the K values of the higher system

Arterials and Collectors — The minimum lengths of crest vertical curves for highways with design speeds of 90 km/h or greater are as follows

Design Speed (km/h)	90	100	110
Minimum Length (m)	100	120	150

All Facilities — The lengths of crest vertical curves are not to be less than 0 6 times the design speed (km/h) expressed in meters

MINIMUM LENGTHS OF CREST VERTICAL CURVES
BASED ON STOPPING SIGHT DISTANCE

Table 2.8.5

2.8 Curves

2.8.2 Vertical Curves

K VALUES FOR SAG CURVES				
Design Speed km/h	FREEWAYS		ARTERIALS	COLLECTORS
	Interstate	Other		
40	—	—	10	10
50	—	—	12	12
60	—	—	18	18
70	—	25	25	20
80	—	30	25	25
90	40	40	35	30
100	50	45	40	40
110	52	50	45	—

Length, L = KA

Where L = Minimum Length (Meters)
K = Constant
A = Algebraic Differance In Grades, Percent

Interstates — Lengths of sag vertical curves on Interstate mainlines are not to be less than 244 m

Service Interchanges — K values for ramp sag vertical curves at freeway terminals are not to be less than the freeway K values. K values for other ramp sag vertical curves are not to be less than arterial K values

System Interchanges — K values for all sag vertical curves on systems interchanges are not to be less than the K values of the higher system

Arterials and Collectors — The minimum lengths of sag vertical curves for highways with design speeds of 90 km/h or greater are as follows

Design Speed (km/h)	90	100	110
Minimum Length (m)	75	90	115

All Facilities — The lengths of sag vertical curves are not to be less than 0 6 times the design speed (km/h) expressed in meters

MINIMUM LENGTHS OF SAG VERTICAL CURVES
BASED ON STOPPING SIGHT DISTANCE
AND HEADLIGHT SIGHT DISTANCE
Table 2.8.6

2.9 Superelevation

TABULATED VALUES

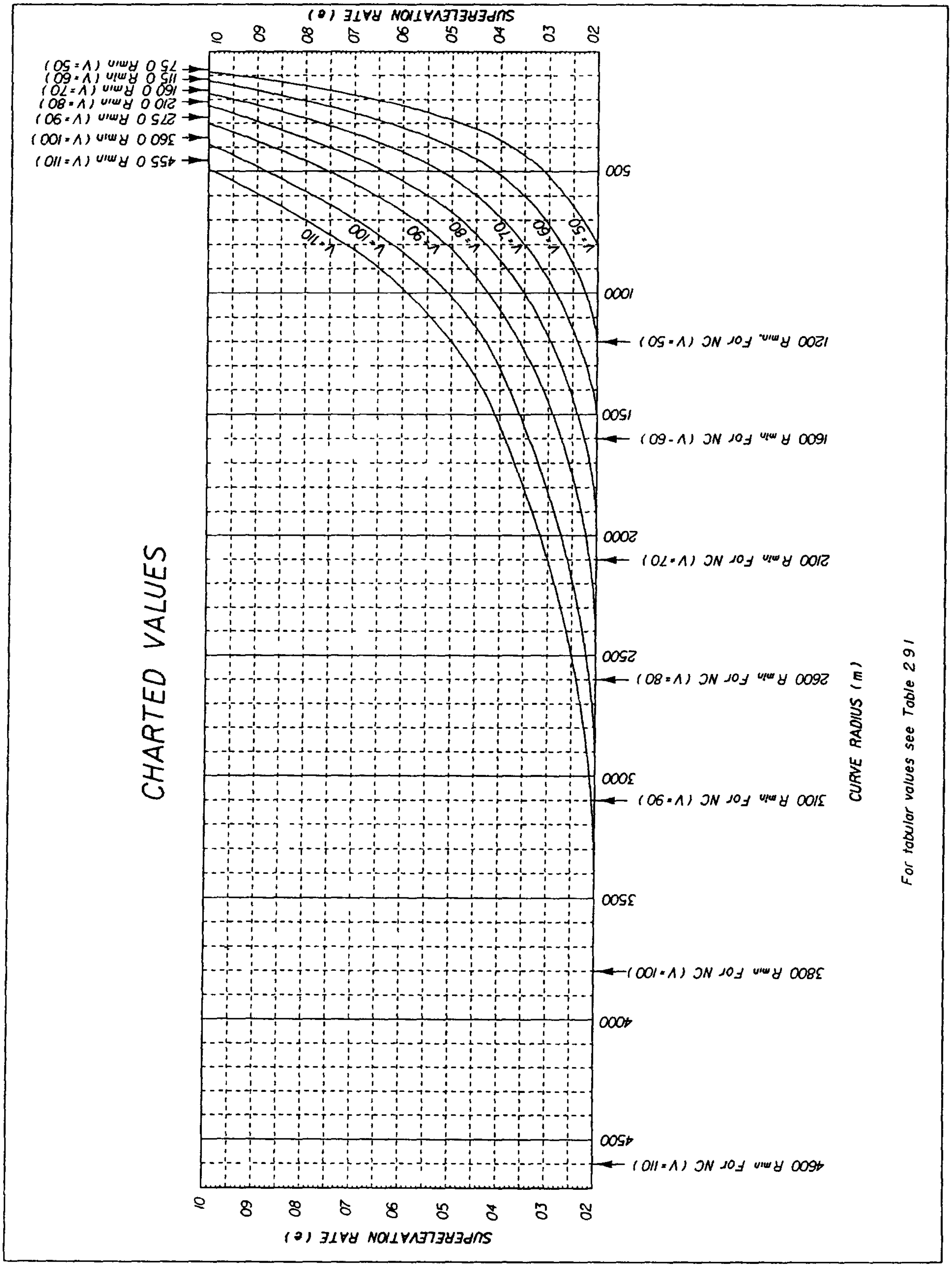
Radius (m)	Design Speed (km/h)						
	50	60	70	80	90	100	110
4600	NC	NC	NC	NC	NC	NC	NC
4500							RC
4400							
4300							
4200							
4100							
4000							
3900							
3800						NC	
3700						RC	
3600							
3500							
3400							
3300							
3200							RC
3100					NC		021
3000					RC		021
2900							022
2800						RC	022
2700						021	023
2600				NC		021	024
2500				RC		022	025
2400						023	026
2300					RC	024	027
2200					021	025	029
2100			NC		021	026	030
2000			RC		022	027	032
1900				RC	023	029	033
1800				021	024	030	035
1700				021	026	032	037
1600		NC		023	027	034	039
1500		RC	RC	024	029	036	041
1400			021	026	031	038	043
1300			022	027	033	040	046
1200	NC	RC	024	030	036	043	050
1100	RC	021	026	032	039	046	054
1000		022	029	035	043	051	059
900		025	032	039	046	056	065
800	RC	027	035	043	051	062	072
700	023	031	040	048	057	070	080
600	027	035	045	055	066	078	089
500	031	041	052	064	075	088	099
450	034	045	057	069	081	093	0.10 R min = 455.0
400	038	050	063	075	087	099	
350	042	056	069	082	093	0.10 R min = 360.0	
300	048	063	077	089	10		
250	056	071	085	096	0.10 R min = 275.0		
200	066	081	095	0.10 R min = 210.0			
175	072	087	10				
150	078	093	0.10 R min = 160.0				
125	086	099					
100	094	0.10 R min = 115.0					
	0.10 R min = 75.0						

NC = Normal Crown
RC - Reverse Crown (0.02)

SUPERELEVATION RATES FOR RURAL HIGHWAYS
URBAN FREEWAYS AND HIGH SPEED URBAN HIGHWAYS
$e_{max} = 0.10$

Table 2.9.1

2.9 Superelevation



SUPERELEVATION RATES FOR RURAL HIGHWAYS,
URBAN FREEWAYS AND HIGH SPEED URBAN HIGHWAYS
$e_{max} = 0.10$

Figure 2.9.1

2.9 Superelevation

TABULATED VALUES				
Radius R (m)	Design Speed (km/h)			
	50	60	70	80
1000+	NC	NC	NC	NC
900				NC
800				RC
700				
600			NC	
500			RC	
450				
400		NC		RC
350		RC		0.023
300			RC	0.036
275	NC		0.021	0.046
250	RC		0.029	Rmin. =
225		RC	0 041	267.9
200		0.020	Rmin =	
175		0.031	213.4	
150		0.046		
125	RC	Rmin. =		
100	0.034	146.3		
	Rmin. =			
	87.2			

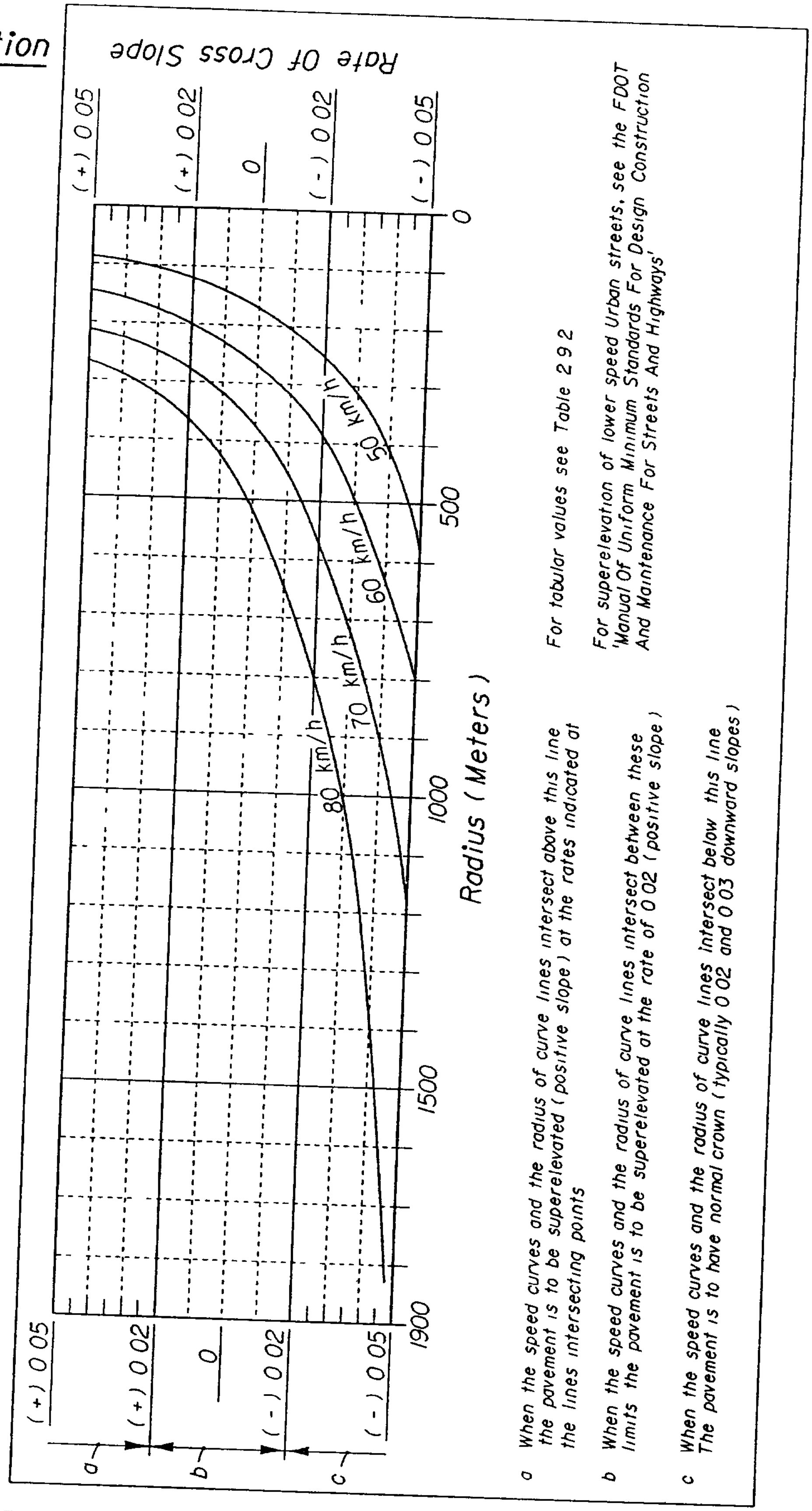
NC = Normal Crown
RC = Reverse Crown (0.02)

SUPERELEVATION RATES FOR URBAN HIGHWAY AND HIGH SPEED URBAN STREETS

$e_{max} = 0.05$

Table 2.9.2

2.9 Superelevation



SUPERELEVATION RATES FOR URBAN HIGHWAY AND HIGH SPEED URBAN STREETS

$e_{max} = 0.05$

Figure 2.9.2

2.9 Superelevation

SLOPE RATES FOR STRAIGHT LINE SUPERELEVATION TRANSITIONS			
SECTION	DESIGN SPEED, km/h		
	70-80	90-100	110
	SLOPE RATES		
2 Lane & 4 Lane	1: 200	1: 225	1: 250
6 Lane	1. 160	1· 180	1 200
8 Lane	1 150	1. 170	1 190

The length of superelevation transition is to be determined by the relative slope between the travel way edge of pavement and the profile grade, except that the minimum length of transition shall be 30 m

For additional information on transitions see Index No 510

SUPERELEVATION TRANSITION SLOPE RATES FOR RURAL HIGHWAYS, URBAN FREEWAYS AND HIGH SPEED URBAN HIGHWAYS

Table 2.9.3

SLOPE RATES FOR STRAIGHT LINE SUPERELEVATION TRANSITIONS	
50 km/h	1. 100
60 km/h	1: 125
70-80 km/h △	1: 150

△ 1 125 may be used for 70 km/h under restricted conditions

The length of superelevation transition is to be determined by the relative slope between the travel way edge of pavement and the profile grade, except that the minimum length of transition shall be 15 m for design speeds under 60 km/h and 20 m for design speeds of 60 km/h or greater
For addition information on transitions see Index No. 511

SUPERELEVATION TRANSITION SLOPE RATES FOR URBAN HIGHWAYS AND HIGH SPEED URBAN STREETS

Table 2.9.4

2.10 Vertical Clearances

2.10.1 Bridges

FACILITY TYPE	CLEARANCE [1,4,5] (METERS)		
	Roadway Or Railroad Over Roadway [2]	Roadway Over Railroad [3,4]	Pedestrian Over Roadway [2]
Freeways And Arterials	4 9	7 0	5 2
Collectors And Others	4 9	7 0	5 2

1 Clearance Measurement
The least vertical distance between the bridge structure and the surface of the roadway (traffic lanes and shoulders) or the top of the highest rail

2 Allowance To Be Added For Future Underpass Resurfacing On Rural Sections
100 mm over flexible pavements
150 mm over rigid pavements

3 Allowance To Be Added For Rail Resurfacing (Track Raised)
305 mm for conventional railroads
Others - see footnote No 4

4 Over High Speed Rail Systems
See Department guidelines and specifications for Intermediate Class Rail Operations entitled "Standard Specifications For The Design And Construction Of Railways"

5 Clearance Over Waterways·
See Department 'Drainage Manual', Topic No 625-040-001, Vol 1, Ch 4

VERTICAL CLEARANCE FOR BRIDGES
Table 2.10.1

2.10 Vertical Clearances

2.10.2 Signs

Overhead Sign Structures:

5.2 m over the entire width of the pavement and shoulder to the lowest sign component

Allowance to be added for future resurfacing on rural sections

100 mm over flexible pavements
150 mm over rigid pavements

2.10.3 Signals

1 Span Wire Mounted

5 2 m between the pavement and the bottom of any signal assembly.

2 Mast Arm Mounted:

5 2 m over the entire width of the pavement and shoulder to the lowest signal or low point on the arm

Allowance to be added for future resurfacing on rural sections:

100 mm over flexible pavements
150 mm over rigid pavements

3 Truss Mounted:

5.2 m over the entire width of the pavement and shoulders to the lowest signal or lowest member of the horizontal truss.

Allowance to be added for future resurfacing on rural sections:

100 mm over flexible pavements
150 mm over rigid pavements

2.11 Horizontal Clearances

PLACEMENT	Placement shall be in accordance with the Roadway and Traffic Design Standards. Placement within sidewalks shall be such that an unobstructed width of 1 2 m or more (not including the width of curb) is provided
SUPPORTS	Supports except overhead sign supports shall be frangible or breakaway When practicable, sign supports should be located behind barriers that are justified for other reasons Overhead sign supports shall be shielded

HORIZONTAL CLEARANCE FOR TRAFFIC CONTROL SIGNS
Table 2.11.1

CONVENTIONAL LIGHTING PLACEMENT	Rural (Flush Shoulders) 6 1 m from the travel lane, 4 3 m from auxiliary lane (may be clear zone width when clear zone is less than 6 1 m) Urban (Curb and Gutter) From right of way line to 1 2 m back of the face of curb (may be 0 8 m back of the face of curb when all other alternatives are deemed impractical) Placement within sidewalks shall be such that an unobstructed width of 1 2 m or more (not including the width of curb) is provided
HIGH MAST LIGHTING	Outside of the clear zone unless shielded

HORIZONTAL CLEARANCE FOR LIGHT POLES
Table 2.11.2

2.11 Horizontal Clearances

Shall not be located within the limited access right of way

Shall not be located in the median

Rural

Not within the clear zone and as close as practical to the right of way without aerial encroachments onto private property

Urban

From right of way line to 1 2 m back of the face of the curb (may be 0 8 m back of the face of the curb when all other alternates are deemed impractical) Placement within sidewalks shall be such that an unobstructed width of 1 2 m or more (not including the width of the curb) is provided

HORIZONTAL CLEARANCE FOR UTILITY POLES, FIRE HYDRANTS, ETC

Table 2.11.3

FREEWAYS	Not permitted
RURAL HIGHWAYS	Post shall be placed at shoulder point but the face of the box shall be no closer than 2 4 m from the edge of the traffic lane
CURB AND GUTTER SECTIONS	With Utility Strip Face of box shall be 150 mm to 300 mm back of the face of the curb Without Utility Strip Locate at back of sidewalk
For additional information see Index No 532	

HORIZONTAL CLEARANCE TO MAILBOXES

Table 2.11.4

2.11 Horizontal Clearances

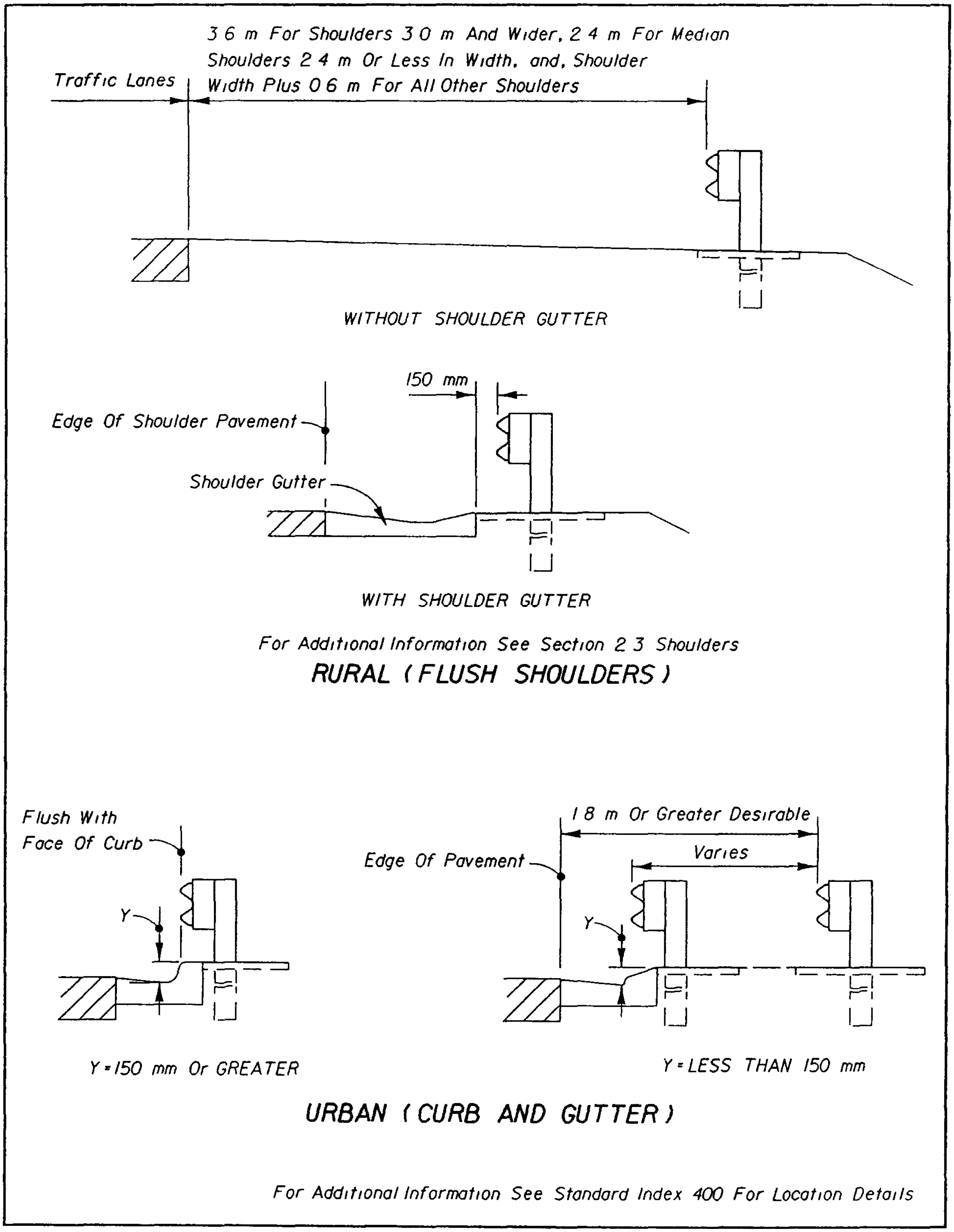
Shall not be located in medians Should be located as far from traffic lanes as practicable Placement within sidewalks shall be such that an unobstructed width of 1.2 m or more (not including the width of curb) is provided

HORIZONTAL CLEARANCE TO SIGNAL POLES AND CONTROLLER CABINETS FOR SIGNALS
Table 2.11.5

Trees shall be outside the clear zone if diameter is or is expected to be greater than 100 mm (measured 150 mm above the ground)

HORIZONTAL CLEARANCE TO TREES
Table 2.11.6

2.11 Horizontal Clearances



HORIZONTAL CLEARANCE TO GUARDRAIL
Figure 2.11.1

2.12 Clear Zone

CLEAR ZONE WIDTH (METER)						
	Rural				Urban (With Curb And Gutter)	
	≥ 1500 AADT		< 1500 AADT			
Design Speed km/h	Travel Lanes & Multi-Lane Ramps	Auxiliary Lanes & Single Lane Ramps	Travel Lanes & Multi-Lane Ramps	Auxiliary Lanes & Single Lane Ramps	All Outside Lanes	All Median Lanes
<70	5.4	3.0	4.8	3.0	1.2	1.8
70	7.3	4.2	6.0	4.2		
80	7.3	4.2	6.0	4.2	NA	NA
90	9.1	5.4	7.3	4.2		
>90	11.0	7.3	9.1	5.4		

Above clear zone widths are for side slopes of 4:1 or flatter.

AADT = Mainline 20 year projected annual average daily traffic.

Clear zone widths shall be adjusted on the outside of horizontal curves with flush shoulders in accordance with Table 2.12.2.

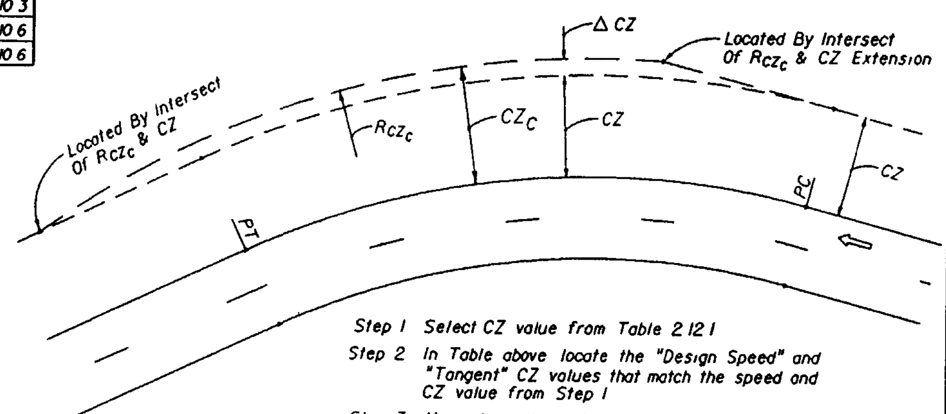
Clear zone widths for facilities without curbs are measured from the edge of the traffic lane.

Clear zone widths for outside curbs are measured from the face of the curb. Clear zone width for median curbs are measured from the edge of the inside lane.

CLEAR ZONE WIDTHS
Table 2.12.1

CLEAR ZONE OF CURVED ALIGNMENT (CZ_c) METERS

RADIUS (METERS)	Design Speed (km/h)																							
	50			60			70			80			90				100				110			
Tangent CZ	3.0	4.8	5.4	3.0	4.8	5.4	4.2	6.0	7.3	4.2	6.0	7.3	4.2	5.4	7.3	9.0	5.4	7.3	9.0	11.0	5.4	7.3	9.0	11.0
6985.0	3.0	4.8	5.4	3.0	4.8	5.4	4.2	6.0	7.3	4.2	6.0	7.3	4.2	5.4	7.6	9.4	5.4	7.6	9.4	11.3	5.7	7.6	9.4	11.3
3495.0	3.0	4.8	5.4	3.0	4.8	5.4	4.2	6.4	7.6	4.2	6.4	7.6	4.5	5.7	7.6	9.4	5.7	7.6	9.4	11.6	5.7	7.6	9.7	11.6
2330.0	3.0	4.8	5.4	3.0	4.8	5.7	4.5	6.4	7.6	4.5	6.4	7.6	4.5	5.7	7.6	9.7	5.7	7.9	9.7	11.9	6.0	7.9	10.0	11.9
1745.0	3.0	4.8	5.4	3.0	5.1	5.7	4.5	6.4	7.6	4.5	6.4	7.9	4.5	6.0	7.9	9.7	6.0	8.2	10.0	12.2	6.0	8.2	10.3	12.2
1165.0	3.0	4.8	5.4	3.3	5.1	5.7	4.5	6.4	7.9	4.5	6.7	7.9	4.8	6.0	8.2	10.0	6.4	8.2	10.3	12.5	6.4	8.5	10.6	12.8
875.0	3.0	5.1	5.7	3.3	5.1	5.7	4.5	6.7	7.9	4.8	7.0	8.2	4.8	6.4	8.5	10.6	6.4	8.8	11.0	13.1	6.7	8.8	11.3	13.4
700.0	3.3	5.1	5.7	3.3	5.1	6.0	4.8	6.7	8.2	5.1	7.3	8.5	5.1	6.4	8.8	11.0	6.7	9.0	11.3	13.4	7.0	9.4	11.6	14.0
585.0	3.3	5.1	5.7	3.3	5.4	6.0	4.8	7.0	8.5	5.1	7.3	8.8	5.1	6.7	9.0	11.3	7.0	9.4	11.6	14.0	7.3	9.7	12.2	14.6
500.0	3.3	5.1	5.7	3.3	5.4	6.0	4.8	7.0	8.5	5.4	7.6	9.0	5.4	7.0	9.0	11.6	7.3	9.7	12.2	14.6	7.6	10.0	12.8	15.0
455.0	3.3	5.1	6.0	3.6	5.4	6.4	5.1	7.3	8.8	5.4	7.6	9.0	5.4	7.0	9.4	11.9	7.6	10.0	12.5	14.9	7.9	10.6	13.1	15.8
360.0	3.3	5.4	6.0	3.6	5.7	6.4	5.1	7.6	9.0	5.4	7.9	9.4	5.7	7.6	10.0	12.5	7.9	10.6	13.4	15.8				
350.0	3.3	5.4	6.0	3.6	5.7	6.4	5.1	7.6	9.0	5.4	7.9	9.4	5.7	7.6	10.0	12.5	7.9	10.6	13.4	15.8				
290.0	3.3	5.4	6.0	3.6	6.0	6.7	5.4	7.9	9.4	5.7	8.2	10.0	6.0	7.9	10.6	13.1								
275.0	3.6	5.4	6.4	3.9	6.0	7.0	5.7	8.2	9.7	6.0	8.5	10.3	6.4	8.2	11.0	13.4								
250.0	3.6	5.4	6.4	3.9	6.0	7.0	5.7	8.2	9.7	6.0	8.5	10.3												
220.0	3.6	5.7	6.4	3.9	6.4	7.0	5.7	8.5	10.0	6.4	9.0	11.0												
210.0	3.6	5.7	6.4	3.9	6.4	7.3	6.0	8.8	10.3	6.4	9.0	11.0												
195.0	3.6	5.7	6.4	3.9	6.4	7.3	6.0	8.8	10.3															
175.0	3.6	5.7	6.7	4.2	6.7	7.6	6.4	8.8	10.6															
170.0	3.6	5.7	6.7	4.2	6.7	7.6	6.4	9.0	10.6															
160.0	3.6	6.0	6.7	4.2	6.7	7.6																		
145.0	3.9	6.0	7.0	4.5	7.0	7.9																		
134.0	3.9	6.0	7.0	4.5	7.3	8.2																		
132.0	3.9	6.0	7.0	4.5	7.3	8.2																		
125.0	3.9	6.4	7.0																					
115.0	3.9	6.4	7.3																					
98.0	3.9	6.7	7.6																					
97.0	4.2	6.7	7.6																					
87.0	4.2	6.7	7.6																					
79.0	4.2	7.0	7.9																					
75.0	4.5	7.3	8.2																					



Step 1 Select CZ value from Table 2.12.1

Step 2 In Table above locate the "Design Speed" and "Tangent" CZ values that match the speed and CZ value from Step 1

Step 3 Move down the radius column to the radius under consideration then across the table to the column found under Step 2 to find the CZ_c value

CZ_C

CLEAR ZONE WIDTHS ON CURVED ALIGNMENTS ON HIGHWAYS WITH FLUSH SHOULDERS

Table 2.12.2

2.15 Lighting Criteria

CONVENTIONAL LIGHTING - ROADWAYS			
ROADWAY CLASSIFICATIONS	ILLUMINATION LEVEL AVERAGE INITIAL (LUX)	UNIFORMITY RATIOS	
		AVG /MIN	MAX /MIN
INTERSTATE, EXPRESSWAY, FREEWAY & MAJOR ARTERIALS	16	4 1 OR LESS	10 1 OR LESS
ALL OTHER ROADWAYS	11	4 1 OR LESS	10 1 OR LESS

NOTE These values should be considered standard, but should be increased if necessary to maintain an acceptable uniformity ratio The maximum value should be one and one-half these values

Table 2 15 1

HIGHMAST LIGHTING - ROADWAYS			
ROADWAY CLASSIFICATIONS	ILLUMINATION LEVEL AVERAGE INITIAL (LUX)	UNIFORMITY RATIOS	
		AVG /MIN	MAX /MIN
INTERSTATE, EXPRESSWAY, FREEWAY & MAJOR ARTERIALS	9 TO 11	3 1 OR LESS	10 1 OR LESS
ALL OTHER ROADWAYS	9 TO 11	3 1 OR LESS	10 1 OR LESS

Table 2 15 2

UNDERDECK LIGHTING - ROADWAYS		
LUMINAIRE TYPE	LIGHT SOURCE	MOUNTING LOCATION
PIER CAP	150 WATT TO 250 WATT HPS	PIER OR PIER CAP
PENDANT HUNG	150 WATT TO 250 WATT HPS	BRIDGE DECK

NOTE The light levels for underdeck lighting shall be equal to the adjacent roadway lighting

Underdeck lighting is accomplished by mounting either pier cap or pendant hung fixtures under the bridge structure

Pier cap luminaires should be installed when bridge piers are located less than 4 6 meters from edge of travel lane

Pendant hung luminaires shall be mounted to the bottom of the bridge deck and should suspend where 50% of the lamp is below bridge beam

Table 2 15 3

REST AREA LIGHTING			
AREA ILLUMINATED	ILLUMINATION LEVEL AVERAGE INITIAL (LUX)	UNIFORMITY RATIOS	
		AVG / MIN	MAX / MIN
ENTRANCE & EXIT	16	4 1 OR LESS	10 1 OR LESS
INTERIOR ROADWAYS	16	4 1 OR LESS	10 1 OR LESS
PARKING AREAS	16	4 1 OR LESS	10 1 OR LESS

Table 2 15 4

MOUNTING HEIGHT RESTRICTIONS		
LUMINAIRE WATTAGE	LIGHT SOURCE	MOUNTING HEIGHT (MIN)
150	HIGH PRESSURE SODIUM (HPS)	7 5 METERS
200	HIGH PRESSURE SODIUM (HPS)	9 0 METERS
250	HIGH PRESSURE SODIUM (HPS)	9 0 METERS
400	HIGH PRESSURE SODIUM (HPS)	12 0 METERS
750	HIGH PRESSURE SODIUM (HPS)	15 0 METERS
1000	HIGH PRESSURE SODIUM (HPS)	24 0 METERS

Table 2 15 5

Chapter 3

Earthwork (Metric)

CHAPTER 3

EARTHWORK (METRIC)

3.1 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 highway project Sections 120 and 125 of the Standard Specifications define the terms, method of measure, basis of payment and pay items associated with earthwork

In general, earthwork on a highway project consists of

(1) Classified excavation - Earthwork designated as Regular (Roadway and Borrow), Subsoil, Lateral Ditch and Channel Excavation

(2) Unclassified Excavation - Excavation, removal and disposal of material, for pipe culverts, bridge foundations, box culverts, storm sewers, inlets, manholes and similar structures where the materials are unclassified and considered as excavation regardless of the material encountered

(3) Embankment - Compacted fill material needed to construct the roadway, excluding the base and pavement portions of the roadway and shoulders Embankment includes compacted backfill to replace unsuitable material excavated within the lines and grades shown in the plans

EARTHWORK

BASIC PROCESS

The most important operation involving earthwork is constructing the roadbed. The roadbed is constructed by excavating soil from CUT sections -- and placing soil as embankments in FILL sections. In cut sections, the roadbed is built below the natural ground -- the natural ground is excavated to the elevation of the proposed roadbed. In fill sections, the roadbed is built above the natural ground -- the earth fills an embankment.

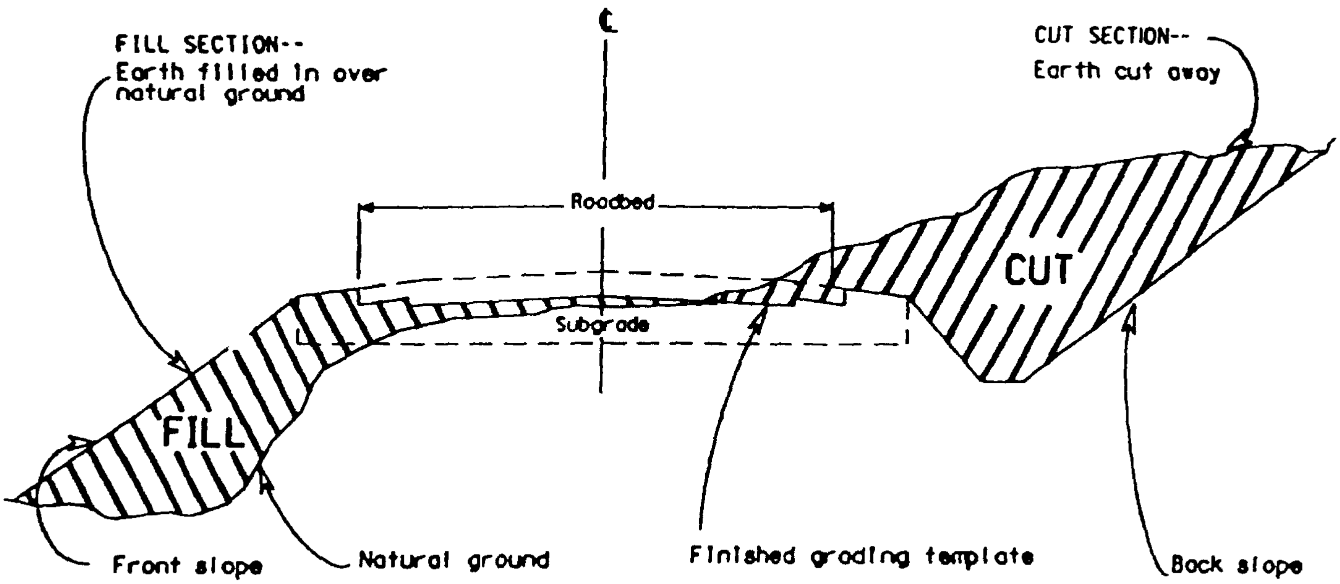


Exhibit 3-A

3.2 <u>Classification of Soils</u>

The Department uses a system of soil classification which places materials into groups and subgroups based on soil fracture, liquid limit and plasticity index This classification determines <u>if</u> and <u>where</u> the materials may be placed or left in their original position on a highway project The designer cannot determine the proper removal and utilization of earthwork materials until the soils survey, testing and classification of materials has been performed by a qualified geotechnical laboratory For more details, see the Volume II of the Plans Preparation Manual (English version) and Index 505, <u>Roadway and Traffic Design Standards</u>

3.3 Removal and Utilization

Earthwork is a major cost component of highway construction The accurate detailing, utilization and calculation of earthwork is a very important part of the design effort Earthwork is not a simple task, but with proper care and attention, very accurate quantities can be determined

3 3 1 Criteria for Earthwork Details

The details of removal and utilization of earthwork are shown on the roadway 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 roadway template at each location where an existing cross section was obtained Sometimes it is advisable to develop and plot intermediate cross sections or half-sections to accurately determine quantities

For resurfacing and minor widening and resurfacing projects, refer to Section 3 5 7 of this chapter

Additional criteria used for plotting the earthwork details are found in the Standard Specifications, Section 120, the Roadway and Traffic Design Standards, Indexes 500 and 505, and Volume II of the Plans Preparation Manual (English version)

3 3 2 Cross Sections - A Design Tool

Roadway cross-sections cannot be finalized until late in the design process However, preliminary cross section templates, 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 templates should be plotted as soon as the alignment, grades and typical section details are established

3.4 Earthwork Quantities

3 4 1 Method of Calculating

Earthwork quantities can be accurately determined by computer or by plan calculation, if proper care is taken Therefore, the specifications allow it to be designated for payment as the original plan quantity unless determined to be substantially in error Earthwork quantities are calculated by the method of average end areas

$$CUBIC\ METERS = \frac{EA1 + EA2}{2} \times LENGTH$$

Each set of end areas for the different types of earthwork (cut, fill, subsoil, etc) are calculated separately and shown in the appropriate column on the cross section sheets, as indicated in Volume II of the Plans Preparation Manual (English version)

3 4 2 Suitable and Unsuitable Materials

Select material or suitable material and plastic, muck or unsuitable materials are calculated and tabulated separately Material is also summarized in pay item categories as Roadway Excavation, Subsoil Excavation and Embankment or Fill The designer must be familiar with the material classes, basis of payment and the specifications for earthwork operations in order to properly delineate and calculate earthwork quantities

TABULATION OF UNSUITABLE MATERIAL ON LEFT SIDE OF CROSS SECTION SHEETS

(1) A-7 MATERIAL A-8 MATERIAL A-2-5, A-2-7, A-5 MATERIAL					
(2) SUBSOIL EXC		(3) RDWY EXC		(4) FILL	
A	V	A	V	A	V

TABULATION OF SUITABLE MATERIAL ON RIGHT SIDE OF CROSS SECTION SHEETS

(5) A-2, A-3 MATERIAL					
(6) SUBSOIL EXC		(7) RDWY EXC		(8) FILL	
A	V	A	V	A	V

(1) UNSUITABLE MATERIAL on a project may consist of one or more of the classifications shown The tabulation should be "titled" with the actual classification for the given project as documented by the soil survey

(2) SUBSOIL EXCAVATION (UNSUITABLE) is material that does not meet the specification requirements in its original position so it must be excavated and backfilled with suitable material It must also be below the finished grading template to be subsoil excavation

(3) ROADWAY EXCAVATION (UNSUITABLE) is material that may be used in the earthwork only as stipulated in the standards and specifications, if allowed at all It will be removed by excavating to the lines and grades of the finished grading template It must be above the bottom of the finished grading template to be roadway excavation

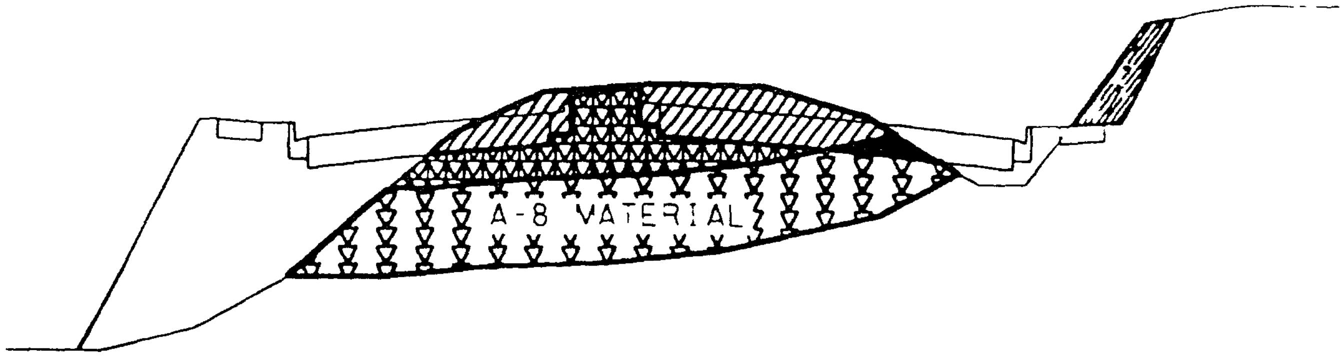
(4) FILL (UNSUITABLE) is material that does not meet the requirements for suitable material but may be utilized in certain areas of the embankment as indicated in Standard Index 505

(5) SUITABLE MATERIAL consists of those classifications that have been determined to be acceptable for construction of the roadbed, shoulders and other embankments of the highway

(6) SUBSOIL EXCAVATION (SUITABLE) is material that would be acceptable in its original position, but it must be excavated below the finished grading template in order to remove material below it that is unsuitable in its original position

(7) ROADWAY EXCAVATION (SUITABLE) is the good or acceptable material removed by excavating to the bottom of the finished grading template

(8) FILL (SUITABLE) is the material utilized in the embankment in those areas calling for select material by the Standards and Specifications Fill material is placed above the natural ground surface up to the bottom of the finished grading template Fill material includes the backfill required to replace all subsoil excavation



CUT
AREA BELOW NATURAL GROUND LINE AND ABOVE THE BOTTOM OF THE PROPOSED ROADWAY TEMPLATE

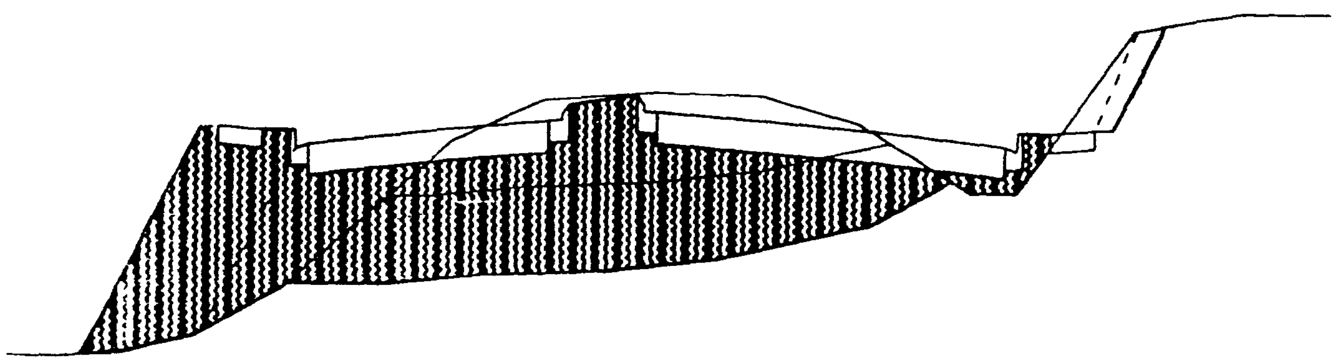
REGULAR EXCAVATION -- SUITABLE MATERIAL

REGULAR EXCAVATION -- UNSUITABLE MATERIAL

SUBSOIL EXCAVATION
ALL SUITABLE AND UNSUITABLE MATERIAL BELOW THE BOTTOM OF THE PROPOSED ROADWAY TEMPLATE AND ABOVE THE BOTTOM OF THE LAYER OF UNSUITABLE MATERIAL

SUBSOIL EXCAVATION -- SUITABLE MATERIAL

SUBSOIL EXCAVATION -- UNSUITABLE MATERIAL



FILL
AREA BELOW THE BOTTOM OF THE PROPOSED ROADWAY TEMPLATE AND ABOVE THE BOTTOM LAYER OF UNSUITABLE MATERIAL

FILL - SUITABLE MATERIAL

Exhibit 3-B

3 4 3 Earthwork Accuracy

There are two methods of documenting the earthwork quantities for projects The most accurate and preferred method involves the preparation of cross-sections to define the quantities of earthwork involved This method is mandatory on all new construction and major reconstruction projects The other method, using working typical sections, is only to be used on RRR type projects where it has been determined that the project is a candidate for payment by Regular Excavation, Lump Sum It is critical that the designer choose which method is best suited for their project with input from construction

The calculation of earthwork volumes is not simple but, when performed with care and properly checked, many of the inaccuracies common in earthwork quantity calculations can be avoided The primary causes for inaccurate earthwork quantities are found to be errors in calculating end areas and choosing inappropriate intervals between the cross sections Correct methods and techniques for computing earthwork quantities will eliminate the gross errors

3 4 3 1 Projects with horizontal and vertical controlled cross sections

1 Calculate end areas and volumes by computer, when possible, and print the calculations for verification and future use by others

2 Plot cross section details at the largest scale the sheets will permit This is especially critical if plotting is done manually and the end areas are to be calculated from the plotted sections Care should also be taken when plotting slopes that extend over long distances

3 If end areas are calculated from cross sections manually, show the breakdown of areas, etc on work sheets and include these as backup in the computation book

4 When computing volumes, determine lengths between sets of end areas to compensate for volumes that do not run the entire lengths between the normal station lengths

5 Properly use match lines and turning lines to divide end areas when separate lengths should be used to calculate volumes

6 Reduce the interval between cross sections to 10 meters or less on ramps or sharp turning roadways, or determine and use the centroid of the section as the length for computing volumes

7 Proper use of cross section pattern sheets to determine where cross sections should be taken, will help yield more accurate volumes

8 Exclude bridge spans, large culverts or other exceptions where earthwork is not required

9 Include quantities for fill slopes under bridges, at guardrail installations and at culvert extensions Show extended shoulder slope on cross sections at guardrail locations (not steeper than 10 to 1 per Standard Index 400, Sheet 8 of 14)

10 Make sure that backfill for <u>all</u> subsoil excavation is added to the roadway fill quantities

11 Separate all Suitable and Unsuitable Subsoil Excavation Calculate Roadway Excavation as Suitable and Unsuitable quantities Show these end areas and tabulations on the work sheets so they can be verified and used by others Make sure these quantities are tabulated in the proper columns on the cross section sheets

3 4 3 2 Projects without horizontal and vertical controlled cross sections

1 Include working typical cross sections in the computation book at all locations where there is a change in either the existing or proposed templates

2 Working typicals should include the station limits of the typical, and the end areas of all cut and fill sections Working typicals may be placed in the plans, but are not required

3 The thickness of the base box shall be calculated on the most probable base option A plan note should also be shown in the plans stating which option was used for calculating the earthwork quantities

4 Extra fill material needed for the extended shoulder for guardrail placement should be documented in the computation book with the final quantity being tabulated on the summary of earthwork The quantity should be based on working typical sections showing the extended shoulder slope on cross sections at guardrail locations (not steeper than 10 to 1 per Standard Index 400, Sheet 8 of 14)

3 4 4 Variation in Quantities

When detailing and determining earthwork quantities, the designer should use the most probable base option within the optional base group, as identified in the pavement design and indicated on the typical section 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 The Specifications do not allow adjustment of the earthwork quantities that were designated to be paid as plan quantity because a base of different depth was chosen during construction

3 4 5 Sequence of Construction

The designer must be aware of the Traffic Control Plan and, to some extent, the most likely sequence of construction for the project when figuring earthwork utilization If the contractor cannot excavate material because of a detour or other TCP requirements, different provisions may need to be made in the earthwork items for the project

EXAMPLE A project has balanced earthwork quantities, i e , embankment is balanced by sufficient excavation to offset it The embankment is required in Phase I of the construction During this Phase, the area where the excavation is to be obtained is still under traffic and can NOT be excavated Unless this is realized and taken care of by design, a Supplemental Agreement will most likely be required to establish a pay item for the materials and work It could even result in the contractor filing a claim for delay of the work

SOLUTION The designer should change the TCP and construction sequence to ensure that the material in the excavation area is available when it is needed, if possible Or, if the project is not a balanced job and already has Borrow set up as a pay item, make sure the quantity includes a sufficient amount to cover the embankment in Phase I The Excavation could then be used to reduce Borrow later in the project, when it is free of traffic and could be excavated Or, it may be necessary to set up an item for Borrow and then pay for the excavation as Regular Excavation and waste it

3 4 6 Earthwork by Computer

The Department has several options for computing earthwork quantities by computer, In detailing the cross sections on the CADD or other automated system, the requirements and techniques noted above are just as applicable and necessary for accuracy

3.5 Earthwork Items of Payment

3 5 1 Regular Excavation

This is the most general classification of earthwork excavation When Lateral Ditch or other excavation pay items are not called for in the plans, the total quantity of all excavation shall be paid for as regular excavation Roadway Excavation consists of the net volume of material excavated between the original ground surface and the bottom of the proposed roadway template

Retention or detention areas that require considerable excavation should be summarized separately and added into the Regular Excavation. This is especially important if there is a large quantity and the area is removed from the project by some distance

Projects where the predominate earthwork item is roadway excavation should designate Regular Excavation as the pay item, then the embankment would not be paid for as a separate item, as a general rule

3 5 5 Borrow Excavation

Borrow Excavation is the pay item used to indicate that the contractor is to furnish earthwork material from areas provided by him and generally outside the project limits, including material with a specific minimum bearing value for building up existing shoulders, when appropriate for the project

Borrow material, if available, may be obtained from within the right of way of the project, including those projects where the material is to be paid for under the embankment pay item Each project must be analyzed to determine if this option is feasible FHWA concurrence is required on federal-aid projects prior to utilization of the right of way as a source of borrow

Obtaining material from the project right of way shall not create an unsafe condition or unprotected hazard Proper design criteria shall be applied to proposed excavated areas which will fill with water

The proposed borrow areas shall be reviewed and coordinated with the District Environmental Coordinator to minimize environmental disturbance and promote a future natural appearance

The designer has two options for designating the method of payment for borrow material on highway projects With either option, a fill adjustment must be made to the net total fill material calculated from the plans, to allow for handling Recommendations on fill adjustment percentages should always be obtained from the District Materials and Construction Offices during the design process Because the final measurement procedures are very labor intense, the designer should always check with construction before setting up a project for Borrow Excavation (Pit Measure)

1 Borrow Excavation (Pit Measure) - When the designer, with input and recommendations from construction, determines that the borrow material shall be measured by pit measure, the Earthwork Summary should show the adjusted quantity of borrow material estimated to be required

<u>EXAMPLE</u>	Fill (From Cross Section Totals)	253 m^3
	Fill Adjustment (+35%) (253 x 0 35)	<u>89 m^3</u>
	Total fill	342 m^3
	Roadway Excavation (Select) Deducted	<u>115 m^3</u>
	Borrow Excavation (Pay Item Total)	227 m^3

2 Borrow Excavation (Truck Measure) - The designer's second option for designating how borrow material shall be bid and paid on projects is truck measure Truck measure should be specified only for projects which require small amounts of borrow material Typical types of projects are small resurfacing projects, widening and safety projects When this option is designated, an <u>additional</u> <u>adjustment</u> (truck) is added to obtain a representative volume of material required This is not a plan quantity item, but it is very important that the most realistic determination of quantities possible be calculated by the designer

<u>EXAMPLE</u>	Borrow Excavation (As Above)	227 m^3
	Truck Adjustment (+25%) (227 x 0 25)	<u>57 m^3</u>
	Borrow Excavation (Pay Item)	284 m^3

On some projects it is desirable that construction have the flexibility to pay for the item of borrow by pit measure, but determine the volume by loose truck measure When this method of measurement is requested by construction, it will be necessary for the designer to calculate a percentage by which the truck measured quantity will be adjusted to determine the pit measured volume This percentage compensates for the truck adjustment and converts the quantity back to its in-place volume A pay item note similar to the following should be shown in the plans

> At the contractor's option, and with the approval of the engineer, measurement of borrow material may be based on loose truck volumes In this case, payment will be made on _______% of the truck measured quantity

The percentage for the above note is calculated as follows

<u>EXAMPLE</u>	Borrow Excavation	227 m^3
	Truck Adjustment (+25%)	<u>57 m^3</u>
	Total Borrow	284 m^3

Percentage (%) is obtained from $227\ m^3 - 284\ m^3 = 80\%$

3 5 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 template, 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 or roadway Excavation If there is a significant amount of Lateral Ditch Excavation, it should be detailed, calculated and summarized on separate cross section sheets and shown separately in the Earthwork Summary For more details on lateral ditch cross sections, see the Plans Preparation Manual, Volume II (English vresion)

Excavation included for payment or that will be bid as work under Section 125 (Excavation for Structures) must not be included again in Lateral Ditch or other Excavation pay items

3 5 4 Subsoil Excavation

The payment for Subsoil Excavation should <u>NEVER</u> be included in other pay items, and subsoil quantities should <u>NOT</u> be included in other quantities, no matter how small the quantities are

The pay item, Subsoil Excavation, consists of the excavation and disposal of muck, clay, rock or any other material that is unsuitable in its original position and that is excavated below the bottom of the finished grading template Subsoil Excavation also includes all suitable material (usually above the unsuitable material, i e , overburden) excavated within the above limits in order to excavate the unsuitable material

The soils investigation survey must document the limits of any unsuitable material found on the project Likewise, the cross sections and the earthwork calculations must use these limits in determining the quantities for Subsoil Excavation

Unsuitable subsoil areas and volumes shall be tabulated on the left side of the cross section sheets, and areas and volumes for the suitable subsoil excavation shall be tabulated on the right side of the cross section sheets The fill quantities (areas and volumes) on the right shall also include areas and volumes required to backfill the excavated areas created by all subsoil removal See example given in Section 3 4 2 of this chapter

3 5 5 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 should be detailed, calculated and summarized separately, in most cases

3 5 6 Embankment

This item includes placing material above the original ground line and within the lines and grades indicated by the plans When subsoil excavation is involved, the embankment must include the material necessary to backfill all of the material excavated

When the work of constructing the embankment is shown to be paid for as Embankment, such price and payment shall be full pay for all the earthwork specified in Section 120, including all excavating, dredging, pumping, placing, compacting, dressing, and protection of the completed earthwork So, when Embankment (pay item) is used, no other earthwork items are generally required Subsoil, however, will always be paid for as a separate item Also, if there are large amounts of lateral ditch or channel excavation, these should be specified to be paid for as separate items of work

The decision to use Embankment or Borrow Excavation as items of payment should be made with recommendation from the responsible District Construction Office This decision will have an impact on the manpower required to control the work and document the final estimate records

Generally, Embankment should be used as the pay item when the project is predominately a fill earthwork project Most new construction and major reconstruction projects should be considered for payment under this earthwork item The Summary of Earthwork quantities will show the net fill quantity, with no shrinkage applied

Only when the project has very little embankment or when construction specifically requests it, should the borrow excavation pay item be used (See borrow excavation, Section 3 5 2)

SUMMARY OF EARTHWORK (CUBIC METERS)		
ROADWAY EXCAVATION, A-2, A-3 MATERIAL	=	10 000
ROADWAY EXCAVATION, A-7 MATERIAL	=	800
ROADWAY EXCAVATION, A 8 MATERIAL	=	1 005
EXCAVATION FROM LATERAL DITCHES	=	5 000
TOTAL ROADWAY EXCAVATION (ROADWAY AND DITCH)	=	**16 805**
EMBANKMENT	=	**7 000**
SUBSOIL EXCAVATION, A-2, A-3 MATERIAL	=	980
SUBSOIL EXCAVATION, A-7 MATERIAL	=	1 400
SUBSOIL EXCAVATION, A-8 MATERIAL	=	800
TOTAL SUBSOIL EXCAVATION	=	**3 180**

3 5 7 Regular Excavation - Lump Sum (3-R Projects only)

The Pay Item for Regular Excavation - Lump Sum (3-R Projects only) is to be used only on resurfacing or minor widening and resurfacing projects which conform to the same guidelines given in the Plans Preparation and Assembly volume

Earthwork will be paid for as Borrow Excavation (Truck Measure) and Regular Excavation - Lump Sum (3-R Projects only) The designer will calculate these quantities based on information obtained from the field and the proposed typical section The designer will have to allow for additional time in the field to gather data on the existing field conditions using a hand level (See Exhibit 3-C)

The designer will continue to show the Summary of Earthwork in the plans The summary should show all quantities and adjustments

SUMMARY OF EARTHWORK (CUBIC METERS)		
FILL	=	253
GUARDRAIL LOCATIONS	=	70
CROSS DRAINS	=	100
		423
FILL ADJUSTMENT (35%) (423 x 0 35)	=	148
TOTAL FILL	=	**571**
REGULAR EXCAVATION	=	- 215
BORROW EXCAVATION	=	356
TRUCK ADJUSTMENT (25%) (356 x 0 25)	=	89
TOTAL BORROW EXCAVATION	=	**445**

The pay items used will be Regular Excavation - Lump Sum
Borrow Excavation (Truck Measure) 445 M3

3.6 Summary

Regardless of the decisions made about establishing the items of pay for the earthwork on a project, it is imperative that the designer

1 Obtain good soil survey data, especially the limits of unsuitable material within the project limits

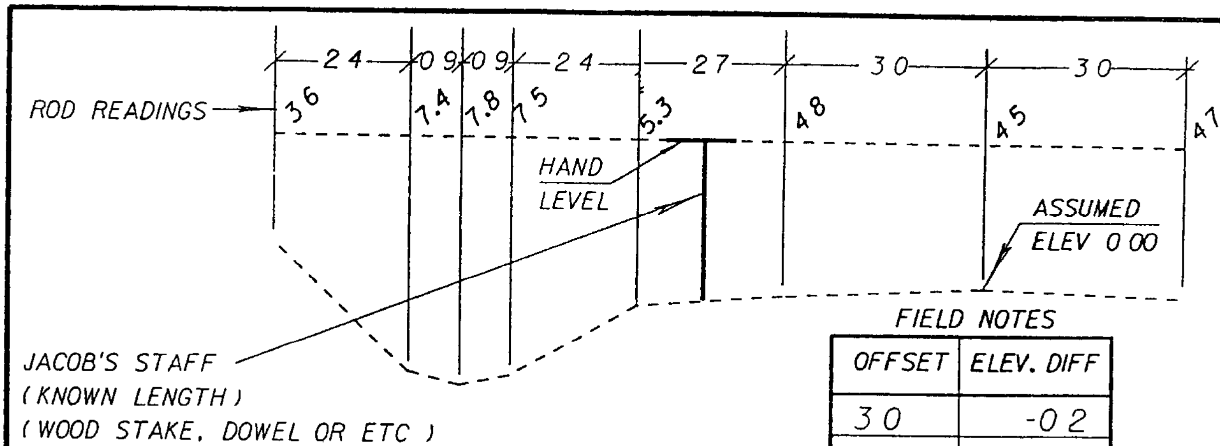
2 Accurately detail the earthwork on cross sections

3 Determine the areas and volumes of the different earthwork items (Roadway, Subsoil, Lateral Ditch, & Channel Excavation) and embankment very accurately

4 Show on the Summary of Earthwork all the different types of earthwork operations the contractor must consider

5 Use plan notes and pay item notes to explain any unusual conditions or treatments which are not apparent, not to repeat or modify Specifications

6 Make a decision on how to pay for earthwork items with the input and recommendations of the district construction office



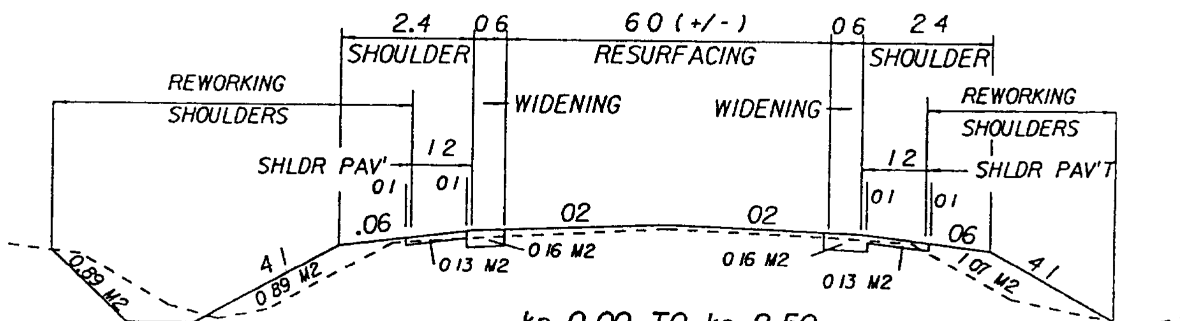
EQUIPMENT NEEDED

HAND LEVEL AND STAFF
LEVEL ROD
TAPE
NOTEPAD AND PENCIL
STRAIGHT LINE DIAGRAMS/ OLD PLANS

FIELD NOTES

OFFSET	ELEV. DIFF
3 0	-0 2
CL	0 0
-3 0	-0 3
-5 7	-0 8
-8 1	-3 0
-9 0	-3 3
-9 9	-2 9
-12 3	+0 9

FIELD SURVEY



kp 0.00 TO kp 2.50

WORKING CROSS SECTION (TYP. FOR LIMITS)

1 WORKING CROSS SECTIONS SHALL BE PLACED IN THE COMPUTATION BOOK (PLOTTED FROM FIELD SURVEY NOTES & PROPOSED TYPICAL)

2 THE THICKNESS OF THE BASE BOX SHALL BE CALCULATED ON THE MOST PROBABLE BASE OPTION.

3 END AREAS SHALL BE SHOWN ON EACH WORKING CROSS SECTION

4 LIMITS WILL BE SHOWN FOR EACH WORKING CROSS SECTION. (VERIFY ENTIRE PROJECT IS INCLUDED)

5 EARTHWORK CALCULATIONS WILL BE AS SHOWN IN THE PLANS PREPARATION MANUAL VOLUME I CHAPTER 3
PAY ITEMS ARE. REGULAR EXCAVATION, (LUMP SUM)
BORROW EXCAVATION (TRUCK MEASURE) (CUBIC METER)
REWORKING SHOULDERS (SQUARE METER)

EX-I-3-C

Chapter 4

Roadside Safety (Metric)

CHAPTER 4

ROADSIDE SAFETY (METRIC)

4.1 Clear Zone

4 1 1 Clear Zone Concept

A significant number of accidents involve a single vehicle leaving the roadway and either overturning or colliding with a fixed object A roadside that is traversable and unobstructed by fixed objects will allow vehicles that leave the roadway to recover safely The designer should provide as much traversable and unobstructed area (clear zone) as practical

Roadsides are considered traversable if a vehicle can traverse them without seriously endangering the occupants Roadsides are considered recoverable if there is a reasonable probability of regaining control of a vehicle or bringing it to a safe stop

If natural or man-made hazards, including slopes steeper than 1 3, occur within the clear zone, the designer should attempt 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 This treatment should only be taken if the barrier or crash cushion presents a lesser hazard

3 Leave the hazard unshielded This treatment should be taken only if a barrier or crash cushion is more hazardous than the hazard, if the likelihood of striking the hazard is very small or if the expense of treatment outweighs the benefits in terms of accident reduction

If accident data or safety reports indicate that early treatment of the hazards will result in fewer or less severe accidents, designers should consider directing that those treatments be accomplished as the first order of work, if feasible and practical

4 1 2 <u>Clear Zone Criteria</u>

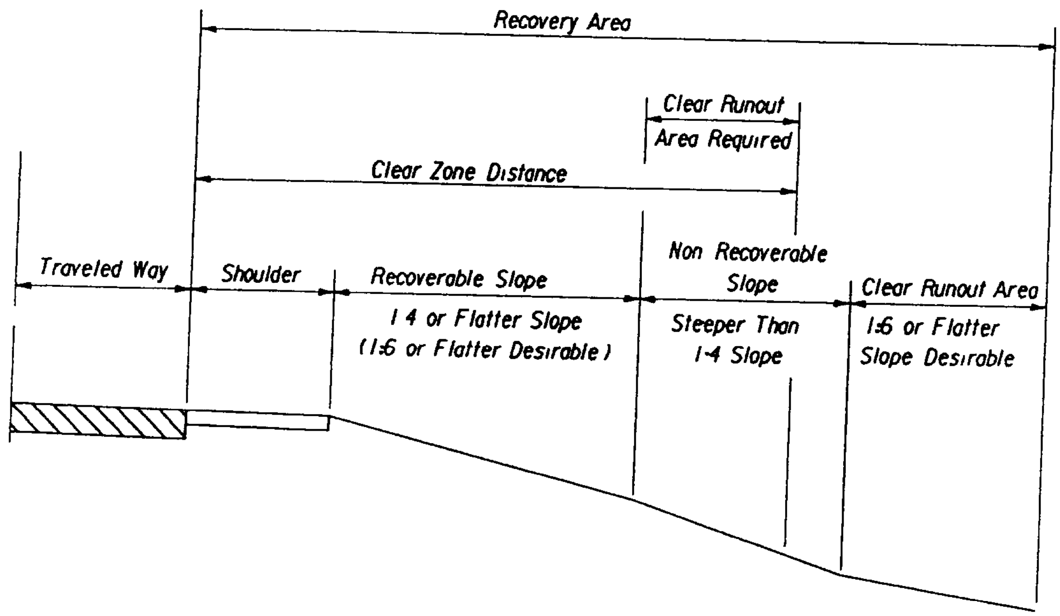
Criteria have been developed with the objective of providing the necessary recovery area for the vehicles that might leave the roadway The criteria are based on limited empirical data which was then extrapolated for a wide range of conditions The criteria represent a reasonable degree of roadside safety, but they are neither absolute nor precise These criteria must be applied with judgement In some cases, the clear zone can be adjusted higher or lower than shown In all cases, the most clear zone that can be practically provided is desirable

The Roadway and Traffic Design Standards include criteria for determining clear zones, as well as other design criteria related to highway safety for new construction or reconstruction projects The designer should keep safety in mind as the objective when applying clear zone criteria

If a non-recoverable slope encroaches the clear zone, then a clear runout area should be provided beyond the toe of slope equal to the width of the encroachment A minimum of 3 0 meters of clear runout area beyond the toe of slope should be provided

Chapter 25 provides clear zone criteria for RRR type projects

RECOVERY AREA AND CLEAR ZONE DISTANCE



Example of a Parallel Embankment Slope Design This figure illustrates a recoverable slope followed by a non-recoverable slope. Since the clear zone distance extends onto a non-recoverable slope, the portion of the clear zone distance on such a slope may be provided beyond the non-recoverable slope if practical This clear runout area would then be included in the total recovery area The clear runout may be reduced in width based on existing conditions or site investigations. Such a variable sloped typical section is often used as a compromise between roadside safety and economics By providing a relatively flat recovery area immediately adjacent to the roadway, most errant motorists can recover before reaching the steeper slope beyond

Exhibit 4-A

4.2 Canal Hazard Standards

Canals are defined as an open ditch parallel to the roadway for a minimum distance of 300 meters and with a seasonal water depth in excess of one meter for extended periods of time (24 hours or more)

The distance from the outside edge of the through travel lane to the top of the canal side slope nearest the road will be no less than 18 meters for highways with design speeds of 80 km/h or greater For highways with design speeds less than 80 km/h this minimum distance may be reduced to 15 meters for rural highways or 12 meters for urban (curb and gutter) highways When new canal or roadway alignment is required, distances greater than these above should be provided, if possible, to accommodate possible future improvements to the roadway (widening, etc)

On fill sections, a flat berm (maximum 10 1 slope) of width no less than 6 meters will be provided between the toe of the roadway front slope and the top of the canal side slope nearest the roadway This minimum berm width applies to all types of highways, both rural and urban (curb and gutter) construction (See Exhibit 4-2)

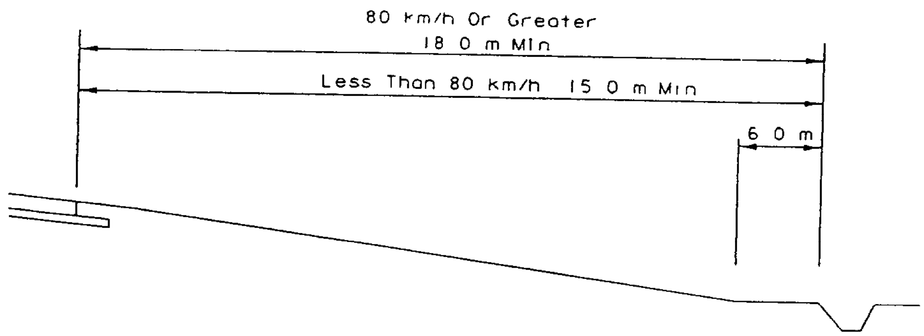
When the slope between the roadway and the "extended period of time" water surface is 6 1 or flatter, the minimum distance can be measured from the edge of the through lane to the "extended period of time" water surface and a berm is not required

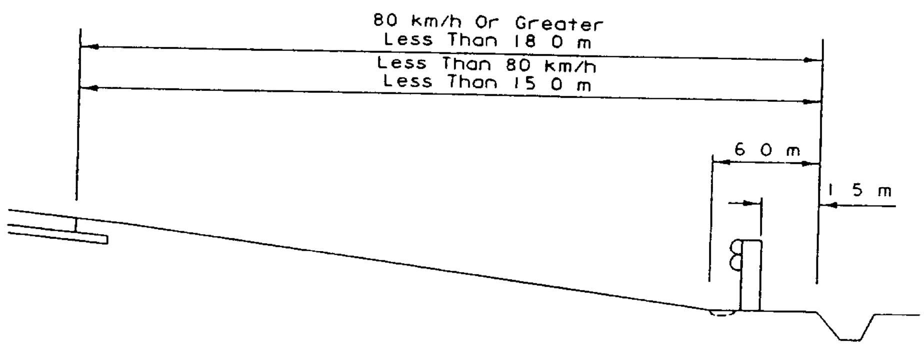
In sections with ditch cuts 6 meters will be provided between the toe of the front slope and the top of the canal

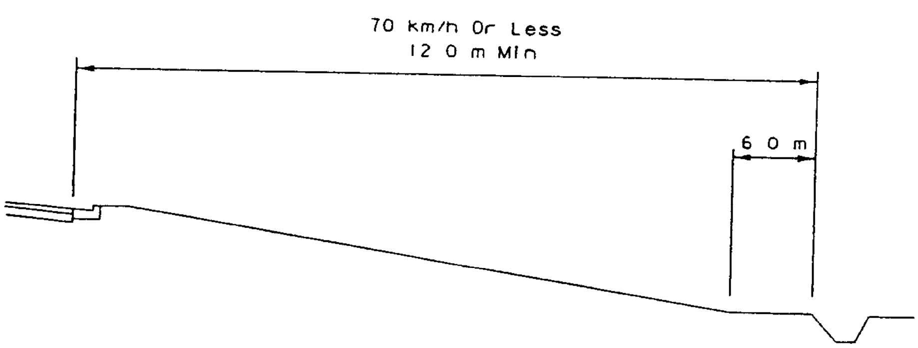
Guardrail, or other protective devices shall be installed 1 5 meters from the canal front slope where it is not possible to meet the above minimum criteria The design is complicated when clear zone and slope criteria are combined with canal hazard criteria Extreme caution must be taken to ensure that all criteria are met

If the minimum standards for canal hazards cannot be met, then the standard guardrail treatments as provided in the Roadway and Traffic Design Standards should be used

MINIMUM STANDARDS FOR CANAL HAZARDS







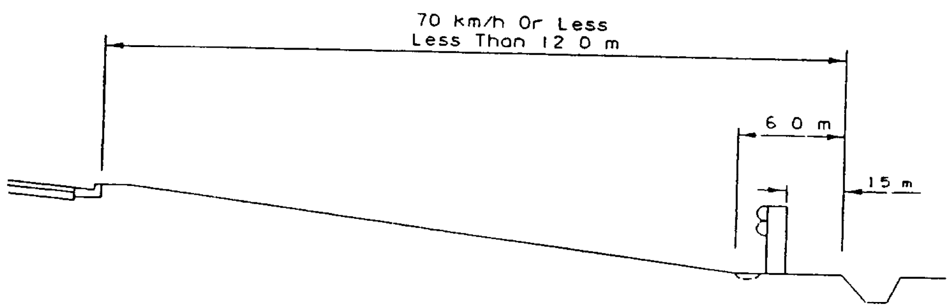


Exhibit 4-B

4.3 Roadside Barriers

4 3 1 Warrants

Roadside barriers are warranted when hazards exist within the clear zone, cannot be cost effectively eliminated or corrected and collisions with the hazards will be more serious than collisions with the barriers

The length of advancement and length of need necessary to properly shield the hazard must be determined on an installation by installation basis as indicated in the Roadway and Traffic Design Standards

The following conditions within the clear zone are normally considered more hazardous than a roadside barrier

- Fill slopes steeper than 1 3
- Bridge piers, abutments and railing ends
- Large, non-traversable culverts, pipes and headwalls
- Non-traversable parallel or perpendicular ditches and canals
- Bodies of water other than parallel ditches and canals that the engineer determines to be hazardous
- Parallel retaining walls with protrusions or other potential snagging features
- Retaining walls at an approach angle with the edge of pavement larger than 7 degrees (1 8)
- Non-breakaway sign or luminaire supports
- Trees greater than 100 mm in diameter measured 150 mm above the ground at maturity
- Utility poles
- Rigid protrusions above the ground in excess of 100 mm in height

In addition to the above hazards, there may be other situations that warrant barrier consideration, such as nearby pedestrian or bicycle facilities, schools, residents or businesses

4 3 2 Barrier Selection

Acceptable standard roadside barriers are detailed in the Roadway and Traffic Design Standards They include

- Standard blocked-out W-beam on wood post (strong post)
- Standard blocked-out W-beam on "C" steel post (strong post)
- Standard blocked-out W-beam on wide flange steel post (strong post)
- Blocked-out Thrie-Beam on any of the above post systems
- Standard concrete barrier wall

Most guardrail installations will be blocked-out W-beam on wood or steel posts The Thrie-Beam guardrail should be considered when additional rail depth is needed because of a potential to under-ride the rail or because additional height may be needed A special design detail shall be approved by the State Roadway Design Engineer prior to inclusion of Thrie-Beam in the plans Concrete barrier wall may be used in locations where no barrier deflection can be tolerated Other barrier designs may be required by specific site conditions These must be called for and detailed on a project by project basis

4 3 3 End Treatments

Non-crashworthy longitudinal barrier ends can present serious hazards if they terminate within the clear zone The F D O T end anchorage Type IV is the only crashworthy end treatment standardized by the Department. Other proprietary end treatments may be required under special circumstances Special details would be required in the plans

- End Anchorage Type IV It is very important that the standard parabolic flare with offset be provided exactly as shown in the Roadway and Traffic Design Standards The end offset should be measured off a projection of the face of guardrail alignment immediately downstream If the guardrail alignment is on a flare off the roadway or curve, the standard parabolic flare is an additional flare The maximum allowable cross slope in front of the rail is 1 10, including the area in front of the Type IV and the upstream approach to the Type IV
- Non-crashworthy end treatments will be used outside the clear zone and at downstream terminations, which are not within the clear zone of the opposing traffic flow The Type II end anchorage is non-crashworthy and, therefore, may not be used as an approach terminal end treatment
- Thrie-beam and concrete barrier wall will be terminated as shown in the Roadway and Traffic Design Standards Appropriate transitions to W-beam guardrail will be necessary to use the End Anchorage Type IV Crash cushions may also be used to terminate thrie-beam or concrete barrier wall The sloped Concrete Barrier Wall Terminal will only be used on roadways with a design speed of 70 km/h or less or where the terminal can be located the clear zone width or greater from the traffic lane approaching the sloped terminal

4 3 4 Transitions

Whenever standard W-beam or Thrie-beam guardrail transitions into bridge rail or concrete barrier wall, a transition section is necessary Transitions for W-beam guardrail must include sound structural connections, nested beams and additional posts for increased stiffness, as shown in the Roadway and Traffic Design Standards Transitions for Thrie beams must be included in the plans Standard flares should be introduced upstream of the transition section Care must be taken in the details of the junction of the two barrier types to avoid snag points

4 3 5 Placement

The pnmary desıgn factors associated wıth guardraıl placement are

- o Lateral offset from the edge of pavement
- o Terraın effects
- o Flare rate
- o Length of advancement
- o Length of need

The standard offset ıs the shoulder wıdth plus 0 6 m, not to exceed 3 6 m Alternate guardraıl offset locatıons are shown ın the Roadway and Traffic Desıgn Standards

A 0 6 m dıstance from the back of the barrıer posts to the shoulder lıne or slope break ıs desırable for post support

The length of advancement ıs dependent on the desıgn speed, the offset dıstance to the face of guardraıl and the lesser dıstance (a) to the back of the hazard or (b) to the clear zone needed The desıgner must establısh thıs advancement need for all ınstallatıons on the project On all facılıtıes the guardraıl needs must consıder traffic from both dırectıons

A barrıer should not be located so close to the hazard that ıt ıs shıeldıng that ıt ıs wıthın the dynamıc deflectıon dıstance of the barrıer The dynamıc deflectıon of standard barrıers are shown ın Table 4 3-1

Table 4.3-1

Minimum Offset of Barriers

(Measured from the face of the barrier)

Barrier Type	Offset (m)
W-Beam, Strong Post	1 2
Thrie-Beam, Strong Post	0 6
Barrier Wall	0
Double W-Beams (Nested) w/strong Post spacing @ 0 476 m	0 15

Curbs shall not be placed in the front of barriers When guardrail is necessary, the guardrail shall be located at the face of the curb or in front of it

Barriers should not be placed on slopes steeper than 1 10 This is particularly important on the approach to the standard flare of the End Anchorage Type IV

4 3 6 Resetting Guardrail

For those projects that include the resetting of guardrail, refer to the Standard Specifications, the Basis of Estimate and the Roadway and Traffic Design Standards for pay items, notes and quantity calculations

4.4 Median Barriers

4 4 1 Warrants

A medıan barner shall be provıded on Interstate and expressway facılıtıes where reconstructıon reduces the medıan wıdth to less than the standard for the facılıty No varıances or exceptıons to thıs crıterıa wıll be approved

4 4 2 Selectıon

The same barner types as dıscussed ın Sectıon 4 3 2 are avaılable as medıan barners In general, the concrete barner wall ıs preferable ın narrow medıans

4.4 3 End Treatments

Medıan barners can be termınated wıth any of the treatments dıscussed ın 4 3 3

4.5 Crash Cushions

Crash cushions are attenuating devices that may be non-directive or re-directive

4.5 1 Warrants

Hazards within the clear zone which present a more serious collision potential than a crash cushion, are warrants for the installation of a crash cushion

4 5 2 Selection

The following types of crash cushions are currently standardized for use

- o Hex-Foam Sandwich System
- o Guardrail Energy Absorbing Terminal (G-R-E-A-T)
- o Crash Attenuating Terminal (CAT)
- o Brakemaster
- o Sand-filled Plastic Barrels
- o Work Zone Attenuator (G-R-E-A-T-cz)
- o Vehicle Arresting Barrier (DRAGNET)

The Roadway and Traffic Design Standards and manufacturer's publications provide detailed information about these systems Each system has its own unique physical and functional characteristics The designer shall indicate in the plans which system is to be used at each location The design engineer shall consider the following factors when selecting a system for a particular location

- Site characteristics
- Structural and safety characteristics of candidate systems
- Initial and replacement/repair costs
- Expected frequency of collisions
- Maintenance characteristics

Site characteristics and economics dictate the crash cushion selection Sand barrels 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 The other systems have higher initial costs but can be repaired after collisions relatively cheaply, so are more appropriate where frequent collisions are expected The ability of maintenance forces to perform routine maintenance and to place a crashed system back into service quickly should be a major consideration Crash cushions that require stocking unusual and expensive parts or that are complex to replace should not be selected

4 5 3 Design

Crash cushion suppliers normally provide design assistance for their system These systems must decelerate both large and small automobiles from the established design speed of the facility to a gradual stop If the AASHTO Roadside Design Guide charts are used, the maximum average deceleration level should not exceed approximately 7 g's

All terrain within the likely approach of a vehicle should be relatively flat An impacting vehicle should strike the unit at normal height, with the vehicle's suspension system neither collapsed nor extended Curbs exceeding 100 mm in height shall not be used in the approach area of a crash cushion

Sand barrels do not have redirection capability, so they should be oriented toward the expected angle of impact

Care must be taken with all systems shielding a rigid object to ensure that there is not a potential to impact the hazard by opposing traffic

The nose of all crash cushions shall be delineated with reflective material or standard object markers, as indicated in the Roadway and Traffic Design Standards

4.6 Roadside Appurtenances

4 6 1 Sign Supports

All sign supports, except overhead cantilever, truss type or bridge or barrier wall mounted, shall be either breakaway or frangible as defined in the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and the AASHTO Roadside Design Guide Supports not meeting the frangibility or breakaway criteria should not be installed within the clear zone Sign supports not meeting these requirements which must be installed within the clear zone shall be protected by a barrier or crash cushion Sign supports shall be of an acceptable and crashworthy design as described in the Roadway and Traffic Design Standards

4 6 2 Mailbox Supports

Mailbox supports shall be of an acceptable crashworthy design, as described in Roadway and Traffic Design Standards

4 6 3 Other Appurtenances

The Roadway and Traffic Design Standards contain design criteria for numerous other roadside appurtenances

4 6 4 Location Criteria

Most breakaway mechanisms are designed to be impacted at bumper height, typically about 500 mm above the ground. If impacted at a significantly higher point, the bending moment in the breakaway base may be sufficient to bind the mechanism, resulting in non-activation of the breakaway device For this reason, it is important that breakaway supports not be located in ditches or on steep slopes where a vehicle is likely to be partially airborne at the time of impact

4 6 5 Bus Benches and Transit Shelters

These features are discussed in Section III of the Florida Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Green Book)

Chapter 5

Utilities (Metric)

Chapter 5

UTILITIES (METRIC)

5.1 General

Highways serve the public by carrying people and goods from place to place Public and privately owned utilities have a public-serving function similar to that of highways The needs of utilities (power lines, communication lines, gas and other pipelines, water mains and sewers) to go from place to place (often to or from the same points as the highway system), are recognized by the Department Utility facilities, both above and under ground level, are permitted by the Department to be accommodated within the road rights-of-way on the state maintained highway system (non-interstate)

For interstate facilities parallel utilities within the right-of-way are not allowed Lateral crossings are allowed by permit only (see Utilities Policy # 710-020-001) The designer should make every effort to design a project that will avoid conflicts with major utilities The selection of typical section features, horizontal alignment and location of storm sewer lines are two areas that can sometimes be adjusted without violating safety standards and design criteria A dual storm sewer system to avoid lateral crossings may be practical on some projects to avoid utility conflicts The increased cost of some features may be offset by reduced construction time and the associated costs

5.2 Relocation

Relocation is the adjustment of utility facilities required by a roadway project Examples are removing and reinstalling a utility at a new location, moving or rearranging existing utilities, changing the type of facility, improving safety and protective measures Relocation includes constructing a replacement facility functionally equal to the existing facility, where necessary for continuous operation of the utility services, the project economy, or sequence of roadway construction

5.3 Utility Accommodation Manual

The Department has established certain guidelines to regulate the location and manner for installation and adjustment of utility facilities in order to ensure safe and efficient operation and maintenance of the roadway facility

The Department's Utility Accommodation Manual governs on matters concerning future location, manner and methods for the installation or adjustment and maintenance of utilities on highway right-of-way

A permit must be approved by the Department before any utility is installed on the right-of-way, whether it is for aerial or underground installations Exceptions and requirements for permits are enumerated in the guide

Design considerations for accommodating utilities within the highway rights-of-way 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 Additional information can be found in the TRB's publication Policies for Accommodation of Utilities on Highway Rights-of-Way

5.4 Verification of the Location of Major Existing Utilities

Utility delays account for 17 to 18% of the construction contract time extensions Inaccurate location of existing utility facilities has been identified as a significant contributor to these extensions As a result, positive horizontal and vertical verification of the location of major existing utilities is required on those urban reconstruction and add lane projects where timely completion is essential because of disruptions to traffic flow

Major utilities are defined as those underground utilities that potentially conflict with construction activities to the extent that the existing location may interfere with pavement construction, stabilizing, curb and gutter construction, bridge foundations, sign and signal foundation, light poles, drainage structures, and/or storm sewer installation, manholes or inlet construction or those utilities that lie within the normal excavation limits for these structures Construction personnel should be consulted for assistance in determining the excavation limits Major utilities are also defined as water mains (150 mm or larger), all gas lines except service lines, telephone-coaxial toll lines and multi-duct lines, telephone cables and ducts (50 pair or larger), sanitary lines (all gravity flow mains), sanitary force mains (150 mm or larger) and electric power cable (all buried electric transmission cables - not service lines) Service connections are not to be considered as major utilities

Positive verification of utility locations can be either by DOT or consultant survey or utility company verification based on previous surveys or certified as built plans To avoid obtaining detailed verification at locations that may not be necessary, it is desirable that designs be advanced to the stage that the location of the storm sewer is known It will be the responsibility of the District Utility Engineer, or his designee, with assistance from the Designer and construction personnel to determine the appropriate locations of positive verification

5 4 1 Locating Underground Utilities

To further identify the responsibilities of the Department and utility companies regarding the location of underground utilities, the following will be used along with, and in accordance with, the Location Survey Manual

1 Contact the utility owner, give details as to the location, length, and/or extent of job Advise if the underground utilities are to be located horizontally only, or that they will have to be uncovered and located both horizontally and vertically Request that personnel necessary to locate the utilities meet DOT or consultant forces at a specific time and place

2 All underground utilities must be marked by the company representative with a DOT employee or consultant present, giving size, type and use The utility company will furnish the DOT with as built plans, if available The DOT or consultant survey forces will tie all major utilities and others deemed necessary to the centerline or baseline of survey and record all field data usually horizontally only, giving the approximate depth estimated by the utility company representative If field verified vertical data are also available, these data will also be shown by positive tie in the field book

3 During the design of the project, those major utilities requiring vertical location of the underground utilities will be identified The utility company will be contacted to uncover (dig, excavate, and so forth) their utilities as deemed necessary by the DOT The DOT location or consultant survey personnel will locate and record all finding, both horizontally and vertically, showing the positive horizontal and vertical ties in the field book for future reference All storm sewer systems and sanitary sewer gravity flow lines will be shown as presently outlined in the Location Survey Manual

4 All as built plans obtained from the utility companies are to be marked as follows

Date
DOT Job No
Party Chief
Utility Company
Utility Company Representative

All field books in addition to the standard heading, index, etc , will denote the following

Date
Personnel
Utility Company
Utility Company Personnel
Utility Company Work Order No , if applicable

Those locations where positive horizontal and vertical location is known will be designated on the plans It is important to the contractors bidding on projects to know at which locations the information is exact and not interpolated The Plans Preparation and Assembly volume gives specific instructions on how to show this information on the plans

5.5 Coordination Process

Copies of plans, with all utilities shown, should be given to the utility owner for verification at approximately Phase I design completion stage Right-of-way map or R/W key map with existing utilities shown may be used for utility contact The District Utility Engineer normally coordinates this activity through a utility predesign conference The utility owners are required to verify or indicate the correct location of their respective utilities within the project limits on the plans provided to them These marked up plans should be used by the design team to show the correct locations, horizontal and vertical, of the various utilities

The designer should make every effort to design a project that will avoid conflicts with major utilities At the completion of Phase II, when the drainage design is well underway, the potential utility conflicts should be identified Only major utilities potentially in conflict shall be field verified horizontally and vertically

At approximately 80% completion of plans, the utility companies should be provided with two sets of plans showing all utilities One marked up set is transmitted back to the designer and the other is retained by the utility company for their use

5 5 1 Coordination of Traffic Monitoring Sites

The Transportation Statistics Office in Tallahassee should be notified of any work within 800 m of a traffic monitoring site If relocation or reconstruction of the site is required, the action should be made part of the project The Transportation Statistics Office can provide plans and specifications and other information, if needed

Chapter 6

RAILROAD CROSSING (METRIC)

Chapter 6

RAILROAD CROSSING (METRIC)

6.1 General

A railroad-highway crossing, like any highway-highway intersection, involves either a separation of grades or a crossing at grade The geometrics of a highway and structure that entails the overcrossing or undercrossing of a railroad are substantially the same as those for a highway grade separation without ramps

Selection of the warning devices to be used is a function of the geometrics of railroad-highway grade crossing, including the alignment, profile, sight distance and cross section of both the roadway and the railroad Railroad grade crossing angles should be as near 90 degrees as practical

Design Criteria and Standards are given in the Florida Green Book and the Department's Railroad Procedures Manual Volume III Design considerations are discussed in Chapter IX of the AASHTO policy on Geometric Design

6.2 Devices

Traffic control devices for railroad-highway grade crossings consist primarily of signs, pavement markings, flashing light signals and automatic gates A large number of significant variables must be considered in determining the types of warning device to be installed at a railroad grade crossing The type of highway, volume of vehicular traffic, volume of railroad traffic, speed of vehicular traffic, volume of pedestrian traffic, accident record, and geometrics of the crossing are some of the factors influencing the choice of warning devices to be provided at the railroad crossing Standards and criteria for design placement, installment and operation of these devices are covered in the MUTCD and the Department's Railroad Procedure Manual Volume III The Department's Roadway and Traffic Design Standards should also be consulted in the design of railroad crossings

6.3 Surfaces

The highway traveled way at a railroad 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 should be carried across the crossing The 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 highway The Department's Highway-Railroad Grade Crossing Material Selection Handbook should be consulted in selecting the material

Roadway Design Standard Index #560 contains specifications for the construction of crossings of the following types

- Bituminous
- Wood Plank Crossing
- Prefabricated Sectional Treated Timber Crossings
- Concrete Slab Crossings (Precast)
- Concrete Slab Crossings (Prestressed)
- Steel Grid Crossing
- Rubber (Elastomeric) Panel Crossings
- Epoxy-Rubber Mix Cast-In-Place Crossings
- Linear High Density Polyethylene Modules Crossings

6.4 Clearances at Railroad/Highway Structures

An offset horizontal dimension to the abutment slope of up to 6 m from the centerline of tracks requires no special justification. Horizontal offsets in excess of 6 m should be justified based on individual site conditions. Vertical clearances up to 7.2 m require no special justification. Greater vertical clearances can be justified based on special site conditions or the need to meet documented railroad electrification plans. The horizontal clearance to an obstruction is a minimum of 2.7 m. Greater clearances may be necessary to preclude the placement of piers in drainage ditches. Roadway Design Standard Index 280 contains additional criteria for culvert clearances below railroads.

Chapter 7

Signing, Marking, Lighting and Signals (Metric)

Chapter 7

SIGNING, MARKING, LIGHTING AND SIGNALS (METRIC)

7.1 <u>General</u>

Traffic control devices are necessary to help ensure highway safety by providing the orderly and predictable movement of all traffic, motorized and non-motorized, throughout the highway transportation system, and to provide such guidance and warnings as are needed to ensure the safe and informed operation of individual elements of the traffic stream The design and layout of signs, signals, pavement marking and lighting should complement the basic highway design

7.2 <u>Signing and Marking</u>

The designer responsible for a signing and marking project should be aware that the design must comply with various standards In addition to Department Standard Specifications, the following standards should be consulted

<u>Manual on Uniform Traffic Control Devices</u> (MUTCD) - 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 therefore the basic guide for signing and marking The requirements of the MUTCD must be met, as a minimum, on all roads in the State

<u>Standard Highway Signs</u>, FHWA - This manual contains detailed drawings of all standard highway signs Each sign is identified by a unique designation Signs not included in this manual or in the <u>Roadway and Traffic Design Standards</u> must be detailed in the plans

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, AASHTO and Structures Design Guidelines, FDOT - These documents provide structural design criteria

Roadway and Traffic Design Standards - These standards are composed of a number of standard drawings or indexes which address specific situations which occur on a large majority of construction projects

7 2 1 Design Criteria

The MUTCD and the Roadway and Traffic Design Standards should be consulted for sign location All signs not bridge or barrier wall mounted and installed within the clear recovery zone, must be frangible or protected by an approved barrier The Roadside Safety chapter of this manual contains detailed instructions on safety design

Post sizes for single column signs are covered in the Roadway and Traffic Design Standards The supports for multi-post signs are not in that reference and must be included in the plans The designer must provide post sizes and length for each multi-post sign The Structures Design Office has written a program for personal computers that calculates post sizes and length for multi-post signs This program may be used for these calculations

When specified, signs will be illuminated with 175 watt mercury vapor Deluxe White Lamps The following table gives the number of luminaires for various sign widths See Roadway and Traffic Design Standard Index 17505 for spacing details and mounting location

Sign Width (m)	To 3 0	To 6 3	To 9 6	To 12 9
Luminaires	1	2	3	4

7 2 2 Wind Loading Criteria - Signs

The wind loadings given below were taken from the AASHTO Standard Specification For Structural Supports For Highway Signs, Luminaires and Traffic Signals The Counties are listed by wind loading for the appropriate sign type

GROUND SIGNS

100 km/h Alachua, Baker, Bay, Bradford, Calhoun, Clay, Columbia, Escambia, Gadsden, Gilchrist, Hamilton, Holmes, Lafayette, Lake, Leon, Liberty, Jackson, Jefferson, Madison, Marion, Okaloosa, Putnam, Santa Rosa, Sumter, Suwannee, Union, Walton, Washington

115 km/h Citrus, DeSoto, Dixie, Duval, Flagler, Franklin, Glades, Gulf, Hardee, Hendry, Hernando, Highlands, Hillsborough, Levy, Nassau, Okeechobee, Orange, Osceola, Pasco, Pinellas, Polk, Seminole, St Johns, Taylor, Wakulla

130 km/h Brevard, Charlotte, Collier, Indian River, Lee, Manatee, Martin, Palm Beach, Sarasota, St Lucie, Volusia

145 km/h Broward, Dade, Monroe

OVERHEAD SIGNS

See Structures Design Guidelines

7.2 3 Project Coordination

Coordination with other offices and other agencies is a very important aspect of project design The offices discussed in this section are not intended to be an all inclusive list with which the designer should coordinate, but are those that are typically involved in a signing and marking project

Roadway Design - The designer of a signing and marking project receives the base sheets for design from the roadway designer, who can also provide any required cross sections If the signing project is not an active roadway design project, base sheets may be obtained from existing plans or aerial photographs

Utilities - The District Utilities Engineer provides the coordination between the designer and the various utilities involved in the project The Utilities Section can also identify potential conflicts with overhead and underground utilities or verify those which have previously been identified The District Utilities Engineer should be contacted as early in the design phase as possible

7 2 4 Foundation Criteria

Refer to Section 7 5, Foundation Design, for geotechnical requirements

7.3 Lighting

The designer responsible for a highway lighting project should be aware that the design must comply with various standards In addition to the Department's Standard Specifications, the following standards should be consulted

An Information Guide for Roadway Lighting, AASHTO -- This is the basic guide for highway lighting It includes information on warranting conditions and design criteria

Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, AASHTO -- This specification contains the strength requirements of the poles and bracket arms for the various wind loadings in Florida as well as the frangibility requirements All Luminaire supports, poles and bracket arms must be in compliance with these specifications

Roadway and Traffic Design Standards -- These indexes are composed of a number of standard drawings or indexes which address specific situations which occur on a large majority of construction projects

7 3 1 Design Criteria

The AASHTO Guide for Roadway Lighting permits either the illuminance technique or the luminance technique to be used in the design of highway lighting The luminance technique requires a more complex design process and a knowledge of the reflective characteristics of the pavement surface used These reflective characteristics change as the pavement ages and with variations in weather conditions The Department has elected to use the illuminance technique for lighting design The design values for light levels given by the AASHTO Guide for Roadway Lighting are maintained values The light levels given in this criteria have been adjusted and are listed as average initial lux

This, in effect, sets the maintenance factor to be used in the calculation process to a value of 1

Mounting height (M H) for conventional lighting is the vertical distance from the roadway to the light source, regardless of lateral placement of the pole Pole setback is the horizontal distance from the edge of the travel lane to the pole

7 3 2 Pole Design Criteria

Roadway and Traffic Design Standards Index 700 and the criteria section of this manual specify minimum horizontal clearances for light poles A 6 0 meter minimum should be used where possible Poles should be located at least 1 2 meters behind the face of guard rail and from the face of curbs High mast lighting poles should be located as far from the travelled way as possible and in no case shall they be within the clear zone unless the pole is protected by barrier wall or guardrail High mast lighting poles should not be located in gore areas within the runout length as defined in the AASHTO Roadside Design Guide Engineering judgement should be used when locating high mast poles adjacent to bridges and high fills All conventional height poles shall be frangible unless bridge or barrier wall mounted

Frangible pole installations shall not be used in areas of heavy pedestrian traffic where the hazard of a falling pole is a greater hazard to others than it is to the motorist See Roadway and Traffic Design Standards for frangibility requirements

The installation of lighting in certain locations (e g adjacent to residential areas) may require the luminaires to be shielded This is especially true for high mast poles

Poles on bridges over open bodies of water or on causeway sections should be considered for dampers These poles are subject to sustained winds of a critical velocity which may induce vibrations in the pole

7 3 3 Foundations Criteria

Refer to Section 7 5, Foundation Design, for geotechnical requirements and to the Structures Design Guidelines for additional design information

For projects allowing the screw type foundation as an alternate, the geotechnical engineer shall verify that the soil characteristics meet the requirements of Section 715 of the specifications If the soil conditions do not allow the screw type of foundation shown in Section 715, either a note shall be added to the plans stating "The screw type foundation is not allowed on this project", or an appropriate design shall be provided

Foundations for high mast poles are not standard and the designs must be provided for each project Boring data must be obtained to provide a basis for the design A boring data sheet is to be included in the plans

7 3 4 Wind Loading Criteria - Lighting

See the Structures Design Guidelines

7 3 5 Lighting Project Coordination

Coordination with other offices and other agencies is a very important aspect of project design The offices discussed in this section are not intended to be an all inclusive list with which the designer should coordinate, instead it includes offices that are normally involved in projects

o Roadway Design - Normally the designer of a lighting project receives the base sheets for lighting design from the roadway designer The roadway designer can also provide any required cross sections If the lighting project is not an active roadway design project, base sheets may be obtained from existing plans or aerial photographs If copies of existing plans are used for base sheets, the drainage maps are usually a good choice

o Utilities - The District Utilities Engineer provides the coordination between the designer and the various utilities involved in the project This usually is limited to agreements with the power company for electrical service The Utilities Section can also identify potential conflicts with overhead and underground utilities or verify those which have previously been identified

The Utilities Engineer should be contacted as soon as pole locations are set and the electrical load has been determined The designer should indicate a preferred location for the electrical service location

o Soils - Conventional height poles require the standard base shown in the Roadway and Traffic Design Standards, and only require foundation designs in special cases High mast poles, on the other hand, require foundation designs for each location Soil Borings are required for the design of the foundations The District Soils Engineer should be requested to provide soils data as soon as high mast pole locations are determined

o Drainage - When the locations of high mast poles are established, they should be checked with the Drainage Section to determine if high water level is a problem High mast poles are often located in the center of interchange loops These same areas may be used as drainage retention areas Coordination with the Drainage Section will alleviate this type problem

Chapter 14-64 of the Department Rules established the maintenance responsibility of lighting systems not on limited access or toll facilities as a local government function

Normally the District Traffic Operations Engineer in conjunction with the District Utilities Engineer obtain 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 be a potential problem Any lighting project within 5 kilometers of an airport should be discussed with the Office of Public Transportation, Aviation Office to determine if a problem exists

7 3 6 Voltage Drop Criteria

When determining conductor sizes for lighting circuits, the maximum allowable voltage drop from the service point on any one circuit is 7%

7.4 <u>Traffic Signals</u>

The designer responsible for a traffic signal project should be aware that the design must comply with various standards In addition to the Department's Standard Specifications, the following standards should be consulted

> <u>Manual on Uniform Traffic Control Devices</u> (MUTCD), FHWA - The MUTCD was adopted by the Department as the uniform system of traffic control for use on the streets and highways of the State The action was in compliance with Chapter 316 0745 of the Florida Statutes The MUTCD is therefore the basic guide for traffic signals The requirements of the MUTCD must be met, as a minimum, on all roads in the State
>
> <u>Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals</u> AASHTO and <u>Structures Design Guidelines</u>, FDOT - These documents provide structural design criteria
>
> <u>Roadway and Traffic Design Standards</u> - These standards are composed of a number of standard drawings or indexes which address specific situations which occur on a large majority of constructions

7 4 1 <u>Design Criteria</u>

The MUTCD, as noted above, has been adopted as the uniform system of traffic control for use on the streets and highways of the state The MUTCD is the basic guide for traffic signal design, therefore, the traffic signal designer should be familiar with this document The criteria below supplements the MUTCD

7 4 2 Certification and Specialty Items

Traffic signal equipment installed in Florida is required to be certified by the Department The Office of Traffic Engineering in the Central Office is charged with the responsibility of certifying traffic control equipment The designer of a traffic signal project, if requiring new equipment types or types not normally used, should contact Traffic Engineering in Tallahassee to determine the certification status of the equipment Non-certified equipment cannot be used

Standard specifications have not been developed for all signal equipment Some items are project dependent and the development of standard specifications is difficult Specifications for these items must be developed on a project by project basis and included in the contract as a special provision Some of these specialty items are included on the Department's approved products list For these items, detailed specifications are not required The Office of Traffic Engineering should be consulted on these items

7 4 3 Stop Line Location

A stop line which is not properly located invites violation by the motorist The MUTCD specifies the minimum and maximum distances from the signal head to the stop line for adequate visibility The traffic signal designer must insure that this requirement is met

Instead of relocating the signal heads, the stop lines at many intersections have been moved from their proper location to comply with these requirements The tendency for the motorist is not to stop at the new stop line location, but rather to creep beyond the stop line This could in some cases result in valid calls being dropped, thereby increasing delay and decreasing the overall efficiency of the intersection

The first step in the design process should be to locate crosswalks and stop lines properly Then the signal head location should be determined to meet the MUTCD requirements This may require changing the mounting configuration A box span, for example, may be required where a diagonal span would normally be installed

7 4 4 Controller Timings

The development of controller timings is a basic part of traffic signal design A recent ruling from the Board of Professional Engineers stated that the development of timings is considered engineering and therefore requires the signature and seal of a professional engineer

All traffic signal designs prepared for or by the Department shall include initial timings of all controllers This is also true for signals to be included in local systems If the timings in the plans are not implemented, it will be the responsibility of the agency providing the timings to insure they were prepared under the supervision of a professional engineer

7 4 5 Left Turn Treatments

The guidelines given below should be followed when determining signal treatments for left turns

- Single Turn Lane

  Restrictive/Permissive Phasing - A five-section cluster should be used for this location The head 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

Restrictive 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

o Dual Turn Lanes

Only restrictive phasing should be used Permissive movements should not be allowed for dual turn lanes 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 thru movement

o Separated Turn and Thru Lanes

Turn lanes that are separated from the thru lanes more than 3 6 meters by a raised or painted island shall not be operated in the permissive mode

o Single Lane Approach on Stem of "T"

Two three-section heads are required as minimum All indications must be circular in this situation

o 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

o 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 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

NOTE

1 For all cases, the approach shall display "dual indications" This means that there must 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

7 4 6 Signal Preemption

The engineer responsible for the design of a traffic signal project should, as a matter of routine, check each intersection to determine if the need for signal preemption is present

Intersections located within 60 meters of moveable span bridges or railroad crossings should be considered Those located at distances greater than 60 meters should be considered if the queues frequently extend to the moveable span or crossing

Intersections near fire stations require individual study This is necessary to determine the interaction between the fire station vehicles and the intersection operation This information must be known before the preemption sequence can be developed

7 4 7 Intersection Design - 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

The results are dependent upon the traffic volumes used in the analysis The traffic used for this calculation shall be the design hourly volume based on the 30th highest hour (k factor) and not a peak to daily (P/D) ration based on a 24 hour count The k factor volumes account for traffic variations through the year, and, in most case,are higher than P/D volumes

The K, D, and T factors covert the two-way AADT volumes to a one-way Design Hour Volume (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 These percentages should then be applied to the DHV for each approach volume to determine the turning volumes which should be used for the turn lane design calculations These values should be compared to the movement counts supplied by Planning and the greater of the two values used for the design of turn lanes The District Planning Office should be contacted 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

The important factors which determine the length needed for a left turn storage lane are

- The design year volume for the peak hour (see discussion above)
- An estimate for the number of cycles per hour

  NOTE If the cycle length doubles, the length of the storage for the same traffic also doubles.
- The type of signal phasing and timing which will control the left turn lanes

There are several techniques used to determine necessary storage length The following are suggested guidelines for left turn lanes

- o Where protected left turn phasing is provided, an exclusive turn lane should be provided
- o Left turn lanes should be provided when turn volumes exceed 100 vph and may be considered for lesser volumes if space permits
- o For signalized intersections, the following formula may be used, assuming an average vehicle length of 7 5 meters

$$L = \frac{(2\ 0)\ (DHV)\ (7\ 5)}{N}$$

Where

L = design length for left turn storage in meters

DHV = left turn volume during design peak hour, in vph

N = number of cycles per hour for peak hour, use N = 30 as default

- o Where left turn volumes exceed 300 vph, a double left turn should be considered
- o 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 vphpl

7 4 8 Signal Loops

Traffic signal loops are detailed in Roadway and Traffic Design Standard, Index 17781 These loops are standard and will be appropriate for most locations

The traffic signals for each intersection should be individually designed The requirement for type and placement of loops is a part of this design The above standard allows for some variation in size and placement of the standard loops These modifications are intended to be used only when required by the design of a particular location

7 4 9 Wind Loading - Traffic Signals

See the Structures Design Guidelines

7 4 10 Foundation Criteria

Refer to Section 7 5, Foundation Design, for geotechnical requirements.

7.5 Foundation Design

Foundation design of strain poles, mastarms, high mast light poles, and overhead sign structures requires that the following information be provided by the project's geotechnical engineer

1) The soil type Is it cohesive or cohesionless, rock, etc ?
2) For cohesive soils, the value of the cohesion
3) For cohesionless soils, the effective friction angle of the soil
4) The effective unit weight of the soil
5) The seasonal high water elevation

The geotechnical engineer shall establish the required soils information from SPT borings, auger borings or cone soundings as deemed appropriate and shall determine the number and location of borings required Borings taken for the roadway and other structures can also be used for this information if appropriate

The above information shall be included in the plans It may be shown on an appropriate pole, mast arm, or sign location or detail sheet, if space permits A separate sheet may be required, such as a boring data sheet for high mast lighting.

Chapter 8

Bicycles and Pedestrian Facilities (Metric)

Chapter 8

BICYCLES AND PEDESTRIAN FACILITIES (METRIC)

8.1 General

Pedestrians and bicycle riders may often wish to travel between the same locations as other vehicular traffic When this occurs, the designer should consider the effects on the safety and operation of the roadway system A special effort should be made to provide the greatest degree of safety within the economic constraints that must always be considered

Additional special bicycle and pedestrian facilities should be provided where the use of travel lanes or wide paved shoulders is deemed unacceptable or unsafe for the pedestrian or bicycle rider

Pedestrian facilities include sidewalks, crosswalks, traffic control features, special walkways, curb cut ramps for the handicapped and bus facilities

8.2 Sidewalks

The design of sidewalks is affected by pedestrian volume, traffic volume, average pedestrian age, walking rate, required level of service, location, etc The Florida Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Green Book) and the AASHTO Policy on Geometric Design present the various factors that influence the design of sidewalks and other pedestrian facilities

All urban projects that have sufficient right-of-way to provide adequate lane, median, sidewalk and border widths should be thoroughly evaluated to provide a reasonably safe and cost effective design A distance of as little as 0 6 meter between the back of sidewalk and right-of-way can be effective in minimizing construction easements by using a 0 3 meter berm and 2 1 slope or a 4 1 slope between the sidewalk and right-of-way Differences in elevation up to 150 mm can be accommodated in this manner Caution must be exercised in using this treatment at connections to driveways since this distance and slope will not assure adequate vehicular connections (see the Roadway and Traffic Design Standards, Index 515)

Sidewalks should be constructed in conjunction with all new construction, major reconstruction and lane addition curb and gutter projects As a general practice, sidewalks should be constructed along both sides of arterial streets that are not provided with shoulders, even though pedestrian traffic may be light Exceptions may be made to the construction of sidewalks on both sides of the street when the roadway parallels a railroad or drainage canal and pedestrians would not be expected and in some cases on bridges If sidewalks are constructed on the approaches to bridges, they should be continued across the structure

The standard width for sidewalks is 1 5 meters when separated from the curb by a buffer strip When sidewalks are constructed adjacent to the curb, the minimum width should be 1 8 meters Additional width of sidewalk should be provided for high pedestrian volumes, i e sidewalks in close proximity to schools Separation between the curb and sidewalk should be provided when traffic volumes, truck volumes or vehicular speeds are high The Department's Bicycle Facilities

Planning and Design Manual states that it is important to recognize that the development of wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel Wide sidewalks encourage higher-speed bicycle use and can increase the potential for conflicts with motor vehicles at intersections, as well as with pedestrians and fixed objects Both the AASHTO Guide for Bicycle Facilities and the Florida Green Book state that bicycle riding on sidewalks can be expected in residential areas with young children who are too inexperienced to ride in the street This type of bicycle use is generally accepted, but it is not appropriate to sign a sidewalk as a bicycle path Separate bike lanes should be provided when warranted to accommodate bicycle traffic Standard width sidewalks are to be provided unless greater widths are justified for pedestrian use A method for determining pedestrian facility needs is given in the Highway Capacity Manual

8.3 Disabled Access

Pedestrian facilities such as walkways and sidewalks must be designed to accommodate the physically disabled persons whose mobility is dependent on wheelchairs and other devices Street intersections with steep-faced curbs are one form of obstacle that can be alleviated while still providing reasonable mobility for the disabled without sacrificing the mobility of others

In areas with sidewalks, curb cut ramps must be incorporated at locations where a marked crosswalk adjoins the sidewalk The basic ramp type and design application depends on the geometrical characteristics of the intersection Standard Index No 304 sets forth the requirements and standards of curb cut ramps for use in Florida Placement of inlets should not conflict with curb cut ramps

All Department facilities (roadway, parking lots, rest areas, buildings, pedestrian bridges, etc) must be designed in compliance with Florida statutes, rules and regulations and Florida Americans with Disabilities Accessibility Implementation Act Design must also meet minimum requirements of the American National Standards Institute (ANSI 117 1 - 1986) for accommodation of the disabled

8.4 Bicycle Facilities

The bicycle has become an important element for consideration in the highway design process In recent years the emphasis in bicycle system planning has changed from attempts to provide completely separate facilities for bicyclists to the growing recognition that bicyclists are legitimate users of the roadway Recent studies have shown that in many cases shared roadway facilities afford greater safety for the bicyclists than sidewalk facilities because of the increased visibility and maneuverability Certain measures such as.

- o Paved shoulders, either designated or undesignated as bike lanes
- o Full bike lanes adjacent to curb and gutter, either designated or undesignated
- o Bicycle-safe drainage grates
- o Adjusting manhole covers to grade
- o Maintaining a smooth, clean riding surface
- o Bicycle corridors on off system routes

can considerably enhance a route's safety and capacity for bicycle traffic without impacting the service for motor vehicles on the roadway.

Planning and design consideration for bicycle facilities are given in the AASHTO Policy on Geometric Design and the AASHTO Guide for Development of New Bicycle Facilities.

The Department's current policy is to consider the needs of bicyclists on all projects, except limited access facilities This policy will generally provide for the construction of bicycle lanes or paved shoulders for the needs of bicyclists in conjunction with other planned roadway improvements The lack of adequate right of way and the cost associated with its acquisition in built up areas may not allow provision of the additional width for bicyclists on all projects The inclusion of bicycle facilities on roadway improvements should be reviewed on a case-by-case basis analyzing anticipated bicycle travel and the need for wider pavement or paved shoulders Anticipated bicycle travel should be considered of sufficient volume when the roadway section is identified for bicycle improvements in the Transportation Improvement Program, the State Transportation Plan (Bicycle Elements) or other approved Community Comprehensive Bicycle Transportation Plans Planning for bicycle routes through local government contact is essential

The Chapter 2 of this volume discusses shoulder width criteria when bicycle use is anticipated

Chapter 9

Landscaping (Metric)

Chapter 9

LANDSCAPING (METRIC)

9.1 General

The complete highway is one wherein the elements of design, construction and maintenance have been integrated to provide a facility that possesses utility, safety, beauty and economy The highway should be considered as an element of the total environment, not apart from it or in conflict with it All highway-oriented disciplines should collaborate at each stage of highway corridor selection, location, and design to obtain the maximum beneficial potential of the highway, its roadsides, and its environment

The highway roadside is an integral unit of a total highway facility The term "roadside" generally refers to the area between the outer edge of the roadway and the right-of-way boundary It could include extensive areas in a wide median of a divided highway Roadside development is the treatment given to the roadside to conserve, enhance, and effectively display the natural beauty of the landscape through which the highway passes It should provide safety, utility, economy, and highway-related recreation facilities by means of proper location, design, construction, and maintenance

Because the potential for conflict between the highway and environmental values is greatest in urban areas, it is essential that special attention be given to the multiple use-joint development possibilities in areas over, under, and adjacent to the highway to ensure that land and space above the highway provides the greatest benefit to the greatest number

Landscape development should be in keeping with the character of the highway and its environment Programs include the following general areas of improvement

- Preservation of existing vegetation
- Transplanting of existing vegetation where feasible
- Planting of new vegetation
- Selective clearing and thinning
- Regeneration of natural plant species and material

The objectives in planting or the retention and preservation of natural growth on roadsides are closely related In essence, they are to provide vegetation that will be an aid to esthetics and safety, aid in lowering construction and maintenance costs, and create interest, usefulness, and beauty for the pleasure and satisfaction of the traveling public

Landscaping of urban highways and streets assumes additional importance by mitigating many of the nuisances associated with urban traffic Landscaping should be arranged to permit sufficiently wide, clear, and safe pedestrian walkways Combinations of turf, shrubs, and trees are desirable in border areas along the roadway However, care should be exercised to ensure that requirements for sight distances and clearance to obstructions are observed, especially at intersections

Further information concerning landscape development and erosion control is presented in AASHTO's A Guide for Highway Landscape and Environmental Design The Department's Roadway and Traffic Design Standards Booklet sets forth specific criteria and standards for erosion control and roadside landscaping The Department's Landscaping Guidelines (document No 650-050--001) provides the general criteria for use in the development of landscaping plans for roadway projects

Chapter 10

Work Zone Traffic Control

Exhibits

Chapter 10

WORK ZONE TRAFFIC CONTROL

10.1 General

The need to improve the capacity of, and to rehabilitate Florida's highways, has greatly increased the frequency of highway construction taking place immediately adjacent to or under traffic The travelling public, as well as construction and inspection personnel, are exposed to conflicts that may become hazardous In addition to the safety issue, the potential delays to the public, as traffic is interrupted by construction, can be significant As a result, the Department places a great deal of emphasis upon ensuring that traffic can be accommodated through construction zones with minimum delay and exposure to unsafe conditions

10.2 References

The following references contain the basic criteria for work zone traffic control in Florida

The Manual on Uniform Traffic Control Devices for Streets and Highways, (MUTCD), Federal Highway Administration Part VI of the MUTCD deals specifically with work zone traffic control Other parts of the MUTCD may also be useful in designing a traffic control plan

Traffic Control Devices Handbook, (TCDH) Part VI, Federal Highway Administration

Policy on Geometric Design of Highways and Streets, AASHTO

Roadside Design Guide, AASHTO, Chapter 9

Roadway and Traffic Design Standard Index Series 600, 415 and 700

Federal-aid Highway Program Manual (FHPM) 6-4-2-12

10.3 Comprehensive Work Zone Traffic Control Planning

Consideration of traffic control must begin at the Project Development and Environmental (PD&E) study stage Impacts on traffic, traffic handling options, constructability, and design features and constraints, as they affect traffic, are to be evaluated for each alternate alignment studied The preliminary and final engineering reports must specifically address work zone traffic control

Traffic control considerations must begin in the early stages of design, using the work zone traffic control material from the PD&E study as the basis As the design progresses, the following should be considered

Design features and constraints Length of the project, lane configuration, and grade differentials between existing and proposed, interchanges and intersections, pavement materials, storm sewers, roadway lighting, utilities and bridge features are some of the design element decisions that might be influenced by work zone traffic control considerations

Contract specifications Provisions such as time restrictions on construction activities, incentive-disincentive clauses, daily, weekly and seasonal restrictions and special materials may be necessary Public relations activities such as media releases, television and radio spots, hand bills, and highway advisory radio may be specified

Other actions Actions may need to be taken by the Department prior to or during construction that may not be a contract requirement Examples are dealing with the media and local businesses, provisions for mass transit options to commuters, service patrols, improvements to alternate routes, coordination with other projects and maintenance activities, and special inspection requirements

Public input On very large and complicated projects, it may be necessary to involve the public through informal public meetings to be held early in the design of a project Close coordination with city and county officials may be necessary Citizen and business advisory committees may be established as sources of input

<u>Utility work</u> If contract utility work is anticipated in conjunction with or during the highway construction, the Traffic Control Plan (TCP) 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 to have a TCP by FHWA's FHPM 6-6-3-2 This requires early and effective coordination with utilities

10.4 Traffic Control Plans (TCP)

A TCP is a set of specific plan sheets, references to standard (typical) layouts, and/or notes on roadway plans describing how traffic will be controlled through a work zone All projects and work on highways, roads and streets shall have a traffic control plan, as required by Florida Statute and Federal regulations All work shall be executed under the established plan and Department approved procedures The TCP is the result of considerations and investigations made in the development of a comprehensive plan for accommodating traffic through the construction zone These considerations include the design itself, contract specifications, and plan sheets

TCP sheets detail the proper delineation of traffic through the work zone during all construction phases The complexity of the TCP varies with the complexity of the traffic problems associated with a project Many situations can be covered adequately with references to specific sections from the Manual on Uniform Traffic Control Devices (MUTCD), the Traffic Control Devices Handbook (TCDH), or Roadway and Traffic Design Standard Series 600. Specific TCP sheets shall be required in the plans set whenever project conditions are not specifically addressed in a typical layout from the manuals noted above This is usually the case for complex projects, and therefore references to Standard Indexes, as well as specific TCP sheets, will both likely be necessary

A quality traffic control plan should include the following information for the mainline and any affected cross roads, side streets, and ramps

(1) the location of all advance warning signs and lighting units
(2) temporary pavement markings, (including RPM's) for detours, transitions or other special situations
(3) location of temporary barriers and attenuators
(4) temporary drainage devices
(5) channelizing devices at special locations

(6) locations for special devices such as variable message signs (VMS), arrow boards, and temporary signals

(7) VMS messages for each phase

(8) signal timing for each phase, including method of temporary actuation if needed (Check with Traffic Operations Engineer)

(9) location and geometry for transitions and detours

(10) typical sections for each phase of work on all projects, except simple resurfacing projects, in order to show lane widths, offsets, barrier locations and other features influencing traffic control

(11) the proposed regulatory speed(s) for each phase

(12) reference to appropriate Standard Indexes or MUTCD drawings whenever applicable

(13) appropriate quantities, pay items and pay item notes

(14) resolve any conflicts between permanent signing and markings and work zone signing and markings

(15) key strategies such as service patrol, police, public service announcements, Highway Advisory Radio, night work

(16) good plan notes

(17) address the need for maintaining existing roadway lighting

(18) work area access plan

Chapter 19, Volume II, Plans Preparation and Assembly, explains the required information for specific TCP sheets

Consideration must also be given to adjoining, intersecting or sequential work zones This can be a particular problem with maintenance operations, bridge or roadway projects under different contracts, operations of other jurisdictions or utilities When such work must take place, the operations must be coordinated and taken into account in the TCP so that the motorist encounters one, consistently designed, work zone

TCP's for project designs "on the shelf" must be updated prior to contract letting

10.5 TCP Development

The following step-by-step process should be followed by designers when preparing traffic control plans

STEP #1 Understand the Project

- o Field reviews by designers should be required
- o Review the scope
- o Examine the plans (Phase I to Phase II)
- o Look at plan-profiles and cross-sections for general understanding
- o Review PD&E study for any constraints
- o Consider bicycle/pedestrian needs during construction
- o For complex projects consider developing a TCP study and other possible strategies such as public awareness campaigns, alternate route improvements, service patrols, etc

STEP #2 Develop Project Specific Objectives

What are your objectives? Examples might be

- o use barrier wall to separate workers from traffic
- o close road if adequate detour exists
- o maintaining 2-way traffic at all times
- o maintaining existing roadway capacity during peaks
- o maintaining business/resident access
- o provide bike/pedestrian access
- o minimize wetland impacts
- o expedite construction

STEP #3 Brainstorm TCP Alternatives

Develop some rough alternatives, considering what could be used to accomplish the work, such as constructing temporary pavement and/or temporary detours, using auxiliary lanes, placing 2-way traffic on one side of divided facility, using detour routes, etc Also, southside as opposed to northside on an east-west roadway Don't worry that an alternate doesn't meet all objectives

Designers should check condition of any proposed detour routes If off state system, may need agreement with locals

STEP #4 Develop a Construction Phasing Concept

- o Examine existing facility versus what is to be built This is a major task on jobs other than resurfacing
- o Coordinate with bridge designers
- o Color or mark the plan and profile sheets to show existing roadway versus new construction Then, check station by station, the plan sheet against cross-section sheets Make notes on plan sheets as to dropoffs or other problems Use profile grade lines or centerlines for reference points
- o List out major tasks to be completed, such as
  - construct new WB Roadway
  - construct new EB Roadway
  - construct frontage roads
  - construct bridge/flyover

  NOTE The designer may need input from construction personnel or even contractors representatives in determining construction phases
- o Make notes on plan sheets or notepad as to "decisions" that you make along the way

STEP #5 Examine/Analyze Alternatives Which Meet Objectives (for each phase)

Next, consider how you could achieve the proposed alternatives and meet the stated objectives

Examine pros and cons of various alternatives

Consider how much work and expense is involved for each alternative

Consider detour/transition locations, signal operations during construction, how to handle alternate modes of transportation-buses, bikes, pedestrians, service vehicles, etc

STEP #6 Develop Detailed TCP

Select the most feasible alternative for each phase Add details such as

- o detour/transition geometrics and locations
- o if lane closures are needed, use the lane closure technique discussed in 10 15 7 to determine time frame for closures,
- o advanced signing scheme and locations, revisions needed to existing signs - including guide signs, and proposed signs for all work activities - lane closures, detours, etc , on mainline, sideroads, x-roads and ramps
- o need for portable traffic signals, variable message signs, and barriers,
- o how existing operations will be maintained - side streets, businesses, residents, bikes, pedestrians, buses - bus stops, etc ,
- o revisions to signal phasing and/or timing during each TCP phase,
- o regulatory speed desired for each phase,
- o all pay items and quantities needed for TCP
- o how existing Auxiliary lanes will be used and any restriction necessary during construction
- o typical sections for each phase

- outline key strategies to be used
  - (a) service patrol
  - (b) police
  - (c) public service announcements
  - (d) Highway Advisory Radio
  - (e) night work
- need for Alternate route improvements

10.6 Coordination

Work zone traffic control can be a complex undertaking that requires the coordination of a number of agencies and other interested parties Planning and coordination must begin early in a project design

Traffic control is a joint responsibility of design (both roadway and bridge), construction and traffic operations personnel Coordination is necessary by all three parties in the development of TCPs Both traffic operations and construction personnel must routinely review TCPs in the early stages of development (Phase I to Phase II plans) to ensure that the plan is sound and constructable and bid items are complete and quantities reasonable Designers are also encouraged to contact contractors for ideas on Traffic Control Plans

Traffic control plans should also be reviewed with other appropriate offices such as maintenance, FHWA, community awareness teams, public, businesses, freeway coordinator management teams and local agencies Initial reviews should be made by construction and traffic operations no later than the Phase II plans stage with subsequent reviews of Phase III plans Input from local engineering and law enforcement agencies should be obtained early in the process, such as during the PD&E study and the Phase I plans stage

Adjoining work zones may not have sufficient spacing for standard placement of signs and other traffic control devices within their traffic control zones These situations can occur when separate contracts adjoin each other (separate bridge and roadway contracts are a typical example), utility work performed separately from roadway work or when maintenance activities are performed adjacent to a construction project Where such restraints or conflicts occur, or are likely to occur, the designer should try to resolve the conflicts in order to prevent misunderstanding on the part of the travelling public

10 6 1 FHWA Review

The type and format of TCPs on Federal-aid projects must be coordinated with FHWA early during design TCPs for federal aid projects are to be submitted to FHWA for review not later than at the Phase II plan stage

10 6 2 Phase Submittals

TCP phase submittals should include the following

Phase I - a typical section for each phase as well as a description of the phasing sequence and work involved

Phase II - a majority of the TCP completed (≈75-90%) including the information outlined in section 4 of this chapter (Section 10 4) and a list of the pay items needed

Phase III - a final TCP, including all notes, pay items and quantities

10.7 Work Zone Traffic Control Training

10 7 1 Background

Work zone traffic control is an important function affecting the safety of the traveling public, contractor personnel and equipment, and department employees Every reasonable effort should be made to eliminate or reduce involvement in accidents within work zones Proper traffic control training is vital to achieving this objective

The Department's Maintenance of Traffic Committee consists of representatives from Roadway Design, Construction, Safety, Maintenance, Traffic Engineering, Value Engineering and FHWA Its purpose is to develop, review or revise procedures, standards and specifications regarding work zone traffic control to maximize efficiency and enhance safety of motorists, pedestrians, and workers in these zones

10 7 2 Training Requirements

The Department's Maintenance of Traffic Committee has prescribed work zone traffic control training requirements for Department employees and shall furnish training course information and requirements to each District's Human Resource Development Manager

Every employee, including consultants, whose activities affect maintenance and construction work zone safety, from upper-level management through construction and maintenance field personnel, shall complete appropriate training as prescribed above and as required by Department procedure number 750-030-006

District Design, Construction, and Maintenance Engineers shall ensure that employees, including consultant personnel, who are responsible for traffic control plan design, implementation, inspection or supervision of the design, selection, placement, or maintenance of traffic control schemes and devices in work zones have been certified under the provisions of this procedure

10.8 Traffic Control Devices

Traffic control devices/methods that are available for use include

- Signs (warning, regulatory and guide)
- Lighting units (arrow panels, barricade and sign lights, illumination devices, temporary signals and variable message signs)
- Channelizing devices (cones, tubular markers, plastic drums, vertical panels, Types I, II and III barricades)
- Markings (pavement markings, raised pavement markings, delineators, and removal of conflicting markings)
- Safety appurtenances (portable concrete barriers, guardrail and crash cushions) - See AASHTO Roadside Design Guide (Chapter 9)
- Flaggers
- Police
- Guardrail attached to barrels for work zones $\leq$ 70 km/h - See AASHTO Roadside Design Guide

The MUTCD contains detailed instructions on the use of traffic control devices Special design considerations applicable to Florida are discussed in the following sections

10.9 Signs

10 9 1 Advance Warning Signs

The TCP should identify the advance construction warning signs, including legends and location These include signs such as "Road Construction Ahead", and "Road Construction One Mile" The TCP should provide the advanced warning signs, legends and locations for all proposed operations which require signing These include detours, lane closures, and flagging operations on the mainline as well as crossroads The sequence for advance signing should be from general to more specific As an example Road Construction Ahead (general), Left Lane Closed Ahead (more specific), Merge Right (specific)

10 9 2 Length of Construction Sign

The length of construction sign (G20-1) bearing the legend "Road Construction Next ____ Miles" is required for all projects of more than 3 000 meters in length The sign shall be located at begin construction points

10 9 3 Sign Covering

Signs (temporary and permanent) that warn of conditions shall be covered or removed when the condition is not present, such as might occur in work zones with daytime only operations Traffic control signs that require covering shall be fully covered with a durable opaque sheet materials Plastic film and woven fabrics including burlap will not be permitted Covering of only the legend or symbol will not be permitted Reflective coverings will not be permitted Hinged signs designed to cover when folded and sign blanks are permitted Signs to be covered or removed will be identified in the TCP, along with acceptable procedures

10 9 4 Existing Signs

Existing (regulatory, warning, etc) signs that conflict with the TCP shall be removed Existing guide signs should be modified as necessary It is good practice to revise existing guide signs by using black on orange panels to show changes made necessary by the construction operations

If permanent guide signs are to be removed during construction, provisions should be made 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 whenever possible

10.10 Lighting Units

10 10 1 Warning Lights

Warning lights shall be in accordance with Section 6E-5 of the MUTCD except for the limitations below

Flashing

Type A low intensity flashing warning lights should be mounted on barricades, drums, or vertical panels and are intended to continually warn drivers that they are approaching or proceeding in a hazardous area Flashing lights shall not be used to delineate the intended path of travel, and shall not be placed with spacings that will form a continuous line to the driver's eye The Type A light will be used to warn of isolated obstructions that are located adjacent to or in the intended travelway, and, to mark the approach to closed or detoured travel lanes Type A lights shall not be used in conjunction with the first and second advance warning signs

Type B high intensity flashing warning lights shall be mounted on the first advanced warning sign and on the first and second advanced warning sign where two or more signs are used This applies to all approaches to any work zone The first and second advance warning signs shall be supplemented with a 450 mm by 450 mm warning flag

Steady-Burn

Type C steady-burn lights are to be mounted on barricades, drums, concrete barrier walls or vertical panels and used in combination with those devices to delineate the travel way on lane closures, lane changes, detour curves and other similar conditions Steady-burn lights are intended to be placed in a line to delineate the traveled way through the work zone and around obstructions in the transition area, buffer space, work space and termination area of the traffic control zone Steady burn lights often serve the dual purpose of delineation and hazard warning

10 10 2 Advance Warning Arrow Panels

Arrow panels shall be used to supplement other devices for all lane closures on high-speed (90 km/h or greater) and high-traffic density multi-lane roadways The use of arrow panels should be considered for all other multi-lane closures These devices are also useful for short-term operations, such as during work zone installation and removal Arrow panels should not be used in lane shift situations Research has shown that motorists tend to change lanes (on multi-lane facilities) whenever an arrow panel is used to indicate a lane shift Since this "response" is not desired, the arrow panel should not be used for lane shift situations on multi-lane roadways Refer to MUTCD 6E-7 for further information

Arrow panel locations shall be shown on the TCP, along with any necessary notes concerning the use of this device

10 10 3 Variable Message Signs

Variable message signs may be used to supplement a traffic control zone As a supplemental device, it cannot be used to replace any required sign or other device These devices can be useful in providing information to the motorist about construction schedules, alternate routes, expected delays, and detours Variable message signs should be considered for use in complex, high-density work zones Messages must be simple, with a minimum number of words and lines and should require no more than three displays of no more than three lines each The TCP shall include the location and messages to be displayed

The message displayed should be visible and legible to the motorist at a minimum distance of 270 meters on approach to the signs All messages should be cycled so that two message cycles are displayed to a driver while approaching the sign from 270 meters at 90 km/h

The VMS units may be used

- To supplement conventional traffic control devices in construction work areas and should be placed approximately 150 to 250 meters in advance of potential traffic problems, or

- 1-3 kilometers in advance of complex traffic control schemes which require new and/or unusual traffic patterns for the motorists

Message Selection

Programmed messages should provide appropriate messages for the conditions likely to be encountered The following items must be carefully considered in the development of a message

(1) Message elements - not necessarily in order

- (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) Message length

- (a) limited by reading time (e g , 270 m at 90 km/h provides about 11 seconds of reading time)
- (b) limited by driver's processing capability
- (c) 4 word maximum, one part message
- (d) 8 word desirable max if two or three sequence message is used
- (e) shorter messages desirable to permit multiple readings
- (f) if two or three sequence messages is programmed, allow for off-time between messages

(4) <u>Display format</u>

(a) discrete with entire message displayed at once is most desirable

(b) sequential is OK, 2 part preferred, 3 part maximum

(c) run-on moving displays prohibited

(d) one abbreviation per panel display desirable, two abbreviations are maximum Route designation is considered as one abbreviation and one word

EXAMPLE

	Display 1	Display 2	Display 3
(a)	R A M P TO SR 26 E C L O S E D	U S E A L T R O U T E	
(b)	I-95 R O A D C L O S E D	F O L L O W D E T O U R R O U T E	
(c)	I-495 A T E X I T 30	2 R I G H T L A N E S C L O S E D	E X P E C T D E L A Y S

Typical Conditions

Consistent with the factors described above, VMS messages should be considered under the following conditions

(1) Road closures

(2) Ramp closures

(3) Delays one hour or longer created by

  (a) congestion

  (b) accidents

  (c) lane closures

  (d) two-way traffic on divided highway

  (e) multiple lane closures

  (f) unexpected shifts in alignment

10 10 4 Traffic Signals

Frequently portable or temporary traffic signals will be a preferred alternative to a flagger Also, existing signal operations may need to be revised to accommodate the construction operations The TCP should identify the specific alterations (physical location and timing) necessary for existing signals and the location and timing of portable signals Signal displays and location must meet MUTCD requirements

10.11 Channelizing Devices

10 11 1 Type III Barricades

The large Type III barricades have proven too cumbersome for work site applications Two smaller Type III barricades should be used to block off or close a roadway Whenever two smaller barricades are used together, only one warning light is required on the barricade

10 11 2 Separation Devices

Placing two lane two-way operations (traffic) (TLTWO) on one roadway of a normally divided highway should be a last resort and should be done with special care An analysis similar to that presented on pp 6-57 thru 6-61 of the TCDH referenced in 10 2, should be performed and documented when contemplating the need for TLTWO

"Separation" is defined in FHPM 6-4-2-12 and requires the use of devices such as those presented on pp 6-57 and 58 of the TCDH These include temporary barrier, drums, cones, tubular markers, or vertical panels Separation devices are required for TLTWO unless (1) it is used on an urban street where speeds are low, or (2) drivers entering the TLTWO can see the transition back to normal one-way operation on each roadway Striping, RPM's and signing alone, are not allowed when separation devices are required

Experience has also shown that stand alone tubular markers for long term operations are difficult to maintain and therefore their effectiveness is questionable The use of a temporary asphalt separator in conjunction with the tubular markers has been very effective (see Index 614)

10 11 3 Channelizing Device Alternates

It is intended that cones, Type 1 and 2 barricades, vertical panels, drums and tubular markers be considered as alternative channelizing devices to be used at the contractor's option The only exception to this is that cones and tubular markers are not allowed at night If the designer wants to further restrict the options (i e require drums, etc) it must be so noted on the plans or in the supplemental specifications

10.12 Pavement Markings

10 12 1 Removing Pavement Markings

Existing pavement markings that conflict with temporary work zone traffic patterns must be obliterated where operations will exceed one work period Painting over existing pavement markings is not permitted

10 12 2 Reflectorized Raised Pavement Marker (RPM)

Temporary RPMs are required on the lane lines of all transitions, crossovers and detours and to delineate temporary gore areas within the work zone The spacing shall be 12 0 m on tangent sections and 6 0 m on transitions, curves and crossovers

The designer should also consider using temporary RPMs on temporary lane lines, particularly on high-volume, high-speed facilities An example would be on urban freeways where lane line removal and restriping is required due to lane shifts

10 12 3 Work Zone Markings

Markings for work zones include "Removable" and "Non-Removable" maekings Section 102-3 3 of the Specifications describes when each type is required A separate pay item number is used for each The designer should be aware of this information and provide appropriate pay items in the plans

The designer should also consider using a miscellaneous asphalt pavement pay item for covering unneeded markings, especially in areas such as detours or crossovers

10.13 Safety Appurtenances for Work Zones

10 13 1 Traffic Barriers

Work zone traffic barriers are designed either as permanent barriers or as temporary barriers that can be easily relocated They have four specific functions to protect traffic from entering work areas, such as excavations or material storage sites, to provide positive protection for workers, to separate two-way traffic, and to protect construction such as false work for bridges and other exposed objects The designer should anticipate when and where barriers will be needed and include this information and the quantities on the plans

10 13 2 Portable Concrete Safety Shape (Temporary Barrier Walls)

Portable concrete safety shape barriers, also known as portable concrete barriers (PCB's), are widely used in work zones to protect motorists as well as workers However, improper use of these barriers can provide a "false sense of security" for both the motorist and the worker Therefore, care must be taken in their design, installation and maintenance Installation instructions and flare rates are given in the Roadway and Traffic Design Standards, Index 415

To perform properly and redirect vehicles, the PCB system must be capable of withstanding severe impacts The PCB's weakest point is its connector which includes the physical connection and mating faces of adjoining barriers or guardrail

Acceptable connections are noted on the Roadway and Traffic Design Standards, Index 415

The designer should show or note the location of all temporary barrier wall in the plans The plans should also include a work area access plan for those projects with median work which is shielded with barrier wall

10 13 3 End Treatments

The desirable treatments for exposed ends of barriers are

- connecting to an existing barrier (smooth, structural connections are required - Refer to the Roadway and Traffic Design Standards, Indexes 410 and 415) or
- attaching a crashworthy terminal such as a crash cushion or
- flaring away to the edge of the clear zone (See Chap 2 of this volume)

10 13 4 Modifications of Existing Barriers

When 2-way traffic is placed on a facility that is normally one-way, the existing permanent or temporary barriers will 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

10 13 5 Crash Cushions

Crash cushions in work zones may be used in the same manner as at permanent highway installations Crash cushions are used to protect the motorists from the exposed ends of barriers, fixed objects and other hazards within the clear zone Two types of stationary crash cushions are commonly used, the sand filled plastic barrel (the Roadway and

Traffic Design Standards, Index 415) system, and the GREAT CZ system Selection of a system should be the result of an analysis of site condition (i e space and need), first cost and replacement cost after hits The GREAT system is designed to shield a hazard and redirect vehicles, whereas sand barrels only provide hazard shielding Therefore, the designer must determine what is needed in order to provide the appropriate device The designer should anticipate the need for these devices and provide appropriate quantities on the plans The AASHTO Roadside Design Guide can be consulted for more information

10 13 6 Truck-Mounted Attenuator (TMA)

In many short-term, mobile, and moving work zones, trucks can be used as blocking vehicles to protect workers Large trucks are effective in preventing vehicle encroachment into the work site, however, serious injury to occupants of the impacting vehicle and truck can result

Crash cushions called truck-mounted attenuator (TMA) can be attached to the rear of these protective vehicles to reduce the severity of rear-end crashes TMA may either be trailer or truck-mounted If the designer sees the need for TMAs for a particular work zone activity, it should be noted on the plans and included in the pay items

TMAs are used for three classes of protective vehicles in work zones

1 Shadow Vehicle. a moving truck spaced a short distance from a moving operation, giving physical protection to workers from traffic approaching from the rear

2 Barrier Vehicle a truck parked upstream from a stationary operation and usually unoccupied

3 Advance Warnıng Truck a truck parked a consıderable dıstance upstream of a movıng or statıonary operatıon dısplayıng an arrow panel and other sıgns as appropnate

Shadow trucks and barrıer vehıcles may be equıpped wıth a TMA Advance sıgn trucks should use TMAs ıf they encroach on the traveled way Protectıve vehıcles usually are equıpped wıth arrow panels, varıable message sıgns or flashıng amber lıghts

A truck wıth a TMA must be posıtıoned properly wıth respect to the work If the TMA ıs too close to the work when hıt, ıt may strıke the worker, ıf too far back, traffic may go around ıt and hıt the workers The manufacturer's recommendatıons should be followed for deployment and use A "rule of thumb" for spacıng ıs less than one-half tımes the speed lımıt ın meters (e g , 0 5 X 90 km/h = 45 m) and at least 10 meters

10.14 Flaggers

10 14 1 General

Flaggers shall be used only when other traffic control devices cannot adequately ensure safe and smooth traffic operations Alternate devices such as temporary signals should be considered Appropriate advanced warning signs shall be used in conformance with the MUTCD, and shall be removed when flaggers are not in use

10 14 2 Location of Flaggers

Location of flaggers for known flagging operations shall be shown on the TCP, along with all notes necessary to fully explain conditions and requirements for their use Refer to the MUTCD for further information on flagging

10 14 3 Police Agencies

Police agencies (FHP, Sheriffs, or City Police) should be contacted for assistance in speed enforcement in work zones Police escorts can also be used to assist dump trucks and other construction equipment in re-entering the traffic stream on high speed congested facilities The designer should use plan notes or specifications to state which operations/ phases are anticipated as needing police assistance

10.15 Traffic Control Plan Details

The Roadway and Traffic Design Standards, Indexes 601 through 650, are layouts of work zone traffic control for typical conditions These indexes should be referenced only if project conditions are nearly the same as the typical layout Otherwise, specific plan sheets or details must be prepared Some conditions that will require specific plan sheets include

- Construction work zones near railroad crossings
- Work not covered by a typical layout
- Nighttime work requiring special lighting, oversized or additional devices
- Ramps and intersections that interrupt the standard layout
- Sight distance restrictions such as horizontal or vertical curves
- Lane or shoulder configurations that do not match the standards
- Special considerations during installation, intermediate traffic shifts and removal
- Complex projects, including add-lane projects, that involve many phases, traffic shifts, entrances and exits

When designing layouts, the following shall be considered

10 15 1 Taper Lengths

Minimum taper lengths shall be calculated by the formulas for transition distances given on the Roadway and Traffic Design Standards, Index 17346

"L" is the length of the taper, "W" is the width of the closed lane and "S" is the posted regulatory speed for the work zone Both L and W are measured in meters Speeds are given in the Index in MPH and kilometers per hour

The following table (taken from MUTCD 6C-2) gives the criteria for the lengths of the various taper types

Table 10 15 1

Taper Length Cntena for Work Zones

Type of Taper	Taper Length
UPSTREAM TAPERS	
Mergıng Taper	L Mınımum
Shıftıng Taper	1/2 L Mınımum
Shoulder Taper	1/3 L Mınımum
Two-way Traffic Taper	30 m Maxımum
DOWNSTREAM TAPERS (use ıs optıonal)	30 m per lane

10 15 2 Intersectıng Road Sıgnıng and Sıgnals

Sıgnıng for the control of traffic enterıng and leavıng work zones by way of ıntersectıng hıghways, roads and streets shall be adequate to make drıvers aware of work zone condıtıons Under no condıtıon wıll ıntersectıng leg sıgnıng be less than a "Road Constructıon Ahead" sıgn for approachıng vehıcles and an "End Constructıon" sıgn for departure vehıcles unless the ıntersectıng street consısts of a shell, sand, or dırt surface, ın whıch case ıt shall be left to the dıscretıon of the engıneer as to the need for thıs type sıgnıng The desıgner should remember to ınclude these sıgns ın the estımated quantıty for Constructıon warnıng sıgns

Exıstıng traffic sıgnal operatıons that requıre modıficatıon ın order to carry out work zone traffic control shall be as approved by the Dıstrıct Traffic Operatıons Engıneer If lane shıfts occur, sıgnal heads may have to be adjusted to maıntaın proper posıtıon The DTOE should also determıne the need for temporary loops for traffic actuated sıgnals The TCP should ınclude all necessary sıgnal adjustments

10 15 3 Sight Distance To Delineation Devices

Merging (lane closure) tapers should be obvious to drivers If restricted sight distance is a problem (e g , a sharp vertical or horizontal curve approaching the closed lane), the taper should begin well in advance of the view obstruction The beginning of tapers should not be hidden behind curves

10 15 4 Pedestrians and Bicyclists

When pedestrians and/or bicyclists are accommodated on the existing facility (mainline or sidestreet), provisions must be included in the TCP to accommodate them during construction Pedestrian accommodations through the work zone must include provisions for the disabled

10 15 5 Superelevation

Horizontal curves constructed in conjunction with temporary work zone detours, transitions, and crossovers should have the required superelevation Under conditions where superelevation is not used, the minimum radii that can be applied are listed in the Table 10 15 2 Superelevation must be included with the design whenever the minimum radii cannot be achieved

TABLE 10 15 2

MINIMUM RADII FOR NORMAL CROSS SLOPES

SPEED (km/h)	MINIMUM RADIUS (meters)
110	955
100	730
90	560
80	425
70	330
60	185
50	131

10 15 6 Lane Widths

Existing lane widths of through roadways should be maintained through work zone travel ways wherever practical The minimum widths for work zone travel lanes shall be 3 0 meters for all roadways other than Interstate On Interstate highways the minimum width for work zone travel lanes shall be 3 3 m except at least one 3 6 m lane in each direction shall be provided

10 15 7 Lane Closure Analysis

The lane closure analysis is a process used by designers 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 or should not be allowed and the time of day or night a lane closure could occur without excessive travel delay

Exhibit 10-A includes the Lane Closure Analysis Worksheets and two sample analyses The Sample Lane Closure Worksheet (Exhibit 10-A, sheet 3 of 11) has been cross-referenced to the Lane Closure Symbols and Definitions Sheet (Exhibit 10-A, sheets 1

& 2 of 11) with circled numbers The circled numbers correspond to the numbers of the symbols and definitions The symbols and definition sheet shows the designer where to find the necessary information to fill out the Lane Closure Worksheet

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 Transfer these percentages to the graph on the Lane Closure 24 Hour Counts Sheet (Exhibit 10-A, sheet 5 of 11) Draw a line across the graph representing the percentage for both open road and signalized intersections (see Exhibit 10-A, sheet 7 of 11) 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 indicated lane closure problems The bottom of the graph gives times for AM and PM By coordinating the lane closure problem areas to the time of day, a designer knows when to restrict lane closure

Many of Florida's roadways have directional peak hour traffic volumes, with inbound morning traffic and outbound afternoon traffic Doing a composite lane closure analysis would in many cases require night work However, if a separate lane closure analysis is calculated for inbound and outbound separately, a lane closure may be allowed and the contractor could work in daylight hours (See Exhibits 10-A, sheet 10 of 11 and 10-A, sheet 11 of 11)

LANE CLOSURES

Symbols and Definitions

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 exhibit 10-A, sheet 7 of 11)

2 P/D = Peak Traffic to Daily Traffic Ratio Highest hourly volume divided by the total twenty four hour volume Convert the percentage to a decimal on the Lane Closure Worksheet (see exhibit 10-A, sheet 7 of 11)

3 D = Directional Distribution of peak hour traffic on multi-laned 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 PMF = Peak Month Factor Many counties in Florida have a significant variance in monthly traffic volumes and since the actual date of a lane closure would be difficult to estimate, the designer should use the highest monthly factor in calculating the volume on the Lane Closure Worksheet The Office of Planning has tables showing monthly traffic factors for every county in Florida (see sample table on Exhibit 10-A, sheet 4 of 11)

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 180 meters 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 month 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

Exhibit 10-A
Sheet 1 of 11

LANE CLOSURES

Symbols and Definitions

8 C = Capacity of a 2L, 4L or 6L roadway with one lane closed, and the remaining lane(s) unrestricted by lateral obstructions The capacity of a 4L or 6L roadway is based on lane closure in only one direction (see Lane Closure Capacity Table on Exhibit 10-A, sheet 3 of 11)

9 RC = Restricting Capacity of the above facilities by site specific limitations detailed in the MOT 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 on Exhibit 10-A, sheet 4 of 11 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 3 6 m and lateral clearance less than 1 8 m (see MOT plans and Obstruction Factor Table in Exhibit 10-A, sheet 4 of 11)

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 on Exhibit 10-A, sheet 4 of 11)

12 TLW = Travel Lane Width is used to determine the obstruction factor (see MOT plans and the Obstruction Factor Table on Exhibit 10-A, sheet 4 of 11)

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 MOT plans and Obstruction Factor Table on Exhibit 10-A, sheet 4 of 11)

LANE CLOSURE WORKSHEET

STATE PROJECT NO ____________________ FAP NO ________________________

WPI NO ___________COUNTY ___________DESIGNER ___________________________________

NO EXISTING LANES ______ SCOPE OF WORK ___________________________________

____

Calculate the peak hour traffic volume (V)

V=ATC__7__X P/D__2__X D__3____X PMF__4__X RTF__5__ = ____7______

LANE CLOSURE CAPACITY TABLE

Capacity(C) of an Existing 2 Lane-Converted to 2 Way,1 Lane = 1400VPH
Capacity(C) of an Existing 4 Lane-Converted to 1 Way,1 Lane = 1800VPH
Capacity(C) of an Existing 6 Lane-Converted to 1 Way,2 Lane = 3600VPH

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, or 6L 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 180 0 m 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

$$\% = \frac{\text{RC (Open Road) \_\_9\_\_}}{\text{ATC\_7\_X D\_3\_X PMF\_4\_X RTF\_5\_}} = \_\_\_\_\_\_\_\_\_\_ \%$$

Signalized % = Open Road %_________ X G/C__6___ = __________

Plot 24 hour traffic to determine when Lane Closure permitted (See Exhibit 10-A, Sheet 5 of 11)

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 ______________________________

____

____

Exhibit 10-A
Sheet 3 of 11

LANE CLOSURES

CAPACITY ADJUSTMENT FACTORS

PMF SAMPLE

Tropic County Monthly Factors			
January	1 12	July	0 88
February	1 20	August	0 85
March	1 18	September	0 88
April	1 12	October	0 94
May	1 05	November	1 00
June	0 95	December	1 06

Note February is the peak month in Tropic County, therefore the PMF in the 2L and 4L samples is 1 20 − 1 00 The counts were taken in November

OBSTRUCTION FACTORS (OF)

Lateral Clearance (LC) (meters)	Travel Lane Width (TLW) (meters)			
	3 6	3 3	3 0	2 7
1 8	1 00	0 96	0 90	0 80
1 2	0 98	0 94	0 87	0 77
0 6	0 94	0 90	0 83	0 72
0 0	0 86	0 82	0 75	0 65

WORK ZONE FACTORS (WZF)

WZL (m)	WZF	WZL (m)	WZF	WZL (m)	WZF
60	0 98	660	0 81	1260	0 64
120	0 97	720	0 80	1320	0 63
180	0 95	780	0 78	1380	0 61
240	0 93	840	0 76	1440	0 59
300	0 92	900	0 74	1500	0 57
360	0 90	960	0 73	1560	0 56
420	0 88	1020	0 71	1620	0 54
480	0 86	1080	0 69	1680	0 53
540	0 85	1140	0 68	1740	0 51
600	0 83	1200	0 66	1800	0 50

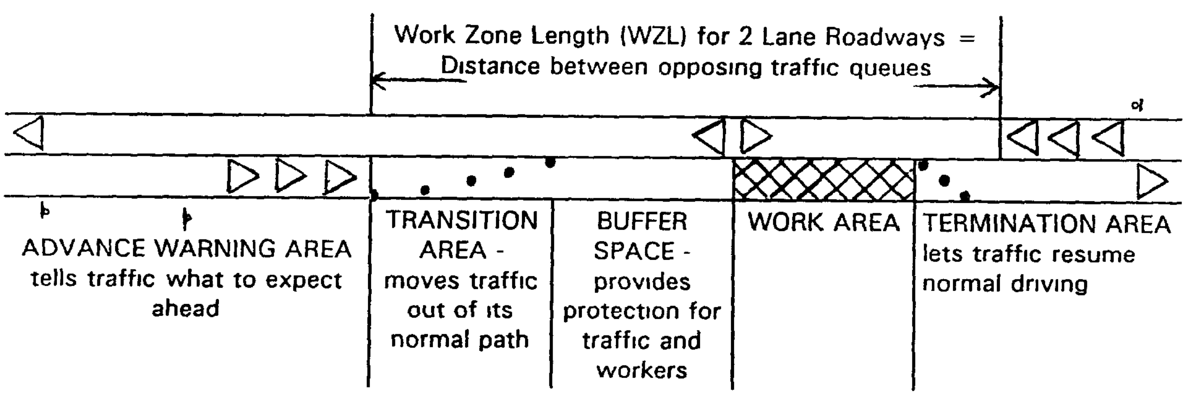


Exhibit 10-A, Page 4 of 11

LANE CLOSURES

24 HR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 - 1				
1 2				
2 3				
3 4				
4 5				
5 6				
6 7				
7 8				
8 9				
9 10				
10 11				
11 12				
		TOTAL		

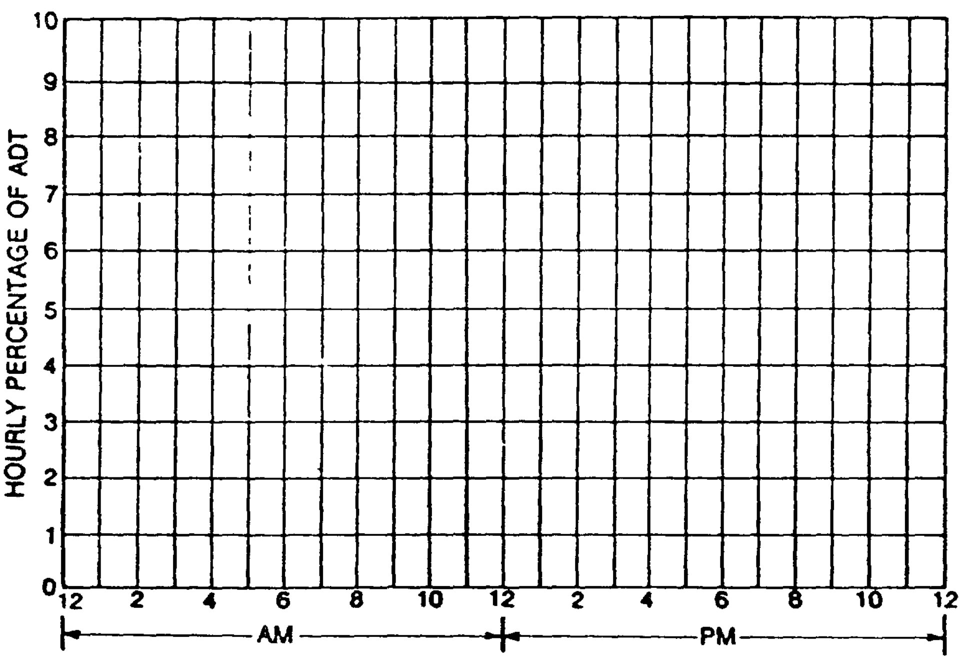
DATE ______

DESIGNER: ______

PROJECT NO ______

LOCATION ______

HOURLY VARIATION OF DAILY TRAFFIC



— CONCLUSIONS —

Round to the nearest ½ hour conservatively

OPEN ROAD LANE CLOSURE

SIGNALIZED LANE CLOSURE

EX-I-10-A

5 of 11

LANE CLOSURE WORKSHEET

STATE PROJECT NO 12345-6789 FAP NO NA

WPI NO 1234567 COUNTY Tropic DESIGNER Yates

NO EXISTING LANES 2 SCOPE OF WORK Widen & Resurface

Calculate the peak hour traffic volume (V)

V = ATC 15 000 X P/D 0 083 X D NA X PMF 1 20 X RTF 0 75 = 1120

LANE CLOSURE CAPACITY TABLE

Capacity(C) of an Existing 2 Lane-Converted to 2 Way, 1 Lane = 1400VPH
Capacity(C) of an Existing 4 Lane-Converted to 1 Way, 1 Lane = 1800VPH
Capacity(C) of an Existing 6 Lane-Converted to 1 Way, 2 Lane = 3600VPH

Factors restricting Capacity

TLW 3.0 LC 1.2 WZL 630 G/C 0 64

Calculate the Restricted Capacity (RC) at the Lane Closure Site by multiplying the appropriate 2L, 4L, or 6L 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 180 0 m of a signalized intersection, multiply the RC by the G/C Ratio

RC (Open Road) = C 1400 X OF 0.87 X WZF 0.82 = 999

RC (Signalized) = RC (Open Road) 999 X G/C 0.64 = 639

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

$$\% = \frac{\text{RC (Open Road) } 999}{\text{ATC } 15\,000 \text{ X D } 1.00 \text{ X PMF } 1\ 20 \text{ X RTF } 0\ 75} = 7\ 40\ \%$$

Signalized % = Open Road % 7 40 X G/C 0 64 = 4.74

Plot 24 hour traffic to determine when Lane Closure permitted (See Exhibit 10-A, Sheet 5 of 11)

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 25% of existing traffic diverted on Bullard Blvd , north on Newhall Nene, then east on Xanders Xway

Exhibit 10-A
Sheet 6 of 11

LANE CLOSURES

24 HR COUNTS

TIME	AM HOURLY VOLUME	ATC %	PM HOURLY VOLUME	ATC %
12 1	160	1.1	960	6.4
1 2	90	0.6	830	5.5
2-3	30	0.2	810	5.4
3-4	25	0.2	1080	7.2
4-5	30	0.2	1190	7.9
5-6	130	0.9	1240	8.3
6 7	525	3.5	930	6.2
7 8	1135	7.6	680	4.5
8-9	910	6.1	530	3.5
9 10	870	5.8	425	2 8
10-11	825	5.5	365	2.4
11-12	960	6.4	270	1.8
		TOTAL	15,000	100

P/D =.083

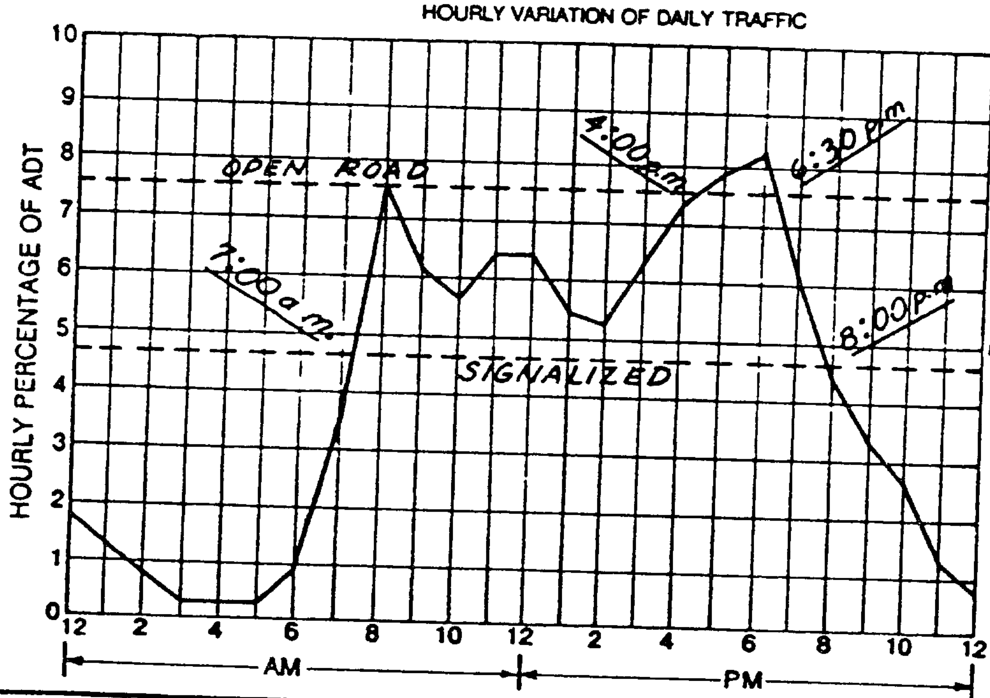
DATE Feb-1988

DESIGNER YATES

PROJECT NO 12345-6789

LOCATION Buck Lake Rd

HOURLY VARIATION OF DAILY TRAFFIC



7.40

4.74

— CONCLUSIONS —

Round to the nearest ½ hour conservatively

OPEN ROAD LANE CLOSURE
6:30 p.m - 4 00 p.m

SIGNALIZED LANE CLOSURE
8:00 p m - 7:00 a m

EX-I-10-A
7 of 11

LANE CLOSURE WORKSHEET

STATE PROJECT NO 12345-6789 FAP NO NA

WPI NO 1234567 COUNTY Tropic DESIGNER Giddens

NO EXISTING LANES 4 SCOPE OF WORK Resurface

Calculate the peak hour traffic volume (V)

V=ATC 30 000 X P/D 0.083 X D 0 55 X PMF 1.20 X RTF 1 00 = 1643

LANE CLOSURE CAPACITY TABLE

Capacity(C) of an Existing 2 Lane-Converted to 2 Way,1 Lane = 1400VPH
Capacity(C) of an Existing 4 Lane-Converted to 1 Way,1 Lane = 1800VPH
Capacity(C) of an Existing 6 Lane-Converted to 1 Way,2 Lane = 3600VPH

Factors restricting Capacity

TLW 3 3 LC 1.8 WZL NA for 4L G/C 0 74

Calculate the Restricted Capacity (RC) at the Lane Closure Site by multiplying the appropriate 2L, 4L, or 6L 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 180 0 m of a signalized intersection, multiply the RC by the G/C Ratio

RC (Open Road) = C 1800 X OF 0.96 X WZF 1 00 = 1728

RC (Signalized) = RC (Open Road) 1728 X G/C 0.74 = 1279

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

% = RC (Open Road) 1728 / (ATC 30 000 X D 0 55 X PMF 1.20 X RTF 1 00) = 8 73 %

Signalized % = Open Road % 8.73 X G/C 0.74 = 6.46

Plot 24 hour traffic to determine when Lane Closure permitted (See Exhibit 10-A, Sheet 5 of 11)

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 NA

Exhibit 10-A
Sheet 8 of 11

LANE CLOSURES

24 HR 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 %

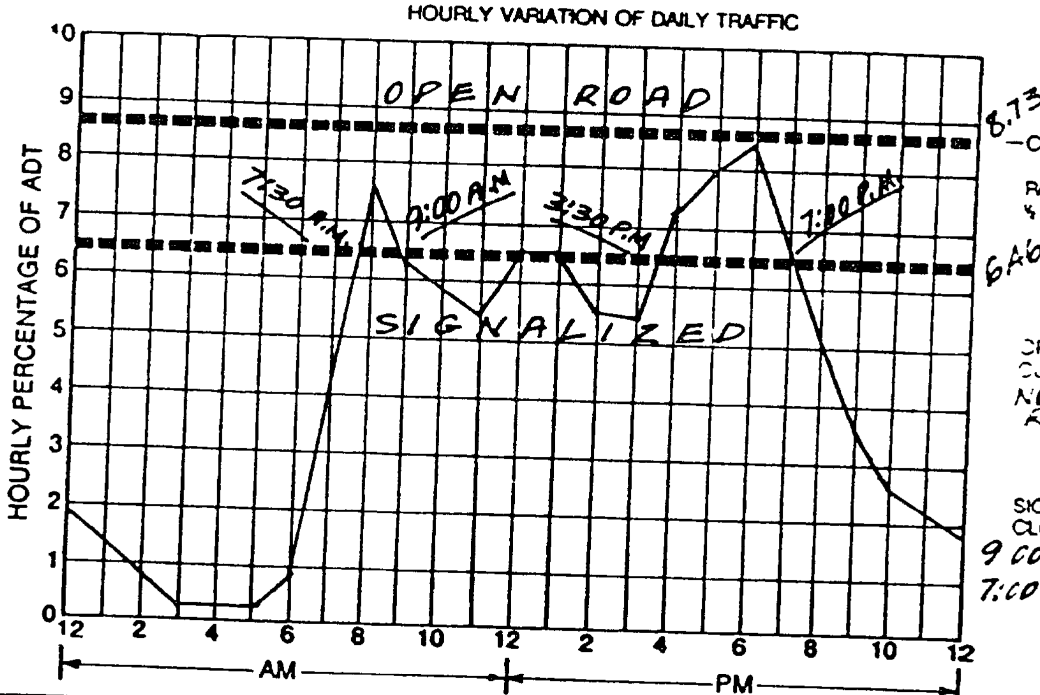
DATE
FEB. 1988

DESIGNER
GIDDENS

PROJECT NO
12345-6789

LOCATION
BUCK LAKE RD

HOURLY VARIATION OF DAILY TRAFFIC



— CONCLUSIONS —

Round to the nearest ½ hour conservatively

OPEN ROAD LANE CLOSURE
NO RESTRICTION

SIGNALIZED LANE CLOSURE
9:00 AM - 3:30 PM
7:00 PM - 7:30 AM

EX-I-10-A

9 of 11

SAMPLE 4 LANE SITE = SR 60 @ US 301 EAST OF TAMPA HILLSBOROUGH CO

INBOUND LANE CLOSURES

24 HR COUNTS

TIME	AM HOURLY VOLUME	AM ATC %	PM HOURLY VOLUME	PM ATC %
12 1	146	0.7	1437	6.6
1 2	88	0.4	1387	6.4
2 3	99	0.5	1357	6.2
3 4	94	0.4	1358	6.2
4 5	158	0.7	1261	5.8
5 6	392	1.8	1188	5.5
6 7	1377	6.3	998	4.6
7 8	2235	10.3	901	4.1
8 9	1602	7.4	594	2.7
9 10	1339	6.2	518	2.4
10 11	1276	5.9	380	1.7
11 12	1316	6.0	259	1.2
TOTAL			21,760	100.2

COMPOSITE LANE CLOSURES

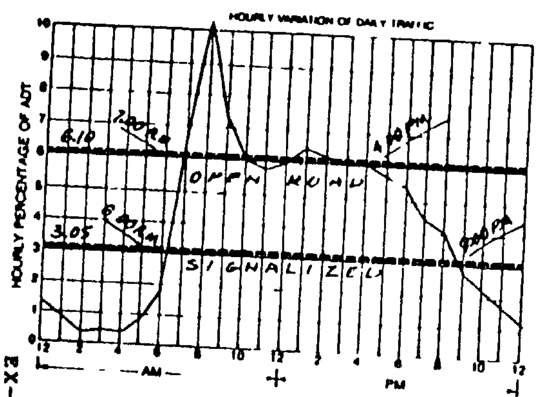
24 HR COUNTS

TIME	AM HOURLY VOLUME	AM ATC %	PM HOURLY VOLUME	PM ATC %
12 1	444	1.1	2836	6.7
1 2	232	0.5	2594	6.1
2 3	195	0.5	2844	6.3
3 4	245	0.6	2823	6.7
4 5	294	0.7	3066	7.3
5 6	599	1.4	3080	7.3
6 7	1895	4.5	2362	5.6
7 8	3070	7.3	1775	4.2
8 9	2559	6.1	1291	3.0
9 10	2403	5.7	1212	2.8
10 11	2367	5.6	890	2.1
11 12	2694	6.4	662	1.5
TOTAL			42,232	100.2

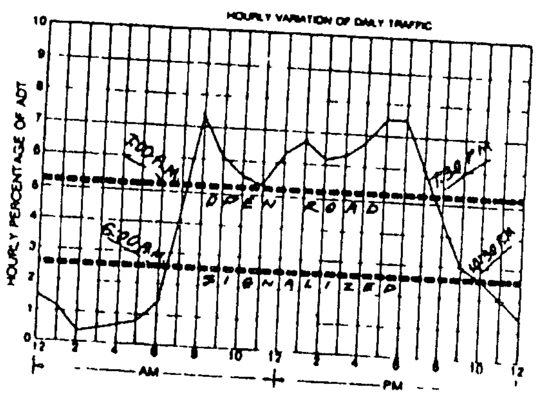
OUTBOUND LANE CLOSURES

24 HR COUNTS

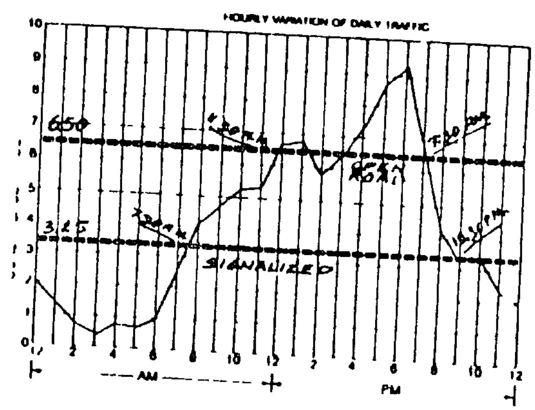
TIME	AM HOURLY VOLUME	AM ATC %	PM HOURLY VOLUME	PM ATC %
12 1	298	1.5	1399	6.8
1 2	144	0.7	1201	5.9
2 3	96	0.5	1281	6.3
3 4	151	0.7	1465	7.2
4 5	136	0.7	1805	8.8
5 6	207	1.0	1892	9.2
6 7	518	2.5	1364	6.7
7 8	835	4.1	874	4.3
8 9	957	4.7	691	3.4
9 10	1064	5.2	694	3.4
10 11	1091	5.3	510	2.5
11 12	1378	6.7	403	2.0
TOTAL			20,472	100.2



HOUR OF DAY



HOUR OF DAY



HOUR OF DAY

EX-I-10-A

10 of 11

LANE CLOSURE WORKSHEET SUMMARY LANE SAMPLE WITH SIGNIFICANT AM-PM PEAKS SAMPLES = INBOUND (WB), COMPOSITE (EB & WB), OUTBOUND (EB) SITE = SR 60 @ US 301 EAST OF TAMPA, HILLSBOROUGH CO			
COMPONENT	INBOUND	COMPOSITE	OUTBOUND
ADT	*21 760*	*42 232*	*20 472*
P/D	*0.103*	*0.073*	*0.092*
D	*1.00*	*0.60*	*1.00*
PMF	*1 17*	*1.17*	*1.17*
RTF	*1.00*	*1.00*	*1.00*
V	*2622*	*2164*	*2203*
TLW	*3 6*	*3 6*	*3.6*
LC	*0*	*0*	*0*
C	*1800*	*1800*	*1800*
OF	*0.86*	*0.86*	*0.86*
RC (OPEN ROAD)	*1548*	*1548*	*1548*
G/C	*0.50*	*0.50*	*0.50*
RC (SIGNAL)	*774*	*774*	*774*
% OPEN ROAD	*6.10*	*5.20*	*6.50*
% SIGNAL	*3.05*	*2.60*	*3.25*
LANE CLOSURE (OPEN ROAD)	*7:00 A.M.* *4 00 P.M.*	*7:00 A.M* *7:30 P.M*	*11:30 A.M* *7:30 P.M*
LANE CLOSURE (SIGNAL)	*6:00 A.M.* *9:00 P.M.*	*6:00 A.M.* *10:30 P M.*	*7:30 A.M.* *10:30 P.M.*

Exhibit 10-A Page 11 of 11

10 15 8 Detours

A detour is a deviation from the normal roadway and is initiated when traffic is directed to leave the roadway Activities such as traffic shifting and/or splitting accomplished within the confines of the roadway do not involve detours, but a crossover involves a detour because traffic is directed to depart the directional roadway

There are two types of detours on-site and off-site An on-site detour is generally defined as a shift in the traffic of one lane or more At an on-site detour traffic is diverted onto a temporary roadway generally constructed within or adjacent to the right-of-way or onto a frontage road At an off-site detour traffic is diverted onto another highway in order to bypass the work zone

For off-site detours, the detour signing is usually done under the direction of the traffic engineer who has authority over the roadway The detour should be signed clearly so drivers can traverse the entire detour and return to the original roadway Detour signing is not required for minor shifts from the direct or regular route There will be situations that are between minor shifts and re-routing In these cases engineering judgement must be applied to ensure that traffic is given clear and adequate direction When shifts and detours are required the designer should analyze the effects of the action on the capacity of the roadway and take the necessary steps to minimize adverse impacts The structural capacity of the shoulder or detour pavement should also be considered and additional structure provided if necessary

The designer has two methods of paying for detours by (1) using the "special detour" lump sum pay item or (2) using the lump sum MOT pay item. When the special detour pay item is used, the work and quantities included for pay under the item are to be tabulated and noted in the plans The special detour pay item is intended to be used in all situations where traffic is shifted one lane width or more onto temporary pavement

All work and materials necessary to construct temporary pavement widening for shifts less than one lane width shall be included under lump sum MOT

Even though shifts may meet the definition of a detour and a "special detour" may be called for contract pay purposes, it may not be appropriate to sign the shift as a detour Signing should match the perceptions and desired responses of the driving public as per the MUTCD rather than administrative definitions

TCPs should include sufficient detail for detour geometry Detours should be designed with shoulders (0 6 m min) whenever practical The radius of curvature and taper lengths should be shown Detours should be designed and operated as close to the normal speed as possible When speed reductions are necessary, the reduction should be in 10 km/h increments The recommended minimum radius of curvature (without superelevation) for detours is shown in Table 10 15 2

10 15 9 Above Ground Hazards

An above ground hazard is any object, material, or equipment, which does not meet the Department's safety criteria for clear zones - i e , anything that is greater than 100 mm in height and is firm and unyielding or doesn't meet breakaway requirements

Construction hazards located within the travel way or from the outside edge of pavement through the clear zone for the highway are to be considered work areas and treated as required by the appropriate warning devices during the contractor's work hours or eliminate the hazard During non-working hours, all objects, materials, or equipment that constitutes a hazard, must be stored/placed outside the clear zone or be shielded by a barrier wall

For above ground hazards within a work zone, the clear zone used should be based on the regulatory speed posted during construction (See Index 700)

10 15.10 Drop-offs in Work Zones

Acceptable warning and barrier devices for traffic control at drop-offs in work areas are detailed in Standard Index 600

The designer should anticipate dropoffs which are likely to occur during construction and provide the appropriate devices For those projects where barrier wall would be needed and yet it is not practical - such as highly developed urban areas where numerous driveways exist - the designer should consider adding plan notes which restrict the length of the contractors operations in order to reduce the dropoff at acceptable level, prior to the end of the days operations

10 15 11 Narrow Bridges

Simultaneously working on both sides of a bridge (bridge widening, etc) may be hazardous due to the narrow width of some bridges Consideration should be given to specifying that work be done only on one side at a time, particularly on high speed roadways In some situations, the installation of barrier wall on both shoulders can totally eliminate any shoulder or refuge area The designer should consider whether or not this restriction of the effective bridge width is acceptable and consistent with the desired operational ability of the facility

10 15 12 Existing Highway Lighting

If the project has existing roadway lighting, the designer shall prepare a specification that completely describes what is to be done with the existing lighting during all phases of construction Give detailed information on any poles that have to be relocated or any new conduit or conductors that would have to be installed A field survey should be conducted to establish the condition of the existing system and what responsibility the contractor will have in bringing the existing lighting system back to an acceptable condition.

The designer shall determine what work is to be done and, using the pay items established for roadway lighting shown on Index 17506 of the Roadway and Traffic Design Standards, develop pay items and quantities for all work to be done for maintaining existing lighting throughout construction

10 15 13 Work Area Access

The TCP must also include a work area access plan, if necessary This is a constructability issue in which the designer addresses the question of how the contractor is to get materials and equipment into the work area safely This is a particularly critical issue on high speed facilities (such as the Interstate) where barrier wall is used to protect median work areas

10 15 14 Railroads

Railroad crossings that are affected by a construction project must be evaluated to ensure that the Traffic Control Plan does not cause queuing of traffic across the railroad tracks Evaluate the Plan's signal timing, tapers, lane closures and distance to intersections as compared to projected peak traffic volumes

10 15 15 Pay Items and Quantities

The Basis of Estimates Manual has been updated to provide better instructions on calculating many of the MOT quantities

10.16 Speed Zoning

10 16 1 Regulatory Speeds in Work Zones

The goal of traffic control plans for construction, maintenance, and utility operations is to route traffic through such areas in a manner comparable to normal highway conditions Changes to the existing posted speed limits should only be made after consideration of actual or anticipated field conditions, including vehicular volumes, congestion, TCP phasing, lane restrictions, type of construction, closeness of traffic to workers, equipment, flagger usage, pedestrians, geometrics, and physical conditions By virtue of F S 316 187, all regulatory speeds must be established on the basis of a traffic and engineering investigation The justification for establishing work zone regulatory speeds different from normal speed limits must be included in the project file

When developing a TCP, the considerations noted above must be addressed in determining the appropriate regulatory speeds The TCP and the project file will suffice as the traffic and engineering investigations TCPs for all projects must show specific regulatory speeds for each phase of work This can either be the existing posted speed or a reduced speed The speed shall be noted in the TCP Guidelines for determining the appropriate speed reduction are given in Table 10 16 1

If field conditions warrant speed reductions greater than those shown in the Traffic Control Plan (TCP), then the contractor may submit to the project engineer for approval by the Department, a signed and sealed study to justify the need for further reducing the posted speed or the engineer may request the District Traffic Operations Engineer (DTOE) to investigate the need It will not be necessary for the DTOE to issue regulations for regulatory speeds in work zones due to the revised provisions of F S 316 0745(2)(b) However, all other regulatory signs, work zone or permanent, require issuance of a regulation by the DTOE

Table 10 16 1

**REGULATORY SPEED REDUCTIONS
FOR USE IN CONSTRUCTION AND MAINTENANCE OPERATIONS**

CONDITIONS	TYPICAL APPLICATIONS	DURATION OF WORK	REDUCTIONS TO EXISTING REGULATORY SPEEDS	SUGGESTED AMOUNT OF SPEED REDUCTION
Activities are more than 4 5m from the edge of pavement	Landscaping Work Utility Work Fencing Work Cleaning Drainage Structures Reworking Ditches	Any time period	SHOULD NOT BE USED*	N/A
Activities which encroach the area closer than 4 5m but not closer than 0 6m to the edge of pavement	Utility Work Culvert Extensions Side Slope Work Guardrail Maintenance Landscaping Work Cleaning Drainage Structures Reworking Ditches Sign Installation and Maintenance Shoulder Work	One daylight period or less	SHOULD NOT BE USED*	N/A
		Greater than one daylight period	MAY BE USED	10 km/h
Activities which encroach the area from the edge of the pavement to 0 6m from the edge of pavement	Utility Work Guardrail Maintenance Shoulder Work	One daylight period or less	SHOULD NOT BE USED*	N/A
		Greater than one daylight priod	MAY BE USED	10 km/h

NOTE Regulatory Speed signs shall meet all requirements of the Manual on Uniform Traffic Control Devices (MUTCD)

* Unless drop-offs or other situations create hazardous conditions for motorists, pedestrians or workers

Table 10 16.1
(continued)

REGULATORY SPEED REDUCTIONS
FOR USE IN CONSTRUCTION AND MAINTENANCE OPERATIONS

CONDITIONS	TYPICAL APPLICATIONS	DURATION OF WORK	REDUCTIONS TO EXISTING REGULATORY SPEEDS	SUGGESTED AMOUNT OF SPEED REDUCTION
Activities are encroach the area between the centerline and the edge of pavement (lane closures)	Pavement Marking Pavement Resurfacing Pavement Repair Utility Work Bridge Repair Widening	One hour or less	SHOULD NOT BE USED*	N/A
		Greatr than one hour	MAY BE USED	10-20 km/h
Activities which require intermittent or moving operation on the shoulder	Shoulder and Slope Utility Work Guardrail Maintenance Landscape Work Delineator Installation Widening	One hour or less	SHOULD NOT BE USED*	N/A
		Greater than one hour	SHOULD NOT BE USED*	N/A
Activities requiring a temporary detour to be constructed **	Bridge Construction Subgrade Restoration Culvert Repair Roadway Construction	Any time period	MAY BE USED	10-20 km/h
Activities which encroach the area beyond either the centerline of a roadway or lane line of a multi-lane highway	Pavement Marking Pavement Resurfacing Use of Temporary Barrier Wall Installation of Drainage Laterals	Any time period	MAY BE USED	10-20 km/h

NOTE Regulatory Speed signs shall meet all requirements of the Manual on Uniform Traffic Control Devices (MUTCD)

* Unless drop-offs or other situations create hazardous conditions for motorists, pedestrians or workers

**Detour and transition geometrics which meet the existing regulatory speed should be provided whenever possible

Regulatory speed signs in rural areas (Interstate and Non-Interstate) are to be preceded by a "Reduce Speed Ahead" sign positioned as follows

Interstate (Rural)	-	300 m in advance
Non-Interstate (Rural)	-	150 m in advance

All urban areas do not require an advance sign, however, it may be included at the designer's option

The "Regulatory Speed" and "Reduce Speed Ahead" signs are to be paid for under the pay item for Temporary Regulatory Signs (per each per day)

If the existing regulatory speed is to be used, consideration should be given to supplementing the existing signs when the construction work zone is between existing regulatory speed signs For projects greater than one kilometer in length for rural areas (Non-Interstate) and on Rural or Urban Interstate, regulatory signs are to be placed at no more than one kilometer intervals For urban situations (Non-Interstate) regulatory speed signs are to be placed at a maximum of 300 m apart

The 85 percentile speed used to establish normal regulatory speeds does not apply for construction zones Changes to the existing speed should be made on actual or anticipated field conditions such as· vehicular volumes, congestion, TCP phasing, lane restrictions, type of construction, closeness of traffic to workers, equipment, flagger usage, pedestrians, geometrics and physical conditions This is interpreted to mean, using engineering judgement, the responsible designer is to establish the regulatory speed and so note in the plans and project file, after considering the above conditions and the degree to which warning devices are required In general, the regulatory speed should be established to route vehicles safely through the work zone as close to normal conditions as possible The regulatory speed should not be reduced more than 20 km/h below the posted speed without the approval of the District Traffic Operations Engineer and the appropriate District Director (See the Roadway and Traffic Design Standards, Index 600) This reduction is to be done in 10 km/h per 150 m increments

To ensure credibility with motorists and enforcement agencies, reductions in the existing posted speed shall be removed as soon as the conditions requiring the reduced speed no longer exist On longer projects, such as interstate resurfacing, the speed reductions should be located in proximity to the activities which merit a reduced speed and not "blanketed" for the entire project

When the regulatory speed is changed in a work zone, the permanent speed limit signs are to be removed during the period when the work zone regulatory speed zones are in effect

Once the work zone regulatory speeds are removed, the regulatory speed existing prior to construction will automatically go back into effect unless a new regulation is issued by the DTOE to revise the previous speed

10.16.2 Advisory Speeds in Work Zones

Advisory Speed plates should not normally be specified in the plans, unless they are being used merely to reinforce the regulatory speed signs Advisory Speed plates will be used at the option of the field engineer for temporary use while processing a request to change the regulatory speed specified in the plans when deemed necessary Advisory speed plates cannot be used alone, but must be placed below the construction warning sign for which the advisory speed is required

10.17 Law Enforcement Services

Work zones may require active law enforcement services to protect the safety of both workers and motorists during construction or maintenance activities The need for these services should be considered during the development of the Traffic Control Plan The service needed could involve either patrolling or stationary officers, or a combination of the two

Patrolling law enforcement services are used when the Florida Department of Highway Safety and Motor Vehicles (DHSMV), namely uniformed officers from the Florida Highway Patrol (FHP), are required to control traffic speed through work zones by regular patrols during construction or maintenance activities, and when scheduled patrols are required at times when no construction or maintenance activities are in progress, but conditions warrant patrols

Stationary law enforcement services are used when a parked law enforcement vehicle with or without flashing blue lights parked near the work site will aid in the protection of workers and the travelling public Stationary law enforcement services may be acquired from local agencies (city, county or Sheriff) or by the hireback of off-duty Florida Highway Patrol officers Such law enforcement services will not include patrolling or speed enforcement activities within the work zone However, they may be called for on a project in combination with patrolling law enforcement services

10 17 1 Required Active Law Enforcement Services

The Department has determined that construction or maintenance activities on freeways and other limited access facilities during night time hours that require lane closures that divert or restrict vehicular movement through work zones will require active patrolling to provide for the safety and protection of both workers and motorists

It has also been determined that certain work zones on these normally high-speed facilities may require scheduled patrolling on days when there is not any construction or maintenance activities in progress When the work zone posted speed limits must be reduced for safety, but there is not any visible work in progress, the travelling motorists will attempt to overdrive the posted work zone speed unless speed enforcement measures are taken

All such required active law enforcement services shall be acquired, administered and paid for in accordance with the "Contractural Services Agreement" between FDOT and DHSMV

10 17 2 Other Uses of Active Law Enforcement Services

The Project Engineer may request these services during any construction or maintenance activity where he determines that active patrolling of the work zone is required to control the speed of traffic to the posted speed limit for the protection of workers, motorists and equipment

For active law enforcement services, only uniformed FHP officers on detail from their regular work assignments shall be used to control traffic through work zones by regular patrols during construction or maintenance activities or scheduled patrols during periods of inactivity

10 17 3 Determination of Need

The need for all law enforcement services should be determined during the development of the Traffic Control Plan This can only be accomplished through consultation with construction personnel and review of the MOT phases and proposed MOT set-ups

Knowledge of local traffic, drivers and their experience with work zone controls will be helpful Similar projects, the experiences of project engineers on these projects and a review of the records will also offer some insights Local law enforcement agencies familiar with the project corridor should be contacted for assistance and consultation

The requirements for each MOT phase, the conditions requiring law enforcement services, the estimated number of personnel, and other requirements shall be shown on the Traffic Control Plan Pay items and the estimated manhours shall be established Such pay items and manhours shall include only the stationary law enforcement services Payment for patrolling law enforcement services will be separate and handled in accordance with the "Contractural Services Agreement" through which FDOT and DHSMV have agreed to these FHP services

The contractor may require other law enforcement services to assist with traffic control when setting up MOT plans, moving construction equipment and performing construction operations that are potentially hazardous to motorists These services should be designated in the contractor's MOT plan and the costs for these services shall be included in the specific items of work or in the contract pay items for maintenance of traffic (Lump Sum MOT) Pay items and estimated manhours for these contractor required services are not to be included in the Department's contract pay items for law enforcement services

When the need for active patrolling is determined, such as during a night time operation requiring lane closure, a shift of lanes or restricted maneuvers, this need shall be clearly indicated in the TCP by construction phase, operation and duration The TCP shall also state the following stipulations related to patrolling and reference all stipulations contained in the "Contractural Services Agreement"

1 FDOT will provide the opportunity to FHP for review of the work zone traffic control plan

2 FDOT will coordinate project schedules with FHP to allow for advance scheduling of patrols

3. FDOT will provide a minimum of two weeks advanced notification for project patrol needs

4 The FDOT Project Engineer or Maintenance Engineer shall provide a minimum of 24-hour advance notification for unscheduled needs that occur

5 The designated FDOT representative will provide at least two hours of prior notification to FHP should scheduled patrols change or become unnecessary

6 Scheduled patrols may occur on days with no construction or maintenance activity in progress

7 In the event an FHP officer must leave the work zone for an emergency, the designated FDOT representative will be notified

8 The specific project information and patrol needs contained in the contract documents may be modified by the FDOT Project Engineer or Maintenance Engineer if conditions warranting patrol needs change

9 FHP officers participating in work zone patrols will be compensated only for those hours in which patrols are actually performed within the project limits, or as otherwise provided in the stipulations

10 FHP personnel assigned to work zone patrols will be directly accountable only to assigned FHP District Commanders. The assigned FHP patrol personnel will coordinate work zone activities with the FDOT Project Engineer or Maintenance Engineer or their project designee

10 17.4 Determining Staffing Requirements

Staffing needs shall be estimated and detailed in the TCP and provisions by considering the requirements of each construction operation, the MOT plan for that phase and the duration of the operations Short-term lane closures, diversions of traffic or restricted maneuvers may require limited patrols or none at all. Long-term work zones set up over long distances of alternate work activity and inactivity will almost always require periods of patrolling to control traffic speed for the protection of workers, motorists and equipment Each construction operation and its respective work zone traffic control plan must be analyzed with respect to the work zone speed limit, type of operation, length of work zone and duration of the conditions. The total number of estimated patrolling manhours for the project shall be determined by adding up the requirements for each phase of the operation. This estimate is used to determine the budget to be encumbered for that project The actual hours shall depend on FHP's ability to provide staff utilizing existing overtime hireback procedures

Chapter 11

Storm Water Pollution Prevention Plan (Metric)

Chapter 11

STORM WATER POLLUTION PREVENTION PLAN (METRIC)

11.1 General

A Storm Water Pollution Prevention Plan (SWPPP) shall be developed as part of the contract plans for each FDOT construction project site that discharges to waters of the United States

The site specific SWPPP is a requirement of the Florida General Permit issued and made effective by the Environmental Protection Agency (EPA) on September 25, 1992 In order to use the General Permit the FDOT must

1 Prepare a plan that assures compliance with the terms and conditions of the General Permit, including the State of Florida Department of Environmental Protection (DEP) requirements which are a part of the General Permit This includes obtaining a storm water quality permit, if appropriate

2 File a Notice of Intent (NOI) which documents our intent to be authorized as a permittee under the terms and conditions of the General Permit

The SWPPP will be prepared by the responsible design engineer in consultation with Drainage, Construction and Environmental personnel, as required.

The District Permits Coordinator will make the distribution of the NOI, SWPPP and signed certification statements in accordance with Environmental Management procedures

The objectives of the SWPPP are to

- Prevent erosion where construction activities are occurring
- Prevent pollutants from mixing with storm water
- Prevent pollutants from being discharged by trapping them on-site, before they can affect the receiving waters

The SWPPP consists of three major phases The first two (2) are performed by Design and the third is the responsibility of Construction and the contractor

1 Site evaluation and characterization
2 Assessment, selection/description of control measures and design details to address the objectives
3 Implementation of actions, schedules and design details

The SWPPP will include a narrative description, outlined in section 11 2, and a site map, described in section 11 3 Additional information will be found in the FDOT Erosion and Sediment Control Handbook and in workshop training material

11.2 Narrative Description

The SWPPP shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site In addition, the SWPPP shall describe and ensure the implementation of practices which will be used to reduce the pollutants in storm water discharges and assure compliance with the terms and conditions of the General Permit

Prepare the SWPPP narrative on letter size paper to be included in the specifications package Use the following outline to prepare the narrative

Storm Water Pollution Prevention Plan

1 Site Description
  - a Nature of Construction Activity
  - b Sequence of Major Soil Disturbing Activities
  - c Area Estimates
  - d Runoff Data
  - e Site Map
  - f Receiving Waters

2 Controls
  - a Erosion and Sediment Controls
    - (1) Stabilization Practices
    - (2) Structural Practices
  - b Storm Water Management
  - c Other Controls
    - (1) Waste Disposal
    - (2) Off-Site Vehicle Tracking
    - (3) State or Local Regulations
    - (4) Application of Fertilizers and Pesticides

d State and Local Plans

3 Maintenance

4 Inspection

5 Non-Storm Water Discharges

11 2 1 Site Description

The SWPPP shall provide a description of the site, construction activities, and potential pollutant sources The area estimates shall include the total project area and the area expected to be disturbed The runoff data shall include the rational runoff coefficient before, during, and after construction, the drainage area for each outfall, and existing data describing the soil or the quality of discharge from the site The narrative discussion of the site map is discussed in section 11 3 The name of the receiving waters shall be given, as well as the wetland area on the site

11 2 2 Controls

The SWPPP shall include a description of the controls that will be implemented at the construction site Describe the timing of the control measures to be used during each of the major activities identified in part 1 b of the site description narrative Also describe the storm water management measures that will be installed during construction to control pollutants in the storm water discharges that will occur after construction

Most of the narrative for other controls will be supplied by the contractor at the pre-construction conference A plan for off-site vehicle tracking is the exception and must be included in the SWPPP prepared during design

Any Water Management District or Local Water Management permits obtained in connection with the project should be noted

11 2 3 Maintenance, Inspection and Non-Storm Water Discharges

A description of the maintenance and inspection of the controls identified in the plan will be provided by the contractor at the pre-construction conference Non-storm water discharges shall also be identified by the contractor

11.3 Site Map

The following information shall be shown on a site map

- Drainage patterns
- Approximate slopes
- Areas of soil disturbance
- Areas that may not be disturbed
- Locations of major controls identified in the plan
- Areas that are to be stabilized against erosion
- Surface waters (including wetlands)
- Locations where storm water is discharged to a surface water

There are three methods that may be used to develop the required site map

1 Use the construction plans as the site map
2 Use the construction plans with some additional special sheets
3 Prepare a site map separately from the construction plans

All the information required above is shown in a typical set of construction plans except the drainage patterns and the locations of major temporary controls If an optional Drainage Map is included in the construction plans, then the drainage patterns will also be shown Use method two or three if the Drainage Map is not included

Method one can be used if the Drainage Maps are included and the major temporary controls are shown somewhere in the construction plans The preferred location to show the controls is on the Maintenance of Traffic (MOT) sheets If the MOT sheets are not adequate, then the controls may be shown on the Plan and Profile sheets If they are not adequate or are too cluttered, then use method two or three

Method two uses special sheets to show information required by the General Permit that is not shown any other place in the construction plans This will usually be the locations of the controls and the drainage patterns Use a plan view with baseline information and sufficient topo to locate the controls

Method three will be used when Plan and Profile sheets are not prepared for the project A topographic map or aerial photo must be prepared as a base for the site map Maps of the vicinity of the site may be available from the local government or the Water Management District As a last resort, a USGS quadrangle map may be used as the base map

The narrative description of the site map (part 1 e of the outline) shall describe the option chosen for the site map If options 1 or 2 are chosen, the narrative shall list the construction plan sheet numbers where the site map information required by the General Permit can be found

Regardless of the method used to prepare the site map, details should be prepared for all controls that are not detailed in the Roadway and Traffic Design Standards The details should show the work intended, where and how the control is to be placed, and any other special design details required Any Technical Special Provisions required by the erosion control items of work should be prepared as part of the specifications package

11.4 <u>Summary of Quantities</u>

The Summary of Quantities - Erosion Control items shall be prepared to document what, where and how much material and work is required for the contractor to implement all phases of the Plan These items shall be input to the CES with the regular roadway quantities

Chapter 12

Right-of-Way (Metric)

Chapter 12

RIGHT OF WAY (METRIC)

12.1 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 the real property estate rights, donated or acquired by purchase or condemnation, to accommodate permanent transportation improvements Fee simple right of way is the strongest estate 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 purchased as fee simple right of way for the improved facility Purchased, condemned or donated R/W transfers ownership and estate rights to the Department Right of Way donations are always to be considered

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 permits the general public and land owners along the corridors reasonable access, but in a controlled pattern that will facilitate the movement of through traffic. A mainline roadway with fully controlled access and parallel service roads to serve local traffic is the type of facility that best meets both objectives This type of acquisition is encouraged for high volume corridors at major intersections, especially if adjacent property is vacant at the time of the proposed improvement This allows sufficient right-of-way for urban interchange design

Perpetual Easements (perpetual right of use over, under or through the property of another) are used when permanent structures or improvements are to be constructed and maintained on parcels where acquisition of fee title would be impractical, i e , when acquisition of the fee would cause excessive severance damages due to green area or setback requirements or where underground structures are to be constructed which will not impair the surface utility of the land A sight triangle or drainage facility are examples of features that may require a perpetual easement Condemnation powers may be utilized to acquire necessary 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 temporary detours, stock piling materials or parking equipment No improvement which requires maintenance by the Department beyond the term of the easement can be constructed on a temporary easement

License Agreements (permission to do a particular thing which without the license would not be allowable) 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 solely 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

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

Examples of license agreements are right of entry agreements and restoration agreements Right of entry agreements are for a specific purpose such as to demolish the remainder of a severed building that has no value or to enter a property before the formal permanent documents can be executed Restoration agreements are permissions to enter the property and perform minor grading, grassing, planting, etc , to harmonize and restore conditions

12.2 Procedures for Establishing R/W Requirements:

The procedures for addressing R/W requirements in design are an integral part of the engineering analyses, economic comparisons and professional judgements the designer must make Consultation with R/W appraisers and acquisition personnel will be necessary, if the best decisions are to be expected 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

12 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 permanently established and major revisions are highly unlikely

The procedures should, at this point, include a joint review of the proposed R/W, including a field review if necessary 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 the Plans Preparation and Assembly Manual and should address such issues as

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

2 Can fee takings be avoided on certain key parcels where the fill would cause substantial damages to the parcel or to an existing business by designing a retaining wall?

3 Can the grade of the roadway be revised or slopes adjusted on specific parcels to minimize damages or to reduce the difference in elevation between the remainder and the project grade at the R/W line? Review potential claims relating to driveway modifications or severe elevation differences

4 Can the roadway grades be revised or connections relocated so access to the remainders can be constructed without impairing the use of the remainder, thereby avoiding huge severance and business damages caused by impairment of access?

5 Can drainage facilities (outfalls, ponds, ditches, etc) be maintained without additional R/W space? Can uneconomical remainders be used for stormwater treatment?

6 Check the suitability and cost effectiveness of stormwater treatment facilities and the status of permit approval

7 What type 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 "double takes" 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 from takings

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

11 Discuss any means available to protect R/W requirements against development prior to acquisition

12 Check for unrecognized 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 "maintained R/W" maps

15 Discuss alternatives and cost effectiveness of excessive damages or parcel acquisitions

12 2 2 Curb and Gutter Roadway Section

Establishing R/W requirements in urban 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 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 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 the 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

The design engineer cannot assume the property owner's intentions or disposition with respect to his property The designer must design the highway facility within the existing R/W or request acquisition of R/W to accommodate the project elements The most economical means of constructing the project should always be the objective 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

12 2 3 Driveway Connections

Access to the Department's facilities is an important element of the design and R/W determination procedures The designer must understand and follow the Access

Management Rules (14-96 and 14-97) and the standards adopted to implement the objectives of those rules

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 owners needs and to reduce the costs of business damages Generally, the best option can be reached by negotiating with the property owner in a give and take atmosphere

Driveway connections must be addressed in consultation with R/W personnel, generally appraisers or review appraisers This fact should not be overlooked on projects such as resurfacing, etc 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 If the driveway can be harmonized without impacting the value or the utility of the property, the Department should make a good faith offer to provide a suitable connection, at FDOT expense, in exchange for the permission to enter the land during construction for the purpose of doing the construction If this offer is refused by the owner, the Department should provide a reasonable temporary commercial base material connection and place the burden for constructing the connection on the owner The designer must make sure he can provide a traversable connection

2 If providing the driveway connection reduces the remainder value or utility of the property and no other acquisition of that property is contemplated for the project, a temporary easement will be requested and shown on the plans 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

3 If it can not be determined during design that the harmonization work will reduce the remainder value or utility of the property, the owner can negotiate or claim damages through inverse condemnation during construction This is not a desirable position for the Department, therefore the decision to employ this approach should be carefully considered

4 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

12 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

1 License agreements (Restoration and Right of Entry) should be used only if the following conditions can be met

- The improvements or changes contemplated are minor in nature and are for the benefit of the property owner,

- No compensation will be offered to the property owner, except the benefits derived from the improvements or changes

- None of the improvements are required for the construction of the transportation facility and removal of, or change to the improvements will not be detrimental to the facility,

- The property owner is or will be fully informed of the nature and extent of the proposed improvements and has no objections, and,

- The transportation facility can be constructed without adverse impact on safety or operation

2 Temporary Easements should be used under the following conditions

- The improvements or harmonization work are primarily for the benefit of the property owner, but to properly construct the improvements the remainder value or some utility of the property is reduced, and there is no other acquisition of that property involved in the construction of the project

∘ The contemplated improvements or uses of the property owner's land are required only during the period of construction of the transportation facility,

∘ The changes or improvements to the property owner's land are temporary and removal or alteration of the property subsequent to construction would not be detrimental to the facility, and,

∘ After construction is complete, there will be no need for periodic re-entry onto the property for maintenance or other purposes

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

∘ The planned improvements to the property owner's land are required as a part of construction of the transportation facility,

∘ The improvement on that land must remain in place as a part of the facility, and,

∘ Periodic re-entry to the property is required for maintenance or repair

4 Perpetual Easements may be considered as an alternative to fee simple purchase in the R/W process

∘ If the property estate rights are not required to be as complete as a fee simple taking and the owner may continue to enjoy some benefits of the property without impairing the Department's interest The costs associated with the easements must be much less than a fee simple purchase before it becomes a viable alternate

12 2 5 Transmittal of R/W 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 recognizing that it is not practical to contract for appraisals, etc , on small project 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

R/W requirement submittals must be coordinated with the production management staff and scheduled in advance

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 (i e , outfalls, pond locations, corner clips, access needs, etc) 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

12.3 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 project manager's role as lead coordinator is especially critical

12 3 1 New or Major Reconstruction Projects

These projects generally have Project Development and Environmental (P D & 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 P D & 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 Topo
5 R/W Mapping and property research activities
6 Preliminary R/W cost estimates work

These activities should also be performed by in-house staff doing preliminary engineering on projects This early identification of potential R/W requirements, approximate costs and work effort to complete R/W Administration activities will greatly improve both cost estimates and schedules of projects Also, involving R/W mapping and appraisers for value judgements 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 Normally, the final design process will establish final R/W requirements well before the completion of the Phase III design activities

12 3 2 Reconstruction Projects With Anticipated R/W Requirements

These projects may not have a formal P D & 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 (See the Plans Preparation and Assembly Volume)

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 project manager, on consultant projects

2 Roadway Design 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 Roadway Design will identify proposed R/W requirements as indicated by the completed design details such as the following

- Limits of construction slopes for roadway and bridges
- Cross section elements, ditches, curb returns and sidewalks
- Driveway and street connections

2 Drainage will identify proposed R/W requirements as indicated by the completed drainage features

- Retention or Detention Ponds
- Mitigation of environmental issues
- Drainage outfalls, sediment basins, etc

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 Section 12 2 of these procedures

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 Section 12 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

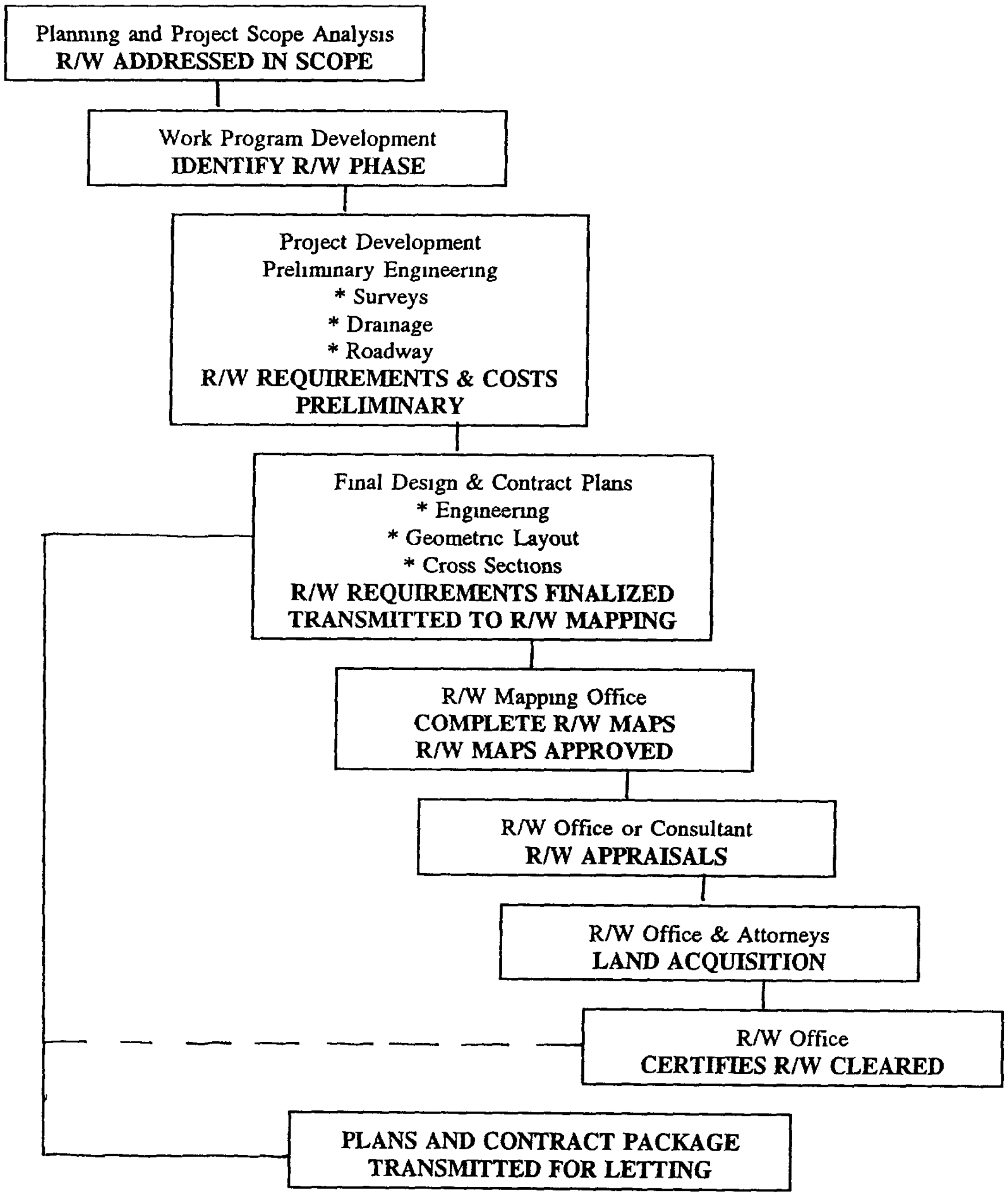
12 3 3 Projects Without an Identified R/W Phase

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 resurfacing projects to ensure that a maintenance survey is not required

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

R/W 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)



Chapter 13

Project Development (Metric)

Chapter 13

PROJECT DEVELOPMENT (METRIC)

13.1 General

This chapter explains the overall process of highway project development, from the Five Year Work Program to the project letting stage A brief outline of the scope requirements at the various significant phases of the process will also be discussed

13.2 Process

13.2.1 Five Year Work Program

The development of a Five Year Work Program begins with the identification of short and long range statewide transportation needs. Planning documents are developed with inputs from Florida DOT, regional planning groups and local governments. Data concerning the condition of existing highways are also used to establish priorities among the proposed projects. Once the basic needs are established, a financial plan identifying the sources and amounts of available funding is developed. Funding allocations are made based on each district's transportation needs, population, lane-kilometers, gasoline sales and other appropriate factors. Each district then refines their list of proposed projects to be consistent with the amount of funding available.

13.2.2 PD&E Process

The project development phase for projects included in the Five Year Work Program and requiring PD&E includes environmental studies, the determination of project alignment and completion of preliminary design. Coordination with the Federal Highway Administration (FHWA), the State Department of Environmental Protection, and public input are important elements of this phase. The PD&E process is described in detail in the PD&E Manual.

A detailed engineering report is normally produced in the PD&E stage which documents some of the key criteria to be used in the design of the particular facility. Typical sections, interchange and intersection locations and configurations, drainage features, conceptual bridge design, highway lighting justification, and right-of-way requirements are some of the elements that are sometimes finalized during the PD&E study of the project For some projects, value engineering reviews are conducted during the PD&E phase Traffic control through work zones should also be considered

Environmental investigations made during the course of a PD&E study are documented in the Environmental Impact document Environmental documents frequently commit the State to certain restrictions, features and mitigation measures that must be included in the final design The designer should carefully review the environmental documents before beginning the design Sometimes restrictions, features and/or mitigation measures stipulated in the environmental document are such that the final design becomes unworkable This will require a change in the environmental document This document also lists the permits required to be obtained prior to construction of the project

Although the district offices take the lead role in project development, the central office performs a quality assessment review of selected projects to ensure compliance with department standards and procedures The project development phase usually takes from 12 to 36 months to complete

13 2 3 <u>Final Design</u>

The next major phase in the project life cycle includes engineering design and right-of-way acquisition During this phase of the project, the final and detailed engineering design is completed and plans, specification and contract documents prepared for construction For most projects, right-of-way acquisition is planned and carried out during this phase of the project All required permits are also obtained The various elements of the final design phase are explained in detail in subsequent chapters of this manual

Engineering and right-of-way activities normally require from 12 to 36 months to complete, depending upon the size and scope of the project

13 2 4 Project Letting

Project letting is the next phase after final design Once the design is complete and approved, the contract is let To prepare a project for letting the DOT prepares specifications, plans packages, project cost estimate, and administers various procurement activities leading up to and including contract execution These activities are performed both in the district and in the central office and require approximately 3 months to complete

13.3 RRR Design

Resurfacing, Restoration and Rehabilitation (RRR) work is defined as work undertaken to extend the service life of an existing highway and enhance highway safety 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 It may include resurfacing, pavement structural and joint repair, minor lane and shoulder widening, the removal of parking and restriping as through lanes, removal of median curb to provide a turning lane or 2-way left turn lane, shoulder pavement, alterations to vertical and horizontal curvature, superelevation upgrading, bridge widening, modifications to bridge rails, intersection improvements, the addition of sidewalks and bikeways, utility relocation, removal or shielding of roadside obstacles, modification of side slopes and ditches, drainage modifications, upgrading of at-grade railroad crossings, aesthetic improvements, landscaping, lighting, and signing, signals and pavement markings Pavement repairs on short segments, and patching and repair of minor pavement failures are considered by FHWA to be routine maintenance and are ineligible for RRR projects To qualify for Federal funding, a resurfacing structural overlay must be a minimum thickness of 19 mm based on a structural analysis and the RRR project is required to adequately meet existing and probable future traffic needs in a manner conducive to safety, durability and economy of maintenance, within acceptable levels of community and environmental impact The RRR project must be designed and constructed in a manner that will enhance highway safety and accomplish the foregoing objectives according to the particular needs

The design process and standards to be used for RRR projects on the State Highway System facilities other than interstate and freeways are given in this manual The Key Sheet shall have a note stating that the project was designed to RRR standards

13.4 In-House (DOT) Design

For in-house (DOT) design projects, all activities related to the project are performed by the various sections of the department The complete design and preparation of the contract documents is accomplished by a team of roadway design personnel lead by the DOT Project Manager/Coordinator Guidelines for in-house project flow are available in Florida DOT Project Management Guidelines

13.5 Consultant Design

Some design projects are contracted to consultants for design A DOT project manager/coordinator is assigned to coordinate the project with the consultant and the various sections of the department At specified stages in the project, the consultant is required to submit his plans to the Department for review The DOT Project Coordinator/Manager distributes the plans as needed to the various sections for their review and comments However, it is the consultant's responsibility to throughly check the plans for quality, accuracy and completeness before submitting to the Department The DOT reviews the plans for compliance with scope, project requirements and progress

Coordination with utility companies, permitting agencies, railroad companies, and adjacent projects is an important aspect of the design project. Responsibility for this coordination is usually specified in the consultant's scope of services

At the completion of the design the complete plans package - consisting of the design plans, computations book, engineer's cost estimate, special provisions and other related data - is submitted to the department by the consultant Following the preparation of the Specifications by the district, the project is production ready The consultant's scope of services will define the required number of plan sets and distribution

13.6 Project Scheduling

As mentioned earlier in this chapter, engineering and right-of-way activities of final design phase normally takes 12 to 36 months Usually the project letting date is decided well in advance and, hence, other project activities are scheduled accordingly

A design project undergoes four phase reviews Some small projects (less than $2,000,000) may undergo only two or three reviews depending upon the scope of work or the district's discretion District's may also require reviews in addition to these phase reviews

The Phase I review is the first milestone in the design of the project The plans developed at this stage, with all existing utilities, topography, drainage, and other relevant data shown are used for preliminary utility and railroad coordination and review of preliminary proposed roadway geometrics For complex projects, the preliminary or conceptual traffic control plan is also reviewed at this stage If bridge structures are included in the project, then this phase also marks the review of the preliminary structural drawings including bridge data sheets and soil borings Phase I completion of the project triggers other activities such as final drainage design, soil survey, utility contact conference, permit activities, requirements for final right-of-way maps, and foundation investigation activities for structures

The next milestone, in a design project is the Phase II review At the completion of this phase, the geometrics should be final and the mainline and sidestreet drainage design and soil survey are complete New activities which start at this point are signalization, signing and marking, and roadway lighting design Other ongoing activities are permits, bridge design, utility contact conference and adjustments, engineer's cost estimate, and right-of-way acquisition At this stage of completion, the plans should be submitted to Construction for a constructability review

The WPA data should be reviewed and updated, if needed at this stage of plans completion The Phase II plans should be used to compare the "net" project length as shown on the key sheet with the gross project length shown If the project length shown on the plans is more than 1 kilometer less than that in the WPA system, the project manager/designer should check with Production Management to correct the length

At Phase III plans, most activities including quantities, computation books and technical special provisions are complete, except, in some cases, the permit process and R/W acquisition At this stage of completion, the plans, comp book and technical special provisions should be submitted to Construction for a biddability review

Once the Phase IV submittal has been reviewed and approved, and all utility agreements, R/W certifications and required permits are completed, the project is at the PID (Plans in District) stage At this stage, the transmittal letter can be completed and the plans package transmitted to the central office in Tallahassee Plans package requirements are listed in Chapter 20 of this volume An example of the transmittal letter utilized to transmit final plans to Tallahassee is included in that chapter

For a detailed description of plans requirements for each phase, please refer to the Plans Preparation and Assembly volume

Chapter 14

Data Collection (Metric)

CHAPTER 14

DATA COLLECTION (METRIC)

14.1 General

Data required for the design of a project are available from various sources in different forms Prior to the start of design of the project, all available relevant data should be collected The remainder of this chapter explains the various types of data required for the design process and their sources

All correspondence concerning a project, including requests for or transmittal of data, shall contain the following information

W P I Number
State Project Number
Federal Project Number (if applicable)
Description
County

14.2 Project Data

Project data are the data specific to the project and identify the project

14 2 1 Project Description

A complete description of the type of project, or facility, to be designed is available in the scope of services The project length, location, county and kilometer point, type of facility and proposed modification or construction and total time to completion of the design are key items pertaining to the project description

14 2 2 Project Number

Each DOT project is assigned a project number and a work program identification (WPI) number The project number indicates the county of the location of the project, the type of facility and the type of project - i e , PD&E, or R/W, or construction

For federal-aid projects, the project has a DOT project number and federal-aid project number

The project and WPI numbers are shown on the keysheet of the project plans (See exhibit in the Plans Preparation and Assembly volume)

14 2 3 Project Cost

The Long Range Estimate is prepared during the five-year program phase of the project, and this information is included in the program data documents As plans are developed the Contract Estimating System (CES) should be updated to reflect the most current estimate

14 2 4 Production Schedule

As mentioned in the previous chapter, the project goes through various phases during the design process Each of these phases marks a production milestone which is of particular importance to the overall schedule of the project Certain activities in the production schedule are critical and cannot be delayed without jeopardizing the production schedule Usually, the production schedule is set using two main constraints - the letting date and the total design project time

14.3 Design Data

Technical data required for the design of a roadway project can be available from various sources in different forms Some of those major sources and forms are discussed below

14 3 1 Surveys

a) Design Survey A design survey documents the horizontal and vertical alignment, along a baseline or centerline of a project This alignment is established with reference to fixed horizontal and vertical control points Locations of other features - both natural and man-made - are also documented and tied to the baseline or centerline Horizontal and vertical locations of existing aboveground and underground utilities are also given in the design survey, as described in the Utilities chapter Requirements and details of conducting a design survey are given in the DOT Location Survey Manual

b) Topographical Survey This is one of the most important of field surveys This survey documents all the existing features of the project site such as buildings by type, size and location with respect to baseline of survey, locations of streets and sidewalks, locations and limits of grassed or paved areas, wood lines, fence locations, lakes or ponds, changes in type of cultivation, drainage structures, and breaks in terrain The Location Survey Manual describes procedures to be used in detail All information from the topographical survey is input into the CADD file to provide the base data for the project

c) Aerial Survey Another method of obtaining project site existing features information is by aerial photographic survey The information obtained by aerial photography survey is digitized and used as base data for the project Good aerial photo control is very important in order to get accurate aerial mapping Procedures for establishing horizontal and vertical control points for aerial photo mapping are given in the Department's Location Survey Manual

Digitized aerial mapping proves to be of great value in the preparation of drainage maps as it effectively records the development of the project vicinity at the time of design as well as the existing ground features

d) Drainage Survey All information pertaining to existing drainage conditions at the project site can be obtained from the drainage survey documents A good drainage survey records pertinent historical facts related to the drainage of the area, reflects land use trends and any other data that may help in solving drainage problems of the project Details of survey information required for drainage design are given in the DOT Drainage Manual

e) Right-of-Way Location Survey Project right-of-way is one of the important factors of the project and should be documented precisely The R/W survey documents the existing R/W of the project facility It also documents all public land corners, monuments, property lines, property owners, and complete dimensions of the properties

f) Soil Survey Soils information is required for the design of foundations for structures, pavement design and drainage design A soils report for the project documents the type and extent of different types of soils encountered within the limits of the project Physical properties and classifications of the soils together with the soils engineer's recommendations are documented in the soils and foundation report

14 3 2 Traffic Data

Traffic volumes and/or counts to be used for the design of a new facility or for the improvement of an existing one are obtained from the District Planning and/or Traffic Operations office

Traffic data are obtained by actual traffic counts on existing roads, roadside interviews and polls of potential users The ADT (Average Daily Traffic) volume is projected over the expected life of the facility. The total volume and the percent trucks are factors used in determining geometric design criteria, projected truck volume and truck weight data Traffic counts, classification data, weight-in-motion data and W-4 Tables are used to produce 80 kN equivalent single axle loadings (ESAL), used for pavement design

14 3 3 Pavement Design

The pavement design should be completed as early as possible For some projects, it is completed during the PD&E phase and for other projects it is one of the tasks to be completed during the design phase The pavement type, composition and thickness, are determined using traffic data, projected 80 kN ESAL's, expected life-span of the facility, serviceability, and existing soils information Details on pavement design can be found in DOT's pavement design manuals

14 3 4 Environmental Documents

During the PD&E phase of a project, studies are made to evaluate the impact of the project on the environment Factors such as noise generation and its abatement, business and residential relocations, wildlife habitat impact, and wetlands mitigation are documented in the Environmental document Information relating to the expected permits required for the construction of the project, and other related data are also contained in the environmental document For small projects, a formal EIS may not be available, but all environmental data is usually available in the form of environmental reports The environmental document may commit the State to certain design features The designer should carefully review these documents to determine what design commitments have been made Significant changes to the scope of the project may require reevaluation of the environmental factors

14 3 5 Original Plans

Original plans of existing facilities requiring reconstruction prove to be a very good source of information Information pertaining to existing alignment - both horizontal and vertical - and R/W can be helpful in the design of the new facility

14 3 6 Accident Data

Accident data are provided by the District Safety Engineer These data should be requested for all projects, but are especially useful for the design of RRR, safety and intersection projects and justification of signalized intersections

14.4 List of Requests and Contacts

During the design process, the design engineer will require various items of information from different sections or departments The following is a list of some of those items and their source

A) Planning and Programs

1) Request pavement design (80 kN ESAL)

2) Request traffic data (motorized)

3) Request projected traffic data for intersections

5) Request updates of traffic data (as needed)

6) Railroad contact (Phase I)

7) Railroad contact (Phase III)

8) Plans transmittal letter data (railroad)

9) Notification that project is in vicinity of a traffic monitoring site

B) Location

1) Request survey

C) Traffic Plans

1) Request turns and counts for intersection design

3) Notification that project includes milling

4) Signing and pavement marking plans (Phase I)

5) Signing and pavement marking plans (Phase II)

6) Signing and pavement marking plans (Phase III)

7) Traffic signal plans (Phase I)

8) Traffic signal plans (Phase II)

9) Traffic signal plans (Phase III)

10) Lighting plans (Phase I)

11) Lighting plans (Phase II)

12) Significant review of accident data

13) Safety review of design plans

14) Response to safety review of design plans

15) Operational and capacity review of design plans

D) Soils and Foundations

1) Request pavement design LBR

2) Request roadway soil survey

3) Submit cross-sections for plotting of soils data

4) Request foundation investigations

5) Request pavement composition and milling recommendations

6) Request dynaflect testing

7) PH and soils resistivity for culvert material selection

8) Phase III review, if unsuitable soils exist

9) Review if any changes are made in alignment, grade or typical section

E) Drainage

1) Pavement design comments

2) Request grade and high water review

3) Request drainage design

4) Request final drainage review

5) Permit review

F) Maintenance

1) Pavement design comments

2) Phase I Plans review

3) Phase II Plans review

4) Phase III Plans review

5) Response to Phase I plans review

6) Response to Phase II plans review

7) Response to Phase III plans review

G) Construction

1) Pavement design comments
2) Phase I Plans review
3) Phase II Plans review (Constructability Review)
4) Phase III Plans review (Biddability Review)
5) Response to Phase I plans review
6) Response to Phase II plans review
7) Response to Phase III plans review
8) Submit traffic control plan request
9) Transmit marked-up utility adjustment plans

H) R/W Surveying and Mapping

1) Submit title search request
2) Request existing right-of-way maps
3) Transmit right-of-way requirements
4) Final right-of-way check
5) Plans transmittal letter data

I) Utilities

1) Preliminary (First) contact (Phase I)
2) Horizontal and vertical verification of utilities
3) Pre-Design conference and contact (Phase II)
4) Final contact (Phase III)
5) Plans transmittal letter data (utilities)
6) Number of sets of final prints for utility companies

J) Estimates and Specifications

1) Preliminary estimate and time (LRE)
2) Preliminary estimate and time (Phase I)
3) Preliminary estimate and time (Phase II)
4) Preliminary estimate and time (Phase III)
5) Complete estimate and contract time (Phase IV)

K) Right-Of-Way Department

1) Project schedule updates as needed
2) R/W estimates as needed
3) Pre-Proposal appraisal conference
4) Field questions from R/W agents as needed
5) Plans transmittal letter data
6) Hazardous waste determination
7) Phase I Plans Review (by Appraiser)
8) Phase II Plans Review (by Appraiser)
9) Phase III Plans Review (by Appraiser)
10) Phase IV Plans Review (by Appraiser)

L) FHWA (if not CA or exempt)

1) Phase I Plans review
2) Phase II Plans review
3) Phase III Plans review
4) Phase IV Plans Review
5) Submit for typical section approval
6) Submit for pavement design approval
7) Response to Phase I plans review
8) Response to Phase II plans review
9) Response to Phase III plans review
10) Submit exception request letters

M) Value Engineering ($2,000,000+)

1) Phase I review
2) Phase II review

The following exhibits are examples of some request forms utilized in obtaining the various information items required for design

DATE

TO Highway Statistics Engineer

FROM

COPIES TO

SUBJECT W P I No ________________

State Project ____________

F A P No ____________

County ____________

Description ____

____

Limits of Job ____

Budget Construction Year ____

Year Open to Traffic ____

No of Lanes, Existing ____

No of Lanes, Proposed ____

Type of Facility ____

(e g major, intermediate or minor arterial, freeway, expressway, city street, rural road, ramp)

System Name ____

(e g Interstate, FAU, FAS, etc)

Pavement Type ____

Type of Work ____

____

Please forward this Design Section the following information for the subject project

A Traffic Parameters requested are

1 ADT's

2 K, D & T factors

a T Factor Breakdown

1 % of ADT

B 80 kN ESAL

C Years

1 ______ Current Year

2 ______ Construction Year

3 ______ Mid-year (10 years from opening)

4 ______ Design Year (20 years from opening)

Exhibit 14-A

DATE

TO Soils Engineer

FROM

COPIES TO

SUBJECT W P I No ______________

State Project ____________

F A P No ___________

County ___________

Description ____

Transmitted herewith are prints of Plan and Profile Sheets and Cross Section Sheets on the subject project, indicating proposed alignment, gradient and flow line of proposed structures

(For Widening and/or Resurfacing, Key Map and Typical Section Sheets only)

This is for your use in obtaining the following

( ) Soils Survey

( ) Percolation Test

( ) Water Samples

( ) Thickness and Type of Asphalt

( ) Thickness and Type of Base

( ) Thickness and L B R Value of Existing Subgrade

( ) Design L B R

( ) Amount and Type of Leveling Recommended

( ) Milling Recommendation

( ) Soil Boring (For Structure)

( ) Pavement Composition

Please furnish this information by ________________

If additional information is required, please feel free to contact this office

Enclosure

Exhibit 14-B

SURVEY REQUEST

W P I NO ______________ PROJECT NO ______________________________

PROJECT DESCRIPTION ____

____

____

____

____

LIMITS OF SURVEY ____

____

____

____

____

REQUEST

1 ALIGNMENT

____

____

2 TOPO

____

____

3 R/W

____

____

4 CROSS SECTION

____

____

Exhibit 14-C

Page 1 of 2

5 OUTFALLS

6 SIDE STREETS

7 UTILITIES

8 OTHER

Charges can be made to Project No ______________________________

Comments ______________________________

Requested by ______________________________ Date ______________

Exhibit 14-C
Page 2 of 2

DATE

TO Materials Engineer

FROM

COPIES TO

SUBJECT W P I No ______________________

State Project ____________________

F A P No ___________________

County ____________________

Description ____

Enclosed for your use are Key Map, Cross Sections and marked prints of Plan and Profile Sheets for boring locations on the subject project

If additional information is required, please feel free to contact this office

Enclosures

Exhibit 14-D

DATE

TO Environmental Permit Coordinator

FROM

COPIES TO

SUBJECT PERMIT SKETCH

W P I No ____________________

State Project ____________________

F A P No ____________________

County ____________________

Description ____

Transmitted herewith are the original permit sketches for the above referenced project

The following information is included to enable you to apply for the necessary permits

1 Production date ____

2 Letting Date ____

3 Approximate construction days ______________________________

4 Natural _______ or man-made __________ body of water

5 Name of waterway ____

6 Brief description of project:

If additional information is required, please feel free to contact this office

Enclosures

Exhibit 14-E

DATE

TO District Railroad Coordinator

FROM

COPIES TO

SUBJECT W P I No ____________________

State Project ____________________

F A P No ____________________

County ____________________

Description ____

Submitted this date is Sheet ______ of the signalization plans for your handling with the railroad

The following work is proposed within railroad right-of-way

If additional information is required, please feel free to contact this office

Enclosure

Exhibit 14-F

DATE

TO Utilities Engineer

FROM

COPIES TO

SUBJECT UTILITIES TRANSMITTAL

W P I No ______________________

State Project ____________________

F A P No ___________________

County ___________________

Description ____

Transmitted herewith are ________ sets for your use in the coordination of utilities for the subject project

If additional information is required, please feel free to contact this office

Enclosures

Exhibit 14-G

BUREAU OF TOPOGRAPHY
FLORIDA DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL WORK REQUEST FORM
FOR CADD AND CROSS SECTION PROJECTS

(ATTACH TO WORK REQUEST
FORM PD 100) # 87-1417

PROJECT NAME ______________________________

______________________________ STATE JOB NO ____________

REQUESTED BY ____________________ DATE ____________________

DELIVER TO ______________________________

DIGITIZED TOPOGRAPHY
SCALE OR SCALES
DESIRED

1 200	1 400	1 500	OTHER

LIMITS OF
COMPILATION

LEFT LIMITS	RIGHT LIMITS

HAS HORIZONTAL ALIGNMENT BEEN CODED IN ELECTRONIC DESIGN FILE?

YES	NO

NAME OF PERSON IN CHARGE OF DESIGN FILE ____________________

ARE PHOTOGRAMMETRIC CROSS SECTIONS DESIRED?

YES	NO

WHAT CENTERLINE INTERVALS ______________________________

____

COVERAGE RIGHT
AND LEFT

LEFT LIMITS	RIGHT LIMITS

SPECIAL REQUEST REQUIREMENTS OR COMMENTS ____________________

____

FIELD CHECK BY

DISTRICT	TOPO	OTHER

DELIVERY MEDIA

PLOTTED ON MYLAR______
PLOTTED ON PAPER______
WRITTEN ON TAPE________
WRITTEN TO DISC________

Exhibit 14-H

Chapter 15

Phase Reviews and Scheduled Submittals (Metric)

Chapter 15

PHASE REVIEWS AND SCHEDULED SUBMITTALS (METRIC)

15.1 General

All major projects will have four phase reviews prior to transmittal of plans to the Central office for letting Phase I, II, III, and IV reviews will be performed and documented Minor projects, such as resurfacing, will have a minimum of two phase reviews The two reviews should consist of a final phase and one prior phase review

Phase reviews are performed to allow other District Office units (Safety, Maintenance, Construction, etc) to provide input regarding the development of the project and to review the adequacy and completeness of the plans Phase reviews are not intended to be the only Quality Control Quality Control shall be performed prior to each submittal of the plans for a phase review as discussed in the following chapter

Each District shall develop a procedure for accomplishing all phase reviews The procedure will identify the persons responsible for coordinating the phase reviews and distributing the plans for the reviews The individuals and offices that will review and provide comments on each phase review should be identified in the procedure The procedure must also outline the method of documenting all phase reviews, including the resolution of any comments made during the reviews

The District shall ensure that the requirements of each phase review as shown in this manual are met Phase reviews are complete when the comments from all the various offices have been resolved and documented

15.2 Design Plans Phase Review

On minor projects reviews will be held at a final phase and at one prior phase One of these reviews must be an on-site review All reviews will include personnel from Design, Construction, Maintenance, Safety, FHWA (for Federal Aid Projects which are not CA or exempt) and any other department representatives who can provide review input A formal on-site review shall be made to ensure the design is appropriate and that no physical features have been altered or added

On complex projects reviews must be held at the Phase I, II and III stages as well as the final check at Phase IV Two on-site reviews will be required Generally these are held at Phases I and III with personnel from the offices noted under minor project reviews Also, an on-site visit before design by the senior designer is desirable

For phase reviews which are not held on-site, construction, maintenance, Safety and FWHA (for federal aid projects which are not Certification Acceptance or exempt) offices must be sent copies of the plans and requested to furnish comments

An additional update review, including an on-site review, will be required on all projects that have been delayed and shelved for more than nine months since the final review

The District Safety Engineer shall be given an opportunity to be included in these reviews The use of accident history is required on all reconstruction, intersection improvements and 3R type projects to ensure that all accident problems have been addressed

The District Project Manager/Coordinator is responsible for ensuring that prints are distributed to the appropriate personnel and that the above reviews are held on each project Size "B" (half size) prints may be used for reviews, at the District's option

For consultant projects, the Districts are to specify the number of prints required and the size prints, if there is a preference This should be stated in the consultant's scope of services

For detailed requirements of each phase review submittal, please refer to the Plans Preparation and Assembly volume

15 2 1 Plans Disposition

As discussed in the Project Development chapter of this manual, each phase of the plans preparation triggers other activities in the process of the project's design life cycle

The Phase I plans are used for the initial contact with the utility companies The alignment, horizontal and vertical, and typical sections are checked for compliance with design criteria, project and site requirements, compatibility with adjacent projects and drainage requirements

The Phase II plans are used for the signing and marking design, roadway lighting design, signalization design, traffic control sheets, other component plans preparation, permit package preparation, constructability review and updating of the WPA system Usually at this stage of the project a utility predesign conference also occurs CES data input is recommended at the completion of Phase II plans

At Phase III all plans are usually complete including the Quantity Computation Book(s) and the cost estimate and Construction has performed a biddability review After Phase IV a record set of plans are signed, sealed and dated, and the originals placed in PID Status to be transmitted to the Central Office in Tallahassee

15.3 Other Submittals and Requests

Other design plans, besides the roadway plans, of a project also go through reviews at various stages of the design as listed below

15 3 1 Structures (Bridges, Walls and Buildings)

1 Bridges

Bridge design begins when the foundation investigation is complete and on a schedule which permits 90% bridge plans and the Phase III roadway plans to be reviewed simultaneously In the case of a stream or river crossing, the drainage design, including preliminary scour considerations, must also be complete prior to beginning structures design All structures design work is coordinated through District Structures Engineer or the State Structures Design Office in the Central Office, depending on the category or complexity of the structure A typical section of the facility crossing, horizontal and vertical clearances required and the profile grades should be determined prior to beginning structures design For complete details and requirements for structural designs and plans preparation, the reader is referred to the Structures Design Guidelines (Topic 625-020-101) and the Structures Detailing Manual (625-020-201) issued by the Structures Design Office

Generally, the completion and review of bridge plans are completed in three phases as listed below These reviews do not necessarily coincide with the phase reviews of the roadway plans

Preliminary - (30%)
Final (90%)
Tracings (100%)

In order to prevent problems and to "Do it right the first time," the following procedures should be used

Typical Section Package - The typical section approval package should include a section showing width of bridge that is to be provided for all bridges. The structural design should not proceed until the typical section has been approved by the District Design Office

Request for Structural Design - (Bridges and Retaining Walls) All requests for structural design should include roadway plan and profile sheets showing horizontal and vertical alignment and cross sections within 150 meters on 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 Superelevation transition (runoff) details must be included with the transmittal if any part or all of the transition is on the bridge or wall The approved typical section should be included with the transmittal

Provisions for access to property near the end of bridges and adjustments to avoid costly right-of-way takings should be resolved prior to submittal An attempt should be made to avoid horizontal and vertical curvature on the bridge, if possible, without sacrificing safety Superelevation transition lengths may be appropriately adjusted, to avoid transitions on the bridge

Coordination of Final Plans - The District will request prints of bridge plans prior to submittal of the final roadway plans to Tallahassee to ensure that roadway and bridge plans are consistent, i e , widths, superelevation transitions, vertical and horizontal alignment, and work zone traffic control agree

2 Other Structural Submittals and Reviews

In addition to bridge plans, structures plans may include retaining walls, noise barrier walls, box culverts, pedestrian overpasses, and special structural appurtenances

For projects where bridges <u>and</u> other structure plans are involved, preliminary and final plan submittals (usually along with bridge plans) should be handled according to the instructions for current and future handling of structures tracings (reproducibles) for both Category 1 and 2 structures from the Structures Design Office

For projects where retaining walls are required along with roadway plans only (no bridge in the project), DOT District Offices shall be responsible for development of wall plans, proper reviews and submittal of preliminary and final plans and submittals to the FDOT prequalified wall companies, if applicable

3 <u>Mechanically Stabilized Earth Walls</u>

Where proprietary walls are involved, the detailed control plans shall be submitted to DOT approved wall companies This will be the responsibility of the consultant or the DOT Office responsible for development of wall plans The preliminary control plans should be submitted early in the project development This will give the wall companies time to prepare a good bid by the time the contract is let

After appropriate structural and geotechnical review, the wall plans are submitted directly to all appropriate prequalified wall companies for their bidding information The Florida DOT District Office is responsible for the structural and geotechnical review prior to submitting these plans for review The submittal of detailed control plans should occur as early in the design process as possible to give companies plenty of time to prepare a good construction bid proposal

Where the District Office cannot carry out the structural review or verify the review as proper by a consultant, such review may be requested from the Structures Design Office

The wall companies only claim responsibility for their system, the wall and soil mass engaged - thus the geotechnical review must include analysis of the boundary soil conditions Chapter 18 of the <u>Structures Design Guidelines</u> (Topic 625-020-101) contains the procedures and requirements for the engineering and geotechnical design of retaining walls

15 3 2 Surveys

Most field surveys will be completed before the start of the design since the survey information is needed for the design The Roadway soils survey is normally completed between the Phase I and Phase II Roadway plans review

Survey for bridge data sheets and channel alignment should be completed during this same period

15 3 3 Typical Sections

All projects except intersection improvements and state funded resurfacing projects require approval of the typical section For most projects, the typical section is approved during the PD & E phase For final design projects that require approval of typical sections, the typical section package should be submitted before the Phase I review to allow ample time for approval Typical sections shall be submitted on legal size sheets, approved, signed and sealed by the responsible engineer Space must be provided for concurrence by the DOT and, for projects with FHWA oversight, by FHWA

When preparing typical section packages, only typical sections for the main roadway and/or bridge are necessary Minor variations to these do not need typical sections All side street tie-ins, etc , can be handled as part of the routine plan review process or as partial sections which show typical details

15 3 4 Pavement Design

For projects that require pavement design in the design phase, the pavement design package should be submitted as early as possible For some projects, a preliminary pavement design is approved at or before the Phase I review with the final pavement design being approved at the Phase II completion stage

Pavement design packages sent to the FHWA for approval should only be for the major items of the main roadway Minor variations can be handled as part of the normal plans review process

15 3 5 Permits

The required permits will be determined during Project Development and Environmental Study phase The District permitting office is responsible for coordinating and processing the permits and must be contacted early in the project to determine the level of detail needed in the permit packages The DOT Project Manager/Coordinator must communicate this information to the appropriate office preparing the permit packages In general, permit approval is a lengthy process and permit applications must be submitted early enough so that the construction schedule will not be delayed due to permits being processed

The permitting agencies and the estimated processing time frame should be listed in the overall project schedule developed by the Project Manager/Coordinator

Agencies with permitting authority are listed below:

- Florida Department of Environmental Protection
- U S Coast Guard
- Local Environmental Agencies
- U S Army Corps of Engineers

Agencies with an interest but no permitting authority are listed below

- Florida Game and Freshwater Fish Commission - Office of Environmental Services
- Florida Department of Veterans and Community Affairs - Bureau of Land and Water Management
- U S Fish and Wildlife Services
- National Marine Fisheries Service - Environmental Assessment Branch
- Regional Planning Councils
- Local Governments and Transportation Authorities
- U S Environmental Protection Agency

15 3 6 Right of Way Surveying and Mapping

During right-of-way map preparation there are typically four phases as described below All map preparation procedures shall be in accordance with the DOT Right-of-Way Surveying and Mapping Manual

Preliminary -	involves project alignment, curve data, section corners, cross road alignments.
Intermediate -	revisions from preliminary submittal, existing right-of-way, subdivisions, interchanges, proposed right-of-way with takings dimensioned.
Near Final -	revisions from intermediate submittal, easements, tabulation of ownerships, right-of-way requirements for drainage easements
Final -	revisions from near final submittal, complete right-of-way maps in accordance with the DOT Procedure 575-010-000

Right-of-way maps are prepared in accordance with the procedures as described in the Department's Right-of-Way Surveying and Mapping Manual Information is added to the right-of-way maps as it becomes available and close coordination is required between the design and right-of-way sections R/W requirements should be well identified on roadway plans as early as possible Final requirements on project alignment must be identified by Phase II roadway plans and transmitted to R/W office

Title search will be ordered as soon as feasible alternatives are determined It is necessary, particularly on urban projects, to obtain ownership search to assist in the establishment of the right-of-way limits The ownership search may be conducted by the District Right-of-Way Surveying and Mapping office or the design consultant

Access road and drainage (outfalls) requirements are generally the last requirements to be established in the R/W phase and must not be overlooked They should be established in the PD&E phase when possible and adjustments made as necessary Access road studies (justification) are required on limited access and federal aid projects and will necessitate appraisals The appraisals and justification are developed by Department personnel or by fee appraisers This activity takes time and therefore should be requested as soon as possible Appraisals have an age limit, therefore, they must be compatible with the acquisition schedule

The instruments are prepared by the Department, although the legal descriptions may be prepared by the design consultant's surveyor

It is important to note that, on federal-aid projects, the formal appraisal activity cannot begin until the final right-of-way map is approved and the function is programmed with the FHWA The right-of-way requirements must be made available for R/W map preparation at the earliest possible time to facilitate the timely acquisition of title searches

Occupancy permit requirements must be defined by the Phase IV plans completion stage so they can be obtained by the right-of-way office

15 3 7 Value Engineering

Any FDOT projects with a construction cost in excess of $2,000,000 are candidates for a value engineering review The Value Engineering Coordinator will screen and select projects based on cost saving potential The Project Manager and/or Designer should expect recommendations from the value engineering team that will need to be incorporated into the design However basic concepts established during the PD&E phase will not be altered except in extraordinary circumstances

If a project has been selected for a value engineering review, it is the Project Manager's/Designer's responsibility to ensure the review is conducted in a time frame that allows maximum opportunity for value improvement considerations and still maintain proper project progress Value engineering reviews shall be conducted in accordance with the Value Engineering Design Review Procedure As such, value engineering reviews should occur no later than Phase I plans completion Accepted design changes can be accomplished with minimal impact of project schedule if value engineering recommendations are provided early in the design phase

VALUE ENGINEERING TEAM

The Project Manager, as the leader of the design effort, should be available to the value engineering team to provide input concerning project decisions and data When the project is being developed by a consultant, a representative of the consultant should be available to present to the team, assumptions and data for project decisions The Project Manager should maintain close communications with the value engineering team leader as the study progresses, continually providing input for consideration by the team

VALUE ENGINEERING FINDINGS

After completion of the value engineering team study, a draft summary report will be prepared The Project Manager should make a thorough review of the findings with the team's input Questions that should be asked are

- o Do the recommendations achieve the objectives of the project?
- o Have all design and existing conditions been considered?
- o Are all changes suggested economically feasible?
- o Will the project schedule be affected by the changes? Are the delays justified by the savings resulting from the changes?
- o Are the changes consistent with agreements with the local community or citizen groups?
- o Will additional public meetings be required?
- o Are any design controls altered? Are they acceptable?
- o Do the recommendations provide a long term advantage or short term solutions?
- o Will the recommended changes improve the project?

The purpose of this session is to afford the Project Manager with a "first" review of the team's recommendations, and to evaluate with the team, their potential implementation The Project Manager, being the most knowledgeable person of the project specifics and objectives, should use this opportunity to ensure that recommended changes are consistent with project intent

If the Project Manager and the value engineering team are in agreement, the value engineering summary study should be finalized and distributed to all persons concerned with the project, along with written concurrence of implementation by the Project Manager In the event that the Project Manager and value engineering team cannot reach an agreement, a presentation to management will be scheduled At this meeting, the value engineering team will present their recommendations The Project Manager will present his evaluation of the value engineering recommendations

At the conclusion of the management presentation, a decision should be made to accept all, or a portion of, the value engineering recommendations Having this decision, the Project Manager should inform, in writing, all persons involved in the project of the recommendations accepted for the continuation of the work

15 3 8 Aviation Office

Federal law requires that notice of construction must go to the Federal Aviation Administration (FAA) under the following circumstances

1) Any construction or alteration of more than 200 feet[1] in height above the ground level at its site, or
2) Any construction or alteration of greater height than an imaginary surface extending outward and upward at 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of any public or military airport

For assistance, contact

F D O T Aviation Office
605 Suwannee Street, M S. 46
Tallahassee, FL 32399-0450
(904) 488-8444 SC 278-8444

[1]Horizontal and vertical distances are given in English units due to current FAA policy that only English units of measure are to be used for airport facilities

Chapter 16

Quality Control (Metric)

Chapter 16

QUALITY CONTROL (METRIC)

16.1 Quality Control

The design and preparation of plans for all projects shall include the necessary assurances for accuracy, proper engineering criteria application, completion, and quality This is the responsibility of the designer, and shall be accomplished by adhering to a Quality Control Plan A Quality Control Plan is a comprehensive, well defined, written set of procedures and activities aimed at developing designs that meet or exceed Department criteria, and producing plans in accordance with this manual The plan will identify the organization or individuals responsible for quality control and the specific procedures used to insure the control of quality The plan will also detail the method of accountability and documentation

Each District will adopt its own Quality Control Plan Consultant firms working for the Department will also have a QC Plan in place The Project Manager/Coordinator is responsible for ensuring that the appropriate District or Consultant Quality Control Plan is adhered to

Chapter 17

Quality Assurance (Metric)

Chapter 17

QUALITY ASSURANCE (METRIC)

17.1 General

Quality Assurance is the planned, coordinated and continuing activities performed to compare process, work products and services with written predetermined critical requirements. The objective of all Quality Assurance activities is the continual improvement of the total delivery process to ensure quality, productivity and user satisfaction.

The offices under the State Transportation Engineer have developed a Quality Assurance monitoring plans. The Roadway Design monitoring plan is designed to compare work product processes with the predetermined critical requirements necessary to ensure quality designs and control.

Critical areas to be monitored are based on well established roadway design policy and practice. These policies, guidelines and accepted practices formulate the criteria used to measure compliance in the areas critical to quality. The plan designates methods to be used to monitor design functions on a two year frequency or as necessary. Latitude is granted to the reviewer for the depth and frequency of reviews, based on the individual district's observed performance, review findings or the needs of the unit being reviewed.

Results of the monitoring activities are reported to management in exit interviews and reports to point out areas that need improvement, to obtain feedback on the effectiveness and appropriateness of established policies, procedures and standards and to recognize outstanding areas of quality success. The reports are also used to share improvement ideas between districts, to maintain consistency in process and practice and to transfer technology.

While the Q A plan covers only the main functional areas of roadway design, the designers and reviewers must recognize that quality is the result of doing many individual activities and details correctly. All activities must conform with the valid requirements no matter how large or small their overall contribution Good drafting techniques, attention to details, making the plans legible and reproducible are just as essential to quality as good engineering practice

17.2 Authority

The Florida Statutes (20 23(3)) specifically states that the Central Office shall establish departmental policies, rules, procedures and standards and shall monitor the implementation in order to ensure uniform compliance and quality performance by the districts and central office units that implement transportation programs

17.3 Areas of Responsibility

A) Central Office Role--Quality Assurance Provide all the planned and systematic actions necessary to provide adequate direction to the districts so that all resulting design products can meet predetermined requirements This involves the establishment of design policies, procedures, standards and guidelines, training, and the monitoring and review of district compliance with these items

B) District Role--Quality Control Following established design policies, procedures, standards and guidelines in the preparation of all design products, and the checking and review of individual designs for compliance and good engineering practice

C) Area Design Engineer (ADE) Manage the Quality Assurance plan, document findings and maintain continuity with the department on design policy, procedures, standards and guidelines.

17.4 Critical Areas to be Monitored

The current Roadway Design monitoring plan for Quality Assurance lists the following critical areas to be monitored

1 Geometric Design - Design functions include typical sections, horizontal and vertical alignment, decision and conflict points, pedestrian and other non-motor vehicle elements and quality control

2 Drainage Design - Design functions include stormwater management, conveyance, permitting, erosion and scour, and quality control

3 Traffic Design - Design functions include traffic signals, signing and pavement markings, highway lighting and quality control

4 Traffic Control Plan Design - Design functions include construction phases, layout geometrics, detour plans, drainage design, traffic control devices and quality control

5 Estimates and Specifications - Design functions include pay item list, documentation of quantity take-off, summary of quantities, preparation of special provisions to cover items of work, measurement and payment and quality control

6 Contract Plans - Design functions include plans assembly, proper signing and sealing and proper handling of revisions This area is also monitored for results such as completeness, reproductivity, legibility, biddability and constructability

7 CADD Design - Design functions include file naming convention, working units, cell library, symbolism, proper software and geometry programs and quality control

8 Certification Acceptance - Critical requirements of the certification acceptance agreements cover all areas of engineering design functions Functions and responsibilities are covered in detail in the procedures

9 Utilities - Critical functions include advance coordination, detailed adjustment documentation and quality standards and criteria for clearing utilities prior to construction

10. Special Facilities - Critical functions include architectural design services, asbestos management, fixed capital outlay management and quality control

The foregoing critical areas and design functions can be revised from time to time with input and feedback from the districts Compliance with the criteria and critical requirements defined in the procedures and standards referenced is essential to ensure quality, productivity and user satisfaction in the roadway design delivery process

17.5 Documentation

A Documentation The Quality Assurance process will be documented in a quarterly report that will be distributed to the District Secretaries and other affected offices A brief summary of the data will also be entered in the Quality Assurance Reporting (QAR) data base

B Area Design Engineer (ADE) An ADE is assigned to each district and will be responsible for conducting and/or coordinating all roadway design QA activities with that district

C Review A review will be conducted in each design function and its associated components a minimum of once every two years This review will be for assurance that the districts have adequate control measures in place and are complying with policy, procedures, standards, guidelines and processes and for identification of any areas of excellence, noncompliance and need

17.6 Consultant's Role

The consultant's role is much the same as the districts' (Quality Control) since their primary responsibility is the preparation of contract plans as agents for the districts Consultants must ensure quality and adherence to policies just as must any office with the Department The consultant firms are held responsible for the quality, accuracy and completeness of the work supplied to the Department

17.7 Training

Training and assistance are also a mandated role of the Central Office units and the Quality Assurance program

A Development Roadway Design will formulate a training plan based upon the districts' requests and needs as determined by the Q A reviews

B Delivery Training courses will be conducted for district personnel as requested, with schedules and locations sensitive to budgets and production schedules

Chapters 18

Plans, Specifications and Estimates

Exhibits

Chapter 18

PLANS, SPECIFICATIONS AND ESTIMATES

18.1 General

Project cost estimating and the establishment of contract time are important phases of the design project and occur after the roadway design plans are complete This chapter briefly describes these requirements for the completion of the Bid Package

18.2 Pay Items

A pay item has been established for each item of work used in highway construction A method of measurement and basis of payment has been established for each of the pay items The Basis of Estimate Manual contains the item number, description and unit of measurement for each construction element The establishment of new pay items is covered in Section 18 11 of this chapter

Pay items are identified during Phase II and quantities added during Phase III. At the completion of Phase IV, all pay items are finalized and the final Summary of Pay Items is obtained The Plans Preparation and Assembly volume contains information on the requirement of Phase Review submittals

All projects (including resurfacing, widening, traffic operations, safety, etc) shall utilize the individual pay items as listed in the Master Pay Item List.

18.3 CES

The purpose of the Contract Estimating System (CES) is to compile and produce an accurate contract cost estimate in the same manner as that of a contractor preparing his bid. For detailed procedures on the use of the CES program, please refer to "Contract Estimating System, District Manual."

18.4 Computation Book

The computation book contains all computations and tabulations required to substantiate the quantities required for each pay item used on the project. The computation book supports the pay item quantities and is required to be submitted with the Phase III and Phase IV reviews. The original Comp book, including the Structures Comp book, shall be sent to Tallahassee as part of the transmittal package. After the project is let, the Comp book will be sent to the District Construction Office with the original plans.

All computations should be done on standard computation forms as described in the Department's Basis of Estimates Manual. The Computation Manual presents the standard method of calculating design quantities for construction pay items. All nonstandard methods used in computing quantities should be clearly and completely documented in the comp book by showing calculations and the basis of estimates used. Items calculated using the standard basis of estimate may sometimes require clarification if several intermediate computations are necessary to arrive at the total quantity. These computations should also be documented in the comp book.

18.5 Plan Quantity Payment Concept

The Department's current practice is to provide for final payment under the plan quantity concept for a large number of commonly used items Items under this concept require that the estimated quantities be calculated and documented as accurately as possible Asphalt and base items for resurfacing, widening and intersection improvement projects may be evaluated for payment under final measurement on a project by project basis Projects for which the Districts desire to have these items paid under final measurement shall include in the plans transmittal package to Tallahassee, a letter to the Engineer of Specifications, listing the specific items desired to be paid by final measurement The items for which payment may be allowed under final measurement are the pavement and base square meter items Metric ton items are not included in the plan quantity concept

Allowing final measurement on these items does not release the designer from calculating the quantities as accurately as possible Field reviews and design surveys are still required, when necessary, to define or establish scope and/or essential topography Planimetering of areas from plans for resurfacing and widening is allowed, as long as the scale is such that the area can be calculated as accurately as possible

For plan quantity items, the designer shall sign the computation sheet verifying that all backup data and computations are included in the computation book

18.6 Partial Federal Funding

For projects that have partial federal funds, adequate distinction should be clearly made between participating (included in federal aid) and nonparticipating (not included in federal-aid) items All nonparticipating items or partial quantities should be identified on the plans, on the Summary of Quantities sheet and in the Computation Book, as has been done in the past The method of presenting this information must be of sufficient detail for project personnel to readily distinguish between participating and nonparticipating work, including its physical location in the project Project personnel must be able to properly account for the necessary separation of quantities These separated quantities should be properly identified as to participating and nonparticipating work when entered into CES In a few cases certain lump sum items such as mobilization, maintenance of traffic, etc may be at least partially Federal Aid nonparticipating depending upon the nature of other nonparticipating items which must be separated Where it is determined that certain lump sum items should be partially nonparticipating, the percentage assignment of nonparticipating should be negotiated with the FHWA Upon mutual agreement, the summary of quantities should so note the appropriate percentage by footnote to the summary, and describe the area of the project to which this note applies This percentage should also be reflected when entering data into CES Where joint project agreements are involved between the Department and the City or County, appropriate participation information regarding this particular phase of the work should be so noted These items should be determined during early stages of project development Appropriate final adjustments should be included in the plans package and CES entries appropriately modified, if such items arise during the PS & E phase

18.7 Utility Contract Plans

Utility contract plans which have a 6000 job number, and are let in the contract as roadway work, need to have special attention given to the establishment of pay items and loading CES All items of work related to the utility work shall be included in the CES under 6000 project numbers Lump sum items such as Mobilization and Maintenance of traffic should be loaded for both the roadway work (3000 series project number) and utility work (6000 series project number) Traffic Control Plan (TCP) items that are paid by per each or per each per day (barricades, signs, etc) are to be included under the 6000 project when the work is clearly done separately from the roadway construction work If the utility work is done concurrently with the roadway work, individual TCP items are not required under the 6000 However, the TCP Lump Sum item must be included in all cases under both the 3000 and 6000 projects when TCP work is anticipated

18.8 Contract Time

After the Phase III completion of the design project including the completion of the cost estimate, the plans package is submitted to the district construction office scheduling engineer for establishing the contract duration Contract duration is the time required for the complete construction of the contract A copy of the contract time is submitted to the Central Office in Tallahassee with the Plans Transmittal Package Certain large complex projects should have the desired contract duration established earlier in the design process

Once the contract time has been established for federal-aid projects, trainee manhours should be computed The Basis of Estimates Manual has instructions for computing the number of trainees and the number of manhours required. Contract time is also used in calculating quantities for maintenance of traffic items

18.9 Plan Notes

Plan notes are intended to be used to clarify design detail, construction practices or method for payment In general, plan notes should be kept to a minimum Only those notes which are job specific should be used The standard notes provided in other sections of this manual are considered job specific type notes. Only those that apply should be included in the plans As the design process changes, these standard notes may also change Many of the "old" standard notes have been eliminated recently and incorporated into the specifications Notes which restate the standard specifications or standard indexes should not be used This will help to place proper emphasis on those notes that are job specific

18.10 Shop Drawings

For non-structural shop drawings, the Engineer of Record that will be responsible for the review must be listed on the key sheet of the specific plans, along with his/her mailing address

Example.

Engineer of Record
Lighting Shop Drawings
John Doe, P.E
111 S Avery Street
Tallahassee, Florida 32301

18.11 New Pay Items

New construction material and new uses of existing construction materials require new pay item definitions The Department has established the following procedure to establish new pay items

The originator of a new pay item should submit a draft of the pay items specification, any manufacturer's brochures, estimated material and labor cost, a completed Pay Item Request form (Exhibit 18-A, Form 600-000-02, available through the CICS Forms Menu) and any other relevant data to the pay item coordinator in the central roadway design office This package will be thoroughly reviewed Any inquiries arising during the review will be addressed to the originator through the Central office design coordinator. Upon successful completion of review, the package will be forwarded to the specifications office for further review, approval and pay item number assignment, after which it is transmitted to the estimates office for review, approval and entry into the data base system After the pay item number is entered into the estimates office's database system, the design coordinator will be notified of the approval and copies of the new pay item will be distributed

Before a new pay item is requested, the designer should contact the District CES coordinator to determine if an existing pay item or a pay item that has been blocked is available to cover the anticipated work

FLORIDA DEPARTMENT OF TRANSPORTATION

PAY ITEM REQUEST

JOB NO [ ][ ][ ][ ][ ] - [ ][ ][ ][ ] PAY ITEM NO [ ][ ][ ][ ] - [ ][ ][ ] - [ ][ ][ ] UNIT OF MEASURE [ ][ ]

FULL ITEM NAME ______________________________

DETAIL PAY ITEM INFORMATION (ATTACH ADDITIONAL SHEET IF NECESSARY)

SPEC YR [ ][ ] COST DATA ______________________________

ORIGINATOR ______________ DISTRICT ______ DATE ___/___/___ PHONE ______

DESIGN COORDINATOR ______________ ☐ APPROVED ☐ DISAPPROVED*

COORDINATOR ______________ DESIGN GROUP [ ][ ] DATE ___/___/___ PHONE ______

SIGNATURE ______________ DATE ___/___/___ PHONE ______

SPECIFICATIONS OFFICE ☐ APPROVED ☐ DISAPPROVED*

☐ SPECIFICATION BOOK ☐ SPECIAL PROVISIONS ☐ SUPPLEMENTAL SPECIFICATIONS

☐ DEVELOPMENT ☐ ATTACHMENT ☐ TECHNICAL SPECIAL PROVISIONS

SIGNATURE ______________ DATE ___/___/___ PHONE ______

ESTIMATES (ENGINEERING SUPPORT) ☐ APPROVED ☐ DISAPPROVED*

SIGNATURE ______________ DATE ___/___/___ PHONE ______

*DISAPPROVAL REASON ______________________________

NOTE ORIGINAL TO BE PROCESSED THROUGH ESTIMATES
COPY TO BE RETAINED BY COORDINATOR AND SPECIFICATIONS

Exhibit 18 A
Page 1 of 2

JOB NUMBER
USE STATE PROJECT NUMBER FOR WHICH THE NEW ITEM NUMBER WILL FIRST BE USED

PAY ITEM NUMBER
THIS NUMBER WILL BE ASSIGNED BY THE STATE SPECIFICATIONS ENGINEER IN THE CENTRAL OFFICE

UNIT OF MEASURE
A MAXIMUM OF TWO SPACES USED TO ABBREVIATE THE METHOD OF MEASURE FOR THIS ITEM (SEE STANDARD INDEXES FOR STANDARD ABBREVIATIONS)

FULL ITEM NAME
DESCRIBE THE NEW PAY ITEM SO THAT THIS "NAME" BEST RELATES TO FUTURE USERS WHAT THIS ITEM IS USED FOR

DETAILED PAY ITEM INFORMATION
PROVIDE DRAFT SPECIFICATIONS WHICH FULLY DESCRIBE THE NEW PAY ITEM FORMATTED TO THE CURRENT SPECIFICATION BOOK THE SPECIFICATIONS OFFICE WILL PUT THE DRAFT INTO FINAL FORM BUT THEY MUST HAVE THE USER'S IDEAS ON THE DESCRIPTION METHOD OF MEASUREMENT, HOW THIS ITEM WILL BE USED AND SUGGESTED METHOD OF PAYMENT

COST DATA
PROVIDE A BREAKDOWN OF THE COST PER UNIT OF MEASUREMENT WITH NUMBER OF SKILLS REQUIRED AND EQUIPMENT SHOULD SUPPLIER OR MANUFACTURER BE KNOWN, PLEASE INCLUDE NAME & PHONE

ORIGINATOR SIGNATURE
WHEN THE ORIGINATOR HAS PREPARED THE DRAFT SPECIFICATIONS, COST DATA AND ANY OTHER AVAILABLE DATA HE/SHE WILL SIGN THIS FORM SIGNIFYING HIS/HER APPROVAL OF THE ATTACHED MATERIAL

DISTRICT
ORIGINATOR'S DISTRICT NUMBER

DATE AND PHONE NUMBER SEE NOTE BELOW

DESIGN COORDINATOR
THE CENTRAL OFFICE DESIGN COORDINATOR WILL RECEIVE THE PAY ITEM PACKAGE, REVIEW FOR COMPLETENESS, EVALUATE THE REQUEST FOR STATEWIDE UNIFORMITY AND AFTER FINAL APPROVAL DISTRIBUTE PAY ITEM PACKAGE TO DISTRICT DESIGN ENGINEERS, ORIGINATOR AND DISTRICT ESTIMATOR FOR THEIR FUTURE REFERENCE

DESIGN GROUP
THE NUMERIC CODE THAT REFERS TO THE DESIGN SECTION APPROVING THE USE OF ABOVE PAY ITEM [EXAMPLE STRUCTURES (10), ROADWAY (20), SIGNING (30), LIGHTING (40), SIGNALIZATION (50), LANDSCAPING//PERIPHERALS (60), UTILITIES (70), ARCHITECTURE (80)]
DATE AND PHONE NUMBER SEE NOTE BELOW

DESIGN COORDINATOR SIGNATURE
WHEN THE DESIGN COORDINATOR HAS REVIEWED/EVALUATED THE REQUEST HE/SHE WILL SIGN THIS FORM SIGNIFYING HIS/HER APPROVAL OF THE ATTACHED MATERIAL

SPECIFICATIONS
SPECIFICATIONS OFFICE WILL REVIEW AND EVALUATE REQUEST AND DESIGNATE SECTION LOCATION SECTION LOCATION IS INDICATED BY THE 2ND, 3RD & 4TH DIGIT IN THE FIRST GROUP OF THE PAY ITEM NUMBER

TYPE OF SPECIFICATION
THIS OFFICE WILL ALSO DESIGNATE SPECIFIC LOCATION OF THE REQUEST IN SPECIFICATIONS PACKAGE (SPECIAL PROVISIONS, SUPPLEMENTAL SPECIFICATIONS, ETC)

SIGNATURE
SIGNATURE OF THE AUTHORIZED PERSON IN SPECIFICATIONS OFFICE

DATE AND PHONE NUMBER SEE NOTE BELOW

ENGINEERING SUPPORT

SIGNATURE
SIGNATURE OF AUTHORIZED PERSON FOR ESTIMATES ENGINEERING SUPPORT OFFICE

DATE AND PHONE NUMBER SEE NOTE BELOW

NOTE
DATE IS THE MONTH, DAY AND YEAR REQUEST IS LEAVING THAT OFFICE PHONE NUMBER - THE PHONE NUMBER OF THE AUTHORIZED PERSON TO CONTACT IF ADDITIONAL INFORMATION SHOULD BE REQUIRED

RECYCLED PAPER

Chapter 19

Signing and Sealing Design Drawings

Chapter 19

SIGNING AND SEALING DESIGN DRAWINGS

19.1 General

The Florida State Board of Professional Engineers has reviewed this Chapter and is in concurrence with its requirements To assure continued concurrence, the Board will have the opportunity to review future changes.

Section 334 175 of the Florida Statutes, requires that all design drawings prepared by or for the Department be signed, sealed and dated by the professional engineer in responsible charge of the project work, in accordance with Chapter 471, Rules 21H-19, 21H-23 and 21H-26 Such professional engineer must be duly registered in this state Responsible charge means direct control and personal supervision of engineering work done by oneself or by others over whom the engineer exercises supervisory authority

This chapter will outline the proper procedures of signing and sealing the Department's drawings and engineering documents It shall be the District's responsibility to ensure that all record sets and documents are properly signed, sealed and dated

19.2 Signing and Sealing of Plans

19 2 1 Original Plans

No signatures or seals are to be placed on the original sheets of a plan set Filling out the title block with initials and dates is optional. If the "Approved by" box is used, the name shall be printed

The key sheet for each component set (i e , roadway, signing, etc) shall have the responsible professional engineer's name (printed or leroyed) The professional engineer's registration number shall be placed under the completion date The following format shall be used

Roadway Plans Approved By	______________________
Date·	______________________
P E. No·	______________________

For the other components, "Roadway" should be substituted with the title of the component set, such as "Signing and Marking"

19 2 2 Record Set

The Record Set shall be a xerographic copy. For CADD developed plans, half size ("B" size) plotted to scale, i e 1 400, may be used All plans with hand drawn sheets shall be full size ("D" size), plotted to scale, i.e 1·200 Each sheet of the Record Set must be signed and sealed by the responsible professional engineer in charge The date shall be placed immediately under the signature and the embossed seal placed over the signature and date For convenience of storage, it is recommended that the location of this seal be varied across the bottom area of the sheet

19.3 Signing and Sealing Other Engineering Documents

Engineering Documents are defined as any reports, computations, or recommendations that influence or limit the design engineer's decisions in the development of design plans Bound Engineering Documents must be signed and sealed on a signature page or cover letter by each professional engineer who is in responsible charge of any portion of the document The date shall be placed immediately under the signature and the embossed seal placed over the signature and date Any document, report or computations not bound shall require all sheets to be signed and sealed

A signed and sealed record copy of the following Engineering Documents shall be placed in the District Project Records File

- Specifications & Special Provisions
- Pavement Design Package
- Typical Section Package
- Drainage Computations
- Hydraulics Reports
- Traffic Engineering Reports and Recommendations
- Environmental Reports and Recommendations
- Soil Survey Reports and Geotechnical Analysis
- Value Engineering Record
- Roadway and Traffic Design Standards
- All other Engineering Reports
- Permit Documentation

19.4 Signing and Sealing of Revisions

Whenever practical, the original responsible professional engineer shall prepare the revisions If revisions are made by a professional engineer other than the original responsible professional engineer, a signed and sealed record set of revised sheets shall be forwarded to the original responsible professional engineer, or to the appropriate consulting firm

19 4 1 Revisions to Plans

The revisions to the original sheets shall be prepared as outlined in the Plans Processing and Revisions chapter and the revision blocks filled out A record set of the revised sheets shall be signed and sealed and placed behind the key sheet of the original Record Set In addition to the signature, date and seal, the responsible professional engineer shall add above his signature, "Revisions Dated _____________ Approved "

19 4 2 Revisions to Engineering Documents

Each revised sheet shall be signed, sealed and dated by the responsible professional engineer who prepared the revision All revision sheets shall be placed behind the cover sheet of the Record Copy of the document

19.5 Information Requiring Certification

Engineering decisions are often made on the basis of support data furnished by non-engineering staff or offices. These data are to be certified as being obtained in accordance with official Department procedures The following data are to have the noted certification attached when submitted for use in engineering related work

19 5 1 80 kN Equivalent Single Axle Loads (ESAL)

"I have reviewed the Traffic Forecasting Procedure, adopted by the Florida Department of Transportation, and have arrived at the projected 80 kN ESAL volume. I have found these to be consistent with the historical traffic data and other available information "

____

Name

____

Signature

____

Title

____

Organizational Unit

____

Date

19 5 2 Project Traffic (Traffic to be used for Design)

"I have reviewed the Traffic Forecasting Procedure, adopted by the Florida Department of Transportation, and arrived at the project traffic volumes I have found these to be consistent with the historical traffic data and other available information "

Name

Signature

Title

Organizational Unit

Date

Chapter 20

Plans Processing and Revisions

Chapter 20

PLANS PROCESSING AND REVISIONS

20.1 General

The central office plans processing activities required to get funds authorized, advertisements prepared and to receive bids on construction contracts are on a critical schedule Activities in the process are concurrent and there may be any number of project plans going through the process at the same time The time-frame for processing plans through all Central Office activities is approximately 4 weeks The advertisement period for contract bids is 6 weeks From the time the plans for a contract are received in the central office on the Plans to Tallahassee date until the letting is ten (10) weeks and three (3) days

This chapter describes in general terms the critical activities required to process the contract plans, specifications and estimate (P S & E) It also identifies the various offices that have responsibilities in the process Also, revisions to plans, specifications or other contract documents during this critical period must be performed and documented in a consistent and timely manner The requirements and responsibilities for performing and documenting such revisions are outlined in Section 20 3 of this chapter

20.2 Plans Processing Responsibilities

20.2 1 District Activities

Development of the plans and specifications is a district responsibility and is accomplished with in-house staff or by professional services contracts with qualified design consultant firms

The four weeks prior to the Plans to Tallahassee Date (PTT) is the District Specifications Phase (242) of a project. During this time the Preliminary Estimates Office in Tallahassee is also beginning their work on the official estimate Therefore, it is necessary at the beginning of this phase for the Project Manager/Designer to send to Tallahassee a "B" size (11 x 17) copy of the plans and a copy of the computation book This submittal shall be made to the Plans Processing Section at Mail Station 32 The CES will be locked upon receipt of this package

Any modification to the plans or quantities during this four weeks will be referred to as Plan Changes These changes are not revisions Revisions are modifications to the plans or specifications made after the Plans Transmittal Package has been mailed to Tallahassee Plan Changes may be made any time during the four week period However, the Estimates Office has requested that all quantity changes be held until the last week of this phase The exception to this rule is that significant changes to the quantities which would affect the estimate by greater than 20 per cent should be handled immediately

A Plans Change Letter (see Exhibit 20-E) is required to let the District Specification Section and the Tallahassee Estimetes Office know of any changes to the plans On changes that involve quantities, this letter should be faxed or mailed to the Plans Processing Section during the week prior to the PTT date to open the CES

The Plans Change Letter also requires a sign-off by the District Specifications Engineer to ensure that all the changes have been coordinated with that office

The Plans Change Letter, along with a copy (for Estimates) of all the changed plans sheets and computation booklet sheets, shall be sent to Tallahassee as part of the Plans Transmittal Package

The designer or project manager shall prepare a contract file either during design or before plans transmittal to Tallahassee. The Contract File Index (Exhibit 20-A) lists all documents which must be in the contract file that is transmitted with the plans package for letting

The district is responsible for ensuring the completeness, legibility and contents of all final plans packages The plans package transmitted to the Roadway Design Office in Tallahassee shall include

> The Transmittal Letter (Exhibit 20-B)

> The Contract File (Exhibit 20-A) with listed documents

> The Contract Plans Set (Original, reproducible plan details, half size, if CADD)

> The Record Set (Xerographic copy signed & sealed by Engineer of Record)

> The Specifications Package (signed & sealed with transmittal letter).

> Copy of the Spec Package (2 copies for all federally funded projects).

> Copy of the plans "B" size (11 x 17) (2 copies for all federally funded projects)

> Copy of all changed plans sheets (for Estimates)

> Copy of all changed Comp Book Sheets

> Reproducible negatives or bond copy of any aerial photo sheets

Aerial photo sheets are no longer permitted in the plans On projects begun before the no photo sheet policy, the District shall provide reproducible negatives or copies of these sheets along with the transmittal package Negatives can be made through the Topographics Office in Tallahassee

20 2 2 State Roadway Design Office Activities

When the plans package is received by the Plans Processing Section in Tallahassee, they are logged in The contract file is checked to be sure that all required documents are included in the file If the file is incomplete, the District Director of Production and the Tallahassee Production Management Office are notified

The Tallahassee Plans Processing Section then distributes the Plans Transmittal Package as follows

Specifications Office

Specifications Package (with Specs Transmittal Letter)

Checks the package for completeness and forwards it to Reprographics for printing The Specifications Transmittal Letter attached to the package is given to the Contracts Office for preparation of the Contract Proposal

Estimates

Copy of the Specifications

Plans Change Letter & Plans

JPA(s)

Prepares the Official Estimate, which is only given to the Federal Aid Office for the PS&E package

Federal Aid Office

Copy of the Specifications

'B' size copy of the plans

Contract file

Estimate (from Estimates)

Prepares the P S & E package and submits to Federal Highway for authorization and obligation of Federal Funds

Reprographics

Contract Plans

Specifications Package (from Specifications office)

Prints the plans and specifications for distribution to the contractors

Contracts

Specifications Transmittal Letter (from Specifications Office)

Prepares the Advertisement and Contract Proposal

File Room

Signed and Sealed Plans

Changed Computation Booklet sheets

Contract Plans (from Reprographics)

Stores the Signed and Sealed plans and mails the Contract Plans and Computation Booklet to the District Construction Office upon award of the contract

Production Management Office

Environmental Permits Transmittal Letter (from Contract File)

Tracks the project through the Tallahassee process by monitoring the Critical Dates List and the progress and completeness of the plans

As the project is processed through Tallahassee, all documents are removed from the contract file and incorporated into the Plans, Specifications and Estimates (PS&E) package Therefore, processing cannot be completed until all items listed on the Contract File Index are received in Tallahassee Documents not included with the original submittal shall be sent to the Plans Processing Section, Mail Station 32 The District should keep a copy of all contract file documents in their project file for future needs

20.3 Revisions to Contract Documents

Revisions are occasionally necessary to change plans or other documents Any changes to the plans or specifications, between the time the submittal package is received in Tallahassee and the letting date is considered a revision

Making revisions to the plans and specifications is the responsibility of the Districts **All revisions shall be processed through the Plans Processing Section, Mail Station 32, in the State Roadway Design Office.**

The engineer making the revisions to plans, specifications or other documents that affect the engineer's estimate, pay items or quantities will be responsible for up-dating the Computation Book, Pay Item Listing and Contract Estimating System (CES)

20 3 1 Revision Process

When changes to the plans or other contract documents are necessary after they have been submitted to Tallahassee, a revision letter is required. The revision process is as follows

1 Plans must be requested to be returned to the District for both in-house and consultant plans When consultant-prepared plans are returned for revision, the District will be responsible for sending plans to the Consultant

2 If the project involves federal funds and is not exempt from FHWA oversight under CA or the ISTEA (1991) exemptions, concurrence must be obtained by the District Office from the responsible FHWA Engineer prior to making the revisions FHWA concurrence is not required on minor quantity changes.

3 The District Design Engineer or Project Manager/ Designer will generally be the contact person for revisions on in-house or consultant plans respectively

4 A revision letter is required (see Exhibit 20-C) and the date shown shall match the date on the revised sheets and the revision listing on the lead key sheet This is the official revision date For revision involving CES changes the date should be the day you fax the revision letter to Tallahassee to unlock the CES On revisions not involving pay items or quantity changes the date should be the approximate date you anticipate mailing the revision to Tallahassee

5 Whenever a revision involves pay items and/or quantities, the CES will be unlocked for 24 hours once the revision letter is received All quantities, pay items, computation books, etc , shall be updated as part of the revision To open the CES, fax the completed revision letter to Plans Processing at SC number 292-9293

6 The lead key sheet shall have all the revisions noted in the revision listing in the lower left hand corner of the sheet (Revisions to the Key Sheet are noted on the right side of the sheet in the revision block)

7 When the project contains other components such as signing and pavement markings or signalization plans, the revisions shall be made on the plan sheets, and all the revisions, along with the other component revisions, noted on the lead key sheet only

8 The responsible professional engineer making the revision shall complete the revision block on all revised sheets and sign and seal record prints, as noted in the Signing and Sealing chapter Where no revision block exists (CES sheets, pay item sheets etc), the revision date shall be noted on the sheet (along the top of computer generated pay item sheets)

9 The revision package submitted to Tallahassee shall include the following

- Revised contract plans sheets including the Key Sheet
- Revised CES (if applicable)
- Revised computation booklet sheets (if applicable)
- Signed and sealed xerographic bond copies of all revised sheets including the CES
- Revised signed and sealed Specifications (if applicable)
- Revision letter

10 If time remaining until letting date is fifteen working days or less by the time the revision will reach the Central Office, processing of the revision must be approved by the State Roadway Design Engineer or his designee

11 No revisions are allowed within five working days of letting After this date, the project must be let as is or withdrawn from the letting, unless otherwise approved by the State Highway Engineer and the District Secretary. Withdrawal of the plans package after advertisement requires the approval of the State Highway Engineer and the District Secretary

12 All revisions, including those that deal with specifications only, shall be sent to the Plans Processing Section, Mail Station 32

20.3 2 Complete Project Revisions

If an entire project is requested to be returned to the District for revisions before the letting, the following steps will be required for resubmittal

1 The plans and computation books shall be resubmitted with a new contract file containing those items which need to be updated

2 The lead Key Sheet shall be noted "Plans Completely Revised" in the lower left corner and dated. This note implies that a project has been pulled from letting, rejected, or that a sufficient number of sheets have been revised to warrant a total reprinting The revision block on each sheet that is revised shall be completed by the revisor and dated

3 The revision letter should state that the project has been completely revised

4 A copy of each plans sheet that is revised shall be signed and sealed in accordance with the Signing and Sealing chapter The signed and sealed sheets will be included with the Record Set in the Central Office

Project # ____________

CONTRACT FILE INDEX

WPI # ______________________

	Number Reqd	Included in File
District Prepared Specification Package		________
Calendar Days Recommendation		________
Preliminary Engineering Certification		________
Utility Certification		________
Environmental Re-evaluation (Exhibit 20-D)		________
Environmental Permit Transmittal Letter		________
Maintenance Agreement where appropriate	______	________
Joint Project Agreements (J P A)		
Reimbursable	______	________
Non-reimbursable	______	________
FA Project Certification to Standards		________

Form - 37 (on-line form for Form FHWA-37) has been electronically transmitted	Yes___ No___
This project was developed under Certification Acceptance procedure	Yes___ No___
Project exempt from FHWA oversight per request under ISTEA, 1991	Yes___ No___
If CA, there are special features that require FHWA review and concurrence (Ch 24)	Yes___ No___
R/W Certification has been forwarded to Tallahassee R/W Office	Yes___ No___

Name ______________________________ Sig ______________________________
Project Manager/Designer

Note All Contract File Documents are due on Plans to Tallahassee date.

Exhibit 20-A, Page 1 of 2

REMINDER

CONTRACT FILE

- Put in order of file list
- Show number of agreements
- Show anticipated date of arrival on any item not included in file
- R/W Certification is required on all projects
  - R/W Certifications shall be forwarded directly to the Tallahassee R/W Office
  - Attn State Administrator, R/W Work Program & Production Reporting, Mail Sta 22
- Send late documents to Plans Processing (M S 32)

Exhibit 20-A, Page 2 of 2

DATE

TO Director, Office of Design

Attn State Roadway Design Engineer

FROM District Director of Production

COPIES TO

SUBJECT **TRANSMITTAL OF PLANS** - Scheduled Letting Date ____, ____ (Mo, Yr)

WPI NO __________ (GOES WITH __________)

LEAD STATE JOB NO __________

P E Job Number __________

* F A NO __________

DESCRIPTION __________

WORK TYPE/MIX __________

Other work to be performed by Contractor via J P A

Job #__________ Description __________

Information contained herein has been checked and verified as needed A plans package, suitable for processing, which consists of the following is forwarded under separate cover

Contract Plans	**Plans Copy "B" Size (11x17)
Record plans set	**Specifications Copy (without worksheets)
Specifications Package	Copy of all changed plan sheets ("B" Size)
Contract File	Copy of all changed computation book sheets

** Two copies for Federally funded projects

The affixed signatures below indicate and attest that

1 The plans package is complete, free of known errors and has been reviewed for constructibility and bidability and is ready for processing to an advertisement status
2 The contract file is complete as noted on the Contract File Index, is accurate and contains all documentation required for the PS&E package
3 The Record plans set represents a true copy of the contract plans set as produced by the Engineer of Record
4 WPA and CES project descriptive information is correct for advertisement purposes
5 Where appropriate, I certify that the project was designed in compliance with the Certification Acceptance Agreement dated July 30, 1990 or with the request for exemption under ISTEA, 1991

Name __________ Sig __________
Project Manager/Designer

Name __________ Sig __________
District Director - Production

*Place a block letter "F" (25mm X 25mm) in the upper right corner for (1) I Funds completion, new or reconstruction projects > $1M or (2) NHS (Off Interstate) new or reconstruction > $5M

Exhibit 20-B, Page 1 of 2

REMINDER

TRANSMITTAL PACKAGE

S&S Xerox copies on bond (no bluelines)
Punch and pin all plans (no staples)
All plans and plans components must be the same size
Check for missing sheets
Check reproducibility of all sheets, especially aerials
On strung jobs, all CES sheets go in lead job
Provide Reproducible plates or bond copies of any aerial photos
Make sure bridge CES is the CESPJ15 Option 4 which shows bridge numbers and the quantity breakdowns

Exhibit 20-B, Page 2 of 2

DATE ______________ 1 of ___

TO State Roadway Design Engineer, Attn Plans Processing

APPROVAL: , Responsible Engineer

CONCURRENCE: , District Design Engineer

COPIES TO: Specifications Office, Contracts Office, FA Office, Estimates Office, Reprographics

SUBJECT: **Revision Package**

W P I No (s) ______________________________

Letting (mo /yr) ______________________________

State Project No. (s) ______________________________

F A Project Yes _____ No _____

County ______________________ S R No ____________

This is to advise you that a revision was made to the plans and/or special provisions and the sheets listed below will require reprinting and the Record Set will need to be updated The revision package includes

___ Specifications ___ Contract Plan Sheet(s)

___ Updated Comp Sheet(s) ___ Signed and Sealed Print(s)

This revision has been reviewed for its impact to the Specifications Package and a Specifications Revision is ___ is not ___ required ________________ Date______
District Specification Engineer

PREPARED BY ______________ REQUESTED BY· ______________

PROCESSED BY·Central Office ______________________ DATE __________

AUTHORIZED BY FHWA ______________________ DATE __________

APPROVAL IF WITHIN 15 WORKING DAYS OF LETTING.

SIG ______________________________________ DATE.__________
State Roadway Design Engineer

Sheets No (s)	Description of Revision

Exhibit 20-C, Page 1 of 3

REMINDER

REVISION DEFINITION- Changes to plans or other contract documents after Plans have been submitted to Tallahassee

PROCESS

Notify Tallahassee of pending revisions and determine if sufficient time exists to complete and process revision
Determine who is to do revision? Tally or D O
Request necessary sheets to be returned (Revisions to CADD sheets shall be done in district)
Make changes to plans sheets
Calculate quantities, if applicable
If quantities are involved FAX completed revision letter to S C 292-9293 to have CES unlocked
Make changes to CES
Submit revision to plans processing in Tallahassee, M S 32

REVISION PACKAGE

Letter
Revised sheets including CES
S&S copies of revised sheets
Two half size copies
Revised comp book sheets
Revised S&S specifications if applicable

REVISION LETTER REMINDERS

On quantity changes, letter shall show,

New pay item numbers with quantity
Deleted pay item numbers only
Changes to quantities shall show pay items number with old and new quantities
FHWA approval on oversight projects is the District's responsibility
Key Sheet is only listed on the letter and shown on the revision listing when it is actually revised, but is included in the package for all revisions to the plans
Date on the letter must match the date on plans

REVISED SHEET REMINDERS

Include CES Sheets in revision listing on Key Sheet and furnish new CES and S&S CES
Show Revision Date on all revised sheets including CES, Box Culvert Shts etc
Revision date must match date on letter
If adding or deleting a pay item, revise the complete CES for that Design Group because of rollover
Change CES in System and then pass to CADD if CADD CES is used (Do not change CADD CES sheets manually)

SIGNED AND SEALED COPIES

Signed and sealed copies must be bond or Xerox
On Consultant projects, S&S revised sheets may be sent to Tallahassee a few days after the rest of the revision

COMP BOOK

Show Project number on Revised comp book sheets

Exhibit 20-C, Page 2 of 3

DATE ____________ __ OF __

PROJECT NO ________

Sheets No (s)	Description of Revision

Exhibit 20-C, Page 3 of 3

ENVIRONMENTAL RE-EVALUATION

ENVIRONMENTAL DOCUMENT

1 The project is a Categorical Exclusion under (check one)
(___) 23 CFR 771 117(c) (Type 1) or
(___) "Programmatic" list approved by FHWA on 2/25/88 & amended 5/21/93
which was reevaluated in accordance with 23 CFR 771 129 on ____________________,
and the determination remains valid

2 The environmental document for this project was a (check one)
(___) Categorical Exclusion under 23 CFR 771 117(d) (Type 2)
approved on ____________,
(___) FONSI under 23 CFR 771 121 approved on ____________,
(___) Final Negative Declaration approved on ____________), or
(___) Final Environmental Impact Statement under 23 CFR 771 125
approved on ____________
A reevaluation in accordance with 23 CFR 771 129 was approved on ______________

Name ______________________________ Sig ____________________________________
Project Manager/Designer

Exhibit 20-D

DATE	________________	1 of ___
TO.	State Roadway Design Engineer, Attn Plans Processing	
FROM:		
COPIES TO	District Specifications Engineer	
SUBJECT	**Plans Change Letter**	

W.P I No.(s) ____

Letting (mo /yr) ____

State Project No (s) _____________________________________

F A Project (y)______ (n)______

County __________________________ S R No ______________

The changes listed below have been incorporated into the specs package ________________
District Specifications Engineer

This is to advise you that the following changes were made to the plans during the District Specifications Phase prior to submitting the Plans Package to Tallahassee This submittal includes the sheets on which changes occurred and are intended to replace the similar sheets from the Central Office Preliminary Estimates copy

<u>Sheets No (s)</u> <u>Description of Revision</u>

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

___ ____

Exhibit 20-E, Page 1 of 3

REMINDER

Change Definition: Changes are modifications which occurto the plans during the four (4) week Specifications Phase and must be tracked to ensure that both Specs and Estimates incorporate them into their final packages These changes are not listed on the Key Sheet nor noted in the Revision Blocks of the Plans sheets

___ Show all changed plans sheets including CES

___ List all quantity changes, additions or deletions

___ Fax to (904) 922-9293, (Suncom 292-9293) or mail to M S 32

___ Coordinate all changes with Specifications and get DSE's sign-off

___ Include letter and copies of all changed sheets in Plans Transmittal Package

DATE ________

PROJECT NO ________

Sheets No (s) | Description of Change

Exhibit 20-E , Page 3 of 3

W.P.I. NO: ______________________

STATE PROJECT NO. ______________________

F.A. PROJECT NO. ______________________

County ______________ S.R. No. _____

____ The District Director of Production certifies that all work will meet or exceed the standards approved by the Secretary of The U.S. Department of Transportation under 23 U.S.C.109(c).

I do, hereby, certify to the above statement:

______________________________ ______________

District Director of Production Date

____ The District Director of Production certifies that all work will meet or exceed, except as noted below, the standards approved by the Secretary of The U.S. Department of Transportation under 23 U.S.C.109(c).

I do, hereby, certify to the above statement and listed below are the exceptions/variances to the standards:

______________________________ ______________

District Director of Production Date

LIST OF EXCEPTIONS/VARIANCES	DATE OF APPROVAL

Exhibit 20-F

Chapter 21

Consultant Project Management

Chapter 21

CONSULTANT PROJECT MANAGEMENT

21.1 General

The Florida DOT may elect to use a consultant to provide all or a portion of the engineering services required for a transportation project Guidelines for use in acquiring and managing such a consultant are contained in the Florida DOT Project Management Guidelines

21.2 Consultant Acquisition

Consultant acquisition is accomplished according to established rules and procedures and includes, requests for proposals, proposal evaluation, negotiation and contract execution Each of these are further explained in the Project Management Guidelines and in the procedures of the Contractual Services Office

Chapter 22

ARCHITECTURAL PLANS (METRIC)

(PENDING)

Chapter 23

DESIGN EXCEPTIONS AND VARIATIONS (METRIC)

23.1 General

The Department's roadway design criteria and standards are contained in this volume The values given in those chapters have been accepted by FHWA and are usually within the desirable ranges established by AASHTO

Occasionally, it becomes necessary to deviate from the standard criteria used in the design process When this is the case, early documentation and approval is required Two specific deviations may occur (1) design exception (2) design variation

It is very important that the correct term is used when it becomes necessary to deviate from standard criteria This chapter includes specific requirements for the proper treatment of both design exceptions and design variations. In both cases, the design project file should clearly document the action taken and approval given

23.2 Design Exceptions

Design Exceptions are required when design criteria are applied which fall below the minimums established by AASHTO for the following controlling design elements

- Design speed
- Lane widths
- Shoulder widths
- Bridge widths

- Structural capacity
- Vertical clearance
- Vertical alignment
- Horizontal alignment
- Stopping sight distance
- Cross slope
- Superelevation
- Grade
- Horizontal Clearance

Any request for exception must address the following items as a minimum

1) the effect of the deviation from the design criteria on the safety (including clear recovery area) and operation of the facility, and safety mitigating measures considered and provided,
2) the compatibility of the design and operation with adjacent sections,
3) amount and character of traffic using the facility,
4) accident history (type, location, severity, etc),
5) comparative cost of AASHTO criteria vs the proposed criteria;
6) the long term effect of the proposed criteria vs AASHTO criteria (effect of capacity reduction),
7) difficulty in obtaining AASHTO criteria (cost, R/W involvement, delay, environmental impacts, etc),
8) level of service for AASHTO criteria vs proposed criteria, and
9) any other design criteria that is not being met, i e , cumulative effect of more than one criterion that is being proposed

In addition to the items listed above, requests for design exceptions shall include any background information which documents and/or justifies the request

In order to allow time to research alternatives and begin the required documentation process, it is critical that design exceptions be identified as early in the plans process as possible This is preferably done during the PD&E phase

When the need for a design exception has been determined, it is required that approval be requested no later than Phase II for major projects, and the initial phase for minor projects

As an aid to the designer, Appendix "A", Pages 23-13 through 23-26 are given in the back of this chapter **The information displayed in these exhibits may be used as a reference for determining when a design exception is required (based on AASHTO criteria), but is in no way intended to replace FDOT design criteria.**

23.3 Routing for Exceptions

The chart below gives the required routing and distribution schedule for design exception requests.

PROJECT TYPE	DISTRICT	STATE ROADWAY DESIGN ENGINEER	DIRECTOR FDOT OFFICE OF DESIGN	FHWA	APPROVAL	CONCURRED *	SEE EXHIBIT
District Let ≤ $250,000	XXXX				LOCAL**		B-14-E
District Let $250,000 - $1 Million	XXXX	XXXX			DDE	SRDE	B-14-B
State Projects (non-FA)	XXXX	XXXX			DDE	SRDE	B-14-B
Exempt Projects***	XXXX	XXXX	XXXX		DDE	SRDE, DOD	B-14-C
CA Projects New/Reconst $1-5 Million	XXXX	XXXX		XXXX	FHWA	SRDE	B-14-A
New/Reconst Interstate >$1 Million	XXXX	XXXX		XXXX	FHWA	SRDE	B-14-A
All Projects which reduce Interstate Vert Clear to < 4 9 m	XXXX	XXXX		XXXX	FHWA	SRDE	B-14-A
All Non-RRR FA Projects >$5 Million	XXXX	XXXX		XXXX	FHWA	SRDE	B-14-A

* Any issue impacting the geometry, vertical clearance or layout of structures or any exception to criteria in Article 10 21 of the Structures Design Guidelines shall be concurred in by the appropriate Structures Staff

** For District let projects, the approval of the District Design (or Project Management) Engineer, with concurrence by the District Director of Production, is required This approval shall be documented in the project file.

*** Projects exempt from FHWA oversight are defined as follows.

- All RRR projects, including interstate (project-by-project),
- All Non-National Highway System projects, and
- All FA < $1 Million, including new and reconstruction interstate projects
- For further information, see the Federal Aid Project Certification Chapter

DDE = District Design Engineer
DOD = Director, Office of Design
SRDE = State Roadway Design Engineer

23.4 Design Variation

A Design Variation is required when design criteria are applied which fall below Department established criteria and the deviation is not covered by the Design Exception definition

A Design Variation request must address

- Design criteria vs proposed criteria,
- Reason the design criteria is not appropriate, and
- Justification for the proposed criteria

In addition to the items listed above, requests for design variations should include any background information which documents and/or justifies the request

Requests begin with the Responsible Professional Engineer Requests are submitted to the District Design Engineer for approval A copy of the approved variation is then sent to the State Roadway Design Engineer.

For approvals of design variations on projects to be let by the District equal to or less than $250,000 construction costs, the approval of the District Design Engineer is required This approval shall be documented in the project file

As with design exceptions, it is critical that design variations be identified as early in the plans process as possible, preferably during the PD&E phase

When the need for a design variation has been determined, it is required that approval be requested no later than Phase II for major projects, and the initial phase for minor projects

23.5 Routing for Variations

The chart below gives the required routing, distribution and approval schedule for design variation requests

PROJECT TYPE	DISTRICT	REQUEST	APPROVAL	COPIES TO SRDE	SEE EXHIBIT
District Let Projects <$250,000	XXXX	RPE	DDE		I-23-E
District Let Projects $250,000 - $1M	XXXX	RPE	DDE	XXXX	I-23-D
All Others	XXXX	RPE	DDE	XXXX	I-23-D

* Any issue impacting the geometry, vertical clearance or layout of structures or any variation to criteria in Article 10 21 of the Structures Design Guidelines shall be concurred in by the appropriate Structures Staff

** For District let projects, the project file must contain the justification for the variation as developed by the Responsible Professional Engineer

RPE = Responsible Professional Engineer
DDE = District Design Engineer
SRDE = State Roadway Design Engineer

23.6 Permit Variations

For design variations related to permits (maintenance, drainage, utility, etc), request must be by the Responsible Professional Engineer, with approval by the District Design Engineer

Date

Mr J R Skinner
Division Administrator
Federal Highway Administration
227 North Bronough Street, Room 2015
Tallahassee, Florida 32302

SUBJECT Design Exception

REF W P I Number
State Project Number
Federal Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) requiring exception and specific exception requested

Address each of the nine items listed under Section 23 2

Also, include justification, supporting documentation, etc

REQUESTED BY

____
District Secretary or Production Director

CONCURRENCE	APPROVAL.
______________________________	______________________________
State Roadway Design Engineer	Division Administrator Federal Highway Administration

Exhibit 23-A

DATE

TO District Design Engineer

FROM

COPIES

SUBJECT Design Exception

REF W P I Number
State Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) requiring exception and specific exception requested

Address each of the nine items listed under Section 23.2

Also, include justification, supporting documentation, etc

RECOMMENDED BY

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVAL CONCURRENCE

District Design Engineer State Roadway Design Engineer

Exhibit 23-B

DATE

TO District Design Engineer

FROM

COPIES

SUBJECT Design Exception

REF W P I Number
State Project Number
F A Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) requiring exception and specific exception requested

Address each of the nine items listed under Section 23 2

Also, include justification, supporting documentation, etc

RECOMMENDED BY	APPROVAL
______________________________	______________________________
Responsible Professional Engineer (Name of Consultant Firm)	District Design Engineer
CONCURRENCE	CONCURRENCE
______________________________	______________________________
State Roadway Design Engineer	Director of Design

Exhibit 23-C

DATE

TO District Design Engineer

FROM

COPIES State Roadway Design Engineer

SUBJECT Design Variation

REF W P I Number
State Project Number
F A Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) for which variation is requested, along with specific variation description

Address each of the items listed under Section 23.4

Also, include other supporting documentation, etc

RECOMMENDED BY·

____

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVAL

____

District Design Engineer

Exhibit 23-D

DATE

TO District Design Engineer

FROM

COPIES State Roadway Design Engineer

SUBJECT Design Exception (*Variation*)

REF W P I Number
State Project Number
County

Include a brief background statement concerning project and item(s) of concern

Indicate design element(s) requiring exception/variation and specific deviation requested

Address each of the nine items listed under Section 23 2

Also, include justification, supporting documentation, etc

RECOMMENDED BY

____

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVAL

____

District Design Engineer
or Project Management Engineer

Exhibit 23-E

DISTRICT VARIANCE APPROVAL FORM

DATE

TO , State Roadway Design Engineer

FROM , District Design Engineer

COPIES , Engineer of Record

SUBJECT Design Variation
WPI Number ______________________
State Project Number ______________________
State Road Number ______________________
Project Description ______________________
____
New Construction __________ RRR __________

CRITICAL VARIATION ELEMENTS (Criteria Below AASHTO Minimums of These Elements Requires an Exception)

1	Design Speed	______	8	Vertical Alignment	______
2	Lane Width	______	9	Horizontal Alignment	______
3	Shoulder Width	______	10	Stopping Sight Distance	______
4	Bridge Width	______	11	Cross Slope	______
5	Structural Capacity	______	12	Grades	______
6	Vertical Clearance	______	13	Superelevation	______
7	Horizontal Clearance	______			

ADDITIONAL ELEMENTS

1	Border Width	______	5	Pvmt Marking Criteria	______
2	Clear Zone	______	6	Signing Criteria	______
3	Drainage Criteria	______	7	Auxil Lane Criteria	______
4	Pvmt Design Criteria	______	8	Other	______

APPROVAL

Remarks/Basis of Recommendations

____
____
____
____
____

The above approved variance has been documented appropriately in the project file Justification for not meeting the subject design criteria is sufficient for the approval granted

Signed ______________________
District Design Engineer

Exhibit 23-F

APPENDIX

A

The information displayed in this appendix may be used as a reference for determining when a design exception is required (based on AASHTO criteria), but is in no way intended to replace FDOT design criteria.

Appendix A (AASHTO Metric Criteria for determining the need for a design exception)

METRIC DESIGN CRITERIA
(BASED ON COMPARABLE AASHTO ENGLISH UNITS)
FOR DETERMINING DESIGN EXCEPTIONS

1 DESIGN SPEED (MINIMUM)

Type Facility	Design Speed (km/h)
Freeway - Rural	110
- Urban	80
Major Urban Arterials	50*
Other Urban Arterials	50*
CBD (major or minor)	50
Rural Arterials	100 (Level Terrain)
	80 (Rolling Terrain)
Urban Collectors	50

Rural Collectors	ADT*		
	0-400	400-2000	>2000
Level	60	80	100
Rolling	50	60	80

Ramps	Design Speed (km/h)							
Highway	50	60	70	80	90	100	110	120
Ramp	20	30	40	40	50	50	60	70

Loop Ramps	40 (50 m radius)
Semi-Direct Connections	50
Direct Connections	60

* Changed with AASHTO Metric update

METRIC DESIGN CRITERIA
(BASED ON COMPARABLE AASHTO ENGLISH UNITS)
FOR DETERMINING DESIGN EXCEPTIONS

2 LANE WIDTHS (MINIMUM)

Type Facility	Lane Width (m)
Freeways	3 6
Rural Arterial	3 3
Urban Arterial	3 0
Urban Collectors	3 0
Rural Collectors	3 0
Low Speed	3 0
Residential	2 7
Auxiliary	3 0
Continuous TWLTL	3 0

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

3 SHOULDER WIDTHS (MINIMUM)

Type Facility	Other Factor	Right	Median
Freeways	4 lanes	3 0 m	1 2 m
	6 lanes	3 0 m	3 0 m
Rural Arterial	ADT > 2000*	2 4 m	
	ADT 400-2000*	1 8 m	
	ADT < 400	1 2 m	
	Divided highway 4 lanes	2 4 m	1 0 m
	6 lanes	2 4 m	2 4 m (1 2 m with rigid constraints)
Urban Arterial	Low Type	0 6 m	
	High Type	3 0 m	
	If barrier curb is used	1 8 m	
Heavily Traveled	High Speed ($\geq$80 km/h)	3 0 m	
Rural & Urban Collectors	ADT > 2000*	2 4 m	
	ADT 1500-2000*	1 8 m	
	ADT 400-1500*	1 5 m	
	ADT < 400	0 6 m	

* Changed with AASHTO Metric update

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

4 BRIDGE WIDTHS (MINIMUM)

Type Facility	Other Factor	Bridge Width	
Freeways	New Bridges	Approach Roadway Width	
Rural Arterial	New Bridges (Short)	Approach Roadway Width	
	Long Bridges (≥ 60 m)	Travel Lanes + 1 2m each side	
	Remain in Place	Travel Lanes + 0 6m each side	
Urban Arterial	Long	Travel lanes + 1 2m each side	
	Short	Curb to Curb Width of Street (New Bridges)	
Collectors		New/Reconstruction*	To Remain in Place (≤30m)**
Rural	Under 400 ADT	Traveled Way + 0 6m each side	6 6m
Urban	ADT 400-1500*	Traveled Way + 1 0m each side	6 6m
	ADT 1500-2000*	Traveled Way + 1 2m each side***	7 2m
	ADT >2000	Approach Roadway Width***	8 4m

* If the approach roadway has paved shoulders, then the surfaced width shall be carried across the bridge

** Bridges longer than 30 m are to be analyzed individually

*** For bridges ≥ 30 m in length, the minimum bridge width of traveled way plus 1 0 m on each side is acceptable

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

5 STRUCTURAL CAPACITY (MINIMUM LOADINGS)

Type Facility	Other Factor	Loading
Freeway	-	MS 18
Rural Arterial	-	MS 18
Urban Arterial	-	MS 18
Local Roads	New & Reconstruction Bridges	MS 18
	Existing	MS 13 5
Collectors	New & Reconstruction Bridges	MS 18
	Existing	MS 13 5

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

6 VERTICAL CLEARANCE (MINIMUM)

Type Facility	Vertical Clearance (m)
Freeways	5 0*
Arterials	
Rural	5 0*
Urban	5 0*
Other Highways	4 4
Sign Trusses	5 3
Pedestrian Overpass	5 3
Tunnels	
Freeways	5 0
Other Highways	4 4
Railroads	6 6

All of the above clearances include the recommended allowance of 150mm for future resurfacing

* 4 3m allowed in highly developed urban areas if alternate route has 4 9m

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

7 GRADES (MAXIMUM)

Type Facility	Type Terrain	Grades (%) For Design Speed (km/h) 50	60	70	80	90	100	110
Freeway								
	Level	---	---	---	4	4	3	3
	Rolling	---	---	---	5	5	4	4
Rural Arterial								
	Level	---	5	5	4	4	3	3
	Rolling	---	6	6	5	5	4	4
Urban Arterial								
	Level	8	7	6	6	5	5	---
	Rolling	9	8	7	7	6	6	---
Rural Collector								
	Level	7	7	7	6	6	5	4
	Rolling	9	8	8	7	7	6	5
Urban Collector								
	Level	9	9	8	7	7	6	5
	Rolling	11	10	9	8	8	7	6

Note Grades one percent steeper than the values shown may be used for extreme cases in urban areas where development precludes the use of flatter grades and for one-way down grades

GRADES (MINIMUM) URBAN CURB & GUTTER

Type Facility	Minimum %
Arterials	as required for adequate drainage
Collector Roads & Streets	0 30
Local Roads & Streets	0 20

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

8 CROSS SLOPE (MINIMUM AND MAXIMUM)

Type Facility		Cross Slope Minimum	Cross Slope Maximum
Freeway		0 015	0 025*
Arterials	Rural	0 015	0 02*
	Urban	0 015	0 03
Divided Highway		0 015	0 02*
Collectors.	Rural	0 015	0 03
	Urban	0 015	0 03
Shoulders·	Paved	0 02	0 06
	Gravel	0 04	0 06
	Turf	0 08	0 08

* The values given are for up to two lanes in one direction Additional outside lanes may have a cross slope of 0 03.

Maximum Algebraic difference not stated in AASHTO

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

9 SUPERELEVATION (MAXIMUM)

Type Facility	Super Elevation Rate
Open Highways (Rural)	0 12
Urban	0 06
Low Speed Urban w/severe constraints	0 0
Ramps	See Table Below

Radius (meters)	Range in Superelevation Rate for Intersection Curves with Design Speed (km/h) of 20	30	40	50	60	70
15	02 - 10	---	---	---	---	---
25	02 - 07	02 - 10	---	---	---	---
50	02 - 05	02 - 08	04 - 10	---	---	---
70	02 - 04	02 - 06	03 - 08	06 - 10	---	---
100	02 - 03	02 - 04	03 - 06	05 - 09	08 - 10	---
150	02 - 03	02 - 03	03 - 05	04 - 07	06 - 09	09 - 10
200	02	02 - 03	02 - 04	03 - 05	05 - 07	07 - 09
300	02	02 - 03	02 - 03	03 - 04	04 - 05	05 - 06
500	02	02	02	02 - 03	03 - 04	04 - 05
700	02	02	02	02	02 - 03	03 - 04
1000	02	02	02	02	02	02 - 03

Note Preferably use superelevation rate in the upper half or third of the indicated range For design speeds greater than 70 km/h see the superelevation chart for roadways

METRIC DESIGN CRITERIA
(BASED ON COMPARABLE AASHTO ENGLISH UNITS)
FOR DETERMINING DESIGN EXCEPTIONS

10 HORIZONTAL ALIGNMENT

A Minimum Radius (m) with Superelevation

Type Facility	Super-Elevation Rate	Minimum Curve Radius (m) for Design Speed (km/h)									
		30	40	50	60	70	80	90	100	110	120
Rural Hwys &	04	35	60	100	150	215	280	375	490	635	870
High Speed	06	30	55	90	135	195	250	335	435	560	755
Urban Streets	08	30	50	80	125	175	230	305	395	500	665
	10	25	45	75	115	160	210	275	360	455	595
	12	25	45	70	105	150	195	255	330	415	540

B Maximum Curvature for Section with Normal Cross Slope

Type Facility	Minimum Curve Radius (m) for Design Speed (km/h)									
	30	40	50	60	70	80	90	100	110	120
All	470	840	1160	1590	2090	2580	3110	3790	4350	5040

(Need maximum curvature for municipal Index 511)

C Passing Sight Distance (minimum)

Design Speed (km/h)								
30	40	50	60	70	80	90	100	110
217	285	345	407	482	541	605	670	728

METRIC DESIGN CRITERIA

(BASED ON COMPARABLE AASHTO ENGLISH UNITS)

FOR DETERMINING DESIGN EXCEPTIONS

11 STOPPING SIGHT DISTANCE (MINIMUM) AND VERTICAL ALIGNMENT

Design Speed (km/h)	Stopping Sight Distance Computed for Design (m)	K Value* for Vertical Curves Rounded for Design	
		Crest	Sag
30	29 6	3	4
40	44 4	5	8
50	57 4	9	11
60	74 3	14	15
70	94 1	22	20
80	112 8	32	25
90	131 2	43	30
100	157 0	62	37
110	179 5	80	43

*K Value is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide minimum stopping sight distance.

METRIC DESIGN CRITERIA
(BASED ON COMPARABLE AASHTO ENGLISH UNITS)
FOR DETERMINING DESIGN EXCEPTIONS

12 HORIZONTAL CLEARANCE (MINIMUM)

Feature	Clearance
Bridges	See Page A-5
Tunnels	0 8 m from edge of traffic lane
Underpasses	2-lane Normal shoulder width (to edge of barrier*)
	Divided Roadway Normal shoulder (outside or median) width (to edge of barrier*)
Barrier Wall & Guardrail	Normal shoulder width
Light Poles	Rural Outside Clear Zone
	Urban (Curb & Gutter): 0.5 m from face of curb
Sign Supports	Outside clear zone (if non-breakaway)
Building Line	4 5 m from elevated roadway (wall)

* for metal guardrail, add deflection distance

CHAPTER 24

FEDERAL AID PROJECT CERTIFICATION

The values (pages 24-2 and 24-3) in this chapter have not been converted to metric The CA agreement with FHWA is being revised and this chapter will be updated when the new agreement has been approved

CHAPTER 24

FEDERAL AID PROJECT CERTIFICATION

24.1 General

Certification Acceptance (C A) is an agreement between the Department and the Federal Highway Administration (FHWA) Under this agreement FHWA accepts the Department's certification that the design and construction phases of specific Federal-Aid highway projects have been carried out in accordance with all appropriate Federal and State laws, regulations and standards Under C A the Department assumes the oversight responsibilities and duties previously performed by FHWA during the final design, award and construction of federal funded projects

Exemptions from the Federal Highway Administration (FHWA) oversight were also granted in accordance with the Secretary's request, dated March 20, 1992 per Title 23 USC 106(b) as amended by Section 1016(6) of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991

24.2 Certification Acceptance Coverage

C A applies to the design phases for Roadway, Signing, Marking, Lighting, Signalization, Structural, Landscaping and Architectural plans on National Highway System (NHS) off-Interstate system projects C A also applies to the award and construction activities on these NHS projects where the official cost estimate for construction is less than five million dollars Final design and plans preparation for projects will be developed under C A after FHWA's acceptance of the project's location and design concepts (see chapters 3, 5 and 7 of the PD&E Manual) FHWA reviews and approvals are not required during the final design phases for any projects developed under C A , up to and including the authorization to advertise for bids The agreement is documented in Topic No 625-010-000

24 2 1 Areas not Included

The final design phases of some Federal-Aid projects are not included under C A and will be developed with routine FHWA involvement These types of projects are projects on the Interstate system with an estimated construction cost greater than $1 0 million as well as projects that affect the Interstate system Projects affecting the Interstate might involve a crossing of the Interstate or work associated on a cross road at the ramp terminals, regardless of the source of funding If there are questions as to whether a project affects the Interstate system, the appropriate Area Design Engineer should be consulted

In addition to the above projects that are not included in C A , there are special project features that require FHWA reviews and concurrences These special features are

A Individual structures with an estimated total deck area greater than 125,000 square feet, unusual or moveable bridges, tunnels and unusual hydraulic or geotechnical structures

B Major storm drainage systems designed to carry more than 200 cfs, or regardless of quantity of discharge, systems which have a surface detention storage system with an accumulated volume greater than five acre feet

C Storm water pumping facilities designed to discharge more than 20 cfs

D Major channel changes which may significantly change the stream regimen or ecology

E Experimental features in the project design, including materials or construction methods

F Traffic surveillance and control systems with an estimated construction cost greater than $1 million

G The use of proprietary or sole source items or materials

H Operational plans for motorist-aid systems

Projects including these features may be developed under C A , however, the design of these features must be coordinated with FHWA to obtain the necessary reviews and approvals Current and accurate areas, discharges and cost estimates must be used to determine if FHWA involvement is required FHWA should be involved in a project as soon as it is evident that any of the above features will be included

C A also does not apply to the processing of the environmental document for a project (including reevaluations), any right-of-way phases, construction activities on projects where the official cost estimate is greater than five million dollars, or the acquisition of professional services, including authorizations for in-house design FHWA should be kept fully involved in these phases of Federal-Aid projects in accordance with current procedures Hazard elimination projects (HES funded) and railroad grade crossing improvement projects (RRP/RRS funded) are covered under alternate C A procedures approved by FHWA on 9-12-88 (HES) and 11-17-88 (RRP/RRS)

24.3 Exemptions under ISTEA

Exemptions granted under the ISTEA of 1991 apply to the design, award and construction activities and require that the FDOT certify that all work will meet or exceed the design and construction standards approved by FHWA

24 3 1 Interstate

New or reconstruction projects, with any funding source except Interstate Completion, and which are less than $1 0 M in construction cost are exempt from FHWA oversight per 106(b)(2) of Title 23 and the Secretary's request of March 20, 1992

24 3 2 Interstate, RRR

On all projects, regardless of cost, FDOT will elect on the PR1240/PR2 to exempt itself from FHWA oversight per 106(b)(1) of Title 23 and the Secretary's request of March 20, 1992

24 3 3 NHS off "I" System (Non-RRR)

New or reconstruction projects, any funding source, $0 to $1 0 M in construction cost are exempt from FHWA oversight per 106(b)(2) of Title 23 and the Secretary's request of March 20, 1992 All other projects are covered under Certification Acceptance per section 24 2

24 3 4 NHS off "I" System, RRR

All projects regardless of cost or funding, FDOT will elect on the PR1240/PR2 to exempt itself from FHWA oversight per 106(b)(1) of Title 23, and the Secretary's request of March 20, 1992

24 3 5 Non-NHS Projects

All projects of any funding source are exempt from FHWA oversight per 106(b)(2) of Title 23 and the Secretary's request of March 20, 1992

24.4 Certification Responsibilities

The final design documents, reports and plans for projects exempt from FHWA oversight 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 has 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 are

A Typical Section Package

The typical section package should be prepared as described in Chapter 15 3 3 of this volume Concurrence by the District Design Engineer documents the acceptability of the package Concurrence from the District Structures Engineer may also be required on unusual bridge typical sections

B 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

C 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

D. 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, or Project Management Engineer is required to document the acceptability of the report in lieu of FHWA review and concurrence

E Design Plans Phase Reviews

Plan reviews should be conducted as described in chapters 15 2, 15 3 1, and 16 of this volume Concurrence in the resolution of phase review comments from the District Design, Structures, or Project Management Engineer is required to document the acceptability of the reviews in lieu of FHWA review and concurrence (See Exhibit I-24-C)

F Roadside Safety

Roadside safety should be a consideration in the design process, as is discussed in Chapter 4 of this volume The District Safety Engineer is required to review all project designs to ensure and document that all accident and safety problems have been addressed in lieu of FHWA compliance reviews

G Design Variations

Design variations described in Chapter 23 of this volume must be approved by the District Design Engineer A copy of the approved variation must be sent to the State Roadway Design Engineer to document the acceptability of the variation in lieu of FHWA concurrence (See Exhibit I-24-D)

H. Design Exceptions

For projects subject to FHWA oversight or prepared under CA procedures, design exceptions, as described in chapter 23 of this volume, still require approval by FHWA A design exception is required when less than minimum

AASHTO criteria is used for any of the following 12 controlling design elements design speed, lane width, shoulder width, bridge width, structural capacity, vertical clearance, vertical alignment, horizontal alignment, stopping sight distance, cross slope, superelevation and grade A request to allow a design exception must be documented, justified and submitted to FHWA by the District Secretary or the District Production Director, with concurrence from the State Roadway Design Engineer

I 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 Design, Structures (or, for Category II structures, the State Structures Engineer), or Project Management Engineer is required to document the acceptability of the special provisions in lieu of FHWA review and concurrence (See Exhibit I-24-E)

J Plans, Specifications and Estimate

The plans package, specification package and contract file will be transmitted to Tallahassee as described in chapter 20 of this volume The District Production Director will sign the transmittal letter certifying that the design and plans have been prepared according to the appropriate certification procedures The specifications package will be approved by the District Specifications Engineer The Department's official estimate will be approved by the State Estimates Engineer

K Authorization to Advertise

The letter requesting FHWA authorization to advertise for bids and the PS&E package, including reimbursable utility agreements, will be submitted to FHWA by the Federal Aid Office The Federal Aid Manager will certify in the letter to FHWA that the package was prepared under the appropriate certification procedures An FHWA PS&E checklist (the Contract File Index, filled out by the District and submitted with the plans package) will be submitted to FHWA

L Revisions

Revisions to the PS&E will be processed as described in chapter 20 of this volume Concurrence from the District Design, Structures, or Project Management Engineer is required to document the acceptability of the revision in lieu of FHWA review and concurrence

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 Exhibit I-24-A outlines the approval and concurrence procedures used in the C A process

24.5 Certification Documentation and Reviews

FHWA will perform periodic reviews of projects developed under C A and other exemption agreements and may have access to review project phases and records at any time To support the exemption program, 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 chapter 17 of this volume will be used by the Central Office to monitor district compliance with the certification requirements

24.6 Certification Statement

The following statement will be furnished by the District (in the Contract File, see Chapter 20 exhibits) when plans are transmitted for letting The same statement will be included in the letter requesting authorization (PR1240/PR2)

> "The Florida Department of Transportation certifies that all work will meet or exceed, except as noted below, the standards approved by the Secretary of the U S Department of Transportation under 23 USC (109)(c) "

A list of all design exceptions, the dates requested and the dates approved must be immediately below the statement If there were no exceptions on the project, a statement to that effect must be shown immediately below the statement Copies of the approved design exceptions may be requested, if the Central Office files do not contain copies

CERTIFICATION ACCEPTANCE APPROVAL AND CONCURRENCE PROCESS

<table>
<tr>
<td>TYPICAL SECTION PACKAGE

Approved 6
Concurrence 3 or 4

(PPM Vol I, Chap 15 3 3)</td>
<td>PAVEMENT DESIGN PACKAGE

Approved 6
Concurrence 3

(Pav t Design Manual)</td>
<td>DESIGN CRITERIA
DESIGN EXCEPTIONS
Requested 1 or 2
Concurrence 8
Approved FHWA or 11
DESIGN VARIATION
Recommended 6
Approved 3

(PPM Vol I, Chap 23)</td>
<td>BRIDGE HYDRAULICS REPORT

Approved 6
Concurrence Dist Drainage Engr

(Drainage Manual Vol 2, Chap 9)</td>
</tr>
<tr>
<td>BRIDGE DEVELOPMENT REPORT

Approved 6
Concurrence 3 4 5 or 7

(Struct Design Guidelines Chap 3 3)</td>
<td>APPROVAL OF PHASE REVIEW PLANS
(Roadway and Structures)

Approved 6
Concurrence 3 4 5 or 7

(PPM Vol I, Chap 15)</td>
<td rowspan="2">PLANS, SPECIFICATIONS AND ESTIMATE

PLANS PACKAGE
Approved 2

SPECIFICATIONS PACKAGE
Approved 9

OFFICIAL ENGINEERS ESTIMATE
Approved 10

(PPM Vol 1, Chap 20 1)</td>
<td>REVISIONS TO PS & E

Approved 6
Concurrence 3 4 or 5

(PPM Vol I, Chap 20 2)</td>
</tr>
<tr>
<td>ACCIDENT/SAFETY REVIEW

Approved Dist Safety Engr</td>
<td>SPECIAL PROVISIONS

Approved 6
Concurrence 3 4 or 5</td>
<td>ASSEMBLY OF PS & E & CERTIFICATION OF OTHER REPORTS AS REQUIRED

Responsibil ty FA Manager</td>
</tr>
</table>

1 DISTRICT SECRETARY
2 DISTRICT PRODUCTION DIRECTOR
3 DISTRICT DESIGN ENGINEER
4 DISTRICT STRUCTURES DESIGN ENGINEER
5 DISTRICT PROJECT MANAGEMENT ENGINEER
6 RESPONSIBLE PROFESSIONAL ENGINEER
7 STATE STRUCTURES DESIGN ENGINEER
8 STATE ROADWAY DESIGN ENGINEER
9 DISTRICT SPECIFICATIONS ENGINEER
10 STATE ESTIMATES ENGINEER
11 STATE DIRECTOR OF DESIGN (for exempt projects)

NOTE
In special cases where programs or projects are developed in the Central Office, an appropriate Central Office Manager will provide concurrence in lieu of the District Manager

Exhibit I-24-A

DESIGN OVERSIGHT

DUTIES AND RESPONSIBILITIES
FEDERAL-AID PROJECTS

PROJECT TYPE	FHWA OVERSIGHT	FDOT DESIGN RESPONSIBILITIES
INTERSTATE SYSTEM		
COMPLETION PROJECTS	REQUIRED	COORDINATE FHWA REVIEWS/APPROVALS
NEW/RECONSTR 〉$ 1M	REQUIRED	OBTAIN APPROVALS FOR EXCEPTIONS
NEW/RECONSTR 〈$ 1M	EXEMPT ISTEA	PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIANCES CERTIFY TO DESIGN STANDARDS
R-R-R PROJECTS ALL ON I-SYSTEM	EXEMPT PROJ BY PROJ ISTEA	REQUEST EXEMPTION PR1240/PR2 PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIANCES CERTIFY TO DESIGN STANDARDS
NATIONAL HWY SYSTEM OFF-INTERSTATE	C A AGREEMENT	
NEW/RECONSTR 〉$ 1M SEE "NOTE"	REQUIRED FOR SPECIAL FEATURES ONLY	PERFORM ALL OVERSIGHT REVIEWS COORDINATE SPECIAL FEATURES W/FHWA DOCUMENT EXCEPTIONS/VARIANCES AGREED APPROVALS/CONCURRENCES
NEW/RECONSTR 〈$ 1M	EXEMPT ISTEA	PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIATIONS CERTIFY TO DESIGN STANDARDS
R-R-R PROJECTS ALL ON NHS	EXEMPT PROJ BY PROJ ISTEA	REQUEST EXEMPTION PR1240/PR2 PERFORM ALL OVERSIGHT REVIEWS DOCUMENT EXCEPTIONS/VARIANCES CERTIFY TO DESIGN STANDARDS
NON-NHS ALL PROJECTS	NO FHWA OVERSIGHT	PERFORM ALL OVERSIGHT DUTIES DOCUMENT EXCEPTIONS/VARIANCES

"NOTE" C A DOES NOT APPLY TO CONSTRUCTION ACTIVITIES ON PROJECTS WITH CONSTRUCTION COSTS OF $ 5M OR GREATER

EX I-24-B

DATE:

TO: (See Below)*

FROM:

COPIES:

SUBJECT: Response to ________ Phase Review

REF: W.P.I. Number
State Project Number
F.A. Project Number
County

In content of letter include a statement confirming that all review comments have been responded to or satisfactorily resolved.

Include appropriate copies of review comments, responses and other pertinent data.

APPROVED:

____
Responsible Professional Eng.
(Name of Consultant Firm)

CONCURRENCE:

____
* District Design Engineer
* District Structures Engineer
* District Project Mgmt. Eng

* As appropriate

EX I-24-C

DATE:

TO: District Design Engineer

FROM:

COPIES: State Roadway Design Engineer

SUBJECT: Design Variation

REF: W.P.I. Number
State Project Number
F.A. Project Number
County

Include a brief background statement concerning project and item(s) of concern.

Indicate design element(s) for which variation is requested, along with specific variation description.

Also, include justification, supporting documentation, etc.

RECOMMENDED BY:

____

Responsible Professional Engineer
(Name of Consultant Firm)

APPROVED BY:

____

District Design Engineer

EX I-24-D

DATE:

TO: District Design, Structures or Project Management Engineer

FROM:

COPIES: State Specifications Engineer

SUBJECT: Special Provisions

REF: W.P.I. Number
State Project Number
F.A. Project Number
County

Include detailed information concerning special provisions required.

Appropriate section(s) of F.D.O.T. Standard Specifications should be referenced.

Questions concerning format and content should be directed to the Specifications Office of F.D.O.T.

APPROVED: CONCURRENCE:

____
Responsible Professional Eng.
(Name of Consultant Firm)

____
* District Design Engineer
* District Structures Engineer
* District Project Mgmt. Eng

* As appropriate

EX I-24-E

Chapter 25

Florida's Design Standards for Resurfacing, Restoration and Rehabilitation (RRR) of Streets and Highways

Chapter 25

Florida's Design Criteria for Resurfacing, Restoration and Rehabilitation (RRR) of Streets and Highways

25.1 Introduction

25 1 1 General

Resurfacing, restoration and rehabilitation (RRR) work is defined as work undertaken to extend the service life of an existing highway and/or enhance highway safety This includes the placement of additional surface materials and/or other work necessary to return an existing roadway to a condition of structural and functional adequacy. Many of the RRR Standards used by the Department are derived from the National Academy of Sciences "Special Report 214" This publication contains many of the methods necessary to make the safety and cost effective evaluations required by this chapter

RRR projects must be designed and constructed in a manner that will comply with the accessibility standards and requirements set forth in the Americans with Disabilities Act of 1990 (ADA)

25 1 2 Application

The criteria included herein are for all RRR projects except Interstate and freeways, and are not intended to apply to new construction or major modifications of existing facilities Interstate and freeway RRR projects are designed using new construction criteria except that the standards used for horizontal alignment, vertical alignment, and widths of median, traveled way and shoulders may be the AASHTO interstate standards that were in effect at the time of original construction or inclusion into the interstate system

The RRR criteria may be used for establishing the minimum requirements for intersection improvement projects with the understanding that when right-of-way is adequate, new construction criteria will be used to the maximum extent feasible

25.2 Planning and Programming RRR Projects

RRR projects must balance a number of competing objectives, the principal ones being the preservation of highways, improved service levels and enhancement of safety The success in meeting these objectives depends on the quality of individual project designs and project programming decisions

25 2 1 Projects Requiring Right-of-Way

Facilities programmed for RRR projects should be given a review of the existing right-of-way, roadway, access management, drainage design elements and other improvements to identify locations which require additional right-of-way For such locations, the design should be expedited to determine actual right-of-way requirements The designer must coordinate the requirements with the Right-of-Way Office so that necessary areas will be cleared before the project is ready for letting.

25 2 2 Projects with Bridges within Project Limits

Bridges must be reviewed in sufficient detail to clearly establish the cost effective and appropriate changes to be included in the project design effort

25 2 3 Project Features Requiring Exceptions and Variations

Projects may have features below criteria values which have not been programmed and/or which are determined not to be appropriate to accomplish under this design project These usually require design exception or variation approval, as appropriate See Sections 25 3 5 and 25 5

25.3 RRR Project Design Process

Significant improvements in overall safety can be brought about by a systematic safety conscious design process The design process is a team effort which requires the expertise of persons familiar with design, safety, maintenance, traffic operations and others To assure that safety issues are fully addressed on RRR projects, in addition to the usual design process, the following is also required

- A review of the purpose for which the RRR project was programmed
- An assessment of current safety conditions
- A final scope of work with recommendations for specific safety improvements
- Documentation of the safety design decisions
- Reviews of the design for safety issues

25 3 1 Review of Project Purpose

A RRR project is generated by specific needs or conditions The designer must become familiar with these needs or conditions at the very beginning of involvement with the project in order to assure that the final scope of work and final design actually accomplish the original purpose of the project This may involve research of background data or other information that provide the reason, the proposed improvements, estimated project cost and project priority

25 3 1 1 Principal Reason(s) for the RRR Project

The following list indicates some, but not all, of the principal reasons that can generate a RRR project

a To preserve or extend the life of the existing pavement

b Improve capacity (without adding continuous through lanes)

c Improve operating characteristics

d Site specific accident reduction

e Section wide accident reduction

f General safety modifications

25 3 1 2 General Nature of Proposed Improvements (Type of Work)

In addition to resurfacing, restoration and rehabilitation a project may include one or more of the following types of work as a general improvement The list is not all inclusive

a Widen roadway and bridge lanes

b Widen or add roadway and bridge shoulders

c Provide disability access

d Provide clear zone

e Upgrade pavement markings

f Add, update or remove traffic signals

g Correct skid hazards

h Replace bridges rated "insufficient"

i Upgrade bridge rail

j Upgrade to current Access Management requirements

k Provide non-vehicular transportation needs

l Add or extend auxiliary lanes to a roadway

m Add turn lanes at an intersection or on a roadway

n Realign an intersection or roadway

o Replacement of bridges which cannot be widened economically

p Upgrade at-grade railroad crossings

q Intersection improvements

r Removal of parking lanes

s Other safety improvements

25 3 1 3 Review Project Budget and Priority

The design and construction of a RRR project must be accomplished with expediency and at reasonable cost Nevertheless, the project design must address all issues of safety, plus preservation of investment, and service to the user Conditions which are discovered but cannot be resolved within the programmed budget and schedule must be addressed and the decisions documented

25 3 2 Assessment of Conditions

Before beginning actual design of the project, the designer shall assess current conditions on the project This assessment shall include both physical conditions and operating conditions plus a safety assessment Office reviews and field reviews shall be performed as part of the assessment

25 3 2 1 Office Reviews

Office reviews shall be conducted to assimilate and analyze data that may be pertinent to the improvements that can be made on the project

a) Assess Physical Conditions

This assessment should include

- geometrics,
- degree, length, and superelevation of curves,
- typical shoulder treatments,
- cross drain and structure locations,
- location and design of intersections, etc

A review of old plans, as built drawings, Straight Line Diagrams, and other historical records will determine many of the existing conditions b) Assess Operating Conditions

This assessment should include

- A summary of legal posted speeds on the project
- Drainage and Maintenance section's verbal or written concerns of past, present and/or anticipated future problems.
- Conditions attributable to current control of access

c) Assess Safety

A review of historical accident and travel statistics shall be performed by a qualified safety specialist This assessment, with written recommendations, should include

- Identification of significant accident locations, with
  - (a) possible causes
  - (b) suggested corrective measures
- Review of correspondence files for letters of public concern

25 3 2.2 Field Reviews

A field review shall be performed by a multi-discipline team This review should assess physical, operational and safety conditions

a) Assess Geometric and Physical Conditions

- Verify office review findings
- Check roadway features such as·

  alignment

  cross slope

  superelevation

  lane width

existing traffic control markings and signs

side slopes

clear zones

shoulder type and width

intersection elements

sight distances

drainage (including erosion problems)

pavement condition

highway appurtenances

other features

b) Assess Operating Conditions

- verification of posted regulatory speeds
- verification of posted advisory speeds
- verification of reported problems
- observation of operating conditions
- evaluation of access features

c) Assess Safety Conditions

- observation of known accident locations
- indications of unsafe operations, such as run-off-the-road indications or previous repairs

25 3 3 <u>Project Scopes</u>

Utilizing the office and field review findings, prepare a final scope of work by incorporating, where appropriate, other work including engineering and surveying services not identified in the original scope Improvements other than resurfacing, restoration or rehabilitation to be considered are listed below The list is not all inclusive

- Remove, relocate or make crashworthy roadside obstacles
- Remove unwarranted guardrail
- Upgrade or replace non-standard guardrail
- Replace or retrofit obsolete bridge rails
- Improve side slopes, slope flattening/stabilizing
- Correct shoulder drop off
- Pave shoulders
- Improve pavement cross slope
- Provide side drain safety modifications
- Increase sight distance at intersections
- Improve pavement markings
- Improve pavement drainage
- Provide or upgrade sidewalks and bikeways
- Upgrade railroad crossings
- Provide or upgrade signalization
- Provide or upgrade lighting
- Upgrade signing and other traffic control devices
- Provide or upgrade curb cuts, ramps and other disability access features
- Reconstruct or close driveways to comply with Access Management standards

25 3 4 Review Project Plans

RRR design plans are reviewed by other disciplines including a safety specialist These reviews are detailed in the Scheduled Submittals chapter of this manual

25 3 5 Document the Design Process

The designer shall include in the design file all documentation that substantiates the design process and decisions made, including 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 right-of-way 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, safety, etc A brief overall summary of findings is recommended

3 Document the selected standards based on project intent and conditions When RRR criteria cannot be met, a design exception/variation is required.

4 A summary of safety issues that have been identified for the project and the recommended solution of those issues

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 deleted or delayed

25.4 RRR Design Criteria

Design values and decisions for roadway features should reflect the anticipated service life of the project The designer has the responsibility to choose the specific design value to be used, taking into consideration its cost-effectiveness, which can range from the minimum RRR Criteria presented herein, to new construction criteria Design values in the following sub-sections apply to RRR projects only When specific values are not provided, the standards used in the original construction or subsequent enhancements may be retained except when an upgrade is identified in the project scope Designers are encouraged to make a deliberate selection of design values by explicitly addressing issues of safety cost-effectiveness, overall highway consistency in geometric design, design of adjoining segments and expected trends in traffic growth and truck use before specifying design values The design values indicated in this chapter usually reflect a cost-effective basis for evaluating existing roadway characteristics to determine which features require upgrading

The design values presented herein are the minimum to be used for a RRR project on the State Highway System without obtaining an exception or variation See Section 25.5

25 4 1 Design Period

Improvements should be evaluated using a design period which is consistent with the design period selected for the pavement rehabilitation The design period (service life) for RRR projects should be from 8 - 12 years for projects without milling and 14 - 20 years for projects with milling See the Flexible Pavement Manual for additional details For skid hazard projects, where other improvements are not made, the design year is the expected year of construction

25 4 2 Design Traffic Volume

The design year for traffic volume is the same design year as the year established for service life Traffic data to be used for design

1. ADT and DHV for mainline (current, post construction and design year),
2. K, D and T factors,
3. Peak turning movements at signalized and problem intersections and major traffic generators,
4. Movements for future traffic generators that are scheduled during the service life should be considered

25 4 3 Pavement Design

The pavement design procedures are found in

Flexible Pavement

Document 625-010-002, Flexible Pavement Design Manual For New Construction And Pavement Rehabilitation

Rigid Pavement

Document 625-010-005, Rigid Pavement Rehabilitation

Document 625-010-006, Jointed Plain Concrete Pavement Design Manual

25 4 4 Design Speed

Most highway features are based on design speed Design speed is the maximum safe speed that can be maintained when conditions are so favorable that the design features of the highway govern Selection of the design speed must be logical for the type and location of the highway Design speed must not be less than the legal posted speed Design speed must not be dictated by an isolated geometric feature

The design speed used in the original design of the highway should be used for RRR projects If that is not practical, the design speed used should be consistent with comparable projects For urban curb and gutter projects with an original design speed of 45 mph, 80 km/h design speed shall be used to evaluate geometric features

Regardless of the original design speed or posted speed, the following are the minimum design speeds

Rural Facilities 90 km/h

Urban Facilities 50 km/h

Note Values for design speeds less than these minimums have been provided in the following tables in the event that lower design speeds can be justified Design speed values are provided for 65 and 105 km/h (40 and 65 mph) in the design tables These design speeds are to be used to evaluate existing conditions If reconstruction is indicated, the design speed used for design should be selected from those provided in the Roadway Design Criteria chapter of this manual

25 4 5 Lane and Shoulder Widths

The minimum lane and shoulder widths to be used are provided in Tables 25 4 5 1 - 25 4 5 3

Lane and Shoulder Widths

Rural Multilane			
Design Year ADT	Design Speed (km/h)	Minimum Lane Width (m)	Minimum Shoulder Width (m)
ALL	ALL	3 6	1 8

Table 25.4.5.1

Two Lane Rural and Urban, Without Curb and Gutter			
Design Year ADT	Design Speed (km/h)	Minimum Lane Width (m)	Minimum Shoulder Width (m)
1 - 750	ALL	3 0(1)	1 8
751 - 2000	< 80	3 3(2)	1 8
	≥ 80	3 6(2)	1 8
> 2000	ALL	3 6(2)	1 8

(1) For rural and urban projects without curb and gutter (regardless of traffic volume), when widening is required, a minimum lane width of 3 3 m is required

(2) May be reduced by 0 3 m if trucks < 10% of design year traffic

Table 25.4.5.2

Urban Multilane or 2 Lane with Curb and Gutter				
Design Year ADT	Design Speed (km/h)	Minimum Thru Lane (m)	Minimum Turn Lane (m)	Minimum Parking Lane (m)
ALL	ALL	3 0(1)	2 7(2)	2 1(3)

(1) 3 3 m if Trucks are >10% of Design Year Traffic

(2) 3 0 m for 2 Way Left Turn Lanes

(3) A minimum width of 2 1 m measured from face of curb may be left in place Otherwise provide 2 4 m minimum, measured from face of curb

Table 25.4.5.3

25.4.6 Cross-Slopes

Whenever practical, pavement cross-slope shall be constructed to new construction criteria. When new construction cross slope criteria cannot be met, documentation in the design file is required and the normal non-superelevated cross-slope used shall be consistent with the values in Table 25.4.6. Superelevation requirements are covered in Section 25.4.7.

Roadway Cross-Slopes		
Feature	Standard	Range
Travel Lanes	0.02	0.02 - 0.04[1]
Shoulders	0.06	0.03 - 0.08[2]
Parking Lanes	0.05	0.03 - 0.05

[1] Existing multi-lane curb and gutter sections 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.

[2] When existing shoulders are to remain, the algebraic difference between the shoulder slope and adjoining roadway pavement slope shall be $\leq$ 0.07.

Table 25.4.6

25.4.7 Superelevation

Roadway and shoulder superelevation shall be provided in accordance with Standard Drawing 510 for rural curves and Standard Drawing 511 for urban curves, consistent with Section 25.4.11(b).

25 4 8 Shoulder Treatment

On projects with rural type (without curb) construction, shoulders, erosion control, sodding and reworking shoulders shall be provided consistent with the criteria for new construction Paved shoulders shall be provided in accordance with new construction criteria, however the widening of existing 1 2 m paved shoulders is optional For new construction paved shoulder criteria, refer to the Roadway Design Criteria chapter of this manual

25 4 9 Side Slopes

The values selected shall be the flattest that are practical On RRR projects where existing ditches can be modified for stormwater management purposes, the use of steeper than standard side slopes and additional depth may be cost-effective but would require a variation Justification must fully address safety, water depth, frequency and duration, as well as cost-effectiveness The decision to shield steep side slopes shall be made consistent with the guidelines in the AASHTO Roadside Design Guide

Front Slopes·

- 1 6 are desirable
- 1 4 may be constructed within the clear zone
- 1 3 may be constructed outside the clear zone
- Existing front slopes 1 3 or flatter may remain within the clear zone Shielding may be required
- Steeper than 1 3 shall be shielded as per Standard Index 400, General Notes

- Consideration should be given to flattening slopes of 1 3 or steeper at locations where run-off-road type accidents are likely to occur (e g , on the outsides of horizontal curves)

    - The proposed construction should not result in slopes steeper than the existing slopes in violation of the above values

Back Slopes

- 1 4 are desirable
- 1 3 may be constructed in the clear zone
- 1 2 may be constructed outside the clear zone without shielding
- Existing back slopes 1 2 and flatter may remain
- Existing back slopes steeper than 1 3 within the clear zone may require shielding

25 4 10 <u>Vertical Alignment</u>

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 generally satisfied by the existing vertical alignment

- the sight distance provided meets or exceeds the values in Table 25 4 10, column B
- grades do not significantly affect truck operations
- there are no hidden dips which could obscure traffic or hazards
- steep grades and sharp vertical curves do not exist at or near an intersection

Stopping Sight Distance for Vertical Curvature

DESIGN SPEED (km/h)	STOPPING SIGHT DISTANCE (m) (1) A	B	C
50	60	60	55
60	75	75	70
65	90	85	75
70	110	95	85
80	120	115	100
90	145	135	115
100	170	160	130
105	185	170	140

For the design speed, compare the length of the available sight distance to the tabulated values

a If the length is equal to or greater than the "A" value, the curve is satisfactory

b If the curve is equal to or greater than the "B" value but less than the "A" value, a study **should** be made to evaluate possible mitigation of hazards requiring driver reaction and/or appropriate treatment such as relocation of the hazard, hazard warning signs, reduced safe speed signs, etc

c If the length is equal to or greater than the "C" value but less than the "B value, a study **shall** be made and appropriate treatment such as relocation of the hazard, hazard warning signs, reduced safe speed signs, etc provided Possible reconstruction of the curve should be considered.

d If the value is less than the "C" value, **reconstruction** of the curve is required

(1) Based on height of eye of 1070 mm and height of object of 15 mm above road surface

Table 25.4.10

25 4 11 Horizontal Alignment

Vertical and horizontal alignment must be reviewed together to assure that the necessary balance of standards is realized and the combination is both safe and pleasing

The designer should review the alignment to identify that the existing alignment generally adheres to the following guidelines

- consistent with no sudden changes from easy to sharp curvature
- sufficient tangent length between reverse curves
- superelevation transitions provided
- maximum curvature is not used
  on high fills or elevated structures,
  at or near crest in grade,
  at or near low points in grade,
  at the end of long tangents,
  at or near intersections or points of access or egress,
  at or near decision points

At all locations where the existing alignment does not adhere to these conditions, the designer should evaluate for hazardous conditions and determine if corrective measures are warranted

25 4 11 1 Horizontal Curves

Horizontal curves shall be reviewed for horizontal curvature and superelevation Review existing curves against the values in Table 25 4 11 1 Every practical attempt shall be made to upgrade curves which are below State Highway System (SHS) minimum values for new construction The review should also include an on-site review for evidence of near accidents or operational problems

a) Horizontal Curvature

Condition #1 - Horizontal curves which meet or exceed the SHS minimum radius values are satisfactory unless there is evidence of safety or operational problems

Condition #2 - Curves which are below the SHS minimum radius values but meet or exceed the RRR minimum radius values shall be reviewed for specific safety problems at the curve If the review indicated significant operational or safety problems exist, the curve must be reconstructed If problems are identified but reconstruction is not warranted, corrective measures shall be included in the project

Condition #3 - Those curves which do not meet the RRR minimum radius values must be reconstructed Reconstructed curves shall meet the criteria for new construction contained in Chapter 2 Sufficient time and budget must be programmed into the RRR project to obtain any right-of-way necessary for reconstruction of the curve

b) Superelevation

Rural Curves - Existing rural curves not having the indicated superelevation rate on Standard Index 510 shall be corrected to that rate Other measures appropriate to correct or improve identified safety or operational problems shall be provided

Urban Curves - Existing urban (C&G) curves not having the indicated superelevation rate on Standard Index 511 shall be corrected to that rate by reconstruction of the curve or curb adjustment to accommodate overbuild, if practical Other measures appropriate to correct or improved identified safety or operational problems shall be provided

SAFE CRITERIA FOR STATE HIGHWAY SYSTEM WITH MAXIMUM SUPERELEVATION				
DESIGN SPEED (km/h)	e_{max} = 0 10		e_{max} = 0 05	
	SHS	RRR	SHS	RRR
	R_{min} (m)	R_{min} (m)	R_{min} (m)	R_{min} (m)
50	75	57	87	68
60	115	84	123	101
65*	135	118	163	143
70	160	159	212	194
80	210	205	269	259
90	275	259	N/A	N/A
100	360	318	N/A	N/A
105*	411	388	N/A	N/A
* Not to be used for desıgn (reconstructıon)				

Table 25.4.11.1

25 4 11 2 <u>Stoppıng Sıght Dıstance</u>

Stoppıng sıght dıstance shall be provıded for all horızontal curvature ın accordance wıth Table 25 4 11 2

DESIGN SPEED (km/h)	STOPPING SIGHT DISTANCE (m) for Horizontal Curvature
50	55
60	70
65	75
70	85
80	100
90	115
100	130
105	140

Table 25.4.11.2

25 4 12 Stoppmg Sight Distance

Stoppmg sight distance requirements are provided in Sections 25 4 10, Vertical Alignment and 25 4 11, Horizontal Alignment

25 4 13 Vertical Clearance

The following clearances apply to highway bridges and other roadway features over the entire roadway Entire roadway includes lanes and shoulders

Underpass Clearance - For roadways passing under existing bridges, vertical clearance shall be at least 4 267 m over the entire roadway Signing and warning features shall be provided whenever vertical clearance is less than 4 420 m

Signs and Traffic Control Devices - Clearances shall be provided consistent with new construction standards

Bridges - Vertical clearance requirements are provided in Section 25 4 25 4

25 4 14 Horizontal Clearance

Horizontal clearance shall provide sufficient lateral distance from the roadway (travel lanes and shoulders) for vehicles to utilize these features without the possibility of contact damage While closely related, clear zone and border width requirements are separate issues which are addressed in Sections 25 4 15 and 25 4 16

New construction horizontal clearance criteria shall be used for RRR projects

25 4 15 Clear Zone

Clear Zone requirements are outlined in Table 25 4 15 Any obstruction located within the clear zone should be removed, shielded or made crashworthy See the Roadside Safety chapter of this manual

CLEAR ZONE WIDTH (m)					
RURAL			URBAN C & G		
DESIGN SPEED (km/h)	TRAVEL LANES & MULTI-LANE RAMPS	AUXILIARY LANES & SINGLE LANE RAMPS	DESIGN SPEED (km/h)	ALL OUT-SIDE LANES	ALL ME-DIAN LANES
< 70	1 8	1 8	< 80	1 2	1 8
70 (6)	4 2	2 4			
>70	5 5	2 4			

Table 25 4 15

GENERAL NOTES

1 When relocation is required to meet minimum clear zone requirements, consideration should be given to providing new construction clear zone widths

2 Rural clear zone widths are for side slopes 1 4 and flatter For steeper slopes, provide a clear runout area at toe of fill according to the Roadside Safety chapter of this manual

3 Clear zone widths shall be adjusted on the outside of horizontal curves with flush shoulders in accordance with Standard Index 700, Sheet 2 of 2

4 Clear zone width is measured as follows

(a) on facilities without curbs - from the edge of the traffic lane
(b) on facilities with outside curbs - from the face of the outside curb
(c) on facilities with median curbs - from the edge of the inside traffic lane

5 On projects where the 1 2 m width can not be reasonably obtained and other alternatives are deemed impractical, the width may be reduced to 0 5 m Documentation is required in the project design file

6 May be reduced to <70 km/h widths if conditions more nearly approach those for low speed (70 km/h or less)

25 4 16 Border Width

The minimum border width shall be the greatest of the following

- The border width used in the original project,
- The border width required to satisfy ADA accessibility standards,
- 2 4 m

When right of way is being acquired for other reasons, the minimum border width shall be that used for new construction projects, however, the minimum length of wider border width shall be a segment of sufficient length to provide reasonable continuity

25 4 17 Intersections

Intersections shall be evaluated to determine those that need a traffic engineering study The following items should be considered

- Addition of right and left turning lanes
- Realignment of intersection
- Adequate turning radii for left and right turning lanes
- Use of channelization to reduce excessive areas of conflict at large intersections
- Placement of crosswalks as related to sidewalks and stop bars
- Locations of pedestrian facilities
- Locations of utilities, signal poles, controller cabinets, lighting poles and drainage structures as related to sidewalks and curbcut ramps
- Warrants for traffic control systems
- Installation of buried conduit for future traffic control systems
- Lighting for intersection illumination
- Adequate sight distance
- ADA needs

25 4 18 Drainage

The designer or drainage specialist must evaluate the hydraulic and physical adequacy of the existing drainage system This requires examination of the existing drainage in the field and by consulting with maintenance personnel and records If there are apparent problems with the existing drainage system, additional evaluation is required to determine the extent and type of improvements necessary to upgrade the system The Drainage Manual contains design criteria and methods which provide guidance in formulating suitable drainage features, either through modification or replacement

Prior to selecting any plan of highway improvement, the designer should consult with drainage and environmental permitting specialists since almost all roadway modifications reduce storage and infiltration and increase discharge rates and volumes Stormwater retention and detention for quality, rate and volume may be required Theoretical evaluation of proposed changes to existing and new drainage features necessary to correct operational deficiencies should be referred to a drainage specialist The drainage specialist will provide the necessary drainage design, flood data information, Storm Water Pollution Prevention Plan (SWPPP) and any stormwater permit computations

25 4 19 Pedestrian and Bicyclist Needs

Many existing corridors do not provide for pedestrian or bicyclist needs Whenever a RRR project is undertaken, pedestrian and bicyclist needs must be addressed Recommendations by the District Bicycle/Pedestrian Coordinator shall be obtained Local government contact in developing these recommendations is essential This should be part of the project scoping and programming effort

Pedestrian Needs

Sidewalks - Upgrading sidewalks to meet ADA accessibility standards shall be included.

Medians - Medians shall be evaluated to determine if modifications such as pedestrian refuge sections are necessary. 5-lane and 7-lane sections are restricted or eliminated under current policy, usually by the introduction of a raised or restrictive median, which enhances the opportunity to accommodate pedestrian needs. Traffic separators with a width sufficient to provide refuge should be used at intersections where possible. When adequate pedestrian refuge cannot be provided at the intersection, mid-block islands should be provided.

Design details for disability access features including sidewalk, curb cuts and ramps are found in the Roadway and Traffic Design Standards. Additional standards for ADA are found in the regulations and design guidelines issued by the Secretary of the U.S. Department of Transportation.

Bicyclist Needs - Features to provide for identified bicycle traffic needs must be incorporated into the project or as a planned off-system route. Design criteria for bicycle lanes are found in other chapters of this manual. For existing curbed sections where no widening is planned, consideration should be given to reducing lane widths, e.g. 3.3 m through and 3.0 m turn lanes on sections with 4.267 or 4.572 m wide lanes.

25.4.20 Utilities (Underground and Overhead)

Where utilities are involved on RRR projects, the clear zone and horizontal clearance criteria in this chapter, the Utility Accommodation Manual, and the Utilities chapter of this manual shall be followed.

Relocation or adjustment is required if (a) the minimum clear zone or horizontal clearance requirements are not met or (b) the utility system conflicts with proposed RRR improvements and sufficient right-of-way is available

In some cases, the utility system on RRR projects may be retained without adjustment or relocation if (a) the accident history does not indicate the existance of a hazard or (b) the system has demonstrated adequate performance and does not conflict with proposed improvements

25 4 21 At-grade Railroad Crossings

When highway improvements are undertaken that include at-grade railroad crossings, the physical and operational characteristics shall be reviewed and upgraded to meet minimum standards Recommendations shall be made by the District Railroad Coordinator for incorporation into the project

25 4 22 Aesthetics and Landscaping

Landscaping, including median and intersection treatment, shall be consistent with Standard Indexes 546 and 700

25 4 23 Highway Lighting

Lighting may be installed at specific locations to improve safety For example

- Reducing the effects of ambient light conditions,
- Busy or high accident intersections,

- Bus stops,
- Channelized intersections,
- Car pool parking lots,
- Pedestrian and bicycle crossings,
- Ramp terminals

Any lighting, existing or proposed, shall be reviewed by the District Lighting Engineer to determine specific needs Lighting shall meet new lighting criteria, found in the Signing, Marking, Lighting and Signals chapter of this manual

25 4 24 Highway Traffic Control Devices

Traffic control devices such as signals, signing, and pavement markings shall be updated as required to comply with the Manual on Uniform Traffic Control Devices, the Manual on Uniform Traffic Studies, the Department's Roadway and Traffic Design Standards, and the ADA design guidelines issued by the Secretary of the U S Department of Transportation The District Traffic Operations Engineer (or staff) shall determine any new or additional devices required

25 4 25 Bridges

On each project, a determination must be made as to whether an existing bridge should remain as is, be rehabilitated or be replaced The decision shall be made based on an assessment of the bridge's structural and functional adequacy for the type and volume of traffic over the structure's design life

Any structure which has been identified and is scheduled for rehabilitation or replacement in the 5 year work program should be considered for an exception (or variance) from widening or rail retrofit A detailed accident history must be included in the justification

25 4 25 1 <u>Bridge Loading</u>

Bridges shall have an Inventory Load Rating equal to or greater than the following load requirements

TYPE	LOAD REQUIREMENT
Collector Facilities	MS-13 5
Arterial Facilities	MS-18

25 4 25 2 <u>Bridge Width</u>

Bridges shall meet or exceed the following clear width criteria If lane widening is planned as part of the RRR project, the minimum useable bridge width shall be determined using the width of approach lanes after widening

Design Year ADT	Minimum Usable Bridge Width (m)
UNDIVIDED	
0 - 750	Total width of approach lanes + 1 2 m
751 +	Total width of approach lanes + 2 4 m
DIVIDED	
ALL	Total width of approach lanes + 1 7 (median separator) *
	Total width of approach lanes + 2 0 (median barrier wall)**
	* 0 5 m median and 1 2 m outside shoulder
	** 0 8 m median and 1 2 m outside shoulder

If widening is required, it shall be in accordance with the Structures Design Guidelines and meet the geometric requirements for new construction.

25 4 25 3 <u>Bndge Raılıng</u>

Bndge raılıng shall be both structurally and functıonally adequate Bndge raılıng whıch wıll not contaın vehıcles ıs consıdered structurally ınadequate Bndge raılıng whıch wıll not redırect vehıcles wıthout snaggıng or vaultıng ıs consıdered functıonally obsolete

All safety shape raıls, New Jersey or F-Shape, are structurally and functıonally adequate All other former FDOT standard bndge raıl desıgns are ınadequate

Only when ıt ıs determıned appropnate for an exıstıng ınadequate handraıl to remaın ın place may the detaıls provıded by Scheme 1 ın Standard 401 be consıdered Refer to the General and Desıgn notes on Sheet 1 of that Standard Other retrofit concepts may be used when ȷudged to meet performance expectatıons

Raıls to be replaced shall be desıgned usıng the cntena in the Structures Desıgn Guıdelınes

25 4 25 4 <u>Vertıcal Clearance</u>

The followıng clearances apply to exıstıng bndges to remaın or be modıfied only Replacement structures shall be to new constructıon standards

<u>Underpassıng Clearance</u> - Vertıcal Clearance for roadways passıng under exıstıng bndges shall be at least 4 267 m over the entıre roadway The exıstıng vertıcal clearance shall not be reduced by the RRR proȷect ıf the exıstıng clearance ıs 4 877 m or less

Low Member Clearance - Existing bridges with sway bracing members over the bridge deck shall have at least 4 267 m clearance over the entire roadway

Signing and warning features shall be provided whenever vertical clearance is less than 4 420 m

25 4 25 5 Considerations

When evaluating bridge replacement or widening, the following should be considered

a Cost of replacing the existing bridge with a wider bridge designed to new bridge criteria,

b Cost of widening the existing bridge (if widening is practical), including life cycle costs of maintaining a widened bridge,

c The number of accidents that would be eliminated by replacement or widening,

d The hydraulic sufficiency and the risk of failure due to scour and/or ship impact as well as the consequences of failure

25.5 Design Exceptions and Variances

Every effort should be made to adhere to the desirable criteria stated herein However, under unusual conditions, it may be necessary and appropriate to use values that are less than the minimum values shown If lesser values are proposed for use, these shall be identified and the necessary approval and concurrence obtained at the earliest possible time, but not later than Phase II, so that the denial of any such request will not alter the project letting date Refer to the Design Exceptions and Variations chapter of this manual for the necessary procedure

APPENDIX

B

FDOT Metric Practice

10-21-94

FDOT METRIC PRACTICE

(Formerly FDOT Incipient Metric Policy)

SUMMARY OF RULES

1 Convert values related to surveys, right of way and other geometric alignment using the U S Survey Foot taken to a minimum of 8 decimal places

$$1\ \text{foot} = \frac{12\ \text{inches/foot}}{39\ 37\ \text{inches/meter}} = 0\ 304\ 800\ 61\ \text{meters}$$

For other direct mathematical conversions use the SI definition 1 foot = 0 3048 meters

2 Display direct mathematical (soft) converted values to the nearest 0 001 m or 1 mm

3 Do not use commas to separate digits if a number has more than 4 digits For numbers with more than 4 digits either right or left of the decimal, leave a space
Example 10 000 <u>or</u> 0 609 35 <u>or</u> 13 471 359

4 To the extent practical, use the following rules for dimensioning roadway plans

- For dimensions in meters, display values to at least one decimal place
- For dimensions in millimeters, display values as whole numbers with no decimal place
- Do not use the centimeter

Using the above rules, do not show the unit symbols "m" and "mm" unless needed for clarification. Show even dimensions in meters with a decimal and following zero digit, e g 300 0 to avoid confusion with 300 mm

5 If a dimensioned item has a numerical quantity that is part of a group of numbers in a different range, select the unit that most adequately covers the range without unduly large or small numbers For example, if 300 mm is part of a group of numbers shown in meters, show it as 0 3 m.

6 Show long dimensions, including all horizontal and vertical geometry, wall lengths, bridge span lengths and box culvert lengths, spans and heights in meters

7 In general, show cross section dimensions of structural members in millimeters This will normally include most drainage structures (except box culverts), drainage pipe, and special drainage structure details (Note The actual size of drainage pipe and standard drainage structure boxes will remain the same. However, label these items in nominal size based on 1" = 25 mm. Example Label 24" pipe as 600 mm pipe, Label a 4' diameter structure as a 1200 mm structure)

8 Show pavement thickness descriptions in millimeters

9 Use 0 1 m for both base extension on rural sections (formerly 3") and for stabilization extension on curbed sections (formerly 6")

10. On typical sections, show type of curb, "E" or "F", not the dimension

11 As a general rule, display metric dimensions to one more decimal place than the corresponding dimension in English units

- Typical Section Elements, including lane widths and shoulder widths - in meters, generally to 1 decimal place

- Horizontal control points on plans, including survey baseline, intersections and alignment - in meters to 3 decimal places

- Vertical alignment control points, (PVC, PVI, PVT) and profile grade elevations - in meters to 3 decimal places

- Profile Grade - in percent to 4 decimal places

- Proposed flow lines - in meters to 2 decimal places

- Manhole tops and grate elevations - in meters to 2 decimal places.

- Ditch elevations - in meters to 2 decimal places

12 Where practical, round short radius curves (<150 0 m), including curb returns and control radii, to the nearest meter Round longer radius curves to the nearest 5 meters (See attached tables)

13 Display alignment bearings and delta angles in curve data in degrees, minutes and seconds, rounded to the nearest second

14 Omit "degree of curvature" from curve data It has no definition in the metric system

15 On resurfacing projects, hard convert typical section dimensions (lane widths, shoulder widths, etc) where existing conditions permit. Exception Use direct mathematical (soft) conversion (Rule Number 2) for existing pavement widths in curbed sections, existing right of way widths, and existing median widths

16 Continue to post sign messages for speed limits and distances in English units. Note The posted speed for curb and gutter sections with design speed of 80 km/h (corresponds to 50 mph), should not exceed 45 mph

17 A "hard" metric project is defined as one where metric standard index drawings and metric specifications are used, and the design complies with adopted metric criteria

18 Beginning with metric projects express slope ratios in vertical to horizontal (V H) format For example, show roadside slopes as 1 6, 1 4, rather than past convention as 6 1 or 4 1

PLAN SCALES

ENGLISH SCALE	METRIC SCALE
1" = 2'	1 25
1" = 5'	1 50
1" = 10'	1 100
1" = 20'	1 200
1" = 40'	1 400 or 1 500
1" = 50'	1 500
1" = 100'	1 1000
1 = 200'	1 2000
1" = 400'	1 5000

Plan sheet size will remain the same. The viewing area of a plan sheet will be 800 mm long on "D" size sheets and 400 mm on "B" size sheets. Allowing for open space at each side, this provides a coverage of 140 m at 1 400 scale, 350 m at 1 1000 and 700 m at 1 2000 on "B" size sheets

Plan/Profiles

	Sheet Size	Horizontal	Vertical
Rural -	D	1 1000	1 50 or 1 100
	B	1 2000	1 100 or 1 200
Urban -	D	1 200	1 50
	B	1 400 or 1 500	1 50 or 1 100

Cross Sections

	Sheet Size	Horizontal	Vertical
Normal	D	1 50	1 25
	B	1 100	1 50
Wide Sections	D	1 100	1 25 or 1 50
	B	1 200	1 50 or 1 100
Narrow Sections	D	1 25	1 25
	B	1 50	1 50

COMPARISON OF ENGLISH AND METRIC VALUES 10-21-94

LANE WIDTHS

CURRENT	SOFT	HARD
8 ft	2 438 m	2 4 m
9 ft	2 743 m	2.7 m
10 ft	3 048 m	3 0 m
11 ft	3 353 m	3 3 m
12 ft	3.658 m	3 6 m
14 ft	4 267 m	4 2 m
15 ft	4 572 m	4 5 m

BIKE LANE WIDTHS

4 ft	1 219 m	1.2 m
5 ft	1 524 m	1 5 m

SIDEWALK AND UTILITY STRIP WIDTHS

CURRENT	SOFT	HARD
2 FT	0 610 m	0 6 m
3 FT	0 914 m	0 9 m
4 FT	1 219 m	1 2 m
5 ft	1 524 m	1 5 m
6 ft	1 829 m	1 8 m
7 FT	2 134 m	2 1 m
8 FT	2 438 m	2.4 m
9 FT	2 743 m	2 7 m
10 FT	3 048 m	3 0 m

CURB AND GUTTER WIDTHS

TYPE	CURRENT	SOFT	HARD
E	2.25 ft	686 mm	675 mm
F	2 00 ft	610 mm	600 mm
Shoulder Gutter	3 50 ft	1067 mm	1050 mm

SHOULDER WIDTHS

CURRENT	SOFT	HARD
2 ft	0 610 m	0 6 m
4 ft	1 219 m	1 2 m
5 ft	1 524 m	1 5 m
6 ft	1 829 m	1 8 m
8 ft	2 438 m	2 4 m
10 ft	3 048 m	3 0 m
12 ft	3 658 m	3 6 m

COMPARISON OF ENGLISH AND METRIC VALUES 10-21-94

TRAFFIC SEPARATOR WIDTHS

CURRENT	SOFT	HARD
4 ft	1 219 m	1 2 m
6 ft	1 829 m	1 8 m
8 5 ft	2 591 m	2 6 m

MEDIAN WIDTHS

CURRENT	SOFT	HARD
15 5 ft	4 724 m	5 0 m
17 5 ft	5 334 m	N/A
19 5 ft	5 944 m	6 0 m
22 ft	6 706 m	6 6 m
26 ft	7 925 m	7 8 m
30 ft	9 144 m	9 0 m
40 ft	12 192 m	12.0 m
50 ft	15 240 m	15 0 m
60 ft	18 288 m	18 0 m
64 ft	19 507 m	19 2 m
88 ft	26.822 m	26 4 m

DITCH WIDTHS

CURRENT	SOFT	HARD
3 ft	0 914 m	0.9 m
3 5 ft	1 067 m	1 0 m
4 ft	1 219 m	1 2 m
5 ft	1 524 m	1 5 m

DESIGN SPEED

CURRENT mph	METRIC km/h	
20	30	
25	40	
30	50	
35	60	low speed
40	60	
45	70	
50	80	
55	90	
60	100	high speed
65	110	
70	110	

METRIC CONVERSIONS

RETURN RADII
CONTROL RADII
SHORT RADIUS CURVE RADII

TURNING SPEED mph	RADIUS (feet)	SOFT (meters)	HARD (meters)	TURNING SPEED km/h	RADIUS (meters)	
	15	4 572	5 0			
	20	6 096	6 0			
10	25	7 620	8 0	15	7 0	
	30	9.144	9 0	20	10.0	
	35	10 668	11 0			
	40	12 192	12 0			
	45	13.716	14.0			
15	50	15 240	15 0			
	60	18 288	18 0			
	75	22 860	23.0			
20	90	27 432	27 0	30	25 0	
	100	30 480	30 0			
25	150	45 720	46.0	40	50.0	
30	230	70 104	70 0	50	80.0	
35	310	94.488	94.0	60	115 0	Small
40	430	131.064	131 0	60	115.0	Radii ⇑
	550	167.640	170 0			⇓
	690	210 312	210 0			Large
	840	256 032	255 0			Radii
	1040	316 992	315 0			

Note Selection of appropriate radii should also consider design vehicle

Conversions on this sheet and the next are accomplished as follows

- Radius in feet x (12 - 39.37) = radius in meters (soft)
- Values for metric turning speeds based on proposed AASHTO metric criteria

COMPARISON OF ENGLISH AND METRIC VALUES 10-21-94

DEGREE OF CURVE TO RADIUS VALUES			
DEGREE	RADIUS (feet)	RADIUS-Soft (meters)	RADIUS-Hard (meters)
0°-15'	22918 31	6985 515	6985 0
0°-30'	11459.16	3492 758	3495 0
0°-45'	7639 44	2328 505	2330 0
1°-00'	5729 58	1746 379	1745 0
1°-15'	4583 66	1397 103	1395 0
1°-30'	3819 72	1164 253	1165 0
1°-45'	3274 04	997 931	1000 0
2°-00'	2864.79	873 189	875 0
2°-15'	2546 48	776 168	775 0
2°-30'	2291 83	698 552	700 0
2°-45'	2083 48	635 047	635 0
3°-00'	1909.86	582 126	580 0
3°-15'	1762.95	537 347	535 0
3°-30'	1637.02	498 965	500 0
3°-45'	1527.89	465 701	465 0
4°-00'	1432.39	436 595	435 0
4°-15'	1348.14	410 913	410 0
4°-30'	1273.24	388 084	390 0
4°-45'	1206 23	367 659	370 0
5°-00'	1145.92	349 276	350 0
5°-30'	1041.74	317 523	320.0
6°-00'	954.93	291.063	290 0
7°-00'	818.51	249 483	250 0
8°-00'	716.20	218 297	220 0
9°-00'	636.62	194 042	195 0
10°-00'	572 96	174 638	175 0

Note Degree of Curvature is not used in the Metric System

GENERAL METRIC INFORMATION

SI PREFIXES

M	mega	10^6 = 1 000 000
k	kilo	10^3 = 1 000
m	milli	10^{-3} = 0 001

RECOMMENDED PRONUNCIATION

mega - as in megaphone

kilo - kill' oh

milli - as in military

joule - rhyme with tool

kilometer - kill' oh meter

pascal - rhyme with rascal

Base SI Units			Related Units		
Quantity	Unit	Symbol	Unit	Symbol	Relation
length	meter	m	millimeter kilometer	mm km	=0 001 m (10^{-3}m) =1000 m (10^3m)
mass	kilogram	kg	gram megagram	g Mg	=0.001 kg (10^{-3}kg) =1000 kg (10^3kg)
time	second	s	hour	h	=3600 s

DERIVED SI UNITS WITH SPECIAL NAMES

Quantity	Unit	Symbol	Formula
force	newton	N	kg•m/s^2
pressure	pascal	Pa	N/m^2
moment	newton meter	N•m	N•m
Temperature	degree Celsius	°C	

Common Derived Units of SI			Related Units		
Quantity	Unit	Symbol	Unit	Symbol	Relation
acceleration	meter/second^2	m/s^2			
area	square meter	m^2	sq millimeter	mm^2	=0 000 001 m^2 (10 m)
			hectare	ha	=10 000 m^2 (10^4 m)
			sq kilometer	km	=1 000 000 m^2 (10 m)
density, mass	kilogram/cubic meter	kg/m^3			
velocity	meter/second	m/s	kilometer/hour	km/h	=0 2778 m/s
volume	cubic meter	m^3	liter	L	=0 001 m^3 (10 ^{3} m^3)
			milliliter	mL	=0 000 001 m^3 (10 ^{6} m^3)

SOFT CONVERSION FACTORS

CLASS	MULTIPLY	BY		TO GET
LENGTH	inches	25 400 000		mm
	inches	0 025 400		m
	feet	0 304 800	**	m
	yards	0 914 400		m
	miles	1609 344 000		m
	miles	1 609 344		km
AREA	sq inches	645 160 000		mm^2
	sq feet	0 092 903		m^2
	sq yard	0.836 127		m^2
	acres	4046 873 000		m^2
	sq miles	2 589 988		km^2
VOLUME	board foot	0 002 360		m^3
	cubic feet	0 028 317		m^3
	cubic yard	0 764 555		m^3
	gallon (fluid)	3 785 412		L
	ounce (fluid)	29 573 530		mL
	bushels	0 035 239		m^3
MASS	ounce	0.028 350		kg
	pound	0.453 592		kg
	ton	907 184 700		kg
	lb/ft	1 488 164		kg/m
	lb/ft^2	4 882 425		kg/m^2
	lb/ft^3	16 018 460		kg/m^3
	ounces/ft^2	0 305 152		kg/m^2
FORCE	pound (force)	4 448 222		N
	lb/ft	14 593 900		N/m
	lb/ft^2	47 880 260		N/m^2
	lb/ft^3	157.087 5		N/m^3
STRESS	psi	6894 757 000		Pa
	kips/in^2	6 894 757		N/mm^2
VELOCITY	fps	0 304 800		m/s
	mph	0.447 040		m/s
	mph	1.609 344		km/h

TEMPERATURE $(^0F-32) - 1.8 = {}^0C$

ANGLES (no change) deg,min,sec

** For conversion from U S. Geodetic Survey, the U S survey foot equals 0 304 800 610 m

APPENDIX

C

FDOT Metric Symbols

FDOT METRIC SYMBOLS

Revised September 30, 1994

FDOT METRIC SYMBOL STANDARDS

Quantity	Unit	FDOT Specs/ Roadway & Traffic Symbols	ASTM E380	2 Characters (i.e., Pay Units)	3 Characters (i.e., CQR Format)
Length	millimeter	mm	mm		MM
	centimeter		cm	CM	CM
	meter	m	m	M1	M1
	kilometer	km	km	KM	KM
	lane kilometer	lane km		LK	LK
	net kilometer	net km		NK	NK
	gross kilometer	gross km		GK	GK
	kilometer point	kp			
Area	square meter	m^2	m^2	M2	M2
	hectare*	ha	ha	HA	HA
Volume	cubic meter	m^3	m^3	M3	M3
	liter	L	L	LI	LI
	kiloliter	kL		KL	KL
Mass (in the inch - lb system called weight)	gram		g	G	G
	kilogram	kg	kg	KG	KG
	metric ton*	t	t	MT	MT
Density	kilogram per cubic meter	kg/m^3	kg/m^3		KG3
Temperature	degree Celsius	°C	°C	DC	DC
	kelvin	K	K		K
Time	month*			MO	MON
	day*		d	DA	DAY
	hour*	h	h	HR	HR
	minute*	min	min		MIN
	second	s	s	SE	SEC
Plane Angle	radian	rad	rad		RD
	degree*	°	°	DG	DG
	minute*	'	'		MIN
	second*	"	"		SEC
Frequency	hertz	Hz	Hz		HZ
Force	newton	N	N		N
Torque	newton meter	N•m	N•m		N1
Viscosity, dynamic	pascal second	Pa • s	Pa • s		PAS

FDOT METRIC SYMBOL STANDARDS

Quantity	Unit	FDOT Specs/ Roadway & Traffic Symbols	ASTM E380	2 Characters (i e , Pay Units)	3 Characters (i e , CQR Format)
Viscosity, kinematic	centistokes		m^2/s		M2S
Pressure, Stress	pascal	Pa	Pa	PZ	PZ
	megapascal	MPa	MPa		MPA
	bar*	bar	bar		BR
Energy, Work, Quantity of Heat	joule	J	J		J
	kilowatthour*	kW•h	kW•h		KWH
Power Radiant Flux	watt	W	W		W
Electric Current	ampere	A	A		A
Electric Charge, Quantity	coulomb	C	C		C
Electric Potential	volt	V	V		V
Capacitance	farad	F	F		F
Electric Resistance	ohm	Ω	Ω		OHM
Electric Conductance	seimens	S	S		S
Magnetic Flux	weber	Wb	Wb		WB
Magnetic Flux Density	tesla	T	T		T
Inductance	henry	H	H		H
Luminous Intensity	candela	cd	cd	CA	CA
Luminous Flux	lumen	lm	lm	LN	LN
Illuminance	lux	lx	lx		LX
Speed, Velocity	kilometer per hour	km/h	km/h		KMH
	meter per second	m/s	m/s		M1S
	knot*	kn	kn		KN
Rotational Frequency	radian per second	rad/s	rad/s		RDS
	revolution per second*	r/s	r/s		RPS
	revolution per minute*	r/min	r/min		RPM
Activity	becquerel	Bq	Bq		BQ
Absorbed Dose	gray	Gy	Gy		GY
Dose Equivalent	sievert	Sv	Sv		SV
Amt of Substance	mole	mol	mol		MOL

* asterisked items indicate non-SI metric units which currently are approved for usage in the SI

OTHER FDOT METRIC DERIVED SYMBOLS USED IN SPECS

UNIT	SYMBOL
blows per meter	blows/m
blows per millimeter	blows/mm
candela per lux per square meter	$cd/(lx \cdot m^2)$
cubic meter per second	m^3/s
gram per liter	g/L
kilogram per linear meter	kg/m
kilogram per millimeter	kg/mm
kilogram per square meter	kg/m^2
kilojoule per kilogram	kJ/kg
kilojoule per millimeter	kJ/mm
kilojoule per square meter	kJ/m^2
kilonewton millimeter	J
liter per cubic meter	L/m^3
liter per kilogram	L/kg
liter per second	L/s
liter per square meter	L/m^2
lux per millimeter	lx/mm
meganewton per square meter	MN/m^2
meter per minute	m/min
milligram per centimeter	mg/cm
millimeter per meter	mm/m
millimeter per millimeter per degree Celsius	mm/mm/°C
millimeter per second	mm/s
nanogram per pascal second square meter	$n/(Pa \cdot s \cdot m^2)$
newton per millimeter	N/mm
square meter per liter	m^2/L
square millimeter per square meter	mm^2/m^2
US dollars per cubic meter	$\$/m^3$
US dollars per liter	$/L
US dollars per metric ton	$/t
US dollars per square meter	$\$/m^2$

APPENDIX

D

Sample Metric Plans Sheets