

## **PART 2, CHAPTER 3**

# **ENGINEERING ANALYSIS**

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## PART 2 CHAPTER 3 ENGINEERING ANALYSIS

### 3.1 OVERVIEW

#### 3.1.1 Purpose

This chapter contains the Florida Department of Transportation (FDOT's) procedure for engineering analysis to support development of project location and design concepts during Project Development and Environment (PD&E) Studies. The engineering analysis defines project features essential to the assessment of project impacts on the social, cultural, natural, and physical environment while also seeking to balance the extent to which project needs are addressed to ensure project costs and environmental impacts are minimized. Further, the analysis establishes necessary design considerations to support progression of the project from concept to preliminary design and eventually to final design. Engineering analysis builds upon the information developed and documented by FDOT during the Planning phase of a project.

This chapter provides guidance on engineering analysis and considerations including evaluation of existing conditions, selection of design parameters, engineering considerations for alternatives, selection of the preferred alternative(s), and documentation of engineering analyses in the *Preliminary Engineering Report (PER)*.

#### 3.1.2 Definitions

**Access Management** - Access management is a comprehensive approach to the management and regulation of driveways, medians, median openings, intersections, and freeway interchanges. The purpose of access management is to increase safety and efficiency of the transportation system by providing proper access from the State Highway System (SHS) to abutting lands while limiting and separating traffic conflict points. It also ensures balance between accessibility and mobility while increasing the capacity of a roadway system.

**Alignment** - Refers to both horizontal and vertical placement of a transportation facility. Horizontal alignment refers to the location of the transportation facility as described by curves and tangents. Vertical alignment refers to the vertical profile of the facility (i.e., below grade, at grade, or above grade).

**Alternative** - A potential transportation corridor, alignment, mode, or improvement under consideration.

**Bicycle Lane** - A bicycle lane (bike lane) is a portion of a curbed roadway designated for the exclusive use of bicyclists.

**Build Alternative** - A proposed improvement that involves constructing or implementing a project to address the project's purpose and need.

**Corridor** - Any land area designated by the state, a county, or a municipality which is between two geographic points and which is used or suitable for the movement of people and goods by one or more modes of transportation.

**Design Exception** - A documented decision for the reason(s) for a specific deviation from FDOT's governing criteria and the American Association of the State Highway and Transportation Officials' (AASHTO's) new construction criteria for Controlling Design Elements.

**Design Variation** - A documented decision for the reason(s) for a specific deviation from design elements that do not meet FDOT's criteria.

**Final Design** - Any design activities following preliminary design, expressly including the preparation of final construction plans and detailed specifications for the performance of construction work, final plans, final quantities, and final engineer's estimate for construction, also referred to as Plans Specifications & Estimates (PS&E).

**Managed Lane** - Highway facilities or sets of lanes within an existing highway facility where operational strategies are proactively implemented and managed in response to changing conditions with a combination of tools. These tools include access control, vehicle eligibility, variable pricing, or a combination thereof. Managed Lanes can include express lanes, high occupancy vehicle (HOV) lanes, reversible lanes, truck-only toll lanes, and vehicle-restricted lanes.

**No-Action (No-Build) Alternative** - The option in which the proposed project activity would not take place. The no-action (no-build) alternative provides the baseline for establishing impacts of the build alternatives. The terms no-action and no-build are used interchangeably.

**Preferred Alternative** - The alternative identified in the Environmental Document that will be advanced to the Design phase.

**Preliminary Design** – Activities that define the general project location and design concept. These include, but are not limited to preliminary engineering and other activities and analyses, such as environmental assessments, topographic surveys, metes and bounds surveys, geotechnical investigations, hydrologic analysis, utility investigation/coordination, traffic studies, financial plans, revenue estimates, hazardous materials assessments, general estimates of the types and quantities of materials, and other work needed to establish parameters for the final design. Prior to completion of the **National Environmental Policy Act (NEPA)** process, any such preliminary engineering and other activities and analyses must not materially affect the objective consideration of alternatives in the **NEPA** process as defined by **23 Code of Federal Regulations (CFR) § 636.103** and **Federal Highway Administration (FHWA) Order 6640.1A Policy on Permissible Project Related Activities During the NEPA Process**.

**Preliminary Engineering Report (PER)** - The engineering report that documents engineering analyses and decisions made during the PD&E Study. The **PER** contains

preliminary design plans and design parameters that support advancing the project into final design.

**Reasonable Alternatives** - [Term used in the Environmental Impact Statement (EIS) only] A reasonable range of alternatives that are technically and economically feasible and meet the purpose and need for the proposed action.

**Sea Level Rise (SLR)** - A projected change in ocean elevation, relative to land. For the purposes of this chapter, SLR refers to relative sea levels, not global mean sea levels.

**Transportation Systems Management and Operations (TSM&O)** – A set of strategies to manage traffic congestion and minimize other unpredictable causes of service disruption and delay to preserve the capacity and improve the security, safety, and reliability of the transportation system.

**Viable Alternatives** - [Term used in Type 2 Categorical Exclusion (CE), Environmental Assessment (EA), and State Environmental Impact Report (SEIR) only] - Alternatives that are technically and economically feasible and meet the purpose and need for the proposed action, if there is more than one build alternative proposed.

**Watershed Approach to Evaluating Regional Stormwater Solutions (WATERSS)** – An approach for proactively looking for opportunities for innovative stormwater management projects with agencies and/or stakeholders. The [WATERSS Process Guidebook](#) contains the steps and documentation required to complete the WATERSS process.

## 3.2 PROCEDURE

This section describes the procedure for conducting an engineering analysis during the PD&E phase. FDOT conducts engineering analyses consistent with the [FDOT Design Manual \(FDM\), Topic No. 625-000-002](#), and other manuals and procedures listed in [Figure 3-1](#). Engineering considerations for a project begin during the Planning phase where the project's purpose and need is first defined and continue throughout the PD&E process when conceptual and preliminary design plans are prepared. Engineering analysis and considerations include coordination with other FDOT offices within the District and Central Office, Federally Recognized Native American Tribes, agencies, the public, and Office of Environmental Management (OEM) as the Lead Federal Agency due to **National Environmental Policy Act (NEPA)** Assignment, as appropriate.

### 3.2.1 Level of Detail of Analysis

The level of detail for engineering analysis during the PD&E phase depends on the overall size and complexity of the project. It also depends on the type of Environmental Document prepared for the project. Type 1 Categorical Exclusion (CE) and Non-Major State Action (NMSA) projects require a lesser level of analysis and do not require a PD&E Study. Type 2 CE, Environmental Assessment (EA), Environmental Impact Statement (EIS), and State Environmental Impact Report (SEIR) projects require a more detailed level of analysis

and documentation. Refer to [Part 1, Chapter 2, Class of Action Determination for Federal Projects](#) for additional information.

Projects that will have an accelerated schedule to construction may need to be developed to a higher level of detail during the PD&E phase to enhance the efficiency of project development and provide a higher level of detail for funding needs. For example, a project that is anticipated to be a design-build project may need to be developed to a greater level of engineering detail than a typical Design-Bid-Build project.

Regardless of the Environmental Document type, the engineering analysis should be performed to a level of detail that is sufficient to assess the effects of the alternatives on the social, cultural, natural, and physical environment. In order to analyze multiple alternatives, the Project Manager should ensure that all the alternatives are developed to the appropriate level of detail.

### 3.2.2 Project Coordination

Recognizing that coordination begins during the project scoping process, the PD&E Project Manager is responsible for timely coordination with other offices within the District and Central Office, as applicable, to ensure proper development and evaluation of alternatives. Refer to [Part 2, Chapter 3A, Alternatives Analysis](#) for additional information.

### 3.2.3 Preliminary Engineering Analysis

A variety of early engineering analyses may be needed during the PD&E phase to develop and analyze project alternatives and potential impacts based on existing and future conditions. The level of detail and extent of the preliminary design efforts are tied to the level of detail described in [Section 3.2.1](#).

The results of the engineering analyses are documented in a **PER**. See [Section 3.2.10](#) for a description of the **PER** and required content. The [FDOT Preliminary Engineering Report Outline and Guidance Document](#) and the associated [Preliminary Engineering Report QA/QC Checklist](#) are also resources for the **PER** development.

The **PER** includes **PER Project Involvement Checklists** to document the presence or absence of considerations/conditions in the study area and any involvement with the proposed alternatives. If there is no involvement, further discussion on that item is not needed elsewhere in the **PER**. These checklists are intended to reduce redundancy or irrelevant discussion between and within project documents. The **PER Project Involvement Checklists** are located in the [PER Outline and Guidance Document](#). See [Section 3.2.4](#) for more specific guidance on using the checklists.

The results of engineering analysis may also be documented separately in the Environmental Document, depending on the document type. For Type 2 CEs and SEIRs the engineering analysis may be summarized in the Project Description section of the Environmental Document and the **PER** is incorporated by reference. For EAs and EISs

the information in the **PER** is summarized in the Environmental Document. This chapter is focused on documentation in the **PER**. See [Part 2, Chapter 3A, Alternatives Analysis](#) for guidance on documentation in the Environmental Document.

PD&E Studies for bridge replacement projects may not require preparation of a **PER**, rather the preliminary engineering analysis results for these projects may be documented in the **Bridge Development Report (BDR)** or **Bridge Replacement Report (BRR)**.

The key elements in performing engineering analysis during the PD&E Study are:

1. Project purpose and need
2. Data collection and existing conditions analysis
3. Design controls and criteria
4. Alternatives development and analysis

### **3.2.3.1 Project Purpose and Need**

Purpose and need identification generally occurs during the Planning phase of the project as a part of the Efficient Transportation Decision Making (ETDM) Process. The Project Manager coordinates with the ETDM Coordinator and reviews the **Programming Screen Summary Report** for projects that were screened through the ETDM Process. The Project Manager should also review planning documents such as the Long Range Transportation Plan (LRTP), feasibility reports, and corridor evaluations.

It is important for the Project Manager to review and understand the project's purpose and need, which drives the development of alternatives considered and evaluated during the PD&E process and documented in the **PER**. During the PD&E process, the project's purpose and need is further developed, however, any fundamental changes to the purpose and need, including adding or deleting any elements of need, must be approved by OEM. Refer to [Part 2, Chapter 1, Project Description, Purpose and Need, and Planning Consistency](#) for more information and documentation in the Environmental Document.

### **3.2.3.2 Data Collection and Existing Conditions Analysis**

The data collection process should consider the purpose and need for the project and the goals and objectives of the PD&E Study. Specifically, data collection should start by obtaining the data to assess and support the purpose and need for the project, the existing conditions analyses, and alternatives evaluations. Data collection should include relevant data layers, project specific information, reports, and records to be utilized in understanding the project area, project constraints, and potential impacts. If needed, efforts should be made to determine any gaps in the data and approaches to fill the gaps.

The purpose of the existing conditions analysis is to document available information regarding the existing facility or corridor which can help to identify trends and areas for

further consideration. Existing conditions analysis documents the inventory of roadway elements, structure elements, and environmental features of the project. It also includes a review of planning issues contained in previous planning documents such as corridor feasibility studies or Interchange Access Requests (IARs). The existing conditions analysis helps to identify or confirm design and operational deficiencies associated with the project study area, as well as to verify, refine, and support the purpose and need for the project. It also establishes the baseline conditions from which environmental impacts are evaluated.

The sections below are elements of existing conditions analysis that must be discussed and/or documented in the **PER** for existing or new corridors. For new corridors, analysis of existing conditions requires a description of the adjacent transportation facilities to explain how the existing transportation system is currently operating.

### 3.2.3.2.1 Previous Planning Studies

Previous planning studies and corridor evaluations that were completed to support development of the PD&E Study should be reviewed and documented in the **PER**. When Planning phase corridor studies identified and documented improvement options that may address the needs, the Project Manager should coordinate with the District Environmental Office to determine if planning products or decisions can be reused or adopted according to **23 U.S.C. § 168** and **23 CFR § 450.318** and **Appendix A** of **23 CFR Part 450 - Linking the Transportation Planning and NEPA Processes**. Refer to [Part 1, Chapter 4, Project Development Process](#) for more information regarding planning studies and Planning and Environment Linkages (PEL).

If planning decisions or products were incorporated by reference into the **NEPA** process, then the **PER** should:

- Cite **23 United States Code (U.S.C.) § 168**;
- Discuss the steps taken to incorporate them and how they were used in the PD&E Study;
- Provide a brief description of the planning decision or products;
- Summarize future policy assumptions used in the transportation planning process related to land use, economic development, transportation costs (comparative estimates, Transportation Improvement Plan (TIP), State Transportation Improvement Plan (STIP), etc.), and network expansion;
- Summarize assumptions used in the transportation planning process such as travel demand forecasts, alternatives development, project long-range costs, and purpose and need. It should verify they are consistent with the **NEPA** process;

- Discuss changes that have occurred in the area since the planning decision or products were completed and identify any data or analyses that are required to be updated since the planning decision;
- Include titles of the previous planning reports in the List of Technical Documents.

If there are no previous planning studies completed, the appropriate box is checked in the ***PER Project Involvement Checklist***.

### **3.2.3.2.2 Existing Roadway Conditions**

Existing roadway conditions should be documented in the ***PER*** to reflect, at a minimum, the following elements:

1. Roadway typical sections of each corridor within the project limits. Include dimensions of each cross-sectional element (e.g., Right of Way (ROW), lanes, shoulders, median, curb and gutter, sidewalk, roadside protection, drainage swales).
2. Roadway functional and context classifications. Include any other special classifications (e.g., hurricane evacuation route, Strategic Intermodal System (SIS) corridor)
3. Access management classification and standards
4. ROW of existing roadways within the project limits including extent and type (e.g. limited access) and easements
5. Pavement type and conditions
6. Existing design speed and posted speed limit
7. Horizontal alignment (noting source of best available information):
  - a. Deflections
  - b. Horizontal curves (length, radius, and associated superelevation)
  - c. Horizontal clearances
8. Vertical alignment (noting source of best available information):
  - a. Grades
  - b. Vertical curve components (length, K value)
  - c. Vertical clearances
9. Multimodal facilities:

- a. Pedestrian accommodations - Sidewalks, crosswalks, Americans with Disabilities Act (ADA) accessibility, and school routes
  - b. Bicycle facilities - Location, type, and width
  - c. Shared use paths - Location, width, and pavement type
  - d. Mass transit facilities including bus and rail services - Type, locations and number of stops, transfer centers, park-and-ride facilities, bus bays
  - e. Freight and intermodal logistics centers
  - f. Freight routes
10. Intersections - Lane configuration, intersection control type, technology, and operational conditions
  11. Physical or operational restrictions such as multimodal use lanes, parking, evacuation routes, fixed objects, barriers, and clear zones
  12. Traffic data - Annual Average Daily Traffic (AADT), peak hour volume, Directional Design Hour Volumes (DDHV), truck percentage, pedestrian and bicycle counts, and transit data
  13. Roadway operational conditions - Level of Service (LOS) and relevant performance measures such as delay, travel time, and density
  14. Safety data - Crash data including crash rates, severity, number (frequency), types, locations (e.g., a heat map or other similar diagram), as well as contributing causes and patterns. See FDOT's [State Safety Office Website](#) for information on FDOT's Target Zero Policy. Coordination with the District Safety Administrator or other District Staff is needed to obtain data from the **Safety Assessment Dashboard**.
  15. Drainage/Water Resources - Drainage map depicting basins and flow patterns, floodplains and stormwater management systems including regional facilities, size and location of cross drains and box culverts along the corridor. Known drainage or flooding concerns, are documented as well as designated water resource basins and characteristics, including special regulatory requirements. See [Part 2, Chapter 11, Water Resources](#) for more detail.
  16. Utilities - Location, type, Utility Agency/Owner (UAO), and contact persons
  17. Soils and geotechnical data - Soil map depicting soils and geotechnical data
  18. Traffic signs - General description of the existing signage specifically including location(s) of any overhead cantilever and span sign structures

If the following roadway conditions are present in the project area, they should be documented in the **PER**. If any of the considerations/conditions are not present, the appropriate box in the **PER Project Involvement Checklist** is checked to document the absence without requiring further discussion in the Existing Conditions section of the **PER**.

1. Managed Lanes (e.g., Express Lanes or Toll Lanes) - configurations, and operations within the corridor
2. Railroad crossings - Number of tracks, number of train crossings, speed, type of train (passenger or freight), type of warning devices, operating characteristics, and railroad ROW.
3. Lighting - Location, type, condition, spacing, and maintaining agency
4. Aesthetic features - features such as scenic views, lighting, landscaping, signage, vegetation, and pavers. Including the maintaining agency of each feature.
5. Intelligent Transportation System (ITS)/Transportation Systems Management and Operations (TSM&O) Features - Operational and infrastructure requirements. Including review and a summary of Concepts of Operations (ConOps) and other systems engineering documents, if applicable.
6. Rest areas, weigh stations, truck parking areas.
7. Emergency Repairs - Identifying if the project has had two or more emergency repairs pursuant to **23 CFR § 667**

If review of the existing conditions identifies a deficiency or substandard element, the findings are described in the appropriate subsection in the Existing Conditions section of the **PER** and discussed in detail in the Alternative Analysis section.

### **3.2.3.2.3 Existing Bridges and Structures**

If existing bridges and structures are present in the project area, they should be discussed in the **PER**. If there are no existing bridges or structures, the appropriate box is checked in the **PER Project Involvement Checklist** to document without further discussion in the Existing Conditions section of the **PER**.

FDOT's Bridge Maintenance Office maintains **Bridge Inspection Reports (BIRs)** for every public bridge in the State of Florida. The Project Manager must obtain the recent **BIR** for each bridge on the existing corridor. Additionally, geotechnical and scour reports, environmental permits, and previous studies for existing bridges can be requested from the structures and environmental permits offices. If hydraulic analysis is anticipated, bridge information for each bridge upstream and downstream of the existing crossing can also be obtained. For bridges maintained by other agencies, all relevant information regarding the existing bridge should be requested from the owner of the bridges.

Evaluation of existing bridge conditions should include identification of wildlife crossing features. The results of the **Wildlife Crossings Potential Report**, prepared for the project during the ETDM screening, should be reviewed. Wildlife crossing features include bridges, bridges with shelves, specially identified culverts, enlarged culverts or drainage culverts, and/or exclusionary devices such as fencing, walls or other barriers, or some combination of these features. The Project Manager should confirm the location of a wildlife crossing feature based on coordination with the District Environmental Manager, District Drainage Engineer, District Environmental Permits Coordinator, and District Structures Design Engineer. See [FDOT Wildlife Crossing Guidelines](#) for more information.

A fatigue evaluation is required for existing steel bridges to provide guidance during the decision-making process regarding whether the steel bridge (or portions thereof) should remain or be replaced. Refer to the [Structures Manual, Volume 1, Section 7.5.4, Remaining Fatigue Life Estimate for Steel Bridges, Topic No. 625-020-018](#) and the [FDM, Part 1, Chapter 121, Bridge Project Development](#) for more guidance.

Existing bridge conditions should be documented in the **PER** to reflect, at a minimum, the following elements:

1. Bridge number
2. Bridge Type
3. Typical Section
4. Facility crossed (waterway, roadway, or railroad)
5. Year structure was built and/or modified
6. Type of structure - Timber, concrete, or steel
7. Condition - Structural rating and suitability for widening or retrofitting
8. Load posting information
9. Horizontal and vertical clearances

If the following bridge conditions are present in the project area, they should be documented in the **PER**. If any of the elements are not present, the appropriate box is checked in the **PER Project Involvement Checklist** to document the absence without requiring further discussion in the Existing Conditions section of the **PER**.

1. Ship impact data
2. Span arrangement - Number and length of spans

3. Historical significance - i.e., **National Register of Historic Places (NRHP)** eligible or may be a potentially significant historic bridge (of 50 years of age or older). If a bridge is on the **NRHP**, it is determined if the bridge is a critical landmark or a signature structure.
4. Geotechnical information from existing bridge borings, pile driving records, scour reports, and maintenance history where available
5. Channel data - Alignment, width, depth, and clearance requirements
6. On bridges with moveable spans - The average number of times the bridge opens per day, results of boat traffic and mast height surveys, including any special navigation (shipping/boating) requirements that will require accommodation during construction
7. Normal High Water and Mean High Water (for coastal bridges)
8. Bridge security issues
9. Remaining Fatigue Life Estimate for Steel Bridges

#### **3.2.3.2.4 Existing Environmental Features**

Existing conditions analysis must include a review of environmental features in the project area through coordination and review of supporting documentation. These environmental features (also called environmental topics/resources) undergo a separate environmental analysis during the PD&E phase. Therefore, close coordination between environmental and engineering staff is essential to developing alternatives that reduce environmental impacts.

Descriptions of the existing environmental features in the project area may be available in technical reports prepared during the environmental analysis [e.g., **Natural Resources Evaluation (NRE)**, **Cultural Resources Assessment Survey (CRAS) Report**].

If any of the environmental conditions are not present in the study area, the appropriate box is checked in the **PER Project Involvement Checklist** to document their absence without requiring further discussion in the **PER**. For environmental conditions that are present in the project area but are not involved with the build alternatives or the preferred alternative, no involvement is selected on the checklist. If there is no involvement discussion is not required to be included elsewhere in the **PER**.

Environmental conditions that are present and involved with the build alternative(s), or the preferred alternative are discussed in the appropriate Build Alternatives subsection of the **PER**. See [Part 2, Chapter 3A, Alternatives Analysis](#) for environmental considerations for build alternatives.

### 3.2.3.2.5 Survey and Mapping

Development of the horizontal and vertical alignments of the build alternative(s) requires survey topographic data from publicly available sources or other services that provide topographic data of higher accuracy and density. At the beginning of the PD&E phase, the Project Manager should consult with the District Survey Office and obtain existing information on survey control points, benchmarks, and control data (e.g., vertical and horizontal datum, coordinate system). The scale of surveying and mapping required depends on the project context, project complexity, and adjacent land use intensity. The scale of surveying and mapping also depends on the scope of the design effort for preliminary engineering. Engineering analysis for build alternatives may require the following:

1. Existing aerial photographs and imagery [for existing FDOT aerials see FDOT's [Aerial Photo Look Up System \(APLUS\)](#)]
2. LiDAR data
3. Previous topographic surveys, maps, models, and reports
4. Previous roadway corridor mapping or as-built plans
5. ROW data, including supporting survey and title work
6. County data showing adjacent parcels, plats, and side streets
7. Utility locates

Refer to the [Surveying and Mapping Procedure, Topic No. 550-030-101](#), and [Surveying and Mapping Handbook](#) for standards and guidance for conducting surveying and mapping.

### 3.2.3.2.6 Geotechnical Investigation

Soil exploration during the PD&E phase is part of the analysis that supports location and design of build alternatives. A subsurface investigation may be required at the site of new structures, roadway construction, widening, trails, and rehabilitation locations as directed by the District Geotechnical Engineer or project scope. The scale of geotechnical investigation depends on the level of design analysis for the PD&E phase and the type of soils involved. Geotechnical and subsurface investigation during PD&E may involve:

1. Reviewing project requirements such as project location, alignment, structure location, structure loads, pier locations, and cut/fill area locations.
2. Performing field reconnaissance of the site and existing structures to determine conditions that may affect development and construction of the project.

3. Reviewing or obtaining ground survey data, aerial photography, geological information, U.S. Department of Agriculture (USDA) soil data, U.S. Geologic Survey (USGS) topo maps, U.S Coast and Geodetic Survey (USCGS) maps.
4. Planning and conducting field investigation and laboratory testing.
5. Preparing a preliminary geotechnical report summarizing available data and providing recommendations.
6. Identifying potential needs for the design investigation to address construction requirements and anticipate problems.

Geotechnical and subsurface investigations must be conducted by a geotechnical engineer and the report must be signed by the engineer, in accordance with geotechnical standards, policies, and procedures (refer to the [Soils and Foundations Handbook](#)).

Geotechnical and subsurface investigations may reveal evidence of contamination, solid waste/land-filling activities, or archaeological findings. This information is useful to the environmental analyst tasked to perform additional assessment work on the same project. When these investigations reveal issues, the project geotechnical engineer should inform the Project Manager and the District Contamination Impact Coordinators as appropriate.

### 3.2.3.3 Design Controls and Criteria

Design controls are established parameters or physical characteristics that affect the selection of criteria and standards for geometric design of alternatives. Refer to [FDM, Part 2, Chapter 201, Design Controls](#) for further information on design controls.

For FDOT Federal Projects off the SHS, the *FDM* or *Florida Greenbook* may be the source of design criteria. Refer to the [Local Programs Manual](#) for more guidance on the selection of project design criteria, for Local Agency Projects.

The following design controls are documented in the *PER*, as appropriate. If a design control is not applicable, a statement to that fact is included in the *PER*.

1. Roadway context classification
2. Functional classification and SIS designation
3. Access management class and applicable standards
4. Design speed and Target Speed
5. Capacity and LOS Target
6. Design vehicle

The following are other design elements that may not apply to all projects but that could affect the selection of criteria and standards for geometric design of alternatives. The following elements are documented in the **PER** if they are applicable to the project.

1. Pedestrian and bicycle requirements
2. Physical constraints (e.g., existing ROW, approach roads, intersecting roads, railroads, major utilities)
3. Environmental constraints (e.g., public parks, historic and cultural features, wetlands, floodplains)
4. Type of stormwater management facilities (e.g., closed or open drainage systems)
5. Navigational requirements
6. Design high water, including impacts from sea level rise projections
7. Design wave heights for coastal bridges, including impacts from sea level rise projections

The design controls guide the selection of the appropriate design criteria to be used in developing alternatives. The [FDM, Topic No. 625-000-002](#) is the principal source of values for design criteria for projects on the SHS or National Highway System. The values for design criteria contained in the **FDM** have been accepted by FHWA.

A table is included in the **PER** listing the relevant roadway, structure, and drainage design criteria used in developing alternatives. References to the associated manuals, procedures, or guidelines that defined the criteria, and the published date of the source are included.

[Table 3-1](#) provides an example of a list of items that are included in the design criteria table(s). The list is not exhaustive and should be tailored to each project.

### 3.2.4 Alternatives Development and Analysis

The alternatives analysis is completed by following guidance provided in [Part 2, Chapter 3A, Alternatives Analysis](#). The alternatives analysis includes the no-action (no-build), TSM&O, Multimodal, and build alternatives, and includes other project specific considerations (see [Part 2, Chapter 3A, Alternatives Analysis](#)). Once the preferred alternative is selected, the **PER** can be modified to indicate which of the alternatives was selected as the preferred by highlighting or appending the alternative name to identify the preferred.

### 3.2.5 Required Engineering Considerations for Build Alternatives

The following considerations for build alternatives should be documented in the **PER** including a discussion for each proposed alternative.

### 3.2.5.4 Horizontal and Vertical Geometry

Build alternatives should be designed to comply with the horizontal and vertical design criteria as discussed in [Section 3.2.3.3](#). The horizontal and vertical geometry should be designed to an appropriate level of detail to determine potential ROW needs and potential impacts from the build alternative(s). Special attention should be given to vertical profile needs in areas such as constrained ROW, flooding or high ground water tables, as well as areas of vertical separation including bridges, bridge abutments, ramps, and other significant changes in vertical profile.

Preliminary concept plans showing the horizontal and vertical geometry of the project should be included in the Appendix of the *PER*.

### 3.2.5.5 Typical Sections

The proposed typical sections for each build alternative are discussed. Rendered or graphic typical sections are often included in the *PER* from the presentation or public involvement materials to more easily depict the proposed alternative(s).

After the public hearing is held (if required), the *Typical Section Package* is signed by the Engineer of Record, finalized in accordance with [FDM, Part 1, Chapter 120, Design Submittals](#), and included in the Appendix of the *PER*.

### 3.2.5.6 Right of Way

For each build alternative, the number and acreage of parcels impacted is documented along with the number of expected relocations, and the total cost estimate for the acquisition of those parcels. Considerations of future land use changes around the proposed ROW are included. If a *Conceptual Stage Relocation Plan (CSRP)* has been developed for the project, a reference to the plan and its conclusions is included. Details regarding costs for individual parcels must not be included in this discussion or elsewhere in the report.

### 3.2.5.7 Context Classification

Context classification establishes a framework for understanding the surrounding land use, community character, and multimodal activity that influence a transportation facility. It provides the foundation for decision-making throughout project development and requires early and ongoing coordination with local governments, Metropolitan Planning Organizations (MPOs), transportation agencies, and the public.

Context-based design, as a component of context classification, applies this framework to the physical design of a facility to ensure it appropriately serves users of all ages and abilities, while responding to the needs and character of the surrounding environment. A context-based approach to project development considers accommodating all transportation users and their relationship to safety, economy, mobility, and the environment.

Development of build alternatives must consider context classification early in the alternatives development process. Consideration and integration of context classification during the PD&E phase promotes the efficient development of a multimodal transportation system. Context-based designs should serve the transportation needs of users of all ages and abilities, including cyclists, pedestrians, motorists, transit riders, emergency responders, and freight handlers.

Understanding of community context (transportation network, land use, and local priority), potential users, and needs are key inputs for developing build alternatives that are context oriented. Context classification is determined based on the [\*\*FDOT Context Classification Guide\*\*](#) and coordinated with the District Planning Office to help ensure that the determination of context classification is collaborated for future approvals.

If the future context classification is different than the existing, the future context classification should be used when developing project alternatives. The future context classification for the project corridor(s) should be discussed in the *PER*. The following are questions to consider when defining future context classifications:

- Are there any planned or new developments anticipated in the project area?
- What is the local government future land use vision as identified in the Local Government Comprehensive Plan (LGCP), corridor plan, policies or other credible sources?
- Does the adopted future land use plan include specific recommendations regarding development density, building setbacks, or urban design within the project area?
- Are there locally adopted multimodal plans or policies affecting non-motorists' trips or transit?

There is no single design solution for context-based design because each street and its context and travel demand are unique. For example, a street in an urban setting is quite different from a street in a rural setting; however, both streets must be designed to meet the users' needs and the transportation objectives of safety, mobility, and the environment. Incorporation of context may necessitate modification of design standards to allow typical sections to accommodate non-motorized traffic or allow raised medians, adequate shoulders, narrow lanes, and traffic calming features. Such modifications must follow FDOT's Design Exceptions and Design Variations process.

### **3.2.5.8 Multimodal/Pedestrians and Bicycle Accommodation**

The 2010 United States Department of Transportation (USDOT) *Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations* encourages transportation agencies to integrate safe and convenient walking and bicycling facilities into all transportation projects, recognizing their health, safety, environmental, and quality-of-life benefits. This can be done by treating walking and

cycling as equal to other transportation modes, providing choices for all ages and abilities, and exceeding minimum design standards.

***FHWA Bicycle and Pedestrian Planning, Program and Project Development*** provides additional guidance related to safety and accommodation of pedestrians and bicyclists.

FDOT's procedures are consistent with the 2010 USDOT ***Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations*** and further specify that facilities be context-appropriate, based on existing or planned land use. Additionally, ***Section 335.065, Florida Statutes (F.S.)***, requires full consideration of bicycle and pedestrian ways along state roads and transportation facilities during planning and project development unless contrary to public safety, disproportionate cost, or absence of need. Therefore, all build alternatives must consider pedestrian and bicycle accommodation.

Guidance on the design of pedestrian and bicycle facilities can be found in:

1. [\*\*\*FDM, Part 2, Chapter 222, Pedestrian Facilities, FDM, Part 2, Chapter 223, Bicycle Facilities\*\*\*](#), and [\*\*\*FDM, Part 2, Chapter 224, Shared Use Paths\*\*\*](#)
2. ***FHWA Bicycle and Pedestrian Planning, Program and Project Development***
3. [\*\*\*Florida Greenbook\*\*\*](#) (for off-system projects)

Sidewalks in highly developed urban areas and near schools may require additional width based on anticipated pedestrian volumes and context. When designing pedestrian facilities, the safe crossing needs of the pedestrian must be considered, such as providing median refuge, placing crosswalks perpendicular to the roadway or to match the intersection lines at skewed intersections, and minimizing pedestrian crossing length.

For interchange design, pedestrians and bicyclists' accommodation on the arterial must be considered from the beginning of the planning process and during the PD&E phase. Ramp configurations, speeds, and overall complexity can create impractical and unsafe conditions for bicyclists and pedestrians if not carefully considered throughout the design process.

Where current pedestrian or bicycle facilities or indications of use are identified, the Multimodal Accommodations section of the ***PER*** and the Bicycles and Pedestrians section of a SEIR, EA, or EIS should discuss the current and anticipated use of the facilities, the potential impacts of the build alternatives, and proposed measures, if any, to avoid or reduce adverse impacts to the facility and its users. Where new facilities are proposed as a part of the proposed highway project, the Environmental Document and ***PER*** should include sufficient information to explain the basis for providing the facilities (e.g., proposed bicycle facility is a link in the local plan or sidewalks will reduce project access impact to the community). Where the build alternative(s) would sever an existing major route for non-motorized transportation traffic, the proposed project needs to provide

a reasonable alternative route or demonstrate that such a route exists. This needs to be described in the relevant section of the Environmental Document according to the **FHWA Technical Advisory T6640.8A**, and the **PER** Alternatives Analysis section as appropriate.

Other modes of transportation such as freight, transit, and rail should be considered if applicable to the project. Coordination should occur with the appropriate District office, and the applicable FDM Design Standard and criteria documented in the **PER**.

Some features of the multimodal alternative may be incorporated into the build alternative(s), even if the multimodal alternative does not meet the purpose and need of the project on its own. See [Part 2, Chapter 3A, Alternatives Analysis](#) for more information regarding the required alternatives analysis.

### 3.2.5.9 Traffic Operations and Safety

Build alternatives should be evaluated for their impact on traffic operations. One of the primary objectives of traffic analysis is to determine if the build alternative(s) will operate within performance targets through the design year. Traffic analysis for build alternatives includes both travel demand forecasting and capacity analysis to determine the number of through lanes, intersection control type, intersection configurations, need for auxiliary lanes, or access management. Projects in urban areas may require additional traffic operational analysis as compared to projects in rural areas because of recurring congestion and ROW constraints.

Safety analysis for build conditions should occur after evaluation of crash data to determine any existing safety deficiencies and appropriate corrective measures. Evaluation of existing safety can also include a Road Safety Audit (RSA), which is an examination of safety conditions of a road by an independent audit team, or quantitative, data-driven safety analysis by utilizing the **Highway Safety Manual (HSM)** for existing conditions or predictive analysis of future conditions. Safety analysis for build conditions should analyze potential hazardous elements on the proposed project conditions and draw inferences based on interactions of these elements and users. Development of build alternatives should attempt to correct existing safety deficiencies and is documented in the **Project Traffic Analysis Report (PTAR)**. For existing and prescreened safety needs, the District Traffic Operations Engineer, District Safety Administrator, or other appropriate position according to the Districts' processes are contacted. Refer to the FDOT's [Safety Analysis Guidebook for PD&E Studies](#) for further guidance on safety analysis.

Refer to the FDOT's [Traffic Analysis Handbook, Part 2, Chapter 2, Traffic Analysis](#), and the [Manual on Intersection Control Evaluation, Topic No. 750-010-003](#) for further guidance on traffic operations evaluation, safety, and Intersection Control Evaluations (ICEs).

The **PER** should summarize the travel demand forecasting and traffic analysis results. The forecasting should include discussion of committed projects and discuss how future demand volumes and design hour volumes were estimated. Citation of the **PTAR**, or

**Interchange Access Request (IAR)** document and **Project Traffic Forecasting Memorandum** may be included for more details, if applicable.

The **PER** should summarize the safety analysis, including existing safety deficiencies, analysis methods, and corrective measures proposed for the build alternative(s).

### 3.2.5.10 Intersection and Signal Analysis

The intersection and control strategy evaluations are discussed for the proposed build alternative(s). This may include **Highway Capacity Manual (HCM)**, **HSM** and/or ICEs. Similar to general alternatives analysis, safety impacts of intersection types should be discussed and summarized in the **PER**. Citation of the **PTAR** for traffic capacity and operational analyses, intersection control performance analysis, and a summary of any ICE procedures should be included. Rendered or graphic intersection diagrams are often included in the **PER** from the presentation or public involvement materials to more easily depict the proposed alternative(s). The proposed intersections and control types are included in the **PER** concept plans.

Refer to the FDOT's [Traffic Analysis Handbook, Part 2, Chapter 2, Traffic Analysis](#), and the [Manual on Intersection Control Evaluation, Topic No. 750-010-003](#) for further guidance.

### 3.2.5.11 Access Management

Access management analysis should evaluate the existing and proposed access management classification. The PD&E Study should recommend appropriate locations for median openings and driveways, as applicable. Differences in access management between build alternatives should be considered in the comparison of alternatives. The **PER** should document spacings provided versus required for the preferred alternative.

Conceptual access management elements should be incorporated into the concept plan for the preferred alternative. The concept plans developed in the PD&E Study should show appropriate access management features, including access point changes such as median openings and driveways. Changes in access management should be consistent with [Procedure No. 625-010-021, Median Openings and Access Management](#), the [FDOT Access Management Guidebook](#), and [FDM, Part 2, Chapter 201, Design Controls](#). The Project Manager should coordinate with the District Access Management Review Committee (AMRC) for any proposed deviations from the access management and median opening standards.

The **PER** should document access management issues and preliminary design decisions and actions reached during the PD&E phase. The **PER** should include language about how the project complies with **Section 335.199, F.S.**, if a public meeting is required based on changes in access management. This meeting can be conducted concurrently with any PD&E public meeting(s).

### 3.2.5.12 Drainage and Stormwater Management Facilities

During the PD&E phase, management of how the stormwater from the project area will meet water quality and quantity requirements of FDOT, Water Management Districts (WMDs), and the Florida Department of Environmental Protection (FDEP), is determined. This could include identifying innovative stormwater Best Management Practices (BMP), required pond sites and sizes, or only pond sizing. See the [FDOT Drainage Manual, Topic No. 625-040-002](#), which contains regulatory requirements and the drainage design standards for FDOT projects. See [Part 2, Chapter 11, Water Resources](#) for more information.

If the project uses the Watershed Approach to Evaluating Regional Stormwater Solutions (WATERSS) process, the Project Manager should coordinate with the WATERSS District Champion and the District Drainage Engineer to discuss watershed needs, innovative stormwater management and follow the WATERSS process. The [WATERSS Process Guidebook](#) contains the steps and documentation required to complete the WATERSS process. Stormwater management solutions developed through this process are documented in the project **Stormwater Management Alternatives Report (SMART)**, summarized in the **PER**, and may be modified in future phases of the project.

For projects not using the WATERSS process, drainage decisions are documented in the **PER** and **Pond Siting Report (PSR)** or **Conceptual Drainage Design Report**. For projects using ponds for stormwater management, a **PSR** is prepared, identifying potential pond sites. If the stormwater facilities are features other than ponds, a **Conceptual Drainage Design Report** is prepared (see [Part 2, Chapter 11, Water Resources](#) and **Chapter 5** of the [Drainage Manual, Topic No. 625-040-002](#)). The results of the analysis are summarized in the **PER**.

### 3.2.5.13 Water Quality

A water quality analysis should be performed for each alternative. Information associated with the water quality analysis should be documented in the **PSR**, **SMART**, or **Conceptual Drainage Design Report**, and summarized in the **PER**.

The water quality analysis and documentation in the Environmental Document are discussed in detail in [Part 2, Chapter 11, Water Resources](#).

### 3.2.5.14 Hydrology and Floodplains

Analysis of build alternatives includes hydrology and hydraulic evaluation to determine preliminary location, type, and size of major drainage crossings that may impact floodplains and floodways. Protection of floodplains and floodways is required by **Executive Order (EO) 11988, Floodplain Management, USDOT Order 5650.2, Floodplain Management and Protection** and **23 CFR Part 650A**. The intent of these directives is to avoid or minimize highway encroachments within the 100-year (base)

floodplains, where practicable, and to avoid supporting land use development which is incompatible with floodplain values.

Hydraulics evaluation involves field observations to determine or confirm needed improvements, analysis of existing and proposed drainage basins, design of cross drains and culverts, design of outfall structures, determination of special erosion control and flood control features, among other things. Hydraulics evaluation also determines and corrects roadway design profile issues that may cause roadway flooding or overtopping.

The results of hydrology and hydraulic evaluation are summarized in the **PER** from the **Location Hydraulics Report (LHR)**. See [Part 2, Chapter 13, Floodplains](#) for guidance on how to prepare an **LHR** and documentation in the Environmental Document. For each build alternative, the impacts that occur to floodplains should be discussed in the **PER**. This discussion should include whether the impacts will be longitudinal and transverse to the floodplain, and any mitigation strategies proposed.

### 3.2.5.15 Utilities and Railroads

The Project Manager should coordinate with the District Utility Office and District Railroad Coordinator whenever a project involves utilities and/or rail systems. The goal is to identify potential existing or future conflicts with the project. Coordination requirements for potential utilities and railroad conflicts are outlined in [Part 2, Chapter 21, Utilities and Railroads](#).

The **PER** should summarize the **Utility Assessment Package** and utility coordination efforts. If known, a cost estimate for utility relocations, both direct and indirect, should be included for each alternative.

Documentation of the coordination with the railroads must be included in the project file. The **PER** should discuss coordination and involvement with any rail facilities to the appropriate level of detail required to address any issues identified. Any railroad features incorporated into the build alternative(s) should be discussed along with costs, both direct and indirect, if known. Guidance on documentation in the Environmental Document is in [Part 2, Chapter 21, Utilities and Railroads](#).

### 3.2.5.16 Traffic Control Strategies

A review of conceptual traffic control and transportation management during construction should be completed for each build alternative to assess constructability issues and maintain multimodal traffic during construction. This review must include traffic control strategies, evaluation of potential fatal flaws for transportation management, and may also include additional work zone management strategies based upon the expected work zone impacts of a project. The traffic control review must be discussed in the **PER** including construction phasing to maintain traffic, potential detours, safety considerations, property access, and multimodal accessibility during construction. The **PER** should indicate any differentiators between alternatives regarding traffic control strategies if there are multiple build alternatives. For additional guidance related to the Transportation

Management Plan (TMP) development process, see [FDM, Part 2, Chapter 240, Transportation Management Plan](#).

### **3.2.5.17 Constructability**

The evaluation of build alternatives requires review of constructability, including construction activities, and the ability to maintain traffic. This review should identify issues that may prevent implementation. Constructability review should include assessment of alignment, profile and cross section, vertical clearance, major utility conflicts, access for construction equipment, and adequacy of construction phasing. The Project Manager must include the Roadway Design Office, Structures Office, and Construction Office in the reviews of build alternative concept plans.

The proposed construction phasing of the build alternative(s) should be described in the *PER* and any challenges with implementation of the proposed project identified.

### **3.2.5.18 Construction Impacts**

The discussion in the Construction section of the Environmental Document should include impacts which may occur, whether they are disruptive or beneficial, and measures, where feasible, to reduce the amount of disruption from construction impacts. Generally, FDOT has standard construction practices which take into consideration many of the direct impacts of construction and provide for measures to reduce or eliminate their effects. These measures are found in the [Standard Specifications for Road and Bridge Construction](#).

There are occasions where FDOT may commit to implement specific measures, features, or activities. Such measures will become commitments by FDOT and, as such, must be incorporated in the Commitments section of the Environmental Document consistent with [Part 2, Chapter 22, Commitments](#) and [Procedure No. 650-000-003, Project Commitment Tracking](#).

The following items may be evaluated as appropriate, as part of the construction impacts analysis.

1. Air quality impacts related to open burning and dust control, see [Part 2, Chapter 19, Air Quality](#)
2. Noise and vibration impacts related to construction activities, see [Part 2, Chapter 18, Highway Traffic Noise](#)
3. Water quality protection related to erosion control, sedimentation, and turbidity reduction, see [FDM, Part 2, Chapter 251, Stormwater Runoff Control Concept \(SRCC\) Development](#)
4. Species and habitat protection related to construction activities, see [Part 2, Chapter 16, Protected Species and Habitat](#)

5. Traffic control during construction
6. Disposal of construction materials
7. Stockpiling of construction materials and fill
8. Use of borrow areas
9. Mitigation measures proposed to reduce dredge and fill-related impacts

### **3.2.5.19 Project Costs**

A table summarizing build alternative(s) costs should be included in the **PER**. Project costs include the costs of design, right of way acquisition, residential and business relocation, construction, Construction Engineering Inspection (CEI), environmental mitigation, and utility relocation.

The construction cost for each build alternative may be developed using FDOT's Long Range Estimate (LRE) program or another acceptable cost estimation method, but at a minimum, the LRE should be developed for the preferred alternative once it has been identified. Design and CEI costs may be estimated as a fixed percentage of construction cost. Wetland mitigation costs can be based per acreage costs for the appropriate year in the most recent version of **Chapter 11** of FDOT's [Work Program Instructions](#). FDOT's ROW estimates are used for ROW costs. For a project with utility impacts, the costs of utility relocation (if known) both directly and indirectly to FDOT are included.

Projects estimated to have a total construction cost over \$100 million require an Independent Project Cost (IPC) review on the preferred alternative. Coordination with Central Office Program Management Office is required.

### **3.2.5.20 Design Variations and Exceptions**

Project features that will need a Design Variation or Design Exception based on the project design controls and criteria, are discussed for each build alternative. This should include any design variations or design exceptions which have received approval.

## **3.2.6 Project Specific Engineering Considerations for Build Alternatives**

The following considerations should be documented in the **PER** for each build alternative, if appropriate. In instances of more than one build alternative, once the preferred alternative is selected, the **PER** can be modified to indicate which of the alternatives was selected as the preferred by highlighting or appending the alternative name to identify the preferred.

If any of the elements are not present in the proposed conditions, the appropriate box is checked in the **PER Project Involvement Checklist** to document without requiring further discussion in the **PER**.

### 3.2.6.21 Managed Lanes and Tolled Projects

It is the policy of FDOT to employ Managed Lanes on appropriate facilities that currently, or are expected in the future to, experience significant congestion in accordance with FDOT's [Managed Lanes, Policy No. 000-525-045](#). Managed Lanes are highway facilities or sets of lanes where TSM&O strategies are proactively implemented and managed in response to changing traffic conditions to provide congestion relief. They are generally considered in congested urban areas with limited ROW and where the previous widening projects have not met travel demand. For this reason, the Managed Lanes alternative is evaluated for its ability to provide long-term mobility, managed capacity, travel time reliability, and travel options. The Central Office Connected Vehicles, Arterials & Managed Lanes Engineer and Systems Management Administrator can be contacted for guidance.

PD&E Studies can evaluate the Managed Lanes alternatives against the no-action (No-Build) alternative if the project is included in the MPO LRTP as a Managed Lanes project, or if previously completed planning or corridor studies had recommended Managed Lanes per **23 U.S.C. §§ 129, 166, and 301**.

Typically, development of initial congestion pricing concepts and the decision to apply congestion pricing is made during the Planning phase. The initial congestion pricing concepts may be refined during the PD&E phase as more data related to engineering, finance, and public factors are collected. Therefore, the Project Manager should coordinate with the Florida Turnpike Enterprise Toll Studies and Forecasting Office about the decision to use congestion pricing and the scope of tolling analysis, if required during the PD&E phase.

If the project includes tolled facilities, the Project Manager must coordinate with the Florida Turnpike Enterprise Toll Studies and Forecasting Office for any tolled projects. The **PER** should discuss the results of the **Toll Siting Technical Memorandum (TSTM)**, if applicable.

### 3.2.6.22 Interchanges on Interstate Highways

If the project includes a new interchange or a modification to an existing interchange, the Project Manager must coordinate with the District Interchange Review Coordinator (DIRC) throughout development of the project to ensure that the alternative which received Safety, Operational, and Engineering (SO&E) acceptability in the **Interchange Justification Report (IJR)**, **Interchange Modification Report (IMR)**, or **Interchange Operational Analysis Report (IOAR)** is included as one of the PD&E Study alternatives. Additionally, the Project Manager must coordinate the project schedule with DIRC such that the SO&E acceptability is obtained before the **NEPA** document is sent to OEM for final approval. The IAR process and PD&E approval is further discussed in [Part 1, Chapter 4, Project Development Process](#).

To streamline project development, the traffic operational analysis, safety analysis, and conceptual design analysis performed to address the requirements of **23 CFR Part 624**

also support the development and evaluation of alternatives in the PD&E phase. FDOT's [Interchange Access Request User's Guide](#) provides guidance on how to prepare documents that support requests for new or modified access to the Florida Interstate system, Florida's Turnpike Enterprise, and non-interstate limited access facilities on the SHS.

If the preferred PD&E Study alternative is different from the interchange concept that received SO&E acceptability, the *IJR*, *IMR*, or *IOAR* must be re-evaluated to demonstrate that the preferred alternative meets the requirements of the IAR analysis procedure prior to the final approval of the *NEPA* document. The need and scope for the IAR re-evaluation must be determined through consultation with the DIRC, Statewide Interchange Review Coordinator (SIRC), and FHWA, as appropriate. See the [Interchange Access Request User's Guide](#) for IAR re-evaluation guidance.

### 3.2.6.23 ITS Transportation Systems Management & Operations Strategies

If a project uses federal funds and involves ITS technologies or a system of technologies, the requirements specified in the [Procedure No. 750-040-003, Florida Department of Transportation Systems Engineering and Intelligent Transportation System \(ITS\) Architecture Procedure](#) must be followed. The guidelines ensure an ITS project's compliance with **23 CFR § 940.11** and FDOT's requirements. Authorization of federal funds for construction or implementation of the project cannot proceed until compliance with **23 CFR § 940.11** is demonstrated.

**23 CFR § 940.11** requires that all ITS projects funded with highway trust funds be based on systems engineering analysis and have a project level ITS architecture that is coordinated with the development of the regional ITS architecture before advancing to final design. The Project Manager must prepare a high-level project ConOps and a **Preliminary System Engineering Management Plan (PSEMP)** to document the results of the system engineering analysis. The **PSEMP** is a technical document that defines the project's system engineering process for ITS deployments from concept to system operations in Florida consistent with **23 CFR Part 940**. **PSEMP** specifies systems engineering activities and what must be built to satisfy stakeholder needs. The Project Manager should coordinate with the District TSM&O Engineer or program manager and the County Engineer when developing the **PSEMP**. Example of project alternatives that may require a **PSEMP** are Managed Lanes alternatives, transit alternatives, and any alternative with TSM&O strategies, because they involve ITS technologies and may be funded by federal funds.

Some features of the TSM&O alternative may be incorporated into the build alternative(s), even if the TSM&O alternative does not meet the purpose and need of the project on its own. See [Part 2, Chapter 3A, Alternatives Analysis](#) for more information regarding the required alternatives analysis.

For each build alternative, ITS facilities are discussed based on the systems engineering analysis and TSM&O strategies or technologies that will be added in the build

alternative(s). The applicability of TSM&O strategies or technologies should be confirmed with the District TSM&O Program Engineer.

### **3.2.6.24 Lane Repurposing**

PD&E Studies that involve lane repurposing must meet the [Corridor Capacity Policy, Topic Number 000-525-075](#) and [Lane Repurposing Guidebook](#) requirements.

### **3.2.6.25 Landscape**

Discuss any landscaping accommodations included in the build alternative(s). Refer to [FDM, Part 2, Chapter 270, Planting Designs](#) for more information on planting designs. The Project Manager should meet with the District Drainage Engineer and Landscape Architect to explore opportunities for integrating drainage features with existing and proposed landscaping.

### **3.2.6.26 Lighting**

The **PER** should discuss lighting accommodations included in the build alternatives. Considerations should include safety, the impacts to neighborhoods, aesthetic impact, and impacts to sensitive species. Refer to [FDM, Part 2, Chapter 231, Lighting](#) for more information on lighting designs.

### **3.2.6.27 Wildlife Crossings**

The **PER** should discuss potential wildlife crossings associated with the build alternative(s). See [FDOT Wildlife Crossing Guidelines](#) for more information on evaluating the appropriateness of including wildlife crossings for proposed projects and design considerations.

If applicable, the Project Coordination section of the **PER** should discuss the coordination with appropriate resource/regulatory agencies or reference the discussion included in the **NRE**. Proposed wildlife crossings should also be coordinated with the Structures Office and included in the structures engineering and documentation.

### **3.2.6.28 Sea Level Rise**

Coastal projects should meet the Sea Level Rise (SLR) requirements set forth in **Chapter 3** of the [Drainage Manual, Drainage Manual, Topic No. 625-040-002](#), if feasible. Consultation occurs with the District Drainage Engineer if the project is unable to meet the [Drainage Manual](#) SLR policy, or if using projected sea level elevations higher than the [Drainage Manual](#) are appropriate.

The SLR considerations and proposed measures are documented in the **PER** for each reasonable or viable alternative, including the influence of these measures on the engineering decisions for the alternatives' development and evaluation during the PD&E phase.

### 3.2.6.28.1 FDEP Sea Level Impact Projection Study

Per **Chapter 62S-7, Florida Administrative Code (F.A.C.)**, FDOT must perform a Sea Level Impact Projection (SLIP) study for state-financed construction projects of a “potentially at-risk structure or infrastructure” within an “area at risk due to sea level rise”. A “potentially at-risk structure or infrastructure” means a “critical asset”, as defined in **Section 380.093(2)(a)1.3, F.S.** An “area at risk due to sea level rise” is defined as any location that is projected to be below the threshold for tidal flooding [two feet above (Mean Higher High Water)] within the next 50 years by adding the highest SLR projection required by **Section 380.093(3)(d)3.b., F.S.** In accordance with **Section 380.0937, F.S.**, FDEP has developed a **SLIP Study Tool** for performing a SLIP study analysis and submitting it for review. Although consideration must be given to the findings of the SLIP studies, there is no requirement to implement mitigation strategies based on the **SLIP Study Report**.

The **Resilience Report** that is prepared in the EST identifies whether a project requires a SLIP study. The results generated by the tool fulfill the requirements of **Section 380.0937, F.S.** The FDEP **SLIP Study Tool** must be accessed by an approved, registered user account. The FDOT Project Manager may be contacted for the registration account specific to each FDOT District. For these qualifying projects, per **Rule 62S-7 F.A.C.**, FDOT may not commence construction until notified by the FDEP that:

- The **SLIP Study Report** was approved as meeting the requirements of **Section 380.0937, F.S.**, and
- The FDEP 30-day publication period has ended.

The input parameters to the **SLIP Study Tool** should be documented within the **PER** produced as part of the PD&E Study. The **SLIP Study Tool** generates a **SLIP Study Report**, which is published on the FDEP Slip Study website. If there are modifications to the preferred alternative in Design that would result in more significant impacts from SLR, the SLIP study is modified and resubmitted.

### 3.2.6.29 Structures and Bridges

The sections below include elements of build project alternatives that may require bridges, retaining walls, tunnels, culverts, or other structural analysis.

A proposed typical section and bridge concept for all bridges or build alternatives should be included in the **PER** along with the proposed superstructure, substructure, and foundation type for each bridge and the breakdown of cost.

#### 3.2.6.29.1 Bridge Analysis

A bridge analysis is completed following [FDM, Part 1, Chapter 121, Bridge Project Development](#), which provides guidance on which elements and considerations are to be included in the analysis.

For projects involving replacement of a bridge that is considered historic, or has substantial community value, the study may include a rehabilitation or repair alternative.

If the bridge has an existing or proposed wildlife crossing feature, coordination with the District Environmental Manager and the resource agencies is required to ensure appropriate bridge design alternatives are considered.

The purpose of the bridge analysis is to determine the general attributes for the bridge alternative(s). The bridge analysis must provide conceptual guidance for the bridge designer who will develop specific attributes of the bridge (such as bridge design and structure type) in the **BDR**. The scope of services for the PD&E phase must specify the level of structural analysis and development for each anticipated bridge structure in the study. The findings of the bridge analysis must be approved by the District Structures Design Office or the State Structures Design Office in accordance with [FDM, Part 1, Chapter 121, Bridge Project Development](#). The District Structures Design Engineer must concur with the findings of the bridge analysis by signing the **Typical Section Package**. See [FDM, Part 2, Chapter 260, Bridge Structures](#) for the contents of the bridge analysis and **BDR**. Bridge replacement PD&E Studies do not require preparation of a **PER**, rather the preliminary engineering analysis results for these projects may be documented in the **BDR** or **BRR**.

### 3.2.6.29.2 Braided Underpass Structures

Design of interchange concepts and ramp configurations must consider the three-dimensional relationship of roadway and bridge components. Such components can include the mainline, auxiliary lanes, ramps, Collector-Distributor (C-D) roads, braided (grade-separated) ramps, ramp terminal intersections, and ramp junctions. When an interchange concept involves braided underpass structures, the Project Manager must coordinate with the District Structures Design Engineer to ensure vertical and horizontal geometry of the bridges can be structurally designed. Braided underpass structures usually carry primary roadway traffic (e.g., mainline or C-D road traffic) over secondary roadway traffic (e.g., ramp traffic). They typically consist of single-span bridges where the beams or flat slab superstructure component is not oriented parallel to traffic of the overlying roadway and a portion of the superstructure and substructure extends beyond the limits of the traffic barriers (refer to the [Structures Manual, Topic No. 625-020-018](#) for details).

### 3.2.6.29.3 Bridge and Culvert Hydraulics

The drainage engineer must prepare an **LHR** for bridges over water in accordance with the procedures outlined in the [Drainage Manual, Topic No. 625-040-002](#). See [Part 2, Chapter 13, Floodplains](#) for guidance on how to prepare an **LHR**. Depending on the level of engineering analysis during the PD&E phase, a **Bridge Hydraulic Report (BHR)** may be prepared to determine the hydraulic length of the bridge.

The District Drainage Engineer should review tidal projects, including impacts from SLR, to determine if coastal hydraulics is a meaningful consideration in a roadway or bridge

project's design. When coastal hydraulics is essential to the project, a coastal engineer must assist in determining the level of bridge analysis effort during project scoping. The [Drainage Manual Topic No. 625-040-002](#) discusses when a qualified coastal engineer should become involved in coastal analyses.

#### **3.2.6.29.4 Perimeter Walls**

The request for consideration of a perimeter wall must come from the local municipality in which the project is located or from a group of directly affected residences/property owners adjacent to the project. These requests should be documented in the project file as early in the project as possible (i.e., during the PD&E phase of the project). If a request for perimeter wall consideration has been made, it is the responsibility of the Environmental Office Project Manager to forward the request to the appropriate design staff/project manager to ensure complete follow through on the request.

Perimeter walls are not intended to provide any noise reduction, nor are they intended to serve as a substitute for noise barriers at locations where a noise analysis has determined that the construction of noise barriers is not feasible and cost reasonable. Perimeter walls are also not intended to be used as mitigation for environmental impacts. Perimeter walls will not be considered as a retrofit for existing conditions, and are only given consideration when a minimum of one of the following conditions are met:

1. Expanding the capacity of an existing highway by adding lanes to the outside of the existing travel lanes;
2. The significant alteration of the vertical or horizontal alignment of an existing highway;
3. A new highway on a new alignment;
4. The removal of existing extensive vegetation or visual barrier within the FDOT ROW;

Exceptions to any of the items listed above will be considered on a case-by-case basis by the Assistant Secretary of Engineering and Operations.

If at least one of the above conditions is met, further consideration for the construction of a perimeter wall can proceed. The following requirements must also be met:

1. Building permits for the structures on the adjacent land that would realize a benefit from the perimeter wall must be issued prior to the approval of the Environmental Document.
2. Traffic on the project roadway must be visible from the adjacent property.
3. All structures for which the perimeter wall is being considered must be immediately adjacent to the FDOT's ROW and within 150 feet of the edge of the nearest travel lane. Additionally, the perimeter wall must be constructible

- within the FDOT's ROW or an easement must be granted to facilitate construction, if necessary.
4. The perimeter wall must be continuous, with no openings to accommodate driveways or other access requirements.
  5. The cost of the perimeter wall per adjacent land owner, shall not exceed a unit cost equal to 2/3 that of a noise barrier, based on the current cost effectiveness criteria, for Noise Barriers (see [Part 2, Chapter 18, Highway Traffic Noise](#)).
  6. The height of a perimeter wall is limited to eight feet.
  7. A simple majority of the adjacent property owners must support the construction of the perimeter wall. During the Design phase, FDOT will use either a perimeter wall workshop and/or a public survey to determine the wishes of the adjacent property owners. The survey effort may include a mailing of information related to the perimeter wall along with a survey form to be signed and returned to FDOT. Multiple techniques to solicit input may be used, including multiple mailings, door-to-door follow up, and even telephone solicitation (as needed) to provide adequate information to allow FDOT to make an informed decision on whether the perimeter wall is desired or not.

[FDM, Part 2, Chapter 264, Noise Barriers and Perimeter Walls](#) provides additional details on the requirements for consideration of perimeter walls.

### **3.2.6.30 Rest Areas, Weigh Stations, Truck Parking Areas**

Features such as ramp configuration, signage, and ITS technologies should be coordinated with the Modal Development Office. Engineering considerations are discussed in the *PER*.

### **3.2.6.31 Special Features**

Any features that are not commonly associated with a transportation project should be discussed in the *PER*. Examples could include any features included to protect or minimize impacts to the environment, or special aesthetic features such as public spaces, scenic views, lighting, landscaping, signage, vegetation, or pavers.

## **3.2.7 Environmental Considerations for Build Alternatives**

The environmental topics/resources and environmental constraints identified within the project area must be incorporated as part of the alternative development and evaluation process. Refer to [Part 2, Chapter 3A, Alternatives Analysis](#) for detailed guidance.

If any of the elements are not present in the proposed conditions, the appropriate box is checked in the *PER Project Involvement Checklist* to document without requiring further discussion in the *PER*.

### 3.2.8 Value Engineering

In accordance with the [Value Engineering Program, Topic No. 625-030-002](#), all projects on the National Highway System (NHS) utilizing federal aid highway funding with an estimated total cost of \$50 million or more for non-bridge projects and \$40 million or more for bridge projects shall have a minimum of one **Value Engineering (VE) Study** performed during the development of the project prior to the completion of final design. The estimated total cost shall include all costs associated with all phases of the project, including environment, design, ROW, utilities, and construction. Projects delivered with the Design-Build method of construction are not required by federal regulation to have a VE analysis. Projects that have a potential for value improvements and do not meet the minimum criteria may also be studied. For more information about conducting a VE Study, refer to [Value Engineering Program, Topic No. 625-030-002](#).

A VE Study can be conducted either during PD&E phase or during Initial Engineering Design. If the VE Study is conducted during the PD&E phase, it must occur after alternatives analysis is complete and before the public hearing (if held). When the VE Study is conducted during the PD&E phase, it gives the project an early review by other FDOT Offices, such as construction and maintenance, that could lead to significant life cycle cost savings. In addition, all VE issues/recommendations should be resolved before scheduling a public hearing. The Project Manager should coordinate scheduling of the VE Study with the District Value Engineer and make sure that the draft Environmental Document, **PER**, and other technical documents are available for review by the VE team. Recommendations from the VE Study must be incorporated in the comparative alternatives evaluation and documented in the **PER** and the Environmental Document. If a VE Study is deferred to Initial Engineering Design, a statement to that fact is included in the **PER**.

### 3.2.9 Preferred Alternative

The identification of the preferred alternative is based on the results of the alternatives evaluation, community feedback, and agency coordination. Refer to [Part 2 Chapter 3A, Alternatives Analysis](#) for information regarding alternatives development and analysis.

The Preferred Alternative section of the **PER** should include discussion of the supporting reasons for selecting a specific alternative as the preferred. In instances of more than one build alternative, once the preferred alternative is selected, the **PER** can be modified to indicate which of the alternatives was selected as the preferred by highlighting or appending the alternative name to identify the preferred. The **PER** should include the concept plans of the preferred alternative in the Appendices.

When the design features of the preferred alternative do not meet the designated design criteria, Design Exceptions or Design Variations must be prepared and approved per [FDM, Part 1, Chapter 122, Design Exceptions and Design Variations](#). Detailed design of these features is performed during final design, in accordance with the [FDM, Part 1, Chapter 111, Final Engineering Design Process](#).

The **PER** should discuss if the preferred alternative was designed to a higher level of detail compared to other alternatives and any updates after the public hearing. After the public hearing (if held) and public and agency comments are considered, appropriate sections of the **PER** are updated to include preliminary design details associated with the preferred alternative based on comments received.

### 3.2.10 Preliminary Engineering Documentation

A **Preliminary Engineering Report (PER)** is prepared to document the results of engineering analysis for a SEIR, Type 2 CE, EA, or EIS. This section provides guidance on documenting the engineering considerations and alternatives analysis in the **PER**. Refer to [Part 2 Chapter 3A, Alternatives Analysis](#) for information on documenting alternatives in the Environmental Document. For bridge projects, a **PER** can be substituted with a **BDR** or **BRR**.

**PERs** for FDOT Federal Projects are required to go through a Quality Assurance (QA)/Quality Control (QC) check at the District level before submittal to OEM for review. During this process the [Preliminary Engineering Report QA/QC Checklist](#) is completed and then submitted to OEM with the **PER** for review. The OEM review team has 30 days to review the **PER**.

If the project requires a public hearing, a draft version of the **PER** is developed prior to the public hearing. After the public hearing is held, the draft **PER** is updated and finalized. A Florida registered Professional Engineer (PE) must sign and seal the Final **PER** in accordance with **Chapter 471, F.S.**

The FDOT [Preliminary Engineering Report Outline and Guidance Document](#) provides guidance for the preparation of the **PER**. At a minimum, the **PER** should contain the following:

1. Cover Page
  - a. The **PER** must use the **Technical Report Cover Sheet Requiring PE Signature, Form No. 650-050-38b** as the cover page of the report. Only the Final Report is signed and sealed. “Draft” and the date should be included on the cover of the Draft Report. The cover page of the **PER** and any transmittal letters associated with information packages for FDOT Federal Projects should include the following **NEPA** Assignment standard statement (see [Part 1, Chapter 4, Project Development Process](#))
2. Project Summary
  - a. Project Description - The project description includes a brief description of the project including name of the facility, location (City and County), project length, number of interchanges and bridges and/or major features, as applicable and as listed in [Part 2, Chapter 1, Project Description, Purpose and Need, and Planning Consistency](#). It must be consistent with

the Project Description in the Environmental Document. A project location map illustrating the project limits should display any landmarks mentioned in describing the proposed project or action. If the project is going to be designed or constructed in segments, then these segments should be clearly shown on the project location map.

- b. Purpose and Need – This section includes the purpose and need for the project. It must match exactly with purpose and need described in the Environmental Document. Refer to [Part 2, Chapter 1, Project Description, Purpose and Need, and Planning Consistency](#) for more information.  
  
PER Project Involvement Checklists- The **PER Project Involvement Checklists** document presence in the study area and any involvement with the proposed alternatives. If any of the considerations/conditions listed on the checklist are present, but have no involvement with the alternatives, “no involvement” is selected in the **PER Project Involvement Checklist**. Further discussion on that item is not needed elsewhere in the **PER**. These checklists are intended to reduce redundancy or irrelevant discussion between and within project documents. The **PER Project Involvement Checklists** can be found in the **PER Outline and Guidance Document** on FDOT’s [Engineering Resources Website](#).
  - c. Alternatives Analysis Summary – A summary of the alternatives analysis is provided per [Section 3.2.4](#) and [Part 2, Chapter 3A, Alternatives Analysis](#).
  - d. Description of the Preferred Alternative - This section includes a brief description of the preferred alternative, and explains why it was chosen as the preferred alternative, as well as any design exceptions or variations. An appropriate level of engineering detail is used to describe the preferred alternative such as alignment, number of lanes, their width, major structures, proposed capacity and safety improvements, multimodal accommodation, and estimated ROW to be acquired (parcels and acreage) and construction year per [Section 3.2.9](#).
  - e. List of Technical Documents – A list of technical documents prepared for the study is includes along with the dates of the draft or final Technical Documents as appropriate.
3. Existing Conditions - This section of the **PER** discusses previous planning studies, existing roadway conditions, and existing bridge conditions (if applicable) as listed in [Section 3.2.3.2](#) and [Part 2, Chapter 3A, Alternatives Analysis](#).
  4. Design Controls and Criteria - Design controls and criteria used to develop alternatives are listed as discussed in [Section 3.2.3.3](#). This section also includes the sources of the applicable criteria.

## 5. Alternatives Analysis

- a. The no-action (no-build) alternative, TSM&O alternative, multimodal alternative, and build alternative(s) are included per [Part 2, Chapter 3A, Alternatives Analysis](#).
- b. Alternatives that have been considered but eliminated, both in previous planning studies and during the PD&E study are discussed per [Part 2, Chapter 3A, Alternatives Analysis](#).
- c. The engineering considerations in the development of build alternative(s) are discussed per [Section 3.2.5](#) and [Section 3.2.6](#).
- d. The potential environmental involvement for the build alternative(s) and no-action (no-build) alternative are summarized. The results of the environmental technical reports are incorporated by reference based on project involvement identified on the **PER Project Involvement Checklists** to reduce repetition and in accordance with [Part 2, Chapter 3A, Alternatives Analysis](#).
- e. The recommendations from the VE Study are summarized per [Section 3.2.8](#) in the comparative alternatives evaluation, if applicable. It should be stated if the VE Study will be performed in later project phases if not completed in PD&E. If a standalone VE Alternative was prepared, the findings are summarized per [Part 2, Chapter 3A, Alternatives Analysis](#). If other project specific alternatives were developed, they are summarized in accordance with [Part 2, Chapter 3A, Alternatives Analysis](#).
- f. The criteria used to assess the performance of the viable and reasonable alternatives and no-action (no-build) alternative are summarized. This should include an Alternatives Evaluation Matrix to tabulate the performance of each reasonable or viable alternative in meeting the evaluation criteria per [Part 2, Chapter 3A, Alternatives Analysis](#). The comparative alternative evaluation must include the no-action alternative (no-build alternative).
- g. The selection of the preferred alternative, and any other relevant details are discussed per [Section 3.2.9](#). The concept plans are included in the Appendix of the **PER**.

## 6. Project Coordination

- a. Agency Coordination- This section briefly explains how the ETDM comments, local agency, and resource agency coordination were used to develop alternatives and select a preferred alternative.
- b. Public Involvement - This section includes a brief discussion of how public and stakeholder comments were considered in the development and

refinement of build alternatives and the comparative alternatives evaluation. It also should discuss any changes to the preferred alternative based on public hearing feedback. Refer to [Part 1, Chapter 11, Public Involvement](#) for public involvement requirements. It should include a reference to the project's **Summary of Public Involvement (SPI)**.

- c. Engineering Design Coordination - This section summarizes coordination with ongoing or committed projects near the project area. Major decisions affecting engineering items resulting from internal meetings and coordination should be noted. Refer to [Part 2, Chapter 3A, Alternatives Analysis](#) for more information on project coordination.
7. Appendices – The Appendices should include the **Typical Section Package**, alternative(s) concept plans, and project costs. Draft **PERs** should include the concept plans that have been developed, and the Final **PER** should include the preferred alternative concept plans.

### 3.3 REFERENCES

Chapter 62S-7, F.A.C. Public Financing of Coastal Construction “Slip Study Rule”.  
<https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62S-7>

Executive Order (EO) 11988, Floodplain Management. <https://www.epa.gov/cwa-404/floodplain-management-executive-order-11988>

FDOT, 2021, WATERSS Process Guidebook. <https://www.fdot.gov/environment/oem-divisions/eng/engineering-resources>

FDOT, Access Management Guidebook.  
[https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/systems/systems-management/document-repository/access-management/fdot-access-management-guidebook---nov-19.pdf?sfvrsn=c5aa6e5\\_4](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/systems/systems-management/document-repository/access-management/fdot-access-management-guidebook---nov-19.pdf?sfvrsn=c5aa6e5_4)

FDOT, Drainage Manual, Topic No. 625-040-002.  
<https://www.fdot.gov/roadway/drainage/drainage-design-aids>

FDOT, ETDM Manual, Topic No. 650-000-002. <https://www.fdot.gov/environment/oem-divisions/qa-qc/etdm-manual>

FDOT, Florida Design Manual, Topic No. 625-000-002.  
<https://www.fdot.gov/roadway/fdm/default.shtm>

FDOT, FDOT Wildlife Crossing Guidelines. <https://www.fdot.gov/environment/oem-divisions/env/protected-species-habitat>

FDOT, Local Programs Manual, Topic No. 525-010-300.  
<https://www.fdot.gov/programmanagement/LAP/LAP-TOC.shtm>

FDOT, Preliminary Engineering Report Outline and Guidance Document.

<https://www.fdot.gov/environment/documents-resources>

FDOT, Preliminary Engineering Report QA/QC Checklist.

<https://www.fdot.gov/environment/documents-resources>

FDOT, Project Commitment Tracking, Procedure No. 650-000-003. <https://pdl.fdot.gov/>

FDOT, State Safety Office Website. <https://www.fdot.gov/Safety/default.shtm>

FDOT, Safety Assessment Dashboard.

<https://www.fdot.gov/safety/safetyengineering/safetyanalysismethods.shtm>

FDOT, Safety Analysis Guidebook for PD&E Studies.

<https://www.fdot.gov/Safety/safetyengineering/publications-and-manuals.shtm>

FDOT, Traffic Analysis Handbook. <https://www.fdot.gov/planning/systems/systems-management/traffic-analysis>

FDOT, Work Program Instructions. <https://www.fdot.gov/workprogram/development/wp-instructions.shtm>

FDOT, Value Engineering Program, Topic No. 625-030-002.

<https://www.fdot.gov/roadway/qa/value-engineering.shtm>

FHWA, 1987, FHWA Technical Advisory. T6640.8A, Guidance for Preparing and Processing Environmental and Section 4(f) Documents.

<https://www.environment.fhwa.dot.gov/projdev/impta6640.asp>

FHWA, 2019, FHWA Bicycle and Pedestrian Planning, Program and Project Development.

<https://www.fhwa.dot.gov/pgc/index.cfm?ddisc=121&dsub=1475>

Section 335.065, F.S., Bicycle and pedestrian ways along state roads and transportation facilities. <https://m.flsenate.gov/statutes/335.065>

Section 380.093, F.S., Resilient Florida Grant Program.

[https://www.leg.state.fl.us/statutes/index.cfm?App\\_mode=Display\\_Statute&Search\\_String=&URL=0300-0399/0380/Sections/0380.093.html](https://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0380/Sections/0380.093.html)

Section 380.0937, F.S., Public Financing of Construction Projects Within Areas at Risk to Sea Level Rise.

[https://www.leg.state.fl.us/statutes/index.cfm?App\\_mode=Display\\_Statute&Search\\_String=&URL=0300-0399/0380/Sections/0380.0937.html](https://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=0300-0399/0380/Sections/0380.0937.html)

Title 23 CFR Part 450, Planning Assistance and Standards. <https://www.ecfr.gov/cgi-bin/text-idx?SID=41629bc4699d654b4164d357da2329e0&mc=true&node=pt23.1.450&rqn=div5>

Title 23 CFR Part 940, Intelligent Transportation System Architecture and Standards.  
<https://www.ecfr.gov/current/title-23/chapter-I/subchapter-K/part-940>

Title 23 U.S.C. § 129, Toll roads, bridges, tunnels, and ferries. <https://uscode.house.gov/view.xhtml?req=granuleid:USC-2010-title23-section129&num=0&edition=2010>

Title 23 U.S.C. § 301, Freedom from Tolls. <https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title23-section301&num=0&edition=prelim#:~:text=%C2%A7301.,from%20tolls%20of%20all%20kinds.>

USDOT Order 5650.2, Floodplain Management and Protection.  
<https://www.fhwa.dot.gov/engineering/hydraulics/policymemo/order56502.pdf>

USDOT, United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations. 2010.  
[https://www.fhwa.dot.gov/environment/bicycle\\_pedestrian/guidance/policy\\_accom.cfm](https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/policy_accom.cfm)

### **3.4 FORMS**

[Technical Report Cover Sheet Requiring PE Signature, Form No. 650-050-38b](#)

**Table 3-1 Example Elements in Design Criteria**

<b>Typical Section Design Criteria</b>	
Travel lane width	Shared use path width
Bicycle lane width	Border width/Horizontal Clearance/Lateral Offset
Outside Shoulder width (paved width and full width) Inside Shoulder width (paved width and full width)	Pavement cross slope
Median width	Maximum roadside slopes
Sidewalk width	
<b>Horizontal Alignment Design Criteria</b>	
Maximum deflection without a horizontal curve	Desired length of curve
Maximum deflection angle through intersections	Maximum superelevation
Minimum radius of curve	
<b>Vertical Alignment Design Criteria</b>	
Maximum profile grade Vertical Clearance	Minimum stopping sight distance
Maximum change in grade without a vertical curve	Minimum crest vertical curve K value
Base Clearance	Minimum sag vertical curve K value
Minimum distances required between VPI's	Minimum crest vertical curve length
Minimum grade	Minimum sag vertical curve length
<b>Structure Design Criteria</b>	
Design loading and structural capacity	Inside shoulder width, bridge
Lane width, bridge	Cross slope, bridge
Bicycle lane width, bridge	Median width, bridge
Sidewalk and shared use path width, bridge	Vertical clearance, bridge
Outside shoulder width, bridge	
<b>Drainage Design Criteria</b>	
Water quality criteria	Hydraulic bridge/bridge-culvert design criteria
Water quantity/attenuation criteria	Coastal design criteria
Floodplain/Floodway criteria	Scour criteria
BMP design criteria	

Engineering analyses, design concepts, and accompanying reports should be prepared consistently with the latest edition of the following documents:

1. [FDOT Design Manual \(FDM\), Topic No. 625-000-002](#)
2. [Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways \(Florida Greenbook\), Topic No. 625-000-015](#)
3. [Structures Manual, Topic No. 625-020-018](#)
4. [Approval of New or Modified Access to Limited Access Highways on the State Highway System \(SHS\), Topic No. 000-525-015](#)
5. [Level of Service Targets for the SHS, Topic No. 000-525-006](#)
6. [Median Openings and Access Management, Procedure No. 625-010-021](#)
7. [Manual on Uniform Traffic Studies \(MUTS\), Topic No. 750-020-007](#)
8. [Drainage Manual, Topic No. 625-040-002](#)
9. [Drainage Design Guide](#)
10. [Utility Accommodation Manual, Rule 14-46.001, F.A.C.](#)
11. [CADD Manual, Topic No. 625-050-001](#)
12. [Standard Plans for Road and Bridge Construction, Topic No. 625-010-003](#)
13. [Americans with Disabilities Act \(ADA\) Requirements for Access to Department Facilities, Topic No. 625-020-15](#)
14. [Transit Corridor Program, Topic No. 725-030-003](#)
15. [Right of Way Procedures Manual, Topic No. 575-000-000](#)
16. [Standard Specifications for Road and Bridge Construction](#)
17. [Project Traffic Forecasting, Procedure No. 525-030-120](#)
18. [Quality/Level of Service Handbook](#)
19. [Landscape, Policy No. 000-650-011](#)
20. [Traffic Engineering Manual \(TEM\), Topic No. 750-000-005](#)

**Figure 3-1 Manuals, Procedures, and Design Guides, and to Establish Project Development Design Controls and Criteria**

21. [Speed Zoning For Highways, Roads and Streets In Florida](#)
22. [Managed Lanes Guidebook](#)
23. [Context Classification Guide](#)
24. [Surveying and Mapping Procedure, Topic No. 550-030-101](#)
25. [Surveying and Mapping Handbook](#)
26. [Soils and Foundations Handbook](#)
27. [Interchange Access Request User's Guide](#)
28. [Traffic Analysis Handbook](#)
29. [Manual on Intersection Control Evaluation, Topic No. 750-010-003](#)
30. [FDOT Preliminary Engineering Report Outline and Guidance](#)
31. [Managed Lanes Policy, Policy No. 000-525-045](#)
32. [Systems Engineering and Intelligent Transportation System \(ITS\) Architecture Procedure, Procedure No. 750-040-003](#)
33. [General Tolling Requirements \(GTR\) Florida's Turnpike](#)
34. [WATERSS Process Guidebook](#)
35. [Corridor Capacity Policy, Topic No. 000-525-075](#)
36. [Lane Repurposing Guidebook](#)

The engineering analysis may also use national publications such as:

1. Highway Capacity Manual (HCM)
2. American Association of the State Highway and Transportation Officials (AASHTO) A Policy on Highway Geometric Design (AASHTO Green book)
3. AASHTO Highway Safety Manual (HSM)
4. NCHRP Report 1043, Guide for Roundabouts
5. AASHTO Guide for the Development of Bicycle Facilities
6. AASHTO Guide for the Development of Pedestrian Facilities
7. Manual on Uniform Traffic Control Devices (MUTCD)

**Figure 3-1 Manuals, Procedures, and Design Guides, and to Establish Project Development Design Controls and Criteria (Page 2 of 2)**