CHAPTER 17
PRELIMINARY ENGINEERING AND DESIGN

17.1 OVERVIEW

Various FDOT publications contain information on procedures, criteria, and standards for guiding and controlling preconstruction activities. These activities include project development, preliminary engineering analyses, environmental impact documentation, location surveys, right of way mapping, roadway and bridge/structures designs, and the development of PS&E. The Offices of Planning, Environmental Management, Right of Way, Design, and Program Management develop and control these manuals, guidelines, and standards. LAs must work with these offices through the District LP Administrator for current criteria, procedures, and standards that may apply to the design of a project.

For transportation projects on, under, or over Department-owned right of way, Florida law, ***Section 334.175 (2), F.S.***, requires the Department to review the project's design plans for compliance with Department design standards. In its sole discretion, the Department may reject designs which do not meet Department standards. The Department may also, in its sole discretion, allocate Department-managed resources, including structures engineers and/or project managers to projects involving complex design structures and other design structures not commonly used by the Department. In addition, all complex bridges and bridge types not commonly used by the Department constructed via the LAP delivery method will be monitored and inspected by Department personnel.

17.2 PROJECT DEVELOPMENT AND ENVIRONMENT PHASE

The PD&E phase consists of the evaluation of project potential impacts on natural, physical, social, and cultural environment. In this phase, various project alternatives are developed and analyzed to assess project impacts on the environment. Project alternatives may include geometric alignments and typical sections that avoid or minimize environmental impacts. Additionally, design parameters that support project progression from concept and preliminary design to final design are established during PD&E. Interagency coordination and public involvement must be conducted throughout the entire duration of the process to identify project impacts, permit requirements, commitments, and funding sources.

Each LA project must comply with the ***NEPA***, ***FDOT PD&E Manual (Topic No. 650-000-001)*** and the ***LPM, Chapter 18***.

17.3 LOCATION SURVEYS AND RIGHT OF WAY MAPPING

Field survey data for engineering and related right of way mapping activities may be required in the project development phase and will almost always be required in the final

design of local projects. For location survey and right of way mapping activities and products, LAs refer to ***Topic 550-030-101, Surveying and Mapping*** for guidance and may additionally use the ***FDOT Surveying and Mapping Handbook***, as a reference, but all such activities must comply with the ***Rule Chapter 5J-17, F.A.C. pursuant to Chapter 472, F.S***. Where applicable, survey work must obey the ***State Jurisdiction Boundary Surveys*** of the FDEP.

17.4 ROADWAY AND STRUCTURES DESIGN

Design criteria are intended to ensure that transportation projects are safe, economical, and fully functional transportation facilities. The Department supports the use of the highest level of criteria and standards that is practical for all facilities according to good engineering practice. LAs determine and document which standards apply when preparing the project prospectus and application for Federal funds. There are many local, State, and Federal laws, rules, and executive orders that may impact the design of a project.

The application of appropriate design criteria is dependent upon the LAP Project Classification. Classifications are determined by three primary factors: 1) highway system location, 2) total project cost, and 3) bridge/structures scope components.

LAP projects may be one of four types of classifications.

- **Class A** – On the SHS or NHS.

Further information on roadways included in the NHS can be found in multiple locations including:

1.) *At the Department's Transportation Data and Analytics Office website:* FDOT - NHS Maps.

2.) *At FHWA's map showing the NHS by County:* FHWA - NHS Maps - by FL County's.

3.) *At the USDOT Geographic Information System (GIS)* map *showing the NHS:* National Highway System | HEPGIS.

- **Class B** – Off the SHS and NHS with an estimated construction value of $10 million or greater.
- **Class C** – Off the SHS and NHS and includes structural components inclusive of a vehicular bridge, a pedestrian bridge over a roadway, or a box culvert that meets the definition of a bridge.

- **Class D** – Off the SHS and NHS; may include structural components inclusive of pedestrian bridges not over a roadway, bridges on multi-use paths not over a roadway, and box culverts that do not meet the definition of a bridge.

A bridge is defined per 23 CFR 650.305 as a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between under copings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

The project classification determines the minimum design criteria and standards, the construction specifications, related materials testing requirements, and the qualifications requirements that are applicable to a project. Additional information on incorporating the appropriate project construction specifications and materials testing requirements is provided in ***Chapter 20*** of the ***LPM***. Additional information on FDOT Prequalification programs for consultants and contractors is found in ***Chapters 14*** and ***20*** respectively. An illustration of how design standards, construction specifications, materials testing and related qualifications requirements are tied to project classifications is shown in ***Table 1*** on the next page. ***Table 1*** *identifies the* ***minimum*** *criteria required for a LAP project, LAs may use standards above the identified minimums to develop projects.*

For **Class A** construction projects, **Class B** construction projects, and the structures components in **Class C** projects apply the FDOT Design Manual (FDM) (***Topic No. 625-000-002)***, Standard Plans for Road and Bridge Construction (commonly referred to as the Standard Plans), and the Utility Accommodation Manual ***(Topic No. 710-020-001***) (commonly referred to as the ***UAM***).

The ***FDM*** is reviewed by FHWA annually, in compliance with ***23 USC 109***, which provides that design standards for projects on the NHS must be approved by the Secretary of the US Department of Transportation in cooperation with the State DOT's. Per ***23 CFR 637.201-207***, NHS projects must meet FHWA's quality assurance criteria as described in the referenced CFR. Since the State's process is the only process "approved" by FHWA, all NHS projects must use the FDOT's approved design criteria, specifications, and construction quality assurance program (the ***CPAM*** is the approved construction QA program).

For the **Class C** non-structural components and **Class D** construction projects apply the ***Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways***, commonly known as the Florida Greenbook ***(Topic No. 625-***

000-015). The ***Florida Greenbook*** provides uniform minimum standards and criteria for the design, construction, and maintenance of all public streets, roads, highways, bridges (as defined by ***23 CFR 650.305***), sidewalks, curbs and curb ramps, crosswalks, bicycle facilities, underpasses, and overpasses used by the public for vehicular and pedestrian traffic.

TABLE 1: Project Classifications

Full Manual titles and Topic Numbers are identified in the following paragraphs and **Chapter 20*

PROJECT CLASSIFICATIONS	DESIGN CRITERIA AND STANDARDS$_1$*	SPECIFICATIONS*	MATERIALS TESTING*	QUALIFICATIONS
Class A On the SHS or NHS	FDOT Design Manual, FDOT Structures Manual and FDOT Standard Plans	LAP Division 1 Specifications as well as Division II and III of the FDOT Standard Specifications for Road & Bridge Construction	Samples Testing and Reporting Guide and ***FDOT Materials Manual***	FDOT Prequalified consultants and contractors
Class B Off the SHS and NHS with an estimated construction value of $10 million or greater.	FDOT Design Manual, FDOT Structures Manual and FDOT Standard Plans	LAP Division 1 Specifications as well as Division II and III of the FDOT Standard Specifications for Road & Bridge Construction	Samples Testing and Reporting Guide and ***FDOT Materials Manual***	FDOT Prequalified consultants and contractors

Class C Off the SHS and NHS and includes structural components: • a vehicular bridge • pedestrian bridge over a roadway • box culvert meeting the definition of a bridge as stated in 23 CFR 650.305	1) For structures components, use the FDOT Design Manual, FDOT Structures Manual and FDOT Standard Plans 2) For all other components, use the Florida Greenbook	1) For the structures components, LAP Division 1 Specifications as well as Division II and III of the FDOT Standard Specifications for Road and Bridge Construction 2) For all other components, LAP Division 1 Specifications and either LAP Big 3 or approved Local Agency Specs	1) For structures components, use the Samples Testing and Reporting Guide and ***FDOT Materials Manual*** 2) For all other components, use Local Agency materials testing process as approved by FDOT	FDOT Prequalified consultants and contractors
Class D Off the SHS and NHS, may include structural components: • pedestrian or shared use path bridges not over a roadway • box culverts that do not meet the definition of a bridge as stated in 23 CFR 650.305	Florida Greenbook -Or- Approved Minimum Design Standards chosen by local agency which conform to the minimum criteria provided in *Florida Greenbook*	LAP Division 1 Specifications and either LAP Big 3 or approved Local Agency Specs	Local Agency materials testing process as approved by FDOT	Local Agency qualified consultants and contractors

[1]For structures constructed within State Road right of way, the Department reserves the right to review and approve the bridge concept. In general, spans constructed within State Road right of way shall utilize "form-follows-function" design philosophies. Concept shall avoid non-structural attachments, cables, or cladding elements.

23 CFR 625 - Design Standards for Highways, includes those standards, policies, and standard specifications that are acceptable to the FHWA for application in the geometric and structural design of highways. Projects on the NHS must be designed to meet those FHWA approved standards. Requirements for the design and construction of transportation facilities include, but are not limited to the following:

- Manual on Uniform Traffic Control Devices (commonly known as the *MUTCD*)
- 2006 ADA Standards for Transportation Facilities as required by ***49 CFR 37.41*** or ***37.43***

- 2012 Florida Accessibility Code for Building Construction as required by Rule *61G20-4.002, F.A.C.*

For situations where specific design criteria and standards are not currently addressed in Department publications, use current approved technical publications, such as ***A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, AASHTO Guide for the Development of Bicycle Facilities and AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities*** as design guidelines. LAs must ensure that project designs meet or exceed the referenced design criteria and that the standards developed are appropriate for the proposed facility.

The FDOT Design Office's Documents and Publications webpage provides a listing of publications that establish the criteria for the critical areas of roadway and bridge/structure designs.

17.5 DESIGN EXCEPTIONS, UTILITY EXCEPTIONS, AND DESIGN VARIATIONS

The LA must identify all Design Exceptions and Design Variations for the project early on during PD&E or initial engineering design phase, as appropriate. This allows time for designers to evaluate design alternatives and to obtain Design Exceptions and Design Variations approval before plans are in the final design phase.

Design Exceptions, Design Variations, and Utility Exceptions must be prepared and submitted for review according to the governing design criteria. If the project is on the SHS or NHS, the EOR shall obtain approval consistent with the FDM 122 – Design Exceptions and Design Variations. If the project is off the SHS and NHS, the EOR obtains approval of the Design Exceptions, consistent with the Florida Greenbook, Chapter 14 – Design Exceptions. For all utilities located on the SHS, the criteria in the ***UAM*** govern, and the Utility Agency/Owner (UAO) must use the Utility Exception processes found therein.

17.6 SOLE SOURCE OR PROPRIETARY PRODUCTS

The use of patented and/or proprietary products may only be used with approval from the Department. Specifications should be formulated to allow full opportunity for competition among equivalent materials, equipment, and methods. References in specifications and on plans to single trade name materials, sole-source processes, or if a project calls for a proprietary product, the Department's ***FDM 110.4.1*** must be followed. The District's

Design Project Manager will coordinate approvals and ***PSEE*** tracking per the ***FDM*** process.

17.6.1 Approved Products List

The Department maintains a database that identifies products that have been approved for use on SHS and NHS called the *Approved Products List* (APL). The products are listed by Specification, Structures, or Design Index reference that identifies the product or material requirements. If a desired product for a LAP project is not on the APL, the LA or their EOR may contact the District LP Administrator and State Materials Office at Product.Evaluation@dot.state.fl.us for further assistance. The APL may contain products produced by convict labor under the State's "PRIDE" program. Convict produced materials (or labor) are not allowed on Federal-aid highway projects.

17.7 LOCAL AGENCY RESPONSIBILITIES

Funding for the design phases of LAP projects varies from project to project. Whether the Department reimburses the LA for the design or the LA funds the design work itself, the Department must review and accept design plans prior to construction for all LAP projects. Specific details on executing a LAP Agreement and procuring a Federal-aid participating design contract may be found in ***Chapters 5*** and ***14*** of the ***LPM***.

17.7.1 Use of Department Technology for Project Administration and Review

The LA is required to use the Department's Electronic Review Comments (ERC) application and GAP for submission of various documents during the design phase, as applicable. Specific documents are identified in the ***LPM***, but coordination with the District LP Teams for periodic updates and project specific requirements may be required of the LA. Department staff may request any documentation required to administer and monitor LAP projects. Furthermore, LAs should subscribe to the Department's Contact Mailer system for design updates. Contact Mailer is the Department's primary mechanism for notifying our customers of changes that impact the way the Department and our partners do business.

17.7.2 Design Phase Review Process

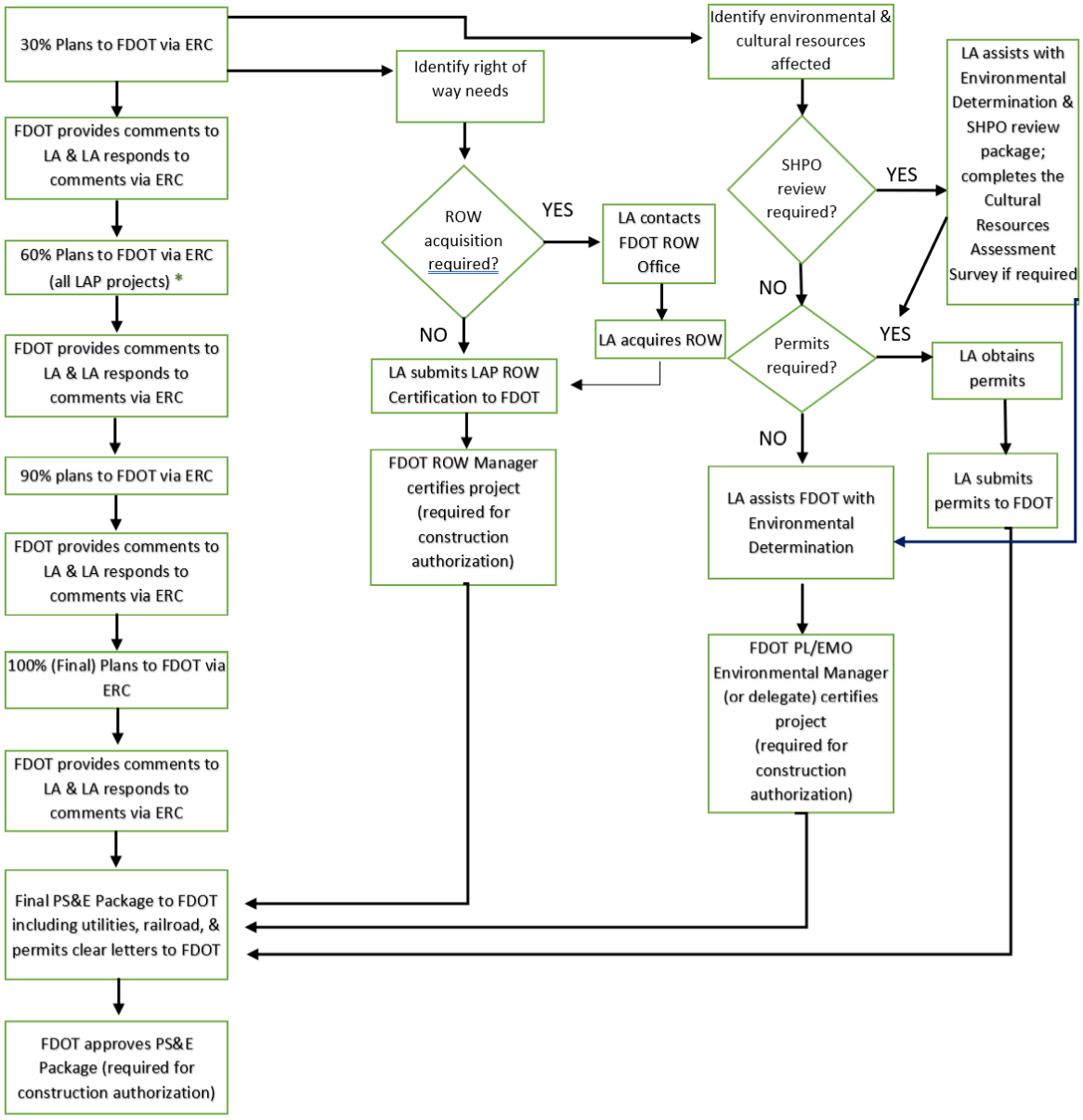
The process outlined in this ***Chapter*** represents a high-level outline of how a design phase may be administered by the Department. ***Figure 1: Design Phase Submittals Flowchart*** on the next page provides an overview of the general LAP project design

process and those elements in the process requiring Department review and acceptance in order to obtain Federal Authorization for the construction phase of the project. Due to the nature of construction projects, the Districts must establish a detailed process tailored to each project. Contact the District LP Team to coordinate a schedule and specific requirements for your project.

In addition, FDM 301, Table 301.2.1 ***"Summary of Phase Submittals"*** provides an excellent guide to what sheets are expected at each phase submittal and whether the sheets should be preliminary, complete, or final.

The number of phase submittals, complexity of right of way acquisition, and environmental impacts may vary by project. ***Chapter 19*** contains detailed information on the LAP right of way acquisition process. ***Chapter 18*** contains detailed information on the ***NEPA*** documentation process.

Figure 1: Design Phase Submittals Flowchart



* FHWA reviews & comments based on oversight determination, and in accordance with project's Stewardship and Oversight Plan.

17.8 RESOURCES

FDOT Project Development & Environment (PD&E) Manual (Topic No. 650-000-001)

FDOT's Surveying and Mapping (Topic No. 550-030-101-d), this procedure replaces:

- FDOT's Right of Way Mapping Policy (Topic No. 550-030-015)
- FDOT's Surveying Procedure (Topic No. 550-030-101)

FDOT Right of Way Mapping Handbook

FDOT Design Manual (Topic No. 625-000-007)

FDOT Construction Project Administration Manual (Topic No. 700-000-000)

Utility Accommodation Manual (Topic No. 710-020-001)

Florida Greenbook also known as the Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways (Topic No. 625-000-015)

FDOT Design Office's Documents and Publications webpage

Electronic Review Comments (ERC) application

GAP

FDOT - NHS Maps - Florida Federal Aid Systems

FHWA - NHS Maps website by FL County's

USDOT - FHWA - HEPGIS NHS Maps Website

FDOT's Contact Mailer system

Federal Highway Administration Design Webpage