111 Final Engineering Design Process

111.1 General

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

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

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

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

Toll facility design requirements are contained within ***FDM 280*** through ***FDM 286*** and ***FDM 947***. For projects that propose new toll infrastructure, utilize the preliminary Toll Siting Technical Memorandum (TSTM) to refine and finalize it throughout the design process in accordance with ***FDM 280.10.3***.

Figure 111.1.1 Major Activities – Final Engineering Design Process



111.2 Final Engineering Design

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

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

(1) Pavement design

(2) Drainage design

(3) Structural (bridge) design

(4) Structural (roadway) design

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

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

(7) Utility adjustment design

(8) Permit preparation design including ponds, mitigation

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

(10) R/W requirements design

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

(12) Estimates and quantities preparation

(13) Specifications and special provisions

(14) Landscape design including accommodating existing and proposed vegetation

(15) Noise barrier design

(16) Toll facilities design

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

111.2.1 Work Program Administration (WPA) System

Project stationing information is to be checked and entered into the Work Program Administration (WPA) system during final engineering design. This information is

important for tying construction records (such as material coring, sampling and testing) to other databases. The information is entered by stations, which are related to roadway milepost for future information retrieval.

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

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

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

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

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

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

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

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

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

111.3 Contract Plans and BIM Files

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

(1) Roadway

(2) Signing and Pavement Marking

(3) Signalization

(4) Intelligent Transportation Systems (ITS)

(5) Lighting

(6) Landscape

(7) Architectural

(8) Structures

(9) Toll Facilities

(10) Utility Work by Highway Contractor

When a Utility Work by Highway Contractor (UWHC) Agreement is assigned a separate Financial Project ID, the UWHC Plans are prepared as a strung project with a separate Estimated Quantities (EQ) Report. The EQ Report must identify which quantities are reimbursable (and non-reimbursable) to the Department under the terms of the agreement.

When the utility work to be performed by the highway contractor is minor (such as manhole, valve box, or meter box adjustments under Phase 52 and Sequence 02 through 99), the UWHC Plans may be either:

- Included as a separate component of the lead Contract Plans Set,
- Incorporated directly into the lead Contract Plans Set.

In both cases, include the utility quantities in the lead Project EQ Report.

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

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

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

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

111.4 Standard Specifications and Special Provisions

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

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

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

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

111.4.1 Modified Special Provision (MSP)

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

111.4.2 Technical Special Provision (TSP)

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

TSPs describe:

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

TSPs should be developed and entered into Electronic Review Comments (ERC) as early as practical, but not later than the Phase III submittal.

District Specifications and Estimates Office reviewers and appropriate technical discipline reviewers will provide comments through ERC. The State Specifications Office may assist the district with the review of a TSP, when requested. After the TSP ERC comments have been reconciled, the District Specifications Office will coordinate the required legal review

with the (District/Department) General Counsel. After receiving concurrence from the General Counsel, the District Specifications Office will approve the TSP.

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

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

TSPs associated with toll facilities are maintained under Turnpike governance. Refer to ***FDM 280.11*** for toll-specific TSPs.

111.5 Pay Items and Summaries of Quantities

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

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

111.6 PS&E Submittal Package

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

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

111.7 Project Documentation

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

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

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

111.7.1 File Naming Convention

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

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

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

111.7.2 Documents

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

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

Table 111.7.1 Document Summary Table

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

Table 111.7.1 Document Summary Table (Cont.)

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

Table 111.7.1 Document Summary Table (Cont.)

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

Table 111.7.1 Document Summary Table (Cont.)

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

Table 111.7.1 Document Summary Table (Cont.)

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

Table 111.7.1 Document Summary Table (Cont.)

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

Table 111.7.1 Document Summary Table (Cont.)

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