121 Bridge Project Development

121.1 General

Structural designs for new construction are developed under the direction of the Structures Design Office (SDO) and the District Structures Design Offices (DSDO).

Designs are to be developed in accordance with:

- This manual
- The ***Structures Manual*** ***(Topic No. 625-020-018)***
- The ***Standard Plans*** ***(Topic No. 625-010-003)***
- The ***AASHTO-LRFD Bridge Design Specifications*** as referenced in the ***Structures Manual***
- Applicable FHWA Directives
- Other criteria as specified by the Department

Structural designs for repair or rehabilitation of bridges are generally developed under the direction of the District Structures Maintenance Engineer (DSME) and may not include all the submittal types discussed in this chapter.

Modification for Non-Conventional Projects:
Delete the above paragraph.

Structure designs for other agencies or authorities such as the Jacksonville Transportation Authority or various Expressway Authorities may meet the Department's criteria or additional criteria as specified by the authority.

For projects involving bridges over navigable water, notify the DSME a minimum of 90 days prior to engaging in any action in, on, or around the bridge. Refer to ***FDM 110.5.3*** for further information.

121.2 Organization

The SDO is a subdivision of the Office of Design under the direction of the Chief Engineer and the Assistant Secretary for Engineering and Operations. The SDO is under the direction of the State Structures Design Engineer (SSDE). Each district, including the Turnpike, has a staff of structural design engineers that comprise the DSDO, and which is under the direction of the District Structures Design Engineer (DSDE).

121.3 Definitions

All structures are grouped into the following two categories based upon design difficulty, structural complexity, type of construction materials used and history of use in Florida.

121.3.1 Category 1 Structures

The following structure types are classified as Category 1 Structures:

(1) Box or three-sided culverts

(2) Bridges with simple or continuous span reinforced concrete slab superstructures

(3) Bridges with prestressed concrete slab superstructures

(4) Bridges with simple span non-post-tensioned concrete beam or concrete girder superstructures with cast-in-place decks

(5) Widenings for the structure types listed above

(6) Prefabricated steel truss pedestrian bridges meeting the Category 1 conditions of ***FDM 266.4***

(7) Retaining walls

(8) Roadway signing, signalization, and lighting supports

(9) Overhead sign structures and toll gantries

(10) Noise walls and perimeter walls

121.3.2 Category 2 Structures

All structure types not listed above are classified as Category 2 Structures unless exempted by the SDO. In addition to, or in lieu of, the criteria listed above, a structure is classified as a Category 2 Structure when any of the following are present:

(1) Bridge substructures containing any of the following:

- (a) Post-tensioned components
- (b) Straddle piers
- (c) Integral caps
- (d) Mildly reinforced pier column with net sustained tension on the extreme fiber under permanent service loads in the final condition

(2) Bridges designed for vessel collision or bridges with superstructures subject to the application of wave loads per ***Drainage Manual*** ***Section 4.9.5***.

(3) Bridges with non-redundant foundations, micropiles, or auger cast piles

(4) Any component designed using Fiber Reinforced Polymer (FRP) composite materials except components in the ***Standard Plans*** that include FRP composite materials

(5) Braided underpass structures where the beams or flat slab superstructure element is not oriented parallel to traffic of the overlying roadway and a portion of the superstructure and substructure extends beyond the limits of the overlying traffic barriers

(6) Design concepts, components, elements, details, or construction techniques not normally used by Florida DOT, including but not limited to:

- (a) New bridge types
- (b) New materials used to construct bridge components
- (c) New bridge construction methods
- (d) Non-standard or unusual bridge component-to-component configurations and connection details
- (e) Department issued ***Developmental Standard Plans*** or modified versions of Developmental Design Standards
- (f) Items not covered by the Department's ***Standard Specifications***
- (g) All atypical precast structural elements (the following are not considered to be atypical: AASHTO Beams, and precast elements included in the ***Standard Plans***)
- (h) Prefabricated Bridge Elements and Systems (PBES) not meeting all requirements of Chapter 25 of the ***Structures Detailing Manual***

The Department supports the use of accelerated project construction techniques including the expanded use of precast/prefabricated bridge elements and systems as a way to reduce costs, construction time, and user impacts; however, the use of precast/prefabricated bridge elements can create long-term durability and quality issues depending on the details utilized. Therefore, the designs and details for these elements must be approved by the Department prior to use.

Modification for Non-Conventional Projects:
Items listed in numbers 4 through 6 above are not allowed unless they are specifically permitted in the RFP or unless they are submitted and approved during the Alternative Technical Concept (ATC) process.

121.4 Abbreviations and Acronyms Used in Structures Design

Terminology used in the area of Structures Design is often written in the form of abbreviations or acronyms. The following is a list of acronyms frequently encountered in this manual and in other references used in structures design and include those commonly used for offices, organizations, materials, systems, features, equipment, conditions, and expertise:

AASHTO	***American Association of State Highway and Transportation Officials***
ACI	***American Concrete Institute***
ACIA	***Assigned Commercial Inspection Agency***
ADA	***Americans with Disabilities Act***
AISC	***American Institute of Steel Construction***
ANSI	***American National Standards Institute***
APL	***Approved Products List***
AREMA	***American Railway Engineering and Maintenance Association***
ASTM	***American Society for Testing and Materials***
AWS	***American Welding Society***
BBS	***Bulletin Board System***
BDR	***Bridge Development Report***
BHR	***Bridge Hydraulics Report***
BHRS	***Bridge Hydraulics Recommendation Sheet***
CADD	***Computer Aided Design and Drafting***
CEI	***Construction Engineering and Inspection***
C.I.P. (C-I-P)	***Cast-in-Place (Concrete)***
CSIP	***Cost Savings Initiative Proposal***

CPAM	***Construction Project Administration Manual***
CVN	***Charpy V-Notch (Impact Testing)***
DSDE	***District Structures Design Engineer***
DSDO	***District Structures Design Office***
DSME	***District Structures Maintenance Engineer***
EOR	***Engineer of Record***
FDOT	***Florida Department of Transportation***
FHWA	***Federal Highway Administration***
GRS	***Geosynthetic Reinforced Soil***
LRS	***Low-relaxation Strands***
LRFD	***Load and Resistance Factor Design***
MHW	***Mean High Water***
MSE	***Mechanically Stabilized Earth (Walls)***
MUTCD	***Manual on Uniform Traffic Control Devices***
NBR	***Nominal Bearing Resistance***
NHS	***National Highway System***
NHW	***Normal High Water***
NOAA	***National Oceanic and Atmospheric Administration***
OEM	***Office of Environmental Management***
OIS	***Office of Information Systems***
OSHA	***Occupational Safety and Health Administration***
PDA	***Pile Driving Analyzer***
PD&E	***Project Development and Environment***
PPD	***Plans Production Date***
RDR	***Required Driving Resistance***
RFP	***Request For Proposal***
SDO	***Structures Design Office***
SIP (S-I-P)	***Stay-in-Place (Forms)***
SRS	***Stress-relieved Strands***
SSDE	***State Structures Design Engineer***
TAG	***Technical Advisory Group (SDO and DSDEs)***
TFE (PTFE)	***Polytetrafluoroethylene (Teflon)***
TRB	***Transportation Research Board***
TTCP	***Temporary Traffic Control Plans***
UBC	***Ultimate Bearing Capacity***
UV	***Ultraviolet***

121.5 Responsibility

The DSDO has total project development and review responsibility for projects involving Category 1 Structures. The SDO has total project development and review responsibility for projects involving Category 2 Structures. This responsibility for Category 2 Structures extends to widening and rehabilitation projects and repairs of bridge components that qualify the structure as a Category 2 Structure. For large projects with multiple bridges, review responsibilities will be coordinated between the DSDO and the SDO based on the category of the individual bridge, workload demands and project make-up.

The District Project Manager must coordinate with the DSDE who will review and concur with the bridge aspects of all projects during the PD&E process in accordance with ***Part 2, Chapter 3*** of the ***PD&E Manual***.

The DSDE or the SSDE, as appropriate, must concur/approve all bridge related work after location design approval is granted.

To ensure a uniform approach to a project, the Engineer of Record (EOR) must coordinate with the appropriate Structures Design Office (i.e., DSDO or SDO) to discuss structures-related phase review comments and obtain concurrence on how to proceed.

Modification for Non-Conventional Projects:
Delete ***FDM 121.5*** and replace with the following: **121.5 Responsibility** Submit RFP's on those projects where it is anticipated that Category 2 bridges will be designed and constructed to the SSDE for review and approval. Submit RFP's on those projects where it is anticipated that Category 1 bridges will be designed and constructed to the DSDE for review and approval. The DSDO has total component structure plan review responsibility for projects involving Category 1 Structures. The SDO has total component structure plan review responsibility for projects involving Category 2 Structures. This responsibility for Category 2 Structures extends to widening and rehabilitation projects and repairs of bridge components that qualify the structure as a Category 2 Structure. The DSDE or the SSDE, as appropriate, determine when structure component plans should be "Released for Construction." The District Project Manager must coordinate with the DSDE who will review and concur with the bridge aspects of all projects during the PD&E process in accordance with ***Part 2, Chapter 3*** of the ***PD&E Manual***.

121.6 Projects of Division Interest

See ***FDM 128*** for FHWA requirements.

121.7 Bridge Project Development

The following sections will define, clarify, and list the information necessary to produce an acceptable set of contract documents (special provisions, bridge contract drawings) ready for advertisement and construction.

Bridge project development normally includes five phases of development. The first phase of development, bridge analysis, occurs during PD&E. After location design approval is granted, the second phase, Bridge Development Report/30% Structures Plans, is initiated. After approval of the BDR, the final phases of work will begin. The third phase is the 60% Structures Plans that consists of the substructure foundation submittal for all projects and 60% Structures Plans for most Category 2 Structures. The fourth phase includes the 90% Structures Plans and specifications. The fifth phase includes the 100% Structures Plans and specifications. For efficiency, one engineering firm (one design team) should be responsible for the BDR and the final plans and specifications.

For Category 2 bridges and some Category 1 bridges, step negotiations are suggested. Step negotiations are desirable because the final bridge type cannot be determined until the BDR is complete. Utilizing this scenario, the first step of the negotiations would include the BDR/30% Structures Plans. After submittal of the BDR/30% Structures Plans, negotiations for the final three phases of work (60% Structures Plans, 90% Structures Plans and 100% Structures Plans) would begin. Negotiations should not be finalized until the BDR/30% Structures Plans are approved by the DSDO or the SDO as appropriate.

Modification for Non-Conventional Projects:

Delete ***FDM 121.7*** and replace with the following:

121.7 Bridge Project Development

Bridge project development normally includes four phases of development. The first phase of development, bridge analysis, occurs during PD&E**.** The second phase includes the development of bridge-related project constraints based on project specific requirements and development of the bridge concept plans for inclusion into the RFP. A series of pre-scoping questions has been compiled and are available on the Office of Construction website to aid in the development of project specific constraints. Depending on the complexity of the project and at the discretion of the Department, this second phase may include a Bridge Feasibility Assessment for the purpose of developing the structures concept plans. The third phase involves the project procurement process. See ***Procurement and Administration Procedure (Topic No. 625-020-010)*** for specific requirements. The fourth phase includes component structure plan reviews in accordance with the requirements of the RFP.

121.8 Bridge Analysis

121.8.1 General

The bridge analysis is performed during the PD&E phase by qualified bridge engineers. The findings of the bridge analysis must be approved by the DSDO or the SDO, as applicable, in accordance with the responsible review authority specified in ***FDM 121.5***. The function of the bridge analysis is to determine the general attributes for the recommended bridge. The specific attributes of the bridge will be defined in the BDR.

For bridges over water, a Location Hydraulics Report will be prepared in conjunction with the bridge analysis. General site geotechnical knowledge is also required (usually from existing bridge plans) or, in some cases, it may be desirable to obtain borings.

121.8.2 Contents

The bridge analysis provides conceptual guidance for the bridge design consultant. Conceptual guidance on how the bridge should fit into the uniqueness of the site should be provided. Bridge design and structure type should be left to the design team in the later phases of work. Include the following in the bridge analysis:

(1) Environmental and site considerations, including the need for wildlife connectivity (see ***FDM 110.5.4***).

(2) Vertical and horizontal clearances (existing and proposed).

(3) Load Rating of existing bridge if any portion is retained.

(4) Evaluate the fatigue limit state for existing steel bridges if any portion is retained per ***Structures Design Guidelines*** ***7.5.4*** and determine if replacement should be recommended.

(5) Disposition of existing structure (Final disposition of demolished bridge debris will depend on whether or not a local, State or Federal agency has agreed to receive the debris. See ***FDM 110.5.2.3***).

(6) Vertical and horizontal geometry.

(7) Typical section.

(8) Conceptual ship/barge impact data (sample of recreational and commercial traffic).

(9) Identification of historical significance of bridge and surrounding structures.

(10) Aesthetic level for bridge and bridge approaches.

(11) Location Hydraulics Report.

(12) Bridge deck drainage considerations.

(13) Stream bottom profile.

(14) Conceptual geotechnical data.

(15) For sites with movable bridge options, a life cycle cost comparison will be prepared and compared to fixed bridge options (Ref: ***AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual, 2nd Edition***).

(16) Phased construction impacts.

(17) Construction time.

121.9 Bridge Development Report (BDR)/30% Structures Plans

The BDR is intended to be a tool in selecting the optimal bridge type and to establish all the basic parameters that will affect the work done in the design and plans preparation phase. Initiate the BDR after location design approval (for those sites not requiring location design approval, a categorical exclusion will be required before initiation of the BDR). Include the Phase I Geotechnical Report and the Bridge Hydraulic Report with the submittal containing the BDR. For some projects, the 30% Structures Plans will be included as an appendix to the BDR. See ***FDM 121.9.9***.

The work necessary to prepare the BDR is determined on a case-by-case basis and depends upon the bridge's complexity and other factors as described below:

(1) Considering the site constraints of the crossing (vertical and horizontal clearance requirements, etc.), the optimal bridge type may be evident for some simple Category 1 Structures without comparing various bridge types, and an abbreviated BDR that requires less effort may be appropriate. In certain cases, the BDR may simply document the reasons for the bridge type selected.

(2) An abbreviated BDR will usually be appropriate for widenings; however, in some cases a thorough evaluation of viable structural possibilities and economical options may be required to determine if replacement of the bridge would be more appropriate than widening. Factors to consider when determining the BDR effort for widenings include, but are not limited to, the following:

(a) Load rating,

(b) Condition of the existing bridge,

(c) History of structural problems,

(d) Clearance limitations in the widened configuration,

(e) Historical significance (see FDM 121.9.5), and

(f) Sites where there has been a record of serious flooding or scouring.

See ***Section 7.1.1*** of the ***Structures Design Guidelines*** for load rating considerations to be included in the BDR recommendations.

(3) For all other situations, including all new Category 2 Structures and major widenings of Category 2 Structures, the BDR will consider all viable bridge types and alternatives. See ***Section 7.1.4*** of the ***Structures Design Guidelines*** for definitions of minor and major widenings.

The DSDE will make the final determination on the scope of work necessary to prepare a BDR.

Once approved, the BDR will define the continuing work by the EOR. It is mandatory that the EOR obtain and coordinate the information and requirements of the offices and engineering disciplines whose input is essential to the preparation of an effective BDR. Changes to the parameters after the BDR is approved could result in schedule delays and supplemental agreements; therefore, it is critical that the districts, FHWA (if involved), the SDO and other involved agencies recognize the purpose and importance of the BDR. The BDR phase of work will contain sufficient detail for the justification of the proposed bridge type. The BDR is developed from information outlined on the Bridge Development Report Submittal Checklist shown in ***FDM 103***, ***Form 121-A***. This information is often provided by others; however, the EOR is responsible for ensuring that all of the information is adequate and appropriate. If the data is not sufficient, the EOR must obtain the required information before the BDR can be completed and submitted.

When alternate designs are considered, consistency between the alternates is essential in ensuring equitable competition and optimum cost-effectiveness. This consistency includes uniformity of design criteria, material requirements and development of unit costs.

The BDR should contain only supportable and defendable statements. Subjective opinions or unsubstantiated statements are not acceptable. All arguments are to be clearly and logically defensible with calculations, sketches, or other technical data.

121.9.1 Contents

The major items to be considered in the BDR are:

(1) General: The bridge length, height and pier locations are subject to vertical and horizontal design clearance requirements such as those for clear zone, navigation, wildlife connectivity, and hydrology. After these considerations are met, span lengths are governed by economics and aesthetic considerations. Superstructure depths (grade separation structures in particular) are to be kept to the minimum that is consistent with good engineering practice. Recommended span/depth ratios for steel superstructures are shown in AASHTO.

The length of the bridge will be affected by:

(a) Opening required by the Bridge Hydraulic Report.

(b) Environmental considerations, including wildlife connectivity (see ***FDM 110.5.4***).

(c) Railroad clearances and cross sections.

(d) Width of waterway or width of cross section of roadway being spanned including the use of retaining walls, or fender systems.

(2) Statical System: Address the economic and engineering advantages of both simple span and continuous spans.

(3) Superstructure: Some superstructure types that could be considered are prestressed concrete girders, inverted-tee sections, reinforced or prestressed concrete slabs, steel rolled sections or plate girders, steel or concrete box girders, and post tensioned slabs, bulb-tees, or boxes.

(4) Substructures: Some substructure types that could be considered are pile bents and multi-column or hammerhead piers. Variations of column shapes may be appropriate for aesthetic or economical requirements.

(5) Foundations: Some foundation types that could be considered are steel and concrete piles, drilled shafts, geosynthetic reinforced soil (GRS) abutments and spread footings. Assess GRS abutments to determine feasibility for all new bridges. If GRS abutments are determined not to be the most suitable alternative for the project, provide a statement in the BDR indicating so and the reasons why (e.g., sinkhole-prone area or differential settlement limit exceeded).

(6) Vessel Collision: Vessel collision forces will often have a major effect on the structural configuration and overall economics. See vessel collision requirements in the ***Structures Design Guidelines***.

(7) Scour: The 100 year and 500 year predicted scour elevations will often have a major effect on the foundation design. See the foundations and geotechnical requirements in the ***Structures Design Guidelines***.

(8) Temporary Traffic Control: Show how traffic will be maintained during construction for each of the bridge alternates considered. Assess the impacts of the traffic carried on the structures as well as under the structures being constructed. Consider all major overhead work items such as bridge demolition and girder placement. Show stability tower locations, phased construction sequences, girder splice locations, for each alternate being considered. Compare traffic user impacts for each of the alternates.

(See ***FDM 240.4*** for additional requirements)

(9) Precast Feasibility Assessment: Investigate the use of either partial or full precast bridge alternate(s) with the specific purpose of accelerating bridge construction and reducing user impacts. As part of this investigation:

(a) Conduct a feasibility assessment responding to questions similar to those listed in ***FDM 121.19***.

(b) Based on responses to the feasibility questions, explain whether a precast alternate should be considered an advantage on the project or what site constraints, economic impacts, or other factors (e.g., haul distance from precast yard, project variability) precluded or limited its application. If precasting is determined not to be applicable for the project, provide a statement in the BDR indicating so and the reasons why. This statement fulfills the requirements of this section.

(c) Only if precasting is found to be viable, evaluate preliminary precast alternates and associated MOT schemes against conventional methods using the assessment matrix and referenced links given in ***FDM 121.19***. Provide enough detail in the preliminary evaluation in order to estimate total direct and indirect costs. Indirect costs, typically referred to as road user costs, include fuel use and man-hour losses resulting from detours, anticipated traffic flow reduction, and reduced speed limits. Determine indirect costs using the FDOT Road User Cost (RUC) software located at:

https://fldot.sharepoint.com/sites/CO-Construction/Scheduling%20Engineer%20Info/Forms/AllItems.aspx

(d) At this stage, a meeting with the DSDE is recommended to discuss the preliminary evaluation and cost estimates before finalizing the alternates for inclusion in the BDR.

(e) See ***Chapter 25*** of the ***Structures Detailing Manual*** for design considerations as it relates to Prefabricated Bridge Elements and Systems (PBES).

(f) Report the estimated total direct costs and estimated total indirect costs, as well as the sum of both, for *each* alternate as three separate dollar amounts in a summary table in the same section as the completed assessment matrix (see ***Table 121.19.2***).

Providing both the direct and indirect costs of the project in the BDR enables Department management to make informed decisions to maximize construction dollars while at the same time minimizing construction time and economic impacts to Florida's traveling public.

Also, demonstrate in the BDR text that consideration was given to identify and employ other innovative techniques aimed at reducing costs, shortening project delivery time, enhancing safety during construction, and protecting the environment.

(10) Quantity estimates: For minor bridges, rough quantities (such as reinforcing steel based on weight per volume of concrete) may be sufficient. For major and complex bridges, the degree of accuracy may require more exact calculations keeping in mind that the intent is to establish relative and equitable costs between alternates and not necessarily to require the accuracy of the Final Estimate. For major and complex structures, it may be necessary to develop unit costs from an analysis of fabrication, storage, delivery, and erection costs of the different components. Provide calculated debris volume quantities for projects involving the demolition of bridges.

(11) Unit costs: Data available from the Department or contractors and suppliers should be used to arrive at unit costs. Record the sources of all price data for later reference. Base cost should be obtained from the ***BDR Estimating Section*** of the ***Structures Manual***.

(12) Develop cost curves: For each alternative, establish the most economical span arrangement, i.e., minimum combined superstructure and substructure cost.

(13) Retaining Wall Study: If retaining walls are present, include a retaining wall study in the BDR. This study will conform to the work as specified in ***FDM 262*** and the ***Structures Manual***.

(14) Movable bridges: Include information in the BDR on the type of equipment for the machinery and electrical drive systems, together with a general description of the control system to be utilized. Include a written description and preliminary layouts of system components. Utilize acronyms and terminology as defined in ***AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual, 2nd Edition***.

(15) Bicycle and pedestrian facilities: Describe in the BDR the facilities to be provided and the means to be used to comply with ADA requirements. Describe the pedestrian railing and fencing to be provided. See ***FDM 222, 223,*** and ***224***.

For rehabilitation project plans, include the BDR stage in the plans and written descriptions of those system components to be modified from the existing configuration, along with plans of the existing configuration. Submittal of information described in the previous paragraph is not required unless the electrical and mechanical configuration is modified from the existing configuration.

121.9.2 Format

Present the report in a logical sequence with narrative, as required, to explain the section contents. Provide an Executive Summary to compare the relative features and costs of the alternates considered and recommend alternate(s) to be carried forward into the Final Structures Plans Preparation phase.

The BDR is to be as self-contained as possible by including all arguments that establish, justify, support, or prove the conclusions. It is acceptable to refer to other documents that will be included in the final submittal package; however, include any documentation that will help emphasize a point, support a statement, or clarify a conclusion. Such documentation may include drawings, clear and concise views, or other such illustrated information.

Address construction time requirements in the BDR and the effect that components, systems, site constraints and conditions, or other site characteristics or criteria have upon the construction time, whether additive or deductive.

121.9.3 Aesthetics

(1) General: Integrate three basic elements in any bridge design: efficiency, economy, and elegance. Regardless of size and location, the quality of the structure, its aesthetic attributes and the resulting impact on its surroundings is to be carefully considered. Achieving the desired results involves:

(a) Full integration of the three basic elements listed previously.

(b) The EOR's willingness to accept the challenge and opportunity presented. A successful bridge design will then be elegant or aesthetically pleasing in and of itself and will be compatible with the site by proper attention to form, shapes, and proportions. Attention to details is of primary importance in achieving a continuity of line and form. Use the rule of "form following function."

Consider the totality of the structure as well as its individual components and the environment of its surroundings. A disregard for continuity or lack of attention to detail can negate the best intent. Formulas cannot be established; however, ACI's ***Aesthetic Considerations for Concrete Bridges*** and TRB's ***Bridge Aesthetics Around the World,*** as well as authors such as David P. Billington can guide the

designer. A book developed by the Maryland Department of Transportation entitled ***Aesthetic Bridges*** provides excellent guidance. In bridge aesthetics the designer is dealing with the basic structure itself; not with enhancement, additions, or other superficial touches. The EOR is expected to be well-read on the subject of bridge aesthetics and committed to fulfilling both the structural and aesthetic needs of the site.

The challenge differs for major and minor structures. Indeed, the challenge may be greater the smaller the project. Major structures, because of their longer spans, taller piers, or curving geometry often offer inherent opportunities not available for minor bridges.

Some basic guidelines where aesthetics may play a more important role are:

(a) Bridges highly visible to large numbers of users (maritime and motorists).

(b) Bridges located in or adjacent to parks, recreational areas, or other major public gathering points.

(c) Pedestrian bridges.

(d) Bridges in urban areas in or adjacent to commercial and residential areas.

(e) Multi-bridge projects, such as interchanges, or corridors should attain conformity of theme and unifying appearance. Avoid abrupt changes in structural features.

Considering these guidelines, the district will determine the level of aesthetic effort warranted on a project early in its development. When significant aesthetic expense is proposed, such as is the case with Level Three (Level of Aesthetics), Federally funded projects require legitimate written justification.

(2) Levels of Aesthetics:

Normally the district will establish one of the following three general levels of aesthetic consideration and effort at each structure's site:

(a) **Level One:** Consists of cosmetic improvements to conventional Department bridge types, such as the use of color pigments in the concrete, texturing the surfaces, modifications to fascia walls, beams, and surfaces, or more pleasing shapes for columns and caps.

(b) **Level Two:** The emphasis is on full integration of efficiency, economy and elegance in all bridge components and the structure as a whole. Consideration should be given to structural systems that are inherently more pleasing, such as hammerhead or "T" shaped piers, oval or polygonal shaped columns, integral caps, piers in lieu of bents, smooth transitions at superstructure depth change locations, box-type superstructures, concealed drainpipes, conduits, and utilities.

(c) **Level Three:** The emphasis in this level applies more to the overall aesthetics when passing through or under an interchange or at other sites such as historic or highly urbanized areas where landscaping or unique neighborhood features are to be considered. The bridge itself must comply with Level Two requirements. This level of work may require, at the district's option, a sub-consultant (architect to consider adjacent building styles, and landscape themes) with the necessary expertise and credentials to perform the desired work.

These aesthetic levels are not exclusive. For example, where the EOR believes a specific landscape feature might significantly enhance bridge site elegance, even on a Level One design, the recommendation should be offered for the Department's consideration. For aesthetic Levels Two and Three, public input into this issue may be appropriate. The EOR may recommend particular public involvement to the Department for consideration, or the district might specify such efforts at specific times during the BDR and final plan development phase of the project.

Include a summary of aesthetic considerations for the structure and the site in the BDR. The summary consists of sketches or drawings of recommended treatments as well as the options considered in the aesthetic study but not recommended as appropriate. Also include an estimate of cost to implement the recommended aesthetic treatments in the summary.

The default condition for new steel bridges is uncoated weathering steel where site conditions permit (See ***Structures Design Guidelines 1.3.2***). Use an inorganic zinc coating system where site conditions preclude uncoated weathering steel and may be used elsewhere with approval of the Chief Engineer. Use of a high-performance coating system to any extent for steel bridges requires written approval from the Chief Engineer.

121.9.4 Construction and Maintenance Considerations

Evaluate all viable structure concepts for constructability. Consider items such as member sizes, handling, fabricating, and transporting members as well as maintenance of traffic, construction staging, equipment access, and equipment requirements. Perform a special evaluation to insure against potential problems that may occur in obtaining permits and equipment to transport long and heavy members from point of manufacture to the project site. Contact the Department's Road Use Permits Office for questions concerning the feasibility of transporting long and heavy structural components. Also, take into account considerations for future maintenance inspection in the structure's design. Include those considerations described in ***FDM 121.15*** and the requirements of the ***Structures Manual***. All special construction and maintenance requirements should be identified and appropriately considered in any concepts recommended for design. A design is able to

be inspected properly when it permits safe inspector access to all portions of the structure using equipment available to district Structures Maintenance personnel.

121.9.5 Historical Significance Considerations

When an older bridge is considered for rehabilitation or replacement, the Environmental Management Office will evaluate the historical significance of the structure. A structure may be historically significant due to some of the following characteristics:

(1) The structure may be an historic example in the development of engineering.

(2) The crossing may be historically significant.

(3) The bridge may be associated with an historical property or area.

(4) The bridge may be associated with significant events or circumstances.

(5) National Register of Historic Places or on a state or local historical register. If it is determined that the structure is historically significant, then the project should be developed to preserve the historic character of the structure.

121.9.6 Bridge Security

Perform a refined evaluation of all new Category 2 bridges identified in a PD&E study as critical, landmark or signature bridges to determine if anti-terrorist countermeasures are to be included as part of the design. Contact the SDO and the State Maintenance Office for guidance and assistance. Minimize the bridge vulnerability through alternative designs developed in the BDR. Design countermeasures to minimize the effectiveness of explosives. Minimize vulnerability to shape charges and vehicle bombs. Maximize the use of structural redundancy and continuity to limit structural damage.

Countermeasures designed into the bridge alternatives must meet one or more of the following objectives:

(1) Protect structure from blast effects,

(2) Maximizing explosive standoff distance,

(3) Denial of access,

(4) Minimizing time-on-target,

(5) Selective protection of the structural integrity of key members, or

(6) Structural redundancy.

Use one or more of the following countermeasure strategies in the design:

(1) Deter attacks by the possibility of exposure, capture or failure of the attacker due to visible countermeasures,

(2) Detect potential attacks before they occur and provide the appropriate response force,

(3) Defend the bridge by delaying and distancing the attacker from the bridge and protecting the bridge from the effects of weapons, fire and vehicle and vessel impacts, or

(4) Design the bridge to minimize the potential effects of Weapons of Mass Destruction (WMDs) and conventional explosives, fire and vehicle and vessel impacts.

Structural members that are fracture critical or are cable stays, cable stay pylons, hollow boxes, single columns, twin wall columns and thin wall columns require design modifications to reduce the potential impact of explosions. Access into cable stay pylons, box superstructures and movable bridge machinery require heavy doors with secure lock systems. Bridges with essential communication utilities and/or gas lines require the design to minimize risk to the utility.

121.9.7 Alternative Designs

The use of alternative designs for some larger or complex projects may result in more competitive bids and lower costs. Accordingly, the EOR is to evaluate benefits from alternatives for the particular structure being developed and provide a recommendation for or against preparing alternative designs. Support the alternative designs recommended by the evaluations included in the BDR. As a guide, consider the following in evaluating justification for alternative designs:

(1) Alternative designs are to be considered for all structures that cost more than $25 million and a difference in alternate material (steel versus concrete) construction costs that are within twice the cost of producing the alternate plans. For example, alternative designs would be warranted if the additional preliminary engineering cost for final plans preparation is $1.5 million per alternate and the difference between the construction cost estimates utilizing the Department estimating practices in the BDR was less than $3 million.

(2) For bridges that cost less than $25 million, consider alternative designs when project issues reflect possible advantages (i.e., TTCP, A+B) from competitive bids.

(3) For bridges estimated to cost more than $10 million, consider evaluation of alternative designs whenever a unique design concept is proposed, until such time that a bid history is established for the unique design.

(4) Projects containing multiple bridges with a reasonable mixture of concrete and steel designs do not require alternate designs.

Steel box structures and steel plate girders should be evaluated including the differences in corrosion potential. Box girders are preferred over plate girders when located in extremely aggressive environments.

121.9.8 Conclusions and Recommendations

With due consideration for all applicable data, the engineer is required to recommend the final bridge design system for the site. Thorough justification for the selection will be presented which examines each element of data, and the total estimated construction cost of the recommended design must be indicated in the BDR.

The following sections will define, clarify, and list the information necessary to produce an acceptable set of contract documents (special provisions, bridge contract drawings) ready for advertisement and construction. The production of a bridge project commences with the Bridge Development Report (BDR) and ends with complete Contract Documents.

121.9.9 30% Structures Plans

The consultant's scope of services should clearly state at what point the 30% plans are to be submitted. The 30% Structures Plans may be submitted with the Bridge Development Report. If the 30% Structures Plans are submitted separately, the BDR is required to contain enough information and drawings to depict the information needed to properly determine the type, size and location of the bridge.

The 30% Structures Plans should show the following applicable information, as a minimum:

(1) General Notes Sheet: As many general notes as possible should be included on this sheet at this stage. Add subsequent notes, when necessary, as the design progresses (for examples of General Notes, see ***Chapter 5*** of the ***Structures Detailing Manual***).

(2) Plan and Elevation Sheet: Provide contents as required by the Structures Detailing Manual.

(3) Substructures: For end bents, piers, or intermediate bents, show substructure elements and sizes including all deviations from the typical dimensions, foundation type including element spacing and the arrangement of piles or drilled shafts.

(4) Superstructure: Include cross section showing lanes, shoulders, railings, slab thickness, beam type, and beam spacing. Show web depth for steel girders. Show width between webs and web slope for steel box girders. If applicable, show geometric changes in shapes of various components. Also show construction phases and maintenance of traffic data, outline of the existing structure and

portions to be removed, and utilities (existing and proposed as available).

(5) Retaining Walls: Submit preliminary control drawings when proprietary or standard cast-in-place walls are proposed. Include control drawings for all critical temporary walls.

(6) Bridge Hydraulics Recommendation Sheet.

(7) Report of core borings.

(8) Proposed construction sequence and methods indicate construction easements and methods of construction access.

(9) Preliminary aesthetic details.

(10) Preliminary post-tensioning layouts.

(11) Preliminary foundation layouts and pile/shaft data table.

(12) Sidewalks: If provided, show preliminary accessible elements.

(13) Any other special details required by the Engineer or details which are not normally used on Department projects.

In addition to these requirements, the following items will be included for moveable bridges: preliminary electrical and mechanical equipment layouts in plan and elevation, submarine cable routing, and single line electrical diagrams including service voltage. Rough size all equipment and submit the supporting calculations.

Include requests for Design Exceptions and Design Variations for structural design criteria in the 30% Structures Plans Submittal. Design Exceptions and Design Variations are required to be approved in accordance with ***FDM 122*** with concurrence of the DSDO or SDO as appropriate.

Modification for Non-Conventional Projects:
Delete ***FDM 121.9*** and replace with the following. **121.9 Bridge Feasibility Assessment/Structures Concept Plans** At the discretion of the Department, a Bridge Feasibility Assessment may be necessary during the RFP development phase for the purpose of developing the structures concept plans. When required, the assessment must target specific critical bridge components to ensure that the preliminary information presented in the concept plans can meet all of the project constraints depicted in the RFP. For aesthetic and wildlife connectivity requirements, see the RFP.

121.10 Bridge Development Report (BDR) Submittal Checklist

The Bridge Development Report (BDR) Submittal Checklist (***FDM 103, Form 121-A***) contains a list of the key supporting elements that are required for the preparation, submittal, and review of a BDR. Include this Checklist with the BDR when submitted for review. The BDR Checklist consists of the following items:

(1) Typical Sections for Roadway and Bridge:

The approved typical sections for both the bridge and roadway are required.

(2) Roadway Plans:

Preliminary roadway plans covering the bridge vicinity are required.

(3) Maintenance of Traffic Requirements:

Show the number of required lanes and the lane widths of all affected roadways in the Maintenance of Traffic Plan.

(4) Bridge Hydraulics Report and Bridge Hydraulics Recommendation Sheet:

Prepare the Bridge Hydraulics Report (BHR) and Bridge Hydraulics Recommendation Sheet (BHRS) in accordance with the ***Drainage Manual***. Concurrence of the BHR by the District Drainage Engineer with the DSDE for Category 1 Structures and SSDE for Category 2 Structures is required.

(5) Geotechnical Report:

Prepare the Bridge Geotechnical Report (Phase I) in accordance with Chapter 3 of the ***Structures Design Guidelines*** and the Department's ***Geotechnical Design Manual***. Document a thorough investigation of all viable foundation types for the bridge and retaining walls. Concurrence of the District Geotechnical Engineer is required for Category 1 Structures and both the State and District Geotechnical Engineers for Category 2 Structures.

(6) Bridge Corrosion Environment Report:

Prepare a Bridge Corrosion Report to determine the environmental classifications for the structure in accordance with the ***Structures Design Guidelines*** and receive approval from the District Materials Office.

(7) Geosynthetic Reinforced Soil (GRS) Feasibility Assessment:

Assess GRS abutments to determine feasibility for all new bridges.

(8) Precast Feasibility Assessment:

Investigate the use of either partial or full precast prefabricated bridge alternate(s) with the specific purpose of accelerating bridge construction and reducing user impacts.

(9) Existing Bridge Plans:

A set of prints of the existing (preferably as-built) bridge plans should be included for replacement structures and widenings. This is of particular importance for widenings and phase construction. These plans are not usually necessary for completely separate alignments or new interchanges unless the existing structures either will be used for new construction activities or will infringe upon the contractor's allowed work zone.

(10) Existing Bridge Inspection Report:

A copy of the latest existing Bridge Inspection Report and Structures Inventory and Appraisal Form is required for all widenings and rehabilitations and may be required for new structures. Identify the existing paint system(s) on all significant metal elements of existing structures. Clearly delineate the presence of lead-based paint and asbestos.

(11) Existing Bridge Load Rating:

A copy of the latest existing Bridge Load Rating is required for all widenings and rehabilitations.

(12) Wildlife Connectivity:

Describe the decision to include or exclude wildlife connectivity features into the design. The discussion for excluding a wildlife connectivity feature should summarize coordination with the Environmental Management or Permit office (or may be an attached summary memo from one of these offices). The discussion for including wildlife connectivity should refer to the ***Wildlife Crossing Guidelines***, commitments made during PD&E, and any other documentation regarding the wildlife connectivity related to the bridge (or may be an attached summary memo from the Environmental Management or Permit office).

(13) Utility Requirements:

Identify proposed utility attachments to the structure as well as all existing and proposed utilities in the vicinity of the structure. Follow the requirements of the Department's ***Utility Accommodation Manual*** regarding attachments to the structure.

(14) Railroad Requirements:

Identify existing and future railroad requirements. This will include all clearances and crash wall or other construction parameters. Include copies of correspondence with the Railroad Agency.

(15) Retaining Wall and Bulkhead Requirements:

Identify permanent and temporary retaining wall requirements and show the proposed type of wall. Also identify the type, location, and extent of temporary walls to accommodate phased construction and maintenance of traffic.

For water crossings where erosion and wave action are anticipated, identify the type, location, and extent of bulkhead production. Include the proposed tie-back and anchor system in the submittal.

(16) Lighting Requirements:

Identify proposed lighting on or under the structure.

(17) ADA Access Requirements:

Identify ADA access requirements that affect the structure.

(18) Other:

Modification for Non-Conventional Projects:
Delete ***FDM 121.10***.

121.11 Final Plans and Specifications Preparation

121.11.1 General

Within this phase of work for both Category 1 and 2 Structures, there are three phases of work; namely, 60% Substructure Submittal or 60% Structure Plans, 90% Structure Plans and 100% Structures Plans and Specifications. For projects where preapproved proprietary wall systems cannot be used and fully designed proprietary wall plans are required, submit approved control drawings to the appropriate proprietary wall companies as soon as possible and no later than the 60% Substructure submittal. Send a copy of this submission to the DSDO or SDO as appropriate.

At any time during the project development, the reviewer may require submittal of design calculations. All Electronic Review Comments (ERC) must be resolved to the Department's satisfaction prior to submitting the next phase submittal of the project.

121.11.2 60% Substructure Submittal / 60% Structures Plans

This submittal phase is divided into two distinct parts: the 60% Substructure Submittal (required for all projects), and the 60% Structures Plans for Category 2 Structures and some Category 1 Structures.

(1) 60% Substructure Submittal:

This submittal is required for every project and should be made a part of the 60% Structures Plans phase when that phase is part of the project. The submission is only a partial plan set. The purpose of this submittal is to communicate essential project information to the Geotechnical and Hydraulic Engineers so that all remaining calculations can be performed using actual structural shapes, loads, and dimensions. Plan sheets required for this submittal include: Plan & Elevation, Bridge Hydraulics Recommendation Sheet, Boring Logs, Foundation Layout, Substructure Plans, and draft technical specifications.

60% Substructure Submittal contents:

(a) Foundation Layouts

(b) Foundation Installation Notes

(c) Pile/Drilled Shaft Installation Table

(d) Footing Concrete Outlines (All Variations)

(e) Pier Concrete Outline (All Variations)

(f) Wall Plans - Control Drawings

(g) Pile Details

(h) Lateral Stability Analysis Completed

(i) Phase II Geotechnical Report

(j) Draft Technical Specifications

(k) Reinforcement of Footing and Column

(l) Post-Tensioning Details

(m) Plan and Elevation Sheet

(n) Bridge Hydraulics Recommendation Sheet

(o) Boring Logs

(2) 60% Structures Plans:

When a 60% Structures Plans submittal is required, all comments from earlier reviews will have been resolved. At this phase, the design should be 90% complete and the plans should be 60% complete. In addition to the documents required for the 60% Substructure Submittal, the 60% Structures include the following details as applicable in the plans: final concrete outlines of all individual components, major reinforcing steel, final post-tensioning layouts, steel box/I-girder details, segmental concrete box details, bearing details, seismic details, details of congested areas, details of unique features, accessible pedestrian facilities details,

and other details as required. For moveable bridges, the following additional information is required: electrical calculations (for generator size, service voltage drop, short circuit, service size, automatic transfer switch), single line diagram showing equipment sizes and utilities, conduit and wire sizes, panelboard schedules, and light fixture schedules.

121.11.3 90% Structures Plans

Upon approval of the BDR/30% Structures Plans or 60% Structures Plans, as applicable, 90% Structures Plans begin. At this stage of plans development, the EOR will have resolved the 30% and 60% Structures Plans review comments and developed the plans for completion. The design and plan production are required to be 100% complete. This submittal will include the completed plans, Estimated Quantities Report, design calculations, Final Phase II Geotechnical Report, Addendums to Hydraulic Report and, if appropriate, Technical Special Provisions. No sheet or detail should be missing at this stage.

121.11.4 100% Structures Plans and Specifications

After resolution of the 90% Structures Plan comments, the EOR will make all authorized changes necessary to complete the plans and Technical Special Provisions. The EOR will provide a list of all changes made to the plans or specifications that were not directly related to the 90% Structures Plans review comments. The intent is to help minimize the Department's review time and to help the Department's review office to focus on only those new items or details proposed by the EOR. This will, in turn, help to expedite the project's authorization.

The 100% Structures Plans submittal is divided into two distinct phases. First, plans and technical special provisions are submitted 30 days prior to the district's Plans Production Date. Second, once notified by the Department, the plans and all other documents are submitted to the district.

Within the 30-day period allotted, the EOR will receive notification either of additional changes/corrections to be made or to submit the Final Plans as they are. If at any time during the 30-day period the EOR finds additional changes/corrections that should be made, the structures design office responsible for plans approval (either the DSDO or the SDO as appropriate) is required to be notified for discussion and resolution.

Once all changes/corrections are made, or if no changes/corrections are necessary, the EOR will submit all work to the district prior to or on the Plans Production Date. Submittal of this stage of the work will include the plans, sealed in accordance with ***FDM 130***, sealed Technical Special Provisions (if required), and Estimated Quantities Report.

Modification for Non-Conventional Projects:
Delete ***FDM 121.11***. See the RFP for plans submittal requirements.

121.12 Independent Peer Review of Bridges

An Independent Peer Review (IPR) is used to validate the design of structures or portions thereof as defined below. The designated IPR firm will have no involvement with the project other than conducting the IPR and is required to be pre-qualified in accordance with ***Rule 14-75 of the Florida Administrative Code***. The designated IPR firm must be a completely separate, independent company from the design firm responsible for the bridge design. The responsible independent peer review engineer or the IPR Quality Assurance Manager must be on the Department's list of consultant qualifying engineer personnel (as a P.E. Qualifier) for the specific Group 4 work type.

(1) The Department may require an IPR for conventional projects. Consult with the SDO when determining the need for such reviews. Consideration of when to require an IPR include, but is not limited to, the following:

(a) The introduction of new complex details or structure types.

(b) Work being performed that is outside the normal structure type designed by the selected consultant.

(c) Structures using complex details within standard bridge types (e.g., integral piers, straddle piers, complex or unusual geometry).

Modification for Non-Conventional Projects:
Delete item (1) above and replace with the following: (1) An Independent Department Review (IDR) ***(FDM 103, Forms 121-D & 121-E)*** is required for all Category 2 Structures. When a firm is designated by the Department to conduct the IDR, the firm will not be a party to the contract with, or perform work for, the Design-Build Firm/Joint Venture.

(2) An IPR is required for Cost Savings Initiatives involving Category 2 Structures. The IPR function must be performed by a single independent engineering firm other than the engineer responsible for the design. The IPR must include:

(a) The superstructure and substructure for bridges consisting of Category 2 superstructures.

(b) Only the substructure for bridges where the superstructure is Category 1, but the substructure is Category 2.

(c) The superstructure and substructure for bridges designed for vessel collision. The IPR must include all spans or continuous units subject to vessel collision.

(d) The superstructure and substructure on bridges for which the superstructure is subject to application of wave loads per the ***Drainage Manual Section 4.9.5***. The IPR must include all spans or continuous units for which the superstructure is subject to application of wave loads.

(3) An IPR is required for the following structures and components of non-Department-owned projects constructed within, under or over State Road right-of-way, regardless of funding source:

(a) Category 1 (excluding miscellaneous structures) or Category 2 Structures

(b) Existing bridge retrofits and modifications regardless of bridge category

(c) Bridge cladding components and attachments

The peer review is intended to be a comprehensive, thorough independent verification of the original work. An independent peer review is not simply a check of the EOR's plans and calculations; it is an independent verification of the complete design, including but not limited to an evaluation of all nodal forces, using different programs and independent processes than what was used by the EOR. In addition, all independent peer reviews must include but are not limited to the independent confirmation of the following when applicable:

(1) Compatibility of bridge geometry with roadway geometrics including typical sections, horizontal alignment, and vertical alignment. Minimum lateral offsets and vertical clearance requirements.

(2) Compatibility of construction phasing with Traffic Control Plans.

(3) Conflicts with underground and overhead utilities.

(4) Compliance with AASHTO, Department and FHWA design requirements.

(5) Conformity to Department Standard Plans.

(6) Structural Analysis Methodology, design assumptions, and independent confirmation of design results including verification of the design through all phases of construction.*

(7) Global and local analyses including nodal forces, considering all structural members, connections/nodes and boundary conditions consistent with the structure type.*

(8) Design results/recommendations (independent verification of the design).*

(9) Completeness and accuracy of bridge plans.

(10) Technical Special Provisions and Modified Special Provisions where necessary.

(11) Constructability assessment limited to looking at fatal flaws in design approach.

* When Category 2 elements are designed with software using refined analyses (e.g., Grid, Finite Element Method), the peer review consultant is required to verify the design results by a different program/method.

In addition to the requirements of ***FDM 121.11.3*** and ***121.11.4***, include the following documents with plan submittals requiring an independent peer review:

(1) 90% Plan Submittals

(a) A tabulated list of all review comments from the independent review engineer and responses from the originator of the design.

(b) A standard peer review certification letter following the format presented in ***Form 121-B*** (see ***FDM 103***) signed by the independent review engineer. All outstanding/unresolved comments and issues presented in this letter are required to be resolved and implemented prior to the 100% plan submittal.

(c) A copy of the Department-issued Professional Services Qualification Letter, Part 1, containing the Work Types in which the independent PEER review firm has been qualified to work. The DSDE, for Category 1 bridge projects, or the SSDE, for Category 2 bridge projects, will confirm with the Procurement Office the independent PEER review firm's prequalification status of the appropriate Work Type.

(d) Independent peer review calculations conforming to the requirements of ***FDM 121.13.2***.

(2) 100% Plan Submittals

(a) A certification letter following the format presented in ***Form 121-C*** (see ***FDM 103***) signed and sealed by the independent review engineer stating that all review comments have been adequately addressed and that the design is in compliance with all Department and FHWA requirements.

(b) A copy of the Department-issued Professional Services Qualification Letter, Part 1, containing the Work Types in which the independent PEER review firm has been qualified to work. The DSDE, for Category 1 bridge projects, or the SSDE, for Category 2 bridge projects, will confirm with the Procurement Office the independent PEER review firm's prequalification status of the appropriate Work Type.

(c) Independent peer review calculations conforming to the requirements of ***FDM 121.13.2***.

Modification for Non-Conventional Projects:
Delete items (1) and (2) above.

121.13 Assembly of Plans and Calculations

121.13.1 Plans Assembly

Consult the ***Structures Detailing Manual*** for plans assembly, materials, content of plans, and other drafting information.

121.13.2 Calculations Assembly

The requirements herein are applicable to calculations submitted to the Department. All calculation submittals must be complete, understandable, and organized. Submit calculations as a high-quality PDF report, wherein any scanned pages have a minimum 300 dpi and 75% quality compression, and include the following:

(1) Cover page listing project information and EOR

(2) All design sections and sub-sections delineated with bookmark links

(3) Comment Tracking Log listing all current and previous comments from the Department (including all Department Representatives) with responses to date, at the time of submission

(4) Detailed narrative of the design methodology, including a summary of all applicable design criteria (e.g., specifications and references, loads and load combinations, software and versions used for each component design, geotechnical considerations, modeling considerations for elastic/inelastic behavior, how results from one program were utilized in another, etc.)

(5) Supporting design assumptions and associated commentary

(6) Relevant software input and output

(7) Member or component governing force effect and section capacity

(8) Refined analyses shall include visual graphics of the structural model(s), loading diagrams, and results

Category 2 Structures require extensive analysis and design documentation due to their inherent complexity. The following are typical requirements for concrete and steel Category 2 Structures to be addressed in the calculations submittal and modified as necessary for each structure type. Other types of bridge structures such as cable stay, suspension, arch, truss, moveable, FRP, bridges using Prefabricated Bridge Element Systems, etc. shall include similar information.

(1) General

(a) General project overview and description

(b) Describe purpose of submittal

(c) Document all unique or non-standard details pertinent to the calculations submittal

(d) Design Specifications. List all relevant design specifications and references used during the design, including the date and edition for each.

(e) Redundancy and Operational Importance

(f) Bridge target service life

(g) Analysis Software. Name, version number and provide a description of the programs.

(h) Properties for each material considered in the analysis and design, including but not limited to yield strength, tensile strength, compression strength, modulus of elasticity, thermal coefficient, Poisson's ratio, etc.

(2) Geometry

(a) Horizontal alignment

(b) Vertical alignment

(c) Horizontal and vertical clearances

(d) Finish grade elevations

(e) Substructure elevations

(3) Loads and Load Combinations

(a) Document all loads and load combinations considered in the analysis and design.

(4) Structural Analysis Models

At a minimum, provide the following sections for any structural model to document the assumptions:

(a) Overview of Model

i. Diagram of what components are included in the model stiffness

ii. Element and node numbering

iii. Tendon/Cable Layouts

iv. Tendon/Cable Stressing Forces

(b) Boundary condition assumptions for all structural components

i. Connection between superstructure and substructure

ii. Connection between substructure and foundation

iii. Connection between foundation and soil

(c) Basic model assumptions

i. Cross-sectional information

ii. Effective Flange Width

iii. FEM element types used

(d) Construction stages with sequence and descriptions

(e) Loading diagrams or sketches to clearly document magnitude and direction of loading

(f) Non-linear analysis assumptions

i. Geometric non-linearity

ii. Material non-linearity

(5) Structural Analysis Software Results

Structural analysis software outputs should be limited to pertinent results and document the following minimum requirements:

(a) Force effects for each element

(b) Envelope of Forces and Stresses for applicable Load Combinations

(6) Component Design Calculations

The calculations shall provide the governing loading combinations and section capacities for the structural elements and connections for critical stages during construction and the design life of the bridge listed as follows:

(a) Superstructure

(b) Substructure

(c) Foundation

(d) Miscellaneous (bearings, expansion joints, etc.)

(7) Appendices

Provide additional documentation used as a basis of design assumptions for the submittal. Examples include wind-tunnel testing reports, pertinent design related correspondence, side studies, sensitivity analyses, etc.

121.14 Plans Submittal

121.14.1 Schedule

The District Project Manager is responsible for establishing the schedule of submittals with input from the EOR and either the DSDE for Category 1 or SDO for Category 2 projects.

121.14.2 Submittal Schedule

(1) BDR/30% Structures Plans

(2) 60% Substructure Submittal/60% Structures Plans

(3) 90% Structures Plans

(4) 100% Structures Plans

Modification for Non-Conventional Projects:
Delete ***FDM 121.14.1*** and ***121.14.2***. See the RFP for requirements.

121.14.3 Summary of Phase Submittals

Submittals made at various stages of project development are required to conform to a uniform standard of completeness for each phase. Use ***Table 121.14.1*** to prepare deliverables for each stage of project development for fixed bridges. Use ***Table 121.14.1*** and ***Table 121.14.2*** to prepare deliverables for each stage of project development for moveable bridges.

Table 121.14.1 and ***Table 121.14.2*** give a listing of specific structure plan sheets to be submitted at Bridge Development Report, 30%, 60%, 90% and 100% Plans stages. For specific sheet content requirements, see ***Structures Detailing Manual Examples for Design-Bid-Build Projects***. For sheets not covered by specific example, see the general descriptions below for required level of completion.

(1) **Preliminary (P):** Basic shapes, geometry and layout of specified members are shown. Rebar and elevations are not required for Preliminary submittals. For example, the outline drawing of an end bent with complete dimensions including stationing, beam, and pedestal layout but without pile layout dimensions or rebar.

(2) **Substantially Complete (S):** Shapes, geometry and layout have been finalized. Design is 90% complete with most rebar, plate sizes, bolt patterns, concrete

strengths finalized and incorporated into the plans. For example, an end bent drawing with rebar, complete dimensions, pile, and beam layout but without elevations.

(3) **Complete but Subject to Change (C):** The design, drawings and details are complete for the specified component. Only reviewer-initiated changes should be expected at this level. For example, an end bent drawing would be complete, including all rebar callouts, elevations, dimensions.

(4) **Final (F):** All drawings and designs are complete. No changes are expected at this level. Plans are ready to be signed and sealed by the EOR.

Modification for Non-Conventional Projects:

Delete ***FDM 121.14.3*** and replace with the following:

121.14.3 Design-Build Technical Proposal and Component Plan Submittals

Component Plan Submittals are required to conform to a uniform standard of completeness for each submittal. Use ***Table 121.14.3*** to prepare deliverables for each component submittal for fixed bridges. Use ***Table 121.14.3*** and ***Table 121.14.4*** to prepare deliverables for component submittals for moveable bridges. Unless otherwise shown in the RFP, Technical Proposals are required to include the requirements of ***Table 121.14.3*** and ***Table 121.14.4***.

Submit component submittals per ***Table 121.14.3*** and ***Table 121.14.4*** (e.g., foundation, substructure, and superstructure) for each bridge. Partial submittals of individual elements within a bridge (e.g., End Bent 1, Pier 3, I-girder details) are not permitted.

Table 121.14.3 and ***Table 121.14.4*** give a listing of specific structure plan sheets to be submitted at Technical Proposal, 90% and Final Plans stage. For specific sheet content requirements, see ***Structures Detailing Manual Examples for Non-Conventional Projects***. For sheets not covered by specific example, see the general descriptions below for required level of completion.

(1) **Preliminary (P):** Basic shapes, geometry and layout of specified members are shown. Rebar and elevations are not required for Preliminary submittals. For example, the outline drawing of an end bent with complete dimensions including stationing, beam and pedestal layout but without pile layout dimensions or rebar.

(2) **Substantially Complete (S):** Shapes, geometry and layout have been finalized. Design is 90% complete with most rebar, plate sizes, bolt patterns, concrete strengths finalized and incorporated into the plans. For example, an end bent drawing with rebar, complete dimensions, pile and beam layout but without elevations.

(3) **Complete but Subject to Change (C):** The design, drawings and details are complete for the specified component. Only reviewer-initiated changes should be expected at this level. For example, an end bent drawing would be complete, including all rebar callouts, elevations, and dimensions.

(4) **Final (F):** All drawings and designs are complete. No changes are expected at this level. Plans are ready to be signed and sealed by the EOR.

Table 121.14.1 Summary of Phase Submittals

Provide the sheets listed as applicable based on structure type.

ITEM	BDR	30%	60% Substr. Submittal	60% Structures Plans*	90%	100%
Cover Sheet		P	S	S	C	F
Key Sheet		P	S	S	C	F
Sheet Index		P	S	S	C	F
General Notes		P	S	S	C	F
Standard Plans Index Sheets					F	F
Surface Finish Details			S	S	C	F
Riprap Details			S	S	C	F
Slope Protection Details			S	S	C	F
Plan and Elevation	S	S	C	C	C	F
Typical Section	S	S	C	C	C	F
Hydraulics Recommendation	P	P	S	S	C	F
Construction Sequence	S	S		C	C	F
Borings		C	C	C	C	F
Foundation Layout		S	S	S	C	F
Pile/Shaft Data Table		P	S	S	C	F
End Bent		P	S	S	C	F
End Bent Details			S	S	C	F
Wing Wall Details			S	S	C	F
Pier	P	P	S	S	C	F
Pier Details		P	S	S	C	F
Footing		P	S	S	C	F
Intermediate Bent	P	P	S	S	C	F
Intermediate Bent Details			S	S	C	F
Drilled Shaft Details		P	S	S	C	F
Finish Grade Elevations				C	C	F
Camber/Build-up/Deflection Diagrams				C	C	F
Framing Plan		P		S	C	F
Superstructure Plan				S	C	F
Superstructure Details				S	C	F
Erection Sequence	P	P	S	S	C	F
P/S Beam Data Tables				S	C	F
Cross Frames/Diaphragm Details				S	C	F
Steel Girder Details		P		S	C	F
P/T Systems		P		S	C	F
Bearing Details				S	C	F
Expansion Joint Details				S	C	F
Approach Slab Details				S	C	F
Reinforcing Bar List					C	F
Conduit and Inspection Lighting Details				P	C	F
Vermin Guard				S	C	F
Wall Control Drawings		P***	S	S	C	F
Wall Details		P	S	S	C	F
Temporary Critical Wall Drawings	P	P	S	S	C	F
Wall Data Tables			S	S	C	F
Temp. Bridge Plan and Elevation			P	P	C	F
Temp. Bridge Foundation Layout			P	P	C	F

Table 121.14.1 Summary of Phase Submittals (continued)

Provide the sheets listed as applicable based on structure type.

ITEM	BDR	30%	60% Substr. Submittal	60% Structures Plans*	90%	100%
Segment Joint Coordinates/Deck Elev.				S	C	F
Segment Layout		P		S	C	F
Typical Segment Dimensions	P	P		C	C	F
Typical Segment Reinforcing				S	C	F
Pier Segment Dimensions	P	P		C	C	F
Pier Segment Reinforcing **				S	C	F
Abutment Segment Dimensions	P	P		C	C	F
Abutment Segment Reinforcing **				S	C	F
Expansion Joint Segment Dimensions		P		S	C	F
Expansion Joint Segment Reinforcing **				S	C	F
Deviation Segment Dimensions		P		C	C	F
Deviation Segment Reinforcing **				S	C	F
Post Tensioning Layout		P		C	C	F
P/T Details	P	P		S	C	F
Transverse P/T Details		P		C	C	F
Bulkhead Details		P		S	C	F
Drainage Layout		P		S	C	F
Drainage Details		P		S	C	F
Load Rating Summary Sheet					C	F
Developmental Standard Plans		C	C	C	F	F
Existing Bridge Plans		F ‡‡	F ‡‡	F ‡‡	F	F

Status Key:
P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
***** – 60% Structures Plan submittals are required for all Category 2 and some Category 1 bridges. See ***FDM 121.11.2*** for additional information
****** – May require integrated drawings
*** – Control Plans only showing geometry, stationing, and offsets
‡ – Where required for project
‡‡ – Widenings and projects with phased construction

Table 121.14.2 Summary of Phase Submittals - Movable Bridges

For approach span requirements, see ***Table 121.14.1***.

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Bascule Pier Notes		P	S	C	F
Bascule Span Elevation	P	S	S	C	F
Leaf Clearance Diagrams		P	S	C	F
Bridge Railing Clearance Diagrams		P	S	C	F
Bascule Pier North Elevation View	P	S	S	C	F
Bascule Pier South Elevation View	P	S	S	C	F
Bascule Pier East Elevation View	P	S	S	C	F
Bascule Pier West Elevation View	P	S	S	C	F
Bascule Pier Deck Plan	P	S	S	C	F
Bascule Pier Deck Elevations	P	S	S	C	F
Bascule Pier Trunnion Level Plan	P	S	S	C	F
Bascule Pier Machinery Level Plan	P	S	S	C	F
Bascule Pier Pit Plan	P	S	S	C	F
Bascule Pier Footing Plan	P	S	S	C	F
Bascule Pier Longitudinal Sections	P	S	S	C	F
Bascule Pier Transverse Sections	P	S	S	C	F
Bascule Pier Railing Details			P	C	F
Bascule Pier Stair Details			P	C	F
Bascule Pier Trunnion Access Platform Details	‡	‡	S	C	F
Bascule Pier Finger Joints			P	C	F
Bascule Pier Deck Level Reinforcing			P	C	F
Bascule Pier Trunnion Level Reinforcing			P	C	F
Bascule Pier Machinery Level Reinforcing			P	C	F
Bascule Pier Pit Reinforcing			P	C	F
Bascule Pier Footing Reinforcing			P	C	F
Bascule Pier North Elevation Reinforcing			P	C	F
Bascule Pier South Elevation Reinforcing			P	C	F
Bascule Pier East Elevation Reinforcing			P	C	F
Bascule Pier West Elevation Reinforcing			P	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Bascule Pier Longitudinal Section Reinforcing			P	C	F
Bascule Pier Transverse Section Reinforcing			P	C	F
Bascule Pier Reinforcing Bar List			P	C	F
Control House General Notes			P	C	F
Control house Reflected Ceiling Plan			P	C	F
Control House Access Bridge Dimensions	‡	‡	S	C	F
Control House Access Bridge Reinforcing	‡	‡	S	C	F
Control House Access Bridge Bar List	‡	‡	S	C	F
Control Tower Floor Plans	P	S	S	C	F
Control Tower Sections	P	S	S	C	F
Control Tower Reinforcing Plans			P	C	F
Control Tower Reinforcing Elevations			P	C	F
Control Tower Section Reinforcing			P	C	F
Control Tower Bar List			P	C	F
Control Tower Schedules			P	C	F
Control Tower Elevations	P	S	S	C	F
Control Tower Building Sections			P	C	F
Control Tower Details			P	C	F
Control Tower Stair Plans			P	C	F
Control Tower Stair Sections			P	C	F
Control Tower Roof			P	C	F
Control Tower Door and Window Types and Details			P	C	F
Control Tower Architectural Details			P	C	F
Control Tower HVAC Notes			P	C	F
Control Tower HVAC and Plumbing Floor Plans			P	C	F
Control Tower HVAC and Plumbing Elevations			P	C	F
Bascule Leaf Notes			S	C	F
Bascule Leaf Framing Plan and Longitudinal Section	P	S	S	C	F
Bascule Leaf Transverse Sections at Floorbeams	P	S	S	C	F
Bascule Leaf Transverse Sections at Trunnion	P	S	S	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Bascule Leaf Transverse Sections at Counterweight Girders	P	S	S	C	F
Main Girder Elevation	P	S	S	C	F
Main Girder Details			P	C	F
Main Girder Web Geometry and Camber Details			P	C	F
Main Girder Force Diagrams			P	C	F
Main Girder Reaction Influence Lines			P	C	F
Main Girder Moment Influence Lines			P	C	F
Floorbeam Details			P	C	F
Counterweight Girder Details			P	C	F
Stringer Details			P	C	F
Lateral Bracing Details			P	C	F
Counterweight Bracing Plan and Details			P	C	F
Counterweight Bracing Sections and Details			P	C	F
Counterweight Plan			P	C	F
Counterweight Longitudinal Sections			P	C	F
Counterweight Transverse Sections			P	C	F
Counterweight Details and Reinforcing Bar List			P	C	F
Bridge Deck Panel Layout			P	C	F
Bridge Deck Panel Sections			P	C	F
Bridge Deck Panel Details			P	C	F
Armored Joint Details			P	C	F
Span Lock Housing Details			P	C	F
Bascule Leaf Jacking Details and Notes			P	C	F
Mechanical General Notes		P	S	C	F
Mechanical Equipment Schedules		P	S	C	F
Drive Machinery Layout		P	S	C	F
Machinery Support Details			S	C	F
Trunnion Assembly Details		P	S	C	F
Open Gearing Details		P	S	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Rack/Rack Frames and Rack Pinion Details		P	S	C	F
Mechanical Bearing Details		P	S	C	F
Drive Hydraulic Cylinders Details		P	S	C	F
Hydraulic System Layout/Piping Details		P	S	C	F
Hydraulic Cylinder Support Assemblies		P	S	C	F
Hydraulic System Details		P	S	C	F
Live Load Shoe Details		P	S	C	F
Centering Device Details			S	C	F
Span Lock Assembly Details		P	S	C	F
Control Tower – Control Console and Operator's Visualization Geometry Analysis Including CCTV Locations		P	S	C	F
Electrical General Notes		P	S	C	F
Electrical Site Plan		P	S	C	F
Conduit Riser Diagram		P	S	C	F
Single Line Diagram		P	S	C	F
Electrical Symbol Legend		P	S	C	F
Lighting and Equipment Plan (Including Control Tower Lighting, Fire Detection and Lighting Panel Schedules)		P	S	C	F
Lightning Protection, Bonding, and Grounding Plan		P	S	C	F
Navigation Lighting Plan		P	S	C	F
Communication Equipment Plan		P	S	C	F
Control Panel Details		P	S	C	F
Control Console Details		P	S	C	F
Block Diagram of Operating Sequence Control System Architecture Diagram		P P	S S	C C	F F
Schematic Diagrams of all Control Systems and Interlocks		P	S	C	F
Control System I/O Points		P	S	C	F
Ladder Logic for PLC			P	C	F
Submarine Cable/Submarine Cable Termination Cabinet Details		P	S	C	F

Table 121.14.2 Summary of Phase Submittals - Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

ITEM	BDR	30%	60% Structures Plans*	90%	100%
Fire and Security Panel Schematic Diagram		P	C	C	F
CCTV Plan and Elevation		P	C	C	F
Limit Switch Development		P	C	C	F
Conduit and Cable Schedule		P	C	C	F
Electrical Equipment Layout - Including but not limited to Generators, Motors, Control Console, Control Panels, and Motor Control Center.		P	C	C	F
CCTV Layout			P	S	F

Status Key:

P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
***** – 60% Structures Plan submittals are required for all movable bridges. See ***FDM 121.11.2*** for additional information
‡ – Where required for project

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals

Provide the sheets listed as applicable based structure type.

Foundation Submittal

ITEM	Technical Proposal	90%	Final
Cover Sheet		C	F
Key Sheet		C	F
Sheet Index		C	F
General Notes	S	C	F
Standard Plans Index Sheets		F	F
Surface Finish Details		C	F
Riprap Details		C	F
Slope Protection Details		C	F
Plan and Elevation	P	C	F
Typical Section	P	C	F
Hydraulics Recommendation	P	C	F
Construction Sequence	P	C	F
Borings		C	F
Foundation Layout	P	C	F
Pile/Shaft Data Table		C	F
Drilled Shaft Details		C	F
Temp. Bridge Foundation Layout	P	C	F
Existing Bridge Plans		F‡‡	F
Foundation Related Temporary Critical Wall Drawings	P	C	F

Include in all submittals additional details and backup information necessary to substantiate the loading on the foundations. Include a copy of the Geotechnical Report in all submittals.
‡‡ – Widenings and projects with phased construction
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals (Continued)

Provide the sheets listed as applicable based structure type.

Substructure Submittal

ITEM	Technical Proposal	90%	Final
End Bent	P	C	F
End Bent Details		C	F
Wing Wall Details		C	F
Pier	P	C	F
Pier Details		C	F
Footing	P	C	F
Intermediate Bent	P	C	F
Intermediate Bent Details		C	F
Reinforcing Bar List		C	F
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals (Continued)

Provide the sheets listed as applicable based structure type.

Superstructure Submittal

ITEM	Technical Proposal	90%	Final
Finish Grade Elevations		C	F
Camber/Build-up/Deflection Diagrams		C	F
Framing Plan		C	F
Superstructure Plan		C	F
Superstructure Details		C	F
Erection Sequence	P‡	C	F
P/S Beam Data Tables		C	F
Cross Frames/Diaphragm Details		C	F
Steel Girder Details	P	C	F
P/T Systems	P	C	F
Bearing Details		C	F
Expansion Joint Details		C	F
Approach Slab Details		C	F
Reinforcing Bar List		C	F
Conduit and Inspection Lighting Details		C	F
Vermin Guard		C	F
Wall Control Drawings	P	C	F
Wall Details		C	F
Non-Foundation Related Temporary Critical Wall Drawings	P	C	F
Wall Data Tables		C	F
Temp. Bridge Plan and Elevation	P	C	F
Segment Joint Coordinates/Deck Elev.		C	F
Segment Layout	P	C	F
Typical Segment Dimensions	P	C	F
Typical Segment Reinforcing		C	F
Pier Segment Dimensions	P	C	F
Pier Segment Reinforcing **		C	F
Abutment Segment Dimensions	P	C	F
Abutment Segment Reinforcing **		C	F
Expansion Joint Segment Dimensions	P	C	F
Expansion Joint Segment Reinforcing **		C	F
Deviation Segment Dimensions	P	C	F
Deviation Segment Reinforcing **		C	F
Post Tensioning Layout	P	C	F

Table 121.14.3 Summary of Design-Build Technical Proposal and Component Plan Submittals (Continued)

Provide the sheets listed as applicable based structure type.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
P/T Details	P	C	F
Transverse P/T Details		C	F
Bulkhead Details		C	F
Drainage Layout		C	F
Drainage Details		C	F
Load Rating Summary Sheet		C	F
Developmental Standard Plans		F	F
Existing Bridge Plans		F‡‡	F
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Status Key:

P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
****** – May require integrated drawings
‡ – For geometrically constrained sites, show temporary stability towers in the vicinity of the underlying roadways consistent with the Traffic Control Plans. Also show temporary stability towers within navigable waterways.
‡‡ – Widenings and projects with phased construction

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges

For approach span and foundation submittal requirements, see ***Table 121.14.3***.

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Substructure Submittal

ITEM	Technical Proposal	90%	Final
Bascule Pier Notes		C	F
Bascule Span Elevation	P	C	F
Leaf Clearance Diagrams		C	F
Bridge Railing Clearance Diagrams		C	F
Bascule Pier North Elevation View	P	C	F
Bascule Pier South Elevation View	P	C	F
Bascule Pier East Elevation View	P	C	F
Bascule Pier West Elevation View	P	C	F
Bascule Pier Deck Plan	P	C	F
Bascule Pier Deck Elevations	P	C	F
Bascule Pier Trunnion Level Plan	P	C	F
Bascule Pier Machinery Level Plan	P	C	F
Bascule Pier Pit Plan	P	C	F
Bascule Pier Footing Plan	P	C	F
Bascule Pier Longitudinal Sections	P	C	F
Bascule Pier Transverse Sections	P	C	F
Bascule Pier Railing Details		C	F
Bascule Pier Stair Details		C	F
Bascule Pier Trunnion Access Platform Details	‡	C	F
Bascule Pier Finger Joints		C	F
Bascule Pier Deck Level Reinforcing		C	F
Bascule Pier Trunnion Level Reinforcing		C	F
Bascule Pier Machinery Level Reinforcing		C	F
Bascule Pier Pit Reinforcing		C	F
Bascule Pier Footing Reinforcing		C	F
Bascule Pier North Elevation Reinforcing		C	F
Bascule Pier South Elevation Reinforcing		C	F
Bascule Pier East Elevation Reinforcing		C	F
Bascule Pier West Elevation Reinforcing		C	F
Bascule Pier Longitudinal Section Reinforcing		C	F
Bascule Pier Transverse Section Reinforcing		C	F
Bascule Pier Reinforcing Bar List		C	F
90% and Final submittals for category 2 bridges require an Independent Department Review ***(FDM 103, Forms 121-D & 121-E)***.			

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal

ITEM	Technical Proposal	90%	Final
Control House General Notes		C	F
Control house Reflected Ceiling Plan		C	F
Control House Access Bridge Dimensions	‡	C	F
Control House Access Bridge Reinforcing		C	F
Control House Access Bridge Bar List		C	F
Control Tower Floor Plans	P	C	F
Control Tower Sections	P	C	F
Control Tower Reinforcing Plans		C	F
Control Tower Reinforcing Elevations		C	F
Control Tower Section Reinforcing		C	F
Control Tower Bar List		C	F
Control Tower Schedules		C	F
Control Tower Elevations	P	C	F
Control Tower Building Sections		C	F
Control Tower Details		C	F
Control Tower Stair Plans		C	F
Control Tower Stair Sections		C	F
Control Tower Roof		C	F
Control Tower Door and Window Types and Details		C	F
Control Tower Architectural Details		C	F
Control Tower HVAC Notes		C	F
Control Tower HVAC and Plumbing Floor Plans		C	F
Control Tower HVAC and Plumbing Elevations		C	F
Bascule Leaf Notes		C	F
Bascule Leaf Framing Plan and Longitudinal Section	P	C	F

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
Bascule Leaf Transverse Sections at Floorbeams	P	C	F
Bascule Leaf Transverse Sections at Trunnion	P	C	F
Bascule Leaf Transverse Sections at Counterweight Girders	P	C	F
Main Girder Elevation	P	C	F
Main Girder Details		C	F
Main Girder Web Geometry and Camber Details		C	F
Main Girder Force Diagrams		C	F
Main Girder Reaction Influence Lines		C	F
Main Girder Moment Influence Lines		C	F
Floorbeam Details		C	F
Counterweight Girder Details		C	F
Stringer Details		C	F
Lateral Bracing Details		C	F
Counterweight Bracing Plan and Details		C	F
Counterweight Bracing Sections and Details		C	F
Counterweight Plan		C	F
Counterweight Longitudinal Sections		C	F
Counterweight Transverse Sections		C	F
Counterweight Details and Reinforcing Bar List		C	F
Bridge Deck Panel Layout		C	F
Bridge Deck Panel Sections		C	F
Bridge Deck Panel Details		C	F
Armored Joint Details		C	F
Span Lock Housing Details		C	F
Bascule Leaf Jacking Details and Notes		C	F
Mechanical General Notes	P	C	F
Mechanical Equipment Schedules	P	C	F
Drive Machinery Layout	P	C	F
Machinery Support Details		C	F

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
Trunnion Assembly Details	P	C	F
Open Gearing Details	P	C	F
Rack/Rack Frames and Rack Pinion Details	P	C	F
Mechanical Bearing Details	P	C	F
Drive Hydraulic Cylinders Details	P	C	F
Hydraulic System Layout/Piping Details	P	C	F
Hydraulic Cylinder Support Assemblies	P	C	F
Hydraulic System Details	P	C	F
Live Load Shoe Details	P	C	F
Centering Device Details		C	F
Span Lock Assembly Details	P	C	F
Control Tower – Control Console and Operator's Visualization Geometry Analysis Including CCTV Locations	P	C	F
Electrical General Notes	P	C	F
Electrical Site Plan	P	C	F
Conduit Riser Diagram	P	C	F
Single Line Diagram	P	C	F
Electrical Symbol Legend	P	C	F
Lighting and Equipment Plan (Including Control Tower Lighting, Fire Detection and Lighting Panel Schedules)	P	C	F
Lightning Protection, Bonding, and Grounding Plan	P	C	F
Navigation Lighting Plan	P	C	F
Communication Equipment Plan	P	C	F
Control Panel Details	P	C	F
Control Console Details	P	C	F
Block Diagram of Operating Sequence	P	C	F
Control System Architecture Diagram	P	C	F
Schematic Diagrams of all Control Systems and Interlocks	P	C	F

Table 121.14.4 Summary of Design-Build Technical Proposal and Component Plan Submittals – Movable Bridges (Continued)

Provide the sheets listed as applicable based on machinery and electrical components utilized.

Superstructure Submittal (Continued)

ITEM	Technical Proposal	90%	Final
Control System I/O Points	P	C	F
Ladder Logic for PLC		C	F
Submarine Cable/Submarine Cable Termination Cabinet Details	P	C	F
Fire and Security Panel Schematic Diagram	P	C	F
CCTV Plan and Elevation	P	C	F
Limit Switch Development	P	C	F
Conduit and Cable Schedule	P	C	F
Electrical Equipment Layout - Including but not limited to Generators, Motors, Control Console, Control Panels, and Motor Control Center.	P	C	F
CCTV Layout		S	F

Status Key:

P – Preliminary
S – Substantially Complete
C – Complete but subject to change
F – Final
‡ – Where required for project.

121.15 Review for Constructability and Maintainability

121.15.1 Purpose

The purpose of this review is to provide reasonable and practical use of fabrication and construction techniques and equipment without overloading and overstressing components, provide for proper material handling and transportation, provide safe maintenance of traffic, and provide an appropriate construction sequence. Additionally, provide features which will retard bridge deterioration, permit reasonable access to all parts of the bridge for inspection and performance evaluation and provide features to facilitate replacement of damaged and deteriorated bridge components.

121.15.2 Responsibility

For Category 1 and 2 Structures, it will be the responsibility of the District Project Manager, or his/her designee, to coordinate a review of both the 30% and 90% Structures

Plans submittals by the appropriate district Construction and Maintenance personnel for constructability and maintainability. For Category 1 Structures, technical issues will be resolved to the satisfaction of the appropriate DSDE. For Category 2 Structures, technical issues will be resolved to the satisfaction of the SDO.

The Construction and Maintenance Offices should be given adequate time to perform these reviews. All comments from these reviews will be addressed prior to the next submittal and its subsequent review.

Modification for Non-Conventional Projects:
Delete ***FDM 121.15*** and see the RFP for requirements.

121.16 Review for Biddability

121.16.1 Purpose

To prevent construction problems, the District Construction Office will review the plans to make certain the plans are clearly understandable and contain all pertinent notes. During the biddability review, the Construction Office will check for the interface with the roadway segment of the project, utility agreements and environmental permits.

121.16.2 Responsibility

For Category 1 and 2 Structures, it will be the responsibility of the District Project Manager to coordinate a review of the 90% Structures Plan submittal. This review should occur at the same time as the Phase III Plans submittal for the roadway segments of the project.

Additionally, for Category 2 Structures, it will be the responsibility of the SDO to coordinate a review of the 90% Structures Plans submittal.

The Construction Offices should be given adequate time to perform these reviews. All comments from these reviews are required to be addressed prior to the 100% Structures Plans submittal.

Modification for Non-Conventional Projects:
Delete ***FDM 121.16***.

121.17 Bridge Load Rating

For new bridges, the EOR is required to load rate the bridge(s) and submit the calculations with the 90% plan submittal.

Prior to developing the scope-of-work for bridge widening or rehabilitation projects, the Department or their consultant will determine the suitability of the bridge project using the load rating. If the existing load rating is inaccurate or was performed using older methods (e.g., load factor), perform a new load rating using the procedures outlined in the ***Structures Manual, Volume 1 - Structures Design Guidelines, Chapter 7***. Submit load rating calculations for the entire structure (existing and new) with the 90% plan submittal for the project.

Modification for Non-Conventional Projects:
Delete ***FDM 121.17*** and see the RFP for requirements.

121.18 Review of Non-Department-Owned Projects (New Construction)

Portions of transportation projects on, under or over a Department-owned right-of-way, regardless of funding source or owner, will be subject to review by the Department. FHWA review will be required whenever a privately funded or LAP structure crosses over an interstate route, or when such work otherwise affects such a route; i.e., lane closures, access, R/W changes. The extent of the Department and FHWA review is that:

(1) Plans will meet all current clearance requirements (vertical and horizontal).

(2) Review and approve the maintenance of traffic scheme for construction.

(3) Securely fasten all attachments to the structure over the highway.

(4) Design will be sealed by a licensed professional engineer employed by a Department prequalified engineering firm.

(5) Designs will be in accordance with applicable Department publications.

(6) Plans will meet all district permit requirements and procedures.

(7) Submit to FHWA for approval only projects over or affecting an NHS facility.

(8) Department review for these structures will be performed by the DSDO for Category 1 and the SDO for Category 2 Structures. Structural reviews will be performed to the same extent as reviews performed on Department projects to ensure compliance with the Department's design criteria.

121.19 Precast Alternate Development

Modification for Non-Conventional Projects:
Delete FDM 121.19.

121.19.1 Precast Feasibility Assessment Questions:

Several negative responses to the following questions may indicate precasting is not feasible for the project. In this case, provide a statement in the BDR stating that precasting is not feasible and indicate the reasons why in order to satisfy the requirements of ***FDM 121.9.1 (9).***

(1) Will precasting reduce traffic impacts? Factors may include: average traffic volumes being affected, detour lengths and durations, lane reductions and duration.

(2) Is this structure likely to be on the critical path for construction of the project or is this structure on a hurricane evacuation route which requires accelerated delivery?

(3) Is the size of the project large enough to benefit from economy of scale, assembly line construction processes, and is it large enough to capitalize on a construction learning curve?

(4) Is precasting practical given the project aesthetics when component lifting weights are considered?

(5) Is precasting practical given project variability? Factors may include: formwork reuse, multiple construction methods and steps, and variable equipment requirements.

(6) Does the project site have space within FDOT R/W to use as a near-site casting yard and can precast elements be hauled from likely near-site casting yard locations to the site?

(7) Can precast elements be hauled from likely off-site prestressed yard locations to the site?

(8) Are the lifting weights practical given the assumed equipment, construction access, and construction methods?

(9) Can connection details be developed with the following characteristics?

- (a) Durable
- (b) Easily inspected during construction

(c) Accommodates shaft/pile placement tolerances

(d) Accommodates fit up

(e) Accommodates differential camber (full-depth deck panels)

121.19.2 Assessment Matrix

Table 121.19.1 is a tool that may be used in documenting the decision-making process for evaluation of precast construction versus conventional cast-in-place construction. ***Table 121.19.2*** is a sample Alternate Cost Summary Table indicating how to summarize the component cost estimates and their sum.

Table 121.19.1 Sample Assessment Matrix

- example values in italics -

		PRECAST		CONVENTIONAL	
Selection Factor	**Factor Weight (%)**	**Score *(0 to 5)***	**Weighted Score***	**Score *(0 to 5)***	**Weighted Score***
Total Direct Costs	*40*	*4*	*160*	*5*	*200*
Total Indirect Costs	*10*	*5*	*50*	*4*	*40*
Factor 3 - *Constructability*	*25*	*3*	*75*	*4*	*100*
Factor 4 – *Traffic Impacts*	*0*				
Factor 5 - *Construction Duration*	*0*				
Factor 6 - *Durability*	*0*				
Factor 7 – *Environmental Impacts*	*10*	*5*	*50*	*2*	*20*
Factor 8– *Aesthetics*	*15*	*5*	*75*	*3*	*45*
Factor 9 – *Other*	*0*				
Factor 10 – *Other*	*0*				
TOTAL (å Factor Weights = 100%)	***100***		***410***		***405***
TOTAL (Excluding Indirect Cost Factor)**	*90*		*360*		*365*

*Weighted Score = Factor Weight x Score **See following explanation, Instructions “6.”

121.19.3 Assessment Matrix Instructions

(1) **List Selection Factors** to be used to evaluate the applicability of alternates to meet the goals of the project. Factors are project specific and always include Total Direct Costs and Total Indirect Costs (road user costs) and may include some of the following: Constructability, Traffic Impacts (e.g., Maintenance of Traffic, Detours, Traffic Delays), Construction Duration, Durability, Environmental Impacts, and Aesthetics. Include other Factors as required to capture any unique project characteristics that are not otherwise addressed. Note that as many or as few

criteria may be used in the assessment matrix as deemed appropriate by the designer. However, a sufficient number of Selection Factors (i.e., criteria) are required to provide a thorough evaluation of the alternates being considered to meet the objectives of the project. When choosing selection factors and applying factor weights, avoid double counting benefits. For instance, indirect costs and traffic impacts may be related selection factors.

Costs of precast versus conventional may be affected by:

(a) Savings associated with labor rates and insurance costs for reduced time working from a barge on a large water project.

(b) Savings associated with structural efficiencies resulting from precasting (e.g., composite dead loads in the case of shored deck casting).

(c) Savings associated with simultaneous substructure and superstructure component construction.

(d) Savings associated with increased productivity rates of precasting.

(2) **Construct** a two-dimensional table allowing one row for each Selection Factor and two columns for each alternate, one for Score and one for Weighted Score.

(3) **Factor Weights** to distinguish the level of importance of each criterion relative to the other criteria in achieving the project objectives. Weighting the various factors will usually require Department/district input. Distribute the Factor Weights such that their sum is equal to 100%.

(4) **Score** the relative difference between alternates. Range of scores can vary for a given project (e.g., 0 to 5 or 0 to 10). Scoring may be accomplished by a committee and then the average score for each Selection Factor entered into the matrix.

(5) **Calculate** the Weighted Score by multiplying the Factor Weight by the Score for each alternate.

(6) **Total** the Weighted Score columns: (1) Provide the absolute total of each column, which includes the Indirect Costs Score and, (2) Provide the column total *excluding* the contribution from the “Total Indirect Costs.” It is useful for management to compare the impacts, both relative and in hard dollar amounts, of indirect costs on bridge construction projects when making their decisions. *The column with the largest total weighted score theoretically indicates the alternate which most closely meets the project objectives as implicated by the matrix construct.*

Table 121.19.2 Sample Alternate Cost Summary

Alternate	Direct Costs* ($)	Indirect Costs**							Sum: Direct + åIndirect ($)
		Lane Closures		Detour Time		Facility Closure		åIndirect ($)	
		Days (#)	$/Day	Days (#)	$/Day	Days (#)	$/Day		
Precast 1									
Precast 2									
Conventional 1									
Conventional 2									

***** In calculation of Direct Costs, give specific consideration to factors that will:

(1) Increase the cost of the bridge, as necessary to accommodate:

- (a) Self-propelled modular transporters (SPMTs)
- (b) Large capacity cranes
- (c) Special erection equipment
- (d) Casting yard setup

(2) Decrease the cost of the bridge, as necessary to accommodate:

- (a) Reduced labor rates (e.g., work from barges)
- (b) Reduced maintenance of traffic (MOT) work restrictions
- (c) Reduced worker compensation insurance rates (e.g., work from barges)
- (d) Increased production rates due to assembly line processes
- (e) Increased production rates due to multiple crews working simultaneously

****** Use engineering judgment and knowledge of construction processes to estimate the number of days required for each lane closure, detour, or facility closure for each alternate. Coordinate this estimate with the preliminary construction schedule and MOT scheme.

121.19.4 Referenced Links

(1) Connection Details for Prefabricated Bridge Elements and Systems

https://www.fhwa.dot.gov/bridge/prefab/if09010/

(2) Manual on Use of Self-Propelled Modular Transporters to Remove and Replace Bridges

https://www.fhwa.dot.gov/bridge/pubs/07022/

(3) Framework for Decision-Making
https://www.fhwa.dot.gov/bridge/prefab/framework.cfm

(4) Prefabricated Bridge Elements and Systems Cost Study: Accelerated Bridge Construction Success Stories

https://www.fhwa.dot.gov/bridge/prefab/successstories/091104/index.cfm

(5) FDOT Road User Cost (RUC) Software

https://fldot.sharepoint.com/sites/CO-Construction/Scheduling%20Engineer%20Info/Forms/AllItems.aspx