Chapter 27

Hydraulic Data and Agency Permits

Exhibits

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Chapter 27

Hydraulic Data and Agency Permits

27.1 Bridge Hydraulic Report (BHR)

A Bridge Hydraulic Report (BHR) package consisting of the BHR and, as applicable, the Bridge Hydraulics Recommendation Sheet, bridge hydraulic calculations, and scour calculations must be prepared as specified in ***Chapter 4*** of the FDOT ***Drainage Manual, Topic No. 625-040-002***. Process the BHR package as specified later in this chapter.

27.2 Bridge Hydraulic Recommendation Sheet (BHRS)

A Bridge Hydraulic Recommendation Sheet (BHRS) for new structures and widenings must be prepared as specified in ***Chapter 4*** of the FDOT ***Drainage Manual***. Process the BHRS package as specified later in this chapter.

27.3 Agency Permits

Most projects will require several permits from Federal, State and local agencies. For examples of the types of permits that may be required, please see the ***Project Development and Environmental Manual***, Chapter 12.

Modification for Non-Conventional Projects:
Add the following to the above paragraph: The Design-Build firm is responsible for acquisition of all applicable permits, unless otherwise indicated in the project RFP.

27.4 Scour Considerations

Develop scour estimates using a multi-disciplinary approach involving the Hydraulics Engineer, the Geotechnical Engineer, and the Structures Design Engineer. Design bridges and bridge culverts to withstand the design flood without damage and should withstand the 500-year flood (super flood) without failure. Refer to the ***Structures Design Guidelines*** for specific foundation design steps and the ***Drainage Manual*** for policy on scour computations.

27.4.1 Development of Scour Design Criteria

The extent and the mitigating steps needed to resolve scour problems should be resolved early in the design process. The Bridge Development Report (BDR), or 30% structures plans submittal when a BDR is not required, is a means of addressing and resolving all major design issues early in the total design process and should also define the need for scour considerations, establish the scour parameters, and arrive at possible solutions. The necessary steps are as follows:

Modification for Non-Conventional Projects:
Delete the second sentence of the above paragraph and replace with the following: Submit the scour calculations as part of the 90% foundation component plan submittal.

1. The Drainage Design Engineer evaluates stream stability and scour potential based on all available data, assumed soil conditions, structure positioning, and foundation designs. The Drainage Design Engineer's assumptions (hydraulic, geotechnical, and structural) and design parameters should be discussed with both the Geotechnical and Structures Design Engineers. When evaluating stream stability and scour potential, the recommendations developed from FHWA's ***Hydraulic Engineering Circular (HEC)*** should be followed as well as the design requirements provided in ***Chapter 4*** of the FDOT ***Drainage Manual***. This work should take place early in the PD&E study where changes in the alignment could affect the severity of general scour.
2. Given the scour potential and based on known subsoil conditions and where knowledge of the local variability of the subsoil is available, the Geotechnical Engineer will then consider the possible alignments. It may be necessary to conduct exploratory work if variability of subsoil conditions are suspected but not sufficiently defined. The results of exploratory investigations should be discussed

with both the Hydraulics and Structures Design Engineer, and any previous scour assumption verified and/or modified.

3. The Structures Design Engineer should provide approximate span ranges, pier configurations, and pier locations necessary for the different alternates. In addition, possible foundation types and approximate size should be developed such that the Drainage Design Engineer can estimate local scour potentials. Conditions to be considered are:
   a. The extent and severity of scour along the alignment must be developed. For example, for bridges over a wide body of water, general scour could vary in extent and severity. It may be reasonable, therefore, to consider fewer foundations in the most severe areas (i.e., span the problem), or take appropriate steps to assure the structural integrity of the foundation in those locations.
   b. The pile driving resistance, which must be overcome at the time of construction, may be greater than the ultimate pile capacity at a later date due to subsequent scour activity.
   c. Likewise, design drilled shaft capacity must account for the possibility that ultimate capacity will be reduced as a result of future scour activity.
4. The Drainage, Geotechnical and Structures Design Engineers must develop the scour potential and rate each location and furnish the results to the District Environmental Management Office (DEMO) Engineer for consideration in establishing the recommended alignment(s).
5. The preferred alignment is established by others.
6. The Structures Design Engineer develops more detailed calculations showing possible span arrangements and types and sizes of foundations.
7. The three engineers review the proposed configuration to assure that scour has been properly addressed. (The Drainage Design Engineer reviews both the general and local scour potential and recommends continuation or changes).
8. The Structures Design Engineer finalizes his configuration and proceeds with an even more detailed analysis of the foundation including the anticipated pile tip elevations. All three Engineers must review and concur. The final results are then incorporated into the BDR or 30% Plans Stage as applicable.

The eight (8) steps described above are shown as a flow diagram in ***Exhibit 27-A.***

Modification for Non-Conventional Projects:
Delete the sentence above. Delete the third sentence of item 8, above and replace with the following: Submit the final results as part of the 90% foundation component plan submittal.

27.4.2 Scour Design of Bridge Foundations

This is a multi-discipline effort involving Geotechnical, Structures, and Hydraulics/Coastal Engineers. The process described below will often require several iterations. The foundation design must satisfactorily address the various scour conditions, and furnish sufficient information for the Contractor to provide adequate equipment and construction procedures. These three engineering disciplines have specific responsibilities in considering scour as a step in the foundation design process.

1. The Structures Engineer determines the preliminary design configuration of a bridge structure utilizing all available geotechnical and hydraulic data and performs lateral stability evaluations for the applicable loadings described in the ***Structures Design Guidelines***, Substructure Limit States, (do not impose arbitrary deflection limits except on movable bridges). A preliminary lateral stability analysis generally will occur during the BDR phase of the project, and a final evaluation will occur subsequent to the selection of the final configurations. The Structures Engineer must apply sound engineering judgment in comparing results obtained from scour computations with available hydrological, hydraulic, and geotechnical data to achieve a reasonable and prudent design.

Modification for Non-Conventional Projects:
Delete the second sentence of item 1, above and replace with the following: A preliminary lateral stability analysis will occur during the preparation of the Technical Proposal of the project, and a final evaluation will occur subsequent to the selection of the final configurations.

2. The Hydraulics Engineer, utilizing good engineering judgment as required by policy from the FDOT ***Drainage Manual***, provides the predicted scour elevation through a 100-year flood event (100-Year Scour), a 500-year flood event

(500-Year Scour), and for "Long-Term Scour". "Long Term Scour" is defined and described in Chapter 4 of the FDOT ***Drainage Manual***.

3. The Geotechnical Engineer provides the nominal axial (compression and tension) capacity curves, mechanical properties of the soil and foundation recommendations based on construction methods, pile availability, similar nearby projects, site access, etc.

27.4.3 Submittal Requirements for Scour Design

During the 30% and 90% structures plans stage reviews, the EOR must coordinate the reviews of the design of both the Drainage and Geotechnical Engineers to assure compliance with the results of the scour calculations. The EOR must consult with the District Structures Maintenance Engineer for scour inspection reports on existing bridges.

Modification for Non-Conventional Projects:
Delete the first sentence of the above paragraph and replace with the following: During the 90% foundation component plans submittal, the EOR must coordinate the reviews of the design of both the Drainage and Geotechnical Engineers to assure compliance with the results of the scour calculations.

27.5 Debris Accumulation

Debris accumulation on the upstream side of substructure units can significantly affect the flow of water and cause significant scour. Evaluate the type of vegetation upstream from the bridge and consider the probability of debris accumulation in establishing types and locations of substructure units. Special consideration must be given to mitigating debris accumulation on substructure units.

Debris clearance criteria are specified in ***Section 2.10.1*** of this volume.

27.6 Widenings

The design for scour described above must be included in the widening of an existing bridge structure classified as a major widening as defined in the FDOT ***Structures Design Guidelines***.

The requirement to include scour potential in the design of the widening of an existing structure classified as a minor widening will be considered by the Department on an individual basis.

Modification for Non-Conventional Projects:
Delete the above paragraph and see RFP for requirements.

Scour design procedures are specified in the FDOT ***Drainage Manual***, ***Chapter 4***.

27.7 Scour Elevations

The 100-year and 500-year scour elevations are required for the design of all bridges over watercourses. In addition, the Long-Term Scour Elevation must be established for bridge structures required to meet the extreme event vessel collision load. For more information on these scour elevations see the FDOT ***Drainage Manual***.

Exhibit 27-A Structural Plans Development

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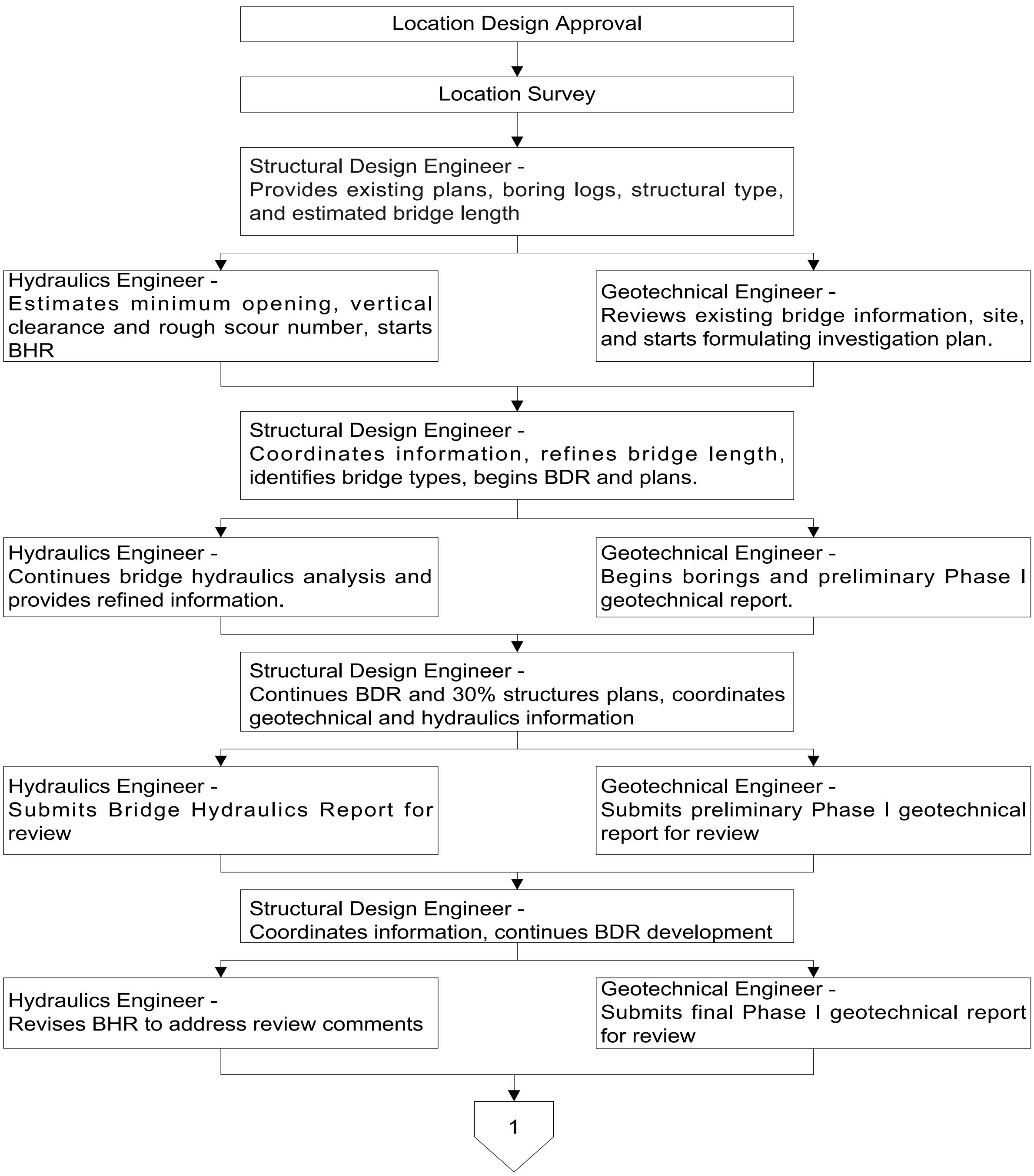

Exhibit 27-A Structural Plans Development

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