TRANSMITTAL MEMORANDUM 19-01

To: Division of Structural Design Staff
Design Consultants

From: Bart Asher
Director
Division of Structural Design

Date: May 15, 2019

Subject: Various Design Issues

Pipe Piling

In an effort to standardize pipe piling use for typical projects a new Sepia has been created with details for a standard 16" pipe pile. Effective with this memo, where pipe piles are required (generally for friction pile applications), utilize piles in accordance with the sepia. If pipe pile sizes other than the one shown on the Sepia are required, obtain written permission from the Division of Structural Design. The Sepia will be posted on the Division of Highway Design's web site and will eventually become a Standard Drawing.

Bridge Railing

Any bridge plans for structures on the National Highway System, which are let after December 31, 2019, must have MASH compliant railing. Other Kentucky Transportation Cabinet bridges will also utilize the new MASH railings unless directed by the project team. Sepias have been created for railing types listed below. The following sepias are posted on the Division of Highway Design's web site and will eventually become a Standard Drawing:

- Sepia 051 Railing System Type II – This Sepia corrected an incorrect dimension.
- Sepia 052 Railing System 36 inch Single Slope – This barrier will be utilized where site distance at approaches is an issue. Generally, this barrier will also have a handrail in accordance with Sepia 058 or 059 in order to satisfy OSHA barrier height requirements for fall protection. Obtain approval from the Division of Highway Design and the Division of Maintenance before leaving off the handrail.
- Sepia 053 Railing System 40 inch Single Slope – This is the typical concrete barrier for new and heavily rehabilitated bridges and will generally replace Standard Drawing BHS-008-02 Rail System Type 3.

- Sepia 054 Railing System Side Mounted MGS Details – This is an approved replacement for Railing System Type II (Standard Drawings BDP-005-05 and BHS-007-07). Generally this railing system should be utilized on side by side box beam structures.
- Sepia 055 Railing System type T631 Details - This is an approved replacement for Railing System Type II (Standard Drawings BDP-005-05 and BHS-007-07). Generally, this railing system should be utilized on spread beam structures with an 8 inch minimum slab thickness.
- Sepia 056 Thrie-Beam Guardrail Transition (TL-2) – Utilize this transition where MASH TL-2 criteria are required in conjunction with the concrete barriers in Sepias 052 and 053 discussed above.
- Sepia 057 Thrie-Beam Guardrail Transition (TL-3) – Utilize this transition where MASH TL-3 criteria are required in conjunction with the concrete barriers in Sepias 052 and 053 discussed above.
- Sepia 058 Aluminum Handrail – use this detail or Sepia 059 Steel Handrail in conjunction with Sepia 052 Railing System 36 inch Single Slope.
- Sepia 059 Steel Handrail – use this detail or Sepia 058 Aluminum Handrail in conjunction with Sepia 052 Railing System 36 inch Single Slope.

Drilled Shafts

Effective with this memorandum, all Drilled Shafts shall conform to the following:

- Design shall conform to all requirements specified in the current edition of the AASHTO LRFD Bridge Design Specifications. This includes, but is not limited to the following points.
    - 10.5.3.1 Design at strength limit states shall not consider deformations required to mobilize the nominal resistance, unless a definition of failure based on deformation is specified. (Design for the calculated loads and deflections unless granted prior approval from the Division of Structural Design)
    - Design should account for potential scour.
    - 10.5.3.4 Design should ensure that geotechnical and structural resistance used for design will be provided in constructed product.
    - 10.5.5.2.4 All Geotechnical resistance is reduced by 20% for a single shaft supporting a pier.
    - For single drilled shafts supporting a pier, Increase strength loads on the shaft and column by 20%.
    - Table 10.5.5.2.4-1 Resistance factor for horizontal geotechnical resistance is 1.0. FHWA drilled shaft manual recommends 0.67 (page 12-24 and 12-25). This equates to 100% or 150% of lateral strength loads.
- Design shall include a lateral load analysis in LPILE or similar program.
- Design of the shaft shall include calculations of moment and shear capacity using loads from the output of LPILE or similar program.
- Instead of designing for the maximum shear spike which occurs when using a non-linear p-y analysis, the design engineer is permitted to design for the average shear within 1 shaft diameter of the maximum shear location.

- Overturning of shaft must be checked (Geotechnical Strength Limit).
    - Geotechnical Strength Limit should be checked at 100% to 150% of lateral loads.

Box Beams

Effective with this memorandum, the following Standard Drawings have been replaced. Use the referenced sepias. Related sepias are located on the Division of Highway Design's Sepia page. These sepias will eventually replace the current Standard Drawings:

Sepia 047 (replaces BDP-001-05) Box Beam General Notes and References – This Sepia updated the sealing limits associated with the beam as well as the concrete strengths.
Sepia 048 (replaces BDP-004-03) Box Beam Tension Rod Details – This Sepia required galvanization of the tensioning components.
Sepia 049 (replaces BDP-006-04) Box Beam B12 and CB12 Details – This Sepia updated these beams to pass the required 44 ton load rating.
Sepia 050 (replaces BDP-007-04) Box Beam B17 and CB17 - This Sepia updated these beams to pass the required 44 ton load rating.

Minimum Bridge Slab Steel

Effective with this memorandum, the minimum reinforcement allowed in the top mat of rebar for all concrete bridge decks is #5 bars on one-foot centers in both directions.

Steel Girder Superstructures

- All girders shall be erected with the webs plumb under steel dead load only.
- For Steel superstructures with skews between 30^0 and 45^0 or varying skewed supports a refined analysis may be required. Designers shall compare the line girder differential deflections due to deck placement loading at each cross frame location with (beam spacing)/100. Excessive differential deflections may require a refined analysis. Curved girders are required to have a refined analysis.
- For steel superstructures with skews > 45^0, a refined analysis of the superstructure is required.
- For plate girders with webs up to 84" tall, the designer shall place a note in the plans that the overhang brackets may not be placed more than 8" above the web/flange junction. For plate girders with webs >84" tall, the designer shall dictate in their plans allowable locations for the overhang brackets and if temporary bracing is required to prevent web "Oil Canning" during construction.
- For structures requiring a refined analysis, the intermediate crossframe members shall be designed for the calculated loads.

Weathering Steel

All Continuous Welded Plate Girder bridges shall be designed with unpainted weathering steel unless site conditions are unfavorable as described in FHWA Technical Advisory T 5140.22 "Uncoated Weathering Steel in Structures".

Some unfavorable site conditions that may apply are the following:

- Industrial areas where concentrated chemical fumes may drift directly onto the bridge,
- Grade separations in "tunnel-like" conditions, and
- Low level water crossings defined as where normal flow is less than 10 feet below low chord or the calculated 2-year storm high water elevation is within 2 feet of low chord.

Particular consideration shall be given to grade separations with "tunnel-like" conditions when all of the following are present:

- Vertical clearance is 20 feet or less, because these bridges are more susceptible to "tunnel-like" conditions, which lends itself to increased chloride deposits on the beams.
- Bridges over interstates in urban corridors, since deicer treatment in these areas is typically more concentrated.
- ADTT = 10% or more under the bridge, since trucks generate more misting with deicers than cars typically do.
- Posted speed limit is 55 mph or greater, since higher speeds generate more misting with deicers.

When bridges meet these criteria, use painted weathering steel for the whole bridge. Painted weathering steel is preferred since uncoated Grade 50 and 50W steel have minimal cost difference. The final decision on material type and usage will be up to the Division of Structural Design and the KYTC project team for all jobs.

Galvanizing Rolled Beam Superstructures

Where practical all rolled beam steel superstructures will be galvanized unless the Division of Structural Design and the KYTC project team approve another anticorrosion system. Where galvanizing will be utilized, contact the Division of Structural Design for the latest steel galvanizing Special Note.

BA/JVZ/CVZ