KYTC Division of Structural Design/ACEC-KY Bridge Sub-Committee Partnering Meeting

Thursday, July 1, 2014, 9:00 AM – 10:30 AM

Minutes

These minutes provide an outline of discussions at the Division of Structural Design (DOSD) and ACEC Bridge Subcommittee partnering meeting held at the Transportation Cabinet Office Building. Those in attendance were:

- Mark Hite, Director, Division of Structural Design
- Bill McKinney, Division of Structural Design
- Kevin Sandefur, Division of Structural Design
- Ajay Shah, Division of Structural Design
- Daryl Greer, Geotechnical Branch
- Scott Ribble, Burgess & Niple
- David Depp, Johnson, Depp & Quisenberry
- Doug Burton, Lochner
- Daryl Carter, Stantec
- David Deitz, Palmer Engineering

Discussion topics included:

1. The Geotech Branch has changed many of their policies in the continued implementation of LRFD. The attached document provided by Mr. Greer summarizes many of these changes regarding piles. The following additional geotechnical topics were discussed in the meeting:
   
   a. Though design capacities of friction piles can be increased by using more stringent field testing techniques, it often proves to be uneconomical for typical projects. The Modified Gates Formula should be assumed for field testing to determine design capacities unless a cost estimate shows a significant savings can be realized by requiring Dynamic Field Testing. If the cost estimate results show a significant savings, then the use of the Dynamic Field testing should be discussed with the Geotech Branch prior to specifying its use in the plans.
   
   b. Geotech Branch is in the process of updating the standard Pile Record Notes available for download on the Cabinet’s website. They will be posted when the process is completed. Until that time, the Geotech Branch will provide necessary plan notes for specific projects.

2. Different methods to accommodate steep longitudinal grades in the design of elastomeric bearings were discussed. AASHTO requires that bearings either be designed for the longitudinal slope, or the slope must be eliminated from the bearings
by some means. It was agreed that the simplest solution was to slope the concrete cap/pedestal surface below the bearing pad.

3. Transmittal Memorandum 08-01 prohibits design using debonded strands. The DOSD prefers to avoid using debonded strands, but will allow it in cases where there is no other working solution.

4. For plan presentations of deck construction elevations, provide elevations at the gutterline. This elevation matches the fascia elevation based on Guidance Manual Exhibit 601.

5. The requirements of TM 08-01, Section 3.6.5.2, regarding vehicle collision with piers was considered. Piers protected by the Concrete Median Barrier shown in Standard Drawing RBE-065-06 are considered adequate protection of the pier to avoid designing for the impact force stipulated in AASHTO.

6. Shear keys vs. roughened construction joints at cold joints for columns, abutments stems, etc. were discussed. The DOSD is open to either of these details based on design preference.

7. The DOSD asked that consultants use the Structural Design Production Hour Worksheet posted on the Professional Services website. The committee offered to work with Professional Services to update the spreadsheet slightly, making it easier to use. The DOSD is open to the committee contacting Professional Services directly.

8. Extremely complex curved and skewed steel girder bridges can require a more refined geometrical analysis and prediction of cross-frame forces and potential uplift at girder reactions than provided by conventional steel girder design software. Typically finite element analysis is required for the refined study. The DOSD is open to providing additional production hours to perform this work, if justified. The need for the additional effort should be clarified in the negotiation process.

9. Prior to the meeting, DOSD preference regarding CVN testing requirements for steel girder bridges was discussed. Fabricators should meet the attached CVN design requirements for redundant steel bridges. This is in excess of AASHTO requirements.
GENERAL NOTES

REFERENCES: All references to the Specifications are to the current editions of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction. When combined with the KSDP-44 Truck and Load Table as specified in the KSDP LRD Specifications. All reinforced concrete members are designed by the load resistance factor method as specified in the current ASHTE LRD Specifications.

FUTURE WEARING SURFACE: This bridge is designed for a 60 PSF wearing surface.

WIND LOAD: This bridge is designed for a wind load based on a wind velocity of 30 mph.

REINFORCEMENT: Dimensions shown from the face of concrete to bare ore are to center of bars unless otherwise shown. Spacing of bars is from center to center of bars unless otherwise shown. Other dimensions are to face of concrete.

COMPLETION OF THE STRUCTURE: The Contractor is required to complete the structure in accordance with the plans and specifications. Material, labor, or construction operations, not otherwise specified, are to be included in the bid from most appropriate to the work involved. This may include coveralls, shoring, scaffolding, excavation, and similar activities.

SHOP DRAWINGS: Submit shop drawings that are required by the plans and specifications directly to the Division of Structural Design. All changes in the design plans are proposed by a fabricator or supplier. Submit these changes to the Department through the Contractor.

FOOTING EXCAVATION: Ensure excavation for footings is in accordance with Section 603.030 of the specifications. Rolling of the bottom of footings is not allowed.

DIMENSIONS: Dimensions are for a normal temperature of 60 degrees Fahrenheit. Layout dimensions are horizontal dimensions.

PAYING SEQUENCE: The pouring sequence of the slab may not be changed without the written approval of the designer.

COFFERDAMS: Cofferdams, temporary sheeting, or shoring may be necessary for construction of the structure. Include the cost of this work in the bid for Structure Excavation.

SPIRAL REINFORCEMENT: Ensure spiral reinforcement is Grade 60 deformed for pilings or Grade 70 deformed for piles. Use a minimum of one and one-half times the spiral for splices. Provide one or one-half closed ends at the ends of each spiral unit. Provide, for each coil, four cadmium, three, or single, not larger than 0.108 pound per linear foot, as a total of all sides of all splices and spacers in the bid for steel reinforcement.

PERSISTENCY: Ensure spiral reinforcement is Grade 60 deformed for pilings or Grade 70 deformed for piles. Use a minimum of one and one-half times the spiral for splices. Provide one or one-half closed ends at the ends of each spiral unit. Provide, for each coil, four cadmium, three, or single, not larger than 0.108 pound per linear foot, as a total of all sides of all splices and spacers in the bid for steel reinforcement.

PAINT: Paint the exposed top flanges, web, and bottom flanges of the exterior girders in accordance with the specifications except as follows: use only a single epoxy shop coat. Do not use a primer on the structural steel. Only use the specified paint, as indicated on the plans. Do not apply any tiling surface of the paint connections. Use fastenings which will not interfere with the completion of the job. The final color is to be painted in the shop, except the face of the steel and the faces of the steel angles.

FABRICATION AND ERECTION: Since it is important that the finished structure be uniform in color, dura-ble, and resistant to weathering, special precautions are to be taken to ensure that all exposed surfaces are kept free of dirt, dust, concrete, stains, polish, or other foreign substances. Take care to avoid gouges, seams, and other defects. Removal of all painting, spacers, and any other material which adheres to the steel that would inhibit formation of the color film is to be removed as soon as practicable.
End Bearing H-Piles

- Maximum Nominal Geotechnical Resistance – Use a resistance factor \( f_c \) = 0.5 unless otherwise stated in the report.
- In karst areas we will likely recommend using a resistance factor \( f_c \) = 0.3 in order to increase the number of piles to assist in bridging any potential voids or features. If this does not result in additional piles under the bents (i.e., the pile design loads are still less the Maximum Nominal at normal spacing), then you may need to consider reducing the spacing as a precaution.

Friction piles

- Typically we are now using pipe piles as friction piles. Usually we recommend closed end pipes although open end pipes and H-piles may be considered if penetration depths or hard driving are issues. All pile points should be inside mount. Common size is 16” diameter unless we determine higher capacities are needed. If the designer has some idea of pile loads or bent design early, it helps the Geotech Branch evaluate pile sizes, penetration depth, etc., and provide appropriate recommendations.
- Scour can control capacities and penetration depths. If possible please provide scour numbers for our use in developing recommendations. This may require some back and forth between the Branch and designer as we can provide grain size information to the designer based on the field exploration so they can complete the scour analysis.
- If certain pile embedment or penetration is needed for lateral stability of the substructure, please let us know so we can evaluate.
- The Branch evaluates drivability of the pile to determine if penetrations can be achieved, pile installation stresses can be handled, hammer sizes can be constrained, etc.
- Capacity tables will provide information for either equation verification or dynamic analysis. Using dynamic analysis does allow for use of higher capacities per pile (higher resistance factors); however, it does require a higher level of capacity verification in the field and special testing. For equation verification, the use of the FHWA Modified Gates formula instead of the formulas in the KYTC Specifications is required.
- The capacity spreadsheets will now show the verification capacities in a clearer format. See attachment. These values need to be included on the plan sets.
### LRFD Pile Capacities (For Friction Piles)

**Location:** Ramp 3 Bridge End Bents
**Size:** 16" Closed End Steel Pipe
**Base of Pile Cap Assumed to be at approximately elev:** 389 ft
**Finish grade elevation:** 396 ft
**Original ground elevation:** 366 ft

#### Depth Below Pile Cap (ft)

<table>
<thead>
<tr>
<th>Depth Below Pile Cap (ft)</th>
<th>Approximate Elevation (ft)</th>
<th>Soil Type</th>
<th>Total Nominal Geotechnical Resistance**</th>
<th>Total Nominal End Bearing</th>
<th>Geotechnical Axial Resistance</th>
<th>Static Analysis Method</th>
<th>Field Verification Values</th>
<th>Dynamic Testing Method</th>
<th>Uplift</th>
</tr>
</thead>
<tbody>
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<td>0</td>
<td>389</td>
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<td>0 Kips 0 Tons</td>
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<td>Dynamic Testing Method:</td>
<td>Uplift</td>
</tr>
</tbody>
</table>

#### Static Analysis Method

- \( R_n \) for design:
- Total Factored
- Geotechnical
- Axial Resistance
- Static Analysis Method
- Calculated Resistance

#### Field Verification Values:

- Total Factored
- Geotechnical
- Axial Resistance
- Dynamic Testing Method
- Nominal Resistance
- Non-Pier Uplift
- Static Analysis Method

#### Dynamic Testing Method:

- Total Factored
- Geotechnical
- Axial Resistance

### Uplift Resistance

- Clay: 0.50
- Sand: 0.35

### Driving Resistance Reductions

- Cohesive soils: 0.50
- Cohesionless soils: 0.35

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**Factors:**

- Axial Capacity
- Uplift Resistance

**Skin Friction and End Bearing:**

- Clays: 0.35
- Sands: 0.25

**Uplift Resistance:**

- Clays: 0.25
- Sands: 0.35

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**How to use this table:**

1. Choose the total factored geotechnical axial resistance that equals or exceeds the total factored loads at the strength limit state (G/30 = \( P_{U \cdot R} \)). Use the corresponding depth below pile-cap plus the required embedment into pile-cap to estimate pile tip elevations and the lengths of pile required. The geotechnical report may recommend higher allowable pile tip elevations.
2. Deeper pile tip elevations may be needed to address scour, tidal loads, seismic, and other loading conditions. If the total factored geotechnical axial resistance is chosen from the Static Analysis Method column, then field verification shall be conducted using the FHWA Modified Gates Formula. If the total factored geotechnical axial resistance is chosen from the Dynamic Testing Method column, then field verification by dynamic testing methods is required.

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**Side Friction Through Embankment Layers (kips):**

- 110

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*If base of pile cap varies from plan elevation by more than four feet contact this office for re-evaluation of capacities.

**Value calculated using static method.