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

SPECIFICATIONS: References to the Specifications are to the current edition of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction including any current Supplemental Specifications. All references to the AASHTO Specifications are to the current editions of the AASHTO Standard Specifications for Highway Bridges or LRFD Bridge Design Specifications, with Interims.

DESIGN LOAD AND METHOD: This bridge is designed for HS25, HL93 Live Load, or alternate military loading, whichever produces the greater stress. The HS25 live load is arrived at by increasing the standard HS20-44 truck and lane loads as specified in the AASHTO LFD Specifications by 25%. All reinforced concrete members are designed by the load resistance factor method as specified in the current AASHTO LRFD Specifications.

FUTURE WEARING SURFACE: This bridge is designed for a 60 PSF Wearing Surface.

DESIGN STRESSES:
- Concrete Class 'A' ~ 3500 psi
- Concrete Class 'AA' ~ 4000 psi
- Steel Reinforcement ~ 60,000 psi
- Structural Steel ~ FY = 50,000psi

WIND LOAD: This bridge is designed for a wind load based on a wind velocity of 100 mph.

REINFORCEMENT: Dimensions shown from the face of concrete to bars are to center of bars unless otherwise shown. Spacing of bars is from center to center of bars. Clear distance to face of concrete is 2", unless otherwise noted. Epoxy coat bars designated by suffix (e) in accordance with Section 811.10 of the Standard Specifications. Use stirrup bend diameters for bars designated by suffix (s) in a Bill of Reinforcement.

BEVELED EDGES: Bevel all exposed edges ¾", unless otherwise noted.

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 item most appropriate to the work involved. This may include cofferdams, shoring, excavations, back filling, removal of all or parts of existing structures, phase construction, incidental materials, labor, or anything else required to complete the structure.

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

FOOTING EXCAVATION: Ensure excavation for footings is in accordance with Subsection 603.03.03 of the specifications. Raising of the bottom of footings is not allowed.

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

POURING 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 substructure. Include the cost of this work in the bid for Structure Excavation.

SPIRAL REINFORCEMENT: Ensure spiral reinforcement is Grade 60 deformed or plain reinforcement. Use a minimum of one and one-half turns of the spiral for splices. Provide one and one-half closed coils at the ends of each spiral unit. Provide, for each coil, four channel, tee, or angle spacers, weighing approximately 0.8 pounds per linear foot, spacing them equally along the inside periphery of the coil. Include the cost of splices and spacers in the bid for steel reinforcement.

PAYMENT FOR STRUCTURAL STEEL: The lump sum bid for structural steel shall be full payment for all structural steel, bolts, washers, welding and welding materials, floor drains, and all labor and materials necessary to erect the steel in accordance with the plans and specifications. The approximate weight of structure steel shown in the estimate of quantities does not include overrun.

HIGH STRENGTH BOLT CONNECTIONS: Unless otherwise specified on the plans, all bolted connections shall be ASTM A325 1" diameter high strength bolts, nuts, and washers. Open holes shall be 1 1/16" diameter. Type 3 bolts suitable for use with weathering steel shall be used as described in AASHTO M164. All high strength bolted field connections are to be installed using "direct tension indicators" (DTI's) in accordance with the Standard Specifications and ASTM F959. All DTI's shall be manufactured from a steel conforming to the chemical requirements of ASTM A325 for Type 3 weathering steel. DTI's shall be installed under the bolt head with the bumps facing the underside of the bolt head. Put a hardened washer under the nut and tension from the nut.

PROHIBITED FIELD WELDING: No welding of any nature, other than indicated on plans, is to be performed without the written consent of the designer, and then only in the manner and at the locations designated in the authorization.

WELDING SPECIFICATIONS: All welding and welding materials shall conform to "Joint Specification ANSI/AASHTO/AWS D1.5 Bridge Welding Code". Modification and additions as stated on the plans and Special Provision 4 (08), shall supersede the joint specifications.

WELDING PROCEDURE: Qualification tests of all welding procedures shall be completed by the Contractor and approved by the Engineer prior to the final approval of the shop drawings and welding procedure and the start of fabrication.

DRAIN DETAILS: Foundry Note- All drains shall be gray iron castings, ASTM A48, current edition, class 30A. Foundries shall cast at least two test bars from each day's production. These test bars shall be tested by the Division of Materials, or by the Foundries' Quality Control Unit who shall furnish actual test results for each date of manufacture or lot number. Drains shall be painted inside and out. Drain pipe and fittings shall be 6" I.D., 0.25" minimum wall thickness, filament wound with fiberglass epoxy resin formulation with ultraviolet inhibitors. Pipe shall be supplied, pigmented to match the final color of the structural steel. Include the cost of the drain in the lump sum bid for structural steel. The cost of the fiberglass drain pipe is a separate bid item.

MATERIAL:	A.S.T.M	AASHTO
High Strength Low Alloy Structural Steel	•A709 GR 50W	•M270 GR 50W
Pintles and stud shear connectors,	UNS G 1018	M-169
High strength bolts, nuts, and washers	A325	M-164 Type 3
Sheet lead and Pig lead	B29-79	

• Use this equivalent specification with the ANSI/AASHTO/AWS D1.5 welding code, Special Provision 4 (03), and welding notes.

All flange and web material, including splice plates, in longitudinal plate girders shall meet the longitudinal charpy V-Notch toughness test applicable to Zone 2 minimum service temperature from -1 deg. F. to -30 deg. F. in accordance with the following:

M270 GR 50W (up to 2" thickness) of 25 ft-lbs at 40° F.
M270 GR 50W (2" to 4" thickness) of 30 ft-lbs at 40° F.

Other structural steel shall meet the impact testing requirements for non-fracture critical components Zone 2.

Sampling and testing procedures shall be in accordance with AASHTO T243 current edition, utilizing (H) frequency testing. When plate thickness exceeds 1½", frequency of testing shall be (P).

SHOP DRAWINGS (STRUCTURAL STEEL): The Contractor shall submit detailed shop drawings for all structural steel to the Department for review in accordance with Section 607.03.01 of the specifications.

SHEAR CONNECTORS: The minimum length of studs is 6⅞". Provide the necessary length to penetrate at least 2" above bottom of slab.

The "Lump Sum Bid" for shear connectors shall be full payment for all necessary shear connectors, welding and welding material, and materials necessary to field weld or shop weld the shear connectors in place according to the plans and specifications.

If the Contractor wishes to use something other than the stud shear connectors shown on the plans, the proposed arrangement shall be submitted for approval with the shop plans.

Studs shall be welded in accordance with AWS Specifications.

CAMBER: Web plates shall be cut to provide for the camber of the girder. Provide for possible warpage due to extra heat in the top flange by virtue of the shear connectors. Rolled beams shall be heat cambered according to the plans and specifications. Girders which do not conform to plan camber and grade in the erected position shall be considered as requiring, at no additional cost to the state, either an adjustment in depth of the concrete haunch over the steel supporting members, or a reworking of the girder camber to meet the plan grade and slab thickness. However, in no case shall the shear connectors be allowed to penetrate the slab less than two inches.

MILL TEST REPORTS: Notarized mill test reports shall be furnished in triplicate to the Department, showing that all material used in the structural steel conform to the requirements of the specifications.

BLAST CLEANING: Blast clean all structural steel.

PAINT: Paint the exposed top flange, web, and bottom flange of the fascia side of the exterior girders in accordance with the specifications except as follows: use only a single epoxy shop coat, do not use the zinc-rich primer coat. Include the exposed surface of the fascia side of the exterior girder splice plates. Do not coat any faying surface of the splice connections. Apply the top coat to the fascia side of the bolt assemblies of the splice connections. Field clean each installed bolt to the satisfaction of the Engineer prior to applying the coating system. The final color is to be pigmented to match the long term weathering steel patina. Include all costs associated with painting in with the lump sum bid for structural steel.

FABRICATION AND ERECTION: Since it is important that the finished structure weather to a uniform dark russet color, special precautions are to be taken to assure that all exposed steel surfaces are kept free of grease, dirt, concrete stains, paint, or other foreign substances. Take care to avoid gouges, scratches, and dents. Removal of scale and stains by using acids is not permitted. No element of the structure is to be painted, unless shown otherwise on standard drawings or these plans. It is mandatory that all exposed surfaces in the complete structure be free of any type of shop markings or identification. Scale discolorations produced by welding and any foreign material which adheres to the steel that would inhibit formation of the oxide film is to be removed as soon as practical.

REVISION	DAT

DATE: September 2007	CHECKED BY
DESIGNED BY: C. Van Zee	J. Van Zee
DETAILED BY: W. T. Mathews	C. Van Zee

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
PIKE

ROUTE	CROSSING
KY 80	Russell Fork, CSX RR & Approach

GENERAL NOTES

ITEM NUMBER	PREPARED BY	SHEET
12-1070.00	Division of Structural Design K. Sandefur Section	S2 DRAWING 258

End Bearing H-Piles

- Maximum Nominal Geotechnical Resistance – Use a resistance factor (ϕ_c) = 0.5 unless otherwise stated in the report.
- In karst areas we will likely recommend using a resistance factor (ϕ_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)
Purchase Parkway/KY 348 Interchange

County: Marshall
Location: Ramp 3 Bridge End Bents
Item #: 1-8101.00

Date: 5/7/2014

Pile Size: 16" Closed End Steel Pipe

Base of Pile Cap Assumed
to be at approximately elev*: **389 ft**
finish grade elevation: **396 ft**
original groundline elevation: **366 ft**

Depth Below Pile Cap (ft)	Approximate Elevation (ft)	Soil Type	Nominal Side Resistance		Nominal End Bearing		R_n Total Nominal Geotechnical Axial Resistance**		Static Analysis Method: ϕR_n for design: Total Factored Geotechnical Axial Resistance Static Analysis Method		Static Analysis Method: Field Verification Values: FHWA Modified Gates Formula Calculated Resistance		Dynamic Testing Method: ϕR_n for design: Total Factored Geotechnical Axial Resistance Dynamic Testing Method		Dynamic Testing Method: Field Verification Values: (EOD) End of Driving Nominal Resistance		Dynamic Testing Method: Field Verification Values: (BOR) Beginning of Restrike Nominal Resistance		Uplift: ϕR_n for design: Total Factored Geotechnical Uplift Resistance Static Analysis Method	
			Kips	Tons	Kips	Tons	Kips	Tons	Kips	Tons	Kips	Tons	Kips	Tons	Kips	Tons	Kips	Tons	Kips	Tons
0	389	cohesive	0	0.0	0	0.0	0	0.0	0	0.0	20	10.0	0	0.0	20.0	10.0	20.0	10.0	0	0.0
35	354	cohesive	60	30.0	18	9.0	78	39.0	27	13.5	178	89.0	51	25.5	103.0	51.5	188.0	94.0	15	7.5
40	349	cohesive	86	43.0	18	9.0	104	52.0	36	18.0	200	100.0	68	34.0	116.0	58.0	214.0	107.0	22	11.0
45	344	cohesive	113	56.5	18	9.0	131	65.5	46	23.0	225	112.5	85	42.5	129.0	64.5	241.0	120.5	29	14.5
50	339	cohesionless	165	82.5	150	75.0	315	157.5	142	71.0	465	232.5	205	102.5	297.0	148.5	425.0	212.5	47	23.5
55	334	cohesive	231	115.5	27	13.5	258	129.0	90	45.0	335	167.5	168	84.0	220.0	110.0	368.0	184.0	64	32.0
60	329	cohesive	264	132.0	27	13.5	291	145.5	102	51.0	365	182.5	189	94.5	236.0	118.0	401.0	200.5	72	36.0
65	324	cohesive	297	148.5	27	13.5	324	162.0	113	56.5	393	196.5	211	105.5	253.0	126.5	434.0	217.0	80	40.0
70	319	cohesive	329	164.5	27	13.5	356	178.0	125	62.5	423	211.5	231	115.5	269.0	134.5	467.0	233.5	88	44.0
75	314	cohesive	362	181.0	27	13.5	389	194.5	136	68.0	450	225.0	253	126.5	285.0	142.5	500.0	250.0	96	48.0
80	309	cohesive	395	197.5	27	13.5	422	211.0	148	74.0	480	240.0	274	137.0	302.0	151.0	532.0	266.0	104	52.0
85	304	cohesive	427	213.5	31	15.5	458	229.0	160	80.0	510	255.0	298	149.0	322.0	161.0	569.0	284.5	112	56.0
90	299	cohesive	459	229.5	31	15.5	490	245.0	172	86.0	540	270.0	319	159.5	338.0	169.0	601.0	300.5	120	60.0
95	294	cohesionless	524	262.0	375	187.5	899	449.5	405	202.5	1123	561.5	584	292.0	725.0	362.5	1010.0	505.0	143	71.5
100	289	cohesionless	723	361.5	375	187.5	1098	549.0	494	247.0	1345	672.5	714	357.0	874.0	437.0	1209.0	604.5	213	106.5
105	284	cohesionless	927	463.5	375	187.5	1302	651.0	586	293.0	1575	787.5	846	423.0	1026.0	513.0	1412.0	706.0	284	142.0
110	279	cohesionless	1137	568.5	375	187.5	1512	756.0	680	340.0	1810	905.0	983	491.5	1184.0	592.0	1622.0	811.0	358	179.0
115	274	cohesionless	1354	677.0	375	187.5	1729	864.5	778	389.0	2055	1027.5	1124	562.0	1346.0	673.0	1839.0	919.5	434	217.0
120	269	cohesionless	1575	787.5	375	187.5	1950	975.0	878	439.0	2305	1152.5	1268	634.0	1512.0	756.0	2060.0	1030.0	511	255.5

All Capacities are for a single pile.

Factors

Axial Capacity

	Static Analysis Method	Dynamic Analysis Method	Gates Analysis Method
Skin Friction and End Bearing in Clays, a-Method (Tomlinson/Skempton)	0.35	0.65	0.40
Skin Friction and End Bearing in Sands, Nordlund/Thurman Method	0.45	0.65	0.40

Uplift Resistance

Clays, a-Method (Tomlinson/Skempton)	0.25
Sands, Nordlund Method	0.35

Driving Resistance Reductions

Cohesive soils =	0.50
Cohesionless Soils =	0.25

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

*** Value calculated using static method.*

How to use this table:

Choose the total factored geotechnical axial resistance that equals or exceeds the total factored loads at the strength limit state ($\phi R_n \Rightarrow \Sigma\, \eta_i\, \gamma_i\, Q_i$) and use the corresponding depth below pile cap plus the required pile embedment into pile cap to estimate pile tip elevations and the lengths of pile required. The geotechnical report may recommend highest allowable pile tip elevations. Deeper pile tip elevations may be needed to address scour, lateral 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.

Side Friction Through Embankment Layers (kips):
110

Note: Reported nominal capacities have been adjusted. They are reduced to account for the effects of scour and side friction accumulated through embankment layers has been negelected.