Commonwealth of Kentucky
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TRANSMITTAL MEMORANDUM 07-01

TO: Division of Bridge Design Staff
Design Consultants

FROM: Allan W. Frank
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DATE: January 22, 2006

SUBJECT: Various LRFD design issues

Background:

We have serious doubts that there is a need to switch to LRFD. We feel that the current code adequately reflects the current state of the art and permits a designer to design a safe and economical structure in a reasonable length of time. Unfortunately, the FHWA has mandated the switch and, more problematic, the current code will no longer be updated to reflect future developments.

Earthquake Criteria:

Until such time as AASHTO adopts new earthquake provisions, structures shall be designed using the criteria contained in the LRFD code. Acceleration time histories shall not be used. Live load need not be applied when considering connection requirements. For the type study phase of the US-68/KY-80 over Lake Barkley and Kentucky Lake bridges use the "Recommended LRFD Guidelines for Seismic Design of Highway Bridges" with a 2% probability of exceedance in 50 years from the seismic hazard maps contained in Report number KTC-07-xx/SPR246-02-6F, "Seismic Hazard Maps and Time Histories from Earthquakes Affecting Kentucky".

Explanation: Earthquake requirements are currently being reviewed/debated within AASHTO. The LRFD provisions are essentially the same as in the current code. The above mentioned guidelines were rejected by the AASHTO Bridge Committee, partly due to a concern that the USGS maps called for in the Guideline were not appropriate for the central US. Currently, the USGS is looking at new seismic risk maps. It therefore seems prudent to wait for developments before finalizing requirements. We may ultimately adopt a dual standard, a 2% probability of exceedance

in 50 years for major structures and a 10% probability of exceedance in 50 years for others. A large earthquake has never been measured in the Central US, so ground motions maps for the New Madrid seismic zone contain more assumptions than in the western part of the country. As a result, time histories should not be used since they give the appearance of a more precise knowledge of the ground motions than the existing data can support. Earthquake design is as much of an art is it is a science so designers should use details and structures types that are more earthquake resistant.

Live Load:

Bridges shall be designed for HL-93 loading, however the resultant girders and slabs shall not have less capacity than if they had been designed for HS-25.

Explanation: Until such time as we can ascertain the overall effect of the HL-93 loading, we intend to see that the capacity of slabs and girders be no less than they would have been had they been designed under the current code.

Vehicular Collision Force:

As applied to bridges over railroads, the provisions of Article 3.6.5.2 need not be considered for bridges with piers within 50 feet of centerline track that are designed using AREMA pier protection criteria.

As applied to bridges over highways, the provisions of Article 3.6.5.2 need only be considered if a pier is particularly vulnerable and the result of a column failure would have a strong likelihood of causing the overhead structure to collapse.

Explanation: For bridges over railroads, extending the crash wall requirement to 50 feet will have little impact. For bridges over highways, Kentucky has never had problems with structures being knocked down by trucks so additional requirements for normal grade separations are not warranted.

LL Distribution Factor on Exterior of Prestressed concrete beams:

Exterior beams shall be at least as strong as interior beams and the distribution factor need not be greater that simple span distribution factor.

Future Wearing Surface:

The 60 psf future wearing surface should be considered a component dead load for purposes of design , i.e. 1.3 load factor.

Explanation: The 60 psf is not intended to account for an unexpected load. It is a provision to allow for thick future deck overlays in lieu of deck replacements. A 52 psf (equivalent to 60 psf at 1.3) is sufficient to account for any unintended additional load.

Live Load Surcharge:

Live load surcharge may be disregarded when there is an adequately designed approach slab. The approach slab length must be long enough to provide 2 foot of soil bearing beyond a 1:1 slope from the heel of the abutment footing or a partial loading must be applied.

Empirical Deck Design:

Empirical deck design shall not be used.

Railings:

The provisions contained in A13 are for the design of test specimens and need not be used in normal designs. Designers not using our typical NJ barrier (Rail System Type 3) should use a railing from the latest FHWA Bridge Rail Guide.

Elastomeric Bearing Pads:

The Elastomeric Bearing Pads shown in Standard Drawing BBP-001-011 can be used in LRFD designs. Rotations need not be checked for standard pads under standard prestressed beams. Elastomeric bearing pads designed for use with steel bridges in which a tapered sole plate is used such that the calculated final rotation is zero will be considered to have "an approved quality control plan" so the allowance for uncertainties can therefore be taken as 0.

Explanation. Kentucky has been using elastomeric bearing pads for a long time and has not had any problems that could be attributed to rotation. Code provisions that would preclude their use or increase the cost are not warranted.

Ductility, Redundancy and Operational Importance Factors:

The ductility factor should normally be taken as 1.0. The redundancy factor for non-redundant steel members may be taken as 1.0 if the only weld is a single pass longitudinal fillet weld. The operational importance factor should normally be taken as 1.0.

Explanation: Although it is generally easy to determine redundancy, what constitutes a more or less ductile structure or a more or less important bridge is difficult to quantify and whatever is used is unlikely to affect the long term performance of the structure.