Oregon Department of Transportation

Stage 1 Research Problem Statement

Number*: 25-63*

Proposed Title: Development of Improved Modular Bridge Expansion Joint Fatigue Design

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs to research.
Fatigue cracking of Modular Bridge Expansion Joints (MBEJ) results in repairs that either continue to crack, or that impose unacceptable cost and traffic impacts. Current state of the art MBEJ fatigue design and test procedures specified in ODOT Special Provision 00586 and detailed in AASHTO LRFD Bridge Design Specifications Section 14.5 and AASHTO LRFD Bridge Construction Specifications Appendix A19 Section 5.3.5 is based on wheel loading always applied at the same station along the expansion joint, while in an actual bridge application wheel loads are applied at different stations along the expansion joint due to trucks in different lanes and different positions in a lane. Since the center beams of the expansion joint are continuous beams over supports approximately 4' apart, this means that the stress range at points of maximum stress on the center beams is on the order of double what is tested – which is far more damaging. Research is needed to establish more realistic fatigue load application and criteria for MBEJ fatigue design.

2. Document how this **transportation issue** is important to Oregon and will meet the Oregon Research Advisory Committee Priorities
Modular Bridge Expansion Joints (MBEJ) are a costly asset maintenance challenge. MBEJ are an important component of our largest bridges (consider the pending Interstate Bridge, Boone Bridge, and the Fremont Bridge as examples) that endure the abuse from millions of cycles of truck loading, greatly magnified by the dynamic effects of impact. Oregon's seismic needs result in more bridges with MBEJ here than in many other states. There is a history of suboptimal performance of these joints, requiring costly maintenance and occasionally exposing traffic to the hazard of a failed center beam sticking up.

The proposed research will enable future MBEJ designs to be robust enough to avoid costly failures and repairs, and will enable repairs to existing MBEJ to be robust enough to avoid further costly failures and repairs. For an idea of the potential scale of savings, a pending repair of the failing MBEJ (which was repaired less than 10 years ago) on Willamette River (Boone) Bridge is estimated to cost $1.6M and to cause extensive traffic hardships.

3. What **final product or information** needs to be produced to enable this research to be implemented?
Implementation products should include proposed revisions to Sections 14.5.6.9.4 "Loads and Load Factors" and 14.5.6.9.7 "Fatigue Limit State Design Requirements" of the AASHTO LRFD Bridge Design Specifications, and Appendix A19 "Standard Test Methods for Modular Bridge Joint Systems" of the AASHTO LRFD Bridge Construction Specifications. Note: Appendix A19 originated as an appendix to NCHRP Report 402 "Fatigue Design of Modular Bridge Expansion Joints".

4. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.

Name	Title	Email	Phone

5. Other comments:
Suggest considering use of finite element structural analysis to evaluate the effect of loading at different positions on the center beam stresses.

Other state DOT's might also be interested in and benefit from the final product.

6. Corresponding Submitter's Contact Information:

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