MPC-362

January 1, 2012 – December 31, 2013

Project Title:
Develop Design Guidelines for Integral Abutment Bridges

University:
Utah State University

Principal Investigators:

Paul Barr, Ph.D. (PI)
Associate Professor (USU)
Paul.barr@usu.edu
(435)797-8249

Marv Halling, Ph.D. (Co-PI)
Associate Professor (USU)
marv.halling@usu.edu
(435)797-3179

Research Needs:
There is a growing trend to use highly skewed bridges. There are also many advantages to making all bridges integral, even highly skewed bridges. Many agencies have set limits on maximum skew on integral bridges to avoid translation and wingwall damage. Many designers in Utah have incorporated "finwalls" into the design. These finwalls can minimize translation and are sized for full seismic loads and can handle significant loads.

It appears that the problems seen are "restraint problems" with the system not moving as expected and forcing large loads back into the superstructure. The resultant forces in skewed or skewed curved bridge are offset and appear to be forming a force couple which is putting moment into the superstructure system. This moment is damaging the girders and the girder abutment connection.

This research is unique in that it will focus on the restraint effects of the abutments and the impacts of the restraint on the superstructure and superstructure abutment connection.

Research Objectives:
The main object of this research is to investigate the cause of cracking in integral abutment bridges in the State of Utah. Obtaining this objective will involve an extensive literature review of previous research, documenting the experiences encountered with integral abutment bridges. Once the cause of cracking is identified, design guides will be developed to eliminate the problem in future designs in addition to development of repair strategies to fix structures exhibiting these types of problems.

Research Methods:
Task 1: Literature Review
Task 2: Monitoring of I-15 to I-80 ramp over 400 South in SLC
Task 3: Finite-Element Model
Task 4: Interim Report
Task 5: Development of Design Guidelines and Repair Strategies
Task 6: Final Report Preparation

Expected Outcomes:
Design guidelines for future integral abutment bridges as well as repair strategies for existing structures. The long-term outcome of the project will be design guidelines that will help engineers address future designs of integral abutment bridges.

Relevance to Strategic Goals:
Infrastructure Monitoring Research: There is a focus on bridge monitoring, locating critical infrastructure defects and identifying tools to detect and prevent serviceability issues in transportation infrastructure. There is also a focus on analytical tools for infrastructure performance management and methods and criteria to measure performance of new materials and methods

Educational Benefits:
Integral Abutment bridges are an attractive alternative to remove the costly use of bridge joints. However, some serviceability problems have been associated with the use of these types of bridges. The knowledge gained by with this research will help develop tools to reduce serviceability problems.

Work Plan:
Task 1, Literature Review: August 2011 – November 2011
Task 2, Review of Literature Review: November – January 2012
Task 3, Implement UDOT Suggestions for Literature Review – February – March 2012
Task 4, Bridge monitoring: August 2011 – December 2012
Task 5, Finite-Element Modeling: August 2011 – December 2012
Task 6, Interim Report of Bridge Monitoring and FEM: July 2012
Task 7, Development of Design Guidelines and Repair Strategies: August, 2012 – December 2012
Task 8, Submit Final Report: January 2013
Task 9, Review of Final Report by UDOT: February 2013
Task 10, Implementation of UDOTs suggestions and Submission of Final Report with powerpoint file and presentation: April 2013

Project Cost:
Total Project Costs: $50,000
MPC Funds Requested: $50,000
Matching Funds: $ 50,000 Source of Matching Funds: UDOT Grant

TRB Keywords:

Integral Abutment Bridges, Deck Joints, Concrete Bridges

References:

Maruri, R.F., and Petro, S.H., “Integral Abutment and Jointless Bridges (IAJB) 2004 Survey Summary”.

Wasserman, E.P. and Walker, J.H., “Integral Abutments for Steel Bridges”, Volume II, Chapter 5 Highway Structures Design Handbook, 1996, National Steel Bridge Alliance, One East Wacker Drive/Suite 1300, Chicago, IL. 60601-2001.

“The State of the Art of Precast/Prestressed Integral Bridges”, Precast/Prestressed Concrete Institute, 209 West Jackson Boulevard, Chicago, IL. 60606.