

DEVELOPMENT OF EARTHQUAKE-RESISTANT PRECAST PIER SYSTEMS FOR ACCELERATED BRIDGE CONSTRUCTION IN NEVADA

By Lindsey Costello

Key Points:

Project Number:

555-14-803

Start Date:

January 1, 2015

Duration:

24 Months

Project Cost:

\$209,617

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PROBLEM

Accelerated Bridge Construction (ABC) has already been used throughout Nevada, but for NDOT to expand its ABC program, reliable and practical earthquake resistant pier systems need to be developed to allow for construction of bridges with two spans or more. There are many emerging technologies that though previously studied, a comprehensive study on different



forms that make up ABC bridge technologies has not been done to take in account the factors of seismic performance, ease of construction, cost, degree of permissible tolerances, required level of workers' skill, and durability. Furthermore, the research that has been done is mostly focused on the proof of concept with no or minimal design guidelines that are useful to designers. To facilitate the discussion of precast member substructure connections it is useful to divide the connection into two groups: those with mechanical couplers, and those without.

OBJECTIVE

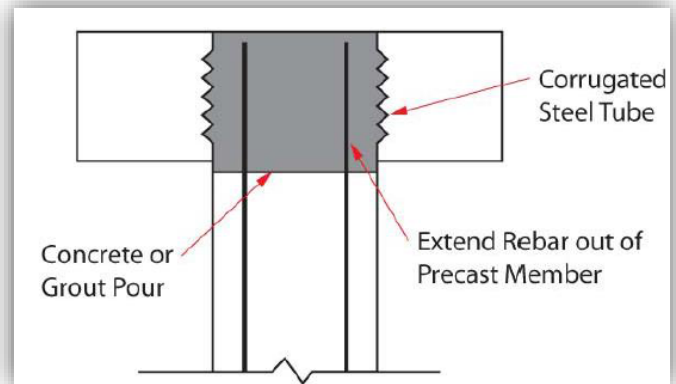
The overall objective is to identify the most appropriate earthquake-resistant precast bridge pier system for implementation of accelerated bridge construction in Nevada. integrate the results to determine the pros and cons of different connections, identify the optimal pier and connection type for Nevada, develop practical design guidelines, and demonstrate the seismic performance through seismic testing of a large-scale model of the proposed pier. a rating system will be developed to help rank different precast pier systems for Nevada.

METHODOLOGY

Task 1- Update Literature Search and Develop Project Website

complete literature search will be conducted including research data that becomes available between the time of writing this proposal and start of the project. The existing and new data will be evaluated and results will be presented to NDOT.

Task 2- Comprehensive Evaluation of Existing Pier Systems – Develop ranking system on seismic performance, degree of adoptability, ease of construction, cost, availability of materials and workers, hardware, and durability for piers and their variations to enable NDOT to quickly identify appropriate piers for ABC.



Task 3- Design and Construct a Pier System Test Models and Conduct Seismic Load Testing

Large scale testing with a model that is instrumented at all critical locations to evaluate seismic performance.

Task 4- Analyze the Test Model Response to Address the Knowledge Gaps:

The test data will be processed and examined for reliability.

Task 5- Develop Implementation Plan for NDOT

With many questions answered through the previous tasks and identification of some of most appropriate earthquake-resistant bridge pier systems, a plan will be developed for the bridge types in which these piers may be implemented.

Task 6- Prepare the Final Report: The draft final report of the project will include an executive summary presenting the study, results, recommendations, and design examples.

IMPLEMENTATION POTENTIAL

It is proposed that the pier system developed because of this study be implemented in design of approximately three representative new bridges in Nevada. Another important aspect of ABC is generally higher quality of materials and construction that could improve durability and reduce long-term maintenance costs. A plan will be developed for the bridge types in which these piers may be implemented. The criteria will be the number of spans (2 or more) and some of the other geometric considerations. ABC could be implemented in a wide range of bridges including straight, skewed, and curved bridges.

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