TAKING BRIDGE INNOVATION INTO THE FIELD

By: Lindsey Costello

Key Points:

Project Number:
556-14-803
Start Date:
January 1, 2015
Duration:
19 Months
Project Cost:
$124,073
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PROBLEM

The focus of nationwide bridge engineers for many years has been solely on life safety. It was important to ensure that bridges would not collapse during an earthquake. The primary issue with this design philosophy is that collapse prevention is ensured through damage of the bridge structures, meaning when the earthquake is over, the bridge may need to be shut down for repairs or even torn down. In the last 10 years, research has turned from just satisfying life safety to long-term bridge serviceability.

OBJECTIVE

The primary objective is to determine new design and construction strategies that can be used by NDOT that not only satisfy life safety but also mitigate earthquake damage. It will be critical to have bridge design, construction, maintenance, and materials involved in all stages since the key to the project is implementation. The performance objectives have been raised so that after a minor earthquake the bridge has no damage and after a major event there is limited repairable damage. The reduction in damage will lead to the reduction in bridge closures and the ability to get an affected area back to "normal" as soon as possible. In a state that relies on its transportation for goods and services, and tourism, returning to "normal" as quickly as possible is very important.

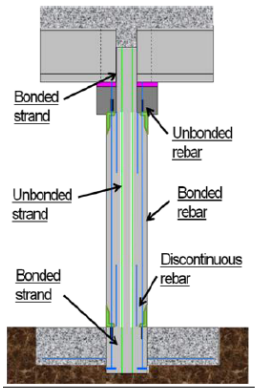

Figure 1: Pretensioned System

METHODOLOGY

Task 1: Literature Survey

The possible design and construction methods that mitigate earthquake damage will be summarized. A presentation will be made to NDOT to discuss the pros and cons of each method. It will be critical to include bridge design, maintenance and construction division so that different systems can be evaluated.

Task 2: Bridge Identification

The project will target recently constructed bridges that were designed to current standards that are similar to future bridges. These bridges have the advantage that they have already been designed using conventional methods.

Therefore, in Task 3, the bridges can be redesigned and analyzed using new methods. This will also enable cost comparisons between methods. It will also be important to select bridges from both lower and higher levels of seismicity. In lower seismic areas, it will be possible to design a bridge so that no damage occurs even due to their largest anticipated earthquake.

Task 3: Design and Analytical Program

Bridges will be designed and analyzed with at least two potential damage mitigating options. The analysis results will enable performance estimates and comparisons between the different methods. As part of the design process, constructability, materials and maintenance will be focal points. It is important that the final solutions be ones that can be constructed and maintained.

Task 4: Initial and Long-Term Cost Estimating

Estimates will be made in the cost of the different alternatives. This will enable NDOT to make a value decision of cost versus performance. Focus will be put on both initial and long-term costs, and feasible repair strategies.

Task 5: Design Guidelines and Construction/Material Specifications

Design guidelines and construction specifications will be developed. This will enable the implementation of the project in actual bridge projects. The design guidelines will assist NDOT engineers in implementing these new methods in future projects. There will likely be construction or material specifications that are necessary for constructing with these new methods. Preliminary construction and material specifications will be developed along with sample details for the methods.

Task 6: Final Report

A final report will be submitted to NDOT for their review. The final report will document all the work that was done for the project.

IMPLEMENTATION POTENTIAL

The anticipated benefit is the reduction in earthquake damage. The reduction in damage will lead to the reduction in bridge closures and the ability to get an affected area back to “normal” as soon as possible. In a state that relies on its transportation for goods and services, and tourism, returning to “normal” with minimal bridge damage as quickly as possible is very important.

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