October 2016 **FHWA-NJ-2016-005**

New Jersey Department of Transportation
Bureau of Research

Technical Brief

Heavy Vehicle Load Simulator for Bridge Deck Testing Application

The Rutgers Center for Advanced Infrastructure and Transportation (CAIT) has procured a full-scale load testing equipment. The Heavy Vehicle Load Simulator for Bridge Deck Testing Application is a one-of-a-kind testing equipment that will evaluate full scale bridge elements and bridge decks in an accelerated manner. The equipment evaluates the samples by applying realistic traffic and environmental loading conditions in a greatly compressed timeframe, simulating 15 years of deterioration in 6 months (30 fold).

Background

To reliably study these complex processes it is necessary to identify a set of parameters that describe the primary drivers of bridge deterioration, and then to vary these parameters in a controlled sense while observing performance/deterioration over time. In this manner, the causal relationships between external inputs (e.g. repetitive live loads, temperature cycles, freeze-thaw, applications of deicing chemicals, etc.), bridge attributes (e.g. superstructure flexibility, cover thickness, rebar coating, girder spacing, etc.), and various performances (associated with durability, serviceability, strength, etc.) can be discerned.

Research Objectives and Approach

Given the importance of overcoming the challenges associated with aging bridges, and the need for a full scale proving ground for evaluating new and advanced materials and devices, CAIT has procured a full-scale load testing equipment. The Heavy Vehicle Load Simulator for Bridge Deck Testing Application, branded as The Bridge Evaluation and Accelerated Structural Testing (BEAST) Laboratory, is a one-of-a-kind testing equipment that will evaluate full-scale bridges in an accelerated manner.

CAIT collaborated with Applied Research Associates (ARA) to prepare, design and fabricate the Heavy Vehicle Load Simulator. The equipment will evaluate the bridge samples by applying realistic traffic and environmental loading conditions in a greatly compressed timeframe, simulating 15 years of deterioration in 6 months (30 fold).

This equipment, for the first time, will allow the study of deterioration on full-scale bridges. Since deterioration operates over long durations and at a glacial time-scale, time compression is highly desirable. The innovative manners implemented in this laboratory to accelerate deterioration processes without distorting them will provide bridge owners with critical information in the near-term.

Findings

The equipment is a large complex system enclosing a 125' long by 75' wide footprint and standing 13'-6" tall. The equipment consists of a load chassis applying a 60,000lb load in an enclosed environmental chamber that weathers the test sample, simulating seasonal temperature fluctuations (0ºF to 104ºF) and applying deicing salts. Physical and environmental loading on the test specimens simulates actual stress and impact levels exerted by truck traffic on bridges at a greatly accelerated pace.

Within the next decade, substantial bridge maintenance and replacement will be necessary, as will ongoing highway rehabilitation. These efforts will significantly affect congestion and commerce, negatively impacting the competitiveness of our nation's manufacturing sectors, shipping/trucking capabilities, and port/maritime operations. The Heavy Vehicle Load Simulator will address the nation's needs with respect to supporting infrastructure health and rapidly evaluating and standardizing new technologies for assessment of deterioration, safety, new materials, and construction techniques to enhance the preservation and life spans of our nation's bridges.

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A final report is available online at: http://www.state.nj.us/transportation/refdata/research/. If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us.

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NJDOT Research Report No: FHWA-NJ-2016-005