RESEARCH
PROJECT CAPSULE [16-3ST]
July 2016
TECHNOLOGY TRANSFER PROGRAM

Live Load Rating of Cast-In-Place Concrete Box Culverts in Louisiana

JUST THE FACTS:

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May 16, 2016

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14.5 months

End Date:
July 31, 2017

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SPR: TT-Fed/TT-Reg

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used Implementation Potential

PROBLEM

Bridges must be inspected and load-rated to make certain they are safe. About 20% of Louisiana's bridge inventory is attributable to culverts. Current load-rating procedures consider culverts to behave like bridges. However, the use of bridge rating procedures for culverts can lead to questionable load restrictions.

It is known that well-performing culverts below pavement and shallow depths of soil often end up with poor rating factors when using current bridge rating procedures. Those procedures are based on gross vehicle weight (GVW) loads. Axle or wheel loads are more applicable to buried culverts.

This project proposes to conduct load testing of eight existing DOTD culverts. A structural health monitoring approach will be adopted for the purpose of extracting load responses that can be used to calibrate refined models for rating of culverts, ultimately leading to a better understanding about the behavior of buried cast-in-place concrete box culverts under typical highway axle loads.

OBJECTIVE

The objective of this study is to assess live load effects on cast-in-place concrete box culverts. Field load testing of selected culverts will be conducted, using instrumentation to monitor their response. The load test response data will be complemented with analytical and numerical investigations to help understand the discrepancy between the apparent good performance of existing culverts and the low rating factors obtained when using current procedures.

METHODOLOGY

Initially, box culverts will be selected for this study from the DOTD inventory. Several parameters (pavement type, geometric configuration, and type of earth fill) are considered critical for the load rating of buried structures. Earth fill depth is one of the most important parameters, and will be an important consideration when selecting culverts to be instrumented.

It is probable that the geometric configuration for each of the selected culverts will be different. Therefore, each will require a unique instrumentation plan devised for the specifics of that culvert. Load tests will be conducted using loaded trucks whose axle loads and dimensions will be measured.

Adjacent wheel loads from side-by-side trucks will be centered on an instrumented gage line. After crawling both trucks across the culvert, the trucks will be shifted laterally and the load test will be repeated. Several load positions will be considered. Thus, the

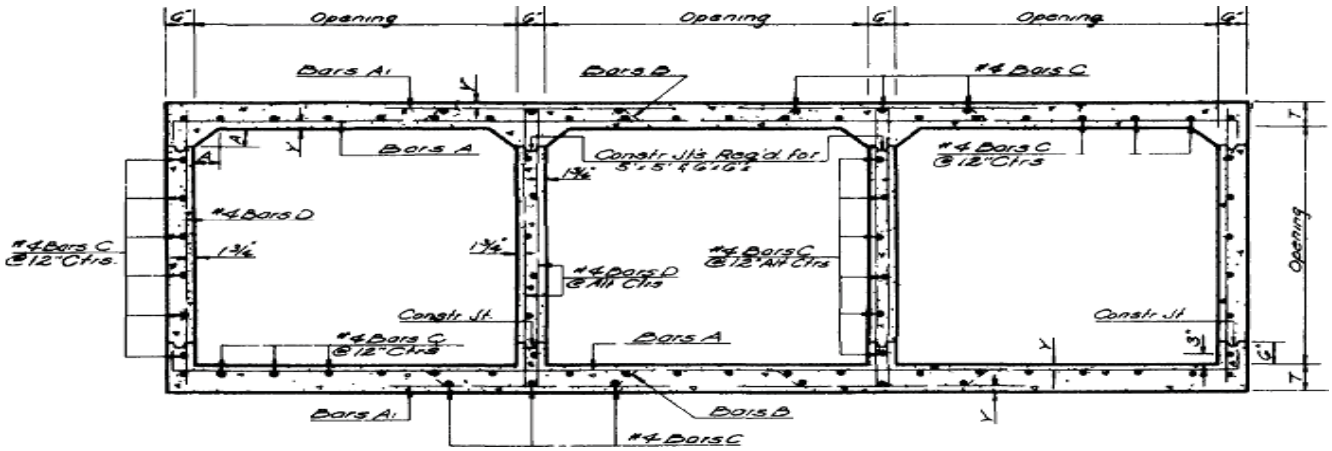
response of the culvert to different pressure distributions can be interpreted.

Strain data from the tests will provide some understanding as to how loads are transferred to the structure. Readings from each strain gage will be used to calibrate a numerical model for estimating strains due to live load.

Once the model is calibrated, strains at critical locations will be used to obtain a rating factor. Rating factors will be determined for both design loads and legal loads. Collected data will be analyzed to better understand the behavior of the culverts and the limitations of current rating methods.

IMPLEMENTATION POTENTIAL

The findings from this study will help DOTD make more-informed decisions about load rating of culverts. Based on the findings, it will be determined if weight-limit posting of some well-performing culverts is actually necessary.



Old DOTD standard detail for a three-cell cast-in-place box culvert