

FIELD OF STUDY

Civil and Environmental Engineering

THESIS TOPIC

THE EFFECTS OF NEW EMERGENCY VEHICLE LOADS ON THE LOAD RATING OF CONCRETE CULVERTS IN TENNESSEE

EXAMINING COMMITTEE

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ABSTRACT

The Fixing America's Surface Transportation Act (FAST act) changed the existing weight limit restrictions for highway vehicles. The new restrictions now allow for certain heavier vehicles to traverse highways without acquiring permits. In response to this, the Federal Highway Administration (FHWA) has required state transportation departments to load rate all bridges and structures for two new loading configurations. The configurations are named EV2 and EV3 and must be evaluated as legal loads per the Load and Resistance Factor Rating method. In addition, the FHWA has developed a new load posting procedure based on the rating results of the new emergency vehicle configurations. The main objectives of this research are to compile a database of culvert ratings for new emergency vehicle loading, conduct a parametric study of the rating results, and investigate possible changes that can be made to culvert models to increase accuracy. This thesis summarizes an investigation into the effects of new emergency vehicle loading configurations on load ratings of concrete culverts in Tennessee. The Tennessee Department of Transportation funded the research and provided all pertinent information. Based on the information provided, structural computer models for all of the culverts were built using the software program AASHTOWare. The culverts were loaded with different loading configurations. It was found that EV2 and EV3 ratings were less than HL-93 truck and HL-93 tandem operating ratings for every culvert. There were culverts whose ratings were sufficient for HL-93 truck and tandem loading, but are now insufficient for the new emergency vehicle loading. The reason for the decrease in ratings is due to EV2 and EV3's heavier weight and shorter length compared to HL-93 loading, larger required live load factor of 2.0 for EV2 and EV3 loads for buried structures versus 1.35 for HL-93 truck and tandem loads, and lack of compliance of EV2 and EV3 loading to federal bridge formula B weight restrictions. The new emergency vehicle load posting procedure and the relatively low EV2 and EV3 load ratings will significantly impact recommended load postings for culverts in Tennessee. The correlations found between HL-93 and emergency vehicle loading are strong and can be used to reasonably estimate EV2 and EV3 ratings when HL-93 ratings are available.

BIOGRAPHICAL SKETCH

Noah Stansfield was born in Buffalo, New York on June 25, 1994. He attended elementary schools in the Williamson County School District in Tennessee and graduated from Ravenwood High School in May 2012. The following August he entered Tennessee Tech University and received the degree of Bachelor of Science in Civil and Environmental Engineering in May 2017. He entered the graduate program at Tennessee Tech University in August 2017 and is a candidate for the Master of Civil and Environmental Engineering Degree. He earned his Engineering Intern certificate in 2017.

EDUCATION

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College of Engineering

TENNESSEE TECH

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