

## JUST THE FACTS

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6 months

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SP&amp;R

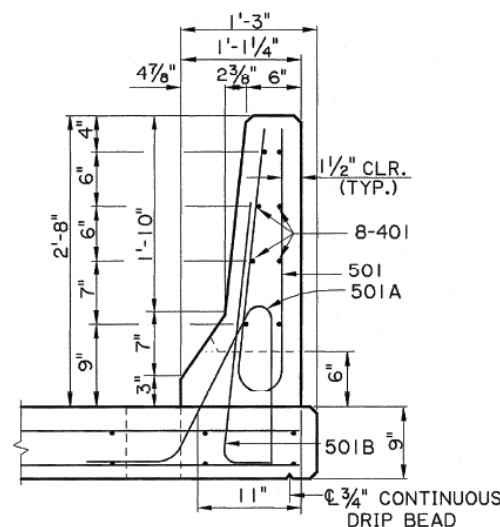
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walaywan@dotd.la.gov**Performance and Analysis of Concrete Bridge Railing Using Conventional and Composite Reinforcement****PROBLEM**

Bridge barriers are designed to resist accidental impact of a standard test vehicle. National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features" specifies various levels of test vehicles for different applications. For the majority of applications on high speed highways, the Test Vehicle TL-4 is specified. TL-4 is a test level at which a 17,650-lb. vehicle traveling at 50 mph impacts a barrier at an angle of 15 degrees.

The Louisiana Department of Transportation and Development (LADOTD) has used the F-Shape concrete railing, which meets the TL-4

requirement, over many of its highway bridges.

However, there were several proposed changes to the current NCHRP Report 350. Parts of the proposed changes were factors pertaining to the center of gravity of impacting vehicles, weight of small car test vehicles, impact angles for all tests, and an increase of the weight of test trucks, to name a few. Based on the reinforcement arrangement and the proposed revisions, it is necessary to reevaluate the performance of the new detail for (1) the earlier bar arrangement modification and (2) the NCHRP Report 350 proposed update to ensure its compliance with AASHTO Load and Resistance Factor Design (LRFD)

**F-SHAPE BARRIER RAILING****SPECIAL POINTS OF INTEREST:**

- Problem Addressed
- Objectives of Research
- Methodology Used
- Implementation Potential

specifications. A computational analysis will be performed based on the guidelines provided in Chapter 13 of the AASHTO LRFD Bridge Design Manual in conjunction with the yield line theory approach.

This work will also enable the opportunity of performing similar computation, design, and field verification for LADOTD's F-Shape concrete barrier with fiber reinforced polymer (FRP) instead of the conventional reinforcing steel used in the current detail.

### **OBJECTIVES**

The principal objectives of this study are to assess the structural adequacy, strength, and overriding potential of the railing section used by the Department using both the current NCHRP 350 guidelines and the newly approved ones, and to evaluate the use of fiber reinforced polymer materials (FRP) for future reinforcement in bridge railings.

### **METHODOLOGY**

This research will be conducted according to the following tasks:

**Task 1:** Conduct a literature review. The purpose of the

literature search is to (1) collect information regarding available publications pertaining to testing of bridge railing systems and (2) use FRP bars in bridge components.

**Task 2:** Perform computational analysis on currently used section to verify it can withstand TL-4 impact based on NCHRP 350 requirement and the newly proposed TL-4 test. If the section flexural capacity is inadequate, then a new reinforcement may be recommended. If section flexural capacity is adequate but its height is challenged, a taller section will be designed.

**Task 3:** Based on the results of Task 2, design the reinforcement of two F-Shape railings—one section using FRP bars for reinforcement and the other using conventional bars.

**Task 4:** Develop an instrumentation plan for field performance to collect data while performing a static load testing on both sections.

**Task 5:** Cast the two sections and perform a static load test on each one. The static load test will be performed through hydraulic rams, which will transmit a force

of 76 kips to the sections. The conventionally reinforced concrete section will serve as:

(1) a control section when comparing the FRP results, and (2) it will also contain the revised reinforcement based on the new NCHRP proposed loads.

**Task 6:** Analyze collected data and compare to results obtained through computations.

**Task 7:** Submit a final report with research findings and recommendations.

### **IMPLEMENTATION**

The results of the proposed research will be presented to LADOTD Bridge Design for implementation in bridge railings that are built every year in Louisiana. The outcome of this research will be an end product that will be used by LADOTD and is compliant with the Manual for Assessing Safety Hardware (MASH 08).