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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

Development of a replacement for breakaway supports for large roadside signs and crash testing to MASH 2016 Test Level 3

Current federal guidelines require that all roadside hardware be evaluated by the latest crash testing criteria. This project is to identify and test sign support systems that need to meet the current criteria.

Geotechnical/ Structures

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Project Title: MASH 2016 Compliance of Roadside Safety Features

Task Number: 3169

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Task Manager:

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WHAT IS THE NEED?

Per Federal Highway Administration guidelines all roadside hardware including sign supports must be evaluated using the 2016 edition of the American Association of State Highway and Transportation Officials Manual for Assessing Safety Hardware (MASH) criteria. Many of the California Department of Transportation's (Caltrans) one and two post sign supports have not been tested under the MASH criteria. The purpose of this project is to research what testing has been or will be conducted by other state departments of transportation or testing agencies. Once completed, sign support systems that require testing will be identified and ranked. Those that are deemed the most critical or represent a large group of sign support systems will be tested under the criteria in MASH.

WHAT ARE WE DOING?

Specific sign and post combinations for testing are being reviewed to include in the testing plan. Crash testing by others, such as Midwest Roadside Safety Facility and Texas Transportation Institute are being monitored to avoid testing overlap and to better define sign and post combinations that are likely to pass MASH testing. Many combinations are failing due to windshield penetration or excessive deformations of the windshield or roof.

Signposts are considered Support Structures in MASH. There are three tests for each signpost configuration. Caltrans's sign supports are considered MASH Test Level 3 systems and the testing criteria details are as follows, additional tests may be

Caltrans

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required for impact angles that are determined to be critical:

MASH Test Number	Vehicle	Impact Speed Mph (km/h)
3-60	1100C Passenger Car	19 (30)
3-61	1100C Passenger Car	62 (100)
3-32	2270P Pickup Truck	62 (100)

WHAT IS OUR GOAL?

The goal is to confirm that one and two post sign support systems on California's highways meet the current safety evaluation criteria. Any systems that do not meet the criteria will be redesigned and tested.

WHAT IS THE BENEFIT?

This research will ensure that the sign support systems on California's highways meet safety standards and federal guidelines. By meeting these standards, Caltrans will improve safety for road users by lowering the potential for injuries and fatalities, reduce tort liability, and will continue to have Federal-aid reimbursement eligibility. Also, other departments of transportation throughout the country will benefit from this research since many use similar sign support systems.

WHAT IS THE PROGRESS TO DATE?

The first sign panel chosen for testing in this project is a 60" x 60" diamond warning aluminum sign sheet. This panel is mounted to two 6" x 6" wood posts. For signpost testing, the conditions of the soil at the installation are important and involves special soil placement, compaction, and specific soil properties related physical testing. Therefore, a 3/4" Virgin Aggregate Base Class 2 soil pit was installed at the test site. We are currently developing a compaction method that will meet MASH soil testing requirements

Three dynamic bogie tests were conducted in the soil pit, but the tests failed to meet the MASH soil strength requirements. The first test failed with the measured load too high due the soil being over compacted. A series of compaction and static tests were conducted until a compaction method was developed that was believed would provide a successful force-deflection curve during a dynamic bogie test. This compaction method was then used on the next two tests. The second test failed with a low force-deflection curve due to frequent rain the prior months increasing the height of the ground water table, the surrounding water seeped into the installation and weakened the soil. The third test's force-deflection curve was just below what is required and failed due to the soil not having enough compaction. Therefore, the chosen compaction method needs to be modified to increase the force-deflection curve.

We are planning to modify the compaction method to increase the level of compaction. We will run static tests on the new method to ensure that it exceeds the force levels of the previous method. Once we believe that the forces are high enough, we will conduct another dynamic bogie test. We have also been monitoring and communicating with other accredited crash testing labs about other on-going signpost and soil testing nationally.

IMAGES

Image 1: Test 610MASH0B24-01: Dynamic Bogie Test

Image 2: Test 610MASH0B24-01: Static Test

Image 3: Test 610MASH0B25-01: Dynamic Bogie Test

Image 4: Test 610MASH0B25-01: Static Test

Image 5: Test 610MASH0B25-02: Dynamic Bogie Test

Image 6: Test 610MASH0B25-02: Static Test