DRISI

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.

Geotechical/ Structures

MAY 2026

Project Title: MASH 2016 Compliance of Roadside Safety Features

Task Number: 3169

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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 required for impact angles

Caltrans

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that are determined to be critical:

MASH Test Number	Vehicle	Impact Speed Mph (km/h)
3-60	1100C Passenger Car	19 (3)
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.

Due to past failures, two new compaction methods were developed and statically tested. Both static test results were higher than the previous method and we picked the method with the lower force-deflection curve of the two results. Test 610MASH0B25-03 used this new compaction method but again the test failed due to the force-deflection curve being below what is required in MASH. The failures we were having surprised us since other agencies had successful tests with similar soil and static test results. Therefore, we began looking at our test bogie.

After reviewing the videos and data from the previous tests, it was felt that the impact head of the bogie was too close to the impact head mounting plate. A new impact head was fabricated to double the length of the distance between the head and mounting plate. We also felt that the bogie's mass needed to be increased and moved toward the front of the bogie. This was achieved with the new impact head, attaching some protective plates to the bottom of the bogie, and moving the rear ballast to the front.

With the hypothesis that our failures were due to the configuration of the impact head and not the compaction of the soil, the compaction method used in Test 610MASH0B25-04 was the original method. Unfortunately, the test failed to meet the force-deflection curve required in MASH. The next step is to increase the level of compaction and conduct another dynamic bogie test. Unfortunately, rainy weather has prevented us from conducting this test the last few months. The next test is tentatively scheduled for mid-June 2026.

IMAGES

Image 1: Static Test of New Compaction Method 1.

Image 2: Static Test of New Compaction Method 2.

Image 3: Test 610MASH0B25-03: Dynamic Bogie Test.

Image 4: Test 610MASH0B25-03: Static Test.

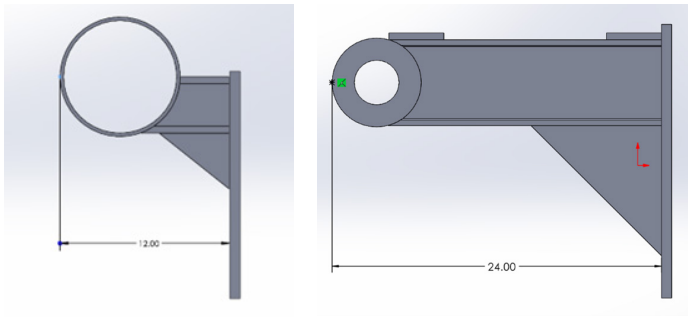

Image 5: CAD Drawing of New Impact Head 1 (left) and New Impact Head 2 (right).

Image 6: Test 610MASH0B25-04: Dynamic Bogie Test.

Image 7: Test 610MASH0B25-04: Static Test.