

0-6948: Analysis of 54-Inch-Tall Single-Slope Concrete Barrier on a Structurally Independent Foundation

Background

The Texas Department of Transportation (TxDOT) requires that on roadways exceeding certain annual traffic frequency, bridge columns adjacent to roadways be designed for impacts from heavy trucks, or be shielded with a 54-inch-tall barrier that has a structurally independent foundation. This barrier should meet American Association of State Highway and Transportation Officials *Manual for Assessing Safety Hardware* (MASH) Test Level 5 (TL-5) testing requirements. Currently, there is no available design for a 54-inch-tall barrier with a structurally independent foundation that meets MASH TL-5 requirements.

What the Researchers Did

In this project, researchers developed structurally independent foundation designs for a 54-inch-tall single-slope concrete barrier (SSCB) that meet the impact performance requirements of MASH TL-5.

Researchers developed seven preliminary foundation design concepts for the SSCB. Of these, TxDOT selected three for further development. The concepts selected were a shallow moment slab, a vertical beam, and a drilled shaft foundation. TTI researchers developed simulation models of the selected preliminary designs and performed vehicle impact simulations to determine the

performance of these systems under MASH Test 5-12 impact conditions, which involve impacting the barrier with a 36000V tractor-van trailer vehicle at an impact speed and angle of 50 mi/h and 15°, respectively.

Simulations were used to optimize the foundation sizes, after which researchers developed reinforcement details for the three barrier and foundation systems. The drilled shaft foundation design was determined to be the most critical of the three systems and was selected for crash testing. The Texas A&M Transportation Institute constructed the 54-inch-tall SSCB barrier with the drilled shaft foundation and performed MASH Test 5-12.

What They Found

During the full-scale crash test, the 54-inch-tall SSCB with the drilled shaft foundation contained and redirected the 36000V vehicle. The vehicle did not penetrate, underide, or override the installation. Maximum dynamic deflection during the test was 2.9 inches, and the working width

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was 40.2 inches. The vehicle remained upright during and after the collision event, and the barrier performed acceptably for MASH Test 5-12. Figure 1 shows the barrier and the interaction with the TL-5 test vehicle.

What This Means

Using the results of the crash test and the simulation analyses, researchers developed guidance on the distance that should be maintained between the 54-inch-tall SSCB and the bridge columns supporting an overpass. To protect the bridge columns from any impact from the tractor trailer, the bridge columns should be placed at an offset equivalent to the distance the vehicle is expected to reach on the field side as it leans over the barrier during an

impact. Table 1 presents this offset distance for the three foundation systems. In the interest of simplifying implementation, a minimum 2-ft offset behind the barrier may be recommended for all three foundation systems.

TxDOT's Bridge Division can achieve statewide implementation of the 54-inch-tall SSCB and its foundation designs through the development and issuance of new standard detail sheets.

Table 1. Offset behind Barrier for Three Foundation Systems of SSCB.

Foundation System	Offset behind Barrier (Inches)
Moment Slab	25.15
Concrete Beam	22.45
Drilled Shaft	19.45



Figure 1. MASH Test 5-12 on 54-Inch-Tall SSCB with the Drilled Shaft Foundation.

For More Information

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