Pooled Fund Post

The Newsletter of the Roadside Safety Pooled Fund Program

http://www.roadsidepooledfund.org

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What's Inside

Completed Pooled Fund Projects

W-BEAM GUARDRAIL ON LOW-FILL BOX CULVERT

Tech Representative: Dave Olsen
TTI Researcher: William F. Williams

The primary objective of this project was to test and evaluate a guardrail design with standard post spacing for use across low-fill box culverts in accordance with MASH TL-3, which involves a 2270P vehicle. A second objective for this study, was to develop a W6x9 post with welded base plate detail for use with an epoxy anchoring system that would simplify installation.

2270P Vehicle Redirecting during Crash Test

In Phase I of this study, NCHRP Report 350 test 3-11 was performed to evaluate a guardrail system across a low-fill culvert. During this test, the W-beam rail element ruptured. The adhesive anchoring system worked as designed with the new W6x9 post and welded baseplate detail. No damage to the deck or failure of the adhesive anchors was observed.

In Phase II, the height of the W-beam guardrail system was raised from 27 inches to 31 inches above the finished grade. The posts were spaced 6 ft-3 in centers ; however the W-beam rail splices were relocated to the midspan of the 6 ft-3 in post spacing. The crash test performed on the W-beam guardrail on low-fill was in accordance with MASH test 3-11. The W-Beam guardrail on low-fill culvert performed acceptably with respect to MASH test 3-11 criteria.

W-Beam Guardrail on Low-Fill Box Culvert Before Crash Test

W-Beam Guardrail on Low-Fill Box Culvert After Crash Test

For the complete report, visit: http://www.roadsidepooledfund.org/2011/01/23/box-culvert-guardrail-phase-ii-405160-23/

CONCRETE BARRIERS FOR SLOPES AND MSE WALLS

Tech Representative: Dave Olsen

TTI Researcher: Nauman Sheikh

The objective of this research was to restrict lateral deflection of a concrete barrier when placed adjacent to slopes as steep as 1.5H:1V or on top of Mechanically Stabilized Earth (MSE) walls, without using a concrete moment slab. The final design was a 100-ft installation of the 42-inch tall single slope barrier was embedded 10 inches in soil. The effective height of the barrier was reduced to 32 inches and was placed at a 2-ft lateral offset from the 1.5:1V slope break point of the soil embankment.

A 2270P vehicle, traveling at an impact speed of 63.1 mi/h, impacted the barrier at an angle of 24.2 degrees. The barrier successfully contained and redirected the vehicle. The vehicle did not penetrate, underride, or override the installation. The design successfully met MASH TL-3 requirements.

Crash Test

Single Slope Barrier in Front of 1.5H:1V Slope

While there are certain metal guardrail designs approved for use adjacent to steep slopes, a significant advantage of using the embedded concrete barrier comes from the low maintenance required in the event of a vehicle impact. Due to the small lateral deflection upon vehicle impact, the barrier can also be used on top of MSE walls.

For complete results and reports visit: http://www.roadsidepooledfund.org/2011/01/13/concrete-barriers-for-slopes-or-mse-walls-405160-13/

T-Intersection for Curved Guardrail System

Tech Representative: Paul Fossier

TTI Researcher: Akram Abu-Odeh

The objective of this study is to investigate the performance of previously tested short radius systems to determine if they meet NCHRP Report 350 TL-2 evaluation criteria. The unique geometry of a short radius T-Intersection guardrail system makes it function more as a terminal/crash cushion rather than a longitudinal barrier. A system designed and tested for Yuma County, Arizona was used as the basis for developing a short radius guardrail system that satisfies NCHRP Report 350 TL-2.

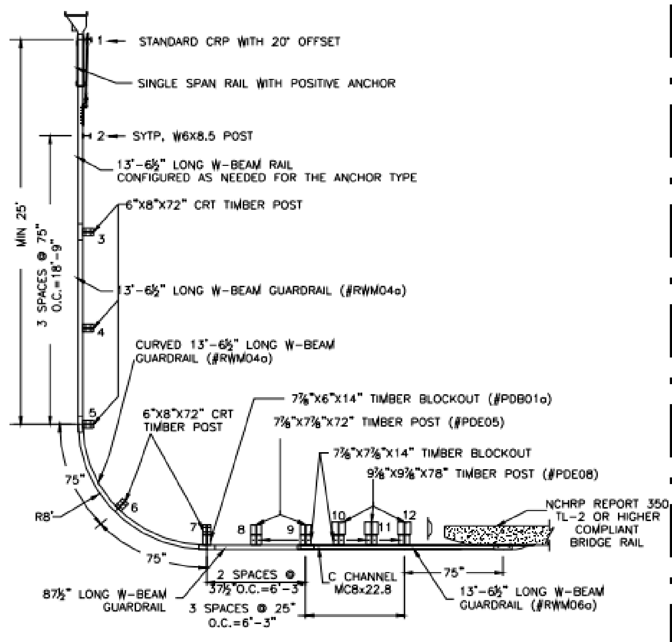
The study approach consisted of the following tasks:

(a) Determination of an appropriate NCHRP Report 350 TL-2 test matrix for short radius guardrail

(b) A review of the crash tests performed on a T-intersection guardrail treatment developed for Yuma County, AZ

(c) A comparison of Yuma County tests with the NCHRP Report 350 tests

(d) An investigation of the energy dissipation contribution of the free standing CRT post that were part of the original design



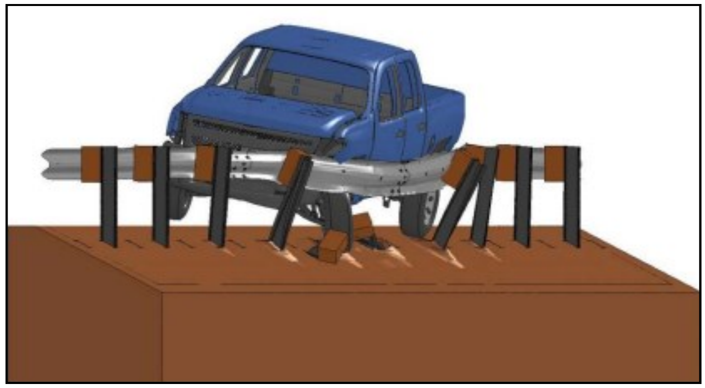
As a result of this research, a recommended T-intersection system is a 27-inch high W-beam rail system. The nose section of this T-intersection system consists of 12.5 ft curved W-beam segment having an 8 ft. radius. The curved section is attached to a straight W-beam section of the secondary road using common W-beam splicing details. The secondary road W-beam should have a 25 ft minimum length and should be terminated with a positive anchor. Five CRT posts, spaced 6.25 ft are placed along the curved section and secondary road section. On the primary road direction, the curved section is as attached to a transition to the bridge rail. The transition in stiffness is achieved by using a reduced post spacing, increasing post size, and using a MC 8 x 22.8 structural steel channel behind a the W-beam adjacent to the bridge rail. FHWA issued an acceptance letter for this T-intersection guardrail system.

For complete results and reports visit: http://www.roadsidepooledfund.org/files/2010/11/T-Intersection-final_2010-08-17.pdf

W-BEAM GUARDRAIL ON SLOPE

Tech Representative: Dave Olsen
TTI Researcher: Akram Y. Abu-Odeh

The objective of this research was to identify an acceptable method for installing standard strong-post W-beam guardrail on a slope based on finite element impact simulations. Researchers reviewed the design details of guardrails on slope previously developed to evaluate the behavior of the guardrail when subjected to NCHRP Report 350 tests. Lateral stiffness of the guardrail system is the primary design feature that determines the maximum deflection of the guardrail during a collision. Changes in lateral stiffness of the guardrail system along its length can influence pocketing of a vehicle. Design features found to be important in terms of capacity of the guardrail to contain and redirect a vehicle are slope, post spacing, post length, post placement, and soil strength.



Phase II Simulation

In Phase 1 of this research, a 2H:1V sloped ditch was excavated behind the rail to represent the sloped terrain. The guardrail had 8-ft long posts placed at 3 ft – 1.5 inch spacing. The guardrail was tested in accordance with NCHRP Report 350 test designation 3-11. The vehicle impacted the installation at 62 mi/h and 15 degrees. The vehicle was contained and redirected. However, after exiting the installation, the vehicle rolled onto its side. Due to the rollover, the guardrail did not meet the NCHRP Report 350 criteria.

Guardrail Installation Before Impact (Phase II)

During Phase II, further simulation was performed to improve the performance of the guardrail on the slope and to develop alternate methods for installing guardrail in front of slopes steeper than 2H:1V.

In this phase, six 6-ft long posts were placed at 6 ft –3 in. The 8-ft long posts along the sloped section were placed with 6 ft – 3 inch spacing. Simulation predicted successful redirection and containment of the vehicle with less severe wheel snag and pocketing. The occupant risk factors were much lower than those from Phase I.

MASH tests 3-10 and 3-11 were performed on the design based on Phase II, involving a pickup truck and passenger car respectively. The guardrail on slope performed successfully for both vehicles according to MASH TL-3 criteria.

Guardrail Installation After Impact (Pickup)

Guardrail Installation After Impact (Car)

For complete results and report visit: http://www.roadsidepooledfund.org/2011/01/06/guardrails-on-slopes-phase-1-405160-4/
http://www.roadsidepooledfund.org/2011/01/20/placement-of-guardrails-on-slopes-phase-ii-405160-20/

Participating Partners

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TEXAS DOT
WASHINGTON STATE DOT
WEST VIRGINIA DOT
FEDERAL HIGHWAY ADMINISTRATION
TEXAS A&M TRANSPORTATION INSTITUTE

Did you Know...

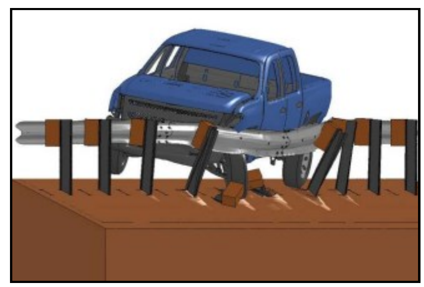
...that TTI inspected the modifications made to a truck to be driven by Franklin McMurrian, who became paralyzed from the chest down? TTI made sure the equipment used met the Texas Department of Assistive and Rehabilitative Services (DARS) and inspected the modified vehicle and the equipment for safety purposes.

"TTI made sure everything was right and that I was safe on the road. It's clear they know what they are doing, and they made the entire process pleasurable."

TTI Proving Grounds Research Facility

Crash Testing

Bogie Test Vehicle



Finite Element Analysis Simulation

The Proving Grounds Research Facility, a 2,000 acre complex, enables researchers to conduct experiments and testing with the ultimate goal of improving transportation safety. This site has large expanses of concrete runways and parking aprons well suited for experimental research and testing in the areas of vehicle performance and handling, vehicle-roadway interaction, durability and efficacy of highway pavements, evaluation of roadside safety hardware, and connected and automated vehicles.

ISO 17025

TTI Proving Ground is an International Standards Organization (ISO) 17025 accredited laboratory with American Association for Laboratory Accreditation (A2LA) Mechanical Testing Certificate 2821.01.

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