Pooled Fund Post

The Newsletter of the Roadside Safety Pooled Fund Program

http://www.roadsidepooledfund.org

SEPTEMBER 2014 VOLUME 1. NO.3

What's Inside

Completed Pooled Fund Projects

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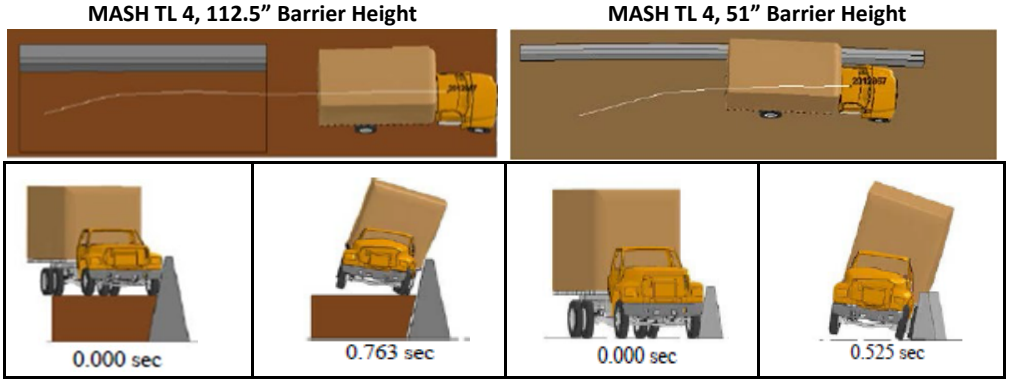
SINGLE SLOPE MEDIAN WALL GRADE SEPARATION

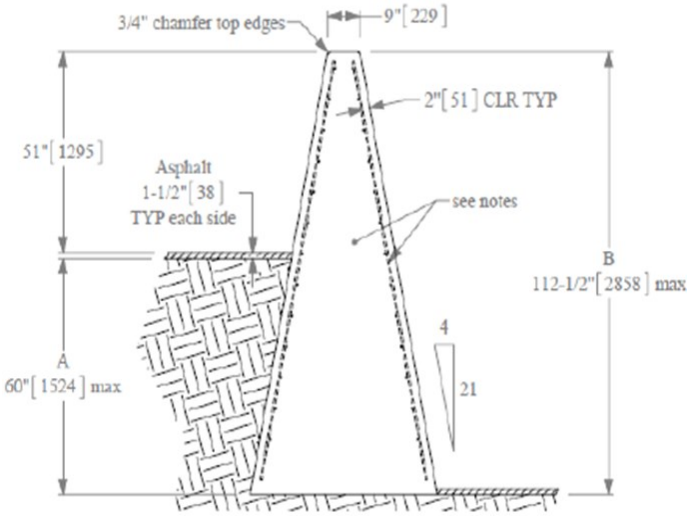
This purpose of the study was to suggest and explore a crashworthy design option of median barriers for use as grade separation on split level highways. The median barrier had also to perform as a retaining wall. Geo technical analysis included determining the stability of the retaining median wall by both evaluating factors of safety, that is, with respect to sliding, bearing capacity and overturning and by verifying the stability according to the Load Resistance Factor Design (LRFD) method suggested by the American Association of State Highway and Transportation Officials (AASHTO).

MASH TL 4, 112.5" Barrier Height | **MASH TL 4, 51" Barrier Height**



Researchers optimized the barrier segment lengths with the scope to maintain the capability of the barrier to resist forces causing sliding and overturning. The authors optimized the minimum barrier segment length needed to resist soil forces and MASH TL-3 and TL-4 impact conditions. The crashworthiness and stability of the sloped median wall were evaluated using finite element analyses. These analyses resulted in acceptable barrier performance according to the criteria set forth in MASH for longitudinal barriers, and soil retention according to AASHTO 2007.

WALL SECTION MINIMUM LENGTH			
A	B	TL-3	TL-4
0-9"	51"-60"	45'	60'
9"-21"	60"-72"	38'	52'
21"-33"	72"-84"	32'	44'
33"-45"	84"-96"	28'	39'
45"-57"	96"-108"	26'	36'
57"-61.5"	108"-112.5"	24'	33'



1. Rebar is Ø1/2" (#4) [13] grade 60 spaced at 8" [200] both ways on both faces.
2. Concrete is 4000psi [27.6MPa].

For the complete report, visit: http://www.roadsidepooledfund.org/files/2011/05/405160-33_35_Version-5.pdf

STEEL POSTS OVER UNDERGROUND STRUCTURES

Tech Representative: William Longstreet (will.longstreet@dot.gov)
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The Study aimed at designing a steel post anchored to a shallow moment slab for use on a post w-beam guardrail system over low fill culverts or underground structures where low deflection limits apply. The project conforms to NCHRP report 350, test level 3 specifications. This structure proves to be the more cost effective method in comparison to moment slabs supporting guardrail posts.

Test P1: Steel posts over underground structure with 60'' concrete footing . BEFORE test.

Test P1: Steel posts over underground structure with 60'' concrete footing . AFTER test.

TEST SETUP

A 5ftx5ft square footing and another 4ftx4ft square footing were used for full testing, both measuring 8 inches thick. Guardrail posts anchored to these footings were W6X8.5. Reinforcement steel at 6 inches center to center in both transverse and longitudinal directions was followed by a 6 inch layer of compacted soil. Posts were connected to a 12"x12"x3/4" plate through a welded connection and anchored to a 8 inch concrete footing with 7/8'' A325 bolts embedded into a minimum of 6 inches into the footings.
Compressive strength tests on the footing resulted in an average compressive strength of 3669 psi.

CONCLUSIONS

Upon performing full scale pendulum tests along the strong axis direction of posts, the 5ftx5ft footing rotated approximately 6 degrees and dynamic rotation of the post as approximately 30 degrees. The 4fx4ft footing rotated 15 degrees resulting in dynamic rotation in excess of 30 degrees. The steel posts experienced plastic failure in both cases but the bolts observed no distress.

A similar test was performed on a w-beam guardrail using W6x9 posts anchored to a simulated concrete box culvert slab topped by a 9'' of fill. The maximum angle of rotation along the strong axis was observed to be approximately 24 degrees, which matched the test results of W6x8.5 posts. However this wasn't a comparable criterion as the W6x8.5 post tests were based on crashing into the weak axis as opposed to the W6x9 posts which is along the strong axis. On comparing the performance results in both the cases, the W6x8.5 post anchored to 5ftx5ft footing proved to be the more suitable case for use in case of single posts over underground structures. Further full scale tests needs to be performed to check the validity of multiple posts supported on shallow footings over underground structures.

(For more details on this projects visit: http://www.roadsidepooledfund.org/files/2011/03/TM-405160-12-P1P2final.pdf)

Test P2: Steel posts over underground structure with 48'' concrete. BEFORE test

Test P2: Steel posts over underground structure with 48'' concrete. AFTER test

Evaluation of Concrete Traffic Barrier with Acoustic Coating

Tech Representative: Dave Edwards (EdwardD@wsdot.wa.gov, (206) 770-3522)
TTI Researcher: Roger P. Bligh (RBligh@tamu.edu, (979) 845-4377)

The objective of this study was to evaluate the impact performance of an acoustic coated single slope concrete traffic barrier according the MASH criteria. This project focused on developing an optimum acoustic coating to be used on the face of concrete barriers when noise abatement is needed. It finds its application in bridge rails, median barriers and roadside barriers.

@ 0.000s

@0.140s

@ 0.280s

@ 0.420s

The test installation comprised of WSDOT standard 48'' tall single slope precast concrete barriers bearing a total length of 80 '3/4'' coated with 1/2'' thick Acoustement® 40'' material. Each barrier joint was secured by a rebar grid. The barrier contained and redirected the 2270P Vehicle with no measurable deflections. Occupant risk factors were well within the preferred limits as per MASH specifications. The test verifies that a 3'' asphalt overlap/key is sufficient for anchorage of the precast concrete barrier with grouted rebar connections.

Completed test Installation

Damaged Coating after test

For the complete details on this project visit : http://www.roadsidepooledfund.org/files/2013/10/TRNo602191-1-rev4.pdf

Guardrail Posts in Mowing Pads

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This project aimed at static laboratory and dynamic impact testing research on an experimental backfill material for low strength grout mix used in filling voids around posts in guardrail mow strips. Tested qualities of this material were its compressive strength and its ability to retard vegetation growth without restricting the motion of the guardrail posts in an impact event. Results suggest that all of the tested products except the flat rubber mat yielded acceptable impact performance.

Two-part Urethane Foam after test

Urethane foam is impermeable to water. Since uniformity and unconfined expansion of foam is difficult to achieve, there is a high chance that the voids collect dirt and lead to vegetative growth.

TopHat™ recycled rubber mat after test

Rubber mat with insert (TopHat™) is molded from recycled crumb rubber. Its design allows it to act as a permanent form around the guardrail post. The upper portion is a 3/8'' thick mat extending over the edges of the leaveout preventing vegetative growth.

Post in unreinforced concrete wedge after test

Conventional concrete is used as a backfill material around the post. Its geometry is modified to allow concrete to displace or pop-out of the leaveout during an impact. Chamfered angle of the wedge at the rear edge is 45°. In this test, roofing tar paper was used as a bond breaker material to allow backfill material (concrete) to release from the pavement mow strip.

For the complete report, visit: http://www.roadsidepooledfund.org/files/2011/03/405160-14-1.pdf

Participating Partners

ALASKA DOT & Public Facilities
CALIFORNIA DOT
FLORIDA DOT
ILLINOIS DOT
LOUISIANA DOT & Development
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TENNESSEE DOT
TEXAS DOT
WASHINGTON STATE DOT
WEST VIRGINIA DOT
FEDERAL HIGHWAY ADMINISTRATION
TEXAS A&M TRANSPORTATION INSTITUTE

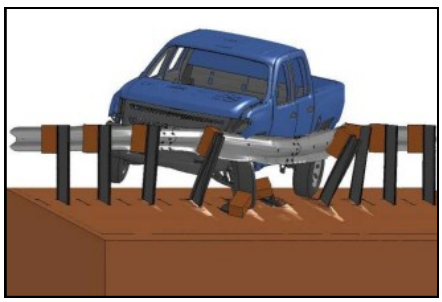
Did you Know...

...that the Roadside Safety & Physical Security Division at TTI has conducted full-scale upright motorcycle crash testing with inclusion of dummy rider?

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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