



July 16, 2007

In Reply Refer To: HSSD/B-177

Mr. Brian Smith
Trinity Highway Products, LLC
PO Box 568887
Dallas, TX 75356-8887

Dear Mr. Smith:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system:	Trinity Guardrail System (TGS)
Type of system:	31 inch strong post w-beam longitudinal barrier
Test Level:	National Cooperative Highway Research Program (NCHRP) Report 350 and Manual for Assessing Safety Hardware 2008 (MASH-08) Test Level 3
Testing conducted by:	Texas Transportation Institute
Date of request:	November 13, 2007
Additional information received:	April 28, 2008
Date of completed package:	June 20, 2008

You requested that we find this system acceptable for use on the NHS under the provisions of the NCHRP Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features" and the proposed American Association of State Highway and Transportation Officials' MASH-08.

Requirements

Roadside safety systems should meet the guidelines contained in the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features." FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers. You have also chosen to anticipate the adoption of the MASH-08, an option that the FHWA has offered with the understanding that additional testing may need to be done if changes to the test criteria are made before the MASH-08 is formally adopted.

Description

The TGS is a non-blocked-out strong post w-beam longitudinal barrier system that consists of 3.81 m (12 foot 6 inch) long, 12 gage w-beam rails supported on 1.83 m (6 foot 0 inch) long



W150 x 12.6 (W6 x 8.5#) standard (non-weakened) line posts spaced 1.905 m (6 feet 3 inches) on center. Measured from the ground level the heights of the top of the posts and the top edge of the w-beam are 813 mm (32 inches) and 787 mm (31 inches) respectively. W-beam rail splices are located at the posts.

The FHWA previously accepted Trinity's 31-inch high non-blocked-out strong post w-beam barrier that used steel yielding line posts with splices located at mid-span (FHWA Acceptance Letter B-140 dated November 2, 2005).

Crash Testing

Two full scale crash tests were conducted on a 53 m (175 foot) length of the TGS:

1. NCHRP Report 350 Test 3-10, (820C, 100 km/hr, 20 degrees) and
2. MASH-08 Test 3-11 (2270P, 100 km/hr, 25 degrees)

In both tests the rail splices were located at the posts with no Flange Protector (backup plate) in use. In test No. 1 the rails were attached to the posts with 16 mm x 44 mm (5/8 x 1 3/4 inch) slotted countersunk head bolts that were previously used in testing the Trinity T-31 and T-39 barrier systems. In test No. 2 the rails were attached to the posts with 16 mm x 44 mm (5/8 x 2 inch) countersunk head bolts with an elongated shaft. You plan on using only the 16 mm x 44 mm (5/8 x 1 3/4 inch) slotted countersunk head bolt as this bolt allowed the rail to release from the post more readily during testing.

Findings

You requested acceptance under both the NCHRP Report 350 and the MASH-08 criteria. Tests No. 1 and No. 2 noted above and detailed in the enclosed Test data summary sheets met the test and evaluation criteria of the NCHRP Report 350 and the Proposed MASH-08, respectively. At our request you provided the overhead view of test No. 1 that showed the small car redirected by the barrier through a yaw of 140 degrees. However we found no evidence of hard snagging on any post and the vehicle trajectory was comparable to that seen in other accepted barrier systems.

The MASH-08 test 3-10 of the 1100C impacting at 25 degrees was waived as previously agreed by the FHWA because of the pair of 3-10 tests conducted on the T-31 system. Those tests showed the 820C impact resulted in higher occupant impact velocities and ridedown accelerations. We concur that the 820C test is the 'worst case scenario' for the TGS as well.

The Report 350 Test 3-11 was waived as previously agreed by the FHWA because of the greater impact severity of the 2270 kg pickup truck. Although it is known that the 2000P vehicle is structurally less stable we concurred in your contention that the heavier truck would be most likely to fail the system due to increased dynamic deflection.

Therefore, the system described above and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency. The maximum dynamic deflection measured in test 3-11 was 980 mm (38.4 inches) and the 'working width' was 1040 mm (40.9 inches.)

You also requested 2 m post spacing be allowed for use in countries that follow the metric system, as we permitted you to do on the T-31 and T-39 systems. As the standard USA spacing is 1.905 m we consider the 5 percent additional distance between the posts to be acceptable.

Please note the following standard provisions that apply to the FHWA letters of acceptance:

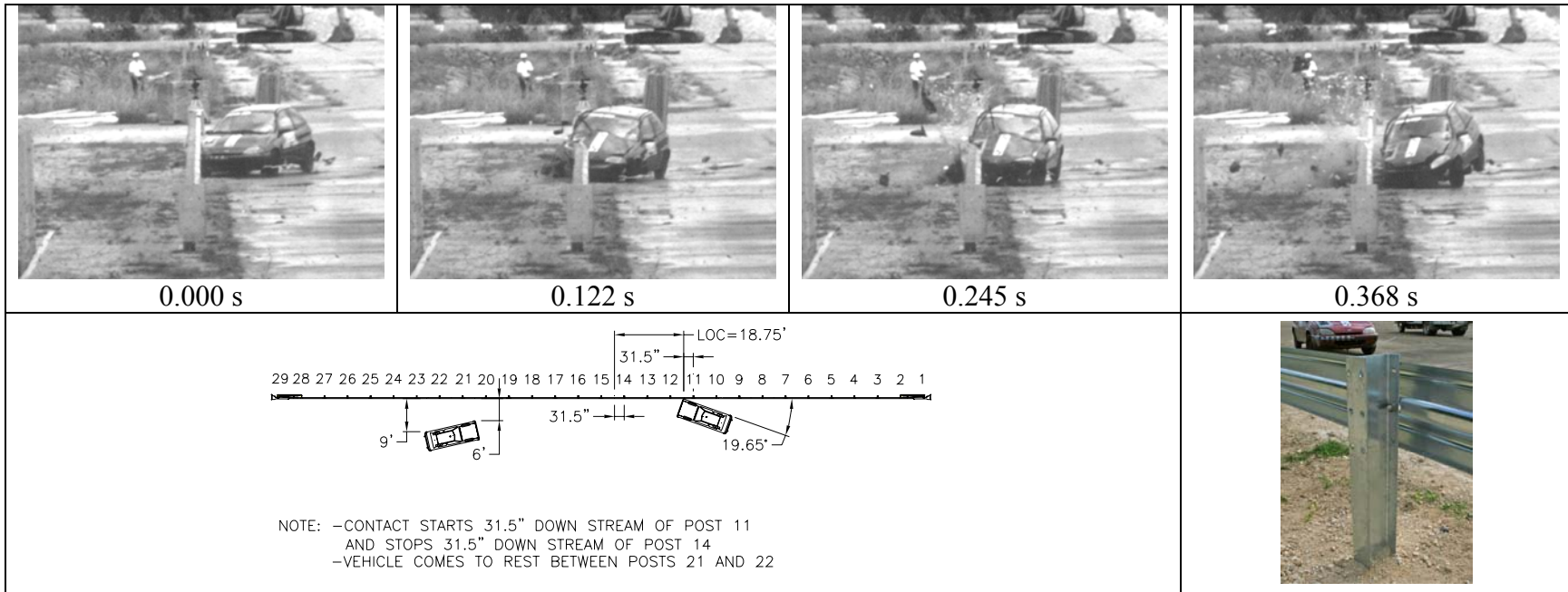
- This acceptance is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number B-177 and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- The TGS is a patented product and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,



David A. Nicol, P.E.
Director, Office of Safety Design
Office of Safety

Enclosure



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General Information

Test Agency..... Texas Transportation Institute
 Test No. 400001-TGS2
 Date 06-08-2007

Test Article

Type..... Longitudinal Barrier
 Name Trinity Guardrail System (TGS)
 Total Installation Length 175 ft
 Key Elements
 Description W-Beam on W6x8.5 x 72 inch
 long posts, splices at posts, no
 blockouts, no flange protectors

Height 31 inches

Soil Type and Condition..... Standard Soil, Damp (9.8%)

Test Vehicle

Type/Designation..... 820C
 Make/Model 1997 Chevrolet Metro
 Mass
 Curb..... 1832 lb
 Test Inertial..... 1830 lb
 Dummy 170 lb
 Gross Static..... 2000 lb

Impact Conditions

Speed61.1 mi/h
 Angle.....19.7 degrees
 Location/OrientationBtw Post 11 and 12

Exit Conditions

Speed28.8 mi/h
 Angle..... 9.3 degrees

Post Impact Trajectory

Vehicle StabilitySatisfactory
 Stopping DistanceBtw Post 21 and 22
 6 ft laterally front

Vehicle SnaggingNone

Vehicle PocketingNone

Post-Impact Behavior

(during 1.0 sec after impact)
 Max. Yaw Angle26 degrees
 Max. Pitch Angle -6 degrees
 Max. Roll Angle13 degrees

Test Article Deflections

Dynamic.....19.4 inches
 Permanent 9.6 inches
 Working Width22.2 inches

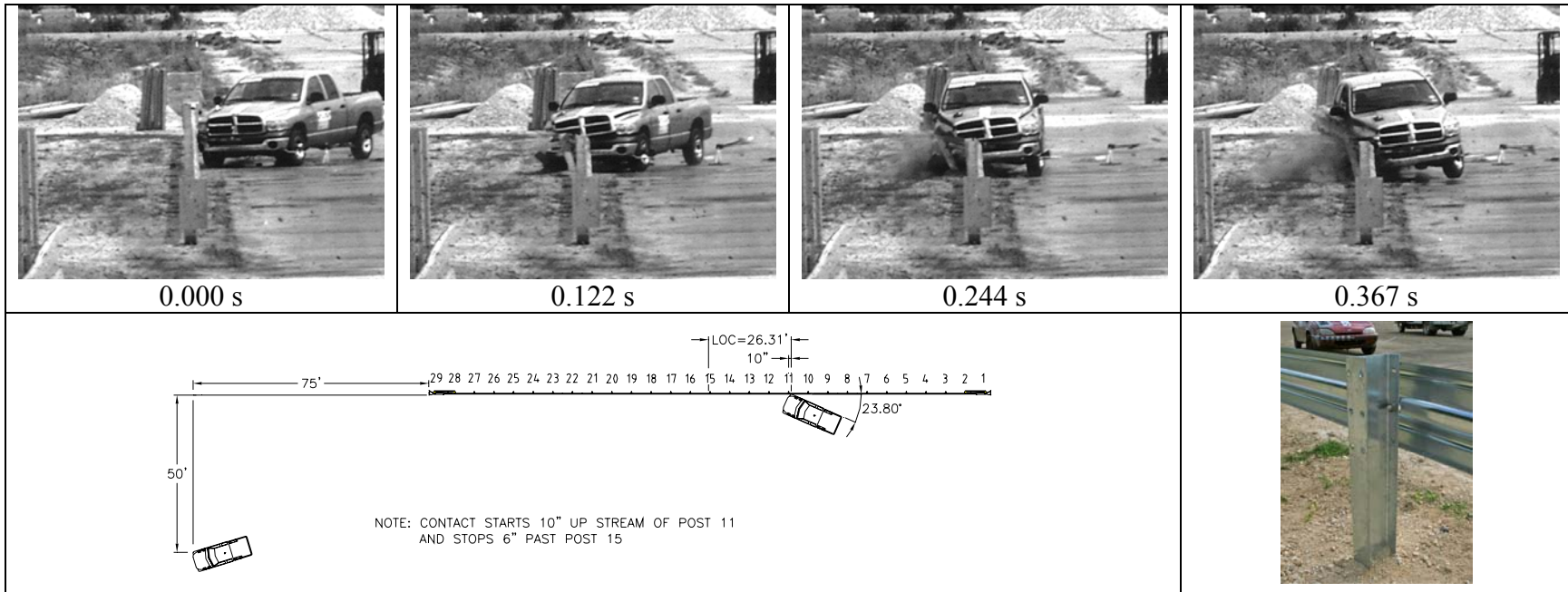
Occupant Risk Values

Impact Velocity
 Longitudinal..... 28.2 ft/s
 Lateral 17.7 ft/s
 Ridedown Accelerations
 Longitudinal.....-12.0 gs
 Lateral -7.7 gs
 THIV 23.5 km/h
 PHD 13.0 gs
 Max. 0.050-s Average
 Longitudinal.....-9.7 gs
 Lateral-6.3 gs
 Vertical -2.5 gs

Vehicle Damage

VDS 01RFQ4
 CDC 01FREW3
 Max. Exterior
 Vehicle Crush 11.8 inches
 OCCDI
 Max. Occupant Compartment
 Deformation..... 5.5 inches

Figure 6.7. Summary of results for NCHRP Report 350 test 3-10 on the TGS.



General Information

Test Agency..... Texas Transportation Institute
 Test No. 400001-TGS1
 Date 05-31-2007

Test Article

Type..... Longitudinal Barrier
 Name Trinity Guardrail System (TGS)
 Total Installation Length 175 ft
 Key Elements
 Description W-Beam on W6x8.5 x 72 inch long posts, splices at posts, no blockouts, no flange protectors

Height 31 inches

Soil Type and Condition..... Standard Soil, Damp (9.8%)

Test Vehicle

Type/Designation..... 2270P
 Make/Model 2002 Dodge Ram 1500 Pickup
 Mass
 Curb..... 4726 lb
 Test Inertial..... 4970 lb
 Dummy No dummy
 Gross Static..... 4970 lb

Impact Conditions

Speed63.3 mi/h
 Angle.....23.8 degrees
 Location/OrientationAt Post 11

Exit Conditions

Speed36.6 mi/h
 Angle.....18.4 degrees

Post Impact Trajectory

Vehicle StabilitySatisfactory
 Stopping Distance175 ft downstream
 50 ft laterally front

Vehicle SnaggingNone

Vehicle PocketingNone

Post-Impact Behavior

(during 1.0 sec after impact)
 Max. Yaw Angle-37 degrees
 Max. Pitch Angle 2 degrees
 Max. Roll Angle-13 degrees

Test Article Deflections

Dynamic.....38.4 inches
 Permanent31.0 inches
 Working Width40.9 inches

Occupant Risk Values

Impact Velocity
 Longitudinal..... 16.1 ft/s
 Lateral 16.7 ft/s
 Ridedown Accelerations
 Longitudinal.....-11.2 gs
 Lateral-7.9 gs
 THIV23.5 km/h
 PHD..... 13.0 gs
 Max. 0.050-s Average
 Longitudinal.....-5.6 gs
 Lateral-6.5 gs
 Vertical-2.5 gs

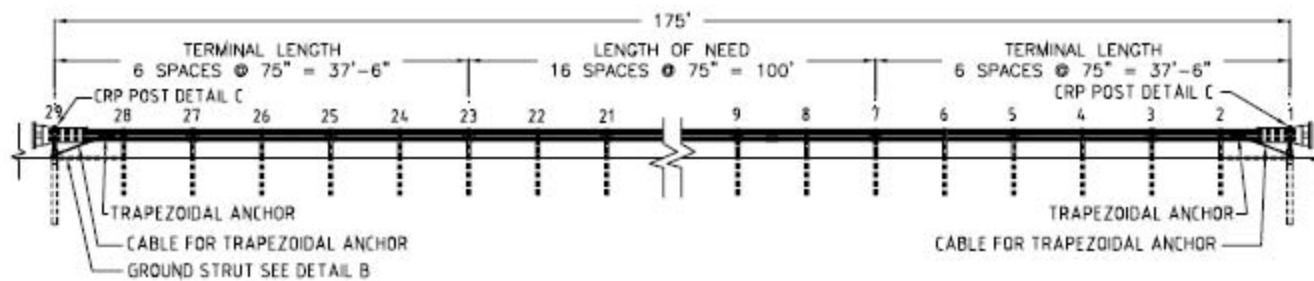
Vehicle Damage

VDS 01RFQ4
 CDC..... 01FREW3
 Max. Exterior
 Vehicle Crush 19.0 inches
 OCCDI
 Max. Occupant Compartment
 Deformation.....0.6 inch

Figure 5.7. Summary of results for NCHRP Report 350 Update test 3-11 on the TGS.



PLAN VIEW

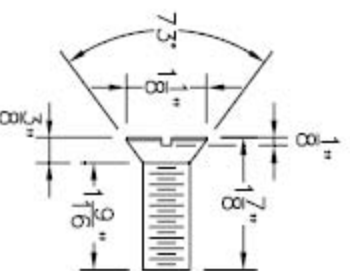


ELEVATION VIEW

- NOTE:
- TERMINAL POSTS ARE SYTP (SEE DETAIL A) EXCEPT FOR CRP'S
 - LENGTH OF NEED POSTS ARE W6x8.5 (SEE DETAIL D)
 - SEE DETAIL E FOR CLEVIS DETAILS
 - SEE DETAIL F FOR BOLT DETAILS
 - ALL SPLICES OCCUR AT A POST

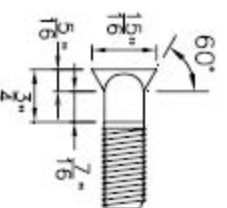
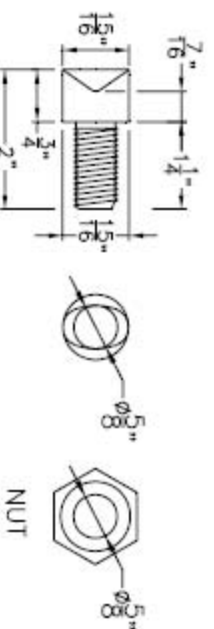
Revisions				The Texas A&M University System			
No.	Date	By		TEXAS TRANSPORTATION INSTITUTE COLLEGE STATION, TEXAS 77843			
1.	08/07	NDE		Project No.	Date	Drawn By	Scale
2.				400001TGS	5/07	AWC	
3.				TRINITY W-BEAM SYSTEM			Sheet No.
4.							1 of 5
5.							

Figure 2.2. Layout of the Trinity Guardrail System (TGS).



BOLT FOR POSTS 1-3 & 23-29

NOTE: BOLT LISTED ABOVE ARE 5/8"x1-9/16" ANSI/ASME
B18.5 GRADE 2, SLOTTED COUNTERSUNK BOLTS
-THREADS: UNIFIED COARSE, CLASS 2A, 11 THREADS PER INCH



BOLT FOR POSTS 4-22

DETAIL F

The Texas A&M University System					
Revisions					
No.	Date	By	Project No.	Date	Drawn By
1.			400001TGS	5/07	AWC
2.					
3.					
4.					
6.			TRINITY W-BEAM SYSTEM		

TEXAS TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS 77843

Scale

Sheet No.
5 of 5

Figure 2.1. Details of countersunk bolt.