U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Avenue, SE.
Washington, DC 20590

August 30, 2007

In Reply Refer To: HSSD/B-163

Mr. Charles Coleman
S.I. Storey Lumber Company, Inc.
285 Sike Storey Road
P.O. Box 99
Armuchee, GA 30105

Dear Mr. Coleman:

In your letter of June 26, 2007, you requested formal Federal Highway Administration (FHWA) acceptance of longitudinal barrier called the TimBarrier™ StreetGuard Plus™ as a National Cooperative Highway Research Program (NCHRP) Report 350 test level 2 (TL-2) device. To support your request, you provided E-Tech Testing Services, Inc. test reports #296 and #312 dated August 2006 and May 2007 respectively, entitled "NCHRP Report 350 Crash Test Results for TimBarrier StreetGuard Plus". You also provided hard copies of the drawings and test videos.

Requirements
Longitudinal barriers should meet the guidelines contained in the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". The FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997 provides further guidance on crash testing requirements of longitudinal barriers. Specific information on acceptance of aesthetic barriers to NCHRP 350 criteria is found in the FHWA Memorandum "INFORMATION: National Cooperative Highway Research Program (NCHRP) Report 350 Aesthetic Barriers and Bridge Rails" of April 9, 2003.

Product description
The TimBarrier™ StreetGuard Plus™ is designed based upon the principles of Eastern Federal Lands approved "Steel Backed Timber Guardrail", previously accepted to the NCHRP Report 230 criteria. It has been modified, however, to use smaller components including a standard timber guardrail post, reduced thickness steel backing, and an engineered splice plate.
The TimBarrier line posts are 152 mm deep x 203 mm wide x 1829 mm long (6"x 8"x 72") timber orientated with the 203 mm (8") wide face toward traffic. The line posts support timber rails which are 102 mm deep x 305 mm high x 2426 mm long (4"x 12"x 95-1/2"). A 152 mm deep x 203 mm wide x 254 mm long (6"x 8"x 10") timber blockout is positioned between the post and the rail. The rail elements are reinforced on the back side by 6.4 mm thick x 152 mm wide x 2286 mm long (1/4" x 6"x 90") steel plates which are attached with (9) 9.5 mm diameter x 63.5 mm long (0.37"x 2.5") hex head lag screws. The rails are coupled to the posts and

blockouts with 6.4 mm thick x 152 mm wide x 610 mm (1/4" x 6"x 24") long steel splice plates having a vertical center relief in the post bolt hole provided by (2) 3.2 mm x 19.1 mm (1/8"x 3/4") vertical cuts extending up and down from the centers of the hole edges. The splice plates are attached to the ends of each adjacent rail with (4) 15.9 mm diameter x 152 mm (0.63"x 6") long TimBarrier carriage bolts with hex nuts and 22 mm (0.87") plane washers on the front side and 15.9 mm (0.63") washers on the backside (8 fasteners per connection). A single 15.9 mm diameter x 292 mm long (0.63"x11.5") TimBarrier carriage bolt passes through the center of the splice plate and through the blockout and post and is fastened with an oversized 6.4 mm x 82.6 mm diameter (1/4"x 3-1/4") plate washer and hex nut. Design details of TimBarrier™ StreetGuard Plus™ are provided in Enclosure 1.

It should be noted that the described design incorporates two important modifications to the initial design which were made after the first test (TL 2-11) was conducted in July 2006. Specifically, in the initial design the rail was installed 2" (51 mm) lower and came in contact with the test vehicle bumper which caused excessive torsional loading of the rail element, rotational failure of the splice plate and "riding up" of the test vehicle. Also, in the initial design the splice plate did not have a vertical center relief in the post bolt hole and could not tear through the bolt head upon the impact. Such design did not allow the rail to properly disengage from the post which was pushed to the ground.

Test article installations

For both tests 2-11 and 2-35, the TimBarrier™ StreetGuard Plus™ was installed with flared end terminals. The first post in each terminal was a 152 mm wide x 203 mm deep x 1141 mm long (6"x 8"x 45") standard CRT timber post embedded in a 1829 mm (72") long steel foundation tube. The following 3 posts in each terminal were typical TimBarrier line posts, however they were positioned in the normal orientation and provided with BCT type through holes bored in them. A cable anchor box was connected to the backside of the backing plate on the outboard most rails with (8) 5.9 mm diameter x 152 mm long (0.23" x 6") TimBarrier carriage bolts with hex nuts and 22 mm (0.86") plane washers on the front side and 15.9 mm (0.63") washers on the backside. A 1981 mm (78") long cable with double 25.4 mm (1") diameter studded and nutted ends was connected to the anchor box and passed down and through the CRT post to tension the system. The posts were embedded to 1041 mm (41") depth for test 2-11 and 991 mm (39") depth for test 2-35.

Testing

The NCHRP Report 350 requires that in order for longitudinal barriers to meet TL-2 criteria they must successfully pass tests 2-10 and 2-11. You conducted test 2-11 on the initial design of TimBarrier StreetGuard Plus which showed some potential to cause ramping of the test vehicle and, after incorporation of two modifications (increased installation height and vertical center relief in the post bolt hole in the splice plate as described above), conducted test 2-35. Critical impact point (CIP) in test 2-11 was selected 0.6 m upstream of the connection splice at post 13 and in test 2-35 it was selected at the beginning of Length of Need, 0.5 m downstream of post 2.

You stated in your request for acceptance letter that test 2-35 validates both the design changes made as well as the end anchorage loading capacity and that re-running of test 2-11 is not necessary. You also stated that because the bottom-rail-to-groundline dimension is the same as the previously accepted TL-3 Steel-Backed Timber Guardrail, test 3-10 is also unnecessary.

Despite the differences in critical impact points and impact angles in tests 2-11 and 2-35 and the fact that the posts in the area of vehicle contact in test 2-35 had different (normal) orientation and were weakened by BCT type through holes at the ground level, we are willing to agree with that statement. Specifically, due to the flare of the terminal in test 2-35, the resulting impact angle relative to the rail was 28 degrees and the actual impact severity was 72.9 kJ, exceeding the nominal impact severity required for test 2-11. We also agree that the CIP and the weakened posts in test 2-35 increase the loading experienced by the rail member, its rotation and the likelihood of pocketing while CIP and stronger posts in test 2-11 contribute to the greatest likelihood of occupant compartment deformation and excessive occupant safety loading. Therefore, while the above differences between the tests 2-11 and 2-35 may alter the barrier performance, we are willing to agree that both tests, considered conjunctively, are sufficient to evaluate the overall validity of the system.

In test 2-11 the test article contained the 2000P vehicle preventing penetration, underride, and override of the installation. Test article damage was categorized as "substantial" since three replacement posts and four rail sections would be needed for repair. The deformation of the vehicle interior was negligible. Occupant risk factors were within the limits specified in the NCHRP 350. During impact the right side of the vehicle rode up on the rail at post 16 and the right front and rear wheels continued riding along the top of the installation with the left front and rear wheels rolling along the ground. The vehicle came to rest 25 m downstream of the point of impact with its right side on top of the installation. Summary of tests results is presented in Enclosure 2.

Based on the analysis of test 2-11 results you made two modifications to the initial design as described above and conducted test 2-35 on the modified design. According to the information you provided the test article performed successfully in test 2-35. The test article redirected the impacting vehicle, which did not penetrate, underride, or override the installation and remained upright during and after the collision period. The exit trajectory of the vehicle center of gravity was essentially parallel to the installation centerline. The deformation of the occupant compartment was negligible. The test article damage was categorized as substantial since three replacement posts and four rail sections would be needed for repair. The heaviest piece of debris was a 10.9 kg piece of post that came to rest 4.9 m behind post 7. The furthest piece of debris came to rest 12.8 m behind post 10. Occupant risk factors were within the limits specified in the NCHRP 350. Summary of tests results is presented in Enclosure 2.

In summary we agree that TimBarrier™ StreetGuard Plus™ as described above meets the appropriate evaluation criteria for NCHRP 350 TL-2 devices. The above system may be used at all appropriate locations on the National Highway System (NHS) when selected by the contracting authority, subject to the provisions of Title 23, Code of Federal Regulations, Section 635.411, as they pertain to proprietary products. Please note that this acceptance is only for the use of the barrier proper, not for the guardrail terminal. It is also limited to “one faced” applications only. Also, this acceptance is based on the reported crash performance of the barrier and is not meant to address its installation, maintenance or repair characteristics.

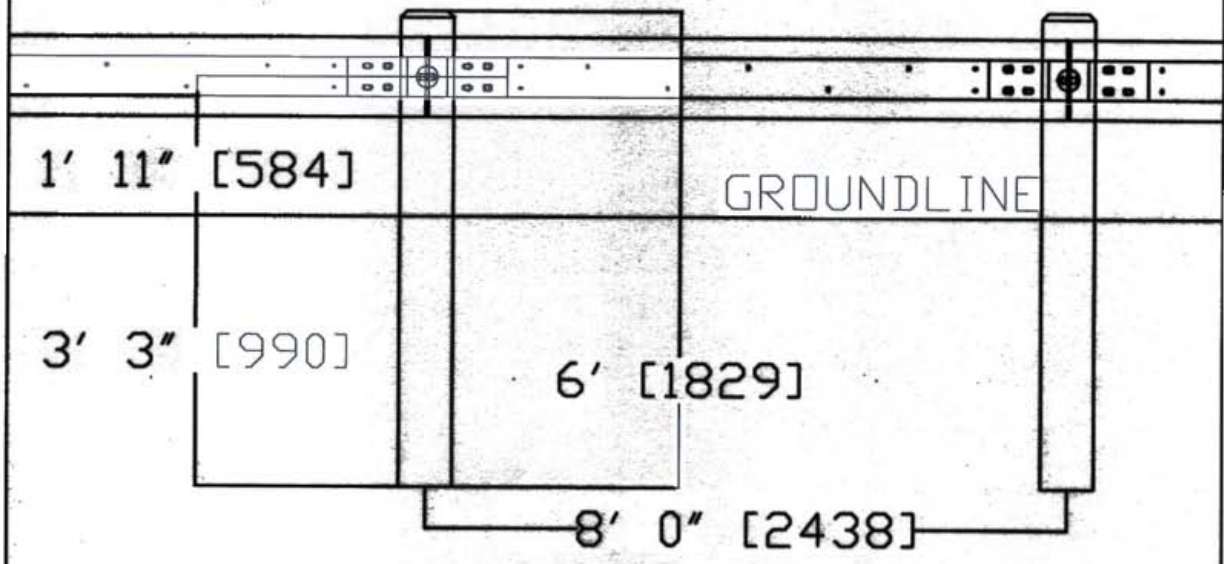
Standard provisions
Please note the following standard provisions that apply to the FHWA letters of acceptance:

- This acceptance is limited to the crashworthiness characteristics of the devices 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 device 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 device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its 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 they will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number B-163 shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The TimBarrier™ StreetGuard Plus™ is a patented product and considered proprietary. If proprietary devices 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 device for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate device, 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.

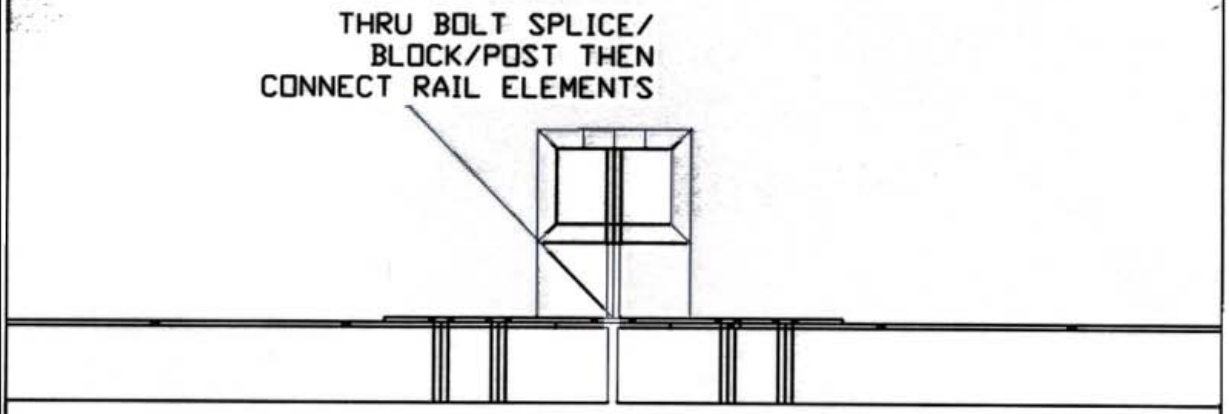
Sincerely yours,

George E. Rice, Jr.
Acting Director, Office of Safety Design
Office of Safety

Synectic File #



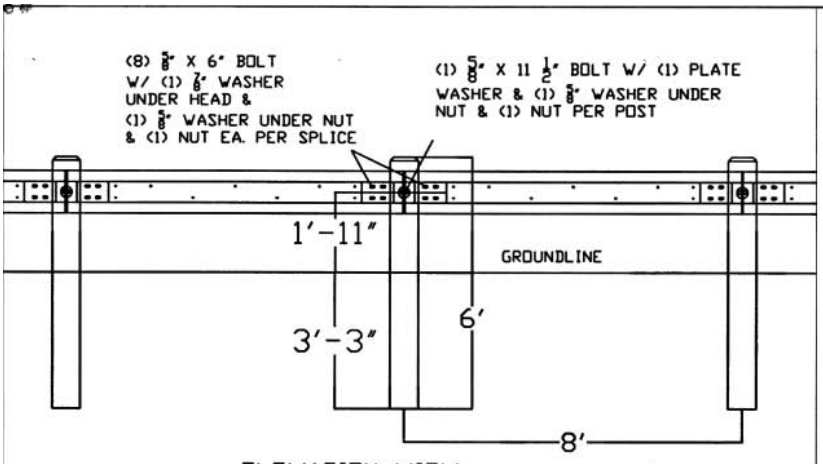
ELEVATION VIEW



PLAN VIEW

TIMBARRIER STREETGUARD PLUS RAIL SYSTEM

SHEET NO.	DATE:
1 of 2	06/19/07



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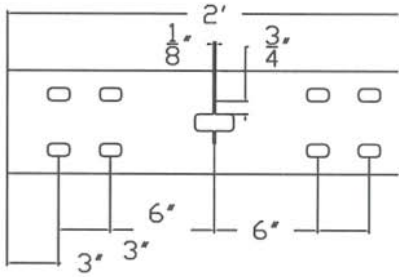
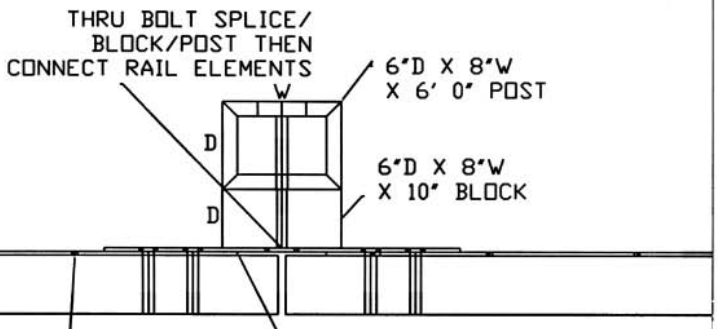
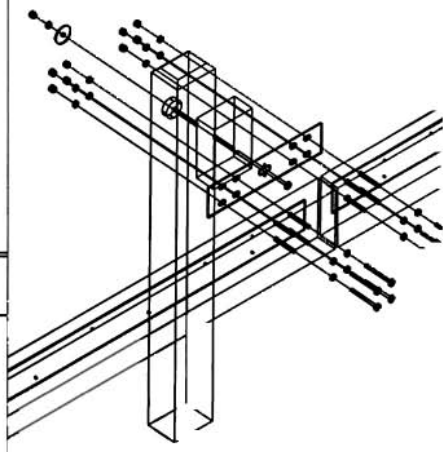


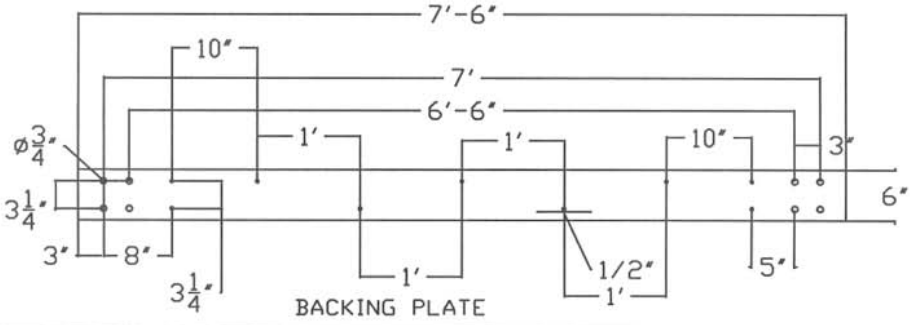
SPLICE PLATE



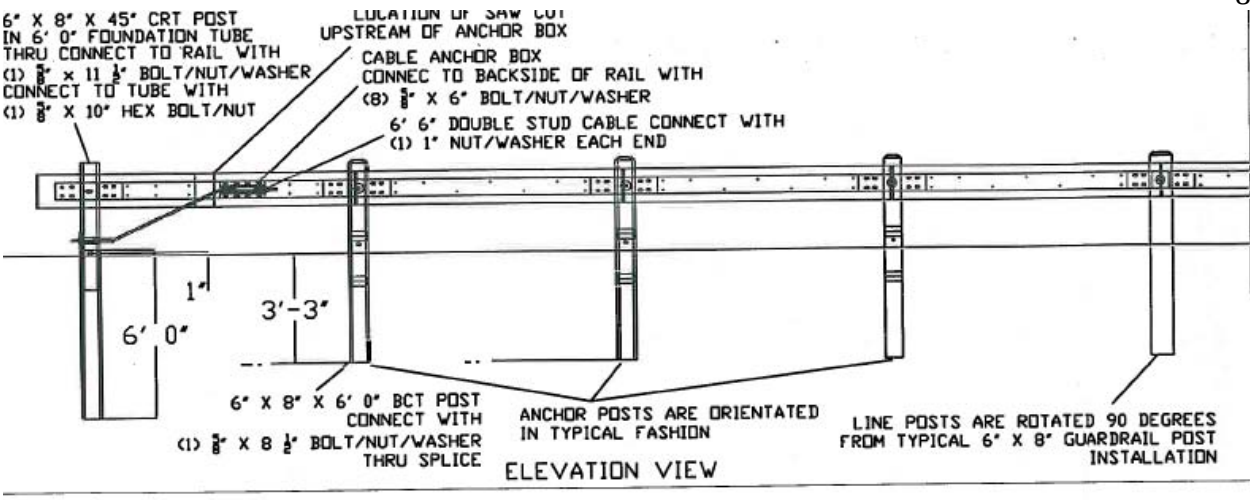
PLAN VIEW OF SPLICE

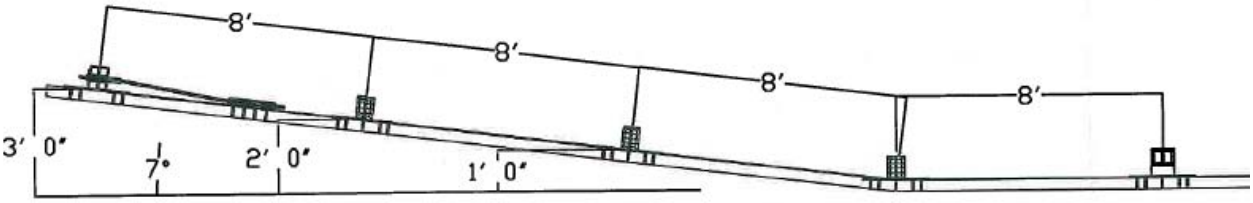


ISOMETRIC SPLICE CONNECTION

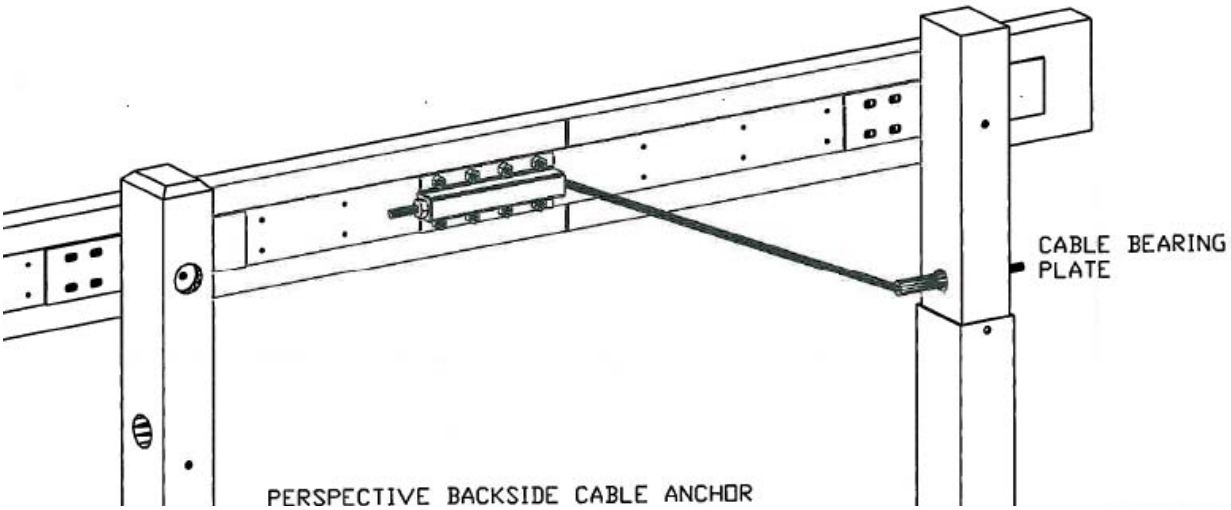


BACKING PLATE





PLAN VIEW



PERSPECTIVE BACKSIDE CABLE ANCHOR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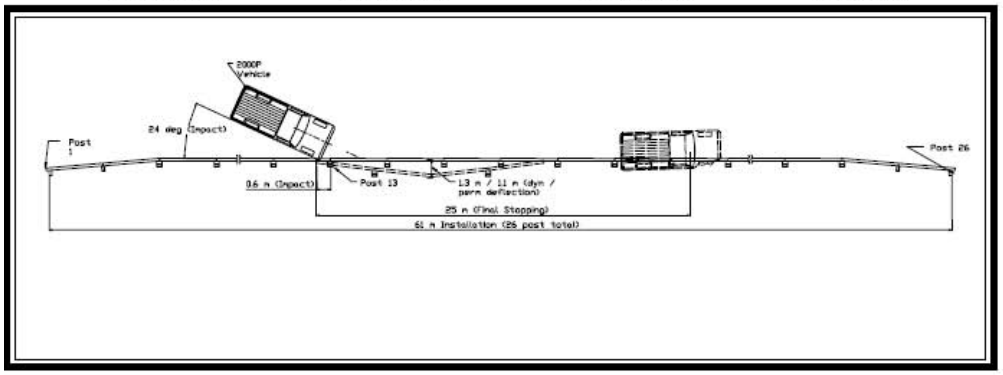
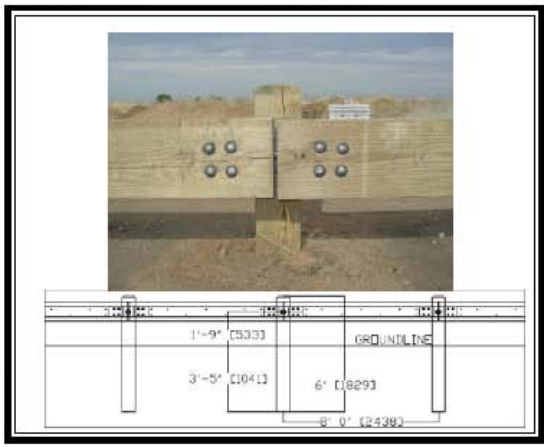




General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 2-11
Test No.	23-1978-001
Date	7/21/06

Test Article

Type	TimBarrier StreetGuard Plus
Installation Length	61 m overall (26 post installation)
Material and key elements	Posts: 152 x 203 x 1829 mm (DxWxL)
	Rails: 102 x 305 x 2426 mm (DxHxL)
	Post and rails #1 S4S southern yellow
	pine treated per AWPA C14
	Straps: 6.4 x 152 x 2286 mm (TxWxL)
	Cor-Ten steel
	Splices: 6.4 x 152 x 610 mm (TxWxL)
	Cor-Ten steel
Foundation Type and Condition	NCHRP 350 Strong Soil, dry

Test Vehicle

Type	Production Model
Designation	2000P
Model	1991 Chevrolet C-2500
Mass (kg)	
Curb	1856
Test inertial	1999
Dummy	N/A
Gross	1999

Impact Conditions

Speed (km/h)	71.3
Angle (deg)	24
Impact Severity (kJ)	70.0

Exit conditions

Speed (km/h)	N/A
Angle (deg - veh. c.g.)	N/A

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	4.0
y-direction	-2.6
Ridedown Acceleration (g's)	
x-direction	-7.0
y-direction	-4.7

European Committee for Normalization (CEN) Values

THIV (km/h)	16.8
PHD (g's)	7.0
ASI	0.4

Test Article Deflections (m)

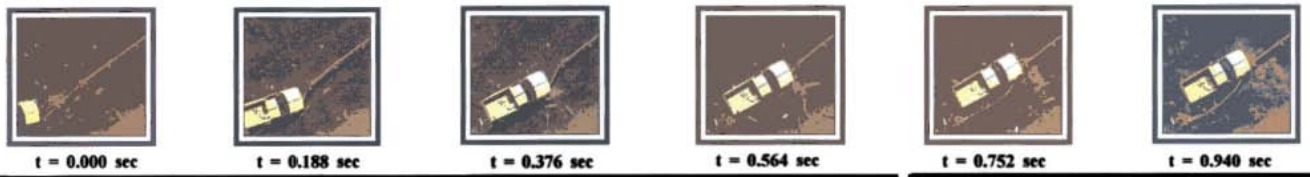
Dynamic	1.3
Permanent	1.1

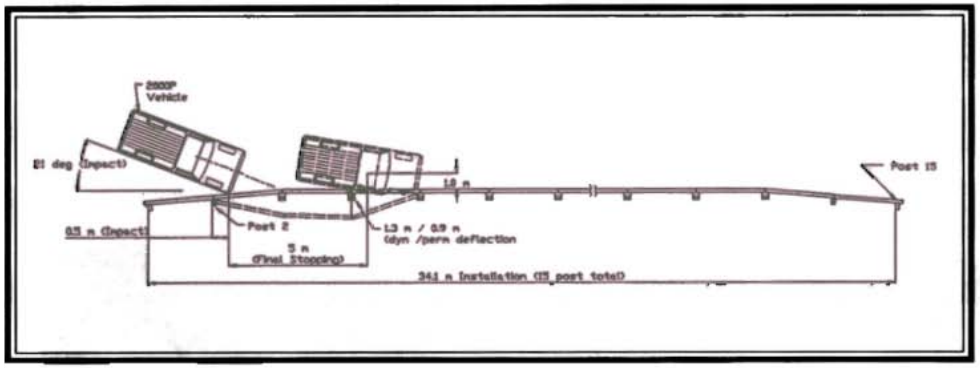
Vehicle Damage (Primary Impact)

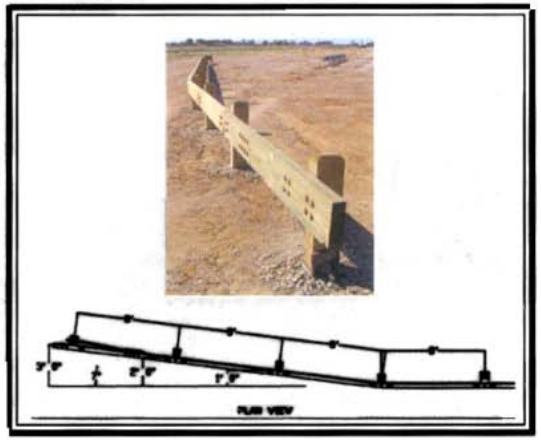
Exterior	
VDS	RFQ-2
CDC	01RFWE2
Interior	
VCDI	AS0000000
Maximum Deformation (mm)	Negligible

Post-Impact Vehicular Behavior (deg - rate gyro)

Maximum Roll Angle	-32.6
Maximum Pitch Angle	43.6
Maximum Yaw Angle	-24.3







General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 2-35
Test No.	23-1978-002
Date	4/10/07

Test Article

Type	TimBarrier StreetGuard Plus
Installation Length	34.1 m overall (15 post installation)
Material and key elements	Posts: 152 x 203 x 1829 mm (DxWxL)
	Rails: 102 x 305 x 2426 mm (DxHxL)
	Post and rails #1 S4S southern yellow
	pine treated per AWPA C14
	Straps: 6.4 x 152 x 2286 mm (TxWxL)
	Cor-Ten steel
	Splices: 6.4 x 152 x 610 mm (TxWxL)
	Cor-Ten steel
Foundation Type and Condition	NCHRP 350 Strong Soil, dry

Test Vehicle

Type	Production Model
Designation	2000P
Model	1994 GMC C-2500
Mass (kg)	
Curb	1885
Test inertial	1995
I	N/A
C	1995

Impact Conditions

Speed (km/h)	67.8
Angle (deg)	21
Impact Severity (kJ)	45.4

Exit conditions

Speed (km/h)	N/A
Angle (deg - veh. c.g.)	N/A

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	6.6
y-direction	-3.5
Ridedown Acceleration (g's)	
x-direction	-6.6
y-direction	6.1

European Committee for Normalization (CEN) Values

THIV (km/h)	24.3
PHD (g's)	7.6
ASI	0.5

Test Article Deflections (m)

Dynamic	1.3
Permanent	0.9

Vehicle Damage (Primary Impact)

Exterior	
VDS	RFQ-3
CDC	01RFWE3
Interior	
VCDI	AS0000000
Maximum Deformation (mm)	Negligible

Post-Impact Vehicular Behavior (deg - rate gyro)

Maximum Roll Angle	-15.5
Maximum Pitch Angle	-3.0
Maximum Yaw Angle	-21.4

est 23-1978-002

§ 635.411 Material or product selection.

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items; or

(2) The State transportation department certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State transportation department wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State transportation department may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.

(f) In the case of a design-build project, the following requirements apply: Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the Request for Proposals document unless the conditions of paragraph (a) of this section are applicable.

[41 FR 36204, Aug. 27, 1976, as amended at 67 FR 75926, Dec. 10, 2002]