



U.S. Department
of Transportation
**Federal Highway
Administration**

1200 New Jersey Ave., SE
Washington, D.C. 20590

August 18, 2011

In Reply Refer To:
HSST/B-88G

Mr. Jesper Sorensen
Safence, Inc.
1557 N.W. Ballard Way
Seattle, WA 98107

Dear Mr. Sorensen:

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

Name of system: SAFENCE Cable Barrier on 1V:4H Slopes
Type of system: Modified Cable Barrier (post design)
Test Level: NCHRP Report 350 TL-3
Testing conducted by: Midwest Roadside safety Facility (MwRSF)
Date of request: December 28, 2010
Date of completed package: December 30, 2010
Task Force 13 designator: SGM32

You requested that we find this modified system acceptable for use on the NHS as a TL-3 barrier under the provisions of NCHRP Report 350.

Requirements

Roadside safety systems should meet the guidelines contained in National Cooperative Highway Research Program (NCHRP) Report 350 if tested prior to January 1, 2011, and the guidelines contained in AASHTO's Manual for Assessing Safety Hardware (MASH) if tested after that date. The FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers.

Decision

The following system was found acceptable, with details provided below:

- SAFENCE Cable Barrier on 1V:4H Slopes Modified Cable Barrier (post design)

FHWA: HSST: WLongstreet: ms: x60087:6/28/11
File: h://directory folder/HSST/ B-88G.docx
cc: HSST Will Longstreet

Description

Various designs of the Blue System/Safence have been previously tested and accepted under the following the FHWA Acceptance Letters:

FHWA Acceptance Letter Number	Date	Test Level	System Types
B-88	July 13, 2001	TL-3	Roadside Driven elliptical posts
B-88A	January 28, 2004	TL-3	3504RI Median Driven I posts
B-88B	June 08, 2004	TL-3	Concrete footers
B-88C	May 26, 2005	TL-3	Roadside Allow "C" posts
B-88D	December 27, 2006	TL-4	3RC Modified "C" posts
B-88E	July 31, 2007	TL-4	Add fourth Cable to TL-4 Safence
B-88F	December 23, 2008	TL-3 (MASH)	3 and 4-cable Safence on 1V:4H slope

The tested metric cable heights for these systems are as follows:

FHWA Acceptance Letter Number	As tested metric cable heights (millimeters)			
	B-88	480	630	780
B-88A	480	560	640	720
B-88B	480	560	640	720
B-88C	480	630	780	930
B-88D	480	640	720	-
B-88E	480	560	640	720
B-88F	500	785	880 [▲]	975

[▲] (Tested with 3 cables – 4th cable optional)

Your current request is the acceptance of a modified version of the 3-cable (and 4-cable) Safence placed 4 feet (1.22 meters) beyond the hinge point of a 1V:4H fill slope. This modification consisted of strengthening the original "C" posts to reduce the dynamic deflection of the barrier system. The posts are made from ASTM A1011-04a high-strength, low alloy Grade 50 steel. Each post is 1480 millimeters (58.3 inches) long, 95 millimeters (3.74 inches) wide, 30 millimeters (1.189 inches) deep, and 4.1 millimeters (0.16-inch) thick. The posts were strengthened by the addition of steel post stiffeners measuring 84 millimeters (3.3 inches) wide x 900 millimeters (35.4 inches) long x 5 millimeters (0.2-inch) thick. The posts were set 457 millimeters (18 inches) in plastic sleeves embedded in a continuous concrete footing. For the test conducted, the posts were spaced 4.9 meters (16 feet) apart. The total installation length was approximately 304 feet (92.7 meters). This length was selected for comparison to other cable systems tested on 1V:4H slopes. Your original slope test, using the MASH pickup truck (B-88F), was conducted on an installation that was 185 meters (607 feet) long with 2100 millimeters (82.7 inches) long posts directly embedded 1050 millimeters (41.3 inches) in a "standard soil". In that test, the design deflection distance was 5 meters (16.4 feet).

The 19 millimeters ($\frac{3}{4}$ -inch) diameter cables were installed at heights of 490 millimeters (19.3 inches), 785 millimeters (30.9 inches), and 975 millimeters (38.4 inches) above the ground and tensioned to approximately 5,600 pounds (24.9 kN) prior to the test. Details of this system are included as enclosure to this correspondence.

Crash Testing

NCHRP Report 350 test 3-11 was conducted on November 2, 2010. A 1990 Chevrolet C2500 impacted the Safence barrier at 101.7 km/hr (63.2 mph) and at a 25 degree impact angle. The vehicle was redirected by the barrier and stopped after traveling about 77 meters (250 feet). As seen in the test summary sheet (Enclosure 3), all evaluation criteria were met. The observed deflection distance under the test conditions was 9.2 feet (2.8 meters). Because one post was inadvertently omitted from the test installation, a post-crash analysis concluded that the deflection would have been slightly less (8.5 feet/2.6 meters) had the post been in place. The FHWA has long contended that minor differences in the reported design deflections of cable barrier systems are relatively inconsequential, considering the large range of impact conditions likely to be found in the field. Crash test summary is included as enclosure to this correspondence.

Findings

The vehicle trajectories and occupant risk values were within the evaluation criteria contained in NCHRP Report 350. You also requested that a 4-cable design also be considered acceptable under similar median conditions, with the 4th cable placed between the middle and top cables at an approximate height of 870 millimeters (34.3 inches). We agree that the addition of a fourth cable would not be detrimental to system performance, but would actually serve to reduce the design deflection below that seen in the test described above as well as improve the overall capacity of the system. However, without an actual test of the single-unit truck on the 1V:4H slope, the FHWA is not willing to classify the 4-cable design used on a 1V:4H slope at NCHRP Report 350 TL-4.

Therefore, the system described above and detailed in the enclosed drawings is acceptable for use on the NHS as an NCHRP Report 350 TL-3 barrier.

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

- This acceptance letter provides an AASHTO/ARTBA/AGC Task Force 13 designator that should be used to identify any new or updated Task Force 13 drawings for this product.
- This acceptance is limited to the crashworthiness characteristics of the systems and does not cover their structural features, or 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-88G 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 Blue Systems/Safence cable barriers are patented products and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, (a) they 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.
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Sincerely yours,

Michael S. Griffith
Director, Office of Safety Technologies
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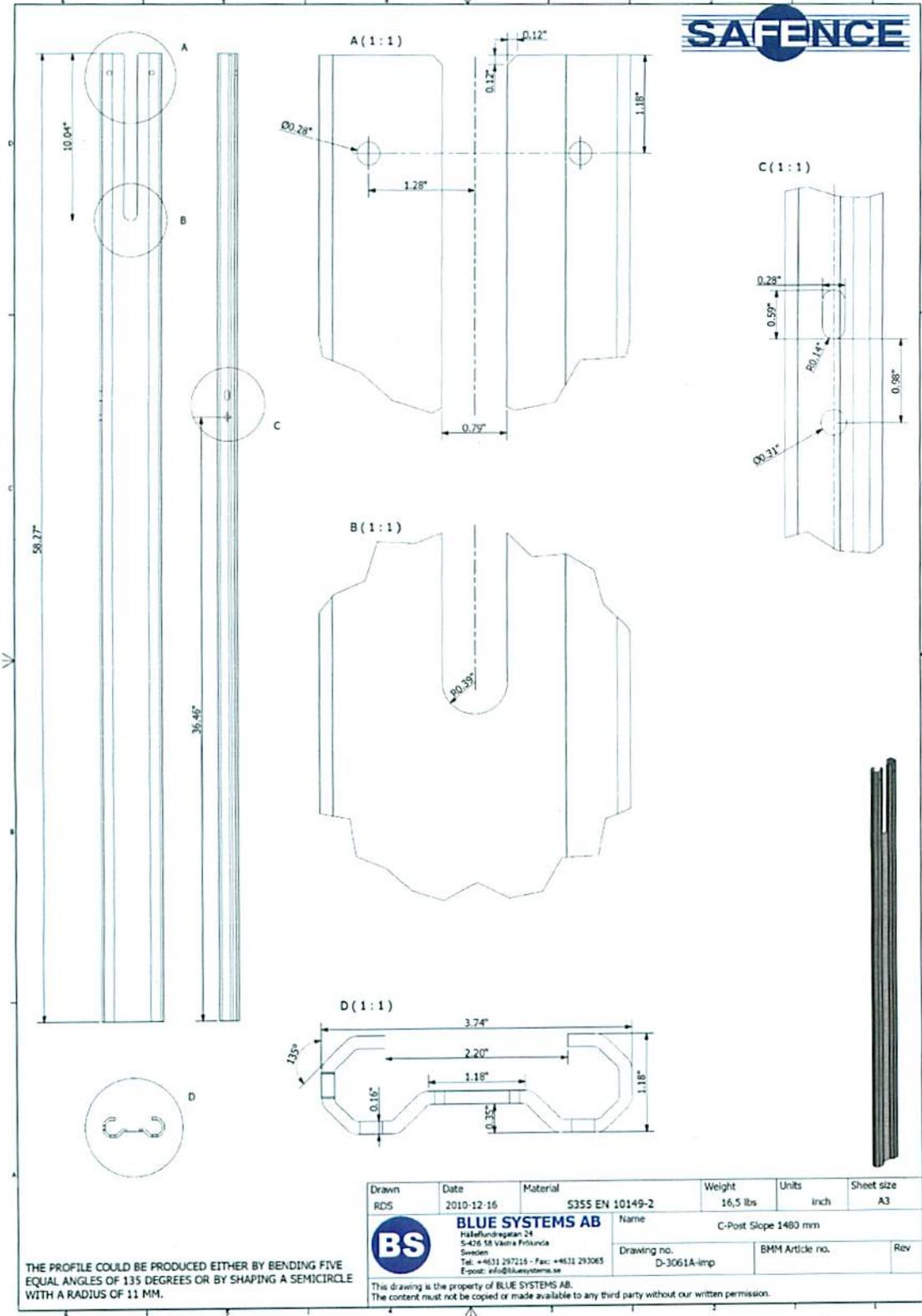
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Michael S. Griffith
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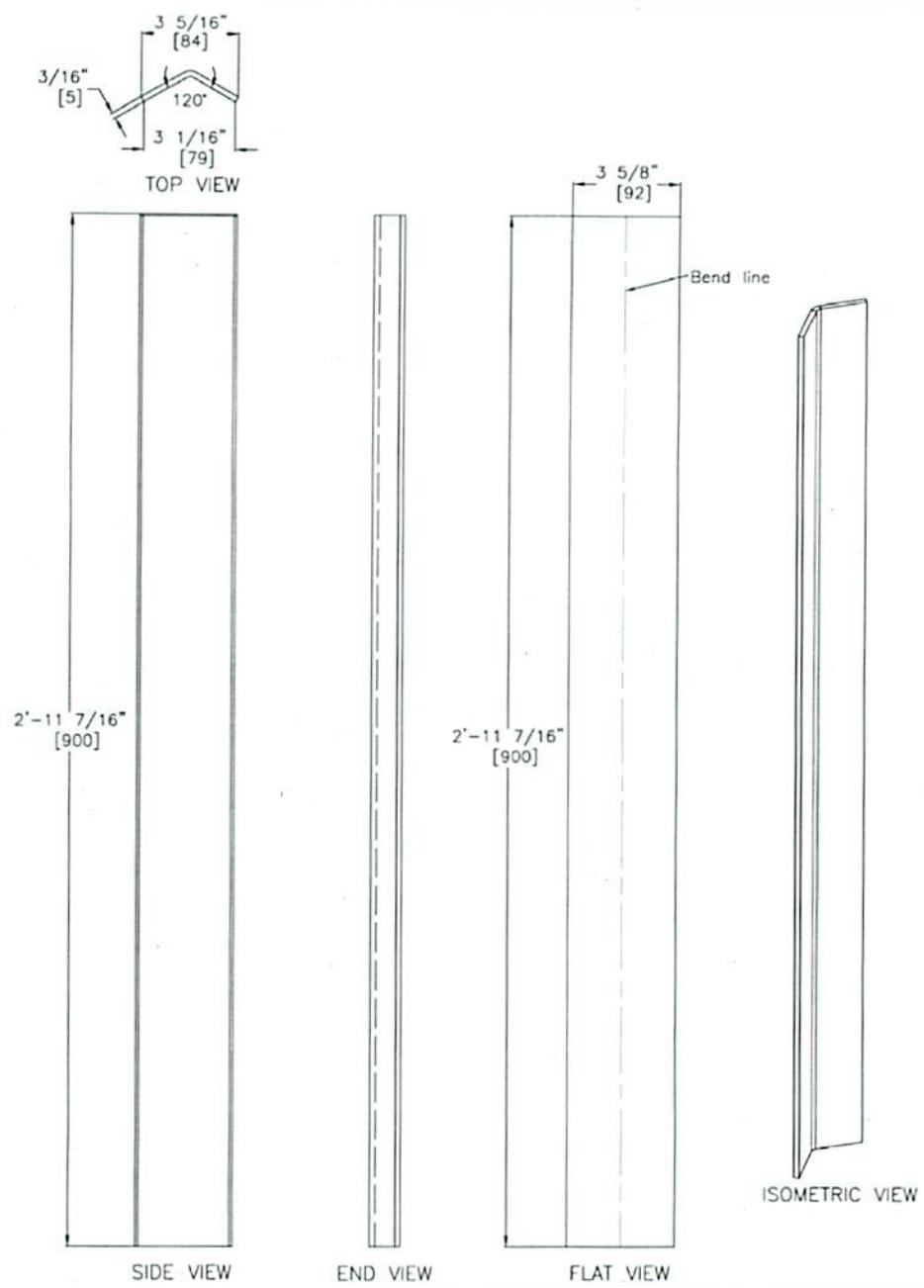
Enclosures



THE PROFILE COULD BE PRODUCED EITHER BY BENDING FIVE EQUAL ANGLES OF 135 DEGREES OR BY SHAPING A SEMICIRCLE WITH A RADIUS OF 11 MM.

Drawn RDS	Date 2010-12-16	Material S355 EN 10149-2	Weight 16,5 lbs	Units inch	Sheet size A3
BLUE SYSTEMS AB Vållöfundgrävan 24 S-426 58 Västra Frölunda Sweden Tel: +4631 297216 - Fax: +4631 293063 E-post: info@bluesystems.se		Name C-Post Slope 1480 mm		Rev	
		Drawing no. D-3061A-imp	BMM Article no.		

This drawing is the property of BLUE SYSTEMS AB. The content must not be copied or made available to any third party without our written permission.



	SAFENCE INC. HIGH-TENSION CABLE BARRIER		Sheet: 13 of 26
	C-POST STIFFENING PLATE 16 ft CONFIGURATION		Date: 11/05/2010
Midwest Roadside Safety Facility	Drawing Name: SAFENCE Retrofit 16 ft-V2	Scale: 1:5	By: JGP Rev: RKF/KAL



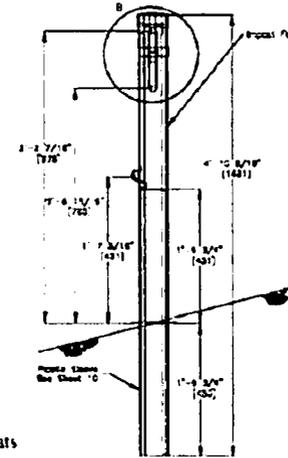
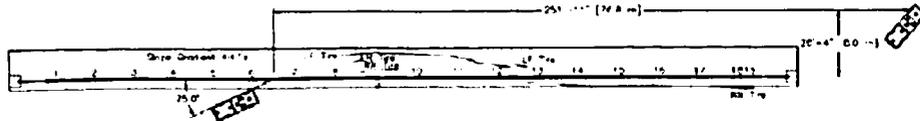
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- Test Agency MwRSF
- Test Number SF3CB-2
- Date 11/2/2010
- NCHRP Report 350 Test Designation 3-11
- Test Article Safence Three-Cable Median Barrier on 4:1 Fill Slope
- Total Length 284 ft (87 m)
- Lateral Offset from Slope Break Point 4 ft (1.22 m)
- Key Component - Rail
 - Length 284 ft (87 m)
 - Make 3/8-in. (19-mm) diameter 3x7 wire rope
- Key Component - Post
 - Length 58.3 in. (1,481 mm)
 - Shape C-shape
 - Spacing 16 ft (4.88 m)
- Soil Type Grade B of AASHTO M147-65 (1990)
- Vehicle Make / Model 1990 Chevrolet C2500
 - Curb 4,335 lb (1,966 kg)
 - Test Inertial 4,413 lb (2,002 kg)
 - Gross Static 4,413 lb (2,002 kg)
- Impact Conditions
 - Speed 63.2 mph (101.7 km/h)
 - Angle 25.0 deg
 - Impact Location 7 ft = 5 1/4 in. (2.28 m) DS of Post No. 6
- Vehicle Stability Satisfactory
- Vehicle Stopping Distance 252 ft (76.8 m)
- Vehicle Damage Minimal
 - VDS⁽¹⁰⁾ 11-LD-1
 - CDC⁽¹¹⁾ 11LYEW1
 - Maximum Interior Deformation 1/2 in. (6 mm)
- Test Article Damage Extensive
- Test Article Deflections
 - Permanent Set 22 in. (559 mm)
 - Dynamic w/ Post No. 4 Removed from Barrier 9.2 ft (2.8 m)
 - Dynamic w/ Post No. 4 Intact 8.6 ft (2.6 m)
 - Working Width 10.8 ft (3.3 m)

- Maximum Angular Displacements
 - Roll 17.7 °
 - Pitch 2.6 °
 - Yaw 34.3 °
- Impact Severity (IS) 142.7 kJ
- Transducer Data

Evaluation Criteria		Transducer			NCHRP Report 350 Limit
		EDR-3	EDR-4	DTS	
OIV ft/s (m/s)	Longitudinal	-5.66 (-1.73)	NA	-6.33 (-1.93)	≤ 39.37 (12.0)
	Lateral	10.14 (3.09)	NA	10.30 (3.14)	≤ 39.37 (12.0)
ORA g's	Longitudinal	-3.65	NA	-4.85	≤ 20.0
	Lateral	6.02	NA	6.26	≤ 20.0
THIV [ft/s (m/s)]		NA	NA	11.52 (3.51)	Not Required
PHD [g's]		NA	NA	6.29	Not Required
ASI		0.39	NA	0.43	Not Required