



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

May 8, 2007

400 Seventh St., S.W.
Washington, DC 20590

In Reply Refer To:
HSSD/B-158

Mr. Owen S. Denman, P.E.
President and CEO
Barrier Systems Inc.
180 River Road
Rio Vista, CA 94571-1208

Dear Mr. Denman:

Thank you for your letter of December 18, 2006, requesting the Federal Highway Administration's (FHWA) acceptance of the **BarrierGuard™ 800 (BG 800) - Minimum Deflection System** of Highway Care, Ltd. and Laura Metaal Eygelshoven, BV, for use on National Highway System under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features". Accompanying your letter was a report on testing of the BarrierGuard™ 800 - Minimum Deflection system prepared by Safe Technologies Inc, test videos, drawings and previously prepared crash test reports providing additional information and background, including report on crash testing of regular BarrierGuard™ 800 system of October 2004 and report on crash testing of BarrierGuard™ 800 with Intermediate Anchors of October 2005.

Requirements

Longitudinal barrier 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 of longitudinal barriers.

Product description

The previously approved BarrierGuard™ 800 system (acceptance letter HSA-10/B-131) is a high containment and low deflection steel barrier designed for both permanent applications and temporary use in roadwork situations, preventing penetration of errant vehicles into working areas. It is constructed from 5-mm (0.2") thick A36 galvanized steel panels assembled in either 6-meter (19.7 ft) or 12-meter (39.4 ft) segments. Each segment is 800-mm (31.5") high with a base width of 540 mm (21") and a top width of 230 mm (9"). The BarrierGuard™ 800 has a

**MOVING THE
AMERICAN
ECONOMY**

sloped face with a "step" 255 mm (10") above the ground. Each 12 meter segment weighs approximately 1080 kg (2381 lb). The system is anchored at each end and at a point approximately 6 m (20 ft) in from each end. The test level 3 (TL-3) dynamic deflection of the BarrierGuard™ 800 system was reported to be 1000 mm (39.4") for Test 3-21 conditions and estimated to be 1500 mm (78.8") for Test 3-11 conditions.

The BarrierGuard™ 800 - Minimum Deflection system is a modification of the previously approved BarrierGuard™ 800 system designed to minimize the dynamic deflection of the system. Minimum Deflection systems are valuable in application where there is only limited space available, such as bridge deck repairs/replacement projects. To achieve this reduction in deflection, BarrierGuard™ 800 - Minimum Deflection system incorporates the following modifications to the standard BarrierGuard™ 800:

- The barrier is anchored every 6 m (20 ft) with either joint anchors or intermediate anchors.
- The system consists of either 6 m (20 ft) or 12 m (40ft) BarrierGuard™ 800 sections.
- The barrier sections are fitted with a T-top attachment to aid in the redirection and stability of the vehicle after impact. The T-top measures 473mm (15 5/8") wide and is 121mm (4 3/4") tall. The effective width of the top section with the T-top installed is 474 mm (18 5/8"). With the T-top installed the barrier height is 921mm (36 1/16") and the mass of each 6 meter (20 ft) BarrierGuard™ 800 section is approximately 135 kg per meter (90 lb/ft) or 800 kg (1800 lb). The mass of a similar 12 meter (40 ft) section is approximately 135 kg per meter (90 lb/ft) or 1600 kg (3600 lb).

Drawings of the BarrierGuard™ 800 - Minimum Deflection system are provided in Enclosure 1.

Test article installation

The barrier installation consisted of eight 6 meter (20ft) sections for a total length of 48 meters (157 ft). The test article configuration and layout, including points of intersection, anchorage and impact, are summarized in the drawing provided in Enclosure 1.

Testing

The NCHRP Report 350 requires that in order for the length-of-need of longitudinal barriers to meet the NCHRP Report 350 TL-3 criteria they must successfully pass tests 3-10 and 3-11 while test S3-10 is optional. However, since your company's regular BarrierGuard™ 800 system (without intermediate anchors) was fully tested and approved before (acceptance letter HSA-10/B-131), you ran only test 3-11 on the BarrierGuard™ 800 - Minimum Deflection system. The assumption was that this test will be more critical than the test 3-10 since it will deliver the maximum load to the anchor point and connection and evaluate the strength of the system in containing and redirecting the 2000P test vehicle.

Taking into account that previous 3-10 comparable crash tests on regular BarrierGuard™ 800 system recorded occupant impact velocities and ridedown accelerations well below the maximum limits (6 m/s and 9.6 g, respectively), it can be reasonably assumed that while increase in lateral stiffness of the barrier provided by BarrierGuard™ 800 - Minimum Deflection system may lead to an increase in the occupant risk values, they will remain within the maximum NCHRP 350 limits. I therefore agree that test 3-10 on the BarrierGuard™ 800 - Minimum Deflection system is redundant and can be waived.

The full-scale NCHRP Report 350 Test 3-11 conducted on your company's BarrierGuard™ 800 - Minimum Deflection system involved a 2000P vehicle impacting the device at 101.4 km/h and 25.0 deg. angle with the impact point 23 meters (76 ft) from the upstream end at a section joint and anchor point. The test vehicle impacted the article, was redirected away from the barrier, and lost contact with the barrier downstream from the impact point at a velocity of 72.4 km/h and an angle of 14 degrees.

The impacted and the downstream barrier sections received moderate damage at the T-top and anchor assembly. The barrier was dented in the impact area, but did not separate or tear. The anchors upstream and downstream from the impact did not lift or crack the concrete or asphalt. The total permanent deflection was 19mm (0.75") at the base and 203 mm (8") at the T-top and the total dynamic deflection was 76mm (3") at the base and 305 mm (12") at the T-top.

All occupant risk factors were within the limits specified in NCHRP Report 350. The theoretical occupant impact velocity values in the longitudinal and lateral directions were 5.9 and 6.5 m/s respectively and the theoretical occupant ridedown acceleration values in the longitudinal and lateral directions were 5.5 and 7.8 g's respectively. A summary of the test results is provided in Enclosure 2.

It is my understanding that you also intending to use the BarrierGuard™ 800 - Minimum Deflection system with the intermediate anchoring every 12 m instead of 6 m. In October 2005 you conducted test 3-11 on the similar system with intermediate anchors every 12 m, however without T-top. While all evaluation criteria were met, the pitch angle was somewhat higher than in free standing tests previously submitted. I therefore agree that if this system is used with the T-top, as BarrierGuard™ 800 - Minimum Deflection system with anchoring every 12 m, its performance will be acceptable. Of course, maximum permanent and dynamic deflection will increase compared to the BarrierGuard™ 800 - Minimum Deflection system anchored every 6 m. The estimated deflection for the system with a T-top and 12 m anchors is less than that observed in the 3-11 test conducted without the T-top, approximately 890 mm (35").

From the documentation accompanying your request for acceptance it is clear that you also request the acceptance of applications where regular BarrierGuard™ 800 system (without intermediate anchors and T-top) and BarrierGuard™ 800 - Minimum Deflection system are used in combinations, provided that transitions are used. You specified that to provide such transitions T-top is to begin a min of 12 m (39.4 ft) prior to any anchor and run a minimum 12 m (39.4 ft) past anchors with T-top transition sections extending additional 1.5 m (4.9 ft). No specific tests were conducted to test these transitions, however test 3-21 on the regular BarrierGuard™ that you successfully conducted in October 2004 (acceptance letter HSA-10/B131) is relevant to predict crash performance of such transitions. In that test the impact point was selected 15 m (49.2 ft) from the downstream end of the system, which was anchored at two points - at the end and 6 m (20 ft) in from the end. Thus, this impact point was located at the transition from freestanding and anchored sections of the barrier. Taking into account that this 3-21 test was successful and that you also propose the use of T-top as an additional treatment smoothing stiffness changes in the transitions between freestanding and anchored sections, I agree that full crash testing of transitions between BarrierGuard™ 800 system (without intermediate anchors and T-top) and BarrierGuard™ 800 - Minimum Deflection systems would be redundant.

In summary I agree that BarrierGuard™ 800 - Minimum Deflection system, as described above, meets the appropriate evaluation criteria for the NCHRP 350 TL-3 longitudinal barriers and may be used at all appropriate locations on the 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. It can also be used with intermediate anchoring every 6m or 12 m when using the T-top adaptor and in combinations with regular BarrierGuard™ 800 provided that proper transitions are used and changes in deflections are taken into account. This acceptance is based on the reported crash performance of the BarrierGuard™ 800 - Minimum Deflection system. Further, I am assuming that production models will be identical to the prototype test units.

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.
- 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-158, 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 BarrierGuard™ 800 - Minimum Deflection system 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.

- Since BarrierGuard™ 800 - Minimum Deflection system is a steel product, the provisions of Title 23, Code of Federal Regulations Section 635.410 (a copy of which is enclosed) are applicable. Note that the “Buy America” provisions apply only to steel products that are permanently incorporated into highway projects, not to temporary barriers used only during construction or maintenance operations.

Sincerely yours,



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

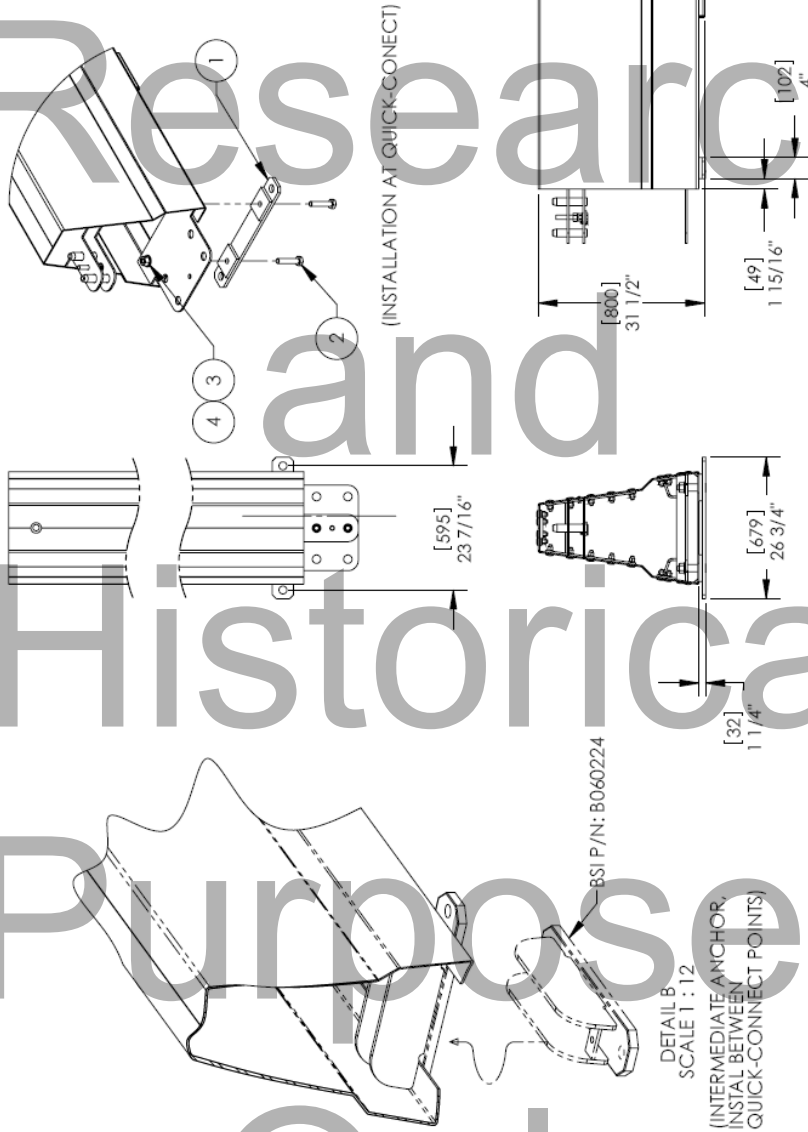
Enclosures

Research
and
Historical
Purposes
Only

DYNAMIC DEFLECTION TL-3					
ANCHORAGE	in	mm			
STANDARD	59	1,500			
12m [40 ft]	35	890			
6m [20 ft]	12	305	TOP	BASE	TOP
			8	305	200

Item	Qty	Part Description	Part	U/M
1	1.00	ANCHOR PLATE WELDMENT, B0600	B0600	EACH
2	2.00	CORR. HLM243 (M25 CL8 ROAL)	201562	EACH
3	2.00	W-01 M24 Gal	201563	EACH
4	2.00	See HLM25-3.0 Gal	201565	EACH

- NOTES: UNLESS OTHERWISE SPECIFIED
- INTERMEDIATE ANCHORS MAY BE INSTALLED TO REDUCED DEFLECTION.
 - T-TOP SHALL BE INSTALLED ON BARRIER GUARD SECTIONS WHEN INTERMEDIATE ANCHORS ARE USED. T-TOP IS TO BEGIN A MIN OF 12m PRIOR TO ANY ANCHOR AND RUN A MINIMUM 12m PAST ANCHORS. TRANSITION SHALL EXTEND AND ADDITIONAL 1.5m.



DETAIL B
SCALE 1 : 12
(INTERMEDIATE ANCHOR, INSTAL BETWEEN QUICK-CONNECT POINTS)

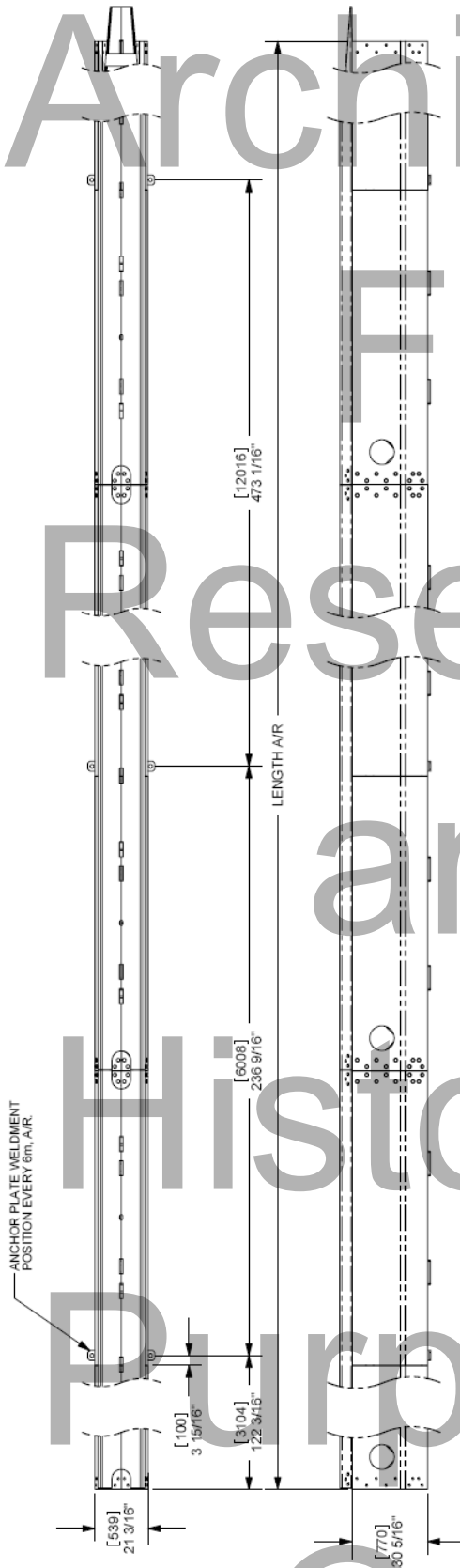
NOTE: THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED		© 2005 Barrier Systems Inc. The information herein is the property of Barrier Systems Inc. and shall not be disclosed, duplicated or used otherwise without the express written approval of Barrier Systems Inc.		SCALE: 1:20 DRAWN BY: DATE: INIT: DATE: INIT: DATE: INIT: DATE: INIT:		Standard Tolerance Dimensions in Drawing Fractional: ± .010 Dec: .005-±.010 Dec: .005-±.005		TITLE: INTERMEDIATE ANCHOR INSTALLATION		MODEL: B051103		REV: 1	
1 ADDED TAB 2 "DRAWING" SECTION "205069 AEM" ADDED DETAIL B		CHANGES		DATE BY RECD		NEXT ASSY. ITEM		TITLE: INTERMEDIATE ANCHOR INSTALLATION		MODEL: B051103		REV: 1	

Item	Qty	Part Description	Part	Unit
1	1.00	ANCHOR PLATE, B03800	1060989	EACH
2	2.00	ANCHOR PLATE, ANCHOR WELDMENT B03800	1060981	EACH

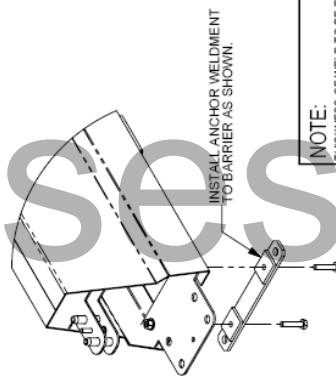
- NOTES: UNLESS OTHERWISE SPECIFIED
1. FINISH TO BE HOT DIPPED GALVANIZED PER ASTM A123
2. ALL HOLES TO BE FREE OF WELD SPATTER.



NOTE: THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED		© 2008 Barrier Systems Inc. The information herein is proprietary to Barrier Systems Inc. and is to be disclosed in writing or otherwise without the express written approval of Barrier Systems Inc.		SCALE: 1:3 DRAWN BY: [REDACTED] CHECKED BY: [REDACTED] DATE: 8/24/08 REV: NEW		Standard Tolerance Regular: ± .015" Precision: ± .010" Dec. XXX: ± .005" Dec. XXX: ± .002"		BARRIER SYSTEMS INC. 1800 RIVER RD. BOX 1074, CA 94571 TEL: 207-374-6800 FAX: 207-374-6901	
								SHEET: 1 OF 1 DRAWING NUMBER: B060982 REV:	
0 NEW DRAWING 9/20/08 ADW		DATE: 9/20/08 BY: ADW		REV: 0 CHANGES:		REQD: BY NEXT ASSY: ITEM		ANCHOR PLATE WELDMENT, B03800	

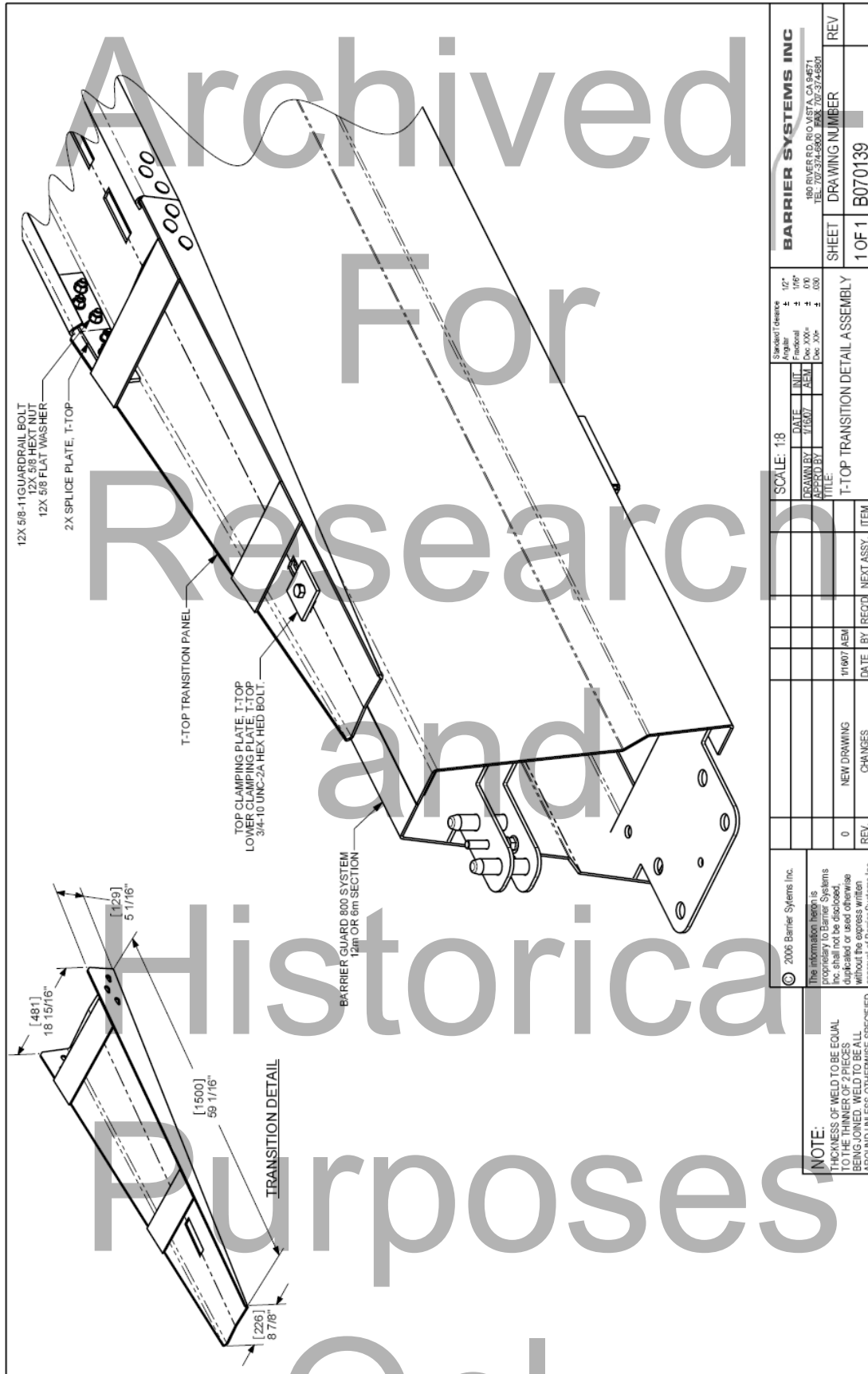


- NOTES: UNLESS OTHERWISE SPECIFIED
 1. DIMENSIONS SHOWN ARE REFERENCE DIMENSIONS IN BRACKETS ARE mm.
 2. BARRIER GUARD SYSTEM SHOWN WITH 6 METER SEGMENTS ANCHORED EVERY 6m.
 3. BARRIER GUARD MAY BE DEPLOYED IN 6m OR 12m (20' OR 40') SECTIONS ANCHORED WITH INTERMEDIATE ANCHORS INSTALLED TO MINIMIZE DEFLECTION.
 4. T-TOP IS TO BEGIN A MINIMUM OF 12m PRIOR TO ANY ANCHOR, GATE OR VLB. ANCHORS MUST BE A MINIMUM OF 12m FROM EACH OTHER. TRANSITION SHALL EXTEND AN ADDITIONAL 1.5m.



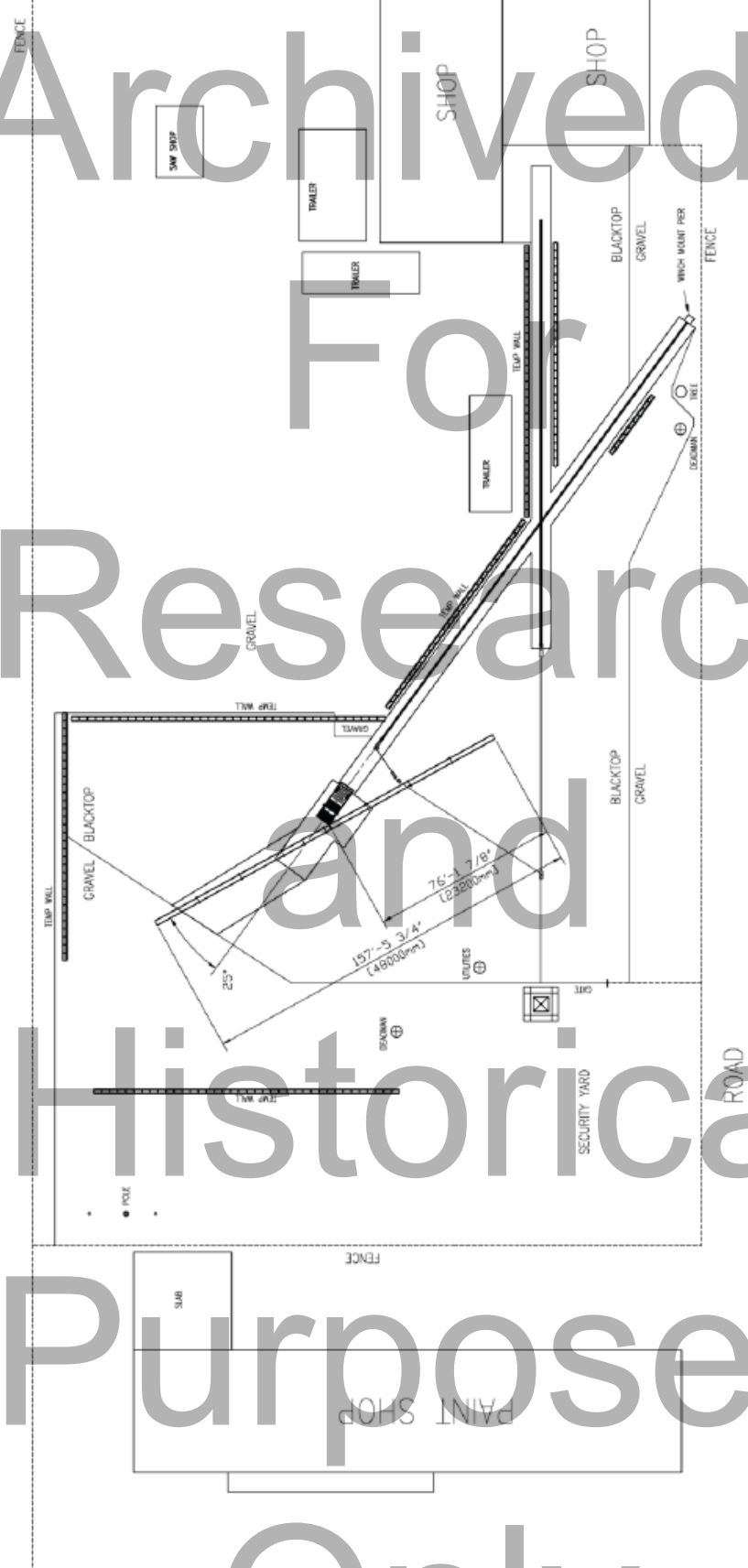
NOTE:
 THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES. WELD TO BE FULL PENETRATION WELD AROUND UNLESS OTHERWISE SPECIFIED.

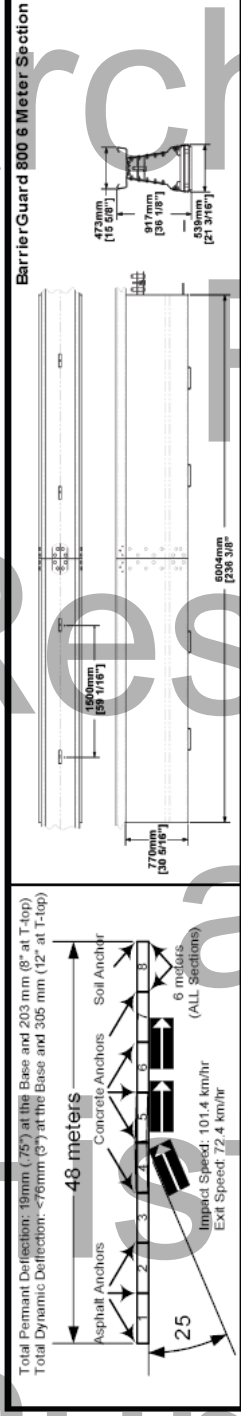
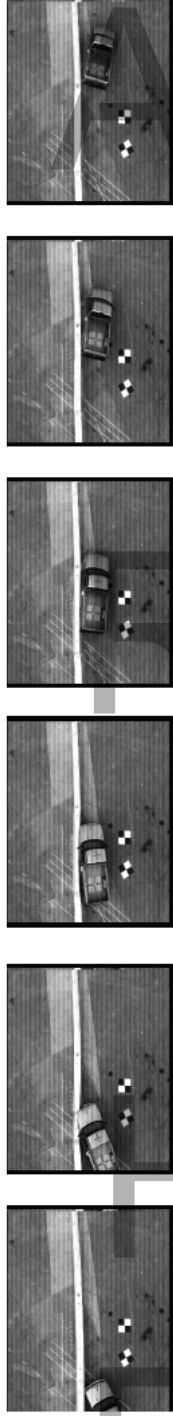
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NOTE: THICKNESS OF WELD TO BE EQUAL TO THE THICKNESS OF THE BASE METAL. BEAD JOINED WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED.		© 2006 Barrier Systems Inc. The information herein is proprietary to Barrier Systems Inc. shall not be disclosed, duplicated or used otherwise without the express written approval of Barrier Systems Inc.		SCALE: 1:8 DRAWN BY: [blank] DATE: 7/2007 APPROVED BY: [blank] TITLE: T-TOP TRANSITION DETAIL ASSEMBLY		Standard Deviance Angular 1/2° Parallel 1/16" Perpendicular 1/32" Hole 2X+		BARRIER SYSTEMS INC 180 POWER RD. ROXBURY, MA 01567 TEL: 508-366-7000 FAX: 508-366-7001	
REV.	CHANGES	DATE	BY	REQD.	NEXT ASSY.	ITEM	SHEET	DRAWING NUMBER	REV
0	NEW DRAWING	11/007	AEM				1 OF 1	B070139	

TOTAL INSTALLATION LENGTH = 48 M (157'-5 3/4")
IMPACT POINT LENGTH = 23.2 M (76'-1 7/8") FROM UPSTREAMED
IMPACT ANGLE = 25°
NCHRP REPORT 350 TEST 3-11

[illegible]



General Information	
Test Agency	SAFE TECHNOLOGIES, INC.
Test Designation	NCHRP Report 360 3-11
Test No.	STI Test #BG808
Date	11/1/2006
Test Article	
Type	BarrierGuard 800 steel barrier
Installation Length	
Size and/or dimension and material of key elements	
Total Barrier Length	48 meters (157')
Segment Lengths	6 meters (20')
Height	800mm (31.5") @ T-top 921mm (36 1/4")
Width (base)	540mm (21 1/4")
Width (T-top)	474mm (18 5/8")
Test Vehicle	
Type	Production Model
Designation	2000P
Model	2000 Chevrolet 3/4 ton pickup
Mass (kg)	2120
Curb	2023
Test Inertial Dummies(s)	n/a
Gross Static	2023
Impact Conditions	
Speed (km/h)	101.4
Angle (deg)	25
Impact Severity (kJ)	143.3
Exit Conditions	
Speed (km/h)	72.4
Angle (deg)	14
Occupant Risk Values	
Impact velocity (m/s)	
x-direction	5.9
y-direction	-6.5
Ridedown Acceleration (g's)	
x-direction	-5.5
y-direction	7.8
THIV (km/hr)	29.6
PHD (g's)	8.4
ASI	1.11
Test Article Deflection (mm)	
Dynamic	305 mm (12") Top / <76mm (3") at Base
Permanent	203 mm (8") Top / 19mm (.75") at Base
Vehicle Damage	
Exterior	
VDS	LF-3
CDC	11FYMMW4
Interior	
CCDI	LD0010000
Post-Impact Vehicular behavior (deg - gyro @ c.g)	
Maximum Roll Angle (before capture)	20
Maximum Pitch angle (before capture)	18
Maximum Yaw Angle (before capture)	14

Title 23, Code of Federal Regulations

§ 635.410 Buy America requirements.

(a) The provisions of this section shall prevail and be given precedence over any requirements of this subpart which are contrary to this section. However, nothing in this section shall be construed to be contrary to the requirements of §635.409(a) of this subpart.

(b) No Federal-aid highway construction project is to be authorized for advertisement or otherwise authorized to proceed unless at least one of the following requirements is met:

(1) The project either: (i) Includes no permanently incorporated steel or iron materials, or (ii) if steel or iron materials are to be used, all manufacturing processes, including application of a coating, for these materials must occur in the United States. Coating includes all processes which protect or enhance the value of the material to which the coating is applied.

(2) The State has standard contract provisions that require the use of domestic materials and products, including steel and iron materials, to the same or greater extent as the provisions set forth in this section.

(3) The State elects to include alternate bid provisions for foreign and domestic steel and iron materials which comply with the following requirements. Any procedure for obtaining alternate bids based on furnishing foreign steel and iron materials which is acceptable to the Division Administrator may be used. The contract provisions must (i) require all bidders to submit a bid based on furnishing domestic steel and iron materials, and (ii) clearly state that the contract will be awarded to the bidder who submits the lowest total bid based on furnishing domestic steel and iron materials unless such total bid exceeds the lowest total bid based on furnishing foreign steel and iron materials by more than 25 percent.

(4) When steel and iron materials are used in a project, the requirements of this section do not prevent a minimal use of foreign steel and iron materials, if the cost of such materials used does not exceed one-tenth of one percent (0.1 percent) of the total contract cost or \$2,500, whichever is greater. For purposes of this paragraph, the cost is that shown to be the value of the steel and iron products as they are delivered to the project.

(c)(1) A State may request a waiver of the provisions of this section if;

(i) The application of those provisions would be inconsistent with the public interest; or

(ii) Steel and iron materials/products are not produced in the United States in sufficient and reasonably available quantities which are of a satisfactory quality.

(2) A request for waiver, accompanied by supporting information, must be submitted in writing to the Regional Federal Highway Administrator (RFHWA) through the FHWA Division Administrator. A request must be submitted sufficiently in advance of the need for the waiver in order to allow time for proper review and action on the request. The RFHWA will have approval authority on the request.

(3) Requests for waivers may be made for specific projects, or for certain materials or products in specific geographic areas, or for combinations of both, depending on the circumstances.

(4) The denial of the request by the RFHWA may be appealed by the State to the Federal Highway Administrator (Administrator), whose action on the request shall be considered administratively final.

(5) A request for a waiver which involves nationwide public interest or availability issues or more than one FHWA region may be submitted by the RFHWA to the Administrator for action.

(6) A request for waiver and an appeal from a denial of a request must include facts and justification to support the granting of the waiver. The FHWA response to a request or appeal will be in writing and made available to the public upon request. Any request for a nationwide waiver and FHWA's action on such a request may be published in the Federal Register for public comment.

(7) In determining whether the waivers described in paragraph (c)(1) of this section will be granted, the FHWA will consider all appropriate factors including, but not limited to, cost, administrative burden, and delay that would be imposed if the provision were not waived.

(d) Standard State and Federal-aid contract procedures may be used to assure compliance with the requirements of this section.

Title 23, Code of Federal Regulations
§ 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.

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