



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-159

Mr. Owen S. Denman, PE  
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) – Gate of Highway Care, Ltd.** (a UK company) and Laura Metaal Eyselshoven, BV, for use on the National Highway System (NHS) under the provisions of 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 your company's BarrierGuard™ 800 - Gate 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.

### **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/B131) is 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.

BarrierGuard™ 800 – Gate is designed to be used with regular application of BarrierGuard™ 800 system. In its basic design the gate is a 6 m (20 ft) barrier section that can be unpinned and swung open from either end to allow vehicle or pedestrian passage. 6 m (20 ft) gate is positioned between two 6 m (20ft) "gate post" connecting sections, making the total length of the basic gate system 18 m (60 ft). Larger gate sections, in 6 meter (20 ft) increments are available. Standard 6 m or 12 m (20 ft or 40 ft) sections of BG 800 can be inserted into the center section of the gate



(i.e. at the splice point). The limitation on gate length is based on handling the mass of the section and the equipment available to open and close the system. This limit will be in excess of 12 m (40 ft).

The gate and adjacent sections are fitted with a T-top attachment to aid in the redirection and stability of the vehicle after impact. The T-top attachment measures 473mm (15 5/8") wide and is 121 mm (4 3/4") tall and shall begin minimum 12 m (40 ft) prior to the gate and extend past the gate a minimum of 12 m (40 ft). The beginning and ending of the T-top has a transition attachment element extending additional 1.5 m (4.9 ft). The purpose of this element is to ensure that there is no snag potential on either end of the T-top.

Drawings of the BarrierGuard™ 800 - Gate are provided in Enclosure 1.

### **Test article installation**

The system assembly that was tested consisted of different types of barrier sections: 12 m (40 ft) end anchor sections, 12 m (40 ft) midsections, 6 m (20 ft) "gate post" connecting sections and the 6 m (20 ft) gate section. The total installation length of the barrier was 78 m (256 ft). The 6 m (20 ft) gate was positioned between two 6 m (20 ft) "gate post" connecting sections, making the total length of the gate system 18 m (60 ft). The 6 m (20 ft) length of the gate section was selected for testing as it is the stiffest section and therefore provides the largest differential stiffness compared to standard runs of BarrierGuard™ 800. The critical impact point was selected to maximize the loading and snagging potential of the transition between the standard BG800 section and the gate section. Based on previous testing with the BG800, it was determined that this point would be approximately 4 m (13 ft) upstream from the upstream hinge point of the gate.

This installation used two different types of end anchors: asphalt anchors (upstream end) and soil anchors (downstream end). At either end of the barrier there were two sets of anchors, one set at the very end and one set located 6 meters (20ft) inboard from the ends.

The test article configuration and layout, including points of intersection and impact, are summarized in the drawing provided in Enclosure 1.

### **Testing**

Since the profile and section properties of the standard BarrierGuard™ 800 system had already been validated in previous tests, and since the gate section is stiffer than the standard section, you determined that the "transition" test (3-21) would be more appropriate to evaluate the performance of the gate section under direct impact conditions, to evaluate the strength of the connection between barrier sections and the gate and to evaluate the functionality of the gate after such an impact.

The NCHRP Report 350 requires that in order for transitions of longitudinal barriers to meet NCHRP Report 350 test level 3 (TL-3) criteria they must successfully pass tests 3-20 and 3-21 while test S3-20 is optional. However, since your company's BarrierGuard™ 800 system was fully tested and approved before (acceptance letter HSA-10/B-131), you ran only test 3-21 on the BarrierGuard™ 800 – Gate.

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), I agree that test 3-20 on the BarrierGuard™ 800 - Gate system would be redundant and can be waived.

The full-scale NCHRP Report 350 Test 3-21 conducted on your company's BarrierGuard™ 800 - Gate involved a 2000P vehicle impacting the device at 97.9 km/h and 25.0 degree angle, at the point 4 meters (13 ft) upstream from the upstream hinge point of the gate. The vehicle was redirected along the length of the barrier with the exit angle essentially parallel to the downstream barrier.

The impacted section and the downstream sections of the barrier received minor to moderate damage. The gate section was dented in the impact area, but did not separate or tear. The upstream and downstream barrier end section anchors did not lift or significantly damage the asphalt. There was no debris expelled from the barrier. The maximum lateral dynamic deflection was 1162 mm (46") and the maximum permanent deflection of the test article was 1073 mm (42"). The gate remained functional after the test.

All occupant risk factors were within the limits specified in the NCHRP Report 350. The theoretical occupant impact velocity values in the longitudinal and lateral directions were 5.2 m/s and 4.9 m/s respectively and the theoretical occupant ridedown acceleration values in the longitudinal and lateral directions were 6.1 g and 7.5 g respectively. Summary of test results is provided in Enclosure 2.

Minimum deflection modifications of regular BarrierGuard™ 800 are currently available. However, as you indicated during our review process, the BarrierGuard™ 800 - Gate is intended to be used with regular application of BarrierGuard™ 800 system (without intermediate anchors) only. However, intermediate anchoring may be used upstream or downstream of the gate system using proper T-top and anchoring transitions as recommended in the BarrierGuard™ 800 – Minimum Deflection System acceptance letter, B-158.

In summary I agree that BarrierGuard™ 800 - Gate, as described above, meets the appropriate evaluation criteria for 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 be used with regular application of BarrierGuard™ 800 or, when properly transitioned, with the Minimum Deflection System. This acceptance is based on the reported crash performance of the BarrierGuard™ 800 - Gate. 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:

- Our 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.

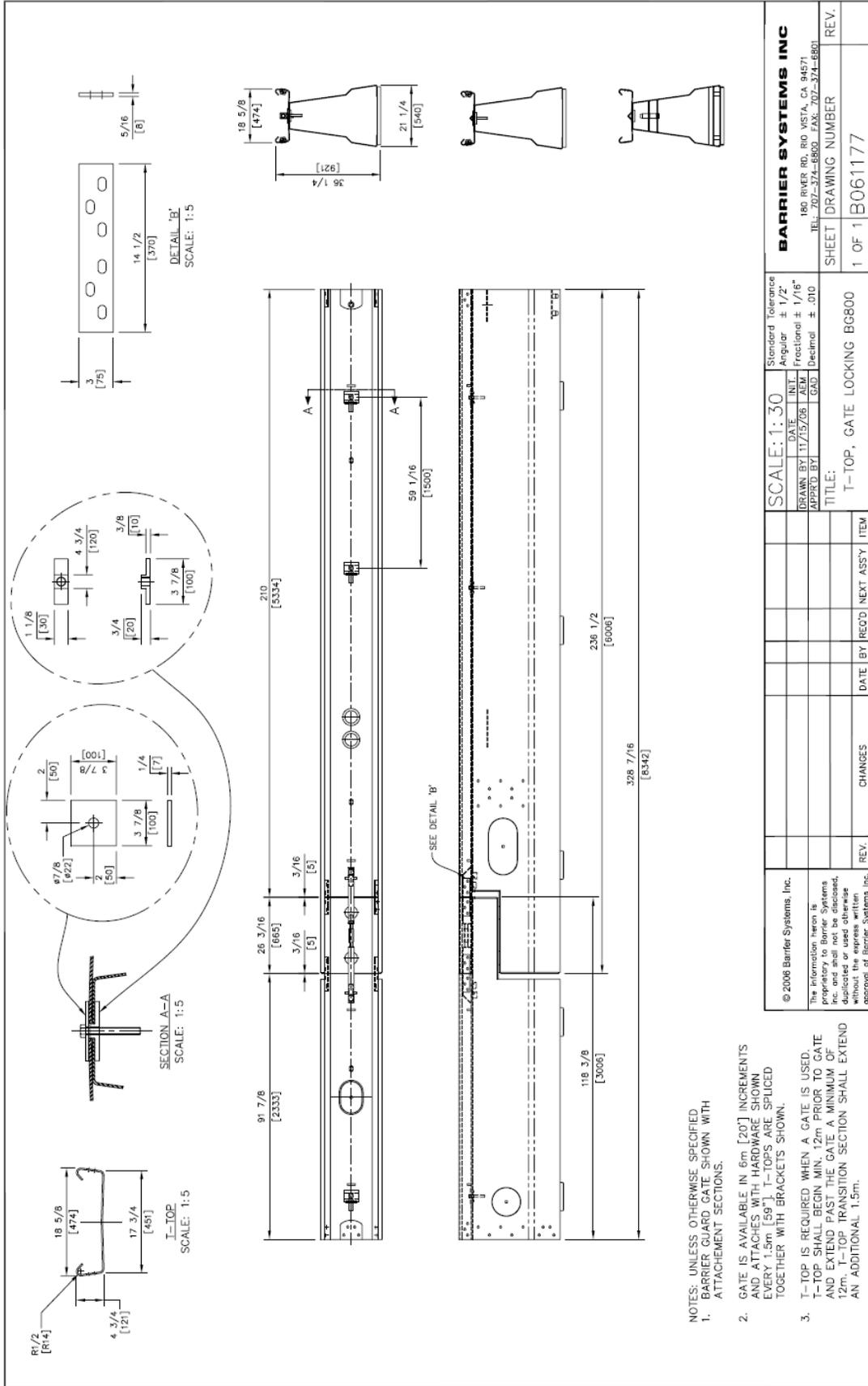
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You 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-159 shall not be reproduced except in full. As this letter and the documentation which support it become public information, it will be available for inspection at our office by interested parties.
- The BarrierGuard™ 800 - Gate is a patent pending device and is considered "proprietary". The use of proprietary devices specified on Federal-aid projects, except exempt, non-NHS projects: (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 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, a copy of which is enclosed.
- Since BarrierGuard™ 800 - Gate 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.

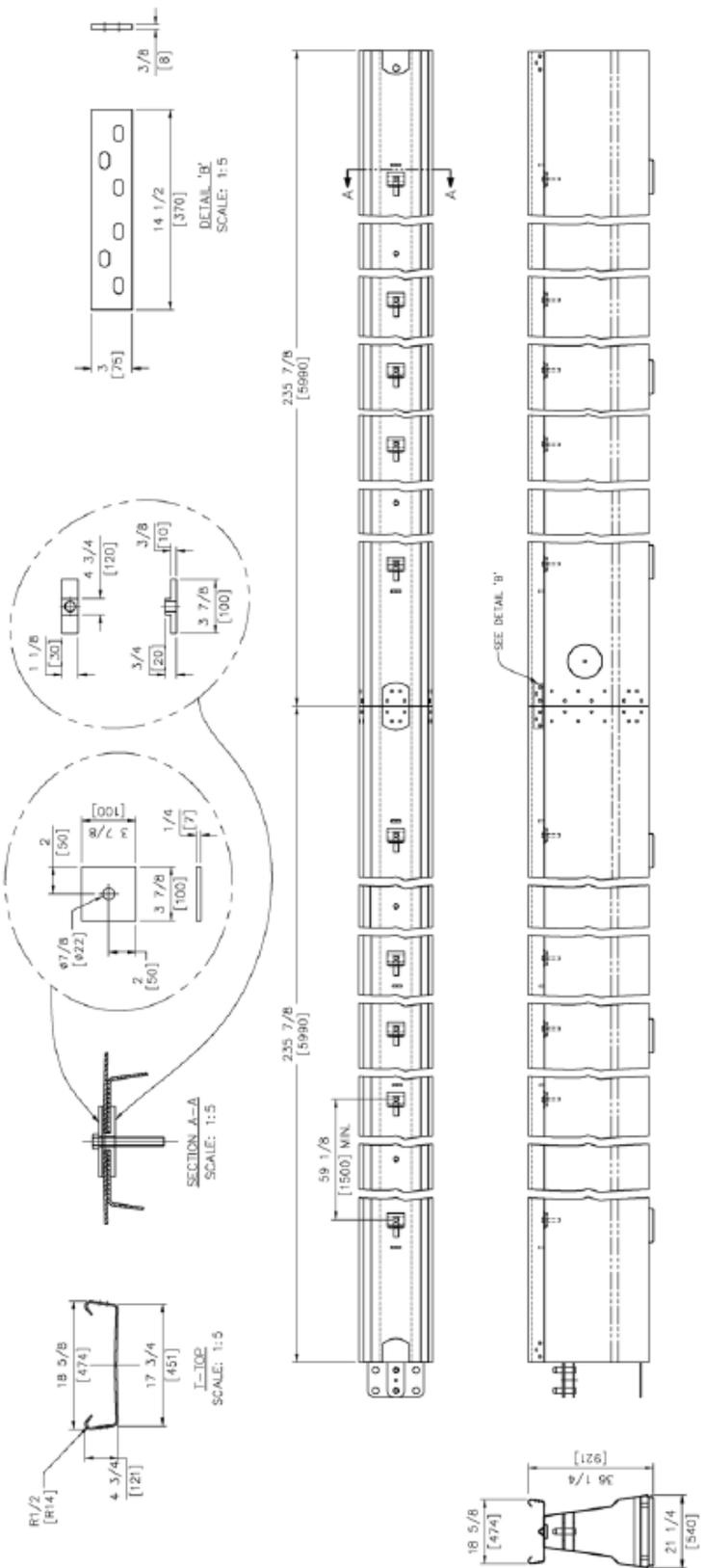
Sincerely yours,

A handwritten signature in blue ink that reads "George E. Rice, Jr." with a stylized flourish at the end.

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

Enclosures



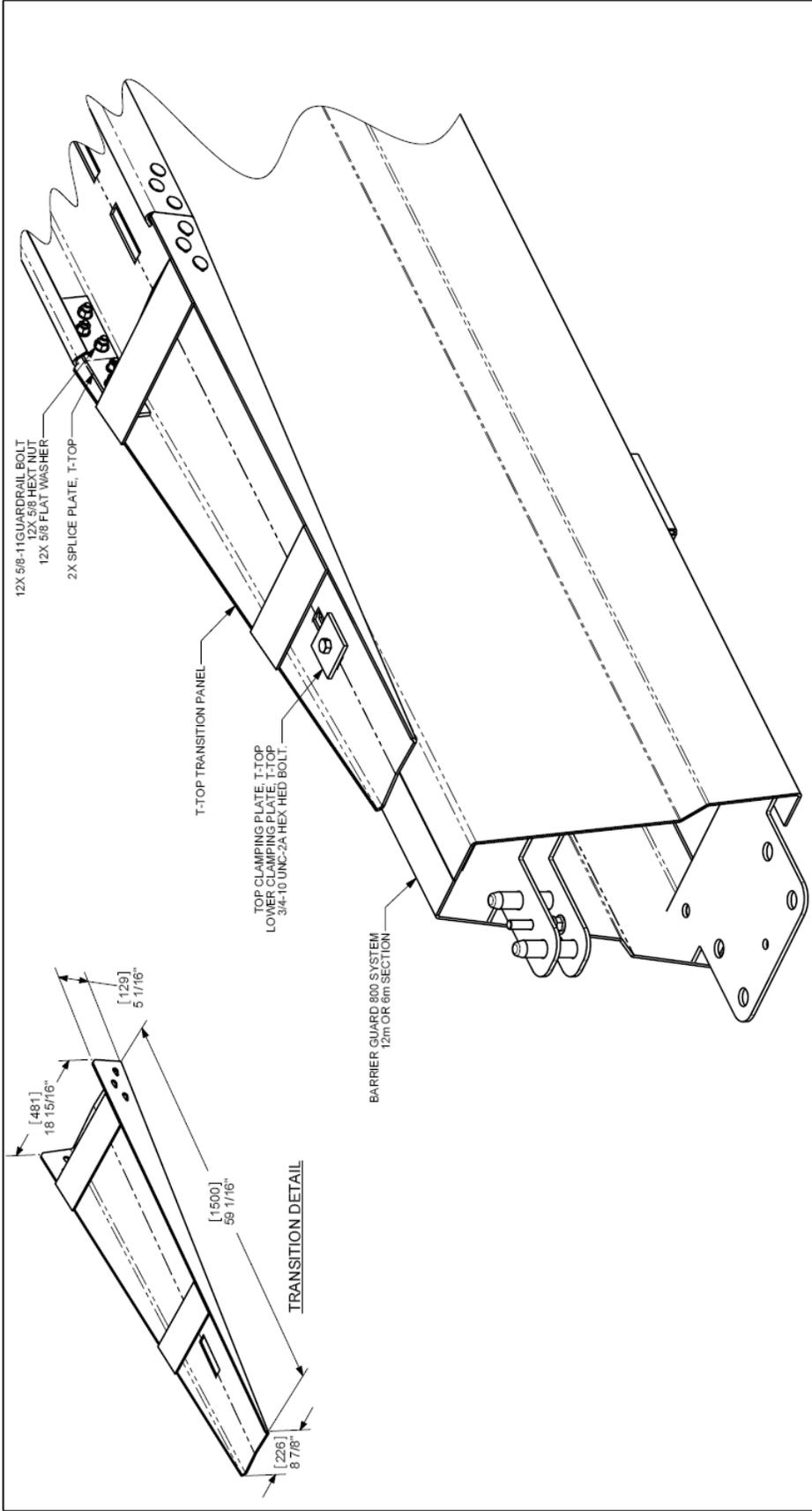


**T-TOP MATERIAL: 1/4" THICK HR A36  
WEIGHT PER FT: 25.7 LB.**

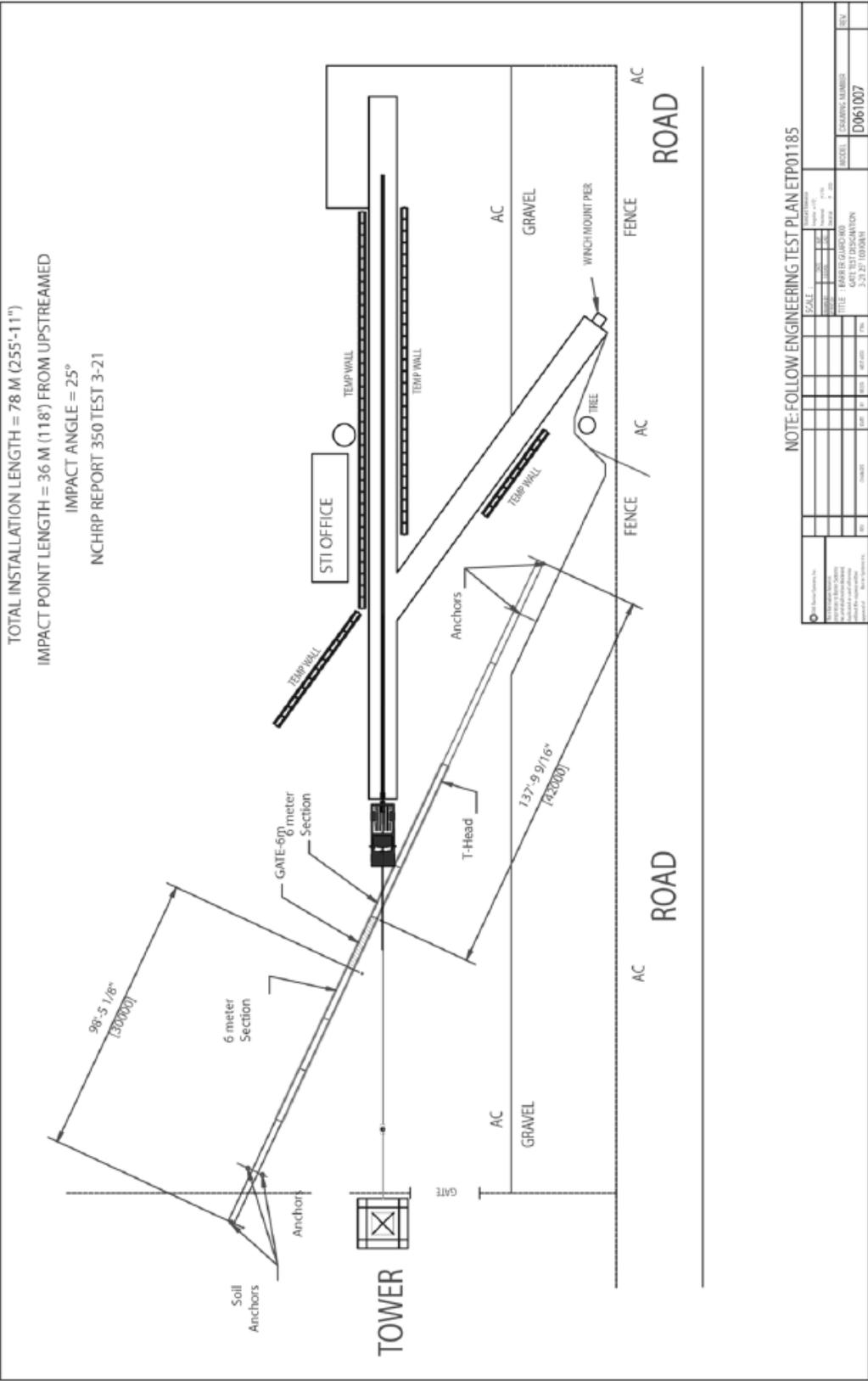
- NOTES: UNLESS OTHERWISE SPECIFIED
- 12-METER BARRIER GUARD SECTION SHOWN WITH T-TOP.
  - T-TOP IS IN 6m [20'] SECTIONS, AND ATTACHES WITH HARDWARE SHOWN EVERY 1.5m [5']. T-TOPS ARE SPLICED TOGETHER WITH BRACKETS SHOWN.
  - T-TOP IS REQUIRED WHEN BARRIER GUARD SECTION IS USED IN CONJUNCTION WITH INTERMEDIATE ANCHORING, GATE SECTIONS, AND/OR VARIABLE LENGTH BARRIERS (BQV(B)) +12M EITHER SIDE.

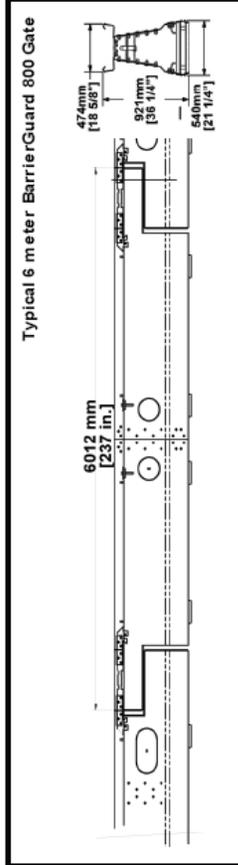
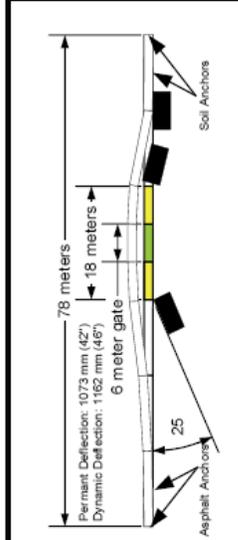
© 2016 Barrier Systems, Inc. The information herein is proprietary to Barrier Systems Inc. and shall not be disclosed, duplicated or used otherwise without the express written approval of Barrier Systems Inc.	SCALE: 1:30 DATE: 11/25/2016 DRAWN BY: JEFFREY B. BROWN CHECKED BY:	Standard Tolerance Angular ± 1/2° Fractional ± 1/16" Decimal ± .010 .000	T-TOP, 12m BCR00 1 OF 1 B061178
	TITLE:	SHEET DRAWING NUMBER 1 OF 1 B061178	REV.

**BARRIER SYSTEMS INC**  
 180 RIVER RD. RED WOOD, CA 94571  
 TEL: 925-342-8800 FAX: 925-342-8800



<p>© 2008 Barrier Systems Inc.          The information herein is proprietary to Barrier Systems Inc. shall not be disclosed, duplicated or taken otherwise without the written approval of Barrier Systems Inc.</p>		<p>SCALE: 1:8</p>	<p>Standard Deviance          Regular          Dec 2008          Dec 2008</p>	<p>1/2"          0/0          0/0</p>	<p><b>BARRIER SYSTEMS INC</b>          180 BILBRO RD. BLDG 187A, CA. 94571          TEL: 707-374-6800 FAX: 707-374-6801</p>
<p>DRAWN BY: [11807] AEM</p>	<p>DATE: [11/20/07]</p>	<p>APPROVED BY: [11807] AEM</p>	<p>TITLE:          T-TOP TRANSITION DETAIL ASSEMBLY</p>	<p>SHEET          1 OF 1</p>	<p>DRAWING NUMBER          B070139</p>
<p>REV. 0</p>	<p>CHANGES          NEW DRAWING</p>	<p>DATE          11/20/07</p>	<p>BY          AEM</p>	<p>RECD  </p>	<p>ITEM  </p>
<p><b>NOTE:</b>          THICKNESS OF WELD TO BE EQUAL TO THE BARRIER PIPE BEING JOINED, WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED</p>					





Typical 6 meter BarrierGuard 800 Gate

**General Information**

Test Agency..... SAFE TECHNOLOGIES, INC.  
 Test Designation..... NCHRP Report 350 3-21  
 Test No..... STI Test #BG807  
 Date..... 10/31/2006

**Exit Conditions**

Speed (km/h)..... 49.7  
 Angle (deg)..... -3 (tracked barrier)

**Occupant Risk Values**

Impact velocity (m/s)  
 x-direction..... 5.2  
 y-direction..... -4.9

**Ride-down Acceleration (g's)**

x-direction..... -6.1  
 y-direction..... 7.5  
 THV (km/hr)..... 24.6  
 PHD (g's)..... 7.7  
 ASI..... 0.88

**Test Article Deflection (mm)**

Dynamic..... 1162  
 Permanent..... 1073

**Vehicle Damage**

Exterior  
 VDS..... FL-3  
 CDC..... 11FLME4  
 Interior  
 OCCL..... LF0010000

**Post-impact Vehicular behavior (deg - gyro @ c.g)**

Maximum Roll Angle (before capture)..... 9  
 Maximum Pitch angle (before capture)..... 7  
 Maximum Yaw Angle (before capture)..... 7.5

**Test Article**

Type..... BarrierGuard 800 steel barrier

**Installation Length**

Size and/or dimension and material of key elements  
 Total Barrier Length : 78 meters (256')  
 Total Gate Length: 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)**

Curb..... 2116  
 Test Inertial..... 2038  
 Dummy(s)..... n/a  
 Gross Static..... 2038

**Impact Conditions**

Speed (km/h)..... 97.9  
 Angle (deg)..... 25  
 Impact Severity (kJ)..... 134.6

**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.

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