



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

1200 New Jersey Avenue, SE.  
Washington, DC 20590

November 21, 2007

In Reply Refer To: HSSD/B-134C

Mr. Barry D. Stephens, P.E.  
Sr. Vice President Engineering  
Energy Absorption Systems, Inc.  
3617 Cincinnati Avenue  
Rocklin, CA 95678

Dear Mr. Stephens:

Thank you for your October 19 letter requesting the Federal Highway Administration's (FHWA) acceptance of your company's unanchored Vulcan, a Vulcan-to-CMB Transition and a new Vulcan component called a Hinge segment as test level 3 (TL-3) devices for use on the National Highway System (NHS). In our November 17, 2005, letter B-134A, we accepted the use of Vulcan barrier to be used in conjunction with transitions in runs of CMB. Your current request is an extension of this previous design. You requested that we find these devices acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

On October 19, 2007, you provided my staff with test results from a crash test conducted on a run of unanchored Vulcan, a Vulcan-to-CMB Transition and a new Vulcan component called a Hinge segment. You requested FHWA's acceptance of this specific design which is referred to as the Vulcan Gate. The test results of the NCHRP Report 350 for test 3-21 are documented in E-TECH Testing Services' summary dated August 2007. For this test, five (5) freestanding Vulcan segments were pinned together and the upstream and downstream ends were pinned to unanchored Hinge segments which were pinned to anchored Vulcan-to-PCMB Transition segments to provide longitudinal tension. The impact point was the first Vulcan segment ahead of the new Hinge segment. The 2000p vehicle was redirected and the reported occupant risk values were acceptable. The Crash Data Summary Sheet, as well as drawings for the devices are enclosed for reference

The principle modification is the addition of a short steel, Vulcan-shaped segment that can act as a lateral hinge mechanism. The Vulcan, when configured with this new hinge section, is referred to as the "Vulcan Gate" and hereafter is referred to as VG. Energy conducted capacity test 3-21 to ensure the integrity of this new configuration under TL-3 impact conditions.



A typical VG system is comprised of existing Vulcan segments, two tested and accepted Transitions to CMB, and two new Hinge Segments. The system configuration is depicted in attached drawings V2000 and V6000. The new Hinges may also be used in a run of Vulcan barrier to create a gate opening. The Hinge is constructed of two three-beam panels integrated into side panels which identically match the cross-section of the Vulcan. The side panels are attached to the Hinge mid-frame by inserting tabs through slots on the Hinge mid-frame and then pinning the two side panels in place. Pinning is accomplished using (2) 48 mm diameter (OD) steel pins per side panel. The Hinge is also connected to the end Transitions and Vulcan sections with 48 mm diameter (OD) steel pins. When both Hinge side panels are manually removed, the Vulcan sections are able to pivot around the remaining 48 mm diameter (OD) steel pin. To minimize corrosion, all Vulcan components, including the new Hinge segment, are hot dipped galvanized.

Based upon the submitted test results, we concur that the Vulcan Gate meets NCHRP Report 350 evaluation criteria and may be used on the NHS as a TL-2 or 3 longitudinal barrier under the range of conditions tested, when proposed by a State or local transportation agency. We also agree that the successful results support the acceptance of this design using any number of Vulcan segments to configure a Vulcan Gate.

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

- This acceptance is limited to the crashworthiness characteristics of the device(s).
- 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-134C, 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 Vulcan Barrier and Vulcan Gate are patented products 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.

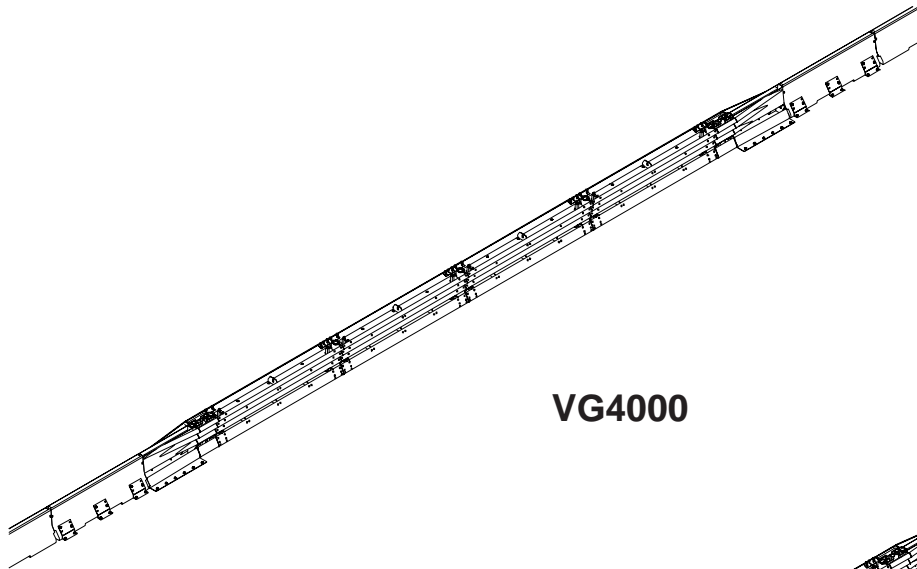
Sincerely yours,

A handwritten signature in blue ink that reads "George E. Rice, Jr." The signature is written in a cursive style with a prominent "G" and "R".

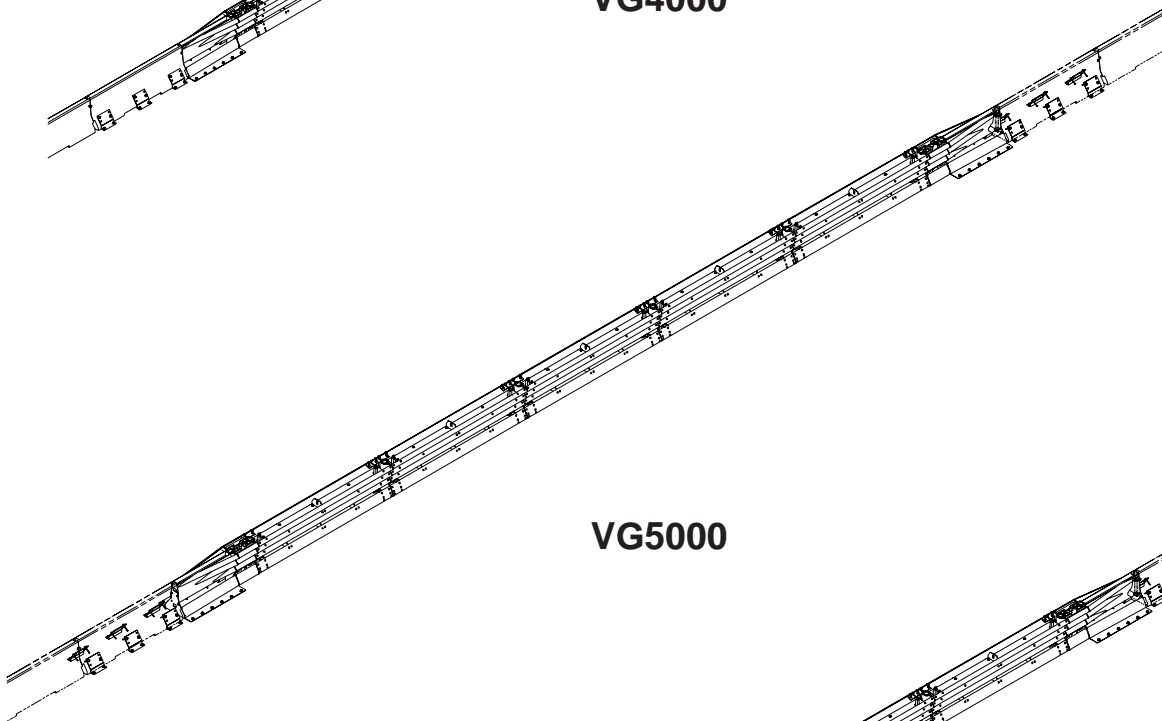
George E. Rice, Jr.  
Acting Director, Office of Safety Design  
Office of Safety

Enclosures

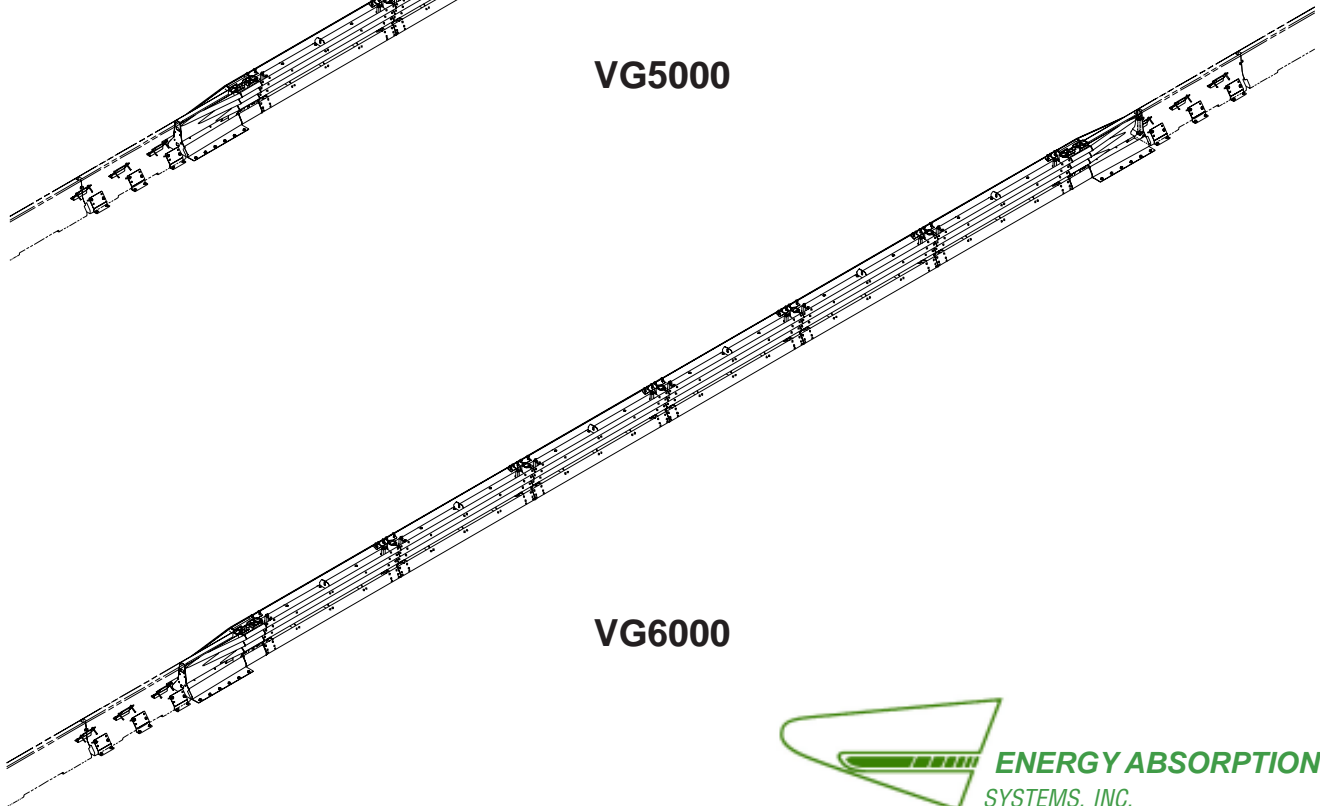
# Vulcan™ Gate



**VG4000**



**VG5000**

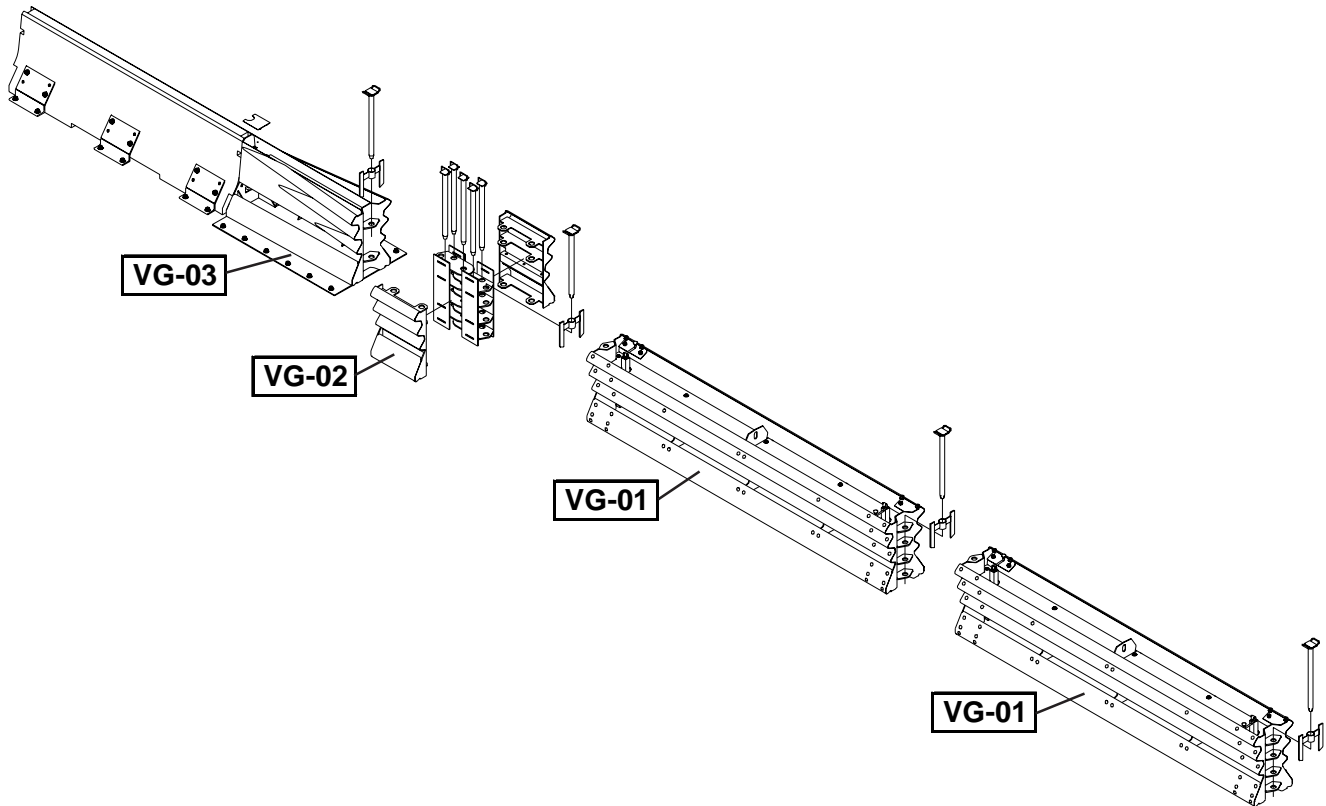
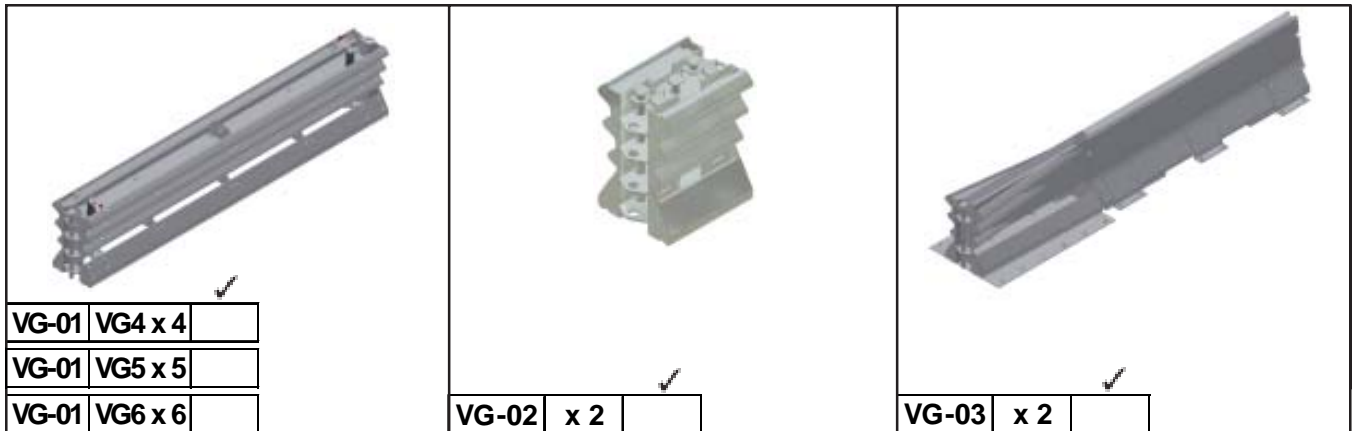


**VG6000**



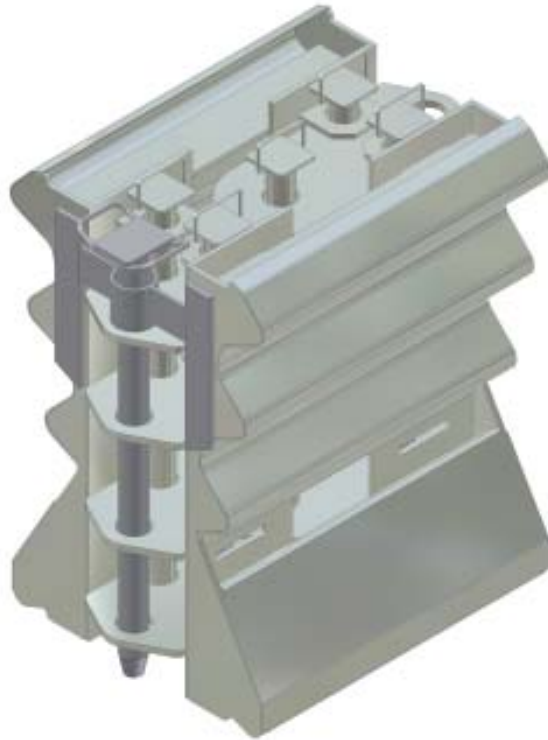
**ENERGY ABSORPTION  
SYSTEMS, INC.**

# Vulcan™ Gate



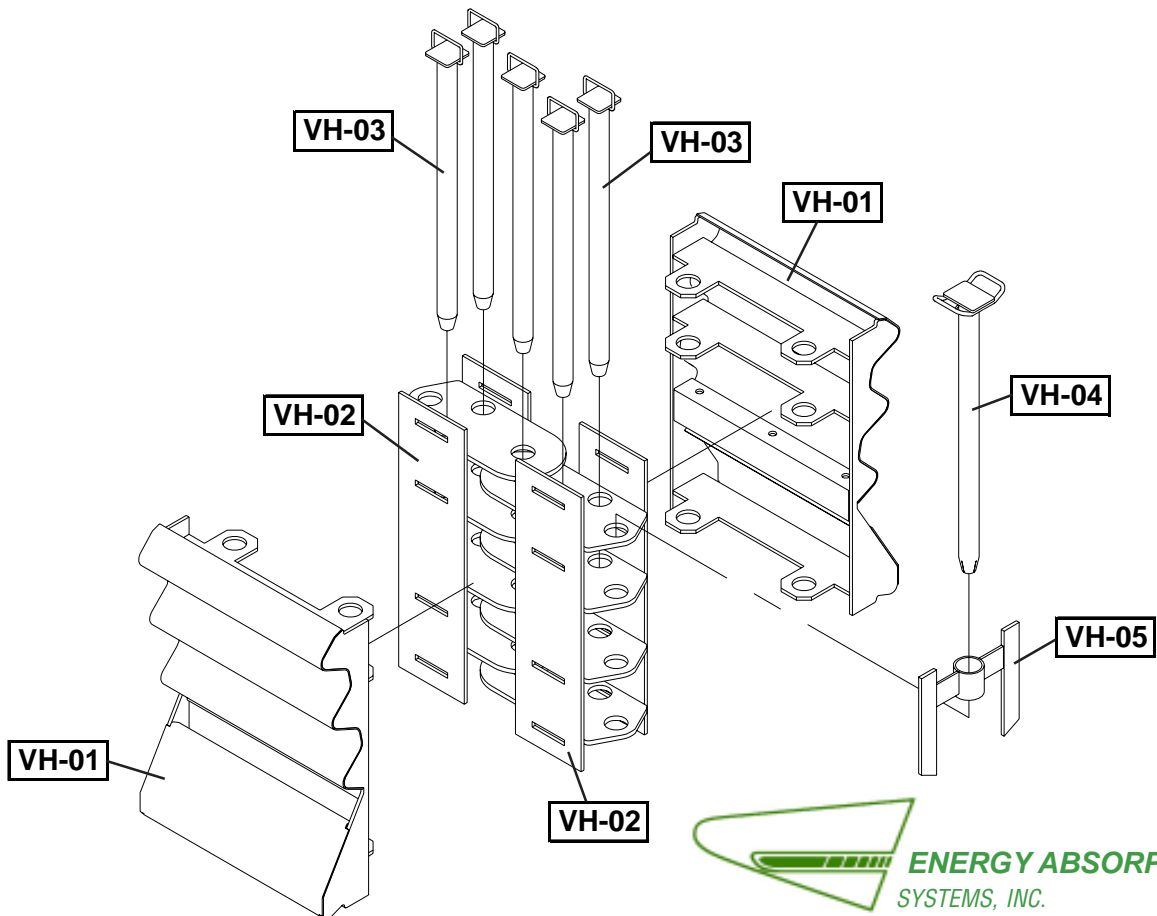
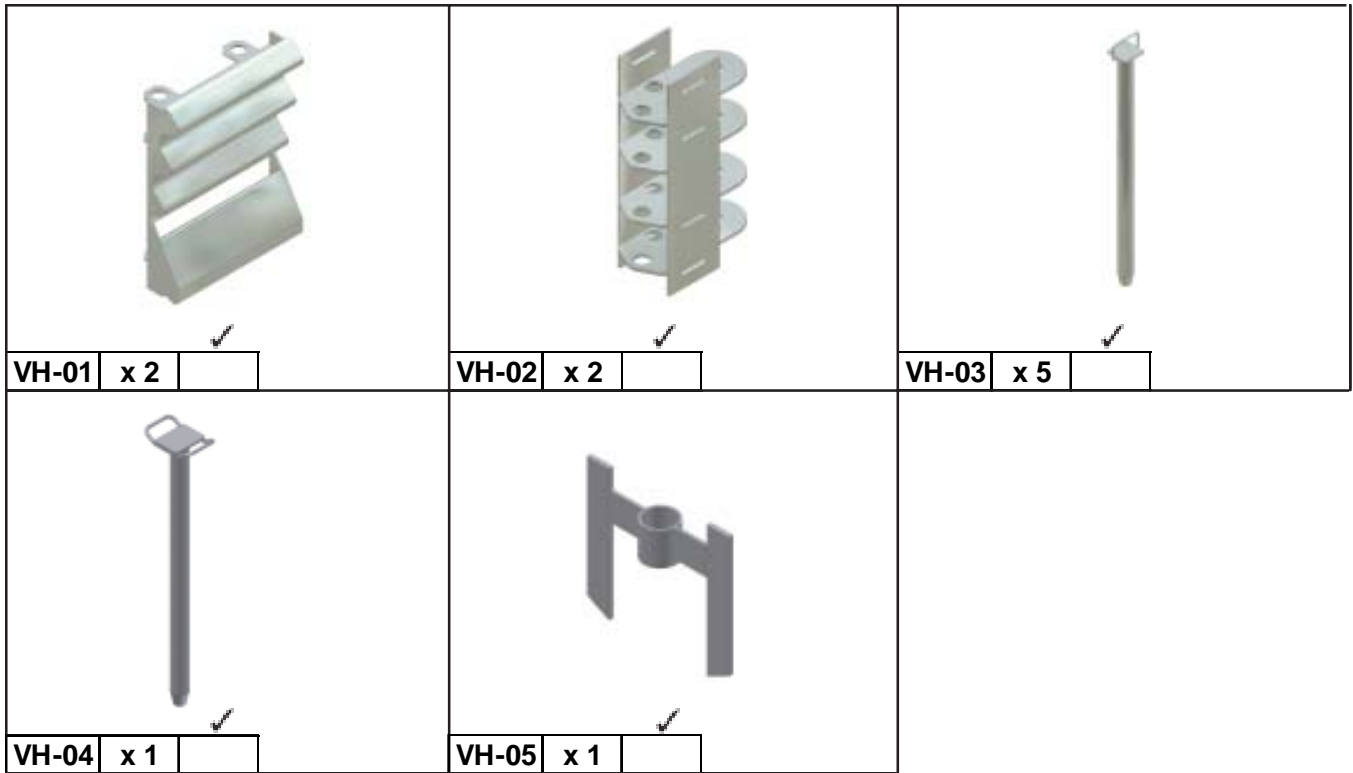
**ENERGY ABSORPTION  
SYSTEMS, INC.**

# Vulcan™ Gate

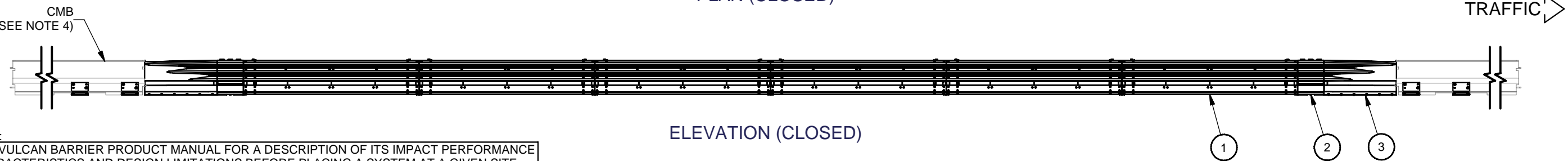
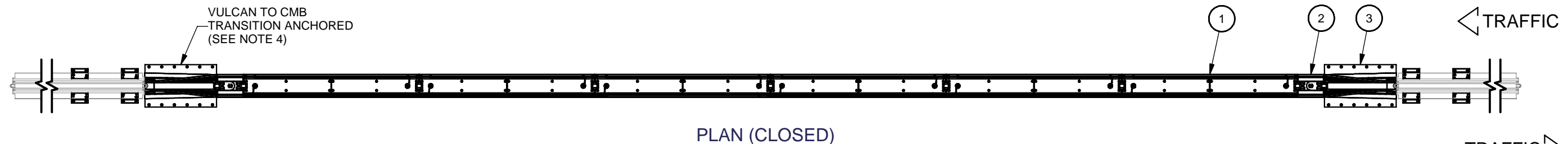
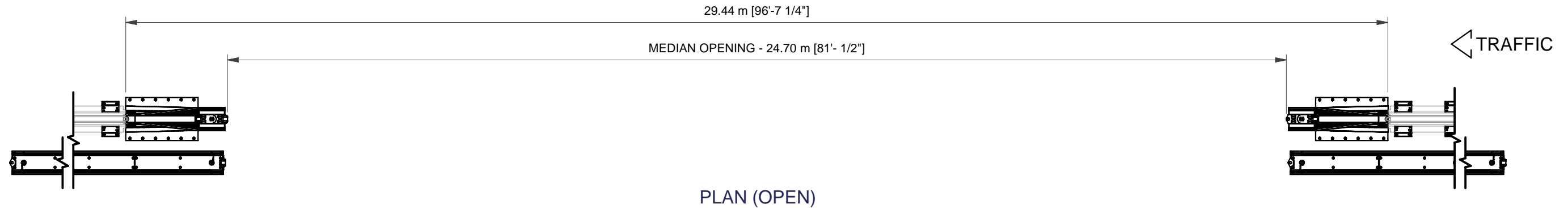


**Vulcan Hinge**  
**3596005-0000**

# Vulcan™ Gate



PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3596000-1000	VULCAN,W/JACKS	6
2	3596005-0000	VULCAN HINGE	2
3	3596008-0000	TRANSITON ASSY,VULCAN-PCMB	2



- NOTES:
- SEE VULCAN BARRIER PRODUCT MANUAL FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND ADDITIONAL COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (312) 467-6750.
  - VULCAN BARRIERS NEED TO BE PINNED AND SPACERS USED.
  - JACK WHEELS SHALL BE RETRACTED WHEN BARRIER IS NOT BEING MOVED.
  - TRANSITIONS AND ADJACENT PCMB SHALL BE ANCHORED, SEE REFERENCE DRAWING 3596008-0000.

**REFERENCES**

SERIAL NO.	VULCAN W/ JACKS	3596000-1000
SALES ORDER	VULCAN HINGE	3596005-0000
EH PROJECT	VULCAN-PCMB TRANSITION	3596008-0000
NO. OF UNITS		

DRAWN:	D. Hayes Jr	DATE:	8/1/2007
DESIGNED:		DATE:	
CHECKED:	K. Mortensen	DATE:	8/2/2007
APPROVED:	B. Eckert	DATE:	8/2/2007
FILE:	VG6000.idw		
NEXT ASSEMBLY:			

MODEL NO. VG6000



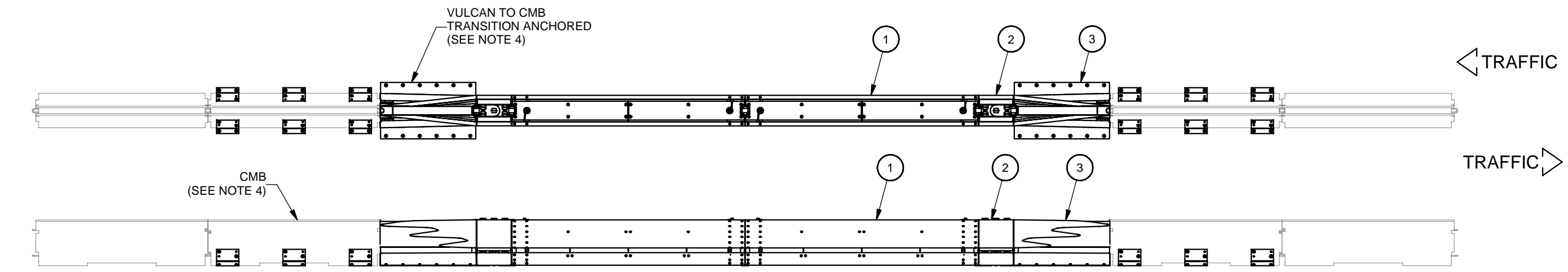
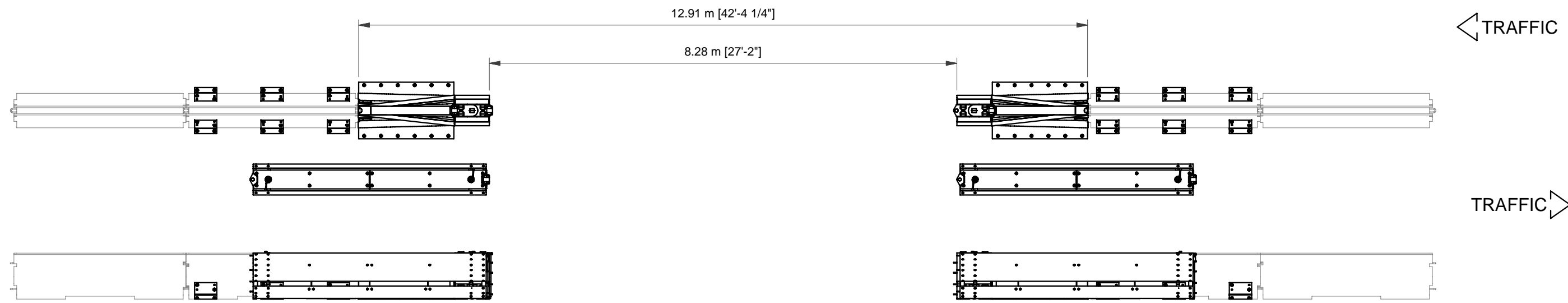
**VULCAN™ GATE  
(6 SECTIONS)**

Revision	Date	Rev	By	Chk.	App.

SCALE:	1:100	DRAWING:	VG6000	SHEET:	1 of 1	REV:	-
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PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	3596000-1000	VULCAN,W/JACKS	2
2	3596005-0000	VULCAN HINGE	2
3	3596008-0000	TRANSITON ASSY,VULCAN-PCMB	2



**NOTES:**

1. SEE VULCAN BARRIER PRODUCT MANUAL FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND ADDITIONAL COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING CUSTOMER SERVICE DEPARTMENT AT (312) 467-6750.
2. VULCAN BARRIERS NEED TO BE PINNED AND SPACERS USED.
3. JACK WHEELS SHALL BE RETRACTED WHEN BARRIER IS NOT BEING MOVED.
4. TRANSITIONS AND ADJACENT PCMB SHALL BE ANCHORED, SEE REFERENCE DRAWING 3596008-0000.

**REFERENCES**

SERIAL NO.	VULCAN W/ JACK	3596000-1000
SALES ORDER	VULCAN HINGE	3596005-0000
EH PROJECT	VULCAN-PCMB TRANSITION	3596008-0000
NO. OF UNITS		

DRAWN:	D. Standridge	DATE:	9/4/2007
DESIGNED:		DATE:	
CHECKED:	JME	DATE:	9/12/2007
APPROVED:	K. Looney	DATE:	9/12/2007
FILE:	VG2000.idw		
NEXT ASSEMBLY:			

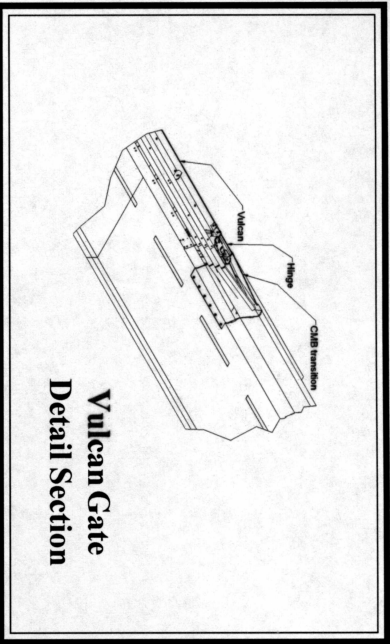
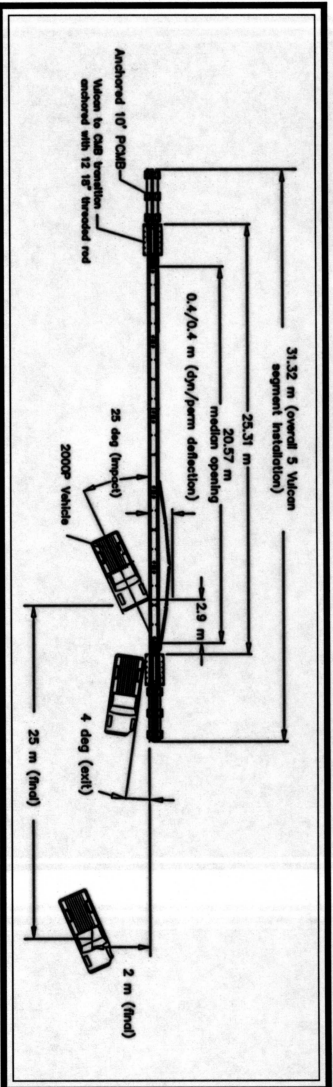
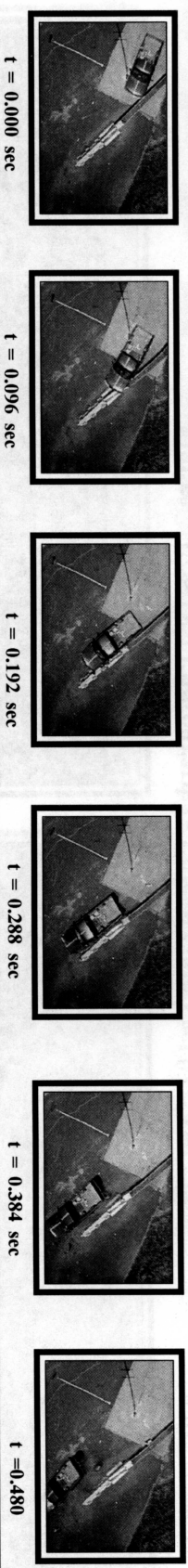
MODEL NO. VG2000



**VULCAN™ GATE  
(2 SECTIONS)**

Revision	Date	Rev	By	Chk.	App.

SCALE:	1:75	DRAWING:	VG2000	SHEET:	1 of 1	REV:	-
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**General Information**

Test Agency ..... E-TECH Testing Services, Inc.  
 Test Designation ..... NCHRP 350 Test 3-21  
 Test No. .... 01-8430-006  
 Date ..... 5/14/07  
 Test Article ..... Vulcan™ Gate System to CMB transition. Segments 4115 x 813 x 546 mm (LxH xW), 395 kg per Segment  
 (5) hinged Segments 31.32 m overall  
 12 Ga. AASHTO M180 galvanized steel  
 Panels  
 1150 mm thick sphalt over 150 mm compacted sub-base; Transition and CMB : (24) 19 mm dia. X 450 mm long threaded rods and MP-3 Polyester anchoring system

Foundation Type and Anchoring .....  
 Test Vehicle .....  
 Type ..... Production Model  
 Designation ..... 2000P  
 Model ..... 1988 GMC C2500  
 Mass (kg) .....  
 Curb ..... 1895  
 Test inertial ..... 1997  
 Dummy ..... N/A  
 Gross ..... 1997  
 Impact Conditions .....  
 Speed (km/h) ..... 99.7  
 Angle (deg) ..... 25  
 Impact Severity (kd) ..... 136.7

Exit conditions  
 Speed (km/h) ..... 53.3  
 Angle (deg - veh. c.g.) ..... 4  
 Occupant Risk Values  
 Impact Velocity (m/s)  
 x-direction ..... 7.6  
 y-direction ..... 7.3  
 Ridedown Acceleration (g's)  
 x-direction ..... -18.1  
 y-direction ..... 18.1  
 European Committee for Normalization (CEN) Values  
 THIV (km/h) ..... 37.7  
 PHD (g's) ..... 22.0  
 ASI ..... 1.6  
 Test Article Deflections (m)  
 Dynamic ..... 0.4  
 Permanent ..... 0.4  
 Vehicle Damage (Primary Impact)  
 Exterior  
 VDS ..... LFO-6  
 CDC ..... 11FLEW1  
 Interior  
 VCDI ..... ASI101000  
 Maximum Deformation (mm) ..... 162  
 Post-Impact Vehicular Behavior (deg - rate gyro)  
 Maximum Roll Angle ..... -25.5  
 Maximum Pitch Angle ..... -15.6  
 Maximum Yaw Angle ..... -70.6

Figure 1. Vulcan Gate System NCHRP 350 Test 3-21 Test 01-8430-006