



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

July 6, 2001

400 Seventh St., S.W.
Washington, D.C. 20590

Refer to: HSA-10/B87

Mr. James R. Keaton
Vice President of Sales and Marketing
Barrier Systems, Inc.
180 River Road
Rio Vista, California 94571-1208

Dear Mr.  Keaton:

In your June 22 letter, you requested the Federal Highway Administration's acceptance of your company's SafeGuard Gate System (SGS) as meeting the requirements for a test level 3 (TL-3) longitudinal barrier under the National Cooperative Highway Research Program (NCHRP) Report 350. To support this request, you also sent me copies of Safe Technologies, Inc., June 22, 2001, report entitled "NCHRP Report 350 Crash Test Results for SafeGuard Gate System," video tapes of the crash tests you conducted, and CD-ROMS containing test data for each of the crash tests.

The SGS is a steel barrier specifically designed to span a permanent opening in a concrete median barrier ranging from 8 meters long to 16 meters long. The typical length of each gate section is 4 m and the effective overall height is 829 mm. The SGS is 700 mm wide at its base and 513 mm wide at the top. Each 4 m section weighs approximately 675 kg. Hinge assemblies at the ends of each unit and compressed air-activated, retractable wheels on each unit allow the SGS to be disconnected from the rigid barrier after removal of the aluminum cover plate and the 28.6 mm diameter ASTM C1018 steel connecting pin. The SGS can then be swung open from one end or completely removed to allow passage of vehicles. One or two persons can accomplish this process manually in 5 minutes or less. Enclosure 1 shows some of the design details for the SGS.

Tests were conducted with an 820 kg vehicle at a 20 degree impact angle and with the 2000 kg pickup truck at 25 degrees. Both tests were run at the NCHRP Report 350 TL-3 speed of 100 km/h. Two critical impact point tests were also conducted with the pickup truck: one to test the hinge assembly in a 12 m span and one to test the SGS-to-concrete barrier transition in an 8 m span. One additional test was run with an 820-kg vehicle at the TL-2 speed of 70 km/h to confirm acceptable low-speed performance. Maximum dynamic deflection noted in the length of need truck test into a 12 m long SGS was 570 mm. Summary reports for each of the four TL-3 tests are included in Enclosure 2.

Based on staff review of the information you provided and its recommendations, I find the SafeGuard Gate System to be acceptable for use on the National Highway System (NHS) as an NCHRP Report 350 TL-3 device to close permanent openings from 8 to 16 meters in length in a rigid concrete barrier. Since the SGS is a proprietary device, its use on Federal-aid projects, except exempt, non-NHS projects, is subject to the conditions listed in Title 23, Code of Federal Regulations, Section 635.411. Please do not hesitate to call Mr. Richard Powers at (202) 366-1320 if you have any questions regarding this acceptance letter.

Sincerely yours,



Frederick G. Wright, Jr.
Program Manager, Safety

2 Enclosures

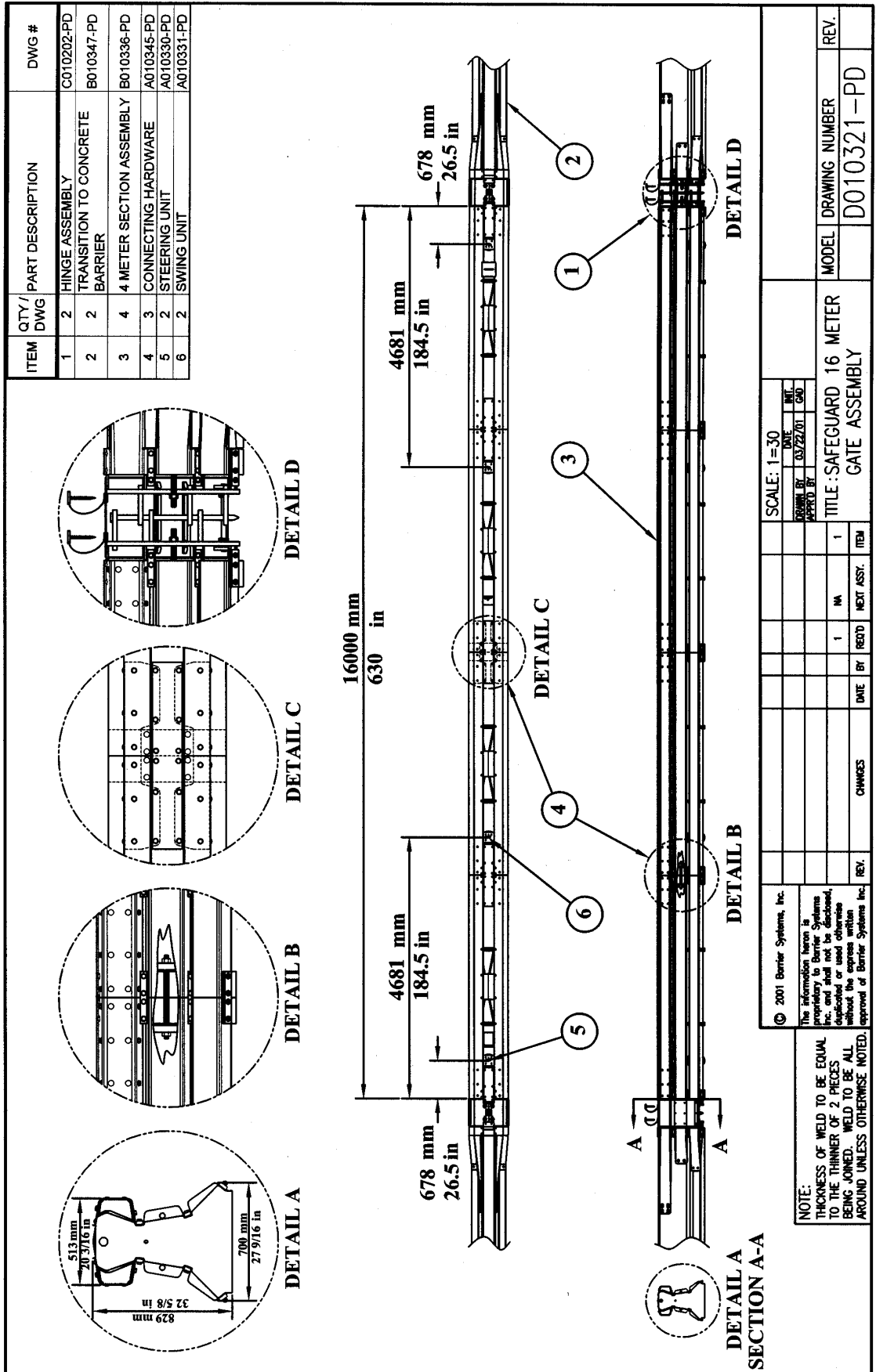


Figure D-1

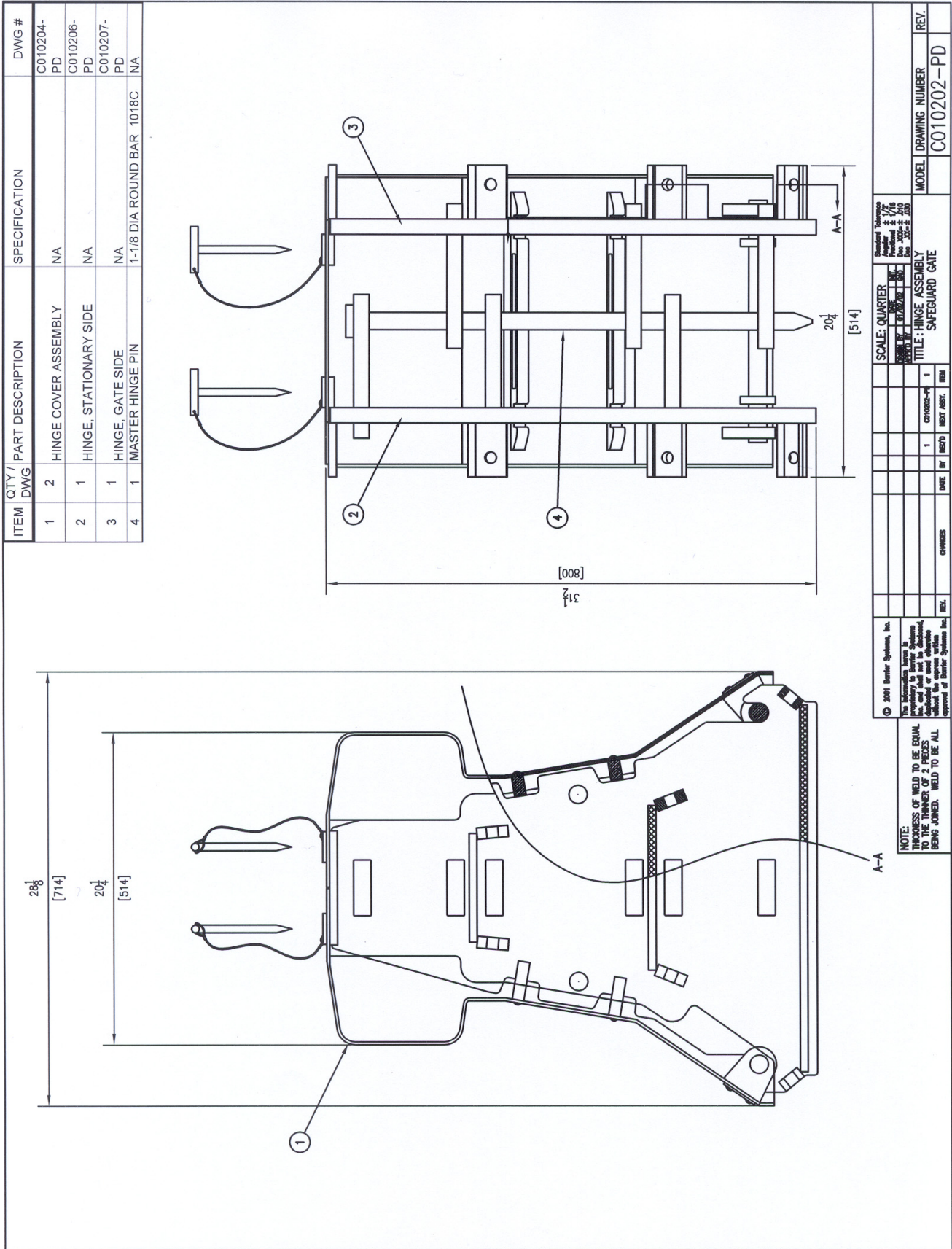


Figure D-4

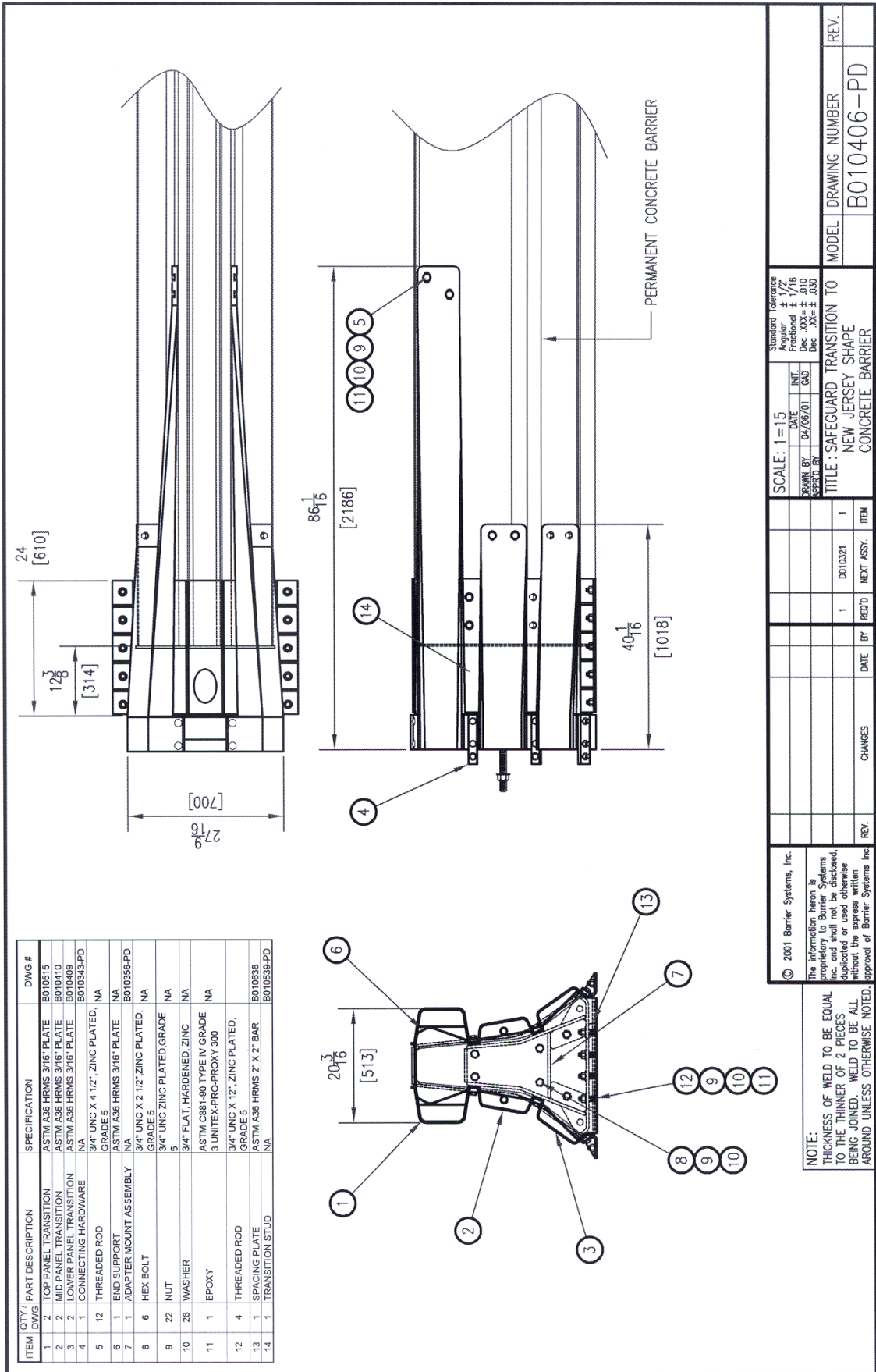


Figure D-9

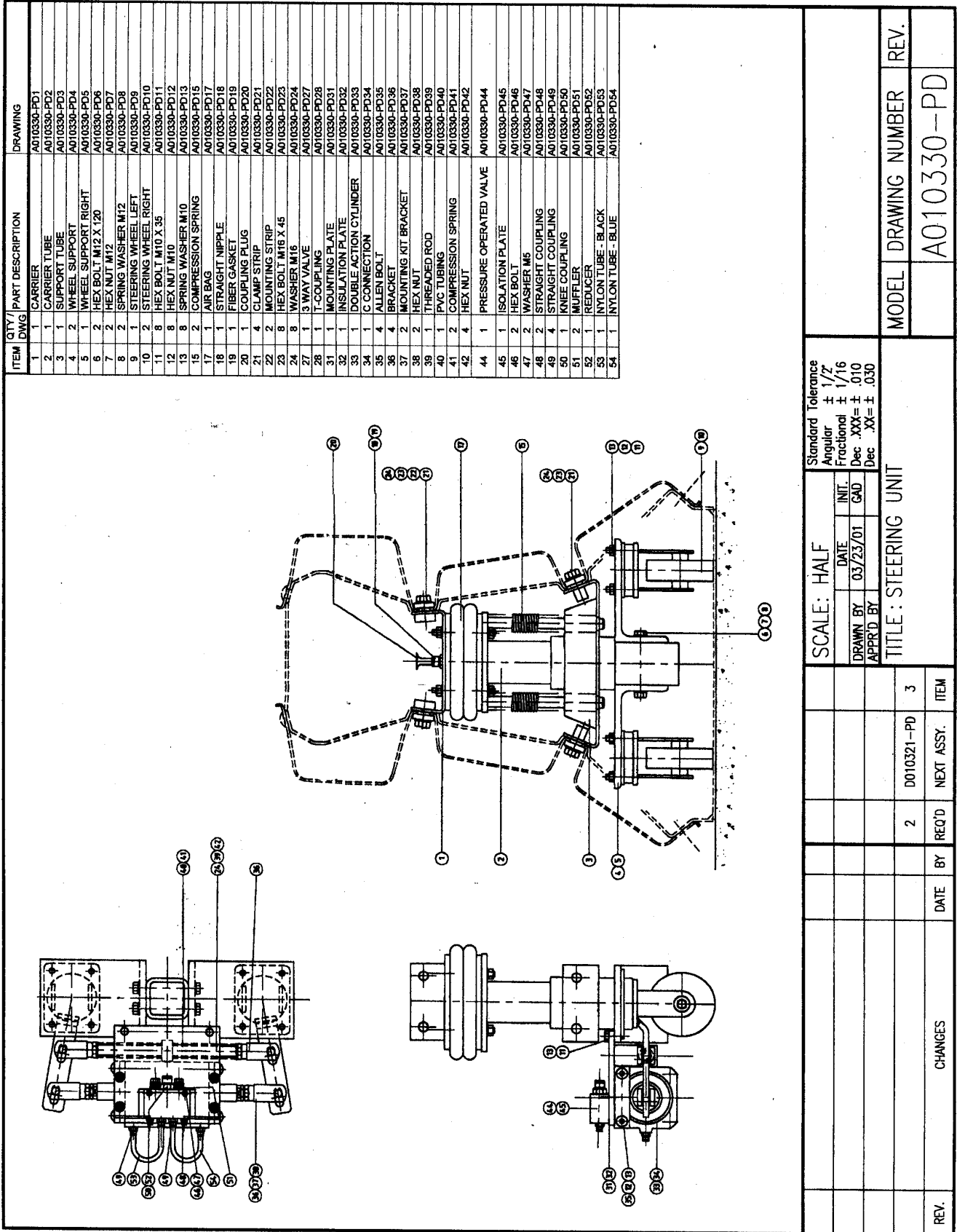
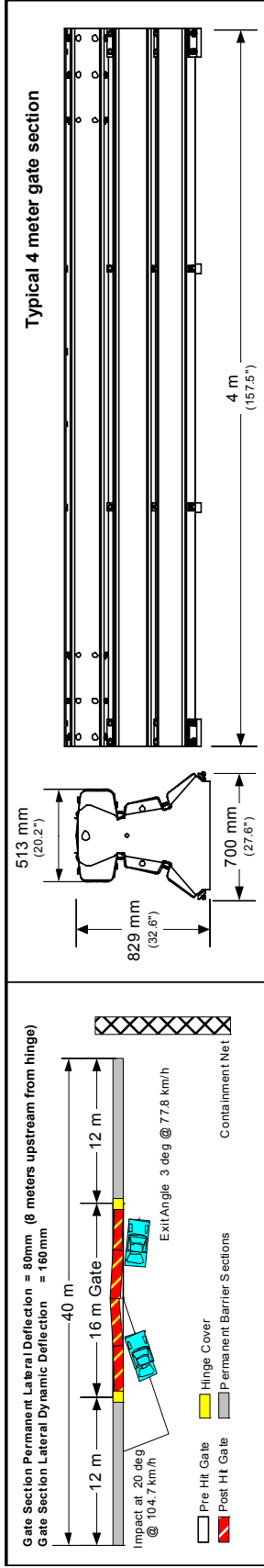
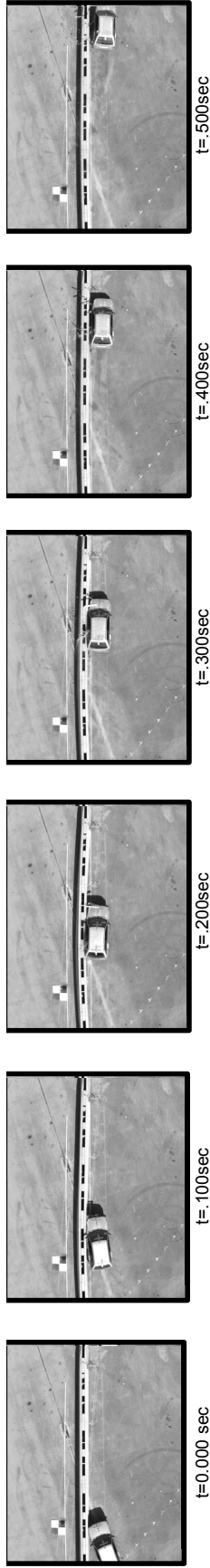
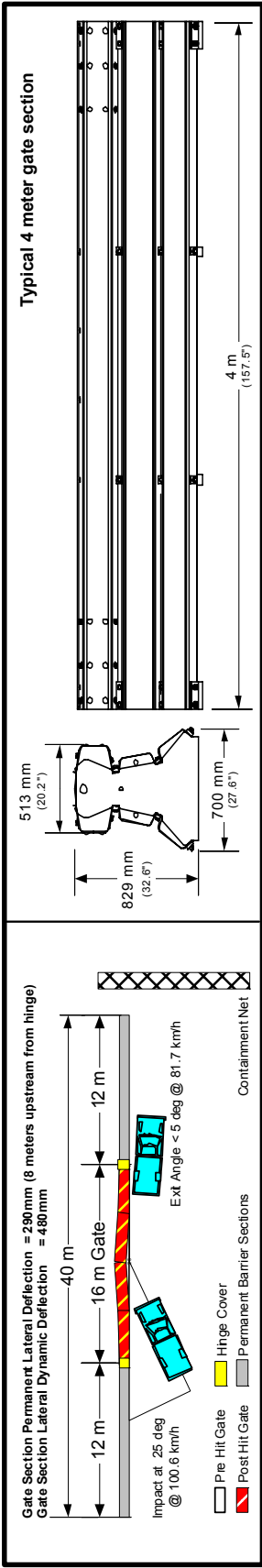
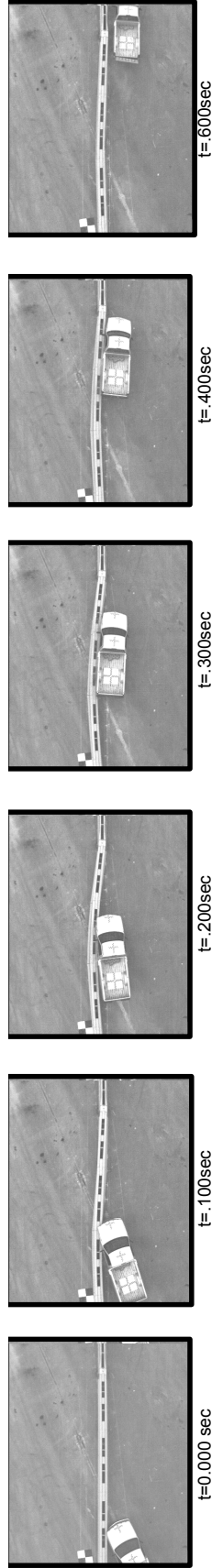


Figure D-14



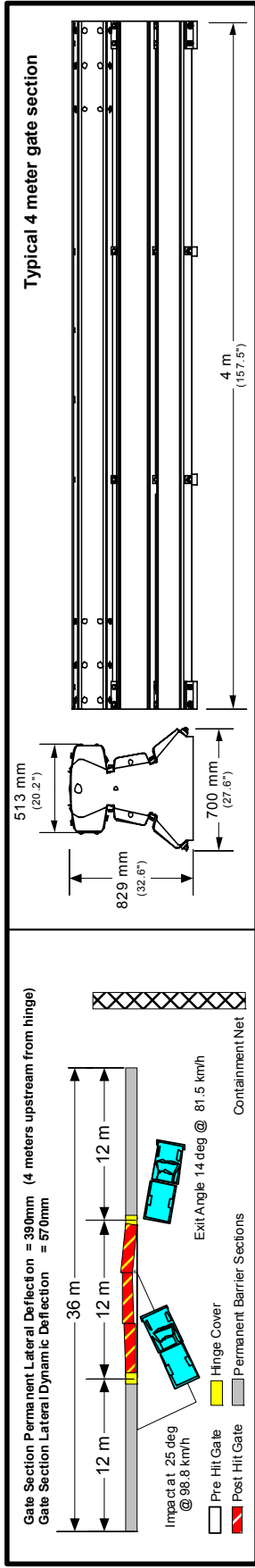
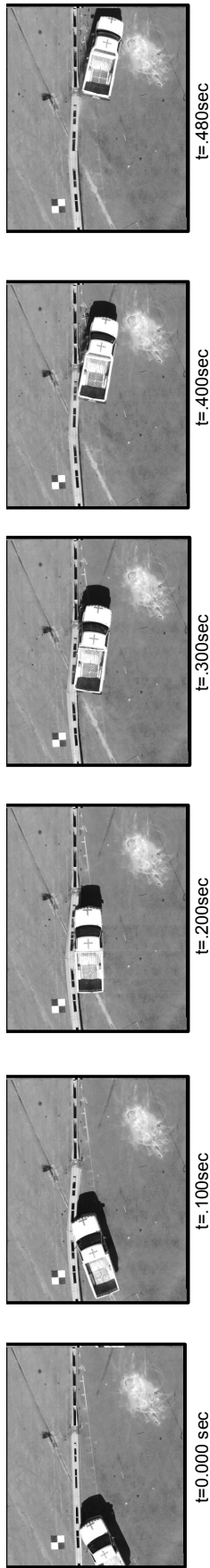
General Information		Exit Conditions	
Test Agency.....	SAFE TECHNOLOGIES, INC.	Speed (km/h).....	77.8
Test Designation.....	NCHRP Report 350 3-10 (LON)	Angle (deg).....	3
Test No.....	STI Test #SGB09	Occupant risk Values	
Date.....	3/15/2001	Impact Velocity (m/s)	
Test Article		x-direction.....	3.1
Type.....	Barrier Systems, Inc.	y-direction.....	-6.1
Installation Length	SafeGuard Barrier Gate System	Ridedown Acceleration (g's)	
Size and/or dimension and material	16 meter gate section (40 meters overall)	x-direction.....	-2.9
of key elements.....	Height 829 mm, Base width 700 mm,	y-direction.....	9.7
	Top width 513mm. Mass 2700kg+128 / 16 meter ζ	THIV (m/s).....	6.6
Test Vehicle		PHD (g's).....	9.7
Type.....	Production Model	ASI.....	1.4
Designation.....	820C	Test Article Deflection (mm)	
Model.....	1987, Ford Festiva	Dynamic.....	160
		Permanent.....	80
Mass (kg)		Vehicle Damage	
Curb.....	800	Exterior	
Test Inertial.....	832.5	VDS.....	LFQ-3
Dummy(s).....	75	CDC.....	11FLEE3
Gross Static.....	909	Interior	
Impact Conditions		OCDI.....	AS0000000
Speed (km/h).....	104.7	Post-Impact Vehicular behavior (deg - gyro @ c.g.)	
Angle (deg).....	20	Maximum Roll Angle.....	-7.7
Impact Severity (kJ).....	41.7	Maximum Pitch Angle.....	-2.4
		Maximum Yaw Angle.....	50

Figure 16. Summary of Results - SafeGuard Gate System- STI Test #SGB09



General Information		Exit Conditions	
Test Agency.....	SAFE TECHNOLOGIES, INC.	Speed (km/h).....	81.7
Test Designation.....	NCHRP Report 350 3-11 (LON)	Angle (deg).....	<5
Test No.....	STI Test #SGB07	Occupant risk Values	
Date.....	3/1/2001	Impact Velocity (m/s)	
Test Article		x-direction.....	3.4
Type.....	Barrier Systems, Inc.	y-direction.....	-5.1
	SafeGuard Gate System	Ridedown Acceleration (g's)	
Installation Length	16 meter gate section (40 meters overall)	x-direction.....	-4.5
Size and/or dimension and material		y-direction.....	11.4
of key elements.....	Height 829mm, Base width 700mm,	THIV (m/s).....	5.8
	Top width 513mm. Mass 2700kg / 16 meter gate	PHD (g's).....	11.6
Test Vehicle		ASI.....	0.94
Type.....	Production Model	Test Article Deflection (mm)	
Designation.....	2000P	Dynamic.....	480
Model.....	1993, Chevrolet Cheyenne 2500	Permanent.....	290
Mass (kg)	3/4 Ton Pickup	Vehicle Damage	
Curb.....	1875	Exterior	
Test Inertial.....	1962	VDS.....	LFQ-3
Dummy(s).....	n/a	CDC.....	11FLEE3
Gross Static.....	1962	Interior	
Impact Conditions		OCDI.....	AS0000000
Speed (km/h).....	100.6	Post-impact Vehicular behavior (deg - gyro @ c.g.)	
Angle (deg).....	25	Maximum Roll Angle.....	-6.1
Impact Severity (kJ).....	136.8	Maximum Pitch Angle.....	2.8
		Maximum Yaw Angle.....	30 (at vehicle exit)

Figure 6. Summary of Results - SafeGuard™ Gate System - STI Test #SGB07



General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
 Test Designation..... **NCHRP Report 350 3-21 (CIP)**
 Test No..... **STI Test #SGB06**
 Date..... 2/6/2001

Test Article

Type..... Barrier Systems, Inc.
 SafeGuard Gate System
 Installation Length..... 12 meter gate section (36 meters overall)

Size and/or dimension and material

of key elements..... Height 829mm, Base width 700mm,
 Top width 513mm. Mass 2700kg / 16 meter gate

Test Vehicle

Type..... Production Model
 Designation..... 2000P
 Model..... 1992, Chevrolet Silverado 2500
 3/4 Ton Pickup

Mass (kg)

Curb..... 1921
 Test Inertial..... 1972
 Dummy(s)..... n/a
 Gross Static..... 1972

Impact Conditions

Speed (km/h)..... 98.8
 Angle (deg)..... 25
 Impact Severity (kJ)..... 132.6

Exit Conditions

Speed (km/h)..... 81.5
 Angle (deg)..... 14

Occupant risk Values

Impact Velocity (m/s)
 x-direction..... 3.2
 y-direction..... -5.2
 Ridedown Acceleration (g's)
 x-direction..... -6.2
 y-direction..... 12
 THIV (m/s)..... 5.7
 PHD (g's)..... 12
 ASI..... 0.93

Test Article Deflection (mm)

Dynamic..... 570
 Permanent..... 390

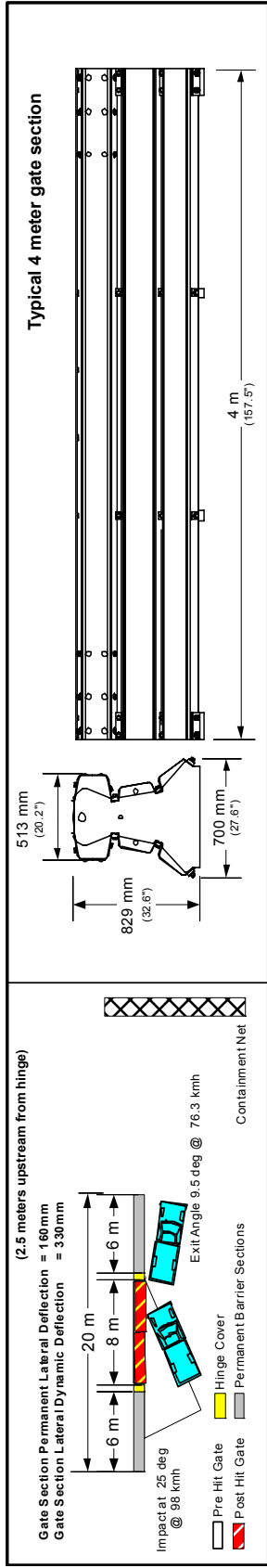
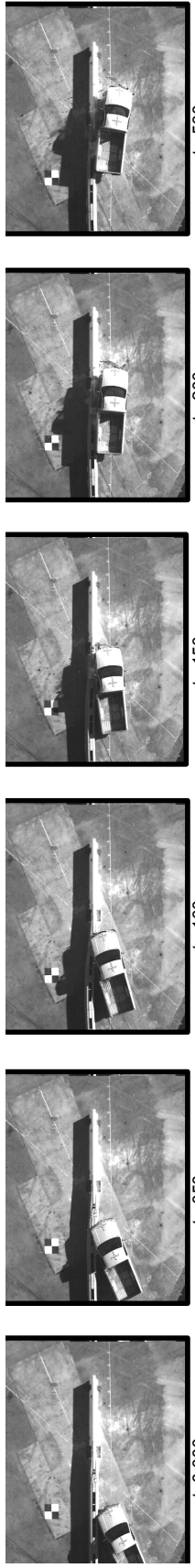
Vehicle Damage

Exterior
 VDS..... LFQ-3
 CDC..... 11FLEE2
 Interior
 OCDL..... AS0000000

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

Maximum Roll Angle..... -5.5
 Maximum Pitch Angle..... -1.5
 Maximum Yaw Angle..... 39 (at vehicle exit)

Figure 1. Summary of Results - SafeGuard Gate System- STI Test #SGB06



General Information		Exit Conditions	
Test Agency.....	SAFE TECHNOLOGIES, INC.	Speed (km/h).....	76.3
Test Designation.....	NCHRP Report 350 3-21 (CIP)	Angle (deg).....	9.5
Test No.....	STI Test #SGB11	Occupant risk Values	
Date.....	3/16/2001	Impact Velocity (m/s)	
Test Article		x-direction.....	6
Type.....	Barrier Systems, Inc. SafeGuard Gate System	y-direction.....	-8.8
Installation Length.....	8 meter gate section (20 meters overall)	Ridedown Acceleration (g/s)	
Size and/or dimension and material of key elements.....	Height 829 mm, Base width 700 mm, Top width 513mm. Mass 2700kg / 16 m gate	x-direction.....	-14.3
Test Vehicle		y-direction.....	-13
Type.....	Production Model	THIV (m/s).....	10
Designation.....	2000P	PHD (g/s).....	18.4
Model.....	1988 Chevrolet 3/4 ton pickup	ASI.....	1.75
Mass (kg)		Test Article Deflection (mm)	
Curb.....	1864	Dynamic.....	330
Test Inertial.....	1958	Permanent.....	160
Dummy(s).....	n/a	Vehicle Damage	
Gross Static.....	1958	Exterior	
Impact Conditions		VDS.....	LFQ3n
Speed (km/h).....	98	CDC.....	11FLEE3
Angle (deg).....	25	Interior	
Impact Severity (kJ).....	130	OCDI.....	LF0001100
		Post-Impact Vehicular behavior (deg - gyro @ c.g.)	
		Maximum Roll Angle.....	-11
		Maximum Pitch Angle.....	-5.5
		Maximum Yaw Angle.....	35 (at vehicel exit)

Figure 21. Summary of Results - SafeGuard Gate System- STI Test #SGB11