

September 5, 2002

HSA-10/CC80

Barry D. Stephens, P.E.
Senior Vice President – Engineering
Energy Absorption Systems, Inc.
3617 Cincinnati Avenue
Rocklin, CA 95765

Dear Mr. Stephens:

In your July 1 letter to Mr. George Ostensen, you requested Federal Highway Administration's (FHWA) acceptance of a w-beam guardrail terminal called the REGENT-C. To support this request, you also sent copies of a report prepared by E-TECH Testing Services, Inc., dated May 2002, entitled "NCHRP Report 350 Crash Test Results for the REGENT-C System" and videotapes of the tests that were conducted.

The REGENT-C is a non-energy absorbing w-beam terminal installed with a straight flare and offset 1.2 meters from the barrier proper at the end of its 11.43 m length. The terminal uses modified w-beam panels containing engineered slots and includes a 19-mm diameter 6 x 9 wire rope nested into the traffic-face of the w-beam. The modified rail elements significantly reduce the column strength of the system, allowing it to collapse in an end-on hit. The nested cable increases the tensile strength of the rail to provide redirection for a side impact beyond post 3, the beginning of the terminal length of need. The REGENT-C uses a standard strut and cable end anchorage and seven 150 mm x 200 mm x 1830 mm weakened wood posts to support the rail. These and other design details are shown in Enclosure 1.

NCHRP Report 350 tests 3-30, 3-31, and 3-35 were successfully conducted on the REGENT-C. Tests 3-32, 3-33, 3-34, and 3-39 were not run because you believed that they were less demanding than the tests that were run and thus not needed. I agree that these tests can be waived. Summary sheets of the three tests you conducted are shown in Enclosure 2. Since the pickup truck came to a stop straddling the rail approximately 45 m downstream from the terminal, this is the minimum length of rail that should be installed when the barrier is used along a high-speed roadway to shield a bridge parapet or a vertical rigid object located directly behind the guardrail. I note also that all three tests were conducted with the terminal set in an NCHRP Report 350 weak soil, thus making its use with any soil acceptable.

Based on staff review of the information you submitted, I concur that the REGENT-C meets the evaluation criteria for an NCHRP Report 350 w-beam guardrail terminal at test level 3 (TL-3) and, subject only to the condition noted above, it may be used on the National Highway System when such use is acceptable to the highway owner. Because it is a proprietary device, its use on federal-aid projects, except

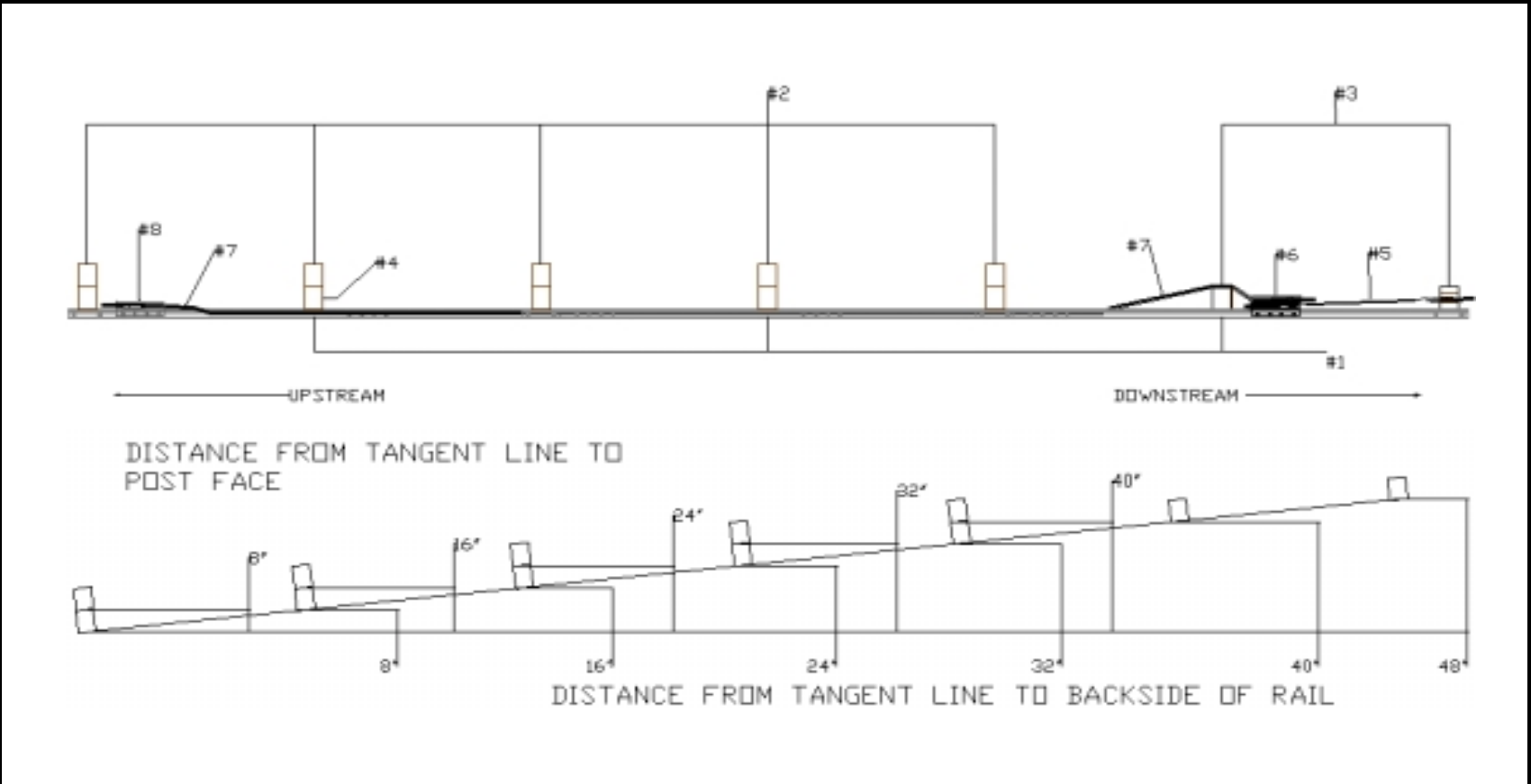
exempt, non-NHS projects, is subject to the conditions in Title 23, Code of federal Regulations, Section 635.411.

Sincerely yours,

(original signed by Carol H. Jacoby)

**Carol H. Jacoby, P.E.
Director, Office of Safety Design**

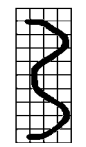
2 Enclosures



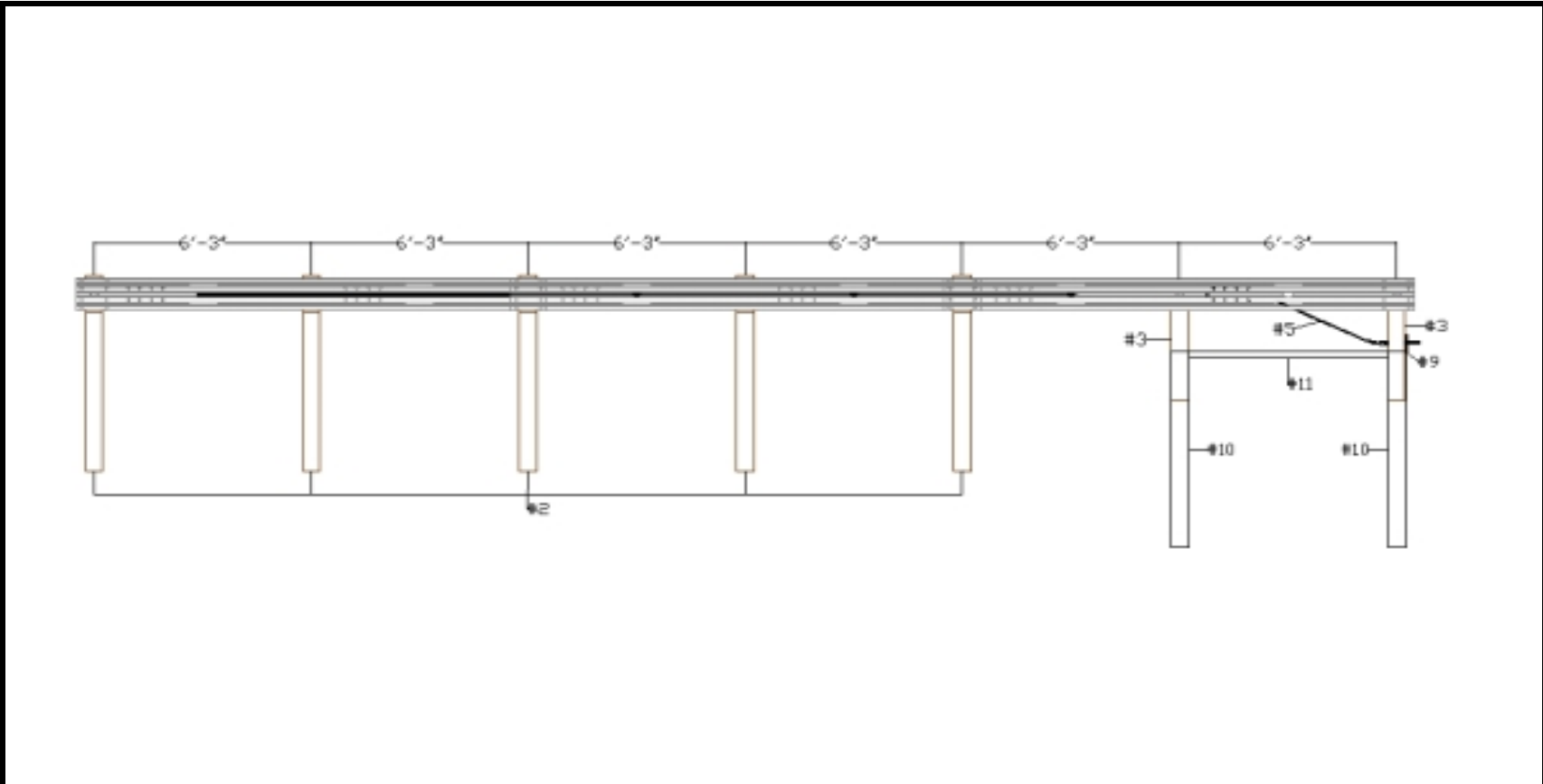
DESCRIPTION:
PLAN VIEW OF REGENT-C

Comments:

FIGURE 1



BRYSON PRODUCTS, INC.	
PART#	REGENT-C
UNIT WEIGHT:	
DATE MADE:	2/21/01
MODIFIED:	2/21/01
MADE BY:	CGH

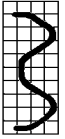


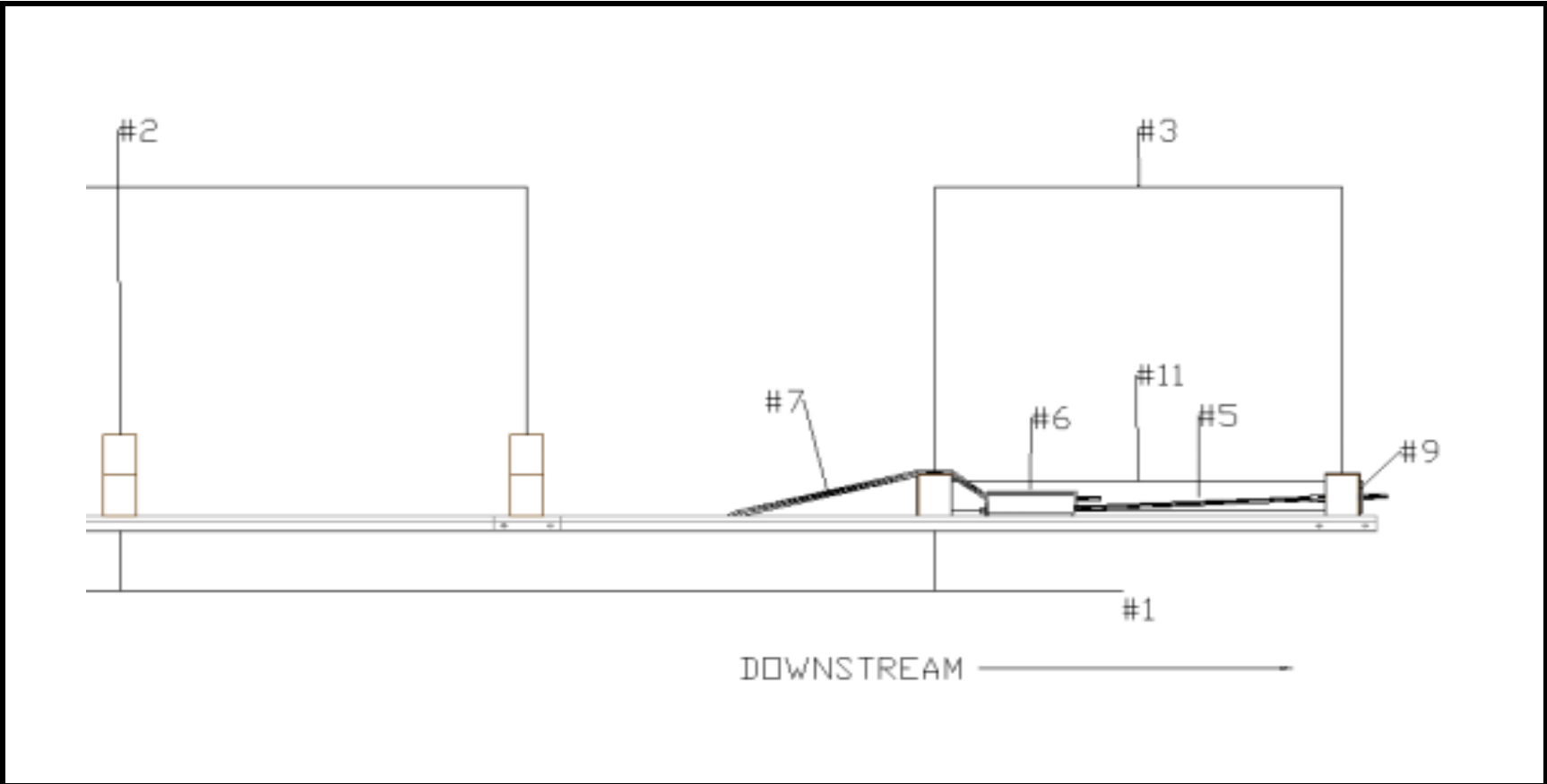
DESCRIPTION:
SIDE VIEW OF REGENT-C

Comments:

FIGURE 2

BRYSON PRODUCTS, INC.	
PART#	REGENT-C
UNIT WEIGHT:	
DATE MADE:	2/21/01
MODIFIED:	2/21/01
MADE BY:	CGH





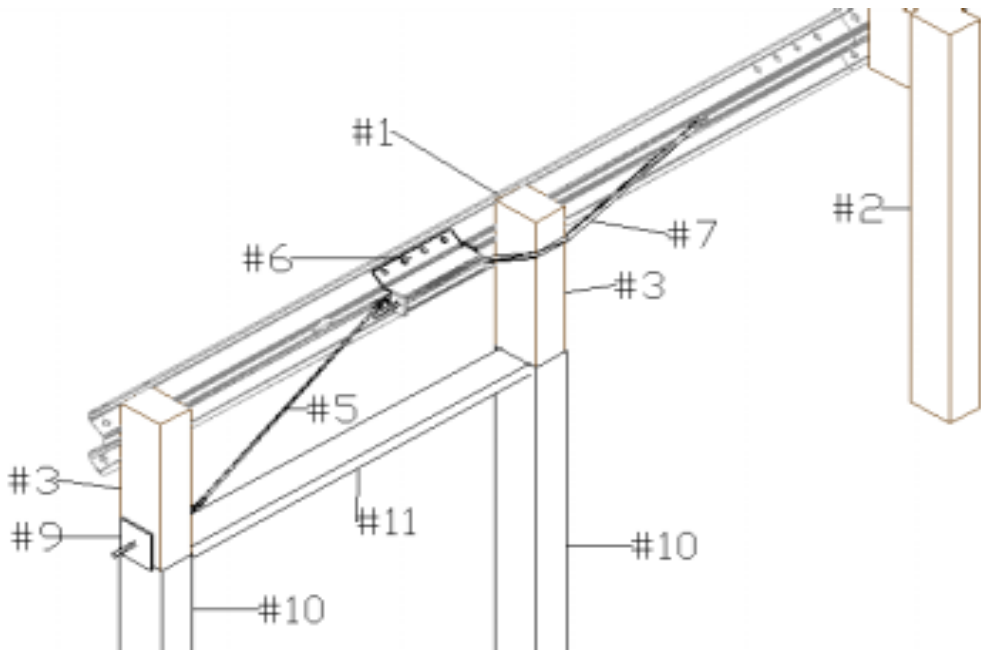
DESCRIPTION:
EXPLODED PLAN VIEW OF REGENT-C CABLE CONNECTIONS

Comments:

FIGURE 3

BRYSON PRODUCTS, INC.	
PART#	REGENT-C
UNIT WEIGHT:	_____
DATE MADE:	2/21/01
MODIFIED:	2/21/01
MADE BY:	CGH





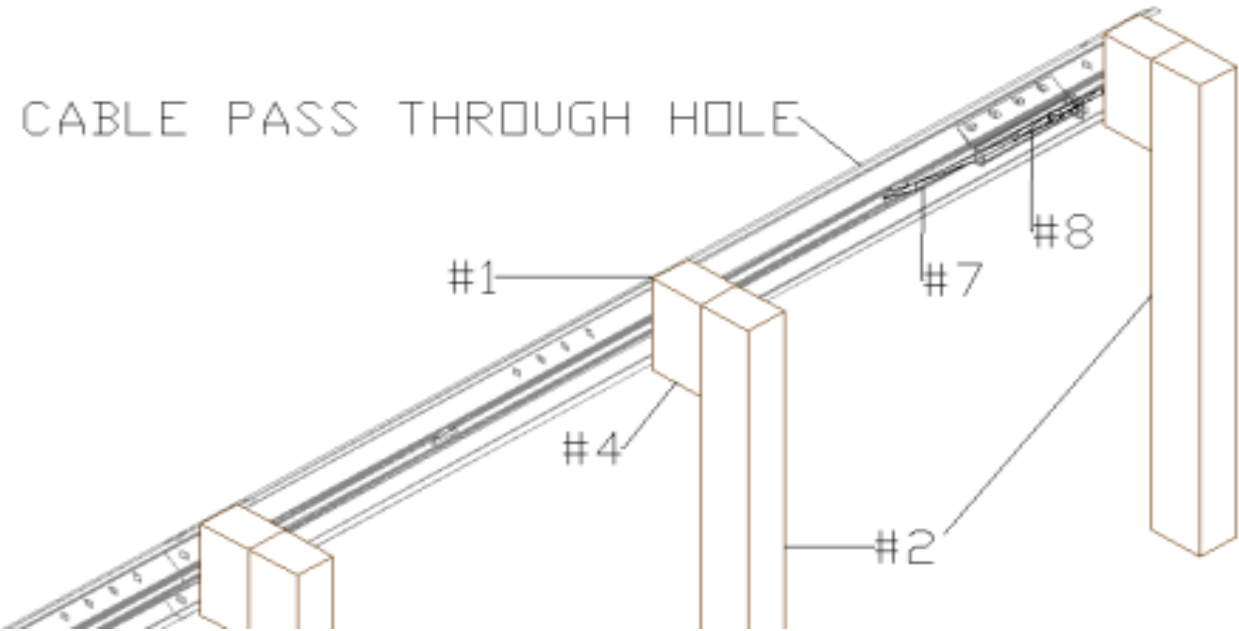
DESCRIPTION:
ISOMETRIC VIEW OF REGENT-C CABLE CONNECTIONS

Comments:

FIGURE 4



BRYSON PRODUCTS, INC.	
PART#	REGENT-C
UNIT WEIGHT:	
DATE MADE:	2/21/01
MODIFIED:	2/21/01
MADE BY:	CGH



CABLE PASS THROUGH HOLE

#1

#4

#7

#8

#2

DESCRIPTION:
ISOMETRIC VIEW OF REGENT-C CABLE ATTACHMENT (UPSTREAM)

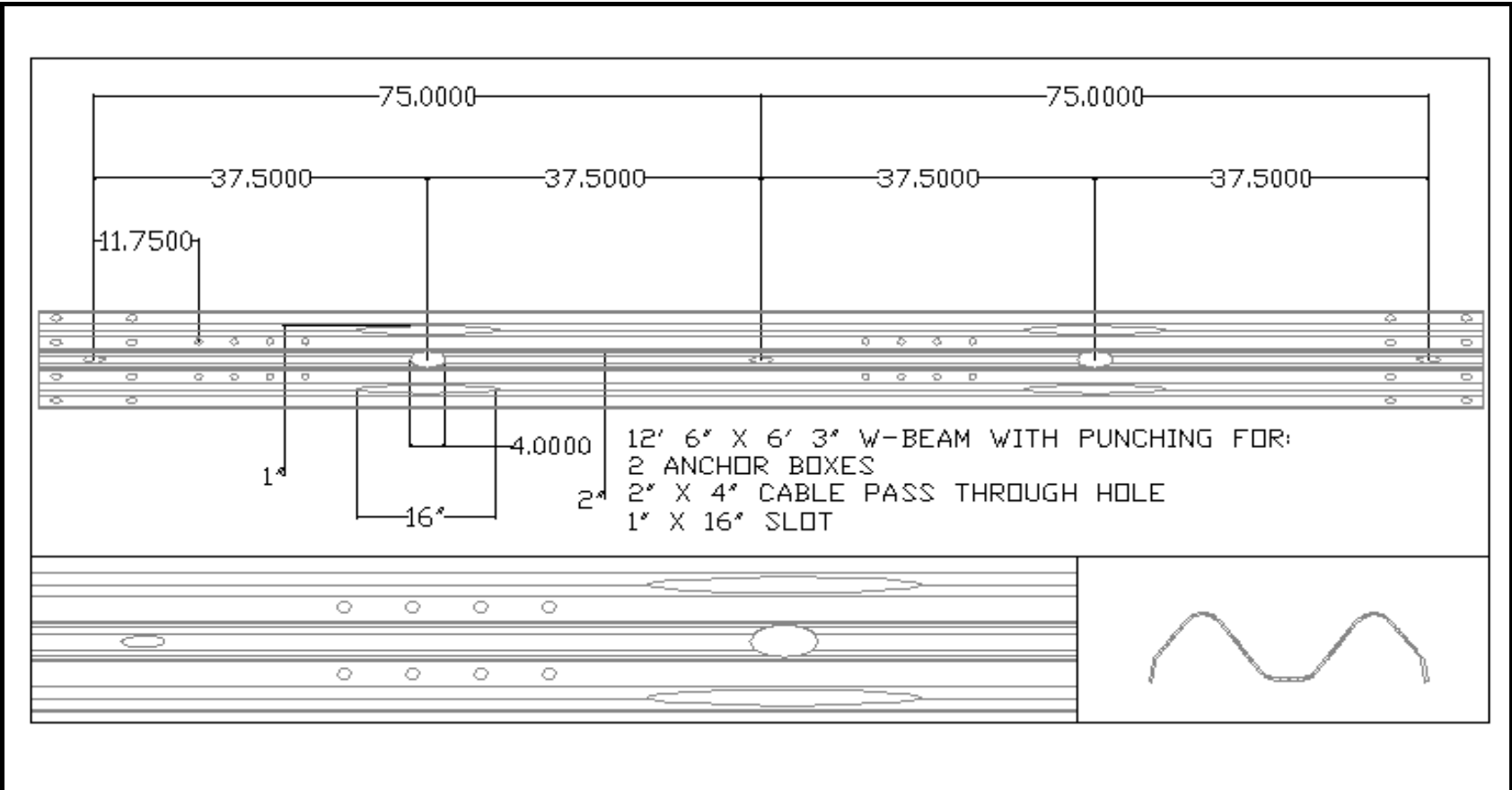
Comments:

FIGURE 5



BRYSON PRODUCTS, INC.

PART#	REGENT-C
UNIT WEIGHT:	
DATE MADE:	2/21/01
MODIFIED:	2/21/01
MADE BY:	CGH



DESCRIPTION:

**12' 6" X 6' 3" ANCHOR PANEL WITH
2 ANCHOR BOX POSITIONS, AND 2 SLOTTED/CABLE PASS-THRU SECTIONS**

12 GA, GALV.

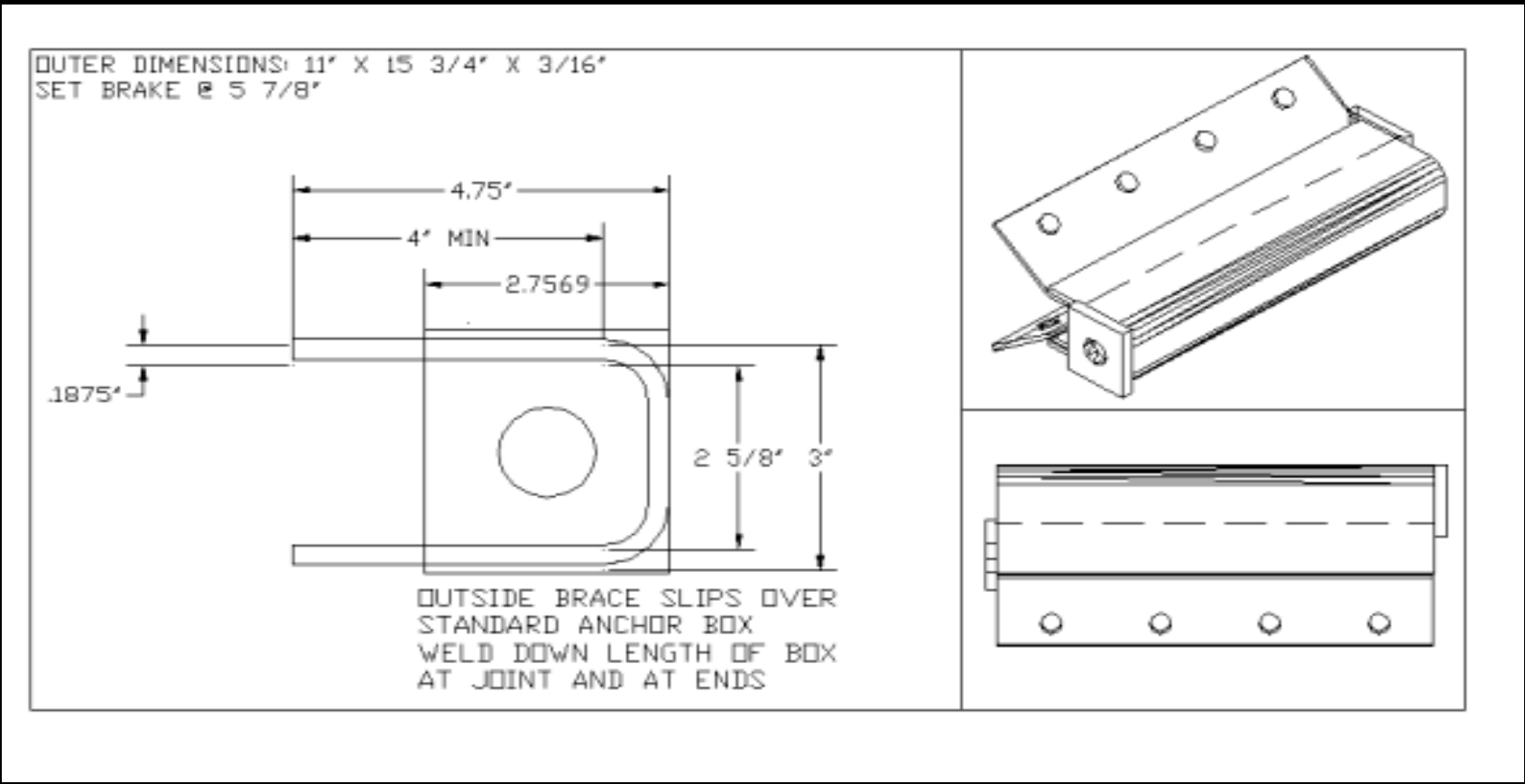
Comments:

FIGURE 6



BRYSON PRODUCTS, INC.

PART#	SREG-RAIL
UNIT WEIGHT:	
DATE MADE:	2/21/01
MODIFIED:	2/21/01
MADE BY:	CGH



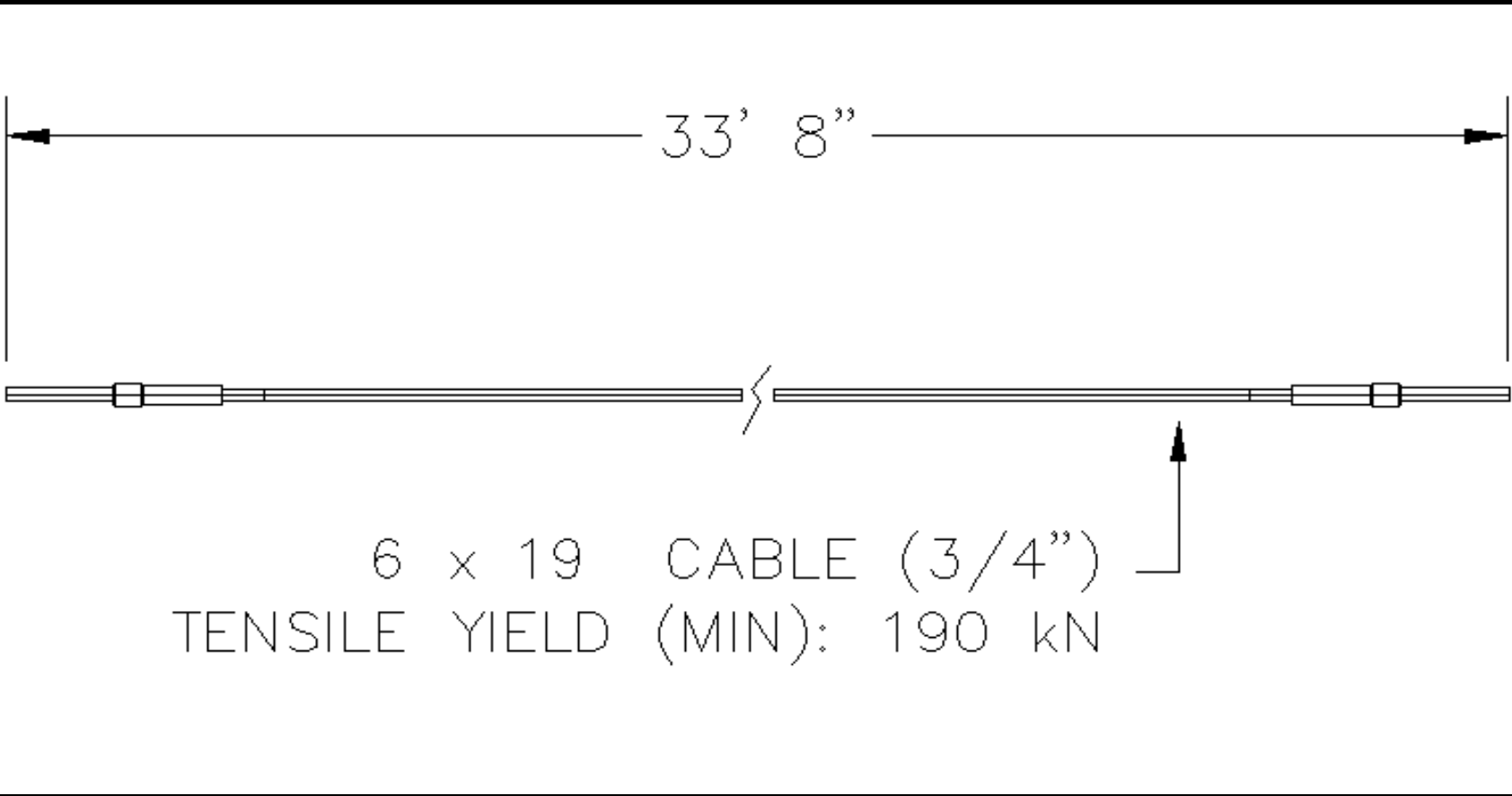
DESCRIPTION:
DOUBLE ANCHOR BOX

Comments:
7/5 - EXTENDED OUTSIDE BRACE OFFSET TO ACCOMMODATE SWEDGE FITTING

FIGURE 7

BRYSON PRODUCTS, INC.	
PART#	SREG-BOX
UNIT WEIGHT:	
DATE MADE:	2/21/01
MODIFIED:	7/5/01
MADE BY:	CGH

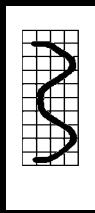
Illustration D-1. REGENT-C Installation Manual for 7 Post System (12 of 14)



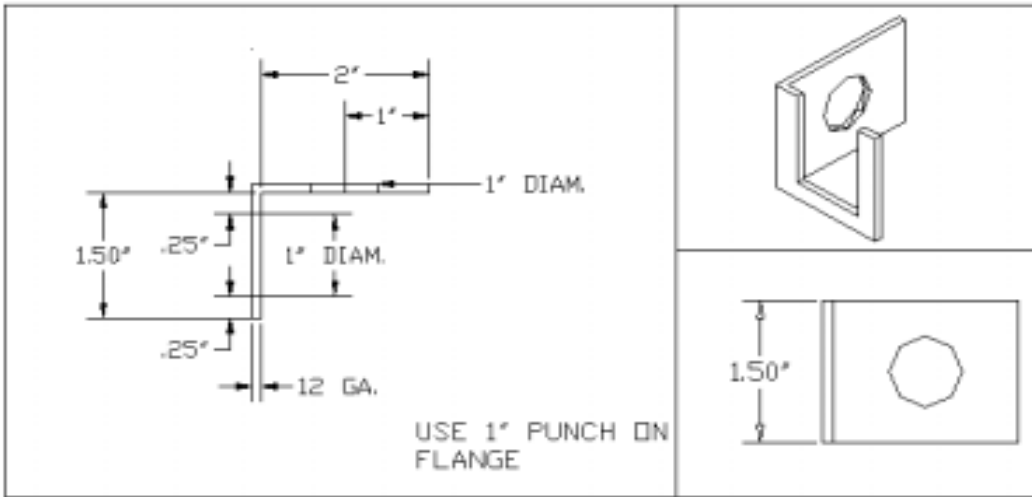
DESCRIPTION:
33' 8" CABLE WITH DOUBLE SWAGED ENDS

Comments:

FIGURE 8



BRYSON PRODUCTS, INC.	
PART#	SREG-CABLE
UNIT WEIGHT:	_____
DATE MADE:	2/21/01
MODIFIED:	5/14/01
MADE BY:	CGH



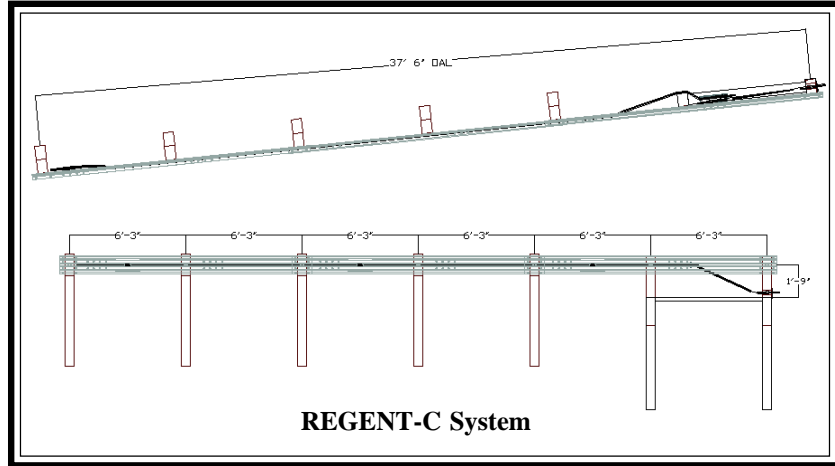
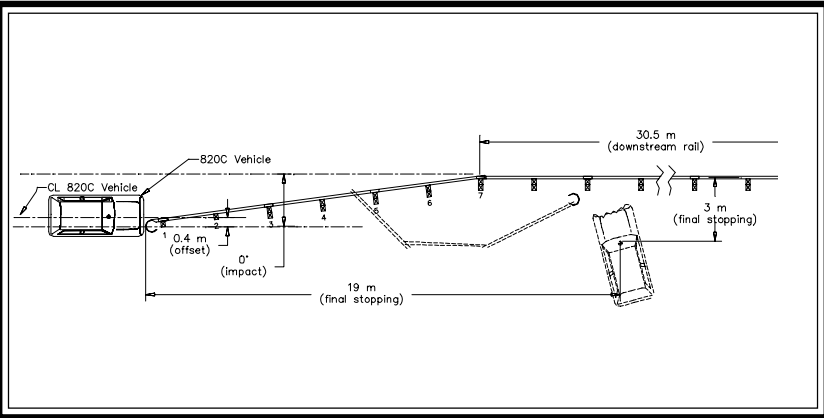
DESCRIPTION:
CABLE CLIP WASHER (AT POST # 3 AND 5)

Comments:

FIGURE 9



BRYSON PRODUCTS, INC.	
PART#	SREG-WASHER
UNIT WEIGHT:	
DATE MADE:	5/14/01
MODIFIED:	5/18/01
MADE BY:	CGH



E-TECH Testing Services, Inc.

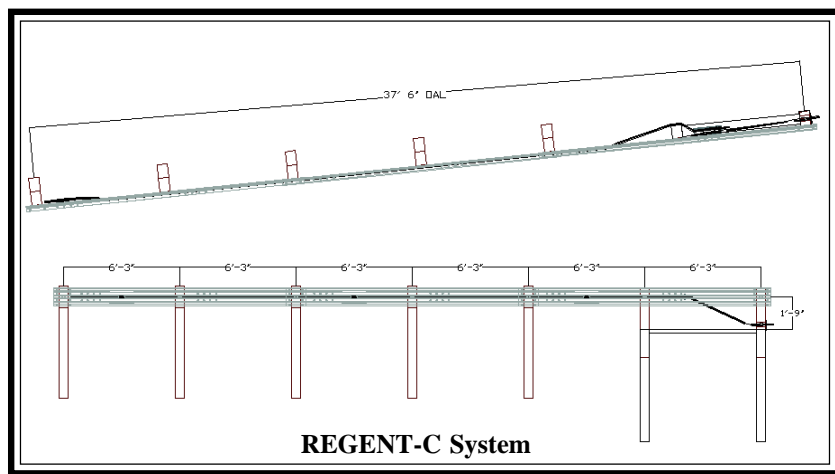
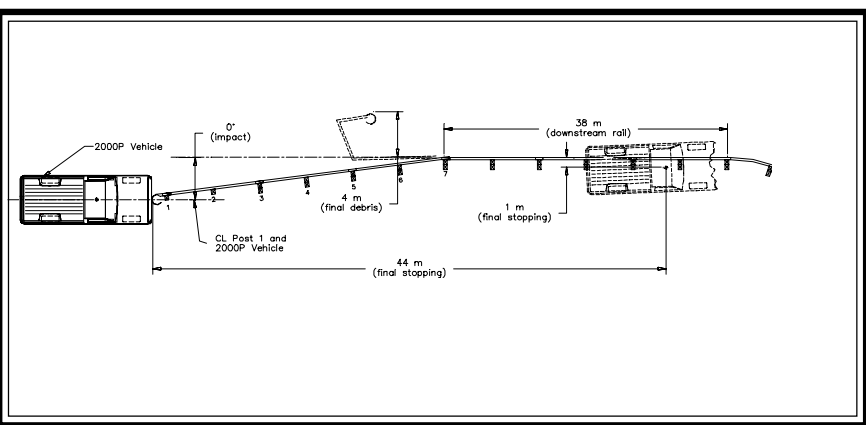
REGENT-C System Crash Test Results - 11 of 74

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-30
Test No.	23-6273-002
Date	7/20/01
Test Article	
Type	Bryson Products, Inc.
.....	REGENT-C System
Installation Length, (m)	11.43 (pay length)
Material and key elements	Seven wood post cable assisted
.....	terminal, 1.22 m straight flare with
.....	1.91 m post spacing
Foundation Type and Anchoring	NCHRP 350 "Weak Soil"
.....	dry and compacted
Test Vehicle	
Type	Production Model
Designation	820C Small Car
Model	1989 Ford Festiva
Mass (kg)	
Curb	792
Test inertial	810
Dummy	75
Gross Static	885
Impact Conditions	
Speed (km/h)	100.4
Angle (deg)	0
Impact Severity (kJ)	314.6

Exit conditions	
Speed (km/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	8.9
y-direction	0.8
Ridedown Acceleration (g's)	
x-direction	-9.3
y-direction	6.6
European Committee for Normalization (CEN) Values	
THIV (km/h)	31.8
PHD (g's)	10.6
ASI	1.1
Test Article Deflections (m)	
Dynamic	N/A
Permanent	N/A
Vehicle Damage	
Exterior	
VDS	FD-4
CDC	12FDEW3
Interior	
OCDI	AS0000000
Post-Impact Vehicular Behavior (deg - rate gyro)	
Maximum Roll Angle	8.7
Maximum Pitch Angle	-6.5
Maximum Yaw Angle	-118.2

Figure 1. Summary of Results - REGENT-C System Test 23-6273-002



E-TECH Testing Services, Inc.

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-31
Test No.	23-6273-003
Date	3/27/02

Test Article

Type	Bryson Products, Inc.
.....	REGENT-C System
Installation Length, (m)	11.43 (pay length)
Material and key elements	Seven wood post cable assisted terminal, 1.22 m straight flare with 1.91 m post spacing
Foundation Type and Anchoring	NCHRP 350 "Weak Soil" dry and compacted

Test Vehicle

Type	Production Model
Designation	2000P Pickup
Model	1990 Chevrolet C2500
Mass (kg)	
Curb	1975
Test inertial	2007
Dummy	0
Gross Static	2007

Impact Conditions

Speed (km/h)	103.2
Angle (deg)	0
Impact Severity (kJ)	824.8

Exit conditions

Speed (km/h)	N/A
Angle (deg)	N/A

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	0.4
y-direction	-1.4
Ridedown Acceleration (g's)	
x-direction	8.4
y-direction	-4.9

European Committee for Normalization (CEN) Values

THIV (km/h)	5.5
PHD (g's)	8.5
ASI	0.4

Test Article Deflections (m)

Dynamic	N/A
Permanent	N/A

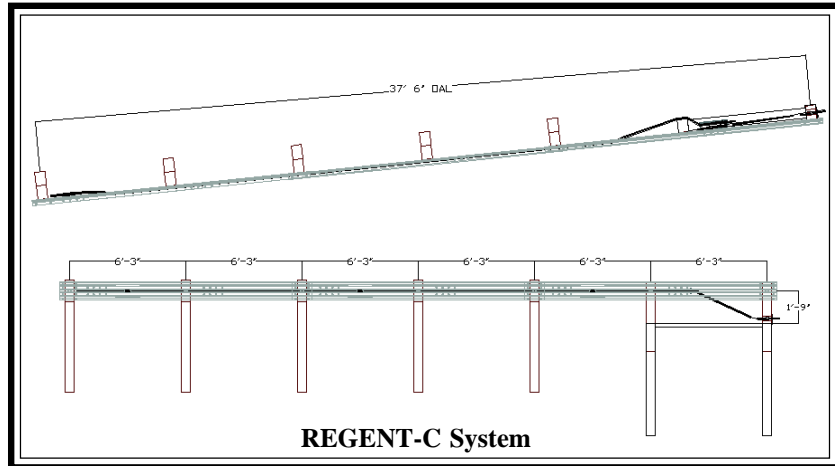
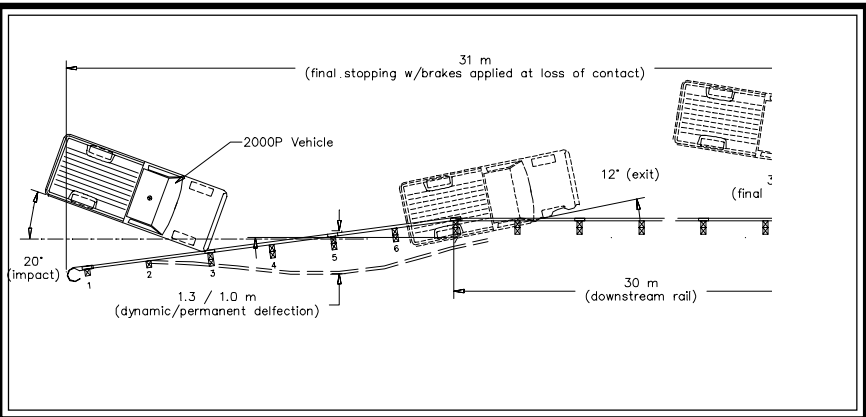
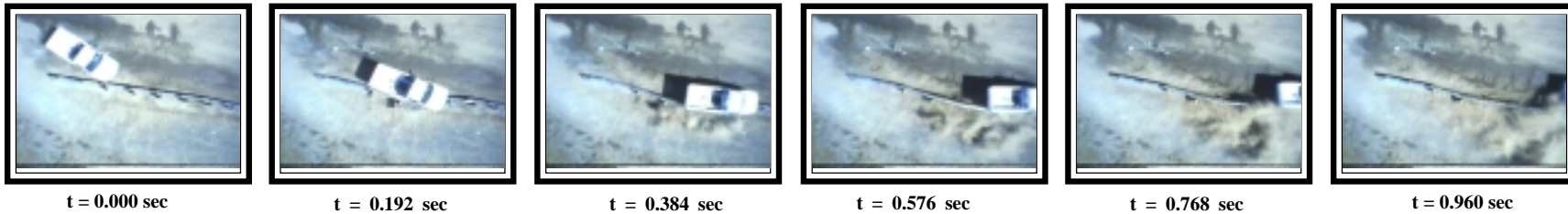
Vehicle Damage

Exterior	
VDS	FD-2
CDC	12FDEW2
Interior	
OCDI	AS0000000

Post-Impact Vehicular Behavior (deg - rate gyro)

Maximum Roll Angle	37.9
Maximum Pitch Angle	-12.7
Maximum Yaw Angle	-22.7

Figure 6. Summary of Results - REGENT-C System Test 23-6273-003



E-TECH Testing Services, Inc.

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-35
Test No.	23-6273-001
Date	6/13/01
Test Article	
Type	Bryson Products, Inc.
.....	REGENT-C System
Installation Length, (m)	11.43 (pay length)
Material and key elements	Seven wood post cable assisted terminal, 1.22 m straight flare with 1.91 m post spacing
Foundation Type and Anchoring	NCHRP 350 "Weak Soil" dry and compacted
Test Vehicle	
Type	Production Model
Designation	2000P Pickup
Model	1994 Chevrolet C2500
Mass (kg)	
Curb	1870
Test inertial	1989
Dummy	0
Gross Static	1989
Impact Conditions	
Speed (km/h)	99.8
Angle (deg)	20
Impact Severity (kJ)	89.3

Exit conditions	
Speed (km/h)	32.4
Angle (deg)	12
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	5.1
y-direction	-4.4
Ridedown Acceleration (g's)	
x-direction	-10.2
y-direction	-10.5
European Committee for Normalization (CEN) Values	
THIV (km/h)	25.9
PHD (g's)	13.2
ASI	0.8
Test Article Deflections (m)	
Dynamic	1.4
Permanent	1.0
Vehicle Damage	
Exterior	
VDS	RFQ-3
CDC	01RFEW2
Interior	
OCDI	RF0001000
Post-Impact Vehicular Behavior (deg - rate gyro)	
Maximum Roll Angle	-14.4
Maximum Pitch Angle	6.6
Maximum Yaw Angle	-32.8

Figure 11. Summary of Results - REGENT-C System Test 23-6273-001