U.S. Department
of Transportation

Federal Highway Administration

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

May 7, 1998

Refer to: HNG-14

J. M. Essex, P.E.
Senior Vice President, Sales
Energy Absorption Systems, Inc.
One East Wacker Drive
Chicago, Illinois 60601

Dear Mr. Essex:

In your April 1 letter to Mr. Henry Rentz, you requested acceptance of a modified Triton Barrier as a National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3) temporary barrier. Your letter also requested Federal Highway Administration's (FHWA) acceptance of a further-modified Triton configuration to function as a TL-3 terminal for the barrier. This second request will be addressed in a separate letter.

To support your request for acceptance of the Triton Barrier at TL-3, you also sent copies of your December 19, 1997, report entitled "TRITON BARRIER TL-3: Qualification to NCHRP Report 350 TL-3 - Engineering Summary," which included the full report prepared by E-TECH Testing Services, Inc., entitled "NCHRP Report 350 Crash Test Results for the TRITON BARRIER TL-3," dated December 1997, and a video tape showing the full scale tests that you conducted on the modified Triton Barrier. We noted that the Triton Barrier TL-3 modules have the same exterior dimensions as those tested earlier to obtain TL-2 acceptance but that the interior U-bolts at the ends of each module are double-nutted to the interior steel framework in the TL-3 units. Each module is set on two 178-mm high plastic pedestals to raise its center of gravity in order to meet TL-3 evaluation criteria. These pedestals. are strapped to each individual unit and are also tethered together (in groups of ten) with a braided polyester cord to reduce debris scatter following an impact. We understand that all new modules will be made with the two-nut connection noted above and that all pedestals shipped to the field separately for use with earlier-manufactured modules will include extra nuts and instructions to modify any existing segments that have only a single nut connection. Enclosure 1 shows the details of the TL-3 design.

The NCHRP Report 350 recommends two tests for longitudinal barriers: tests 3-10 and 3-11, the first being an 820-kg car impacting at 100 km/h and at a 20-degree angle and the second being a 2000-kg pickup truck impacting at 100 km/h and at a 25-degree angle. You ran test 3-11 twice to determine the number of modules needed in advance of the barrier length of need to ensure vehicle containment. In the first test, the vehicle impacted near the center of a 30-module array. In the second, the impact point was between modules ten and eleven. You then concluded that at least ten water-filled modules are needed in advance of the barrier length of need.

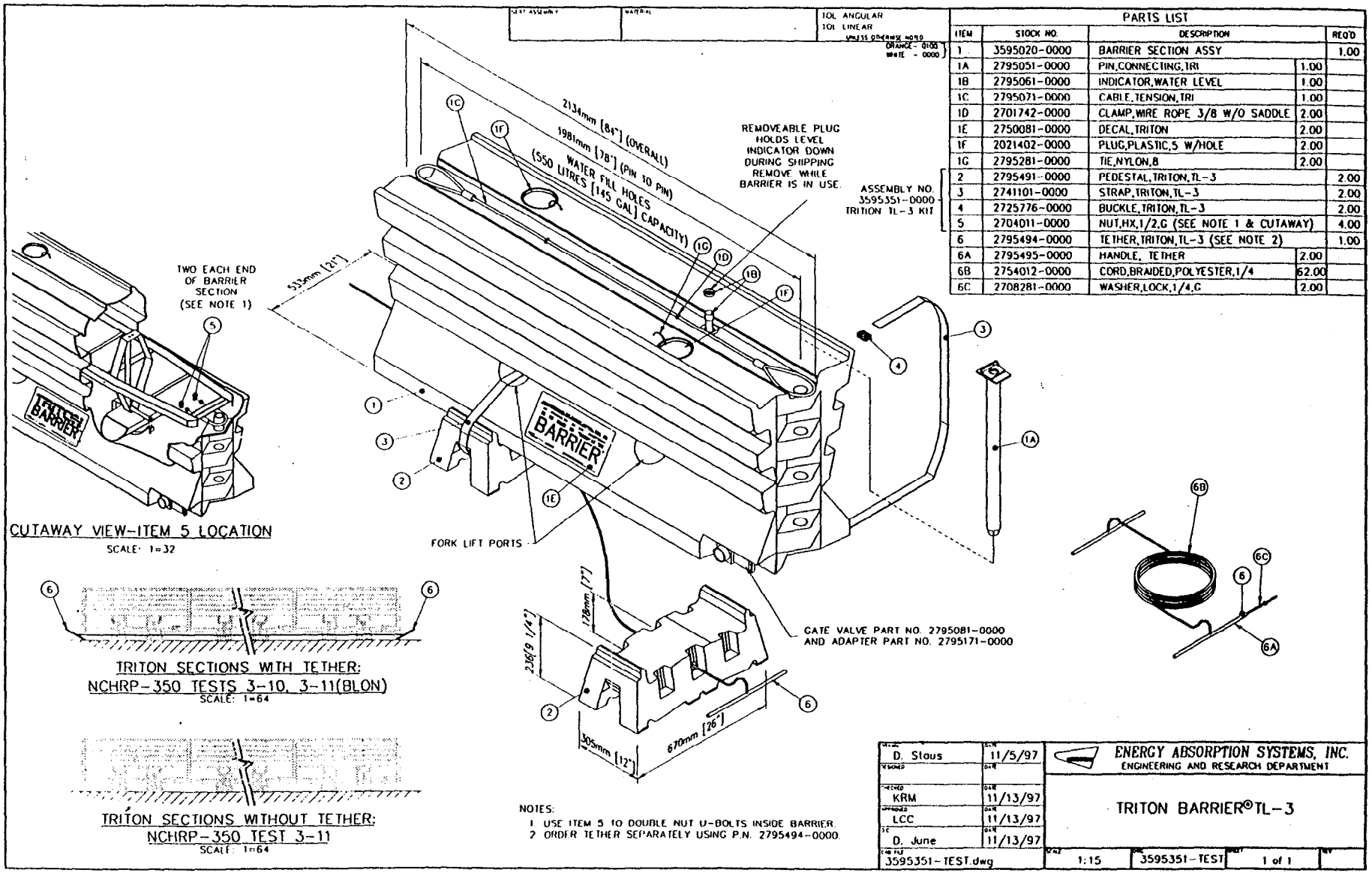
Although both strength tests met NCHRP Report 350 evaluation criteria, barrier deflection was reported as 5.8 and 6.9 meters, respectively. You then ran a non-standard test to determine the outcome of a more typical hit. When impacted with a 2000-kg pickup truck at 100 km/h and 7 degrees, the truck was contained and redirected parallel to the barrier, which deflected only 1.4 meters. User agencies should be informed of the range of deflections to be expected and advised to ensure that these distances are available in any given work zone or that the likelihood of high angle (or heavy vehicle) impacts is low enough to result in an acceptable risk when lesser clearances are available. The results of each of the four tests you reported are shown in Enclosure 2.

Based on our review of the information you provided, we concur that the Triton Barrier, as modified and tested, meets the acceptance criteria for an NCHRP Report 350 TL-3 crash cushion. Because it is a proprietary device, its use on Federal-aid projects, except exempt, non-National Highway System projects, remains subject to the conditions listed in Title 23, Code of Federal Regulations, Section 635.411 when such use is specified by the contracting authority.

Sincerely yours,

Dwight A. Horne
Chief, Federal-Aid and Design Division

2 Enclosures



CUTAWAY VIEW-ITEM 5 LOCATION
SCALE: 1=32

TRITON SECTIONS WITH TETHER:
NCHRP-350 TESTS 3-10, 3-11(BLON)
SCALE: 1=64

TRITON SECTIONS WITHOUT TETHER:
NCHRP-350 TEST 3-11
SCALE: 1=64

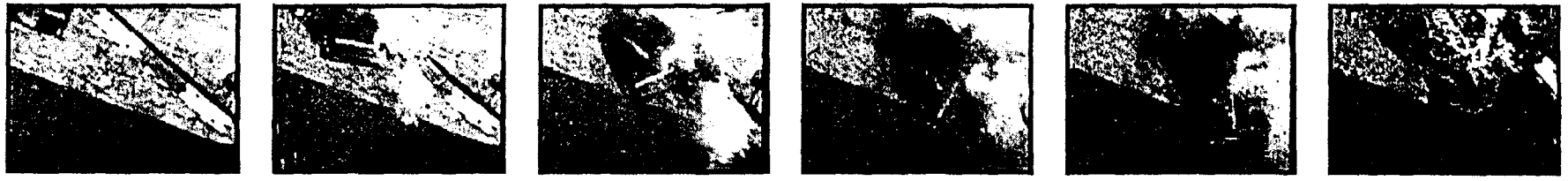
NOTES:
1. USE ITEM 5 TO DOUBLE NUT U-BOLTS INSIDE BARRIER.
2. ORDER TETHER SEPARATELY USING P.N. 2795494-0000.

PARTS LIST

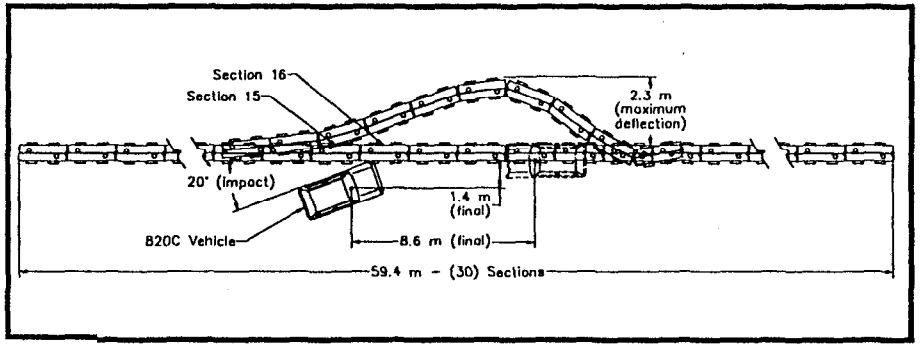
ITEM	STOCK NO.	DESCRIPTION		REQ'D
1	3595020-0000	BARRIER SECTION ASSY		1.00
1A	2795051-0000	PIN,CONNECTING,TRI	1.00	
1B	2795061-0000	INDICATOR,WATER LEVEL	1.00	
1C	2795071-0000	CABLE,TENSION,TRI	1.00	
1D	2701742-0000	CLAMP,WIRE ROPE 3/8 W/O SADDLE	2.00	
1E	2750081-0000	DECAL,TRITON	2.00	
1F	2021402-0000	PLUG,PLASTIC,5 W/HOLE	2.00	
1G	2795281-0000	TIE,NYLON,8	2.00	
2	2795491-0000	PEDESTAL,TRITON,TL-3		2.00
3	2741101-0000	STRAP,TRITON,TL-3		2.00
4	2725776-0000	BUCKLE,TRITON,TL-3		2.00
5	2704011-0000	NUT,HX,1/2,G (SEE NOTE 1 & CUTAWAY)		4.00
6	2795494-0000	TETHER,TRITON,TL-3 (SEE NOTE 2)		1.00
6A	2795495-0000	HANDLE, TETHER	2.00	
6B	2754012-0000	CORD,BRAIDED,POLYESTER,1/4	62.00	
6C	2708281-0000	WASHER,LOCK,1/4,G	2.00	

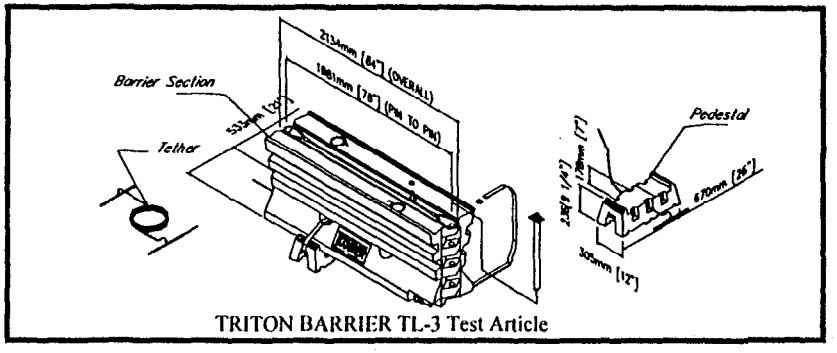
D. Staus	11/5/97	ENERGY ABSORPTION SYSTEMS, INC. ENGINEERING AND RESEARCH DEPARTMENT
CHECKED KRM	11/13/97	TRITON BARRIER®TL-3
APPROVED LCC	11/13/97	
D. June	11/13/97	
CAD FILE 3595351-TEST.dwg		SCALE 1:15 · SIZE 3595351-TEST · SHEET 1 of 1 · REV

ENCLOSURE 1



t = 0.000 sec | t = 0.180 sec | t = 0.360 sec | t = 0.540 sec | t = 0.720 sec | t = final





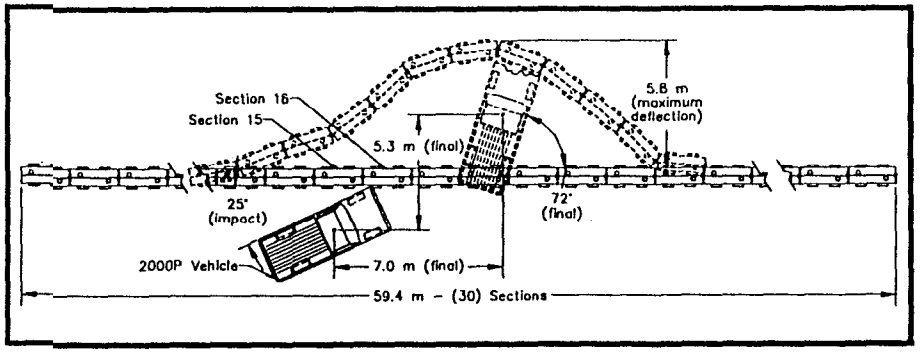
TRITON BARRIER TL-3 Test Article

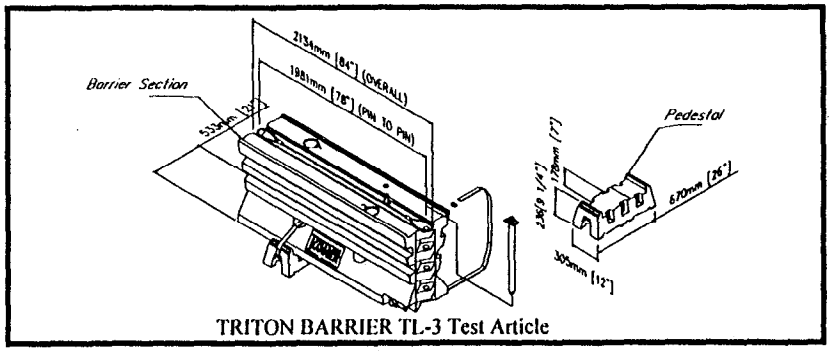
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-10
Test No.	01-7604-002
Date	10/23/97
Test Article	
Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
Installation Length	59.4 m - (30) Sections
Size and/or dimension and material	
of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	738
Test inertial	800
Dummy(s)	75
Gross Static	875
Impact Conditions	
Speed (km/h)	97.04
Angle (deg)	21.0
Impact Severity (kJ)	37.33

Exit conditions	
Speed (km/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	11.04
y-direction	-2.94
Ridedown Acceleration (g's)	
x-direction	-12.23
y-direction	9.55
THIV (m/s)	11.55
PHD (g's)	10.47
ASI	1.05
Test Article Deflections (m)	
Dynamic	2.3
Permanent	2.3
Vehicle Damage	
Exterior	
VDS	FD-5
CDC	11FDEW5
Interior	
OCDI	LS0010000
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)	
Maximum Roll Angle	-11.06
Maximum Pitch Angle	-4.38
Maximum Yaw Angle	-158.08

Figure 1. Summary of Results - TRITON BARRIER TL-3 Test 01-7604-002

t = 0.000 sec | t = 0.180 sec | t = 0.360 sec | t = 0.540 sec | t = 0.720 sec | t = final





General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-11
Test No	01-7604-001
Date	10/15/97

Test Article

Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
Installation Length	59.4 m - (30) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic

Test Vehicle

Type	Production Model
Designation	2000P
Model	1990 Chevrolet C2500
	3/4T Pickup
Mass (kg)	
Curb	1956
Test inertial	2005
Dummy(s)	N/A
Gross Static	2005

Impact Conditions

Speed (km/h)	97.56
Angle (deg)	25.0
Impact Severity (kJ)	131.51

Exit conditions

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

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	9.06
y-direction	1.05
Ridedown Acceleration (g's)	
x-direction	-10.09
y-direction	-4.95
THIV (m/s)	9.10
PHD (g's)	8.88
ASI	0.69

Test Article Deflections (m)

Dynamic	5.8
Permanent	5.8

Vehicle Damage

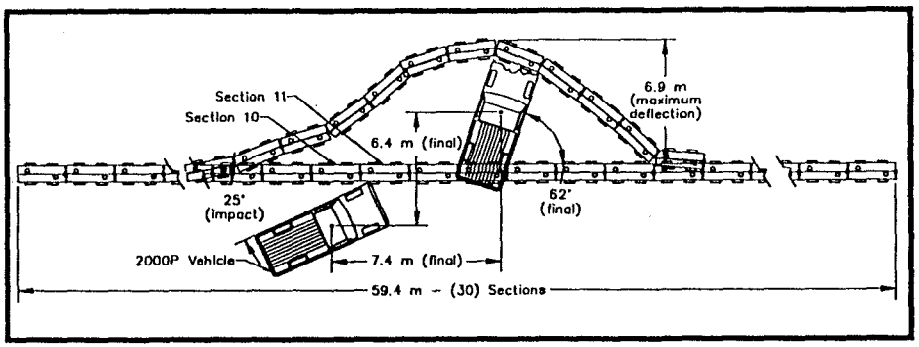
Exterior	
VDS	FD-5
CDC	11FDEW5
Interior	
OCDI	LS2000000

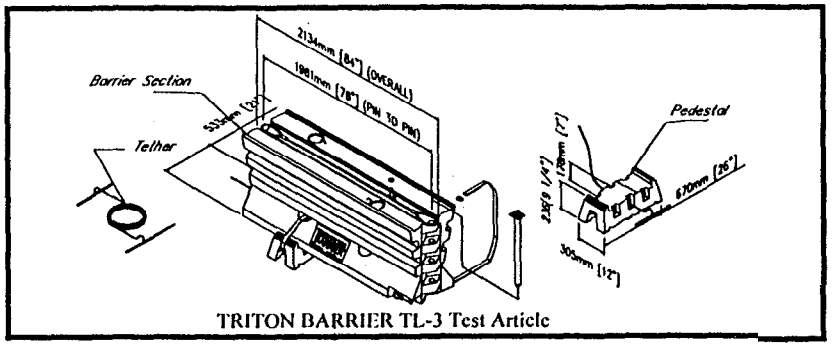
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)

Maximum Roll Angle	12.08
Maximum Pitch Angle	-3. 79
Maximum Yaw Angle	-47.20

Figure 5. Summary of Results - TRITON BARRIER TL-3 Test 01-7604-001

t = 0.000 sec | t = 0.180sec | t = 0.360 sec | t = 0.540 sec | t = 0.720 sec | t = final

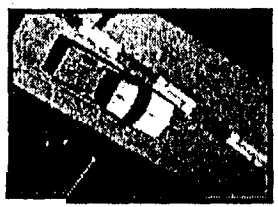




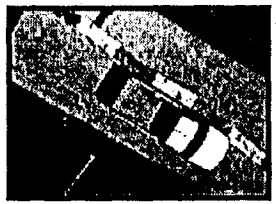
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-11
Test No.	01-7604-003
Date	10/29/97
Test Article	
Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
Installation Length	59.4 m - (30) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic
Test Vehicle	
Type	Production Model
Designation	2000P
Model	1990 Chevrolet C2500
	3/4T Pickup
Mass (kg)	
Curb	2023
Test inertial	2017
Dummy(s)	N/A
Gross Static	2017
Impact Conditions	
Speed (km/h)	96.26
Angle (deg)	25.0
Impact Severity (kJ)	128.81

Exit conditions	
Speed (km/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	8.70
y-direction	0.31
Ridedown Acceleration (g's)	
x-direction	-8.3 I
y-direction	7.45
THIV (m/s)	8.73
PHD (g's)	7.75
ASI	0.66
Test Article Deflections (m)	
Dynamic	6.9
Permanent	6.9
Vehicle Damage	
Exterior	
VDS	FD-5
CDC	11FDEW5
Interior	
OCDI	AS0000000
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)	
Maximum Roll Angle	13.01
Maximum Pitch Angle	3.12
Maximum Yaw Angle	-37.12

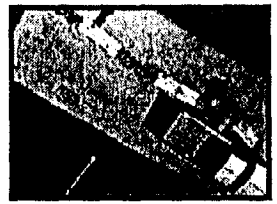
Figure 11. Summary of Results - TRITON BARRIER TL-3 Test 01-7604-003



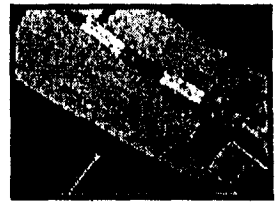
t = 0.000 sec



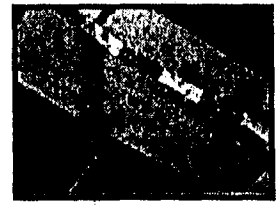
t = 0.120sec



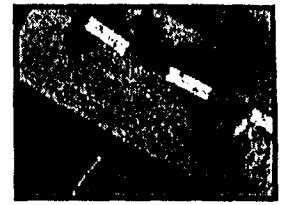
t=0.180sec



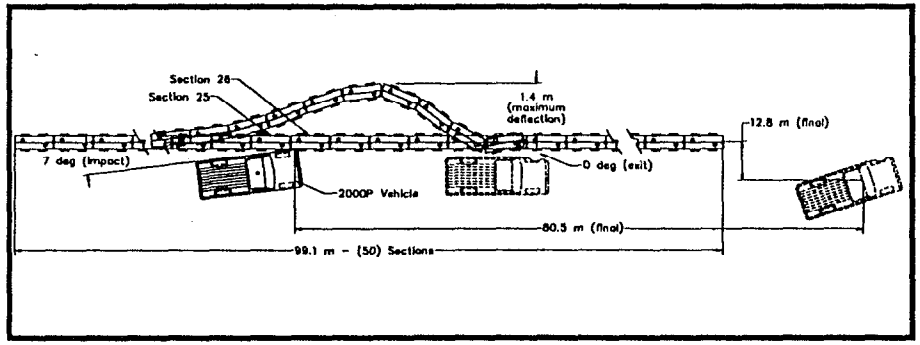
t=0.240 sec

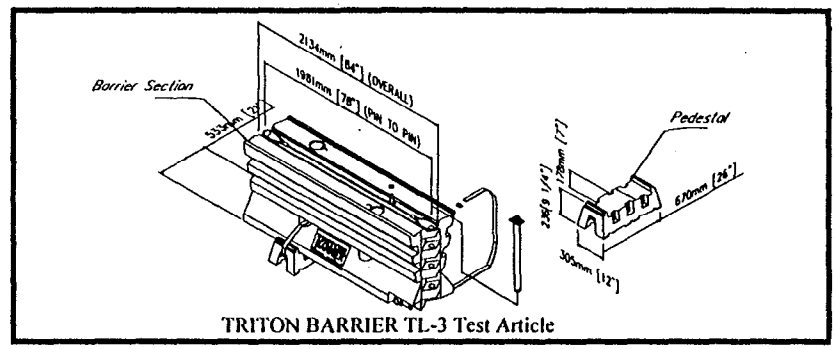


t=0.300 sec



t = final





TRITON BARRIER TL-3 Test Article

General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-11 Modified
Test No	0 l-7604-005
Date	3/18/98
Test Article	
Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
Installation Length	99.1 m - (50) Sections
Size and/or dimension and material	
of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic
Test Vehicle	
Type	Production Model
Designation	2OOOP
Model	1990 Chevrolet C2500
	3/4T Pickup
Mass (kg)	
Curb	1894
Test inertial	2004
Dummy(s)	N/A
Gross Static	2004
Impact Conditions	
Speed (km/h)	95.74
Angle (deg)	7.0
Impact Severity (kJ)	10.53

Exit conditions	
Speed (km/h)	83.52
Angle (deg)	0
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	4.15
y-direction	2.46
Ridedown Acceleration (g's)	
x-direction	-4.41
y-direction	3.99
THIV (m/s)	4.96
PHD (g's)	3.01
ASI	0.35
Test Article Deflections (m)	
Dynamic	1.4
Permanent	1.4
Vehicle Damage	
Exterior	
VDS	LD-5
CDC	10LDEW1
Interior	
OCDI	AS0000000
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)	
Maximum Roll Angle	16.95
Maximum Pitch Angle	7.54
Maximum Yaw Angle	15.58

Summary of Results - TRITON BARRIER® TL-3 at 7 Degree Impact Angle Test 01-7604-005

U.S. Department
of Transportation

**Federal Highway
Administration**

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

May 8, 1998

Refer to: HNG-14

J. M. Essex, P.E.
Senior Vice President, Sales
Energy Absorption Systems, Inc.
One East Wacker Drive
Chicago, Illinois 60601

Dear Mr. Essex:

In your April 1 letter to Mr. Henry Rentz, you requested acceptance of a modified Triton barrier at the National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3) and acceptance of the Triton barrier as its own nonredirecting TL-3 end treatment when the initial module is installed upside down and left empty of water. This letter contains the Federal Highway Administration's response to the end treatment request. The barrier itself was accepted as a TL-3 system in my May 7 letter to you.

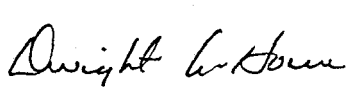
To support your request, you sent copies of your report entitled "TRITON BARRIER TL-3 End Treatment: Qualification to the NCHRP Report 350 Test Level 3 - Engineering Summary," dated December 19, 1997, which included the full report prepared by E-TECH Testing Services, Inc., entitled "NCHRP Report 350 Crash Test Results for the TRITON BARRIER TL-3 End Treatment," also dated December 1997, and a video tape showing the full scale tests that you conducted on the Triton TL-3 end treatment. The TRITON BARRIER TL-3 End Treatment consists of ten sections. The first, or lead section, is an inverted, empty TL-2 TRITON module supported and raised 130 mm by a modified plastic pedestal. Sections two through ten are standard TL-2 TRITON modules filled with water and set on 178-mm high plastic pedestals. Thus, sections two through ten are identical to the TRITON BARRIER TL-3 modules to which the end terminal must be attached. The terminal system is shown on Enclosure 1.

Since the TRITON end treatment is a nonredirective terminal, NCHRP Report 350 guidelines recommend tests 3-40 through 3-44 be conducted. We note that all five tests were run and we agree that appropriate evaluation criteria were met in each test. Enclosure 2 shows the test matrix that you ran and summarizes the evaluation criteria for each test. Enclosure 3 provides

additional information on the individual tests, including the final stopping position of the test vehicles. We also noted that a concrete backup was used in each of your terminal tests. While this did not affect the test results, users must be made aware that the TRITON End Terminal is not acceptable for shielding longitudinal barriers other than the TRITON BARRIER TL-3 itself.

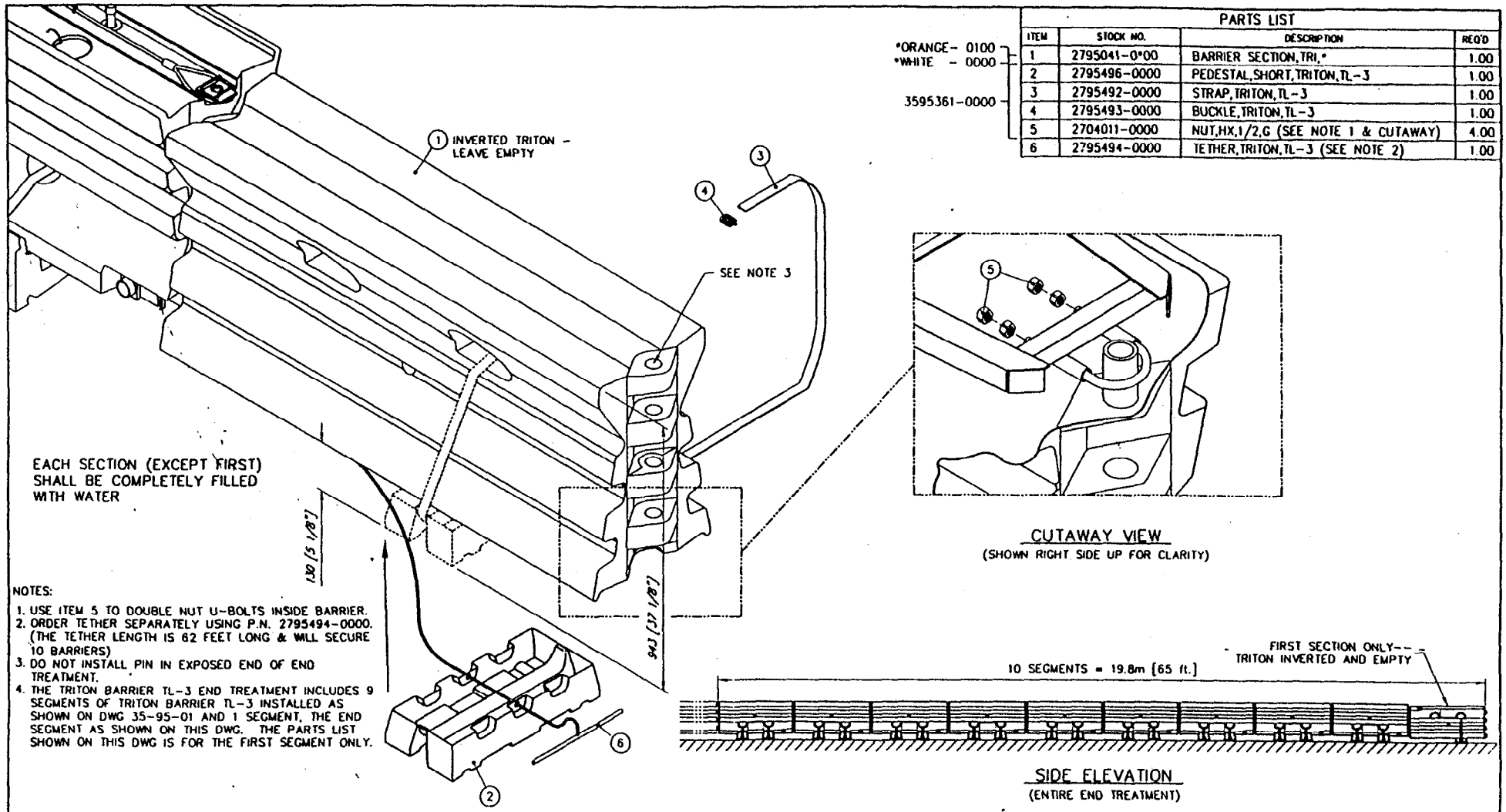
Based on our review of the information you provided, we concur that the TRITON BARRIER TL-3 end treatment, as tested, meets the acceptance criteria for an NCHRP Report 350 TL-3 nonredirective terminal when used to shield the end of a length of Triton TL-3 barrier. It may be used on the National Highway System (NHS) when such use is specified by, or acceptable to, a transportation agency. Because it is a proprietary device, its use on Federal-aid projects, except exempt, non-NHS projects, remains subject to the conditions listed in Title 23, Code of Federal Regulations, Section 635.411 when its use is specified by the contracting authority.

Sincerely yours,



Dwight A. Home
Chief, Federal-Aid and Design Division

3 Enclosures



*ORANGE- 0100
*WHITE - 0000
3595361-0000

PARTS LIST

ITEM	STOCK NO.	DESCRIPTION	REQ'D
1	2795041-0*00	BARRIER SECTION, TRI,*	1.00
2	2795496-0000	PEDESTAL, SHORT, TRITON, TL-3	1.00
3	2795492-0000	STRAP, TRITON, TL-3	1.00
4	2795493-0000	BUCKLE, TRITON, TL-3	1.00
5	2704011-0000	NUT, HX, 1/2, G (SEE NOTE 1 & CUTAWAY)	4.00
6	2795494-0000	TETHER, TRITON, TL-3 (SEE NOTE 2)	1.00

NOTES:

1. USE ITEM 5 TO DOUBLE NUT U-BOLTS INSIDE BARRIER.
2. ORDER TETHER SEPARATELY USING P.N. 2795494-0000. (THE TETHER LENGTH IS 62 FEET LONG & WILL SECURE 10 BARRIERS)
3. DO NOT INSTALL PIN IN EXPOSED END OF END TREATMENT.
4. THE TRITON BARRIER TL-3 END TREATMENT INCLUDES 9 SEGMENTS OF TRITON BARRIER TL-3 INSTALLED AS SHOWN ON DWG 35-95-01 AND 1 SEGMENT, THE END SEGMENT AS SHOWN ON THIS DWG. THE PARTS LIST SHOWN ON THIS DWG IS FOR THE FIRST SEGMENT ONLY.

Revisions	Date	Rev.	By	Ckd.	App.
CHGD TO REFLECT ONLY #2-5 INCL. IN ASSY.	1/12/98	A	DLS	KRM	KRM

REFERENCES

TRITON BARRIER ASSEMBLY 35-95-01

DRAWN: D. Staus	DATE: 12/16/97
DESIGNED:	DATE:
CHECKED: KRM	DATE: 12/18/97
APPROVED: LCC	DATE: 12/18/97
CAD FILE: 3595361-0000.dwg	
NEXT ASSEMBLY:	

ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

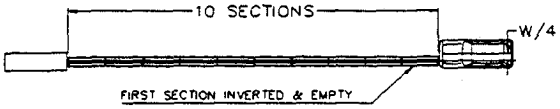
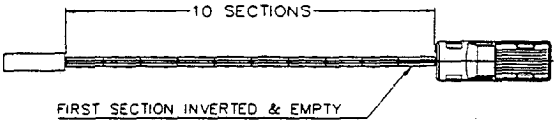
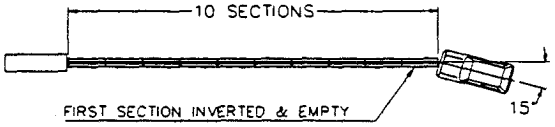
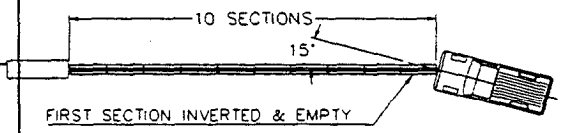
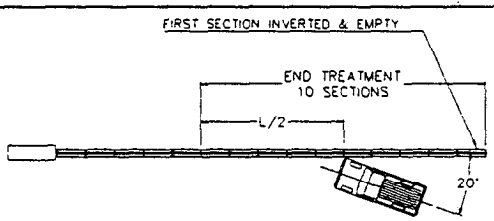
TRITON BARRIER® TL-3
END TREATMENT

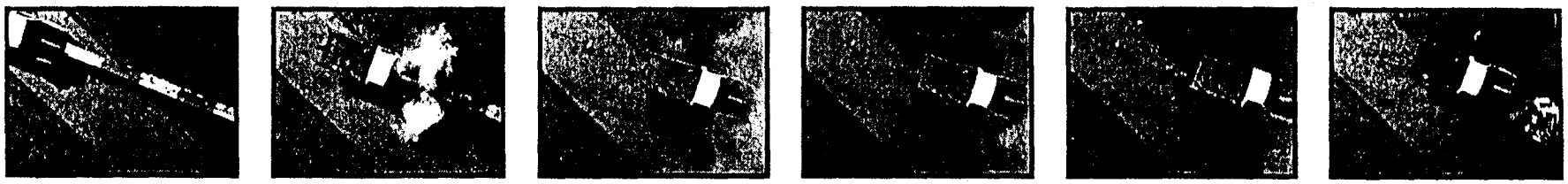
SCALE	DWG.	SHEET	REV.
1:15	3595361-0000	1 of 1	A

ENCLOSURE 1

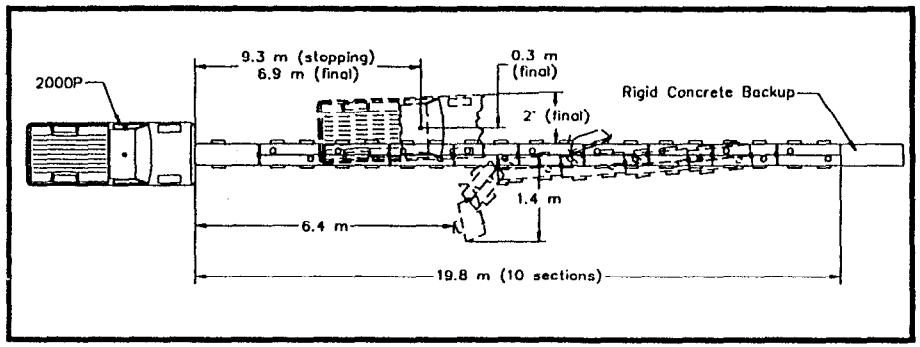
ENCLOSURE 2

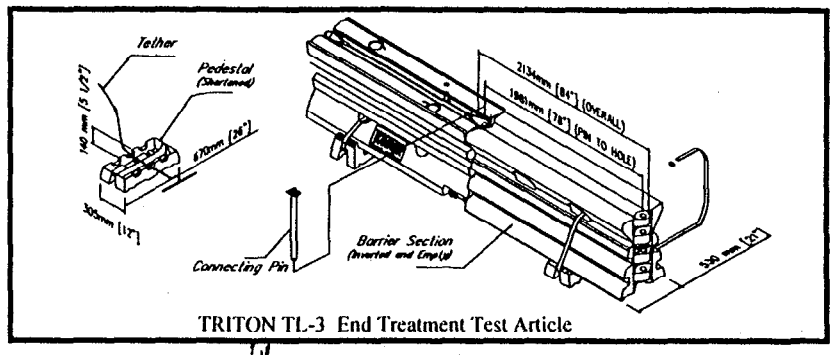
TEST MATRIX FOR CERTIFICATION OF THE TRITON BARRIER® TL-3 END TREATMENT TO NCHRP 350 TEST LEVEL 3 STANDARDS

NCHRP Evaluation Criteria	E-tech Test ID. #	Test Conditions	Impact speed (km/hr)	Impact Angle (deg.)	Occupant Impact Velocity Long. (m/sec)	Occupant Impact Velocity Lateral (m/sec)	Ridedown Accelerations Long. (G)	Ridedown Accelerations Lateral (G)	Overall Assess-ment	Notes
350-3-40	01-7605-002		101.69	0	9.67	1.33	-14.62	-9.11	PASS	
350-3-41	01-7605-001		98.90	0	9.20	0.30	-9.27	3.40	PASS	
350-3-42	01-7605-003		101.69	0	7.96	2.66	-7.50	-13.03	PASS	
350-3-43	01-7605-004		98.36	0	6.48	-2.49	-3.42	-4.11	PASS	
350-3-44	01-7605-005		99.72	20	8.52	1.32	-9.39	-7.34	PASS	Article performed by controlled penetration.



t= 0.000 sec t = 0.240sec t = 0.480sec t = 0.720 sec t = 0.960 set



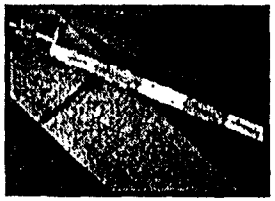


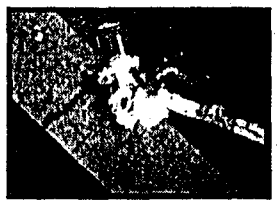
TRITON TL-3 End Treatment Test Article

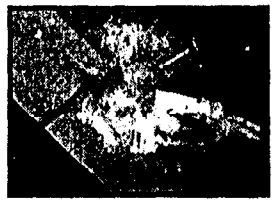
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-41
Test No.	01-7605-001
Date	11/5/97
Test Article	
Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
	End Treatment
Installation Length	19.8 m - (10) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic
Test Vehicle	
Type	Production Model
Designation	2000P
Model	1989 GMC C2500
	Pickup
Mass (kg)	
Curb	2160
Test inertial	1993
Dummy(s)	N/A
Gross Static	1993
Impact Conditions	
Speed (km/h)	98.90
Angle (deg)	0.0
Impact Severity (kJ)	752.11

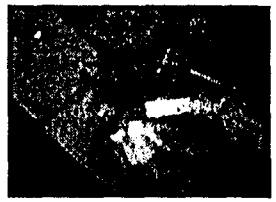
Exit conditions	
Speed (km/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	9.20
y-direction	0.30
Ridedown Acceleration (g's)	
x-direction	-9.27
y-direction	3.40
THIV (m/s)	9.22
PHD (g's)	8.02
ASI	0.76
Test Article Deflections (m)	
Dynamic	6.4
Permanent	6.4
Vehicle Damage	
Exterior	
VDS	FD-3
CDC	12FDEW3
Interior	
OCDI	AS0000000
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)	
Maximum Roll Angle	-29.79
Maximum Pitch Angle	11.21
Maximum Yaw Angle	-5.33

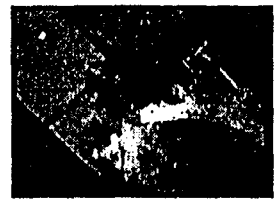
Figure 6. Summary of Results - TRITON BARRIER TL-3 End Treatment Test 01-7605-001


t = 0.000 sec

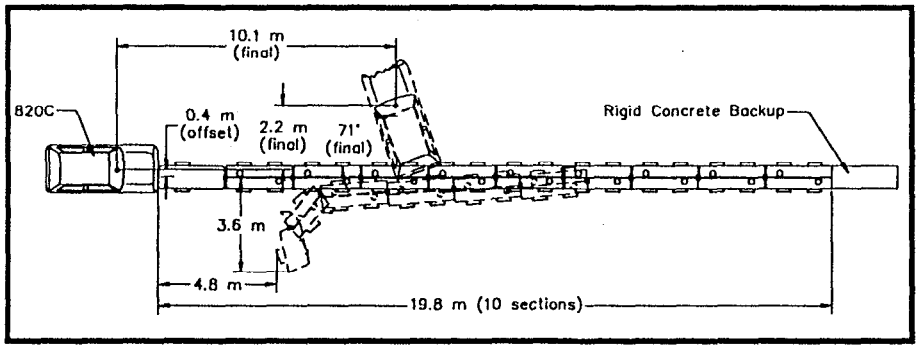

t = 0300sec

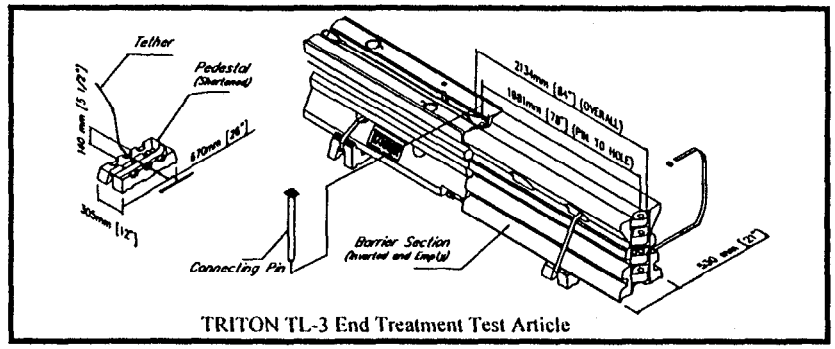

t=0.600 sec


t= 0.900 sec


t = 1.200 sec


t = final





TRITON TL-3 End Treatment Test Article

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-40
Test No.	01-7605-002
Date	11/6/97

Test Article

Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
	End Treatment
Installation Length	19.8 m - (10) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic

Test Vehicle

Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	769
Test inertial	822
Dummy(s)	75
Gross Static	897

Impact Conditions

Speed (km/h)	101.69
Angle (deg)	0.0
Impact Severity (kJ)	328.16

Exit conditions

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

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	9.67
y-direction	1.33
Ridedown Acceleration (g's)	
x-direction	-14.62
y-direction	-9.11
THIV (m/s)	10.27
PHD (g's)	13.28
ASI	1.09

Test Article Deflections (m)

Dynamic	4.8
Permanent	4.8

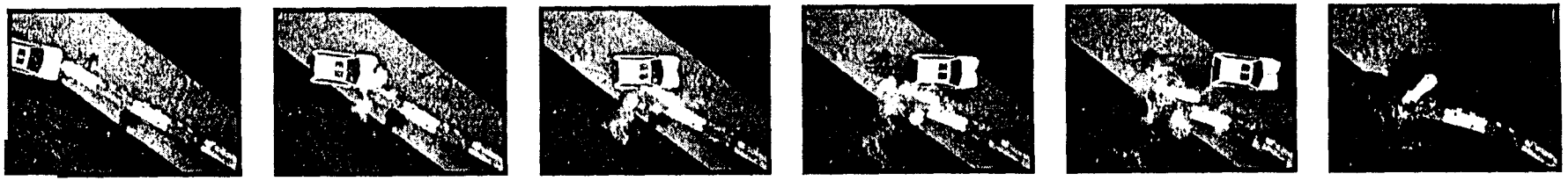
Vehicle Damage

Exterior	
VDS	FD-5
CDC	12FDEW5
Interior	
OCDI	AS0000000

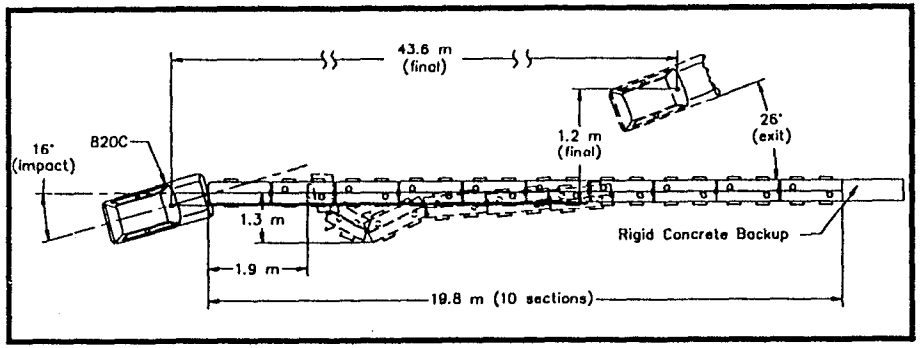
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)

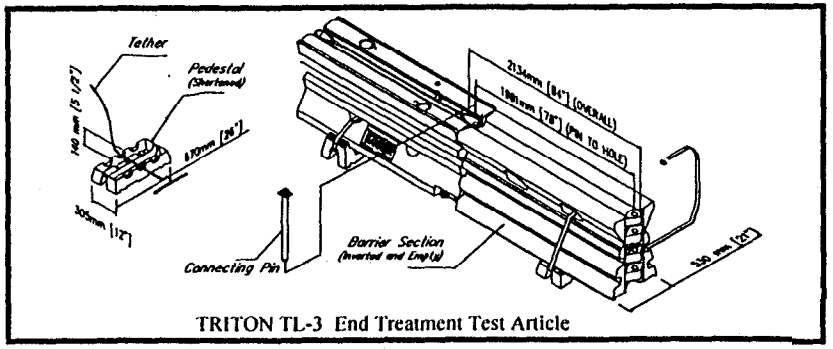
Maximum Roll Angle	11.21
Maximum Pitch Angle	-13.82
Maximum Yaw Angle	234.19

Figure 1. Summary of Results - TRITON BARRIER TL-3 End Treatment Test 01-7605-002



t = 0.000 sec | t=0.120sec | t = 0.240 sec | t = 0.360 sec | t = 0.480 sec

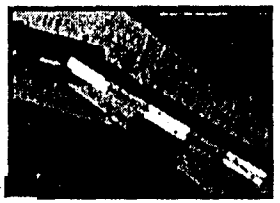


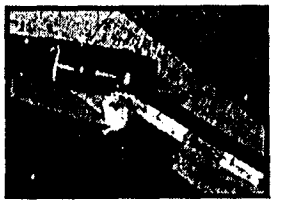


TRITON TL-3 End Treatment Test Article

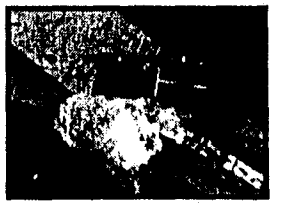
General Information	
Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-42
Test No	01-7605-003
Date	11/10/97
Test Article	
Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL3
	End Treatment
Installation Length	19.8 m -(10) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic
Test Vehicle	
Type	Production Model
Designation	820C
Model	1988 Ford Festiva
	Hatchback
Mass (kg)	
Curb	824
Test inertial	823
Dummy(s)	75
Cross Static	898
Impact Conditions	
Speed (km/h)	101.69
Angle (deg)	16.0
Impact Severity (kJ)	328.56
Exit conditions	
Speed (km/h)	63.0
Angle (deg)	26.0
Occupant Risk Values	
Impact Velocity (m/s)	
x-direction	7.96
y-direction	2.66
Ridedown Acceleration (g's)	
x-direction	-7.50
y-direction	-13.03
THIV (m/s)	8.92
PHD (g's)	10.59
ASI	1.06
Test Article Deflections (m)	
Dynamic	1.9
Permanent	1.9
Vehicle Damage	
Exterior	
VDS	FD-3
CDC	12FDEW3
Interior	
OCDI	AS0000000
Post-Impact Vehicular Behavior (deg - gyro @ c.g.)	
Maximum Roll Angle	-12.97
Maximum Pitch Angle	-6.09
Maximum Yaw Angle	59.12

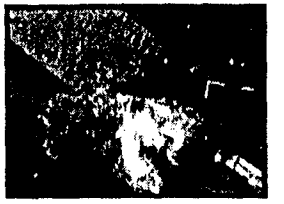
Figure 11. Summary of Results - TRITON BARRIER TL-3 End Treatment Test 01-7605-003


t = 0.000 sec

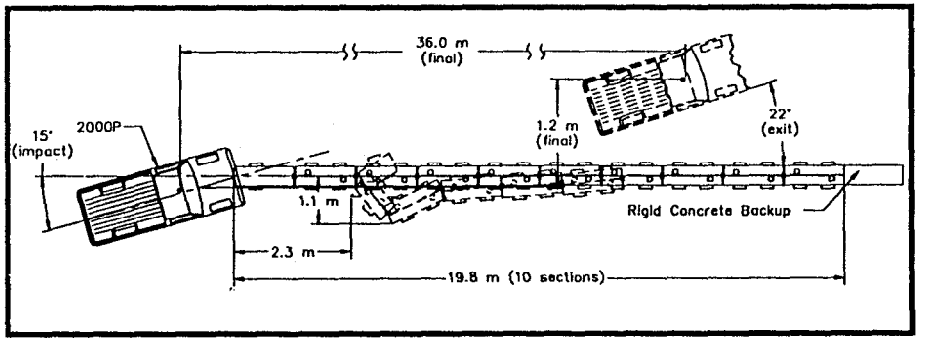

t=0.120sec

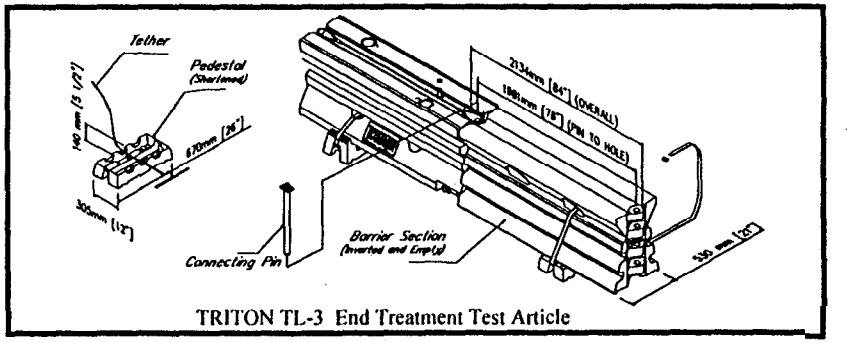

t = 0.240 sec


t = 0.360 sec


t = 0.480 sec


t = final





TRITON TL-3 End Treatment Test Article

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-43
Test No	01-7605-004
Date	11/12/97

Test Article

Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
	End Treatment
Installation Length	19.8 m - (10) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic

Test Vehicle

Type	Production Model
Designation	2000P
Model	1988 GMC C2500 Pickup
Mass (kg)	
Curb	1947
Test inertial	1998
Dummy(s)	N/A
Gross Static	1998

Impact Conditions

Speed (km/h)	98.36
Angle (deg)	15.0
Impact Severity (kJ)	745.79

Exit conditions

Speed (km/h)	73.4
Angle (deg)	22.0

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	6.48
y-direction	-2.49
Ridedown Acceleration (g's)	
x-direction	-3.42
y-direction	-4.11
THIV (m/s)	6.83
PHD (g's)	2.72
ASI	0.53

Test Article Deflections (m)

Dynamic	2.3
Permanent	2.3

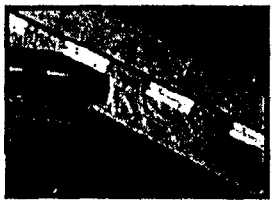
Vehicle Damage

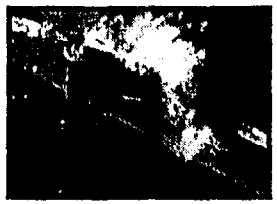
Exterior	
VDS	FD-3
CDC	12FDEW3
Interior	
OCDI	AS0000000

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

Maximum Roll Angle	-5.14
Maximum Pitch Angle	2.00
Maximum Yaw Angle	-8.03

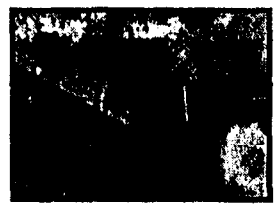
Figure 16. Summary of Results - TRITON BARRIER TL-3 End Treatment Test 01-7605-004


t = 0.000 sec

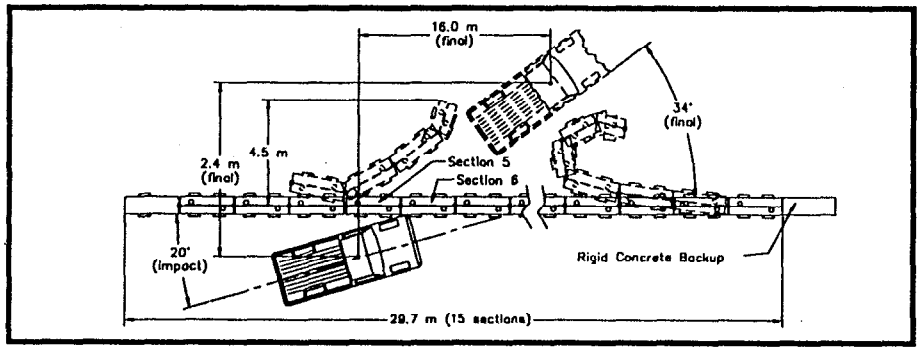

t=0.240sec

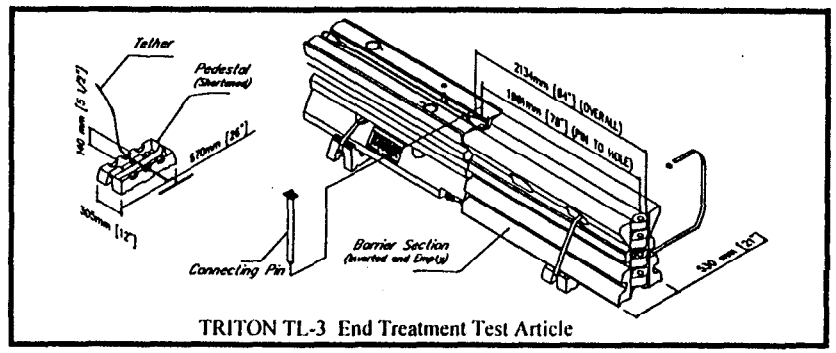

t=0.480sec


t =0.720sec


t=0.960 sec


t = final





TRITON TL-3 End Treatment Test Article

General Information

Test Agency	E-TECH Testing Services, Inc.
Test Designation	NCHRP 350 Test 3-44
Test No	01-7605-005
Date	11/17/97

Test Article

Type	Energy Absorption Systems, Inc.
	TRITON BARRIER TL-3
	End Treatment
Installation Length	29.7 m - (15) Sections
Size and/or dimension and material of key elements	1981 mm Section Length
	178 mm Pedestal Height
	Polyethylene Plastic

Test Vehicle

Type	Production Model
Designation	2OOOP
Model	1990 Chevrolet C2500
	Pickup
Mass (kg)	
Curb	1947
Test inertial	1997
Dummy(s)	N/A
Gross Static	1997

Impact Conditions

Speed (km/h)	99.72
Angle (deg)	20.0
Impact Severity (kJ)	766.14

Exit conditions

Speed (km/h)	1.6
Angle (deg)	30.0

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	8.52
y-direction	1.32
Ridedown Acceleration (g's)	
x-direction	-9.39
y-direction	-7.34
THJV (m/s)	8.63
PHD (g's)	8.66
ASI	0.73

Test Article Deflections (m)

Dynamic	4.5
Permanent	4.5

Vehicle Damage

Exterior	
VDS	FD3
CDC	11FDEW3
Interior	
OCDI	AS0000000

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

Maximum Roll Angle	20.16
Maximum Pitch Angle	-6.07
Maximum Yaw Angle	-14.03

Figure 21. Summary of Results - TRITON BARRIER TL-3 End Treatment Test 01-7605-005