



U.S. Department
of Transportation

**Federal Highway
Administration**

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

February 10, 1995

Refer to: HNG-14

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

Dear Mr. Essex:

On February 8 you met with Messrs. James Hatton and Richard Powers of my staff to provide information on a new impact attenuator developed and tested by your company. A follow-up letter on February 9 to Mr. William Weseman formally requested Federal Highway Administration's (FHWA) acceptance of this device for use on Federally-funded highway projects.

The new device is a narrow, non-redirective, energy absorbing terminal called the NEAT. It is intended to shield the approach end of standard portable concrete safety shaped barrier or the moveable QUICK-CHANGE barrier system. The NEAT is made from aluminum sheet and evolved from the technology used in the design of your ALPHA truck mounted attenuator (TMA). The NEAT cartridge is 570 mm wide by 810 mm tall by 2957 mm long. It weighs 130 kg and can be installed and relocated manually. Back-up attachments have been designed to attach the NEAT to the concrete safety shape or to the QUICK-CHANGE barrier. Drawings of the system components are attached as Enclosure 1.

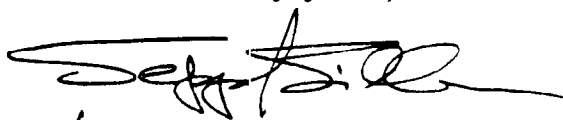
The NEAT was successfully tested as a test level 2 (TL-2) non-redirective crash cushion following the guidelines in the National Cooperative Highway Research Program (NCHRP) Report 350. The actual tests run are shown on Figure 1 in Enclosure 2, and summary data for each individual test are shown in Figures 2, 7, 12, 17, and 22 of that enclosure.

We have noted that the occupant impact velocities range from 8.0 m/s to 10.5 m/s, well within the 9 m/s to 12 m/s recommended by the NCHRP Report 350. Similarly, the occupant ridedown accelerations range from 7.4 g's to 15.6 g's for all tests except 2-44, where this value exceeded 28 g's. The first four tests again fell well within the NCHRP Report 350 range of 15 to 20 g's. Test 2-44, which is intended to evaluate the ability of the cushion to safely stop a large passenger vehicle prior to a life-threatening impact with the corner of the shielded hazard, does not require that the occupant impact velocities and subsequent ridedown accelerations be met. We noted that the former criteria were met and that the ridedown accelerations were a "worst case" scenario since the concrete barrier was anchored for the test. In practice, temporary concrete barrier would seldom be anchored and would be expected to produce significantly lower accelerations.

Based on our review of the data presented, we consider the NEAT to be acceptable for use as a test level 2 attenuator on the National Highway System when such use is requested by a highway agency. Since the NEAT is a proprietary item, its usage is governed by Title 23, Code of Federal Regulations, Section 635.411. Because the NEAT was tested at 70 km/h, its use should be limited to locations where operating speeds are expected to be within this limit. Users must also be aware that controlled penetration behind the attenuator will occur under some impacts (as seen in test 2-43) and the positioning of the barrier itself and of the NEAT must consider this factor.

A copy of this letter and enclosures will be sent to FHWA field offices for their information.

Sincerely yours,

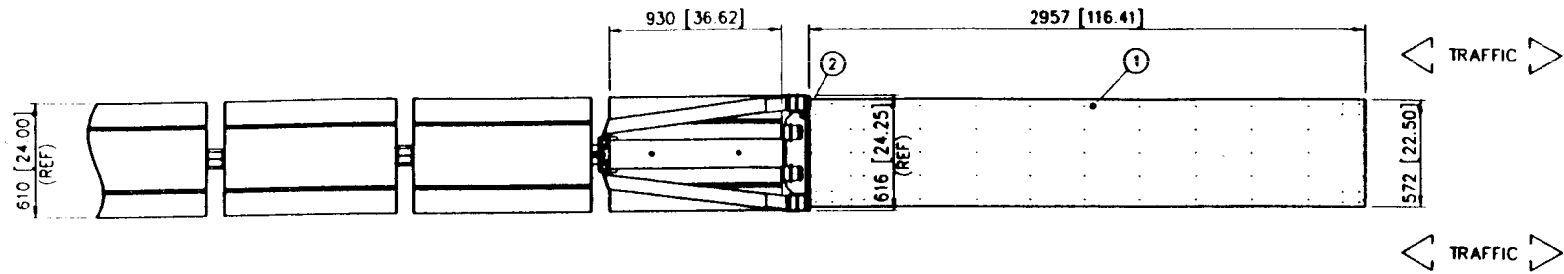


for Jerry L. Poston, Chief
Federal-Aid and Design Division

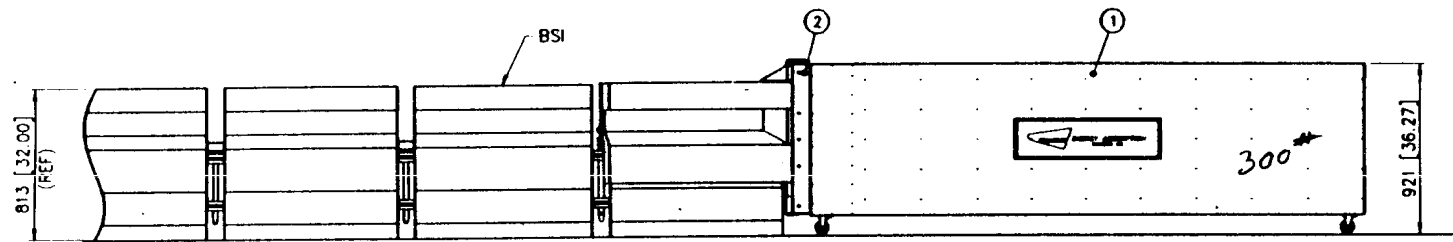
2 Enclosures

Geometric and Roadside Design Acceptance Letter CC-25

PARTS LIST		
ITEM	STOCK NO.	DESCRIPTION
1	3577020-0000	CARTRIDGE ASSY
2	3577111-0000	BACKUP ASSY



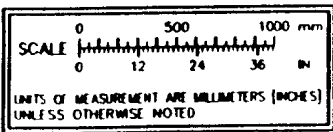
PLAN



ELEVATION

NOTES

- IN COMPLIANCE WITH THE AASHTO 1989 ROADSIDE DESIGN GUIDE, MANUFACTURER RECOMMENDS REMOVAL OF ALL CURBS AND ISLANDS TO ENSURE PROPER IMPACT PERFORMANCE
- SEE THE "N-E-A-T SYSTEM DESIGN MANUAL" CODED _____ 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) 487-8730.
- N-E-A-T SYSTEMS ARE NOT RECOMMENDED FOR SITES WHERE REDIRECTIVE CAPABILITIES ARE WARRANTED



Revisions	Date	Rev	By	Ckd	App	DESCRIPTION
ADDED PARTS LIST	07/94	A	JF	KM	/	DESIGN SPEED 70 km/h [44 mph]
CORRECTED ITEM NO'S	08/94	B	JF	KM	/	AVERAGE G's 79
						EST FORCE ON BACKUP STRUCTURE 240 kN [54 kips]
						Designed _____ Date _____
						Drawn D L Staus 11/30/94
						Checked X Markman 12/14/94
						Approved B D B 01/04/95

REFERENCES

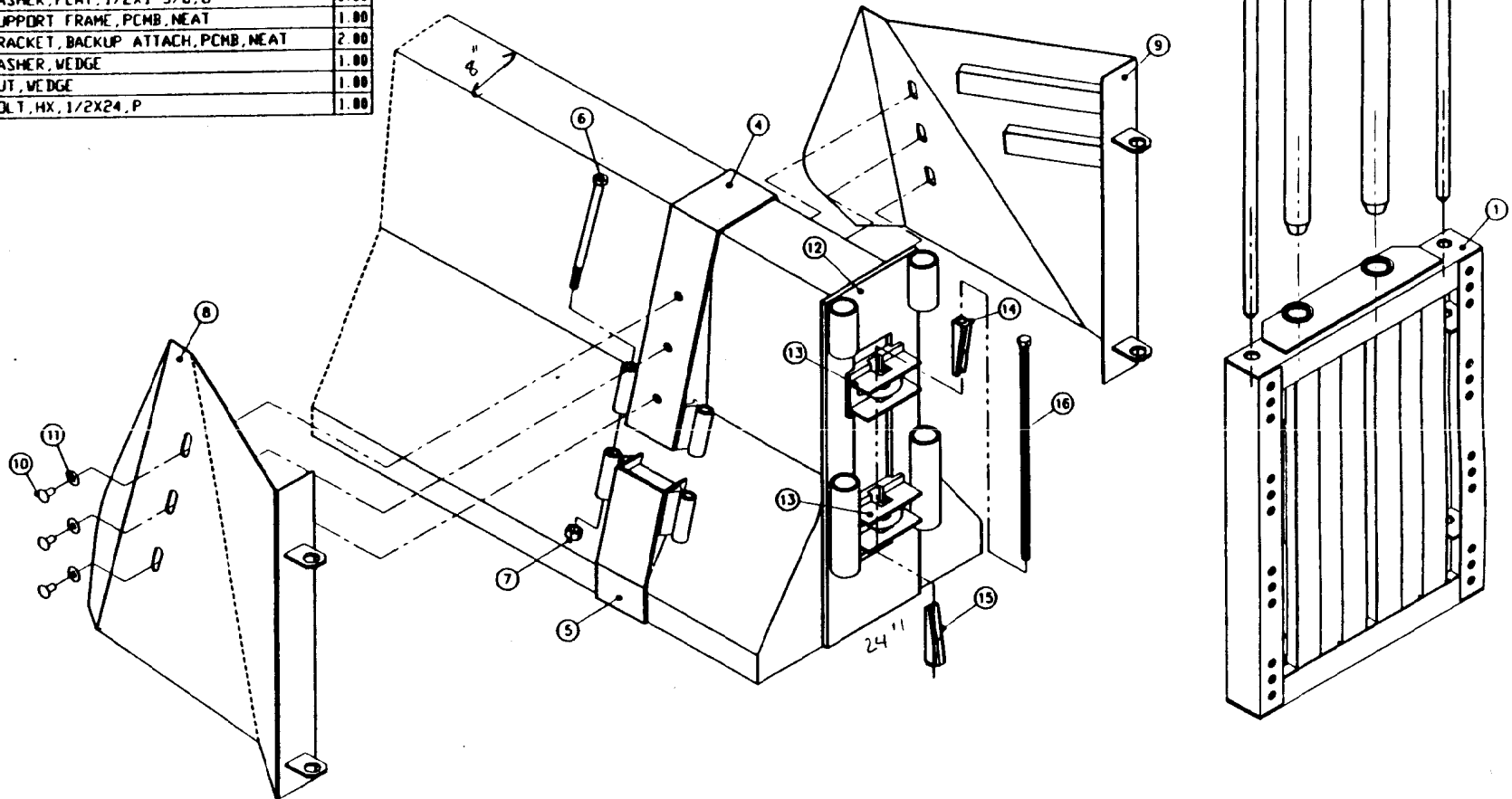
Project No. _____ Sales Order No. _____
 Serial No. _____ Color _____
 CARTRIDGE ATTACHMENT 35-77-12
 BACKUP SUPPORT STRUCTURE 35-77-11

MODEL NO. NEAT2B

ENERGY ABSORPTION SYSTEMS, INC.
 ENGINEERING AND RESEARCH DEPARTMENT

N-E-A-T™ SYSTEM, TL-2
 ATTACHING TO BSI BARRIER

PARTS LIST			
ITEM	NO	DESCRIPTION	QTY
1	-0000	BACKUP, NEAT	1.00
2	2777101-0000	PIN, 35 1/2	2.00
3	2777101-0000	PIN, CONNECTING, PCMB, NEAT	2.00
4	2777111-0000	SUPPORT STRAP, UPPER, PCMB, NEAT	1.00
5	2777121-0000	SUPPORT STRAP, LOWER, PCMB, NEAT	1.00
6	2699991-0100	BOLT, HX, 3/4X10, P	4.00
7	2704091-0100	NUT, HX, 3/4, P	4.00
8	2777131-0000	PANEL, TRANS, LEFT, PCMB, NEAT	1.00
9	277713R-0000	PANEL, TRANS, RIGHT, PCMB, NEAT	1.00
10	2706311-0100	BOLT, BT, 1/2X1 1/4, P	6.00
11	2708011-0000	WASHER, FLAT, 1/2X1 3/8, G	6.00
12	2777141-0000	SUPPORT FRAME, PCMB, NEAT	1.00
13	2777151-0000	BRACKET, BACKUP ATTACH, PCMB, NEAT	2.00
14	2777201-0000	WASHER, WEDGE	1.00
15	2777161-0000	NUT, WEDGE	1.00
16	2512121-0100	BOLT, HX, 1/2X24, P	1.00



ASSEMBLY NO. 3577051-C

Revisions	Date	Rev	By	Chk	App	DESIGN SPEED	M.P.H.
RECREATED FROM 163M03	02/01/94	NEW	J	/	/	AVERAGE G's	
						EST. FORCE ON BACKUP STRUCTURE	KIPS
						Designed	Date
						Drawn	12/02/94
						Checked	12/02/94
						Approved	12/02/94
NEXT ASSEMBLY							

REFERENCES

Project No. _____ Sales Order No. _____
 Serial No. _____ Color _____

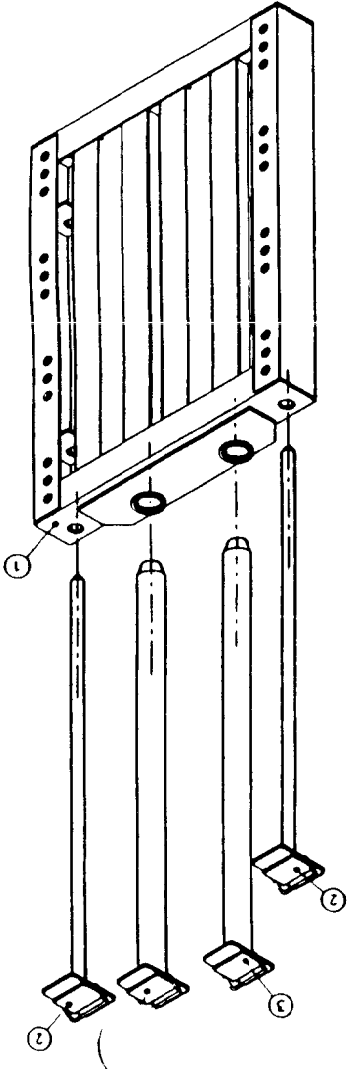
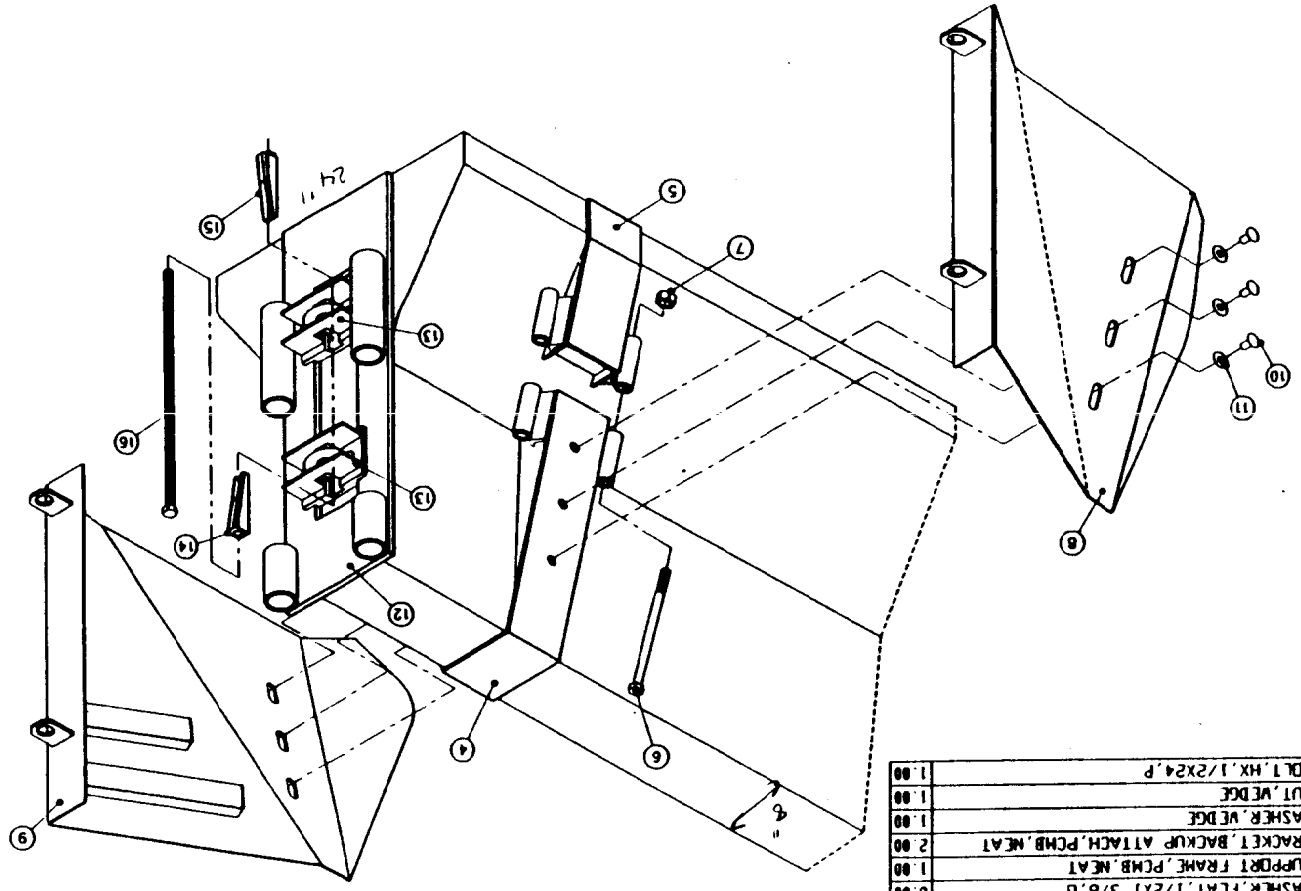
ENERGY ABSORPTION SYSTEMS, IN
 ENGINEERING AND RESEARCH DEPARTMENT

N-E-A-T™ SYSTEM
 PORTABLE CONCRETE MEDIAN BAR
 BACKUP SUPPORT STRUCTURE

SCALE (1:8) 1/8"=1"	INT	DWG NUMBER 35-77-05	SHEET
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ITEM NO	DESCRIPTION	QTY
1	BACKUP, NEAT	1.00
2	PIN, .35 1/2	2.00
3	PIN, CONNECTING, PCMB, NEAT	2.00
4	SUPPORT STRAP, UPPER, PCMB, NEAT	1.00
5	SUPPORT STRAP, LOWER, PCMB, NEAT	1.00
6	BOLT, HX, 3/4X10, P	4.00
7	NUT, HX, 3/4, P	4.00
8	PANEL, TRANS, LEFT, PCMB, NEAT	1.00
9	PANEL, TRANS, RIGHT, PCMB, NEAT	1.00
10	BOLT, BT, 1/2X1 1/4, P	6.00
11	WASHER, FLAT, 1/2X1 3/8, G	6.00
12	SUPPORT FRAME, PCMB, NEAT	1.00
13	BRACKET, BACKUP ATTACH, PCMB, NEAT	2.00
14	WASHER, VEDGE	1.00
15	NUT, VEDGE	1.00
16	BOLT, HX, 1/2X24, P	1.00

PARTS LIST



Revisions		Date	Rev	By	Ckd	App
DESIGN SPEED M.P.H.						
AVERAGE G'S						
EST. FORCE ON BACKUP STRUCTURE KIPS						
Designed _____						
Drawn _____						
Checked _____						
Approved _____						

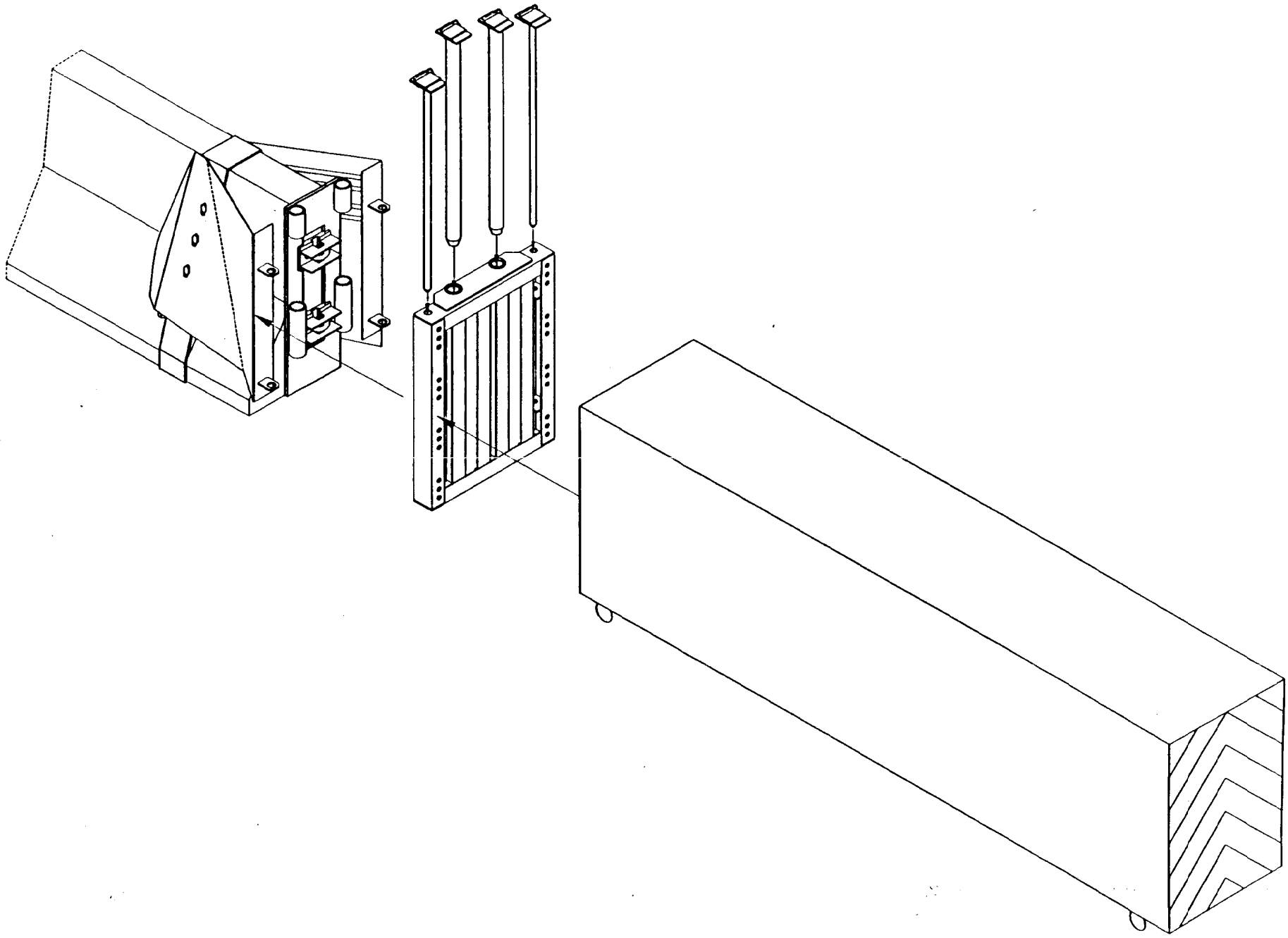
Project No _____
Sales Order No _____
Serial No _____
Color _____

REFERENCES

ENERGY ABSORPTION SYSTEMS, INC
ENGINEERING AND RESEARCH DEPARTMENT
N-E-A-T™ SYSTEM
PORTABLE CONCRETE MEDIAN BARR
BACKUP SUPPORT STRUCTURE

ASSEMBLY NO. 3577051-00

SCALE (1:8)
DATE 11/27/94
DWG NO. 35-77-05



N-E-A-T Certification Tests

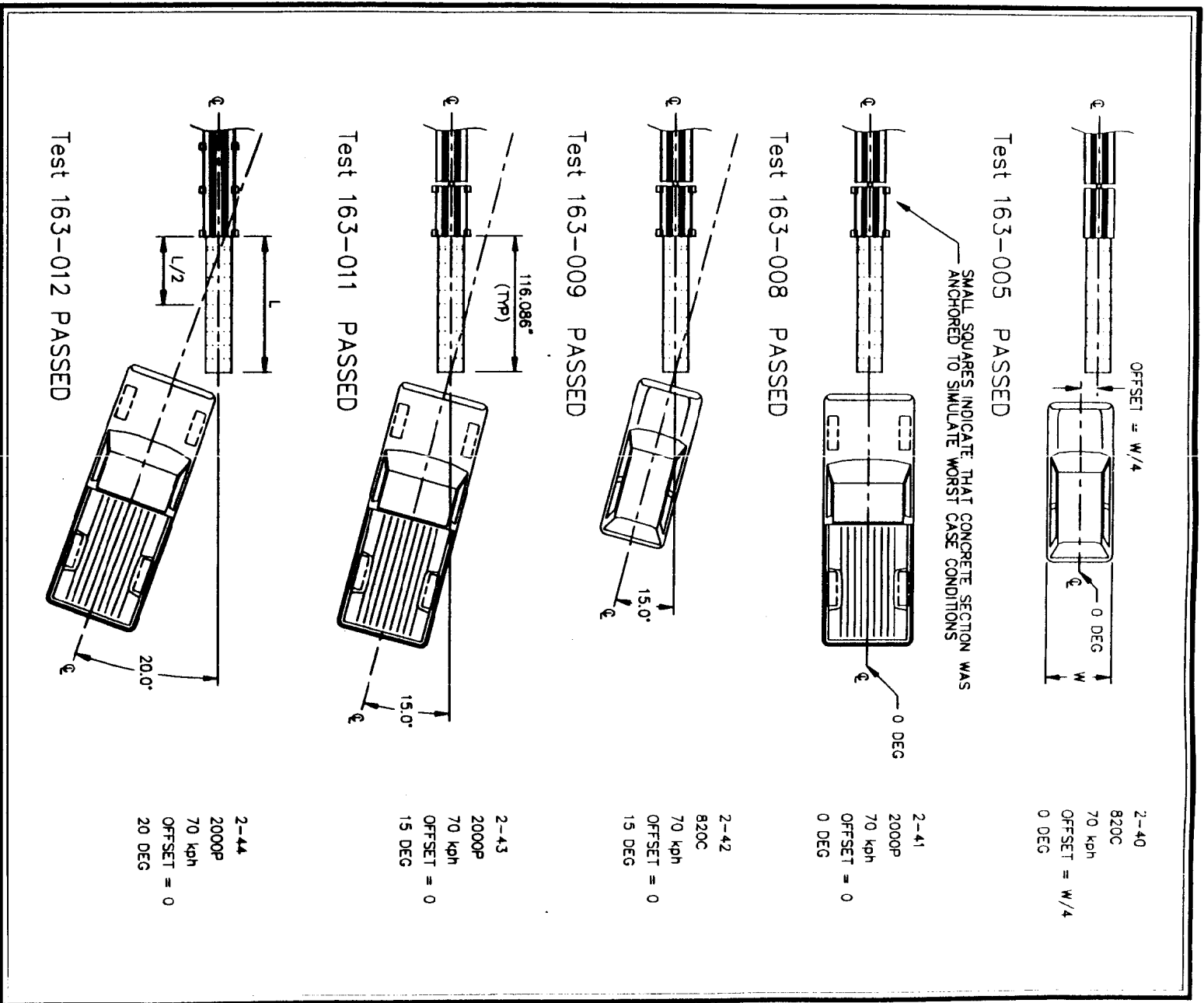


Figure 1



t = FINAL



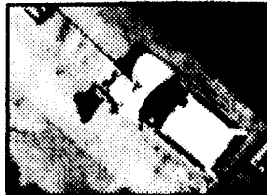
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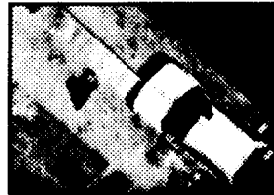
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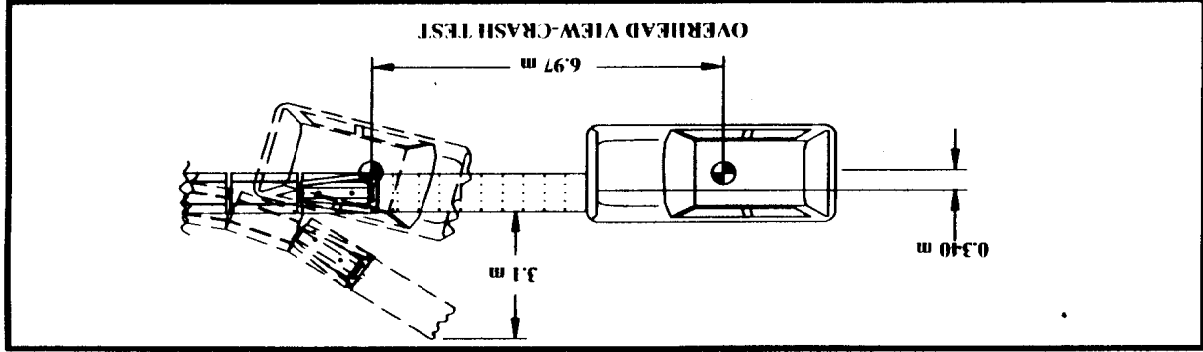
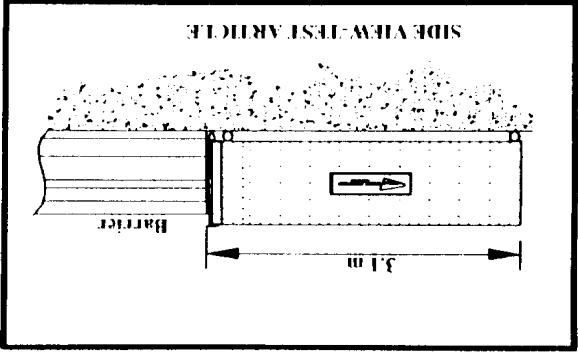
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t = .050 SEC



t = .000 SEC



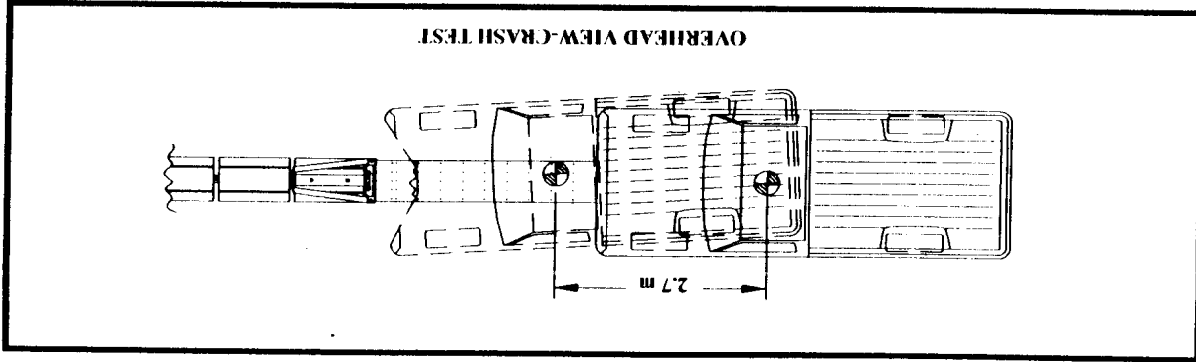
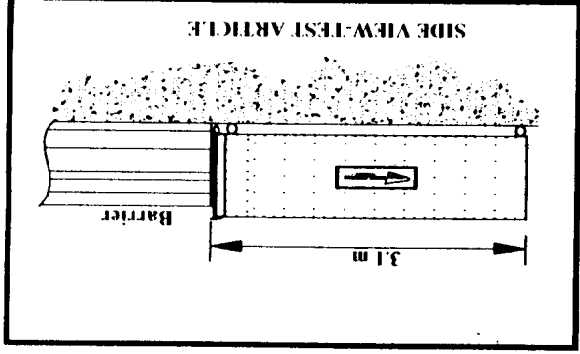
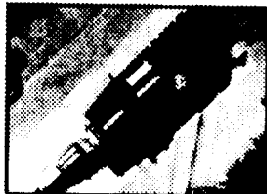
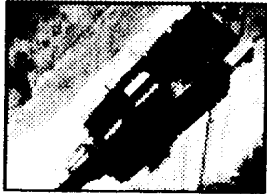
General Information.

Test No.	163-005
Date	8/4/94
Test Article	
Type	End Treatment
Installation Length (m)	3.1
Size and/or dimension and material of key elements	5052-H32 Aluminum
Soil Type and Condition	Clean, dry, pavement
Test Vehicle	
Type	Production Model
Designation	820C
Model	Ford
Mass - (kg)	
Curb	809.1
Test inertial	836.0
Dummy(s)	75.0
Gross Static	911.0
Impact conditions	
Speed (km/h)	73.0
Angle (deg)	0
Impact Severity (kJ)	171.7

Exit conditions

Speed (km/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	10.2
x-direction	
y-direction	.01
Ridedown Acceleration (g's)	
x-direction	9.3
y-direction	2.8
Acceleration Severity Index	.8
Test Article Deflection (m)	
Dynamic (lat/long)	3 /1/ 6
Permanent (lat/long)	3 /1/ 6
Vehicle Damage	
VDS	FC-6
CDC	12FEW1
Post-Impact Vehicular Behavior	
Maximum Roll Angle (deg)	13.3
Maximum Pitch Angle (deg)	8.0
Maximum Yaw Angle (deg)	-151.0

Figure 2. Summary of E - N-E-A-TTM Test 163-005 NCHRP Test 2-40



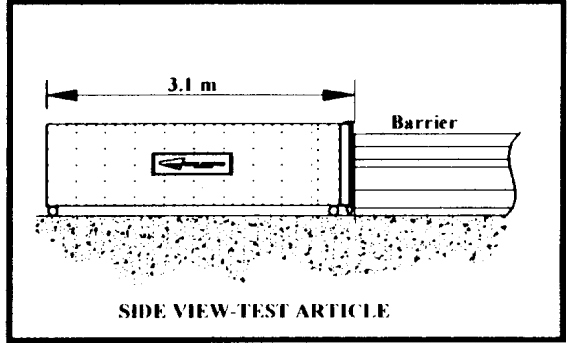
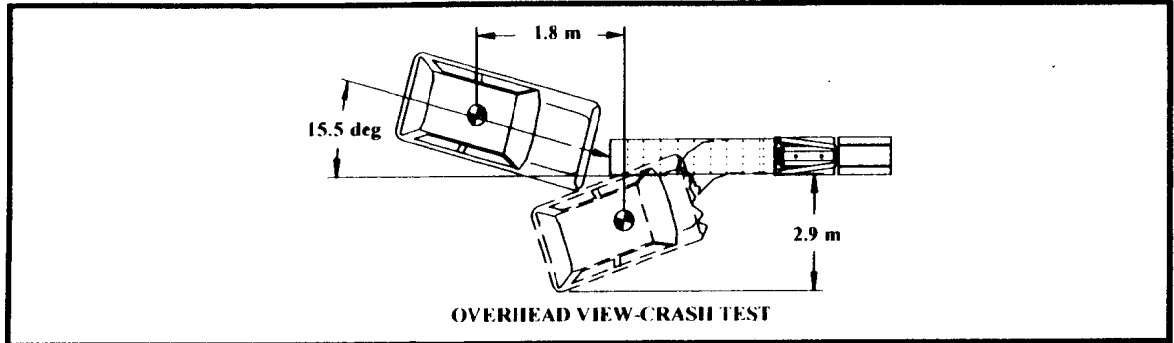
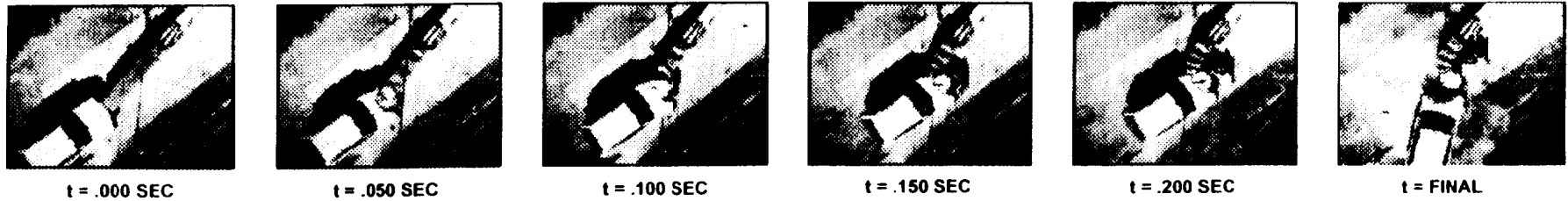
General Information.

Test No.	163-008
Date	9/12/94
Test Article	
Type	End Treatment
Installation Length (m)	3.1
Size and/or dimension and material of key elements	5052-H32 Aluminum
Soil Type and Condition	Clean, dry, pavement
Test Vehicle	
Type	Production Model
Designation	2000P
Model	Chevy
Mass - (kg)	1936.4
Curb	1936.4
Test inertial	2039.5
Dummy(s)	0
Gross Static	2039.5
Impact conditions	
Speed (km/h)	71.2
Angle (deg)	0
Impact Severity (kJ)	398.9

Exit conditions	
Speed (km/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (m/s)	10.5
x-direction	
y-direction	3
Ridgedown Acceleration (g's)	
x-direction	15.6
y-direction	3.9
Acceleration Severity Index	1.2
Test Article Deflection (m)	
Dynamic (lat/long)	.003/2.7
Permanent (lat/long)	.007/1.8
Vehicle Damage	
VDS	FC-6
CDC	12FCEN2

Post-Impact Vehicular Behavior	
Maximum Roll Angle (deg)	-4.2
Maximum Pitch Angle (deg)	-11.1
Maximum Yaw Angle (deg)	-3.4

Figure 7. Summary of Results N-E-A-TTM Test 163-008 NCHRP 35 12-41



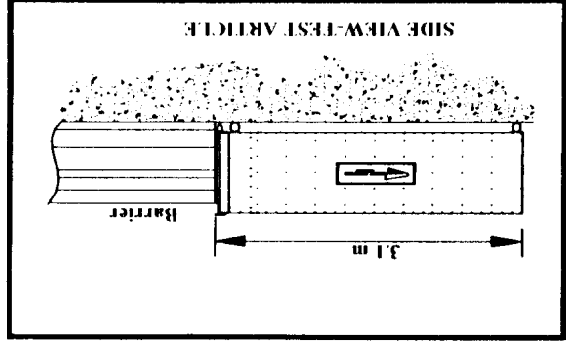
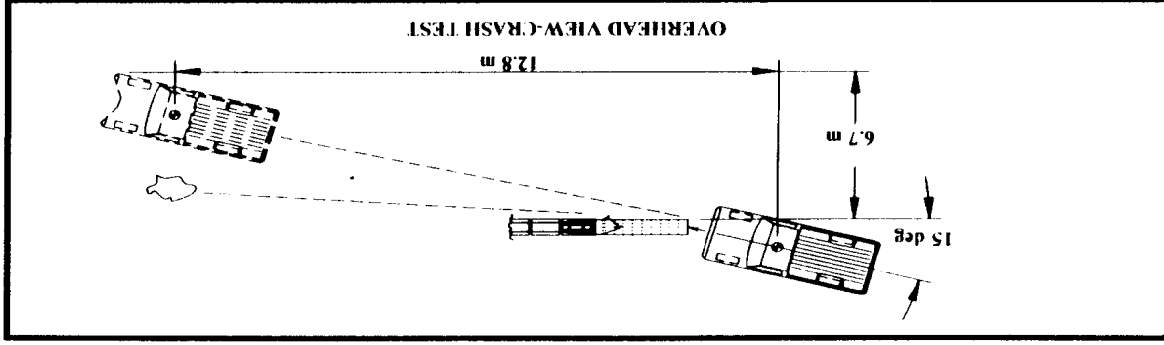
General Information.

Test No. 163-009
 Date 9/19/94
Test Article
 Type End Treatment
 Installation Length (m) 3.1
 Size and/or dimension and material
 of key elements 5052-H32 Aluminum
 Soil Type and Condition Clean, dry, pavement
Test Vehicle
 Type Production Model
 Designation 820C
 Model Ford
 Festiva
Mass - (kg)
 Curb 778
 Test inertial 807
 Dummy(s) 75
 Gross Static 882
Impact conditions
 Speed (km/h) 71.1
 Angle (deg) 15.5
 Impact Severity (kJ) 157.2

Exit conditions

Speed (km/h) N/A
 Angle (deg) N/A
Occupant Risk Values
 Impact Velocity (m/s)
 x-direction 10.1
 y-direction 1.8
 Ridedown Acceleration (g's)
 x-direction 10.9
 y-direction 5.2
 Acceleration Severity Index 1.2
Test Article Deflection (m)
 Dynamic (lat/long) 1.0/1.2
 Permanent (lat/long) 1.0/1.2
Vehicle Damage
 VDS FL-5
 CDC 11FYEW2
Post-Impact Vehicular Behavior
 Maximum Roll Angle (deg) 2.3
 Maximum Pitch Angle (deg) -2.6
 Maximum Yaw Angle (deg) -39.9

Figure 12. Summary of Results - N-E-A-T^{IM} Test 163-009
 NCHRP 350 Test 2-42



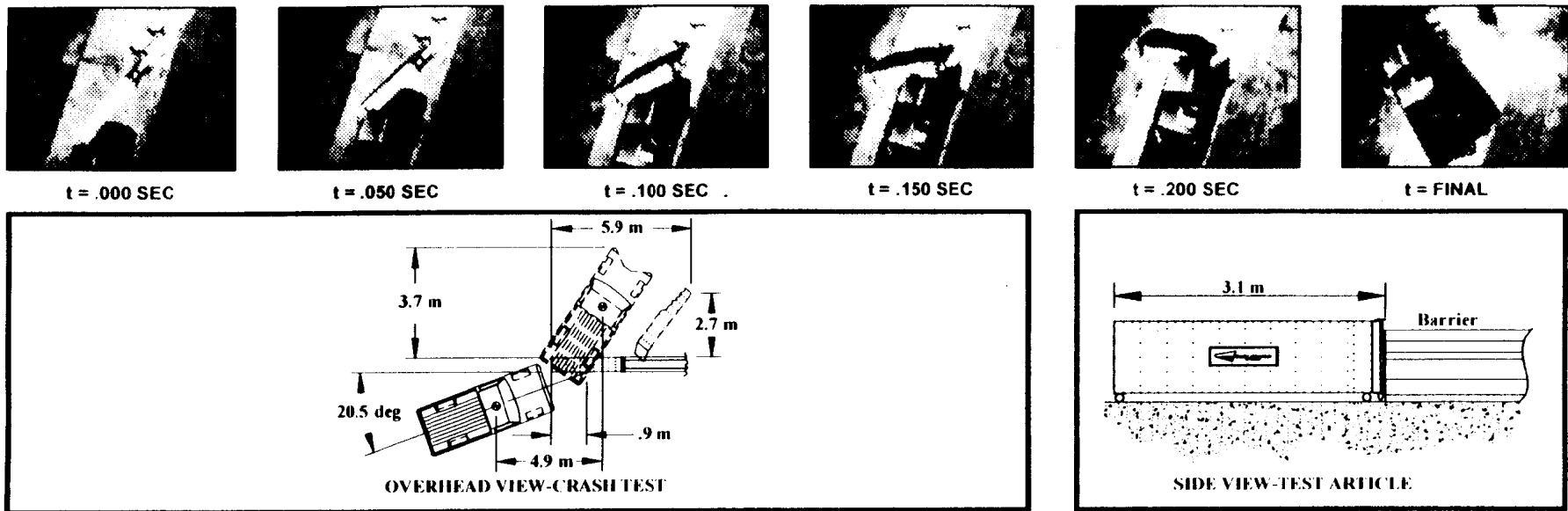
General Information.

Test No.	163-011
Date	9/29/94
Test Article	
Type	End Treatment
Installation Length (m)	3.1
Size and/or dimension and material of key elements	5052-H32 Aluminum
Soil Type and Condition	Clean, dry, pavement
Test Vehicle	
Type	Production Model
Designation	2000P
Model	Chevy
Mass - (kg)	3/4 Ton P/U
Curb	1990
Test inertial	1995
Dummy(s)	0
Gross Static	1995
Impact conditions	
Speed (km/h)	73.0
Angle (deg)	15
Impact Severity (kJ)	408.6

Exit conditions

Speed (km/h)	40.3 km/h
Angle (deg)	25 deg
Occupant Risk Values	
Impact Velocity (m/s)	8.0
x-direction	2.7
y-direction	7.4
Ridedown Acceleration (g's)	
x-direction	5.8
y-direction	7
Acceleration Severity Index	
Test Article Deflection (m)	8/4.3
Dynamic (lat/long)	8/4.3
Permanent (lat/long)	8/4.3
Vehicle Damage	
VDS	FD-6/FL-6
CDC	12FDEW2/11FLESS
Post-impact Vehicular Behavior	
Maximum Roll Angle (deg)	3.0
Maximum Pitch Angle (deg)	-2.1
Maximum Yaw Angle (deg)	-17.1

Figure 17. Summary of Results for N-E-A-T Test 163-011



General Information.

Test No. 163-012
 Date 10/21/94

Test Article

Type End Treatment
 Installation Length (m) 3.1
 Size and/or dimension and material
 of key elements 5052-H32 Aluminum

Soil Type and Condition Clean, dry, pavement

Test Vehicle

Type Production Model
 Designation 2000P
 Model Chevy
 3/4 Ton P/U

Mass - (kg)

Curb 1945
 Test inertial 1956
 Dummy(s) 0
 Gross Static 1956

Impact conditions

Speed (km/h) 72.0
 Angle (deg) 20.5
 Impact Severity (kJ) 391.2

Exit conditions

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

Occupant Risk Values

Impact Velocity (m/s)
 x-direction 9.4
 y-direction 1.4
 Ridedown Acceleration (g's)
 x-direction 28.7
 y-direction 12.5

Acceleration Severity Index 1.7

Test Article Deflection (m)

Dynamic (lat/long) 3.0/5.9
 Permanent (lat/long) 2.7/5.9

Vehicle Damage

VDS FC-6
 CDC 12FCEW2

Post-Impact Vehicular Behavior

Maximum Roll Angle (deg) -11.3 deg.
 Maximum Pitch Angle (deg) 11.7 deg.
 Maximum Yaw Angle (deg) -43.9 deg.

Figure 22. Summary of Results - N-E-A-TTM Test 163-012
 NCHRP 350 Test 2-44