August 27, 1998

Refer to: HNG-14

Mr. Kaddo Kothmann
President
Road Systems, Inc.
P.O. Box 2163
Big Spring, Texas 79721

Dear Mr. Kothmann:

In your July 23 letter to Mr. Henry H. Rentz, you requested the Federal Highway Administration's (FHWA) acceptance of your Flared Energy Absorbing Terminal (FLEAT) with the end offset reduced to 762 mm. My original acceptance letter, dated April 2, 1998, was based on a layout with a 1219 mm offset at the end of the terminal. To support your request, you sent us a copy of a July 15, 1998, test report prepared by the Midwest Roadside Safety Facility entitled "Full-Scale Crash Evaluation of a Flared Energy Absorbing Terminal (FLEAT-350) NCHRP TEST 3-31," a video tape of the test, and detailed drawings of the modified terminal layout.

Only one test was run to confirm the acceptability of the reduced offset and that was test 3-31, a 2000-kg pickup truck impacting the end head-on at 100 km/h. Test results are summarized in Enclosure 1. You stated that test 3-30, an 820-kg car impacting end-on, would be less severe with the reduced offset than the same test which was run successfully with the original 1219-mm offset because of the reduced eccentricity. You also stated that the side redirection tests (3-34 and 3-35) need not be repeated because the effective impact angles would be less with the reduced offset design than they were with the 1219-mm offset which, again, was successfully tested. Based on previous reverse-direction hits on similar terminal designs, test 3-39 was waived earlier for the FLEAT with the 1219-mm offset and was not believed to be needed for the reduced offset option either. The FHWA concurs with your analysis in each case.

Members of my staff have reviewed the information you presented and agree that the FLEAT is acceptable for use on the National Highway System as an NCHRP Report 350 terminal at test level 3 (TL-3) with the reduced offset of 762 mm. We note that the flare on the terminal remains a straight taper over its entire 11.4 m length and that standard line posts start at the beginning of this flare at post number 8. The layout is shown in Enclosure 2. Since the FLEAT is now considered acceptable with either a 762 mm or 1219 mm offset, it is reasonable to conclude that

any offset that falls between the two tested layouts would likewise be acceptable. For this reason, offsets for the intermediate posts are not shown. However, it is critical to the proper performance of the FLEAT that it be installed with a straight taper (not parabolic) that extends back to post number eight and that, as with all gating end treatments, a reasonably traversable runout area is available immediately behind and beyond the terminal.

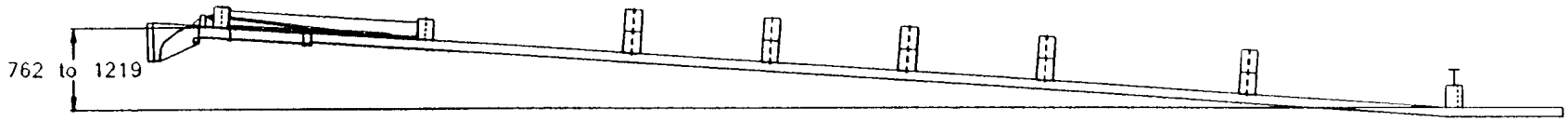
Any questions you may have should be addressed to Mr. Richard Powers at (202) 366-1320.

Sincerely yours,

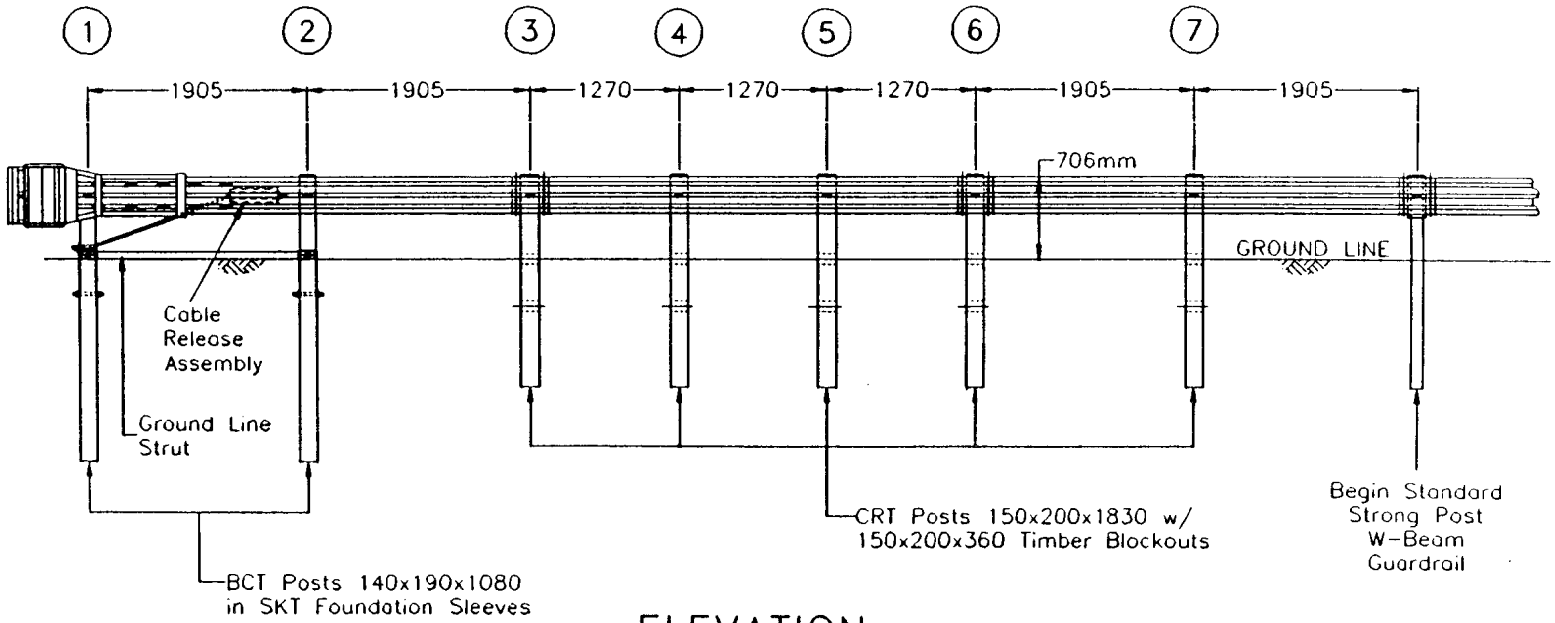
(original signed by Dwight A. Horne)

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

2 Enclosures
Acceptance Letter CC-46A



PLAN

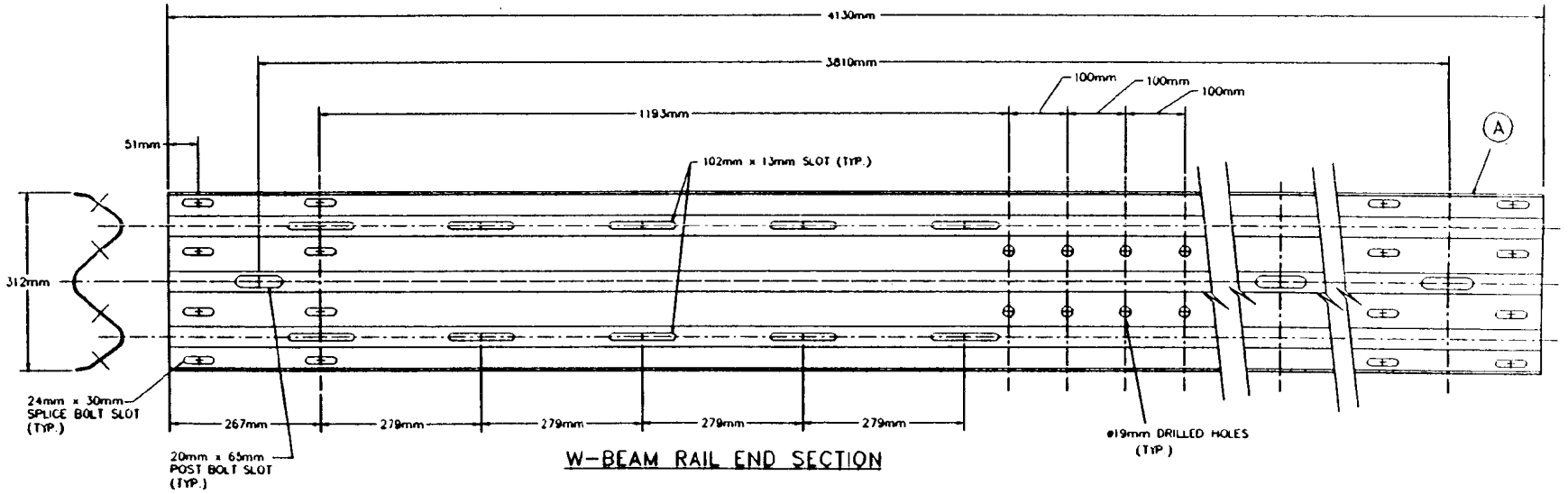


ELEVATION

FLARED ENERGY ABSORBING TERM
(FLEAT-350)

DRAWN BY	DATE	DWG. SET	PG
EAK	3/20/98	SYSTEM	
REVISION DATE	7/16/98	JRR	

ITEM NO.	QTY	DESCRIPTION	MATERIAL
A	1	RAIL END SECTION	12 GA W-BEAM



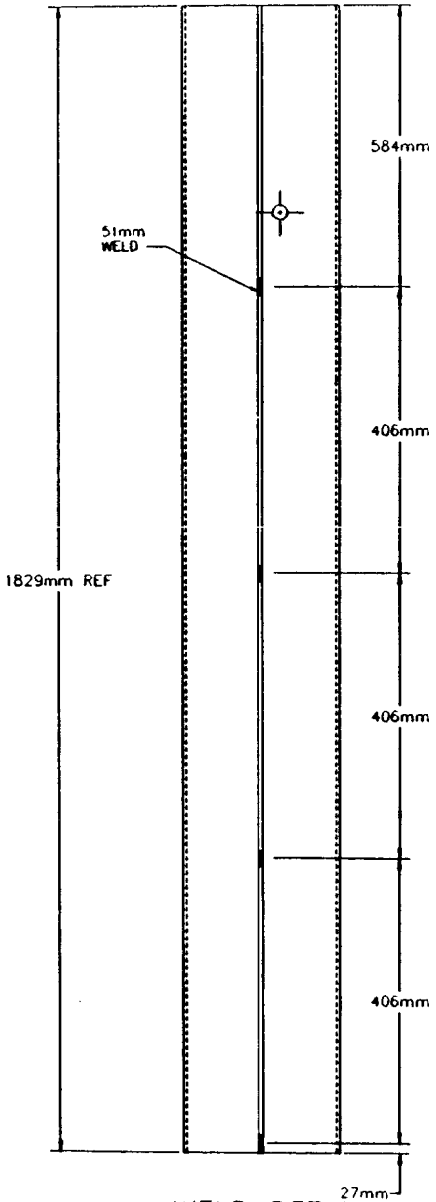
W-BEAM RAIL END SECTION

FLARED ENERGY ABSORBING TERM
(FLEAT-350)

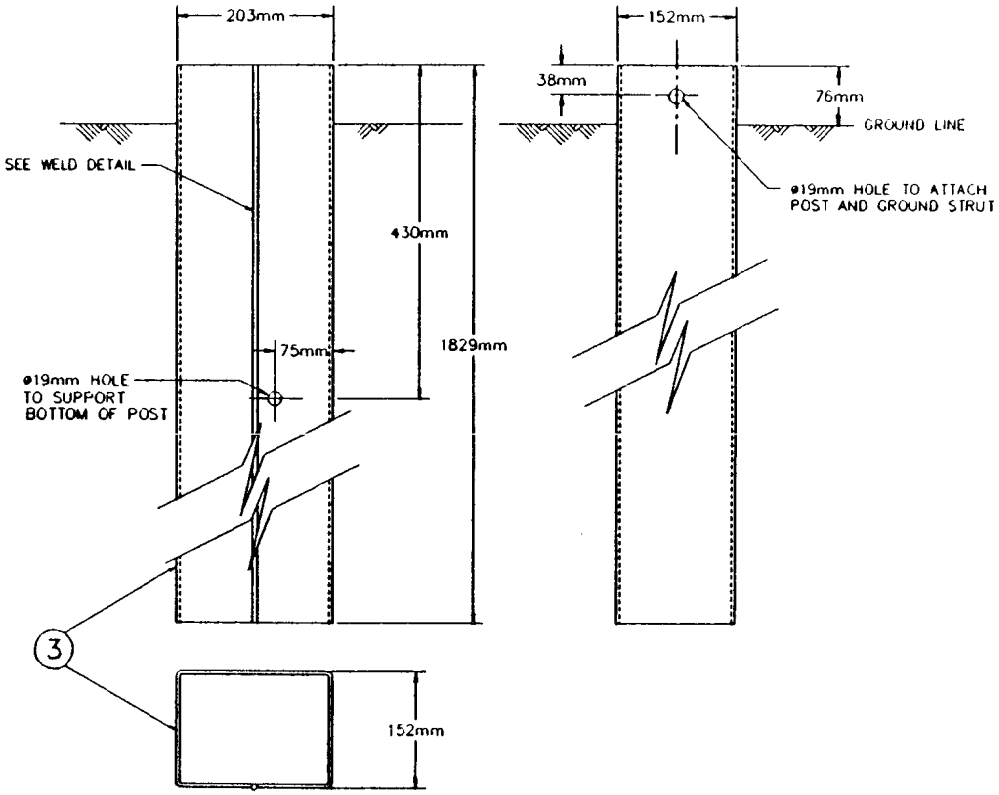
W-BEAM RAIL END SECTION

DRAWN BY	DATE	DWG. SET
JRR	3/20/98	SYSTEM
VERSION 1.1	DATE 7/10/98	

ITEM NO	QTY	DESCRIPTION	MATERIAL
3	2	FOUNDATION SLEEVE	50 ksi 3mm P



WELD DETAIL
NOT TO SCALE



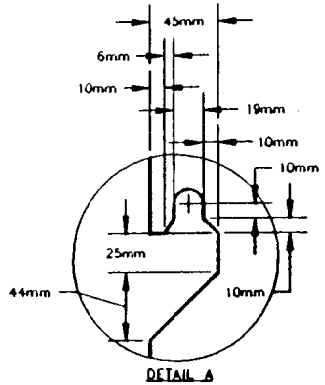
FOUNDATION SLEEVE

FLARED ENERGY ABSORBING TERM
(FLEAT-350)

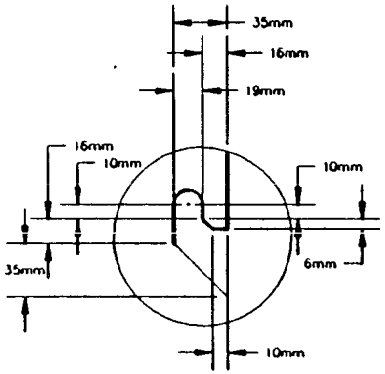
FOUNDATION SLEEVE

DRAWN BY	DATE	DWG SET	PG
EAK/JRR	3/20/98	SYSTEM	3
VERSION 1	DATE 7/10/98		

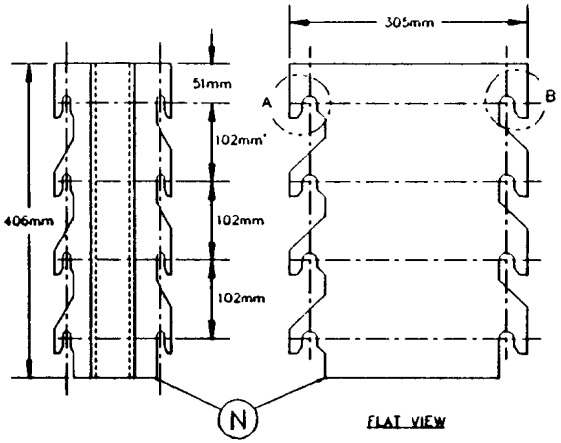
ITEM NO	QTY	DESCRIPTION	MATERIAL
N	1	CABLE RELEASE BRACKET	A36 3mm PLATE
O	1	CABLE RELEASE PLATE	A36 13mm PLATE
P	8	QUICK RELEASE BOLTS	A325
Q	1	GROUND STRUT	54mm x 54mm x 14 GA T
R	2	YOKES	A36 5mm PLATE



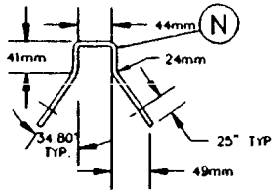
DETAIL A
TYPICAL 4 PLACES



DETAIL B
TYPICAL 4 PLACES

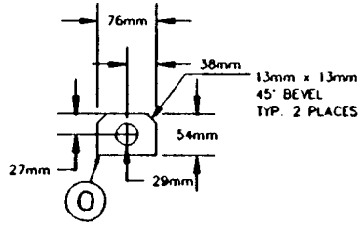


FLAT VIEW



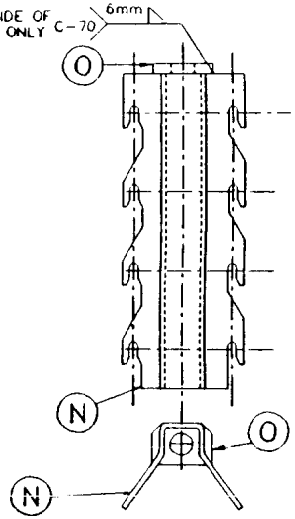
FORMED VIEW

CABLE RELEASE BRACKET

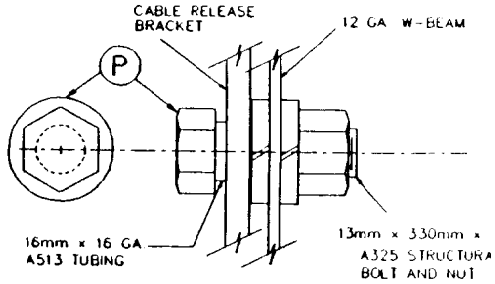


CABLE RELEASE PLATE

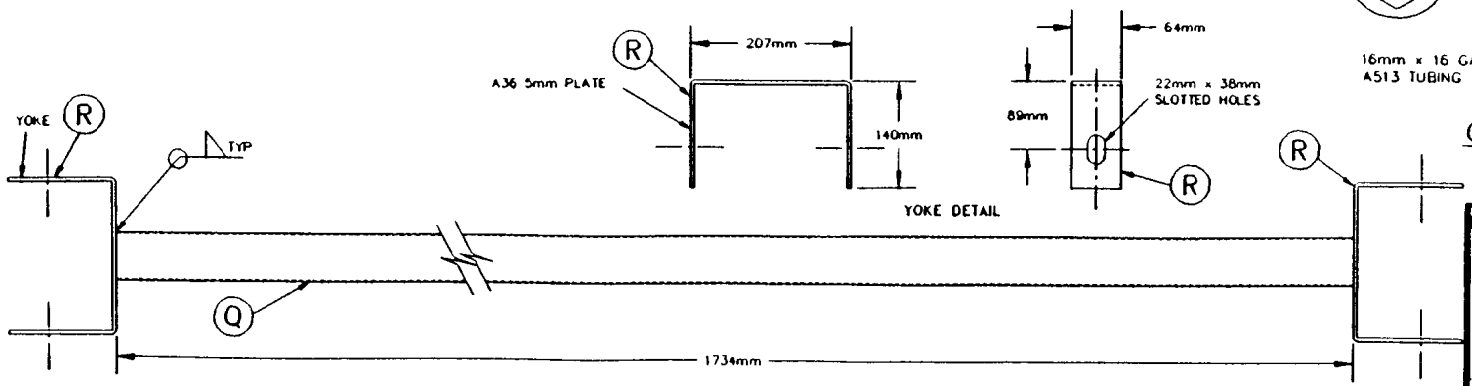
NOTE: WELD INSIDE OF BRACKET ONLY C-70



CABLE RELEASE ASSEMBLY



QUICK RELEASE BOLT



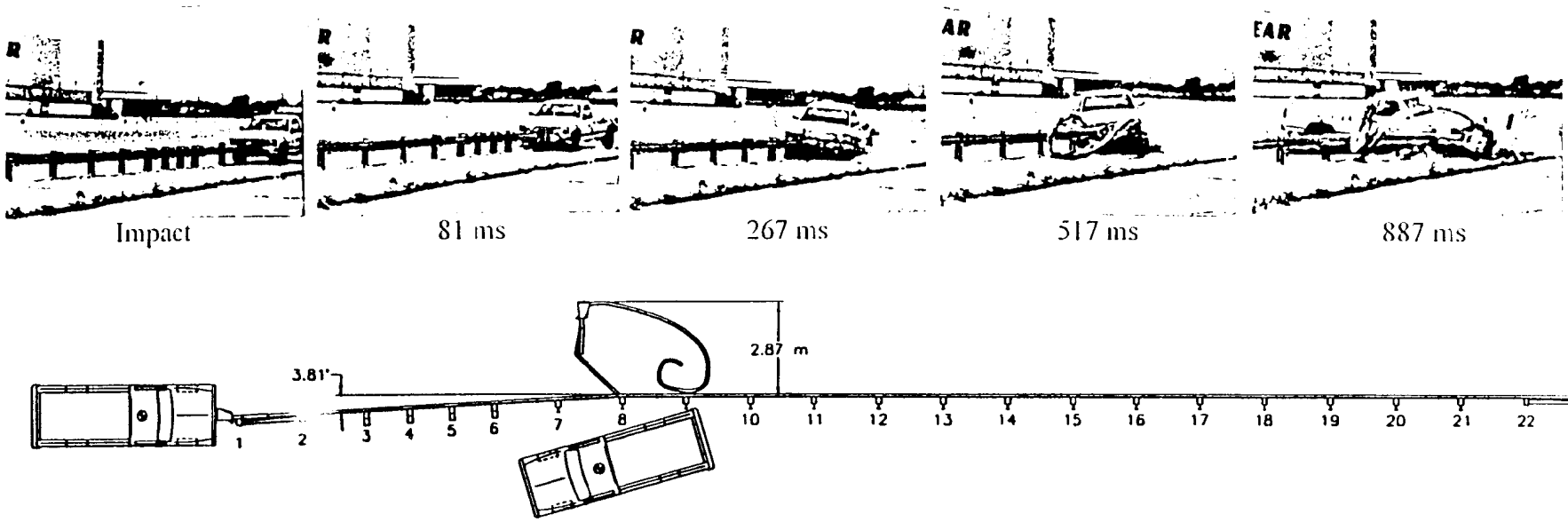
YOKE DETAIL

GROUND STRUT ASSEMBLY

FLARED ENERGY ABSORBING TERI
(FLEAT-350)
CABLE RELEASE BRACKET
CABLE RELEASE PLATE
SLEEVED BOLT
GROUND STRUT
YOKES

DRAWN BY	DATE	DWG. SET	PG.
EAK/JRR	3/20/98	SYSTEM	4

VERSION 1 DATE 7/10/98



Test Number	FLEAT-3
NCHRP 350 Test Designation	3-31
Date	6/26/98
Installation	**FL**ared Energy Absorbing Terminal
System length	40.0 m
Head Dimensions (LxWxH)	1557 mm x 356 mm x 490 mm
Face Angle	6.0 degrees
Flare Details	
Length	11.43 m
Offset	0.61 m
Angle	3.81 degrees
Guardrail	12-gauge W-beam
End Terminal Posts	
Numbers 1-2	BCT timber posts 140x190x1080 long in foundation tubes with groundline strut
Numbers 3-6	CRT timber posts 150x200x1830 long
Numbers 7-8	W150x13.5 steel posts, 1830 long
Vehicle Model	1992 Chevy 2500 ¾-Ton Pickup
Vehicle Weight	
Curb	1885 kg
Test Inertia	1996 kg
Gross Static	1996 kg

Speed	
Impact	100.43 km/h
Exit	N.A.
Angle	
Impact	0 deg
Exit	N.A.
Occupant Impact Velocity	
Longitudinal	6.16 m/s
Lateral	0.157 m/s
Occupant Ridedown Deceleration	
Longitudinal	7.0 g's
Lateral	6.7 g's
Vehicle Damage	
TAD	12-FC-2, 3-RP-1
VDI	12FCLN2, 03RPEN1
Vehicle Rebound Distance	N.A.

Conversion Factors: 1 in.= 2.54 cm; 1 lb= 0.454 kg

Figure 10. Summary of Test FLEAT-3.