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DOT4064

REPORT NO. 301-NTW-83-007-271-6096-7

"COMPOSITE FY83"
FMVSS 301-75
VEHICLE SAFETY COMPLIANCE TESTING
FOR
FUEL SYSTEM INTEGRITY

TOYO KOGYO COMPANY, LTD.
1983 MAZDA B2200 - PICKUP
NHTSA CD0616

NATIONAL TECHNICAL SYSTEMS
1536 EAST VALENCIA DRIVE
FULLERTON, CALIFORNIA 92631-4797

APPROVED: Tom Grubbs
TOM GRUBBS
CONTRACT TECHNICAL MANAGER
FMVSS 204/205/212/301
DATE: DEC 08 1983

NOVEMBER 1983

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
- ENFORCEMENT -
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET S. W.
WASHINGTON, D. C. 20590

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Prepared by D. W. Hamilton

Approved by S. J. Schuyler

Date 30 November 1983

Report Accepted by:

TOM GRUBBS

Contract Technical Manager
Office of Vehicle Safety Compliance

DEC 08 1983

Date

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
301-NTW-83-007		

4. Title and Subtitle	5. Report Date
Final Report of FMVSS 301-75 Vehicle Safety Compliance Testing for Fuel System Integrity on a 1983 Mazda B2200 - Pickup - NHTSA CD0616	11 November 1983
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Don Hand - Project Engineer	271-6096-7

9. Performing Organization Name and Address	10. Work Unit. No.
National Technical Systems 1536 East Valencia Drive Fullerton, California 92631 Phone No.: (714) 879-6110	11. Contract or Grant No. DTNH22-82-D-31140

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U. S. Department of Transportation National Highway Traffic Safety Admin. Enforcement Office of Vehicle Safety Compliance 400 Seventh Street S. W. Washington, D. C. 20590	Final Report May 9 - May 17, 1983
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

FMVSS 301-75 Vehicle Safety Compliance Testing on a 1983 Mazda B2200 - Pickup, NHTSA CD0616, VIN-JM2UD2214D0700323 was conducted at National Technical Systems test facility in Fullerton, California, to determine compliance with the requirements of FMVSS 301-75.

The average moving barrier impact speed was 29.46 mph in the rear (180°) mode. Test date was May 17, 1983, and the ambient temperature was 93°F.

The subject test vehicle appears to comply with all the requirements of FMVSS 301-75.

17. Key Words	18. Distribution Statement
FMVSS 301-75, "Fuel System Integrity"	

19. Security Class. (of this report)	20. Security Class. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	85	

METRIC CONVERSION FACTORS

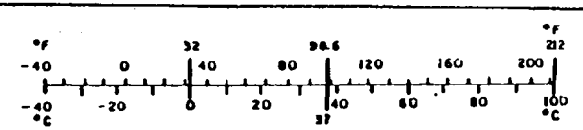
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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NTS

TABLES

ILLUSTRATIONS

ILLUSTRATIONS
(continued)

NTS

SECTION 1

1.0 INTRODUCTION

This report contains information regarding the preparation for and the conduct of a "Composite FY83" vehicle Fuel System Integrity Test relative to Federal Motor Vehicle Safety Standard (FMVSS) No. 301-75. This test was performed under Contract Number DTNH22-82-D-31140 by National Technical Systems, 1536 East Valencia Drive, Fullerton, California, in accordance with the Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures (TP219-02).

The specific purpose of this test was to check the performance of a 1983 Mazda B2200 - Pickup, NHTSA CD0616 to the requirements of FMVSS 301-75, along with vehicle crush and delta -V measurement data relative to accident reconstruction.

Section 2 contains all compliance related data, while Section 3 contains vehicle damage summary data, along with delta -V measurement data. Section 4 discusses NTS's test facilities and data acquisition and reduction system.

SECTION 1

1.1 ADMINISTRATIVE DATA

A. References

1. Federal Motor Vehicle Safety Standard 301-75 - "Fuel System Integrity," as published in the Federal Register, Volume 40, No. 48352, dated 15 October 1975.

2. National Highway Traffic Safety Administration, Office of Vehicle Safety Compliance Laboratory Procedures "Windshield Mounting" FMVSS 212 - "Windshield Zone Intrusion" FMVSS 219 - "Fuel System Integrity" FMVSS 301-75, TP219-02, dated 9 January 1979.

NTS

SECTION 1

B. Description of Test Vehicle

1. 1983 Mazda B2200 - Pickup
2. Vehicle Identification No. JM2UD2214D0700323
3. NHTSA No.: CD0616
4. Manufactured Date: July 1982
5. GVWR: 4,255 pounds

C. Dates

1. Vehicle Received: November 5, 1982
2. Start of Test: May 9, 1983
3. Completion of Test: May 17, 1983

SECTION 2

2.0 COMPLIANCE TEST DATA

The 1983 Mazda B2200 - Pickup was subjected to a rear moving barrier impact and a static rollover maneuver as required by Federal Motor Vehicle Safety Standard (FMVSS) 301-75.

Color motion picture coverage of the impact, along with the static rollover test are considered part of the accumulated pertinent data. Where applicable, still photographs are presented in this report; while the motion picture coverage is submitted separately.

TABLE I

SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION:

Manufacturer: Toyo Kogyo Company, LTD.

Make/Model: Mazda B2200

Body Style: Pickup Model Year: 1983

VIN: JM2UD2214D0700323 Build Date: July 1982

NHTSA No.: CD0616 Color: Ivory

Engine Date: Four (4) Cylinders; 134.8 Cu. In. Displ.

Transmission Data: Five (5) Speed (X) Manual ( ) Automatic

Major Options: Diesel Engine

VEHICLE ATTITUDE:

Delivered Attitude: LF 27.9 in.; RF 28.4 in.; LR 27.9 in.; RR 29.2 in.

LF 26.9 in.; RF 27.6 in.; LR 26.5 in.; RR 26.9 in.

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 26 psi

(Up to Vehicle Load Capacity) Rear = 34 psi

Recommended Tire Size: P205/75R14 Load Range: 1532 @ 35 psi

Tires of Vehicle: P205/75R14 - Bridgestone

Spare Tire: X Yes; ____ No; Space Saver: ____ Yes; X No

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: May 17, 1983 Time of Test: 1345

Ambient Temperature: 93 °F at Impact Area

VEHICLE CAPACITY:

Type of Seats: X Bench; _____ Bucket; _____ Split Bench

Designated Seating Capacity: Front 3
Center 0
Rear 0
Total 3

Cargo: unknown lbs.

Total unknown lbs. (Vehicle Capacity Weight)

GVWR: 4,255 lbs. (Taken From Certification Label)

GAWR: Front 2,000 lbs.; Rear 2,540 lbs.

VEHICLE DELIVERED WEIGHT: (Fuel - 93% of NFC)

Left Front 875 lbs. Left Rear 607 lbs.
Right Front 768 lbs. Right Rear 559 lbs.
Total Front Weight 1,643 lbs. (58.5 % of Total Vehicle Weight)
Total Rear Weight 1,166 lbs. (41.5 % of Total Vehicle Weight)
Total Delivered Weight 2,809 lbs.

CALCULATED VEHICLE TEST WEIGHT: 3,437 lbs.
(With Required Dummies and 300 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front 961 lbs. Left Rear 806 lbs.
Right Front 848 lbs. Right Rear 821 lbs.
Total Front Weight 1,809 lbs. (52.6 % of Total Vehicle Weight)
Total Rear Weight 1,627 lbs. (47.4 % of Total Vehicle Weight)
Total Test Weight 3,436 lbs.
Weight of Ballast Secured in Vehicle Cargo Area 298 lbs.

TABLE Ib

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent ; Specific Gravity: 0.764

Kinematic Viscosity: 1.31

Nominal Fuel Capacity: 17.44 gals. (NFC)

Test Volume: 16.22 gals. (92-94% of NFC)

Fuel System Capacity: 17.40 gals.
(Data from Owner's Manual)

Electric Fuel Pump: X Yes; ____ No; Fuel Injection: X Yes; ____ No

Does Electric Fuel Pump Operate with Ignition Switch "On"

And the Engine Not Operating: ____ Yes; X No; ____ N/A

Details of Fuel System: Fuel filler located on left cargo box wall forward of wheel opening recessed behind a hinged door, fuel tank located longitudinally inside left frame rail forward of rear axel under cargo floor pan.

VEHICLE TEST CONDITIONS:

Temperature in Occupant Compartment: N/A °F

Temperature of Windshield Glazing/Moulding: N/A °F

VEHICLE CRUSH AND REBOUND:

Overall Length of Test Vehicle: Pre-Test - Left 186.1 in.; Right 186.1 in.

Post-Test - Left 173.5 in.; Right 173.4 in.

Crush: Left 12.6 in.; Right 12.7 in.

Rebound (From Rigid Barrier Only): N/A in.

TABLE III

POST IMPACT SUMMARY

Vehicle 1983 Mazda B2200

NHTSA No. CD0616 Test Date May 17, 1983

TYPE OF TEST: [ ] 0° Frontal Impact

[ ] 30° Oblique Impact (Driver/Passenger) Side

[XXX] Rear Impact

REQUIRED IMPACT VELOCITY RANGE: 28.9 to 29.9 mph

IMPACT VELOCITY: (Traps within 5 feet of impact event)

Trap 1 = 29.46 mph

Trap 2 = 29.46 mph

Average 29.46 mph

Actual distance from vehicle rear bumper to barrier face when entering timing trap 54.5 in.

Actual distance from vehicle rear bumper to barrier face when exiting timing trap 30.5 in.

VEHICLE STATIC CRUSH: Driver's Side = 12.6 inches

Passenger's Side = 12.7 inches

Average = 12.65 inches

Crush Details: Right rear tire flat, both frame rails buckled, both doors jammed, rear cab window ejected, roof buckled over both "B" posts.

VEHICLE REBOUND: (From rigid barrier only)

Driver's Side = N/A inches

Passenger's Side = N/A inches

Average = N/A inches

TABLE VI

POST IMPACT SUMMARY

FUEL SYSTEM INTEGRITY - FMVSS 301-75

Vehicle 1983 Mazda B2200

NHTSA No. CD0616 Test Date May 17, 1983

	Actual	Max. Allow.
Fuel spillage from impact until vehicle motion ceases.	- 0 -	1 ounce
Fuel spillage for 5 minute period following cessation of vehicle motion after impact.	- 0 -	5 ounces
Fuel spillage for next 25 minute period.	- 0 -	1 ounce/ 1 minute
Time duration from impact until start of rollover test periods.	20 minutes	30 minutes

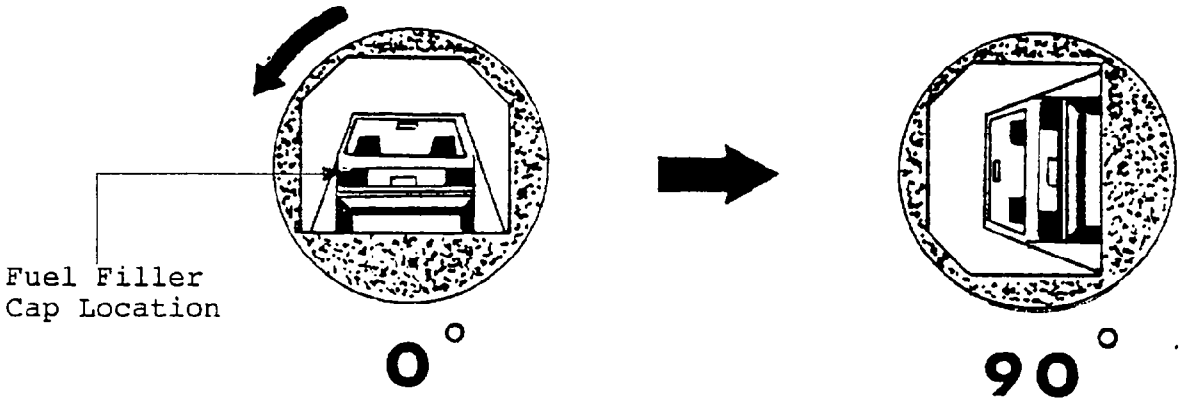
Fuel Spillage Location: Not Applicable

TABLE VII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1983 Mazda B2200 NHTSA No. CD0616



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 13 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

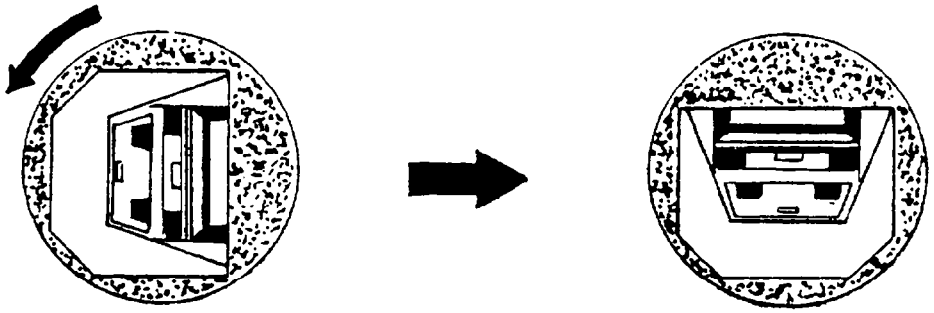
Fuel Spillage Location: Not Applicable

TABLE VIII

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1983 Mazda B2200 NHTSA No. CD0616



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 16 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

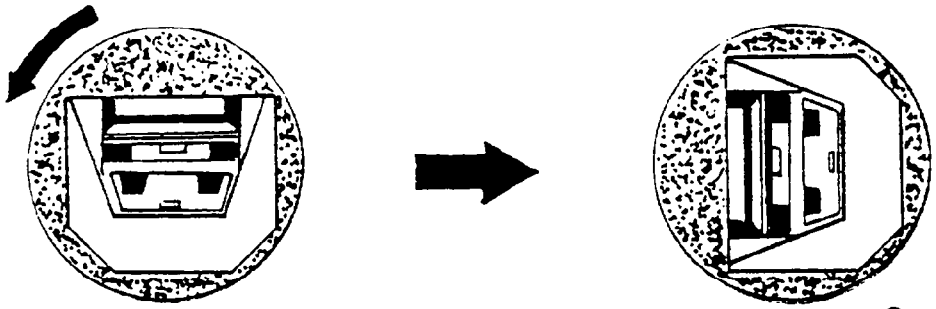
Fuel Spillage Location: Not Applicable

TABLE IX

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1983 Mazda B2200 NHTSA No. CD0616



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 14 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

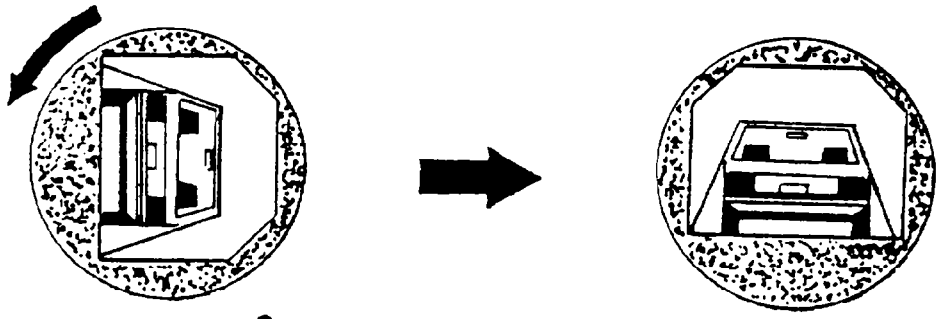
Fuel Spillage Location: Not Applicable

TABLE X

FUEL SYSTEM INTEGRITY - FMVSS 301-75

STATIC ROLLOVER

Vehicle 1983 Mazda B2200 NHTSA No. CD0616



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 10 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable

SECTION 2

2.1 GENERAL TEST INFORMATION

The 1983 Mazda B2200 - Pickup was subjected to a rear moving barrier impact along with a static rollover test in accordance with the procedures referenced in Section 1 of this report under Administrative Data. The results presented here relate specifically to vehicle performance under Federal Motor Vehicle Safety Standard (FMVSS) 301-75 - "Fuel System Integrity"

The test was conducted essentially in accordance with NHTSA Office of Vehicle Safety Compliance Laboratory Procedures. The critical parameters were impact velocity and the fuel spillage criteria defined in FMVSS 301-75, paragraphs S5.5 and S5.6.

Impact velocity for the moving collision barrier impact was regulated by the fixed tow propulsion system and certified by the redundant timing traps described in Section 4.

The test vehicle "rated cargo and luggage weight" (RCLW) was not used as calculated, in lieu, the 300 pound (lesser) cargo ballast was utilized in determining the ultimate calculated vehicle test weight.

2.2 TEST RESULTS

Post-impact inspection of the test vehicle revealed almost all crush occurred rearward of the cab doors. The cargo box impacted the cab deforming both the left and right "B" post and both cab doors were jammed. The left and right frame rail buckled over the rear axel and forward of the rear spring front mounting. The seat back and cab wall were deformed and the cab rear window ejected (unbroken). The roof buckled over the left and right "B" post and the right rear tire was flat. The spare tire (under cargo floor) remained inflated.

No fuel spillage was recorded following the test vehicle impact, nor during the time period before the start of the rollover test. No fuel spillage was recorded during the rollover test increment time periods.

The 1983 Mazda B2200 - Pickup test vehicle appears to comply with all the requirements of FMVSS 301-75.

Figure 2-1

1983 Mazda B2200 - Pickup

NHTSA CD0616

Pre-Test, Left Side View


NHTSACD0616
FMVSS 301

Figure 2-2

1983 Mazda B2200 - Pickup

NHTSA CD0616

Pre-Test, Full Rear View


mazda
DIESEL ENGINE

Figure 2-3

1983 Mazda B2200 - Pickup

NHTSA CD0616

Pre-Test, Right Side View


NHTSA CD0616
NTS
FMVSS 301

Figure 2-4

1983 Mazda B2200 - Pickup

NHTSA CD0616

Post-Impact, Left Side View


NTS
NHTSA CD0616
FMVSS 301
mazda

Figure 2-5

1983 Mazda B2200 - Pickup

NHTSA CD0616

Post-Impact, Full Rear View


mazda
DIESEL ENGINE

Figure 2-6

1983 Mazda B2200 - Pickup

NHTSA CD0616

Post-Impact, Right Side View


NHTSA CDO 6
FMVSS 301
NTS

Figure 2-7

1983 Mazda B2200 - Pickup

NHTSA CD0616

Post-Impact, Rollover Test, 90° Increment

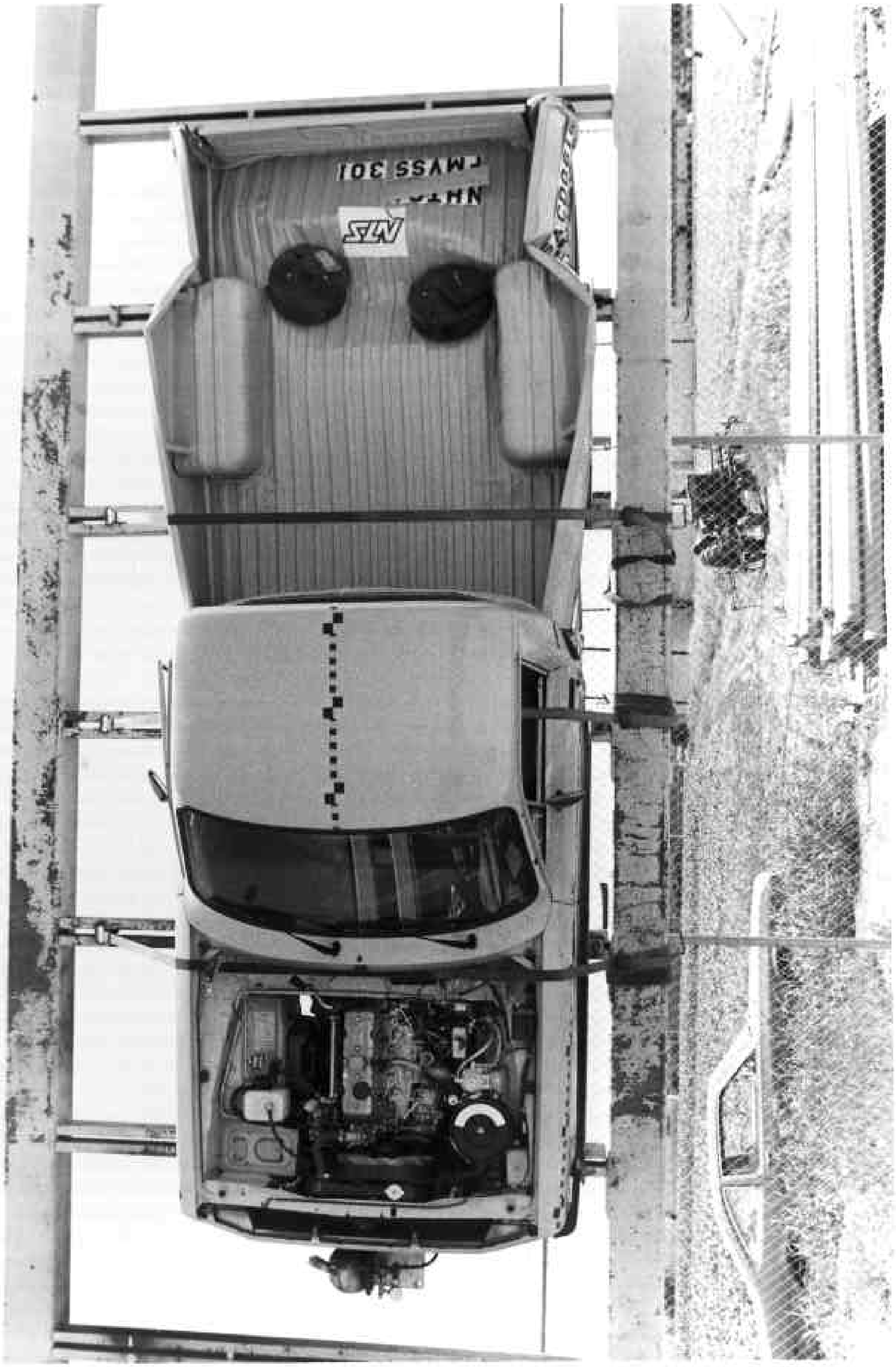
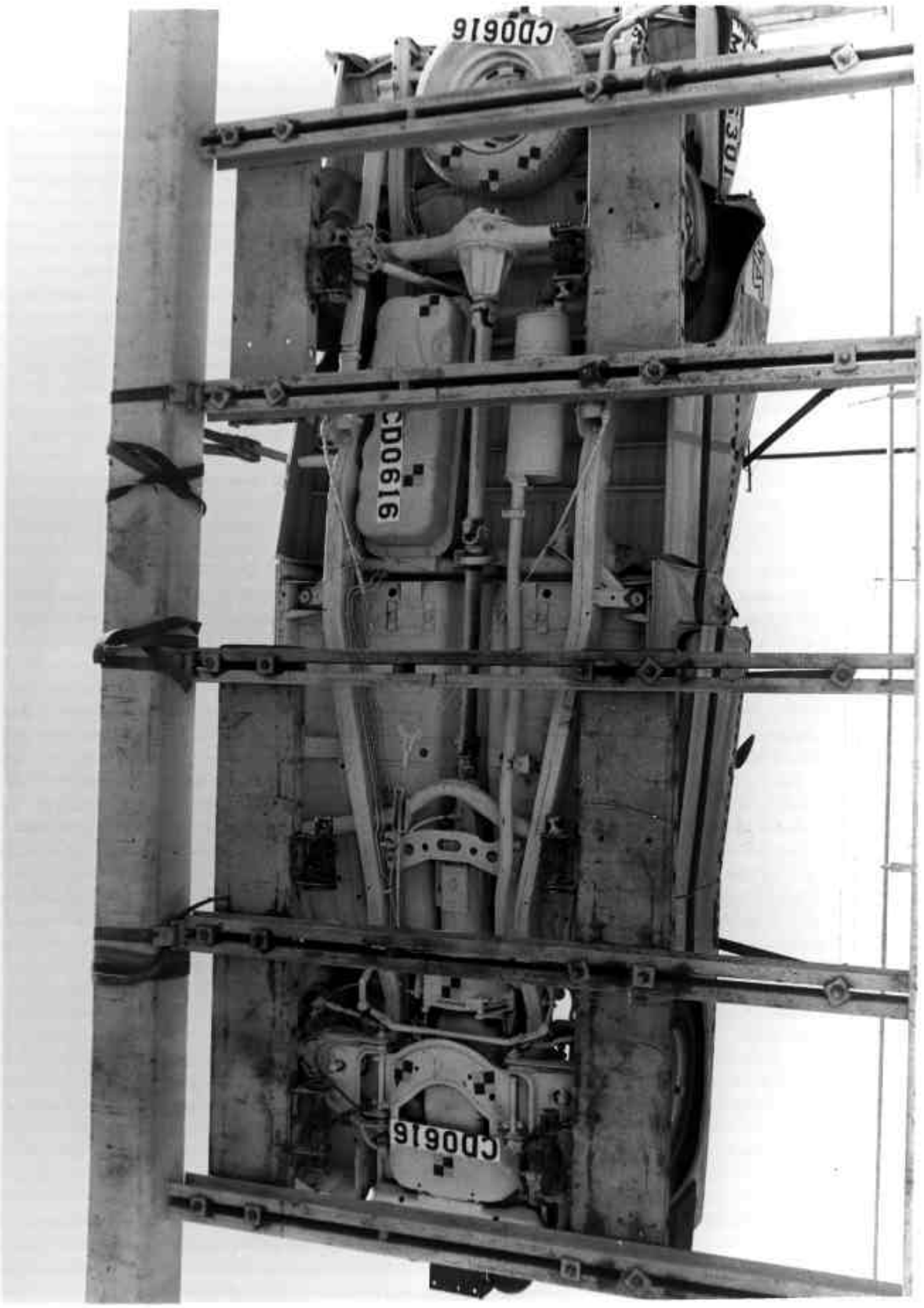

FMVSS 301
NTS

Figure 2-8

1983 Mazda B2200 - Pickup

NHTSA CD0616

Post-Impact, Rollover Test, 270° Increment


CD0616
CD0616
CD0616

SECTION 3

3.0 VEHICLE COLLISION AND DAMAGE DATA

This section contains residual crush and delta -V's along with other related data.

The following damage dimensions examples depict locations used to generate end damage depth profiles as defined in CRASH 2 User's Manual and are presented on the Staged Collision and Damage Data Sheet under Damage Profile: (Bumper/Frame Level) measurements. This desired measurement is the deflection (inches) into the test vehicle interior from the original, undeformed end dimension.

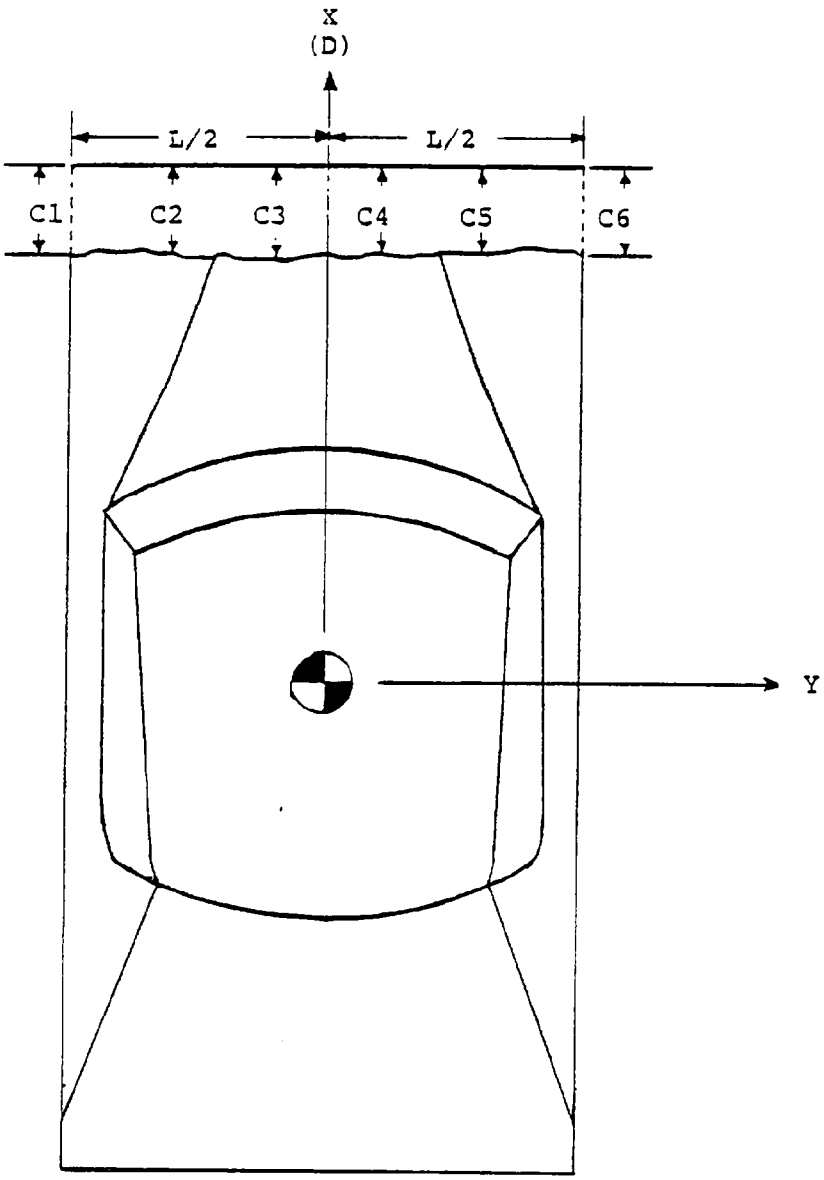
FIGURE 3-1

EXAMPLE

OF

DAMAGE DIMENSIONS

FRONTAL IMPACT



NOTE: D = distance between mid-point of L and X axis.

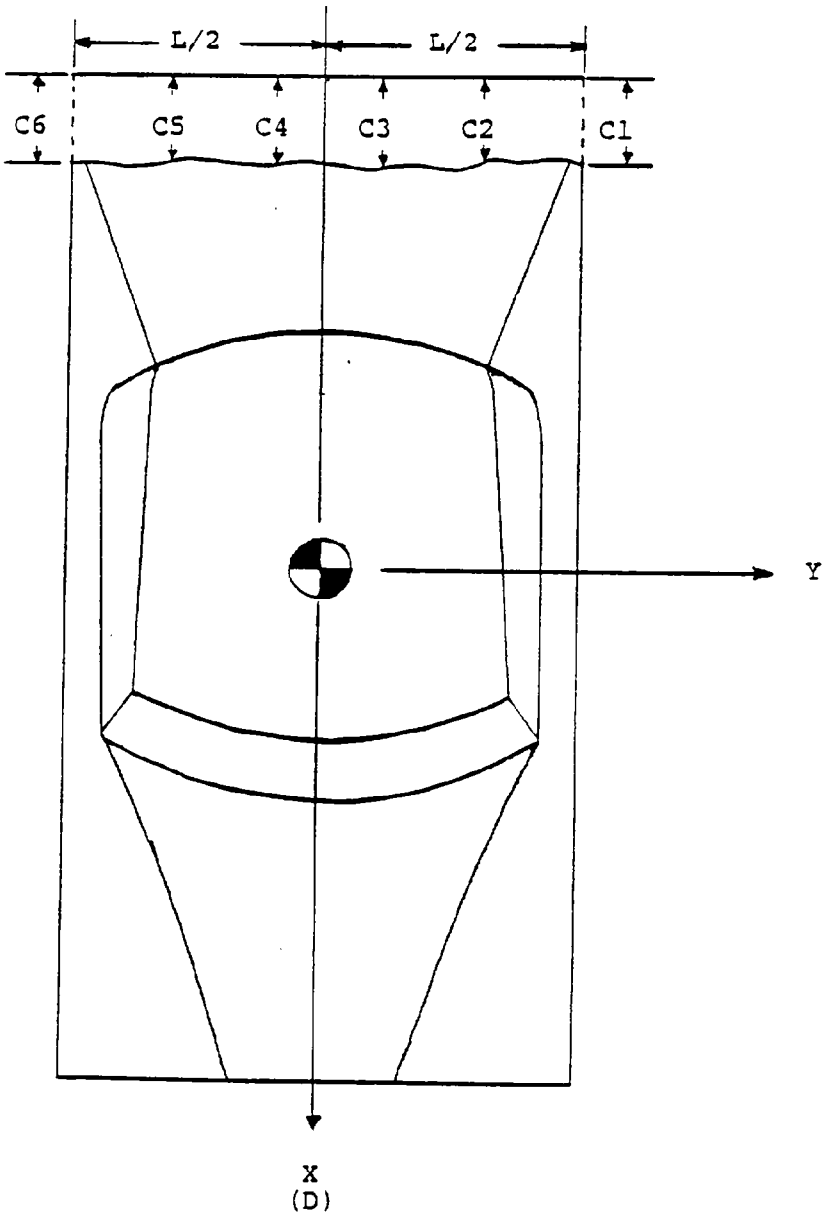
FIGURE 3-2

EXAMPLE

OF

DAMAGE DIMENSIONS

REAR IMPACT



NOTE: D = distance between mid-point of L and X axis.

TABLE 3-1

TEST SUMMARY

STAGED COLLISION AND DAMAGE DATA

Impact Configuration Moving Barrier Into Vehicle

Vehicle Model Year 1983

Vehicle Make Mazda

Vehicle Model B2200 - Pickup

Vehicle Size Category Light Truck

Vehicle Test Weight 3,436 lbs.

Impact Speed 00.00 mph

Speed Change 15.28 mph

Principal Direction of Force 180 deg.

Initial Contact Tail Gate

Damage Profile: (Bumper/Frame Level)

L = 61.8 in.

D = - 0 - in.

C1 = 12.6 in.

C2 = 12.1 in.

C3 = 12.3 in.

C4 = 12.3 in.

C5 = 12.2 in.

C6 = 12.7 in.

Vehicle Information:

Width 64.0 in.

Wheelbase 112.5 in.

Overhang-Front 30.3 in.

Overhang-Rear 46.1 in.

Collision Deformation Classification 06BDEW2

Center of Gravity (Accel.) Location ℄ 53.3" Behind Front Axle

Moving Barrier Model FMVSS 208

Moving Barrier Weight 3,987 lbs.

Impact Speed 29.46 mph

Speed Change 13.04 mph

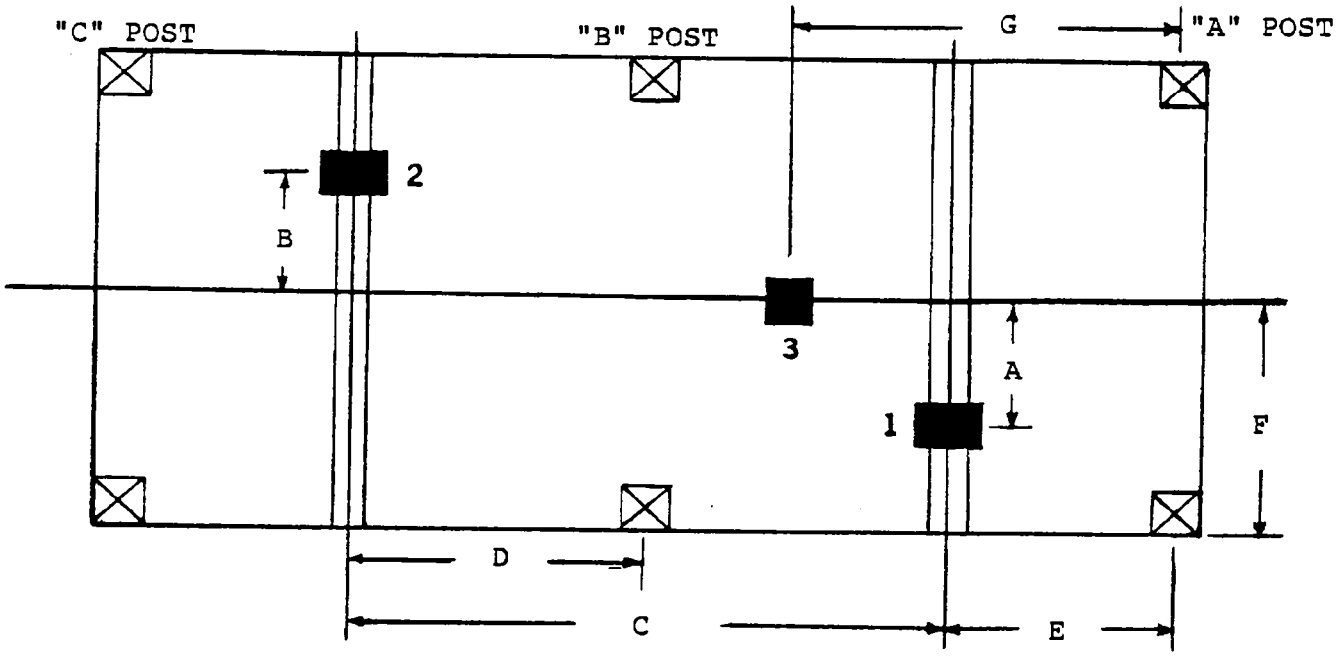
Center of Gravity (Accel.) Location ℄ 16.0" Front of Front Axle

Test Track Dry Concrete

TABLE 3-2

VEHICLE STRUCTURAL DATA

VEHICLE 1983 Mazda B2200 NHTSA NO. CD0616



DIMENSIONS			
LOCATION	MEASUREMENT (IN.)	LOCATION	MEASUREMENT (IN.)
A	N/A	E	N/A
B	N/A	F	32.0
C	N/A	G	27.9
D	N/A		

ACCELERATION PEAKS				
ACCELEROMETER LOCATION	POSITIVE* DIRECTION		NEGATIVE* DIRECTION	
	PEAK "G"	TIME (MSEC)	PEAK "G"	TIME (MSEC)
NO. 1 LONGITUDINAL	N/A	N/A	N/A	N/A
NO. 2 LONGITUDINAL	N/A	N/A	N/A	N/A
NO. 3 LONGITUDINAL	44.8	19.0	10.1	30.0

*POSITIVE - LONGITUDINAL: FORWARD DIRECTION

*NEGATIVE - LONGITUDINAL: REARWARD DIRECTION

DOT CRASH PROGRAM National Technical Systems

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

IMPACT SPEEDS

VEHICLE: 00.00 MPH
BARRIER: 29.46 MPH

DELTA VELOCITIES (AT TIME OF VEHICLE/BARRIER SEPARATION)

BARRIER LONGITUDINAL: 13.04 MPH

VEH. CG LONGITUDINAL: 15.28 MPH
LR FLOORPAN LONG: 0 MPH
RF FLOORPAN LONG: 0 MPH

PLOT DATA

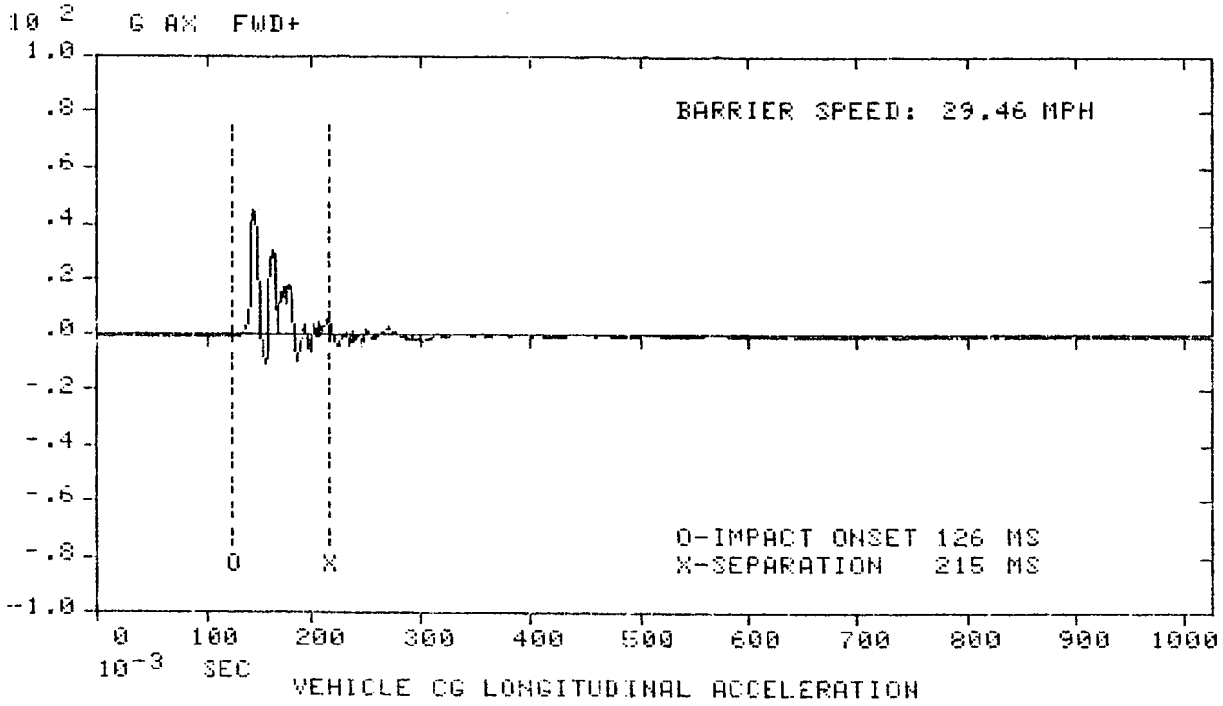
IMPACT OCCURED AT: 126 MS
SEPARATION OCCURED AT: 215 MS

DOT CRASH PROGRAM

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

NTS STRUCTURAL DYNAMICS LABORATORY

MJO NO: 271-6096-7
FILTER: CLASS 60

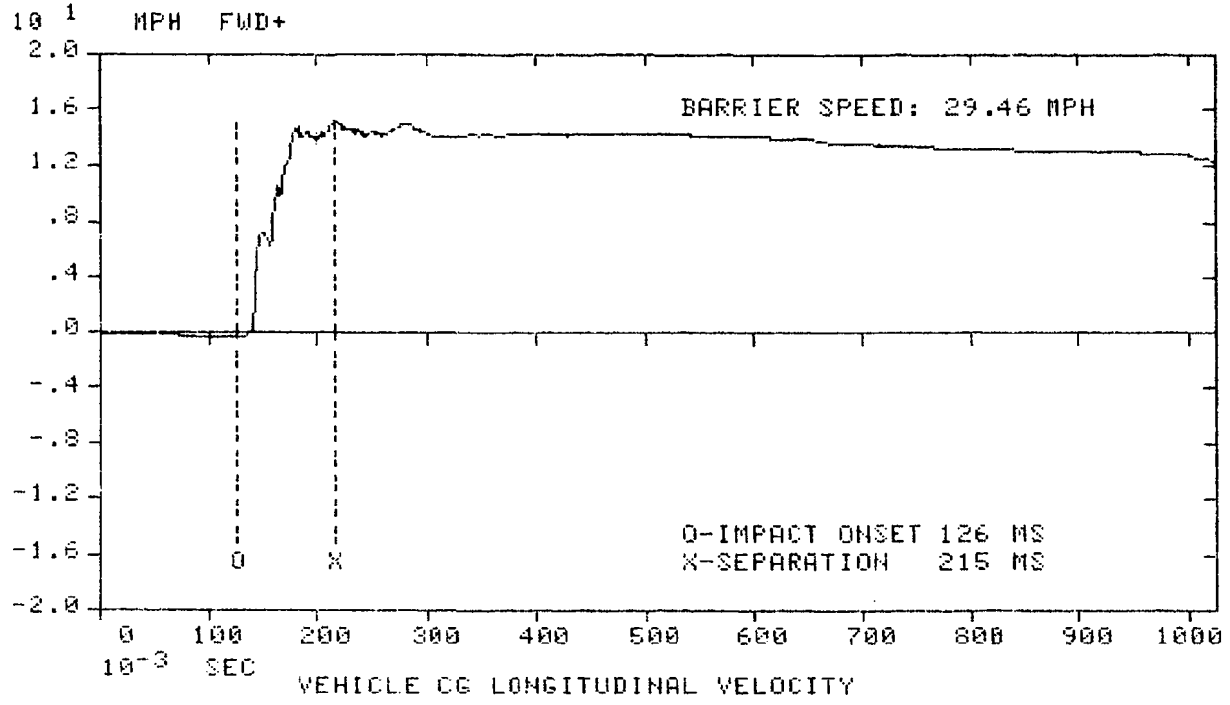


DOT CRASH PROGRAM

NTS STRUCTURAL DYNAMICS LABORATORY

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

MJO NO: 271-6096-5
FILTER: CLASS 180

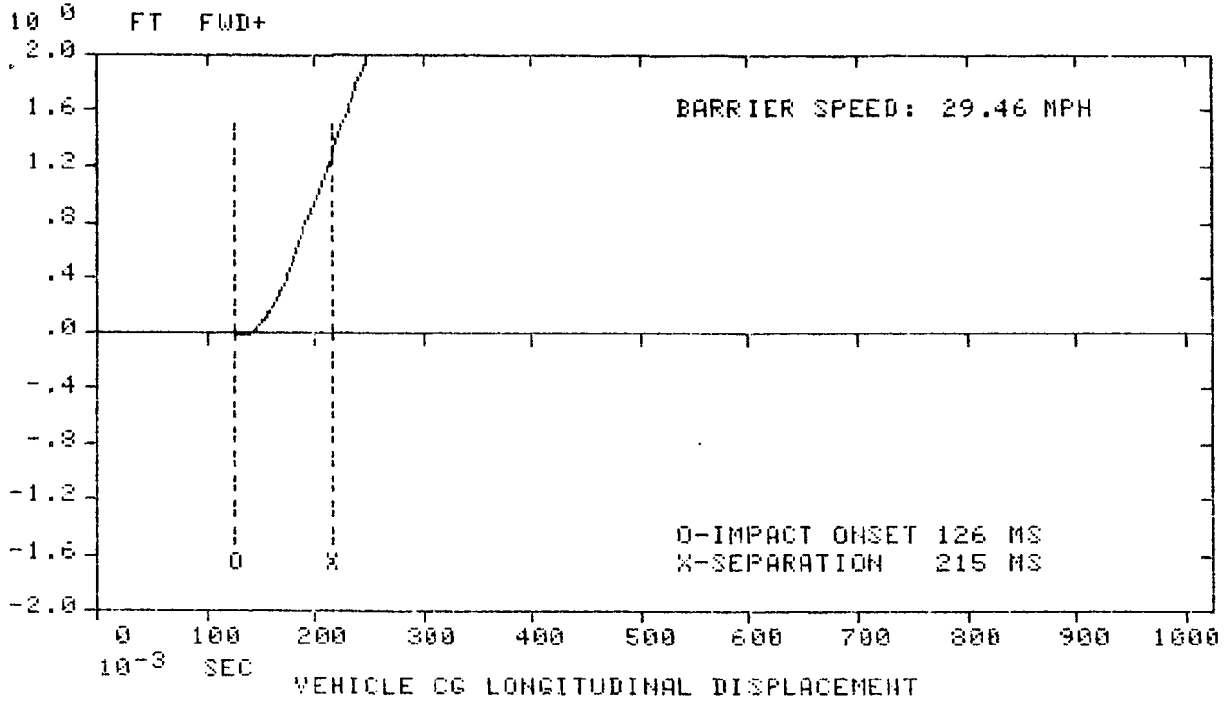


DOT CRASH PROGRAM

NTS STRUCTURAL DYNAMICS LABORATORY

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

MJO NO: 271-6096-5
FILTER: CLASS 180

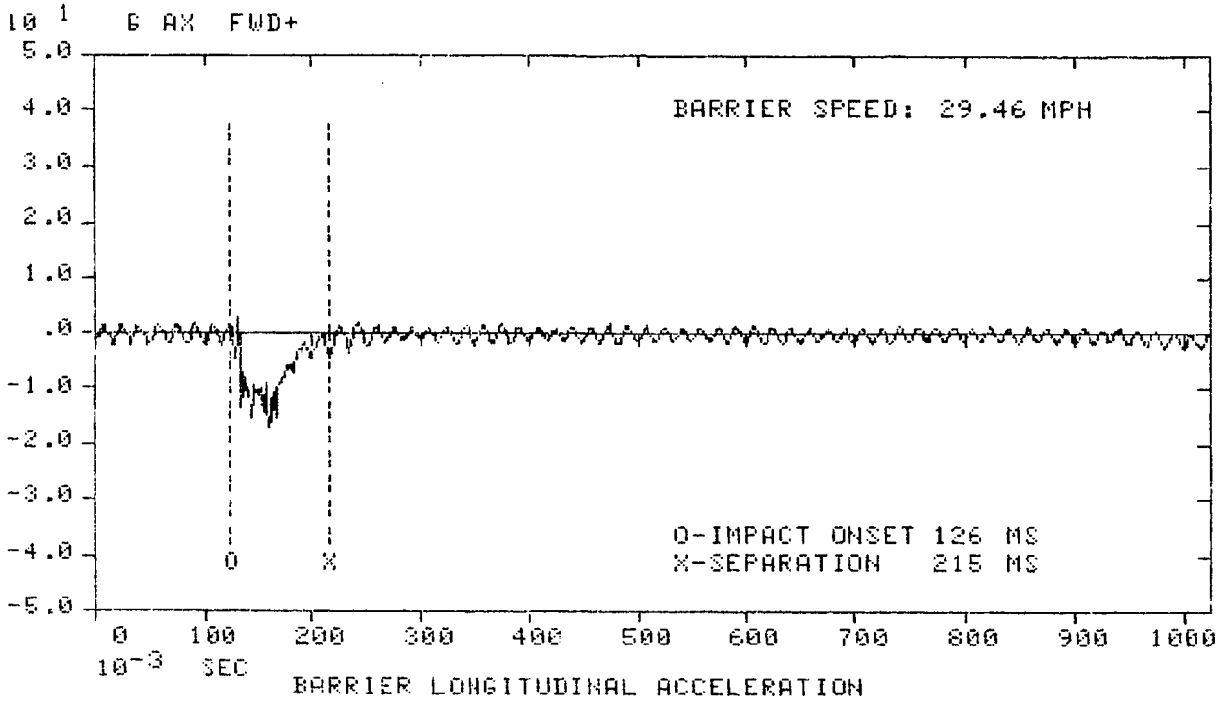


DOT CRASH PROGRAM

NTS STRUCTURAL DYNAMICS LABORATORY

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

MJO NO: 271-6096-7
FILTER: CLASS 60

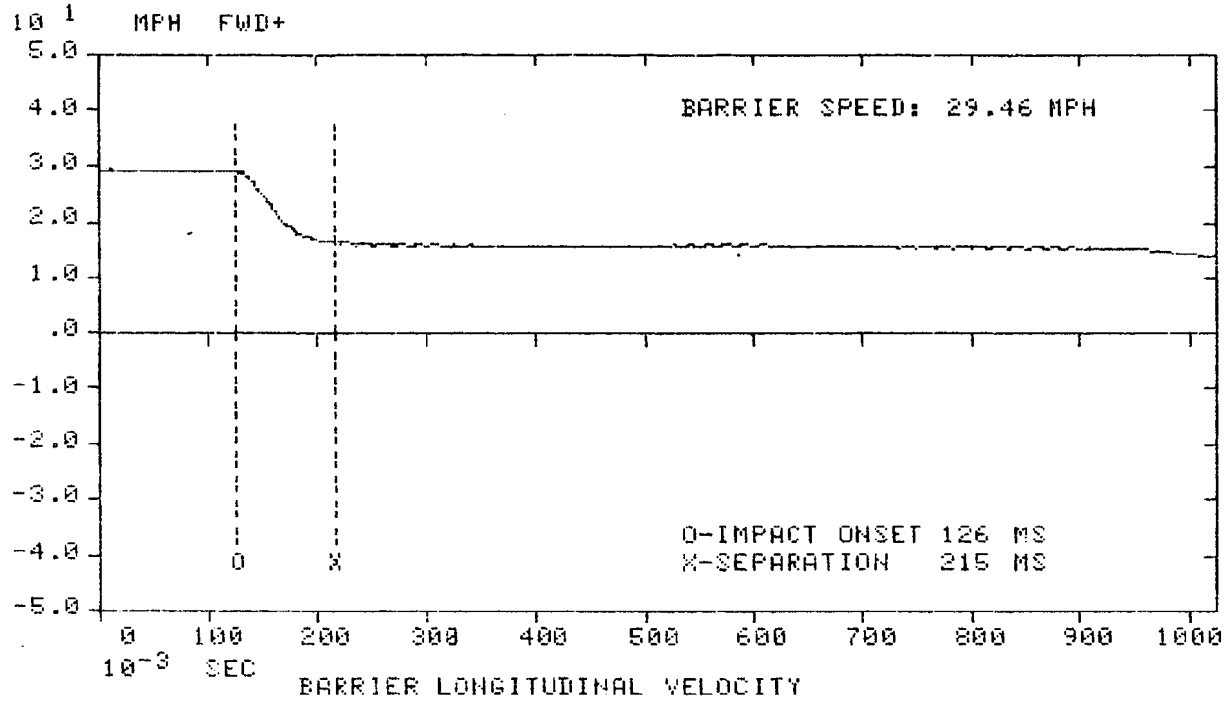


DOT CRASH PROGRAM

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

NTS STRUCTURAL DYNAMICS LABORATORY

MJO NO: 271-6096-5
FILTER: CLASS 180



DOT CRASH PROGRAM

NTS STRUCTURAL DYNAMICS LABORATORY

VEHICLE: MAZDA P/U
VEHICLE ID: NHTSA CD0616
TEST FILE NO: 101
DATE: MAY 17,1983 REAR

MJO NO: 271-6096-5
FILTER: CLASS 180

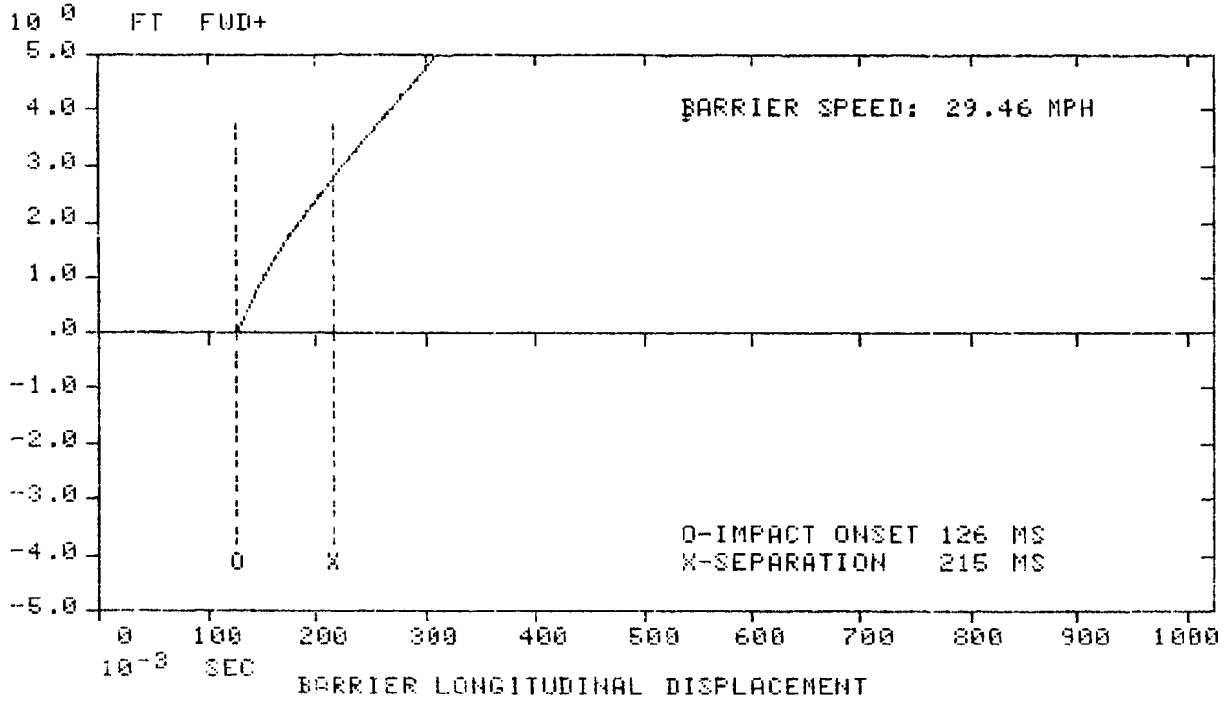


TABLE 3-3

PRE-TEST

VEHICLE MEASUREMENT DATA

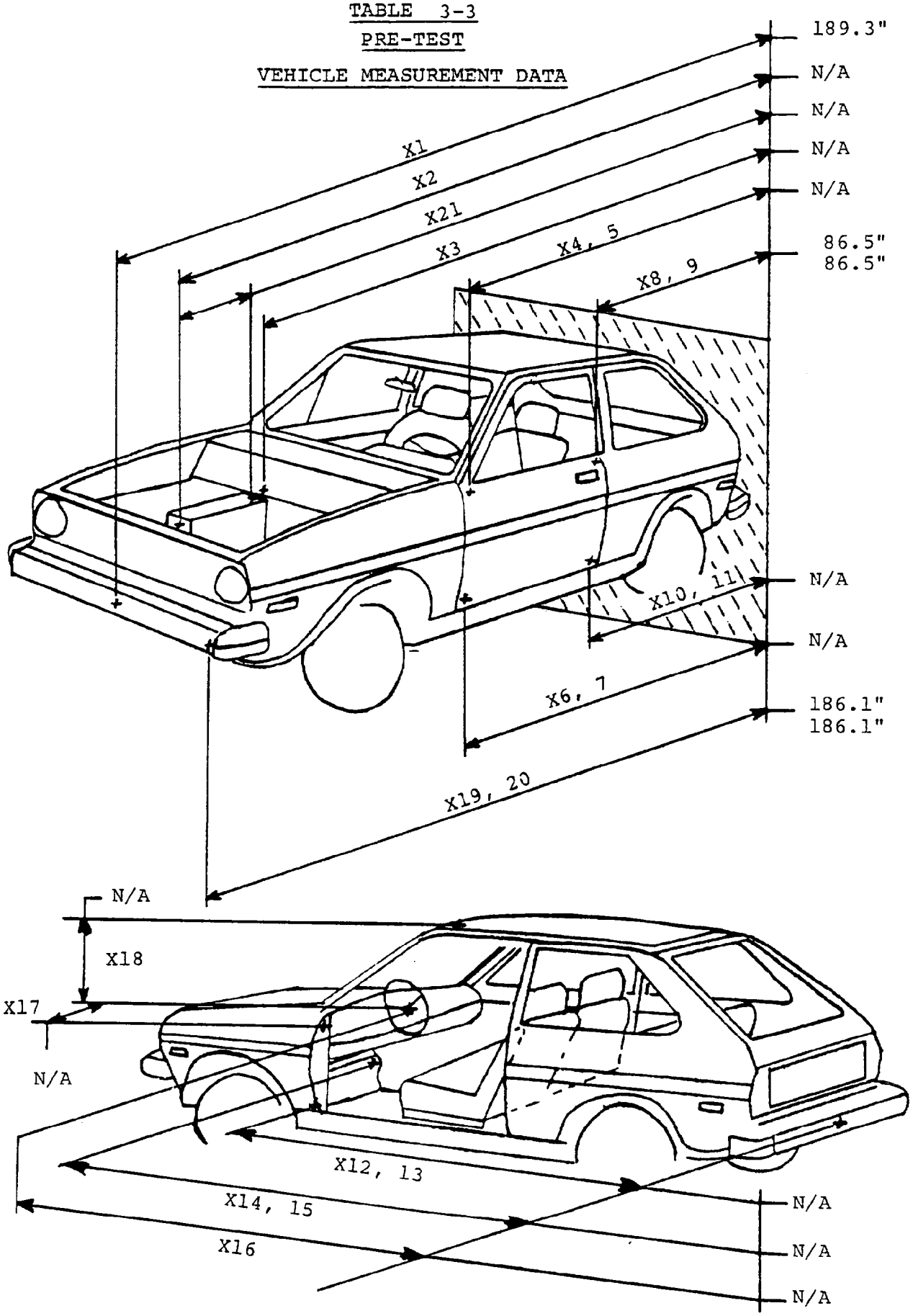


TABLE 3-4

POST-TEST

VEHICLE MEASUREMENT DATA

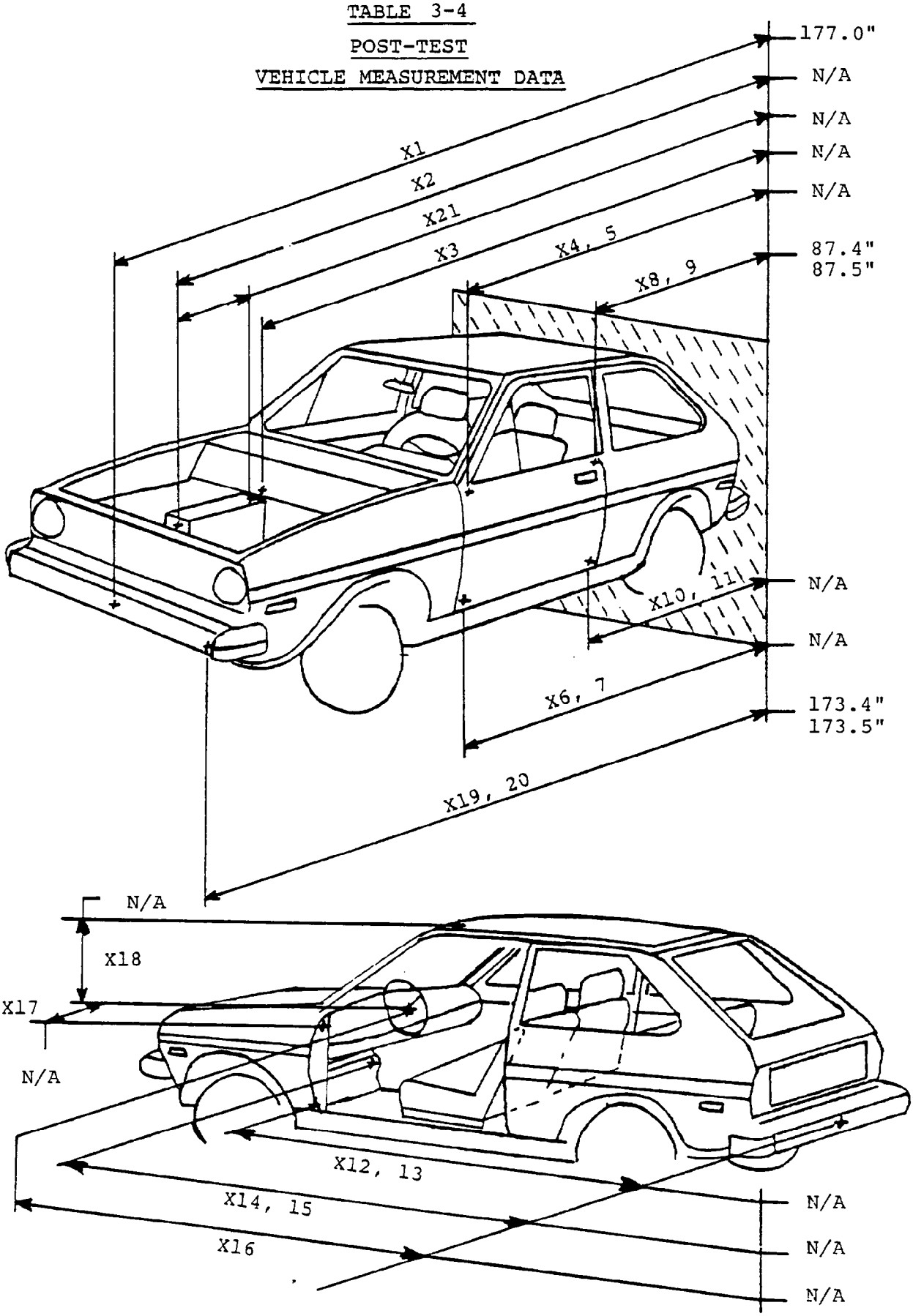


TABLE 3-5

SUMMARY

VEHICLE MEASUREMENT DATA

Measurement Point	Pre-Test	Post-Test	Difference
X1	189.3"	177.0"	12.3"
X8	86.5"	87.4"	-0.9"
X9	86.5"	87.5"	-1.0"
X19	186.1"	173.4"	12.7"
X20	186.1"	173.5"	12.6"

SECTION 4

4.0 TEST FACILITIES AND EQUIPMENT

National Technical Systems (NTS) collision barriers and vehicle static rollover machine test facilities are located at the Fullerton, California Division.

This section discusses these specialized facilities, along with associated equipment and instrumentation required for the performance of this test.

4.1 FRONTAL COLLISION BARRIER

4.1.1 The frontal (fixed) collision barrier conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) and as defined in the Laboratory Procedures for FMVSS 212/219/301-75, TP219-02, dated January 9, 1979, with the following special characteristics.

4.1.2 The fixed collision barrier is a steel clad, steel reinforced concrete block with a 6'4" X 12' face. The face is 1" steel plate faced with 3/4 inch plywood. The total mass of the structure is approximately 200,000 pounds, with a substantial portion below ground to provide resistance against sliding or tipping of the barrier during impact.

4.1.3 The facility consists of a 500 foot concrete paved runway, with a steel monorail embedded in the approach surface. Two camera pits are provided to allow photographing the test vehicle at impact. One pit is located immediately in front of the fixed collision barrier and is 36 inches wide (expandable to 48 inches), 7 feet deep, and 23 feet long (3 feet of the pit length extends under the barrier face). The second (mid) pit with removable monorail section is located approximately 160 feet from the fixed collision barrier and is 43 inches wide, 7 feet deep, and 23 feet long.

4.1.4 Tow propulsion is provided by a fixed prime mover and continuous cable drive system located near the mid camera pit position. The power plant for the tow cable system is a 200 h.p. synchrouous electric motor, coupled to an electronically controlled Eddy Current Clutch and a 4:1 gear reduction transfer assembly.

The endless 1/2 inch diameter steel tow cable is wrapped around the drive pulley and is tensioned by a pneumatic loaded idler wheel. The tow cable passes through the fixed collision barrier and around fixed idler pulleys to complete the loop. The test vehicle or moving collision barrier is towed by a dolly assembly attached to the vehicle

or moving collision barrier by a shear pin release mechanism. For a fixed collision barrier test, the test vehicle is towed within 20 feet of the fixed barrier, at which point the towing dolly assembly is disconnected from the test vehicle and the test vehicle proceeds under its own momentum for the final 20 feet to impact. For a moving collision barrier test, the moving collision barrier is towed within 5 feet of the test vehicle, at which point the towing dolly is disconnected from the moving collision barrier and the moving collision barrier proceeds under its own momentum for the final 5 feet to impact. Heavy steel stops actuate the tow cable release mechanism and prevent the towing dolly from continuing past the point of impact. The towing dolly is designed to fit inside the monorail such that it is constrained in the vertical and lateral directions, and capable of sliding freely along the monorail.

4.2 OBLIQUE ANGLE COLLISION BARRIER

4.2.1 The oblique angle collision barrier conforms to the requirements as set by NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02, with the following special characteristics.

4.2.2 The oblique angle collision barrier is constructed of a flat 1 1/2 inch steel plate faced with 3/4 inch plywood. The barrier face is 6' X 12' and is adjustable for left or right angle impacts by means of seven tubular gussets that attach to the standard fixed frontal collision barrier to form a rigid buttress structure.

4.3 MOVING COLLISION BARRIER

4.3.1 The moving collision barrier conforms to the requirements as set by Federal Motor Vehicle Safety Standard No. 208, Paragraph S8.2 with the following special characteristics.

4.3.2 The chassis is constructed of 12 inch steel channel with tubular frame gussets. The flat impacting face plate is 1/2 inch steel plate faced with 3/4 inch plywood. The face plate is reinforced with 6 inch steel channel horizontally welded to the chassis to form a rigid symetrical structure. A camera boom extends above the barrier face plane to provide a view of barrier to vehicle impact. The barrier assembly weighs 3,987 pounds and has a four wheel electric brake system.

4.4 VEHICLE STATIC ROLLOVER MACHINE

4.4.1 The vehicle static rollover machine conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02 with the following special characteristics.

4.4.2 The vehicle static rollover machine is constructed of 10 inch square tube with adjustable wheelbase and tread width platforms to accommodate the various test vehicles. The total usable platform area is 8 feet wide and 25 feet long with special design feature to accomodate vehicles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less with various body configuration heights to 12 feet. The test vehicle can be rotated left or right and can turn each 90° rotational increment in approximately two (2) minutes.

4.5 IMPACT VELOCITY MEASUREMENT

The test vehicle impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the vehicle to fixed collision barrier face and to one side on the approach apron. Each timing

trap system contains two (2) optical beams, mounted twenty four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the test vehicle traverses the impact apron, a blade attached to the test vehicle rear fender interrupts each optical beam providing the precise measurement of time interval for the test vehicle to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

The moving collision barrier impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the moving collision barrier to vehicle impact location and to one side on the approach apron. Each timing trap system contains two (2) optical beams, mounted twenty-four (24) inches apart, in a mechanical housing assembly providing s start-stop signal to a digital display counter. As the moving barrier traverses the impact apron, a blade attached to the moving barrier side interrupts each optical beam providing the precise measurement of time interval for the moving barrier to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

SECTION 4

4.6 PHOTOGRAPH COVERAGE

4.6.1 Because FMVSS 212/219/301-75 may be a combined test, it is necessary that all photographic coverage of the test vehicle be done at one time with specific photographs to document the areas for Vehicle Safety Compliance consideration; windshield area and the fuel system. Each report will utilize only those photographs pertaining to the Vehicle Safety Compliance Test being reported.

4.6.2 FIXED BARRIER IMPACT TEST

Motion picture coverage of the event employs five (5) 16mm 1B Photo-Sonics cameras and two (2) 16mm 51 Redlake Locam cameras using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, vehicle in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. The seven (7) high speed cameras are located at stationary positions near the point of impact. One is an overhead camera mounted on a tower above the fixed barrier face on centerline of the test vehicle at impact. Its field of view includes the barrier face and the front of the vehicle to a point about one foot aft of the windshield. A second and third camera is mounted on top of the fixed barrier with

their field of view concentrating on the windshield area (FMVSS 212/219). The fourth and fifth camera each have a side view of the test vehicle at impact. The sixth and seventh camera are located in the pit and positioned to photograph the underside of the engine compartment and fuel tank area.

4.6.3 MOVING BARRIER IMPACT TEST

Motion picture coverage of the event employs three (3) 16mm 1B Photo Sonics cameras and two (2) 16mm 51 Redlake Locam cameras using color film at 500 frame per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, barrier in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. Four (4) of the high speed cameras are located at stationary positions near the point of impact. Two (2) cameras are located in the pit and positioned to photograph the underside of the engine compartment, with overlapping field of views, aft to the fuel tank area. The third and fourth camera each have a side view of the test vehicle at impact.

The fifth camera is attached to the moving collision barrier to photograph the contact between the barrier and the test vehicle.

4.6.4 TIME PULSE GENERATOR

Time data from two (2) sources are contained in the high speed film coverage. The first is a time reference of 100 pulse per second (pps) light emitting diode event mark along the film edge. This pulse is generated by the time pulse generator and fed to all high speed cameras. Thus, it is possible to relate film data to a real time base. The second time record is an indication of time zero (moment of impact). This is accomplished by a trip switch and event mark system. The trip switch is positioned at the impact point so that it triggers the light emitting diode event mark along the film edge at the moment of bumper-barrier contact. Thus, the particular film frame corresponding to the point of impact is clearly indicated on all the high speed film.

SECTION 4

4.7 DATA ACQUISITION AND REDUCTION

The data acquisition and analysis system used for acquiring barrier and vehicle accelerations is shown schematically in Figure 4-1. A complete list of instrumentation is shown in Table 4-1. An itemized procedure for acquiring data is provided in Table 4-2.

Prior to the vehicle impact test, onboard instrumentation is installed and a calibration and null reference check is performed to check out all data analog devices including FM magnetic tape recorders. Immediately following vehicle impact a post-impact calibration and null reference check is performed.

Analog data is replayed and digitized using a Hewlett Packard Digital Fourier Analyzer (DFA). The data is digitized three channels at a time and placed into permanent storage on magnetic disc. The only modifications to the data at the time of permanent storage are: the application of a 250 Hz predigitizing analog filter (60 db/octave rolloff), the filtering and digitizing

process of the FM tape recorder (2500 Hz) and the DFA (1000 Hz sampling for a 1 second window), and the application of the appropriate calibration scale factors.

As the data is recalled for integration or plotting, the appropriate SAE filter is applied. These filters are in accordance with SAE J211a, Instrumentation for Impact Tests. Acceleration data is plotted after the application of an SAE class 60 filter. Velocity and displacement data is plotted after the application of an SAE class 180 filter. The filters are shown in Figure 4-2.

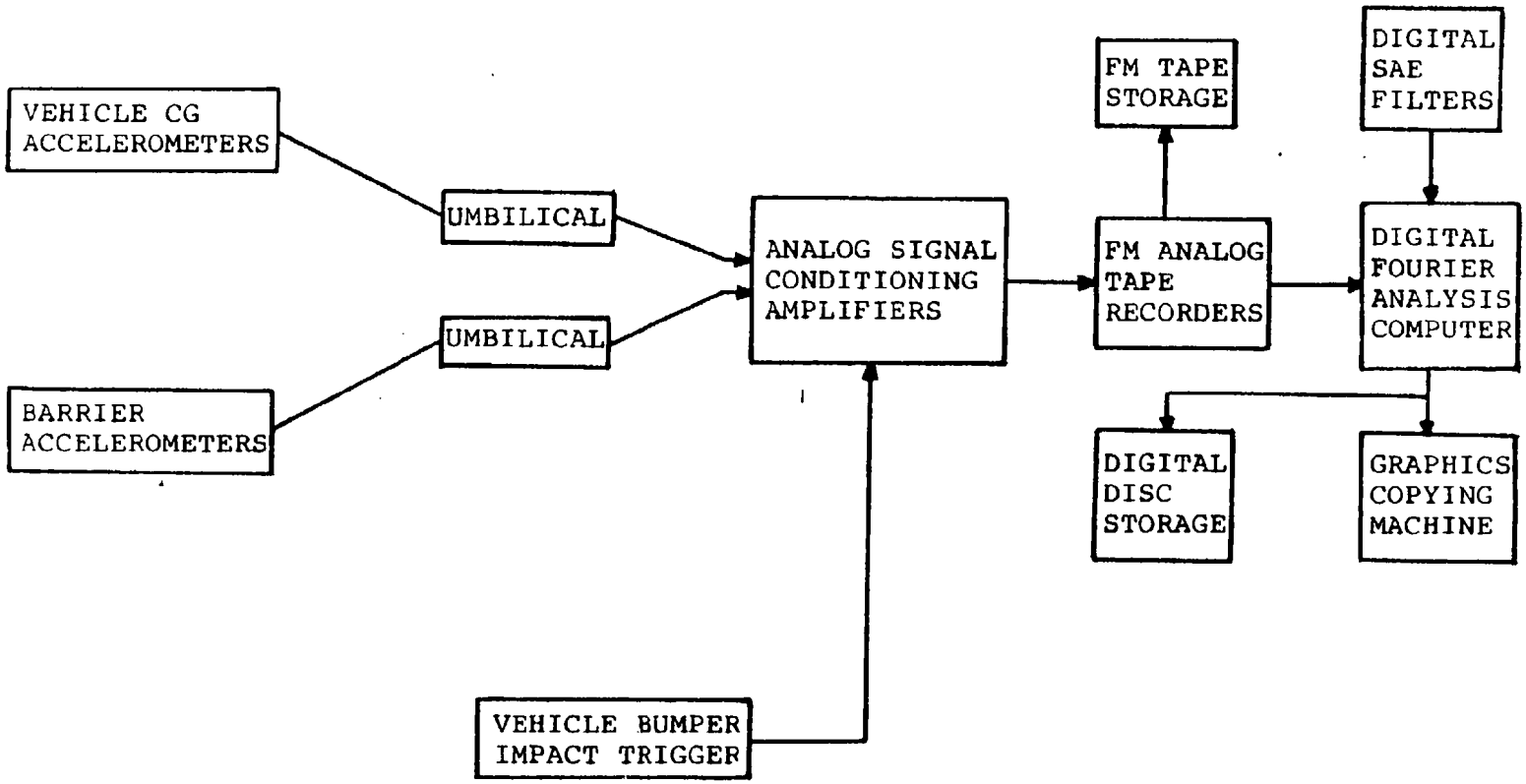
Before plotting, the test engineer determines vehicle onset and vehicle separation times. This is done by looking for characteristics contained in both the vehicle and barrier acceleration signals which indicate when these events occured. Impact onset is verified with the trigger signal. When a velocity, or displacement trace is to be plotted, integration of the appropriate acceleration signal is performed digitally in the DFA.

SECTION 4

All impact data is presented in computer plots of a 1 second time window. Impact onset and vehicle separation times are shown, as well as appropriate labels defining the test vehicle, filter class and data plotted. The descriptions on the plots are self explanetory.

In addition to the data plots, a table listing the barrier closing speed, impact and vehicle separation times and delta velocities is given. Delta velocity is taken as the difference between the velocity at the moment of impact and the velocity at the moment of separation for the barrier or vehicle.

The aforesaid process from digitizing data through plotting data is controlled with standard Hewlett Packard Fourier software in conjunction with NTS designed software written specifically for crash data reduction.



VEHICLE AND OCCUPANT CRASH IMPACT DATA ACQUISITION SYSTEM

FIGURE 4-1

HP 5451 DATA PLOT

NATIONAL TECHNICAL SYSTEMS

COMPARISON PLOT OF SAE CLASS 60, 180, 600, 1000 FILTERS AND THE DATA ANALYSIS 1250 HZ PREDIGITIZING ANALOG FILTER.

SAE FILTERS ROLL OFF IS 12DB/OCT, ANALOG FILTER ROLL OFF IS 60DB/OCT

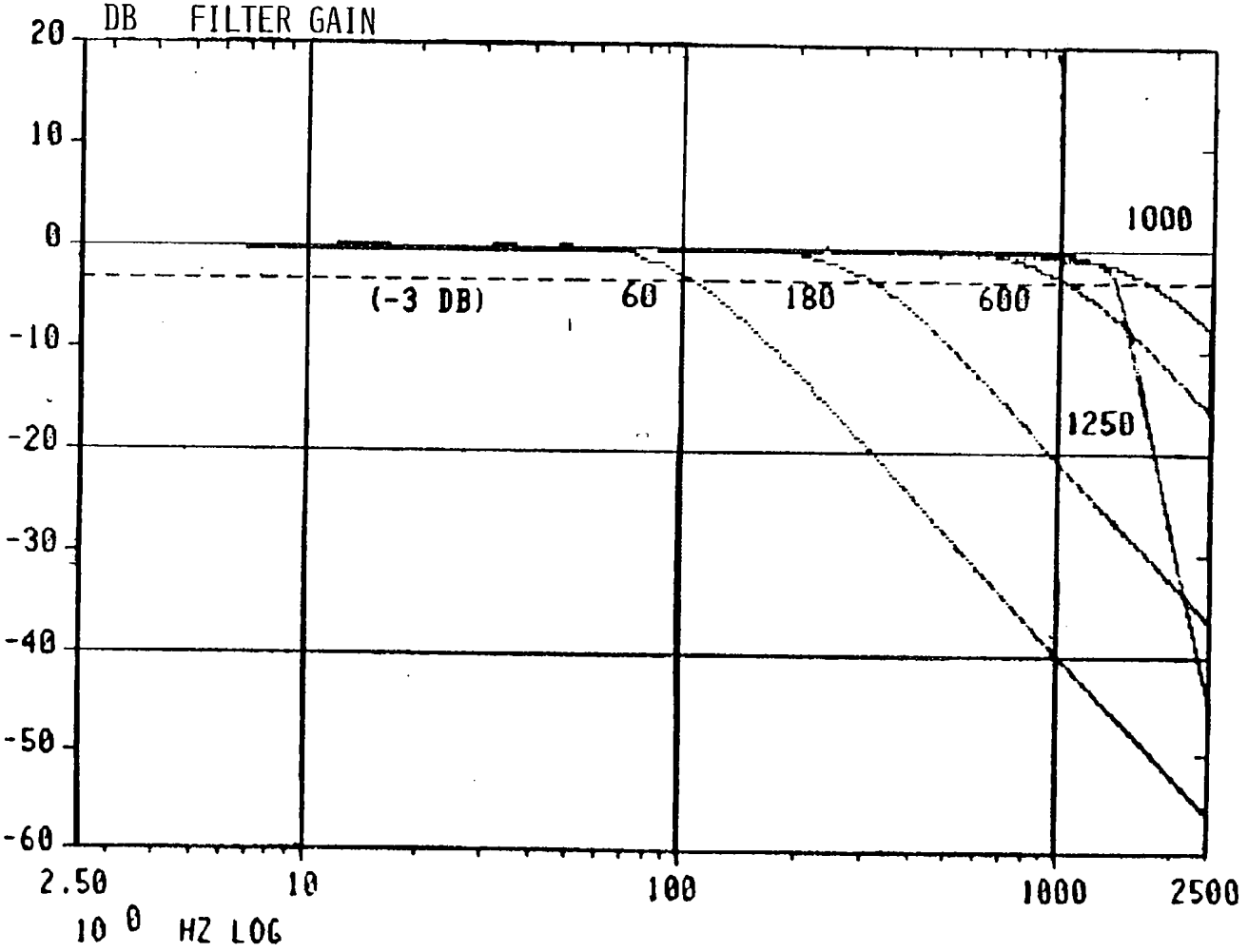


FIGURE 4-2

TABLE 4-1

INSTRUMENTATION FOR CRASH TEST

Instrument	Manufacturer	Model No.	Full Scale	Accuracy	Freq. Max.
Accelerometers, Vehicle, Barrier	Endevco	2262C-200	200g	±1%	3600 Hz.
Contact Switch, Impact	NTS	-	2 V	-	<200 us rise time
FM Tape Recorder	Bell & Howell	4020	±2.8V	47 db SNR	2500 Hz WB
Programmable Filter, All Data	Hewlett Packard	54440A	-	0.5%	1250 Hz, 60 db/oct
Analog-Digital Converter, All Data	Hewlett Packard	5466B	-	0.5%	200 us sampling
Analysis Computer, All Analysis	Hewlett Packard	2100S	32 K Words	16 Bit Word	-
Disc Drive	Hewlett Packard	7900A	5 Meg Words	-	-

TABLE 4-2

DATA ACQUISITION AND REDUCTION PROCESS

STEP	DESCRIPTION
1	DA System Installation
2	DA System Pre-Impact Calibration
3	Impact Trigger Checkout
4	Vehicle Impact Performed
5	DA System Post-Impact Calibration
6	Data Reproduced From_FM Tape Into Computer a) Data analog filtered at 250 Hz b) Data digitized at 100 ms sample rate c) Data sychronized by impact trigger signal
7	Digitized Data Examined
8	Data Transfered Permanent Disc Storage
9	Appropriate SAE Filters Are Applied
10	Each Data Signal Plotted With Labels

4.8 FRONTAL FIXED BARRIER IMPACT DELTA VELOCITY CALCULATION

The data acquisition and reduction process for a frontal fixed barrier impact delta velocity calculation is outlined in the step by step discussion which follows. Figures 4-3 through 4-7 illustrate each step in the process. Reflected in the processed data is:

1) Relying on the optical speed trap data as the most accurate source of the test vehicle impact speed, the calibration factor, which converts the vehicle longitudinal acceleration signal from volts to g's, is forced to produce a velocity consistant with the optical speed trap data.

Step 1: Acquire a two (2) second time history of the test vehicle longitudinal acceleration signal at a sample rate and with a pre-digitizing filter that is in accordance with the guideline established by SAE J211b. (Figure 4-3)

Step 2: Remove bias from the longitudinal acceleration signal. Bias removal is based on the assumption that the test vehicle comes to rest at some point in time prior to the end of the two (2) second time history window. From this point in time through the end of the two (2) second window, the acceleration signal should be at zero, and the velocity trace should exhibit no change (flat). (Figure 4-4 and 4-5)

Step 3: Calculate the test vehicle longitudinal acceleration calibration factor. The optical speed trap reading is used in this step, along with the knowledge that the test vehicle comes to rest, i.e. a known delta velocity from impact to rest. (Figure 4-6)

Step 4: Calculate the delta velocity at the time of test vehicle and barrier separation. The time of separation is determined by examining the test vehicle longitudinal acceleration signal and velocity trace while noting that:

1) Since any external force acting to decelerate the test vehicle in the positive forward direction become zero upon separation, the vehicle should reach its maximum negative velocity (rebound velocity) immediately prior to separation and should exhibit no further deceleration in the positive forward direction after this time.

2) After separation, the vehicle is slowed from its rebound velocity to a stop by the friction forces. The vehicle velocity trace should exhibit a slight positive slope (max 1 G) immediately after separation until the vehicle comes to rest. (Figure 4-7)

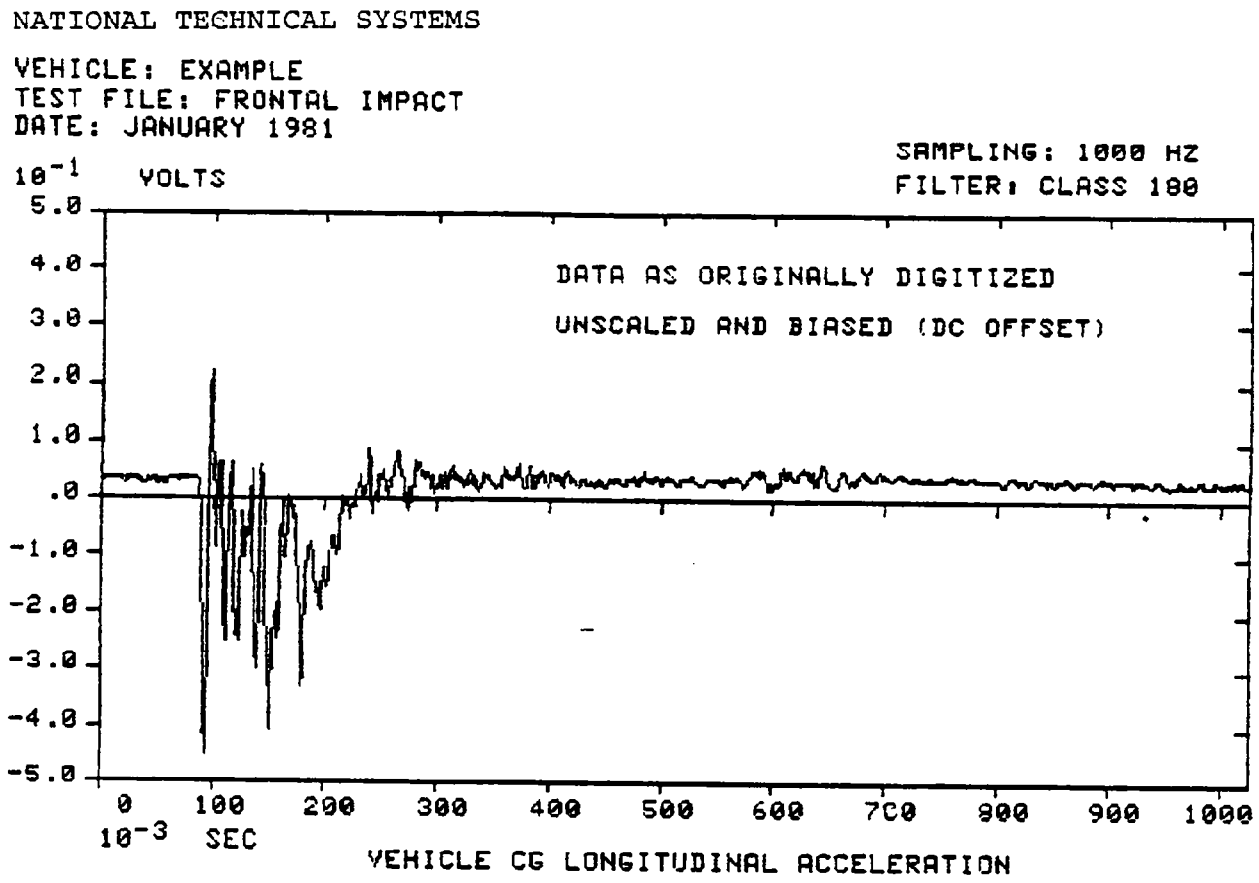

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: FRONTAL IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10^-1 VOLTS
DATA AS ORIGINALLY DIGITIZED
UNSCALED AND BIASED (DC OFFSET)
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
0
100
200
300
400
500
600
700
800
900
1000
10^-3 SEC
VEHICLE CG LONGITUDINAL ACCELERATION

FIGURE 4-3

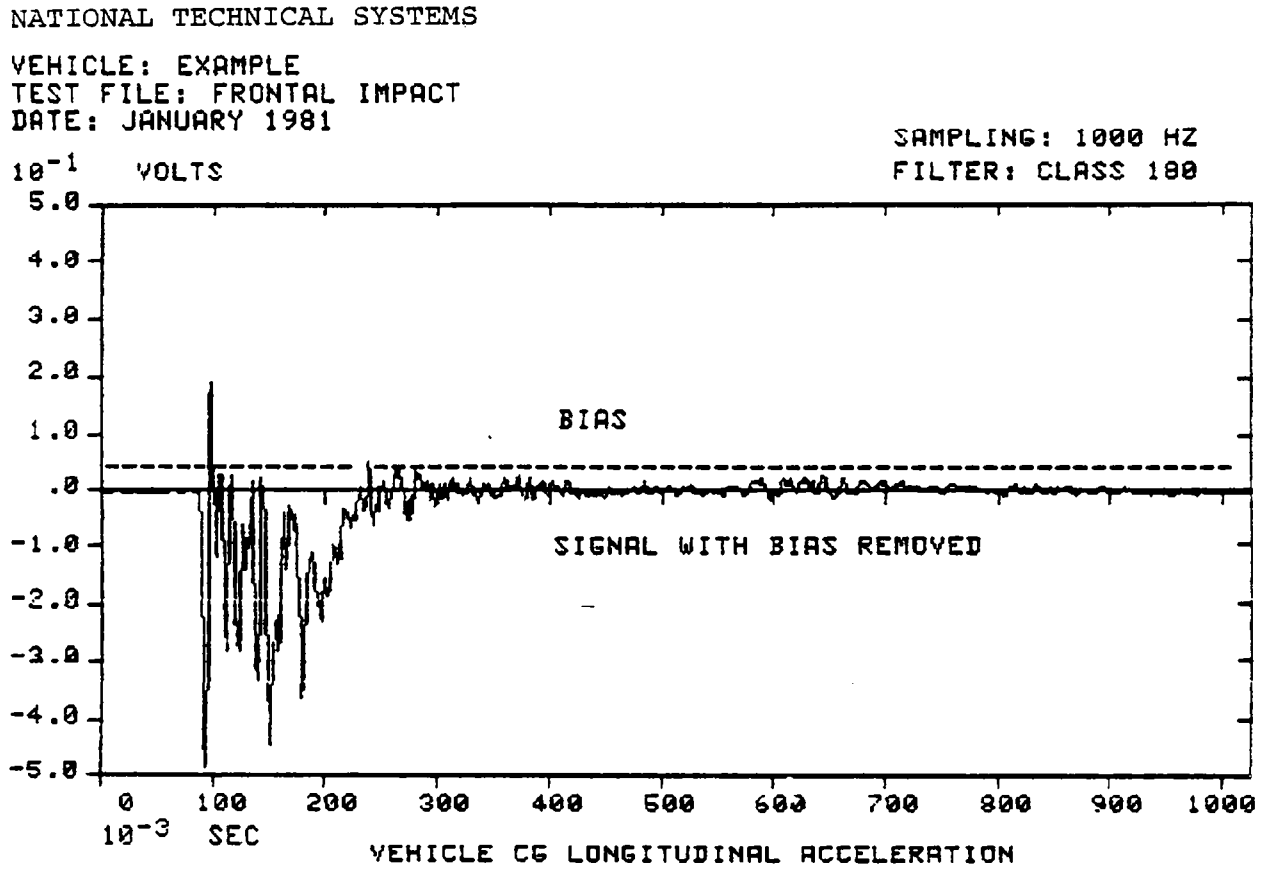

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: FRONTAL IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10-1 VOLTS
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
BIAS
SIGNAL WITH BIAS REMOVED
0
100
200
300
400
500
600
700
800
900
1000
10-3 SEC
VEHICLE CG LONGITUDINAL ACCELERATION

FIGURE 4-4

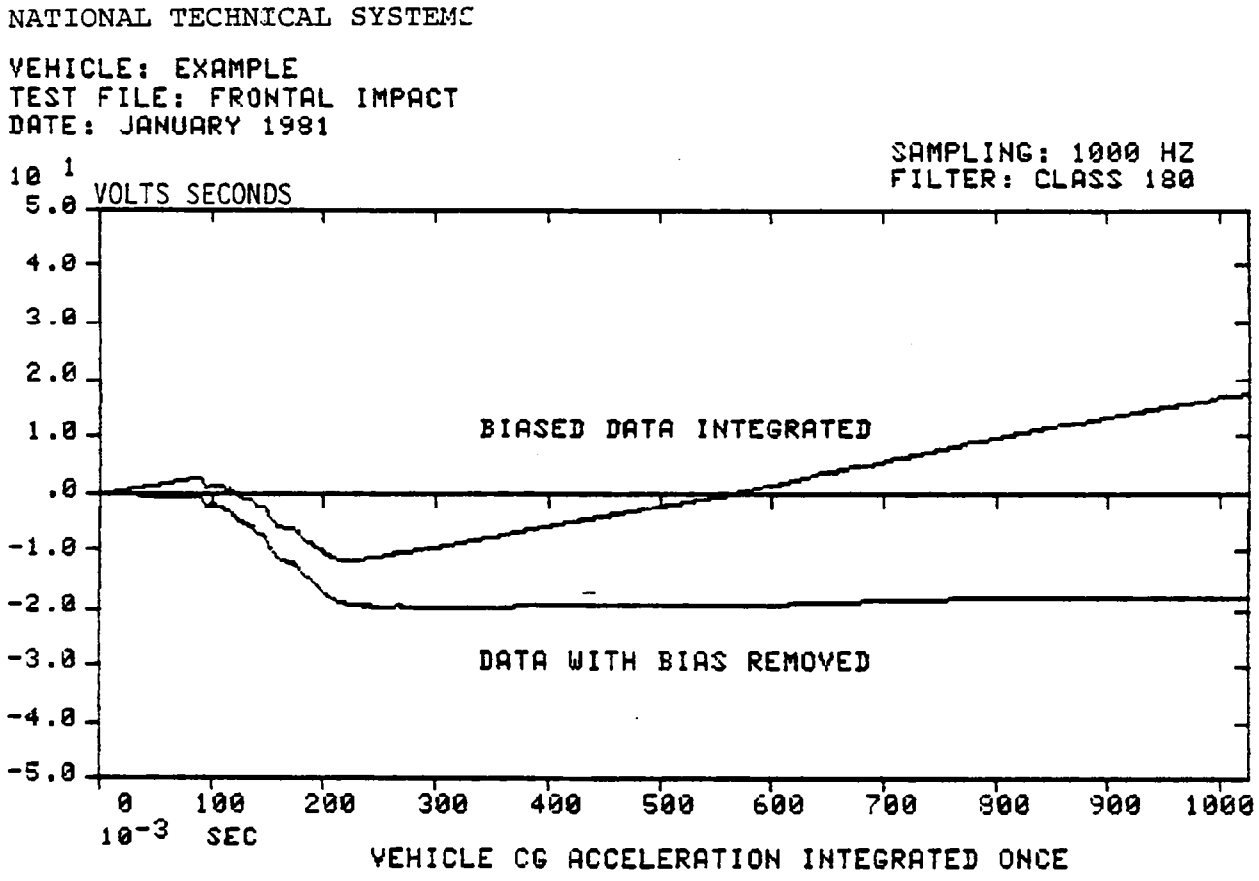

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: FRONTAL IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10 1
VOLTS SECONDS
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
BIASED DATA INTEGRATED
DATA WITH BIAS REMOVED
0
100
200
300
400
500
600
700
800
900
1000
10-3 SEC
VEHICLE CG ACCELERATION INTEGRATED ONCE

FIGURE 4-5

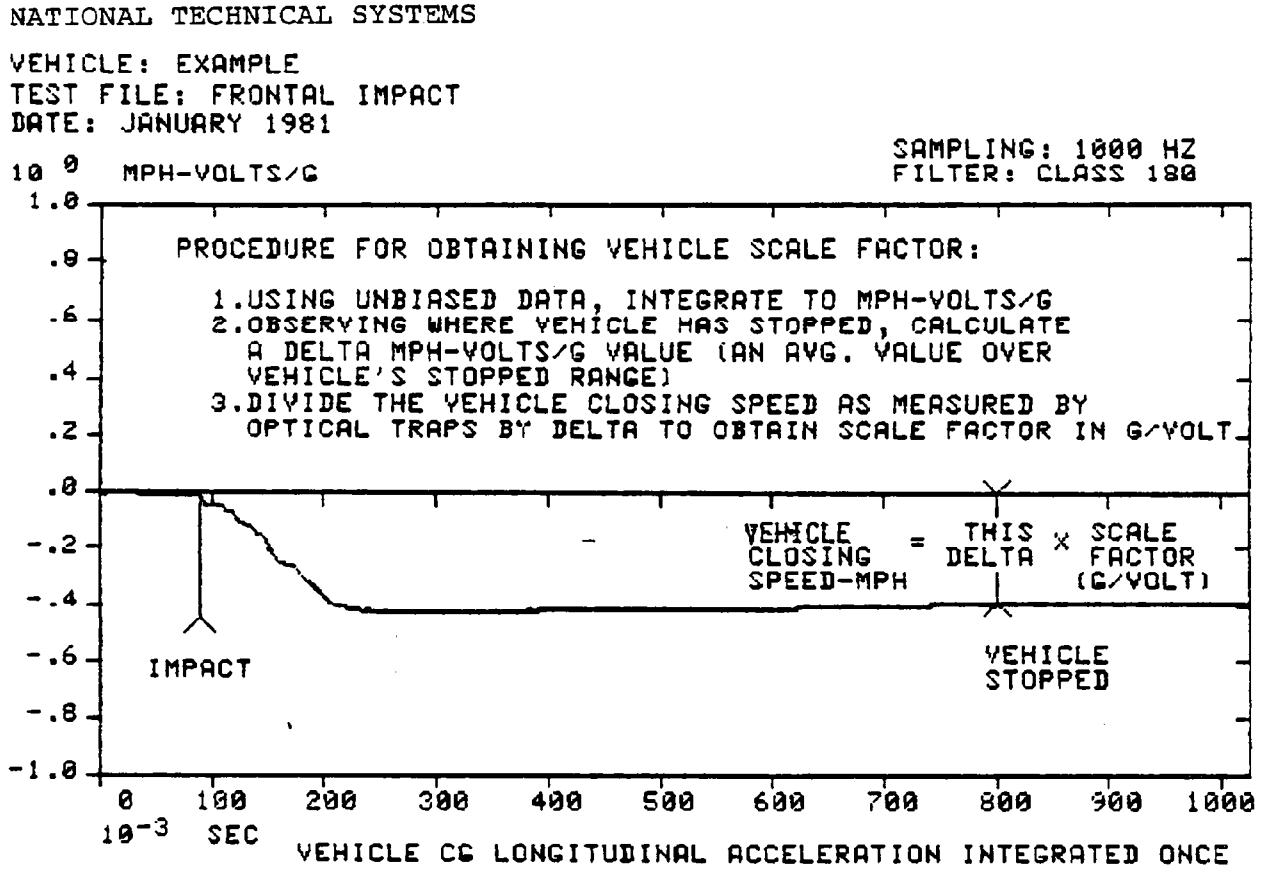
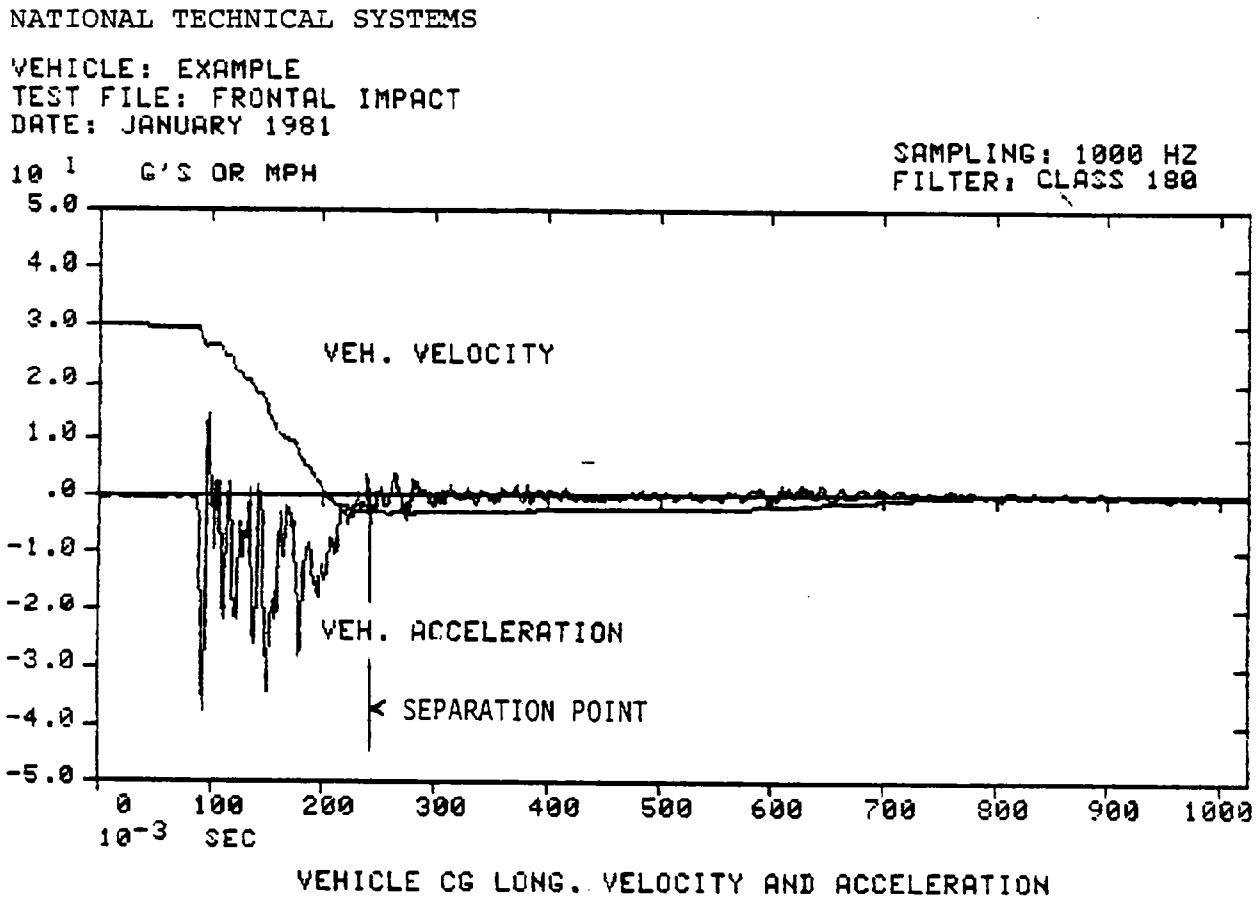

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: FRONTAL IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10 0 MPH-VOLTS/G
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
PROCEDURE FOR OBTAINING VEHICLE SCALE FACTOR:
1.USING UNBIASED DATA, INTEGRATE TO MPH-VOLTS/G
2.OBSERVING WHERE VEHICLE HAS STOPPED, CALCULATE A DELTA MPH-VOLTS/G VALUE (AN AVG. VALUE OVER VEHICLE'S STOPPED RANGE)
3.DIVIDE THE VEHICLE CLOSING SPEED AS MEASURED BY OPTICAL TRAPS BY DELTA TO OBTAIN SCALE FACTOR IN G/VOLT
VEHICLE CLOSING SPEED-MPH = THIS DELTA X SCALE FACTOR (G/VOLT)
IMPACT
VEHICLE STOPPED
0 100 200 300 400 500 600 700 800 900 1000
10-3 SEC
VEHICLE CG LONGITUDINAL ACCELERATION INTEGRATED ONCE

FIGURE 4-6



VEHICLE CG LONG. VELOCITY AND ACCELERATION

FIGURE 4-7

4.9 REAR MOVING BARRIER IMPACT DELTA VELOCITY CALCULATION

The data acquisition and reduction process for a rear moving barrier impact delta velocity calculation is outlined in the step by step discussion which follows. Figure 4-8 through 4-17 illustrate each step in the process. Reflected in the processed data is:

1) Relying on the optical speed trap data as the most accurate source of the moving barrier impact speed, the calibration factor, which converts the moving barrier longitudinal acceleration signal from volts to g's, is forced to produce a velocity consistant with the optical speed trap data.

2) Since there is no comparable method of forcing a calibration factor on the test vehicle longitudinal acceleration signal, calibration factor for the test vehicle data are the result of the pre-test accelerometer calibration.

Step 1: Acquire a five (5) second time history of the moving barrier longitudinal and test vehicle longitudinal acceleration signal. (Figure 4-8 and 4-9)

Step 2: Remove bias from the longitudinal acceleration signals. Bias removal is based on the assumption that once the moving barrier and test vehicle come to rest, the acceleration trace should remain at zero and the velocity trace should exhibit no change (flat) from the "stop" time through the remainder of the five (5) second time history window. (Figure 4-10 through 4-13) The five (5) second time history was selected to allow sufficient time for both the moving barrier and the test vehicle to come completely to rest.

Step 3: Calculate the moving barrier longitudinal acceleration calibration factor. The optical speed trap reading is used in this step, along with the knowledge that the moving barrier comes to rest, i.e. a known delta velocity from impact to rest. (Figure 4-14).

Step 4: Acquire a one (1) second time history of the moving barrier longitudinal and test vehicle longitudinal acceleration signal at a sample rate and with a pre-digitizing filter that is in accordance with the guideline established by SAE J211b. Remove bias and apply calibration factor calculated from the five (5) second time history data. (Figure 4-15 and 4-16)

Step 5: Calculate the delta velocity at the time of moving barrier/test vehicle separation. The time of separation is determined by examining the moving barrier and test vehicle longitudinal acceleration signal and velocity traces while noting that:

1) The moving barrier exhibits no apprecible deceleration from the time of separation until the moment the moving barrier brakes are applied, i.e. a period of constant velocity should be exhibited by the moving barrier immediately following barrier/test vehicle separation.

2) Since any external force acting to accelerate the test vehicle in the positive forward direction becomes zero at separation, the test vehicle should exhibit maximum velocity immediately prior to separation and only deceleration due to friction forces thereafter. (Figure 4-17)

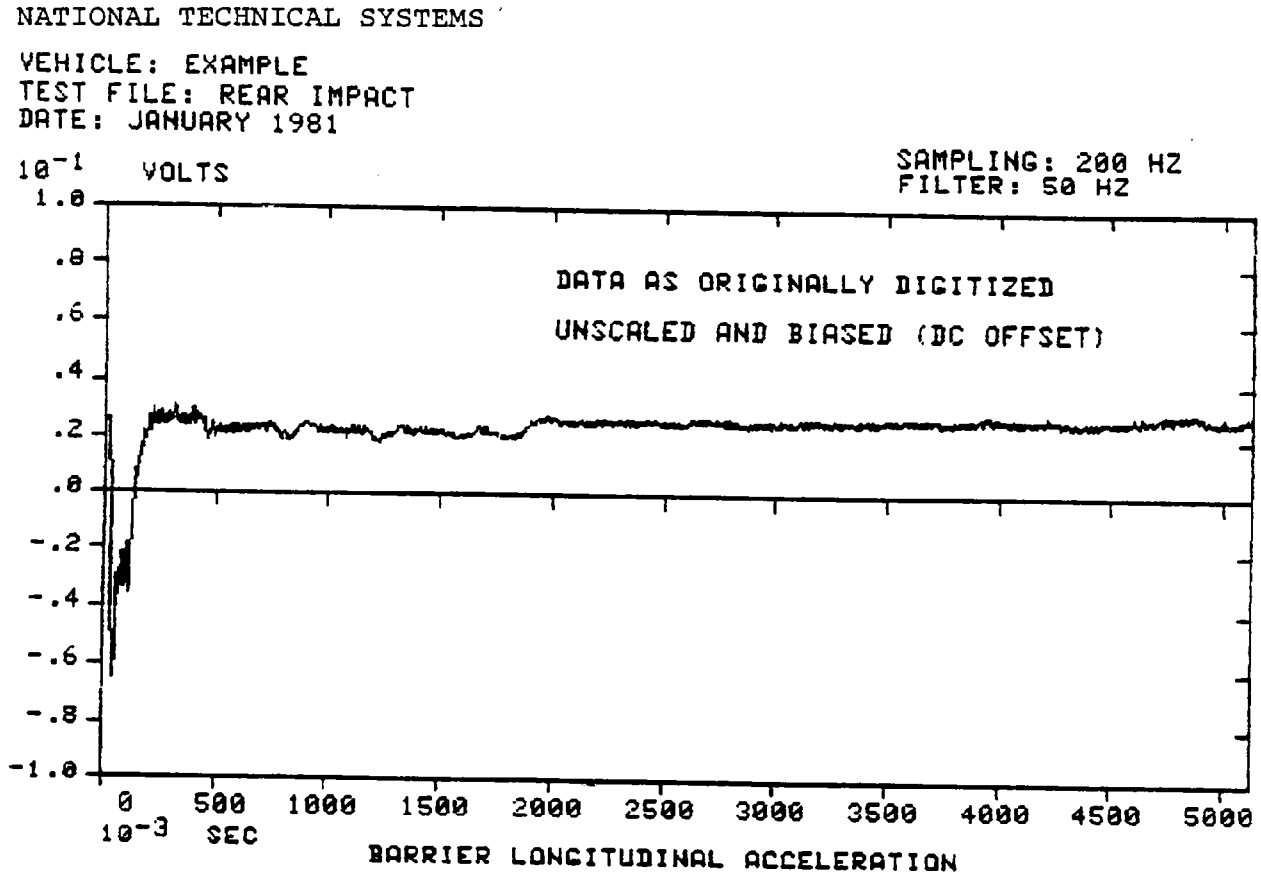

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
10-1 VOLTS
SAMPLING: 200 HZ
FILTER: 50 HZ
DATA AS ORIGINALLY DIGITIZED
UNSCALED AND BIASED (DC OFFSET)
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10-3 SEC
BARRIER LONGITUDINAL ACCELERATION

FIGURE 4-8

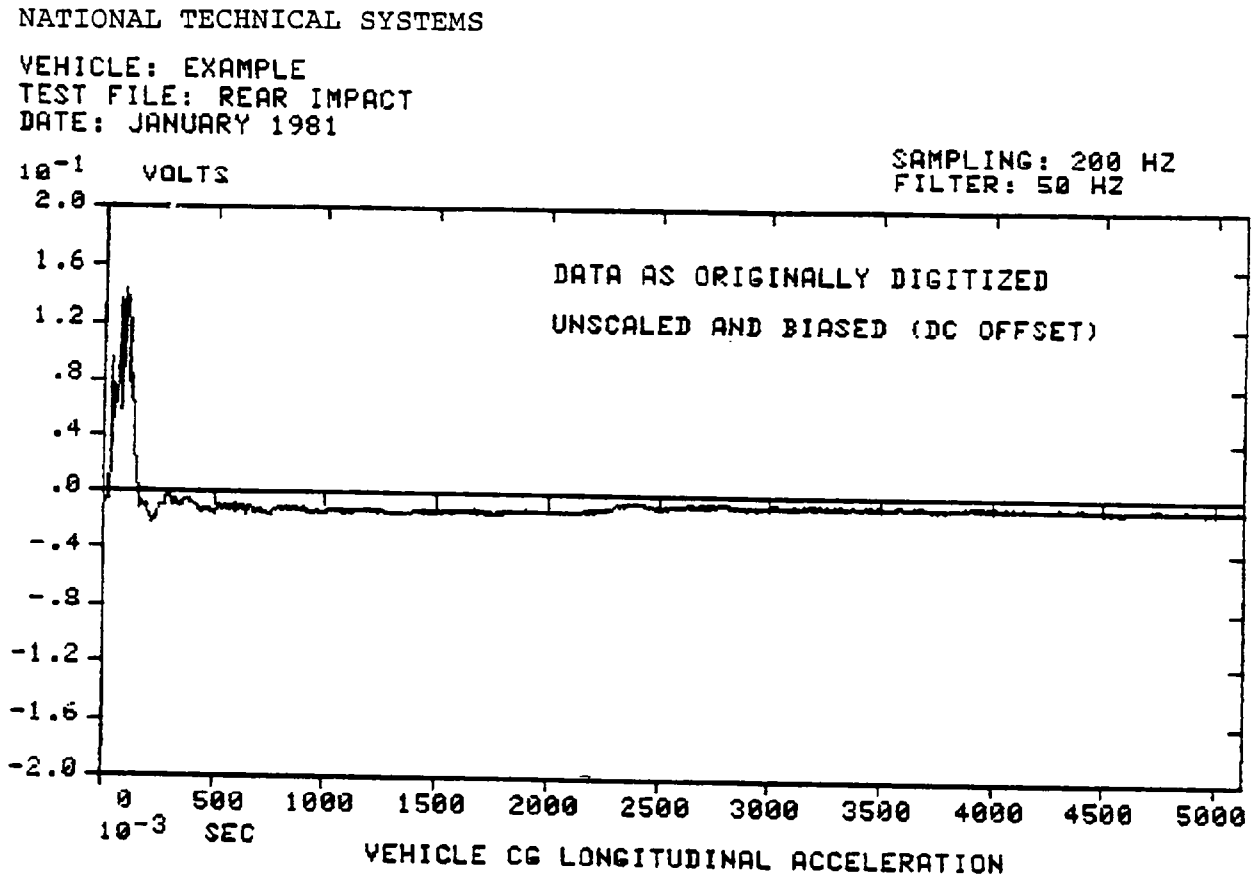

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 200 HZ
FILTER: 50 HZ
10-1 VOLTS
2.0
1.6
1.2
.8
.4
.0
-.4
-.8
-1.2
-1.6
-2.0
DATA AS ORIGINALLY DIGITIZED
UNSCALED AND BIASED (DC OFFSET)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10-3 SEC
VEHICLE CG LONGITUDINAL ACCELERATION

FIGURE 4-9

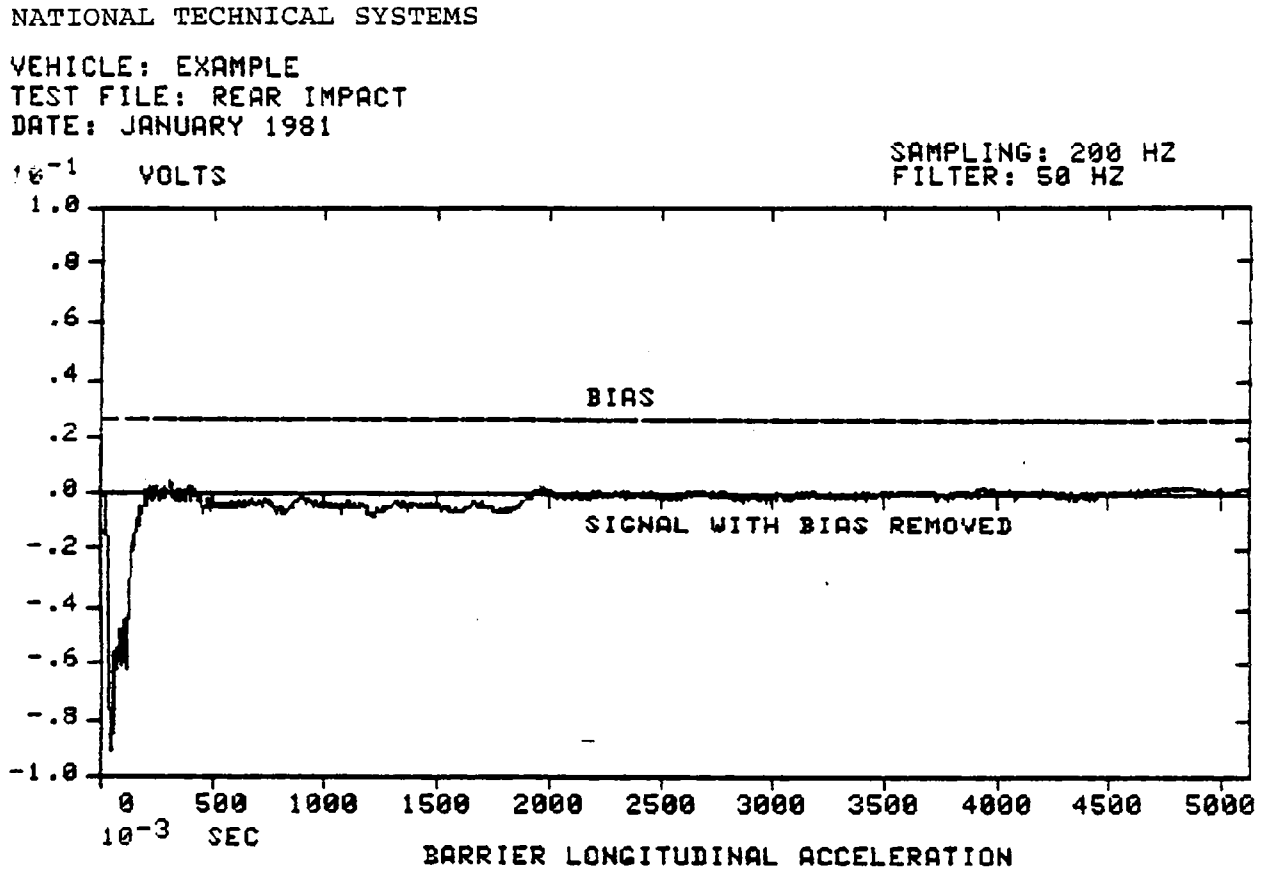

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 200 HZ
FILTER: 50 HZ
10^{-1} VOLTS
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
BIAS
SIGNAL WITH BIAS REMOVED
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10^{-3} SEC
BARRIER LONGITUDINAL ACCELERATION

FIGURE 4-10

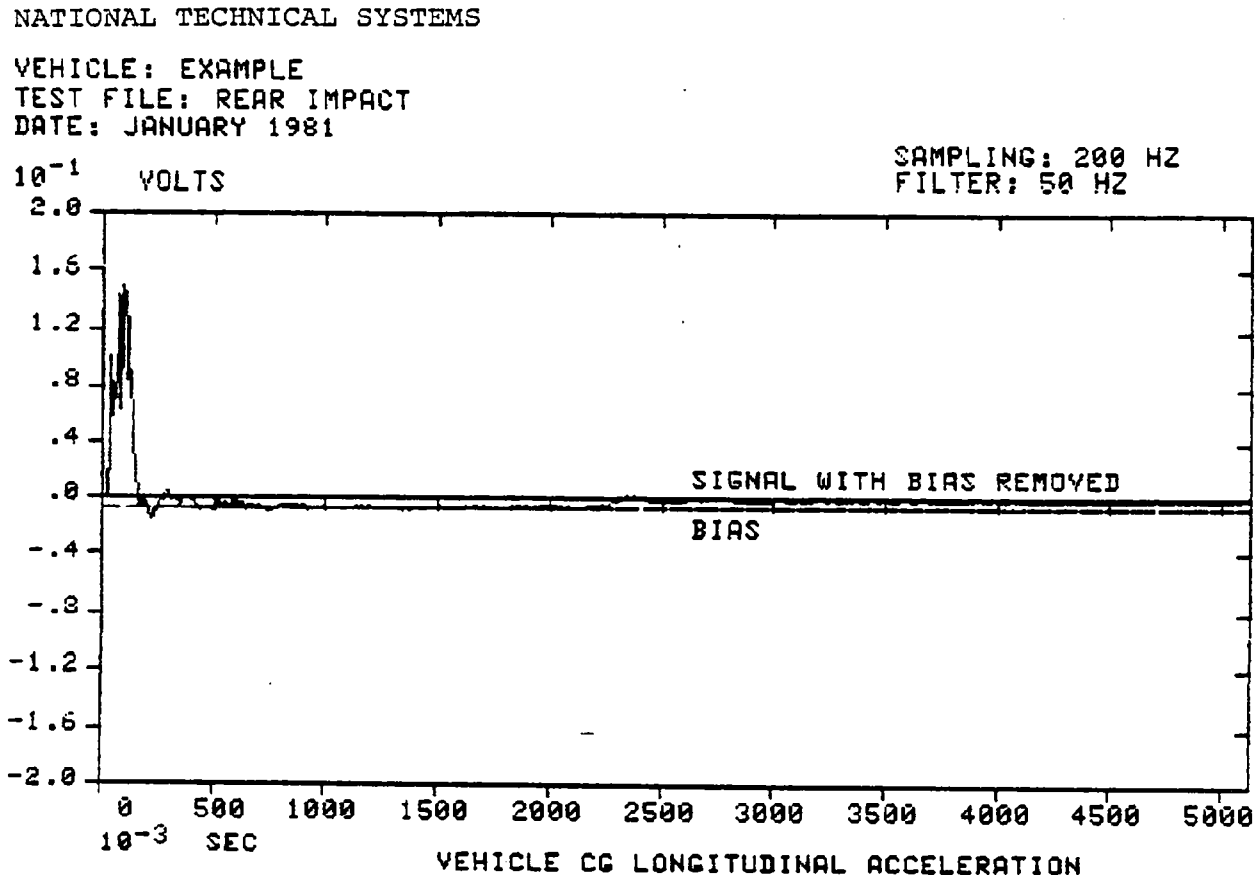

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 200 HZ
FILTER: 50 HZ
10^-1 VOLTS
2.0
1.6
1.2
.8
.4
.0
-.4
-.8
-1.2
-1.6
-2.0
SIGNAL WITH BIAS REMOVED
BIAS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10^-3 SEC
VEHICLE CG LONGITUDINAL ACCELERATION

FIGURE 4-11

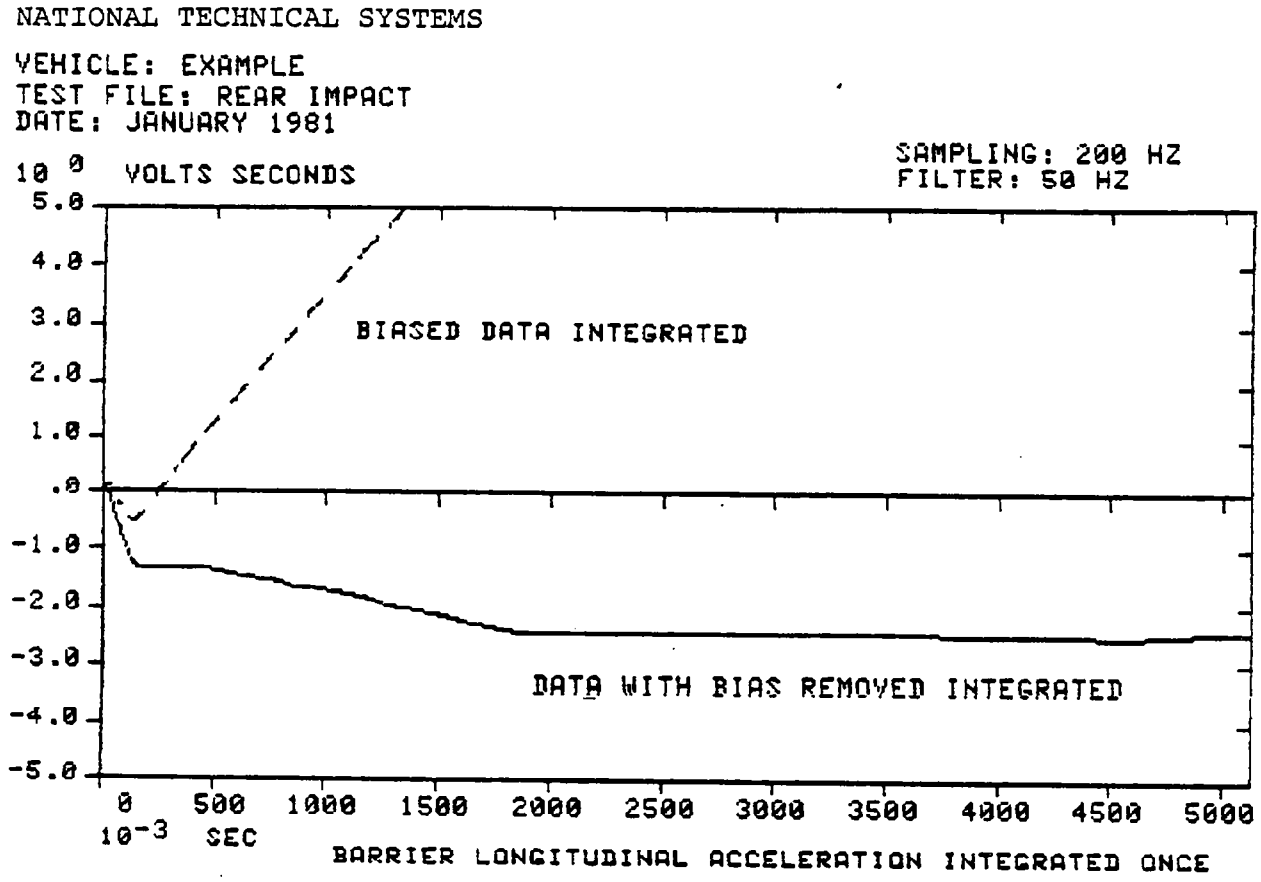

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 200 HZ
FILTER: 50 HZ
10 0 VOLTS SECONDS
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
BIASED DATA INTEGRATED
DATA WITH BIAS REMOVED INTEGRATED
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10-3 SEC
BARRIER LONGITUDINAL ACCELERATION INTEGRATED ONCE

FIGURE 4-12

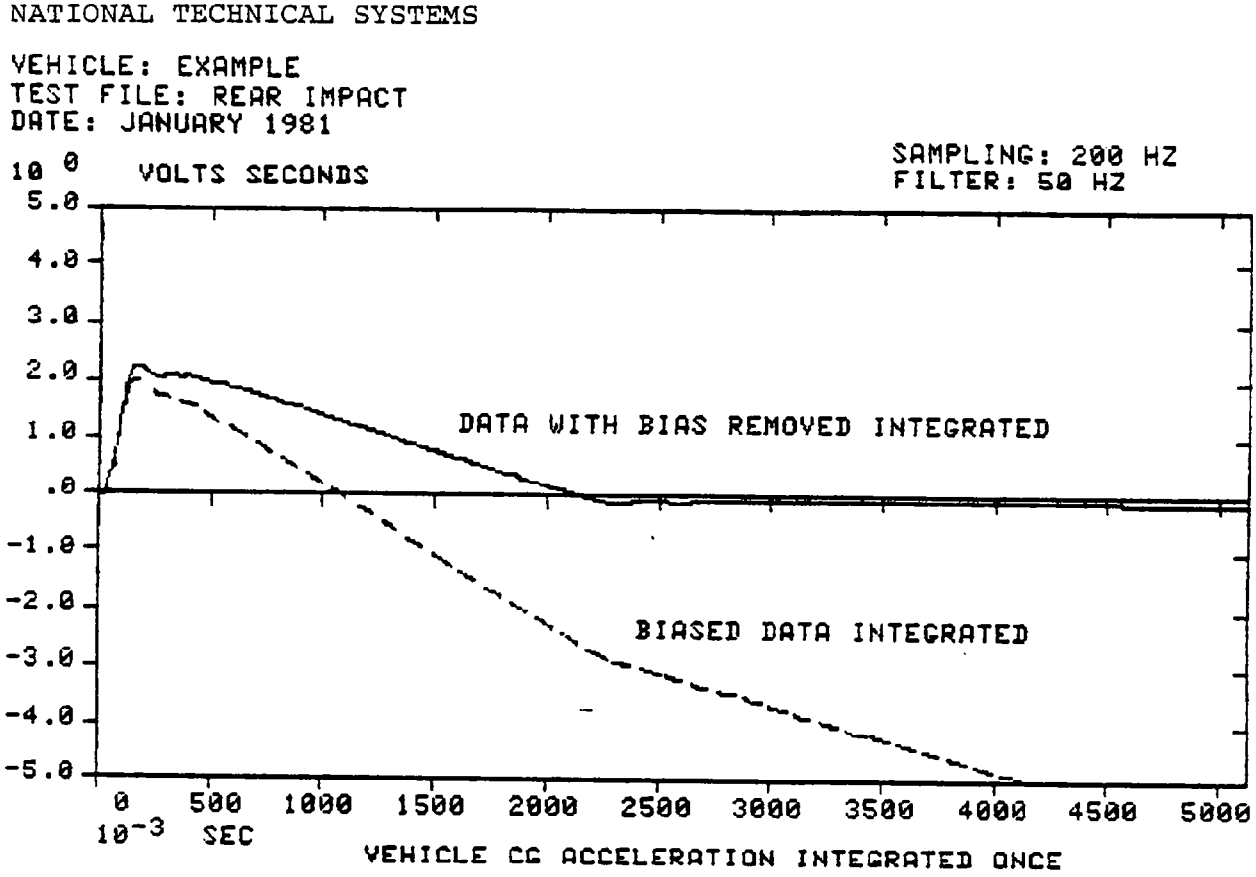

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 200 HZ
FILTER: 50 HZ
10 0 VOLTS SECONDS
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
DATA WITH BIAS REMOVED INTEGRATED
BIASED DATA INTEGRATED
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000
10-3 SEC
VEHICLE CG ACCELERATION INTEGRATED ONCE

FIGURE 4-13

NATIONAL TECHNICAL SYSTEMS

VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981

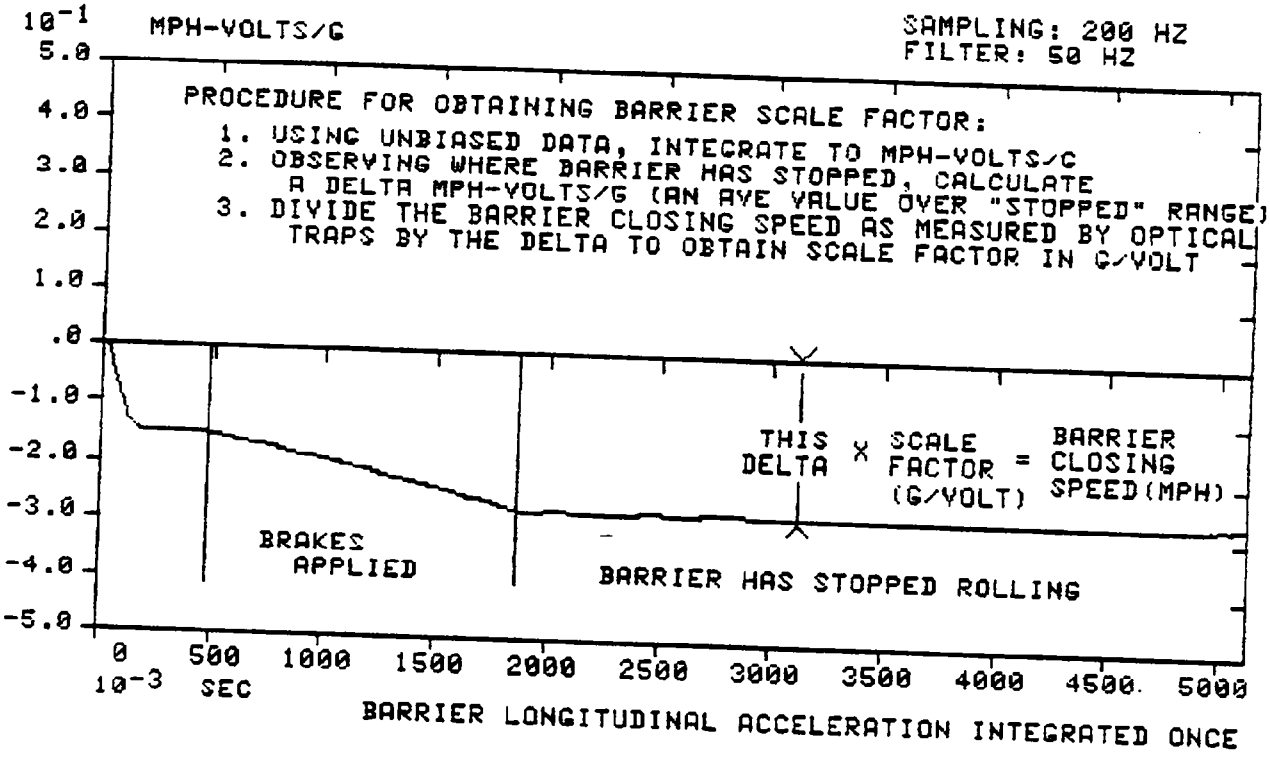


FIGURE 4-14

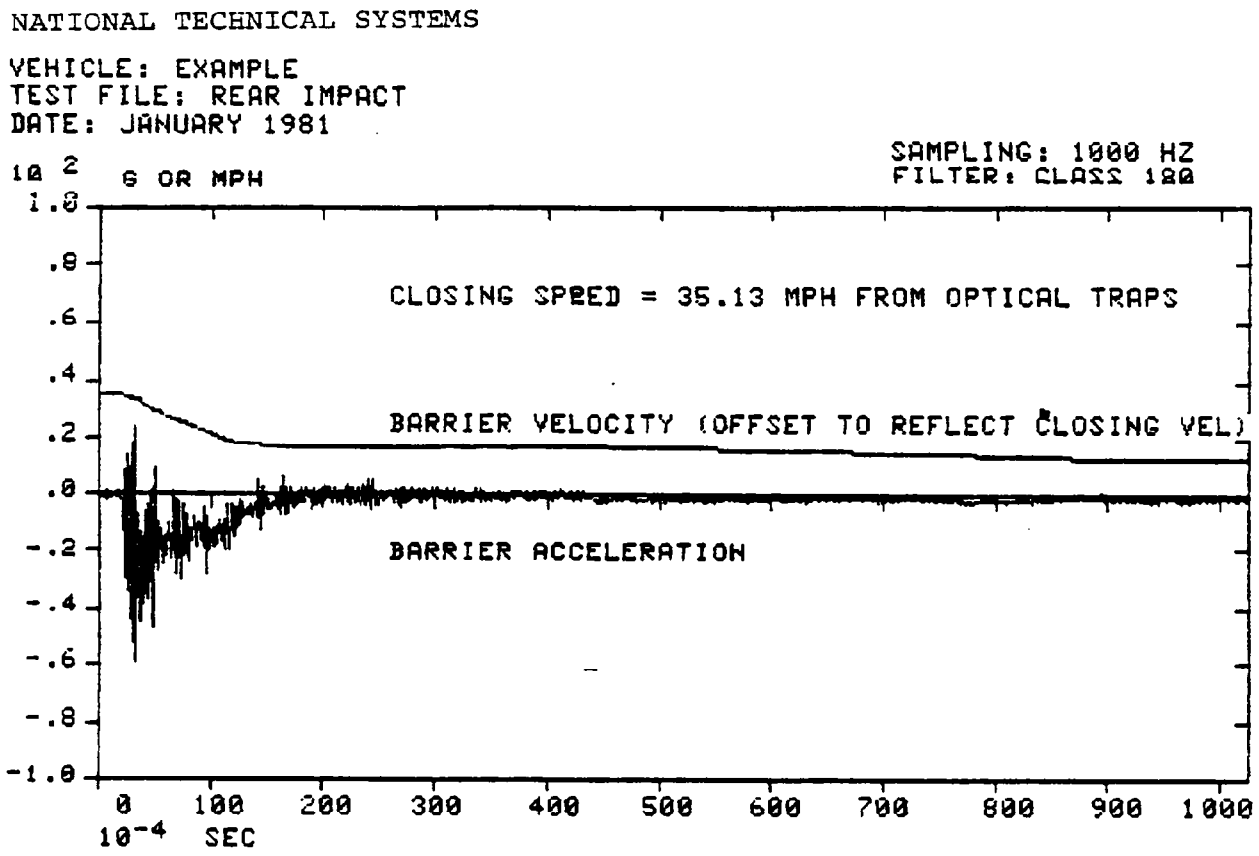

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10 2 G OR MPH
1.0
.8
.6
.4
.2
.0
-.2
-.4
-.6
-.8
-1.0
CLOSING SPEED = 35.13 MPH FROM OPTICAL TRAPS
BARRIER VELOCITY (OFFSET TO REFLECT CLOSING VEL)
BARRIER ACCELERATION
0
100
200
300
400
500
600
700
800
900
1000
10-4 SEC

FIGURE 4-15

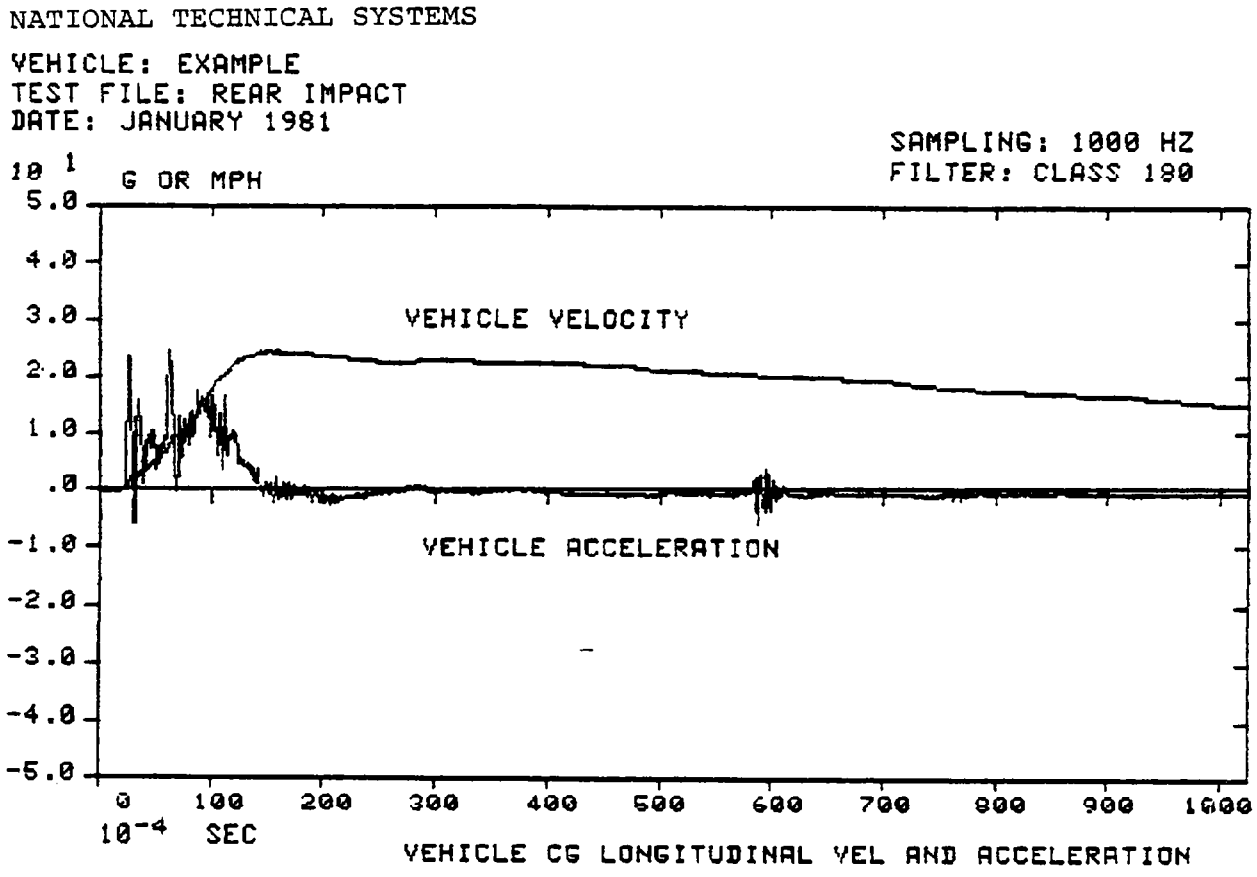

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10 1
G OR MPH
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
VEHICLE VELOCITY
VEHICLE ACCELERATION
0
100
200
300
400
500
600
700
800
900
1000
10-4 SEC
VEHICLE CG LONGITUDINAL VEL AND ACCELERATION

FIGURE 4-16

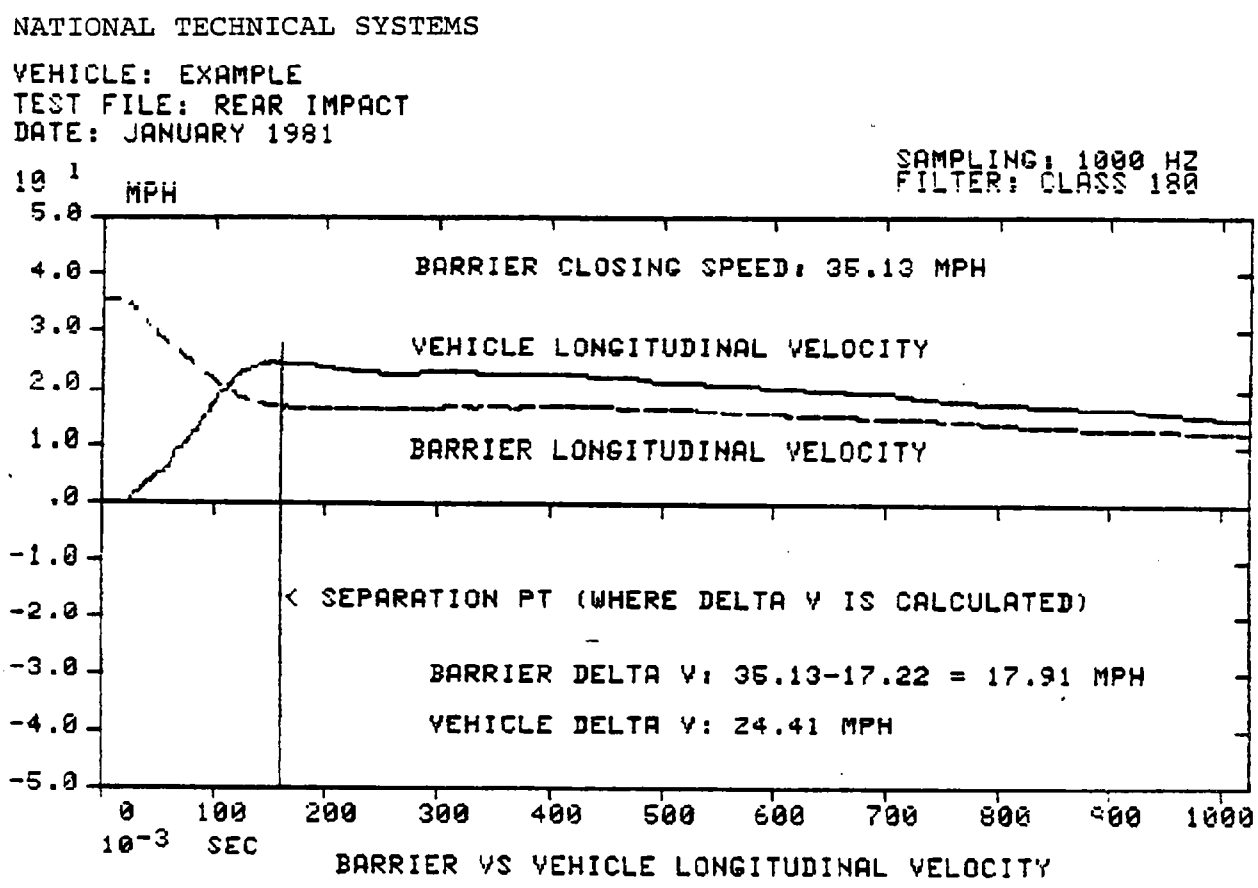

NATIONAL TECHNICAL SYSTEMS
VEHICLE: EXAMPLE
TEST FILE: REAR IMPACT
DATE: JANUARY 1981
SAMPLING: 1000 HZ
FILTER: CLASS 180
10 1 MPH
5.0
4.0
3.0
2.0
1.0
.0
-1.0
-2.0
-3.0
-4.0
-5.0
BARRIER CLOSING SPEED: 35.13 MPH
VEHICLE LONGITUDINAL VELOCITY
BARRIER LONGITUDINAL VELOCITY
< SEPARATION PT (WHERE DELTA V IS CALCULATED)
BARRIER DELTA V: 35.13-17.22 = 17.91 MPH
VEHICLE DELTA V: 24.41 MPH
0
100
200
300
400
500
600
700
800
900
1000
10-3 SEC
BARRIER VS VEHICLE LONGITUDINAL VELOCITY

FIGURE 4-17

NTS

SERVICE FOR: U. S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street S. W.
Washington, D. C. 20590

CONTRACT NUMBER: DTNH22-82-D-31140

I hereby certify that the preceding report is true and correct to the best of my knowledge.

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