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SIDE IMPACT AGGRESSIVENESS
ATTRIBUTES

CAR-TO-POLE SIDE IMPACT TEST OF A 45° CRABBED MOVING 1981 VOLKSWAGEN RABBIT INTO A FIXED RIGID POLE AT 24.9 MPH

PREPARED BY:
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FINAL REPORT
SEPTEMBER 1984

PREPARED FOR:
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400 SEVENTH STREET, S.W.
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16. Abstract

This test report documents a pole crash test conducted under NHTSA Contract DTNH22-82-A-08401, Task Order SRL 92 entitled, "Side Impact Aggressiveness Attributes". Testing was conducted on a 1981 Volkswagen Rabbit 2-door hatchback at the TRCO Crash Test Facility, East Liberty, Ohio. The test vehicle was towed into a fixed, rigid pole, crabbed at a 45 degree angle with a velocity of 24.9 mph. The impact point was 6.5 inches forward of the vehicle wheelbase centerline. Vehicle accelerations were measured, along with occupant responses of two side impact dummies and a 3 year old child dummy. One dummy was located in the driver's designated seating position, one was located in the left rear passenger position, and the child was seated in a child restraint seat located in the right rear passenger position. The test date was August 3, 1984 and the ambient temperature was 80° F.

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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	metric ton	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml.
Tbsp	tablespoons	15	milliliters	ml.
in^3	cubic inches	16	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	degrees Fahrenheit	5 9 (after subtracting 32)	degrees Celsius	°C

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	metric ton (1000 kg)	1.1	short tons	
	VOLUME			
mL	milliliters	0.03	fluid ounces	fl oz
mL	milliliters	0.06	cubic inches	in^3
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	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F

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SECTION 1.0
PURPOSE AND INTRODUCTION

PURPOSE

The purpose of this crash test was to establish a baseline to assess occupant safety when a vehicle impacts a pole at a 45° angle, 6.5 inches forward of the vehicle wheelbase centerline. The vehicle was tested using conditions not currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A 1981 Volkswagen Rabbit 2-door hatchback was towed into a fixed, rigid pole on August 3, 1984, with the driver's side of the car leading at a 45° angle. The intended test speed and impact point were 25 mph and 6.5 inches forward of the wheelbase centerline respectively. Actual impact velocity was 24.9 mph and the actual impact point was 6.5 inches forward of the wheelbase centerline. This test was conducted to establish a baseline for assessing occupant safety under the previously stated impact conditions. No structural modifications were made to this vehicle.

The General Test and Vehicle Parameter Data is contained in Section 2. Section 3 contains all data required by R & D. Appendix A contains pre-test and post-test vehicle and SID dummy photographs. Appendix B contains all Data Plots for the test vehicle and SID dummies. Appendix C contains Dummy Certification. Appendix D contains the Child Dummy Report.

SECTION 2.0
GENERAL TEST AND VEHICLE PARAMETER DATA

The following data sheets describe the General Test and Vehicle Parameter Data.

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Volkswagen of America, Inc.

MAKE/MODEL: Volkswagen Rabbit VIN: 1VWCB9176BV001826

BODY STYLE: 2-Door Hatchback MODEL YEAR: 1981

NHTSA NO.: R & D COLOR: Tan

ENGINE DATA: TYPE: Transverse CYLINDERS: 4 DISPLACEMENT 105 CID

TRANSMISSION DATA: 4 Speed Manual

DATE VEHICLE RECEIVED: 7/10/84 ODOMETER READING: 42784

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	No	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	Yes	REAR WINDOW DEFROSTER	Yes
OTHER	Sun Roof		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

DATA FROM CERTIFICATION LABEL ON LEFT DOOR FACE OR "B" POST:

VEHICLE MANUFACTURED BY: Volkswagen of America, Inc.

DATE OF MANUFACTURE: 9/80

GVWR: 2822 LBS.,

GAWR: FRONT 1609 LBS., REAR 1278 LBS.

VEHICLE TIRE DATA

RECOMMENDED COLD TIRE PRESSURE: FRONT 27 psi; REAR 31 psi

TIRES ON VEHICLE (MFGR. & LINE, SIZE): Stratton Sport Radial 155 SR 13 M/S

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 4

IS SPARE TIRE "SPACE SAVER"? No

IS SPARE TIRE STANDARD EQUIPMENT? Yes

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS):

RIGHT FRONT	640	LBS.	RIGHT REAR	370	LBS.
LEFT FRONT	650	LBS.	LEFT REAR	360	LBS.
TOTAL FRONT WEIGHT	1290	LBS. (63.9 % OF TOTAL VEHICLE WEIGHT)			
TOTAL REAR WEIGHT	730	LBS. (36.1 % OF TOTAL VEHICLE WEIGHT)			
TOTAL DELIVERED WEIGHT	2020	LBS.			

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	RF 24 1/16	;LF 24 1/8	;RR 23 3/4	;LR 23 7/8
PRE-TEST ATTITUDE:	RF 24	;LF 23 11/16	;RR 20 15/16	;LR 20 9/16
POST-TEST ATTITUDE:	RF 24 1/8	;LF 24 3/4	;RR 20	;LR 20 7/16

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 185 LBS. CARGO:

RIGHT FRONT	641	LBS.	RIGHT REAR	619	LBS.
LEFT FRONT	692	LBS.	LEFT REAR	648	LBS.
TOTAL FRONT WEIGHT	1333	LBS. (51.3 % OF TOTAL VEHICLE WEIGHT)			
TOTAL REAR WEIGHT	1267	LBS. (48.7 % OF TOTAL VEHICLE WEIGHT)			
TOTAL TEST WEIGHT	2600	LBS.			

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 0 LBS.

TEST FLUID DATA

TEST FLUID TYPE: RED STODDARD SOLVENT #2; SPEC. GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: 9.5 GALLONS

TEST VOLUME: 2.0 GALLONS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 10.0 GALLONS

DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: Yes FUEL INJECTION: Yes

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? Yes

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.

VEHICLE LOAD (UP TO CAPACITY): FRONT 27 psi; REAR 31 psi

RECOMMENDED TIRE SIZE: 155 SR 13 LOAD RANGE X B, C,

VEHICLE CAPACITY: TYPES OF SEATS: Front - Bucket
Rear - Bench

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT
2 REAR
4 TOTAL

CARGO LOAD 185 LBS.

TOTAL 785 LBS.

*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL TANK THROUGH CARBURETOR BOWL.

TEST CONDITIONS

TEST NUMBER: 840803

DATE OF TEST: August 3, 1984 TIME OF TEST: 14:10

WIND VELOCITY: 0-2 mph 279° W HUMIDITY: 51 %

AMBIENT TEMPERATURE AT IMPACT AREA: 80° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 76° F

SUBJECT VEHICLE DATA

	ACTUAL	INTENDED
VEHICLE TEST WEIGHT (LBS.)	2600	2594
VEHICLE VELOCITY (MPH)*	24.9	25.0
IMPACT POINT (INCHES)**	6.5	6.5

DUMMIES

	DRIVER	LEFT REAR PASSENGER	RT. REAR PASSENGER
TYPE:	SID	SID	3 Year Old
SERIAL NO.:	06	U02	012
INSTRUMENTATION:			
HEAD ACCEL.:	Yes	Yes	Yes
CHEST ACCEL.:	Yes (Upper/Lower)	Yes (Upper/Lower)	Yes
FEMUR L.C.'S:	No	No	No
OTHER:	Pelvis/Ribs	Pelvis/Ribs	

RESTRAINT SYSTEM: Both SID dummies were unrestrained. The child dummy was restrained by a child seat, Century model 4200.

* As measured over final one foot of travel.

** As measured forward of the midpoint of the vehicle's wheelbase.

VISIBLE DUMMY CONTACT POINTS:

	DRIVER 06	PASSENGER U02
Head	Inner Window Frame & Glass, Windshield Left of Center, Pole	Left C-Pillar, Left Rear Window Glass, Pole
Chest	Driver's Inner Door Panel	Left Rear Quarter Panel
Abdomen	Driver's Inner Door Panel	Left Rear Quarter Panel
Left Knee	Driver's Inner Door Panel	Left Rear Quarter Panel
Right Knee	Left Knee	Left Knee

DOOR OPENING:

	LEFT	RIGHT
Front	DNA*	Easy
Rear	DNA	DNA

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
Front	No	Yes
Rear	No	No

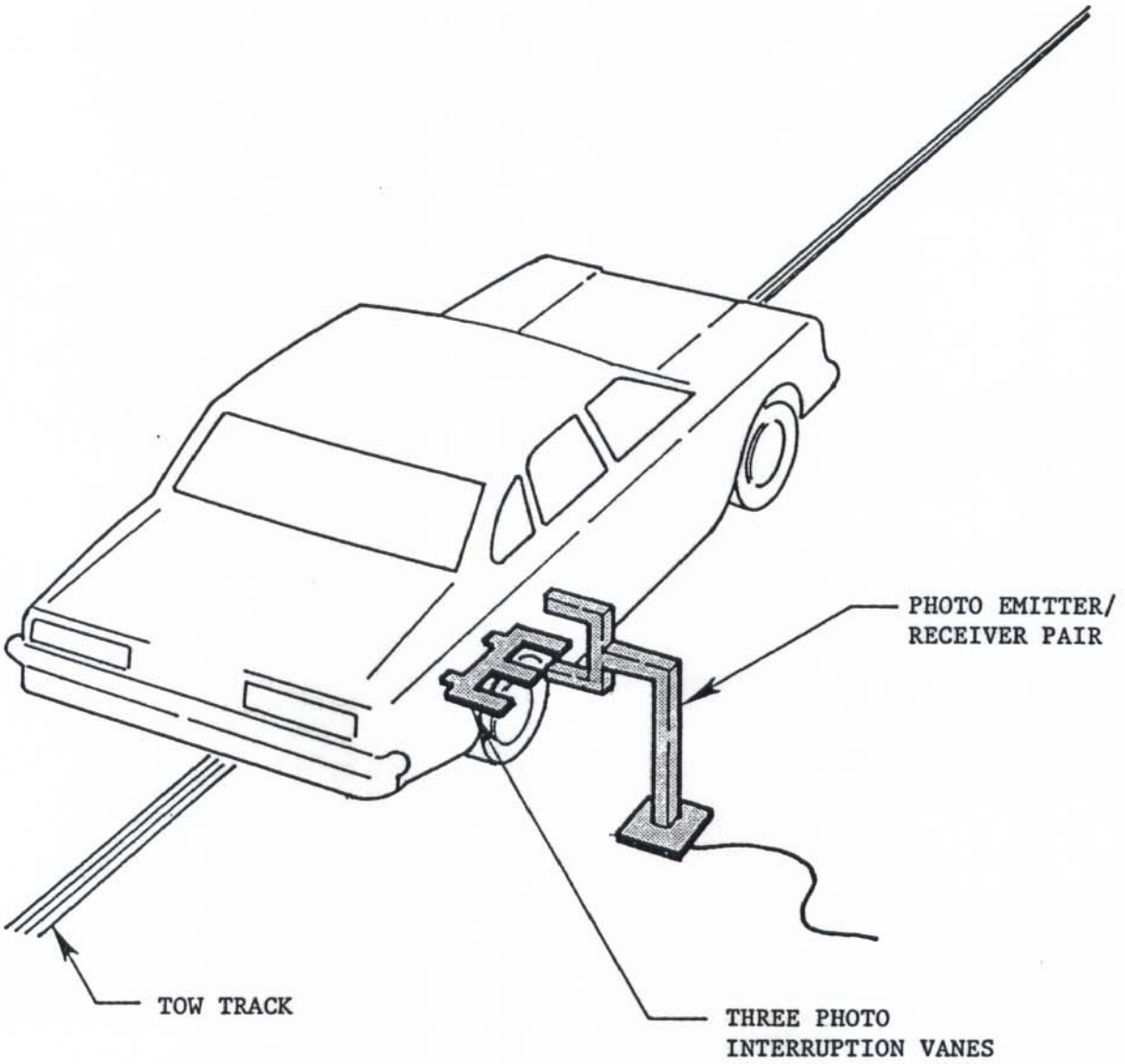
GLAZING DAMAGE: Left front and rear windows shattered; windshield cracked possibly by impact of driver's head; remaining windows undamaged.

OTHER NOTABLE IMPACT EFFECTS:

Sun roof popped out of frame.

*The driver's door to remain closed for subsequent door opening effort studies.

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane is located two inches before impact.

The vanes have one foot spacing.

VEHICLE TEST WEIGHT CALCULATION

Test Weight = Unloaded Delivered Weight +
Number of Dummies X 174 lbs. + Child Dummy +
Restraint Seat + Cargo Weight
= 2020 + 2 X 174 + 32 + 9 + 185 lbs.
= 2594 lbs.

To achieve test weight, the exhaust system, starter, alternator, radiator with fans and hoses, timing chain cover and windshield washer reservoir were removed and 2.0 gallons of Stoddard Solvent were added in the fuel tank. The weight of the test vehicle was measured by placing each wheel on a Loadmeter Corporation Hiway Loadometer.

TEST ANOMALIES

The Left Front Door accelerometer in Position 11, LFDYG5, had a cable separate at approximately 60 msec.

SECTION 3.0

DATA REQUIRED BY R & D

The following pages are included in this section:

1. Dummy temperature control and position data
2. Dummy kinematic summary
3. Vehicle crush data
4. Dummy and vehicle accelerometer location and data summary
5. High speed camera information

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle was kept inside the temperature controlled crash test building until approximately 2 hours prior to the test. Temperature inside the vehicle and ambient temperature at the crash area were recorded. Dummy temperature while outside the crash test building was maintained portably until approximately 1 minute prior to the test.

The following table summarizes the steps taken to position the instrumented, calibrated dummies in the test vehicle.

DUMMY PLACEMENT AND POSITIONING

SIDE IMPACT DUMMY	DRIVER DSP	REAR PASSENGER DSP
HEAD	Surface of transverse instrument mounting platform is as horizontal as possible without inducing torso movement & midsagittal plane falls in longitudinal plane.	Surface of transverse instrument mounting platform is as horizontal as possible without inducing torso movement & midsagittal plane falls in longitudinal plane.
UPPER TORSO	Placed against seat back. Midsagittal plane is vertical and centered on bucket seat.	Placed against seat back. Midsagittal plane is vertical and contained in the same longitudinal plane as the driver's midsagittal plane.
LOWER TORSO	Midsagittal plane is vertical and centered on bucket seat.	Midsagittal plane is vertical and contained in the same longitudinal plane as the driver's midsagittal plane.
UPPER LEGS (thighs or femurs)	Placed against seat cushion. Planes defined by femur and tibia centerlines are as close as possible to vertical.	Placed against seat cushion. Planes defined by femur and tibia centerlines are as close as possible to vertical.
KNEES	Knees set 14.5" apart between pivot bolt head outer surfaces. Outer surface of right knee pivot bolt is 8.6" from midsagittal plane of dummy. Outer surface of left knee pivot bolt is 5.9" from midsagittal plane of dummy.	Located so that planes defined by femur and tibia centerlines are as close as possible to vertical.
LOWER LEGS	Plane defined by femur and tibia centerlines are as close as possible to vertical longitudinal plane.	Plane defined by femur and tibia centerlines are as close as possible to vertical longitudinal plane.
RIGHT FOOT	Placed on undepressed accelerator pedal -- rearmost point of heel on floorplan in plane of pedal.	Centerline falls in vertical longitudinal plane. Placed on floor as far forward as possible without front seat interference.
LEFT FOOT	Placed on toeboard -- rearmost point of heel on floorpan as close as possible to intersection of toeboard and floorpan. Centerline falls in vertical longitudinal plane.	Centerline falls in vertical longitudinal plane. Placed on floor as far forward as possible without front seat interference.

*NOTE: THE SIDE IMPACT DUMMY DOES NOT INCLUDE ARMS.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

VEHICLE NHTSA NO. R & D

MFR./MAKE/MODEL: Volkswagen Rabbit

FRONT SEAT TYPE: ___ BENCH
X BUCKET
___ SPLIT BENCH

ADJUSTER TYPE: X MANUAL
___ POWER

BUCKET SEAT BACK TYPE: ___ FIXED
X ADJUSTABLE

TECHNICIANS:
1. J. Kokoruda
2. N. Echeverria
3. M. Beebe

POSITIONING DATE: 8/3/84

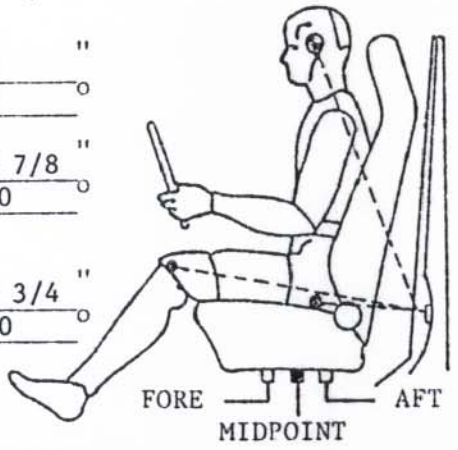
AMBIENT TEMP.: 75° F. TIME: 7:00

DRIVER DUMMY # 06

HEAD 19 "
TARGET* 28 °

KNEE 32 7/8 "
JOINT 100 °

APPROX.
"H" 18 3/4 "
POINT 120 °

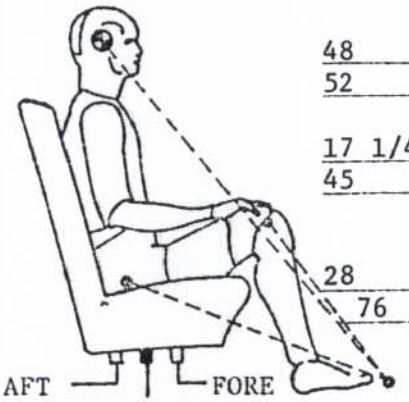


REAR PASSENGER DUMMY # U02

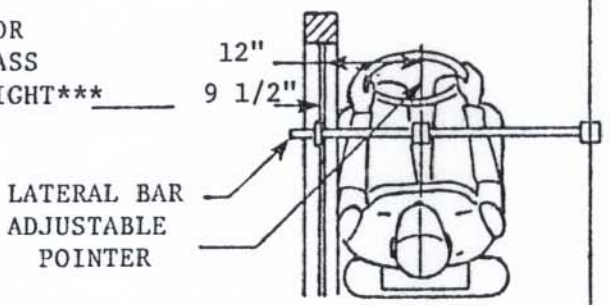
48 "HEAD
52 °TARGET**

17 1/4 "KNEE
45 °JOINT

APPROX.
28 " "H"
76 °POINT

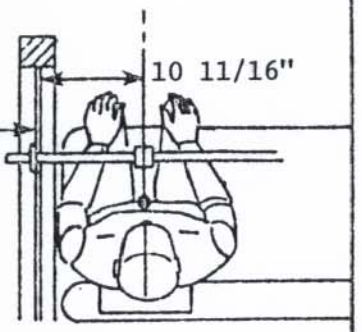


DOOR GLASS HEIGHT*** ___



DRIVER DUMMY # 06

DOOR GLASS HEIGHT ___ DNA

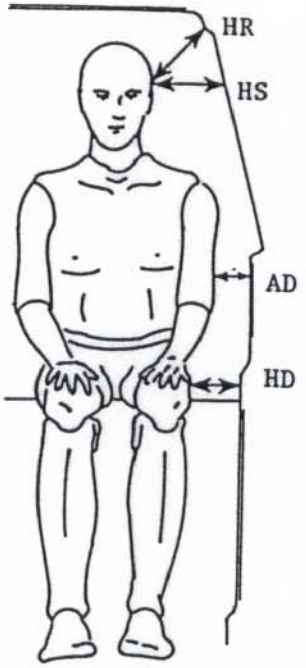


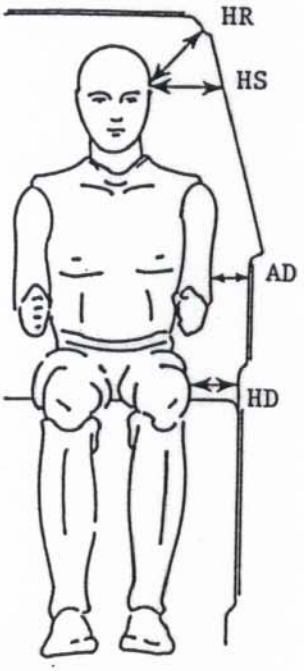
PASSENGER DUMMY # U02

*All driver dummy dimensions referenced to top of striker bolt and all angles referenced to vertical.

**All passenger dummy dimensions referenced to front seat back latch bolt with front seat in mid-position and all angles referenced to vertical.

***Door glass height is equal on the right and left side of vehicle at dummy nose level.

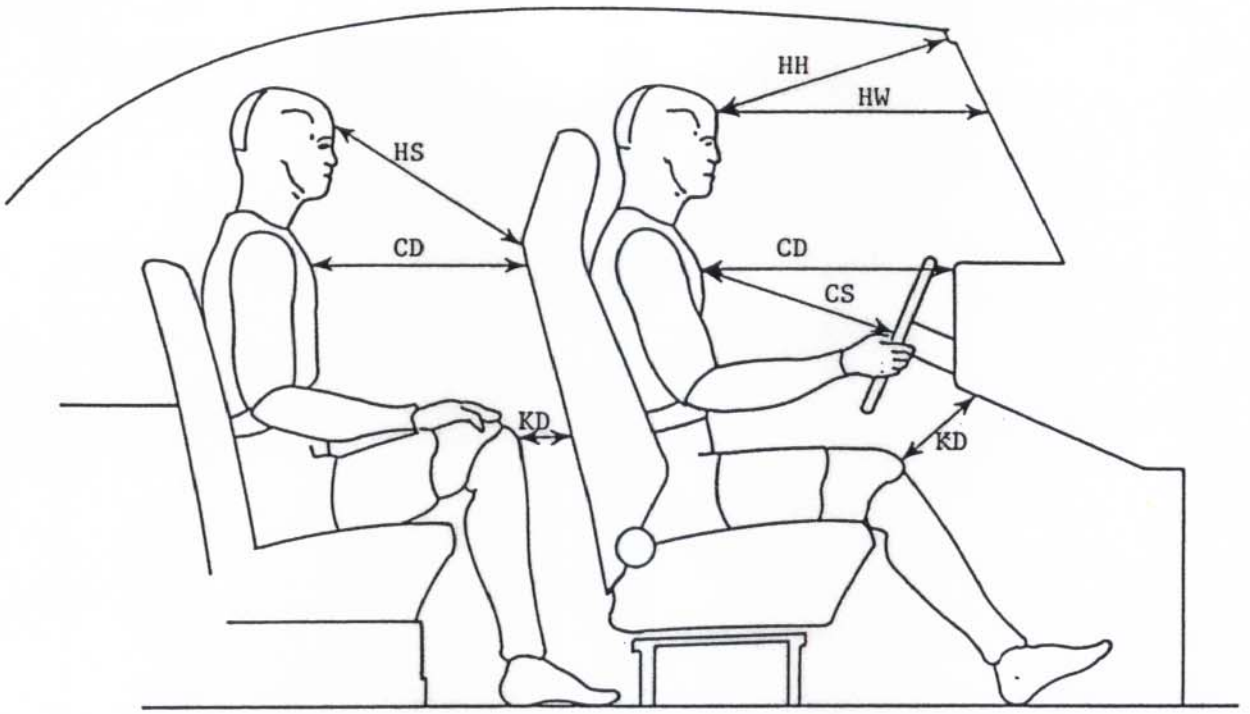




	DRIVER 06	PASSENGER U02
HR	6 5/8	6 5/8
HS	8 1/8	7 3/4
AD	3 3/4	3 7/8
HD	6 1/4	5 1/4

ALL MEASUREMENTS IN INCHES

DUMMY LATERAL CLEARANCE DIMENSIONS



	DRIVER 06	PASSENGER U02
HH	15	DNA
HW	22 1/8	DNA
HS	DNA	20 5/8
CD	20 5/16	15 7/8
CS	13 3/8	DNA
KDL	4 3/4	1 3/4
KDR	4 1/2	1 1/4

ALL MEASUREMENTS IN INCHES

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

DUMMY KINEMATIC SUMMARY

DRIVER

During impact, the driver's thorax struck the side door inner panel as the head went through the driver's side window and grazed the pole. As the dummy rebounded, the body rotated toward the left. The thorax then struck the dash and the head hit the windshield, cracking the glass. In the final resting position, the dummy was seated in the driver's seat facing toward the left.

PASSENGER

During impact, the dummy's thorax struck the left inner quarter panel and the head travelled outside the vehicle to strike the pole. The inner quarter panel crushed inward, preventing the dummy from rebounding. In the final resting position the dummy was sitting upright against the rear quarter panel with the head outside the vehicle against the upper window frame.

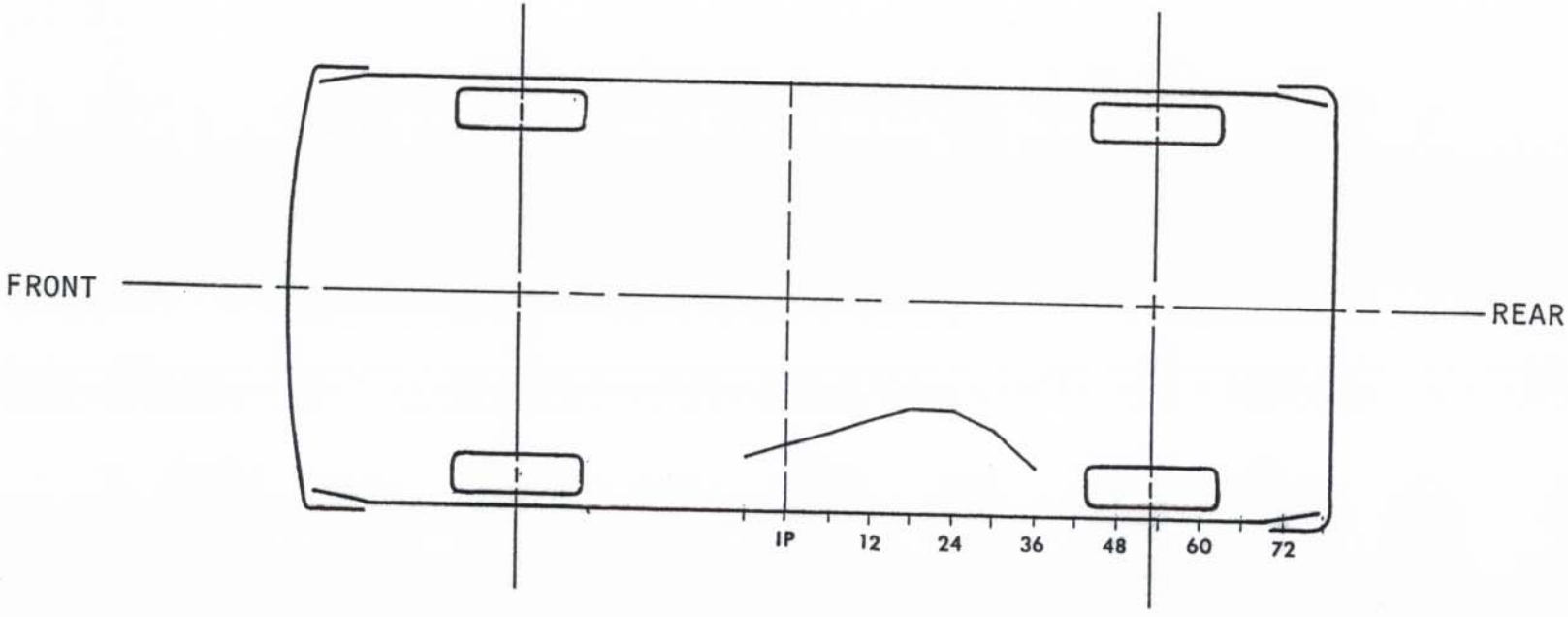
VEHICLE EXTERIOR PROFILES AND STATIC CRUSH

ZERO DISTANCE AT PROJECTED IMPACT POINT*

LOCATION	HEIGHT (in)		6	0	6	12	18	24	30	36	42	48	54	60	66	72	78
	FRONT	REAR	PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)														
Axle Height	8.9	7.8	20.3	20.3	20.2	20.3	20.3	20.3	20.4	20.4	X	X	X	X	X	X	X
H-Point	18.6	17.3	17.8	17.8	17.8	17.8	17.8	17.9	18.0	18.1	16.6	X	X	X	X	X	X
Mid Door	22.3	21.0	17.4	17.3	17.3	17.3	17.4	17.5	17.6	17.7	17.9	16.0	X	X	X	X	X
Window Sill	33.0	31.8	18.8	18.8	18.8	18.8	18.8	18.9	19.0	19.1	19.2	19.3	19.6	20.0	20.6	20.8	X
Window Top	50.8	50.3	26.7	26.1	26.2	26.2	26.2	26.3	26.3	26.5	26.9	27.3	27.9	X	X	X	X
			POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)														
Axle Height	8.9	7.8	28.3	30.0	31.8	33.8	35.4	35.3	32.9	27.8	X	X	X	X	X	X	X
H-Point	18.6	17.3	27.8	29.6	31.8	33.5	36.3	36.4	33.3	27.7	21.9	X	X	X	X	X	X
Mid Door	22.3	21.0	27.8	29.7	32.3	34.3	36.3	36.8	33.4	27.9	23.2	20.3	X	X	X	X	X
Window Sill	33.0	31.8	28.3	30.2	32.8	35.2	37.2	37.4	34.3	28.9	24.9	23.3	23.3	22.9	22.7	23.0	X
Window Top	50.8	50.3	32.3	33.3	35.4	38.2	39.8	40.0	37.9	34.3	31.5	30.9	31.2	X	X	X	X
			STATIC CRUSH (IN)														
Axle Height	8.9	7.8	8.0	9.8	11.6	13.5	15.1	15.1	12.5	7.3	X	X	X	X	X	X	X
H-Point	18.6	17.3	9.9	11.9	14.1	15.8	18.5	18.4	15.3	9.6	5.4	X	X	X	X	X	X
Mid Door	22.3	21.0	10.4	12.4	15.0	16.9	18.9	19.3	15.8	10.2	5.3	4.3	X	X	X	X	X
Window Sill	33.0	31.8	9.4	11.4	14.0	16.4	18.4	18.5	15.3	9.8	5.8	3.9	3.7	2.9	2.1	2.3	X
Window Top	50.8	50.3	5.6	7.1	9.2	12.0	13.6	13.7	11.6	7.8	4.6	3.6	3.3	X	X	X	X

* Projected impact point is 6.5 inches forward of driver's side wheelbase midpoint. Column readings are front to rear from left to right.
** Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

VEHICLE EXTERIOR STATIC CRUSH PROFILE

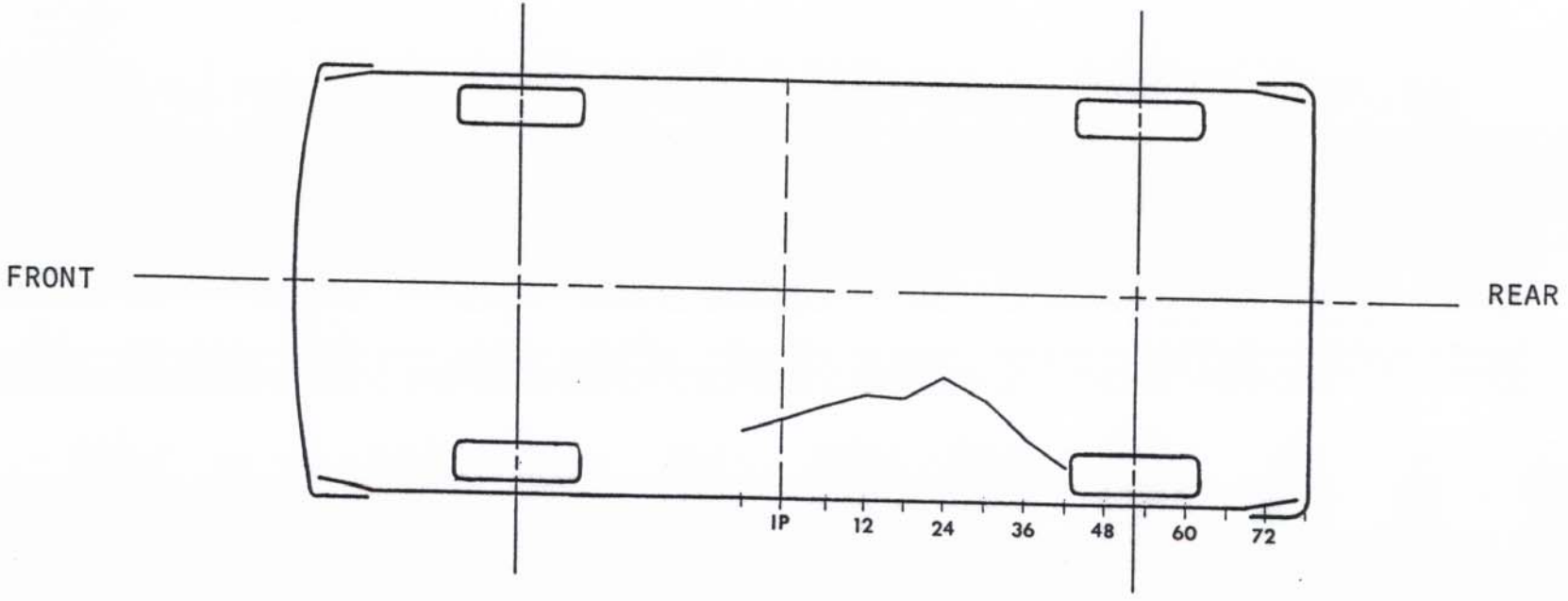


PROFILE LEVEL EQUALS PROJECTED AXLE HEIGHT
IP EQUALS PROJECTED IMPACT POINT

Width of Car = 63.4"
Length of Car = 154.75"

Maximum Crush = 15.13"
Length of Crush = 42.0"

VEHICLE EXTERIOR STATIC CRUSH PROFILE

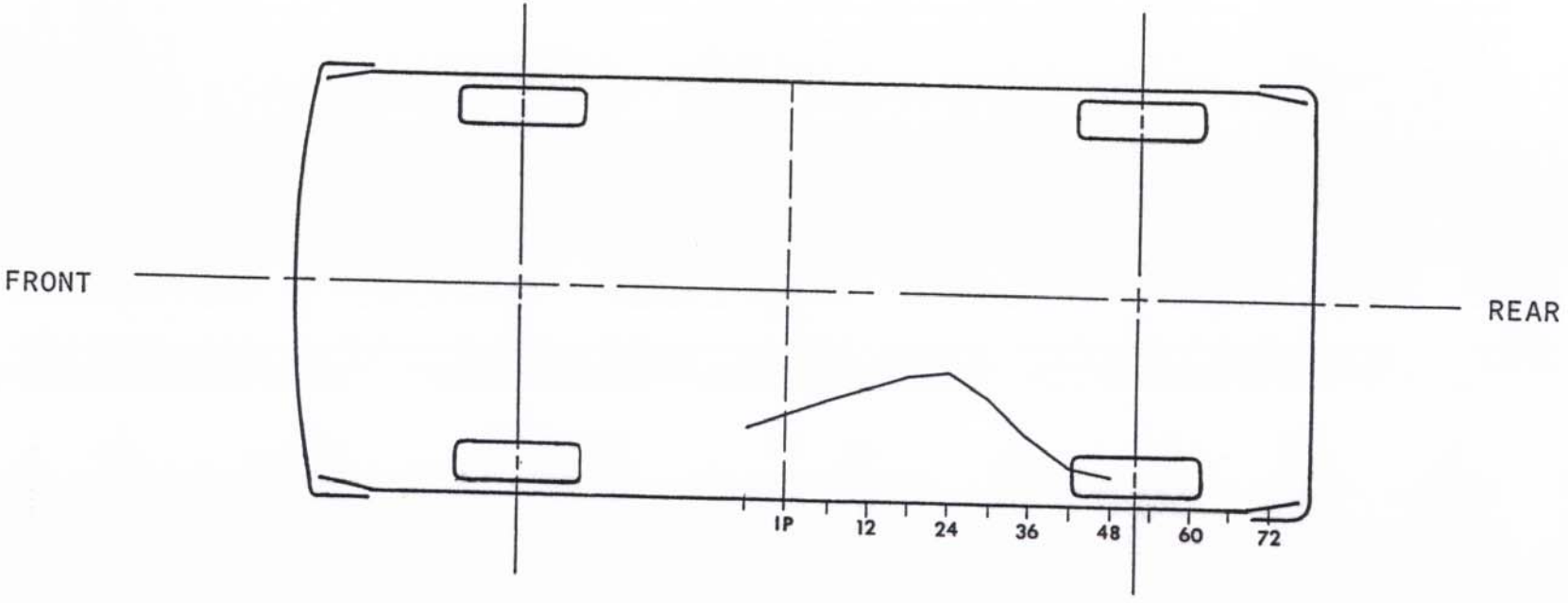


PROFILE LEVEL EQUALS H-POINT HEIGHT
IP EQUALS PROJECTED IMPACT POINT

Width of Car = 63.4"
Length of Car = 154.75"

Maximum Crush = 18.44"
Length of Crush = 48.0"

VEHICLE EXTERIOR STATIC CRUSH PROFILE

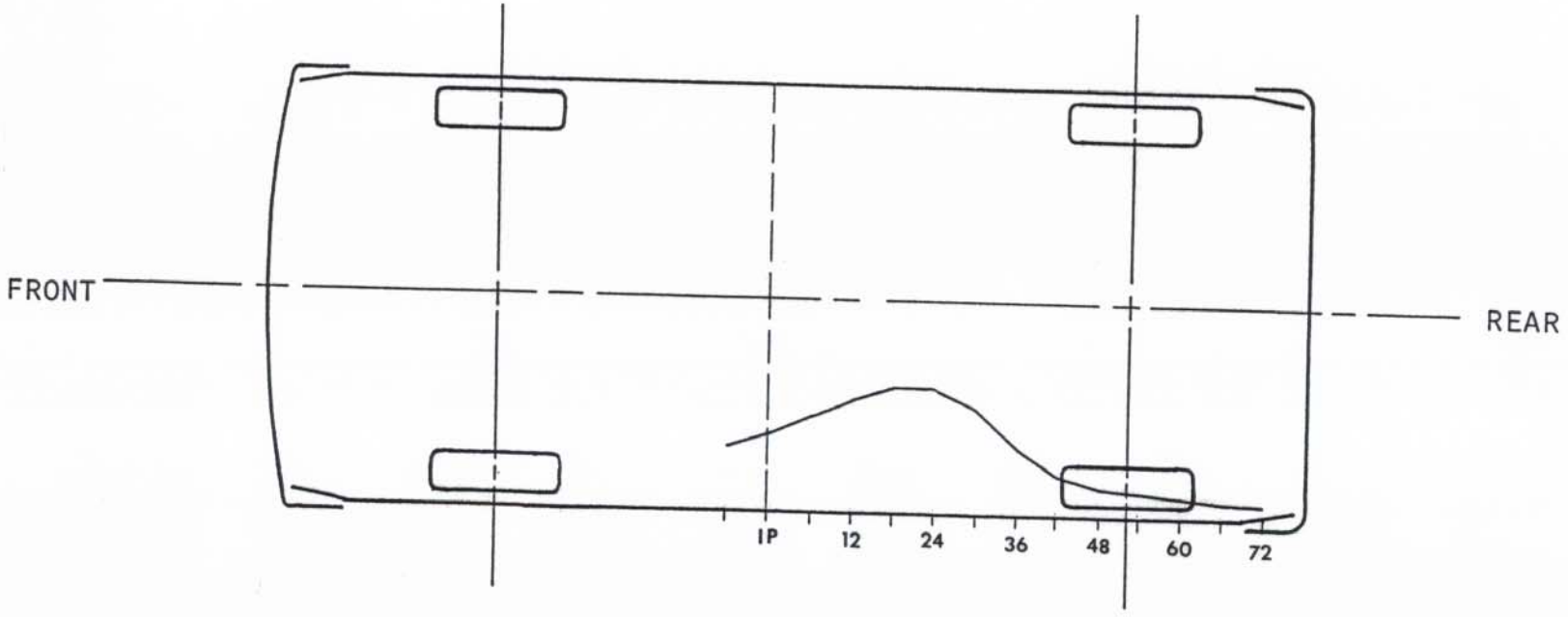


PROFILE LEVEL EQUALS MID-DOOR HEIGHT
IP EQUALS PROJECTED IMPACT POINT

Width of Car = 63.4"
Length of Car = 154.75"

Maximum Crush = 19.31"
Length of Crush = 54.0"

VEHICLE EXTERIOR STATIC CRUSH PROFILE

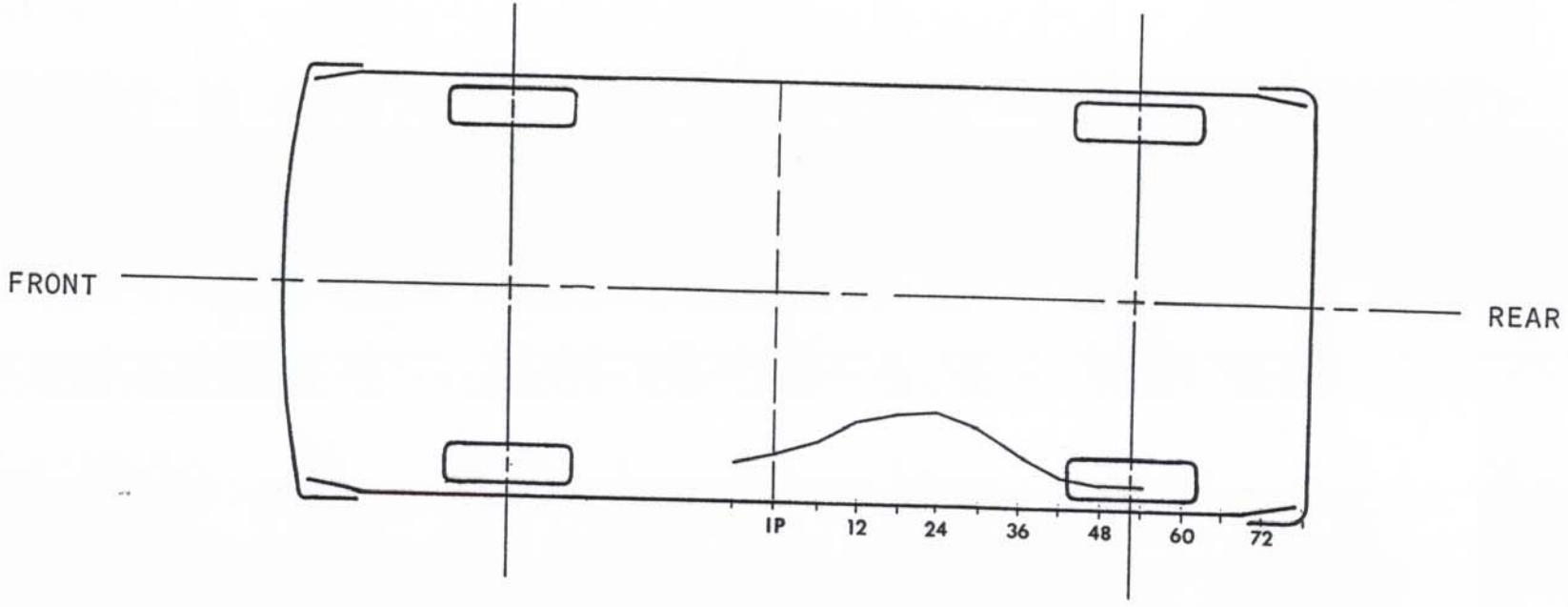


PROFILE LEVEL EQUALS WINDOW SILL HEIGHT
IP EQUALS PROJECTED IMPACT POINT

Width of Car = 63.4"
Length of Car = 154.75"

Maximum Crush = 18.44"
Length of Crush = 88.0"

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW TOP HEIGHT
IP EQUALS PROJECTED IMPACT POINT

Width of Car = 63.4"
Length of Car = 154.75"

Maximum Crush = 13.69"
Length of Crush = 60.0"

SIDE IMPACT DUMMY DATA SUMMARY

	DRIVER DUMMY				PASSENGER DUMMY			
	POSITIVE DIRECTION*		NEGATIVE DIRECTION**		POSITIVE DIRECTION*		NEGATIVE DIRECTION**	
	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
HEAD ACCELERATION								
LONGITUDINAL	50.38	53.13	13.21	76.88	50.44	293.00	37.53	134.88
LATERAL	176.82	52.88	27.81	161.50	73.39	77.38	36.04	134.75
VERTICAL	32.89	53.25	54.79	148.00	44.70	100.38	75.56	123.38
RESULTANT		184.95 @ 52.88				83.50 @ 77.50		
HIC	231.08 from 52.25 to 54.25				553.48 from 74.88 to 136.38			
CHEST ACCELERATION								
UPPER SPINE								
LONGITUDINAL	16.25	48.75	11.87	40.63	18.62	127.50	49.75	105.00
LATERAL (P)***	66.50	40.63	10.63	71.25	49.74	88.75	4.07	62.50
LATERAL (R)***	67.61	40.63	9.13	71.25	50.97	88.75	3.87	61.88
VERTICAL	3.75	48.13	9.71	42.50	---	--- #	---	--- #
RESULTANT (P)		67.68 @ 40.63				54.40 @ 89.38		
RESULTANT (R)		68.77 @ 40.63				55.48 @ 89.38		
DELTA V (MPH)****		21.5 @ 66.25 (P)				24.6 @ 125.00 (P)		
		23.1 @ 66.87 (R)				25.2 @ 125.00 (R)		
LOWER SPINE								
LONGITUDINAL	27.62	46.88	21.60	39.38	59.41	80.63	40.30	75.62
LATERAL (P)	85.79	40.00	---	---ε	49.95	78.75	1.91	42.50
LATERAL (R)	85.64	40.00	---	---ε	46.36	76.88	2.39	42.50
VERTICAL	4.97	38.13	5.74	42.50	---	--- #	---	--- #
RESULTANT (P)		88.27 @ 40.00				75.84 @ 80.00		
RESULTANT (R)		88.12 @ 40.00				68.77 @ 80.63		
DELTA V (MPH)		20.1 @ 67.50 (P)				22.7 @ 100.63 (P)		
		21.0 @ 70.63 (R)				22.8 @ 101.25 (R)		
LEFT UPPER RIB								
LATERAL (P)	80.17	35.00	8.05	48.75	37.02	78.13	0.99	127.50
LATERAL (R)	86.78	34.38	7.94	48.13	38.34	79.38	0.86	127.50
DELTA V (MPH)		20.0 @ 88.75 (P)				29.5 @ 140.00 (P)		
		19.7 @ 88.13 (R)				29.9 @ 140.63 (R)		
LEFT LOWER RIB								
LATERAL (P)	54.33	35.00	3.40	75.00	48.52	81.25	4.23	106.25
LATERAL (R)	60.68	35.00	4.55	75.63	46.29	83.12	3.71	105.63
DELTA V (MPH)		17.6 @ 88.13 (P)				27.8 @ 125.00 (P)		
		18.0 @ 87.50 (R)				28.4 @ 123.75 (R)		
PELVIS ACCELERATION								
LONGITUDINAL	1.70	57.00	19.14	84.13	30.22	54.50	71.62	77.00
LATERAL	67.81	41.00	7.07	90.38	130.77	76.63	42.92	41.63
VERTICAL	9.36	42.63	6.36	40.00	41.73	76.88	12.27	84.25
RESULTANT		68.22 @ 41.00				154.38 @ 76.75		
DELTA V (MPH)		16.3 @ 75.50				28.6 @ 92.63		

SIDE IMPACT DUMMY DATA SUMMARY CONTD

	DRIVER DUMMY				PASSENGER DUMMY			
	POSITIVE DIRECTION*		NEGATIVE DIRECTION**		POSITIVE DIRECTION*		NEGATIVE DIRECTION**	
	MAX (in)	TIME (msec)	MAX (in)	TIME (msec)	MAX (in)	TIME (msec)	MAX (in)	TIME (msec)
RIB DEFLECTION †	1.46	100.50	0.02	13.13	1.11	102.88	0.04	71.88

* LONGITUDINAL:	FORWARD	**LONGITUDINAL:	REARWARD
LATERAL:	RIGHTWARD	LATERAL:	LEFTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD

*** (P) = Primary Sensor, (R) = Redundant Sensor

**** For dummy channels, Delta V is the velocity change at the approximate time of separation from the contact area.

† Compression: Positive

This channel was disconnected due to the use of a child dummy.

ε There were no negative values in the time interval of interest.

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	RIGHT SILL AT FRONT SEAT	83.4	23.6	10.5				
	(LONGITUDINAL)	ΔV = -10.6 mph @ 151.63 msec			0.48	44.50	8.55	89.38
	(LATERAL)	ΔV = 10.7 mph @ 151.63 msec			10.36	60.38	4.34	113.00
	(VERTICAL)				---	--- #	---	--- #
	(RESULTANT)					11.31 @ 60.50		
2	RIGHT SILL AT REAR SEAT	61.4	23.5	8.6				
	(LONGITUDINAL)	ΔV = -8.4 mph @ 151.63 msec			0.72	44.63	7.92	89.00
	(LATERAL)	ΔV = 15.4 mph @ 151.63 msec			13.62	67.38	4.87	134.75
	(VERTICAL)				7.79	92.63	6.07	134.75
	(RESULTANT)					14.40 @ 67.25		
3	REAR DECK OVER AXLE	32.0	0.0	6.7				
	(LONGITUDINAL)	ΔV = -8.4 mph @ 151.63 msec			6.66	28.63	17.67	108.38
	(LATERAL)	ΔV = 26.0 mph @ 151.63 msec			19.47	90.38	2.80	172.88
	(VERTICAL)				---	--- #	---	--- #
	(RESULTANT)					23.16 @ 102.00		
4	LEFT SILL AT REAR SEAT	61.0	-23.8	8.5				
	(LATERAL)	ΔV = ---		--- τ	61.02	46.13	43.70	52.00
5	LEFT SILL AT FRONT SEAT	83.4	-23.5	10.0				
	(LATERAL)	ΔV = 6.6 mph @ 83.25 msec			27.80	35.88	14.70	29.38
6	LEFT FRONT DOOR CENTERLINE	81.2	-25.8	23.0				
	(LATERAL)	ΔV = 16.9 mph @ 11.50 msec			161.09	12.88	84.23	19.00
7	RIGHT REAR COMPARTMENT	31.0	15.4	13.6				
	(LONGITUDINAL)				4.28	152.75	11.12	110.13
8	MIDREAR OF LEFT FRONT DOOR	61.1	-26.3	22.8				
	(LATERAL)	ΔV = 30.7 mph @ 45.38 msec			129.86	45.38	64.95	53.63
9	UPPER LEFT FRONT DOOR CENTERLINE	82.3	-25.7	32.1				
	(LATERAL)	ΔV = ---		--- τ	107.39	15.88	141.35	39.13
10	MIDFRONT OF LEFT FRONT DOOR	100.0	-26.1	22.3				
	(LATERAL)	ΔV = 3.3 mph @ 7.13 msec			22.91	8.25	28.00	13.13
11	UPPER REAR OF LEFT REAR DOOR	71.3	-26.0	32.1				
	(LATERAL)	ΔV = ---		--- Υ	206.00	56.63 Υ	99.75	38.00 Υ

* Reference: X - Rear Bumper (+ Forward), Y - Vehicle Centerline (+ To Right), Z - Ground Level (+ Up)

All measurements of accelerometer locations in inches.

τ This Delta V appears unrealistic after initial velocity change.

Υ See TEST ANOMALIES

This channel was disconnected due to the use of a child dummy.

FIXED POLE LOAD CELL LOCATIONS AND DATA SUMMARY

CELL NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (lb)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (lb)	NEGATIVE DIRECTION TIME (msec)
1		17.75	-3.25	72.5	2071.64	126.00	14371.70	50.25
2		17.75	3.25	72.5	7678.61	52.38	8475.99	93.88
3		17.75	-3.25	4.0	2257.76	178.50	13486.62	48.75
4		17.75	3.25	4.0	1042.86	18.88	23315.28	88.13
TOTAL FORCE					1228.49	156.25	42379.20	78.50

*Reference Facing Pole Front
X - Pole Base (+ forward)
Y - Pole Centerline (+ right)
Z - Ground Level (+ up)

All location measurements are in inches.

Compression - Negative

LOCATIONS OF OFFBOARD HIGH SPEED CAMERAS

CAMERA NO.	X	Y	Z
1	-3' 1/2"	2"	17'3"
2	13'11"	10'3"	13'3"
3	-3'5"	-24'4"	52'1/2"
4	12'9"	5'3/4"	32'1/2"

Origin of Coordinate System is Point of Impact

+X = Forward of Impact Side of Pole with Respect to Striking Vehicle's Velocity Vector
+Y = Rightward from Centerline of Pole
+Z = Upward with Respect to Striking Vehicle's Velocity Vector

HIGH SPEED CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Overhead	Photosonic 1B	25	497	Impact point
2	Overhead	Photosonic 1B	13	495	Vehicle dynamics
3	Left Side	Photosonic 1B	13	497	Vehicle dynamics
4	Behind Pole	Photosonic 1B	25	500	Impact point
5	Onboard - Front	Photosonic 1B	8	795	Driver kinematics
6	Onboard - Driver Side	Photosonic 1B	8	802	Driver kinematics
7	Onboard - Backseat	Photosonic 1B	8	730	Passenger kinematics

NOTE: CAMERAS ARE NUMBERED ACCORDING TO SPLICING SEQUENCE OF FILM. (24 fps) REAL TIME MOVIE FILM COVERAGE OF PRE-CRASH, POST-CRASH AND CRASH EVENT SPLICED AT START AND END OF FILM.

APPENDIX A

PHOTOGRAPHS

Figure A-1. PRE-TEST OVERALL - VIEW 1

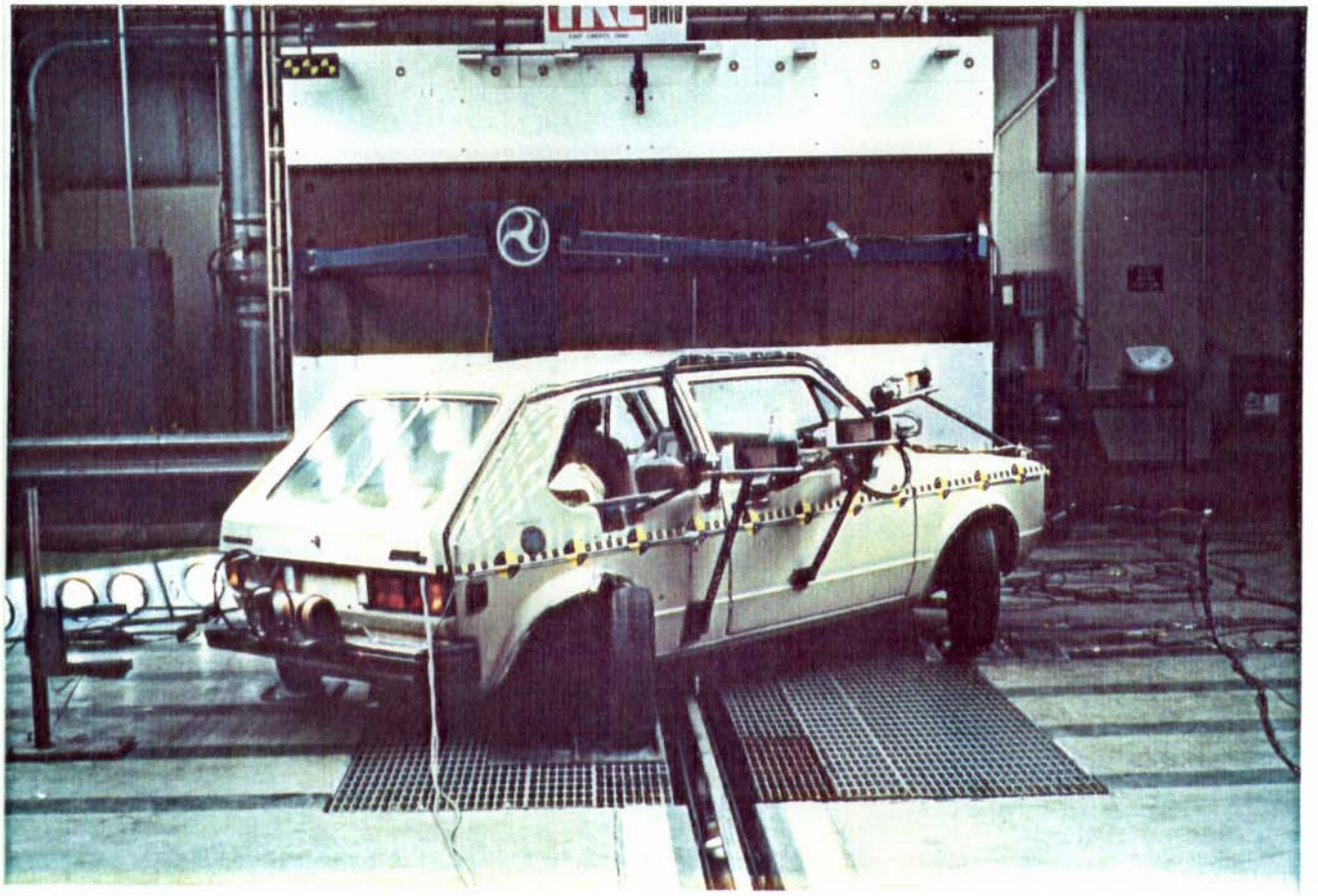


Figure A-2. PRE-TEST OVERALL - VIEW 2

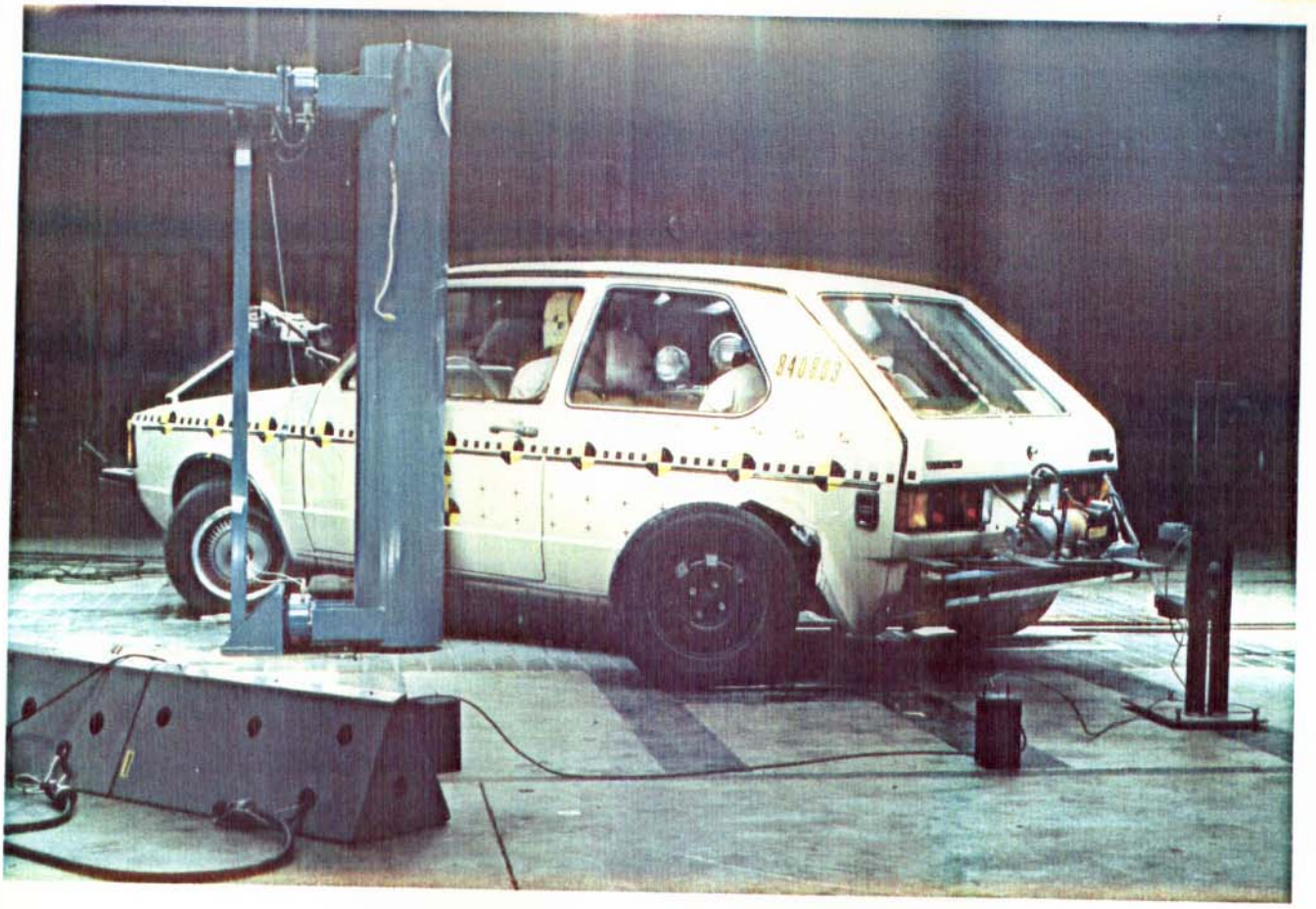


Figure A-3. PRE-TEST OVERALL - VIEW 3

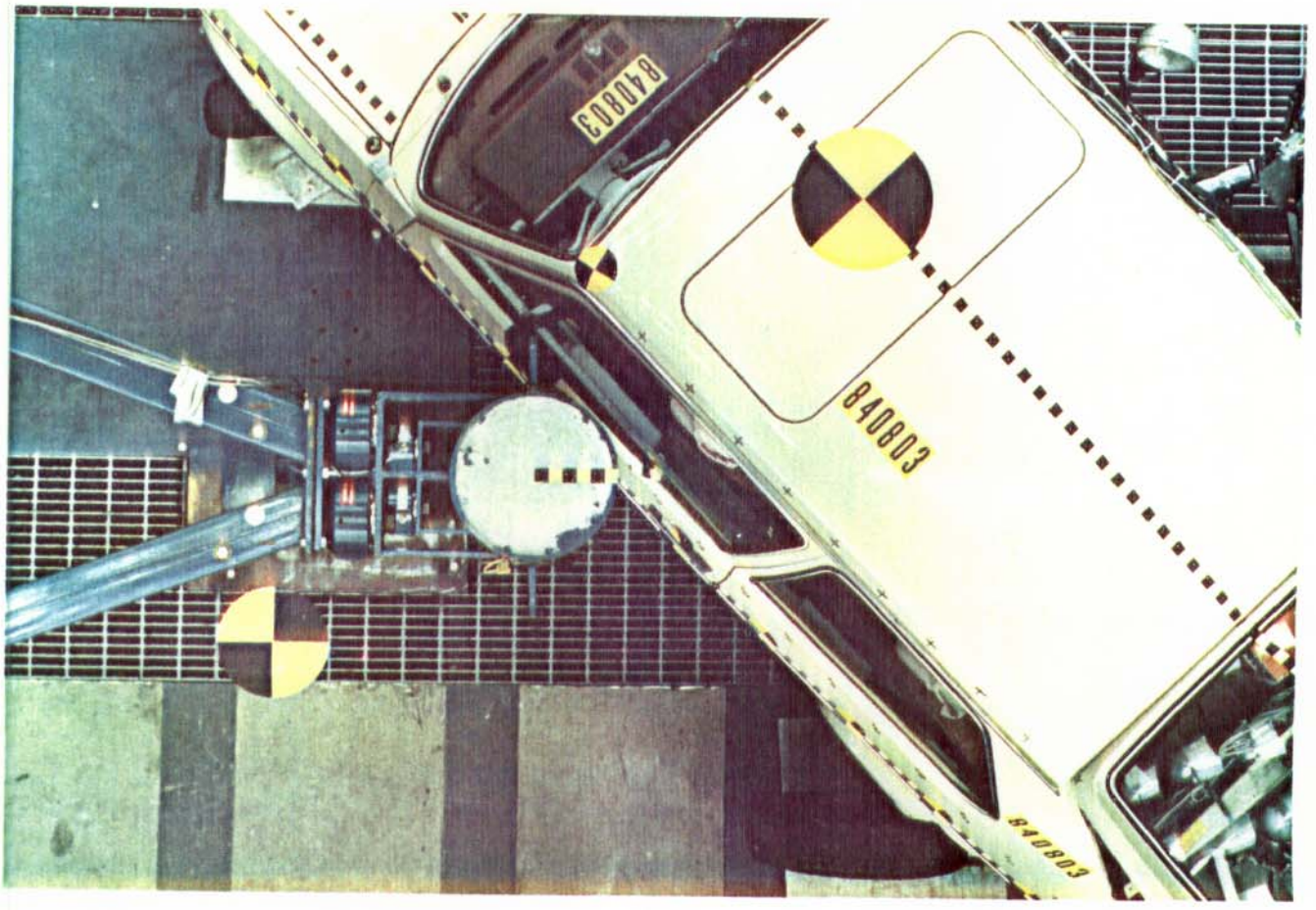


Figure A-4. PRE-TEST OVERALL - VIEW 4

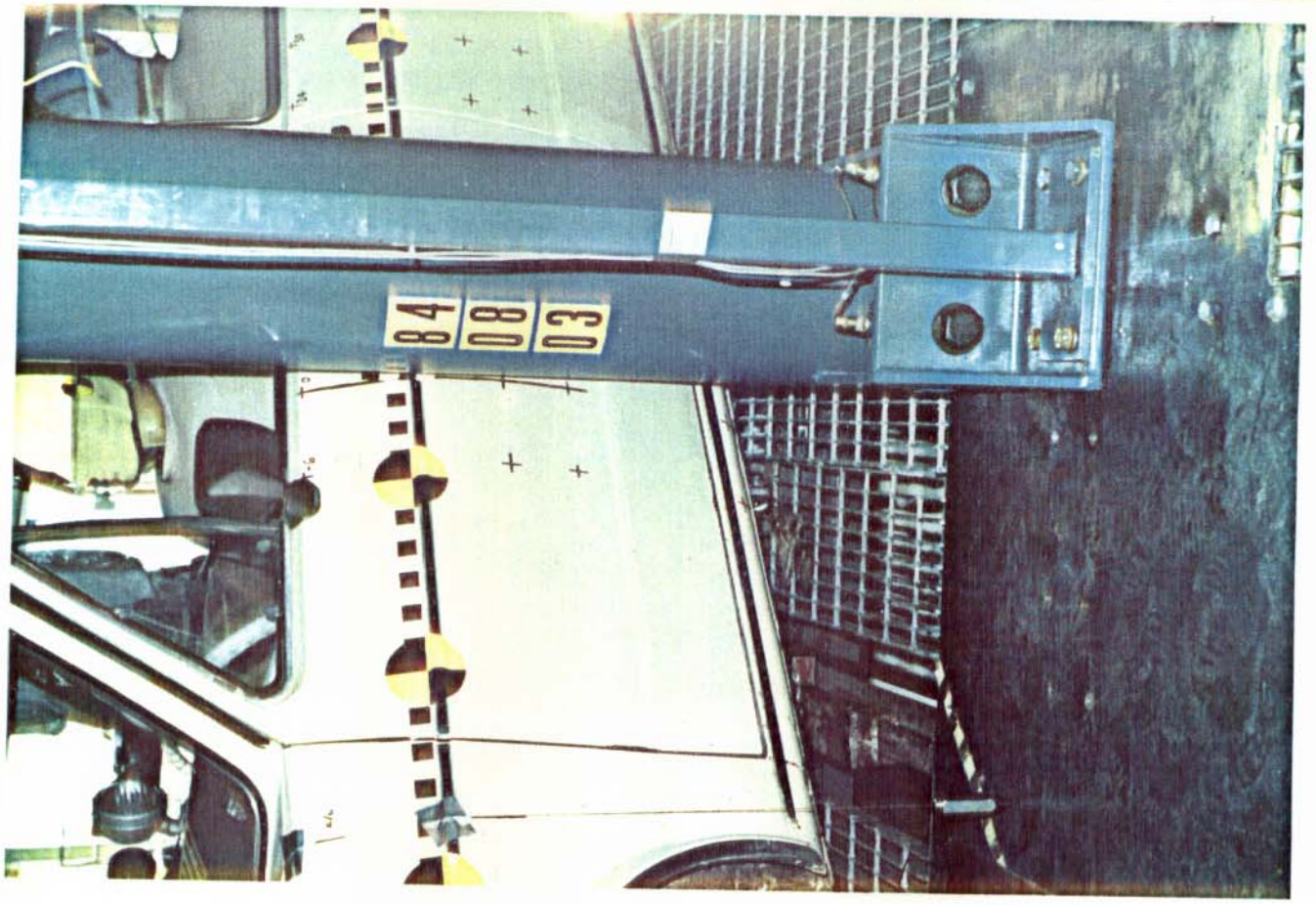


Figure A-5. PRE-TEST CLOSEUP

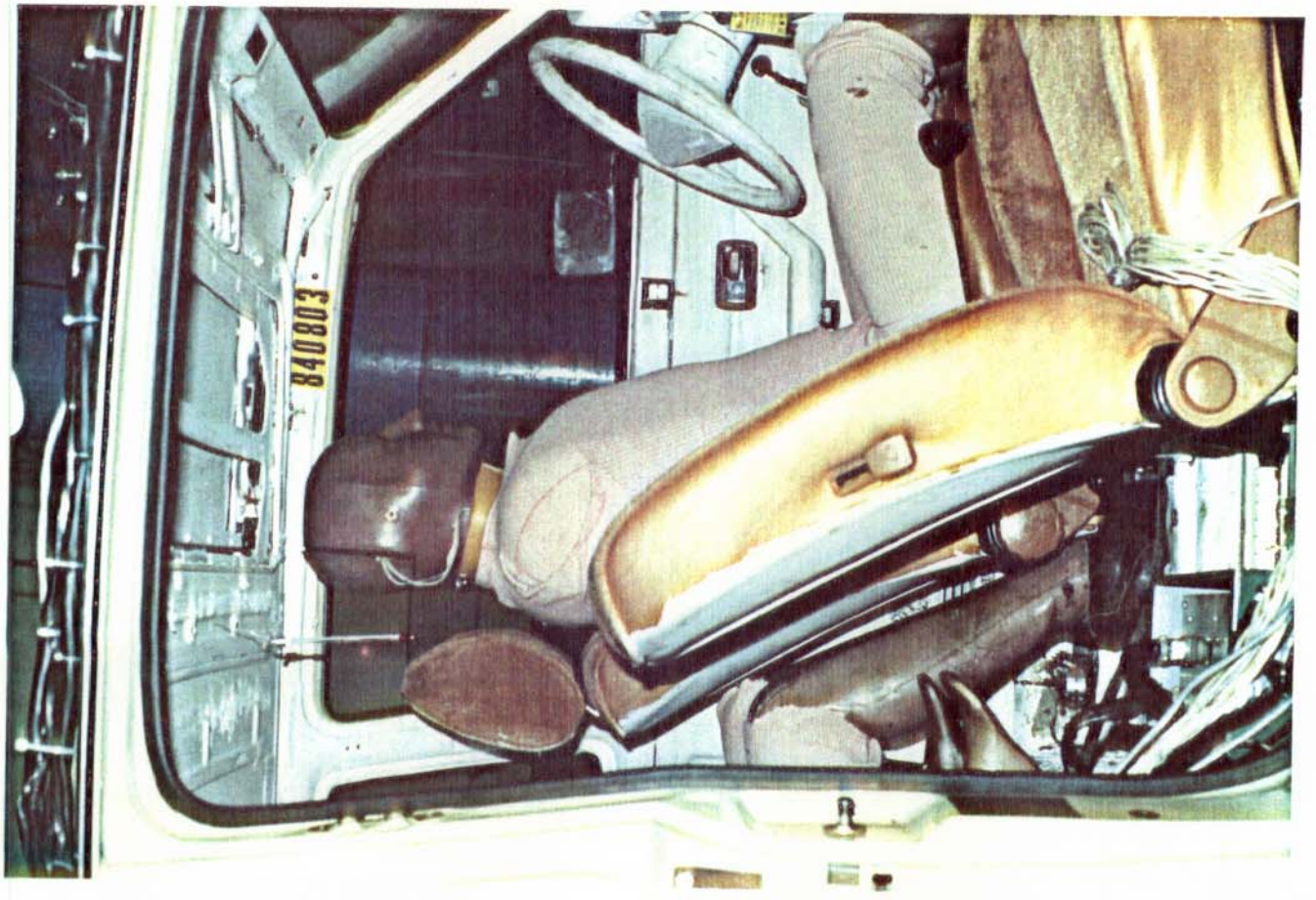


Figure A-6. PRE-TEST DRIVER DUMMY - VIEW 1

Figure A-7. PRE-TEST DRIVER DUMMY - VIEW 2

Figure A-8. PRE-TEST PASSENGER DUMMY - VIEW 1

Figure A-9. PRE-TEST PASSENGER DUMMY - VIEW 2

Figure A-10. PRE-TEST DUMMY OVERALL

Figure A-11. POST-TEST OVERALL - VIEW 1

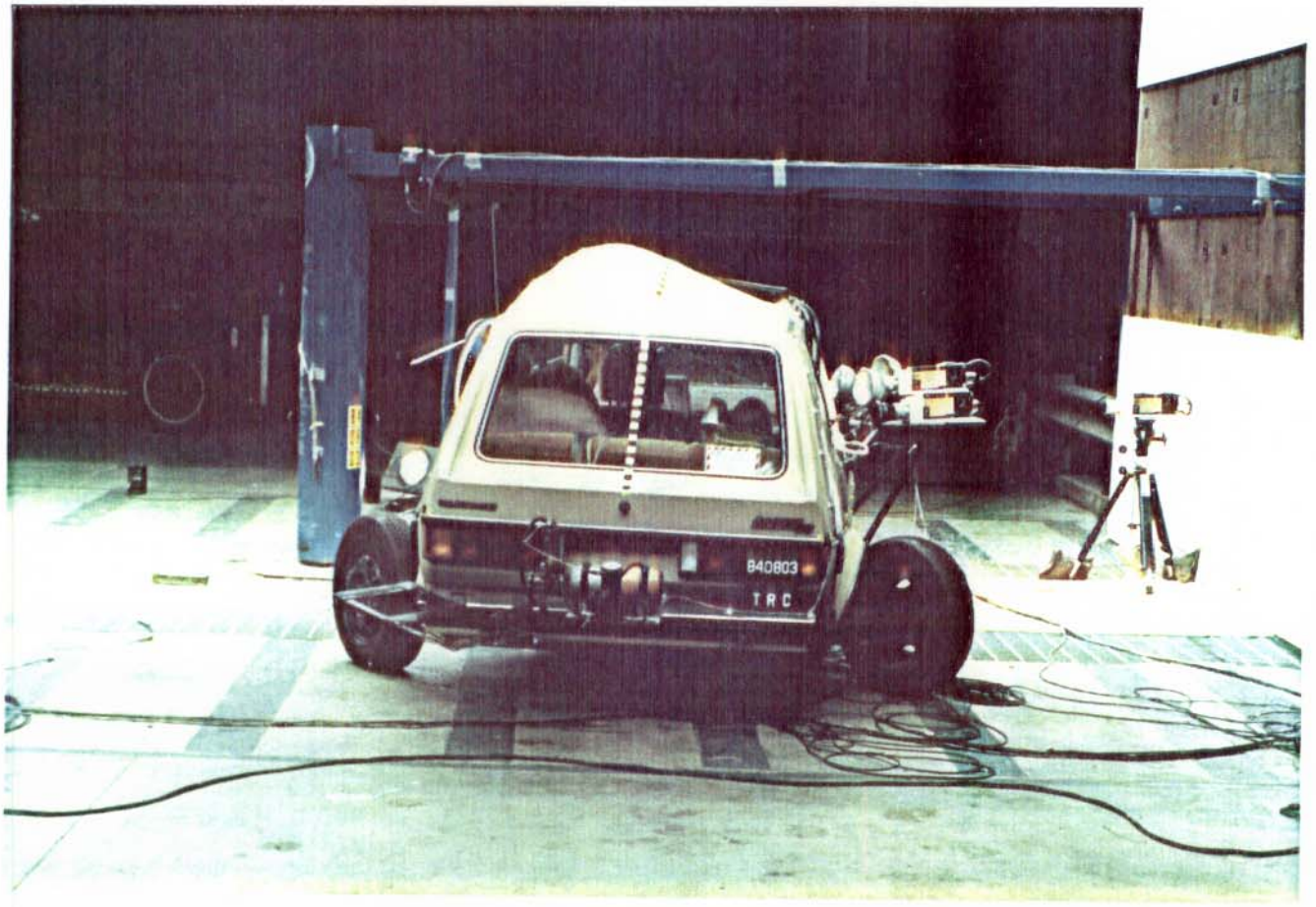


Figure A-12. POST-TEST OVERALL - VIEW 2

Figure A-13. POST-TEST OVERALL - VIEW 3

Figure A-14. POST-TEST OVERALL - VIEW 4

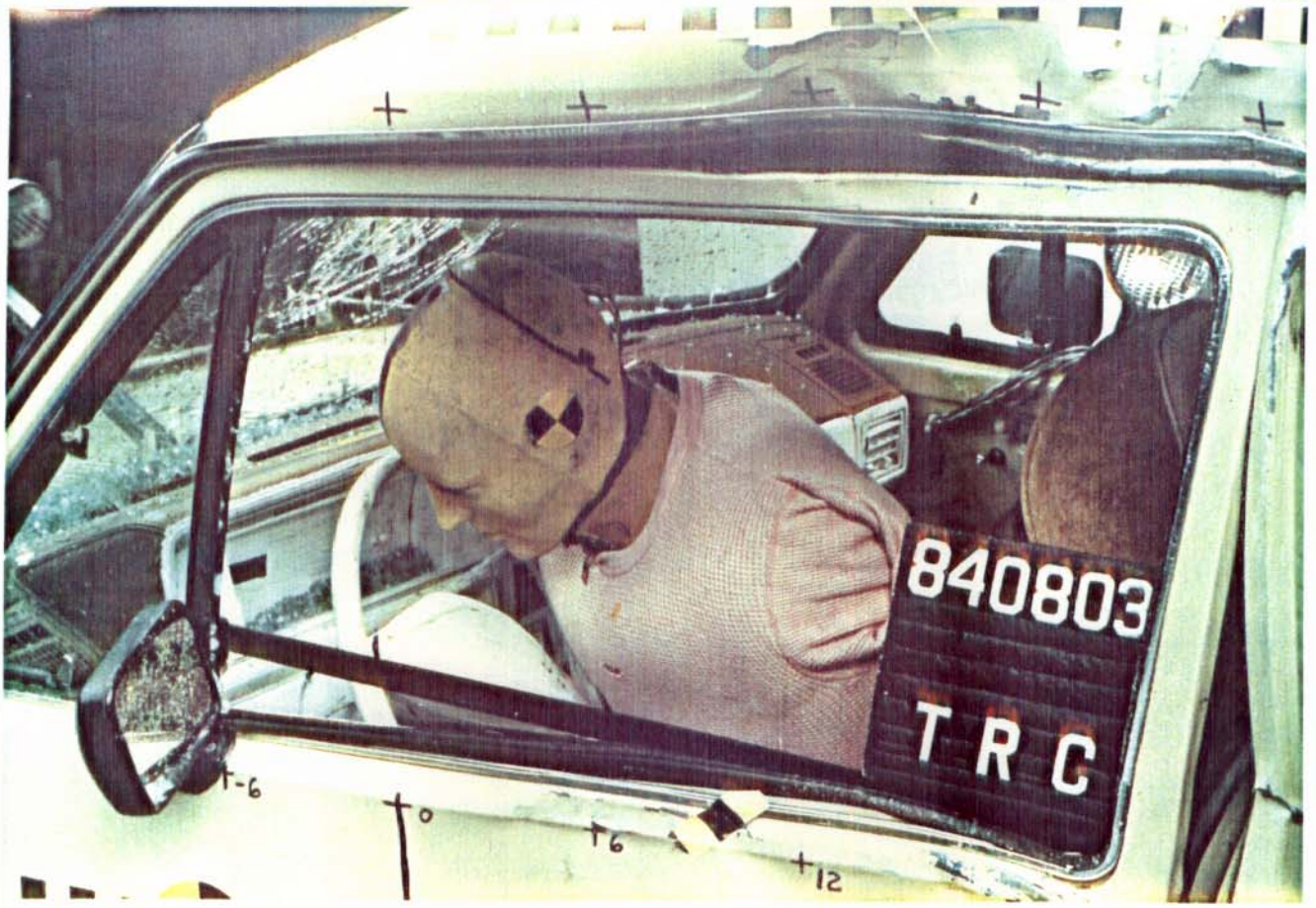


Figure A-15. POST-TEST DRIVER DUMMY

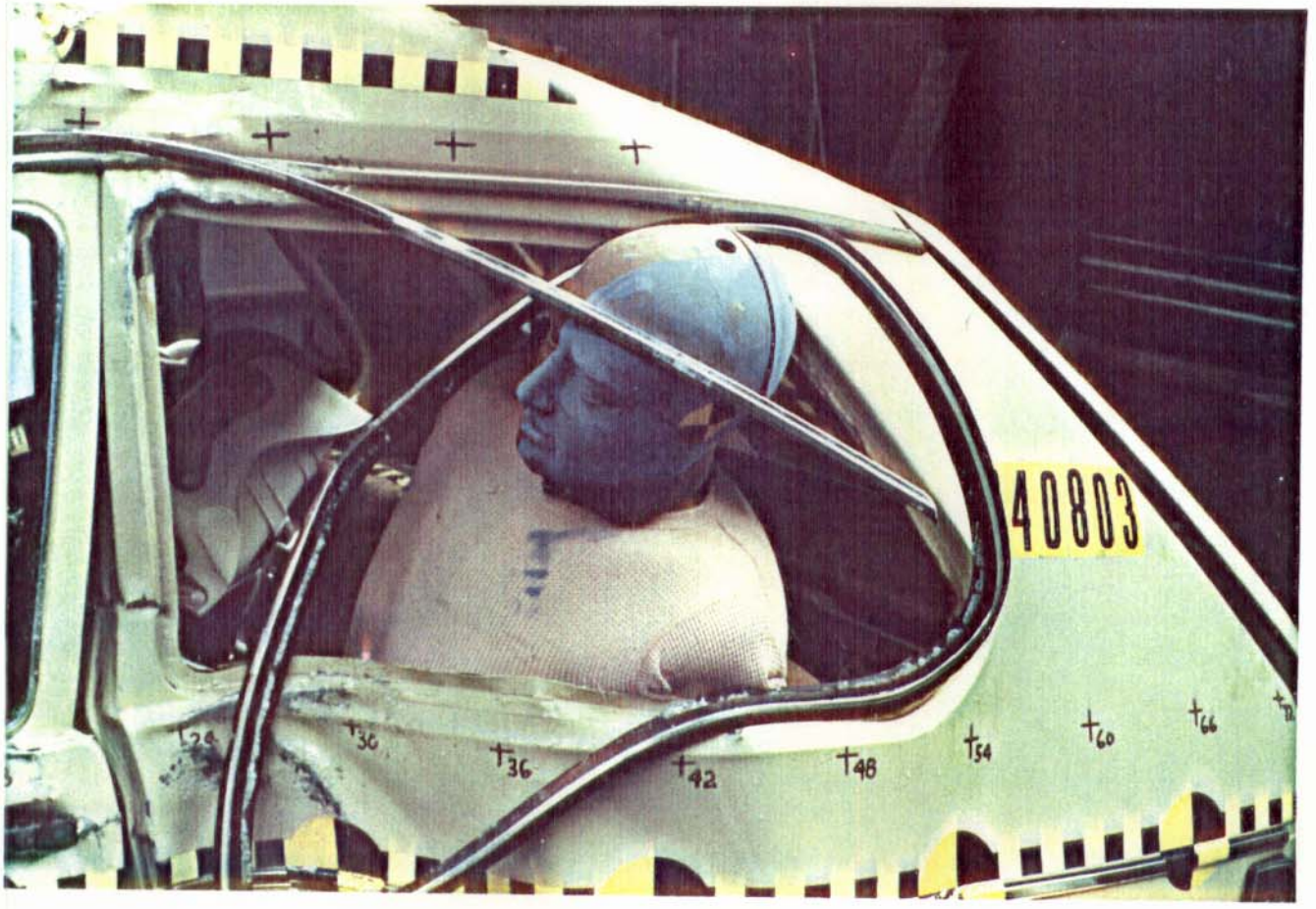


Figure A-16. POST-TEST PASSENGER DUMMY - VIEW 1

Figure A-17. POST-TEST PASSENGER DUMMY - VIEW 2

Figure A-18. POST-TEST PASSENGER DUMMY - VIEW 3

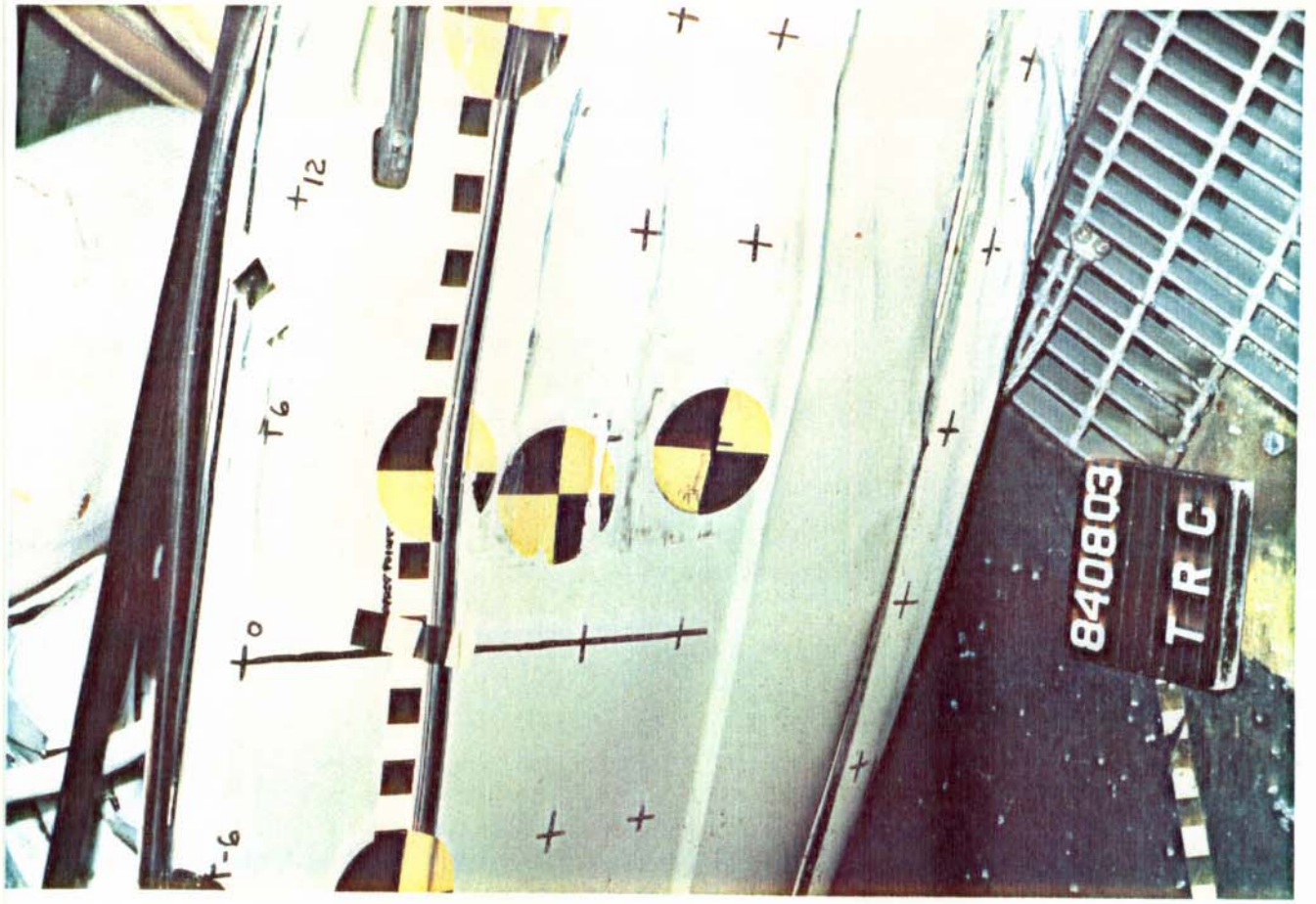


Figure A-19. POST-TEST VEHICLE DAMAGE - VIEW 1

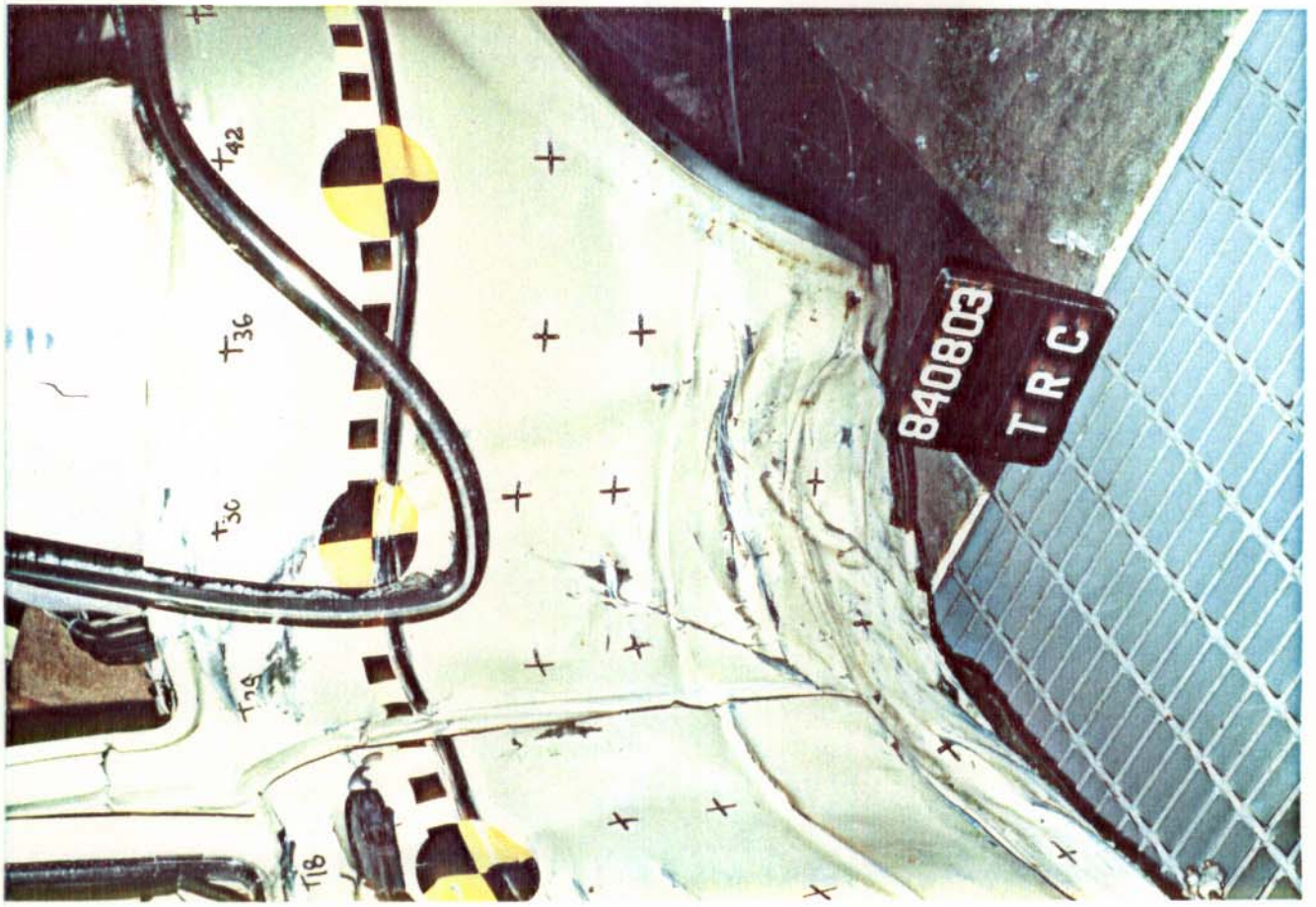
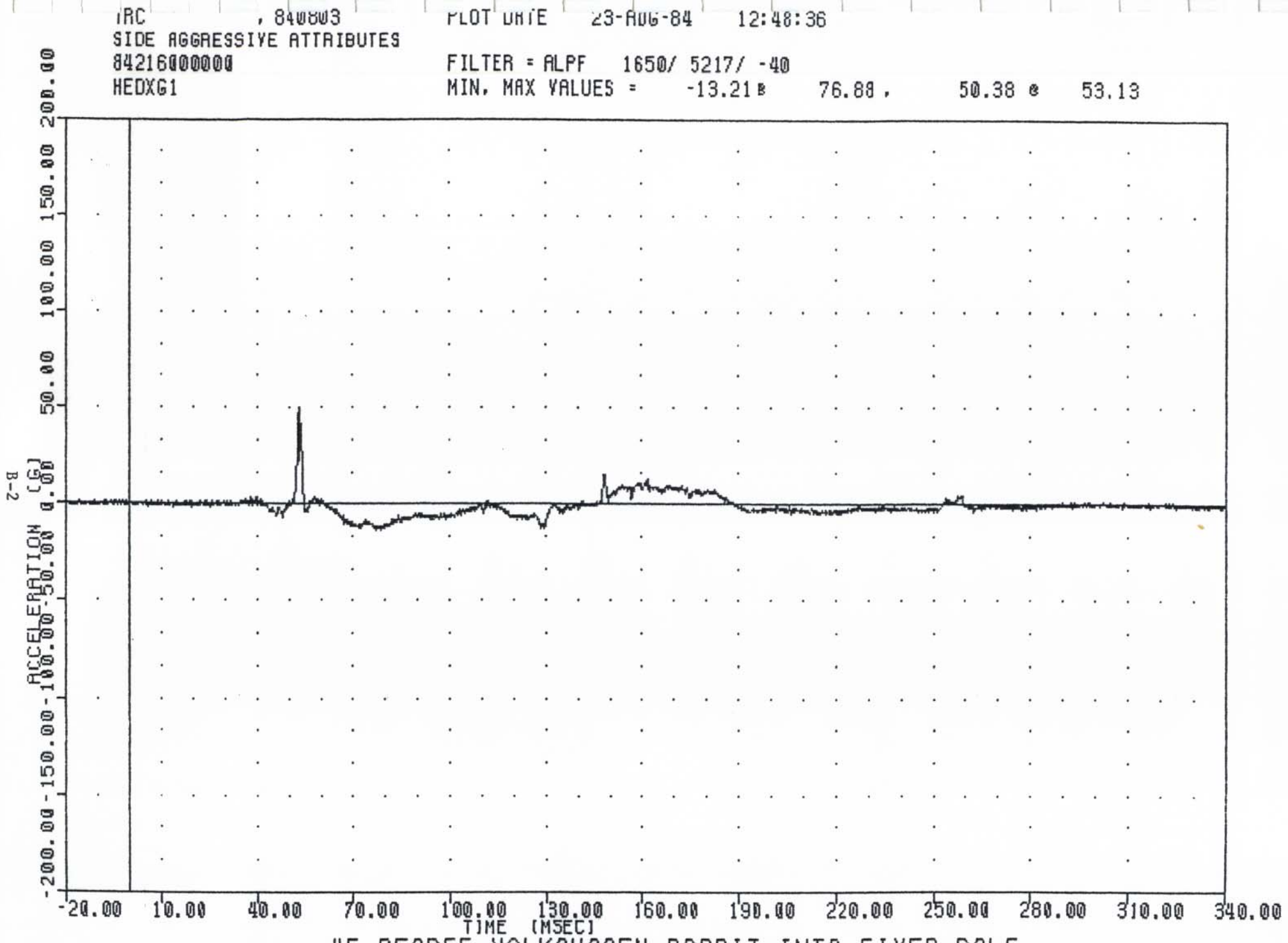


Figure A-20. POST-TEST VEHICLE DAMAGE - VIEW 2

APPENDIX B

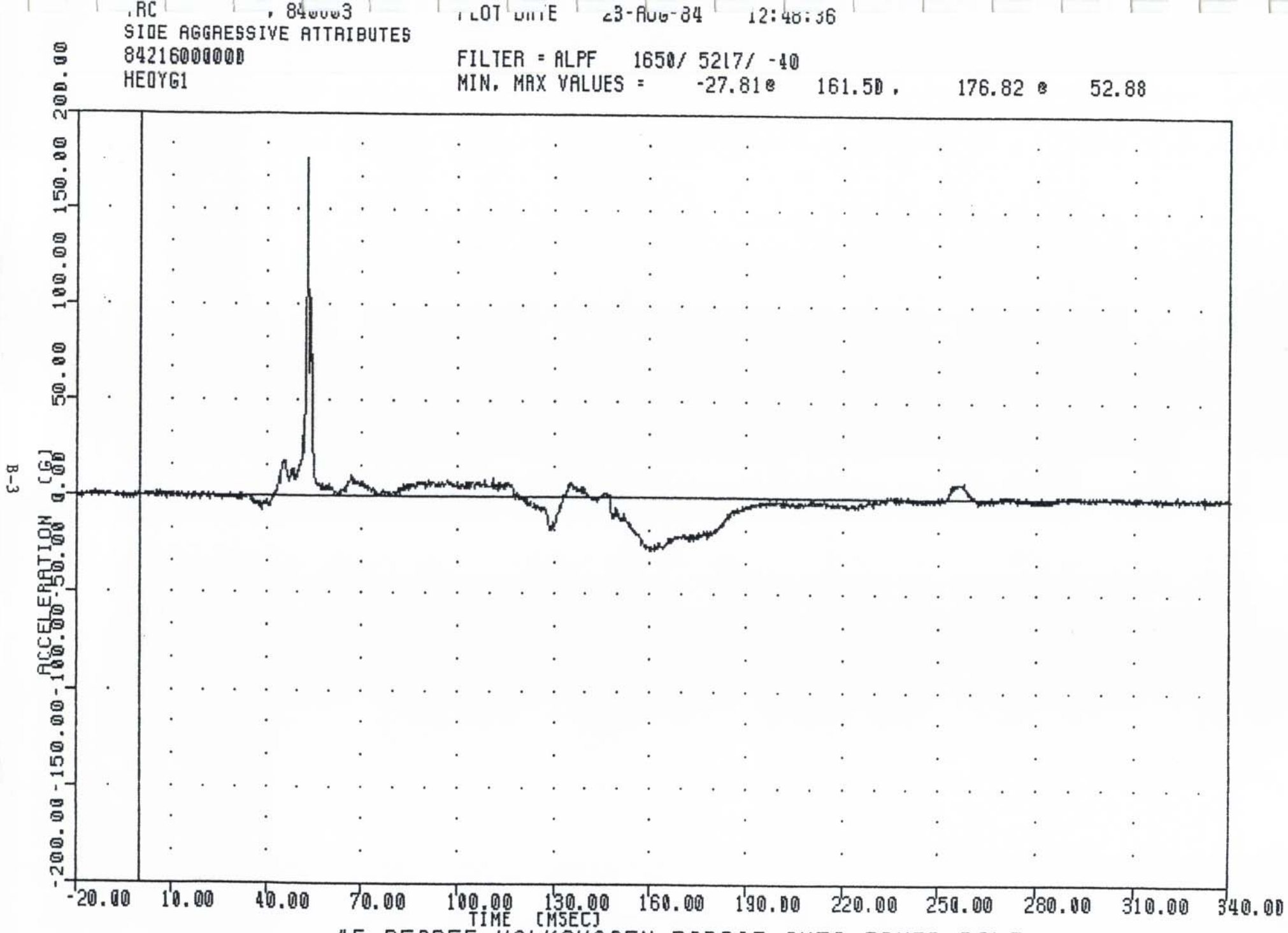
DATA PLOT PRESENTATION

Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. The data was filtered according to SAE J211, except dummy thorax data which was filtered using the HSRI filter.



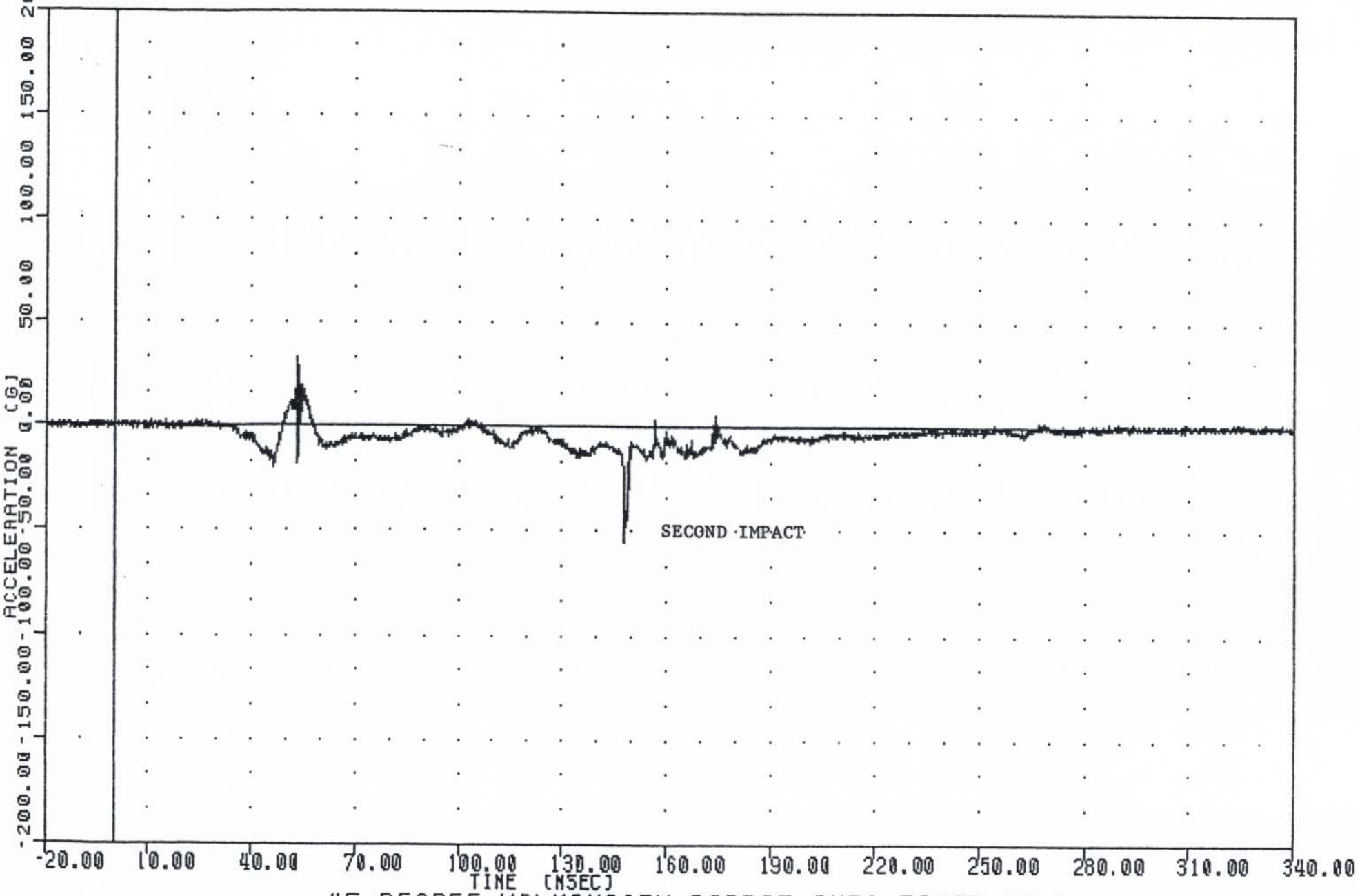
B-2

45 DEGREE VOLKSWAGEN RABBIT INTO FIXED POLE
DRIVER HEAD ACCELERATION X AXIS



45 DEGREE VOLKSWAGEN RABBIT INTO FIXED POLE
DRIVER HEAD ACCELERATION Y AXIS

.AC , 84[illegible]3 PLOT DATE 23-AUG-84 12:48:56
SIDE AGGRESSIVE ATTRIBUTES
8421B0000D0
HEDZ61
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -54.79 @ 148.00 , 32.89 @ 53.25



45 DEGREE VOLKSWAGEN RABBIT INTO FIXED POLE
DRIVER HEAD ACCELERATION Z AXIS