REPORT NUMBER TR-P25001-18-NC

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

HYUNDAI MOTOR COMPANY
2005 HYUNDAI TUCSON
5-DOOR MPV

NHTSA NUMBER: M50508

PREPARED BY:
KARCO ENGINEERING, LLC
9270 HOLLY ROAD
ADELANTO, CALIFORNIA 92301

8/24/05

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
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15. Supplementary Notes

16. Abstract

A 35 mph (56.3 km/h) frontal barrier impact was conducted on a 2005 Hyundai Tucson 5-Door MPV at Karco Engineering, LLC on 8/24/05. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and footwell intrusion performance. The impact velocity is 56.09 km/h. The ambient temperature at the barrier face at the time of impact is 33.9 degrees Celcius. The vehicle's maximum post-test static crush is 530 mm to the left of the vehicle centerline. The test vehicle is equipped with a 3-point continuous belt system and second generation supplemental airbags in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:

Measurement Description	Units	Threshold	Driver ATD	Passenger ATD
Head Injury Criteria (HIC)	N/A	1000	282.6	412.3
Max. Chest Accel. (3 msec Clip)	G's	60	41.6	35.8
Left Femur Force	Newtons	10008	-4717.7	-4864.0
Right Femur Force	Newtons	10008	-4642.8	-2811.4

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56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2005 Hyundai Tucson 5-Door MPV NHTSA No. M50508	Copies of this report available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 400 Seventh St., SW, Room 5108 Washington, D.C. 20590

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SECTION 1

PURPOSE AND SUMMARY OF TEST M50508

1.1 PURPOSE

This 35 mph (56.3 km/h) frontal barrier impact test is part of the New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-01-D-02005. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph (48.3 km/h) requirements.

The 35 mph (56.3 km/h) frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards (OCS) New Car Assessment Program (NCAP) Laboratory Indicant Test Procedure, dated December 1999. Data was obtained indicant of FMVSS 208 “Occupant Crash Protection”, FMVSS 212, “Windshield Retention”, FMVSS 219, “Windshield Zone Intrusion (Partial)”, and FMVSS 301 “Fuel System Integrity”, performance. Procedures for receiving, inspection, testing and reporting of test results are described in the test procedures and are not repeated in this report.

1.2 SUMMARY

A load cell barrier consisting of 36 load cells was impacted by a 2005 Hyundai Tucson 5-Door MPV at a velocity of 56.09 km/h. The test was performed at Karco Engineering, LLC on August 24, 2005.

Two real-time and 16 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in Data Sheet number 14 (page number 24) of this report.

Two Part 572E, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head (primary and redundant), chest (primary and redundant) and pelvic triaxial accelerometers, chest displacement potentiometers, six-axis upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were also placed on the driver’s and passenger’s lap and shoulder belts to measure dummy torso and pelvic section loading. Also, shoulder belt spool-off was measured for the driver and passenger dummy. The driver (position 1) ATD (Serial No. 35) and the right-front passenger (position 2) ATD (Serial No. 34) were calibrated two tests prior to this test.

Ninety seven (97) channels of data were recorded using an on-board data acquisition system. Appendix A contains Pre and Post-Test Photographs, Appendix B contains the Dummy Response data traces. Appendix C contains the Dummy Calibration data.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the impact event. There was no Stoddard solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 530 mm and both the driver and the passenger side doors remained closed and latched during the impact and were operable after the impact.

The driver's visible contact points were as follows: The driver ATD's head contacted the airbag, its chest and abdomen had no contact. Both knees contacted the knee bolster.

The passenger's visible contact points were as follows: The passenger ATD's head, chest and abdomen contacted the airbag. Both knees contacted the glove box.

Occupant injury data is contained in table below.

OCCUPANT DATA SUMMARY

ATD Position	HIC	T 1	T 2	Clip (g)	T 1	T 2	Chest Deflec. (mm)	Left Femur (N)	Right Femur (N)
Driver	282.6	57.7	93.7	41.6	64.4	67.4	-32.3	-4717.7	-4642.8
Passenger	412.3	63.9	99.5	35.8	69.9	72.9	-24.4	-4864.0	-2811.4

Additional data plots for this test are available in the research and development section of the NHTSA website. The website can be found at: www.NHTSA.Dot.Gov

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lbf/in^2	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	^oF	^oC	=(tf -32)/1.8
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

* Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1
CRASH TEST SUMMARY

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
Velocity at Impact	km/h	56.09
Test Weight	kg	1724
Impact Angle	degrees	0
Average Rebound	mm	830
Maximum Static Crush	mm	530

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Front Door opening	Remained closed and latched, opened w/o tools	Remained closed and latched, opened w/o tools
Rear Door Opening	Remained closed and latched, opened w/o tools	Remained closed and latched, opened w/o tools
Seat Track Shift (mm)	None	None
Seat Back Failure	None	None

TEST DUMMY INFORMATION

Description	Driver	Passenger
Dummy Type/ Serial No.	50% Male Hybrid III No. 35	50% Male Hybrid III No. 34
Head Contact	Airbag	Airbag
Chest Contact	None	Airbag
Abdomen Contact	None	Airbag
Left Knee Contact	Knee Bolster	Glovebox
Right Knee Contact	Knee Bolster	Glovebox

MOVIE COVERAGE

High Speed	14
Real Time	2
Total	16

DATA CHANNELS

Driver ATD Sensors	40
Passenger ATD Sensors	40
Belt Assessment Sensors	8
Vehicle Structure Accelerometers	9
Rigid Barrier Load Cells	36
Total	133

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M50508	Anti-Lock Brakes	Yes
Make	Hyundai	All Wheel Drive	No
Model	Tucson	Power Steering	Yes
Body Style	5-Door MPV	Driver Front Airbag	Yes
Vin No.	KM8JM12B25U080720	Driver Side Airbag	Yes
Color	Light Brown	Driver Head Airbag	No
Delivery Date	8/18/2005	Driver Curtain Airbag	Yes
Odometer	36	Pass. Airbag	Yes
Dealer	Romero Hyundai	Pass. Side Airbag	Yes
Transmission	5-Speed Manual	Pass. Head Airbag	No
Final Drive	Front	Pass. Curtain Airbag	Yes
Type/No. Cyl.	4 Cylinder In-Line	Pre-Tensioners	Yes
Engine Disp. (L)	2.0	Load Limiters	Yes
Engine Placement	Transverse	Bucket Seats	Yes
Roof Rack	Yes	Air. Cond.	Yes
Sunroof/T-Top	No	AM/FM Cassette	Yes
Tinted Glass	Yes	Tilt Steering	Yes
Traction Control	No	Automatic Door Locks	Yes
Power Brakes	Yes	Power Windows	Yes
Front Disc	Yes	Power Seats	Yes
Rear Disc	Yes	Other	None

Does Owners Manual provide instructions to turn off automatic door locks. Yes

DATA FROM CERTIFICATION LABEL

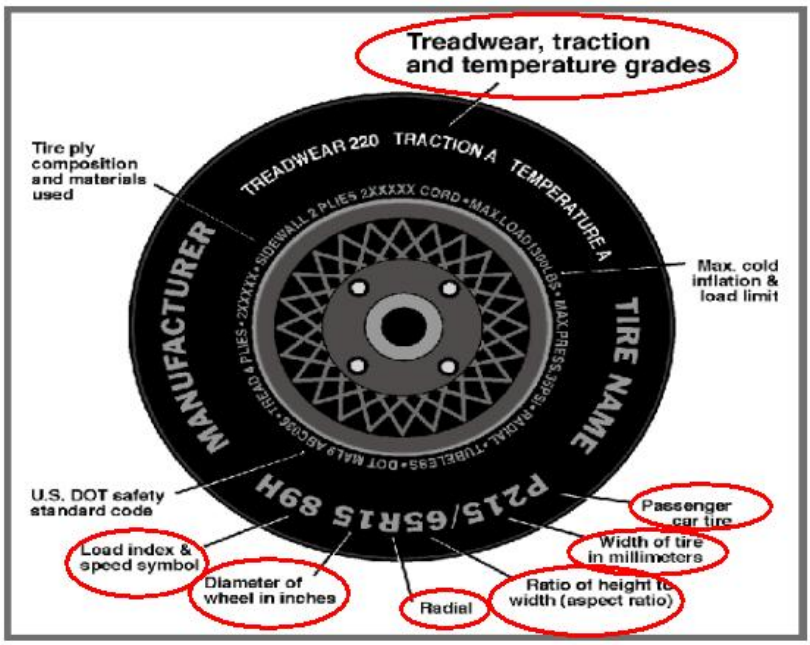
Manufactured By	Hyundai Motor Company	GVWR (kg)	2010
		GAWR Front (kg)	1150
Date of Manufacture	Nov-05-04	GAWR Rear (kg)	1100

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bucket		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				390
Cargo Weight (RCLW) (kg)				50

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

Collect year, make, model, VIN, items circled in red, and tire manufacturer and tire name.



TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	308	308
Cold Pressure (kpa)	210	210
Recommended Tire Size	P215/65R16	P215/65R16
Tire Size on Vehicle	P215/65R16	P215/65R16
Tire Manufacturer	Hankook	Hankook
Treadwear	400	400
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Plies Polyester	2 Plies Polyester
Tire Plies Body	2 Plies Tread, 2 Plies Polyester	2 Plies Tread, 2 Plies Polyester
Load Index/Speed Symbol	96T	96T
Tire Material	Polyester/Steel/Nylon/	Polyester/Steel/Nylon/
DOT Safety Code Right	DOT T79B BWH 4404	DOT T79B BWH 4404
DOT Safety Code Left	DOT T79B BWH 4404	DOT T79B BWH 4404

DATA SHEET NO. 2…(CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508

Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	447	314		474	386	
Right	kg	457	308		555	379	
Ratio	%	59.2	40.8		55.6	44.4	
Totals	kg	904	622	1526	959	765	1724

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1526
Weight of 2 P572 ATD's	kg	152
Rated Cargo/Luggage Wt. (RCLW)	kg	50
Calculated Vehicle Target Wt. (TVTW)	kg	1728

TEST VEHICLE ATTITUDE AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	756	757	782	781	1075
As Tested	mm	742	742	755	762	1170

Vehicle Wheel Base (mm): 2636

Weight of Ballast Secured in cargo area (kg): 0

Weight of Items Removed (kg): Unknown

Vehicle Components Removed: 60% portion of rear seat, rear bumper.

* Ballast weight does not include cameras, instrumentation and brake abort system.

FUEL SYSTEM DATA

Fuel System Capacity From Owners Manual (L): 65.00

Actual Test Volume with entire fuel System Filled (L): 60.45

Test Fluid Type: Stoddard Solvent

Kinematic Viscosity: as per ASTM Standard D484-71 Purple

Is Vehicle Fuel Pump Electric or Mechanical? Electric

If electric, does pump operate with ignition switch "On" & engine "OFF" Yes

Fuel System Particulars: Fuel door on left rear quarter panel, fuel lines run inside of right side frame rail.

DATA SHEET NO. 3
POST-TEST IMPACT DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

SPEED TRAP DATA

Measured Parameter	Units	Requirement	Value
Trap No.1 Velocity (Primary)	km/h	55.51 to 57.12	56.09
Trap No. 1 Entry Distance	mm	<1524	1524
Trap No.1 Exit Distance	mm	<1524	305
Trap No.2 Velocity (Redun.)	km/h	55.51 to 57.12	56.11
Trap No.2 Entry Distance	mm	<1524	1524
Trap No.2 Exit Distance	mm	<1524	305

VEHICLE STATIC CRUSH

Measured Parameter	Units	Pre-Test	Post-Test	Difference
Left Side	mm	4207	3840	-367
Center	mm	4322	3830	-492
Right Side	mm	4207	3837	-370

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	856
Center	mm	835
Right Side	mm	800
Average	mm	830

DATA SHEET NO. 4
TEST VEHICLE INFORMATION

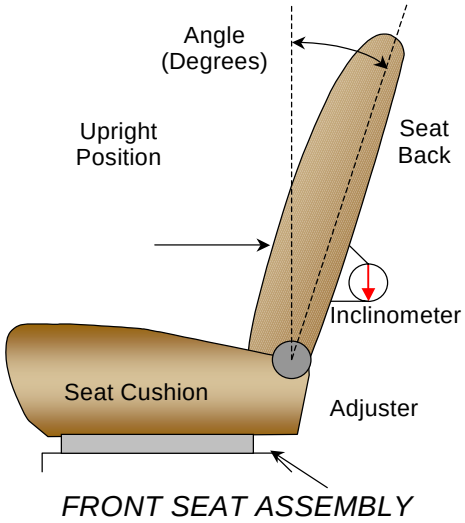
Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

NOMINAL DESIGN RIDING POSITION

The driver and passenger seat backs are positioned to the manufacturer's designated angle. The procedure is as follows: Seat back angle was measured at the headrest of the seat back using a digital inclinometer.

SEAT BACK ANGLES

	Deg.
Driver w/seated Dummy	17.4
Passenger w/seated Dummy	17.0



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The total seat travel was measured from forward most position to rearmost position, irrespective of vertical seat height in those positions. The seat was set at the longitudinal mid position with the vertical adjustment at the lowest position obtainable for the driver and passenger.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel (Detent)	Placed in Position (Detent)
Driver Seat	25	13
Passenger Seat	25	13

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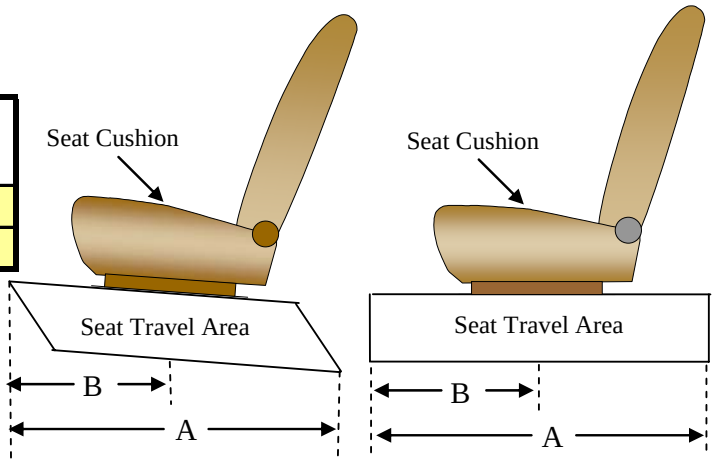


SEAT BELT UPPER ANCHORAGE

Position number one (1) is the uppermost position.

SEAT BELT UPPER ANCHORAGE

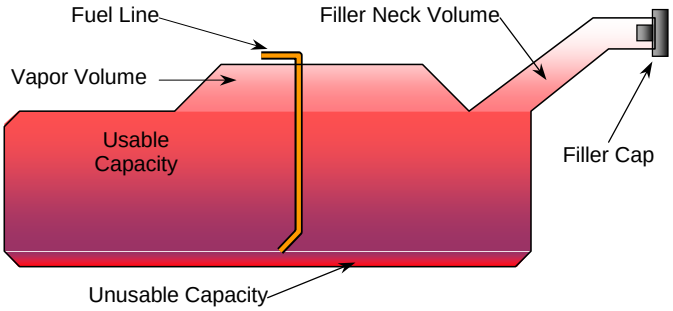
	Total # of Positions	Placed in Position #
Driver Seat	4	2
Passenger Seat	4	2

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	65.00
Usable Capacity of "Optional" Tank	N/A
Usable Capacity used for FMVSS 301	59.77 to 61.06
Actual Amount of Solvent used	60.45

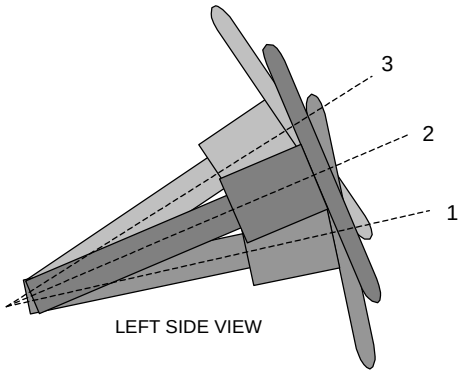
The test vehicle is equipped with an electric fuel pump. The fuel pump operates for approximately two seconds after the ignition is placed in the “ON” position, after which the fuel pump automatically shuts off. The fuel filler door is located on the left rear fender. The standard fuel tank occupies the area under the rear seat.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONS

	Degrees	Fore/Aft Position (mm)
Lowermost positon No. 1	26.2	
Geometric center position No. 2	28.5	
Uppermost position No. 3	30.7	

DATA SHEET NO. 5
DUMMY POSITIONING IN VEHICLE

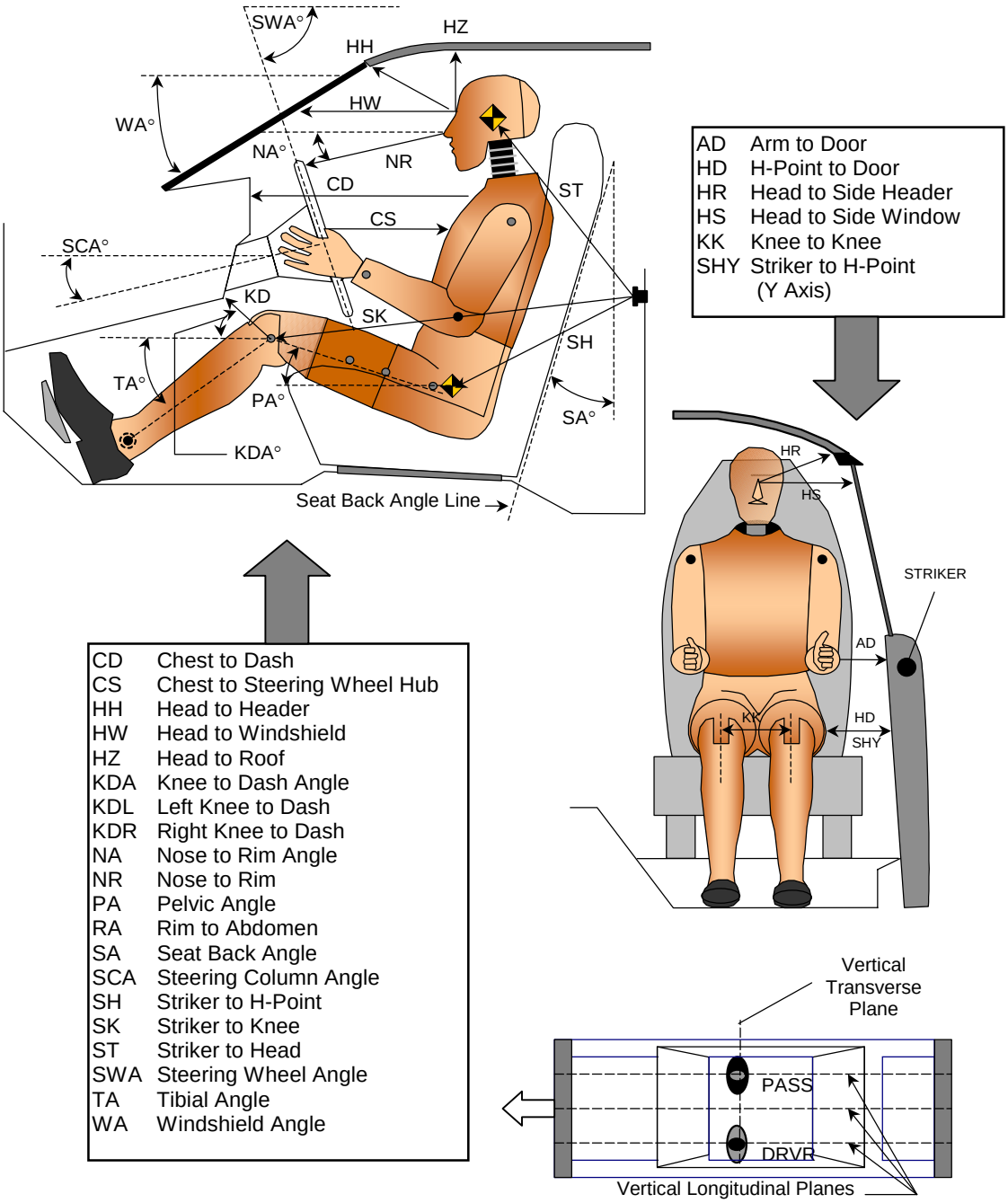
Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (deg)	Length (mm)	Angle (deg)
WA	Windshield Angle		59.0		
SWA	Steering Wheel Angle		61.5		
SCA	Steering Column Angle		28.5		
SA	Seat Back Angle		17.4		17.0
HZ	Head to Roof (Z)	215	90.0	210	90.0
HH	Head to Header	368		360	
HW	Head to Windshield	653		630	
HR	Head to Side Header (Y)	308		295	
NR	Nose to Rim	378	17.0		
CD	Chest to Dash	502		540	
CS	Chest to Steering Hub	250			
RA	Rim to Abdomen	145			
KDL	Left Knee to Dash	128	14.0	120	
KDR	Right Knee to Dash	137		100	28.0
PA	Pelvic Angle		20.0		20.0
TA	Tibia Angle		54.0		53.0
KK	Knee to Knee (Y)	287		280	
SK	Striker to Knee	615		580	1.0
ST	Striker to Head	597	71.0	640	22.5
SH	Striker to H-Point	228	27.0	260	
SHY	Striker to H-Point (Y)	248		228	
HS	Head to Side Window	355		320	
HD	H-Point to Door (Y)	210		285	
AD	Arm to Door (Y)	60		40	

DATA SHEET NO. 5…(CONTINUED)
DUMMY POSITIONING IN VEHICLE

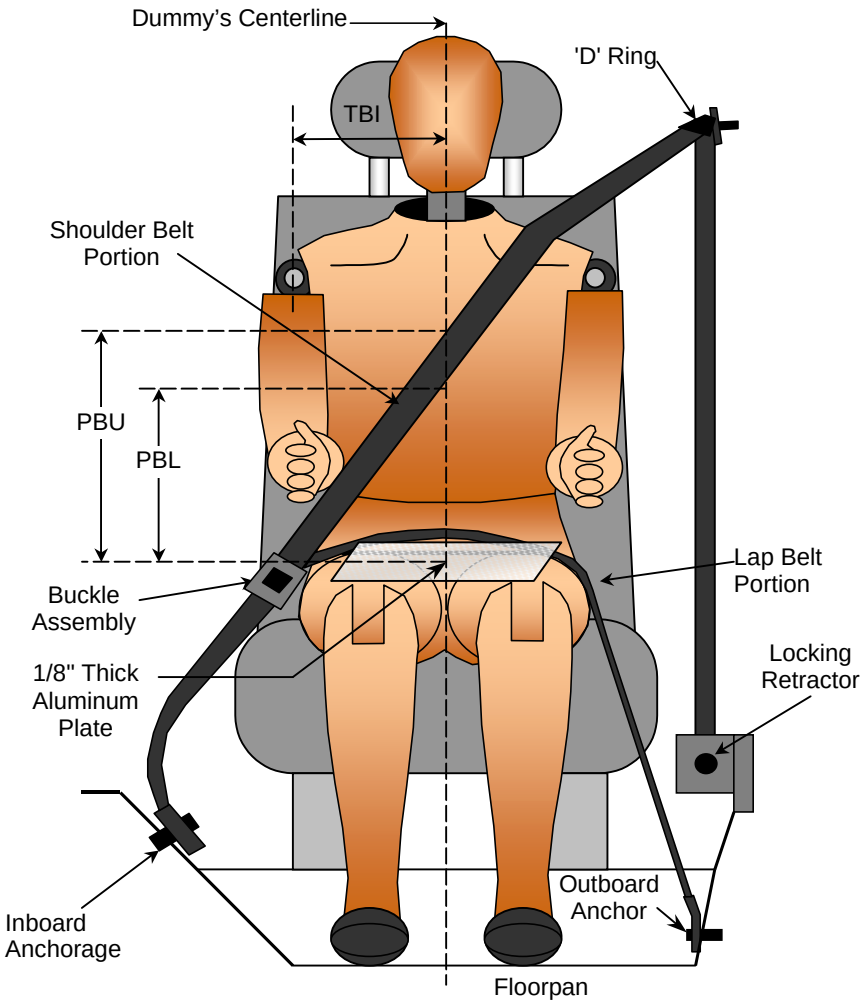
Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05



DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS

DATA SHEET NO. 6
SEAT BELT POSITIONING DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05



SEAT BELT POSITIONING MEASUREMENTS

Measured Parameter	Units	Driver	Passenger
TBI -Dummy C/L to Lap/Shoulder Belt Intersect	mm	210	210
PBU - Top Surface of reference to belt upper edge	mm	318	320
PBL - Top Surface of reference to belt lower edge	mm	250	240
Lap Belt Tension	Newtons	10	10
Shoulder Belt Tension	N/A	Retractor	Retractor

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATION

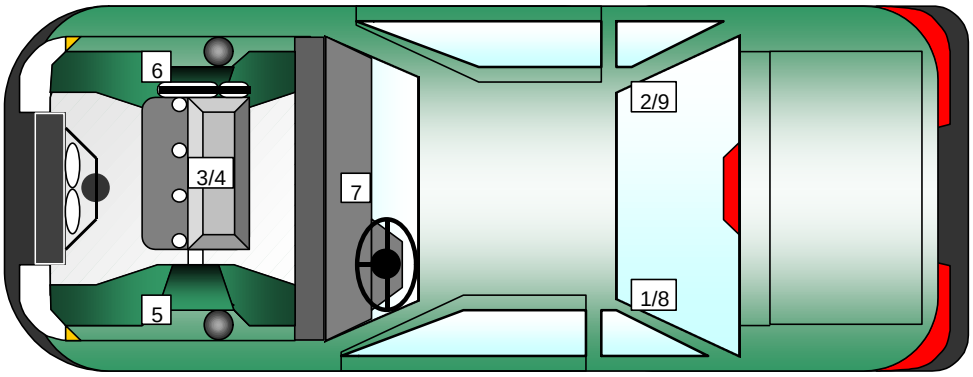
Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508

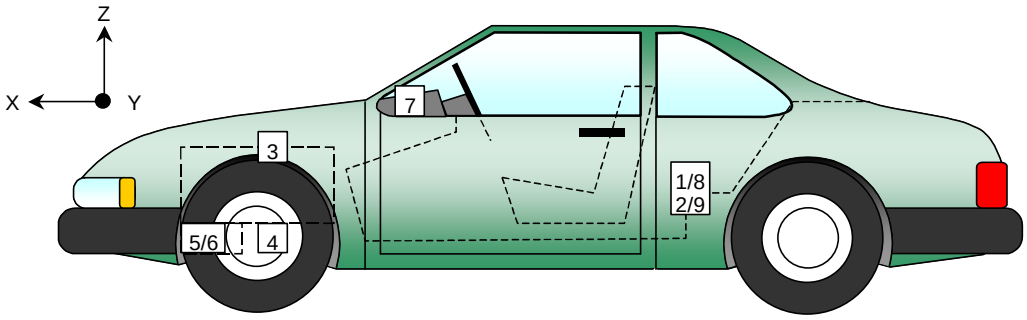
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member	1560	-670	410
2	Right Rear X-Member	1560	670	410
3	Engine Top	3680	-80	855
4	Engine Bottom	3710	250	210
5	Left Brake Caliper	3550	-740	340
6	Right Brake Caliper	3550	740	340
7	Instrument Panel	2780	0	1110
8	Left Rear X-Member (Z-Axis)	1470	-670	410
9	Right Rear X-Member (Z-Axis)	1470	670	410

Reference Planes: X=From Rear Surface of Vehicle, Y=Vehicle Centerline, Z=Ground Plane





DATA SHEET NO. 8
SEAT BELT ASSESSMENT TEST DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
TBI -Dummy C/L to Lap/Shoulder Belt Intersect	mm	210	210
PBU - Top Surface of reference to belt upper edge	mm	318	320
PBL - Top Surface of reference to belt lower edge	mm	250	240
Lap Belt Tension	Newtons	10	10
Shoulder Belt Tension	N/A	Retractor	Retractor

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
Retractor Reel to "D" ring	mm	700	700
Shoulder Belt length as measured on ATD	mm	880	890
Lap Belt length as measured on ATD	mm	810	800
Remainder of belt on reel	mm	765	780
Total belt length for continuous webbing systems	mm	3155	3170

SHOULDER BELT SPOOL-OFF DATA

Measurement Description	Units	Driver	Passenger
As determined mechanically	mm	175.0	270.0
As determined electronically	mm	193.6	348.9

BELT STRETCH DATA

Measuerment Description	Units	Driver	Passenger
Electronically between belt load cell and "D" ring	mm/cm	*	*
Mechanically	mm/cm	N/A	N/A

* Not used with shoulder belt pre-tensioner systems

DATA SHEET NO. 9
SUMMARY OF FMVSS 212 DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

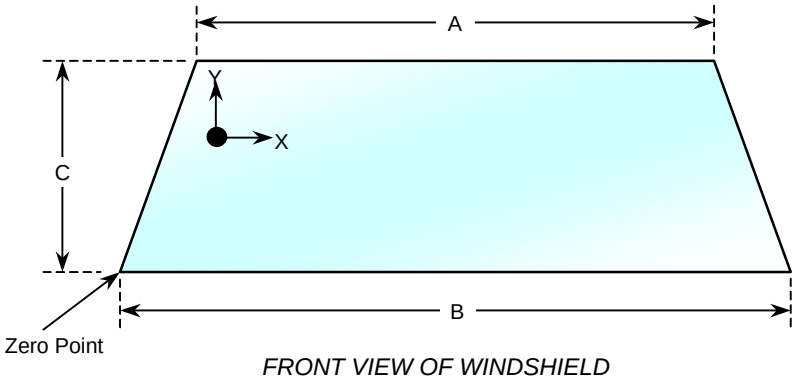
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with a rubber type adhesive. No molding covers the windshield periphery at any point.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pretest total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles that are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.1 °C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test(mm)	Post-Test(mm)	% of Retention
Left Side	2138.5	2138.5	100.0
Right Side	2138.5	2138.5	100.0
Total	4277.0	4277.0	100.0



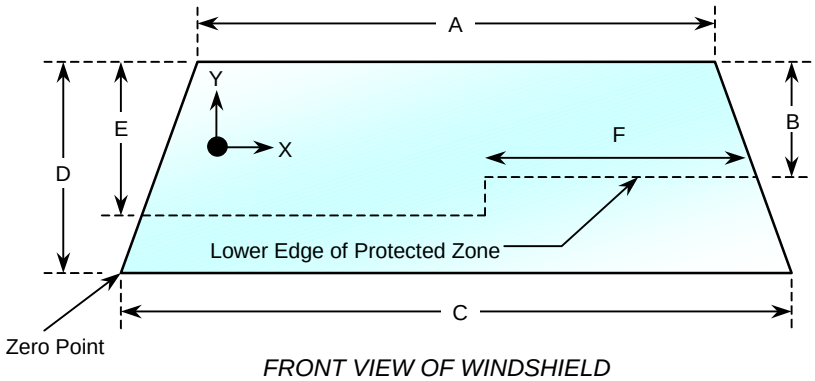
FRONT VIEW OF WINDSHIELD

WINDSHIELD DIMENSIONS

Item	Units	Segment Length	Molding Width
A	mm	1172.0	18.0
B	mm	1465.0	7.0
C-Left	mm	820.0	18.0
C-Right	mm	820.0	18.0

DATA SHEET NO. 10
WINDSHIELD ZONE INTRUSION FMVSS 219 DATA (PARTIAL)

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05



FRONT VIEW OF WINDSHIELD

WINDSHIELD AND PROTECTED ZONE

Item	Units	Value
A	mm	1172
B	mm	532
C	mm	1465
D	mm	820
E	mm	532
F	mm	162

AREA OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 in. by a vehicle component other than one that is normally in contact with the windshield.

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

X	Y

DATA SHEET NO. 11
FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

Test Time: 12:07 PM Temperature: 33.9 Deg. C.

STODDARD SOLVENT SPILLAGE MEASUREMENTS

A. From impact until vehicle motion ceases: 0.0 oz.
(Maximum Allowable = 1 ounce)

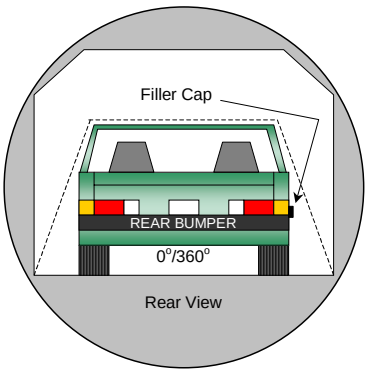
B. For the 5 minute period after motion ceases: 0.0 oz.
(Maximum Allowable = 5 ounces)

C. For the following 25 minutes: 0.0 oz.
(Maximum Allowable = 1 oz./minute)

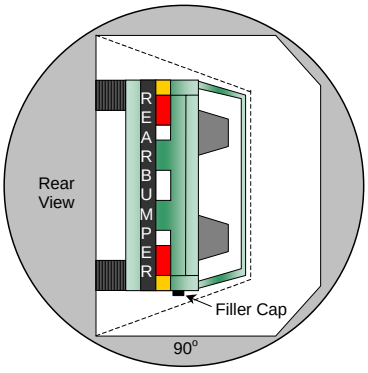
D. Spillage Location Details: No leakage occurred

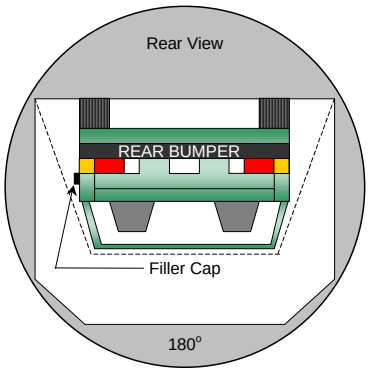
DATA SHEET NO. 12
FMVSS 301 STATIC ROLLOVER DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

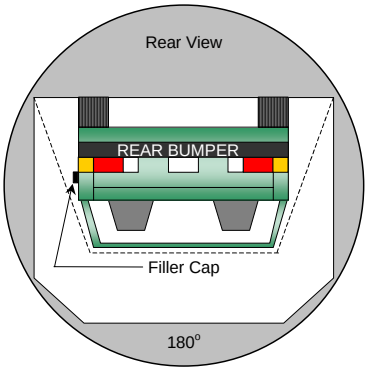


0° to 90°

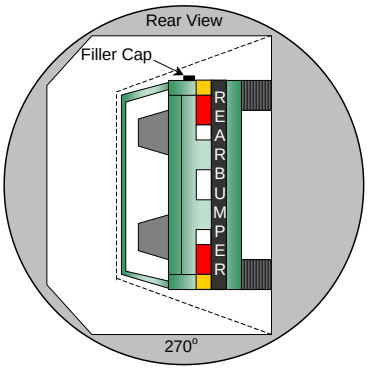


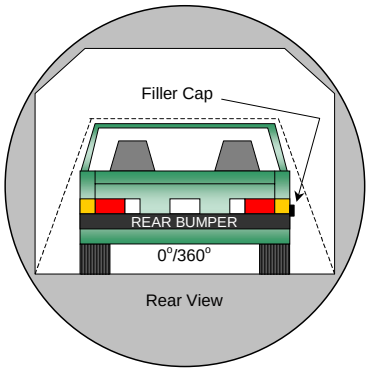


90° to 180°



180° to 270°





270° to 360°

1. The specified fixture rollover rate for each 90° of rotation is 60 to 120 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. No solvent leakage occurred during rollover.

DATA SHEET NO. 12…(CONTINUED)
FMVSS 301 STATIC ROLLOVER DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	83	300	383
90° to 180°	80	300	380
180° to 270°	76	300	376
270° to 360°	82	300	382

FMVSS 301 SPILLAGE TABLE REQUIREMENT (oz.)

First 5 Minutes	5.0
Sixth Minute	1.0
Seventh Minute	1.0
Eighth Minute	1.0

ACTUAL TEST VEHICLE SOLVENT SPILLAGE TABLE (oz.)

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 13
VEHICLE MEASUREMENTS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

VEHICLE MEASUREMENT TABLE

No.	Measurement Description	Units	Pre-Test	Post-Test	Diff.
1	Total length of vehicle at centerline	mm	4322	3830	-492
2	RSOV to front of engine	mm	3772	3627	-145
3	RSOV to firewall centerline	mm	3450	3412	-38
4	RSOV to leading edge of right door	mm	2958	2962	4
5	RSOV to leading edge of left door	mm	2958	2960	2
6	RSOV to lower leading edge of right door	mm	2920	2918	-2
7	RSOV to lower leading edge of left door	mm	2925	2913	-12
8	RSOV to upper trailing edge of right door	mm	1904	1900	-4
9	RSOV to upper trailing edge of left door	mm	1907	1910	3
10	RSOV to lower trailing edge of right door	mm	1902	1900	-2
11	RSOV to lower trailing edge of left door	mm	1910	1900	-10
12	RSOV to bottom of right 'A' pillar	mm	2916	2912	-4
13	RSOV to bottom of left 'A' pillar	mm	2908	2913	5
14	RSOV to firewall on right side	mm	3428	3415	-13
15	RSOV to firewall on left side	mm	3437	3392	-45
16	RSOV to steering column	mm	2552	2470	-82
17	Center of steering column to left 'A' pillar	mm	410	430	20
18	Center of steering column to headlining	mm	495	490	-5
19	RSOV to right side of front bumper	mm	4207	3837	-370
20	RSOV to left side of front bumper	mm	4207	3840	-367
21	Length of engine block	mm	435	435	0
RD	RSOV to right side of dash panel	mm	2620	2620	0
CD	RSOV to center of dash panel	mm	2740	2620	-120
LD	RSOV to left side of dash panel	mm	2625	2680	55

All measurements in millimeters

DATA SHEET NO. 13…(CONTINUED)
VEHICLE STRUCTURAL MEASUREMENTS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

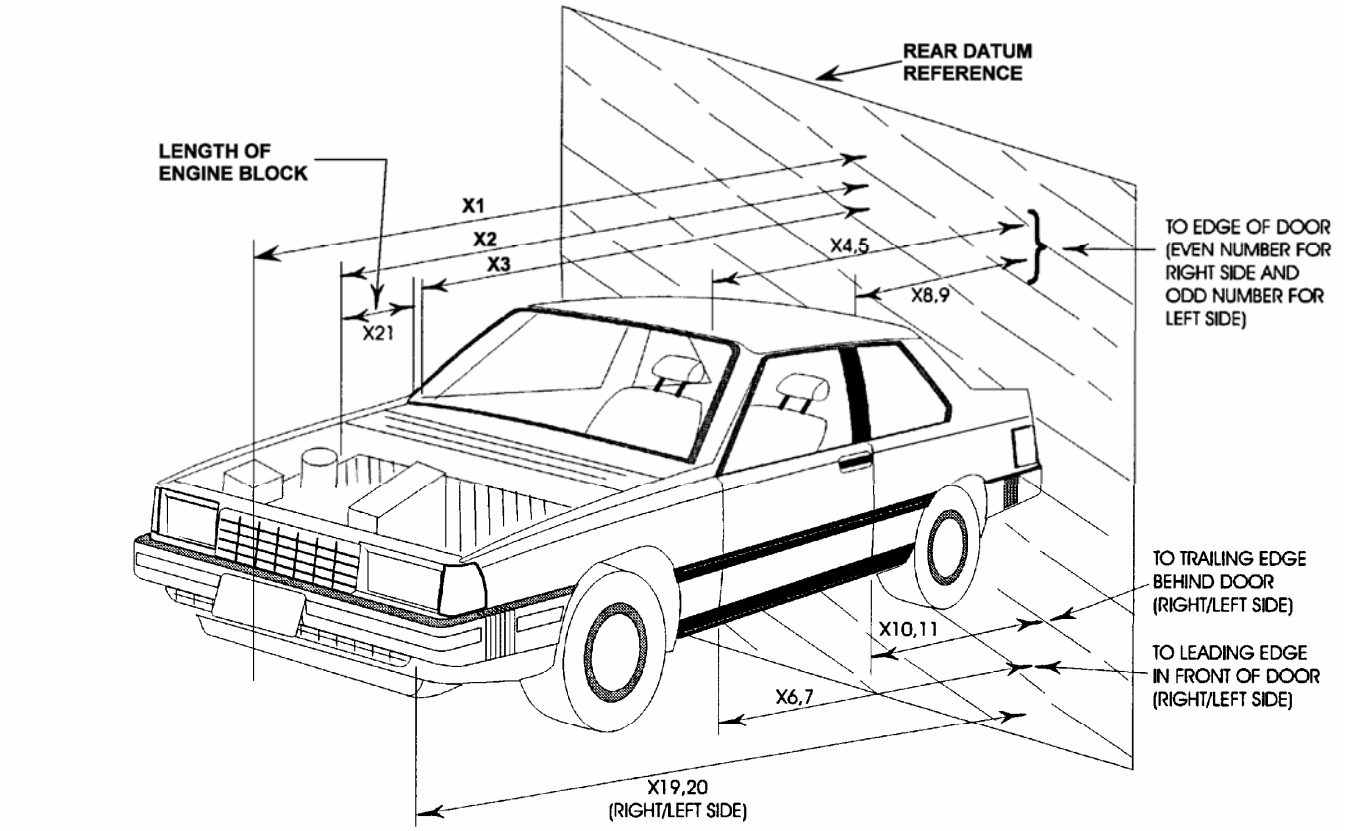
VEHICLE STRUCTURAL MEASUREMENT TABLE

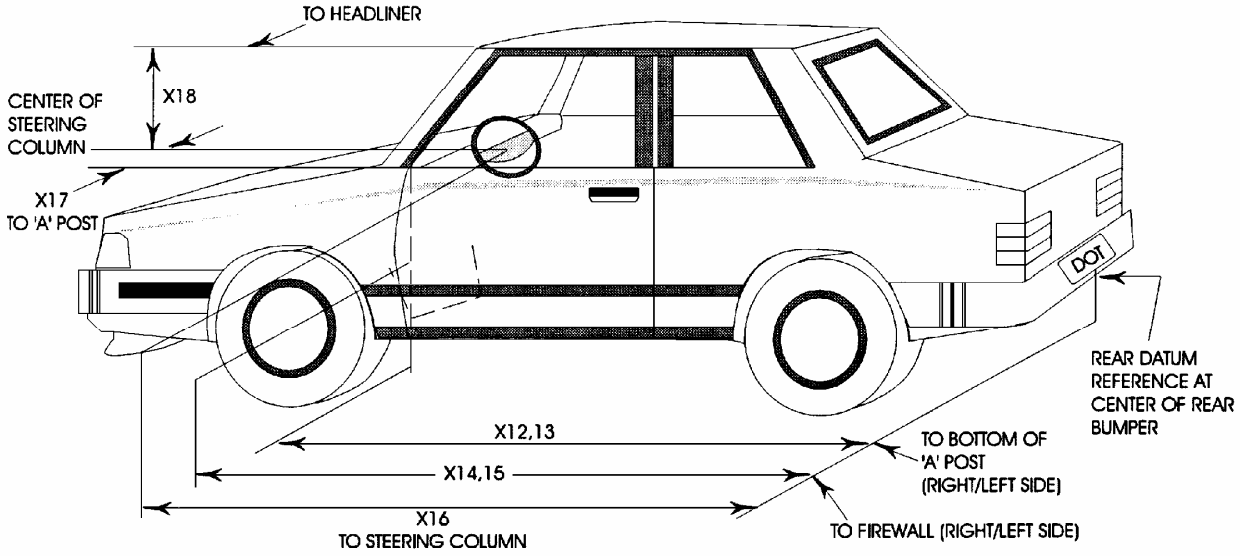
No.	Measurement Description	Units	Pre-Test	Post-Test	Diff.
1	Total length	mm	4322	3830	-492
2	Total width	mm	1765	1765	0
3	Bumper top height	mm	770	780	10
4	Bumper bottom height	mm	290	269	-21
5	Longitudinal member top height	mm	585	560	-25
6	Longitudinal member bottom height	mm	466	439	-27
7	Distance between longitudinal members	mm	950	890	-60
8	Longitudunal member width	mm	65	65	0
9	Engine top height	mm	850	870	20
10	Engine bottom height	mm	222	240	18
11	Engine and gear box width	mm	600	600	0
12	Front bumper to engine distance	mm	550	205	-345
13	Front shock absorber fixing width	mm	895	910	15
14	Bonnet leading edge height	mm	782	975	193
15	Front shock absorber fixing width	mm	1180	1140	-40
16	Front bumper to front axle distance	mm	905	475	-430
17	Front axle to 'A' pillar distance	mm	470	430	-40
18	'A' pillar to 'B' pillar distance	mm	1060	1057	-3
19	'B' pillar to rear axle distance	mm	1110	1110	0
20	'B' pillar to 'C' pillar distance	mm	845	845	0
21	Roof sill bottom height	mm	1478	1450	-28
22	Roof sill top height	mm	1595	1570	-25
23	Floor sill bottom height	mm	305	280	-25
24	Floor sill top height	mm	440	415	-25

All measurements in millimeters

DATA SHEET NO. 13…(CONTINUED)
VEHICLE MEASUREMENTS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05





DATA SHEET NO. 14
CAMERA LOCATIONS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

CAMERA MEASUREMENT TABLE

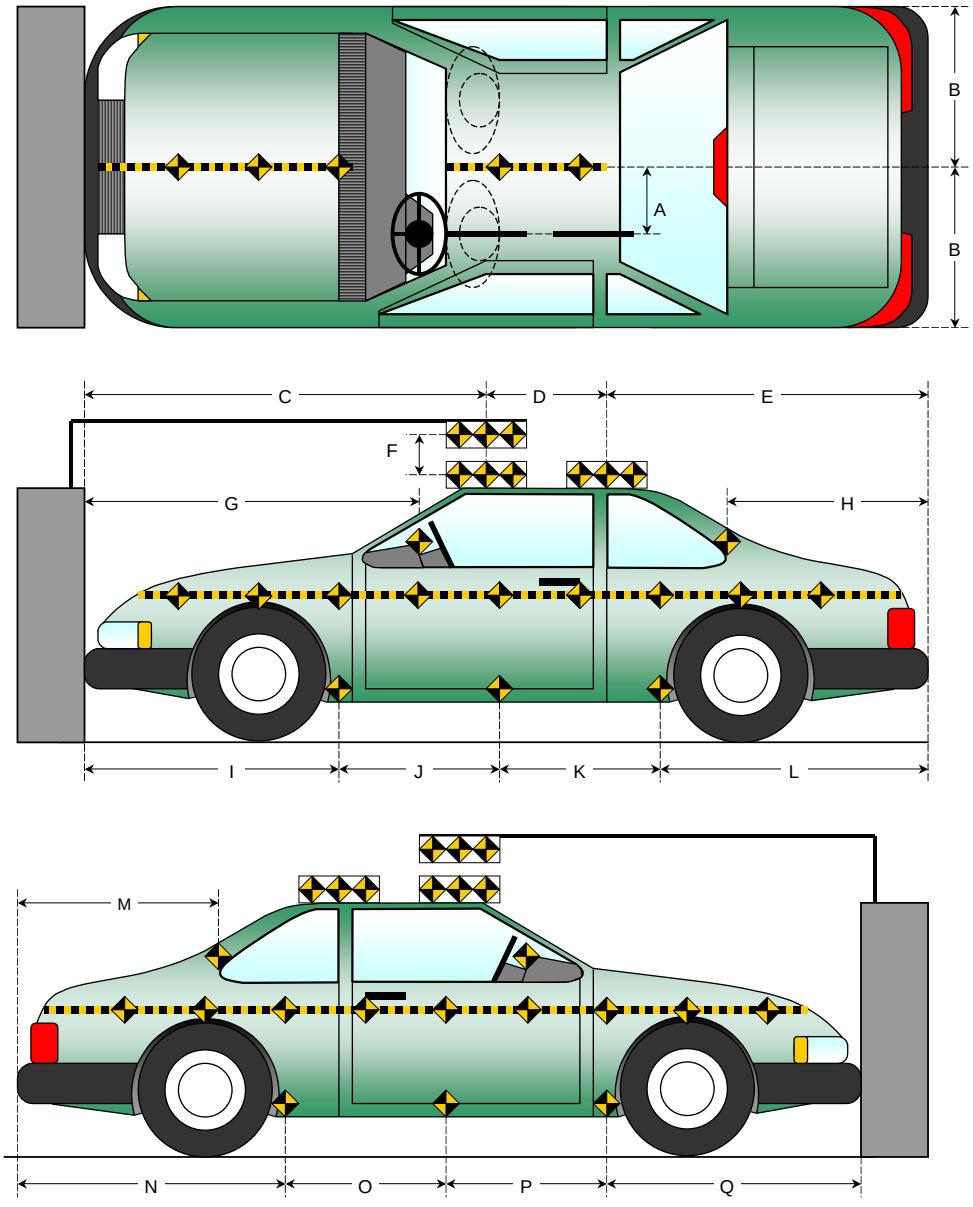
No.	Camera View	Location (mm)			Angle (deg.)	Film Plane to Head	Lens (mm)	Speed (fps)
		X	Y	Z				
1	Real-Time Camera (Panning)	-12192	-6096	-1651	-10	N/A	Zoom	30
2	Overall Left Side	-2489	-8280	-1143	-4	7809	24	1000
3	Left Side View	-1677	-7620	-1329	-4	7162	50	1000
4	Driver and Interior View	-6477	-10185	-4748	-13	11097	80	1005
5	Steering Column (Bottom)	-2134	-8230	-2997	-16	7907	19	990
6	Steering Column (Top)	-2134	-8230	-3404	-20	7998	19	990
7	Overall Right Side	-2083	8230	-1270	-6	7753	13	DNR
8	Right Side View	-1677	7316	-1422	-4	6859	50	1000
9	Passenger and Interior View	-6781	9144	-2997	-9	9906	65	1000
10	Right Side View	-1829	7316	-1422	-4	6848	28	1000
11	Windshield View	-610	0	-5944	-90	N/A	13	DNR
12	Driver Front View	610	-432	-2667	-40	N/A	13	DNR
13	Passenger Front View	610	432	-2667	-40	N/A	13	DNR
14	Pit View Engine	-914	0	1499	90	N/A	9	970
15	Pit View Fuel Tank	-2438	0	1499	90	N/A	6	120
16	Real-Time Camera (Extra)	-1067	7976	-991	0	7599	Zoom	30

X = Barrier Face Y = Monorail Centerline Z = Ground DNR = Did Not Run NTM = No Timing Marks

DATA SHEET NO. 15
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

All Dimensions in (mm)	
Item	Value
A	*
B	882
C	*
D	*
E	*
F	*
G	*
H	1040
I	1330
J	876
K	876
L	1238
M	1030
N	1235
O	876
P	876
Q	1335



* Targets were not installed due to curtain airbags.

DATA SHEET NO. 16
VEHICLE INTRUSION MEASUREMENTS

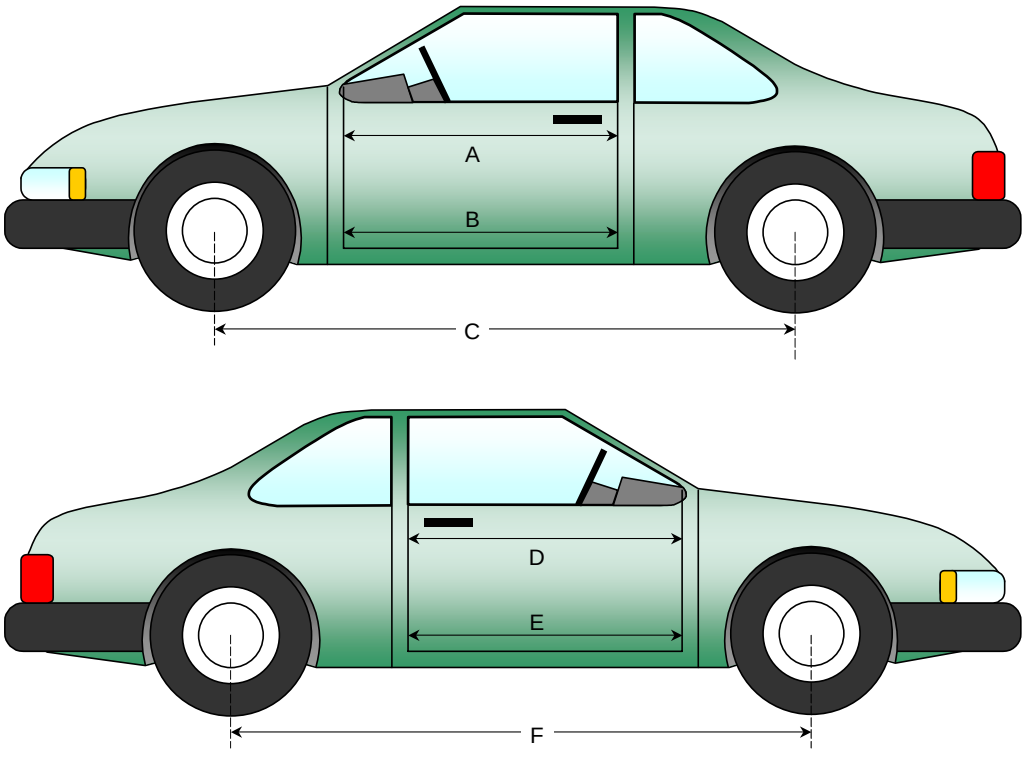
Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

DOOR OPENING WIDTH TABLE

Item	Description	Units	Pre-Test	Post-Test	Diff.
A	Left Side Upper	mm	940	935	-5
B	Left Side Lower	mm	890	888	-2
D	Right Side Upper	mm	938	936	-2
E	Right Side Lower	mm	881	874	-7

WHEELBASE MEASUREMENT TABLE

Item	Description	Units	Pre-Test	Post-Test	Diff.
C	Left Side Wheel Base	mm	2636	2550	-86
F	Right Side Wheel Base	mm	2636	2555	-81



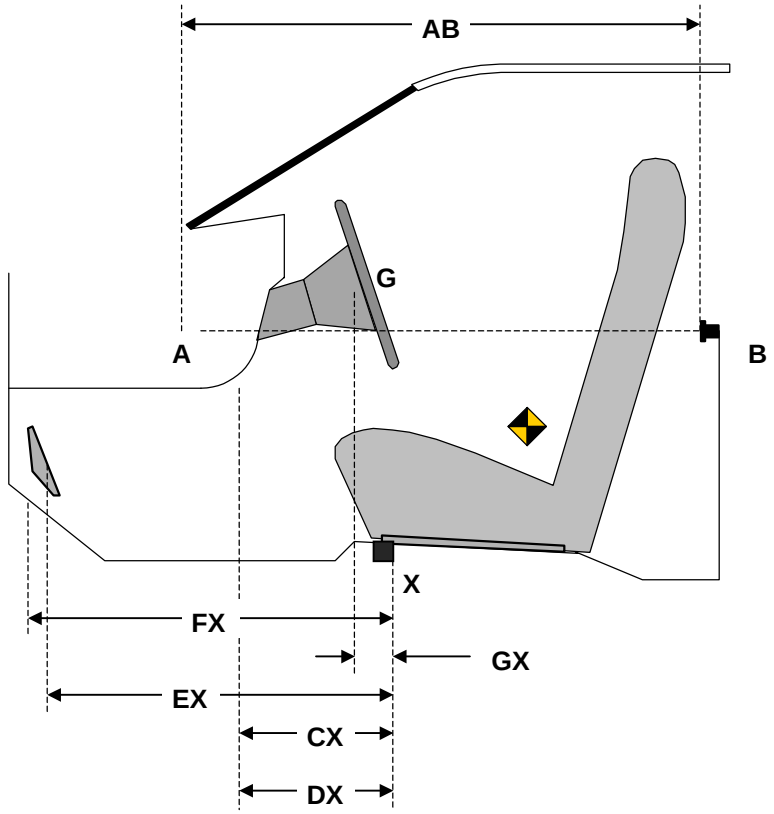
DATA SHEET NO. 16…(CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

DRIVER COMPARTMENT INTRUSION TABLE

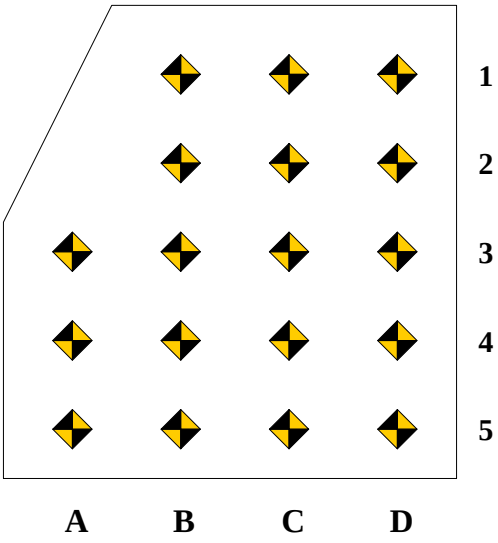
Item	Description	Units	Pre-Test	Post-Test	Diff.
AB	Door Opening (Inside window jam)	mm	940	935	-5
CX	Left Knee Bolster to X	mm	272	300	28
DX	Right Knee Bolster to X	mm	260	282	22
EX	Brake Pedal to X	mm	540	485	-55
FX	Foot Rest to X	mm	560	528	-32
GX	Center of Steering Wheel Hub to X	mm	55	90	35

X = Left Front Seat Outboard Anchor Bolt Head



DATA SHEET NO. 16…(CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05



Measurement reference point for X and Z-axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3, 4 and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.

DRIVER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		-664	-670	-678		-594	-602	-606		70	68	72
2		-585	-584	-589		-560	-540	-525		25	44	64
3	-477	-480	-480	-488	-471	-460	-443	-431	6	20	37	57
4	-378	-382	-386	-390	-379	-363	-360	-369	-1	19	26	21
5	-280	-281	-288	-290	-281	-262	-265	-267	-1	19	23	23

DRIVER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		-45	-53	-54		-13	-24	-29		32	29	25
2		-103	-99	-103		-96	-104	-91		7	-5	12
3	-109	-111	-109	-112	-105	-115	-127	-113	4	-4	-18	-1
4	-115	-119	-114	-115	-127	-117	-127	-127	-12	2	-13	-12
5	-123	-126	-111	-122	-100	-127	-125	-132	23	-1	-14	-10

DATA SHEET NO. 16…(CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

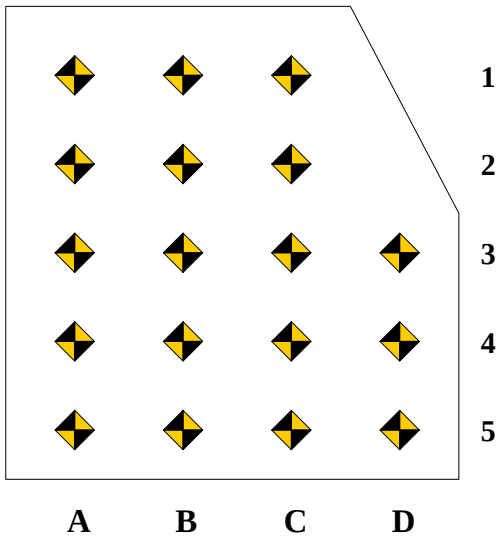
Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

Measurement reference point for X and Z axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3, 4 and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.



PASSENGER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-709	-712	-694		-691	-677	-636		18	35	58	
2	-627	-630	-631		-618	-618	-606		9	12	25	
3	-532	-538	-541	-542	-531	-535	-535	-536	1	3	6	6
4	-433	-439	-443	-446	-431	-440	-439	-442	2	-1	4	4
5	-333	-336	-342	-343	-344	-340	-336	-337	-11	-4	6	6

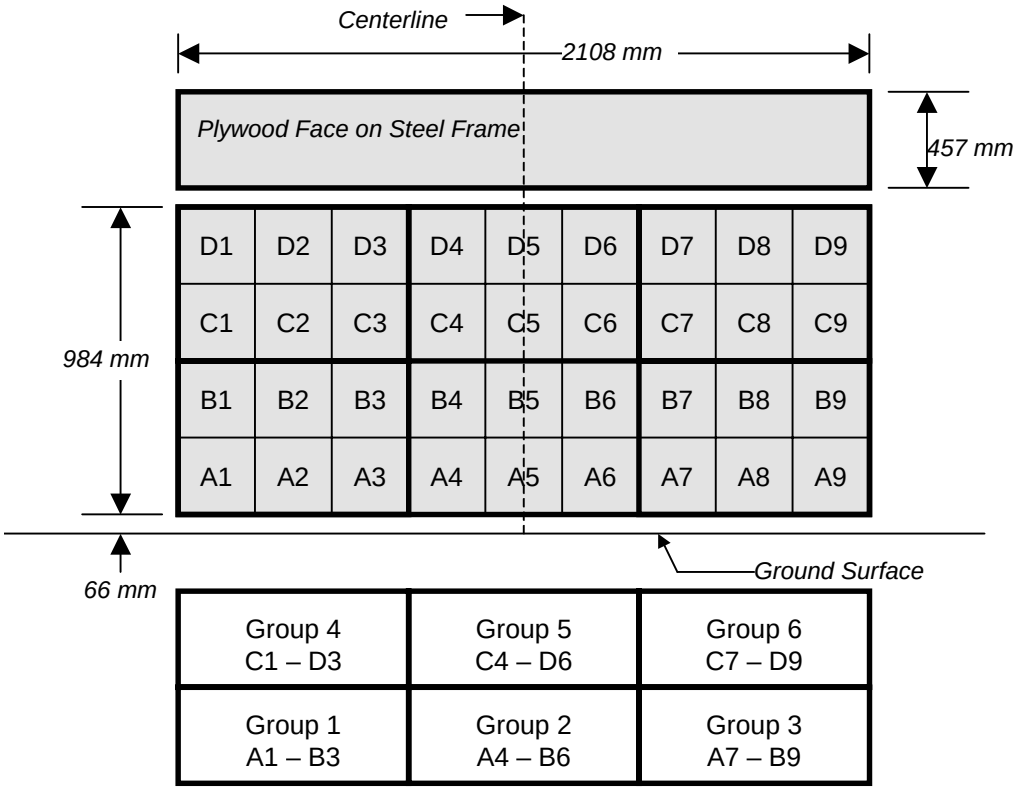
PASSENGER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-21	-15	7		4	16	42		25	31	35	
2	-79	-72	-74		-67	-68	-55		12	4	19	
3	-112	-106	-108	-112	-111	-113	-117	-113	1	-7	-9	-1
4	-116	-112	-114	-112	-126	-115	-111	-106	-10	-3	3	6
5	-107	-113	-122	-122	-115	-120	-108	-118	-8	-7	14	4

DATA SHEET NO. 17
FIXED BARRIER LOAD CELL LOCATIONS

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

36 Load Cell Rigid Barrier (NHTSA Standard)
Load Cell Locations on Fixed Barrier



D1	D2	D3	D4	D5	D6	D7	D8	D9
C1	C2	C3	C4	C5	C6	C7	C8	C9
B1	B2	B3	B4	B5	B6	B7	B8	B9
A1	A2	A3	A4	A5	A6	A7	A8	A9

Group 4 C1 – D3	Group 5 C4 – D6	Group 6 C7 – D9
Group 1 A1 – B3	Group 2 A4 – B6	Group 3 A7 – B9

6 Groups of 6 Load Cells Each

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508
Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05

VEHICLE INFORMATION

VIN: KM8JM12B25U080720 Wheel base (mm): 2636
Vehicle Size Category: 5-Door MPV Test Weight (kg): 1724

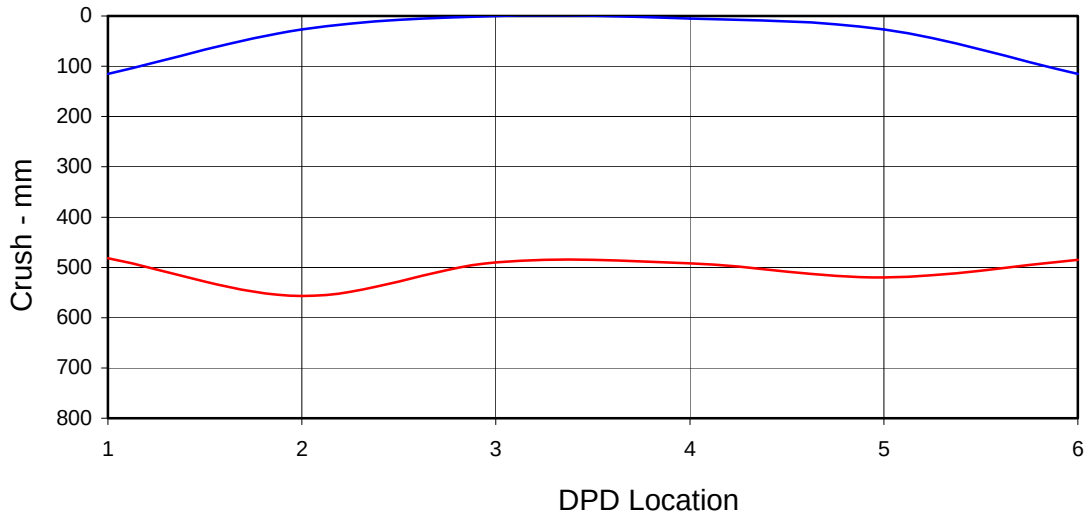
ACCELEROMETER DATA

Accelerometer Location: Left rear floor pan
Cal. Procedure/Interval: 6 months / drop test
Integration Algorithm: NHTSA Standard Linearity: Good
Impact Velocity (km/h): 56.09
Velocity Change (km/h): 64.92 Time of Separation (msec): 68.8

CRUSH PROFILE

Collision Deformation Classification: 12FDEW6 Midpoint of Damage: Vehicle Centerline
Damage Region Length (mm): 1374 Impact Mode: Full Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	115	482	-367
C2	Crush zone 2 on left side	mm	27	557	-530
C3	Crush zone 3 on left side	mm	0	490	-490
C4	Crush zone 4 on right side	mm	5	492	-487
C5	Crush zone 5 on right side	mm	27	520	-493
C6	Crush zone 6 at right side	mm	115	485	-370

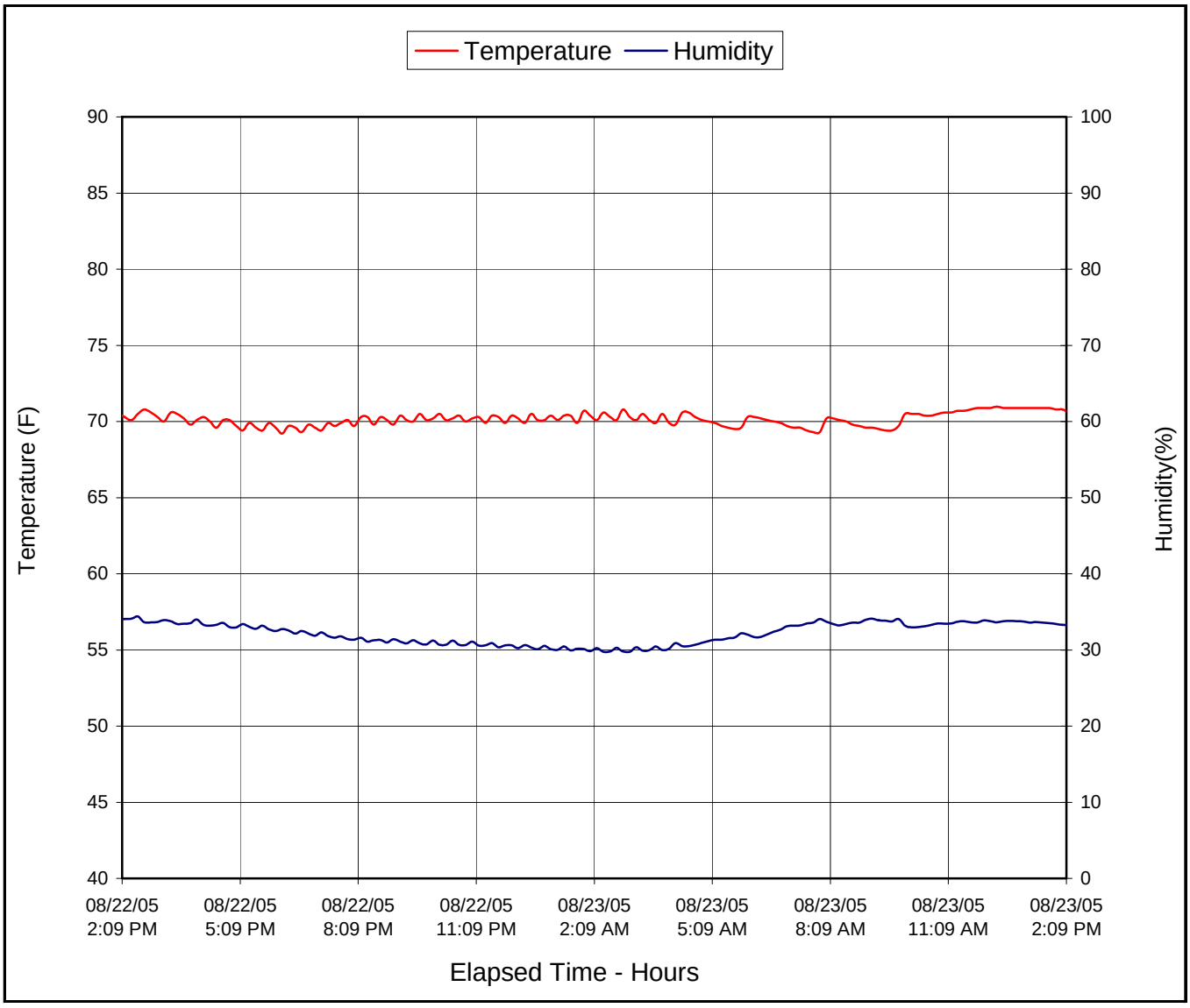


DATA SHEET NO. 19

DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2005 Hyundai Tucson 5-Door MPV NHTSA No.: M50508

Test Program: 2005 NHTSA 35mph NCAP Test Date: 8/24/05



APPENDIX A

PHOTOGRAPHS

LIST OF PHOTOGRAPHS

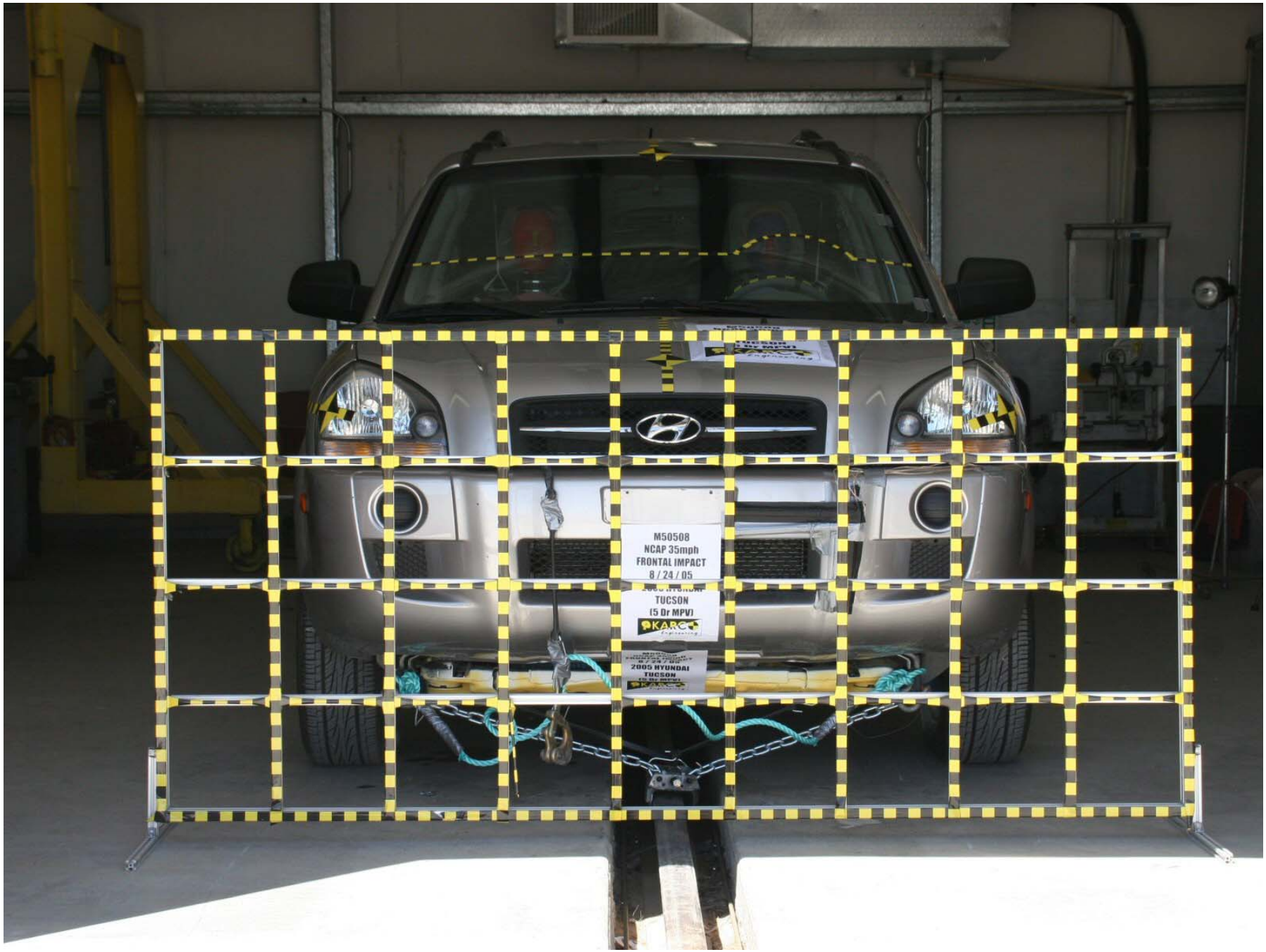


Figure A-1: Load Cell Location

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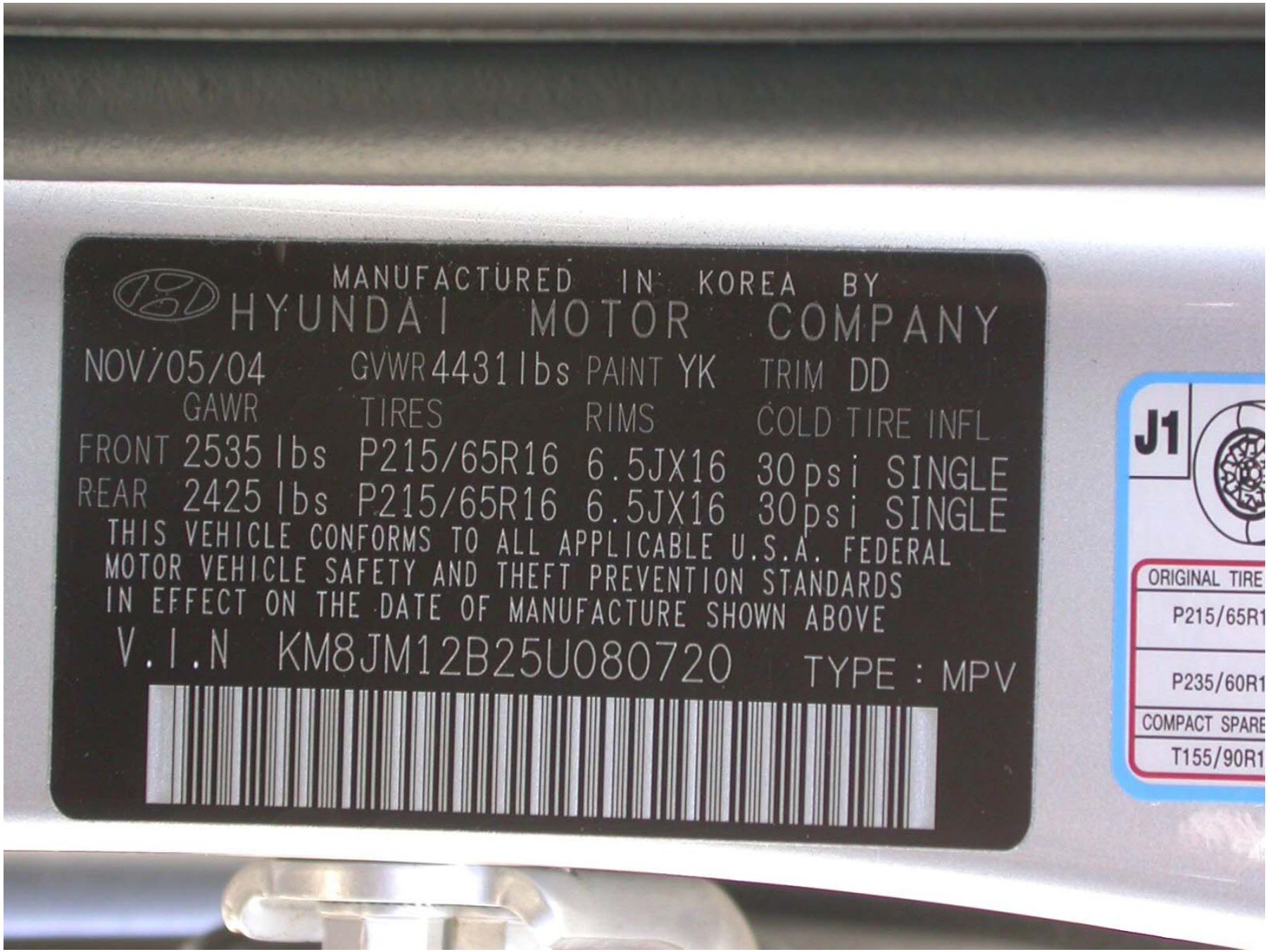


Figure A-2: Manufacturer's Label

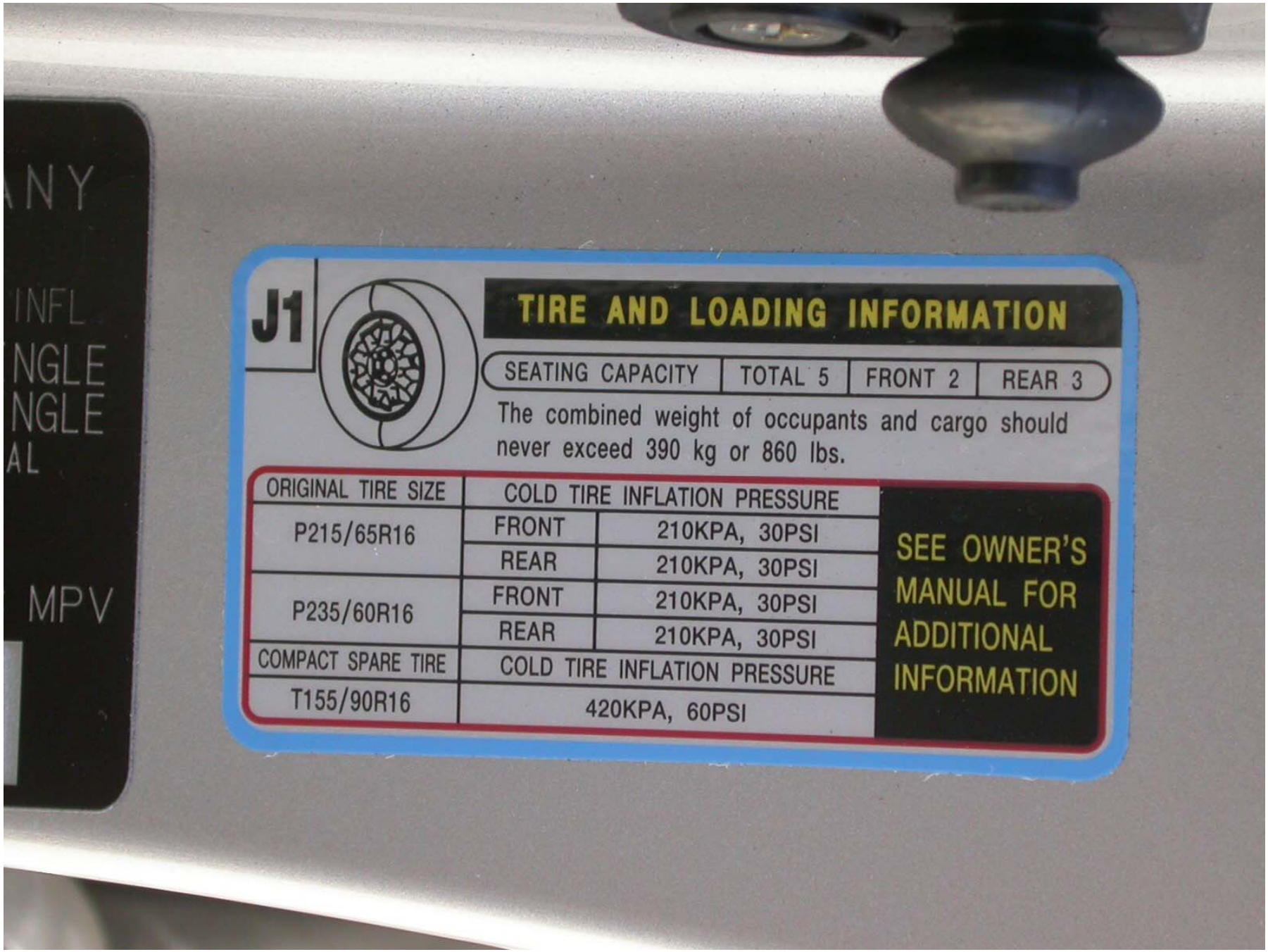


Figure A-3: Tire Placard

Figure A-4: Right Front ¾ View, As Received

Figure A-5: Left Rear ¾ View, as Received

Figure A-6: Pre-Test Front View

Figure A-7: Post-Test Front View (Vehicle Moved)

Figure A-8: Pre-Test Left Side View

Figure A-9: Post-Test Left Side View

Figure A-10: Pre-Test Right Side View

Figure A-11: Post-Test Right Side View

Figure A-12: Pre-Test Right Front ¾ View

Figure A-13: Post-Test Right Front ¾ View (Vehicle Moved)

Figure A-14: Pre-Test Left Rear ¾ View

Figure A-15: Post-Test Left Rear ¾ View

Figure A-16: Post-Test Left Side ¾ View of Doors After Impact

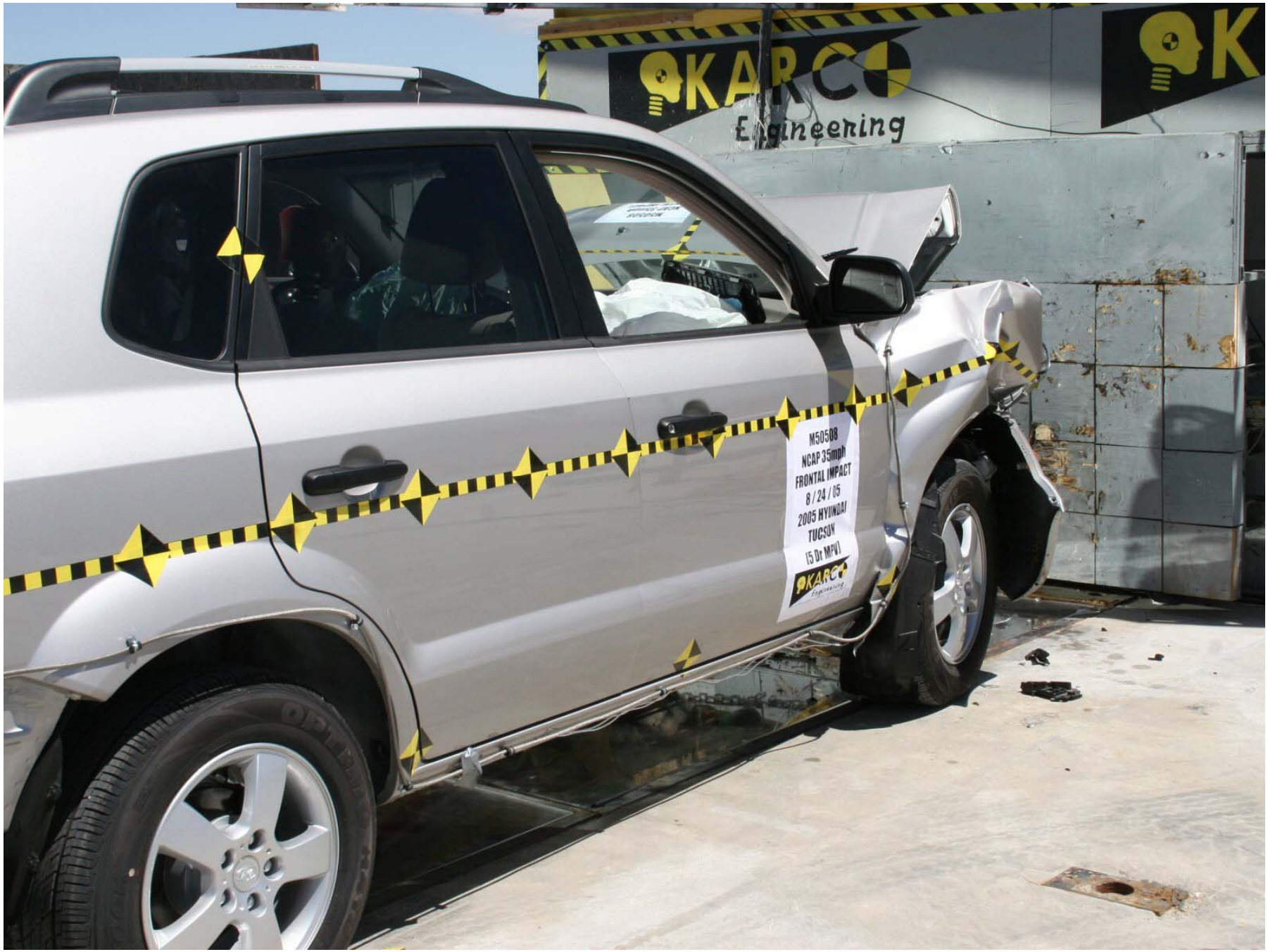


Figure A-17: Post-Test Right Side ¾ View of Doors After Impact

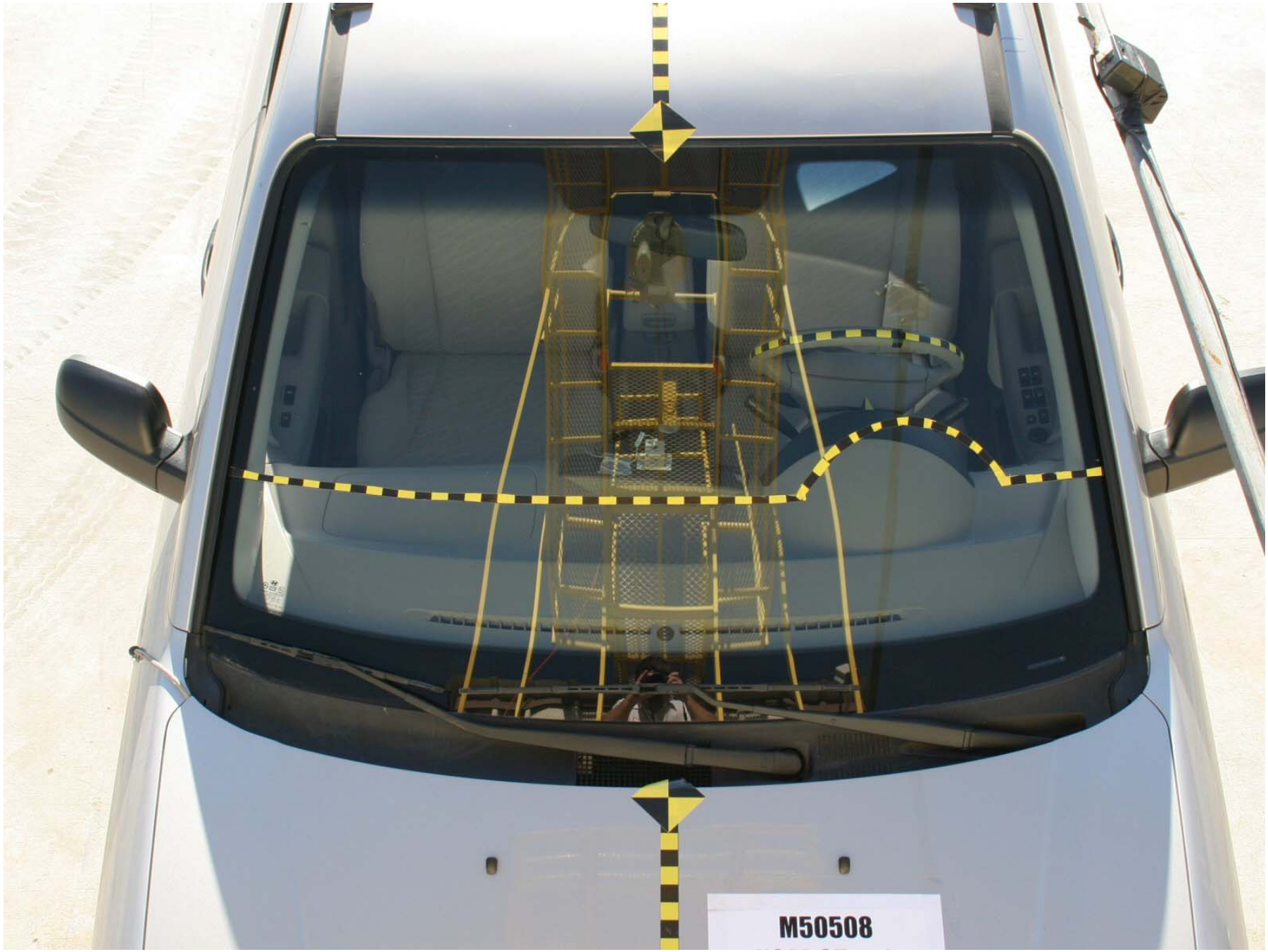


Figure A-18: Pre-Test Windshield

Figure A-19: Post-Test Windshield

Figure A-20: Pre-Test Engine Compartment

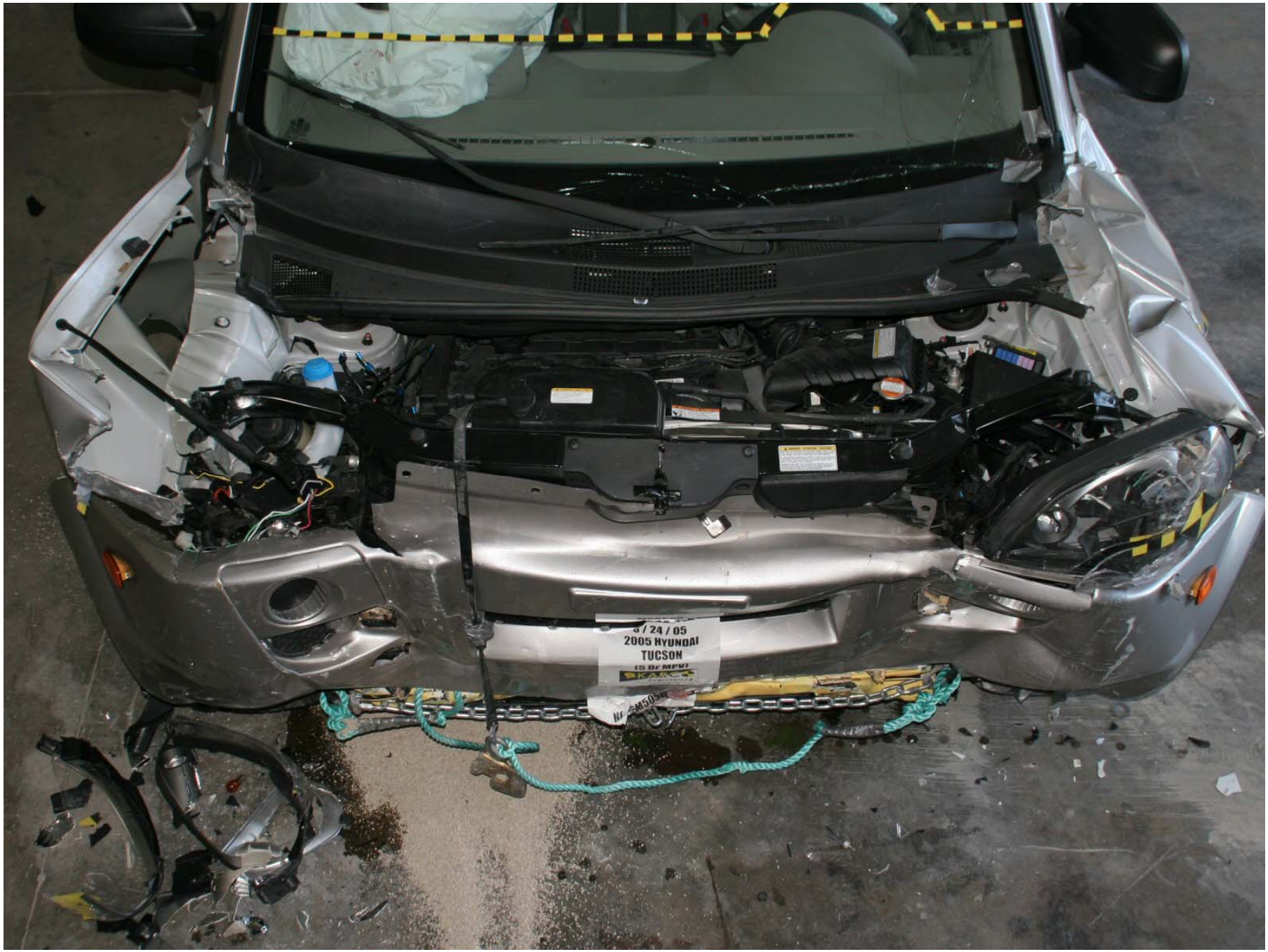


Figure A-21: Post-Test Engine Compartment (Vehicle Moved)

Figure A-22: Pre-Test Fuel Cap

Figure A-23: Post-Test Fuel Cap

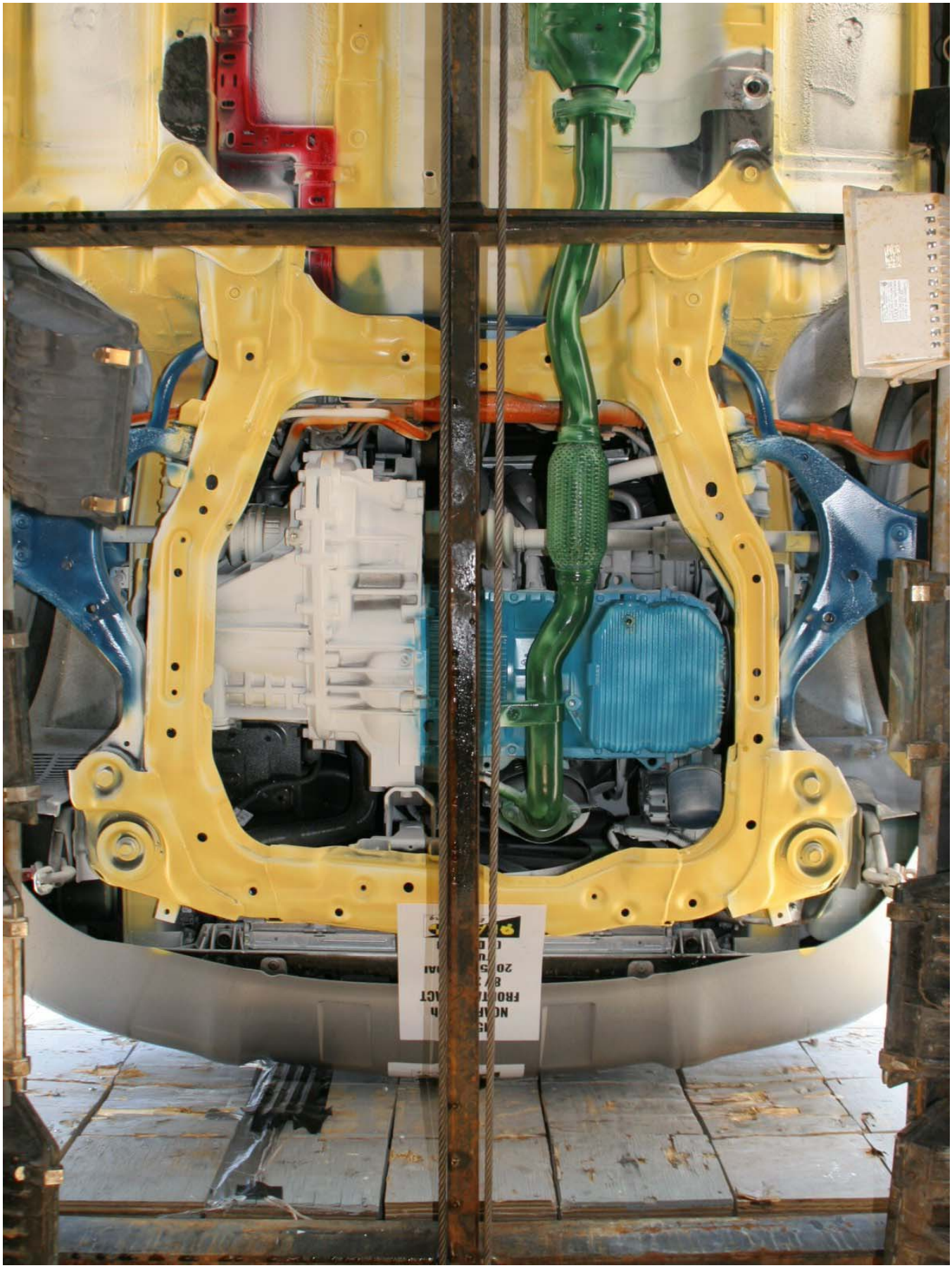


Figure A-24: Pre-Test Front Underbody

Figure A-25: Post-Test Front Underbody

Figure A-26: Pre-Test Mid Underbody

Figure A-27: Post-Test Mid Underbody

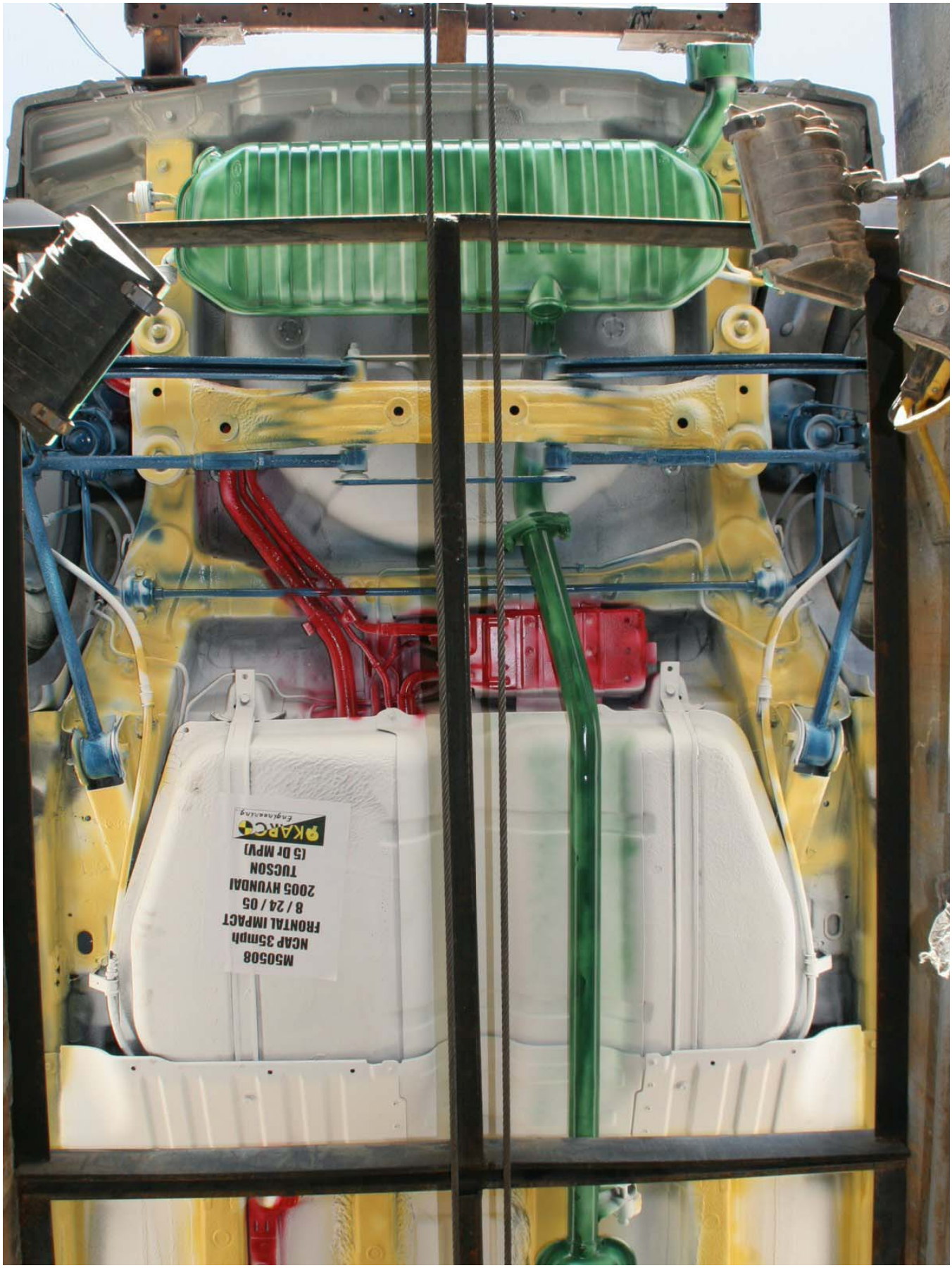


Figure A-28: Pre-Test Rear Underbody

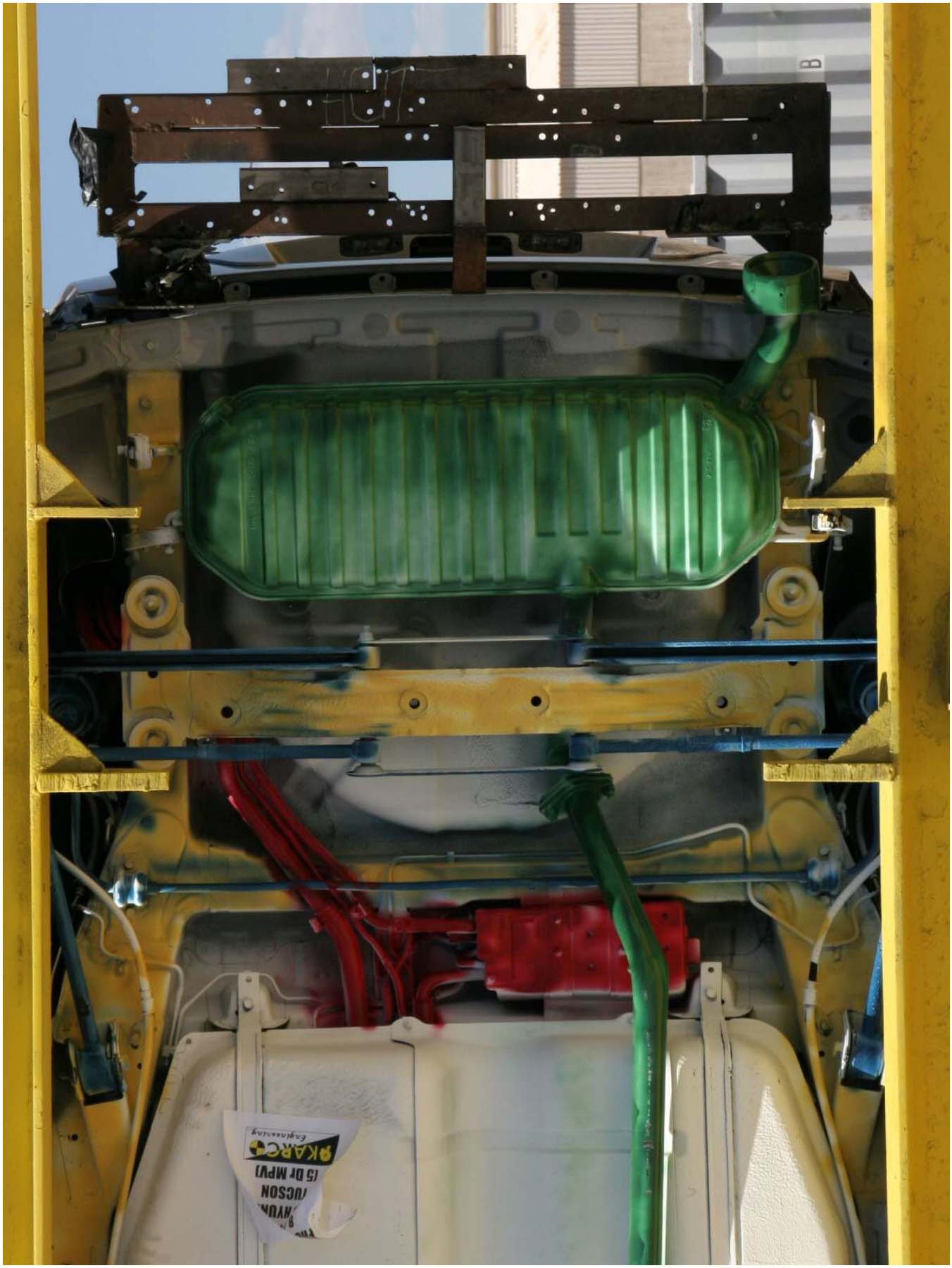


Figure A-29: Post-Test Rear Underbody

Figure A-30: Pre-Test Driver Dummy Front View (Head Position)

Figure A-31: Post-Test Driver Dummy Front View (Head Position)

Figure A-32: Pre-Test Driver Dummy (Through Window)

Figure A-33: Post-Test Driver Dummy (Through Window)

Figure A-34: Pre-Test Driver Dummy (Door Open)

Figure A-35: Post-Test Driver Dummy (Door Open)

Figure A-36: Pre-Test Driver Dummy Feet

Figure A-37: Post-Test Driver Dummy Feet

Figure A-38: Pre-Test Driver Side Knee Bolster

Figure A-39: Post-Test Driver Side Knee Bolster

Figure A-40: Pre-Test Driver Side Floor Pan

Figure A-41: Post-Test Driver Side Floor Pan

Figure A-42: Post-Test Driver Dummy Head

Figure A-43: Post-Test Driver Dummy Airbag Contact

Figure A-44: Pre-Test Passenger Dummy Front View (Head Position)

Figure A-45: Post-Test Passenger Dummy Front View (Head Position)

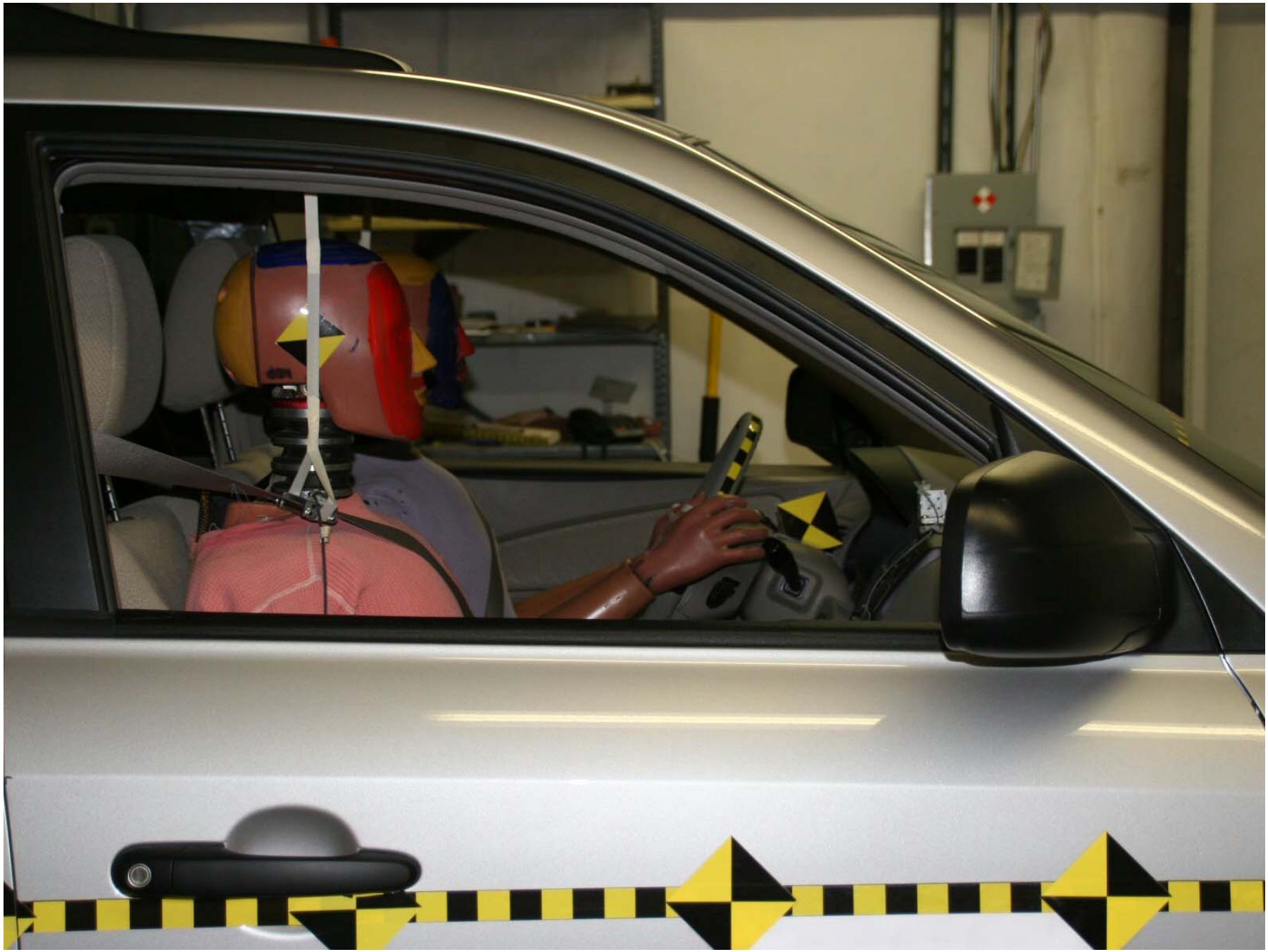


Figure A-46: Pre-Test Passenger Dummy (Through Window)

Figure A-47: Post-Test Passenger Dummy (Through Window)

Figure A-48: Pre-Test Passenger Dummy (Door Open)

Figure A-49: Post-Test Passenger Dummy (Door Open)

Figure A-50: Pre-Test Passenger Dummy Feet

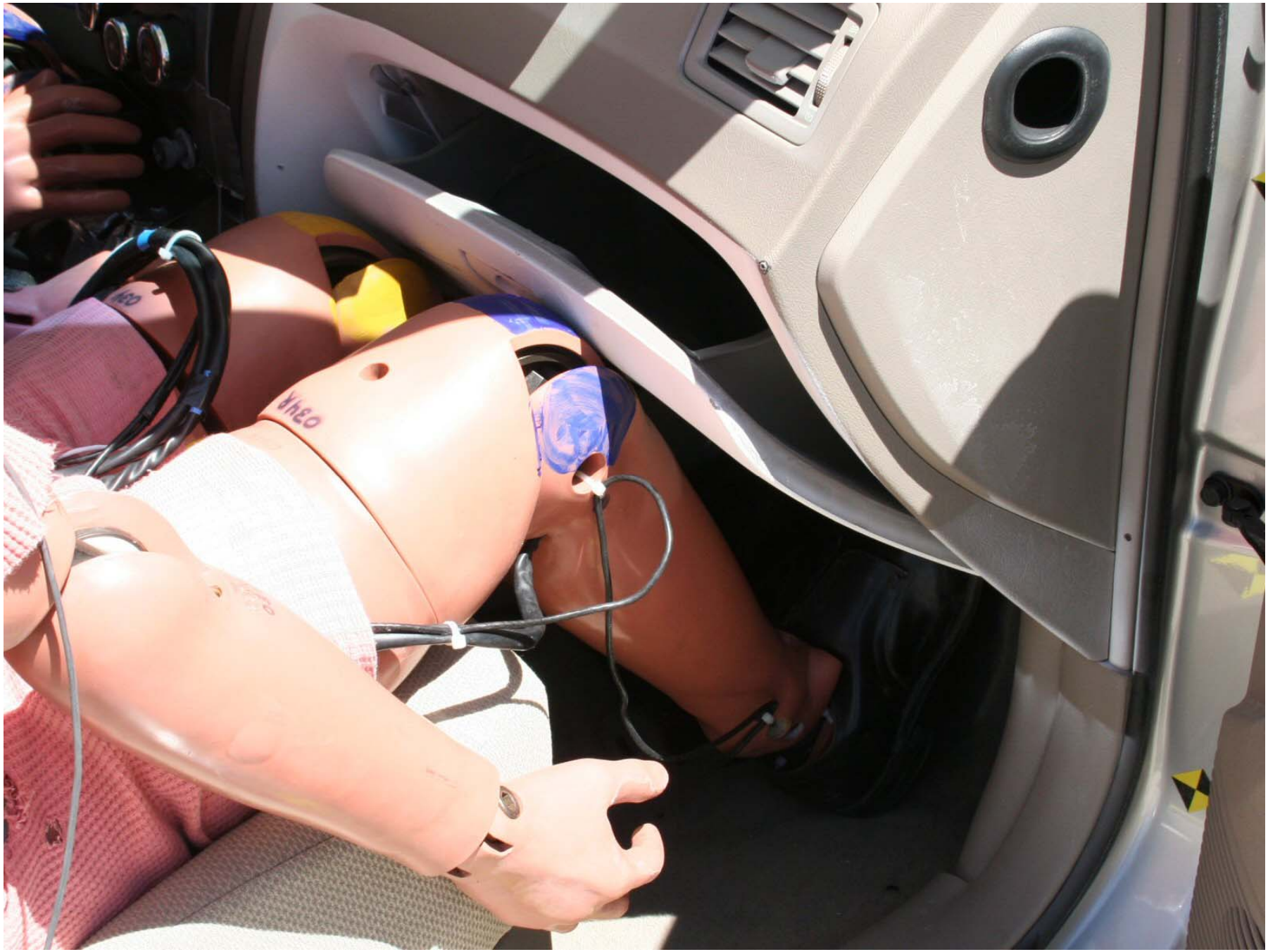


Figure A-51: Post-Test Passenger Dummy Feet

Figure A-52: Pre-Test Passenger Side Glove Box

Figure A-53: Post-Test Passenger Side Glove Box

Figure A-54: Pre-Test Passenger Side Floor Pan

Figure A-55: Post-Test Passenger Side Floor Pan

Figure A-56: Post-Test Passenger Dummy Head

Figure A-57: Post-Test Passenger Dummy Airbag Contact

Figure A-58: Vehicle on Rollover Device (0°)

Figure A-59: Vehicle on Rollover Device (90°)

Figure A-60: Vehicle on Rollover Device (180°)

Figure A-61: Vehicle on Rollover Device (270°)

Figure A-62: Vehicle Impact

APPENDIX B

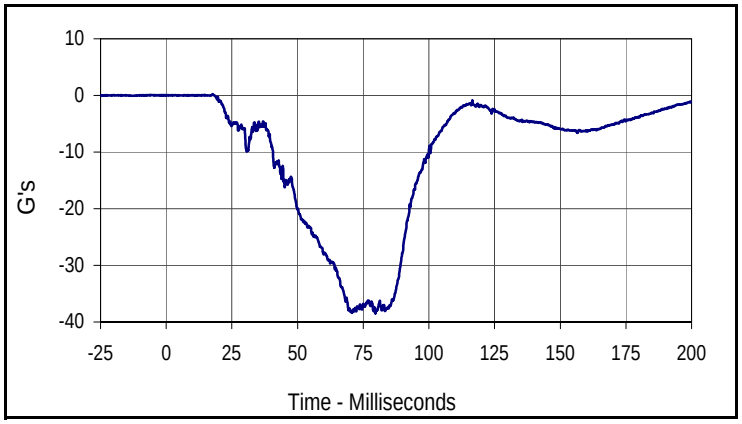
DATA PLOTS

LIST OF DATA PLOTS

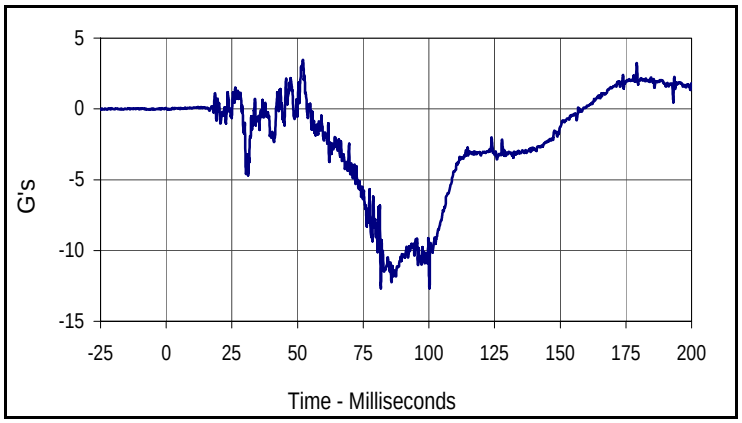
The following additional data plots for this test can be obtained from the research and development section of the NHTSA website. The website can be found at www.NHTSA.dot.gov.

LIST OF DATA PLOTS

Test Vehicle:	2005 Hyundai Tucson 5-Door MPV	Test Date:	8/24/05
Test Program:	2005 NHTSA 35mph NCAP	NHTSA No.:	M50508



Curve Description			
Driver Head Primary X			
CURNO	Type	SAE Class	Units
001	FIL	1000	G's
Max	Time	Min	Time
0.2	17.7	-38.5	79.6



Curve Description			
Driver Head Primary Y			
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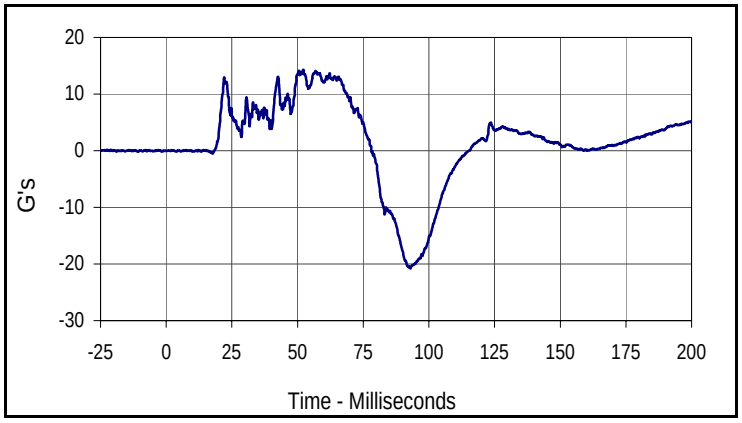
002	FIL	1000	G's
Max	Time	Min	Time
3.5	52.1	-12.7	100.2



Curve Description			
Driver Head Primary Z			
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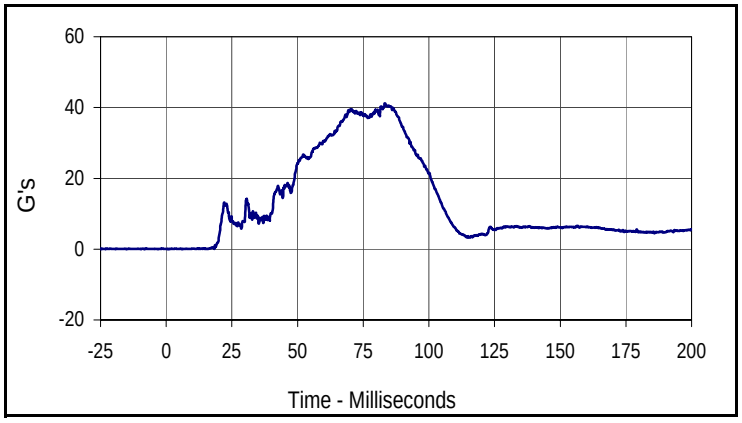
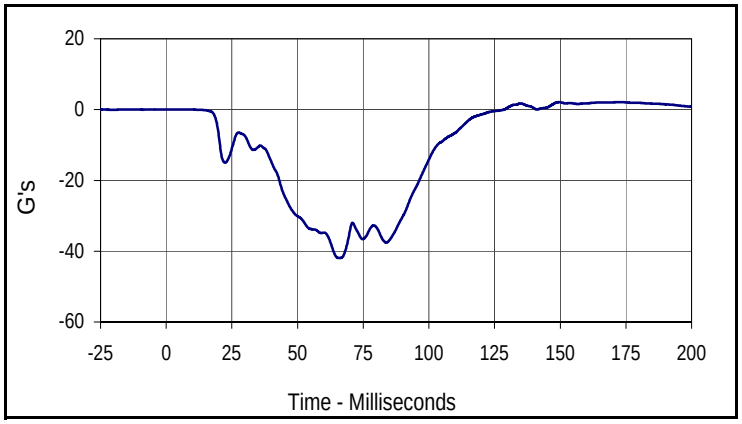
003	FIL	1000	G's
Max	Time	Min	Time
14.3	52.1	-20.8	92.9

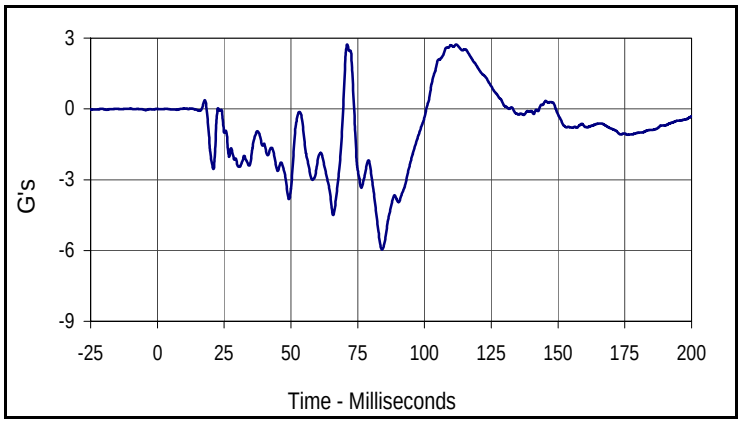


Curve Description			
Driver Head Resultant Primary			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
41.2	83.3	0.0	0.5

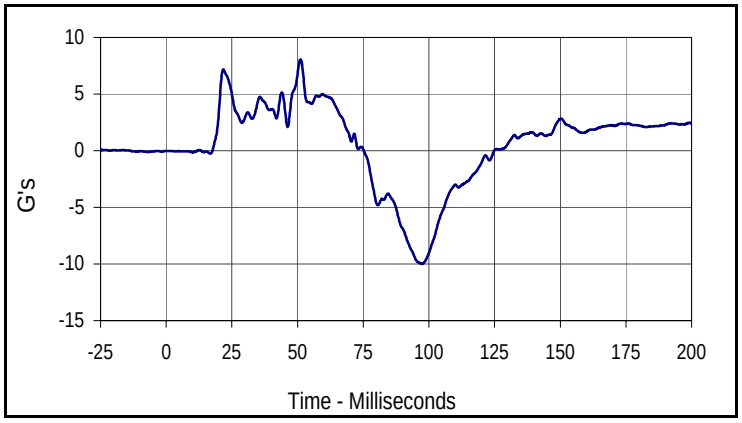
Test Vehicle:	2005 Hyundai Tucson 5-Door MPV	Test Date:	8/24/05
Test Program:	2005 NHTSA 35mph NCAP	NHTSA No.:	M50508



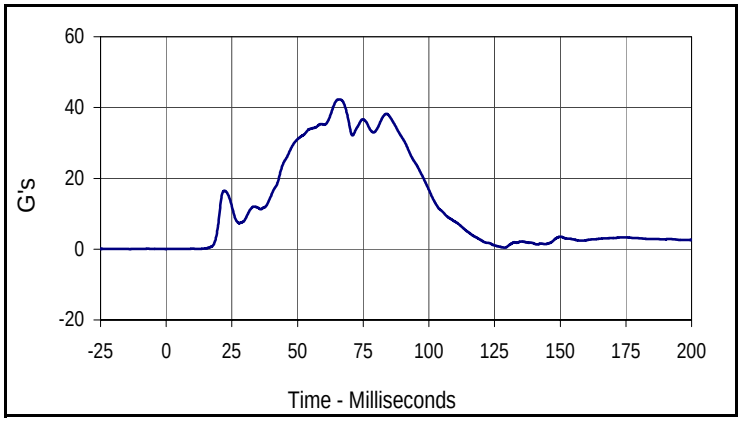
Curve Description			
Driver Chest Primary X			
CURNO	Type	SAE Class	Units
004	FIL	180	G's
Max	Time	Min	Time
2.1	173.4	-42.0	65.9



Curve Description			
Driver Chest Primary Y			
CURNO	Type	SAE Class	Units
005	FIL	180	G's
Max	Time	Min	Time
2.7	111.9	-6.0	84.1

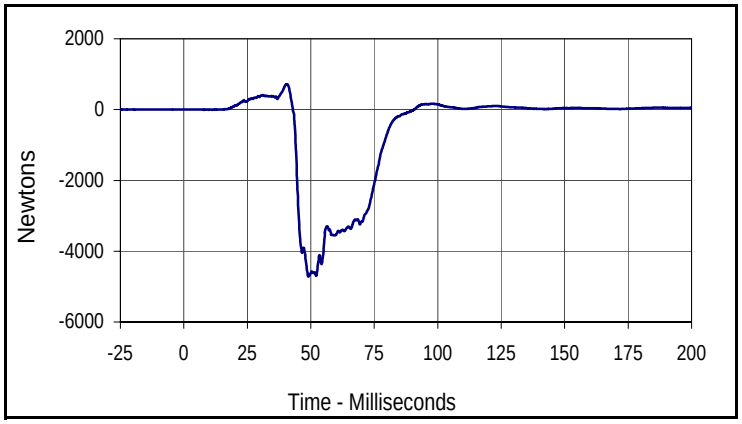


Curve Description			
Driver Chest Primary Z			
CURNO	Type	SAE Class	Units
006	FIL	180	G's
Max	Time	Min	Time
8.1	51.1	-10.0	97.3

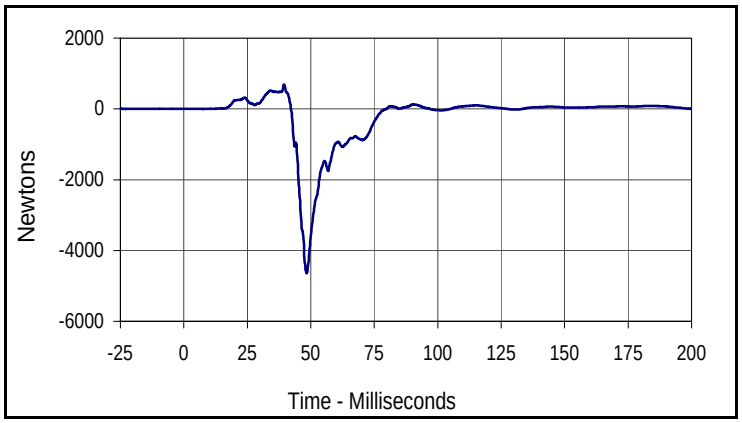


Curve Description			
Driver Chest Resultant Primary			
CURNO	Type	SAE Class	Units
004	RES	180	G's
Max	Time	Min	Time
42.3	65.8	0.0	0.0

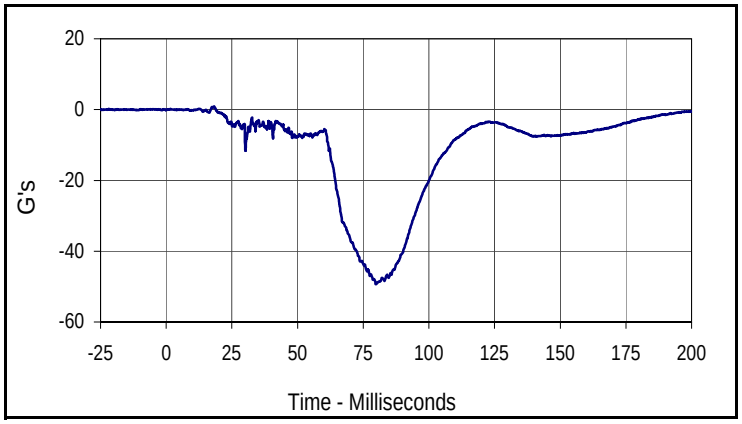
Test Vehicle:	2005 Hyundai Tucson 5-Door MPV	Test Date:	8/24/05
Test Program:	2005 NHTSA 35mph NCAP	NHTSA No.:	M50508



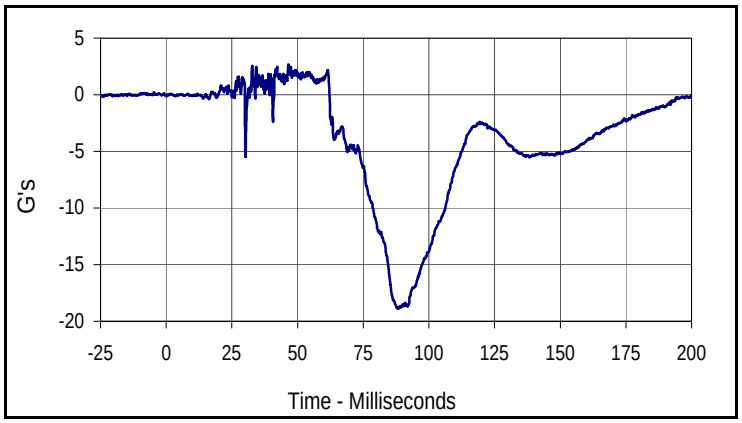
Curve Description			
Driver Left Femur Force Z			
CURNO	Type	SAE Class	Units
007	FIL	600	Newtons
Max	Time	Min	Time
719.5	40.6	-4717.7	49.1



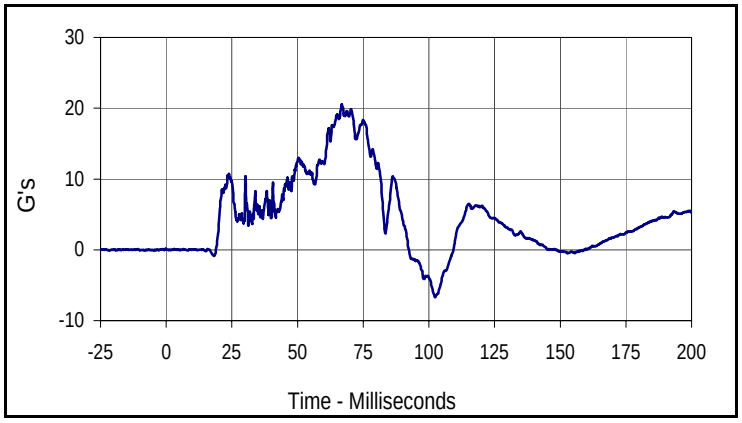
Curve Description			
Driver Right Femur Force Z			
CURNO	Type	SAE Class	Units
008	FIL	600	Newtons
Max	Time	Min	Time
690.1	39.5	-4642.8	48.4



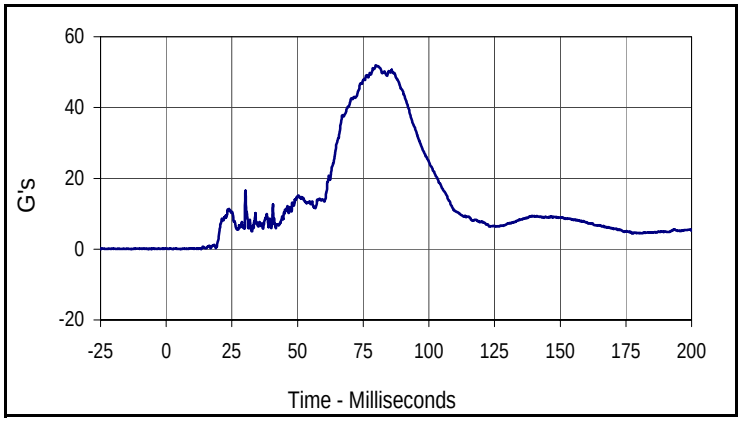
Curve Description			
Passenger Head Primary X			
CURNO	Type	SAE Class	Units
009	FIL	1000	G's
Max	Time	Min	Time
0.9	18.2	-49.3	79.9



Curve Description			
Passenger Head Primary Y			
CURNO	Type	SAE Class	Units
010	FIL	1000	G's
Max	Time	Min	Time
2.7	46.5	-18.9	88.4

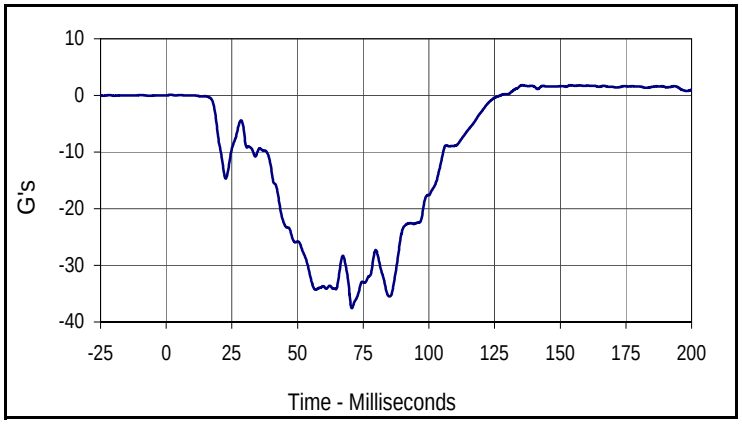


Curve Description			
Passenger Head Primary Z			
CURNO	Type	SAE Class	Units
011	FIL	1000	G's
Max	Time	Min	Time
20.6	66.8	-6.7	102.4

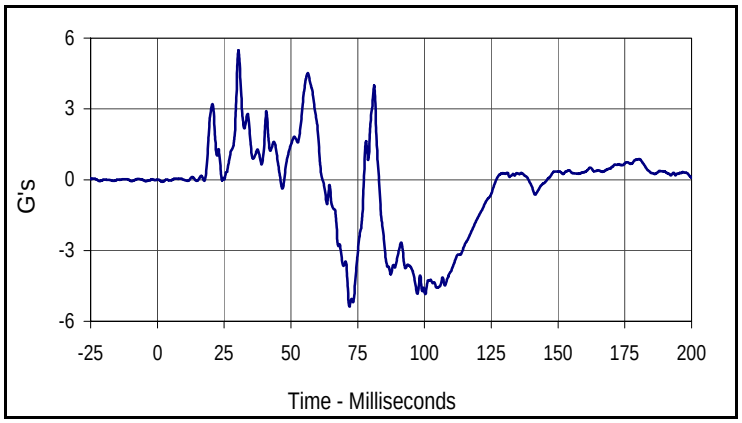


Curve Description			
Passenger Head Resultant Primary			
CURNO	Type	SAE Class	Units
009	RES	1000	G's
Max	Time	Min	Time
51.9	79.8	0.0	5.6

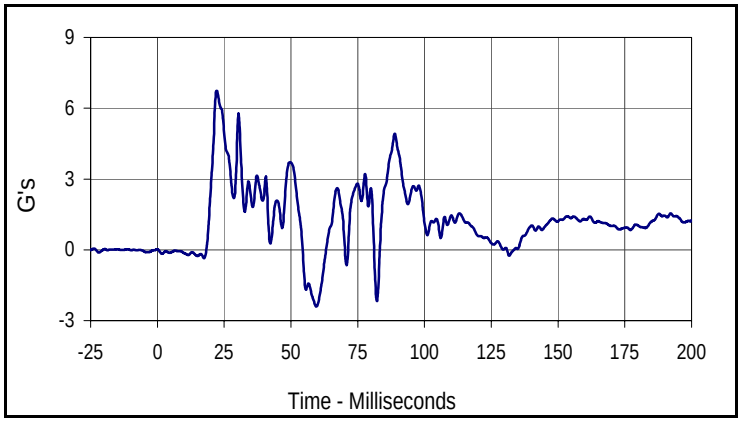
Test Vehicle:	2005 Hyundai Tucson 5-Door MPV	Test Date:	8/24/05
Test Program:	2005 NHTSA 35mph NCAP	NHTSA No.:	M50508



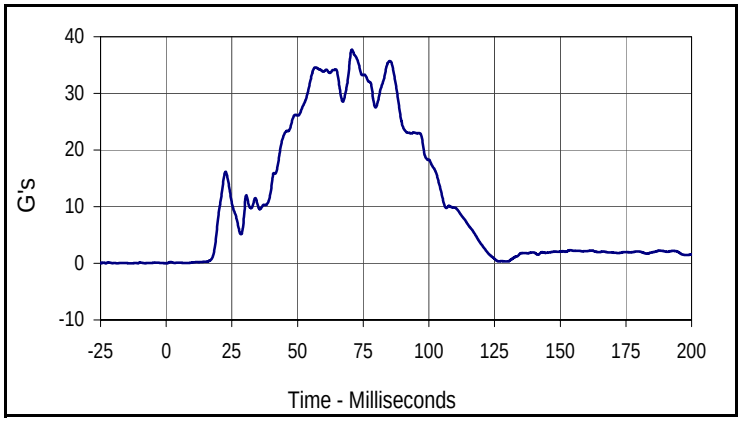
Curve Description			
Passenger Chest Primary X			
CURNO	Type	SAE Class	Units
012	FIL	180	G's
Max	Time	Min	Time
1.8	135.5	-37.6	70.7



Curve Description			
Passenger Chest Primary Y			
CURNO	Type	SAE Class	Units
013	FIL	180	G's
Max	Time	Min	Time
5.5	30.4	-5.4	71.9

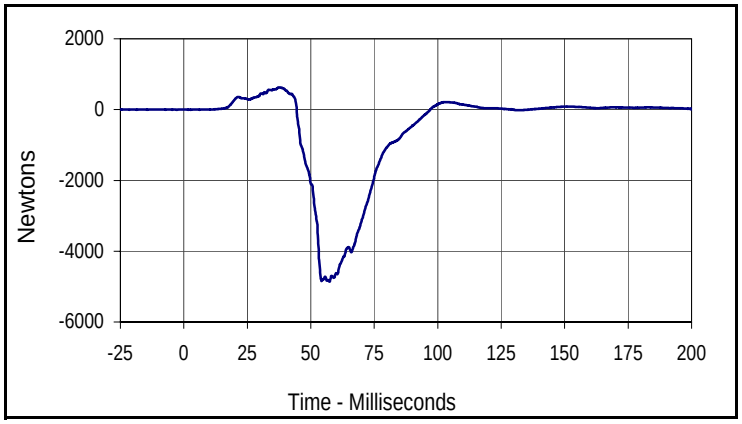


Curve Description			
Passenger Chest Primary Z			
CURNO	Type	SAE Class	Units
014	FIL	180	G's
Max	Time	Min	Time
6.7	22.2	-2.4	59.5

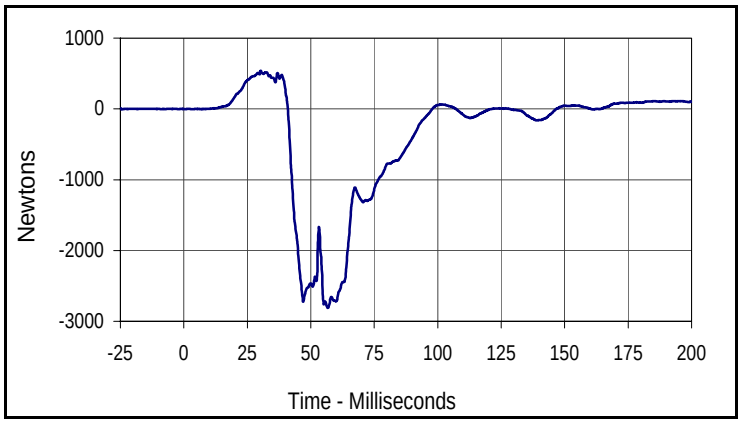


Curve Description			
Passenger Chest Resultant Primary			
CURNO	Type	SAE Class	Units
012	RES	180	G's
Max	Time	Min	Time
37.7	70.7	0.0	0.3

Test Vehicle:	2005 Hyundai Tucson 5-Door MPV	Test Date:	8/24/05
Test Program:	2005 NHTSA 35mph NCAP	NHTSA No.:	M50508



Curve Description			
Passenger Left Femur Force Z			
CURNO	Type	SAE Class	Units
015	FIL	600	Newtons
Max	Time	Min	Time
626.8	37.7	-4864.0	57.4



Curve Description			
Passenger Right Femur Force Z			
CURNO	Type	SAE Class	Units
016	FIL	600	Newtons
Max	Time	Min	Time
539.0	30.2	-2811.4	56.7

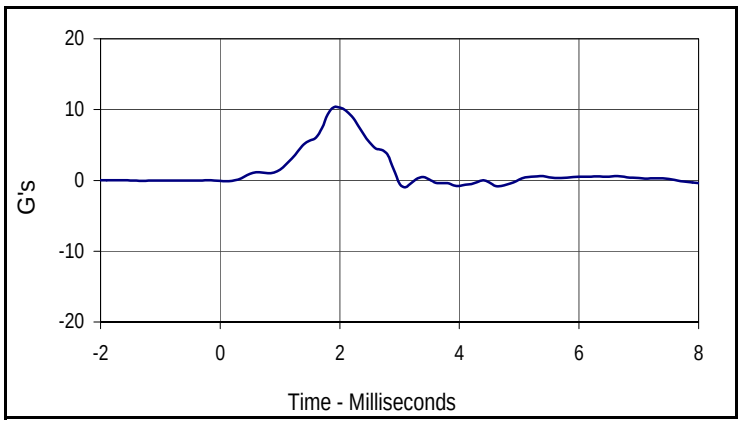
APPENDIX C

DUMMY CALIBRATION DATA

Test Program:	Hybrid III 50th Percentile Male Head Drop Test	Test Date:	8/17/05
ATD Serial No.:	034	Test I.D.:	HD08A

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	270.6	Pass
Peak Lateral Acceleration	G's	≤15.0	10.3	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
		Overall Test Results		Pass

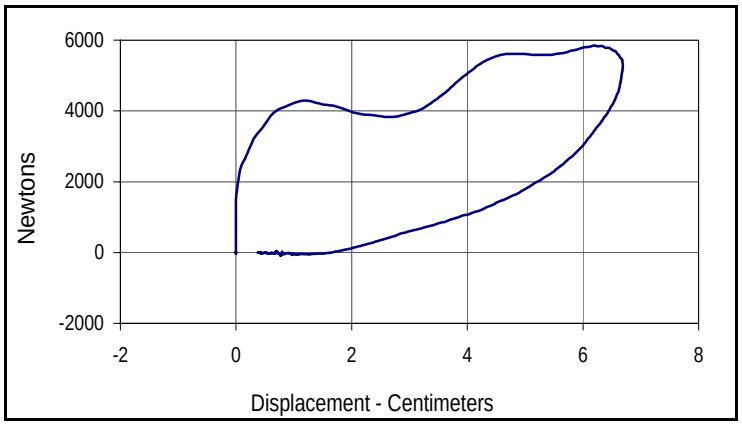
Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
270.6	2.0	0.0	-0.2



Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
10.3	1.9	-1.0	3.1

Test Program:	Hybrid III 50th Percentile Male Thorax Impact Test	Test Date:	8/19/05
ATD Serial No.:	034	Test I.D.:	CH08A

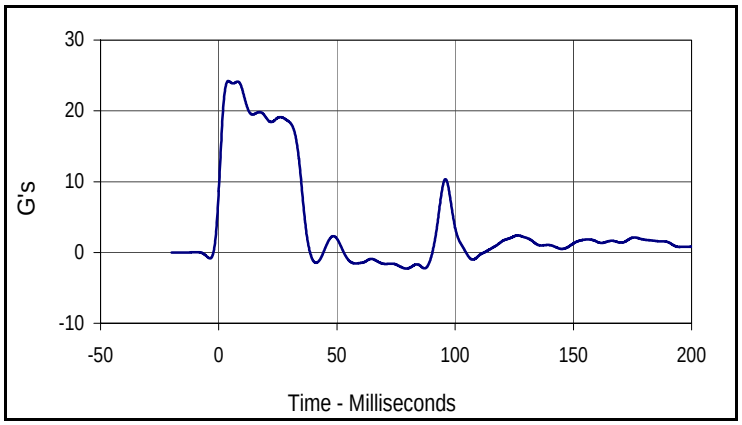
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	6.58 to 6.82	6.75	Pass
Peak Probe Force	Newtons	5159 to 5893	5846	Pass
Peak Sternum Deflection	CM	6.35 to 7.26	6.69	Pass
Internal Hysterysis	%	69 to 85	75.5	Pass
		Overall Test Results		Pass



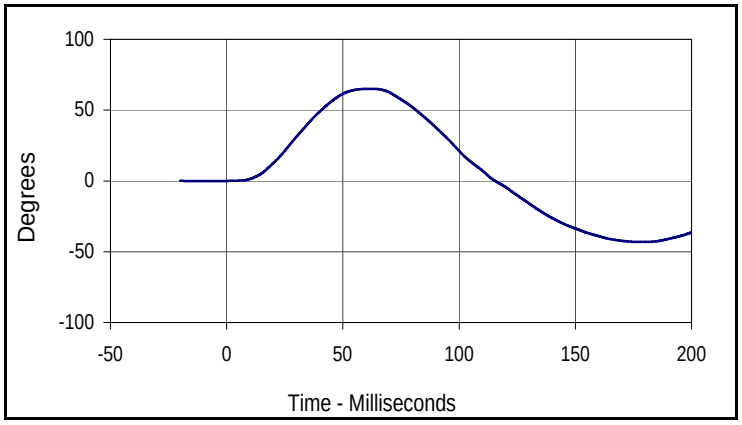
Curve Description			
Probe Force vs. Chest Deflection			
CURNO	Type	SAE Class	Hysterysis
001	FIL	180	75.5
Peak Probe Force		Peak Chest Deflection	
5846		6.69	

Test Program:	Hybrid III 50th Percentile Male Neck Flexion Test	Test Date:	8/18/05
ATD Serial No.:	034	Test I.D.:	NF08A

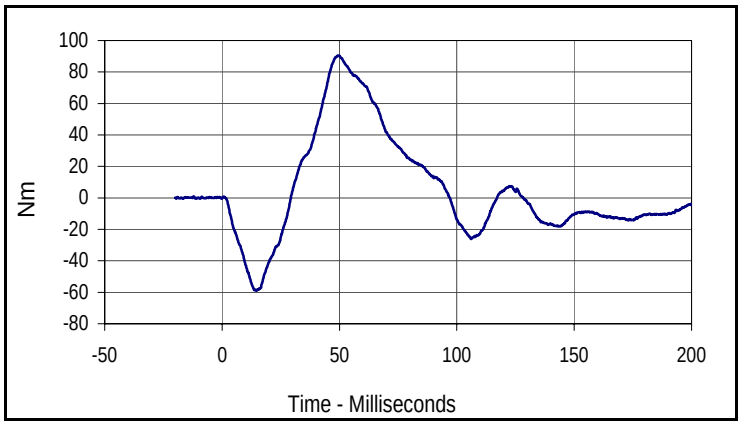
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.10	Pass
Pendulum Deceleration	10 Msec.	G's	22.5 to 27.5	23.0	Pass
	20 Msec.	G's	17.6 to 22.6	19.1	Pass
	30 Msec.	G's	12.5 to 18.5	18.4	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 29.0	18.4	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	34.0 to 42.0	36.4	Pass
Maximum "D" Plane Rotation	Max	Degrees	64.0 to 78.0	65.1	Pass
	Time	Msec.	57.0 to 64.0	62.0	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	113.0 to 128.0	115.5	Pass
Moment About Occ. Condyle	Max	Nm	84.1 to 108.5	90.5	Pass
	Time	Msec.	47.0 to 58.0	49.7	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	97.0 to 107.0	97.1	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Deceleration			
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
24.2	4.0	-2.3	79.4



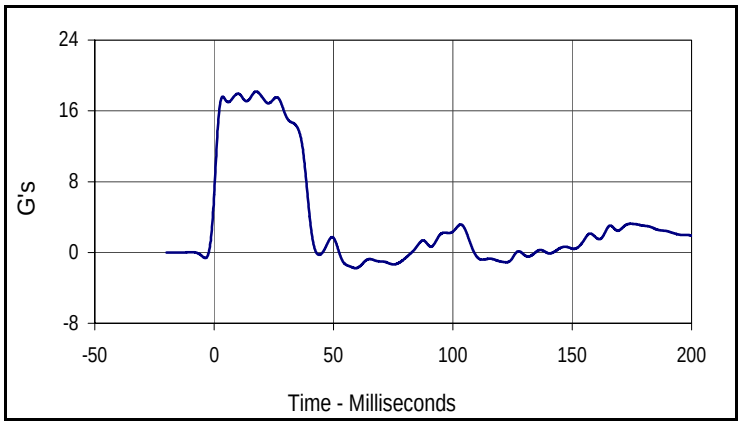
Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
65.1	62.0	-43.1	178.1



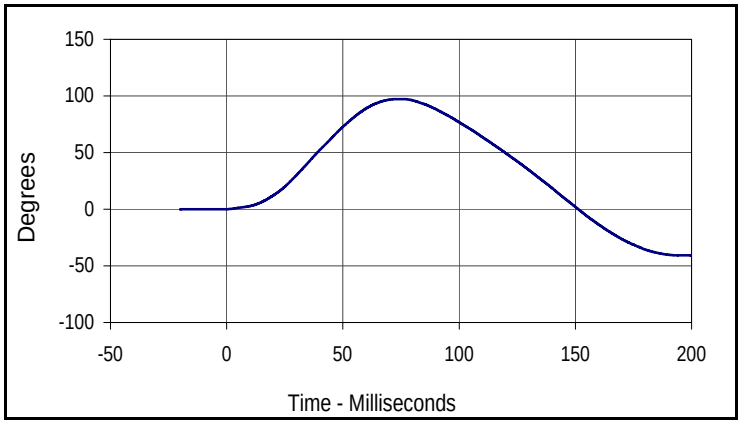
Curve Description			
Moment About Occipital Condyle			
CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
90.5	49.7	-59.1	14.5

Test Program:	Hybrid III 50th Percentile Male Neck Extension Test	Test Date:	8/18/05
ATD Serial No.:	034	Test I.D.:	NE08A

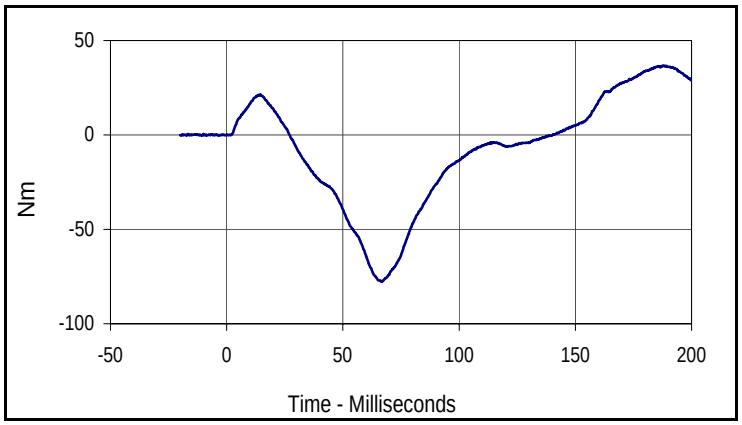
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.94 to 6.19	6.00	Pass
Pendulum Deceleration	10 Msec.	G's	17.2 to 21.2	17.9	Pass
	20 Msec.	G's	14.0 to 19.0	17.6	Pass
	30 Msec.	G's	11.0 to 16.0	15.5	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 22.0	15.5	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	38.0 to 46.0	39.7	Pass
Maximum "D" Plane Rotation	Max	Degrees	81.0 to 106.0	97.3	Pass
	Time	Msec.	72.0 to 82.0	74.6	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	147.0 to 174.0	151.3	Pass
Moment About Occ. Condyle	Max	Nm	-52.9 to- 79.9	-77.7	Pass
	Time	Msec.	65.0 to 79.0	66.7	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	120.0 to 148.0	140.2	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Deceleration			
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
18.2	17.5	-1.8	59.2



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
97.3	74.6	-40.7	197.6



Curve Description			
Moment About Occipital Condyle			
CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
36.7	188.1	-77.7	66.7

Test Program:	Hybrid III 50th Percentile Male Knee Impact Test	Test Date:	8/19/05
ATD Serial No.:	034	Test I.D.:	LK08A , RK08A

Left Knee

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	5519	Pass
		Overall Test Results		Pass

Right Knee

Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5600	Pass
		Overall Test Results		Pass

Curve Description			
Left Knee Probe Force			
CURNO	Type	SAE Class	Units
001	FIL	600	Newtons
Max	Time	Min	Time
5518.6	2.4	-23.7	7.2

Curve Description			
Right Knee Probe Force			
CURNO	Type	SAE Class	Units
002	FIL	600	Newtons
Max	Time	Min	Time
5600.1	2.5	-27.8	7.5

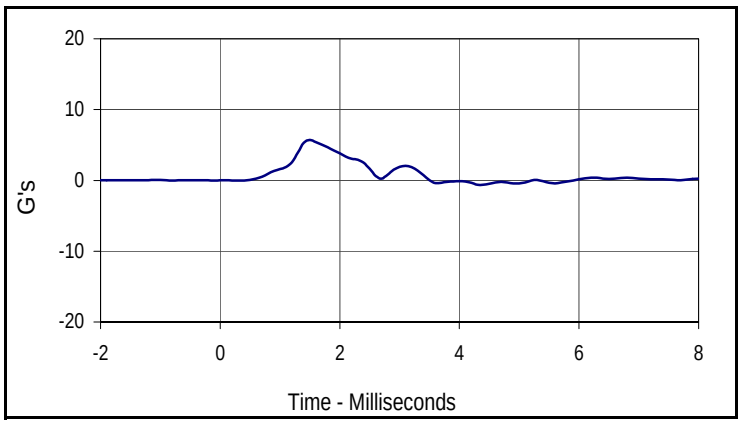
Test Program:	Hybrid III 50th Percentile Male External Measurements	Test Date:	8/19/05
ATD Serial No.:	034	Test I.D.:	N/A

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	879 to 889	880	Pass
B - Shoulder pivot height	mm	505 to 521	517	Pass
C - "H" point height	mm	84 to 89	85	Pass
D - "H" point from seat back	mm	135 to 140	139	Pass
E - Shoulder pivot from back	mm	84 to 94	86	Pass
F - Thigh clearance	mm	140 to 155	145	Pass
G - Elbow back to wrist pivot	mm	290 to 305	296	Pass
H - Skull cap to back line	mm	41 to 46	45	Pass
I - Shoulder to elbow length	mm	330 to 345	341	Pass
J - Elbow rest height	mm	190 to 211	201	Pass
K - Buttock to knee length	mm	579 to 604	602	Pass
L - Poplipteal length	mm	429 to 455	450	Pass
M - Knee pivot height	mm	485 to 500	489	Pass
N - Buttock poplipteal length	mm	452 to 477	470	Pass
O - Chest depth	mm	213 to 229	225	Pass
P - Foot length	mm	251 to 267	261	Pass
V - Shoulder breadth	mm	422 to 437	431	Pass
W - Foot breadth	mm	91 to 107	105	Pass
Y - Chest circumference	mm	970 to 1001	985	Pass
Z - Waist circumference	mm	836 to 866	840	Pass
AA - Location for chest circumference	mm	429 to 434	430	Pass
BB - Location for waist circumference	mm	226 to 231	229	Pass
		Overall Test Results		Pass

Test Program:	Hybrid III 50th Percentile Male Head Drop Test	Test Date:	8/17/05
ATD Serial No.:	035	Test I.D.:	HD08B

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	268.8	Pass
Peak Lateral Acceleration	G's	≤15.0	5.7	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
		Overall Test Results		Pass

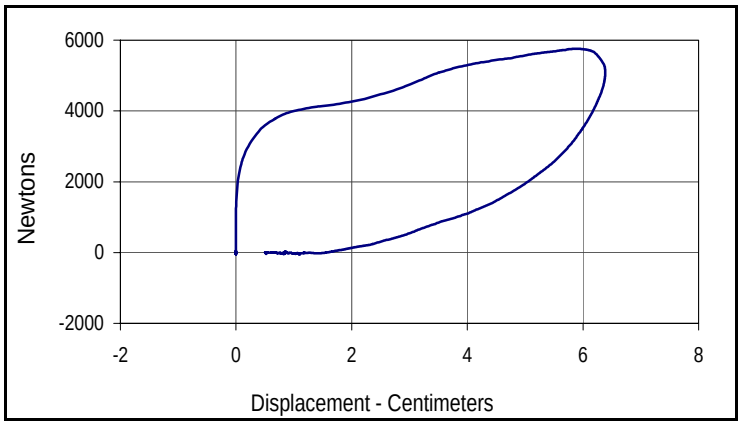
Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
268.8	1.8	0.0	-1.6



Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
5.7	1.5	-0.6	4.4

Test Program:	Hybrid III 50th Percentile Male Thorax Impact Test	Test Date:	8/17/05
ATD Serial No.:	035	Test I.D.:	CH08B

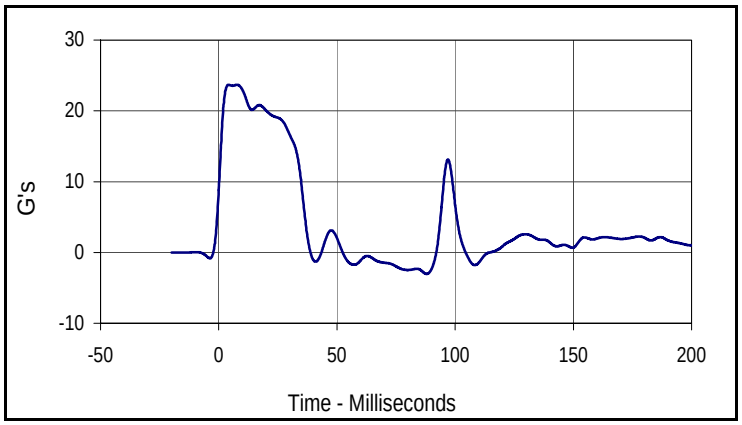
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	6.58 to 6.82	6.64	Pass
Peak Probe Force	Newtons	5159 to 5893	5755	Pass
Peak Sternum Deflection	CM	6.35 to 7.26	6.39	Pass
Internal Hysterysis	%	69 to 85	77.3	Pass
		Overall Test Results		Pass



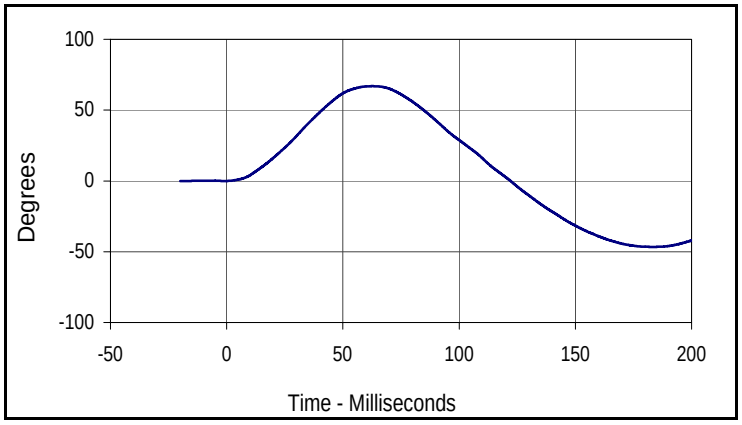
Curve Description			
Probe Force vs. Chest Deflection			
CURNO	Type	SAE Class	Hysterysis
001	FIL	180	77.3
Peak Probe Force		Peak Chest Deflection	
5755		6.39	

Test Program:	Hybrid III 50th Percentile Male Neck Flexion Test	Test Date:	8/18/05
ATD Serial No.:	035	Test I.D.:	NF08B

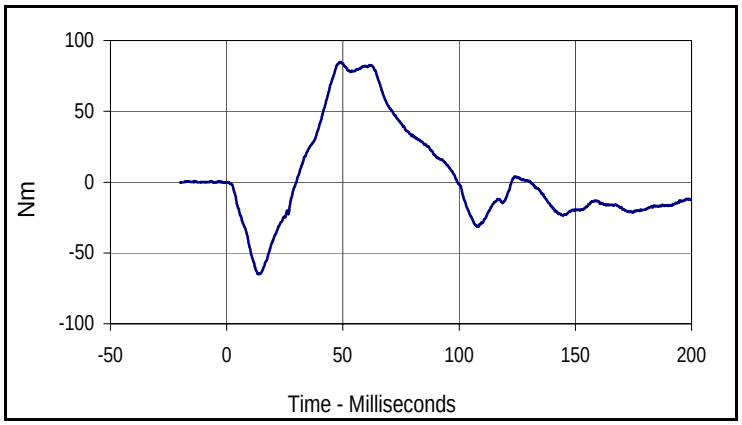
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.04	Pass
Pendulum Deceleration	10 Msec.	G's	22.5 to 27.5	23.0	Pass
	20 Msec.	G's	17.6 to 22.6	20.1	Pass
	30 Msec.	G's	12.5 to 18.5	16.6	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 29.0	16.6	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	34.0 to 42.0	36.5	Pass
Maximum "D" Plane Rotation	Max	Degrees	64.0 to 78.0	66.9	Pass
	Time	Msec.	57.0 to 64.0	62.6	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	113.0 to 128.0	122.1	Pass
Moment About Occ. Condyle	Max	Nm	84.1 to 108.5	84.9	Pass
	Time	Msec.	47.0 to 58.0	48.8	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	97.0 to 107.0	99.3	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Deceleration			
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
23.7	7.7	-3.0	87.9



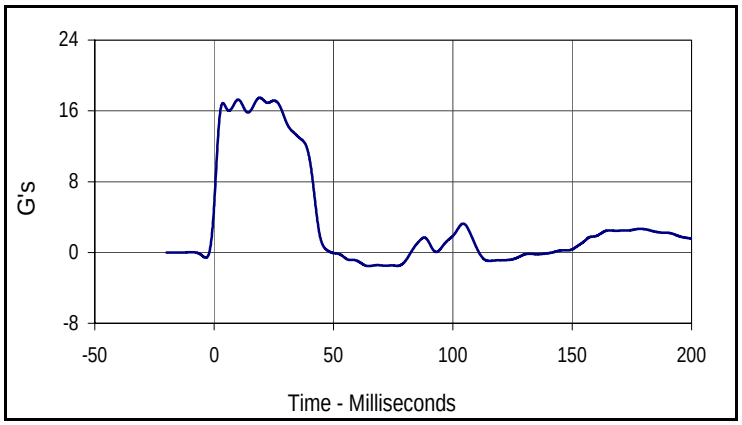
Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
66.9	62.6	-46.6	183.5



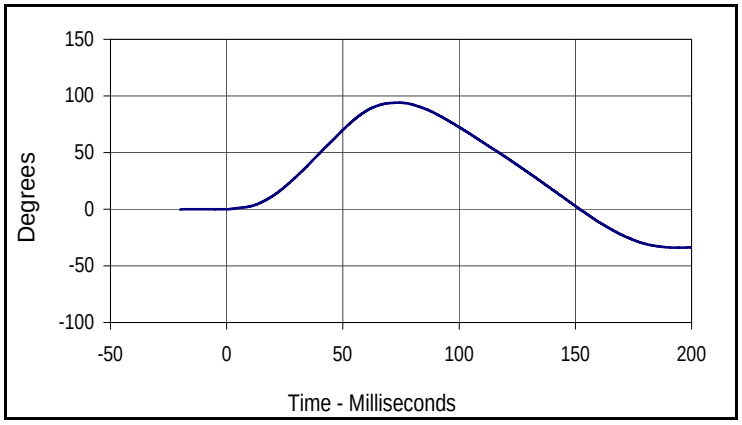
Curve Description			
Moment About Occipital Condyle			
CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
84.9	48.8	-64.9	14.0

Test Program:	Hybrid III 50th Percentile Male Neck Extension Test	Test Date:	8/18/05
ATD Serial No.:	035	Test I.D.:	NE08B

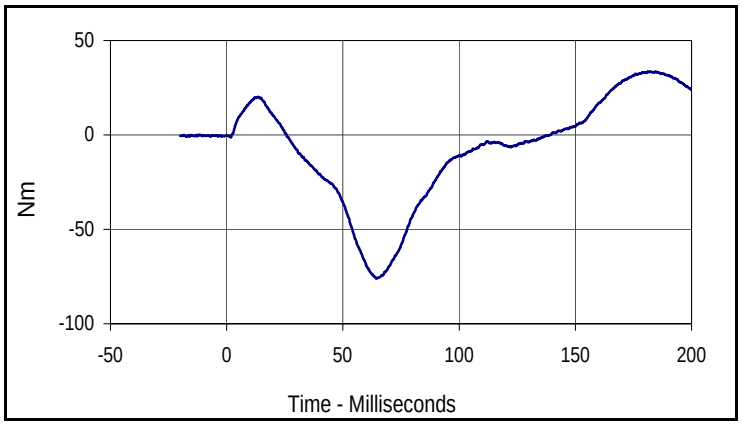
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.94 to 6.19	6.13	Pass
Pendulum Deceleration	10 Msec.	G's	17.2 to 21.2	17.3	Pass
	20 Msec.	G's	14.0 to 19.0	17.4	Pass
	30 Msec.	G's	11.0 to 16.0	14.9	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 22.0	14.9	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	38.0 to 46.0	42.7	Pass
Maximum "D" Plane Rotation	Max	Degrees	81.0 to 106.0	94.0	Pass
	Time	Msec.	72.0 to 82.0	73.9	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	147.0 to 174.0	151.9	Pass
Moment About Occ. Condyle	Max	Nm	-52.9 to- 79.9	-76.1	Pass
	Time	Msec.	65.0 to 79.0	64.3	Fail
Positive Moment Decay, Time To Zero Crossing		Msec.	120.0 to 148.0	139.3	Pass
			Overall Test Results		Fail



Curve Description			
Pendulum Deceleration			
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
17.5	19.1	-1.5	64.7



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
94.0	73.9	-34.0	194.6



Curve Description			
Moment About Occipital Condyle			
CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
33.6	182.3	-76.1	64.3

Test Program:	Hybrid III 50th Percentile Male Knee Impact Test	Test Date:	8/19/05
ATD Serial No.:	035	Test I.D.:	LK08B , RK08B

Left Knee

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.13	Pass
Peak Probe Force	Newtons	4715 to 5782	5578	Pass
		Overall Test Results		Pass

Right Knee

Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5385	Pass
		Overall Test Results		Pass

Curve Description			
Left Knee Probe Force			
CURNO	Type	SAE Class	Units
001	FIL	600	Newtons
Max	Time	Min	Time
5577.9	2.6	-25.5	9.6

Curve Description			
Right Knee Probe Force			
CURNO	Type	SAE Class	Units
002	FIL	600	Newtons
Max	Time	Min	Time
5384.7	2.6	-30.1	9.6

Test Program:	Hybrid III 50th Percentile Male External Measurements	Test Date:	8/19/05
ATD Serial No.:	035	Test I.D.:	N/A

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	879 to 889	882	Pass
B - Shoulder pivot height	mm	505 to 521	515	Pass
C - "H" point height	mm	84 to 89	86	Pass
D - "H" point from seat back	mm	135 to 140	139	Pass
E - Shoulder pivot from back	mm	84 to 94	86	Pass
F - Thigh clearance	mm	140 to 155	150	Pass
G - Elbow back to wrist pivot	mm	290 to 305	300	Pass
H - Skull cap to back line	mm	41 to 46	45	Pass
I - Shoulder to elbow length	mm	330 to 345	336	Pass
J - Elbow rest height	mm	190 to 211	210	Pass
K - Buttock to knee length	mm	579 to 604	585	Pass
L - Poplipteal length	mm	429 to 455	445	Pass
M - Knee pivot height	mm	485 to 500	495	Pass
N - Buttock poplipteal length	mm	452 to 477	460	Pass
O - Chest depth	mm	213 to 229	225	Pass
P - Foot length	mm	251 to 267	260	Pass
V - Shoulder breadth	mm	422 to 437	430	Pass
W - Foot breadth	mm	91 to 107	105	Pass
Y - Chest circumference	mm	970 to 1001	995	Pass
Z - Waist circumference	mm	836 to 866	860	Pass
AA - Location for chest circumference	mm	429 to 434	430	Pass
BB - Location for waist circumference	mm	226 to 231	230	Pass
		Overall Test Results		Pass