

REPORT NUMBER: CAL-07-04

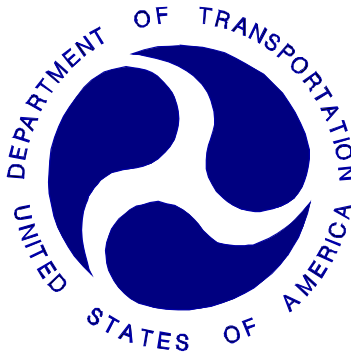
**NEW CAR ASSESSMENT PROGRAM (NCAP)  
FRONTAL BARRIER IMPACT TEST**

GENERAL MOTORS CORPORATION  
2007 SATURN AURA  
4-DOOR SEDAN

NHTSA NUMBER: M70105

CALSPAN TEST NUMBER: 8806-NCAP-03

CALSPAN CORPORATION  
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September 08, 2006

FINAL REPORT

PREPARED FOR:

U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration  
Rulemaking  
Office of Crashworthiness Standards  
Mail Code: NVS-111  
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**TECHNICAL REPORT STANDARD TITLE PAGE**

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				6. Performing Organization Code CAL	
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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards Mail Code: NVS-111 400 Seventh, SW, Room 5311 Washington, D.C. 20590				13. Type of Report and Period Covered Final Report September, 2006	
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16. Abstract  A frontal load cell barrier test of a 2007 Saturn Aura 4-Door Sedan was performed at Calspan Corporation's crash test facility in Buffalo, New York, on September 08, 2006. The impact velocity was 56.49 kph and the temperature at the barrier face was 21.1° C. The maximum post-test vehicle crush was 476 mm. The test vehicle was equipped with 3-point restraint systems, knee bolsters, and airbags at both the driver and right outboard passenger seating positions. With respect to FMVSS 208 "Occupant Crash Protection - Injury Criteria" both the driver and passenger appeared to comply with head, chest, and femur requirements. The occupant injury criteria summary is as follows:					
<b>Measurement Description</b>		<b>Units</b>	<b>Threshold</b>	<b>Driver (142)</b>	<b>Passenger (150)</b>
<b>Head Injury Criteria (HIC - 36 ms)</b>		-	1000	295.7	435.8
<b>Maximum Thorax Acceleration (3 ms Clip)</b>		g's	60 g's	44.3	43.3
<b>Chest Displacement</b>		mm	-76 mm	-33.9	-34.8
<b>Left Femur Force</b>		Newtons	-10000 N	-3887.1	-494.2
<b>Right Femur Force</b>		Newtons	-10000 N	-6423.6	-1256.9
17. Key Words 56 kph Frontal Barrier Impact test New Car Assessment Program (NCAP)				18. Distribution Statement Copies of this report are available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 400 Seventh St., SW, Room 5111 Washington, DC 20590	
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## SECTION 1

### PURPOSE AND SUMMARY OF TEST

#### 1.1 PURPOSE

This 56.49 kph frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-06-D-00024. 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 48.3 kph requirements.

The 56.49 kph frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Indicant Test procedure.

#### 1.2 TEST PROCEDURE

This 56.49 kph 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.

One real-time camera and 14 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in 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 chest and pelvis triaxial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were also installed on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 142) and the right-front passenger (position 2) ATD (Serial No.150) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The vehicle, occupant, camera and measurement data are presented in Section 2. Appendix A contains the still photograph prints. The 128 channels of data were recorded on an on-board data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces. Appendix C contains the dummy calibration data and Appendix D contains the transducer calibration dates.

### 1.3 SUMMARY OF FRONTAL BARRIER IMPACT TEST

A load cell barrier consisting of 36 load cells was impacted by a 2007 Saturn Aura 4-Door Sedan at a velocity of 56.49 kph. The test was performed at Calspan on September 08, 2006. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The occupant data is summarized below.

ATD	HIC	T <sub>1</sub>	T <sub>2</sub>	Clip (g)	T <sub>1</sub>	T <sub>2</sub>	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
<b>Driver</b>	295.7	67.7	103.7	44.3	81.5	84.5	-33.9	-3887.1	-6423.6
<b>Passenger</b>	435.8	62.8	96.7	43.3	77.2	80.4	-34.8	-494.2	-1256.9

The test data can be found on the NHTSA website at [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)

TEST NOTES	
Data Channel	Anomalies
V1P1 Head CG Red y	Transducer failed
V1P1 Left Upper Tibia Mx	Connector damaged at 124 ms
V1P2 Left Foot Aft Ax	Connector damaged
V1P2 RFP Lap Belt	Questionable data after 84 ms
V1 Engine Top #3x	Wire cut at 35 ms
V1 Engine Bottom #4x	Wire cut at 36 ms

**SECTION 2**  
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1  
CRASH TEST SUMMARY

Vehicle NHTSA No.:           M70105           Test Mode:           56.3 kph Frontal Barrier            
 Test Date:           September 08, 2006           Time:           13:45           Temperature:           21.1           °C  
 Vehicle Make/Model/Body Style:           2007 Saturn Aura 4-Door Sedan            
 Vehicle Test Weight:           1828.0           kg Impact Velocity:           56.49           kph (55.5 – 57.1 kph)  
 Vehicle/Barrier Impact Angle:           0           ° Max Static Crush:           476           mm

**ATD INFORMATION AND VISIBLE CONTACT POINTS**

	DRIVER	PASSENGER
ATD Type:	Part 572E	Part 572E
Restraint System:	Three-point safety belt with torso belt pretensioner and load limiter, airbag, knee bolster and adjustable head restraint	Three-point safety belt with torso belt pretensioner and load limiter, airbag, knee bolster and adjustable head restraint
Head Contact:	The face to the upper center of the airbag, the back of the head to the center of the head restraint	The face to the center of the airbag, the back of the head to the inboard half of the head restraint
Abdomen Contact:	None	None
Chest Contact:	Airbag	None
Left Knee Contact:	Knee bolster	Glove compartment door
Right Knee Contact:	Knee bolster	Glove compartment door

**DOOR OPENING, SEAT TRACK AND GLAZING INFORMATION**

Description	Driver Side	Passenger Side
Door Lock Status	Locked	Locked
Front Door Opening	Closed, latched and operable without tools	Closed, latched and operable without tools
Rear Door Opening	Closed, latched and operable without tools	Closed, latched and operable without tools
Hatch/Other Door Opening	Not Applicable	Not Applicable
Front Seat Track Shift (mm)	16 mm forward	18 mm forward
Front Seat Back Failure	None	None
Glazing Damage	Windshield cracked along its lower edge	

**VEHICLE REBOUND FROM BARRIER**

Measured Parameter	Left Side (mm)	Center (mm)	Right Side (mm)	Average (mm)
Value	173	108	160	147

**BELT LENGTH DATA**

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	790	790
Lap belt length as measured on ATD	mm	565	555
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems	mm	1520	1500

DATA SHEET NO. 2  
GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2007 Saturn Aura 4-Door Sedan  
 NHTSA No. : M70105 ; VIN: 1G8ZS57N67F125389 ; Color: Midnight Blue  
 Engine Data: 6 cylinders; - CID; 3.5 Liters; - cc  
 Placement: - Longitudinal or In-Line; X Transverse or Lateral  
 Transmission Data: 4 speeds; - Manual; X Automatic; X Overdrive  
 Final Drive: - Rear Wheel Drive; X Front Wheel Drive; - Four Wheel Drive

AUTOMATIC DOOR LOCKS:

Is test vehicle equipped with Automatic Door Locks (ADLs)? X Yes; - No;  
 Does vehicle owner's manual describe how to deactivate ADLs? - Yes; X No; - N/A

DEALER AND DELIVERY INFORMATION:

Date Received: 8/29/2006 ; Odometer Reading 23 km  
 Selling Dealer: Saturn of Troy  
 Dealer Address: 1790 Maplelawn, Troy, MI 48084

TEST VEHICLE OPTIONS:

X AC; X Power Steering; X Power Brakes; X Power Locks; X Power Seats  
X ABS; X Tilt Wheel; - Stability Control X Traction Control X Anti-Theft

SAFETY BELT FEATURES:

Driver: X Pretensioner (Shoulder); X Load Limiter; X Adjustable Anchorage  
 Passenger: X Pretensioner (Shoulder); X Load Limiter; X Adjustable Anchorage

AIRBAG FEATURES:

Position	Frontal	Knee Bolster	Side Torso	Side Head/Torso Combination	Side Curtain
Driver:	Yes	No	Yes	No	Yes
Passenger:	Yes	No	Yes	No	Yes
Rear Passenger:	N/A	N/A	N/A	N/A	N/A

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: General Motors Corporation  
 Date of Manufacture 08/06  
 GVWR: 2062 kg; GAWR: 1100 kg FRONT; 962 kg REAR

VEHICLE CAPACITY DATA:

Type of Front Seats: - Bench; X Bucket; - Split Bench  
 Number of Occupants: 2 Front; 3 Rear; 5 Total  
 Vehicle Capacity Weight (VCW) = 412.0 kg  
 No. of Occupants x 68.04 kg = 340.2 kg  
 Rated Cargo/Luggage Weight (RCLW) = 71.8 kg

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

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids)= UDW:

	Left Side (kg)	Right Side (kg)	Ratio (%)	Total (kg)
<b>Front =</b>	488.0	497.0	61.1	985.0
<b>Rear =</b>	319.0	307.0	38.9	626.0
<b>Total Delivered Weight (UDW) =</b>				1611.0

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight (UDW) =	1611.0	kg
Rated Cargo/Luggage Weight (RCLW) =	71.8	kg
Weight of 2 p.572 Dummies @ 76 each =	152	kg
<b>TARGET TEST WEIGHT =</b>	<b>1834.8</b>	<b>kg</b>

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 65.0 KG OF CARGO WEIGHT:

	Left Side (kg)	Right Side (kg)	Ratio (%)	Total (kg)
<b>Front =</b>	521.5	535.0	57.8	1056.5
<b>Rear =</b>	388.5	383.0	42.2	771.5
<b>Total Vehicle Test Weight (ATW) =</b>				1828.0

Weight of Ballast Secured in Vehicle Trunk Area<sup>1</sup> = 0 kg

Vehicle Components Removed for Weight Reduction: None

VEHICLE ATTITUDE (all dimension in millimeters):

	Left Front	Right Front	Left Rear	Right Rear	CG <sup>2</sup>
AS DELIVERED:	725	724	739	737	1109
FULLY LOADED:	715	714	709	708	-
AS TESTED:	720	716	716	708	1204

Vehicle's Wheel Base: 2853 mm

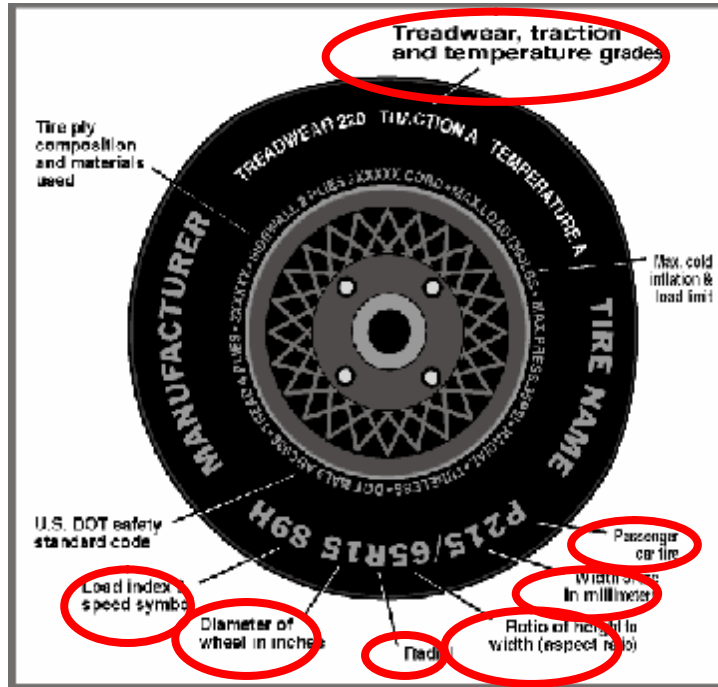
<sup>1</sup>Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

<sup>2</sup>Rearward of the front axle centerline.

DATA SHEET NO. 3  
TEST VEHICLE TIRE INFORMATION

Vehicle Year/Make/Model/Body Style: 2007 Saturn Aura 4-Door Sedan

NHTSA Test No.: M70105 Test Date: September 08, 2006



Measured Parameter	Front	Rear
Maximum Tire Pressure (from sidewall - kPa)	300	300
Cold Pressure (from tire placard - kPa)*	210	210
Recommended Tire Size (from tire placard)	P225/50R17	P225/50R17
Tire size on Vehicle	P225/50R17	P225/50R17
Tire Manufacturer	Hankook	Hankook
Tire Name	Optimo	Optimo
Tire Type	P	P
Tire Width (mm)	225	225
Ratio of Height to Width (aspect ratio)	50	50
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	93 S	93 S
Treadwear	340	340
Traction Grade	A	A
Temperature Grade	A	A

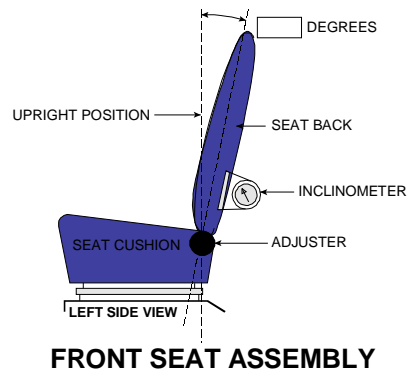
\*Tire pressure used for test

DATA SHEET NO. 4  
TEST VEHICLE INFORMATION

VEHICLE IDENTIFICATION:

Model Year : 2007    Vehicle Model: Saturn Aura    Body Style : 4-Door Sedan

1. NOMINAL DESIGN RIDING POSITION:  
for adjustable driver and passenger seat backs.  
Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.



Seat back angle for driver's seat: 19°

Measurement instructions: With the vehicle rocker panels level, the seat back was positioned so that the bottom center of the plastic trim cover on the rear of the seat back was 19 degrees back from vertical

Seat back angle for passenger's seat: 19°

Measurement instructions: With the vehicle rocker panels level, the seat back was positioned so that the bottom center of the plastic trim cover on the rear of the seat back was 19 degrees back from vertical

2. SEAT FORE AND AFT POSITIONING:

Positioning of the driver's seat: The seat was positioned full down and at the middle of it's absolute fore/aft travel. The absolute travel was 270 mm.

Positioning of the passenger's seat: The seat was positioned at the middle of its absolute fore/aft travel (detent 12 where the forward-most is defined as 0, 25 positions total). The absolute travel was 240 mm.

3. FUEL TANK CAPACITY DATA:

3.1 A. "Usable Capacity" of the standard equipment fuel tank is 61.7 liters

B. "Usable Capacity" of the optional equipment fuel tank is - liters

C. "Usable Capacity" of the vehicle(s) used for certification testing to requirements of FMVSS 301 = 56.8 to 58.0 liters

3.2 Actual Amount of Stoddard solvent added to vehicle for test = 57.5 liters

3.3 One-Third of Useable Capacity = 20.6 liters

3.4 Is vehicle equipped with electric fuel pump? Yes- X ; No- -

If YES, explain the vehicle operating conditions under which the fuel pump will pump fuel.

The fuel pump operates briefly when the ignition is placed in the "ON" position and the vehicle is not started and continuously while the engine is operating.

DATA SHEET NO. 4  
TEST VEHICLE INFORMATION (cont.)

4. STEERING COLUMN ADJUSTMENTS:

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. If the tested vehicle has any of these adjustments, does your company use any specific procedures to determine the geometric center.

Operational Instructions: The steering column was placed at the middle of its tilt and telescopic range of travel. The total tilt range of travel was 3.8 degrees and telescopic range of travel was 50 mm.

5. SEAT BELT UPPER ANCHORAGE:

Nominal design riding position: The adjustable anchorage was placed in detent 0 (upper-most position).

A total of 4 positions were available.

6. AUTOMATIC DOOR LOCKS: Is test vehicle equipped with ADLs?  X  Yes;  -  No;

Does vehicle owner's manual describe how to deactivate ADLs?  -  Yes;  X  No;  -  N/A

Comments: The door locks were placed in the locked position for the test.

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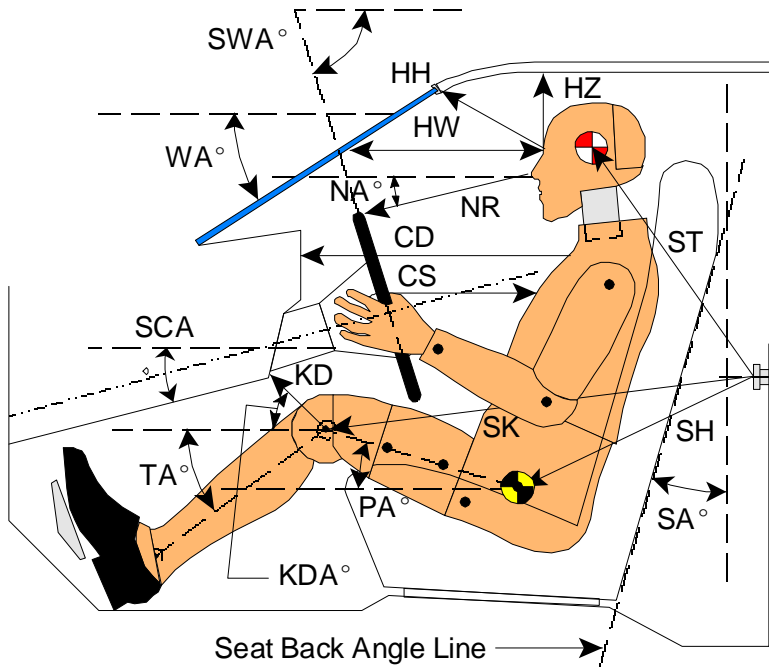
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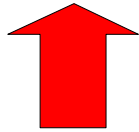
DATA SHEET NO. 5

FRONT SEAT DUMMY POSITIONING MEASUREMENTS IN VEHICLE

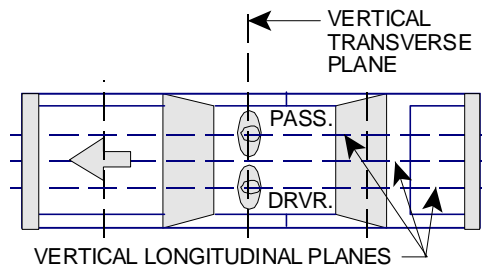
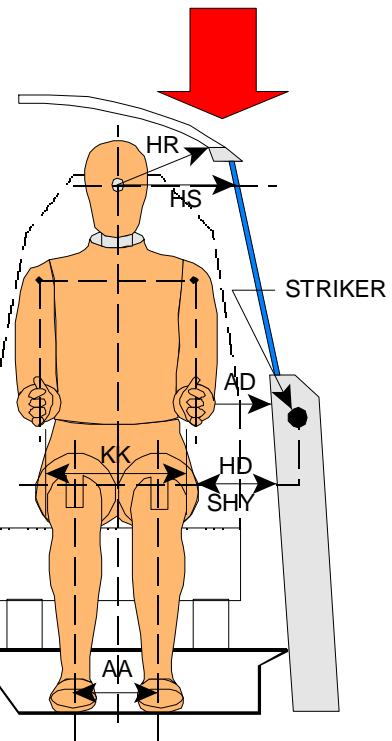
DUMMY MEASUREMENT FOR FRONT SEAT PASSENGERS



- AD - Arm to Door
- HD - H-Point to Door
- HR - Head to Side Header
- HS - Head to Side Window
- KK - Knee to Knee
- AA - Ankle to Ankle
- SHY- Striker to H-Point (Y Direction)



- CD - Chest to Dash
- CS - Steering Wheel to Chest
- HH - Head to Header
- HW - Head to Windshield
- HZ - Head to Roof
- KDA - Knee to Dash Angle
- KDL- Left Knee to Dash
- KDR - Right Knee to Dash
- NA - Nose to Rim Angle
- NR - Nose to Rim
- PA - Pelvic Angle
- RA - Rim to Abdomen
- SA - Seat Back Angle
- SCA - Steering Column Angle
- SH - Striker to H-Point
- SK - Striker to Knee
- ST - Striker to Head
- SWA- Steering Wheel Angle
- TA - Tibial Angle
- WA - Windshield Angle



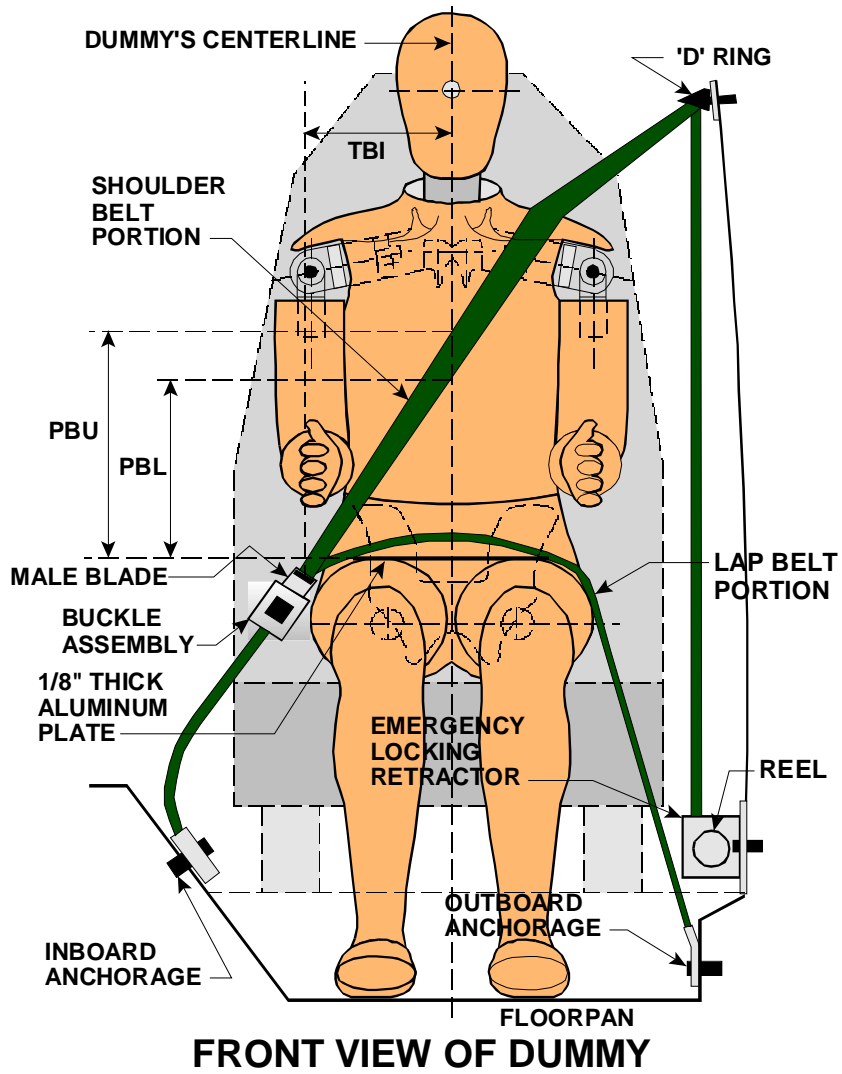
DATA SHEET NO. 5  
FRONT SEAT DUMMY POSITIONING MEASUREMENTS IN VEHICLE (cont.)

	DRIVER (Serial #142)			PASS. (Serial #150)		
WA <sup>o</sup>	26.2 deg.			N/A		
SWA <sup>o</sup>	69.4 deg.			N/A		
SCA <sup>o</sup>	20.6 deg.			N/A		
SA <sup>o</sup>	19 deg.			19 deg.		
HZ	193			188		
HH	365			378		
HW	732			686		
HR	202			204		
NR	403	Angle	7 deg.	N/A		
CD	548			550		
CS	324			N/A		
RA	212			N/A		
KDL	180	Angle (KDA)	34 deg.	190		
KDR	172			204	Angle (KDA)	28 deg.
PA <sup>o</sup>	23.6 deg.			24.2 deg.		
TA <sup>o</sup>	39.0 deg.			39.9 deg.		
KK	400			320		
AA	344			205		
ST	508	Angle	8 deg.	512	Angle	7 deg.
SK	588	Angle	95 deg.	565	Angle	95 deg.
SH	272	Angle	130 deg.	248	Angle	130 deg.
SHY	256			251		
HS	345			346		
HD	131			141		
AD	111			116		

Dimensions in millimeters

DATA SHEET NO. 6  
SEAT BELT POSITIONING DATA

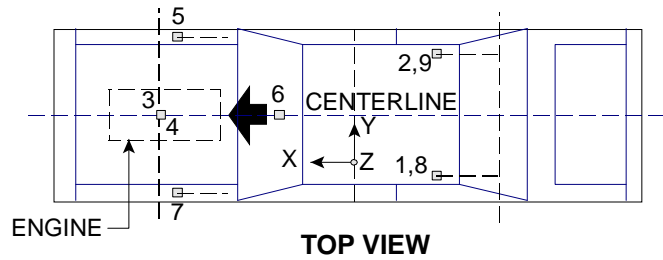
**SEAT BELT POSITIONING DATA**



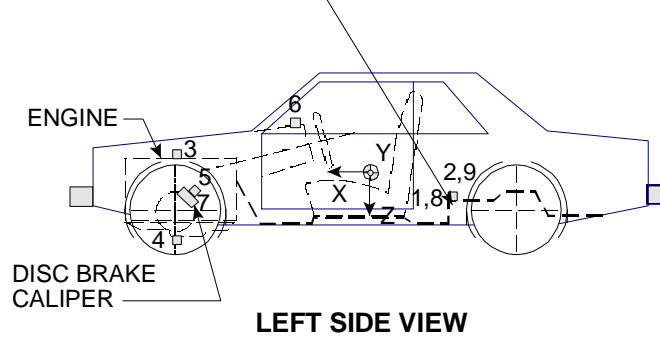
	DRIVER DUMMY (mm)	PASSENGER DUMMY (mm)
PBU -- Top surface of alum. plate to upper edge	320	338
PBL-- Top surface of alum. plate to belt lower edge	240	250
LAP BELT TENSION	10 N	10 N
SHOULDER BELT TENSION	Retractor	Retractor

DATA SHEET NO. 7  
VEHICLE ACCELEROMETER LOCATIONS

**VEHICLE ACCELEROMETER LOCATIONS**



REAR SEAT CUSHION  
ASSY. FRONT ATTACHMENT  
BRACKET SUPPORT



No.	LOCATION	PRE-TEST LENGTH (mm)		
		X	Y	Z
1	Left Rear Seat Cross Member X	2037	-590	-219
2	Right Rear Seat Cross Member X	2037	590	-219
3	Top of Engine Block	4042	-145	-736
4	Bottom of Engine	3827	-78	-209
5	Disc Brake Caliper @ Right Side	3868	643	-471
6	Instrument Panel**	-	-	-
7	Disc Brake Caliper @Left Side	3868	-643	-471
8	Left Rear Seat Cross Member Z	2037	-590	-219
9	Right Rear Seat Cross Member Z	2037	590	-219

X – From rear surface of vehicle (+ forward)

Y – From vehicle centerline (+ right)

Z – From ground plane (+ up)

\*\* Accelerometer was not requested by the COTR

DATA SHEET NO.8  
SUMMARY OF FMVSS 212 and FMVSS 219 (Partial) DATA

DETAILS OF WINDSHIELD MOUNTING SUCH AS RETENTION METHOD, TRIM TYPE, ETC.:

The windshield is bonded in place.

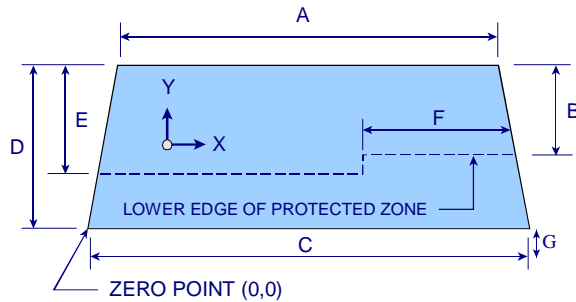
FMVSS 212 REQUIREMENTS:

The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of the windshield for vehicles equipped with automatic restraint systems for front occupants,

Temperature of windshield molding during test: 21.1°C.

FMVSS 212 TEST DATA

	WINDSHIELD PERIPHERY		% OF RETENTION
	PRE-TEST (mm)	POST-TEST (mm)	
RIGHT SIDE	2252.5	2252.5	100.0%
LEFT SIDE	2252.5	2252.5	100.0%
TOTAL	4505	4505	100.0%



DIMENSIONS (mm)	
A	1195
B	570
C	1530
D	890
E	525
F	530
G	0

FRONT VIEW OF WINDSHIELD

FAILURE DETAILS: None

DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 6 mm: None

	COORDINATES	
	X	Y
1.	-	-
2.	-	-
3.	-	-
4.	-	-

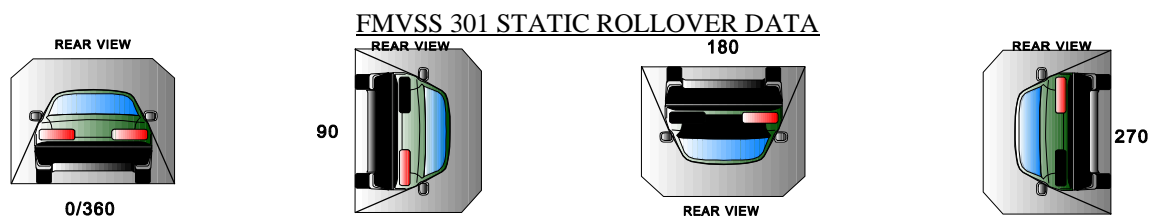
DATA SHEET NO. 9  
SUMMARY OF FMVSS NO. 301 DATA

NHTSA TEST No.: \_\_\_\_\_ M70105 \_\_\_\_\_ TEST DATE: \_\_\_\_\_ September 08, 2006 \_\_\_\_\_  
 VEHICLE MAKE/MODEL: \_\_\_\_\_ 2007 Saturn Aura 4-Door Sedan \_\_\_\_\_  
FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

FUEL SPILLAGE MEASUREMENT:

Time Interval	Amount	Maximum Allowable Spillage
Impact Until Motion Ceases		28 g
First Five Minutes Following Impact		142 g
Next 25 Minutes		28 g / 1 minute

SOLVENT SPILLAGE DETAILS: None



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Stage	Rotation Time (spec. 1 -3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
	1	minutes	15	seconds	5	minutes	6	minutes	15	seconds	7	minutes
0° - 90°	1	minutes	15	seconds	5	minutes	6	minutes	15	seconds	7	minutes
90° - 180°	1	minutes	5	seconds	5	minutes	6	minutes	5	seconds	7	minutes
180°-270°	1	minutes	2	seconds	5	minutes	6	minutes	2	seconds	7	minutes
270°-360°	1	minutes	6	seconds	5	minutes	6	minutes	6	seconds	7	minutes

II. FMVSS 301 REQUIREMENTS: (Maximum allowable solvent spillage):

First 5 minutes from onset of rotation	6th min.	7th min.	8th min. (if required)
142 g	28 g	28 g	28 g

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

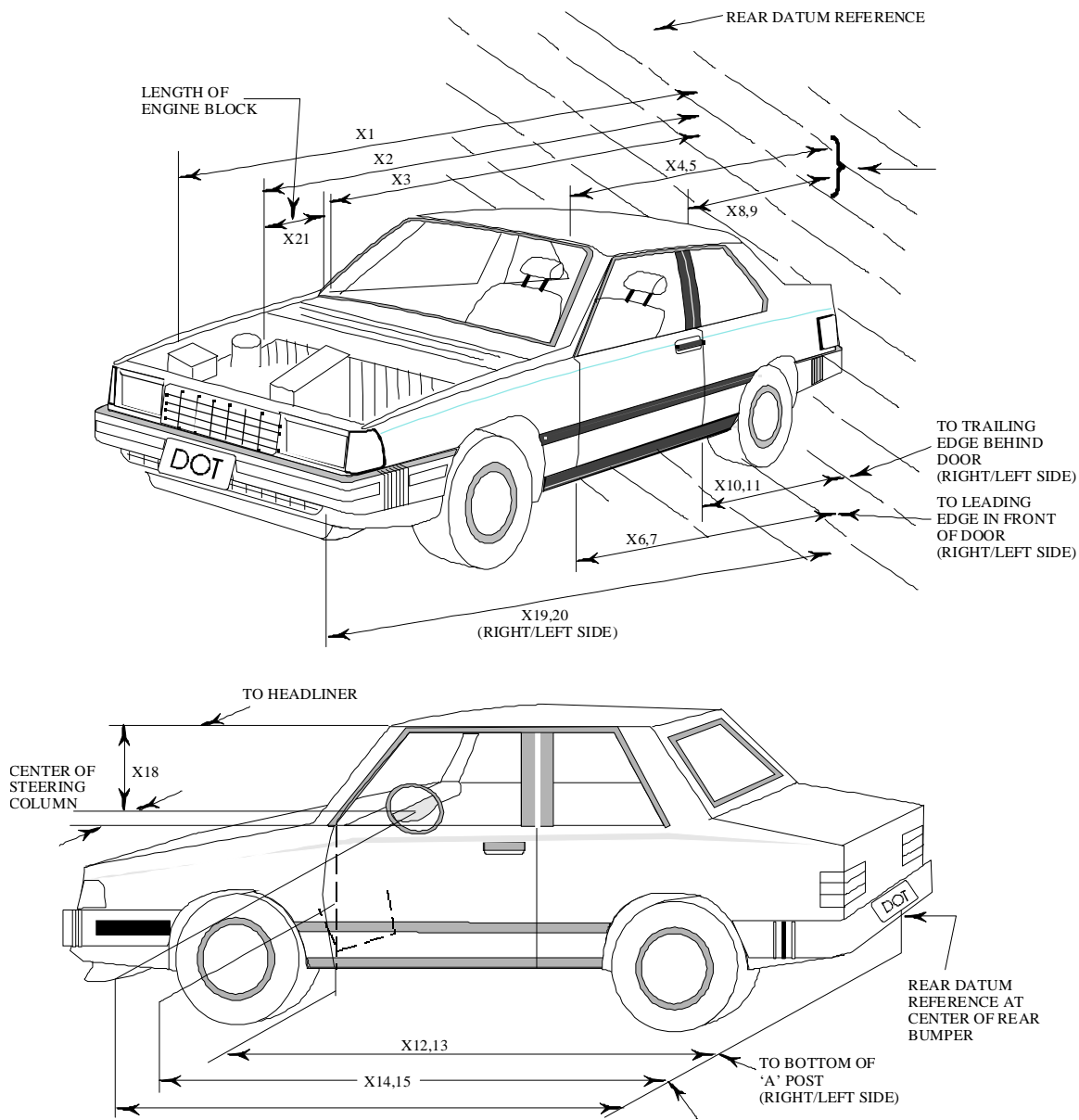
Rollover Stage	First 5 minutes from onset of rotation (g)	6th min. (g)	7th min. (g)	8th min. (if required) (g)
0° - 90°	0	0	0	N/A
90° - 180°	0	0	0	N/A
180°-270°	0	0	0	N/A
270°-360°	0	0	0	N/A

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

Rollover Stage	Spillage Location
0° - 90°	None
90° - 180°	None
180°-270°	None
270°-360°	None

**DATA SHEET NO. 10**  
**TEST VEHICLE MEASUREMENTS**





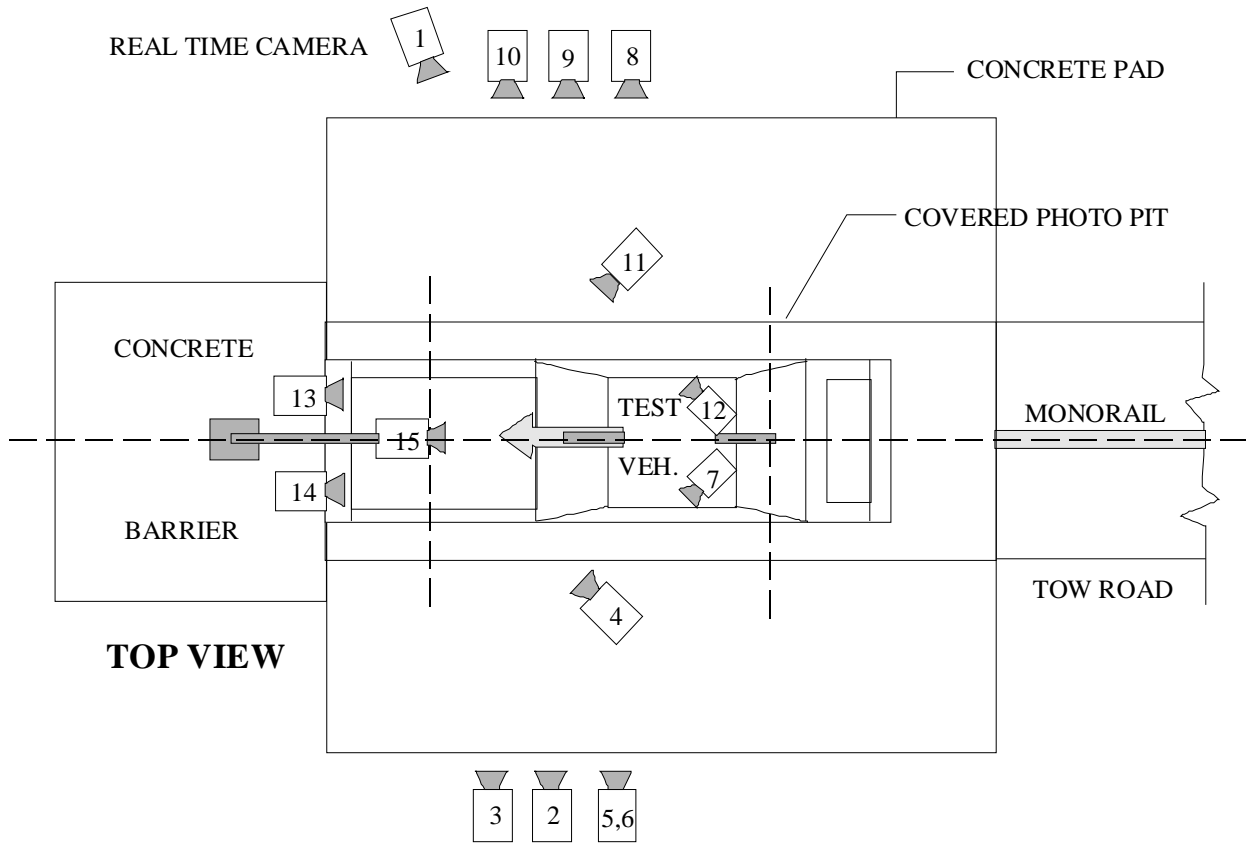
DATA SHEET NO.10  
VEHICLE MEASUREMENTS (cont.)

NHTSA TEST No.: M70105 TEST DATE: September 08, 2006  
VEHICLE MAKE/MODEL: 2007 Saturn Aura 4-Door Sedan

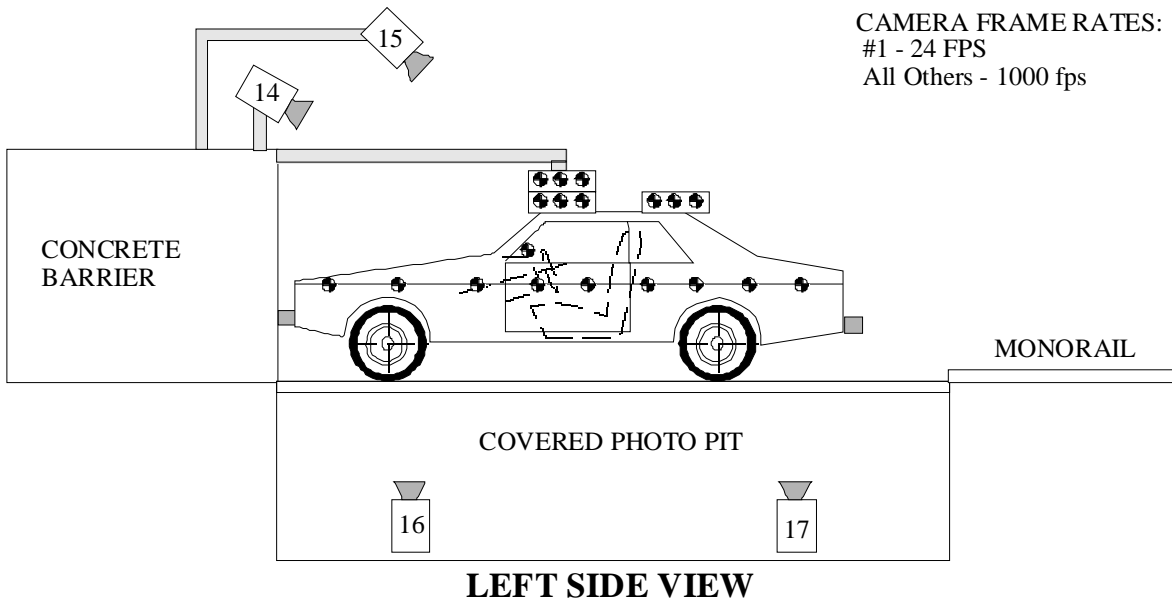
TARGET VEHICLE STRUCTURAL MEASUREMENTS

	Elements	Pre-Test (mm)
1	Total length	4839
2	Total Width	1784
3	Bumper Top Height	510
4	Bumper Bottom Height	381
5	Longitudinal Member Top Height	565
6	Distance Between Longitudinal Members	1058
7	Longitudinal Member Width	95
8	Engine top height	880
9	Engine bottom height	211
10	Engine and gearbox width	675
11	Front bumper-engine distance	529
12	Front shock absorber fixing height	863
13	Bonnet leading edge height	728
14	Front shock absorber fixing width	1136
15	Front bumper – front axle distance	972
16	Front axle – a pillar distance	491
17	A-pillar – B pillar distance	1087
18	B-pillar – rear axle distance	1275
19	B-pillar – C Pillar distance	1154
20	Roof sill bottom height	1310
21	Roof sill top height	1407
22	Floor sill bottom height	258
23	Floor sill top height	354

DATA SHEET NO.11  
HIGH-SPEED CAMERA LOCATIONS



CAMERA FRAME RATES:  
#1 - 24 FPS  
All Others - 1000 fps



DATA SHEET NO.11  
HIGH-SPEED CAMERA LOCATIONS (cont.)

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

CAMERA NO.	VIEW	CAMERA POSITIONS (mm)*			ANGLE (deg)**	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Camera	-	-	-	-	-	-	30
2	Overall Left Side	8120	1875	1080	-5.1	7880	28	1000
3	Left Side View	8980	1075	1095	-3.1	8740	50	1000
4	Driver and Interior View	7300	2525	2050	-9.7	-	35	500
5	Steering Column (Bottom)	8120	1875	1160	-2.9	7880	25	1000
6	Steering Column (Top)	8120	1875	1785	-8.5	7880	28-70	1000
7	Left CRS Lateral View	-	-	-	-	-	-	-
8	Overall Right Side	7900	1945	1035	-3.4	8206	28	500
9	Right Side View	9050	1300	1090	-2.4	9356	50	1000
10	Right Passenger View	8460	1865	1445	-5.0	8766	35	1000
11	Passenger and Interior View	7440	2715	2020	-8.6	-	35	500
12	Right CRS Lateral View	-	-	-	-	-	-	-
13	Passenger Front View	620	-92	1987	-37.5	-	13	500
14	Driver Front View	620	-92	1987	-37.4	-	13	500
15	Windshield View	0	-530	3374	-50.8	-	20	500
16	Pit View of Engine	0	615	-3048	90	-	13	500
17	Pit View of Fuel Tank	0	2600	-3048	90	-	13	500

\*X = film plane to monorail centerline                      \*\* = referenced to horizontal plane

Y = film plane to impact location                      N.T. indicates No Timing

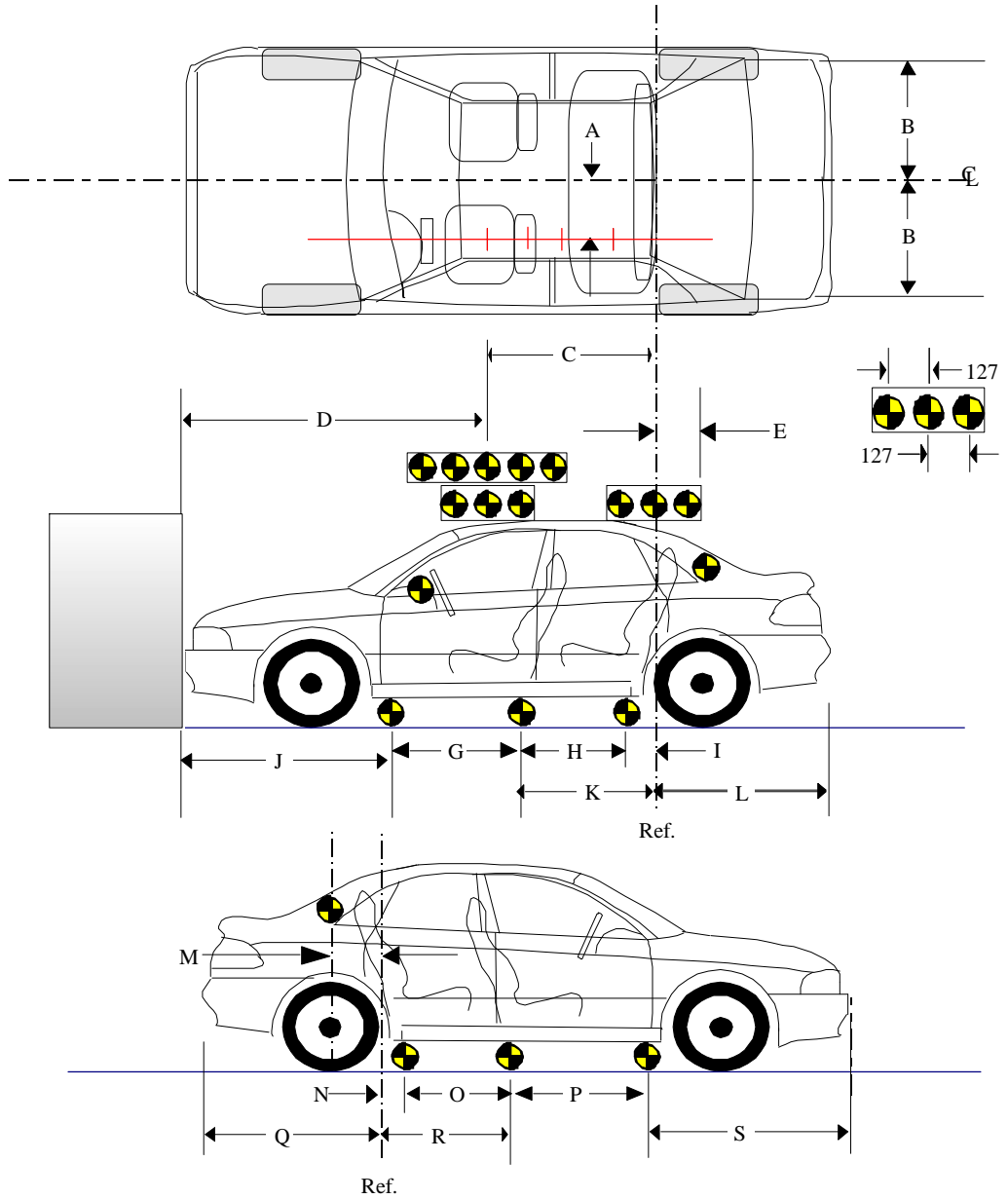
Z = film plane to ground

DATA SHEET NO. 12  
VEHICLE REFERENCE PHOTO TARGET LOCATIONS

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

(Dimensions in millimeters)

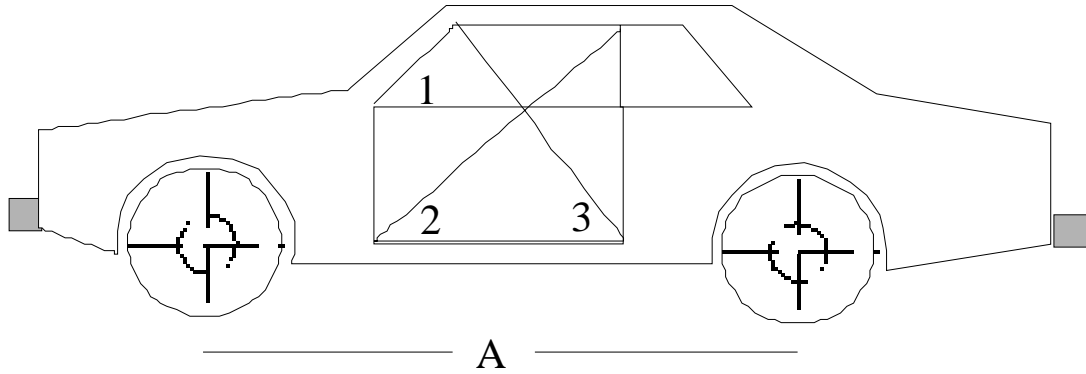
A	382
B	546
C	1220
D	2257
E	328
F	1705
G	984
H	982
I	105
J	1421
K	1087
L	1348
M	327
N	109
O	989
P	975
Q	1346
R	1098
S	1420



DATA SHEET NO. 13  
VEHICLE INTRUSION MEASUREMENTS

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

DOOR OPENING WIDTH AND WHEELBASE MEASUREMENTS



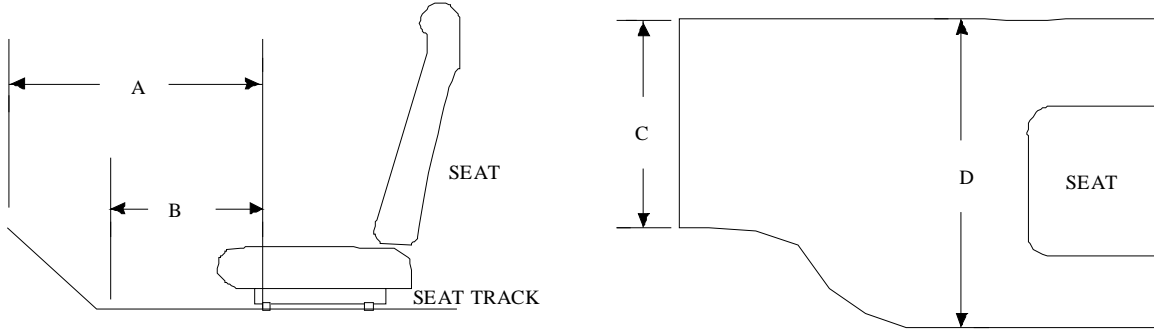
UNITS (mm)	LEFT			RIGHT		
MEASUREMENT	1	2	3	1	2	3
BEFORE TEST	1022	1439	884	1020	1442	873
AFTER TEST	1021	1439	885	1019	1443	873
DIFFERENCE	1	0	-1	1	-1	0

UNITS (mm)	A = WHEELBASE LEFT	A = WHEELBASE RIGHT
BEFORE TEST	2853	2853
AFTER TEST	2771	2790
DIFFERENCE	82	63

DATA SHEET NO.13  
VEHICLE INTRUSION MEASUREMENTS (cont)

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

STATIC FOOTWELL DEFORMATION



DRIVER

Measurement	Pre-Test	Post-Test	Difference
A	777	693	84
B	566	530	36
C	479	469	10
D	462	462	0

PASSENGER

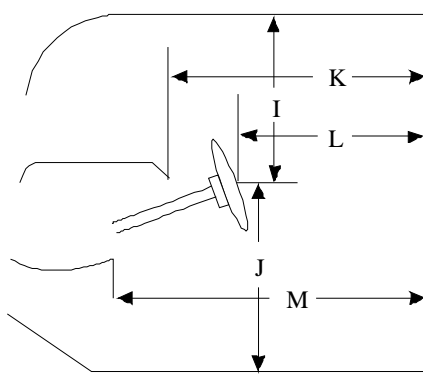
Measurement	Pre-Test	Post-Test	Difference
A	781	706	75
B	566	539	27
C	476	473	3
D	469	466	3

Units = mm

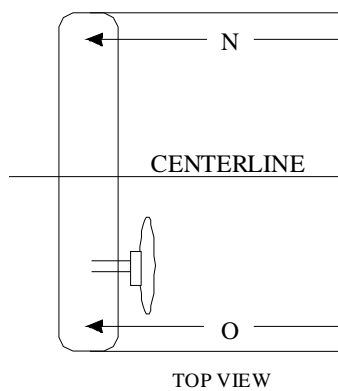
**DATA SHEET NO.13**  
**VEHICLE INTRUSION MEASUREMENTS (cont.)**

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

**STATIC PASSENGER COMPARTMENT INTRUSION**

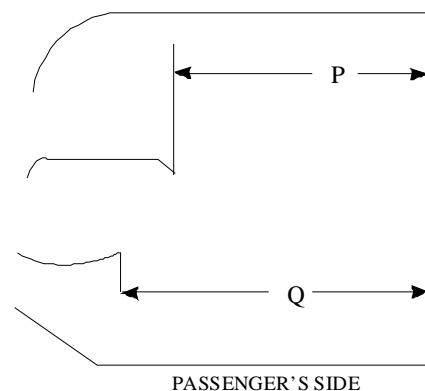


DRIVER'S SIDE



TOP VIEW

MEASUREMENTS  
FROM C-PILLAR  
BELT ANCHORAGE



PASSENGER'S SIDE

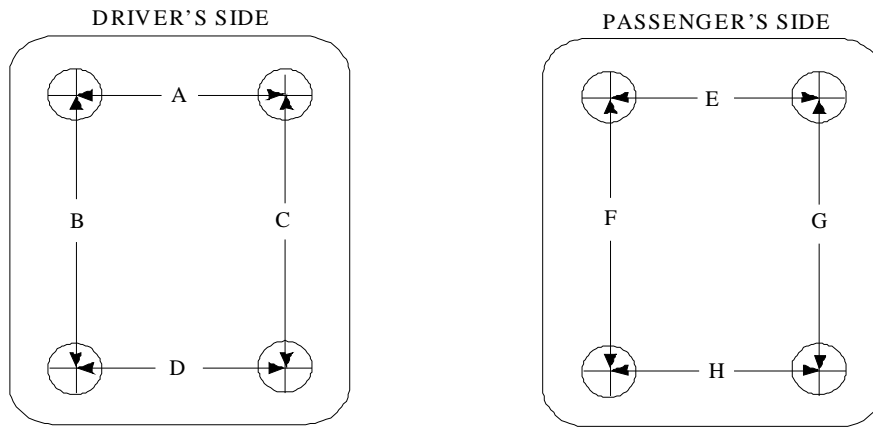
Measurement	Pre-Test	Post-Test	Difference
I	423	445	-22
J	625	616	9
K	757	742	15
L	563	566	-3
M	859	846	13
N	724	721	3
O	714	709	5
P = K (PASS.)	844	832	12
Q = M (PASS.)	838	822	16

Units = mm

DATA SHEET NO.13  
VEHICLE INTRUSION MEASUREMENTS (cont.)

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

FLOORBOARD DEFORMATION



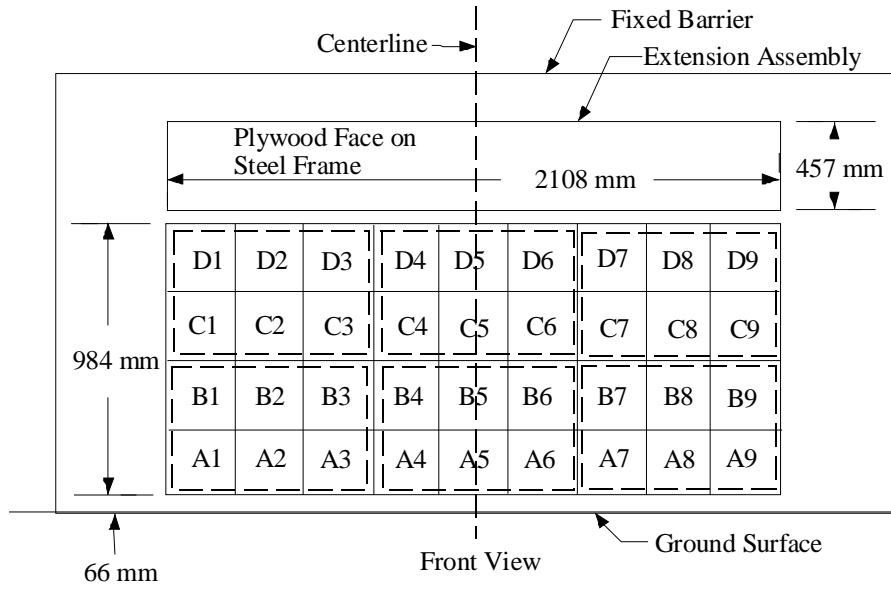
TOP VIEW THROUGH FLOOR PAN

Measurement	Pre-Test	Post-Test	Difference
A	479	469	10
B	300	298	2
C	276	274	2
D	462	462	0
E	476	473	3
F	267	259	8
G	287	277	10
H	469	466	3

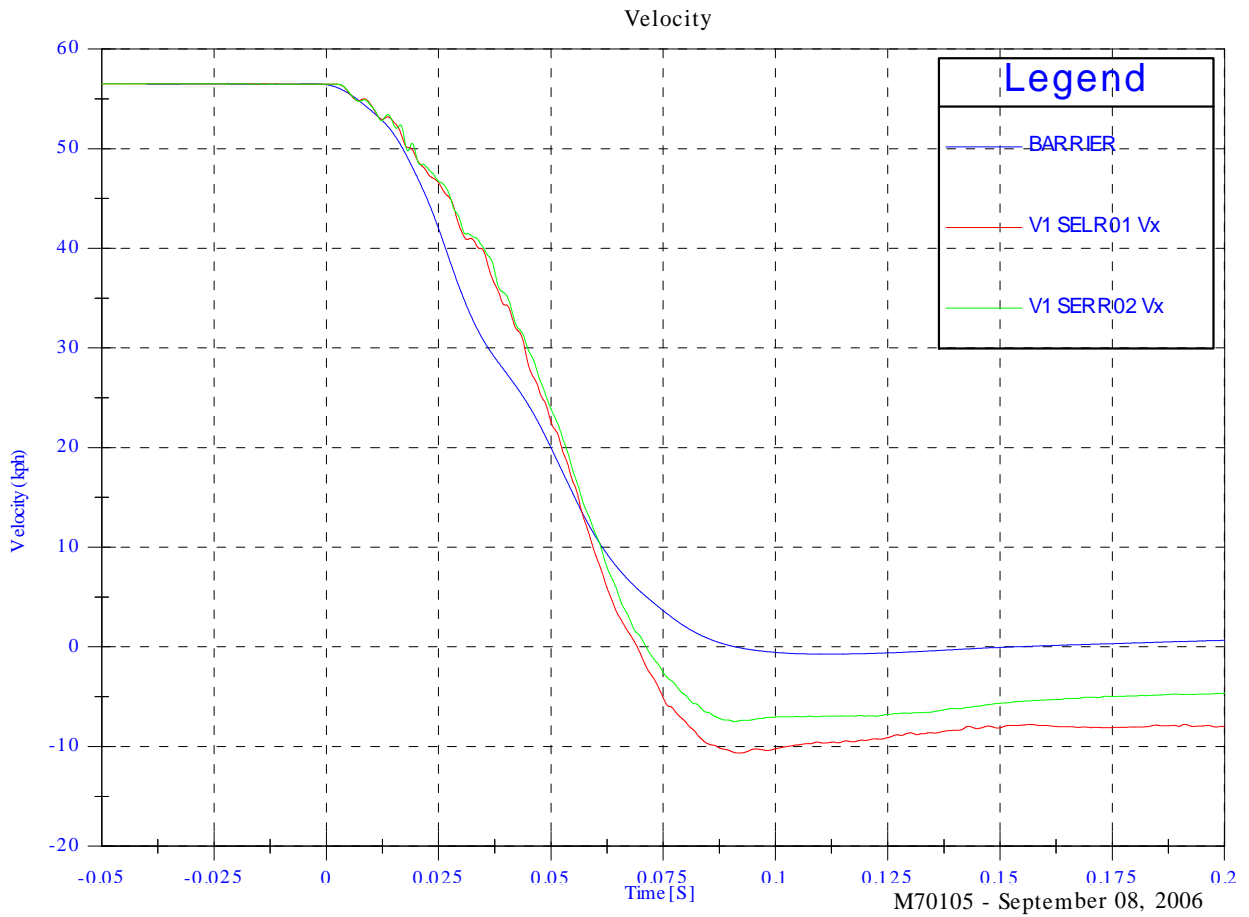
Units = mm

DATA SHEET NO.14  
LOAD CELL LOCATIONS ON FIXED BARRIER

36 Load Cells  
4 Rows  
9 Columns



2007 NCAP - 2007 Saturn Aura



DATA SHEET NO. 15  
ACCIDENT INVESTIGATION DIVISION DATA

FOR FRONTAL BARRIER IMPACT

Vehicle Make/Model/Body Style: Saturn Aura 4-Door Sedan

NHTSA Test No.: M70105 VIN: 1G8ZS57N67F125389

Model Year: 2007 Build Date: 08/06 Test Date: September 08, 2006

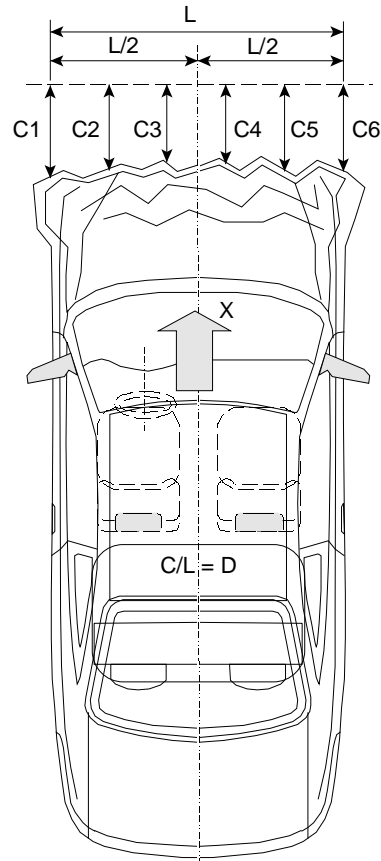
Vehicle Size Category: Mid-Size Passenger Car Test Weight: 1828.0 kg

Vehicle Wheelbase: 2853 mm; Front Overhang: 972 mm; Overall Width: 1784 mm

Collision Deformation Classification (CDC) Code: 12FDEW3

Crush Depth Dimensions

	PRE (mm)	POST (mm)	DIFF (mm)
C1 =	4601	4322	279
C2 =	4752	4276	476
C3 =	4821	4362	459
C4 =	4821	4408	413
C5 =	4751	4389	362
C6 =	4602	4327	275



Midpoint of Damage: D = Vehicle Centerline (Longitudinal)

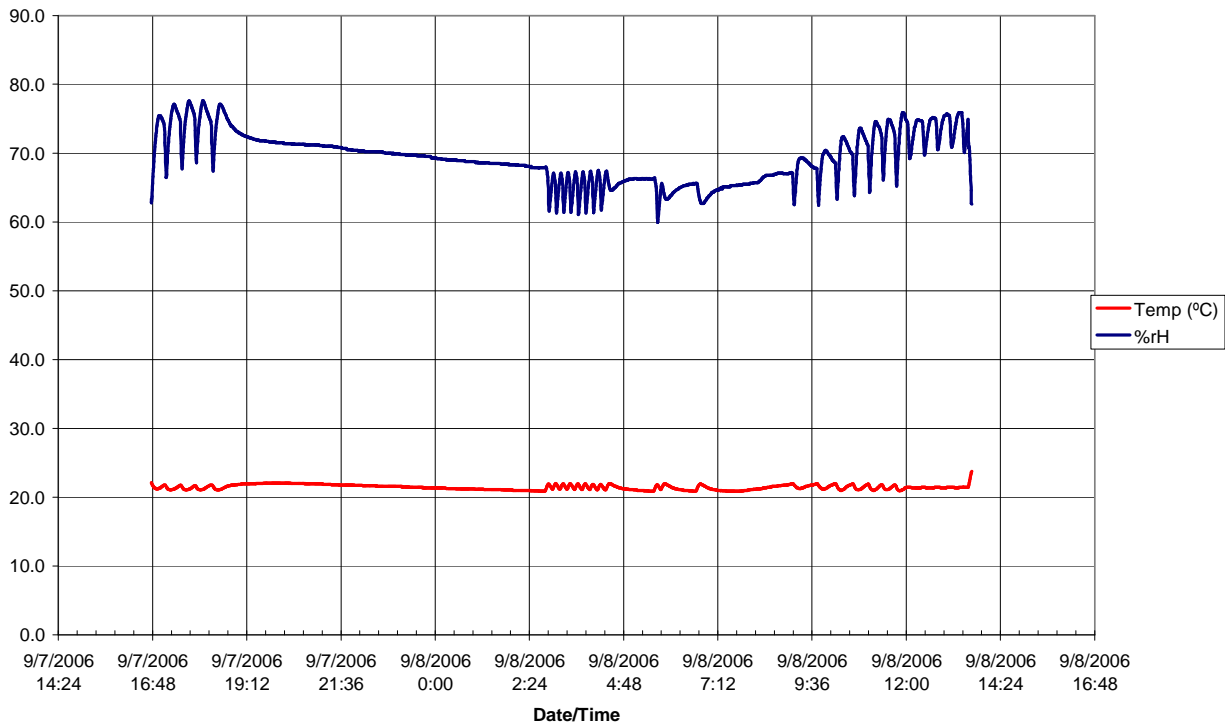
Length of Damaged Region:

L1=	<u>1465</u>	mm
L2=	<u>732.5</u>	mm
L5=	<u>293</u>	mm

DATA SHEET NO.16  
VEHICLE AND DUMMY TEMPERATURE STABILIZATION CHART

NHTSA Test No.:           M70105           Vehicle:           2007 Saturn Aura 4-Door Sedan          

**2007 Saturn Aura M70105 Environmental Conditions**



**APPENDIX A**  
**PHOTOGRAPHS**

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**Figure A-1: Load Cell Locations**

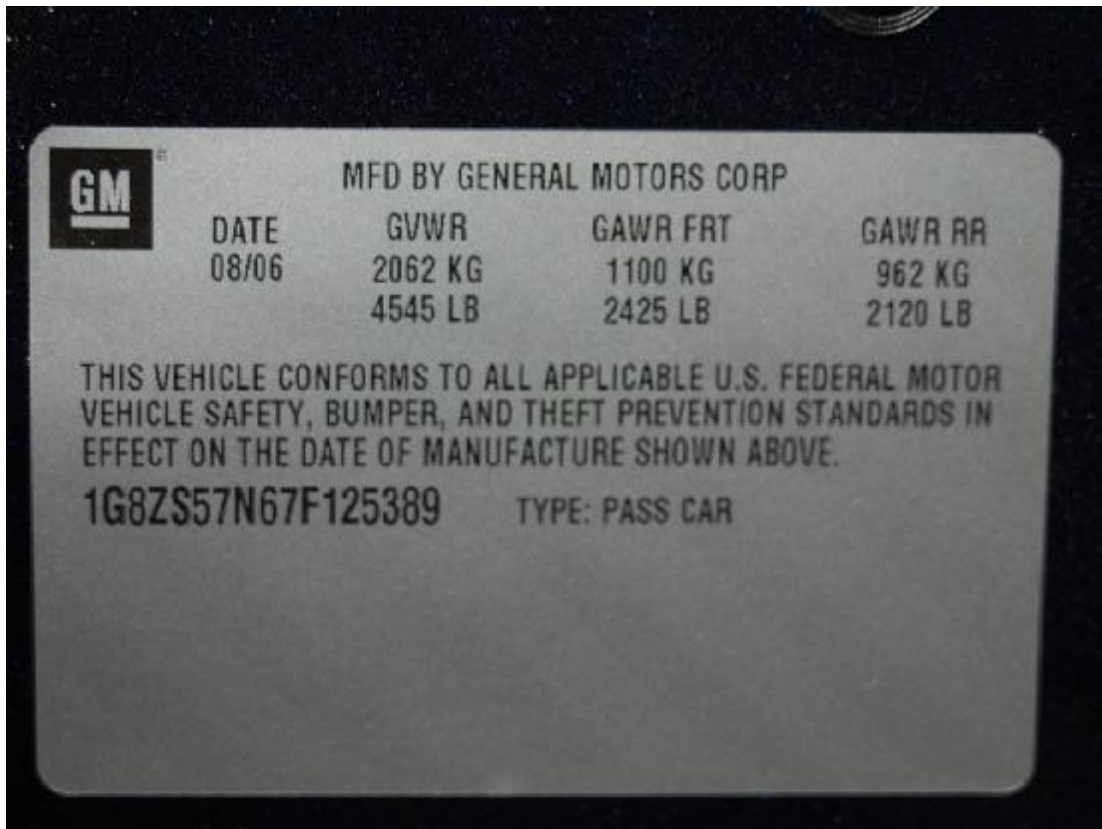


Figure A-2: Vehicle Certification Placard

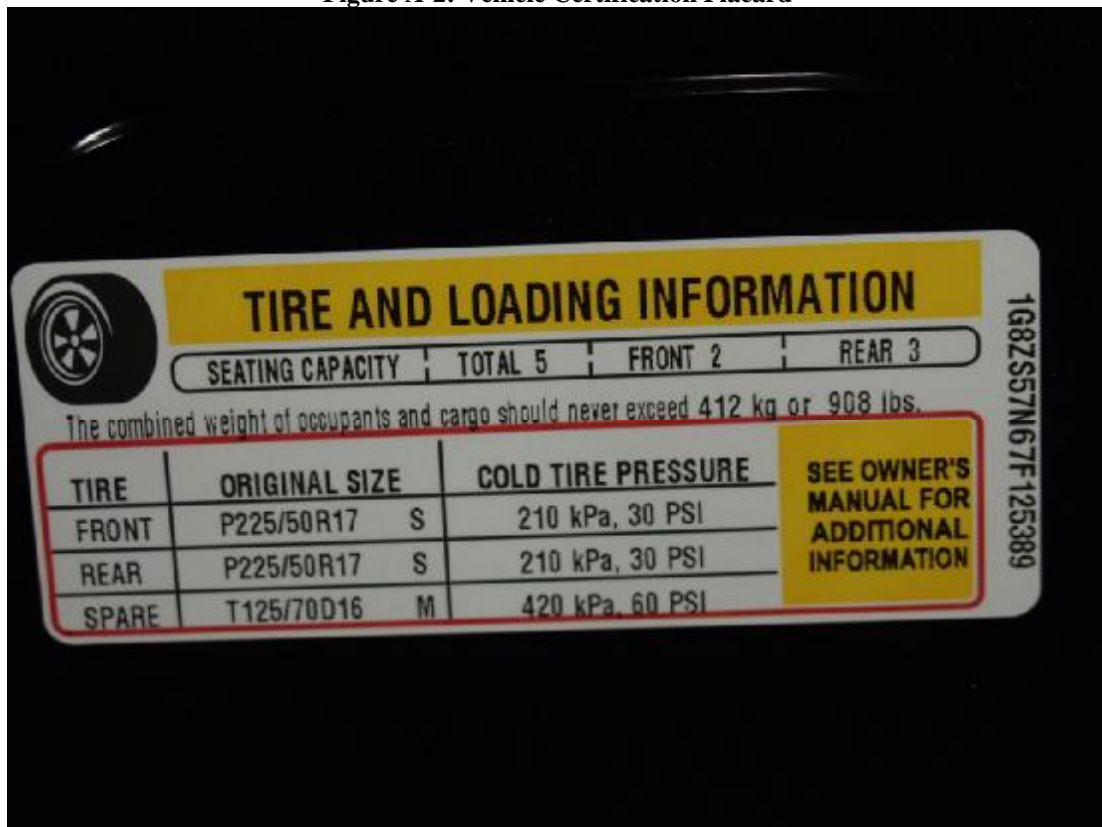


Figure A-3: Vehicle Tire Placard



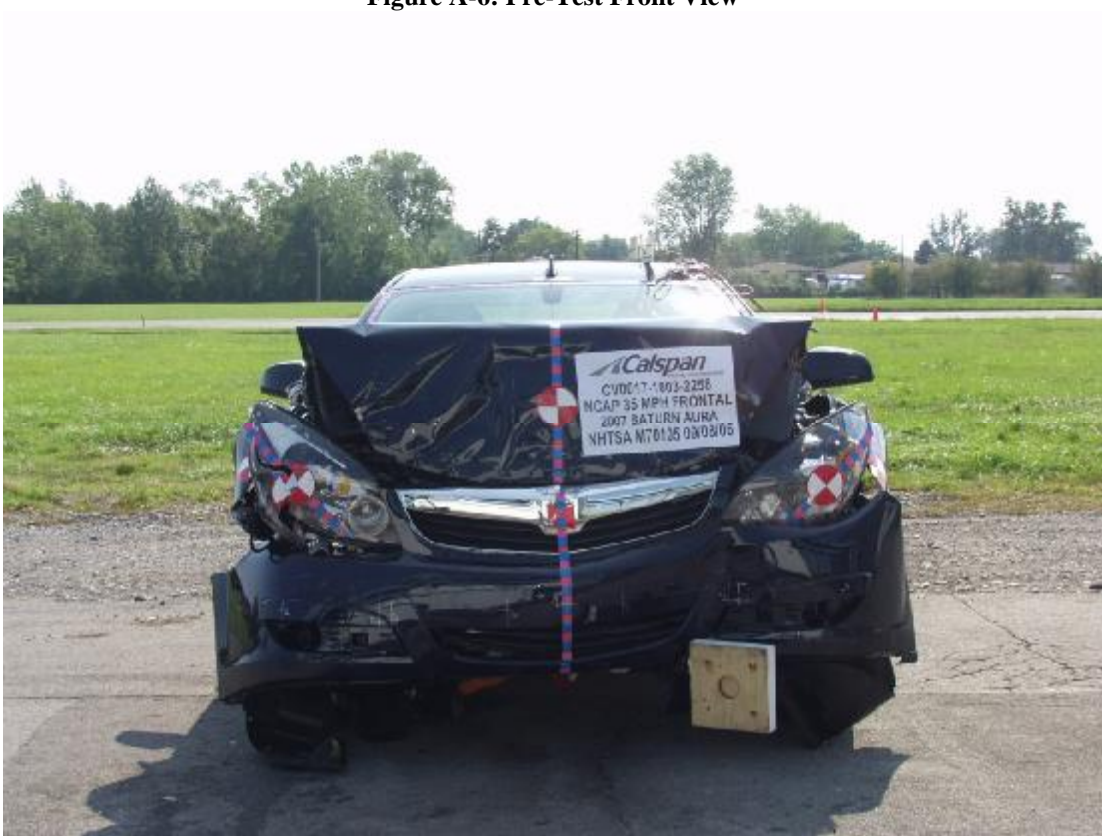
**Figure A-4: Right Front, As Received**



**Figure A-5: Left Rear, As Received**



**Figure A-6: Pre-Test Front View**



**Figure A-7: Post-Test Front View**



**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 Three-Quarter View**



**Figure A-13: Post-Test Right Front Three-Quarter View**



**Figure A-14: Pre-Test Left Rear Three-Quarter View**



**Figure A-15: Post-Test Left Rear Three-Quarter View**



**Figure A-16: Left Rear Three-Quarter View of Doors After Impact**



**Figure A-17: Right Rear Three-Quarter View of Doors After Impact**



Figure A-18: Pre-Test Windshield View



Figure A-19: Post-Test Windshield View



**Figure A-20: Pre-Test Engine Compartment View**



**Figure A-21: Post-Test Engine Compartment View**



**Figure A-22: Pre-Test Fuel Cap View**



**Figure A-23: Post-Test Fuel Cap View**



**Figure A-24: Pre-Test Front Underbody View**



**Figure A-25: Post-Test Front Underbody View**



**Figure A-26: Pre-Test Mid Underbody View**



**Figure A-27: Post-Test Mid Underbody View**



**Figure A-28: Pre-Test Rear Underbody View**



**Figure A-29: Post-Test Rear Underbody View**



**Figure A-30: Pre-Test Driver Head Location**



**Figure A-31: Post-Test Driver Head Location**



Figure A-32: Pre-Test Driver Position View



Figure A-33: Post-Test Driver Position View



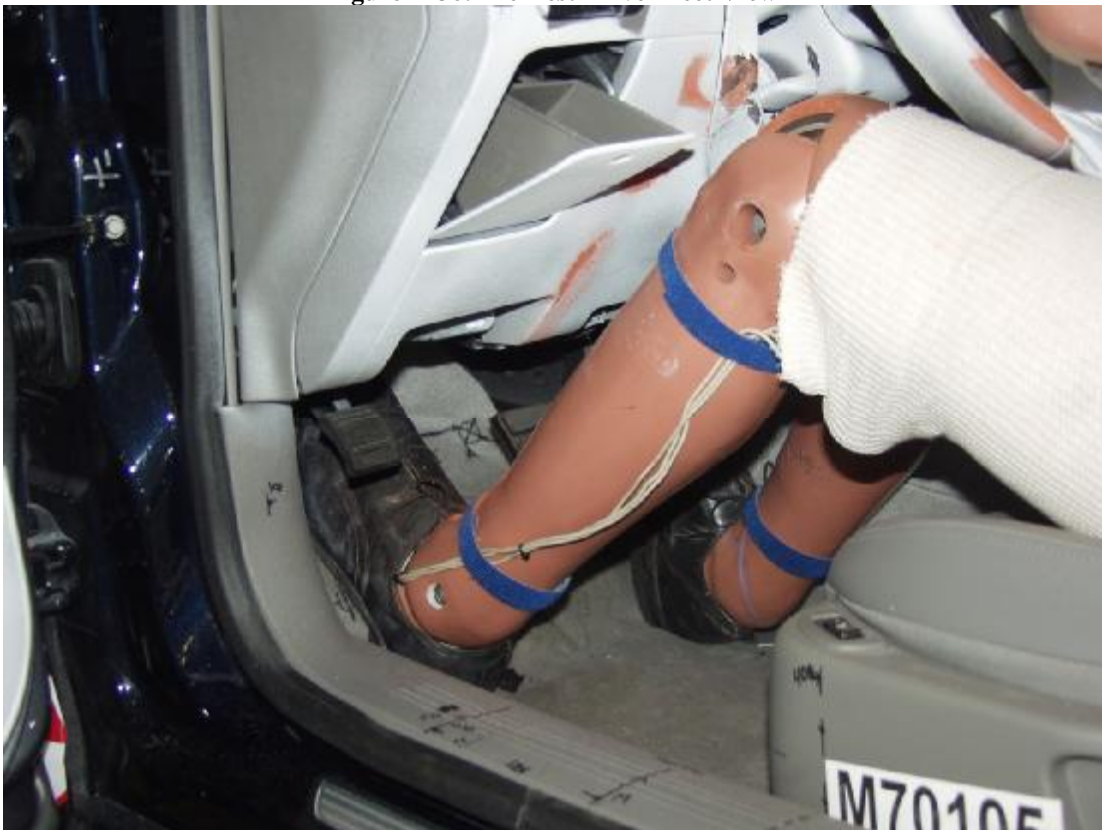
**Figure A-34: Pre-Test Driver and Interior View**



**Figure A-35: Post-Test Driver and Interior View**



**Figure A-36: Pre-Test Driver Feet View**



**Figure A-37: Post-Test Driver Feet View**



**Figure A-38: Pre-Test Driver Knee Bolster View**



**Figure A-39: Post-Test Driver Knee Bolster View**



**Figure A-40: Pre-Test Driver Floor Pan View**



**Figure A-41: Post-Test Driver Floor Pan View**



**Figure A-42: Post-Test Driver Head View**



**Figure A-43: Post-Test Driver Contact to Airbag**



**Figure A-44: Pre-Test Passenger Head Location**



**Figure A-45: Post-Test Passenger Head Location**



Figure A-46: Pre-Test Passenger Position View



Figure A-47: Post-Test Passenger Position View



Figure A-48: Pre-Test Passenger and Interior View



Figure A-49: Post-Test Passenger and Interior View



**Figure A-50: Pre-Test Passenger Feet View**



**Figure A-51: Post-Test Passenger Feet View**



**Figure A-52: Pre-Test Passenger Knee Bolster View**



**Figure A-53: Post-Test Passenger Knee Bolster View**



**Figure A-54: Pre-Test Passenger Floor Pan View**



**Figure A-55: Post-Test Passenger Floor Pan View**



**Figure A-56: Post-Test Passenger Head View**



**Figure A-57: Post-Test Passenger Contact to Airbag**



Figure A-58: Rollover View - 90°



Figure A-59: Rollover View - 180°



Figure A-60: Rollover View - 270°



Figure A-61: Rollover View - 360°



**Figure A-62: Impact View**

## **APPENDIX B**

### **DUMMY, VEHICLE AND LOAD CELL BARRIER RESPONSE DATA**

**Hybrid III Dummy Sign Conventions  
Load Cells and Special Transducers**

<b>Transducer</b>	<b>SAE Sign Convention (positive unless noted)</b>
Upper Neck Load Cell	Fx    Head rearward Fy    Head left Fz    Neck in tension Mx    Left ear to left shoulder My    Chin to chest (flexion) Mz    Chin to left shoulder (look left)
Chest Displacement Potentiometer	Compression is negative
Pelvic Load Cell (Lower Lumbar)	Fx    Chest rearward Fy    Chest left Fz    Spine in tension
Femur Load Cell	Compression is negative
Upper Tibia Load Cell (right and left leg)	Mx    Support tibia at ends, load left side center My    Support tibia at ends, load front (shin) center
Lower Tibia Load Cell (right and left leg)	Fz    Tibia in tension Mx    Support tibia at ends, load left side center My    Support tibia at ends, load front (shin) center

## DATA CHANNEL FILTER CLASS SUMMARY

NHTSA TEST NO.: M70105

<b>DATA TYPE</b>	<b>SAE FILTER CLASS (Hz)</b>
Dummy Head Accelerations	1000
Dummy Chest Accelerations	180
Dummy Chest Displacements	600
Dummy Femur Forces	600
Dummy Belt Loads	60
Dummy Belt Displacements	180
Dummy Neck Forces	1000
Dummy Neck Moments	600
Vehicle Accelerations	60
Vehicle Velocity Integrations	180
Vehicle Displacement Integrations	180
Load Cell Barrier Forces	60

### Table of Data Plots

PLOT	PLOT NAME[UNITS, CHANNEL FILTER CLASS]	PAGE
1	V1P1 Head CG x [g, CFC_1000]	B-8
2	V1P1 Head CG y [g, CFC_1000]	B-8
3	V1P1 Head CG z [g, CFC_1000]	B-8
4	V1P1 Head CG Resultant [g, CFC_1000]	B-8
5	V1P1 Chest x [g, CFC_180]	B-9
6	V1P1 Chest y [g, CFC_180]	B-9
7	V1P1 Chest z [g, CFC_180]	B-9
8	V1P1 Chest Resultant [g, CFC_180]	B-9
9	V1P1 Chest Compression x [mm, CFC_600]	B-10
10	V1P1 Left Femur z [N, CFC_600]	B-11
11	V1P1 Right Femur z [N, CFC_600]	B-11
12	V1P2 Head CG x [g, CFC_1000]	B-12
13	V1P2 Head CG y [g, CFC_1000]	B-12
14	V1P2 Head CG z [g, CFC_1000]	B-12
15	V1P2 Head CG Resultant [g, CFC_1000]	B-12
16	V1P2 Chest x [g, CFC_180]	B-13
17	V1P2 Chest y [g, CFC_180]	B-13
18	V1P2 Chest z [g, CFC_180]	B-13
19	V1P2 Chest Resultant [g, CFC_180]	B-13
20	V1P2 Chest Compression x [mm, CFC_600]	B-14
21	V1P2 Left Femur z [N, CFC_600]	B-15
22	V1P2 Right Femur z [N, CFC_600]	B-15

The following dummy, vehicle and load cell response data can be found in the research and development section of the NHTSA website at: [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov)

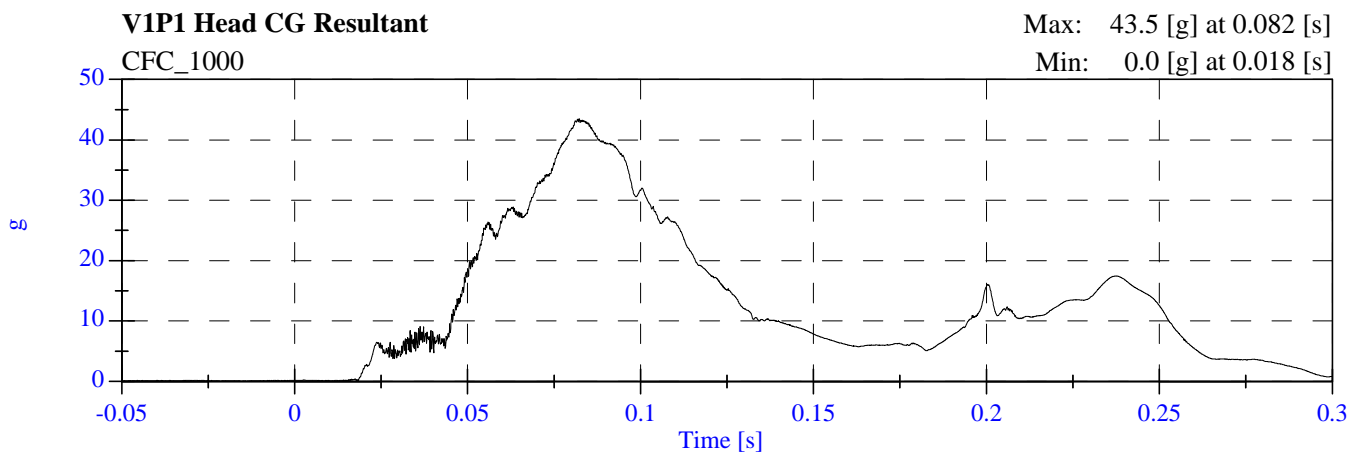
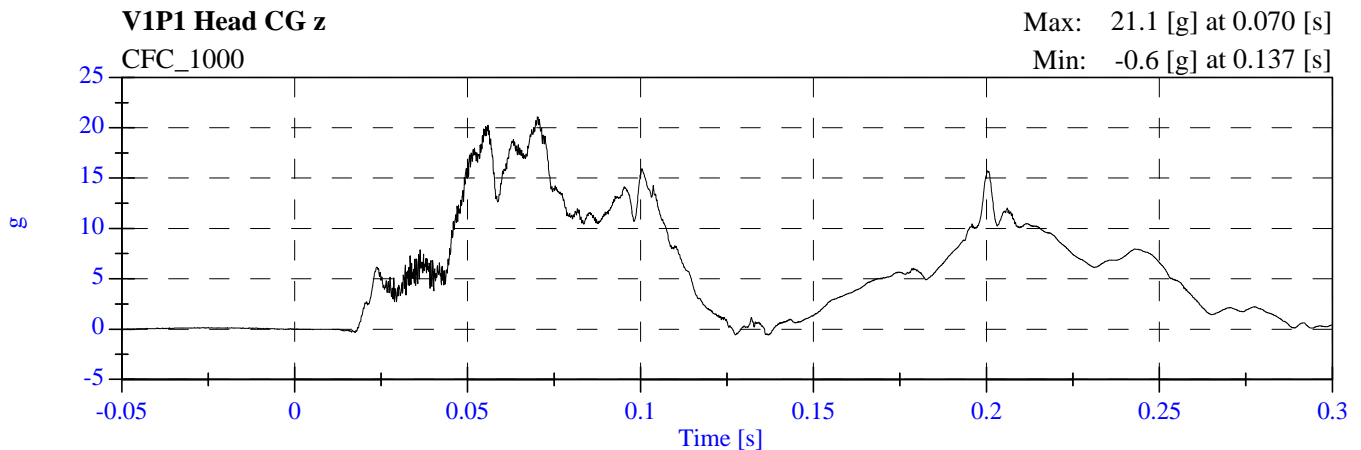
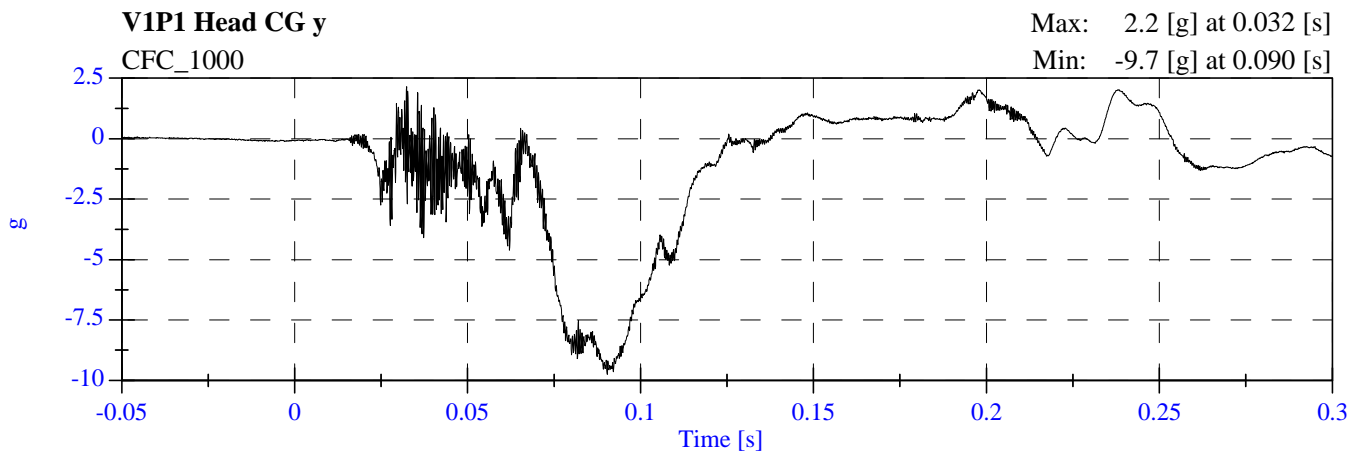
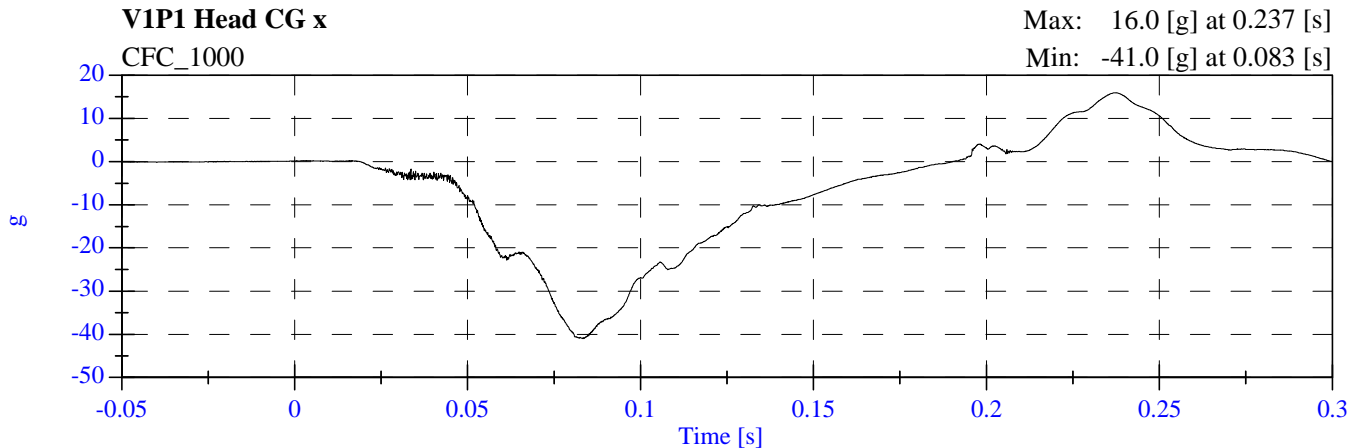
V1P1 Head CG Ax	
V1P1 Head CG Ay	
V1P1 Head CG Az	
V1P1 Head CG Red Ax	
V1P1 Head CG Red Ay	
V1P1 Head CG Red Az	
V1P1 Upper Neck Fx	
V1P1 Upper Neck Fy	
V1P1 Upper Neck Fz	
V1P1 Upper Neck Mx	
V1P1 Upper Neck My	
V1P1 Upper Neck Mz	
V1P1 Chest Ax	
V1P1 Chest Ay	
V1P1 Chest Az	
V1P1 Chest Red Ax	
V1P1 Chest Red Ay	
V1P1 Chest Red Az	
V1P1 Chest Compression	
V1P1 Pelvic Ax	
V1P1 Pelvic Ay	
V1P1 Pelvic Az	
V1P1 Left Femur Fz	
V1P1 Right Femur Fz	
V1P1 Left Upper Tibia Mx	
V1P1 Left Upper Tibia My	
V1P1 Left Lower Tibia Fz	
V1P1 Left Lower Tibia Mx	
V1P1 Left Lower Tibia My	
V1P1 Right Upper Tibia Fz	
V1P1 Right Upper Tibia Mx	
V1P1 Right Upper Tibia My	
V1P1 Right Lower Tibia Mx	
V1P1 Right Lower Tibia My	
V1P1 Left Foot Aft Ax	
V1P1 Left Foot Aft Az	
V1P1 Left Foot Fore Az	
V1P1 Right Foot Aft Ax	
V1P1 Right Foot Aft Az	
V1P1 Right Foot Fore z	
V1P1 Lap Belt Load	
V1P1 Shoulder Belt Load	
V1P2 Head CG Ax	
V1P2 Head CG Ay	
V1P2 Head CG Az	
V1P2 Head CG Red Ax	
V1P2 Head CG Red Ay	

V1P2 Head CG Red Az	
V1P2 Upper Neck Fx	
V1P2 Upper Neck Fy	
V1P2 Upper Neck Fz	
V1P2 Upper Neck Mx	
V1P2 Upper Neck My	
V1P2 Upper Neck Mz	
V1P2 Chest Ax	
V1P2 Chest Ay	
V1P2 Chest Az	
V1P2 Chest Red Ax	
V1P2 Chest Red Ay	
V1P2 Chest Red Az	
V1P2 Chest Compression	
V1P2 Pelvic Ax	
V1P2 Pelvic Ay	
V1P2 Pelvic Az	
V1P2 Left Femur Fz	
V1P2 Right Femur Fz	
V1P2 Left Upper Tibia Fz	
V1P2 Left Upper Tibia Mx	
V1P2 Left Upper Tibia My	
V1P2 Left Lower Tibia Mx	
V1P2 Left Lower Tibia My	
V1P2 Right Upper Tibia Mx	
V1P2 Right Upper Tibia My	
V1P2 Right Lower Tibia Fz	
V1P2 Right Lower Tibia Mx	
V1P2 Right Lower Tibia My	
V1P2 Left Foot Aft Ax	
V1P2 Left Foot Aft Az	
V1P2 Left Foot Fore Az	
V1P2 Right Foot Aft Ax	
V1P2 Right Foot Aft Az	
V1P2 Right Foot Fore Az	
V1P2 Lap Belt Load	
V1P2 Shoulder Belt Load	
Barrier Load Cell A1 Fx	
Barrier Load Cell A2 Fx	
Barrier Load Cell A3 Fx	
Barrier Load Cell A4 Fx	
Barrier Load Cell A5 Fx	
Barrier Load Cell A6 Fx	
Barrier Load Cell A7 Fx	
Barrier Load Cell A8 Fx	
Barrier Load Cell A9 Fx	
Barrier Load Cell B1 Fx	
Barrier Load Cell B2 Fx	
Barrier Load Cell B3 Fx	

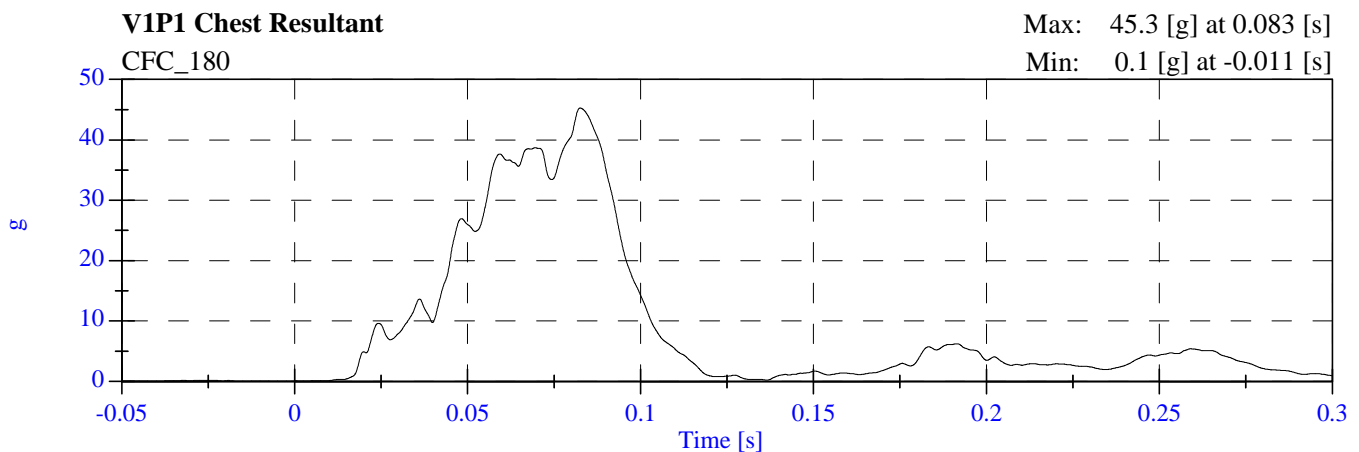
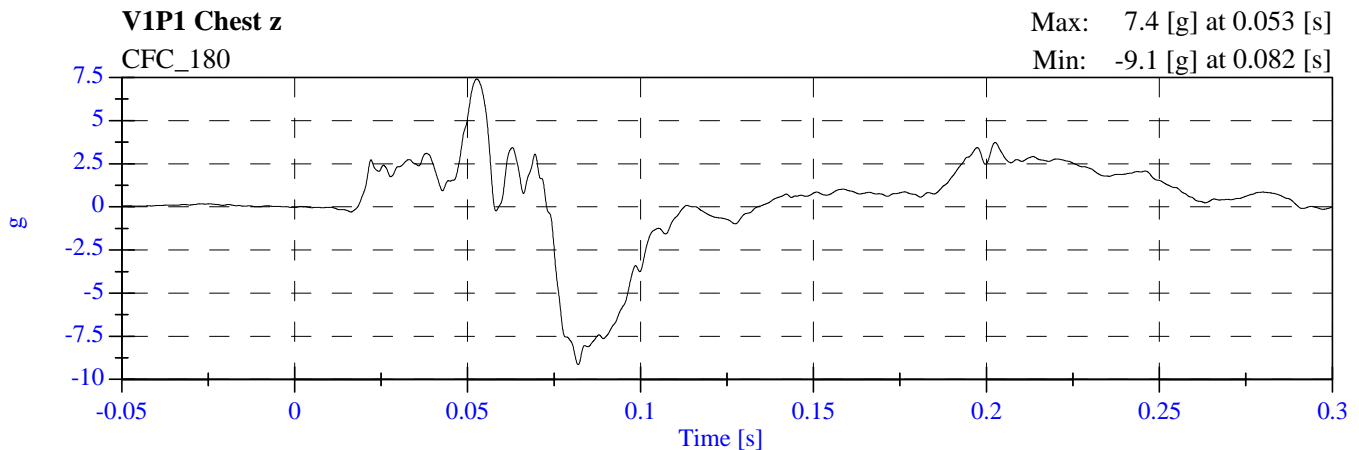
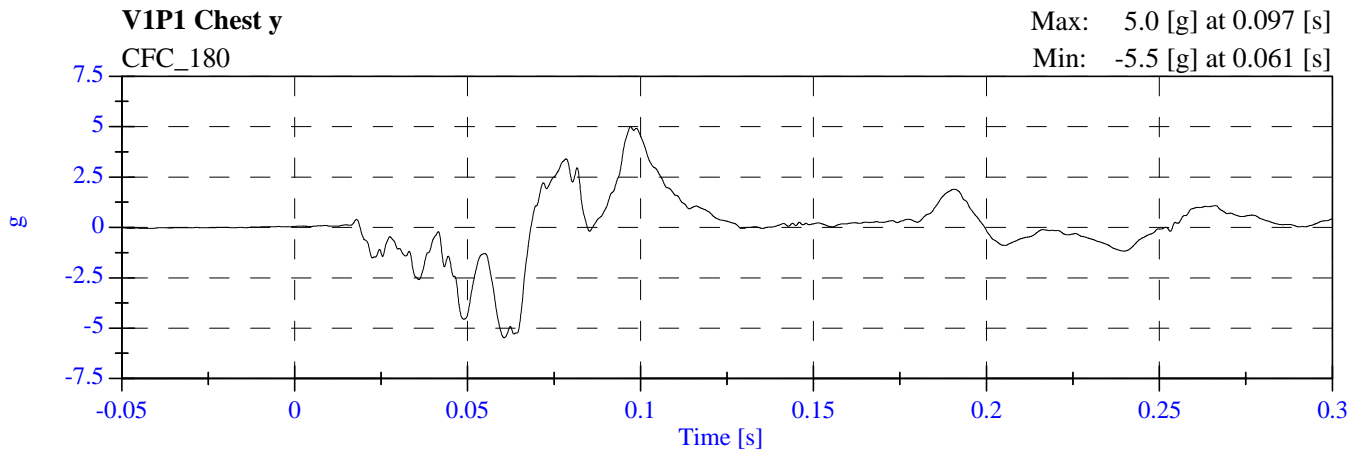
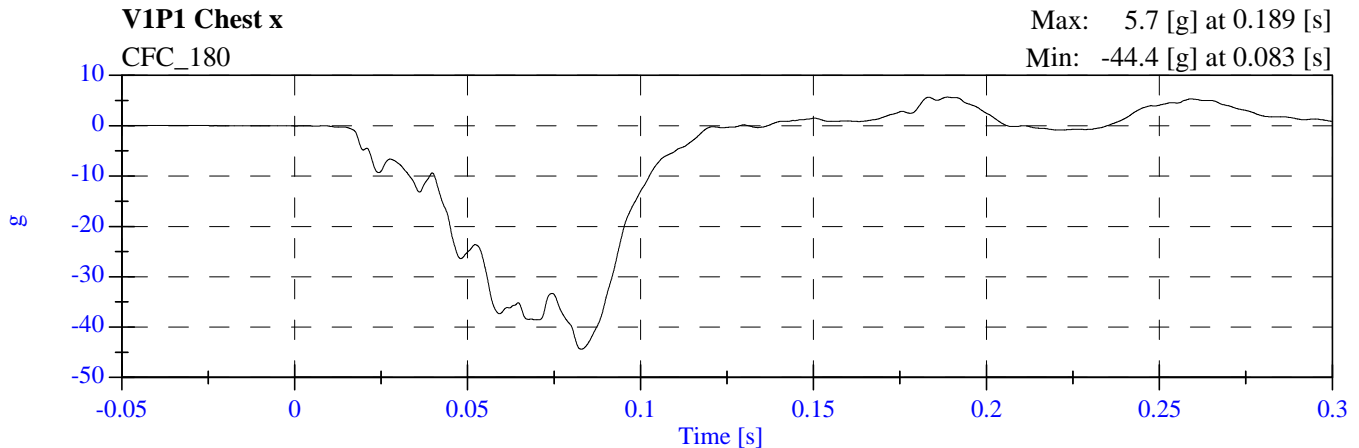
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Barrier Load Cell B5 Fx	
Barrier Load Cell B6 Fx	
Barrier Load Cell B7 Fx	
Barrier Load Cell B8 Fx	
Barrier Load Cell B9 Fx	
Barrier Load Cell C1 Fx	
Barrier Load Cell C2 Fx	
Barrier Load Cell C3 Fx	
Barrier Load Cell C4 Fx	
Barrier Load Cell C5 Fx	
Barrier Load Cell C6 Fx	
Barrier Load Cell C7 Fx	
Barrier Load Cell C8 Fx	
Barrier Load Cell C9 Fx	
Barrier Load Cell D1 Fx	
Barrier Load Cell D2 Fx	
Barrier Load Cell D3 Fx	
Barrier Load Cell D4 Fx	
Barrier Load Cell D5 Fx	
Barrier Load Cell D6 Fx	
Barrier Load Cell D7 Fx	
Barrier Load Cell D8 Fx	
Barrier Load Cell D9 Fx	
V1 Left Rear #1x	
V1 Right Rear #2x	
V1 Engine Top #3x	
V1 Engine Bottom #4x	
V1 Right Caliper #5x	
V1 Left Caliper #7x	
V1 Left Rear #8z	
V1 Right Rear #9z	

<b>TEST NOTES</b>	
Data Channel	Anomalies
V1P1 Head CG Red y	Transducer failed
V1P1 Left Upper Tibia Mx	Connector damaged at 124 ms
V1P2 Left Foot Aft Ax	Connector damaged
V1P2 RFP Lap Belt	Questionable data after 84 ms
V1 Engine Top #3x	Wire cut at 35 ms
V1 Engine Bottom #4x	Wire cut at 36 ms

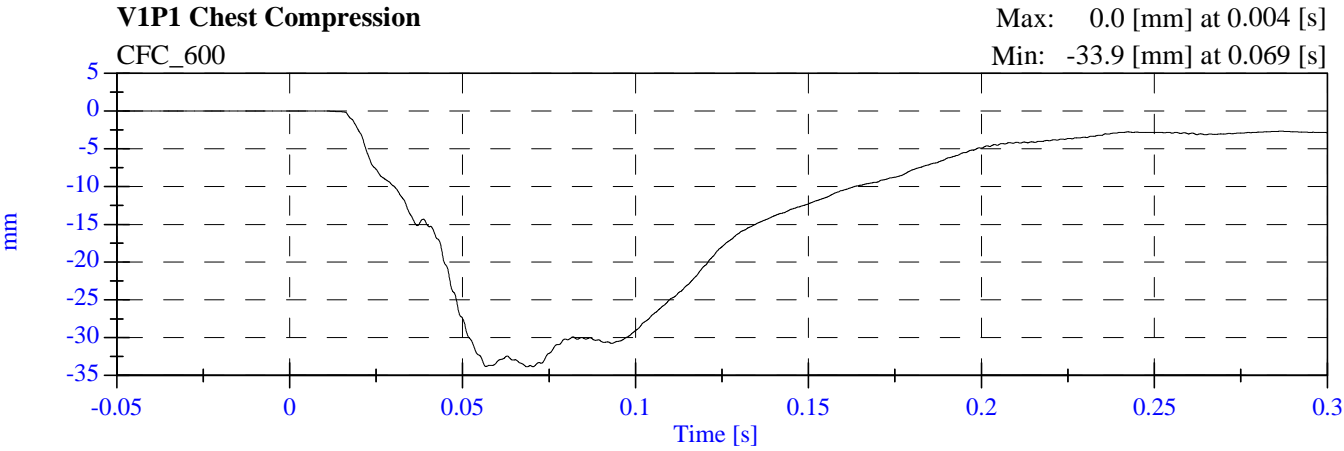
# 2007 NCAP - 2007 Saturn Aura M70105 - September 08, 2006



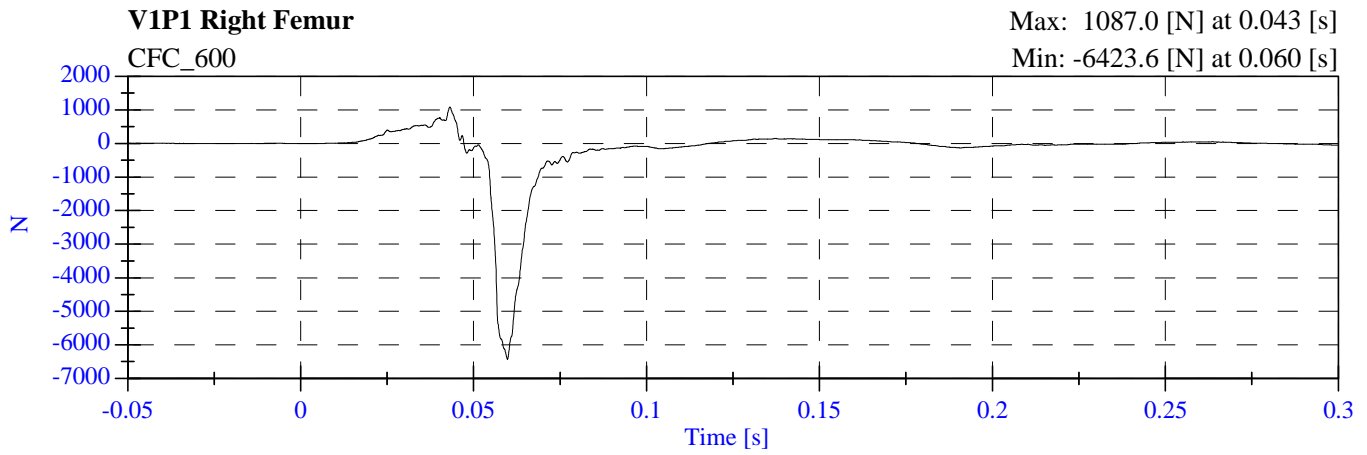
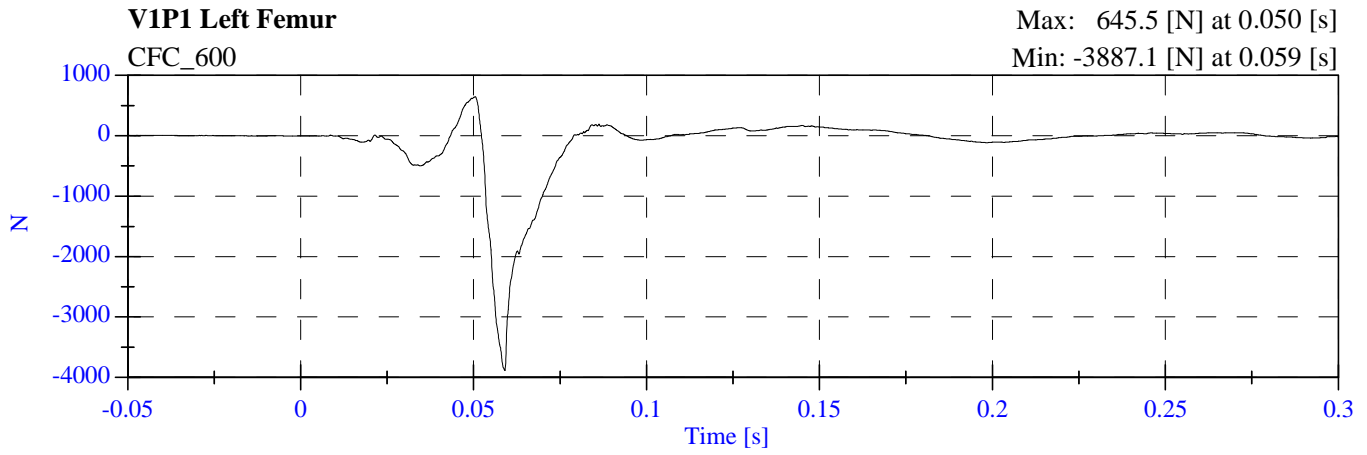
# 2007 NCAP - 2007 Saturn Aura M70105 - September 08, 2006



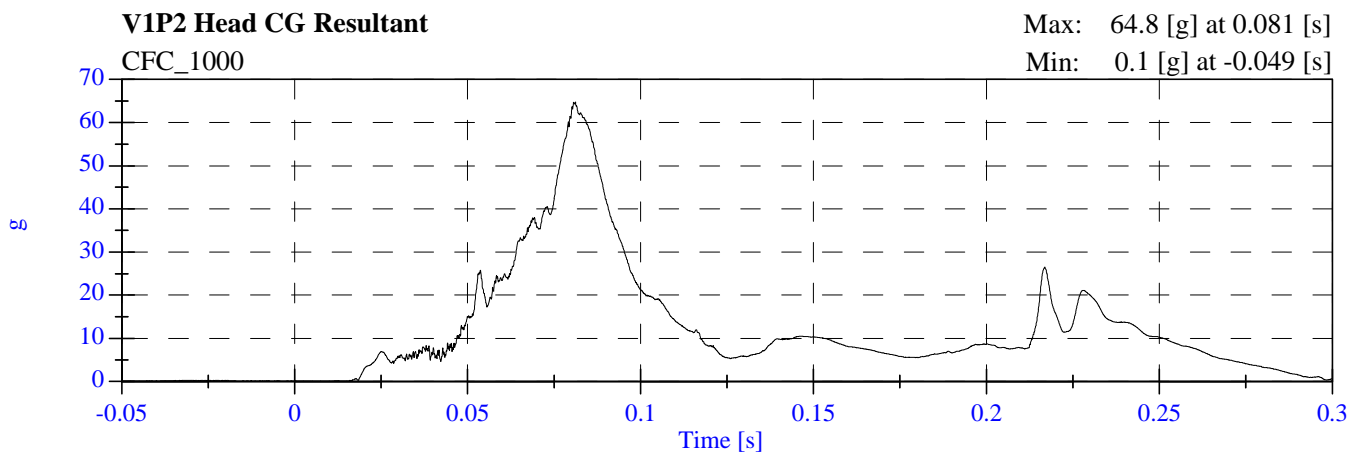
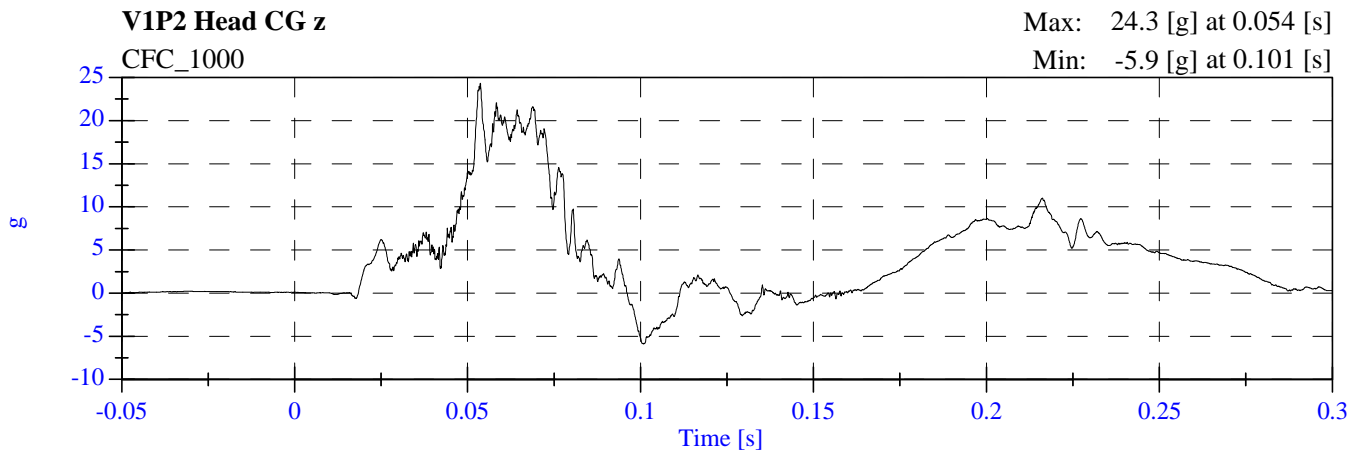
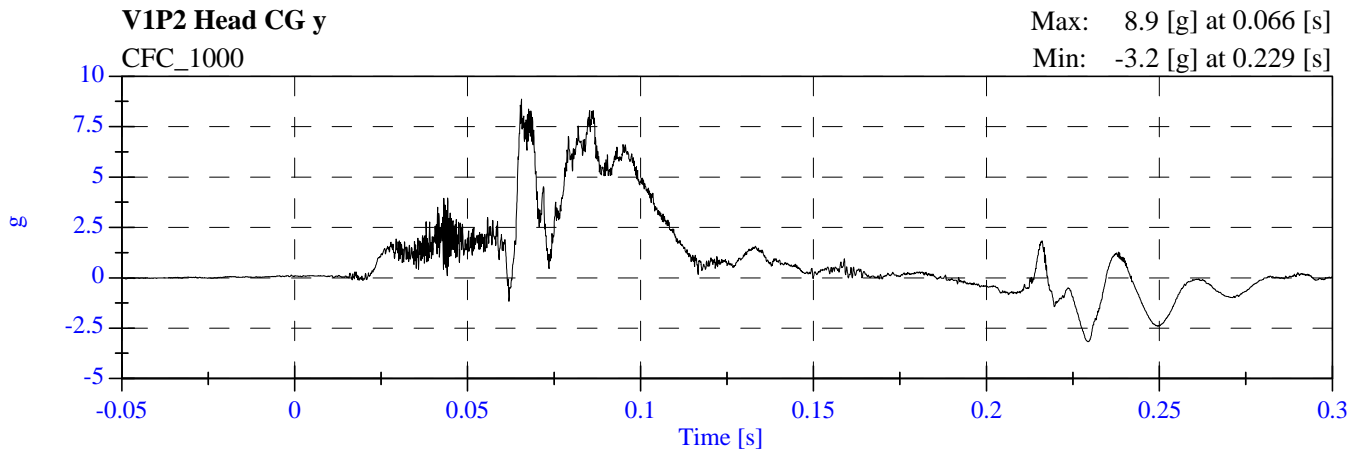
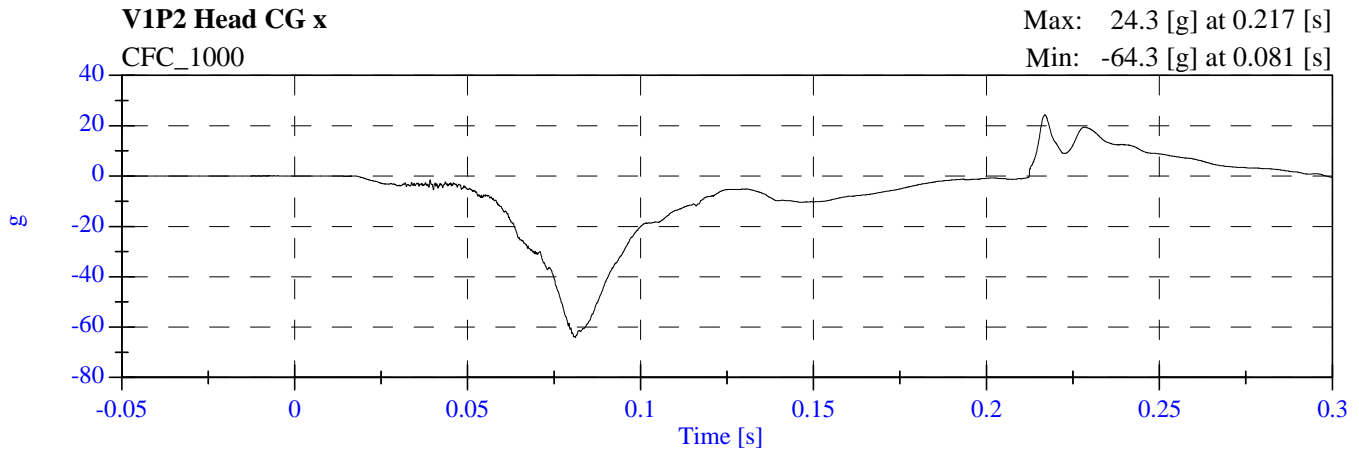
**2007 NCAP - 2007 Saturn Aura  
M70105 - September 08, 2006**



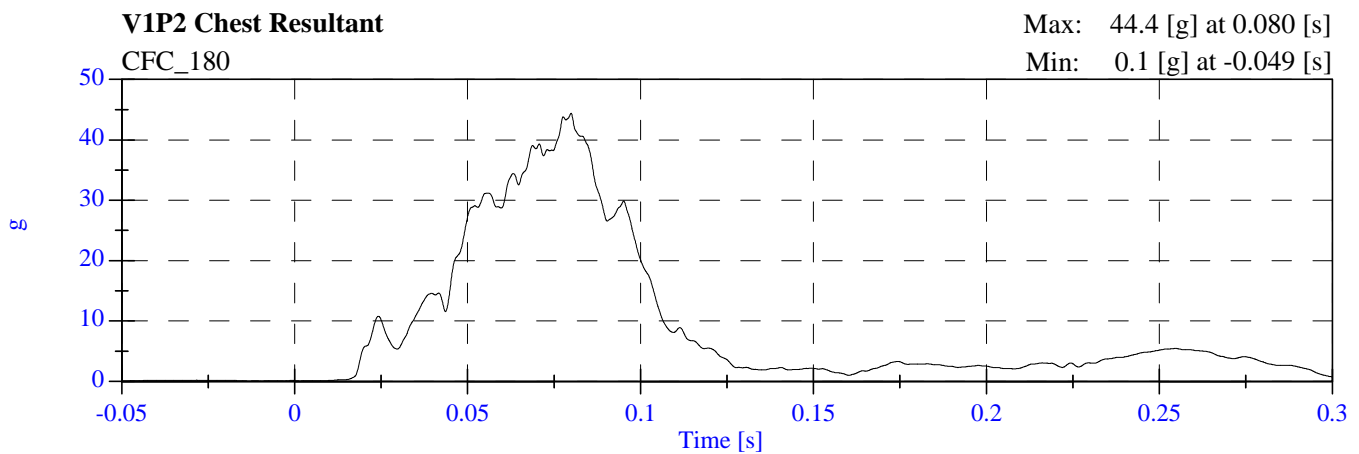
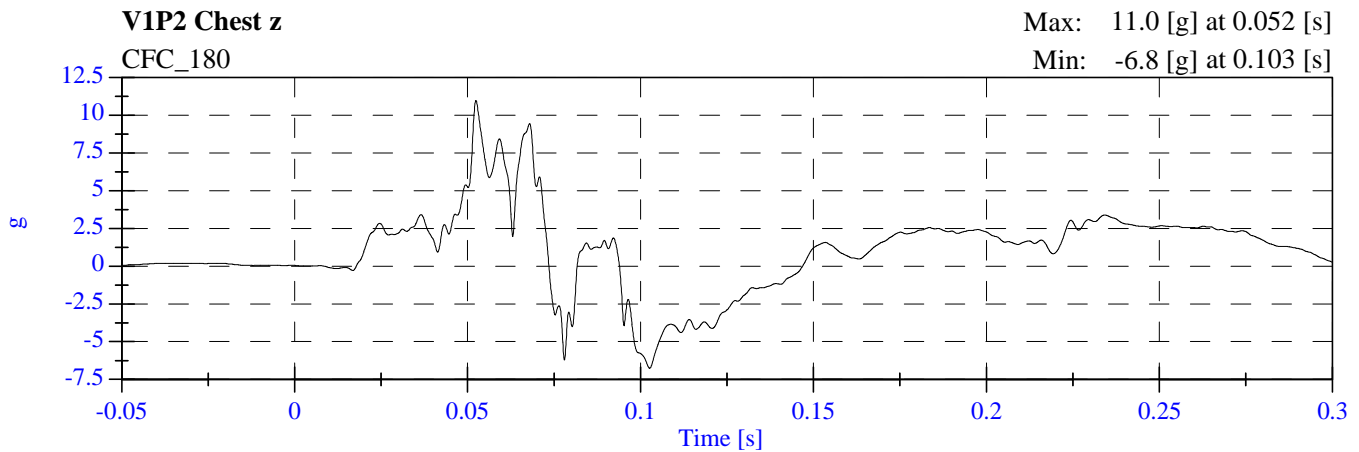
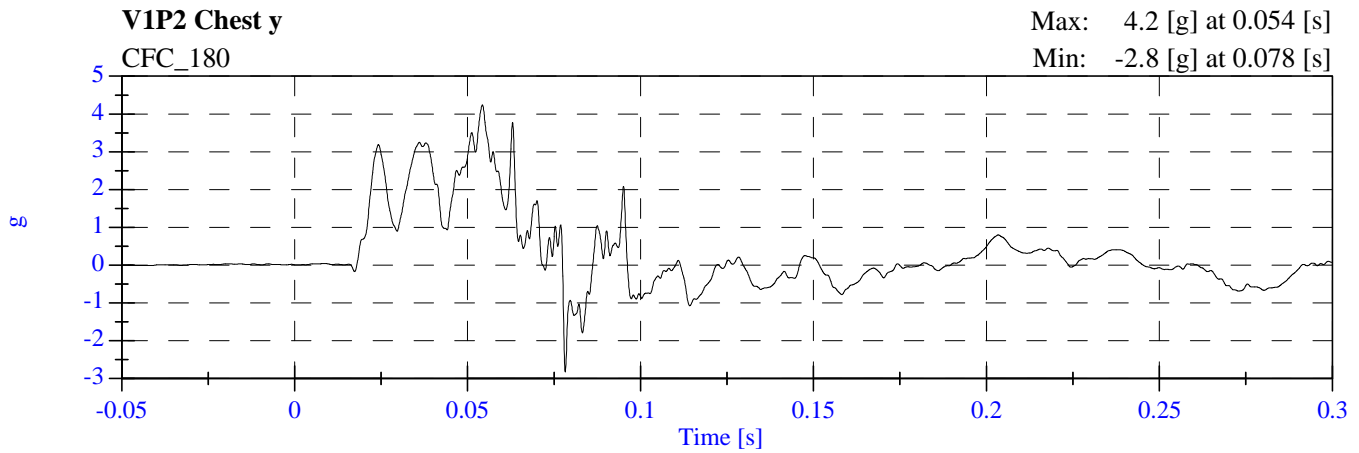
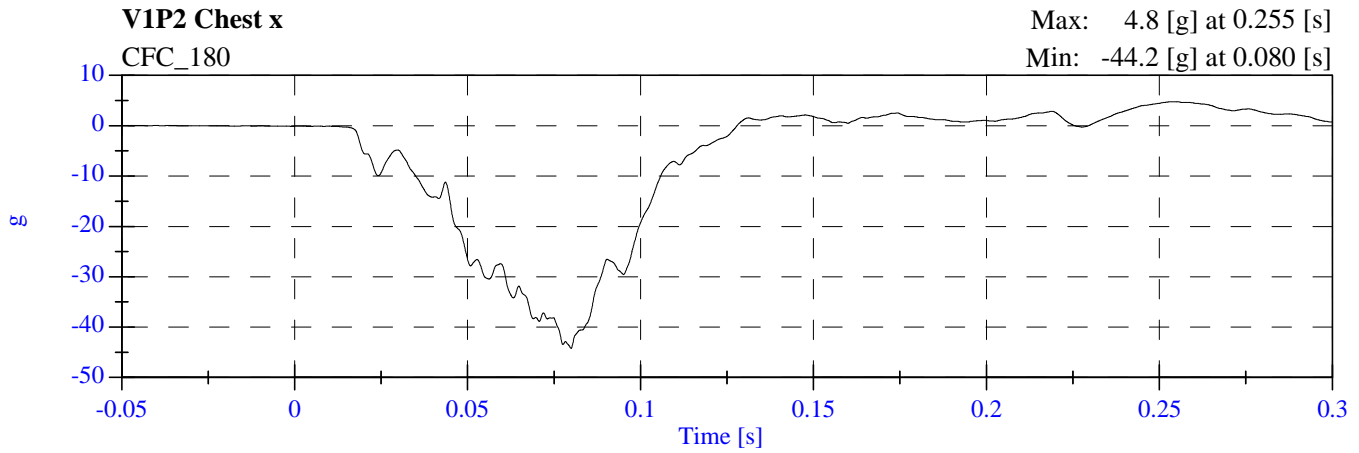
**2007 NCAP - 2007 Saturn Aura  
M70105 - September 08, 2006**



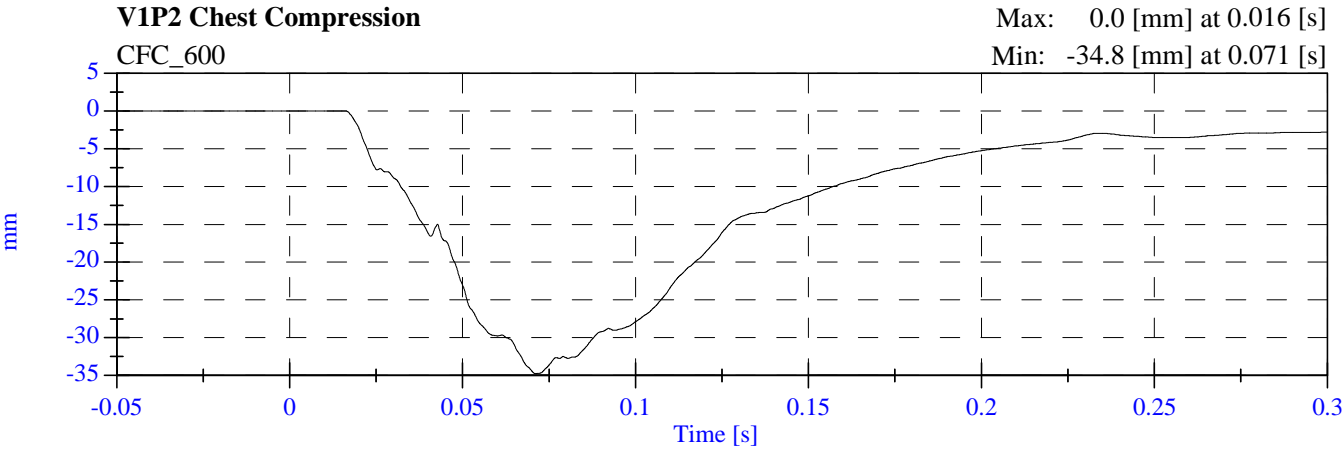
# 2007 NCAP - 2007 Saturn Aura M70105 - September 08, 2006



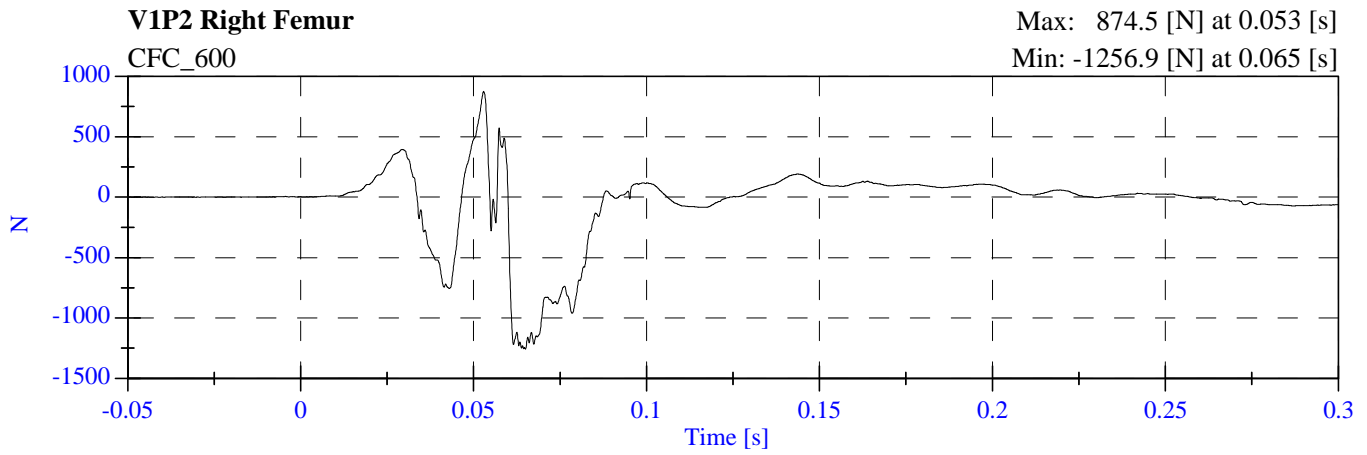
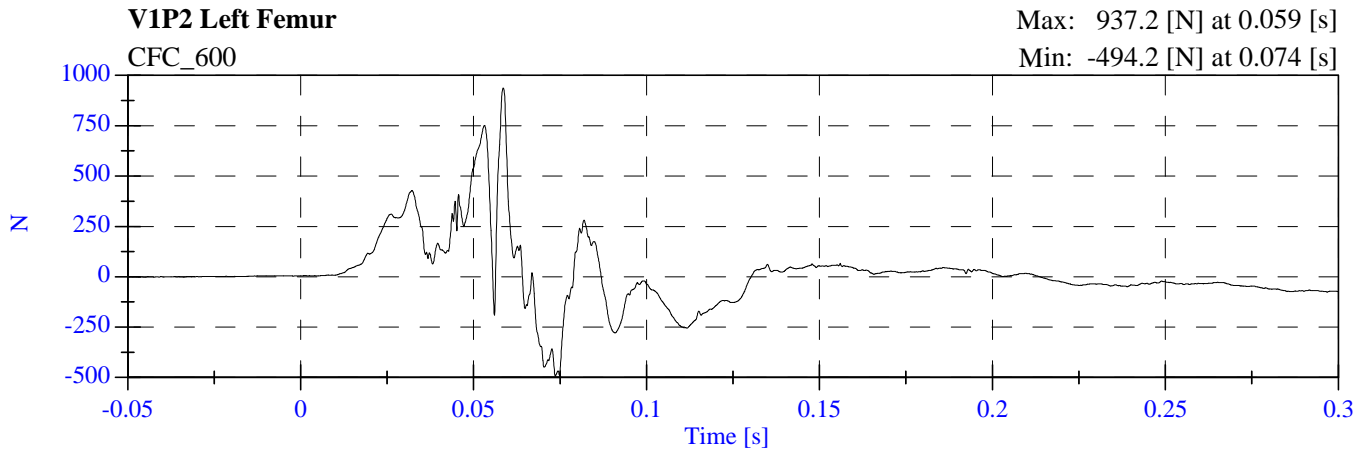
# 2007 NCAP - 2007 Saturn Aura M70105 - September 08, 2006



**2007 NCAP - 2007 Saturn Aura  
M70105 - September 08, 2006**



**2007 NCAP - 2007 Saturn Aura  
M70105 - September 08, 2006**



**APPENDIX C**

**PART 572B/E DUMMY CONFIGURATION  
AND PERFORMANCE VERIFICATION DATA SHEETS**

Appendix C contains the results from certification tests performed on the 50th percentile male anthropomorphic test devices utilized for this crash test. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Volume 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan. A summary of the test results, and Part 572 specifications are included in this Appendix.

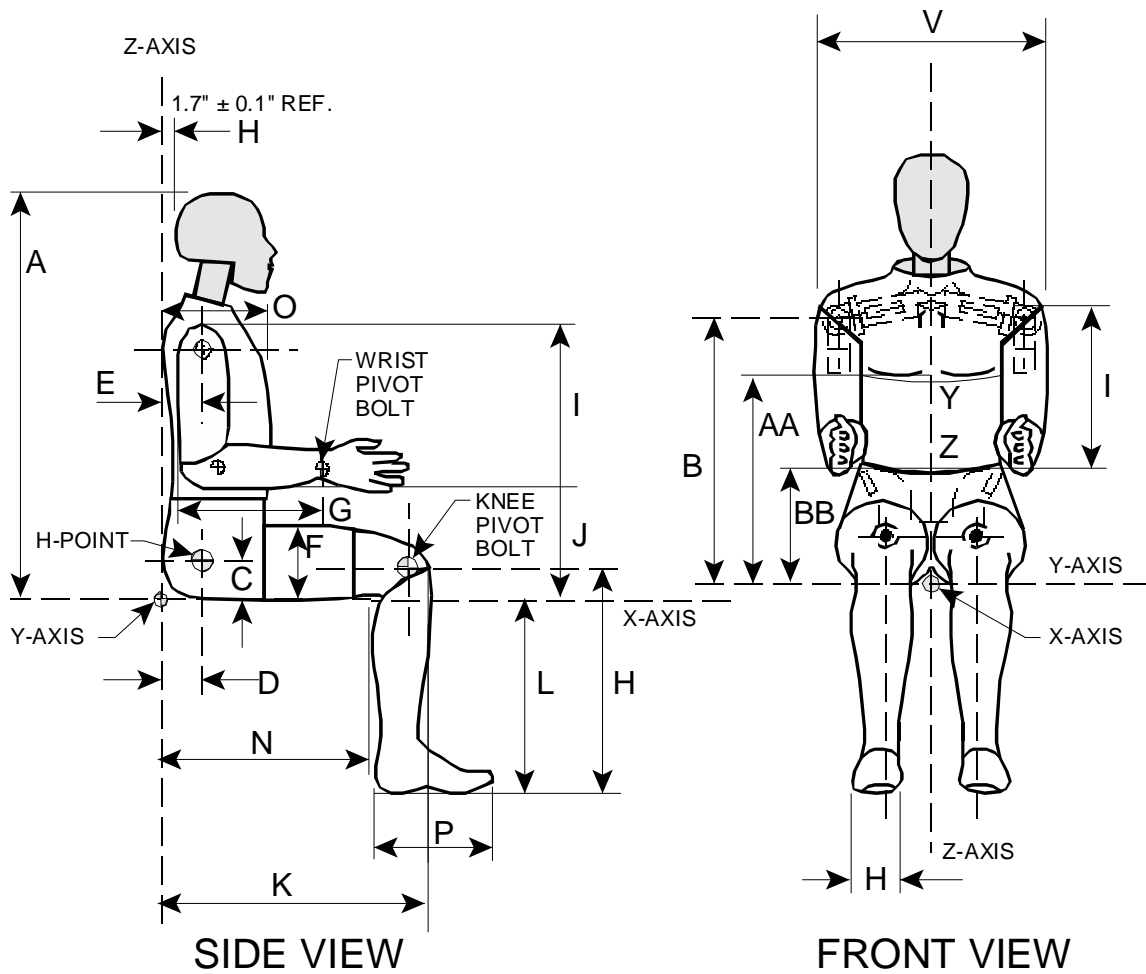
Dummy serial numbers and certification dates are:

<u>Position No./Location</u>	<u>Serial No.</u>	<u>Completion Date</u>
#1/Driver	142	8/4/2006
#2/Right Front Passenger	150	8/4/2006

#### Electronic Test Equipment

The complement of signal conditioning, recording and display equipment, in conjunction with dummy certification testing, can be found in New Car Assessment and Standards Inducant Testing Final Report No. 6525-V-1.

# EXTERNAL DIMENSIONS SPECIFICATIONS



NOTE: Figure is referenced to the erect seated position. The curved lumbar does not allow the Hybrid III to be positioned in a perfect erect attitude. (REF: S572.31(A)(6))

PART 572E  
HEAD DROP TEST

Dummy Serial Number 142  
Sequential Test Number 1  
Date July 31, 2006  
Workfile 142H 07-31-06.dat

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	18.9 – 25.6 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Peak Resultant Acceleration	225-275 G's	248.06
Peak Lateral Acceleration	15 G's Max	13.26
Is Acceleration Curve Unimodal?	YES	Yes

Remarks:

Laboratory Technician:

B. Swiecicki

PART 572E  
NECK FLEXION TEST

Dummy Serial Number	142	
Sequential Test Number	1	
Date	August 01, 2006	6 Axis Neck Transducer
Workfile	142NF 08-01-06.dat	

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature		20.6 – 22.2 Deg C	21.11
Relative Humidity		10% - 70%	50.0
Impact Velocity		6.89 – 7.13 m/s	6.99
Pendulum Deceleration	10 ms	22.50 - 27.50 G's	22.84
	20 ms	17.60 - 22.60 G's	21.18
	30 ms	12.50 - 18.50 G's	17.63
Max Pendulum G's Above 30 ms		29 G's Max	17.63
Deceleration - Time Curve Decay Time to 5 G's		34 - 42 ms	34.90
D Plane Rotation	Max	64 - 78 Deg	64.08
	Time	57 - 64 ms	60.90
Moment About Occipital Condyle	Max	88.13 – 108.47 N-m	89.06
	Time	47 - 58 ms	49.30
Rotation Angle - Time Curve Decay Time to Zero		113 - 128 ms	118.80
Positive Moment - Time Curve Decay Time to Zero		97 - 107 ms	97.10

Remarks:

Laboratory Technician:

B. Swiecicki

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PART 572E  
NECK EXTENSION TEST

Dummy Serial Number	142	
Sequential Test Number	1	
Date	August 02, 2006	6 Axis Neck Transducer
Workfile	142NF 08-02-06.dat	

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	20.6 – 22.2 Deg C	21.11
Relative Humidity	10% - 70%	50.0
Impact Velocity	5.94 – 6.19 m/s	5.97
Pendulum Deceleration    10 ms	17.20 - 21.20 G's	18.38
20 ms	14.00 - 19.00 G's	17.90
30 ms	11.00 - 16.00 G's	15.77
Max Pendulum G's Above 30 ms	22 G's Max	15.77
Deceleration - Time Curve Decay Time to 5 G's	38 - 46 ms	38.00
D Plane Rotation            Max	81 - 106 Deg	81.16
Time	72 - 82 ms	76.30
Moment About Occipital    Max	-79.99 - -52.88 N-m	-73.50
Condyle                            Time	65 - 79 ms	71.30
Rotation Angle - Time Curve Decay Time to Zero	147 - 174 ms	157.30
Positive Moment - Time Curve Decay Time to Zero	120 - 148 ms	148.00

Remarks:

Laboratory Technician: \_\_\_\_\_ B. Swiecicki

PART 572E  
THORAX IMPACT TEST

Dummy Serial Number 142  
Sequential Test Number 1  
Date August 03, 2006  
Workfile 142T 08-03-06.dat

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	20.6 – 22.2 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Pendulum Velocity	6.58 – 6.83 m/s	6.71
Maximum Deflection	63.50 – 72.64 mm	64.04
Maximum Resistive Force	5159.9 – 5893.9 N	5440.18
Internal Hysteresis	69 - 85 %	70.83

Remarks:

Laboratory Technician:

\_\_\_\_\_ B. Swiecicki

PART 572E  
KNEE IMPACT TEST

Dummy Serial Number            142  
 Sequential Test Number        1  
 Date                                 August 02, 2006  
 Workfile                            142LF 08-02-06.dat; 142RF 08-02-06.dat

TEST PARAMETER	SPECIFICATION	TEST RESULTS
<b>LEFT KNEE</b>		
Temperature	18.9 – 25.6 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Probe Velocity	2.07 – 2.13 m/s	2.13
Peak Knee Impact Force	4715.1 – 5782.7 N	5075.18
<b>RIGHT KNEE</b>		
Temperature	18.9 – 25.6 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Probe Velocity	2.07 – 2.13 m/s	2.13
Peak Knee Impact Force	4715.1 – 5782.7 N	5351.09

Remarks:

Laboratory Technician:

\_\_\_\_\_ B. Swiecicki

PART 572E  
EXTERNAL DIMENSIONS

Dummy Serial Number            142  
 Sequential Test Number         1  
 Date                                     August 03, 2006

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature			21.1
Relative Humidity			50.0
Location for Chest Circumference	AA	16.9 - 17.1 in	17.0
Location for Waist Circumference	BB	8.9 - 9.1 in	9.0
Total Sitting Height	A	34.6 - 35.0 in	34.9
Shoulder Pivot Height	B	19.9 - 20.5 in	20.3
H-Point Height	C	3.3 - 3.5 in	3.4
H-Point from Backline	D	5.3 - 5.5 in	5.4
Shoulder Pivot from Backline	E	3.3 - 3.7 in	3.6
Thigh Clearance	F	5.5 - 6.1 in	6.0
Back of Elbow to Wrist Pivot	G	11.4 - 12.0 in	11.5
Skull Cap to Backline	H	1.6 - 1.8 in	1.7
Shoulder - Elbow Length	I	13.0 - 13.6 in	13.5
Elbow Rest Height	J	7.5 - 8.3 in	8.1
Buttock Knee Length	K	22.8 - 23.8 in	23.5
Popliteal Height	L	16.9 - 17.9 in	17.7
Knee Pivot Height	M	19.1 - 19.7 in	19.2
Buttock Popliteal Length	N	17.8 - 18.8 in	18.6
Chest Depth	O	8.4 - 9.0 in	8.9
Foot Length	P	9.9 - 10.5 in	10.3
Shoulder Breadth	V	16.6 - 17.2 in	16.9
Foot Breadth	W	3.6 - 4.2 in	4.0
Chest Circumference (With Jacket)	Y	38.2 - 39.4 in	38.9
Waist Circumference	Z	32.9 - 34.1 in	33.2

Remarks:

Laboratory Technician:

B. Swiecicki

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PART 572E  
HEAD DROP TEST

Dummy Serial Number 150  
Sequential Test Number 1  
Date July 31, 2006  
Workfile 150H 07-31-2006.dat

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	18.9 – 25.6 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Peak Resultant Acceleration	225-275 G's	268.54
Peak Lateral Acceleration	15 G's Max	7.06
Is Acceleration Curve Unimodal?	YES	Yes

Remarks:

Laboratory Technician:

B. Swiecicki

PART 572E  
NECK FLEXION TEST

Dummy Serial Number	150	
Sequential Test Number	1	
Date	August 01, 2006	6 Axis Neck Transducer
Workfile	150NF 08-01-06.dat	

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	20.6 – 22.2 Deg C	21.11
Relative Humidity	10% - 70%	50.0
Impact Velocity	6.89 – 7.13 m/s	6.99
Pendulum Deceleration    10 ms	22.50 - 27.50 G's	22.66
20 ms	17.60 - 22.60 G's	21.08
30 ms	12.50 - 18.50 G's	18.16
Max Pendulum G's Above 30 ms	29 G's Max	18.16
Deceleration - Time Curve Decay Time to 5 G's	34 - 42 ms	35.80
D Plane Rotation            Max	64 - 78 Deg	64.32
Time	57 - 64 ms	58.80
Moment About Occipital    Max	88.13 – 108.47 N-m	93.00
Condyle                            Time	47 - 58 ms	48.30
Rotation Angle - Time Curve Decay Time to Zero	113 - 128 ms	116.90
Positive Moment - Time Curve Decay Time to Zero	97 - 107 ms	97.10

Remarks:

Laboratory Technician: \_\_\_\_\_ B. Swiecicki \_\_\_\_\_

PART 572E  
NECK EXTENSION TEST

Dummy Serial Number	150	
Sequential Test Number	1	
Date	August 01, 2006	6 Axis Neck Transducer
Workfile	150NE 08-01-06.dat	

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature		20.6 – 22.2 Deg C	21.1
Relative Humidity		10% - 70%	50.0
Impact Velocity		5.94 – 6.19 m/s	5.97
Pendulum Deceleration	10 ms	17.20 - 21.20 G's	17.65
	20 ms	14.00 - 19.00 G's	17.40
	30 ms	11.00 - 16.00 G's	15.48
Max Pendulum G's Above 30 ms		22 G's Max	16.56
Deceleration - Time Curve Decay Time to 5 G's		38 - 46 ms	38.10
D Plane Rotation	Max	81 - 106 Deg	82.36
	Time	72 - 82 ms	77.20
Moment About Occipital Condyle	Max	-79.99 - -52.88 N-m	-71.35
	Time	65 - 79 ms	74.50
Rotation Angle - Time Curve Decay Time to Zero		147 - 174 ms	160.80
Positive Moment - Time Curve Decay Time to Zero		120 - 148 ms	144.30

Remarks:

Laboratory Technician:

B. Swiecicki

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PART 572E  
THORAX IMPACT TEST

Dummy Serial Number 150  
Sequential Test Number 1  
Date August 04, 2006  
Workfile 150T 08-04-06.dat

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	20.6 – 22.2 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Pendulum Velocity	6.58 – 6.83 m/s	6.77
Maximum Deflection	63.50 – 72.64 mm	65.18
Maximum Resistive Force	5159.9 – 5893.9 N	5823.33
Internal Hysteresis	69 - 85 %	69.67

Remarks:

Laboratory Technician:

\_\_\_\_\_ B. Swiecicki

PART 572E  
KNEE IMPACT TEST

Dummy Serial Number            150  
 Sequential Test Number        1  
 Date                                 August 02, 2006  
 Workfile                            150LF 08-02-06.dat; 150RF 08-02-06.dat

TEST PARAMETER	SPECIFICATION	TEST RESULTS
<b>LEFT KNEE</b>		
Temperature	18.9 – 25.6 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Probe Velocity	2.07 – 2.13 m/s	2.13
Peak Knee Impact Force	4715.1 – 5782.7 N	4944.39
<b>RIGHT KNEE</b>		
Temperature	18.9 – 25.6 Deg C	21.1
Relative Humidity	10% - 70%	50.0
Probe Velocity	2.07 – 2.13 m/s	2.13
Peak Knee Impact Force	4715.1 – 5782.7 N	4737.28

Remarks:

Laboratory Technician:

B. Swiecicki

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PART 572E  
EXTERNAL DIMENSIONS

Dummy Serial Number            150  
 Sequential Test Number         1  
 Date                                     August 03, 2006

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature			21.1
Relative Humidity			50.0
Location for Chest Circumference	AA	16.9 - 17.1 in	17.0
Location for Waist Circumference	BB	8.9 - 9.1 in	9.0
Total Sitting Height	A	34.6 - 35.0 in	34.8
Shoulder Pivot Height	B	19.9 - 20.5 in	20.2
H-Point Height	C	3.3 - 3.5 in	3.4
H-Point from Backline	D	5.3 - 5.5 in	5.4
Shoulder Pivot from Backline	E	3.3 - 3.7 in	3.6
Thigh Clearance	F	5.5 - 6.1 in	6.0
Back of Elbow to Wrist Pivot	G	11.4 - 12.0 in	11.6
Skull Cap to Backline	H	1.6 - 1.8 in	1.7
Shoulder - Elbow Length	I	13.0 - 13.6 in	13.2
Elbow Rest Height	J	7.5 - 8.3 in	8.2
Buttock Knee Length	K	22.8 - 23.8 in	23.5
Popliteal Height	L	16.9 - 17.9 in	17.8
Knee Pivot Height	M	19.1 - 19.7 in	19.5
Buttock Popliteal Length	N	17.8 - 18.8 in	18.5
Chest Depth	O	8.4 - 9.0 in	9.0
Foot Length	P	9.9 - 10.5 in	10.2
Shoulder Breadth	V	16.6 - 17.2 in	16.9
Foot Breadth	W	3.6 - 4.2 in	4.0
Chest Circumference (With Jacket)	Y	38.2 - 39.4 in	39.1
Waist Circumference	Z	32.9 - 34.1 in	33.8

Remarks:

Laboratory Technician:

B. Swiecicki

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## **APPENDIX D**

### **DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION**

INSTRUMENT CALIBRATION FOR DRIVER DUMMY  
(Six Month Calibration Minimum)

DRIVER DUMMY (S/N 142)		Manufacturer	Serial #	Calibration	
				Last	Next
Head	X	ENTRAN	AC-02A16-A09	19-Apr-06	18-Oct-06
	Y	ENTRAN	AC-02I0210-N20	19-Apr-06	18-Oct-06
	Z	ENDEVCO	AC-J19244	17-Apr-06	16-Oct-06
Head	X (R)	ENTRAN	AC-03D03D09-N18	11-Jul-06	9-Jan-07
	Y (R)	ENTRAN	AC-99102-F09	19-Apr-06	18-Oct-06
	Z (R)	ENDEVCO	AC-J23996	17-Apr-06	16-Oct-06
Neck Load Cell	X	DENTON	LC-280FX	21-Apr-06	20-Oct-06
	Y	DENTON	LC-280FY	21-Apr-06	20-Oct-06
	Z	DENTON	LC-280FZ	21-Apr-06	20-Oct-06
Neck Moment	X	DENTON	LC-280MX	21-Apr-06	20-Oct-06
	Y	DENTON	LC-280MY	21-Apr-06	20-Oct-06
	Z	DENTON	LC-280MZ	21-Apr-06	20-Oct-06
Chest	X	ENTRAN	AC-03E03D16-F16	16-May-06	14-Nov-06
	Y	ENTRAN	AC-05H31-Z04	15-May-06	13-Nov-06
	Z	ENTRAN	AC-04J04I20-Z04	16-May-06	14-Nov-06
Chest	X (R)	ENTRAN	AC-03E03E21-M02	15-May-06	13-Nov-06
	Y (R)	ENTRAN	AC-01G18-F08	16-May-06	14-Nov-06
	Z (R)	ENTRAN	AC-03F03E29-N04	16-May-06	14-Nov-06
Chest Deflection	X	SERVO	DS-142	5-Apr-06	4-Oct-06
Pelvic	X	ENTRAN	AC-00L13-F10	19-Apr-06	18-Oct-06
	Y	ENTRAN	AC-03F03F09-N06	19-Apr-06	18-Oct-06
	Z	ENTRAN	AC-03E03E21-M06	19-Apr-06	18-Oct-06

INSTRUMENT CALIBRATION FOR DRIVER DUMMY  
(Six Month Calibration Minimum)

DRIVER DUMMY (S/N 142)	Manufacturer	Serial #	Calibration		
			Last	Next	
Left Femur Load Cell	Fz	DENTON	LC-1523	21-Apr-06	20-Oct-06
Right Femur Load Cell	Fz	DENTON	LC-1524	21-Apr-06	20-Oct-06
Left Upper Tibia	Mx	DENTON	LC-265MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-265MY	24-Apr-06	23-Oct-06
Left Lower Tibia	Fz	DENTON	LC-178FZ	24-Apr-06	23-Oct-06
	Mx	DENTON	LC-178MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-178MY	24-Apr-06	23-Oct-06
Right Upper Tibia	Mx	DENTON	LC-200MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-200MY	24-Apr-06	23-Oct-06
Right Lower Tibia	Fz	DENTON	LC-128FZ	24-Apr-06	23-Oct-06
	Mx	DENTON	LC-128MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-128MY	24-Apr-06	23-Oct-06
Left Foot Rear	X	ENDEVCO	AC-AJ7G1	17-Apr-06	16-Oct-06
	Z	ENDEVCO	AC-J20084	17-Apr-06	16-Oct-06
Left Foot Front	Z	ENDEVCO	AC-J20004	17-Apr-06	16-Oct-06
Right Foot Rear	X	ENDEVCO	AC-J27079	18-Apr-06	17-Oct-06
	Z	ENDEVCO	AC-ACCE6	18-Apr-06	17-Oct-06
Right Foot Front	Z	ENDEVCO	AC-AAMP6	18-Apr-06	17-Oct-06
Lap Belt Load Cell	FIRST TECHNOLOGY	LC-159	11-Jul-06	9-Jan-07	
Shoulder Belt Load Cell	FIRST TECHNOLOGY	LC-173	11-Jul-06	9-Jan-07	

INSTRUMENT CALIBRATION FOR PASSENGER DUMMY  
(Six Month Calibration Minimum)

PASSENGER DUMMY (S/N 150)	Manufacturer	Serial #	Calibration		
			Last	Next	
Head	X	ENDEVCO	AC-J19996	19-Apr-06	18-Oct-06
	Y	ENDEVCO	AC-J14381	19-Apr-06	18-Oct-06
	Z	ENDEVCO	AC-J19547	19-Apr-06	18-Oct-06
Head	X (R)	ENDEVCO	AC-AJ4P7	19-Apr-06	18-Oct-06
	Y (R)	ENDEVCO	AC-J27366	18-Apr-06	17-Oct-06
	Z (R)	ENDEVCO	AC-P16676	7-Jul-06	5-Jan-07
Neck Load Cell	X	DENTON	LC-157FX	21-Apr-06	20-Oct-06
	Y	DENTON	LC-157FY	21-Apr-06	20-Oct-06
	Z	DENTON	LC-157FZ	21-Apr-06	20-Oct-06
Neck Moment	X	DENTON	LC-157MX	21-Apr-06	20-Oct-06
	Y	DENTON	LC-157MY	21-Apr-06	20-Oct-06
	Z	DENTON	LC-157MZ	21-Apr-06	20-Oct-06
Chest	X	ENDEVCO	AC-J20083	20-Apr-06	19-Oct-06
	Y	ENTRAN	AC-04J04J07-M02	20-Apr-06	19-Oct-06
	Z	ENDEVCO	AC-J19223	20-Apr-06	19-Oct-06
Chest	X (R)	ENDEVCO	AC-P35817	10-Jul-06	8-Jan-07
	Y (R)	ENDEVCO	AC-P35790	10-Jul-06	8-Jan-07
	Z (R)	ENDEVCO	AC-P39574	10-Jul-06	8-Jan-07
Chest Deflection	X	SERVO	DS-150	13-Apr-06	12-Oct-06
Pelvic	X	ENDEVCO	AC-J21985	19-Apr-06	18-Oct-06
	Y	ENDEVCO	AC-AAMW5	19-Apr-06	18-Oct-06
	Z	ENDEVCO	AC-AJ5P9	19-Apr-06	18-Oct-06

INSTRUMENT CALIBRATION FOR PASSENGER DUMMY  
(Six Month Calibration Minimum)

PASSENGER DUMMY (S/N 150)	Manufacturer	Serial #	Calibration		
			Last	Next	
Left Femur Load Cell	Fz	DENTON	LC-1527	21-Apr-06	20-Oct-06
Right Femur Load Cell	Fz	DENTON	LC-1528	21-Apr-06	20-Oct-06
Left Upper Tibia	Mx	DENTON	LC-263MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-263MY	24-Apr-06	23-Oct-06
Left Lower Tibia	Fz	DENTON	LC-174FZ	24-Apr-06	23-Oct-06
	Mx	DENTON	LC-174MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-174MY	24-Apr-06	23-Oct-06
Right Upper Tibia	Mx	DENTON	LC-274MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-274MY	24-Apr-06	23-Oct-06
Right Lower Tibia	Fz	DENTON	LC-185FZ	24-Apr-06	23-Oct-06
	Mx	DENTON	LC-185MX	24-Apr-06	23-Oct-06
	My	DENTON	LC-185MY	24-Apr-06	23-Oct-06
Left Foot Rear	X	ENDEVCO	AC-P14914	20-Apr-06	19-Oct-06
	Z	ENDEVCO	AC-AGRP4	20-Apr-06	19-Oct-06
Left Foot Front	Z	ENDEVCO	AC-AJ4G1	20-Apr-06	19-Oct-06
Right Foot Rear	X	ENDEVCO	AC-J36723	20-Apr-06	19-Oct-06
	Z	ENDEVCO	AC-J27496	20-Apr-06	19-Oct-06
Right Foot Front	Z	ENDEVCO	AC-J35747	20-Apr-06	19-Oct-06
Lap Belt Load Cell	FIRST TECHNOLOGY	LC-178	11-Jul-06	9-Jan-07	
Shoulder Belt Load Cell	FIRST TECHNOLOGY	LC-180	11-Jul-06	9-Jan-07	

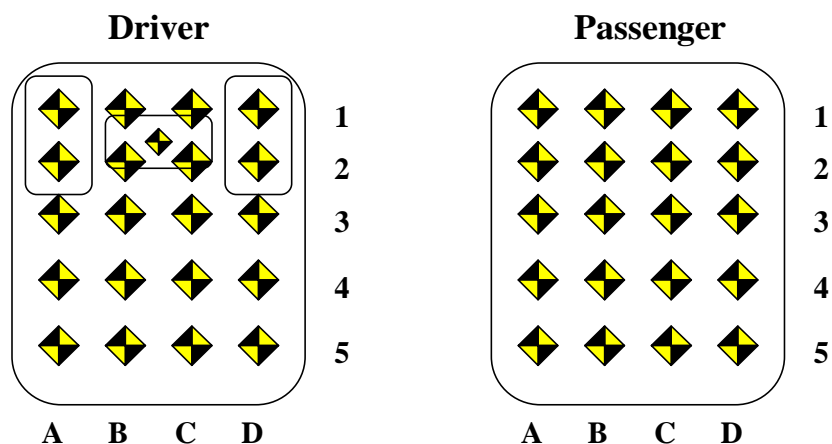
INSTRUMENT CALIBRATION FOR VEHICLE ACCELEROMETERS  
(Six Month Calibration Minimum)

	Manufacturer	Serial #	Calibration	
			Last	Next
Left Seat Rear Crossmember X	GS SENSORS	AC-9440-046	11-Jul-06	9-Jan-07
Right Rear Seat Crossmember X	ICS	AC-FGP19	11-Jul-06	9-Jan-07
Top of Engine	ICS	AC-8062-003	17-Jun-06	16-Dec-06
Bottom of Engine	GS SENSORS	AC-9440-024	3-Aug-06	1-Feb-07
Right Disc Brake Caliper	ICS	AC-FGP03	26-Jul-06	24-Jan-07
Left Disc Brake Caliper	GS SENSORS	AC-9440-045	26-Jul-06	24-Jan-07
Left Seat Rear Crossmember Z	GS SENSORS	AC-9440-023	11-Jul-06	9-Jan-07
Right Seat Rear Crossmember Z	ICS	AC-FGP29	11-Jul-06	9-Jan-07

## **APPENDIX E**

### **VEHICLE INTERIOR INTRUSION MEASUREMENTS**

## DRIVER SIDE INTRUSION MEASUREMENTS

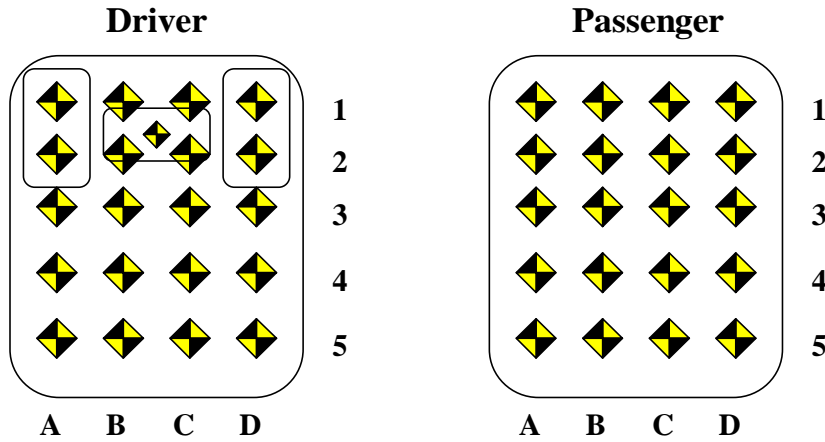


### Driver Side Intrusion Measurements

Intrusion Location	PRE-TEST (mm)			POST-TEST (mm)			CHANGE (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
A1	3449	-577	-395	3423	-569	-417	26	-8	22
B1	3547	-442	-396	3502	-421	-437	45	-21	41
C1	3575	-312	-398	3468	-299	-435	107	-13	37
D1	3579	-182	-397	3435	-185	-439	144	3	42
A2	3413	-577	-335	3390	-569	-355	23	-8	20
B2	3450	-446	-335	3413	-434	-365	37	-12	30
C2	3470	-314	-321	3430	-302	-346	40	-12	25
D2	3486	-181	-301	3415	-187	-334	71	6	33
A3	3362	-577	-286	3342	-569	-305	20	-8	19
B3	3360	-443	-279	3329	-433	-301	31	-10	22
C3	3361	-315	-258	3331	-308	-276	30	-7	18
D3	3364	-181	-239	3335	-180	-240	29	-1	1
A4	3278	-578	-264	3261	-571	-285	17	-7	21
B4	3277	-446	-262	3254	-442	-267	23	-4	5
C4	3276	-315	-252	3248	-312	-262	28	-3	10
D4	3276	-184	-236	3249	-186	-228	27	2	-8
A5	3196	-577	-260	3179	-576	-290	17	-1	30
B5	3198	-446	-261	3175	-448	-263	23	2	2
C5	3196	-317	-258	3169	-318	-256	27	1	-2
D5	3196	-185	-253	3167	-187	-236	29	2	-17
BP	3403	-339	-463	3343	-353	-463	60	14	0
G	3104	-519	-707	3095	-521	-713	9	2	6
H	3098	-220	-705	3083	-223	-720	15	3	15
L	2895	-362	-882	2898	-374	-859	-3	12	-23
AB	2794	-627	-324	2798	-636	-309	-4	9	-15

BP=Brake Pedal, G=Left side of bolster, H=Right side of bolster, L=Steering wheel center;  
 AB = Front outboard seat anchor bolt

PASSENGER SIDE INTRUSION MEASUREMENTS



Passenger Side Intrusion Measurements

Intrusion Location	PRE-TEST (mm)			POST-TEST (mm)			CHANGE (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
A1	3526	190	-415	3448	192	-456	78	-2	41
B1	3574	321	-418	3503	305	-471	71	16	53
C1	3554	446	-419	3508	431	-469	46	15	50
D1	3465	579	-418	3449	579	-437	16	0	19
A2	3455	188	-340	3434	181	-353	21	7	13
B2	3465	317	-347	3442	308	-378	23	9	31
C2	3464	444	-347	3444	436	-382	20	8	35
D2	3432	579	-339	3428	571	-364	4	8	25
A3	3360	188	-284	3347	189	-288	13	-1	4
B3	3360	318	-284	3338	314	-307	22	4	23
C3	3360	445	-284	3347	442	-310	13	3	26
D3	3358	578	-287	3346	568	-326	12	10	39
A4	3280	187	-261	3274	188	-249	6	-1	-12
B4	3278	318	-259	3272	317	-253	6	1	-6
C4	3278	447	-259	3279	448	-270	-1	-1	11
D4	3279	577	-259	3288	576	-291	-9	1	32
A5	3198	182	-261	3193	185	-239	5	-3	-22
B5	3197	316	-257	3196	317	-253	1	-1	-4
C5	3195	448	-257	3200	449	-259	-5	-1	2
D5	3193	580	-255	3209	580	-265	-16	0	10
R	3096	212	-709	3078	209	-717	18	3	8
S	3116	504	-707	3109	499	-710	7	5	3
AB	2794	622	-327	2802	633	-311	-8	-11	-16

R=Left side of bolster, S=Right side of bolster, L=Steering wheel center;  
 AB = Front outboard seat anchor bolt