

REPORT NUMBER: NCAP-MGA-2008-018

**NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST**

**GENERAL MOTORS DE MEXICO, S. DE R.L. DE C.V.
2008 SATURN VUE XR
NHTSA NUMBER: G80102**

**PREPARED BY:
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5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: May 16, 2008

Final Report Date: June 18, 2008

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
1200 NEW JERSEY AVENUE, SE, ROOM W43-410
WASHINGTON, D.C. 20590**

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16. Abstract A frontal barrier impact was conducted on a 2008 Saturn Vue XR at MGA Research Corporation on May 16, 2008. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The impact velocity was 56.8 km/h. The ambient temperature at the barrier face at the time of impact was 21 degrees Celsius. The vehicle's maximum post test static crush is 545 mm located at the vehicle's centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows: <table border="1" style="width: 100%; margin-top: 10px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Measurement Description</u></th> <th style="text-align: left;"><u>Units</u></th> <th style="text-align: left;"><u>Threshold</u></th> <th style="text-align: left;"><u>Driver ATD</u></th> <th style="text-align: left;"><u>Pass. ATD</u></th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC)</td> <td>N/A</td> <td>1000</td> <td>475</td> <td>368</td> </tr> <tr> <td>Max. Thorax Accel. (3ms Clip)</td> <td>G's</td> <td>60</td> <td>42</td> <td>45</td> </tr> <tr> <td>Left Femur Force</td> <td>Newton</td> <td>10009</td> <td>-4305</td> <td>-5520</td> </tr> <tr> <td>Right Femur Force</td> <td>Newton</td> <td>10009</td> <td>-5081</td> <td>-2108</td> </tr> </tbody> </table>				<u>Measurement Description</u>	<u>Units</u>	<u>Threshold</u>	<u>Driver ATD</u>	<u>Pass. ATD</u>	Head Injury Criteria (HIC)	N/A	1000	475	368	Max. Thorax Accel. (3ms Clip)	G's	60	42	45	Left Femur Force	Newton	10009	-4305	-5520	Right Femur Force	Newton	10009	-5081	-2108
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-D-00028. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier was impacted by a 2008 Saturn Vue XR at a velocity of 56.8 kph. The test was performed at MGA Research Corporation on May 16, 2008. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and fourteen 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 head, chest and pelvis tri-axial accelerometers, chest displacement potentiometer, upper neck transducers, right/left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 065) and right-front passenger (position 2) ATD (Serial No. 066) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest, and femur response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the 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 545 mm and both the driver and passenger side doors remained closed and latched during the impact event and were operable after the impact.

The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC	T ¹	T ²	Clip (g)	T ¹	T ²	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver	475	66.4	94.9	42	57.2	60.2	-25	-4305	-5081
Passenger	368	63.3	99.3	45	69.1	72.1	-27	-5520	-2108

The test data can be found on the NHTSA website at www.nhtsa.dot.gov.

TEST NOTES

There was no valid data collected for:

Passenger Chest Y Redundant - Questionable

Top of Engine X

Bottom of Engine X

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
CRASH TEST SUMMARY

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None
Glazing Damage	Windshield cracked	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1162
Center	mm	1103
Right Side	mm	1081
Average	mm	1115

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	856	888
Lap belt length as measured on ATD	mm	760	774
Remainder of belt on reel	mm	1659	1670
Total belt length for continuous webbing systems	mm	3275	3332

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

TEST VEHICLE INFORMATION

Manufacturer	Saturn
Model	Vue
Body Style	MPV
NHTSA No.	G80102
VIN	3GSCL53708S685149
Color	Golden Cashmere
Delivery Date	5/13/2008
Odometer Reading (mile)	89
Dealer	Boucher Fleet Group
Transmission	Automatic
Final Drive	Front
Number of Cylinders	6
Engine Displacement (L)	3.6
Engine Placement	Lateral
Automatic Door Lock (ADL)	Yes
Owners Manual Details Instructions on Disabling ADLs	No
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	Yes
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All Wheel Drive	No
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors de Mexico, S. de R.L. de C.V.
Date of Manufacture	04/08

GVWR (kg)	2214
GAWR Front (kg)	1185
GAWR Rear (kg)	1280

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				418
Cargo Wt. (RCLW) (kg)				78

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

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	525.3	381.0		554.7	462.2	
Right	kg	523.4	362.9		556.6	445.9	
Ratio	%	58.5	41.5		55.0	45.0	
Totals	kg	1048.7	743.9	1792.6	1111.3	908.1	2019.4

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1792.6
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	78
Calculated Vehicle Target Weight (TVTW)	kg	2026.6

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	795	803	801	807	1125
As Tested	mm	785	789	783	788	1219
Post Test	mm	828	821	787	775	

Vehicle Wheelbase (mm): 2710
 Weight of Ballast secured in cargo area (kg): 36.3

Vehicle Components Removed: Jack, spare tire, cargo carpet, spare tire covering

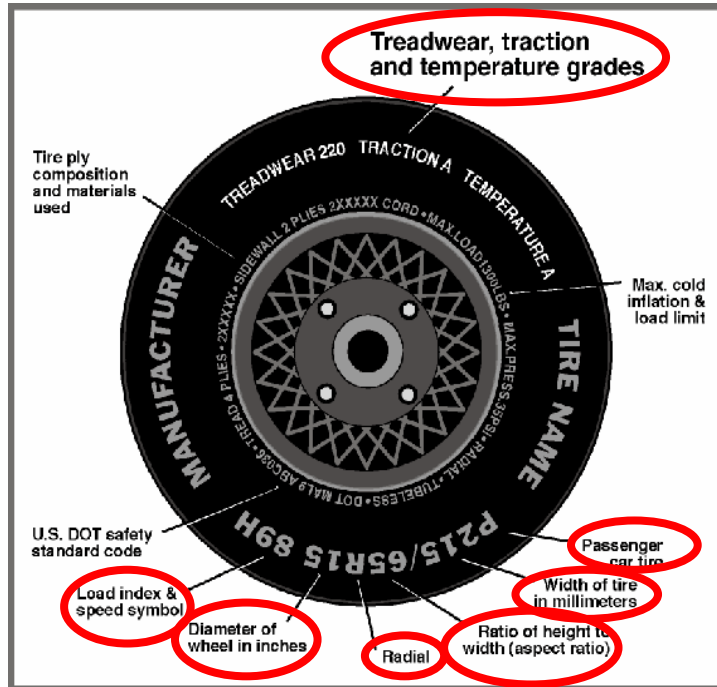
Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008



DATA FROM TIRE AND TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	210	210
Recommended Tire Size	P235/60R17	P235/60R17
Tire Size on Vehicle	P235/60R17	P235/60R17
Tire Manufacturer	Bridgestone	Bridgestone
Tire Name	Dueler H/T	Dueler H/T
Tire Type	Passenger	Passenger
Tire Width (mm)	235	235
Ratio of Height to Width (aspect ratio)	60	60
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	100S	100S
Treadwear	360	360
Traction Grade	B	B
Temperature Grade	B	B

DATA SHEET NO. 4
TEST VEHICLE INFORMATION

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

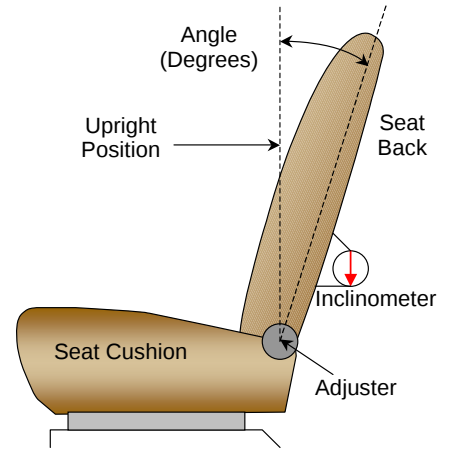
NHTSA No.: G80102
Test Date: 5/16/2008

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Set at 25 degrees measured from upright position (6.5° on headrest post).

Driver seat back angle: 6.4° (on headrest post)

Passenger seat back angle: 6.0° (on headrest post)



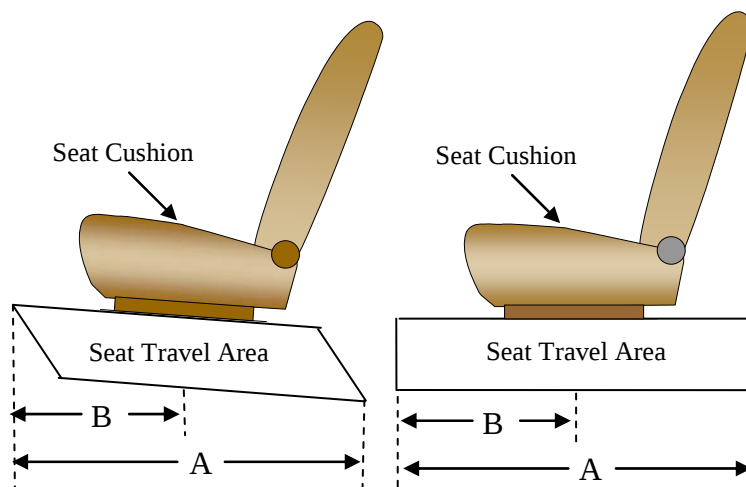
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	266 mm	133 mm
Passenger Seat	240 mm	120 mm

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were set in the mid position.



DATA SHEET NO. 4...(CONTINUED)

TEST VEHICLE INFORMATION

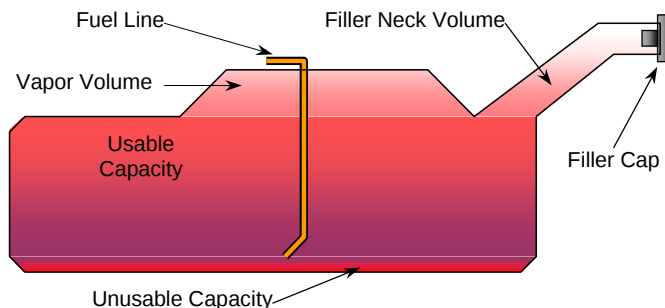
Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	75.7
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	69.6 to 71.2
Actual Amount of Solvent used	69.6
1/3 of Usable Capacity	25.2

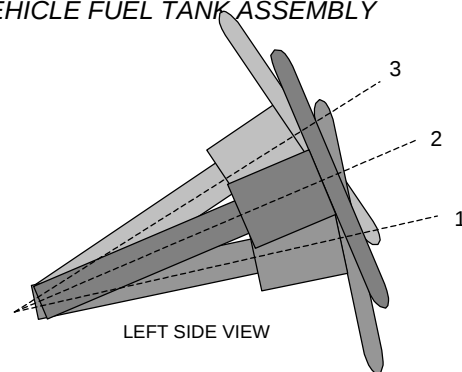
The test vehicle is equipped with an electric fuel pump. When ignition is ON, fuel pump is activated and stops after 3 sec of operation.



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

	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		61.6
Geometric center position No. 2		63.8
Uppermost position No. 3		66.0

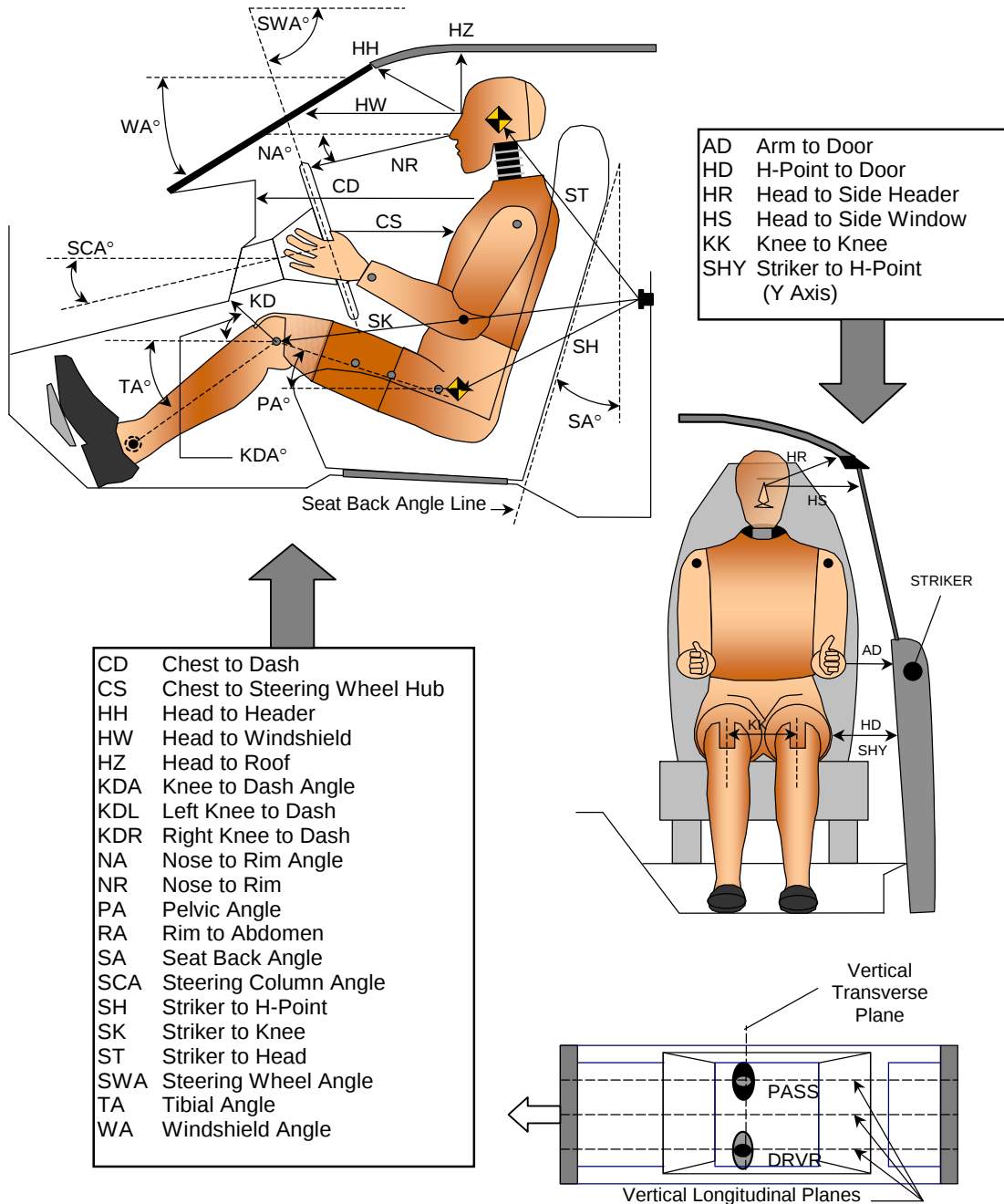
DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

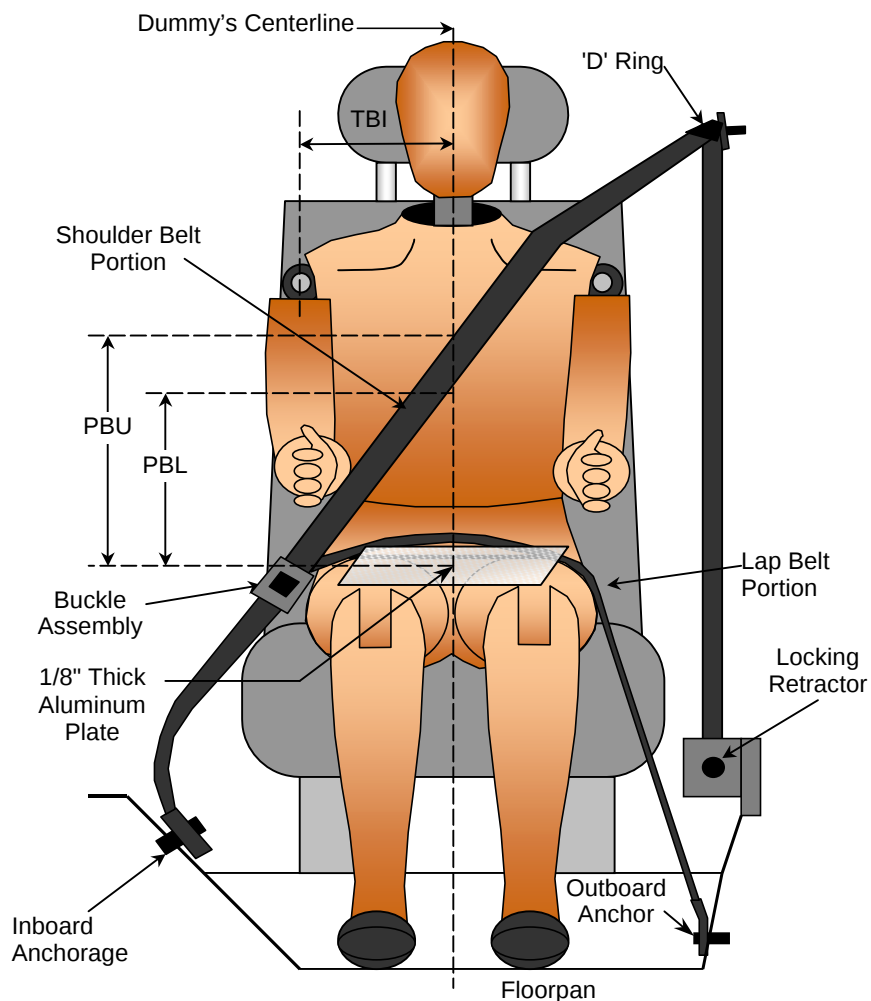
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		30.1		
SWA	Steering Wheel Angle		63.8		
SCA	Steering Column Angle		17.9		
SA	Seat Back Angle		6.4		6.0
HZ	Head to Roof (Z)	234	90	220	90
HH	Head to Header	341	28.7	341	27.3
HW	Head to Windshield	664	0	646	0
HR	Head to Side Header (Y)	229		227	
NR	Nose to Rim	421	10.3		
CD	Chest to Dash	531		519	
CS	Chest to Steering Hub	329	2.1		
RA	Rim to Abdomen	195	0		
KDL	Left Knee to Dash	151	20.9	112	
KDR	Right Knee to Dash	113		135	24.4
PA	Pelvic Angle		23.6		23.6
TA	Tibia Angle		52.1		50.8
KK	Knee to Knee (Y)	326		276	
SK	Striker to Knee	594	93.4	604	92.3
ST	Striker to Head	531	8.4	553	10.9
SH	Striker to H-Point	254	126.7	234	117.9
SHY	Striker to H-Point (Y)	252		241	
HS	Head to Side Window	323		322	
HD	H-Point to Door (Y)	144		113	
AD	Arm to Door (Y)	135		106	
AA	Ankle to Ankle	315		220	

DATA SHEET NO. 6 **SEAT BELT POSITIONING DATA**

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	360	360
PBL - To surface of reference to belt lower edge	mm	280	280

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

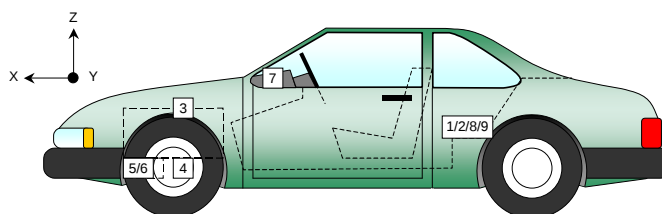
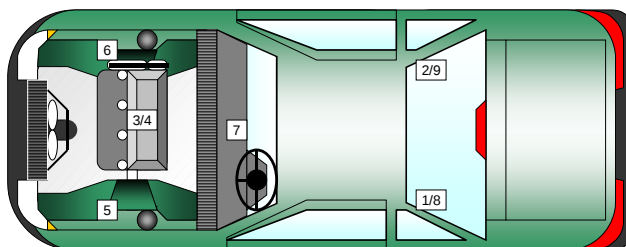
Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1739	-369	473
2	Right Rear X-Member X	1739	369	473
3	Engine Top X	3709	47	1065
4	Engine Bottom X	3825	42	230
5	Left Brake Caliper X	3710	-698	270
6	Right Brake Caliper X	3710	698	270
7	Instrument Panel X			
8	Left Rear X-Member Z	1739	-369	473
9	Right Rear X-Member Z	1739	369	473

Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ up)



DATA SHEET NO. 8

SUMMARY OF FMVSS 212 AND FMVSS 219 (Partial) DATA

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

Windshield Mounting Details:

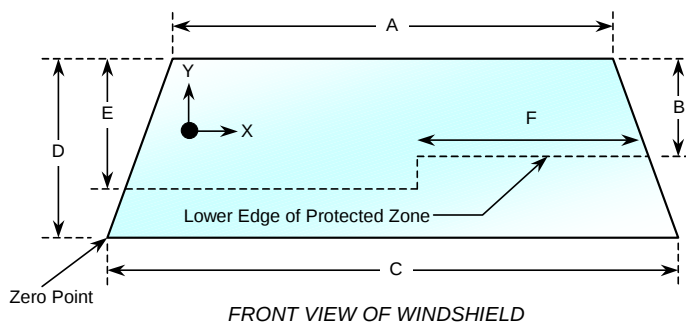
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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, which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2148	2148	100
Right Side	2148	2148	100
Total	4296	4296	100



Item	Units	Value
A	mm	1168
B	mm	570
C	mm	1370
D	mm	879
E	mm	570
F	mm	470

AREA OF PROTECTED ZONE FAILURES - NONE

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

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. **None**

X	Y

DATA SHEET NO. 9
SUMMARY OF FMVSS 301 DATA

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

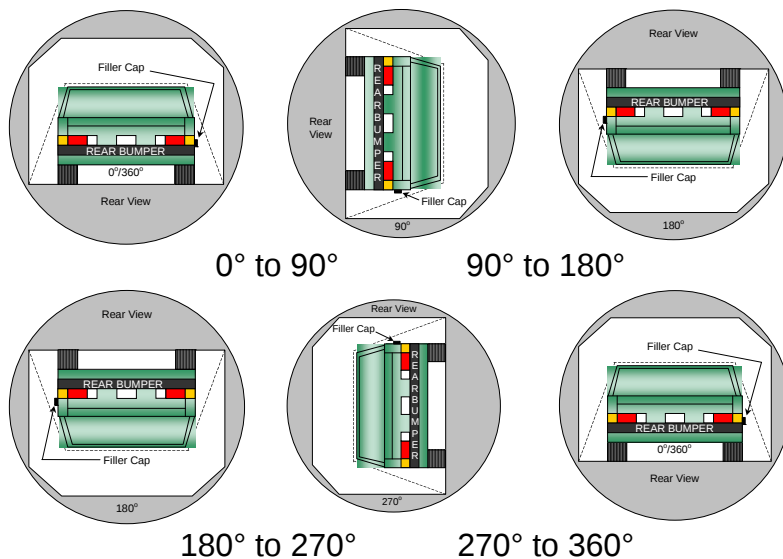
FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 10:20 am

Stoddard Solvent Spillage Measurements

- A. From impact until vehicle motion ceases: 0 oz.
 (Maximum Allowable = 1 ounce)
- B. For the 5 minute period after motion ceases: 0 oz.
 (Maximum Allowable = 5 ounces)
- C. For the following 25 minutes: 0 oz.
 (Maximum Allowable = 1 oz. /minute)
- D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations:

None

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	124	300	0
90° to 180°	112	300	0
180° to 270°	111	300	0
270° to 360°	118	300	0

DATA SHEET NO. 10
VEHICLE MEASUREMENTS

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008

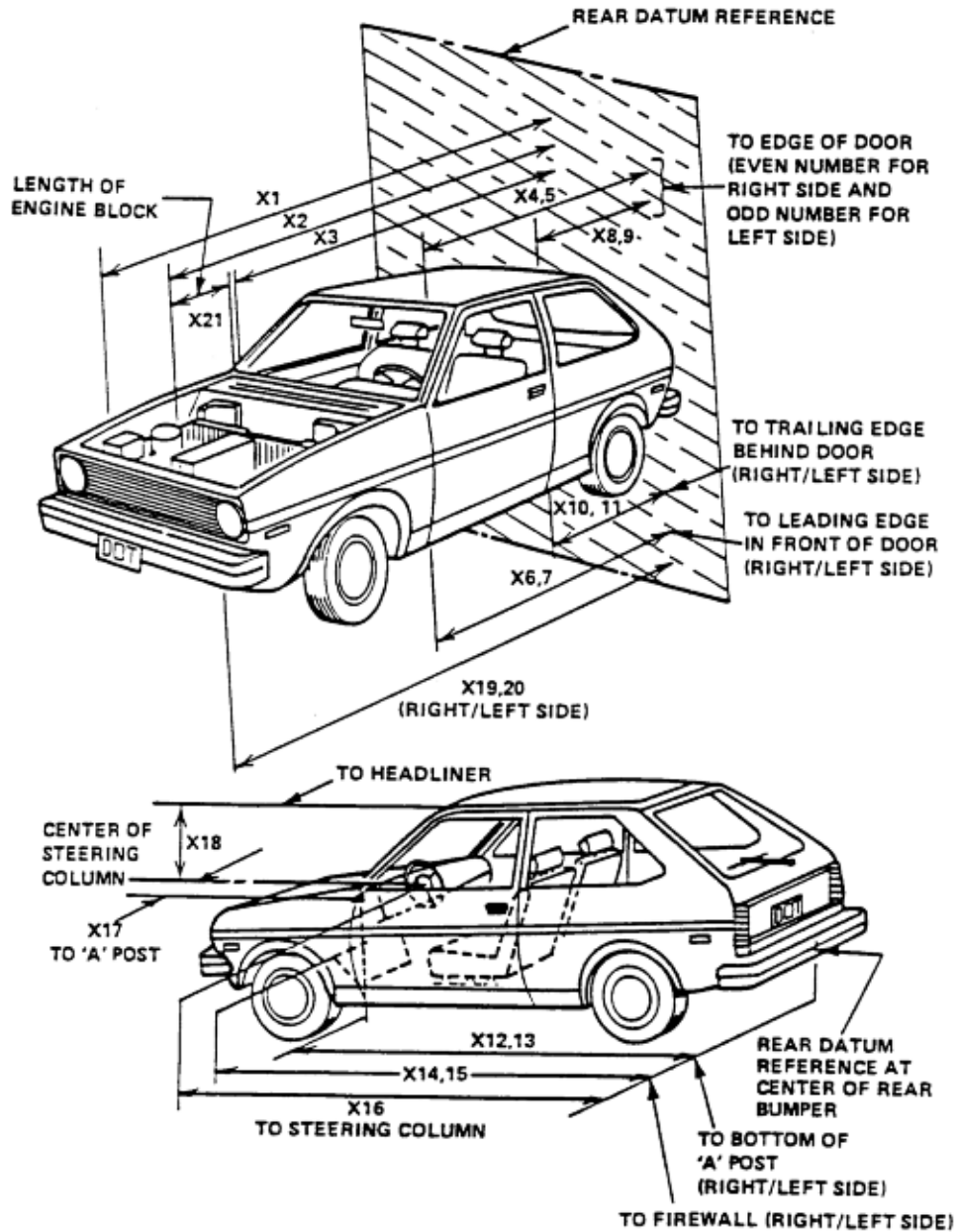
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4537	3992	545
2	RSOV to front of engine	mm	4002	3660	342
3	RSOV to firewall centerline	mm	3604	3420	184
4	RSOV to leading edge of right door	mm	3031	3042	-11
5	RSOV to leading edge of left door	mm	3033	3051	-18
6	RSOV to lower leading edge of right door	mm	3036	3021	15
7	RSOV to lower leading edge of left door	mm	3034	3018	16
8	RSOV to upper leading edge of right door	mm	1978	1980	-2
9	RSOV to upper leading edge of left door	mm	1979	1965	14
10	RSOV to lower trailing edge of right door	mm	2009	1997	12
11	RSOV to lower trailing edge of left door	mm	2007	1990	17
12	RSOV to bottom of right 'A' pillar	mm	3019	3021	-2
13	RSOV to bottom of left 'A' pillar	mm	3012	3008	4
14	RSOV to firewall on right side	mm	3475	3458	17
15	RSOV to firewall on left side	mm	3473	3443	30
16	RSOV to steering column	mm	2636	2652	-16
17	Center of steering column to left 'A' pillar	mm	371	370	1
18	Center of steering column to headlining	mm	461	488	-27
19	RSOV to right side of front bumper	mm	4367	3990	377
20	RSOV to left side of front bumper	mm	4366	3951	415
21	Length of engine block	mm	428	428	0
RD	RSOV to right side of dash panel	mm	2864	2838	26
CD	RSOV to center of dash panel	mm	2780	2773	7
LD	RSOV to left side of dash panel	mm	2843	2844	-1

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008



DATA SHEET NO. 10... (continued)**VEHICLE MEASUREMENTS**

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4537
2	Total Width	1787
3	Bumper Top Height	746
4	Bumper Bottom Height	403
5	Longitudinal Member Top Height	570
6	Distance between Longitudinal Members	1055
7	Longitudinal Member Width	123
8	Engine Top Height	1038
9	Engine Bottom Height	236
10	Engine and gearbox width	759
11	Front bumper-engine distance	412
12	Front shock absorber fixing height	998
13	Bonnet leading edge height	952
14	Front shock absorber fixing width	1167
15	Front bumper – front axle distance	920
16	Front axle – a pillar distance	539
17	A-pillar – B-pillar distance	1058
18	B-Pillar – rear axle distance	1110
19	B-pillar – C-pillar distance	940
20	Roof sill bottom height	1603
21	Roof sill top height	1668
22	Floor sill bottom height	300
23	Floor sill top height	390

DATA SHEET NO. 11
CAMERA LOCATIONS

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1165	-5000	1175	24	1000
3	Steering Column Top	1025	-5515	1275	25	1000
4	Steering Column Bottom	1010	-5440	895	25	1000
5	Driver Close-up	1305	-5670	1420	35	1000
6	Driver Angle	5695	-5155	2115	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	1770	5675	1210	24	1000
10	Right Passenger Half	1075	5105	1150	24	1000
11	Right Close-up	1315	5325	1445	35	1000
12	Right Angle	5600	5035	2150	50	1000
13	Windshield	-285	0	2860	12.5	1000
14	Top Driver	-135	-470	2180	24	1000
15	Top Passenger	-110	420	2180	24	1000
16	Pit Front	1350	0	-3150	24	1000
17	Pit Rear	3120	0	-3150	24	1000

***COORDINATES:**

+X = forward of impact plane
+Y = right of monorail centerline
+Z = above ground level

Cameras 7 & 8 were not used for this test.

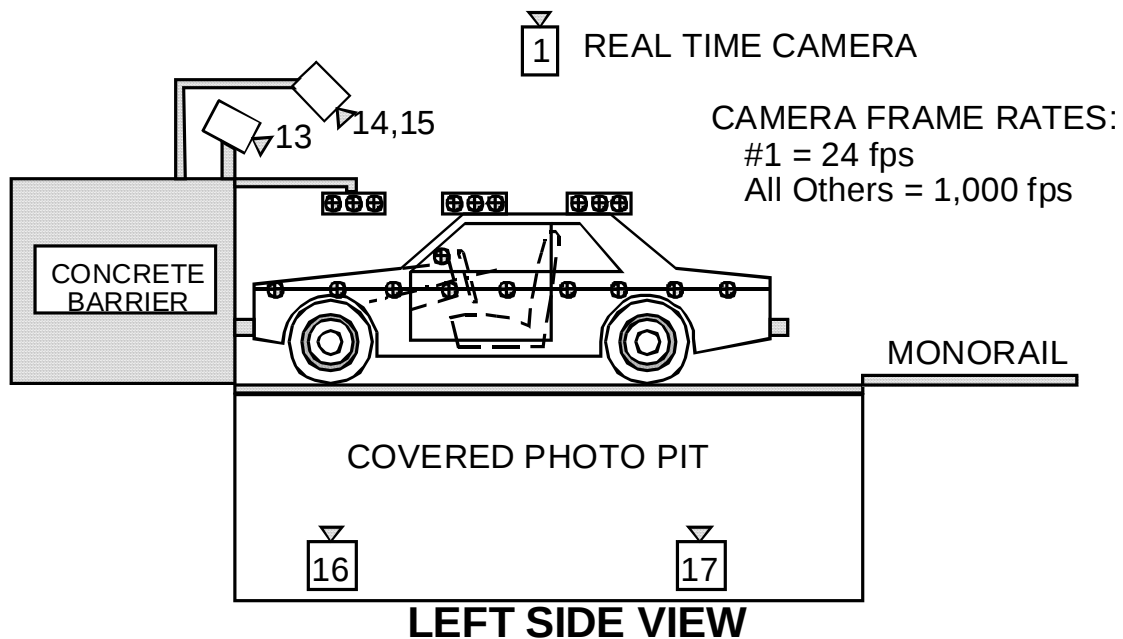
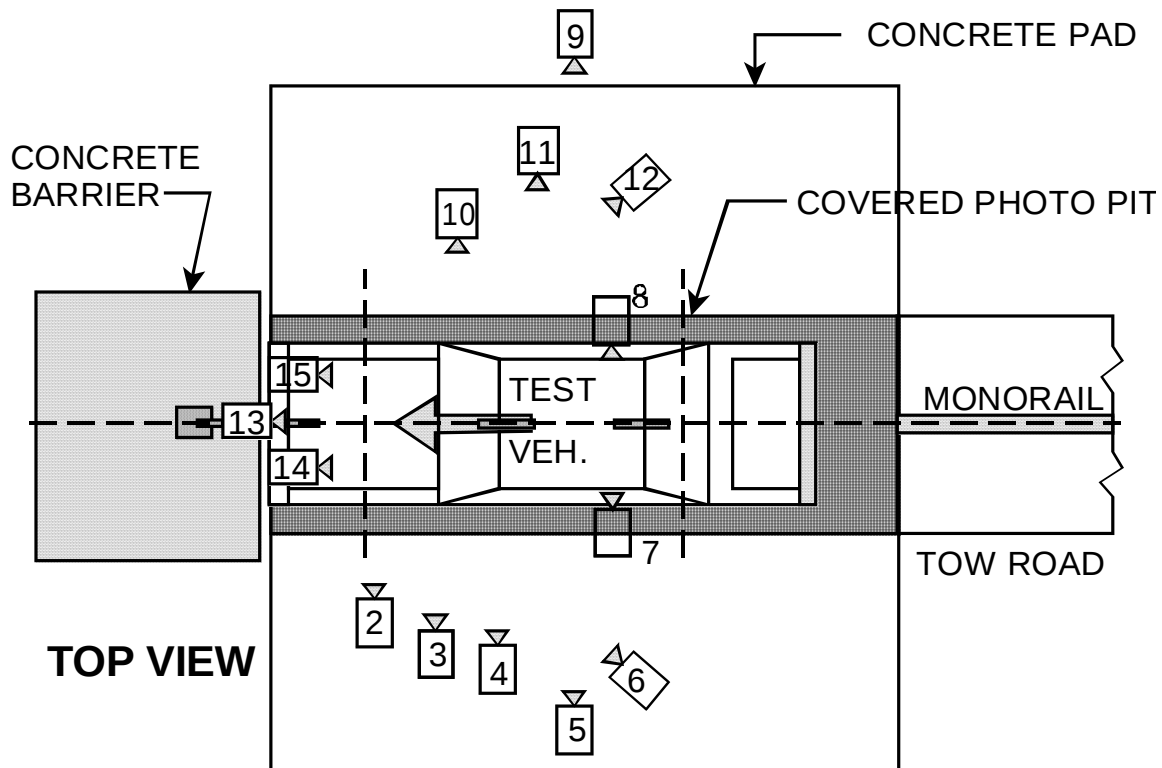
DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008

CAMERA POSITIONS FOR FRONTAL IMPACTS

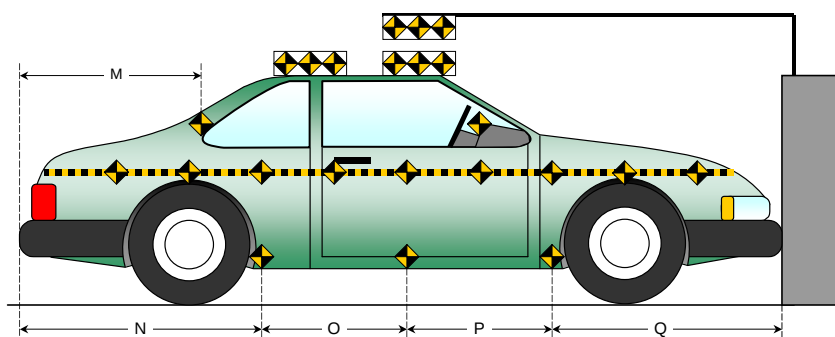
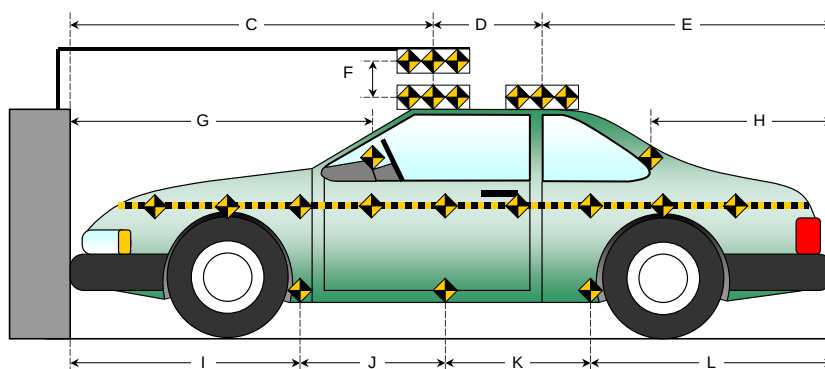
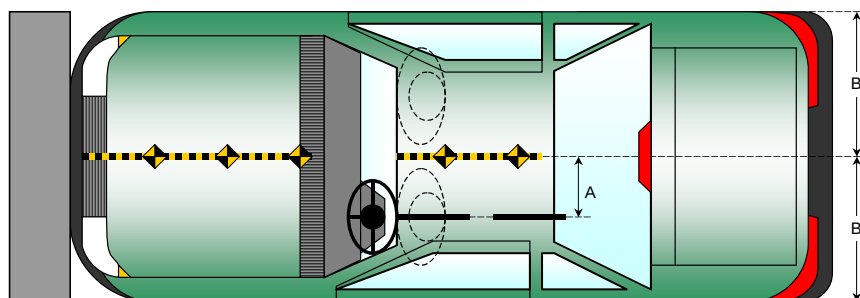


DATA SHEET NO. 12
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

Item	Value
A	375
B	894
C	2357
D	915
E	1265
F	75
G	
H	1026
I	1436
J	864
K	870
L	1367
M	1042
N	1384
O	868
P	871
Q	1414



DATA SHEET NO. 13
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

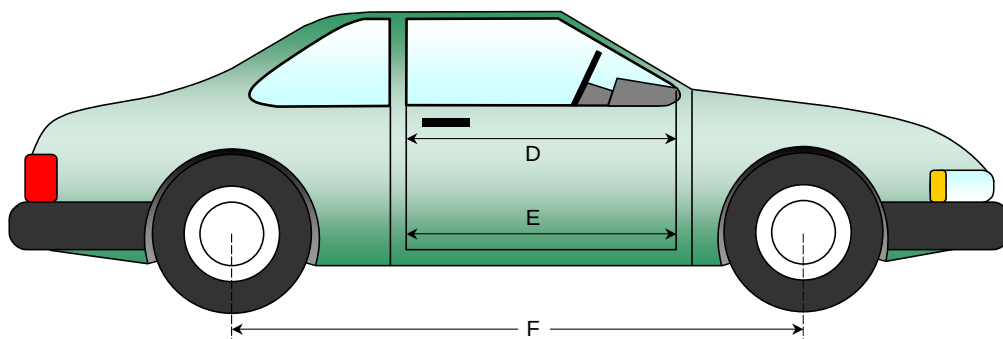
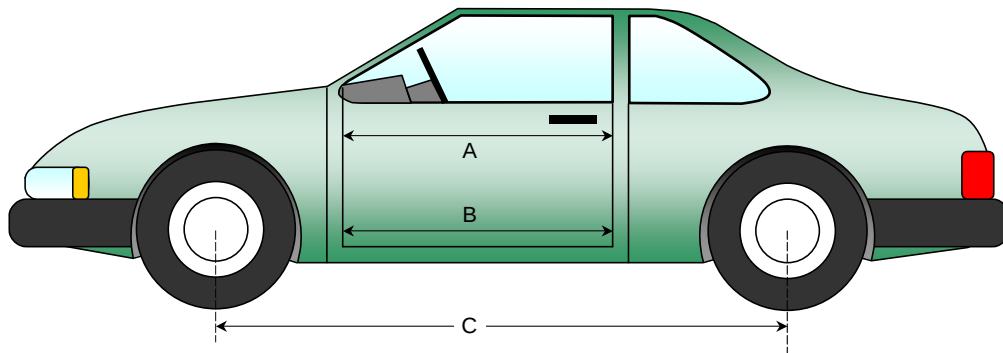
NHTSA No.: G80102
 Test Date: 5/16/2008

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	920	911	9
B	Left Side Lower	mm	820	820	0
D	Right Side Upper	mm	910	905	5
E	Right Side Lower	mm	820	820	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2710	2683	27
F	Right Side Wheelbase	mm	2710	2675	35



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

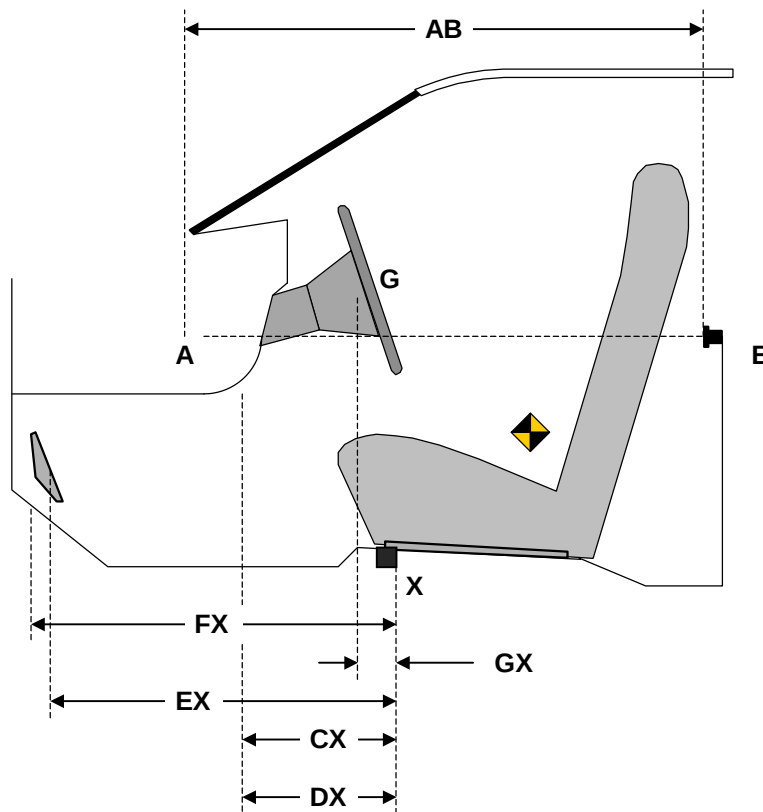
Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	840	840	0
CX	Left Knee Bolster to X	mm	317	348	-31
DX	Right Knee Bolster to X	mm	320	358	-38
EX	Brake Pedal to X	mm	548	515	33
FX	Foot Rest to X	mm	574	570	4
GX	Center of Steering Column Wheel Hub to X	mm	101	143	-42

X = Front of Seat Track (stationary)

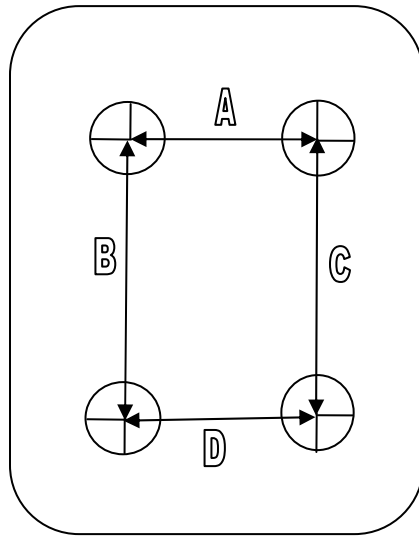


DRIVER COMPARTMENT

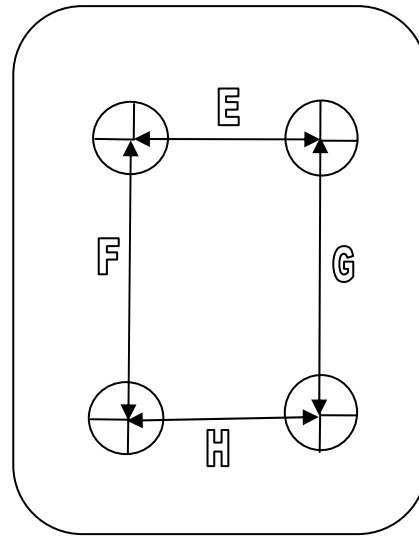
DATA SHEET NO. 13... (continued)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008



Driver



Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	227	241	-14
B	315	316	-1
C	306	305	1
D	226	232	-6
E	251	264	-13
F	273	271	2
G	283	281	2
H	234	236	-2

DATA SHEET NO. 14

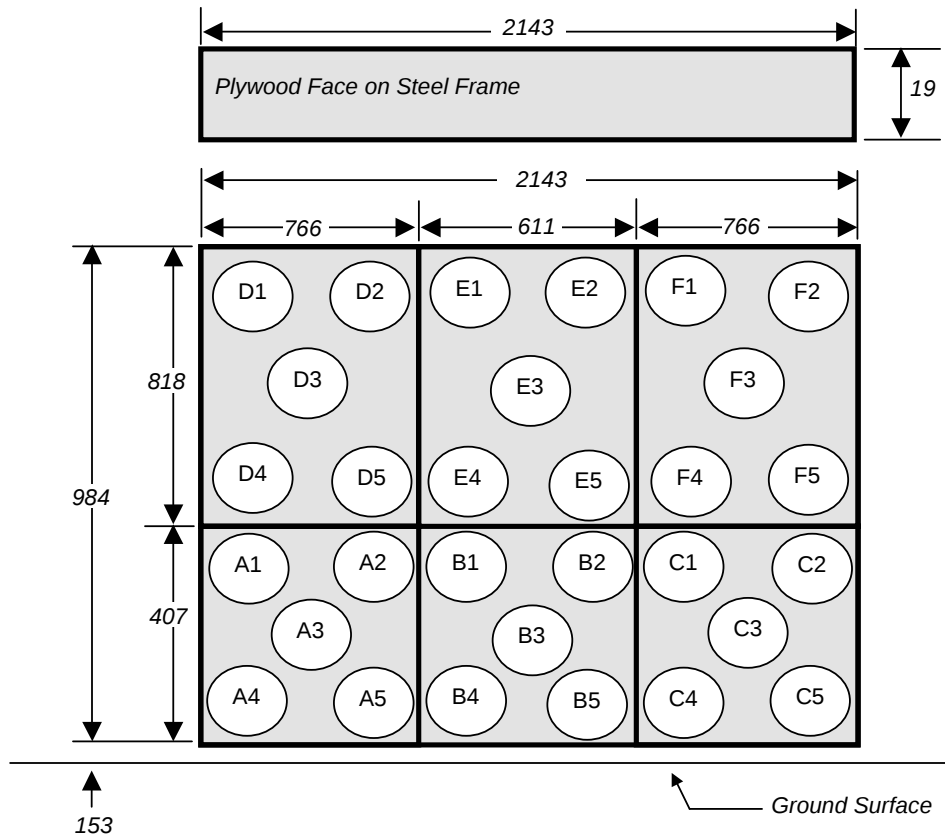
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

30 Load Cell Rigid Barrier

Load Cell Locations on Fixed Barrier



Group 4 D1-D5	Group 5 E1-E5	Group 6 F1-F5
Group 1 A1-A5	Group 2 B1-B5	Group 3 C1-C5

6 Groups of 5 Load Cells Each

DATA SHEET NO. 15
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2008 Saturn Vue XR
 Test Program: 35mph Frontal Impact

NHTSA No.: G80102
 Test Date: 5/16/2008

VEHICLE INFORMATION

VIN: 3GSCL53708S685149 Wheelbase (mm): 2710
 Vehicle Size Category: MPV Test Weight (kg): 2019.4

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 12
 Cal. Procedure/Interval: MGA procedure / 6 month
 Integration Algorithm: Trapezoidal Linearity: > 99%
 Impact Velocity (km/h): 56.8
 Velocity Change (km/h): 62.4 Time of Separation (msec): 114

CRUSH PROFILE

Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
 Damage Region Length (mm): 1219 Impact Mode: Frontal

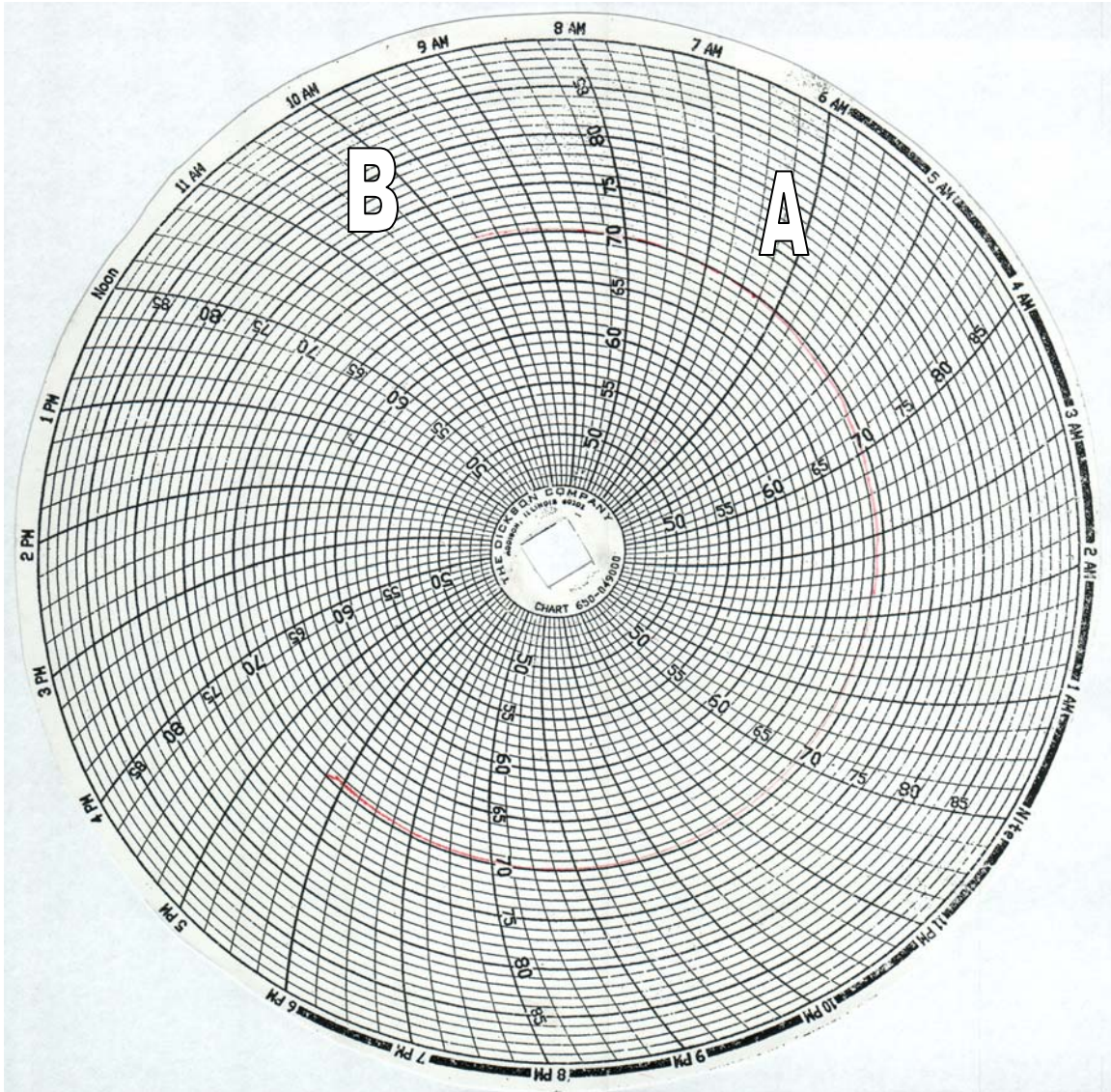
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4366	3951	415
C2	Crush zone 2 at left side	mm	4456	3938	518
C3	Crush zone 3 at left side	mm	4511	3980	531
C4	Crush zone 4 at right side	mm	4512	3971	541
C5	Crush zone 5 at right side	mm	4459	3939	520
C6	Crush zone 6 at right side	mm	4367	3990	377
L	C1 TO C6	mm	1219	1199	20

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2008 Saturn Vue XR
Test Program: 35mph Frontal Impact

NHTSA No.: G80102
Test Date: 5/16/2008



A = Dummies installed in vehicle at 6:00 am

B = Test conducted at 10:20 am

APPENDIX A
PHOTOGRAPHS

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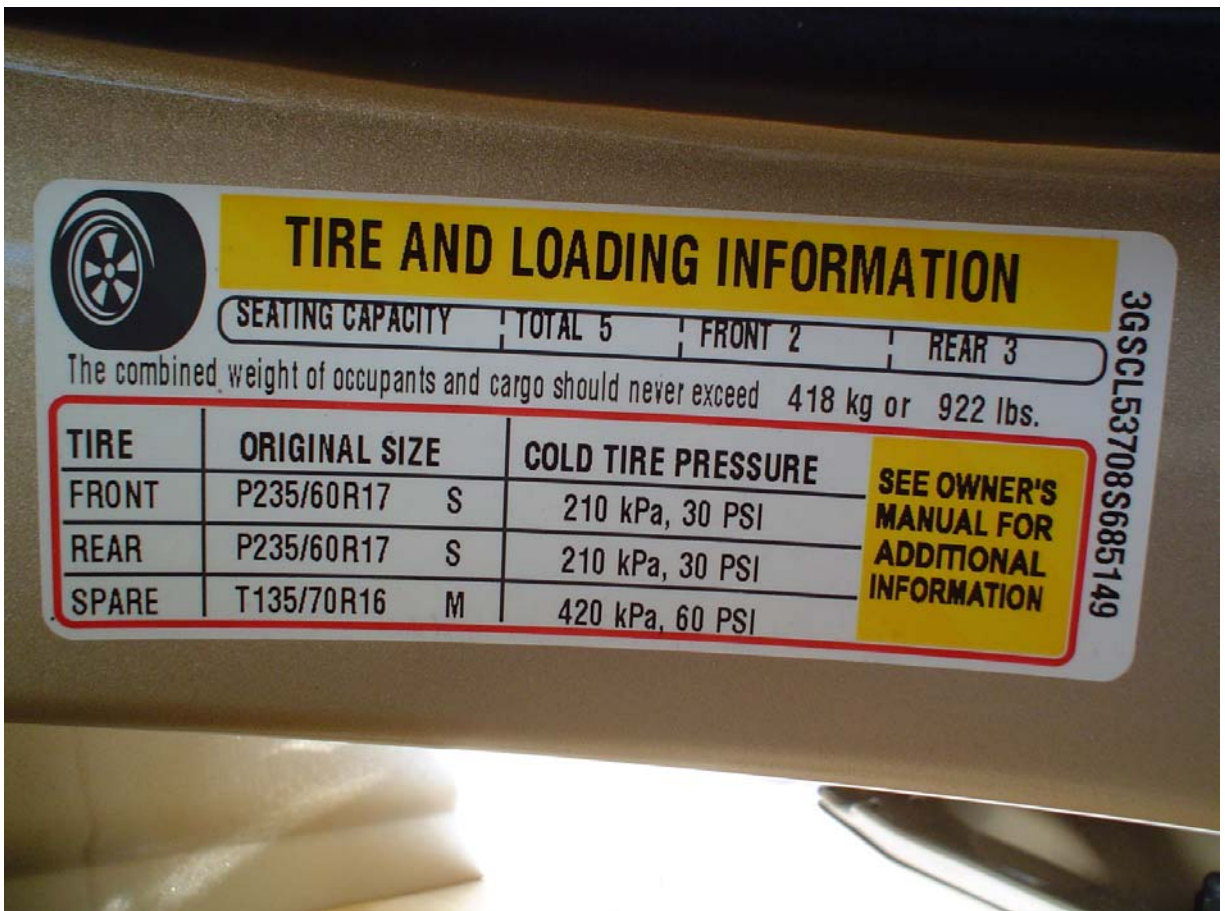
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Load Cell Location



Manufacturer's Label



Tire Placard



Left Front $\frac{3}{4}$ View, As Received



Right Rear $\frac{3}{4}$ View, As Received



Pre-Test Front View



Post-Test Front View



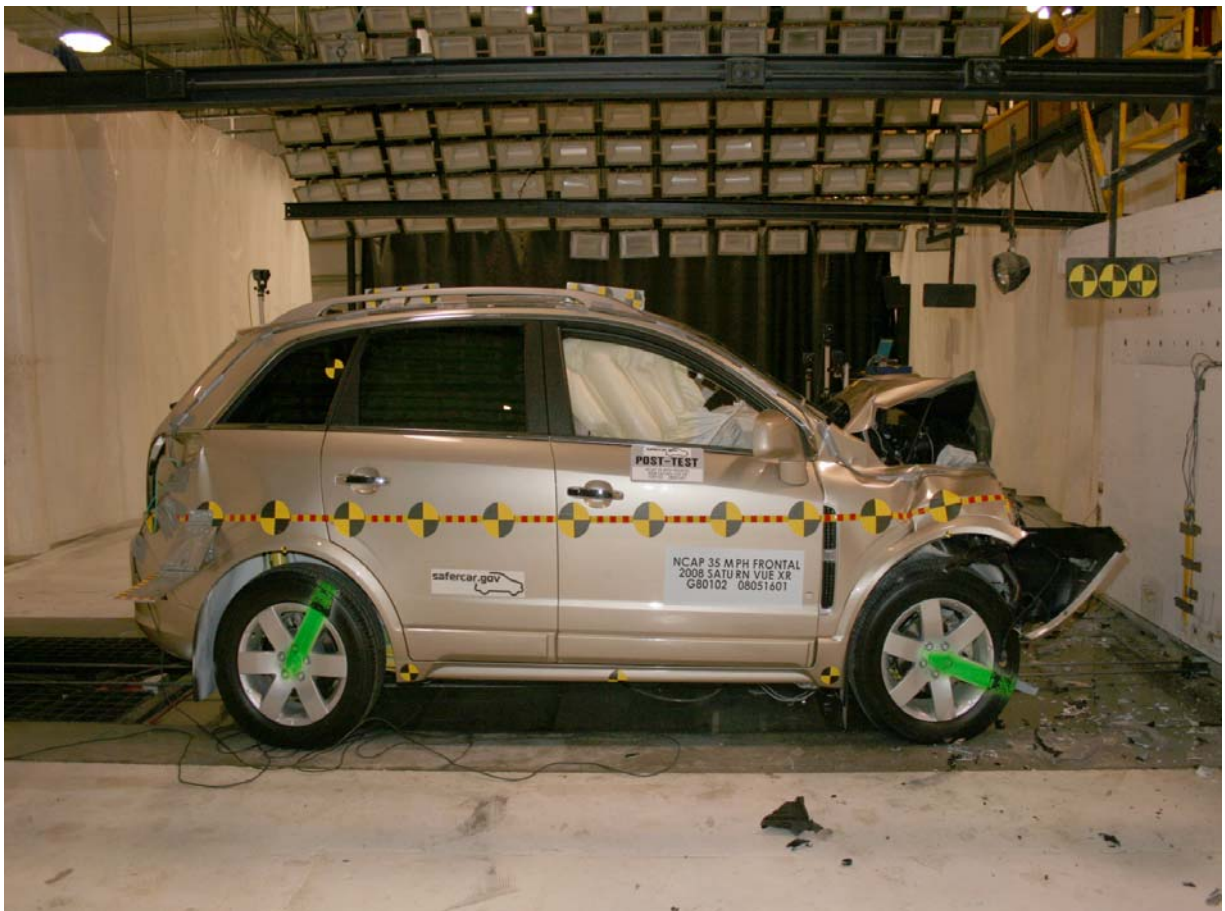
Pre-Test Left Side View



Post-Test Left Side View



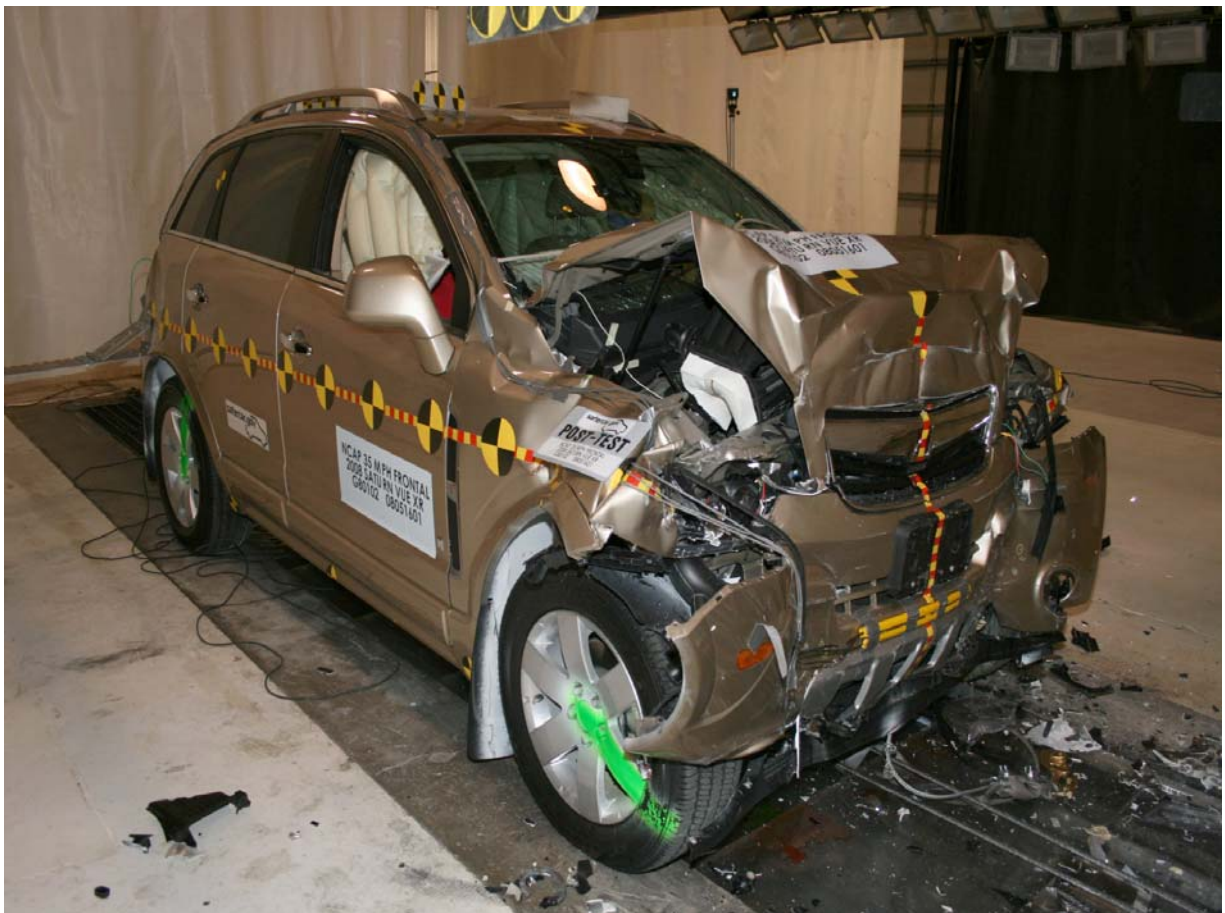
Pre-Test Right Side View



Post-Test Right Side View



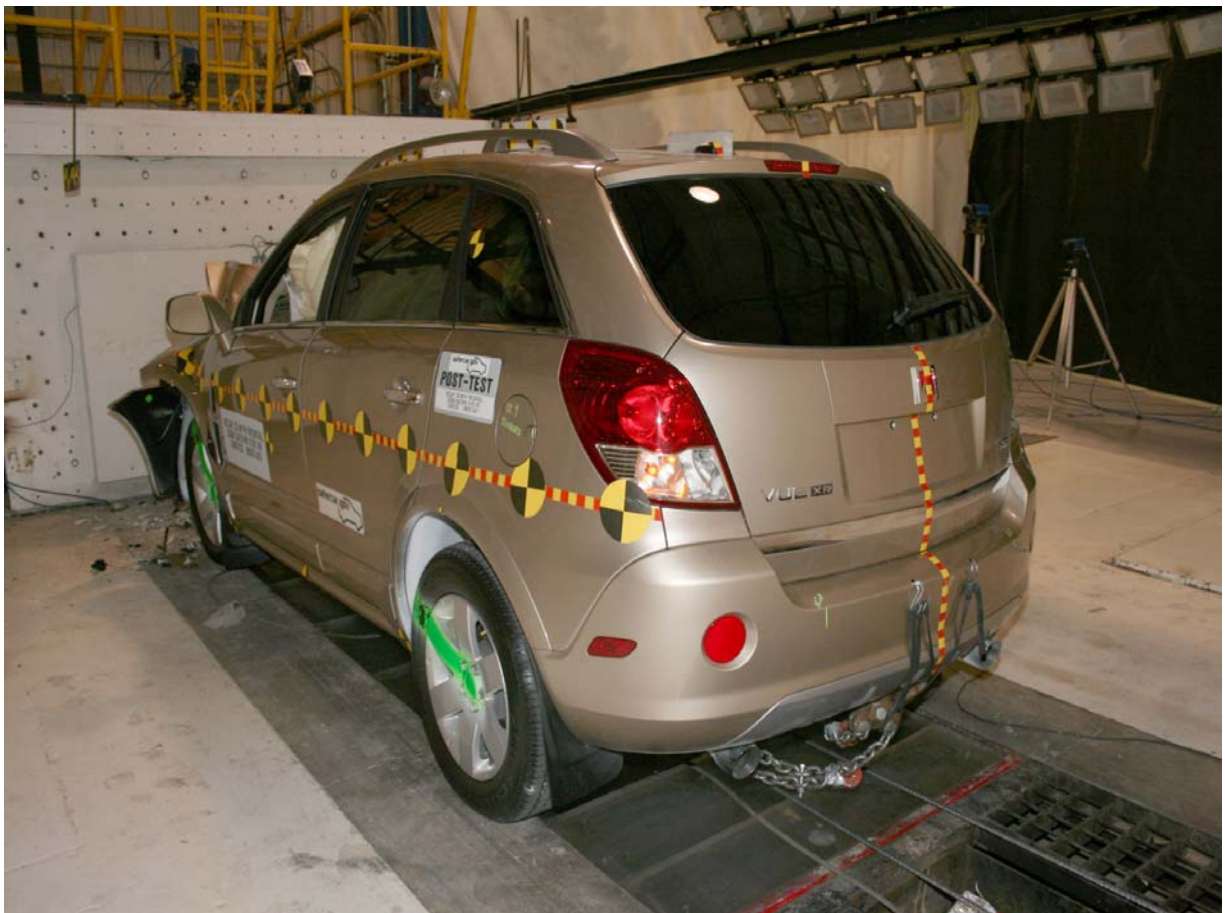
Pre-Test Right Front 3/4 View



Post-Test Right Front 3/4 View



Pre-Test Left Rear 3/4 View



Post-Test Left Rear 3/4 View



Pre-Test Left Side 3/4 View of Doors



Post-Test Left Side 3/4 View of Doors After Impact



Pre-Test Right Side $\frac{3}{4}$ View of Doors



Post-Test Right Side $\frac{3}{4}$ View of Doors After Impact



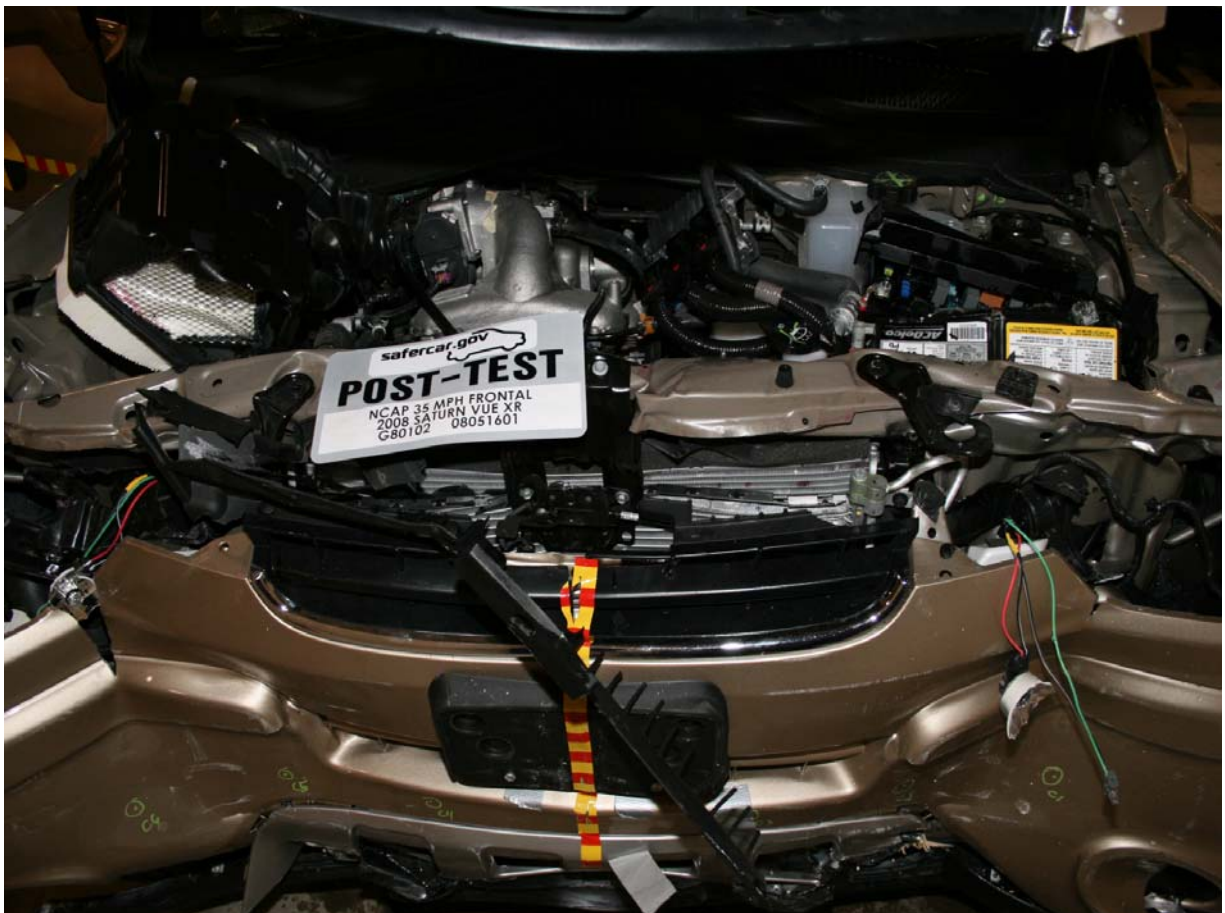
Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



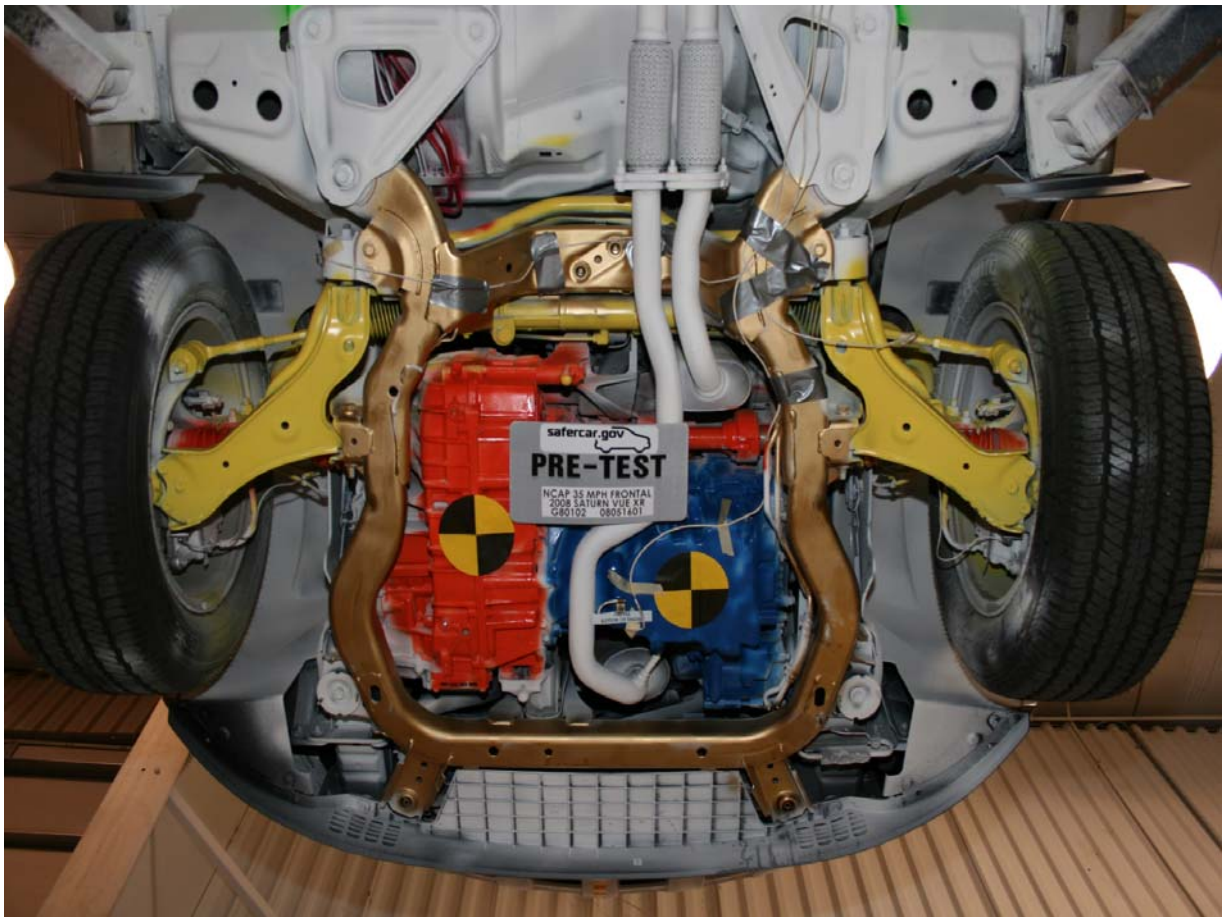
Post-Test Engine Compartment View



Pre-Test Fuel Cap View



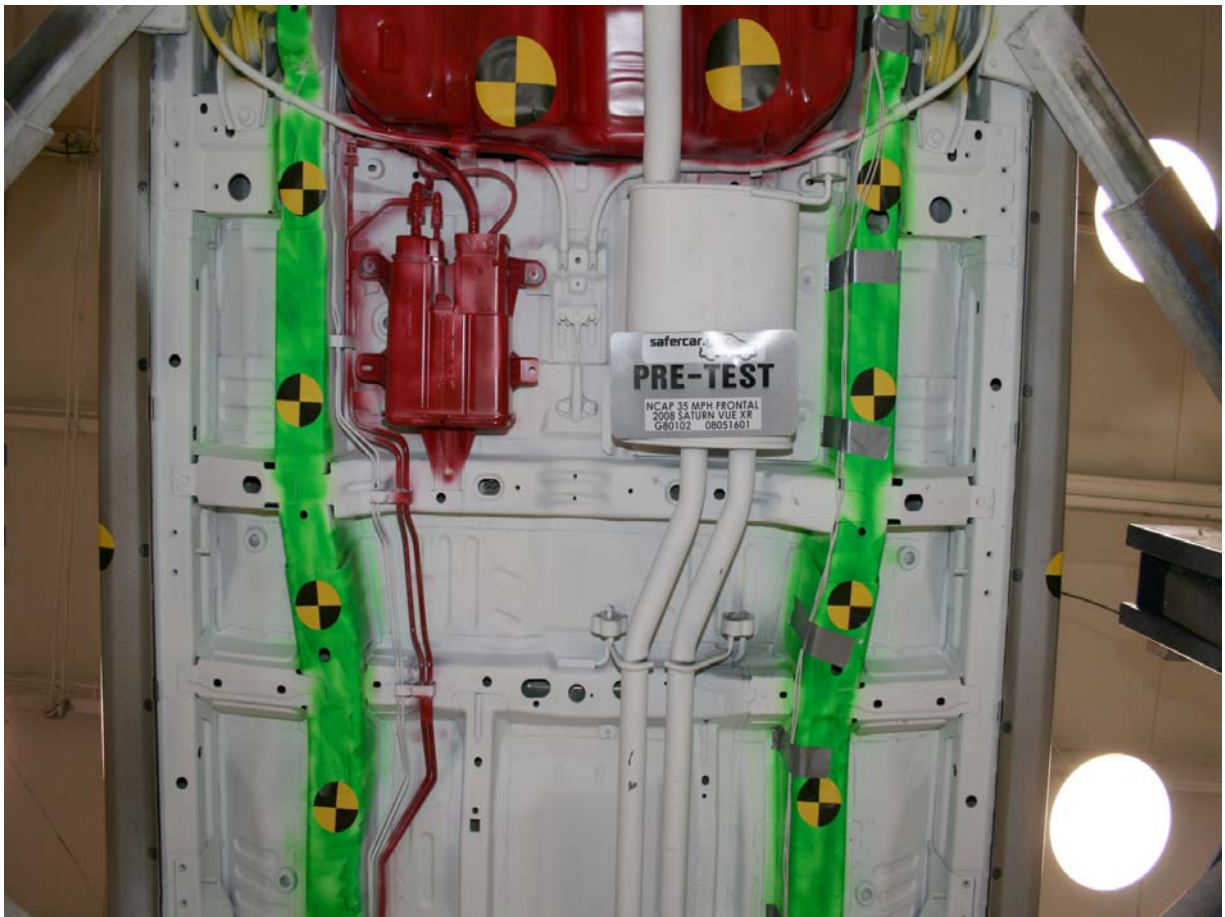
Post-Test Fuel Cap View



Pre-Test Front Underbody View



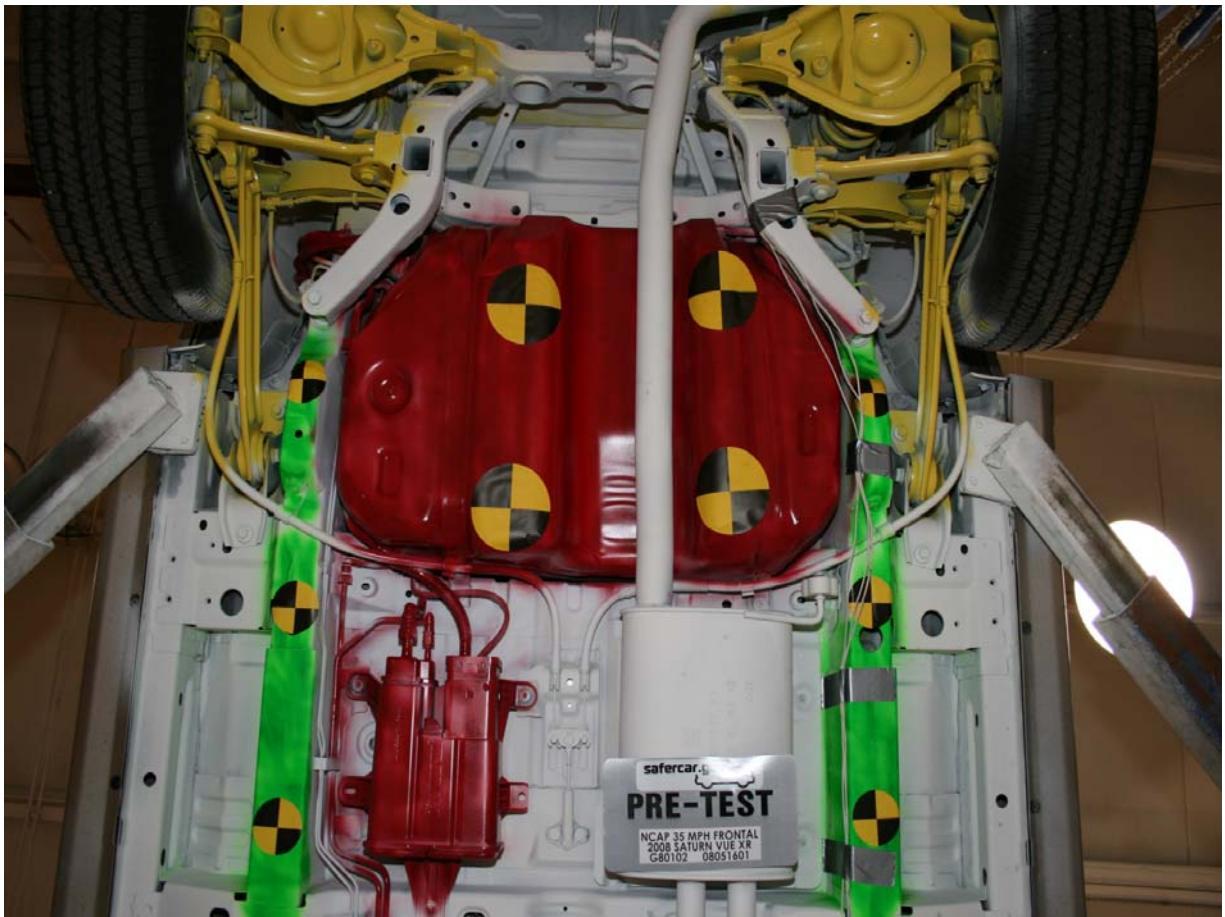
Post-Test Front Underbody View



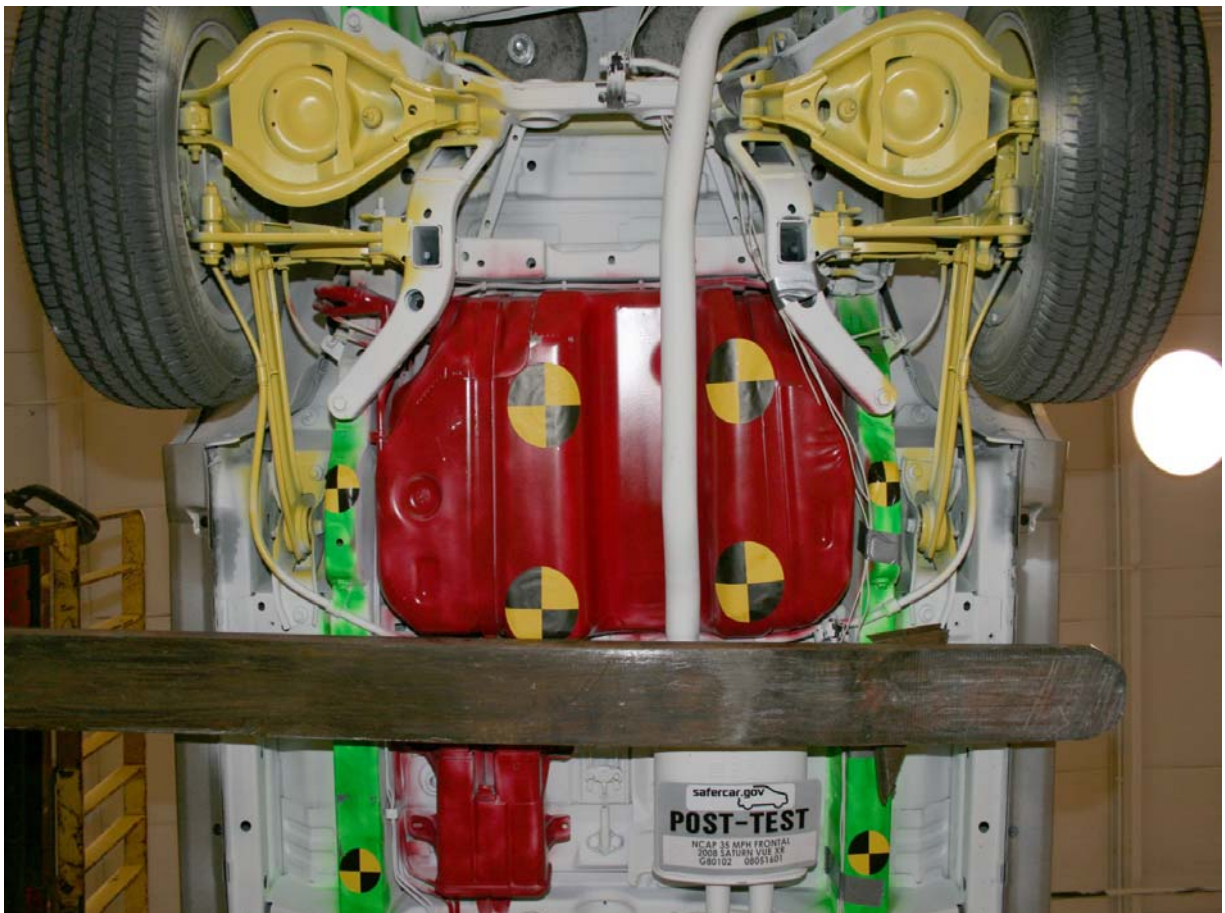
Pre-Test Mid Front Underbody View



Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



Post-Test Mid Rear Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Driver Dummy Front View (Head Position)



Post-Test Driver Dummy Front View (Head Position)



Pre-Test Driver Dummy (Through Window)



Post-Test Driver Dummy (Through Window)



Pre-Test Driver Dummy (Door Open)



Post-Test Driver Dummy (Door Open)



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



Pre-Test Driver Side Knee Bolster



Post-Test Driver Side Knee Bolster



Pre-Test Driver Side Floor Pan



Post-Test Driver Side Floor Pan



Post-Test Driver Dummy Head Contact (Headrest)



Post-Test Driver Dummy Knee Contact



Post-Test Driver Dummy Airbag Contact



Pre-Test Passenger Dummy Front View (Head Position)



Post-Test Passenger Dummy Front View (Head Position)



Pre-Test Passenger Dummy (Through Window)



Post-Test Passenger Dummy (Through Window)



Pre-Test Passenger Dummy (Door Open)



Post-Test Passenger Dummy (Door Open)



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



Pre-Test Passenger Side Glove Box



Post-Test Passenger Side Glove Box



Pre-Test Passenger Side Floor Pan



Post-Test Passenger Side Floor Pan



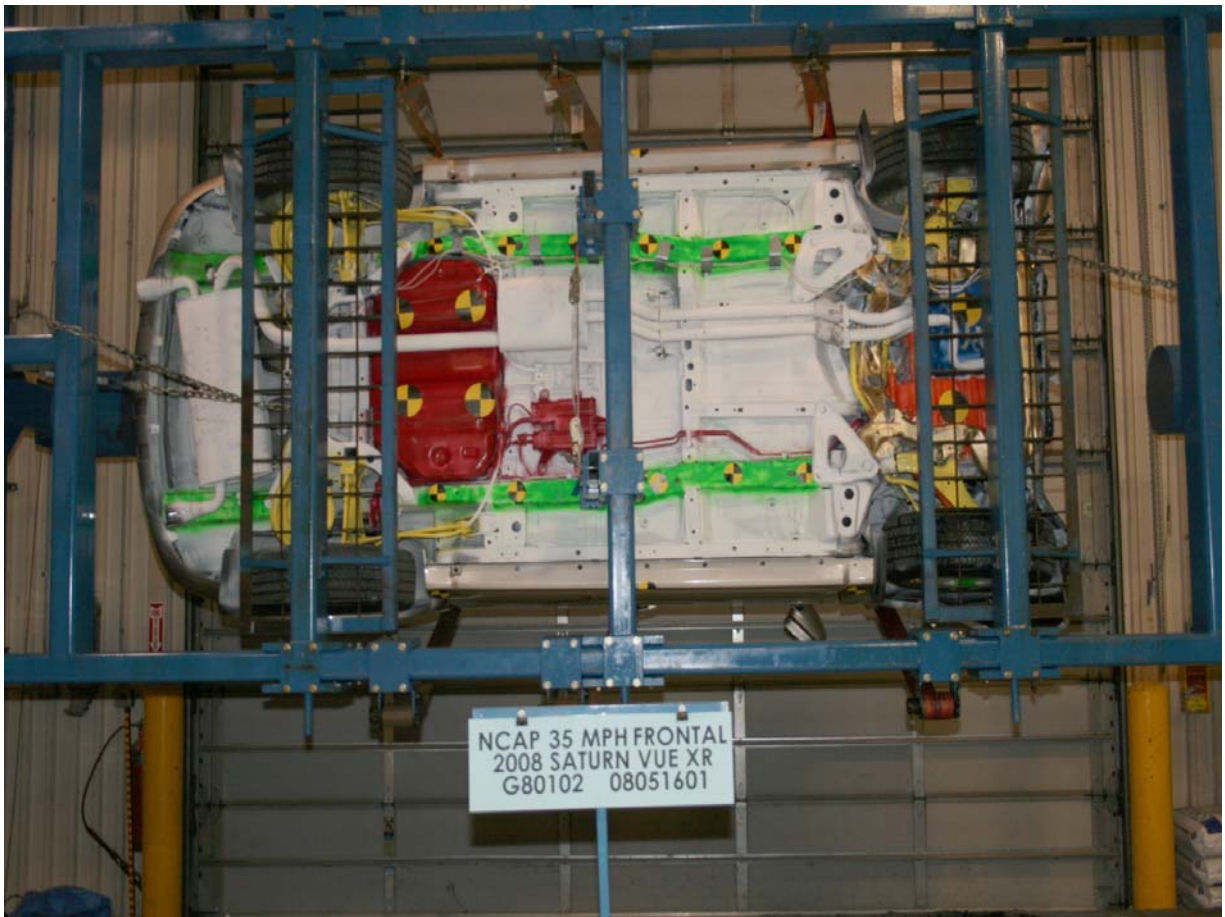
Post-Test Passenger Dummy Head Contact (Headrest)



Post-Test Passenger Dummy Knee Contact



Post-Test Passenger Dummy Airbag Contact



Rollover 90 Degrees



Rollover 180 Degrees



Rollover 270 Degrees



Rollover 360 Degrees



Vehicle Impact

APPENDIX B
DUMMY RESPONSE DATA TRACES

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The following dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

Driver Upper Neck Moment X

Driver Upper Neck Moment Y

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Chest Displacement

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Shoulder Belt Force

Driver Lap Belt Force

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

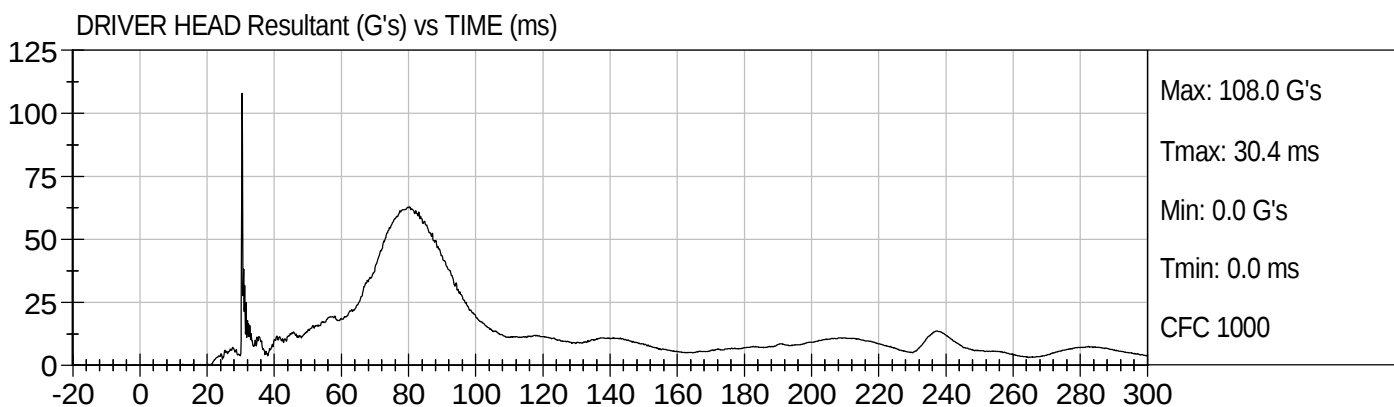
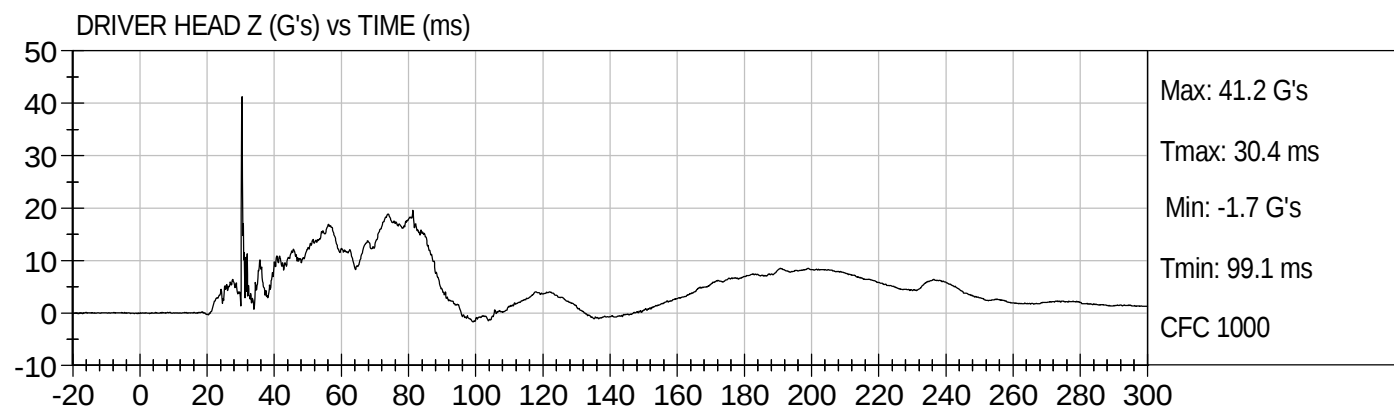
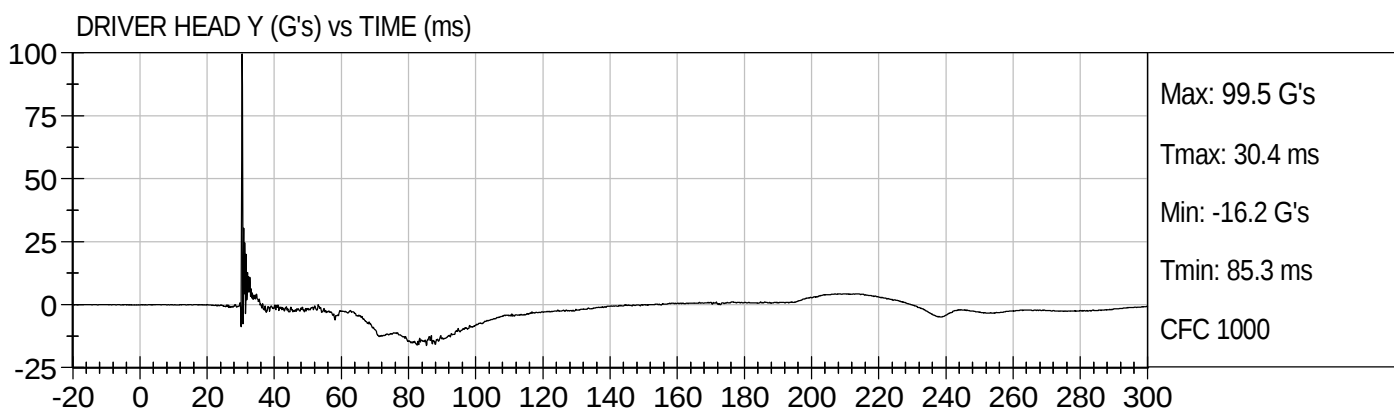
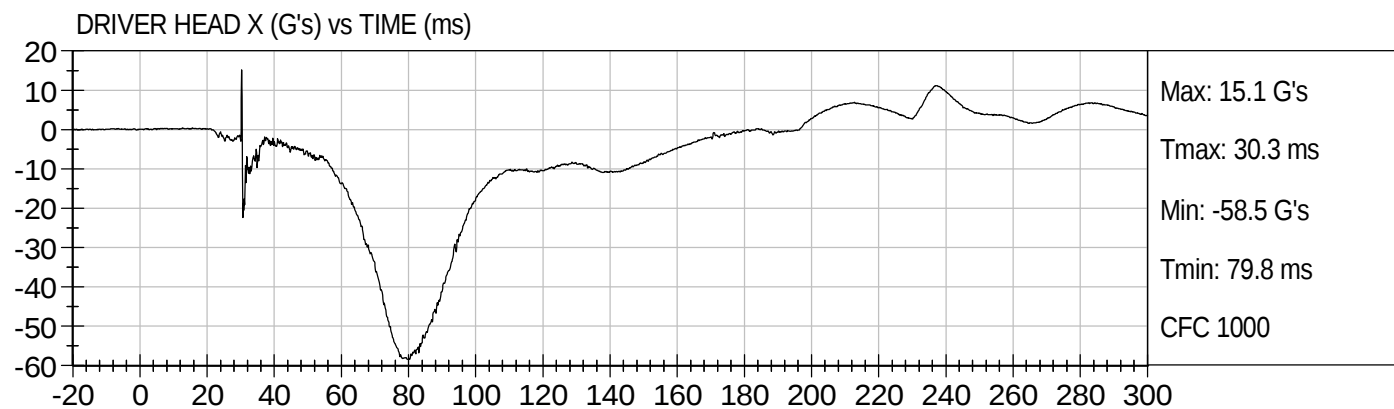
Driver Left Lower Tibia Force Z

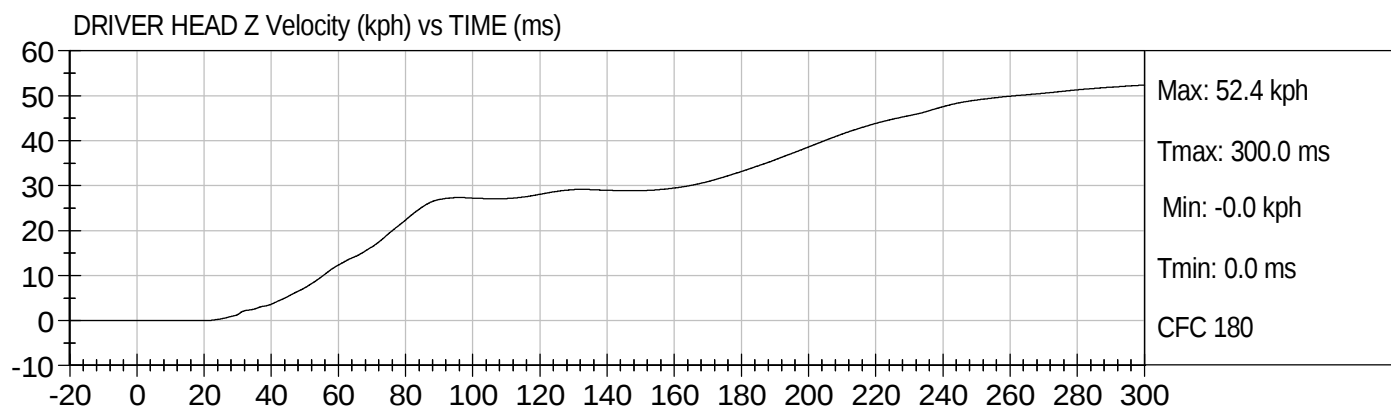
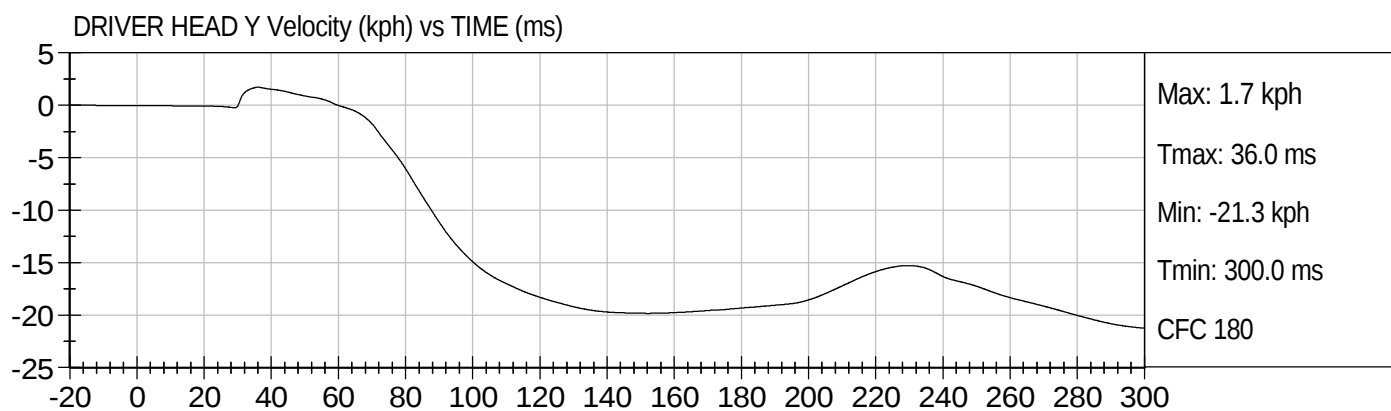
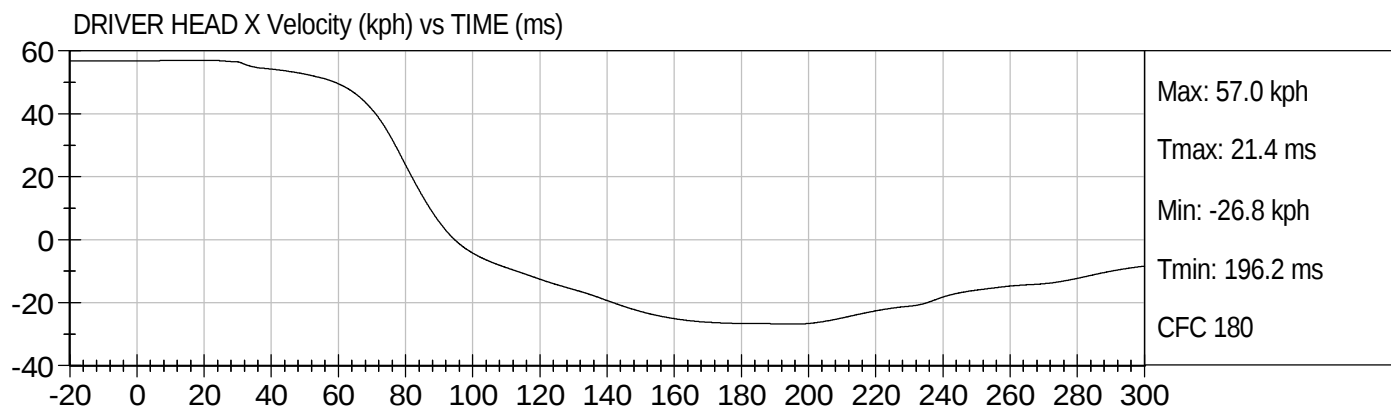
Driver Right Upper Tibia Moment X

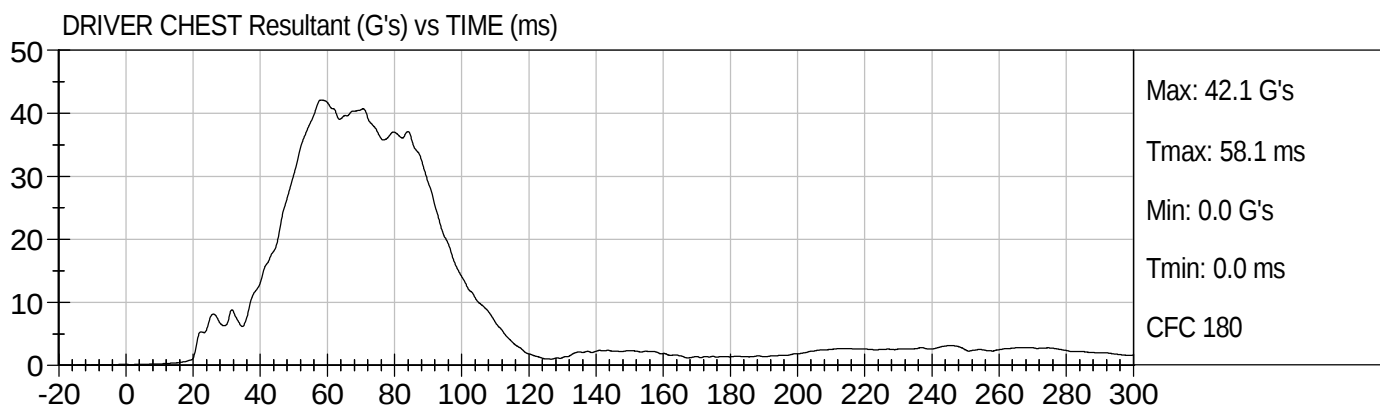
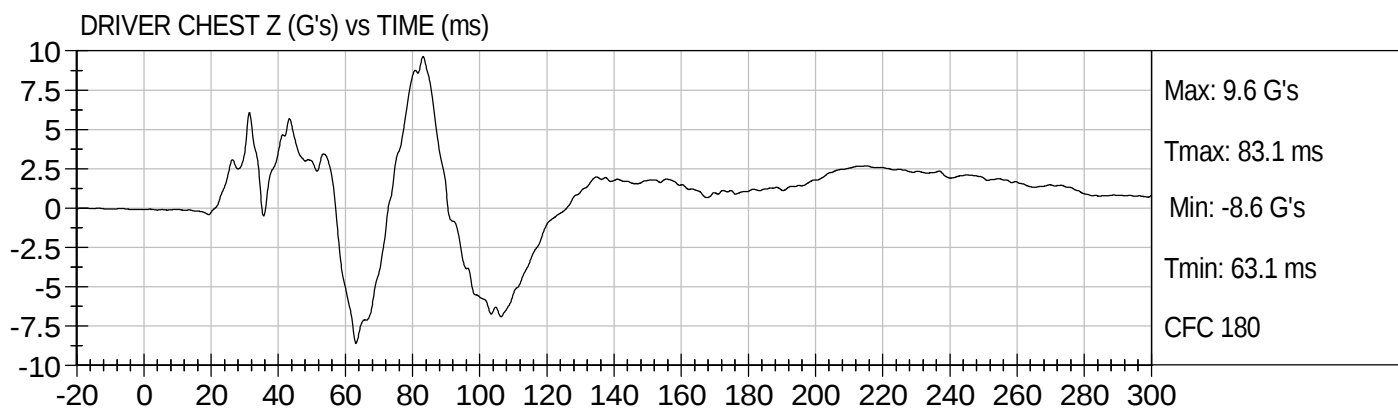
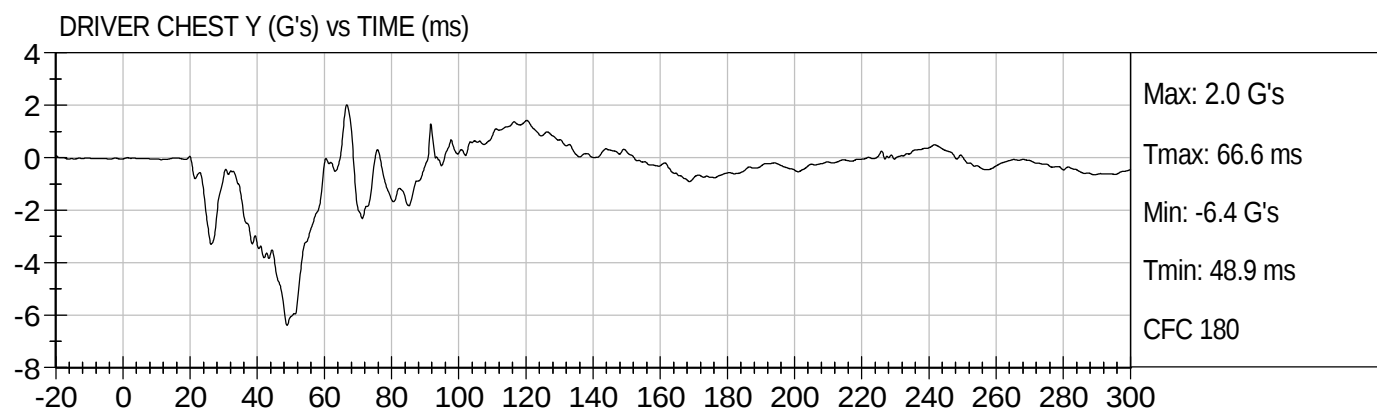
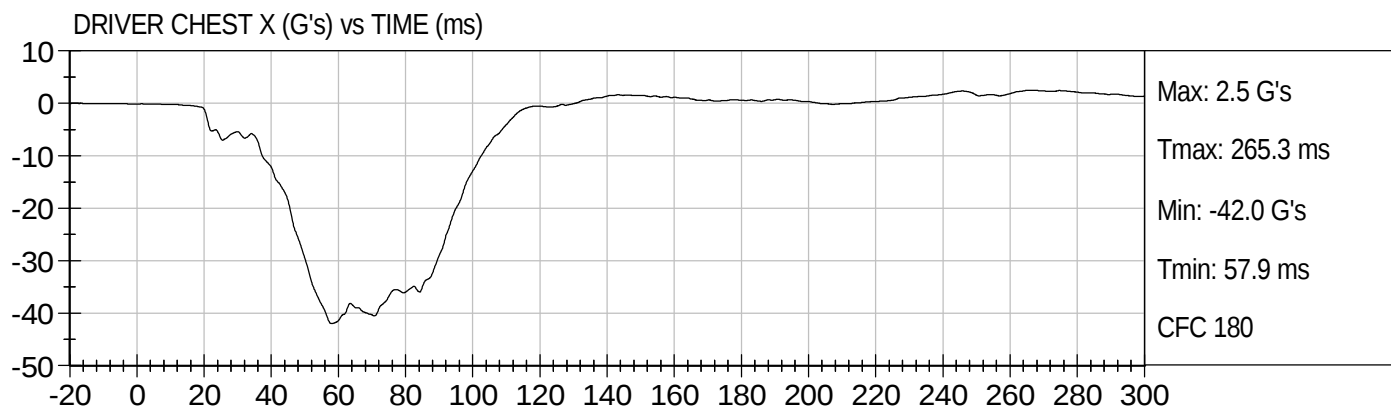
Driver Right Upper Tibia Moment Y

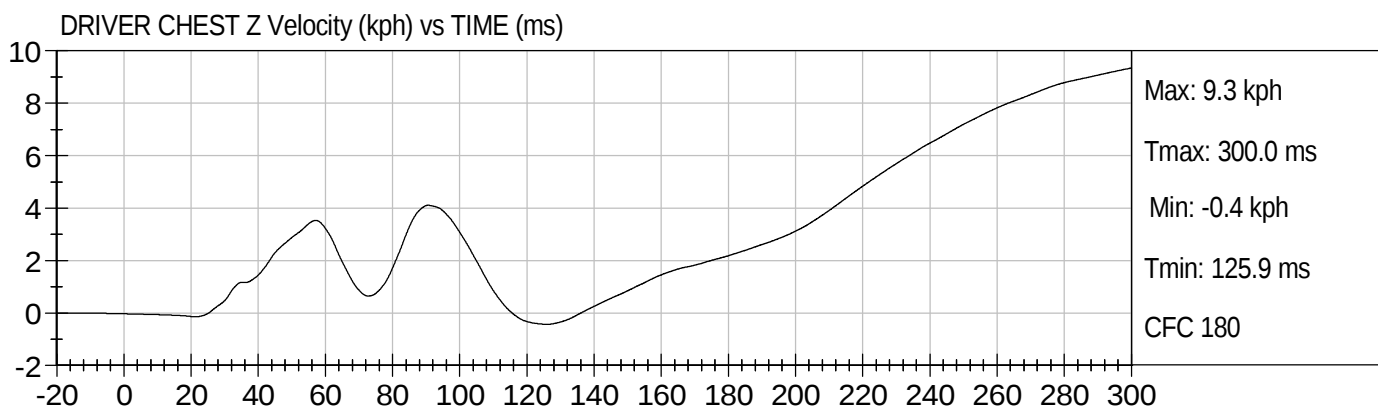
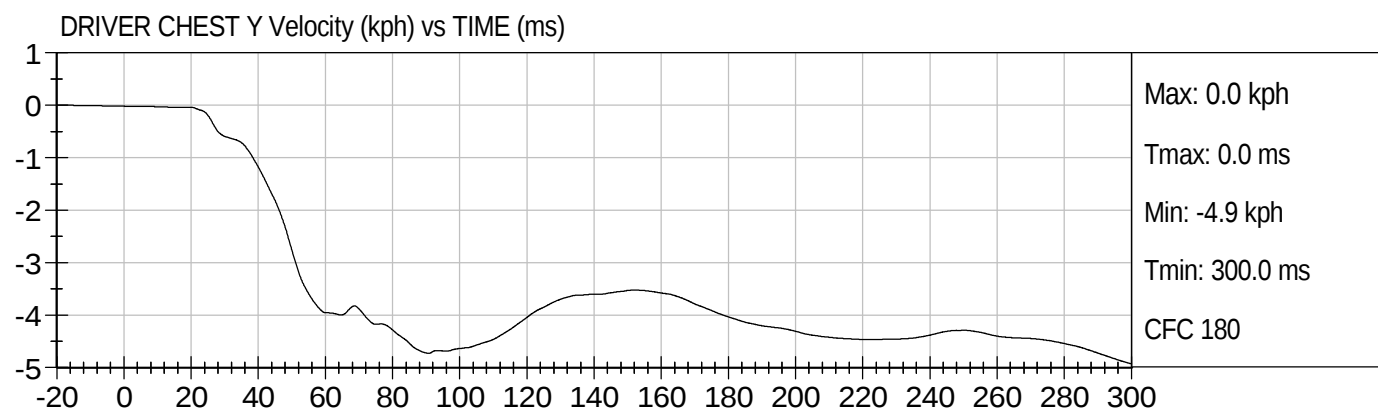
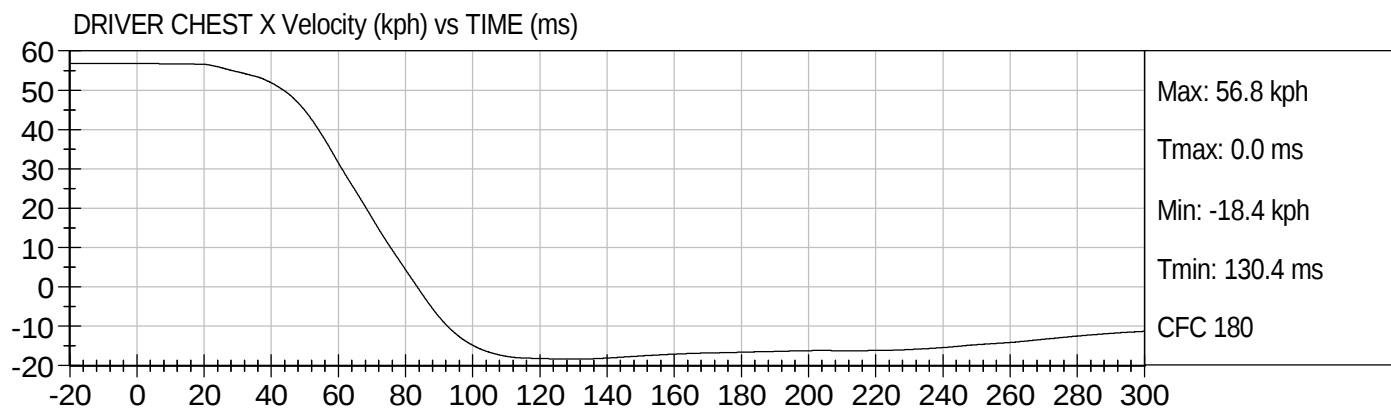
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Upper Neck Force X
Passenger Upper Neck Force Y
Passenger Upper Neck Force Z
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Y
Passenger Upper Neck Moment Z
Passenger Chest X Redundant
Passenger Chest Y Redundant
Passenger Chest Z Redundant
Passenger Chest Displacement
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z
Passenger Shoulder Belt Force
Passenger Lap Belt Force
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X

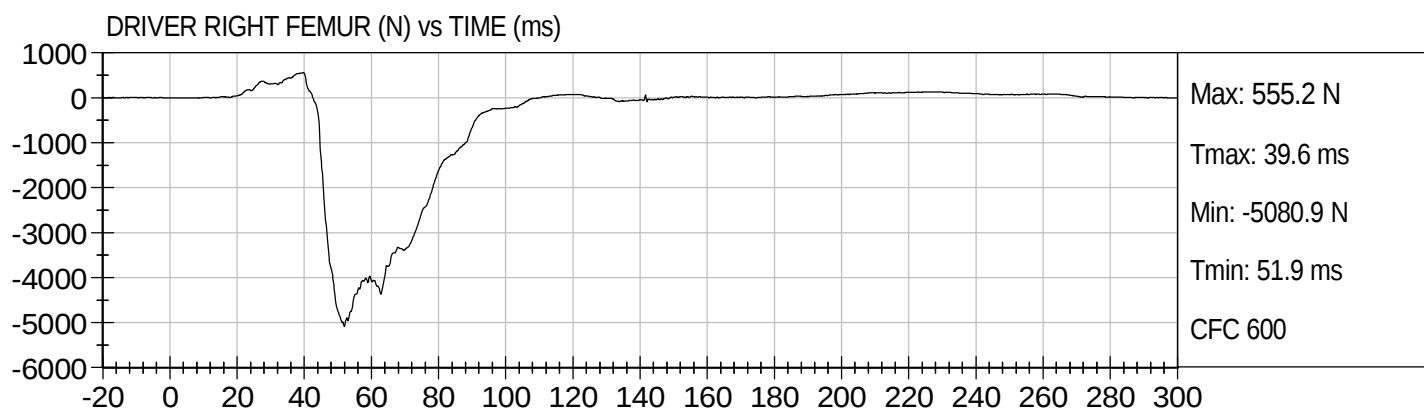
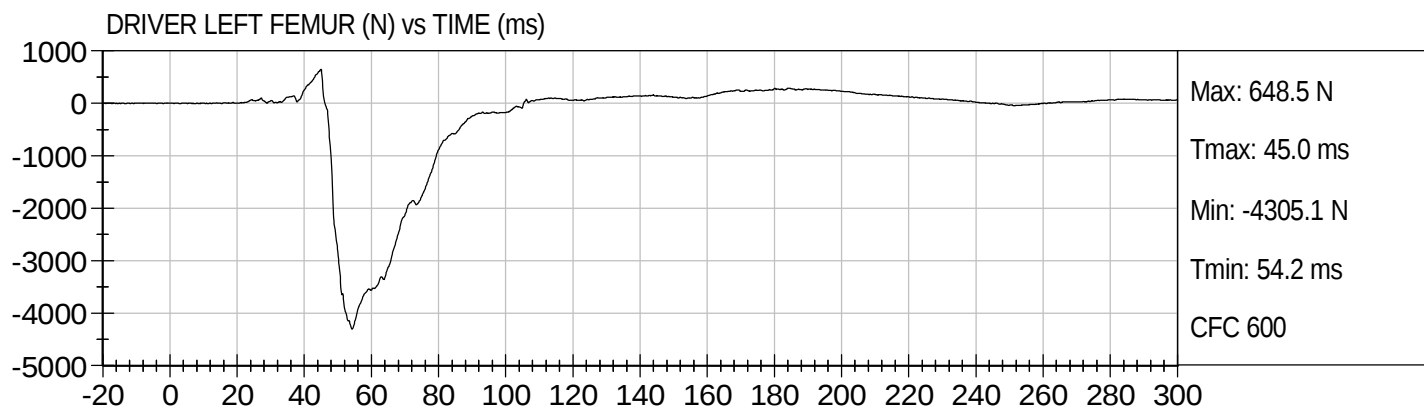
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Left Rear Seat Crossmember X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember X
Right Rear Seat Crossmember Z
Vehicle Engine Top X
Vehicle Engine Bottom X
Vehicle Left Brake Caliper X
Vehicle Right Brake Caliper X
Barrier Force – Upper Left
Barrier Force – Upper Center
Barrier Force – Upper Right
Barrier Force – Lower Left
Barrier Force – Lower Center
Barrier Force – Lower Right

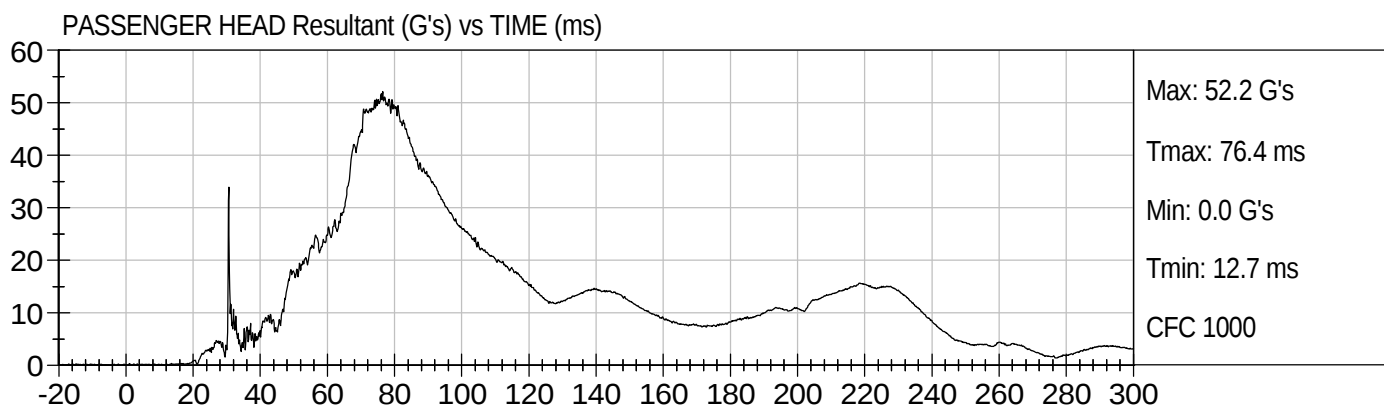
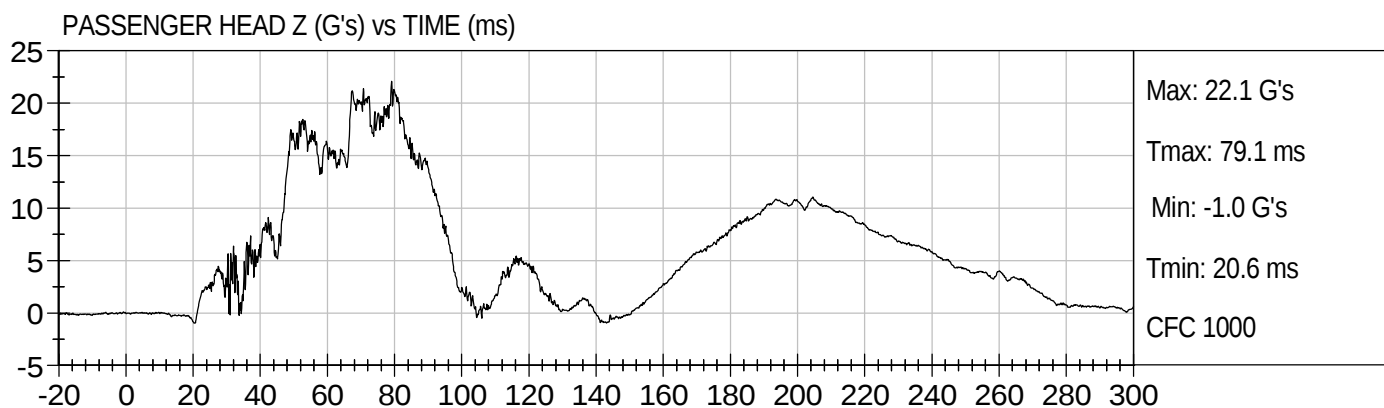
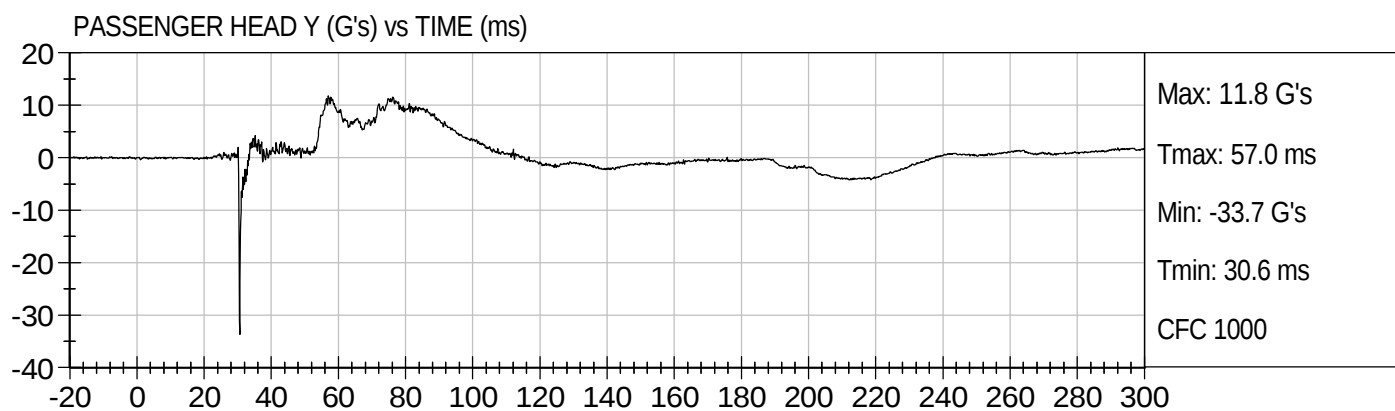
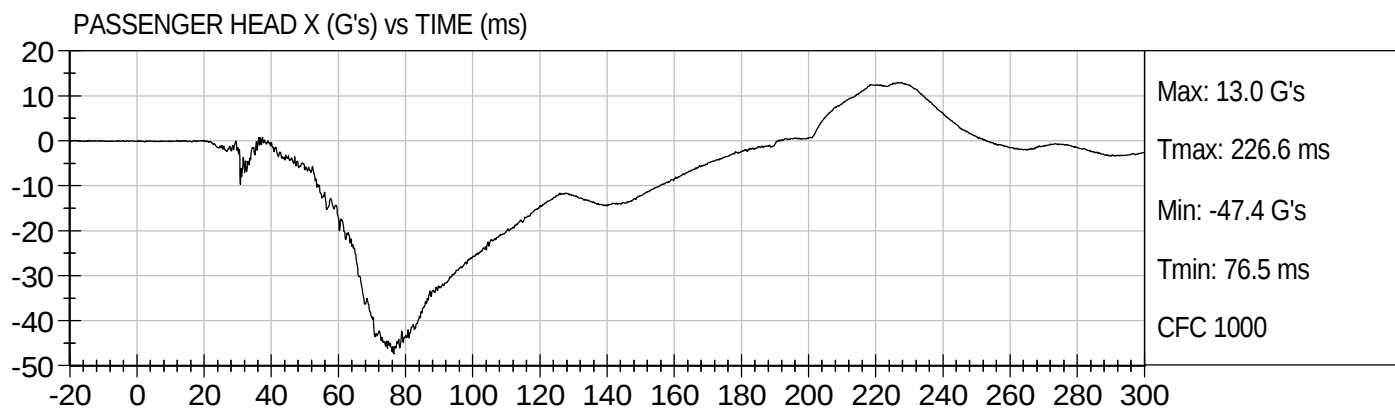


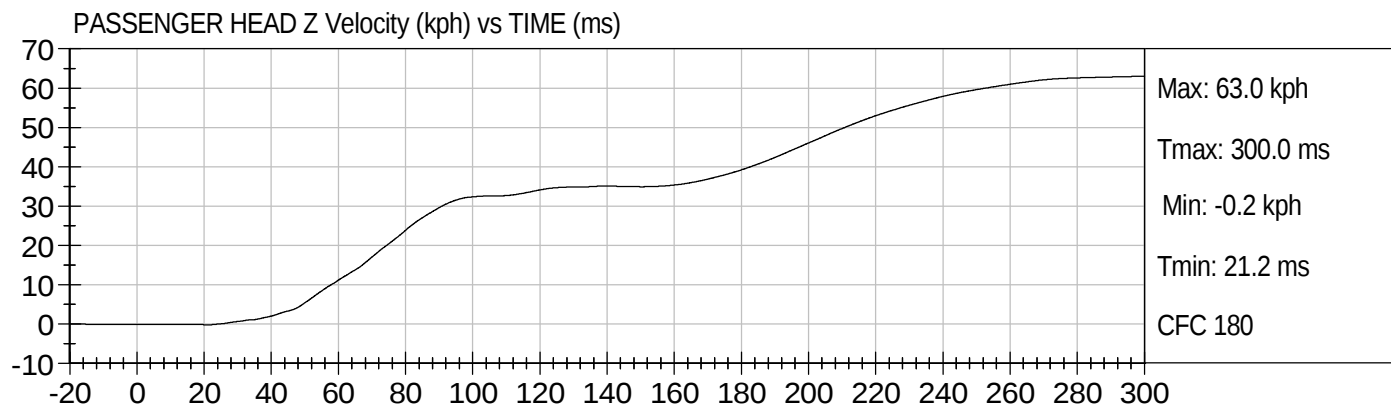
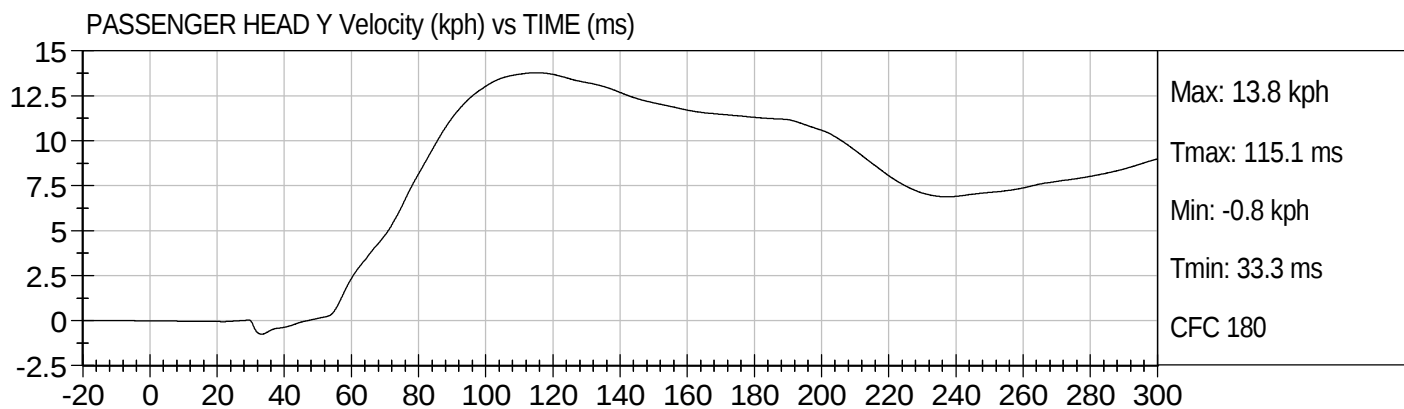
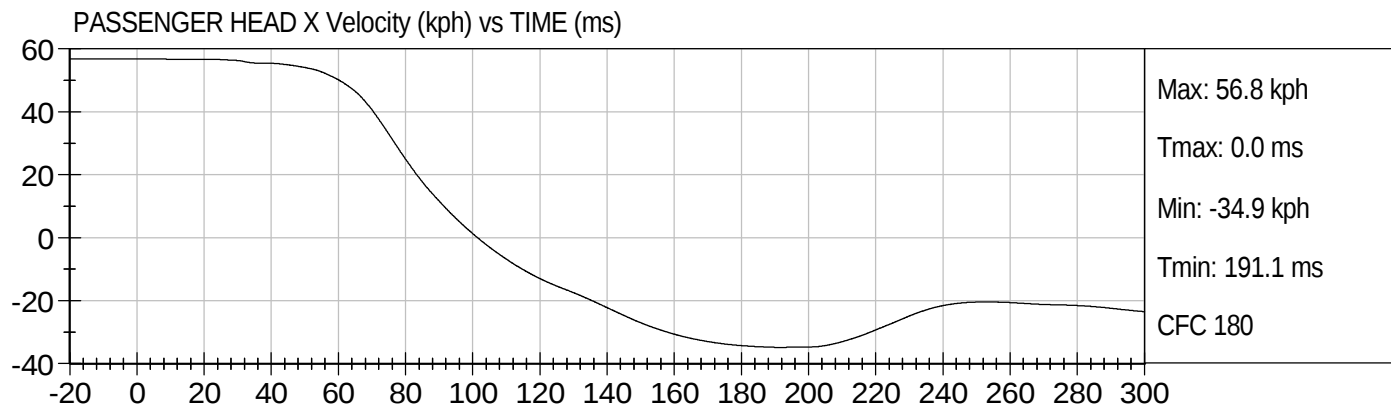


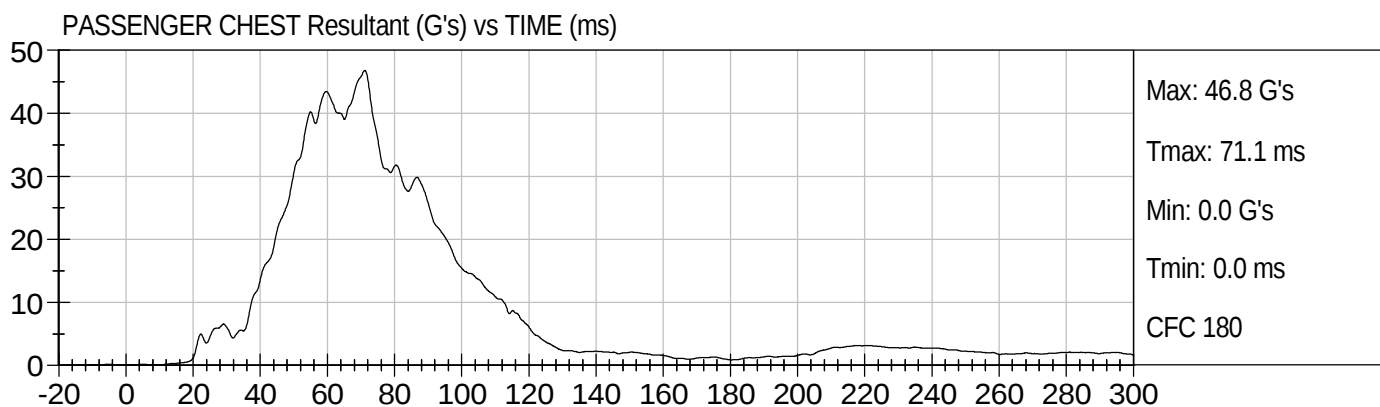
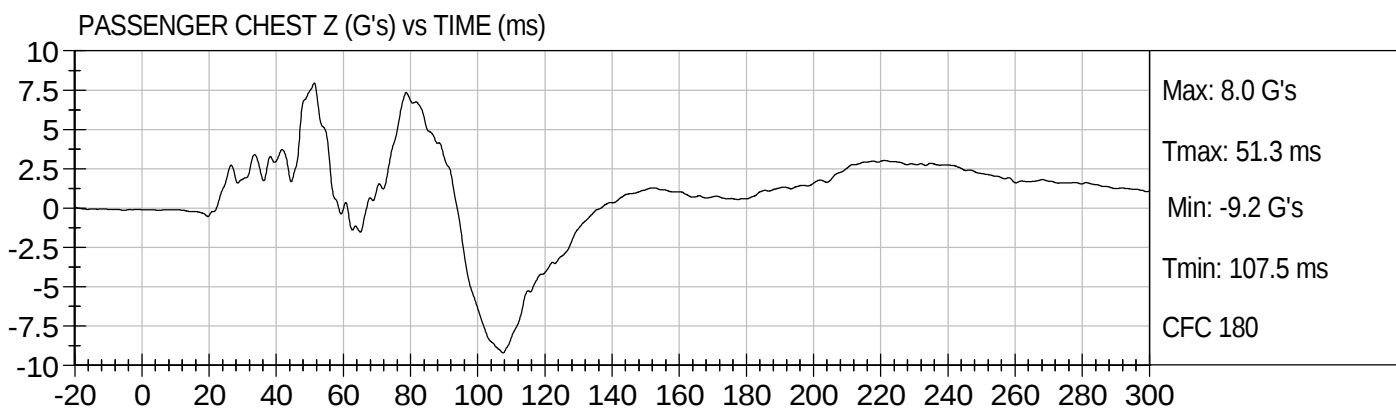
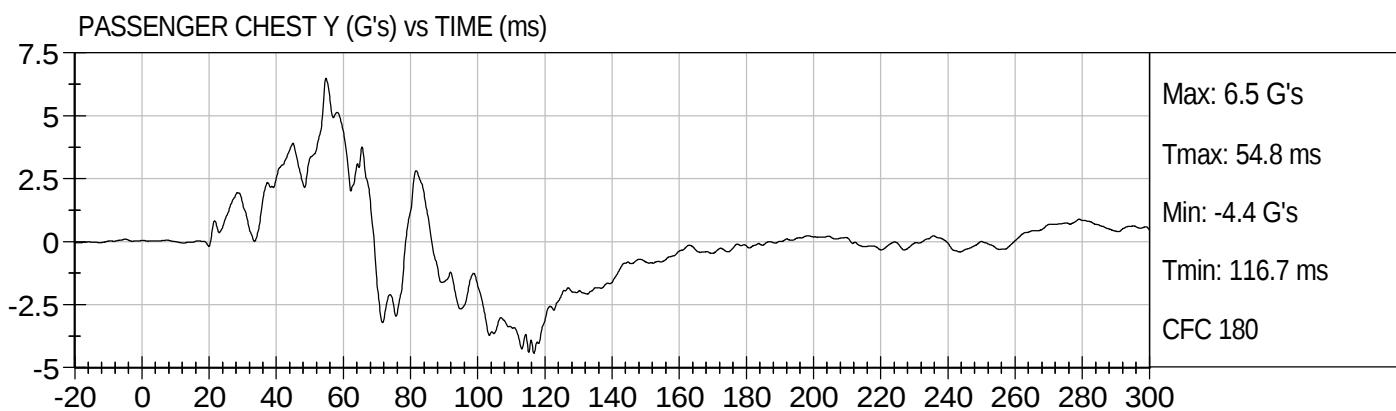
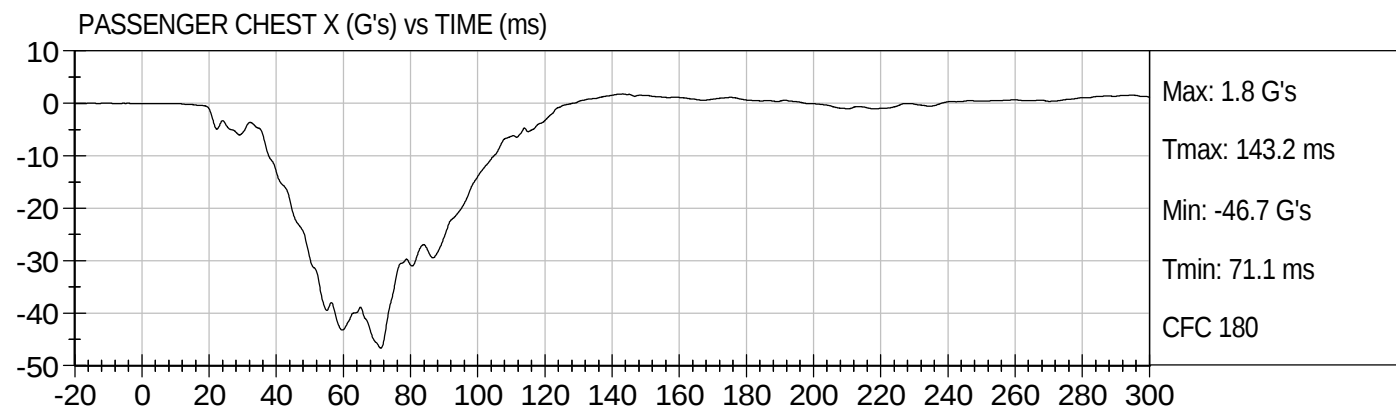


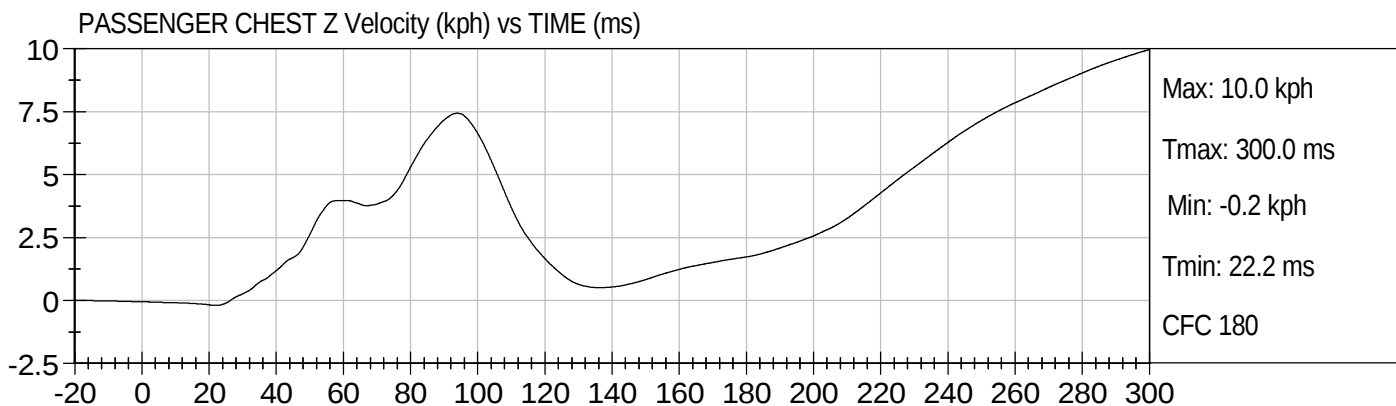
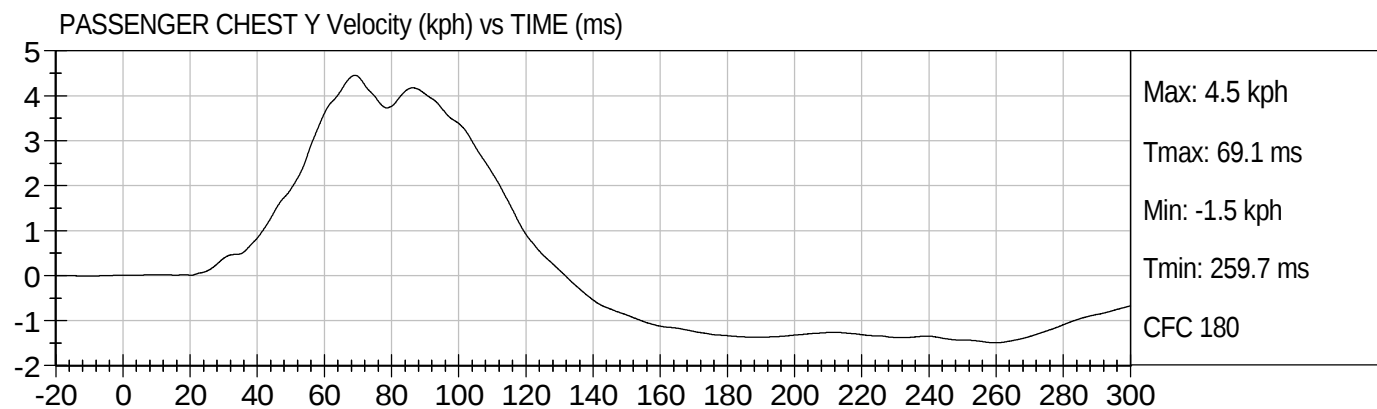
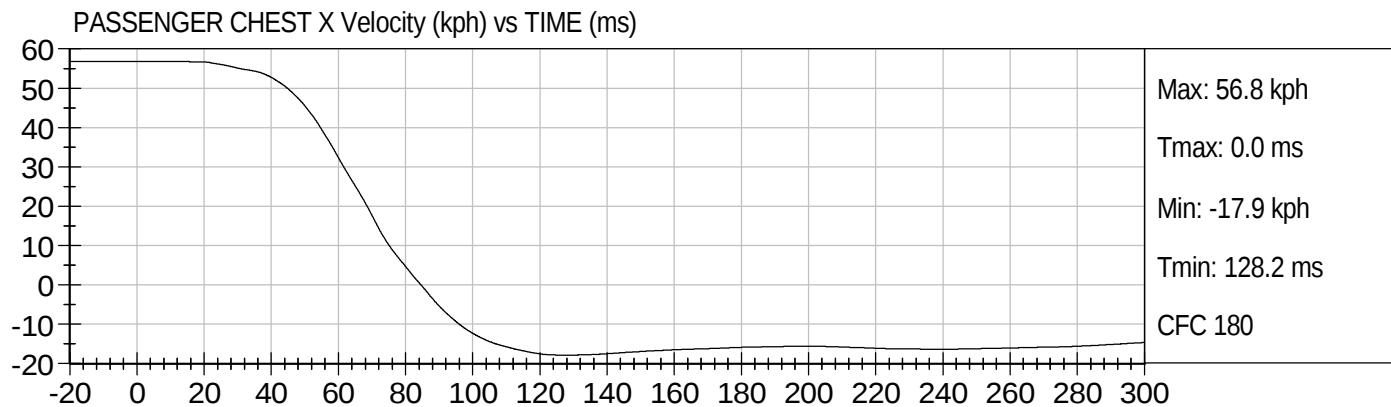


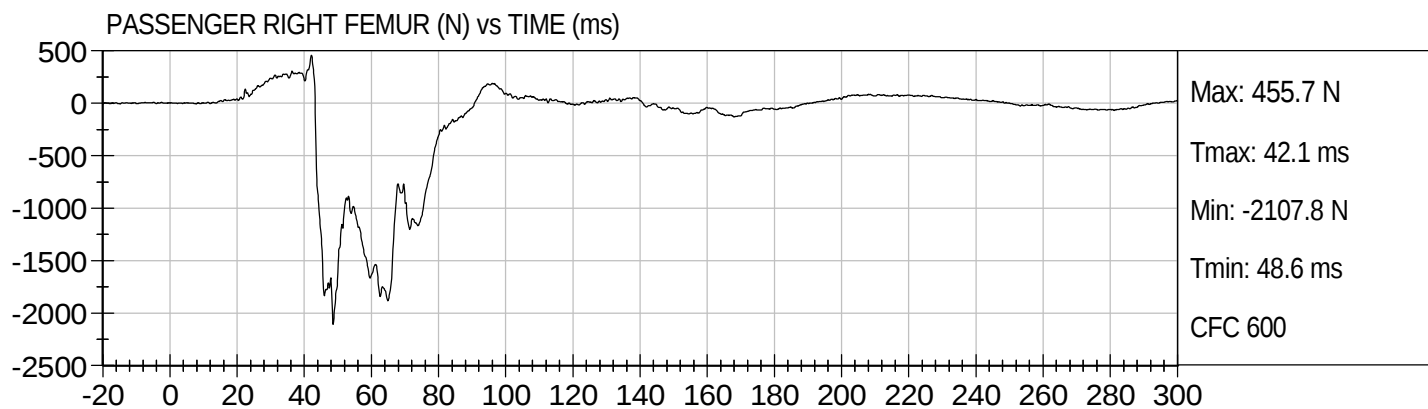
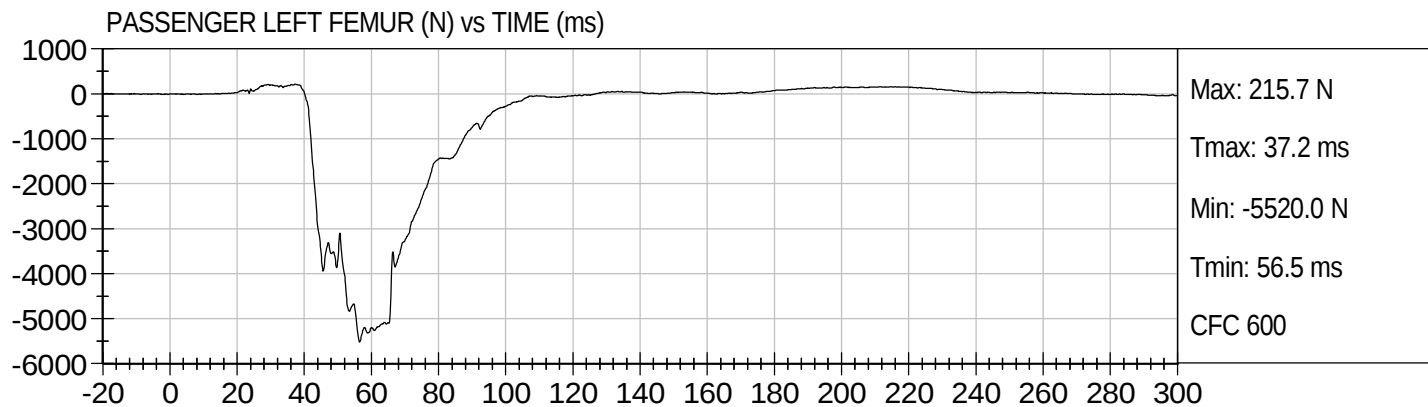












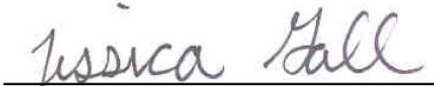
APPENDIX C
DUMMY CALIBRATION DATA

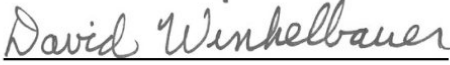
MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test ID: D081151

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	225 - 275	245	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results			Pass	


Laboratory Technician


Approved by

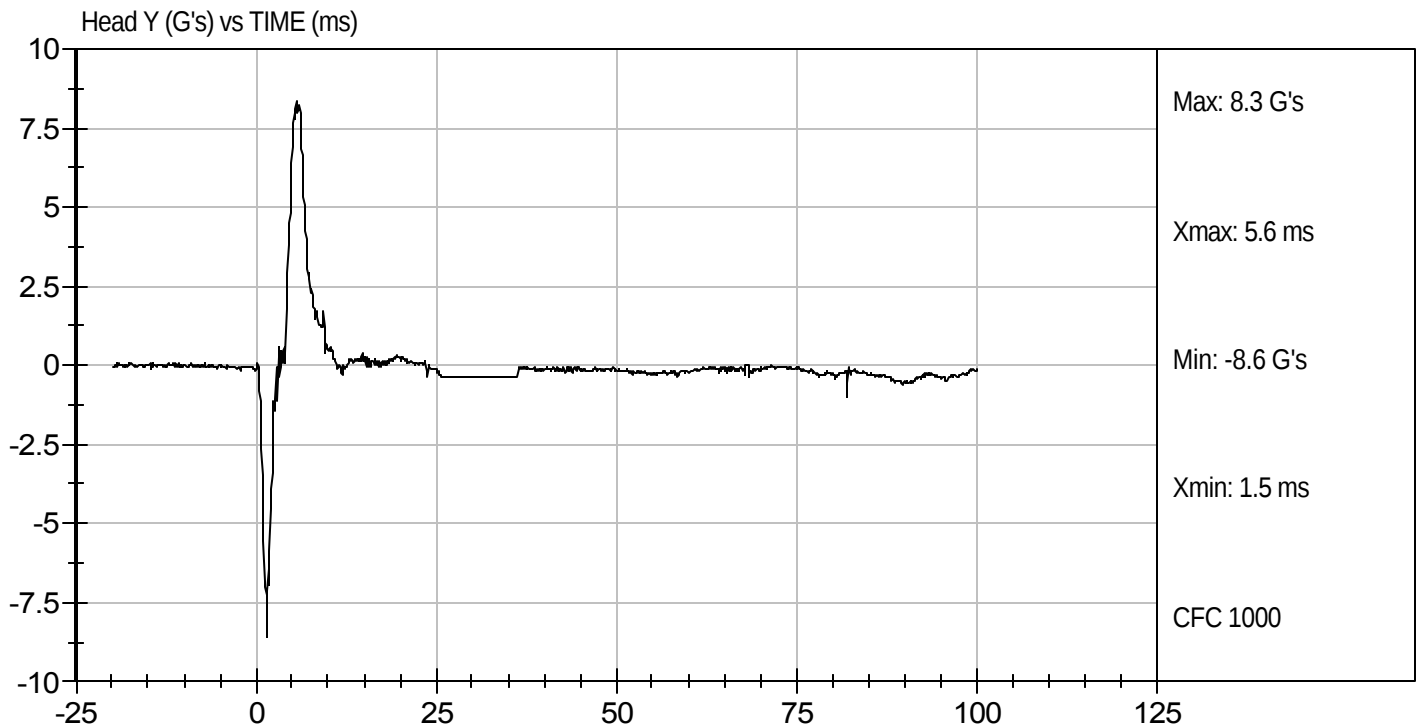
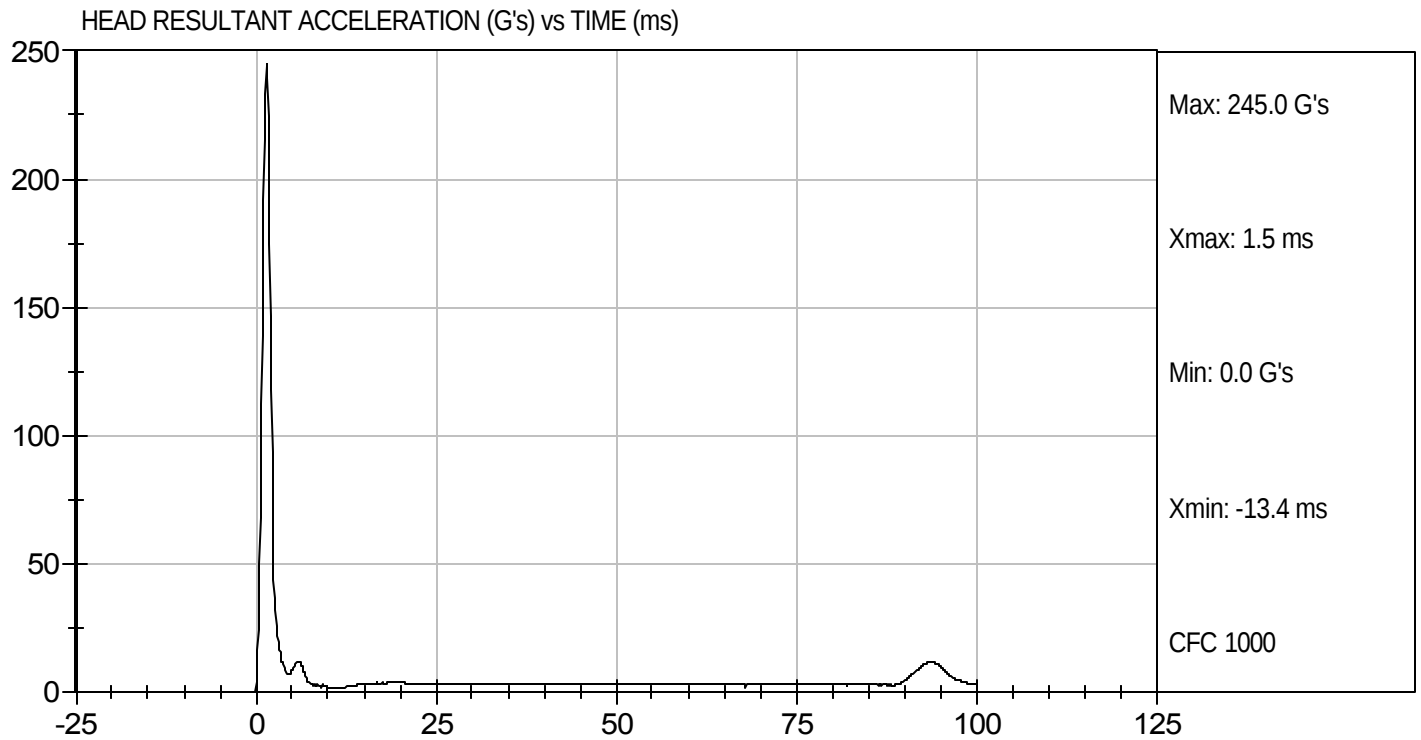
4/23/08

Test Date



Test Desc: Head Drop
Component ID: D081151

Test Date: 4/23/08
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D081152

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.80	Pass
	20 msec	G's	17.60 to 22.60	18.69	Pass
	30 msec	G's	12.50 to 18.50	14.26	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.23	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	34.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	73.1	Pass
	Time	msec	57.0 to 64.0	58.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	113.0	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	96.5	Pass
	Time	msec	47.0 to 58.0	47.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.6	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

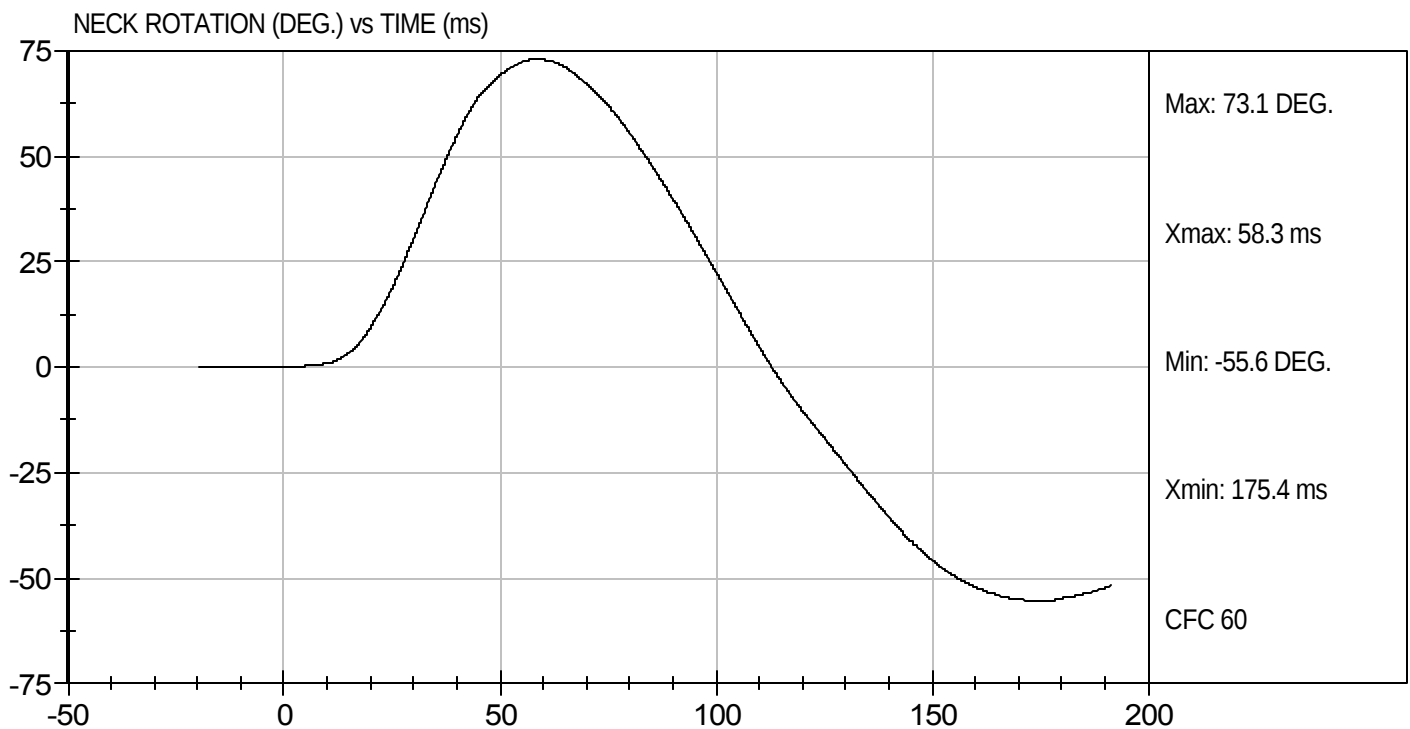
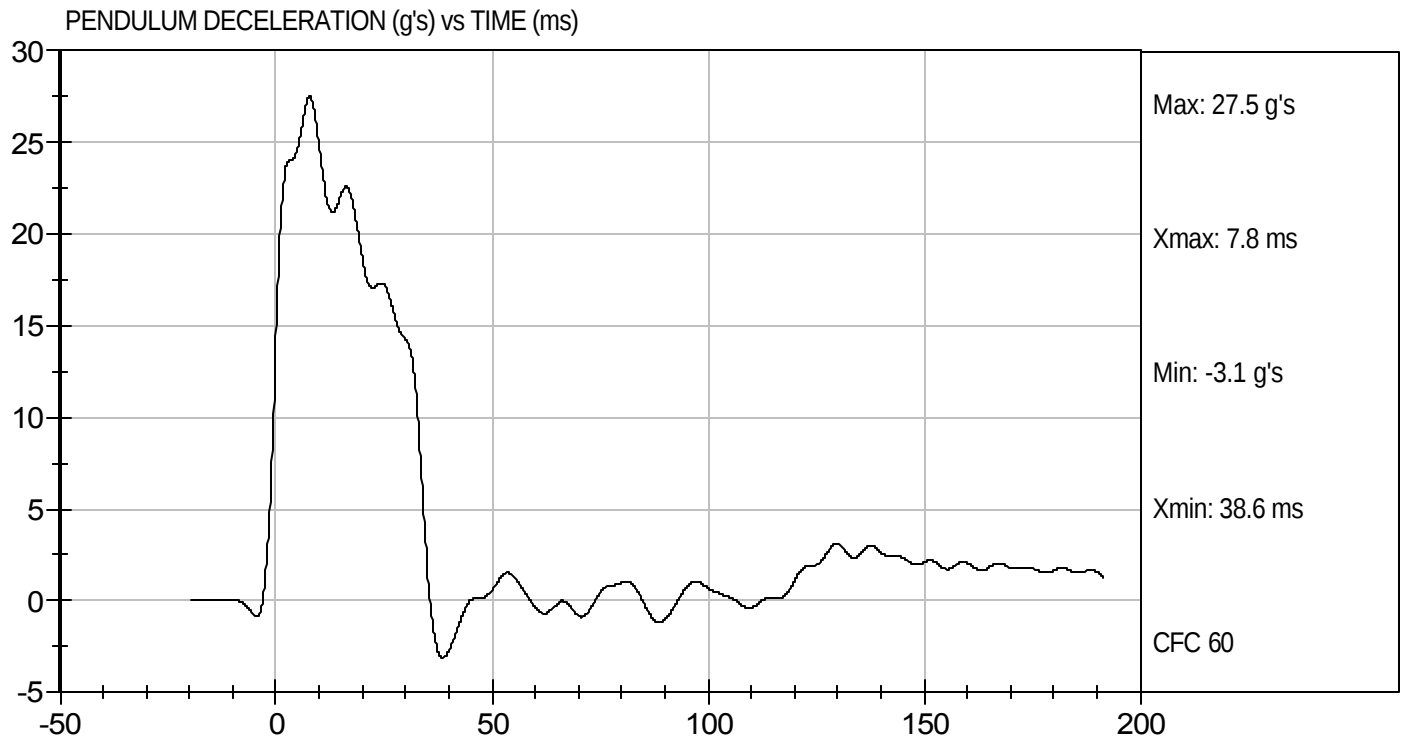
4/23/08
Test Date

David Winkelbauer
Approved by



Test Desc: Neck Flexion
Component ID: D081152

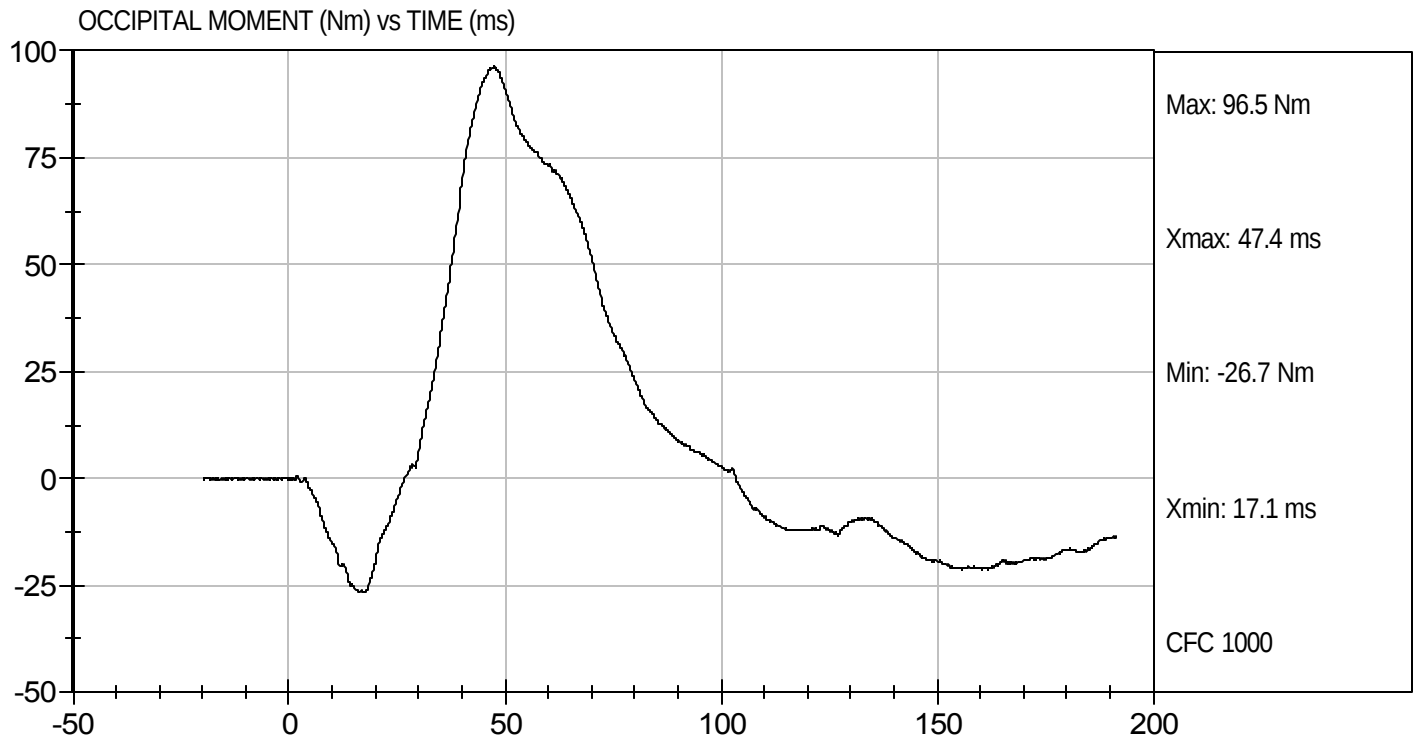
Test Date: 4/23/08
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D081152

Test Date: 4/23/08
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D081153

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	33	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	20.16	Pass
	20 msec	G's	14.00 to 19.00	17.46	Pass
	30 msec	G's	11.00 to 16.00	14.49	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	14.39	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	38.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	100.7	Pass
	Time	msec	72.0 to 82.0	74.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	152.8	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-69.0	Pass
	Time	msec	65.0 to 79.0	69.2	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	140.7	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

4/23/08
Test Date

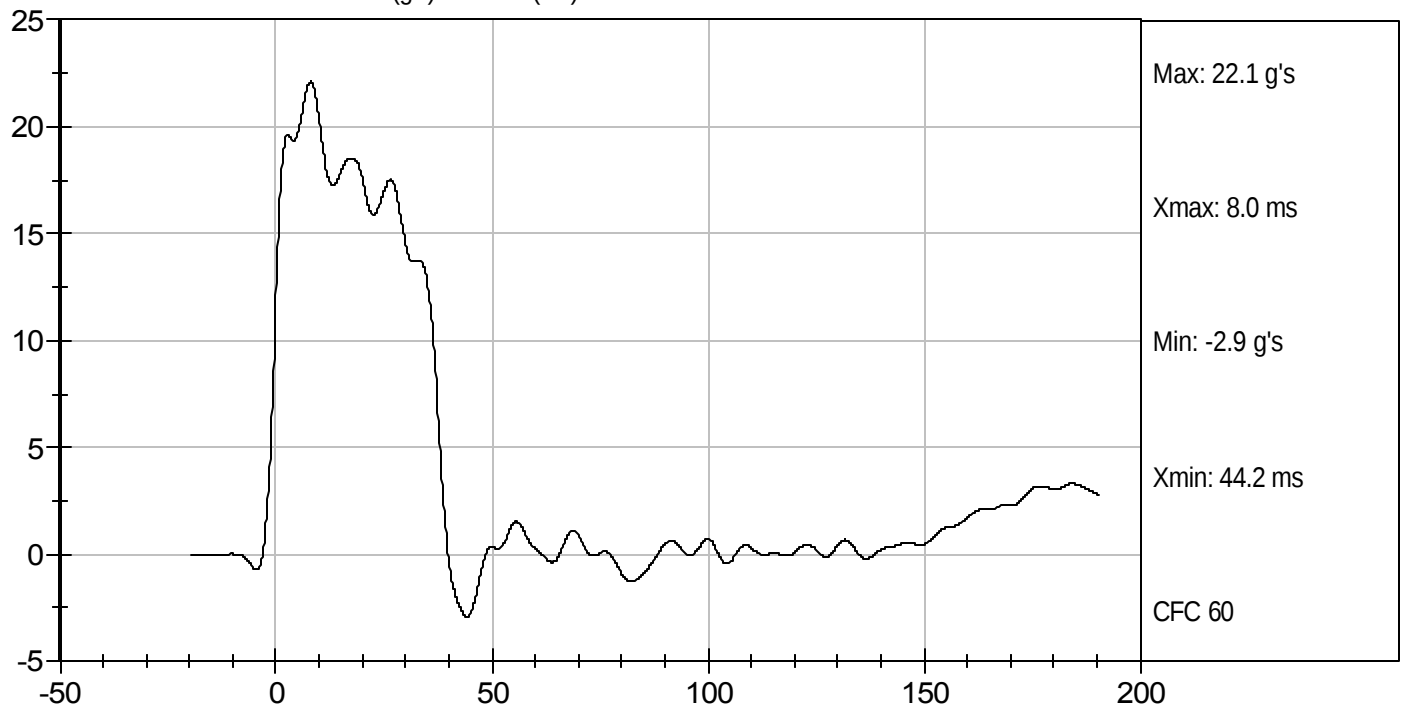
David Winkelbauer
Approved by



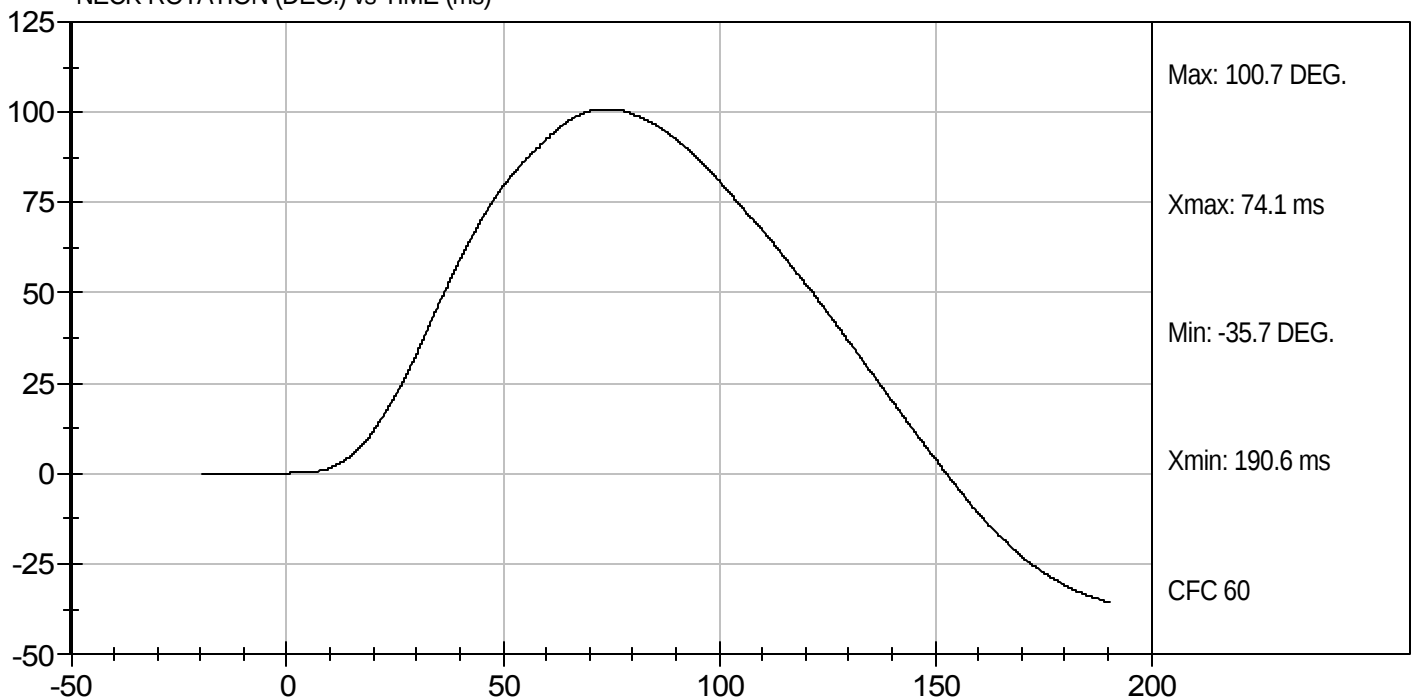
Test Desc: Neck Extension
Component ID: D081153

Test Date: 4/23/08
Velocity: 20.20 ft/s, 6.16 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)



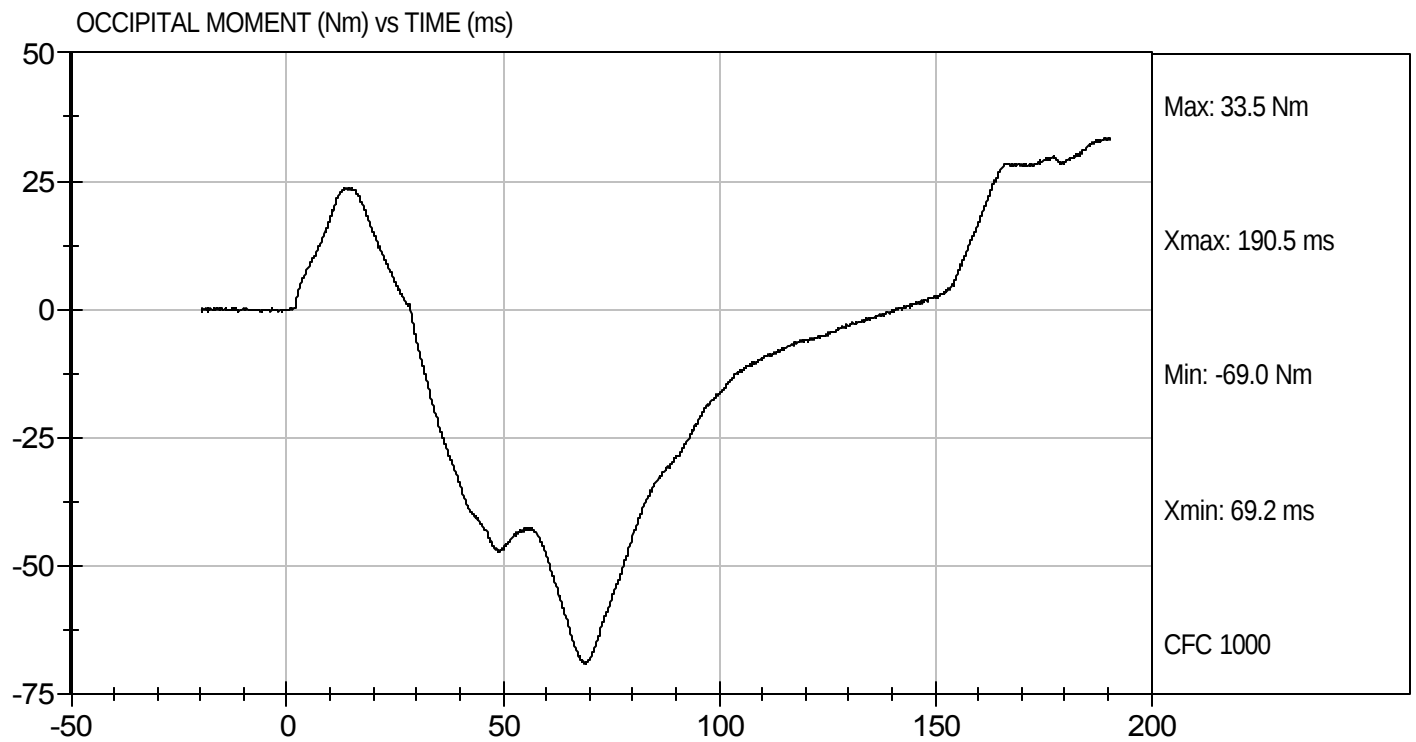
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension
Component ID: D081153

Test Date: 4/23/08
Velocity: 20.20 ft/s, 6.16 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D081154

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,378	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.68	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved by

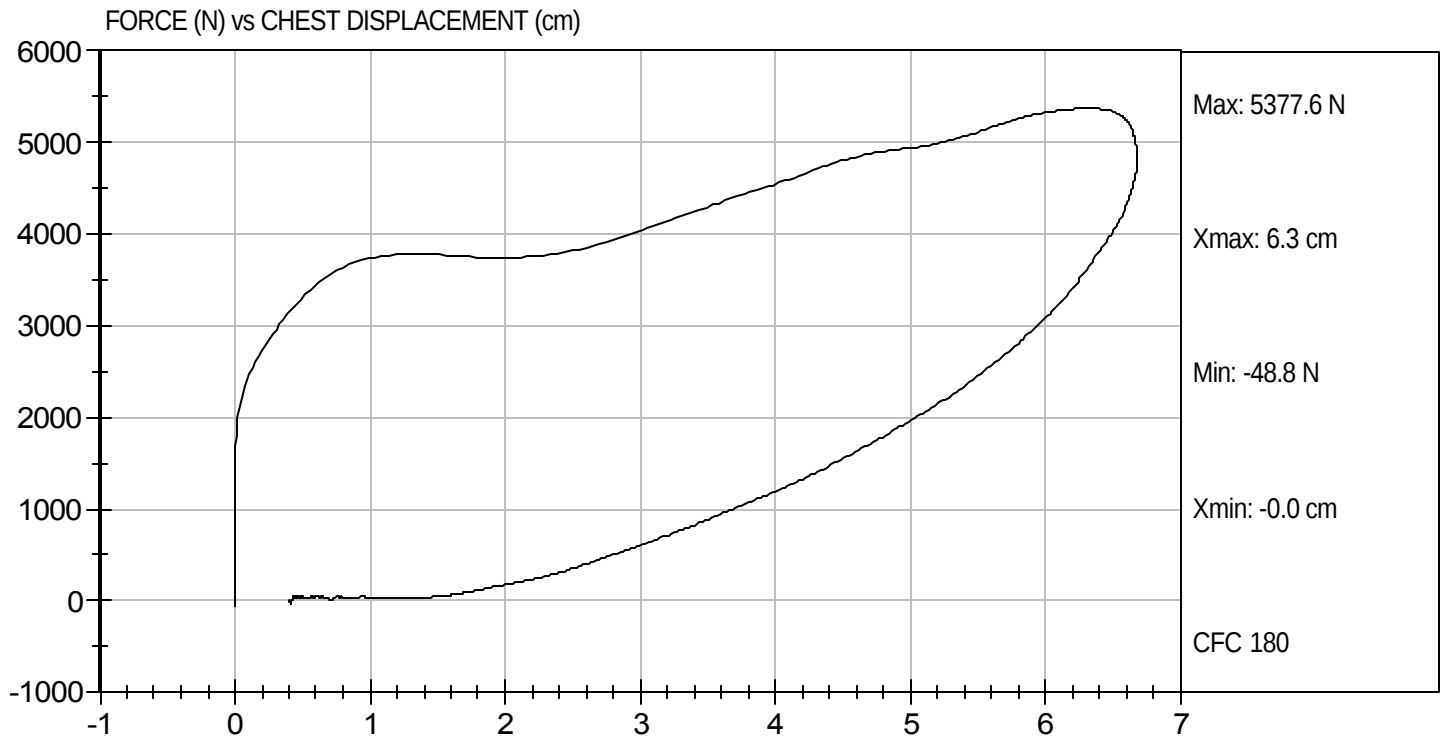
4/23/08

Test Date



Test Desc: Thorax Impact
Component ID: D081154

Test Date: 4/23/08
Velocity: 22.222 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D081155

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	33	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	4,993	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

4/23/08

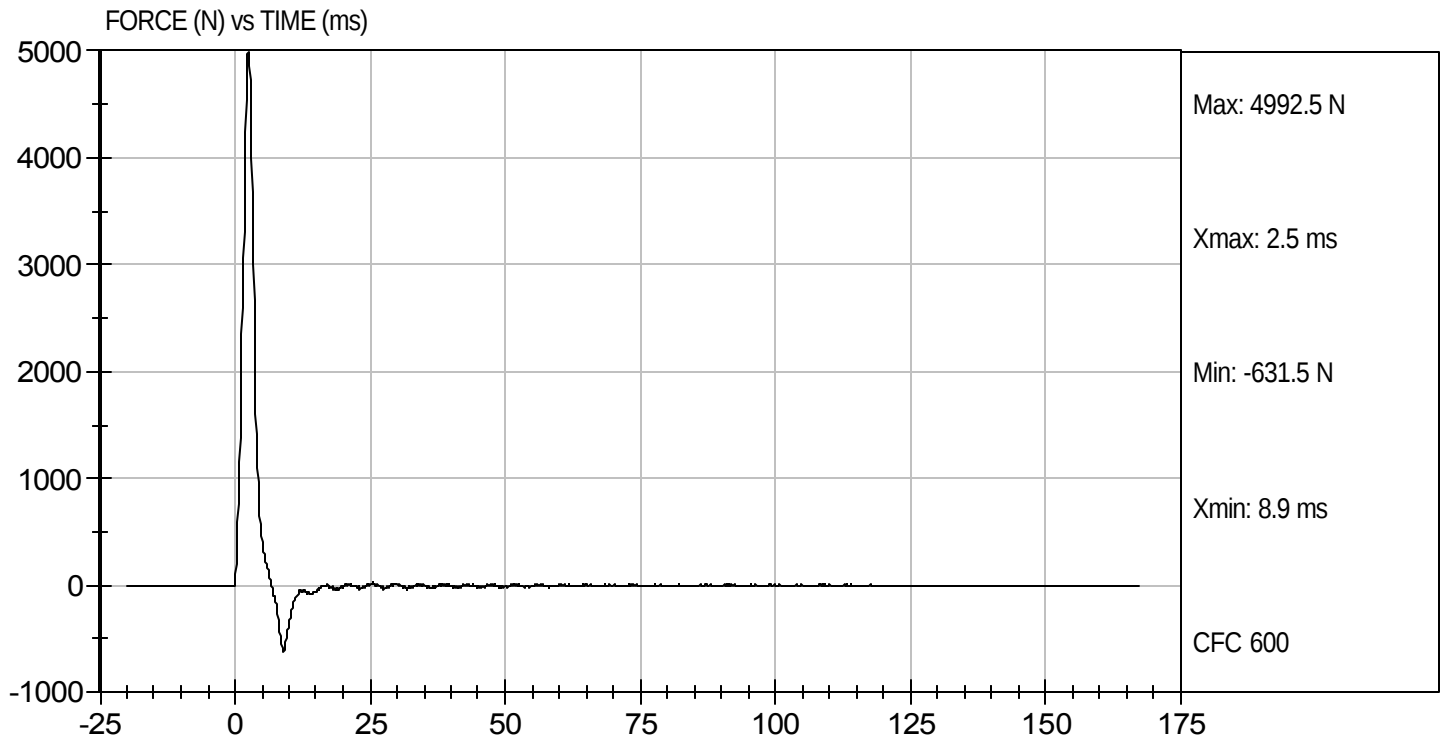
Test Date

David Winkelbauer
Approved by



Test Desc: Right Knee
Component ID: D081155

Test Date: 4/23/08
Velocity: 6.86 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D081156

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	33	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,104	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

4/23/08

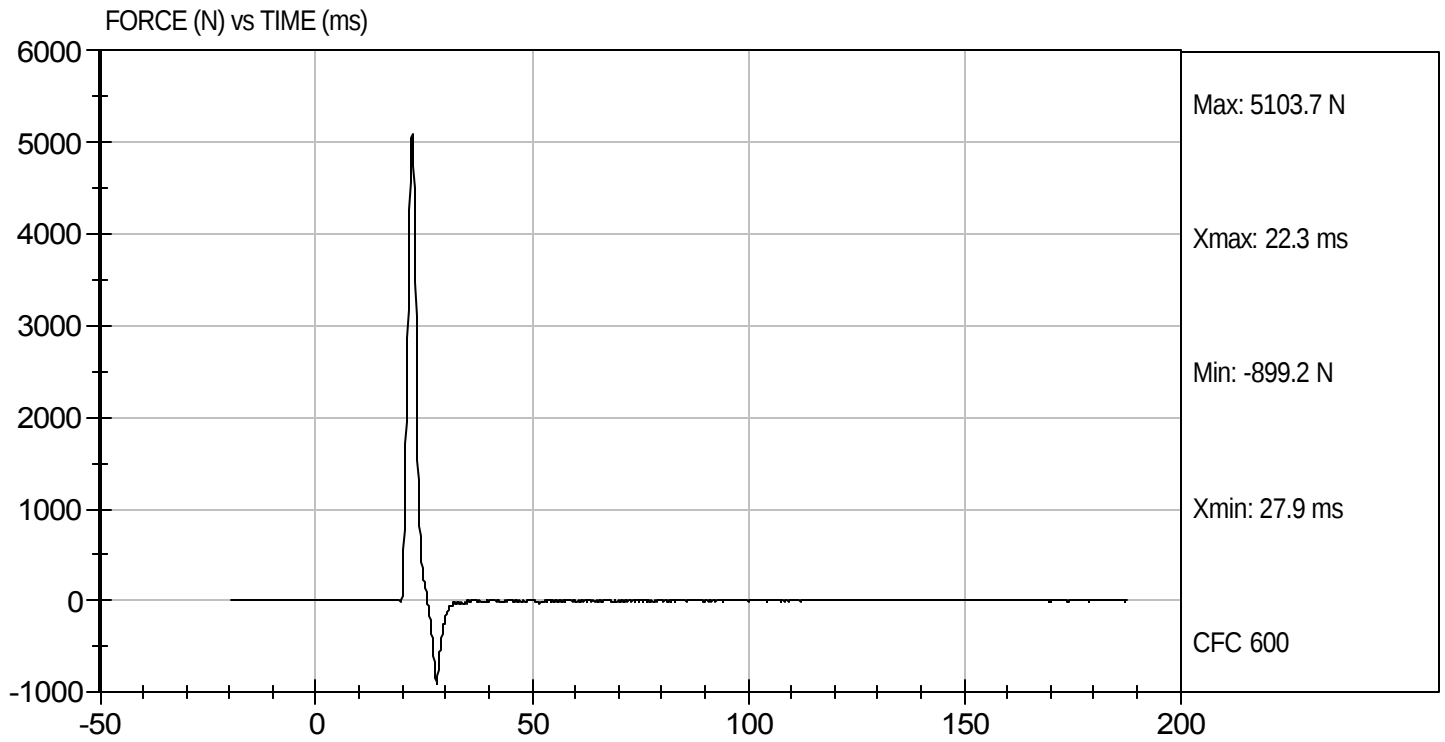
Test Date

David Winkelbauer
Approved by



Test Desc: Left Knee
Component ID: D081156

Test Date: 4/23/08
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D081150

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	31	31	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	71.3	60.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	41	41	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

4/23/08
Test Date

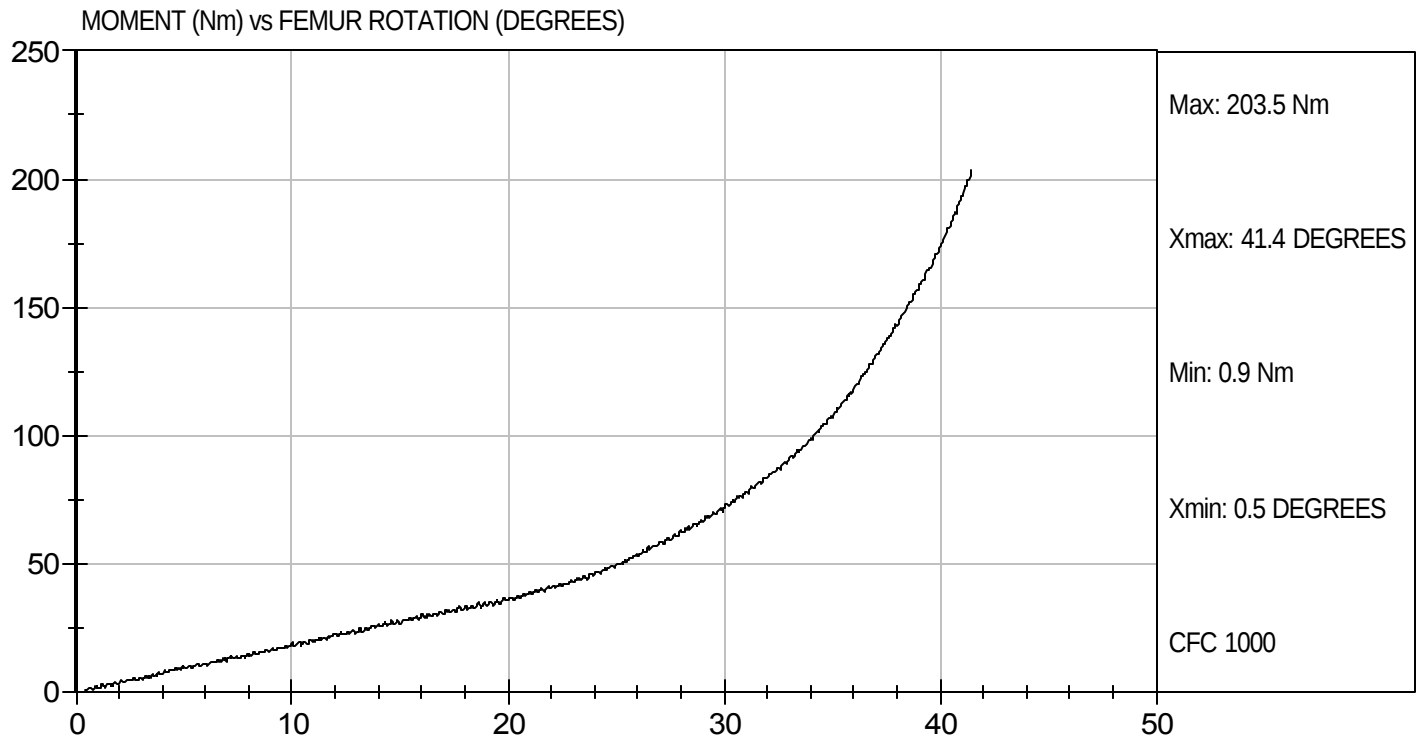
David Winkelbauer
Approved by



Test Desc: Hip Femur Flexion
Component ID: D081159

Test Date: 4/23/08

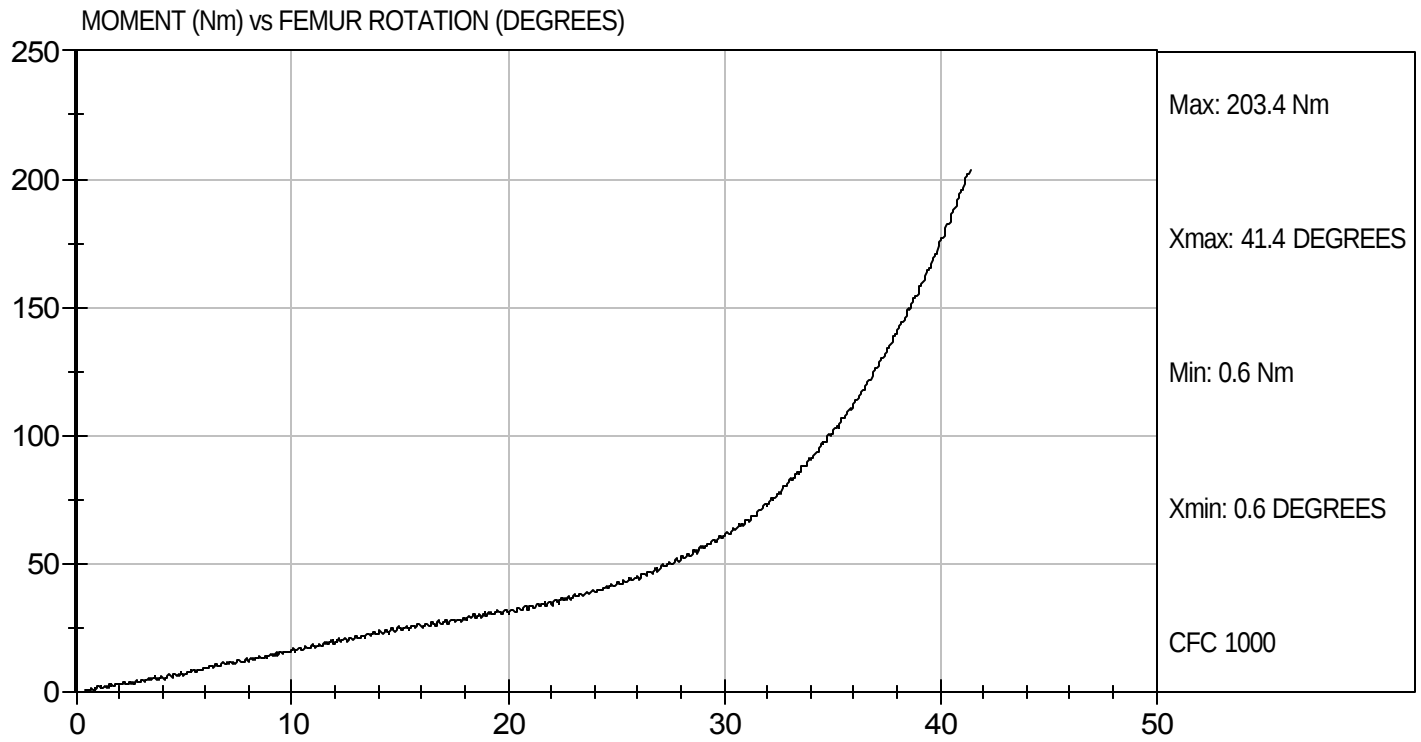
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D081150

Test Date: 4/23/08
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test ID: D081161

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	225 - 275	230	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	5.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

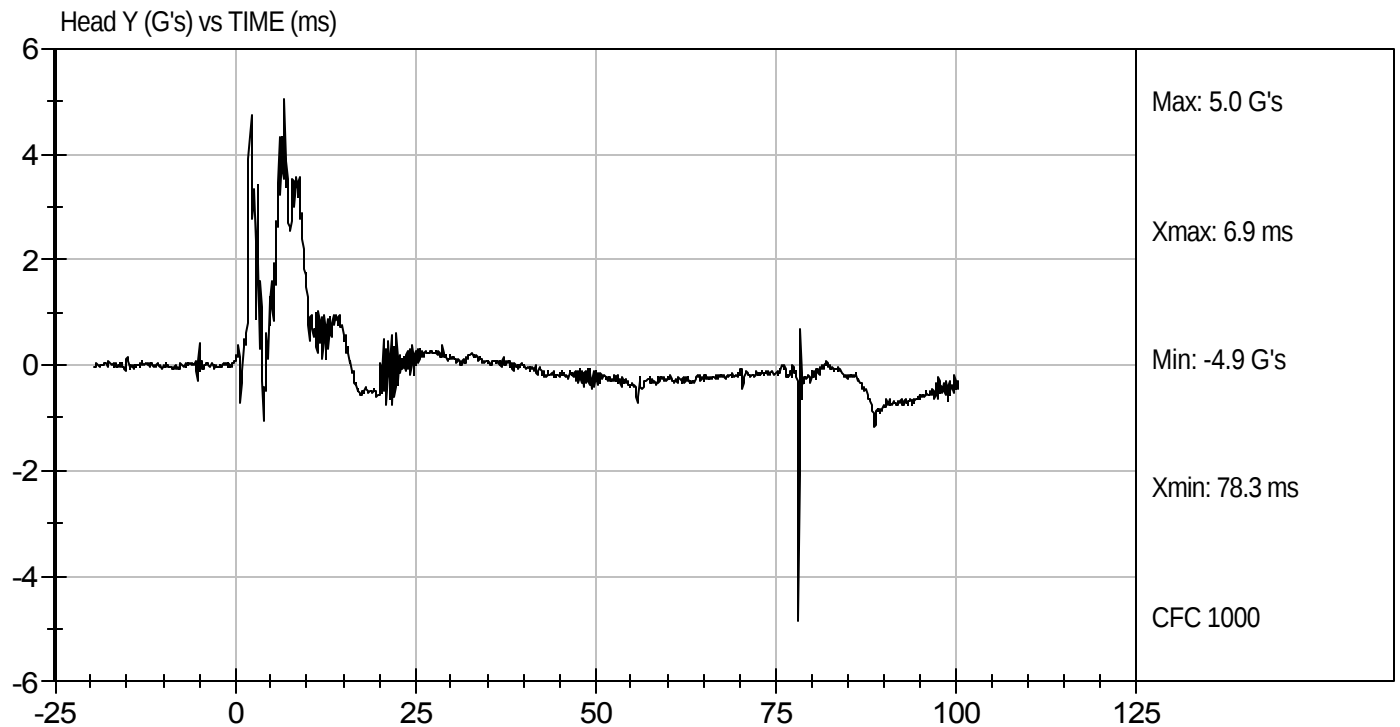
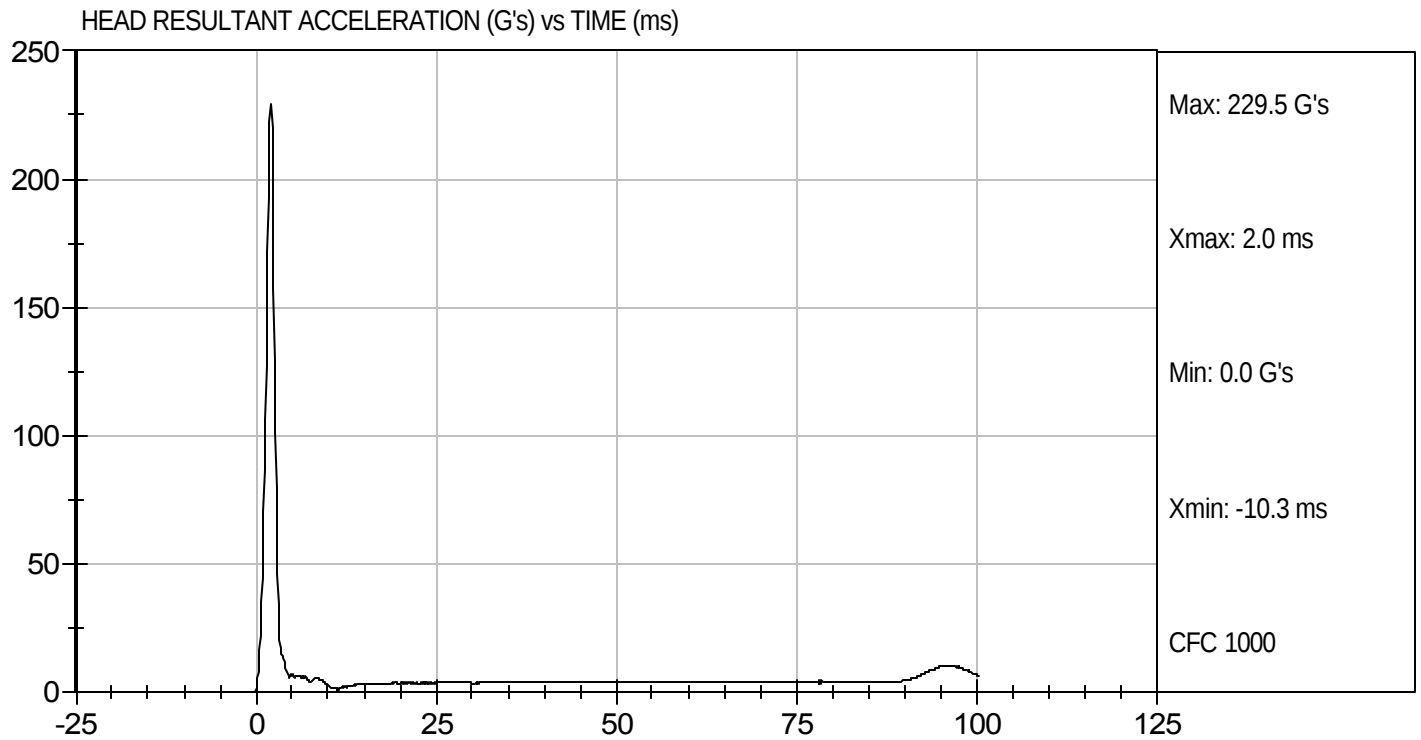
David Winkelbauer
Approved by

4/23/08
Test Date



Test Desc: Head Drop
Component ID: D081161

Test Date: 4/23/08
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D081162

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	32	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	23.01	Pass
	20 msec	G's	17.60 to 22.60	19.85	Pass
	30 msec	G's	12.50 to 18.50	14.34	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.29	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	34.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.8	Pass
	Time	msec	57.0 to 64.0	58.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.4	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.1	Pass
	Time	msec	47.0 to 58.0	47.3	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	102.0	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

4/23/08
Test Date

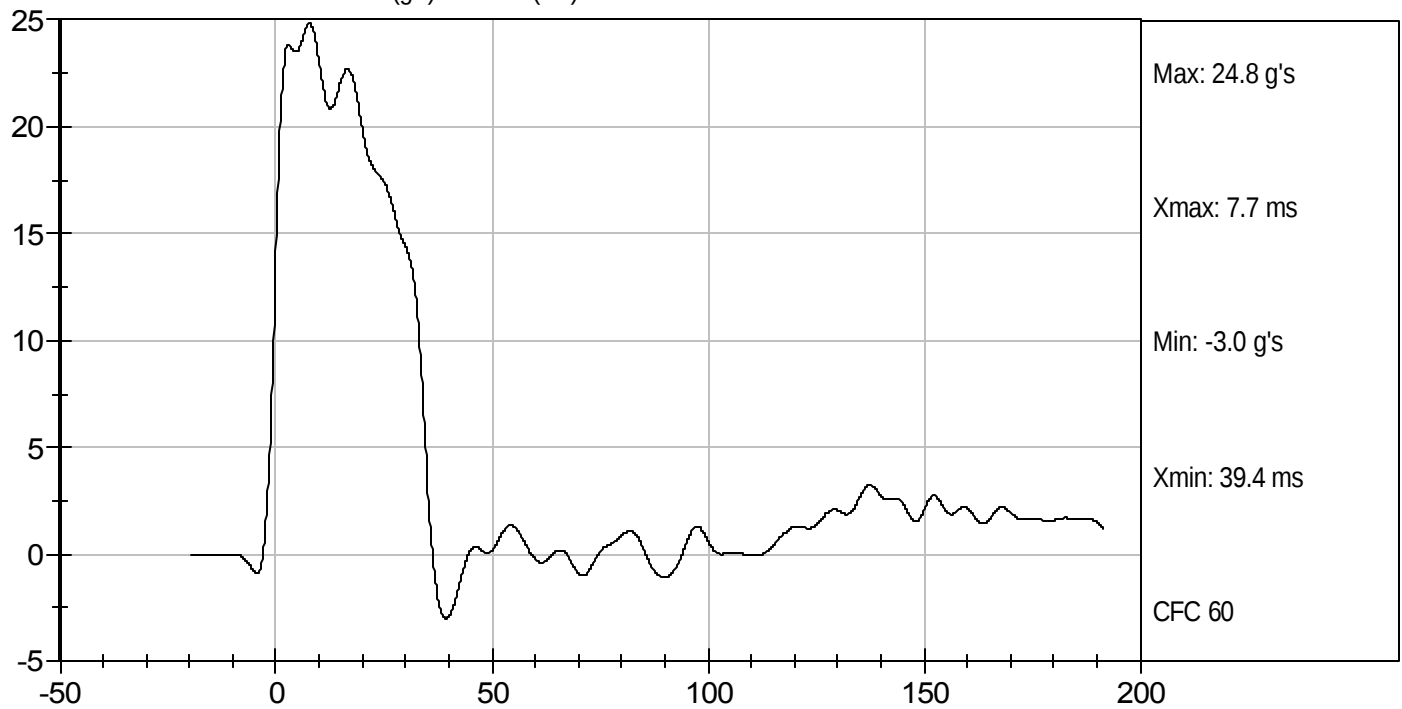
David Winkelbauer
Approved by



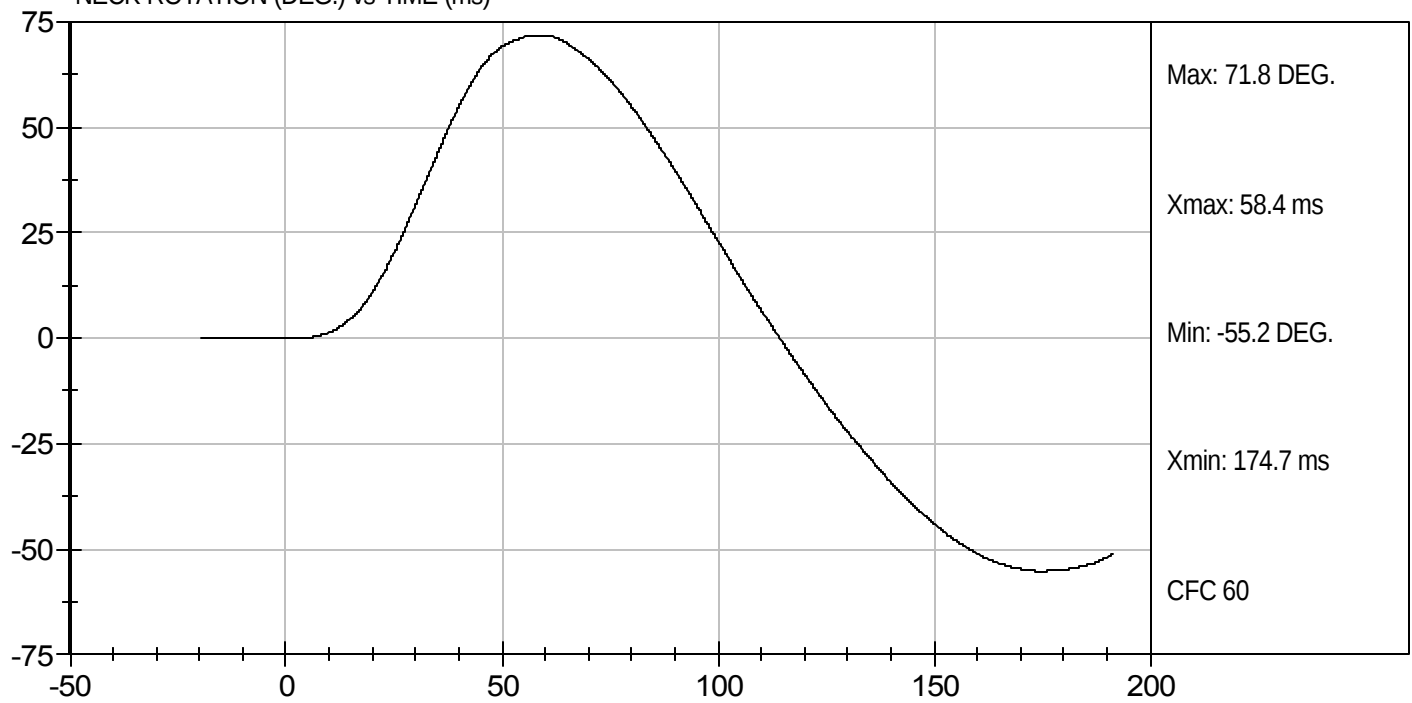
Test Desc: Neck Flexion
Component ID: D081162

Test Date: 4/23/08
Velocity: 22.83 ft/s, 6.96 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)



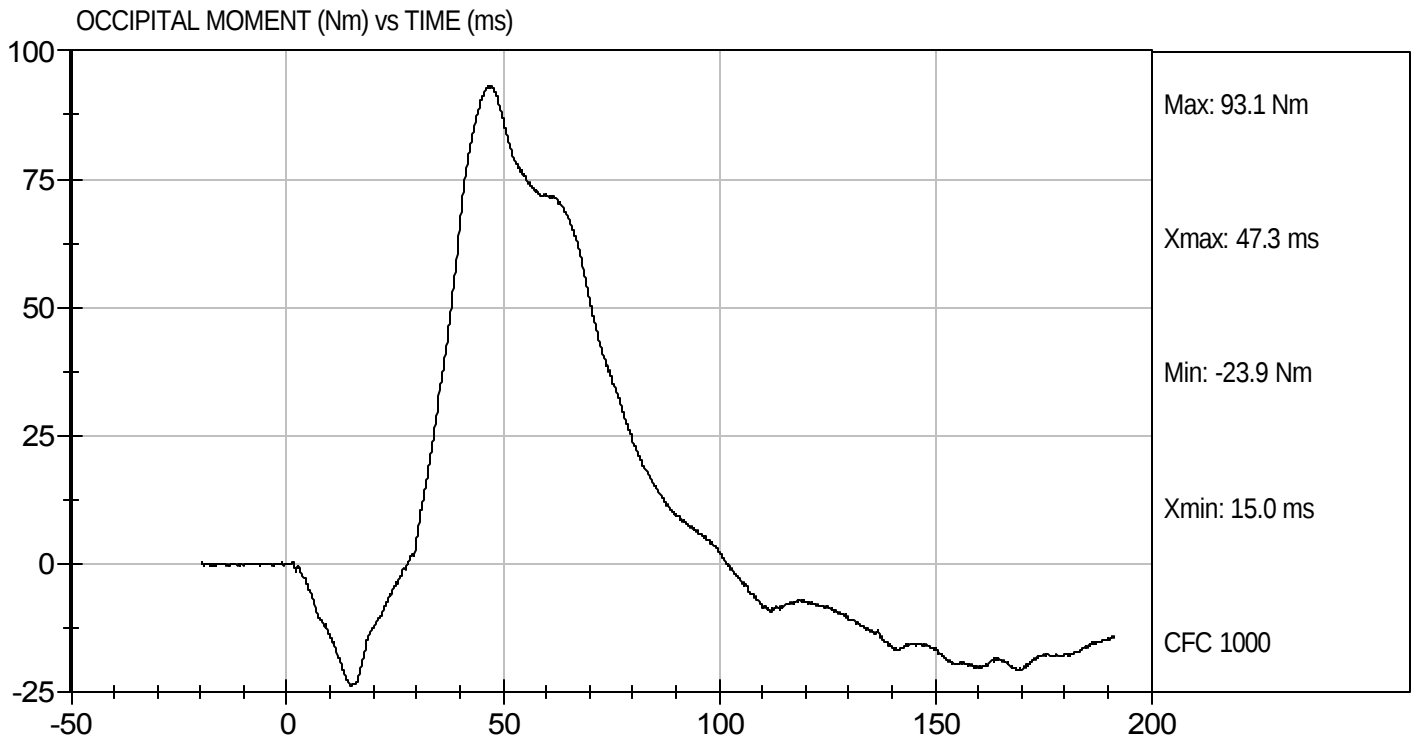
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion
Component ID: D081162

Test Date: 4/23/08
Velocity: 22.83 ft/s, 6.96 m/s

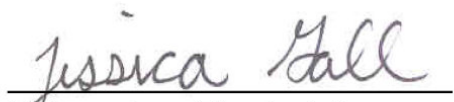


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

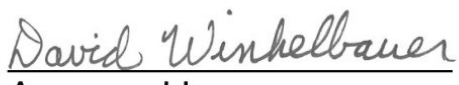
ATD Serial No: 066

Test I.D: D081163

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	32	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	21.08	Pass
	20 msec	G's	14.00 to 19.00	18.29	Pass
	30 msec	G's	11.00 to 16.00	15.34	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	15.27	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	38.6	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	100.0	Pass
	Time	msec	72.0 to 82.0	73.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	151.3	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-70.3	Pass
	Time	msec	65.0 to 79.0	68.5	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	140.5	Pass
Overall Test Results					Pass


Laboratory Technician

4/23/08
Test Date

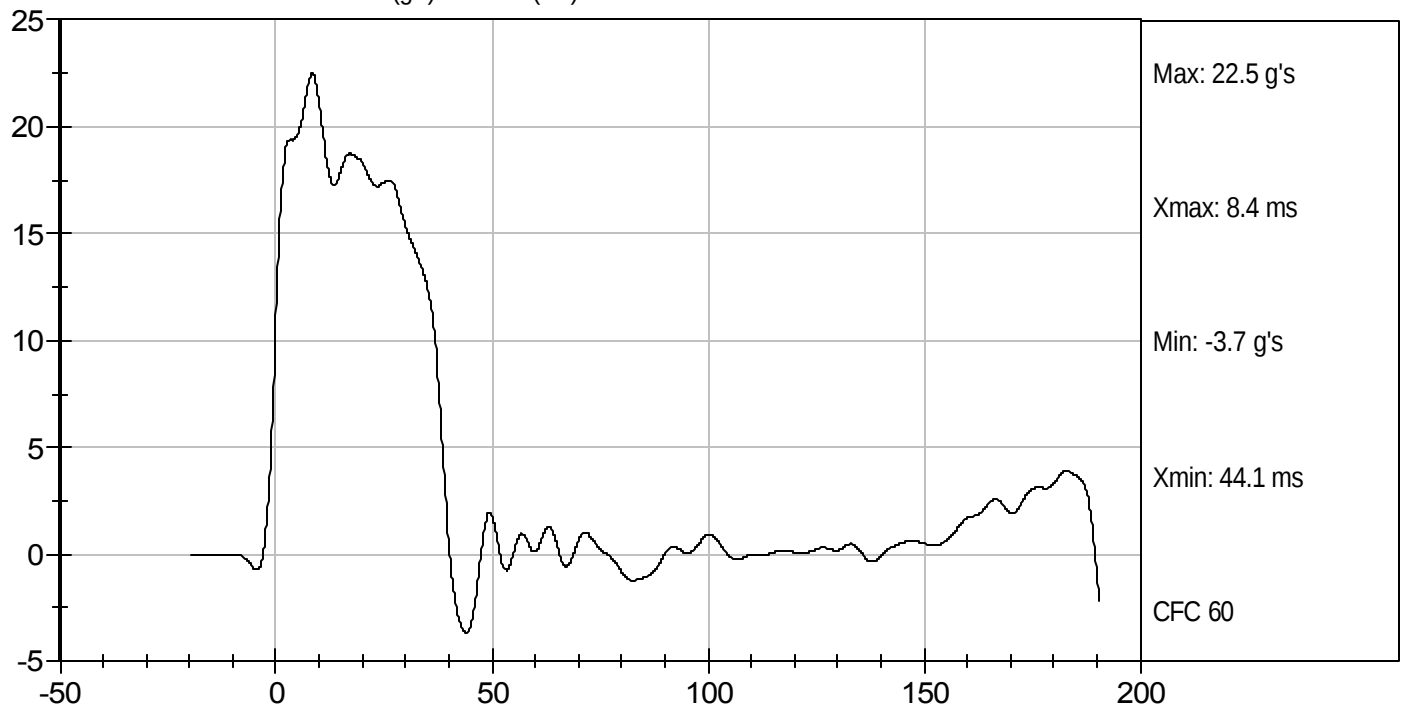

Approved by



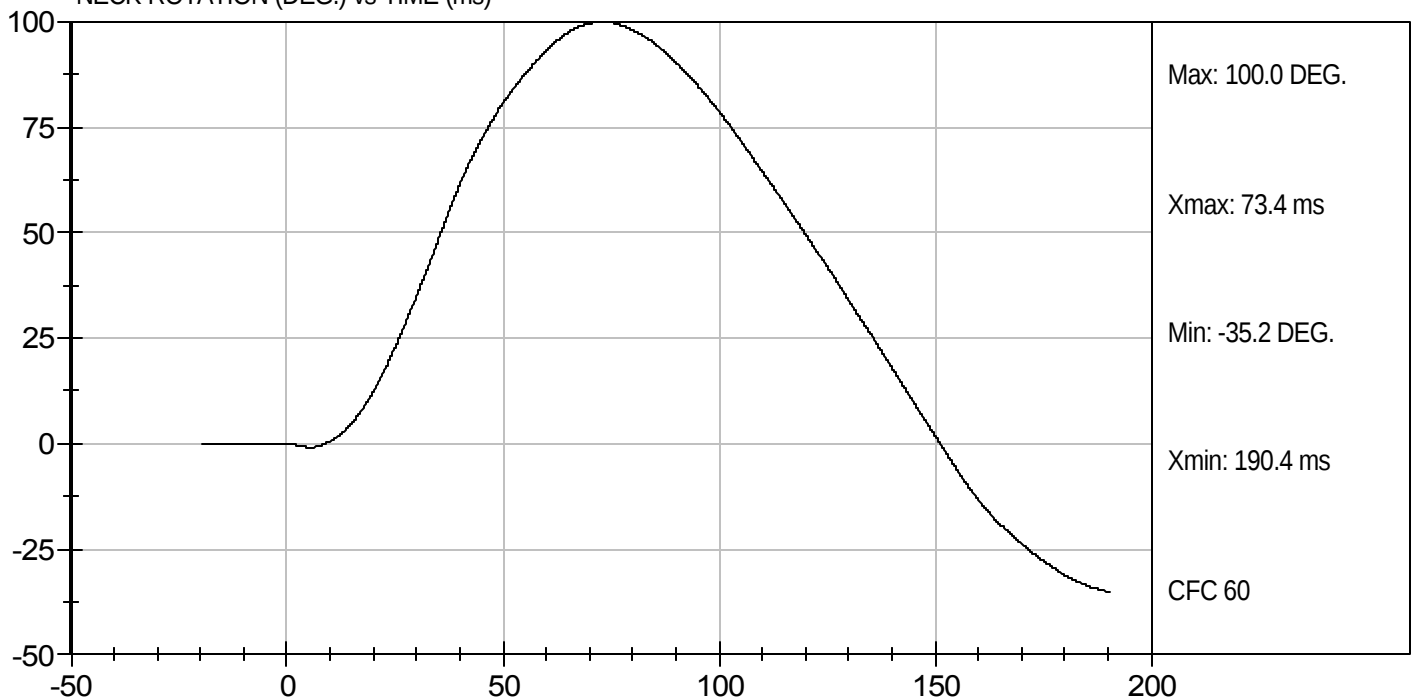
Test Desc: Neck Extension
Component ID: D081163

Test Date: 4/23/08
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (g's) vs TIME (ms)



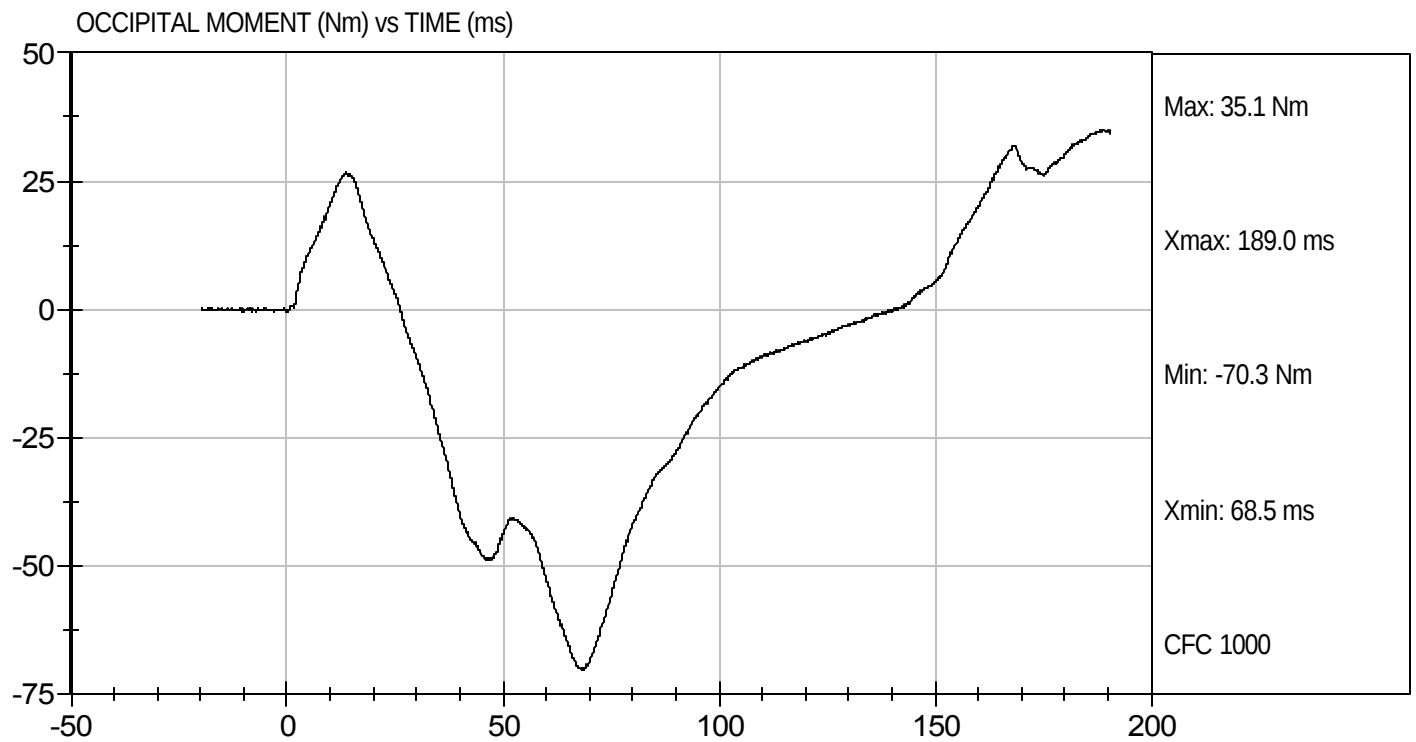
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension
Component ID: D081163

Test Date: 4/23/08
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D081164

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,376	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.39	Pass
Internal Hysteresis	%	69 to 85	73	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

4/23/08

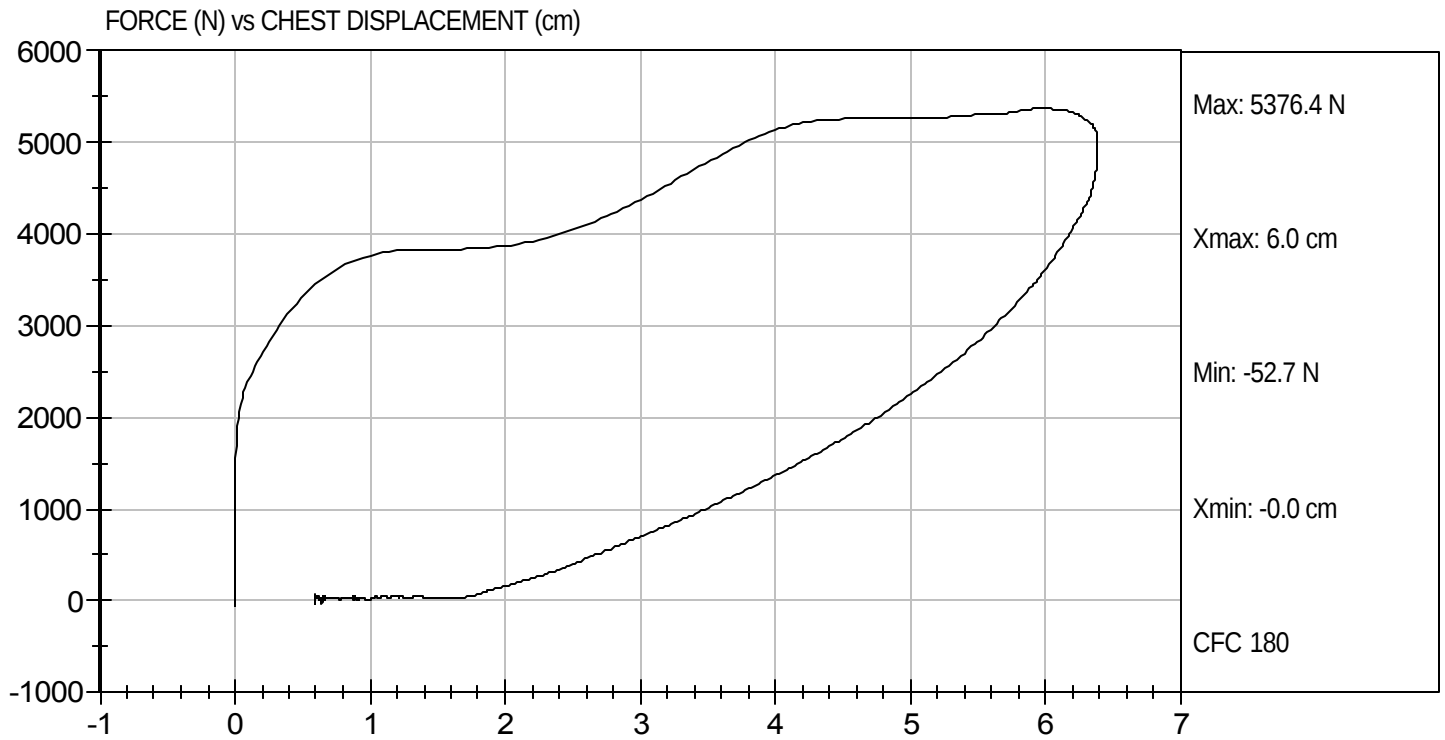
Test Date

David Winkelbauer
Approved by



Test Desc: Thorax Impact
Component ID: D081164

Test Date: 4/23/08
Velocity: 22.222 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D081165

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	4,977	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

4/23/08

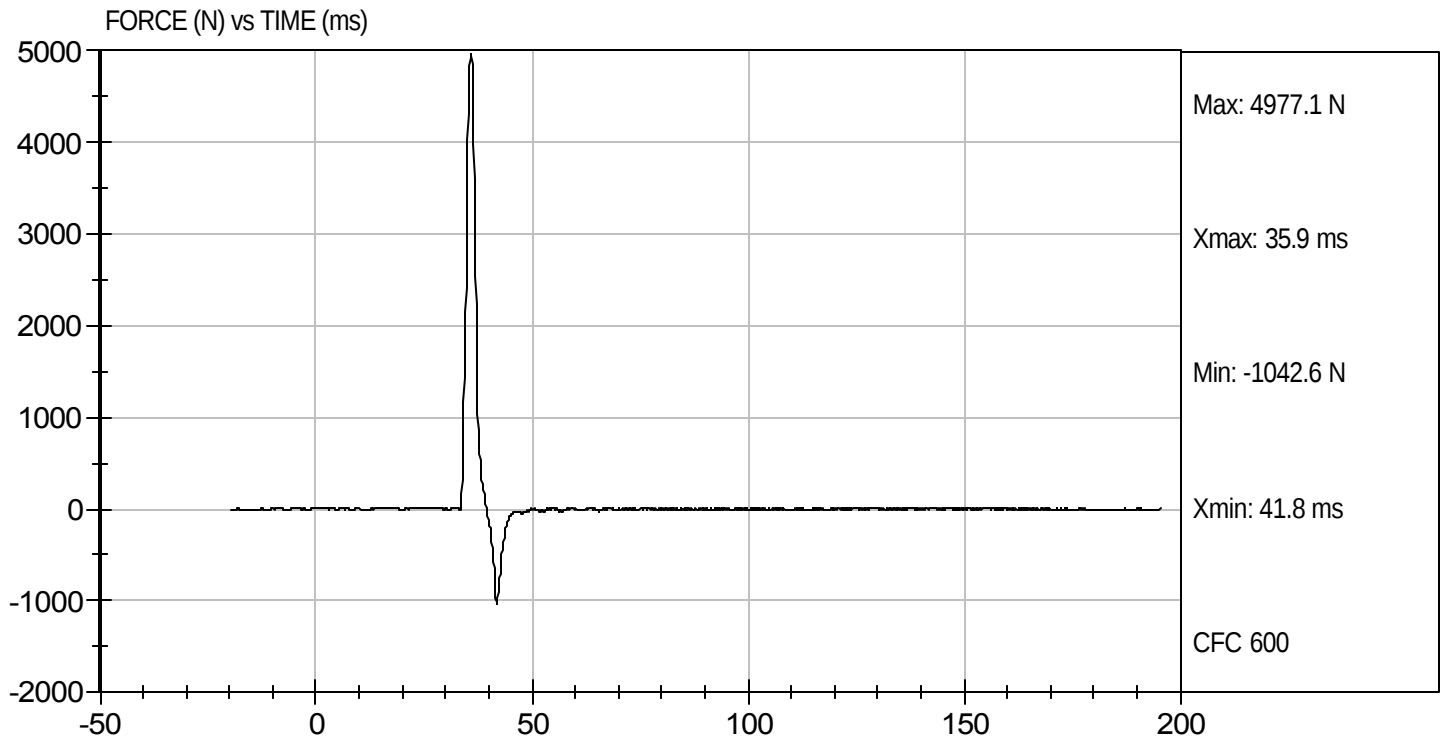
Test Date

David Winkelbauer
Approved by



Test Desc: Right Knee
Component ID: D081165

Test Date: 4/23/08
Velocity: 6.94 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D081166

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	4,873	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

4/23/08

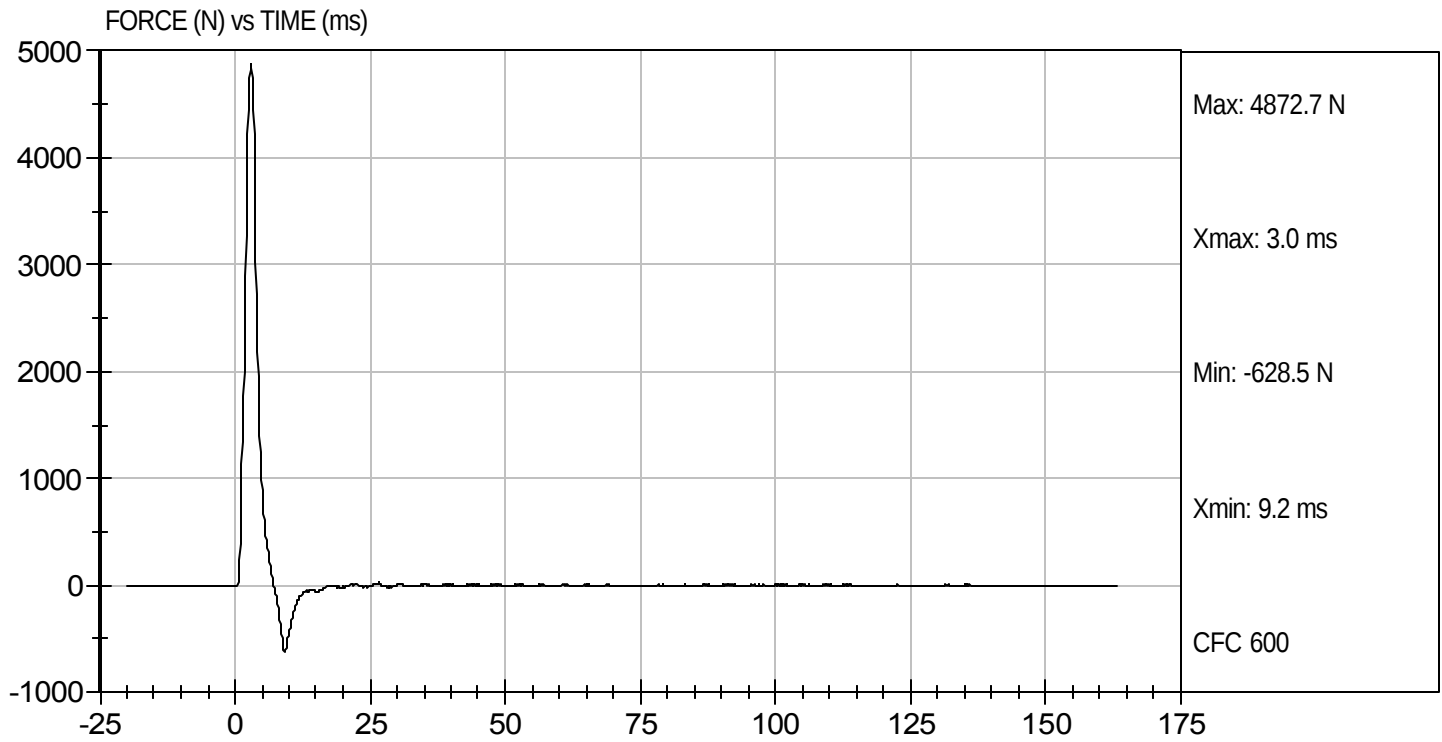
Test Date

David Winkelbauer
Approved by



Test Desc: Left Knee Slider
Component ID: D081166

Test Date: 4/23/08
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D081160

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	31	31	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	71.3	59.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	41	41	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

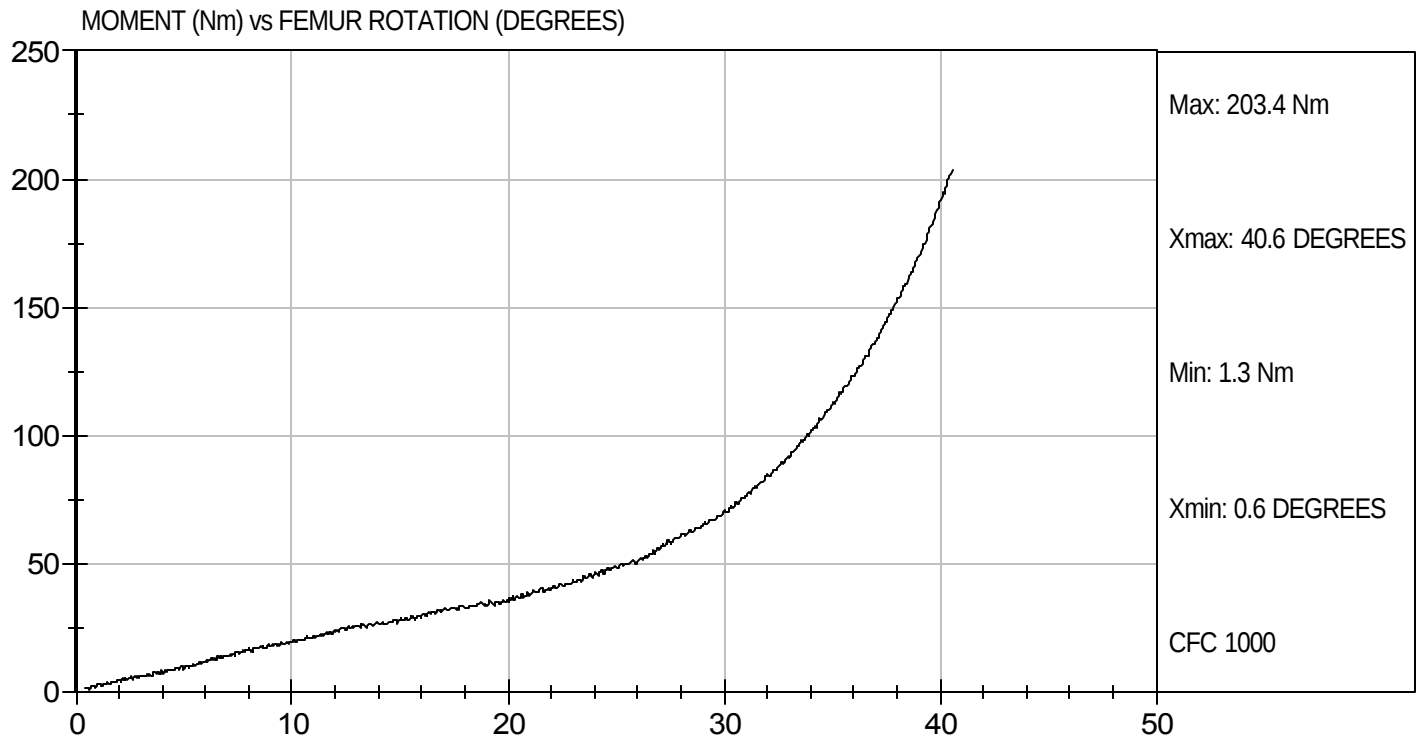
4/23/08
Test Date

David Winkelbauer
Approved by



Test Desc: Hip Femur Flexion
Component ID: D081169

Test Date: 4/23/08
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D081160

Test Date: 4/23/08

Velocity: 0 ft/s, 0.00 m/s

