

REPORT NUMBER: NCAP-MGA-2011-044

**NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test**

**GENERAL MOTORS LLC
2011 Chevrolet Cruze LS 4-Dr Sedan
NHTSA No.: MB0102**

**MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105**



Test Date: November 22, 2010


Final Report Date: December 28, 2010

FINAL REPORT

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
1200 New Jersey Ave, SE
Mail Code: NVS 111, Room W43-410
Washington, DC 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-06-D-00028.

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Approval Date: December 28, 2010

FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

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16. Abstract A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2011 Chevrolet Cruze LS 4-Dr Sedan in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure for the generation of consumer information on vehicle frontal crash protection. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on November 22, 2010. The impact velocity was 56.2 km/h and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle post-test maximum crush was 517 mm located at the vehicle's centerline. The test vehicle's performance was as follows:																																																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Threshold</th> <th rowspan="2">Driver ATD</th> <th rowspan="2">Passenger ATD</th> </tr> <tr> <th>50th</th> <th>5th</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>700</td> <td>191</td> <td>155</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>17</td> <td>9</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.26</td> <td>0.35</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>814</td> <td>658</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>72</td> <td>104</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1352</td> <td>1035</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2265</td> <td>1819</td> </tr> </tbody> </table>				Measurement Description	Units	Threshold		Driver ATD	Passenger ATD	50 th	5 th	Head Injury Criteria (HIC ₁₅)	N/A	700	700	191	155	Maximum Chest Compression	mm	63	52	17	9	Nij	N/A	1	1	0.26	0.35	Neck Tension	N	4170	2620	814	658	Neck Compression	N	4000	2520	72	104	Left Femur Force	N	10008	6805	1352	1035	Right Femur Force	N	10008	6805	2265	1819
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h 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 consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standard's NCAP Frontal Laboratory Test Procedure dated January 2010.

SUMMARY

A load cell barrier was impacted by a 2011 Chevrolet Cruze LS 4-Dr Sedan at a velocity of 56.2 kph. The test was performed at MGA Research Corporation on November 22, 2010. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two real-time cameras and fourteen (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.

One Part 572E, 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were on the driver's lap and shoulder belts and the passenger's lap belt to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with verification data, are found in Appendix C of this report.

The 223 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest displacement, neck, 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 517 mm and both the driver and passenger side doors remained closed 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 airbag. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the knee airbag.

The occupant data is summarized below:

ATD position	HIC ₁₅	T ¹	T ²	Chest Disp. (mm)	Nij	Neck Tension (N)	Neck Comp. (N)	Left Femur (N)	Right Femur (N)
Driver (50 th)	191	76.6	91.6	17	0.26	814	72	1352	2265
Passenger (5 th)	155	48.9	63.9	9	0.35	658	104	1035	1819

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 Pelvis Z after 90 msec.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MB0102	Anti-Lock Brakes	Yes
Model Year	2011	All Wheel Drive	No
Make	Chevrolet	Power Steering	Yes
Model	Cruze	Driver Front Airbag	Yes
Body Style	Sedan	Driver Curtain Airbag	Yes
VIN	1G1PC5SH5B7108798	Driver Head/Torso Airbag	No
Body Color	Imperial Blue Metallic	Driver Torso Airbag	No
Delivery Date	10/28/2010	Driver Torso/Pelvis Airbag	Yes
Odometer (mi)	41	Driver Pelvis Airbag	No
Odometer (km)	66	Driver Knee Airbag	Yes
Dealer	Ray Auto Group	Pass. Front Airbag	Yes
Transmission	Automatic	Pass. Curtain Airbag	Yes
Final Drive	Front	Pass. Head/Torso Airbag	No
Type/No. Cylinders	4	Pass. Torso Airbag	No
Engine Displacement (L)	1.8	Pass. Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Pass. Pelvis Airbag	No
Roof Rack	No	Pass. Knee Airbag	Yes
Sunroof/T-Top	No	Pretensioners	Yes
Tinted Glass	No	Load Limiters	Yes
Traction Control	Yes	Automatic Door Locks	Yes
Power Brakes	Yes	Bucket Seats	Yes
Front Disc	Yes	Tilt Steering	Yes
Rear Disc	No	Other	
Does owner's manual provide instructions to turn off automatic door locks?	No		

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors LLC	GVWR (kg)	1847
Date of Manufacture	09/10	GAWR Front (kg)	962
		GAWR Rear (kg)	885

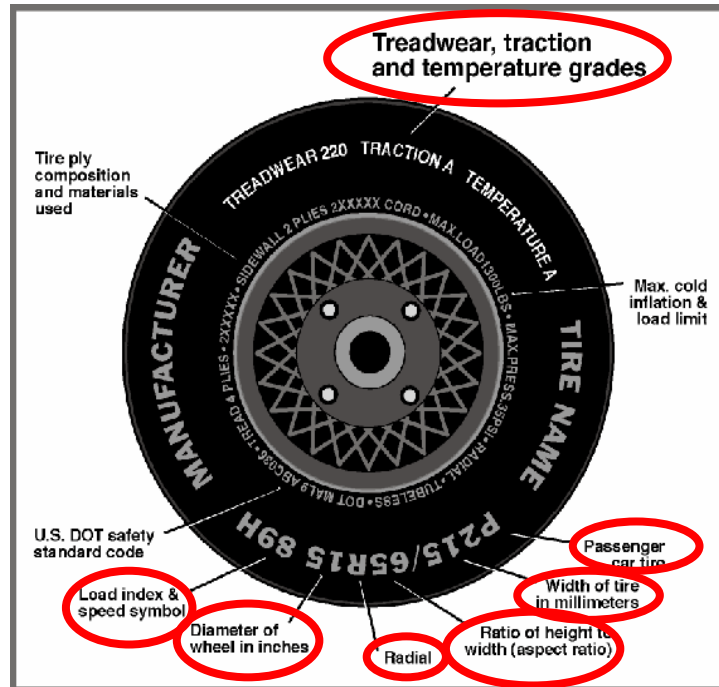
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				408
Cargo Weight (RCLW) (kg)				68

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	240	240
Recommended Tire Size	P215/60R16	P215/60R16
Tire Size on Vehicle	P215/60R16	P215/60R16
Tire Manufacturer	Firestone	Firestone
Tire Model	FR 710	FR 710
Treadwear	560	560
Traction	B	B
Temperature Grades	B	B
Tire Plies Sidewall	1	1
Tire Plies Body	4	4
Load Index & Speed Symbol	94S	94S
Tire Material	Rubber	Rubber
DOT Safety Code Right	V6X8 CKD	V6X8 CKD
DOT Safety Code Left	V6X8 CKD	V6X8 CKD

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	445.4	288.5		474.9	362.9	
Right	kg	417.3	279.4		439.1	354.2	
Ratio	%	60.3	39.7		56.0	44.0	
Totals	kg	862.7	567.9	1430.6	914.0	717.1	1631.1

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1430.6
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	68
Calculated Target Vehicle Target Weight (TVTWTW)	kg	1639.2

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	698	699	698	706	1068
As Tested	mm	692	695	666	674	1183
Post Test	mm	759	790	648	682	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2690
Total Vehicle Length at Left Side	mm	4400
Total Vehicle Length at Centerline	mm	4609
Total Vehicle Length at Right Side	mm	4400
Weight of Ballast in Cargo Area	kg	54.4
Weight of Vehicle Components Removed	kg	25.4
Amount of Stoddard Solvent in Fuel Tank	L	54.9

List of components removed to meet test weight: Spare tire and tools, right tail light, trunk carpet, underbody plastics.

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4609
2	Total Width	1750
3	Bumper Top Height	535
4	Bumper Bottom Height	440
5	Longitudinal Member Top Height	560
6	Distance between Longitudinal Members	900
7	Longitudinal Member Width	126
8	Engine Top Height	796
9	Engine Bottom Height	201
10	Engine and Gearbox Width	725
11	Front Bumper-Engine Distance	505
12	Front Shock Absorber Fixing Height	893
13	Bonnet Leading Edge Height	772
14	Front Shock Absorber Fixing Width	1150
15	Front Bumper – Front Axle Distance	960
16	Front Axle – A-Pillar Distance	439
17	A-Pillar – B-Pillar Distance	1107
18	B-Pillar – Rear Axle Distance	1145
19	B-Pillar – C-Pillar Distance	760
20	Roof Sill Bottom Height	1260
21	Roof Sill Top Height	1435
22	Floor Sill bottom Height	192
23	Floor Sill Top Height	355

DATA SHEET NO. 2

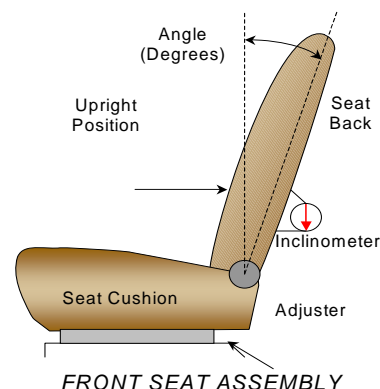
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.



SEAT BACK ANGLE	Degrees
Driver Seat Back Angle	8.6° on headrest post
Passenger Seat Back Angle	5.7° on headrest post

SEAT FORE/AFT POSITIONS

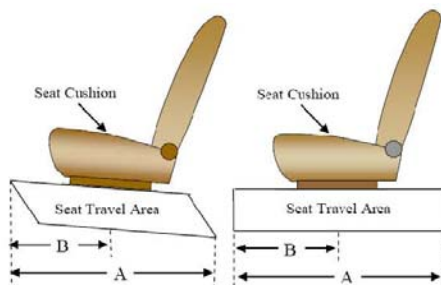
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

SEAT FORE/AFT POSITIONS	Total Fore/Aft Travel	Placed in Position #
Driver Seat	54 detents (1 st as 1)	21st detent (forward-most as 0)
Passenger Seat	50 detents (1 st as 1)	0 mm (forward-most as 0)

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are positioning following the manufacturer's specified position as listed in Form 1.

SEAT BELT UPPER ANCHORAGES	Total # of Positions	Placed in Position #
Driver Seat	5	0 (uppermost as 0)
Passenger Seat	5	0 (uppermost as 0)



DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

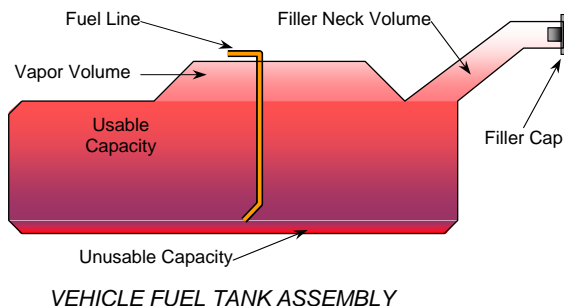
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	59.0
Usable Capacity of "Optional" Tank	54.3 to 55.5
92-94% of Usable Capacity	54.9
Actual Amount of Solvent used	19.7
1/3 of Usable Capacity	

FUEL PUMP

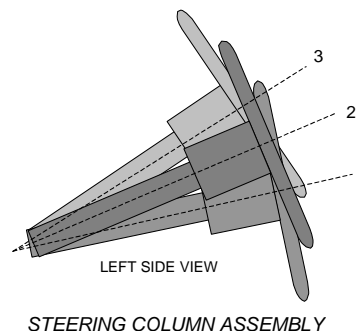
Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

The vehicle is equipped with an electric fuel pump. The fuel pump will activate when the ignition key is turned to the 'Run' position. When the working fuel system pressure is achieved; the pump will turn OFF. The fuel pipe is on the right side.



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 POSITION

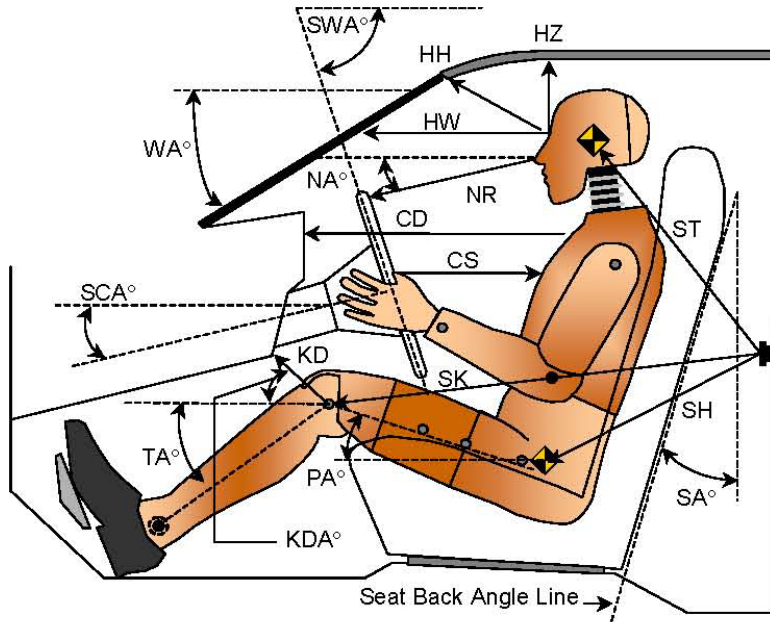
	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	70.2	224
Geometric Center – Position 2	68.1	196
Uppermost – Position 3	66.0	168
Telescoping Steering Wheel Travel		56
Test Position	68.1	196

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

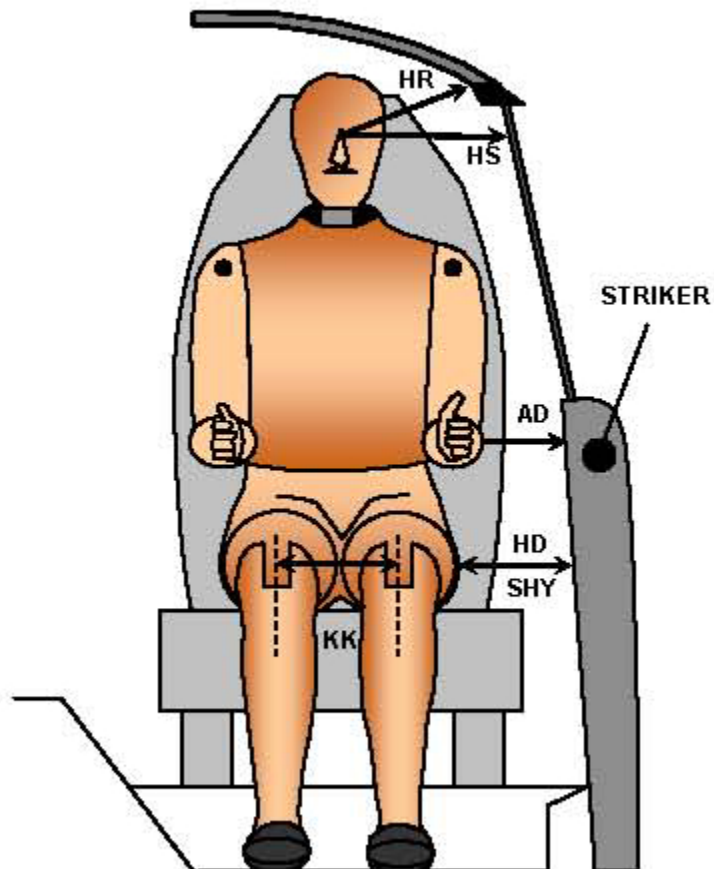


Code	Measurement Description	Driver S/N 351		Passenger S/N 634	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		25.7		
SWA	Steering Wheel Angle		68.1		
SCA	Steering Column Angle		21.9		
SA	Seat Back Angle (headrest bezel)		8.6		5.7
HZ	Head to Roof (Z)	228	90	233	90
HH	Head to Header	365	26.4	280	45.0
HW	Head to Windshield	718	0	682	0
NR	Nose to Rim	428	7.1		
CD	Chest to Dash	555		440	
CS	Chest to Steering Hub	356	2.0		
RA	Rim to Abdomen	235	0		
KDL	Left Knee to Dash	198	38.3	139	42.6
KDR	Right Knee to Dash	161	37.9	145	40.2
PA	Pelvic Angle		24.7		22.2
TA	Tibia Angle		35.1		44.5
SK	Striker to Knee	525	99.5	595	95.5
ST	Striker to Head	450	2.3	410	19.1
SH	Striker to H-Point	219	147.7	300	120.3

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010



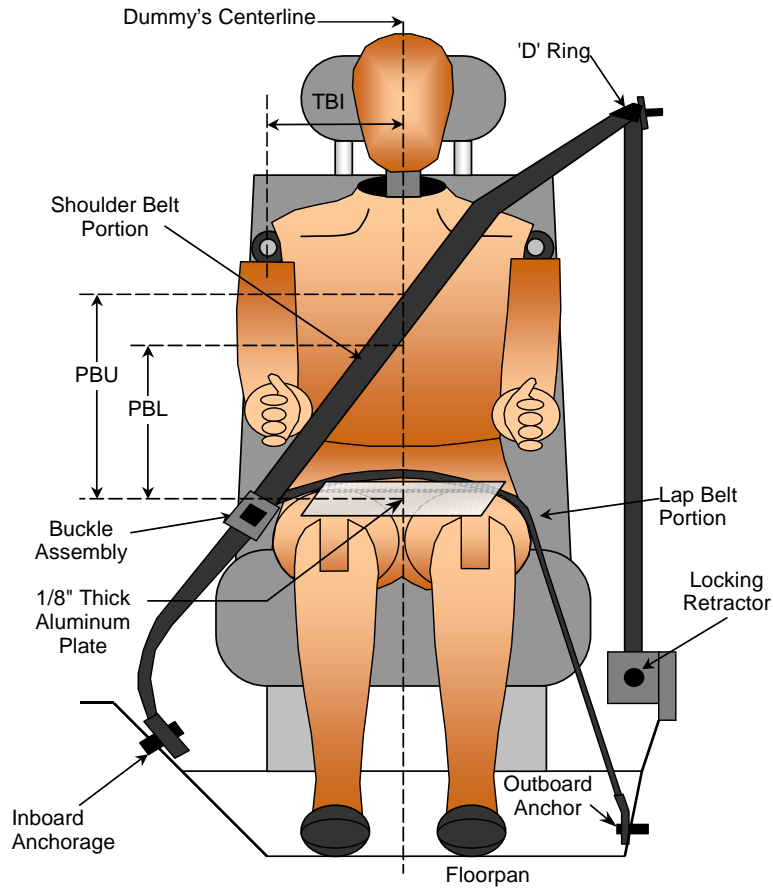
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 351	Passenger S/N 634
		Length (mm)	
AD	Arm to Door	124	193
HD	H-Point to Door	142	171
HR	Head to Side Header	217	236
HS	Head to Side Window	325	354
KK	Knee to Knee	330	219
SHY	Striker to H-Point (Y Direction)	255	285
AA	Ankle to Ankle	320	168

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
Test Date: 11/22/2010



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	355	340
PBL - To surface of reference to belt lower edge	mm	280	260

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	820	870
Lap Belt Length as measured on ATD	mm	455	530
Remainder of belt of reel	mm	1825	1650
Total Belt Length for Continuous Webbing Systems	mm	3100	3050

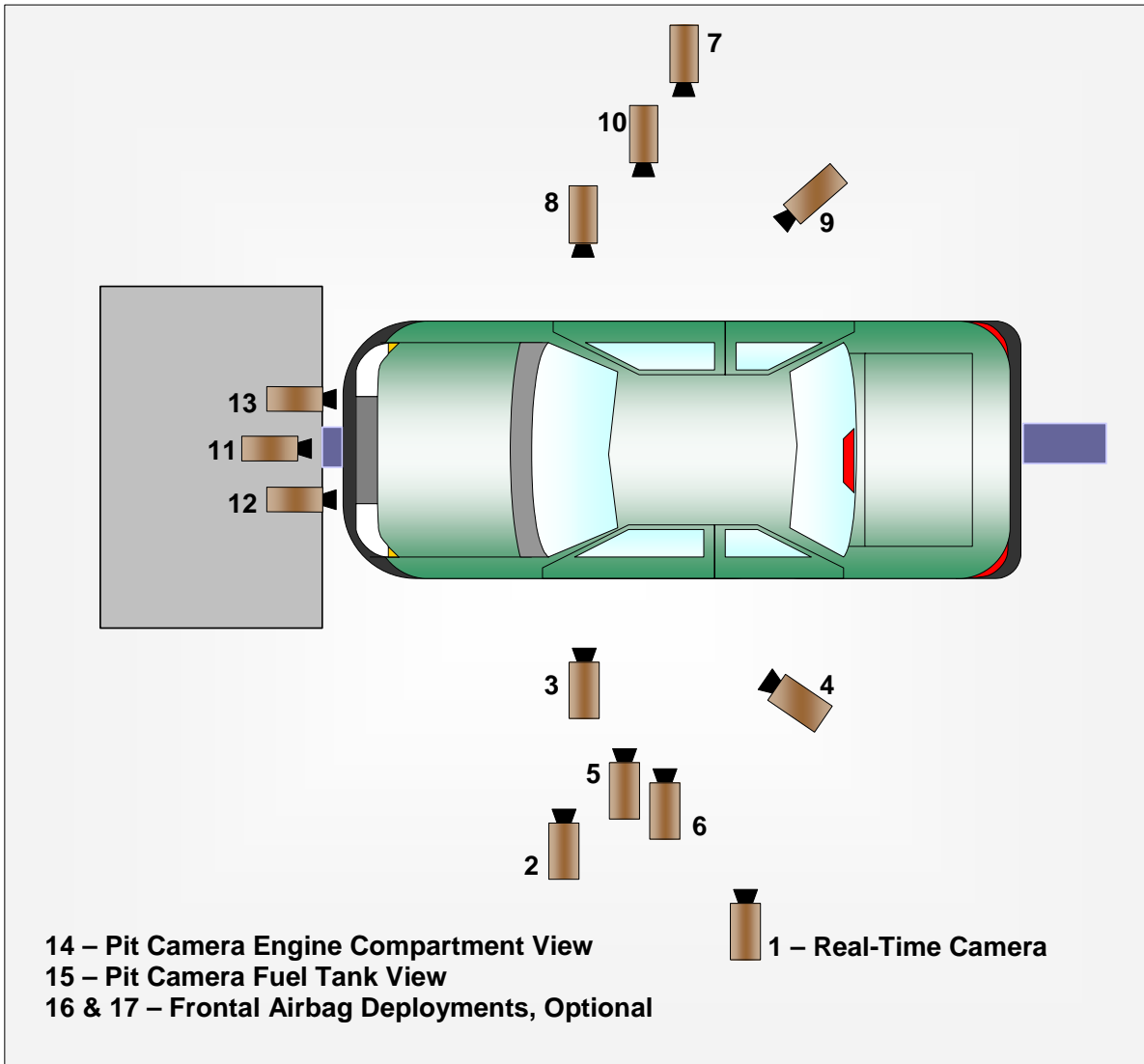
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
Test Date: 11/22/2010

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)

CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Side View					30
2	Left Front Half	1310	-5170	-1230	24	1000
3	Driver Close-Up	1580	-6160	-1570	35	1000
4	Driver Angle	5420	-5100	-1970	50	1000
5	Steering Column Top	850	-5190	-1220	25	1000
6	Steering Column Bottom	830	-5130	-850	25	1000
7	Right Overall	2140	6690	-1320	20	1000
8	Passenger Close-Up	1610	6240	-1540	35	1000
9	Passenger Angle	5450	4990	-1890	50	1000
10	Right Front Half	1320	5130	-1270	24	1000
11	Windshield	-260	0	-2860	24	1000
12	Top Driver	-30	-360	-2210	12.5	1000
13	Top Passenger	-30	360	-2210	12.5	1000
14	Pit Front	1310	0	3150	24	1000
15	Pit Rear	3150	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

***COORDINATES:**

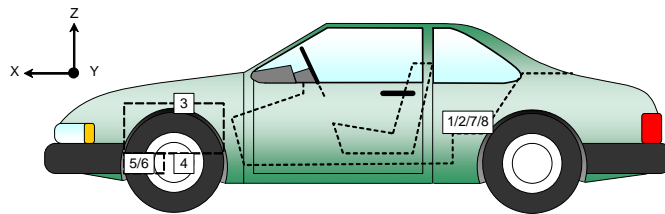
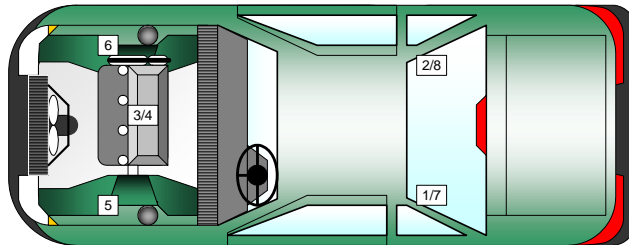
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1892	-280	-190
2	Right Rear X-Member X	1892	280	-240
3	Engine Top X	3795	0	-820
4	Engine Bottom X	3690	0	-285
5	Left Brake Caliper X	3769	-705	-310
6	Right Brake Caliper X	3769	705	-310
7	Left Rear X-Member Z	1892	-280	-190
8	Right Rear X-Member Z	1892	280	-240

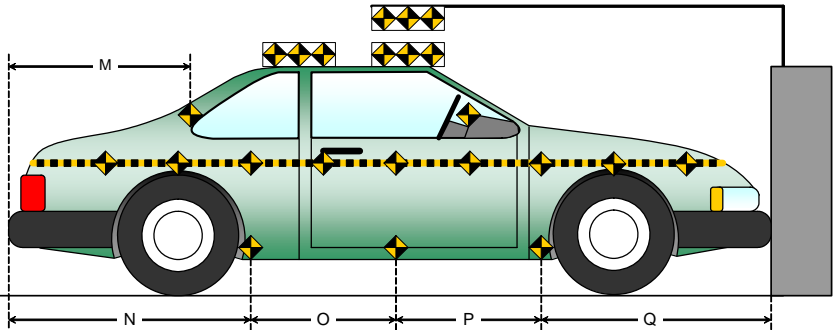
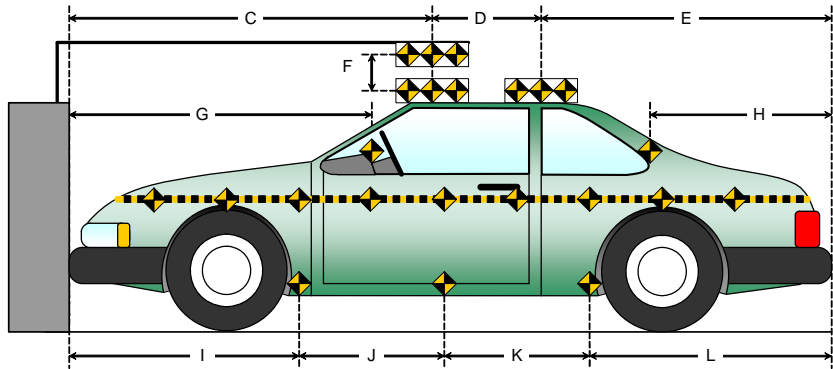
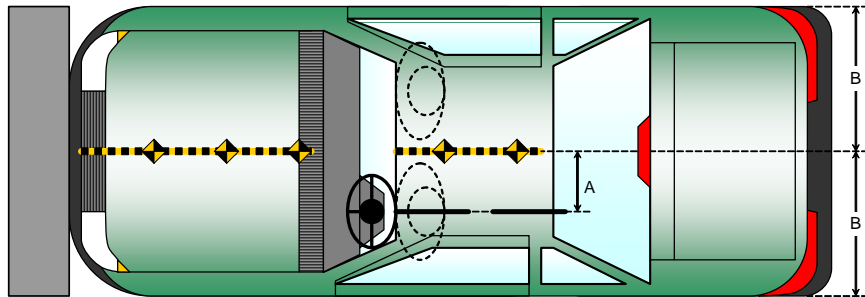
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

Item	Value (mm)
A	360
B	875
C	2364
D	670
E	1575
F	200
G	
H	1024
I	1404
J	908
K	912
L	1385
M	1024
N	1385
O	912
P	908
Q	1404



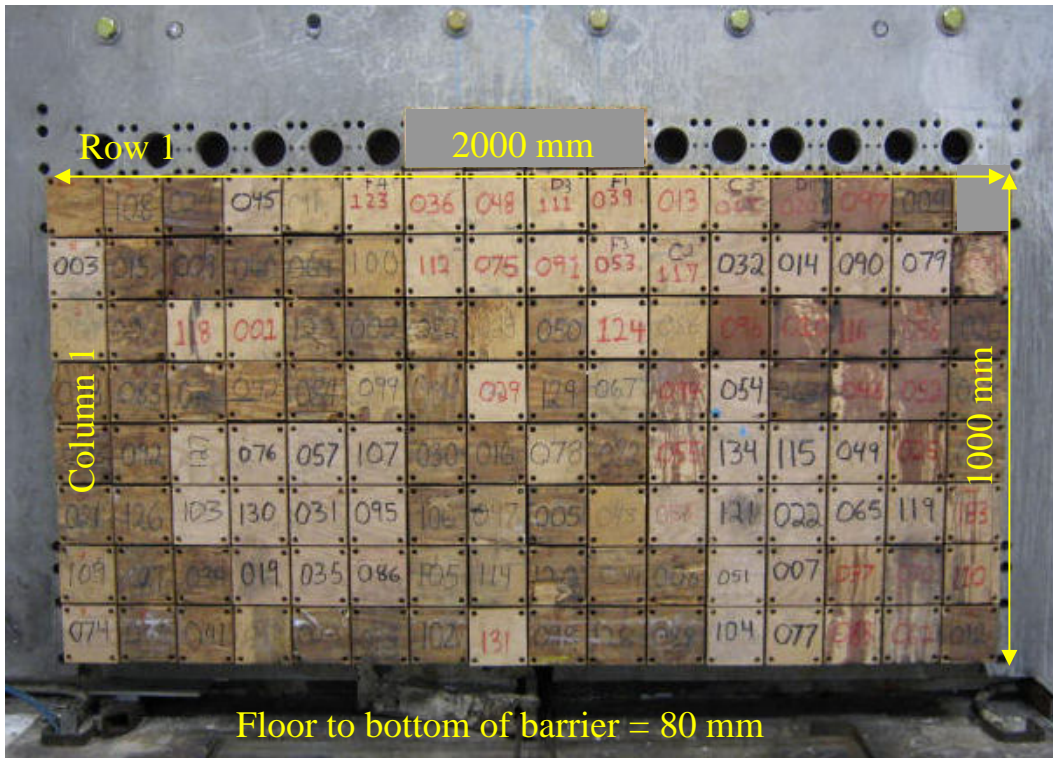
DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

Advanced Research Load Cell Barrier



1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	1-12	1-13	1-14	1-15	1-16
2-1	2-2	2-3	2-4	2-5	2-6	2-7	2-8	2-9	2-10	2-11	2-12	2-13	2-14	2-15	2-16
3-1	3-2	3-3	3-4	3-5	3-6	3-7	3-8	3-9	3-10	3-11	3-12	3-13	3-14	3-15	3-16
4-1	4-2	4-3	4-4	4-5	4-6	4-7	4-8	4-9	4-10	4-11	4-12	4-13	4-14	4-15	4-16
5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12	5-13	5-14	5-15	5-16
6-1	6-2	6-3	6-4	6-5	6-6	6-7	6-8	6-9	6-10	6-11	6-12	6-13	6-14	6-15	6-16
7-1	7-2	7-3	7-4	7-5	7-6	7-7	7-8	7-9	7-10	7-11	7-12	7-13	7-14	7-15	7-16
8-1	8-2	8-3	8-4	8-5	8-6	8-7	8-8	8-9	8-10	8-11	8-12	8-13	8-14	8-15	8-16
9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-9	9-10	9-11	9-12	9-13	9-14	9-15	9-16

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
Test Date: 11/22/2010

INSTRUMENTATION

Driver Dummy Data Channels	44
Passenger Dummy Data Channels	44
Vehicle Structure Accelerometers	8
Barrier Channels	127
Total	223

CAMERA COVERAGE

High-Speed Vehicle Onboard	0
High-Speed Offboard	14
Real-Time	2
Total	16

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 634
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	Airbag	Airbag
Left Knee Contact	Knee Airbag	Knee Airbag
Right Knee Contact	Knee Airbag	Knee Airbag

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were locked	Doors were locked
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

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1006
Center	mm	924
Right Side	mm	946
Average	mm	959

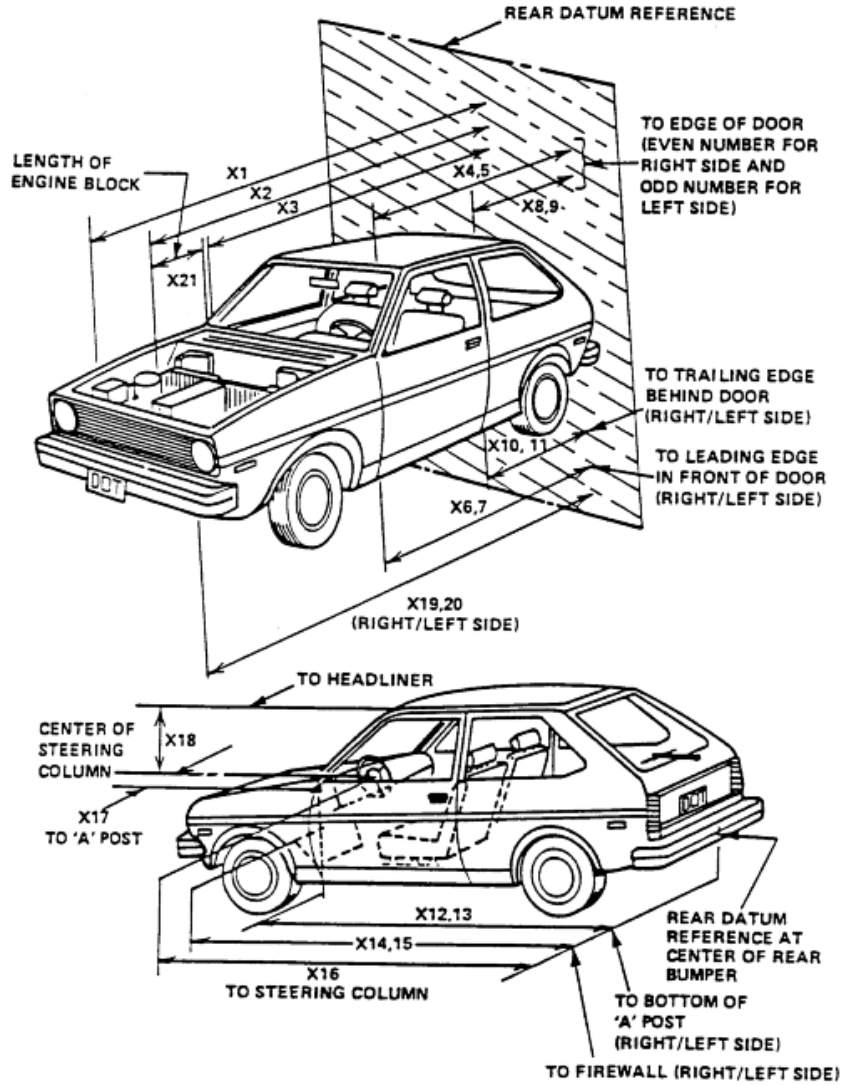
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Left Front (Passenger) P2	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	No	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4609	4092	517
2	RSOV to Front of Engine	mm	3980	3786	194
3	RSOV to Firewall	mm	3500	3494	6
4	RSOV to Upper Leading Edge of Right Door	mm	3070	3073	-3
5	RSOV to Upper Leading Edge of Left Door	mm	3070	3064	6
6	RSOV to Lower Leading Edge of Right Door	mm	3103	3095	8
7	RSOV to Lower Leading Edge of Left Door	mm	3103	3092	11
8	RSOV to Upper Trailing Edge of Right Door	mm	2040	2048	-8
9	RSOV to Upper Trailing Edge of Left Door	mm	2040	2042	-2
10	RSOV to Lower Trailing Edge of Right Door	mm	2080	2081	-1
11	RSOV to Lower Trailing Edge of Left Door	mm	2080	2068	12
12	RSOV to Bottom of "A" Post of Right Side	mm	3075	3085	-10
13	RSOV to Bottom of "A" Post of Left Side	mm	3060	3048	12
14	RSOV to Firewall, Right Side	mm	3520	3426	94
15	RSOV to Firewall, Left Side	mm	3520	3518	2
16	RSOV to Steering Column	mm	2673	2666	7
17	Center of Steering Column to "A" Post	mm	350	361	-11
18	Center of Steering Column to Headliner	mm	434	446	-12
19	RSOV to Right Side of Front Bumper	mm	4400	4078	322
20	RSOV to Left Side of Front Bumper	mm	4400	4042	358
21	Length of Engine Block	mm	235	235	0
RD	RSOV to Right Side of Dash Panel	mm	2805	2823	-18
CD	RSOV to Center of Dash Panel	mm	2765	2785	-20
LD	RSOV to Left Side of Dash Panel	mm	2805	2791	14

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

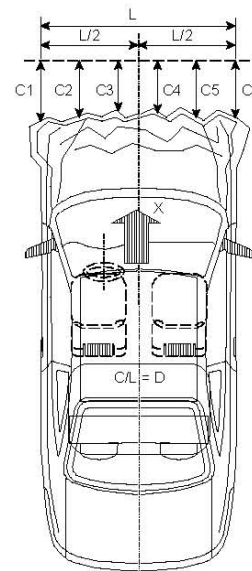
NHTSA No.: MB0102
 Test Date: 11/22/2010

VEHICLE INFORMATION

VIN: 1G1PC5SH5B7108798 Wheelbase (mm): 2690
 Vehicle Size Category: Sedan Test Weight (kg): 1631.1

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15
 Cal. Procedure/Interval: MGA procedure / 6 month
 Integration Algorithm: Trapezoidal Linearity: > 99%
 Impact Velocity (km/h): 56.2
 Velocity Change (km/h): 62.9
 Time of Separation (msec): 101



CRUSH PROFILE

Collision Deformation Classification: Frontal
 Midpoint of Damage: Centerline
 Damage Region Length (mm): 1204
 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4400	4042	358
C2	Crush zone 2 at left side	mm	4502	4046	456
C3	Crush zone 3 at left side	mm	4554	4071	483
C4	Crush zone 4 at right side	mm	4554	4073	481
C5	Crush zone 5 at right side	mm	4504	4054	450
C6	Crush zone 6 at right side	mm	4400	4078	322
L	C1 TO C6	mm	1204	1171	33

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

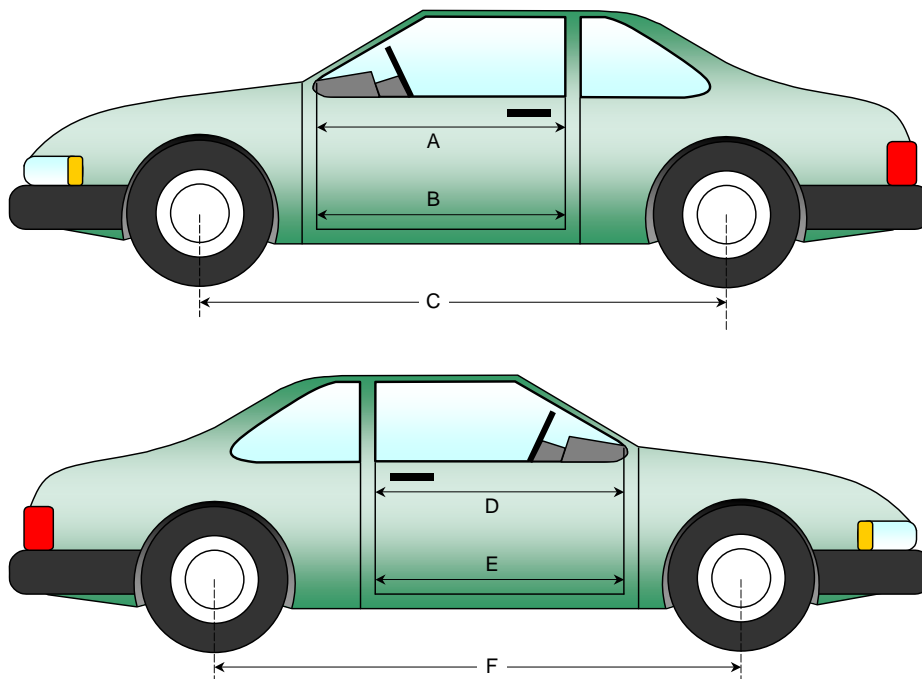
NHTSA No.: MB0102
 Test Date: 11/22/2010

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	920	916	4
B	Left Side Lower	mm	875	875	0
D	Right Side Upper	mm	920	917	3
E	Right Side Lower	mm	875	877	-2

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2690	2609	81
F	Right Side Wheelbase	mm	2690	2633	57



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

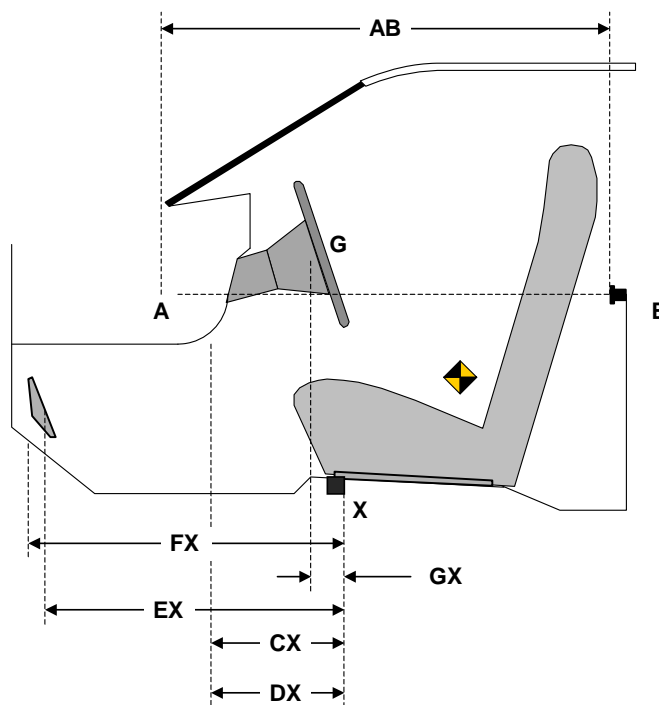
Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	783	783	0
CX	Left Knee Bolster to X	mm	245	261	-16
DX	Right Knee Bolster to X	mm	240	256	-16
EX	Brake Pedal to X	mm	570	565	5
FX	Foot Rest to X	mm	615	598	17
GX	Center of Steering Column Wheel Hub to X	mm	101	124	-23

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

Windshield Mounting Details:

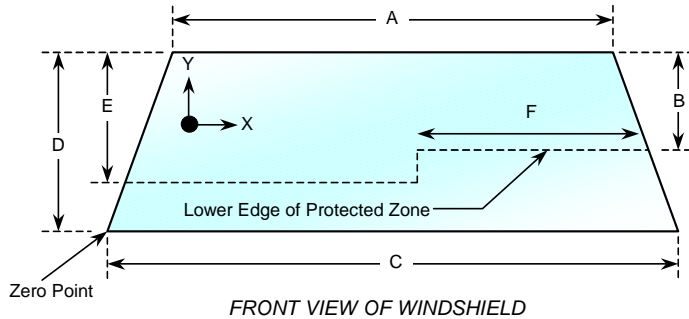
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2129	2129	100
Right Side	2129	2129	100
Total	4258	4258	100



Item	Units	Value
A	mm	1140
B	mm	514
C	mm	1466
D	mm	826
E	mm	522
F	mm	448

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. 15 (CONTINUED)
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan NHTSA No.: MB0102
Test Program: NCAP Frontal Barrier Impact Test Test Date: 11/22/2010

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Time: 10:33 am Temperature: 21° C

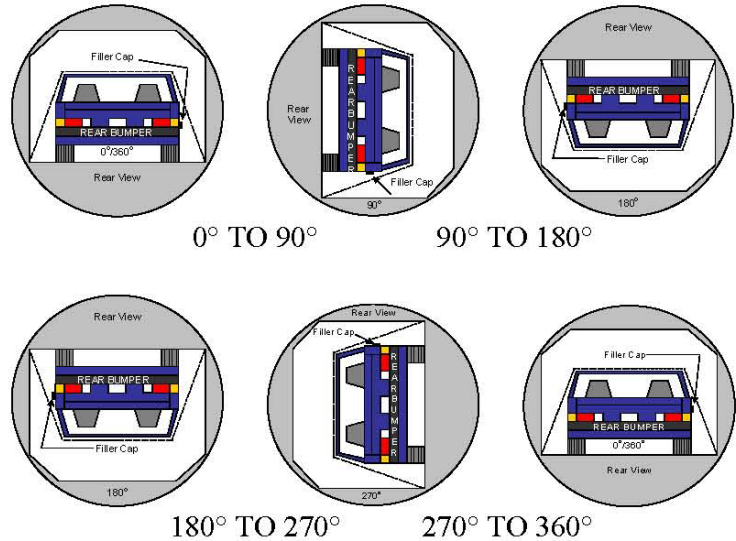
- A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)
- B. For the 5 minute period after motion ceases: None
(Maximum allowable = 5 ounces)
- C. For the following 25 minutes: None
(Maximum allowable = 1 oz./minute)
- D. Spillage Details: None

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
 Test Date: 11/22/2010

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: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	108	300	408
90° to 180°	110	300	410
180° to 270°	102	300	402
270° to 360°	117	300	417

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

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

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

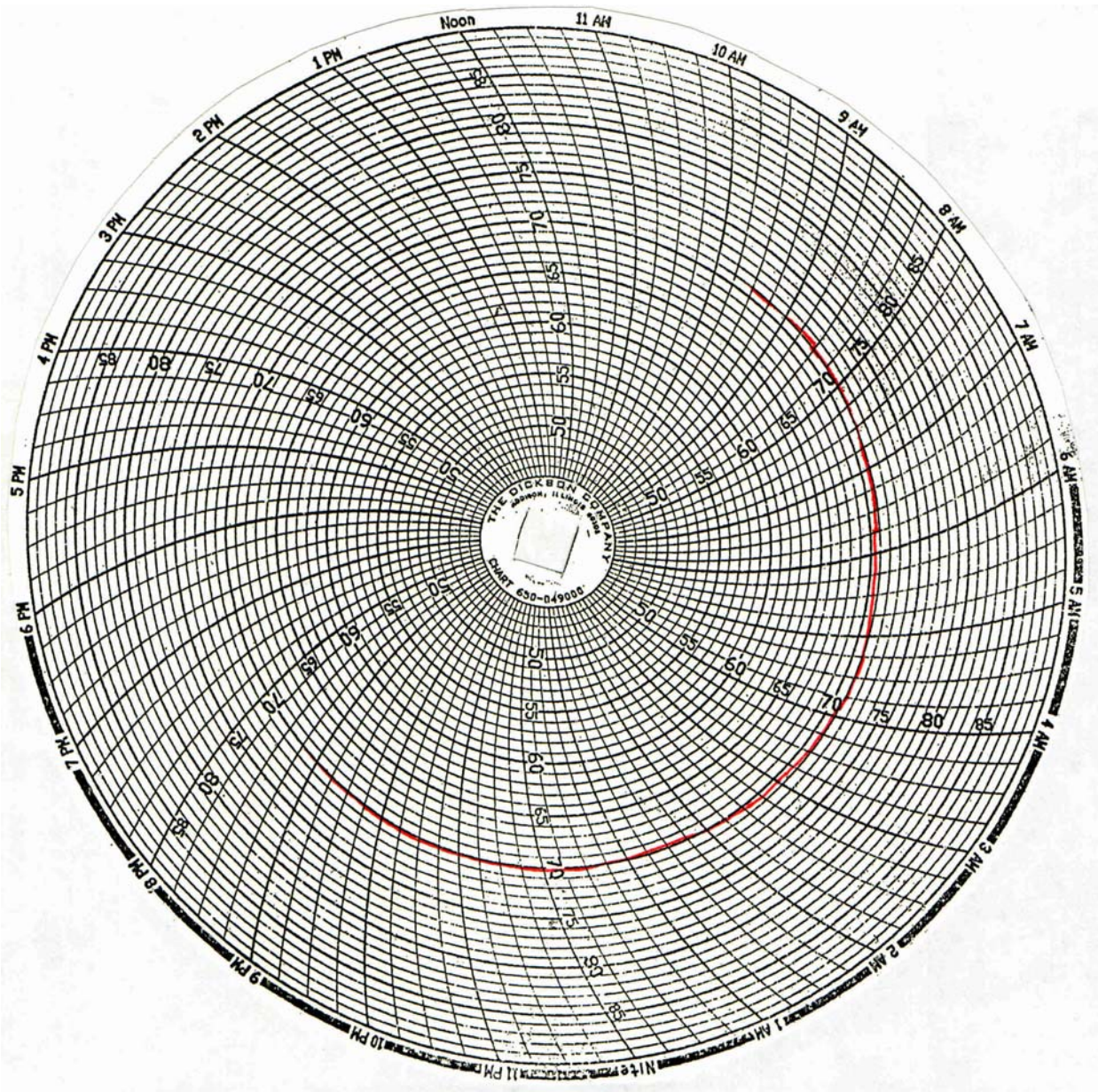
Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

DATA SHEET NO. 17

DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2011 Chevrolet Cruze 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0102
Test Date: 11/22/2010



APPENDIX A
PHOTOGRAPHS

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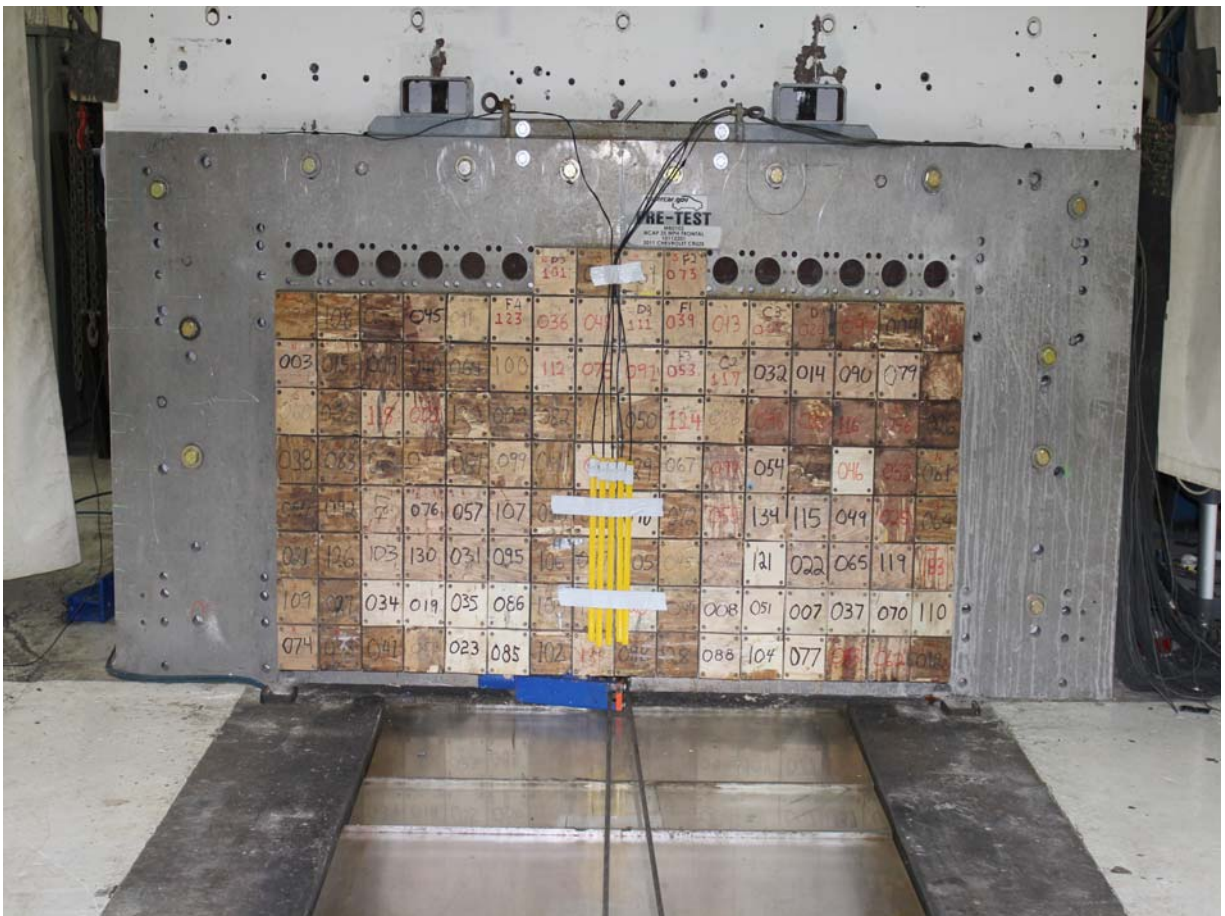
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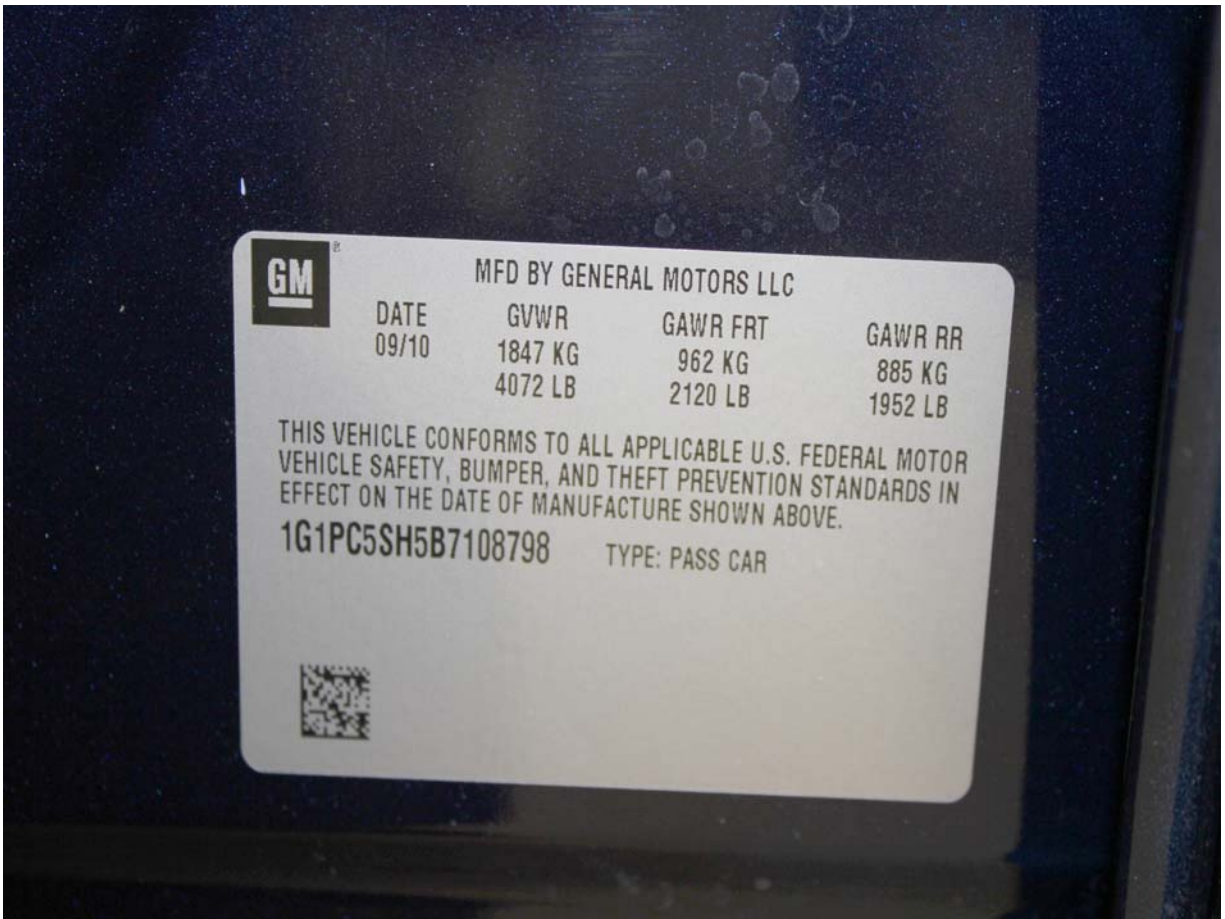
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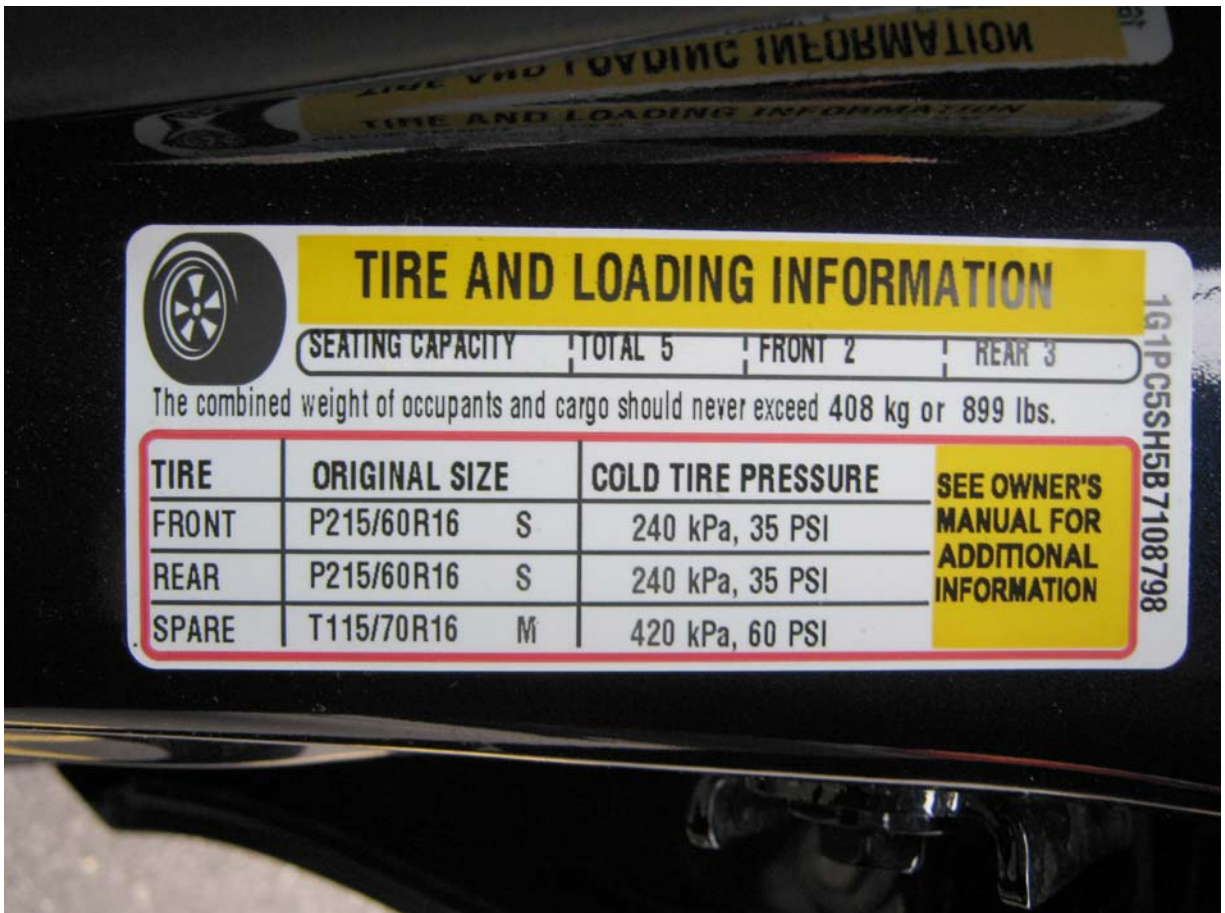
Load Cell Location



Load Cell Wall



Manufacturer's Label



Tire Placard



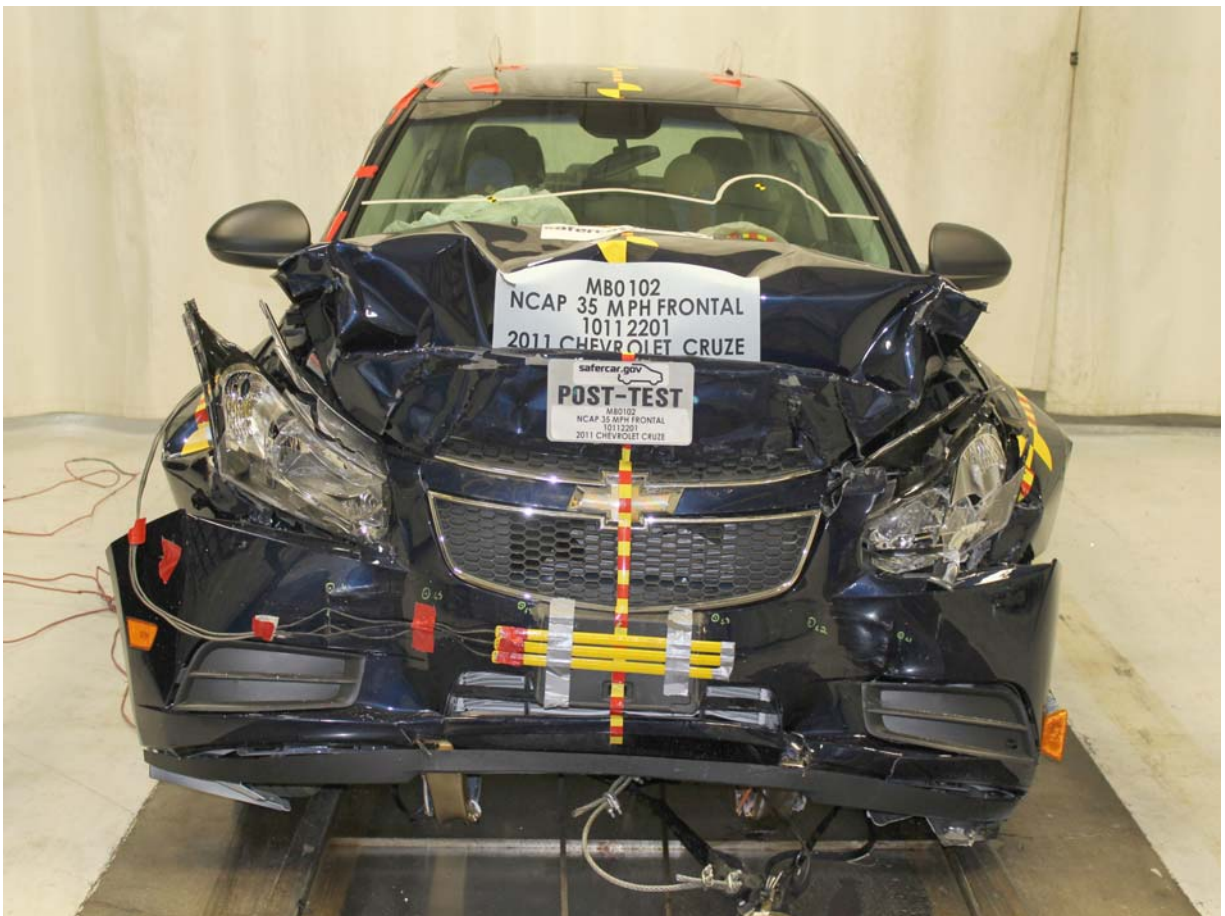
Right Front Three-Quarter View, As Received



Left Rear Three-Quarter View, As Received



Pre-Test Front View



Post-Test Front View



Pre-Test Left Side View (with vehicle at barrier)



Post-Test Left Side View



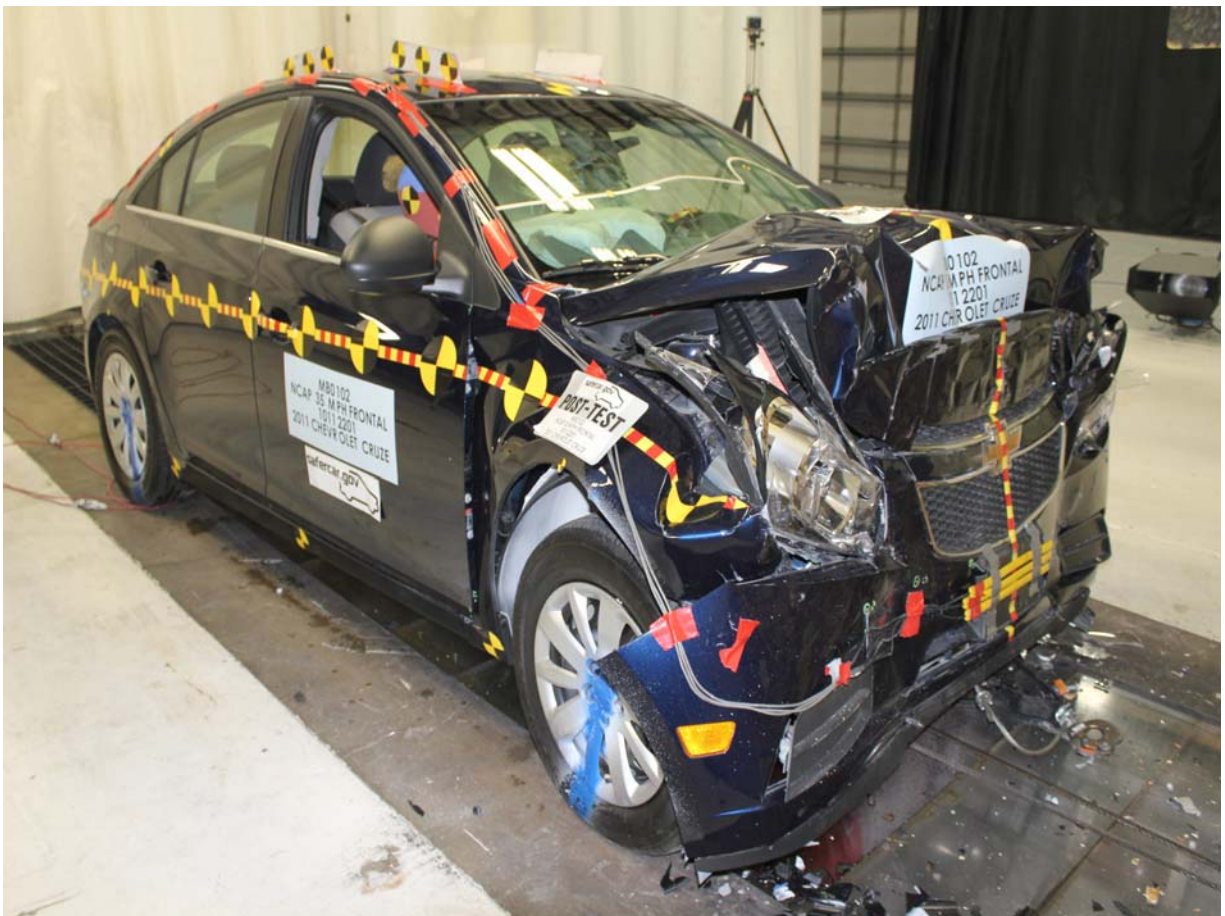
Pre-Test Right Side View (with vehicle at barrier)



Post-Test Right Side View



Pre-Test Right Front Three-Quarter View



Post-Test Right Front Three-Quarter View



Pre-Test Left Rear Three-Quarter View (with vehicle at barrier)



Post-Test Left Rear Three-Quarter View



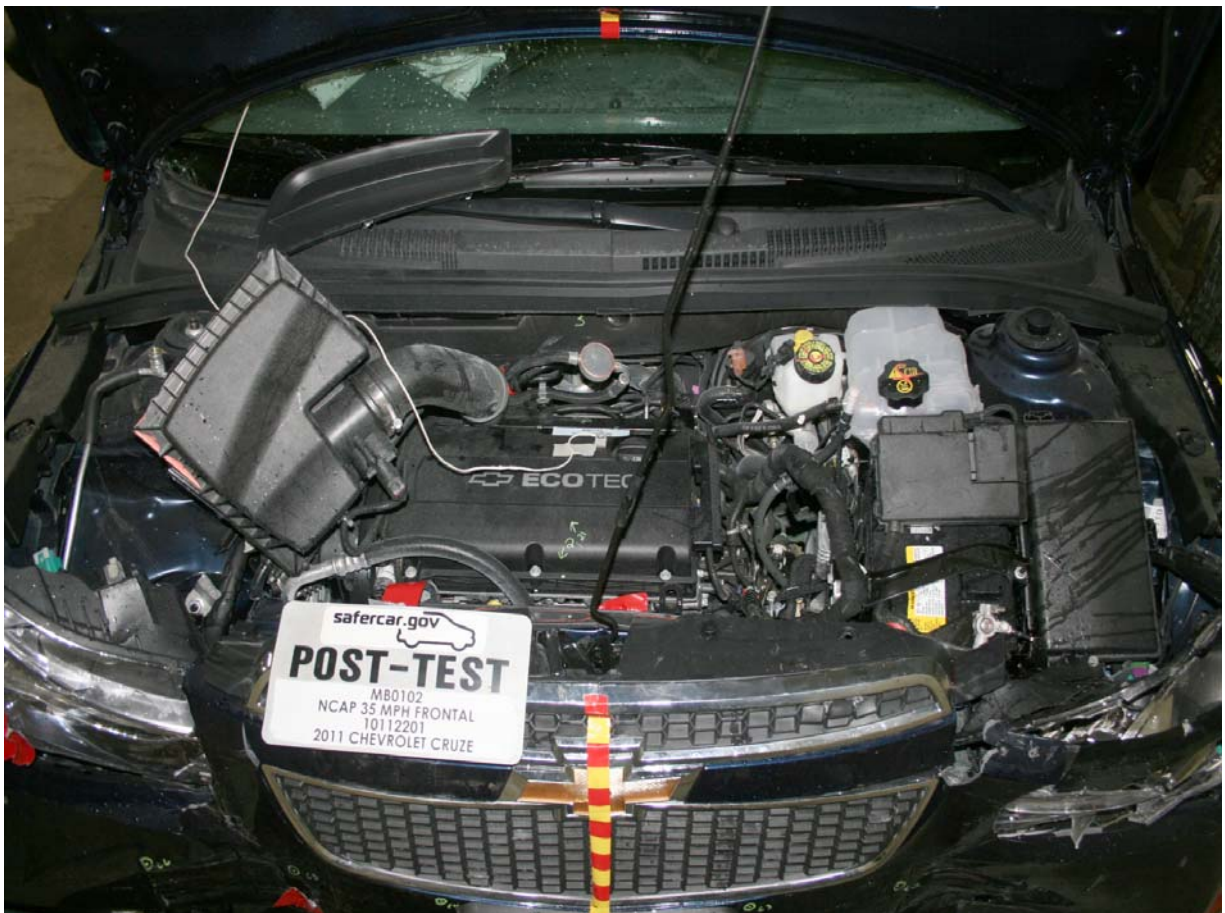
Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



Post-Test Engine Compartment View



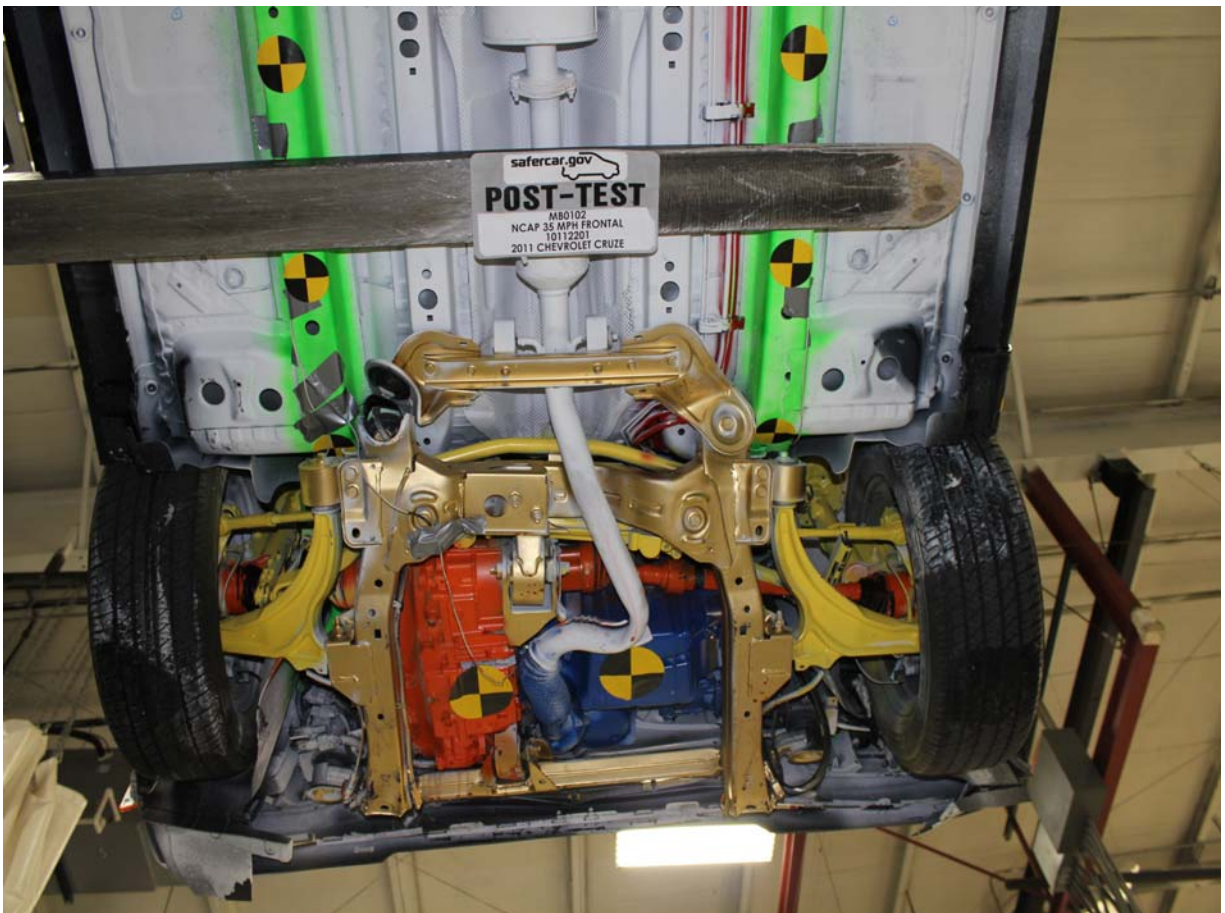
Pre-Test Fuel Cap View



Post-Test Fuel Cap View

PHOTOGRAPH NOT AVAILABLE

Pre-Test Front Underbody View



Post-Test Front Underbody View



Post-Test Mid Underbody View

PHOTOGRAPH NOT AVAILABLE

Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Dummy Cable Routing



Post-Test Dummy Cable Routing



Pre-Test Driver Dummy Front View



Post-Test Driver Dummy Front View



Pre-Test Driver Dummy Window View



Post-Test Driver Dummy Window View



Pre-Test Driver Dummy and Vehicle Interior (Door Open)



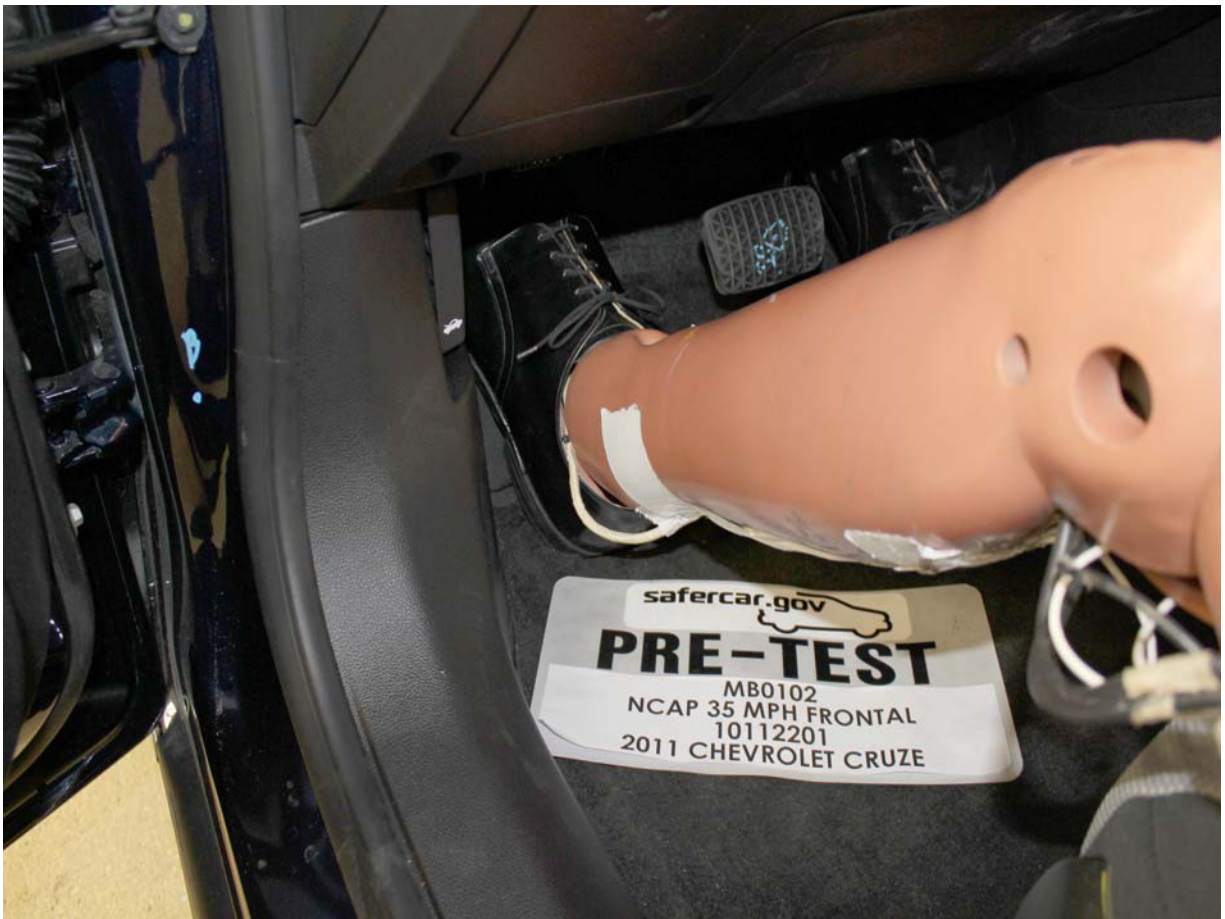
Post-Test Driver Dummy and Vehicle Interior (Door Open)



Pre-Test Driver's Seat Fore-Aft Markings



Post-Test Driver's Seat Fore-Aft Markings



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



Pre-Test Driver's Side Knee Bolster (without dummy)



Post-Test Driver's Side Knee Bolster (without dummy)



Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Contact with Airbag



Post-Test Driver Dummy Contact with Headrest



Post-Test Driver Dummy Contact with Knee Airbag



Pre-Test View of Steering Column Shear Capsule



Post-Test View of Steering Column Shear Capsule



Pre-Test Passenger Dummy Front View



Post-Test Passenger Dummy Front View



Pre-Test Passenger Dummy Window View



Post-Test Passenger Dummy Window View



Pre-Test Passenger Dummy and Vehicle Interior (Door Open)



Post-Test Passenger Dummy and Vehicle Interior (Door Open)



Pre-Test Passenger's Seat Fore-Aft Markings



Post-Test Passenger's Seat Fore-Aft Markings



Pre-Test Passenger Dummy Feet



Post-Test Passenger Dummy Feet



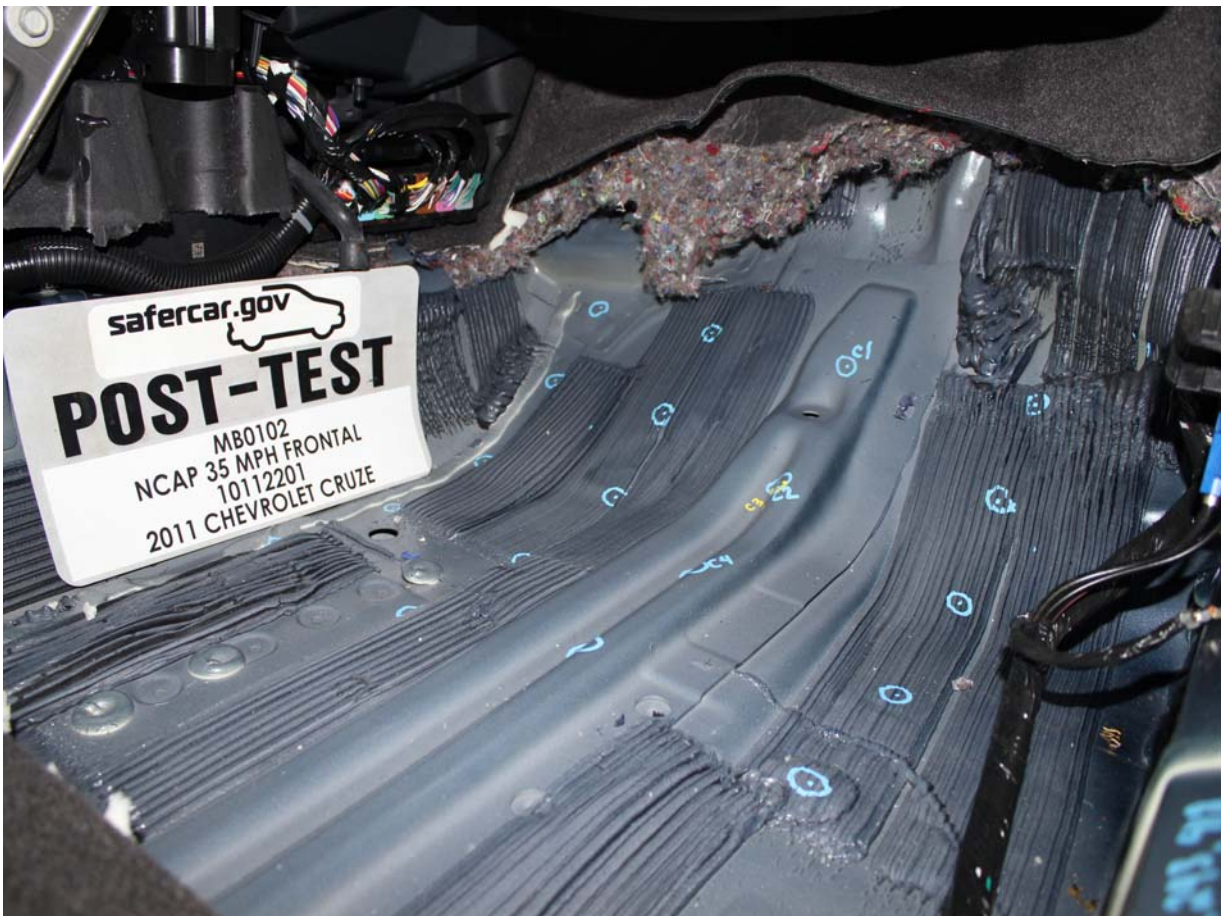
Pre-Test Passenger's Side Knee Bolster (without dummy)



Post-Test Passenger's Side Knee Bolster (without dummy)



Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



Post-Test Passenger Dummy Contact with Airbag



Post-Test Passenger Dummy Contact with Headrest



Post-Test Passenger Dummy Contact with Knee Airbag



Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Post-Test Stoddard Solvent Spillage Location View



Post-Test Speed Trap Read-Out



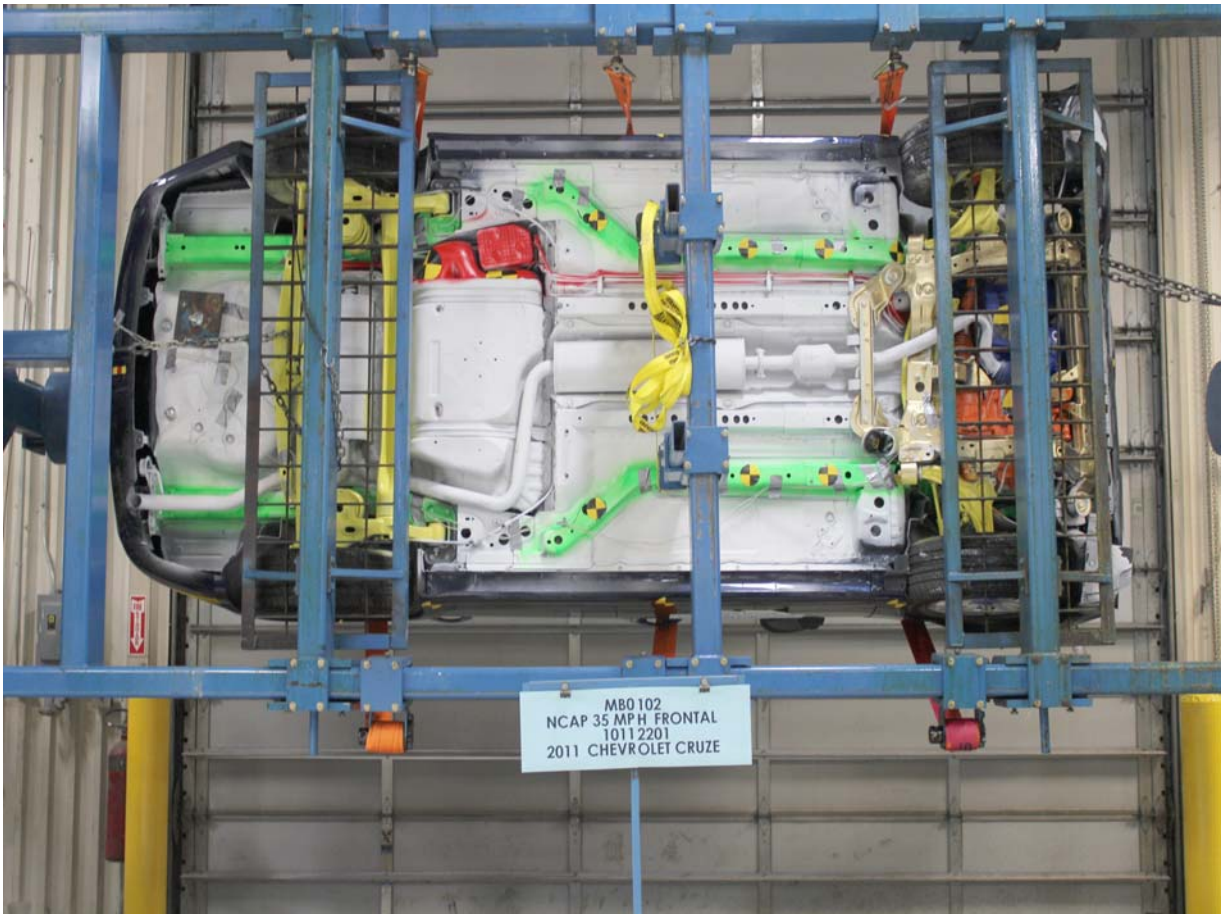
Vehicle at 0 Degrees on Static Rollover Device



Vehicle at 90 Degrees on Static Rollover Device



Vehicle at 180 Degrees on Static Rollover Device



Vehicle at 270 Degrees on Static Rollover Device



Vehicle at 360 Degrees on Static Rollover Device



Vehicle Impact

2011 CRUZE LS
EXTERIOR: IMPERIAL BLUE METALLIC
INTERIOR: JET BLACK / MEDIUM TITANIUM
ENGINE: 1.8L ECOTEC VVT DOHC
TRANSMISSION: 6 SPD AUTOMATIC

2011 CRUZE LS



Visit us at www.chevy.com

DESTINATION CHARGE	720.00
TOTAL VEHICLE PRICE*	\$18,375.00

OPTIONS & PRICING
MANUFACTURER'S SUGGESTED RETAIL PRICE

STANDARD VEHICLE PRICE	\$16,275.00
-------------------------------	--------------------

OPTIONS INSTALLED BY THE MANUFACTURER (MAY REPLACE STANDARD EQUIPMENT SHOWN)

- CONNECTIVITY PACKAGE: 275.00
 - USB AUDIO INTERFACE
 - BLUETOOTH FOR PHONE
 - STEERING WHEEL CONTROLS
- TRANSMISSION, 6 SPD AUTOMATIC 925.00
- COMPACT SPARE TIRE (REPLACES TIRE SEALANT AND INFLATOR KIT) 100.00
- CARPETED FRONT AND REAR FLOOR MATS 80.00

TOTAL OPTIONS \$1,380.00
TOTAL VEHICLE & OPTIONS \$17,655.00

- DESCRIPTION SOLD SEPARATELY BY SIRIUS/XM AFTER 3 MONTHS**
- AUDIO SYSTEM, 6 SPEAKER
- MANUAL SEAT ADJUSTER, DRIVER**
- 8 WAY
 - MANUAL SEAT ADJUSTER, PASSENGER 8 WAY
 - ACOUSTIC INSULATION PKG
 - AIR CONDITIONING
 - VISORS, DRIVER / FT PASSENGER
 - W/ VANITY MIRRORS
 - AUXILIARY AUDIO INPUT JACK
 - POWER WINDOWS, EXPRESS DOWN
 - DRIVER INFO CENTER
 - PERSONALIZATION, WARNING, MESSAGES AND VEHICLE INFO
 - REAR SEAT, 60/40 SPLIT FOLDING SEATBACK
 - STEERING COLUMN, TILT & TELESCOPING
 - REAR SEAT CENTER ARMREST WITH CUPHOLDERS
 - POWER DOOR LOCKS WITH LOCKOUT PROTECTION
 - SEAT TRIM, DELUXE CLOTH
 - XM RADIO - SERVICE

- FRONT DISCREAR DRUM**
- POWER OPERATED REAR DR LOCKS, CHILD SECURITY
 - REAR CHILD SEAT LATCH ANCHORS
 - THEFT DETERRANT SYSTEM, CONTENT THEFT ALARM
 - DAYTIME RUNNING LAMPS
 - REMOTE KEYLESS ENTRY
 - 6 MTHS ONSTAR DIRECTIONS AND CONNECTIONS WITH AUTOMATIC CRASH RESPONSE & TURN-BY-TURN NAVIGATION (ASK DEALER ABOUT GEOGRAPHIC COVERAGE)
- EXTERIOR**
- WHEELS, 16" STEEL
 - GLASS, SOLAR RAY LIGHT TINTED
 - WINDSHIELD WIPERS VARIABLE & INTERMITTENT
 - REAR WINDOW ELECTRIC DEFROGGER
- INTERIOR**
- AM/FM STEREO, CD PLAYER

- STANDARD EQUIPMENT**
ITEMS FEATURED BELOW ARE INCLUDED AT NO EXTRA CHARGE IN THE STANDARD VEHICLE PRICE SHOWN
- 5 YEAR/100,000 MILE POWERTRAIN LIMITED WARRANTY SEE DEALER FOR DETAILS
- MECHANICAL**
- TIRE SEALANT & INFLATOR KIT IN PLACE OF SPARE TIRE
 - OIL LIFE MONITOR SYSTEM
 - ENGINE, 1.8L ECOTEC VVT DOHC 4 CYL
 - TRANSMISSION, 6 SPEED MANUAL
- SAFETY AND SECURITY**
- AIRBAGS, DRIVER & FRONT PASSENGER
 - IMPACT & HEAD CURTAIN, REAR OUTBOARD PASSENGERS SIDE
 - IMPACT & HEAD CURTAIN STABILITRAK-STABILITY CONTROL SYSTEM W/ TRACTION CONTROL
 - 4 WHEEL ANTILOCK BRAKES,

GOVERNMENT SAFETY RATINGS

This vehicle has not been rated by the government for frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).

GOVERNMENT SAFETY RATINGS

This vehicle has not been rated by the government for frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).

EPA Fuel Economy Estimates

CITY MPG 22
 Expected range for most drivers **18 to 25 MPG**

HIGHWAY MPG 35
 Expected range for most drivers **29 to 41 MPG**

Estimated Annual Fuel Cost \$1,665
 based on 15,000 miles at \$3.00 per gallon

Combined Fuel Economy This Vehicle 27
AT COMPACT CLASS

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE:
 U.S./CANADIAN PARTS CONTENT: 45%
 MAJOR SOURCES OF FOREIGN PARTS CONTENT: MEXICO 15% AUSTRIA 19%

NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE:
 FINAL ASSEMBLY POINT: LORDSTOWN, OH U.S.A.
 COUNTRY OF ORIGIN: ENGINE: MEXICO
 TRANSMISSION: MEXICO

GOVERNMENT SAFETY RATINGS

This vehicle has not been rated by the government for frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA).

ORDER NO REPROCESSED SALES CODE E
 SALES MODEL CODE 1PL4B
 FINAL ASSEMBLY: LORDSTOWN, OH U.S.A.
 VIN 1G1PC5S5H5B7108798

DEALER TO WHOM DELIVERED
 RAYMOND CHEVROLET & OLDSMOBILE, INC.
 118 RTE 173
 ANTIPOCH, IL 60002-1885

www.safercar.gov or 1-888-327-4236



See the FREE Fuel Economy Guide at dealers or www.fueleconomy.gov

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 GM/BL_PROD_0018 - 02/1/2009

1GA1211460

Monroney Label

APPENDIX B
DUMMY RESPONSE DATA

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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 Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

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

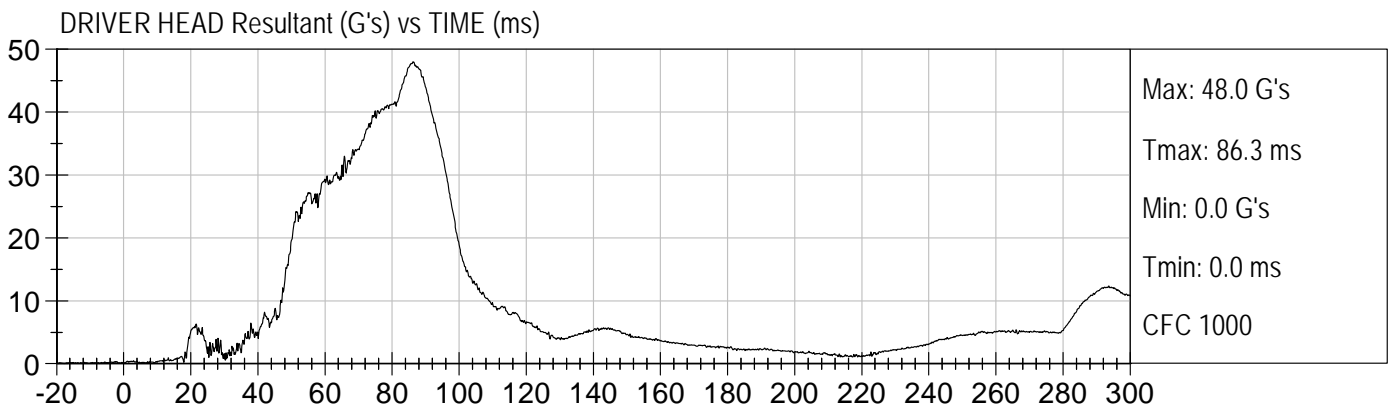
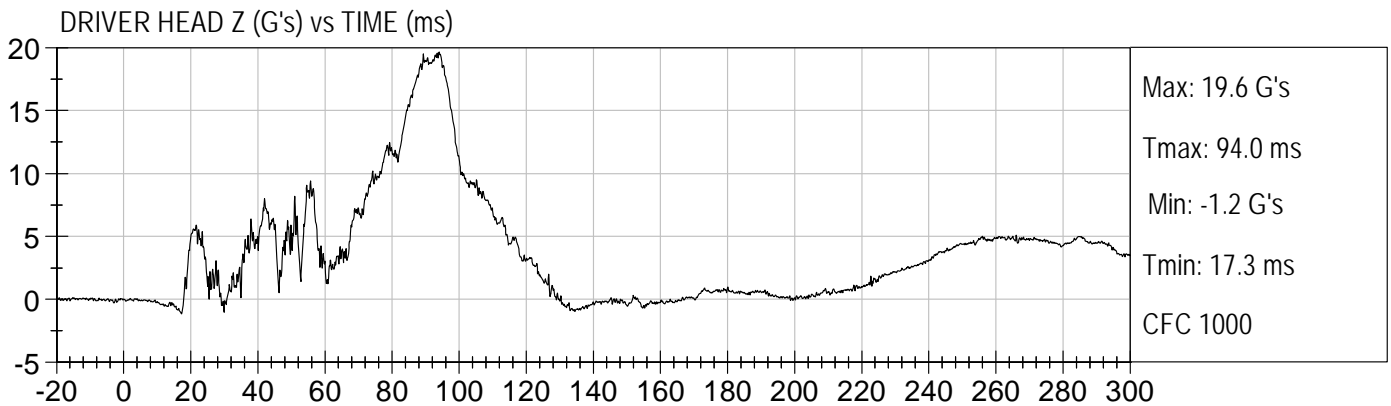
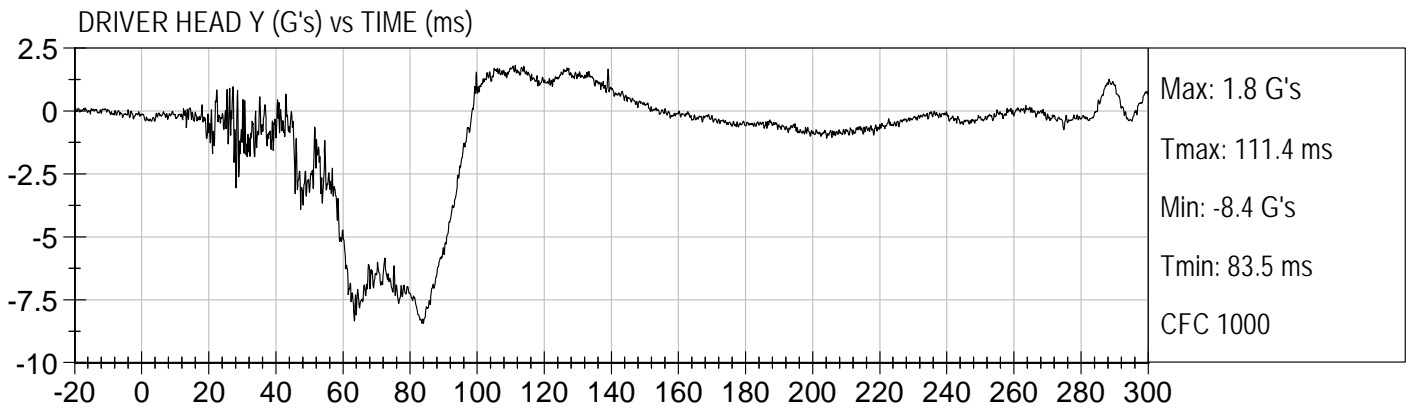
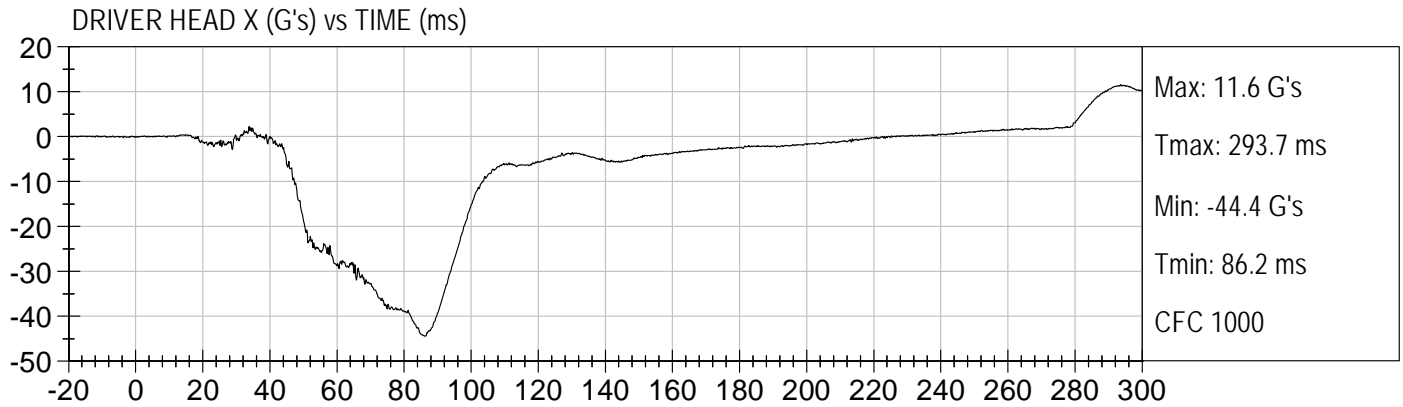
Driver Left Upper Tibia Force Z

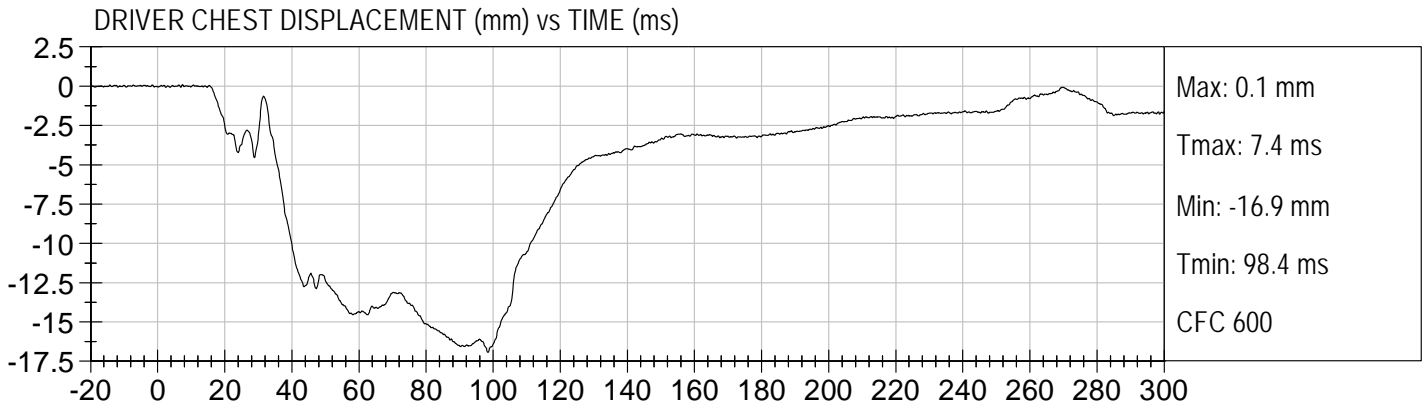
Driver Left Lower Tibia Moment X

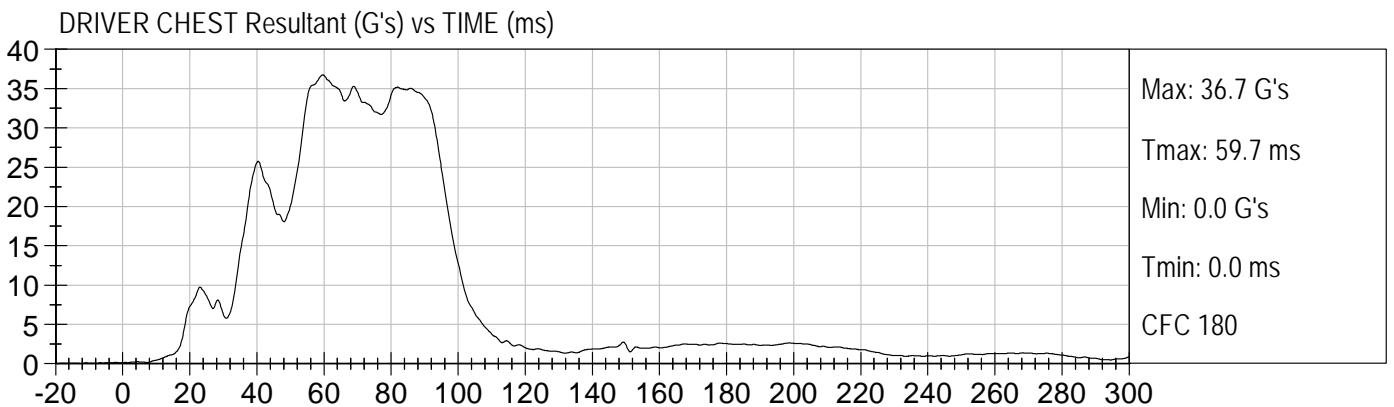
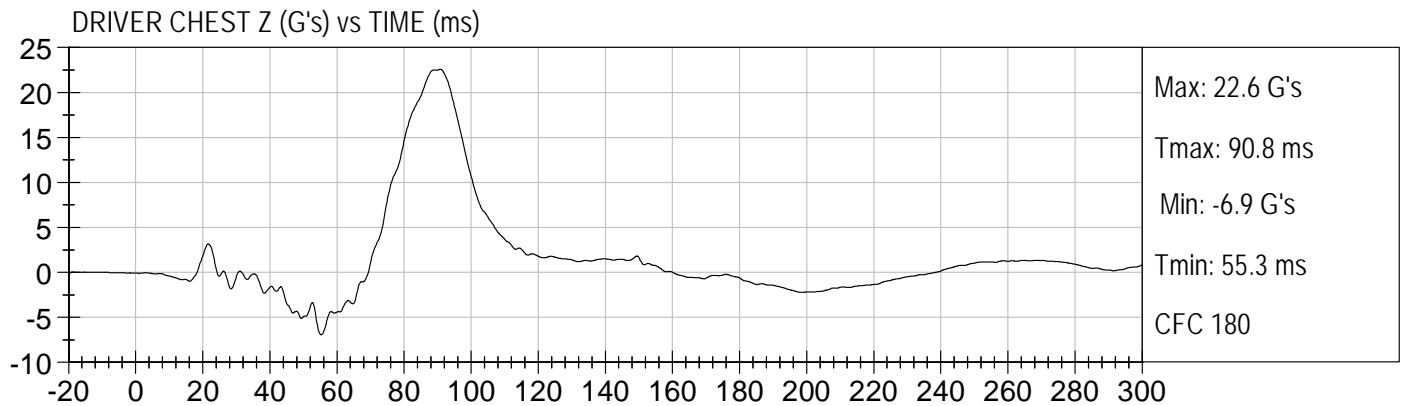
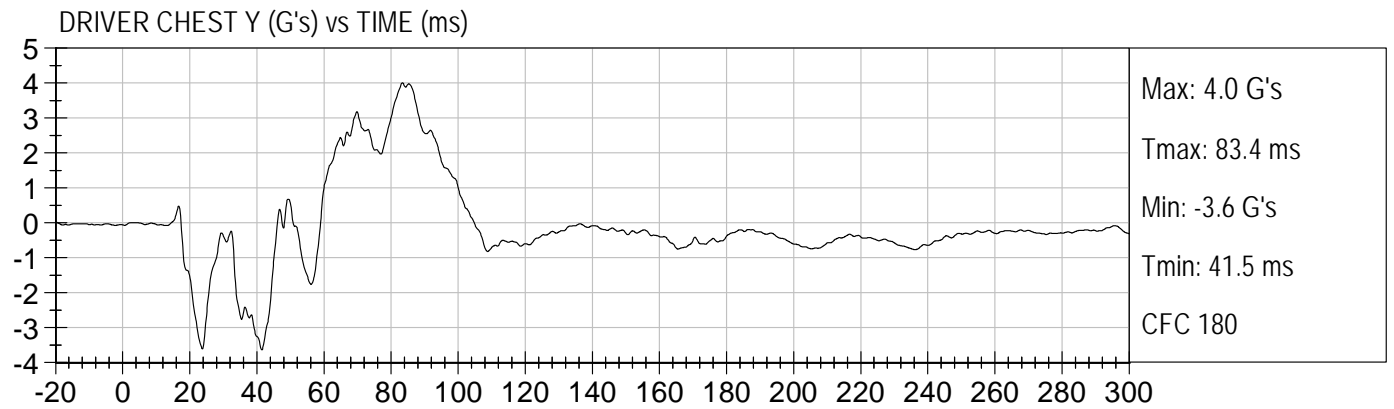
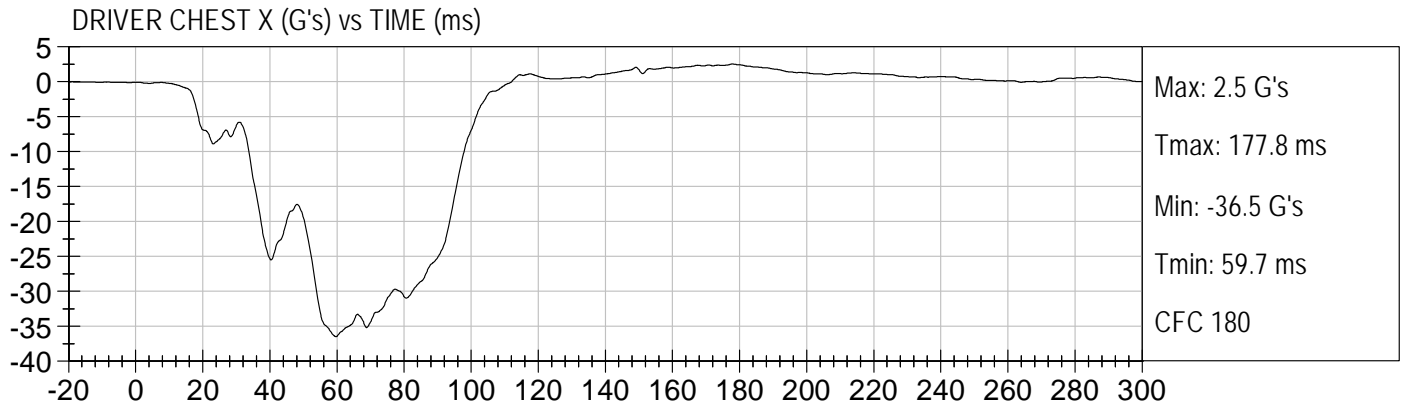
Driver Left Lower Tibia Moment Y

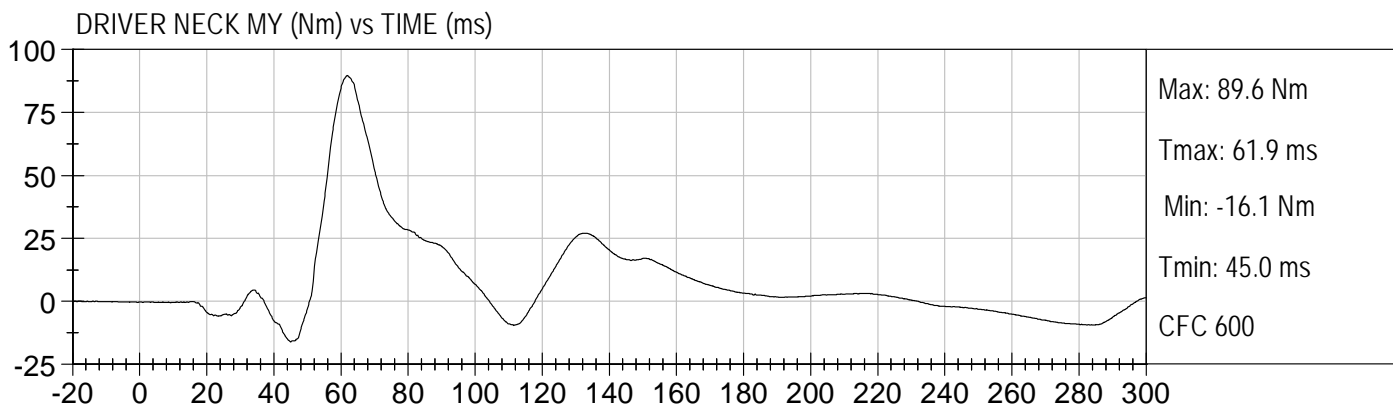
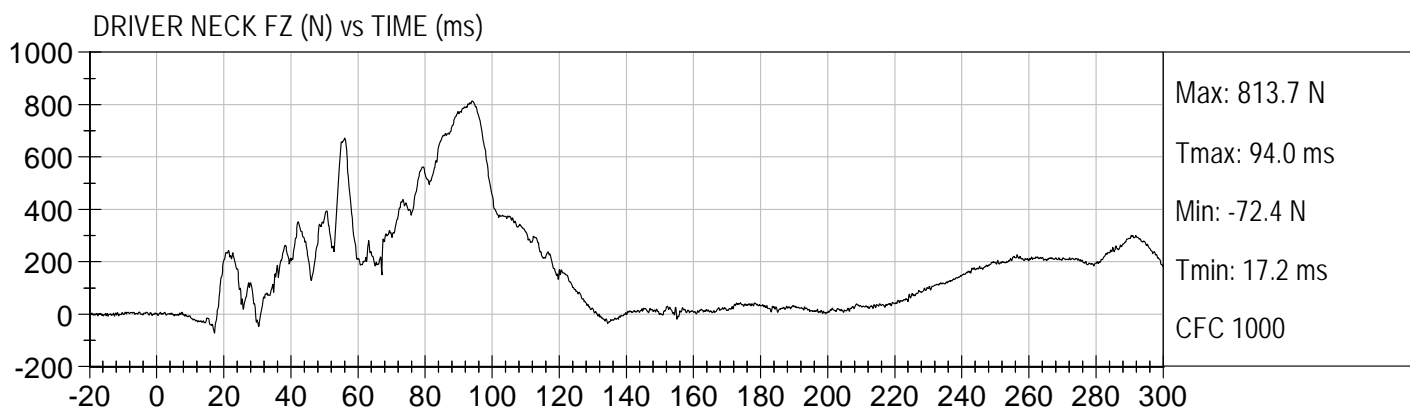
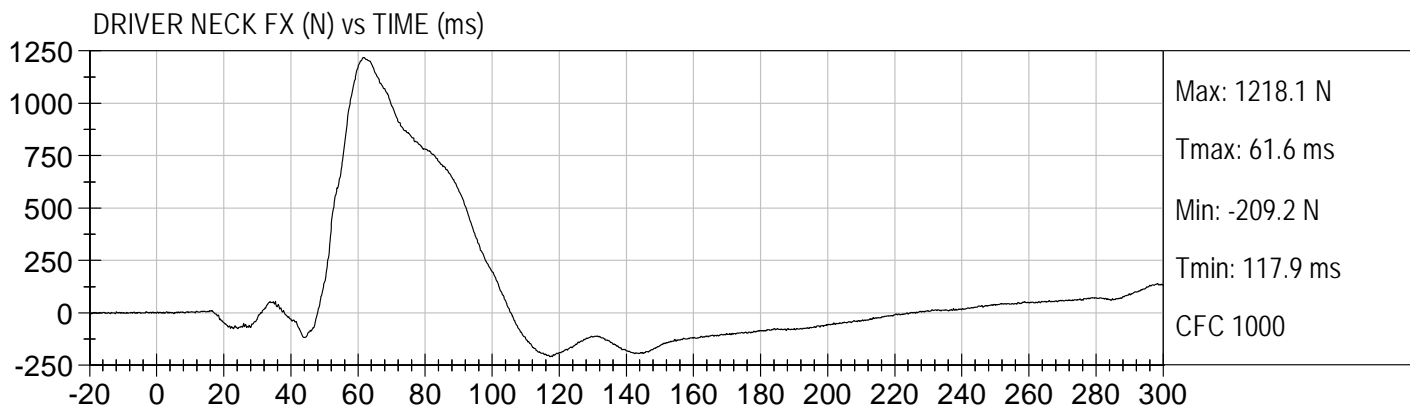
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft 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 Y
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Passenger Chest X Redundant
Passenger Chest Y Redundant
Passenger Chest Z Redundant
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z
Passenger Lap Belt Force
Passenger Shoulder Belt Force – not installed
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X

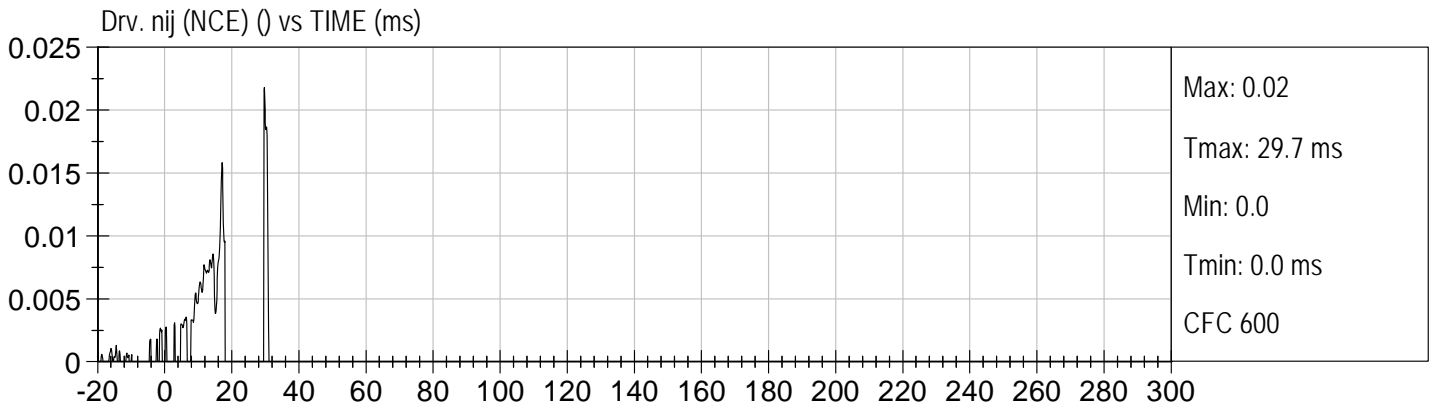
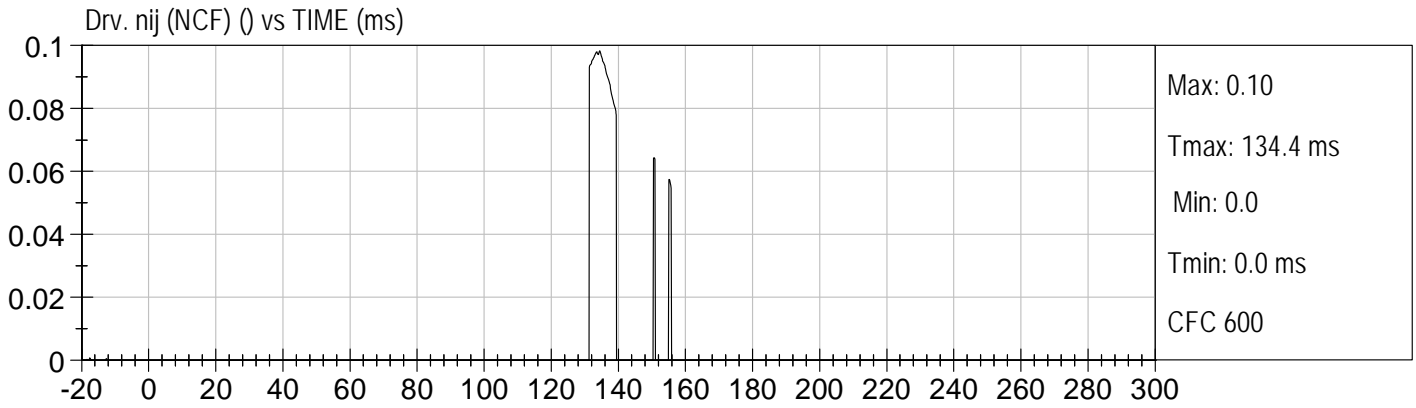
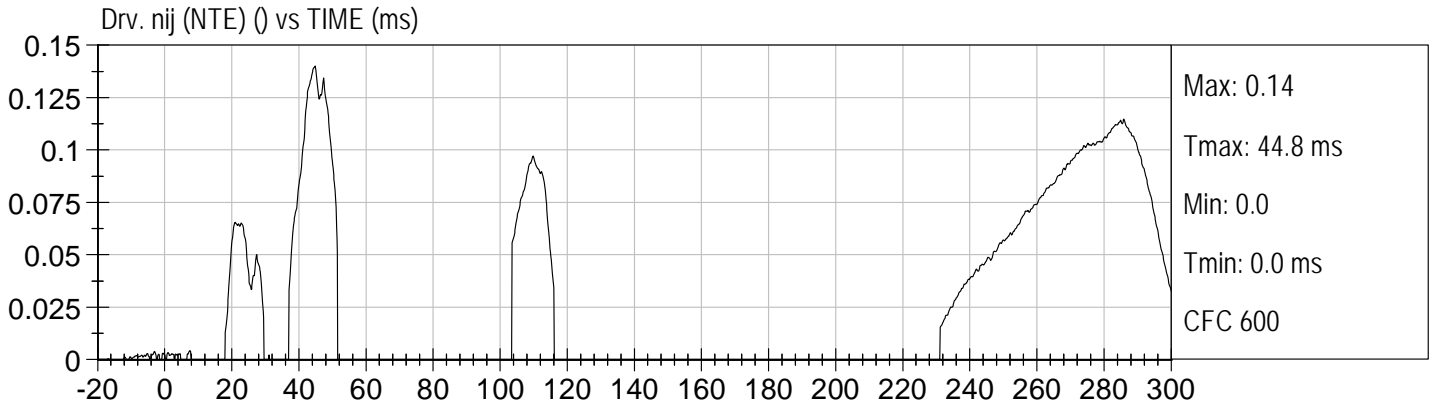
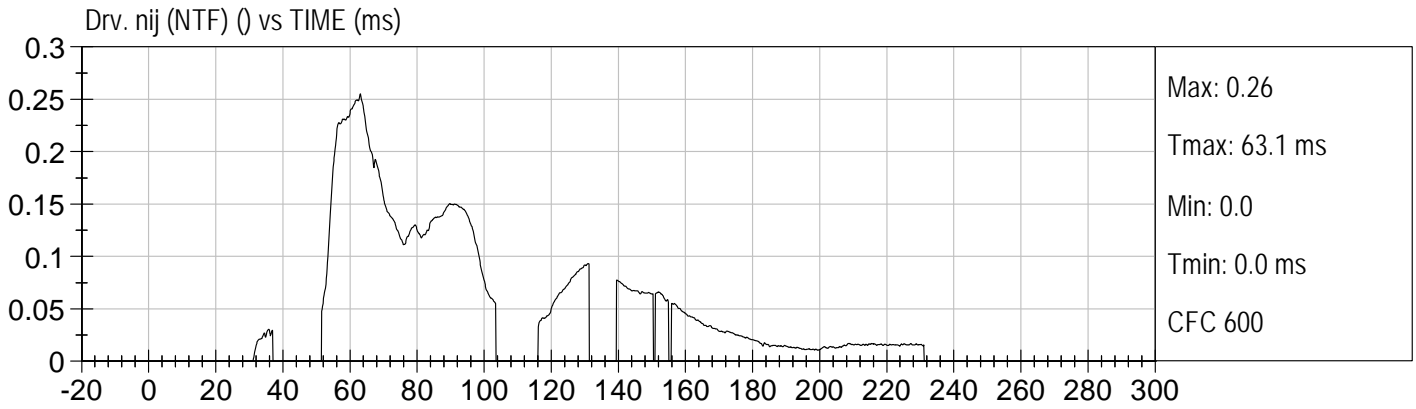
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger 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

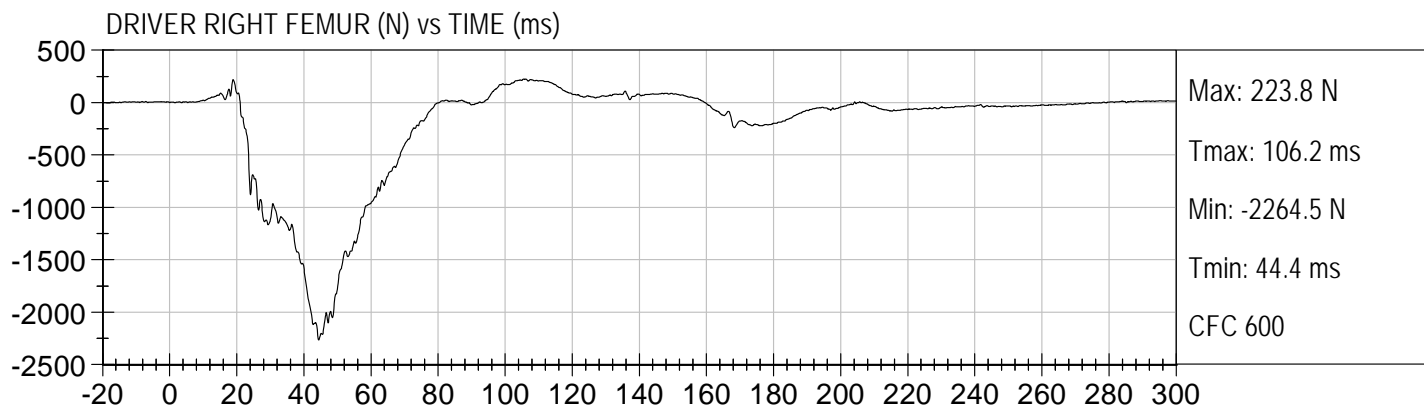
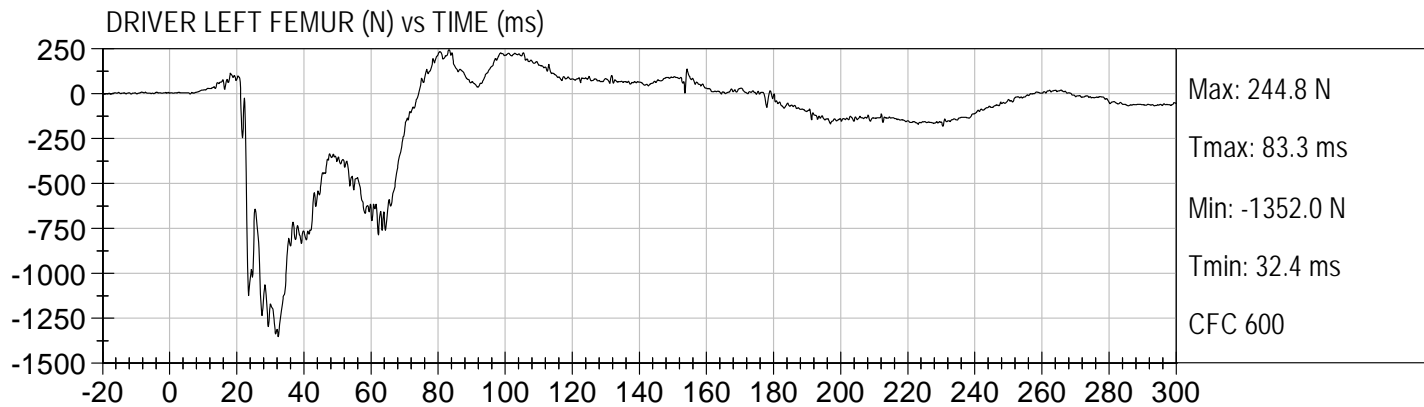


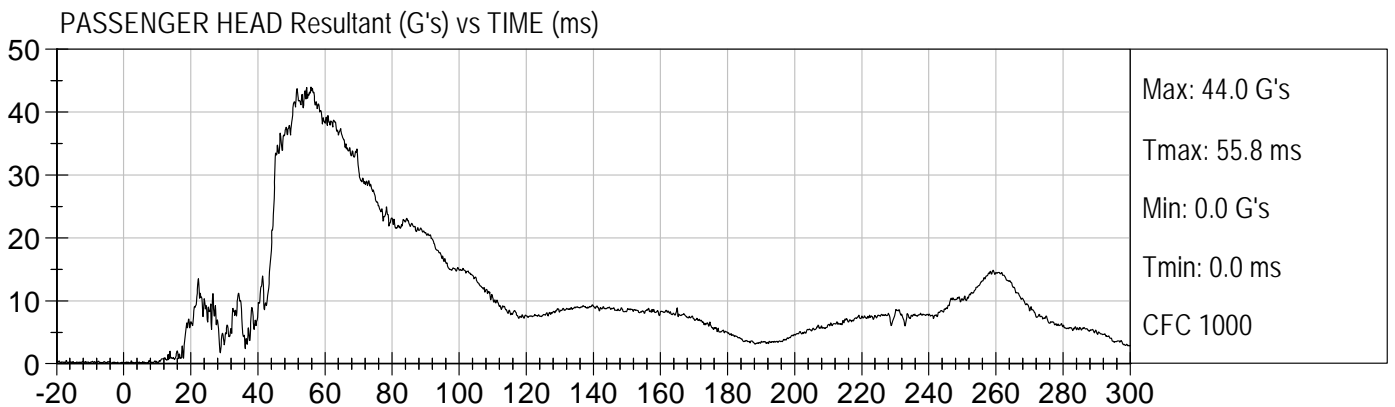
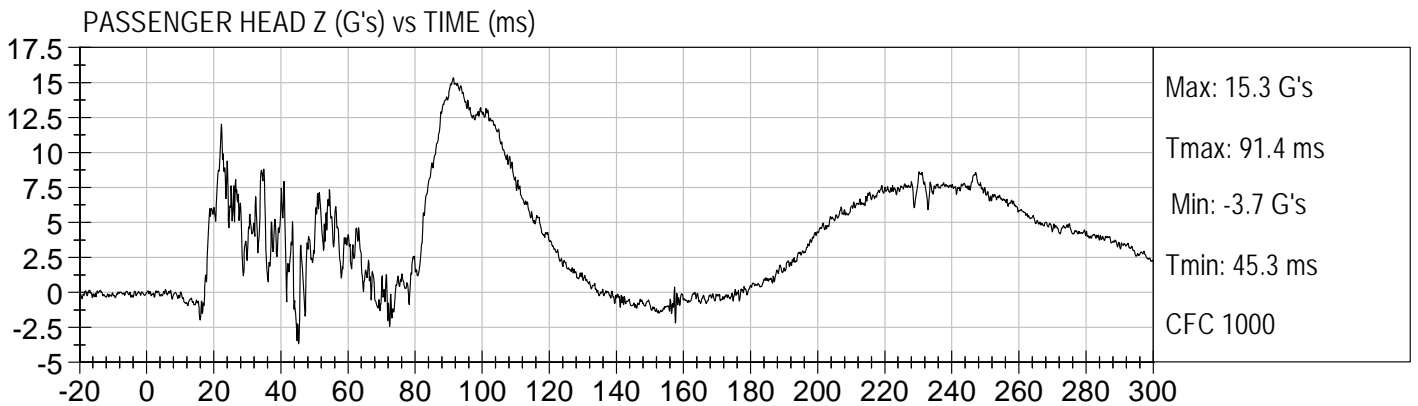
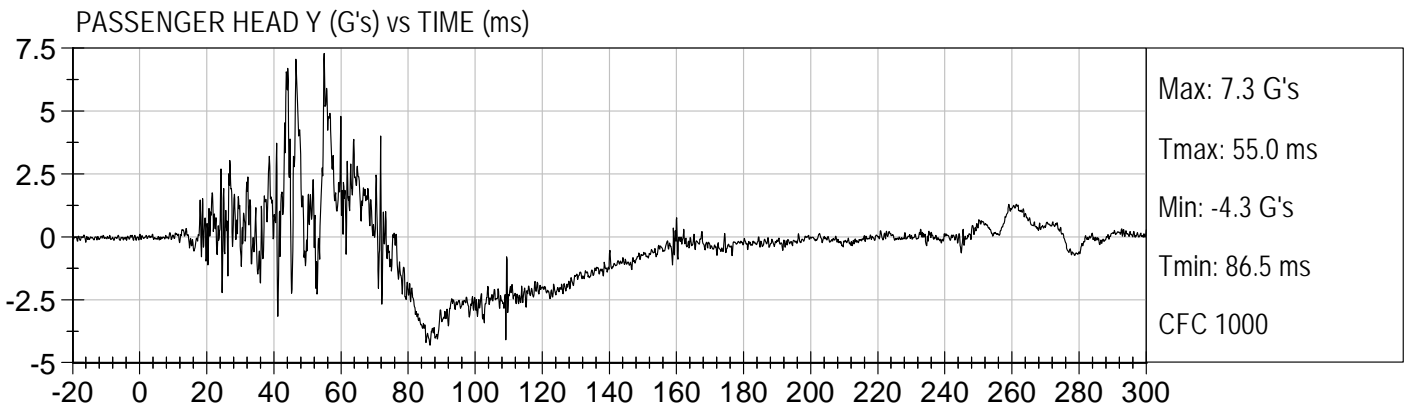
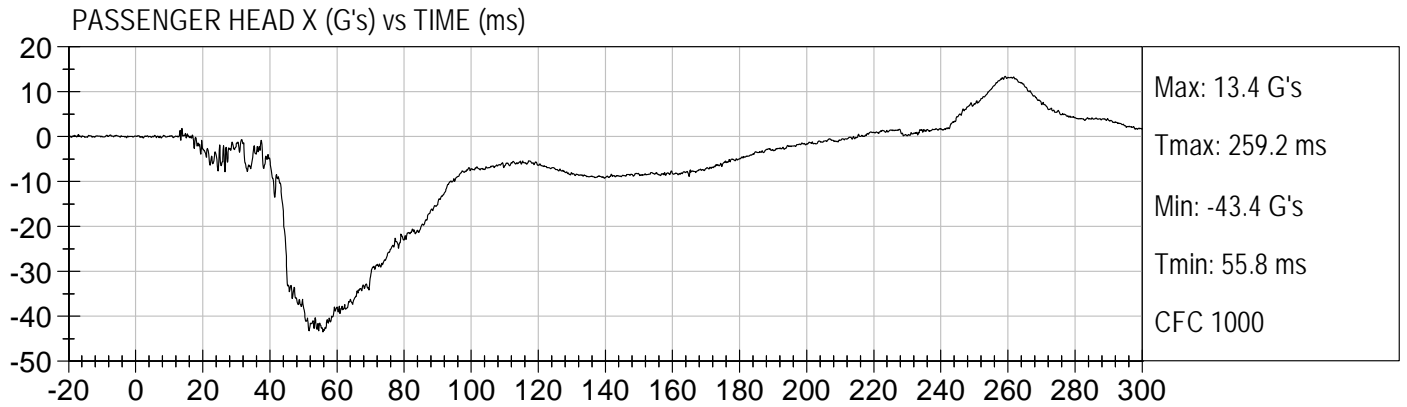


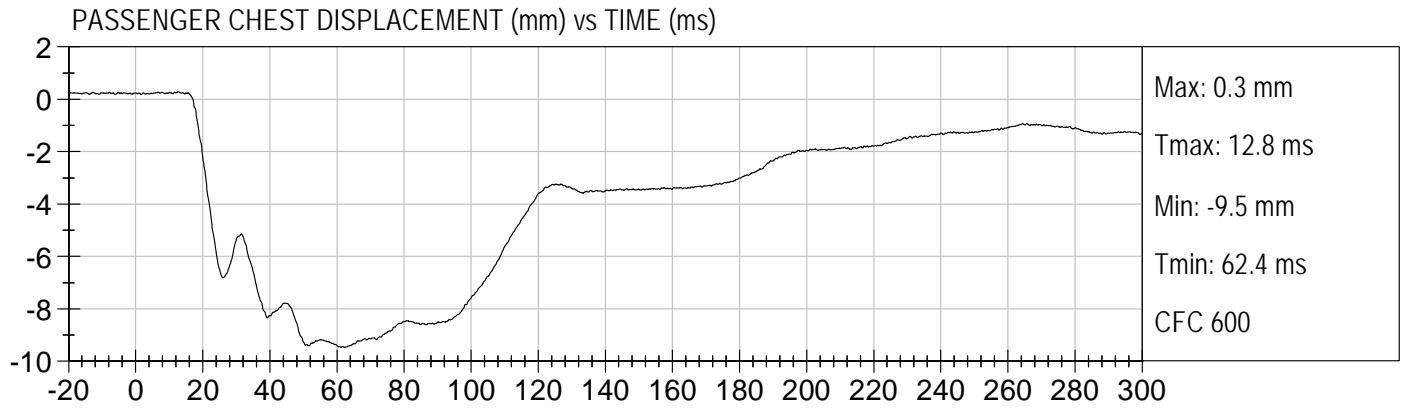


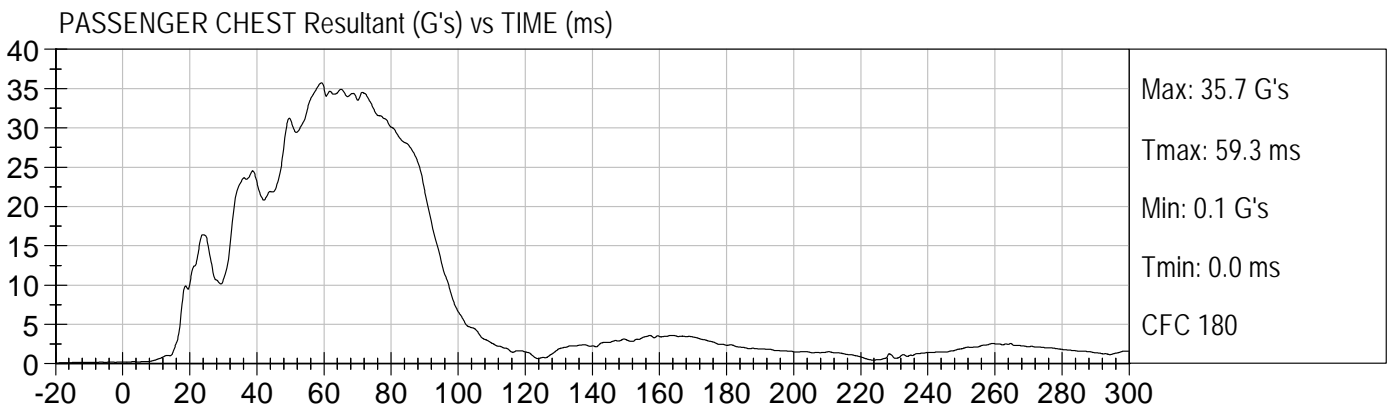
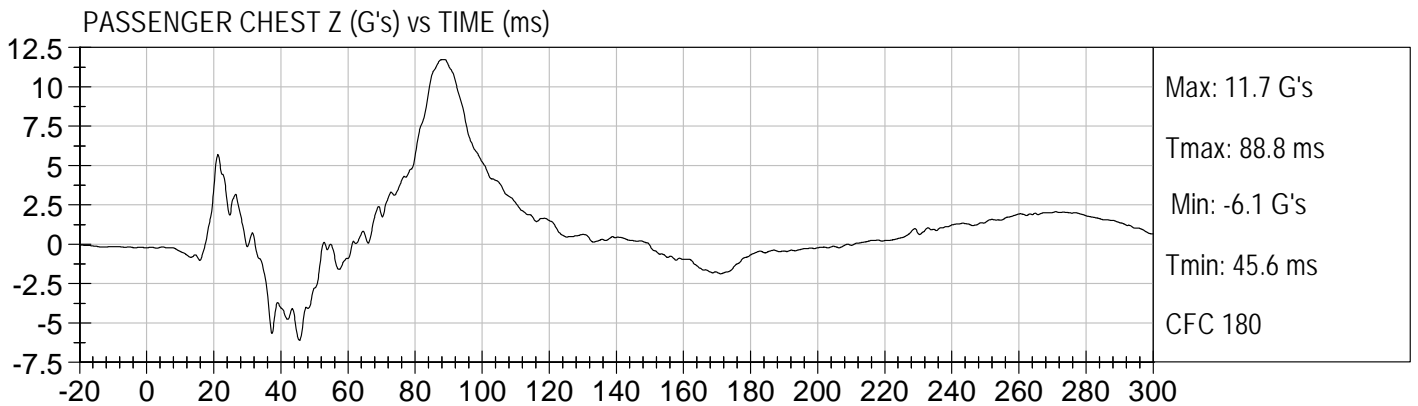
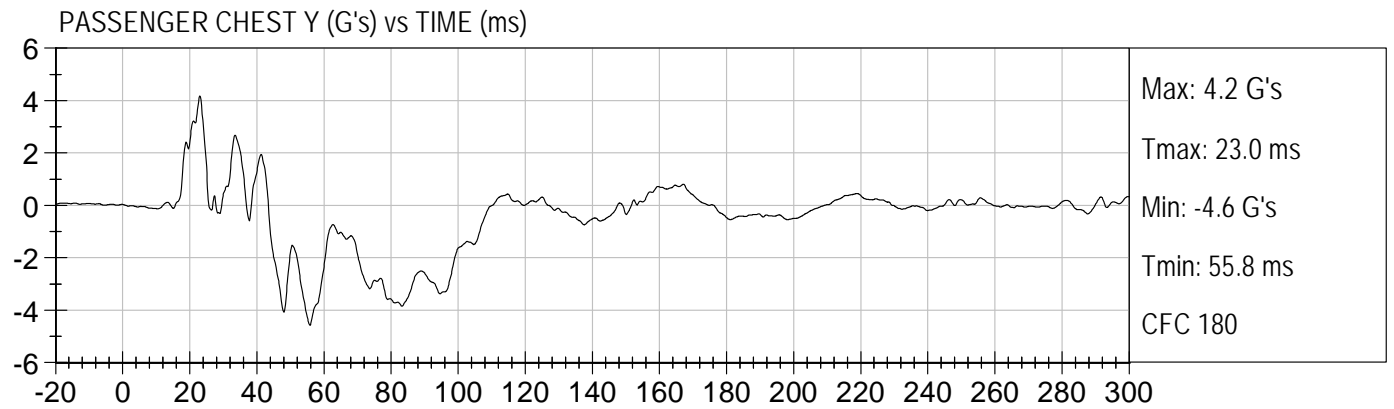
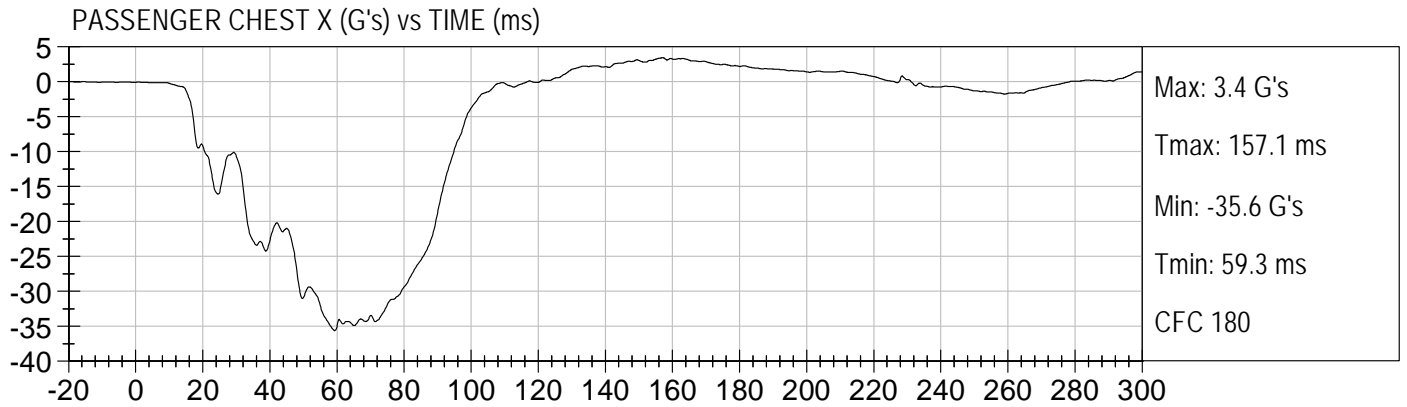


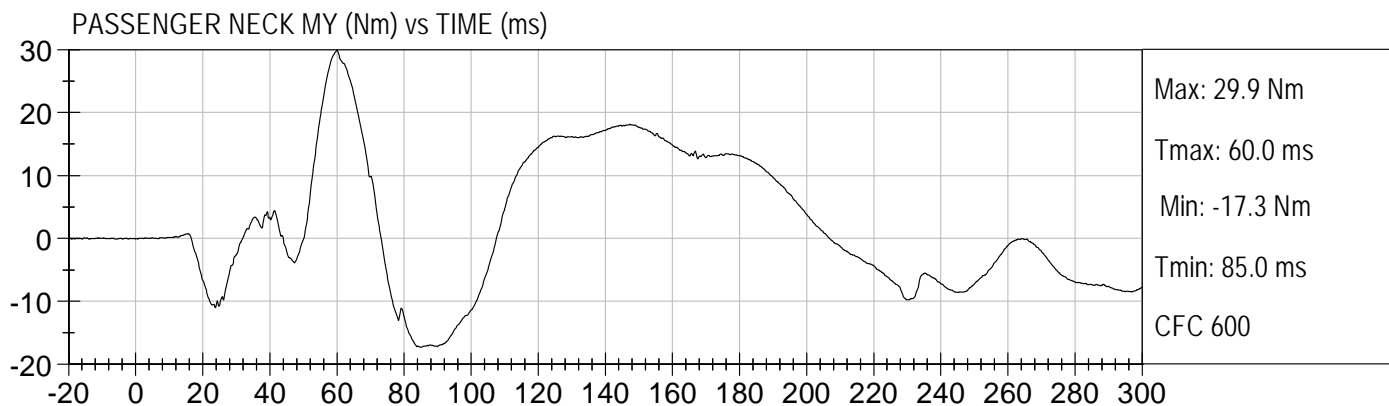
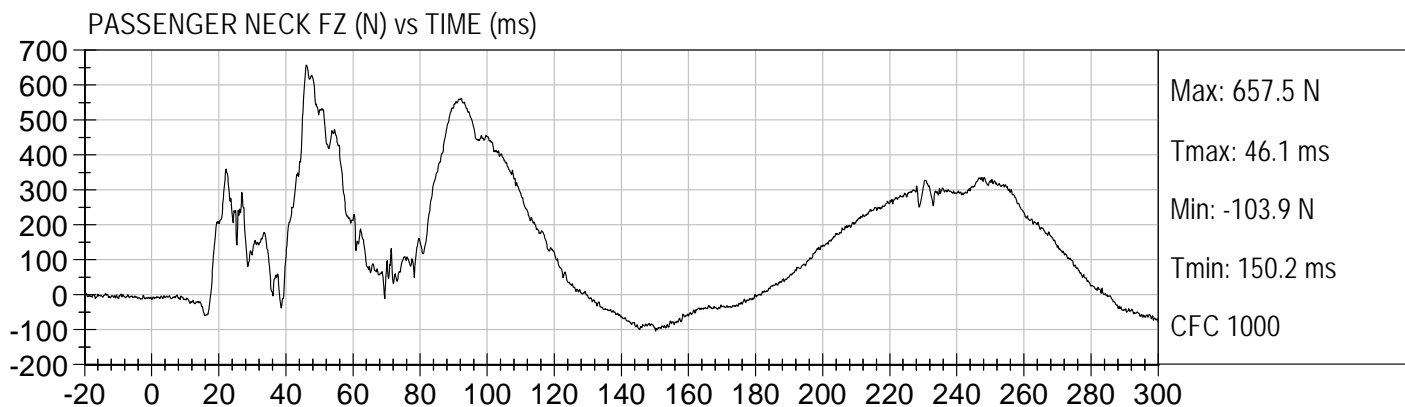
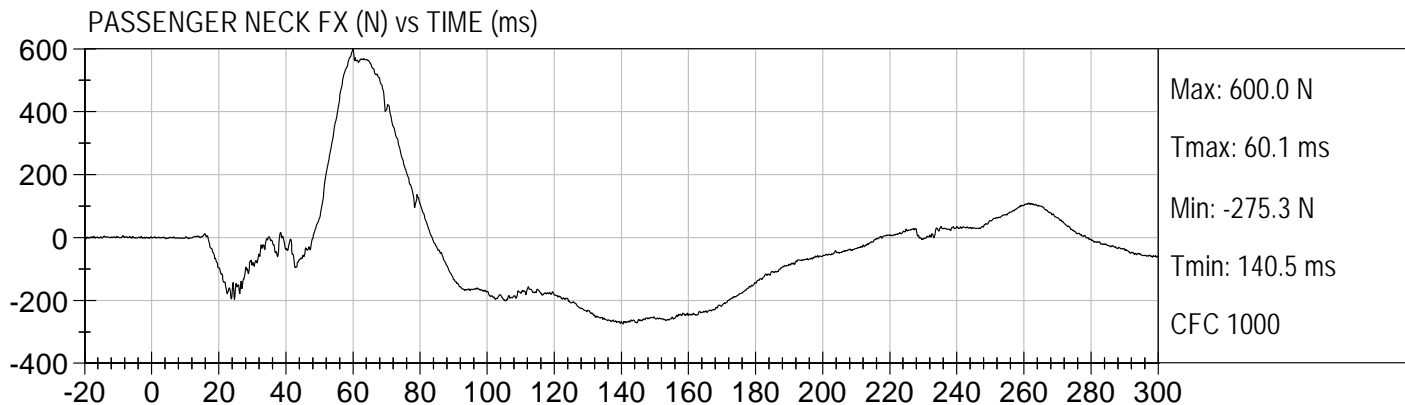


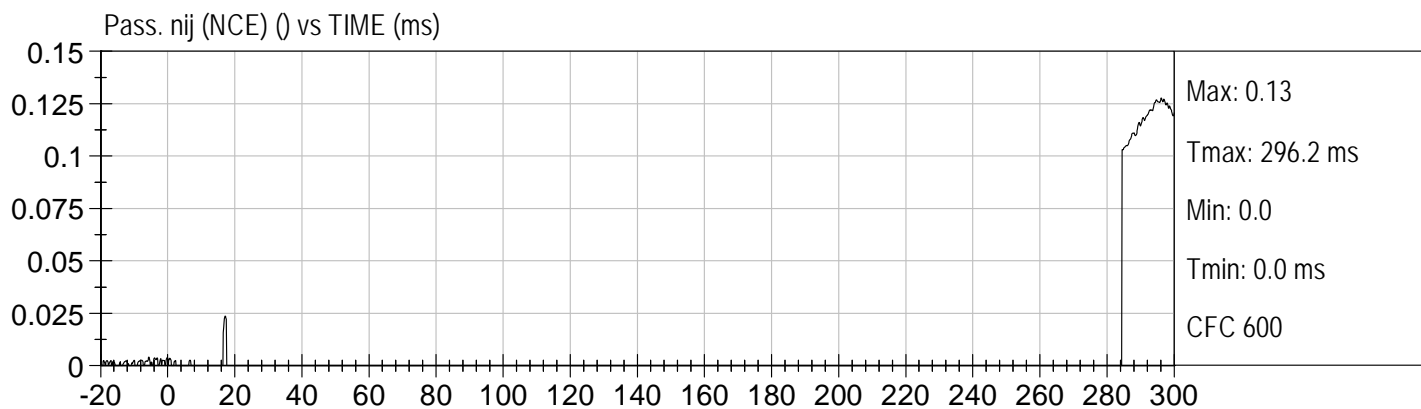
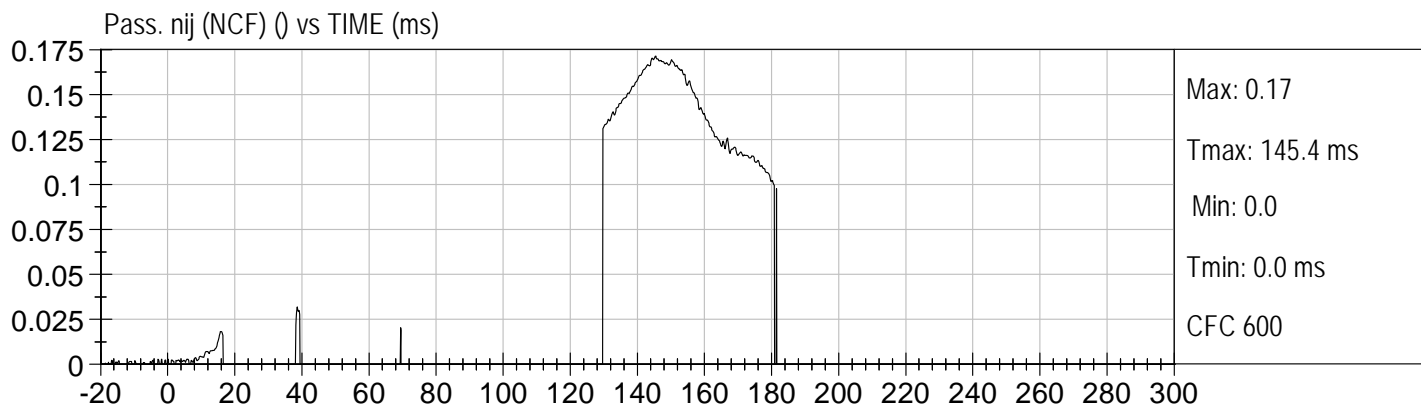
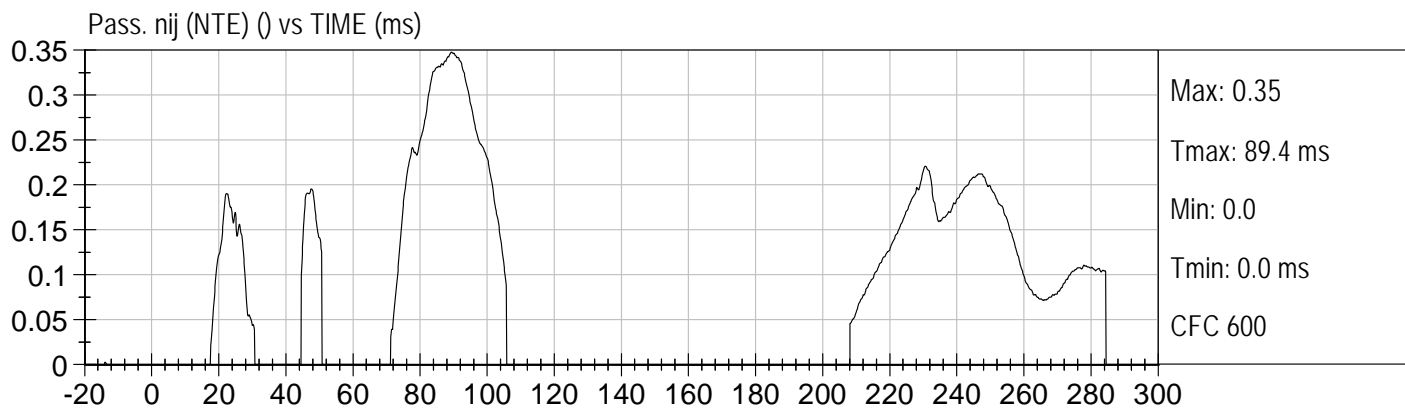
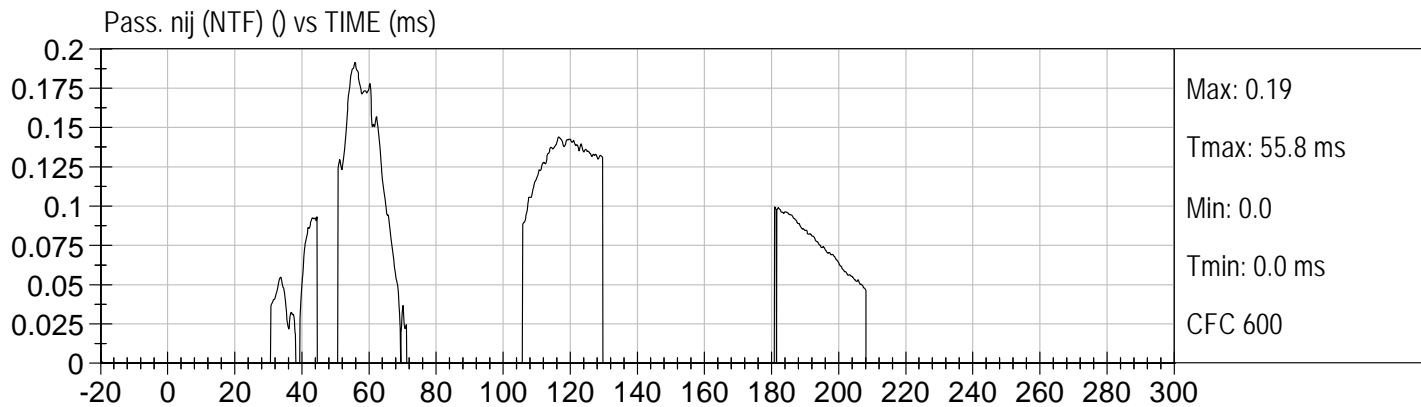


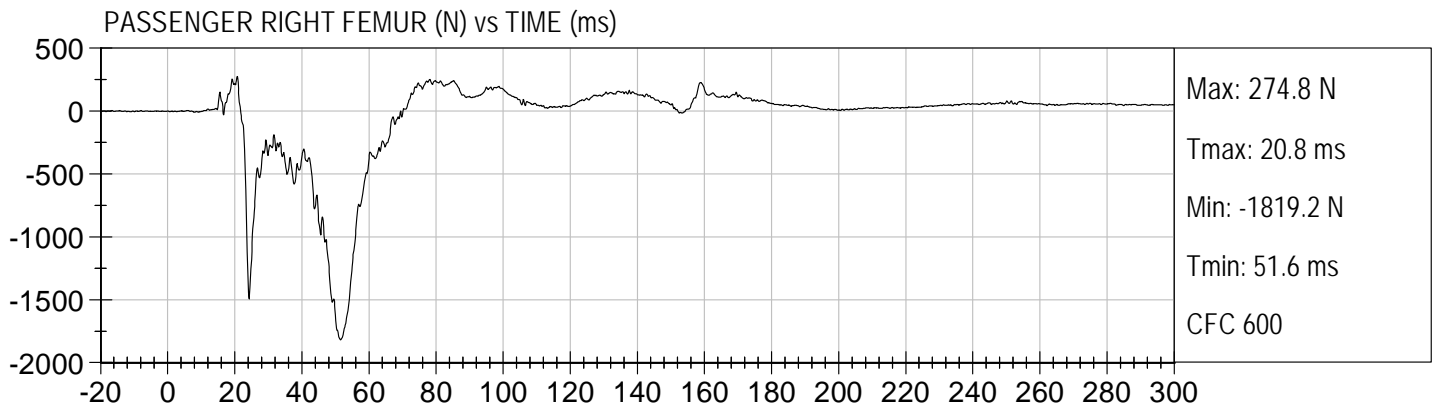
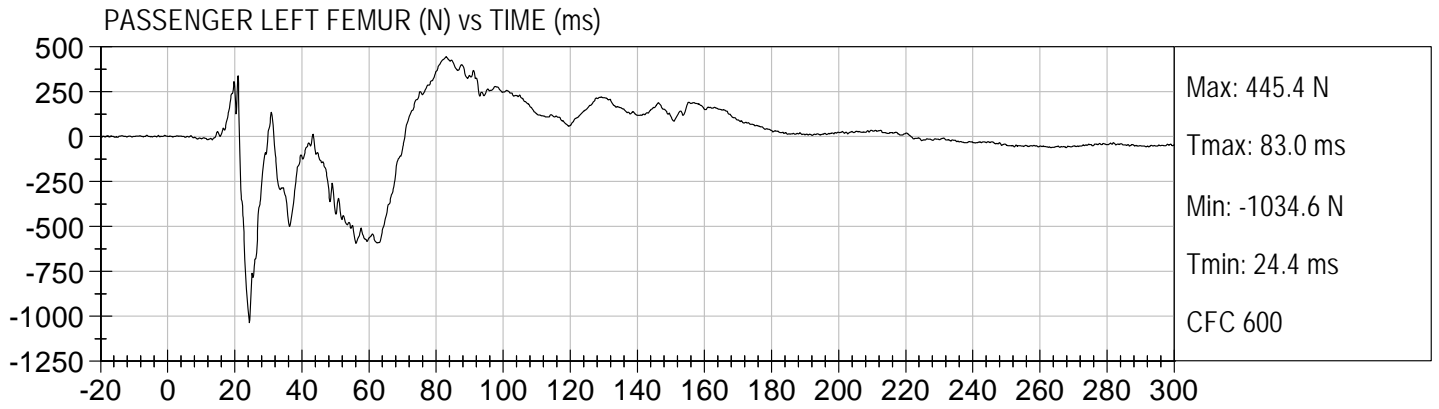












APPENDIX C
DUMMY CALIBRATION DATA

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

ATD Serial No: 351

Test ID: D103971

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	33	Pass
Peak Resultant Acceleration	G's	225 - 275	255	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

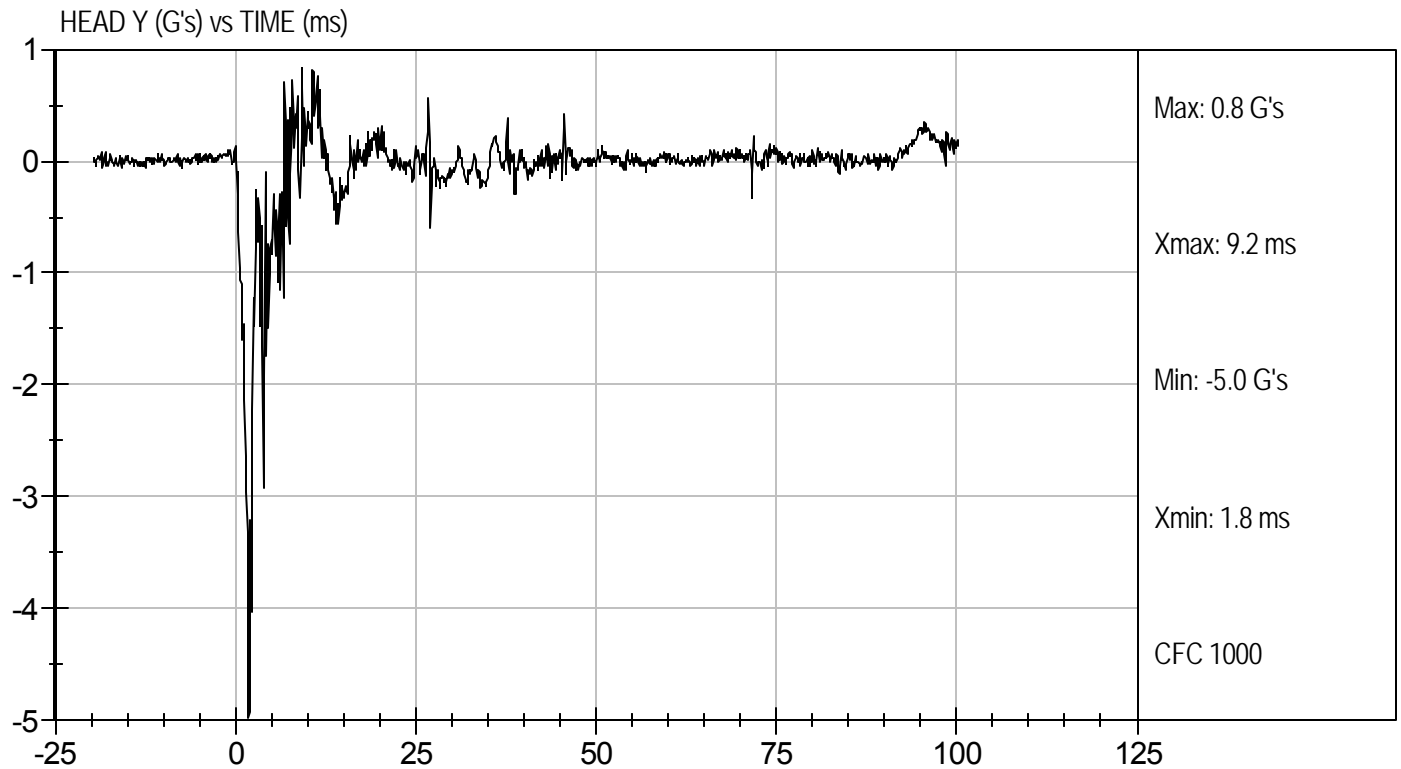
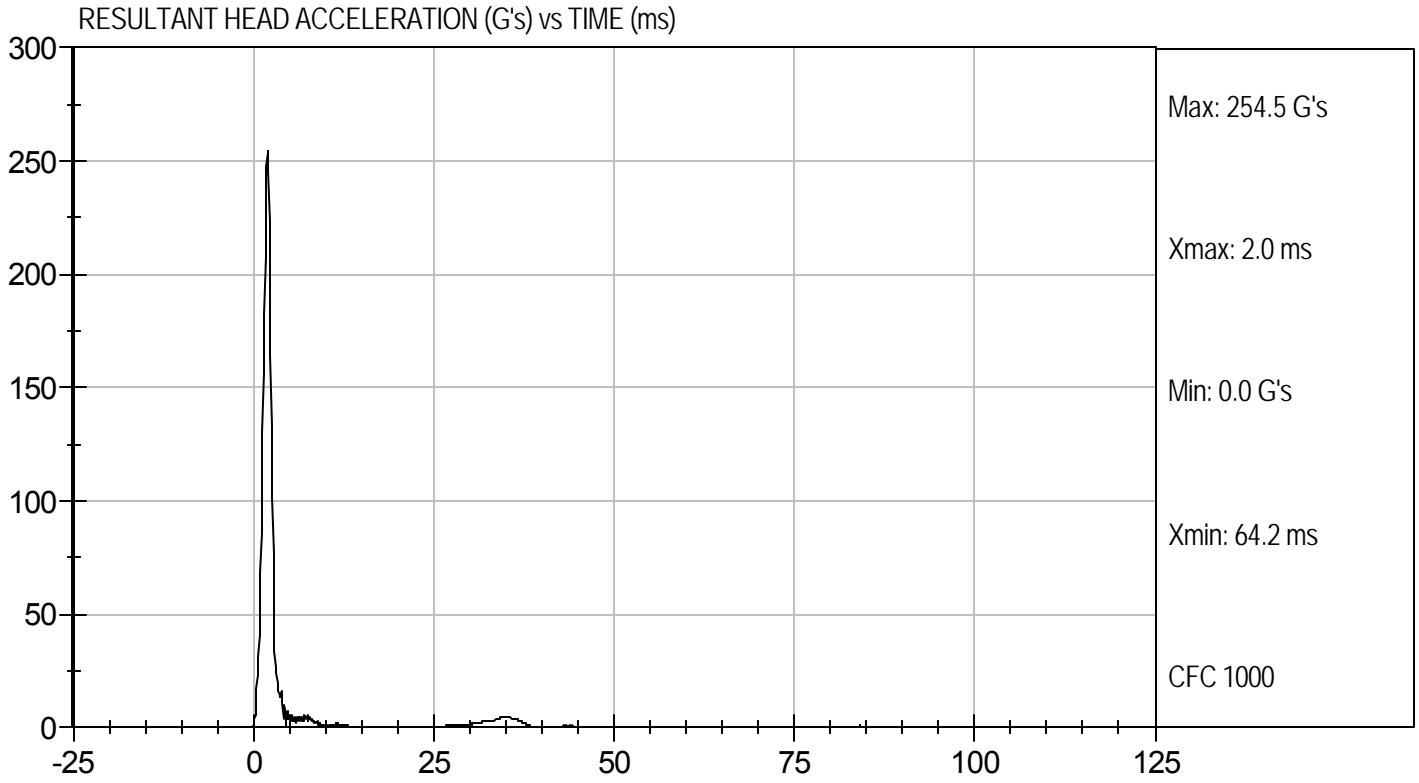
11/16/10
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D103971

Test Date: 11/16/10
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 351

Test I.D.: D103972

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	34	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.44	Pass
	20 ms	G's	17.60 to 22.60	18.43	Pass
	30 ms	G's	12.50 to 18.50	14.58	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.49	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	69.8	Pass
	Time	ms	57.0 to 64.0	57.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.0	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	92.0	Pass
	Time	ms	47.0 to 58.0	47.4	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	100.7	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

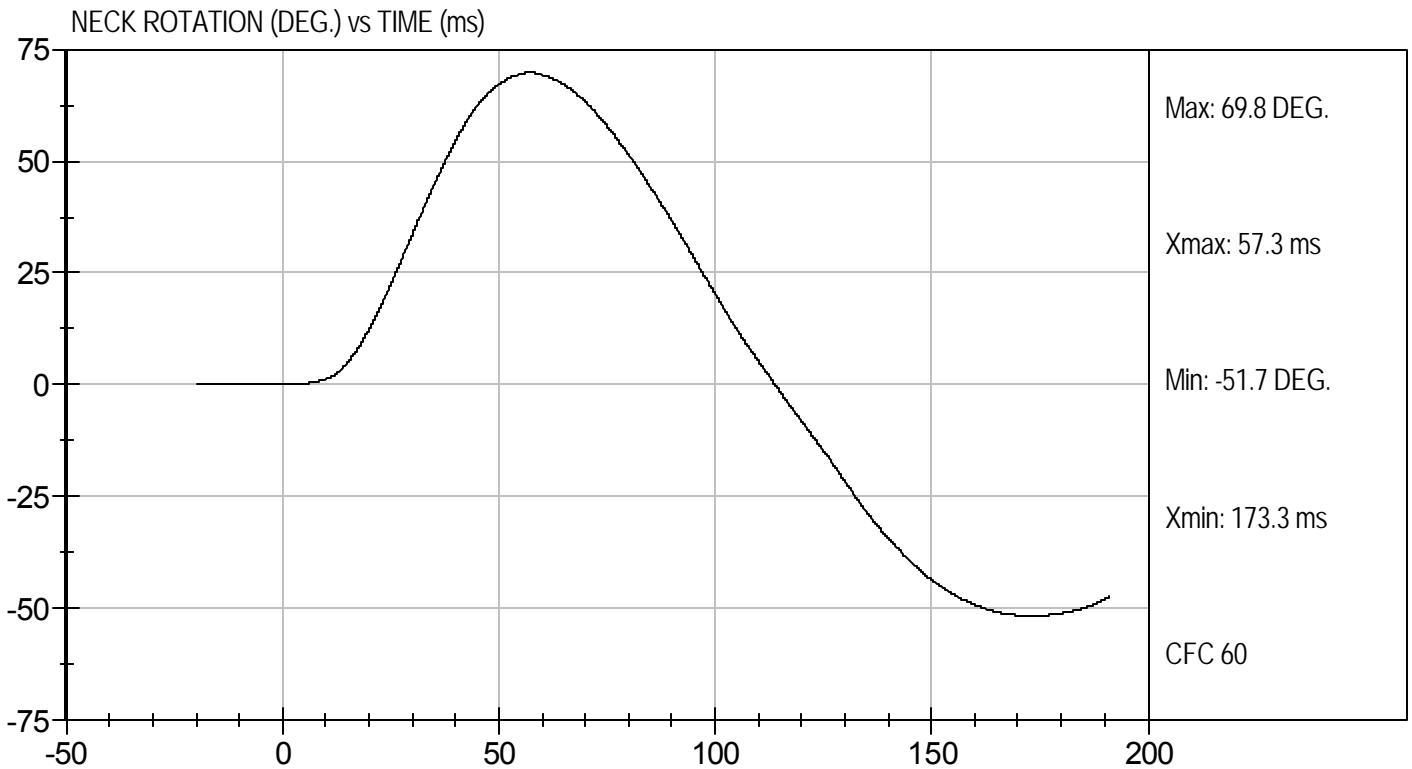
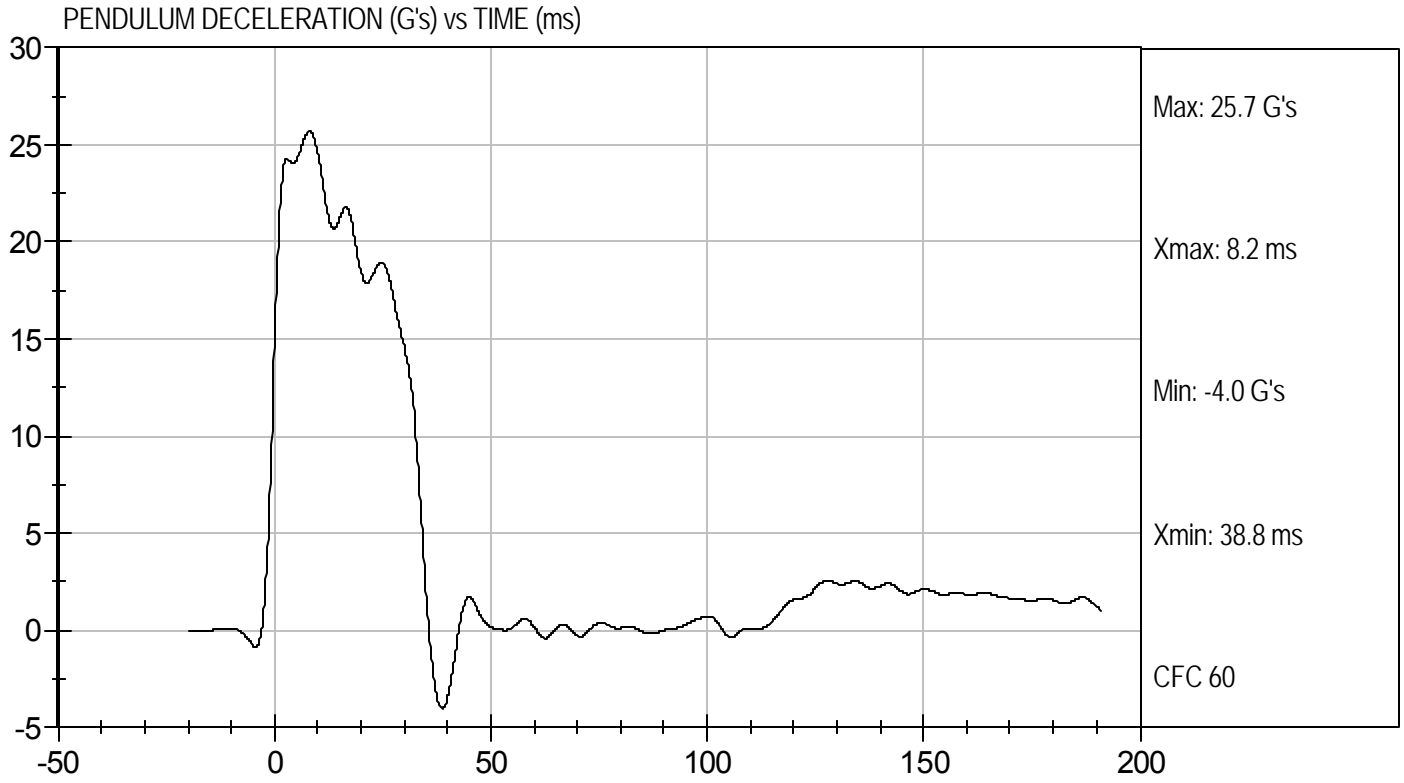
11/15/10
Test Date

David Winkelbauer
Approved By



Test Desc: Neck Flexion
Component ID: D103972

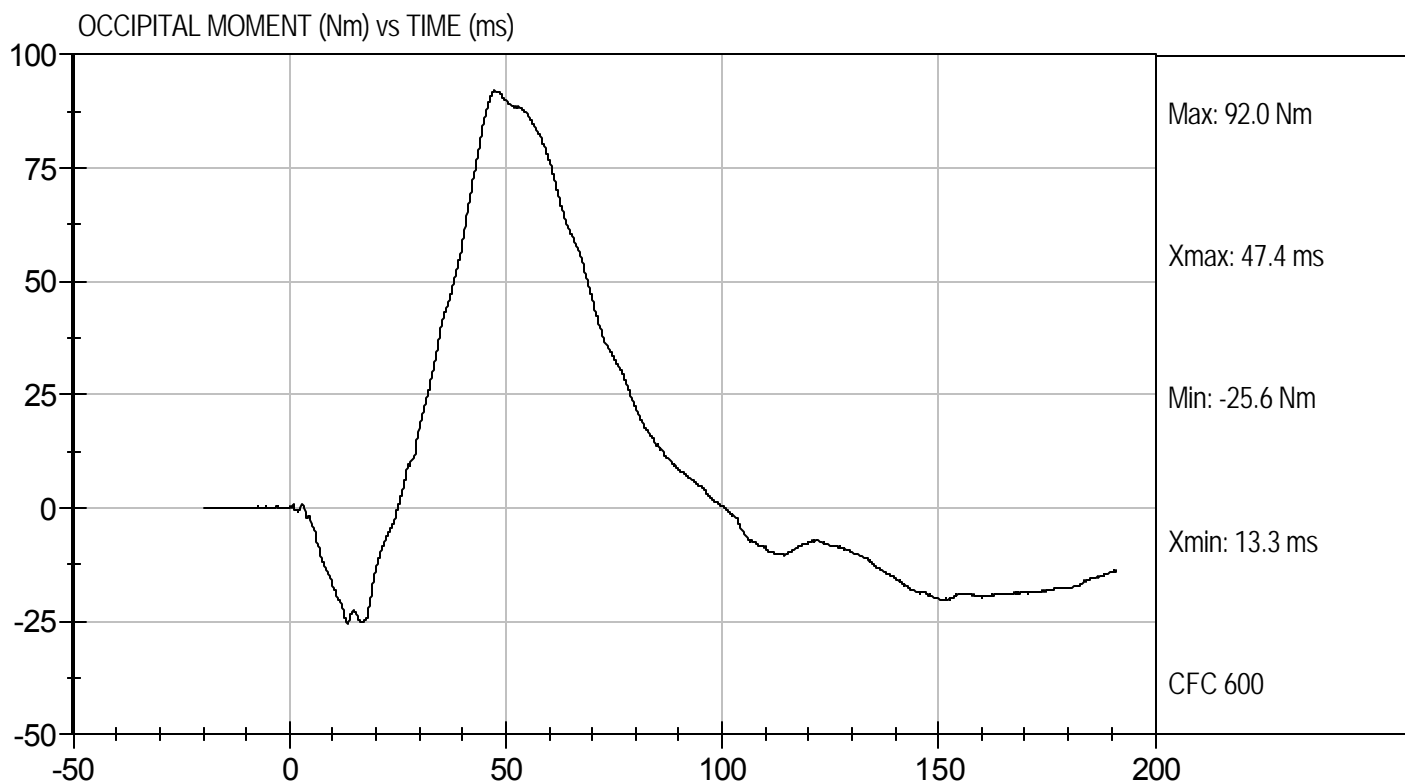
Test Date: 11/15/10
Velocity: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Flexion
Component ID: D103972

Test Date: 11/15/10
Velocity: 23.15 ft/s, 7.06 m/s



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

ATD Serial No: 351

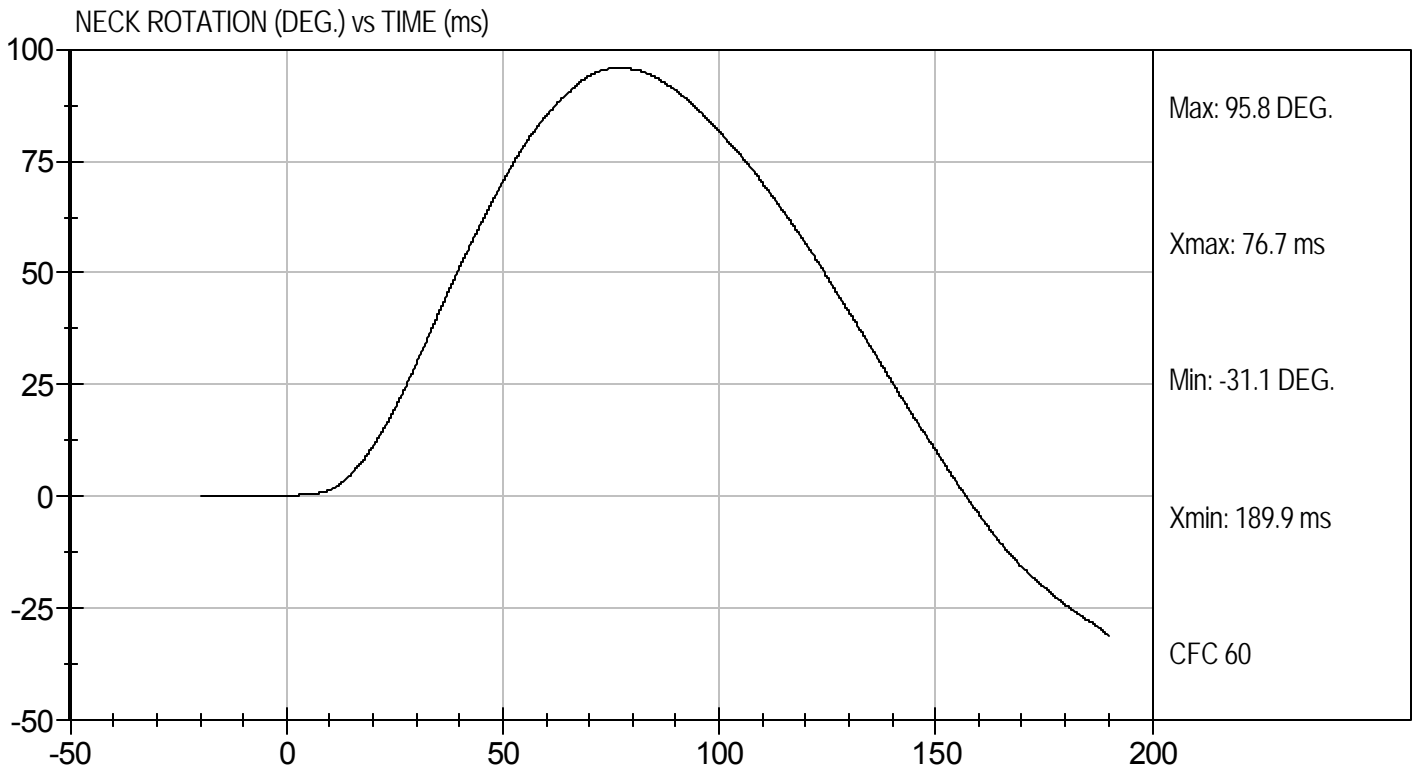
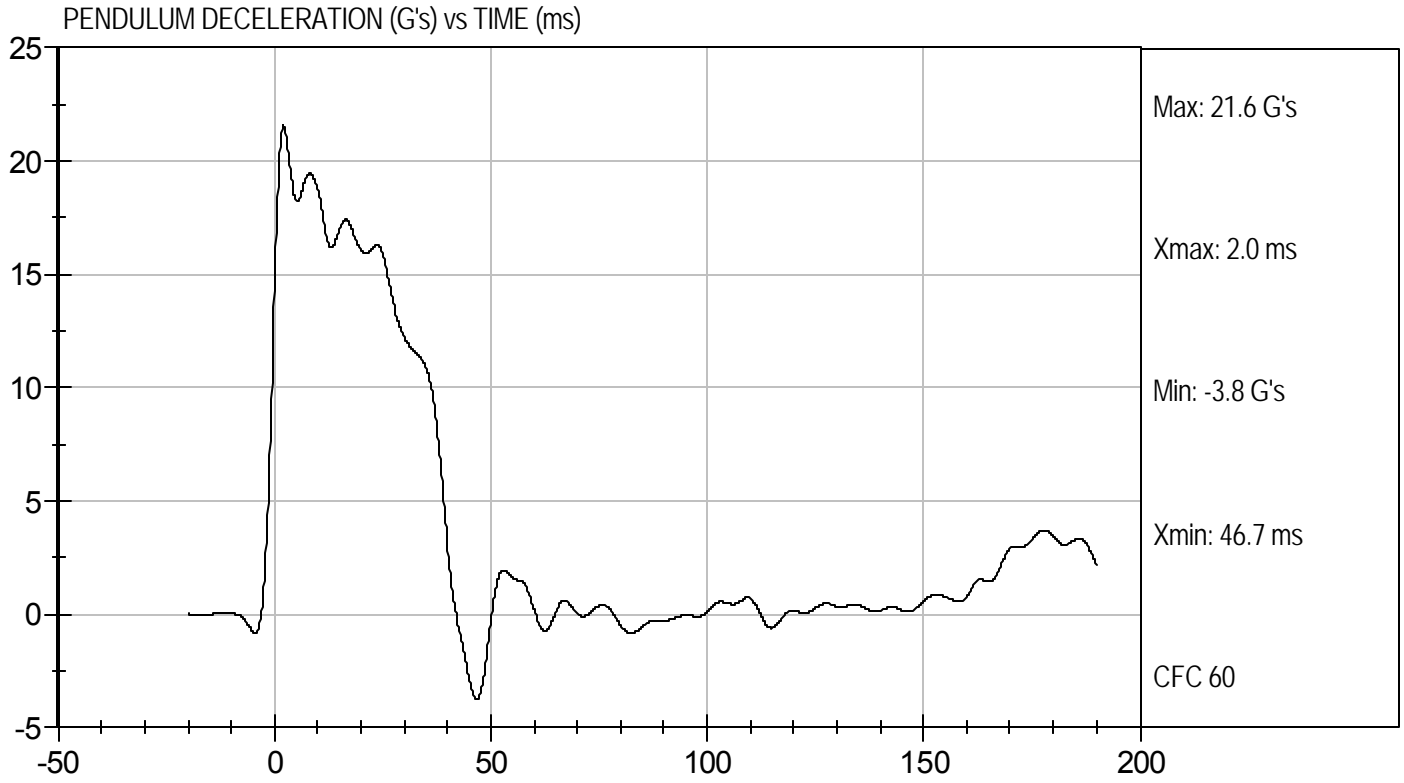
Test I.D.: D103973

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.76	Pass
	20 ms	G's	14.00 to 19.00	16.06	Pass
	30 ms	G's	11.00 to 16.00	12.21	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.8	Pass
	Time	ms	72.0 to 82.0	76.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	157.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-61.4	Pass
	Time	ms	65.0 to 79.0	71.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.5	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

11/15/10
Test Date

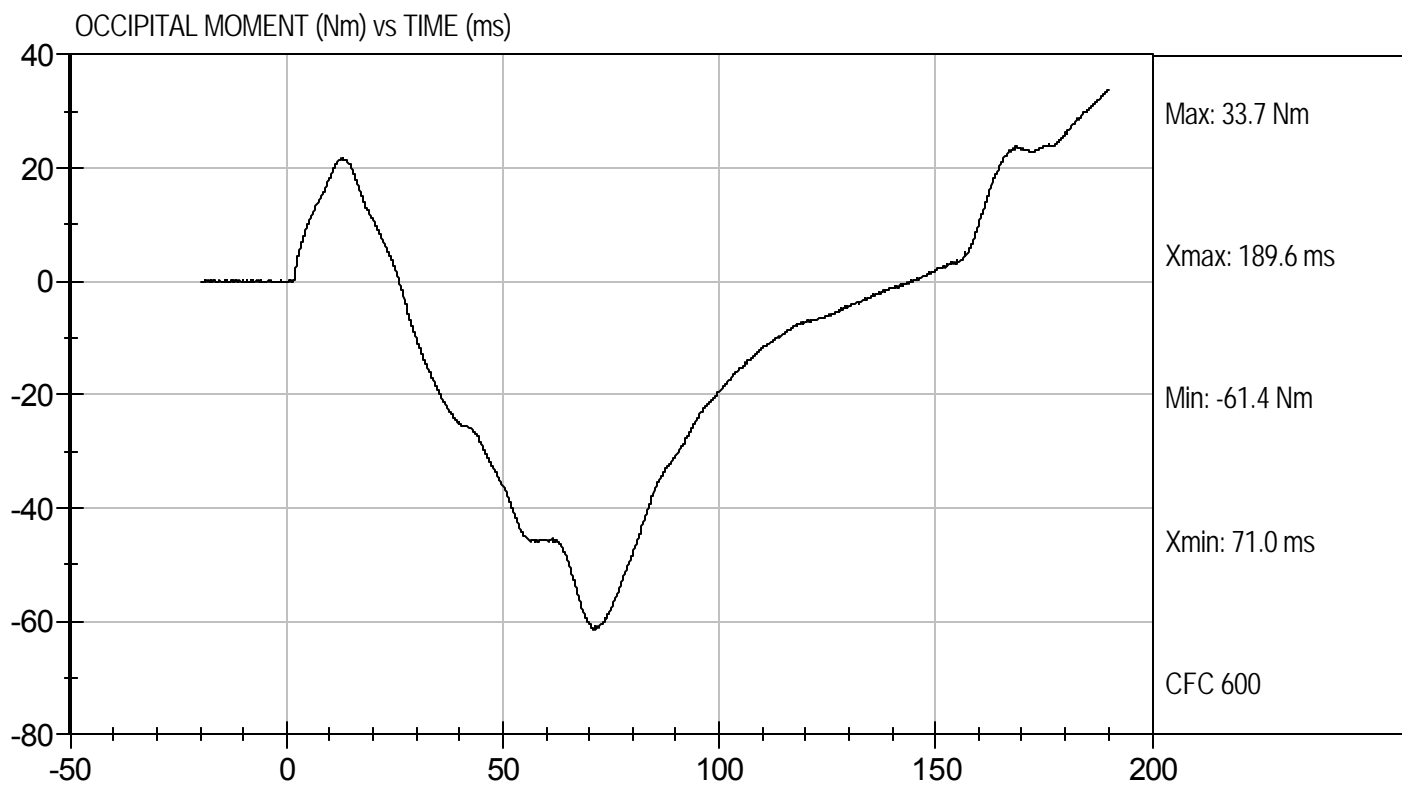
David Winkelbauer
Approved By





Test Desc: Neck Extension
Component ID: D103973

Test Date: 11/15/10
Velocity: 20.10 ft/s, 6.13 m/s



**MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE**

ATD Serial No: 351

Test I.D.: D103974

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	33	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,384	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.45	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

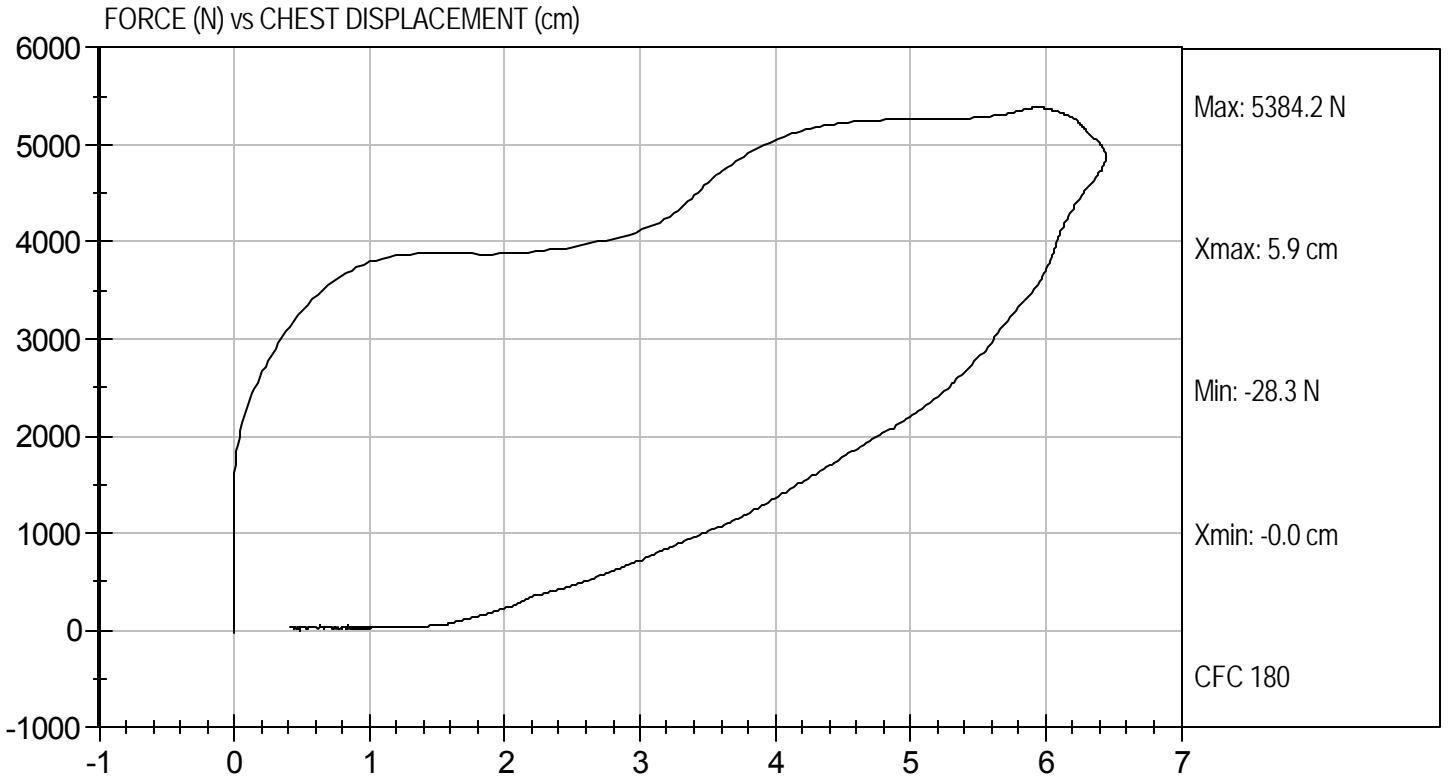
11/16/10
Test Date

David Winkelbauer
Approved By



Test Desc: Thorax Impact
Component ID: D103974

Test Date: 11/16/10
Velocity: 21.64 ft/s, 6.60 m/s



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

ATD Serial No: 351

Test I.D: D103975

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,729	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

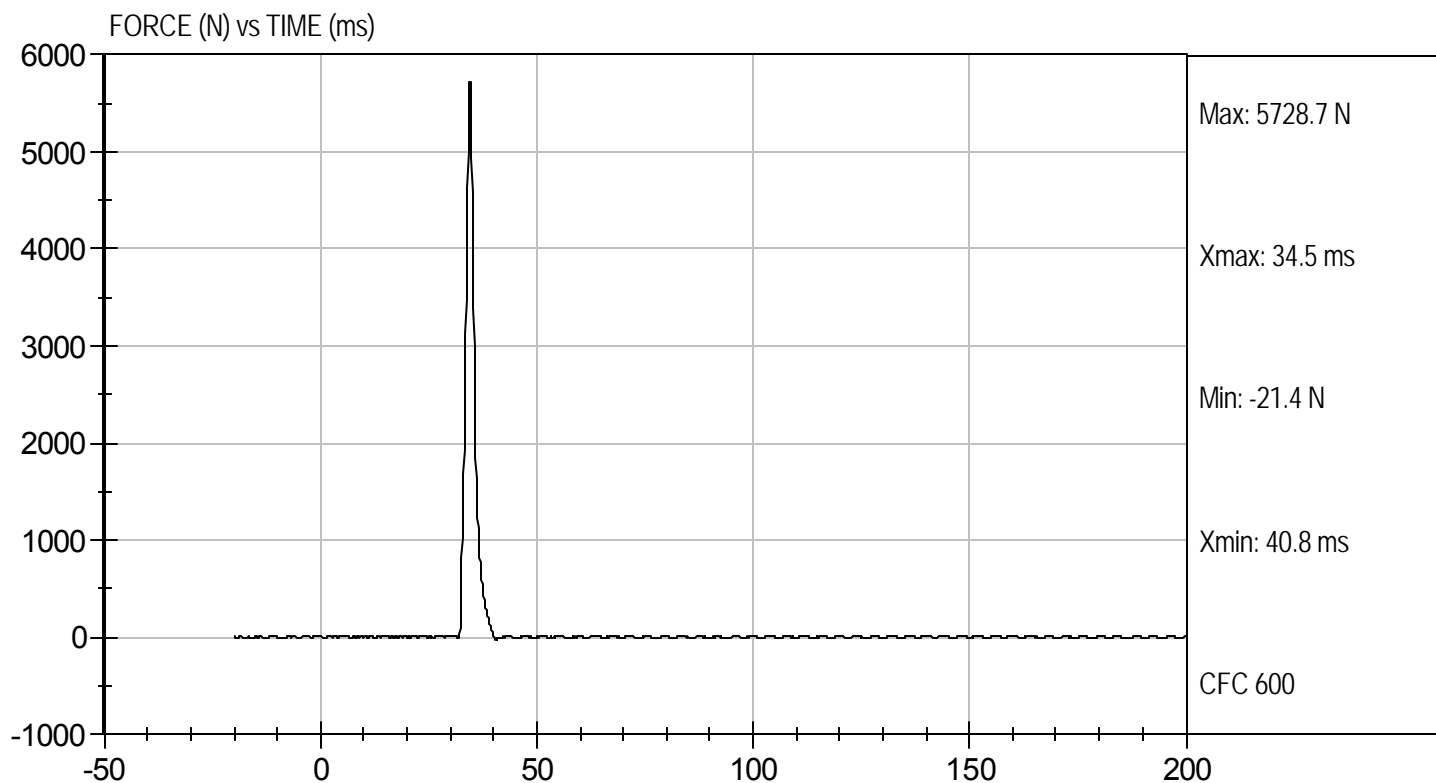
11/16/10
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D103975

Test Date: 11/16/10
Velocity: 6.944 ft/s, 2.12 m/s



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

ATD Serial No: 351

Test I.D: D103976

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,742	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

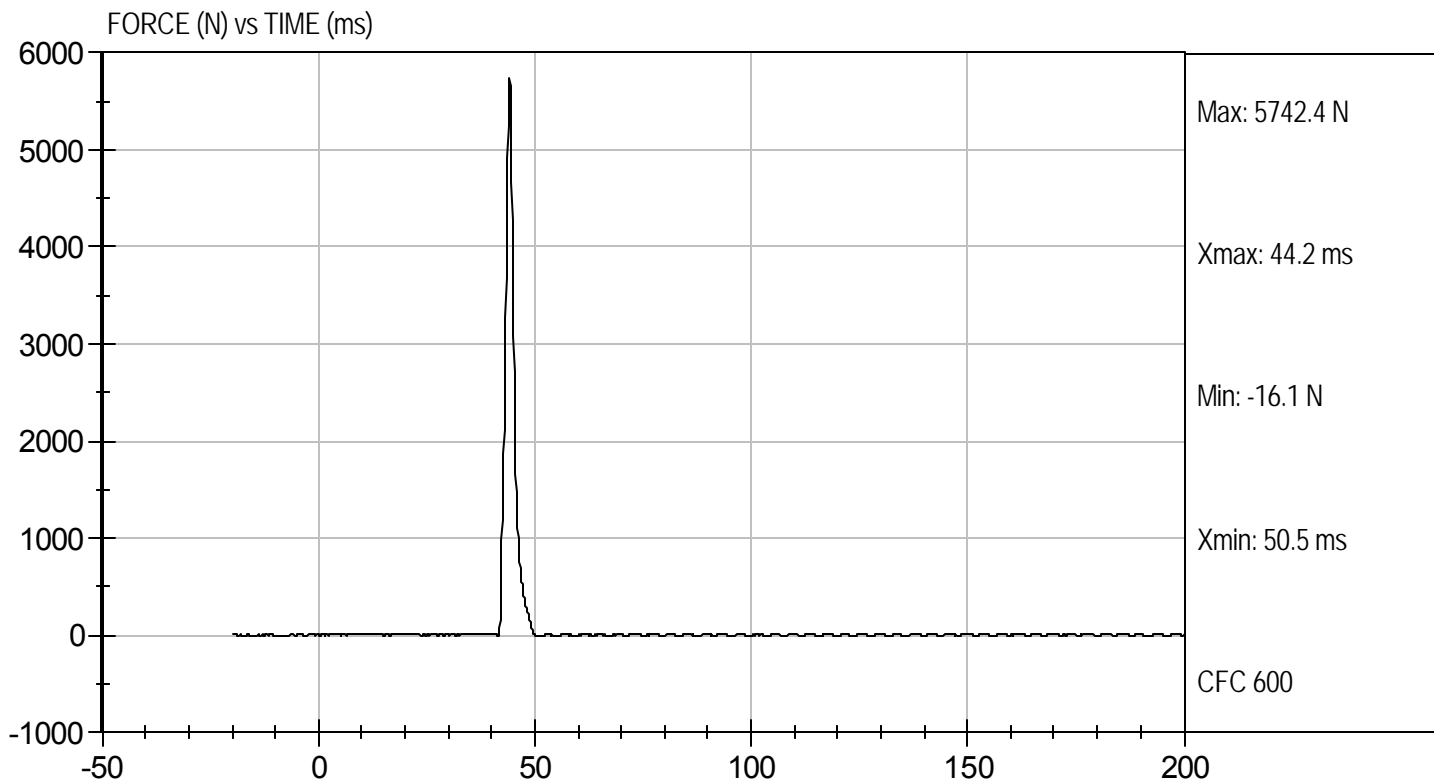
11/16/10
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D103976

Test Date: 11/16/10
Velocity: 6.91 ft/s, 2.11 m/s



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

ATD Serial No: 351

Test I.D: D103970

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.1	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	31	31	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	43.4	40.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	48	49	Pass
Overall Test Results					Pass

Jessica Gall
Laboratory Technician

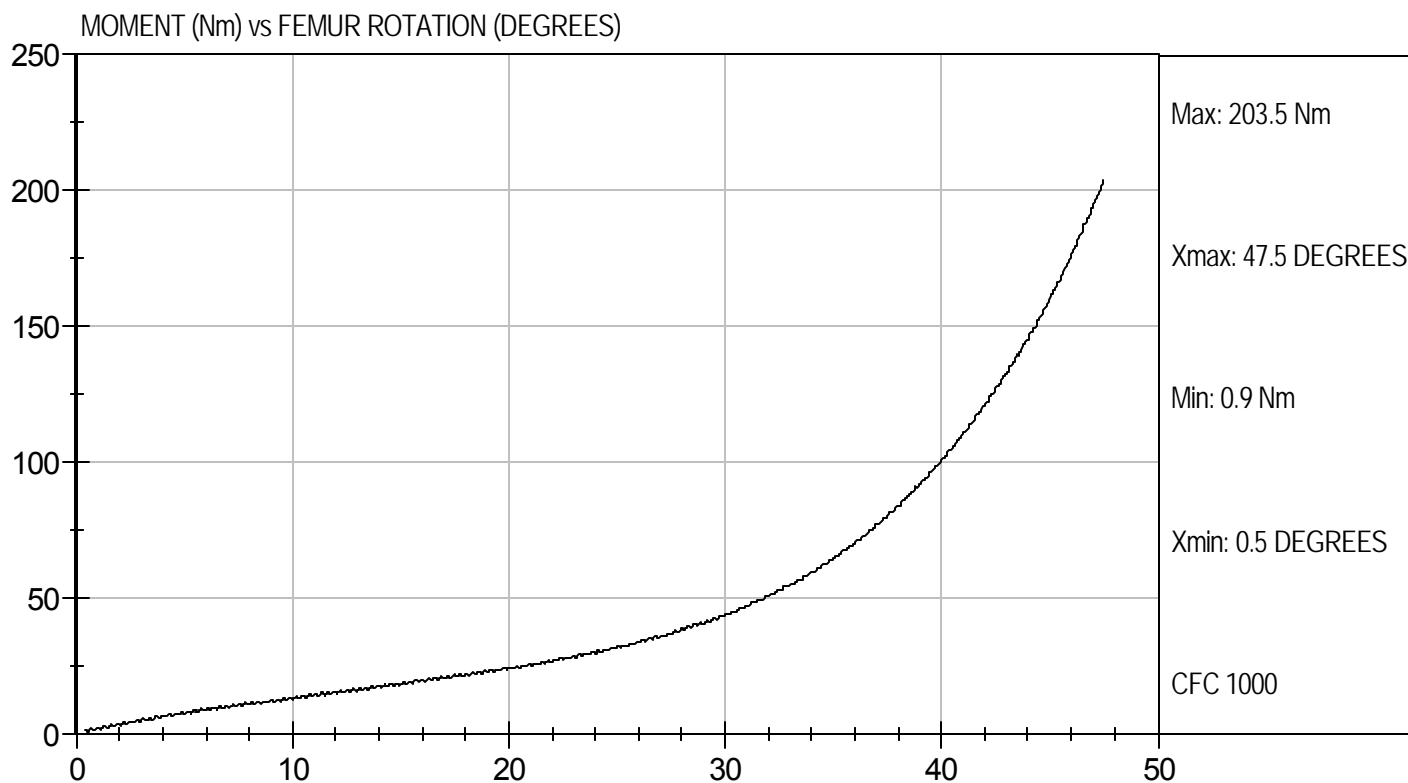
11/15/10
Test Date

David Winkelbauer
Approved By



Test Desc: Hip Femur Flexion
Component ID: D103979

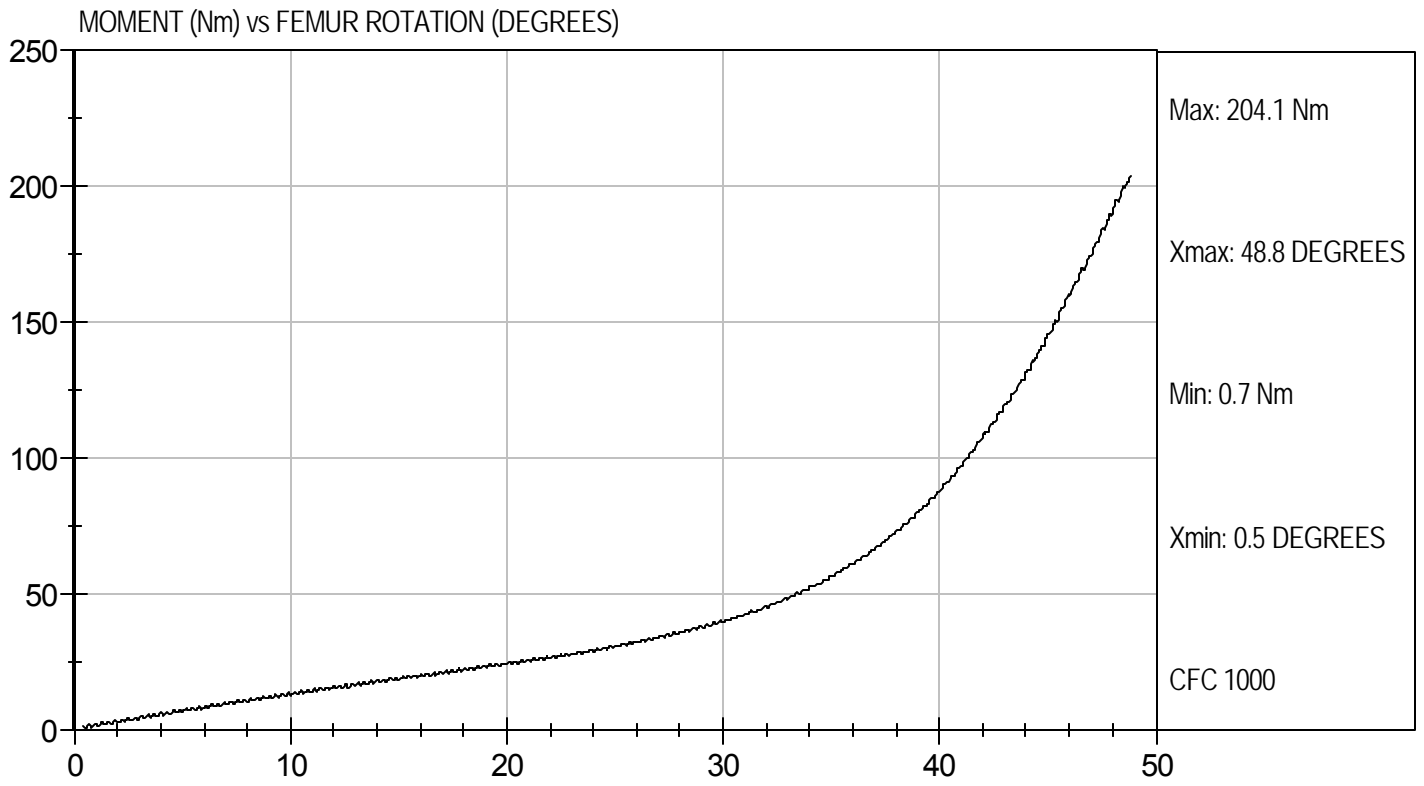
Test Date: 11/15/10
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D103970

Test Date: 11/15/10
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 351

Test ID: D104101

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	56	Pass
Peak Resultant Acceleration	G's	225 - 275	259	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

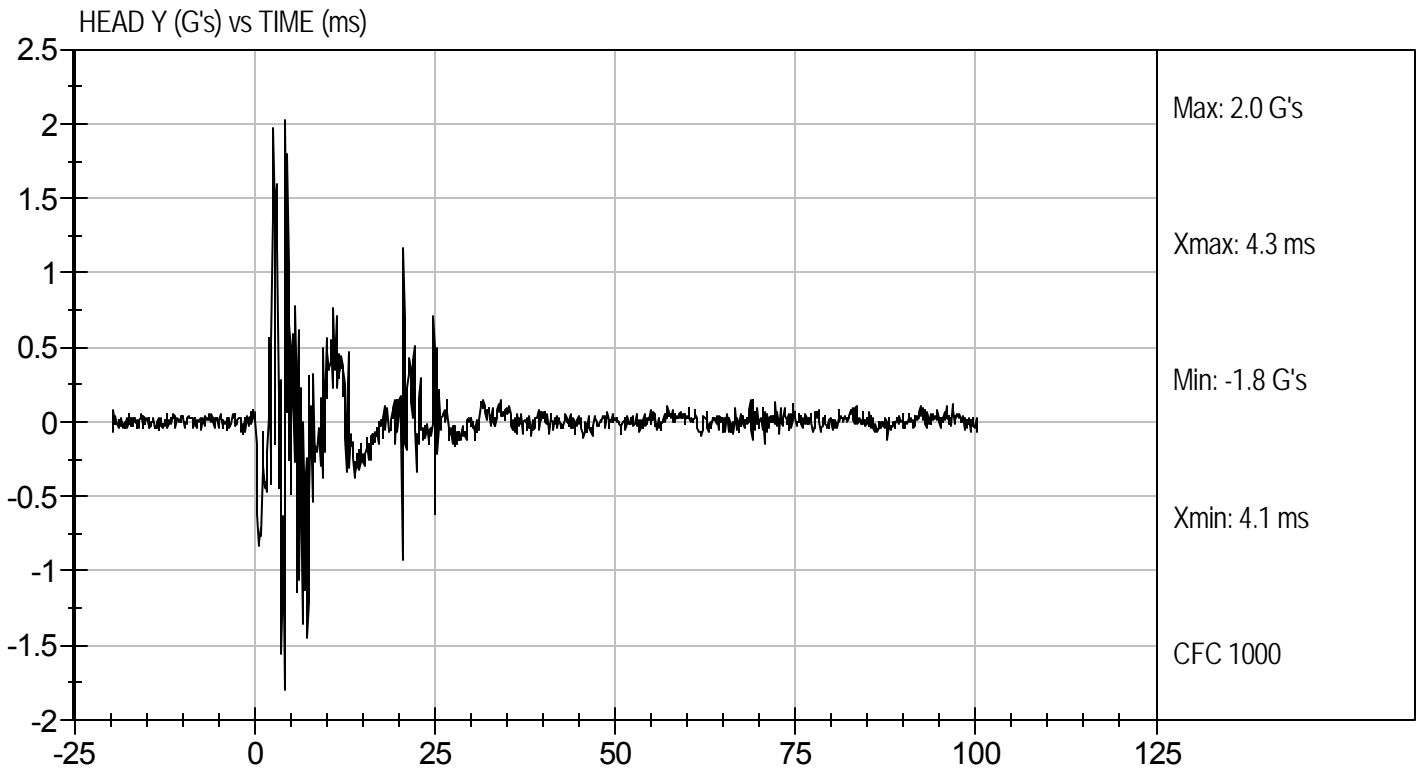
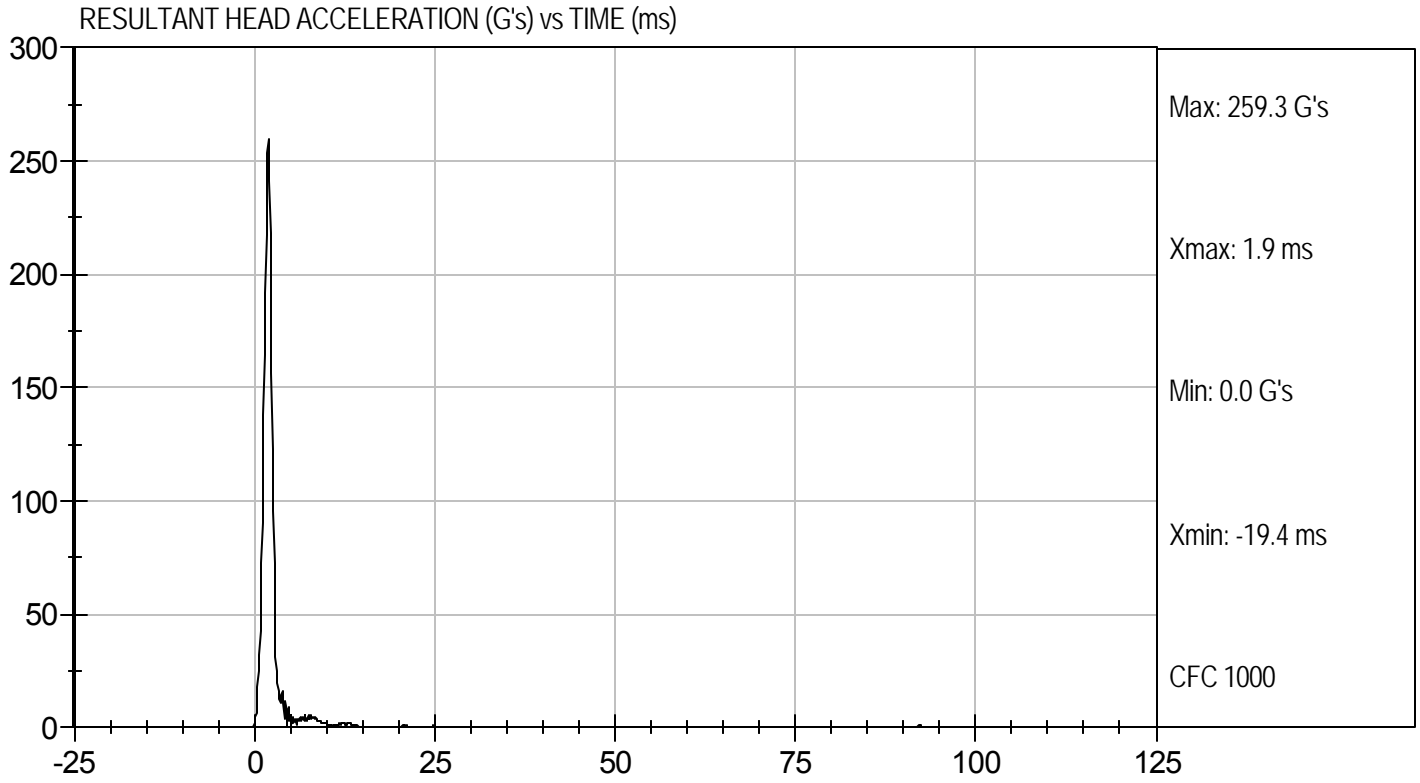
11/22/10
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D104101

Test Date: 11/22/10
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 351

Test I.D.: D104102

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	58	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.21	Pass
	20 ms	G's	17.60 to 22.60	19.35	Pass
	30 ms	G's	12.50 to 18.50	13.85	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.80	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	67.7	Pass
	Time	ms	57.0 to 64.0	58.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.5	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	92.2	Pass
	Time	ms	47.0 to 58.0	47.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.3	Pass
Overall Test Results					Pass

Jessica Hall
 Laboratory Technician

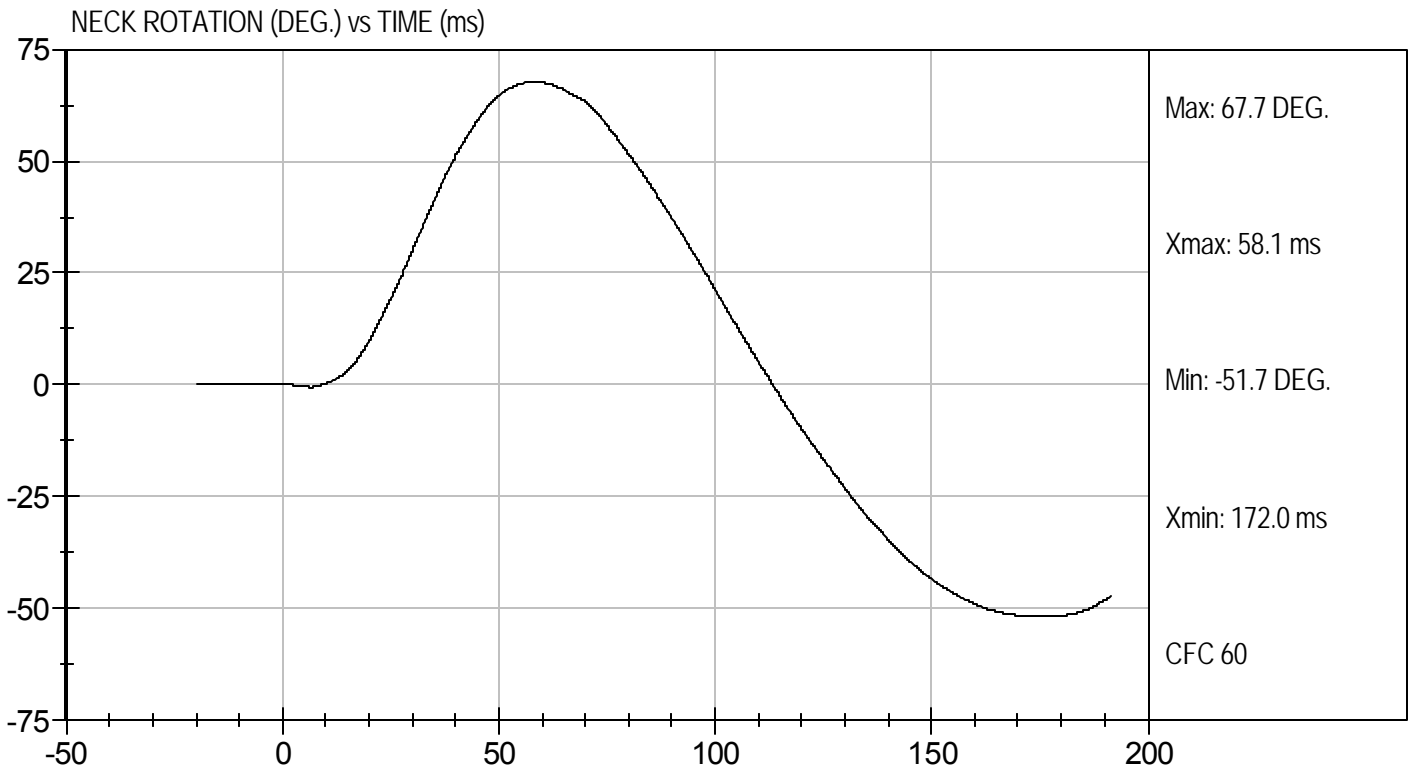
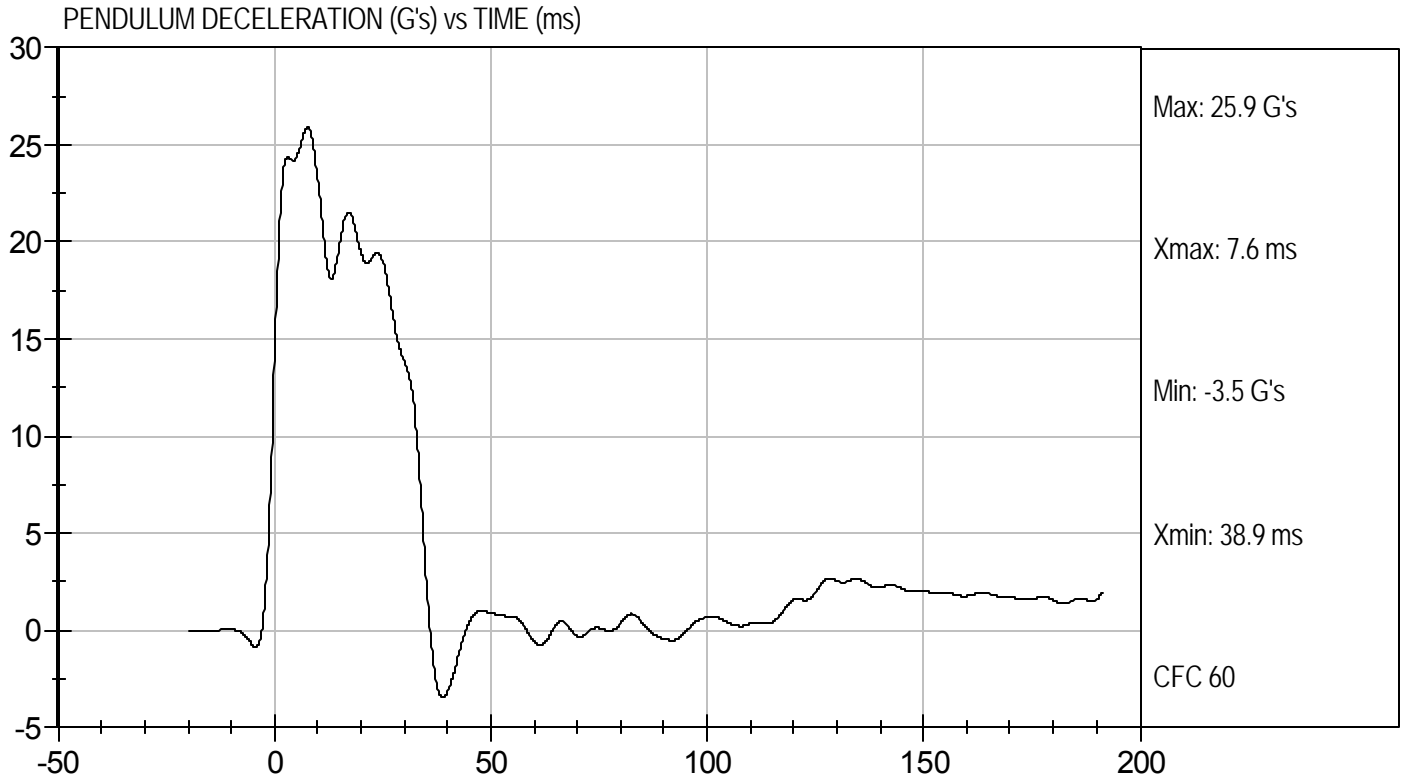
11/22/10
 Test Date

David Winkelbauer
 Approved By



Test Desc: Neck Flexion
Component ID: D104102

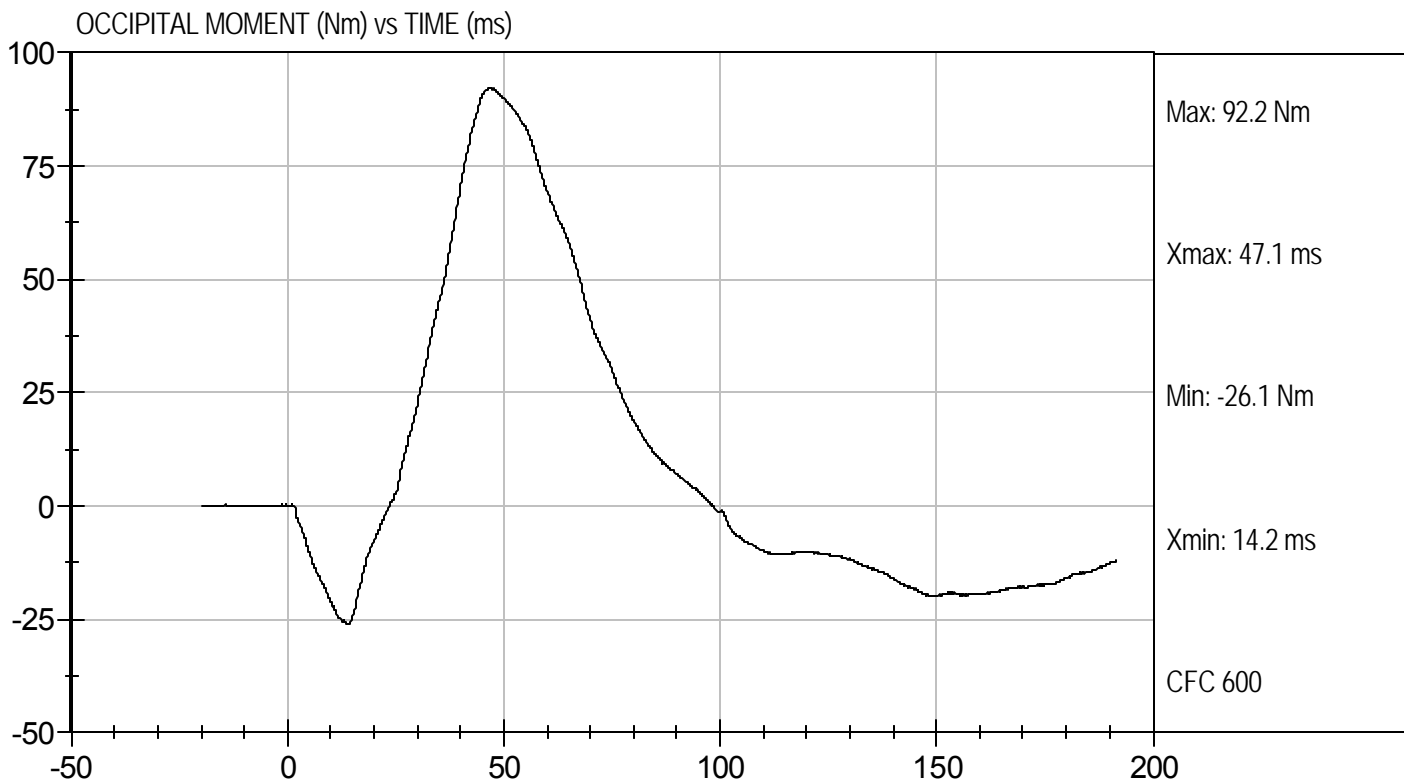
Test Date: 11/22/10
Velocity: 22.83 ft/s, 6.96 m/s





Test Desc: Neck Flexion
Component ID: D104102

Test Date: 11/22/10
Velocity: 22.83 ft/s, 6.96 m/s



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

ATD Serial No: 351

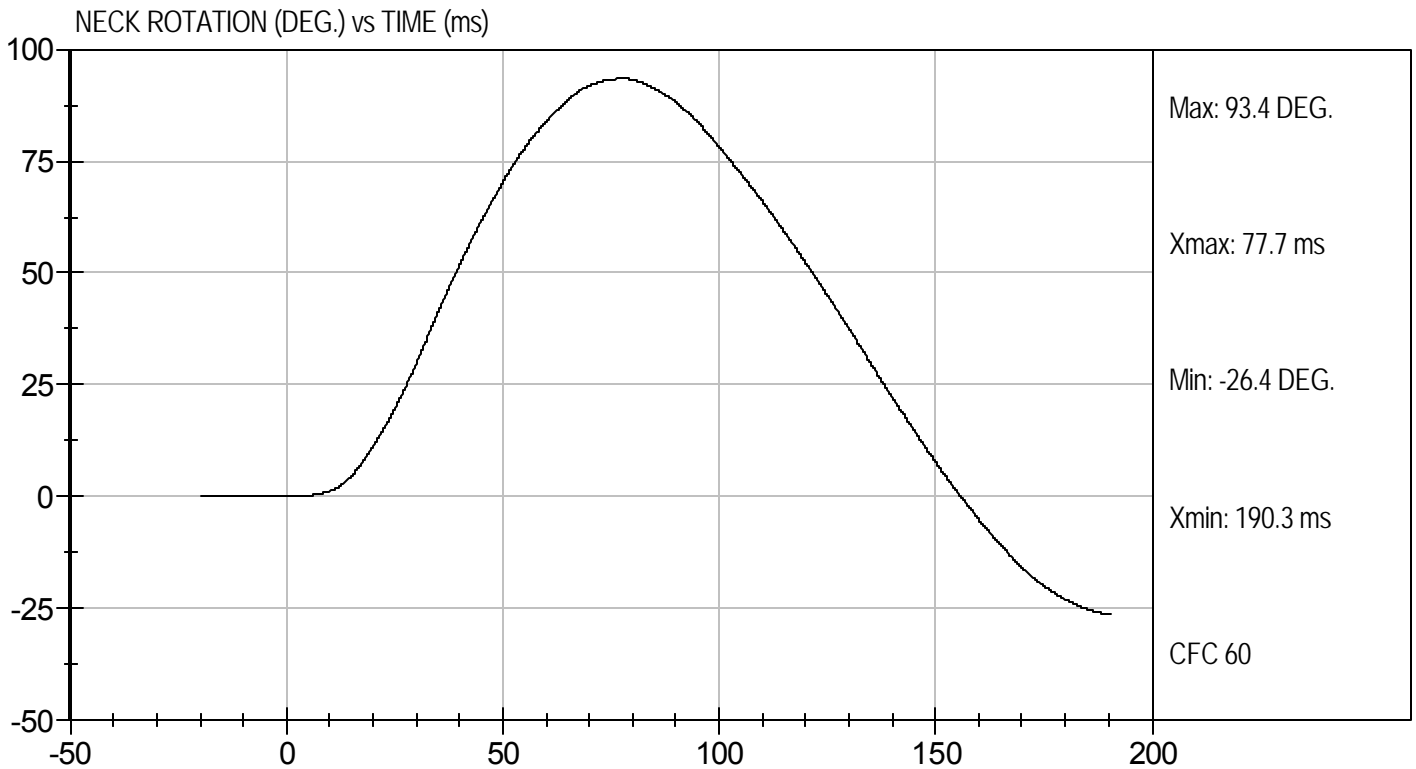
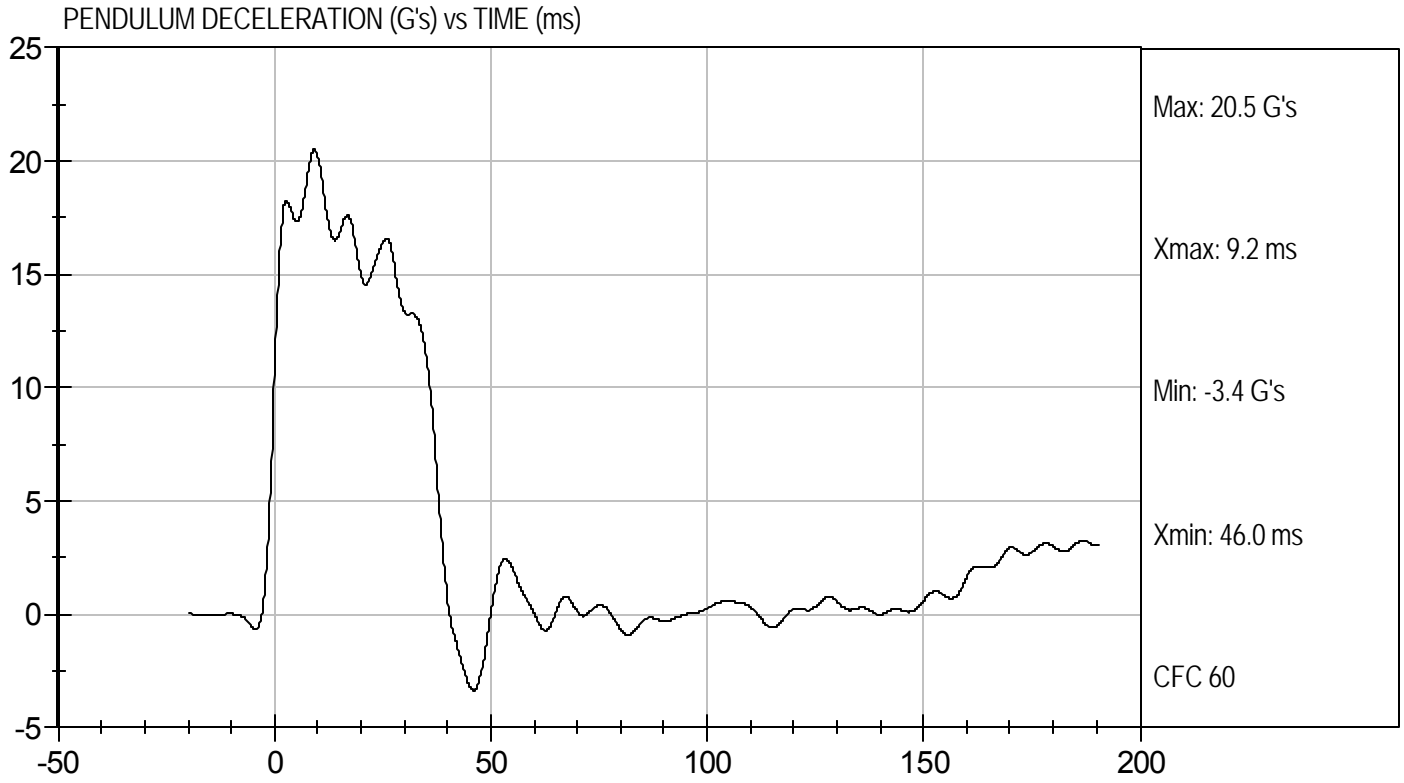
Test I.D.: D104103

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	58	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.20	Pass
	20 ms	G's	14.00 to 19.00	14.95	Pass
	30 ms	G's	11.00 to 16.00	13.34	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	93.4	Pass
	Time	ms	72.0 to 82.0	77.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	156.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.2	Pass
	Time	ms	65.0 to 79.0	70.2	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	140.3	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

11/22/10
Test Date

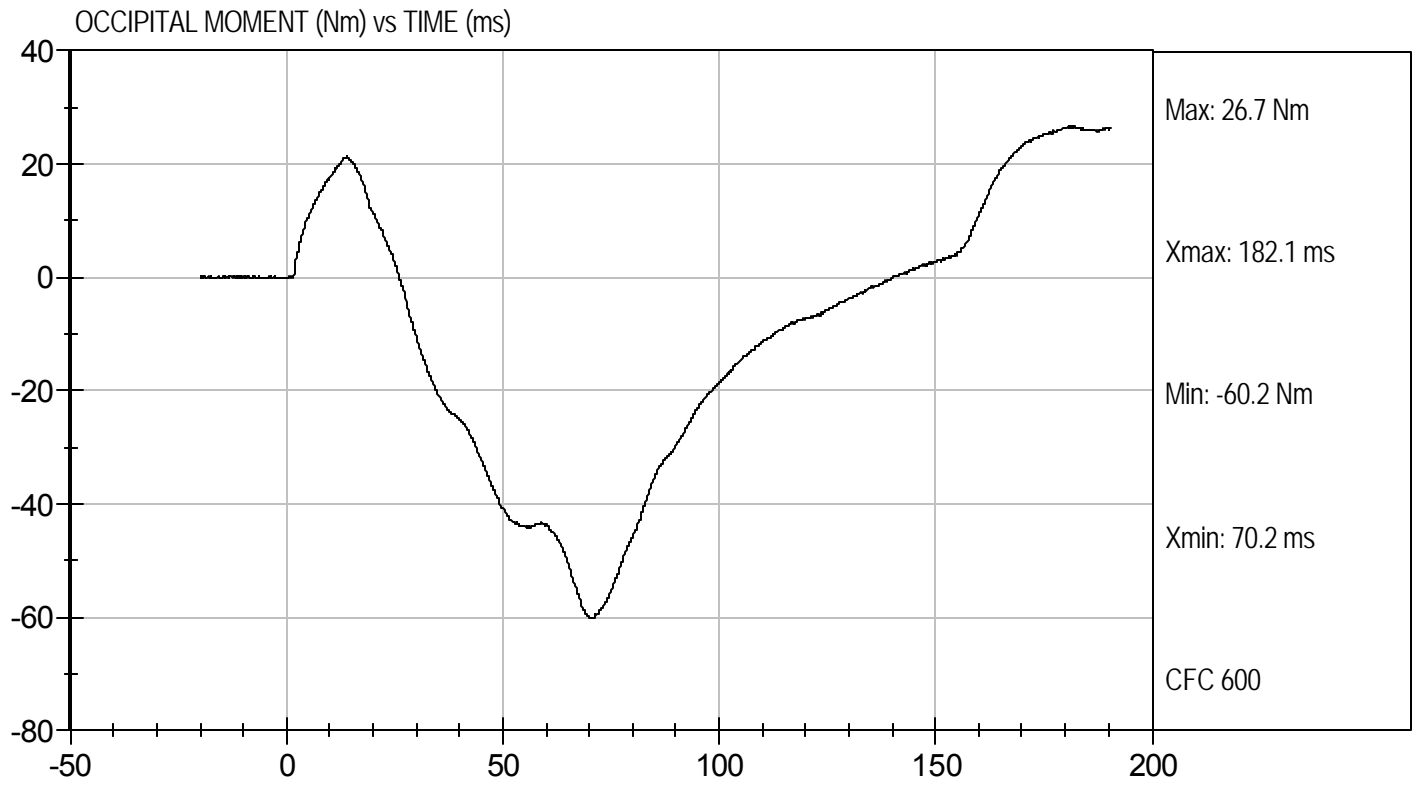
David Winkelbauer
Approved By





Test Desc: Neck Extension
Component ID: D104103

Test Date: 11/22/10
Velocity: 20.08 ft/s, 6.12 m/s



**MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE**

ATD Serial No: 351

Test I.D: D104104

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	55	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,256	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.42	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

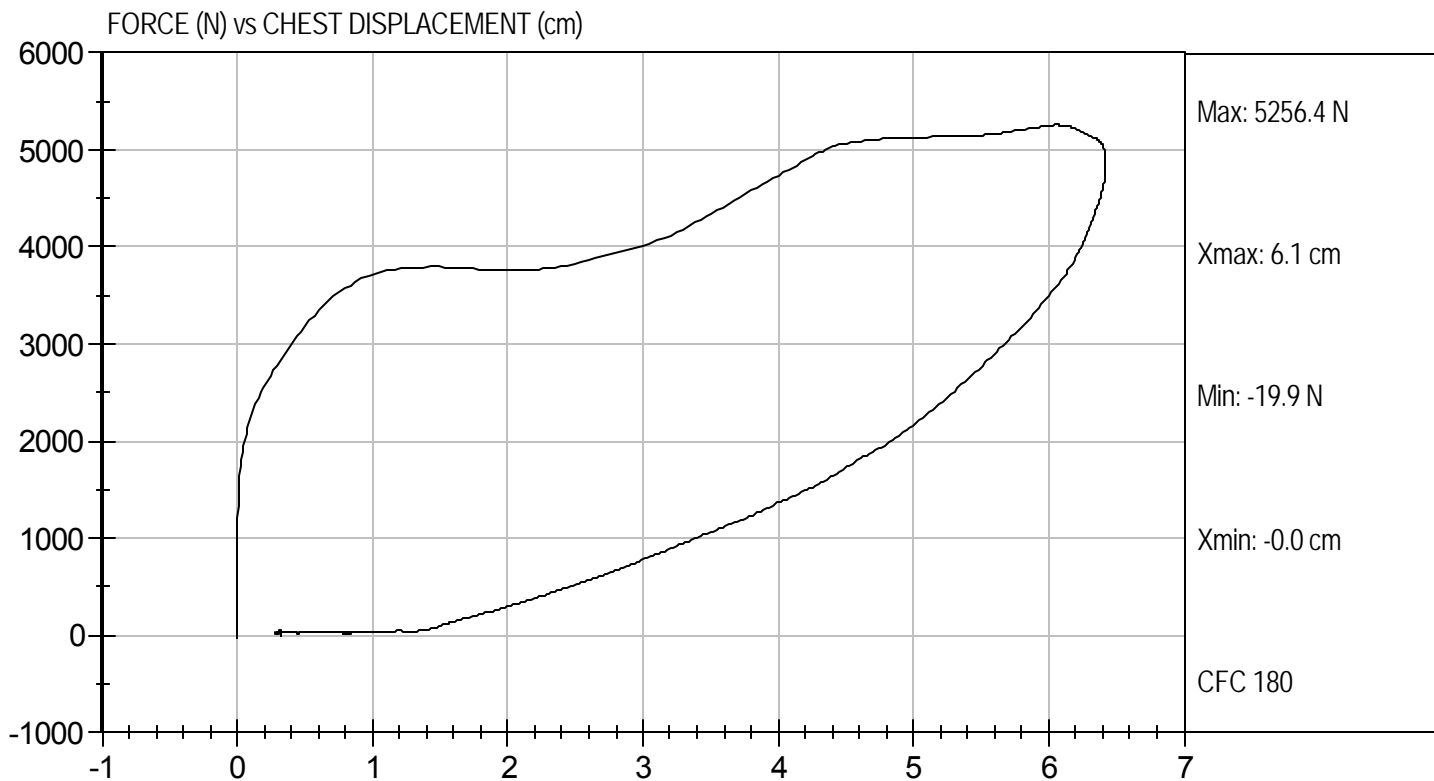
11/22/10
Test Date

David Winkelbauer
Approved By



Test Desc: Thorax Impact
Component ID: D104104

Test Date: 11/22/10
Velocity: 21.92 ft/s, 6.68 m/s



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

ATD Serial No: 351

Test I.D: D104105

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	56	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,407	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

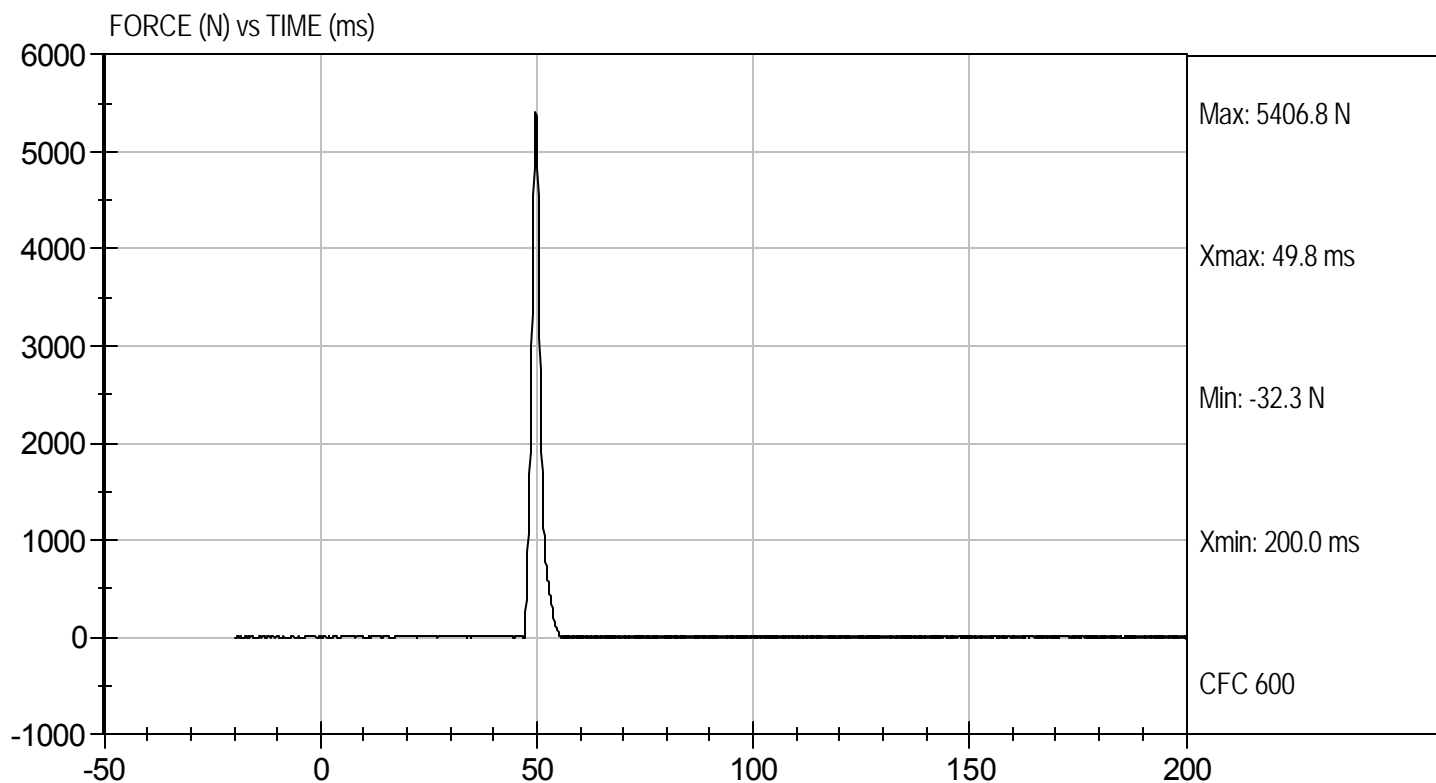
11/22/10
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D104105

Test Date: 11/22/10
Velocity: 6.92 ft/s, 2.11 m/s



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

ATD Serial No: 351

Test I.D: D104106

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	56	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,402	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

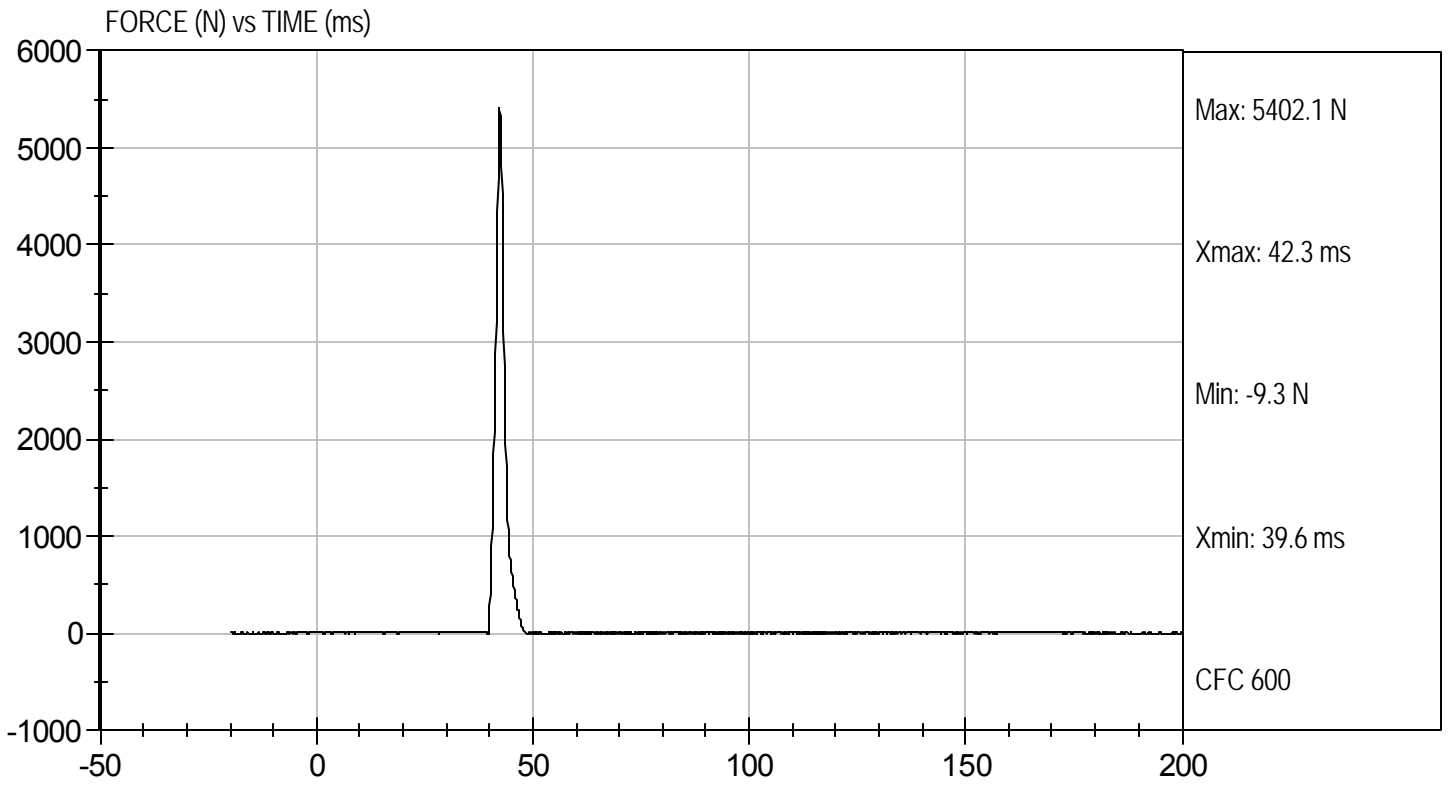
11/22/10
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D104106

Test Date: 11/22/10
Velocity: 6.92 ft/s, 2.11 m/s



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

ATD Serial No: 351

Test I.D: D104100

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	56	56	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	43.6	42.2	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	48	48	Pass
Overall Test Results					Pass

Jessica Gall
Laboratory Technician

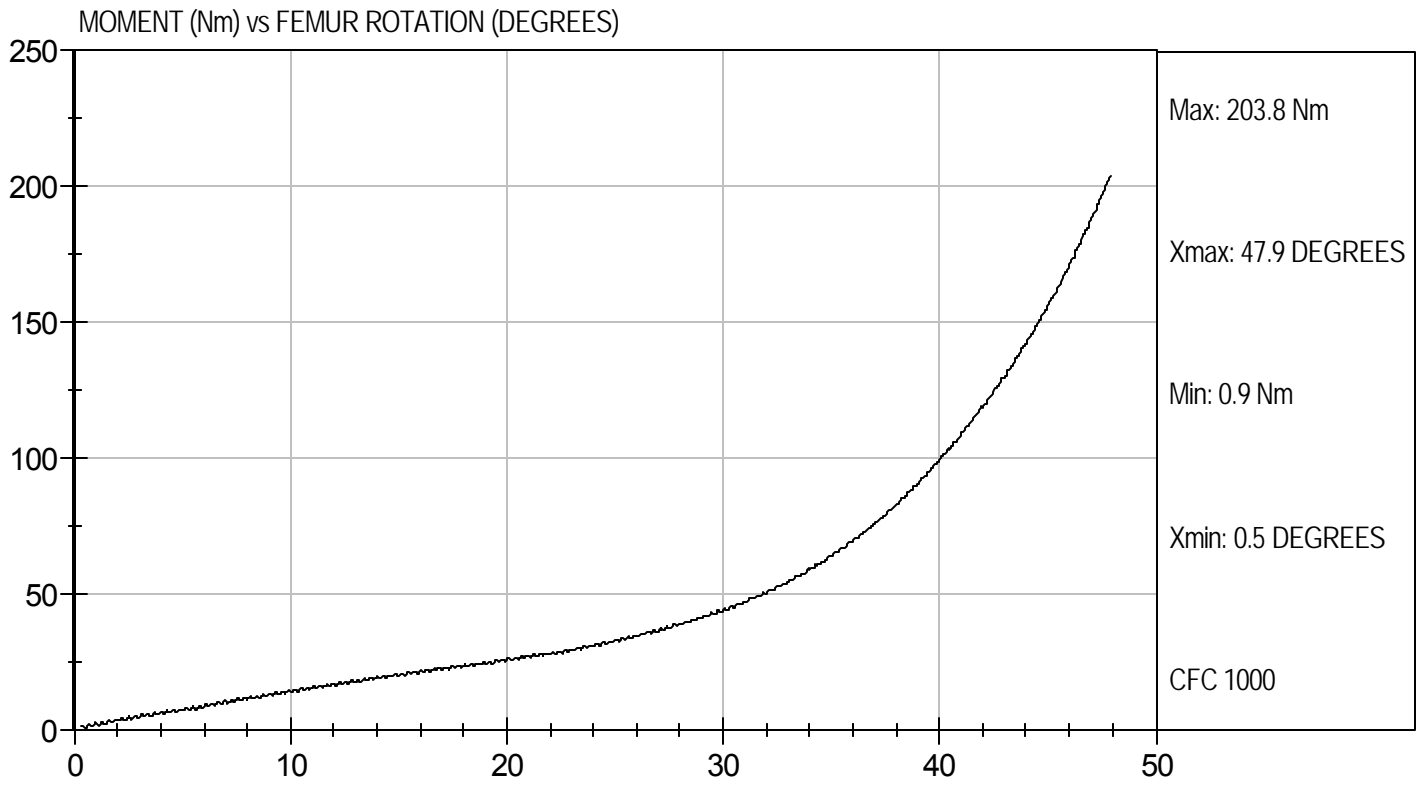
11/22/10
Test Date

David Winkelbauer
Approved By



Test Desc: Hip Femur Flexion
Component ID: D104109

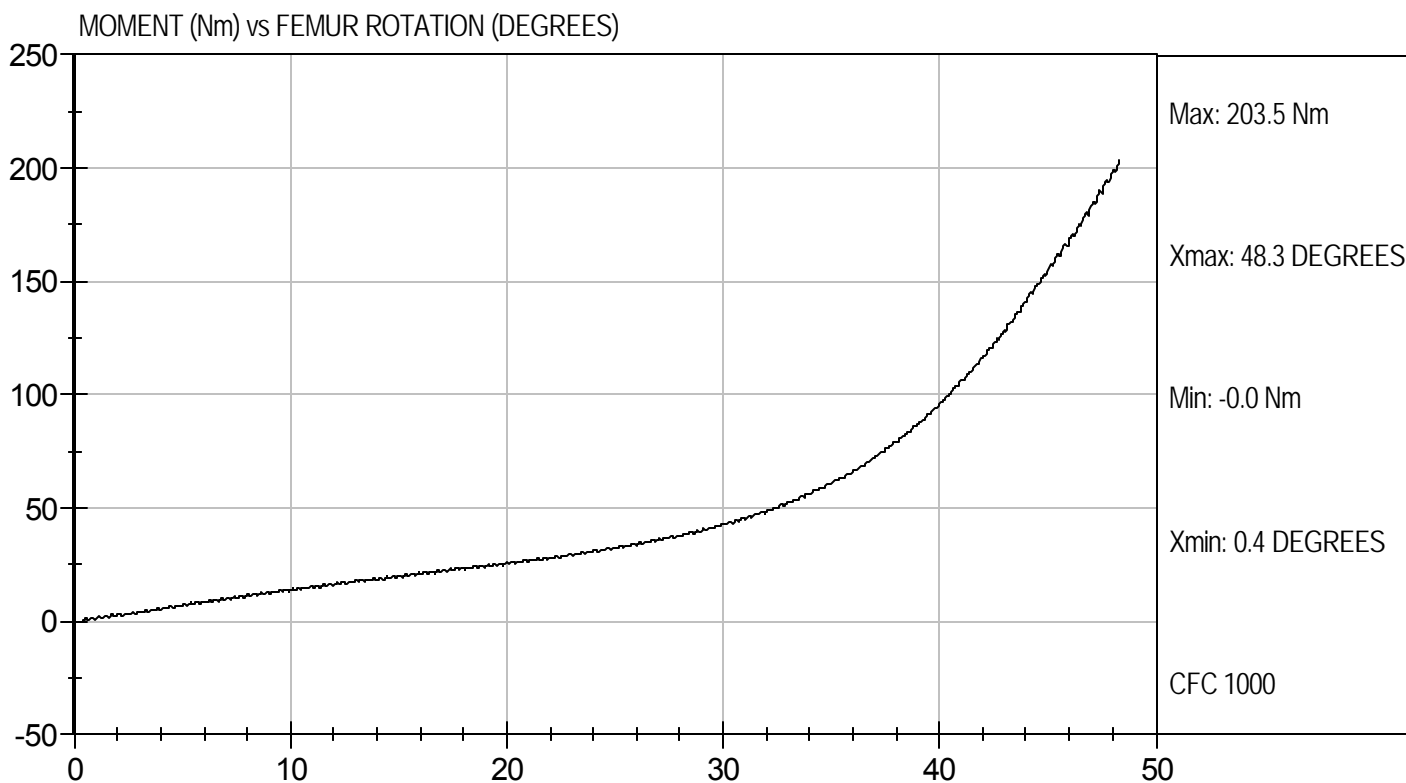
Test Date: 11/22/10
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Component ID: D104100

Test Date: 11/22/10
Velocity: 0 ft/s, 0.00 m/s



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

ATD Serial No: 634

Test ID: D103981

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Peak Resultant Acceleration	G's	225 - 275	273	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
 Laboratory Technician

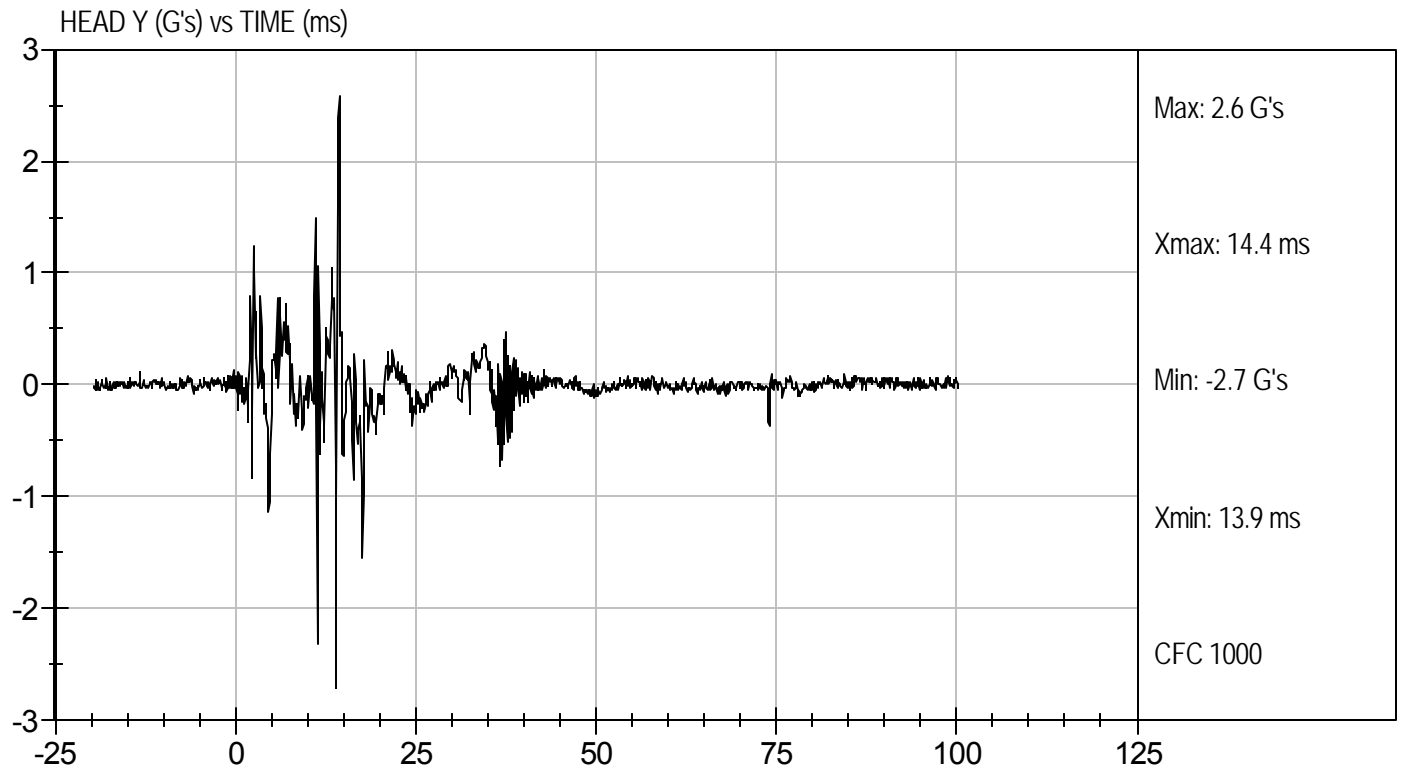
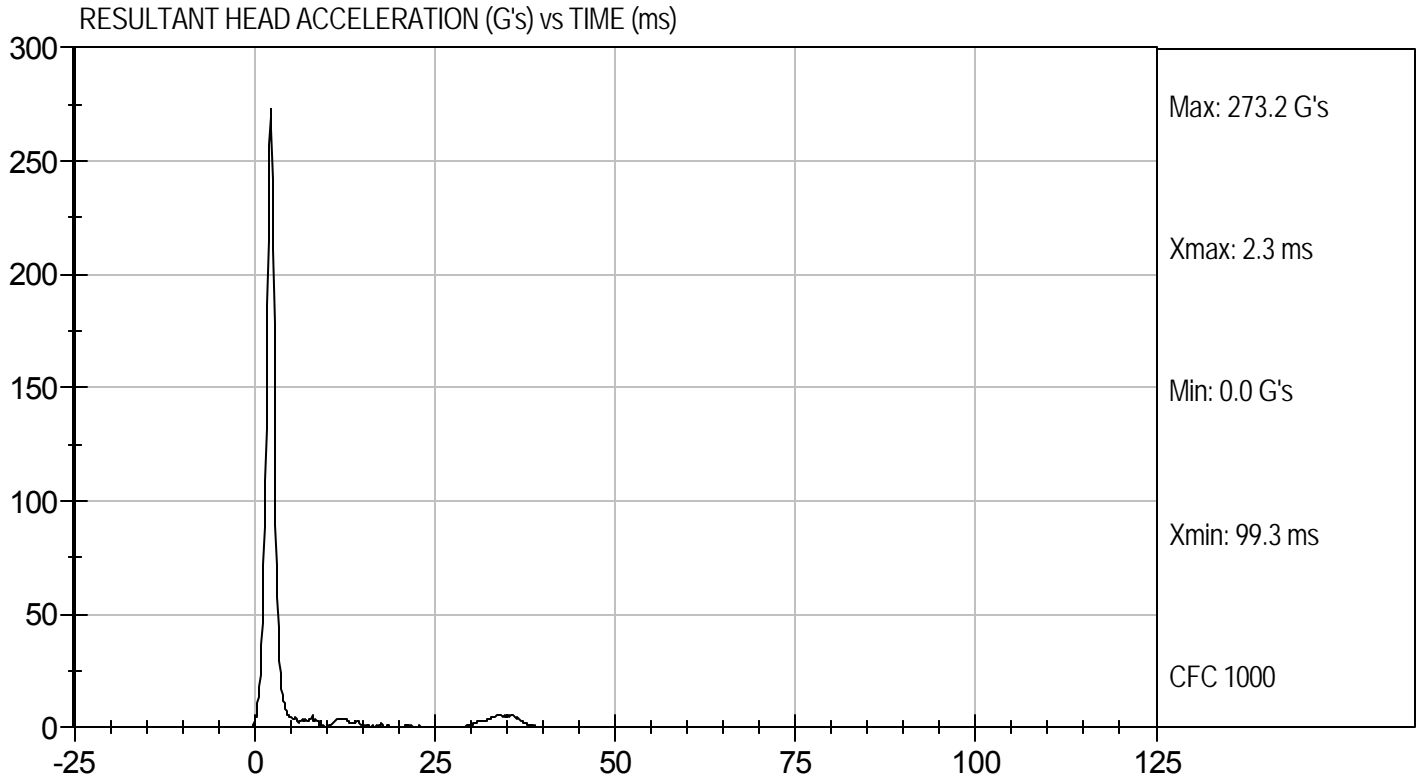
11/16/10
 Test Date

David Winkelbauer
 Approved By



Test Desc: Head Drop
Component ID: D103981

Test Date: 11/16/10
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D.: D103982

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	6.0	Pass
D Plane Rotation	Max	deg	77 to 91	83	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

11/15/10
Test Date

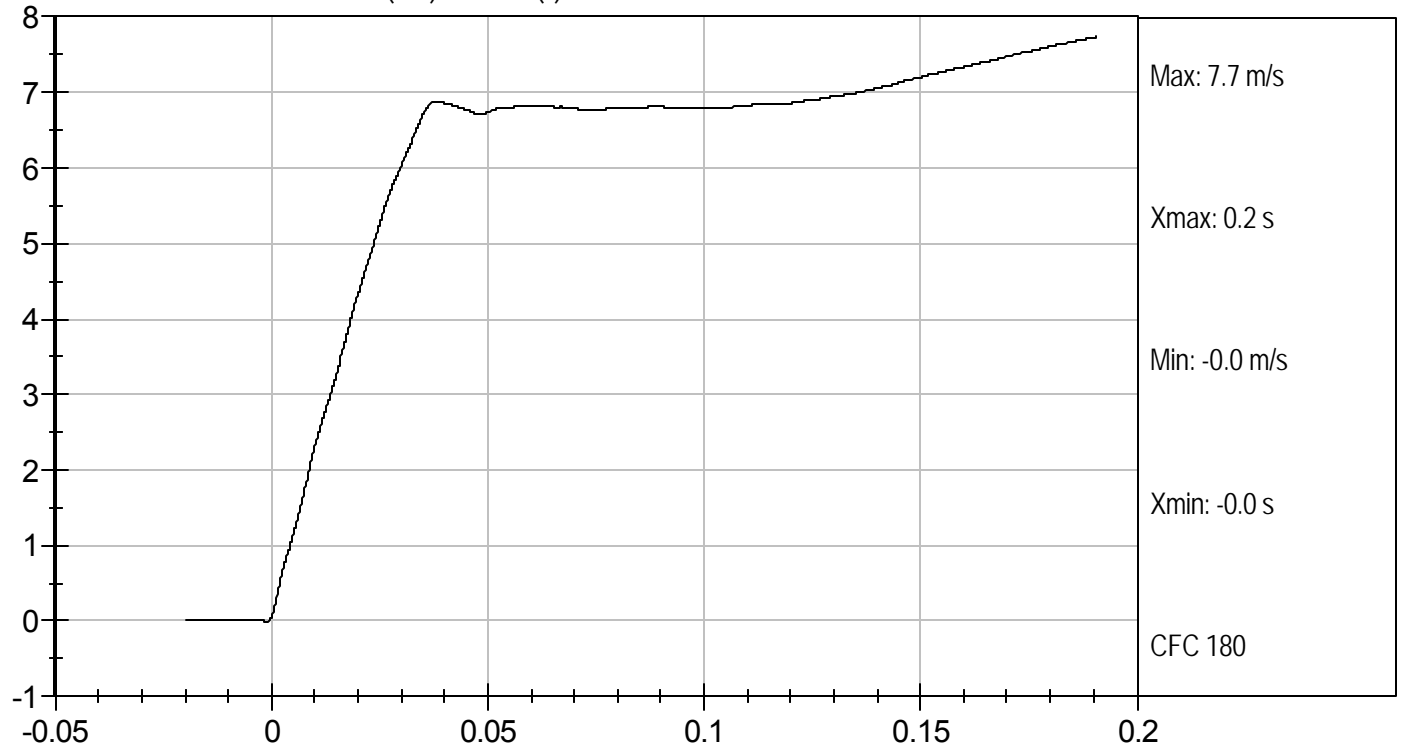
David Winkelbauer
Approved By



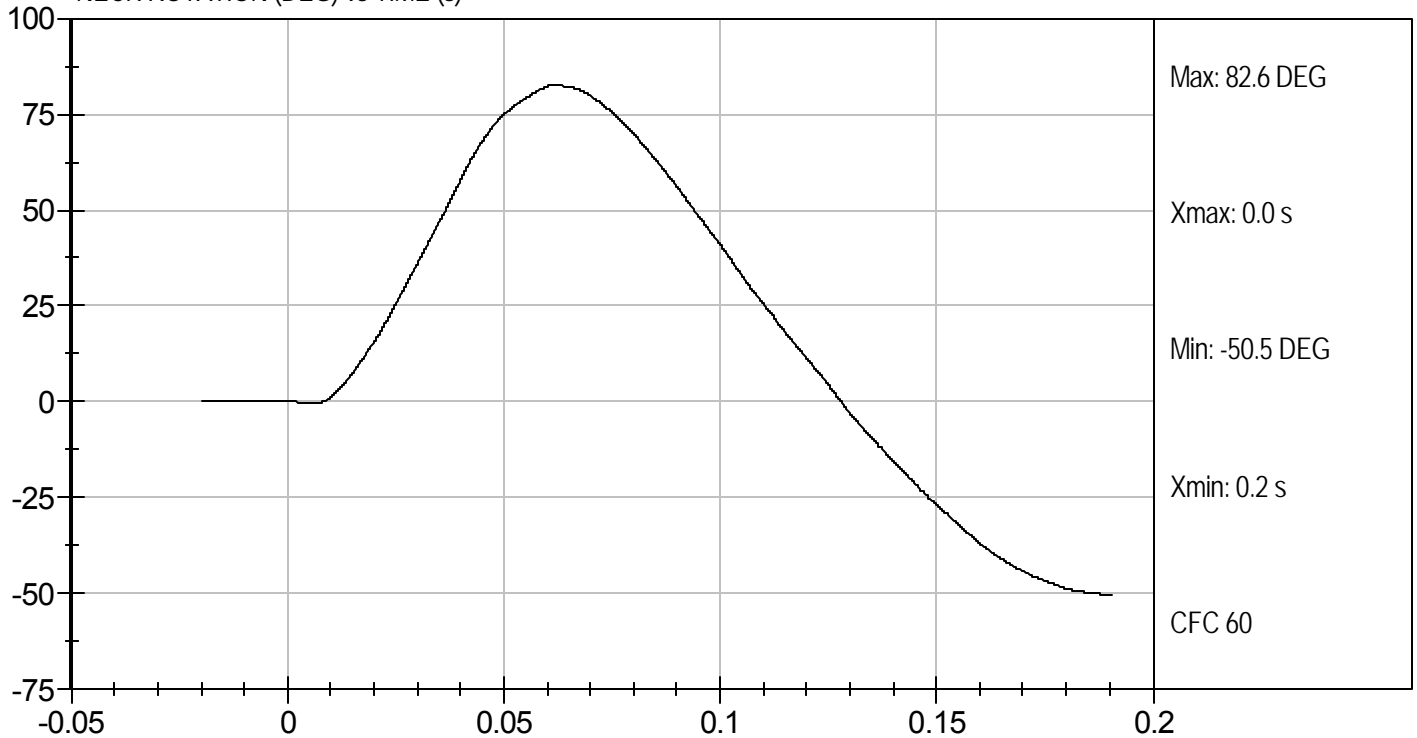
Test Desc: Neck Flexion
Component ID: D103982

Test Date: 11/15/10
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)



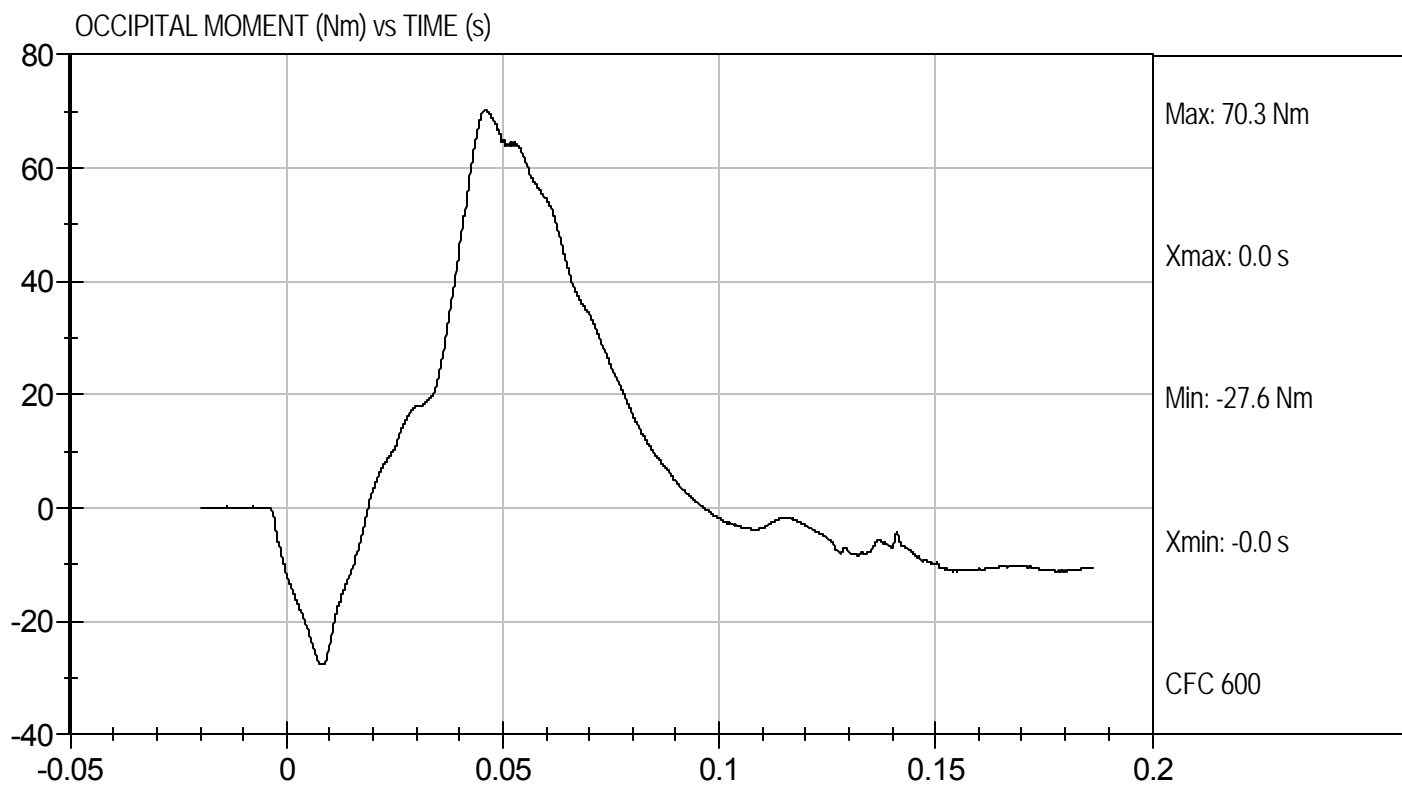
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Component ID: D103982

Test Date: 11/15/10
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D.: D103983

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	103	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	95	Pass
Overall Results					Pass

Jessica Gall
Laboratory Technician

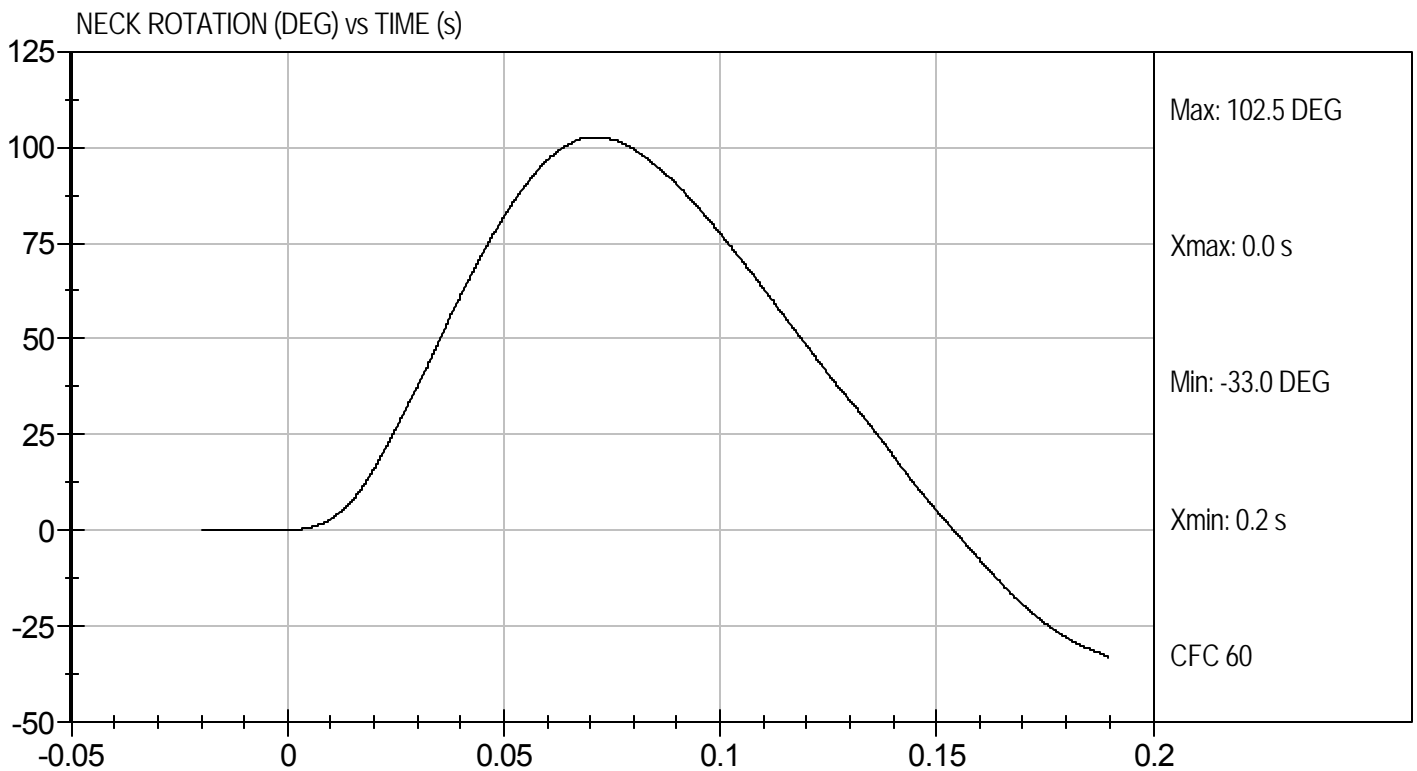
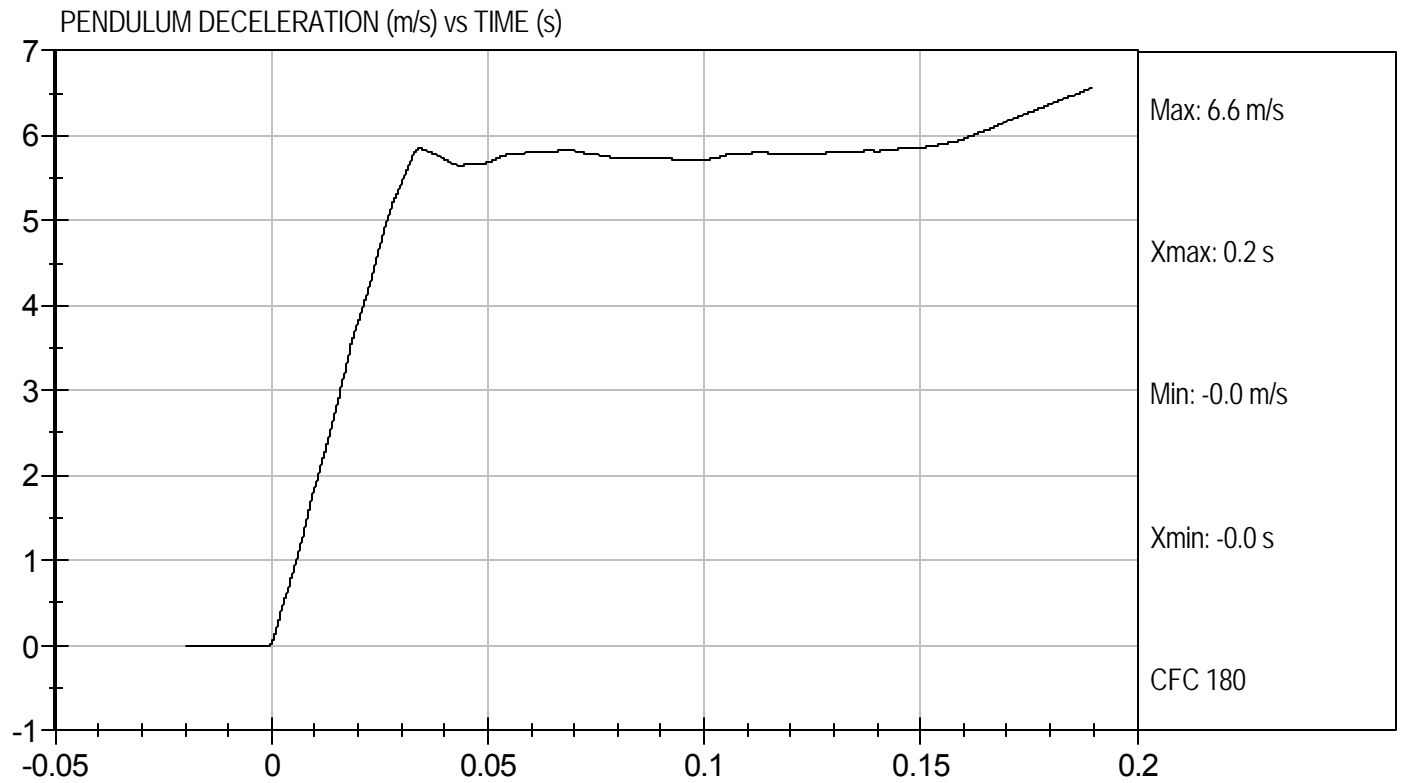
11/15/10
Test Date

David Winkelbauer
Approved By



Test Desc: Neck Extension
Component ID: D103983

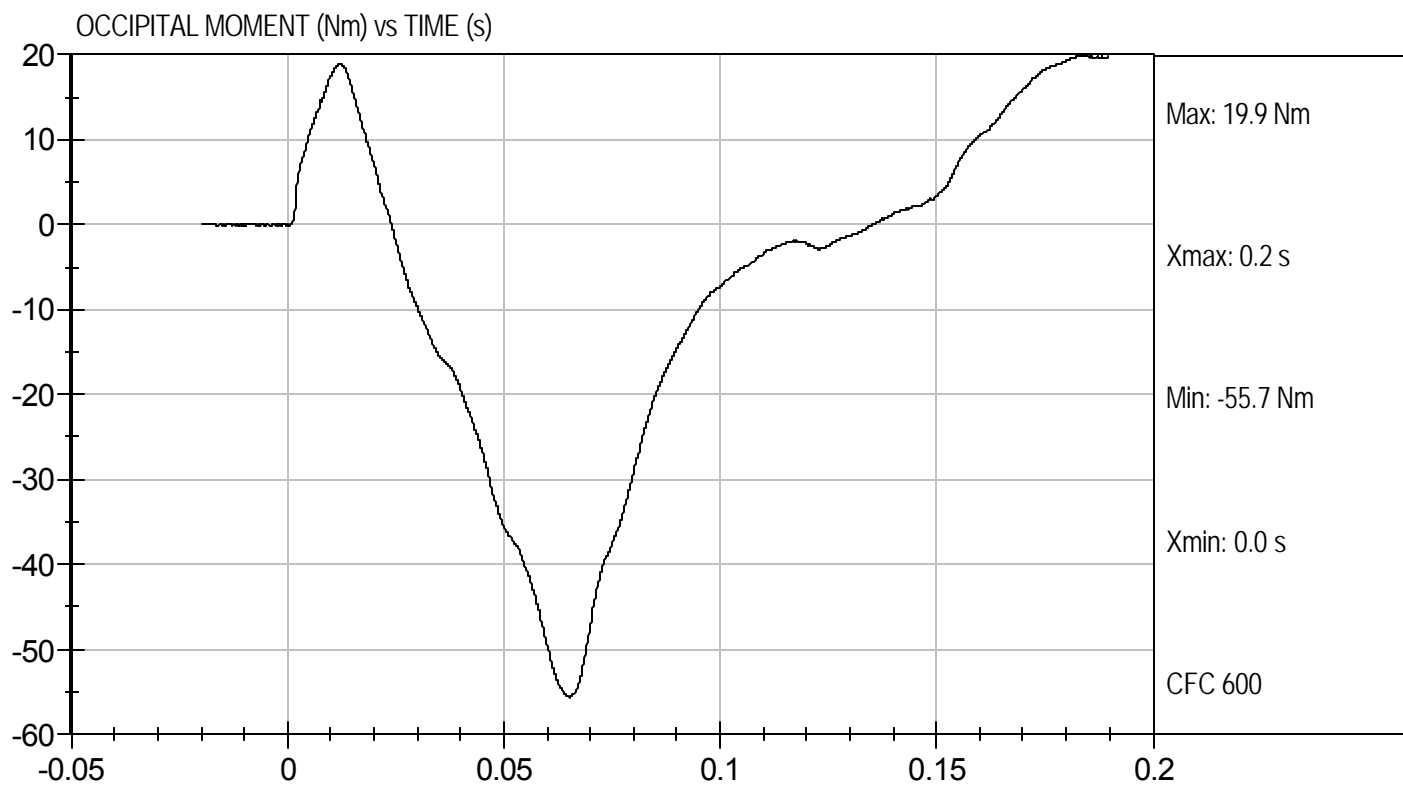
Test Date: 11/15/10
Velocity: 20.20 ft/s, 6.16 m/s





Test Desc: Neck Extension
Component ID: D103983

Test Date: 11/15/10
Velocity: 20.20 ft/s, 6.16 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D103984

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Relative Humidity	%	10 to 70	31	Pass
Probe Speed	m/s	6.59 to 6.83	6.60	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4226	Pass
Overall Test Results				Pass

Jessica Hall
 Laboratory Technician

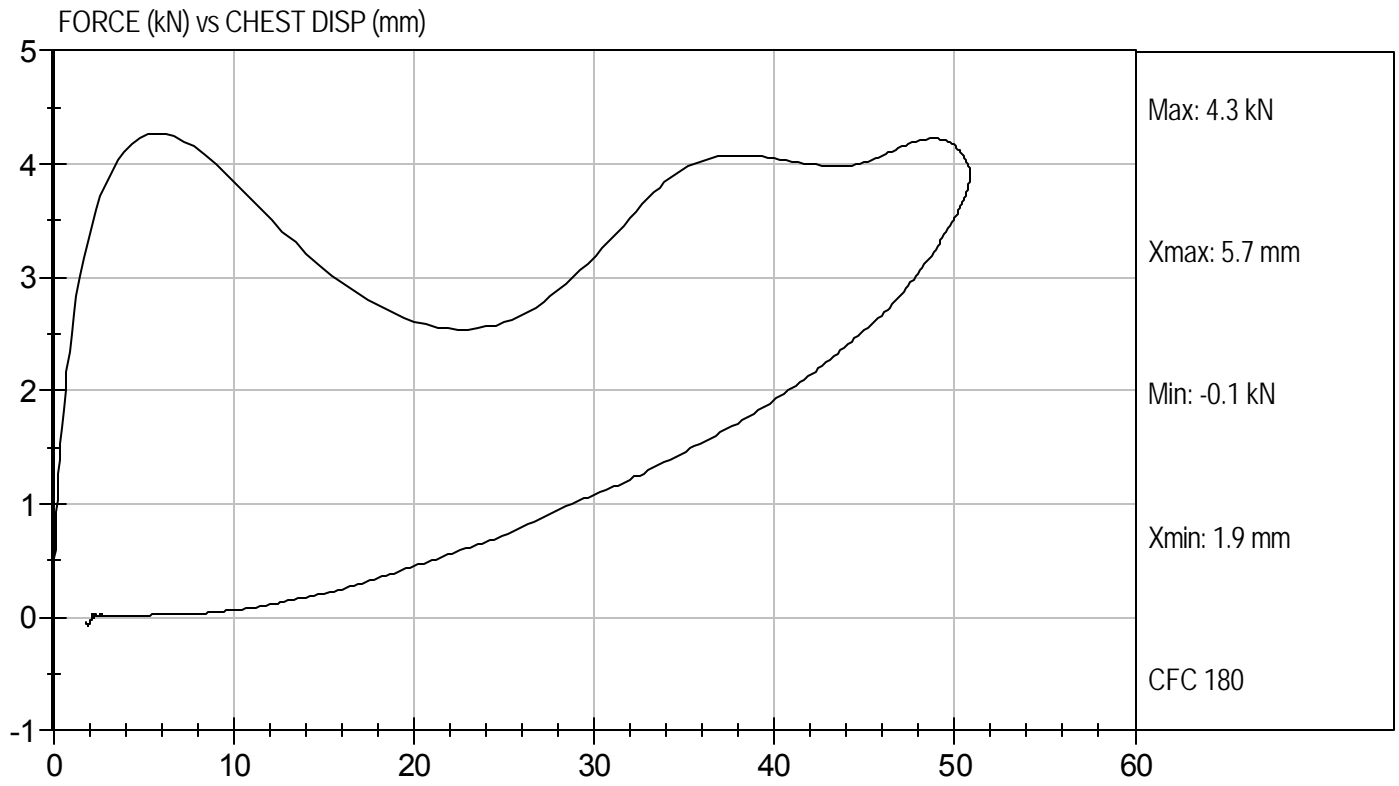
11/15/10
 Test Date

David Winkelbauer
 Approved By



Test Desc: Thorax Impact
Component ID: D103984

Test Date: 11/15/10
Velocity: 21.64 ft/s, 6.60 m/s



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D103985

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.85	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

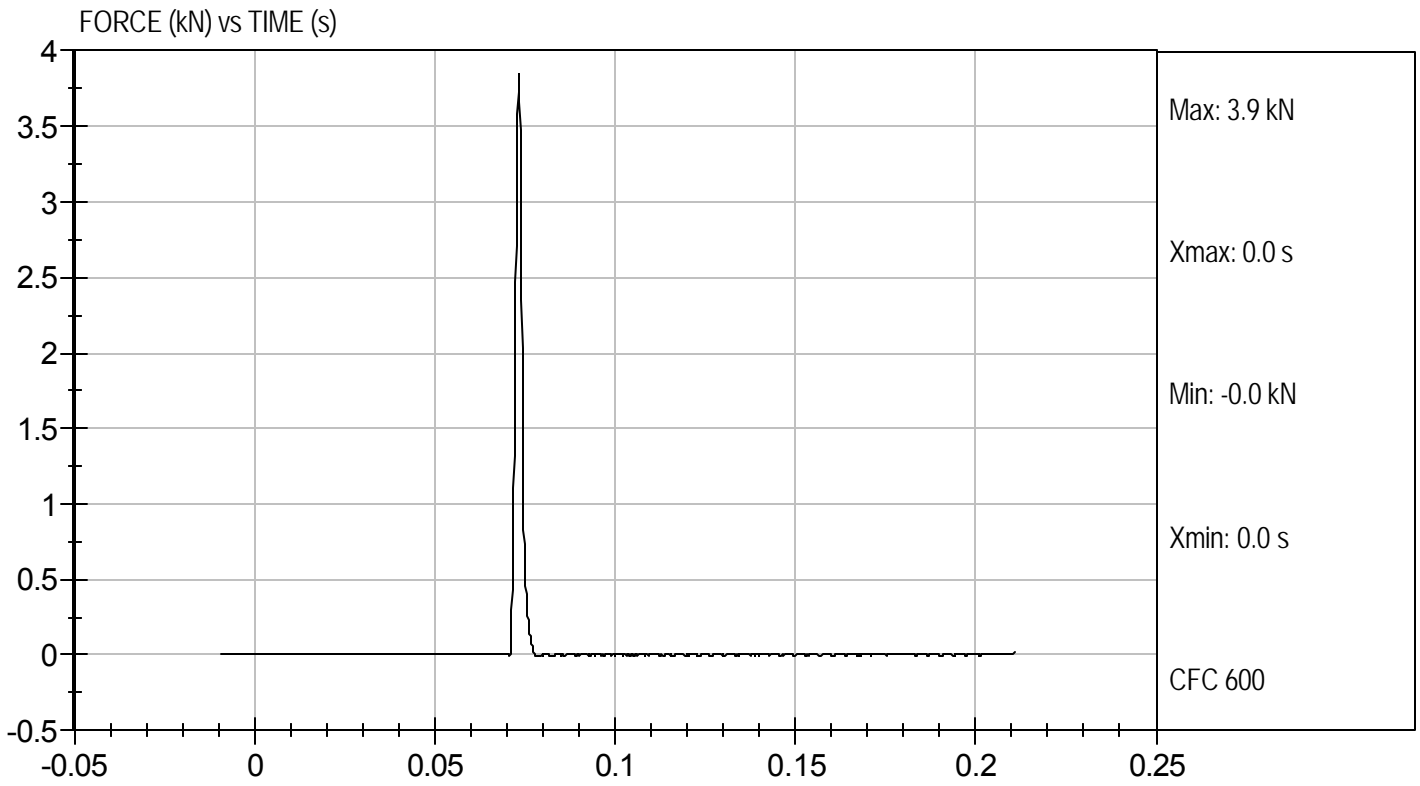
11/16/10
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D103985

Test Date: 11/16/10
Velocity: 6.944 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D103986

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.55	Pass
Overall Test Results				Pass

Jessica Gall
 Laboratory Technician

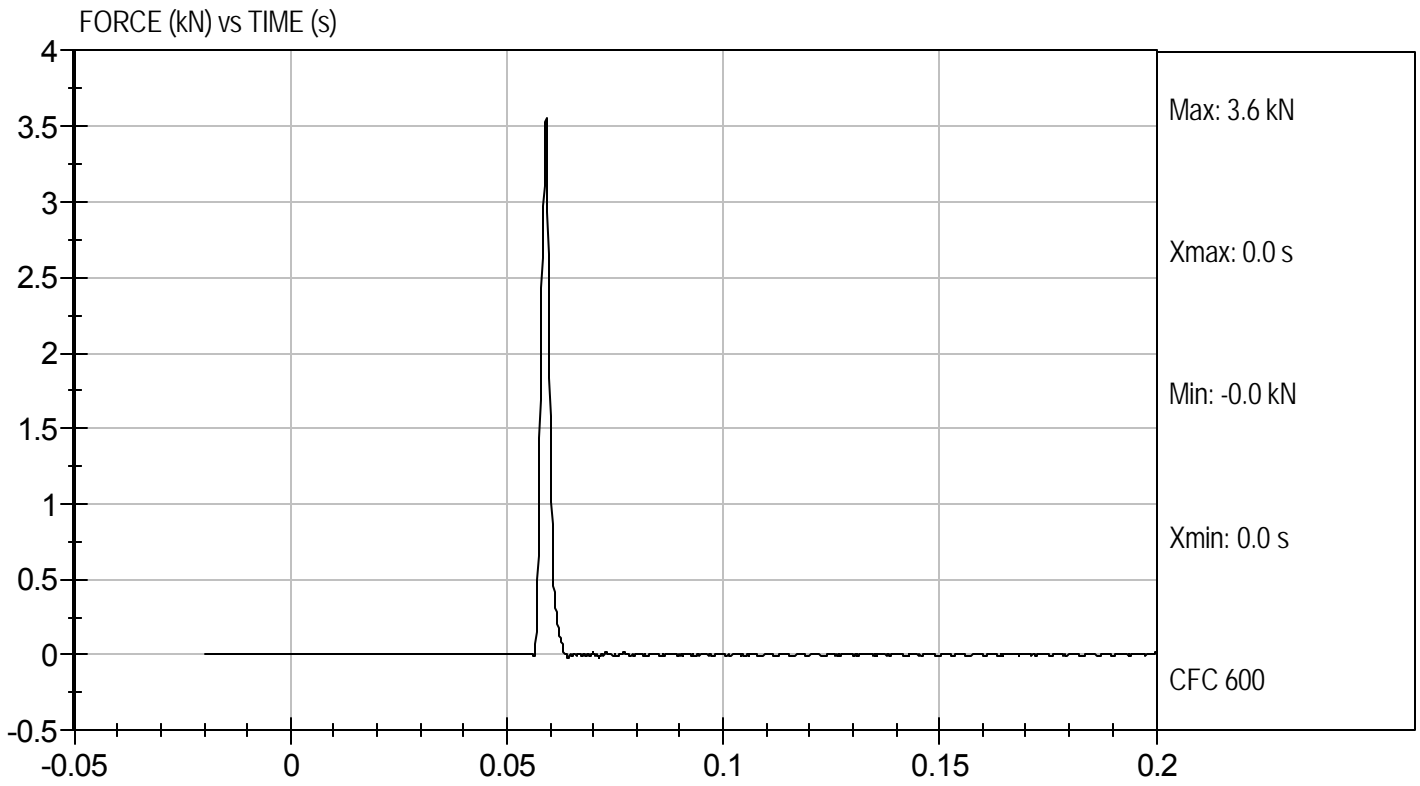
11/16/10
 Test Date

David Winkelbauer
 Approved By



Test Desc: Left Knee
Component ID: D103986

Test Date: 11/16/10
Velocity: 6.944 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D103987

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	371	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result				Pass

Jessica Gall
 Laboratory Technician

11/15/10
 Test Date

David Winkelbauer
 Approved By

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test ID: D104111

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	60	Pass
Peak Resultant Acceleration	G's	250 to 300	277	Pass
Peak Lateral Acceleration	G's	+/- 15	-2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

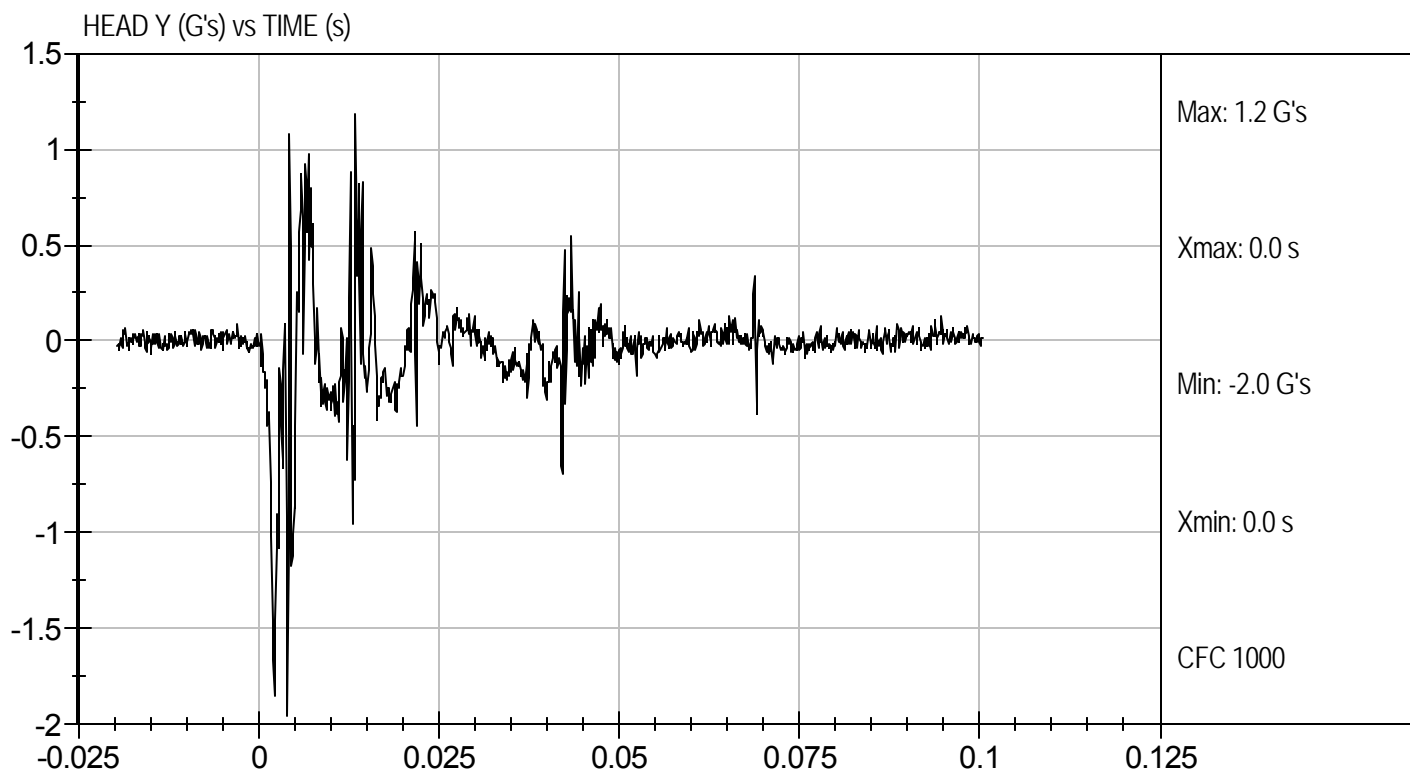
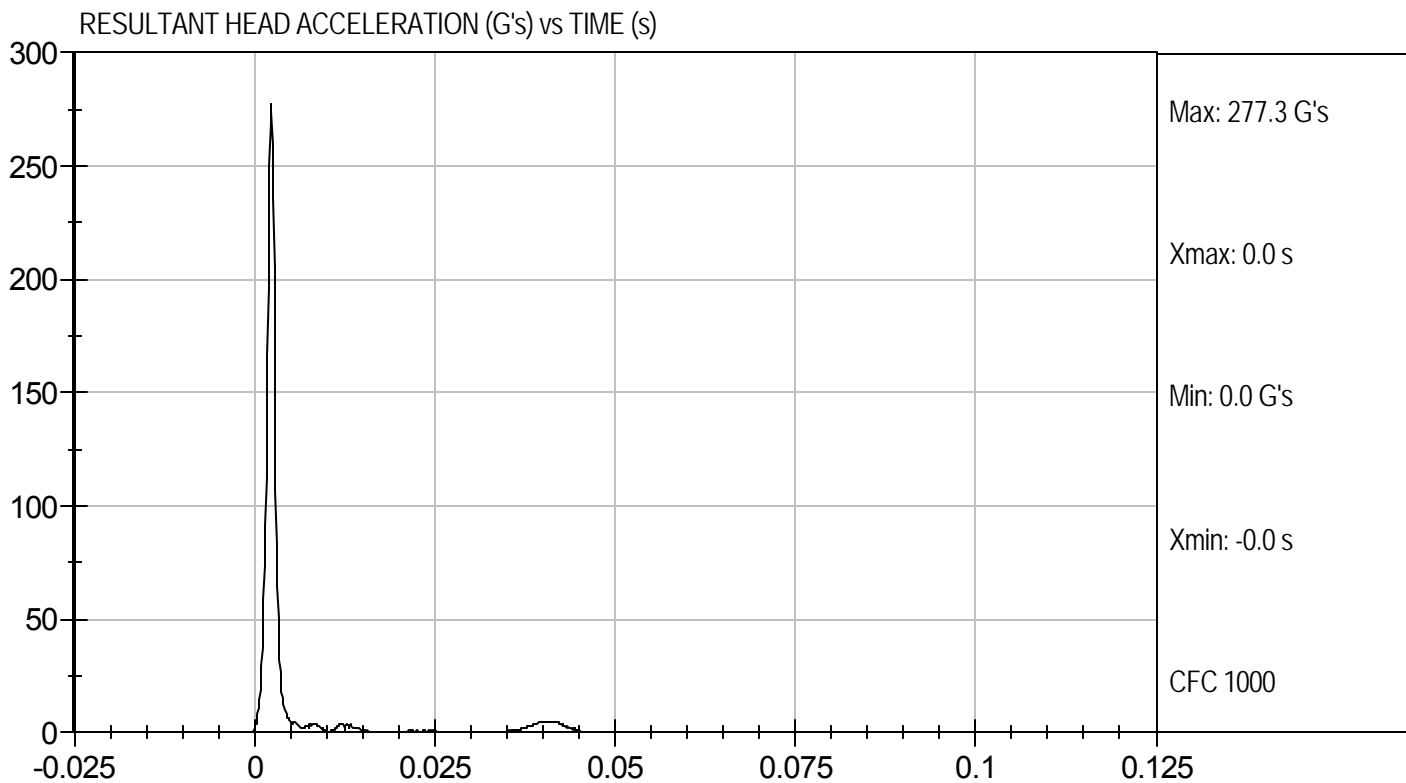
11/22/10
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D104111

Test Date: 11/22/10
Velocity: 0 ft/s, 0 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D.: D104112

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	56	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	6.1	Pass
D Plane Rotation	Max	deg	77 to 91	77	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
Overall Results					Pass

Jessica Gall
Laboratory Technician

11/22/10
Test Date

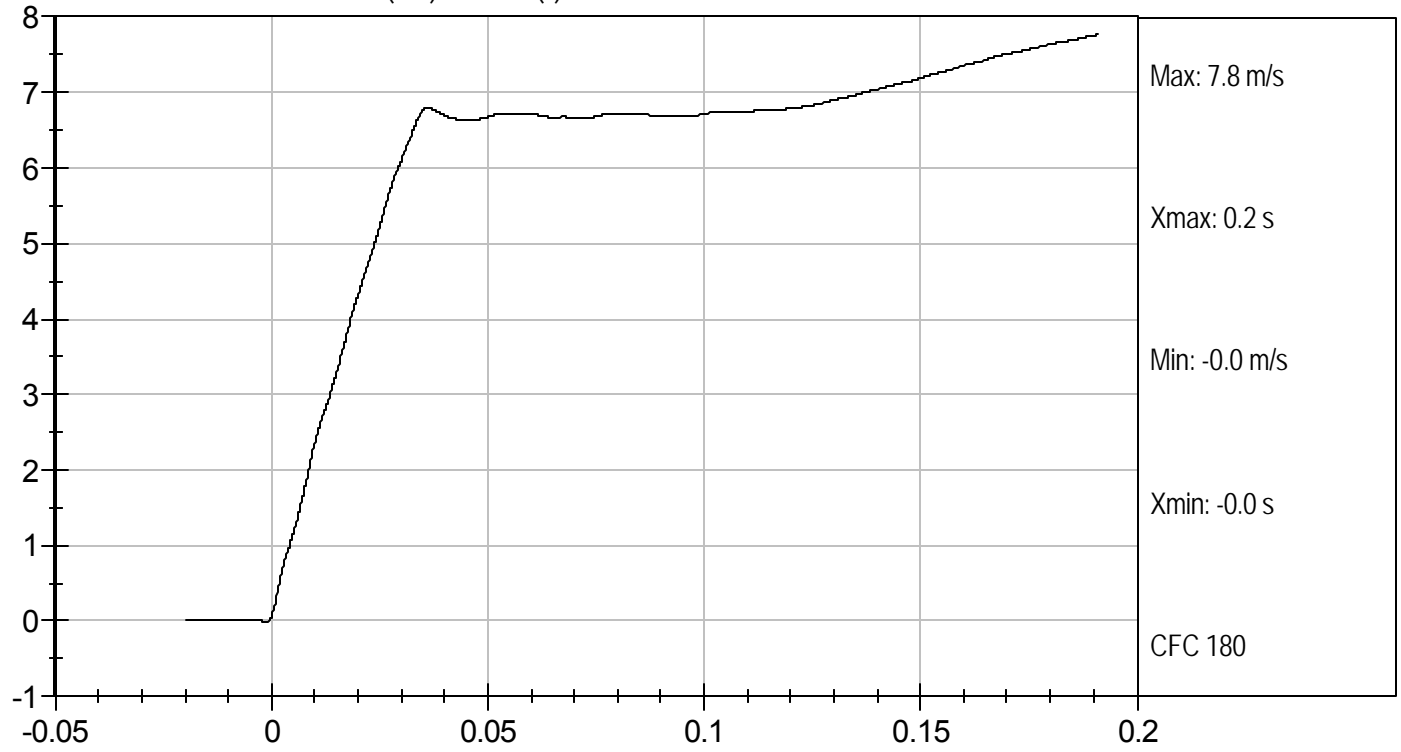
David Winkelbauer
Approved By



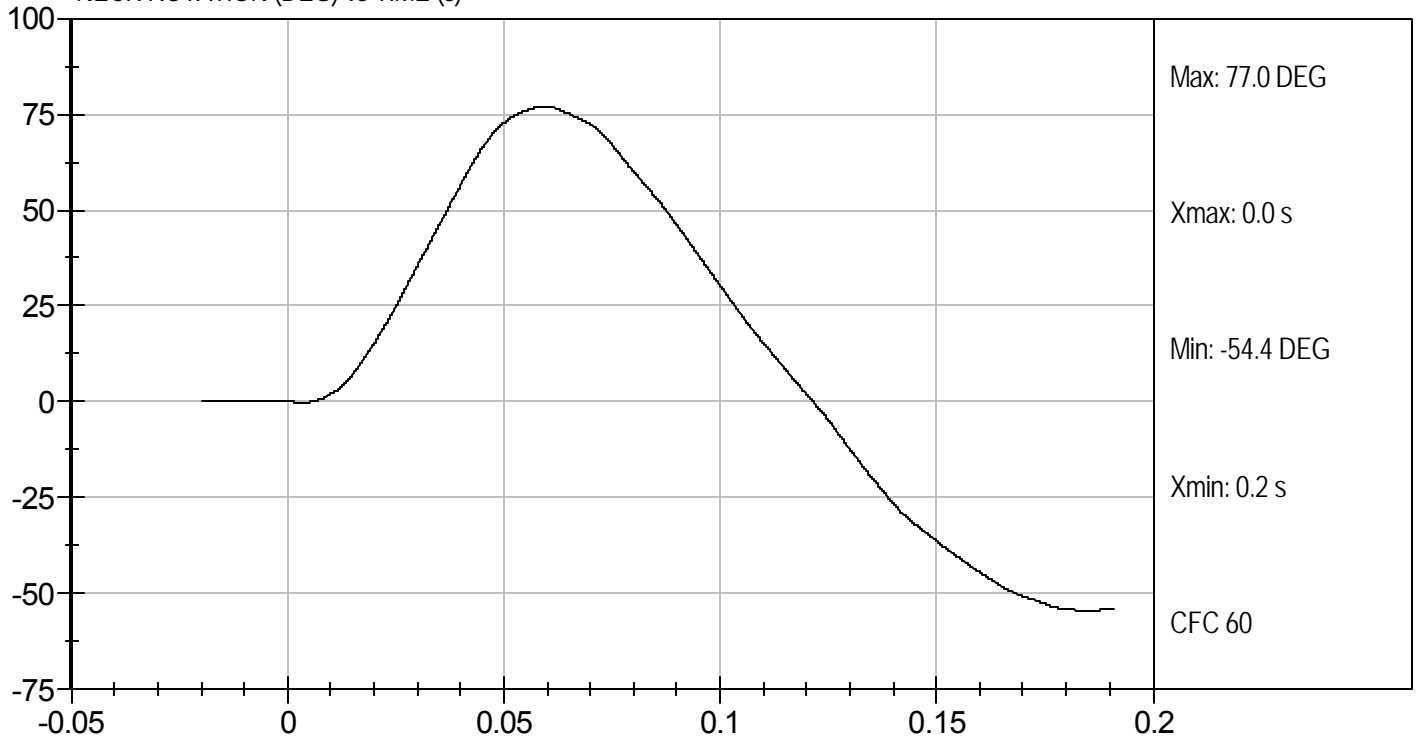
Test Desc: Neck Flexion
Component ID: D104112

Test Date: 11/22/10
Velocity: 22.83 ft/s, 6.96 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)



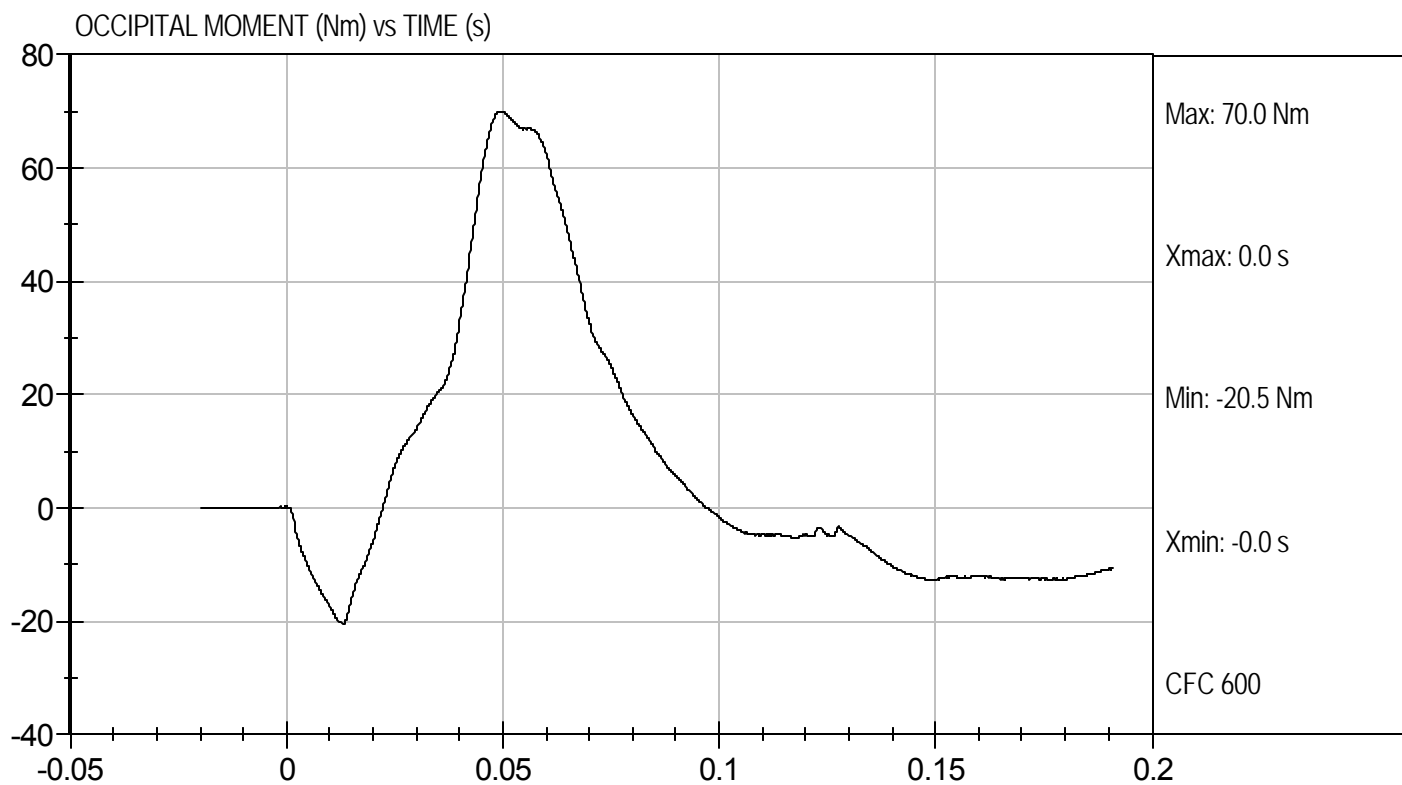
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Component ID: D104112

Test Date: 11/22/10
Velocity: 22.83 ft/s, 6.96 m/s



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D.: D104113

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	56	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	104	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
				Overall Results	Pass

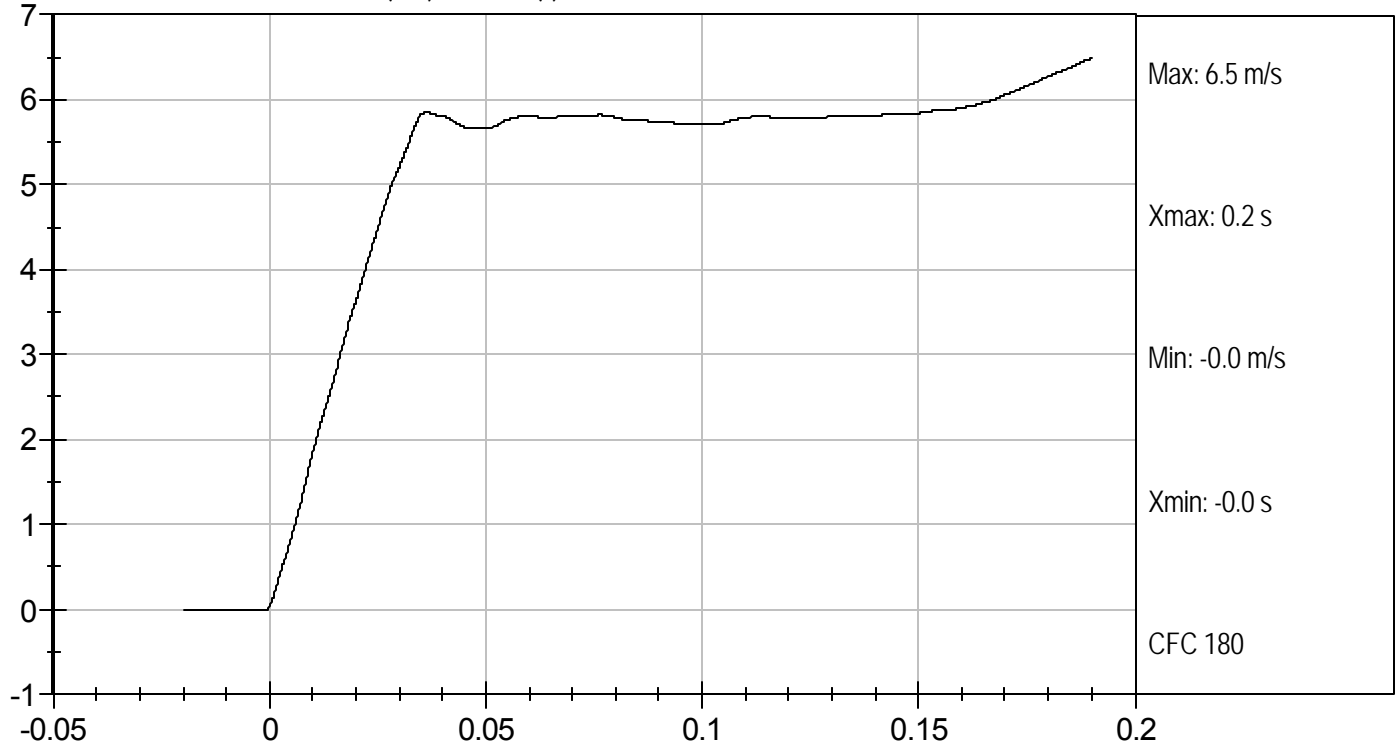
Jessica Hall
Laboratory Technician

11/22/10
Test Date

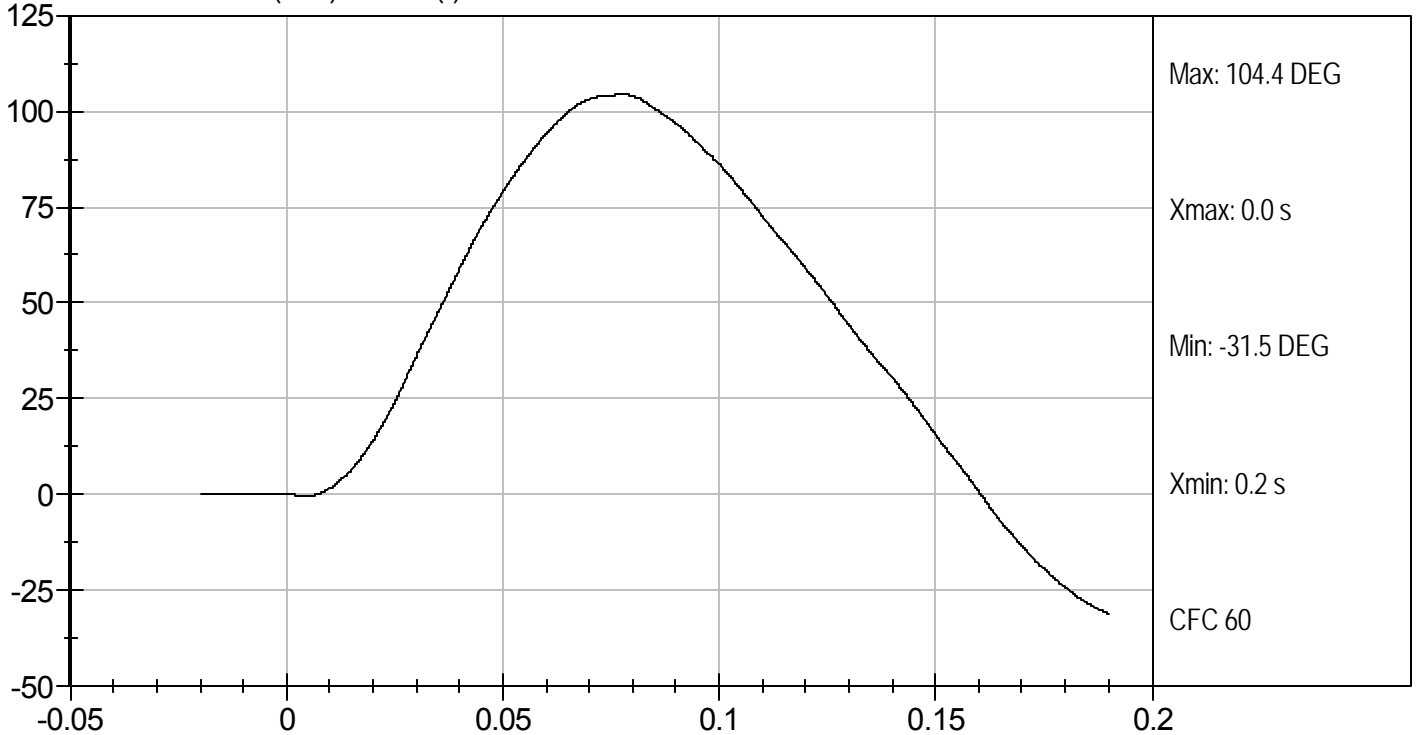
David Winkelbauer
Approved By



PENDULUM DECELERATION (m/s) vs TIME (s)



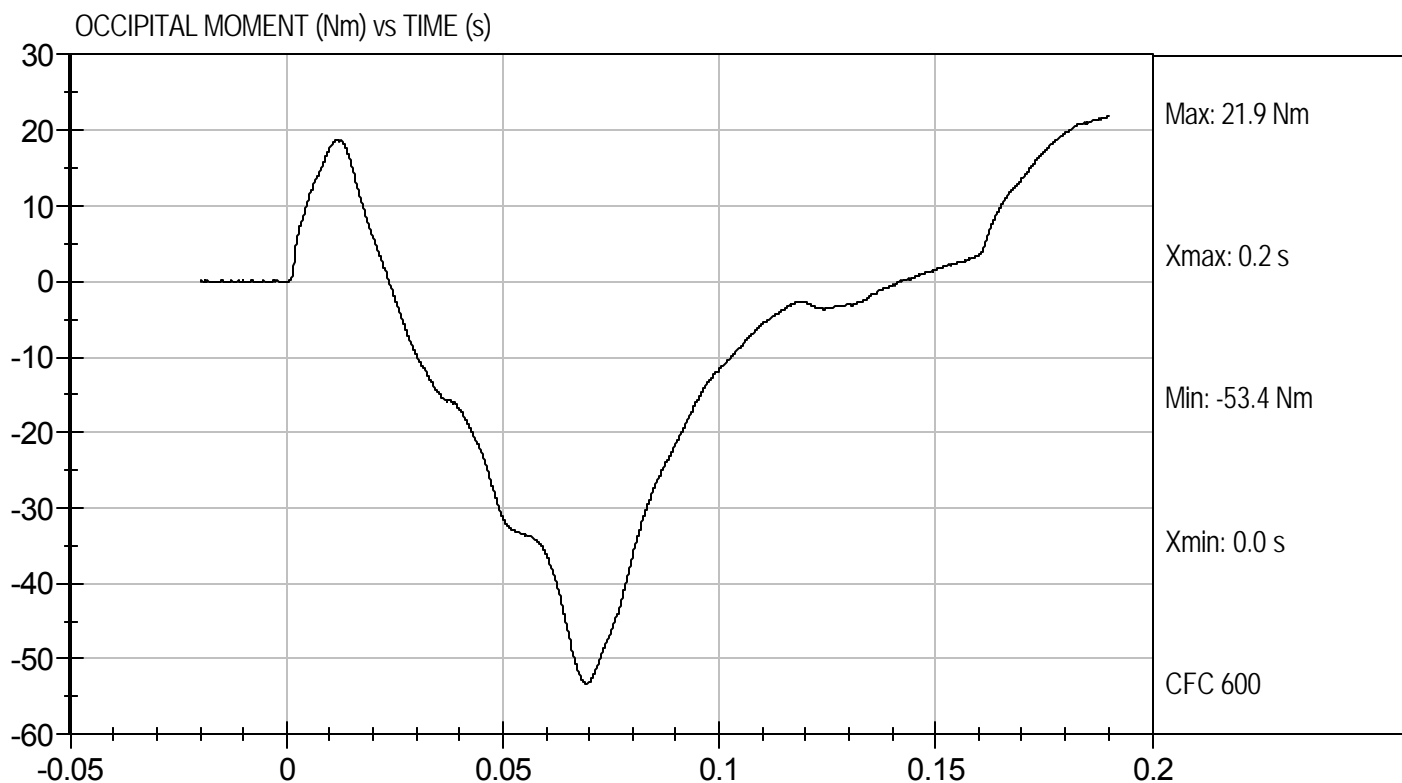
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension
Component ID: D104113

Test Date: 11/22/10
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D104114

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	54	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.17	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4127	Pass
Overall Test Results				Pass

Jessica Gall

 Laboratory Technician

11/23/10

 Test Date

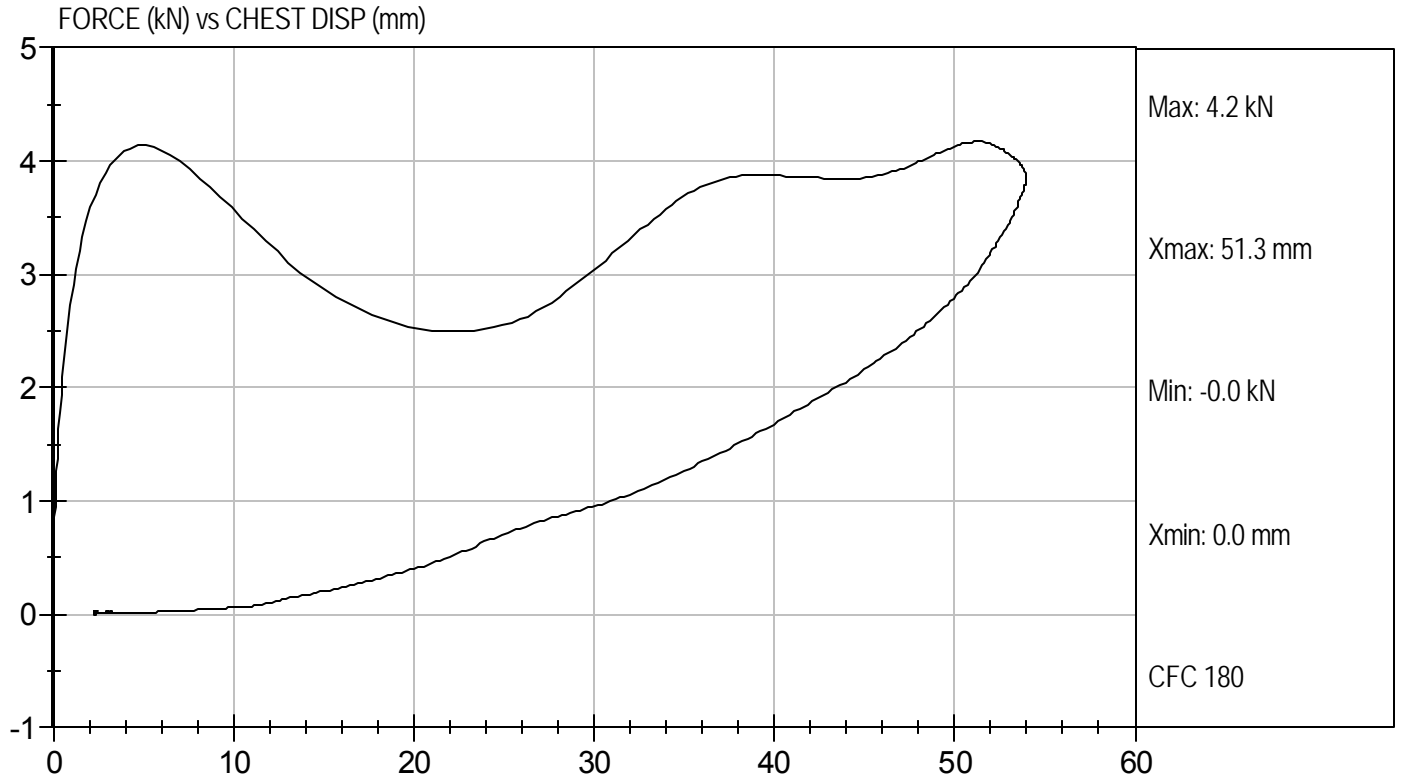
David Winkelbauer

 Approved By



Test Desc: Thorax Impact
Component ID: D104114

Test Date: 11/23/10
Velocity: 21.93 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D104115

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.58	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

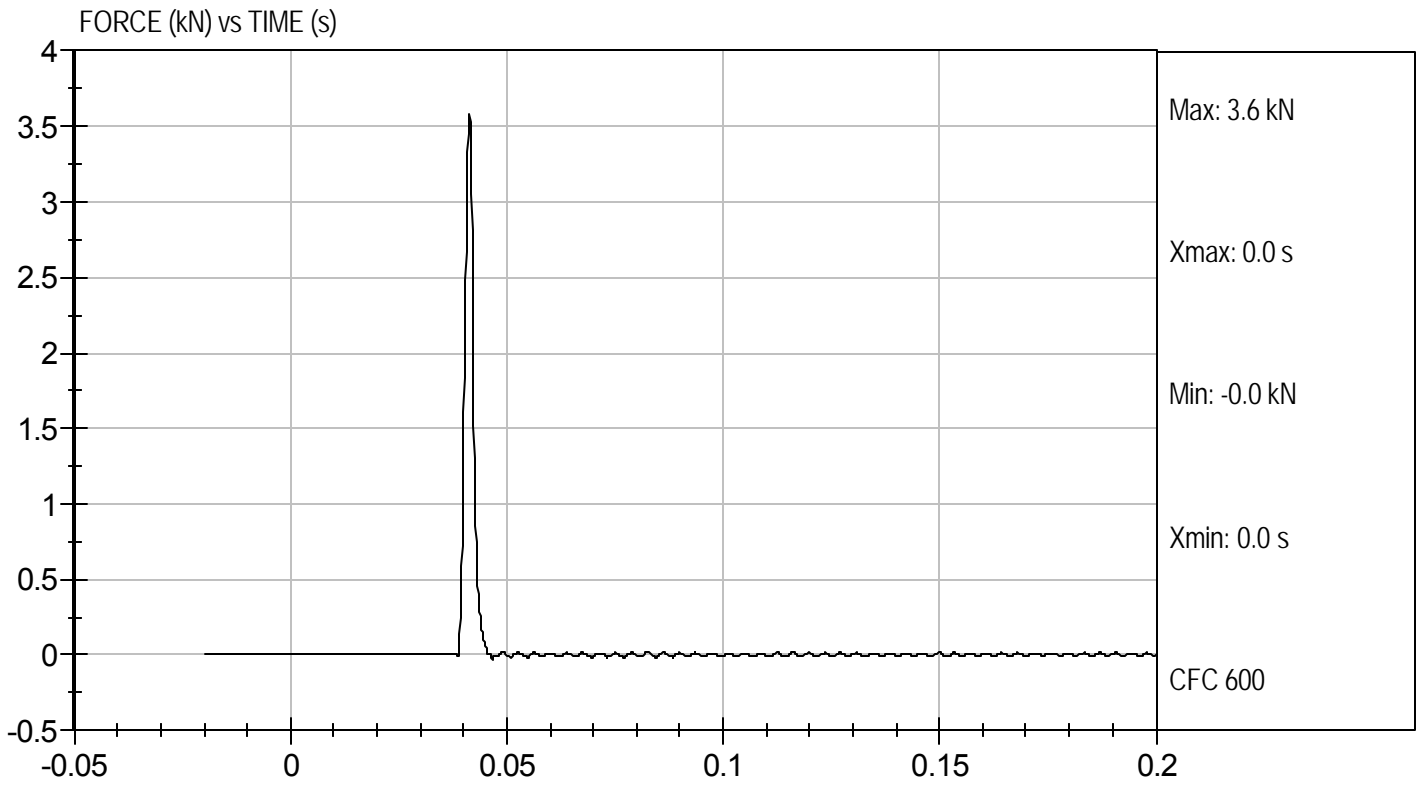
11/23/10
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D104115

Test Date: 11/23/10
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D104116

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.52	Pass
Overall Test Results				Pass

Jessica Gall
 Laboratory Technician

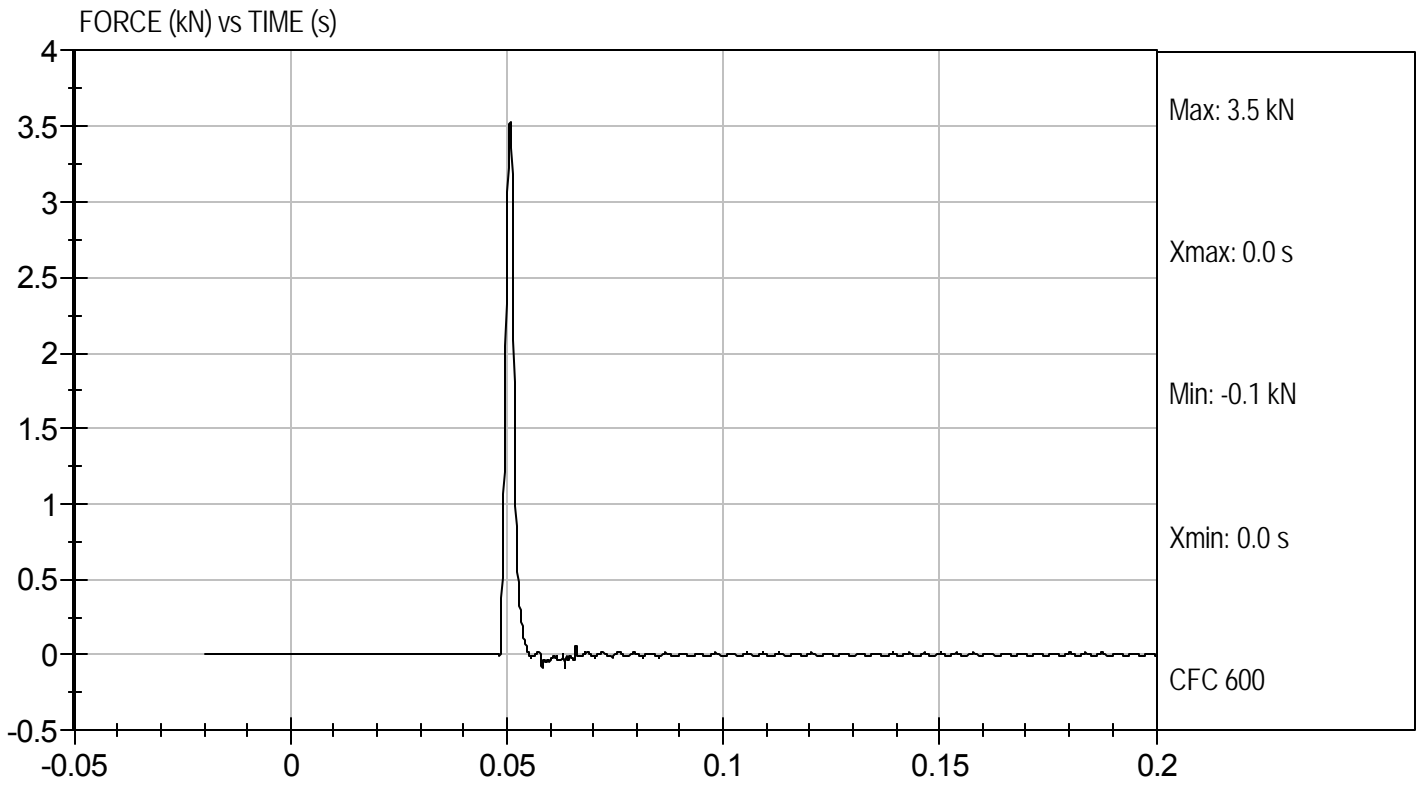
11/23/10
 Test Date

David Winkelbauer
 Approved By



Test Desc: Left Knee
Component ID: D104116

Test Date: 11/23/10
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D.: D104117

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	56	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	347	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass

Jessica Hall
 Laboratory Technician

11/22/2010
 Test Date

David Winkelbauer
 Approved By