

REPORT NUMBER: NCAP-MGA-2009-004

**VALIDATION
FRONTAL BARRIER IMPACT TEST**

**TOYOTA MOTOR MANUFACTURING CANADA INC.
2010 LEXUS RX 350 5-DR SUV
NHTSA NUMBER: MA5101**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: April 24, 2009

Final Report Date: August 5, 2009

FINAL REPORT

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

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

Date: _____

COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

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Technical Report Documentation Page

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16. Abstract A 56.3 km/h NCAP Frontal Validation Test was conducted on a 2010 Lexus RX 350 5-Dr SUV in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. 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 April 24, 2009. The impact velocity was 56.3 km/h and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle's maximum post test static crush is 581 mm located at the vehicle's centerline. The occupant injury criteria summary was as follows: <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <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>207</td> <td>307</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>52</td> <td>27</td> <td>19</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>1</td> <td>0.4</td> <td>0.5</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>2620</td> <td>2075</td> <td>1064</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>2520</td> <td>218</td> <td>622</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>1809</td> <td>1757</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>6805</td> <td>2600</td> <td>2106</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	207	307	Maximum Chest Compression	mm	63	52	27	19	Nij	N/A	1	1	0.4	0.5	Neck Tension	N	4170	2620	2075	1064	Neck Compression	N	4000	2520	218	622	Left Femur Force	N	10008	6805	1809	1757	Right Femur Force	N	10008	6805	2600	2106
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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 NCAP Frontal Validation Test 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 Standards Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier was impacted by a 2010 Lexus RX 350 5-Dr SUV at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on April 24, 2009. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera 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 also on the driver and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 1045) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 102 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 581 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 bag. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the knee bag.

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)	207	68.9	83.9	27	0.4	2075	218	1809	2600
Passenger (5 th)	307	67.1	82.1	19	0.5	1064	622	1757	2106

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

TEST NOTES

There was no valid data collected for:
Driver Neck Force Y after 50 msec.
Driver Left Lower Tibia Force Z
Left Brake Caliper X after 35 msec.
Right Brake Caliper X after 60 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: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MA5101	Anti-Lock Brakes	Yes
Model Year	2010	All Wheel Drive	Yes
Make	Lexus	Power Steering	Yes
Model	RX 350	Driver Front Airbag	Yes
Body Style	SUV	Driver Side Airbag	Yes
VIN	2T2BK1BA6AC001686	Driver Head Airbag	No
Body Color	Golden Almond Metallic	Driver Curtain Airbag	Yes
Delivery Date	4/13/09	Driver Knee Airbag	Yes
Odometer (km/mi)	134 / 83	Pass. Front Airbag	Yes
Dealer	Lexus North Shore	Pass. Side Airbag	Yes
Transmission	Automatic	Pass. Head Airbag	No
Final Drive	AWD	Pass. Curtain Airbag	Yes
Type/No. Cyl	V6	Pass. Knee Airbag	Yes
Engine Displacement (L)	3.5	Pretensioners	Yes
Engine Placement	Lateral	Load Limiters	Yes
Roof Rack	Yes	Air Conditioning	Yes
Sunroof/T-Top	Yes	AM/FM CD	Yes
Tinted Glass	Yes	Tilt & Telescopic Steering Column	Yes
Traction Control	VSC	Automatic Door Locks	Yes
Power Brakes	Yes	Power Windows	Yes
Front Disc	Yes	Power Seats	Yes
Rear Disc	Yes	Other: Tow Package	Yes
Does owner's manual provide instructions to turn off automatic door locks?	No		

DATA FROM MANUFACTURER'S CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing, Canada Inc.
Date of Manufacture	02/09

GVWR (kg)	2560
GAWR Front (kg)	1360
GAWR Rear (kg)	1385

VEHICLE SEATING AND WEIGHT CAPACITY

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bucket		
Designated Seating Capacity (DSC)	2	3		5
Capacity Wt. (VCW) (kg)				370
Cargo Wt. (RCLW) (kg)				30

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

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

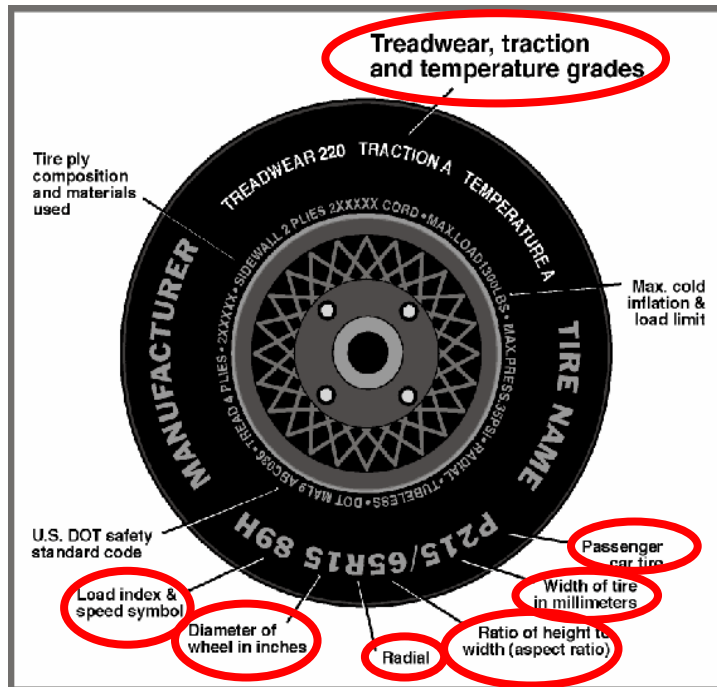
VEHICLE SEAT TYPE

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						w/ Lever	Power
Front Seat	X						X
Rear or Second	X					X	
Third Row Seat							

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
Test Program: Frontal Validation Testing

NHTSA No.: MA5101
Test Date: 4/24/2009



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	220	220
Recommended Tire Size	P235/60R18	P235/60R18
Tire Size on Vehicle	P235/60R18	P235/60R18
Tire Manufacturer	Michelin	Michelin
Tire Model	Latitude	Latitude
Treadwear	440	440
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2	2
Tire Plies Body	5	5
Load Index & Speed Symbol	102V	102V
Tire Material	Rubber	Rubber
DOT Safety Code Right	DOT B9XF	DOT B9XF
DOT Safety Code Left	DOT B9XF	DOT B9XF

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

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	577.0	434.5		615.1	488.5	
Right	kg	550.2	430.0		574.7	474.5	
Ratio	%	56.6	43.4		55.3	44.7	
Totals	kg	1127.2	864.5	1991.7	1189.8	963.0	2152.8

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1991.7
Weight of 1 P572E ATD & 1 P572O ATD	kg	136.1
Rated Cargo/Luggage Weight (RCLW)	kg	30
Calculated Vehicle Target Weight (TVTW)	kg	2157.8

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	803	803	810	810	1188
As Tested	mm	792	798	795	797	1224
Post Test	mm	820	847	795	797	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2736
Total Vehicle Length at Left Side	mm	4557
Total Vehicle Length at Centerline	mm	4731
Total Vehicle Length at Right Side	mm	4560
Weight of Ballast (location: centerline in trunk)	kg	20.4
Weight of Vehicle Components Removed	kg	0
Amount of Stoddard Solvent in Fuel Tank	L	67.4

Vehicle components removed to meet Test Weight: None

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

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4731
2	Total Width	1881
3	Bumper Top Height	641
4	Bumper Bottom Height	490
5	Longitudinal Member Top Height	621
6	Distance between Longitudinal Members	1073
7	Longitudinal Member Width	96
8	Engine Top Height	944
9	Engine Bottom Height	212
10	Engine and Gearbox Width	843
11	Front Bumper-Engine Distance	464
12	Front Shock Absorber Fixing Height	995
13	Bonnet Leading Edge Height	908
14	Front Shock Absorber Fixing Width	1227
15	Front Bumper – Front Axle Distance	988
16	Front Axle – A-Pillar Distance	484
17	A-Pillar – B-Pillar Distance	1095
18	B-Pillar – Rear Axle Distance	1147
19	B-Pillar – C-Pillar Distance	1061
20	Roof Sill Bottom Height	1590
21	Roof Sill Top Height	1644
22	Floor Sill bottom Height	286
23	Floor Sill Top Height	442

DATA SHEET NO. 2

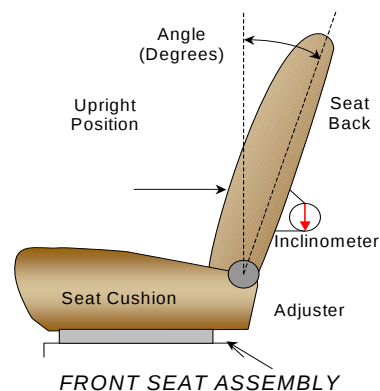
SEAT ADJUSTMENT, SEAT BELTS, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's designated angle. For the passenger seat, seat was adjusted until the dummy's transverse instrumentation platform is level to within ± 0.5 degrees.



SEAT BACK ANGLES

	Degrees
Driver Seat Back Angle	2.8 on headrest post
Passenger Seat Back Angle	-6.3 on headrest post

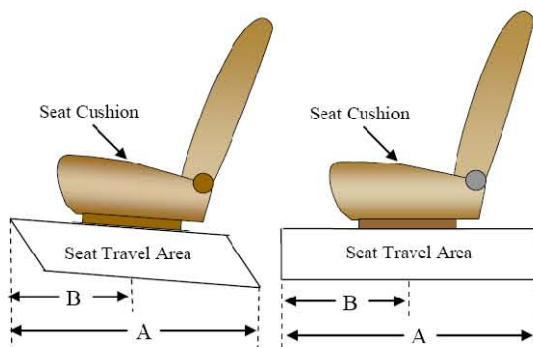
SEAT FORE/AFT POSITIONS

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	285 mm	142.5 mm
Passenger Seat	260 mm	0 mm (full forward)

SEAT BELT UPPER ANCHORAGES

	Total # of Positions	Placed in Position #
Driver Seat	4 detents	0 (uppermost as 0)
Passenger Seat	4 detents	0 (uppermost as 0)

Describe method: Detents to the Nominal Design Position are measured with respect to the upper-most detent, which is defined as 0. The seat belt anchorages were set in the uppermost position for both driver and passenger.



DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, SEAT BELTS, FUEL SYSTEMS, AND STEERING WHEEL DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

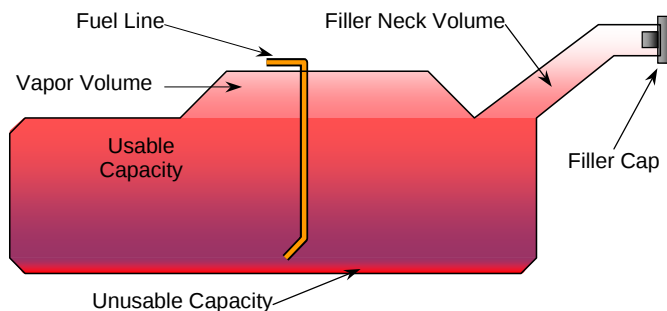
NHTSA No.: MA5101
 Test Date: 4/24/2009

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	72.7
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	66.9 to 68.3
Actual Amount of Solvent used	67.4
1/3 of Usable Capacity	24.2

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

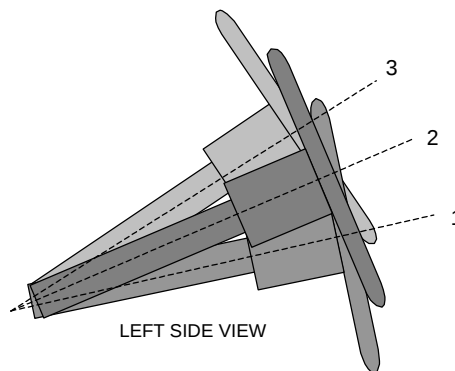
The test vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned on. The fuel pipe is on the left side.



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

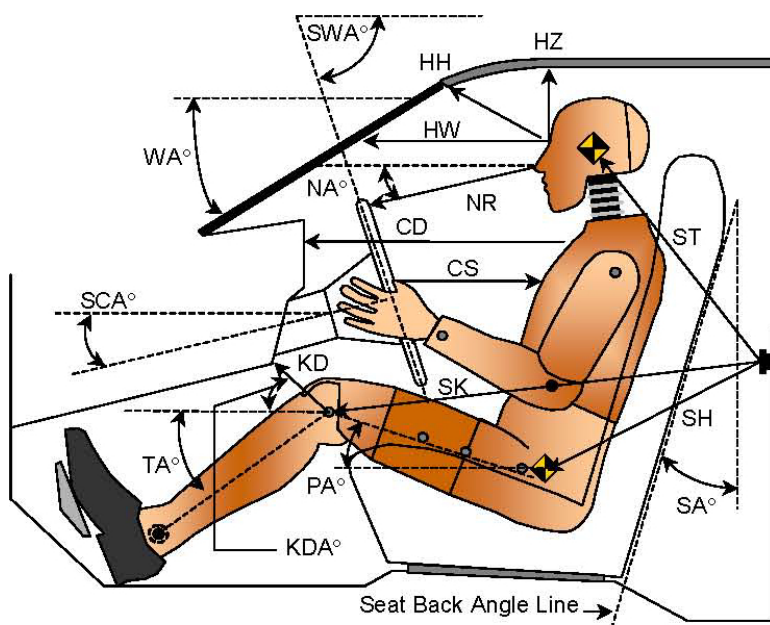
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	66.0	0
Geometric Center – Position 2	63.75	20
Uppermost – Position 3	61.5	40
Telescoping Steering Wheel Travel	63.8	40
Test Position	63.8	20

DATA SHEET NO. 3 **DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

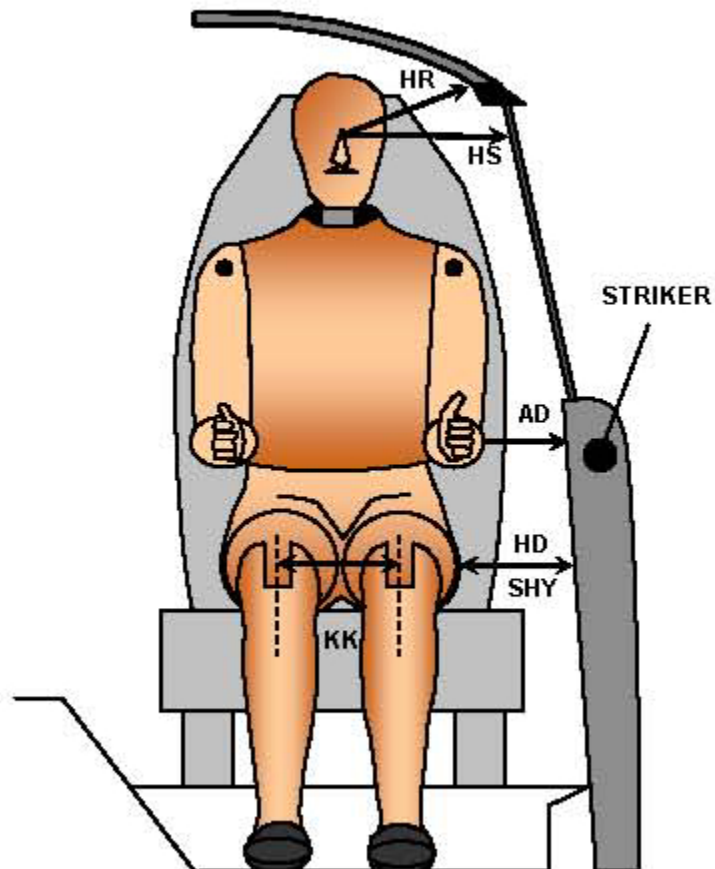


Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		27.6		
SWA	Steering Wheel Angle		63.8		
SCA	Steering Column Angle		26.2		
SA	Seat Back Angle (headrest post)		2.8		-6.3
HZ	Head to Roof (Z)	231	90	192	90
HH	Head to Header	398	23.5	281	45.5
HW	Head to Windshield	751	0	667	0
NR	Nose to Rim	413	10.8		
CD	Chest to Dash	527		371	
CS	Chest to Steering Hub	305	7.2		
RA	Rim to Abdomen	184	0		
KDL	Left Knee to Dash	164	23.3	74	31.2
KDR	Right Knee to Dash	157	27.4	79	25.5
PA	Pelvic Angle		24.2		20.9
TA	Tibia Angle		48.4		58.7
SK	Striker to Knee	629	98.2	739	98.4
ST	Striker to Head	483	11.0	524	33.5
SH	Striker to H-Point	272	131.7	420	109.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

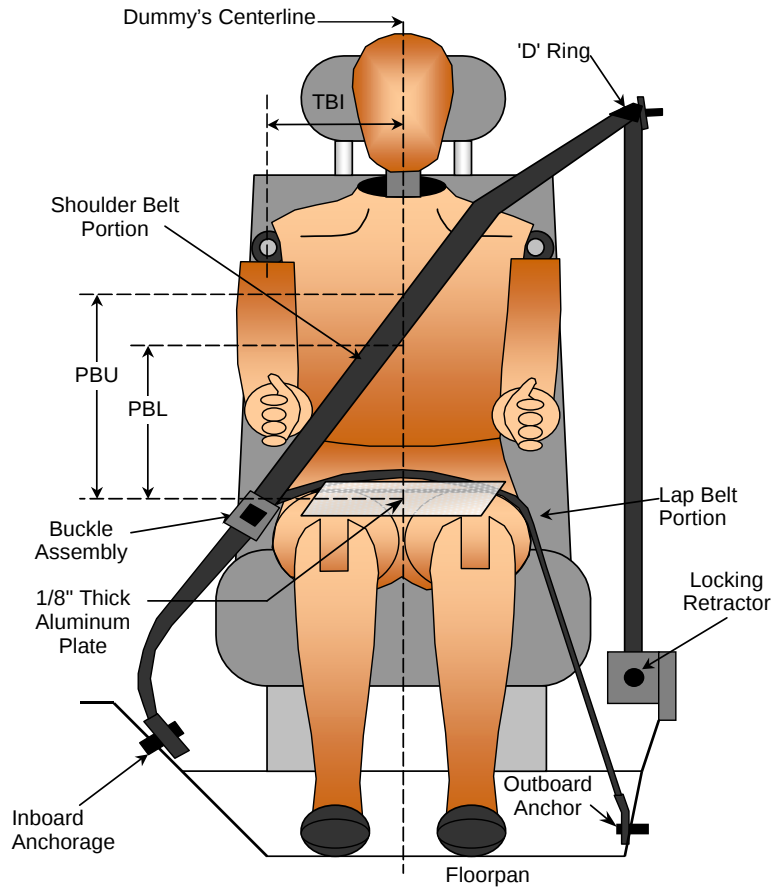


Code	Measurement Description	Driver	Passenger
AD	Arm to Door	145	188
HD	H-Point to Door	158	183
HR	Head to Side Header	219	231
HS	Head to Side Window	331	344
KK	Knee to Knee	352	211
SHY	Striker to H-Point (Y Direction)	334	345
AA	Ankle to Ankle	335	193

DATA SHEET NO. 5 **SEAT BELT POSITIONING DATA**

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	355	317
PBL - To surface of reference to belt lower edge	mm	280	236

BELT LENGTH DATA

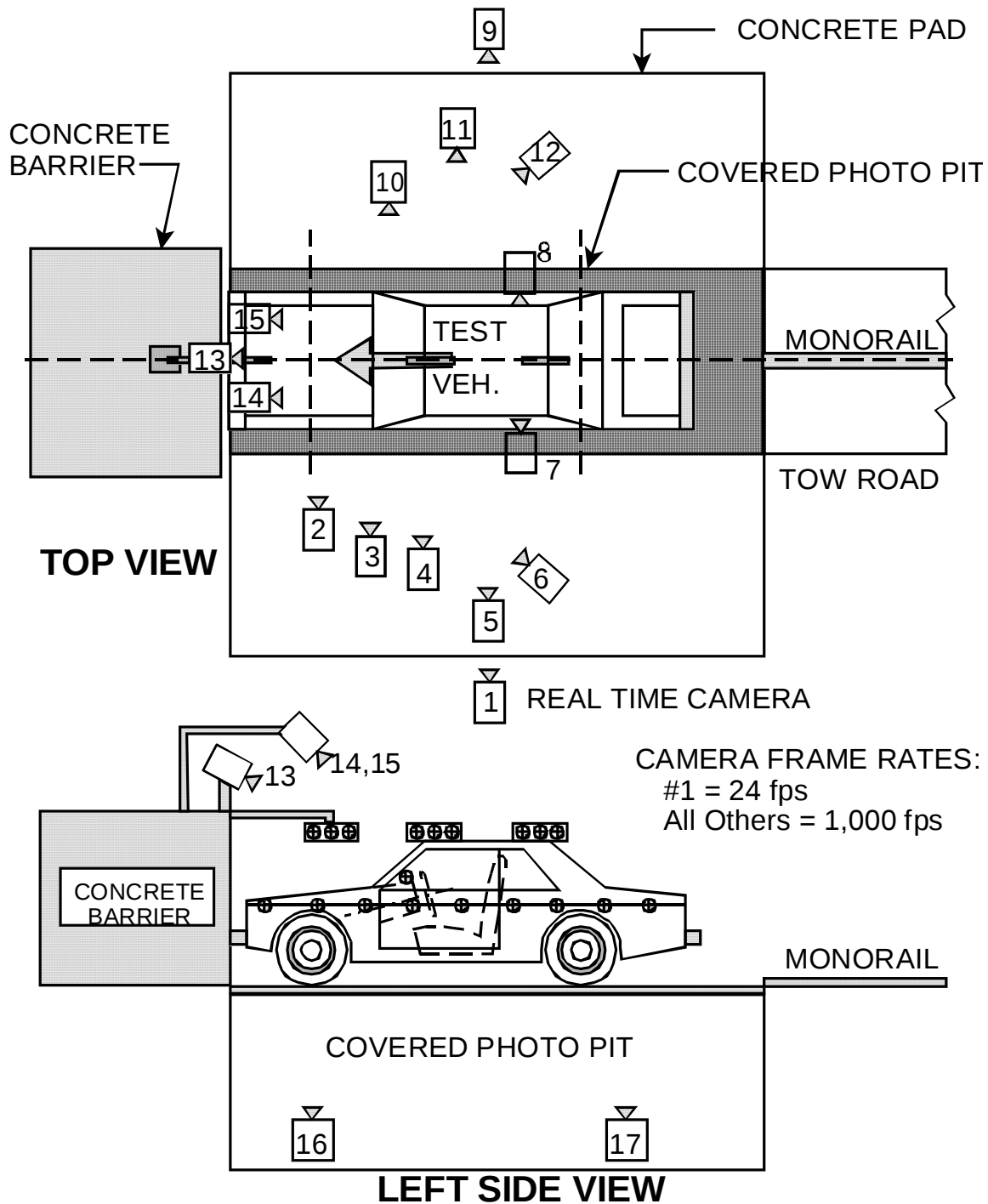
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	875	1044
Lap Belt Length as measured on ATD	mm	900	1037
Reminder of belt of reel	mm	1610	480
Total Belt Length for Continuous Webbing Systems	mm	3385	2561

DATA SHEET NO. 6
CAMERA LOCATIONS AND DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
Test Program: Frontal Validation Testing

NHTSA No.: MA5101
Test Date: 4/24/2009

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)

CAMERA LOCATIONS AND DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV

Test Program: Frontal Validation Testing

NHTSA No.: MA5101

Test Date: 4/24/2009

No.	Camera View	Location (mm) *			Angle (deg)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Real-Time Left Side View					13	24
2	Left Front View	1310	-5310	-1120	5.2	24	1000
3	Steering Column Top	510	-5050	-1130	3.1	25	1000
4	Steering Column Bottom	490	-1500	-760	5.6	25	1000
5	Driver Close-up	1330	-6710	-1280	1.3	24	1000
6	Driver Angle	6490	-5360	-1960	5.7	50	1000
7	Onboard Driver Side						
8	Onboard Passenger Side						
9	Right Overall	2170	6380	-1150	3.3	20	1000
10	Right Passenger Half	1330	5350	-1140	4.3	24	1000
11	Right Close-up	1540	6560	-1320	0.5	35	1000
12	Right Angle	6510	5080	-2020	5.1	50	1000
13	Windshield	-285	0	-2860	43.7	12.5	1000
14	Top Driver	-135	-470	-2180	41.7	16	1000
15	Top Passenger	-110	420	-2180	41.9	16	1000
16	Pit Front	1110	0	3150	89.3	24	1000
17	Pit Rear	3410	0	3150	89.2	24	1000

***COORDINATES:**

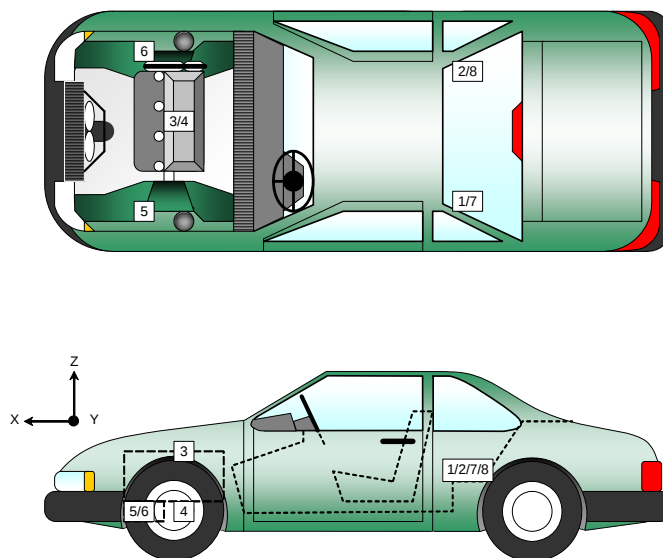
- +X = forward of impact plane
- +Y = right of monorail centerline
- +Z = below ground level

Cameras 7 & 8 were not used for this test.

DATA SHEET NO. 7 **VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1821	-396	-516
2	Right Rear X-Member X	1821	380	-516
3	Engine Top X	4042	0	-844
4	Engine Bottom X	4022	170	-216
5	Left Brake Caliper X	3895	-697	-277
6	Right Brake Caliper X	3895	697	-277
7	Left Rear X-Member Z	1821	-396	-516
8	Right Rear X-Member Z	1821	380	-516

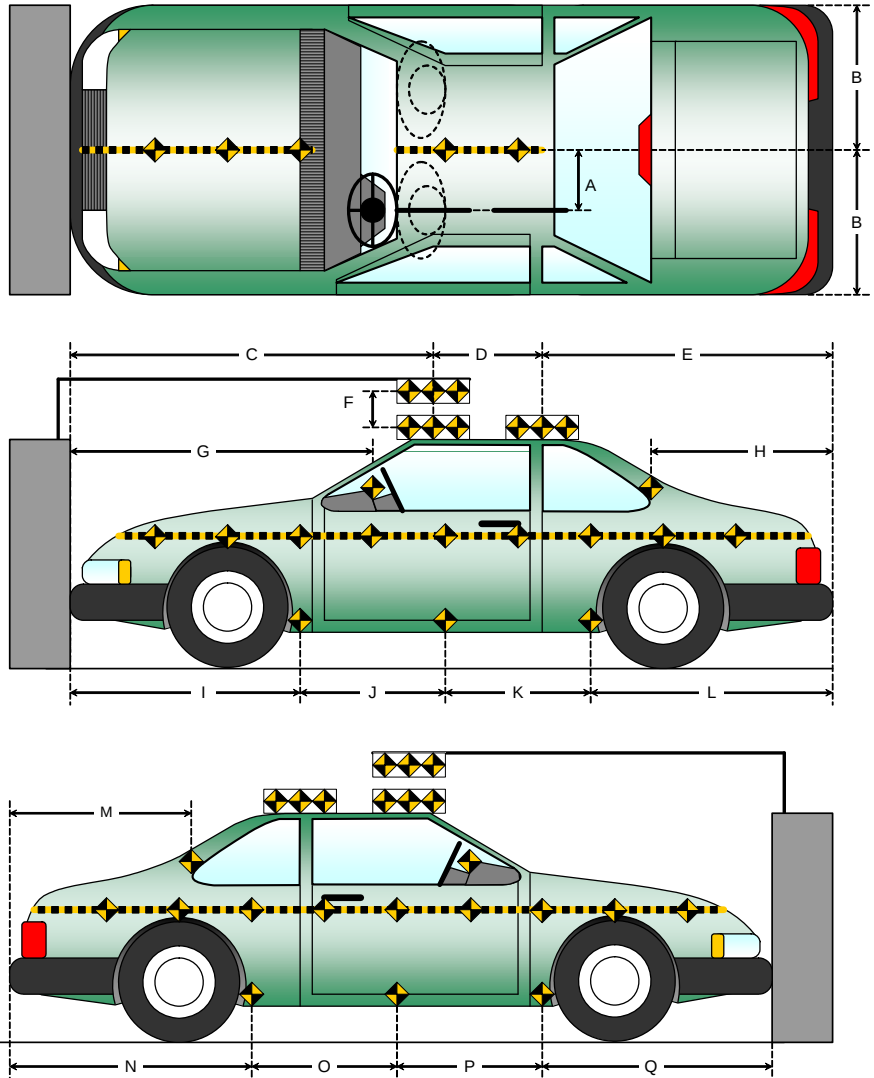
Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

Item	Value (mm)
A	375
B	940
C	2410
D	915
E	1406
F	85
G	
H	802
I	1478
J	885
K	885
L	1483
M	814
N	1492
O	889
P	889
Q	1461



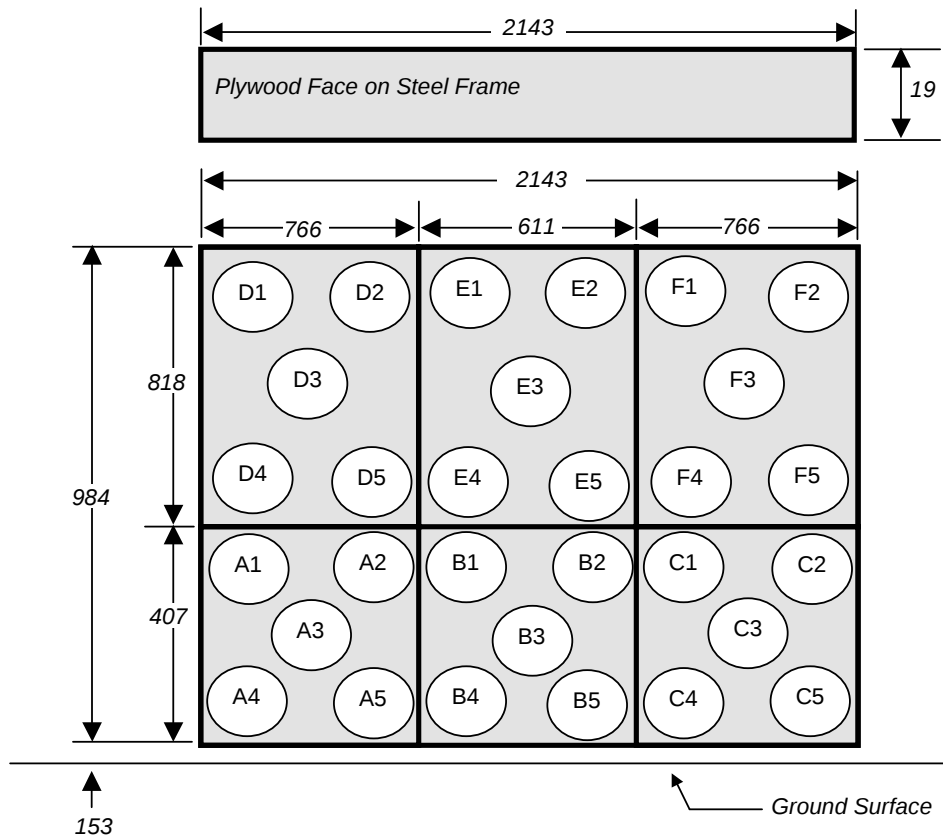
DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

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. 10

TEST VEHICLE CAMERA AND INSTRUMENTATION SUMMARY

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV

NHTSA No.: MA5101

Test Program: Frontal Validation Testing

Test Date: 4/24/2009

INSTRUMENTATION

Driver Dummy Channels	44
Passenger Dummy Channels	44
Vehicle Structure Accelerometers	8
Barrier Channels	6
Total	102

CAMERA COVERAGE

High-Speed Vehicle Onboard	0
High-Speed Offboard	15
Real-Time Panning	1
Total	16

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 1045	HIII 5% / 634
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bag	Knee Bag
Right Knee Contact	Knee Bag	Knee Bag

POST TEST 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	Cracked
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1465
Center	mm	1450
Right Side	mm	1465
Average	mm	1460

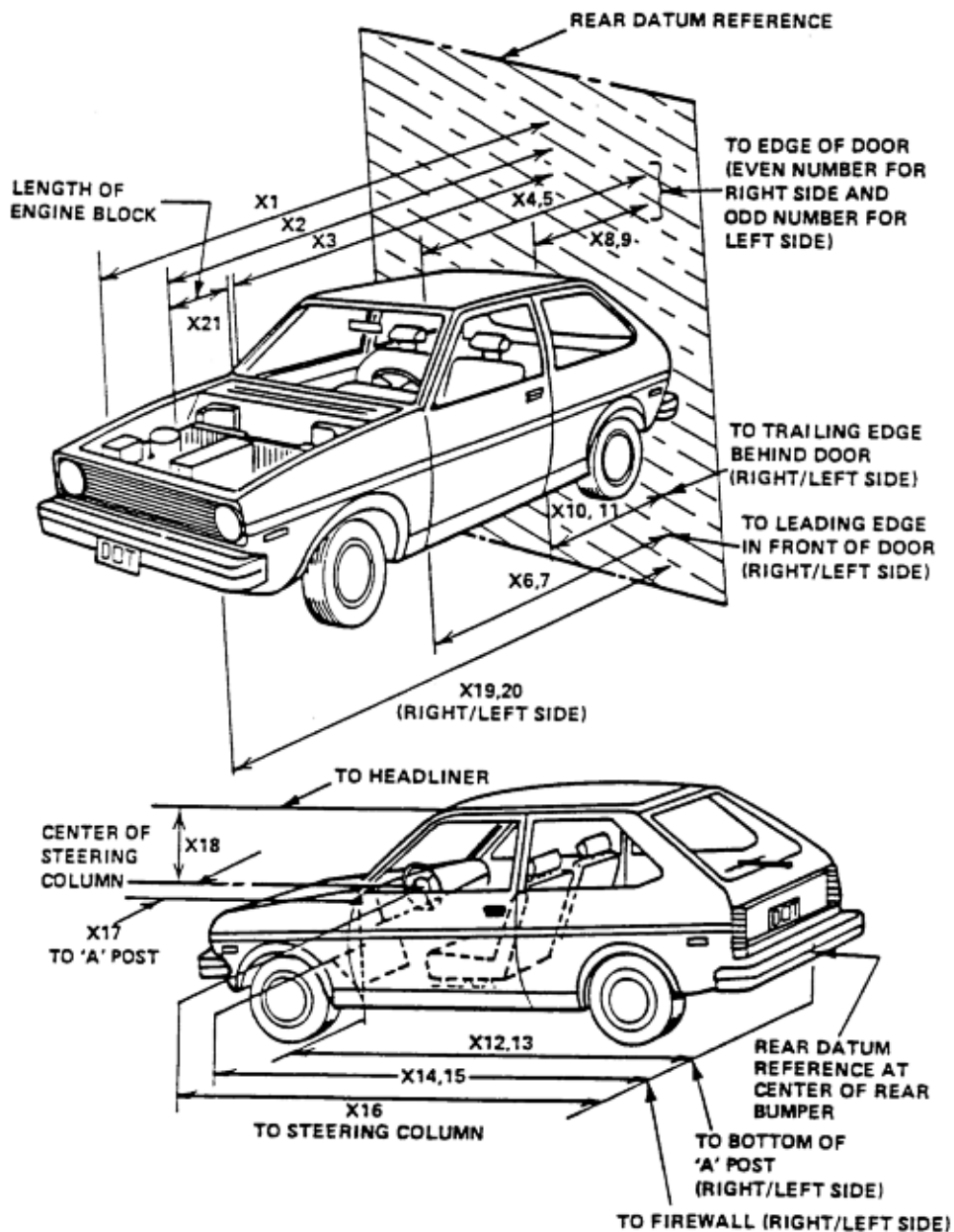
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Installed	Deployed	Installed	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Bag	Yes	Yes	Yes	Yes
Side Torso Airbag	Yes	No	Yes	No
Combination Head/Torso Airbag	No		No	
Side Head Curtain/Tube Airbag	Yes	No	Yes	No
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes

DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4731	4150	581
2	RSOV to Front of Engine	mm	4196	3912	284
3	RSOV to Firewall	mm	3512	3551	-39
4	RSOV to Upper Leading Edge of Right Door	mm	3218	3232	-14
5	RSOV to Upper Leading Edge of Left Door	mm	3219	3214	5
6	RSOV to Lower Leading Edge of Right Door	mm	3163	3163	0
7	RSOV to Lower Leading Edge of Left Door	mm	3163	3156	7
8	RSOV to Upper Trailing Edge of Right Door	mm	2138	2152	-14
9	RSOV to Upper Trailing Edge of Left Door	mm	2136	2141	-5
10	RSOV to Lower Trailing Edge of Right Door	mm	2129	2118	11
11	RSOV to Lower Trailing Edge of Left Door	mm	2124	2114	10
12	RSOV to Bottom of "A" Post of Right Side	mm	3178	3163	15
13	RSOV to Bottom of "A" Post of Left Side	mm	3186	3172	14
14	RSOV to Firewall, Right Side	mm	3807	3787	20
15	RSOV to Firewall, Left Side	mm	3829	3793	36
16	RSOV to Steering Column	mm	2797	2822	-25
17	Center of Steering Column to "A" Post	mm	377	394	-17
18	Center of Steering Column to Headliner	mm	438	468	-30
19	RSOV to Right Side of Front Bumper	mm	4560	4094	466
20	RSOV to Left Side of Front Bumper	mm	4557	4102	455
21	Length of Engine Block	mm	483	483	0
RD	RSOV to Right Side of Dash Panel	mm	3052	3057	-5
CD	RSOV to Center of Dash Panel	mm	3022	3028	-6
LD	RSOV to Left Side of Dash Panel	mm	3052	3056	-4

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

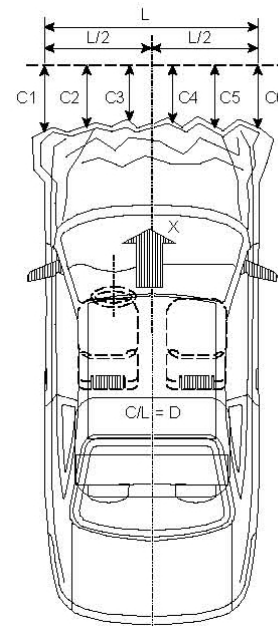
NHTSA No.: MA5101
 Test Date: 4/24/2009

VEHICLE INFORMATION

VIN: 2T2BK1BA6AC001686 Wheelbase (mm): 2736
 Vehicle Size Category: MPV Test Weight (kg): 2152.8

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 16
 Cal. Procedure/Interval: MGA procedure / 6 month
 Integration Algorithm: Trapezoidal Linearity: > 99%
 Impact Velocity (km/h): 56.3
 Velocity Change (km/h): 64.4
 Time of Separation (msec): 89



CRUSH PROFILE

Collision Deformation Classification: Frontal
 Midpoint of Damage: Centerline
 Damage Region Length (mm): 1375
 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4557	4102	455
C2	Crush zone 2 at left side	mm	4646	4139	507
C3	Crush zone 3 at left side	mm	4718	4150	568
C4	Crush zone 4 at right side	mm	4719	4148	571
C5	Crush zone 5 at right side	mm	4650	4132	518
C6	Crush zone 6 at right side	mm	4560	4094	466
L	C1 TO C6	mm	1375	1315	60

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

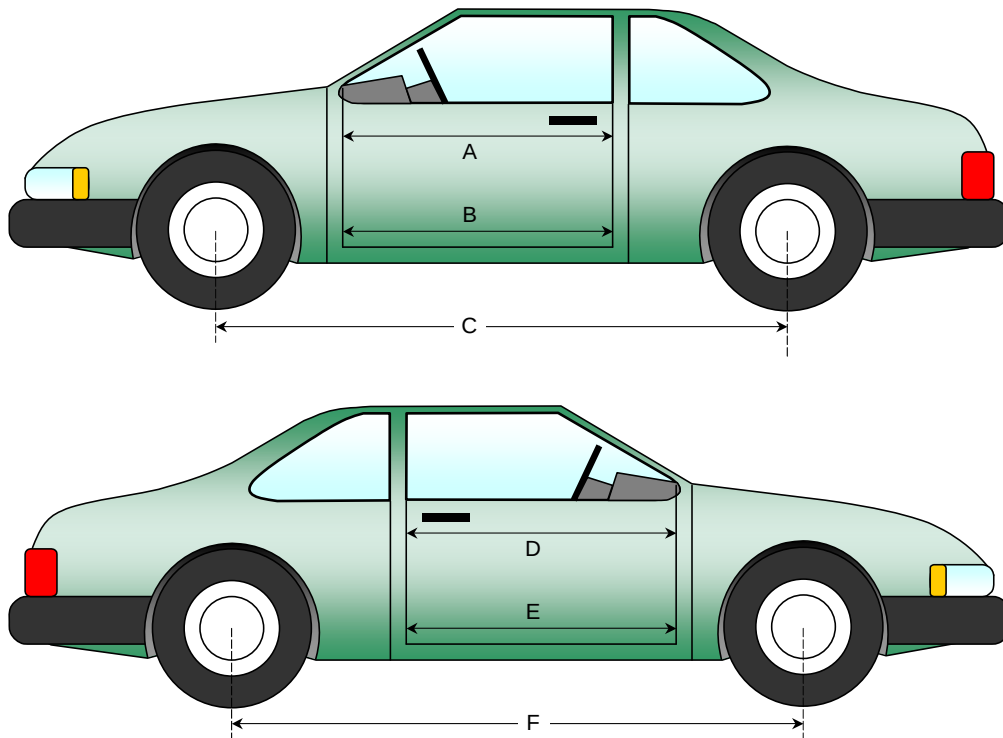
NHTSA No.: MA5101
 Test Date: 4/24/2009

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	922	922	0
B	Left Side Lower	mm	909	906	3
D	Right Side Upper	mm	923	923	0
E	Right Side Lower	mm	909	906	3

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2736	2705	31
F	Right Side Wheelbase	mm	2736	2703	33



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

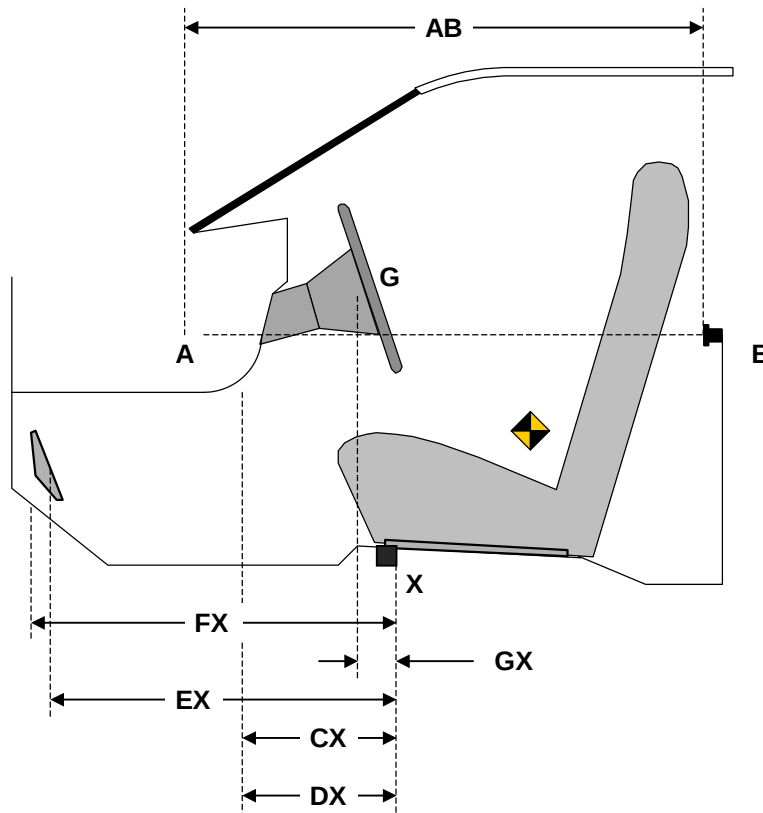
Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	846	846	0
CX	Left Knee Bolster to X	mm	262	278	-16
DX	Right Knee Bolster to X	mm	250	267	-17
EX	Brake Pedal to X	mm	545	565	-20
FX	Foot Rest to X	mm	640	639	1
GX	Center of Steering Column Wheel Hub to X	mm	30	107	-77

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15

SUMMARY OF FMVSS 212 AND FMVSS 219 (PARTIAL) DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV

NHTSA No.: MA5101

Test Program: Frontal Validation Testing

Test Date: 4/24/2009

Windshield Mounting Details:

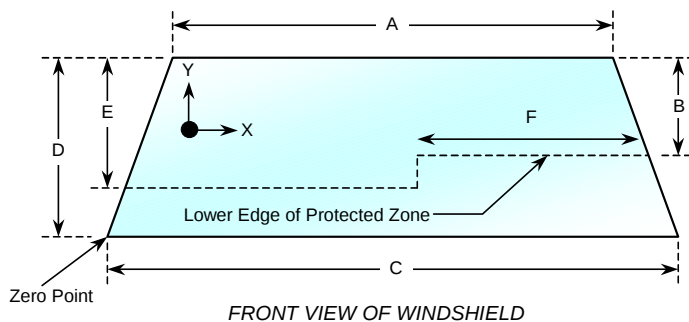
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2254	2254	100
Right Side	2254	2254	100
Total	4508	4508	100



Item	Units	Value
A	mm	1230
B	mm	559
C	mm	1500
D	mm	889
E	mm	601
F	mm	585

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. 16

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV

NHTSA No.: MA5101

Test Program: Frontal Validation Testing

Test Date: 4/24/2009

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

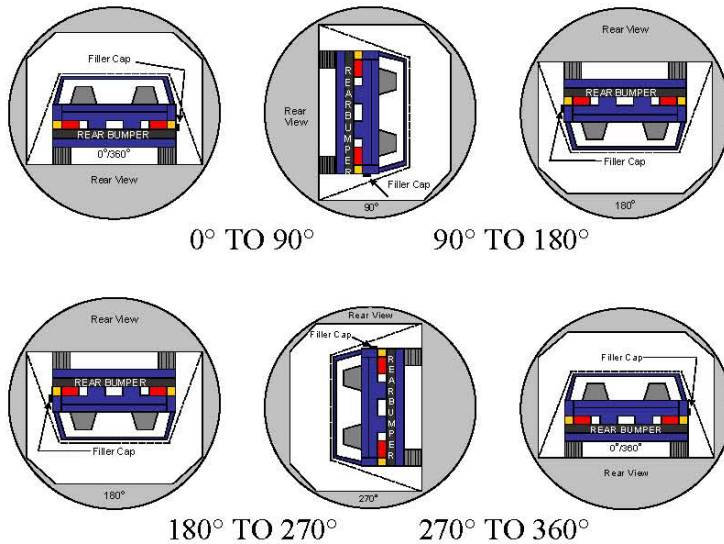
Test Time: 10:42 am Temperature: 21° C

- 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. 17
FMVSS 301 STATIC ROLLOVER DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
 Test Program: Frontal Validation Testing

NHTSA No.: MA5101
 Test Date: 4/24/2009



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°	120	300	420
90° to 180°	114	300	414
180° to 270°	116	300	416
270° to 360°	113	300	413

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

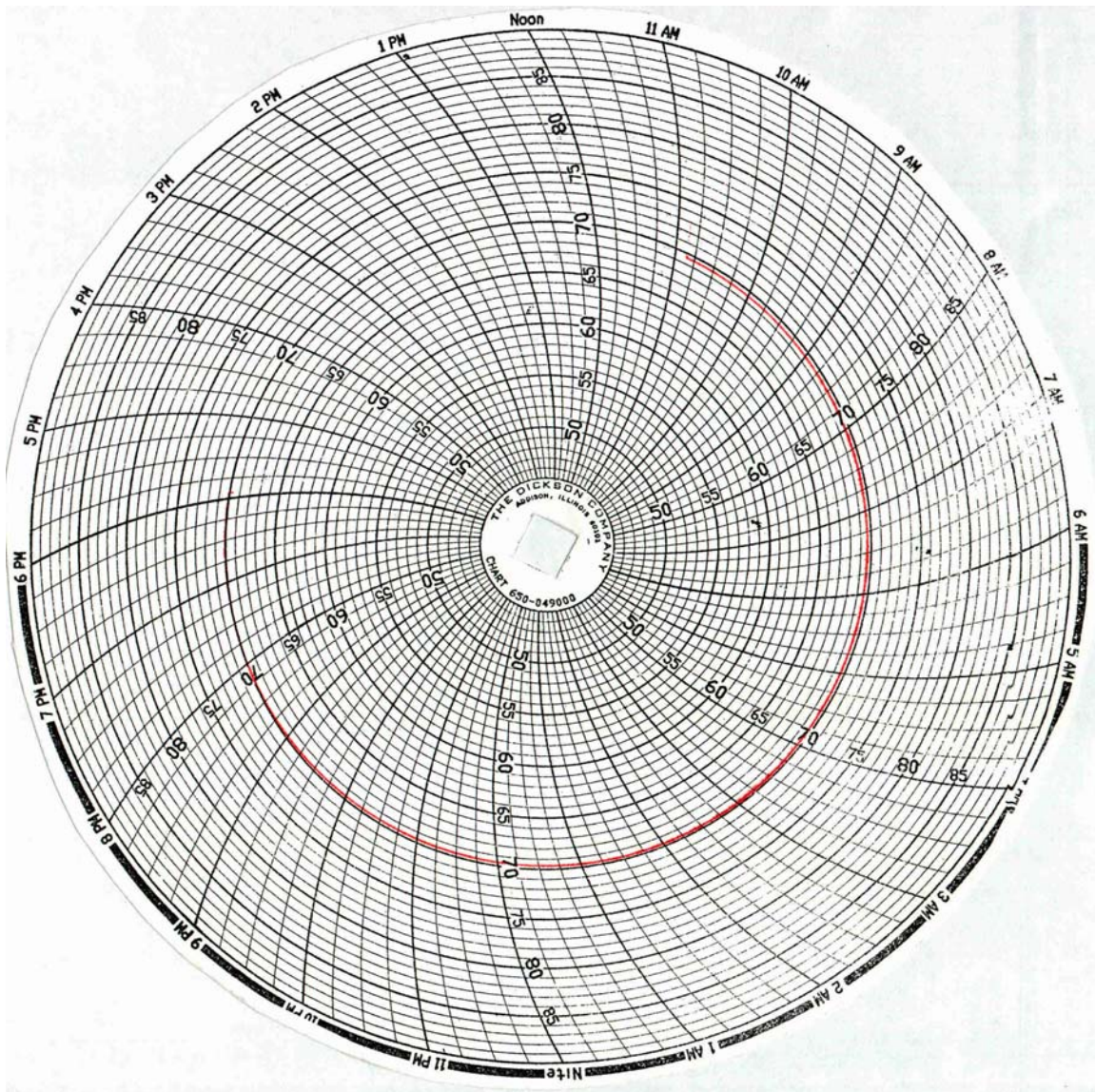
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 18
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2010 Lexus RX 350 5-Dr SUV
Test Program: Frontal Validation Testing

NHTSA No.: MA5101
Test Date: 4/24/2009



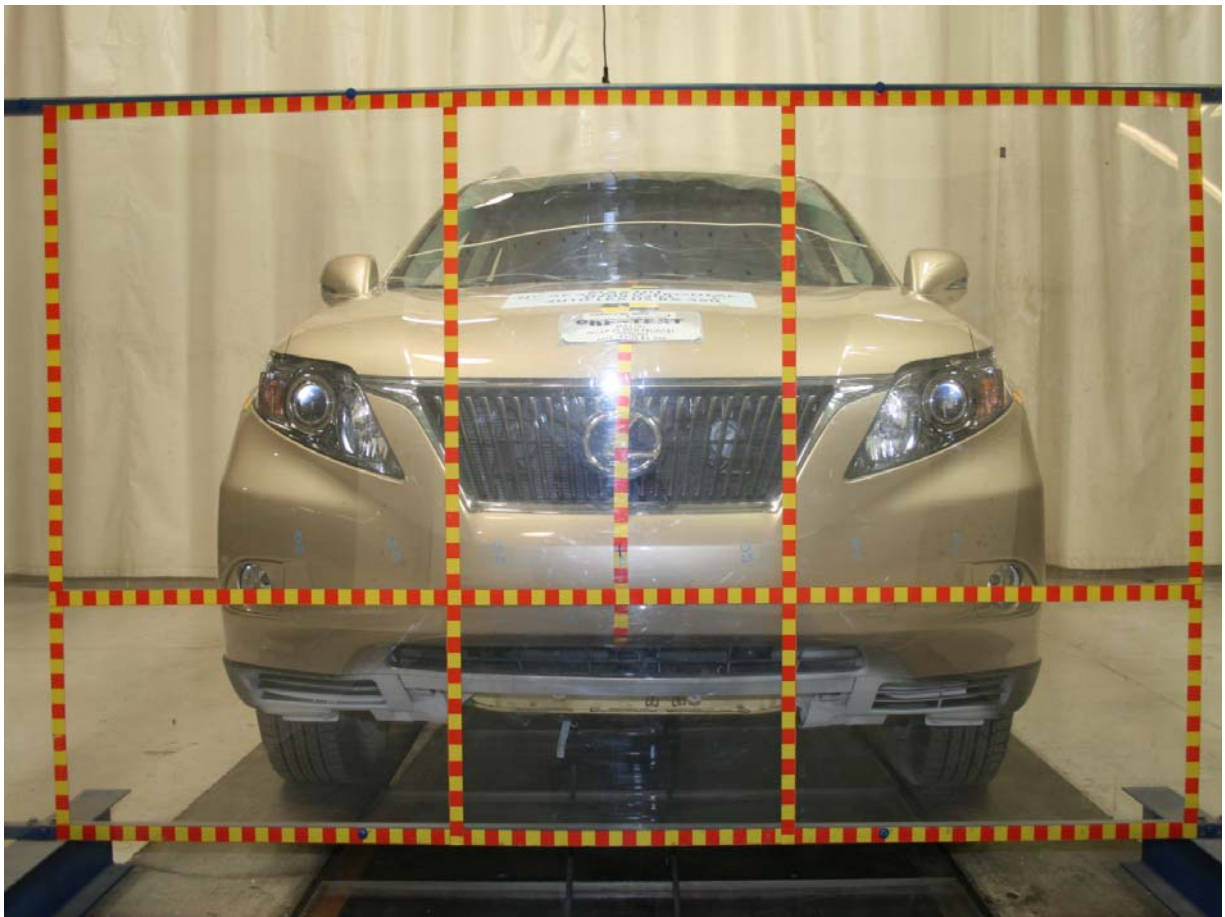
APPENDIX A
PHOTOGRAPHS

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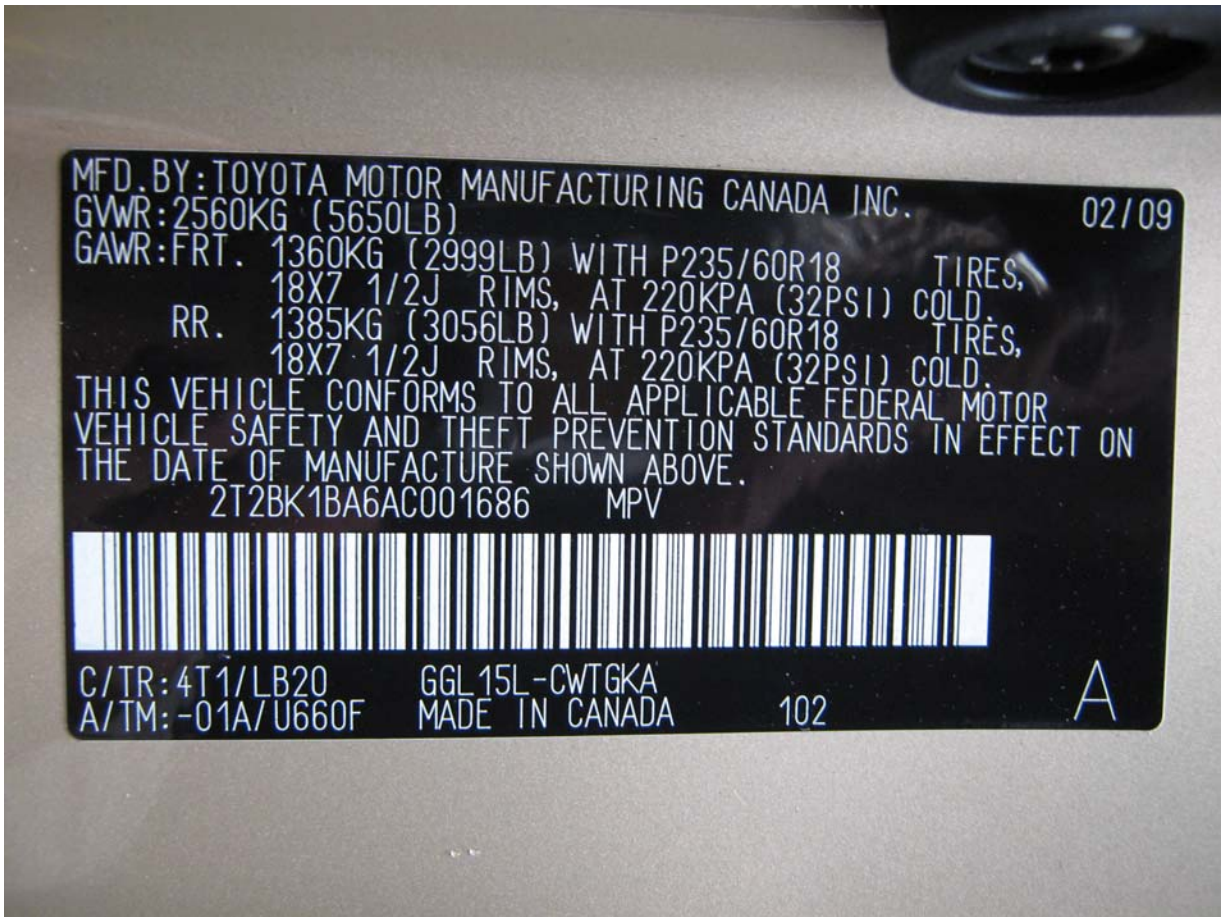
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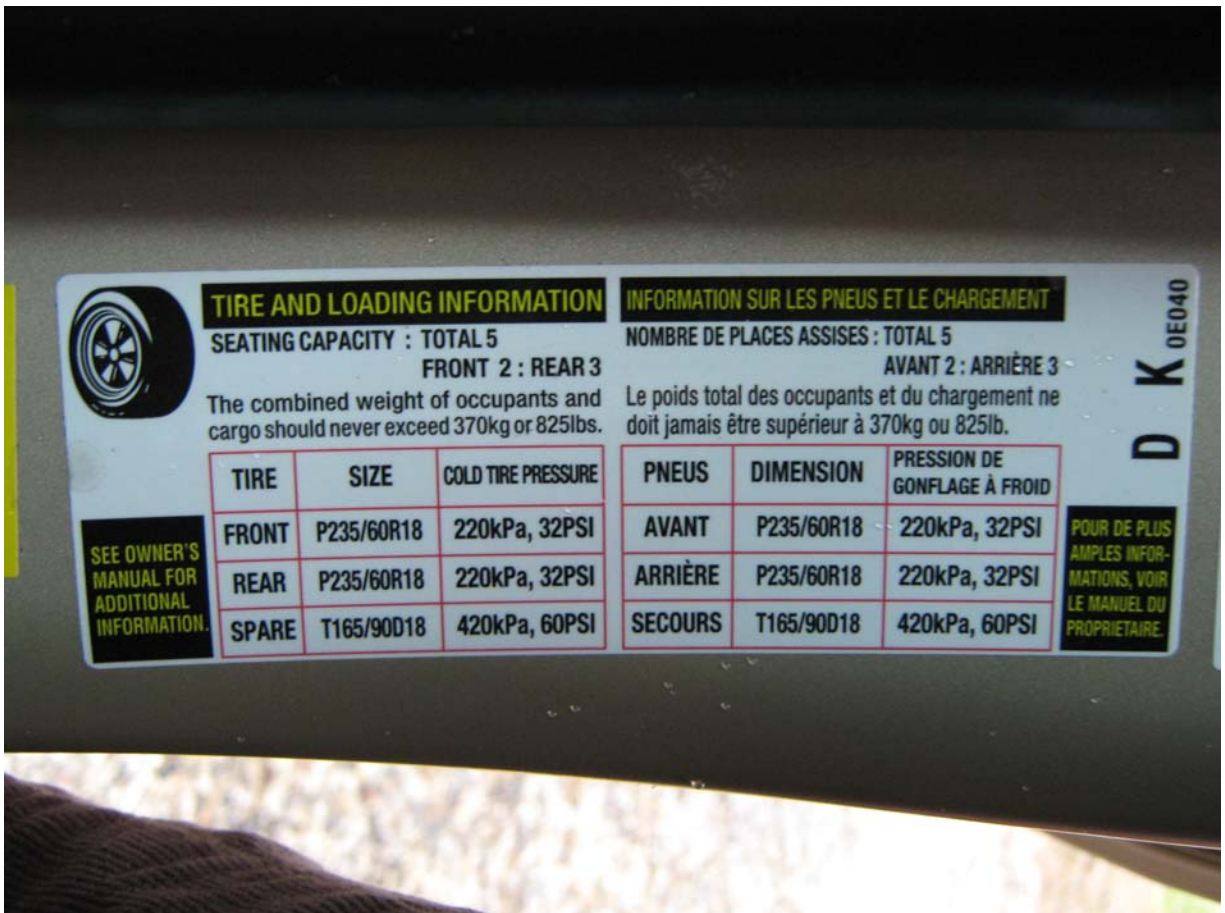
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Load Cell Location



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



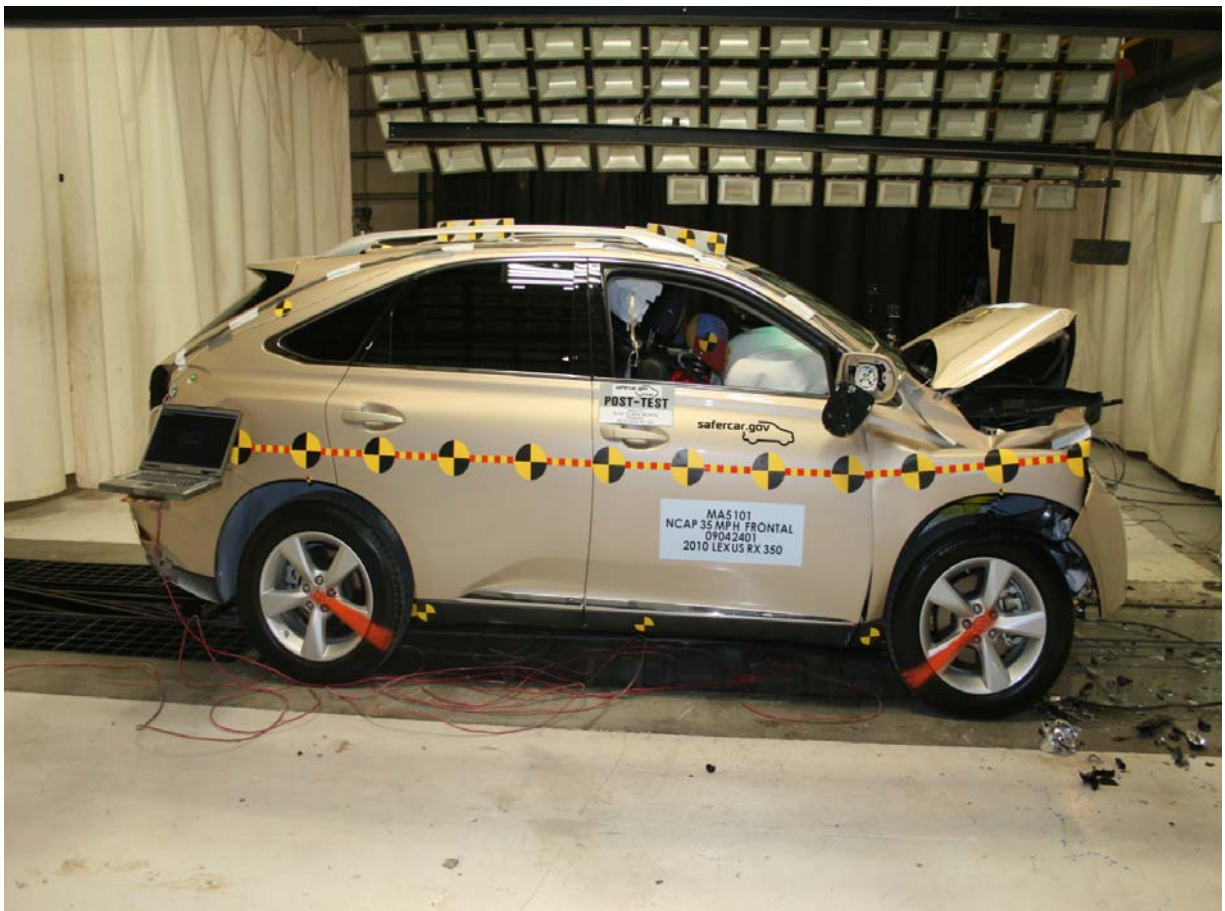
Pre-Test Left Side View (with vehicle at barrier)



Post-Test Left Side View



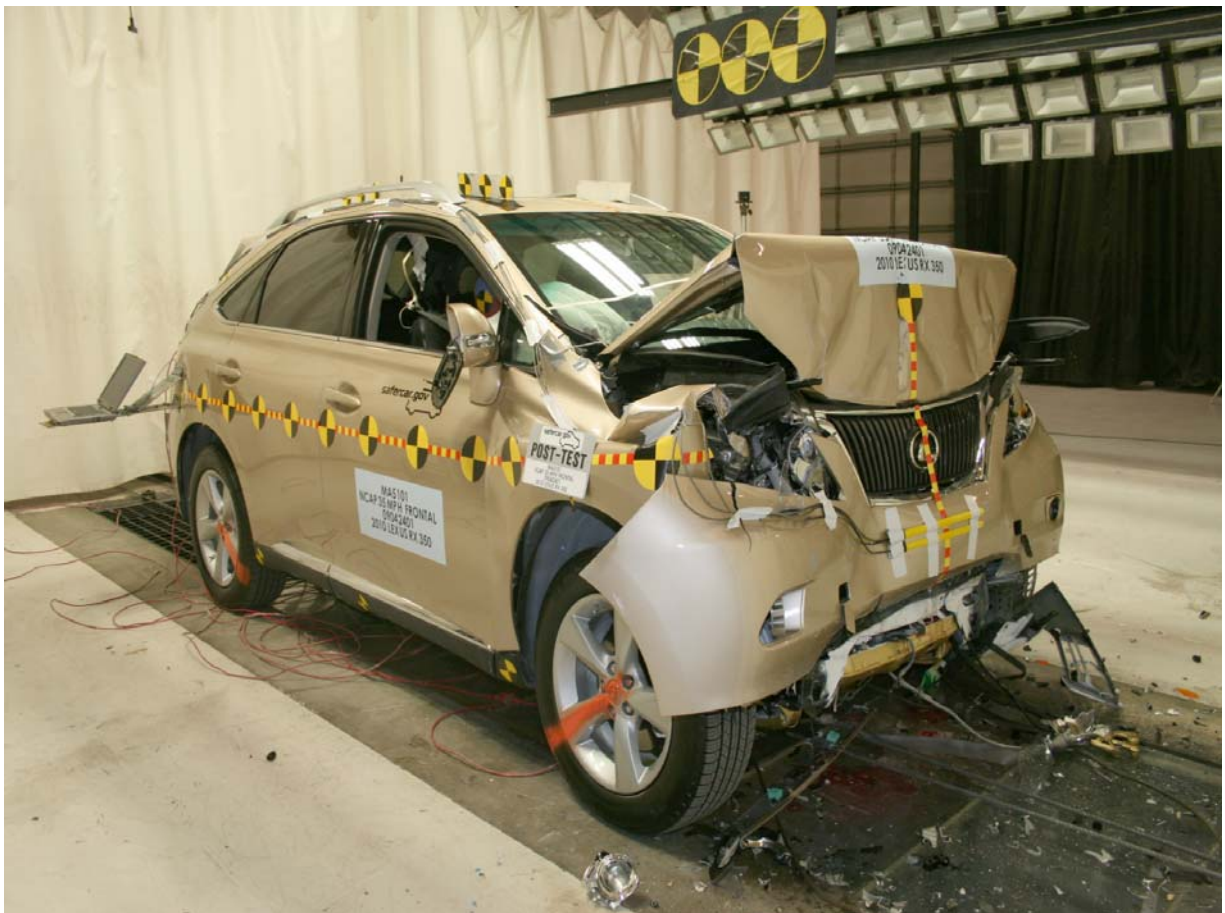
Pre-Test Right Side View (with vehicle at barrier)



Post-Test Right Side View



Pre-Test Right Front $\frac{3}{4}$ View



Post-Test Right Front $\frac{3}{4}$ View



Pre-Test Left Rear $\frac{3}{4}$ View (with vehicle at barrier)



Post-Test Left Rear $\frac{3}{4}$ View



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



Post-Test Engine Compartment View



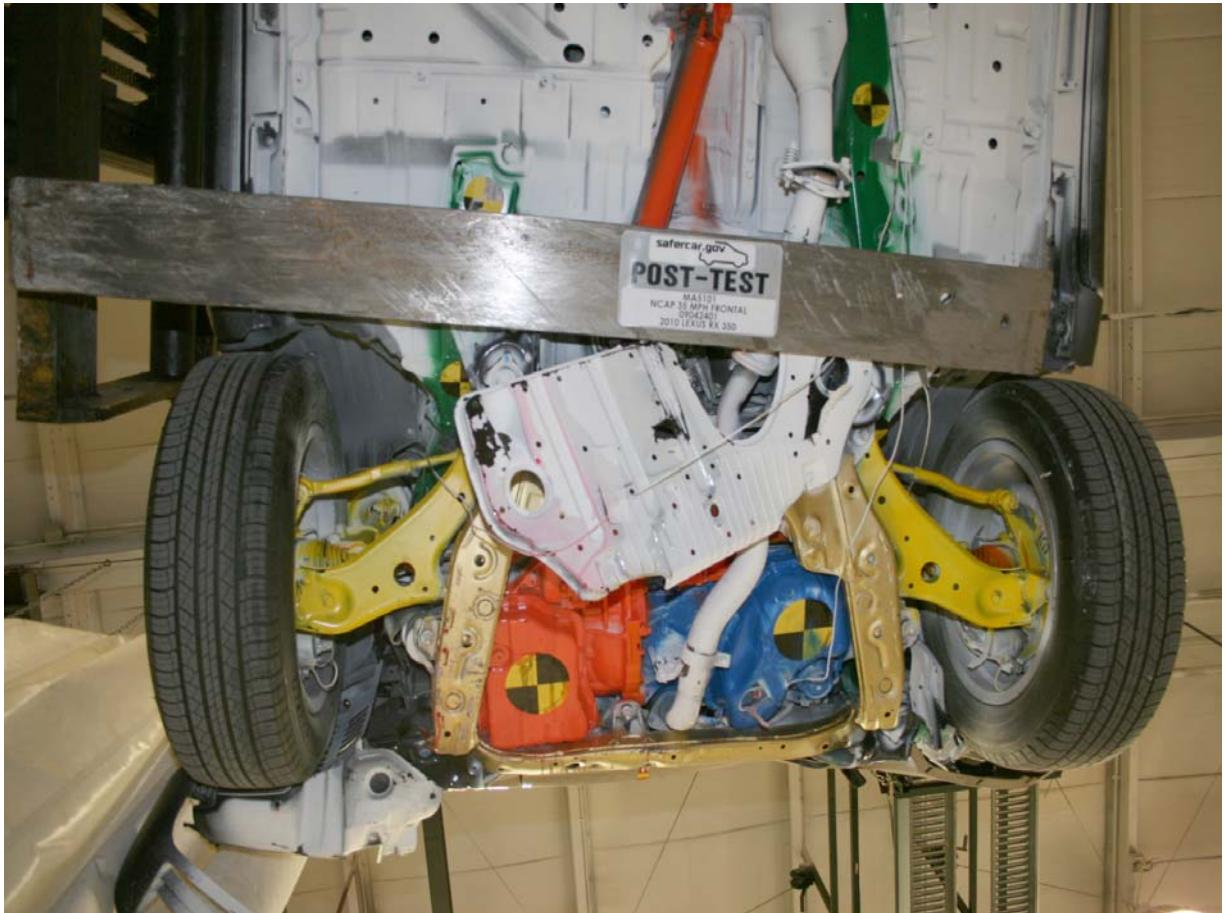
Pre-Test Fuel Cap View



Post-Test Fuel Cap View

NO PHOTO AVAILABLE

Pre-Test Front Underbody View



Post-Test Front Underbody View

NO PHOTO AVAILABLE

Pre-Test Mid Underbody View



Post-Test Mid Underbody View

NO PHOTO AVAILABLE

Pre-Test Rear Underbody View



Post-Test Rear Underbody View

NO PHOTO AVAILABLE

Pre-Test Dummy Cable Routing

NO PHOTO AVAILABLE

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



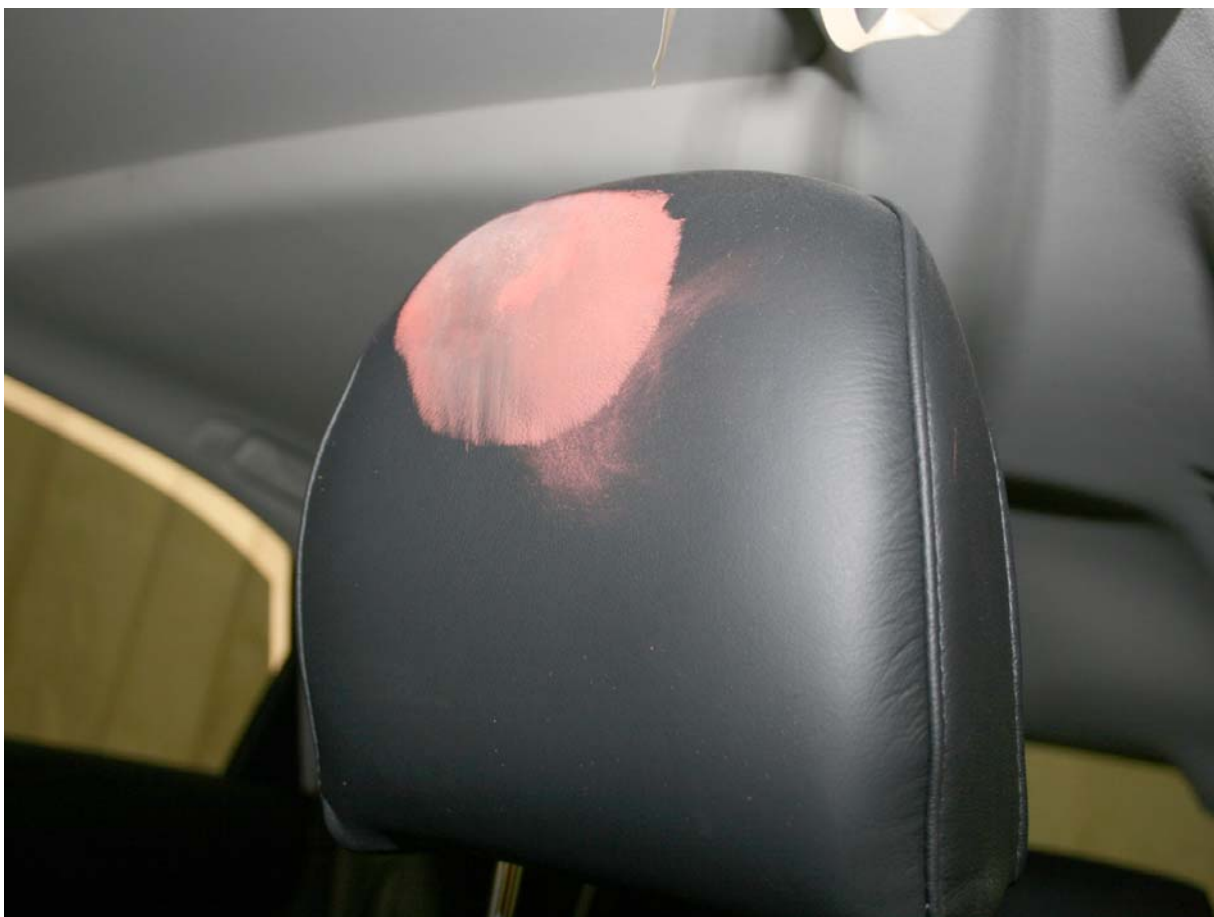
Post-Test Driver's Side Knee Bolster



Pre-Test Driver's Side Floorpan



Post-Test Driver's Side Floorpan



Post-Test Driver Dummy Head Contact



Post-Test Driver Dummy Knee Contact



Post-Test Driver Dummy Airbag Contact



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



Post-Test Passenger's Side Knee Bolster



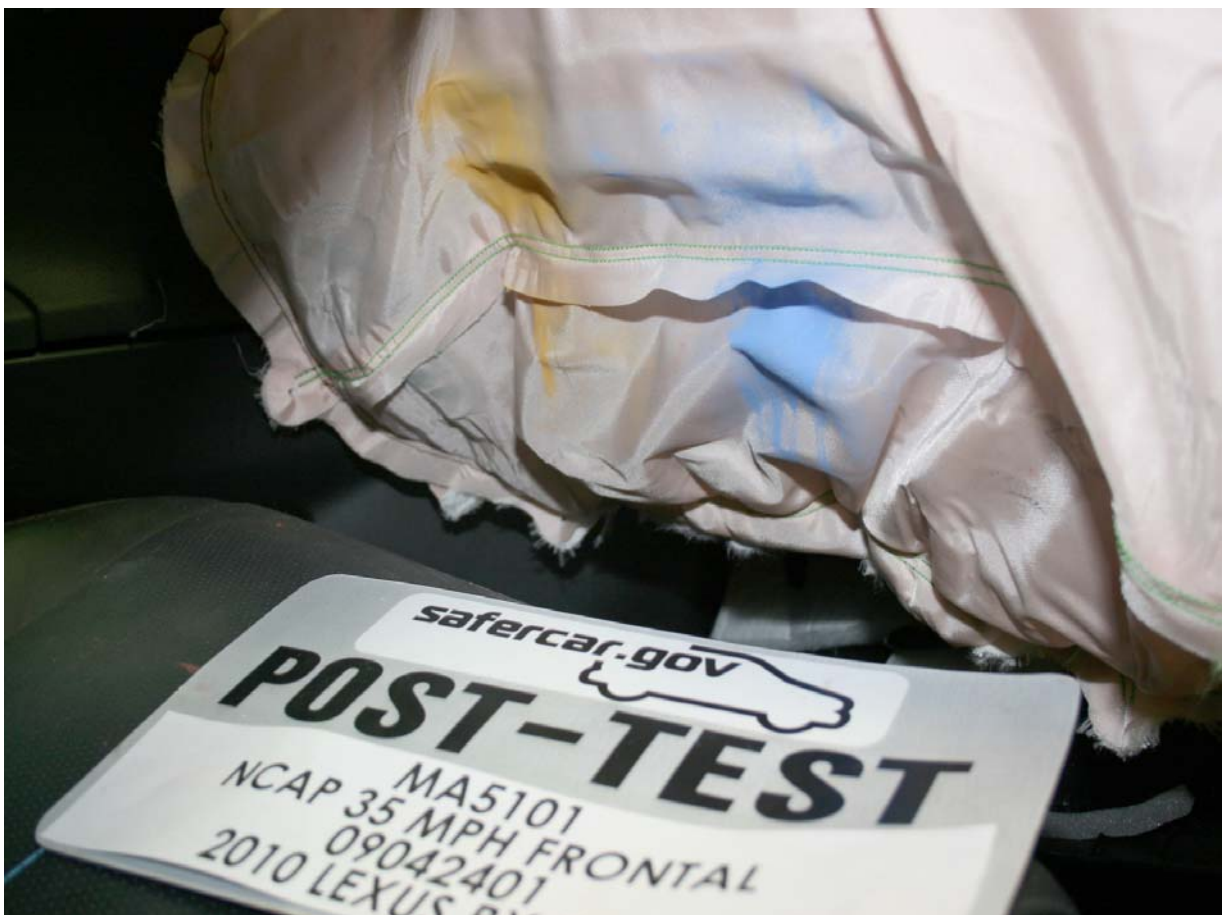
Pre-Test Passenger's Side Floorpan



Post-Test Passenger's Side Floorpan



Post-Test Passenger Dummy Head Contact



Post-Test Passenger Dummy Knee Contact



Post-Test Passenger Dummy Airbag Contact



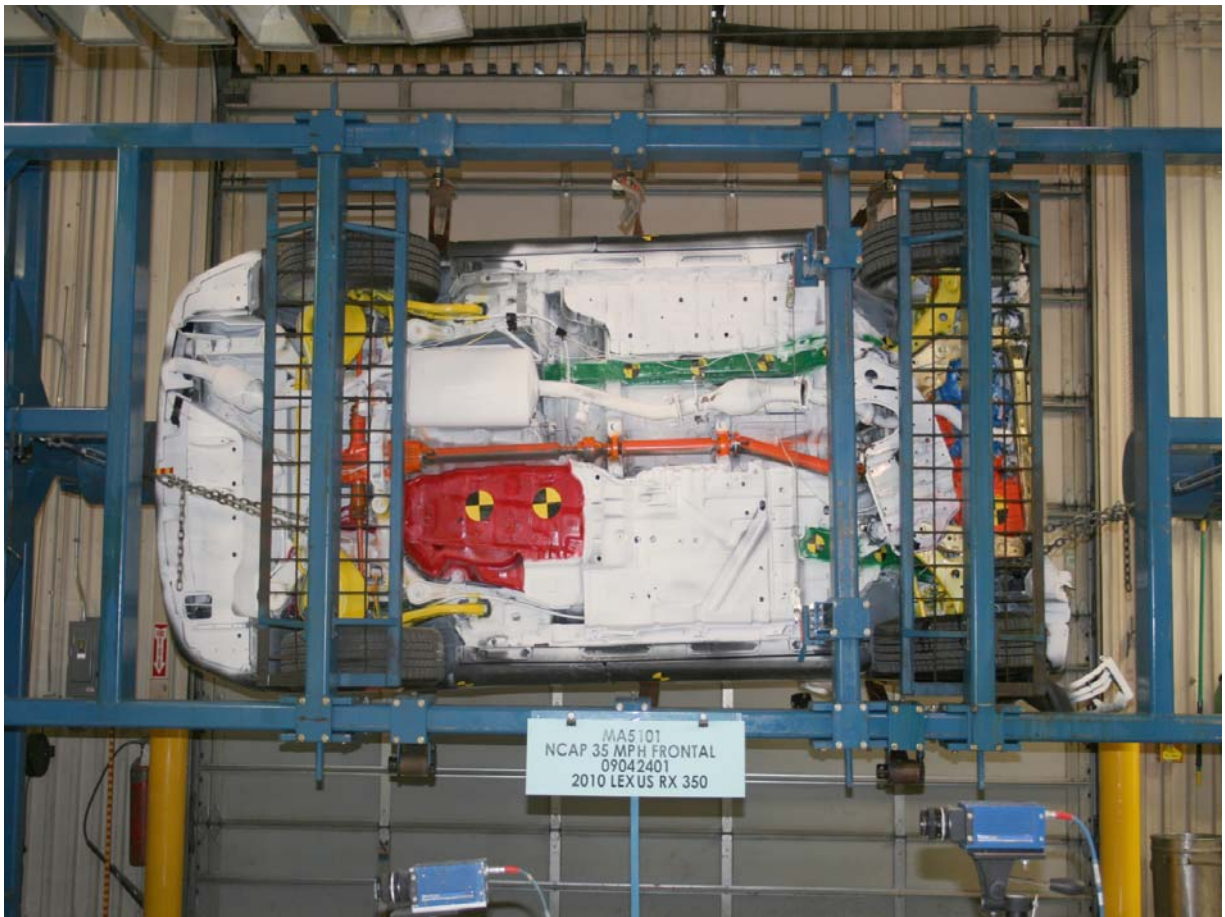
Ballast Installed in Vehicle



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

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 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 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

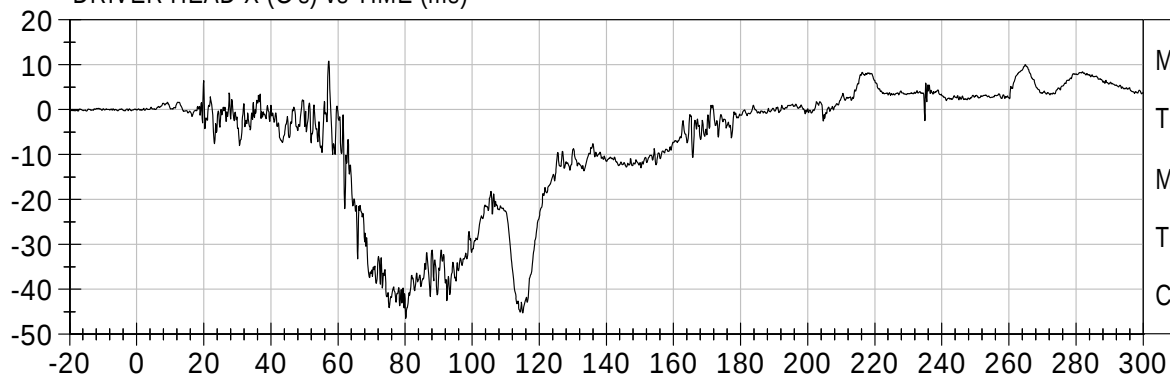


NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

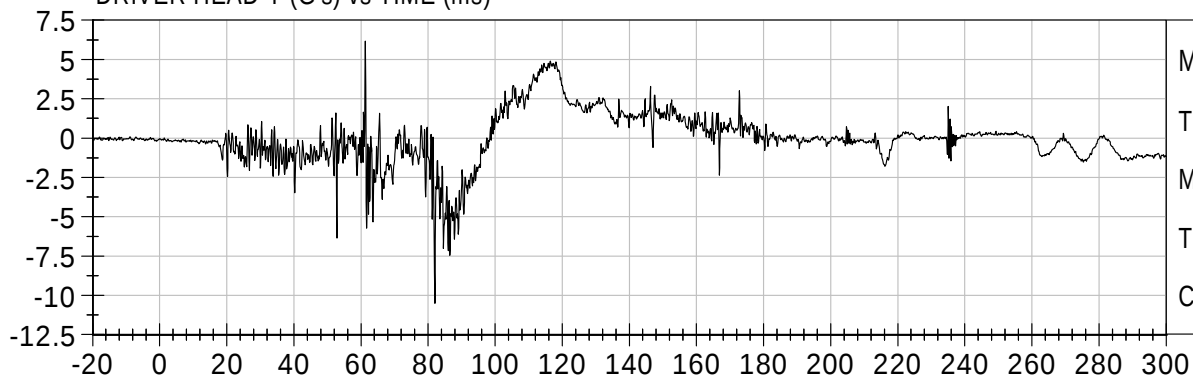
Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)

DRIVER HEAD X (G's) vs TIME (ms)



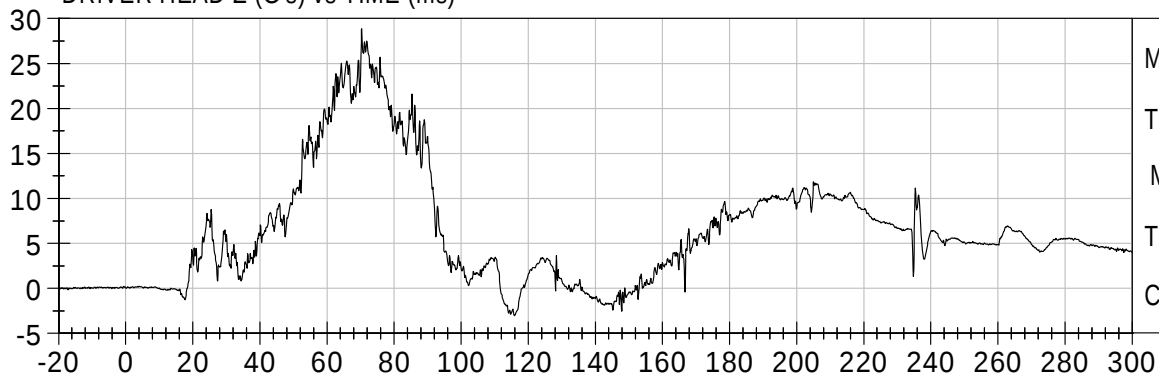
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Tmax: 57.3 ms
Min: -46.4 G's
Tmin: 80.2 ms
CFC 1000

DRIVER HEAD Y (G's) vs TIME (ms)



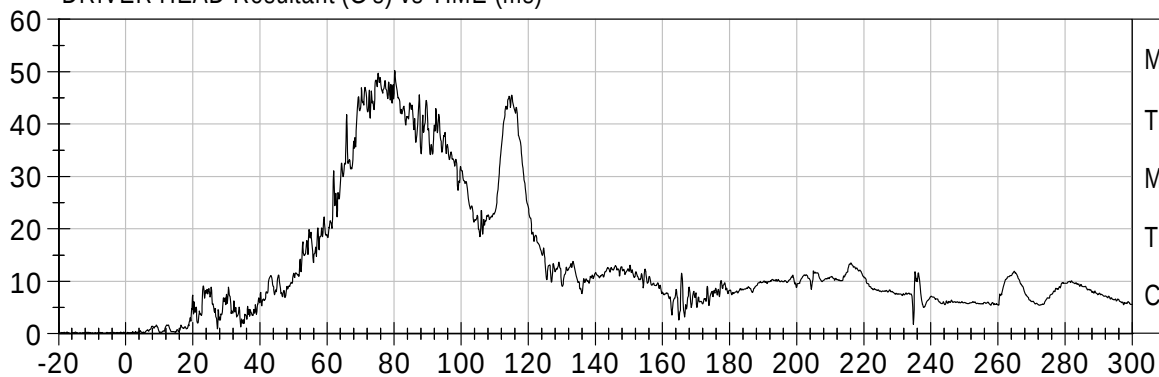
Max: 6.2 G's
Tmax: 61.3 ms
Min: -10.5 G's
Tmin: 82.0 ms
CFC 1000

DRIVER HEAD Z (G's) vs TIME (ms)



Max: 28.9 G's
Tmax: 70.4 ms
Min: -3.0 G's
Tmin: 115.8 ms
CFC 1000

DRIVER HEAD Resultant (G's) vs TIME (ms)



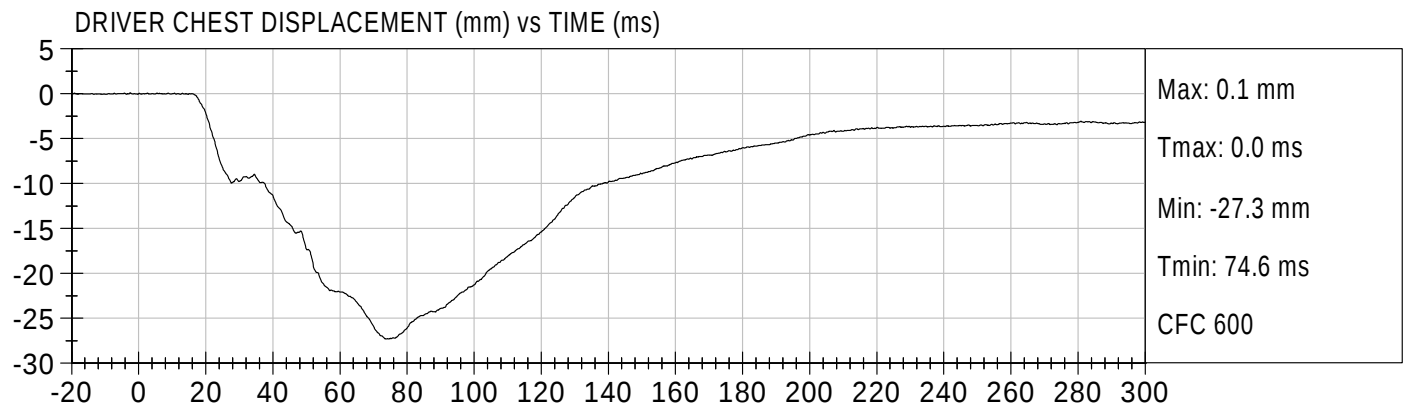
Max: 50.2 G's
Tmax: 80.2 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 1000

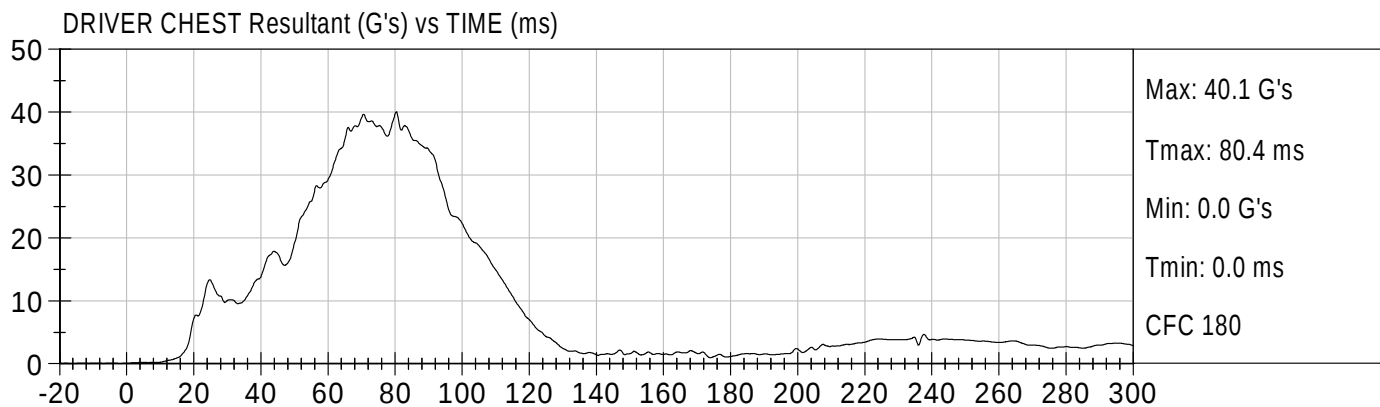
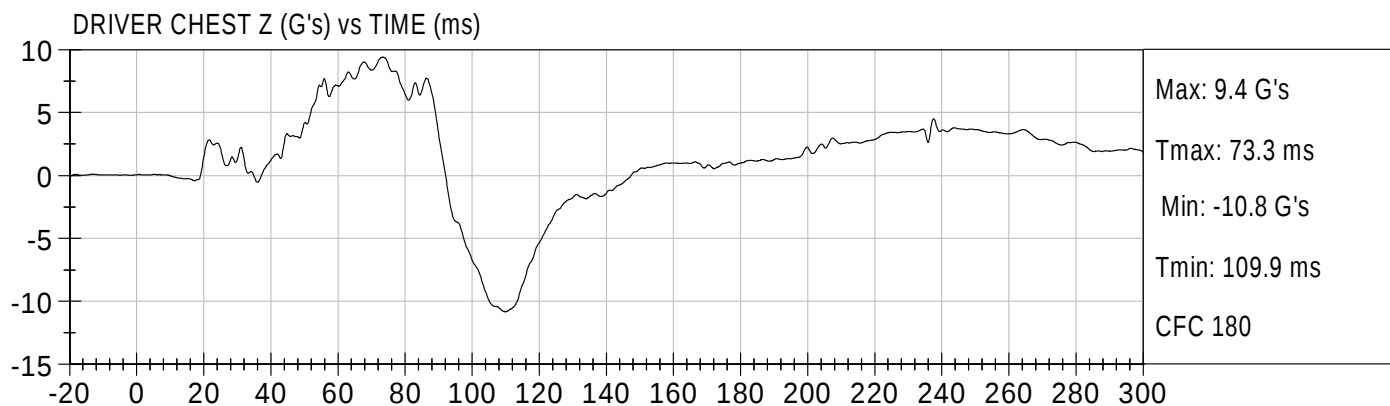
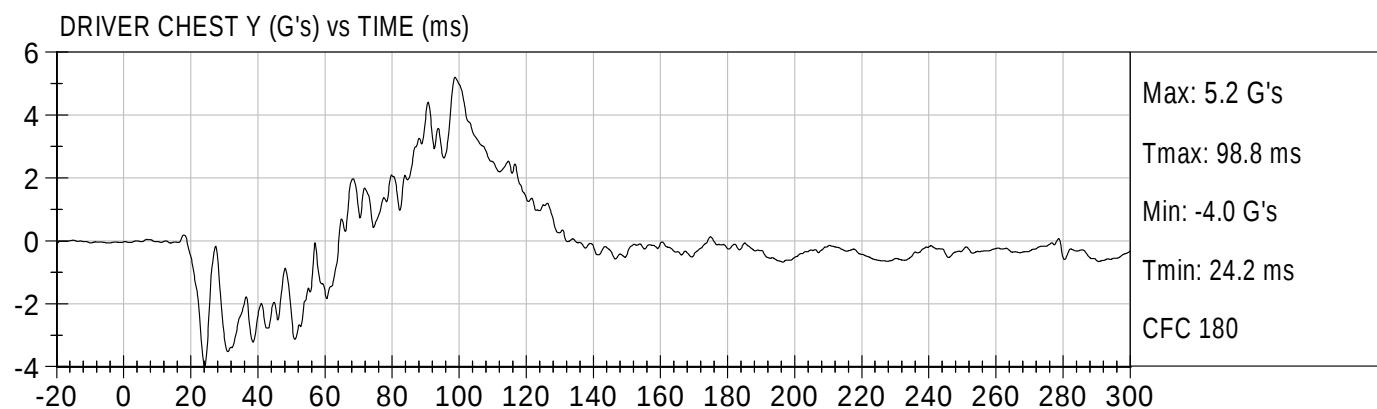
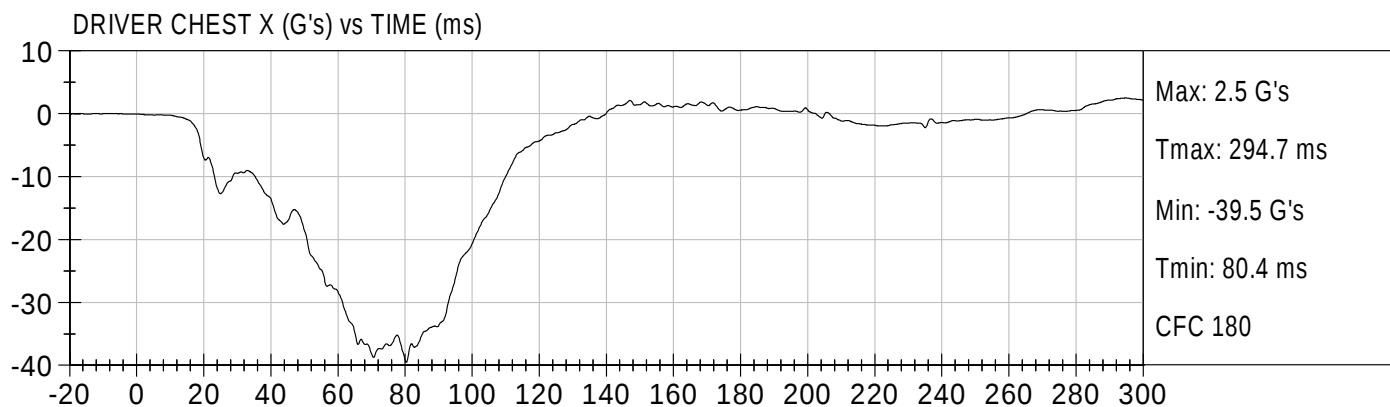


NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)



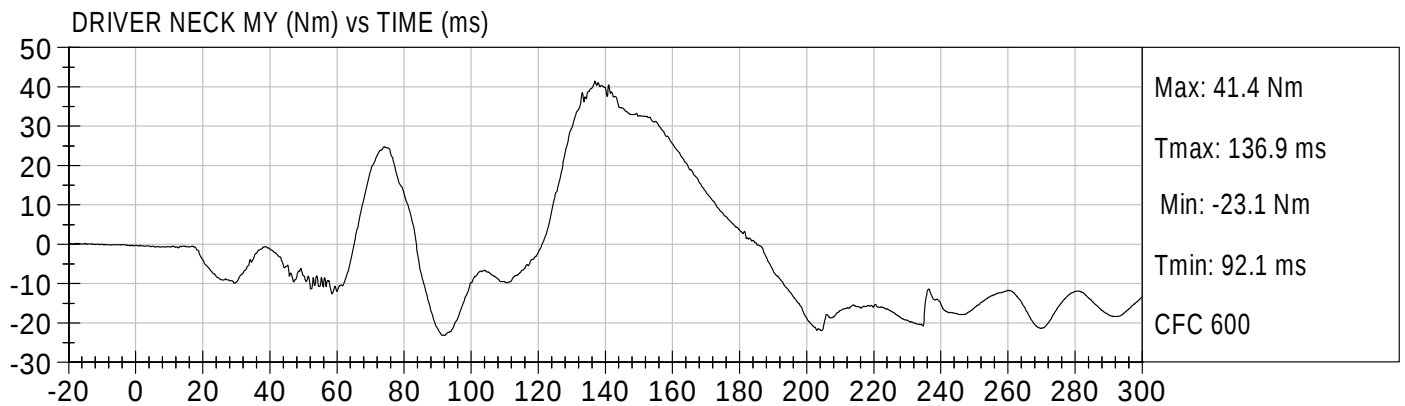
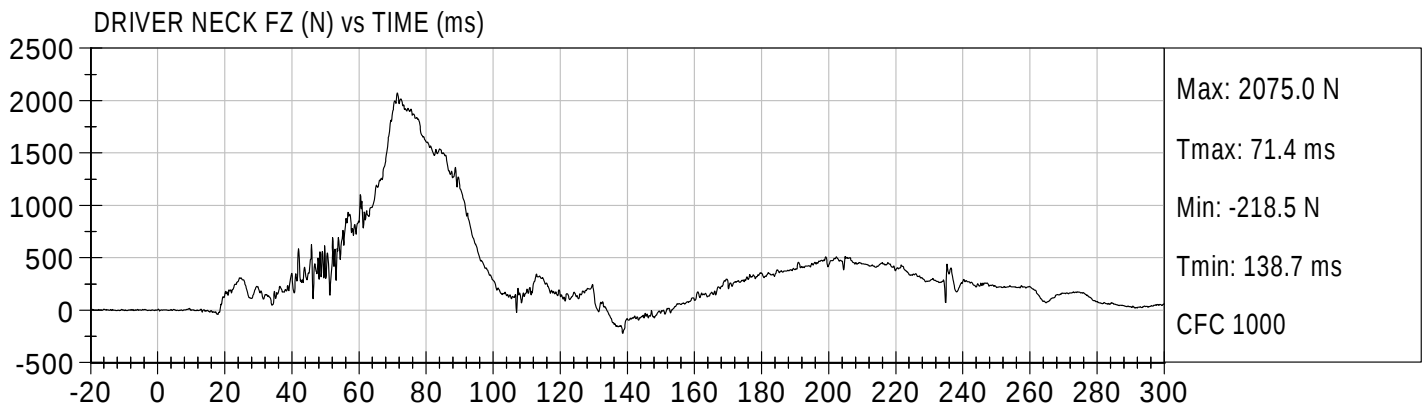
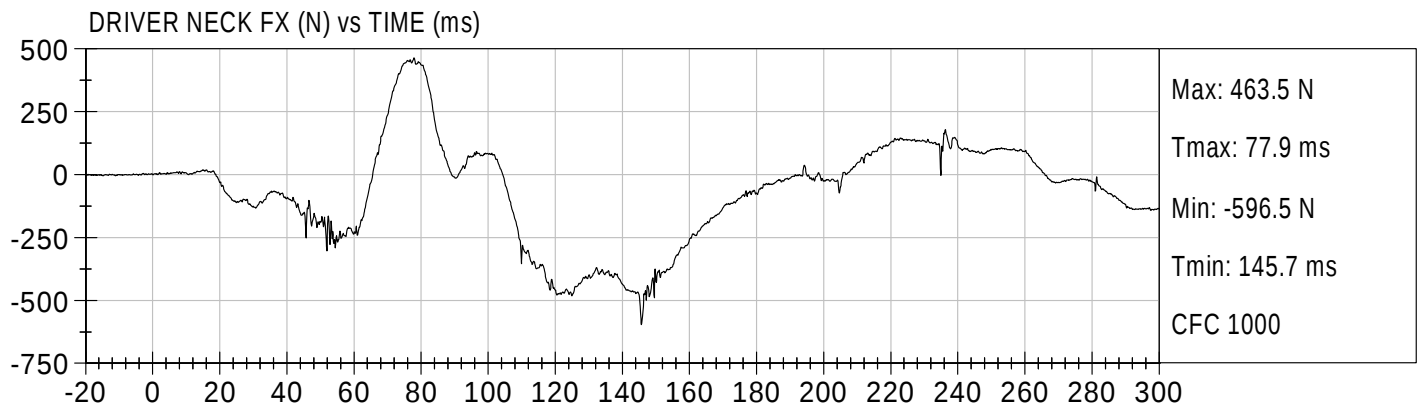




NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)



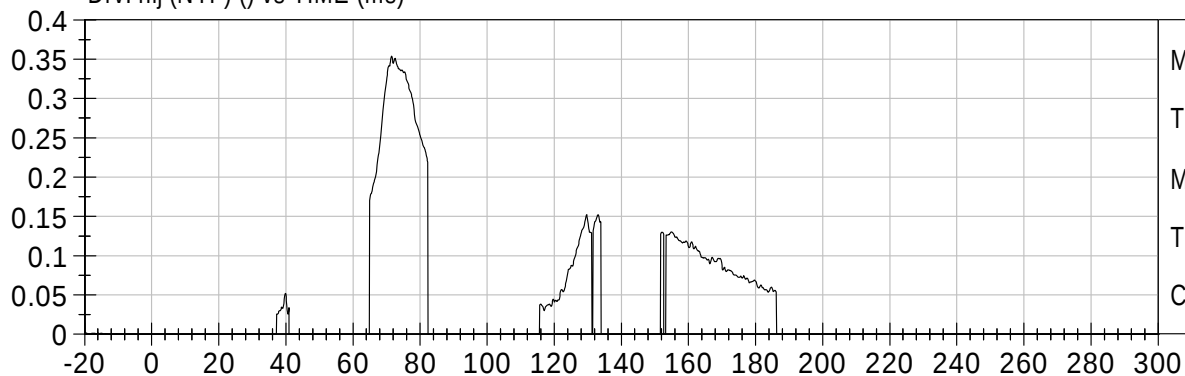


NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

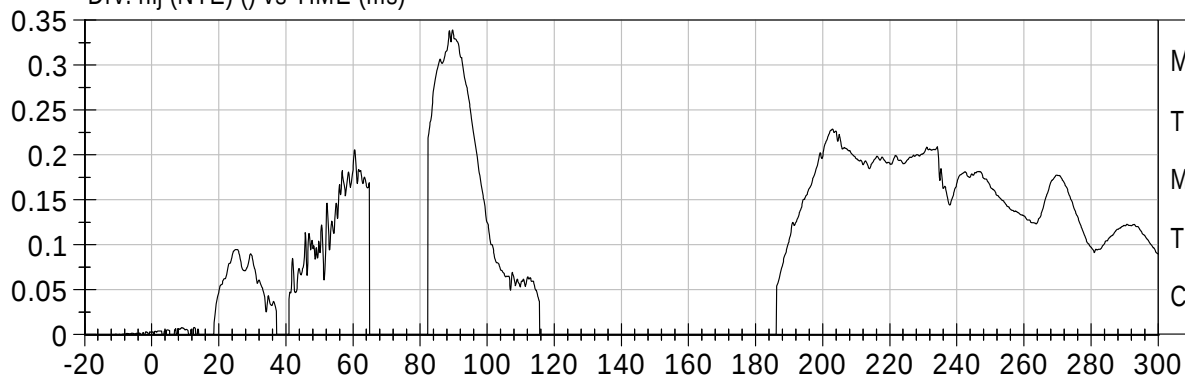
Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)

Drv. nij (NTF) () vs TIME (ms)



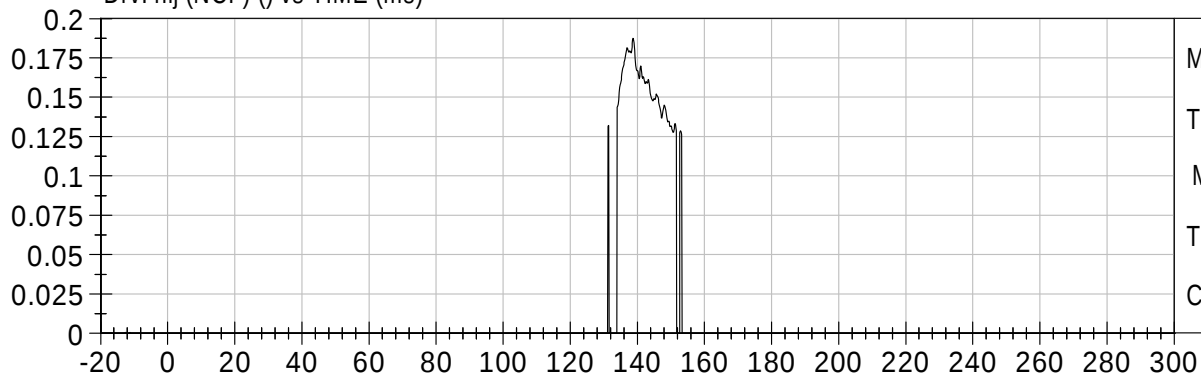
Max: 0.4
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Min: 0.0
Tmin: 0.0 ms
CFC 600

Drv. nij (NTE) () vs TIME (ms)



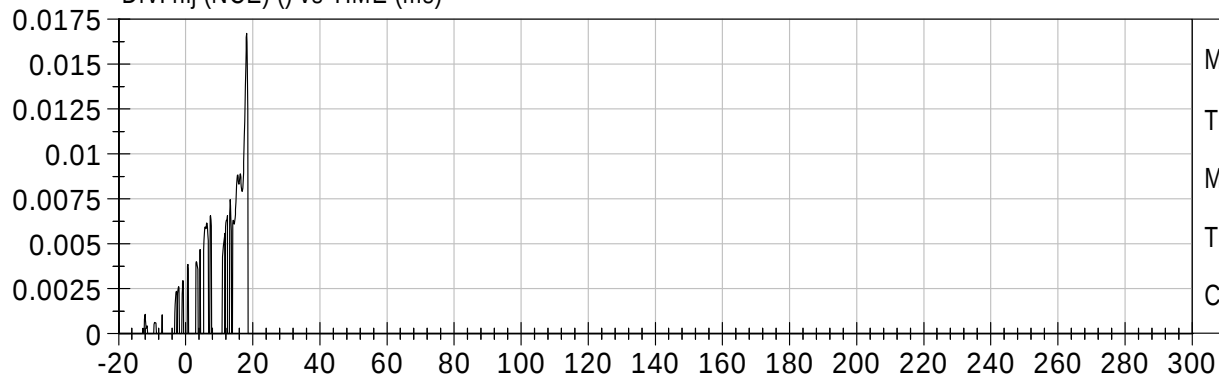
Max: 0.3
Tmax: 89.7 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Drv. nij (NCF) () vs TIME (ms)



Max: 0.2
Tmax: 138.7 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Drv. nij (NCE) () vs TIME (ms)



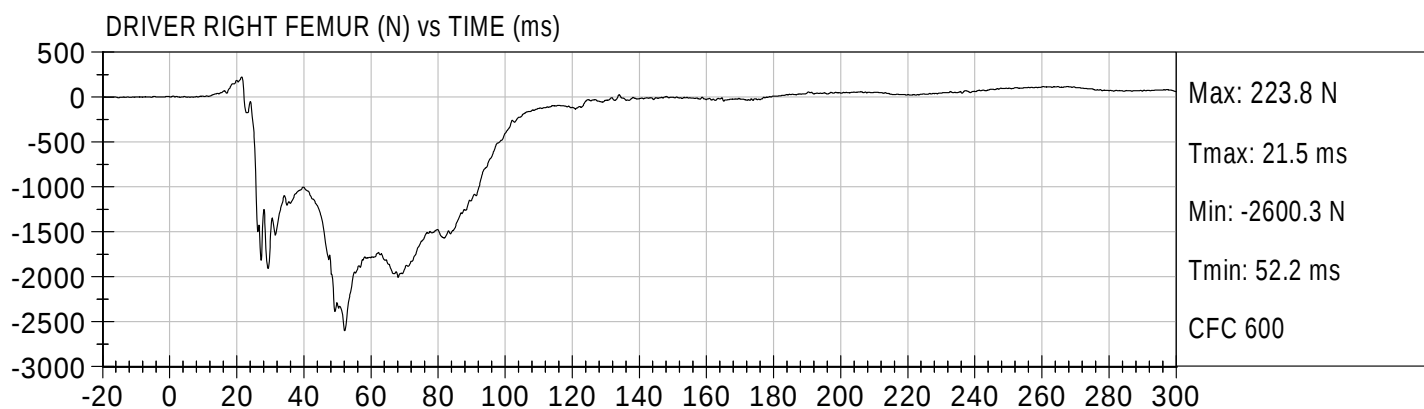
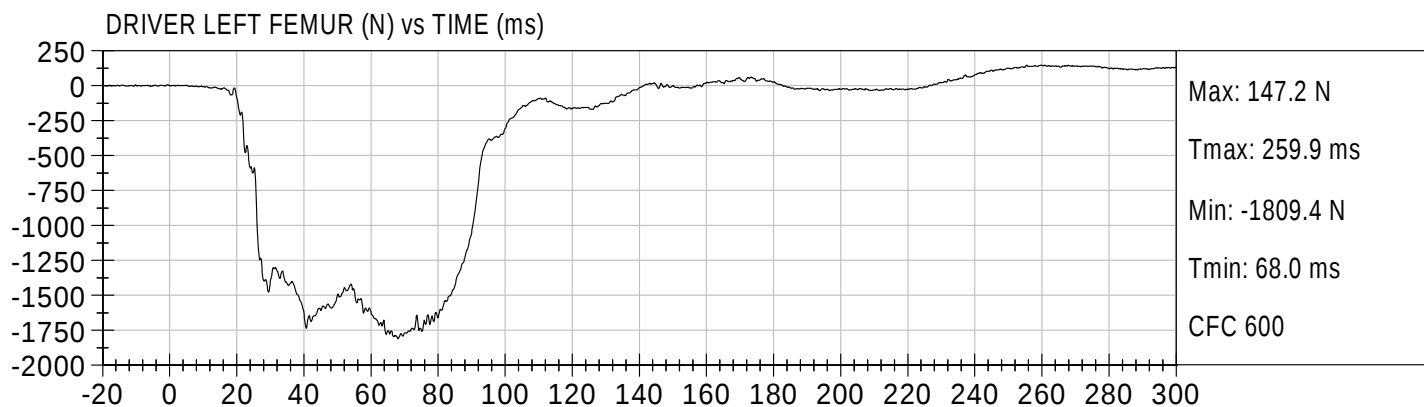
Max: 0.0
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Min: 0.0
Tmin: 0.0 ms
CFC 600



NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)



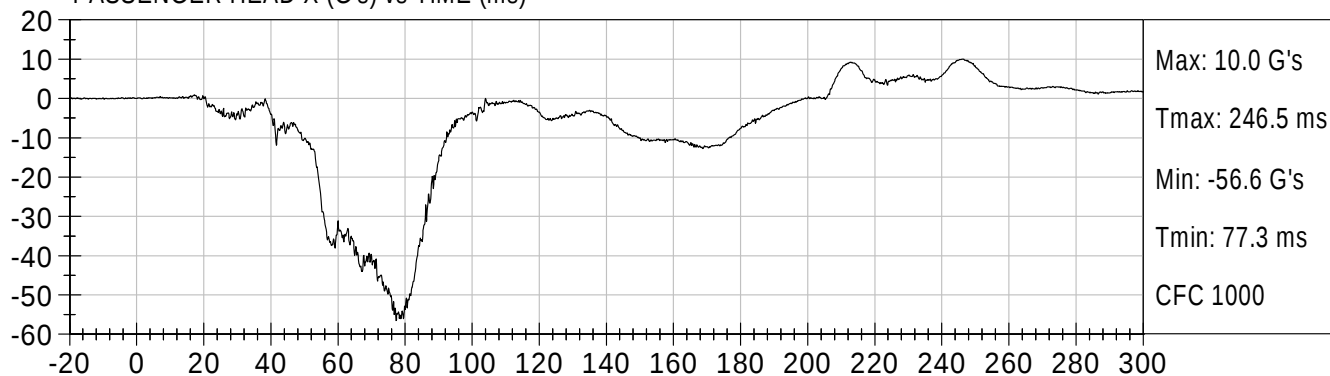


NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

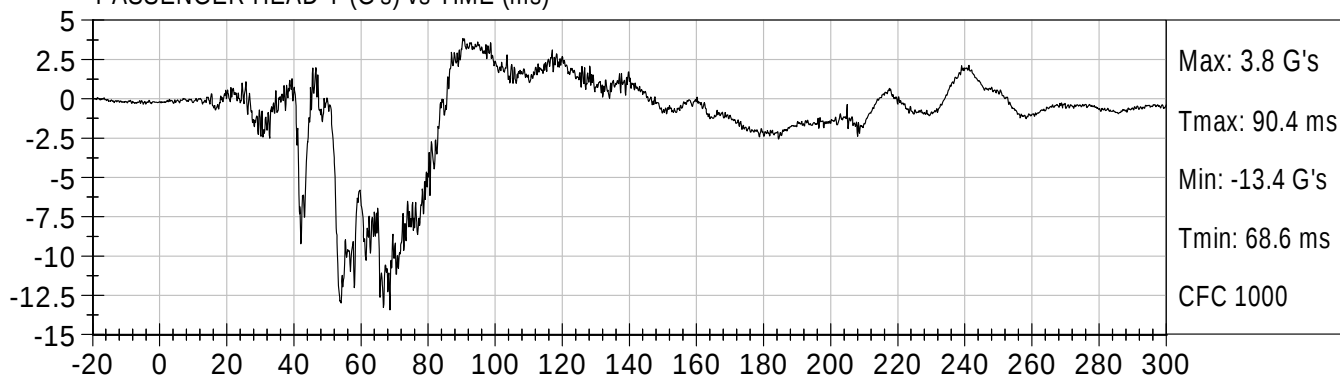
MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)

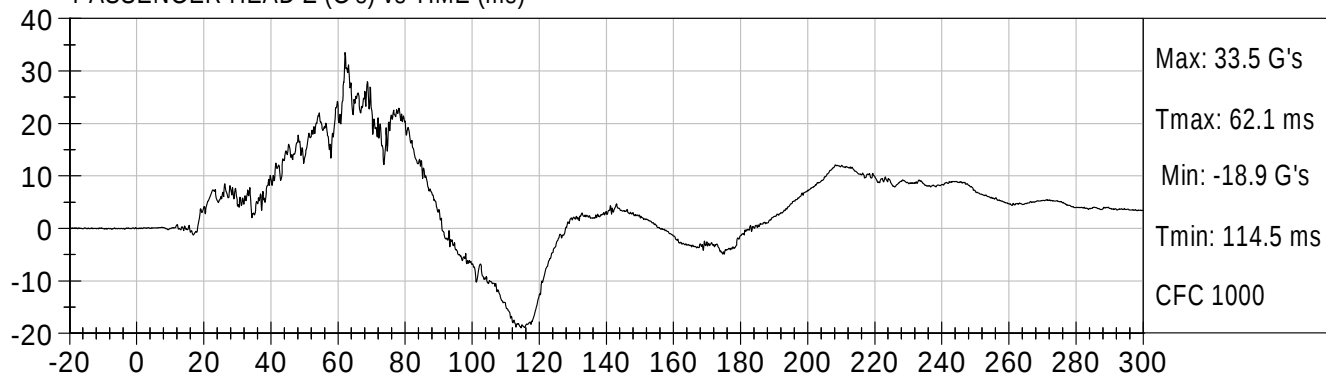
PASSENGER HEAD X (G's) vs TIME (ms)



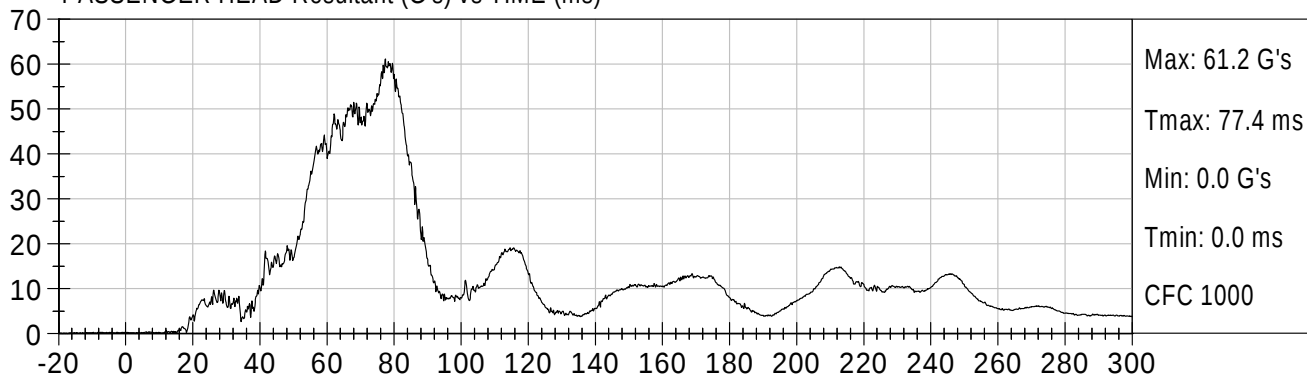
PASSENGER HEAD Y (G's) vs TIME (ms)



PASSENGER HEAD Z (G's) vs TIME (ms)



PASSENGER HEAD Resultant (G's) vs TIME (ms)

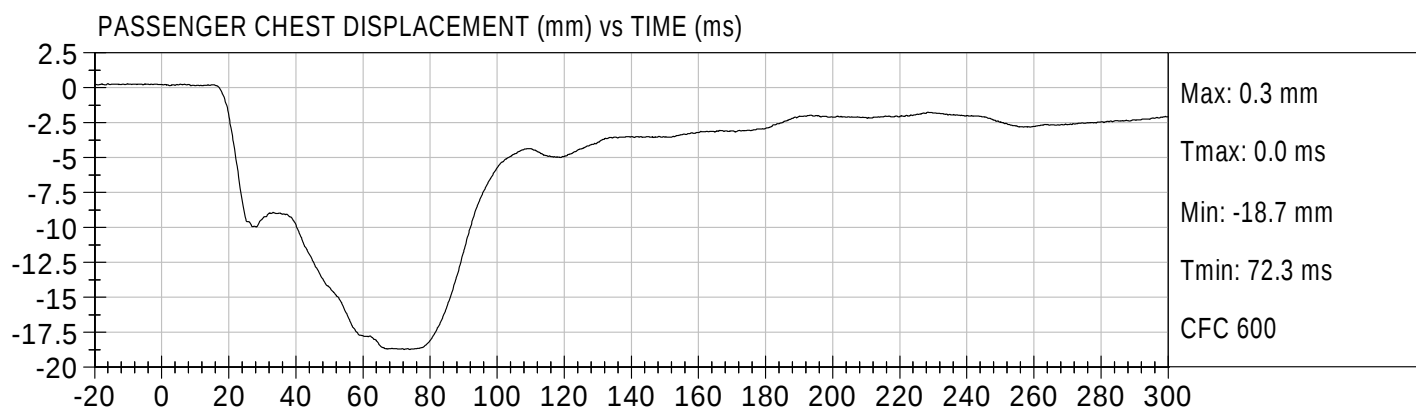




NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)

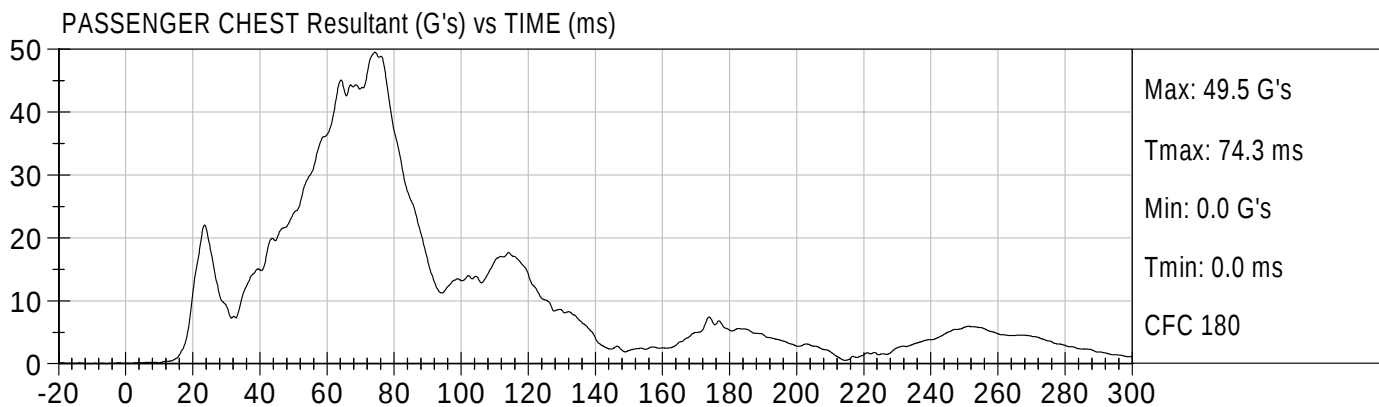
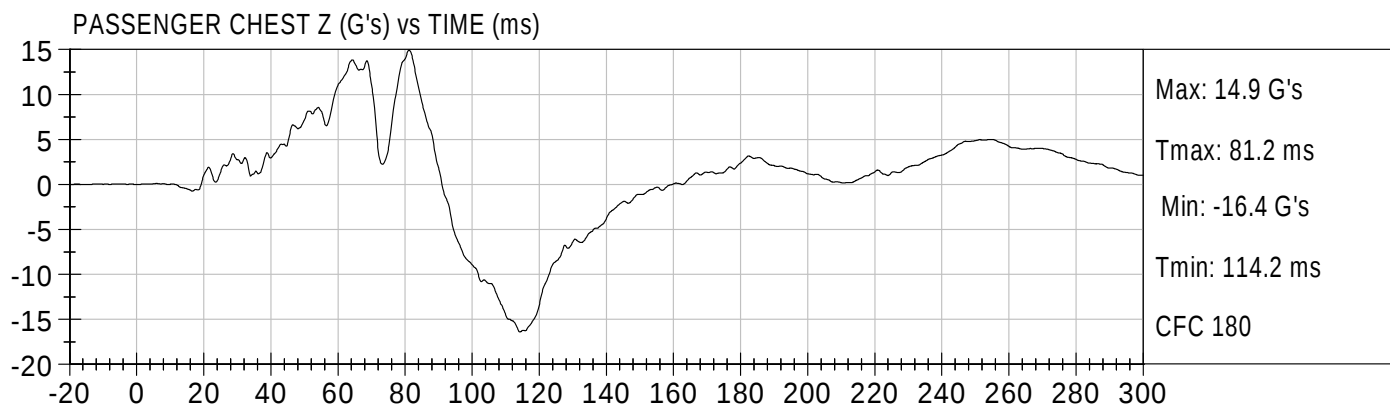
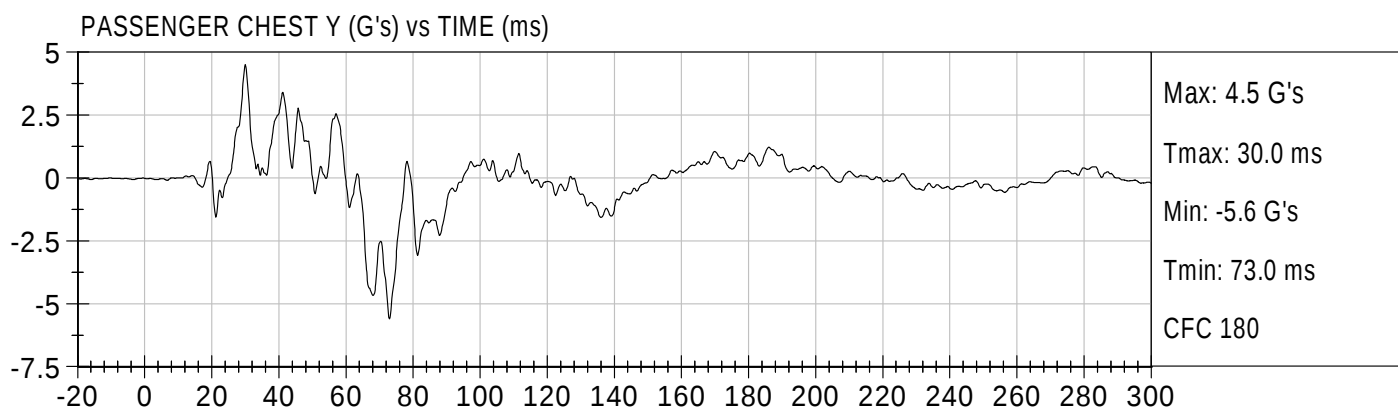
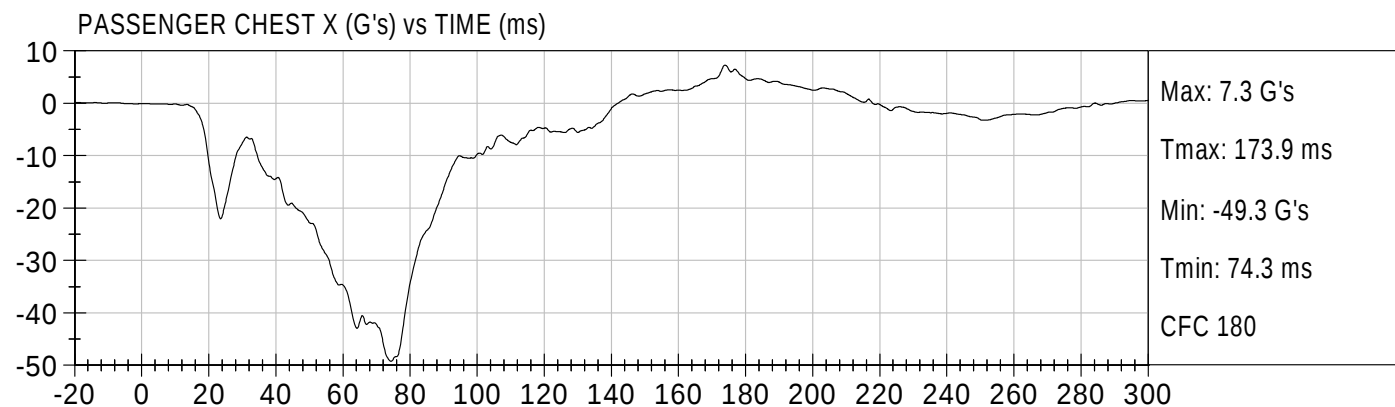




NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)



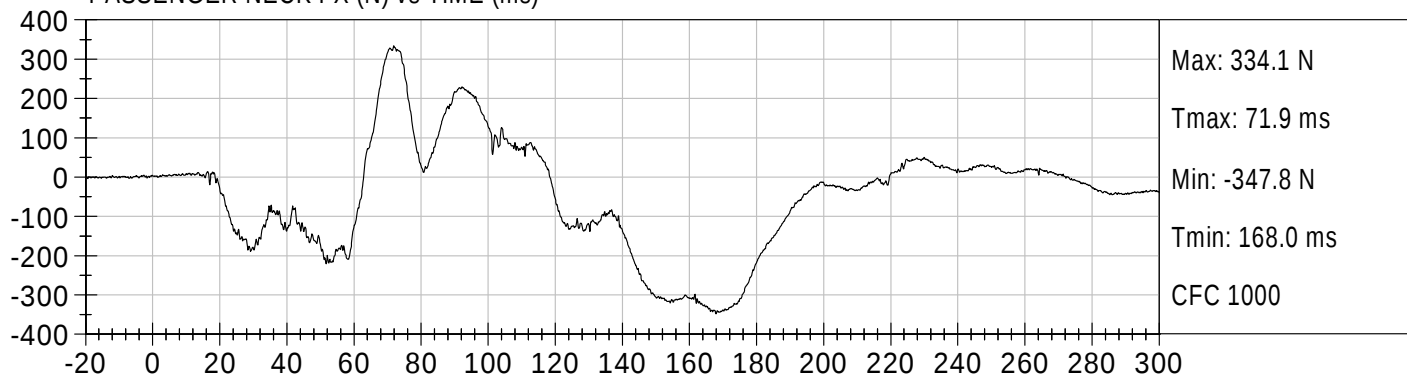


NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

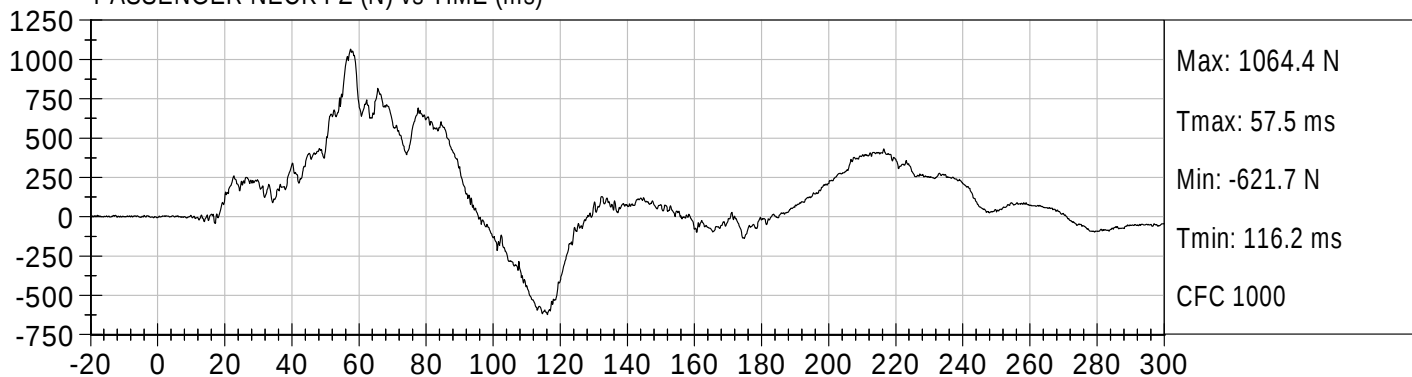
MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)

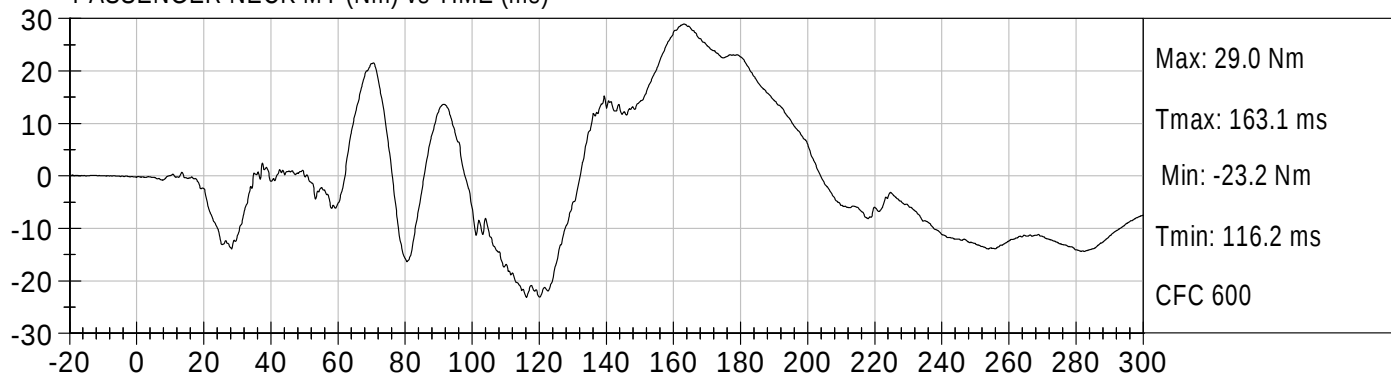
PASSENGER NECK FX (N) vs TIME (ms)



PASSENGER NECK FZ (N) vs TIME (ms)



PASSENGER NECK MY (Nm) vs TIME (ms)

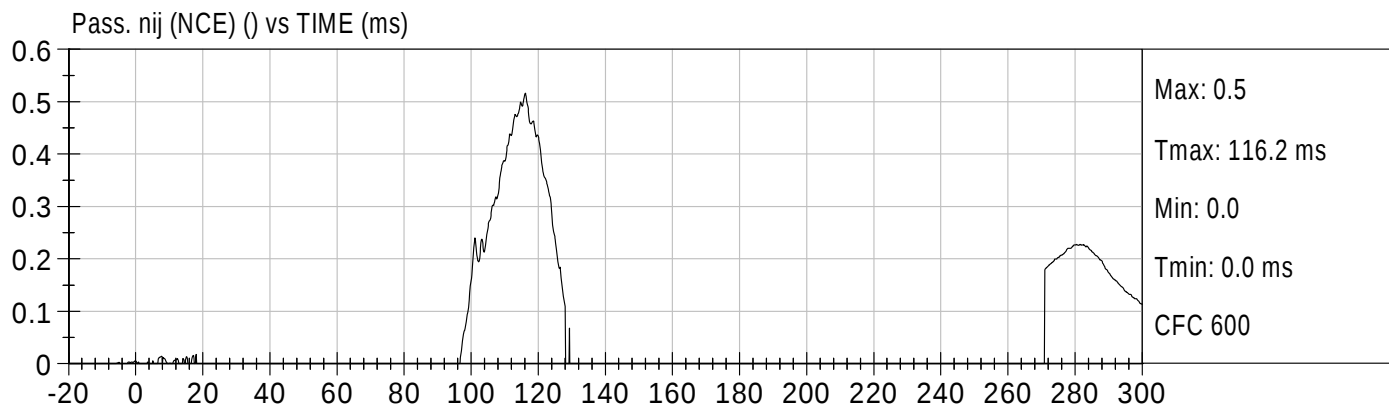
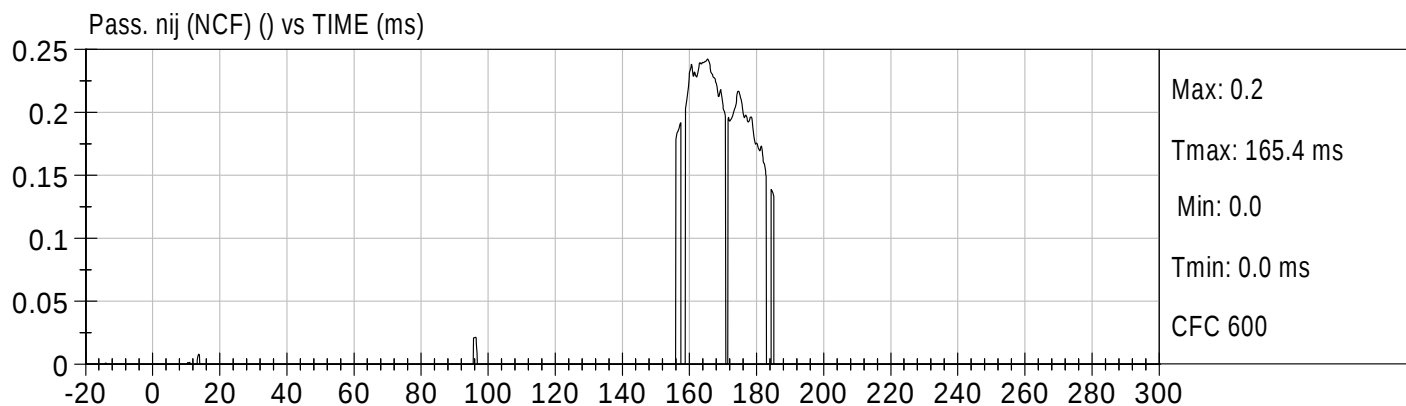
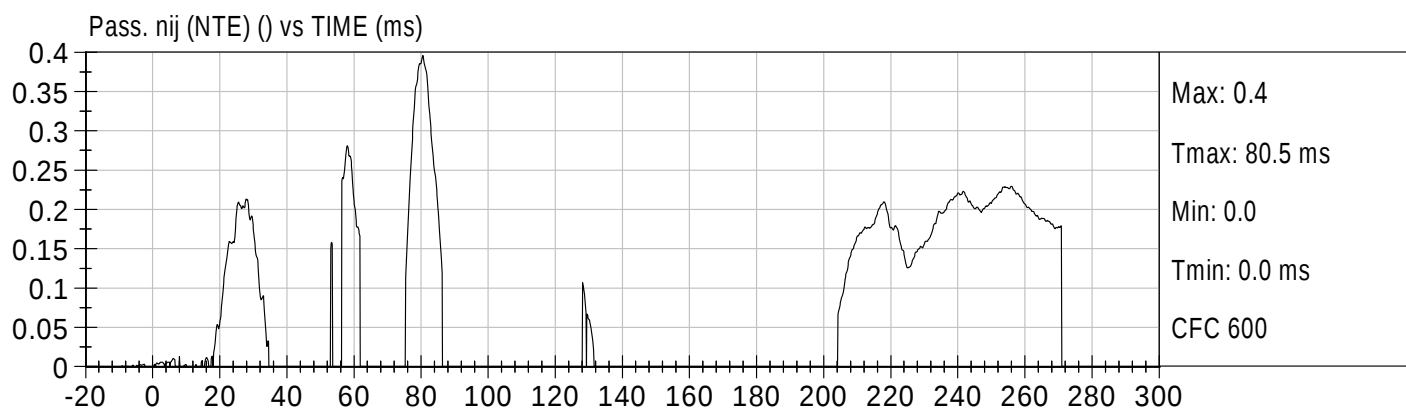
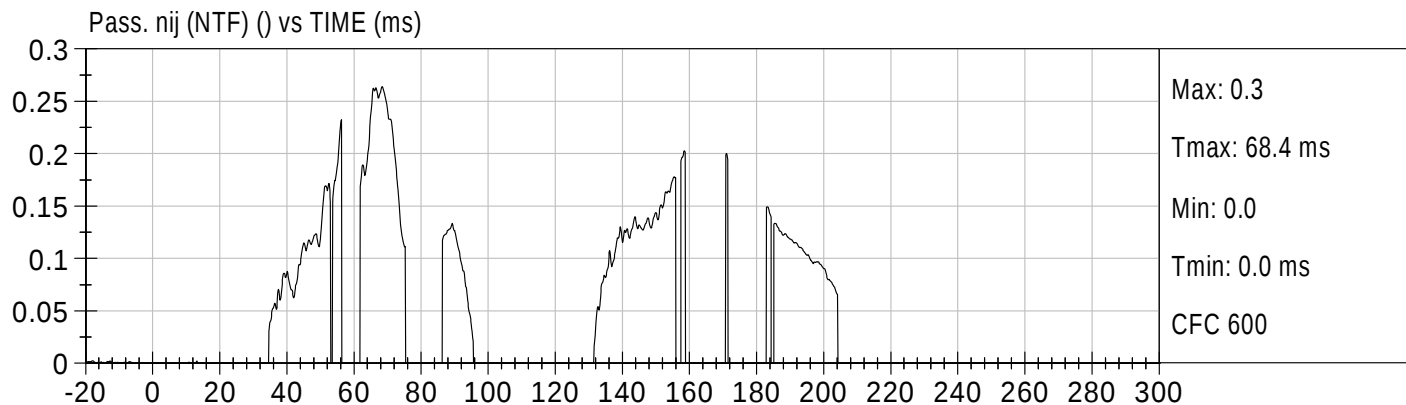




NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)

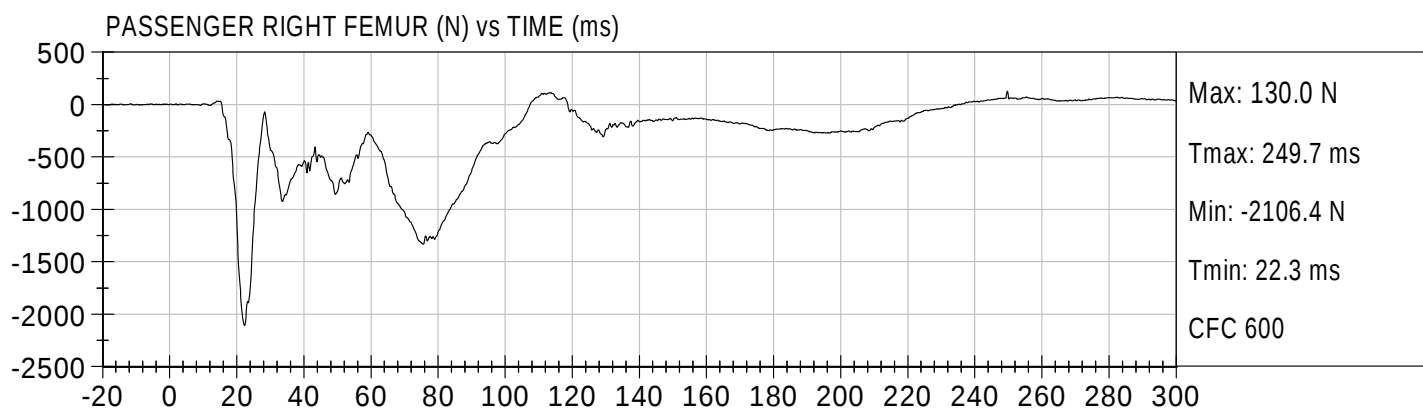
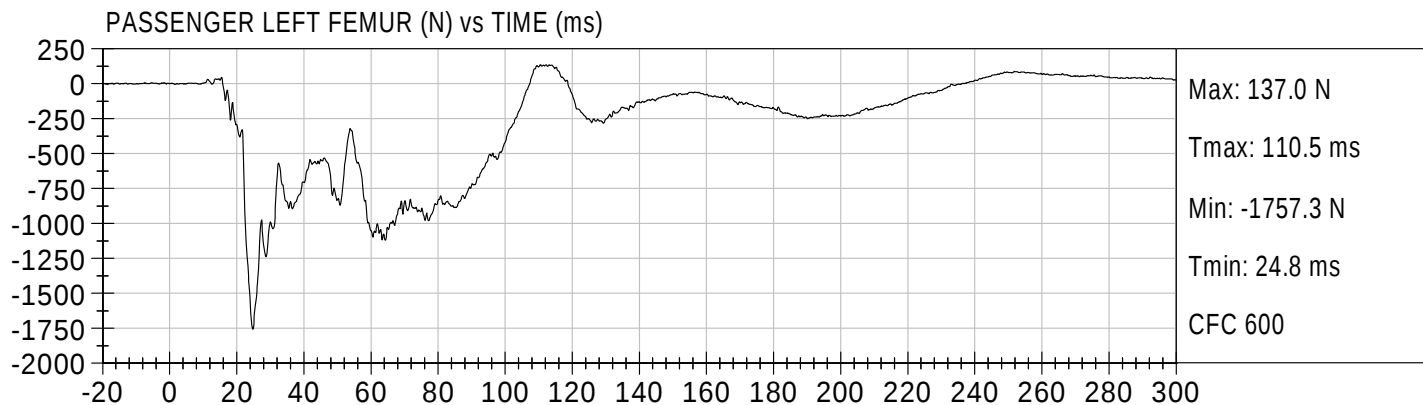




NCAP 35 MPH FRONTAL
2010 LEXUS RX 350

MA5101

Test Date: 04/24/2009
Speed: 35.0 mph (56.3 km/h)



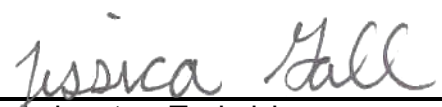
APPENDIX C
DUMMY CALIBRATION DATA

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

ATD Serial No: 1045

Test ID: D09831

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	27	Pass
Peak Resultant Acceleration	G's	225 - 275	248	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

4/13/09
Test Date

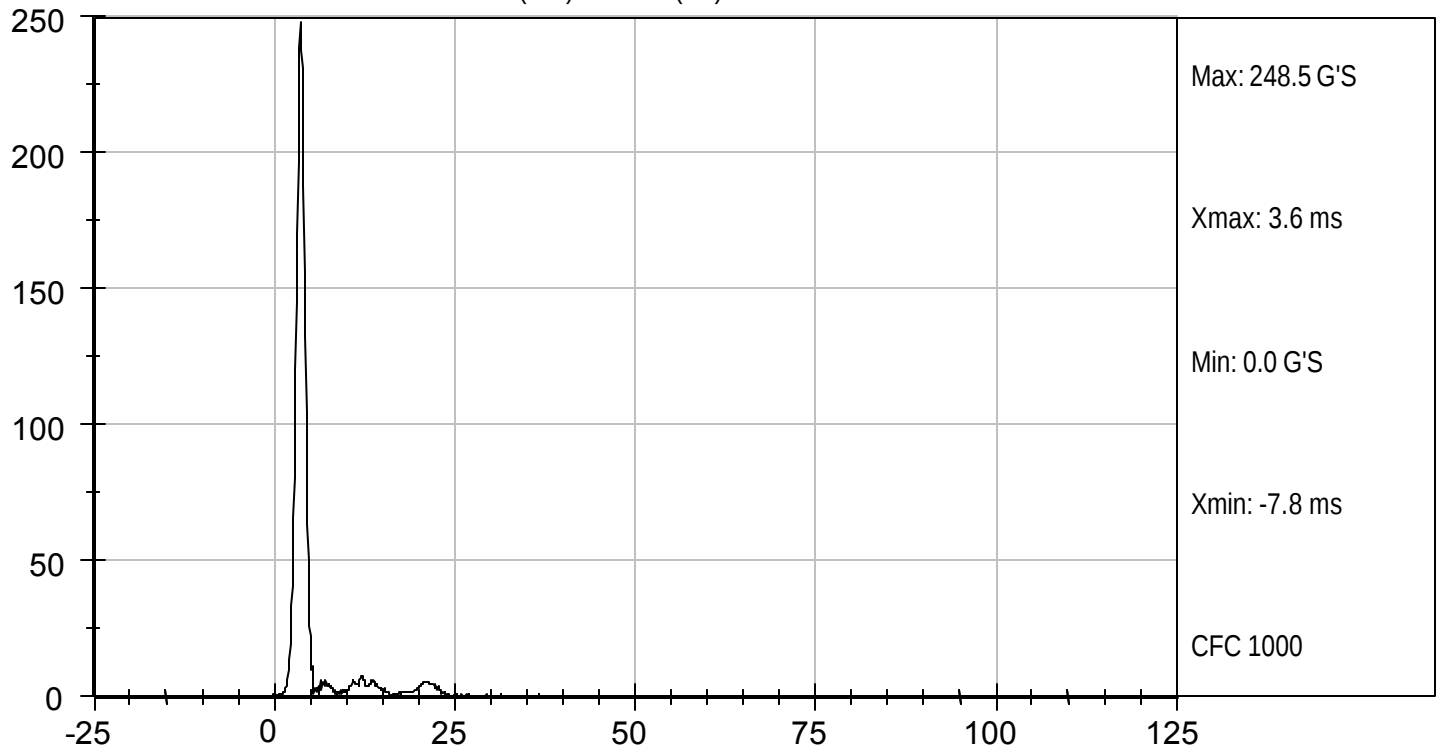

Approved By



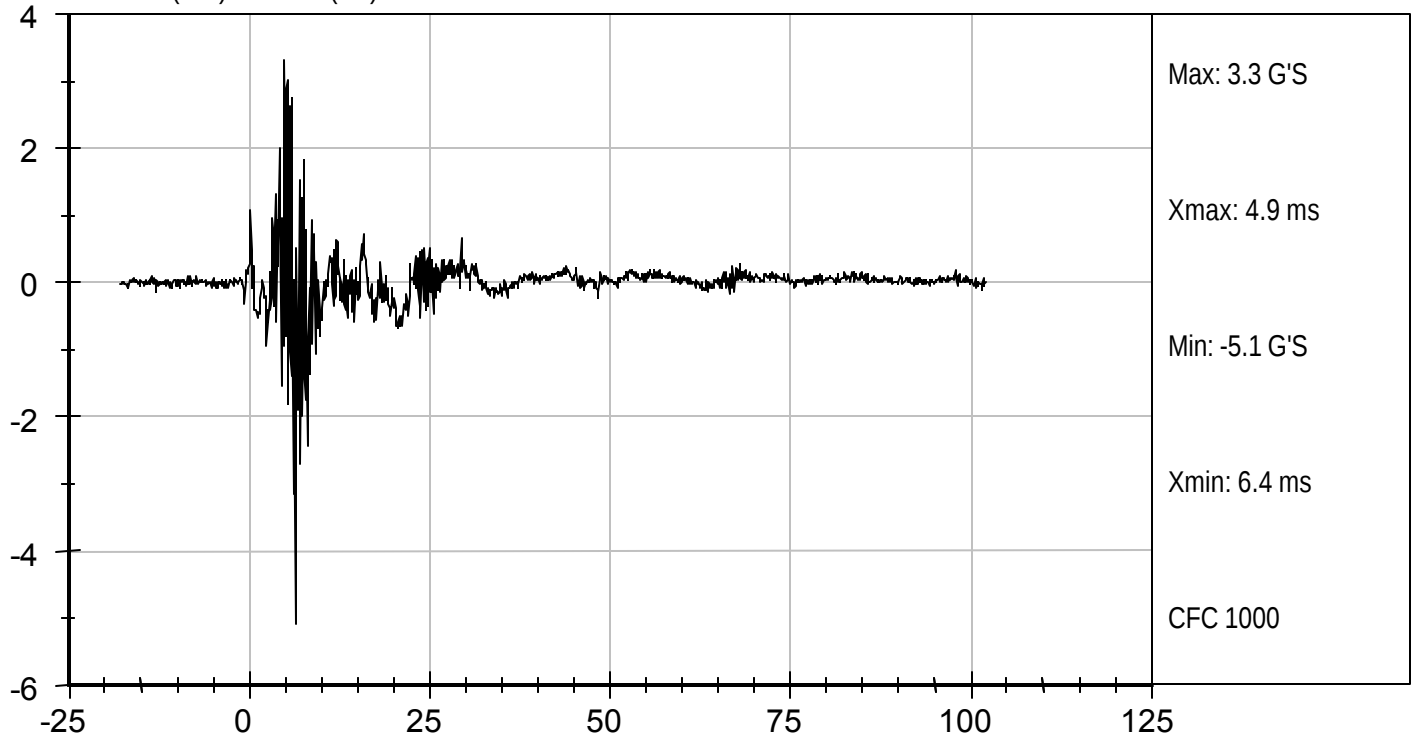
Test Desc: Head Drop
Component ID: D09831

Test Date: 4/13/09
Velocity: 0 ft/s, 0 m/s

RESULTANT HEAD ACCELERATION (G'S) vs TIME (ms)



HEAD Y (G'S) vs TIME (ms)

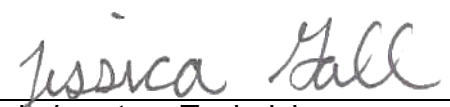


MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 1045

Test I.D: D09832

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	27	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	23.60	Pass
	20 msec	G's	17.60 to 22.60	19.25	Pass
	30 msec	G's	12.50 to 18.50	15.23	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.2	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	36.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	67.6	Pass
	Time	msec	57.0 to 64.0	58.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	113.3	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	107.0	Pass
	Time	msec	47.0 to 58.0	47.8	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	97.6	Pass
Overall Test Results					Pass


 Laboratory Technician

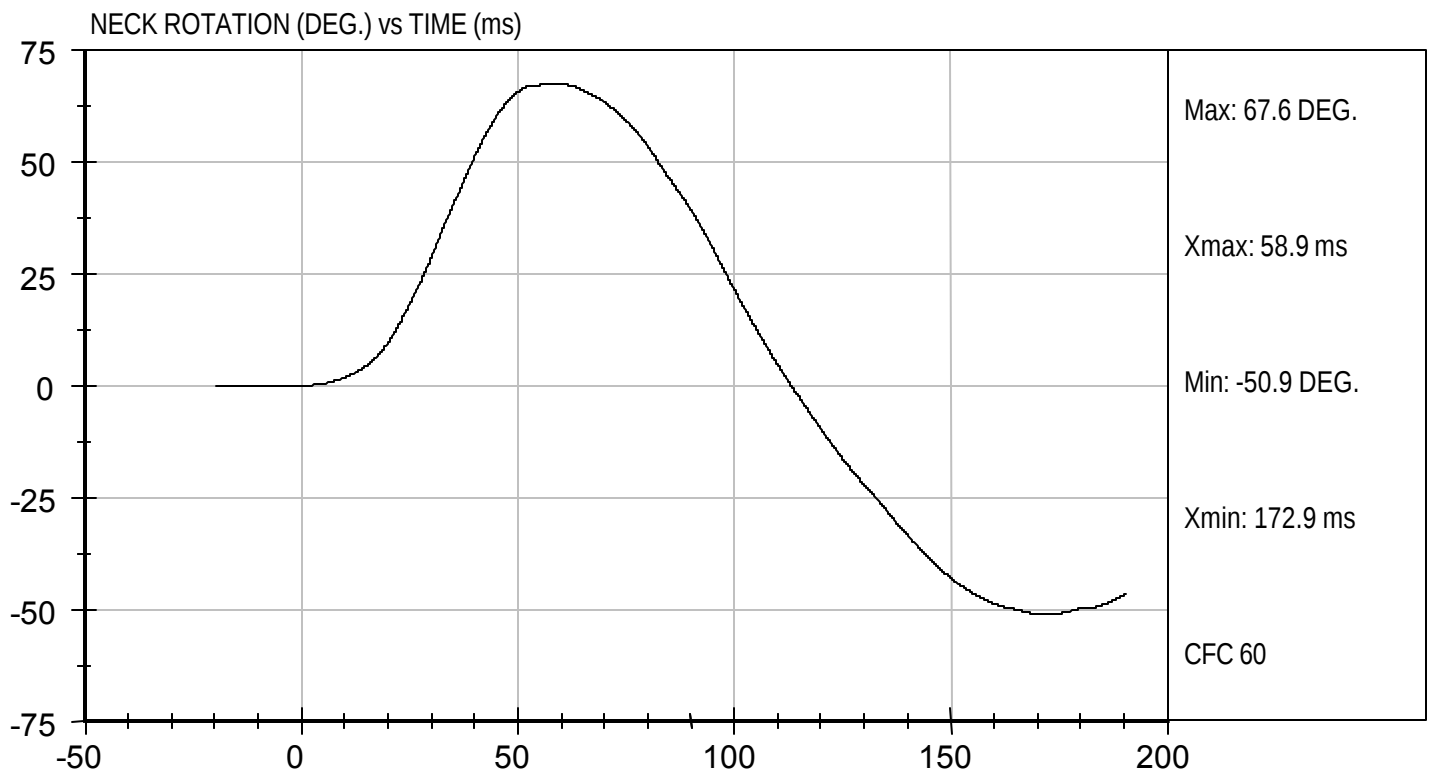
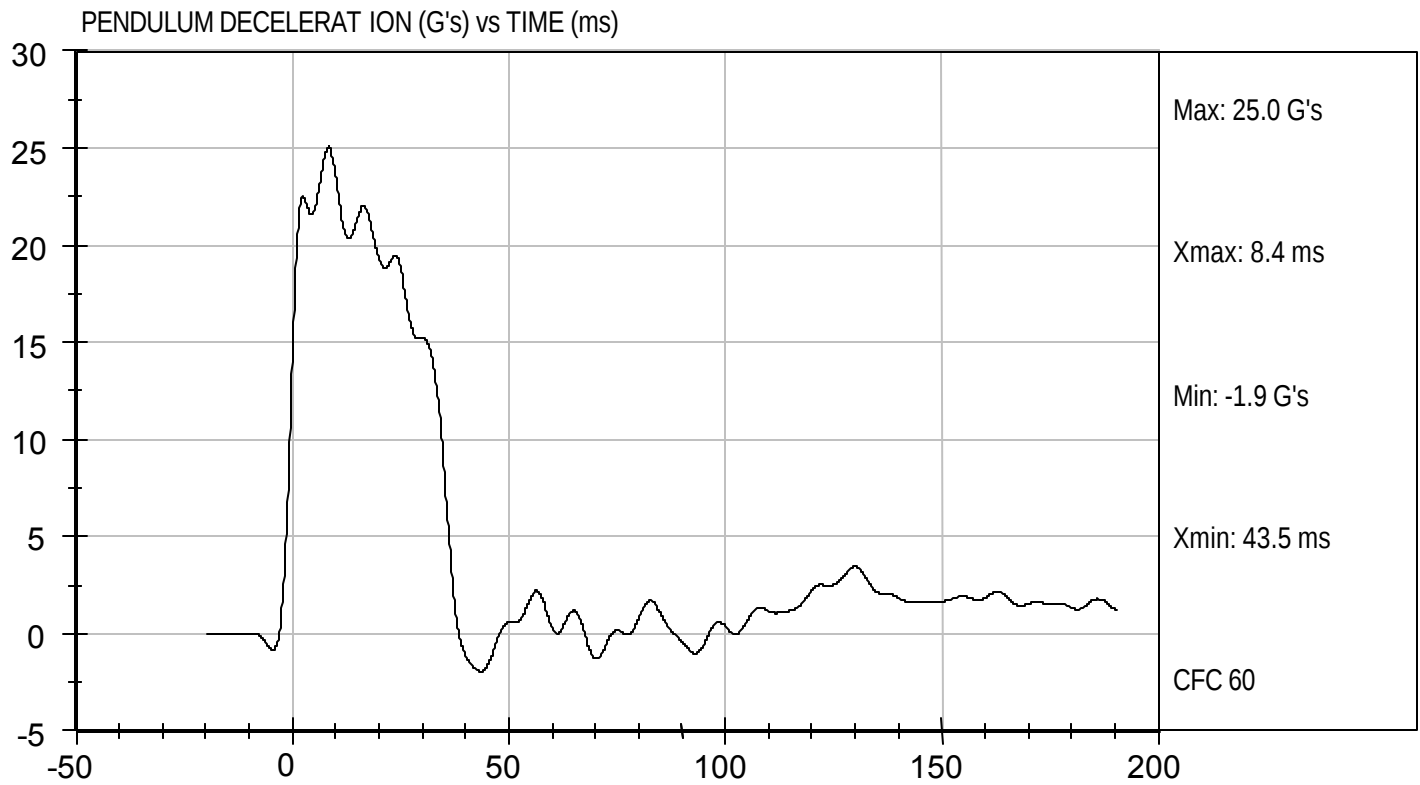
4/14/09
 Test Date


 Approved By



Test Desc: Neck Flexion
Component ID: D09832

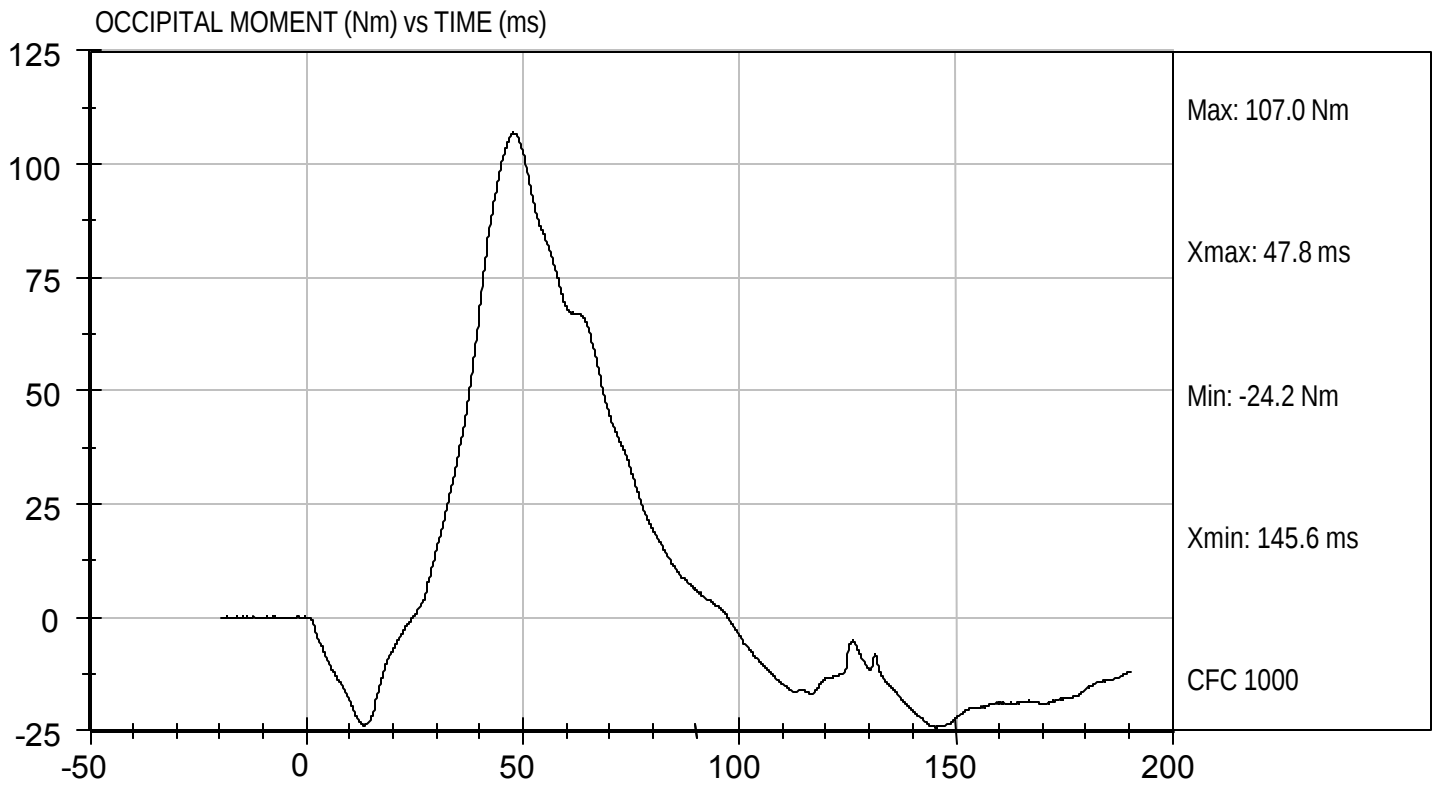
Test Date: 4/14/09
Velocity: 22.8 ft/s, 6.96 m/s





Test Desc: Neck Flexion
Component ID: D09832

Test Date: 4/14/09
Velocity: 22.8 ft/s, 6.96 m/s

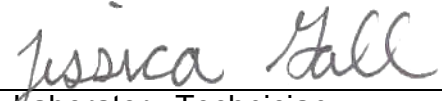


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 1045

Test I.D: D09833

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	27	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	17.24	Pass
	20 msec	G's	14.00 to 19.00	15.71	Pass
	30 msec	G's	11.00 to 16.00	13.53	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.6	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	42.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	92.9	Pass
	Time	msec	72.0 to 82.0	77.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	153.9	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-58.5	Pass
	Time	msec	65.0 to 79.0	72.3	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	143.1	Pass
Overall Test Results					Pass


 Laboratory Technician

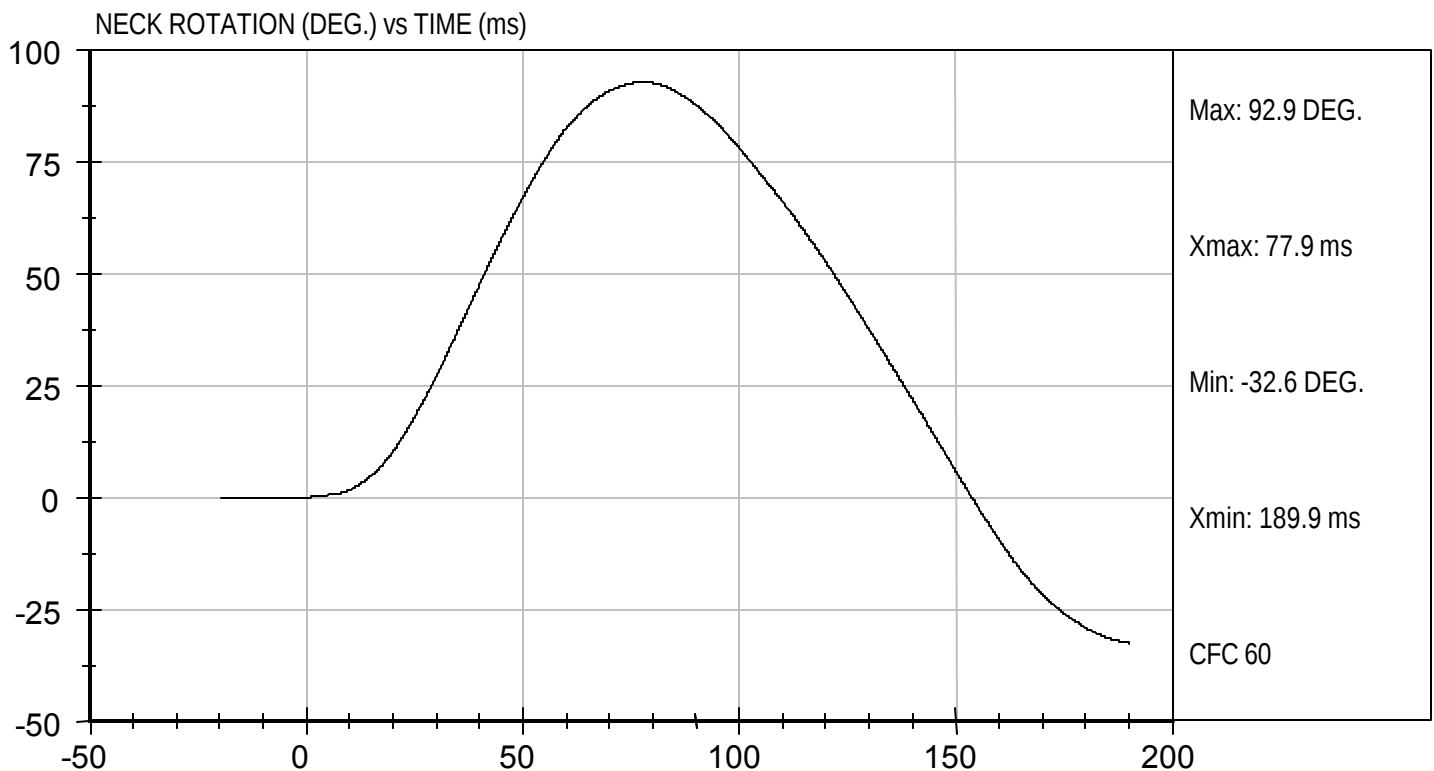
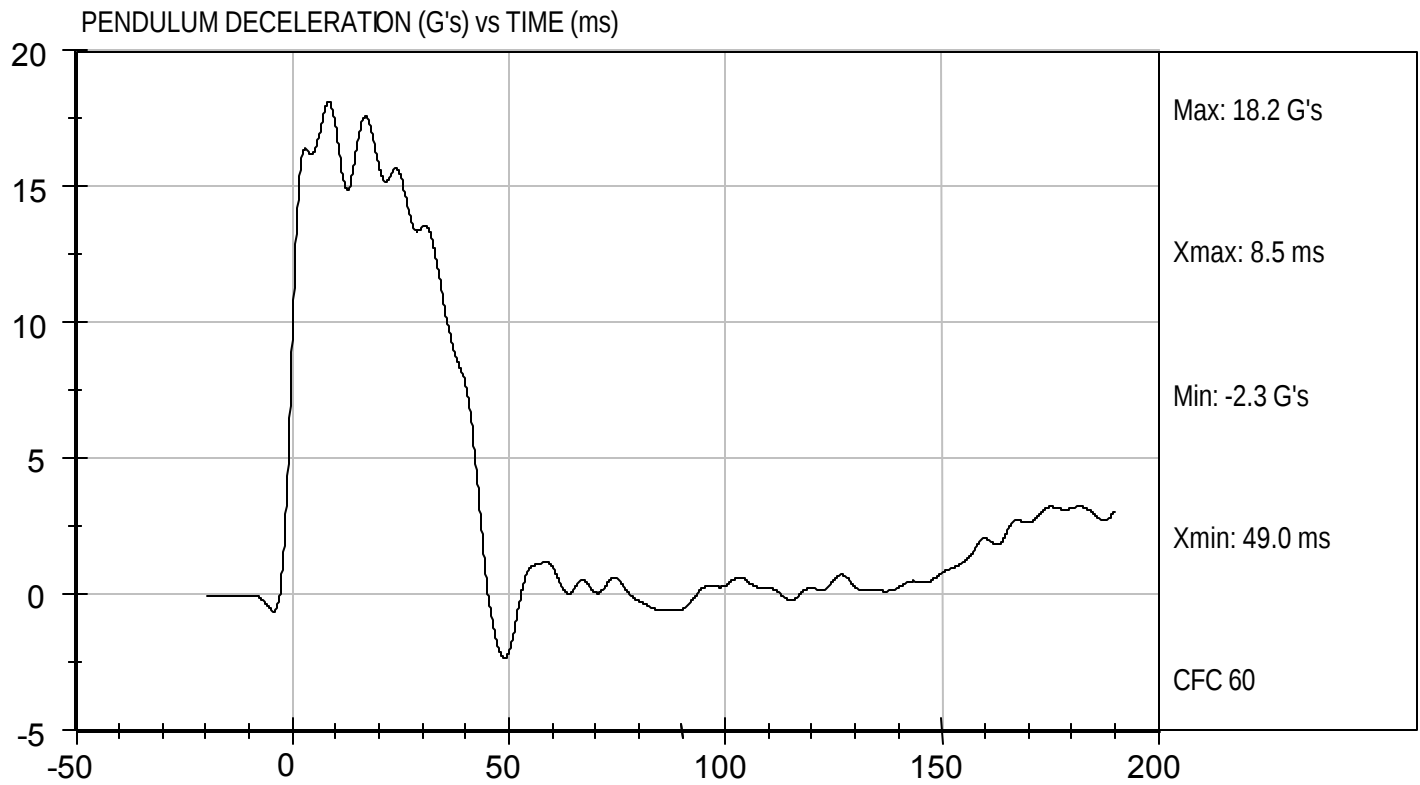
4/14/09
 Test Date


 Approved By



Test Desc: Neck Extension
Component ID: D09833

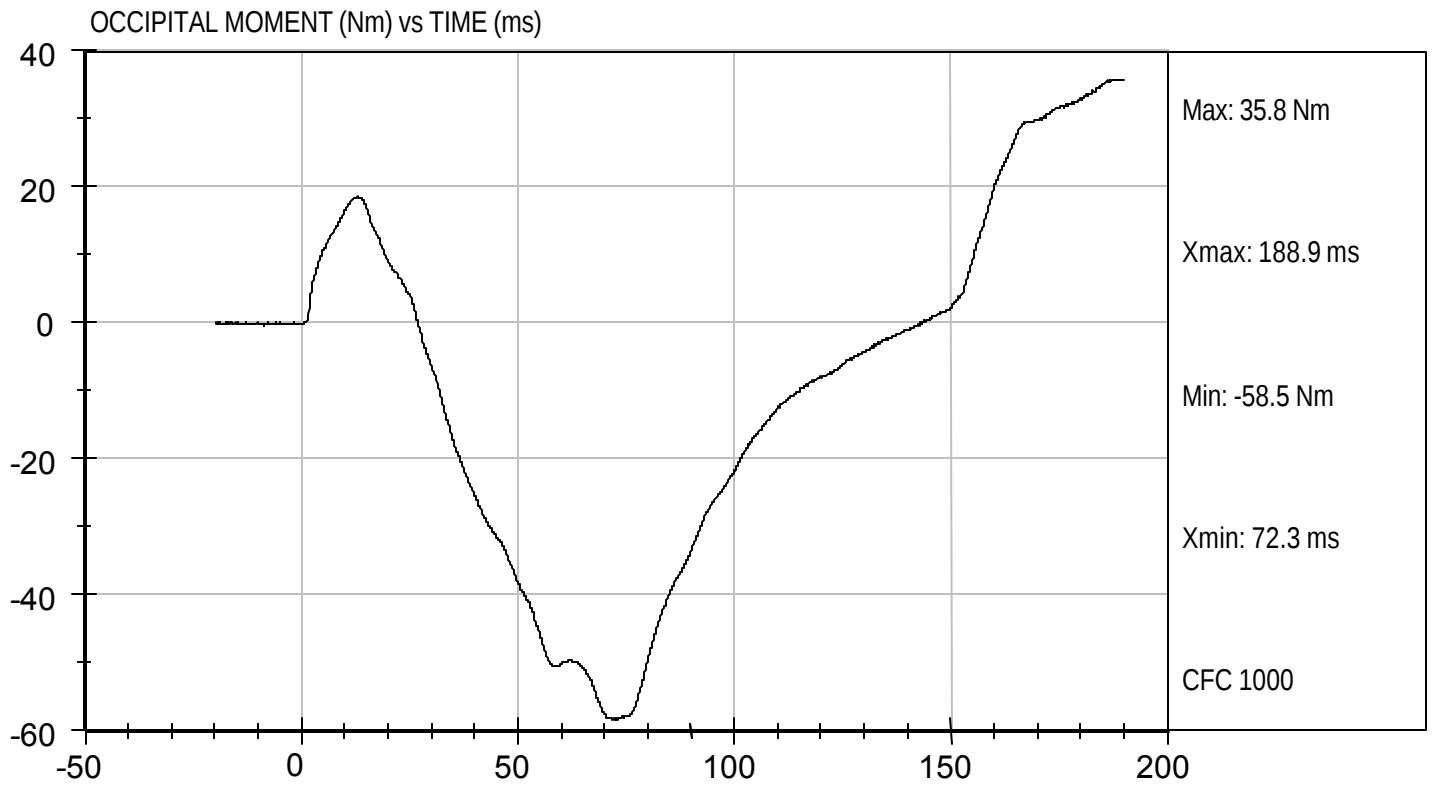
Test Date: 4/14/09
Velocity: 20.1 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D09833

Test Date: 4/14/09
Velocity: 20.1 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 1045

Test I.D: D09834

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	19	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,379	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.47	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results				Pass


Laboratory Technician

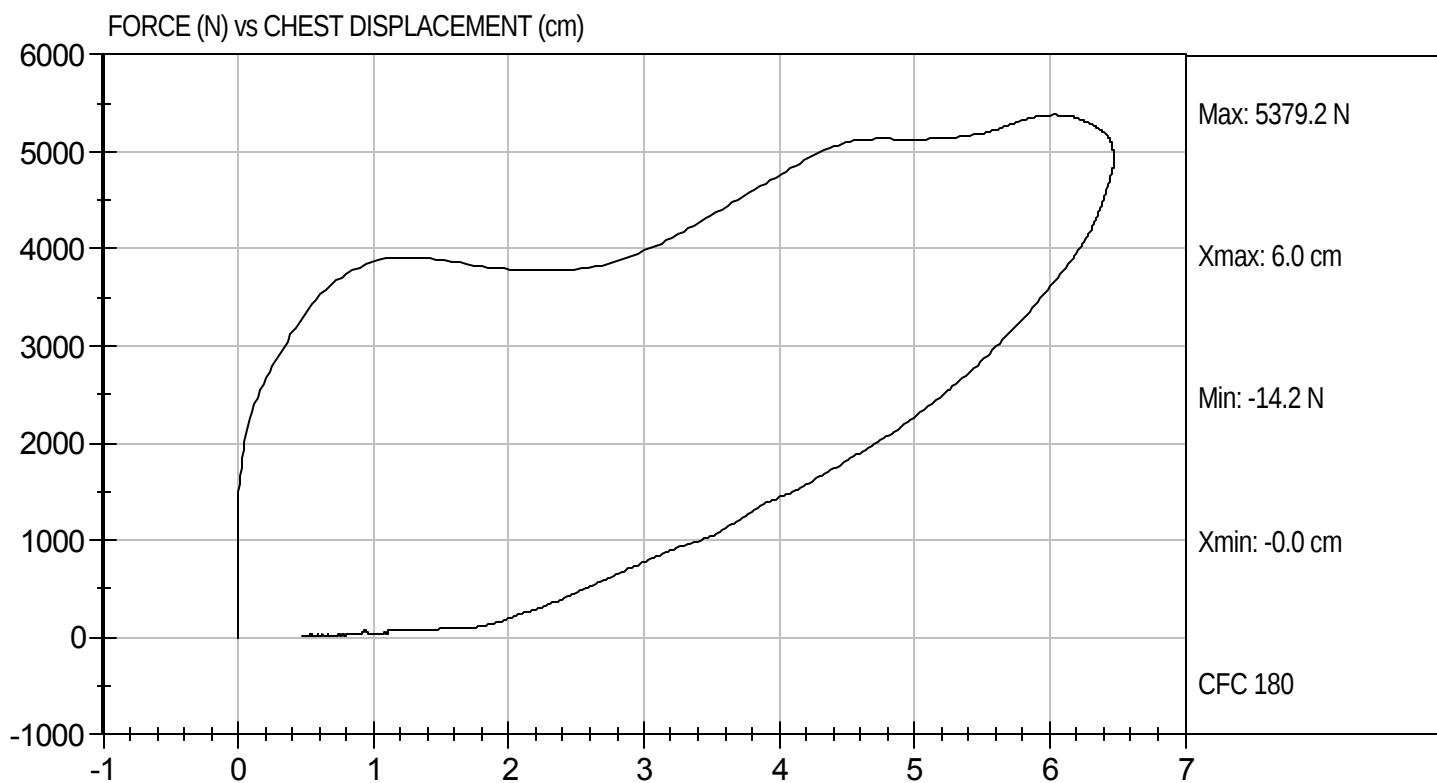
4/15/09
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D09834

Test Date: 4/15/09
Velocity: 22.2 ft/s, 6.77 m/s



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

ATD Serial No: 1045

Test I.D: D09835

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	26	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,383	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

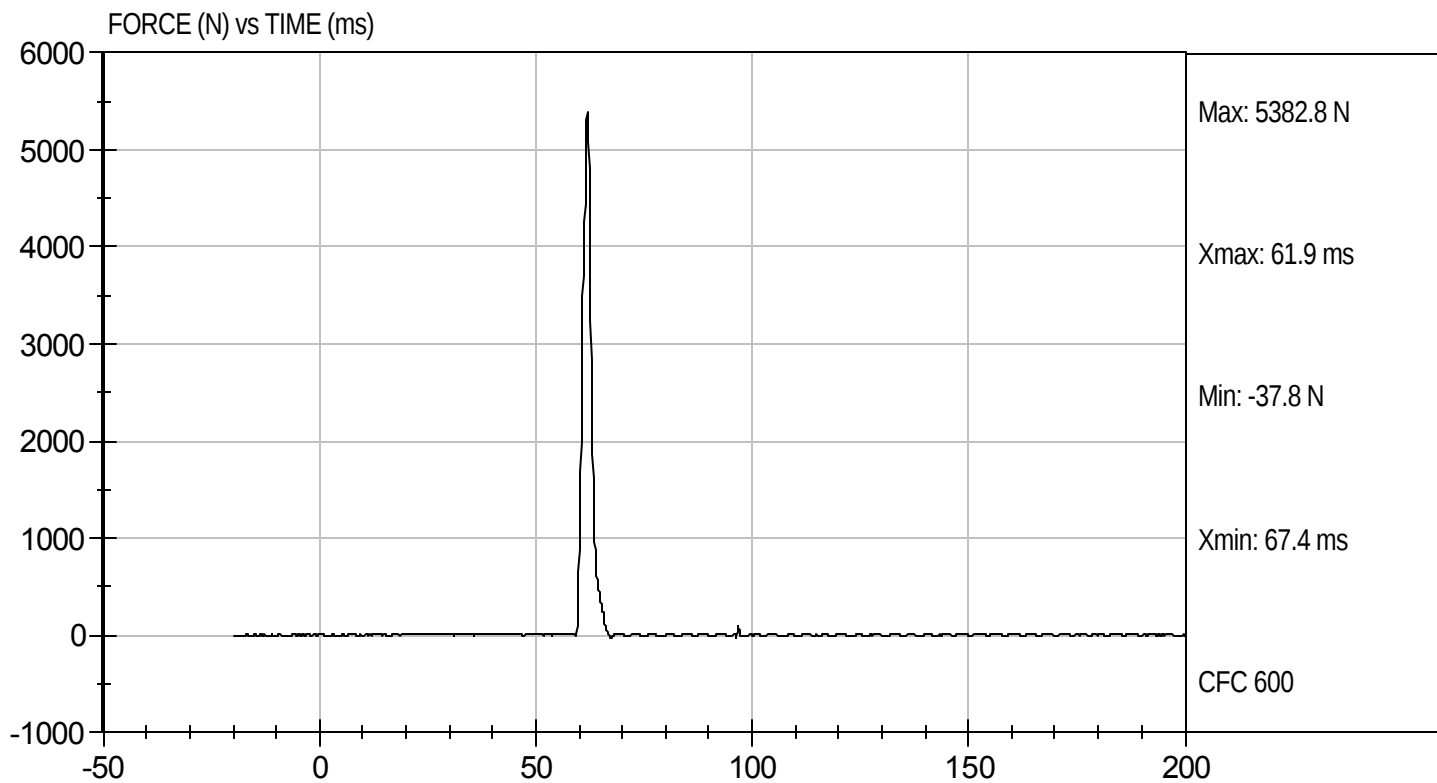
4/13/09
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D09835

Test Date: 4/13/09
Velocity: 6.89 ft/s, 2.10 m/s



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

ATD Serial No: 1045

Test I.D: D09836

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	26	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,403	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

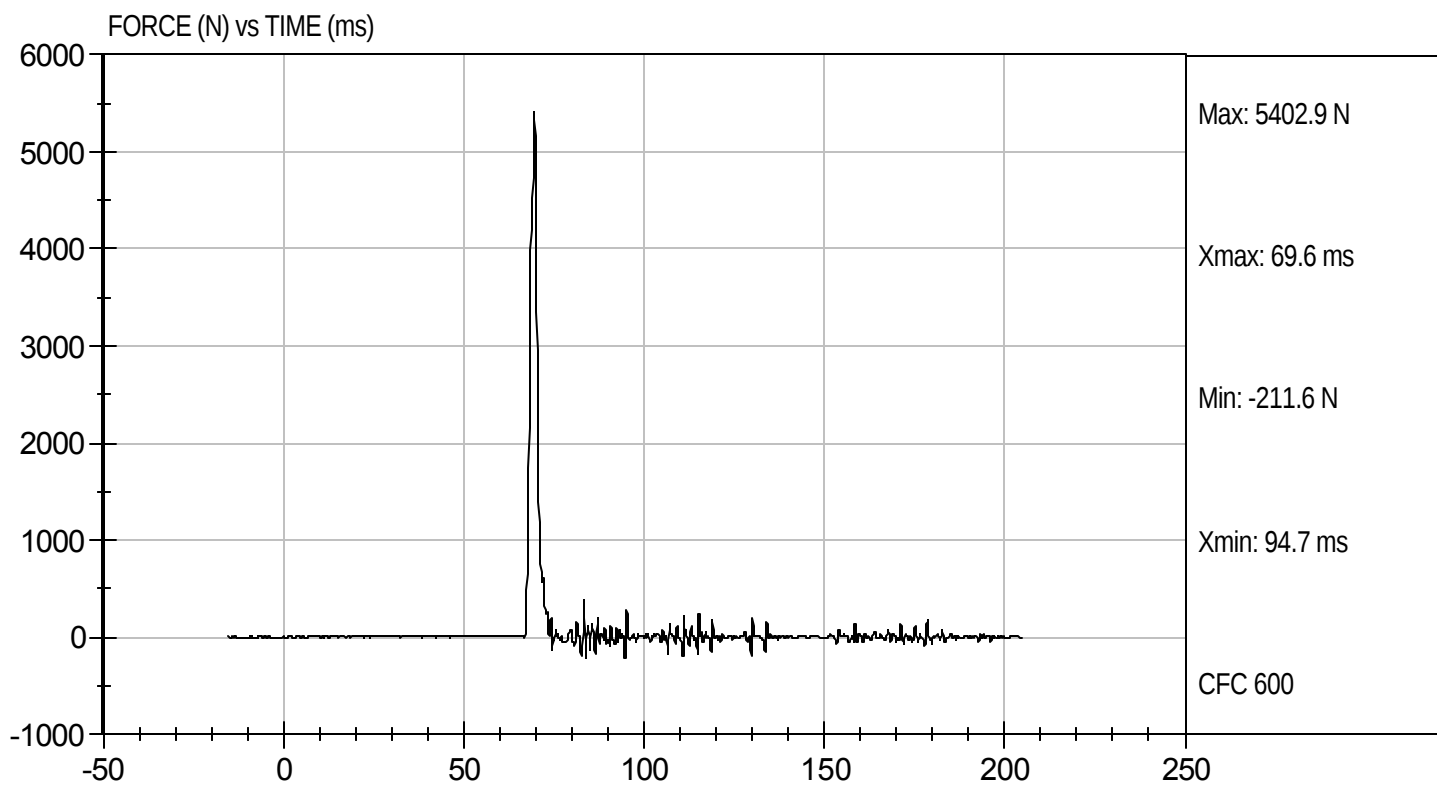
4/13/09
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D09836

Test Date: 4/13/09
Velocity: 6.89 ft/s, 2.10 m/s



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

ATD Serial No: 1045

Test I.D: D09830

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.3	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	27	27	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	68.3	70.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	41	40	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

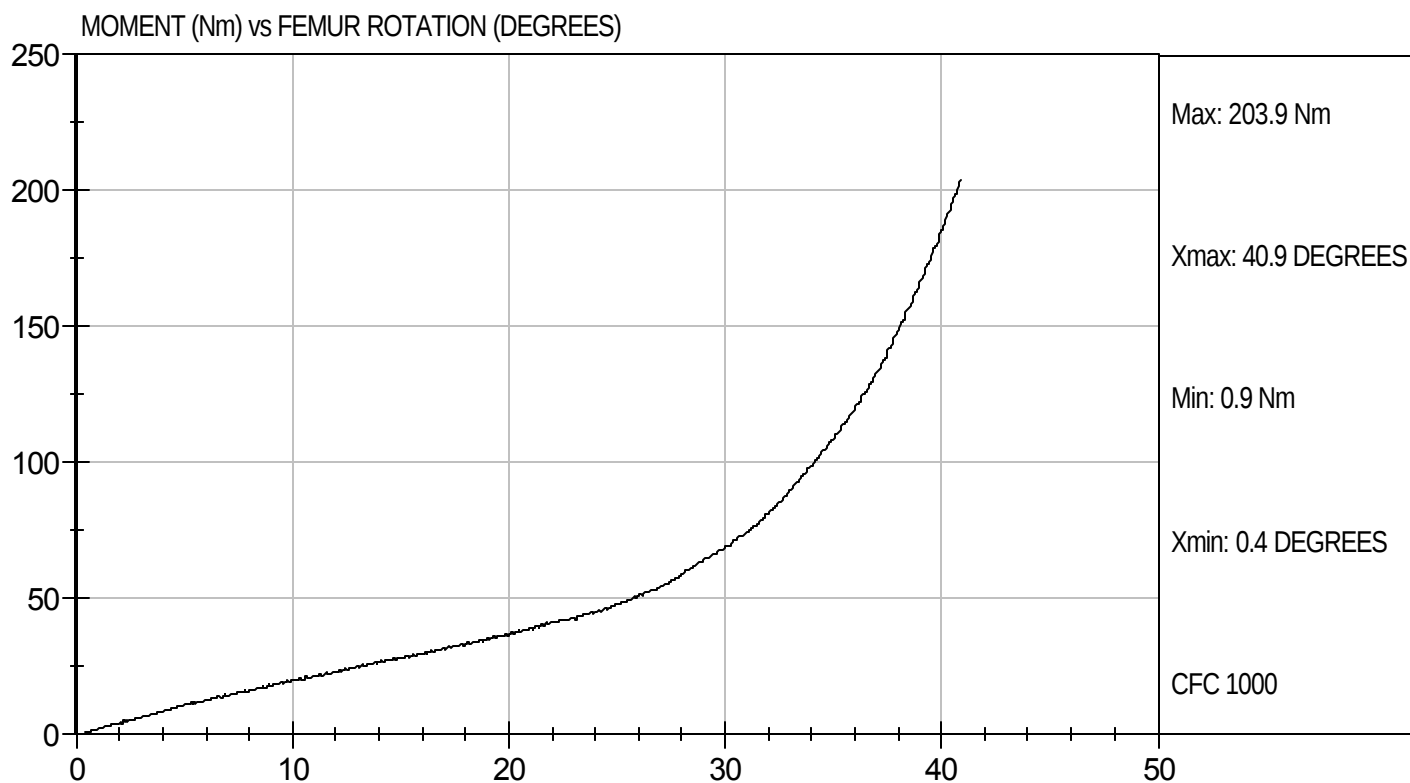
4/13/09
Test Date

David Winkelbauer
Approved By



Test Desc: Hip Femur Flexion
Component ID: D09839

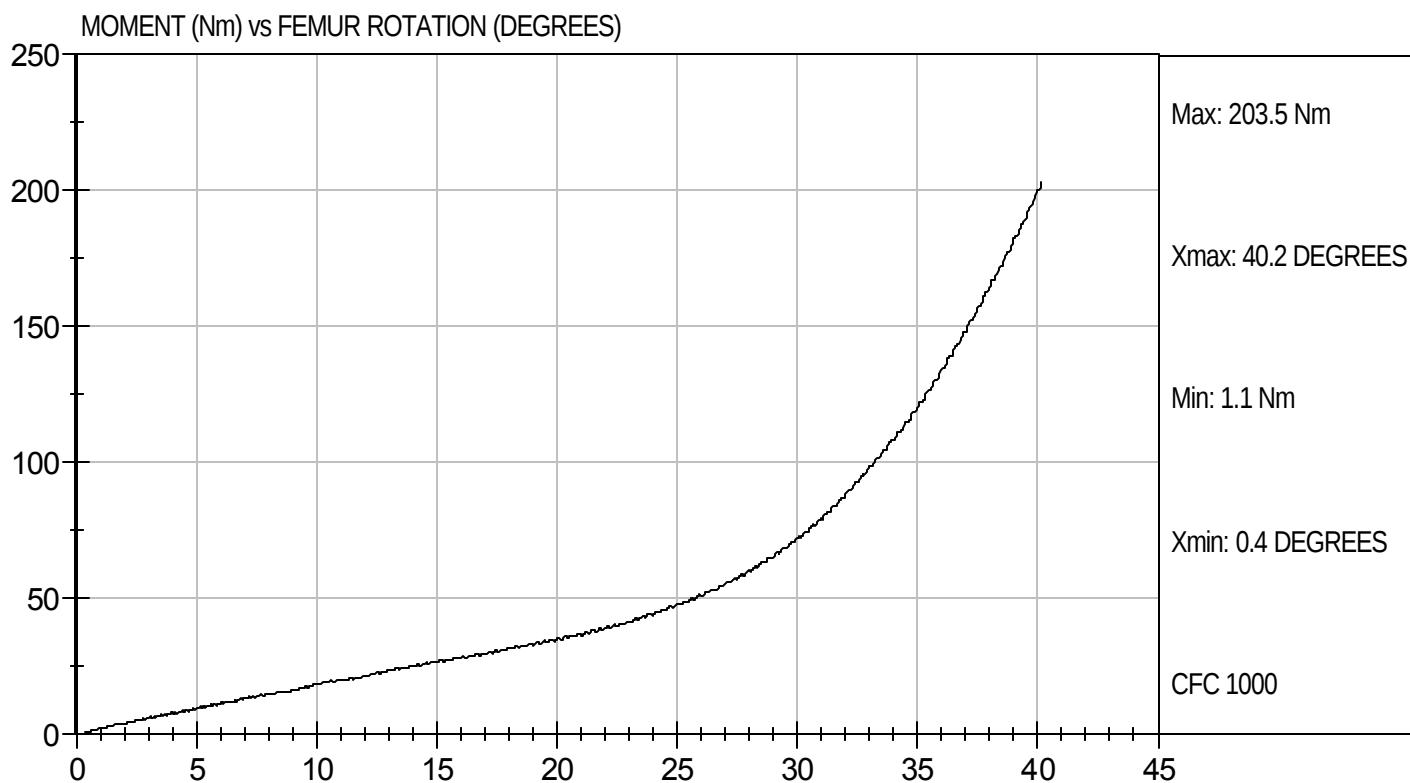
Test Date: 4/13/09
Velocity: 0 ft/s, 0 m/s





Test Desc: Hip Femur Flexion
Component ID: D09830

Test Date: 4/13/09
Velocity: 0 ft/s, 0 m/s



MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test ID: D09851

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	250 to 300	261	Pass
Peak Lateral Acceleration	G's	+/- 15	3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

4/16/09
Test Date

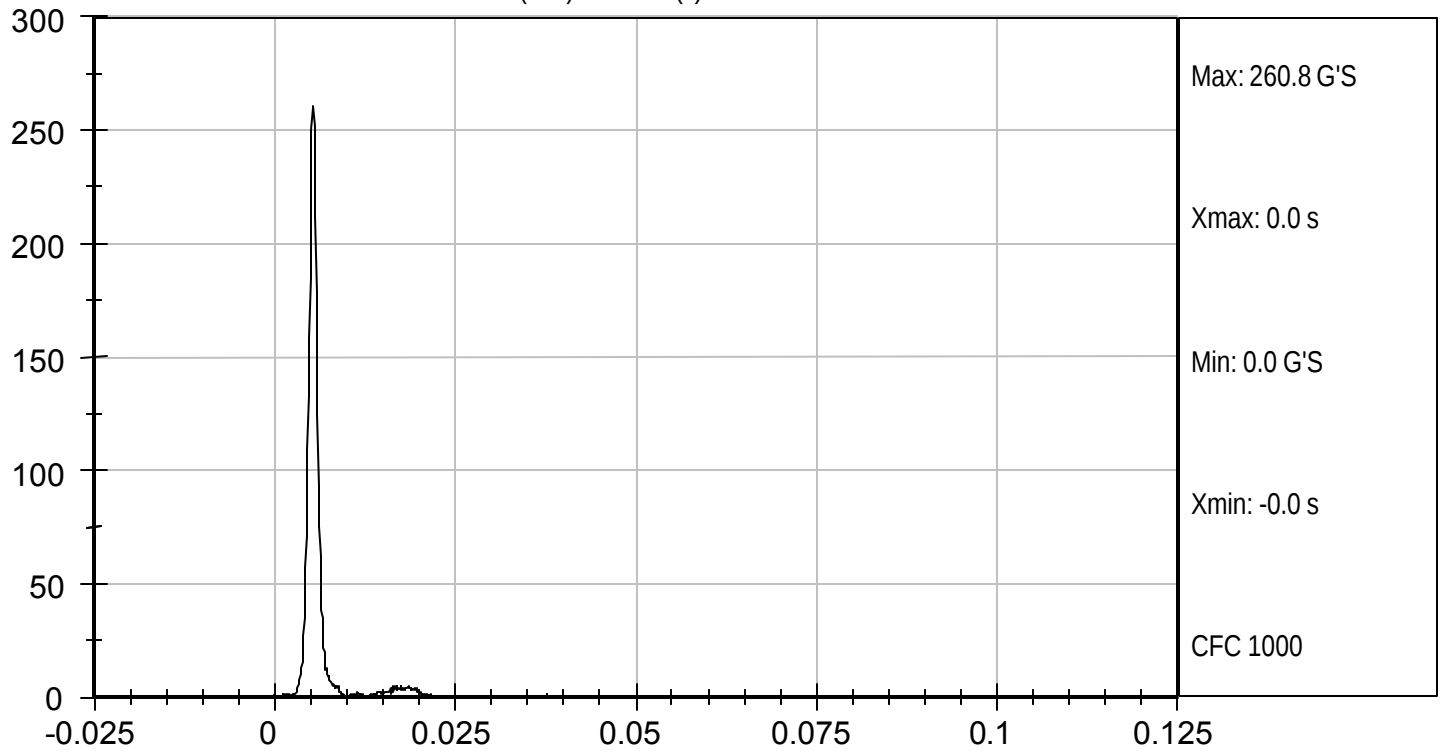

Approved By



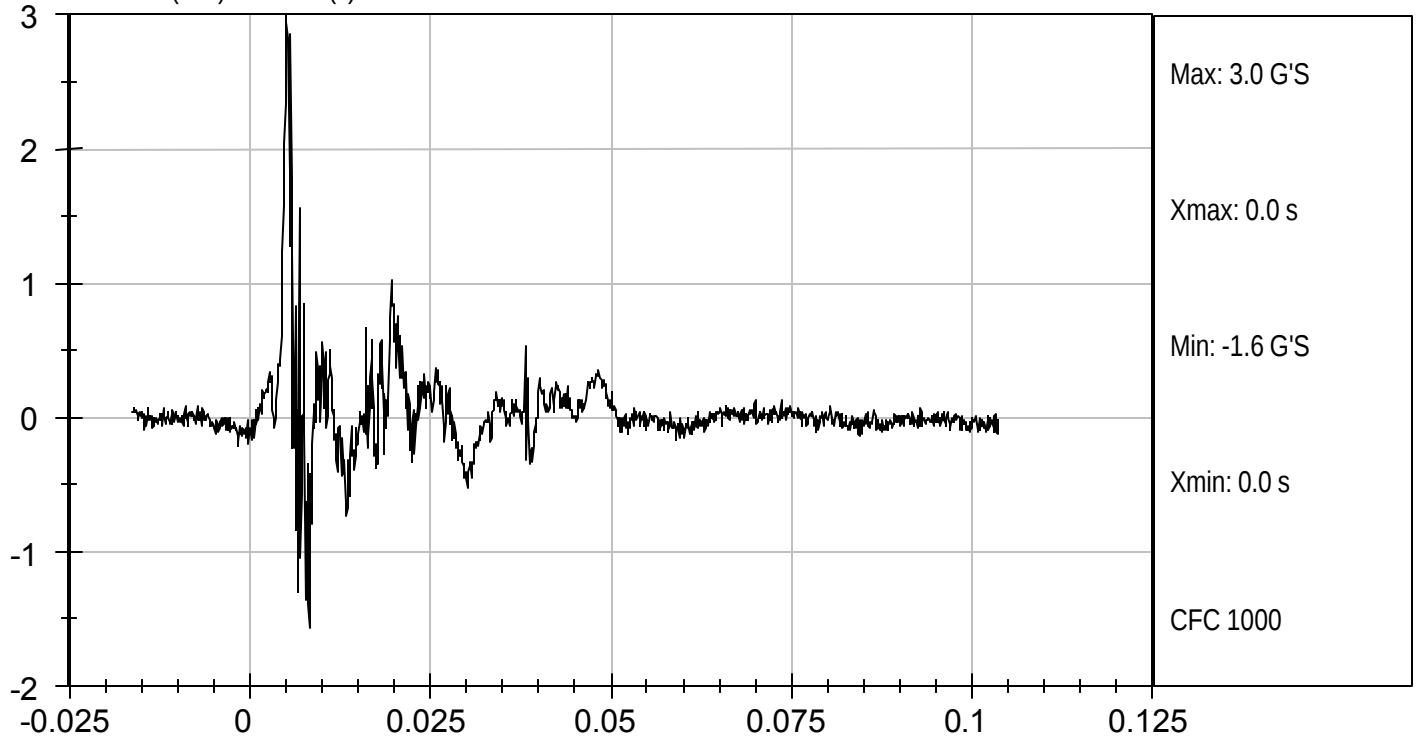
Test Desc: Head Drop
Component ID: D09851

Test Date: 4/16/09
Velocity: 0 ft/s, 0 m/s

RESULTANT HEAD ACCELERATION (G'S) vs TIME (s)



HEAD Y (G'S) vs TIME (s)



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D09852

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	29	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.7	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	84	Pass
Overall Results				Pass	

Jessica Gall
Laboratory Technician

4/22/09
Test Date

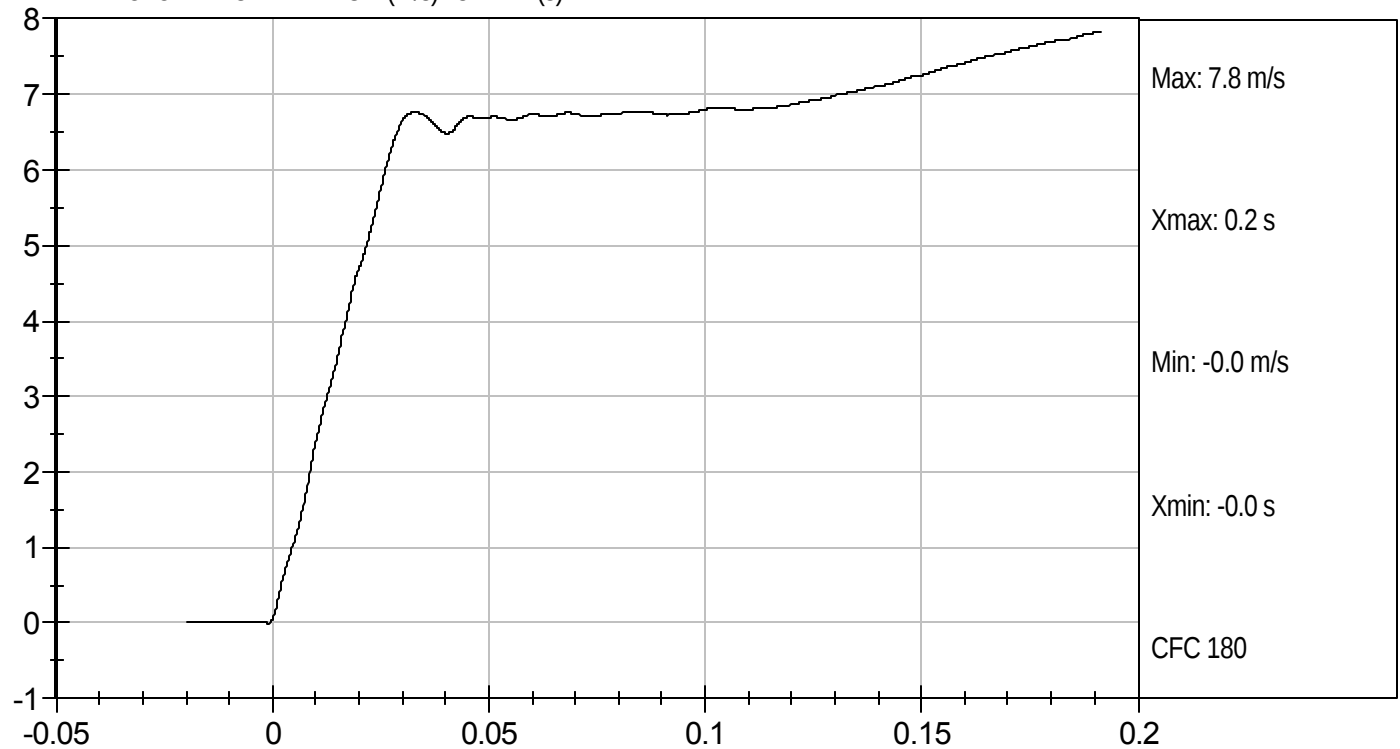
David Winkelbauer
Approved By



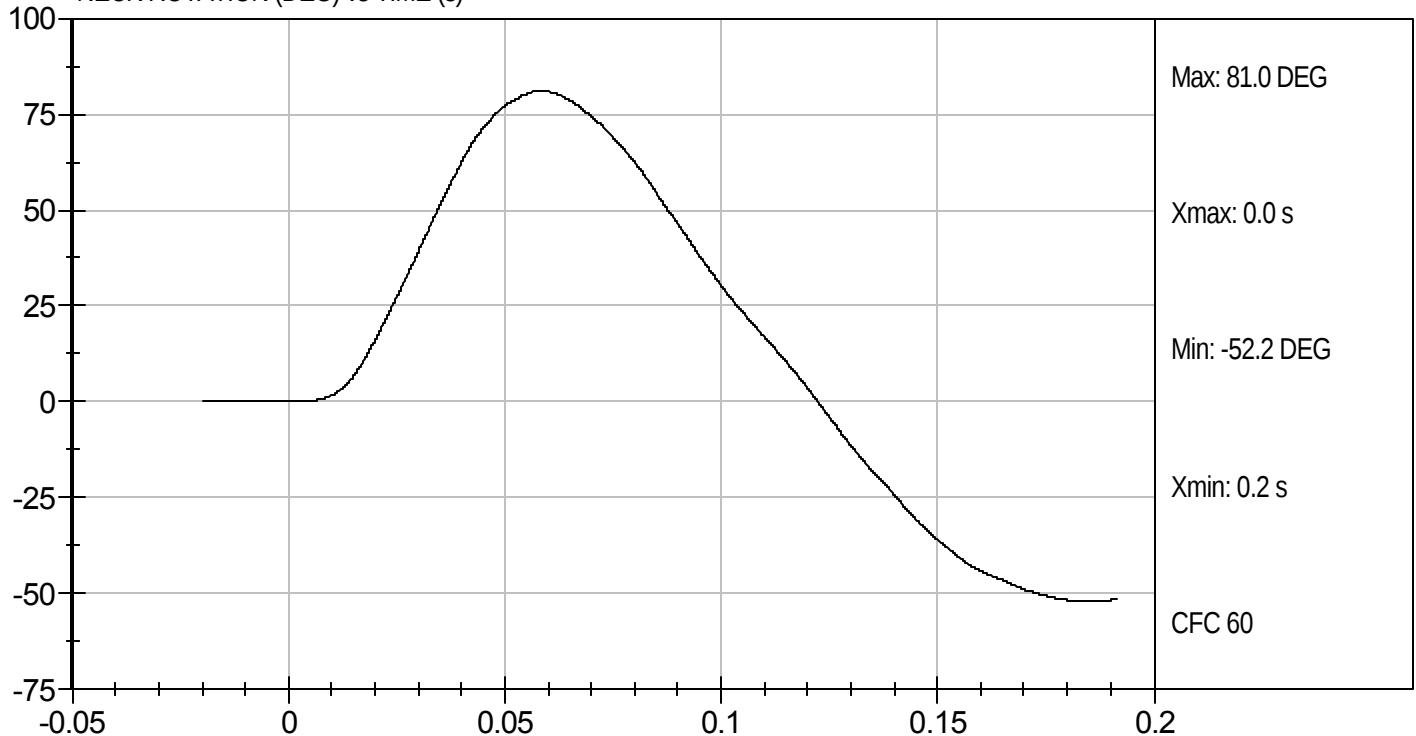
Test Desc: Neck Flexion
Component ID: D09852

Test Date: 4/22/09
Velocity: 23.14 ft/s, 7.05 m/s

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



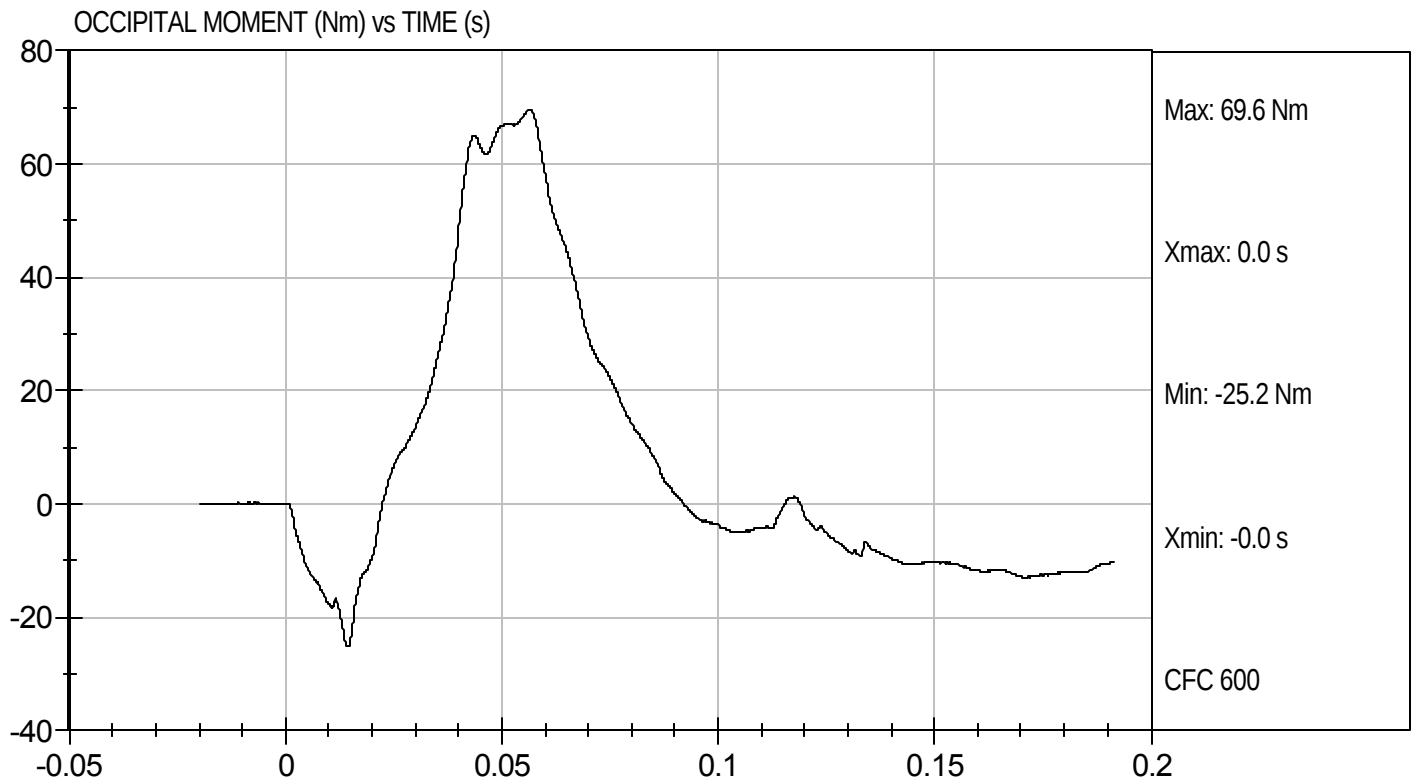
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Component ID: D09852

Test Date: 4/22/09
Velocity: 23.14 ft/s, 7.05 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634Test I.D: D09853

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	30	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	99	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	99	Pass
Overall Results					Pass

Jessica Hall
 Laboratory Technician

4/22/09

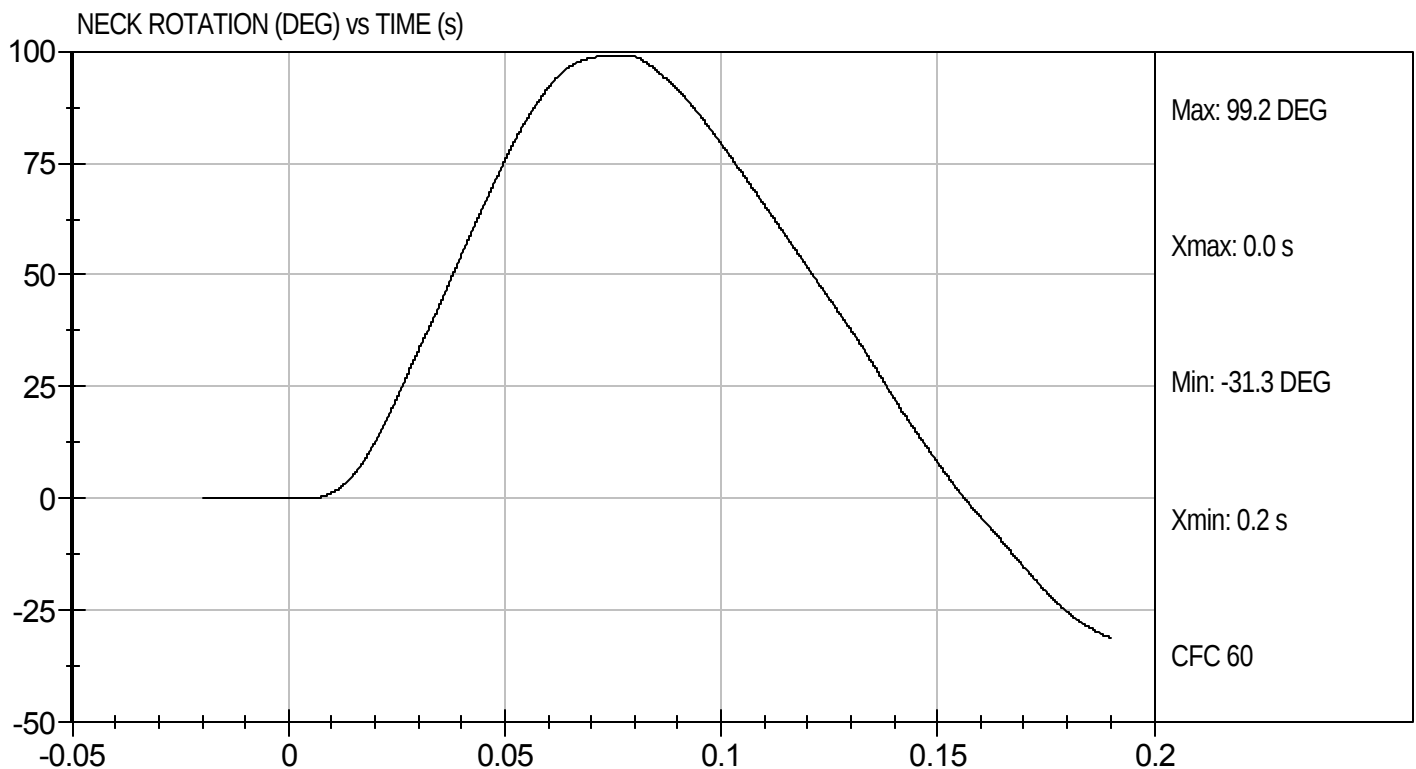
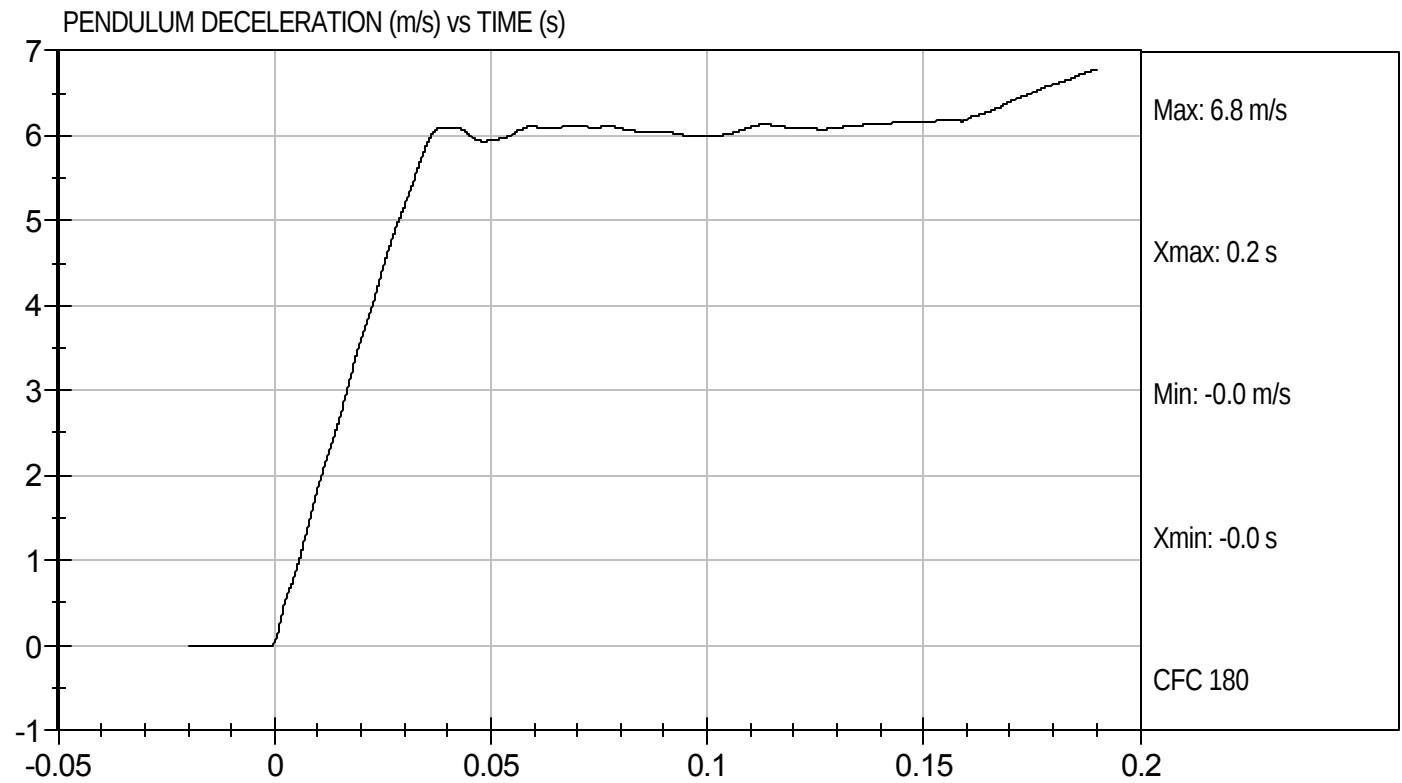
Test Date

David Winkelbauer
 Approved By



Test Desc: Neck Extension
Component ID: D09853

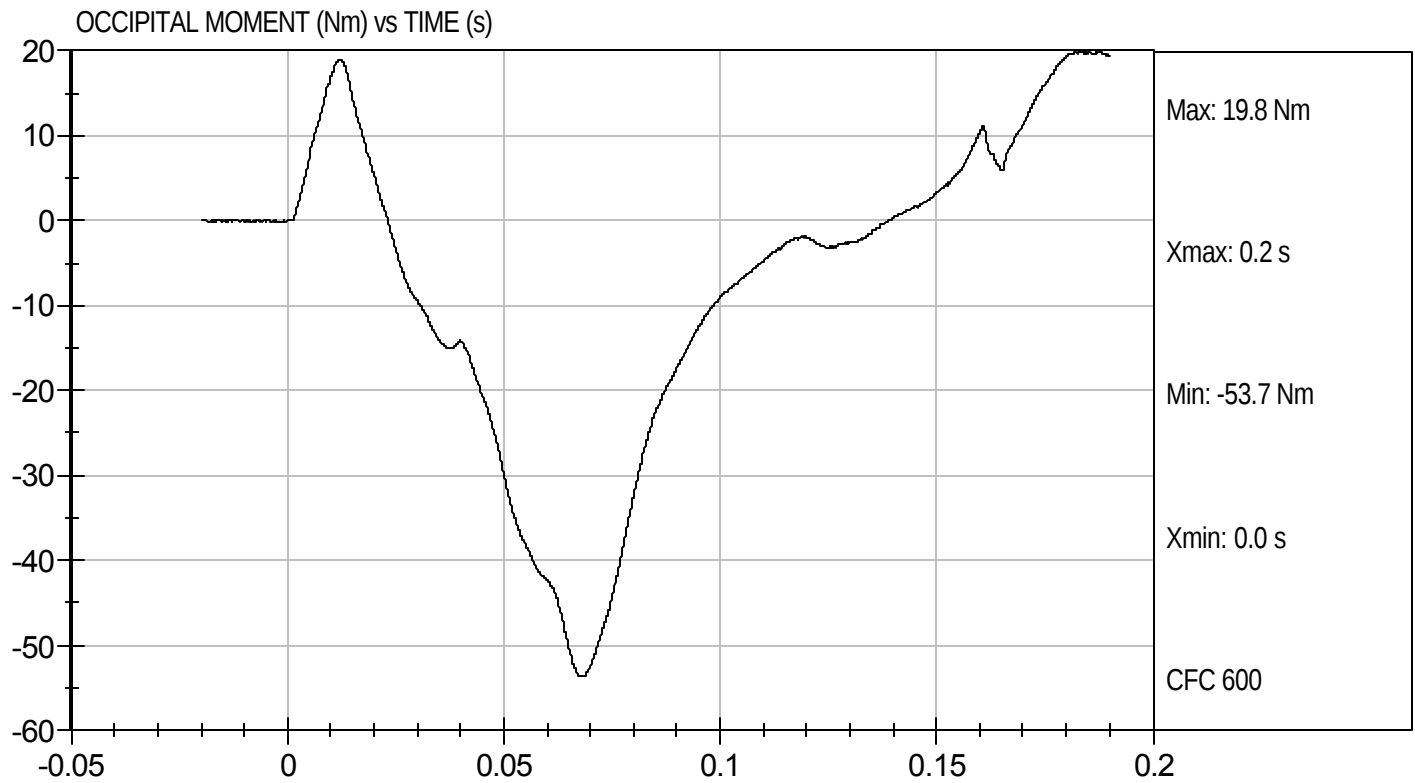
Test Date: 4/22/09
Velocity: 20.08 ft/s, 6.12 m/s





Test Desc: Neck Extension
Component ID: D09853

Test Date: 4/22/09
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: D09854

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	24	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	3.9	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4027	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

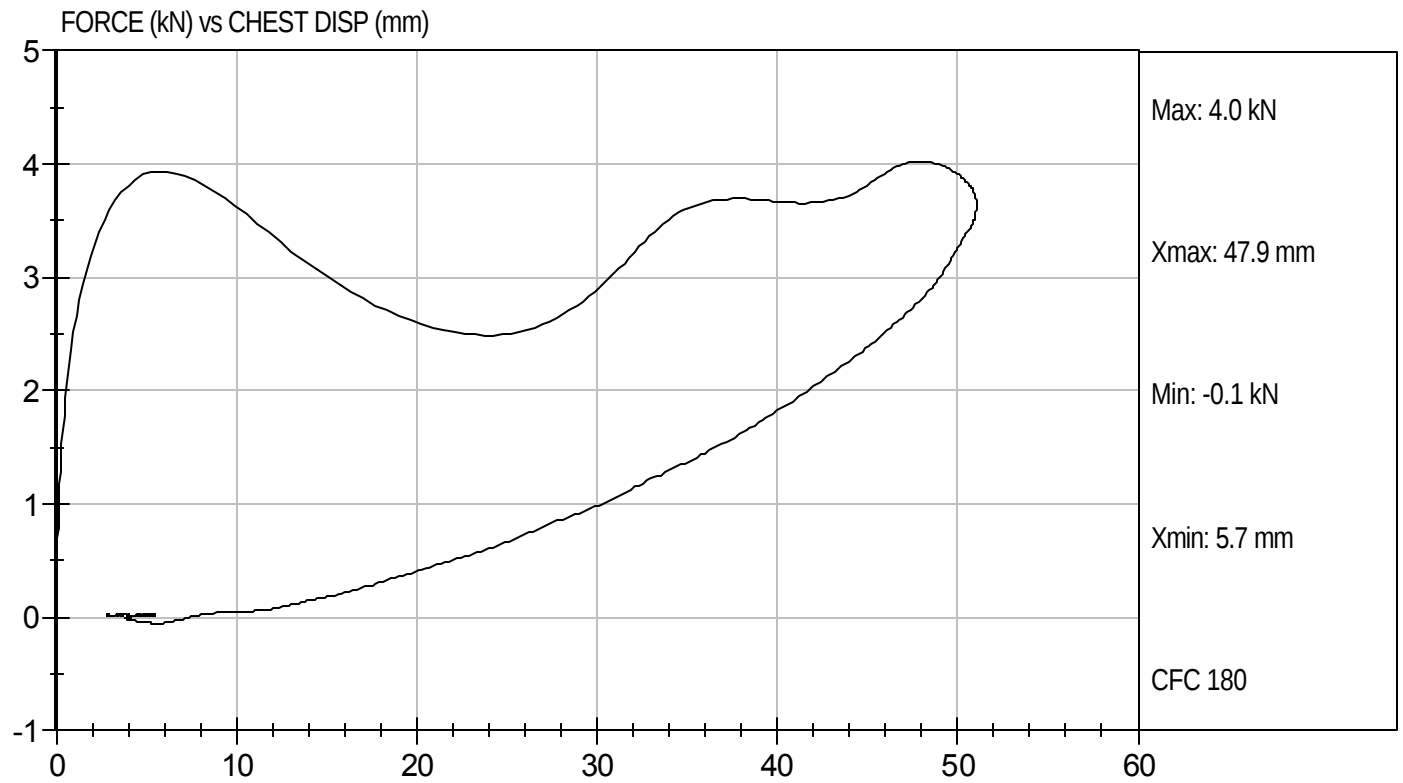
4/17/09
Test Date

David Winkelbauer
Approved By



Test Desc: Thorax Impact
Component ID: D09854

Test Date: 4/17/09
Velocity: 22.2 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D09855

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.74	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

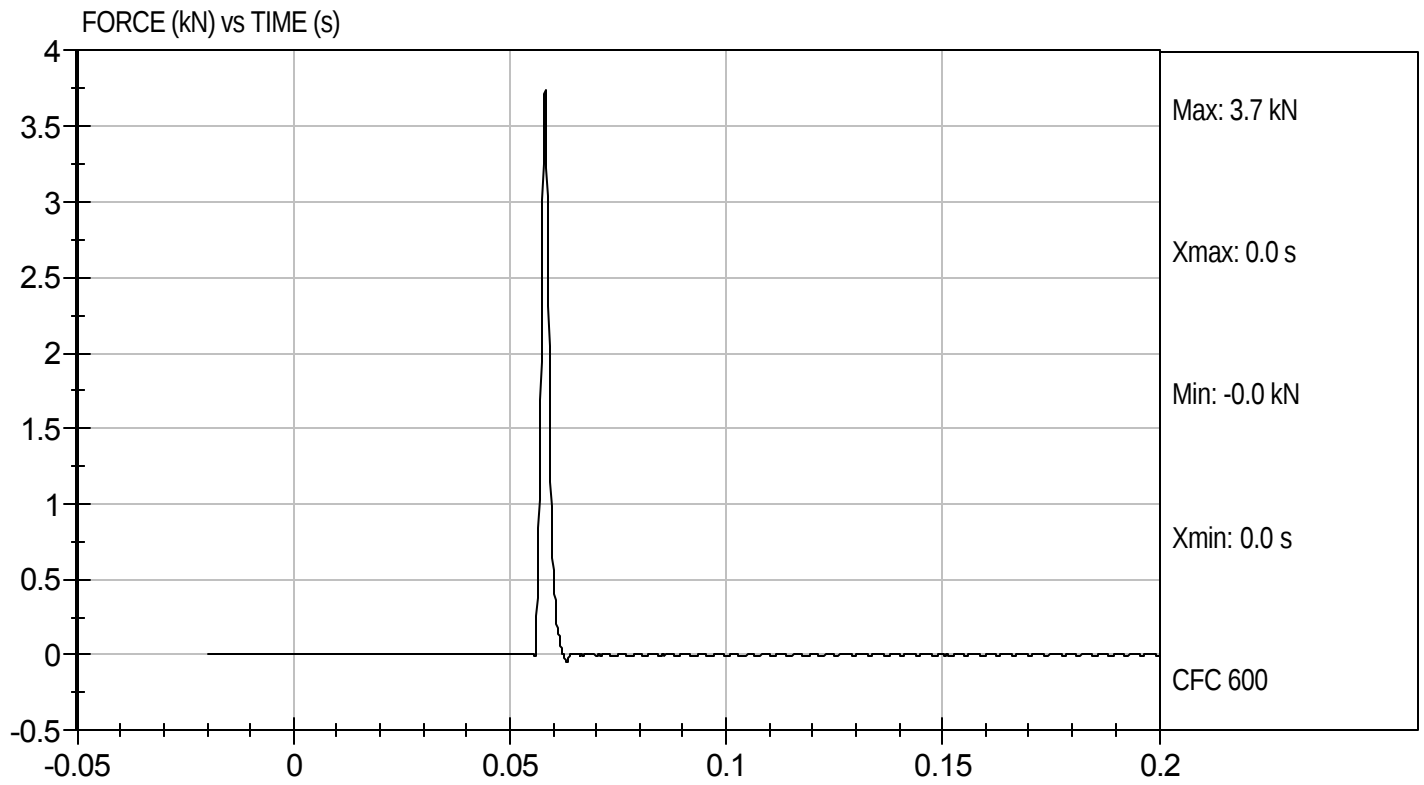
4/16/09
Test Date

David Winkelbauer
Approved By



Test Desc: Right Knee
Component ID: D09855

Test Date: 4/16/09
Velocity: 6.86 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D09856

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	16	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	4.02	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

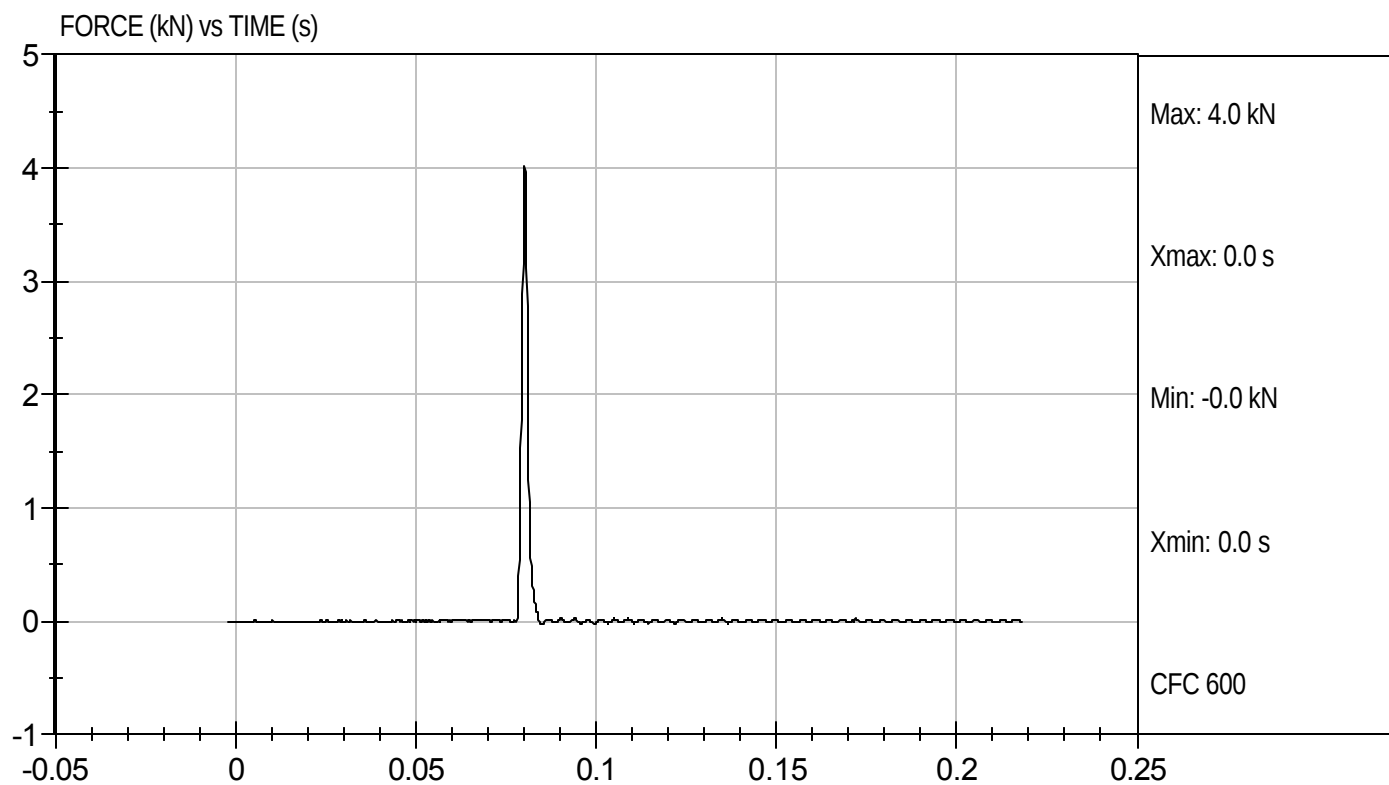
4/16/09
Test Date

David Winkelbauer
Approved By



Test Desc: Left Knee
Component ID: D09856

Test Date: 4/16/09
Velocity: 6.92 ft/s, 2.11 m/s

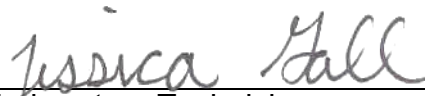


MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 634

Test I.D: D09857

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.8	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	22	Pass
Force at 45 deg	N	320 to 390	385	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
Overall Result			Pass	


Laboratory Technician

4/16/09
Test Date


Approved By