

REPORT NUMBER: NCAPSIDE-MGA-2010-004

**NEW CAR ASSESSMENT PROGRAM
SIDE IMPACT TEST**

**FUJI HEAVY INDUSTRIES LTD.
2010 SUBARU LEGACY 4-DR SEDAN
NHTSA NUMBER: MA5501**

**PREPARED BY:
MGA RESEARCH CORPORATION
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BURLINGTON, WI 53105**



Test Date: October 19, 2009

Report Date: November 9, 2009

FINAL REPORT

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

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-09-D-00124.

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Date: 11/09/2009

Technical Report Documentation Page

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16. Abstract A 55/28 km/h 90° Moving Deformable Barrier NCAP side impact was conducted on the subject 2010 Subaru Legacy 4-Dr Sedan to obtain new car assessment and research data indicant of FMVSS No. 214D performance. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on October 19, 2009. The impact velocity of the Moving Deformable Barrier (MDB) was 62.6 km/h, and the ambient temperature at the struck side (drivers) of the vehicle was 21°C. The target vehicle's maximum post test static crush was 256 mm at level 3. The test vehicle's occupant performance is as follows: <table style="margin-left: auto; margin-right: auto; border: none;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>DRIVER</u></th> <th style="text-align: center;"><u>PASS.</u></th> </tr> </thead> <tbody> <tr> <td>Left Upper Rib (LUR) Accel., g</td> <td style="text-align: center;">35.1</td> <td style="text-align: center;">50.9</td> </tr> <tr> <td>Left Lower Rib (LLR) Accel., g</td> <td style="text-align: center;">33.7</td> <td style="text-align: center;">56.3</td> </tr> <tr> <td>Lower Spine (T₁₂) Accel., g</td> <td style="text-align: center;">37.4</td> <td style="text-align: center;">41.9</td> </tr> <tr> <td>Thoracic Trauma Index (TTI)</td> <td style="text-align: center;">36</td> <td style="text-align: center;">49</td> </tr> <tr> <td>Pelvis (PEV) Accel., g</td> <td style="text-align: center;">79.8</td> <td style="text-align: center;">51.2</td> </tr> <tr> <td>HIC</td> <td style="text-align: center;">119</td> <td style="text-align: center;">393</td> </tr> </tbody> </table> The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.					<u>DRIVER</u>	<u>PASS.</u>	Left Upper Rib (LUR) Accel., g	35.1	50.9	Left Lower Rib (LLR) Accel., g	33.7	56.3	Lower Spine (T ₁₂) Accel., g	37.4	41.9	Thoracic Trauma Index (TTI)	36	49	Pelvis (PEV) Accel., g	79.8	51.2	HIC	119	393
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17. Key Words New Car Assessment Program (NCAP) Side Impact Side Impact Hybrid III Dummy (SID/HIII) Occupant Side Impact Protection		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Adm. Technical Ref. Division, 1200 New Jersey Ave, SE Washington, D.C. 20590																						
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SECTION 1

PURPOSE AND TEST PROCEDURE

PURPOSE

This side impact test was conducted as part of the test program sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-09-D-00124. The purpose of this test was to evaluate side impact protection in a 2010 Subaru Legacy 4-Dr Sedan manufactured by Fuji Heavy Industries Ltd.

TEST PROCEDURE

The side impact test was conducted in accordance with the Laboratory Test Procedure for New Car Assessment Program Side Impact Testing dated November 2002 and the corresponding MGA Research Corporation Test Procedure MGA-NHTSA5. The procedures for receiving, inspection, testing, and reporting of test results are described in the test procedures and are not repeated in this report.

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

SECTION 2

SUMMARY OF NCAP SIDE IMPACT TEST

A model year 2010 Subaru Legacy 4-Dr Sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.6 km/h. The specified impact velocity range is from 61.1 to 62.7 km/h. The test (target) vehicle was stationary and positioned 63° to the line of forward motion. The weight of the vehicle as tested was 1740.9 kg and the test weight of the MDB was 1361.5 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on October 19, 2009.

One (1) real-time motion picture camera and nine (9) high-speed motion picture cameras were used to document the impact event. The pre-test and post-test conditions were recorded by one (1) real-time motion picture camera. Camera locations and pertinent camera information are documented in the data sheets. Pre- and post-test photographs of the vehicle and Side Impact Dummies (SID/HIIIs) can be found in Appendix A. Two 50th percentile adult male SID/HIIIs were placed in the driver and left rear passenger designated seating positions according to instructions specified in the Laboratory Test Procedure for New Car Assessment Program Side Impact Testing dated November 2002. Each SID/HIII was instrumented in the following locations:

- Left Upper Rib (LUR) uni-axial accelerometer (Y-axis primary and redundant)
- Left Lower Rib (LLR) uni-axial accelerometer (Y-axis primary and redundant)
- Lower Thoracic Spine (T12) uni-axial accelerometer (Y-axis primary and redundant)
- Pelvic (PEV) section uni-axial accelerometer (Y-axis primary and redundant)
- Head Center of Gravity (CG) tri-axial accelerometers (X, Y and Z axes primary and redundant)
- Upper Neck load cell (Fx, Fy, Fz, Mx, My, Mz)

The test vehicle was instrumented with twenty (20) structural accelerometers and the MDB was instrumented with five (5) accelerometers and two (2) contact switches on the bumper to compare left side to right side bumper impact timing. All data channels were recorded with a fully self contained on-board DTS TDAS Pro Data Acquisition System. The data was digitally sampled at 10,000 samples per second and processed per Appendix V of the Test Procedure.

2.2 GENERAL COMMENTS

The test vehicle sustained a maximum static crush of 256 mm at level 3, 1650 mm rearward of the vertical impact point. The driver and passenger SID/HIIIs, Serial Nos. 272 and 271 respectively, were calibrated just prior to this test.

Appendix A contains the still photograph prints. Appendix B contains the SID/HIII response data traces. Appendix C contains the dummy calibration data.

The occupant data is summarized below:

ATD position	HIC	T ¹	T ²	TTI (G's)	Peak Pelvis (G's)
Driver	119	42.1	78.1	36	79.8
Passenger	393	49.4	70.0	49	51.2

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Information	Left Front (Driver)		Left Rear (Passenger)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No	No	
Side Torso Airbag	Yes	Yes	No	
Curtain Airbag	Yes	Yes	Yes	Yes

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

TEST NOTES

There was no valid data collected for:

- Floorpan @ Rear Axle X after 50 msec.
- Floorpan @ Rear Axle Y after 50 msec.
- Floorpan @ Rear Axle Z after 50 msec.
- Left Front Sill Y after 40 msec.
- Left Mid A-Post Y

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DATA SHEET NO. 1**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

TEST VEHICLE INFORMATION

Make	Subaru
Model	Legacy
Body Style	Sedan
NHTSA No.	MA5501
VIN	4S3BMCA61A3220040
Color	Ruby Red Pearl
Delivery Date	9/24/2009
Odometer Reading (mile)	50 miles
Dealer	Wilde Subaru
Transmission	Automatic
Final Drive	AWD
Number of Cylinders	4
Engine Displacement (L)	2.5
Engine Placement	Longitudinal
Automatic Door Locks (ADL)	No
Owner's Manual Details Instructions on Disabling ADLs	N/A

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	Yes
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All Wheel Drive	Yes
Power Seats	No
Pretensioners	Yes
Load Limiters	Yes
Bucket Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Fuji Heavy Industries Ltd.
Date of Manufacture	09/09

GVWR (kg)	2010
GAWR Front (kg)	1070
GAWR Rear (kg)	1060

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bucket		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				385
Cargo Wt. (RCLW) (kg)				45

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

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	451.3	331.6		505.8	426.8	
Right	kg	438.2	319.3		434.5	373.8	
Ratio	%	57.7	42.3		54.0	46.0	
Totals	kg	889.5	650.9	1540.4	940.3	800.6	1740.9

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1540.4
Weight of 2 P572M ATDs	kg	161.5
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	1746.9

* Actual As Tested Weight (ATW) will be TVTW -5/-10 kg

Weight of Ballast in Trunk (kg): 22.7

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	703	707	707	705	1162
As Tested	mm	689	704	677	690	1265
Fully Loaded	mm	683	697	670	690	

TEST VEHICLE VERTICAL IMPACT LINE DATA

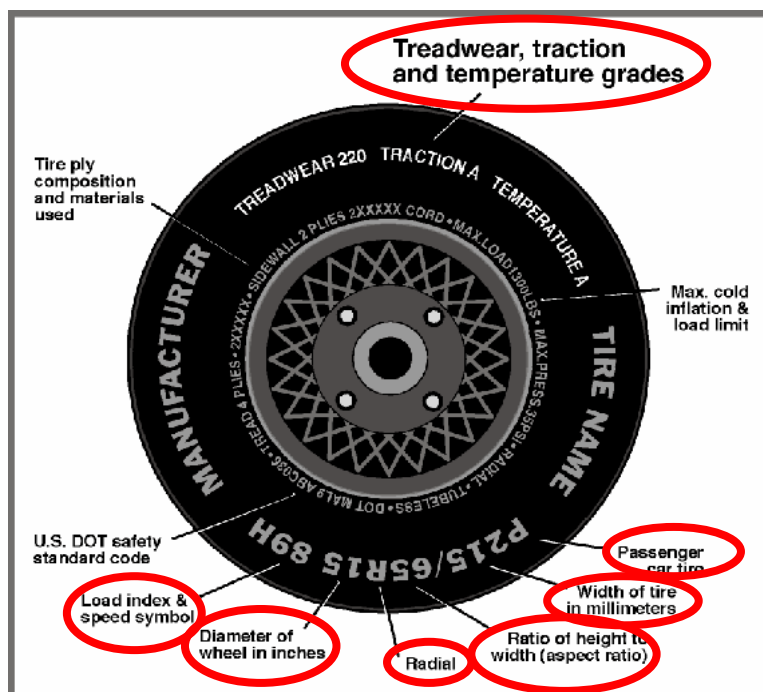
Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2750
Target Impact Point Aft of Front Axle	mm	435
Actual Impact Point Aft of Front Axle	mm	415

DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Test Pressure (kPa)	230	220
Recommended Tire Size	P205/60R16	P205/60R16
Tire Size on Vehicle	P205/60R16	P205/60R16
Tire Manufacturer	Bridgestone	Bridgestone
Tire Name	Turanza	Turanza
Tire Type	Passenger	Passenger
Tire Width (mm)	205	205
Ratio of Height to Width (aspect ratio)	60	60
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	91V	91V
Treadwear	260	260
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 3 **TEST VEHICLE INFORMATION**

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
Test Program: NCAP Side Impact

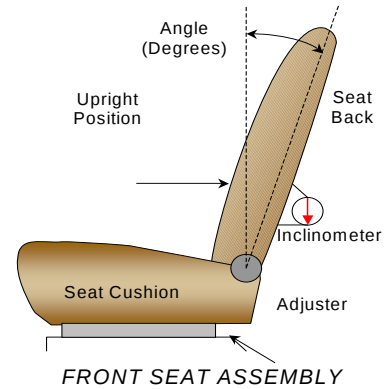
NHTSA No. MA5501
Test Date: 10/19/2009

NOMINAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: For the driver's seat, set seat back in 8th detent with the forward-most detent defined as 0). The left rear passenger's seat is not adjustable.

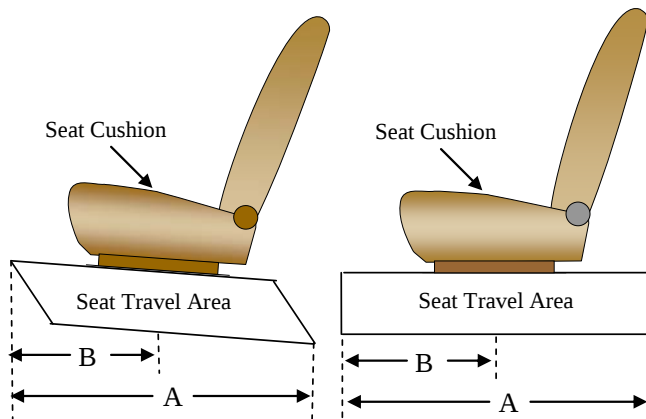
Driver seat back angle: 8th detent (forward-most as 0)

Passenger seat back angle: fixed



SEAT FORE/AFT POSITIONS

	Total Fore/Aft Travel	Placed in position #
Driver Seat	26 detents	10 th detent (forward-most as 0)
Rear Seat	Fixed	Fixed



DATA SHEET NO. 3 (CONTINUED)

TEST VEHICLE INFORMATION

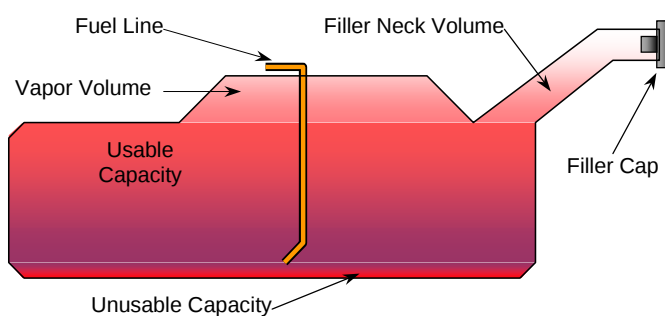
Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	70.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	64.4 to 65.8
Actual Amount of Solvent used	65.1
1/3 of Usable Capacity	23.3

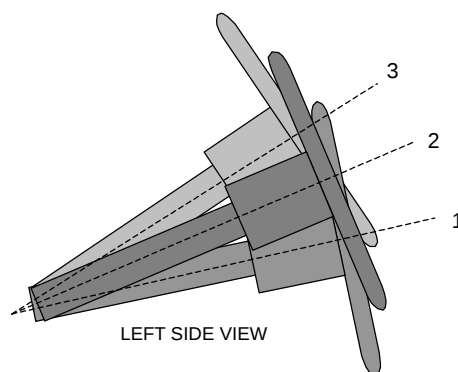
The test vehicle is equipped with an electric fuel pump. The pump normally operates when the vehicle's electrical system is activated.



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

	Fore/Aft (mm)	Degrees
Lowermost position No. 1	132	66.0
Geometric center position No. 2	152	67.5
Uppermost position No. 3	172	69.0

DATA SHEET NO. 4**MOVING DEFORMABLE BARRIER (MDB) SUMMARY OF RESULTS**

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
Test Program: NCAP Side Impact

NHTSA No. MA5501
Test Date: 10/19/2009

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1252
Overall Length Including Honeycomb Face	4115
Wheel base of Framework Carriage	2592
C.G. Location aft of Front Axle	1129

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	411.8	281.6	
Right	kg	356.8	311.3	
Ratio	%	56.5	43.5	
Totals	kg	768.6	592.9	1361.5

SPEED AND IMPACT ANGLE DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.6
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.6
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	89.8

**POST TEST OBSERVATIONS
MDB LEFT EDGE IMPACT POINT DATA**

Measured Parameter	Units	Requirement	Value
Horizontal Offset	mm	+/- 50	20 forward
Vertical Offset	mm	+/-20	4 down

DATA SHEET NO. 5**POST TEST OBSERVATIONS**

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Front Seat SID/HIII	Rear Seat SID/HIII
Dummy Type / Serial No.	SID HIII / 272	SID HIII / 271
Head Contact	Curtain Airbag, Headrest	Curtain Airbag, Headrest
Upper Torso Contact	Side Airbag	Door Panel
Lower Torso Contact	Door Panel	Door Panel
Left Knee Contact	Door Panel	Door Panel
Right Knee Contact	Left Knee	Left Knee

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Locked/Unlocked Doors	Struck side door was unlocked; Non-struck side door was unlocked	Struck side door was unlocked; Non-struck side door was unlocked
Left Side Door Opening	Door remained closed and latched	Door remained closed and latched
Right Side Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Movement	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	None
Windshield Damage	None
Window Damage	Left Front and Left Rear Windows were broken.
Other Notable Effects	None

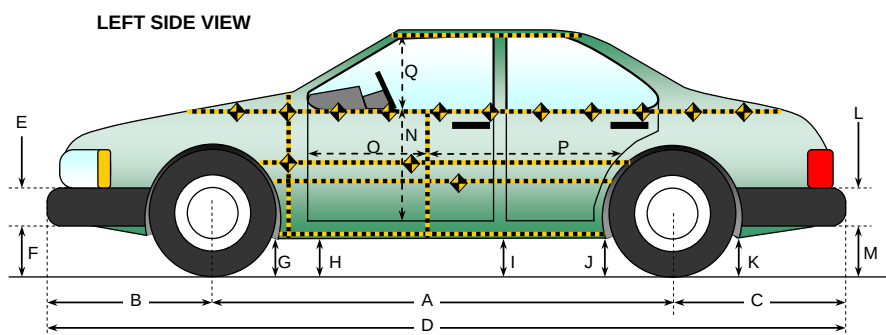
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Information	Left Front (Driver)		Left Rear (Passenger)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	No	No	
Side Torso Airbag	Yes	Yes	No	
Curtain Airbag	Yes	Yes	Yes	Yes

DATA SHEET NO. 6
VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



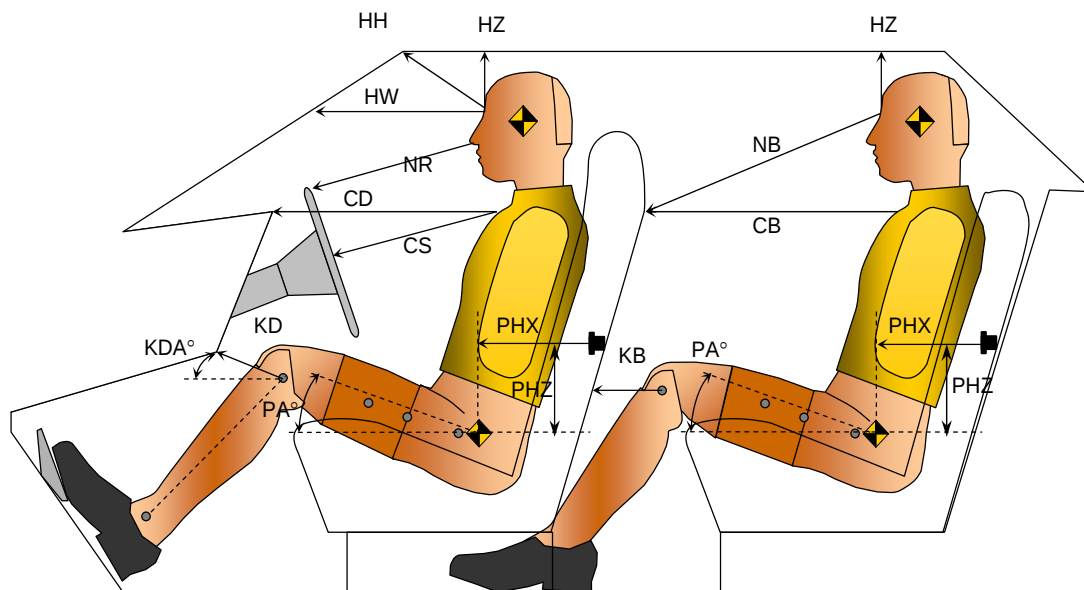
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2750	2756	-6
B	Front Axle to FSOV	951	957	-6
C	Rear Axle to RSOV	1014	1020	-6
D	Total Length at Centerline	4715	4733	-18
E	Front Bumper Thickness	138	138	0
F	Front Bumper Bottom to Ground	225	235	-10
G	Sill Height at Front Wheel Well	158	175	-17
H	Sill Height at Front Door Leading Edge	155	173	-18
I	Sill Height at "B" Pillar	149	155	-6
J1	Sill Height at Rear Wheel Well	147	165	-18
J2	Pinch Weld Height at Rear Wheel Well	143	168	-25
K	Sill Height Aft of Rear Wheel Well	205	198	7
L	Rear Bumper Thickness	158	158	0
M	Rear Bumper Bottom to Ground	325	317	8
N	Sill Height to Window Bottom Sill	716	621	95
O	Front Door Leading Edge to Impact CL	786	740	46
P	Rear Door Trailing Edge to Impact CL	1195	1123	72
Q	Front Window Opening	450	440	10
R	Right Side Length	3669	3680	-11
S	Left Side Length	3669	3660	9
T	Vehicle Width at "B" Post	1775	1554	221

DATA SHEET NO. 7
SID/HII LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

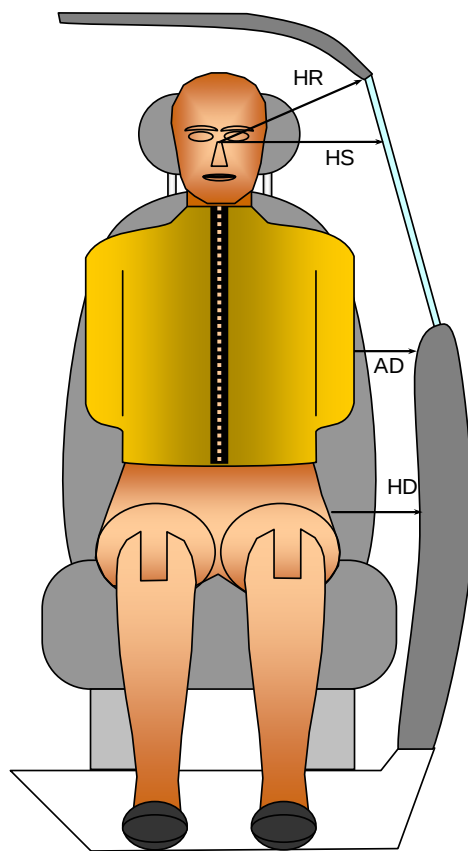


Driver Code	Pass. Code	Measurement Description	Driver S/N 272		Passenger S/N 271	
			Length(mm)	Angle(°)	Length(mm)	Angle(°)
HH		Head to Header	364			
HW		Head to Windshield	708			
HZ	HZ	Head to Roof	180		145	
NR	NB	Nose to Rim/Nose to Seatback	458		654	
CD	CB	Chest to Dash or Seatback	517		559	
CS		Chest to Steering Wheel	349			
KDL	KBL	Left Knee to Dash or Seatback	186	30.8	229	39.4
KDR	KBR	Right Knee to Dash or Seatback	170	32.1	225	39.7
PA	PA	Pelvic Angle		23.5		23.2
PHX	PHX	H-Point to Striker (X-Axis)	228		265	
PHZ	PHZ	H-Point to Striker (Z-Axis)	179		270	

DATA SHEET NO. 8
SID/HIII LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



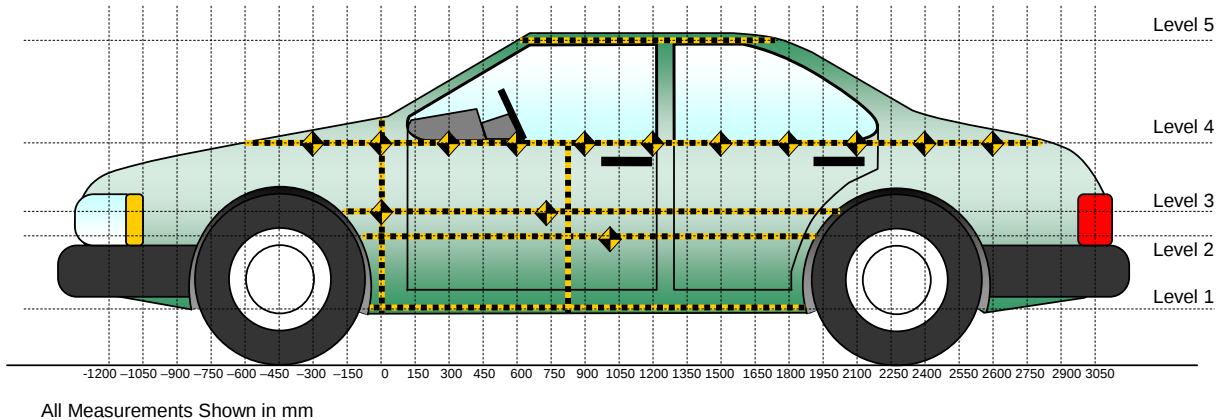
FRONT VIEW OF DUMMY

Code	Measurement Description	Units	Driver S/N 272	Passenger S/N 271
HR	Head to Side Header	mm	220	202
HS	Head to Side Window	mm	334	318
AD	Arm to Door	mm	101	94
HD	H-Point to Door	mm	153	146

DATA SHEET NO. 9 **VEHICLE SIDE MEASUREMENTS**

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



LEFT SIDE VIEW

Measurements are taken with vehicle in the as tested condition.
 Measurements along the vertical 800 mm.
 All measurements below in mm.

Level	Measurement Description	Maximum Exterior Static Crush	Distance From Impact	Height Above Ground
5	Window	26	1200	1396
4	Window Sill	140	1350	925
3	Mid Door	256	1650	612
2	Occupant H-Point	253	1650	253
1	Sill Top	89	1800	275
	Maximum Penetration	256		

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-750				316					311					-5	
-600				306					305					-1	
-450				295					299					4	
-300				290					298					8	
-150			192	289				229	285				37	4	
0	218	205	212	285		251	255	251	307		33	50	39	22	
150	255	222	220	284		212	354	349	291		-43	132	129	7	
300	259	222	218	282		237	385	385	357		-22	163	167	75	
450	260	220	215	281		251	400	404	403		-9	180	189	122	
600	260	218	215	281		261	412	402	410		1	194	187	129	
750	260	216	212	281	487	265	404	425	402	492	5	188	213	121	5
900	260	216	212	280	480	276	411	423	386	491	16	195	211	106	11
1050	260	216	212	282	477	288	417	414	368	494	28	201	202	86	17
1200	261	217	213	282	477	340	443	433	387	503	79	226	220	105	26
1350	259	218	214	285	478	339	460	461	425	494	80	242	247	140	16
1500	261	219	215	285	480	347	460	467	392	494	86	241	252	107	14
1650	260	220	216	287	481	342	473	472	377	494	82	253	256	90	13
1800	247	221	218	291	488	336	440	445	357	499	89	219	227	66	11
1950	218	194	199	293	499	257	332	369	328	508	39	138	170	35	9
2100			191	300	522			250	313	530			59	13	8
2250				302					335					33	
2400				309					335					26	
2550				315					334					19	
2700				323					334					11	
2850				335					337					2	

Reference plane is parallel to test vehicle longitudinal centerline.

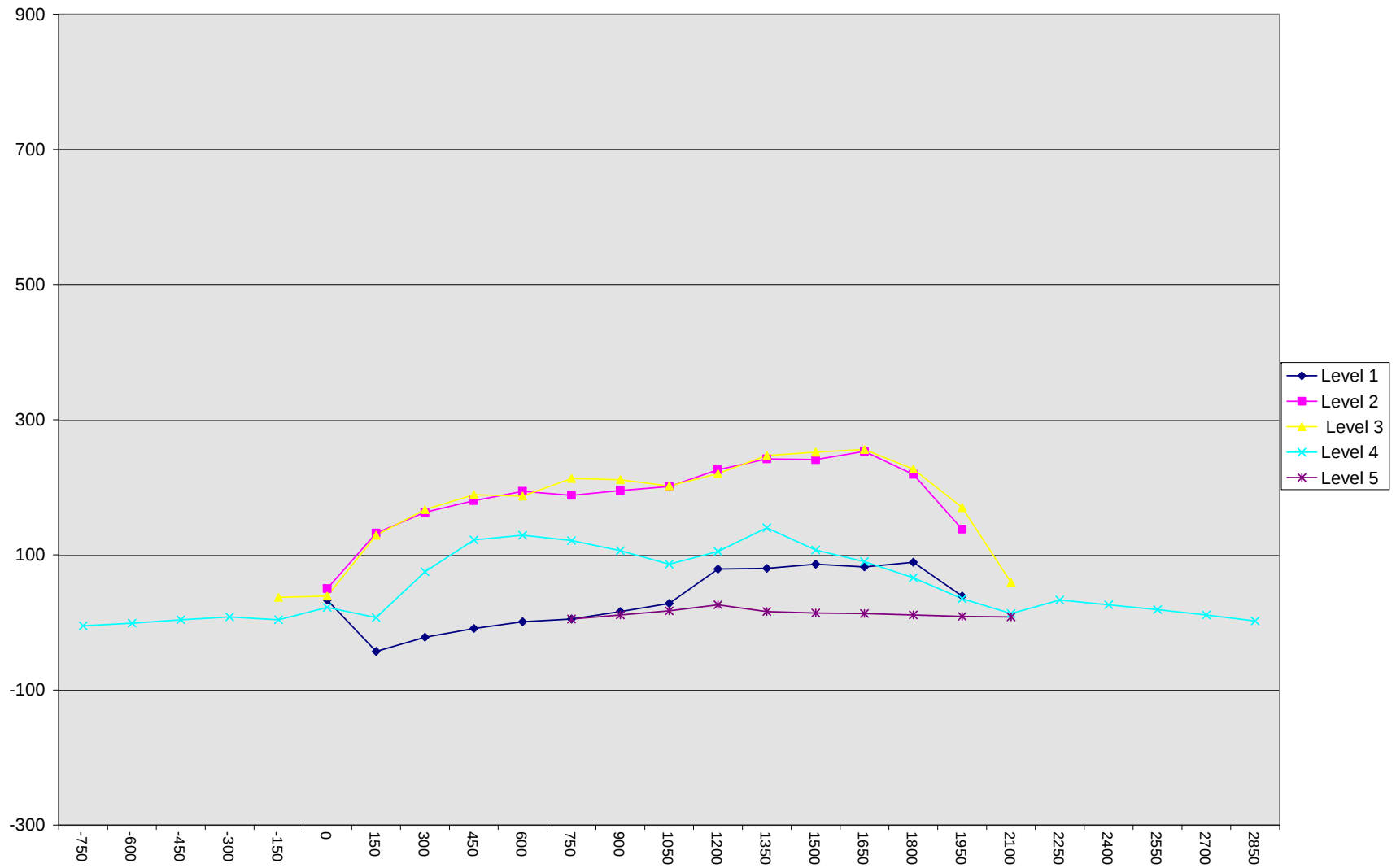
Given dimensions = Reference plane to car body

DATA SHEET NO. 10... (continued)
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
Test Program: NCAP Side Impact

NHTSA No. MA5501
Test Date: 10/19/2009

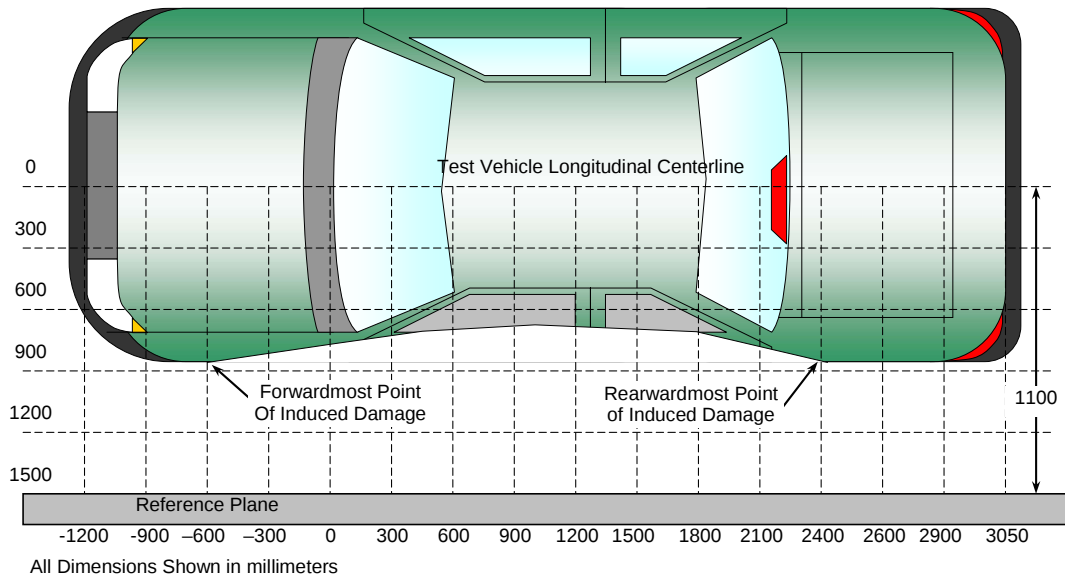
16



DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



TOP VIEW

DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	2850	4	335	337	2
2	2150	4	301	320	19
3	1450	3	214	463	249
4	650	3	214	410	196
5	-50	3	204	242	38
6	-750	4	316	311	-5

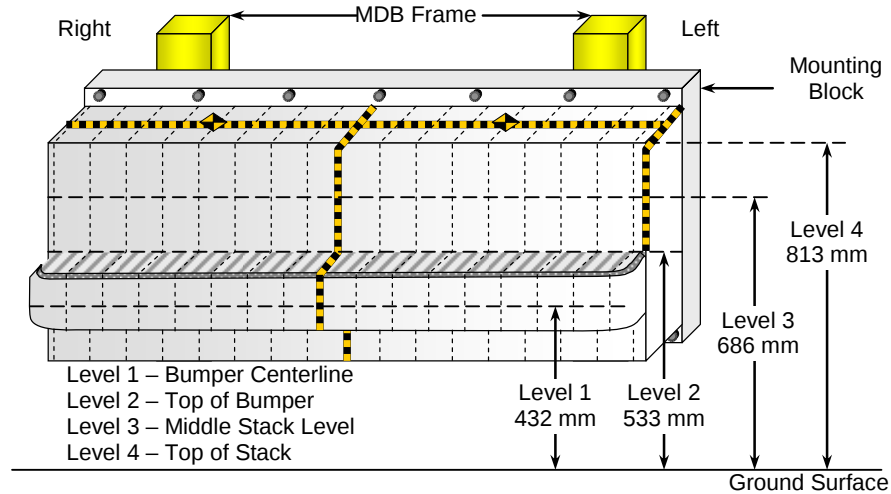
Reference plane is parallel to test vehicle longitudinal centerline.
 Given dimensions = Reference plane to car body.

DATA SHEET NO. 12

DEFORMABLE BARRIER HONEYCOMB FACE STATIC CRUSH

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



DEFORMABLE BARRIER STATIC CRUSH

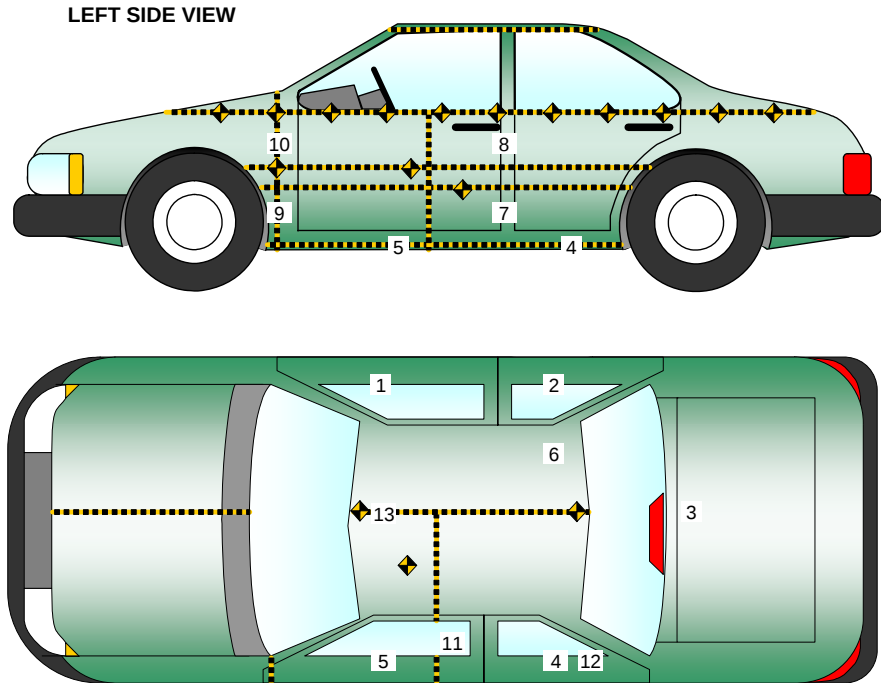
Stack Level	Distance Right of Center								C _L	Distance Left of Center							
	800	700	600	500	400	300	200	100		100	200	300	400	500	600	700	800
1	156	146	148	159	167	194	182	168	151	133	125	121	120	118	120	132	151
2	75	70	72	77	80	90	93	77	61	55	52	50	56	69	71	77	85
3	62	32	29	21	28	56	73	51	25	18	16	16	18	22	27	46	96
4	93	57	32	24	40	86	93	69	53	30	25	26	26	25	53	91	145

All Dimensions in mm

DATA SHEET NO. 13
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



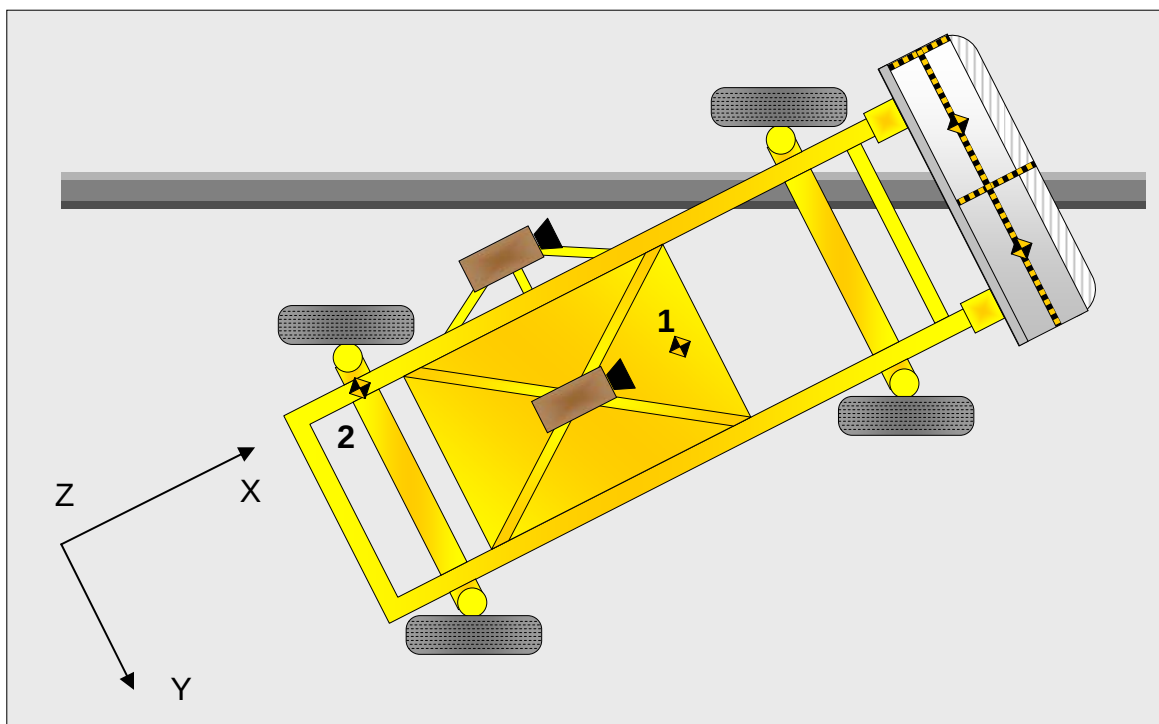
Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Right Sill at Front Seat	2646	722	-195
2	Right Sill at Rear Seat	1797	730	-198
3	Rear Floorpan Above Axle	965	0	-638
4	Left Sill at Rear Door	1800	-730	-190
5	Left Sill at Front Door	2655	-722	-189
6	Rear Occupant Compartment	1862	350	-351
7	Left Lower B-Post	2111	-724	-440
8	Left Middle B-Post	2129	-731	-801
9	Left Lower A-Post	3220	-722	-493
10	Left Middle A-Post	3231	-819	-765
11	Front Seat Track	2333	-550	-278
12	Rear Seat Track or Structure			
13	Vehicle CG	2426	0	-419

Reference Points X - Test Vehicle Rear Bumper (+ forward)
 Y - Test Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 14
MDB ACCELEROMETER LOCATIONS

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	MDB CG	-1105	0	-330
2	MDB Rear	-2580	-650	-625

Reference Points X - MDB Front Axle (+ forward)
 Y - MDB Centerline (+ to right)
 Z - Ground Plane (+ down)

DATA SHEET NO. 15
VEHICLE STRUCTURAL MEASUREMENTS

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
Test Program: NCAP Side Impact

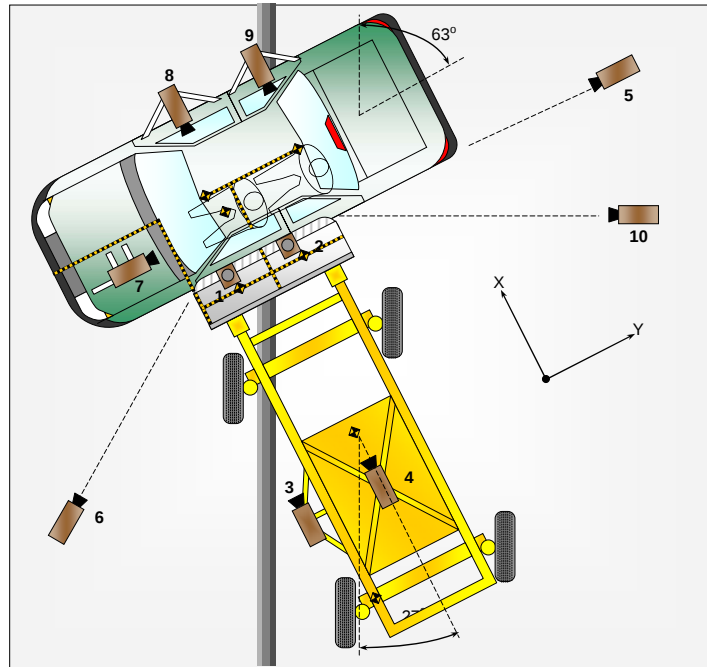
NHTSA No. MA5501
Test Date: 10/19/2009

	Elements	Pre-Test (mm)
1	Total Length	4715
2	Total Width	1820
3	Bumper Top Height	555
4	Bumper Bottom Height	410
5	Longitudinal Member Top Height	470
6	Distance between Longitudinal Members	1017
7	Longitudinal Member Width	64
8	Engine Top Height	846
9	Engine Bottom Height	219
10	Engine and gearbox width	740
11	Front bumper-engine distance	465
12	Front shock absorber fixing height	860
13	Bonnet leading edge height	788
14	Front shock absorber fixing width	1145
15	Front bumper – front axle distance	954
16	Front axle – a pillar distance	470
17	A-pillar – B-pillar distance	1115
18	B-Pillar – rear axle distance	1164
19	B-pillar – C-pillar distance	1110
20	Roof sill bottom height	1344
21	Roof sill top height	1456
22	Floor sill bottom height	195
23	Floor sill top height	344

DATA SHEET NO. 16
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Close-up	-520	-275	-5055	50	1000
2	Overhead Overall	680	1245	-5050	14	1000
3	MDB Onboard, Impact Point Close-up				50	1000
4	MDB Onboard, Centerline of Impact				16	1000
5	Right Side, Ground Level, Overall	50	7250	-1220	24	1000
6	Left Side, Ground Level, Overall	-3150	-4740	-1210	24	1000
7	Vehicle Onboard Front SID/HIII, Front				12.5	1000
8	Vehicle Onboard Front SID/HIII, Side				8	1000
9	Vehicle Onboard Rear SID/HIII, Side				8	1000
10	Real Time Coverage				13	24

Reference Points X - Impact Line
 Y - MDB Left Edge Impact Point
 Z - Ground Plane

DATA SHEET NO. 17
SUMMARY OF FMVSS 301 DATA

Test Vehicle: 2010 Subaru Legacy 4-Dr Sedan
 Test Program: NCAP Side Impact

NHTSA No. MA5501
 Test Date: 10/19/2009

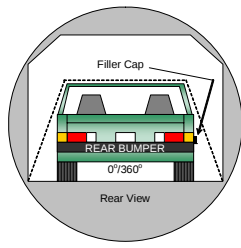
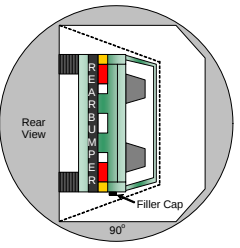
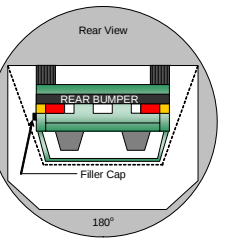
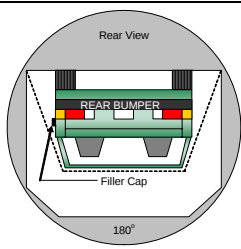
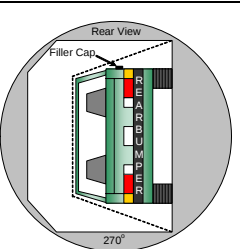
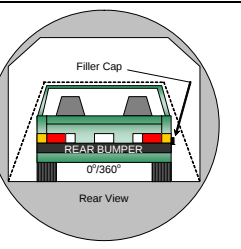
FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 11:20 am

Stoddard Solvent Spillage Measurements

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

FMVSS 301 STATIC ROLLOVER DATA

			1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds. 2. The position hold time at each position is 300 seconds (minimum). 3. Details of Stoddard Solvent spillage locations: None	
0° to 90°		90° to 180°		
				
180° to 270°		270° to 360°		

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage Collection Time (min)	Spillage (oz.)
0° to 90°	114	300	First 5	0
90° to 180°	116	300	First 5	0
180° to 270°	111	300	First 5	0
270° to 360°	118	300	First 5	0

APPENDIX A
PHOTOGRAPHS

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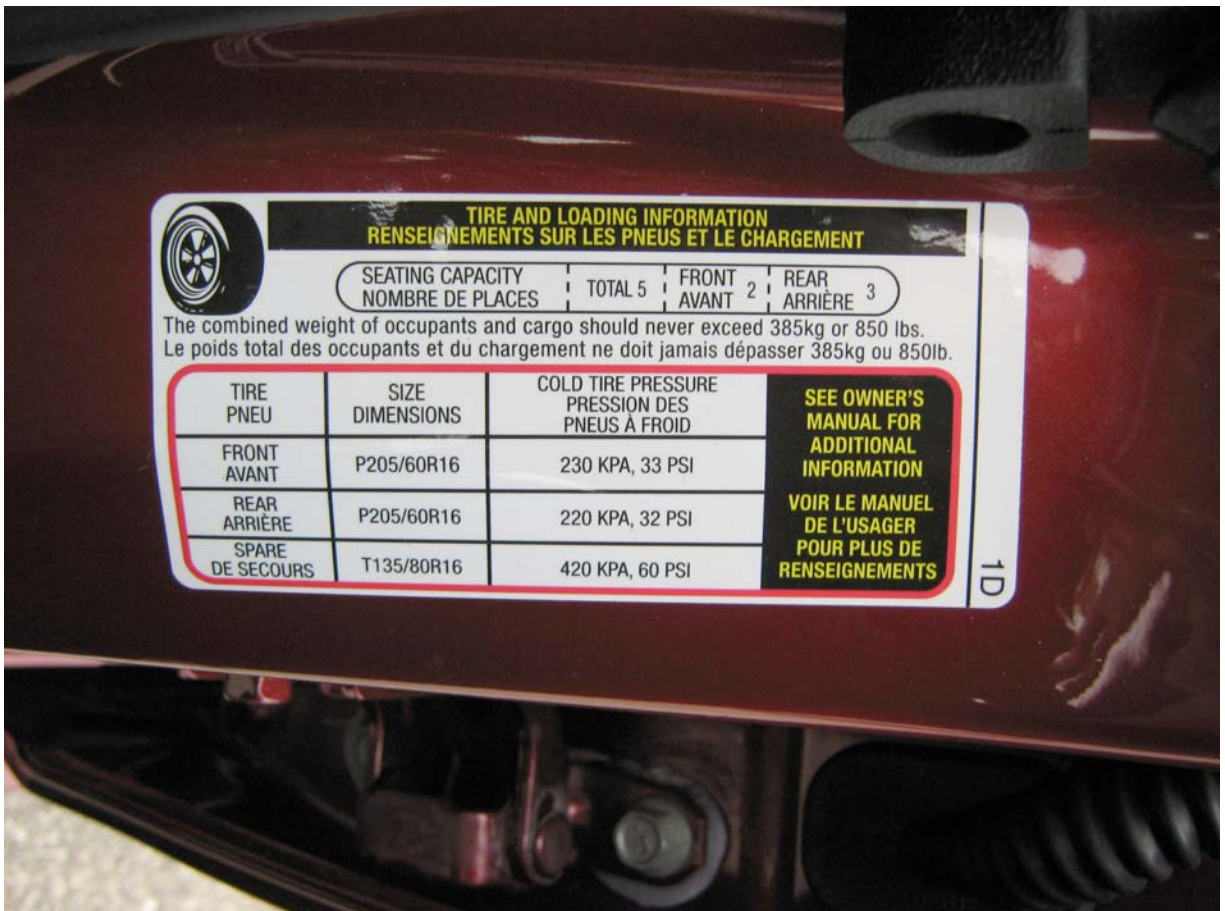
Right Front $\frac{3}{4}$ View, As Received



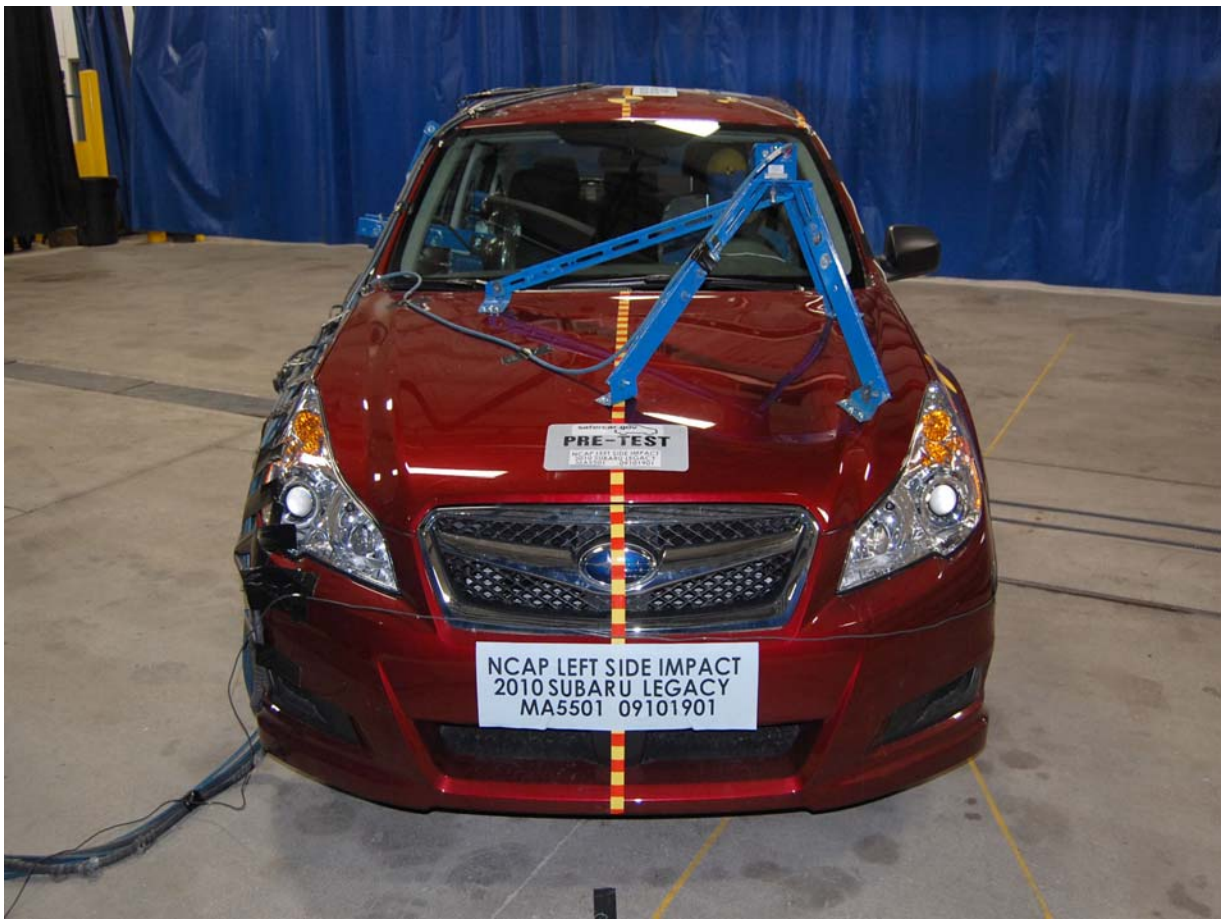
Left Rear $\frac{3}{4}$ View, As Received



Manufacturer's Label



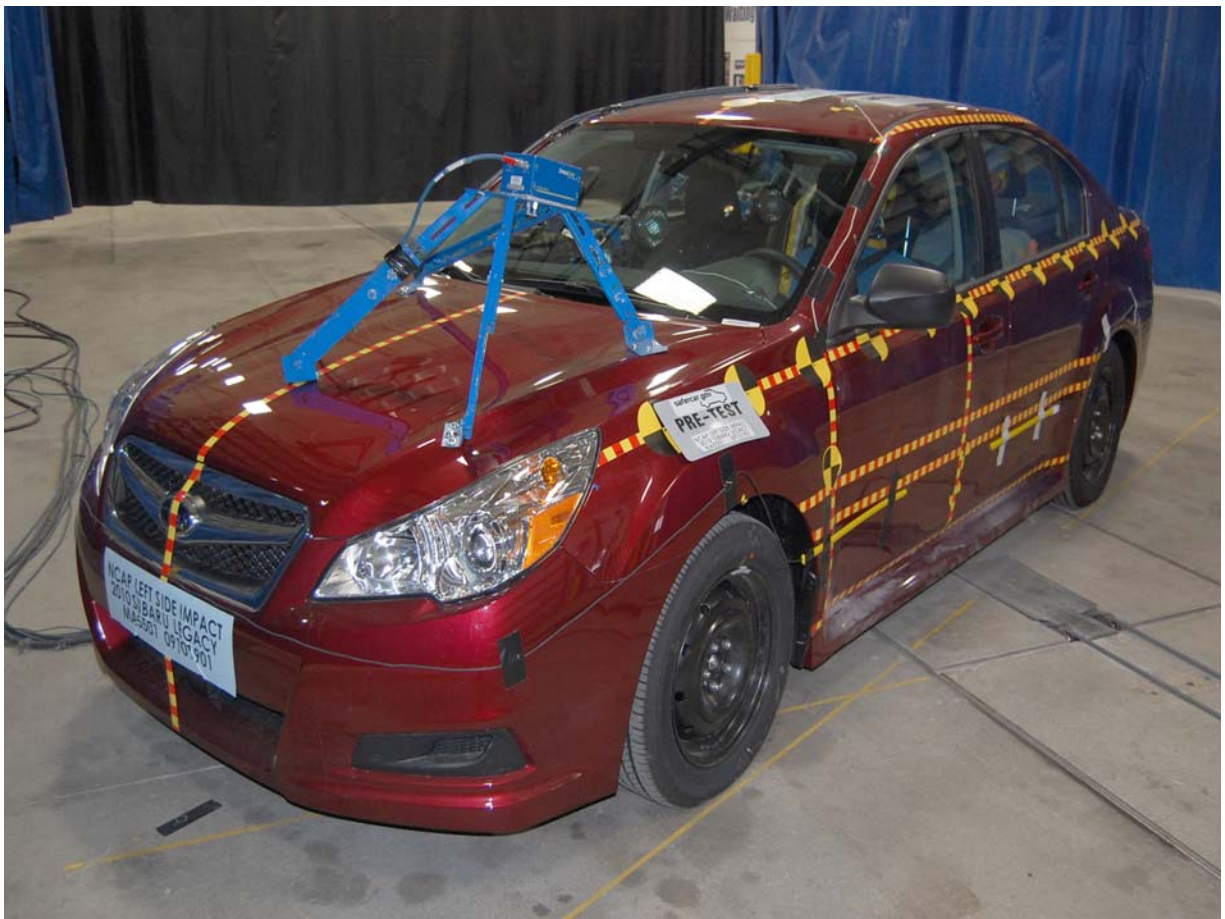
Tire Placard



Pre-Test Front View



Post-Test Front View



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



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



Pre-Test Left Side View



Post-Test Left Side View



Pre-Test Left Rear ¾ View



Post-Test Left Rear ¾ View



Pre-Test Rear View



Post-Test Rear View



Pre-Test Right Rear ¾ View



Post-Test Right Rear ¾ View



Pre-Test Right Side View



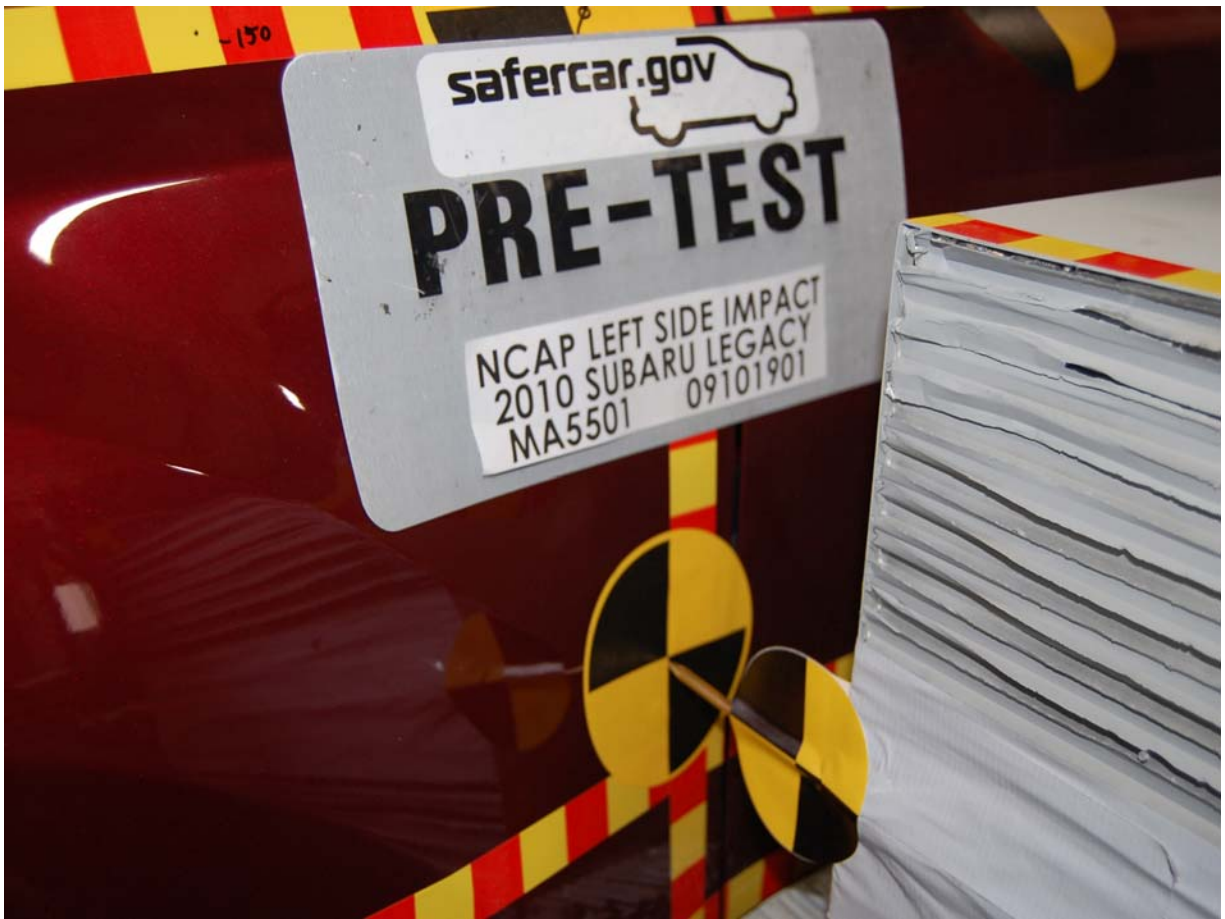
Post-Test Right Side View



Pre-Test Right Front 3/4 View



Post-Test Right Front 3/4 View



Pre-Test Left Impact Point



Post-Test Left Impact Point



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



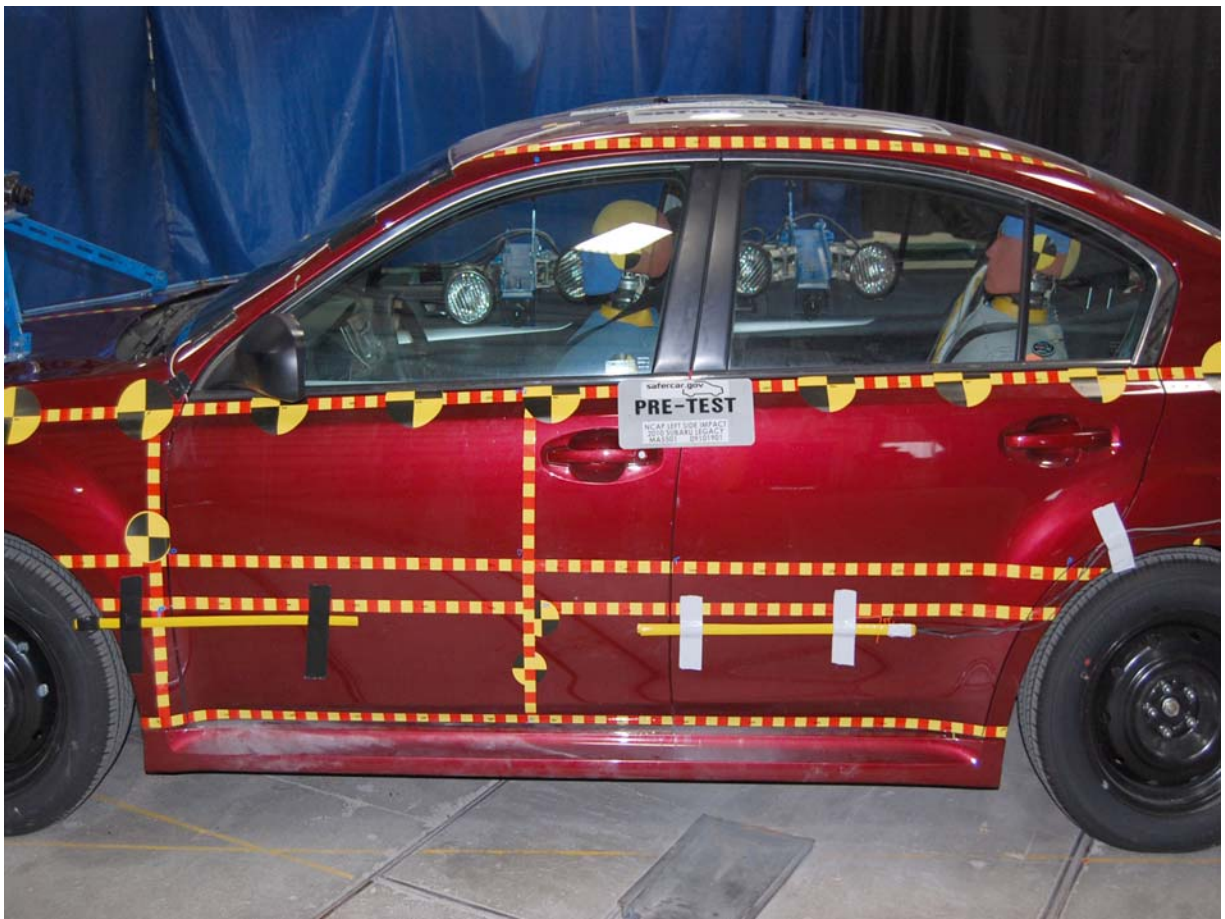
Post-Test Front $\frac{3}{4}$ View of Left Side Doors



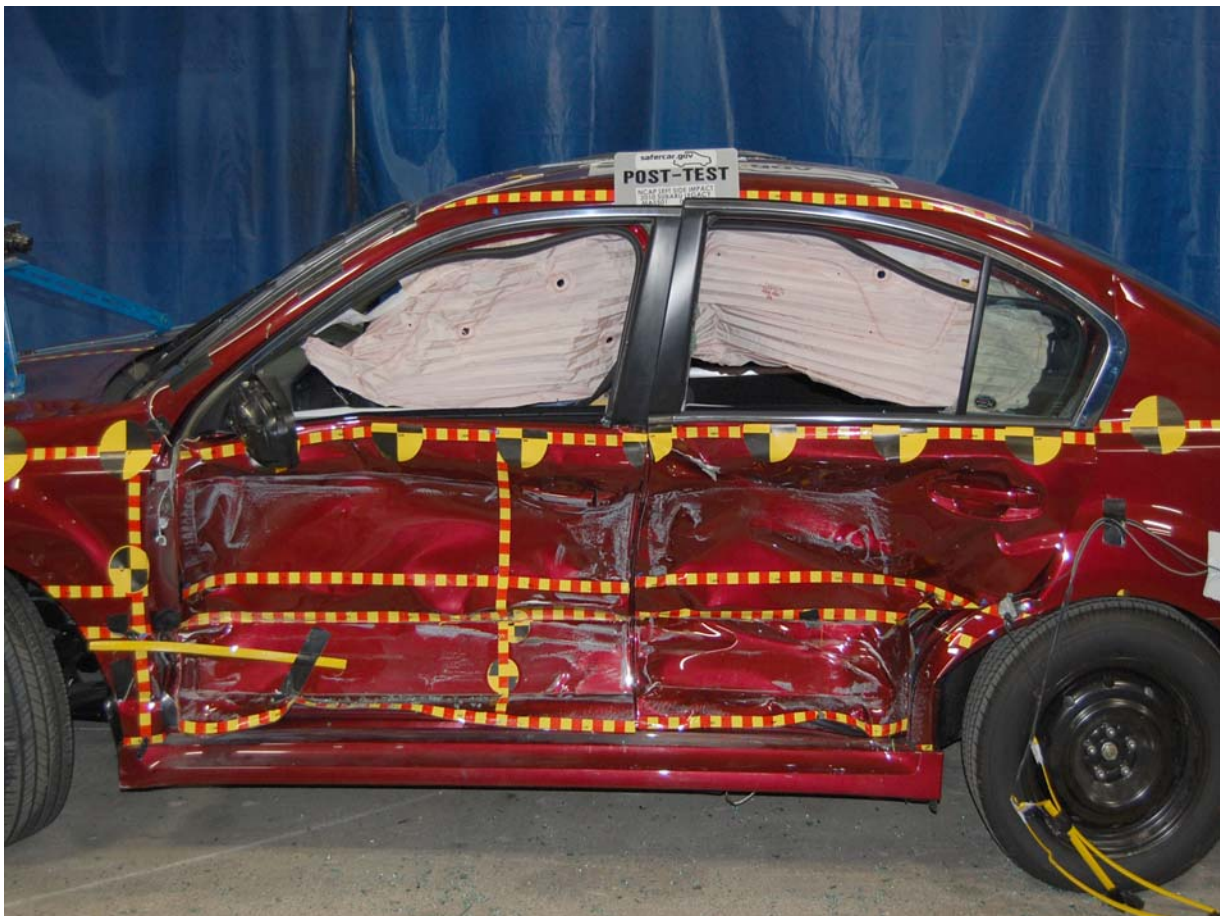
Pre-Test Rear $\frac{3}{4}$ View of Left Side Doors



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



Pre-Test Left Side Impact Close-up



Post-Test Left Side Impact Close-up



Pre-Test Overhead View



Post-Test Overhead View



Pre-Test Overhead Close-up View



Post-Test Overhead Close-up View



Pre-Test Driver Dummy (Door Open)



Pre-Test Driver Dummy Clearance From Door



Post-Test Driver Dummy Clearance From Door



Pre-Test Driver Dummy (Through Window)



Post-Test Driver Dummy (Through Window)



Pre-Test Driver Dummy Right Side View



Post-Test Driver Dummy Right Side View



Pre-Test Passenger Dummy (Door Open)



Pre-Test Passenger Dummy Clearance From Door



Post-Test Passenger Dummy Clearance From Door



Pre-Test Passenger Dummy (Through Window)



Post-Test Passenger Dummy (Through Window)



Pre-Test Passenger Dummy Right Side View



Post-Test Passenger Dummy Right Side View



Pre-Test Front View of Deformable Barrier



Post-Test Front View of Deformable Barrier



Pre-Test Top View of Deformable Barrier



Post-Test Top View of Deformable Barrier



Pre-Test Right Side View of Deformable Barrier



Post-Test Right Side View of Deformable Barrier



Pre-Test Left Side View of Deformable Barrier



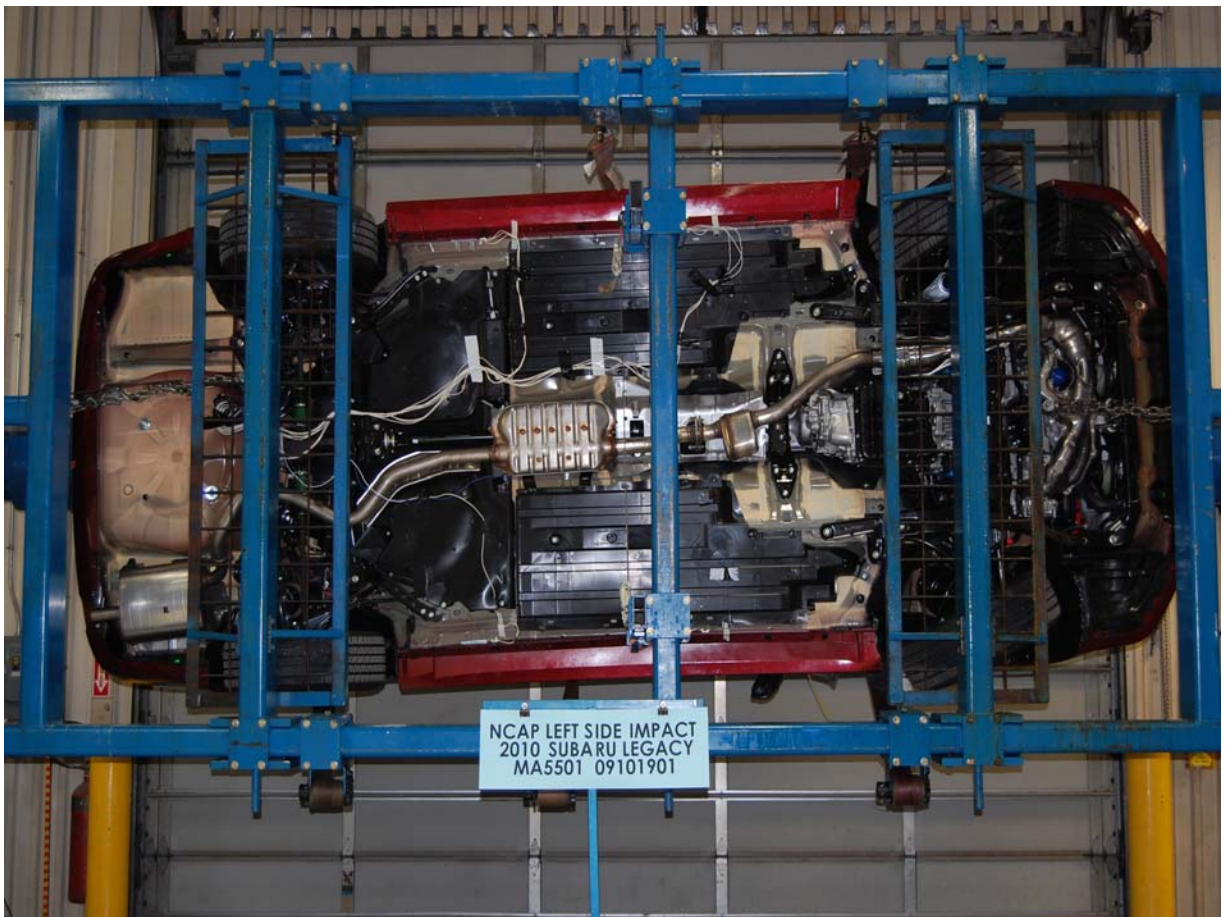
Post-Test Left Side View of Deformable Barrier



Vehicle on Rollover Device (90 Degrees)



Vehicle on Rollover Device (180 Degrees)



Vehicle on Rollover Device (270 Degrees)



Vehicle on Rollover Device (360 Degrees)



Vehicle Impact



Post-Test Driver Dummy Head Contact View



Post-Test Driver Dummy Upper Torso Contact



Post-Test Driver Dummy Lower Torso Contact



Post-Test Driver Dummy Contact



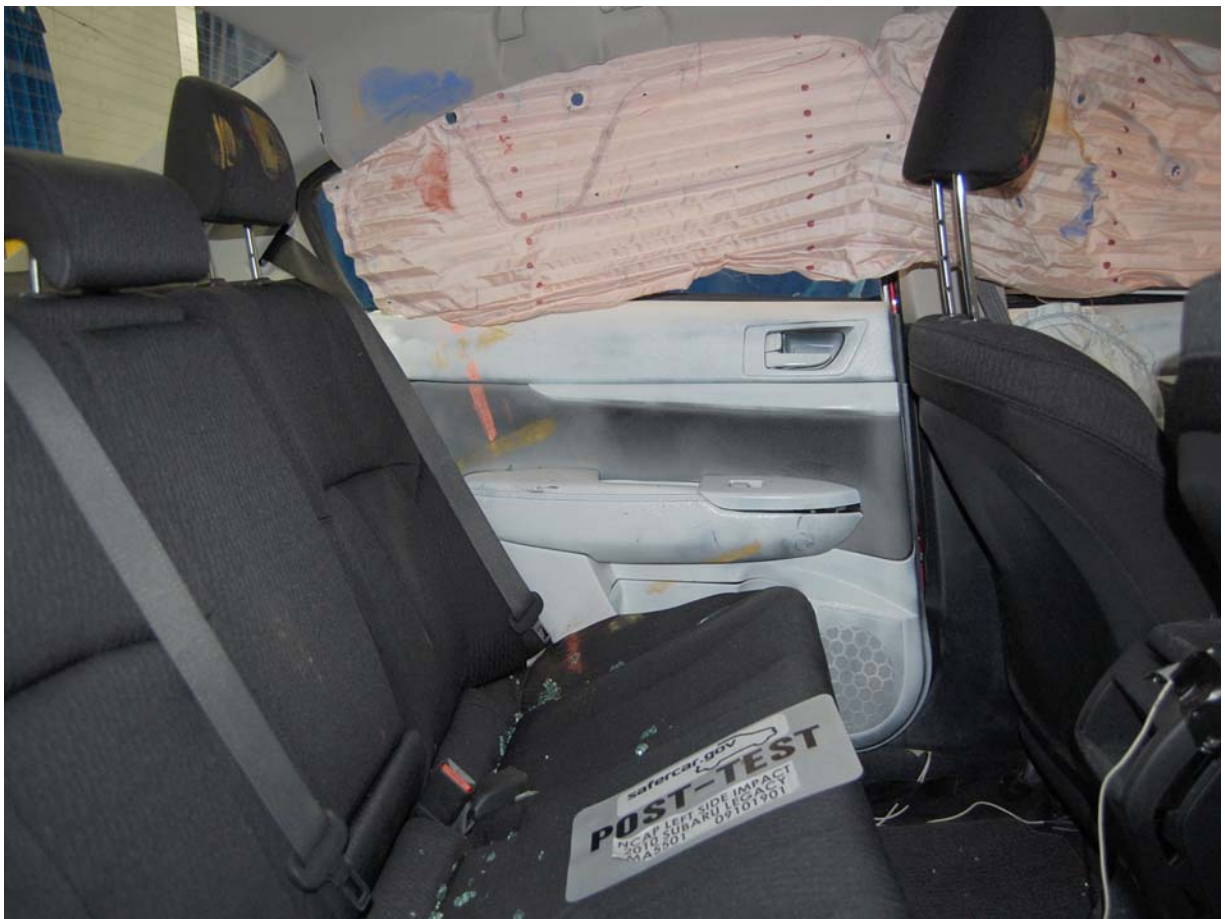
Post-Test Passenger Dummy Head Contact View



Post-Test Passenger Dummy Upper Torso Contact



Post-Test Passenger Dummy Lower Torso Contact



Post-Test Passenger Dummy Contact

APPENDIX B

SID/HIII 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 Primary

Driver Head Y Primary

Driver Head Z Primary

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

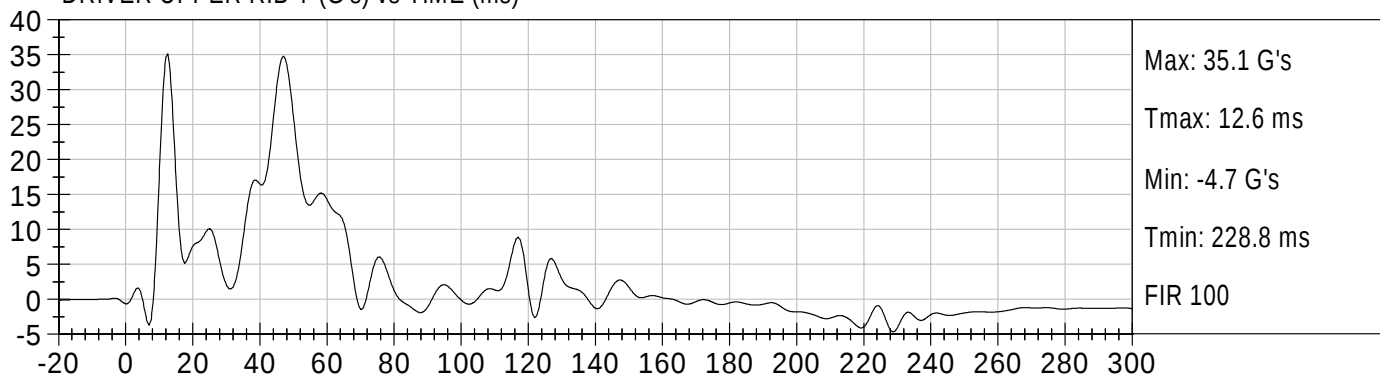
Driver Upper Neck Moment X

Driver Upper Neck Moment Y
Driver Upper Neck Moment Z
Driver Upper Rib Redundant Y
Driver Lower Rib Redundant Y
Driver Lower Spine Redundant Y
Driver Pelvis Redundant Y
Driver Thorax Contact
Driver Pelvis Contact
Passenger Head X Primary
Passenger Head Y Primary
Passenger Head Z Primary
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Upper Neck Force X
Passenger Upper Neck Force Y
Passenger Upper Neck Force Z
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Y
Passenger Upper Neck Moment Z
Passenger Upper Rib Redundant Y
Passenger Lower Rib Redundant Y
Passenger Lower Spine Redundant Y
Passenger Pelvis Redundant Y
Passenger Thorax Contact
Passenger Pelvis Contact
Vehicle Right Sill at Front Seat X
Vehicle Right Sill at Front Seat Y
Vehicle Right Sill at Front Seat Z
Vehicle Right Sill at Rear Seat X
Vehicle Right Sill at Rear Seat Y
Vehicle Right Sill at Rear Seat Z

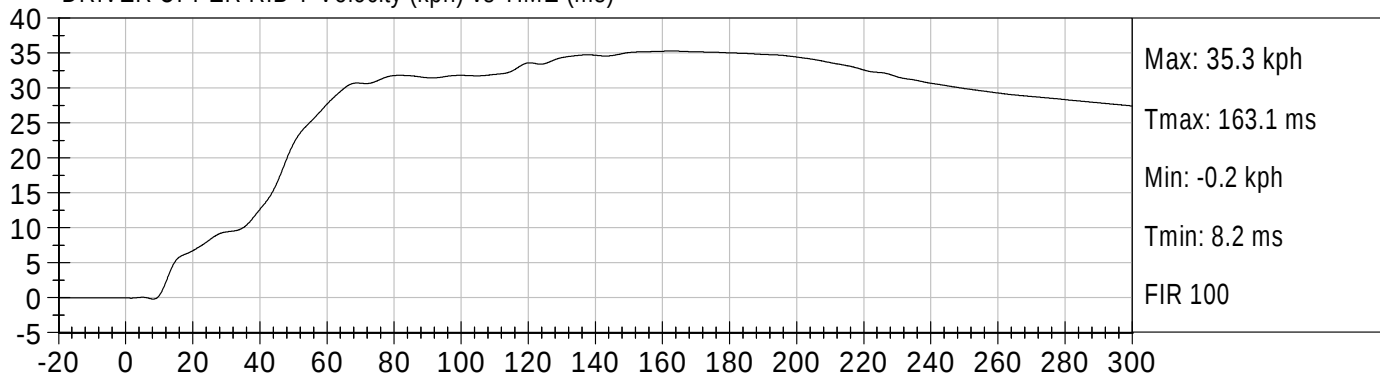
Vehicle Rear Floor Above Axle X
Vehicle Rear Floor Above Axle Y
Vehicle Rear Floor Above Axle Z
Vehicle Left Sill at Rear Door Y
Vehicle Left Sill at Front Door Y
Vehicle Right Rear Occupant Compartment
Vehicle B-Post Lower Y
Vehicle B-Post Middle Y
Vehicle A-Post Lower Y
Vehicle A-Post Middle Y
Vehicle Left Front Seat Track
Vehicle CG X
Vehicle CG Y
Vehicle CG Z
MDB CG X
MDB CG Y
MDB CG Z
MDB Rear X
MDB Rear Y
MDB Left Bumper Contact
MDB Right Bumper Contact



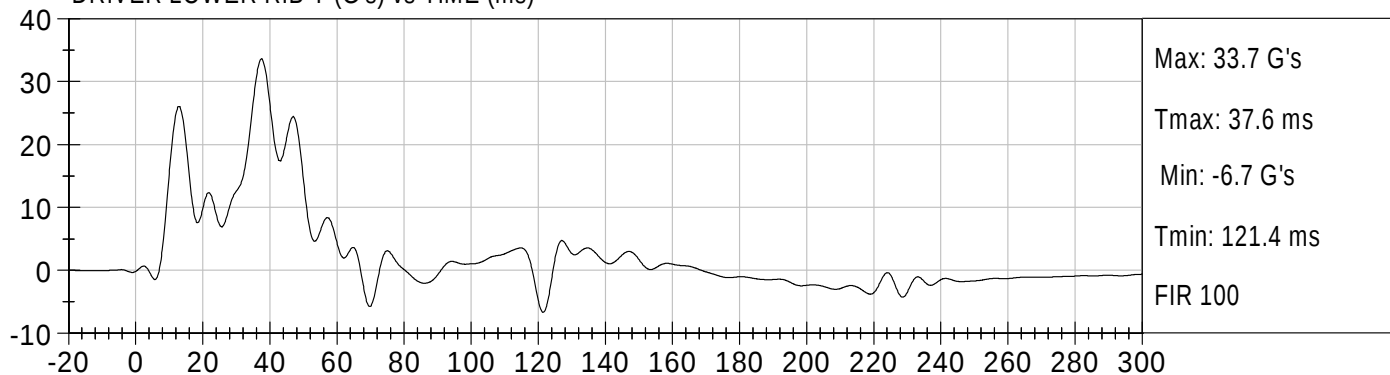
DRIVER UPPER RIB Y (G's) vs TIME (ms)



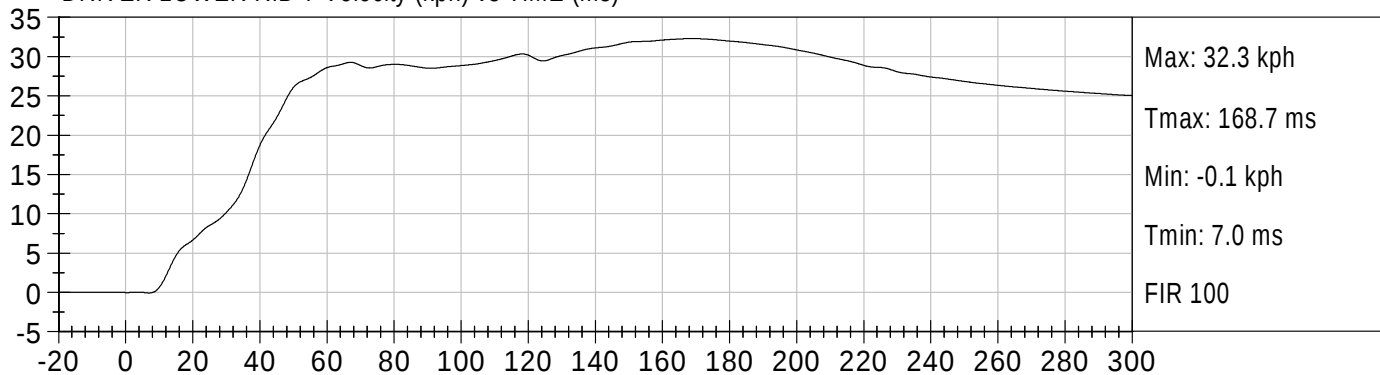
DRIVER UPPER RIB Y Velocity (kph) vs TIME (ms)

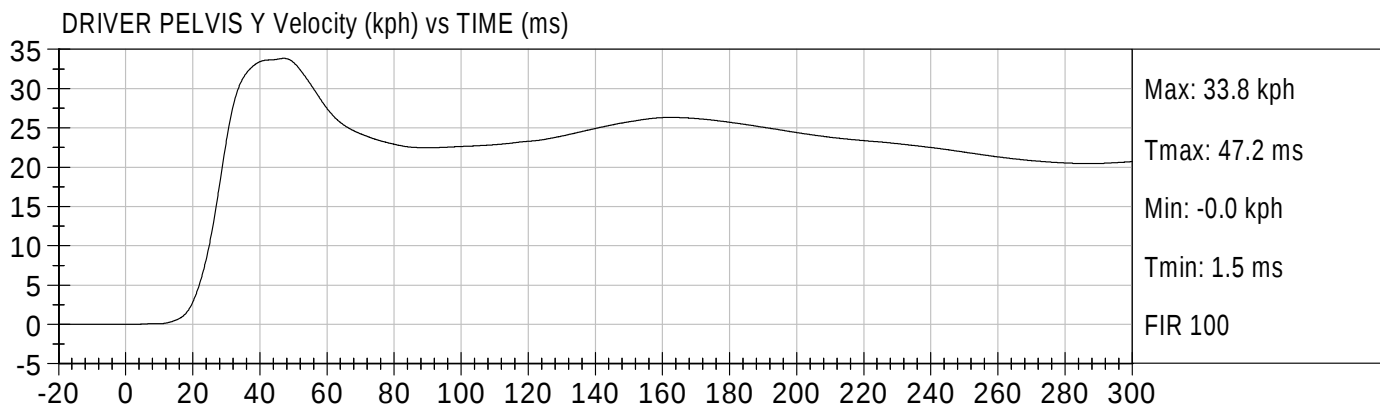
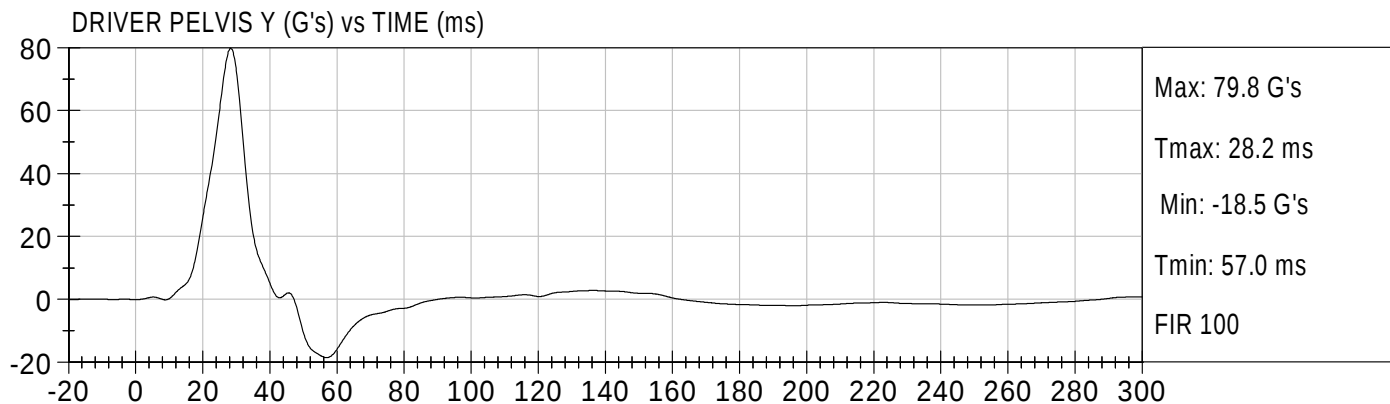
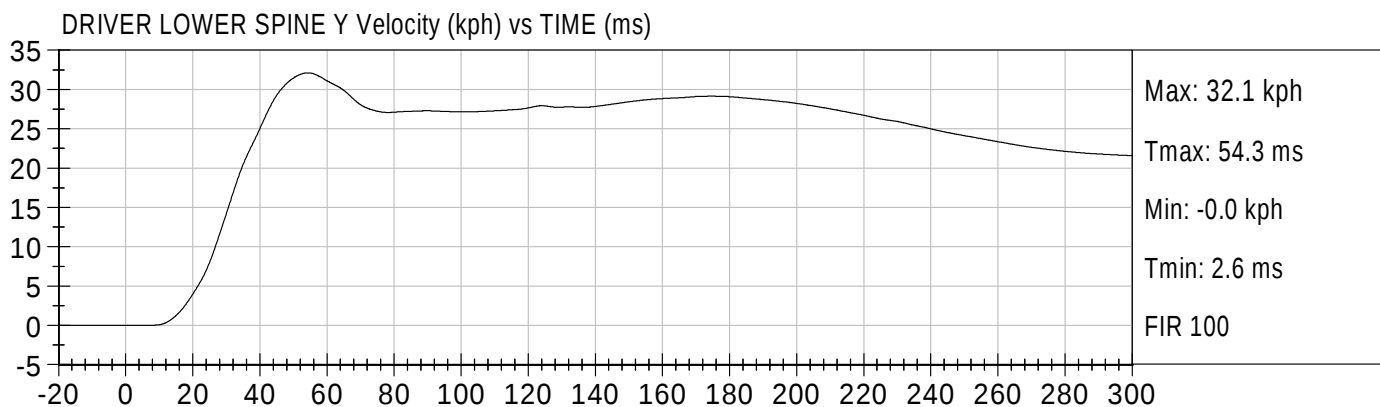
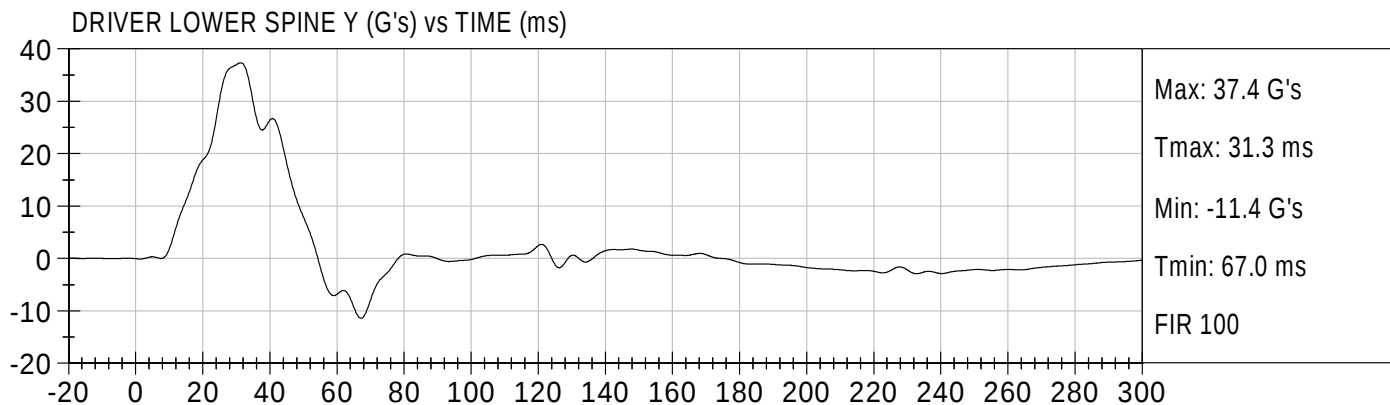


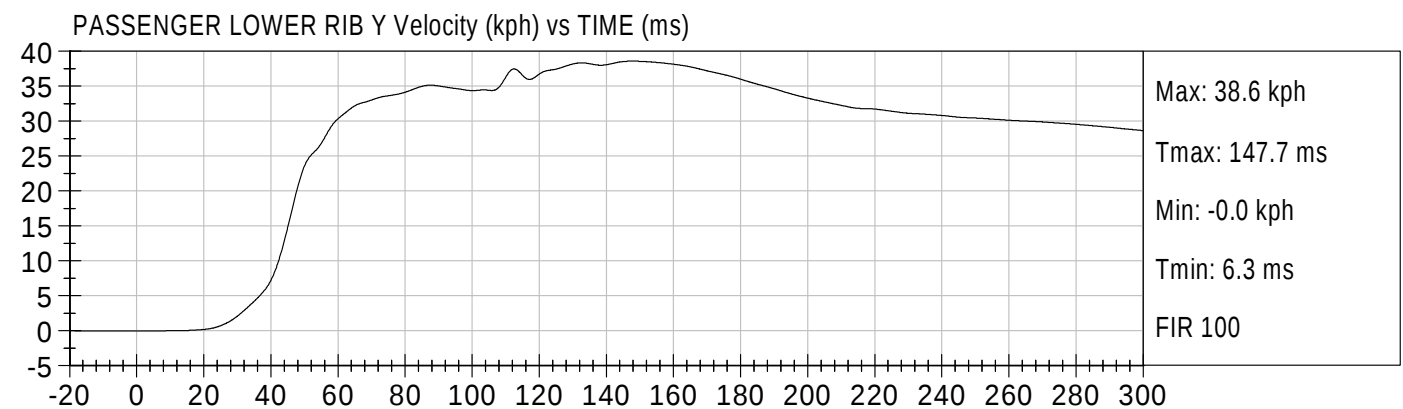
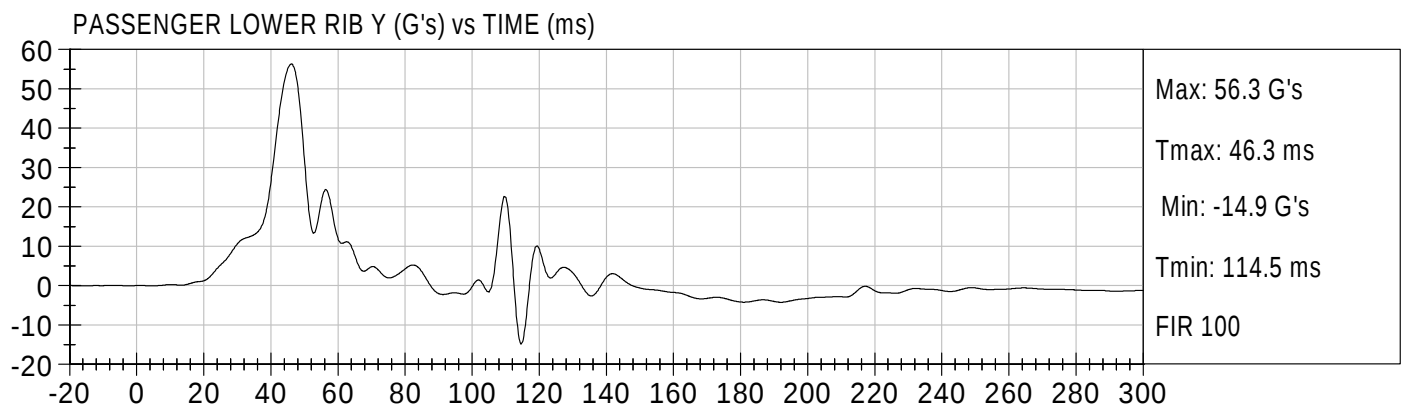
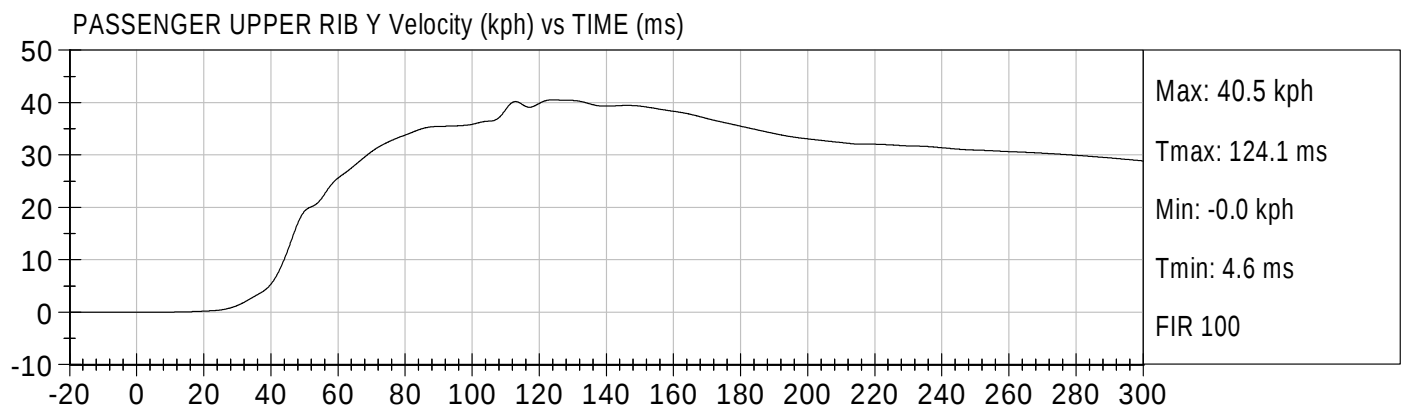
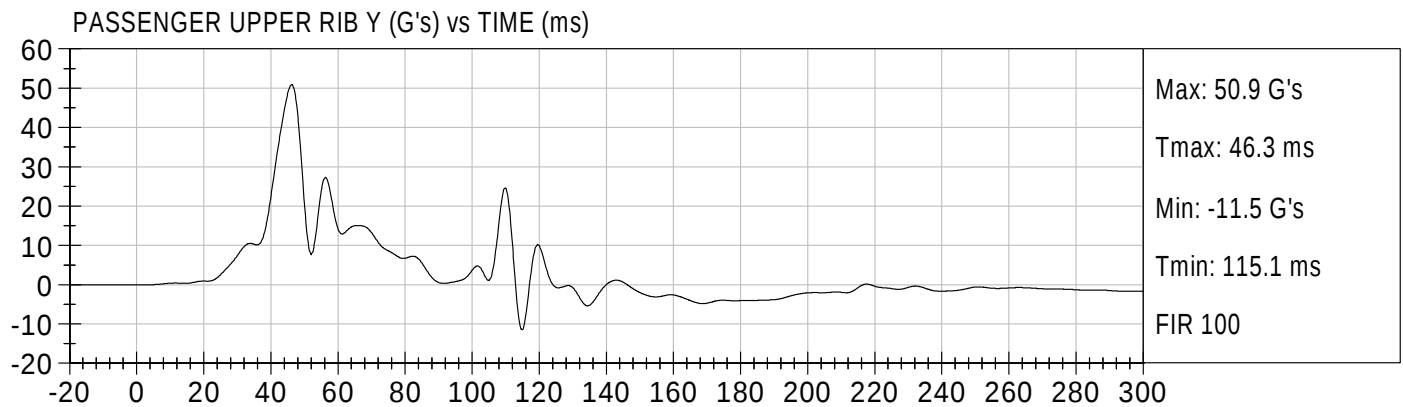
DRIVER LOWER RIB Y (G's) vs TIME (ms)

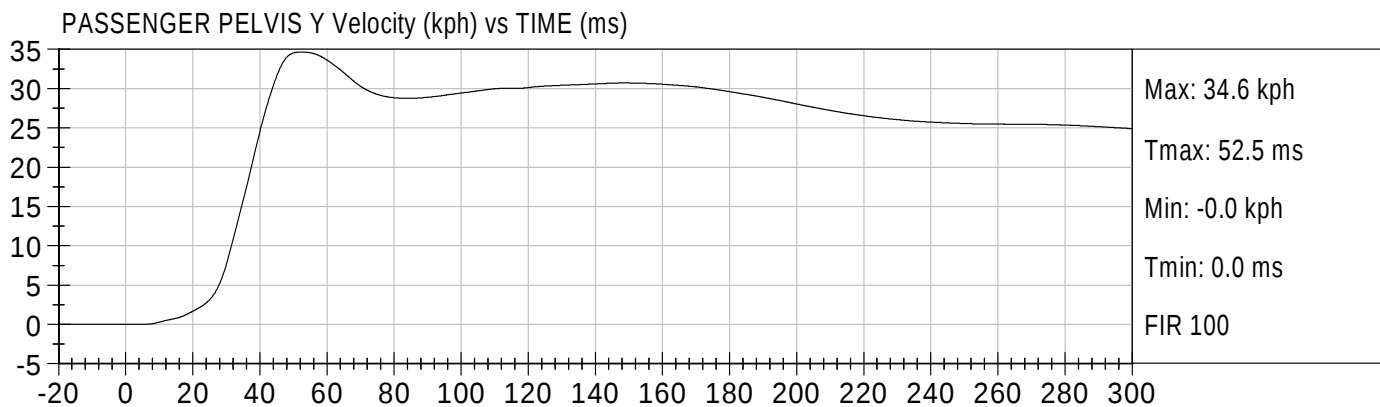
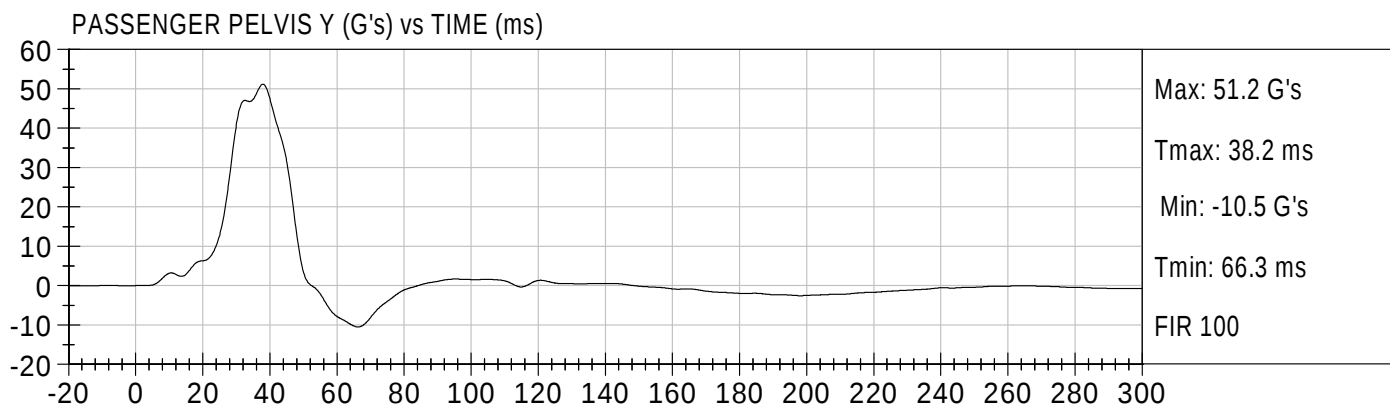
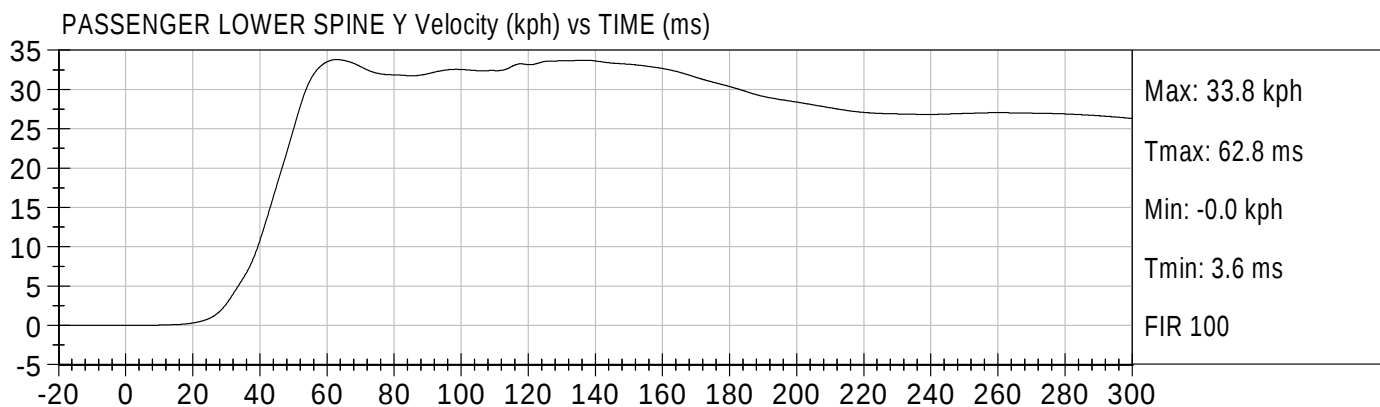
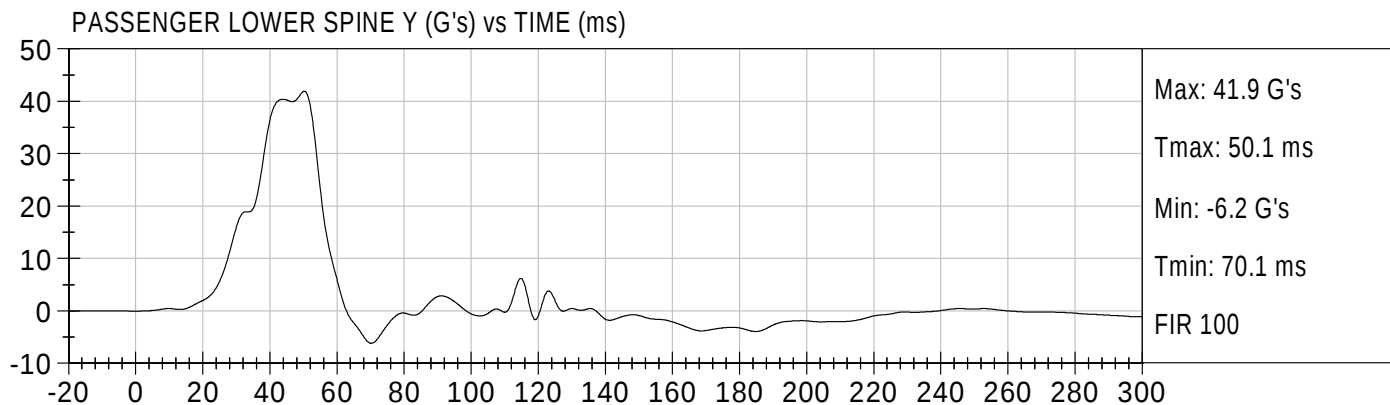


DRIVER LOWER RIB Y Velocity (kph) vs TIME (ms)









APPENDIX C
DUMMY CALIBRATION DATA

CERTIFICATION DATA

Dummy Serial Number: 272

Calibration Test Results Summary

Dummy Serial Number: 272

Pre-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SID Calibration Data Sheet
Side Impact Dummy
External Measurements

ATD Serial No: 272

Test I.D: D09243

Tested Parameter	Units	Specification	Result	Pass/Fail
SH - Seated Height	mm	889 - 909	907	Pass
RH - Rib Height	mm	501 - 521	520	Pass
HP - Hip Pivot Height	mm	99 ref.	99	Pass
RD - Rib from Back Line	mm	229 - 241	230	Pass
KV - Knee Pivot to Back Line	mm	511 - 526	525	Pass
SW - Knee Pivot to Floor	mm	490 - 505	495	Pass
HW - Hip Width	mm	356 - 391	358	Pass
Overall Test Results			Pass	

Jessica Gall
Laboratory Technician

David Winkelbauer
Approved By

10/2/2009
Test Date

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 272

Test I.D: D092431

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	120 to 150	136	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-11.0	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

10/2/09
Test Date



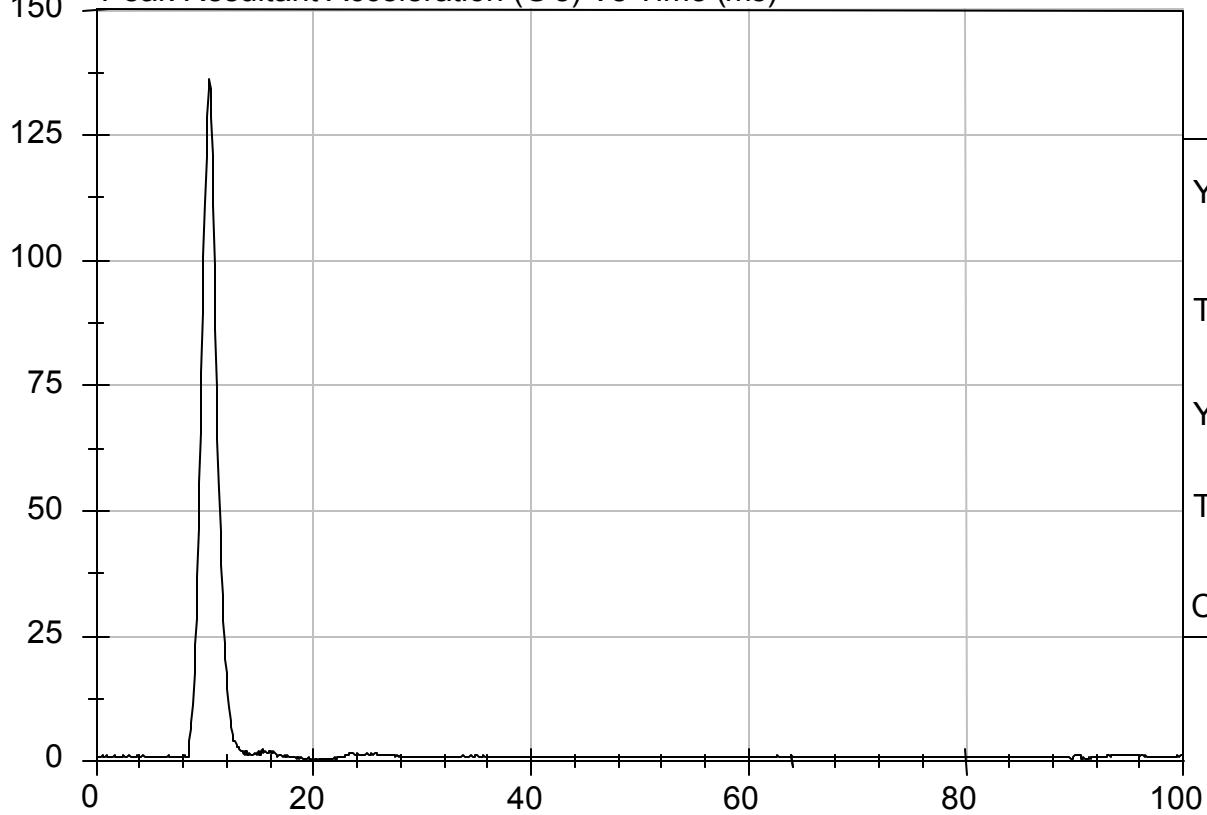
Test Description: Head Drop

Test Date: 10/2/09

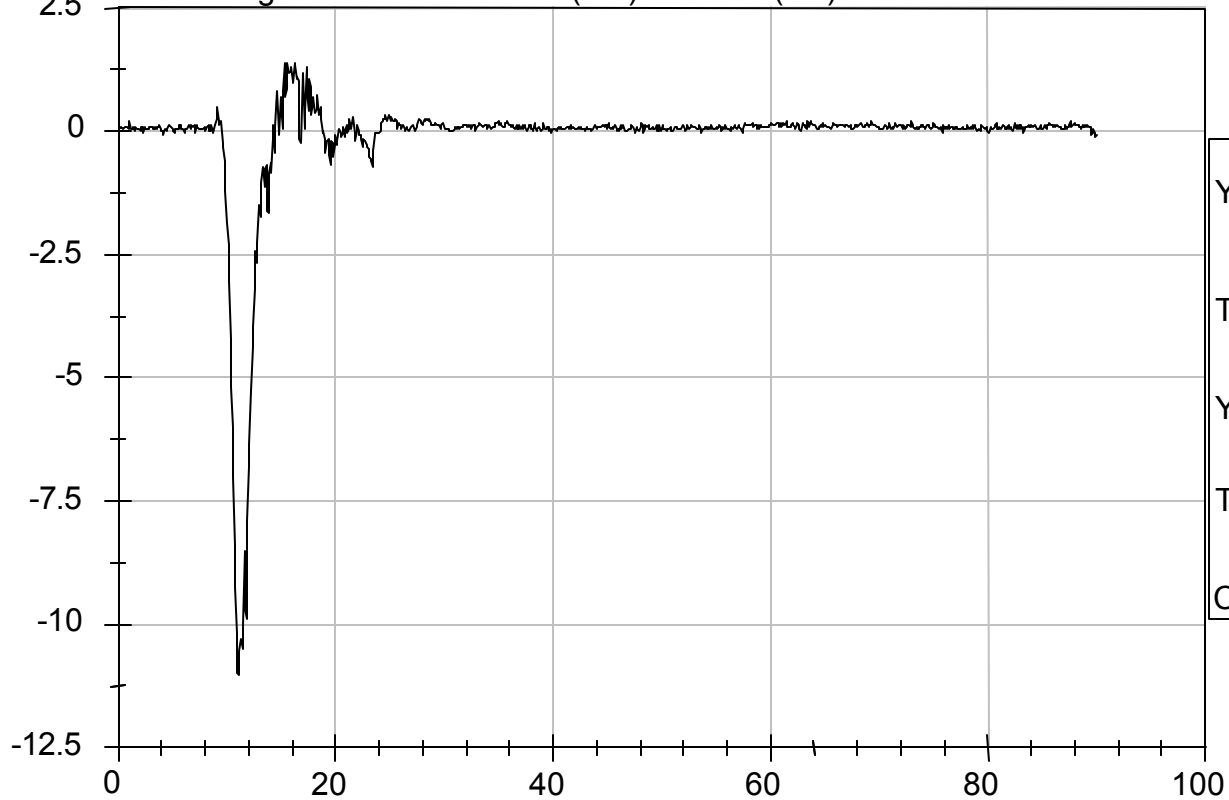
Component: D092431

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



Peak Longitudinal Acceleration (G's) Vs Time (ms)



SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 272

Test I.D: D092432

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	4.22 - 4.31	4.30	Pass
Upper Rib	G's	37 - 46	40	Pass
Lower Rib	G's	37 - 46	40	Pass
Lower Spine	G's	15 - 22	20	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

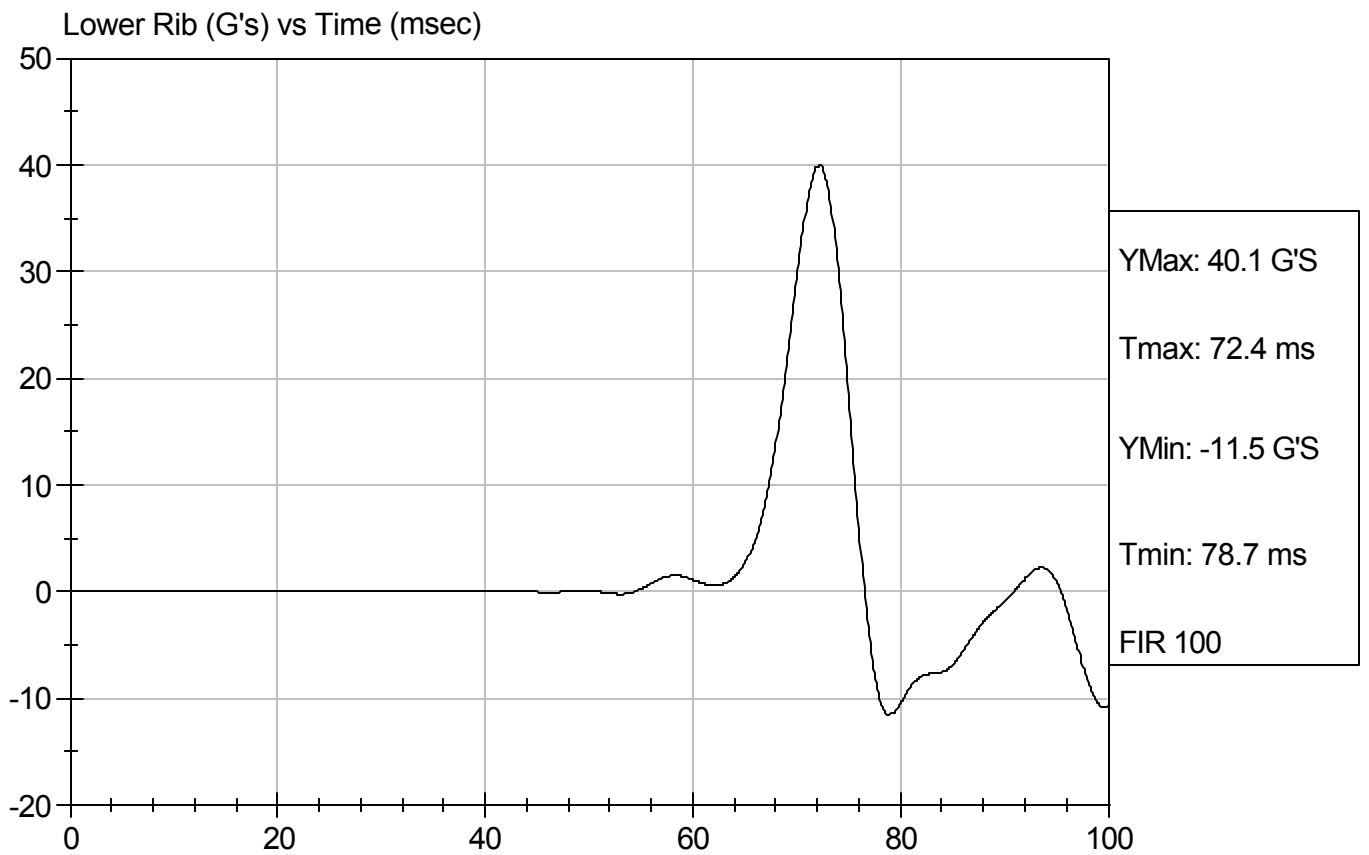
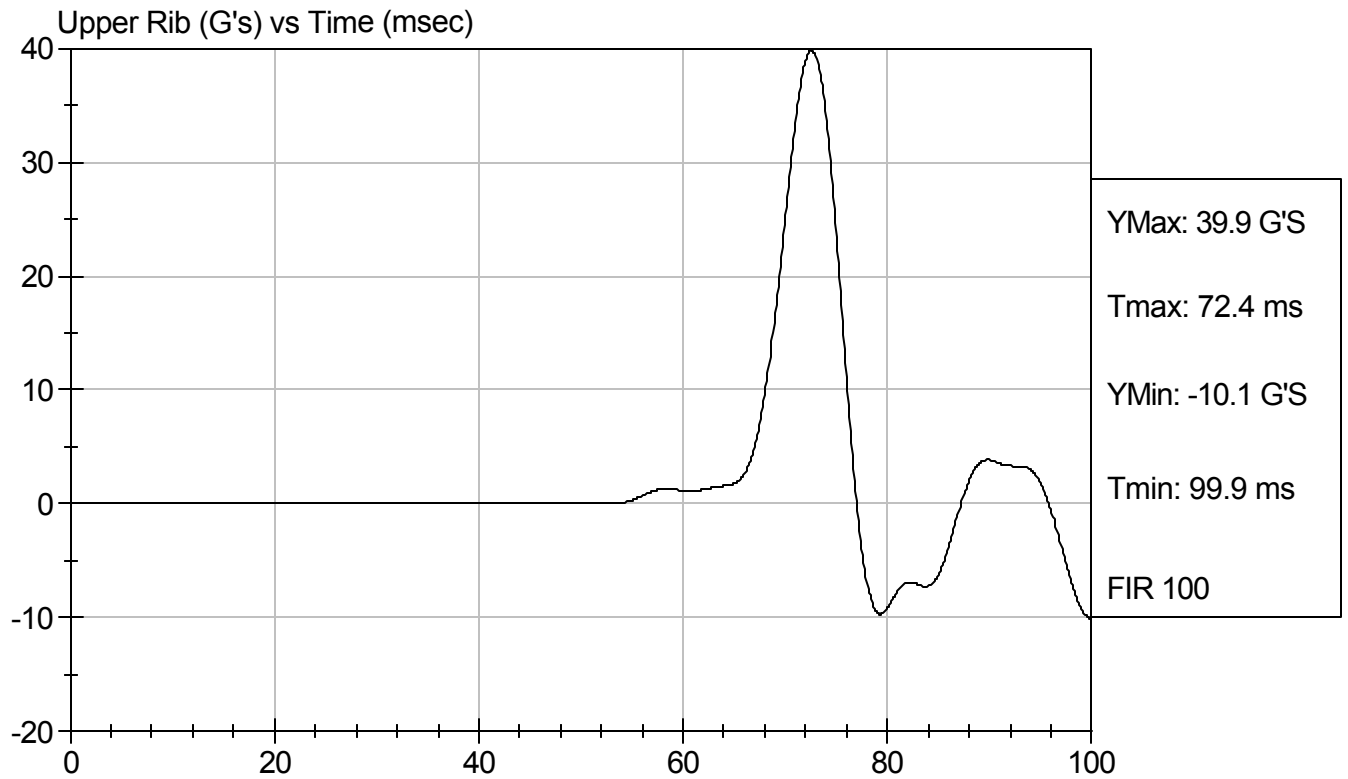
David Winkelbauer
Approved By

10/2/09
Test Date



Test Desc: Thorax Impact
Component ID: D092432

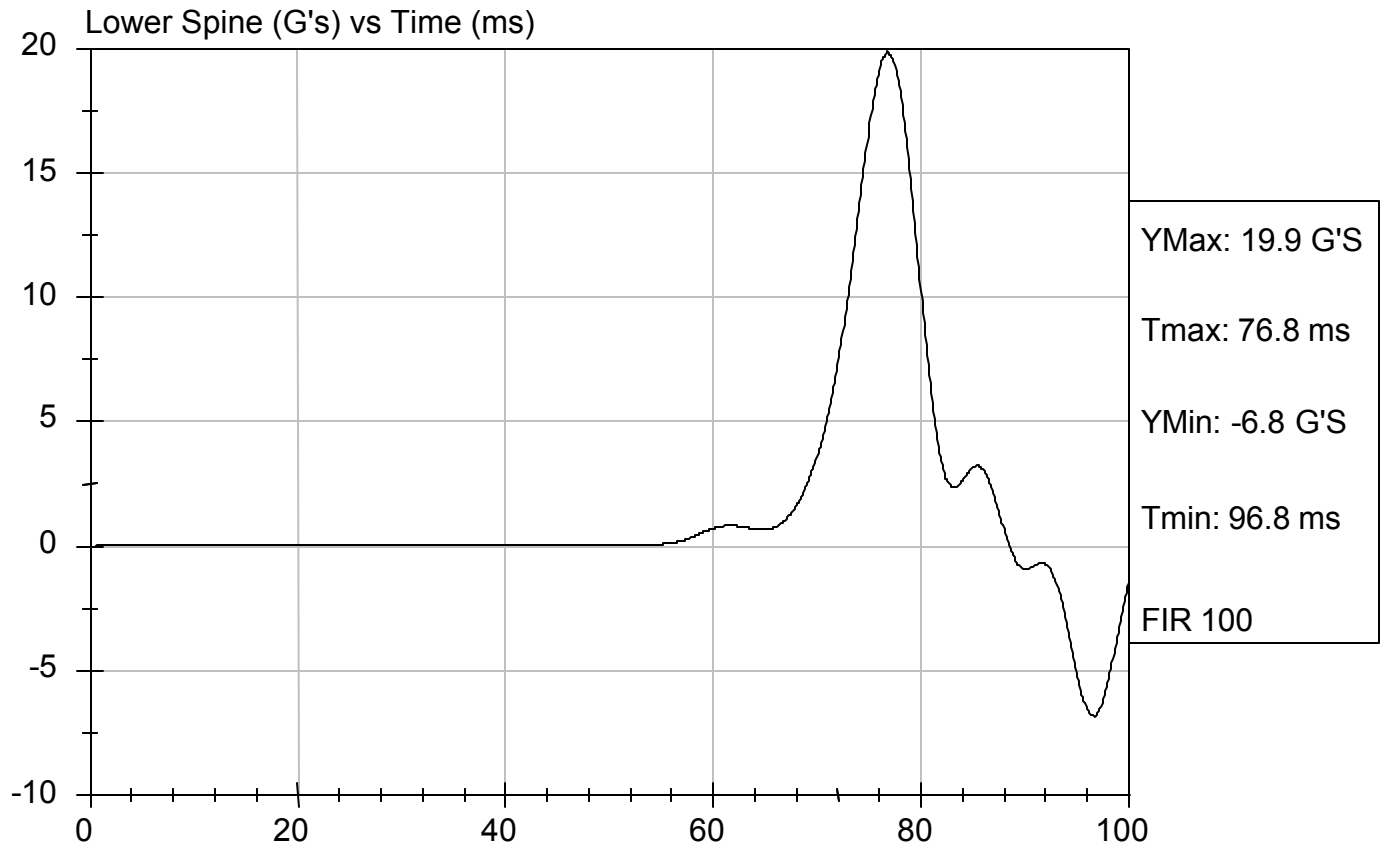
Test Date: 10/2/09
Speed: 14.1 ft/s, 4.30 m/s





Test Desc: Thorax Impact
Component ID: D092432

Test Date: 10/2/09
Speed: 14.1 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 272

Test I.D: D092433

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	41	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

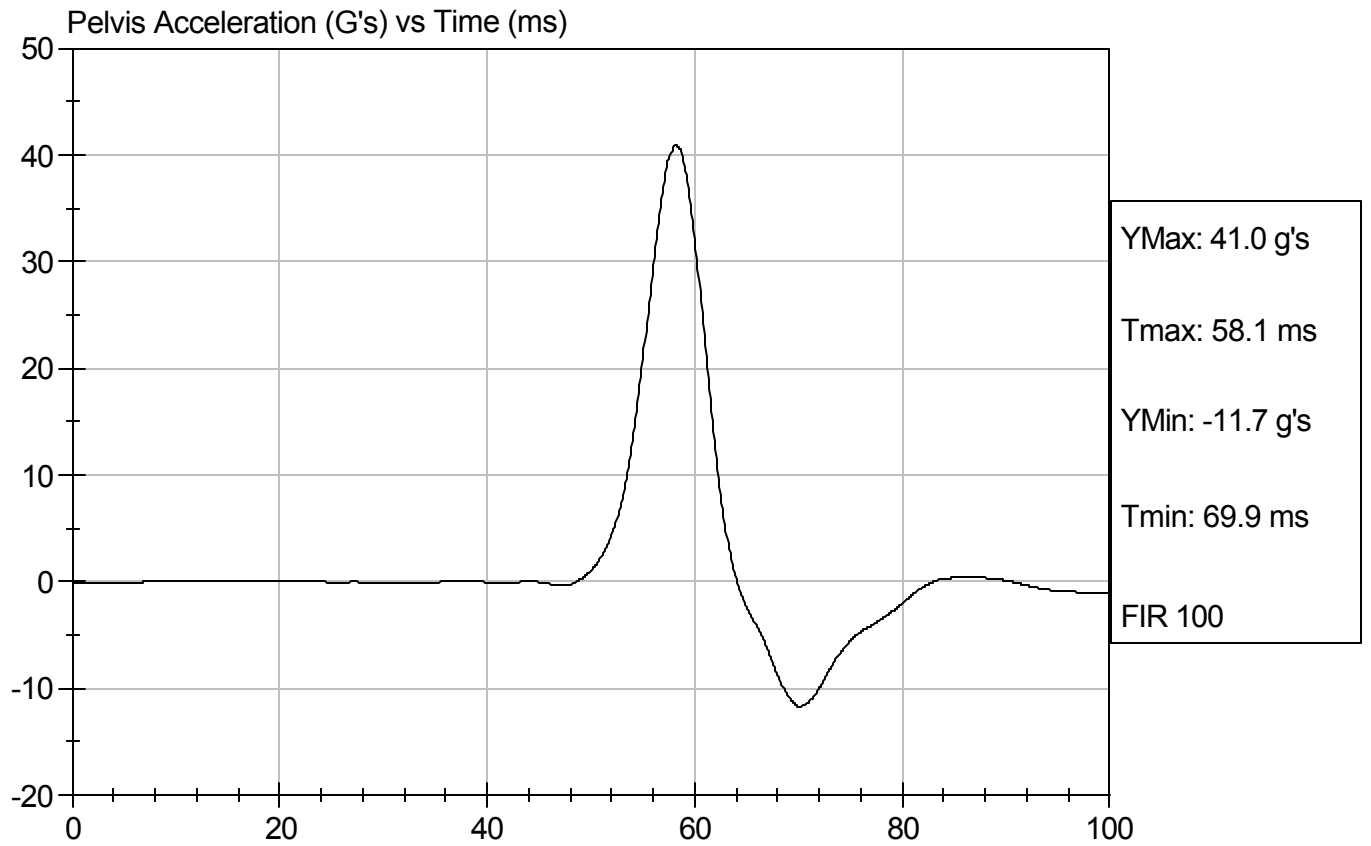
David Winkelbauer
Approved By

10/2/09
Test Date



Test Desc: Pelvis Impact
Component ID: D092433

Test Date: 10/2/09
Speed: 14.1 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 272

Test I.D: D092434

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Force At 12.7 mm	N	104 -162	135	Pass
Force At 19 mm	N	163 - 222	189	Pass
Force At 25.4 mm	N	222 - 280	260	Pass
Force At 33 mm	N	325 - 391	370	Pass
Overall Test Results			Pass	

Jessica Gall
Laboratory Technician

David Winkelbauer
Approved By

10/2/09
Test Date

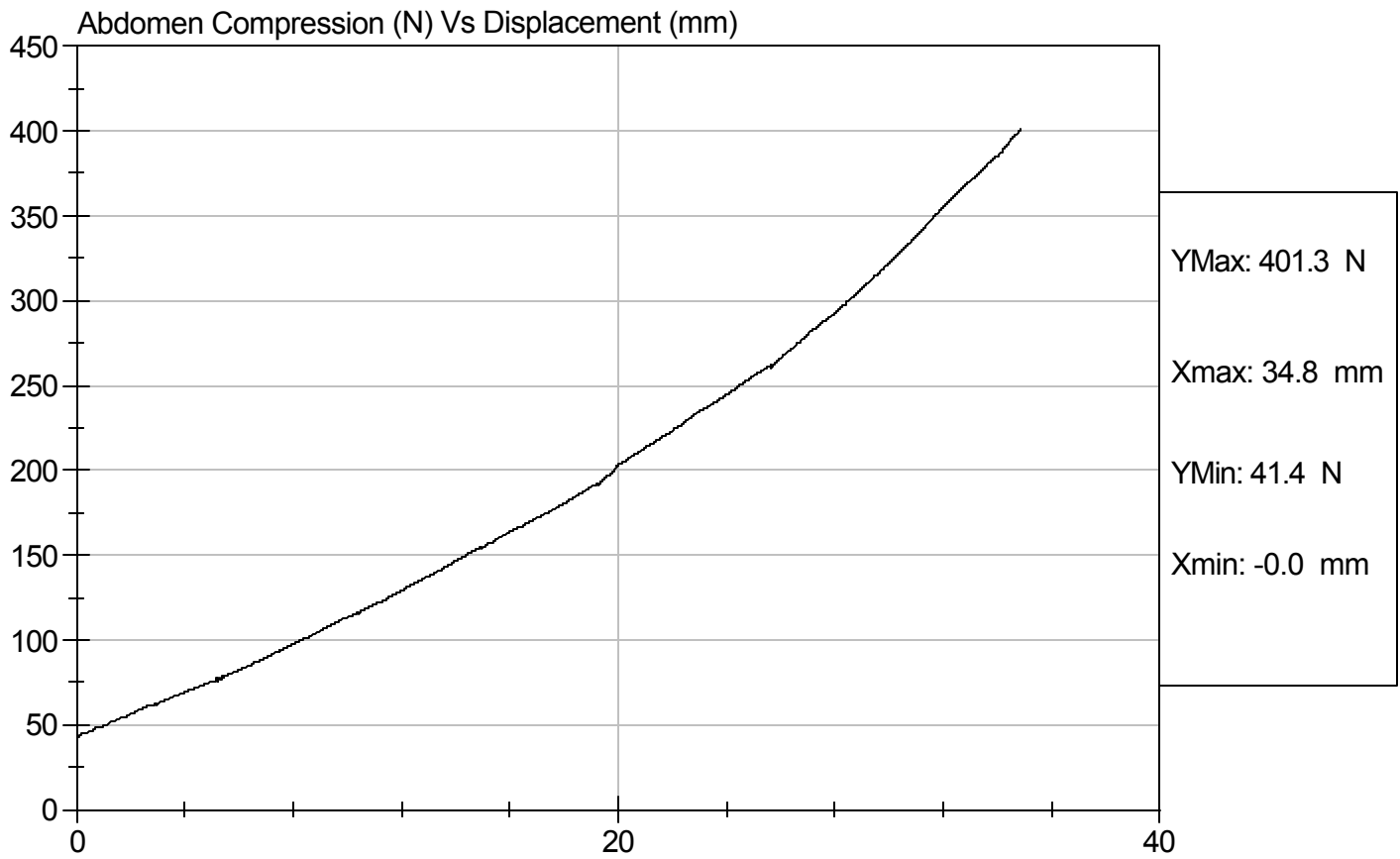


Test Description: Abdomen Compression

Test Date: 10/2/09

Component: D092434

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 272

Test I.D: D092435

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	129.2	Pass
Force At 30 deg	N	151.2 - 204.6	175.6	Pass
Force At 40 deg	N	204.6 - 258.0	229.5	Pass
Return Angle	Deg	12 Maximum	3	Pass
Overall Test Results			Pass	

Jessica Gall
Laboratory Technician

David Winkelbauer
Approved By

10/2/09
Test Date

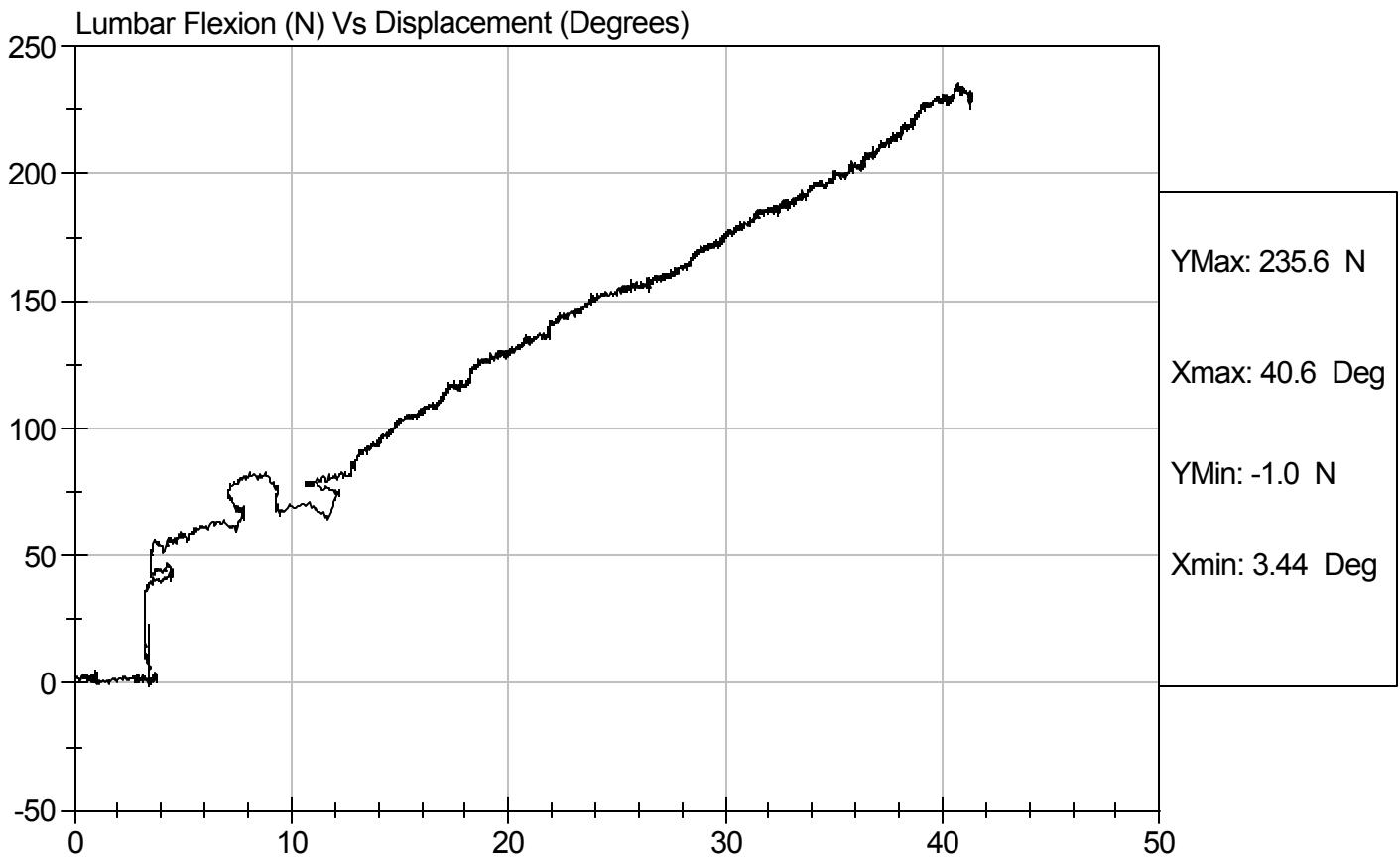


Test Description: Lumbar Flexion

Test Date: 10/2/09

Component: D092435

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 272

Test I.D: D092439

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.38	Pass
	20 ms	m/s	4.12 to 5.10	4.69	Pass
	30 ms	m/s	5.73 to 7.01	6.61	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.81	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	74	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	58	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	77	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	56	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	15	Pass

Jessica Hall
Laboratory Technician

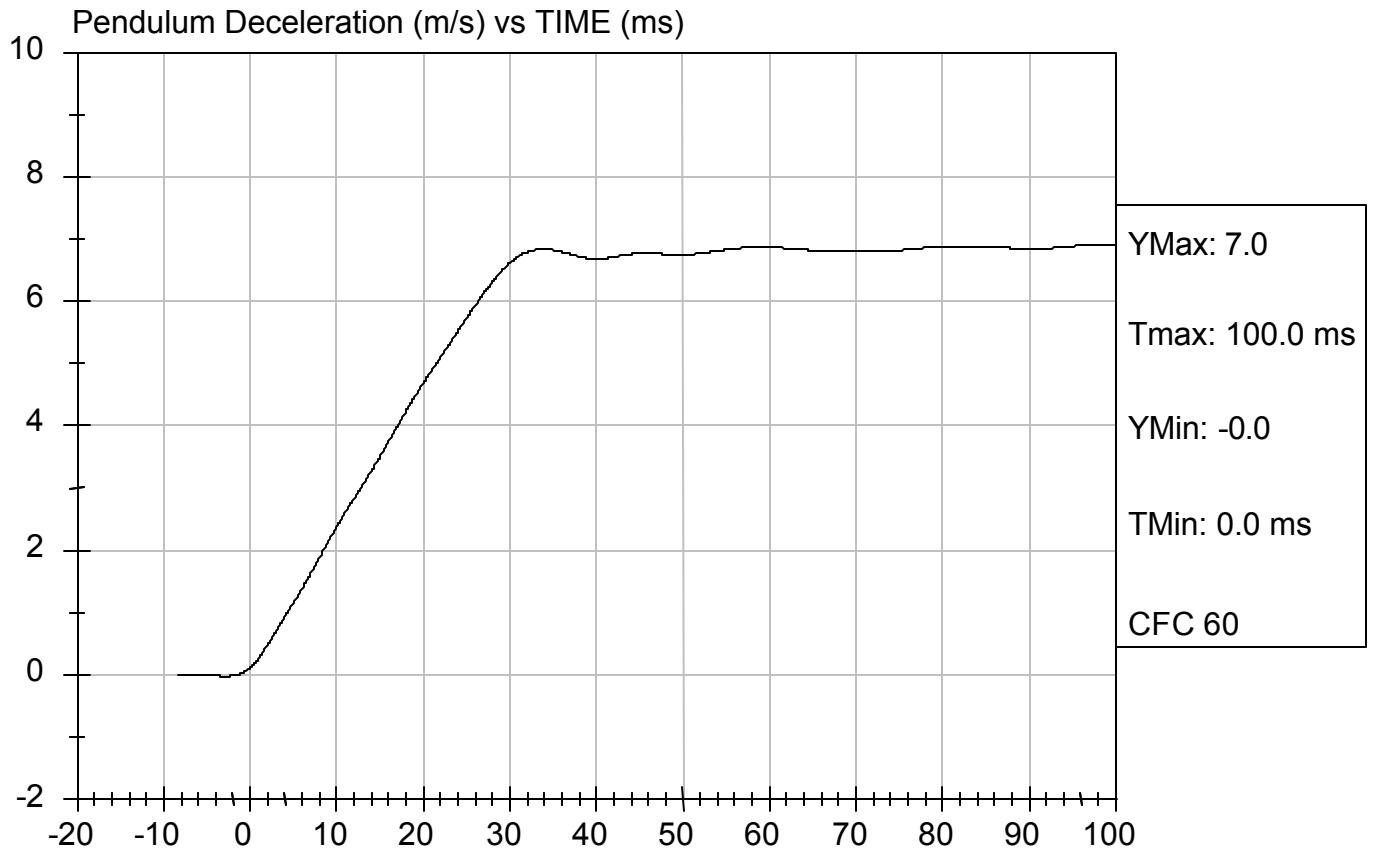
David Winkelbauer
Approved By

10/2/09
Test Date



Test Desc: Neck Bending
Component ID: D092439

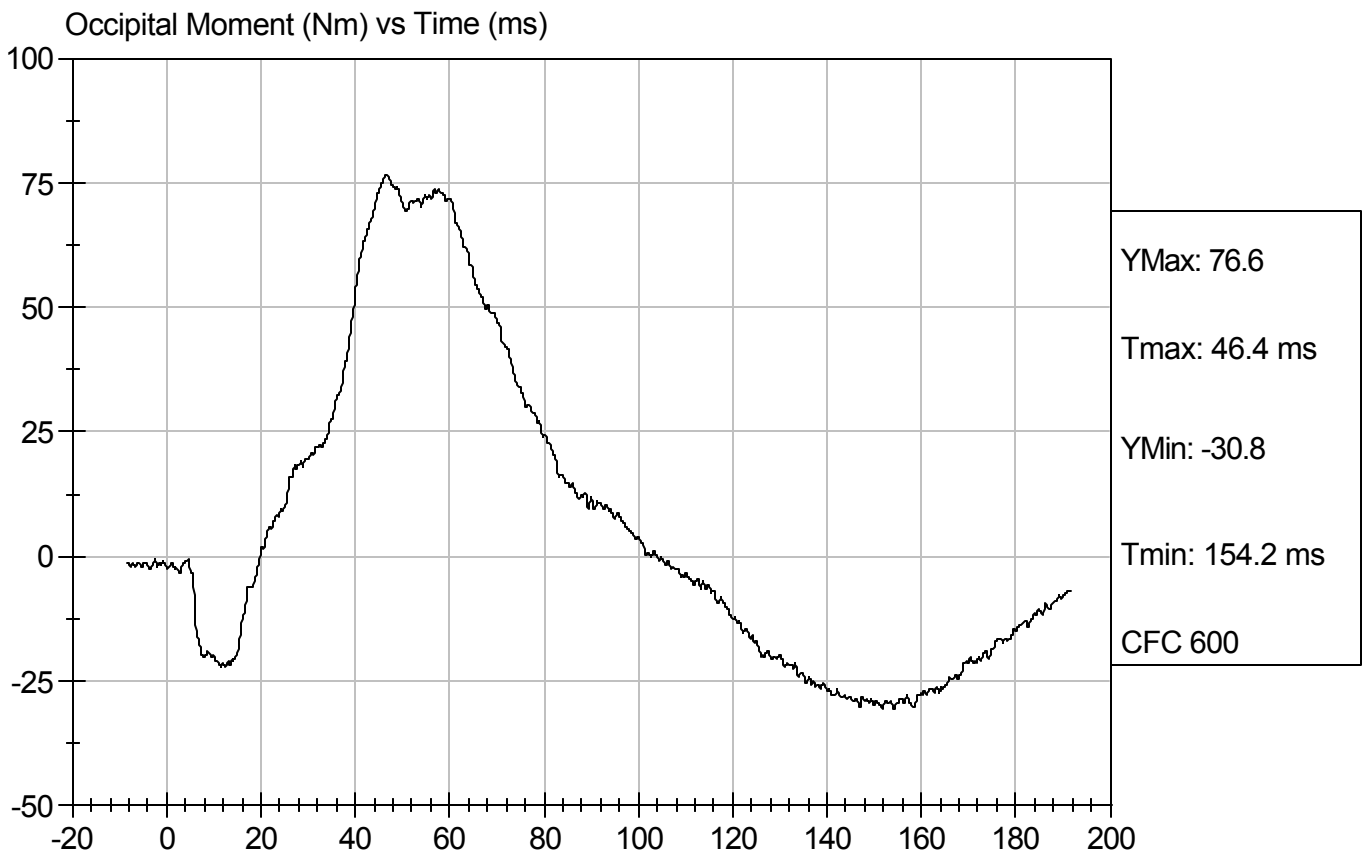
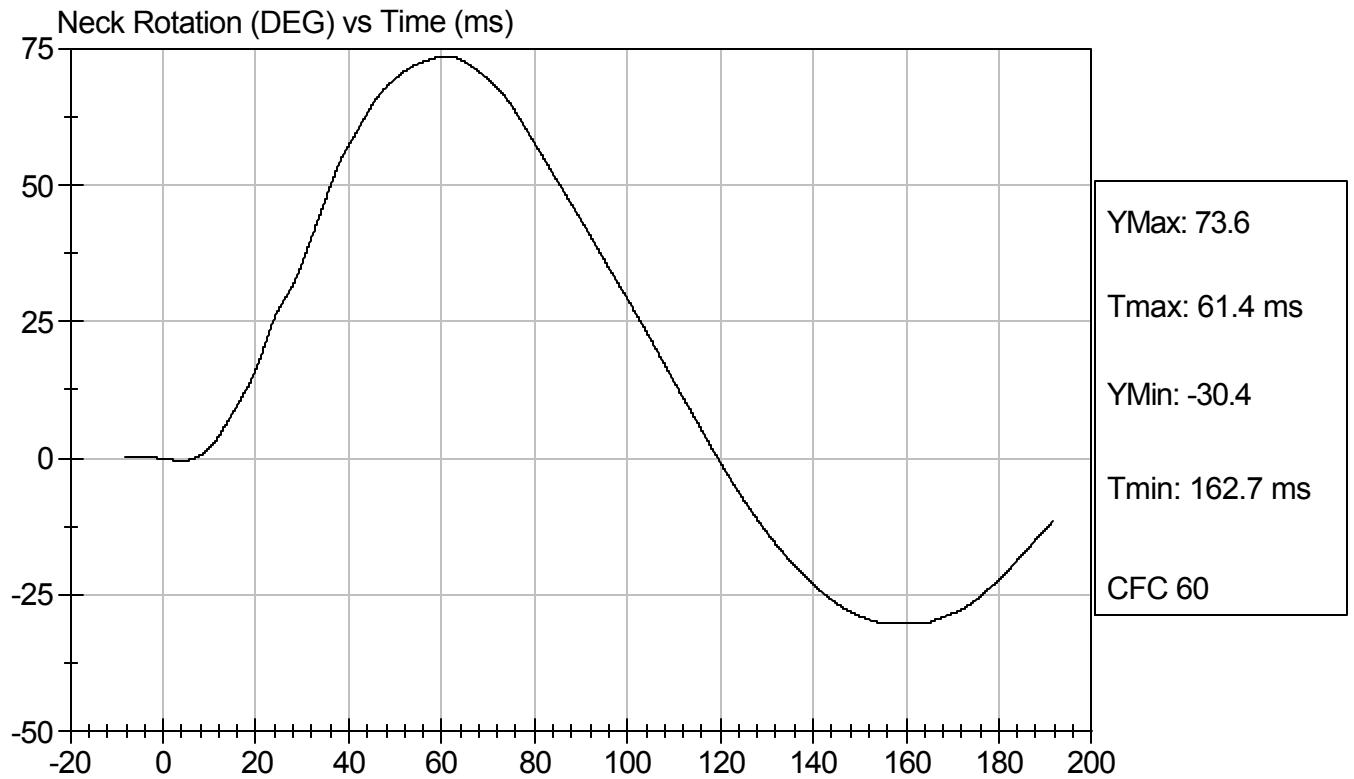
Test Date: 10/2/09
Speed: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Bending
Component ID: D092439

Test Date: 10/2/09
Speed: 23.15 ft/sec, 7.06 m/sec



Calibration Test Results Summary

Dummy Serial Number: 272

Post-Test Calibration

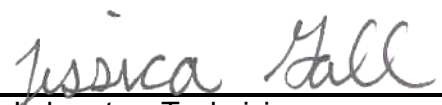
External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 272

Test I.D: D092631

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	120 to 150	138	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-6.8	Pass
Overall Test Results				Pass


Laboratory Technician

10/19/09
Test Date


Approved By



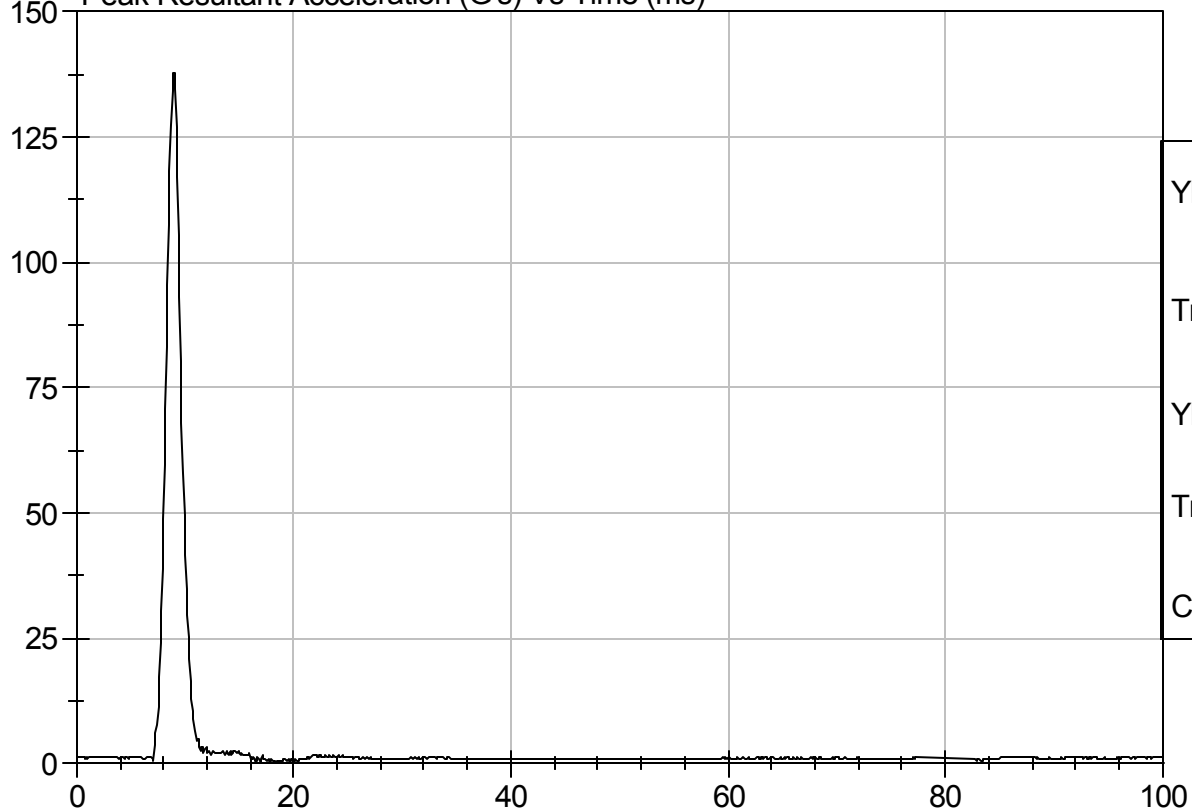
Test Description: Head Drop

Test Date: 10/19/09

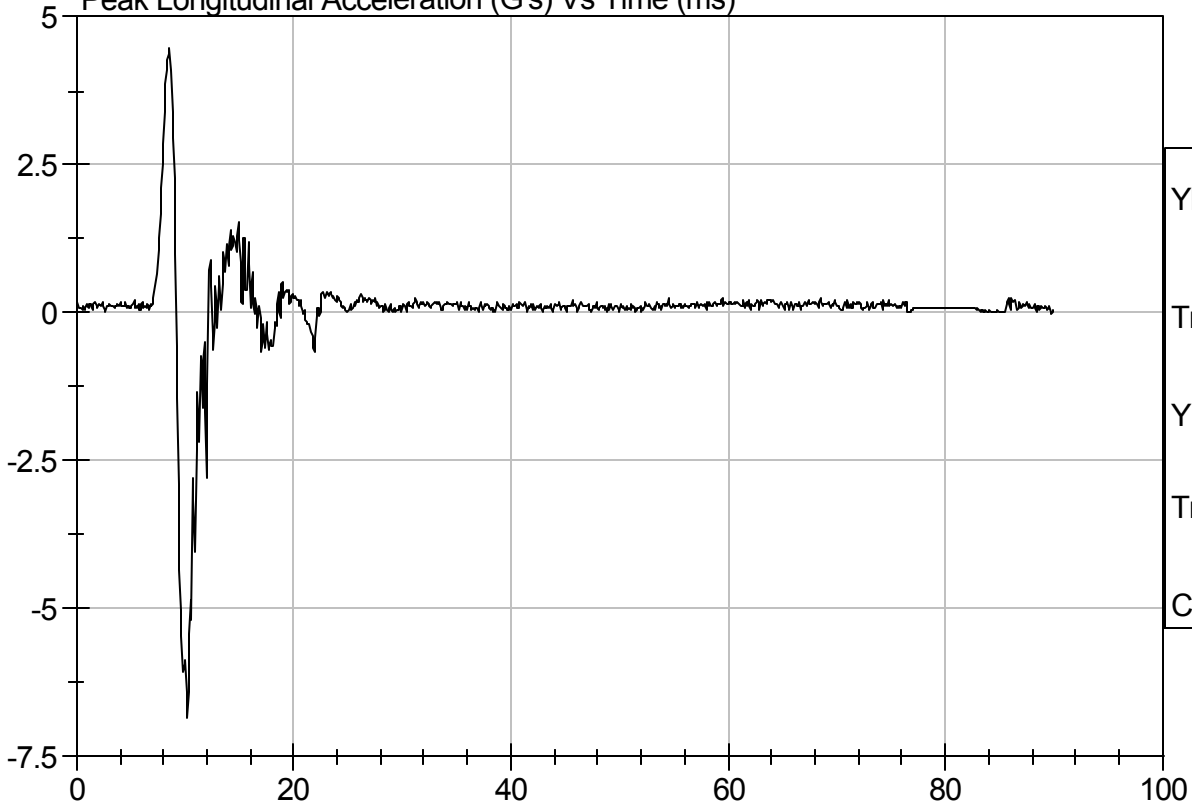
Component: D092631

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



Peak Longitudinal Acceleration (G's) Vs Time (ms)



SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 272

Test I.D: D092632

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Velocity	m/s	4.22 - 4.31	4.27	Pass
Upper Rib	G's	37 - 46	42	Pass
Lower Rib	G's	37 - 46	41	Pass
Lower Spine	G's	15 - 22	21	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

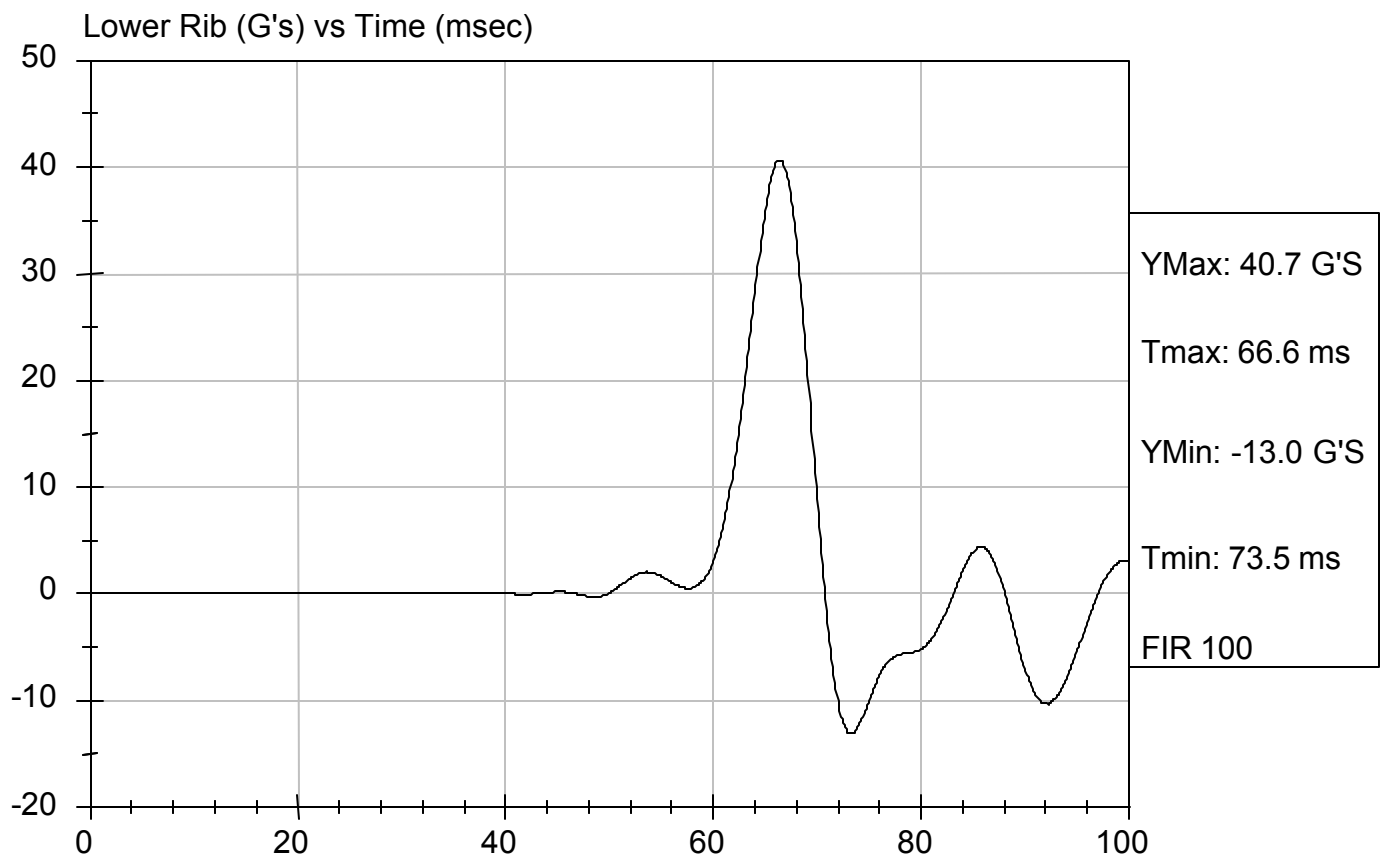
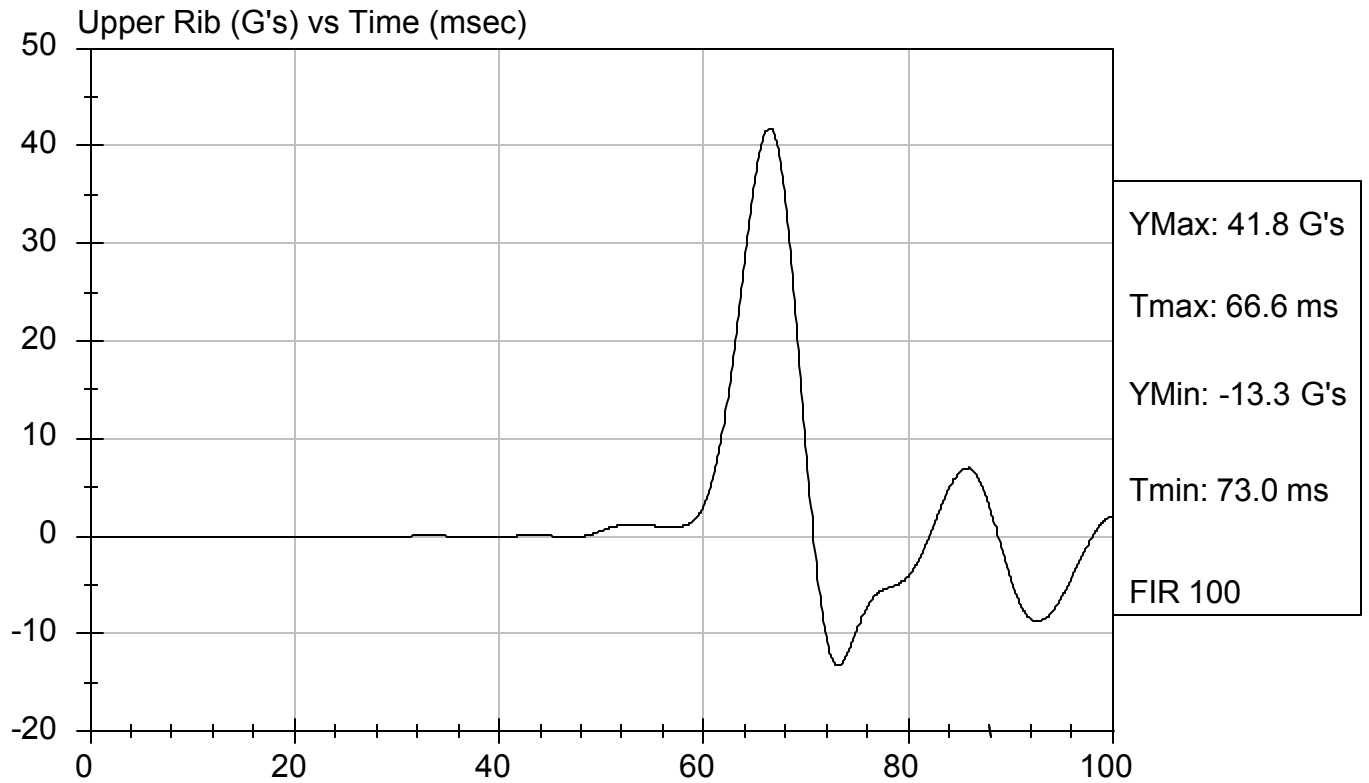
David Winkelbauer
Approved By

10/19/09
Test Date



Test Desc: Thorax Impact
Component ID: D092632

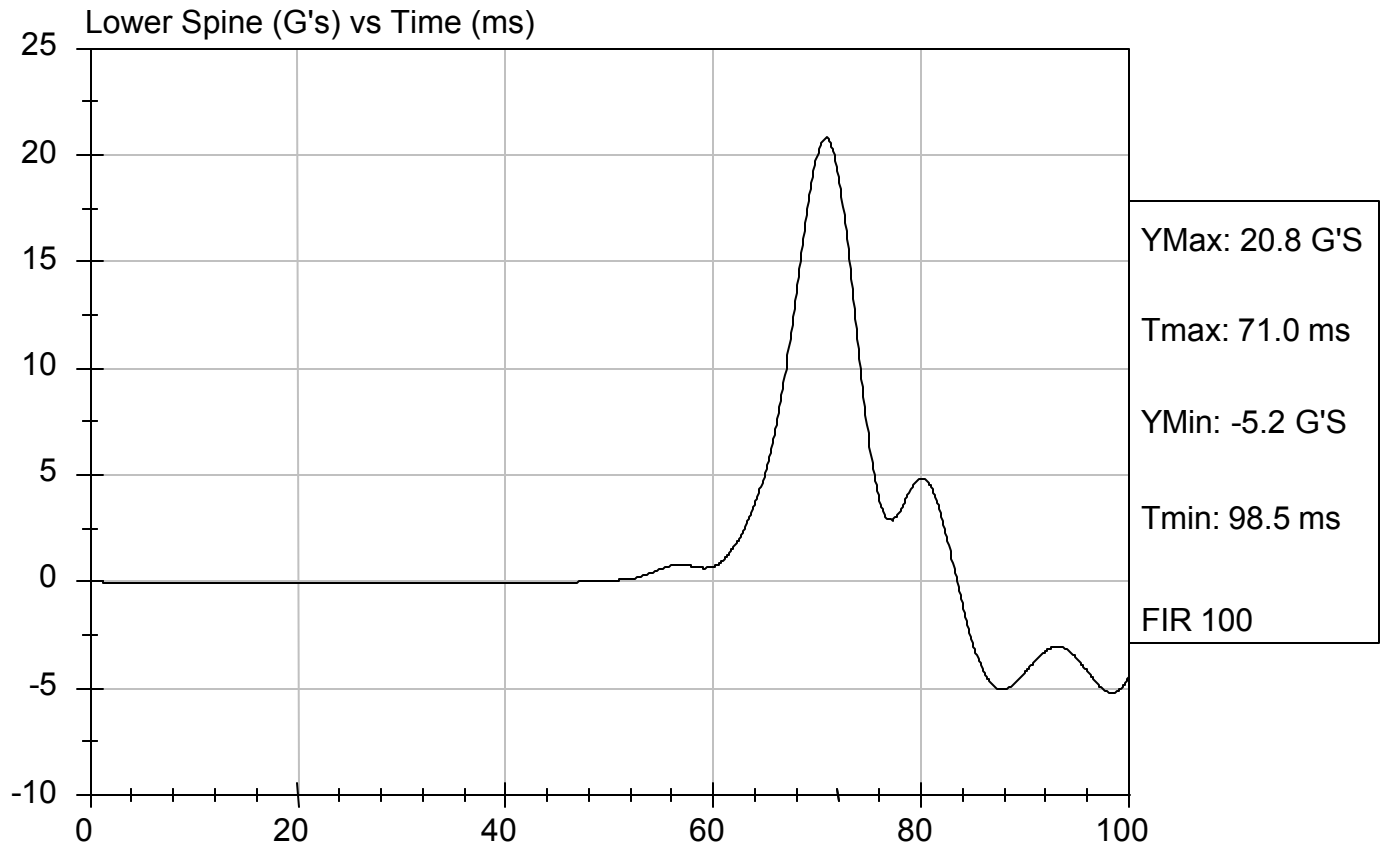
Test Date: 10/19/09
Speed: 14.01 ft/s, 4.27 m/s





Test Desc: Thorax Impact
Component ID: D092632

Test Date: 10/19/09
Speed: 14.01 ft/s, 4.27 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 272

Test I.D: D092633

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	43	Pass
			Overall Test Results	Pass

Jessica Hall
Laboratory Technician

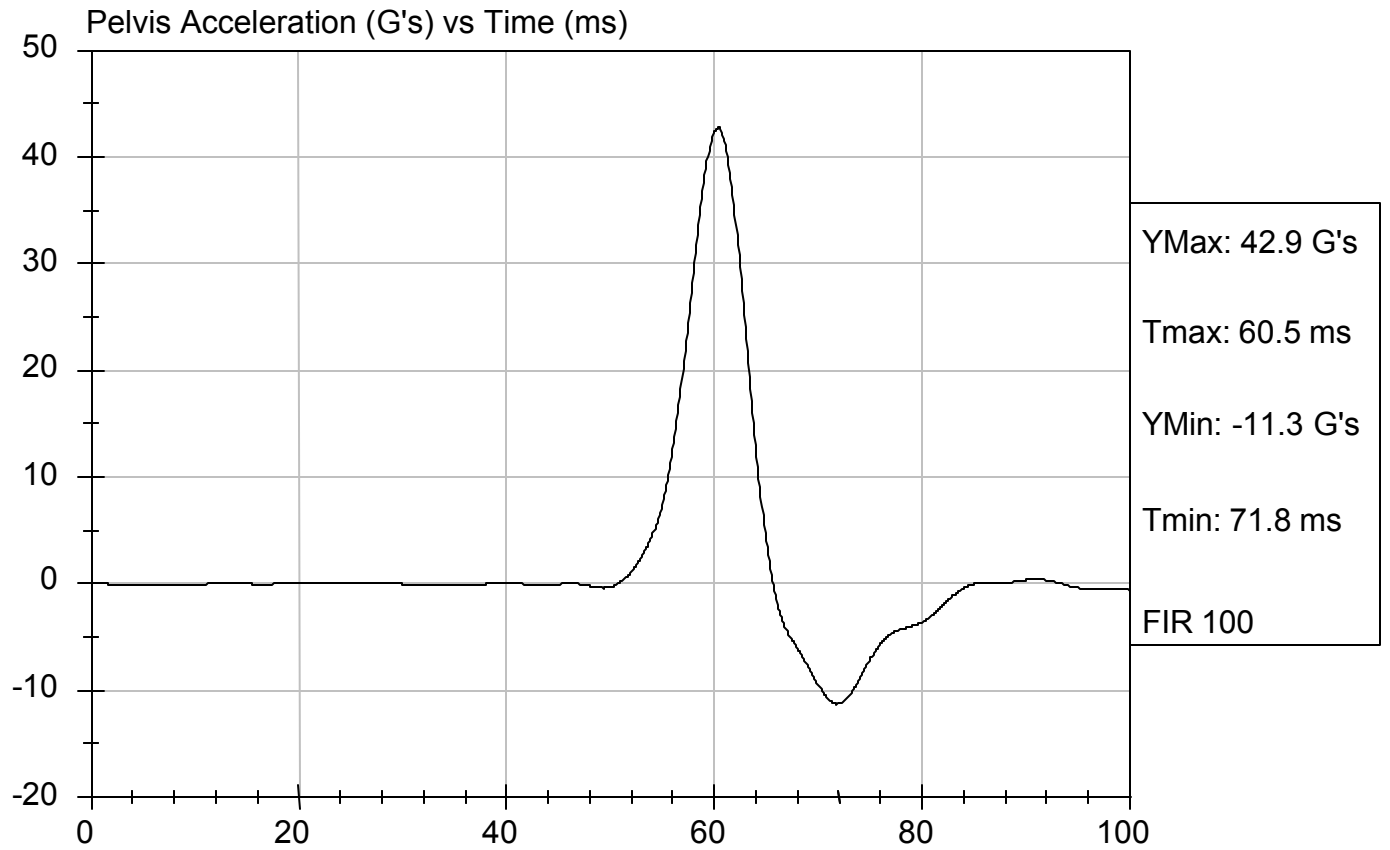
David Winkelbauer
Approved By

10/19/09
Test Date



Test Desc: Pelvis Impact
Component ID: D092633

Test Date: 10/19/09
Speed: 14.12 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 272

Test I.D: D092634

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Force At 12.7 mm	N	104 -162	139	Pass
Force At 19 mm	N	163 - 222	196	Pass
Force At 25.4 mm	N	222 - 280	267	Pass
Force At 33 mm	N	325 - 391	364	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

10/19/09
Test Date

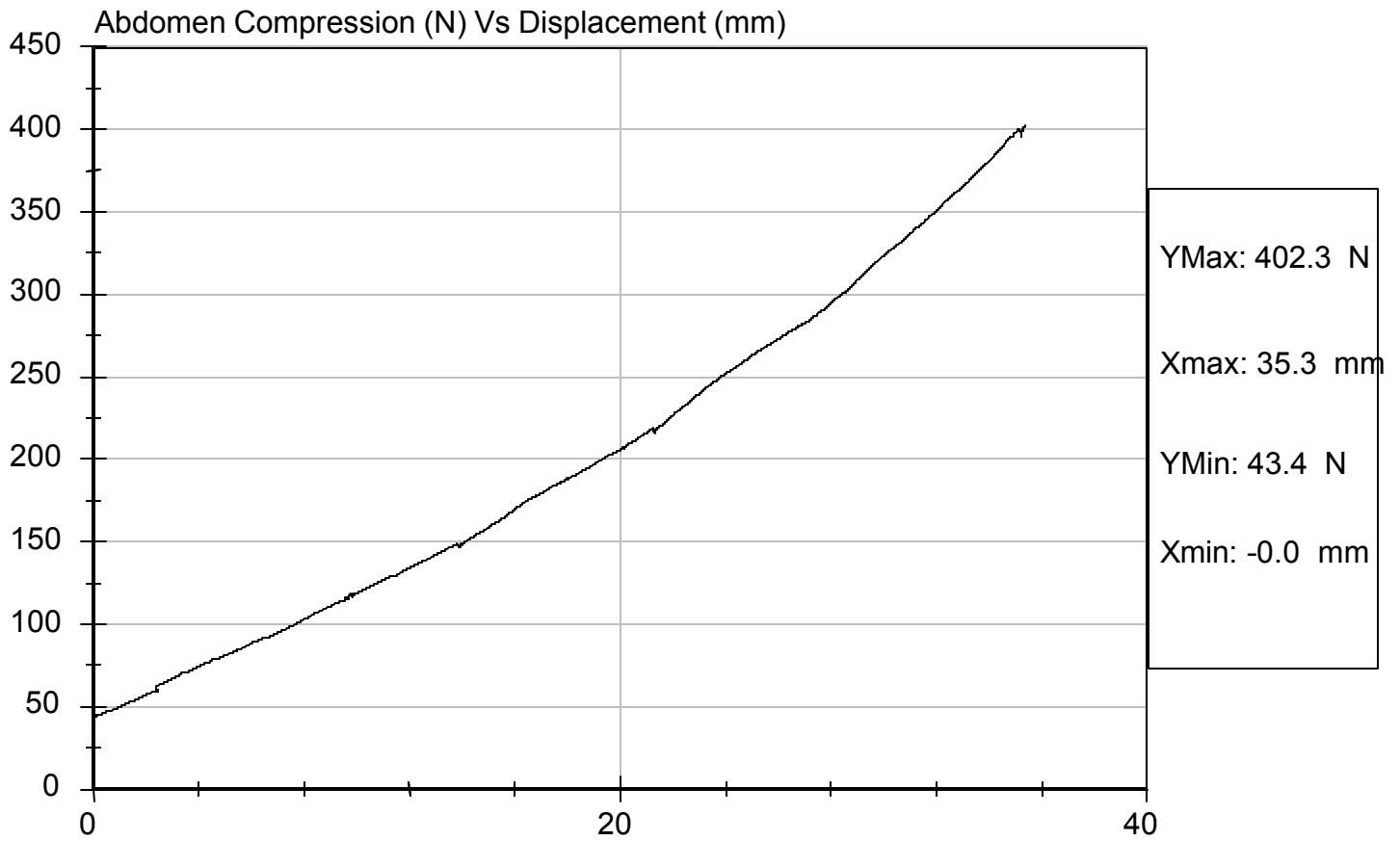
David Winkelbauer
Approved By



Test Description: Abdomen Compression Test Date: 10/19/09

Component: D092634

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 272

Test I.D: D092635

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	128.9	Pass
Force At 30 deg	N	151.2 - 204.6	189.8	Pass
Force At 40 deg	N	204.6 - 258.0	240.0	Pass
Return Angle	Deg	12 Maximum	3	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

10/19/09
Test Date

David Winkelbauer
Approved By

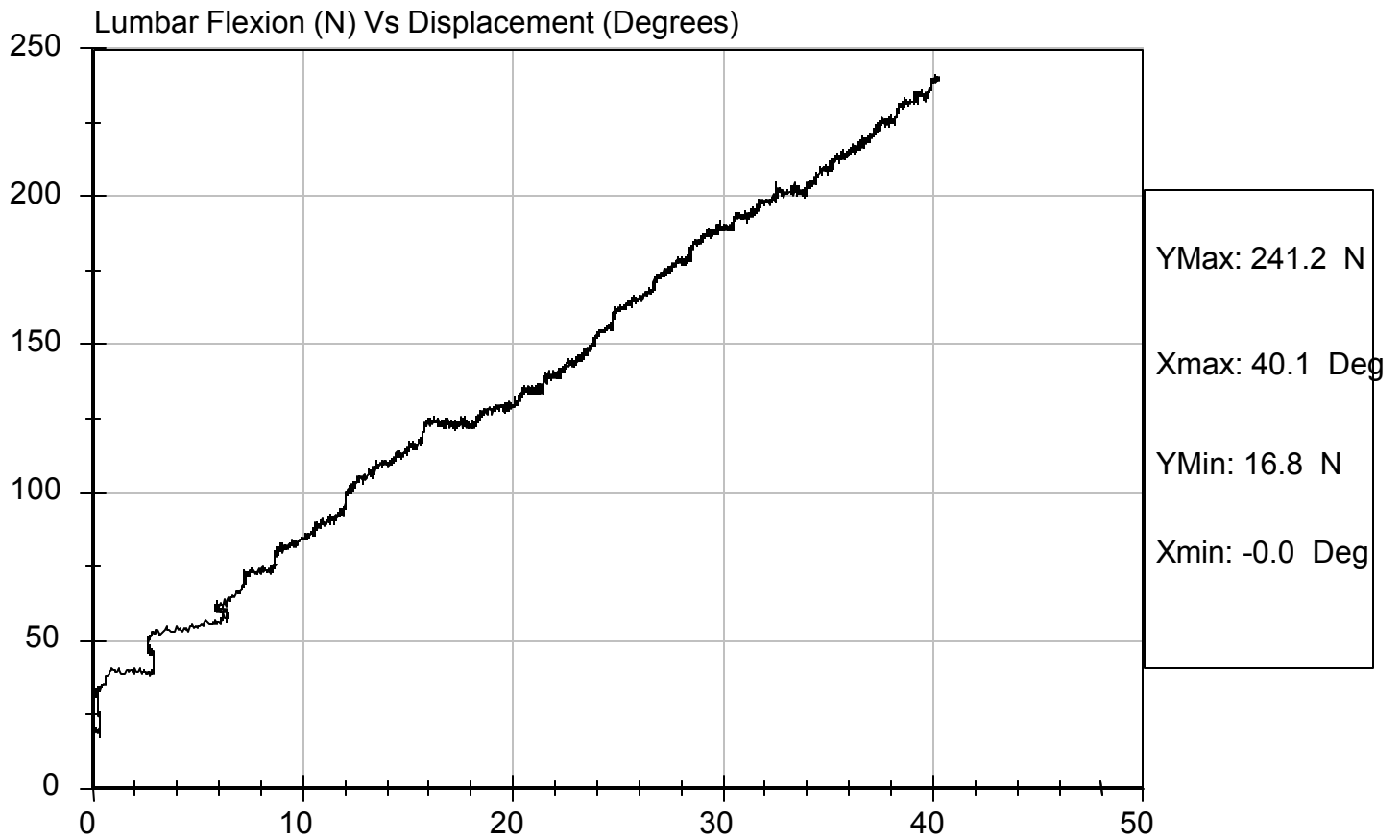


Test Description: Lumbar Flexion

Test Date: 10/19/09

Component: D092635

Speed: 0 ft/s, 0 m/s

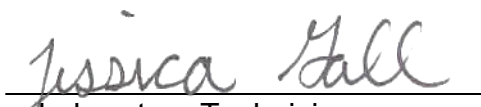


SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 272

Test I.D: D092639

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	39	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.39	Pass
	20 ms	m/s	4.12 to 5.10	4.64	Pass
	30 ms	m/s	5.73 to 7.01	6.37	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.79	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	71	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	66	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	75	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	53	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	12	Pass


 Laboratory Technician

10/19/09

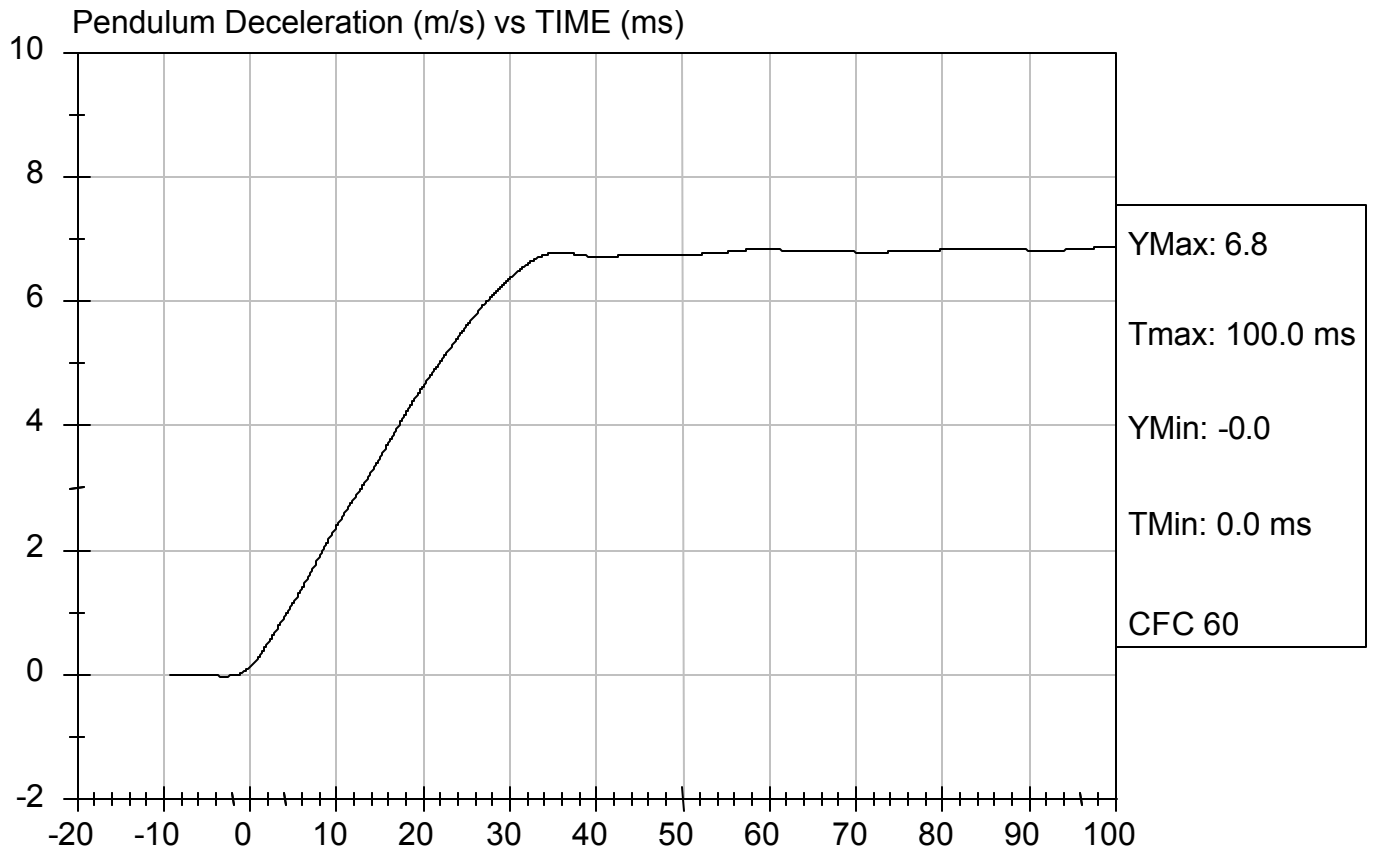
Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D092639

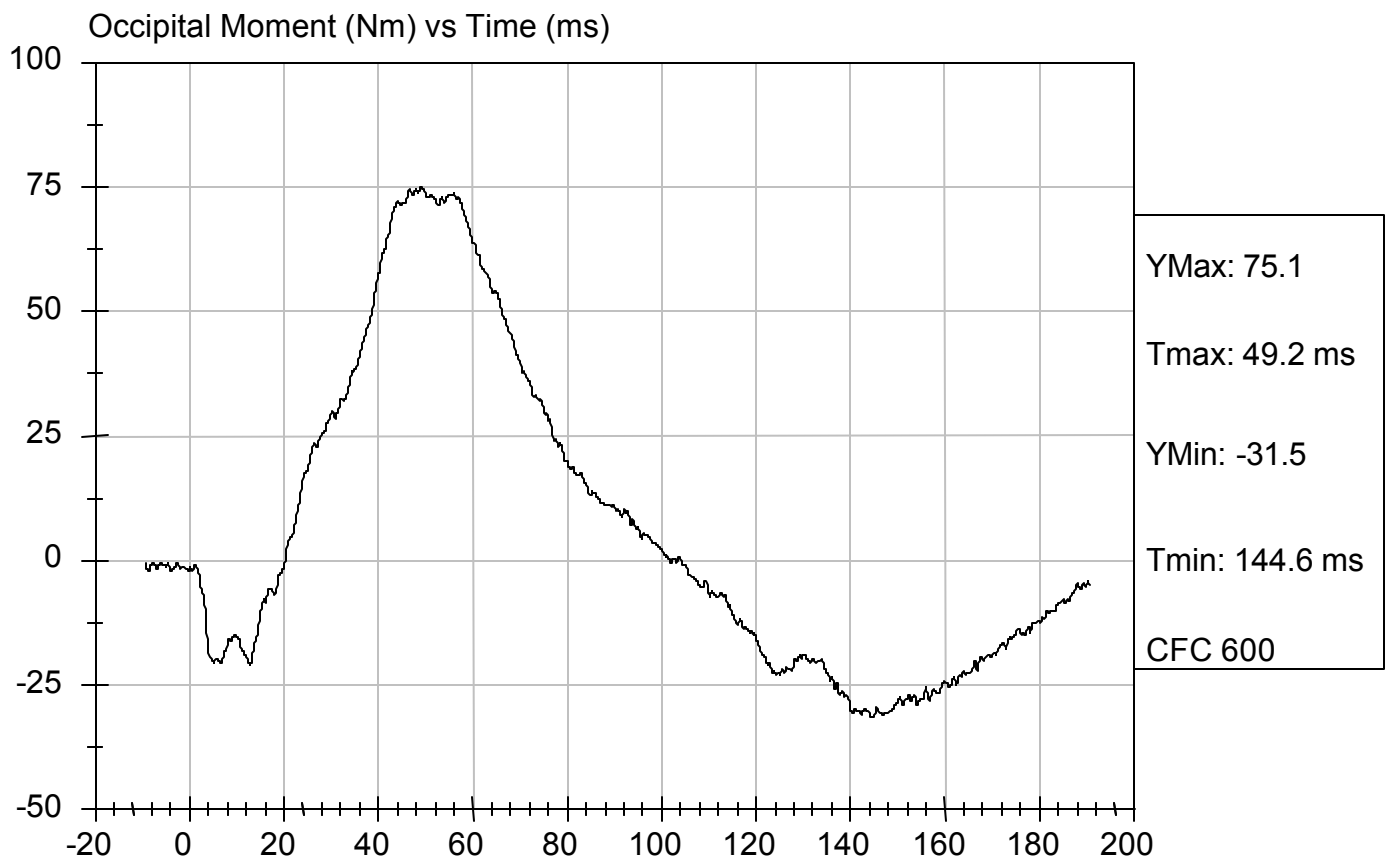
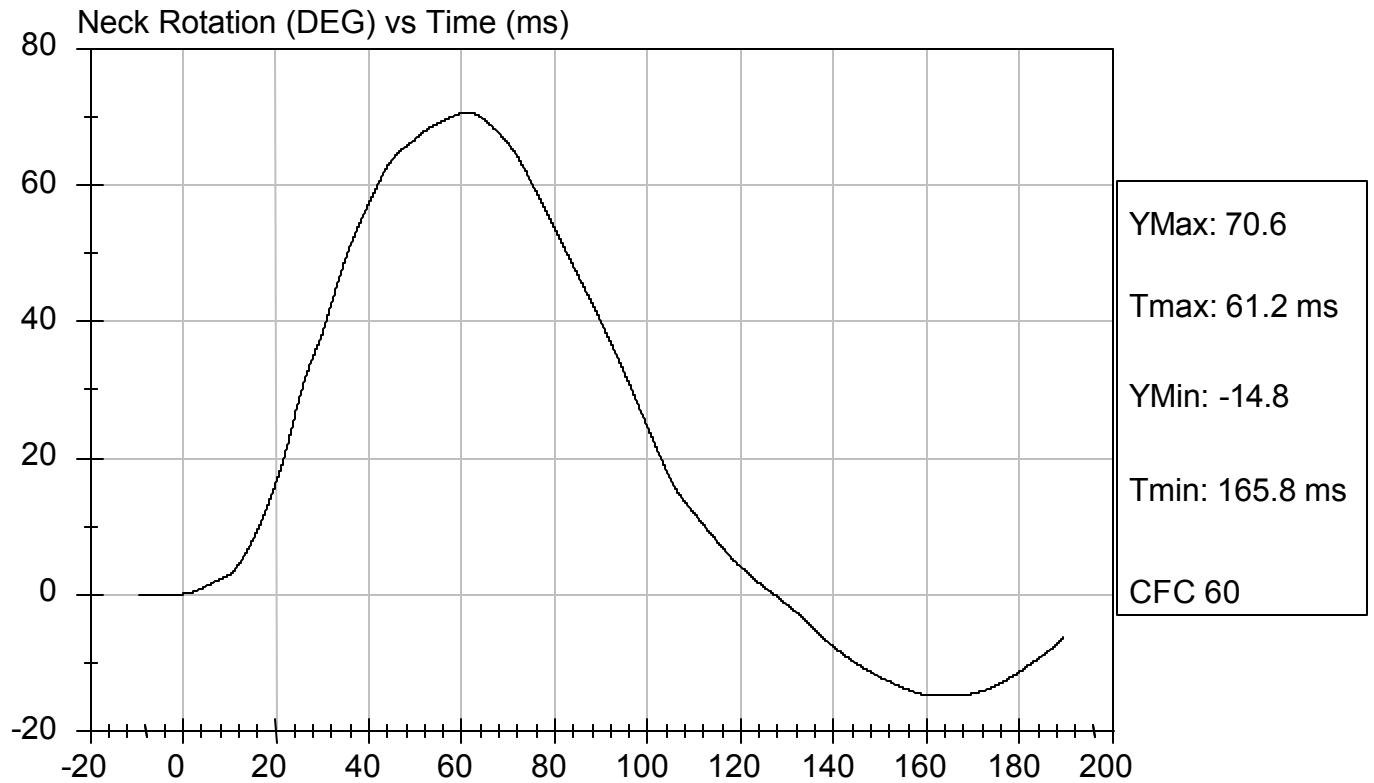
Test Date: 10/19/09
Speed: 23.15 ft/sec, 7.06 m/sec





Test Desc: Neck Bending
Component ID: D092639

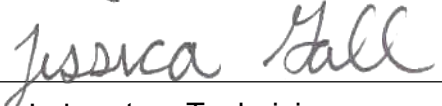
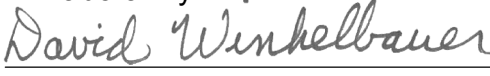
Test Date: 10/19/09
Speed: 23.15 ft/s, 7.06 m/s



SID Calibration Data Sheet
Side Impact Dummy
Inspection Checklist

ATD Serial No: 272

Test Part	Items Checked	Result
Skin	Visual inspection	Pass
Head	Visual, ballast, accelerometer mount	Pass
Neck	Visual	Pass
Spine Box	Visual, ballast, accelerometer mount	Pass
Rib Cage	Visual, measure	Pass
Sternum	Visual	Pass
Lumbar Spine	Visual	Pass
Abdomen	Visual	Pass
Pelvis	Visual, palpate, accelerometer mount	Pass
Upper Legs	Visual	Pass
Knees	Visual	Pass
Lower Legs	Visual, range of motion	Pass
Ankles	Visual, range of motion	Pass
Feet	Visual, range of motion	Pass
Joints	1 to 2 g range	Pass
Other		Pass


Laboratory Technician

Approved By

10/19/2009

Test Date

CERTIFICATION DATA

Dummy Serial Number: 271

Calibration Test Results Summary

Dummy Serial Number: 271

Pre-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SID Calibration Data Sheet
Side Impact Dummy
External Measurements

ATD Serial No: 271

Test I.D: D09242

Tested Parameter	Units	Specification	Result	Pass/Fail
SH - Seated Height	mm	889 - 909	905	Pass
RH - Rib Height	mm	501 - 521	502	Pass
HP - Hip Pivot Height	mm	99 ref.	99	Pass
RD - Rib from Back Line	mm	229 - 241	239	Pass
KV - Knee Pivot to Back Line	mm	511 - 526	526	Pass
SW - Knee Pivot to Floor	mm	490 - 505	497	Pass
HW - Hip Width	mm	356 - 391	371	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

10/2/2009
Test Date

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 271

Test I.D: D092421

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	120 to 150	136	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-6.9	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

10/2/09
Test Date

David Winkelbauer
Approved By



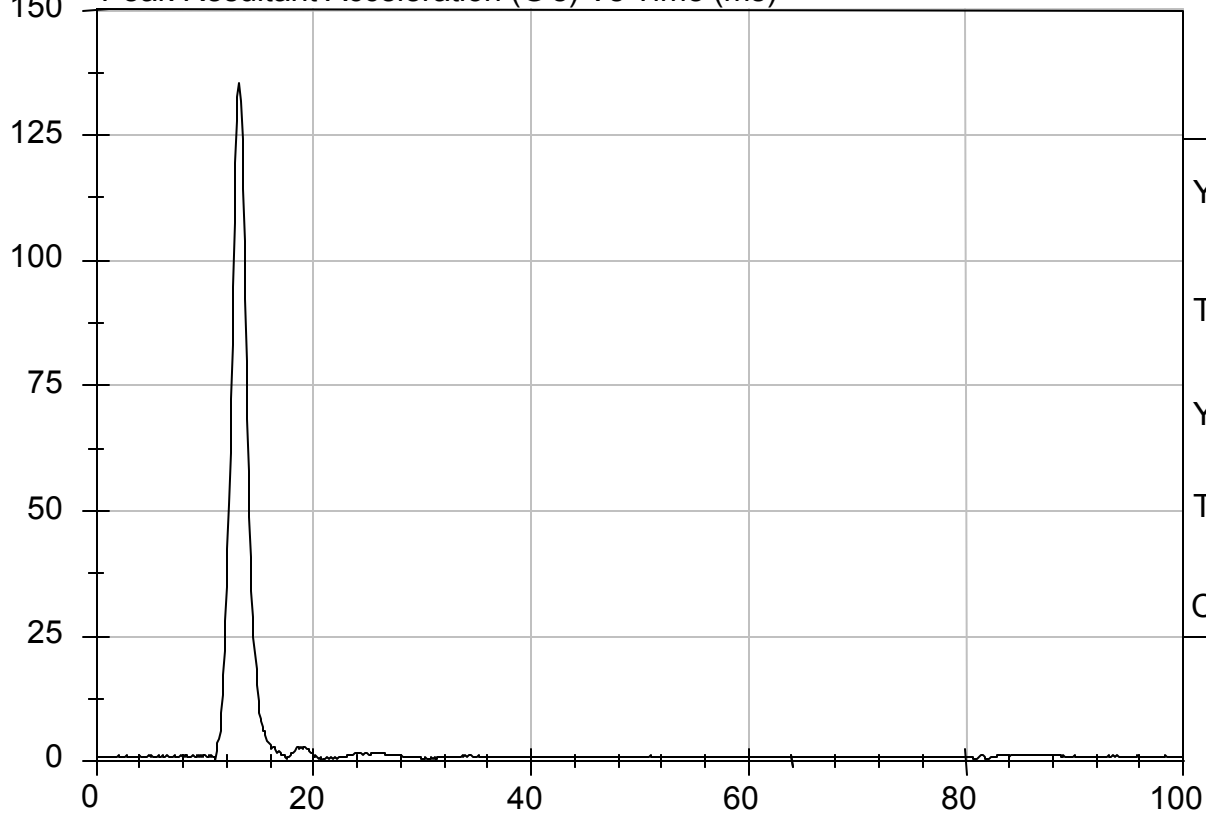
Test Description: Head Drop

Test Date: 10/2/09

Component: D092421

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



YMax: 135.5 G

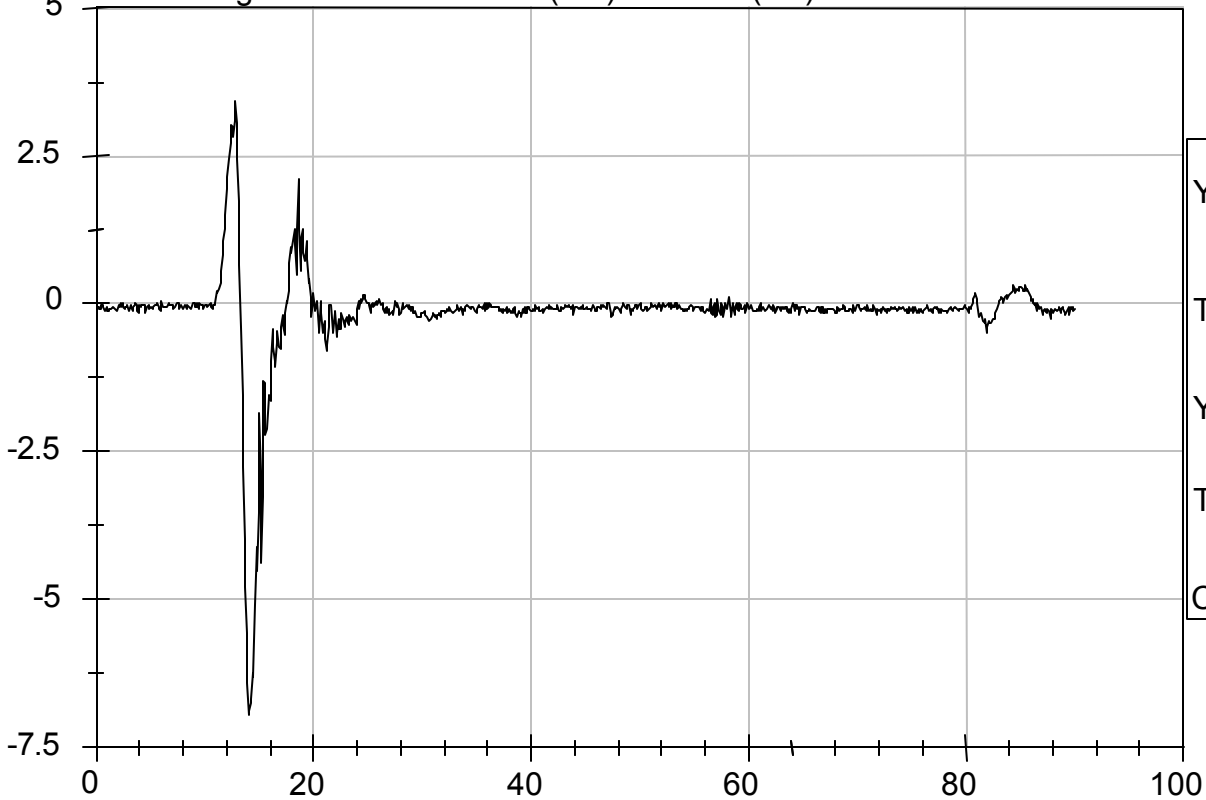
Tmax: 13.2 ms

YMin: 0.3 G

Tmin: 11.0 ms

CFC 1000

Peak Longitudinal Acceleration (G's) Vs Time (ms)



YMax: 3.4 G

Tmax: 12.8 ms

YMin: -6.9 G

Tmin: 14.0 ms

CFC 1000

SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 271

Test I.D: D092422

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	4.22 - 4.31	4.23	Pass
Upper Rib	G's	37 - 46	39	Pass
Lower Rib	G's	37 - 46	38	Pass
Lower Spine	G's	15 - 22	19.8	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

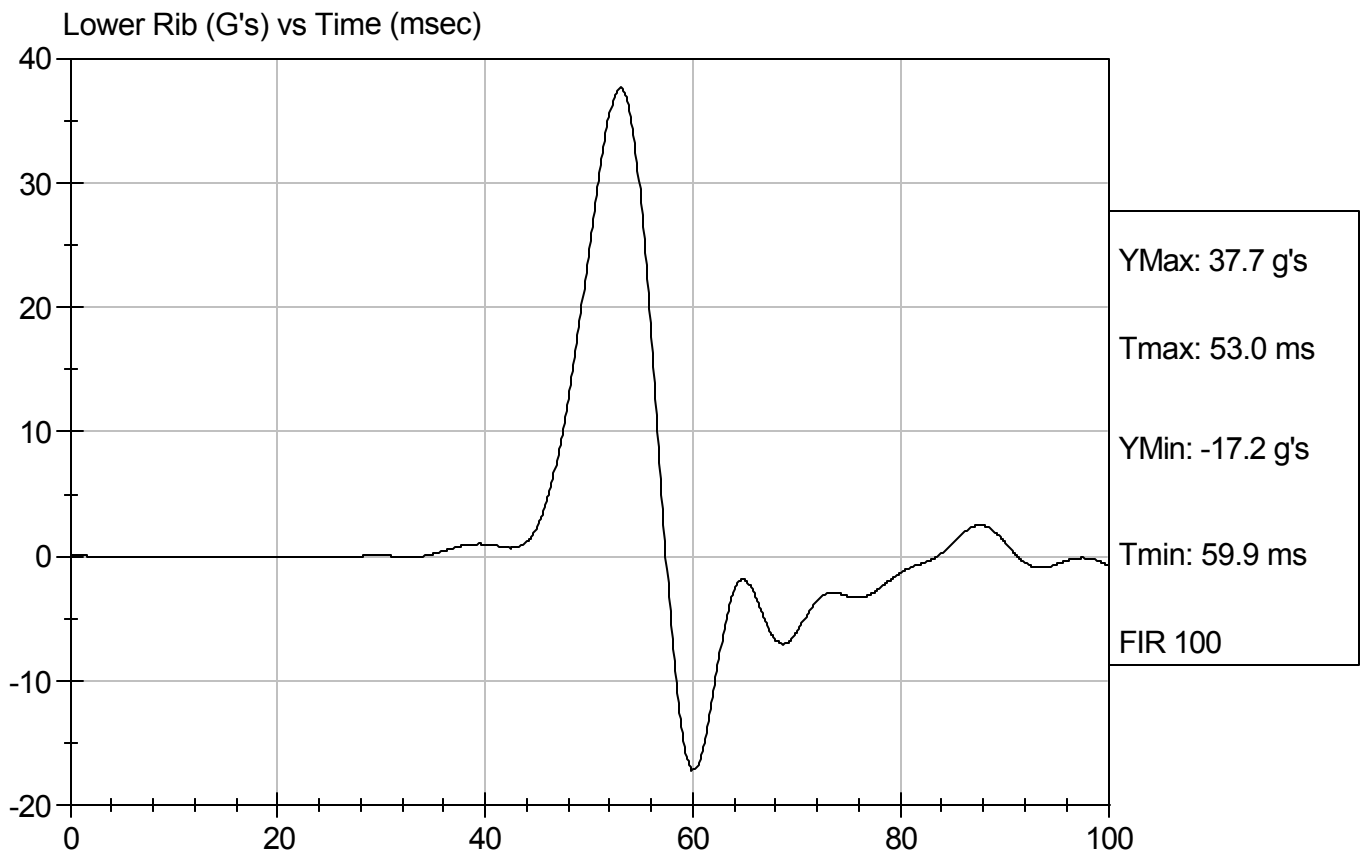
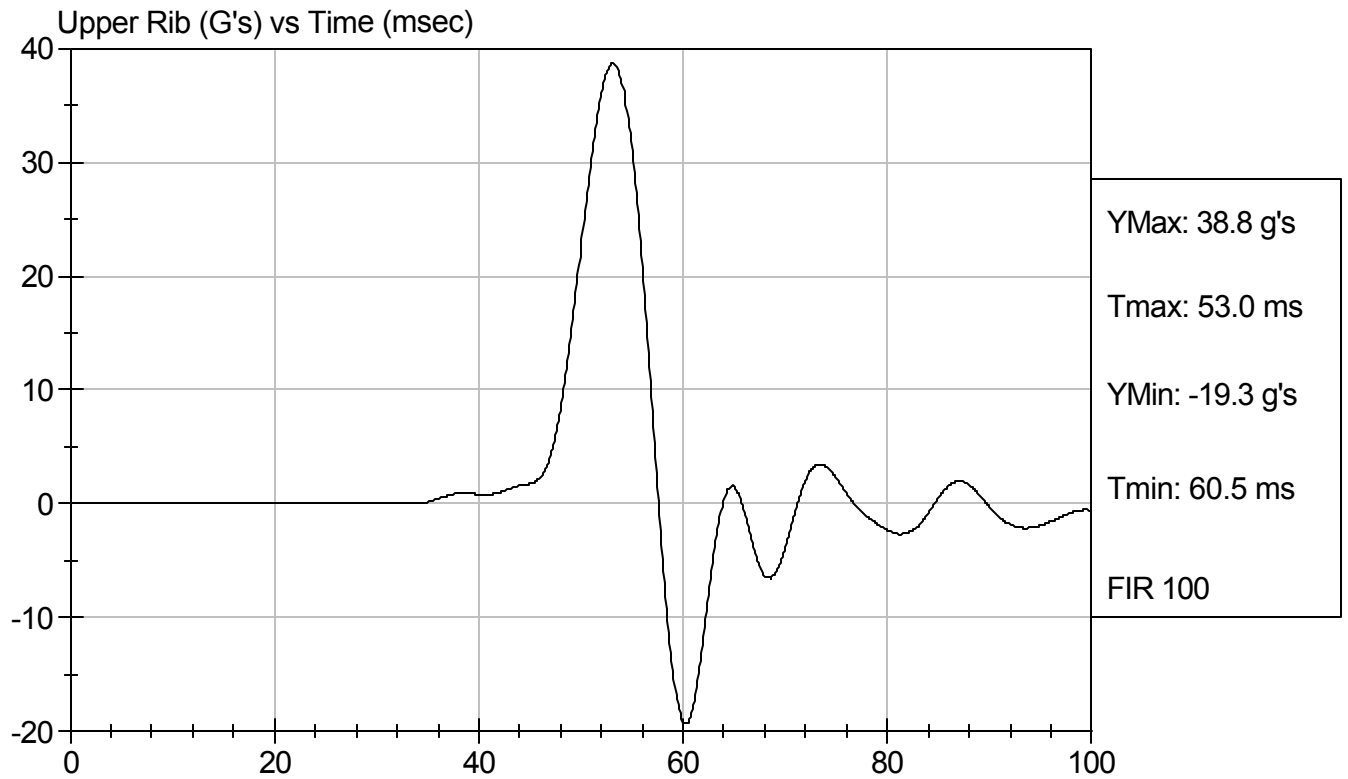
David Winkelbauer
Approved By

10/2/09
Test Date



Test Desc: Thorax Impact
Component ID: D092422

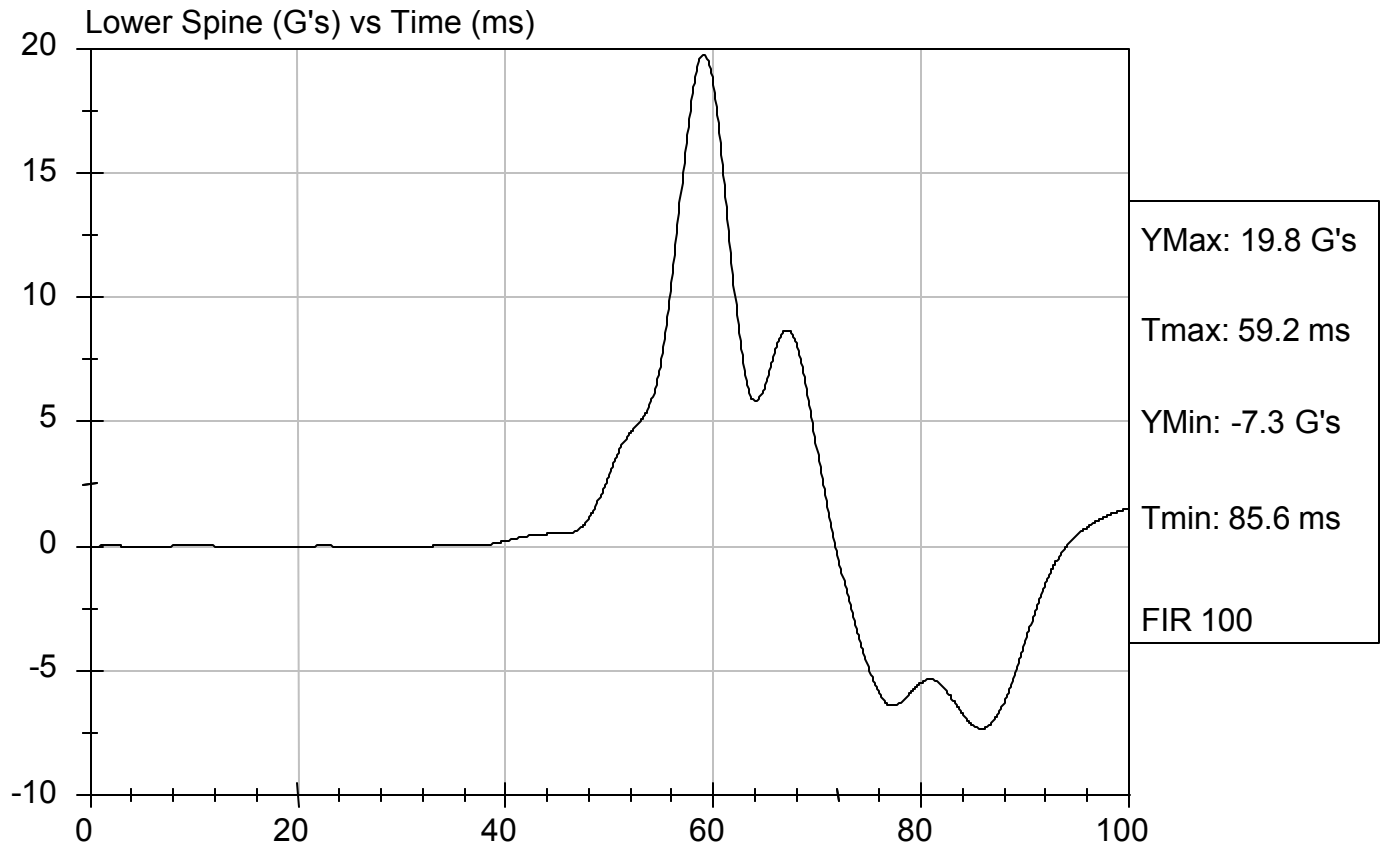
Test Date: 10/2/09
Speed: 13.89 ft/s, 4.23 m/s





Test Desc: Thorax Impact
Component ID: D092422

Test Date: 10/2/09
Speed: 13.89 ft/s, 4.23 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 271

Test I.D: D092423

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	41	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

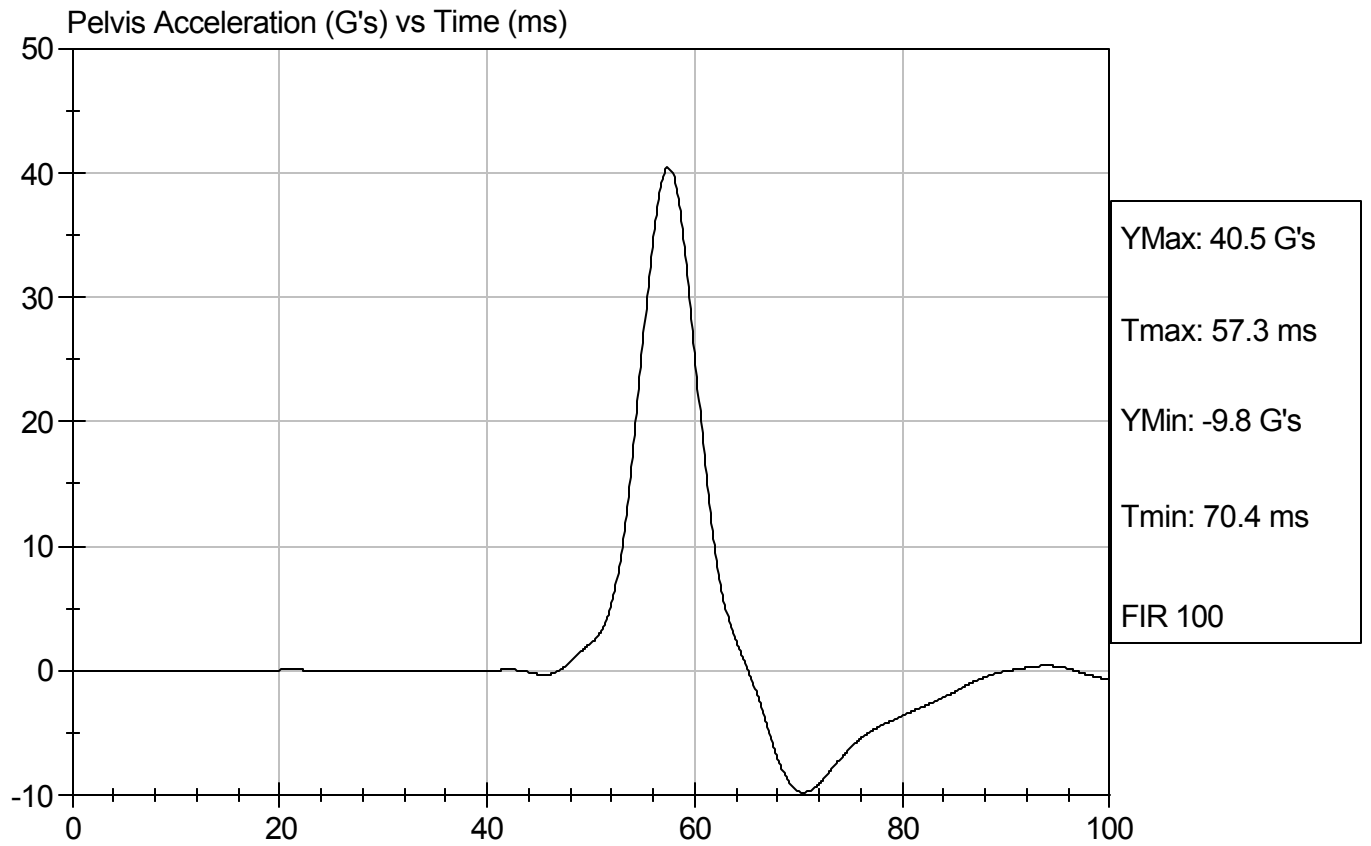
10/2/09
Test Date

David Winkelbauer
Approved By



Test Desc: Pelvis Impact
Component ID: D092423

Test Date: 10/2/09
Speed: 14.1 ft/s, 4.30 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 271

Test I.D: D092424

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Force At 12.7 mm	N	104 -162	144	Pass
Force At 19 mm	N	163 - 222	200	Pass
Force At 25.4 mm	N	222 - 280	272	Pass
Force At 33 mm	N	325 - 391	378	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

10/2/09
Test Date

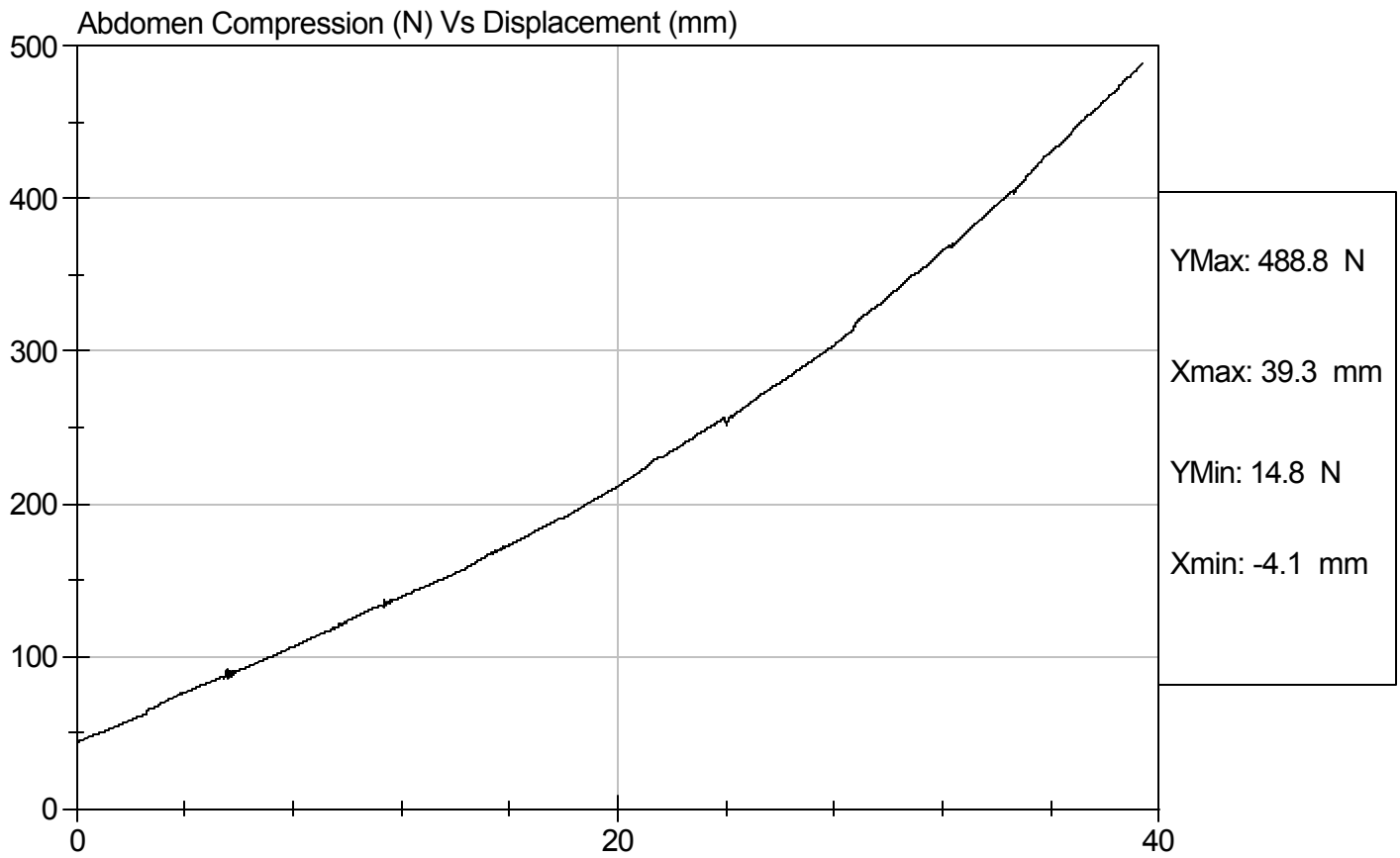


Test Description: Abdomen Compression

Test Date: 10/2/09

Component: D092424

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 271

Test I.D: D092425

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	117.5	Pass
Force At 30 deg	N	151.2 - 204.6	162.2	Pass
Force At 40 deg	N	204.6 - 258.0	230.5	Pass
Return Angle	Deg	12 Maximum	2	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

10/2/09
Test Date

David Winkelbauer
Approved By

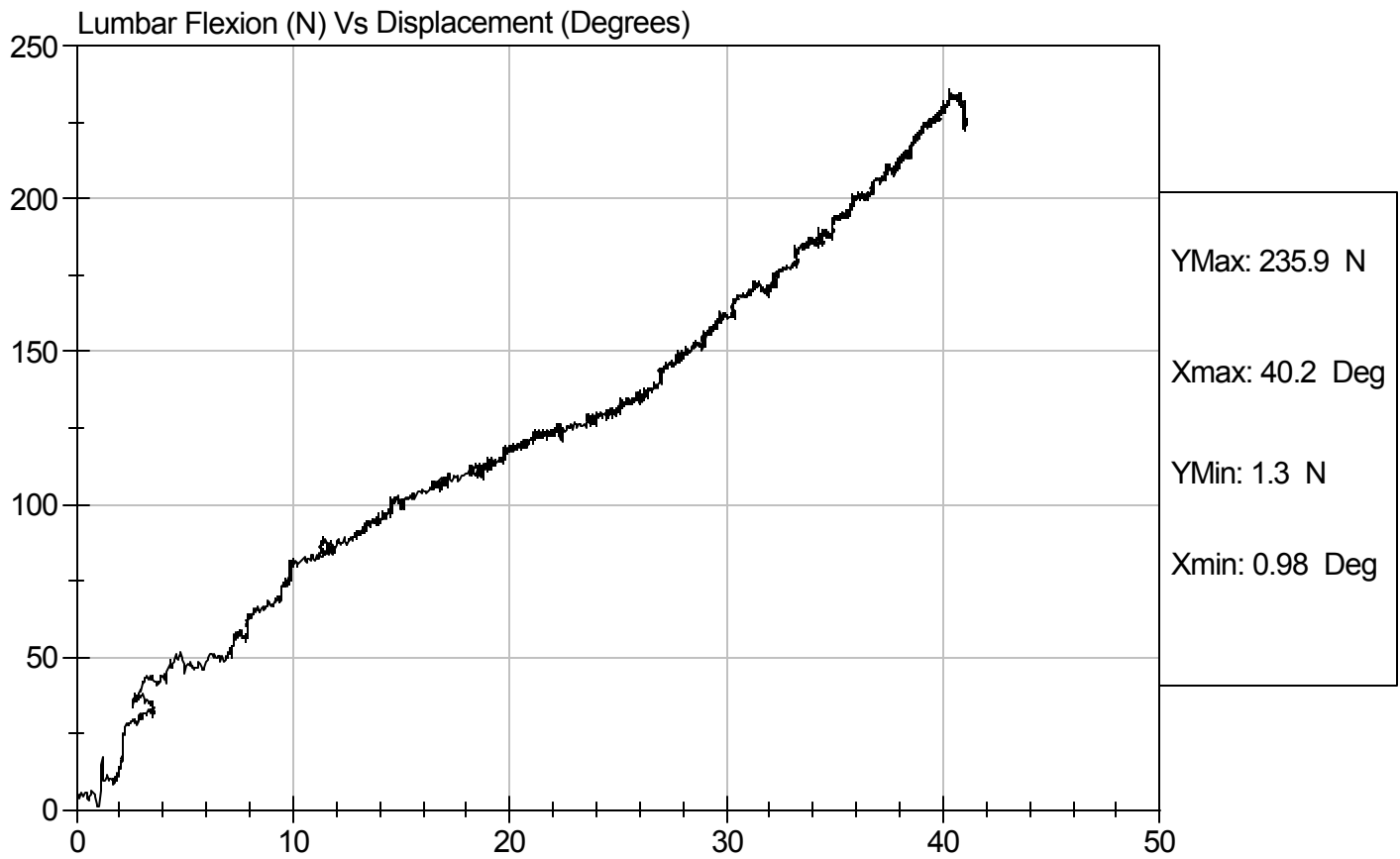


Test Description: Lumbar Flexion

Test Date: 10/2/09

Component: D092425

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 271

Test I.D: D092429

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	2.24	Pass
	20 ms	m/s	4.12 to 5.10	4.57	Pass
	30 ms	m/s	5.73 to 7.01	6.38	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.84	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	78	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	67	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	78	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	49	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	5	Pass


 Laboratory Technician

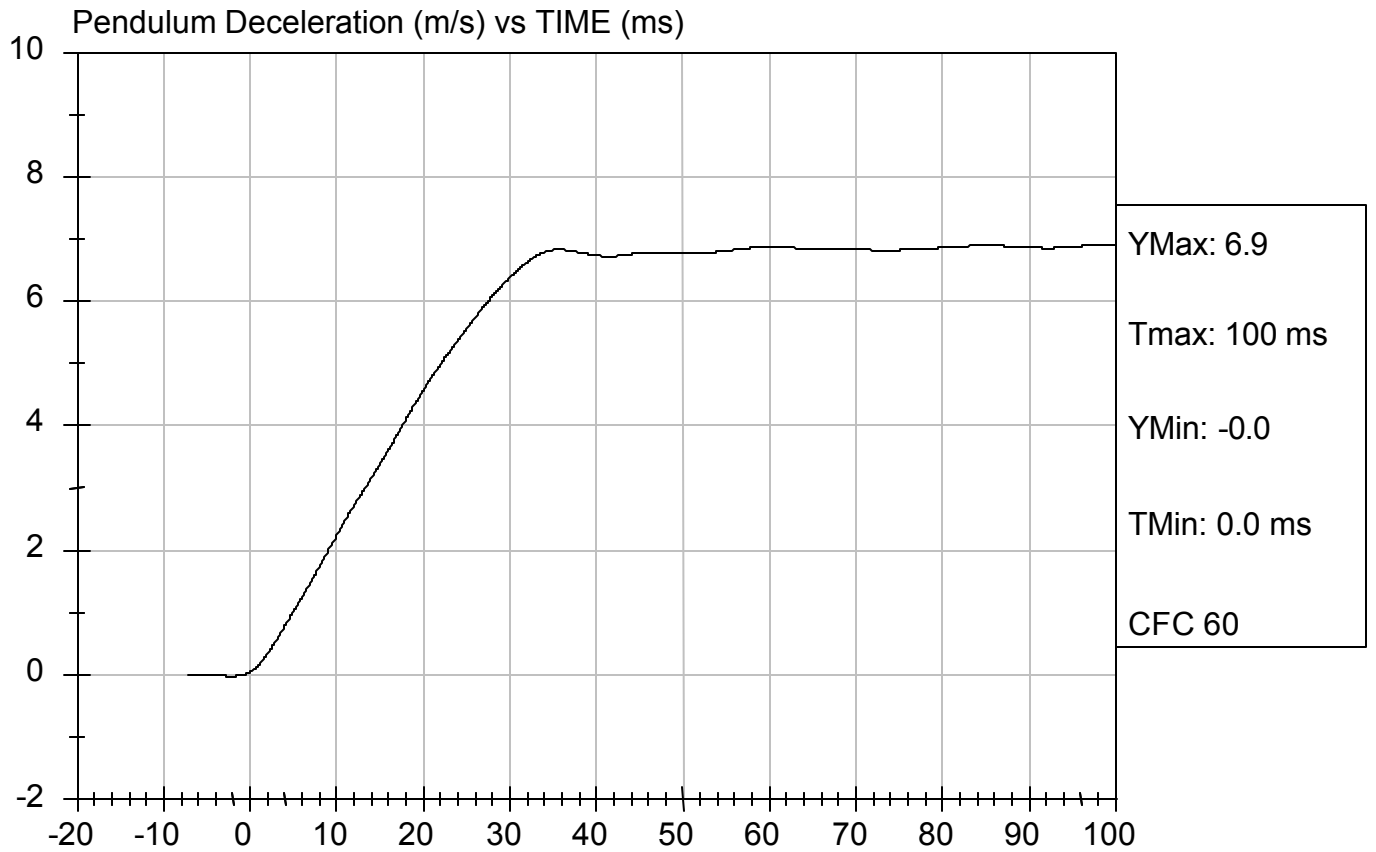

 Approved By

10/2/09
 Test Date



Test Desc: Neck Bending
Component ID: D092429

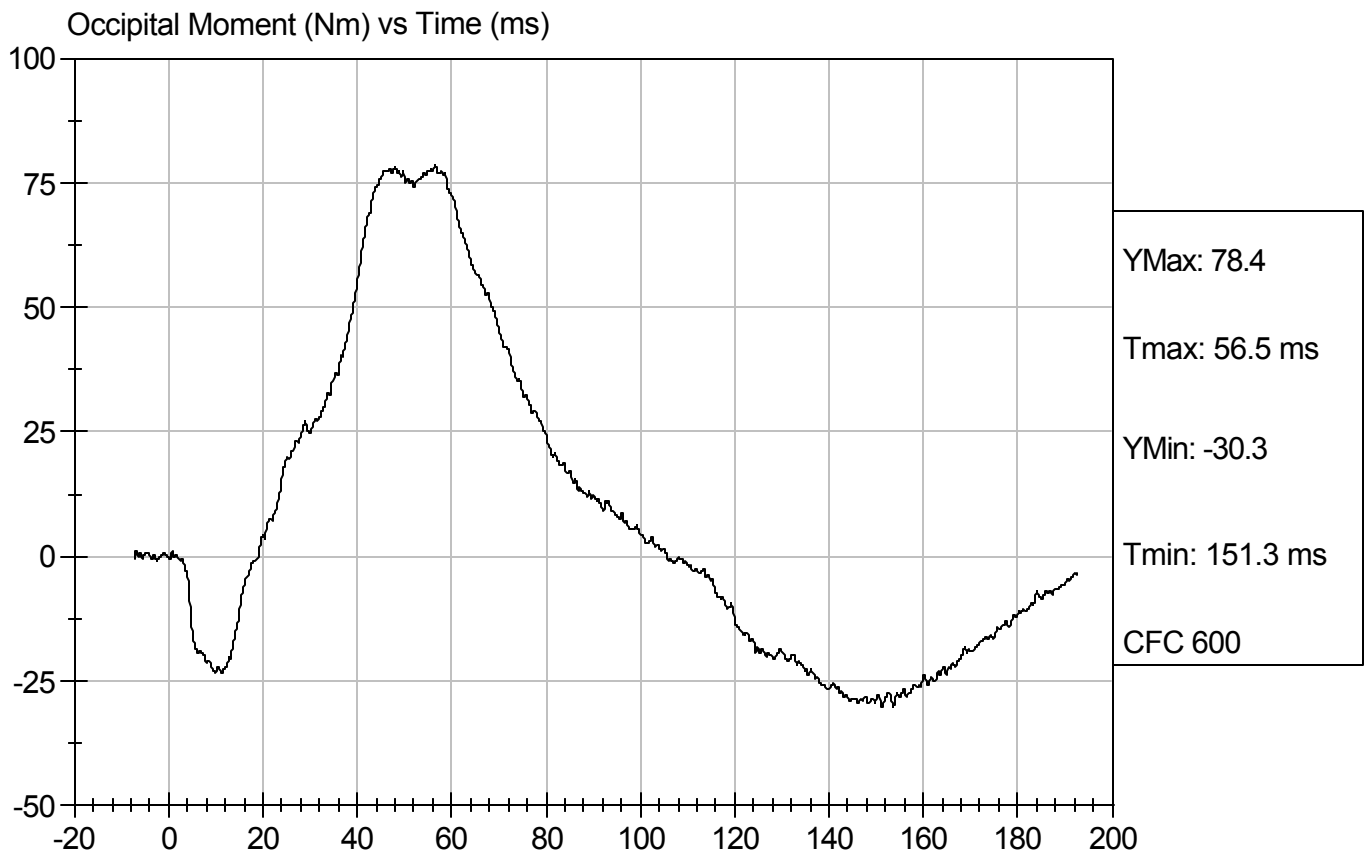
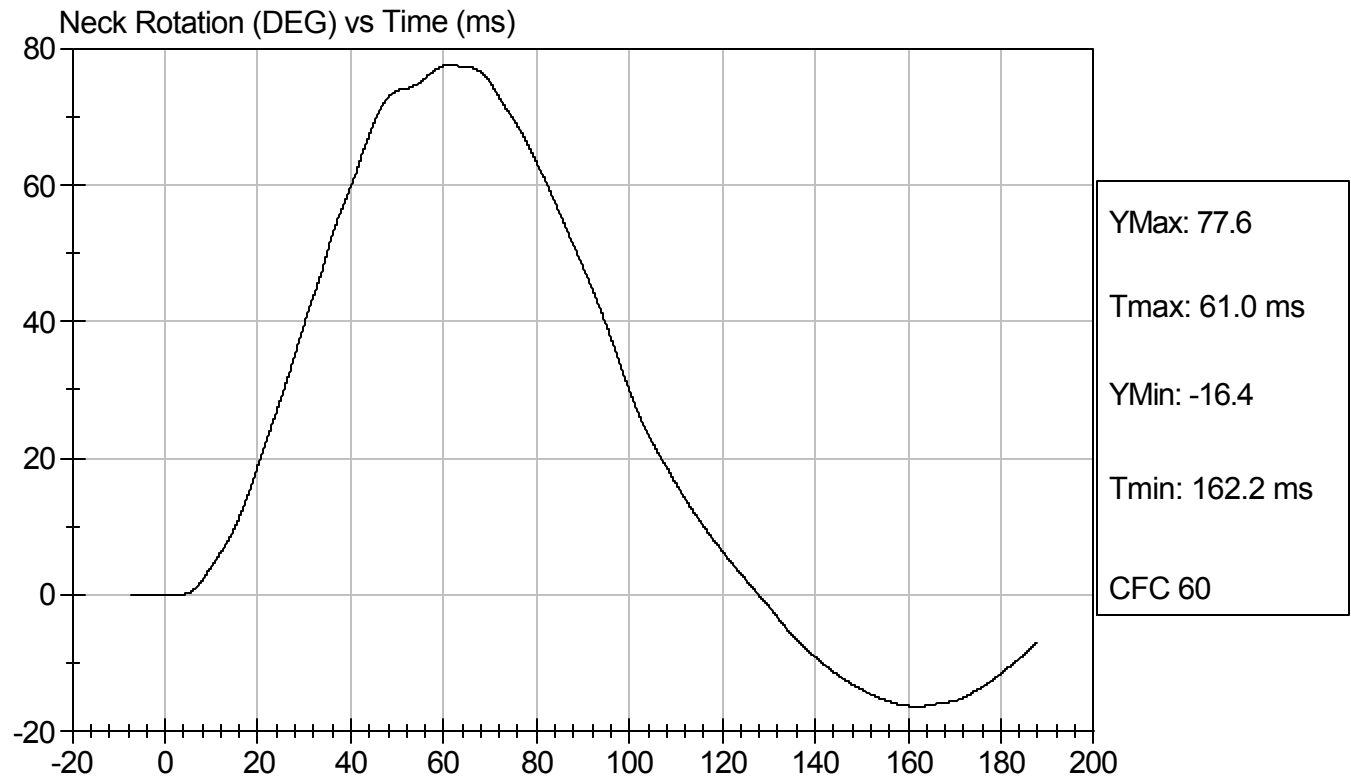
Test Date: 10/2/09
Speed: 23.15 ft/s, 7.06 m/s





Test Desc: Neck Bending
Component ID: D092429

Test Date: 10/2/09
Speed: 23.15 ft/s, 7.06 m/s



Calibration Test Results Summary

Dummy Serial Number: 271

Post-Test Calibration

External Dimensions:	The dummy passed all external dimension requirements.
Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all pendulum test requirements.
Thorax Impact Test:	The thorax passed all impact test requirements.
Pelvic Impact Test:	The pelvis passed all impact test requirements.
Abdominal Compression Test:	The abdomen passed all compression test requirements.
Lumbar Flexion Test:	The lumbar passed all flexion test requirements.

SID/HIII Calibration Data Sheet
Side Impact Dummy
Head Drop Calibration (Lateral)

ATD Serial No: 271

Test I.D: D092621

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	120 to 150	144	Pass
Is Resultant Curve Unimodal?	N/A	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	6.2	Pass
			Overall Test Results	Pass

Jessica Gall
Laboratory Technician

David Winkelbauer
Approved By

10/19/09
Test Date



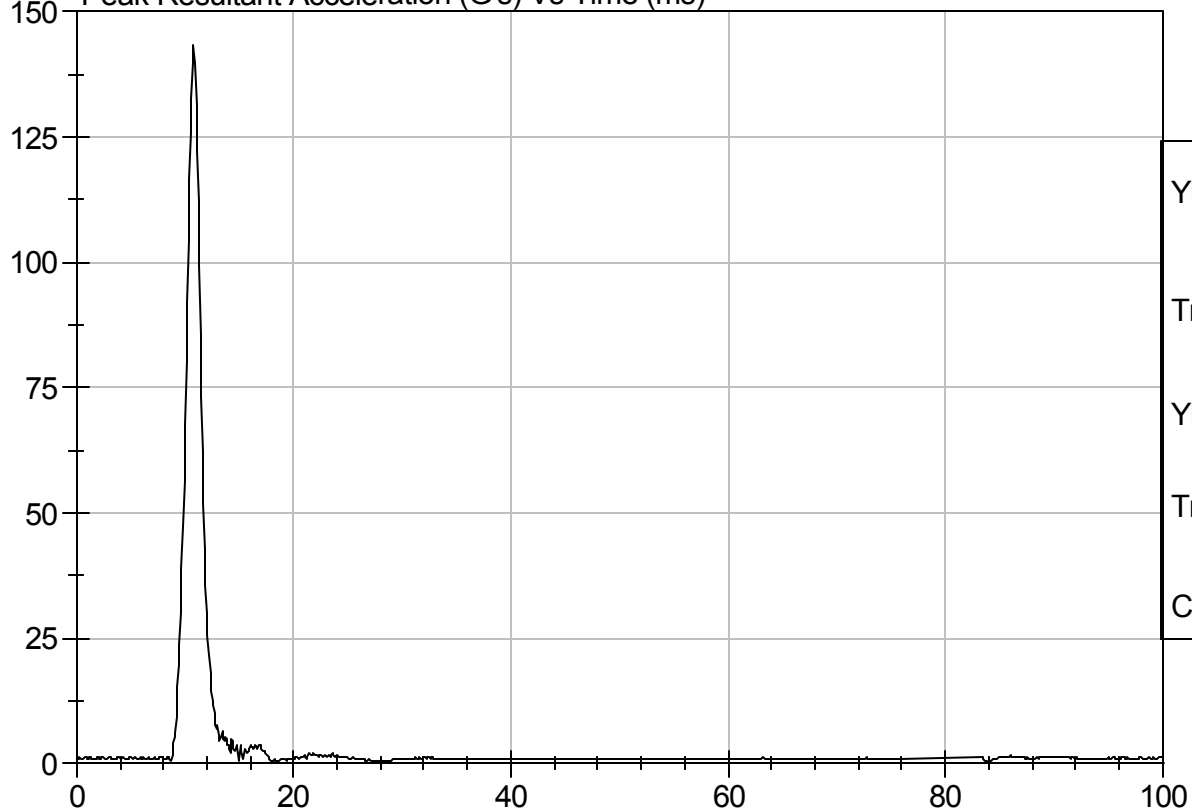
Test Description: Head Drop

Test Date: 10/19/09

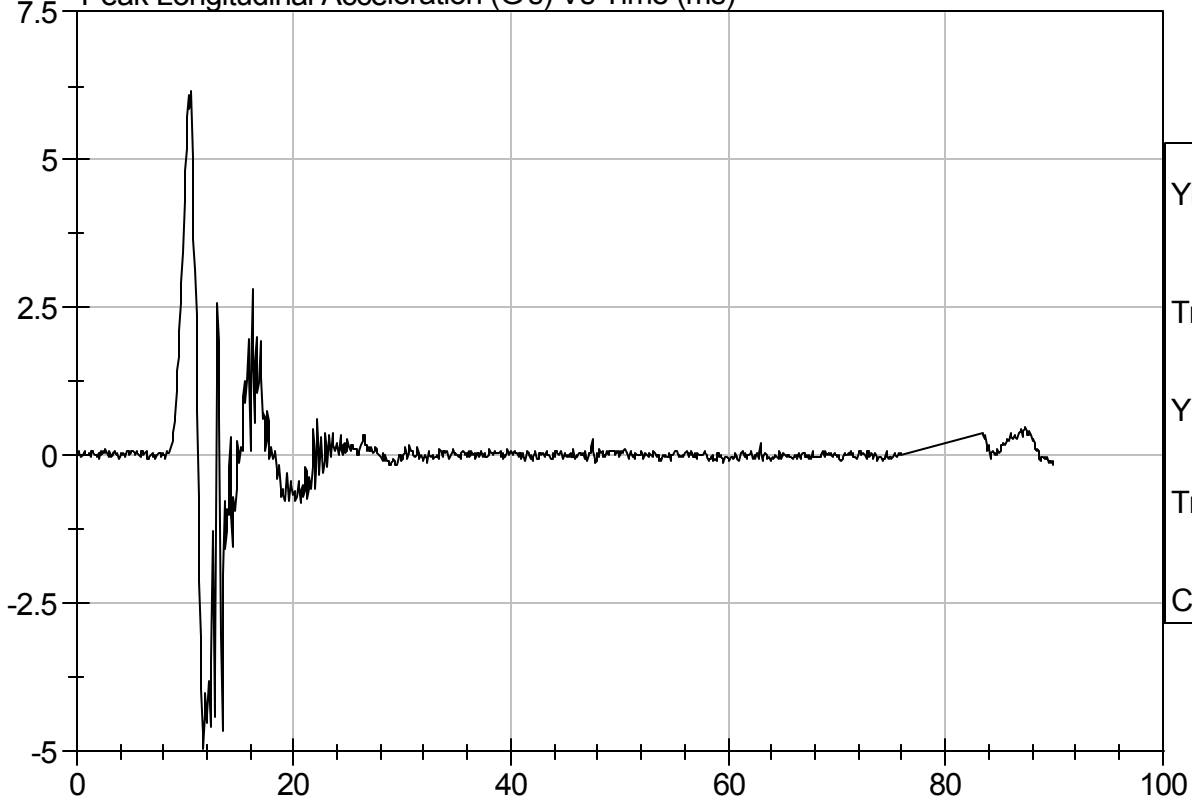
Component: D092621

Speed: 0 ft/s, 0 m/s

Peak Resultant Acceleration (G's) Vs Time (ms)



Peak Longitudinal Acceleration (G's) Vs Time (ms)



SID/HIII Calibration Data Sheet
Side Impact Dummy
Thorax Impact Test

ATD Serial No: 271

Test I.D: D092622

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Velocity	m/s	4.22 - 4.31	4.27	Pass
Upper Rib	G's	37 - 46	40	Pass
Lower Rib	G's	37 - 46	42	Pass
Lower Spine	G's	15 - 22	21	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

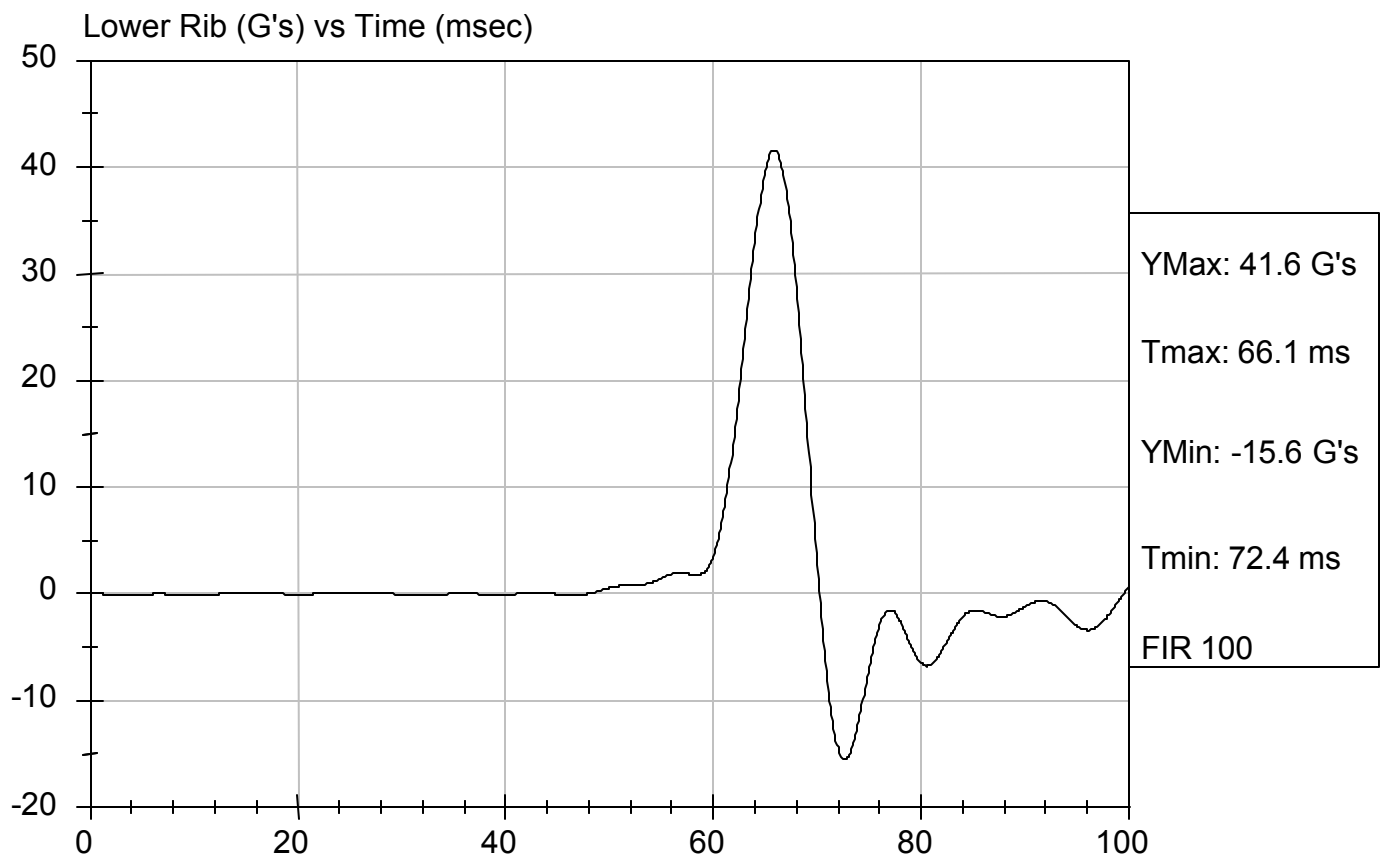
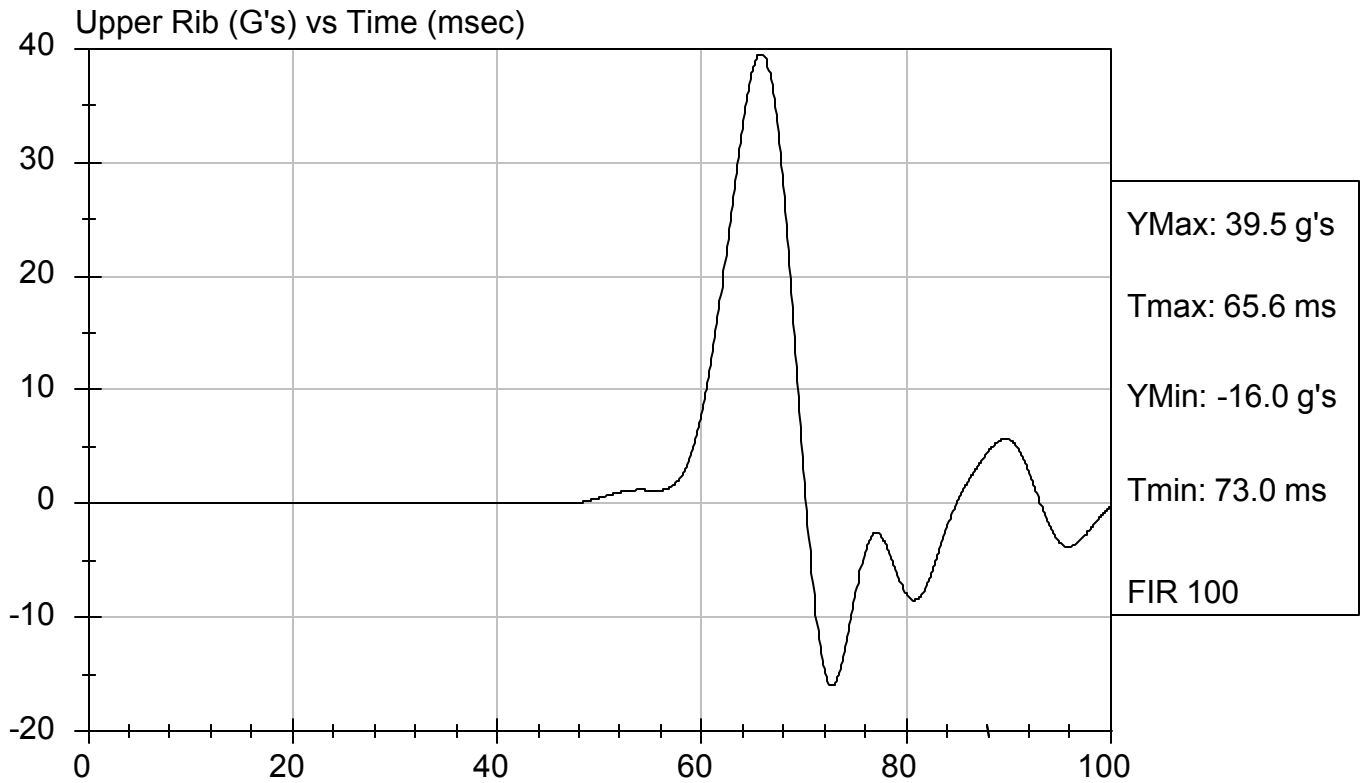
David Winkelbauer
Approved By

10/19/09
Test Date



Test Desc: Thorax Impact
Component ID: D092622

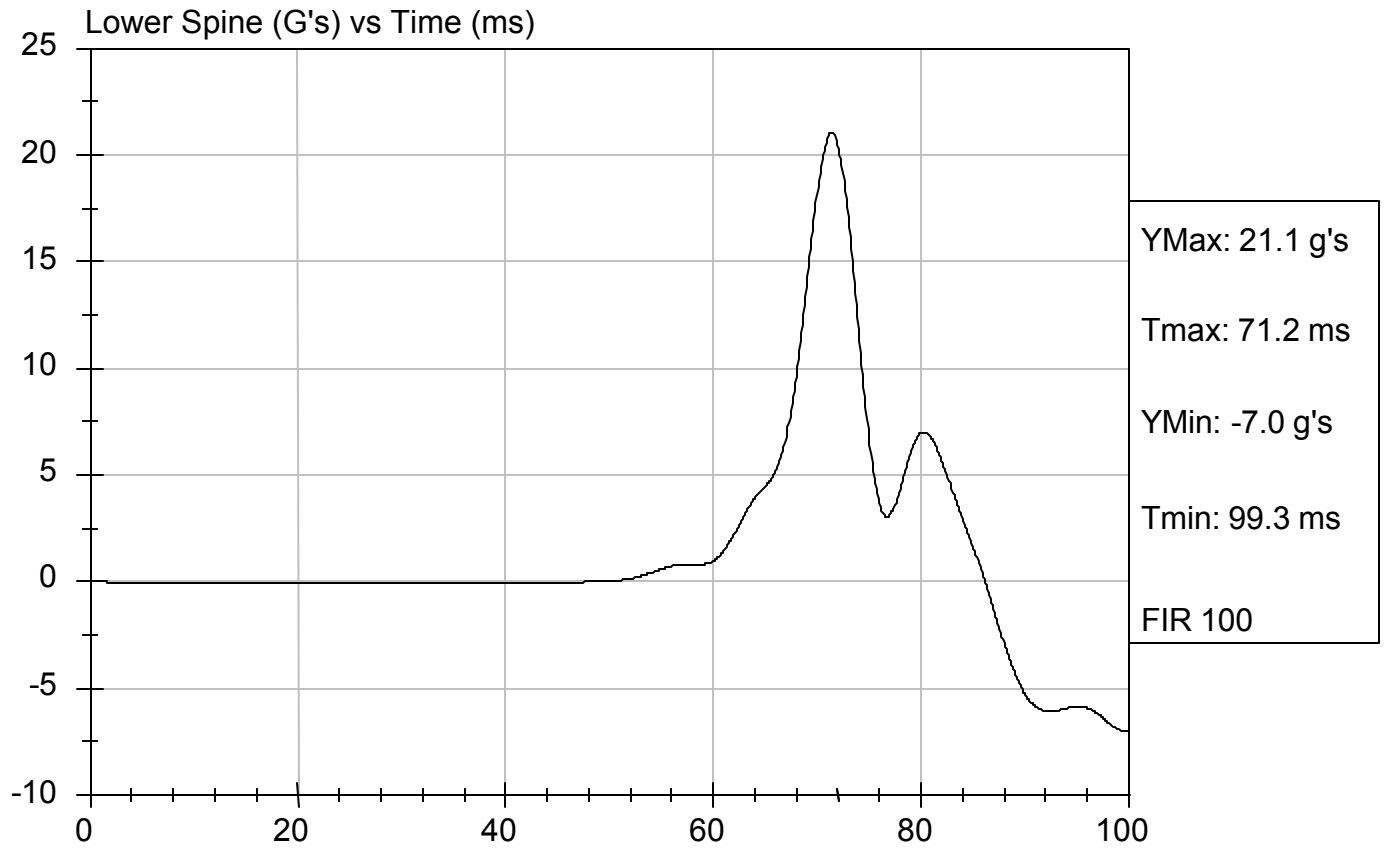
Test Date: 10/19/09
Speed: 14.01 ft/s, 4.27 m/s





Test Desc: Thorax Impact
Component ID: D092622

Test Date: 10/19/09
Speed: 14.01 ft/s, 4.27 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Pelvis Impact Test

ATD Serial No: 271

Test I.D: D092623

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Probe Velocity	m/s	4.27 - 4.33	4.27	Pass
Pelvis Acceleration	G's	40 - 60	45	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

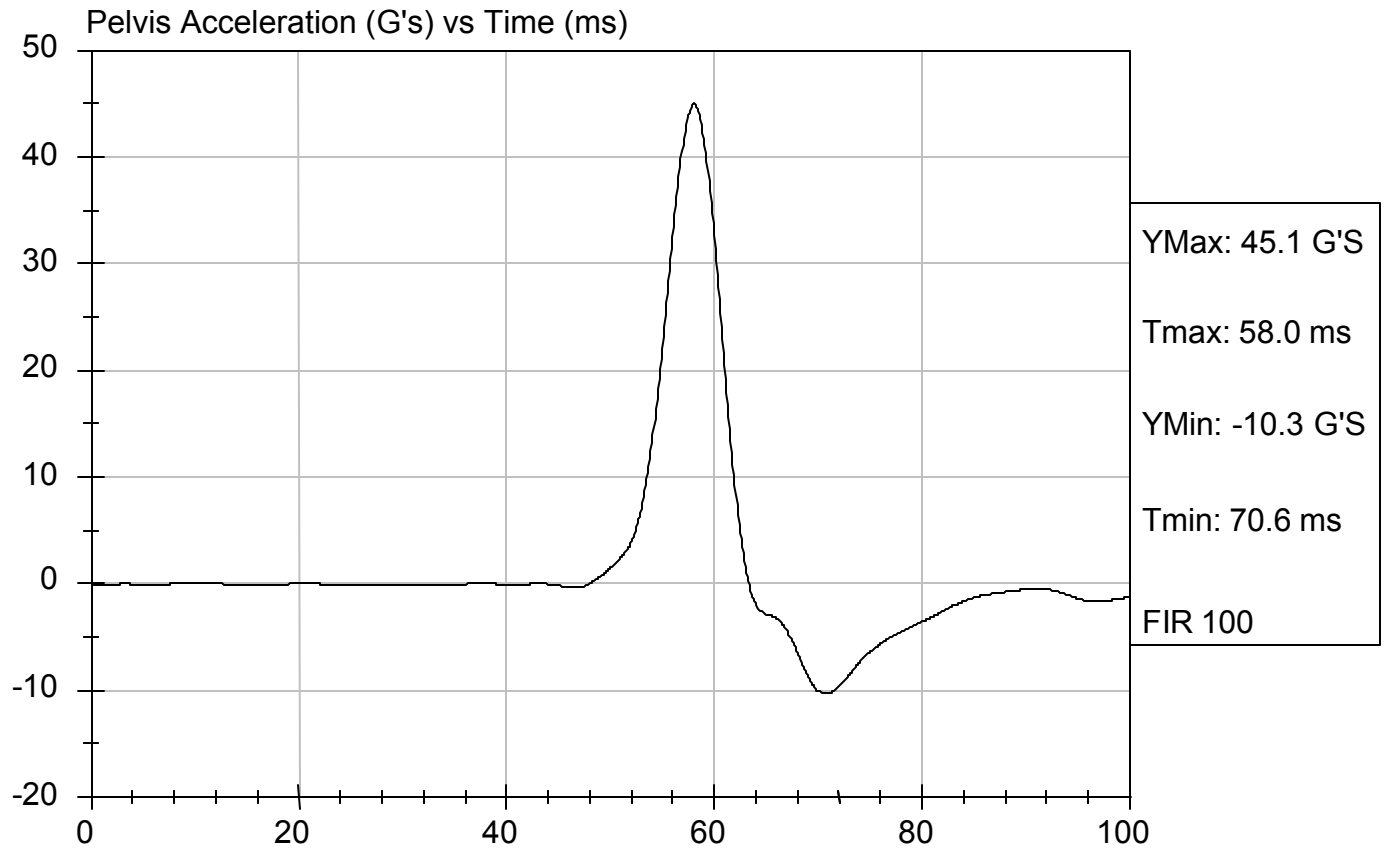
David Winkelbauer
Approved By

10/19/09
Test Date



Test Desc: Pelvis Impact
Component ID: D092623

Test Date: 10/19/09
Speed: 14.01 ft/s, 4.27 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 271

Test I.D: D092624

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Force At 12.7 mm	N	104 -162	139	Pass
Force At 19 mm	N	163 - 222	202	Pass
Force At 25.4 mm	N	222 - 280	278	Pass
Force At 33 mm	N	325 - 391	382	Pass
Overall Test Results			Pass	

Jessica Hall
Laboratory Technician

David Winkelbauer
Approved By

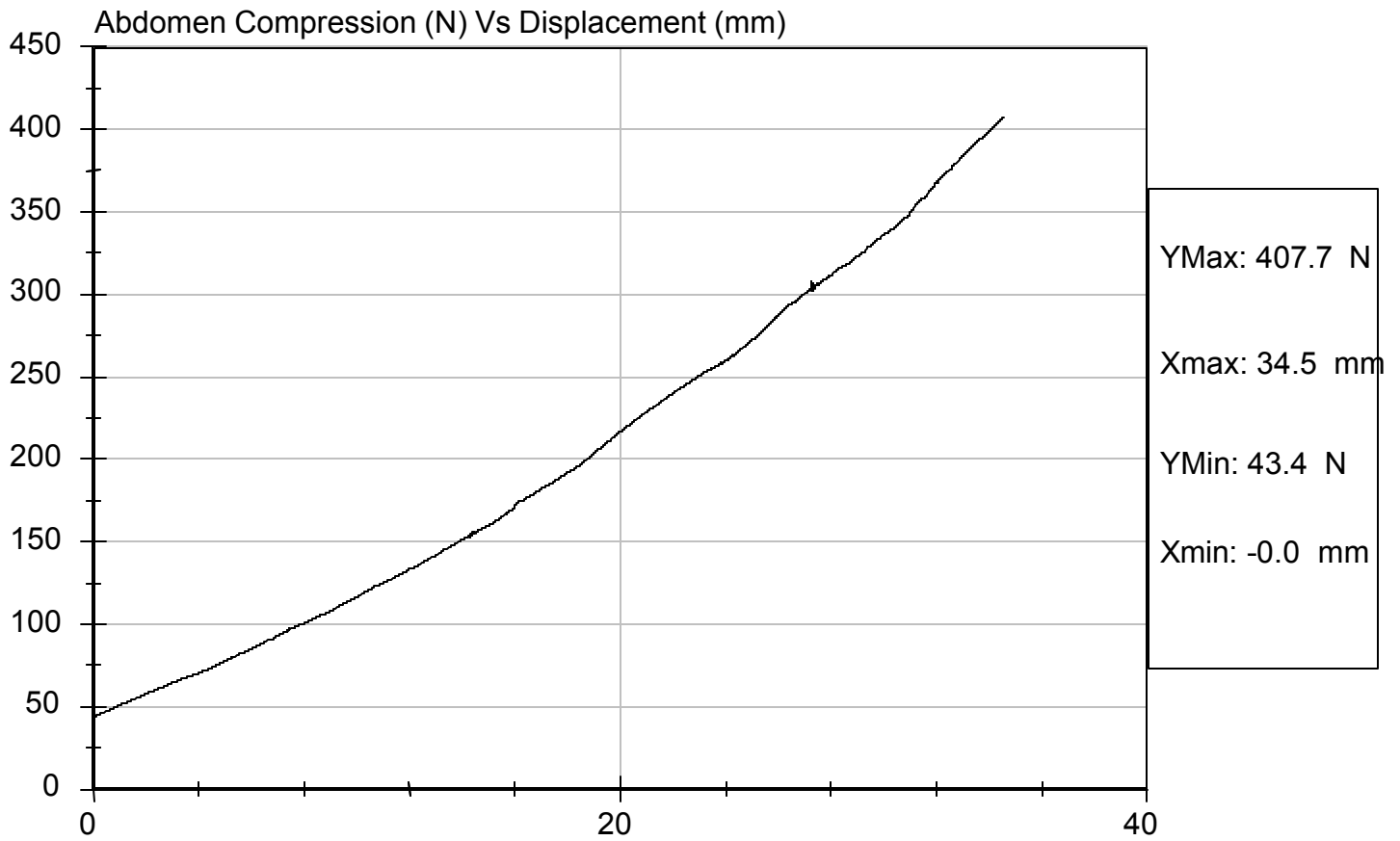
10/19/09
Test Date



Test Description: Abdomen Compression Test Date: 10/19/09

Component: D092624

Speed: 0 ft/s, 0 m/s



SID/HIII Calibration Data Sheet
Side Impact Dummy
Lumbar Flexion Calibration

ATD Serial No: 271

Test I.D: D092625

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Force At 0 deg	N	0 - 26.7	0	Pass
Force At 20 deg	N	97.9 - 151.2	133.3	Pass
Force At 30 deg	N	151.2 - 204.6	187.3	Pass
Force At 40 deg	N	204.6 - 258.0	242.8	Pass
Return Angle	Deg	12 Maximum	2	Pass
Overall Test Results			Pass	

Jessica Gall
Laboratory Technician

David Winkelbauer
Approved By

10/19/09
Test Date

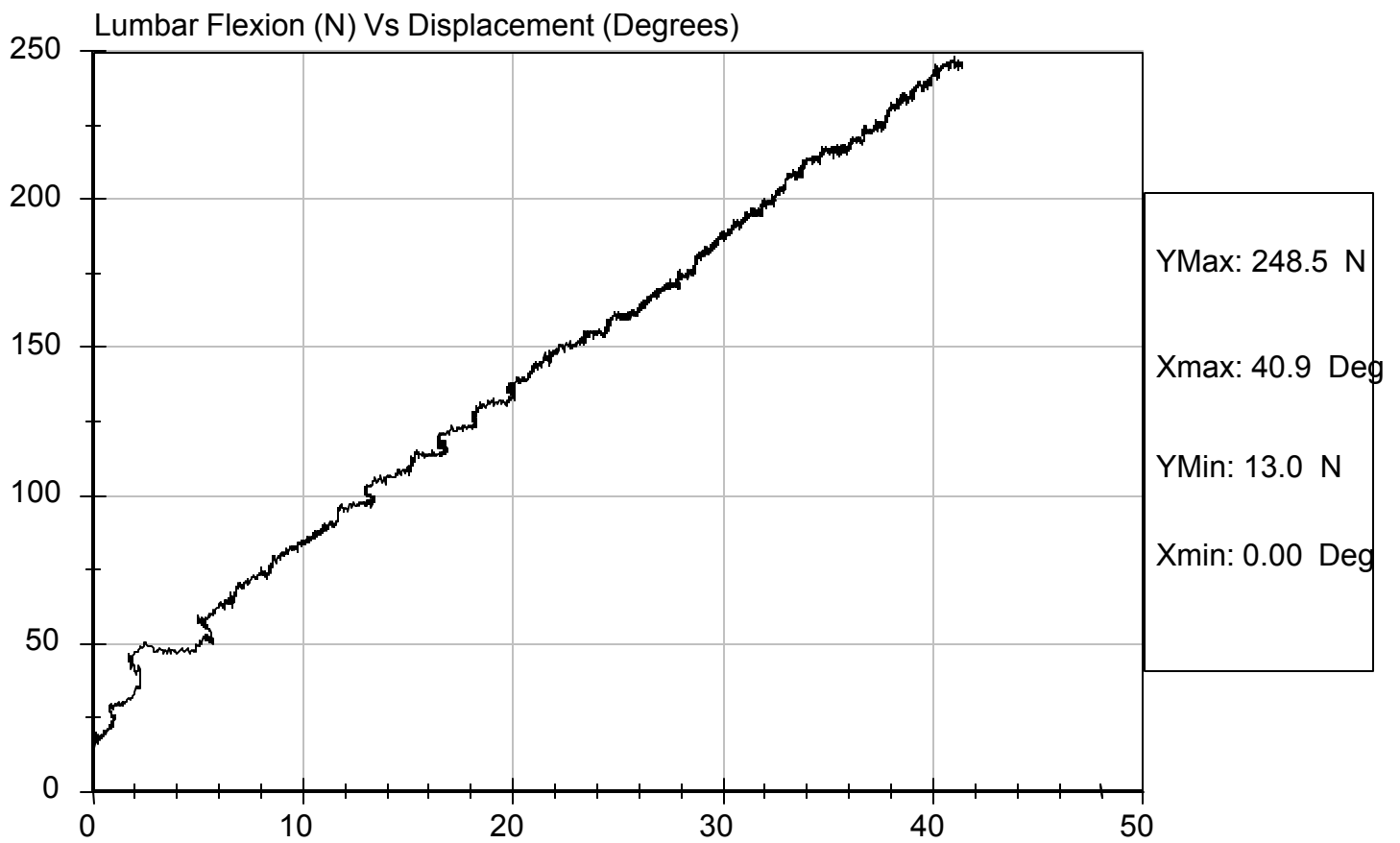


Test Description: Lumbar Flexion

Test Date: 10/19/09

Component: D092625

Speed: 0 ft/s, 0 m/s

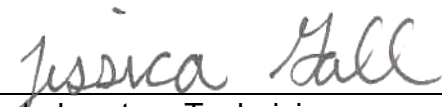


SID/HIII Calibration Data Sheet
Side Impact Dummy
Neck Pendulum Test

ATD Serial No: 271

Test I.D: D092629

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	39	Pass
Impact Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	1.96 to 2.55	1.98	Pass
	20 ms	m/s	4.12 to 5.10	4.45	Pass
	30 ms	m/s	5.73 to 7.01	6.38	Pass
	40 to 70 ms	m/s	6.27 to 7.64	6.85	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	71	Pass
Head Rotation Peak to Zero - Decay Time		ms	58 to 67	61	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	78	Pass
Mx Peak To Zero - Decay Time		ms	49 to 64	51	Pass
Mx Peak to Max. Head Rotation		ms	2 to 16	3	Pass


 Laboratory Technician

10/19/09

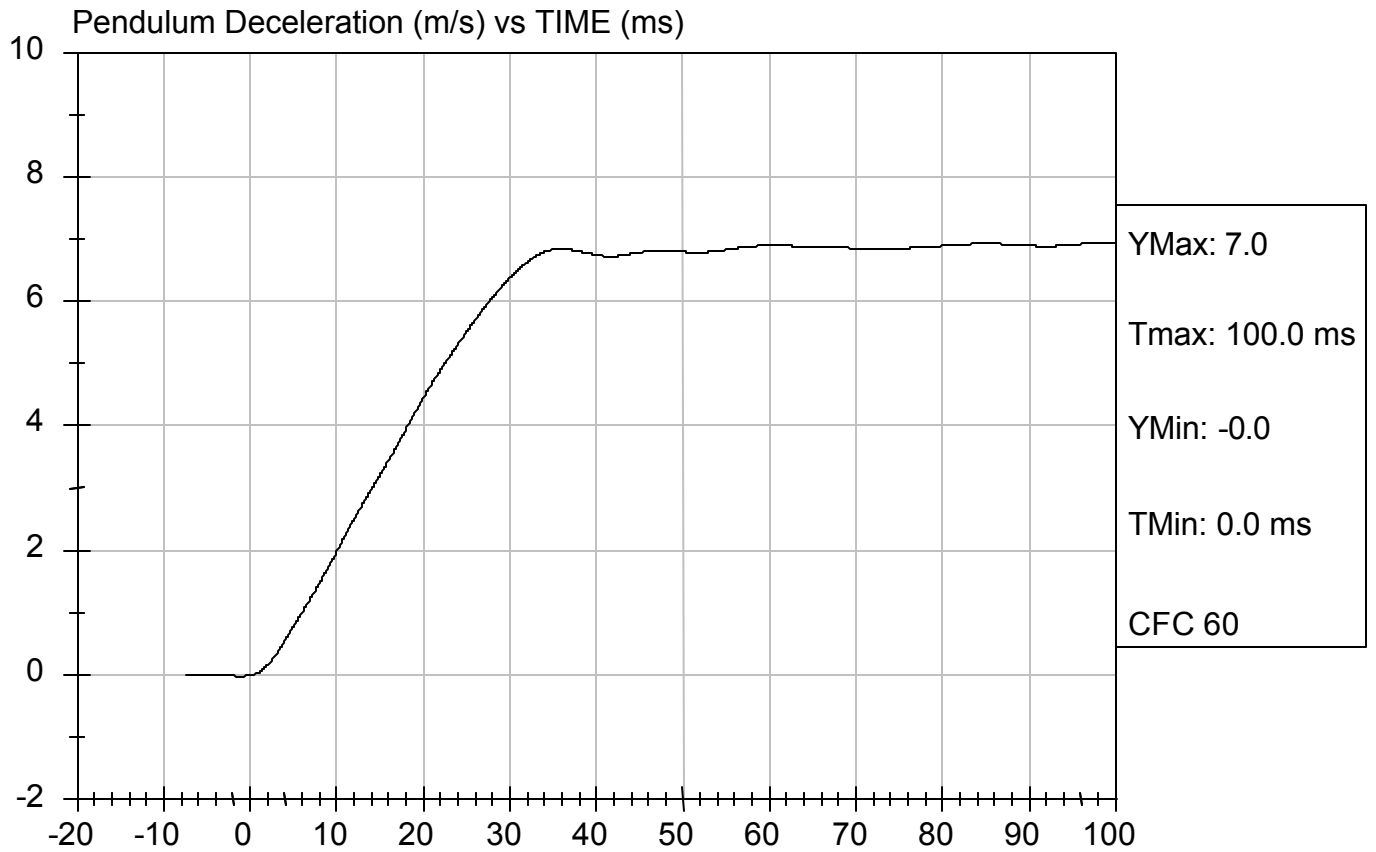
Test Date


 Approved By



Test Desc: Neck Bending
Component ID: D092629

Test Date: 10/19/09
Speed: 23.15 ft/s, 7.06 m/s

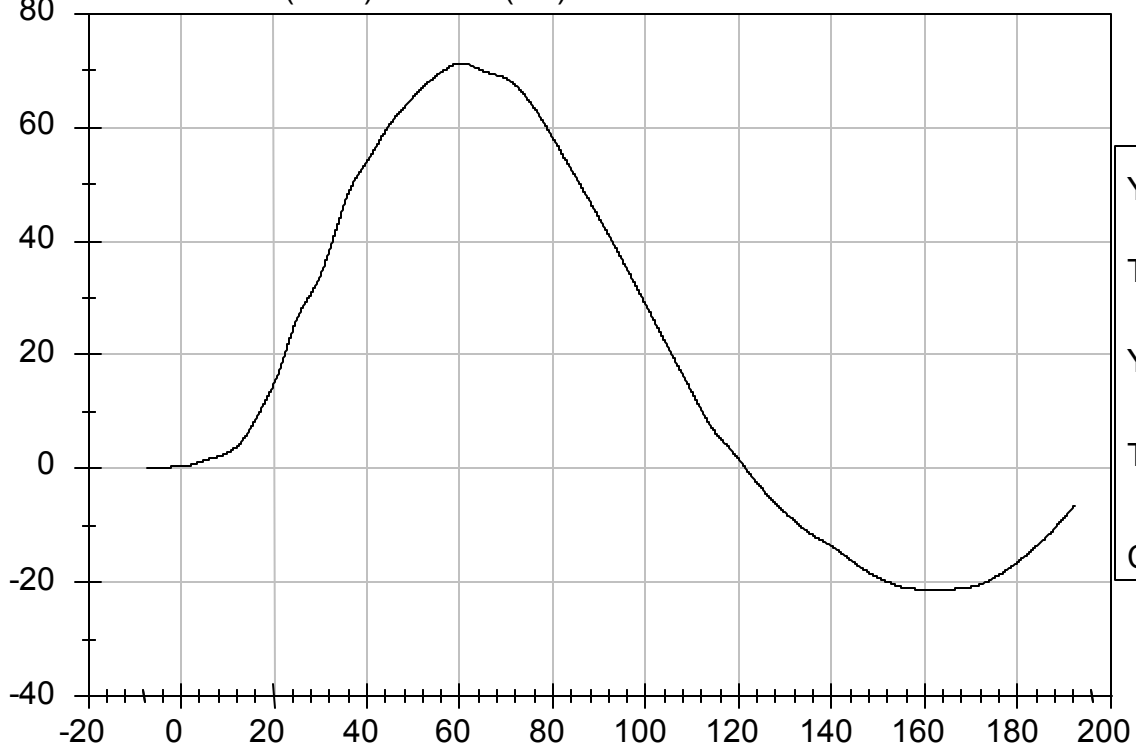




Test Desc: Neck Bending
Component ID: D092629

Test Date: 10/19/09
Speed: 23.15 ft/s, 7.06 m/s

Neck Rotation (DEG) vs Time (ms)



YMax: 71.3

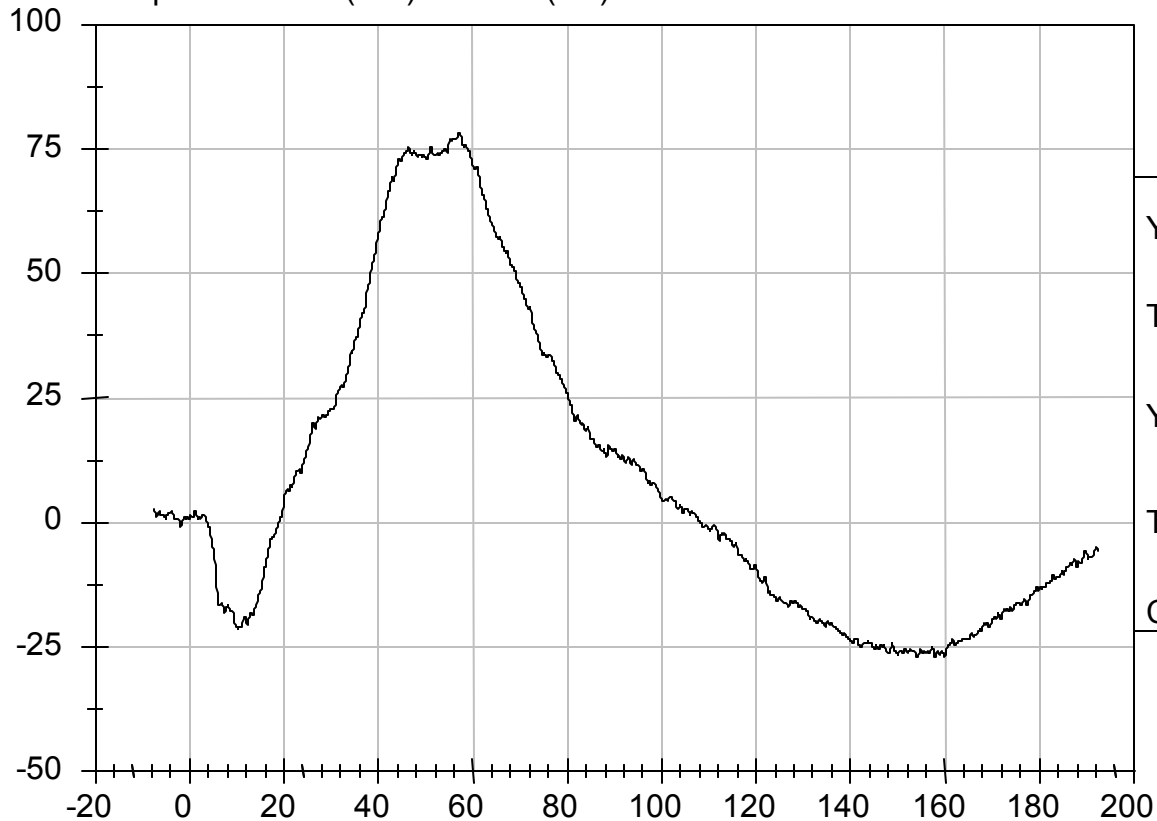
Tmax: 60.2 ms

YMin: -21.4

Tmin: 162.3 ms

CFC 60

Occipital Moment (Nm) vs Time (ms)



YMax: 78.3

Tmax: 57.1 ms

YMin: -27.0

Tmin: 159.9 ms

CFC 600

SID Calibration Data Sheet
Side Impact Dummy
Inspection Checklist

ATD Serial No: 271

Test Part	Items Checked	Result
Skin	Visual inspection	Pass
Head	Visual, ballast, accelerometer mount	Pass
Neck	Visual	Pass
Spine Box	Visual, ballast, accelerometer mount	Pass
Rib Cage	Visual, measure	Pass
Sternum	Visual	Pass
Lumbar Spine	Visual	Pass
Abdomen	Visual	Pass
Pelvis	Visual, palpate, accelerometer mount	Pass
Upper Legs	Visual	Pass
Knees	Visual	Pass
Lower Legs	Visual, range of motion	Pass
Ankles	Visual, range of motion	Pass
Feet	Visual, range of motion	Pass
Joints	1 to 2 g range	Pass
Other		Pass

Jessica Hall
 Laboratory Technician
David Winkelbauer
 Approved By

10/19/2009
 Test Date