REPORT NUMBER: 214P-MGA-2011-008

SAFETY COMPLIANCE TESTING FOR FMVSS 214
DYNAMIC SIDE IMPACT PROTECTION
RIGID POLE

HONDA OF CANADA MFG.
2011 ACURA ZDX SUV
NHTSA NUMBER: CB5303

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

Test Date: March 25, 2011

Report Date: May 18, 2011

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
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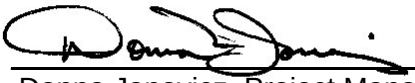
Prepared by: 
Donna Janovicz, Project Manager

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Joe Fleck, Project Engineer

Approval Date: May 18, 2011

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted by: James A. Jones

Acceptance Date: 5/25/2011

Technical Report Documentation Page

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4. Title and Subtitle Final Report of FMVSS 214P Compliance Test Side Impact Protection Testing of 2011 Acura ZDX SUV; NHTSA No.: CB5303		*5. Report Date* May 18, 2011 *6. Performing Organization Code* MGA
7. Author(s) Donna Janovicz, Project Manager Joe Fleck, Project Engineer		*8. Performing Organization Report No.* 214P-MGA-2011-008
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-07-D-00062
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance (NVS-220) 1200 New Jersey Ave, SE Washington, DC 20590		*13. Type of Report and Period Covered:* Final Test Report 3/25/2011 to 5/18/2011 *14. Sponsoring Agency Code* NVS-220
15. Supplementary Notes		

16. Abstract

A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 2011 Acura ZDX SUV in accordance with the specifications of the Office of Vehicle Safety Compliance TP-214P-01 for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on March 25, 2011.

The impact velocity was 31.4 km/h, and the ambient temperature at the struck (driver's) side of the test vehicle at the time of impact was 21°C. The test vehicle post-test maximum crush was 396 mm at level 3. The test vehicle's performance follows:

Measurement Description	Units	Result
Head Injury Criteria (HIC_{36})	N/A	387
Max. Rib Deflection	mm	33
Sum of Abdomen Forces	N	1655
Pubic Symphysis Force	N	2224

The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite side doors did not open during the side impact event.

17. Key Words Compliance Testing Side Impact Protection Pole Test ES-2re SID-IIs		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services (TIS) Room E12-100 East Building 1200 New Jersey Ave. Washington, D.C. 20590 Telephone No. (202) 366-2588	
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Form DOT F1700.7 (8-72)

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This side impact test is part of the FY 2011 FMVSS 214 Side Impact Protection Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-07-D-00062. The purpose of this test was to evaluate side impact protection in a 2011 Acura ZDX SUV. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-214P-01, dated January 2010).

SUMMARY

A rigid pole side impact test was conducted on a 2011 Acura ZDX SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.4 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin, on March 25, 2011. Pre-test and post-test photographs of the test vehicle and side impact dummy are included in Appendix A of this report.

One Part 572U dummy was placed in the left front outboard designated seating position according to instructions specified in TP-214P-01, dated January 2010. The side impact event was documented by ten (10) cameras.

The ES-2re male dummy was instrumented with a triaxial accelerometer pack located in the head, 3 rib displacement transducers located in the chest, 3 load cells located in the abdomen and a load cell located in the pubic symphysis.

A summary of the test results follows:

DUMMY INJURY VALUES

Dummy	HIC (36ms)	Thorax Deflection (mm)		Abdomen Forces (N)		Pubic Symphysis (N)
ES-2re 50th Percentile Male	387	Upper	33.0	Front	417.3	2224.1
		Middle	30.2	Mid	557.4	
		Lower	32.7	Rear	709.3	
		Max.	33.0	Sum	1655.4	

GENERAL COMMENTS

There was no valid data collected for:

A Pillar Sill Y
A Pillar Low Y after 25 msec.
A Pillar Mid Y after 25 msec.

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

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1

TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

VEHICLE INFORMATION	
Make	Acura
Model	ZDX
Body Style	MPV
VIN	2HNYB1H45BH500366
Body Color	Palladium M.
Engine Displacement (L)	3.7
# of Cylinders	6
Engine Placement	Longitudinal
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	AWD
Odometer Reading	144 miles

OPTIONS	
ESC	Yes
All Wheel Drive	Yes
Power Steering	Yes
Tilt Steering Wheel	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso/Pelvis Airbag	Yes
Driver Knee Bag	No
Driver Seat Belt Pretentioners	Yes
Driver Seat Belt Load Limiters	Yes
Driver Power Seat	Yes
Rear Pass. Curtain Airbag	Yes
Rear Pass. Side Torso Airbag	No
Rear Pass. Seat Belt Pretentioners	No
Rear Pass. Seat Belt Load Limiters	No
Rear Pass. Power Seats	No
Power Windows	Yes
Air Conditioning	Yes
AM/FM CD	Yes
Automatic Door Locks (ADL)	Yes
Does owner's manual provide instructions to disable ADL's?	Yes
Anti-Lock Brakes	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Honda of Canada Mfg.
Date of Manufacture	12/10

GVWR (kg)	2510
GAWR Front (kg)	1325
GAWR Rear (kg)	1215

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				380
Cargo Weight (RCLW) (kg)				40

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

TIRE PRESSURES

	Units	LF	RF	RR	LR
As Delivered	kPa	220	220	220	220
As Tested	kPa	220	220	220	220

TEST VEHICLE WEIGHTS

	Units	As Delivered			Fully Loaded			As Tested		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	587.4	435.9		623.8	480.0		610.1	486.7	
Right	kg	577.9	417.3		588.4	443.7		590.1	440.0	
Ratio	%	57.7	42.3		56.7	43.3		56.4	43.6	
Totals	kg	1165.3	853.2	2018.5	1212.2	923.7	2135.9	1200.2	926.7	2126.9

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	2018.5
Weight of 1 P572U ATD (ES-2re) Dummy	kg	77.1
Rated Cargo/Luggage Weight (RCLW)	kg	40
Calculated Target Vehicle Test Weight (TVTW)	kg	2135.6

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	781	797	794	790
As Tested	mm	787	797	796	796
Difference	mm	-6	0	-2	-6

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2750
Vertical Impact Reference Line (Aft of Front Axle)	mm	1291

WEIGHT of BALLAST and VEHICLE COMPONENTS REMOVED TO MEET VEHICLE TEST WEIGHT

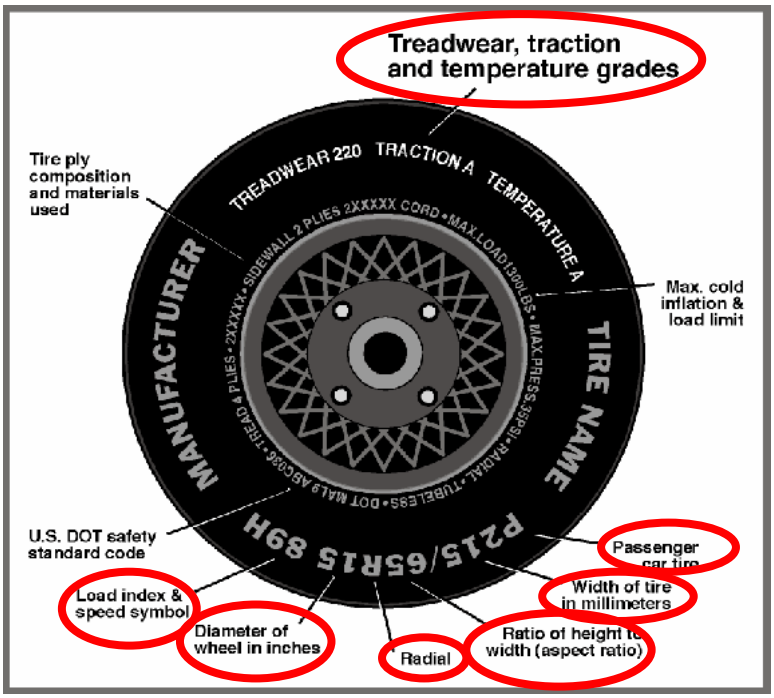
Description of Component	Weight (kg)
Ballast	0
Right Front Headrest and all Rear Headrests	5.4
Both Tail Lights, Engine Cover	4.1

DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	220	220
Recommended Tire Size	P255/50R19	P255/50R19
Tire Size on Vehicle	P255/50R19	P255/50R19
Tire Manufacturer	Michelin	Michelin
Tire Name	Latitude	Latitude
Tire Type	Passenger	Passenger
Tire Width	255	255
Aspect Ratio	50	50
Radial	Yes	Yes
Wheel Diameter	19	19
Load Index/Speed Symbol	103H	103H
Treadwear	440	440
Traction Grade	A	A
Temperature Grade	A	A

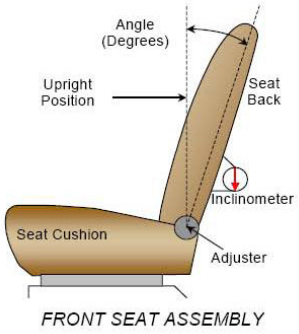
DATA SHEET NO. 4

SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

NORMAL DESIGN RIDING POSITION

The driver seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Seat back angle is measured at the headrest post with the inclinometer zeroed at the door sill. Set seat back at 12.5 degrees.



FRONT SEAT ASSEMBLY

SEAT BACK ANGLE

	Degrees	Detents
Driver without Seated Dummy	12.5° at headrest post	

SEAT FORE/AFT POSITION

The method used for determining seat fore/aft position is as follows: For seat track adjustments, set in mid track position.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Front Seat	240 mm	120 mm (forward-most as 0)

SEAT BELT UPPER ANCHORAGE;

The method of positioning the seat belt upper anchorage is as follows: Detents to the nominal design position are measured with respect to the uppermost detent. Place at 0 detent for the 50th percentile male.

SEAT BELT UPPER ANCHORAGE

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

HEADREST RESTRAINT

The headrest was placed in the uppermost position.

DATA SHEET NO. 5

FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

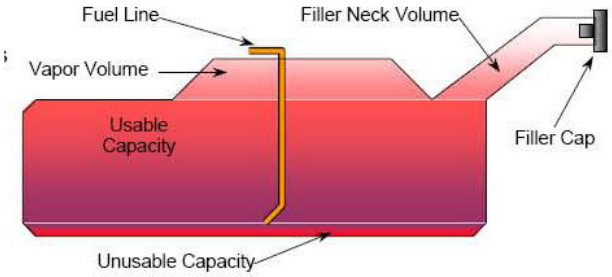
Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	78.7
Usable Capacity (Owner's Manual)	79.5
92-94% of Usable Capacity	72.4 to 74.0
Actual Amount of Solvent Used	73.2

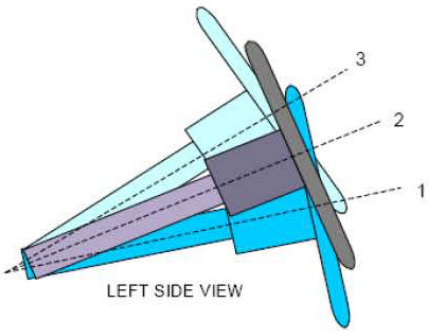
FUEL PUMP

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. After the ignition key is turned from LOCK (0) to ON (II), the pump will be filled up for two seconds, and then the pressure is maintained. The fuel pipe is on the left side.



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves 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

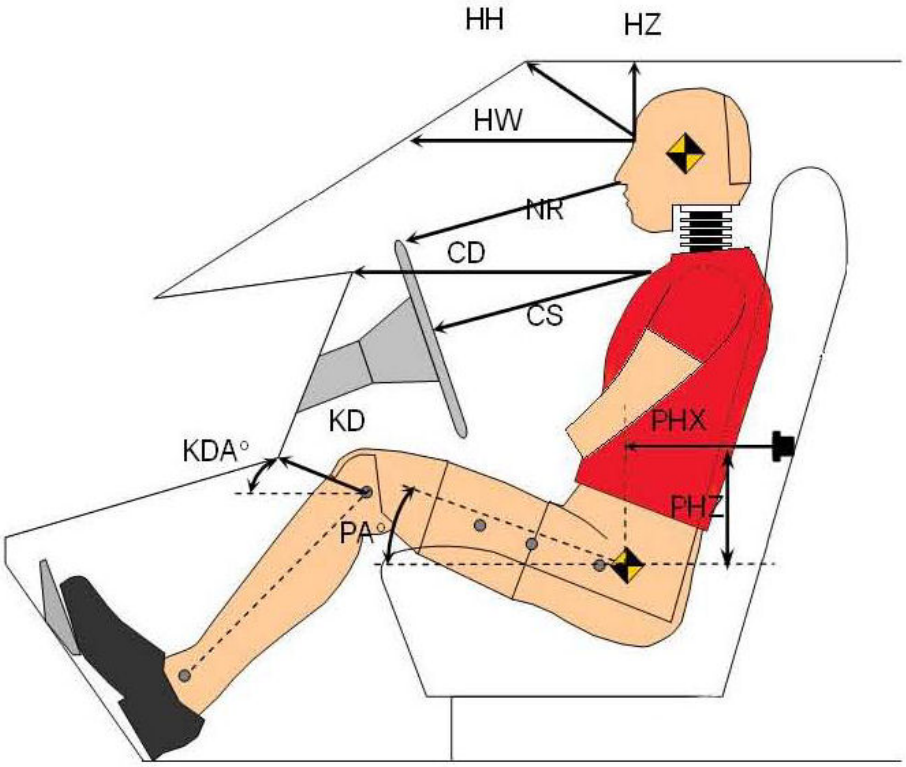
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	72.0	224
Geometric Center – Position 2	69.5	207
Uppermost – Position 3	67.0	190
Telescoping Steering Wheel Travel		34
Test Position	69.5	207

.DATA SHEET NO. 6

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Acura ZDX SUV
Test Program: FMVSS 214 Pole
NHTSA No. CB5303
Test Date: 3/25/2011

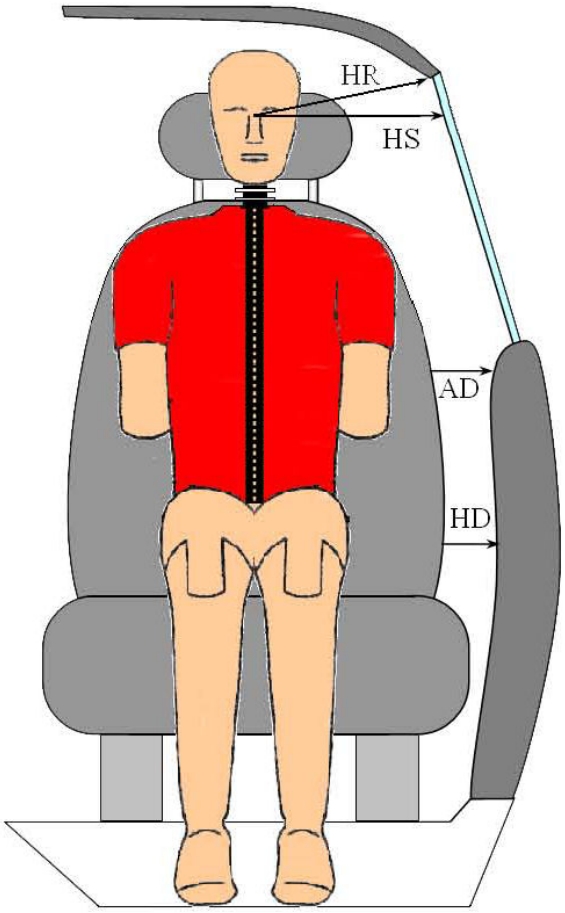


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	397	
HW	Head to Windshield	660	
HZ	Head to Roof	159	
NR	Nose to Rim	446	
CD	Chest to Dash	557	
CS	Chest to Steering Wheel	355	
KDL	Left Knee to Dash	136	29.2
KDR	Right Knee to Dash	124	27.1
PA	Pelvic Angle		
PHX	H-Point to Striker (X-Axis)	269	
PHZ	H-Point to Striker (Z-Axis)	138	

DATA SHEET NO. 7

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

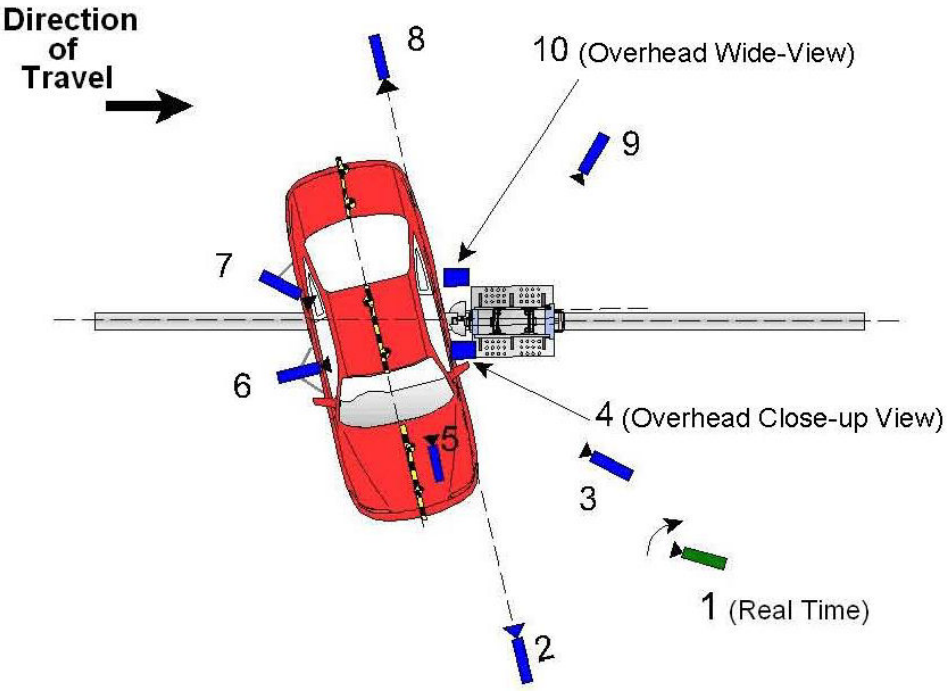


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	184
HS	Head to Side Window	mm	333
AD	Arm to Door	mm	105
HD	H-Point to Door	mm	160

DATA SHEET NO. 8

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011



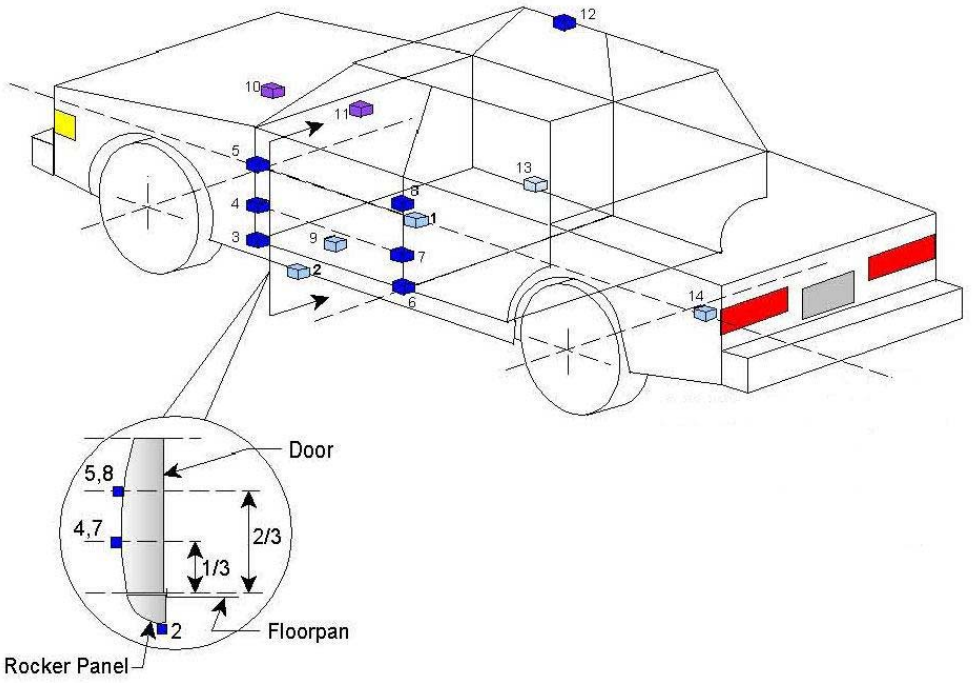
Reference: From Point of Impact for X and Y; from Ground for Z):
+X = Right of Impact, + Y = Forward of Impact, +Z = Up

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5920	40	1700	24	1000
3	Impact Side 45° Forward	4580	2120	1870	20	1000
4	Overhead Closeup	0	40	4520	50	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-5790	50	1730	24	1000
9	Impact Side 45° Rearward	-3940	3860	1850	20	1000
10	Overhead Wide	120	-270	4610	14	1000

DATA SHEET NO. 9

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2556	-110	-370
2	Left Floor Sill	2698	-785	-340
3	A Pillar Sill	3051	-785	-340
4	A Pillar Low	3128	-795	-661
5	A Pillar Mid	3186	-870	-899
6	B Pillar Sill	1976	-785	-345
7	B Pillar Low	2037	-770	-696
8	B Pillar Mid	2037	-750	-918
9	Seat	2327	-600	-453
10	Engine	3956	0	-944
11	Firewall	3771	0	-1048
12	Roof	2122	620	-1585
13	Floor Sill	2072	785	-350
14	Rear Deck	290	0	-632

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

DATA SHEET NO. 10

TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	1.3	130.1	-20.5	64.2
	Vehicle CG (Y)	32.0	49.0	-0.9	96.4
	Vehicle CG (Z)	26.1	60.0	-19.8	66.1
	Resultant	39.7	48.2		
2	Left Floor Sill (Y)	37.9	17.6	-9.2	48.4
3	A Pillar Sill (Y)	(1)	(1)	(1)	(1)
4	A Pillar Low (Y)	(2)	(2)	(2)	(2)
5	A Pillar Mid (Y)	(3)	(3)	(3)	(3)
6	B Pillar Sill (Y)	22.0	53.5	-1.4	232.4
7	B Pillar Low (Y)	52.9	27.7	-10.5	38.8
8	B Pillar Mid (Y)	86.4	27.2	-15.4	34.1
9	Seat (Y)	37.7	28.6	-7.6	83.6
10	Engine (X)	11.1	103.8	-13.7	64.1
	Engine (Y)	16.6	60.6	-1.1	196.6
11	Firewall (Y)	15.0	50.8	-1.0	4.3
12	Roof (Y)	17.7	41.3	-9.1	65.1
13	Floor Sill (Y)	18.0	51.2	-1.1	233.5
14	Rear Deck (X)	3.0	133.4	-5.4	91.6
	Rear Deck (Y)	18.4	53.8	-1.2	195.6

(1) No valid data collected for A Pillar Sill Y
(2) No valid data collected for A Pillar Low Y after 25 msec.
(3) No valid data collected for A Pillar Mid Y after 25 msec.

DATA SHEET NO. 11

DUMMY INJURY RESPONSE DATA

Test Vehicle: 2011 Acura ZDX SUV
Test Program: FMVSS 214 Pole

NHTSA No. CB5303
Test Date: 3/25/2011

Dummy S/N	Positive		Negative	
	MAX	**TIME (ms)**	**MAX**	**TIME (ms)**
HEAD ACCELERATION (G)				
Longitudinal (X)	3.9	36.8	29.8	63.9
Lateral (Y)	52.1	63.2	15.9	118.4
Vertical (Z)	18.2	59.0	0.7	76.8
Resultant (R)	60.6	63.5		
HIC36 (t1, t2)	387		t1 = 49.0	t2 = 75.1
THORAX DEFLECTION (mm)				
Upper Rib			33.0	56.3
Middle Rib			30.2	56.0
Lower Rib			32.7	56.0
ABDOMINAL FORCES (N)				
Front	417.3	49.8		
Middle	557.4	49.6		
Rear	709.3	49.9		
Sum	1655.4	49.8		
PELVIS FORCE (N)				
Pubic Symphysis			2224.1	62.7

Reference: Positive Direction -Longitudinal (X) = forward
-Lateral (Y) = to right
-Vertical (Z) = down

DATA SHEET NO. 12

POST TEST OBSERVATIONS

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Front Occupant
Dummy Type / Serial No.	ES-2re / 016
Head Contact	Curtain Airbag, Headrest
Upper Torso Contact	Side Airbag
Lower Torso Contact	Side Airbag
Left Knee Contact	Door Panel
Right Knee Contact	Left Knee

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Left Side Doors	Remained closed and jammed shut	Remained closed and jammed shut
Right Side Doors	Remained closed and operational	Remained closed and operational
Hatch and Other Doors	Remained closed and operational	Remained closed and operational
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	Cracked
Window Damage	Left Front Window and Sunroof Broke
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

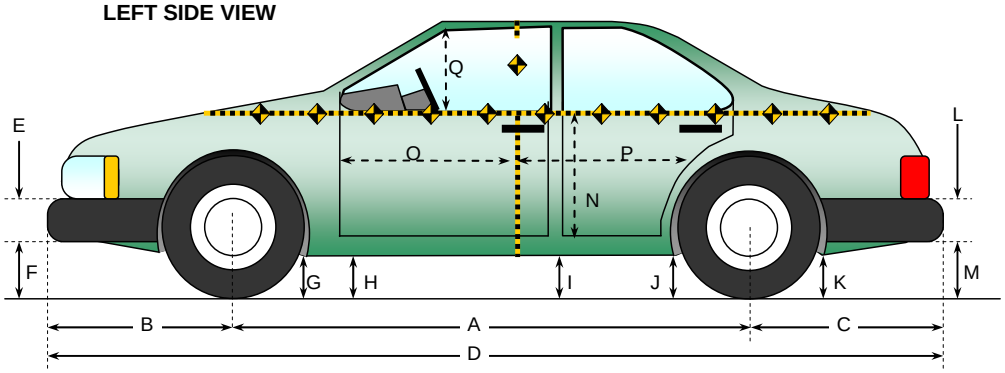
Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso/Pelvis Airbag	Yes	Yes
Head Airbag	No	
Curtain Airbag	Yes	Yes
Knee Airbag	No	
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	

DATA SHEET NO. 13

VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

LEFT SIDE VIEW

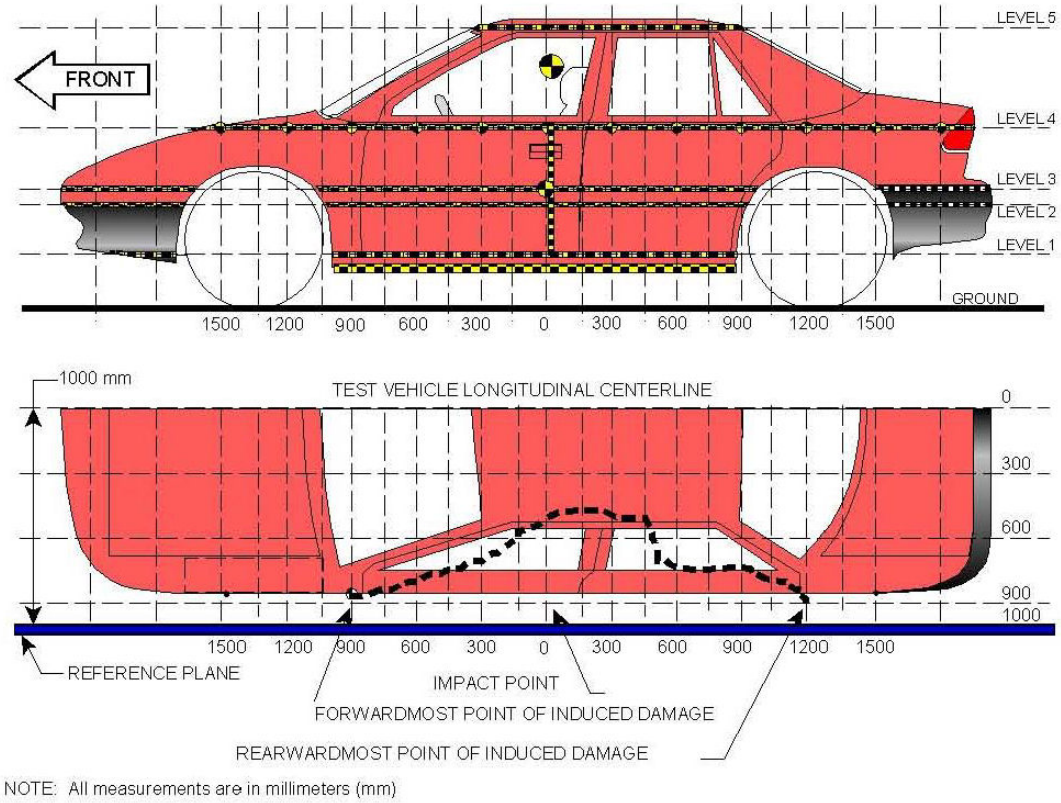


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2750	2670	80
B	Front Axle to FSOV	1110	1100	10
C	Rear Axle to RSOV	1145	1145	0
D	Total Vehicle Length at Centerline	5005	4915	90
E	Front Bumper Thickness	90	90	0
F	Front Bumper Bottom to Ground	263	282	-19
G	Sill Height at Front Wheel Well	247	253	-6
H	Sill Height at Front Door Leading Edge	251	240	11
I	Sill Height at B Pillar	257	285	-28
J1	Sill Height at Rear Wheel Well	252	285	-33
J2	Pinch Weld Height at Rear Wheel Well	261	288	-27
K	Sill Height Aft of Rear Wheel Well	303	307	-4
L	Rear Bumper Thickness	100	100	0
M	Rear Bumper Bottom to Ground	392	381	11
N	Sill Height to Window Bottom Sill	835	835	0
O	Front Door Leading Edge to Impact CL	773	790	-17
P	Rear Door Trailing Edge to Impact CL	1120	1100	20
Q	Front Window Opening	432	375	57
R	Right Side Length	3362	3370	-8
S	Left Side Length	3362	3275	87
T	Vehicle Width at B Post	1980	1828	152

DATA SHEET NO. 14

EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011



NOTE: All measurements are in millimeters (mm)

Maximum Exterior Crush Measurements

Level	Measurement Description	Maximum Exterior Static Crush	Distance from Impact	Height Above Ground (mm)
1	Sill Top	332	0	335
2	Occupant H-Point	394	0	694
3	Mid-Door	396	75	746
4	Window Sill	314	0	1115
5	Window Top	158	0	1550

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

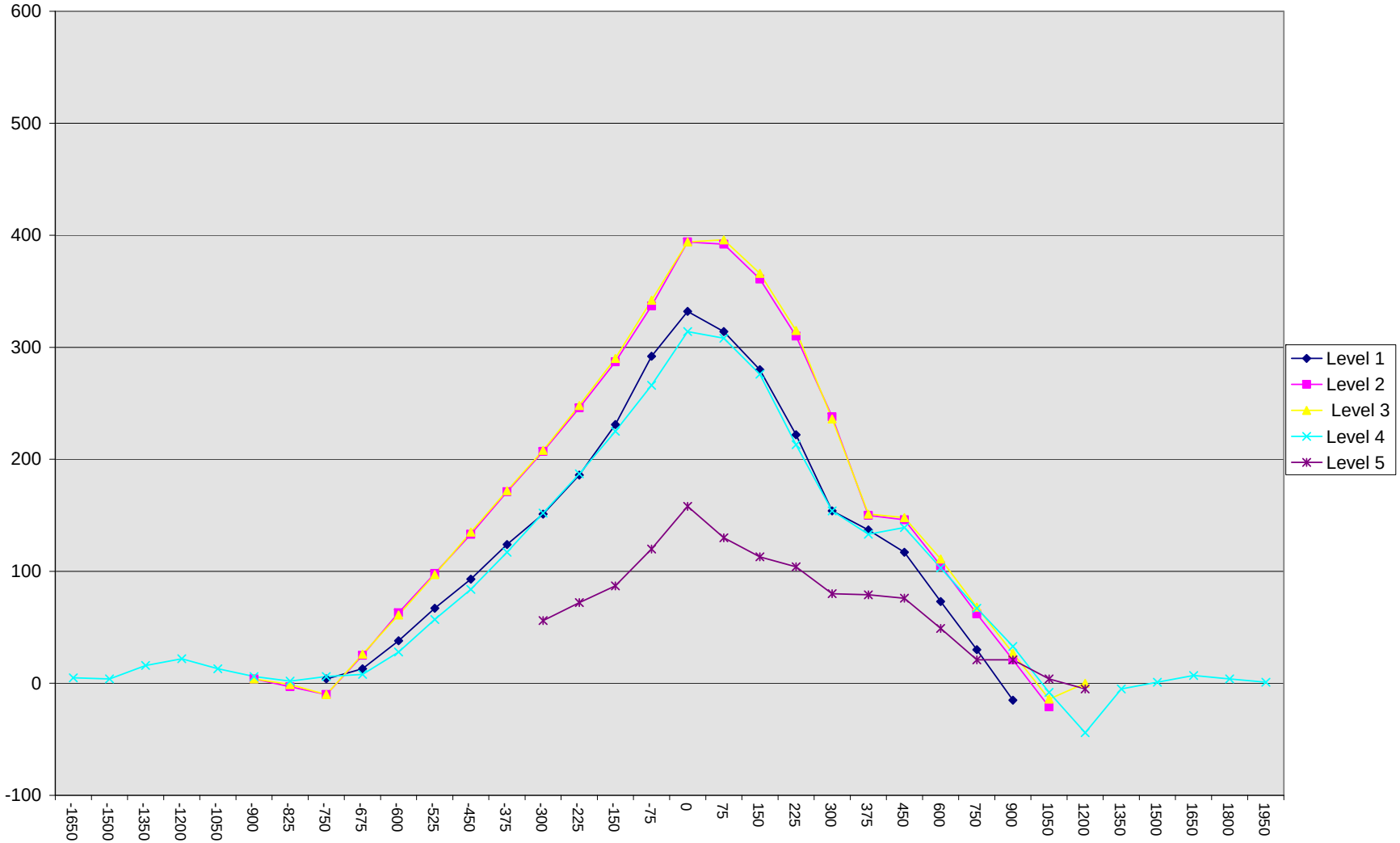
	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	332	394	396	314	158
Distance From Impact (mm)	0	0	75	0	0

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1650				270					275					5	
-1500				255					259					4	
-1350				240					256					16	
-1200				235					257					22	
-1050				230					243					13	
-900		102	102	226			106	106	232			4	4	6	
-825		109	111	226			106	110	228			-3	-1	2	
-750	145	116	117	222		149	106	107	228		4	-10	-10	6	
-675	160	118	119	222		173	143	145	230		13	25	26	8	
-600	160	118	119	222		198	181	180	250		38	63	61	28	
-525	158	119	119	219		225	217	216	276		67	98	97	57	
-450	159	119	117	219		252	252	252	303		93	133	135	84	
-375	158	118	117	217		282	289	289	334		124	171	172	117	
-300	159	117	116	214	440	310	324	324	366	496	151	207	208	152	56
-225	158	116	116	213	430	344	362	364	400	502	186	246	248	187	72
-150	158	116	116	212	425	389	403	406	437	512	231	287	290	225	87
-75	158	116	115	213	425	450	453	457	479	545	292	337	342	266	120
0	158	116	115	214	425	490	510	509	528	583	332	394	394	314	158
75	157	116	115	213	426	471	508	511	521	556	314	392	396	308	130
150	158	117	116	214	430	438	478	482	490	543	280	361	366	276	113
225	156	117	116	215	431	378	427	431	428	535	222	310	315	213	104
300	156	118	116	214	435	310	356	352	368	515	154	238	236	154	80
375	156	119	117	213	439	293	269	268	346	518	137	150	151	133	79
450	156	120	119	214	444	273	266	267	353	520	117	146	148	139	76
600	159	123	122	217	455	232	228	233	320	504	73	105	111	103	49
750	161	126	126	217	475	191	188	194	284	496	30	62	68	67	21
900	159	125	126	220	483	144	146	153	253	504	-15	21	27	33	21
1050		110	114	222	509		89	100	214	513		-21	-14	-8	4
1200			102	220	530			102	176	525			0	-44	-5
1350				213					208					-5	
1500				215					216					1	
1650				229					236					7	
1800				245					249					4	
1950				270					271					1	

DATA SHEET NO. 15 (CONTINUED)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011



DATA SHEET NO. 16

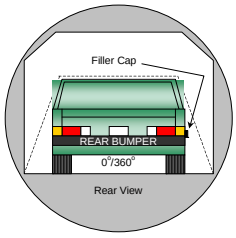
SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

Test Vehicle: 2011 Acura ZDX SUV
Test Program: FMVSS 214 Pole
NHTSA No. CB5303
Test Date: 3/25/2011

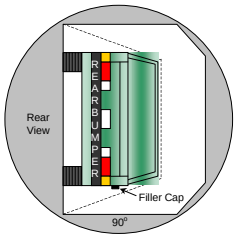
FUEL SYSTEM INTEGRITY POST IMPACT DATA

Time Interval	FMVSS 301 Maximum Allowable Spillage	Spillage (g)
Impact Until Motion Ceases	28 g	0
First Five Minutes Following Impact	142 g	0
Next 25 Minutes	28 g / 1 minute	0

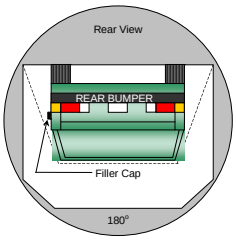
STATIC ROLLOVER DATA



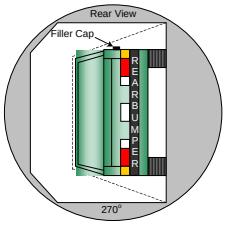
0/360



90



180



270

REAR VIEW

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	minutes	58	seconds	5	minutes	6	minutes	58	seconds	7	minutes
90° - 180°	1	minutes	56	seconds	5	minutes	6	minutes	56	seconds	7	minutes
180° - 270°	1	minutes	57	seconds	5	minutes	6	minutes	57	seconds	7	minutes
270° - 360°	1	minutes	57	seconds	5	minutes	6	minutes	57	seconds	7	minutes

Rollover Stage	Spillage (g)			
	First 5 min. from onset of rotation	6th min.	7th min.	8th min. (if required)
0° - 90°	0	0	0	
90° - 180°	0	0	0	
180° - 270°	0	0	0	
270° - 360°	0	0	0	
FMVSS 301 Maximum Allowable (for each 90° stage)	142	28	28	28

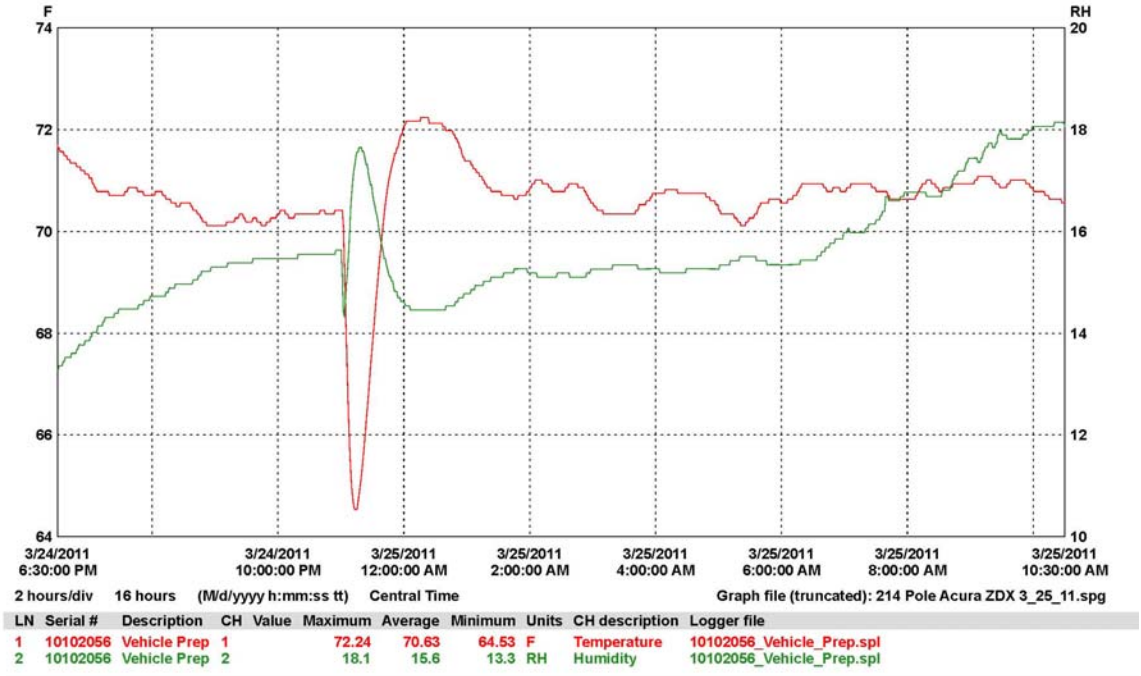
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17

TEMPERATURE AND HUMIDITY TRACES

Test Vehicle: 2011 Acura ZDX SUV NHTSA No. CB5303
Test Program: FMVSS 214 Pole Test Date: 3/25/2011

Time of Impact: 10:20 am



APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Pre-Test Frontal View of Test Vehicle

Post-Test Frontal View of Test Vehicle

Pre-Test Rear View of Test Vehicle

Post-Test Rear View of Test Vehicle

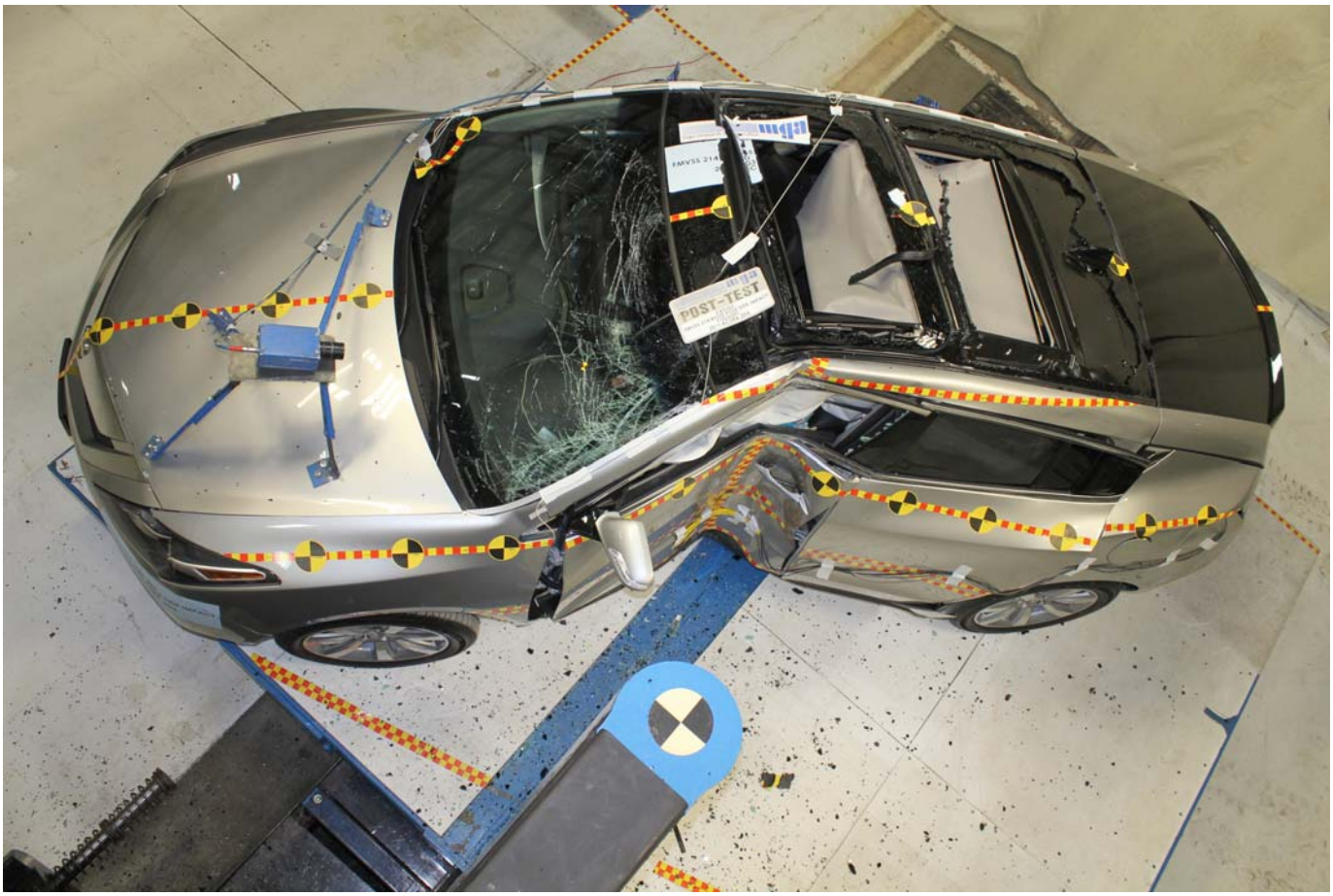
Pre-Test Impacted Side View of Test Vehicle

Post-Test Impacted Side View of Test Vehicle

Pre-Test Left ¾ Front View of Vehicle and Pole

Pre-Test Left ¾ Rear View of Vehicle and Pole

Pre-Test Overhead View of Test Vehicle



Post-Test Overhead View of Test Vehicle

Pre-Test Dummy Through Opposite Window

Post-Test Dummy Through Opposite Window

Pre-Test Close-up of Dummy with Door Closed (Impact Side)

Post-Test Dummy with Door Closed (Impact Side)

Pre-Test Dummy Door Open

Pre-Test Dummy Shoulder and Door Top View

Post-Test Dummy Shoulder and Door Top View

PHOTOGRAPH NOT AVAILABLE

Pre-Test Interior of Front Door Closed

Post-Test Interior of Front Door Showing Dummy Impact Locations

Impact Event

Post-Test Impact Zone Close-up View

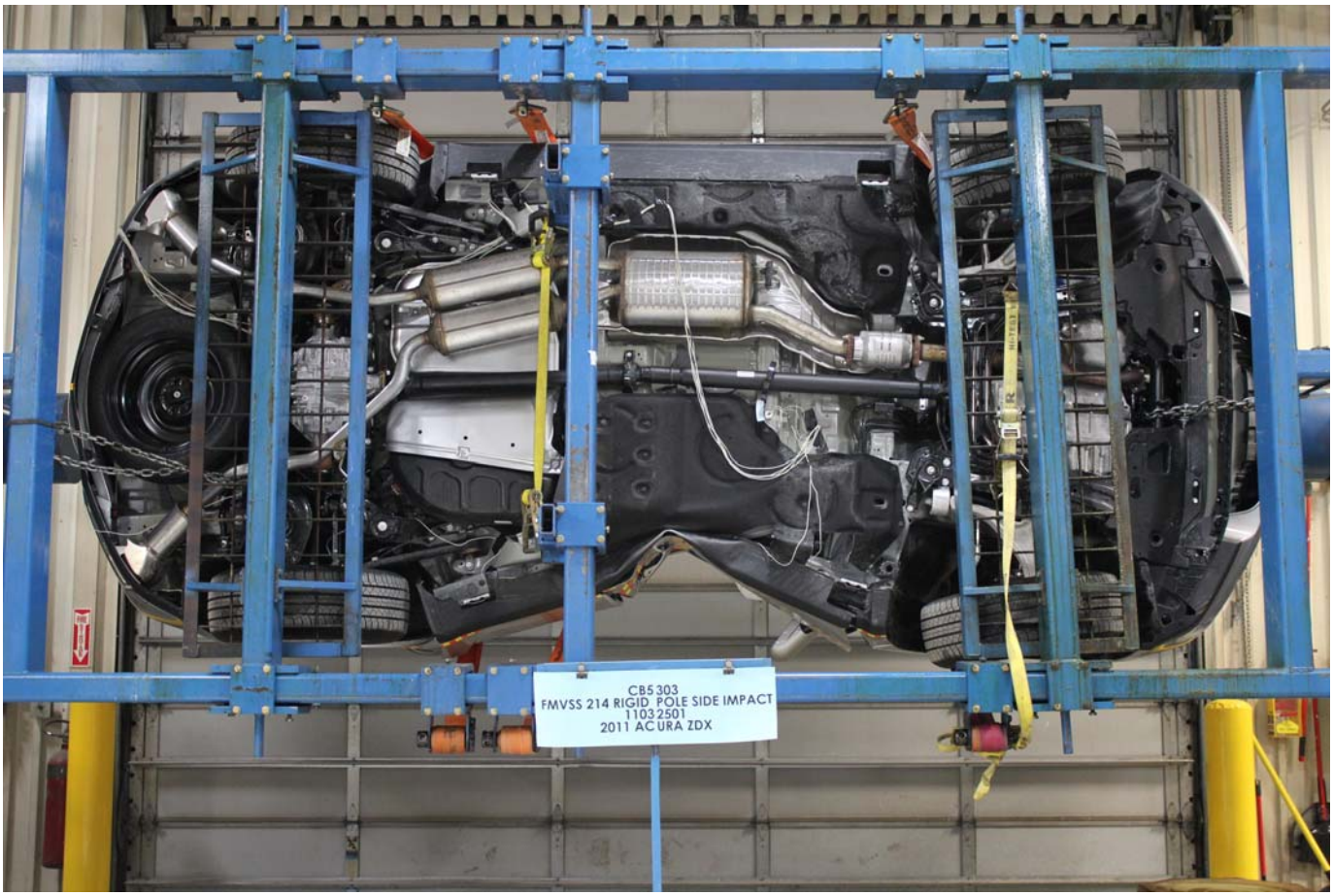
Post-Test ¾ Front View of Impact Zone

Post-Test ¾ Rear View of Impact Zone

Post-Test Close-up View of Impact Point Target

Close-up View of Vehicle's Certification Label

Close-up View of Vehicle's Tire Placard Label



Post-Test Vehicle at 90 Degree Rollover

Post-Test Vehicle at 180 Degree Rollover

Post-Test Vehicle at 270 Degree Rollover

Post-Test Vehicle at 360 Degree Rollover

APPENDIX B

DUMMY RESPONSE DATA

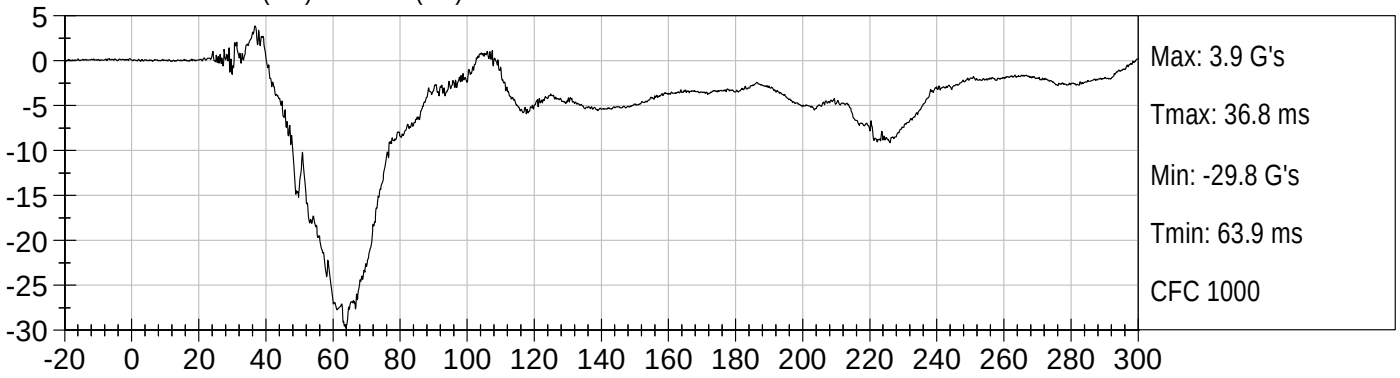
TABLE OF DATA PLOTS

Dummy Instrumentation Plots
FILTERED DATA

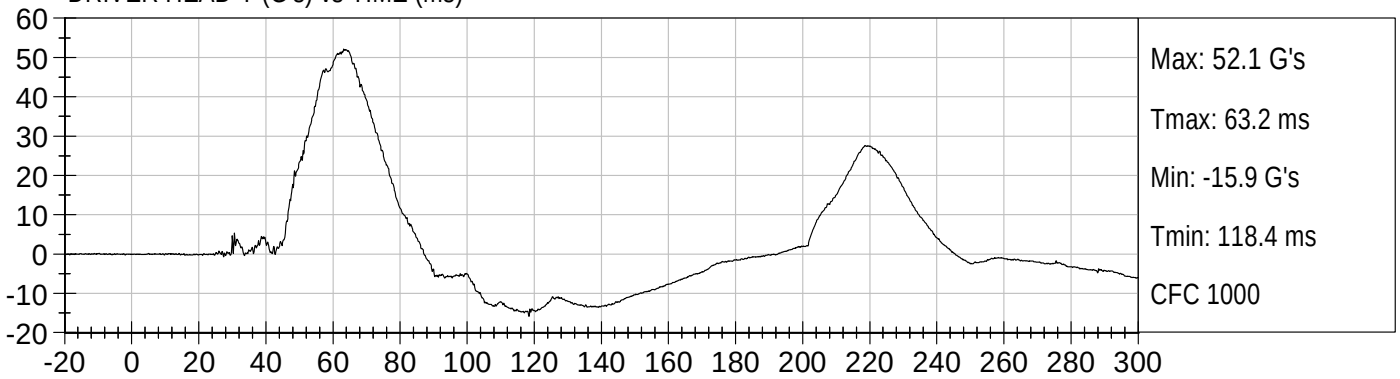
FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)

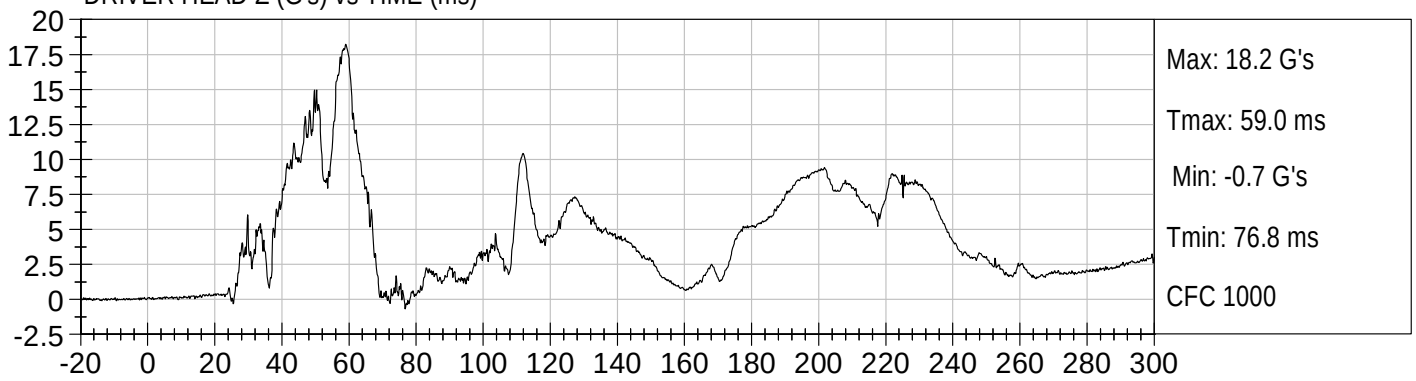
DRIVER HEAD X (G's) vs TIME (ms)



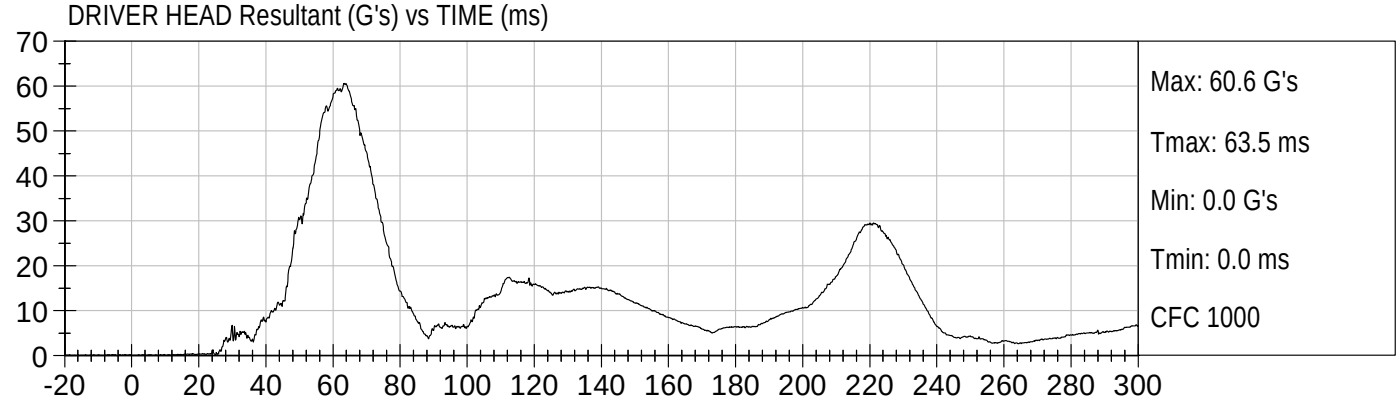
DRIVER HEAD Y (G's) vs TIME (ms)



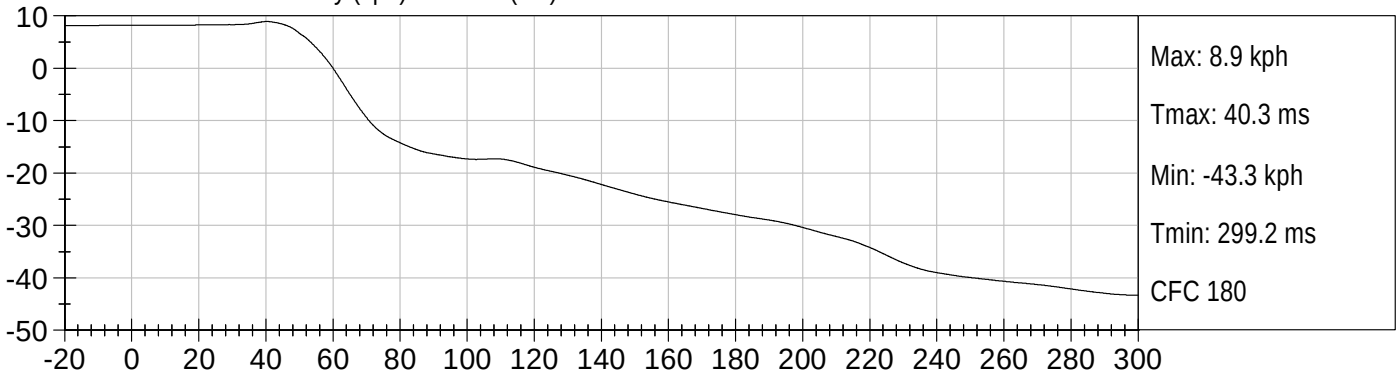
DRIVER HEAD Z (G's) vs TIME (ms)



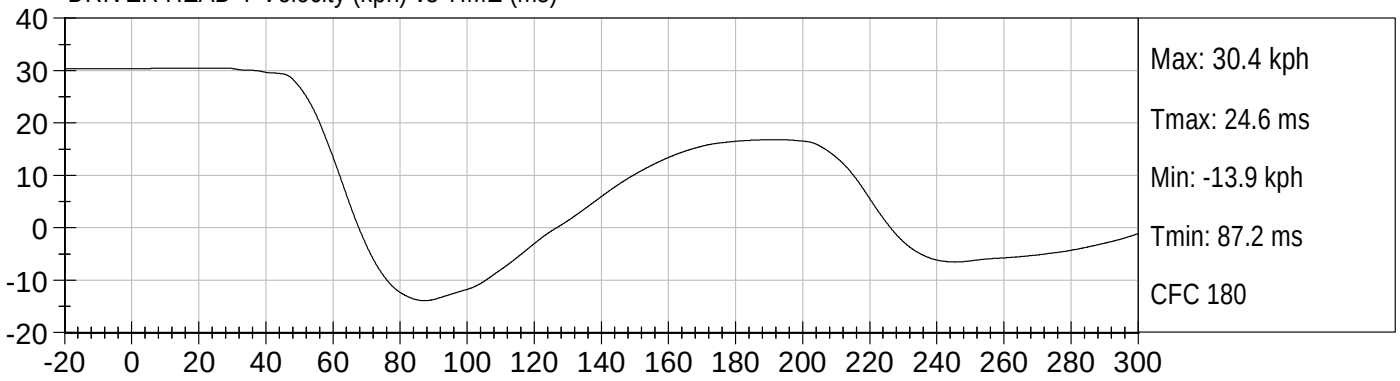
DRIVER HEAD Resultant (G's) vs TIME (ms)



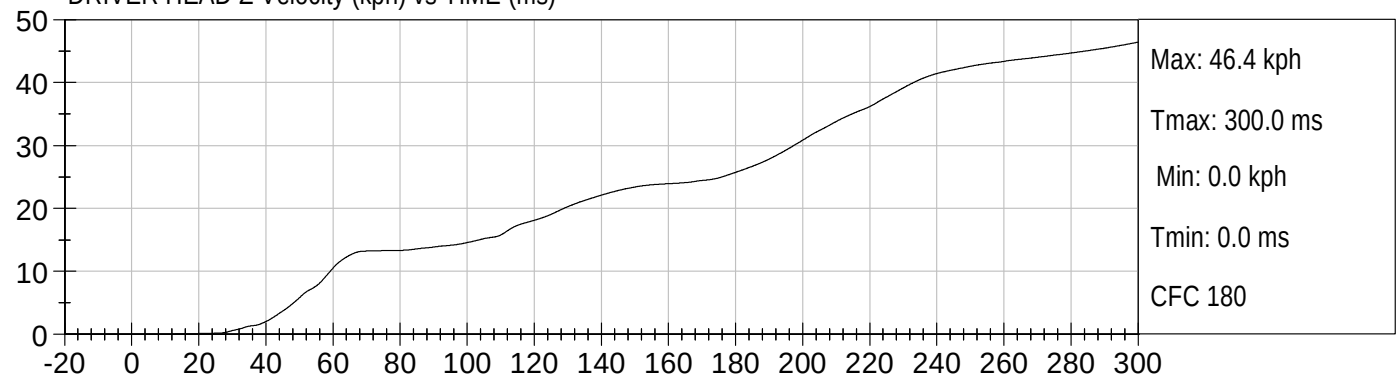
DRIVER HEAD X Velocity (kph) vs TIME (ms)



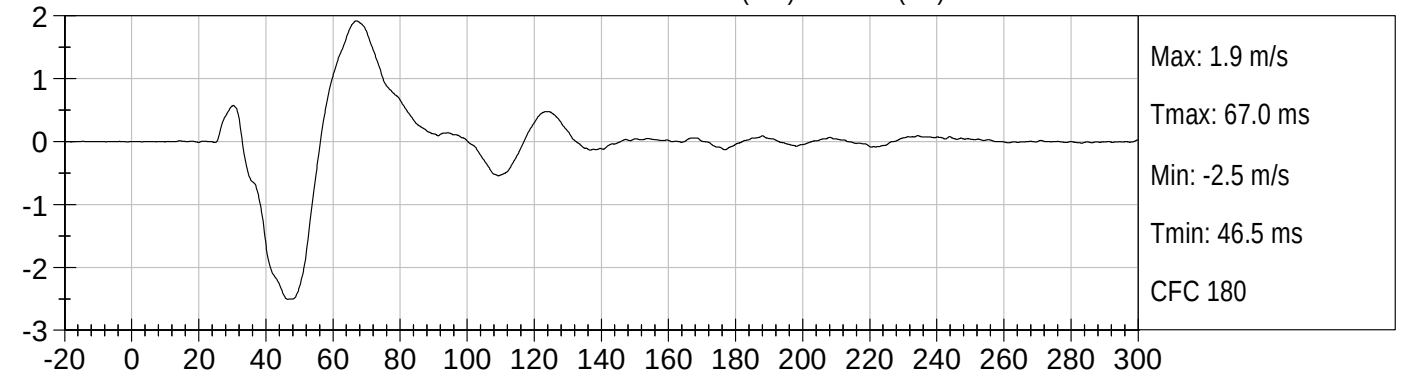
DRIVER HEAD Y Velocity (kph) vs TIME (ms)



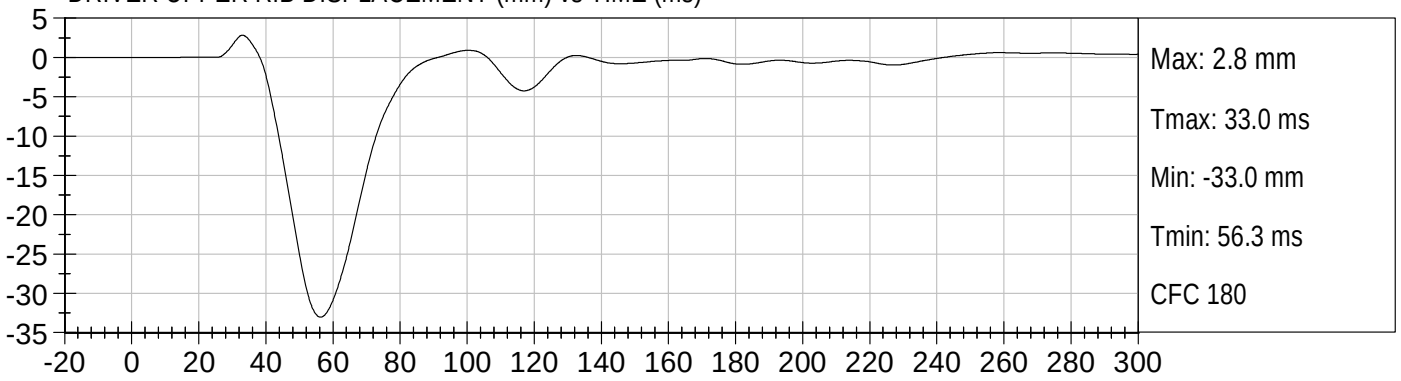
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



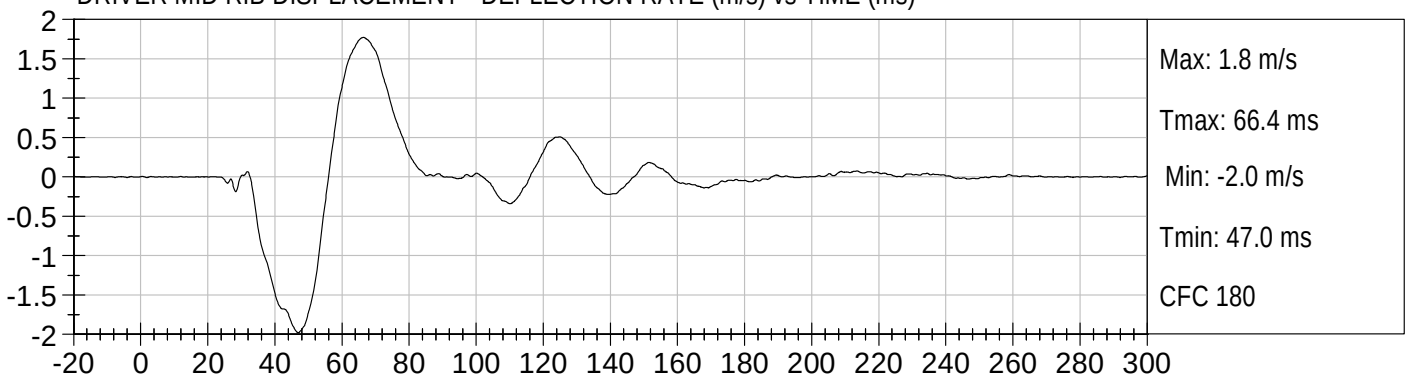
DRIVER UPPER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



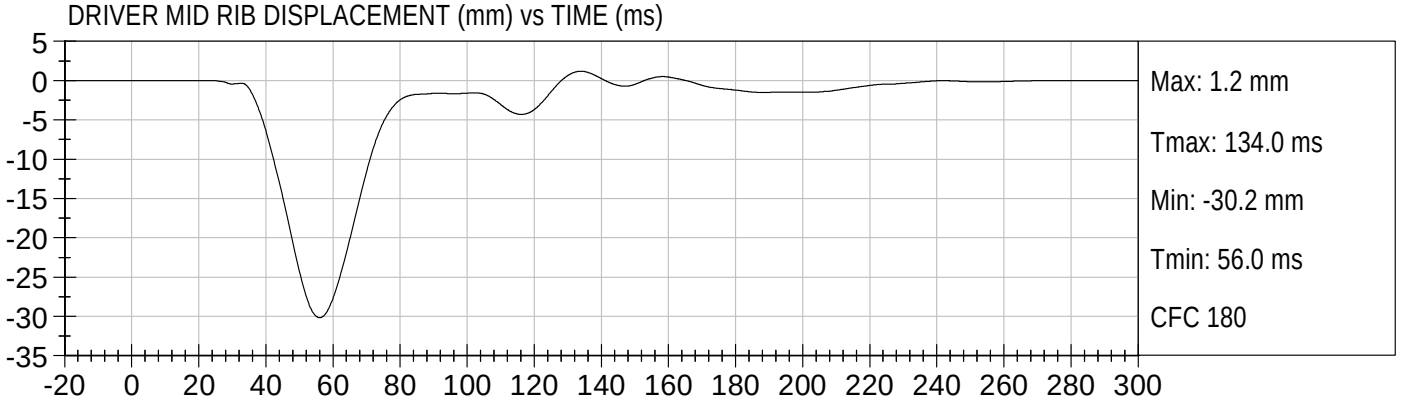
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



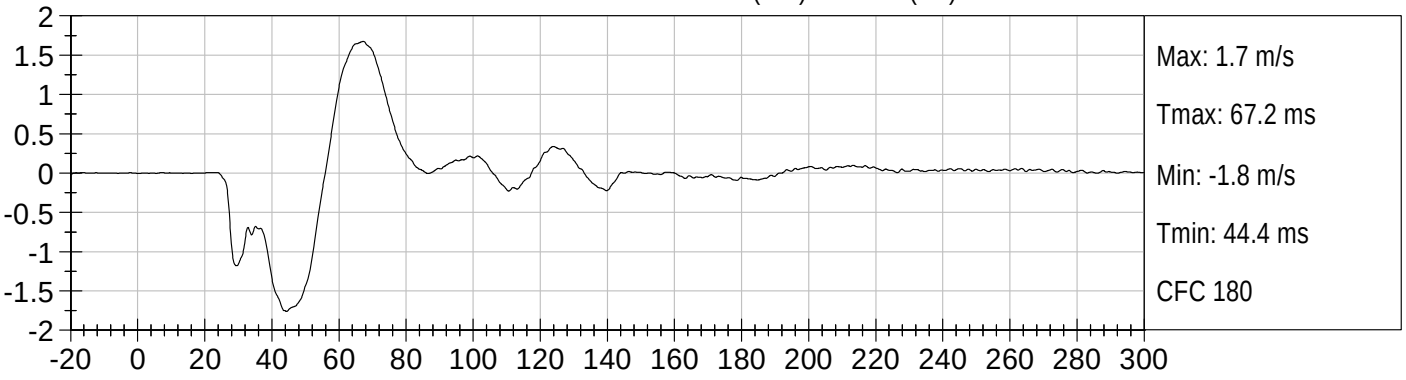
DRIVER MID RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



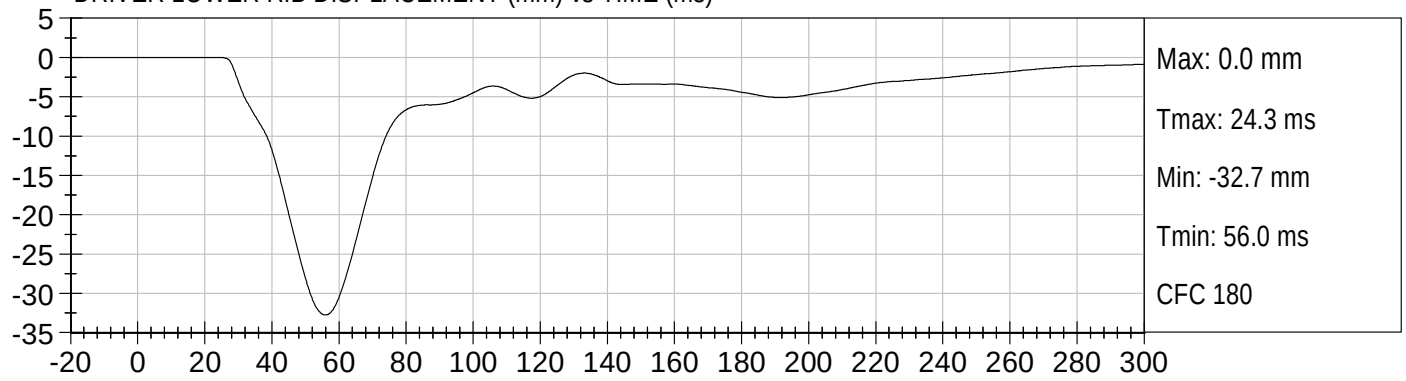
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



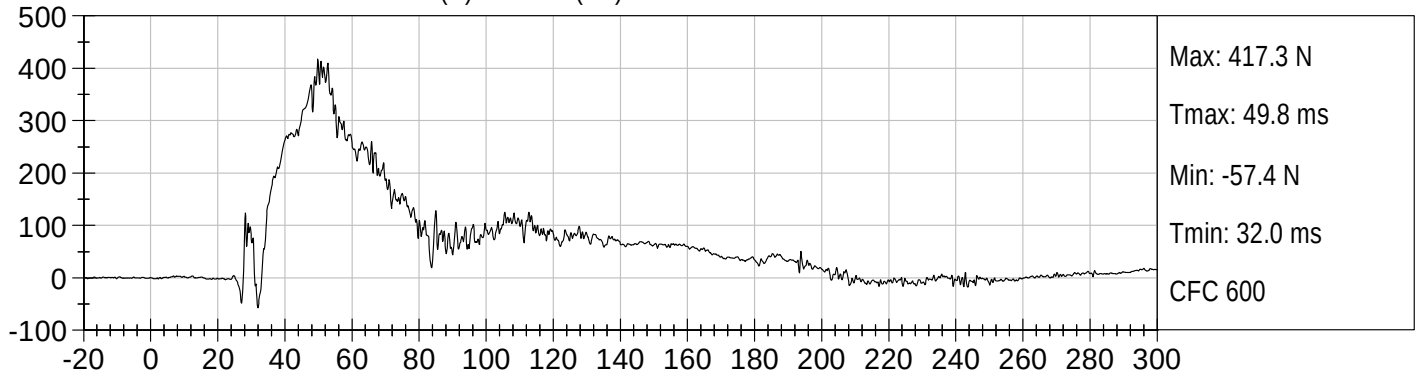
DRIVER LOWER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



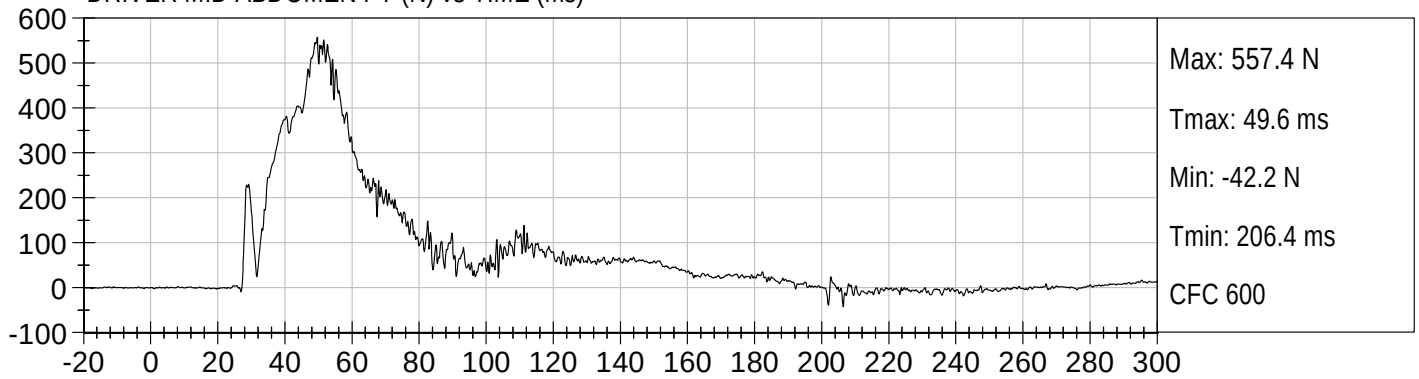
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



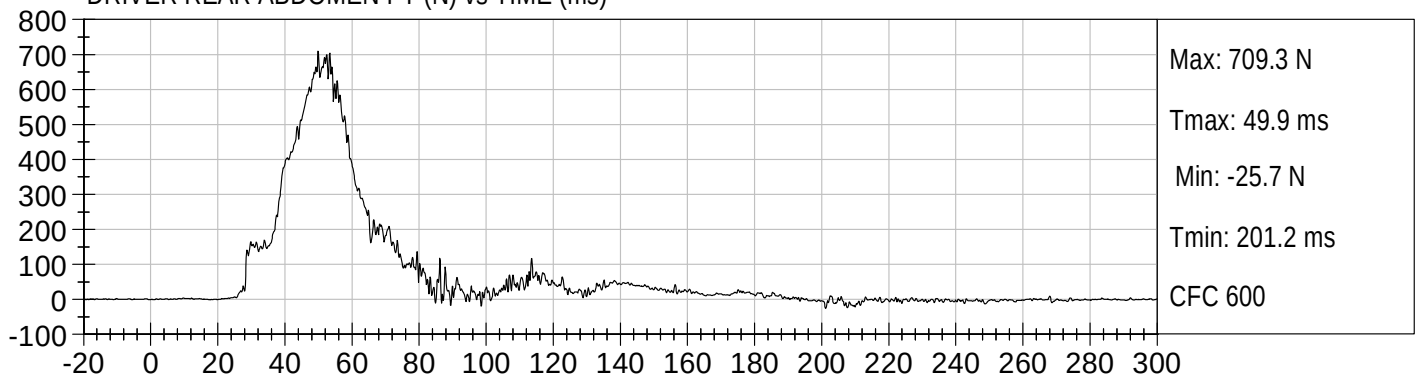
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



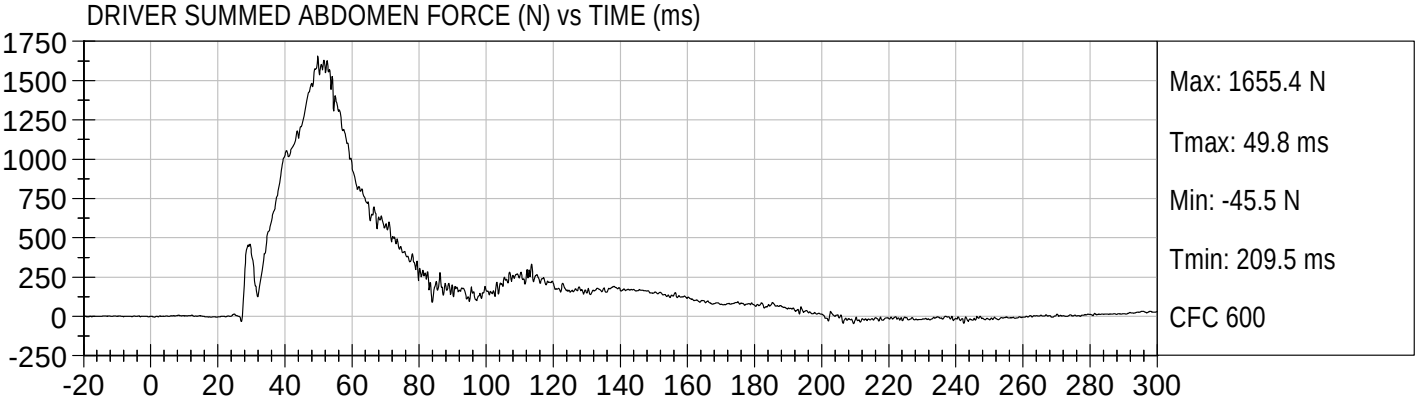
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



DRIVER REAR ABDOMEN FY (N) vs TIME (ms)

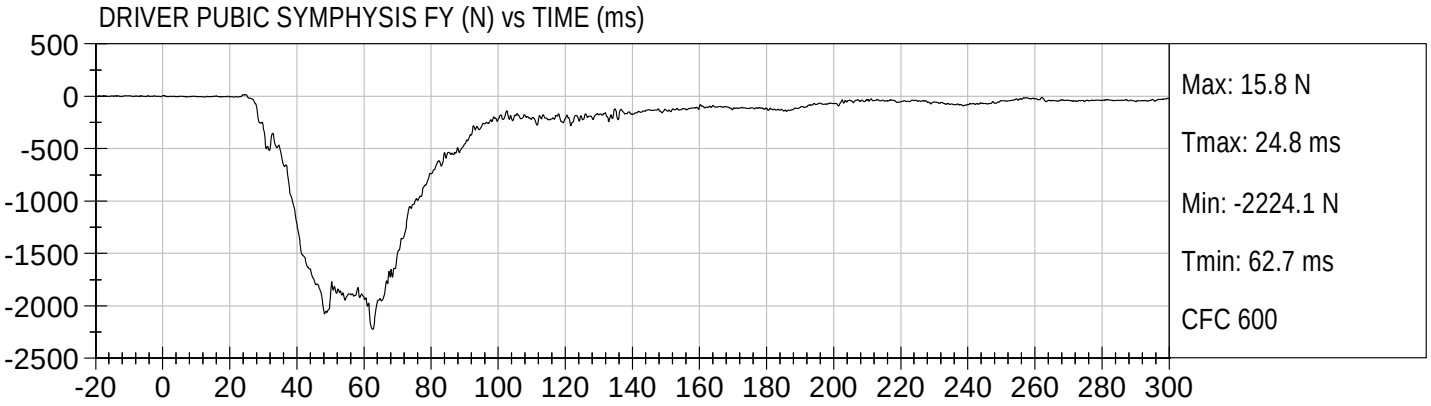


DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)



APPENDIX C

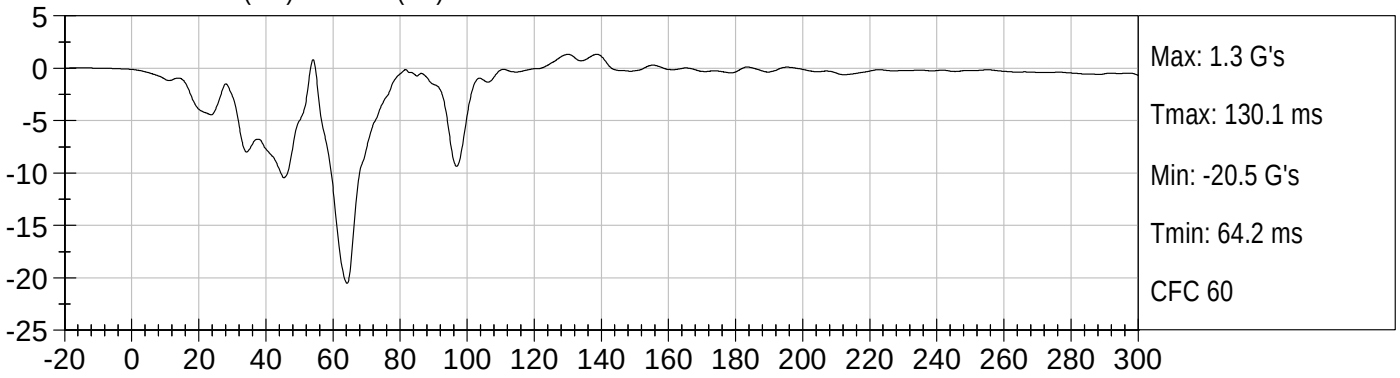
VEHICLE ACCELEROMETER RESPONSE DATA

TABLE OF DATA PLOTS

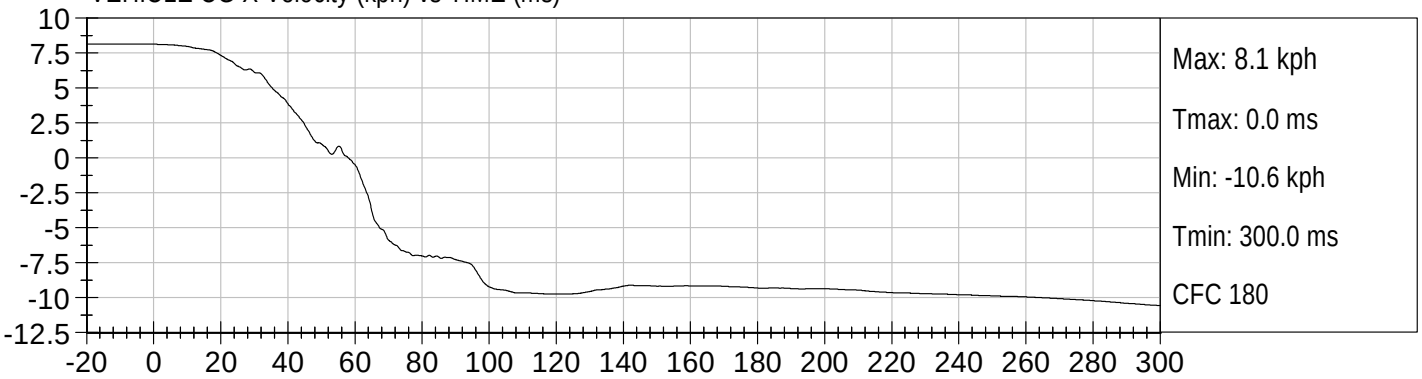
FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)

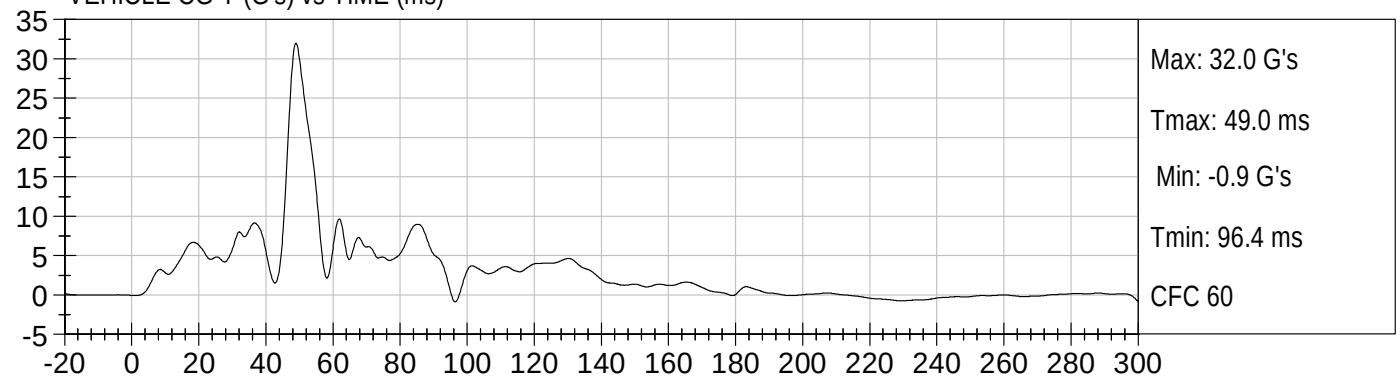
VEHICLE CG X (G's) vs TIME (ms)



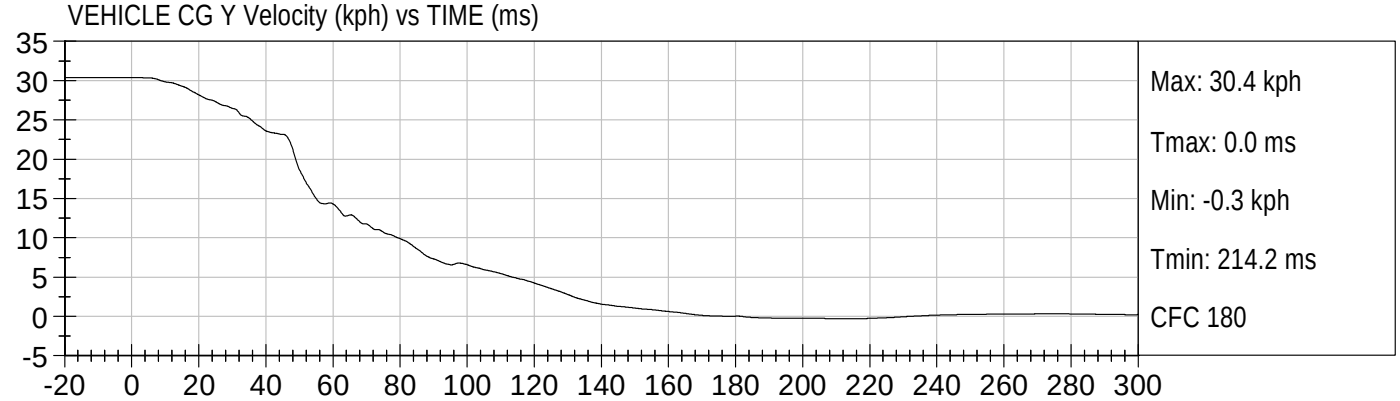
VEHICLE CG X Velocity (kph) vs TIME (ms)



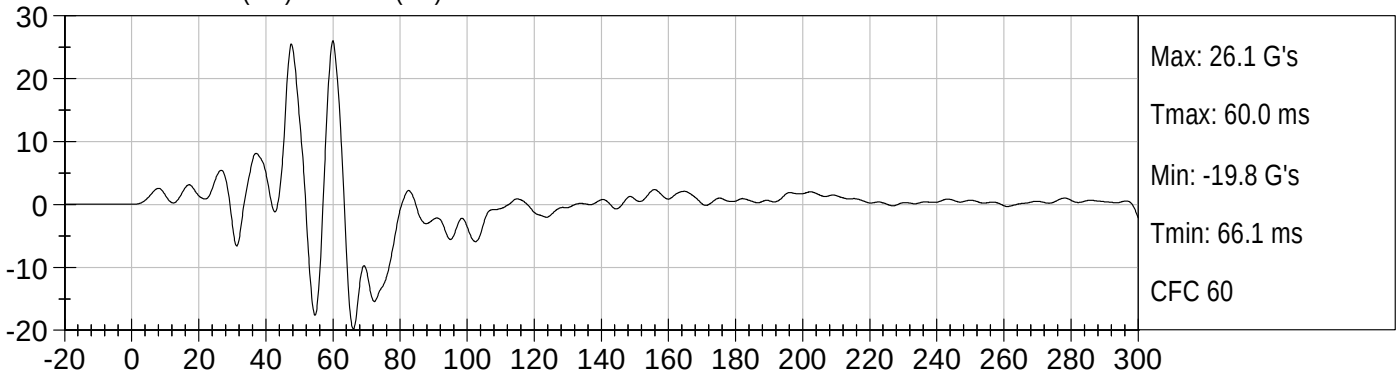
VEHICLE CG Y (G's) vs TIME (ms)



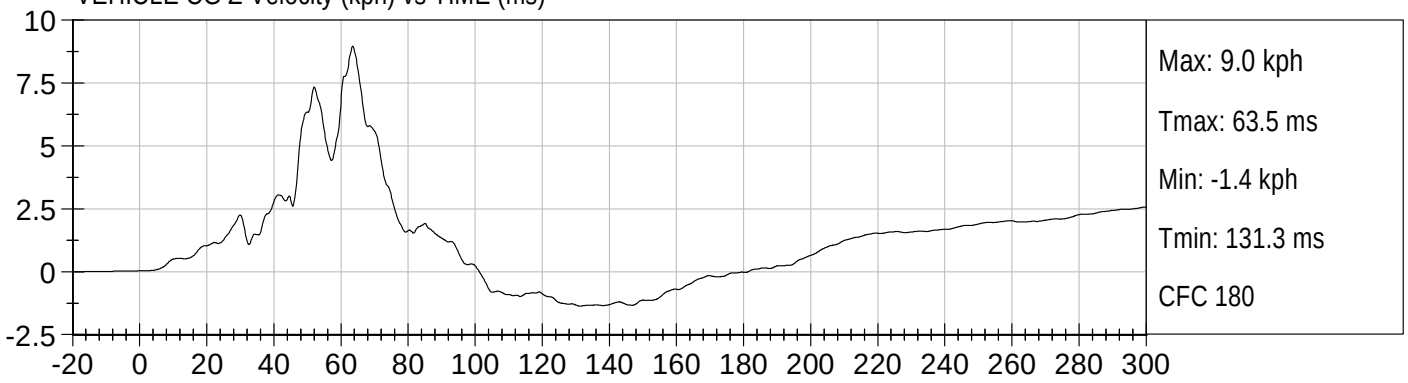
VEHICLE CG Y Velocity (kph) vs TIME (ms)



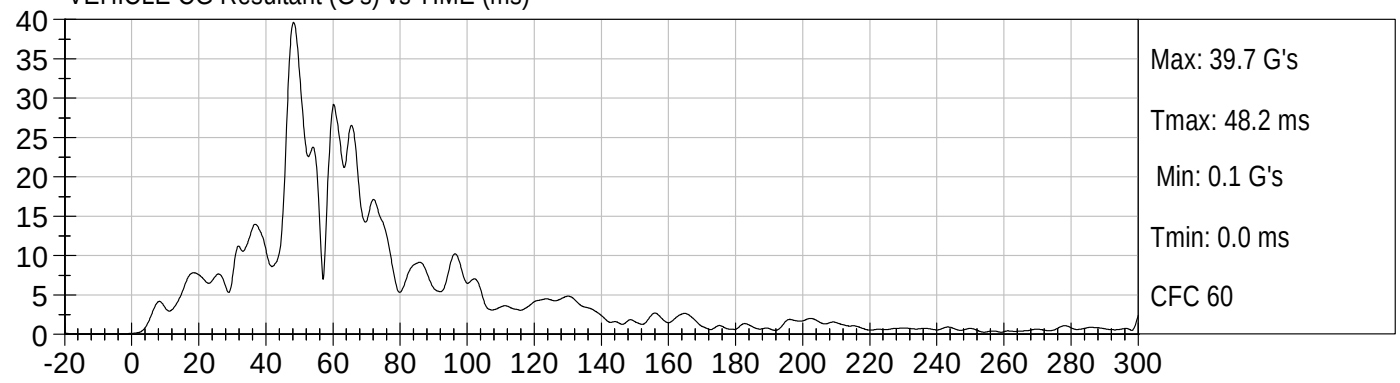
VEHICLE CG Z (G's) vs TIME (ms)



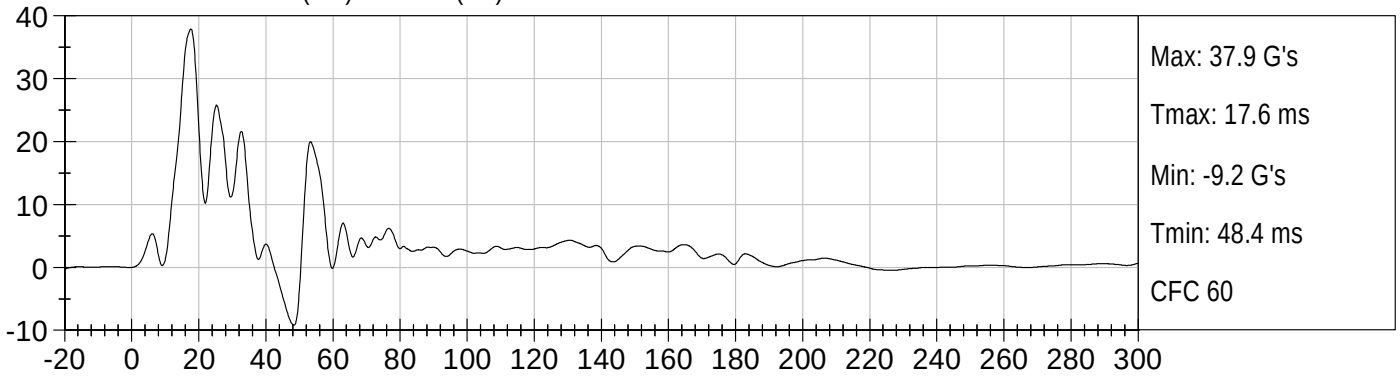
VEHICLE CG Z Velocity (kph) vs TIME (ms)



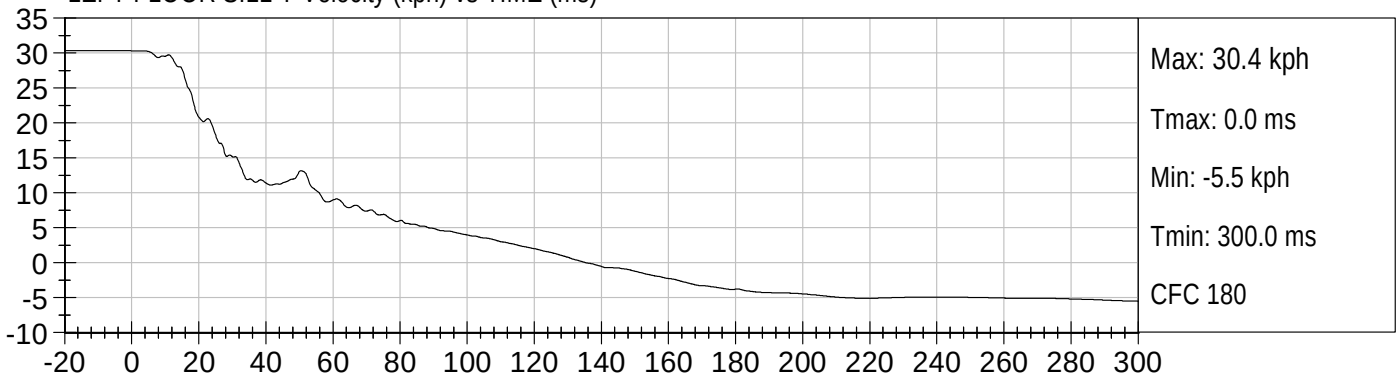
VEHICLE CG Resultant (G's) vs TIME (ms)



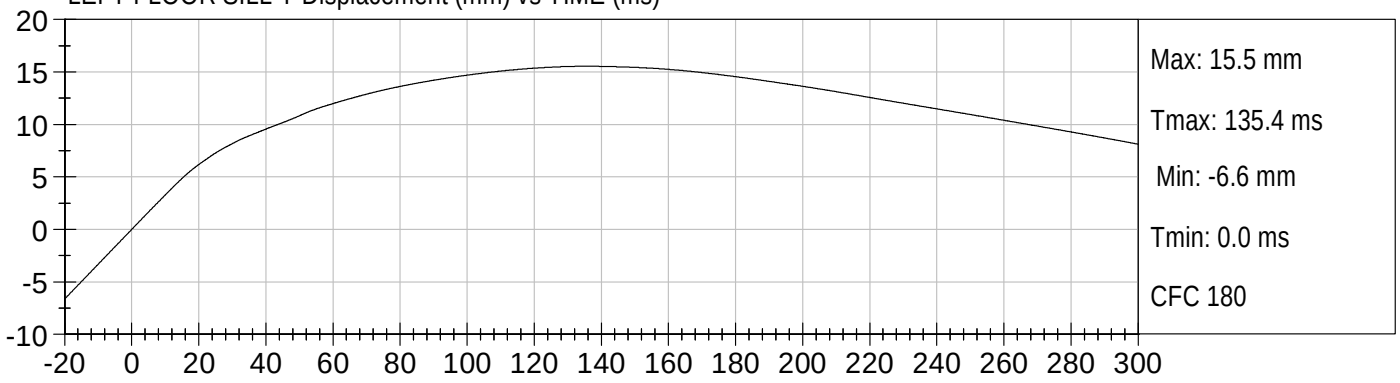
LEFT FLOOR SILL Y (G's) vs TIME (ms)



LEFT FLOOR SILL Y Velocity (kph) vs TIME (ms)



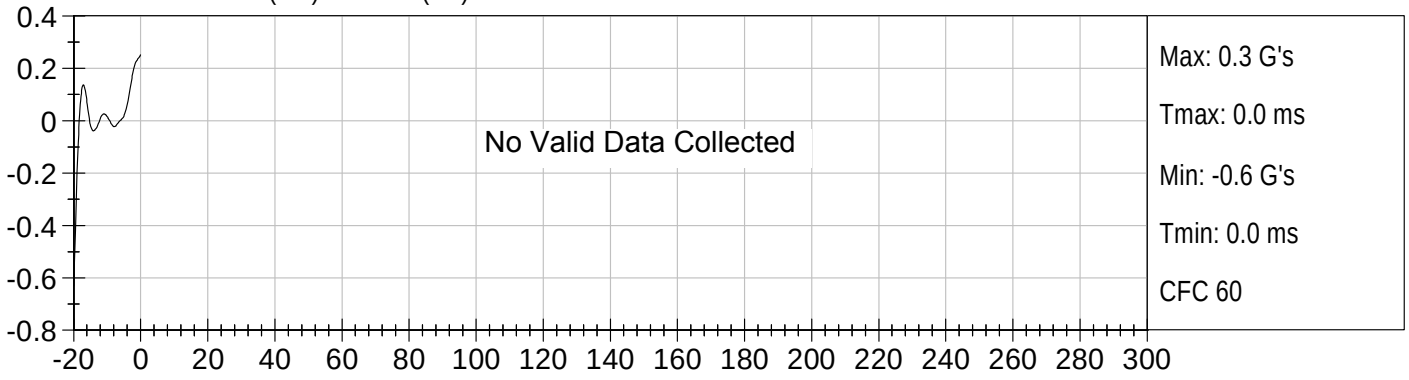
LEFT FLOOR SILL Y Displacement (mm) vs TIME (ms)



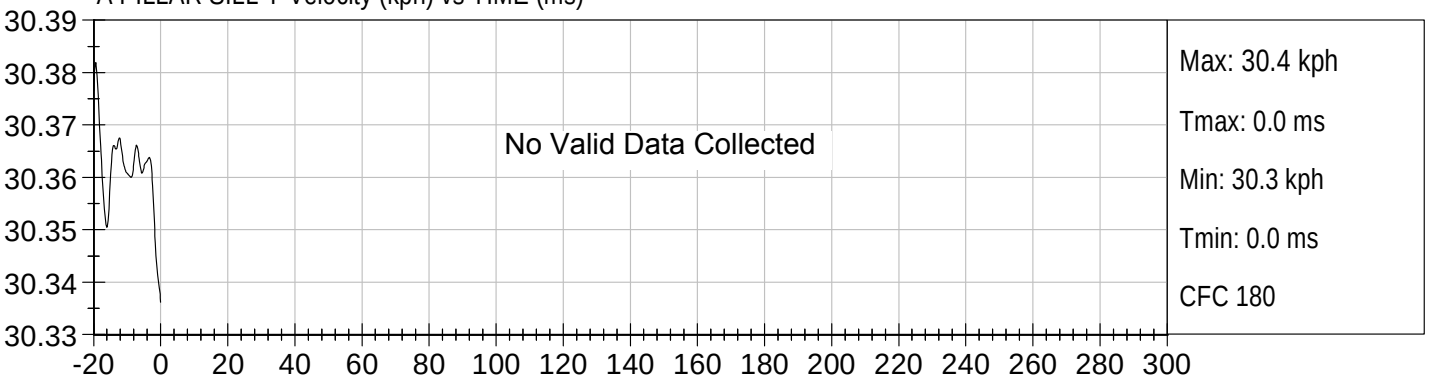
FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)

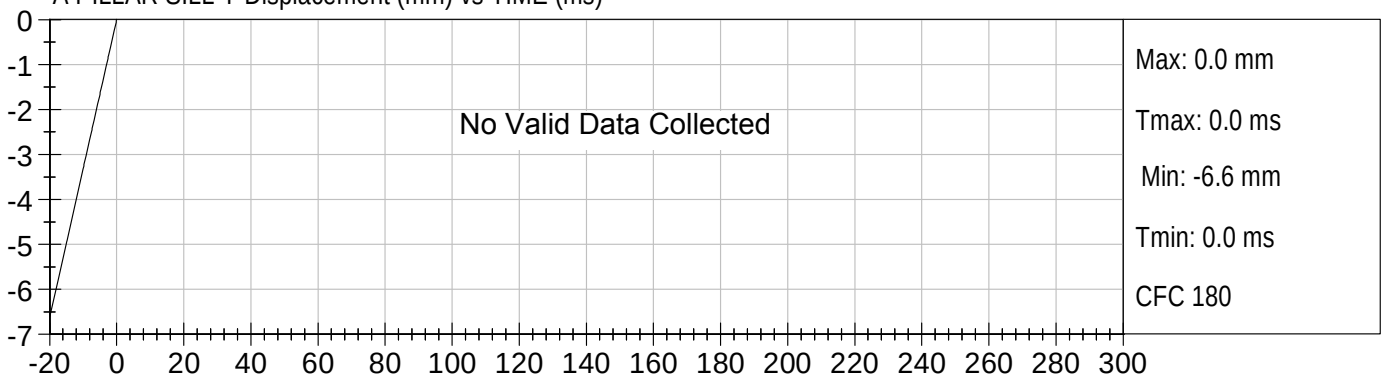
A PILLAR SILL Y (G's) vs TIME (ms)



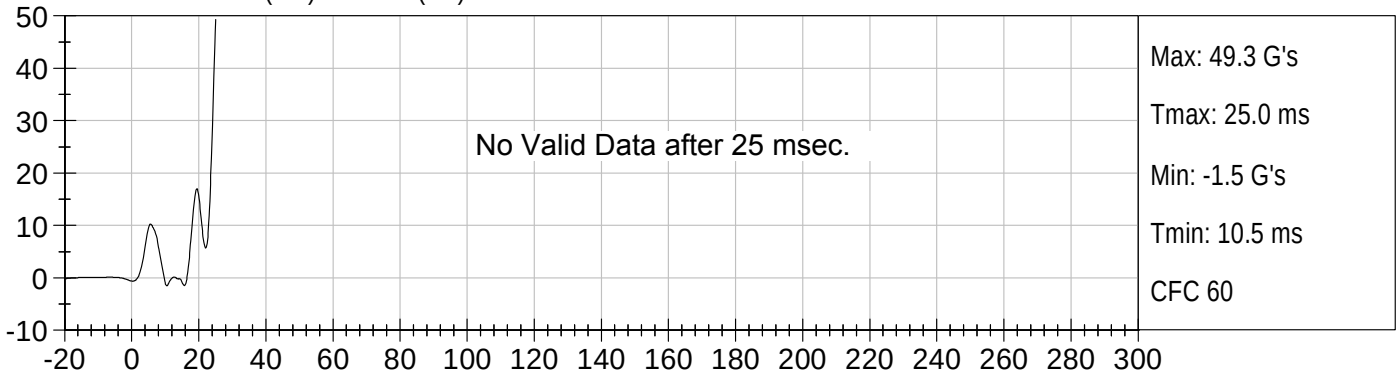
A PILLAR SILL Y Velocity (kph) vs TIME (ms)



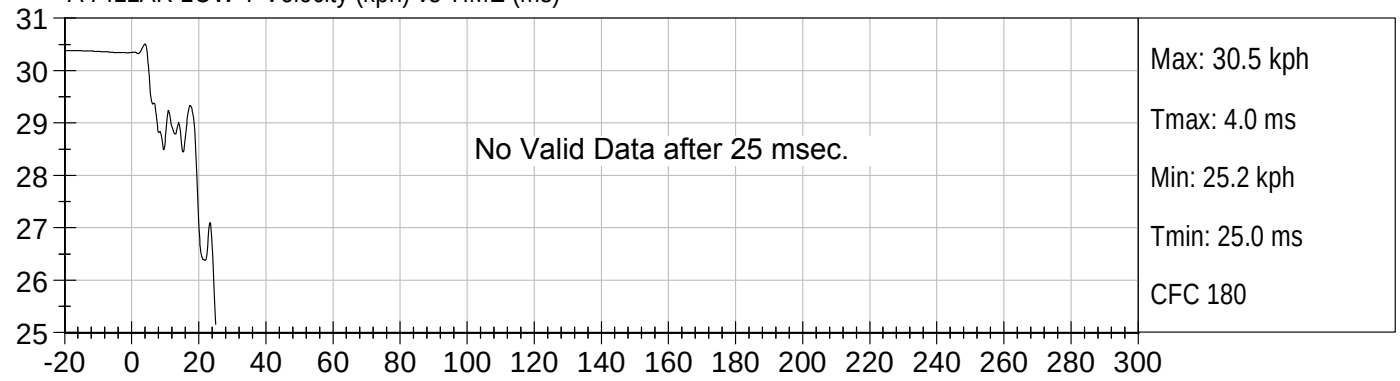
A PILLAR SILL Y Displacement (mm) vs TIME (ms)



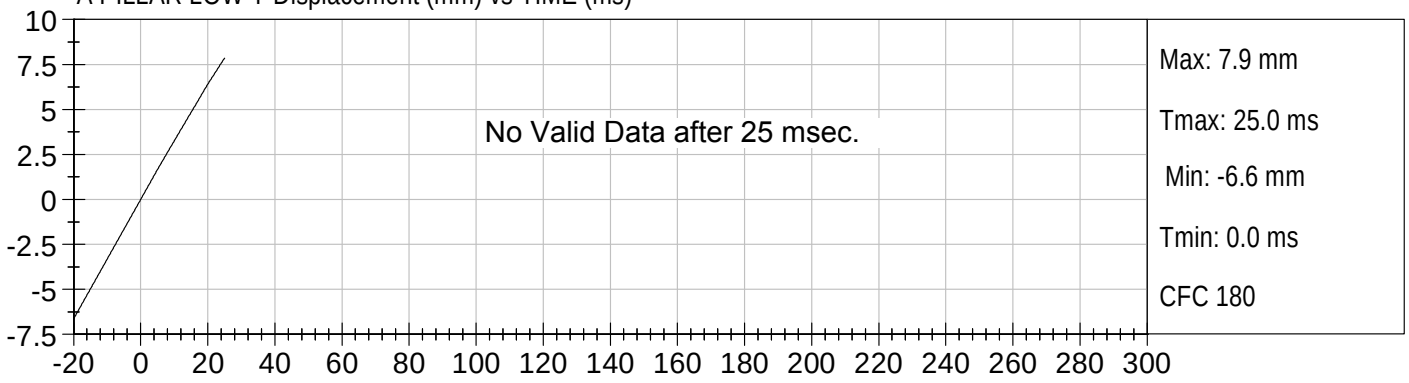
A PILLAR LOW Y (G's) vs TIME (ms)



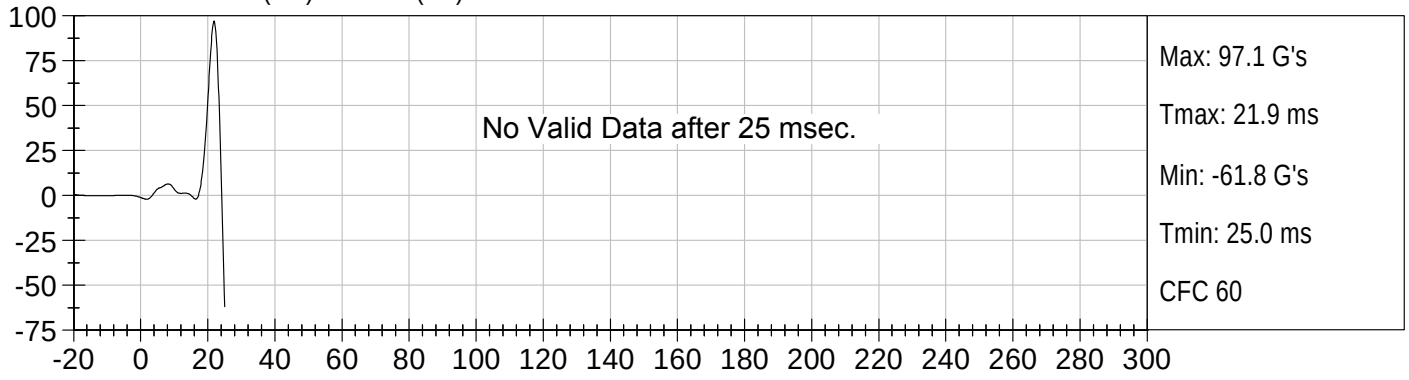
A PILLAR LOW Y Velocity (kph) vs TIME (ms)



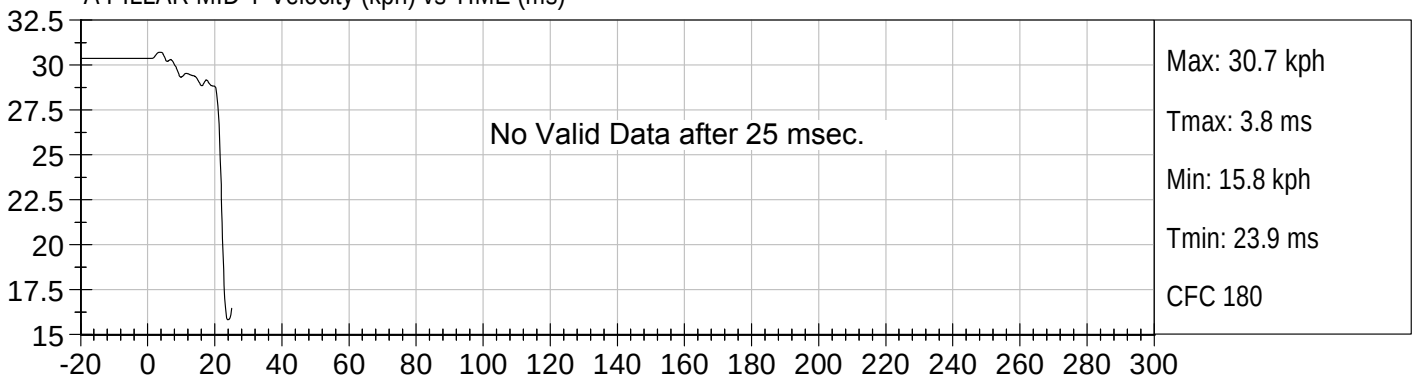
A PILLAR LOW Y Displacement (mm) vs TIME (ms)



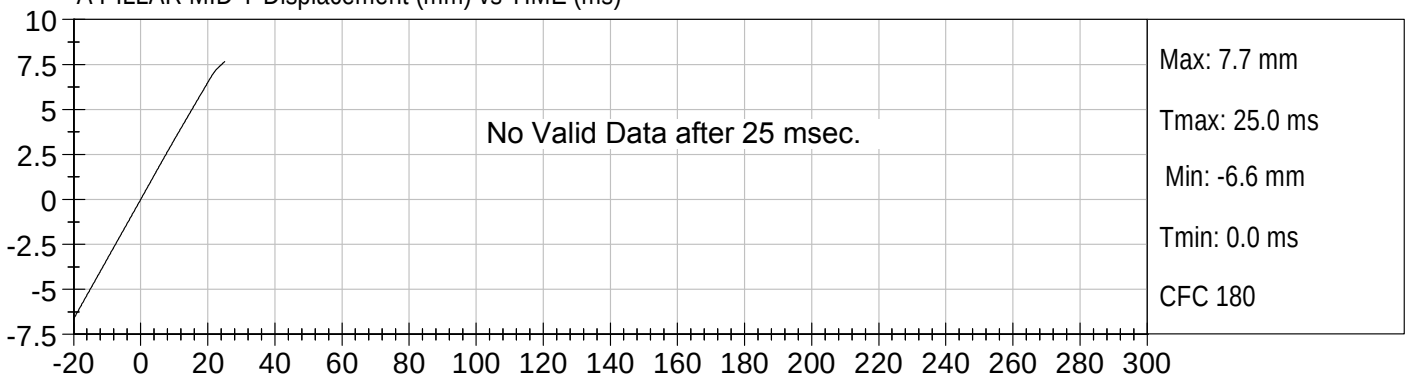
A PILLAR MID Y (G's) vs TIME (ms)



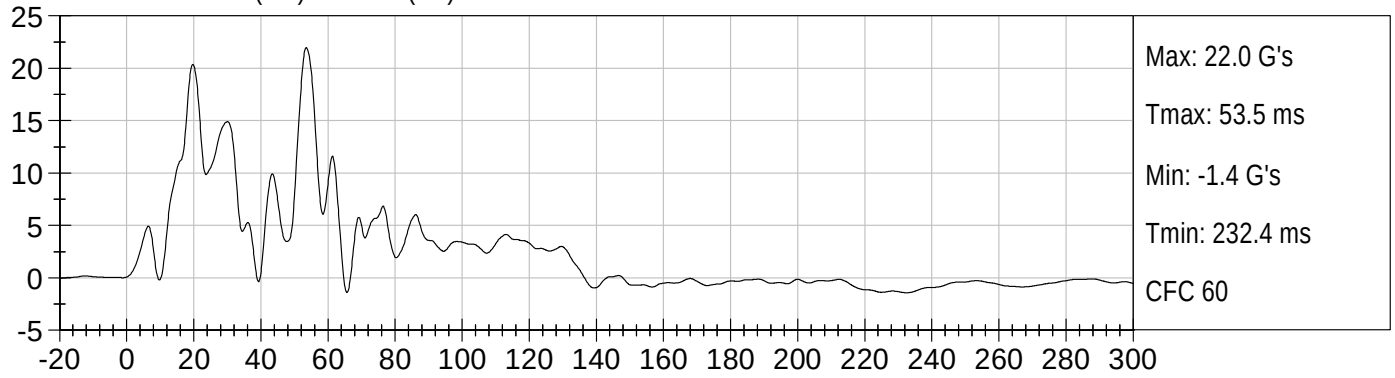
A PILLAR MID Y Velocity (kph) vs TIME (ms)



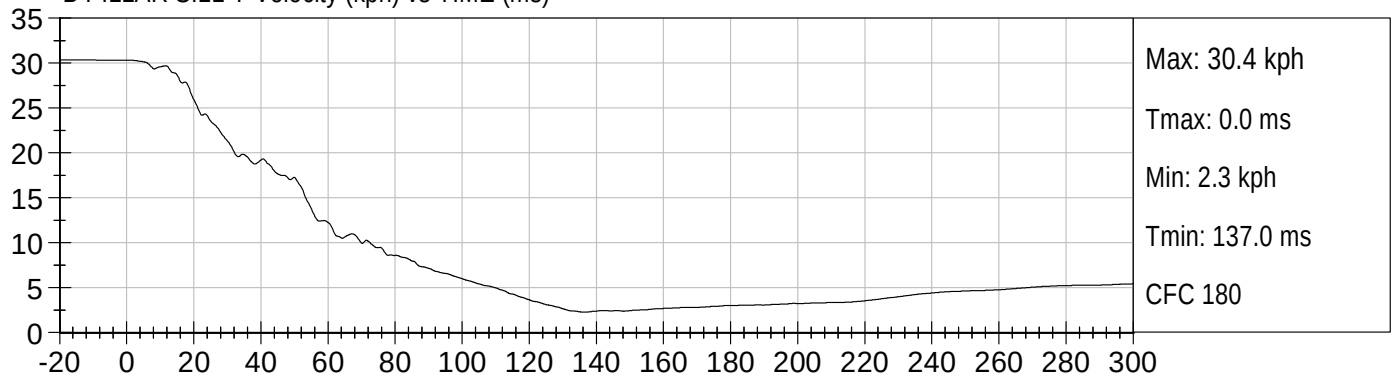
A PILLAR MID Y Displacement (mm) vs TIME (ms)



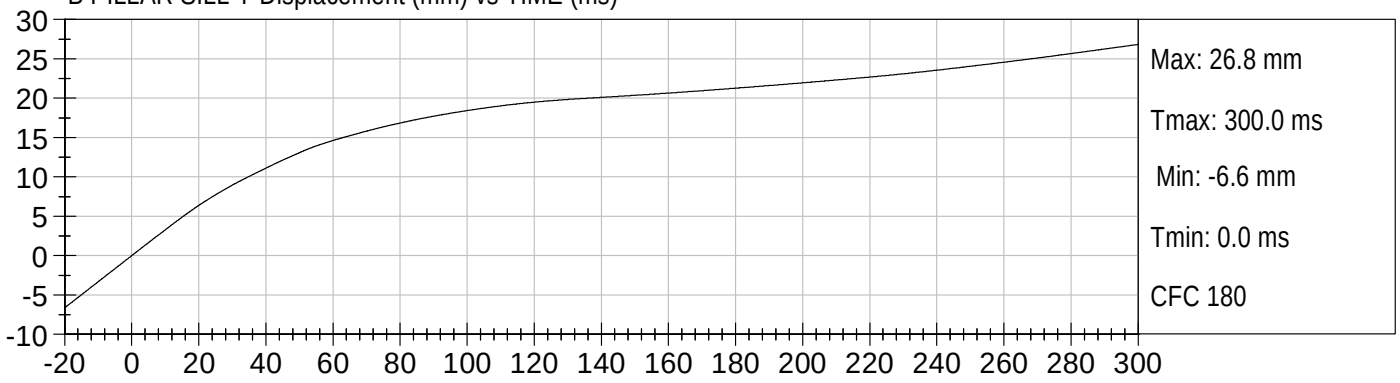
B PILLAR SILL Y (G's) vs TIME (ms)



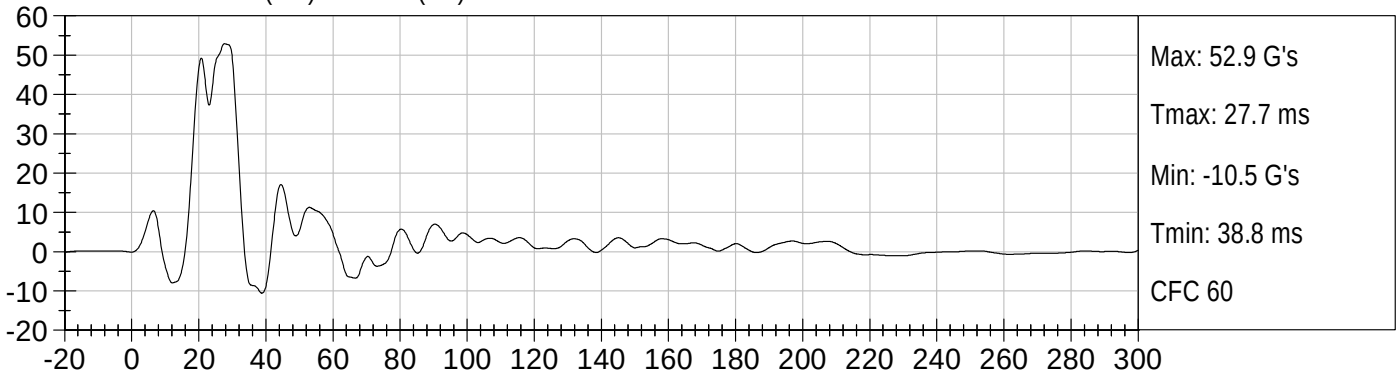
B PILLAR SILL Y Velocity (kph) vs TIME (ms)



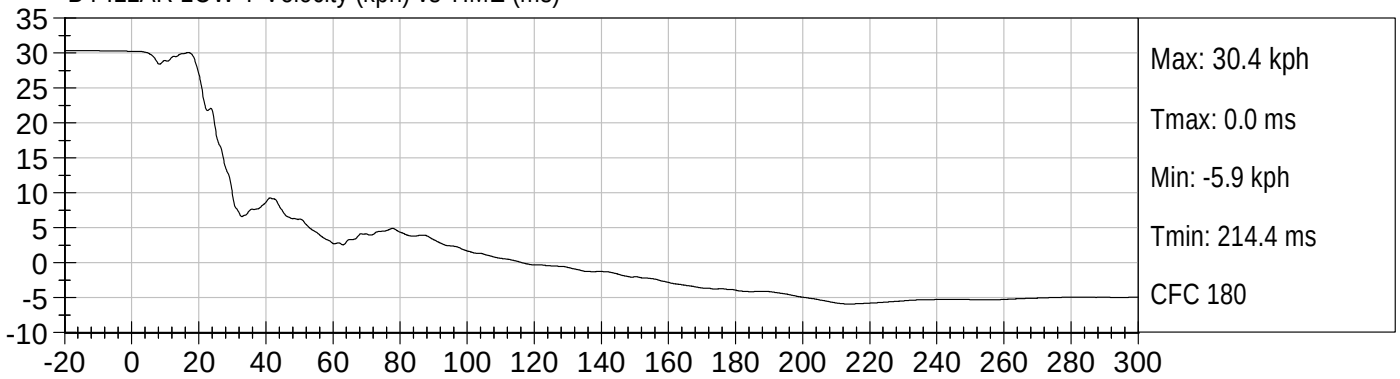
B PILLAR SILL Y Displacement (mm) vs TIME (ms)



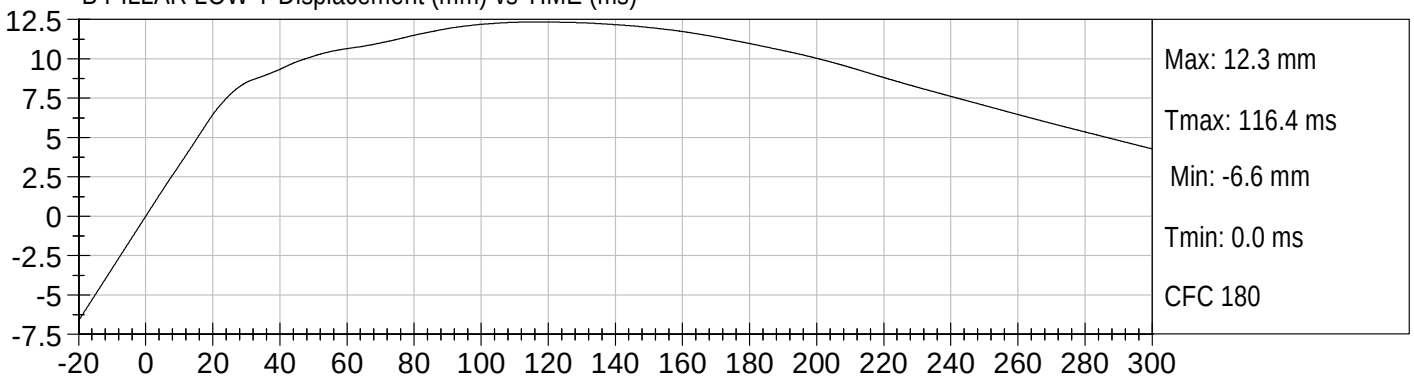
B PILLAR LOW Y (G's) vs TIME (ms)



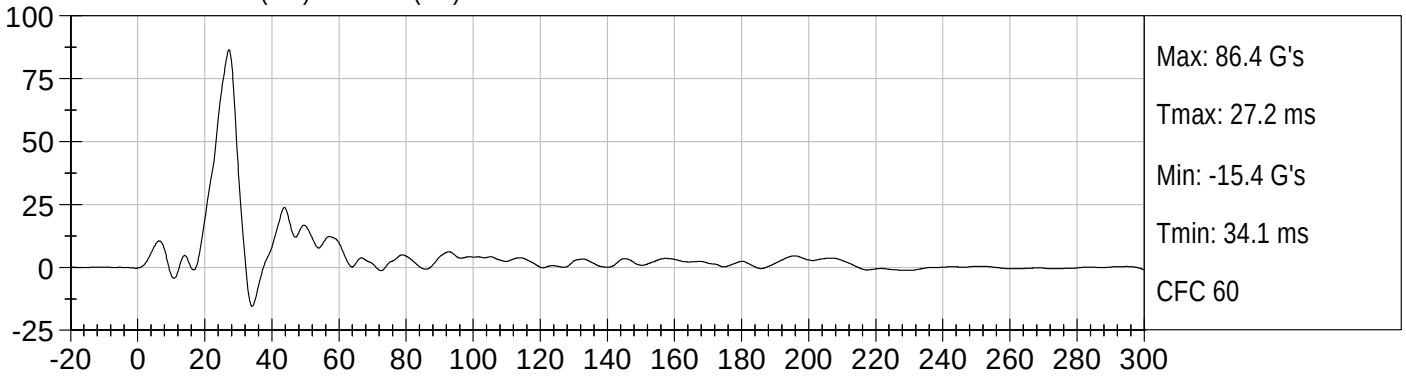
B PILLAR LOW Y Velocity (kph) vs TIME (ms)



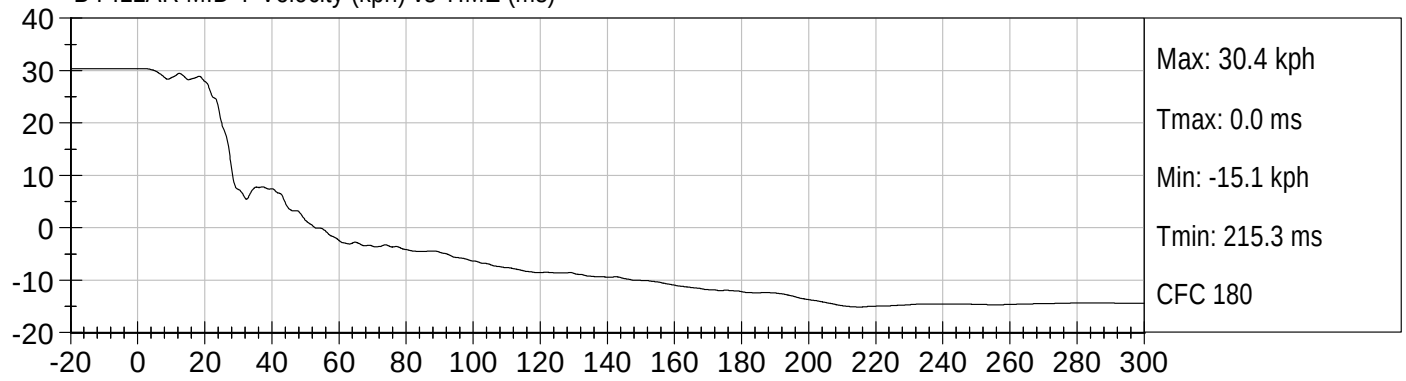
B PILLAR LOW Y Displacement (mm) vs TIME (ms)



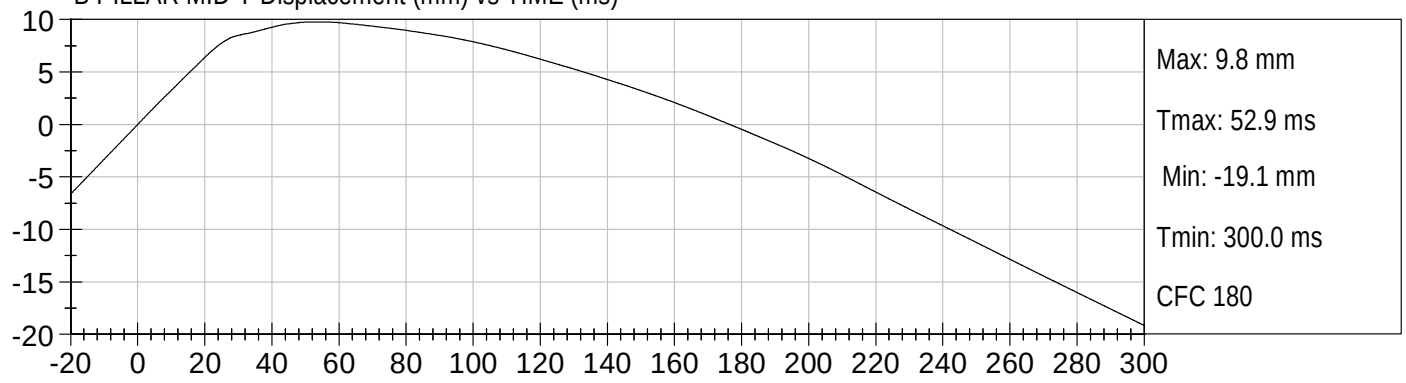
B PILLAR MID Y (G's) vs TIME (ms)



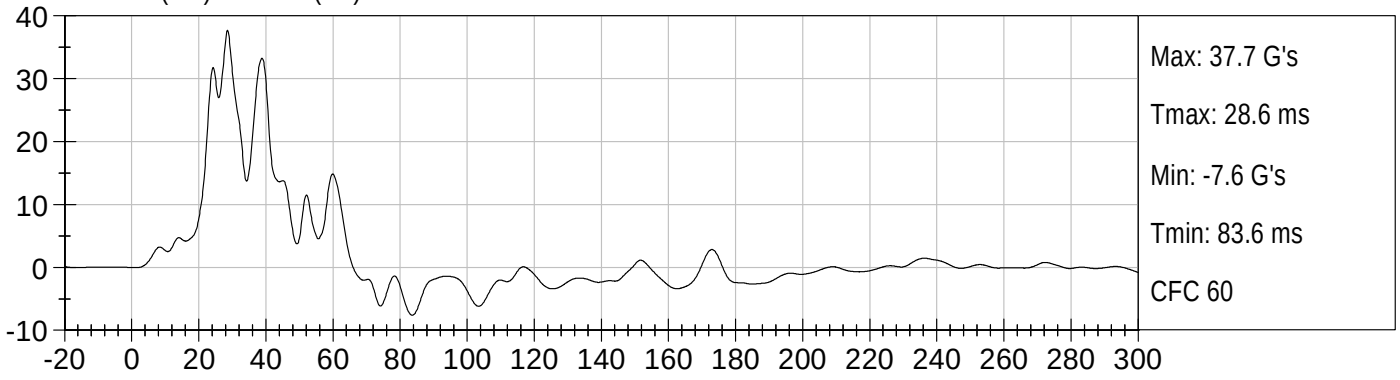
B PILLAR MID Y Velocity (kph) vs TIME (ms)



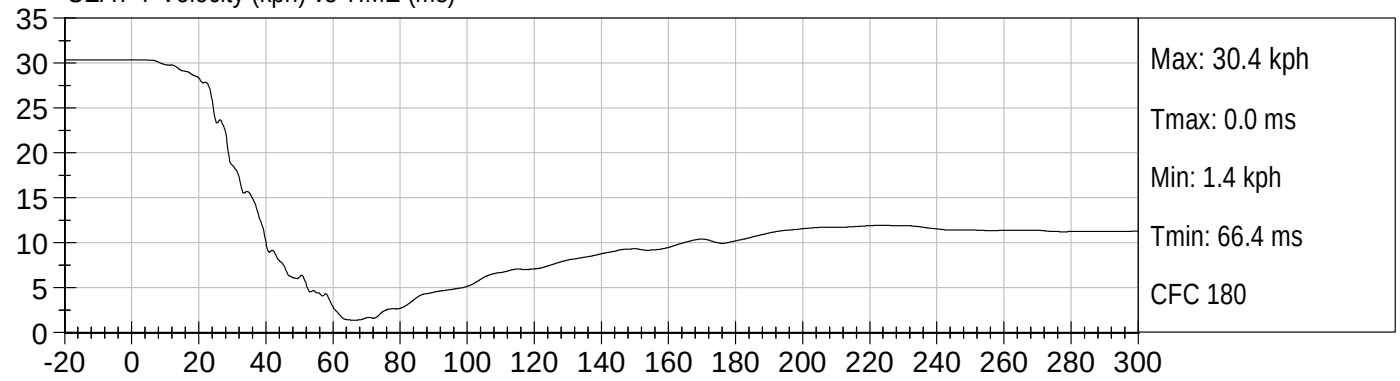
B PILLAR MID Y Displacement (mm) vs TIME (ms)



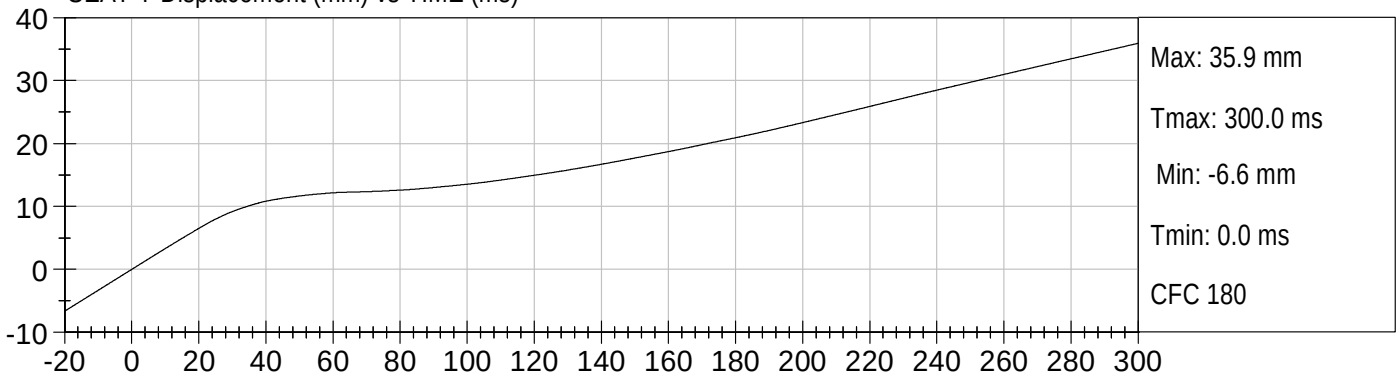
SEAT Y (G's) vs TIME (ms)



SEAT Y Velocity (kph) vs TIME (ms)



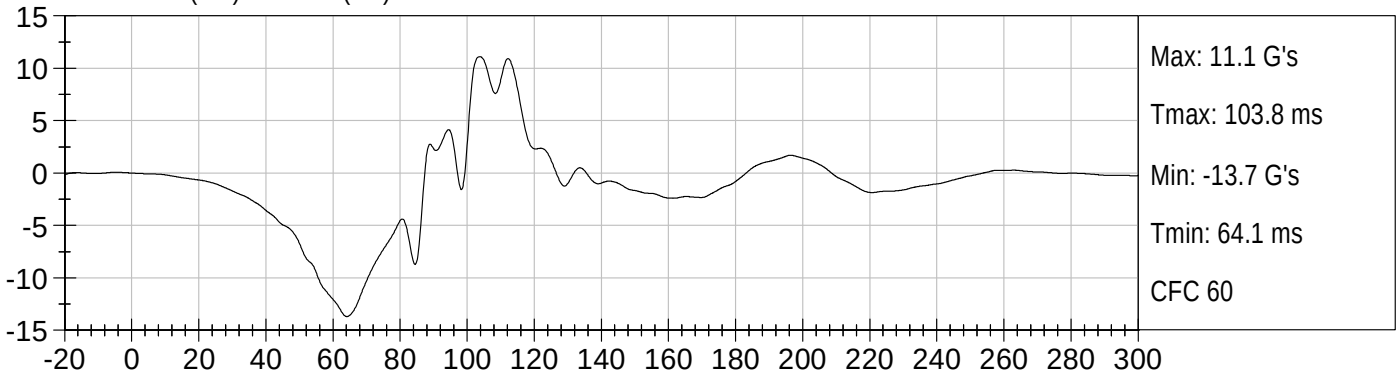
SEAT Y Displacement (mm) vs TIME (ms)



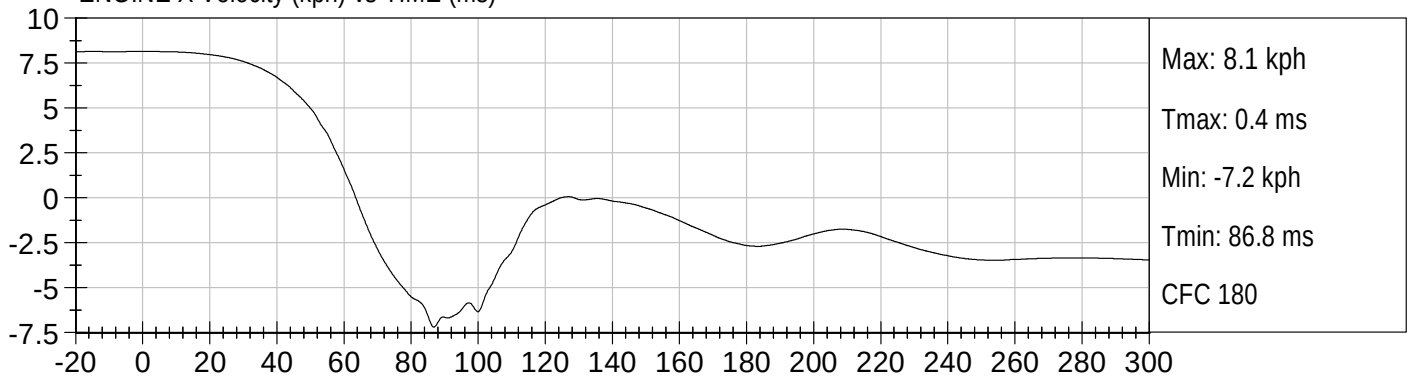
FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)

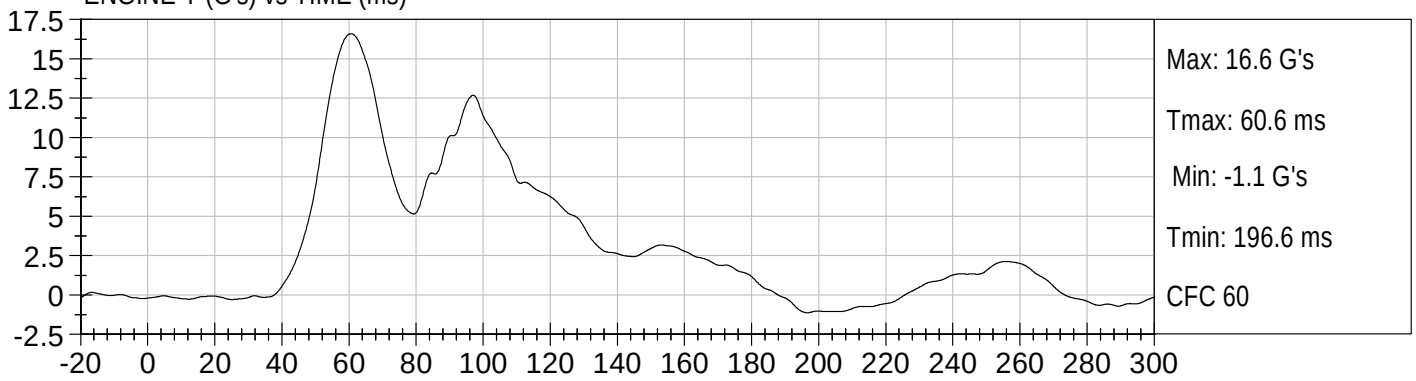
ENGINE X (G's) vs TIME (ms)



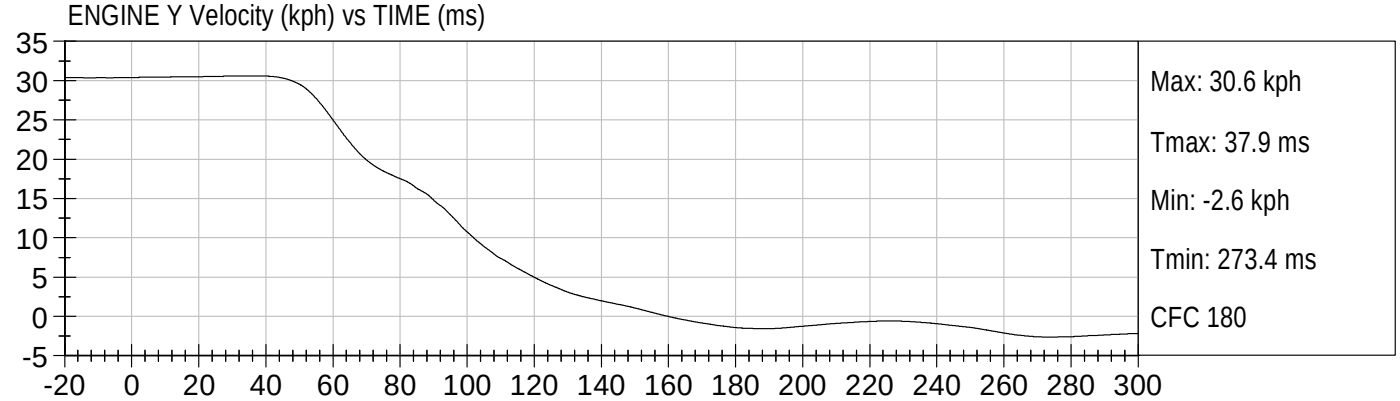
ENGINE X Velocity (kph) vs TIME (ms)



ENGINE Y (G's) vs TIME (ms)

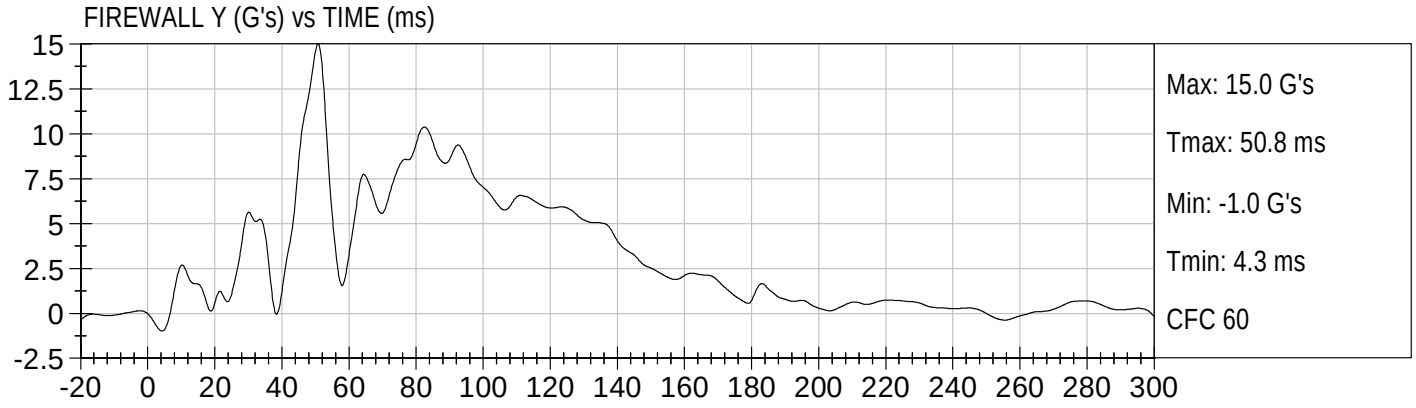


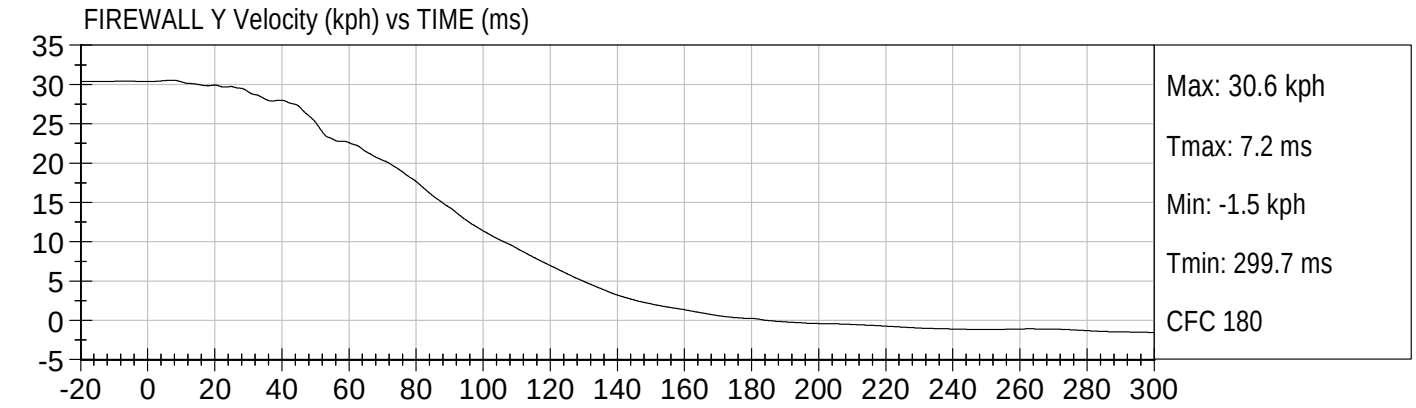
ENGINE Y Velocity (kph) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)

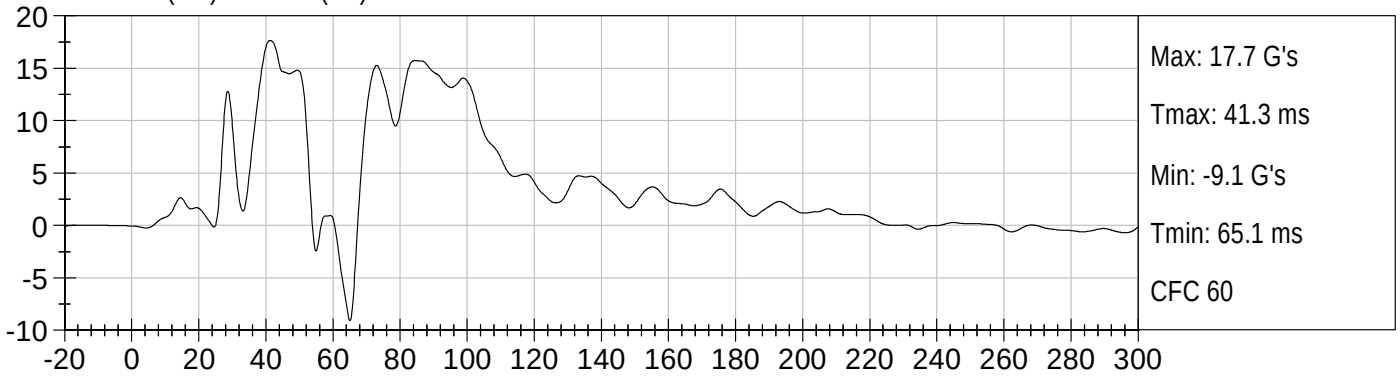




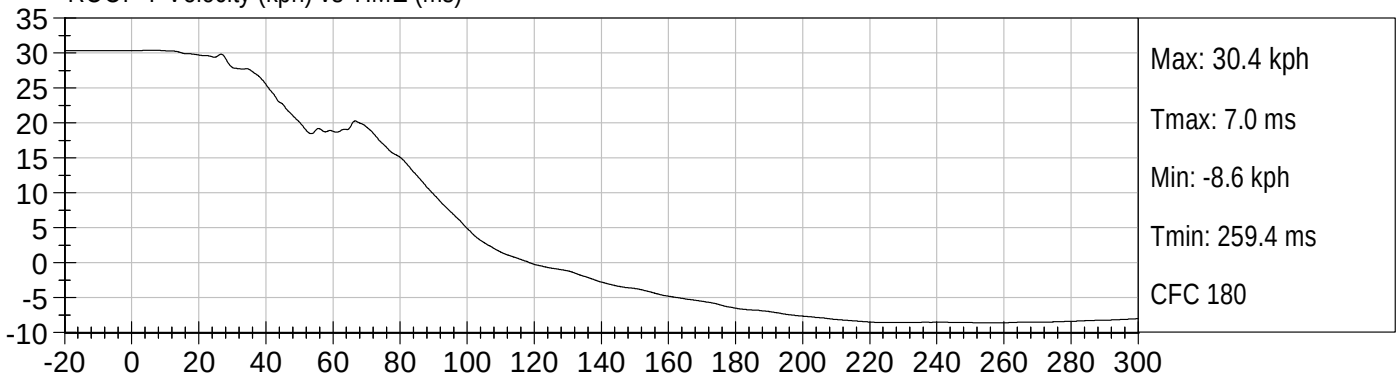
FMVSS 214 Rigid Pole Side Impact
2011 Acura ZDX - CB5303

Test Date: 03/25/2011
Speed: 19.5 mph (31.4 km/h)

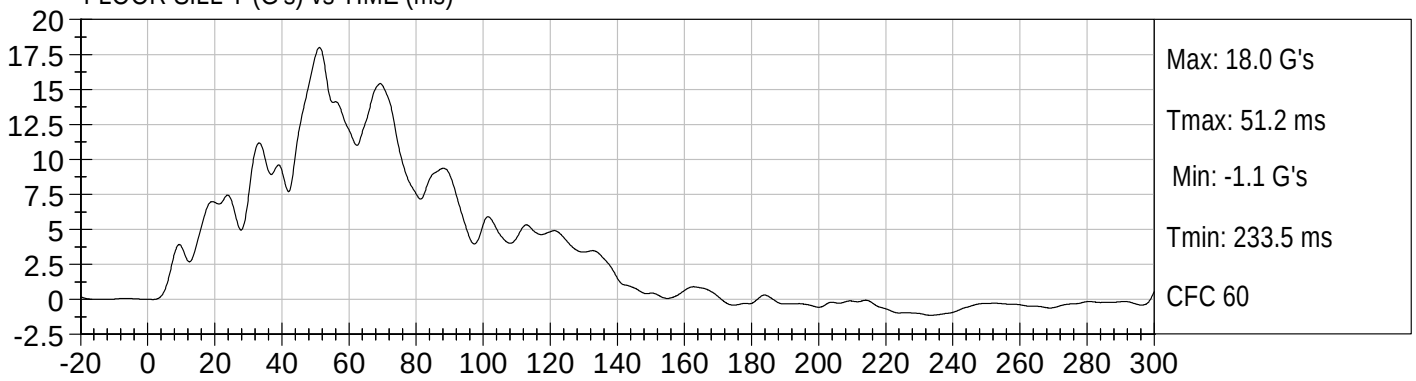
ROOF Y (G's) vs TIME (ms)



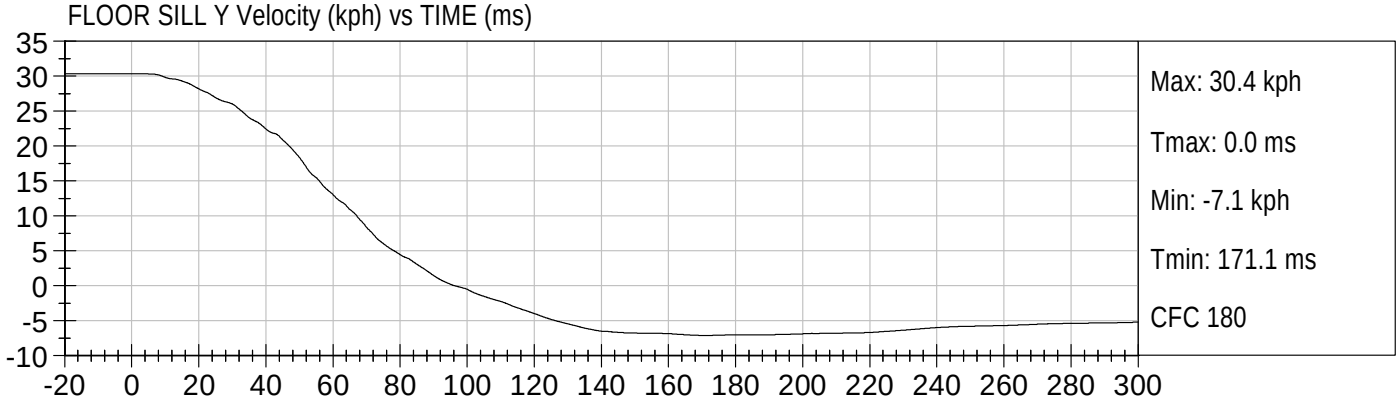
ROOF Y Velocity (kph) vs TIME (ms)



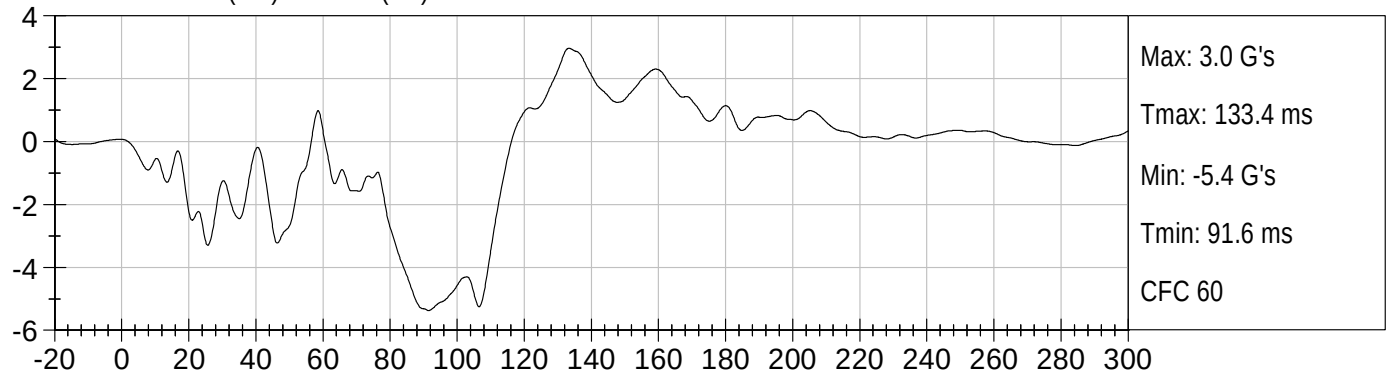
FLOOR SILL Y (G's) vs TIME (ms)



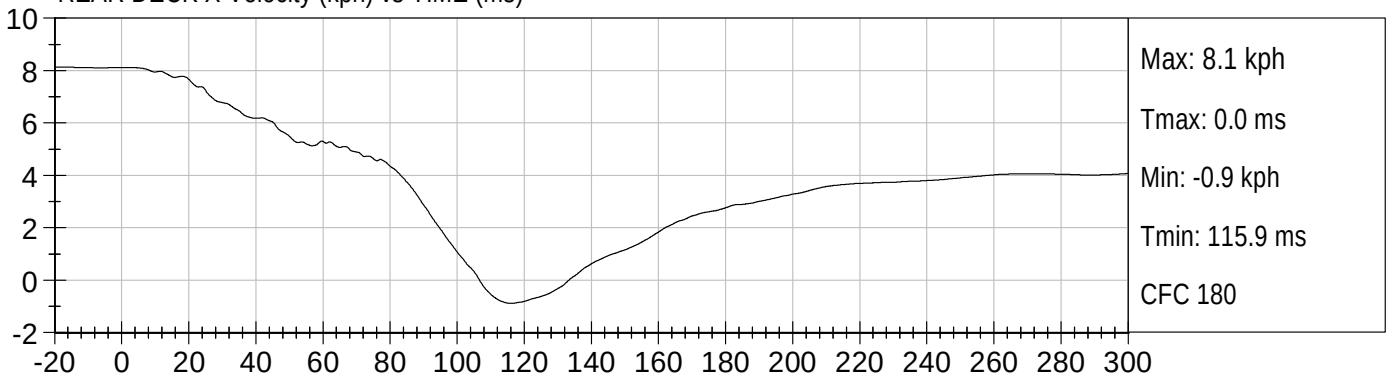
FLOOR SILL Y Velocity (kph) vs TIME (ms)



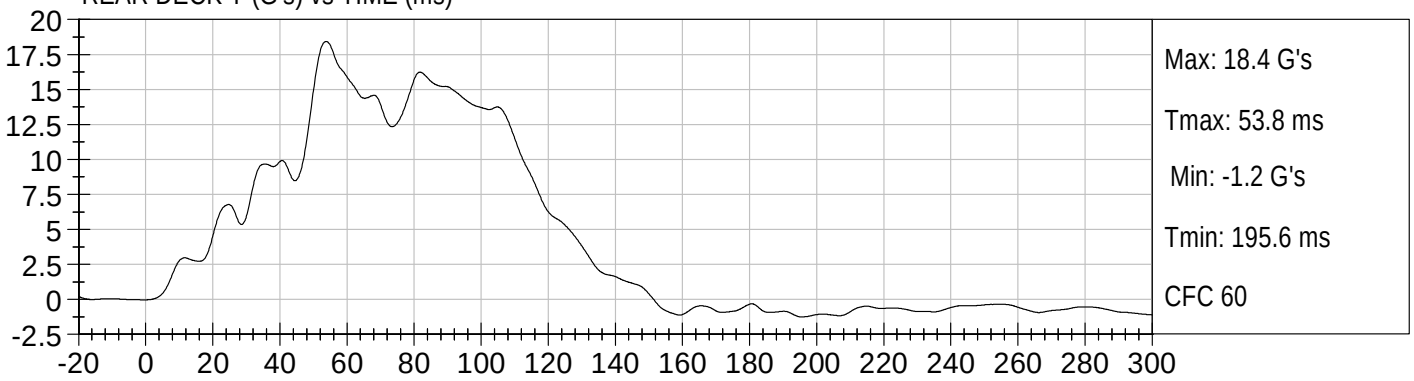
REAR DECK X (G's) vs TIME (ms)



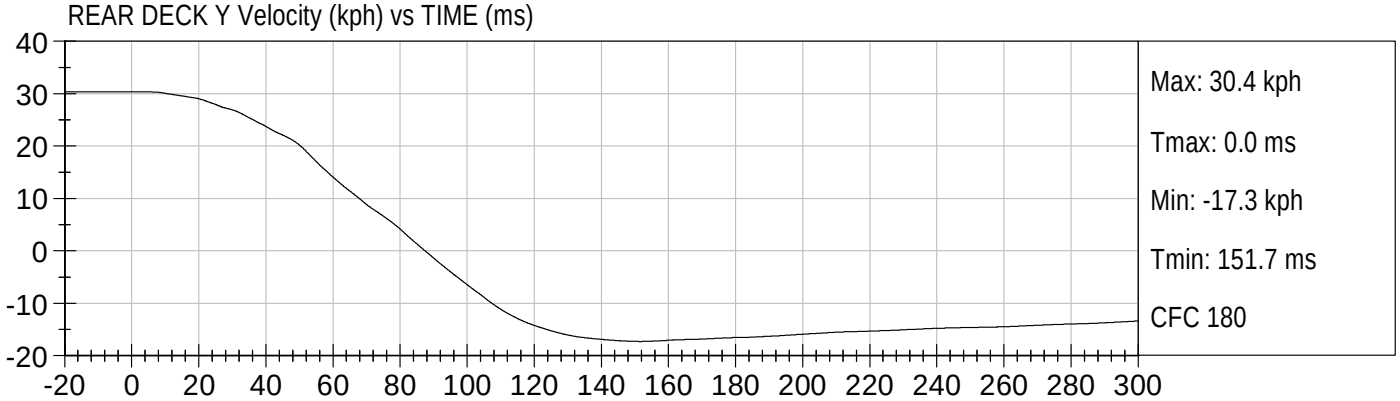
REAR DECK X Velocity (kph) vs TIME (ms)



REAR DECK Y (G's) vs TIME (ms)



REAR DECK Y Velocity (kph) vs TIME (ms)



APPENDIX D

DUMMY PERFORMANCE CALIBRATION TEST DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D111111

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	28	Pass
Peak Resultant Acceleration	G's	125 to 155	151	Pass
Peak Lateral Acceleration	G's	+/- 15	-9.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

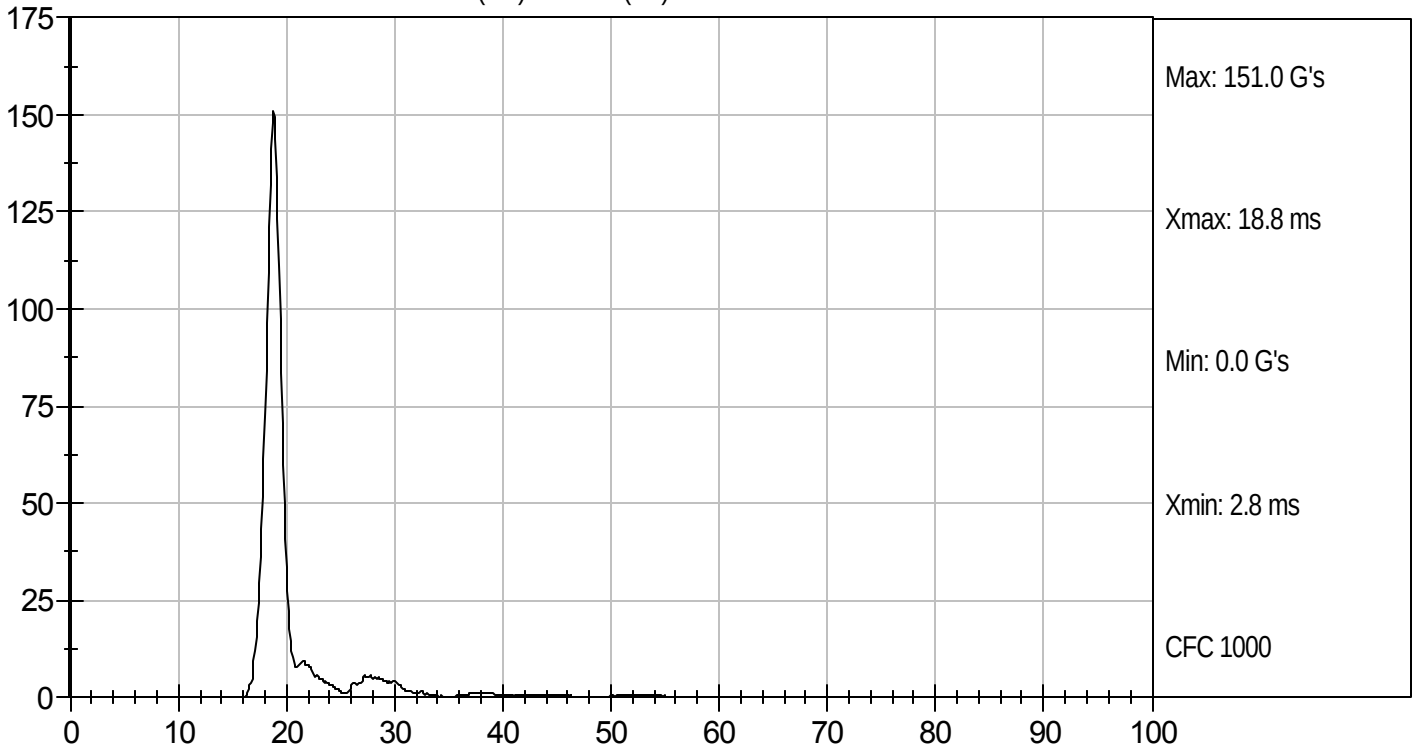
3/23/11
Test Date

David Winkelbauer
Approved By

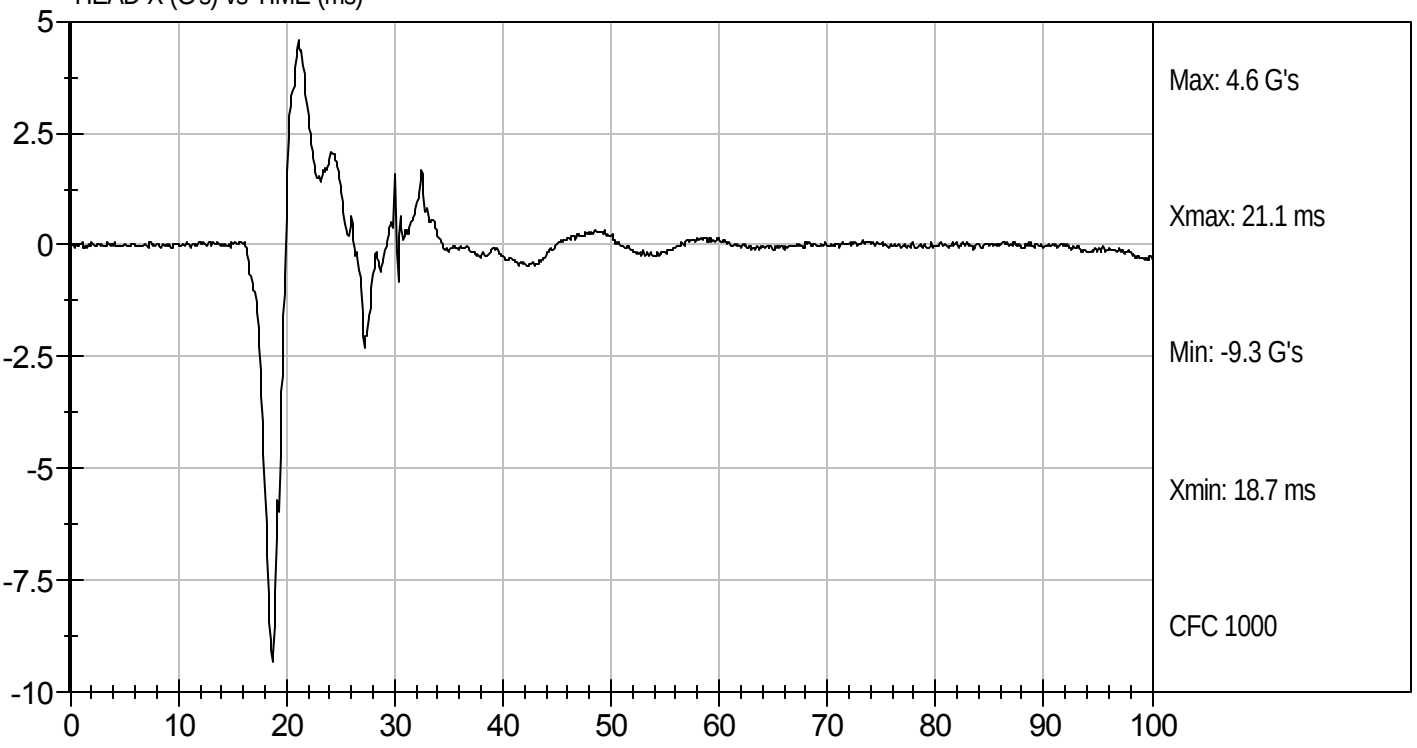
Test Desc: Head Drop
Component ID: D111111

Test Date: 3/23/11
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G's) vs TIME (ms)



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



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111112

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	29	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.5	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.02	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.38	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.0	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	58.8	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	60.6	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

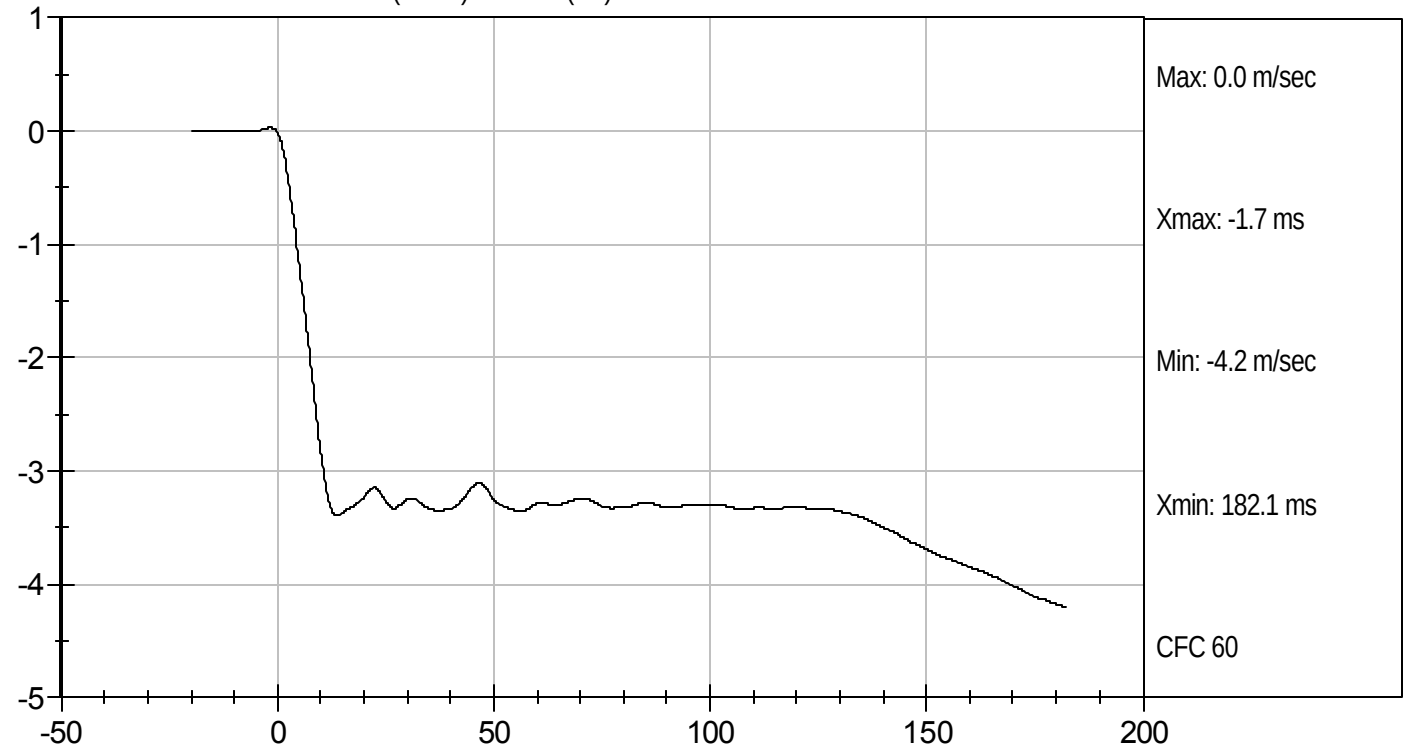
3/23/11
Test Date

David Winkelbauer
Approved By

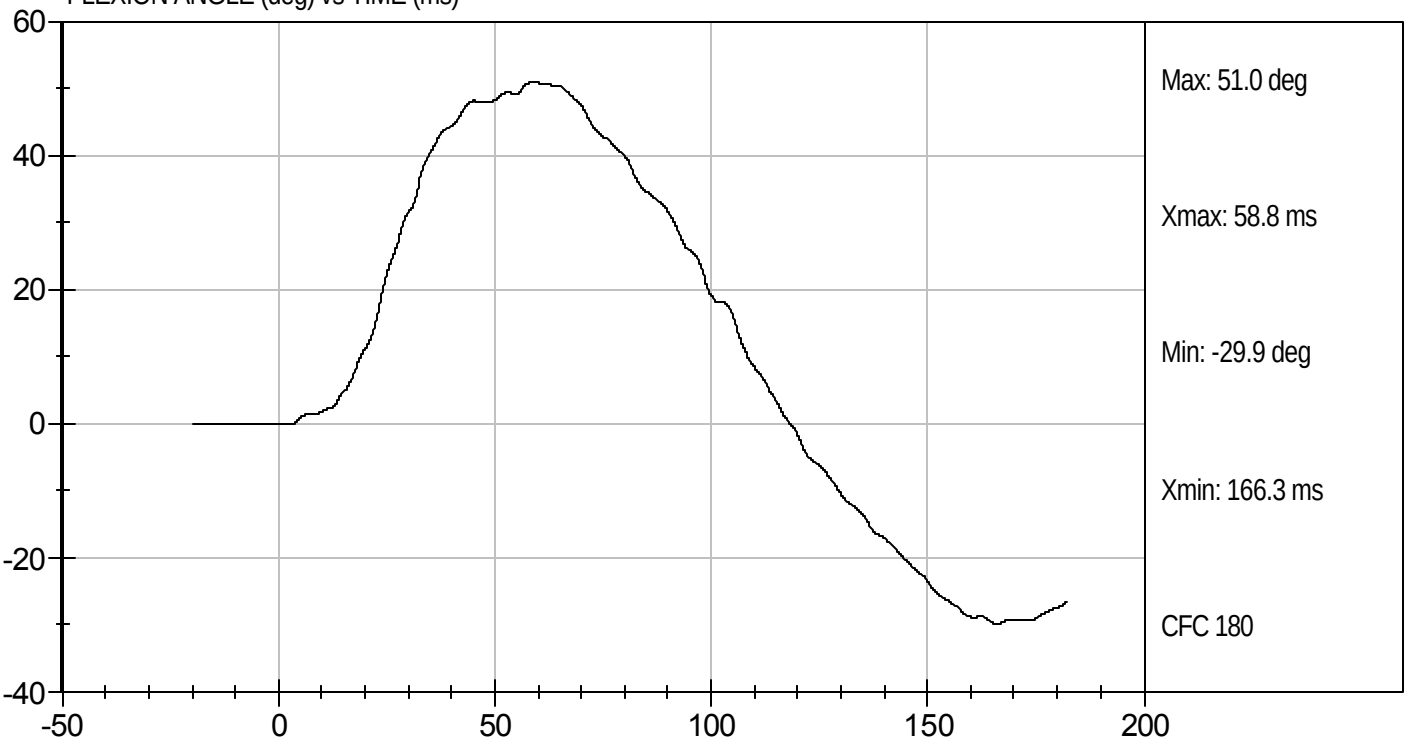
Test Desc: Neck Bending
Component ID: D111112

Test Date: 3/23/11
Velocity: 11.42 ft/s, 3.5 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

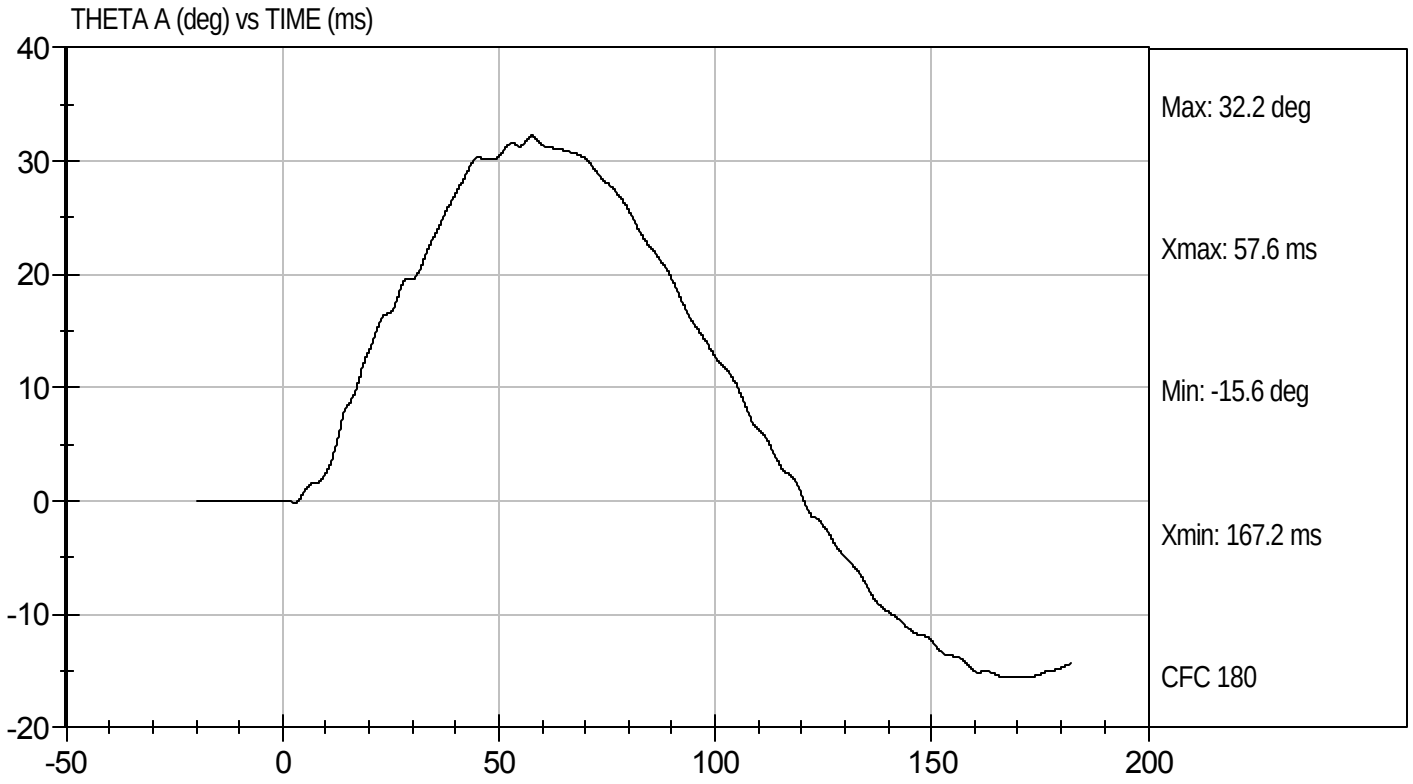


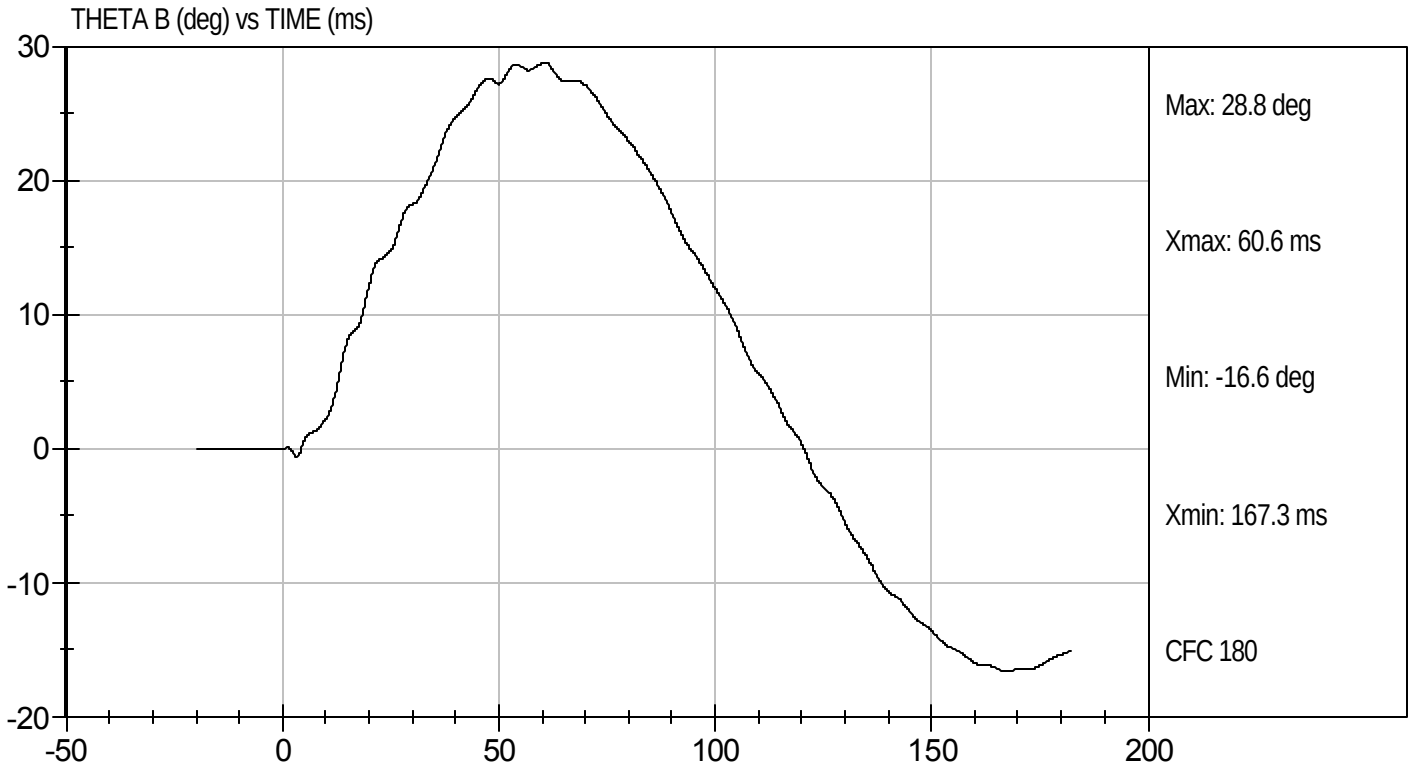
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D111112

Test Date: 3/23/11
Velocity: 11.42 ft/s, 3.5 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111113

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	10.1	Pass
Time of Peak Shoulder Acceleration	ms	NA	18.4	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

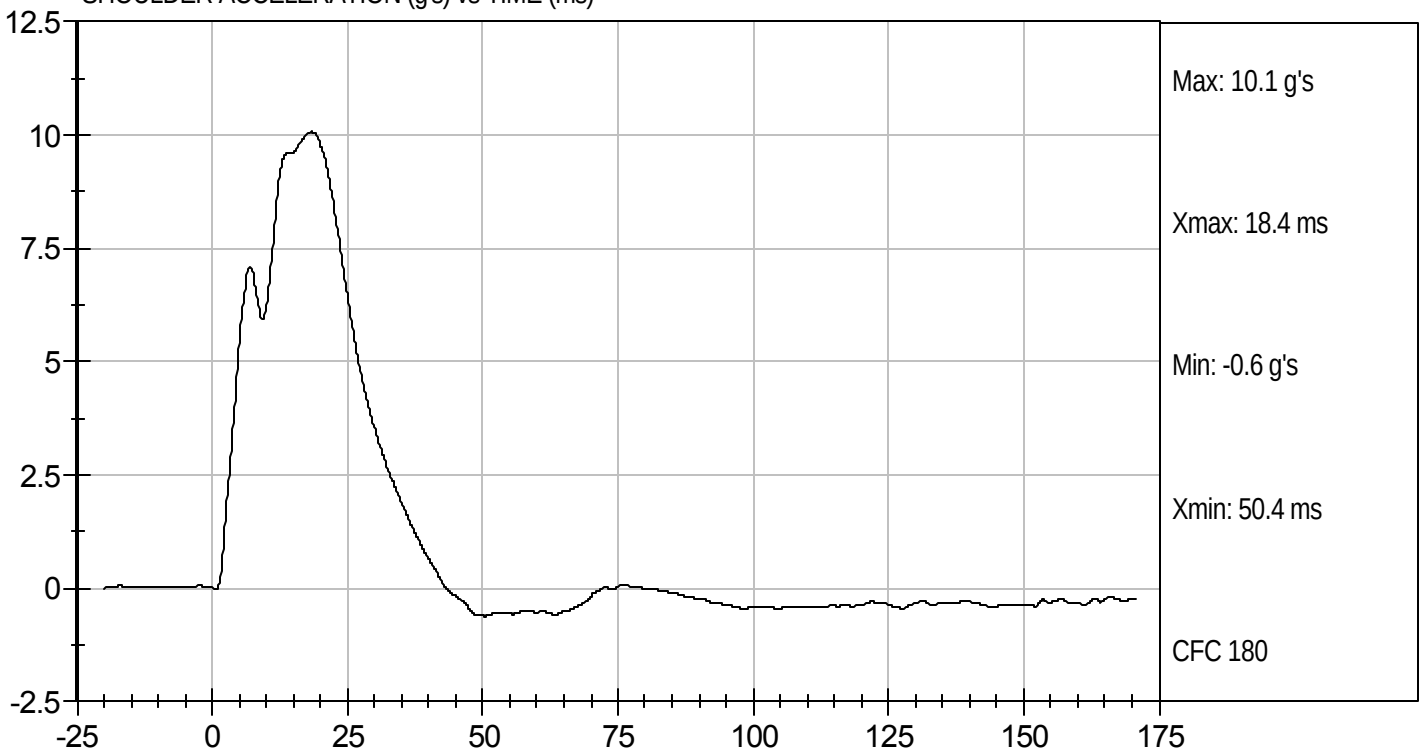
3/24/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111113

Test Date: 3/24/11
Velocity: 14.25 ft/s, 4.3 m/s

SHOULDER ACCELERATION (g's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111114

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.3	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.7	Pass
		Overall Test Results		Pass

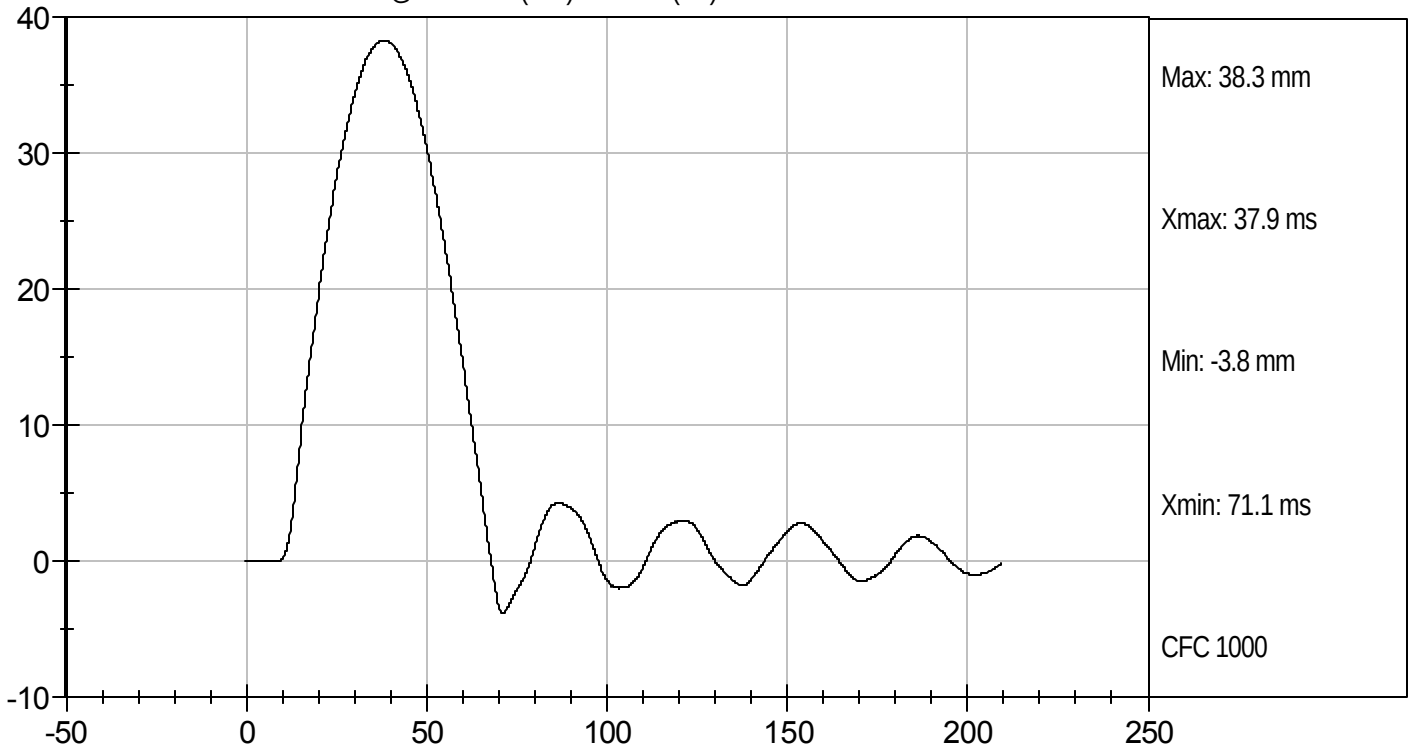
Jessica Hall
Laboratory Technician

3/24/11
Test Date

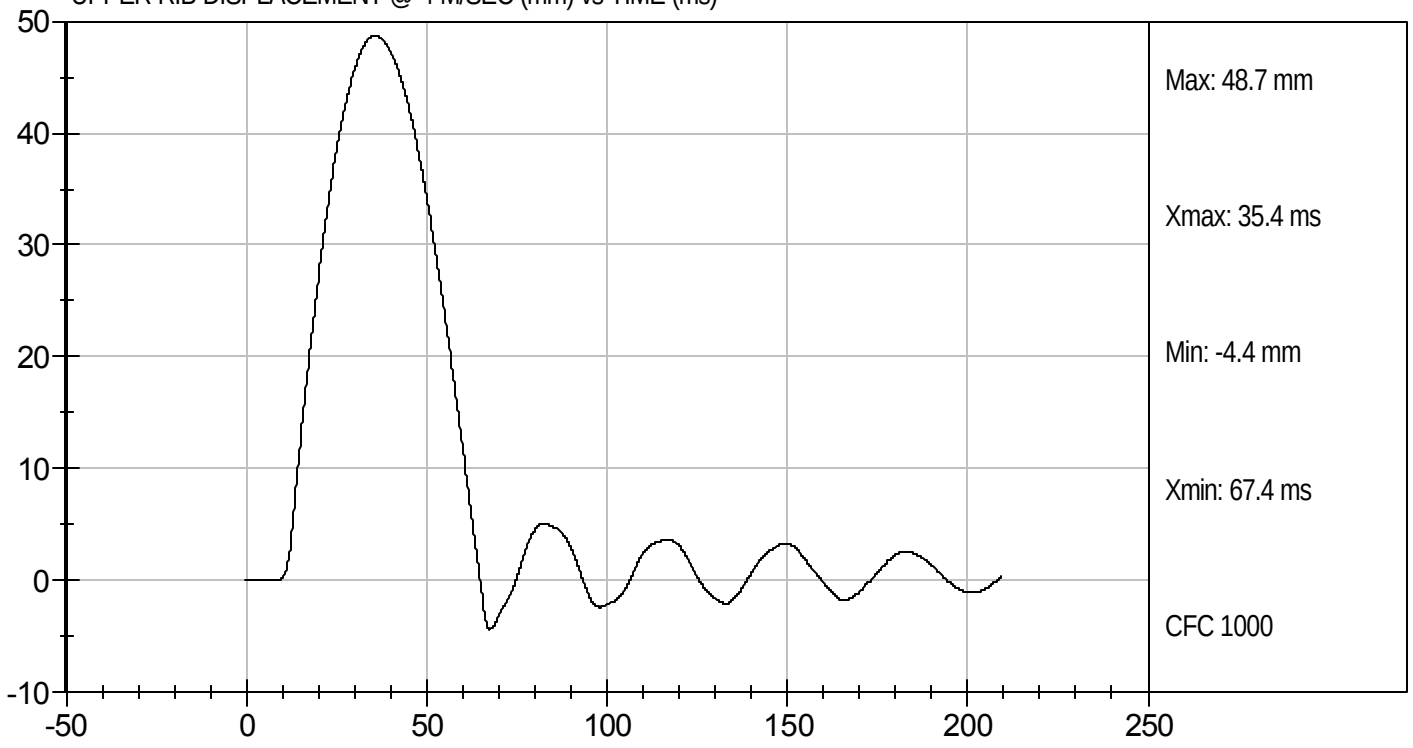
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111114
Test Date: 3/24/11

UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111115

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.5	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.9	Pass
		Overall Test Results		Pass

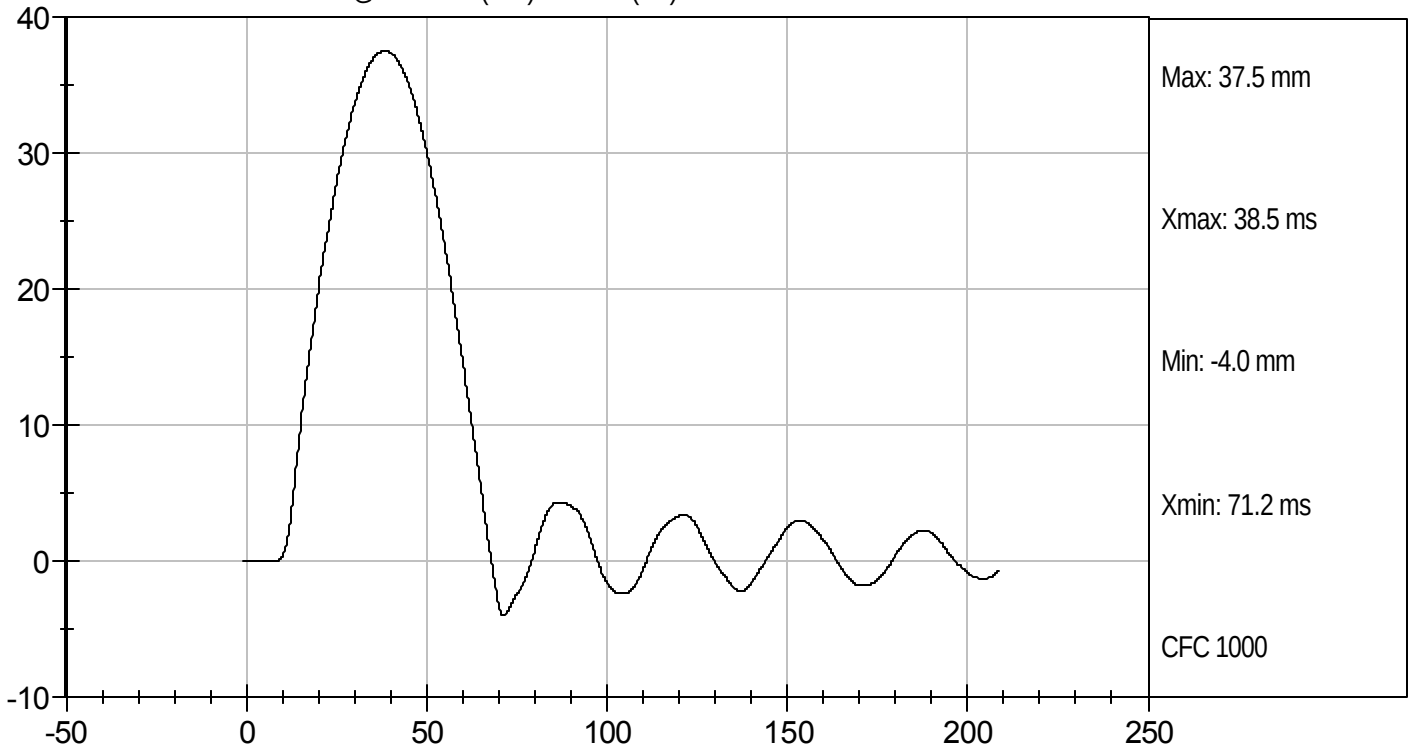
Jessica Gall
Laboratory Technician

3/24/11
Test Date

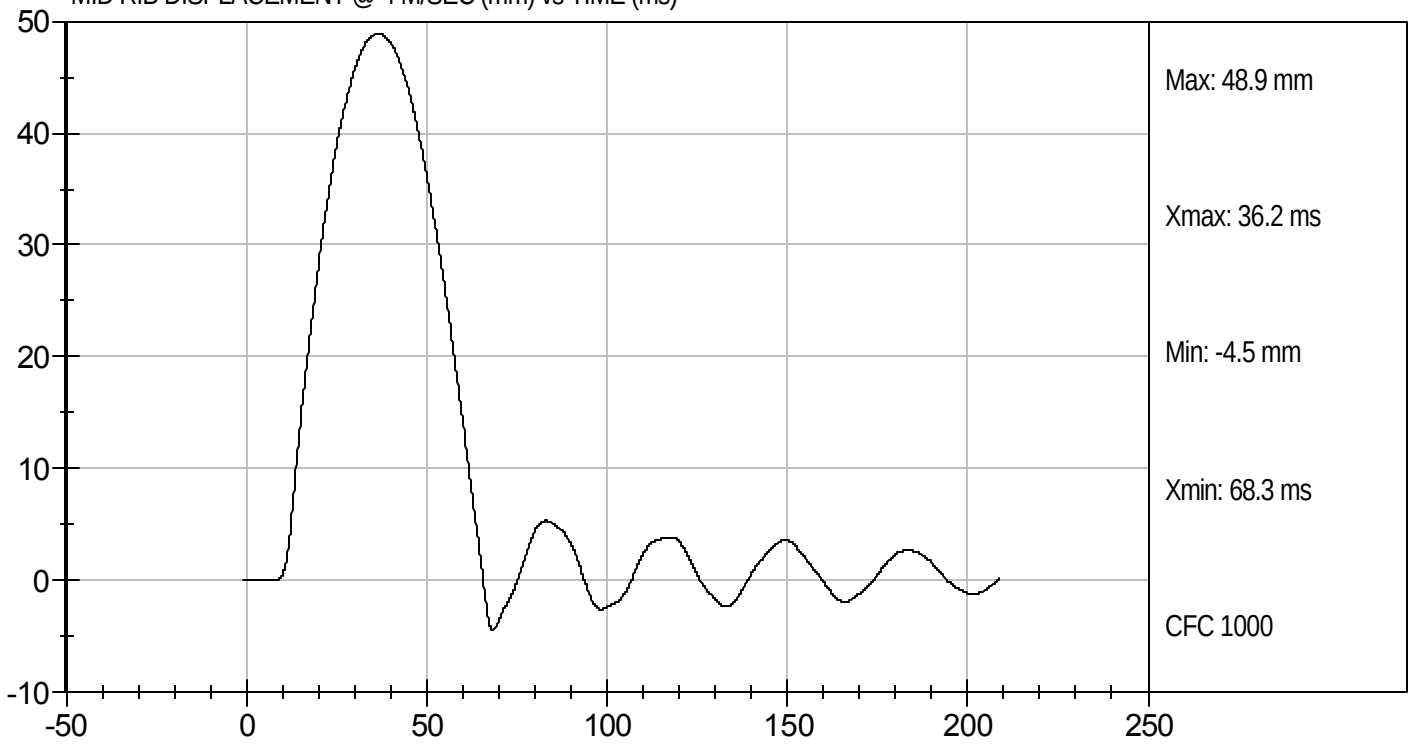
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111115
Test Date: 3/24/11

MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111116

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.6	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.7	Pass
		Overall Test Results		Pass

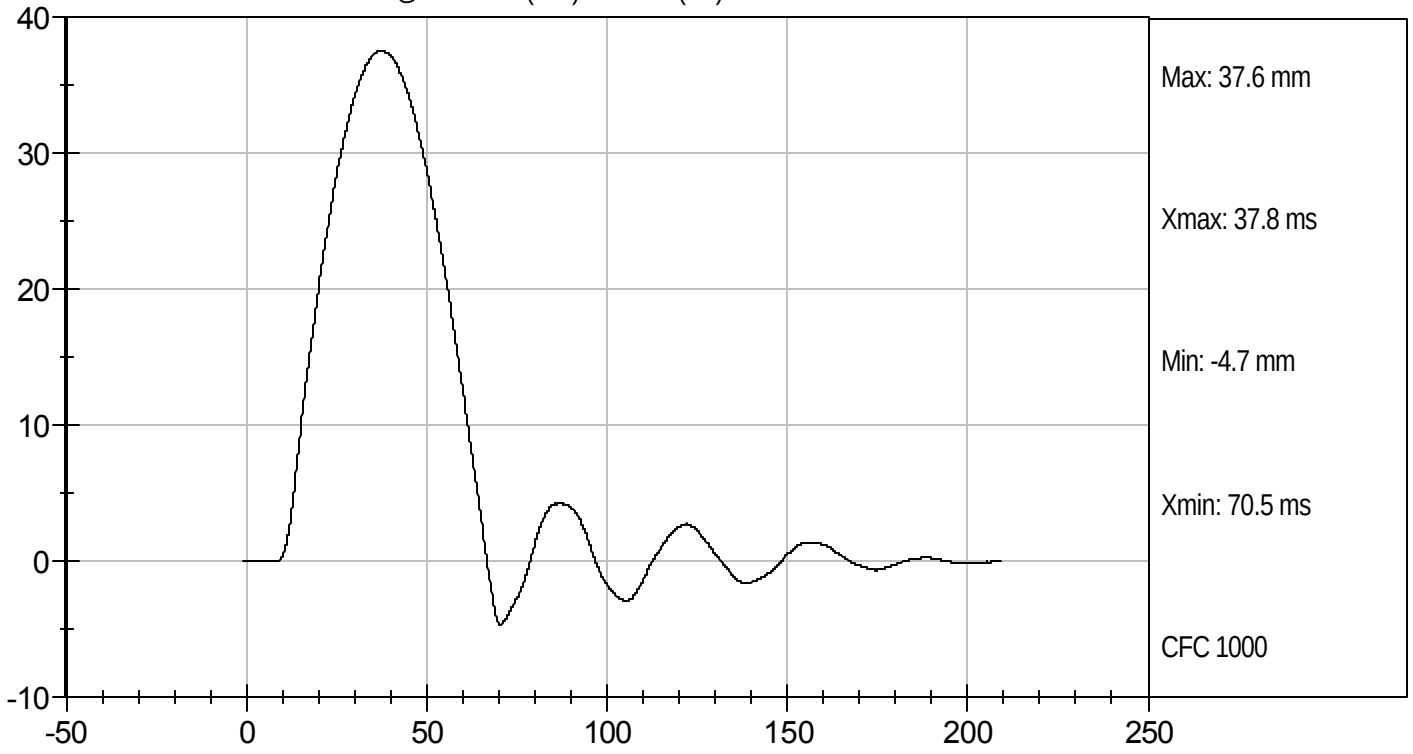
Jessica Hall
Laboratory Technician

3/24/11
Test Date

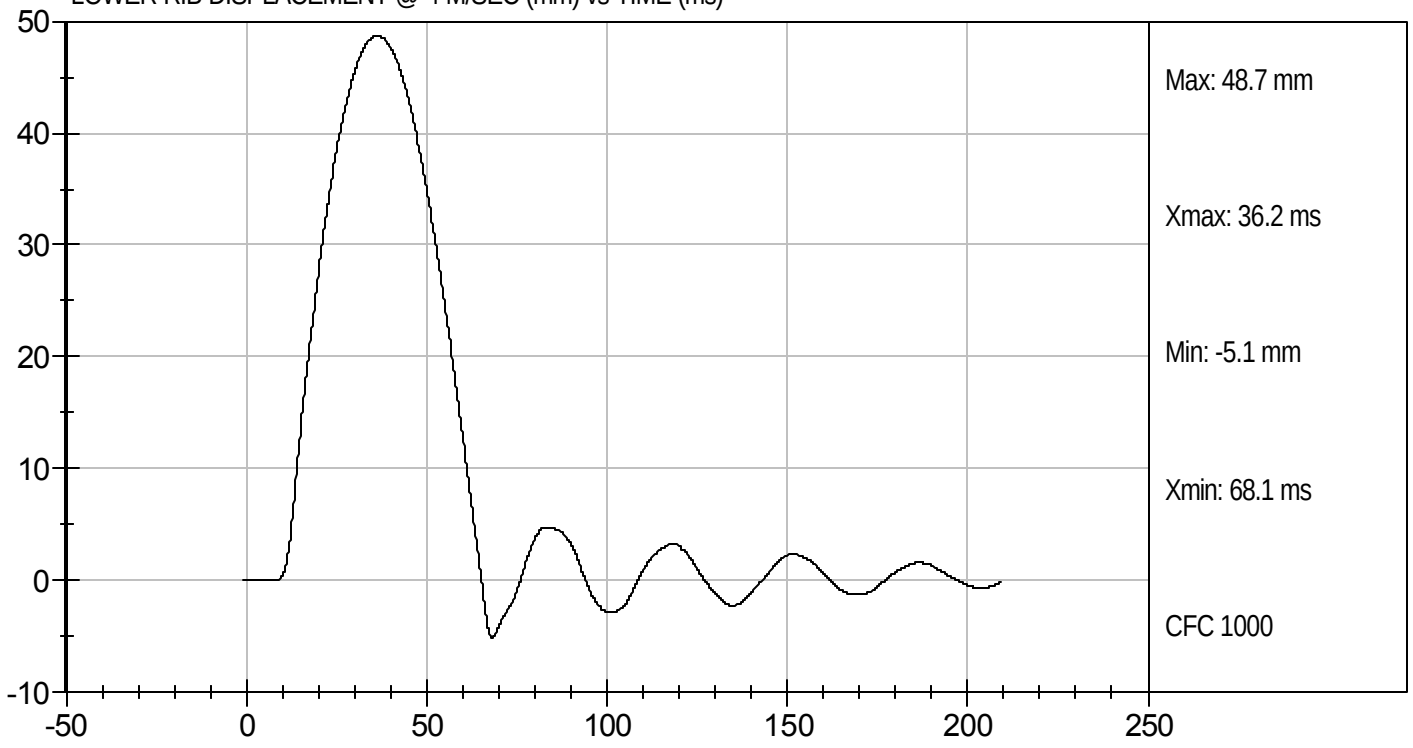
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111116
Test Date: 3/24/11

LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111117

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	22	Pass
Probe Speed	m/s	3.90 to 4.10	4.1	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.07	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	11.20	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.37	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.20	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

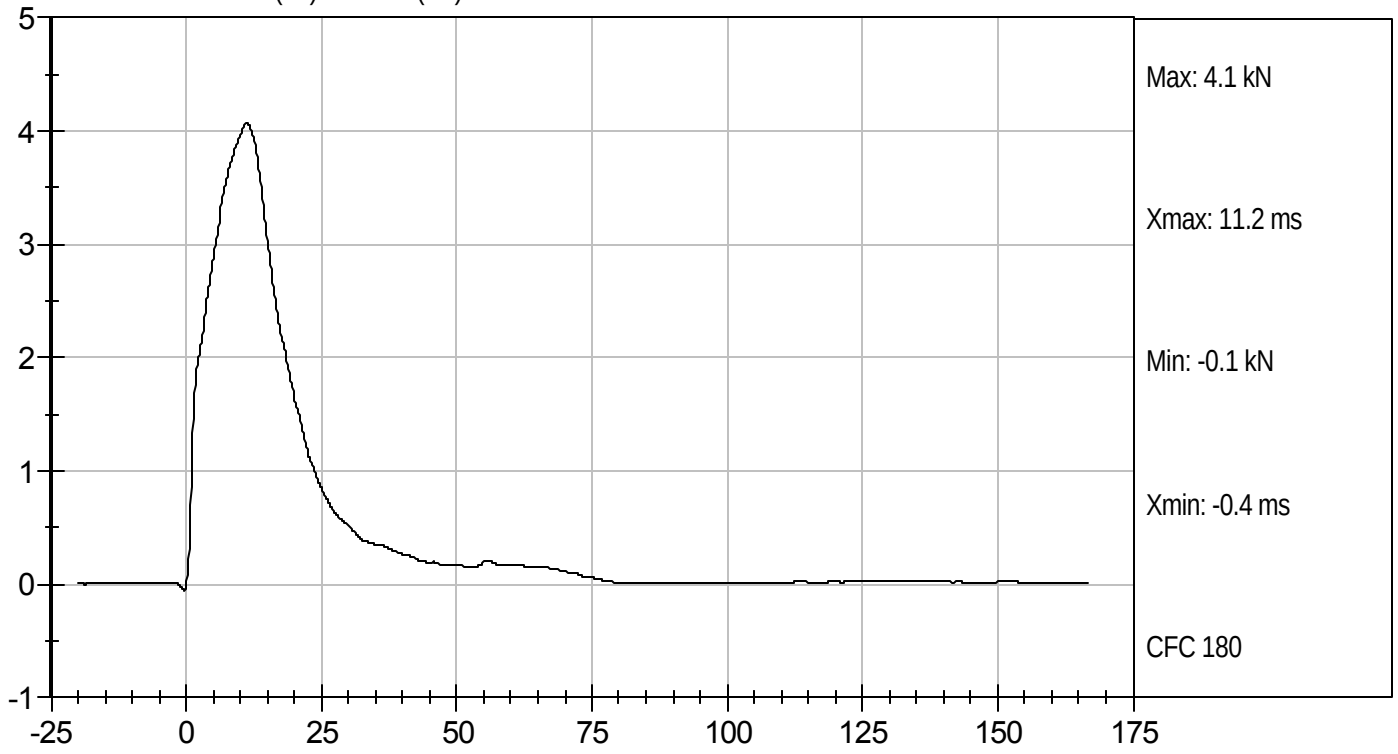
3/24/11
Test Date

David Winkelbauer
Approved By

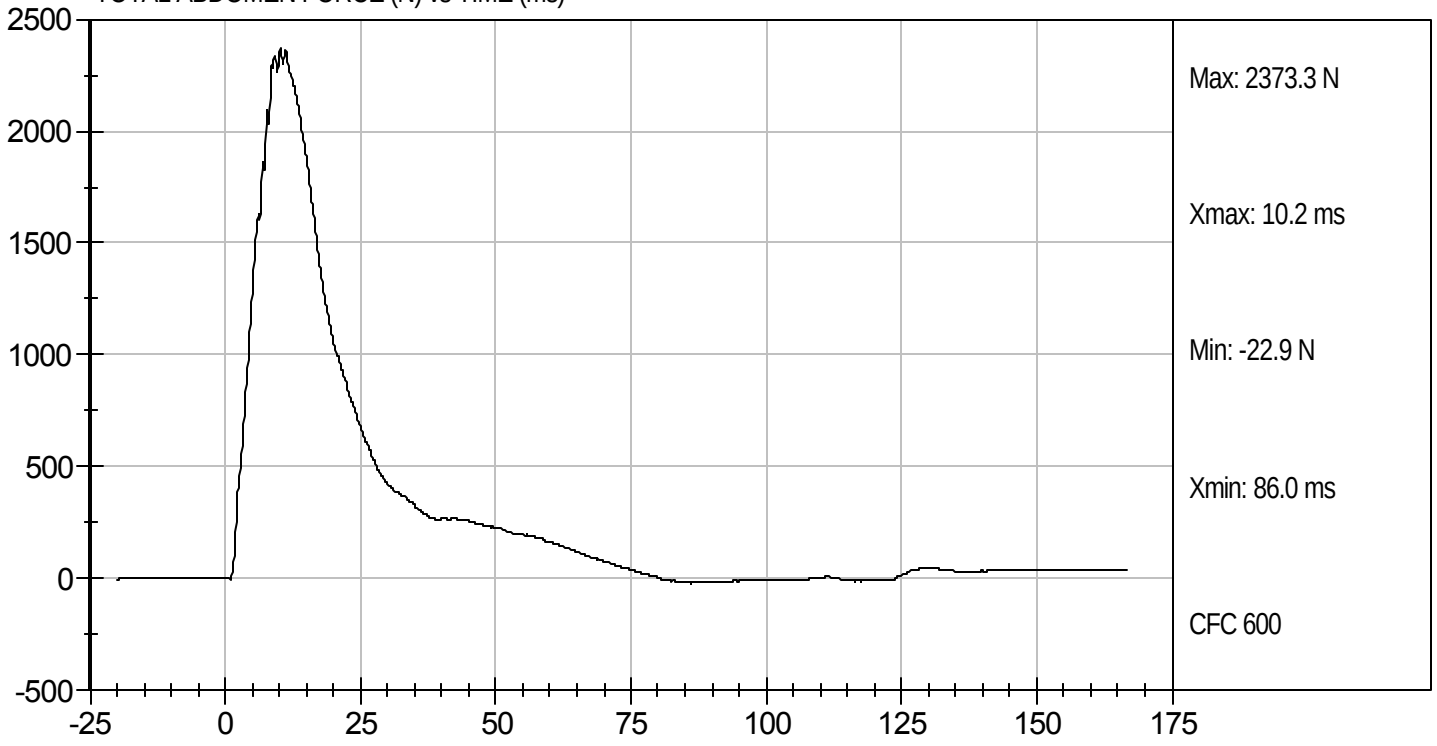
Test Desc: Abdomen Impact
Component ID: D111117

Test Date: 3/24/11
Velocity: 13.44 ft/s, 4.1 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111118

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	28	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.00	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.41	Pass
	27 ms	m/s	-6.50 to -5.80	-5.81	Pass
	30 ms	m/s	>= -6.5	-6.07	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.5	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	48.5	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	48	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

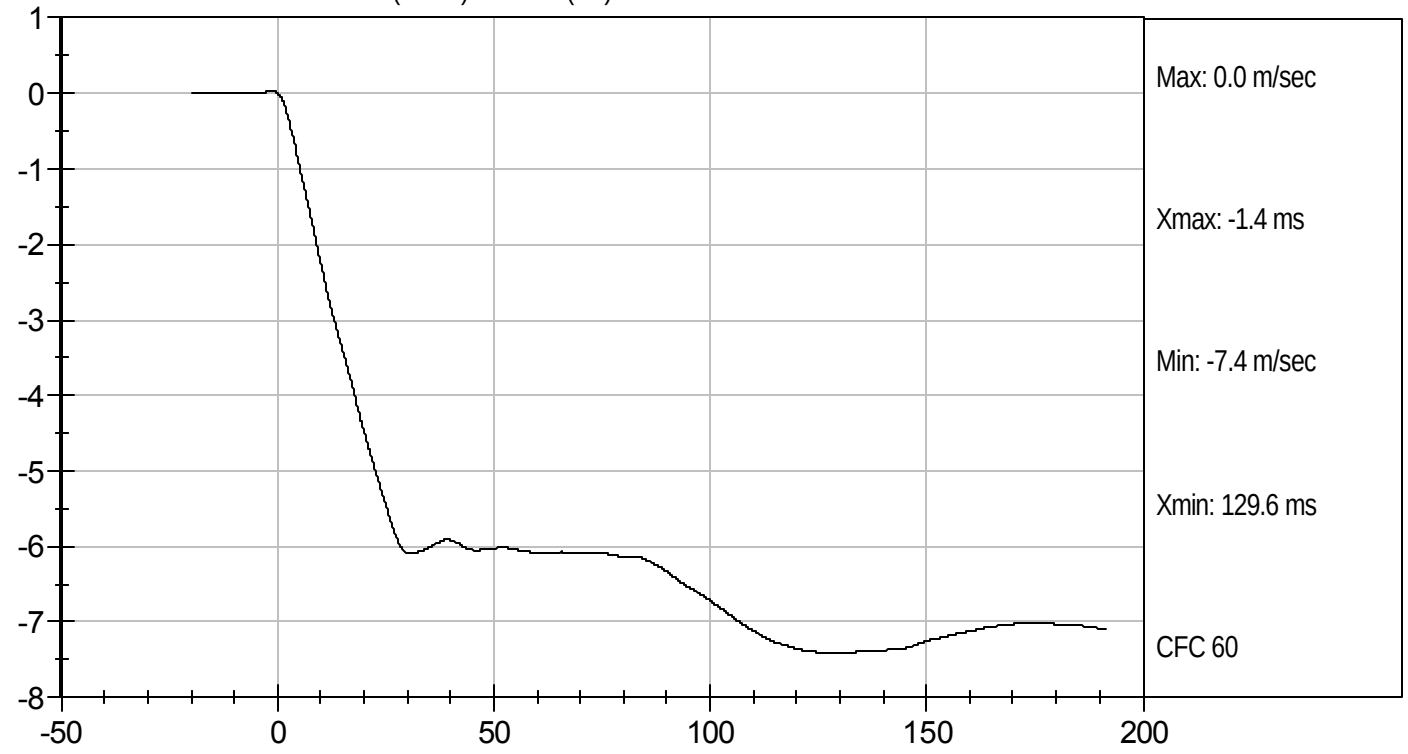
3/23/11
Test Date

David Winkelbauer
Approved By

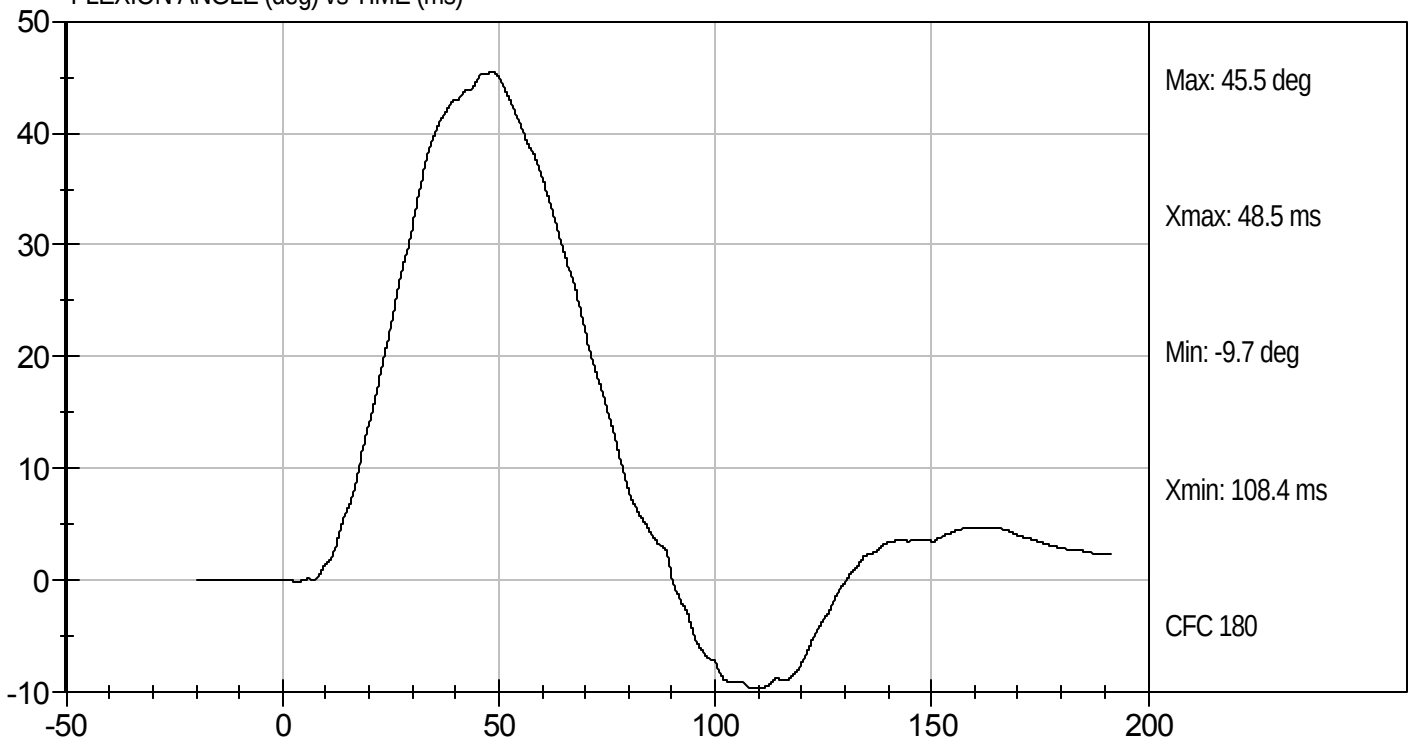
Test Desc: Lumbar Bending
Component ID: D111118

Test Date: 3/23/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

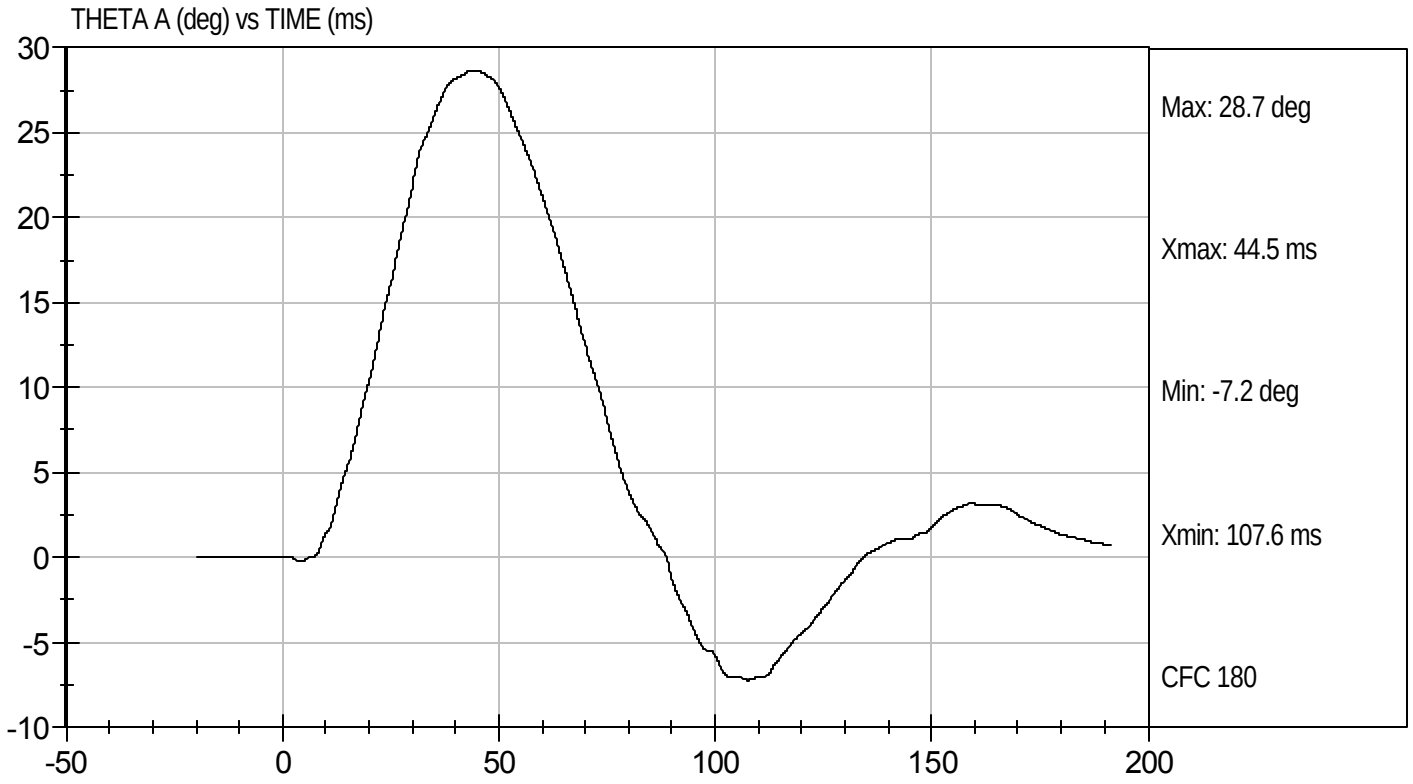


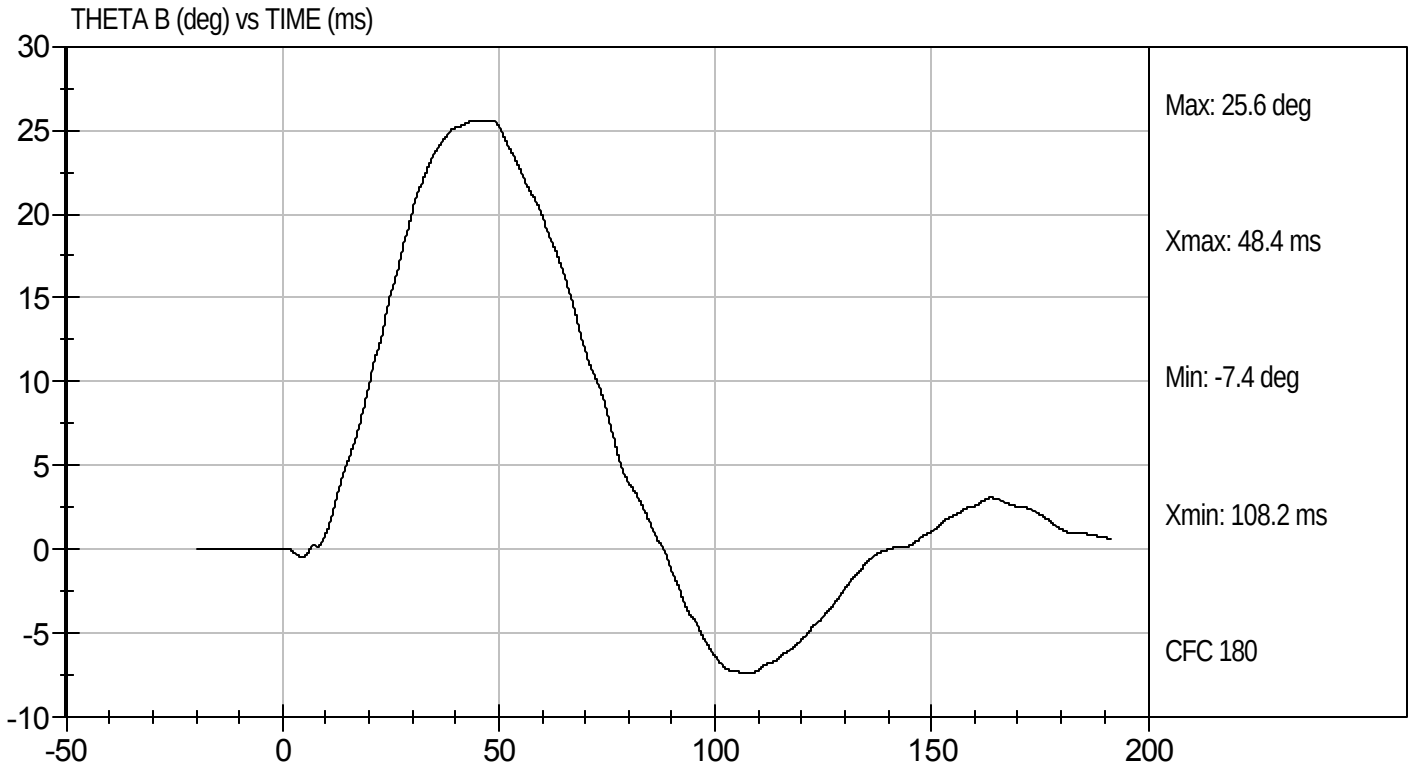
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D111118

Test Date: 3/23/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111119

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.75	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.50	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.41	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.30	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

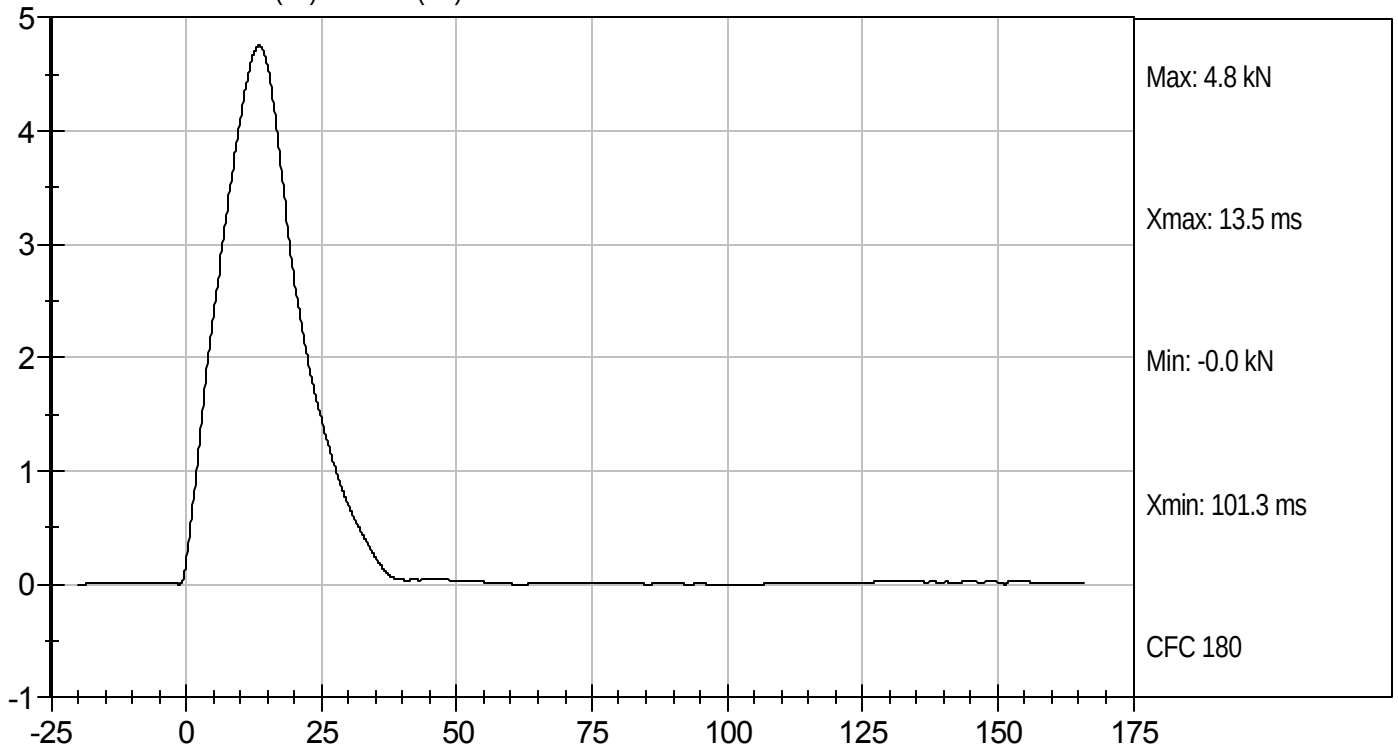
3/24/11
Test Date

David Winkelbauer
Approved By

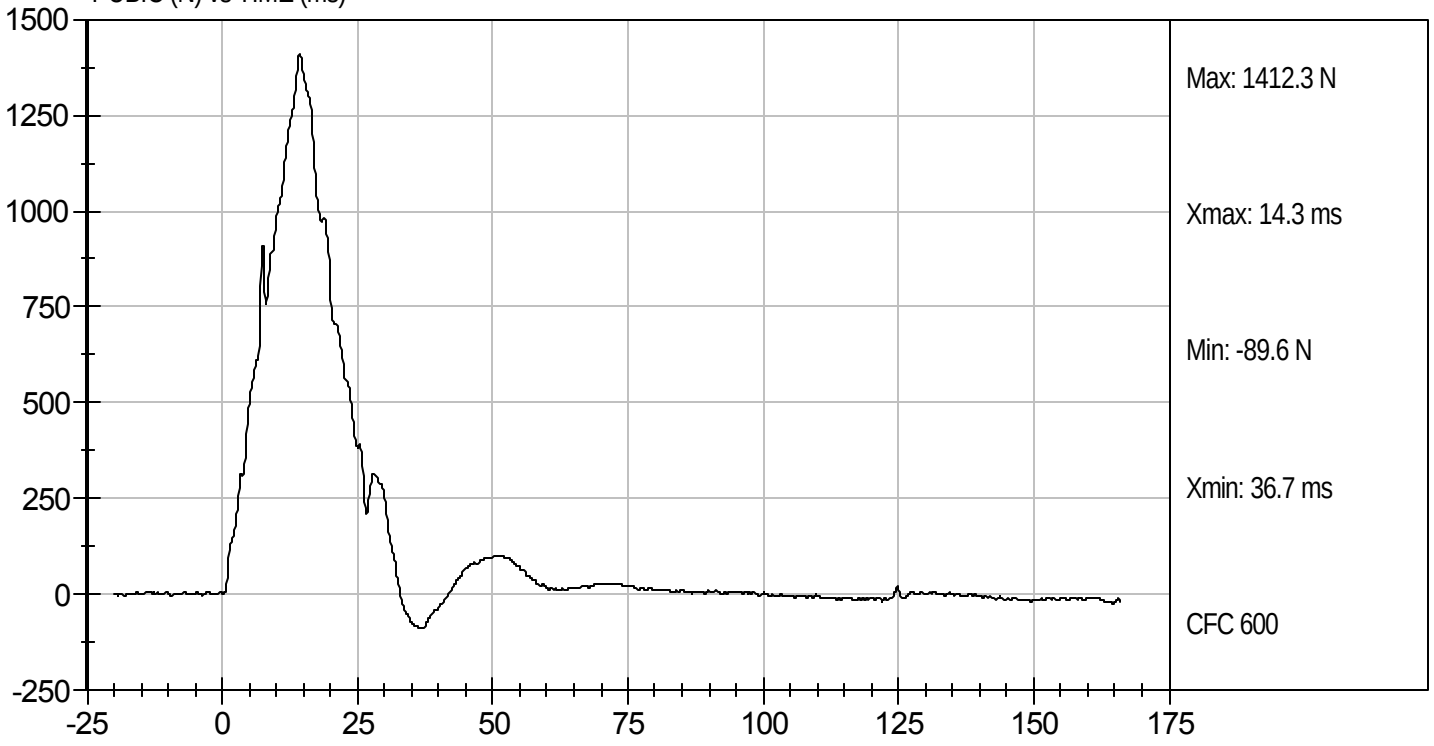
Test Desc: Pelvis Impact
Component ID: D111119

Test Date: 3/24/11
Velocity: 14.25 ft/s, 4.34 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



PUBIC (N) vs TIME (ms)



MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111110

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.14	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.1	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.0	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.0	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

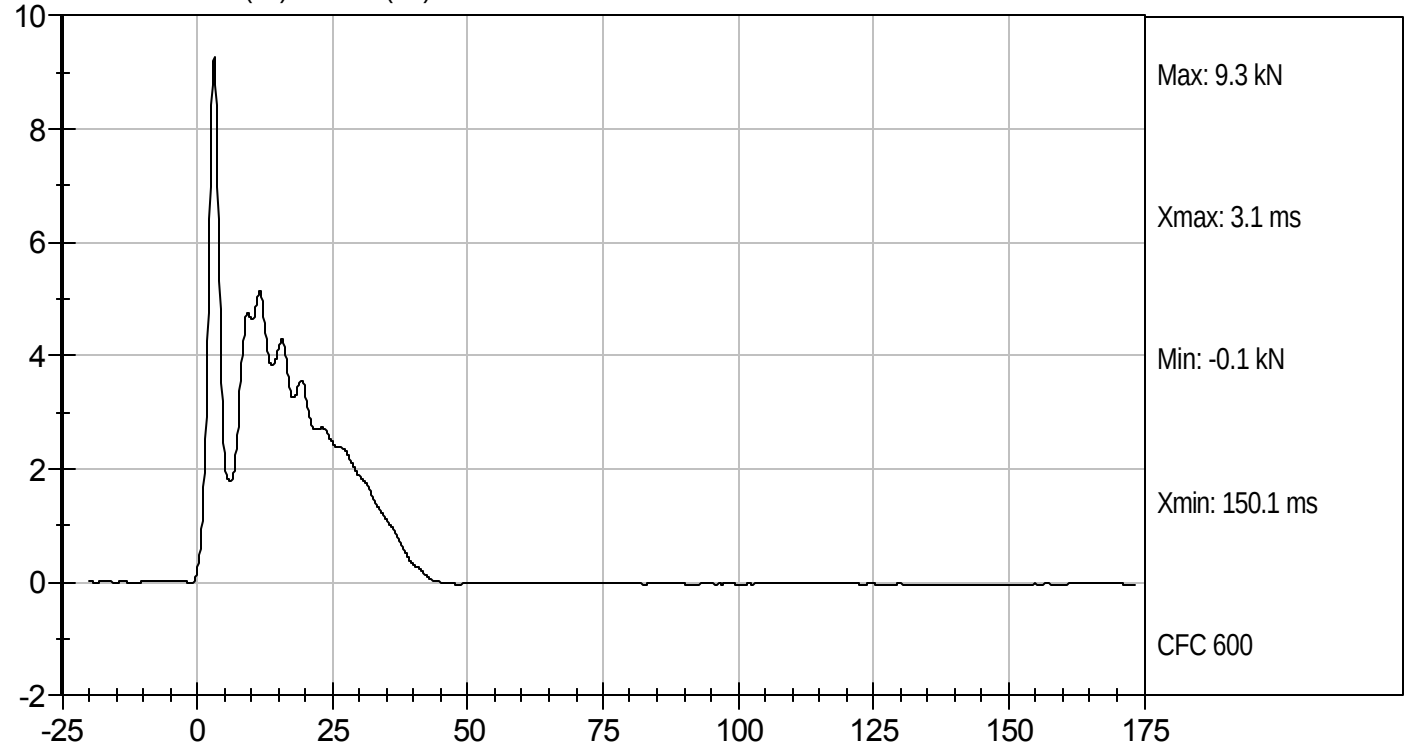
3/24/11
Test Date

David Winkelbauer
Approved By

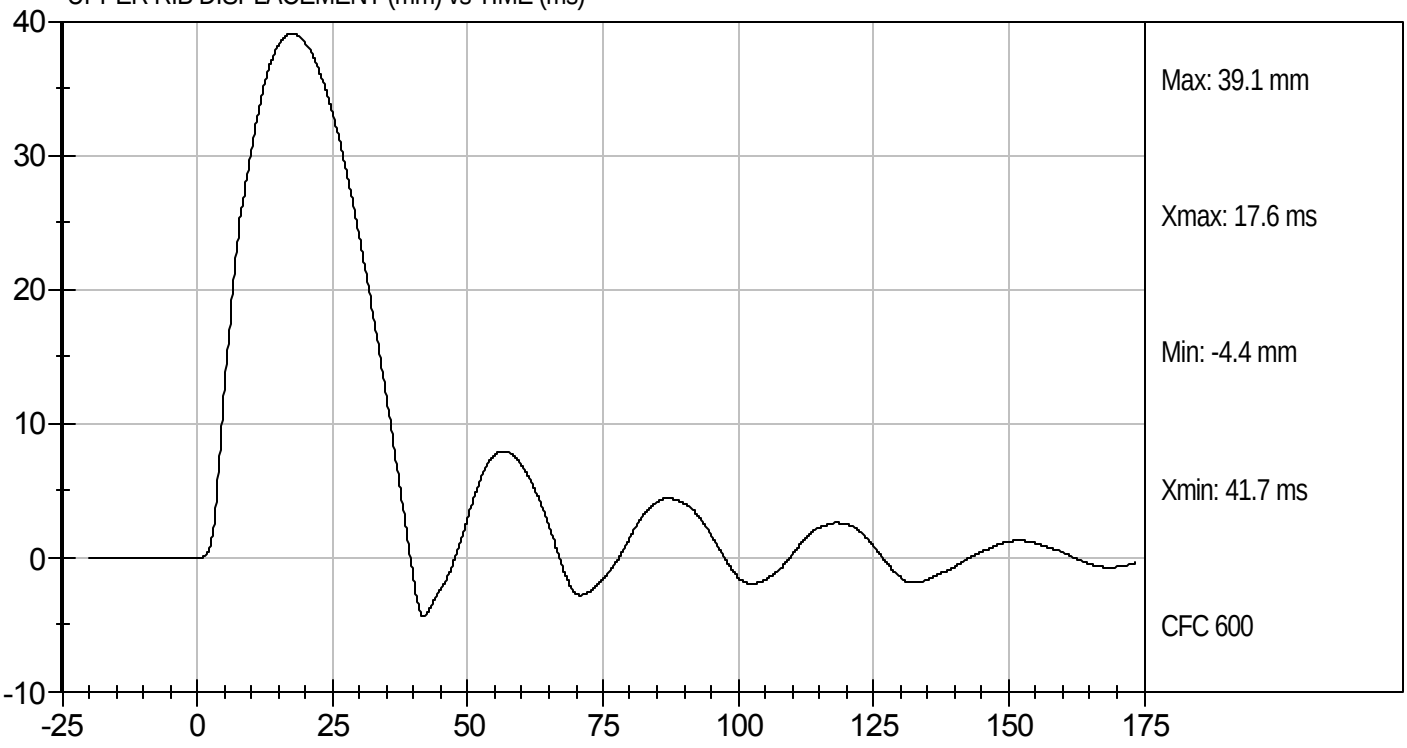
Test Desc: Thorax Impact
Component ID: D111110

Test Date: 3/24/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



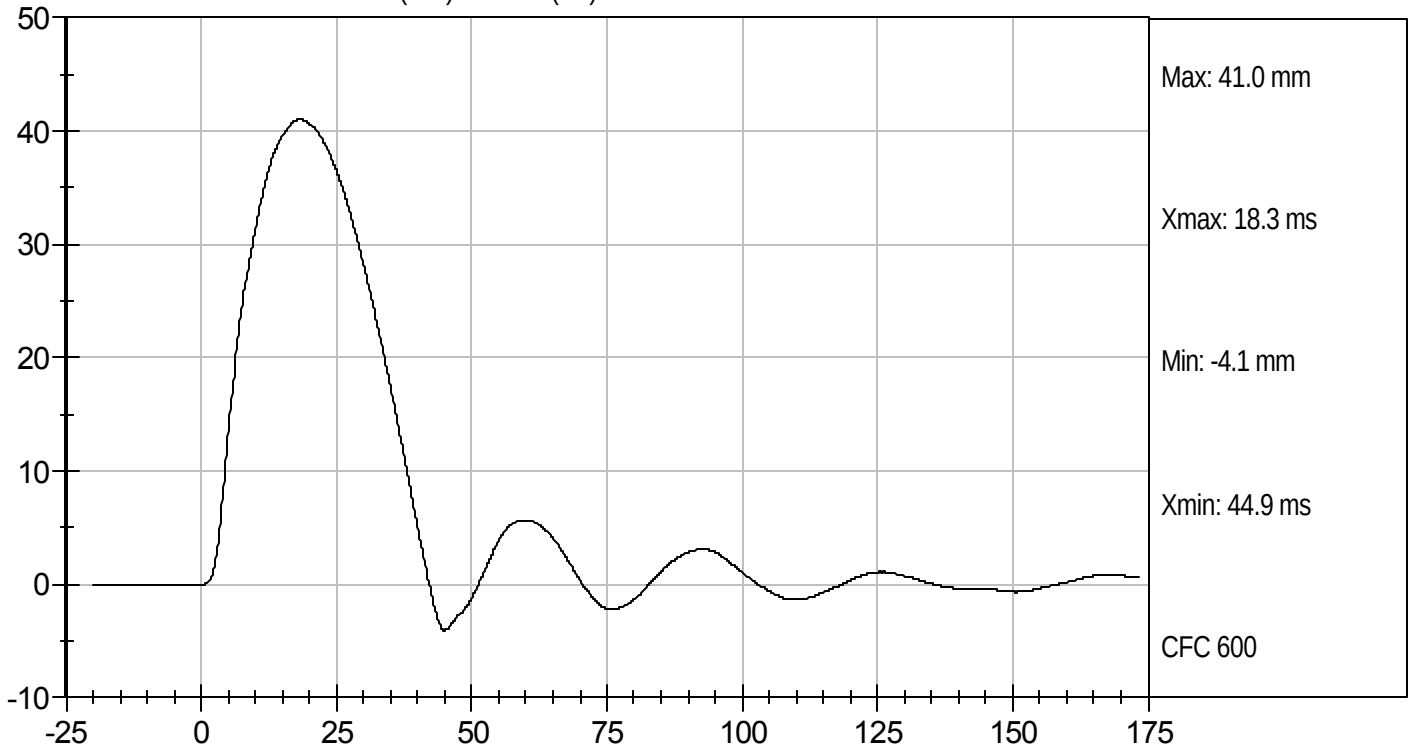
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



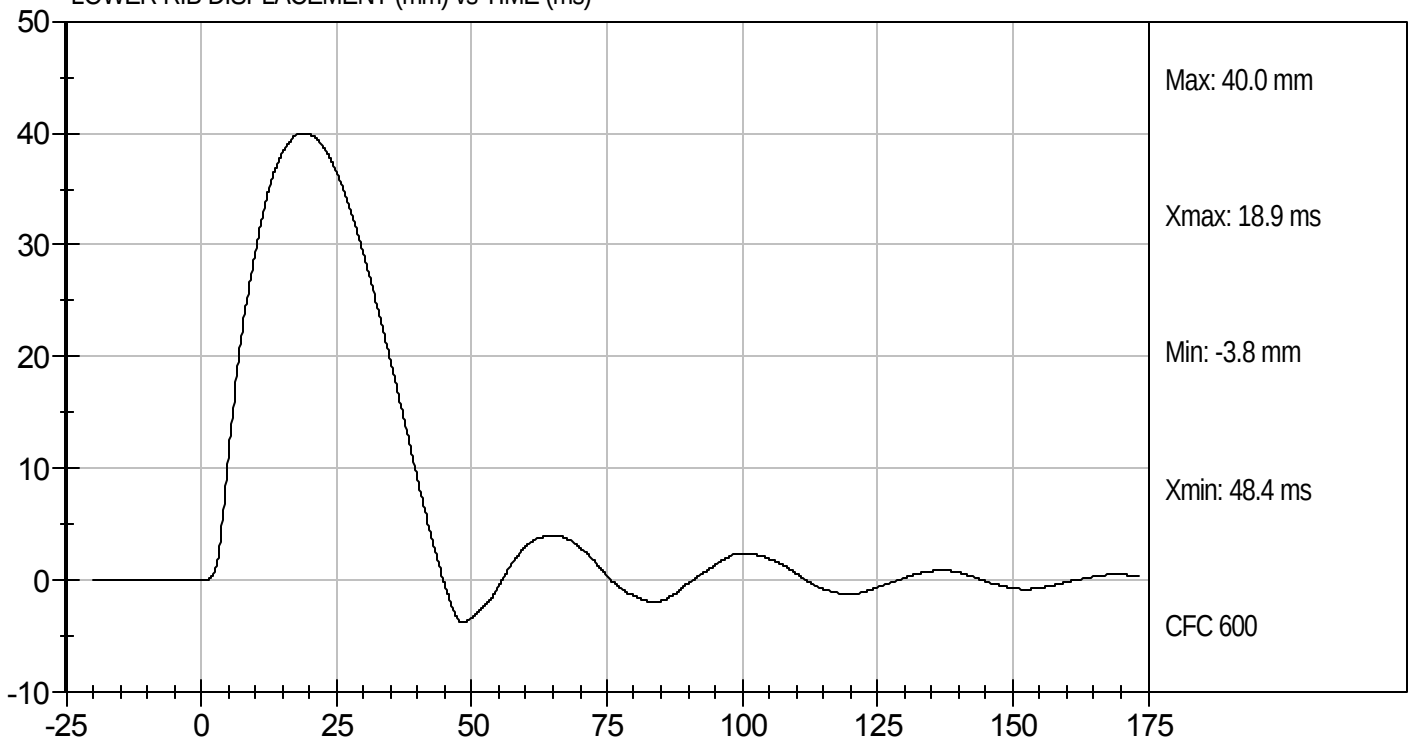
Test Desc: Thorax Impact
Component ID: D111110

Test Date: 3/24/11
Velocity: 18.32 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D111141

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	125 to 155	150	Pass
Peak Lateral Acceleration	G's	+/- 15	-7.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

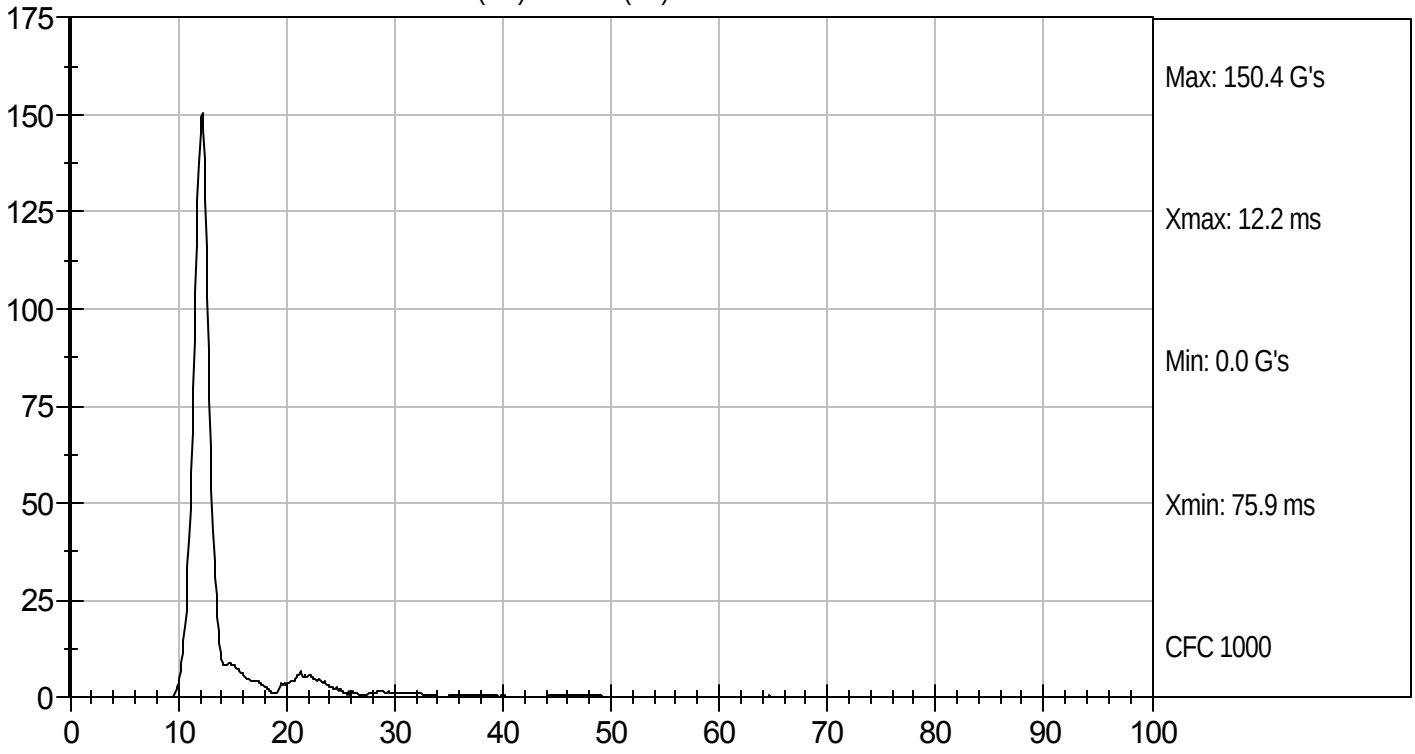
3/25/11
Test Date

David Winkelbauer
Approved By

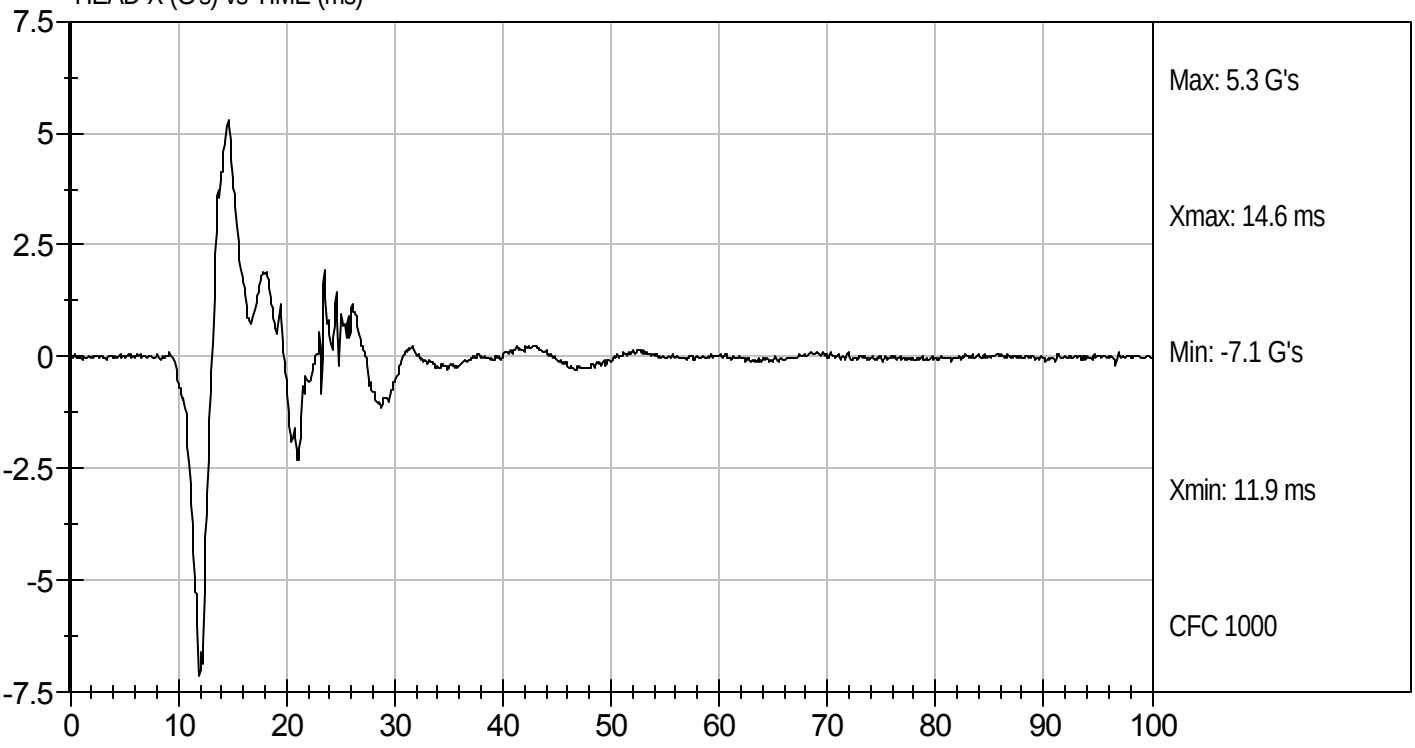
Test Desc: Head Drop
Component ID: D111141

Test Date: 3/25/11
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G's) vs TIME (ms)



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



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111142

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.5	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.01	Pass
	3 ms	m/s	-0.25 to -0.375	-0.32	Pass
	14 ms	m/s	-3.20 to -3.70	-3.37	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	52.5	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	60.7	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	54.5	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

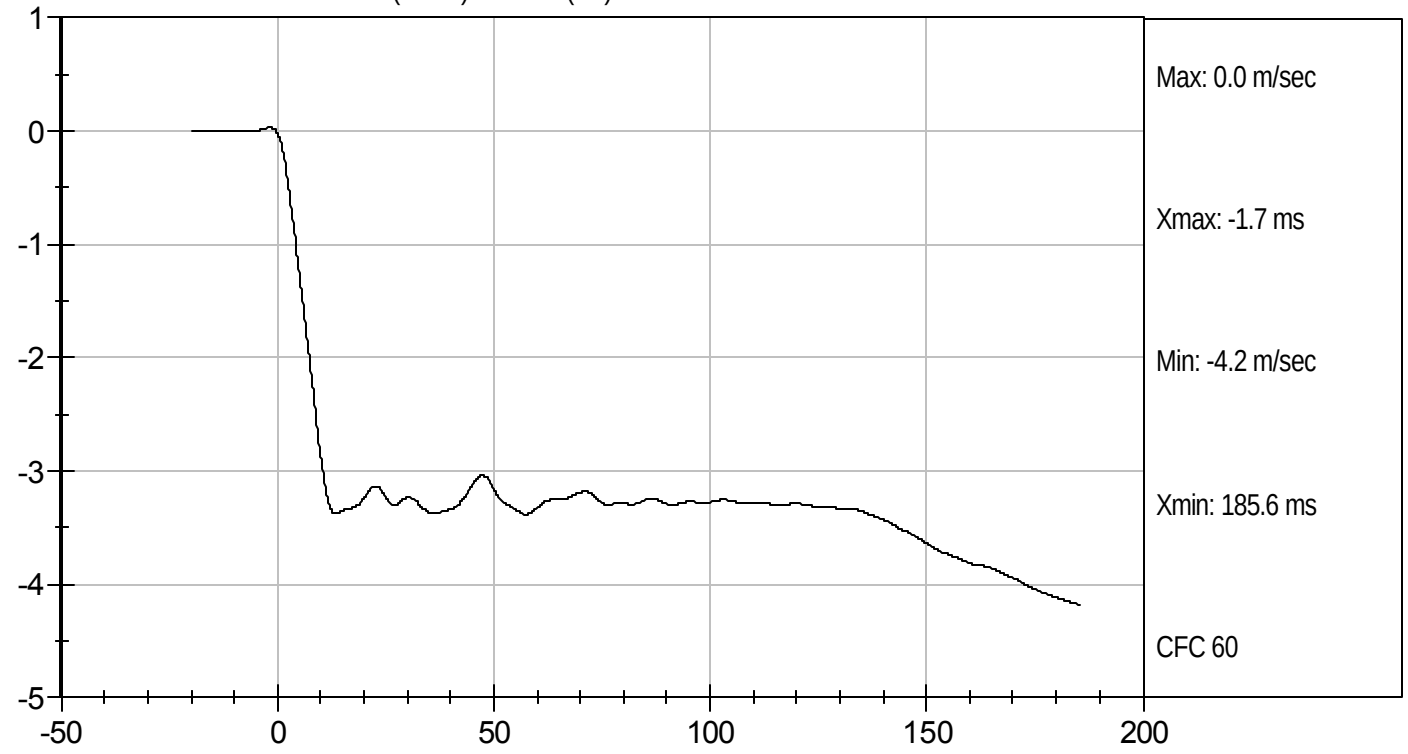
3/25/11
Test Date

David Winkelbauer
Approved By

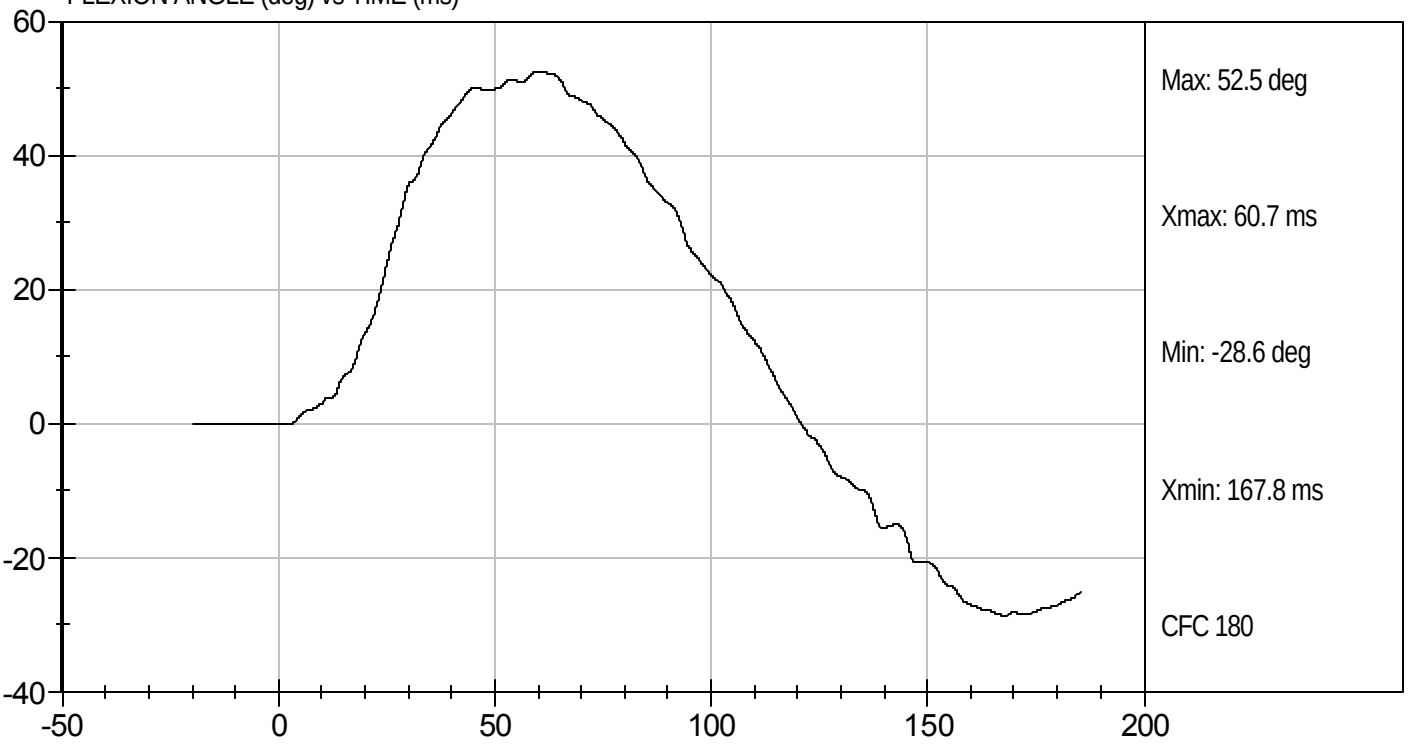
Test Desc: Neck Bending
Component ID: D111142

Test Date: 3/25/11
Velocity: 11.42 ft/s, 3.5 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

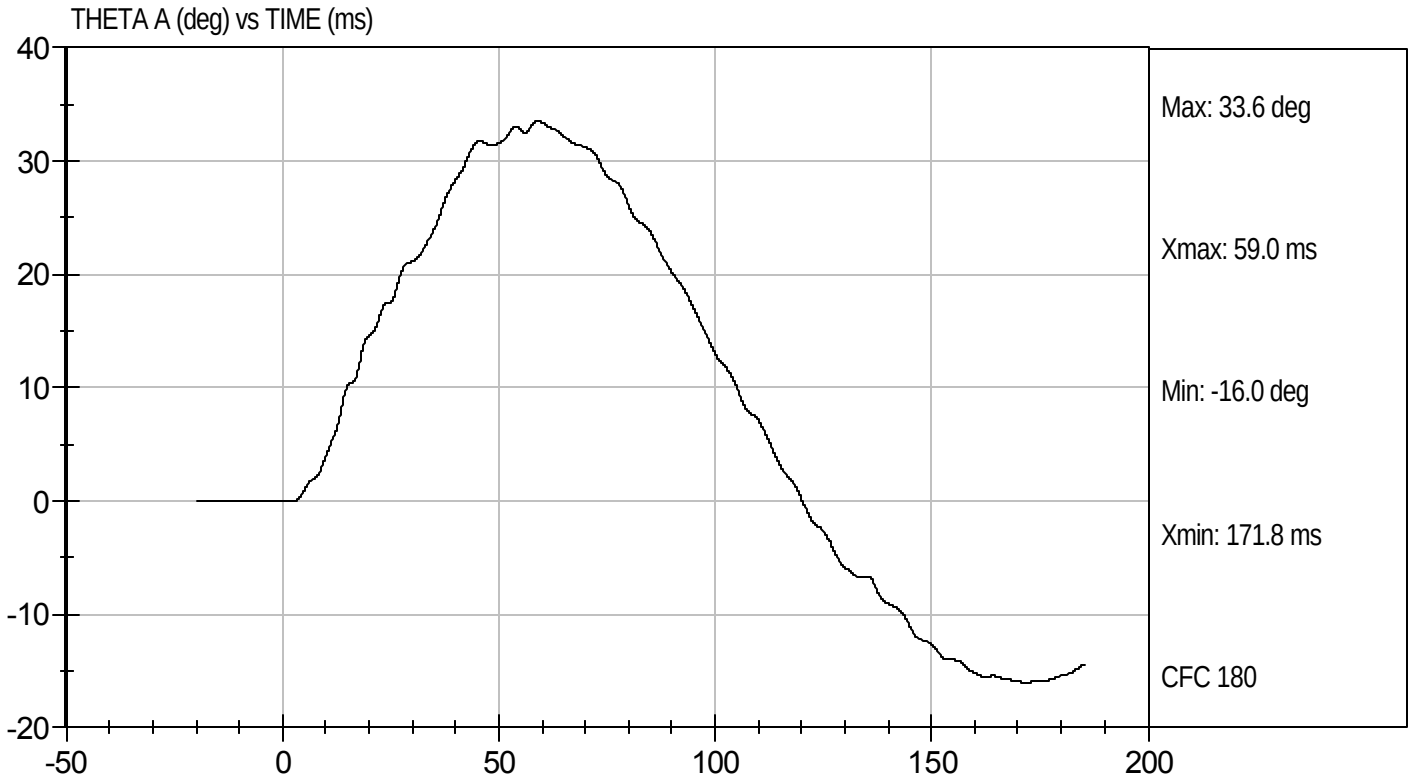


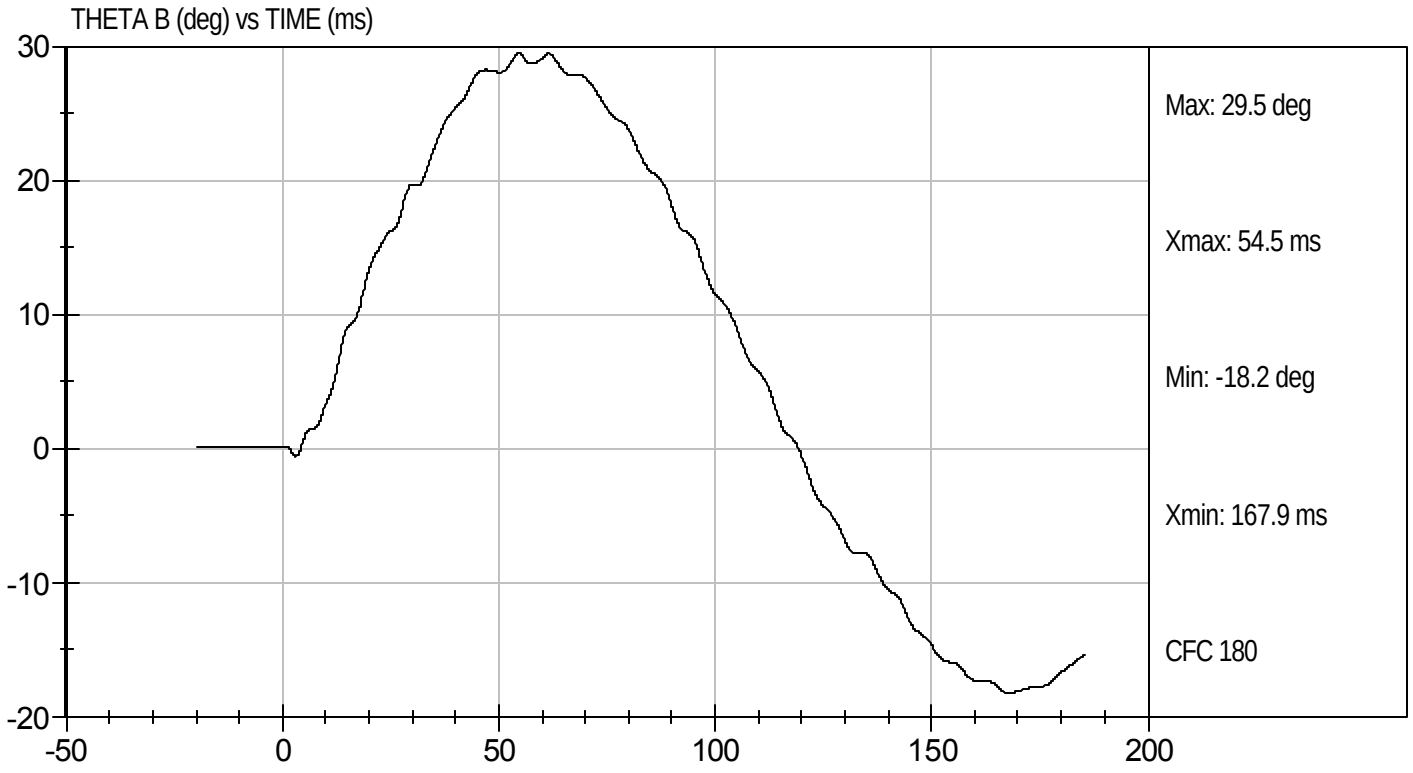
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D111142

Test Date: 3/25/11
Velocity: 11.42 ft/s, 3.5 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111143

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	15	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.6	Pass
Time of Peak Shoulder Acceleration	ms	NA	18.0	Pass
		Overall Test Results		Pass

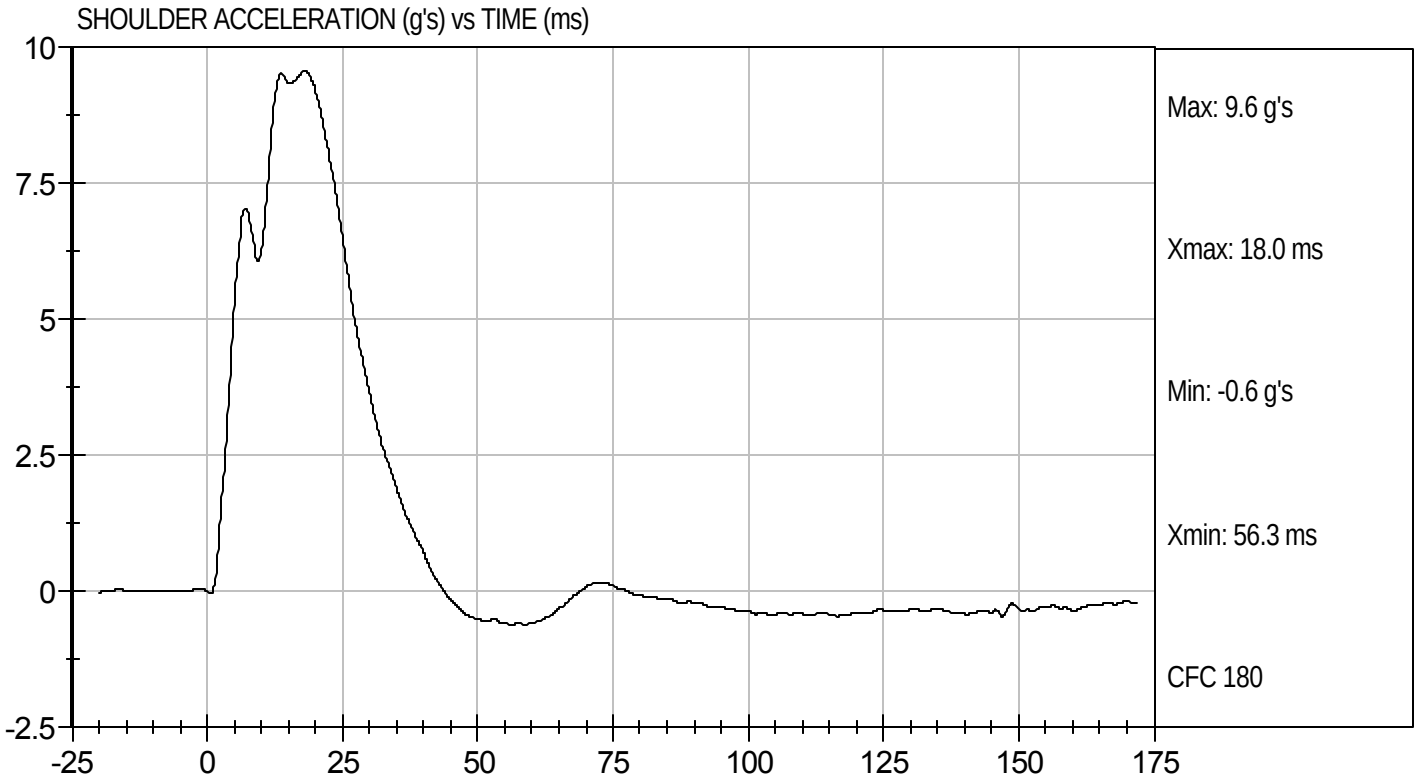
Jessica Hall
Laboratory Technician

3/28/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111143

Test Date: 3/28/11
Velocity: 14.37 ft/s, 4.4 m/s



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111144

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	19	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.3	Pass
		Overall Test Results		Pass

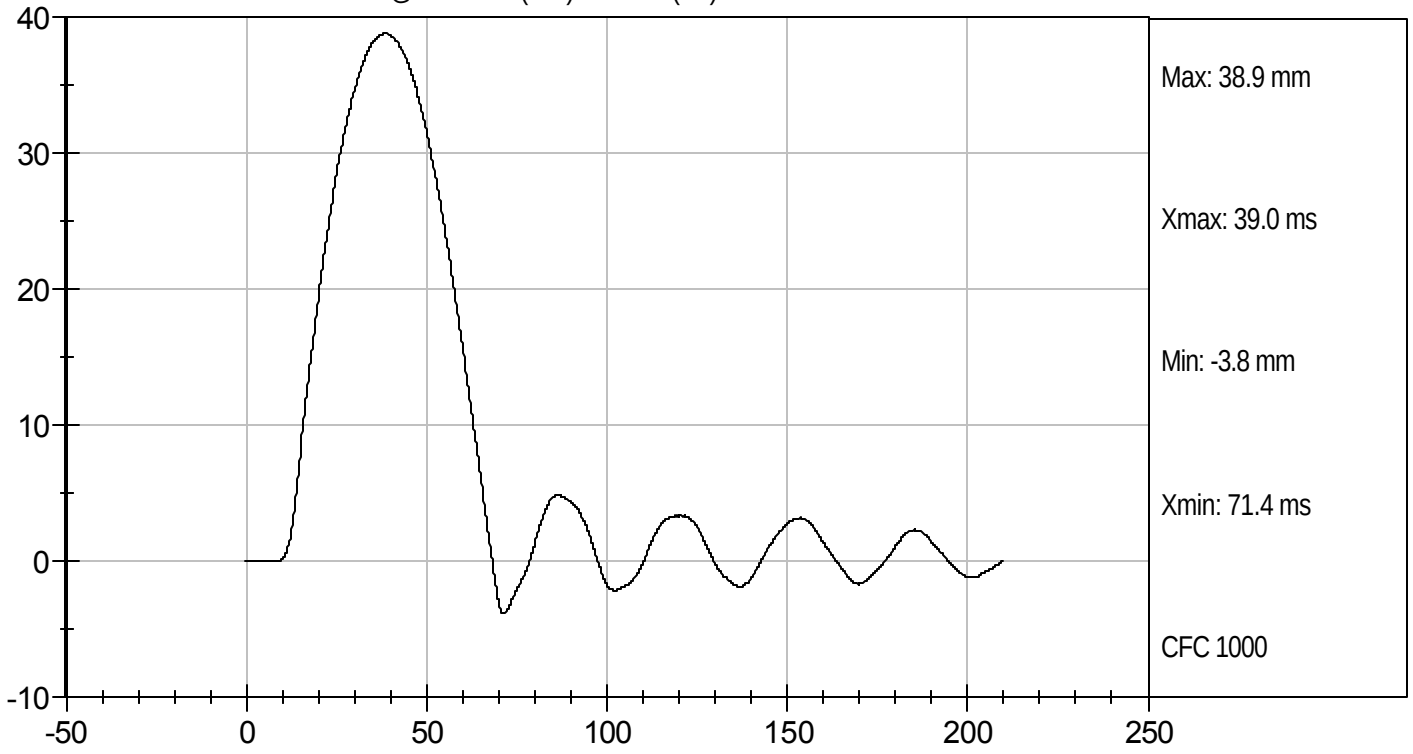
Jessica Gall
Laboratory Technician

3/25/11
Test Date

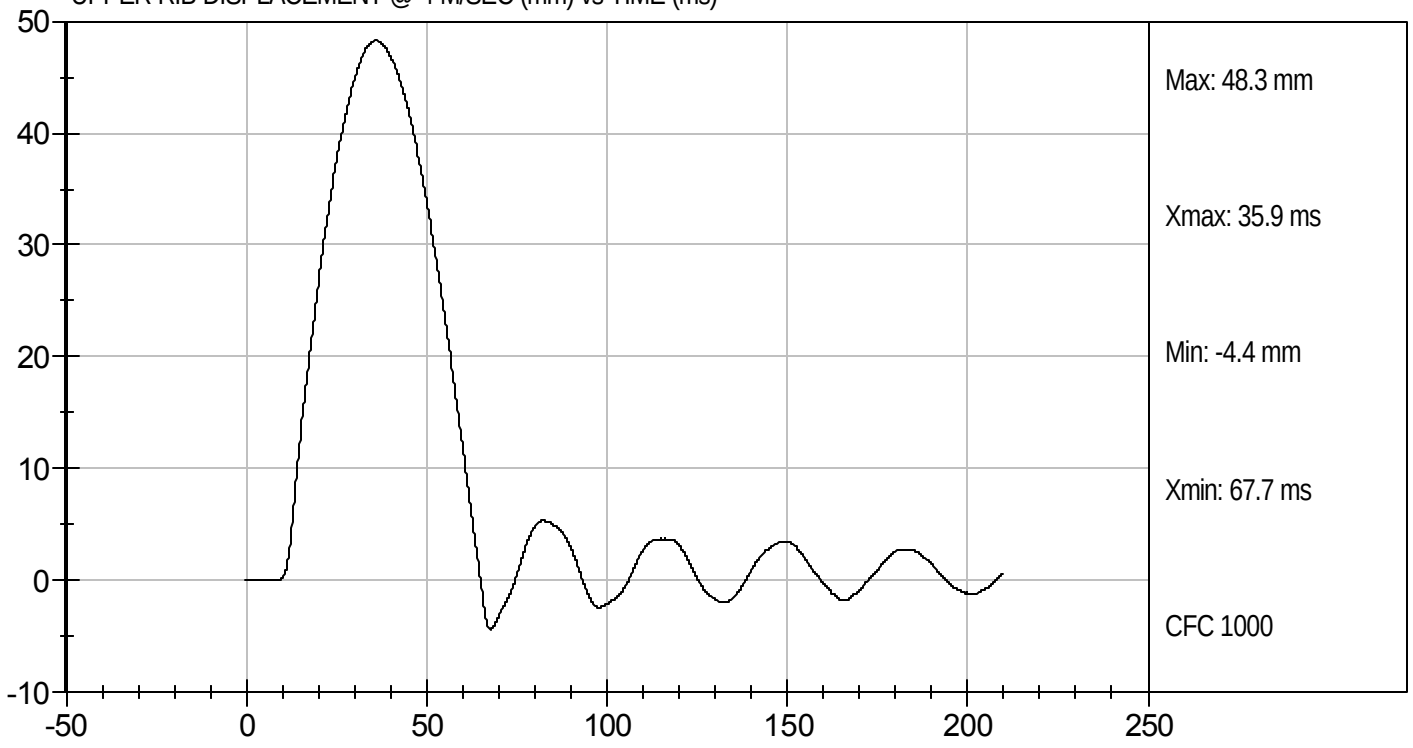
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111144
Test Date: 3/25/11

UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111145

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	19	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.4	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.8	Pass
		Overall Test Results		Pass

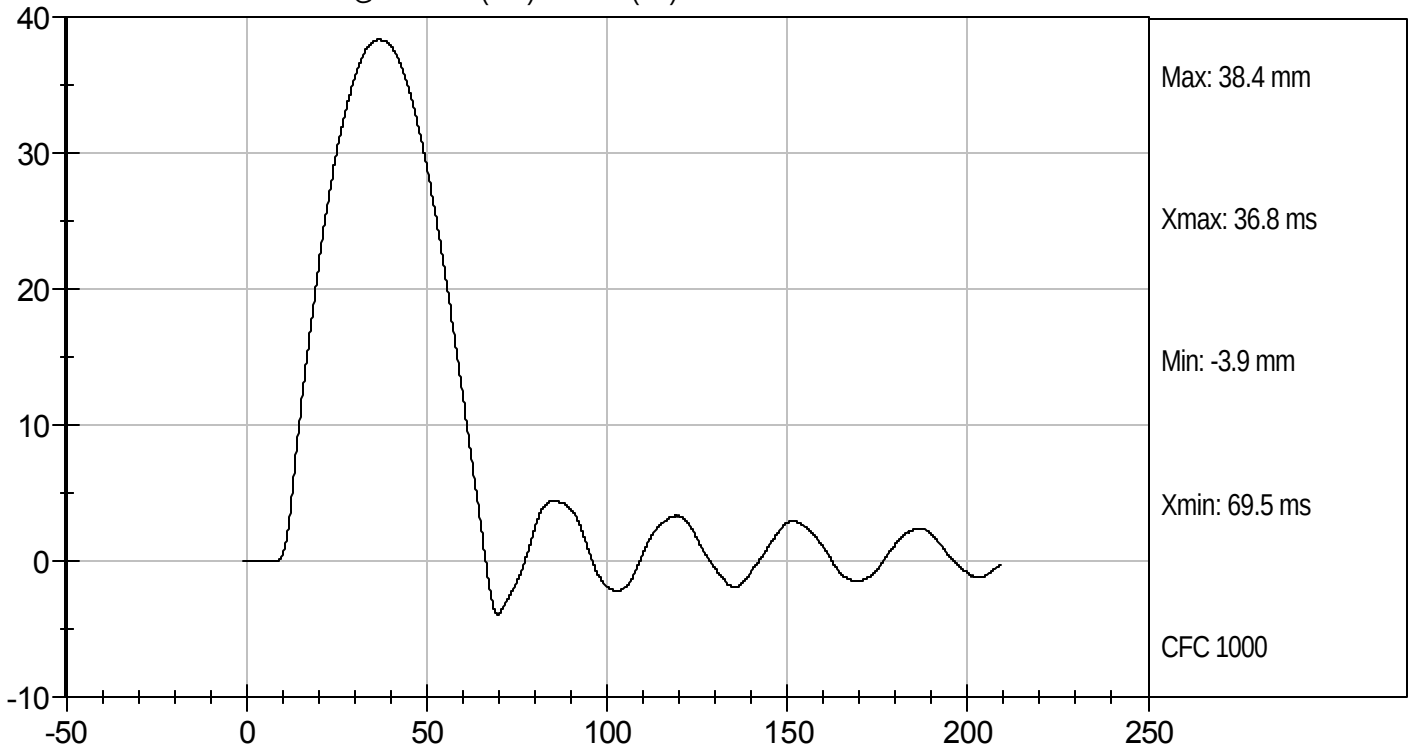
Jessica Hall
Laboratory Technician

3/25/11
Test Date

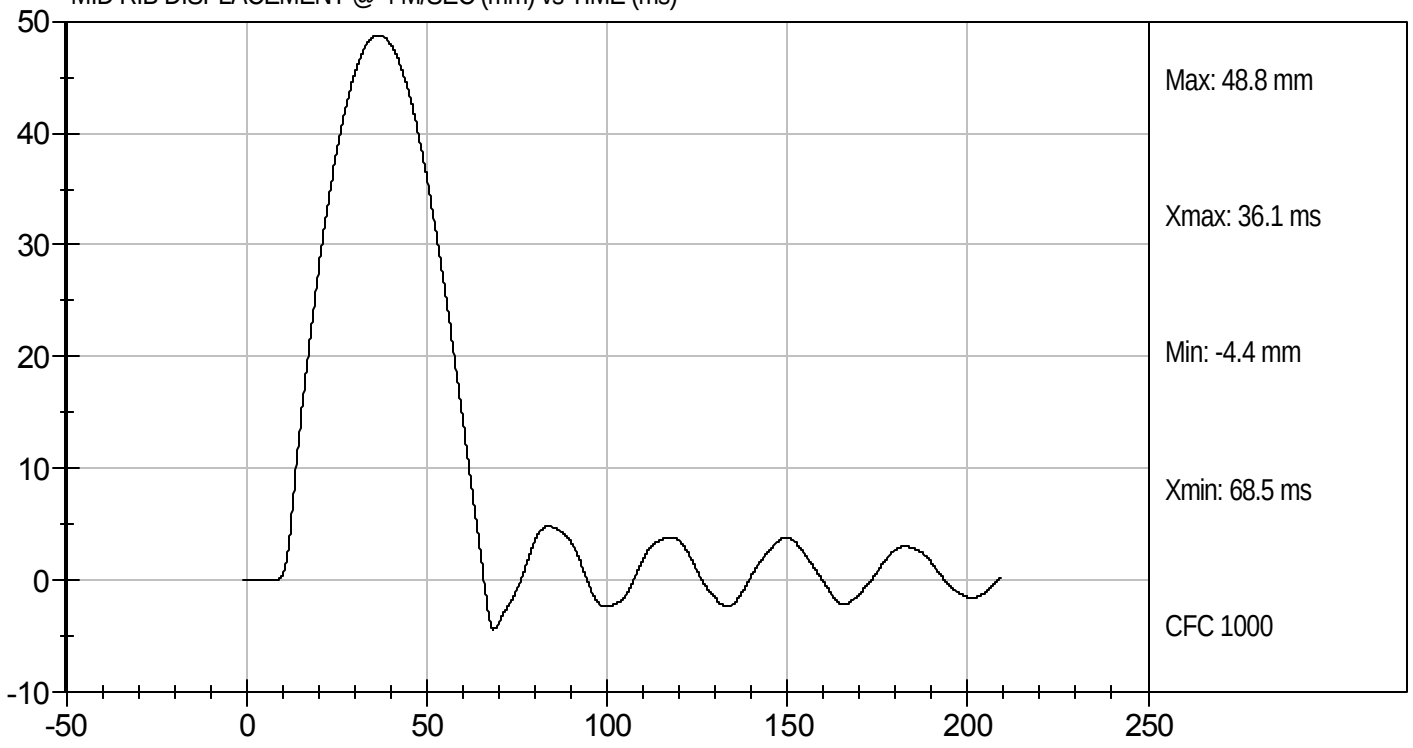
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111145
Test Date: 3/25/11

MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111146

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	19	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.4	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.5	Pass
		Overall Test Results		Pass

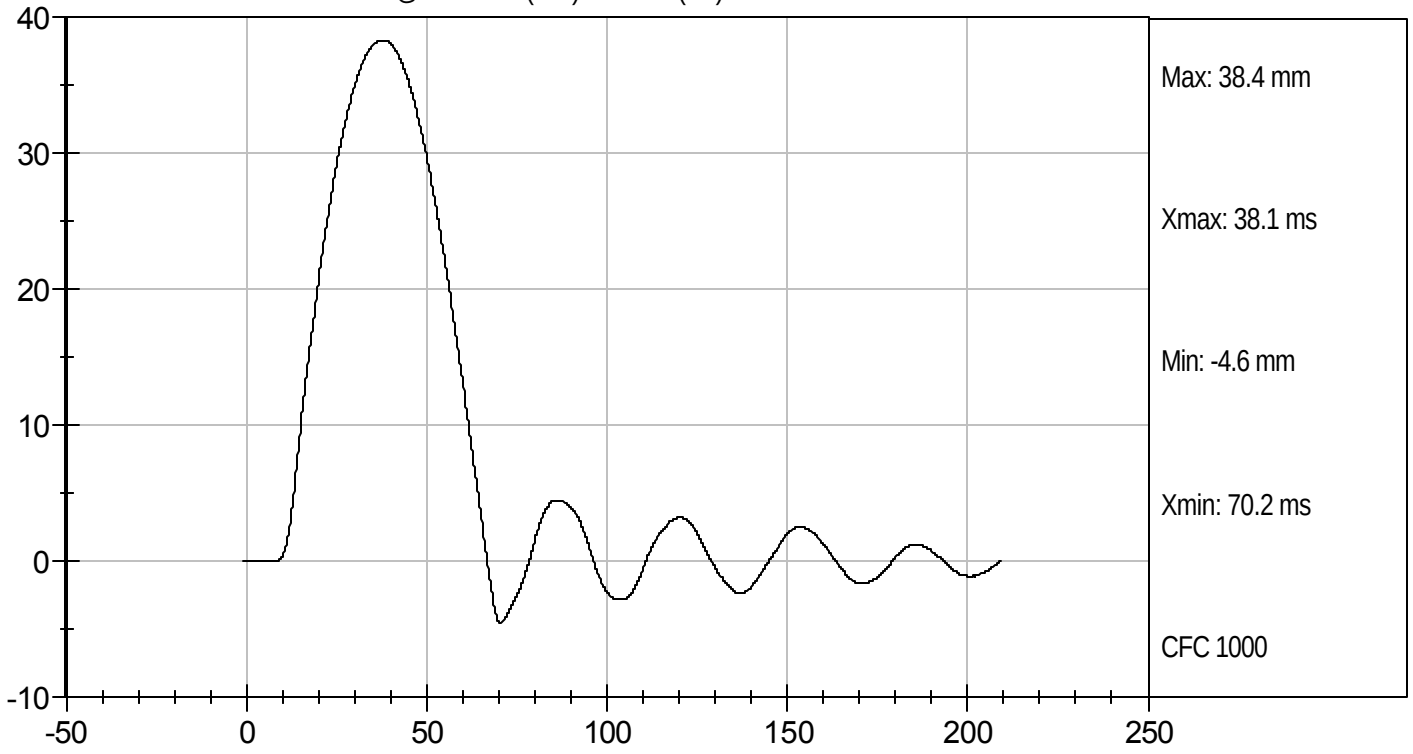
Jessica Gall
Laboratory Technician

3/25/11
Test Date

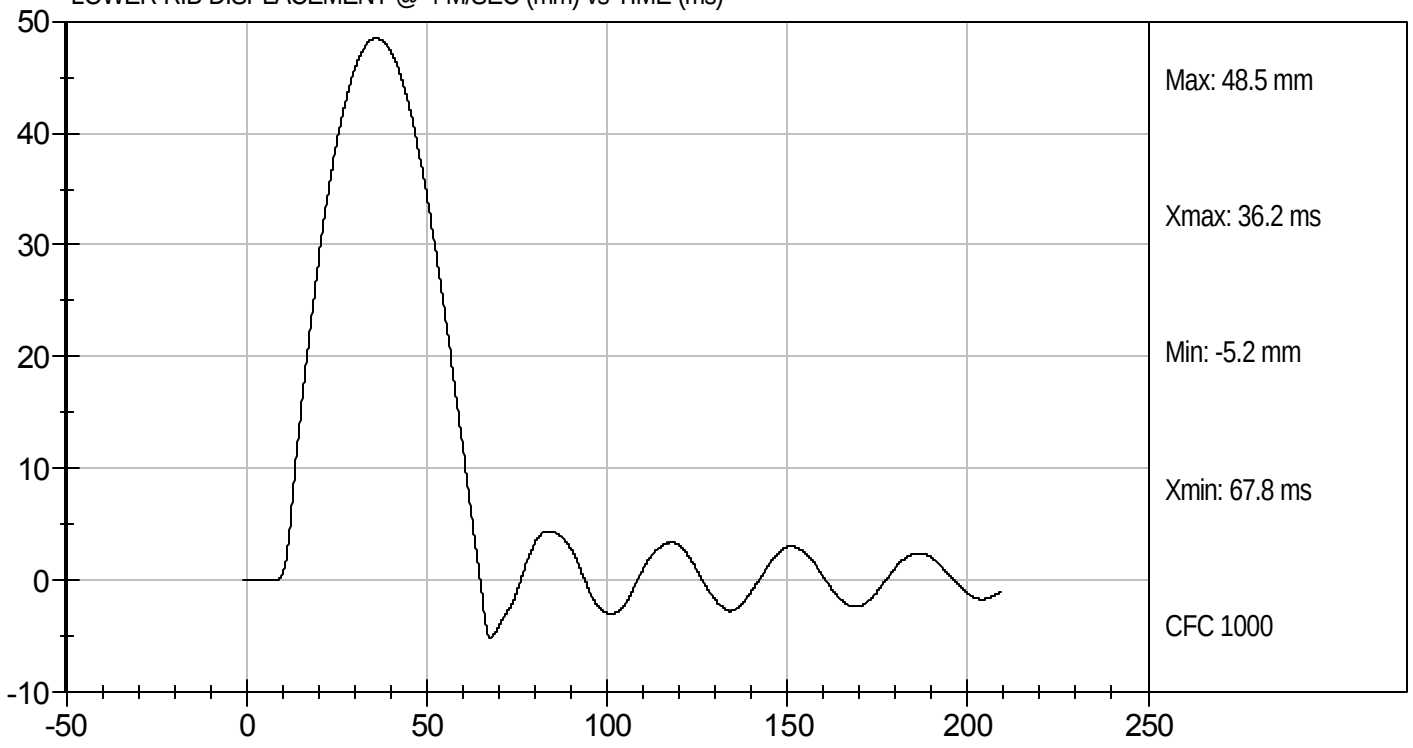
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111146
Test Date: 3/25/11

LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111147

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	15	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.14	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.70	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.50	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.20	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

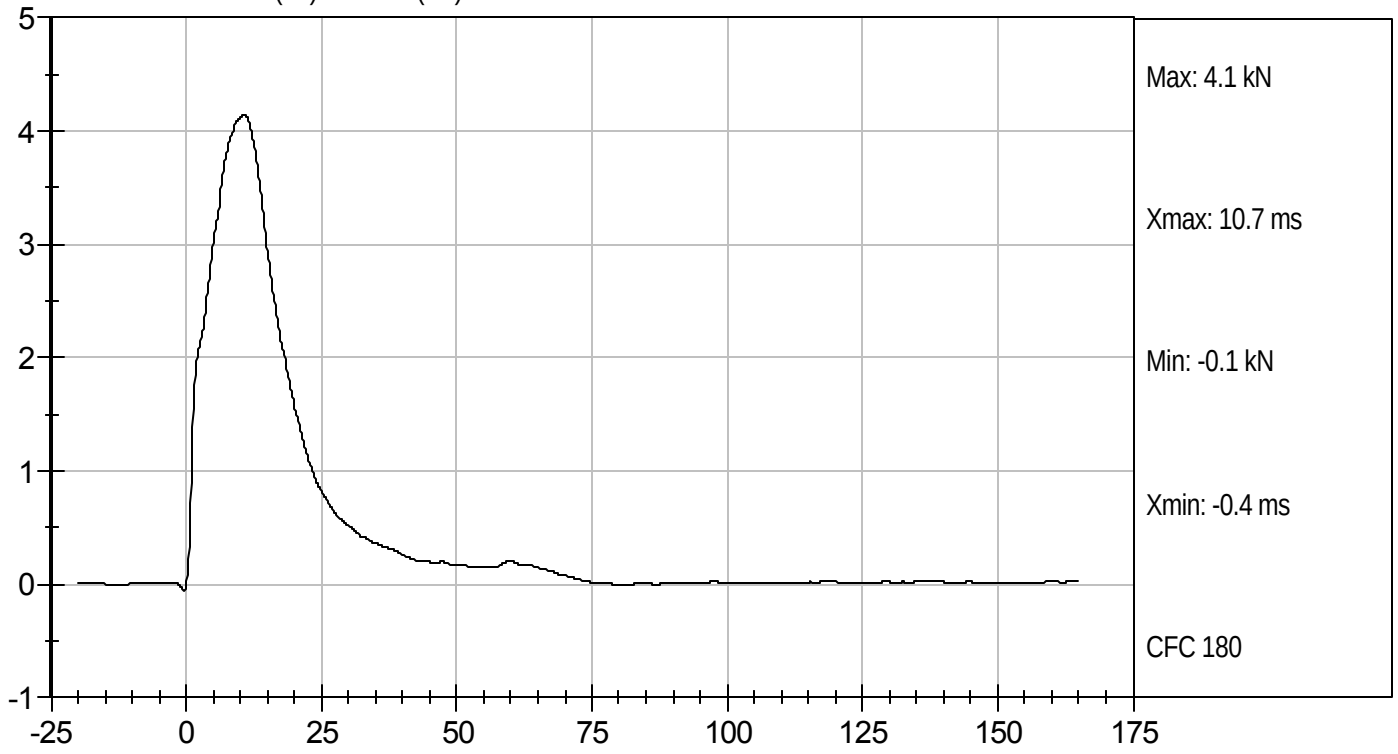
3/28/11
Test Date

David Winkelbauer
Approved By

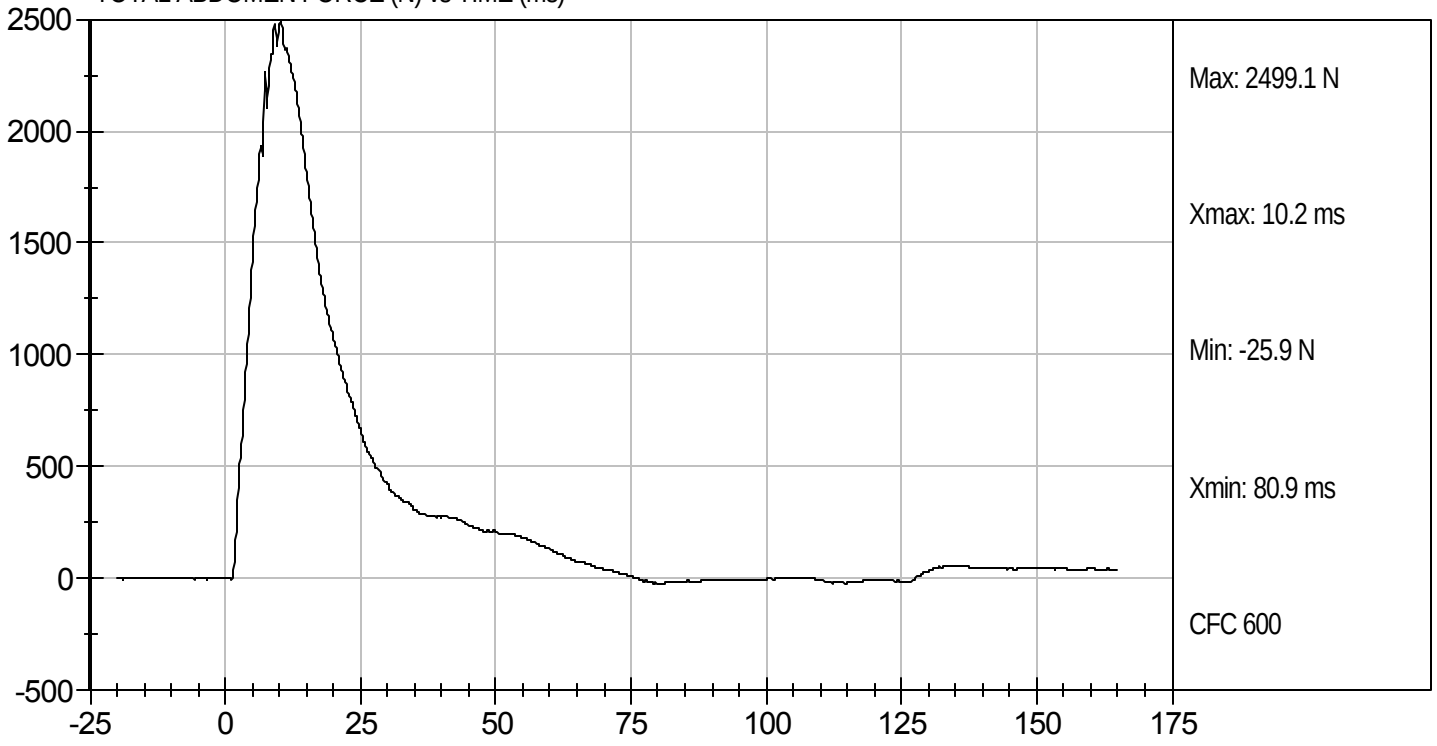
Test Desc: Abdomen Impact
Component ID: D111147

Test Date: 3/28/11
Velocity: 13.33 ft/s, 4.06 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111148

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	20	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.02	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.42	Pass
	27 ms	m/s	-6.50 to -5.80	-5.99	Pass
	30 ms	m/s	>= -6.5	-6.12	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.0	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	44.2	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	44	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

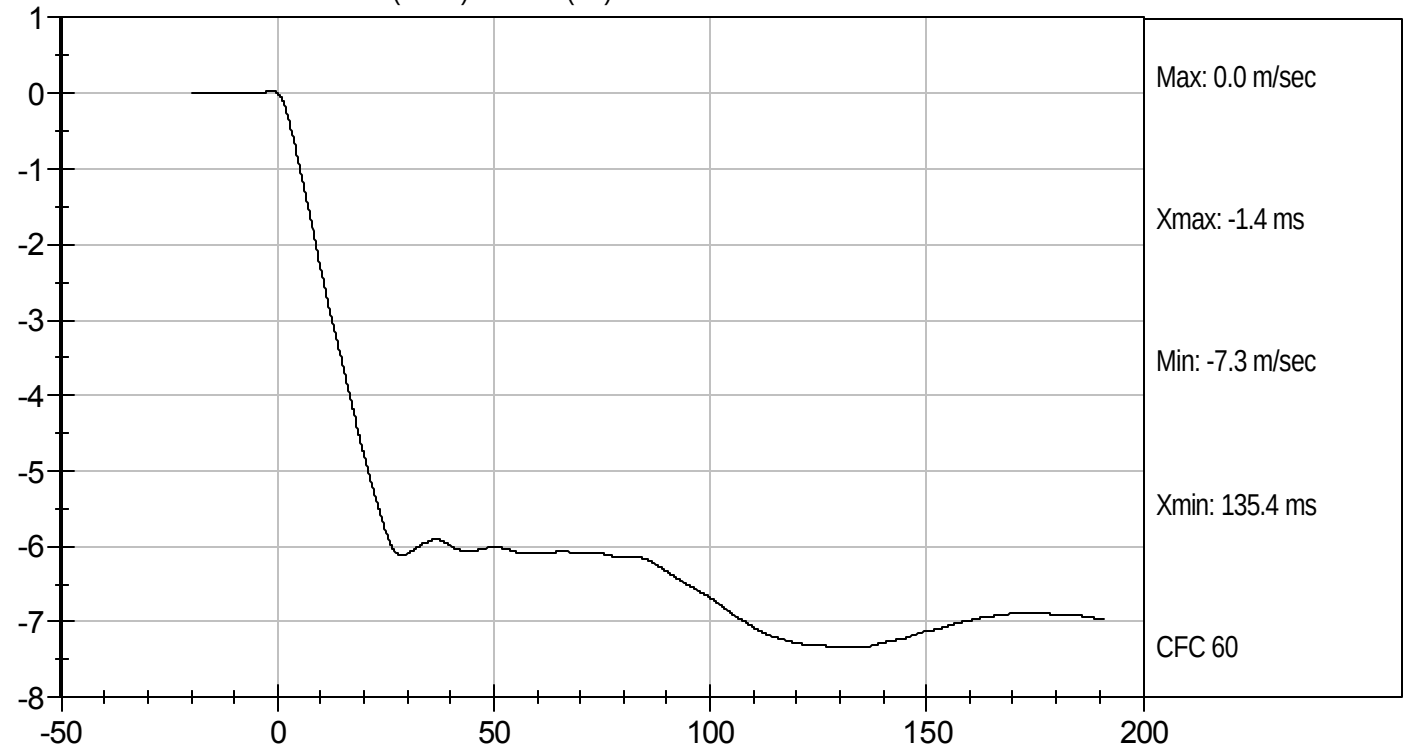
3/26/11
Test Date

David Winkelbauer
Approved By

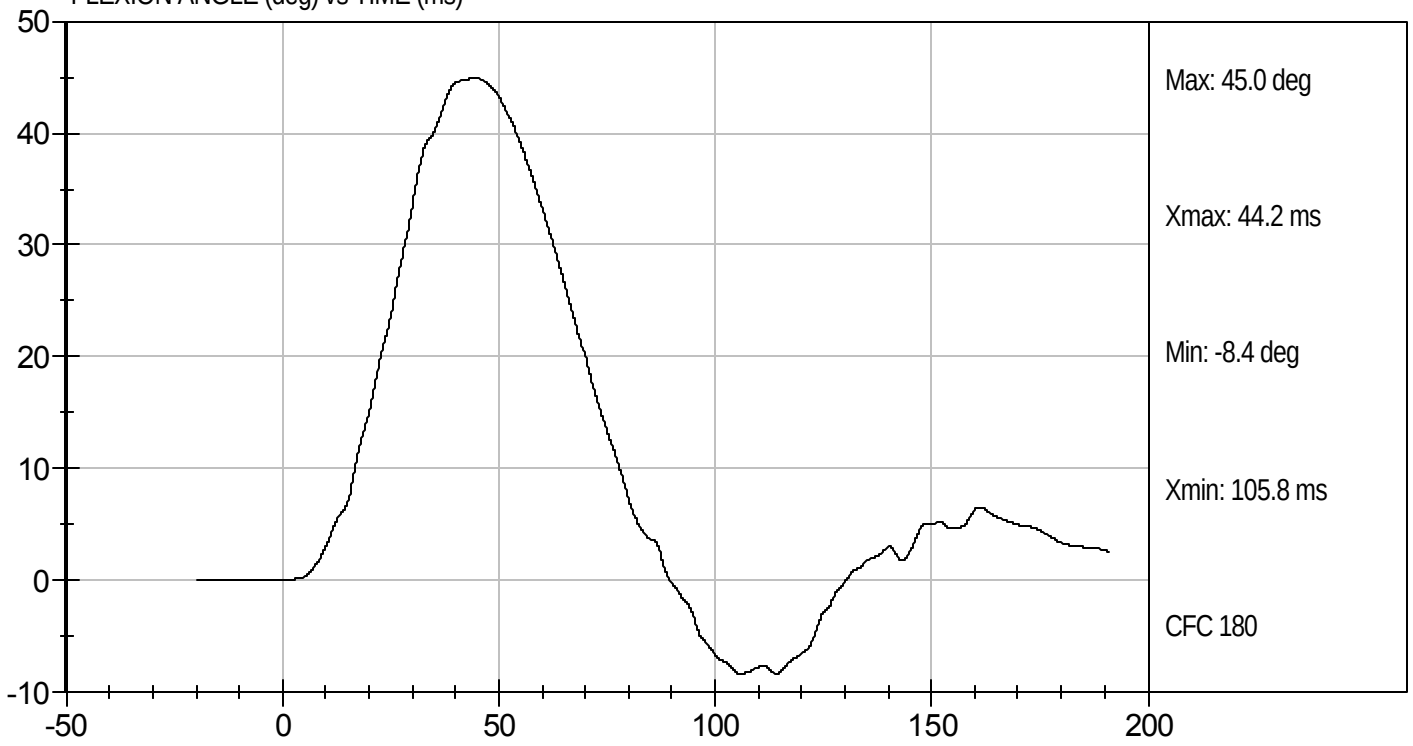
Test Desc: Lumbar Bending
Component ID: D111148

Test Date: 3/26/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

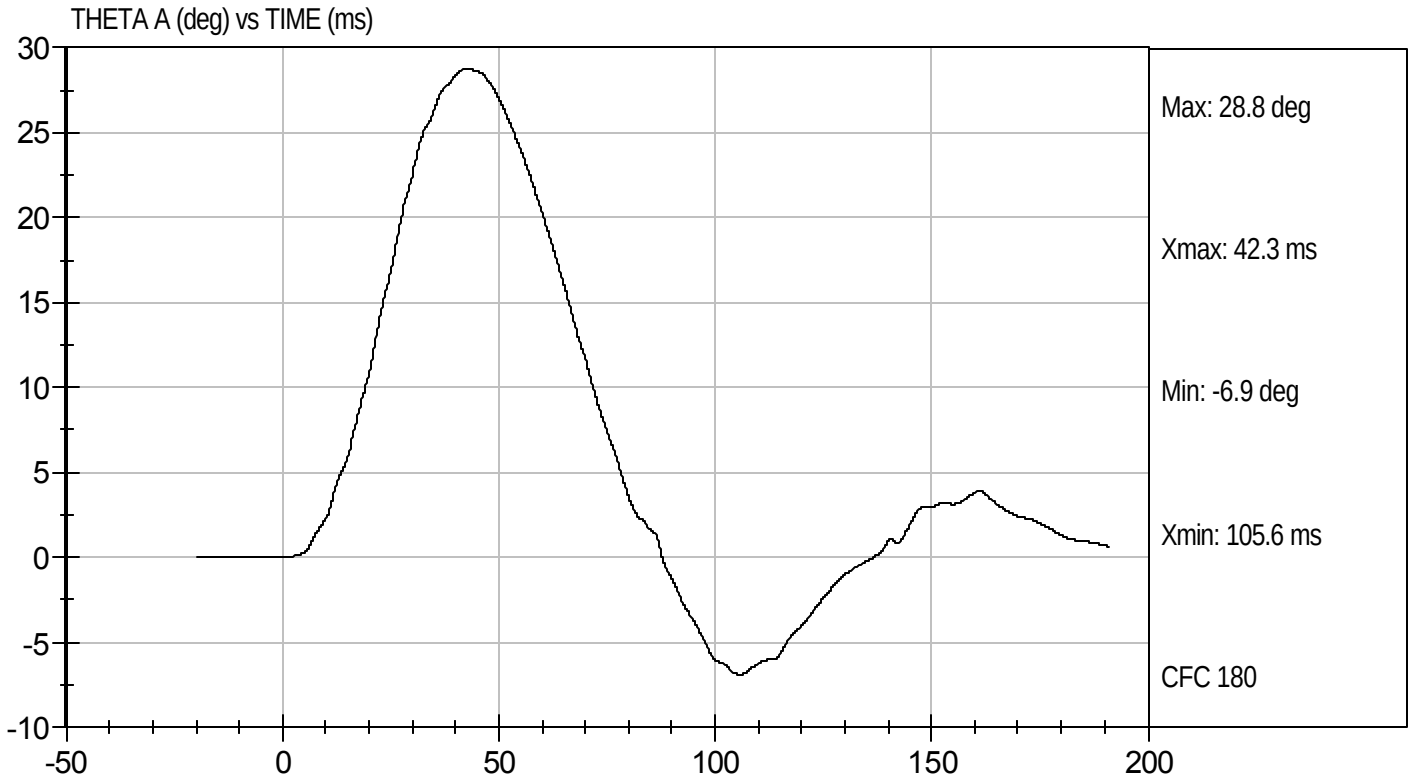


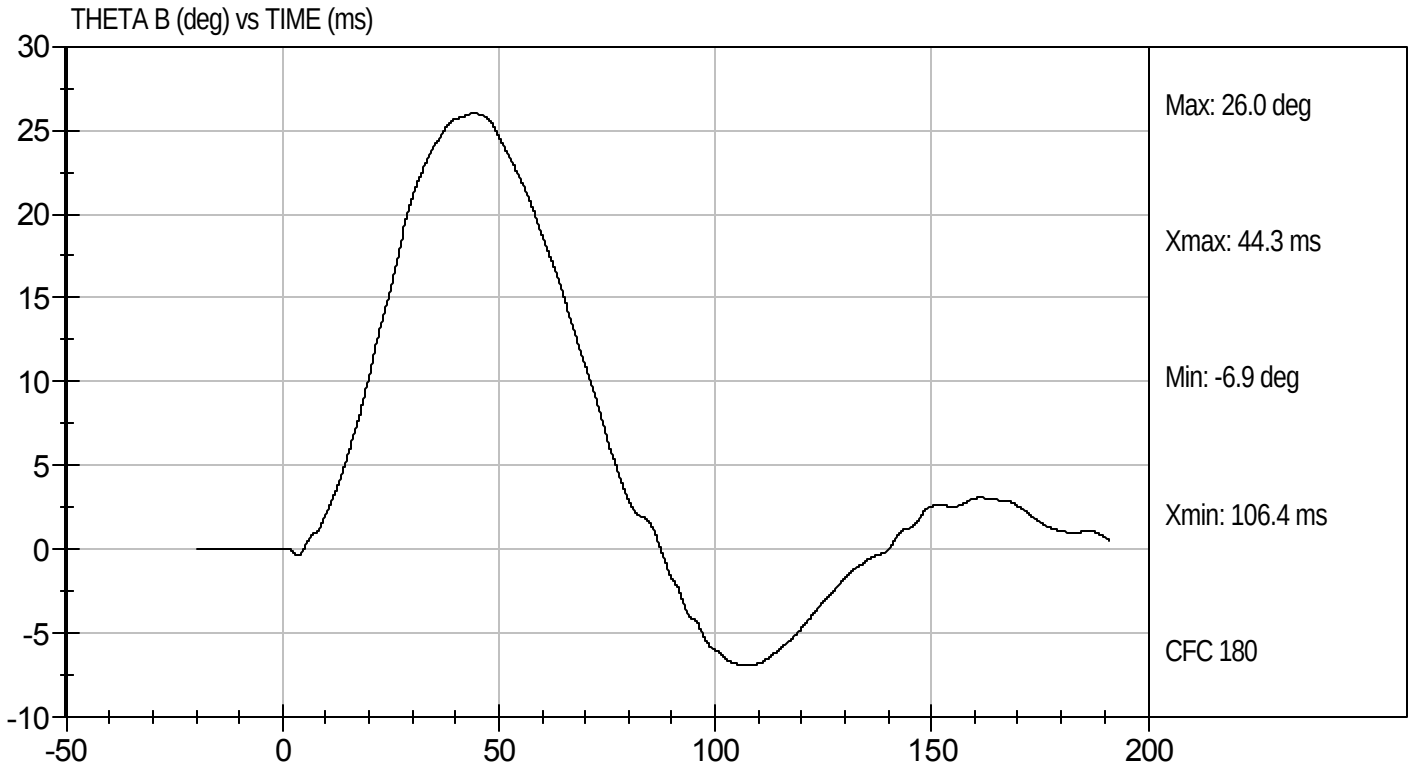
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D111148

Test Date: 3/26/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111149

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	16	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.94	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.30	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.49	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.60	Pass
		Overall Test Results		Pass

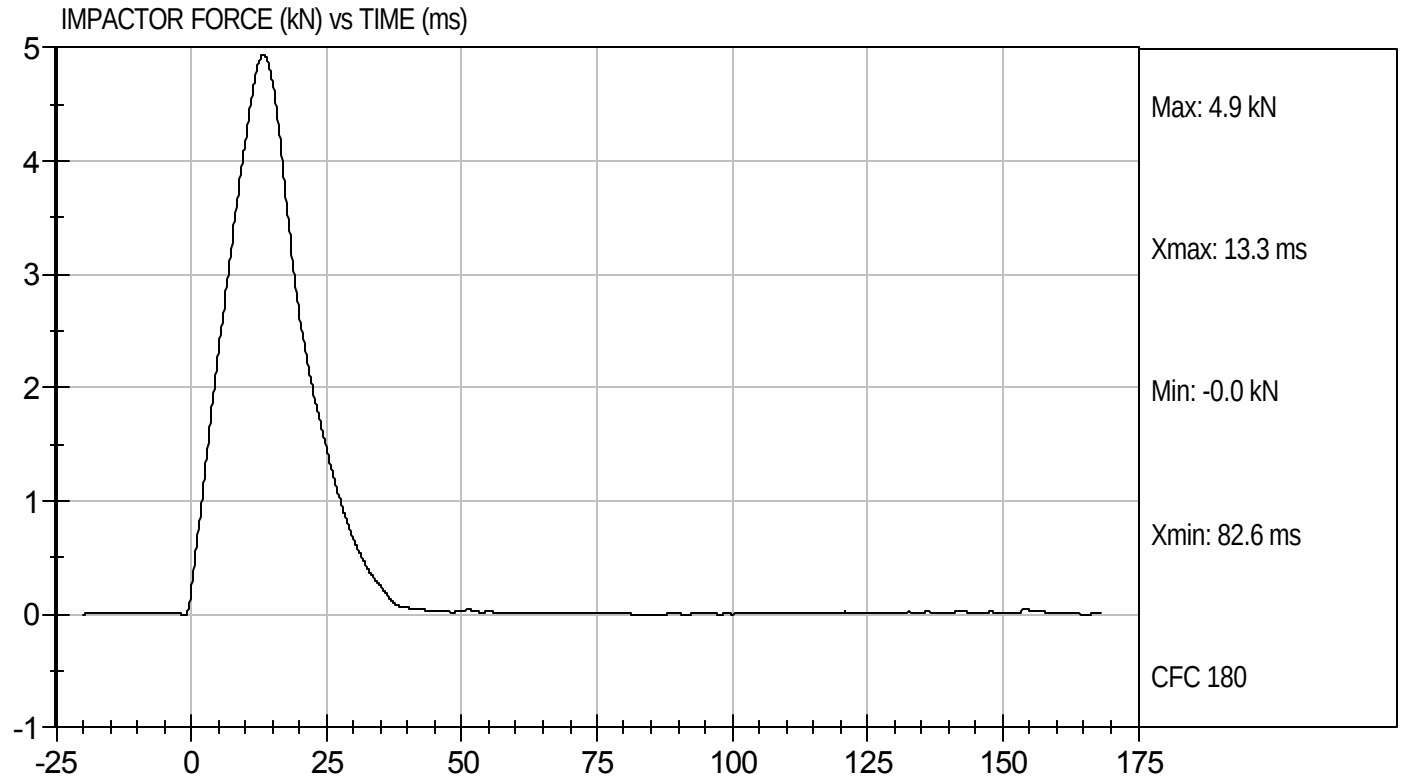
Jessica Hall
Laboratory Technician

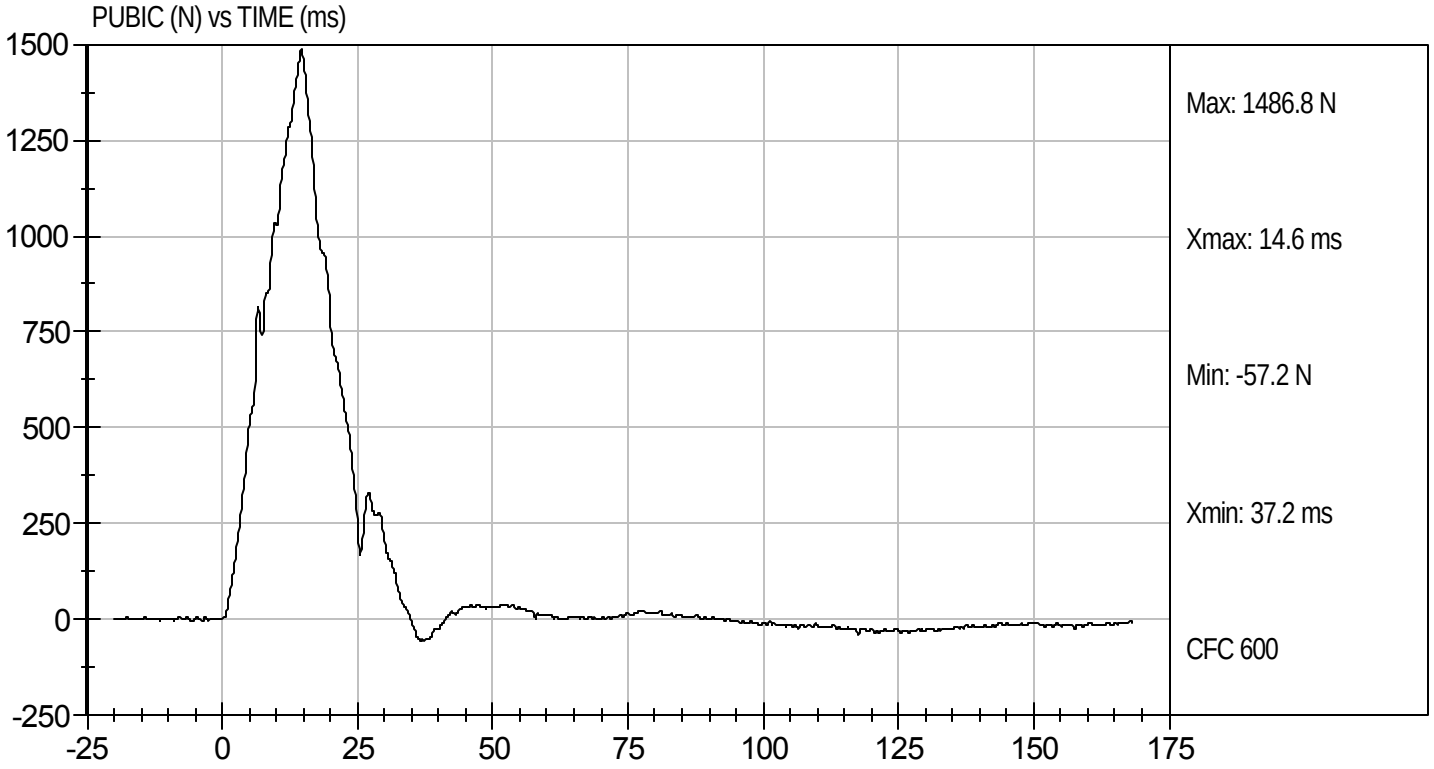
3/28/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D111149

Test Date: 3/28/11
Velocity: 14.25 ft/s, 4.34 m/s





MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111140

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.10	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.4	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.1	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.2	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

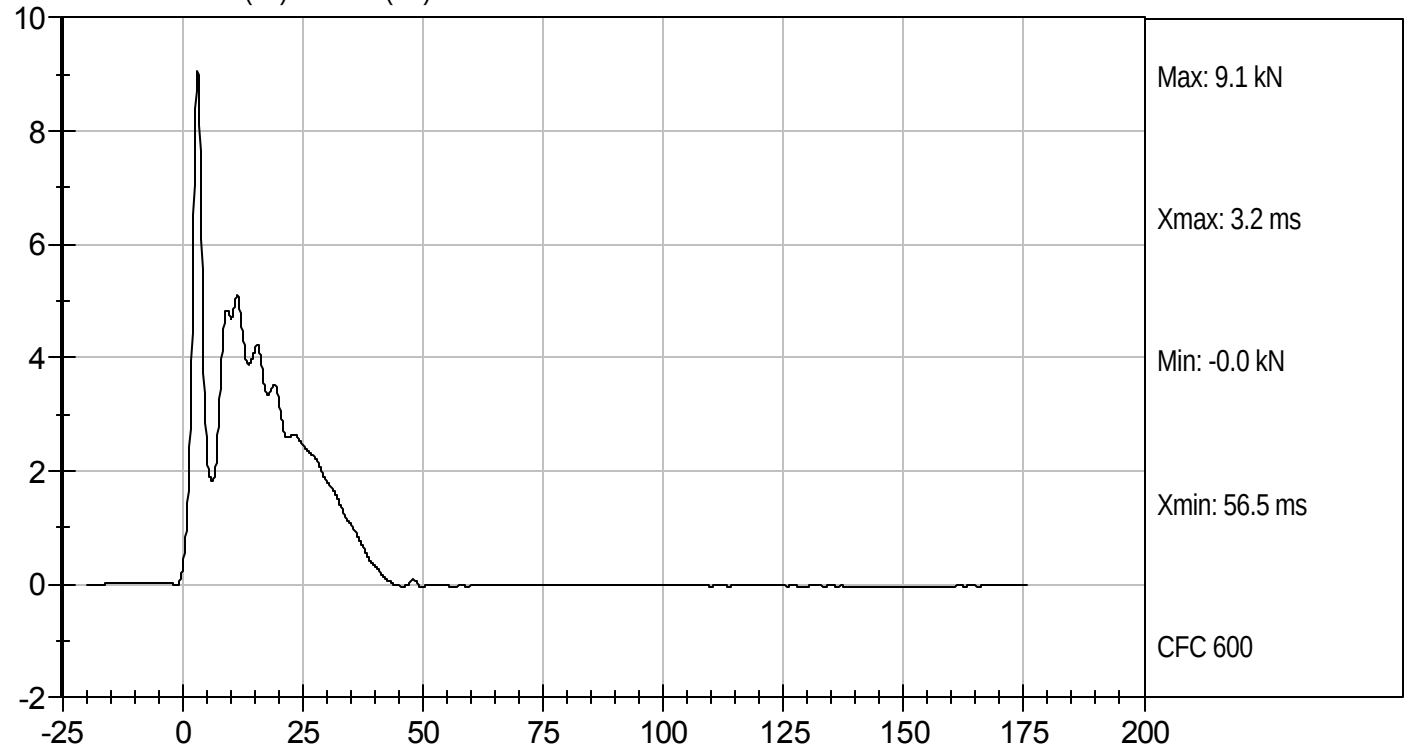
3/28/11
Test Date

David Winkelbauer
Approved By

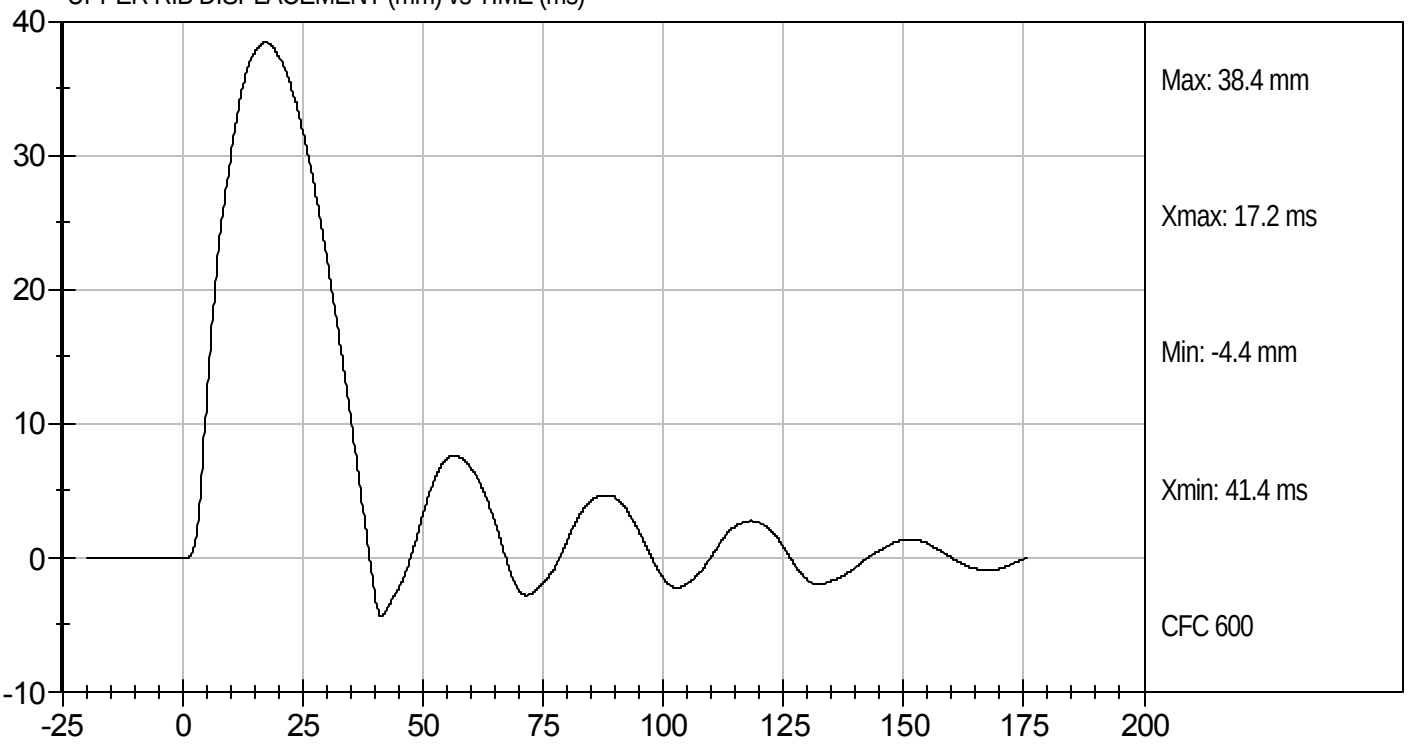
Test Desc: Thorax Impact
Component ID: D111140

Test Date: 3/28/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



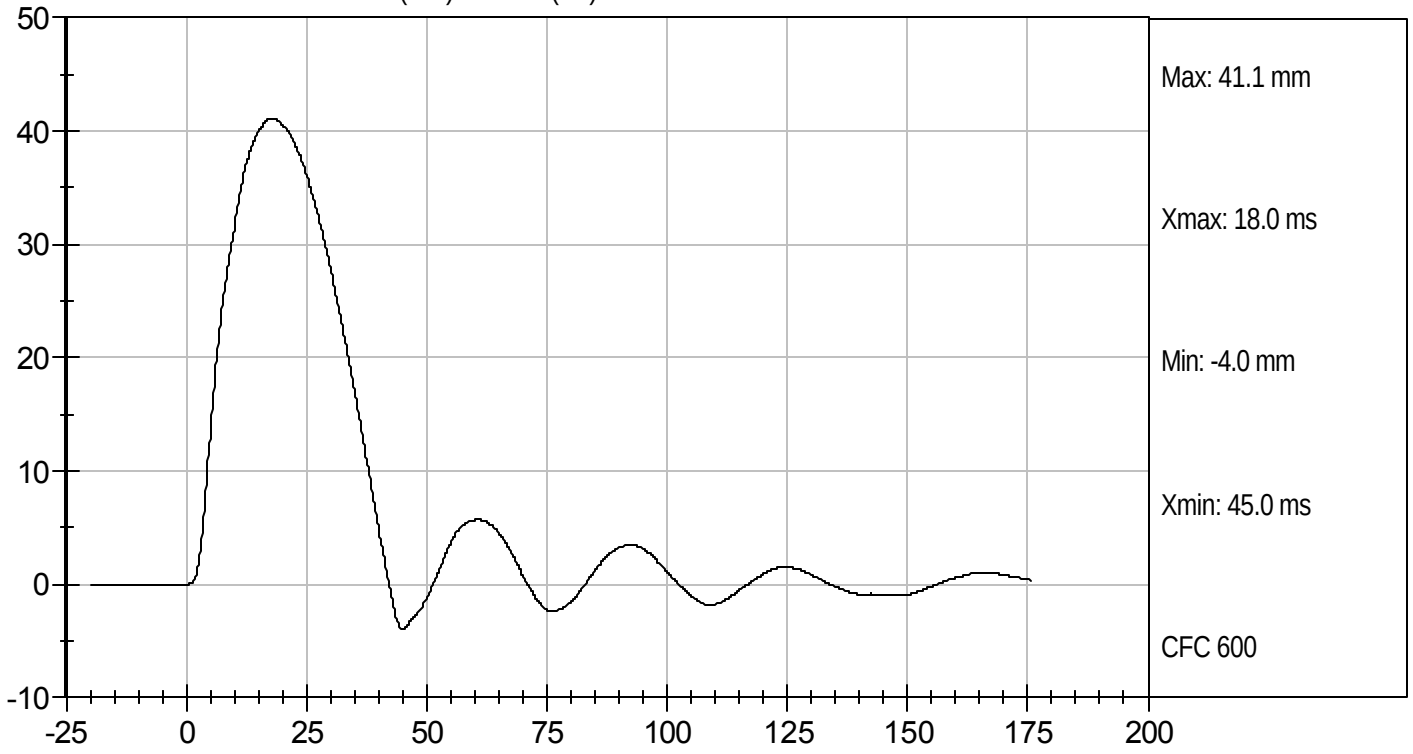
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



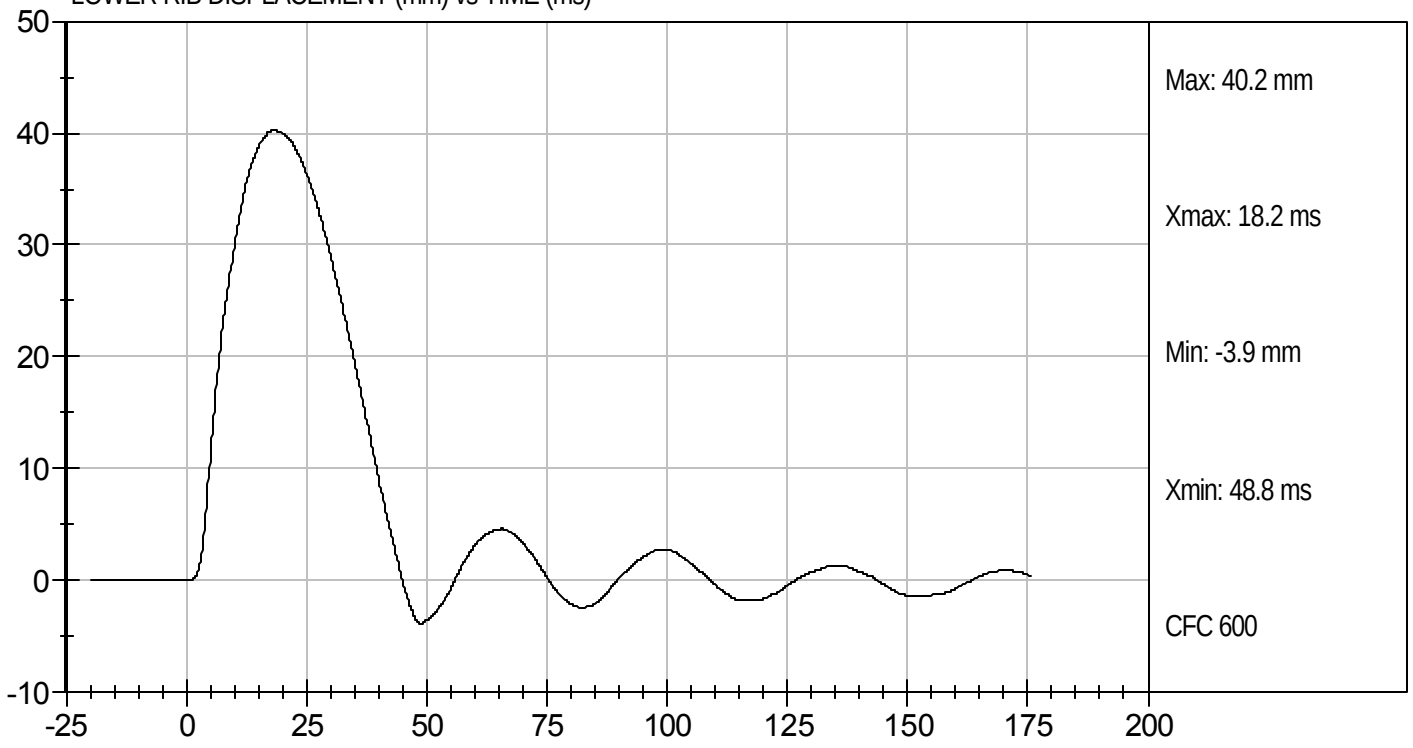
Test Desc: Thorax Impact
Component ID: D111140

Test Date: 3/28/11
Velocity: 18.32 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



APPENDIX E

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

Table 1 – Dummy Instrumentation

		ES-2re S/N: 016		
		Serial Number	Manufacturer	Calibration Date
Head Accelerometers	X	P66854	Endevco	2/14/2011
	Y	P66855	Endevco	2/14/2011
	Z	P66856	Endevco	2/14/2011
Thorax Potentiometers	Upper Rib (Y)	G144	Honeywell	2/17/2011
	Middle Rib (Y)	G143	Honeywell	2/17/2011
	Lower Rib (Y)	G142	Honeywell	2/17/2011
Abdomen Load Cells	Forward (Y)	ABG119	FTSS	11/01/2010
	Middle (Y)	ABG120	FTSS	11/01/2010
	Rear (Y)	ABG121	FTSS	11/01/2010
Pubic Symphysis Load Cell (Y)		PG431	Denton	11/01/2010

Table 2 – Vehicle Instrumentation

	Serial Number	Manufacturer	Calibration Date
Vehicle CG (X)	P55705	Endevco	12/22/2010
Vehicle CG (Y)	P55706	Endevco	12/22/2010
Vehicle CG (Z)	P55704	Endevco	12/22/2010
Left Floor Sill (Y)	P50050	Endevco	12/13/2010
A Pillar Sill (Y)	P59342	Endevco	12/22/2010
A Pillar Low (Y)	P52290	Endevco	3/15/2011
A Pillar Mid (Y)	P59667	Endevco	3/15/2011
B Pillar Sill (Y)	P49503	Endevco	1/13/2011
B Pillar Low (Y)	P52198	Endevco	3/13/2011
B Pillar Mid (Y)	P59397	Endevco	3/15/2011
Seat (Y)	P59339	Endevco	3/15/2011
Engine (X)	P52269	Endevco	12/13/2010
Engine (Y)	P52268	Endevco	12/13/2010
Firewall (Y)	P55687	Endevco	10/11/2010
Roof (Y)	P45126	Endevco	11/05/2010
Floor Sill (Y)	P59634	Endevco	11/05/2010
Rear Deck (X)	P52187	Endevco	11/05/2010
Rear Deck (Y)	P52186	Endevco	11/05/2010