REPORT NUMBER: 214P-MGA-2011-013

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

CHRYSLER GROUP LLC
2011 JEEP GRAND CHEROKEE LAREDO 4X4 SUV
NHTSA NUMBER: CB0304

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

Test Date: April 14, 2011

Report Date: July 11, 2011

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Technical Report Documentation Page

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7. Author(s) Donna Janovicz, Project Manager Joe Fleck, Project Engineer		*8. Performing Organization Report No.* 214P-MGA-2011-013
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 4/14/2011 to 7/11/2011 *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 Jeep Grand Cherokee Laredo 4x4 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 April 14, 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 352 mm at level 3. The test vehicle's performance follows:

Measurement Description	Units	Result
Head Injury Criteria (HIC_{36})	N/A	497
Max. Rib Deflection	mm	32
Sum of Abdomen Forces	N	1545
Pubic Symphysis Force	N	1248

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)

TABLE OF CONTENTS

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 Jeep Grand Cherokee Laredo 4x4 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 Jeep Grand Cherokee Laredo 4x4 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 April 14, 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	497	Upper	32.2	Front	335.9	1248.4
		Middle	25.7	Mid	559.5	
		Lower	26.3	Rear	700.2	
		Max.	32.2	Sum	1545.0	

GENERAL COMMENTS

There was no valid data collected for:

Left Floor Sill Y after 35 msec.
B Pillar Sill Y after 25 msec.
Seat Y after 25 msec.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1

TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

VEHICLE INFORMATION	
Make	Jeep
Model	Grand Cherokee
Body Style	MPV
VIN	1J4RR4GG3BC567225
Body Color	Natural Green Pearl Coat
Engine Displacement (L)	3.6
# of Cylinders	6
Engine Placement	Longitudinal
Transmission Type	Automatic
Transmission Speeds	5
Overdrive	Yes
Final Drive	4WD
Odometer Reading	50 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	Chrysler Group LLC
Date of Manufacture	10-10

GVWR (kg)	2949
GAWR Front (kg)	1452
GAWR Rear (kg)	1679

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				476
Cargo Weight (RCLW) (kg)				136

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

TIRE PRESSURES

	Units	LF	RF	RR	LR
As Delivered	kPa	230	230	230	230
As Tested	kPa	230	230	230	230

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	554.8	509.4		577.4	612.4		570.6	600.1	
Right	kg	552.9	517.5		550.2	607.8		569.7	600.6	
Ratio	%	51.9	48.1		48.0	52.0		48.7	51.3	
Totals	kg	1107.7	1026.9	2134.6	1127.6	1220.2	2347.8	1140.3	1200.7	2341.0

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	2134.6
Weight of 1 P572U ATD (ES-2re) Dummy	kg	77.1
Rated Cargo/Luggage Weight (RCLW)	kg	136
Calculated Target Vehicle Test Weight (TVTW)	kg	2347.7

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	852	853	864	860
As Tested	mm	850	850	871	883
Difference	mm	2	3	-7	-23

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2920
Vertical Impact Reference Line (Aft of Front Axle)	mm	1525

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

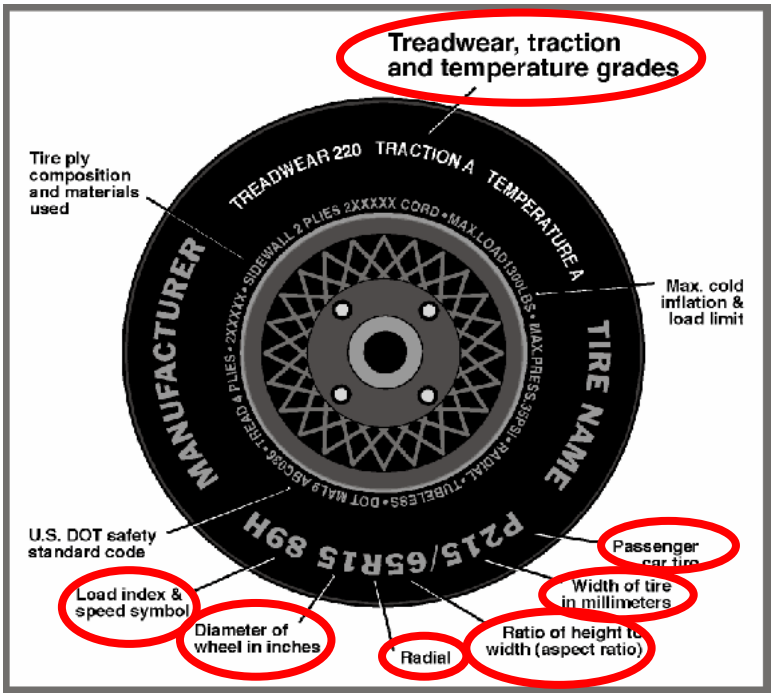
Description of Component	Weight (kg)
Ballast	91.2
No vehicle components removed to meet VTW	0

DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	230
Recommended Tire Size	P245/70R17	P245/70R17
Tire Size on Vehicle	P245/70R17	P245/70R17
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Fortera HL	Fortera HL
Tire Type	Passenger	Passenger
Tire Width	245	245
Aspect Ratio	70	70
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index/Speed Symbol	108T	108T
Treadwear	540	540
Traction Grade	A	A
Temperature Grade	B	B

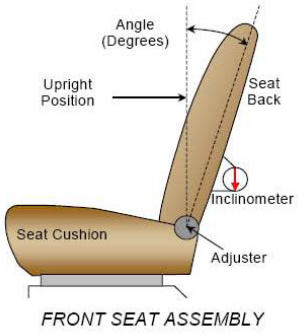
DATA SHEET NO. 4

SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

NORMAL DESIGN RIDING POSITION

The driver seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Set the seat back angle at 14 degrees when measured at headrest post with lower front door sill angle for reference.



FRONT SEAT ASSEMBLY

SEAT BACK ANGLE

	Degrees	Detents
Driver without Seated Dummy	14.0° 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	278 mm	139 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 in the 2nd detent for the 50th percentile male.

SEAT BELT UPPER ANCHORAGE

	Total # of Positions	Placed in Position #
Driver Seat	5 detents	2nd 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

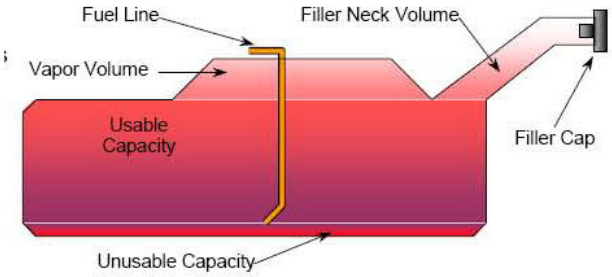
Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	93.5
Usable Capacity (Owner's Manual)	91.0
92-94% of Usable Capacity	86.0 to 87.9
Actual Amount of Solvent Used	86.7

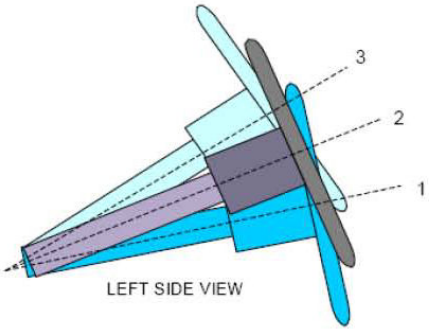
FUEL PUMP

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. The fuel pump starts pumping fuel when the key is "ON" position. 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

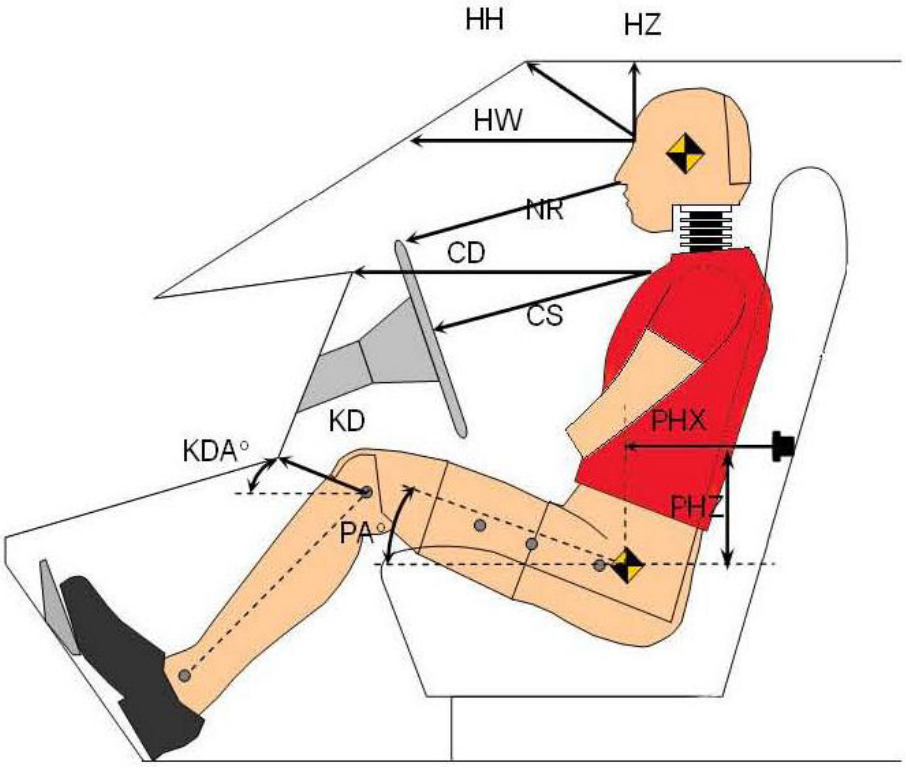
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	70.0	233
Geometric Center – Position 2	67.9	203
Uppermost – Position 3	65.8	173
Telescoping Steering Wheel Travel		60
Test Position	67.9	203

.DATA SHEET NO. 6

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

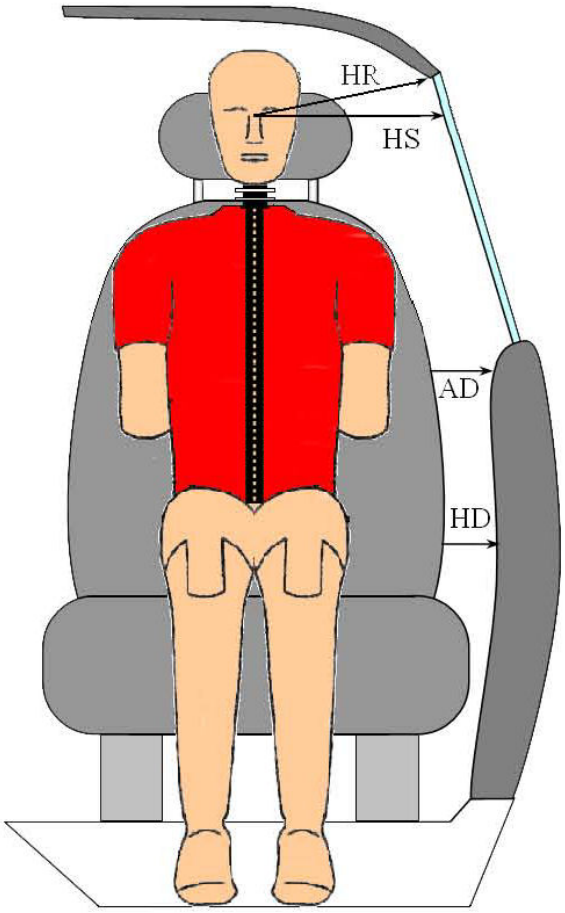


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	431	
HW	Head to Windshield	685	
HZ	Head to Roof	200	
NR	Nose to Rim	486	
CD	Chest to Dash	592	
CS	Chest to Steering Wheel	381	
KDL	Left Knee to Dash	212	27.9
KDR	Right Knee to Dash	178	28.3
PA	Pelvis Angle X		22.4
	Torso Angle Y		-0.7
PHX	H-Point to Striker (X-Axis)	175	
PHZ	H-Point to Striker (Z-Axis)	93	

DATA SHEET NO. 7

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

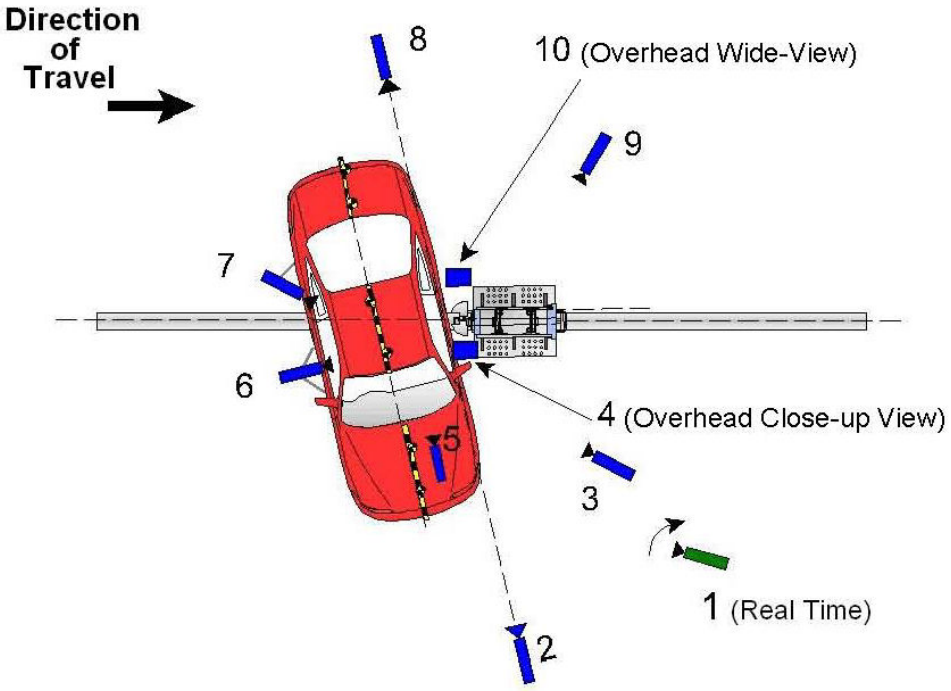


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	223
HS	Head to Side Window	mm	346
AD	Arm to Door	mm	97
HD	H-Point to Door	mm	174

DATA SHEET NO. 8

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011



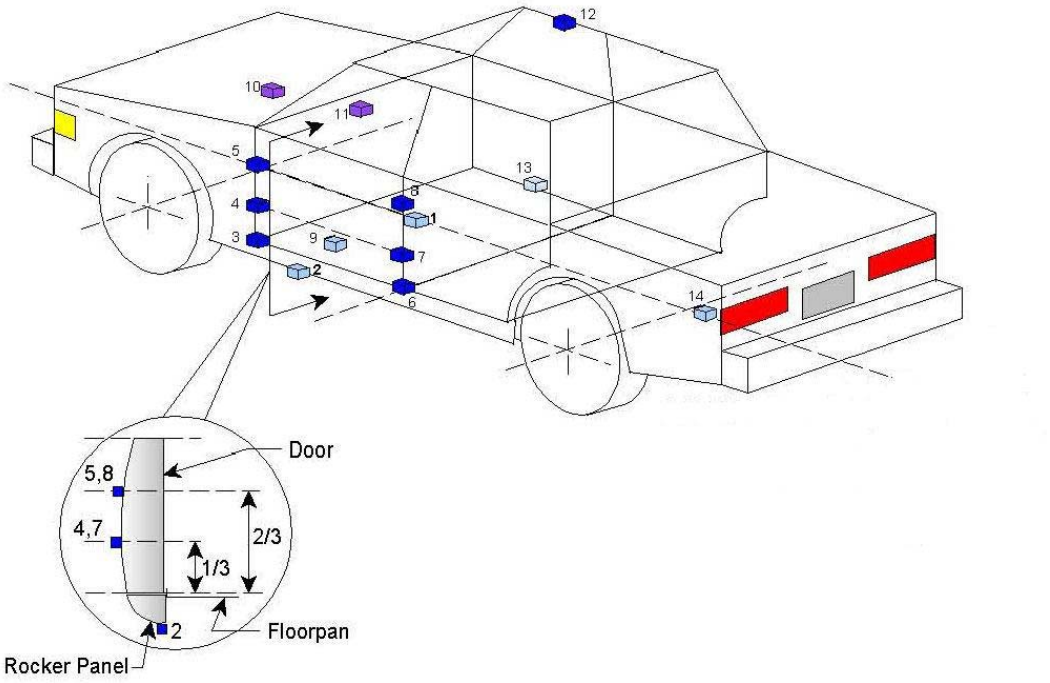
Reference: From Point of Impact for X and Y; from Ground for Z):
+X = Right of Impact, + Y = Forward of Impact, +Z = Up

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5920	30	1680	24	1000
3	Impact Side 45° Forward	4730	2350	1800	20	1000
4	Overhead Closeup	0	-70	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	-5870	30	1710	24	1000
9	Impact Side 45° Rearward	-3910	3940	1830	20	1000
10	Overhead Wide	0	-250	4610	14	1000

DATA SHEET NO. 9

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2250	-365	-314
2	Left Floor Sill	2720	-732	-312
3	A Pillar Sill	3280	-740	-307
4	A Pillar Low	3190	-790	-675
5	A Pillar Mid	3200	-835	-960
6	B Pillar Sill	2190	-740	-315
7	B Pillar Low	2125	-720	-765
8	B Pillar Mid	2125	-722	-952
9	Seat	2220	-590	-535
10	Engine	3905	-30	-1110
11	Firewall	3730	0	-1115
12	Roof	1880	610	-1744
13	Floor Sill	1965	740	-305
14	Rear Deck	420	0	-520

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 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	2.6	109.3	-7.5	59.0
	Vehicle CG (Y)	25.2	56.5	-1.0	300.0
	Vehicle CG (Z)	21.1	57.9	-8.3	15.2
	Resultant	32.5	57.8		
2	Left Floor Sill (Y)	(1)	(1)	(1)	(1)
3	A Pillar Sill (Y)	19.7	42.9	-1.1	3.1
4	A Pillar Low (Y)	24.6	30.2	-10.0	22.9
5	A Pillar Mid (Y)	17.7	46.0	-3.0	33.1
6	B Pillar Sill (Y)	(2)	(2)	(2)	(2)
7	B Pillar Low (Y)	66.3	15.1	-5.3	9.8
8	B Pillar Mid (Y)	67.4	15.3	-19.9	44.1
9	Seat (Y)	(3)	(3)	(3)	(3)
10	Engine (X)	7.7	114.1	-14.5	54.8
	Engine (Y)	28.4	56.0	-11.2	30.0
11	Firewall (Y)	13.9	42.5	-0.9	4.5
12	Roof (Y)	27.8	38.7	-2.0	7.0
13	Floor Sill (Y)	17.5	54.9	-1.2	202.0
14	Rear Deck (X)	2.5	114.8	-6.7	62.5
	Rear Deck (Y)	16.5	71.9	-2.8	300.0

(1) No valid data collected for Left Floor Sill Y after 35 msec.
(2) No valid data collected for B Pillar Sill Y after 25 msec.
(3) No valid data collected for Seat Y after 25 msec.

DATA SHEET NO. 11

DUMMY INJURY RESPONSE DATA

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

Dummy S/N	Positive		Negative	
	MAX	**TIME (ms)**	**MAX**	**TIME (ms)**
HEAD ACCELERATION (G)				
Longitudinal (X)	5.2	107.3	26.1	57.0
Lateral (Y)	64.2	60.3	11.5	95.7
Vertical (Z)	19.9	43.0	0.9	289.0
Resultant (R)	69.1	58.8		
HIC36 (t1, t2)	497		t1 = 47.8	t2 = 70.5
THORAX DEFLECTION (mm)				
Upper Rib			32.2	51.8
Middle Rib			25.7	51.4
Lower Rib			26.3	51.7
ABDOMINAL FORCES (N)				
Front	335.9	55.2		
Middle	559.5	52.9		
Rear	700.2	51.4		
Sum	1545.0	53.1		
PELVIS FORCE (N)				
Pubic Symphysis			1248.4	62.1

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

DATA SHEET NO. 12

POST TEST OBSERVATIONS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

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, Door Panel
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 Cracked
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

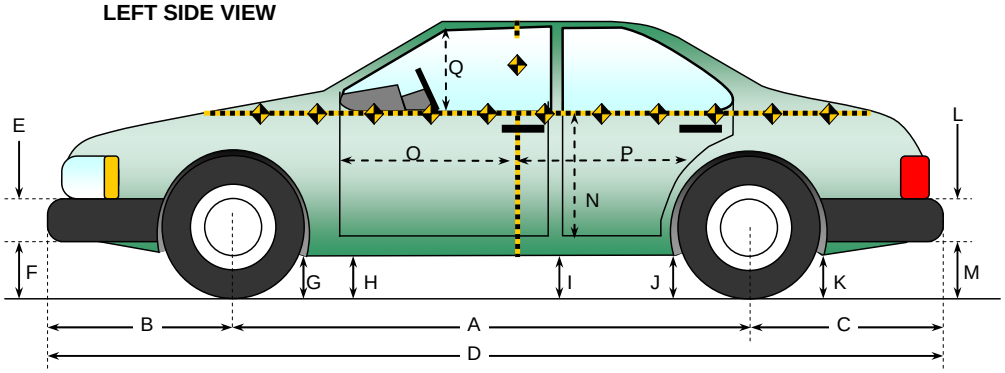
Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso/Pelvis Airbag	Yes	Yes
Head Airbag	No	
Curtain Airbag	Yes	Yes
Knee Airbag	No	
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	

DATA SHEET NO. 13

VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

LEFT SIDE VIEW

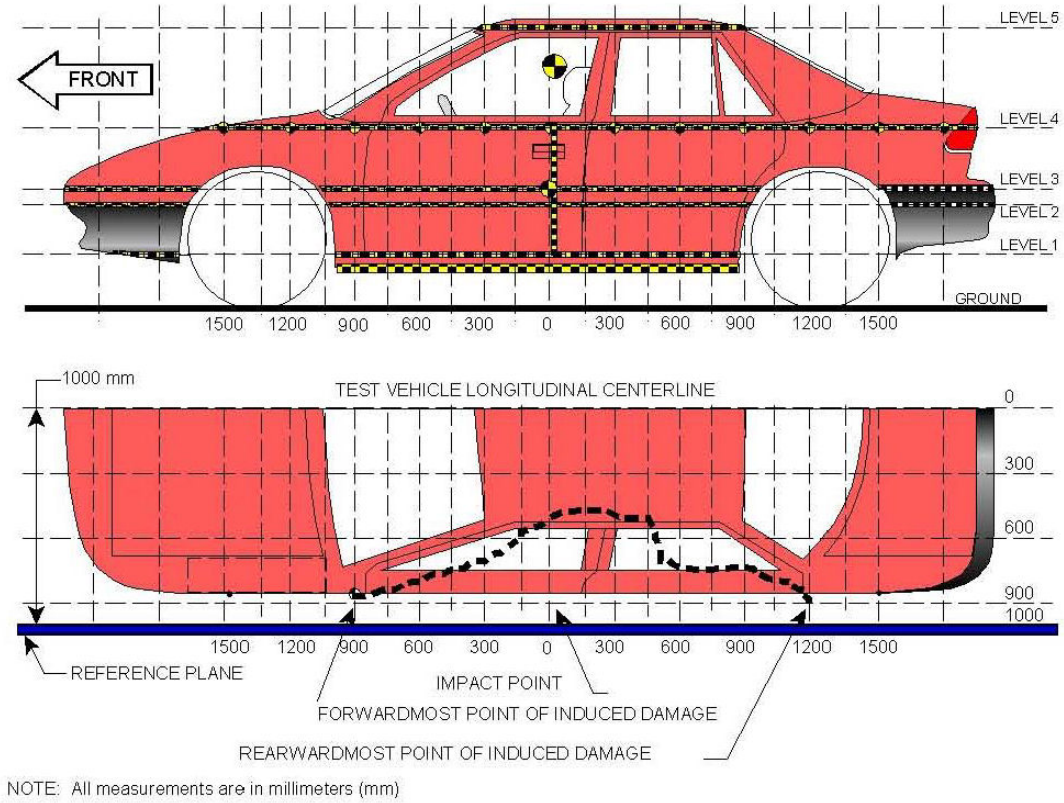


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2920	2879	41
B	Front Axle to FSOV	943	943	0
C	Rear Axle to RSOV	967	967	0
D	Total Vehicle Length at Centerline	4830	4789	41
E	Front Bumper Thickness	146	146	0
F	Front Bumper Bottom to Ground	299	318	-19
G	Sill Height at Front Wheel Well	302	297	5
H	Sill Height at Front Door Leading Edge	296	304	-8
I	Sill Height at B Pillar	303	255	48
J1	Sill Height at Rear Wheel Well	303	310	-7
J2	Pinch Weld Height at Rear Wheel Well	304	309	-5
K	Sill Height Aft of Rear Wheel Well	336	341	-5
L	Rear Bumper Thickness	330	330	0
M	Rear Bumper Bottom to Ground	386	371	15
N	Sill Height to Window Bottom Sill	830	810	20
O	Front Door Leading Edge to Impact CL	850	850	0
P	Rear Door Trailing Edge to Impact CL	1107	1160	-53
Q	Front Window Opening	505	470	35
R	Right Side Length	3911	3915	-4
S	Left Side Length	3911	3825	86
T	Vehicle Width at B Post	1917	1720	197

DATA SHEET NO. 14

EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011



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	292	0	413
2	Occupant H-Point	349	0	775
3	Mid-Door	352	0	803
4	Window Sill	280	0	1182
5	Window Top	119	-75	1680

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

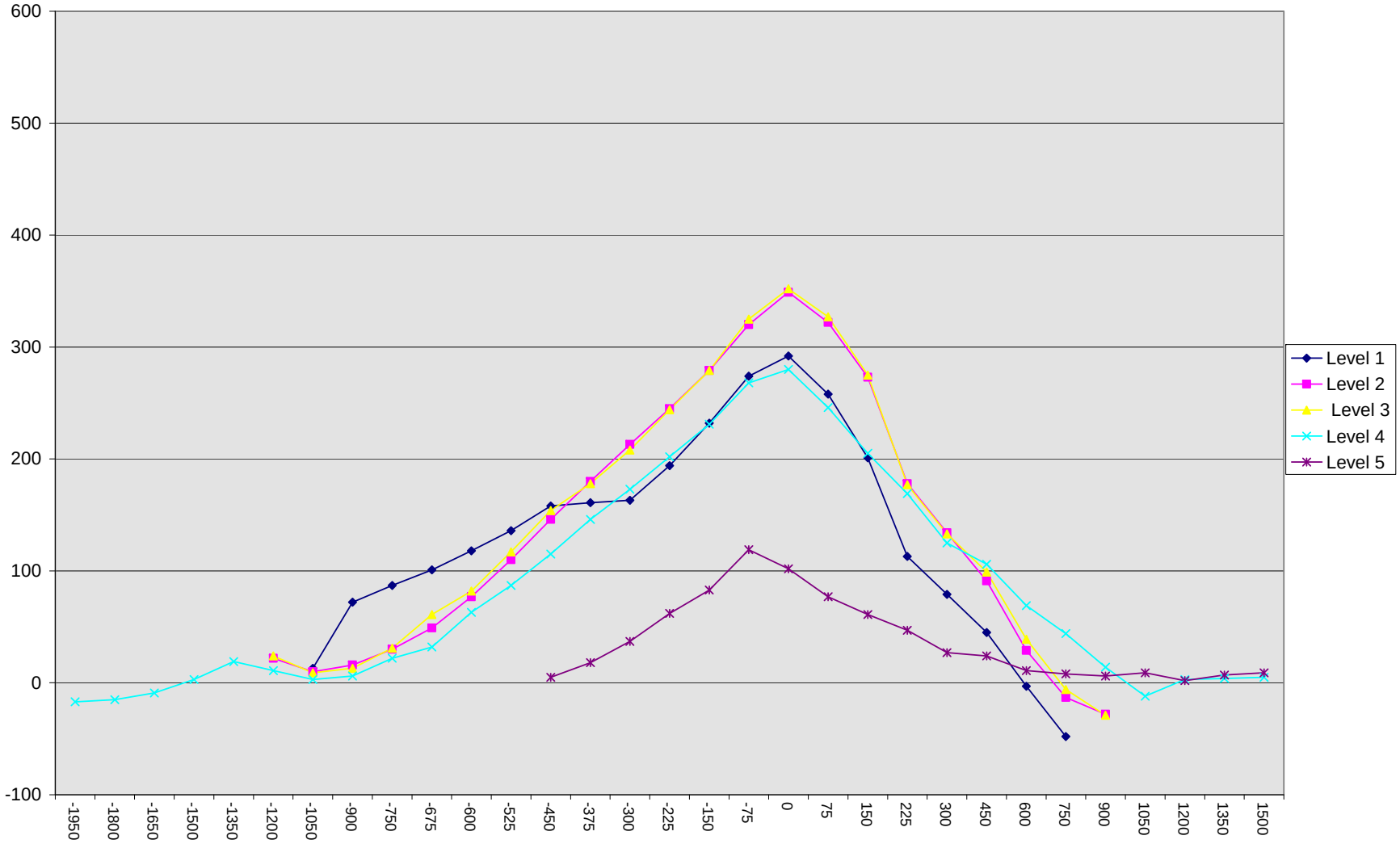
	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	292	349	352	280	119
Distance From Impact (mm)	0	0	0	0	-75

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1950				253					236					-17	
-1800				242					227					-15	
-1650				235					226					-9	
-1500				229					232					3	
-1350				227					246					19	
-1200		140	140	224			162	164	235			22	24	11	
-1050	209	155	156	222		222	165	165	225		13	10	9	3	
-900	212	172	168	222		284	188	181	228		72	16	13	6	
-750	211	171	168	222		298	201	199	244		87	30	31	22	
-675	214	170	166	220		315	219	227	252		101	49	61	32	
-600	215	168	166	221		333	245	248	284		118	77	82	63	
-525	215	168	165	221		351	278	282	308		136	110	117	87	
-450	215	167	164	221	418	373	313	318	336	423	158	146	154	115	5
-375	214	168	164	221	415	375	348	342	367	433	161	180	178	146	18
-300	215	167	164	220	418	378	380	372	393	455	163	213	208	173	37
-225	215	167	163	220	420	409	412	407	422	482	194	245	244	202	62
-150	215	167	163	220	425	447	446	442	451	508	232	279	279	231	83
-75	215	167	162	219	425	489	487	487	487	544	274	320	325	268	119
0	216	167	163	219	428	508	516	515	499	530	292	349	352	280	102
75	212	167	163	221	430	470	489	490	467	507	258	322	327	246	77
150	220	168	164	221	431	421	441	439	426	492	201	273	275	205	61
225	219	170	166	221	431	332	348	343	390	478	113	178	177	169	47
300	220	175	171	224	430	299	309	304	349	457	79	134	133	125	27
450	224	181	177	227	433	269	272	276	333	457	45	91	99	106	24
600	222	185	180	232	433	219	214	219	301	444	-3	29	39	69	11
750	192	161	162	234	434	144	148	156	278	442	-48	-13	-6	44	8
900		140	137	240	436		112	108	254	442		-28	-29	14	6
1050				245	442				233	451				-12	9
1200				253	446				256	448				3	2
1350				262	451				266	458				4	7
1500				272	463				277	472				5	9

DATA SHEET NO. 15 (CONTINUED)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011



DATA SHEET NO. 16

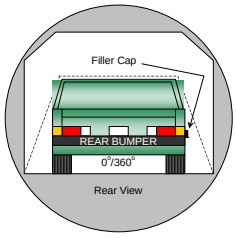
SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

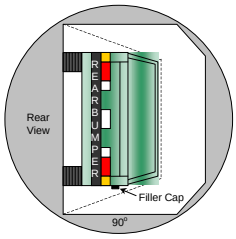
FUEL SYSTEM INTEGRITY POST IMPACT DATA

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

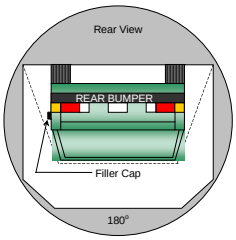
STATIC ROLLOVER DATA



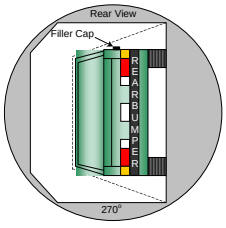
0/360



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	59	seconds	5	minutes	6	minutes	59	seconds	7	minutes
90° - 180°	1	minutes	48	seconds	5	minutes	6	minutes	48	seconds	7	minutes
180° - 270°	1	minutes	54	seconds	5	minutes	6	minutes	54	seconds	7	minutes
270° - 360°	1	minutes	53	seconds	5	minutes	6	minutes	53	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

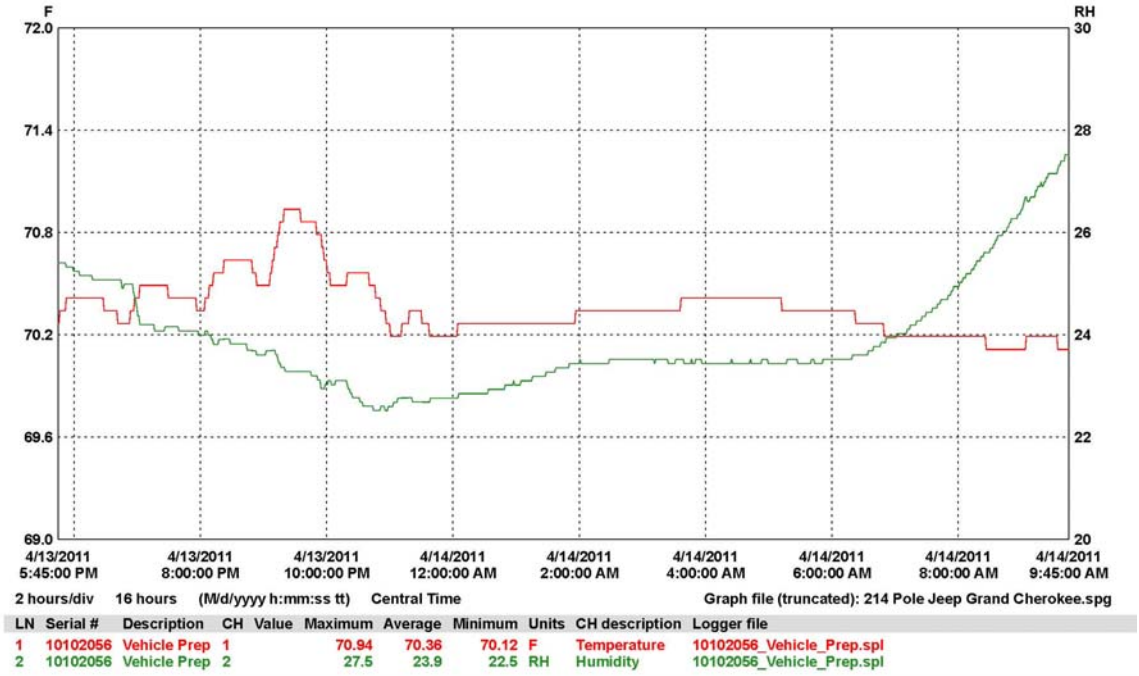
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17

TEMPERATURE AND HUMIDITY TRACES

Test Vehicle: 2011 Jeep Grand Cherokee Laredo NHTSA No. CB0304
Test Program: FMVSS 214 Pole Test Date: 4/14/2011

Time of Impact: 9:41 am



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	10102056	Vehicle Prep	1		70.94	70.36	70.12	F	Temperature	10102056_Vehicle_Prep.spl
2	10102056	Vehicle Prep	2		27.5	23.9	22.5	RH	Humidity	10102056_Vehicle_Prep.spl

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

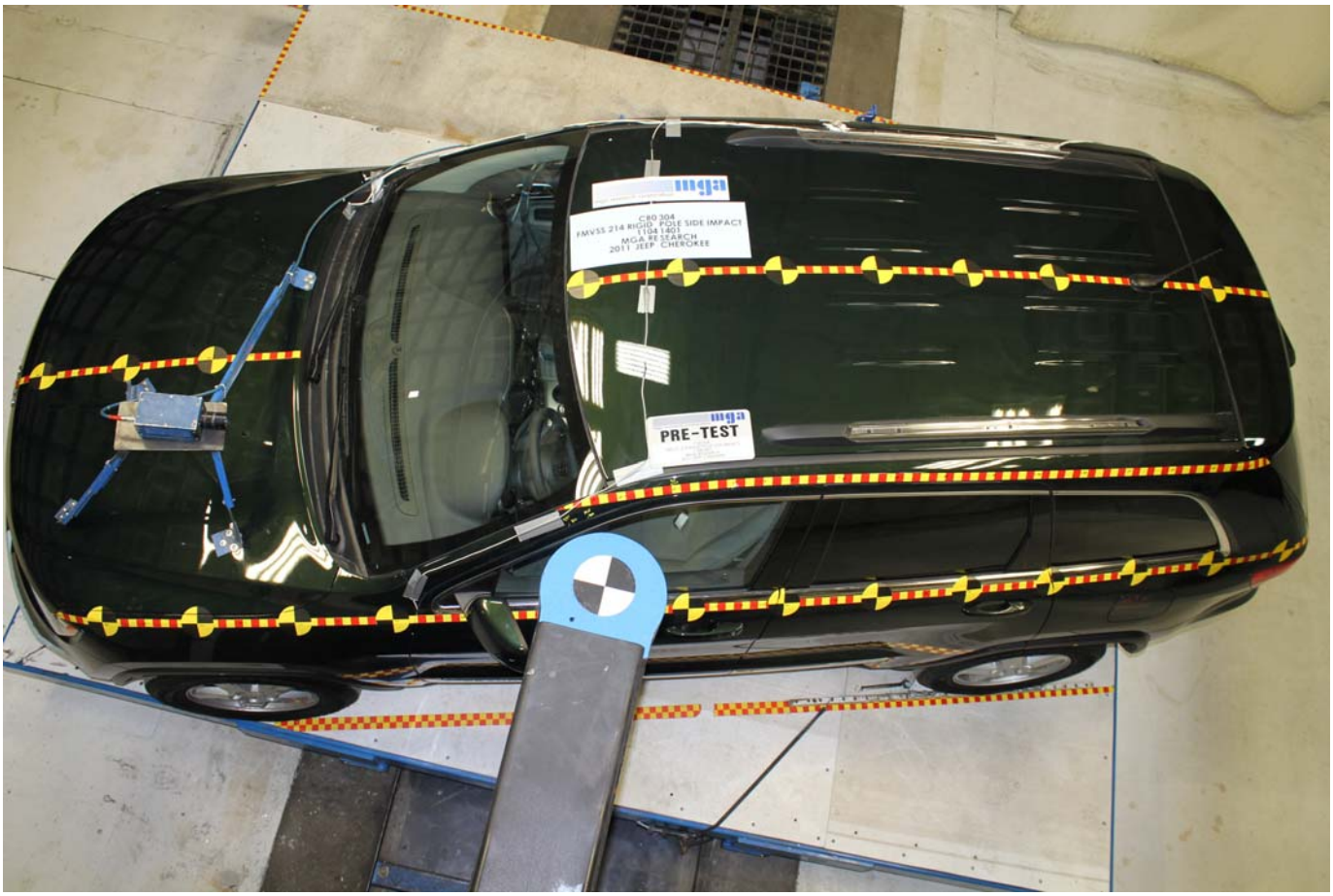
Post-Test Rear View of Test Vehicle

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

Pre-Test Interior of Front Door Closed

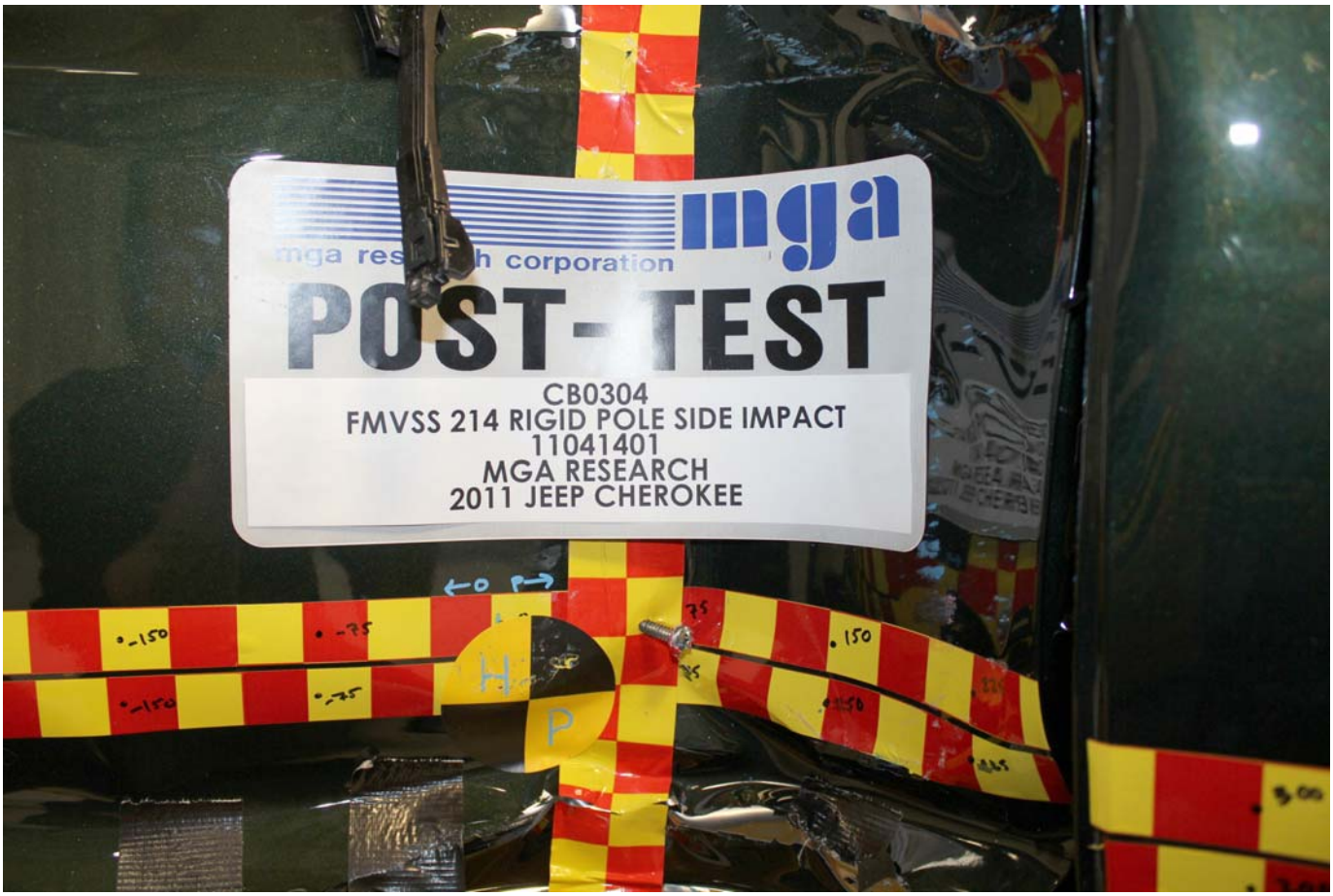
Post-Test Interior of Front Door Showing Dummy Impact Locations

Impact Event

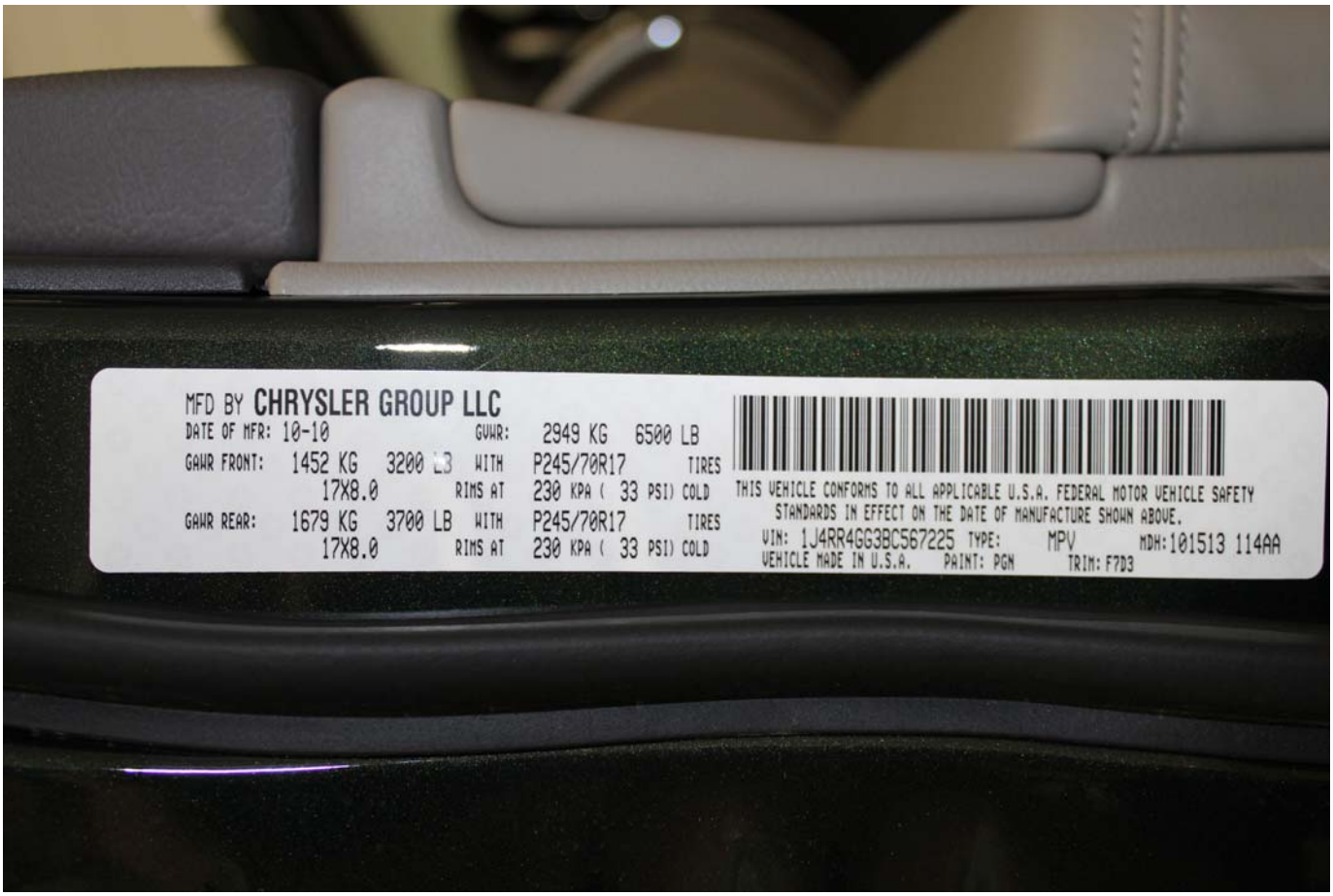
Post-Test Impact Zone Close-up View

Post-Test ¾ Front View of Impact Zone

Post-Test ¾ Rear View of Impact Zone



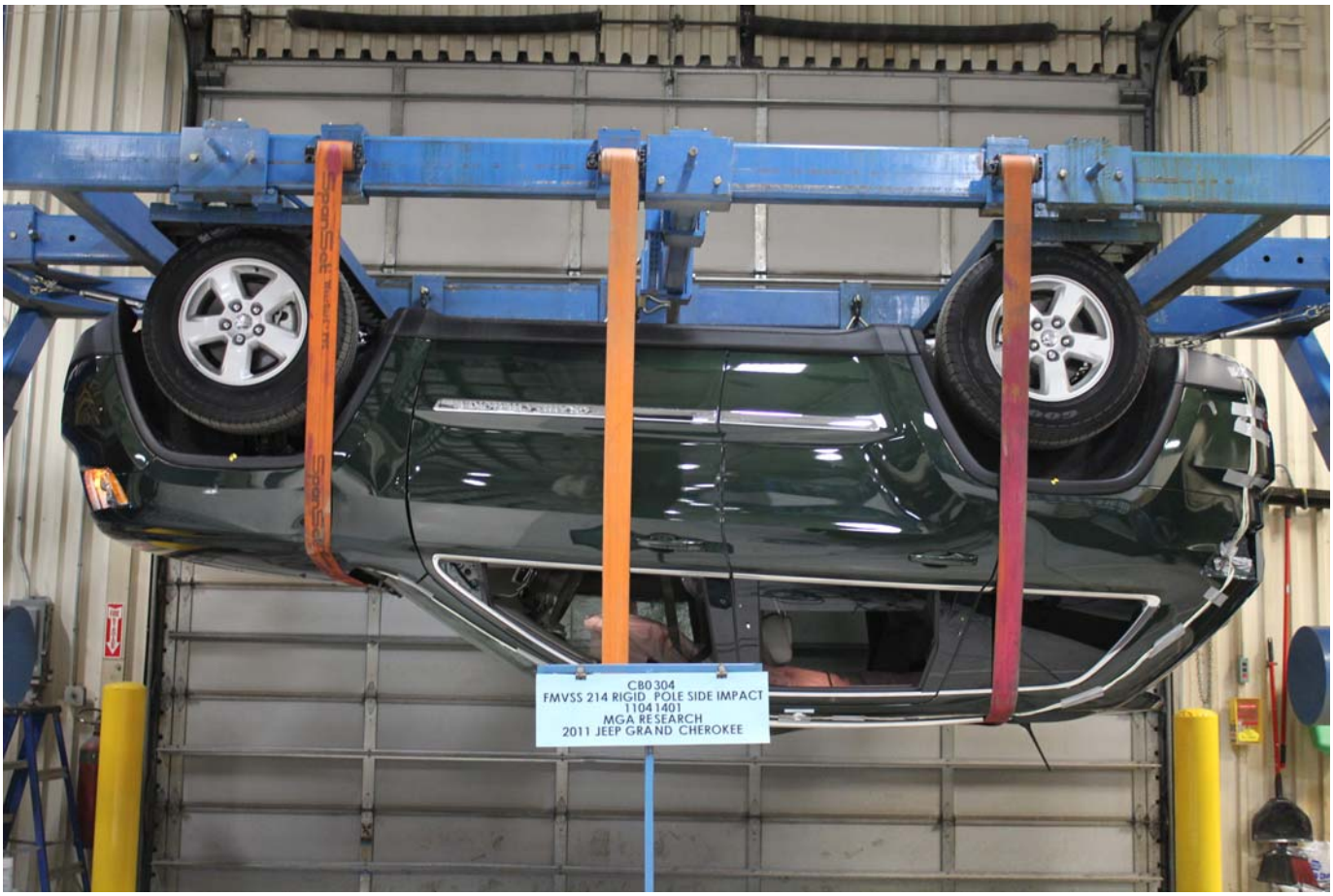
Post-Test Close-up View of Impact Point Target



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

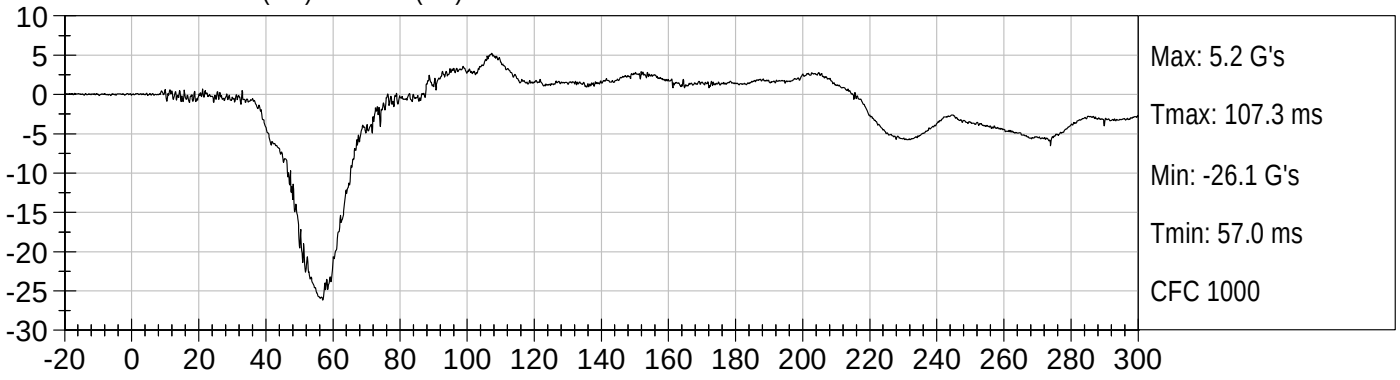
TABLE OF DATA PLOTS

Dummy Instrumentation Plots
FILTERED DATA

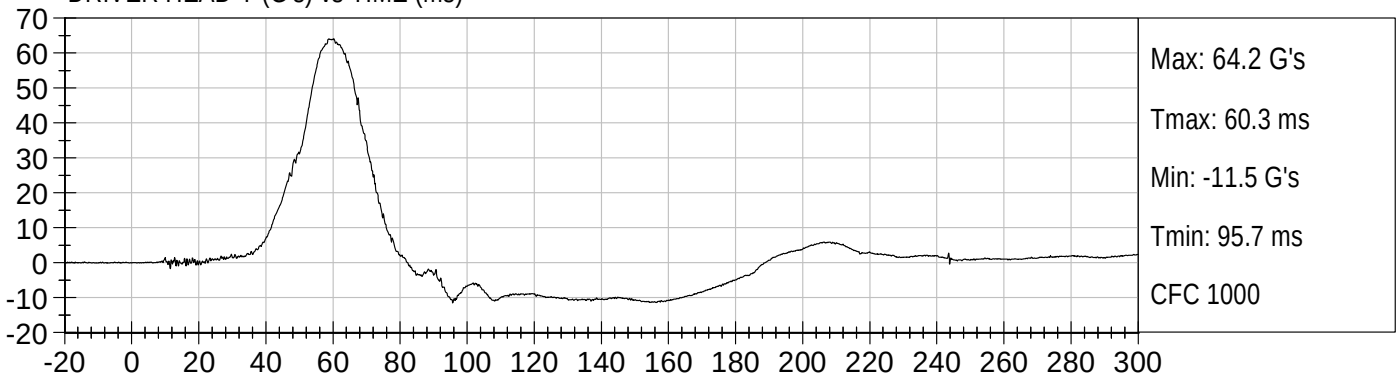
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

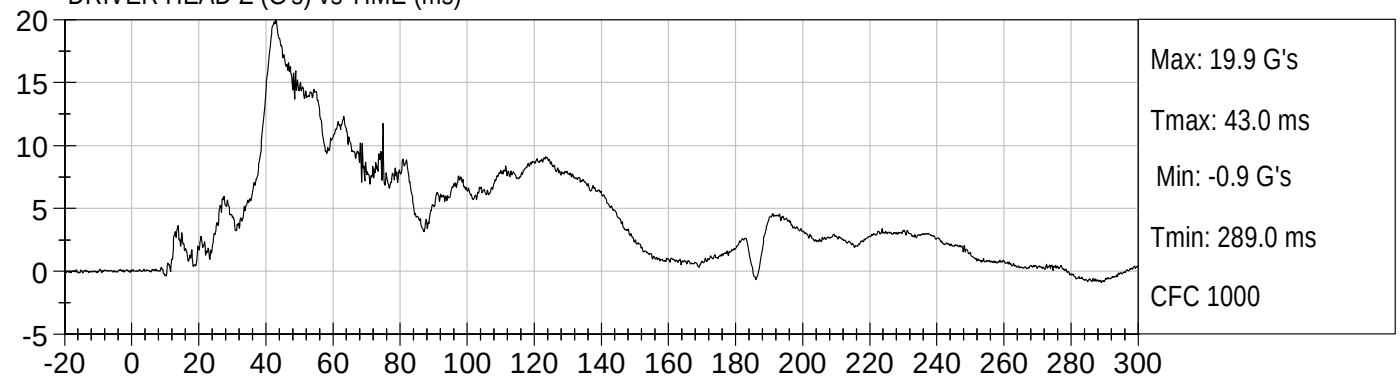
DRIVER HEAD X (G's) vs TIME (ms)



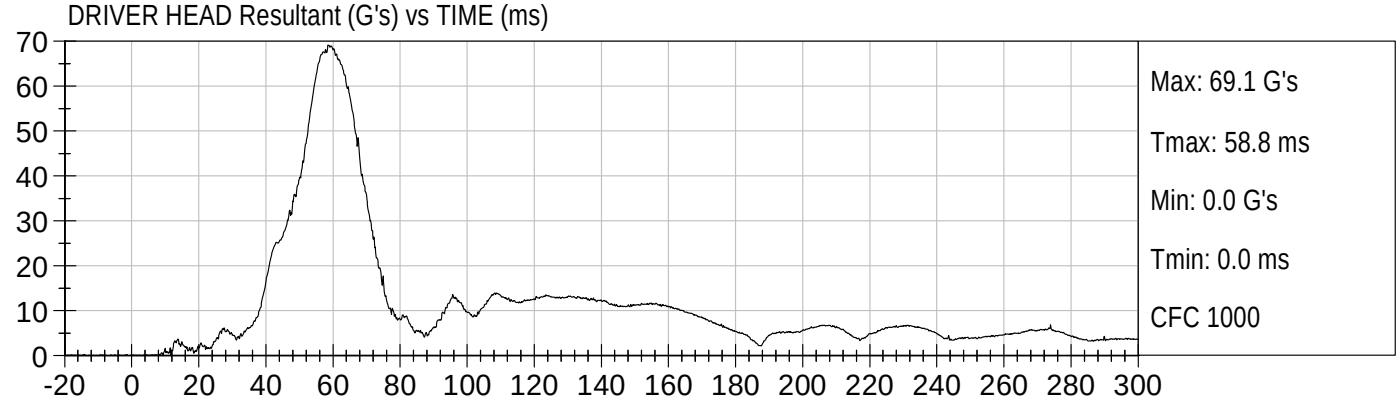
DRIVER HEAD Y (G's) vs TIME (ms)

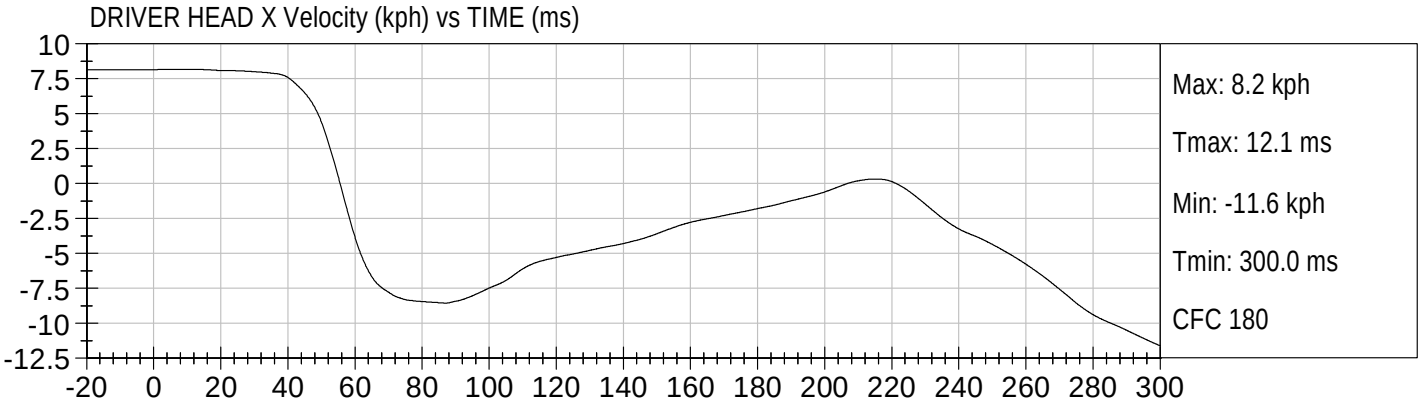


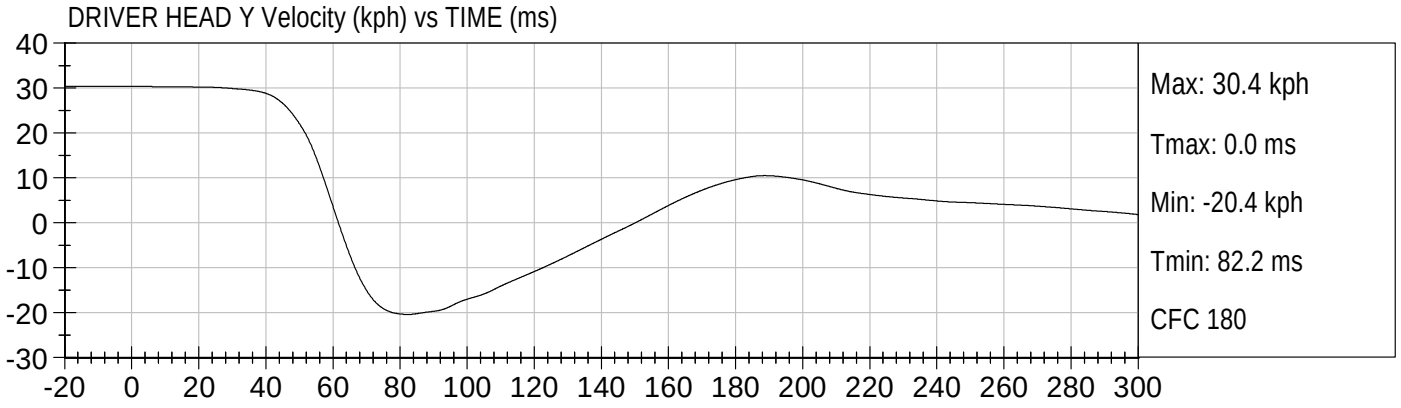
DRIVER HEAD Z (G's) vs TIME (ms)

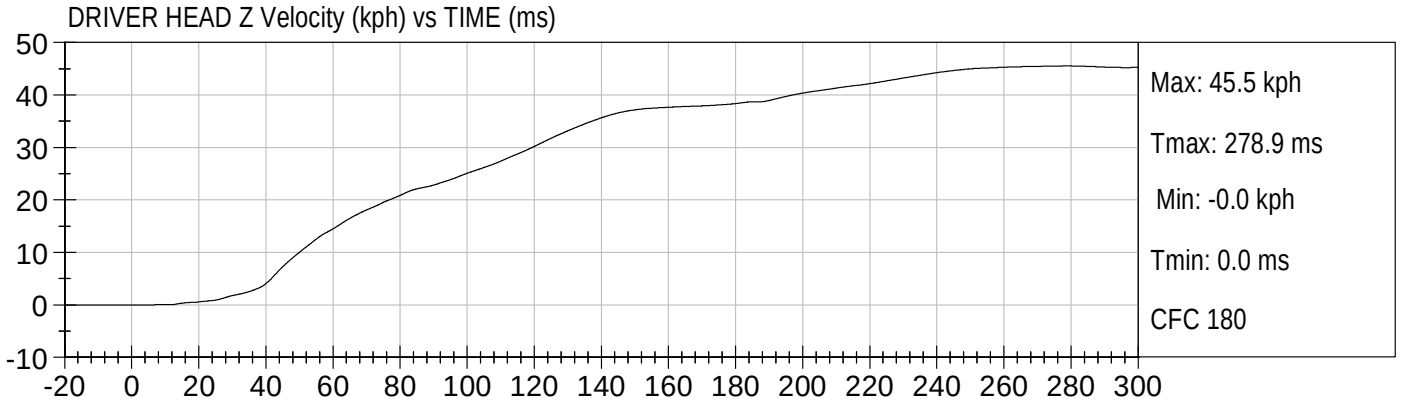


DRIVER HEAD Resultant (G's) vs TIME (ms)

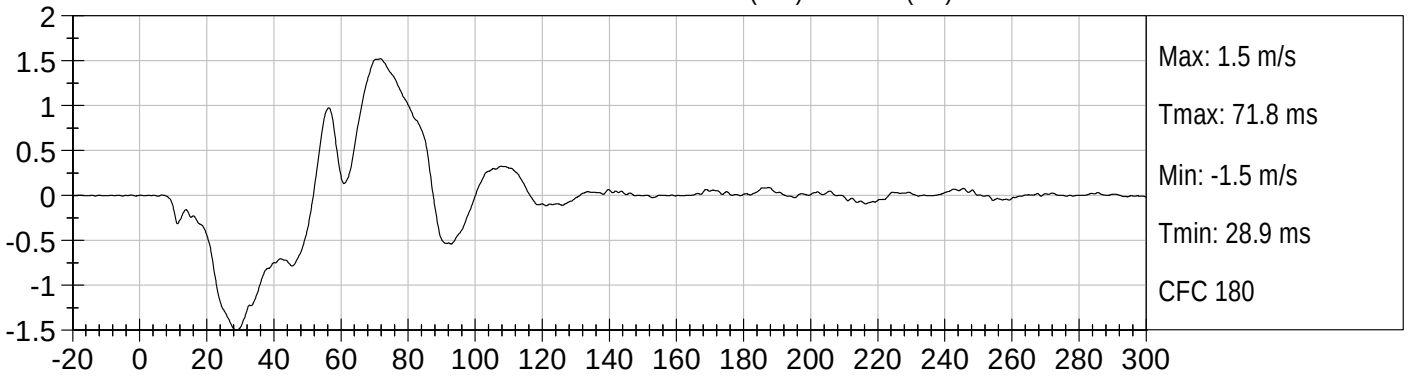



DRIVER HEAD X Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-5
-7.5
-10
-12.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.2 kph
Tmax: 12.1 ms
Min: -11.6 kph
Tmin: 300.0 ms
CFC 180

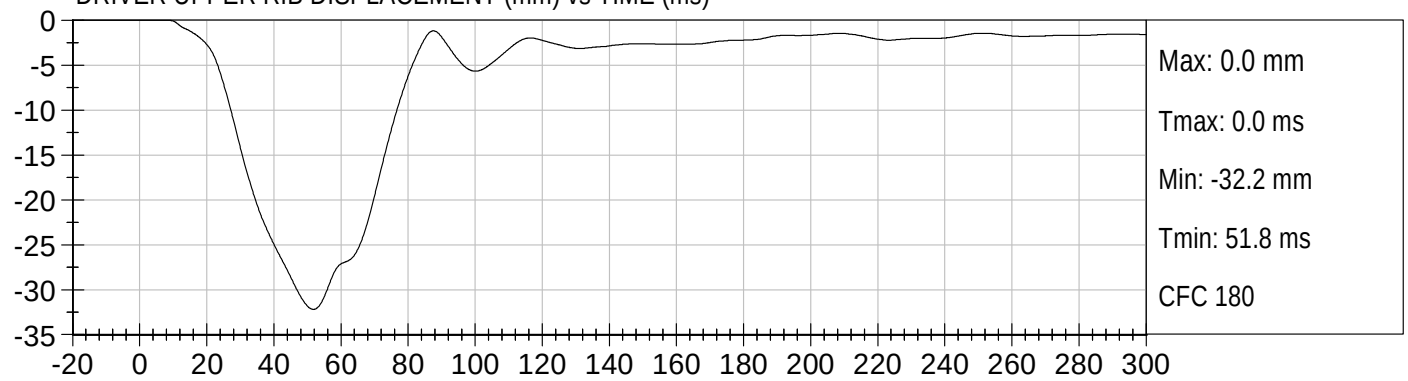

DRIVER HEAD Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-30
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 30.4 kph
Tmax: 0.0 ms
Min: -20.4 kph
Tmin: 82.2 ms
CFC 180


DRIVER HEAD Z Velocity (kph) vs TIME (ms)
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 45.5 kph
Tmax: 278.9 ms
Min: -0.0 kph
Tmin: 0.0 ms
CFC 180

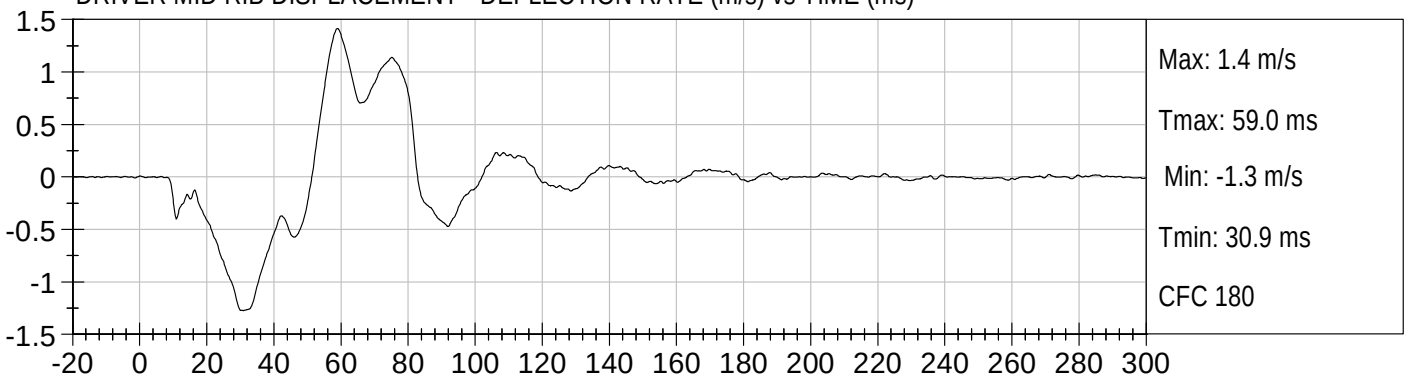
DRIVER UPPER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



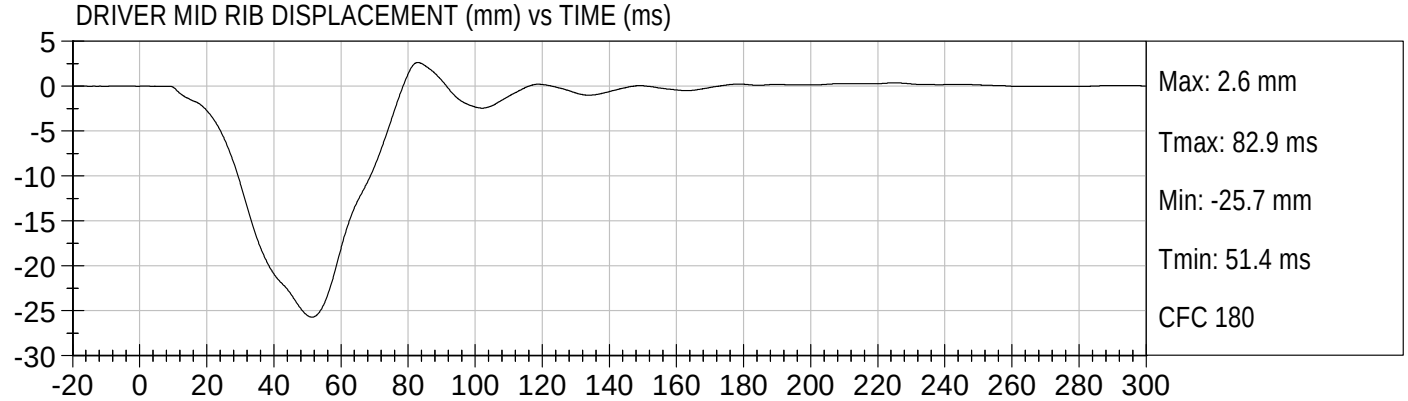
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



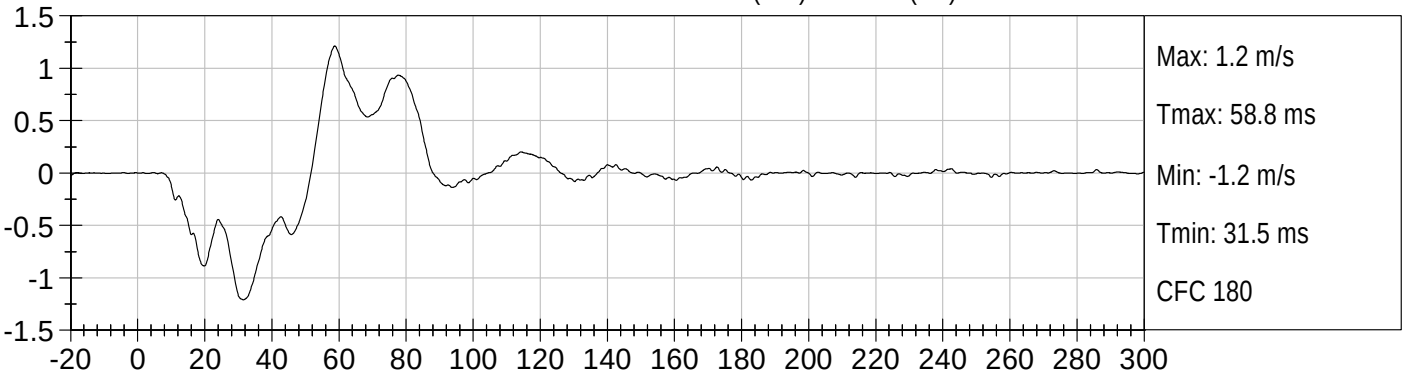
DRIVER MID RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



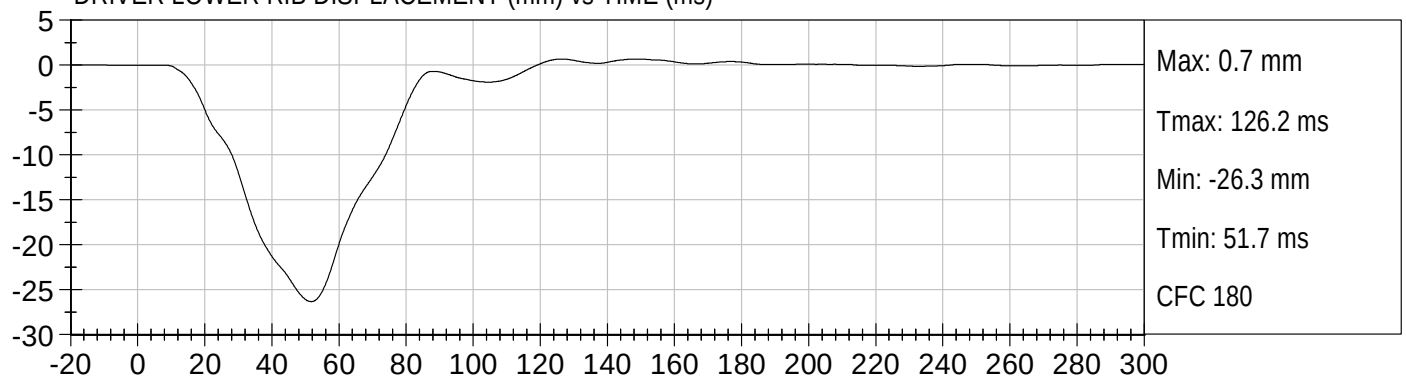
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



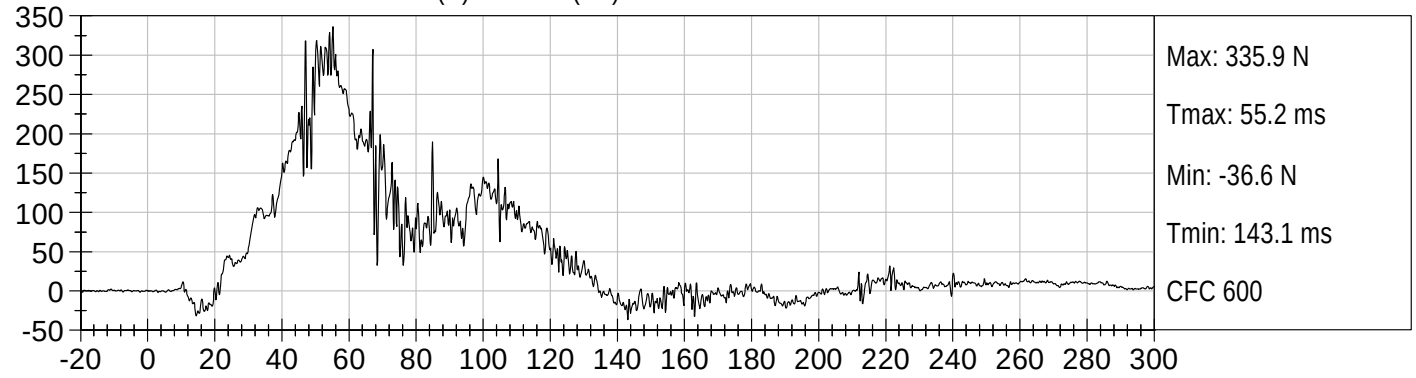
DRIVER LOWER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



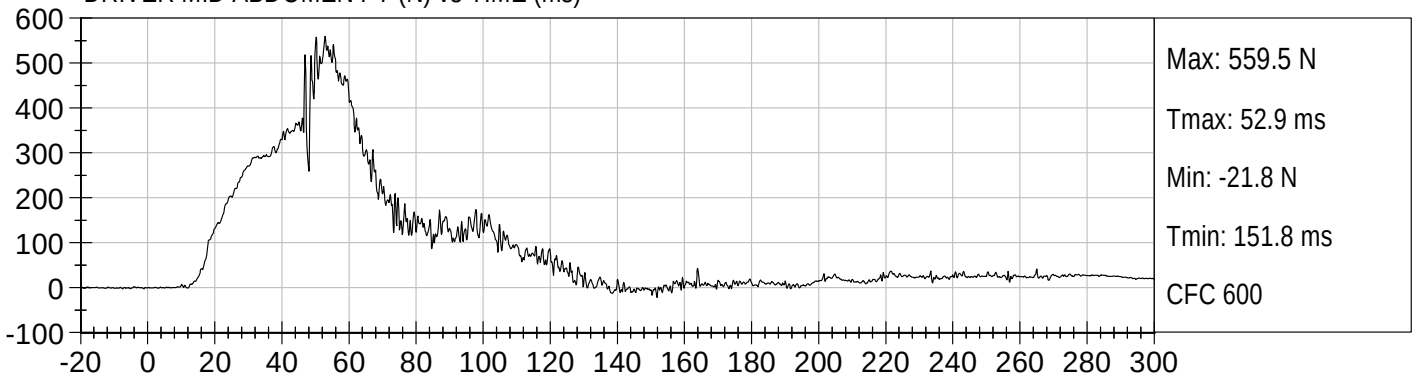
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



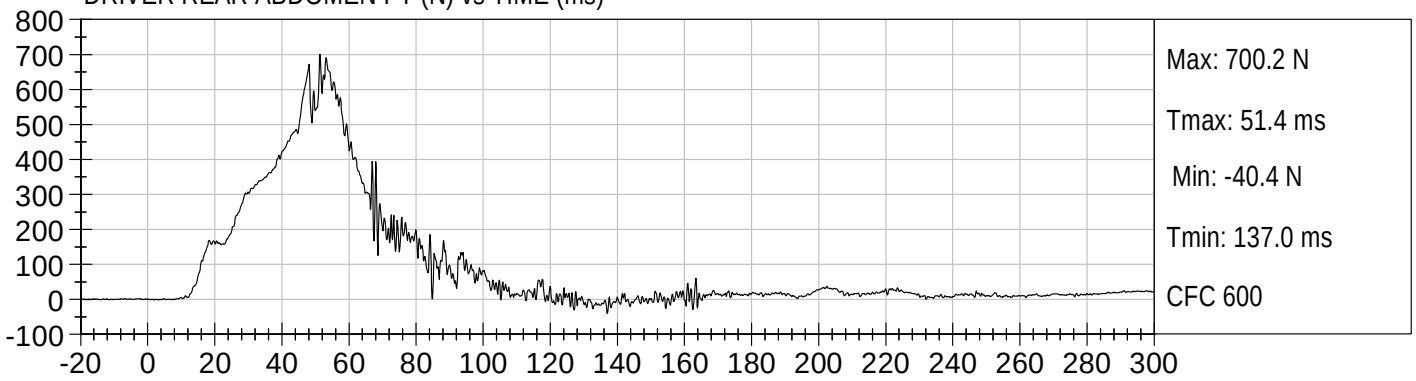
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



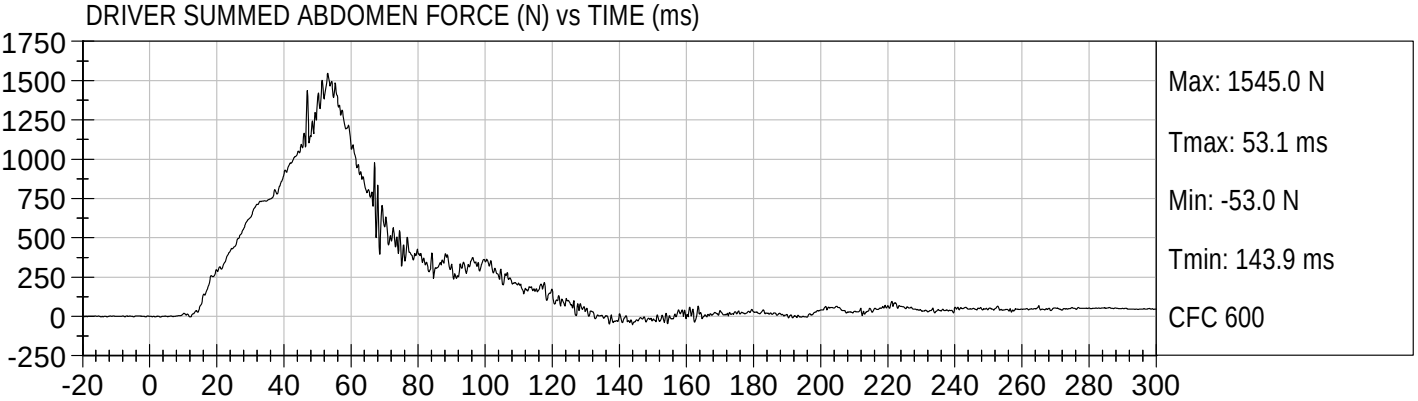
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



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

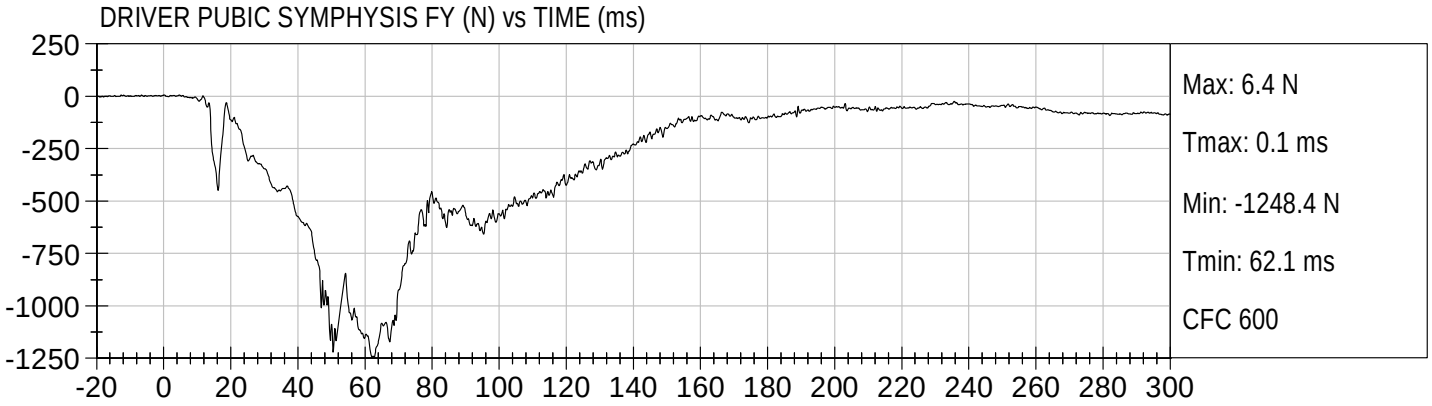


DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)



APPENDIX C

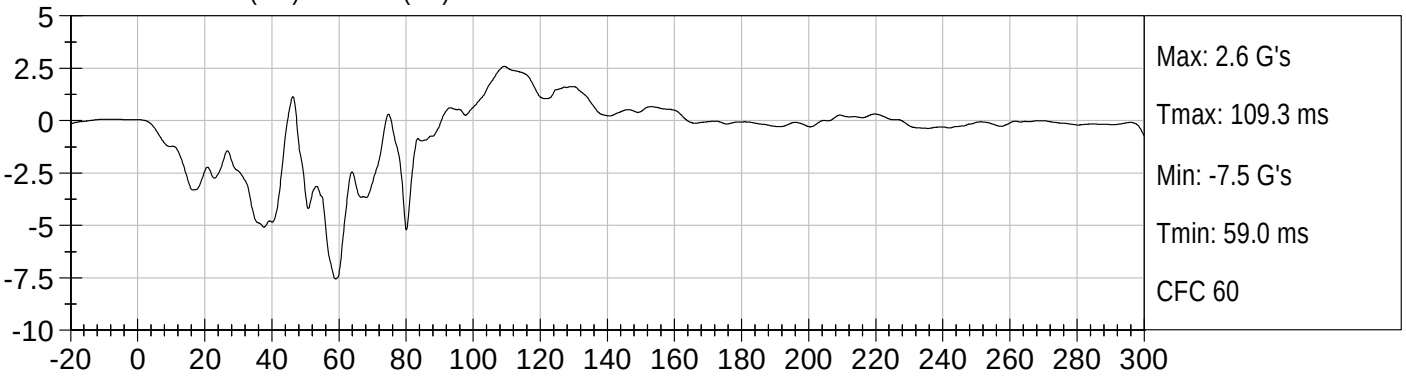
VEHICLE ACCELEROMETER RESPONSE DATA

TABLE OF DATA PLOTS

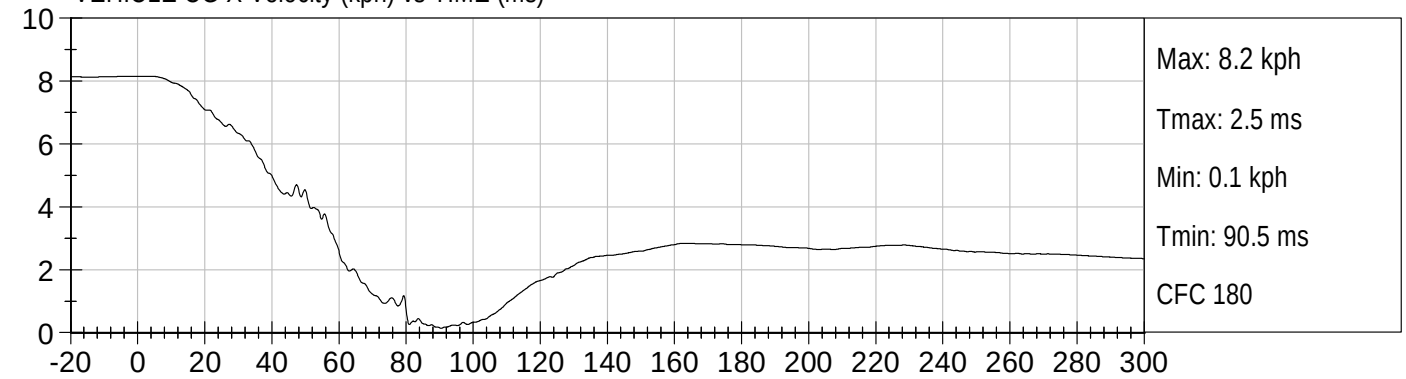
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

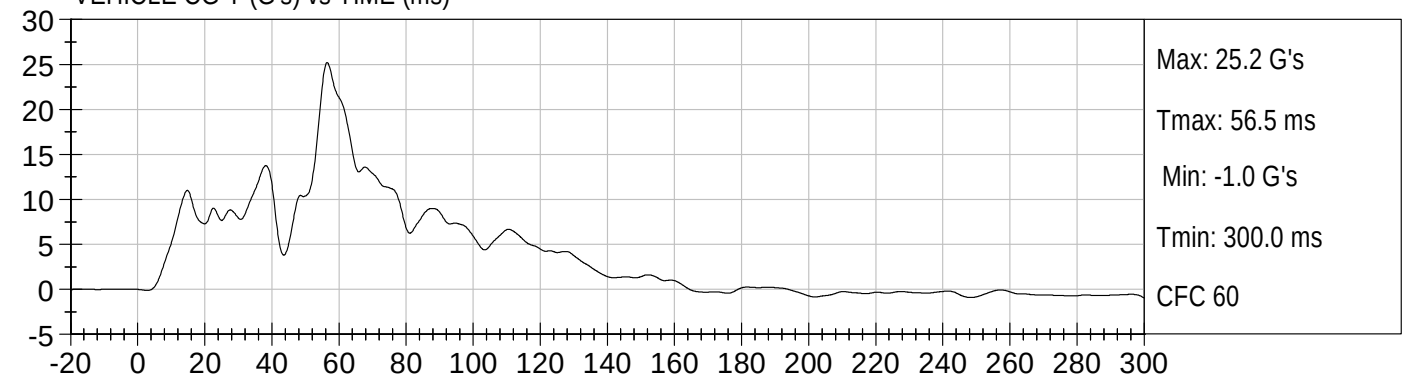
VEHICLE CG X (G's) vs TIME (ms)



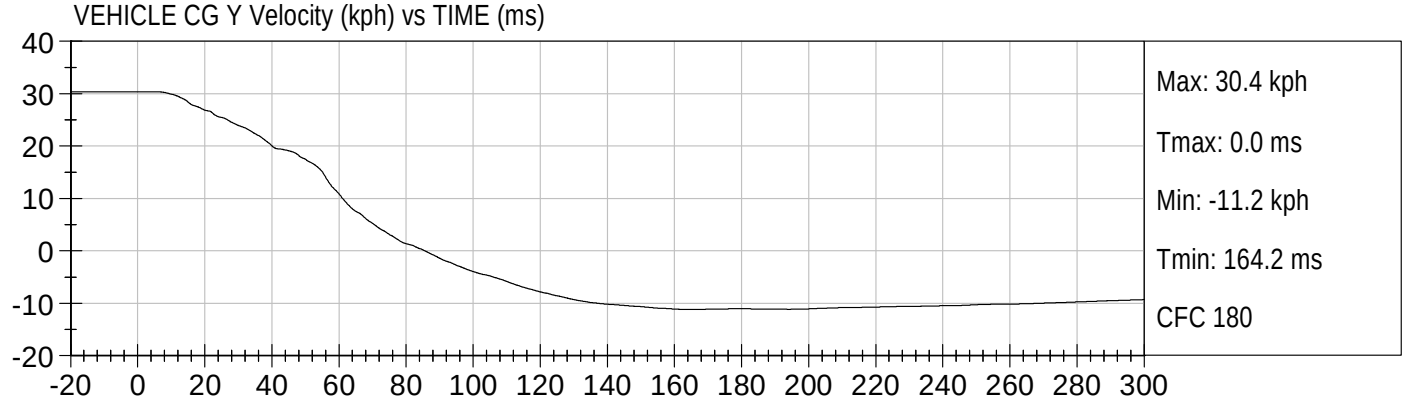
VEHICLE CG X Velocity (kph) vs TIME (ms)



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



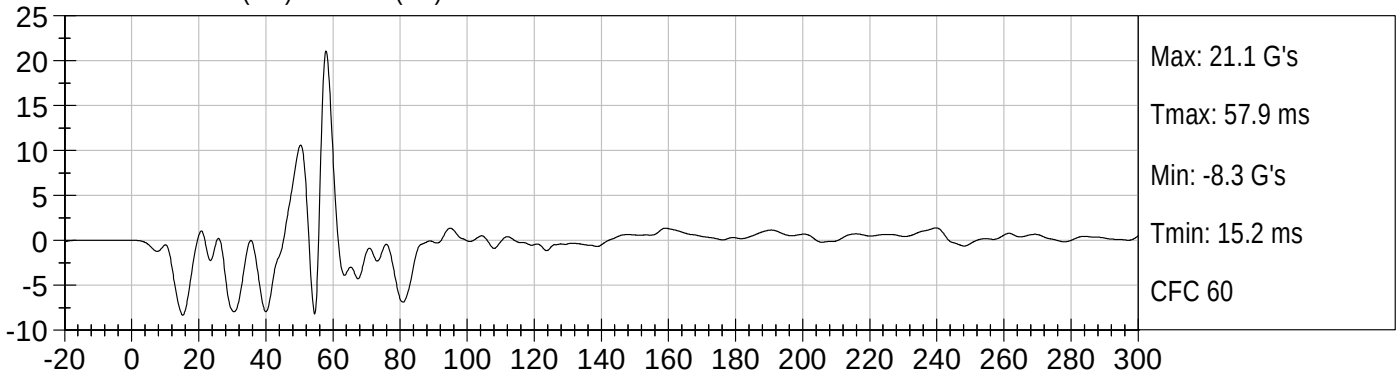
VEHICLE CG Y Velocity (kph) vs TIME (ms)



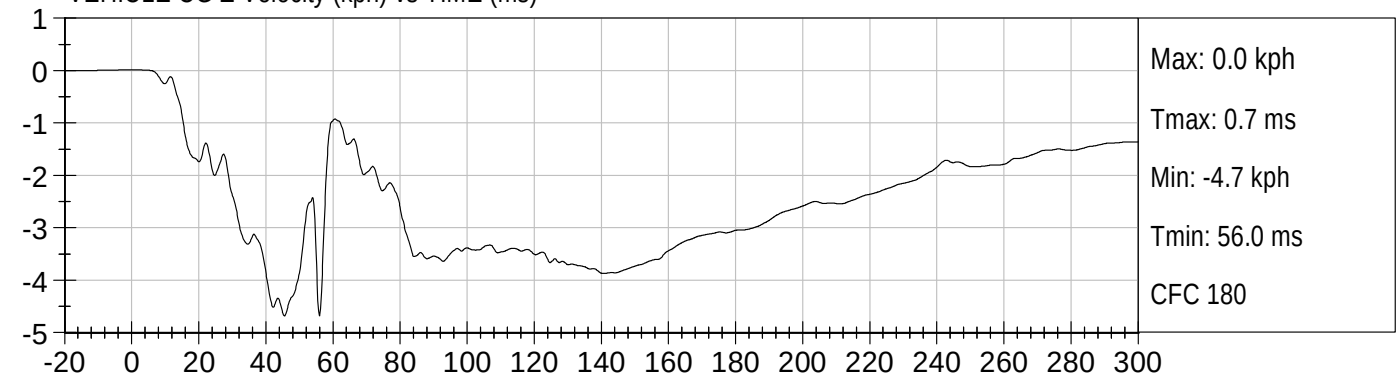
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

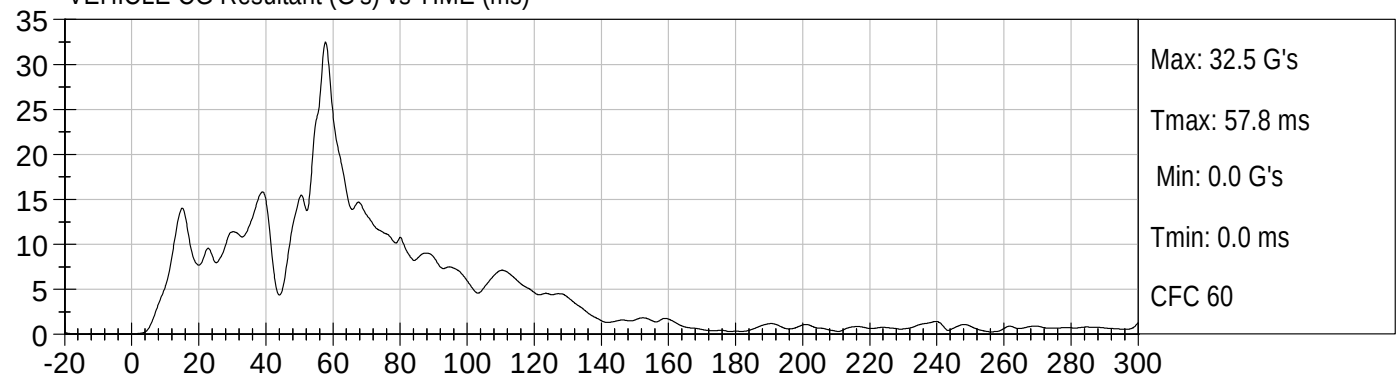
VEHICLE CG Z (G's) vs TIME (ms)



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



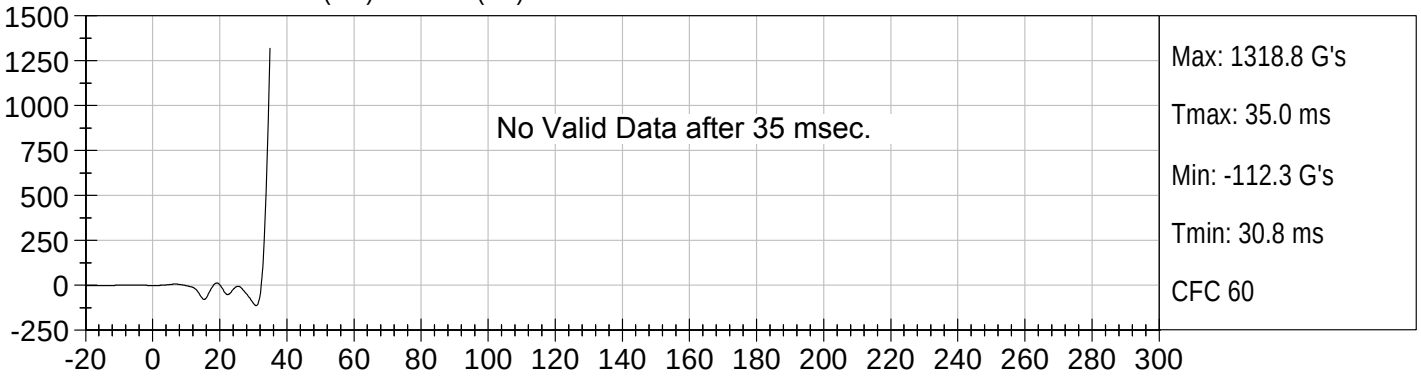
VEHICLE CG Resultant (G's) vs TIME (ms)



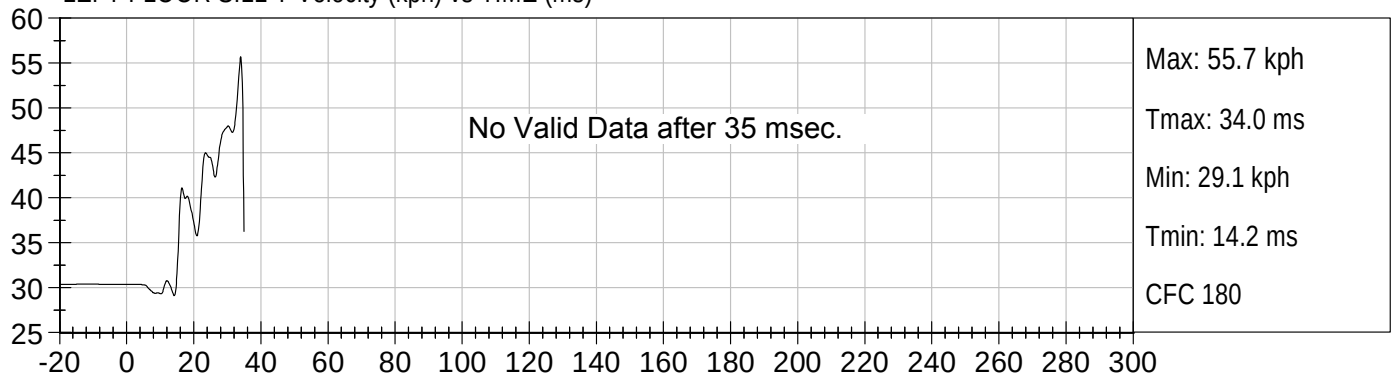
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

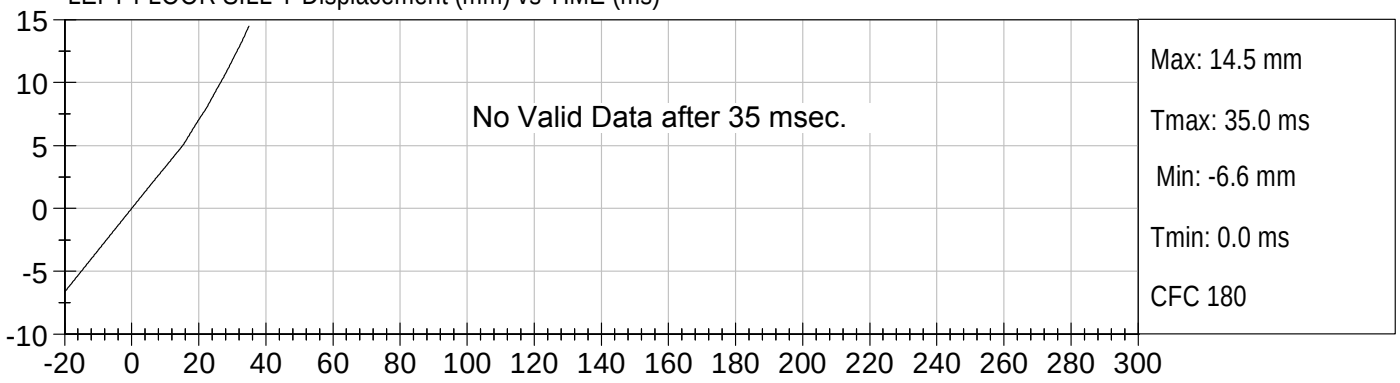
LEFT FLOOR SILL Y (G's) vs TIME (ms)



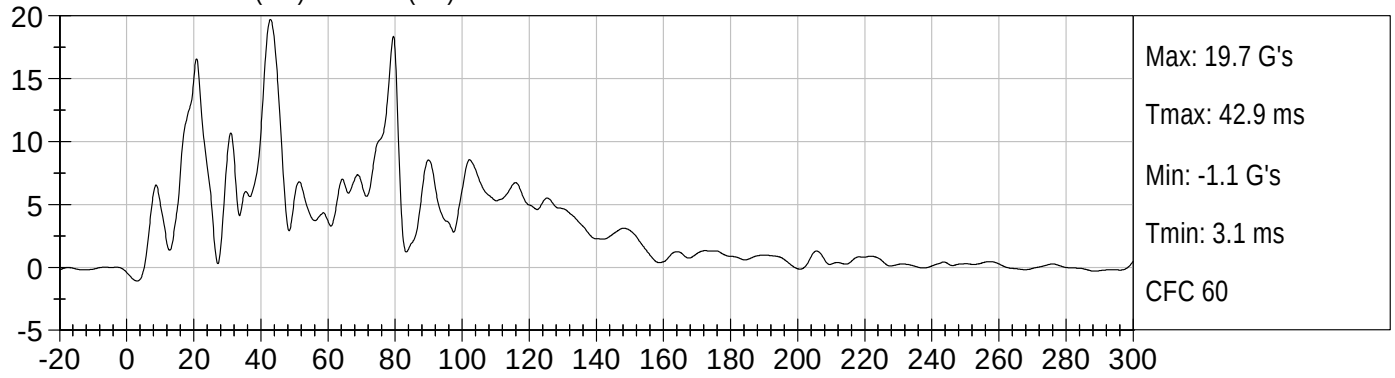
LEFT FLOOR SILL Y Velocity (kph) vs TIME (ms)



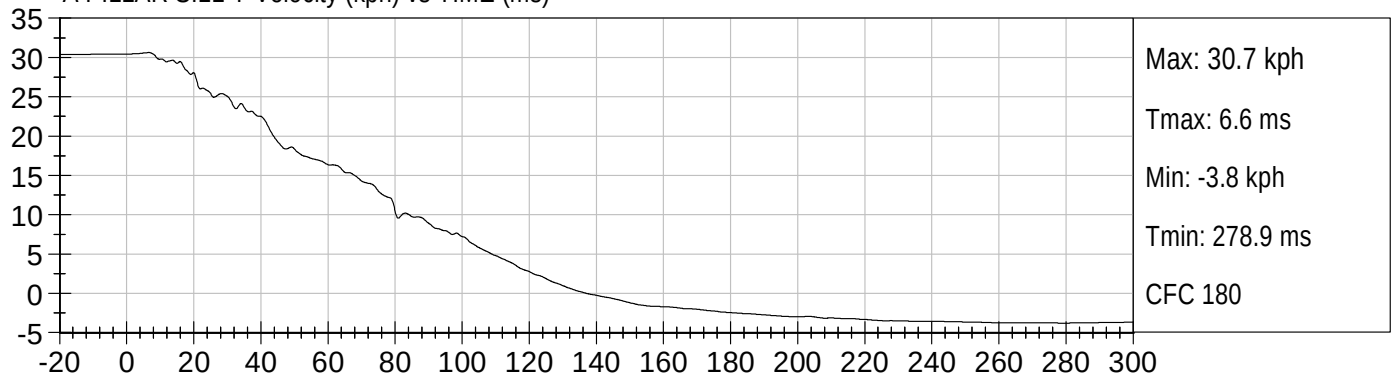
LEFT FLOOR SILL Y Displacement (mm) vs TIME (ms)



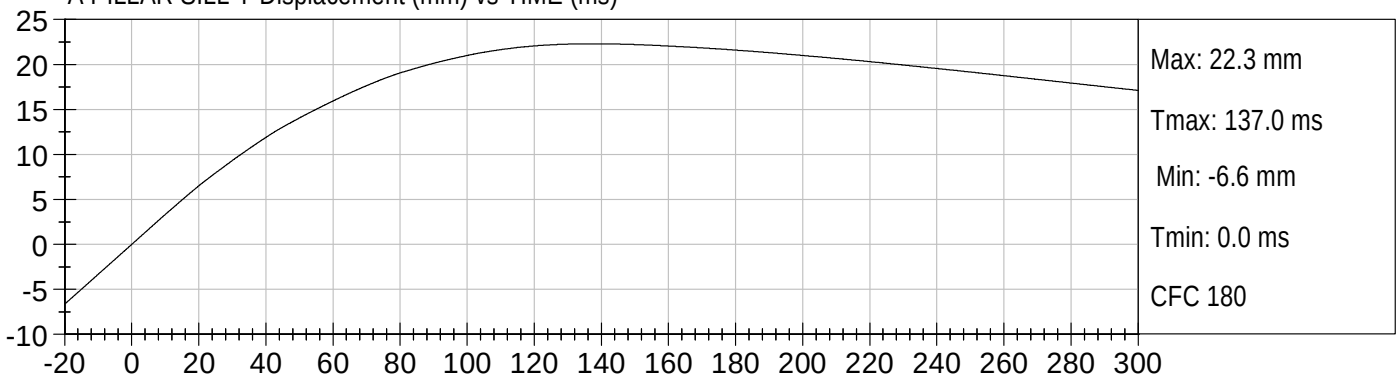
A PILLAR SILL Y (G's) vs TIME (ms)



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



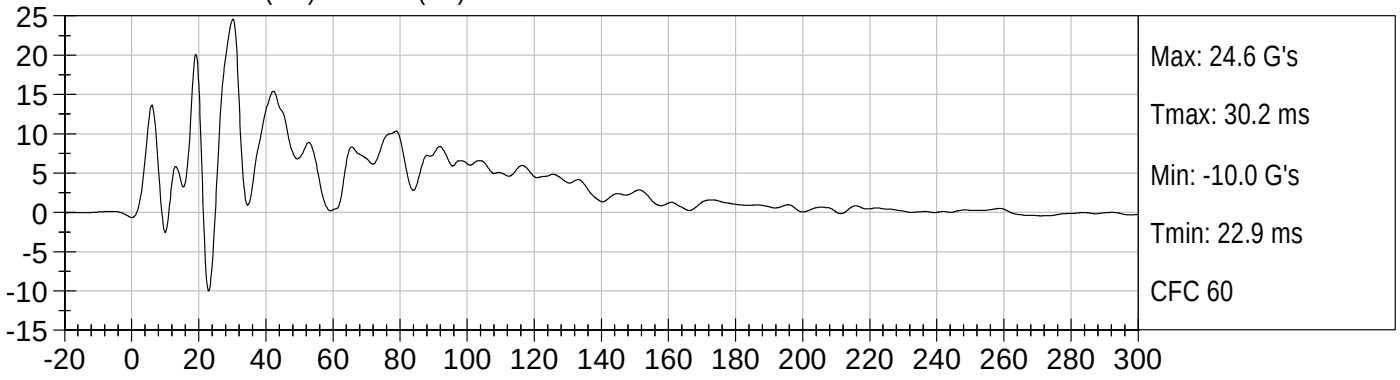
A PILLAR SILL Y Displacement (mm) vs TIME (ms)



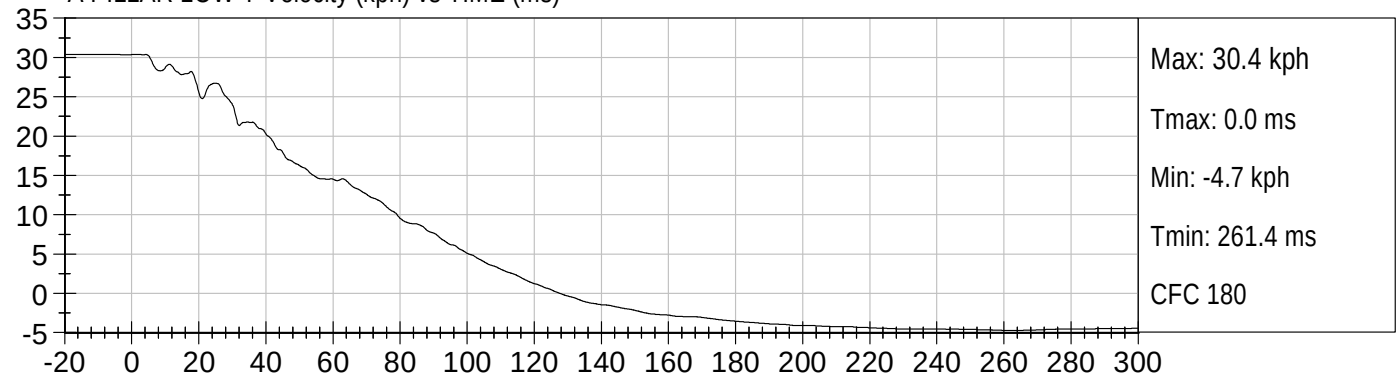
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

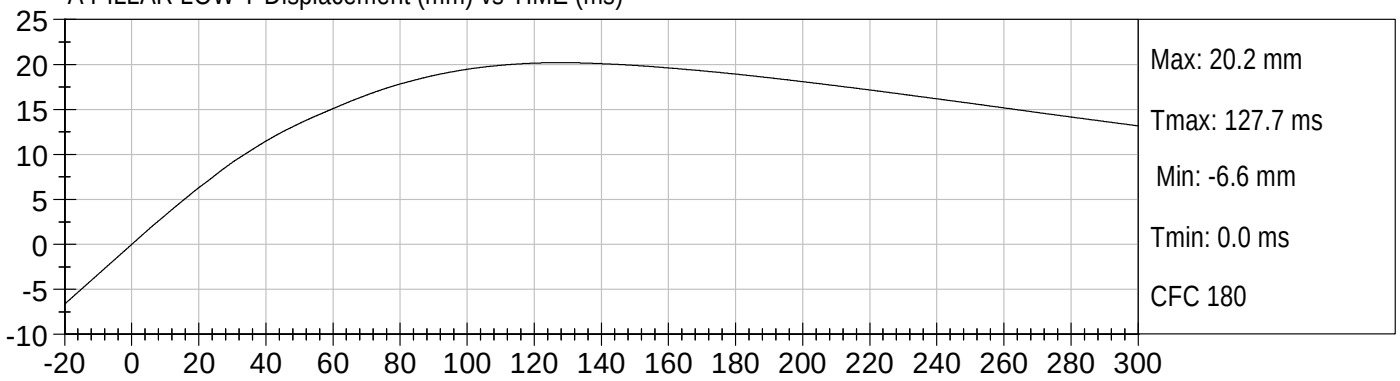
A PILLAR LOW Y (G's) vs TIME (ms)



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



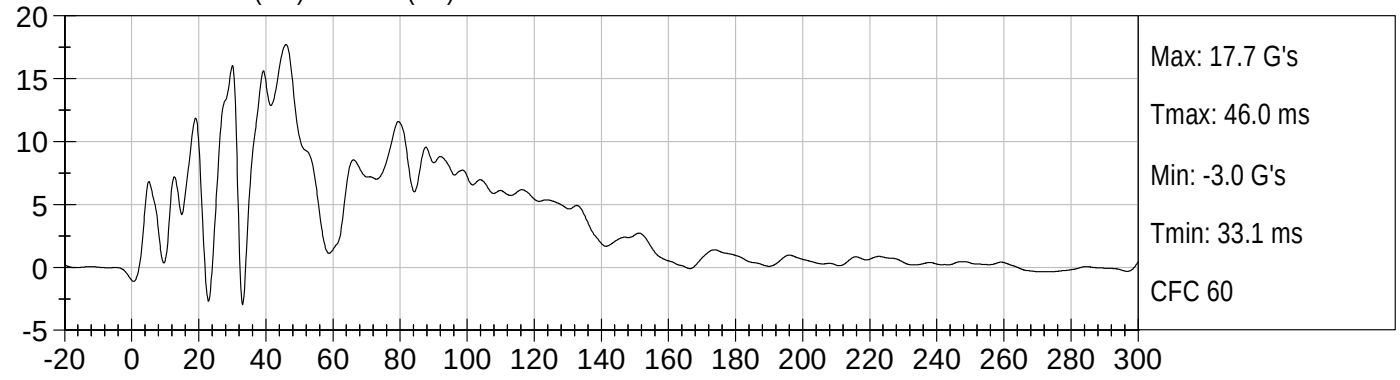
A PILLAR LOW Y Displacement (mm) vs TIME (ms)



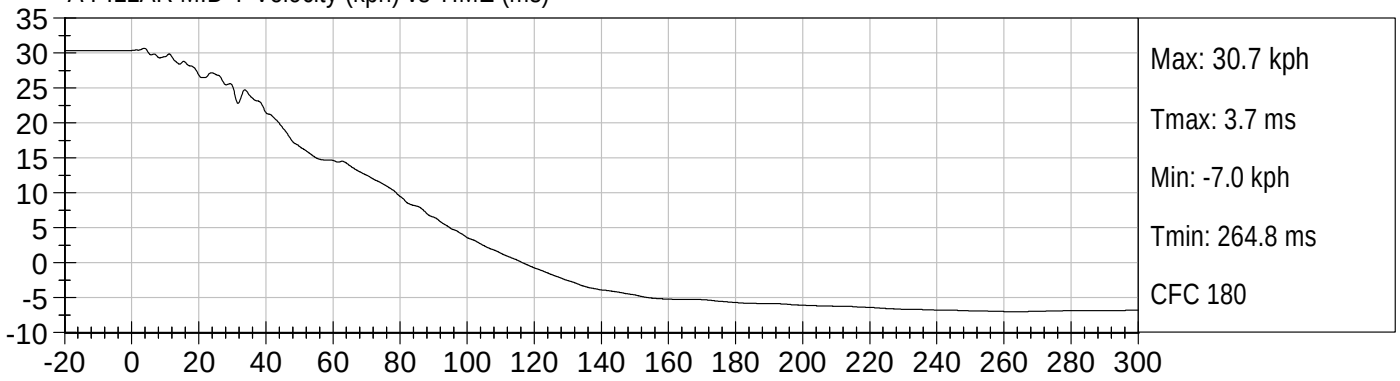
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

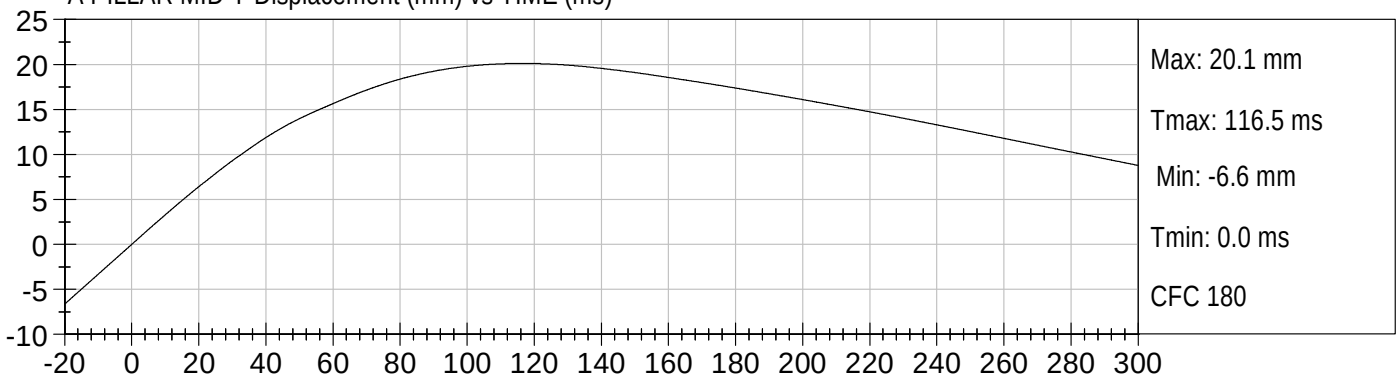
A PILLAR MID Y (G's) vs TIME (ms)



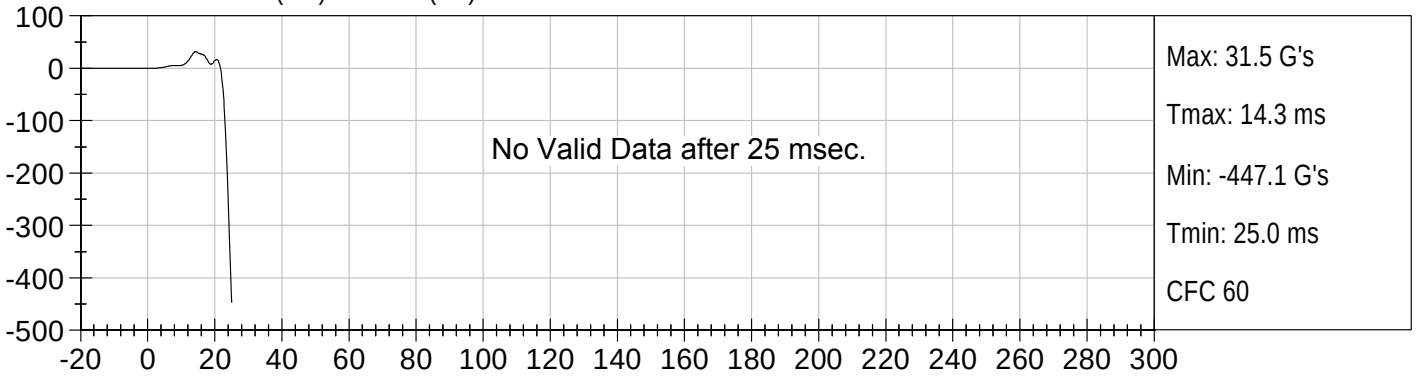
A PILLAR MID Y Velocity (kph) vs TIME (ms)



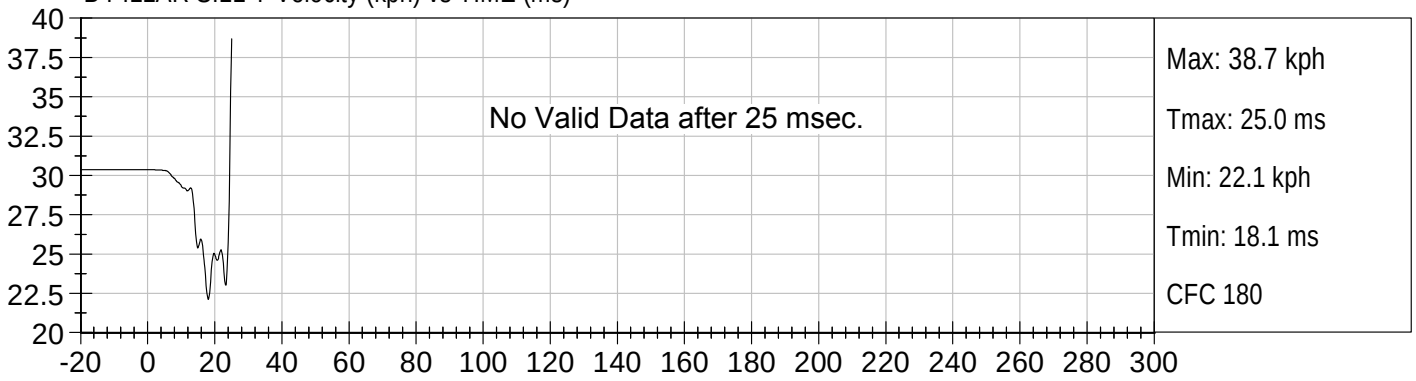
A PILLAR MID Y Displacement (mm) vs TIME (ms)



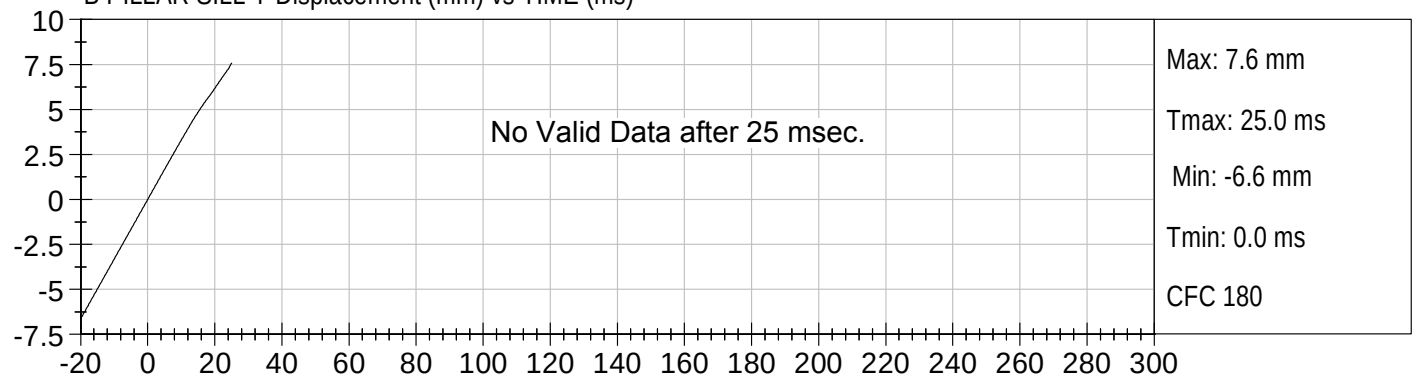
B PILLAR SILL Y (G's) vs TIME (ms)



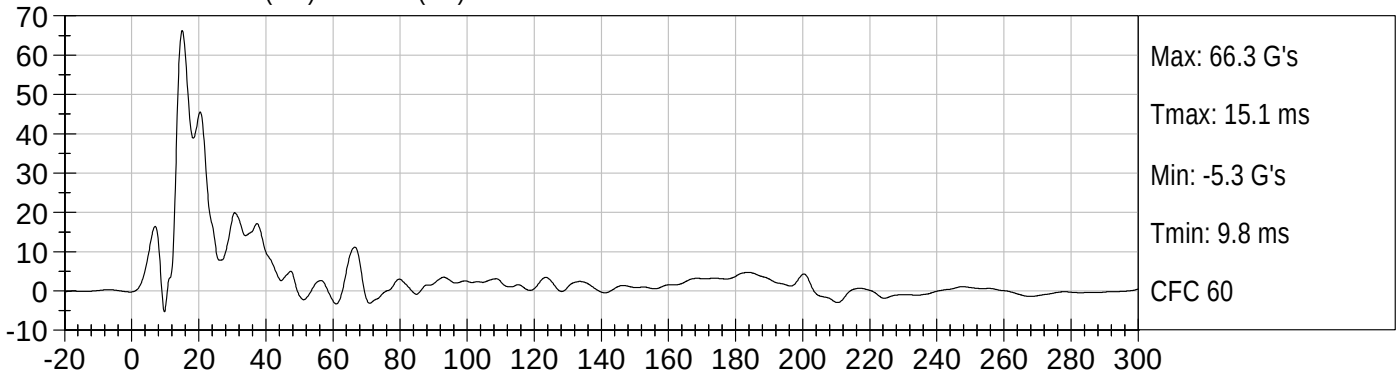
B PILLAR SILL Y Velocity (kph) vs TIME (ms)



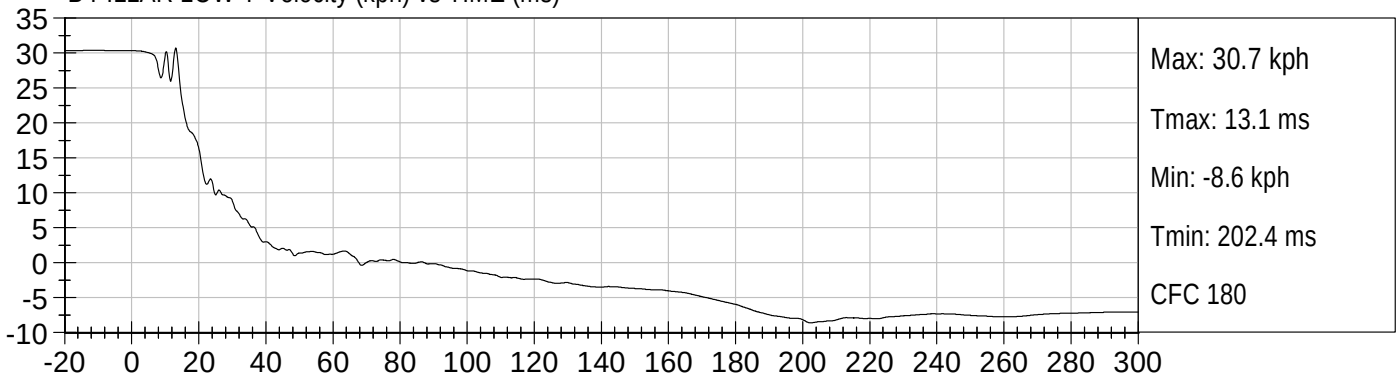
B PILLAR SILL Y Displacement (mm) vs TIME (ms)



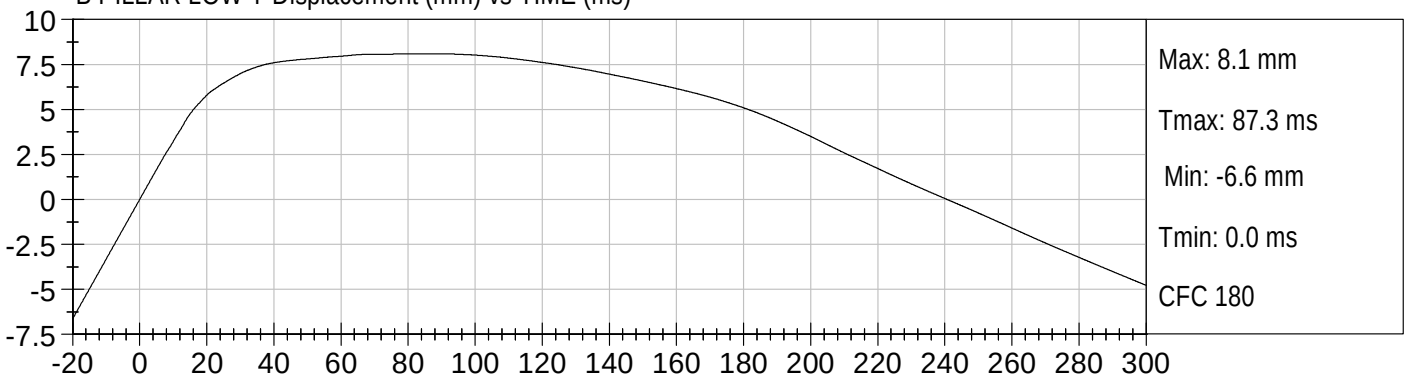
B PILLAR LOW Y (G's) vs TIME (ms)



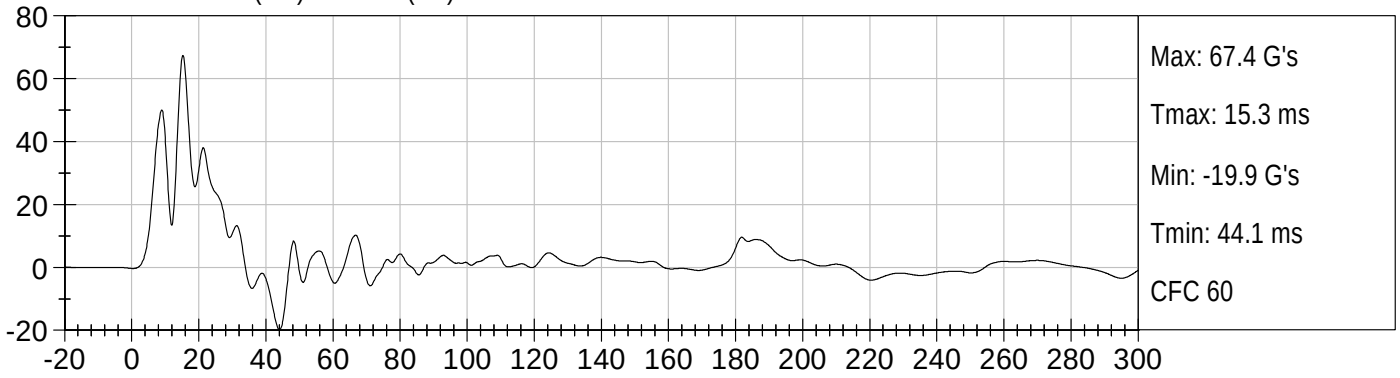
B PILLAR LOW Y Velocity (kph) vs TIME (ms)



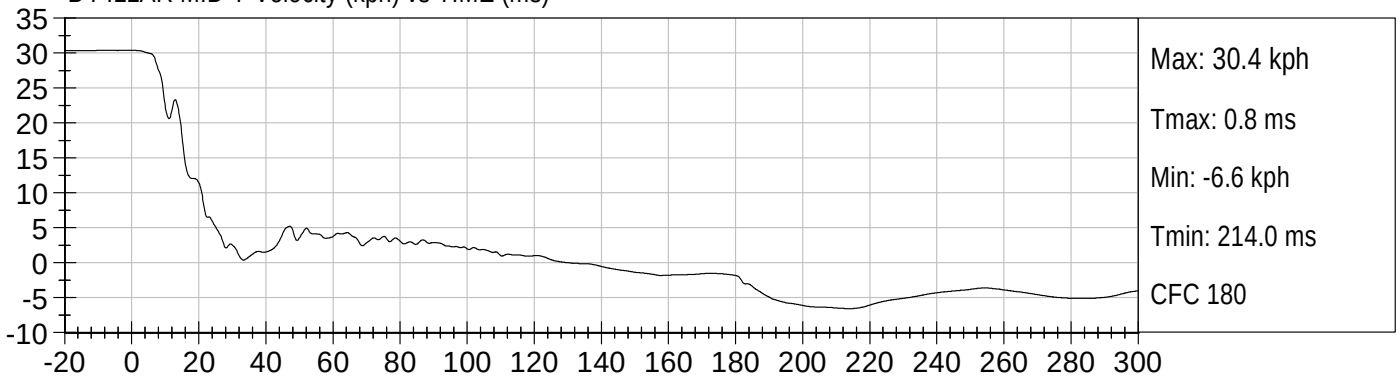
B PILLAR LOW Y Displacement (mm) vs TIME (ms)



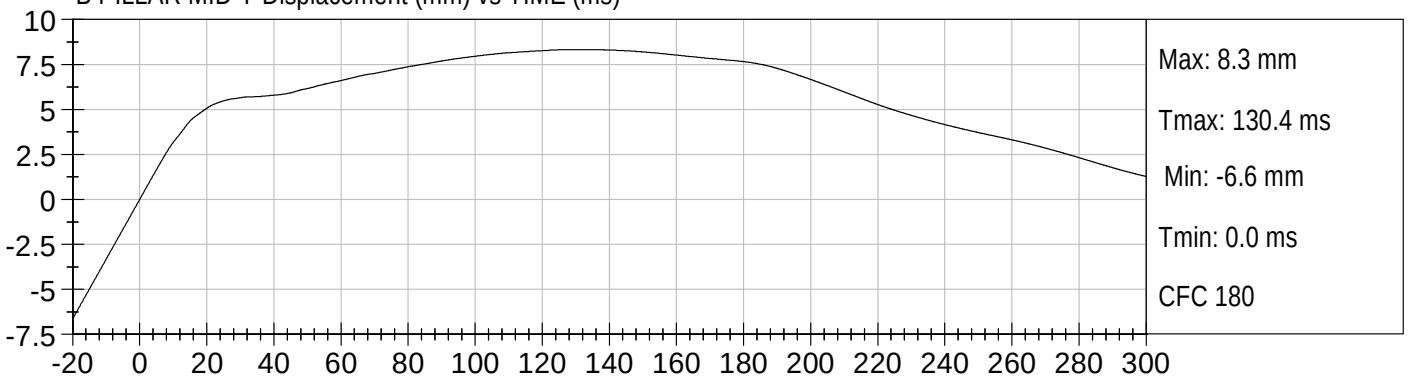
B PILLAR MID Y (G's) vs TIME (ms)



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



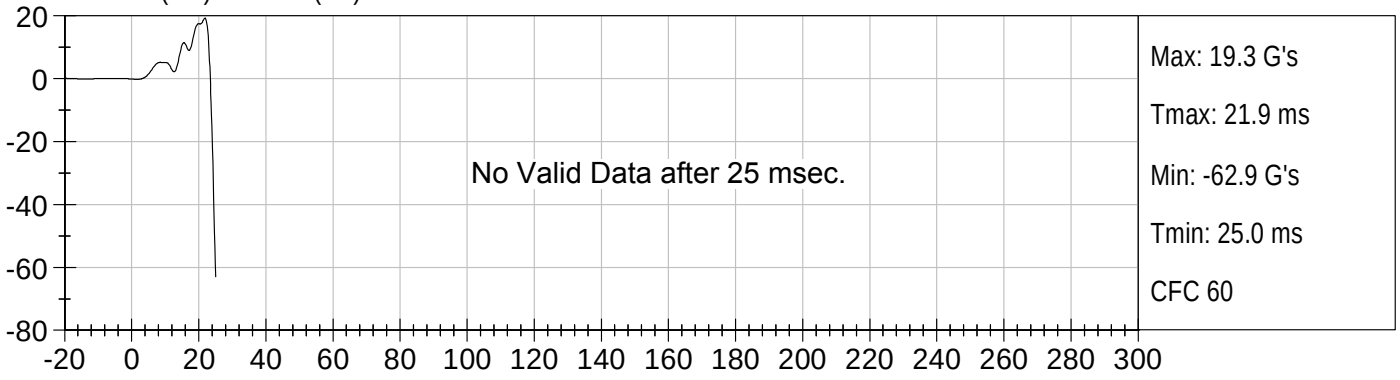
B PILLAR MID Y Displacement (mm) vs TIME (ms)



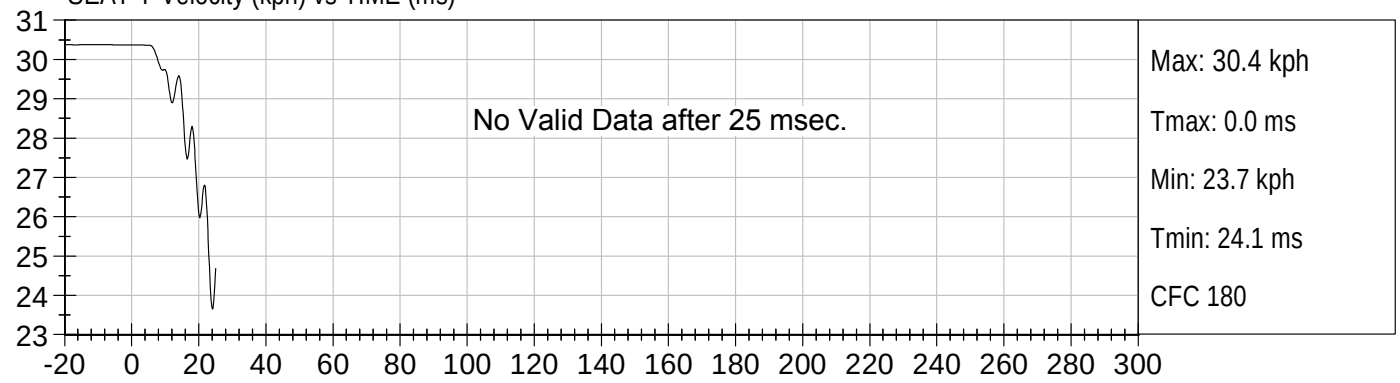
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

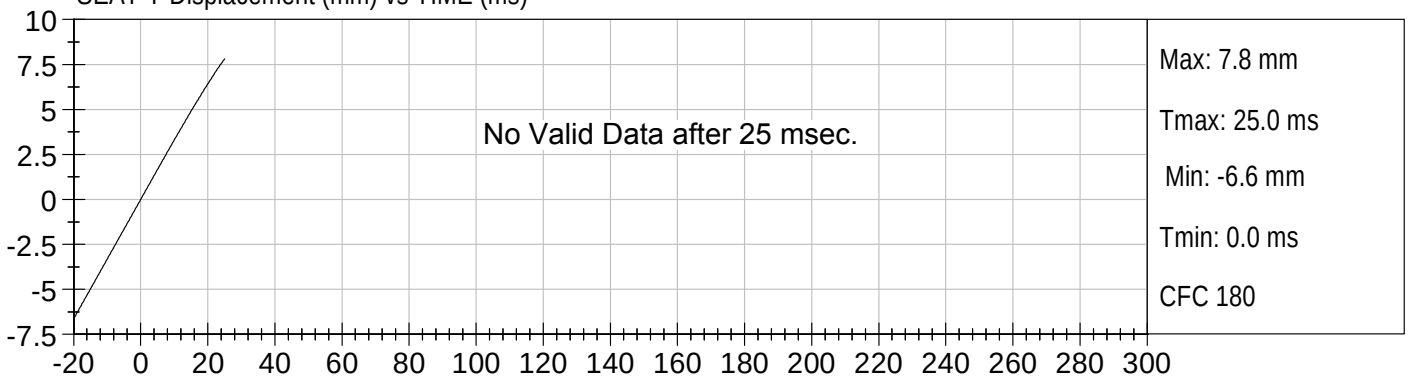
SEAT Y (G's) vs TIME (ms)



SEAT Y Velocity (kph) vs TIME (ms)



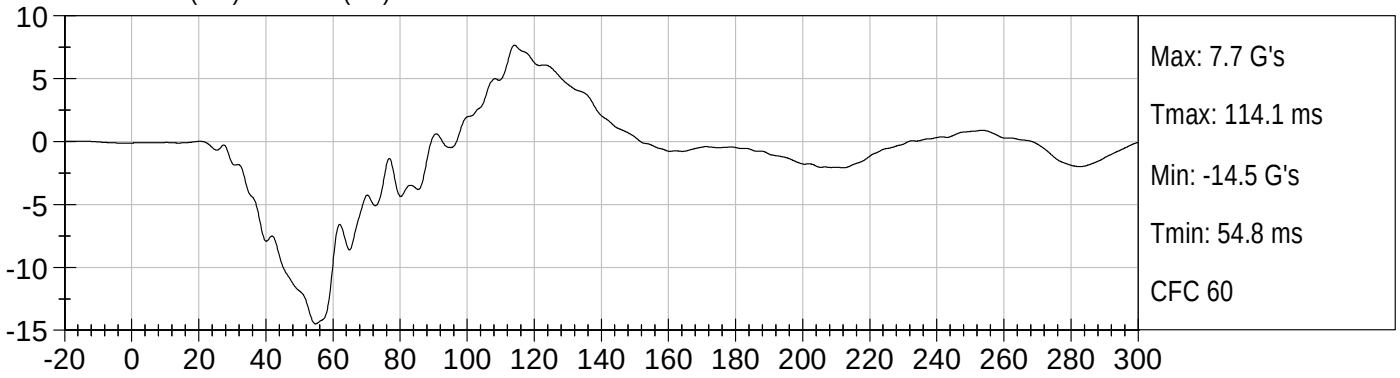
SEAT Y Displacement (mm) vs TIME (ms)



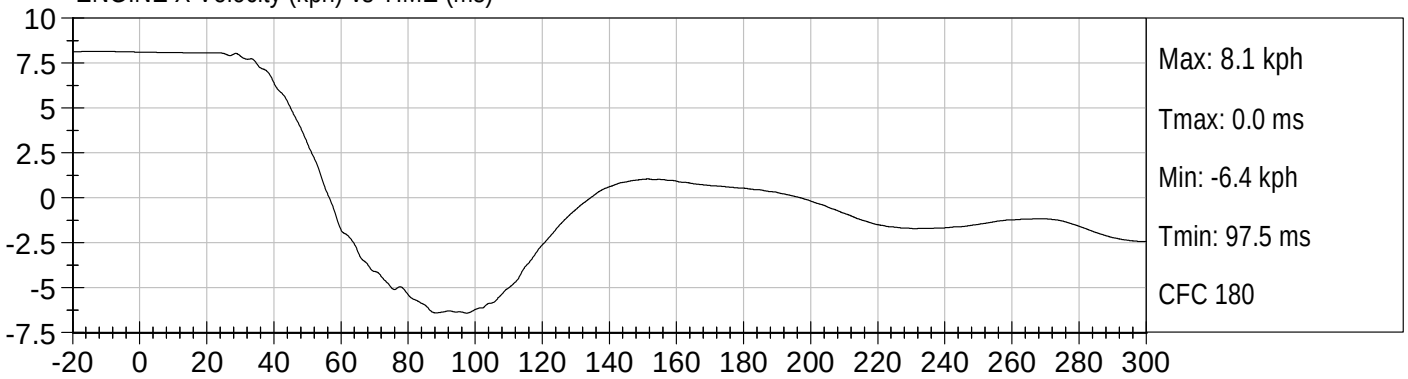
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

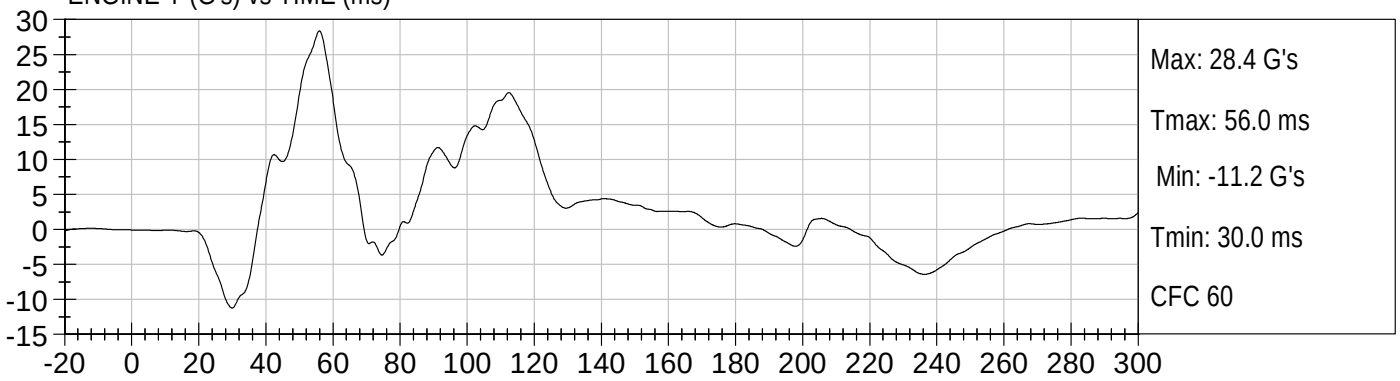
ENGINE X (G's) vs TIME (ms)



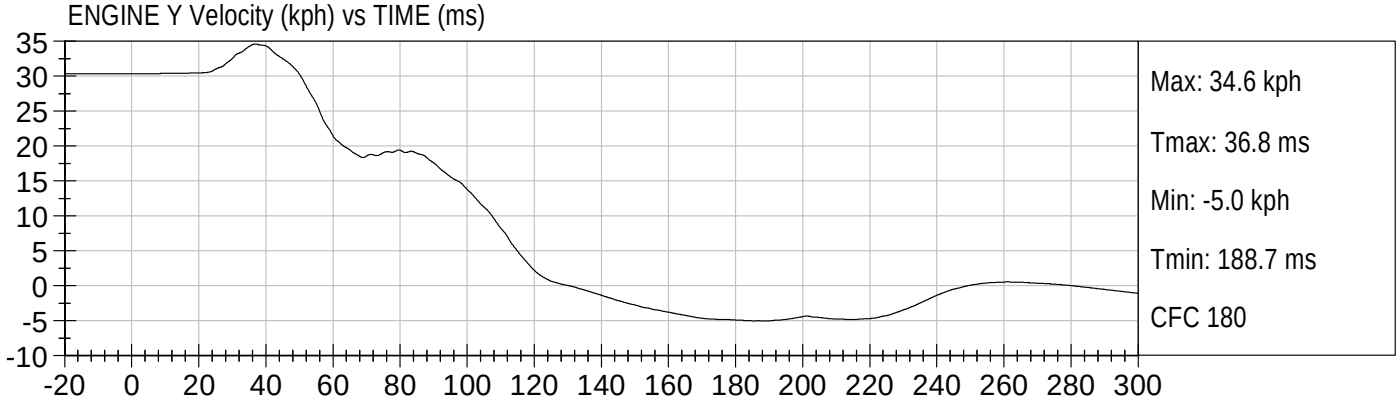
ENGINE X Velocity (kph) vs TIME (ms)



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

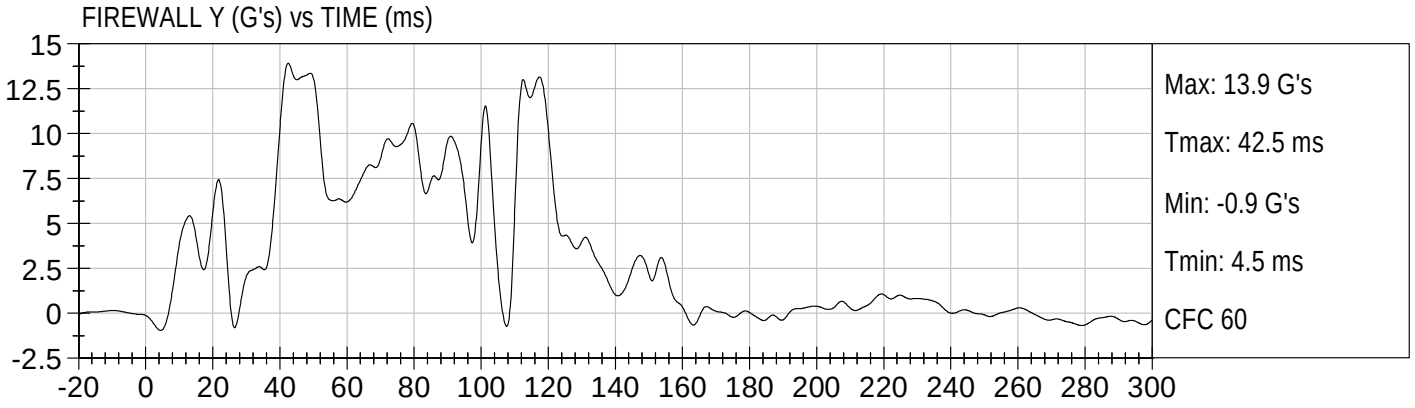


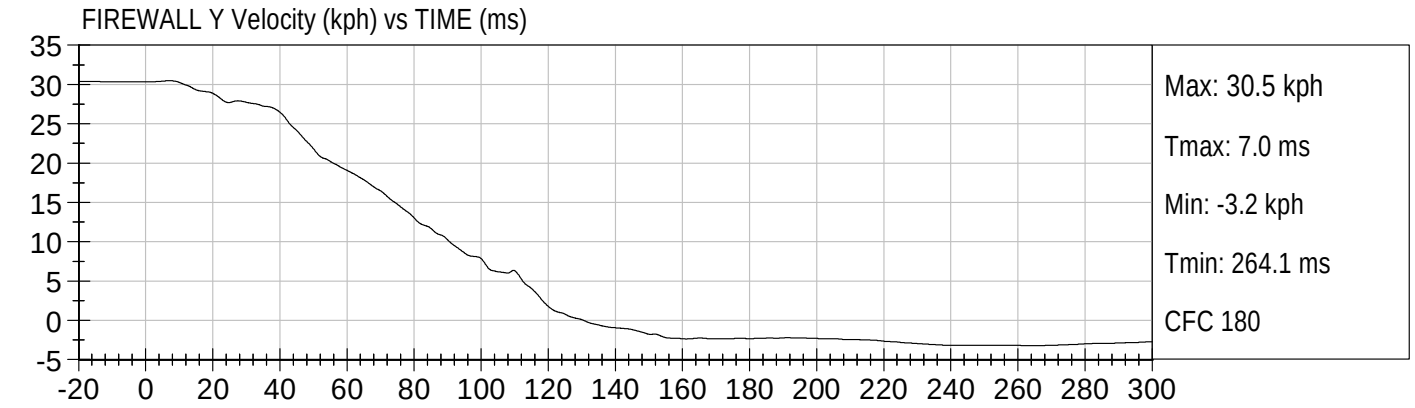
ENGINE Y Velocity (kph) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

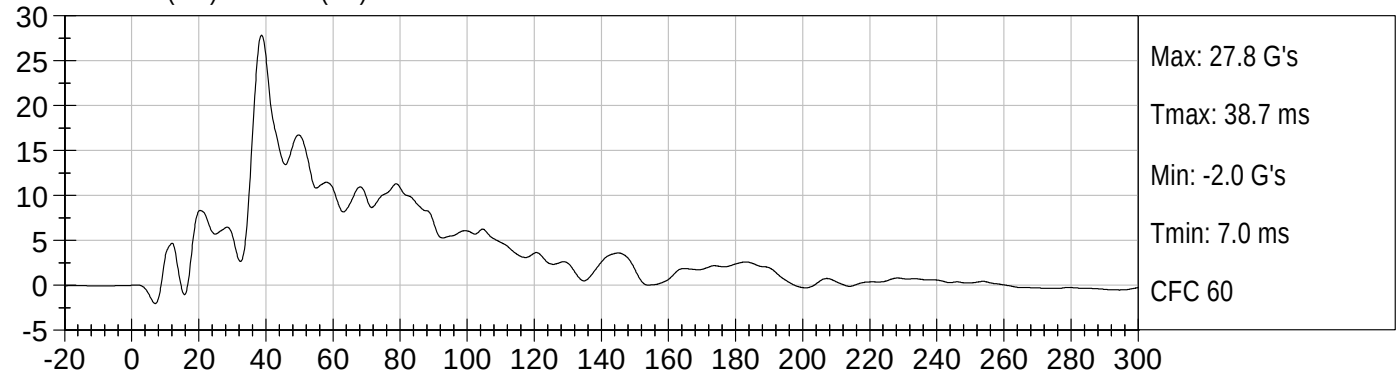




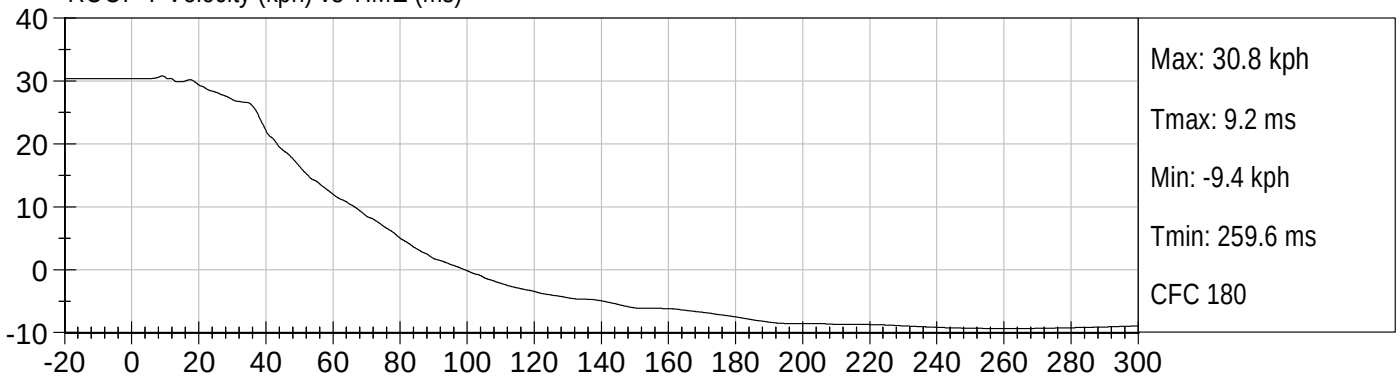
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

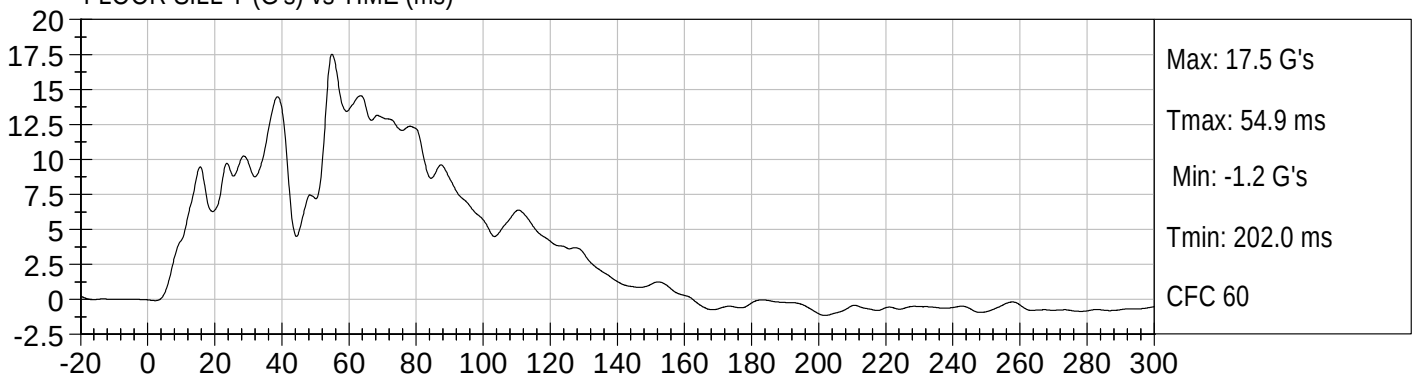
ROOF Y (G's) vs TIME (ms)



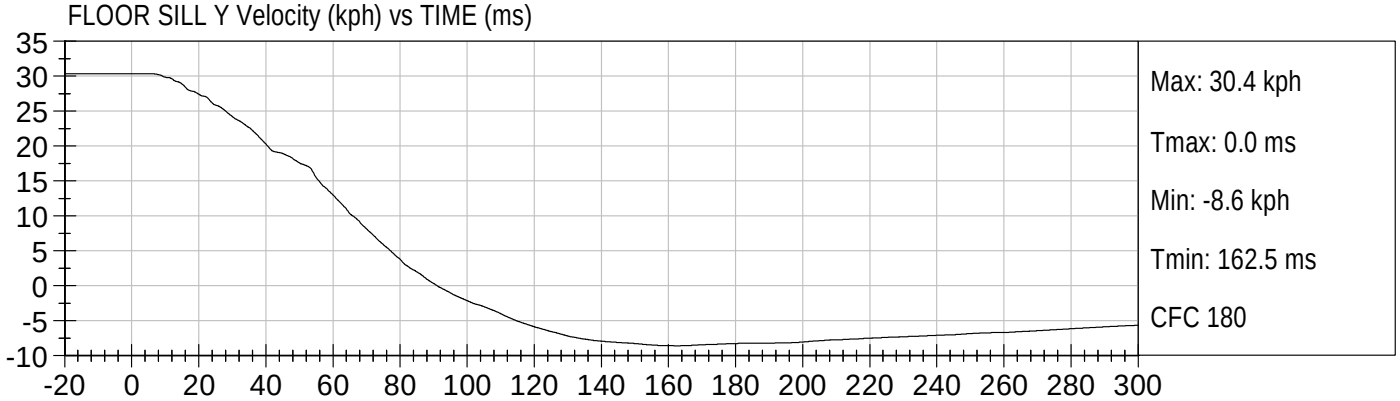
ROOF Y Velocity (kph) vs TIME (ms)



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



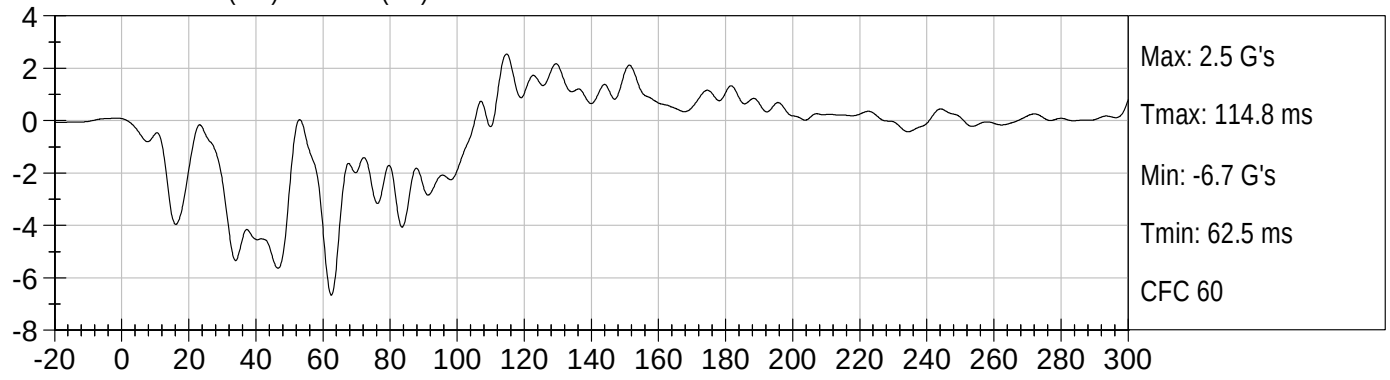
FLOOR SILL Y Velocity (kph) vs TIME (ms)



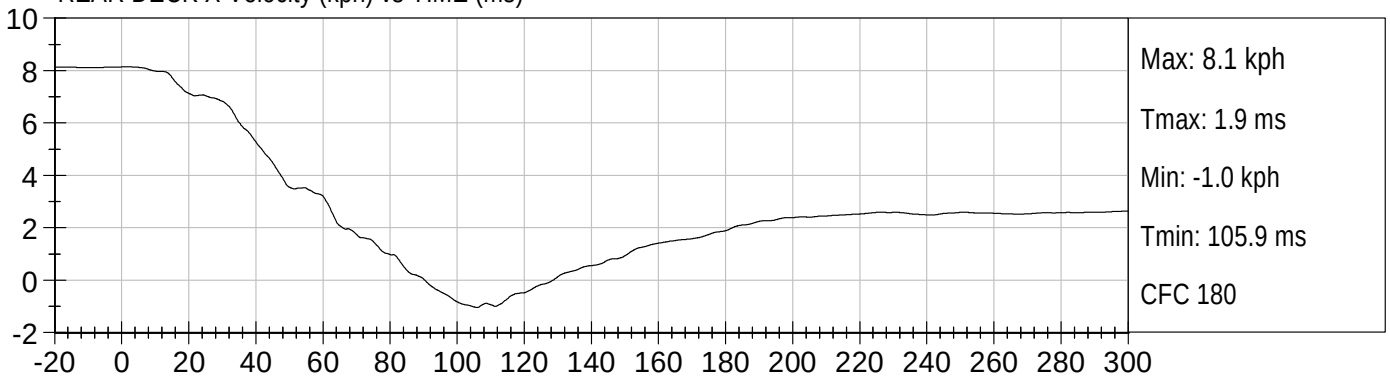
FMVSS 214 Rigid Pole Side Impact
2011 Jeep Grand Cherokee - CB0304

Test Date: 04/14/2011
Speed: 19.5 mph (31.4 km/h)

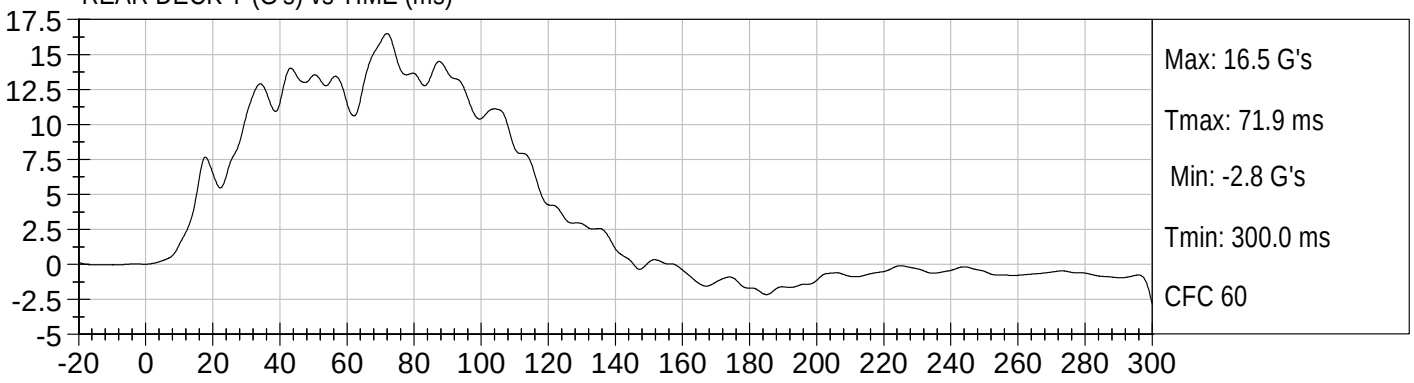
REAR DECK X (G's) vs TIME (ms)



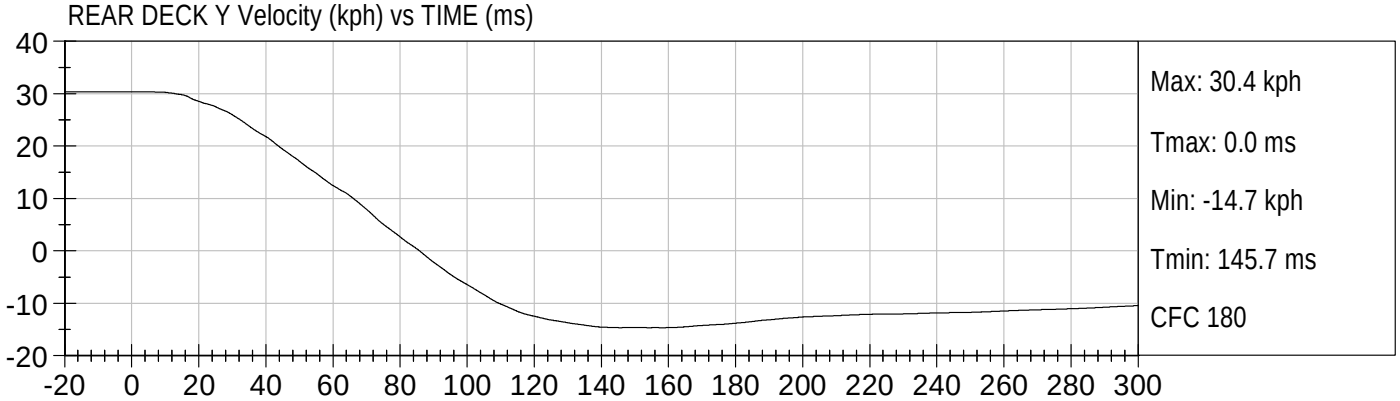
REAR DECK X Velocity (kph) vs TIME (ms)



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:** D111311

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	125 to 155	140	Pass
Peak Lateral Acceleration	G's	+/- 15	-12	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

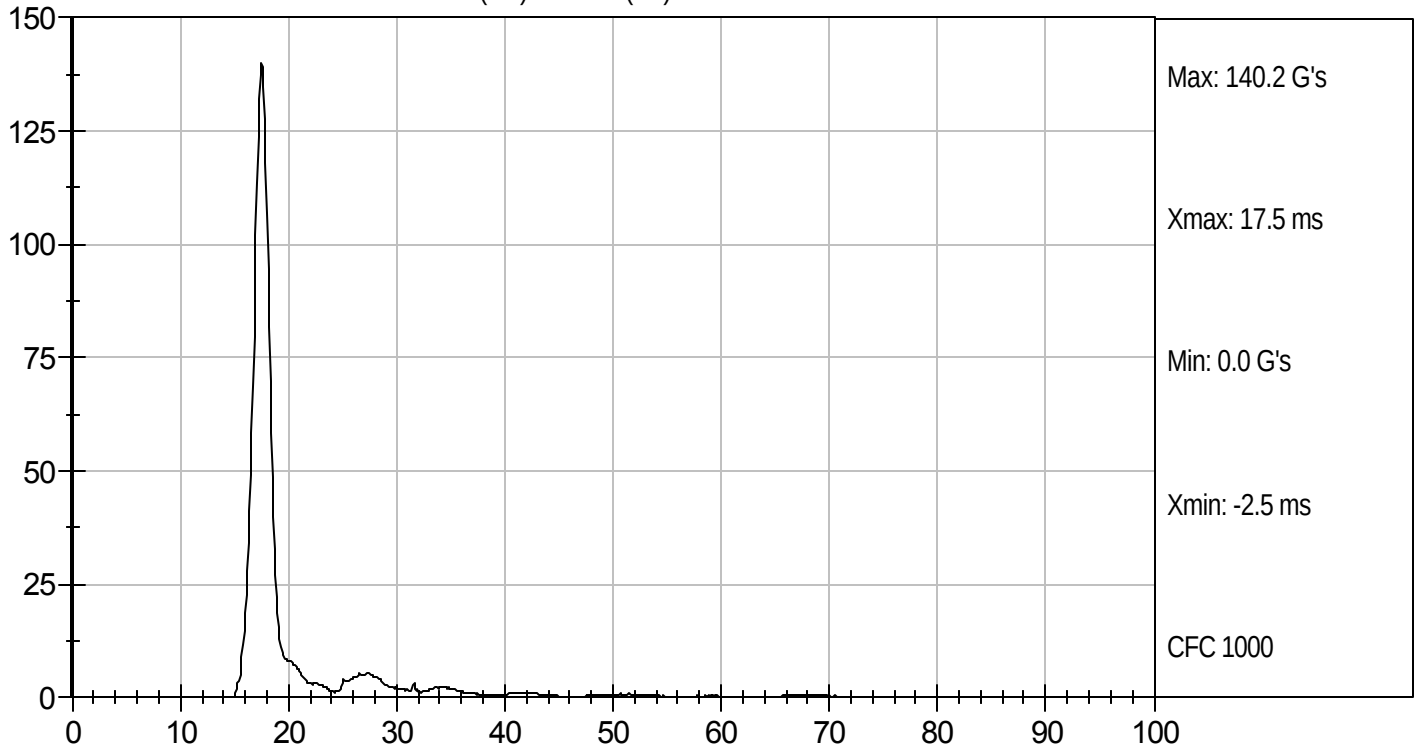
4/7/11
Test Date

David Winkelbauer
Approved By

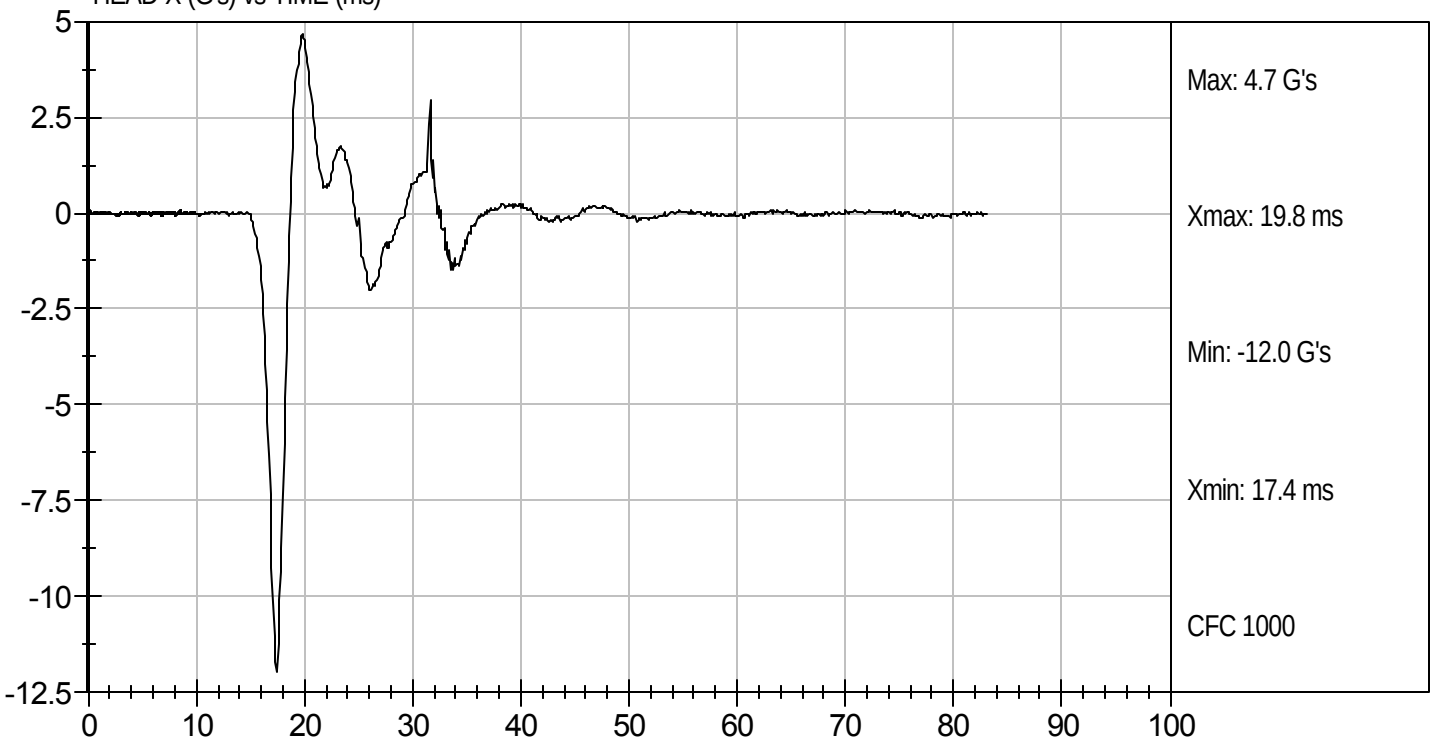
Test Desc: Head Drop
Component ID: D111311

Test Date: 4/7/11
Velocity: 0 ft/s, 0m/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:** D111312

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	31	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	-3.37	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.0	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.1	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	55.8	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

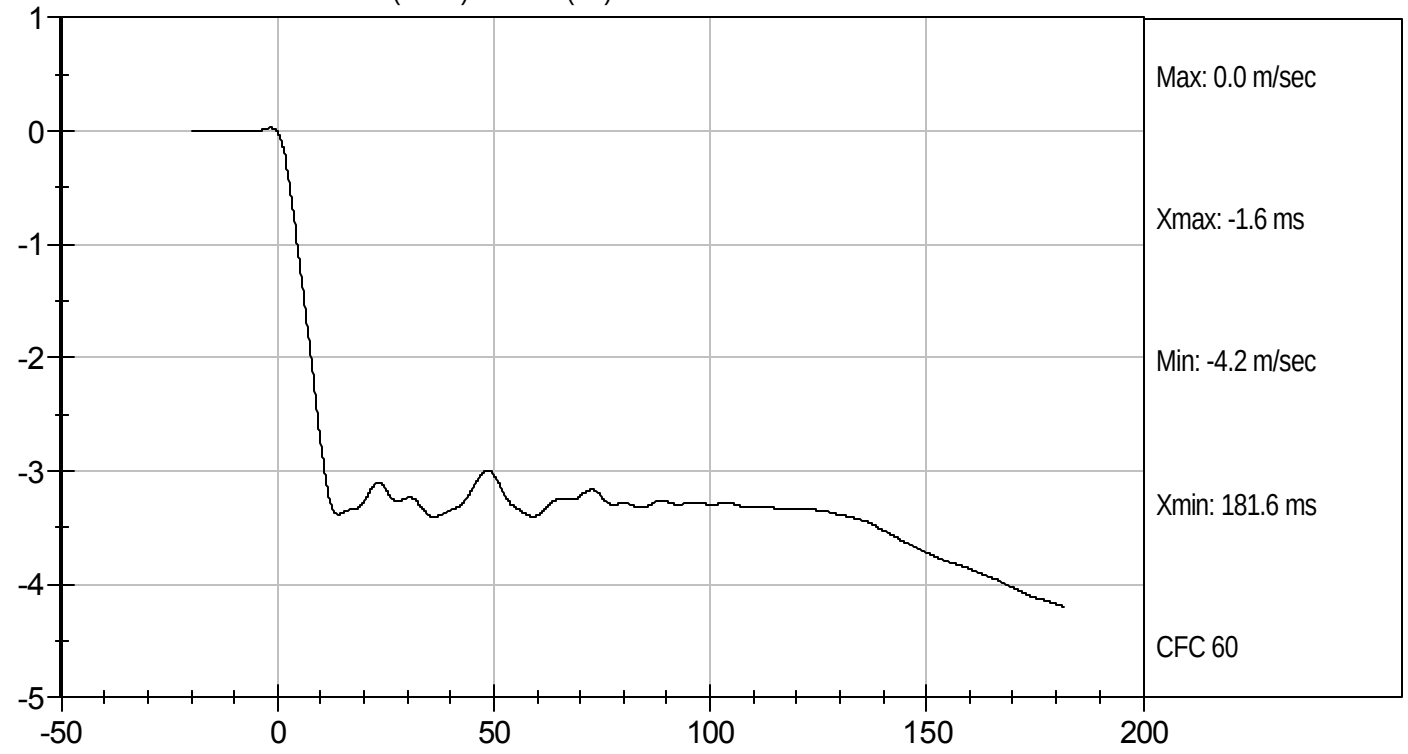
4/7/11
Test Date

David Winkelbauer
Approved By

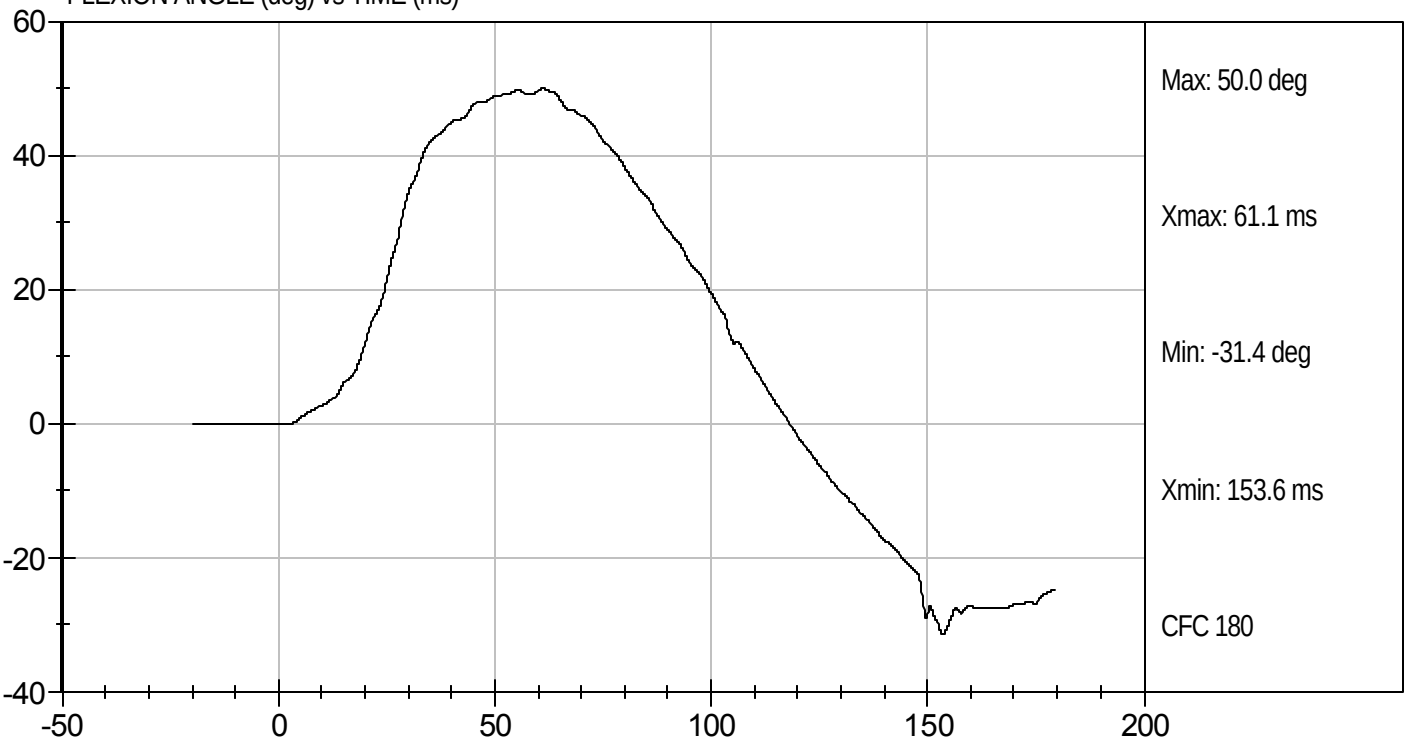
Test Desc: Neck Bending
Component ID: D111312

Test Date: 4/7/11
Velocity: 11.34 ft/s, 3.5 m/s

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

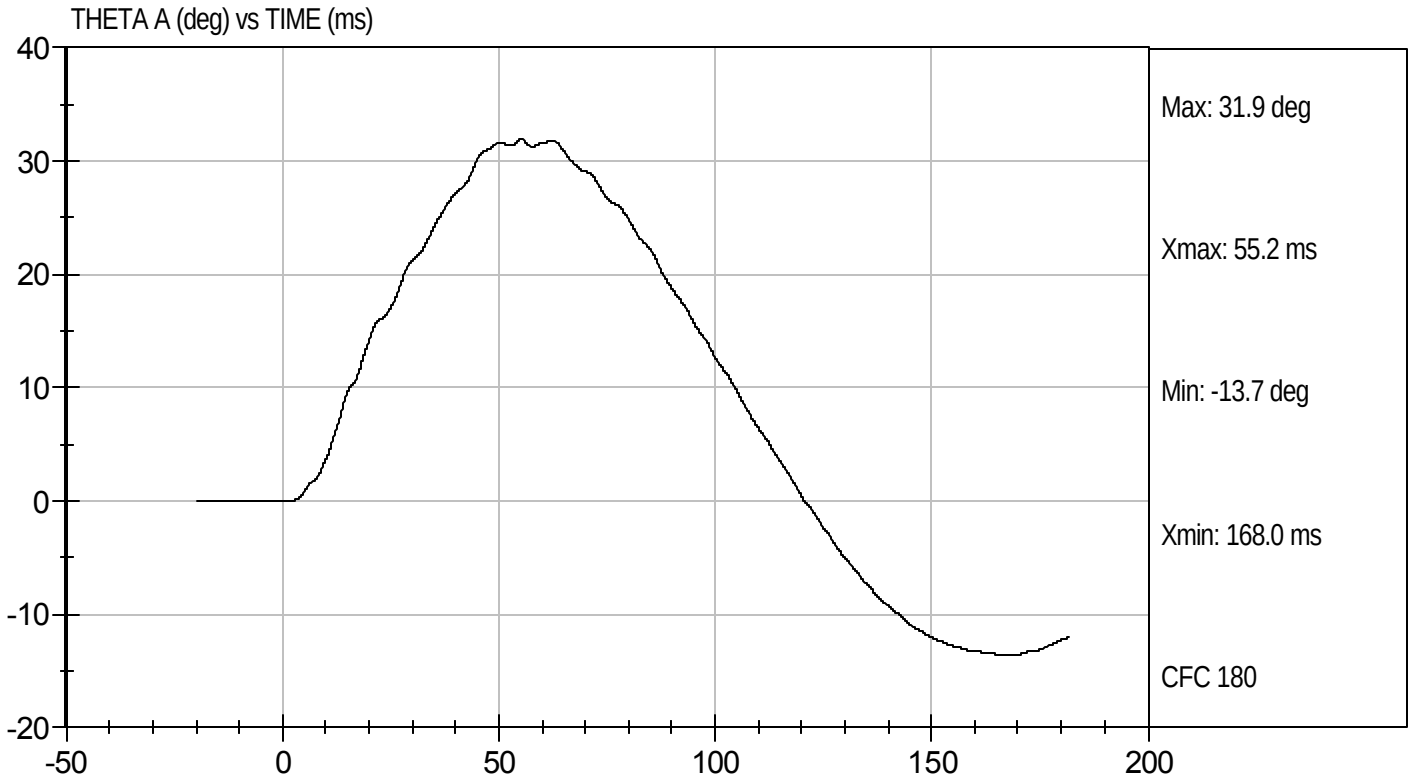


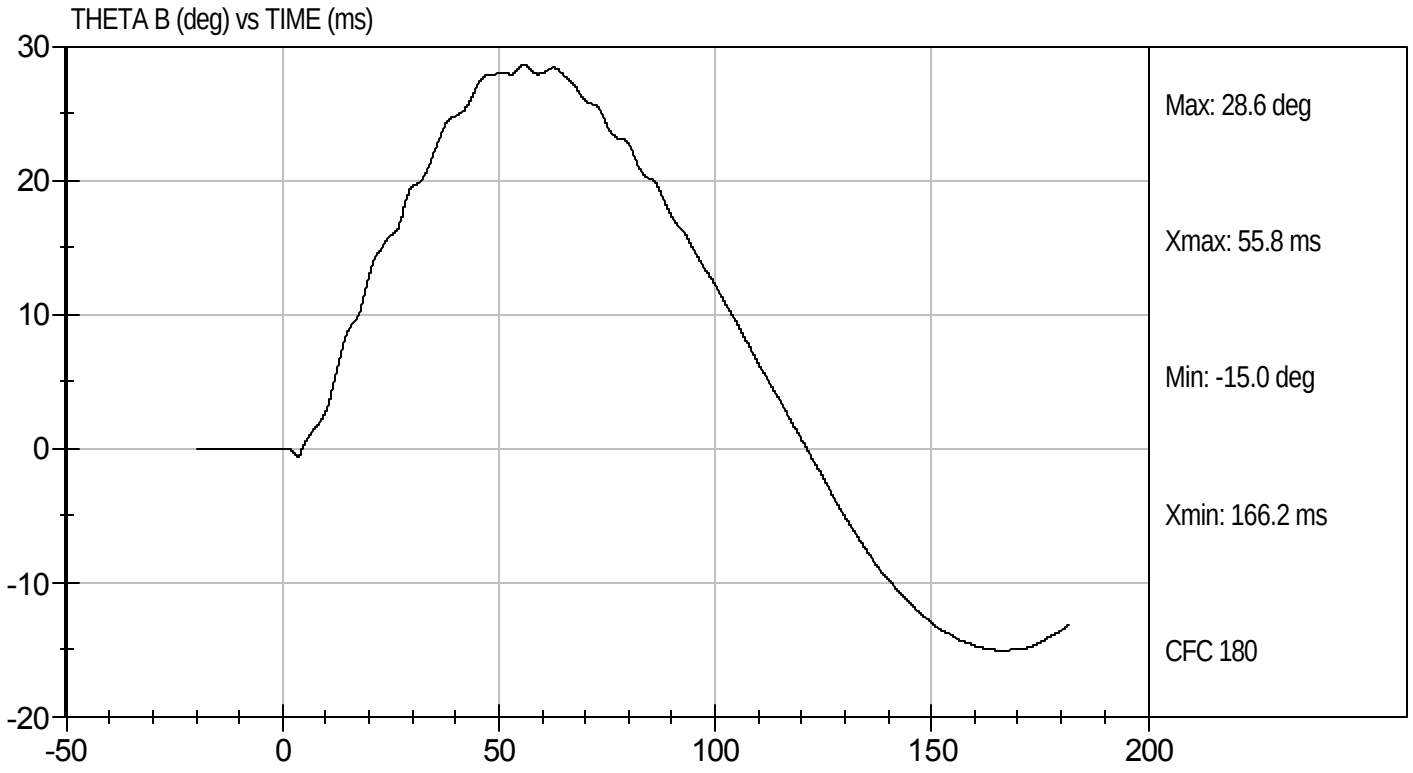
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D111312

Test Date: 4/7/11
Velocity: 11.34 ft/s, 3.5 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111313

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.1	Pass
Time of Peak Shoulder Acceleration	ms	NA	37.8	Pass
		Overall Test Results		Pass

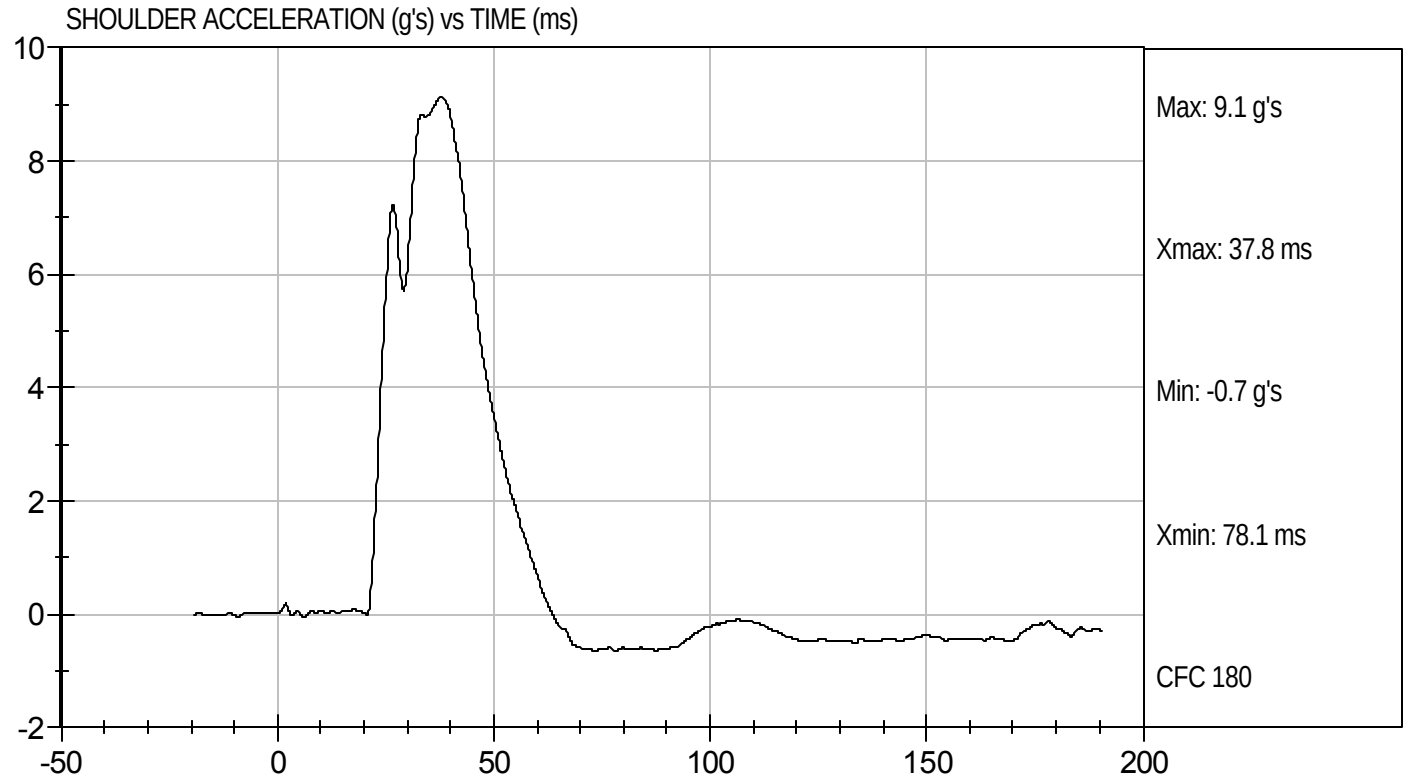
Jessica Hall
Laboratory Technician

4/6/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111313

Test Date: 4/6/11
Velocity: 14.36 ft/s, 4.4 m/s



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111314

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	31	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	49.3	Pass
		Overall Test Results		Pass

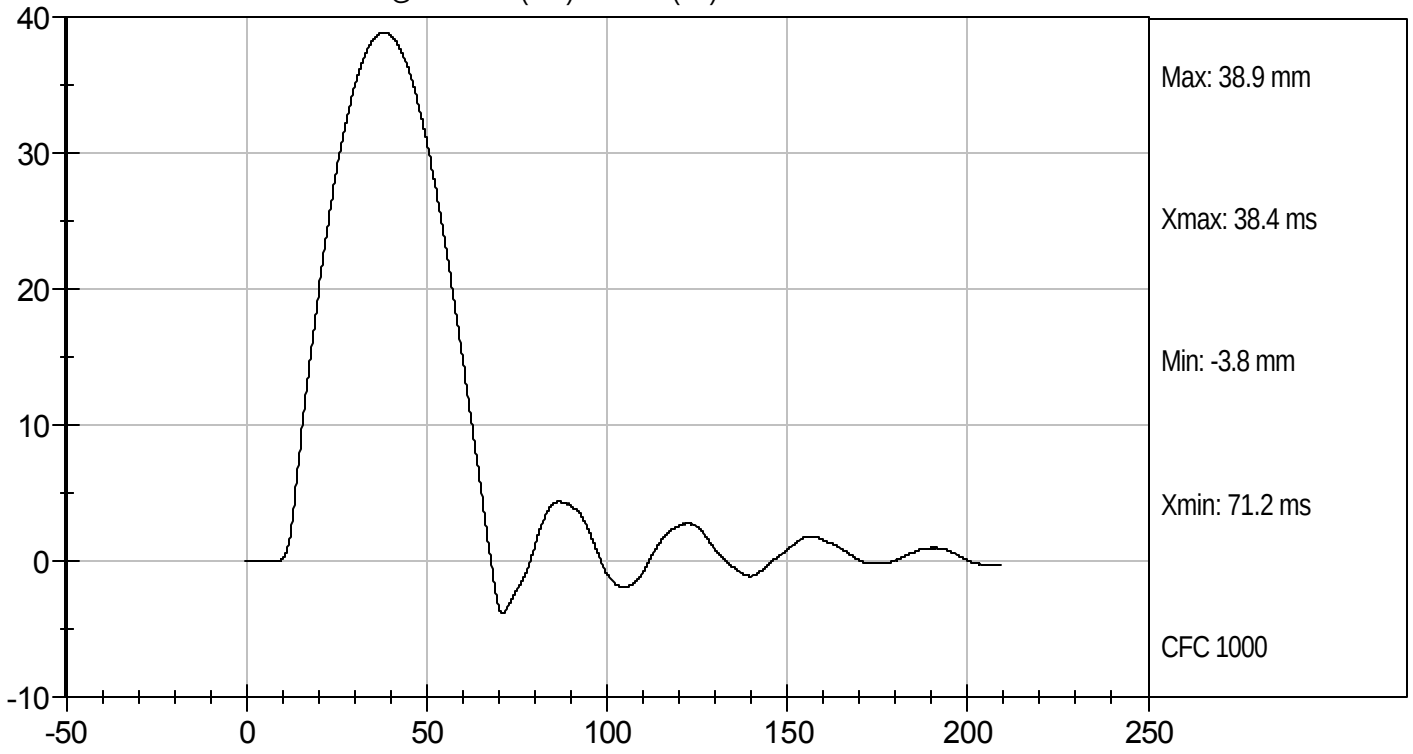
Jessica Hall
Laboratory Technician

4/7/11
Test Date

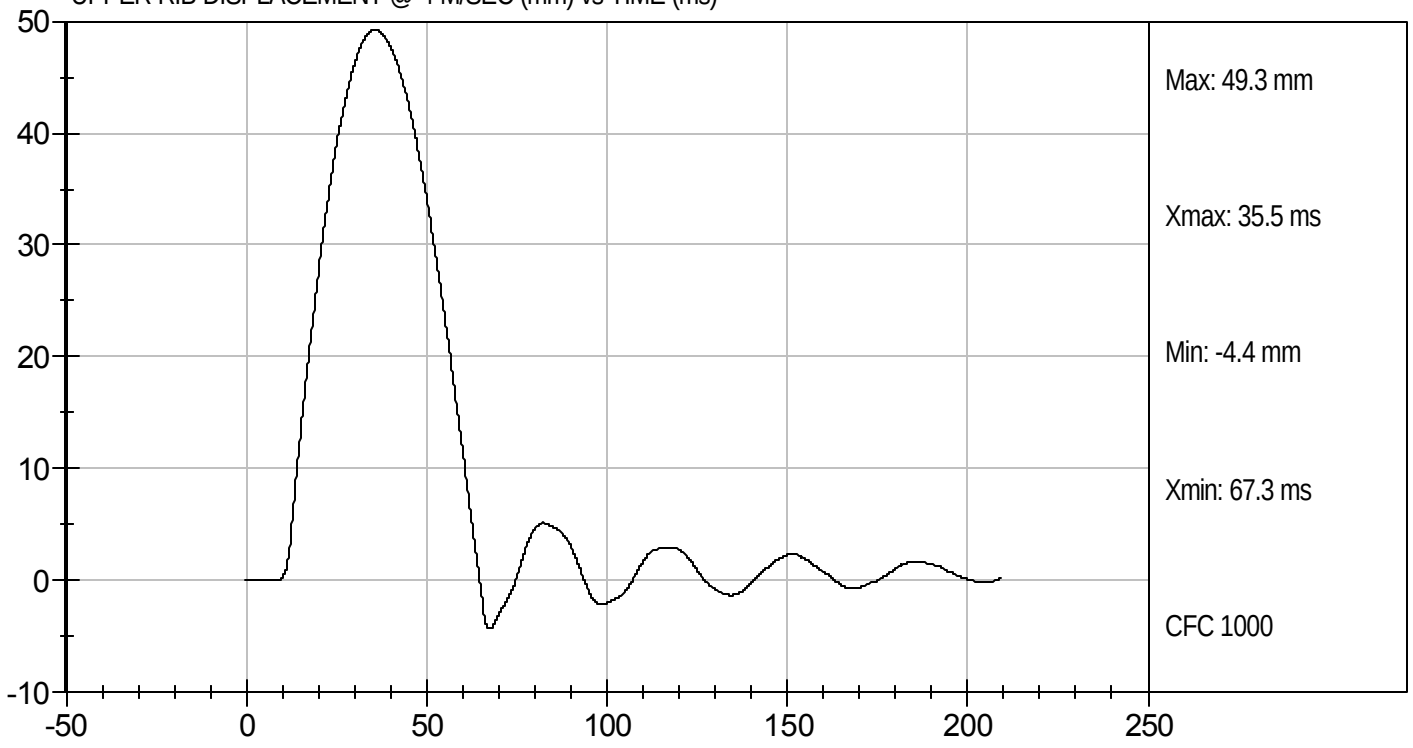
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111314
Test Date: 4/7/11

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:** D111315

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	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.1	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.3	Pass
		Overall Test Results		Pass

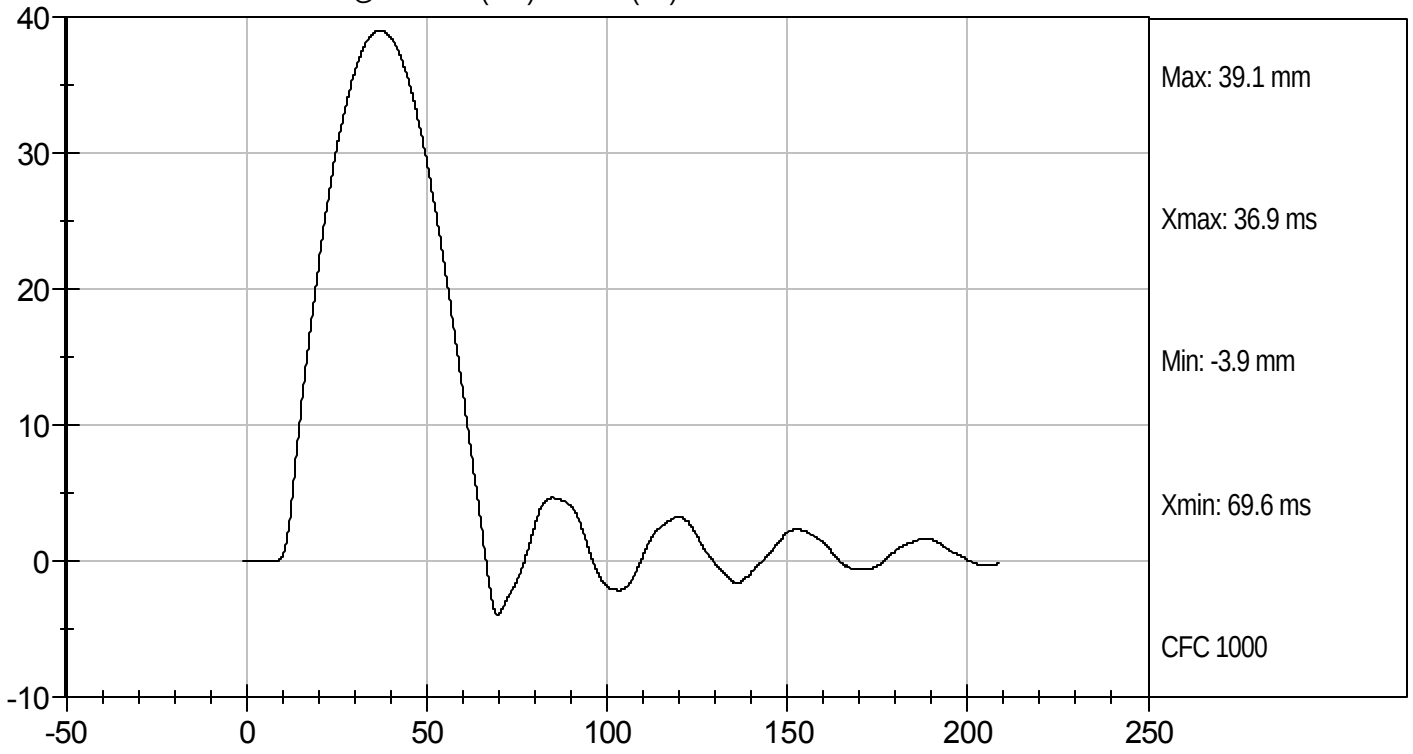
Jessica Hall
Laboratory Technician

4/7/11
Test Date

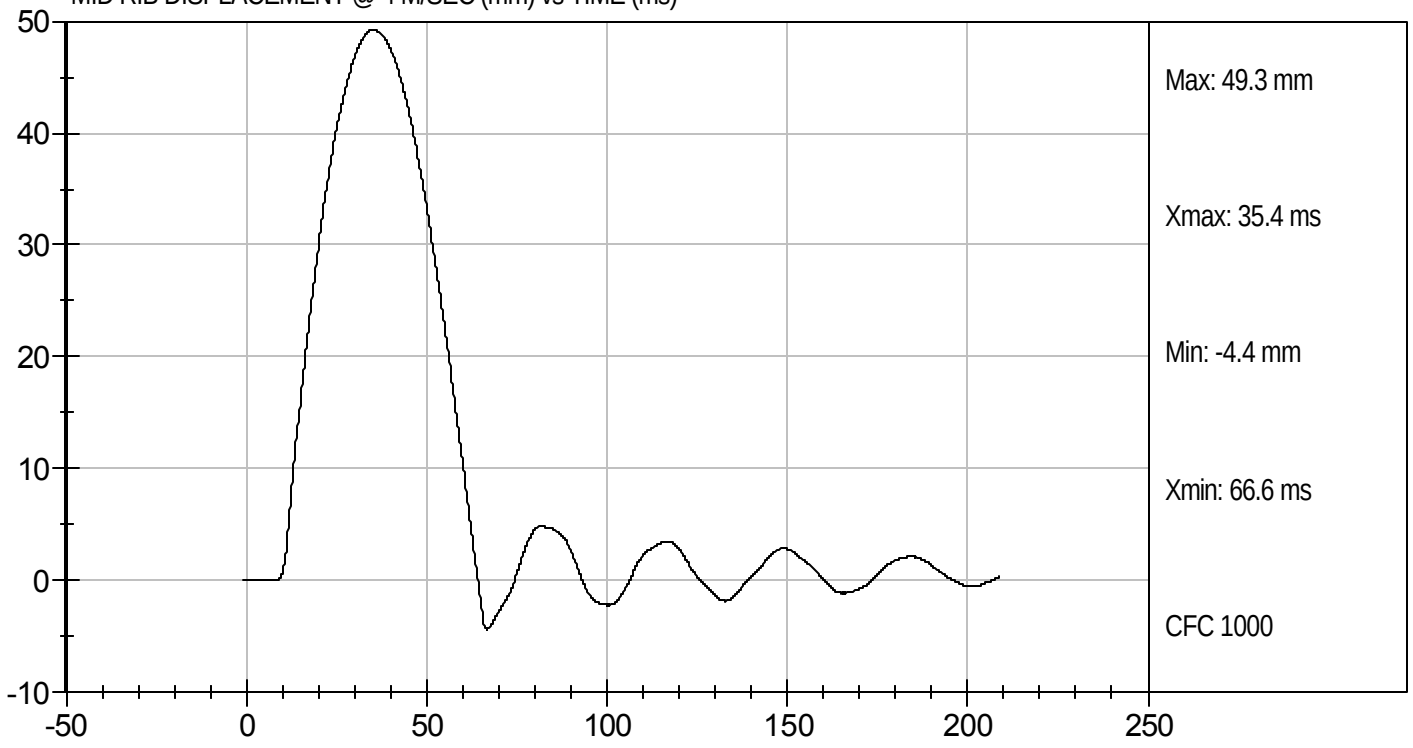
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111315
Test Date: 4/7/11

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:** D111316

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	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.7	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.6	Pass
		Overall Test Results		Pass

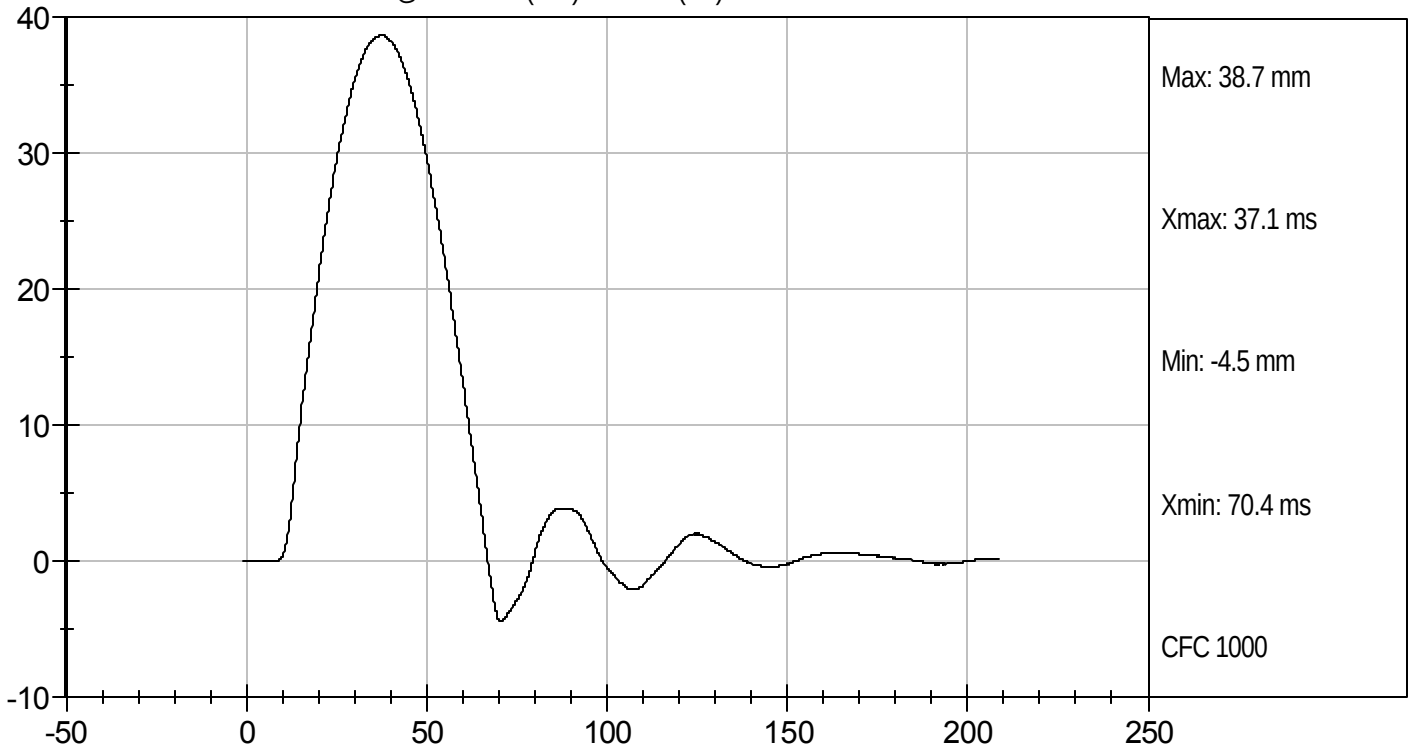
Jessica Hall
Laboratory Technician

4/7/11
Test Date

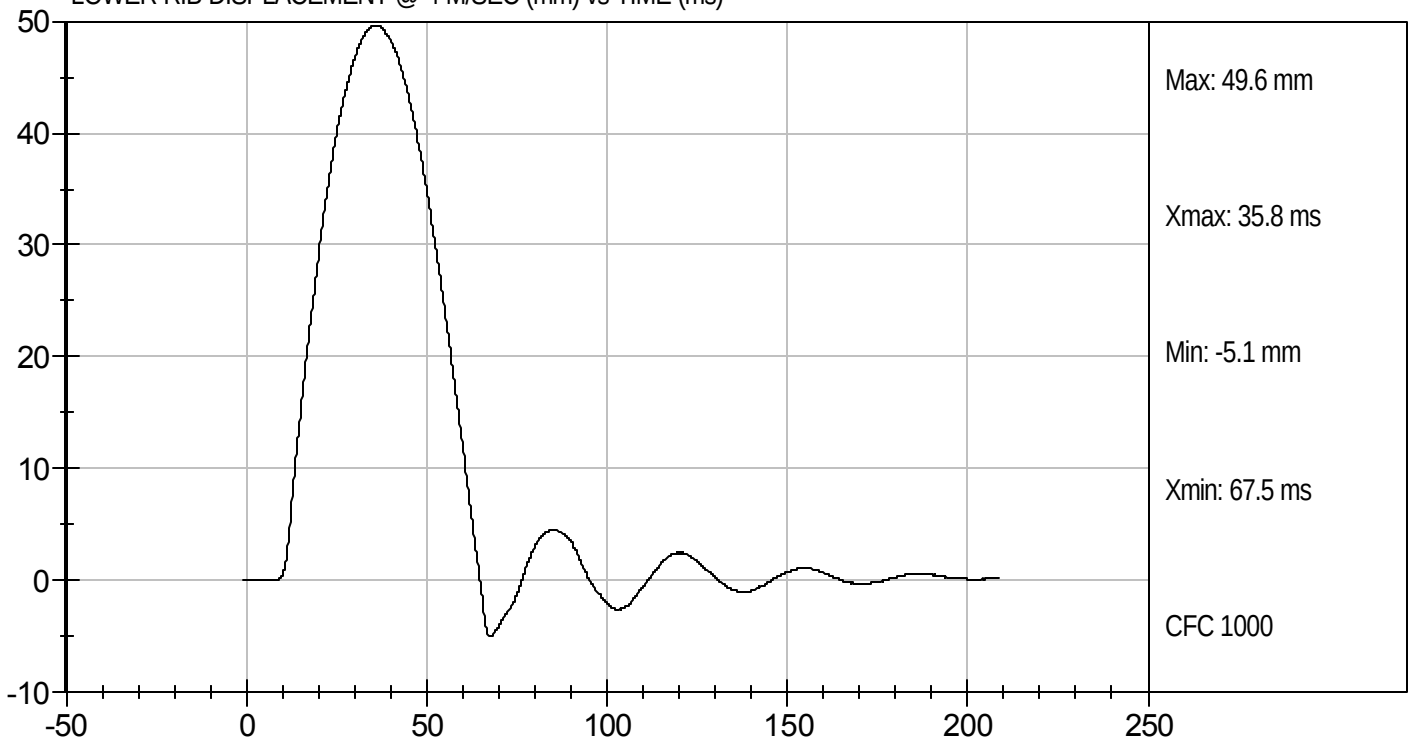
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111316
Test Date: 4/7/11

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:** D111317

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.51	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.90	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.64	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.20	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

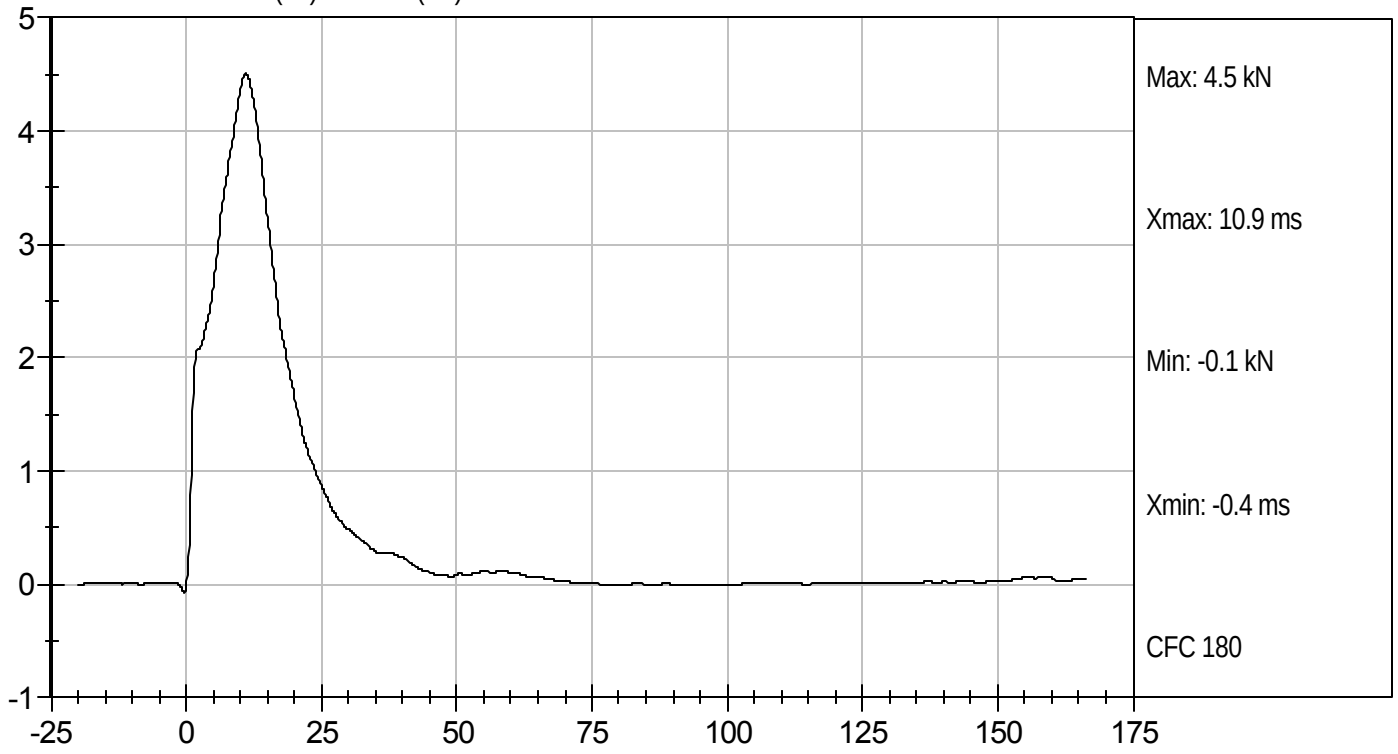
4/6/11
Test Date

David Winkelbauer
Approved By

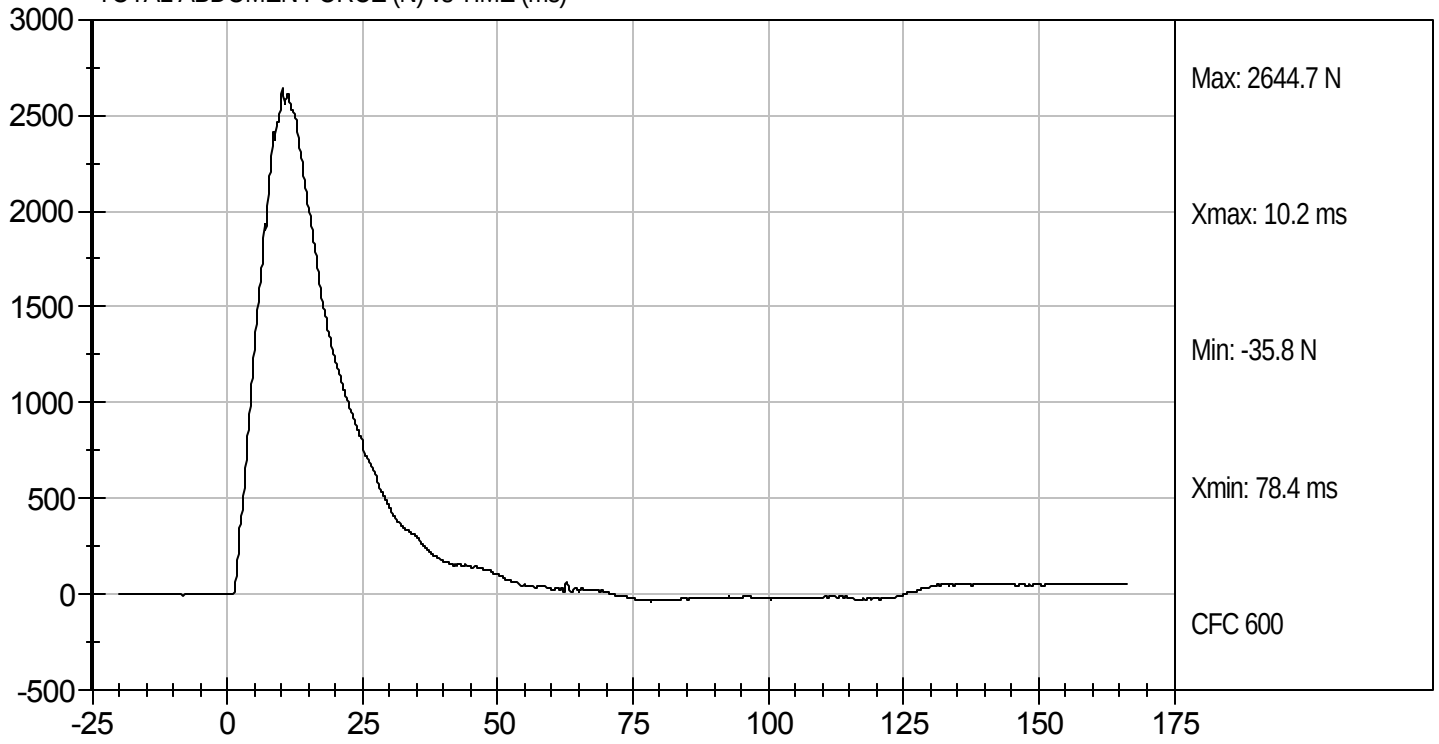
Test Desc: Abdomen Impact
Component ID: D111317

Test Date: 4/6/11
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:** D111318

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.42	Pass
	27 ms	m/s	-6.50 to -5.80	-5.82	Pass
	30 ms	m/s	>= -6.5	-6.01	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.3	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	40.9	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	43	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

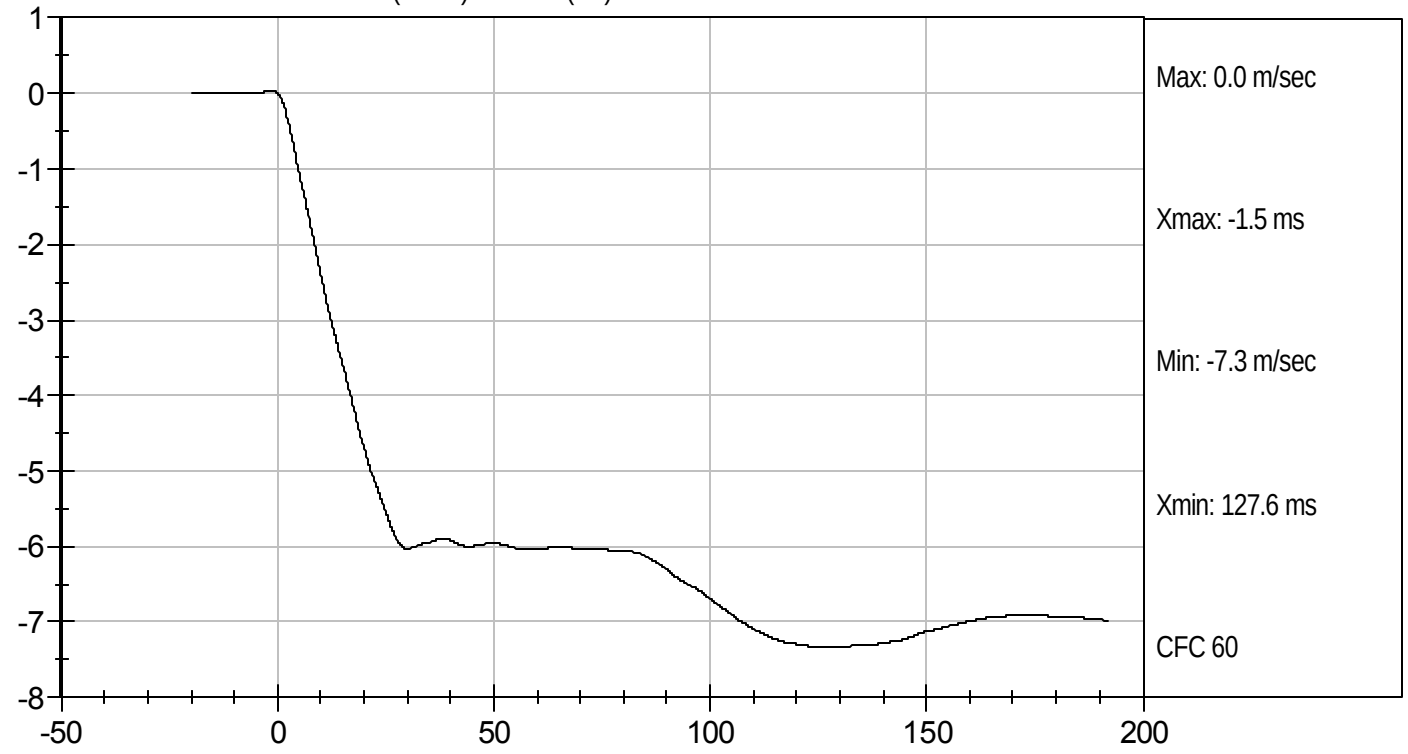
4/7/11
Test Date

David Winkelbauer
Approved By

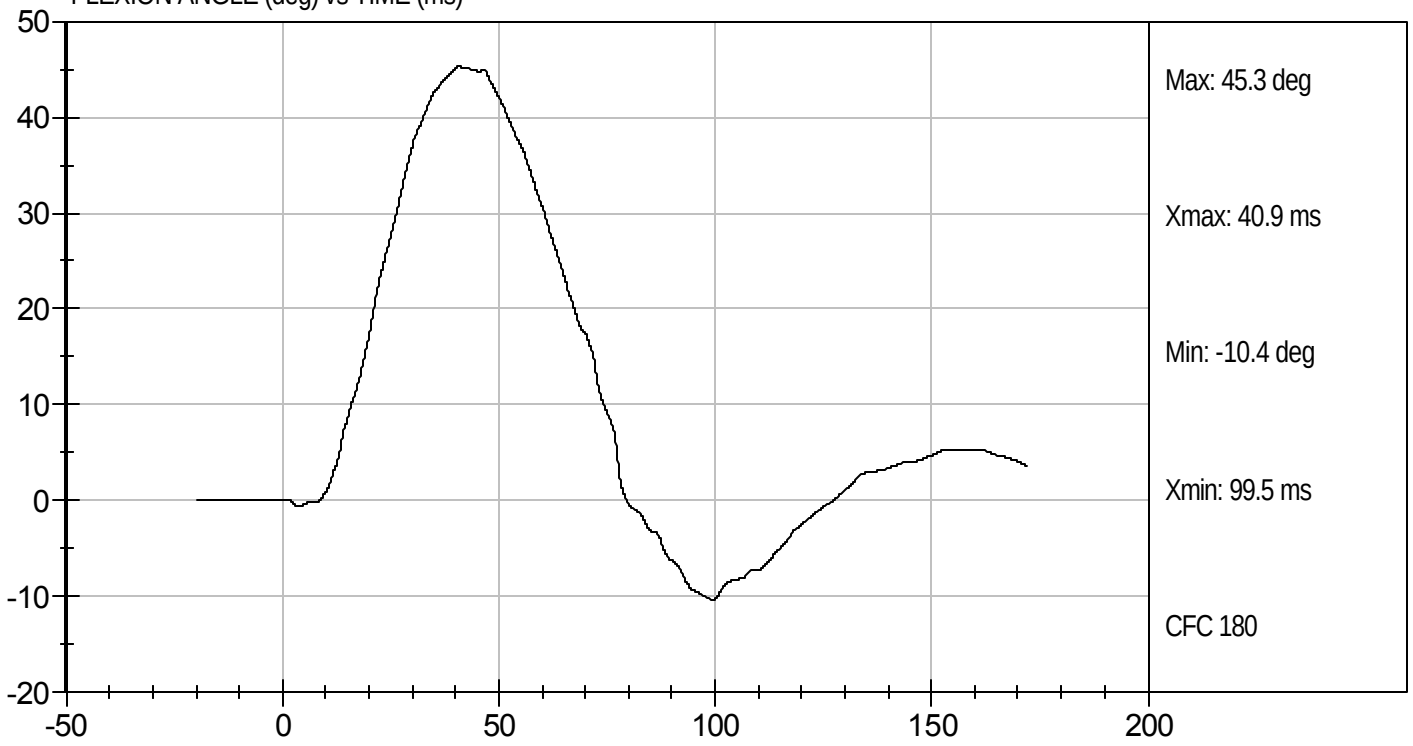
Test Desc: Lumbar Bending
Component ID: D111318

Test Date: 4/7/11
Velocity: 20.08 ft/s, 6.12 m/s

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

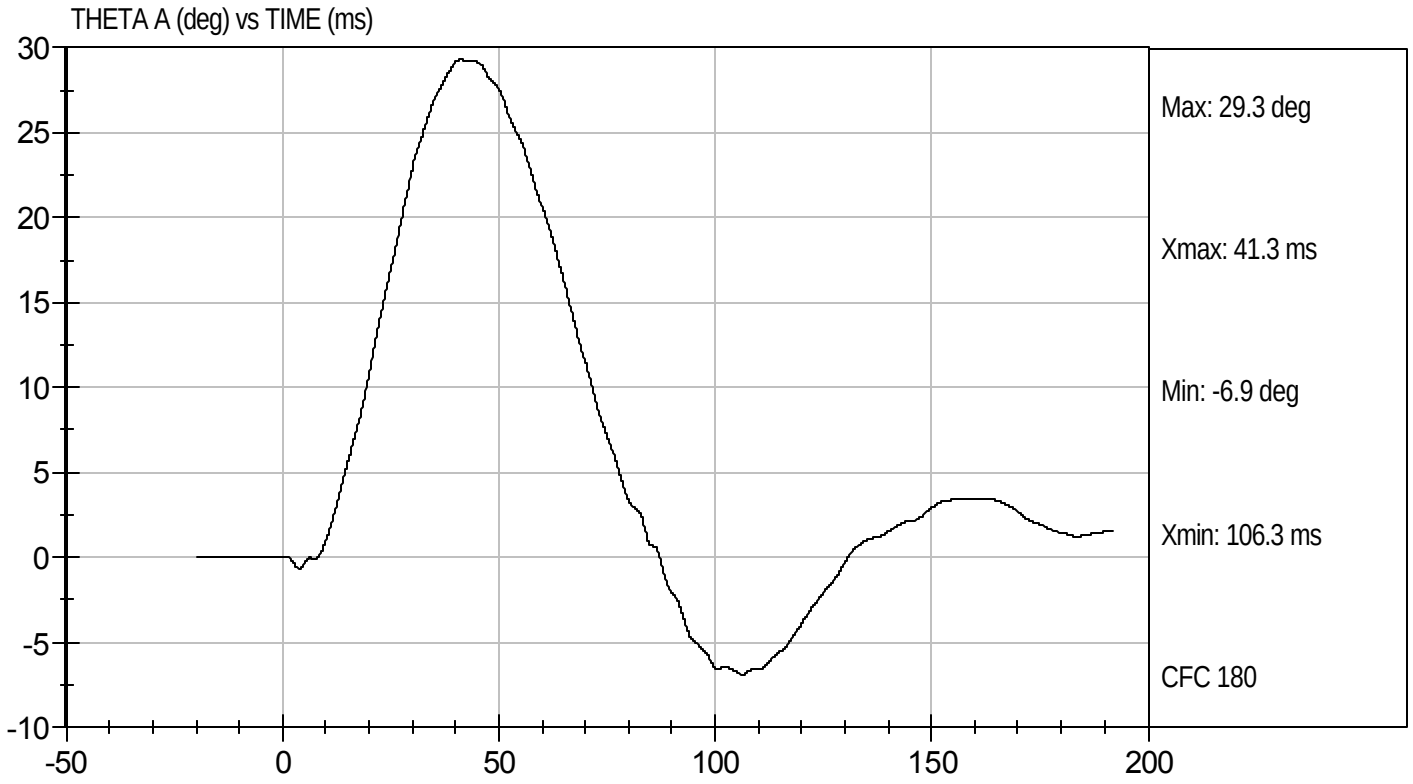


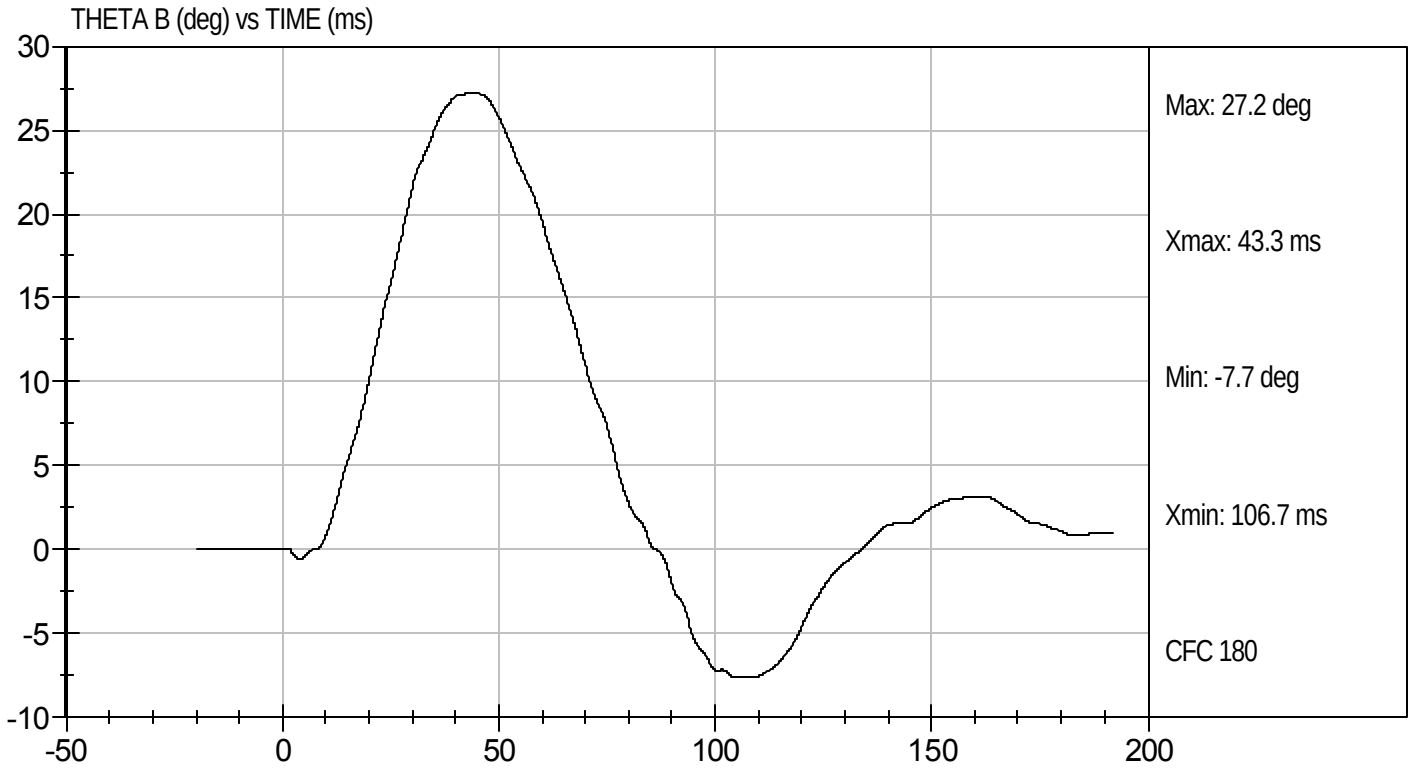
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D111318

Test Date: 4/7/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111319

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Probe Speed	m/s	4.20 to 4.40	4.30	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.88	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.90	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.42	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	15.60	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

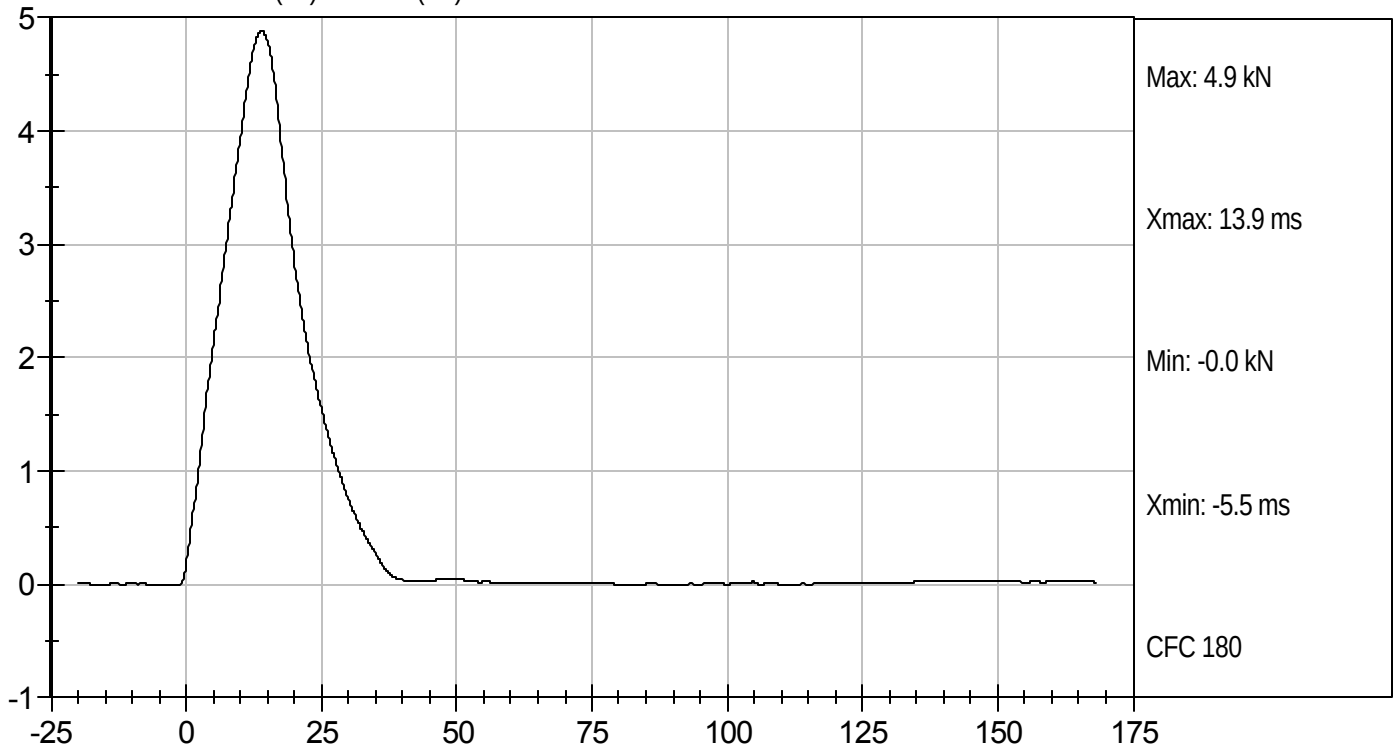
4/6/11
Test Date

David Winkelbauer
Approved By

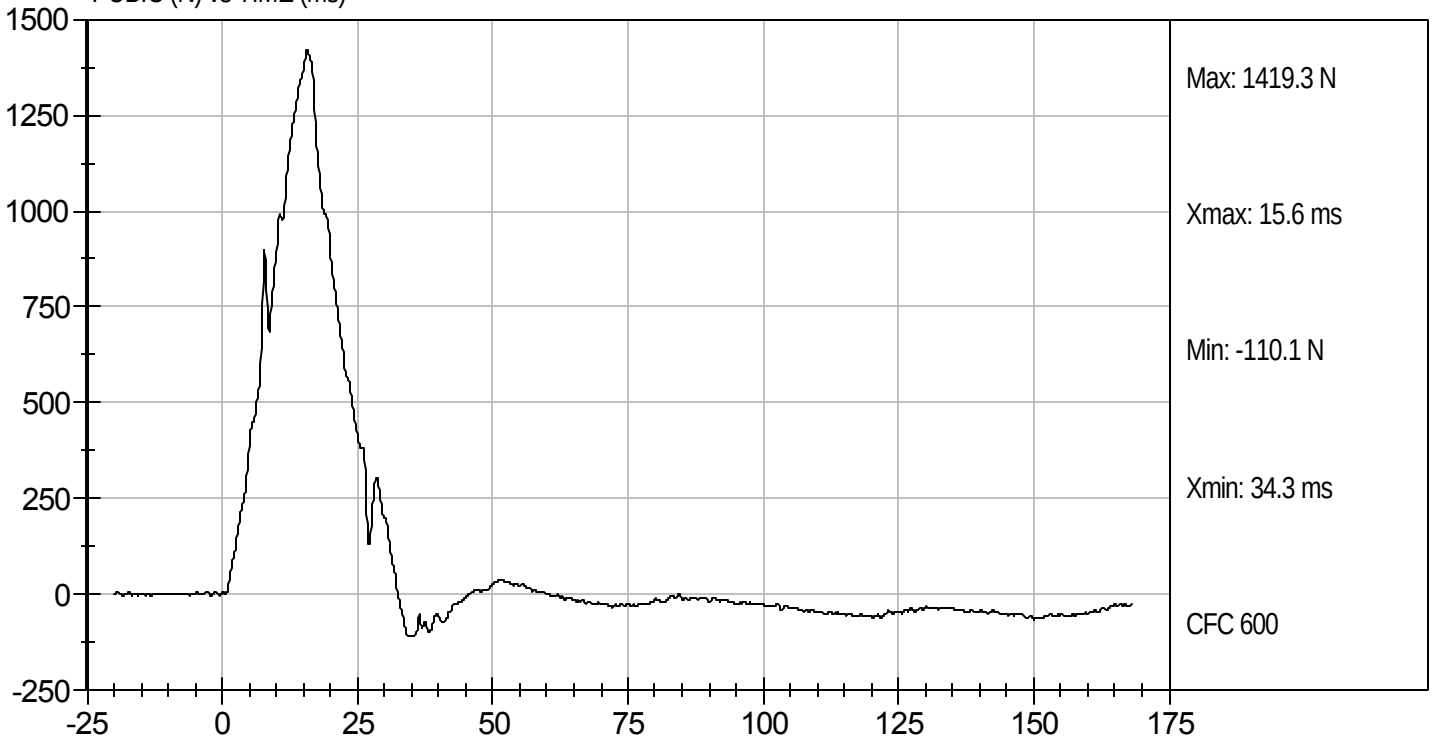
Test Desc: Pelvis Impact
Component ID: D111319

Test Date: 4/6/11
Velocity: 14.12 ft/s, 4.30 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:** D111310

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	31	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	5.15	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.8	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.6	Pass
Lower Rib Displacement	mm	37.0 to 44.0	39.1	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

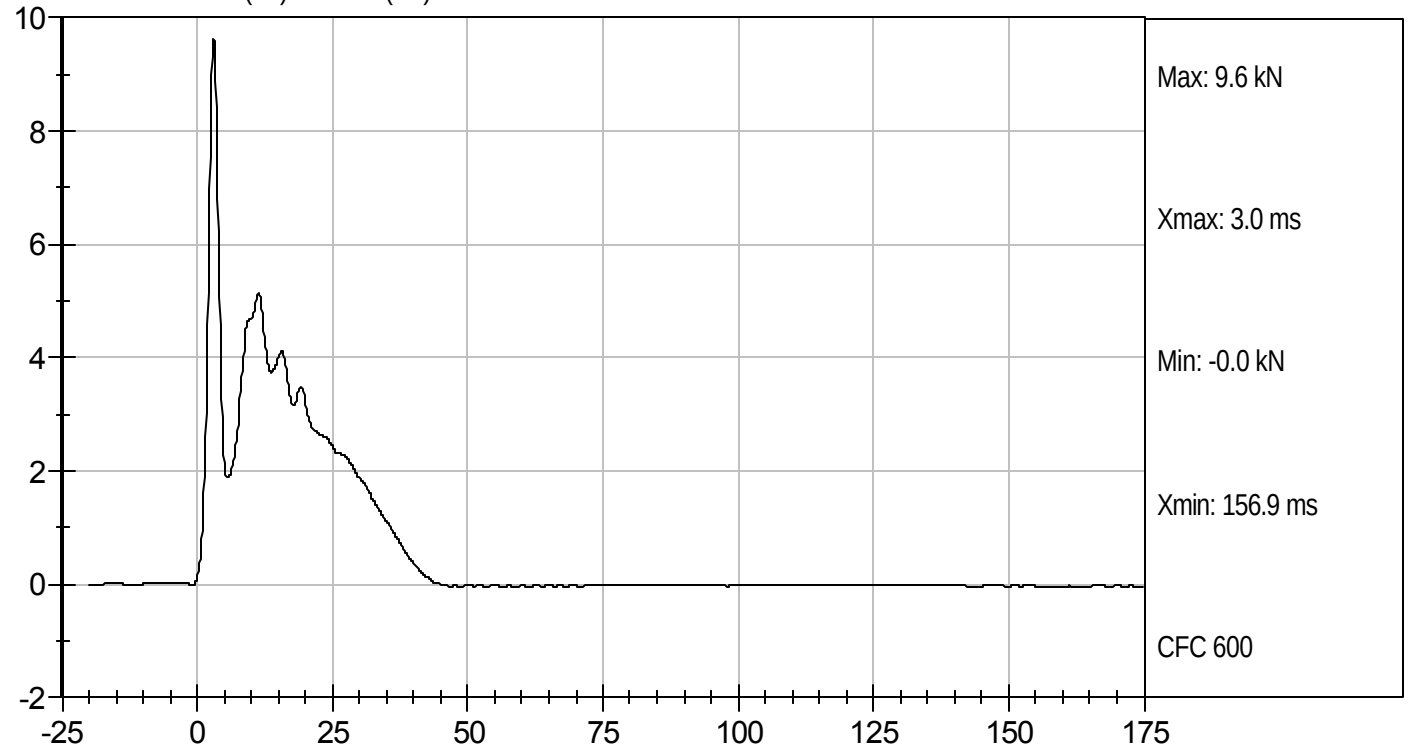
4/6/11
Test Date

David Winkelbauer
Approved By

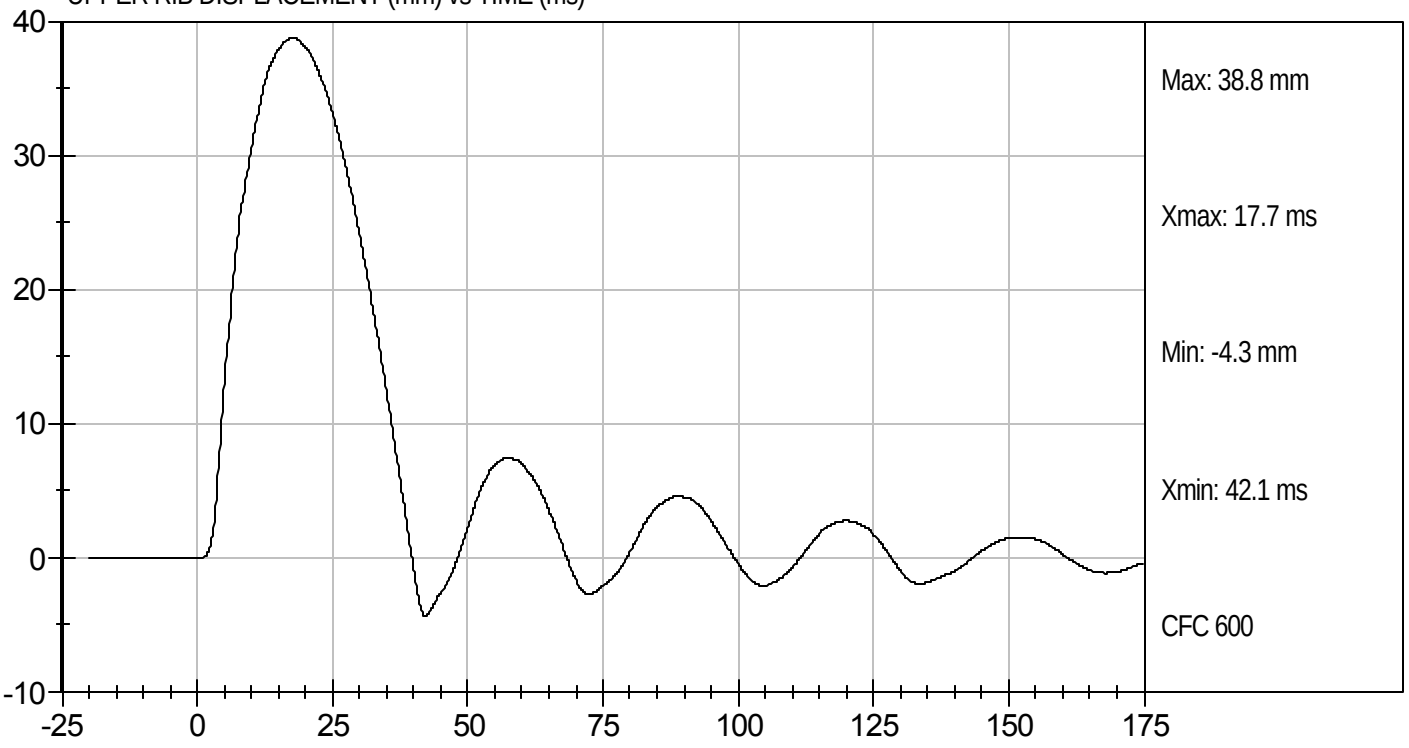
Test Desc: Thorax Impact
Component ID: D111310

Test Date: 4/6/11
Velocity: 18.31 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



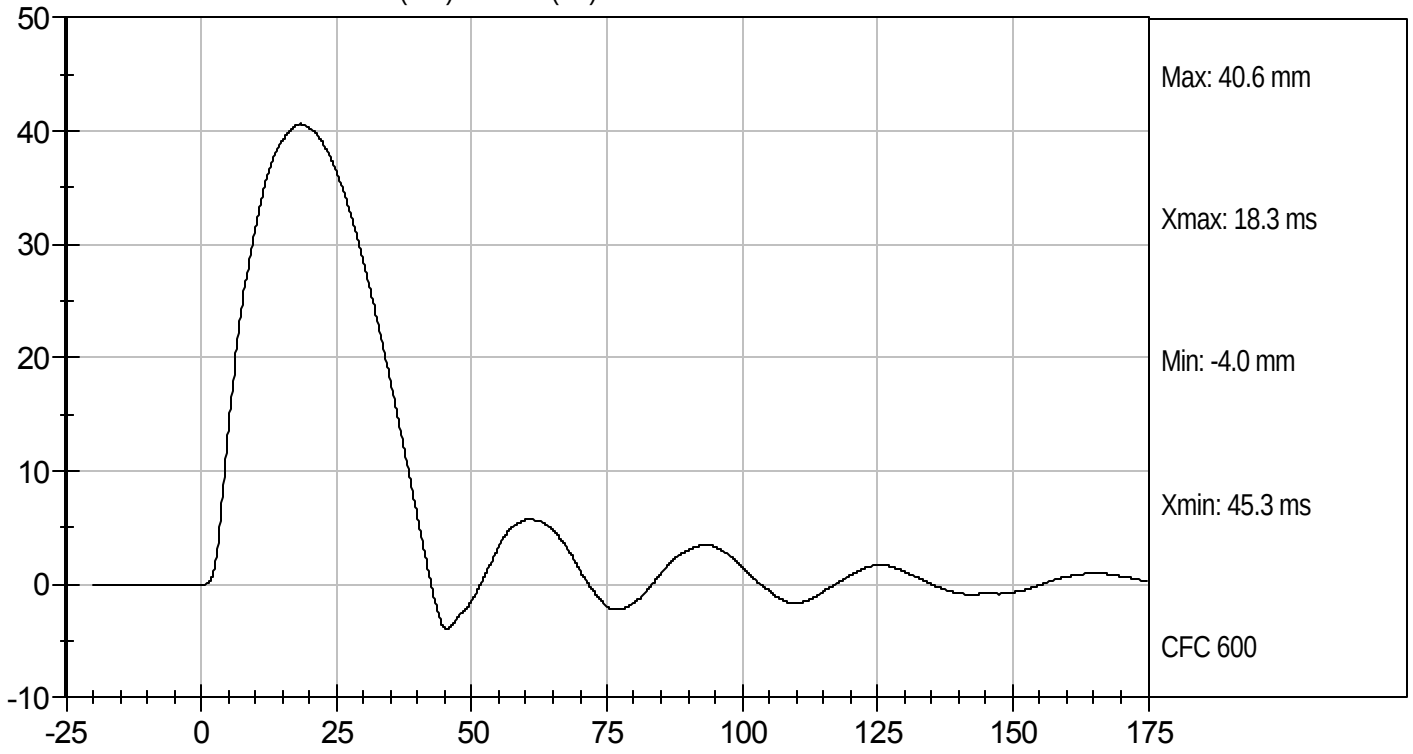
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



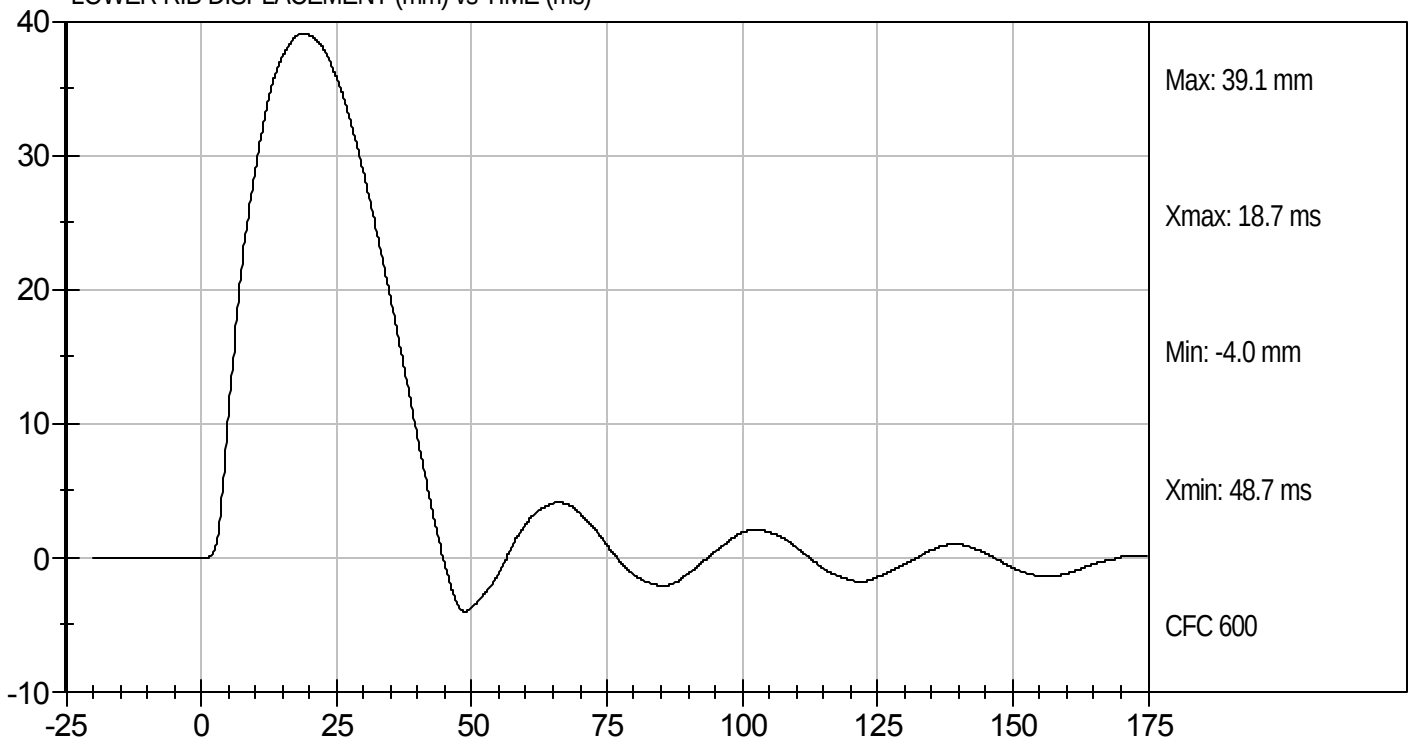
Test Desc: Thorax Impact
Component ID: D111310

Test Date: 4/6/11
Velocity: 18.31 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:** D111411

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Peak Resultant Acceleration	G's	125 to 155	149	Pass
Peak Lateral Acceleration	G's	+/- 15	-11.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

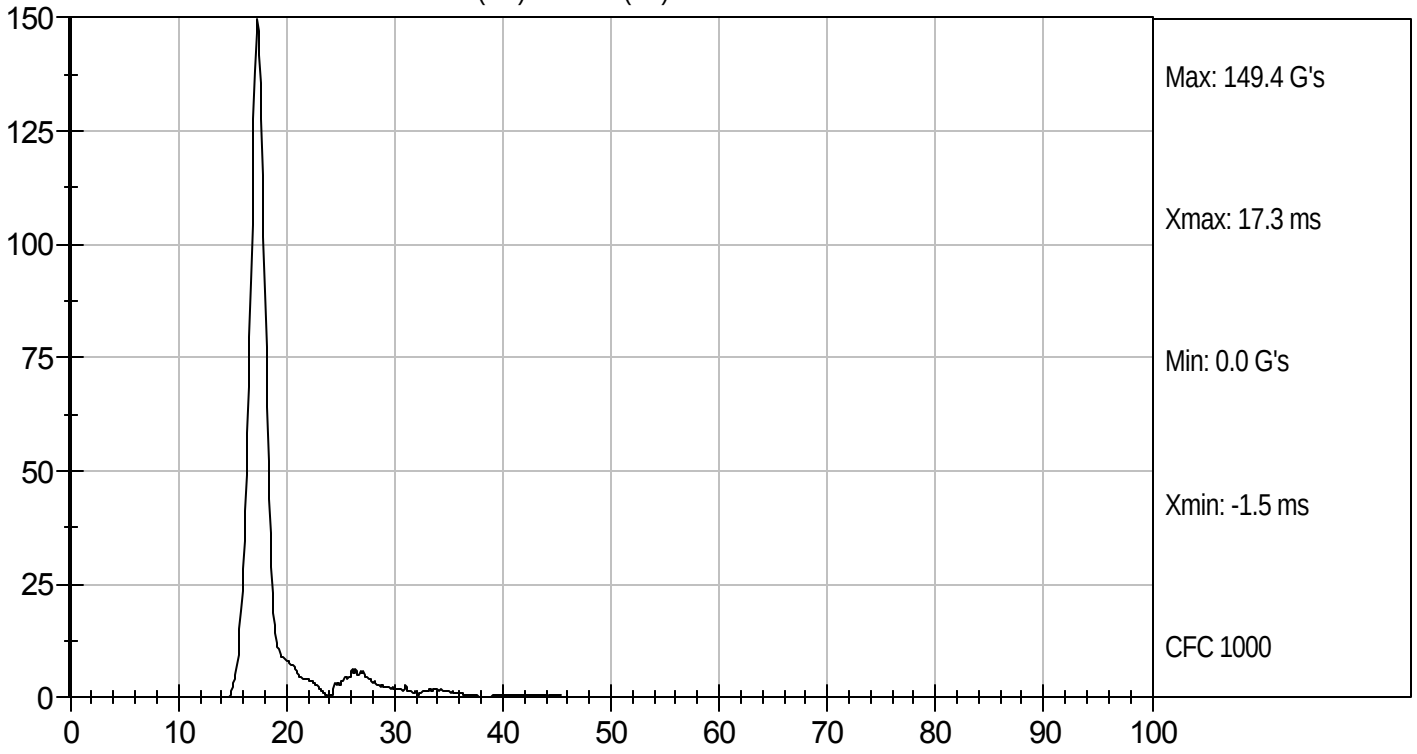
4/15/11
Test Date

David Winkelbauer
Approved By

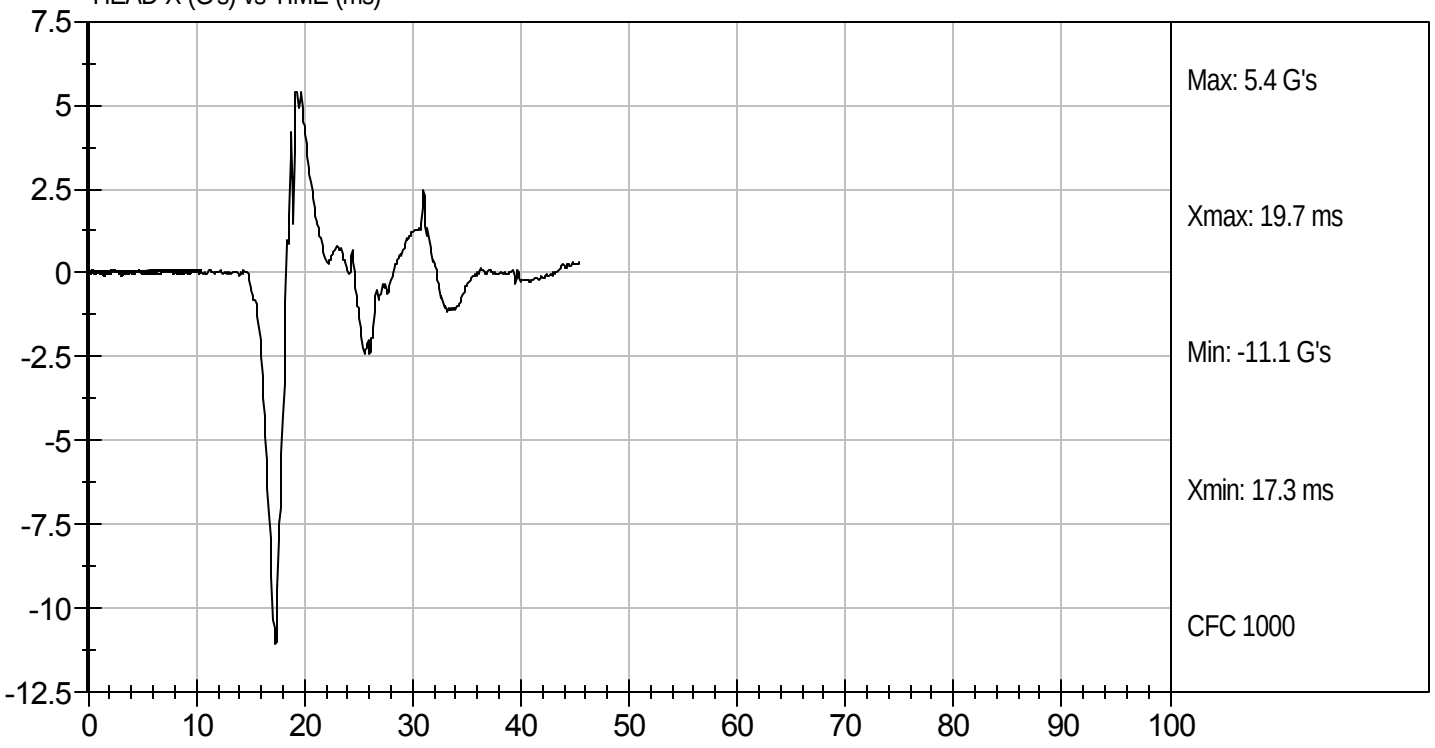
Test Desc: Head Drop
Component ID: D111411

Test Date: 4/15/11
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:** D111412

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	25	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	-0.31	Pass
	14 ms	m/s	-3.20 to -3.70	-3.34	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.7	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	55.4	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

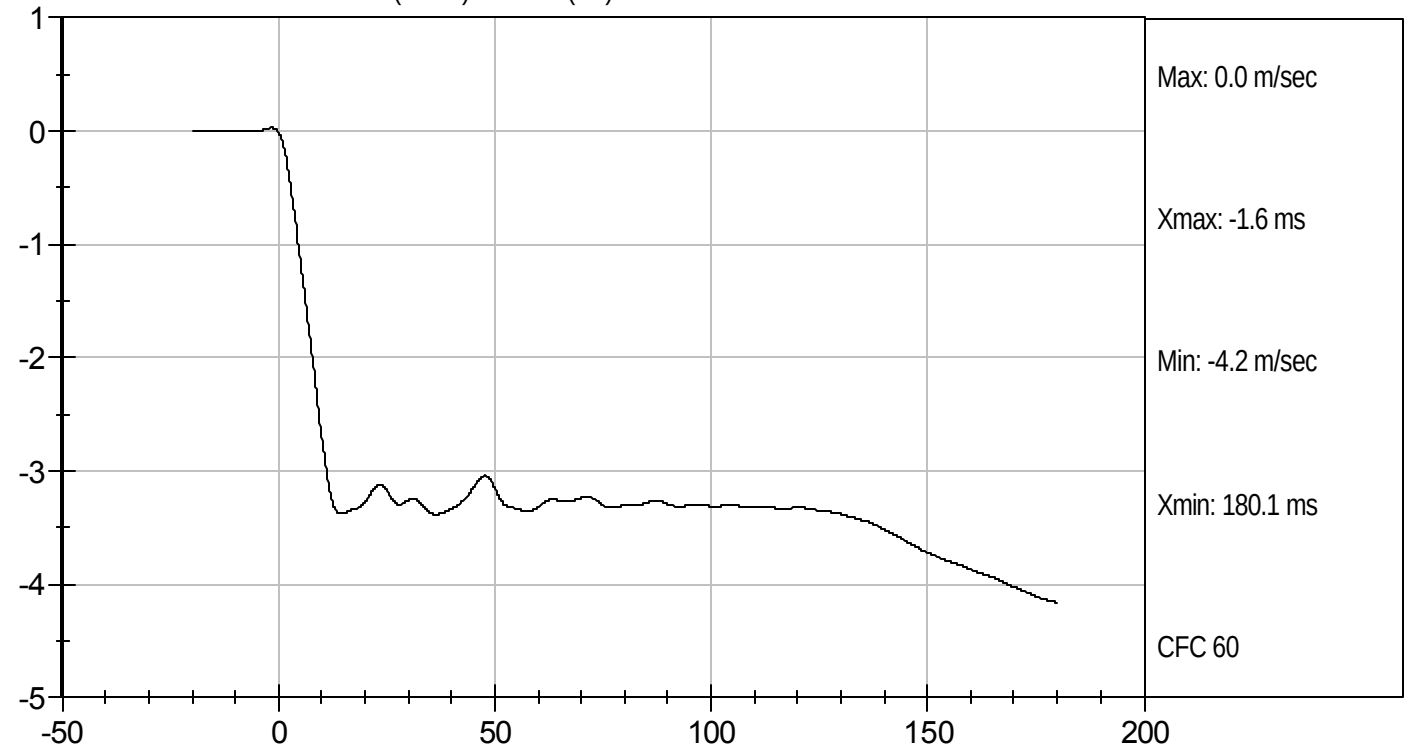
4/15/11
Test Date

David Winkelbauer
Approved By

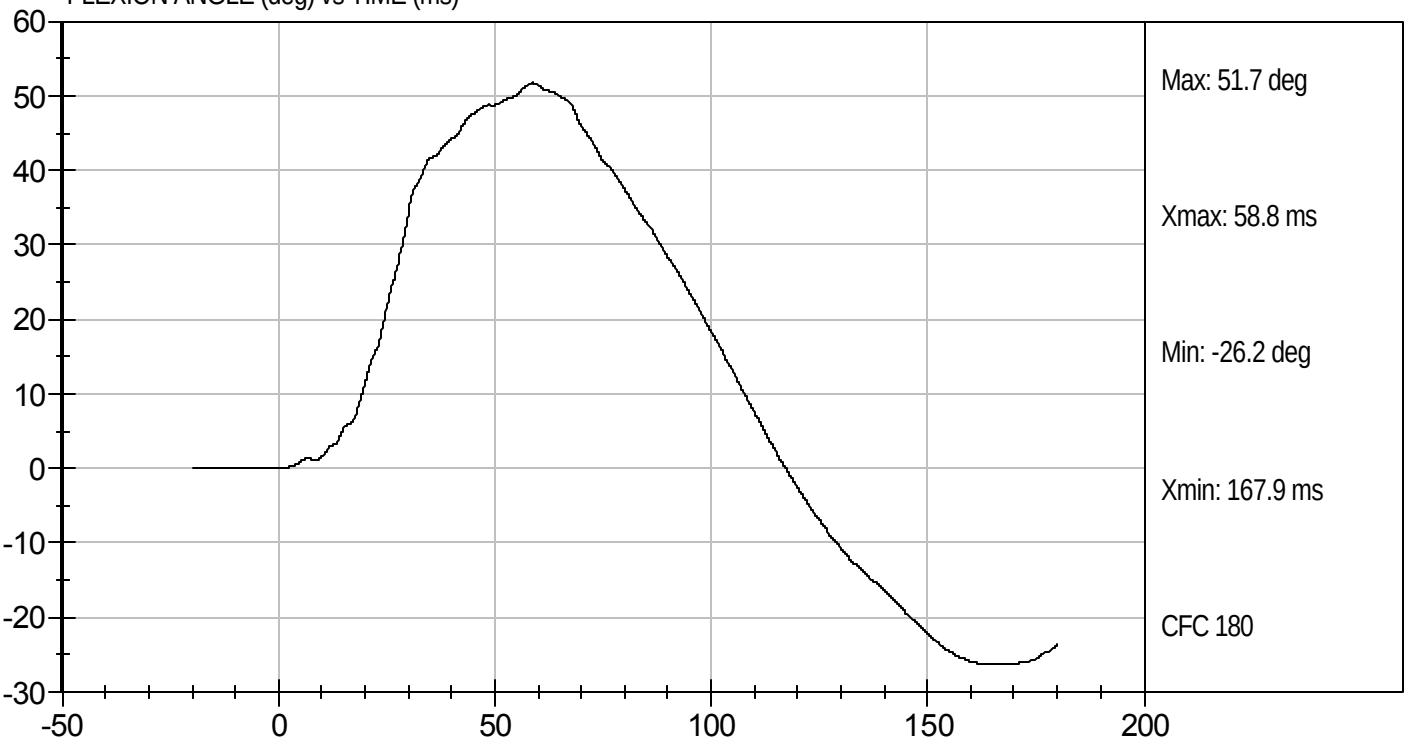
Test Desc: Neck Bending
Component ID: D111412

Test Date: 4/15/11
Velocity: 11.42 ft/s, 3.5 m/s

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

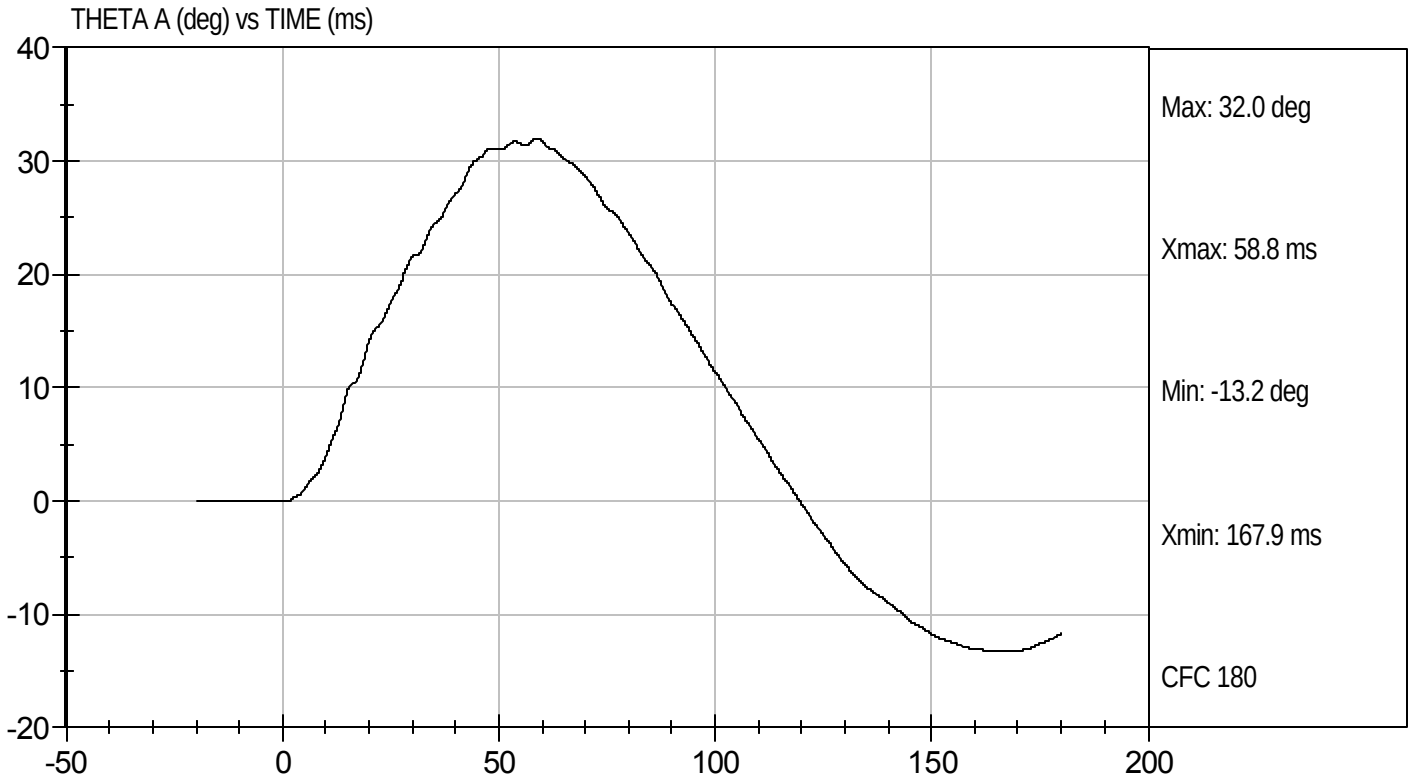


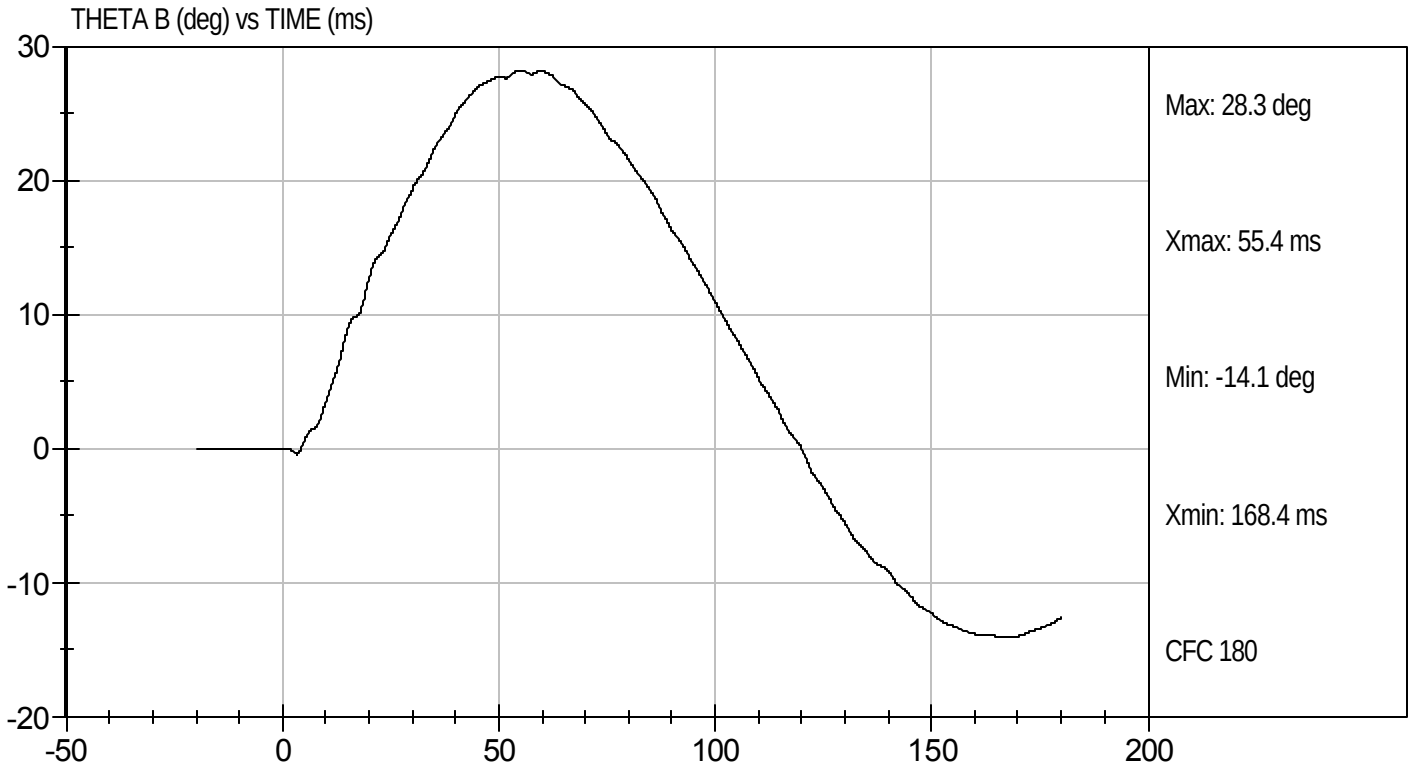
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D111412

Test Date: 4/15/11
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:** D111413

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.2	Pass
Time of Peak Shoulder Acceleration	ms	NA	18.2	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

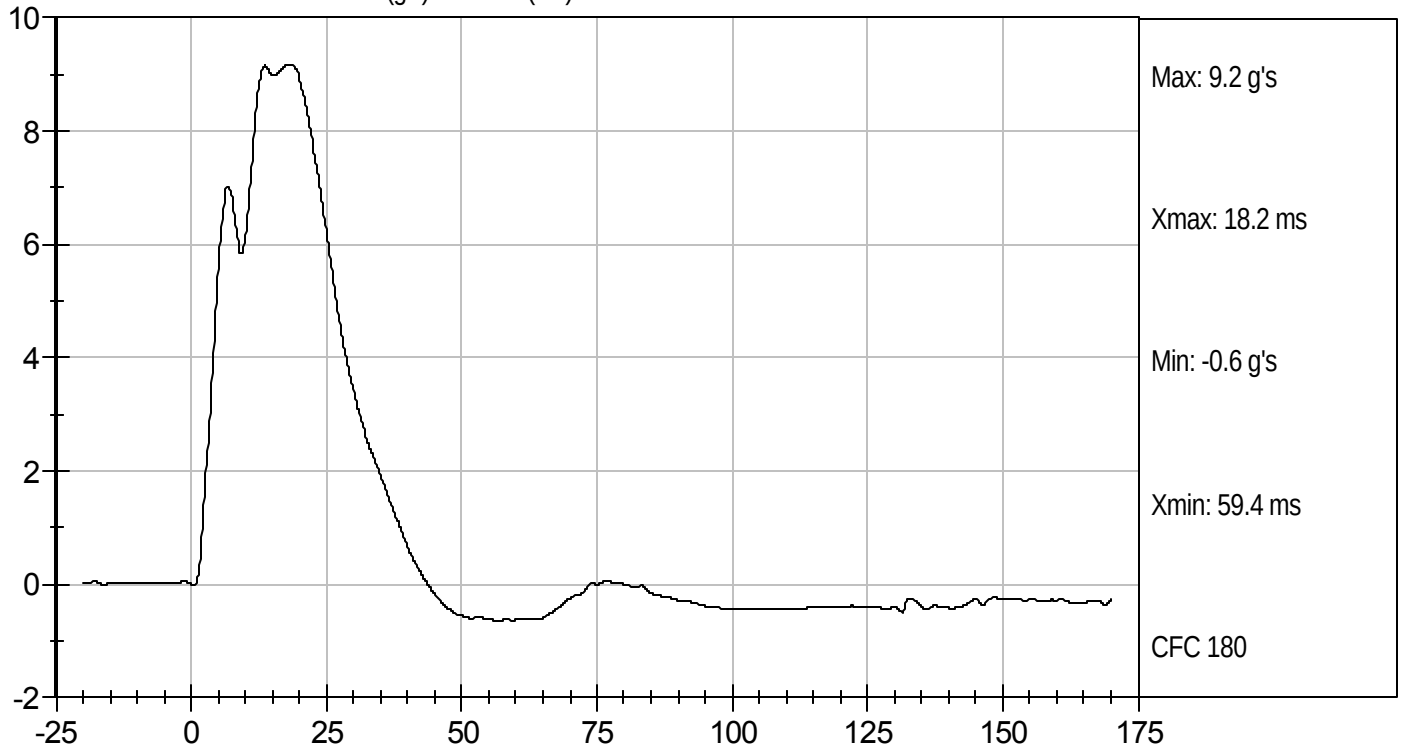
4/15/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111413

Test Date: 4/15/11
Velocity: 14.37 ft/s, 4.4 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:** D111414

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.2	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.1	Pass
		Overall Test Results		Pass

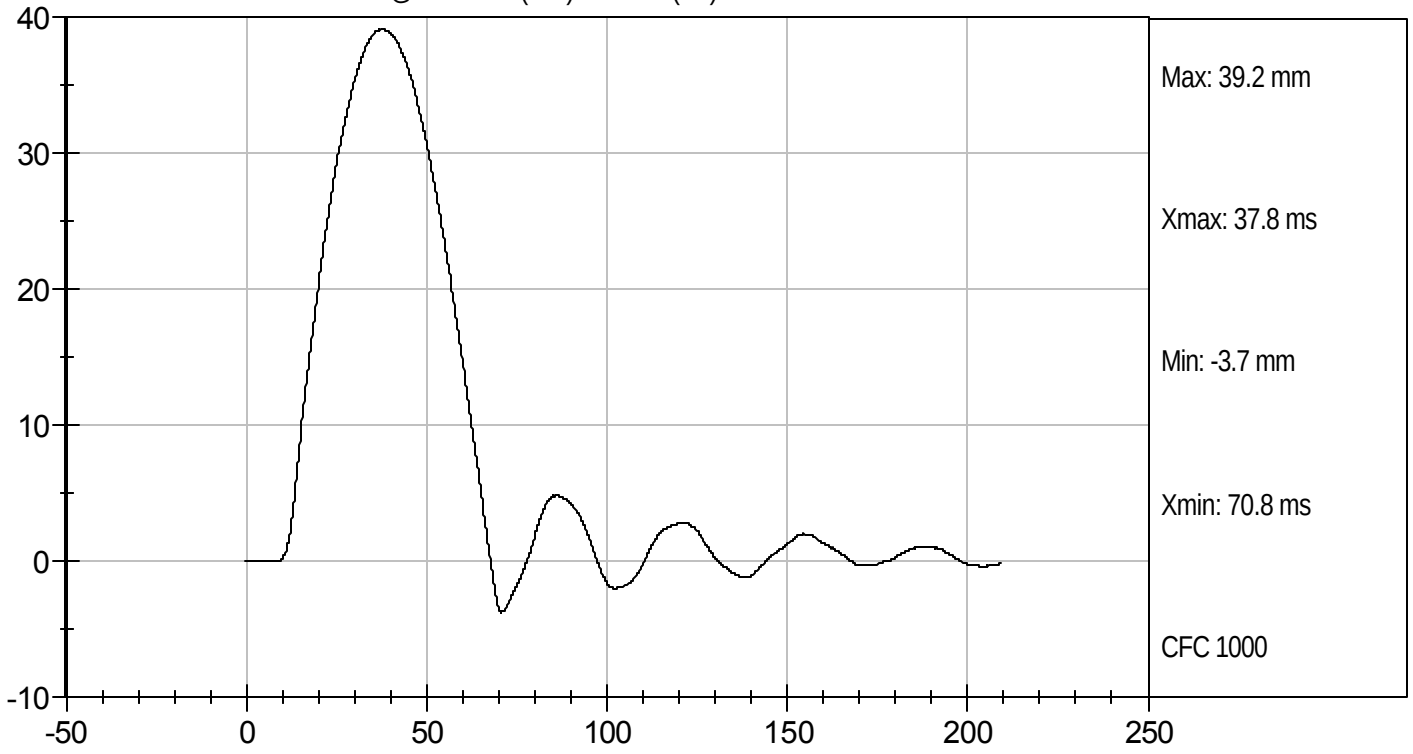
Jessica Hall
Laboratory Technician

4/15/11
Test Date

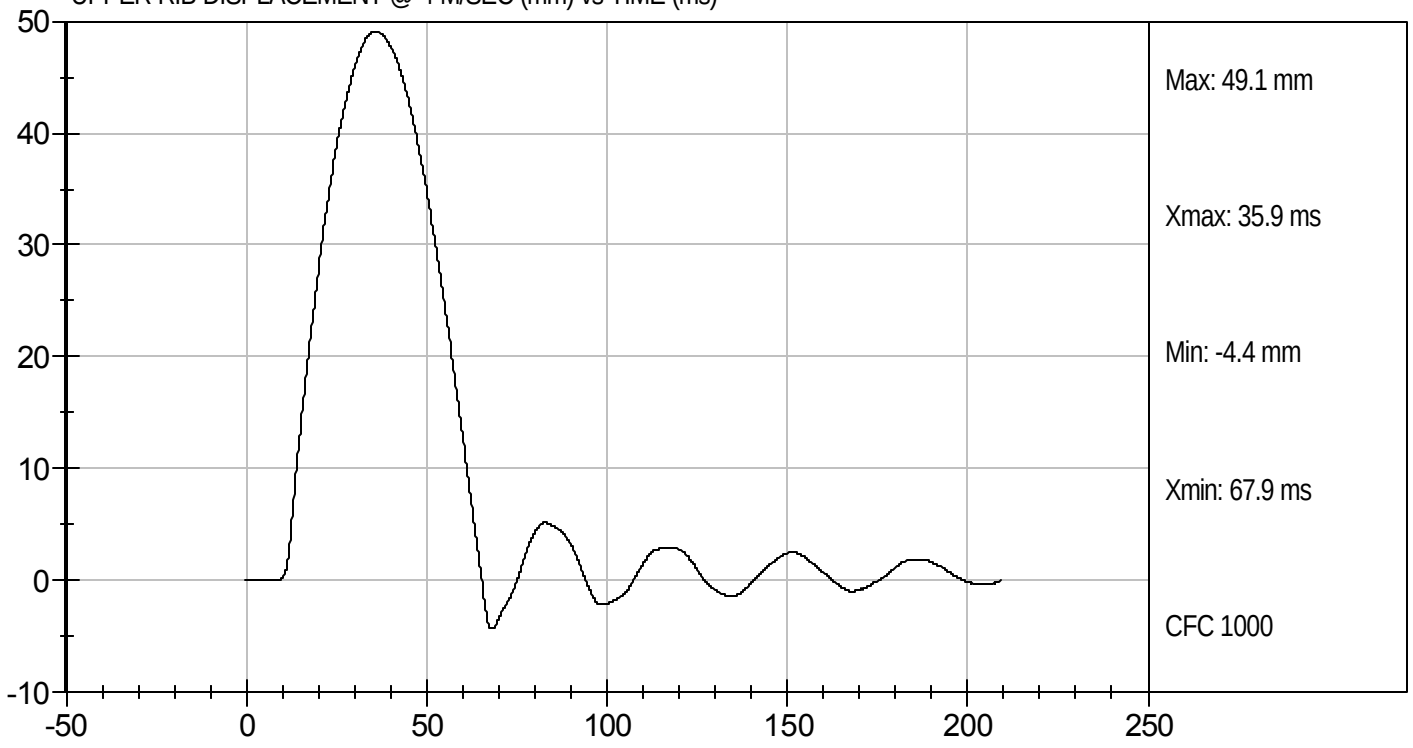
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111414
Test Date: 4/15/11

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:** D111415

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.8	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.5	Pass
		Overall Test Results		Pass

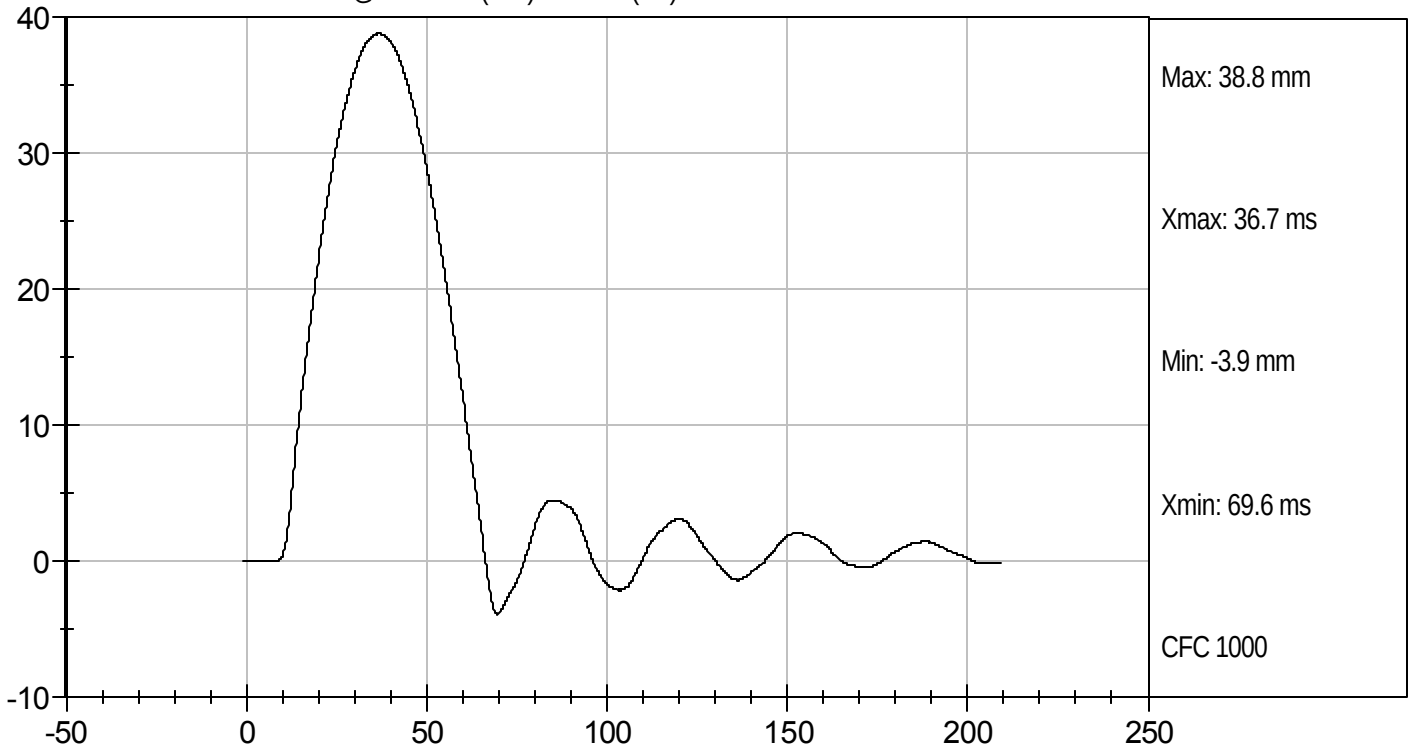
Jessica Gall
Laboratory Technician

4/15/11
Test Date

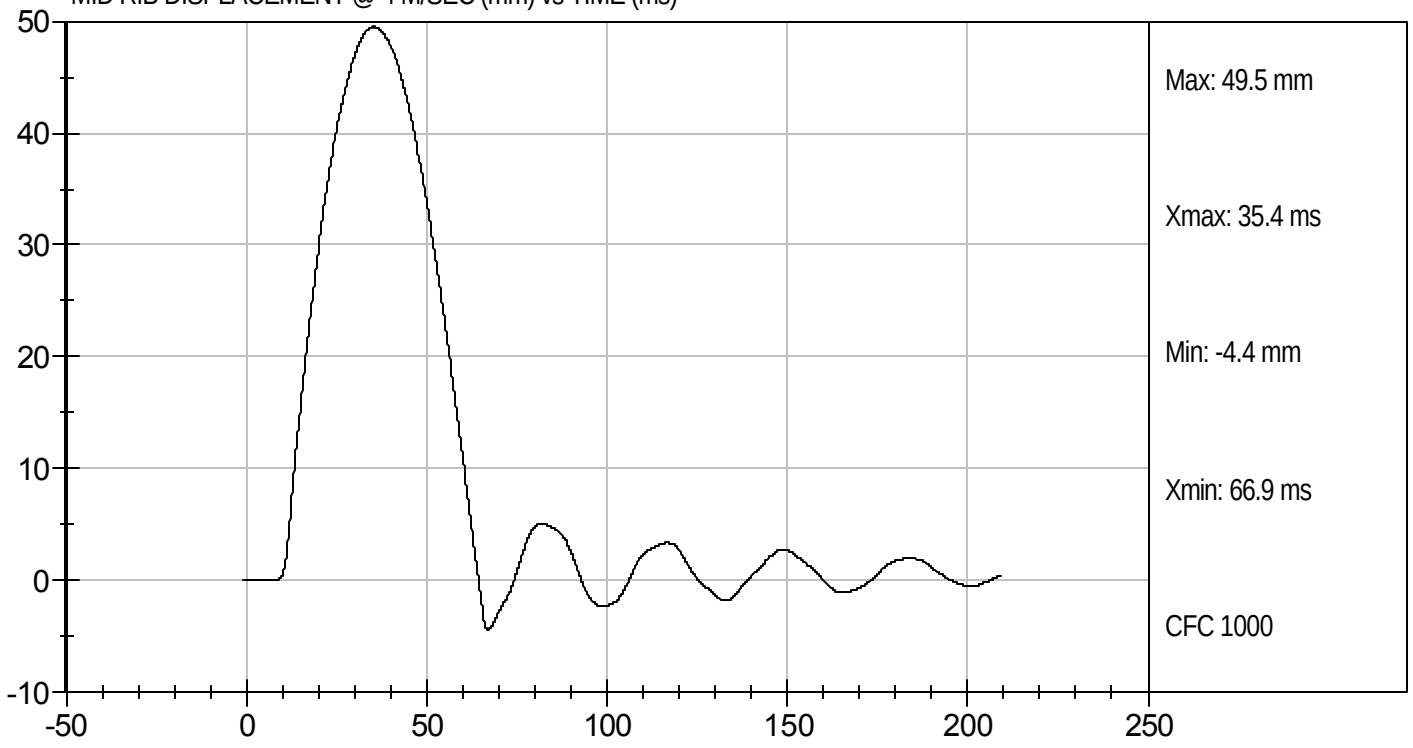
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111415
Test Date: 4/15/11

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:** D111416

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.7	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.3	Pass
		Overall Test Results		Pass

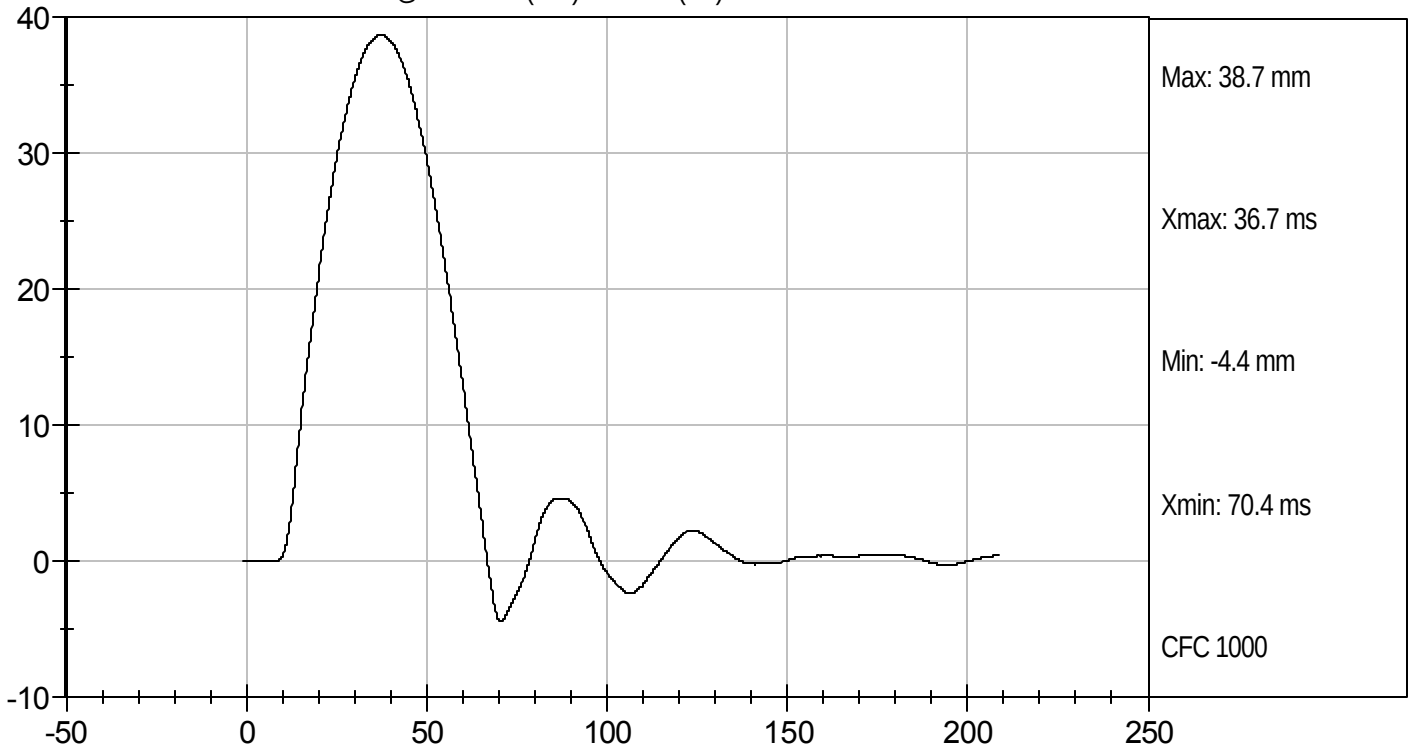
Jessica Hall
Laboratory Technician

4/15/11
Test Date

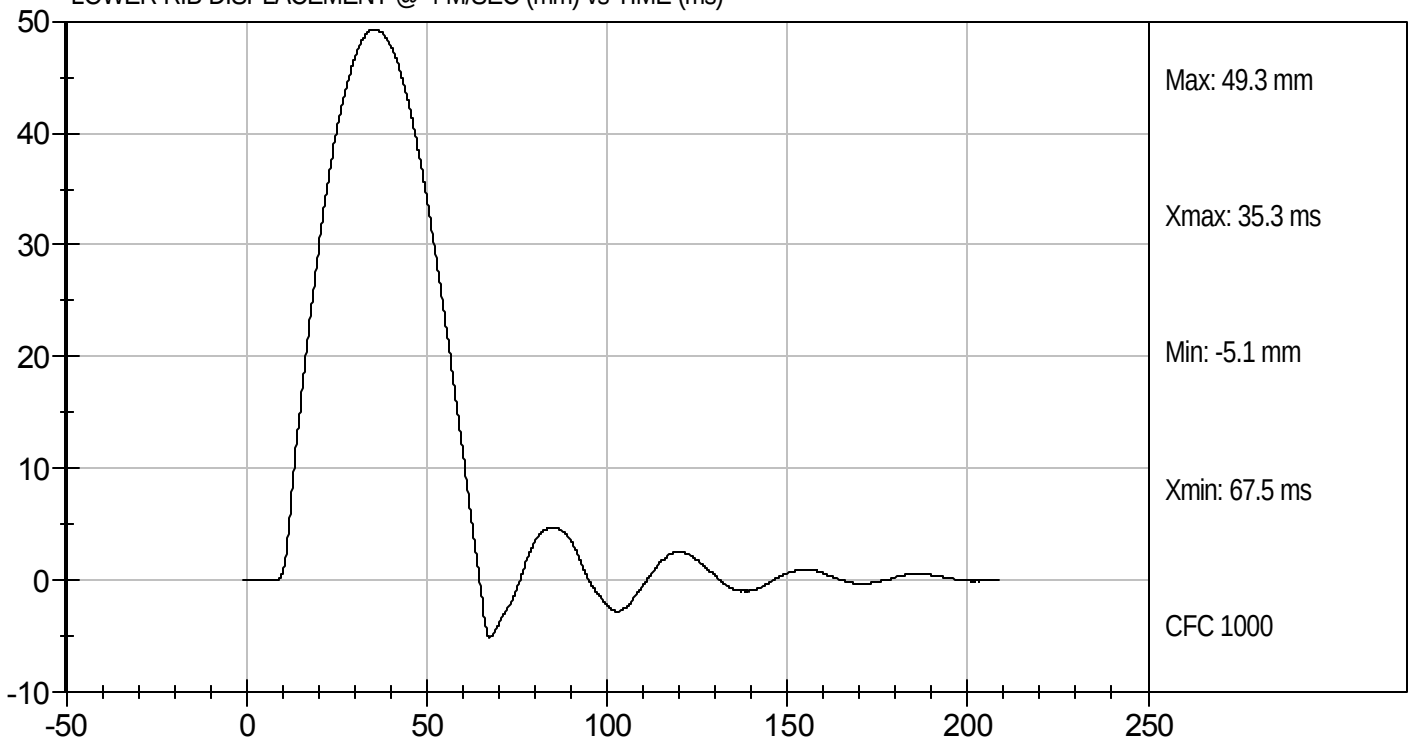
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111416
Test Date: 4/15/11

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:** D111417

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.33	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	2.55	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	11.00	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

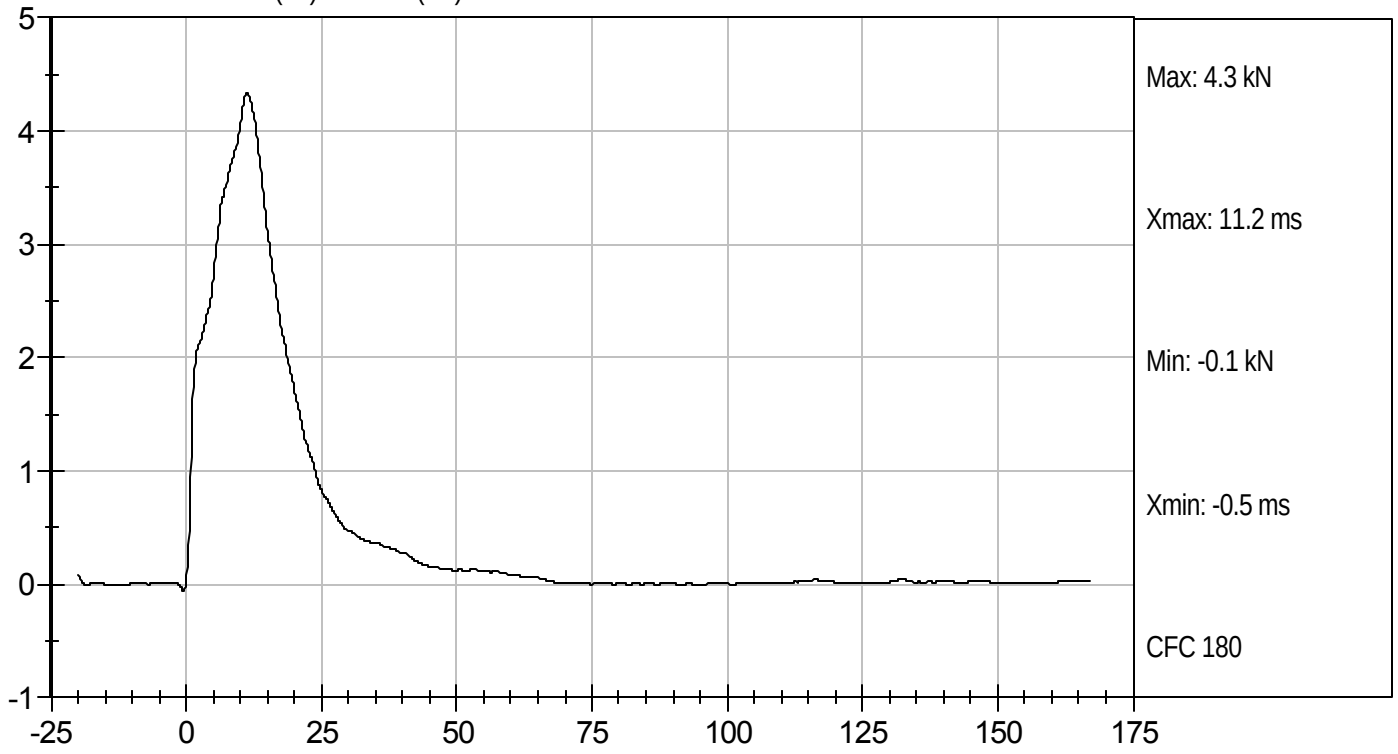
4/15/11
Test Date

David Winkelbauer
Approved By

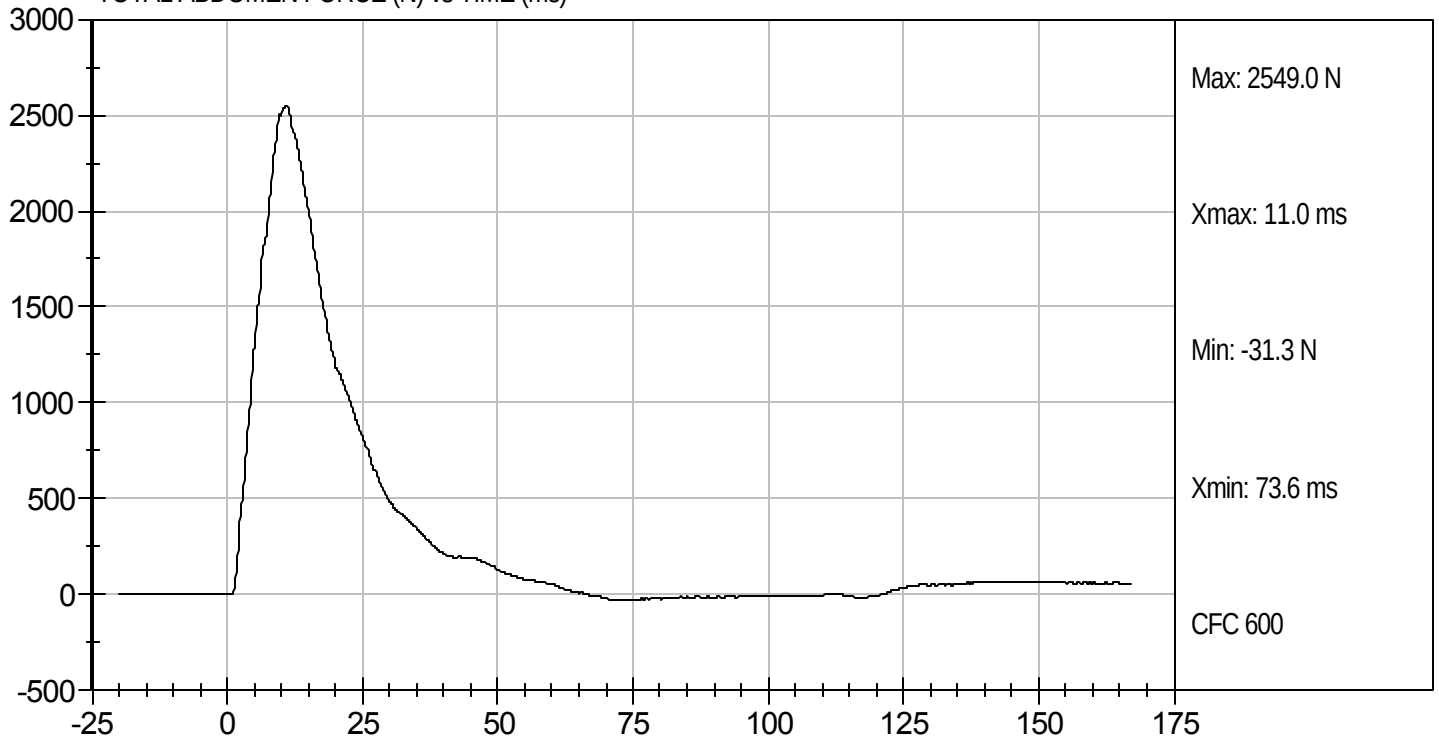
Test Desc: Abdomen Impact
Component ID: D111417

Test Date: 4/15/11
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:** D111418

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	30	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.41	Pass
	27 ms	m/s	-6.50 to -5.80	-5.83	Pass
	30 ms	m/s	>= -6.5	-6.06	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.4	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	45.1	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	46	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

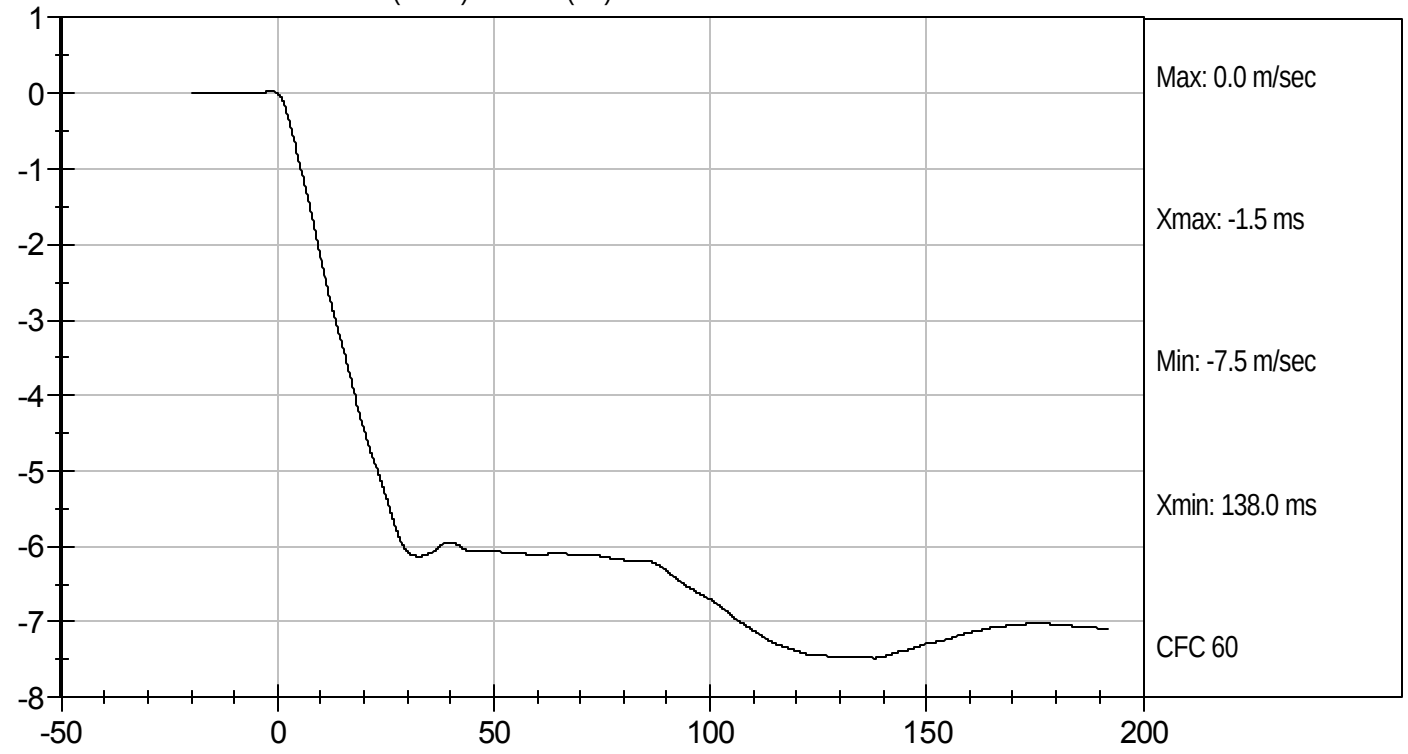
4/15/11
Test Date

David Winkelbauer
Approved By

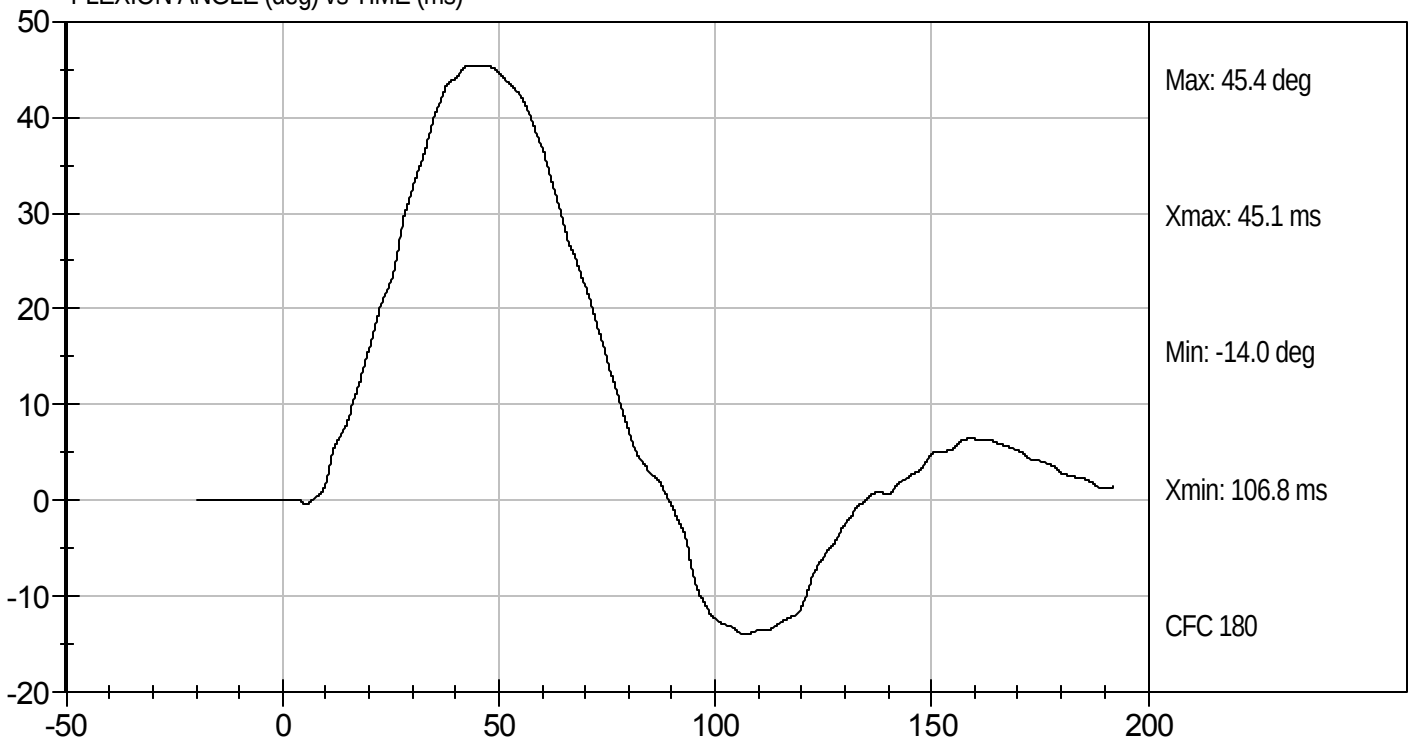
Test Desc: Lumbar Bending
Component ID: D111418

Test Date: 4/15/11
Velocity: 20.08 ft/s, 6.12 m/s

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

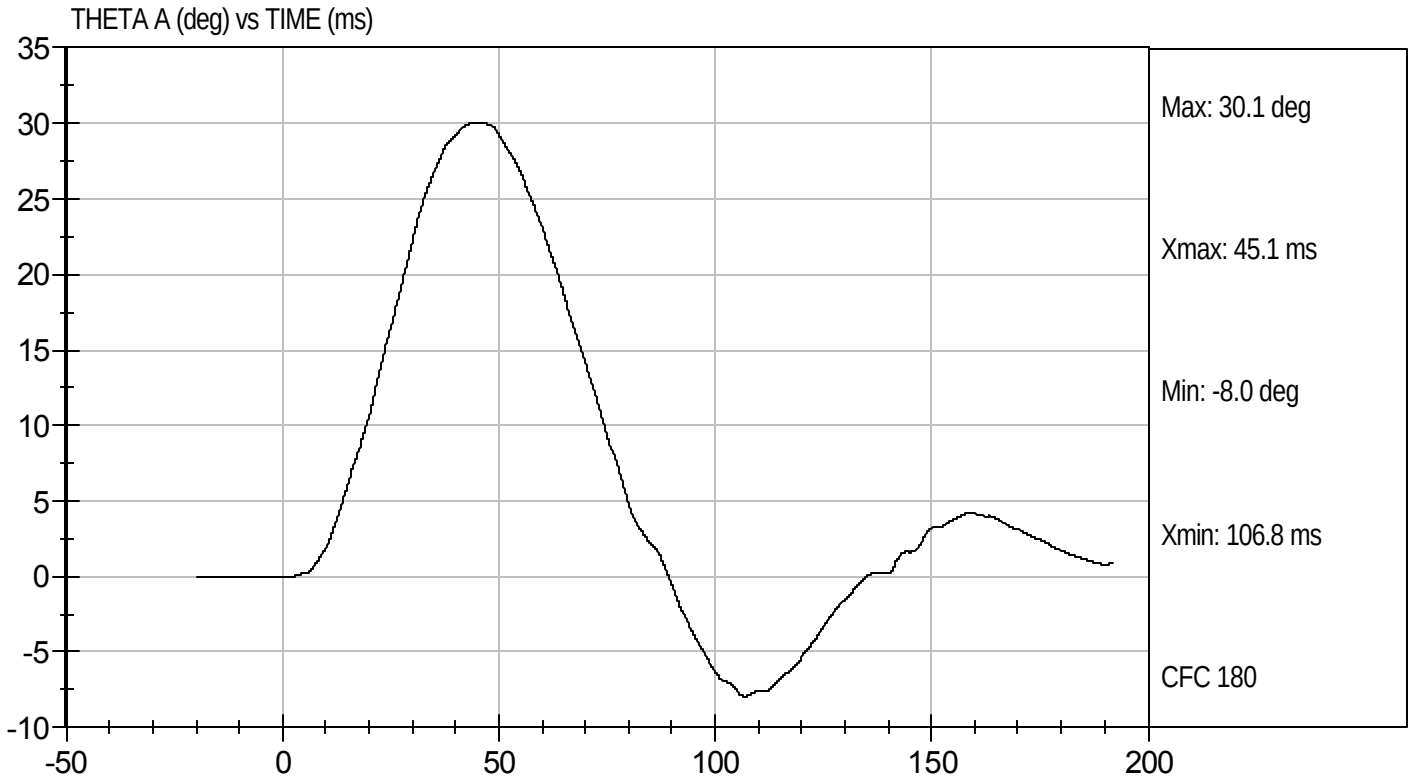


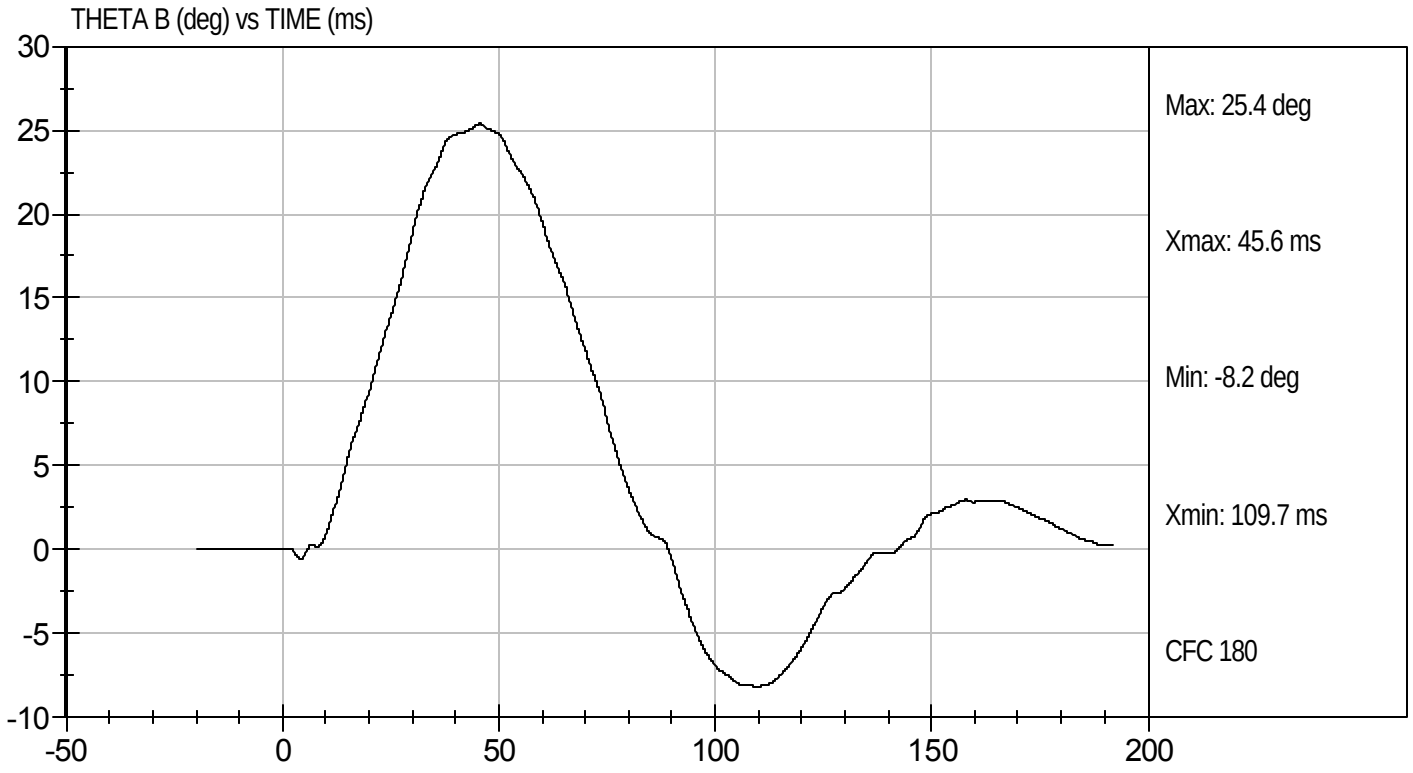
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D111418

Test Date: 4/15/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111419

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.76	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.10	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.35	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.20	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

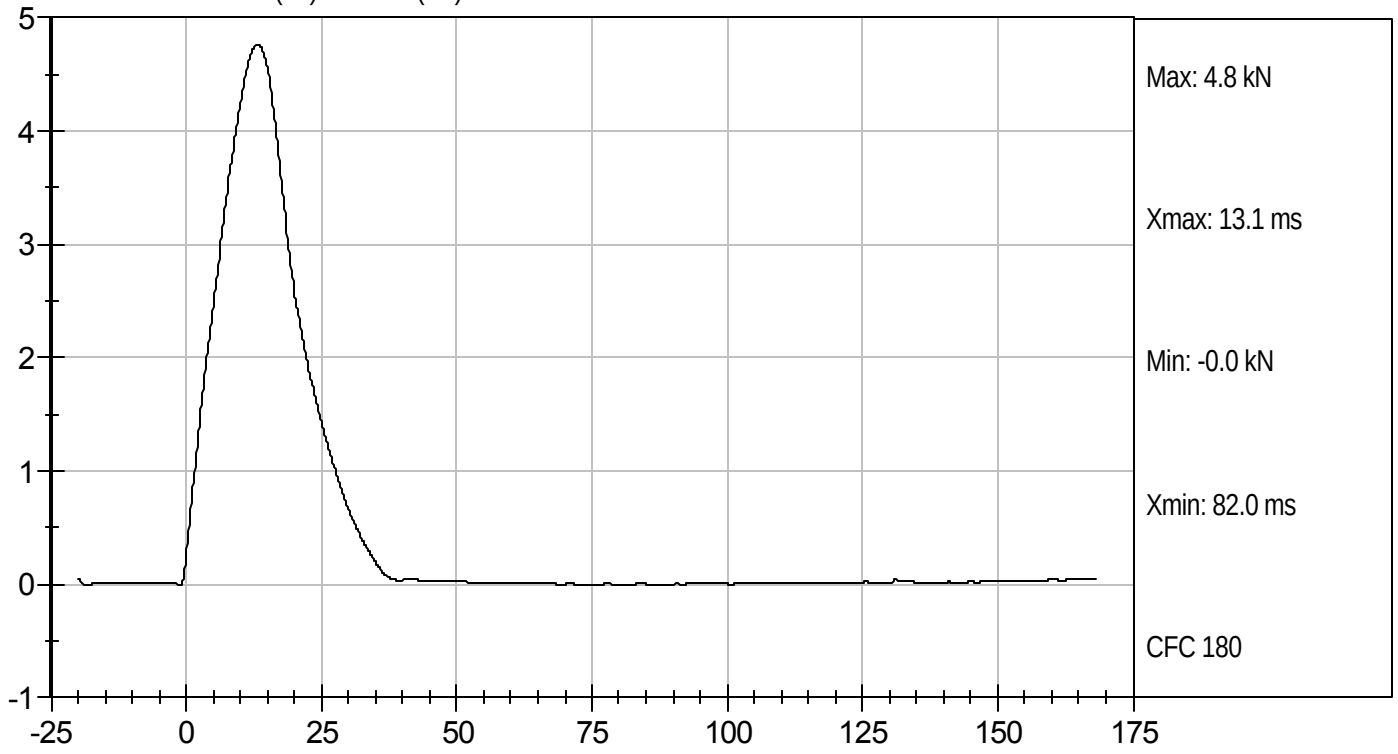
4/15/11
Test Date

David Winkelbauer
Approved By

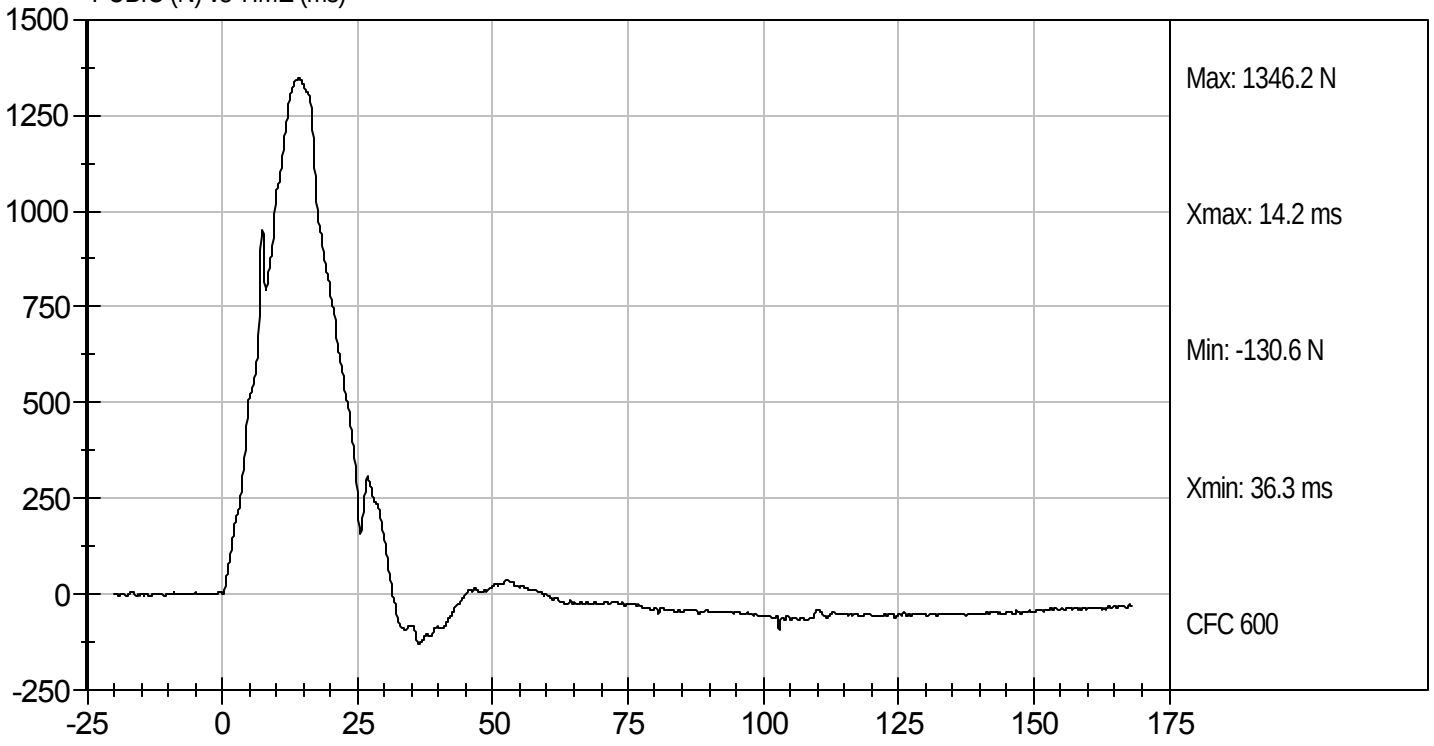
Test Desc: Pelvis Impact
Component ID: D111419

Test Date: 4/15/11
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:** D111410

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Humidity	%	10 to 70	26	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	5.16	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.1	Pass
Middle Rib Displacement	mm	37.0 to 45.0	40.8	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.1	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

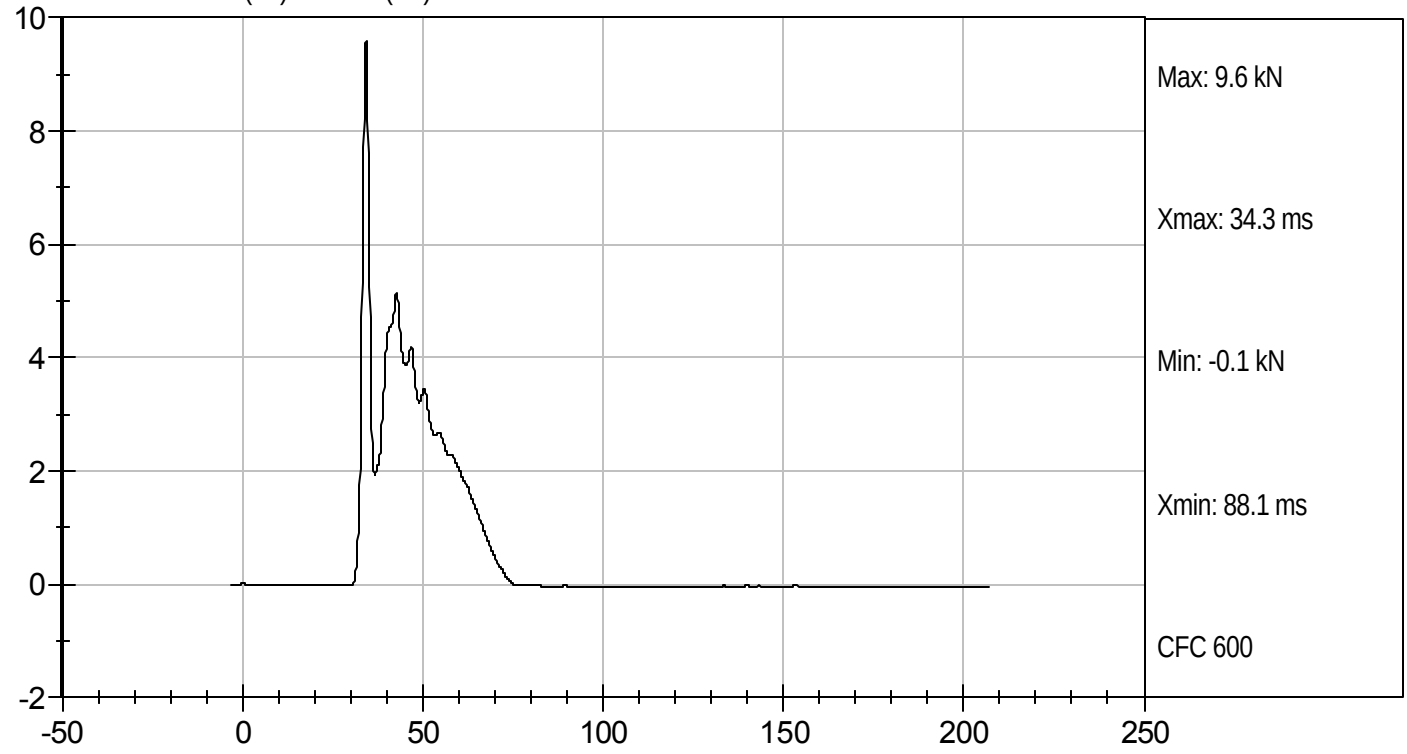
4/15/11
Test Date

David Winkelbauer
Approved By

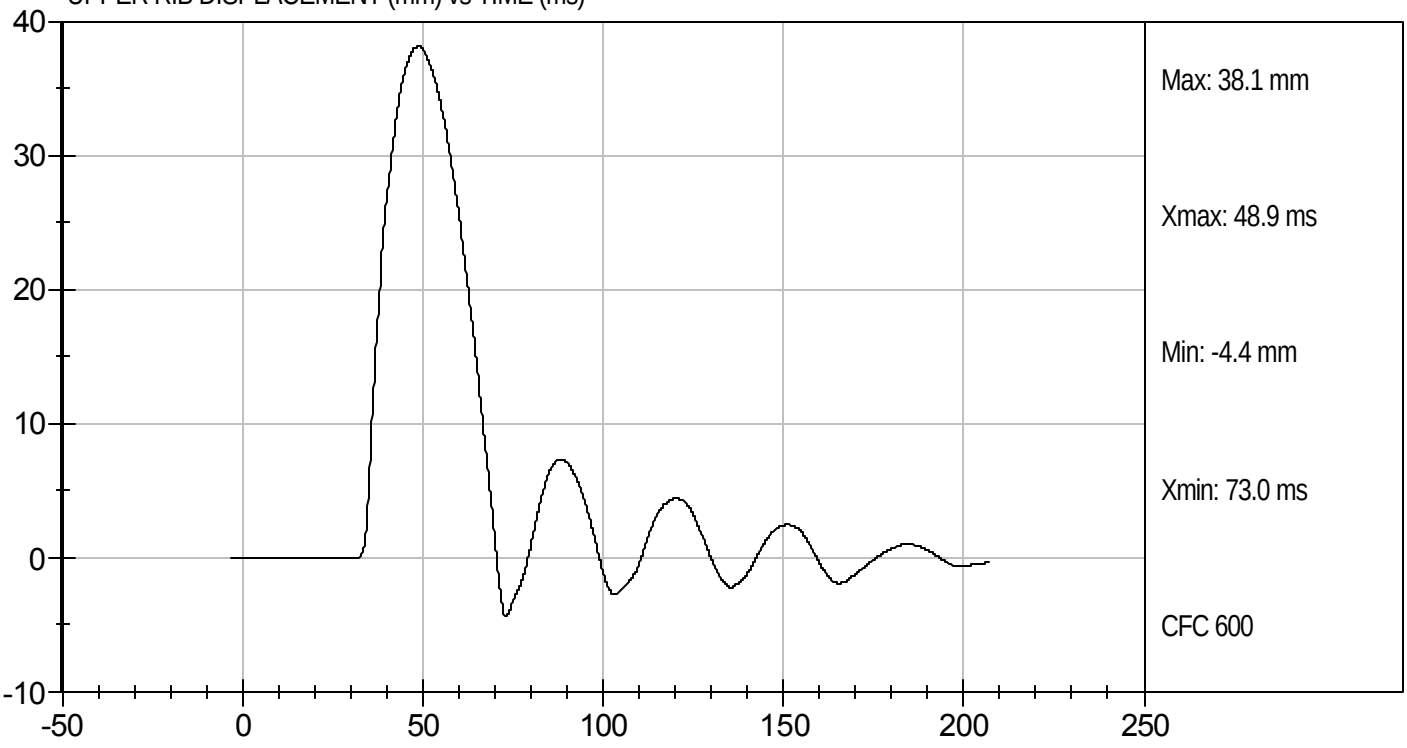
Test Desc: Thorax Impact
Component ID: D111410

Test Date: 4/15/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



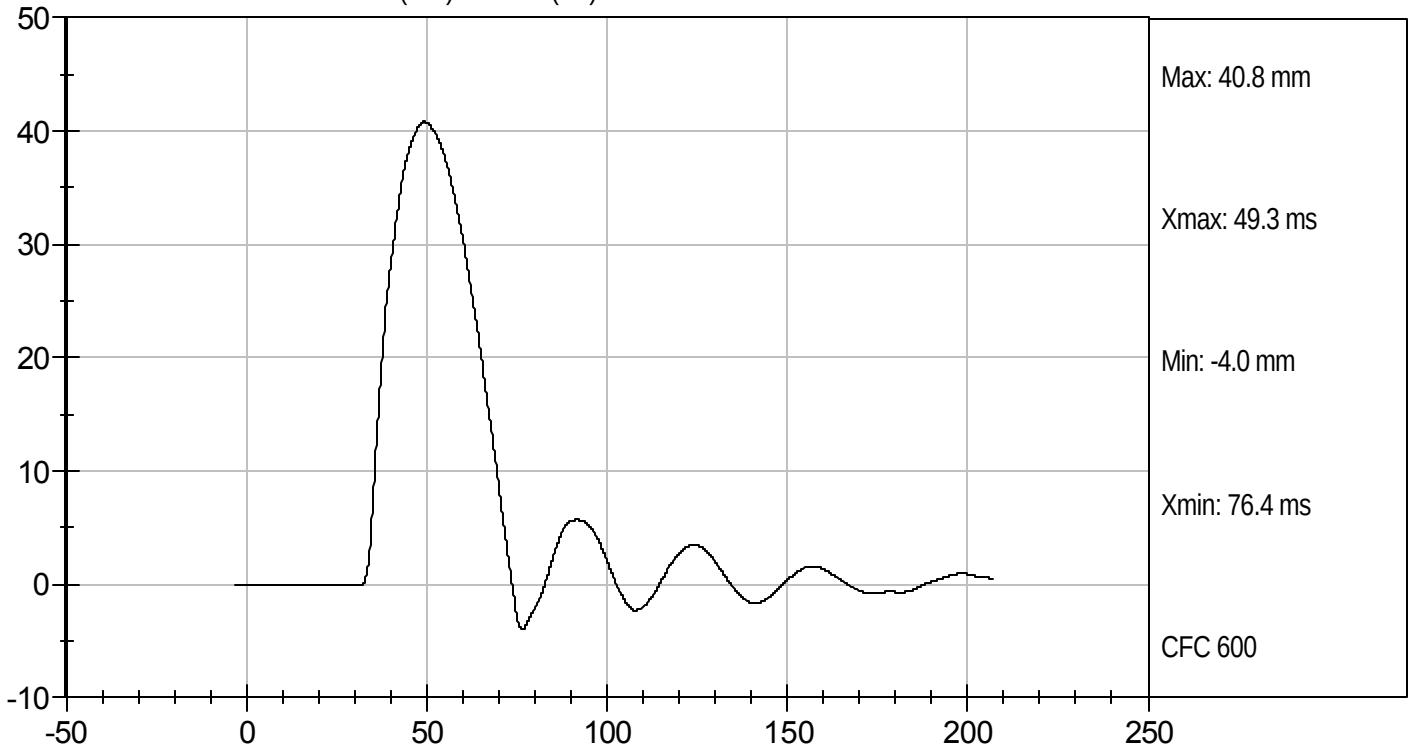
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



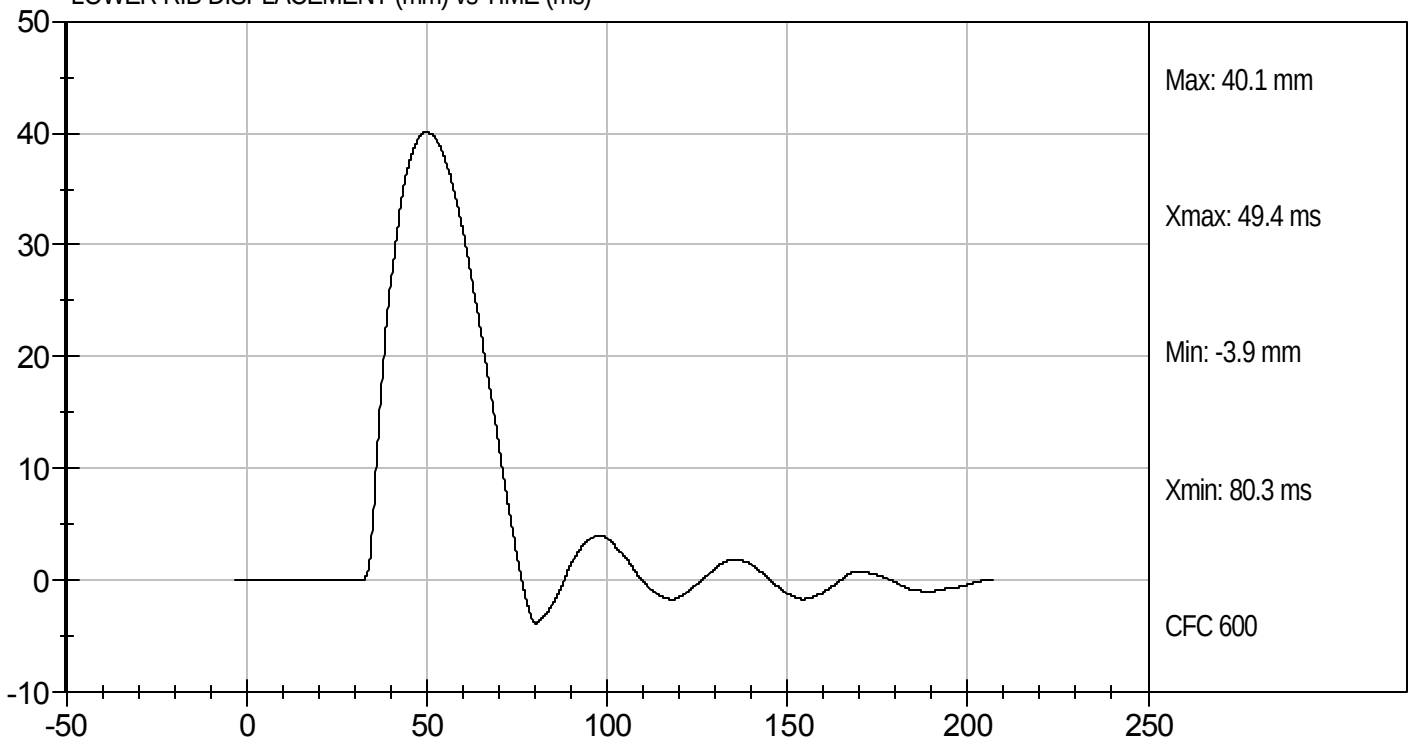
Test Desc: Thorax Impact
Component ID: D111410

Test Date: 4/15/11
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)	P55706	Endevco	12/22/2010
Vehicle CG (Y)	P55705	Endevco	12/22/2010
Vehicle CG (Z)	P55704	Endevco	12/22/2010
Left Floor Sill (Y)	P52226	Endevco	11/05/2010
A Pillar Sill (Y)	P49497	Endevco	11/05/2010
A Pillar Low (Y)	P52142	Endevco	3/15/2011
A Pillar Mid (Y)	P49518	Endevco	12/22/2010
B Pillar Sill (Y)	P49473	Endevco	12/03/2010
B Pillar Low (Y)	P53288	Endevco	1/13/2011
B Pillar Mid (Y)	P49525	Endevco	1/13/2011
Seat (Y)	P59287	Endevco	2/19/2011
Engine (X)	P52186	Endevco	11/05/2010
Engine (Y)	P52187	Endevco	11/05/2010
Firewall (Y)	P59360	Endevco	1/13/2011
Roof (Y)	P47810	Endevco	2/19/2011
Floor Sill (Y)	P49447	Endevco	11/05/2010
Rear Deck (X)	P52281	Endevco	12/13/2010
Rear Deck (Y)	P52282	Endevco	12/13/2010