

REPORT NUMBER: 214P-MGA-2011-001

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

**GENERAL MOTORS LLC
2011 CHEVROLET CRUZE LS 4-DR SEDAN
NHTSA NUMBER: CB0104**

**PREPARED BY:
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BURLINGTON, WI 53105**




Test Date: March 7, 2011


Report Date: April 6, 2011

FINAL REPORT

**PREPARED FOR:
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Acceptance Date: April 13, 2011

Technical Report Documentation Page

1. Report No. 214P-MGA-2011-001	2. Government Accession No. No.	3. Recipient's Catalog No. No.																
4. Title and Subtitle Final Report of FMVSS 214P Compliance Test Side Impact Protection Testing of 2011 Chevrolet Cruze LS 4-Dr Sedan; NHTSA No.: CB0104		5. Report Date April 6, 2011																
		6. Performing Organization Code MGA																
7. Author(s) Donna Janovicz, Project Manager Joe Fleck, Project Engineer		8. Performing Organization Report No. 214P-MGA-2011-001																
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No. 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 3/07/2011 to 4/06/2011																
		14. Sponsoring Agency Code NVS-220																
15. Supplementary Notes No.																		
16. Abstract A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 2011 Chevrolet Cruze LS 4-Dr Sedan 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 7, 2011. The impact velocity was 31.5 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 308 mm at level 3. The test vehicle's performance follows: <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Measurement Description</th> <th style="padding: 5px;">Units</th> <th style="padding: 5px;">Result</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Head Injury Criteria (HIC₃₆)</td> <td style="padding: 5px;">N/A</td> <td style="padding: 5px;">486</td> </tr> <tr> <td style="padding: 5px;">Max. Rib Deflection</td> <td style="padding: 5px;">mm</td> <td style="padding: 5px;">32</td> </tr> <tr> <td style="padding: 5px;">Sum of Abdomen Forces</td> <td style="padding: 5px;">N</td> <td style="padding: 5px;">1578</td> </tr> <tr> <td style="padding: 5px;">Pubic Symphysis Force</td> <td style="padding: 5px;">N</td> <td style="padding: 5px;">2311</td> </tr> </tbody> </table> <p>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.</p>				Measurement Description	Units	Result	Head Injury Criteria (HIC ₃₆)	N/A	486	Max. Rib Deflection	mm	32	Sum of Abdomen Forces	N	1578	Pubic Symphysis Force	N	2311
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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																
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 116	22. Price No.															

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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 Chevrolet Cruze LS 4-Dr Sedan. 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 Chevrolet Cruze LS 4-Dr Sedan. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.5 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin, on March 7, 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 50 th Percentile Male	486	Upper	32.2	Front	430.5	2310.7
		Middle	26.7	Mid	477.3	
		Lower	30.8	Rear	704.0	
		Max.	32.2	Sum	1578.3	

GENERAL COMMENTS

There was no valid data collected for:
 Left Mid A-Post Y after 40 msec.
 Left Mid B-Post Y after 10 msec.
 Driver Seat Track Y after 15 msec.
 Right Roof @ Impact Line – Noise Spike between 15-23 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 Chevrolet Cruze LS 4-Dr Sedan NHTSA No. CB0104
 Test Program: FMVSS 214 Pole Test Date: 3/07/2011

VEHICLE INFORMATION	
Make	Chevrolet
Model	Cruze LS
Body Style	Sedan
VIN	1G1PD5SH8B7148354
Body Color	Silver Ice Metallic
Engine Displacement (L)	1.8
# of Cylinders	4
Engine Placement	Lateral
Transmission Type	Manual
Transmission Speeds	6
Overdrive	Yes
Final Drive	Front
Odometer Reading	30 miles

OPTIONS	
ESC	Yes
All Wheel Drive	No
Power Steering	Yes
Tilt Steering Wheel	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso/Pelvis Airbag	Yes
Driver Knee Bag	Yes
Driver Seat Belt Pretensioners	Yes
Driver Seat Belt Load Limiters	Yes
Driver Power Seat	No
Rear Pass. Curtain Airbag	Yes
Rear Pass. Side Torso Airbag	Yes
Rear Pass. Seat Belt Pretensioners	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	General Motors LLC
Date of Manufacture	12/10

GVWR (kg)	1824
GAWR Front (kg)	946
GAWR Rear (kg)	878

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	60/40 Split		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				412
Cargo Weight (RCLW) (kg)				72

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan NHTSA No. CB0104
 Test Program: FMVSS 214 Pole Test Date: 3/07/2011

TIRE PRESSURES

	Units	LF	RF	RR	LR
As Delivered	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

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	427.7	281.7		457.7	345.2		456.3	337.0	
Right	kg	416.0	272.6		418.2	325.7		426.8	319.4	
Ratio	%	60.3	39.7		56.6	43.4		57.4	42.6	
Totals	kg	843.7	554.3	1398.0	875.9	670.9	1546.8	883.1	656.4	1539.5

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	1398.0
Weight of 1 P572U ATD (ES-2re) Dummy	kg	77.1
Rated Cargo/Luggage Weight (RCLW)	kg	72
Calculated Target Vehicle Test Weight (TVTW)	kg	1547.1

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	702	708	683	688
As Tested	mm	705	704	690	690
Difference	mm	-3	4	-7	-2

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2867
Vertical Impact Reference Line (Aft of Front Axle)	mm	1384

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

Description of Component	Weight (kg)
Ballast	0
Air Pump/Right Side Mirror/Right Tail Light	5.4
Trunk Lining	6.8
Front Splash Guard/Rear Floor Mats	3.2

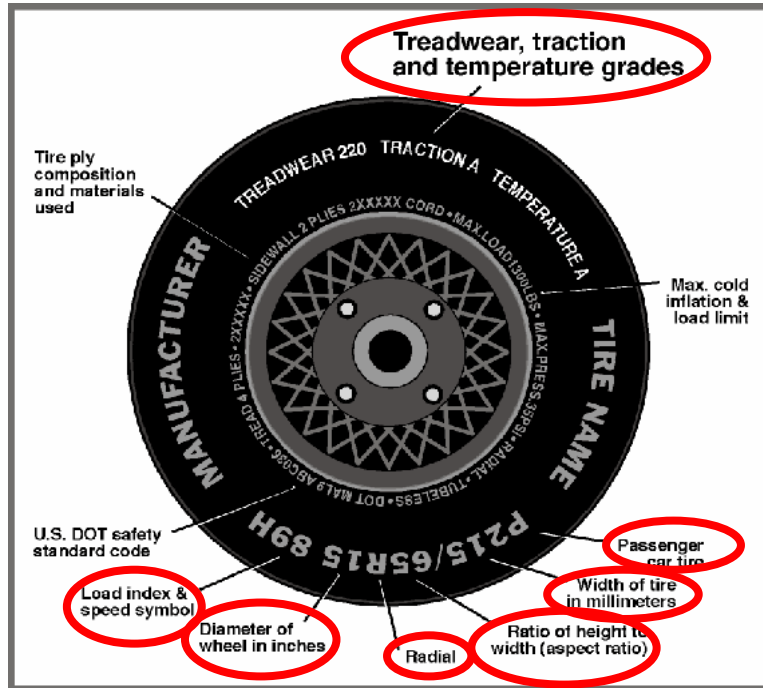
DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	240	240
Recommended Tire Size	P215/60R16	P215/60R16
Tire Size on Vehicle	P215/60R16	P215/60R16
Tire Manufacturer	Firestone	Firestone
Tire Name	FR710	FR710
Tire Type	Passenger	Passenger
Tire Width	215	215
Aspect Ratio	60	60
Radial	Yes	Yes
Wheel Diameter	16	16
Load Index/Speed Symbol	94S	94S
Treadwear	560	560
Traction Grade	B	B
Temperature Grade	B	B

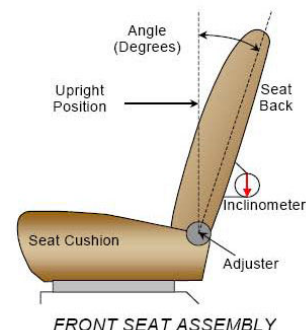
DATA SHEET NO. 4
SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

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 8.5° (zero inclinometer on top surface of rocker panel and measure seat back angle at the headrest posts).



SEAT BACK ANGLE

	Degrees	Detents
Driver with Seated Dummy	8.6° 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	53 detents	27 th detent (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 2nd detent for the 50th percentile male.

SEAT BELT UPPER ANCHORAGE

	Total # of Positions	Placed in Position #
Driver Seat	4 detents (1 st as 0)	2 nd 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 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

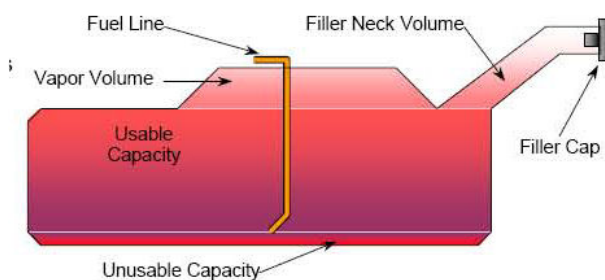
NHTSA No. CB0104
 Test Date: 3/07/2011

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	59.0
Usable Capacity (Owner's Manual)	59.0
92-94% of Usable Capacity	54.3 to 55.5
Actual Amount of Solvent Used	54.9

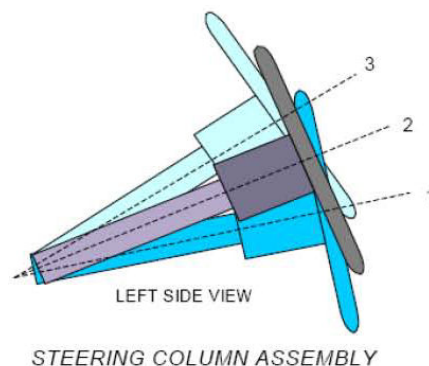
FUEL PUMP

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



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the 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.



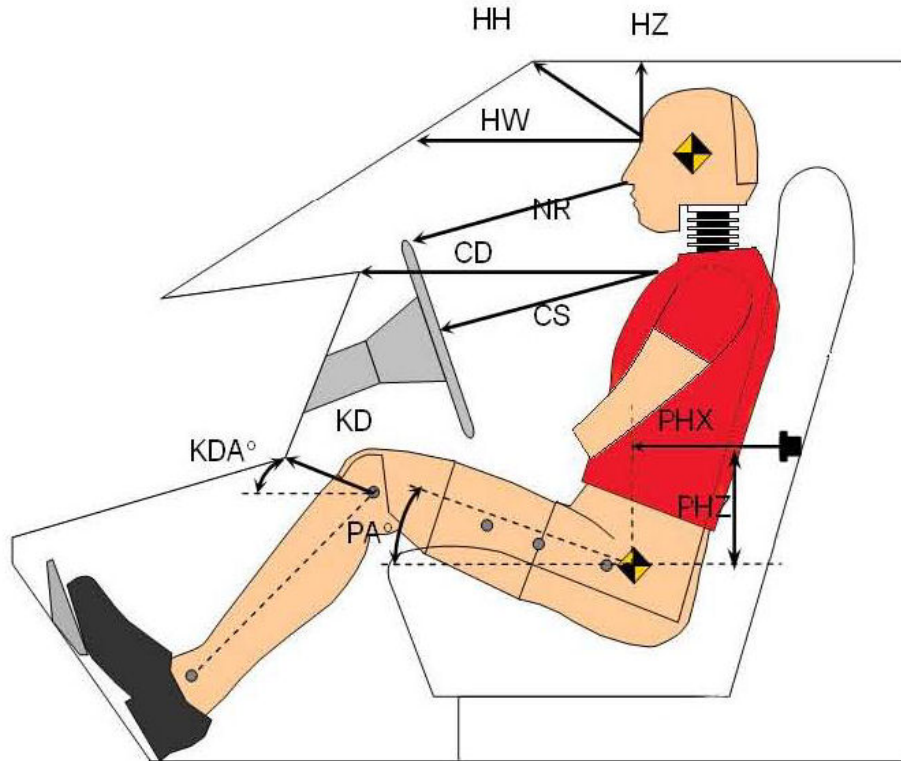
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	70.6	220
Geometric Center – Position 2	68.5	194
Uppermost – Position 3	66.3	168
Telescoping Steering Wheel Travel		52
Test Position	68.5	194

.DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

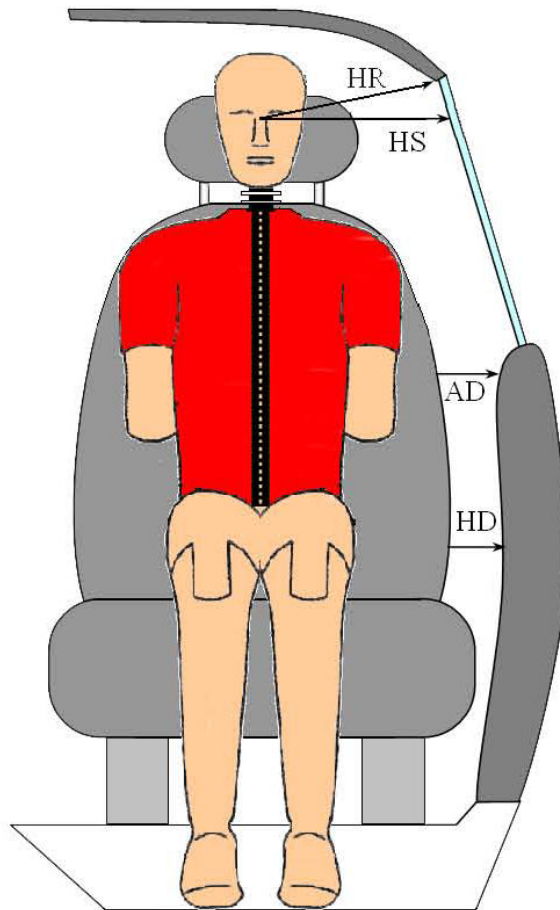


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	412	
HW	Head to Windshield	725	
HZ	Head to Roof	216	
NR	Nose to Rim	498	
CD	Chest to Dash	605	
CS	Chest to Steering Wheel	417	
KDL	Left Knee to Dash	206	32.8
KDR	Right Knee to Dash	179	29.3
PA	Pelvic Angle		
PHX	H-Point to Striker (X-Axis)	116	
PHZ	H-Point to Striker (Z-Axis)	201	

DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

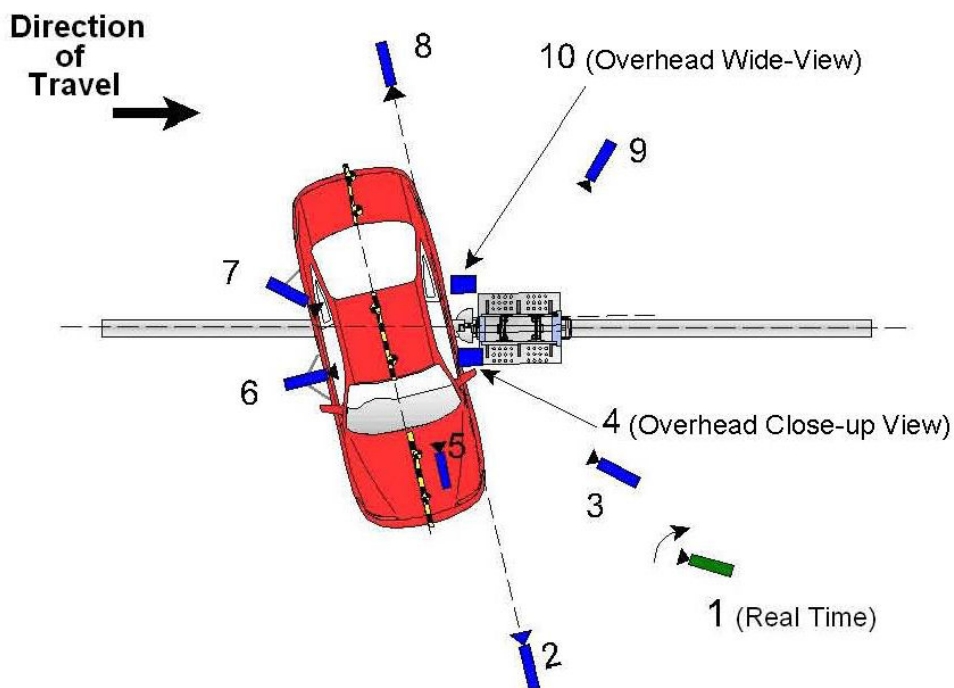


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	203
HS	Head to Side Window	mm	337
AD	Arm to Door	mm	94
HD	H-Point to Door	mm	143

DATA SHEET NO. 8
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011



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

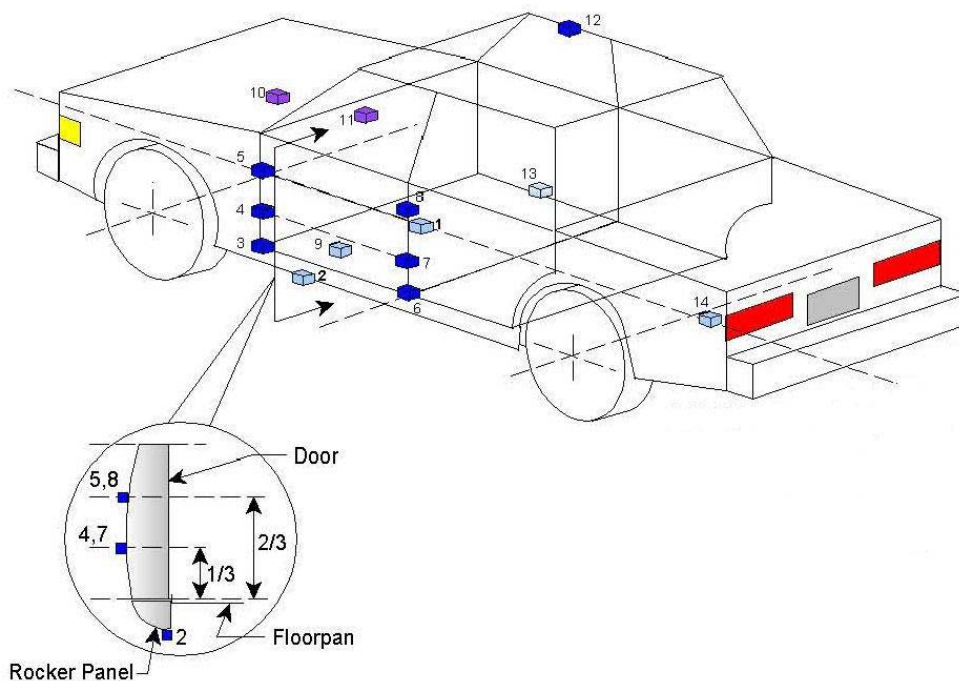
Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5740	50	1750	24	1000
3	Impact Side 45° Forward	4490	2030	1880	20	1000
4	Overhead Closeup	0	-60	4520	50	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-5710	60	1730	24	1000
9	Impact Side 45° Rearward	-3870	3830	1900	20	1000
10	Overhead Wide	0	-350	4610	14	1000

DATA SHEET NO. 9

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2332	-205	-178
2	Left Floor Sill	2628	-730	-200
3	A Pillar Sill	3168	-735	-173
4	A Pillar Low	3048	-700	-538
5	A Pillar Mid	3090	-795	-791
6	B Pillar Sill	2089	-730	-208
7	B Pillar Low	1984	-703	-505
8	B Pillar Mid	2005	-685	-742
9	Seat	2112	-560	-330
10	Engine	3792	20	-832
11	Firewall	3487	0	-845
12	Roof	1958	540	-1461
13	Floor Sill	2169	730	-202
14	Rear Deck	259	0	-340

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 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	3.0	114.0	-11.0	19.4
	Vehicle CG (Y)	31.5	72.4	-11.7	19.7
	Vehicle CG (Z)	20.8	31.8	-29.4	37.9
	Resultant	32.9	72.5		
2	Left Floor Sill (Y)	39.8	27.8	-23.3	22.3
3	A Pillar Sill (Y)	17.1	22.4	-7.3	13.2
4	A Pillar Low (Y)	18.2	33.6	-7.9	23.0
5	A Pillar Mid (Y)	(1)	(1)	(1)	(1)
6	B Pillar Sill (Y)	37.5	14.4	-16.8	22.8
7	B Pillar Low (Y)	47.0	17.2	-4.9	65.7
8	B Pillar Mid (Y)	(2)	(2)	(2)	(2)
9	Seat (Y)	(3)	(3)	(3)	(3)
10	Engine (X)	6.5	111.7	-11.5	42.5
	Engine (Y)	12.8	69.3	-2.8	184.6
11	Firewall (Y)	12.6	52.7	-0.8	150.8
12	Roof (Y)	(4)	(4)	(4)	(4)
13	Floor Sill (Y)	18.6	56.5	-1.5	150.5
14	Rear Deck (X)	4.8	120.1	-6.0	84.4
	Rear Deck (Y)	22.3	72.4	-3.5	152.7

- (1) No valid data collected for Left Mid A-Post Y after 40 msec.
 (2) No valid data collected for Left Mid B-Post Y after 10 msec.
 (3) No valid data collected for Driver Seat Track Y after 15 msec.
 (4) Right Roof @ Impact Line – Noise Spike between 15-23 msec.

DATA SHEET NO. 11
DUMMY INJURY RESPONSE DATA

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

Dummy S/N	Positive		Negative	
	MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (G)				
Longitudinal (X)	3.1	91.7	31.5	58.7
Lateral (Y)	60.3	53.0	17.7	94.1
Vertical (Z)	11.0	41.9	7.4	65.2
Resultant (R)	65.7	54.7		
HIC36 (t1, t2)	486		t1 = 42.4	t2 = 67.3
THORAX DEFLECTION (mm)				
Upper Rib			32.2	49.9
Middle Rib			26.7	54.8
Lower Rib			30.8	54.1
ABDOMINAL FORCES (N)				
Front	340.5	47.8		
Middle	477.3	48.3		
Rear	704.0	48.6		
Sum	1578.3	48.4		
PELVIS FORCE (N)				
Pubic Symphysis			2310.7	46.3

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

DATA SHEET NO. 12
POST TEST OBSERVATIONS

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan NHTSA No. CB0104
 Test Program: FMVSS 214 Pole Test Date: 3/07/2011

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, Door Panel
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		
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 Broke
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

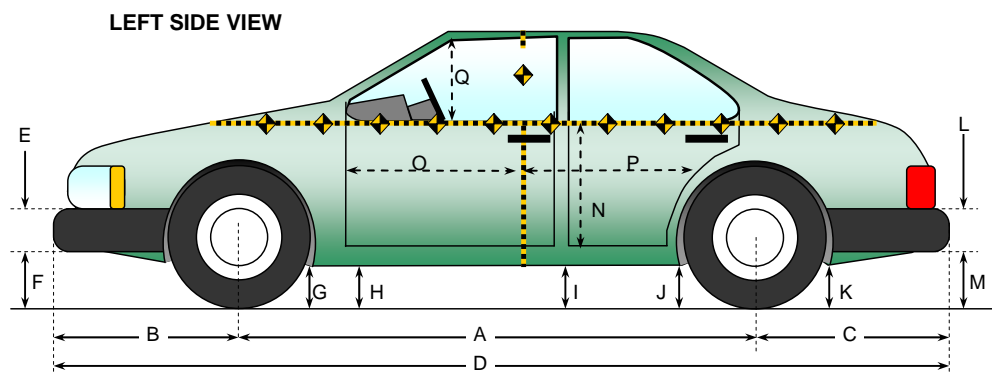
Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso/Pelvis Airbag	Yes	Yes
Head Airbag	No	
Curtain Airbag	Yes	Yes
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	

DATA SHEET NO. 13

VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

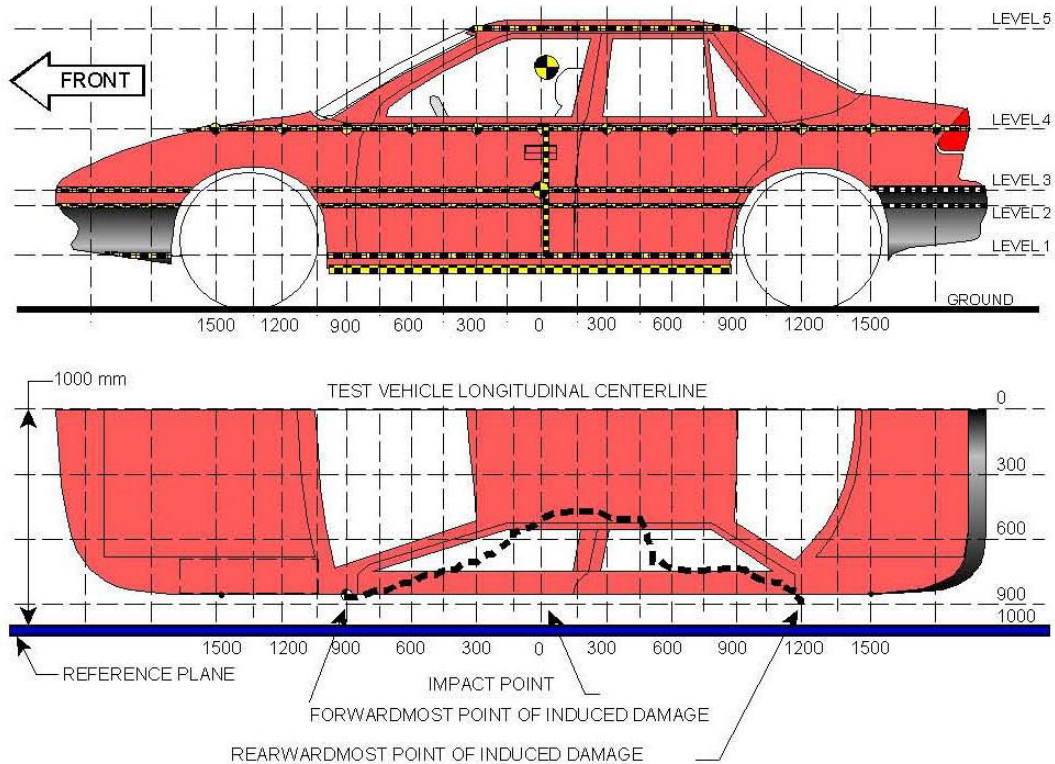


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2867	2630	237
B	Front Axle to FSOV	955	960	-5
C	Rear Axle to RSOV	791	950	-159
D	Total Vehicle Length at Centerline	4613	4540	73
E	Front Bumper Thickness	91	91	0
F	Front Bumper Bottom to Ground	197	209	-12
G	Sill Height at Front Wheel Well	141	159	-18
H	Sill Height at Front Door Leading Edge	161	188	-27
I	Sill Height at B Pillar	167	153	14
J1	Sill Height at Rear Wheel Well	172	205	-33
J2	Pinch Weld Height at Rear Wheel Well	172	195	-23
K	Sill Height Aft of Rear Wheel Well	211	216	-5
L	Rear Bumper Thickness	95	95	0
M	Rear Bumper Bottom to Ground	286	280	6
N	Sill Height to Window Bottom Sill	758	755	3
O	Front Door Leading Edge to Impact CL	845	840	5
P	Rear Door Trailing Edge to Impact CL	1029	1025	4
Q	Front Window Opening	447	415	32
R	Right Side Length	3741	3760	-19
S	Left Side Length	3741	3665	76
T	Vehicle Width at B Post	1749	1524	225

DATA SHEET NO. 14
EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011



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	271	75	252
2	Occupant H-Point	303	75	560
3	Mid-Door	308	75	628
4	Window Sill	267	0	939
5	Window Top	85	0	1425

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan

NHTSA No. CB0104

Test Program: FMVSS 214 Pole

Test Date: 3/07/2011

	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	271	303	308	267	85
Distance From Impact (mm)	75	75	75	0	0

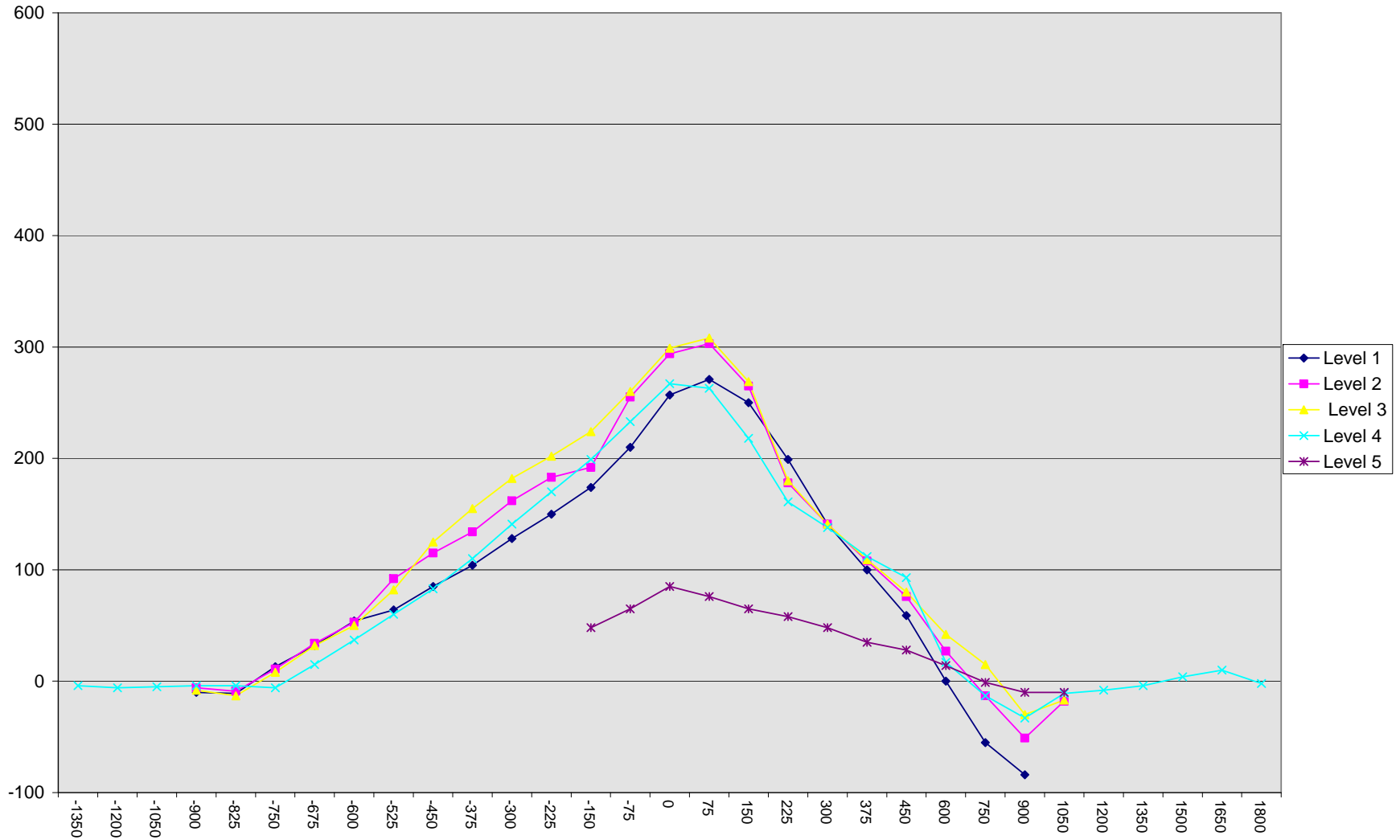
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1350				318					314						-4
-1200				312					306						-6
-1050				303					298						-5
-900	251	222	224	299		241	216	216	295		-10	-6	-8	-4	
-825	254	229	229	298		243	220	216	294		-11	-9	-13	-4	
-750	255	232	230	296		268	243	238	290		13	11	8	-6	
-675	254	232	230	295		286	266	262	310		32	34	32	15	
-600	253	232	230	293		307	285	280	330		54	53	50	37	
-525	253	232	230	289		317	324	312	349		64	92	82	60	
-450	252	231	229	288		337	346	354	371		85	115	125	83	
-375	252	231	229	288		356	365	384	398		104	134	155	110	
-300	252	231	229	286		380	393	411	427		128	162	182	141	
-225	251	231	229	285		401	414	431	455		150	183	202	170	
-150	251	231	228	285	540	425	423	452	484	588	174	192	224	199	48
-75	249	231	228	284	538	459	486	488	517	603	210	255	260	233	65
0	249	230	228	282	533	506	524	527	549	618	257	294	299	267	85
75	249	231	228	280	533	520	534	536	543	609	271	303	308	263	76
150	248	230	227	280	532	498	495	496	498	597	250	265	269	218	65
225	248	231	229	280	529	447	409	409	441	587	199	178	180	161	58
300	248	232	229	279	531	389	373	370	417	579	141	141	141	138	48
375	248	232	230	278	531	348	340	339	390	566	100	108	109	112	35
450	247	233	231	276	532	306	309	311	369	560	59	76	80	93	28
600	247	234	233	274	533	247	261	275	291	547	0	27	42	17	14
750	247	235	234	275	536	192	222	249	262	535	-55	-13	15	-13	-1
900	240	237	231	274	542	156	186	201	241	532	-84	-51	-30	-33	-10
1050		212	214	275	547		194	197	264	537		-18	-17	-11	-10
1200				278					270						-8
1350				285					281						-4
1500				292					296						4
1650				304					315						10
1800				320					318						-2

DATA SHEET NO. 15 (CONTINUED)
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
Test Program: FMVSS 214 Pole

NHTSA No. CB0104
Test Date: 3/07/2011

18



DATA SHEET NO. 16

SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

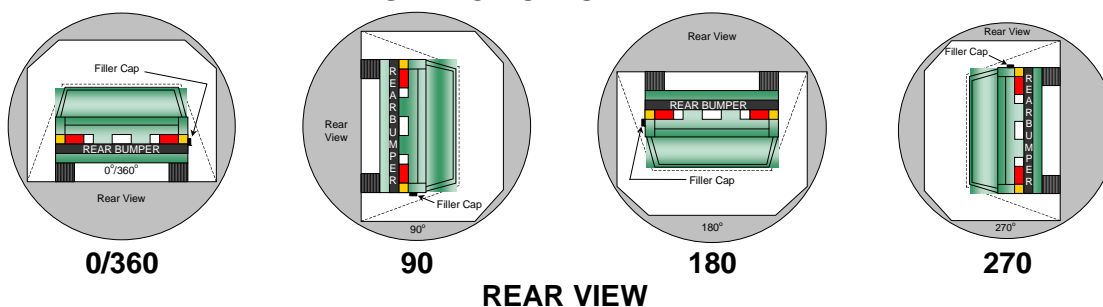
Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

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



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	53	seconds	5	minutes	6	minutes	53	seconds	7	minutes
180° - 270°	1	minutes	56	seconds	5	minutes	6	minutes	56	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	6 th min.	7 th min.	8 th 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

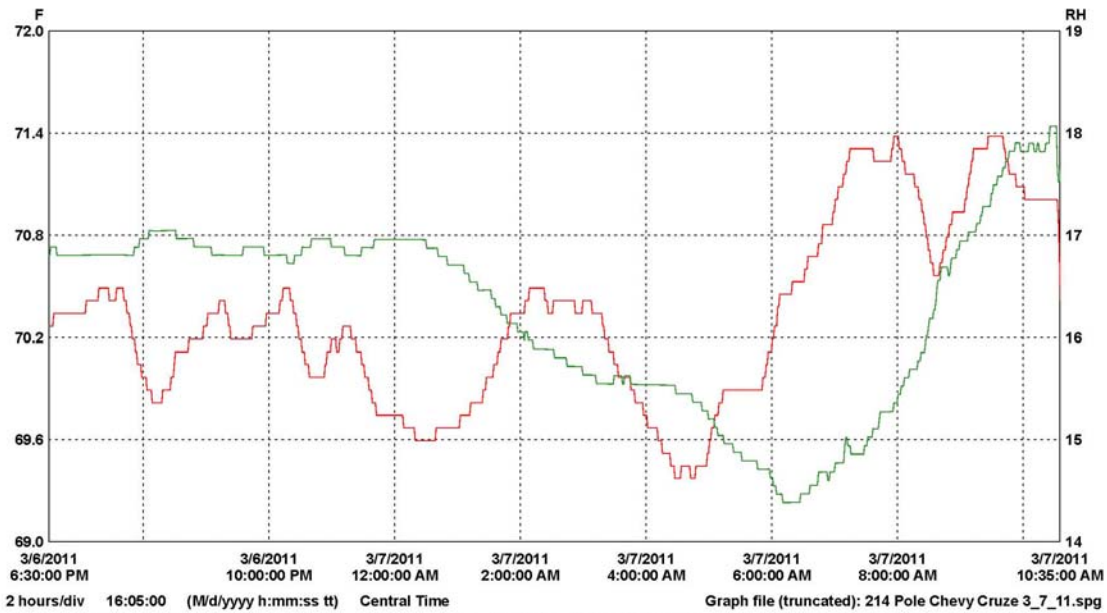
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17
TEMPERATURE AND HUMIDITY TRACES

Test Vehicle: 2011 Chevrolet Cruze LS 4-Dr Sedan
 Test Program: FMVSS 214 Pole

NHTSA No. CB0104
 Test Date: 3/07/2011

Time of Impact: 10:32 am



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	10102056	Vehicle Prep 1	1	71.38	70.32	69.37	F	Temperature	214 Pole Chevy Cruze.spl	
2	10102056	Vehicle Prep 2	2	18.1	16.3	14.4	RH	Humidity	214 Pole Chevy Cruze.spl	

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PHOTOGRAPHS

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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



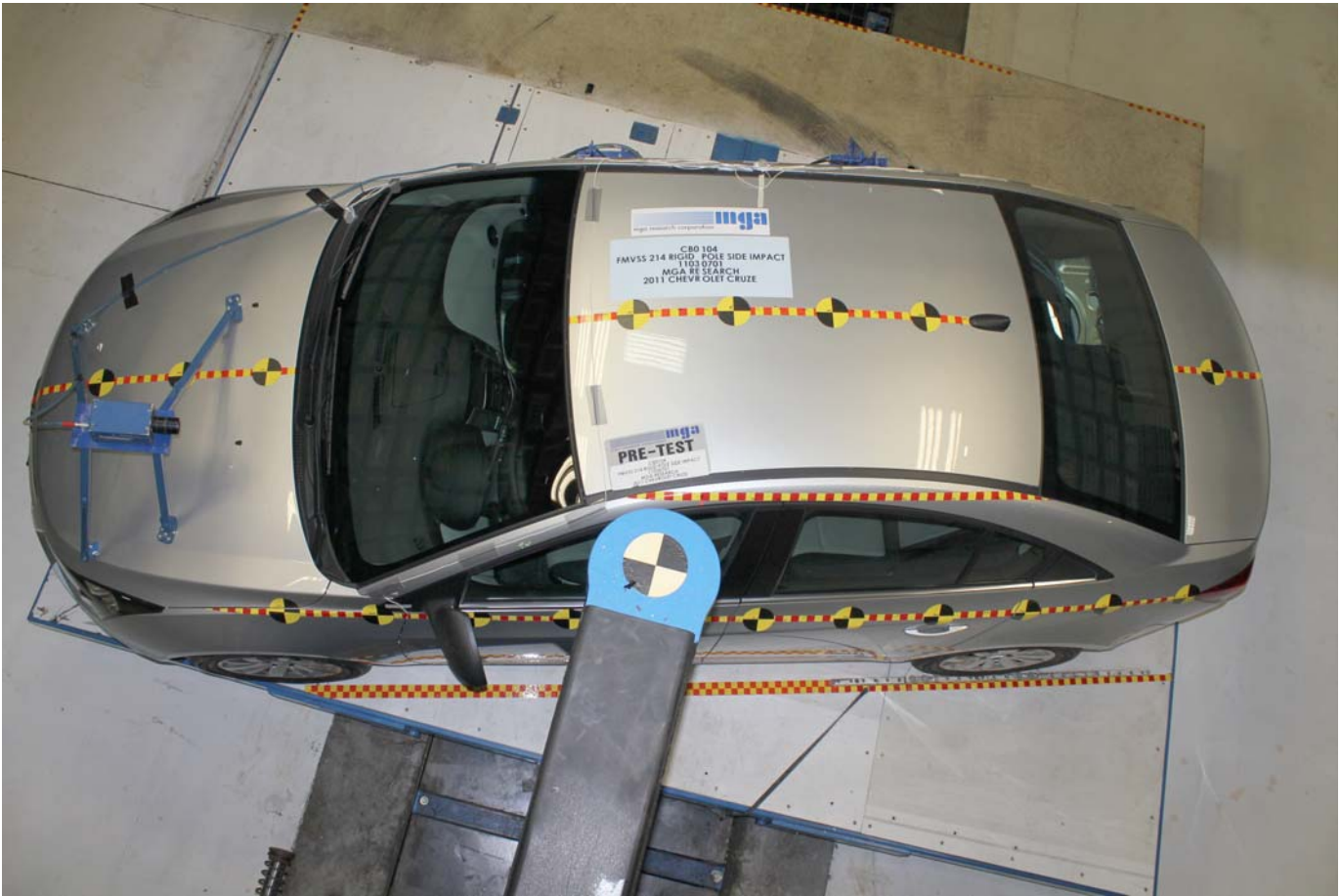
Post-Test Impacted Side View of Test Vehicle



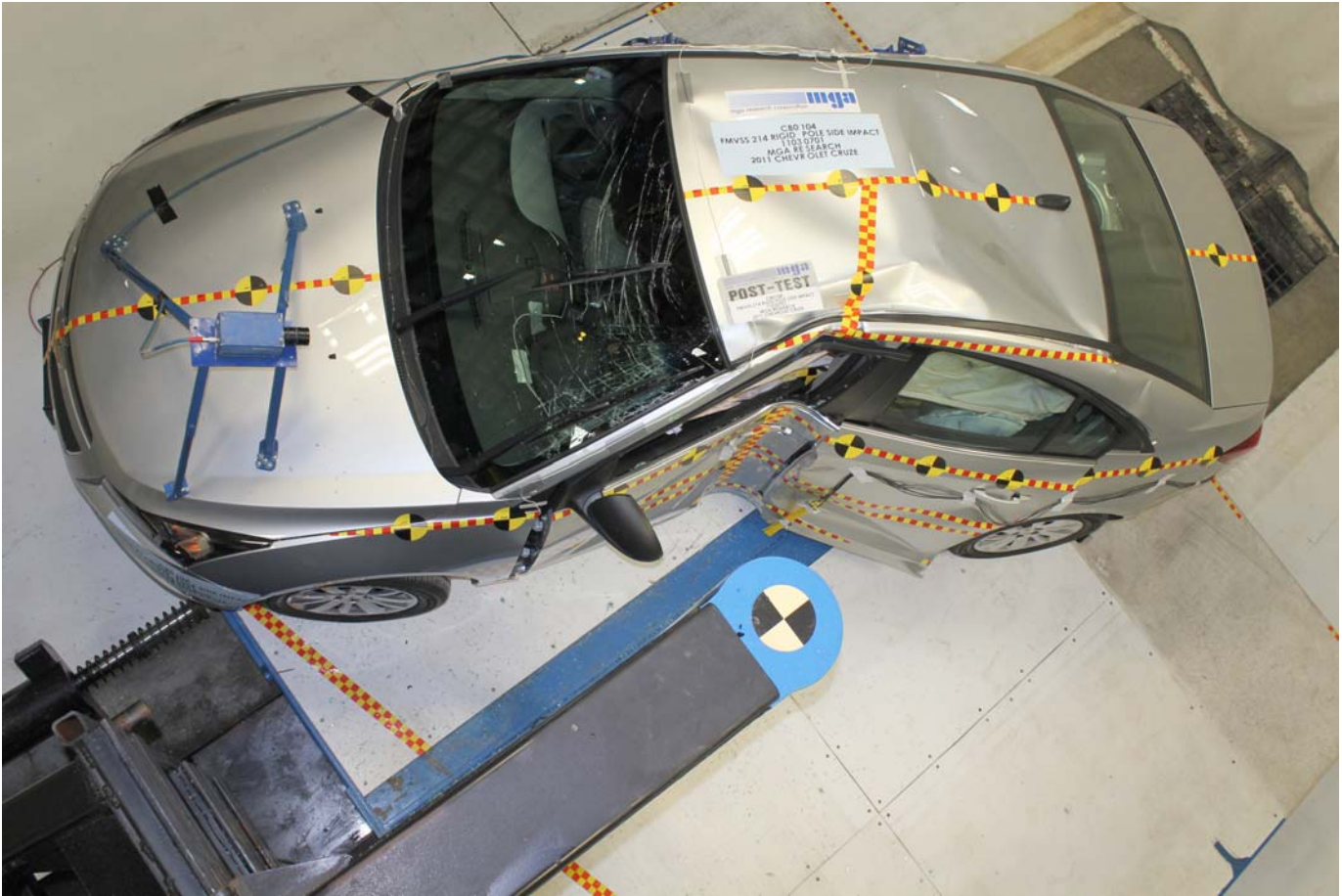
Pre-Test Left $\frac{3}{4}$ Front View of Vehicle and Pole



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



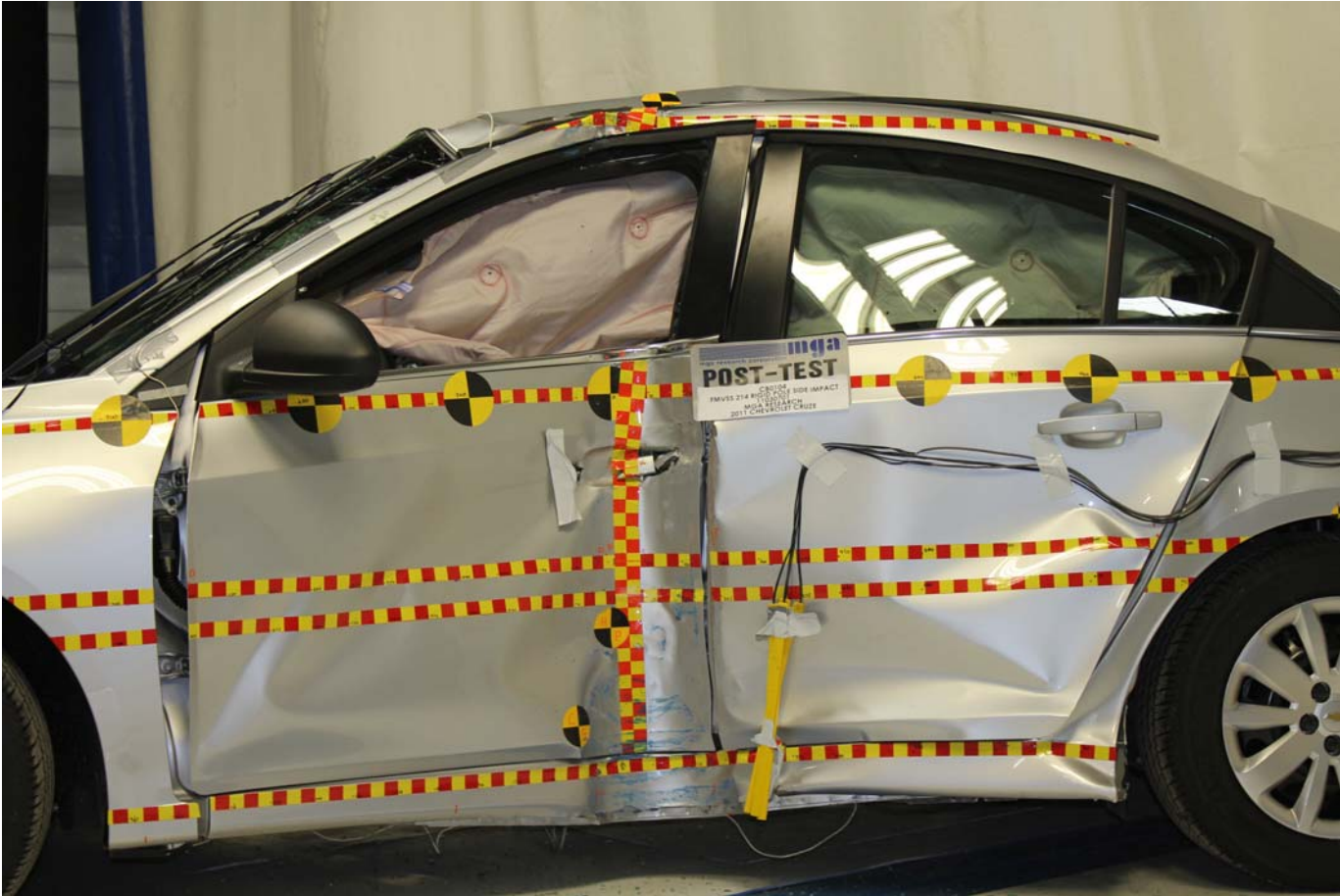
Pre-Test Interior of Front Door Closed



Post-Test Interior of Front Door Showing Dummy Impact Locations



Impact Event



Post-Test Impact Zone Close-up View



Post-Test $\frac{3}{4}$ Front View of Impact Zone



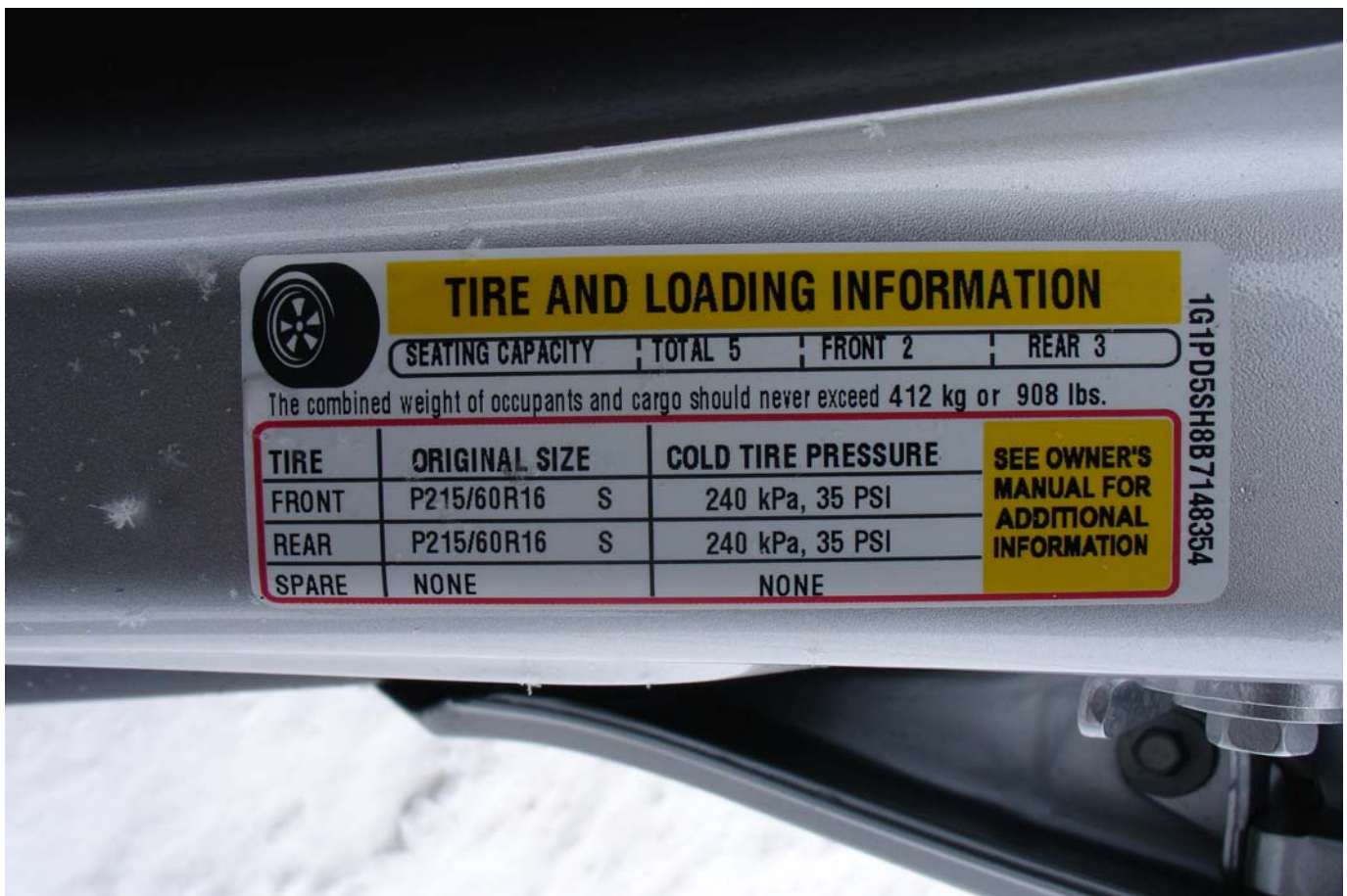
Post-Test $\frac{3}{4}$ Rear View of Impact Zone



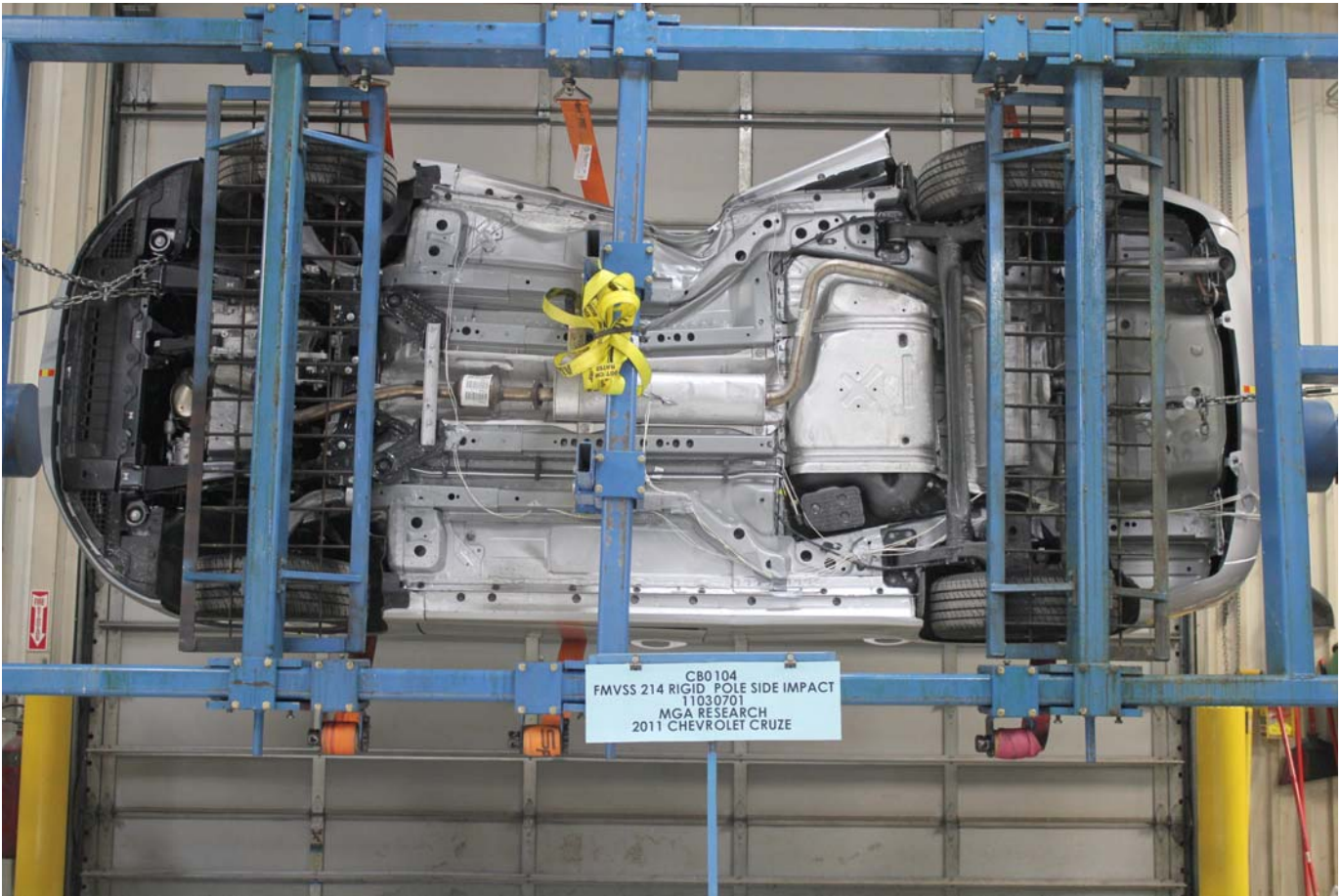
Post-Test Close-up View of Impact Point Target



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



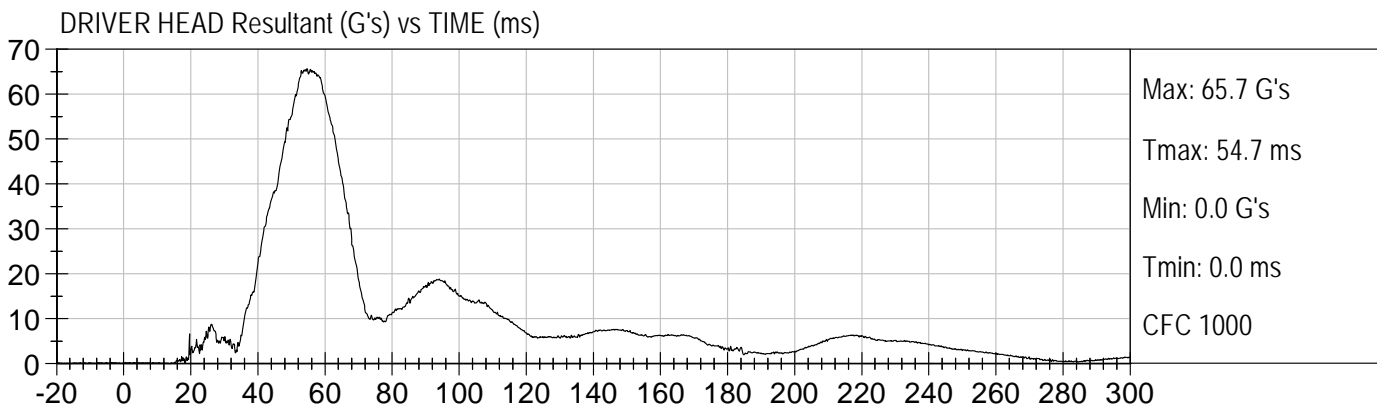
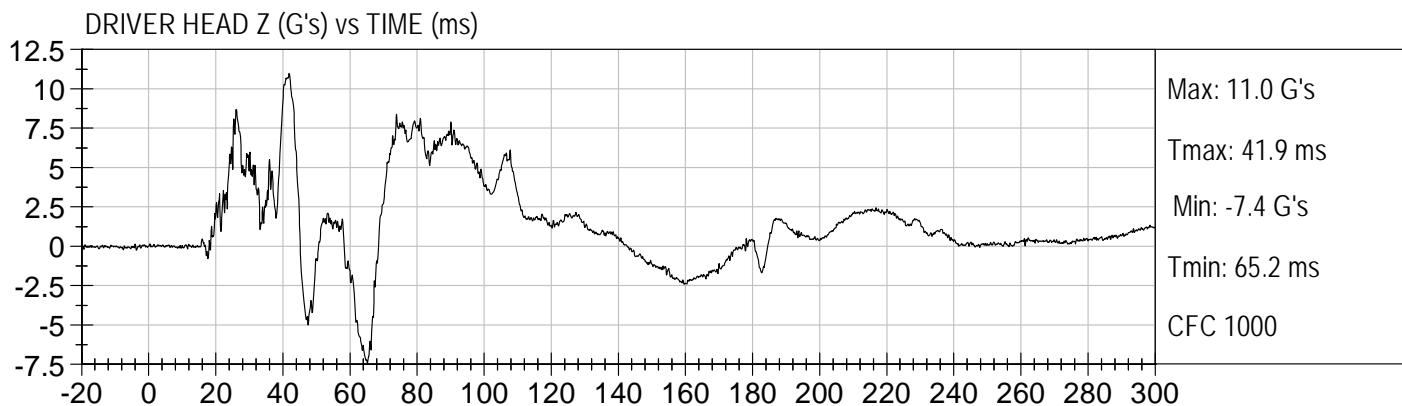
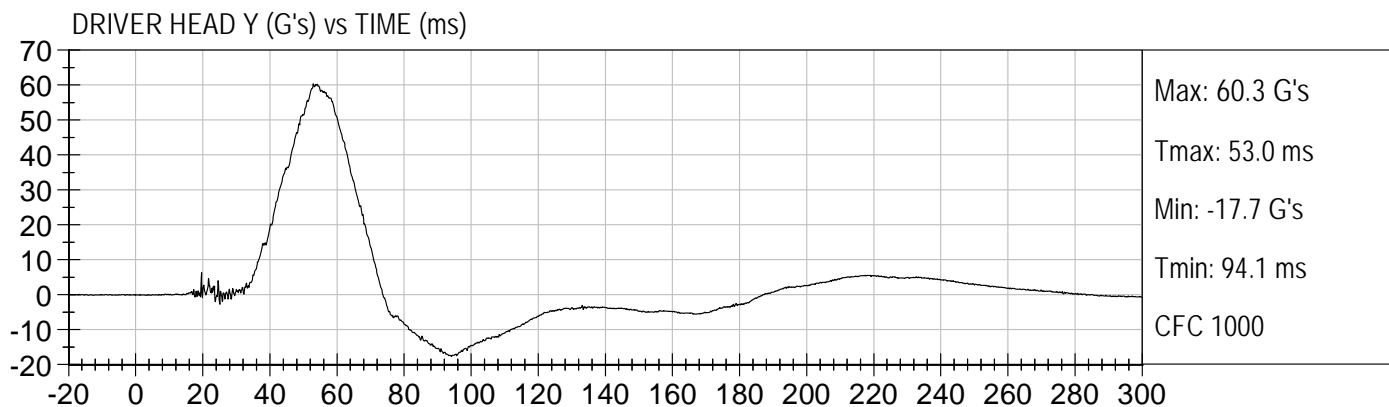
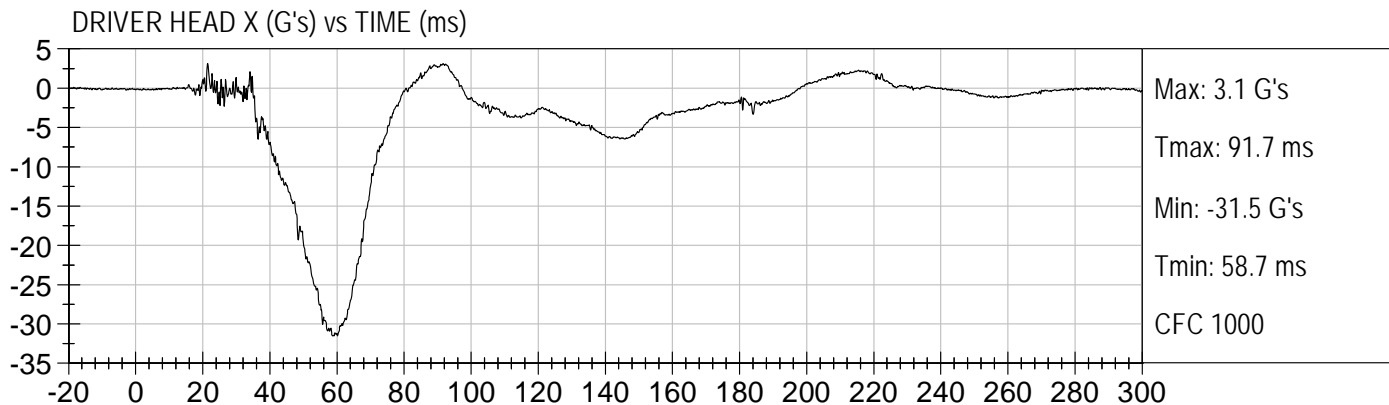
Post-Test Vehicle at 360 Degree Rollover

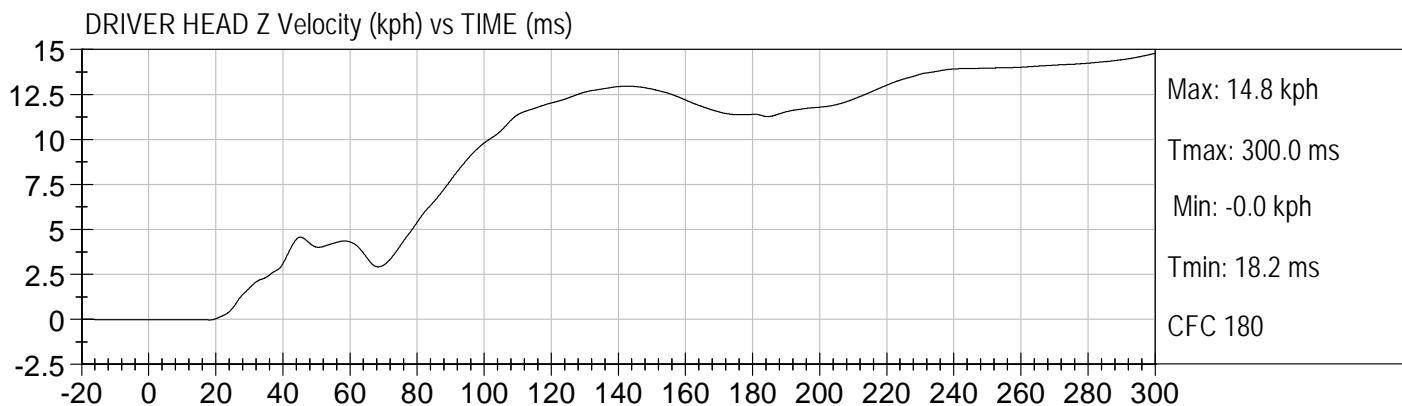
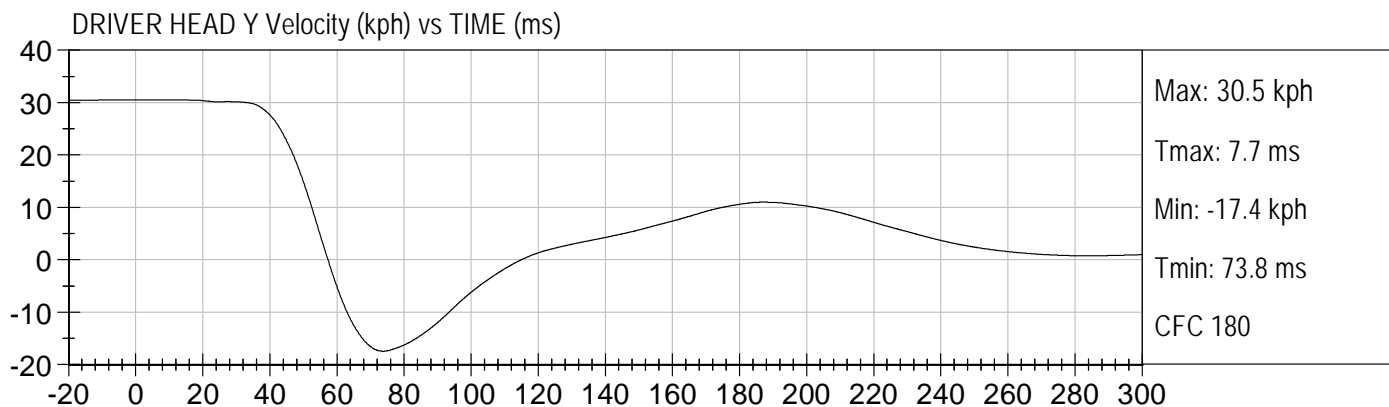
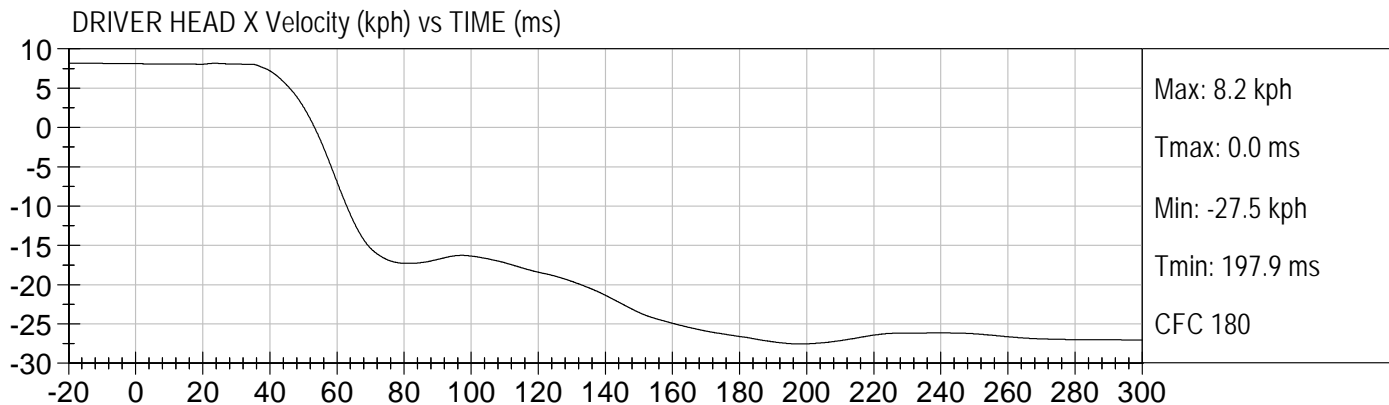
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DUMMY RESPONSE DATA

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Dummy Instrumentation Plots FILTERED DATA

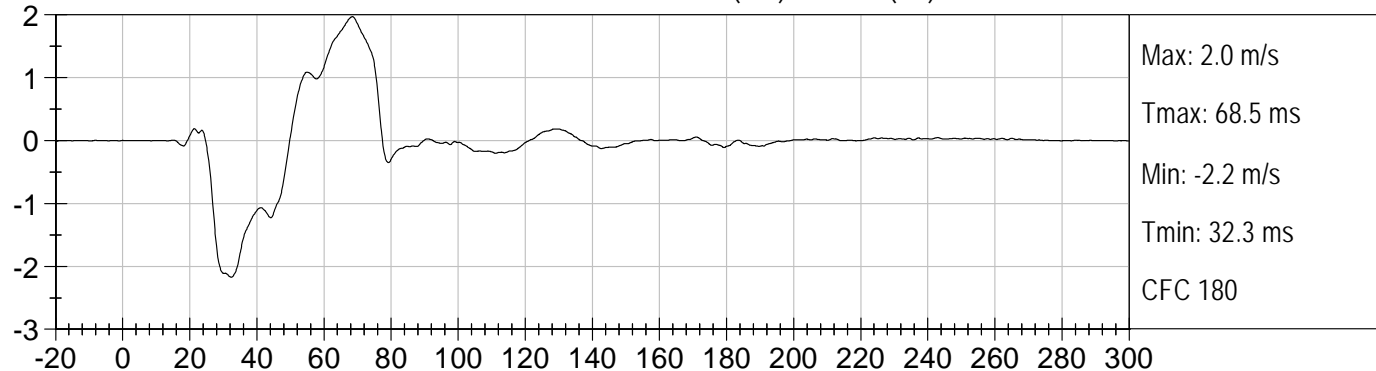
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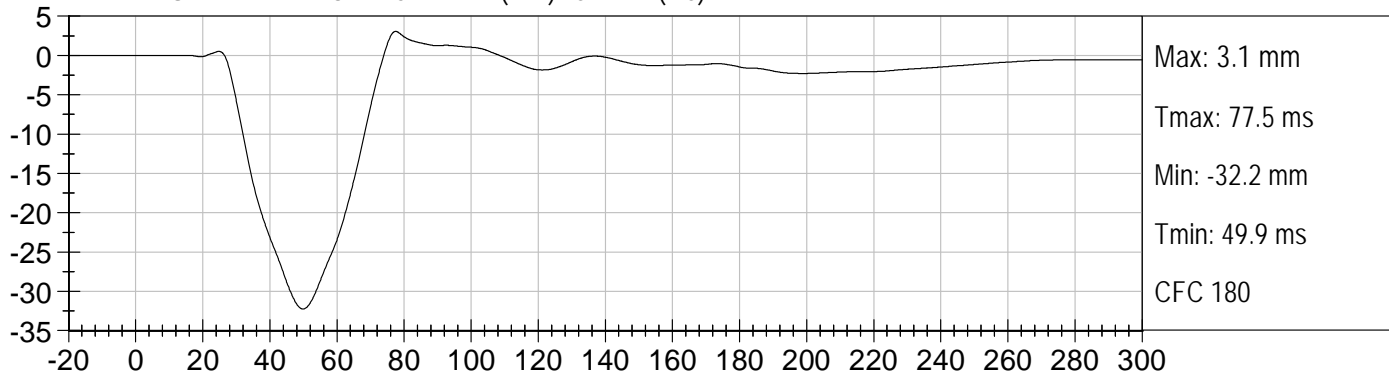




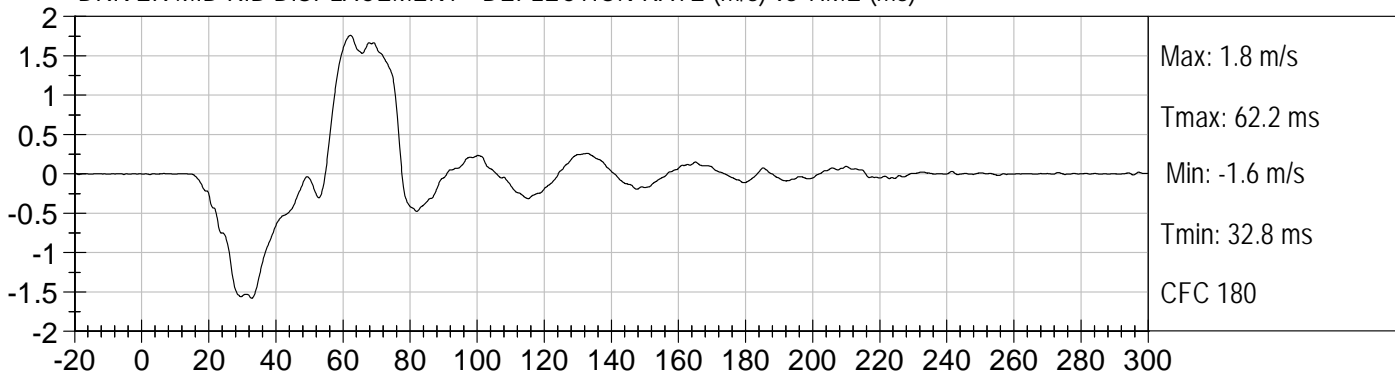
DRIVER UPPER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



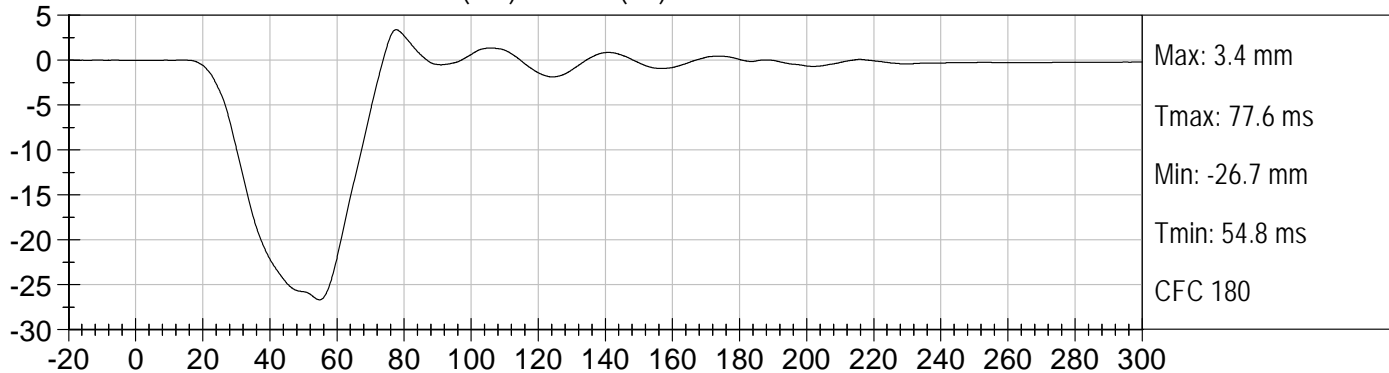
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)

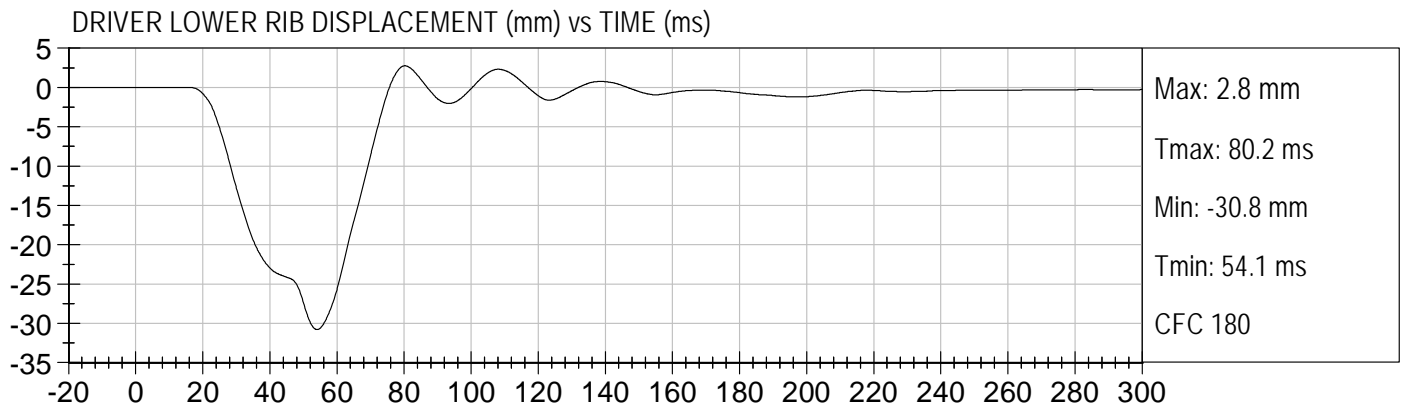
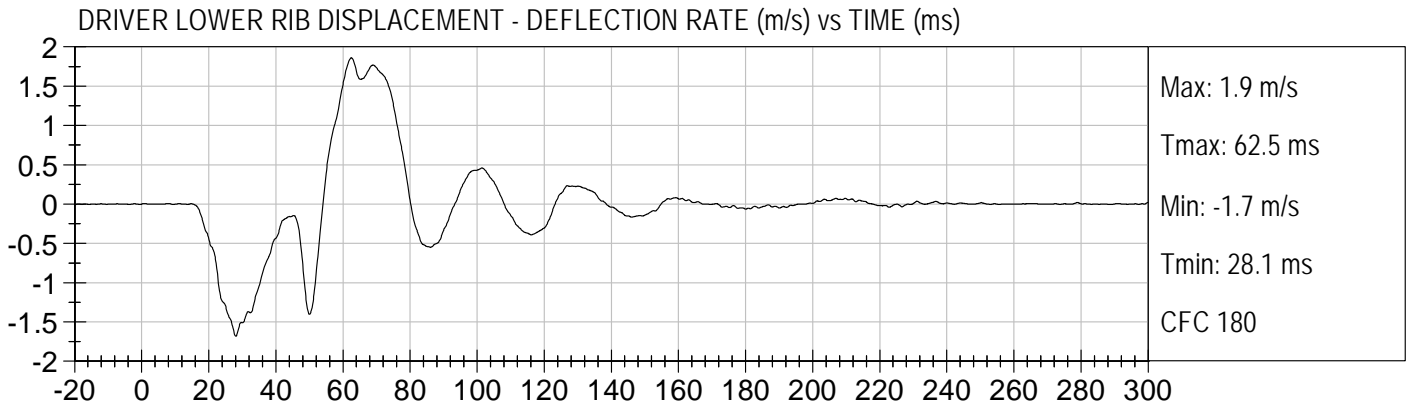


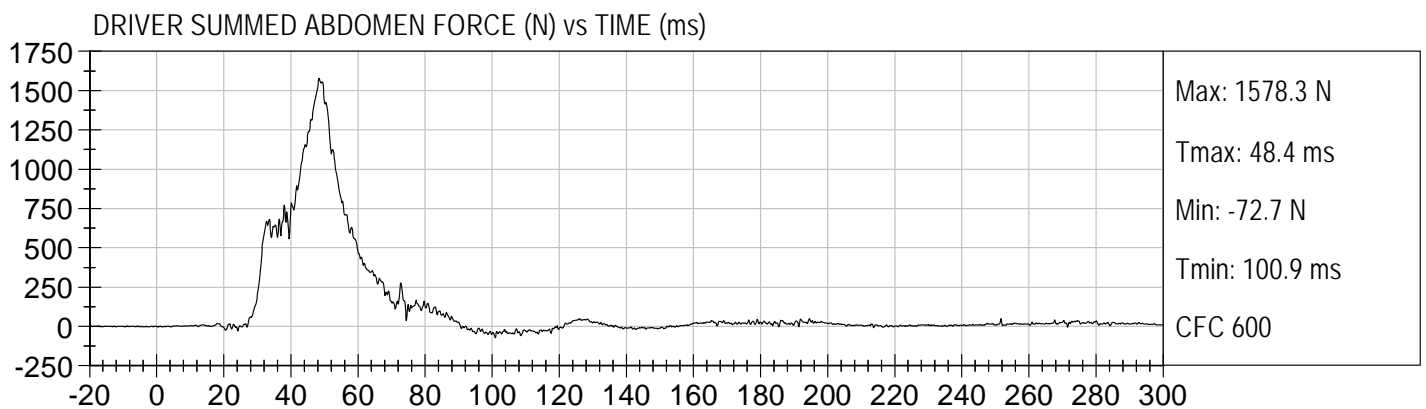
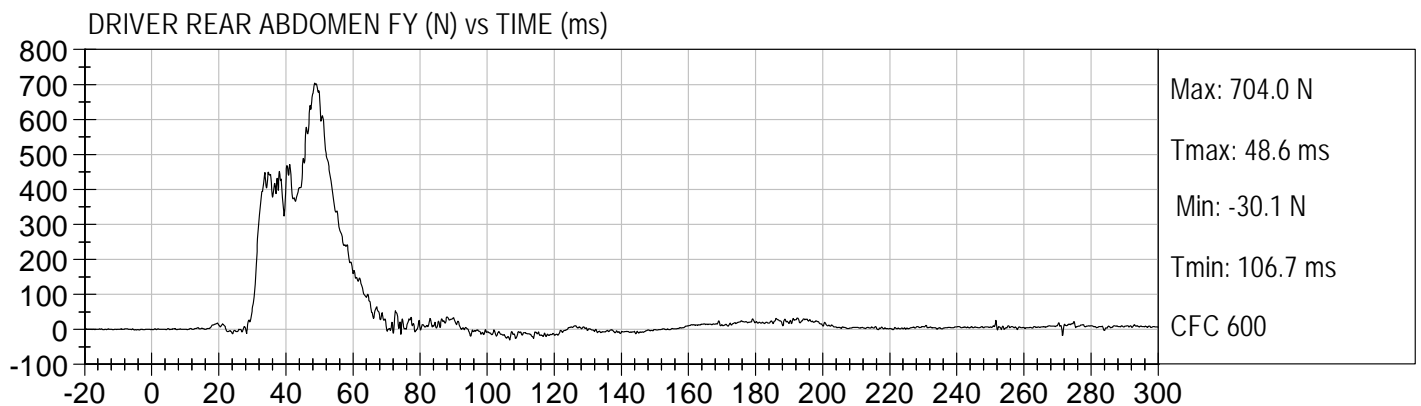
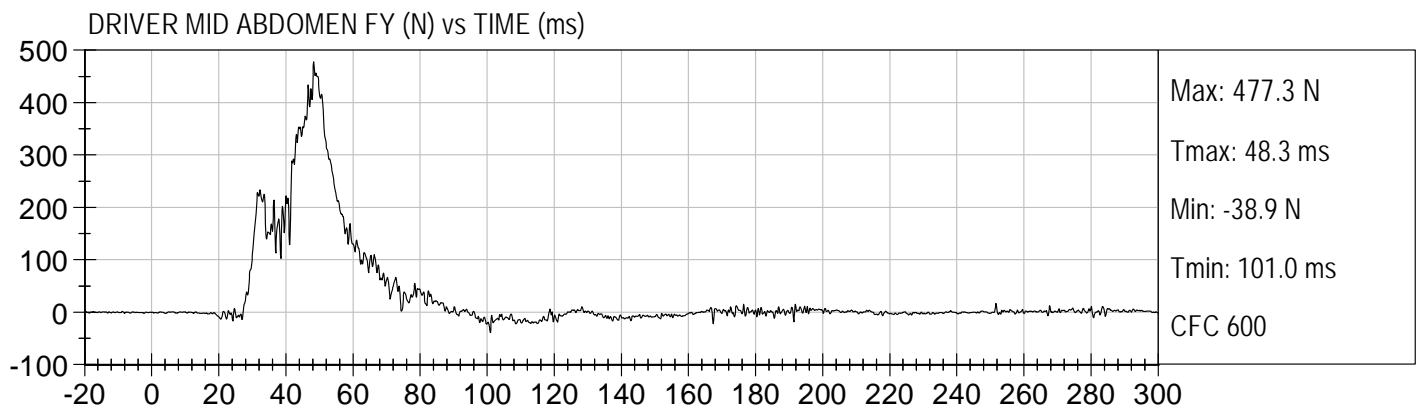
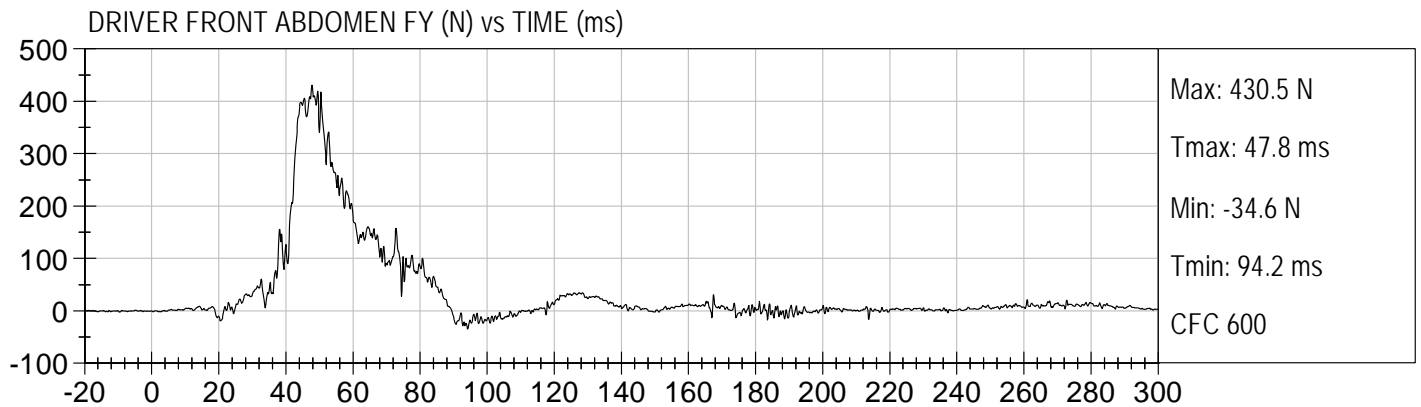
DRIVER MID RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)

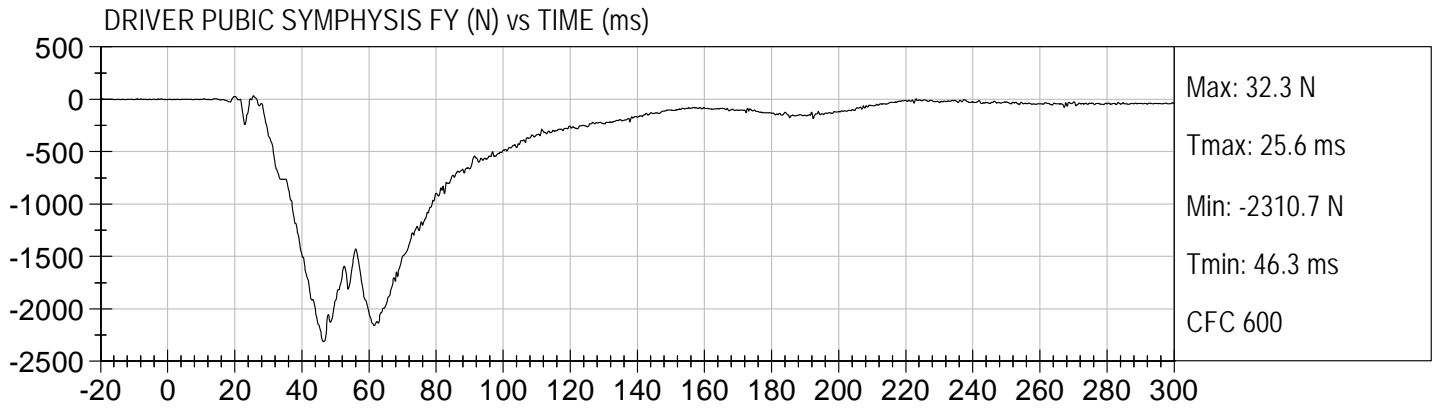


DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)









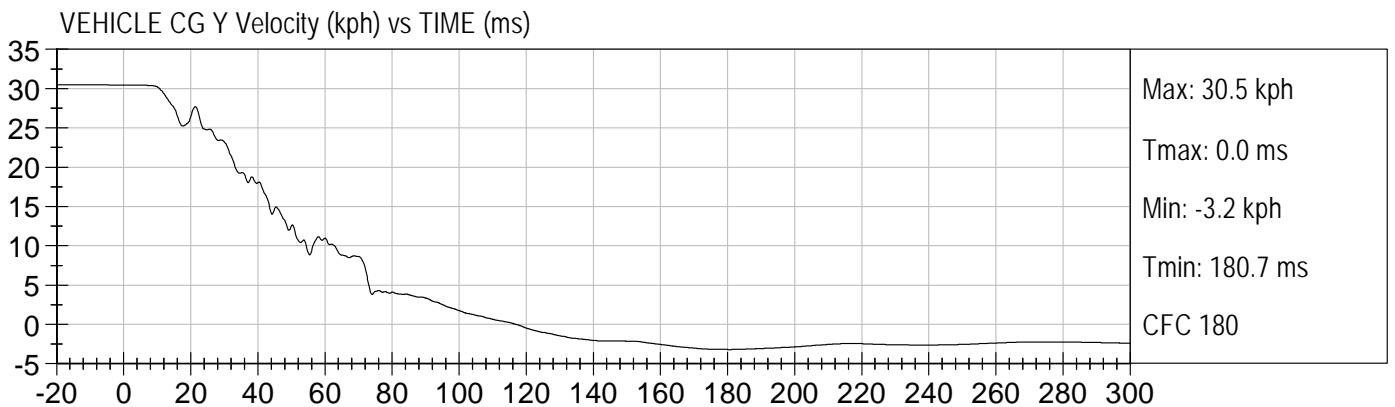
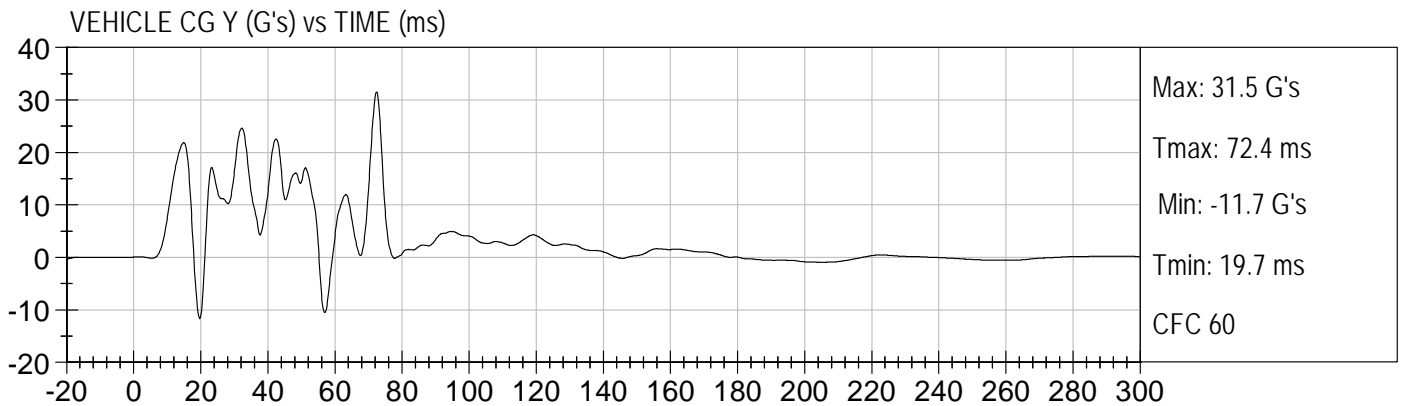
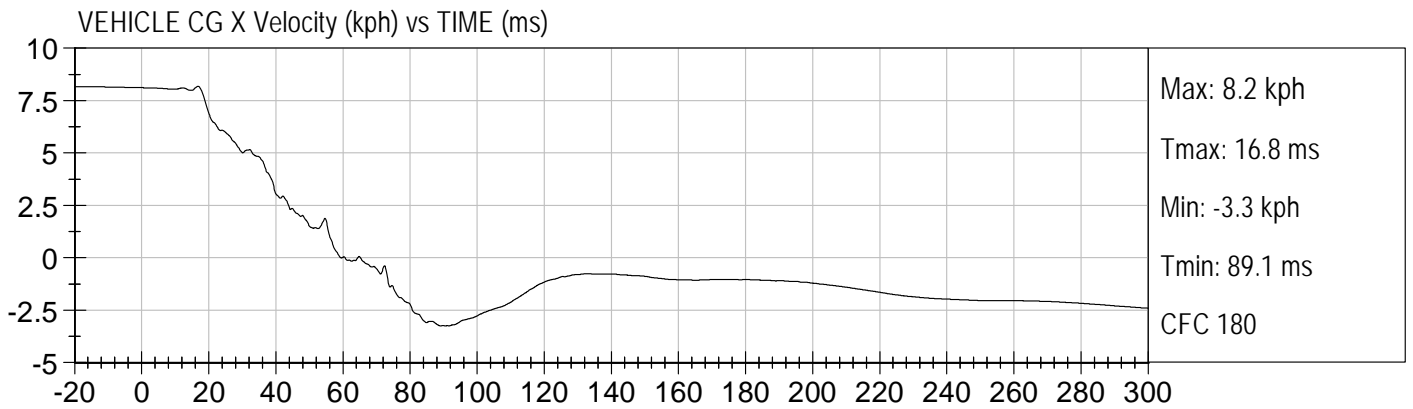
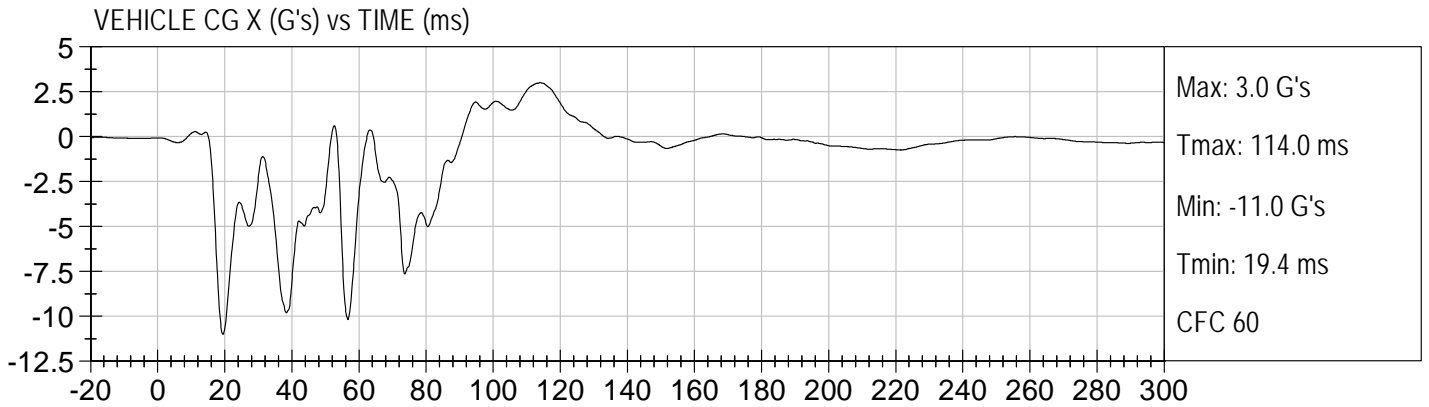
APPENDIX C

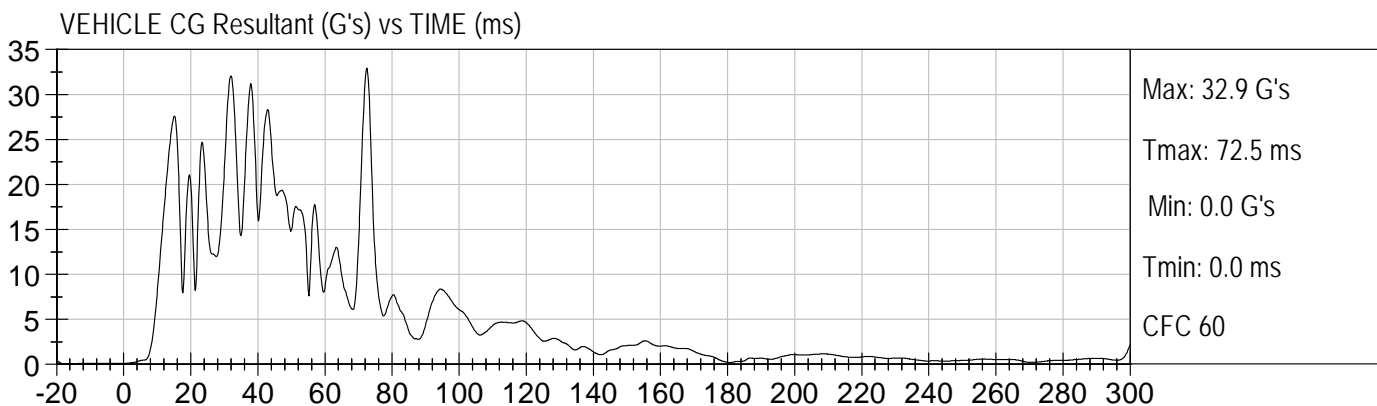
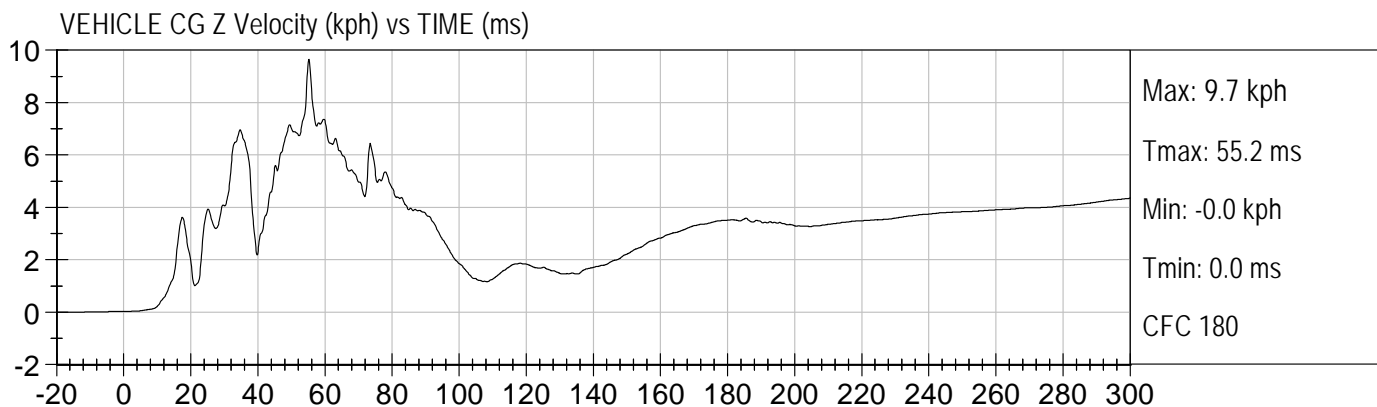
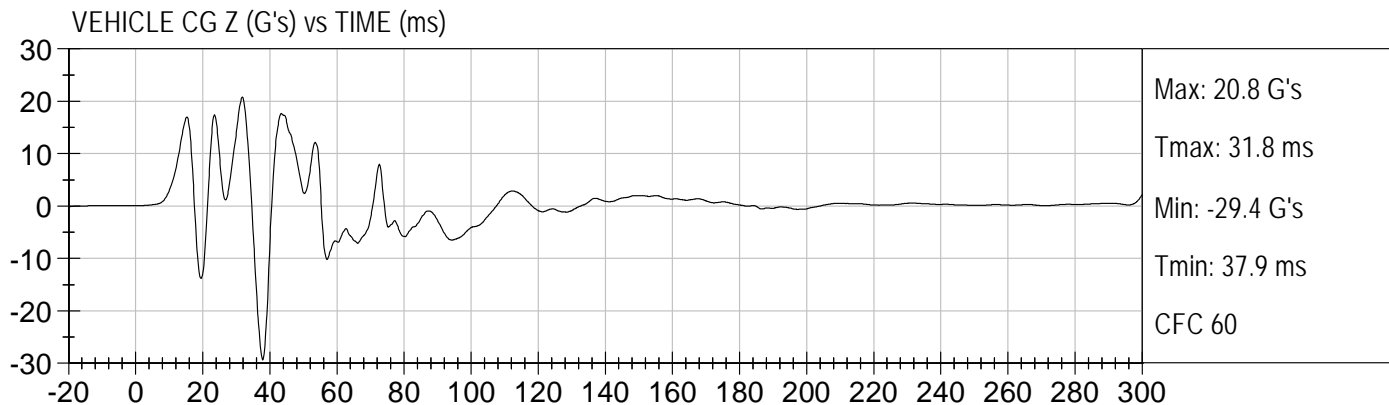
VEHICLE ACCELEROMETER RESPONSE DATA

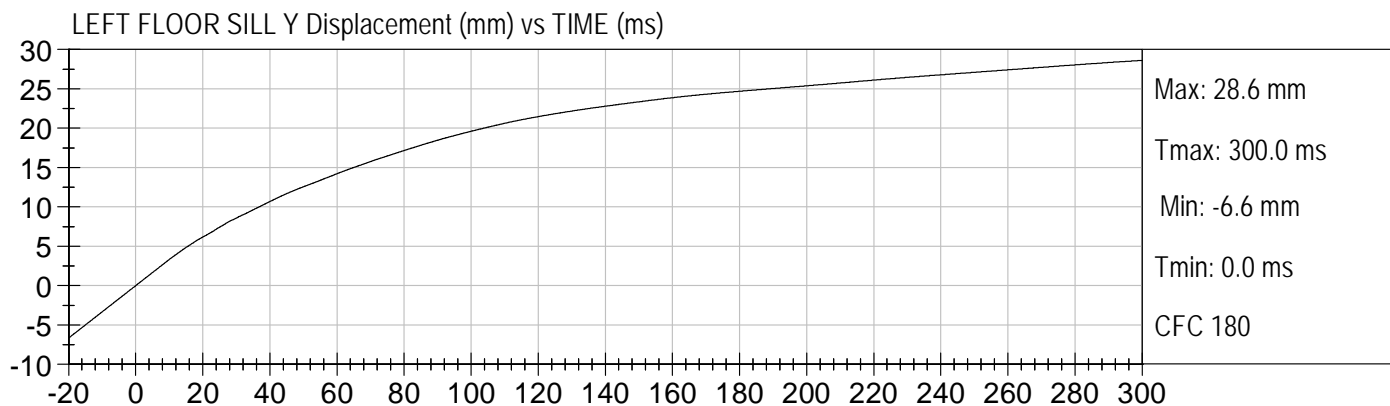
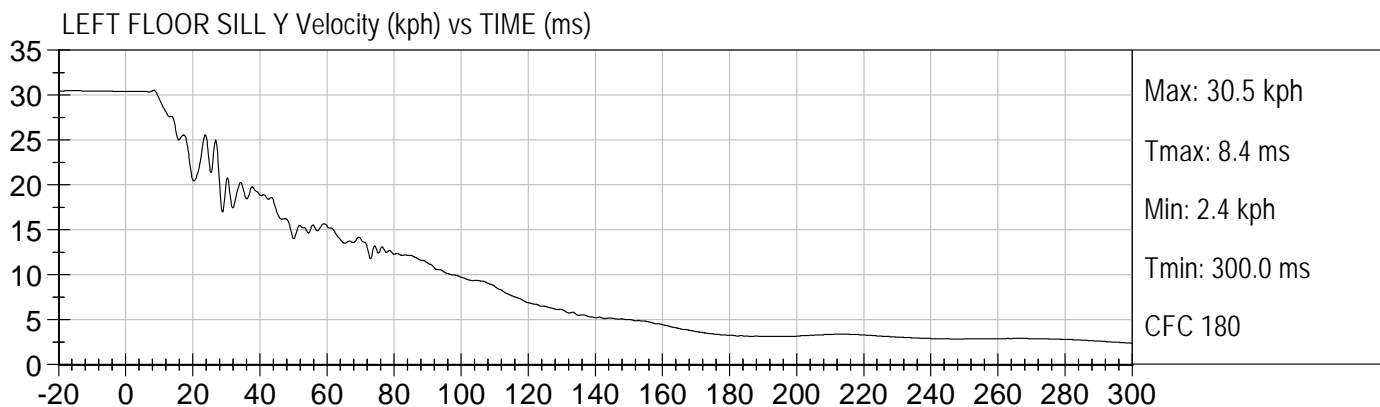
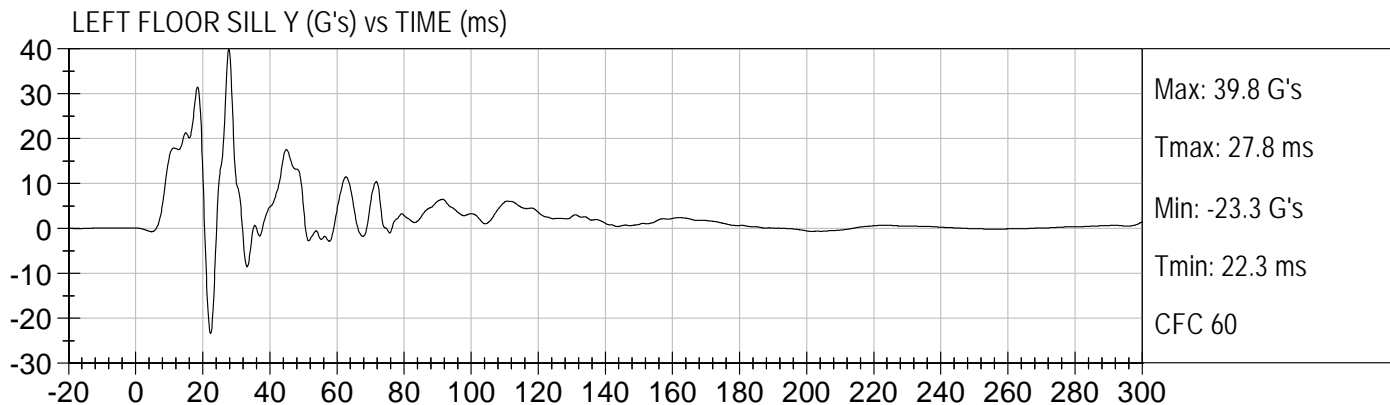
TABLE OF DATA PLOTS

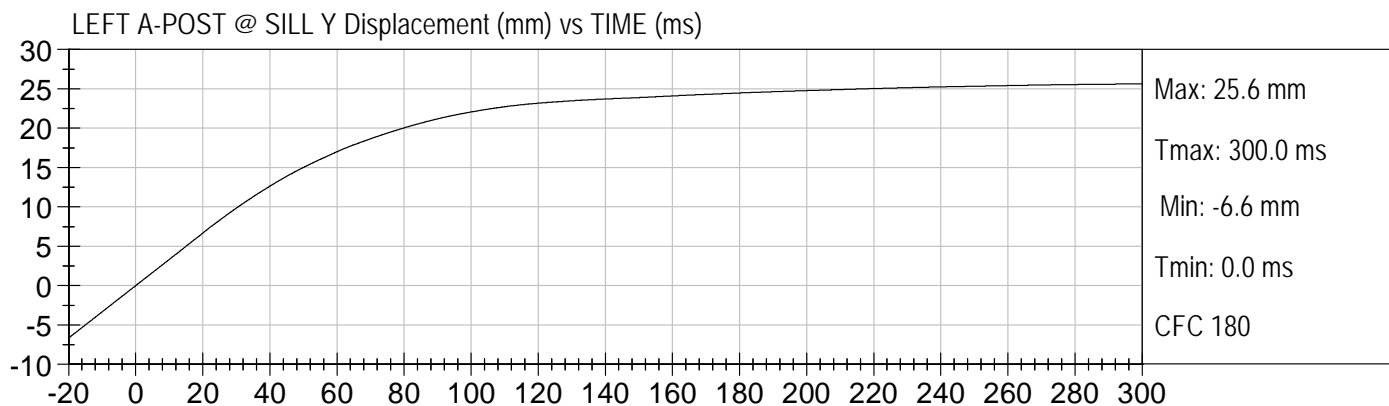
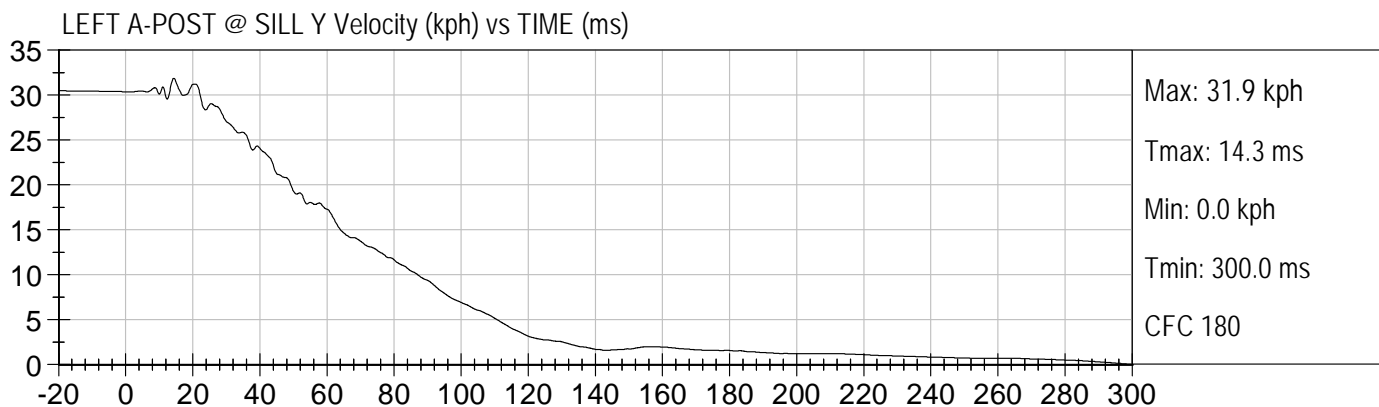
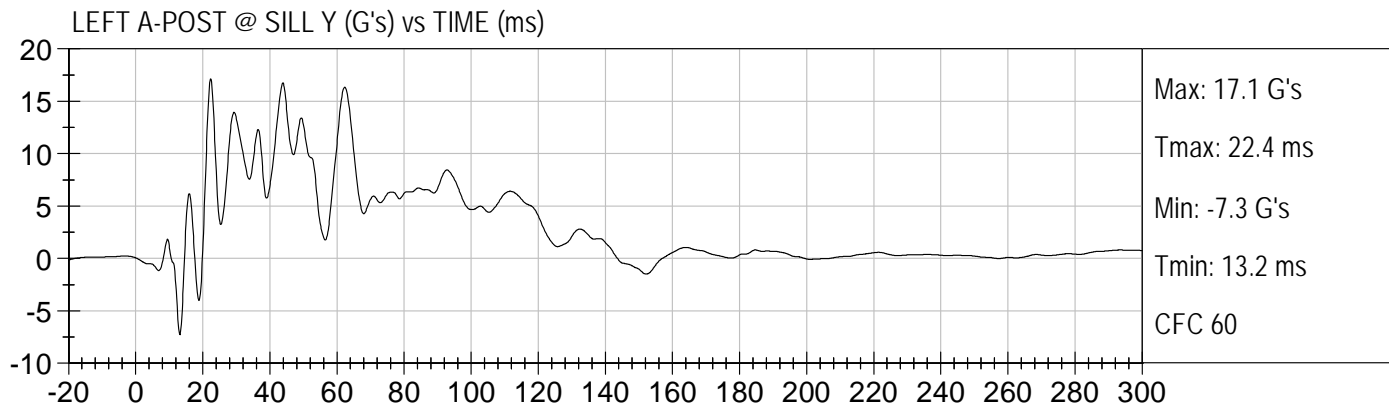
		<u>Page No.</u>
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Figure No. 26.	Left Mid B-Pillar (Y) Acceleration vs. Time	C-9
Figure No. 27.	Left Mid B-Pillar (Y) Velocity vs. Time	C-9
Figure No. 28.	Left Mid B-Pillar (Y) Displacement vs. Time	C-9

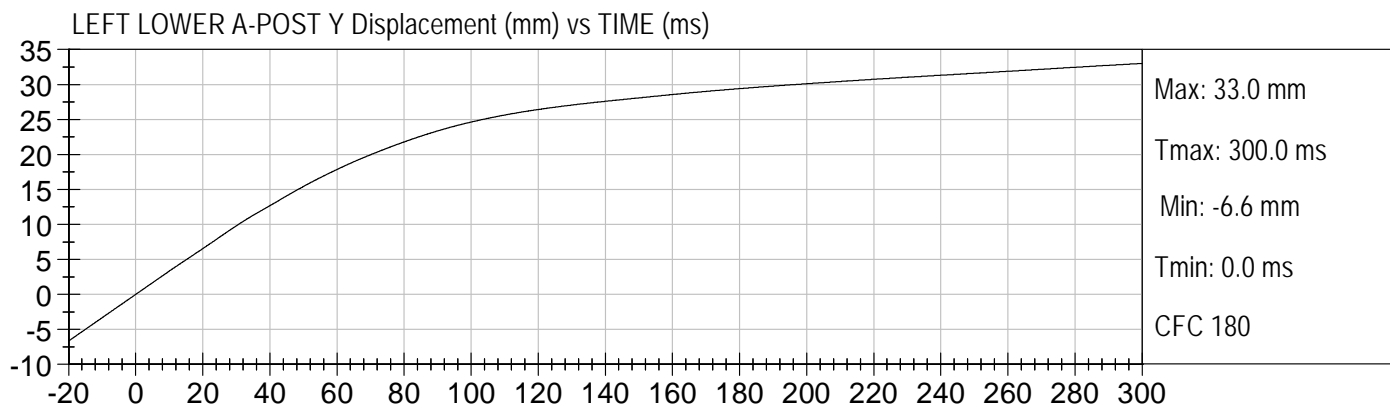
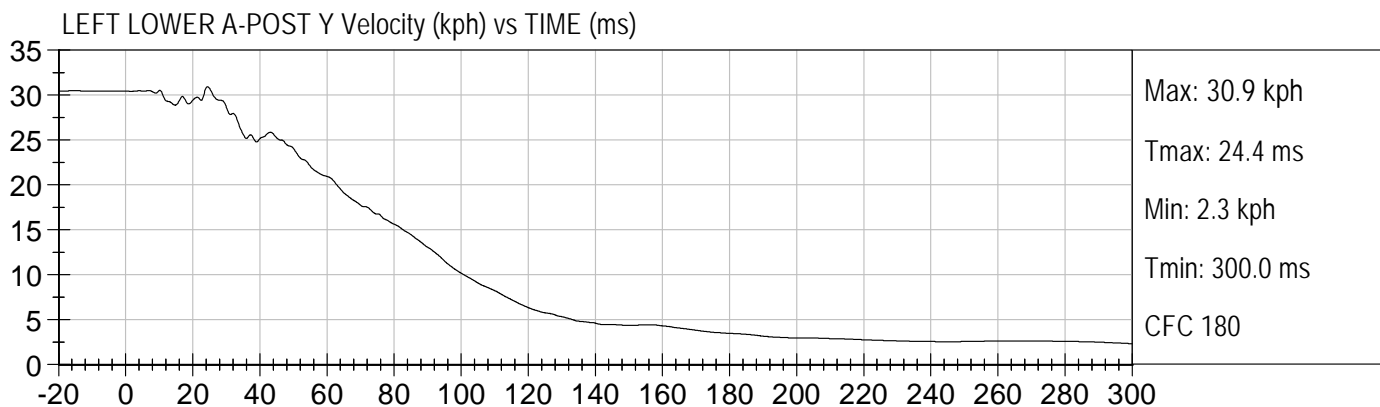
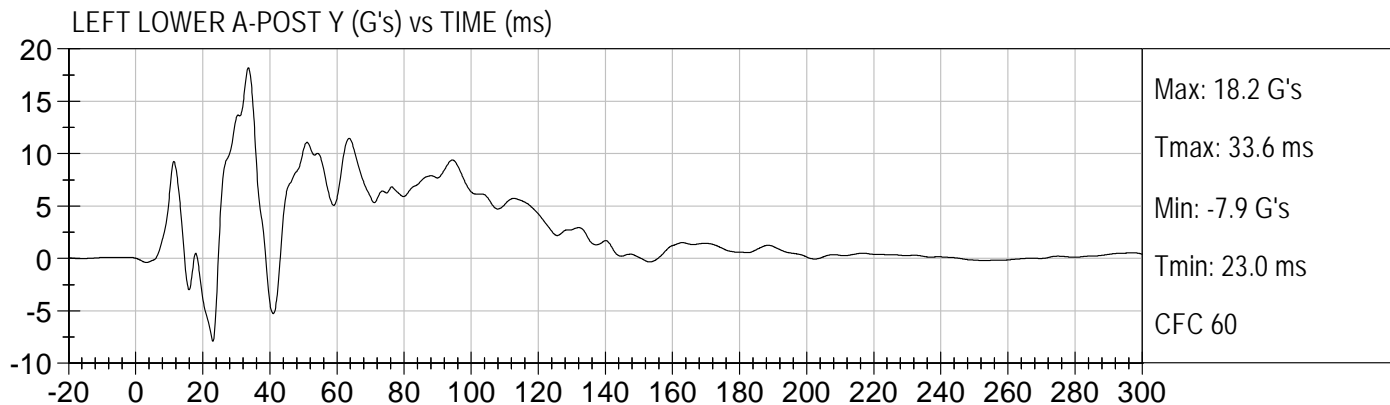
	<u>Page No.</u>
Figure No. 29. Driver Seat Track (Y) Acceleration vs. Time	C-10
Figure No. 30. Driver Seat Track (Y) Velocity vs. Time	C-10
Figure No. 31. Driver Seat Track (Y) Displacement vs. Time	C-10
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Figure No. 43. Rear Deck (X) Velocity vs. Time	C-14
Figure No. 44. Rear Deck (Y) Acceleration vs. Time	C-14
Figure No. 45. Rear Deck (Y) Velocity vs. Time	C-14

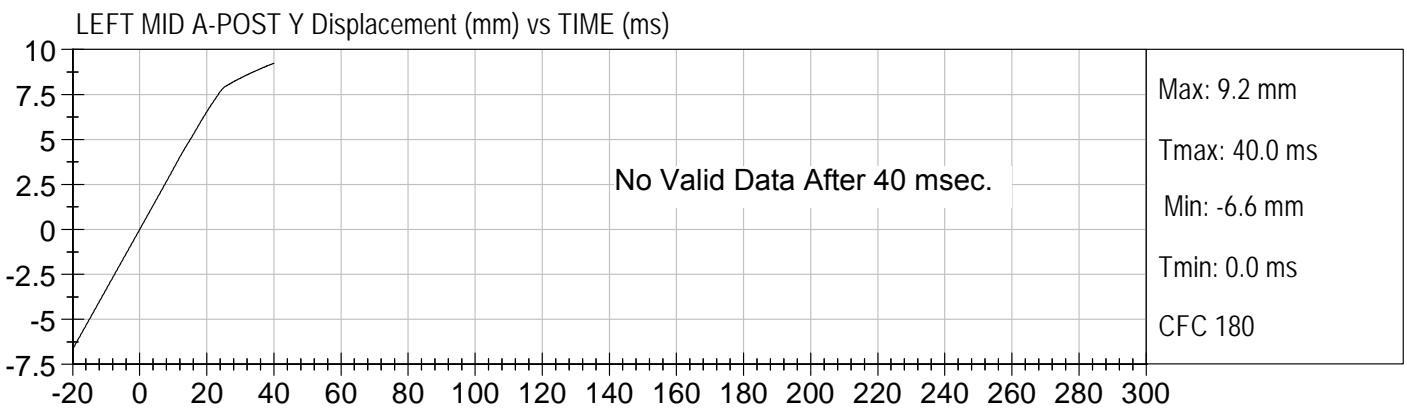
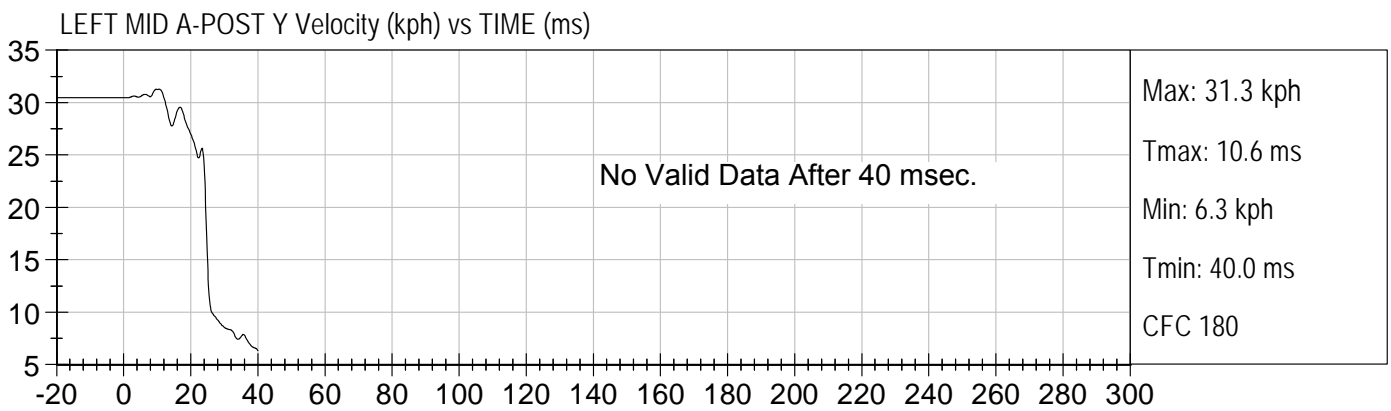
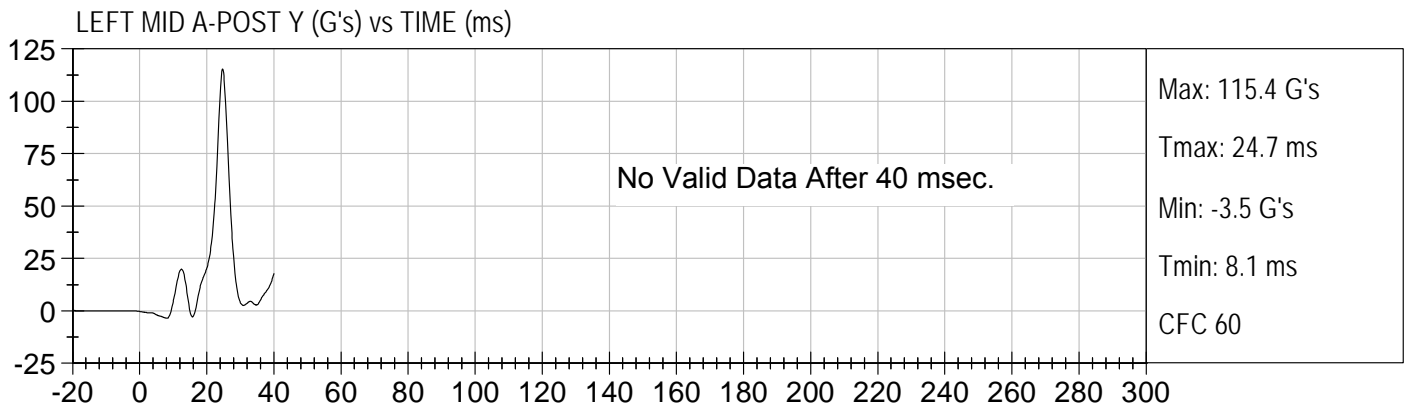


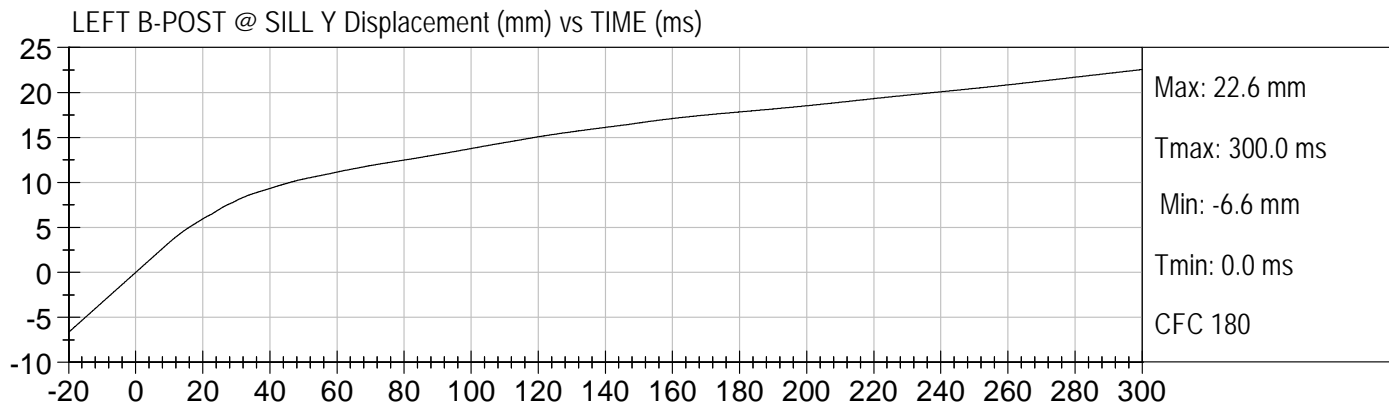
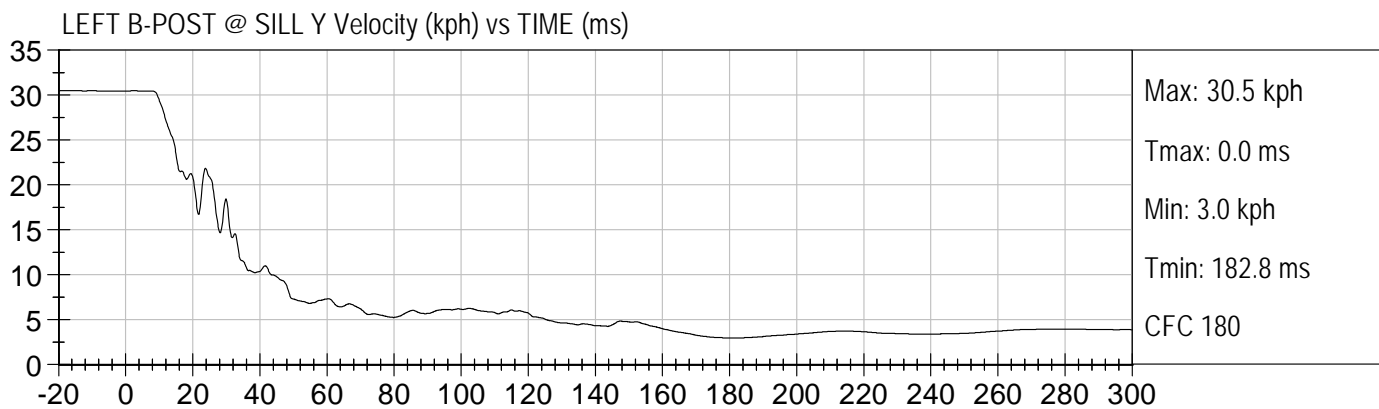
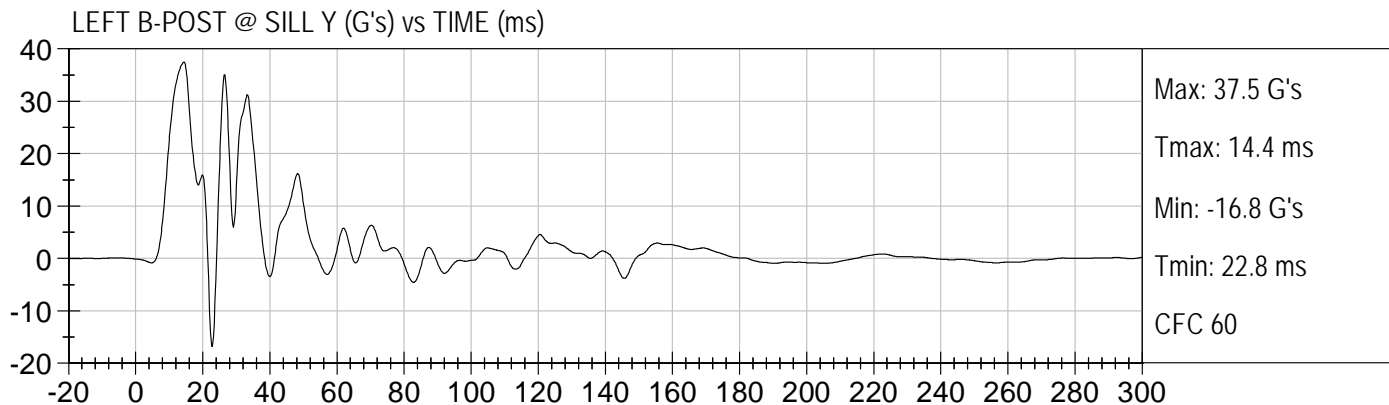


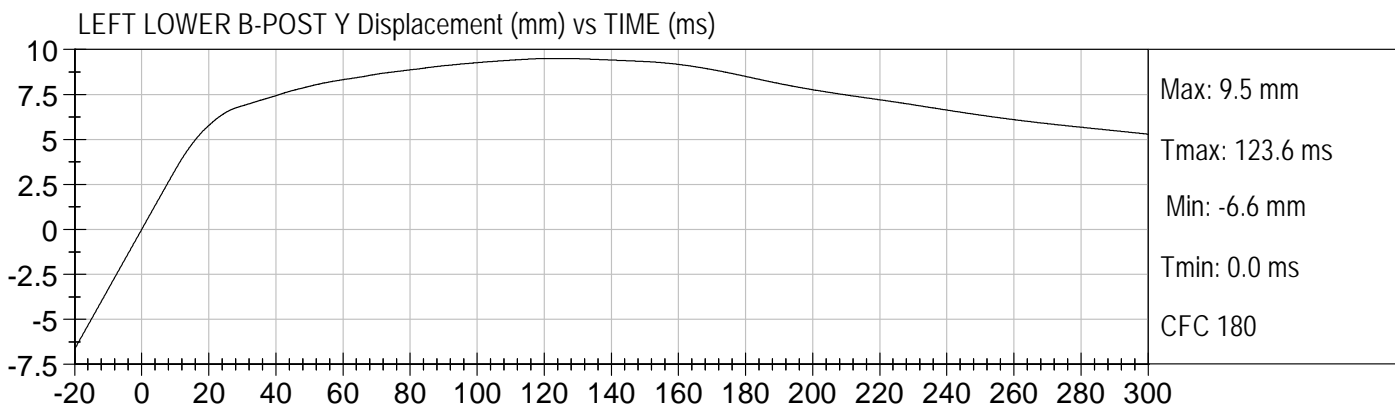
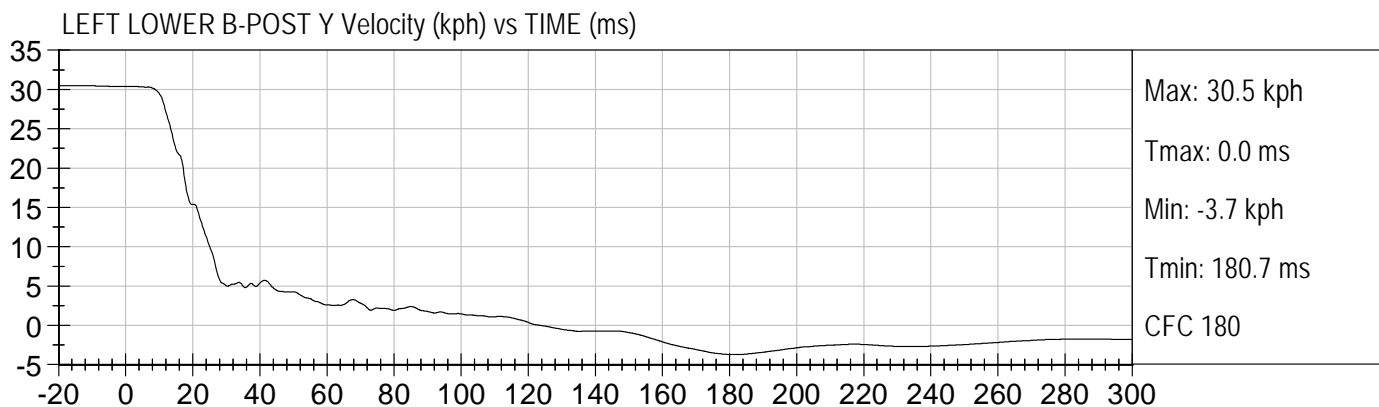
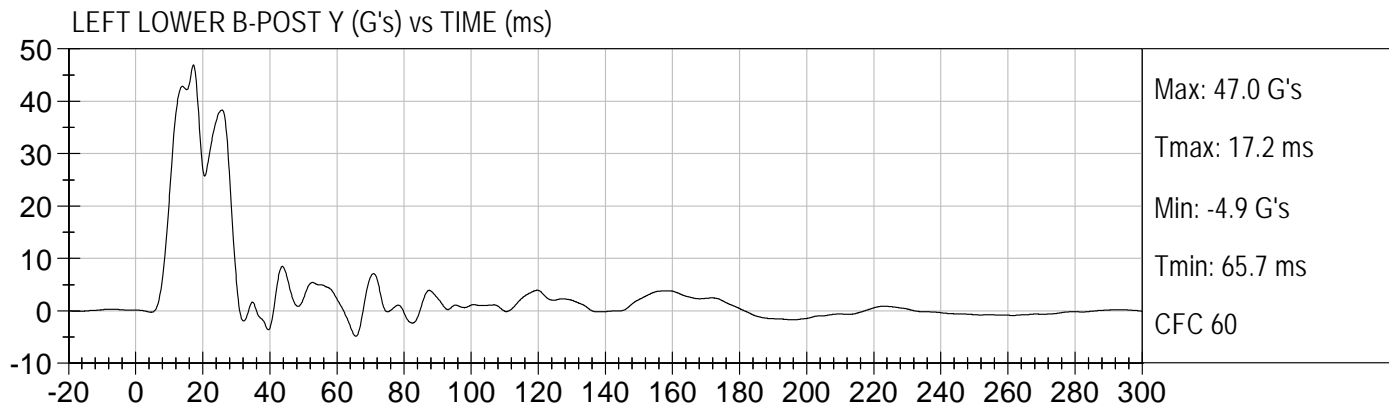






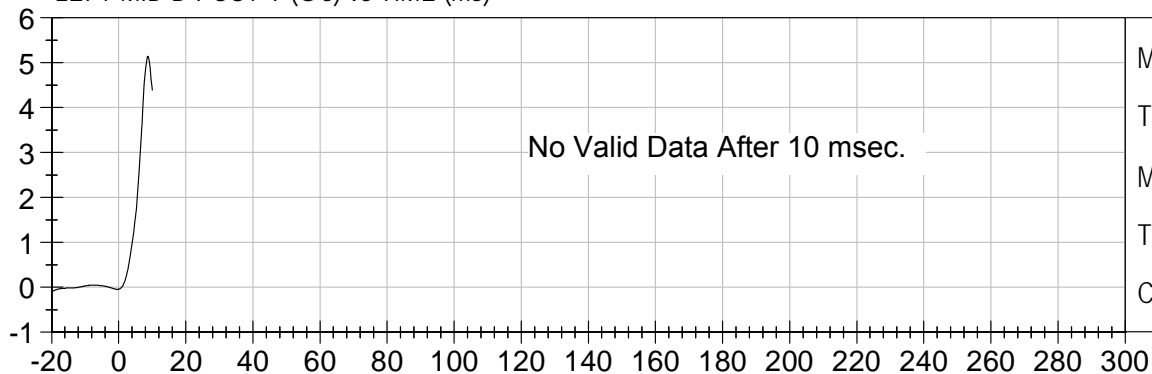






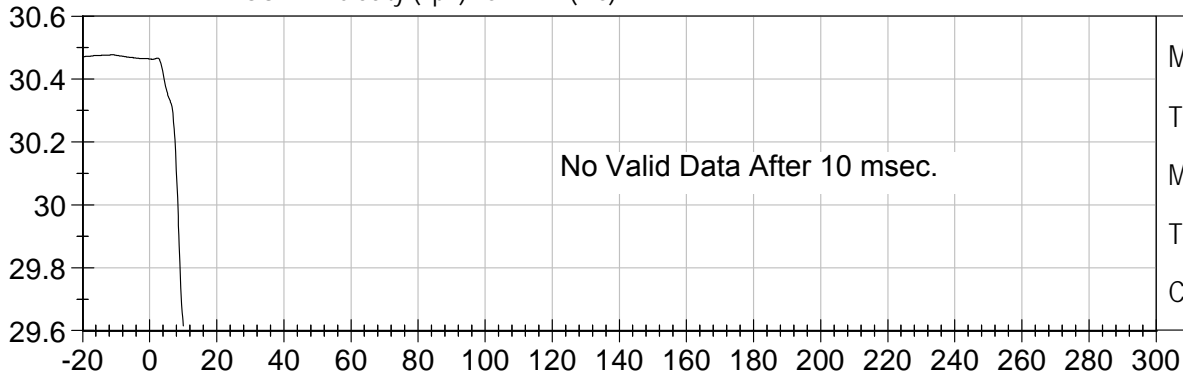


LEFT MID B-POST Y (G's) vs TIME (ms)



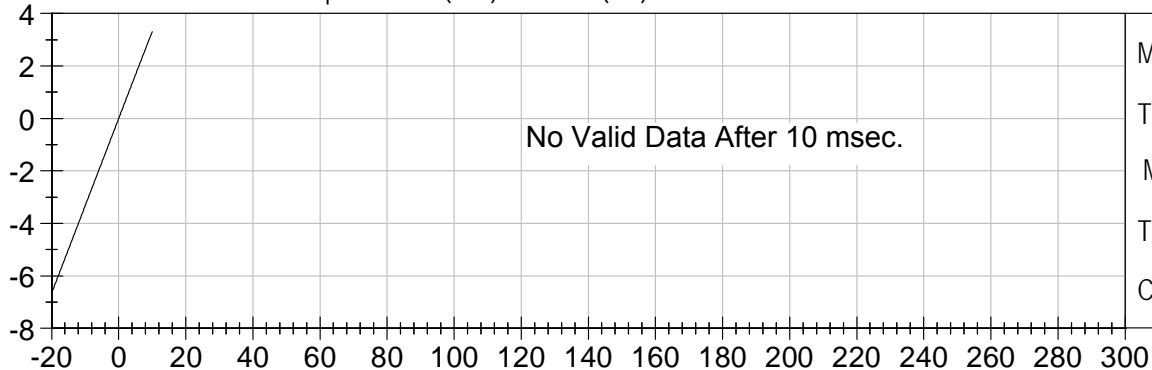
Max: 5.1 G's
Tmax: 8.7 ms
Min: -0.1 G's
Tmin: 0.0 ms
CFC 60

LEFT MID B-POST Y Velocity (kph) vs TIME (ms)

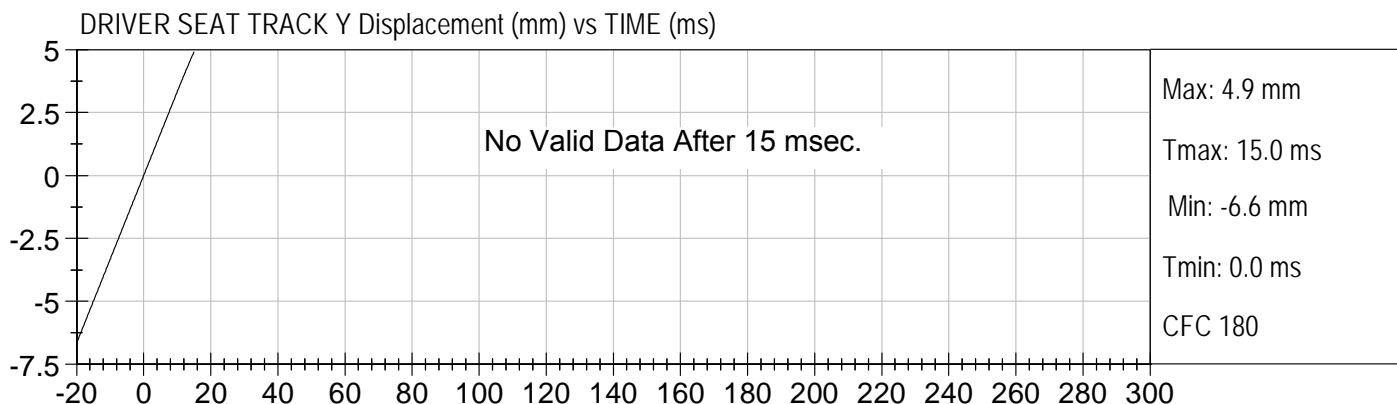
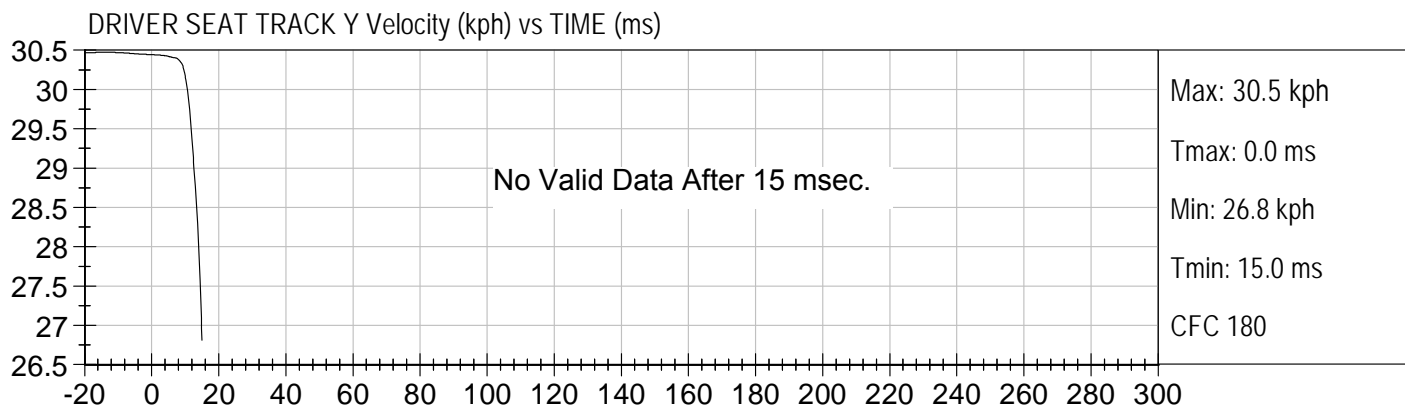
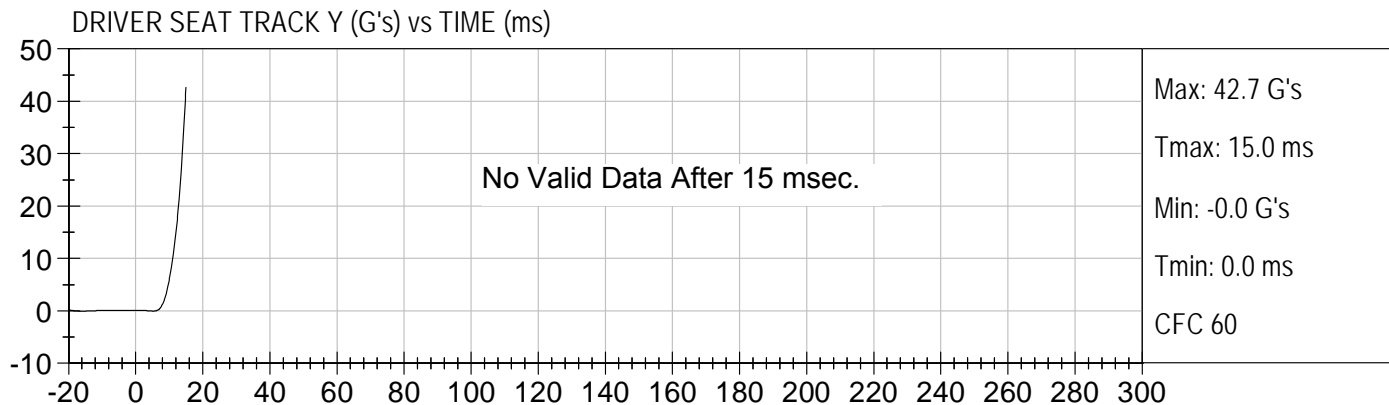


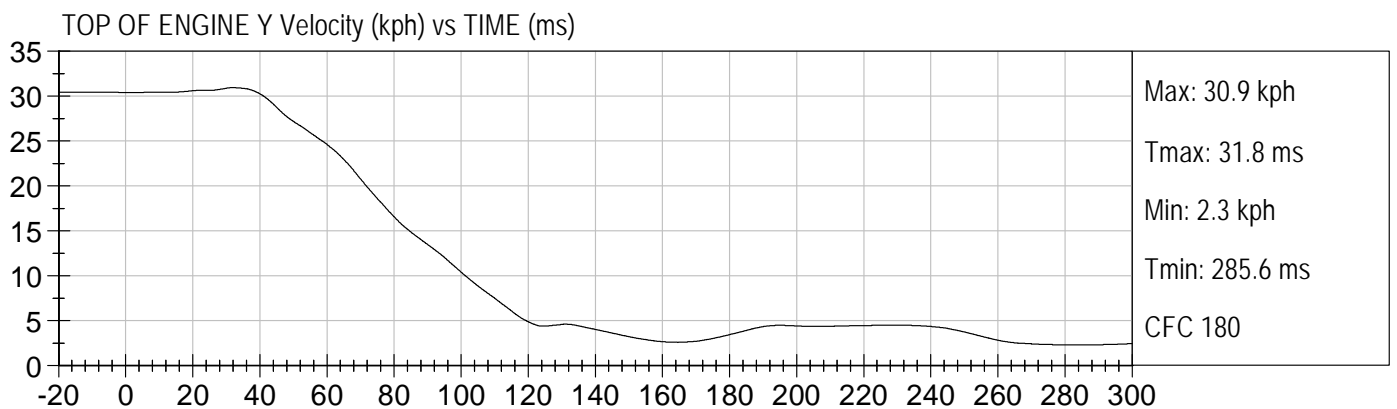
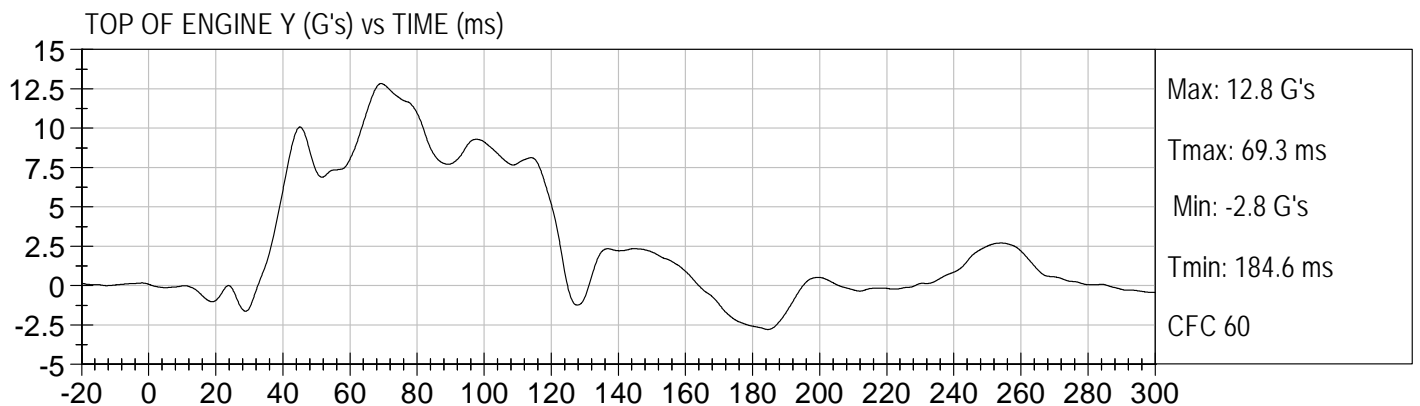
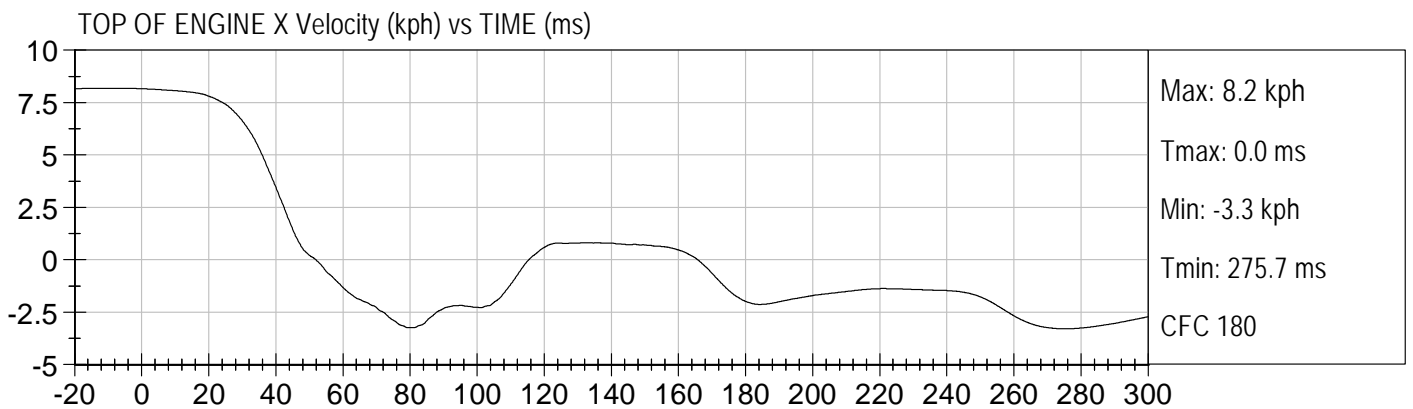
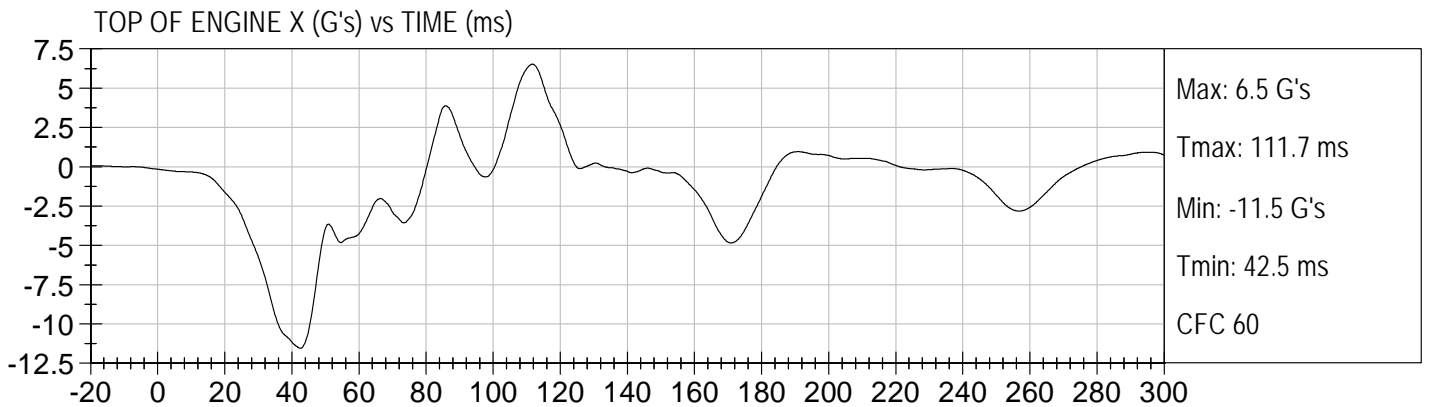
Max: 30.5 kph
Tmax: 0.0 ms
Min: 29.6 kph
Tmin: 10.0 ms
CFC 180

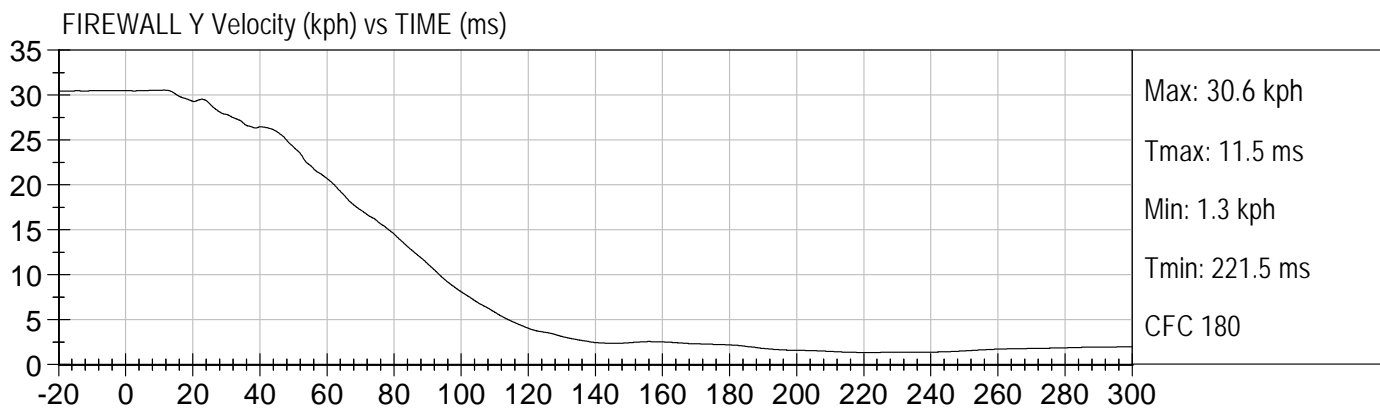
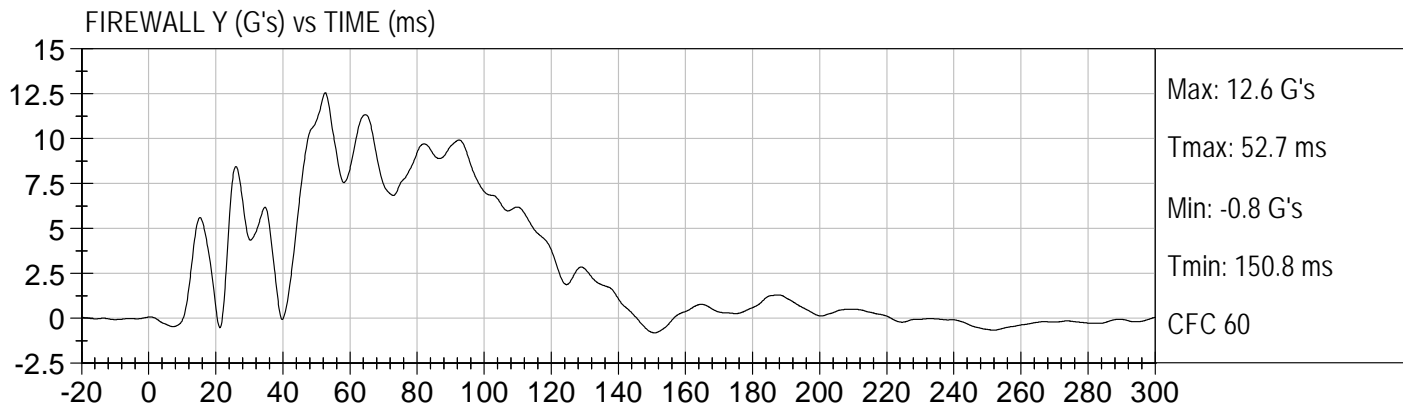
LEFT MID B-POST Y Displacement (mm) vs TIME (ms)

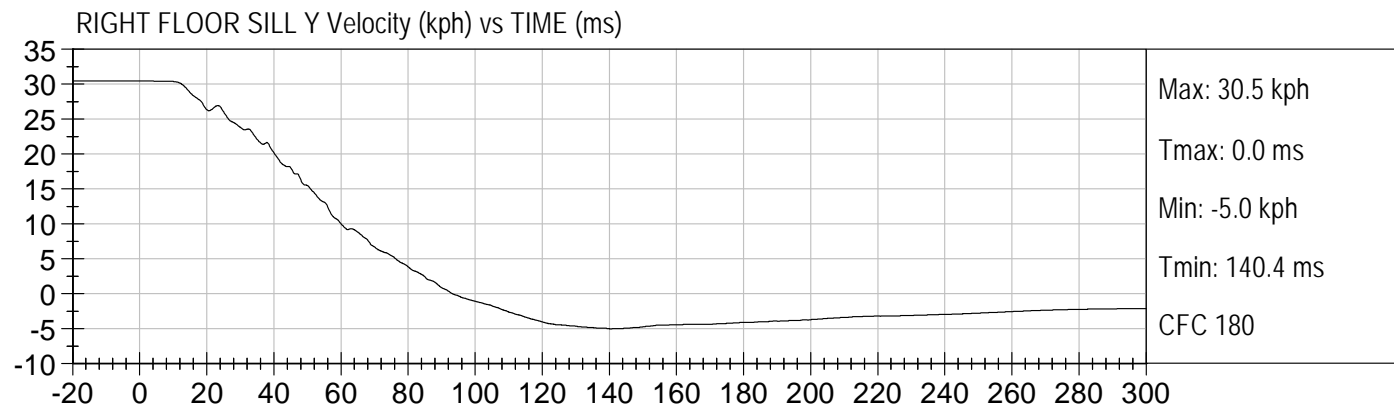
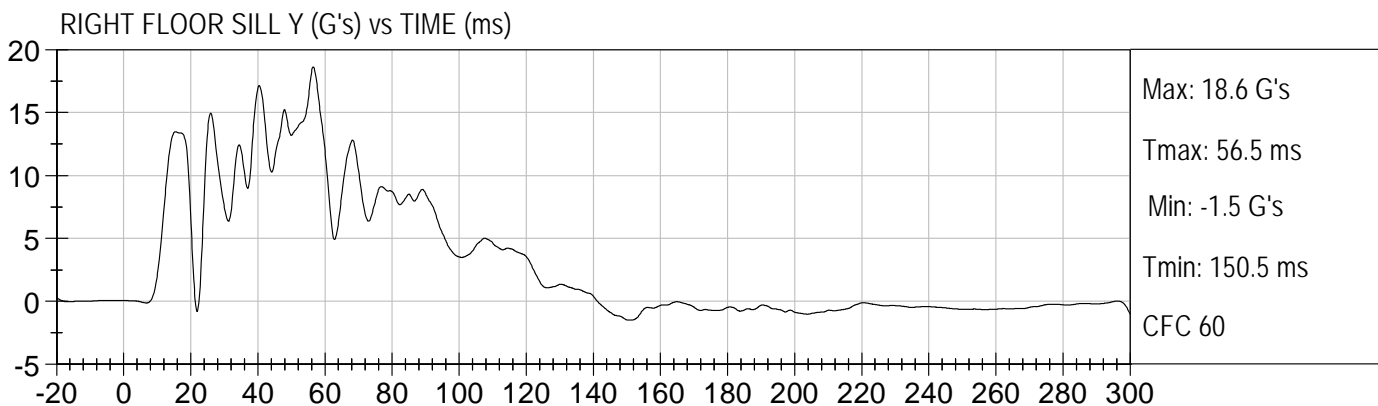
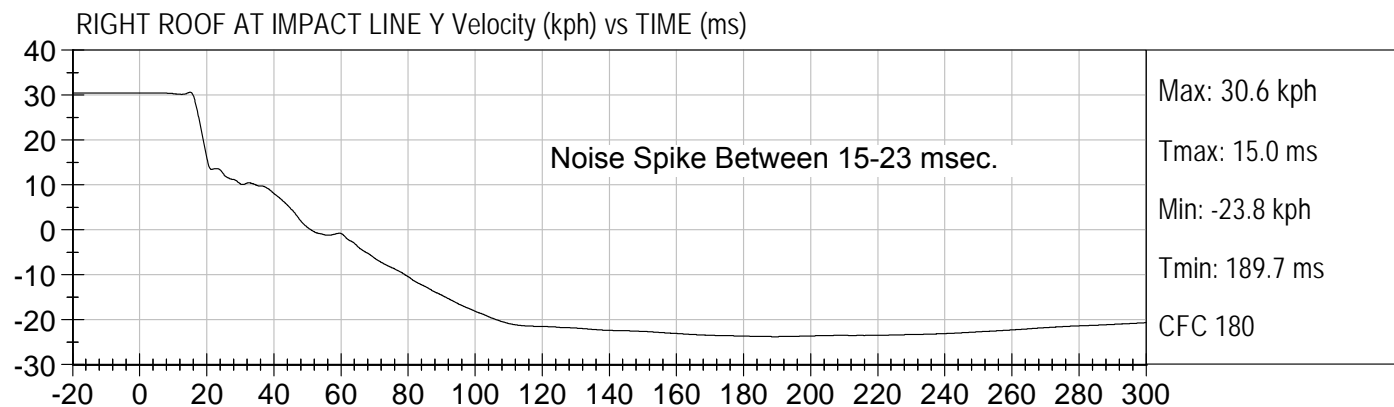
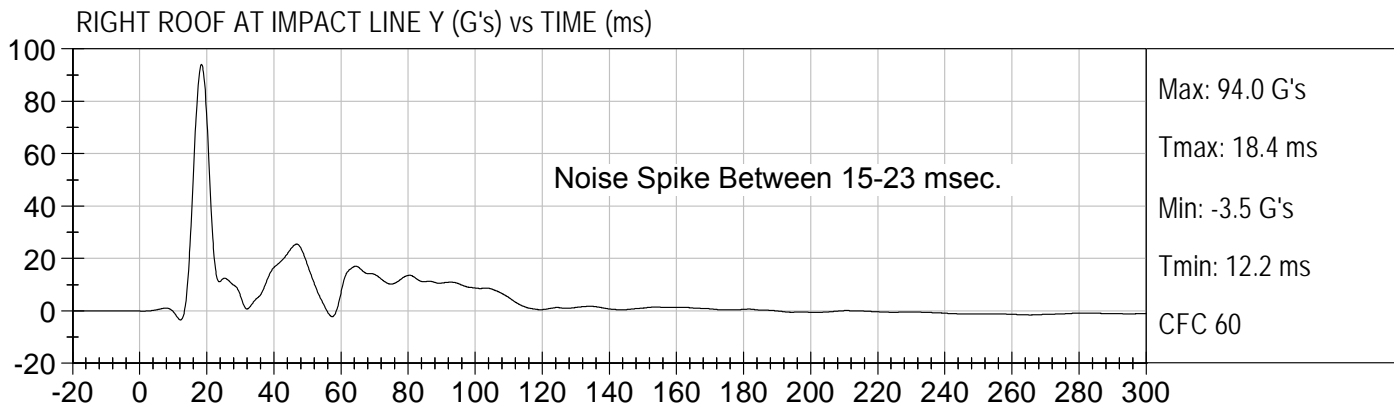


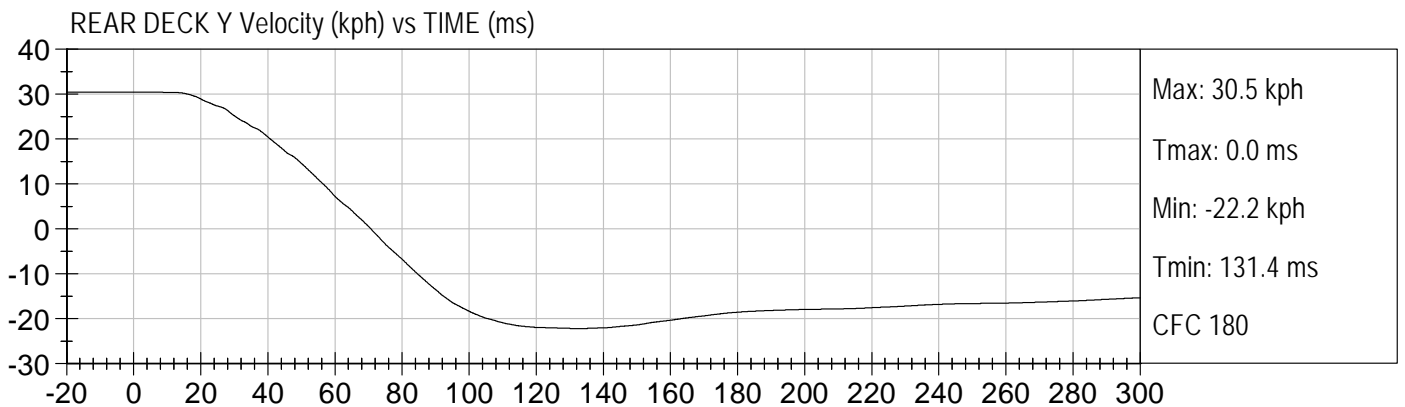
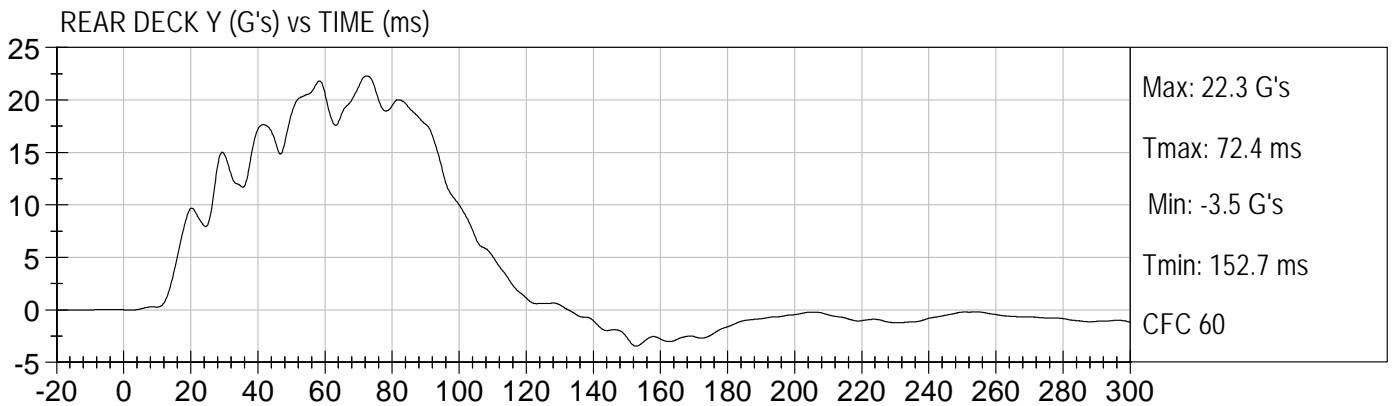
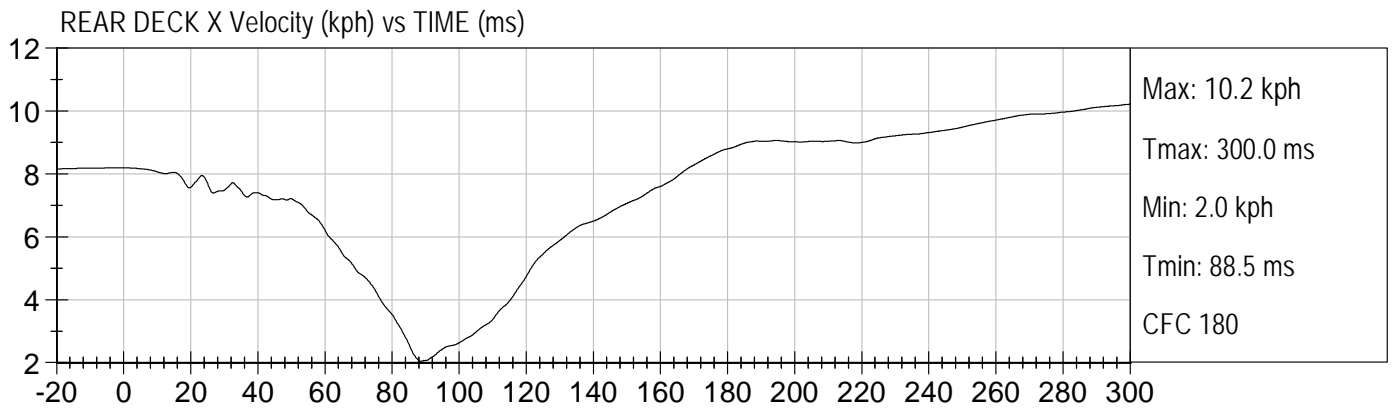
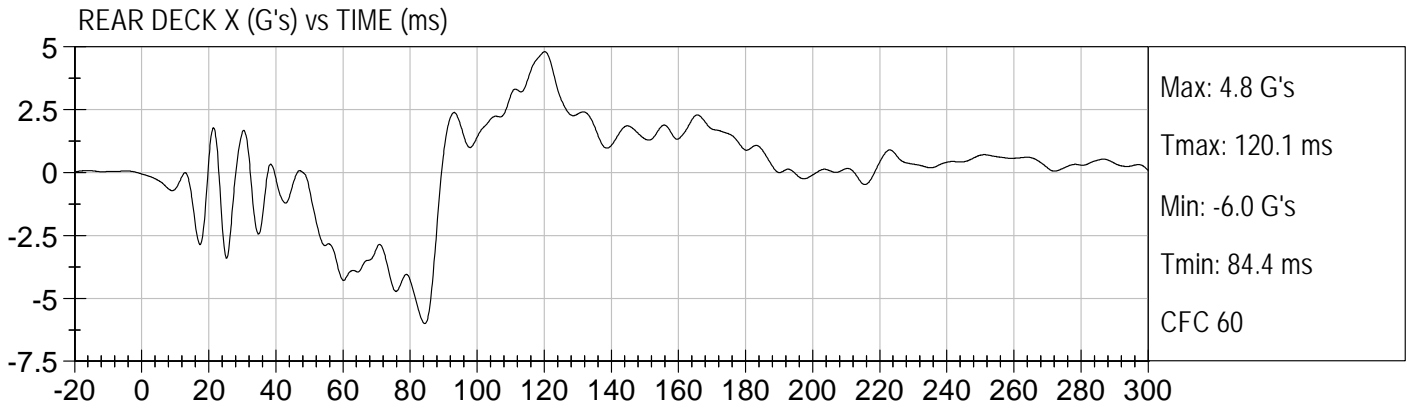
Max: 3.3 mm
Tmax: 10.0 ms
Min: -6.6 mm
Tmin: 0.0 ms
CFC 180











APPENDIX D

DUMMY PERFORMANCE CALIBRATION TEST DATA

MGA RESEARCH CORPORATION
HEAD DROP TEST
ES-2re DUMMY

ATD Serial No: 016

Test ID: D11591

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	42.0	Pass
Peak Resultant Acceleration	G's	125 to 155	146	Pass
Peak Lateral Acceleration	G's	+/- 15	6.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Gall
 Laboratory Technician

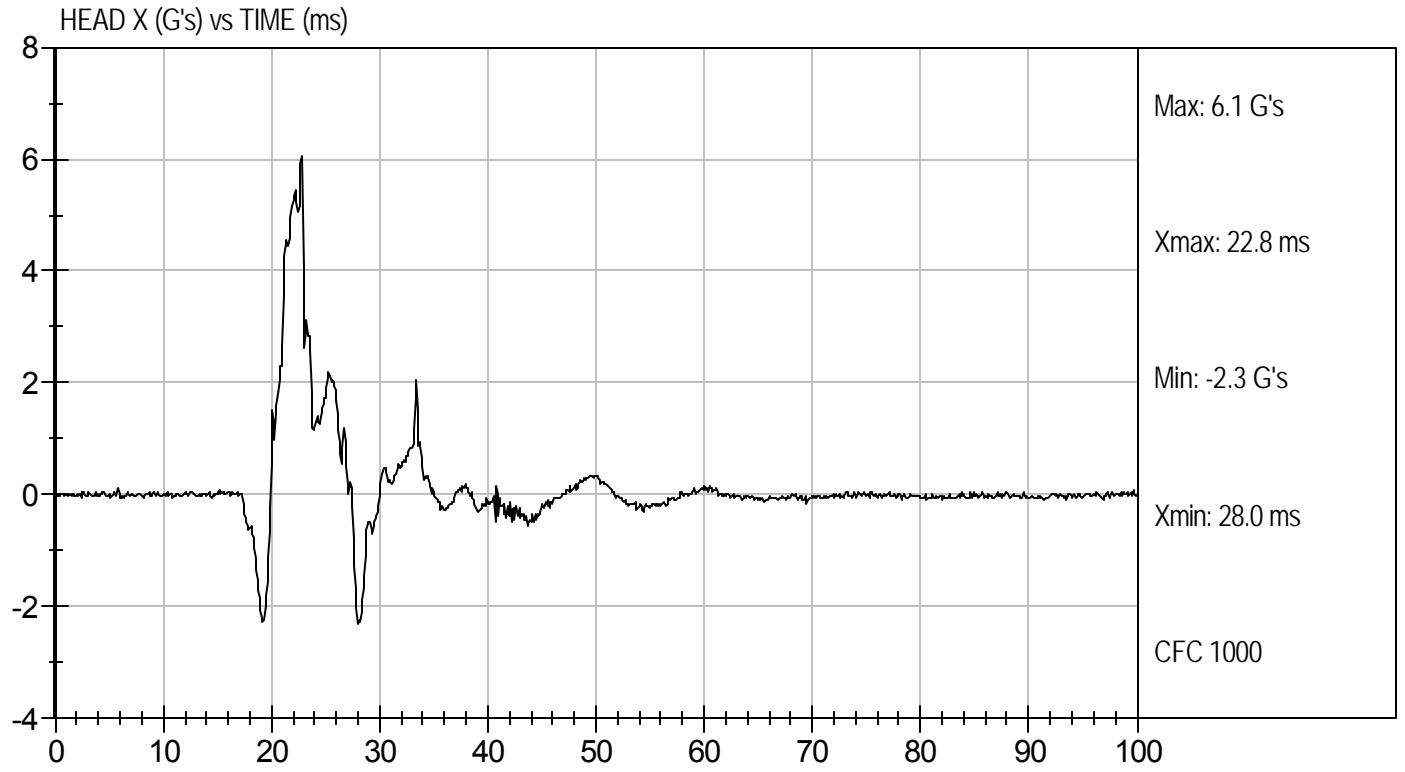
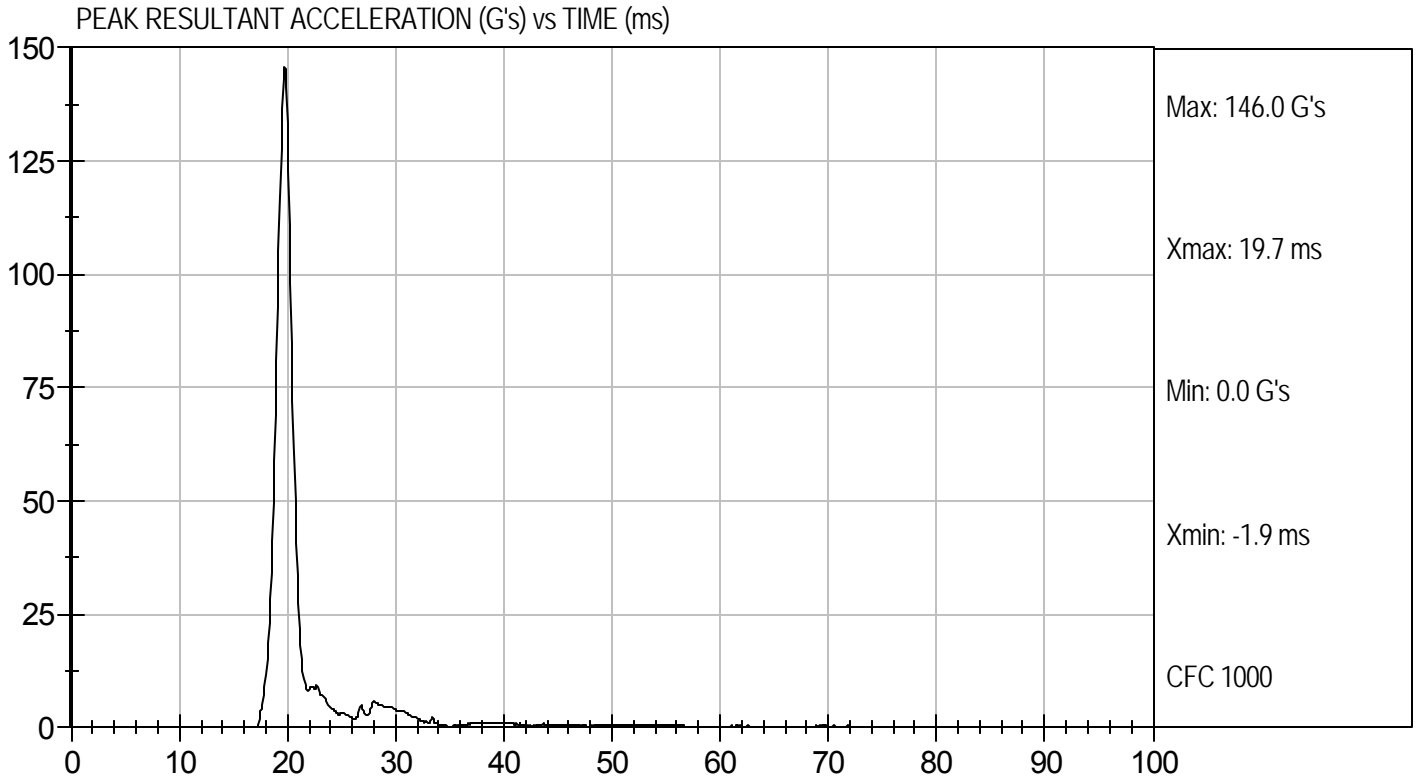
2/17/11
 Test Date

David Winkelbauer
 Approved By



Test Desc: Head Drop
Component ID: D11591

Test Date: 2/17/11
Velocity: 0 ft/s, 0 m/s



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
ES-2re DUMMY

ATD Serial No: 016

Test I.D.: D11592

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	40	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	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.34	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	52.8	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	59.1	Pass
Overall Test Results					Pass

Jessica Hall
 Laboratory Technician

2/17/11
 Test Date

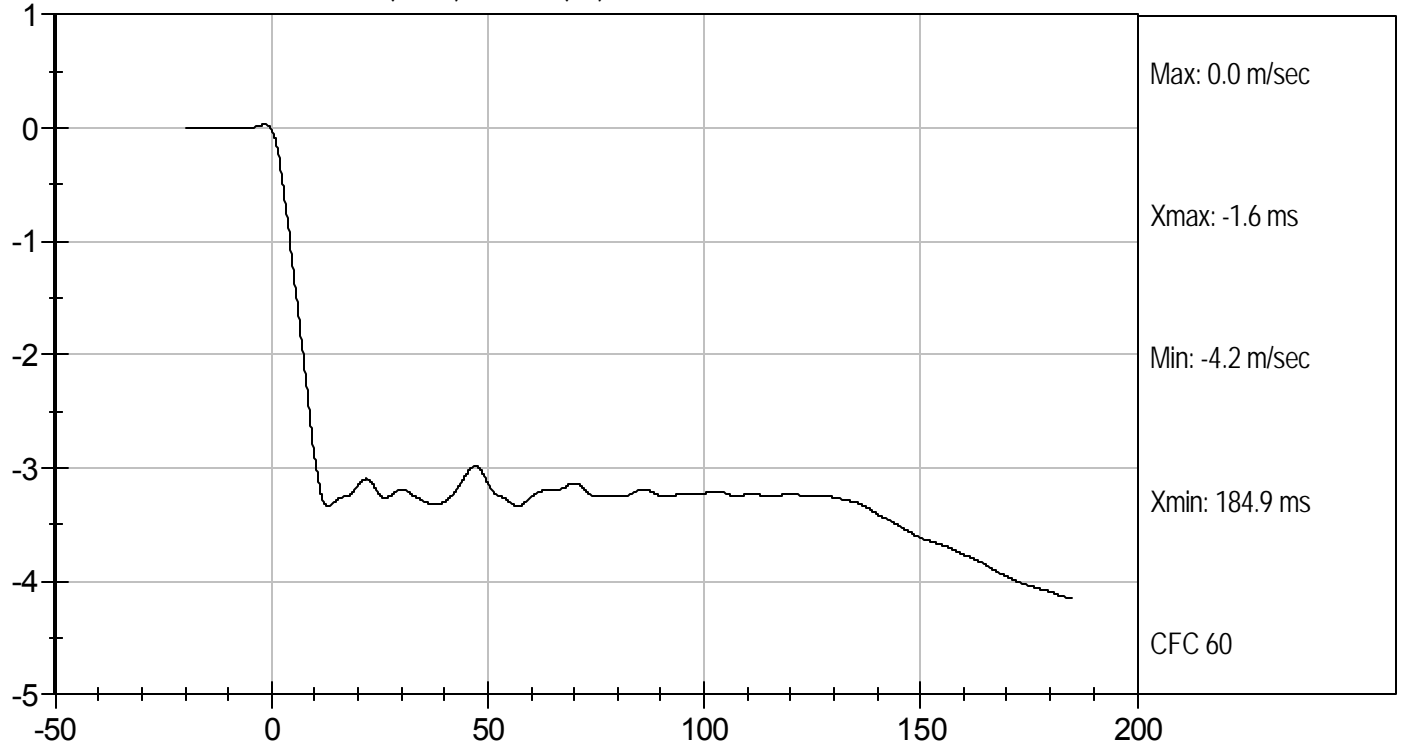
David Winkelbauer
 Approved By



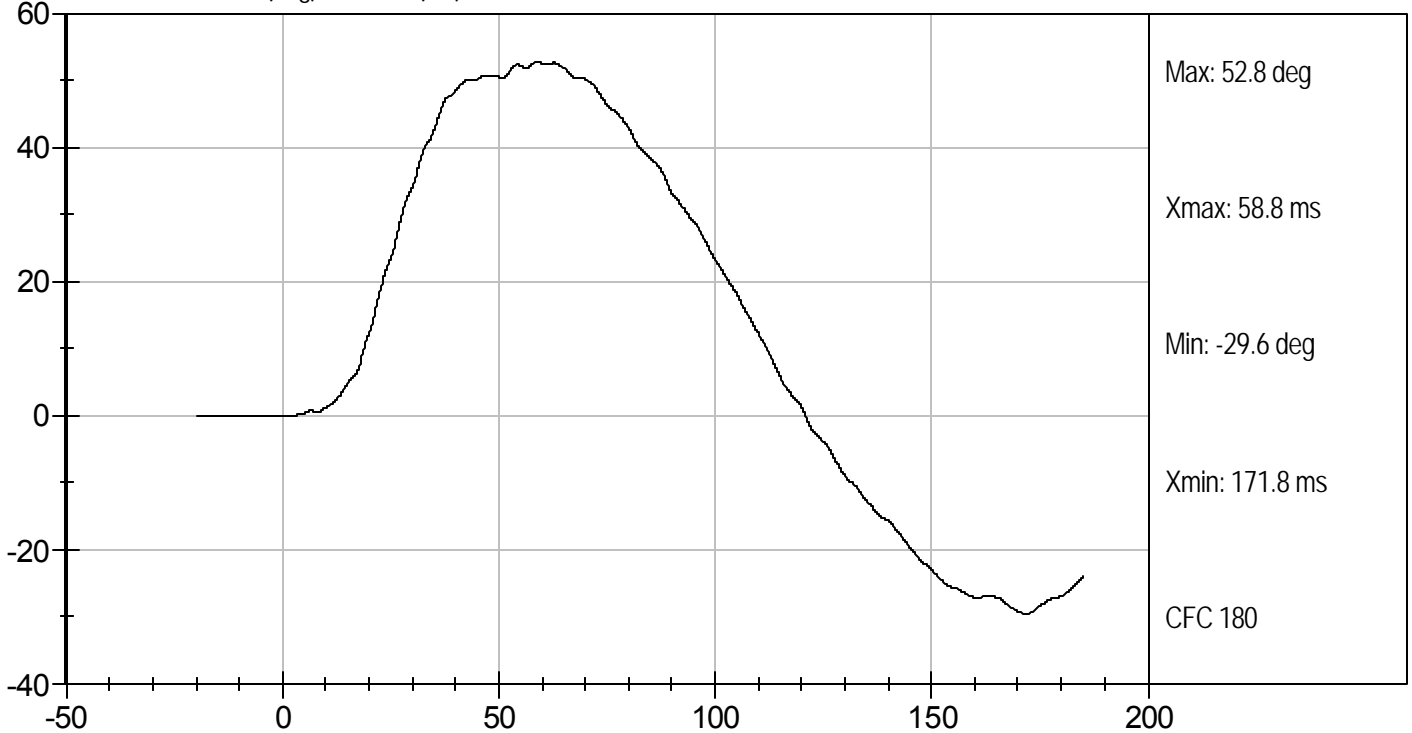
Test Desc: Neck Bending
Component ID: D11592

Test Date: 2/17/11
Velocity: 11.42 ft/s, 3.48 m/s

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



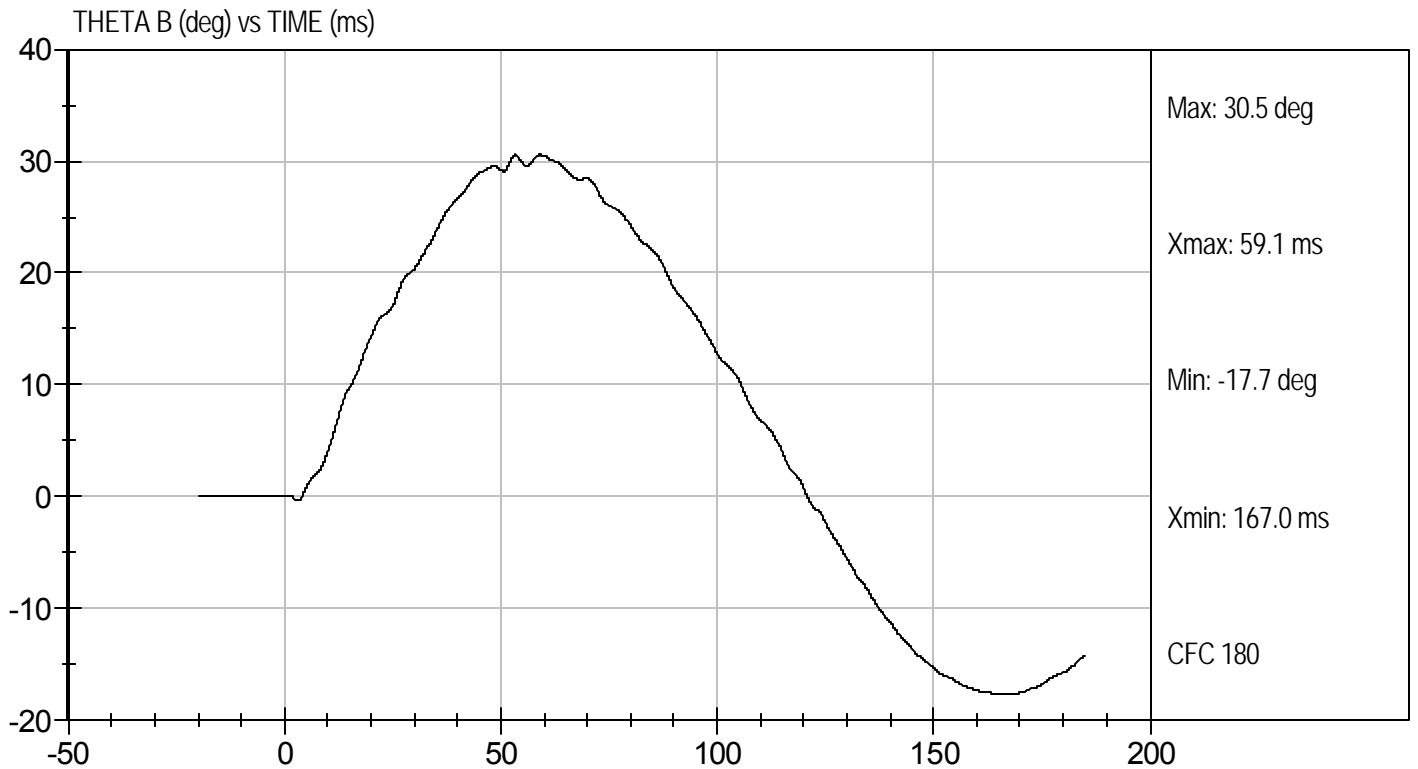
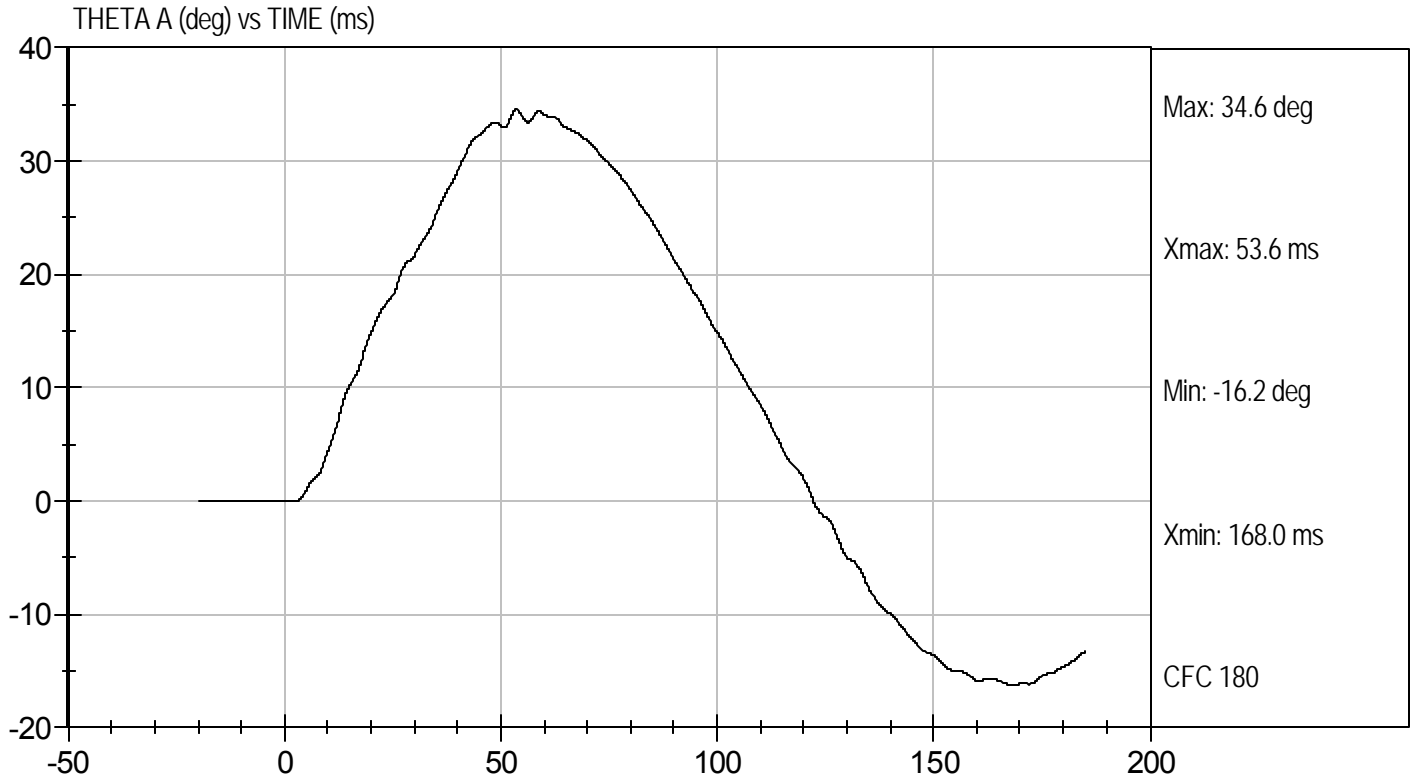
FLEXION ANGLE (deg) vs TIME (ms)





Test Desc: Neck Bending
Component ID: D11592

Test Date: 2/17/11
Velocity: 11.42 ft/s, 3.48 m/s



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
ES-2re DUMMY

ATD Serial No: 016

Test I.D: D11593

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	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	8.3	Pass
Time of Peak Shoulder Acceleration	ms	NA	12.9	Pass
Overall Test Results				Pass

Jessica Gall
 Laboratory Technician

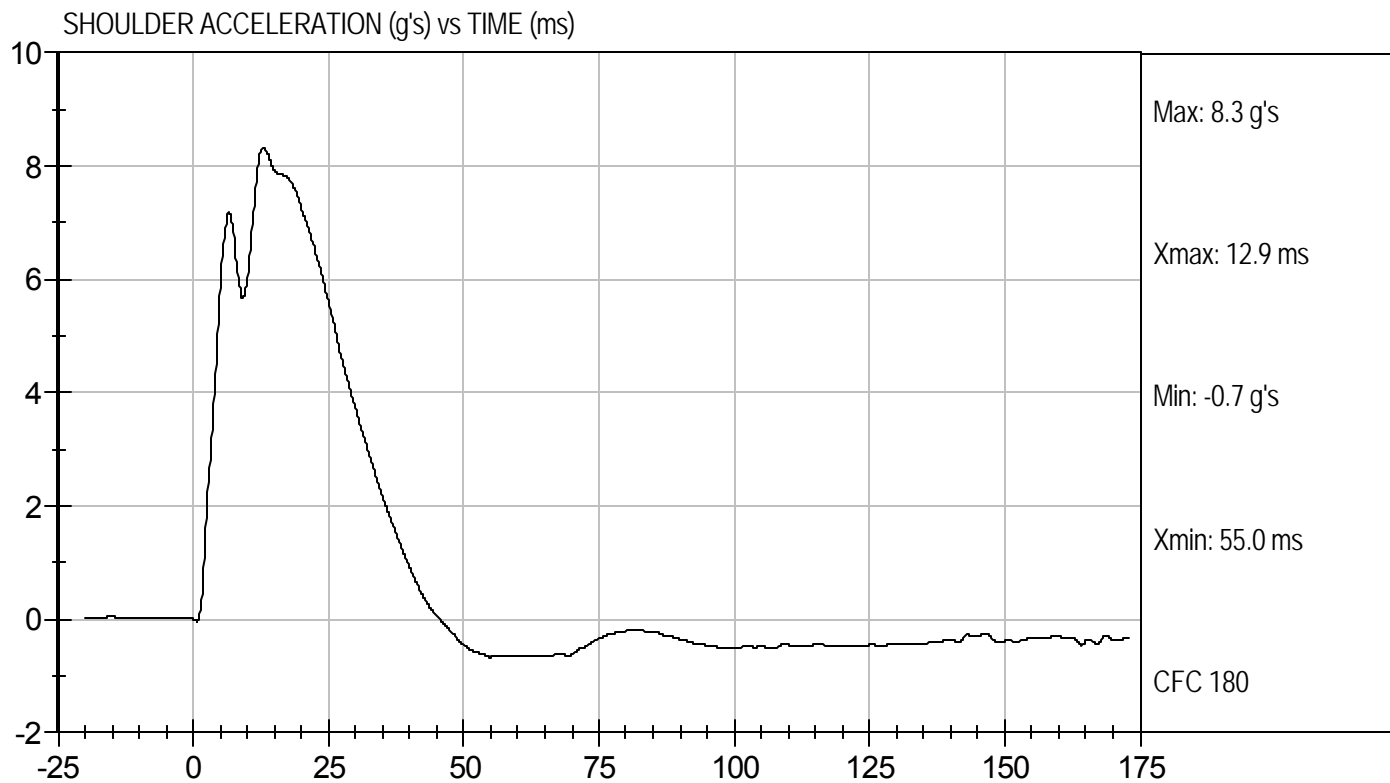
2/18/11
 Test Date

David Winkelbauer
 Approved By



Test Desc: Shoulder Impact
Component ID: D11593

Test Date: 2/18/11
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: D11594

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	41	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	50.2	Pass
Overall Test Results				Pass

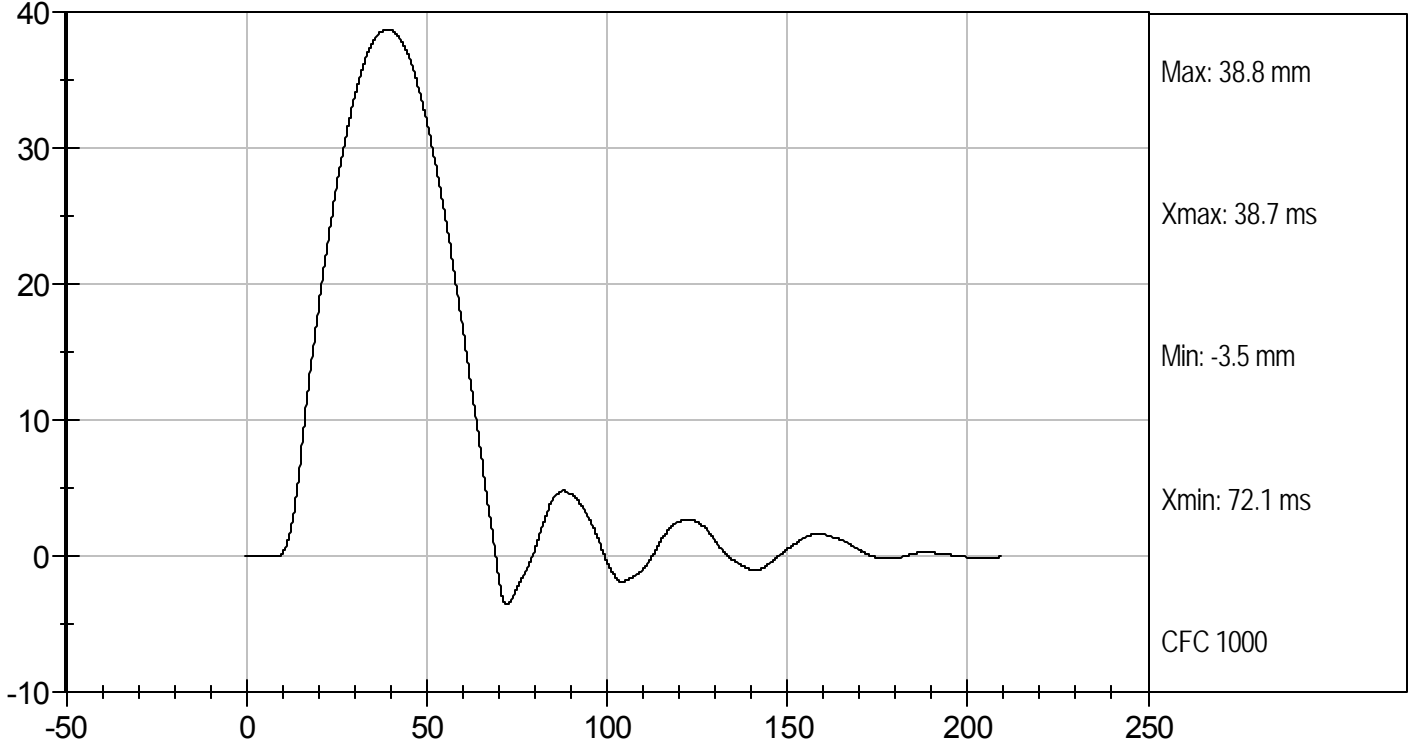
Jessica Hall
Laboratory Technician

2/17/11
Test Date

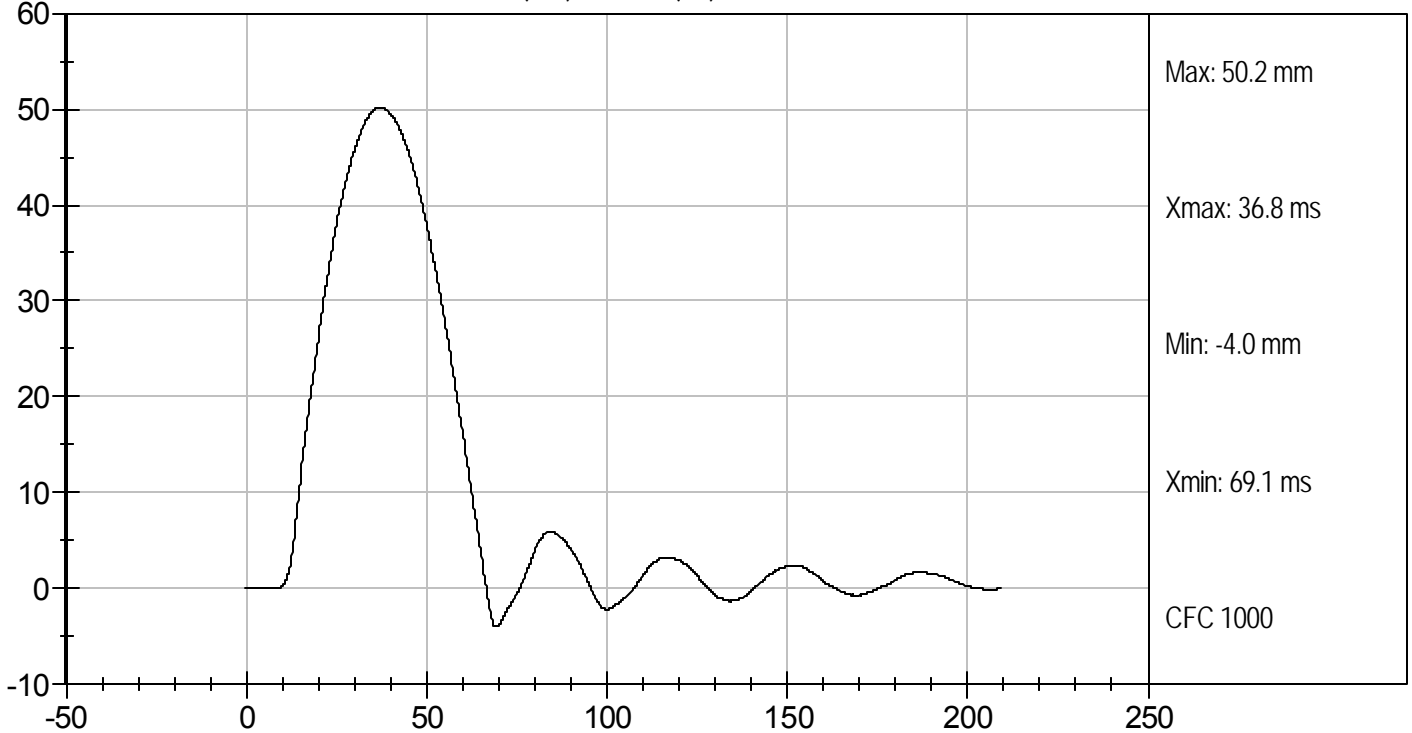
David Winkelbauer
Approved By



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: D11595

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	41	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	50.3	Pass
Overall Test Results				Pass

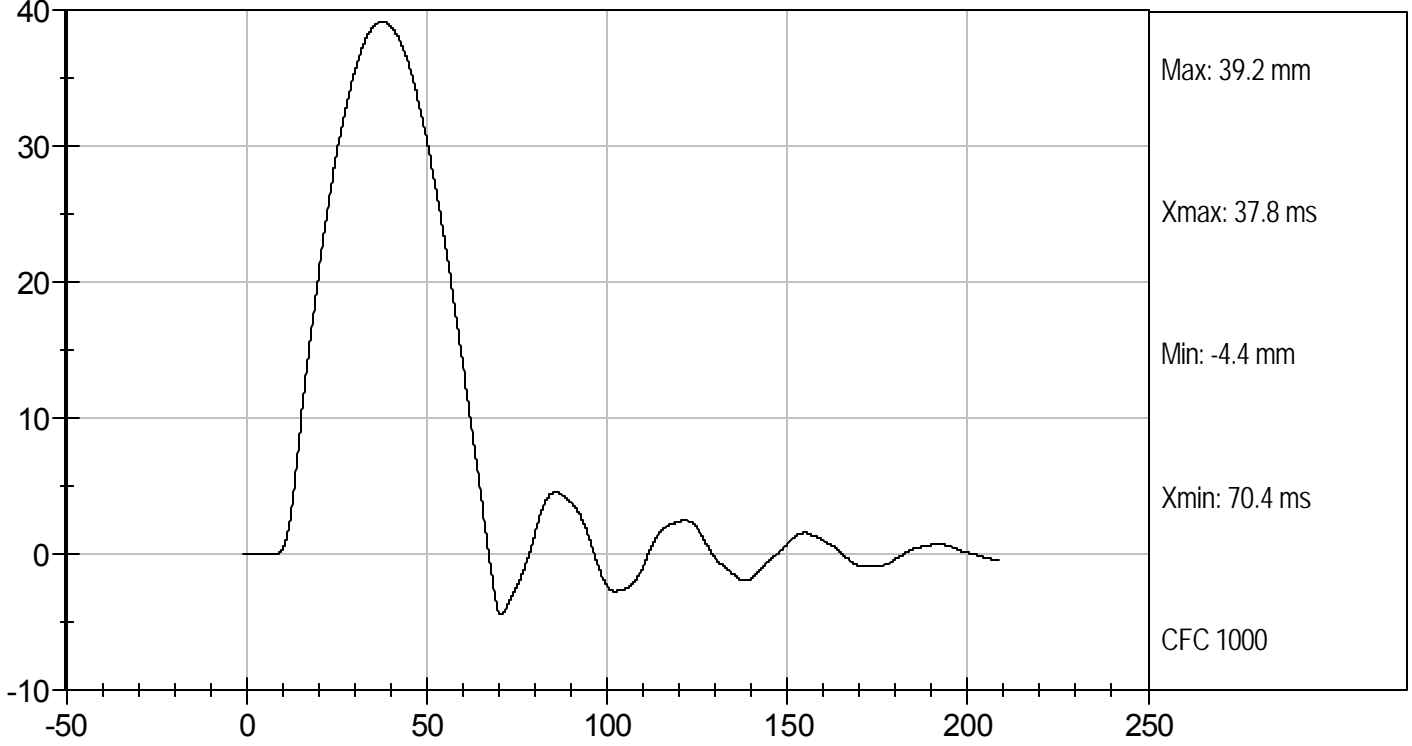
Jessica Gall
Laboratory Technician

2/17/11
Test Date

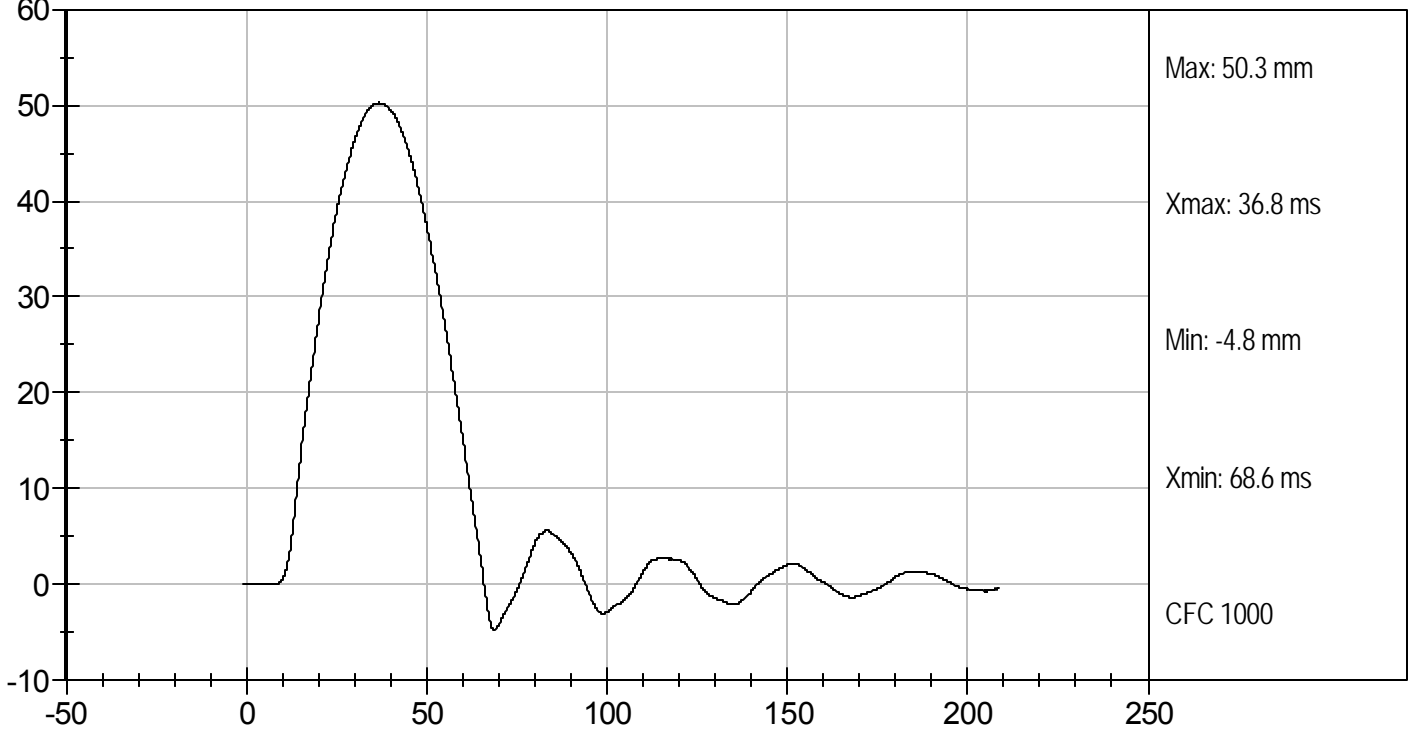
David Winkelbauer
Approved By



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: D11596

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	41	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	48.2	Pass
Overall Test Results				Pass

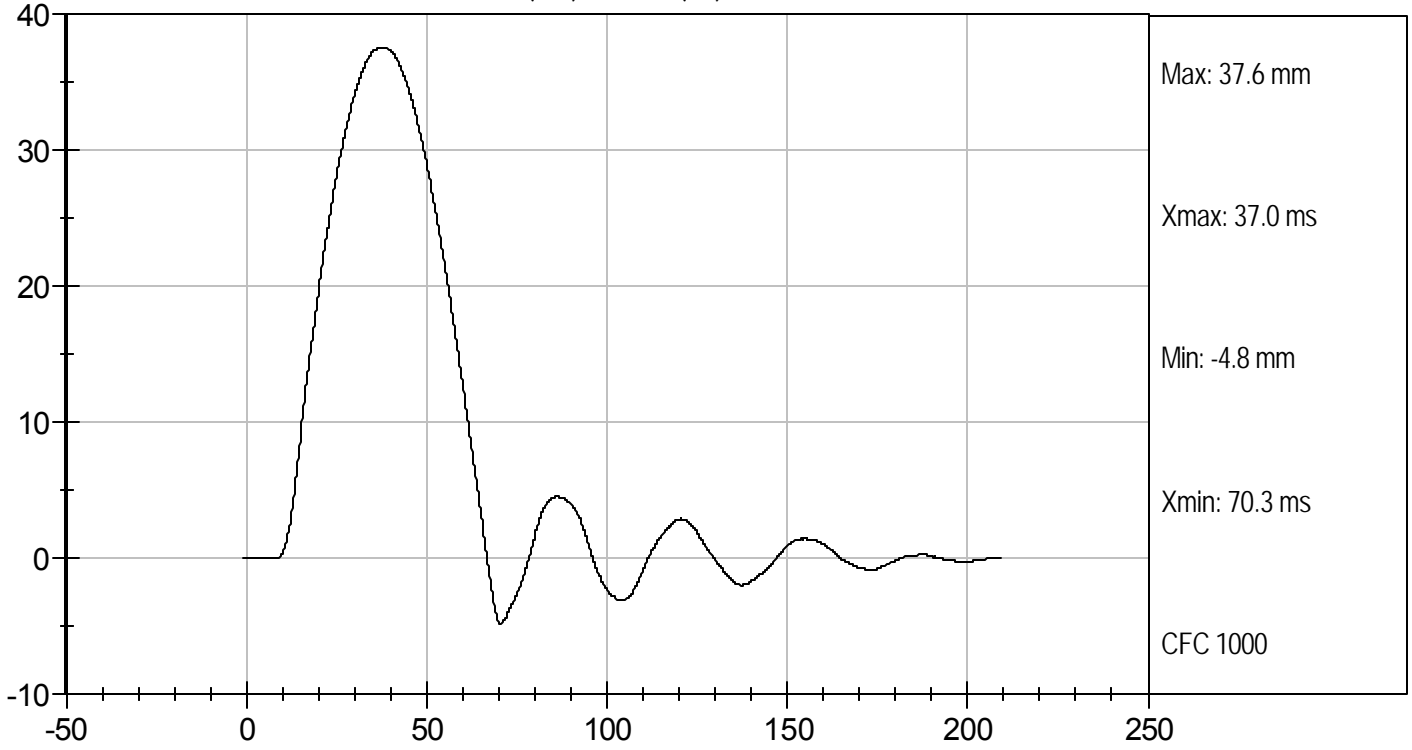
Jessica Gall
Laboratory Technician

2/17/11
Test Date

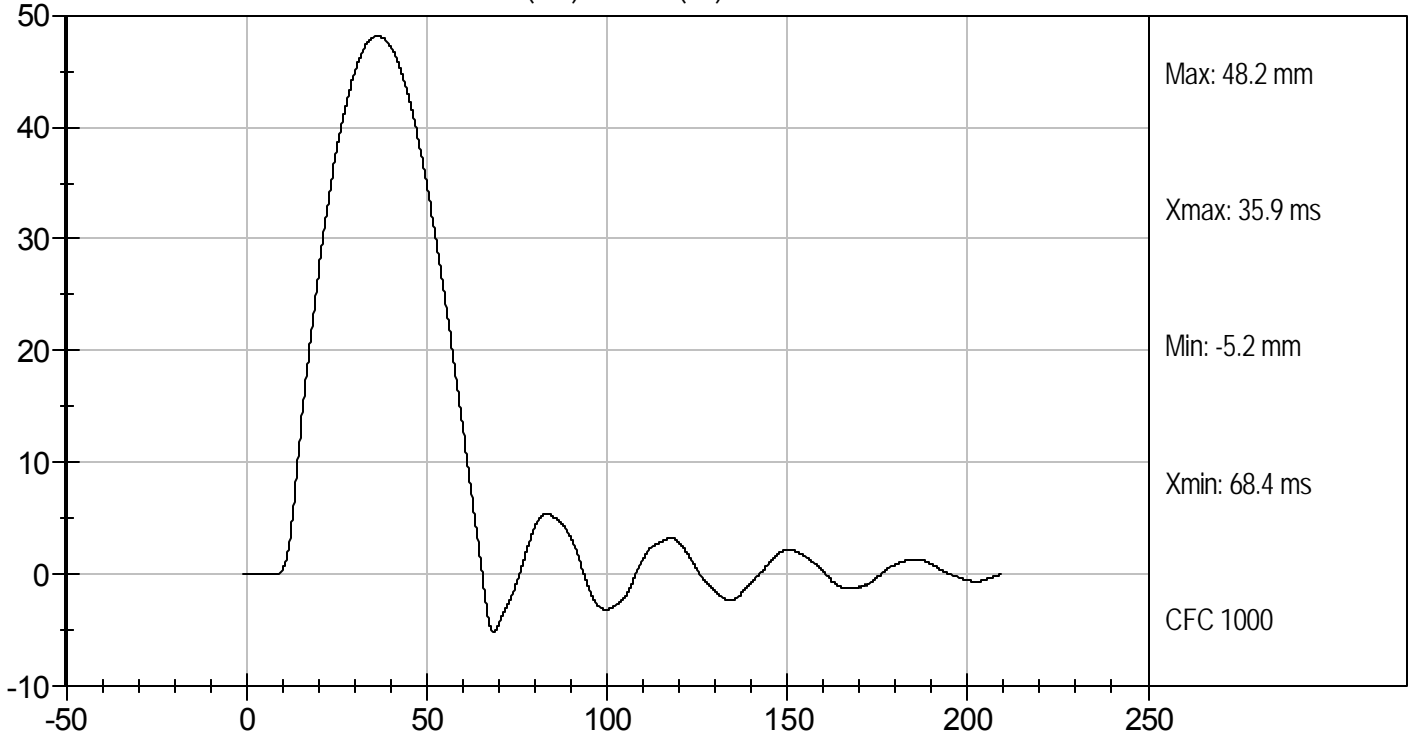
David Winkelbauer
Approved By



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: D11597

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	25	Pass
Probe Speed	m/s	3.90 to 4.10	3.91	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.35	Pass
Time of Maximum Impact Force	ms	10.60 to 13.00	11.50	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.63	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	11.40	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

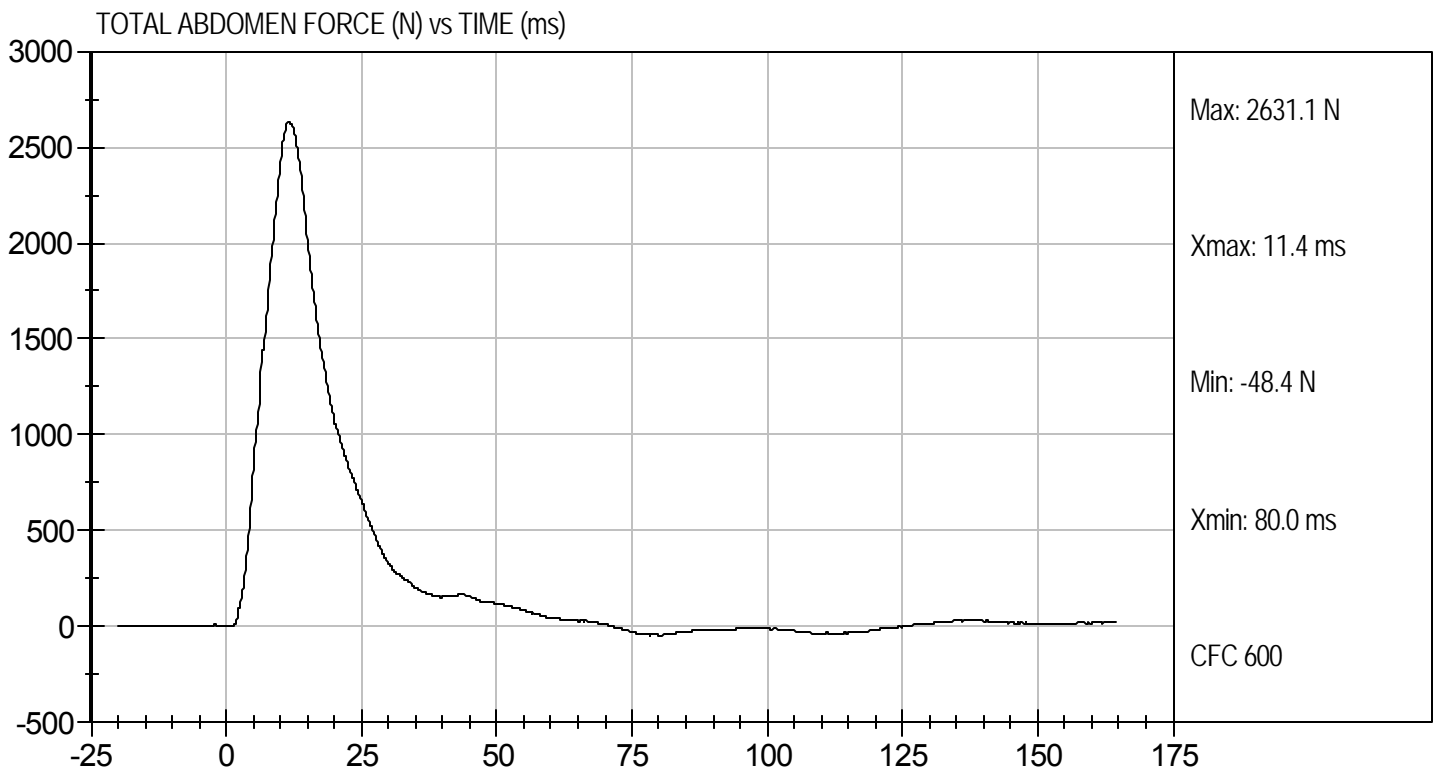
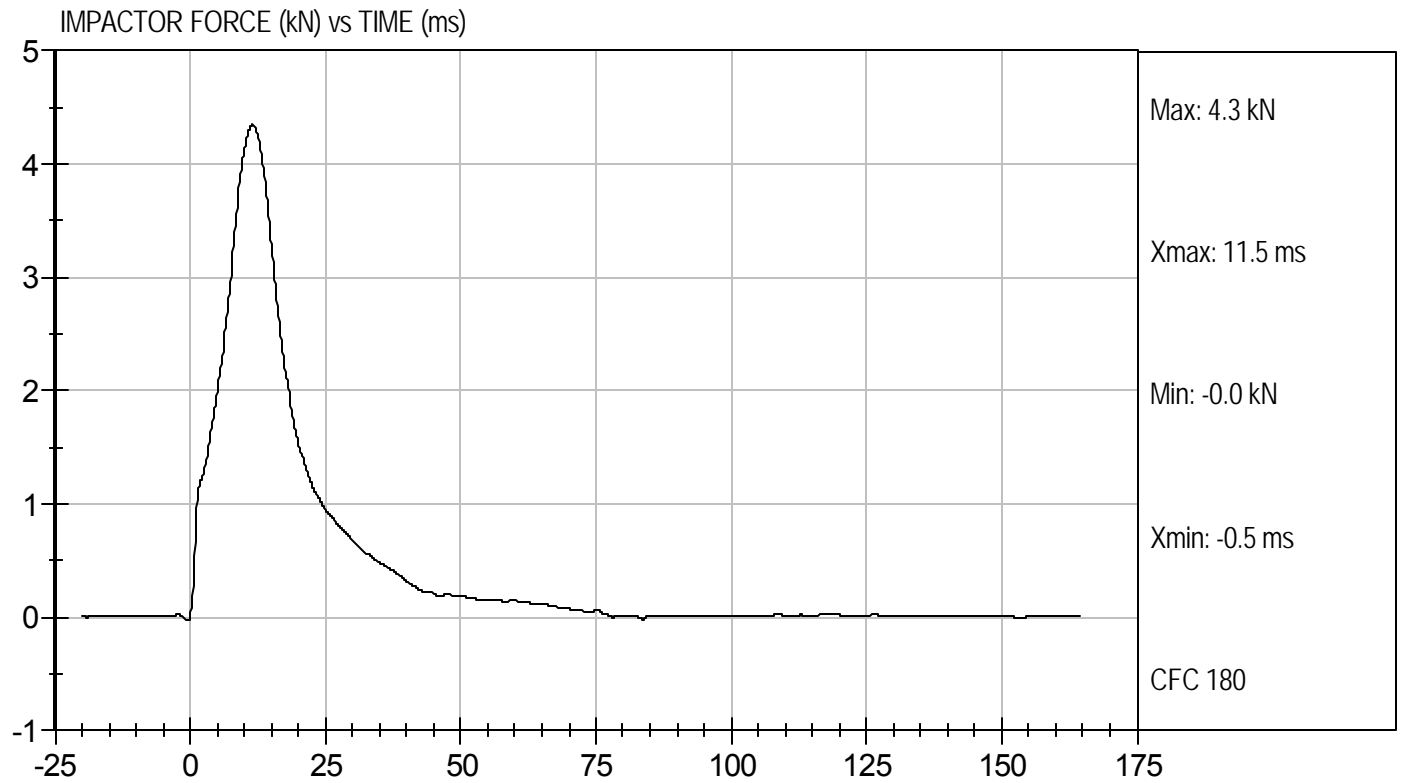
2/18/11
Test Date

David Winkelbauer
Approved By



Test Desc: Abdomen Impact
Component ID: D11597

Test Date: 2/18/11
Velocity: 12.82 ft/s, 3.91 m/s



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
ES-2re DUMMY

ATD Serial No: 016

Test I.D.: D11598

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	40	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	-6.02	Pass
	30 ms	m/s	>= -6.5	-6.03	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	47.7	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	42.1	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	43	Pass
Overall Results					Pass

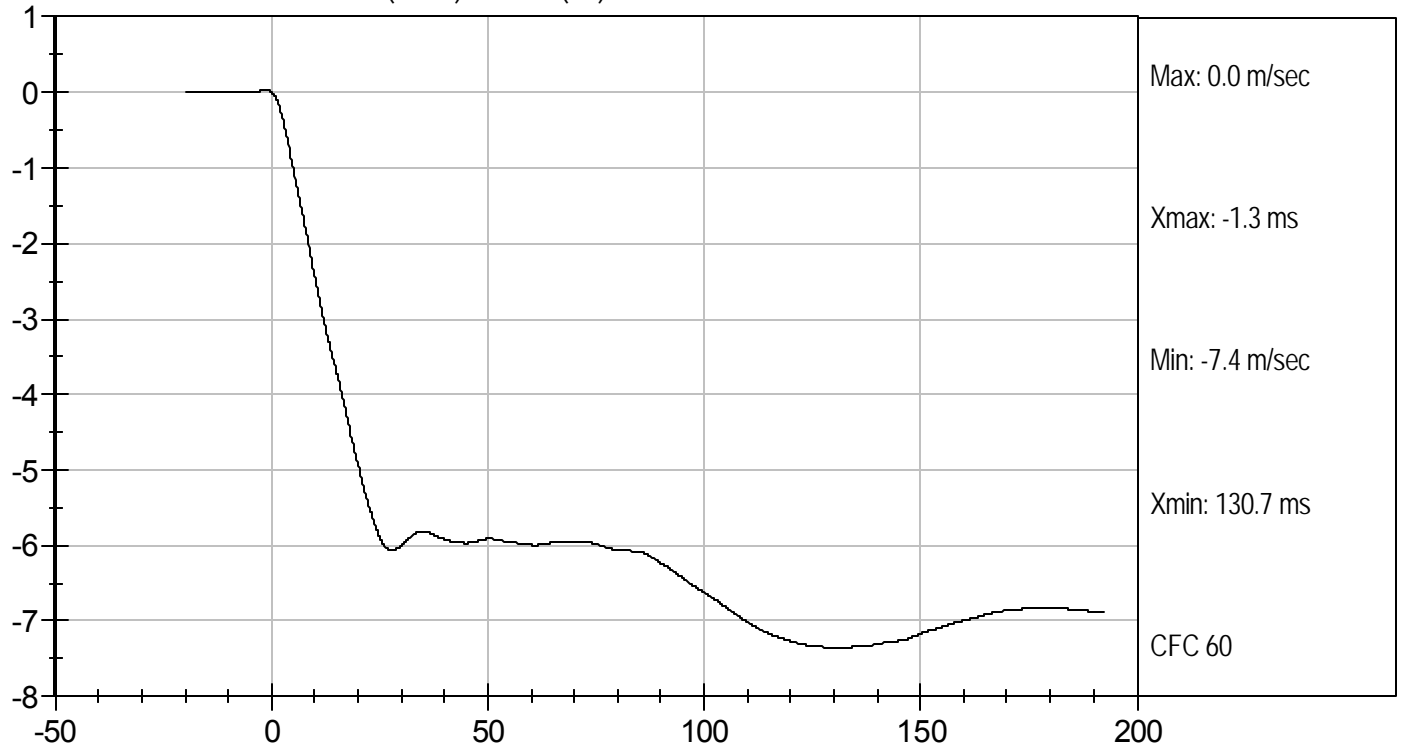
Jessica Hall
Laboratory Technician

2/17/11
Test Date

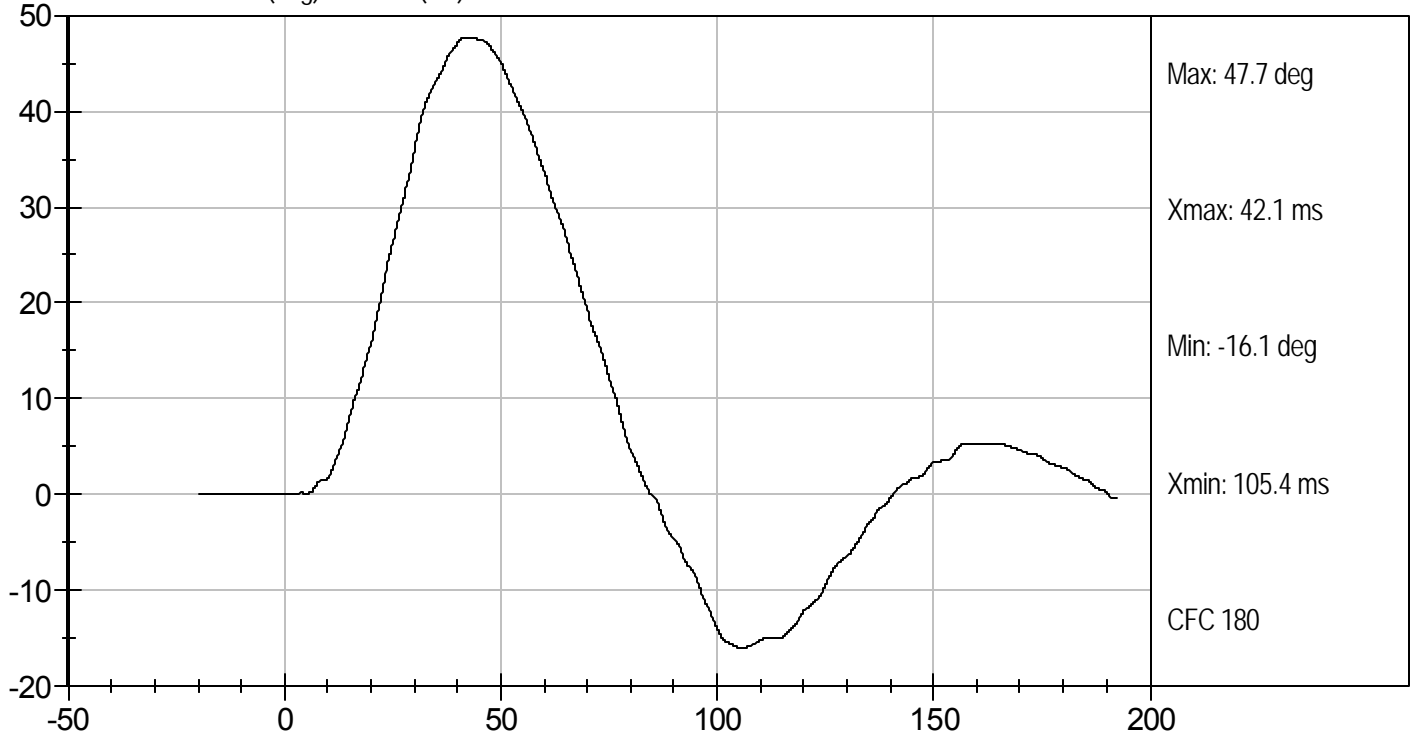
David Winkelbauer
Approved By

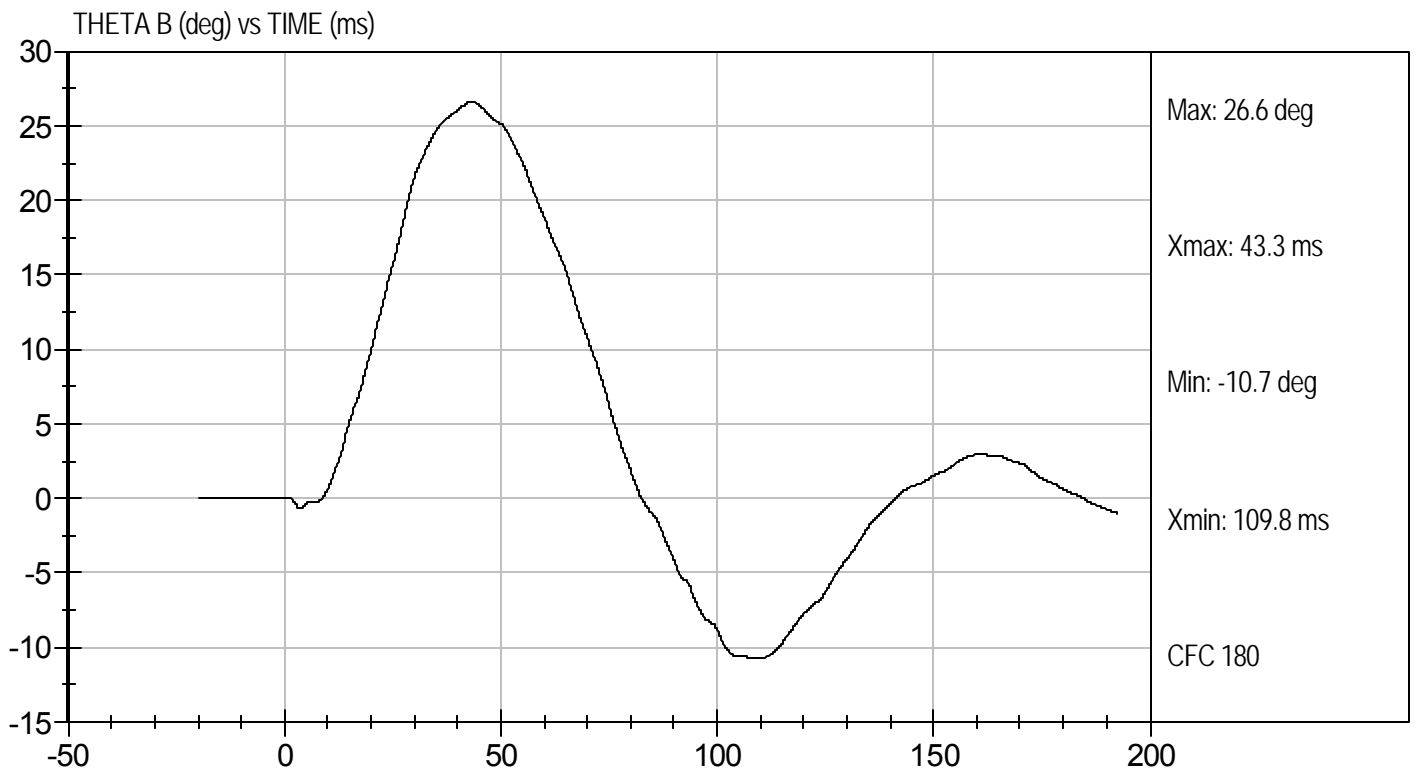
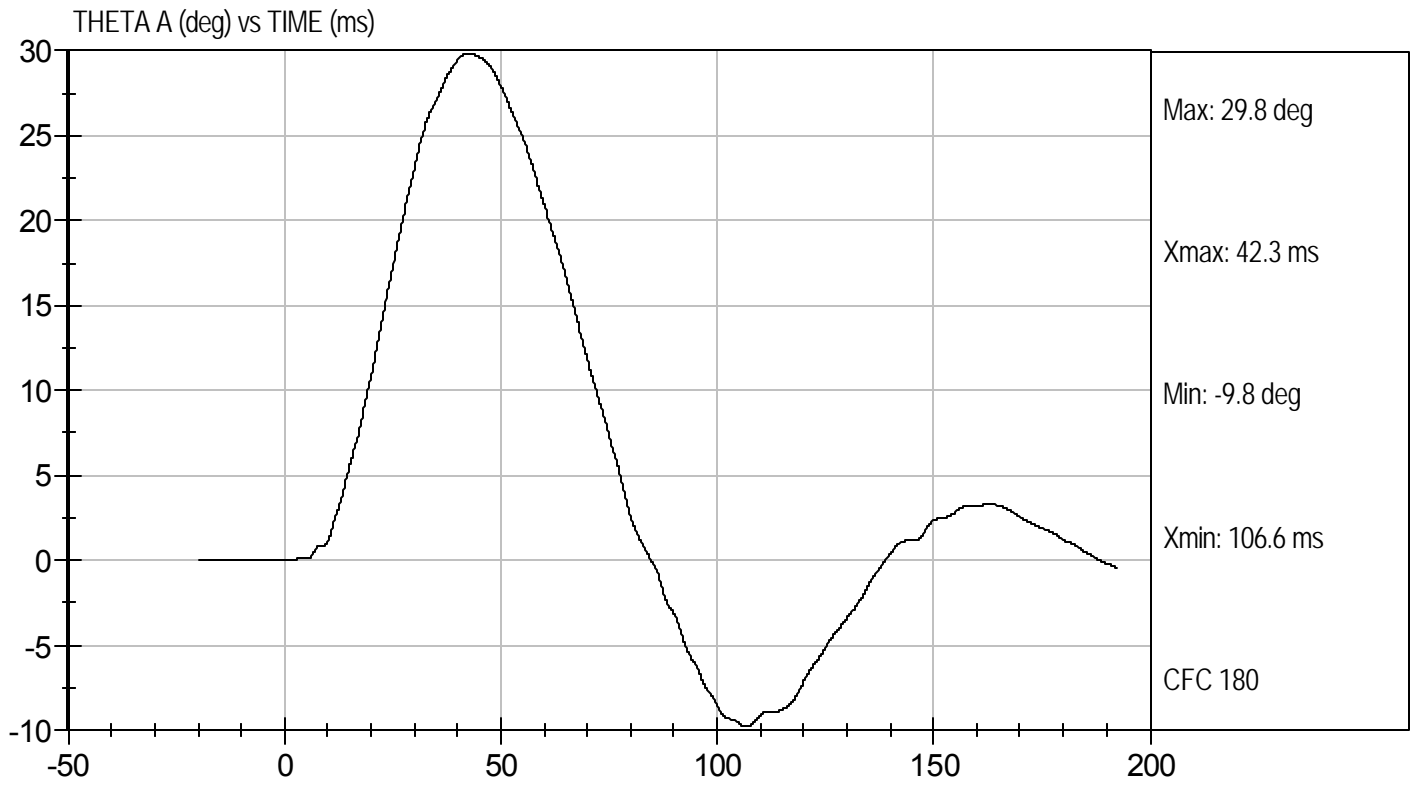


PENDULUM DECELERATION (m/sec) vs TIME (ms)



FLEXION ANGLE (deg) vs TIME (ms)





MGA RESEARCH CORPORATION

**PELVIS TEST
ES-2re DUMMY**

ATD Serial No: 016

Test I.D: D11599

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	25	Pass
Probe Speed	m/s	4.20 to 4.40	4.38	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.71	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.20	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.33	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.70	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

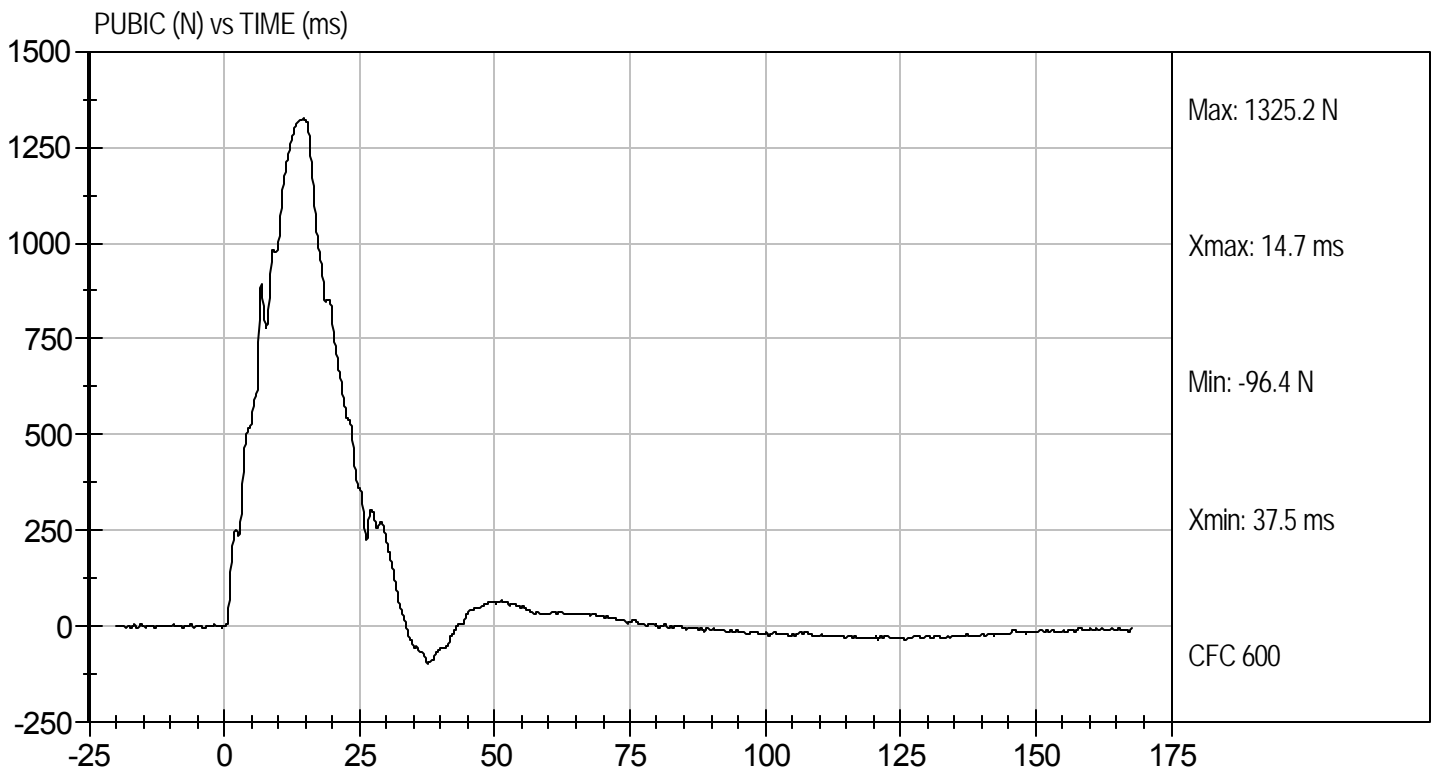
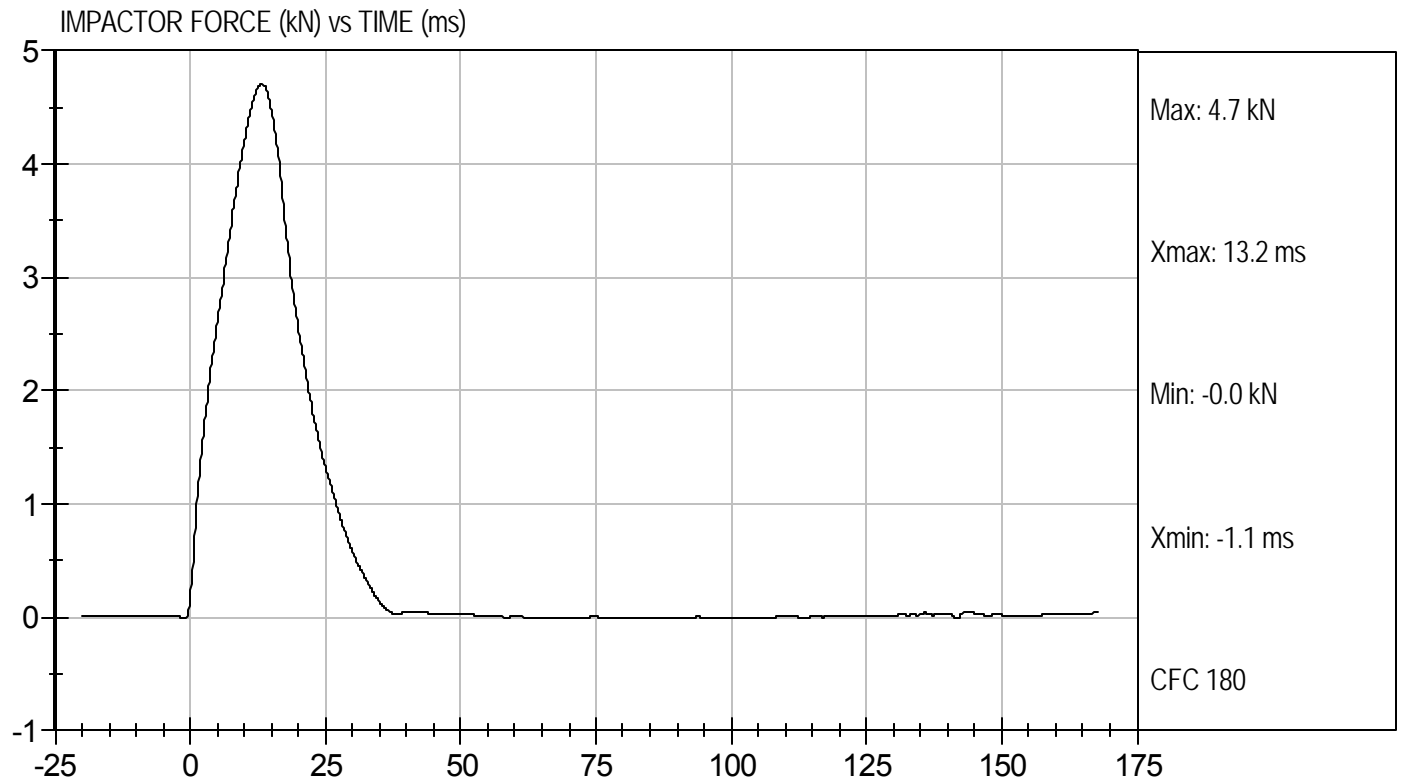
2/18/11
Test Date

David Winkelbauer
Approved By



Test Desc: Pelvis Impact
Component ID: D11599

Test Date: 2/18/11
Velocity: 14.36 ft/s, 4.38 m/s



MGA RESEARCH CORPORATION
FULL BODY THORAX IMPACT TEST
ES-2re DUMMY

ATD Serial No: 016

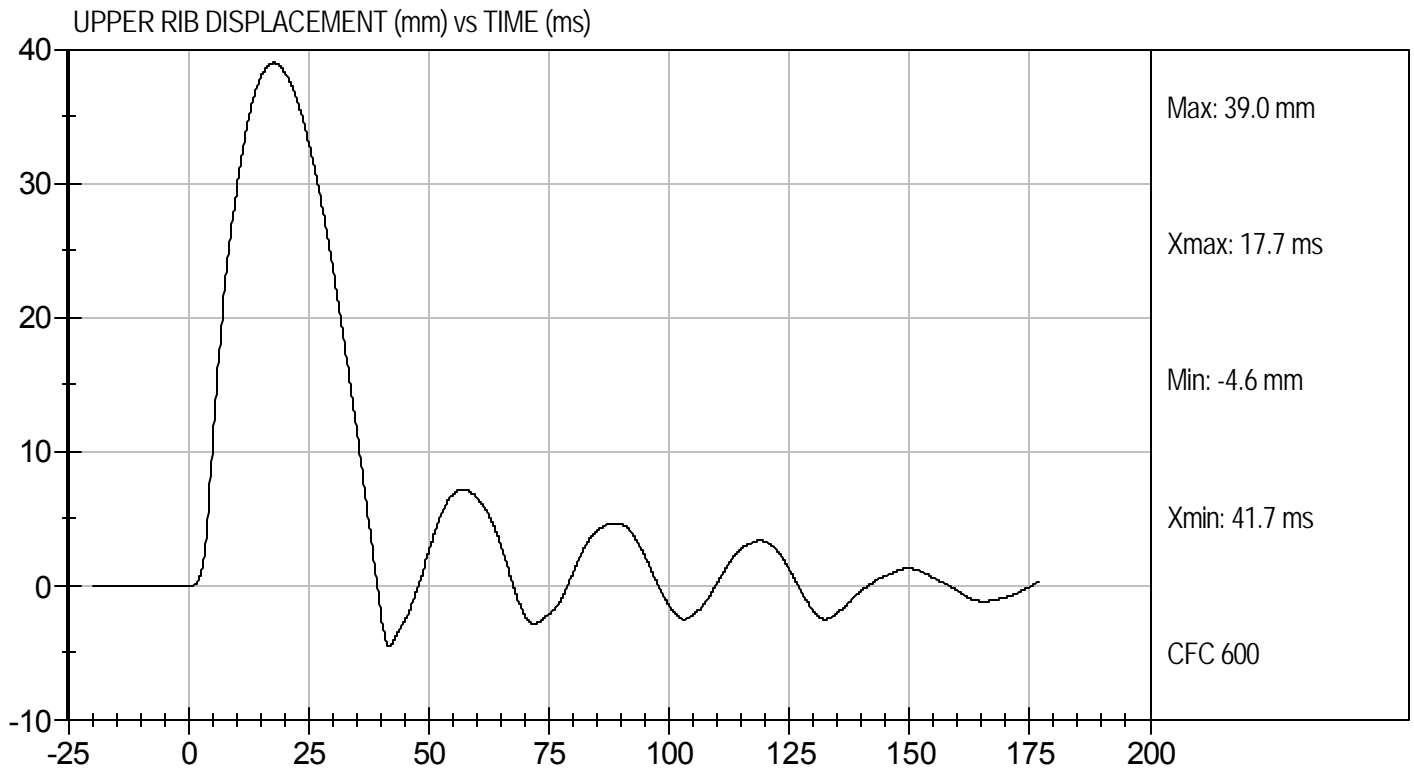
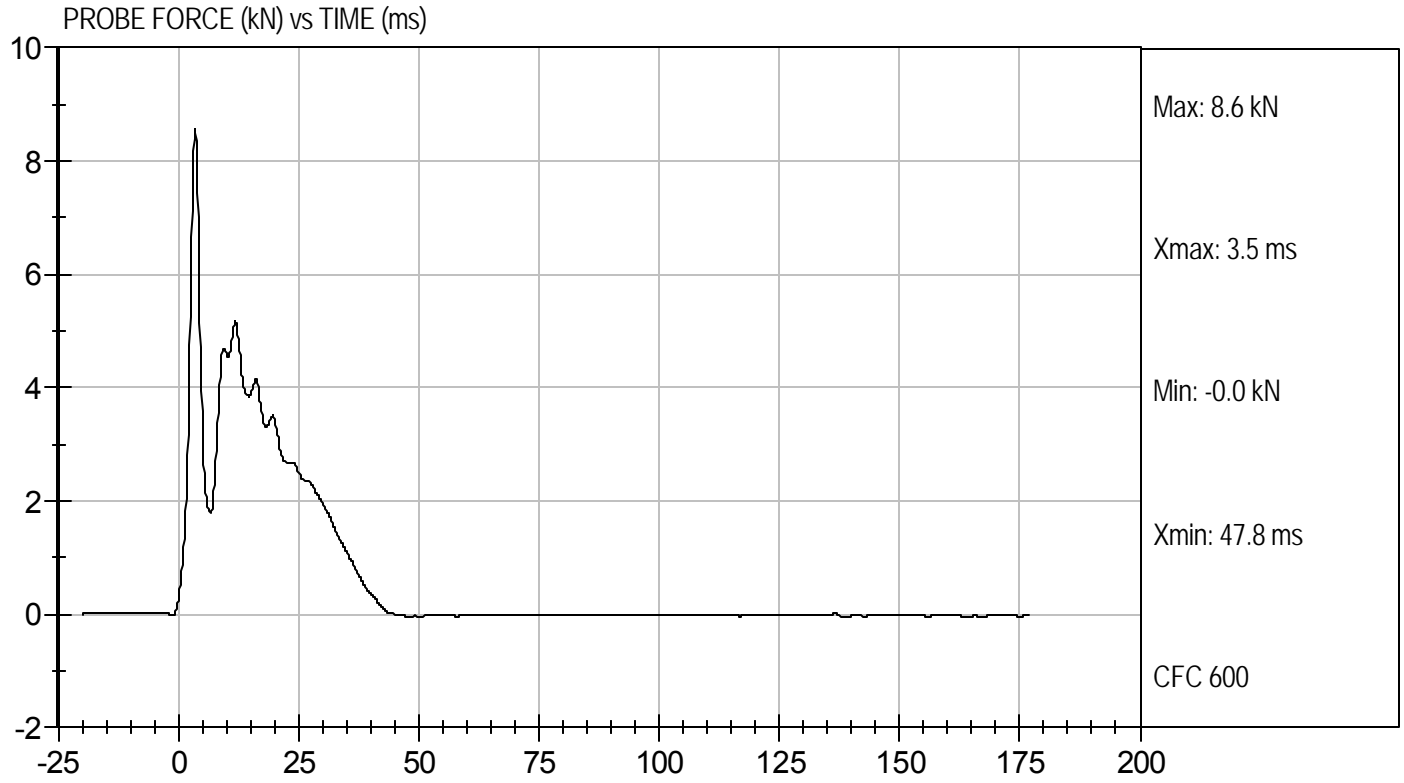
Test I.D: D11590

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Humidity	%	10 to 70	25	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	5.17	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.0	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.4	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.7	Pass
Overall Test Results				Pass

Jessica Hall
 Laboratory Technician

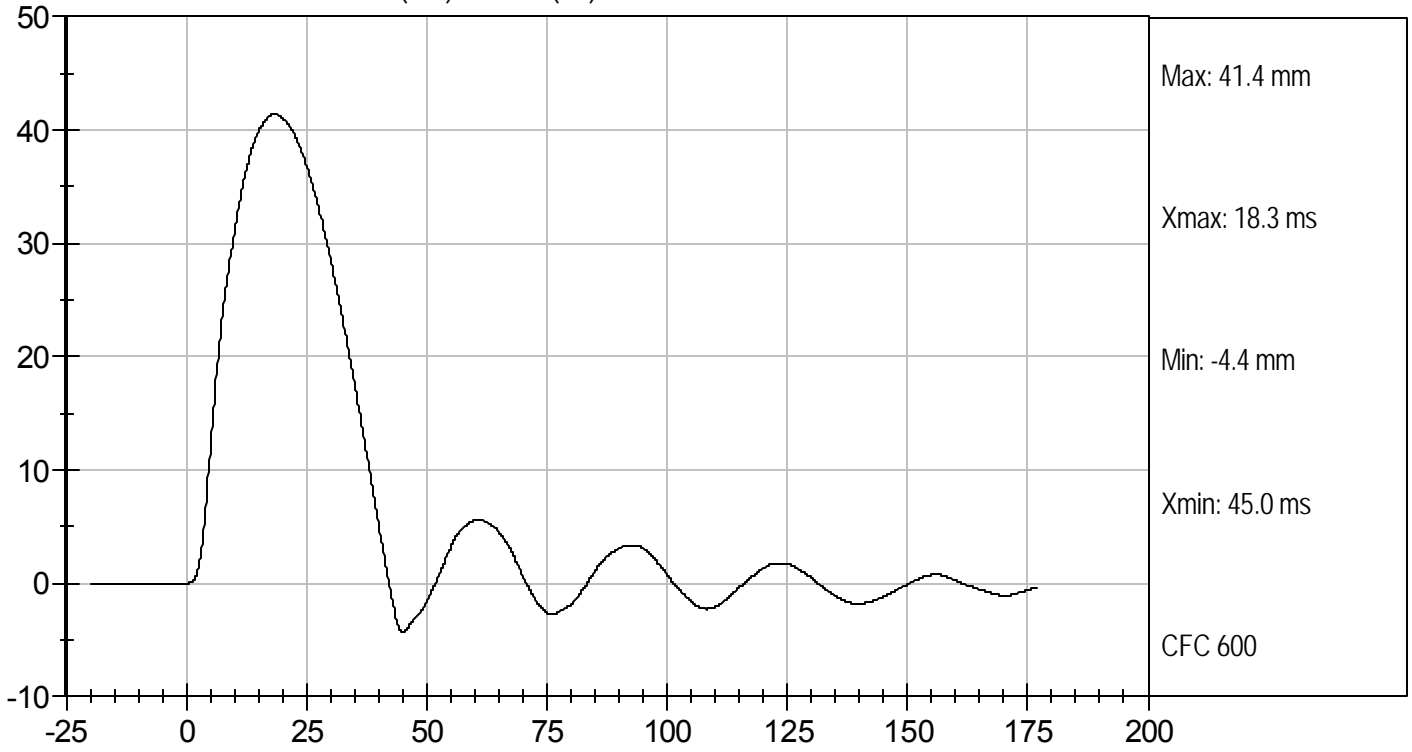
2/18/11
 Test Date

David Winkelbauer
 Approved By

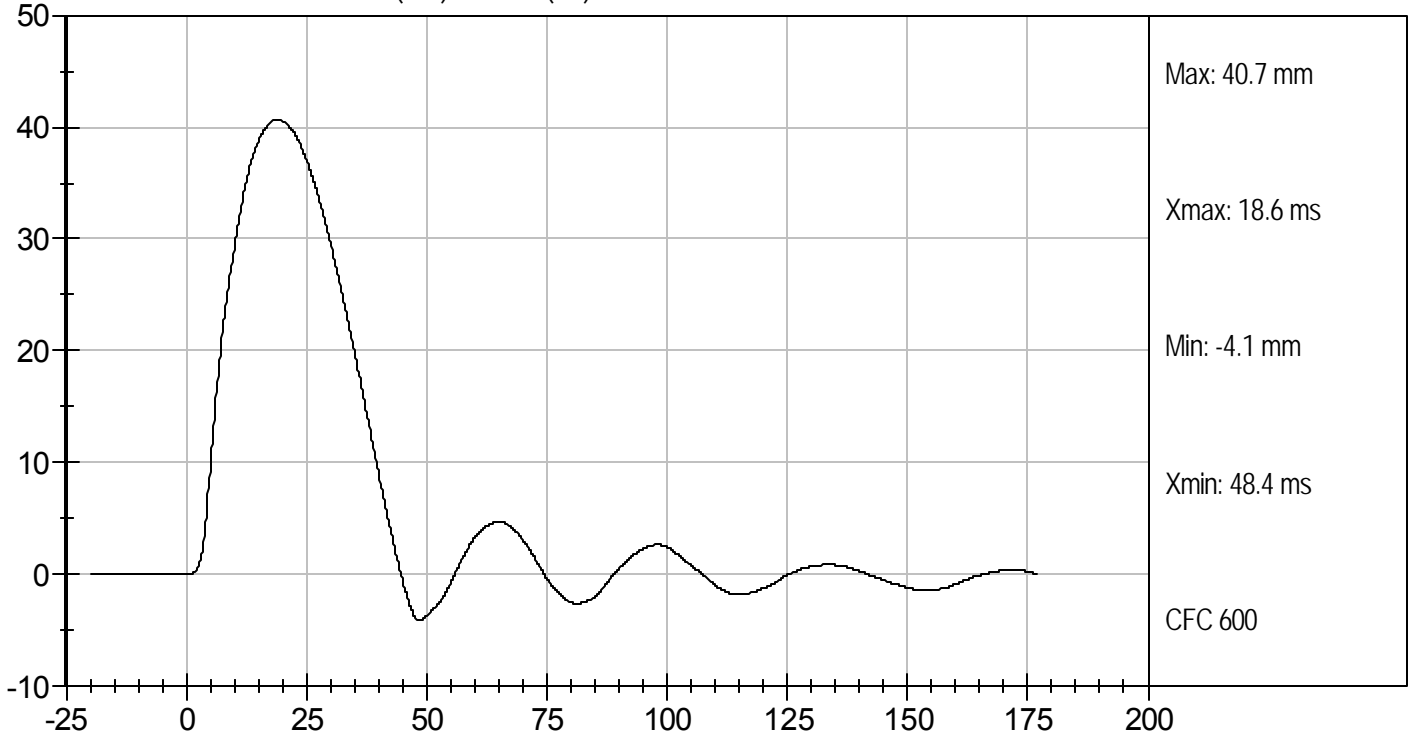




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION
HEAD DROP TEST
ES-2re DUMMY

ATD Serial No: 016

Test ID: D11871

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	125 to 155	148	Pass
Peak Lateral Acceleration	G's	+/- 15	-10.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

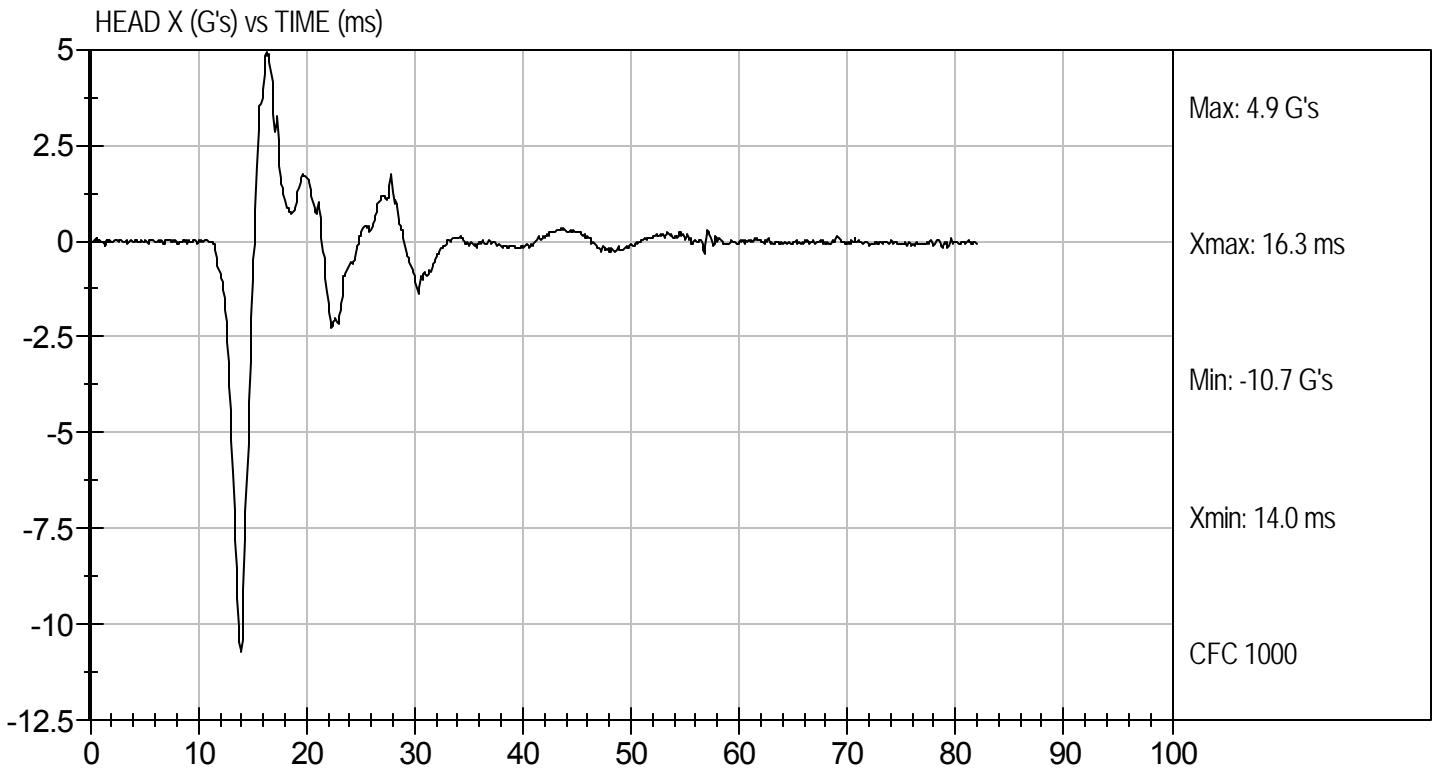
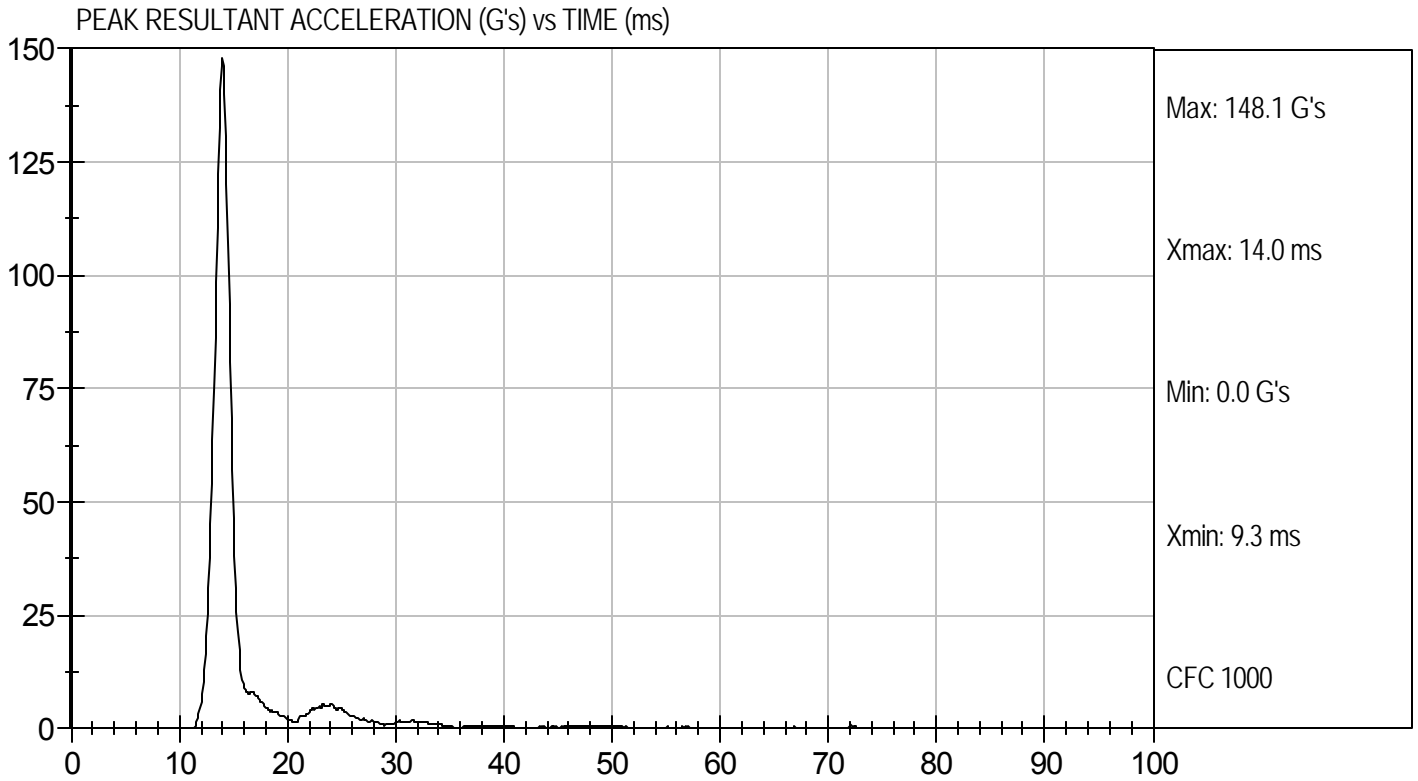
3/7/11
Test Date

David Winkelbauer
Approved By



Test Desc: Head Drop
Component ID: D11871

Test Date: 3/7/11
Velocity: 0 ft/s, 0 m/s



**MGA RESEARCH CORPORATION
NECK PENDULUM TEST
ES-2re DUMMY**

ATD Serial No: 016

Test I.D: D11872

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	22	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	-3.35	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	62.3	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	56.1	Pass
Overall Test Results					Pass

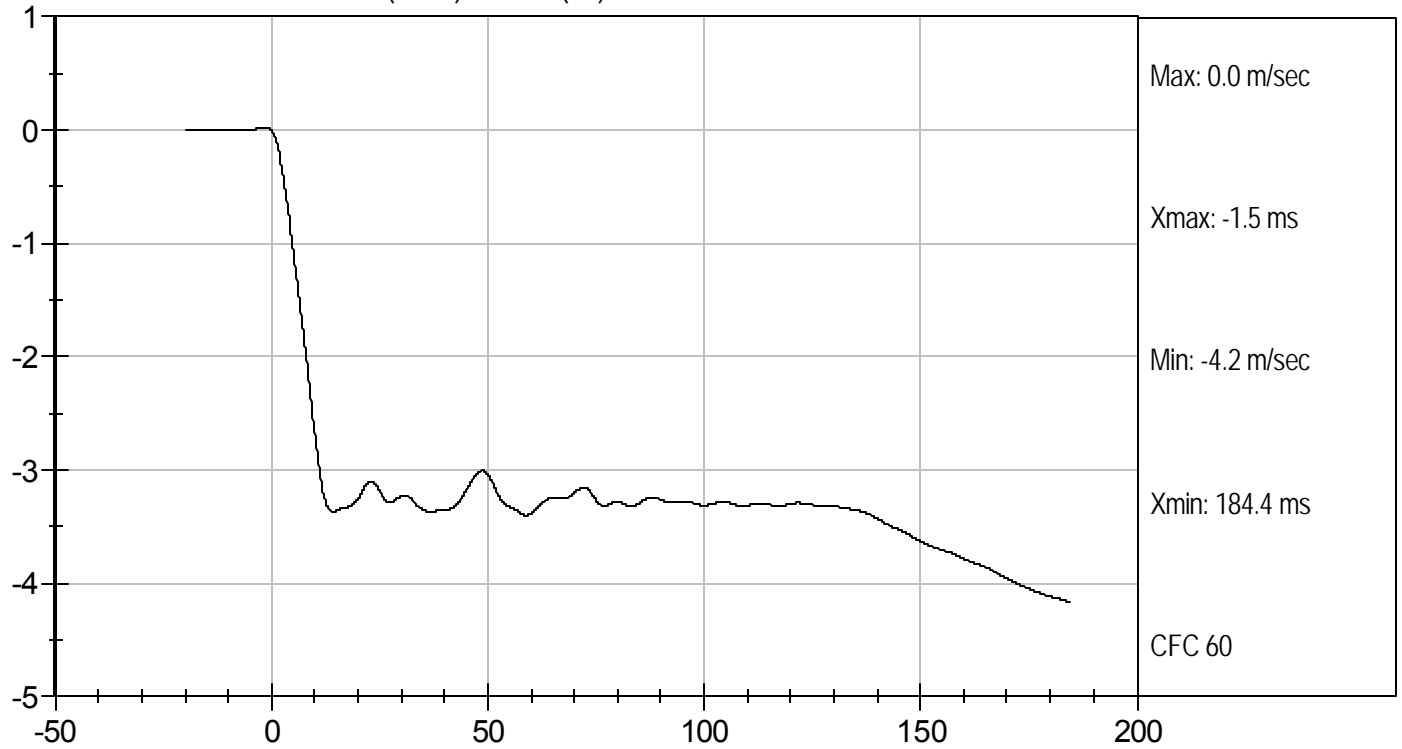
Jessica Hall
Laboratory Technician

3/7/11
Test Date

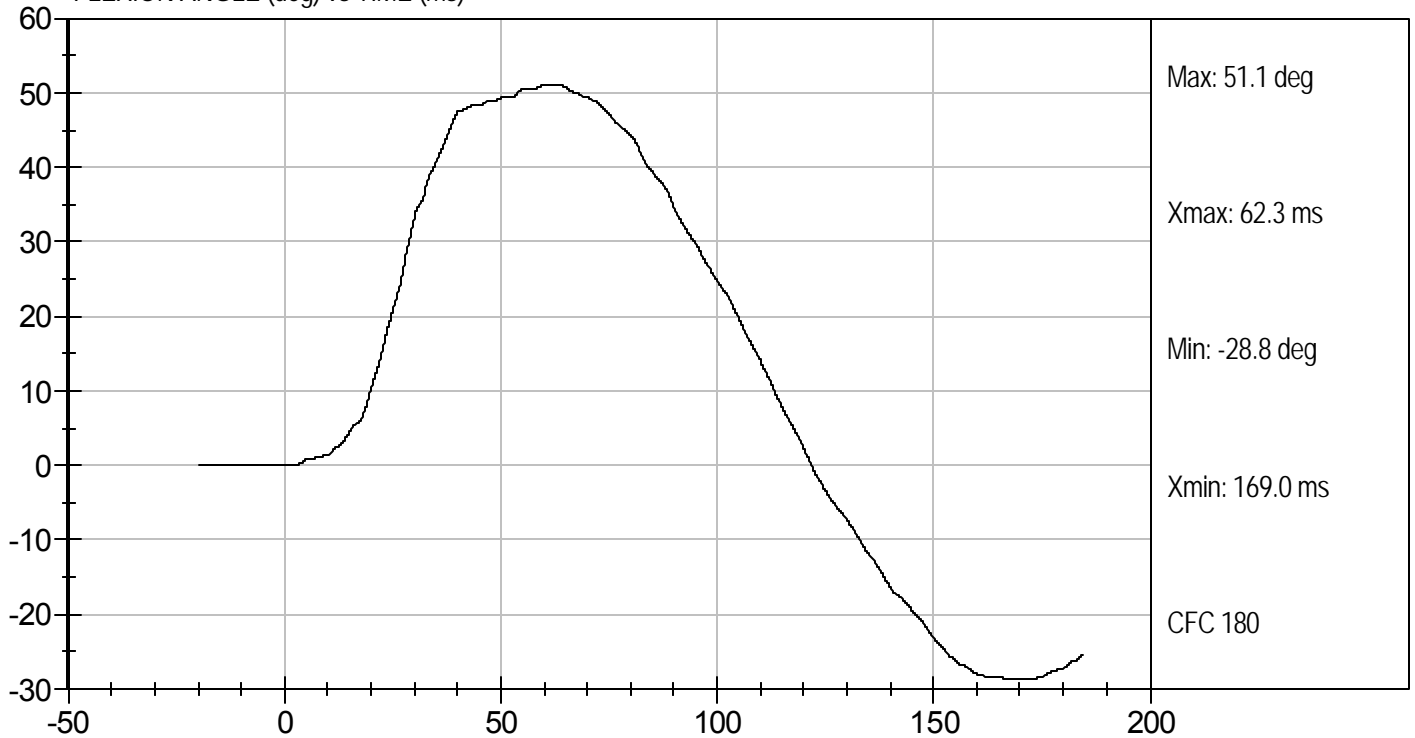
David Winkelbauer
Approved By



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



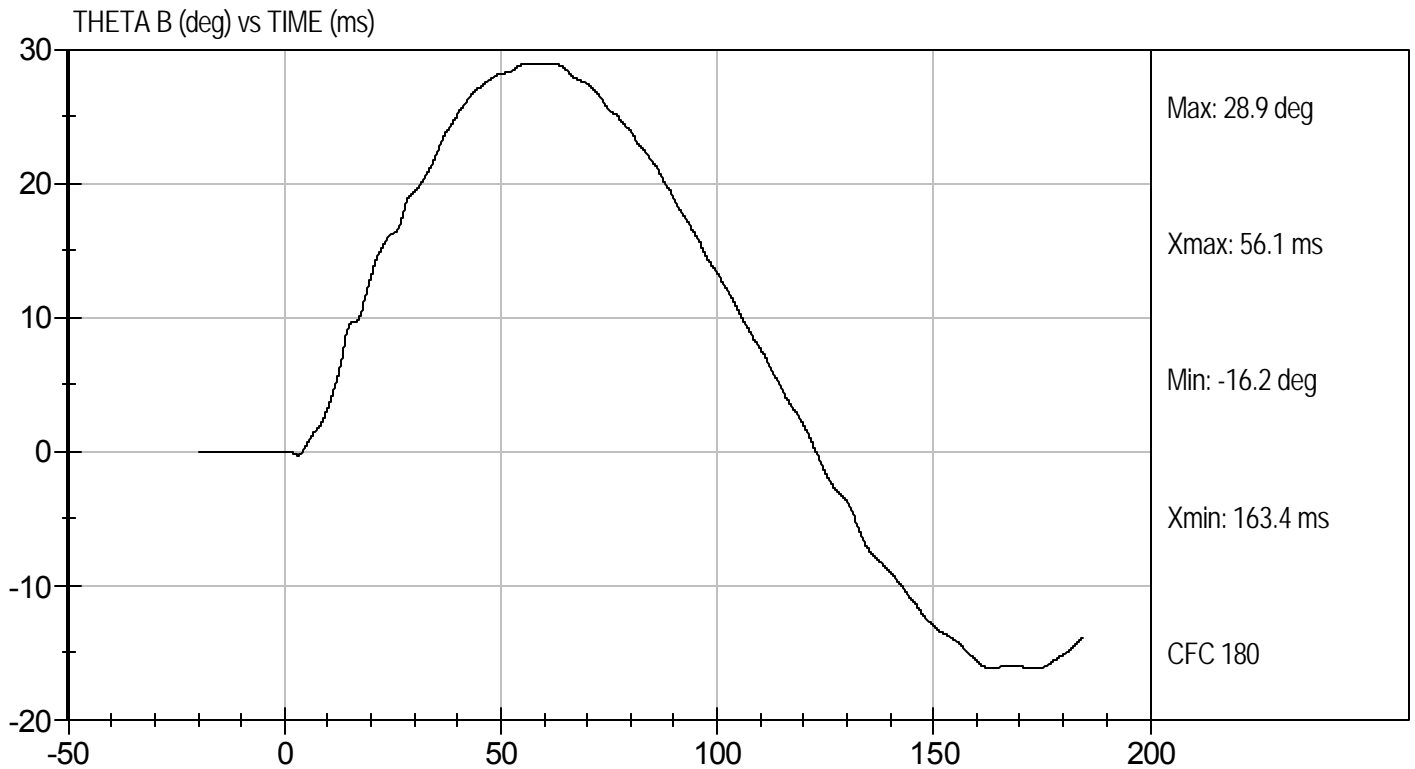
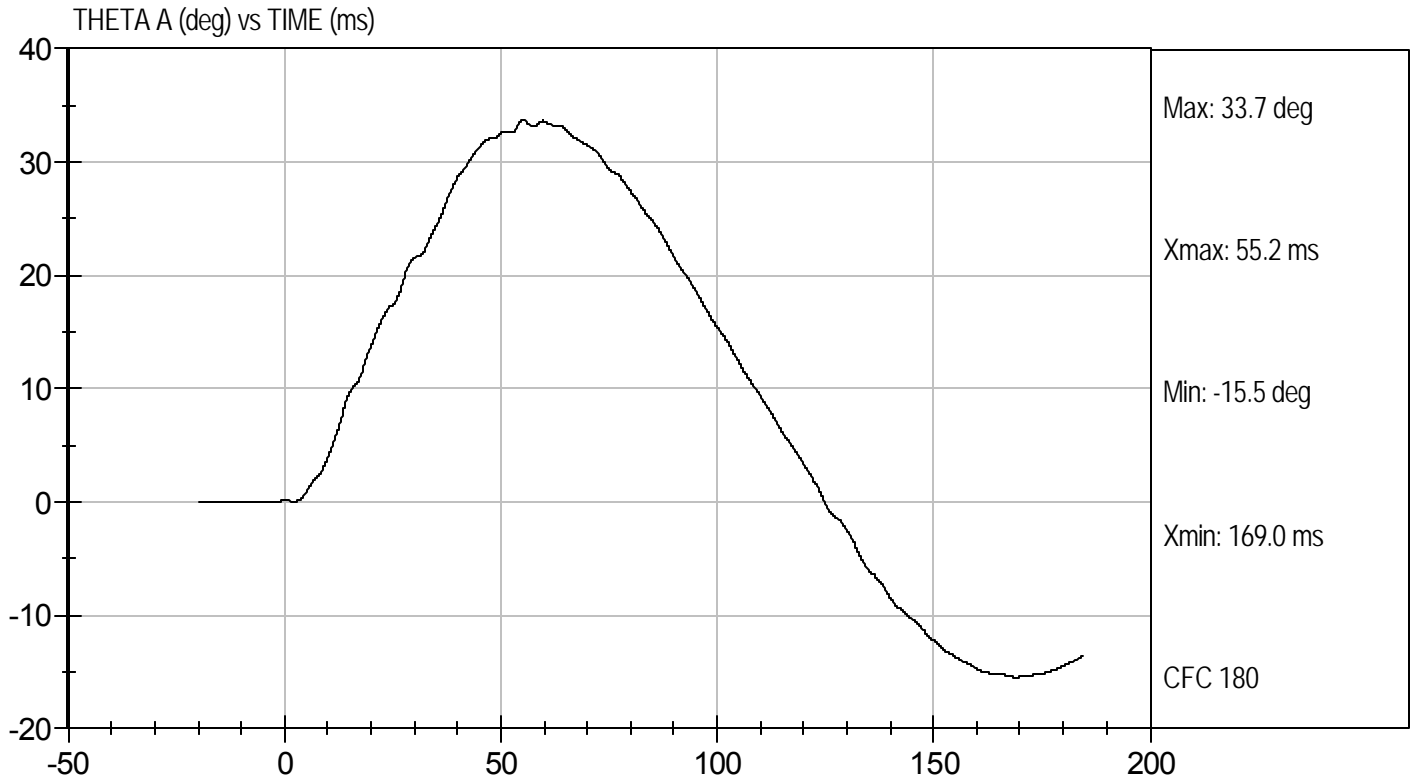
FLEXION ANGLE (deg) vs TIME (ms)





Test Desc: Neck Bending
Component ID: D11872

Test Date: 3/7/11
Velocity: 11.34 ft/s, 3.46 m/s



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
ES-2re DUMMY

ATD Serial No: 016

Test I.D.: D11873


Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	8.4	Pass
Time of Peak Shoulder Acceleration	ms	NA	13.1	Pass
Overall Test Results				Pass



 Laboratory Technician

3/7/11

 Test Date

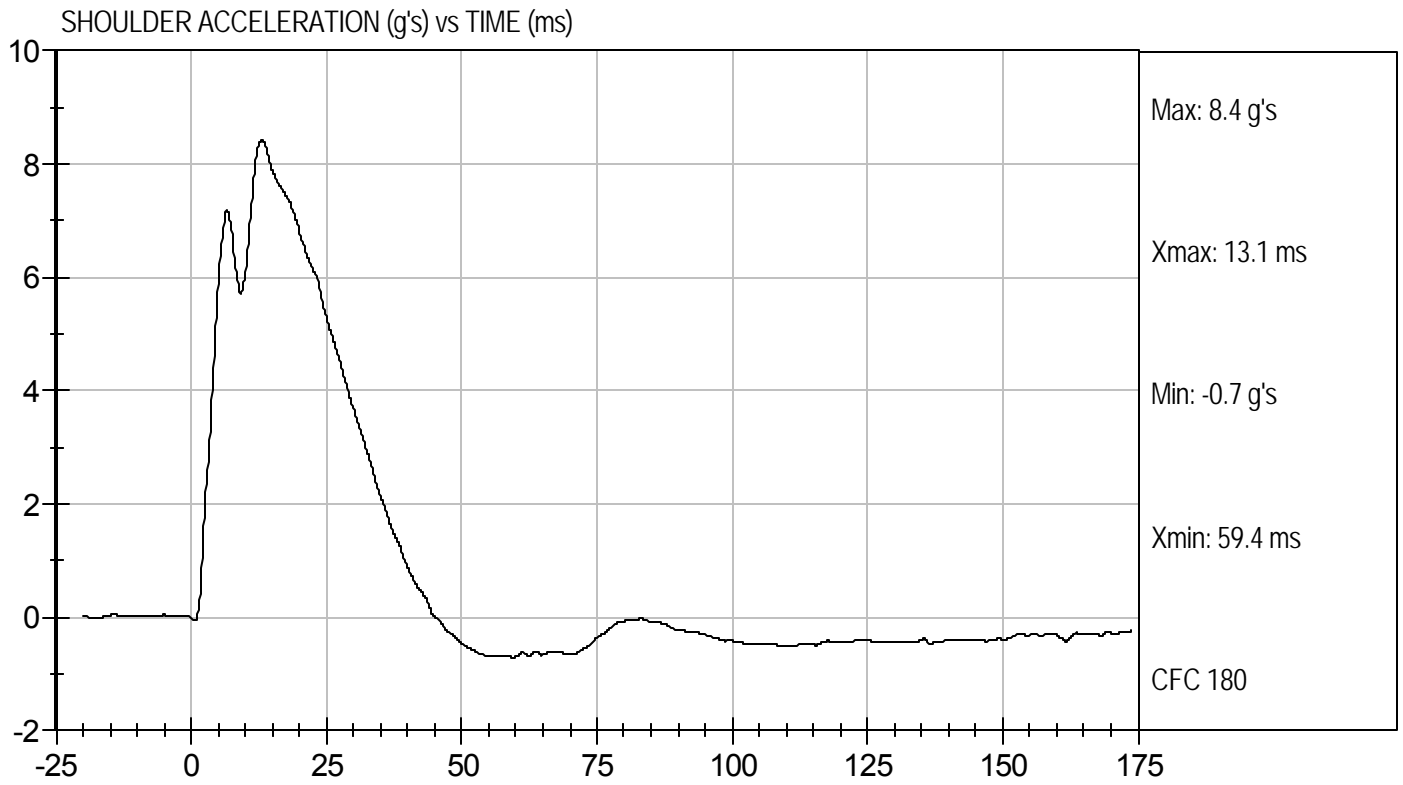


 Approved By



Test Desc: Shoulder Impact
Component ID: D11873

Test Date: 3/7/11
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: D11874

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	22	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	49.3	Pass
Overall Test Results				Pass

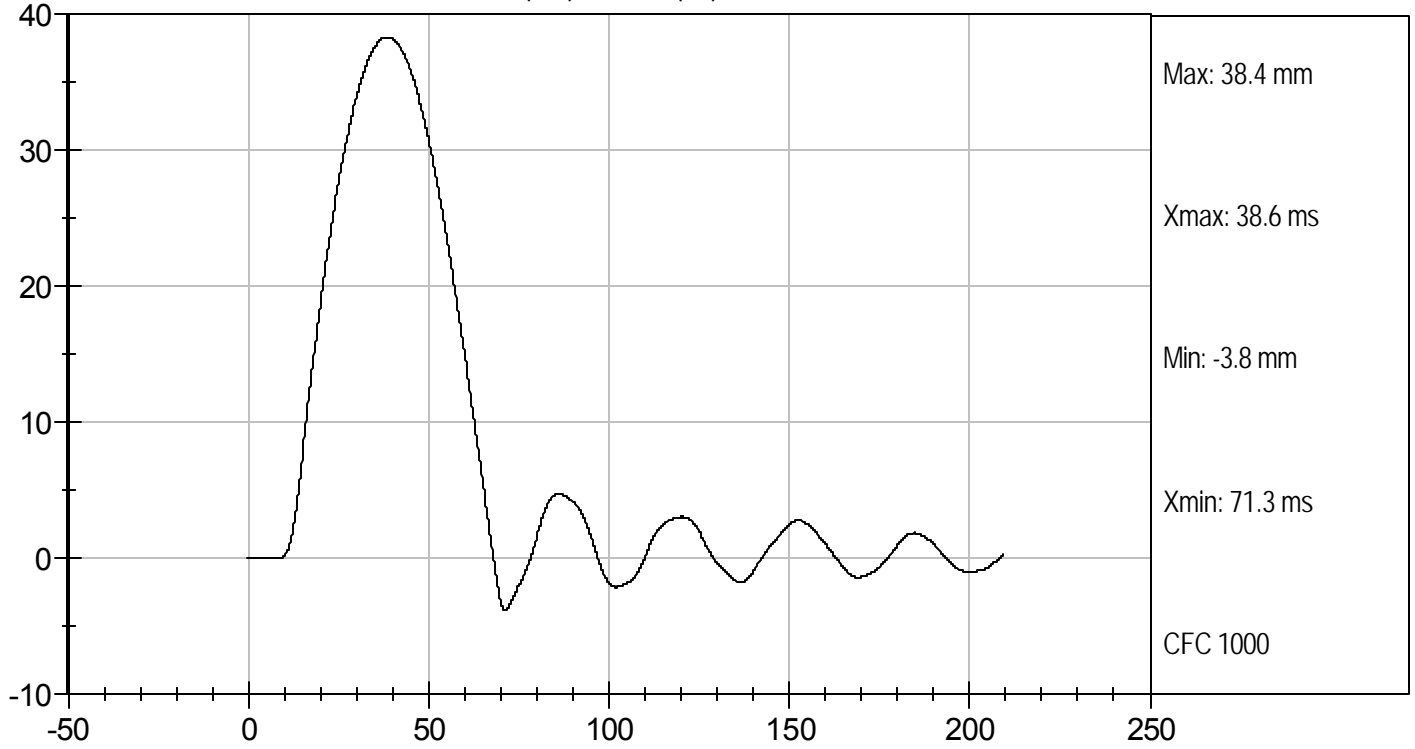
Jessica Hall
Laboratory Technician

3/7/11
Test Date

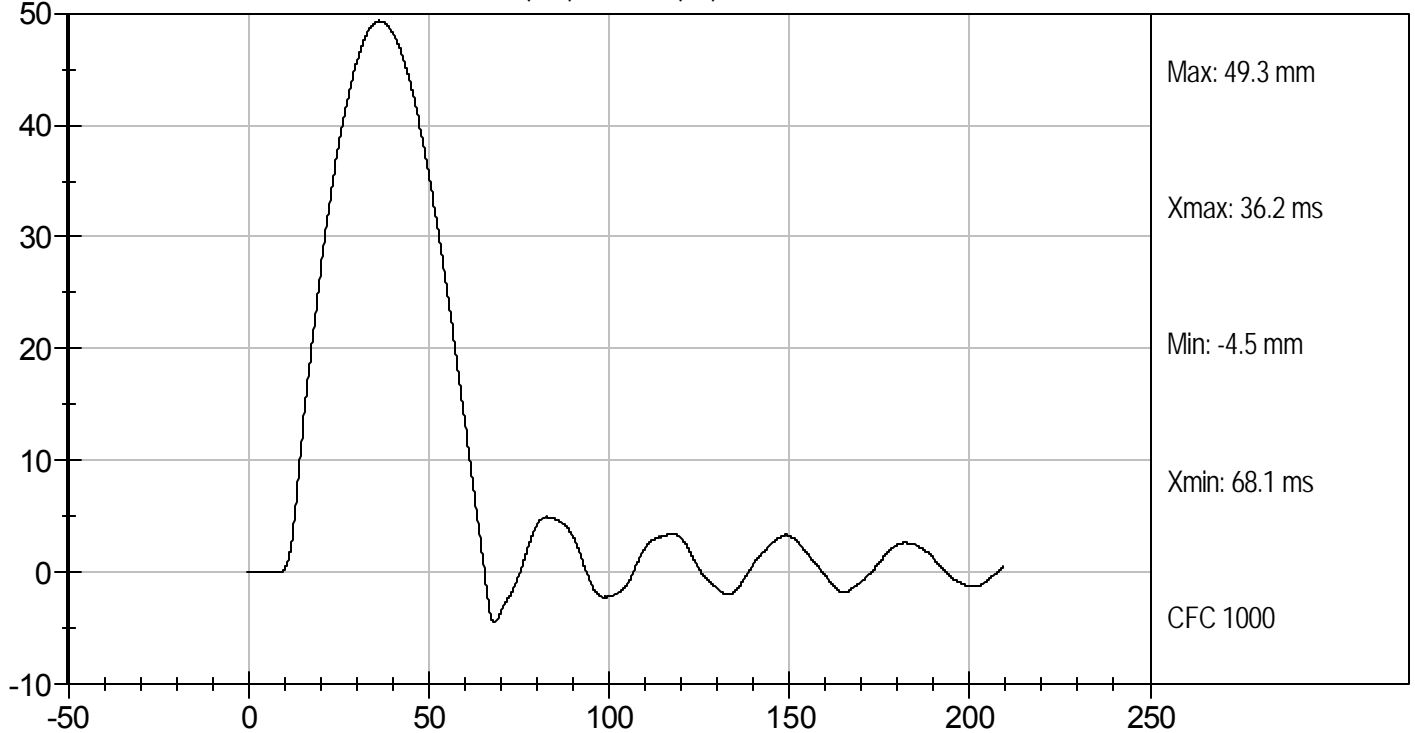
David Winkelbauer
Approved By



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

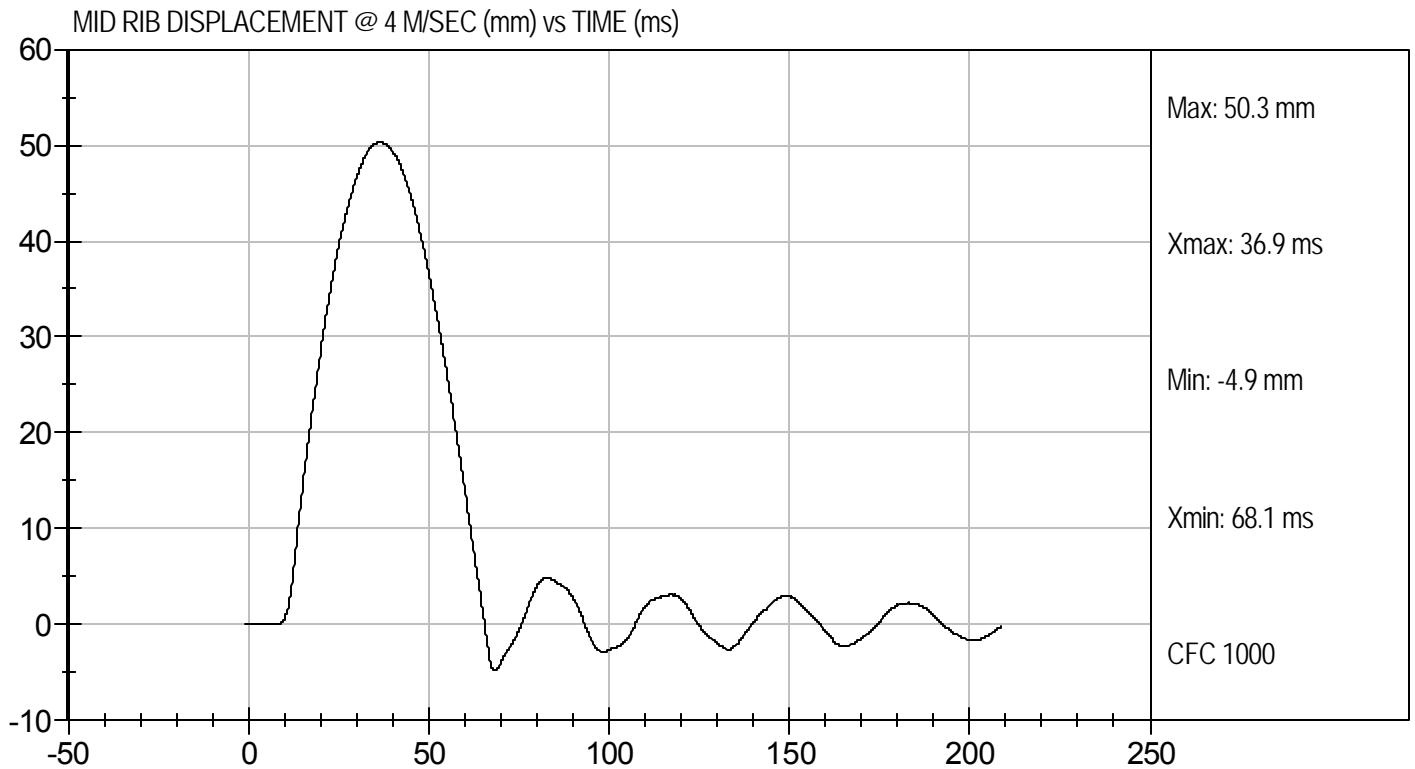
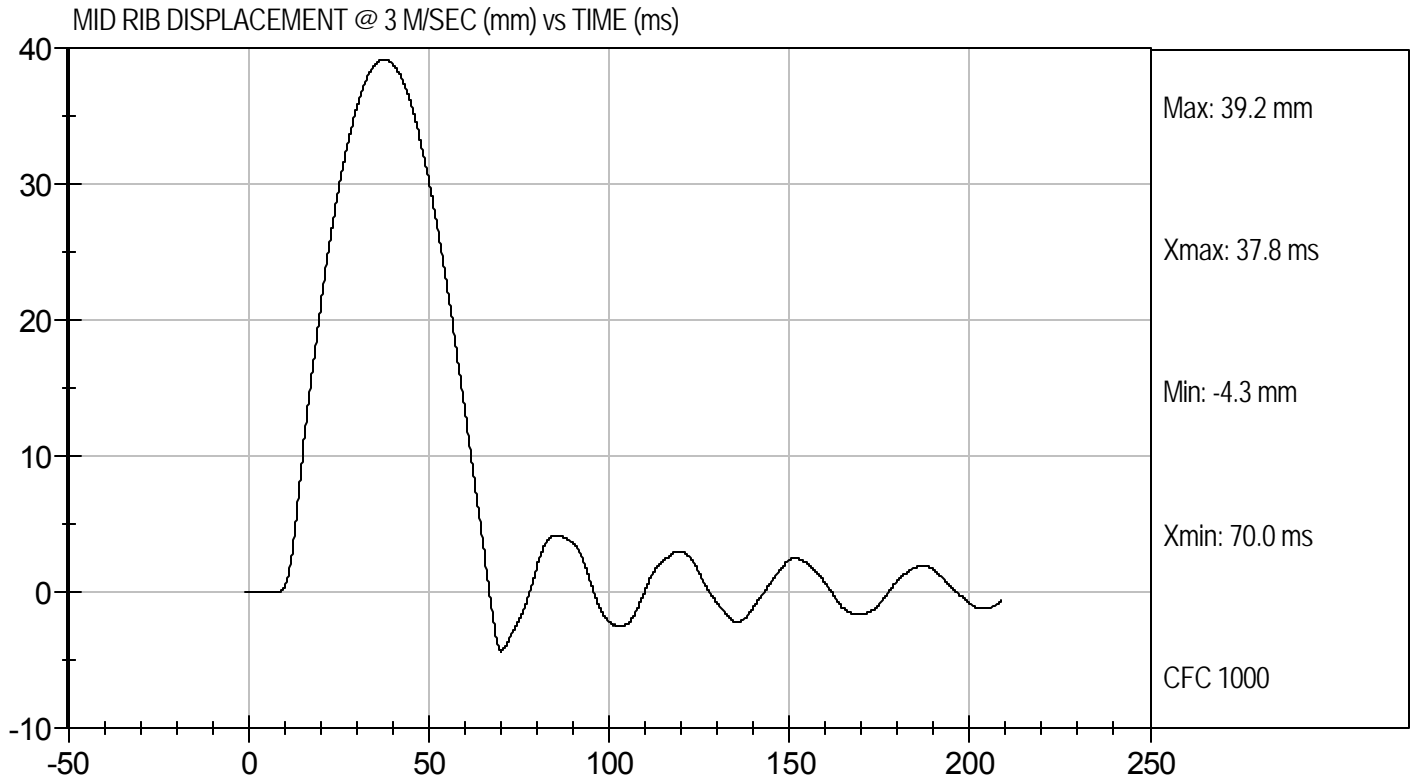
Test I.D: D11875

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	22	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	50.3	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

3/7/11
Test Date

David Winkelbauer
Approved By



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 016

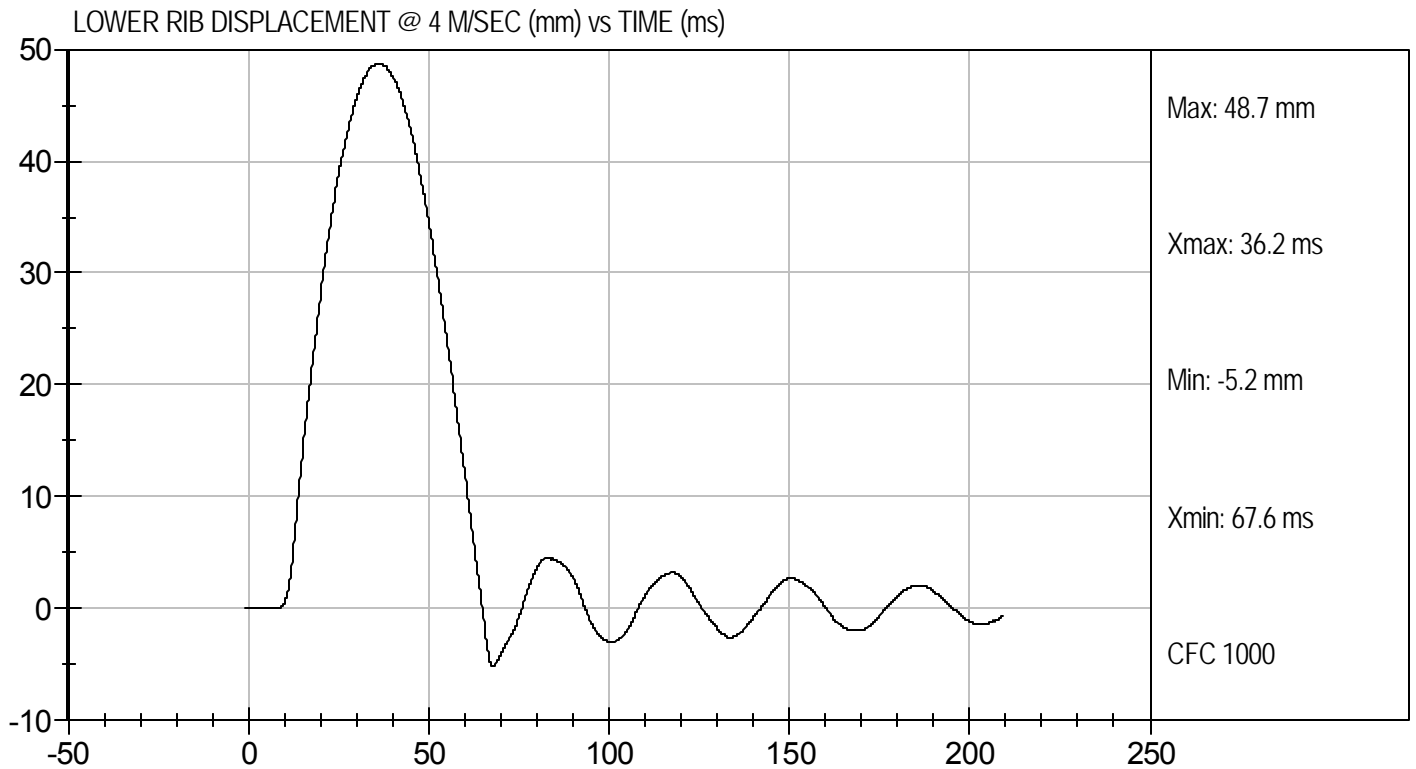
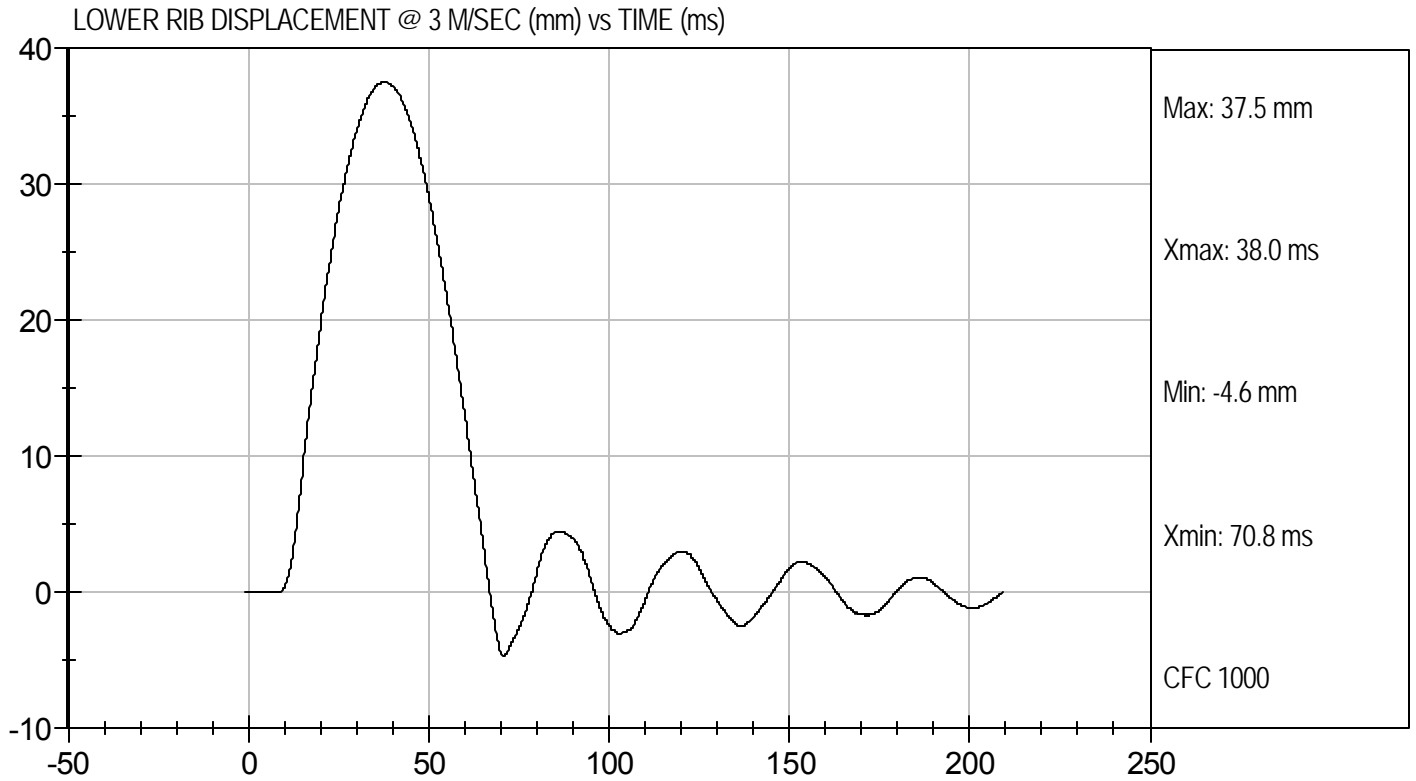
Test I.D: D11876

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	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	48.7	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

3/7/11
Test Date

David Winkelbauer
Approved By



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 016

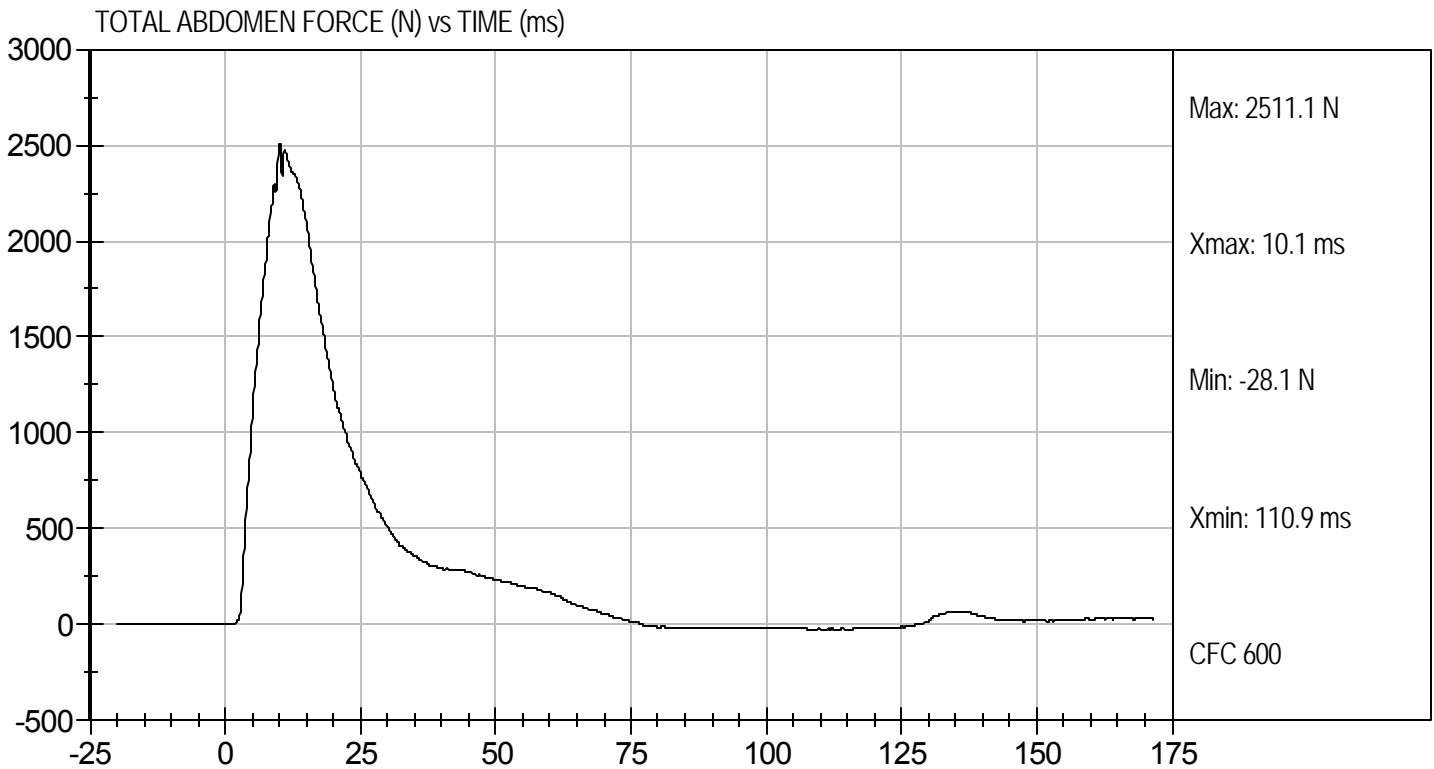
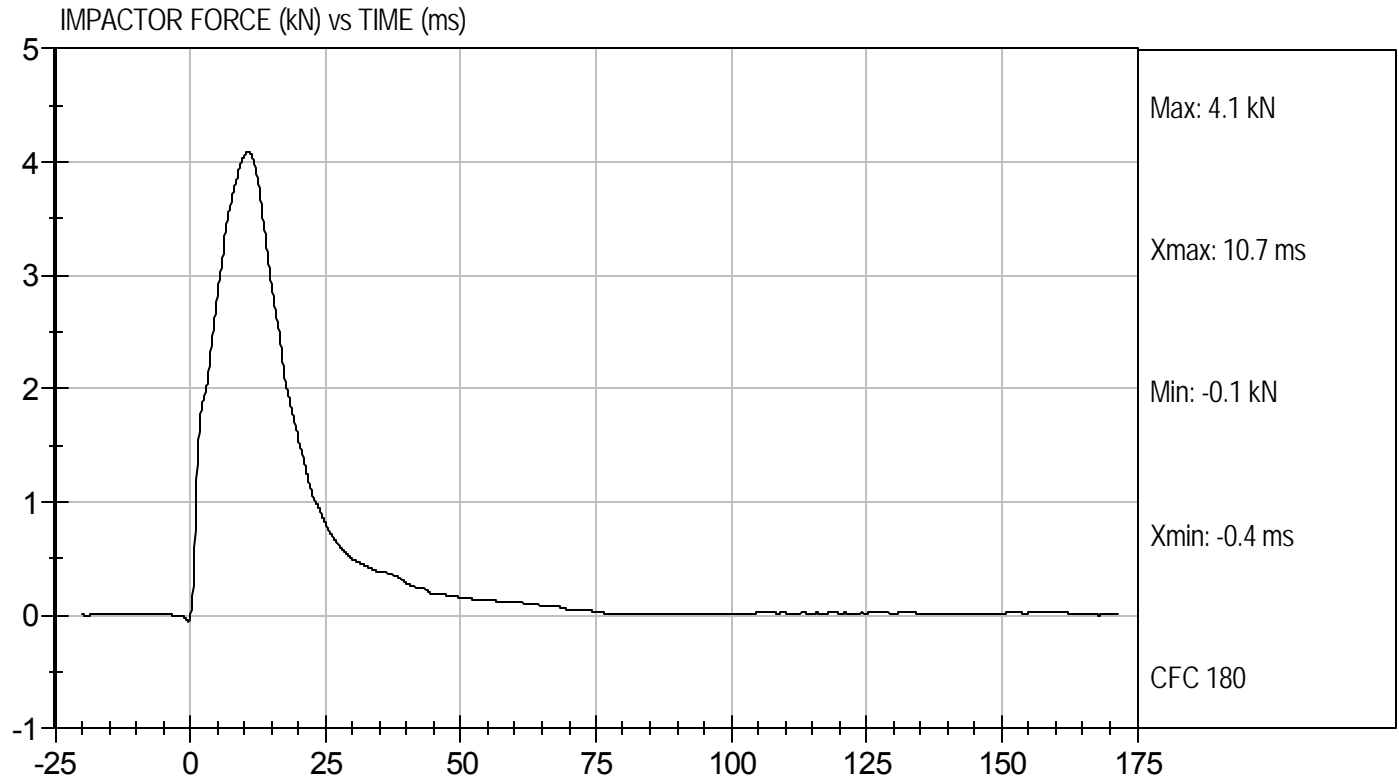
Test I.D: D11877

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Speed	m/s	3.90 to 4.10	4.03	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.09	Pass
Time of Maximum Impact Force	ms	10.60 to 13.00	10.70	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.51	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.10	Pass
Overall Test Results				Pass

Jessica Gall
Laboratory Technician

3/8/11
Test Date

David Winkelbauer
Approved By



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
ES-2re DUMMY

ATD Serial No: 016

Test I.D.: D11878

Tested Parameter	Units	Specification			
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass	
Laboratory Relative Humidity	%	10 to 70	21	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	-0.28	Pass
	27 ms	m/s	-6.50 to -5.80	-5.84	Pass
	30 ms	m/s	>= -6.5	-5.97	Pass
Maximum Flexion Angle	deg	45.0 to 55.0	49.6	Pass	
Time of Maximum Flexion Angle	ms	39.0 to 53.0	45.8	Pass	
Headform Rotation Decay to Initial Position	ms	37 to 57	45	Pass	
Overall Results				Pass	



 Laboratory Technician

3/7/11

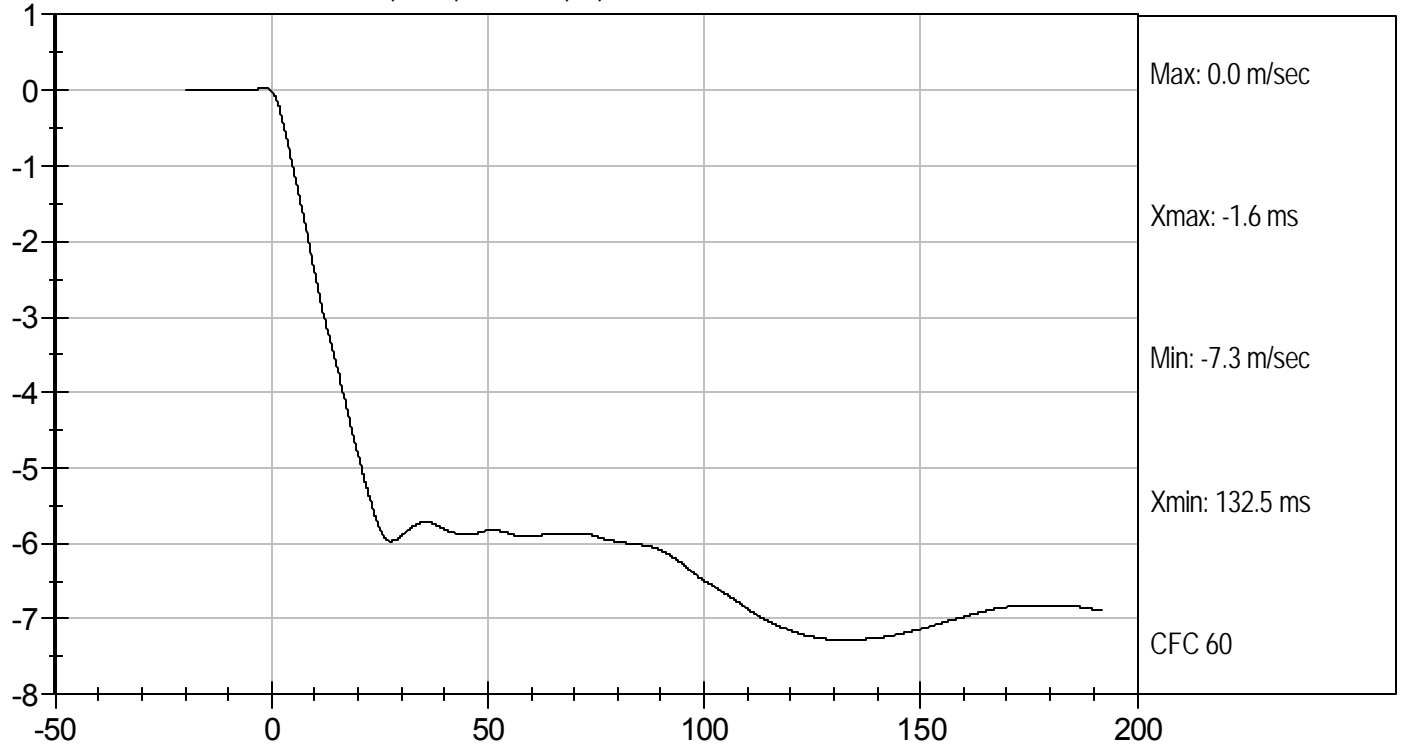
 Test Date



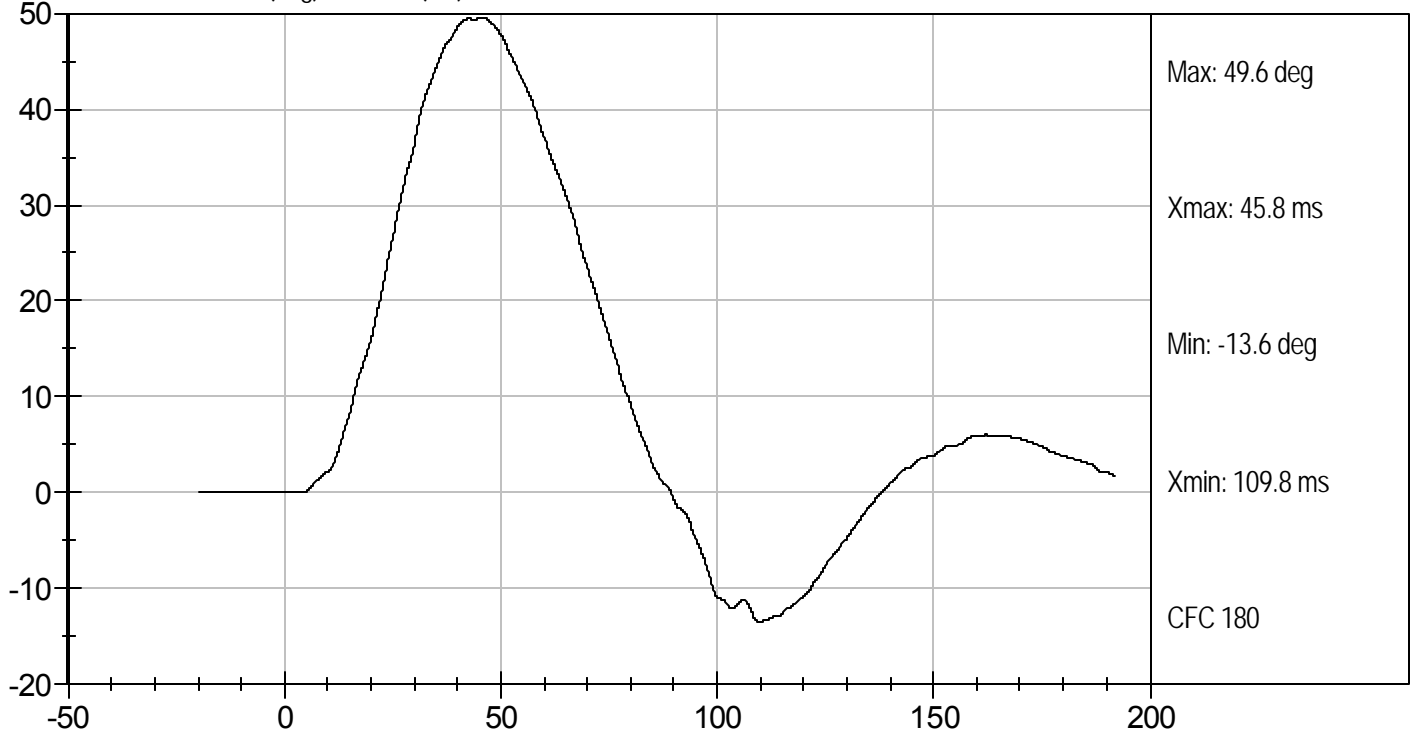
 Approved By



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



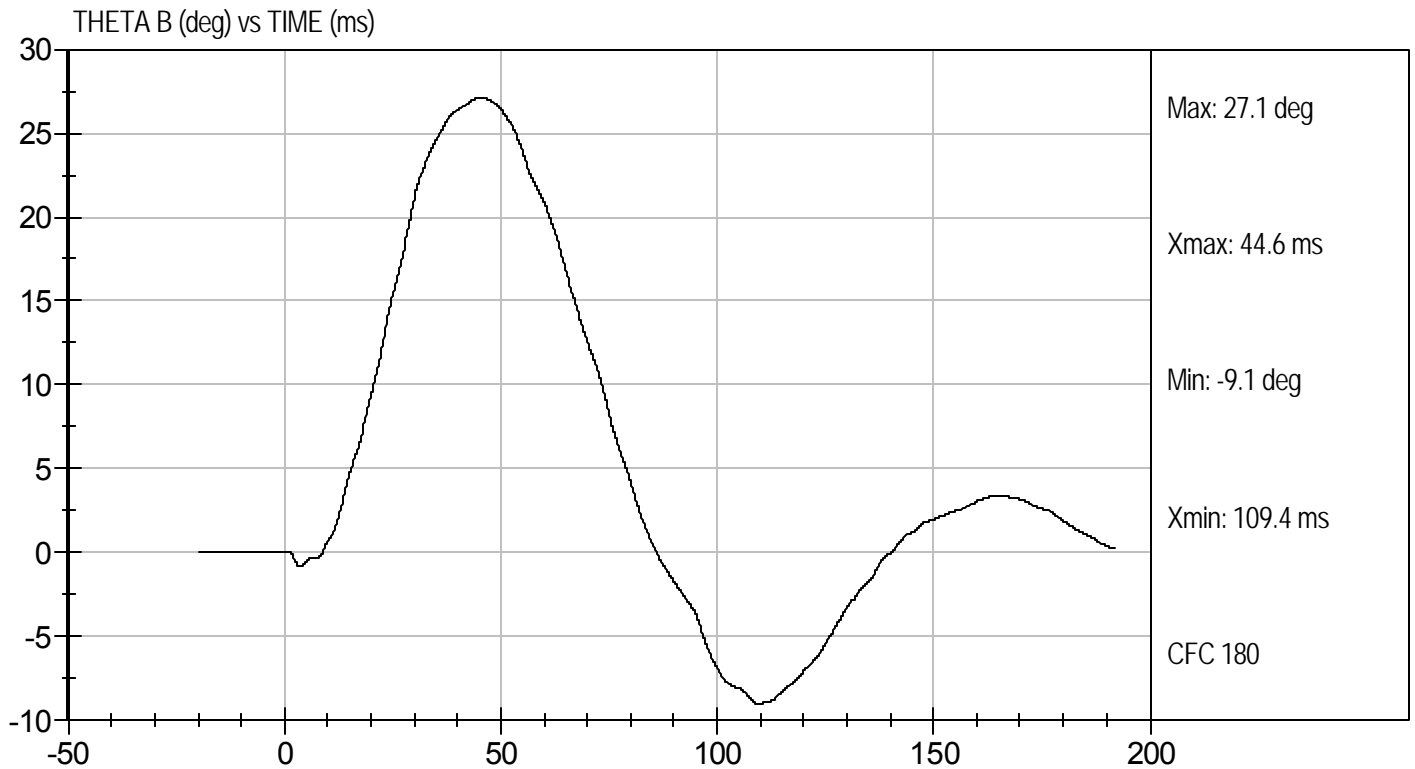
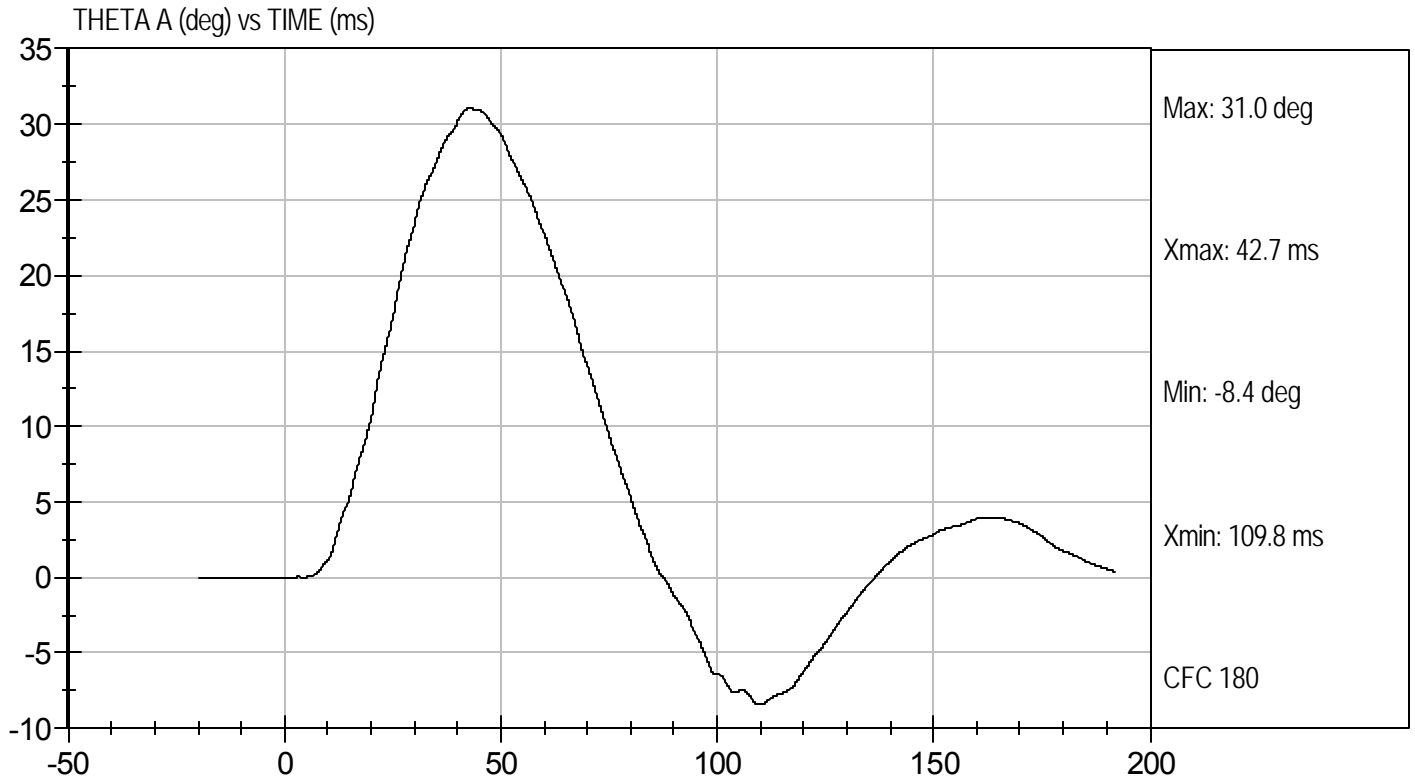
FLEXION ANGLE (deg) vs TIME (ms)





Test Desc: Lumbar Bending
Component ID: D11878

Test Date: 3/7/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

PELVIS TEST
ES-2re DUMMY

ATD Serial No: 016

Test I.D: D11879

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	24	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.86	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.70	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.49	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.10	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

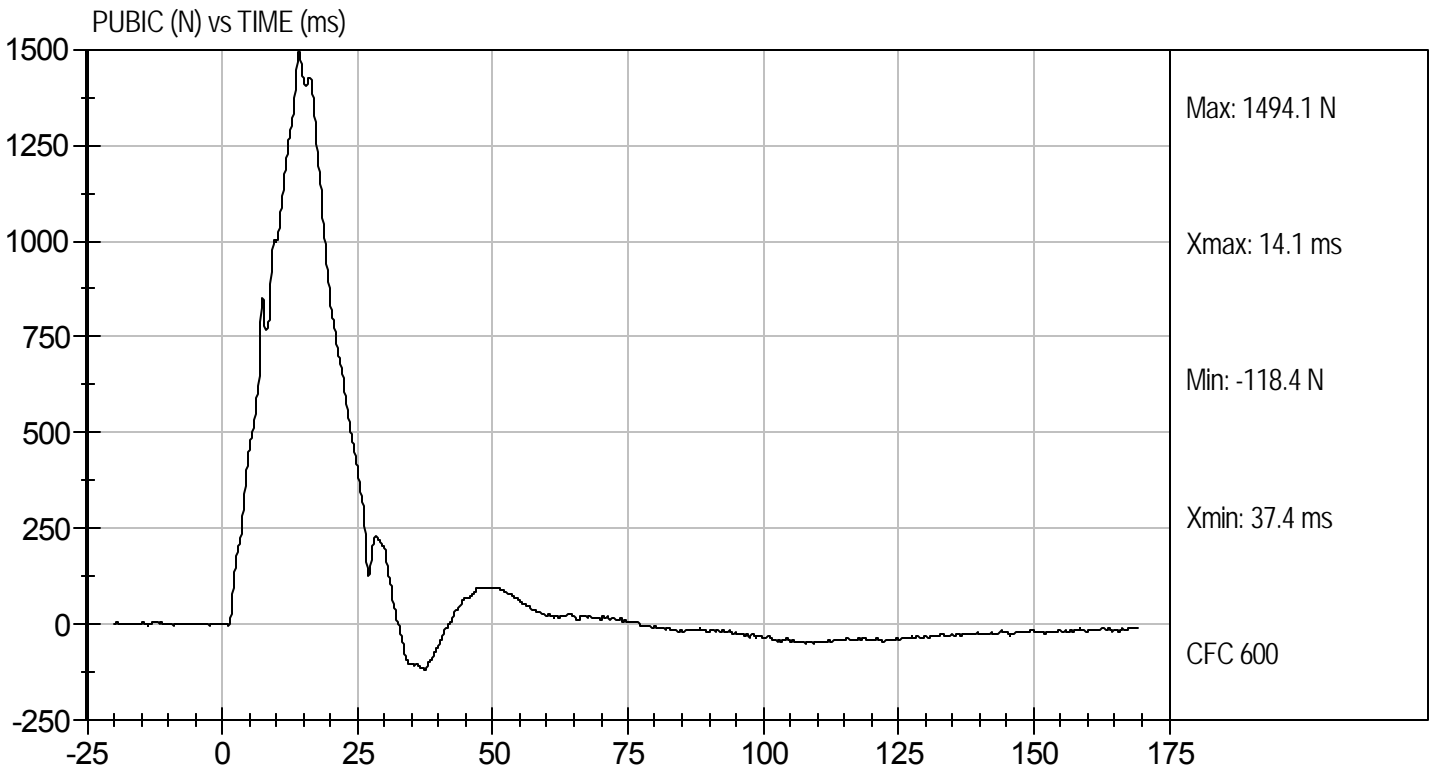
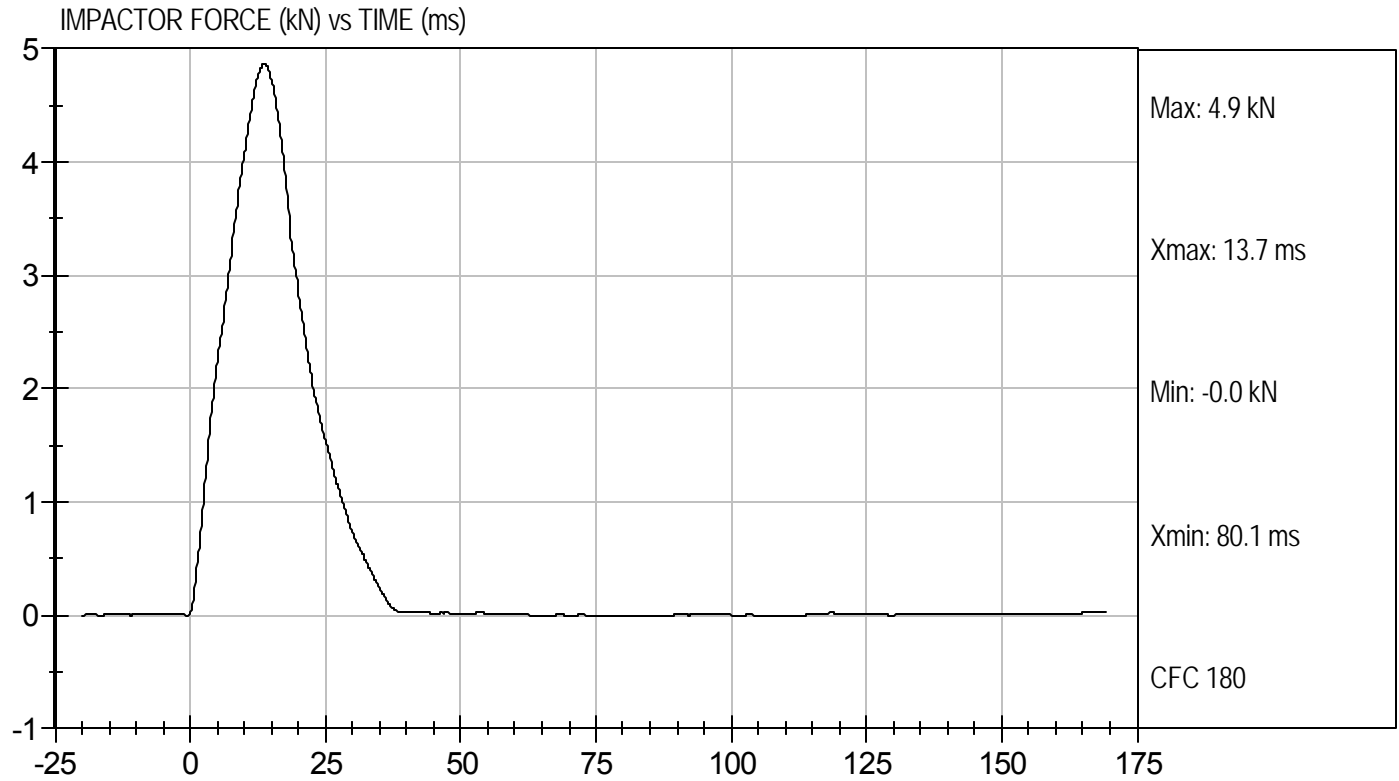
3/8/11
Test Date

David Winkelbauer
Approved By



Test Desc: Pelvis Impact
Component ID: D11879

Test Date: 3/8/11
Velocity: 14.25 ft/s, 4.34 m/s



MGA RESEARCH CORPORATION
FULL BODY THORAX IMPACT TEST
ES-2re DUMMY

ATD Serial No: 016

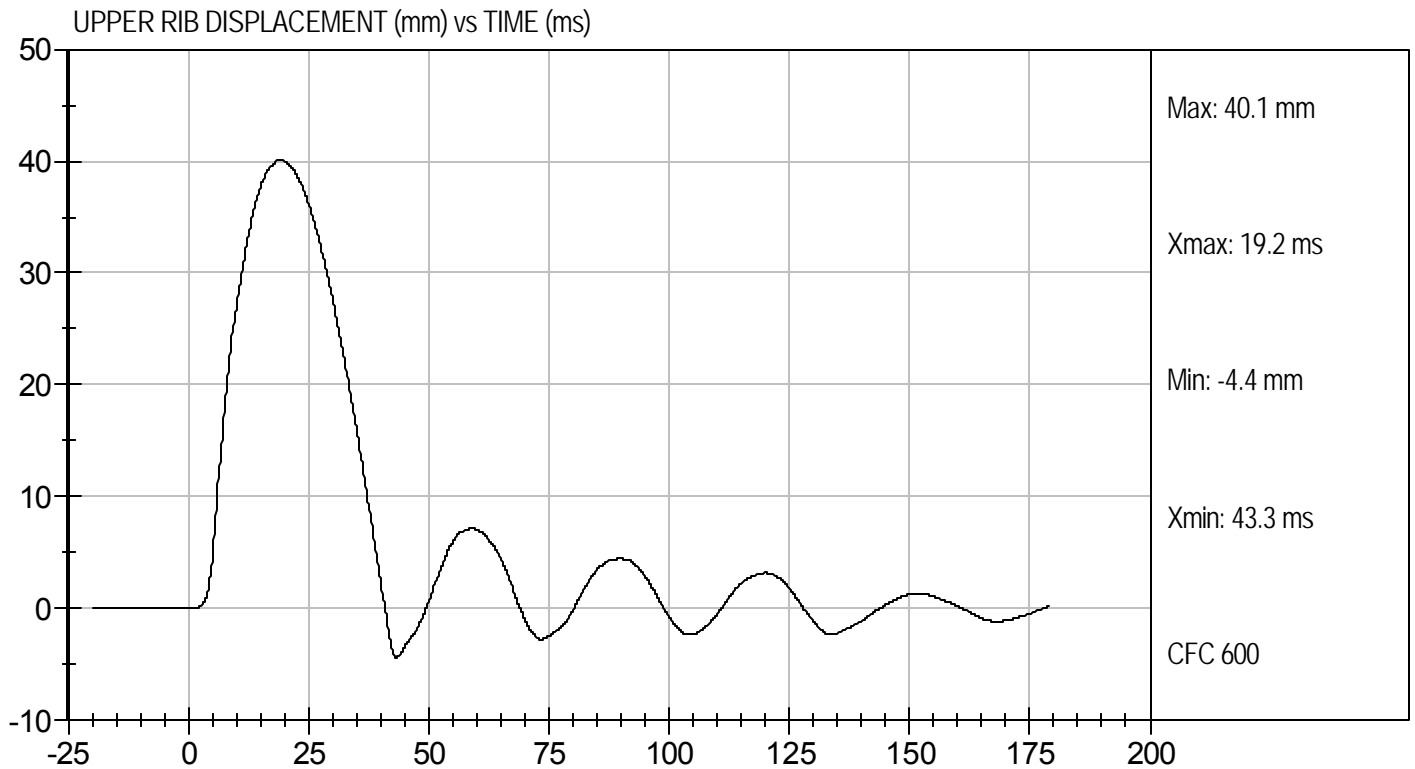
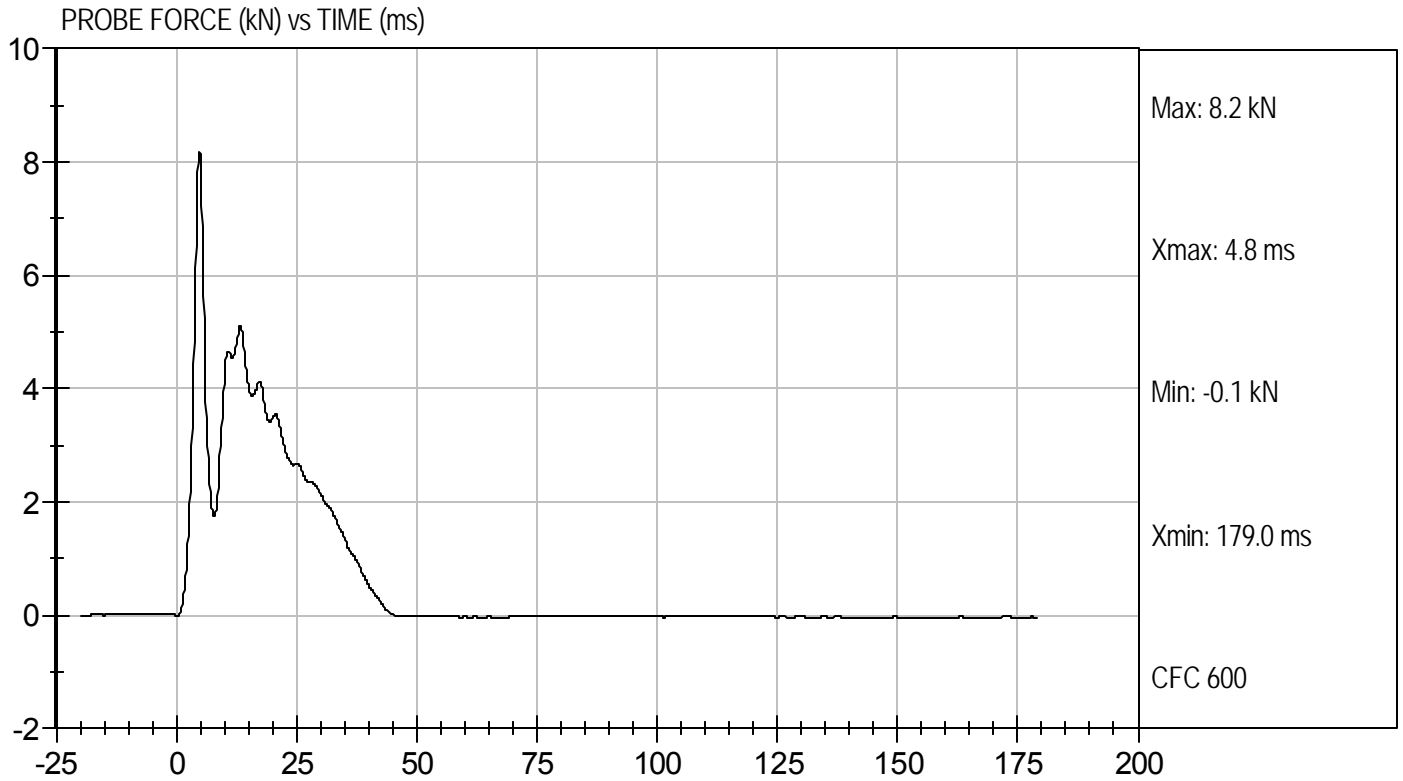
Test I.D: D11870

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	24	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	5.12	Pass
Upper Rib Displacement	mm	34.0 to 41.0	40.1	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.8	Pass
Lower Rib Displacement	mm	37.0 to 44.0	39.9	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

3/8/11
Test Date

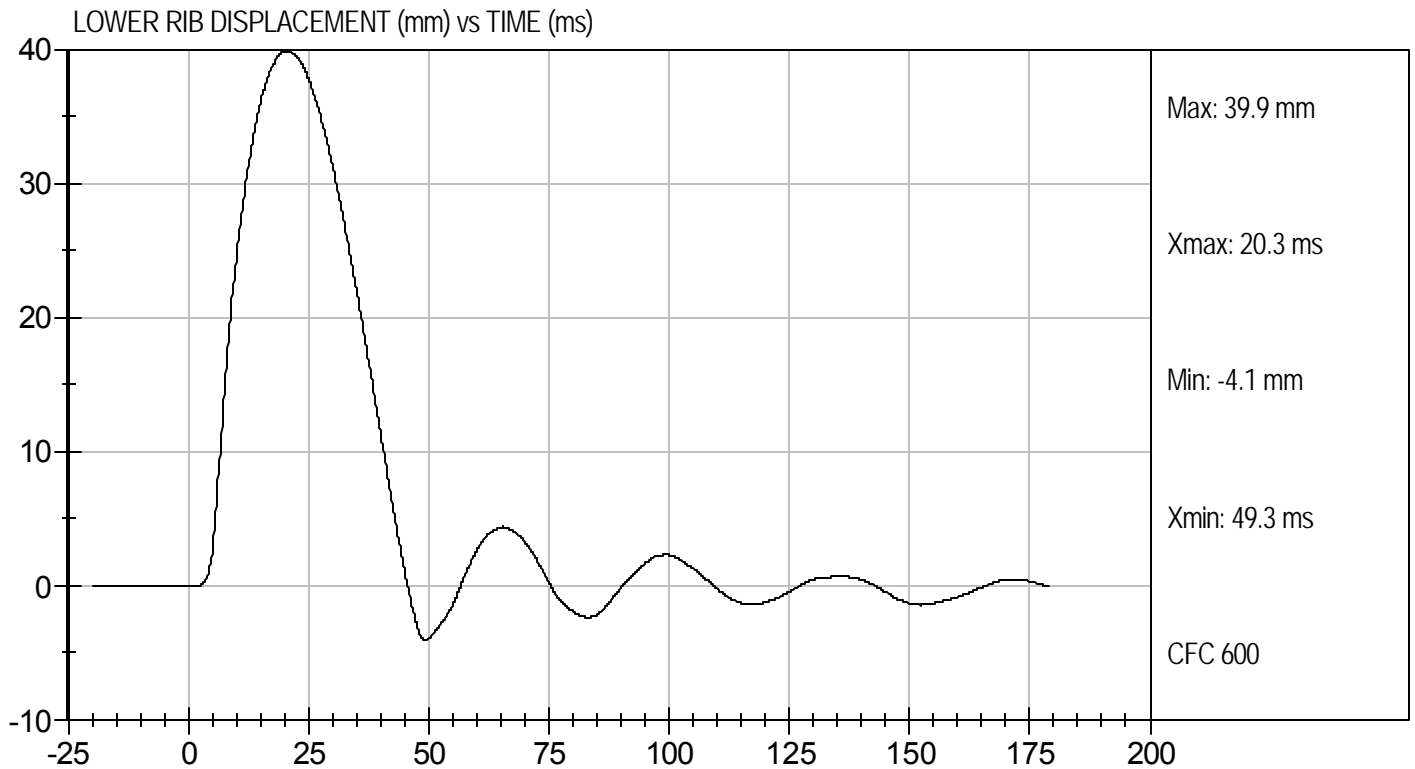
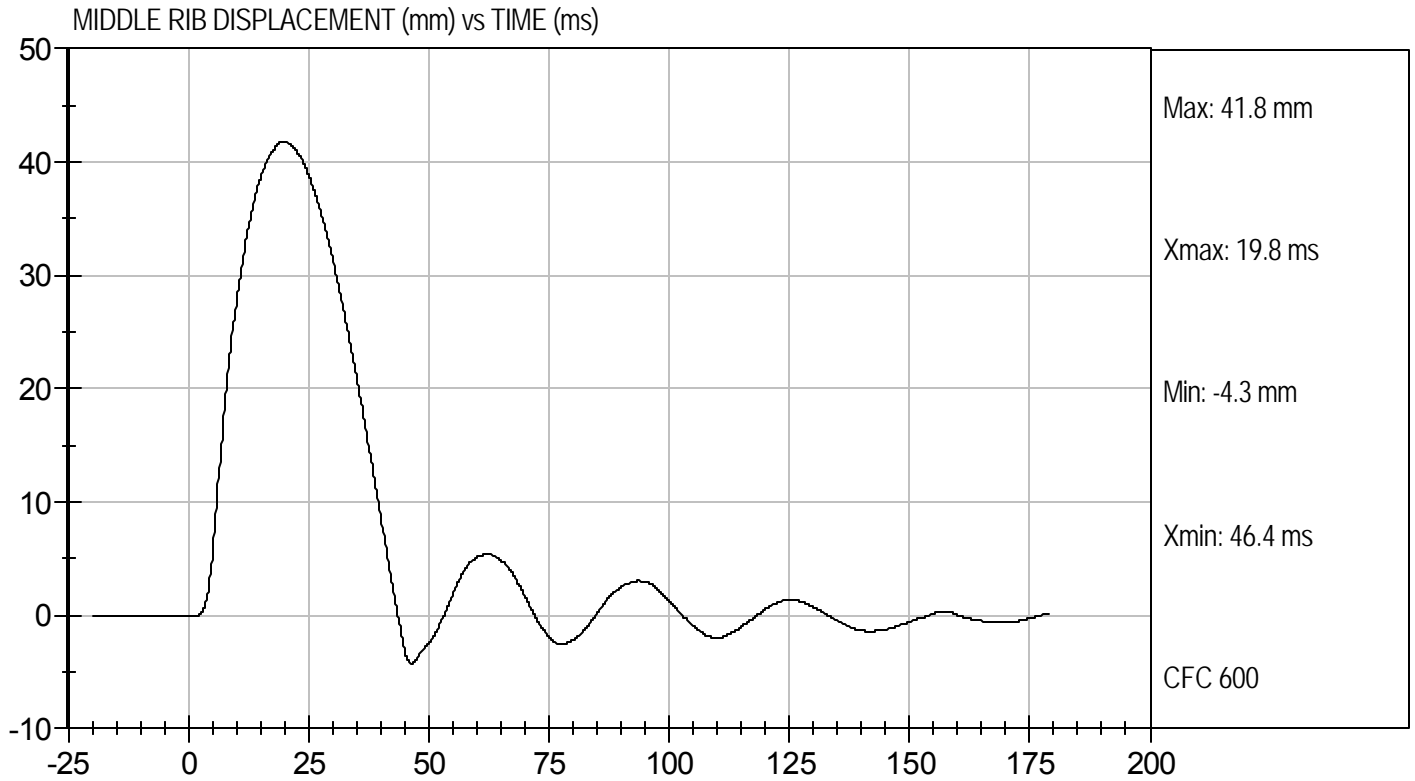
David Winkelbauer
Approved By





Test Desc: Thorax Impact
Component ID: D11870

Test Date: 3/8/11
Velocity: 18.32 ft/s, 5.58 m/s



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)	P47085	Endevco	1/13/2011
Vehicle CG (Y)	P47086	Endevco	1/13/2011
Vehicle CG (Z)	P47087	Endevco	1/13/2011
Left Floor Sill (Y)	P59244	Endevco	12/03/2010
A Pillar Sill (Y)	P59283	Endevco	1/13/2011
A Pillar Low (Y)	P47810	Endevco	2/19/2011
A Pillar Mid (Y)	P52212	Endevco	2/19/2011
B Pillar Sill (Y)	P59670	Endevco	12/22/2010
B Pillar Low (Y)	P53288	Endevco	1/13/2011
B Pillar Mid (Y)	P47111	Endevco	9/15/2010
Seat (Y)	P47893	Endevco	12/13/2010
Engine (X)	P52277	Endevco	12/03/2010
Engine (Y)	P52278	Endevco	12/03/2010
Firewall (Y)	D12-X26	Entran	1/13/2011
Roof (Y)	P52226	Endevco	11/05/2010
Floor Sill (Y)	P37910	Endevco	1/13/2011
Rear Deck (X)	P52223	Endevco	10/01/2010
Rear Deck (Y)	P52222	Endevco	10/01/2010