REPORT NUMBER: 214P-MGA-2011-019

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

TOYOTA MOTOR CORPORATION
2011 LEXUS RX350 SUV
NHTSA NUMBER: CB5108

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

Test Date: May 10, 2011

Report Date: June 6, 2011

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, SE
WEST BUILDING (NVS-220)
WASHINGTON, DC 20590

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Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Joe Fleck, Project Engineer

Approval Date: June 6, 2011

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted by: James A.Jones

Acceptance Date: 6/14/2011

Technical Report Documentation Page

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15. Supplementary Notes		

16. Abstract

A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 2011 Lexus RX350 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 May 10, 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 356 mm at level 3. The test vehicle's performance follows:

Measurement Description	Units	Result
Head Injury Criteria (HIC_{36})	N/A	418
Max. Rib Deflection	mm	29
Sum of Abdomen Forces	N	1214
Pubic Symphysis Force	N	1508

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.

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TABLE OF CONTENTS

Section		Page No.
1	Purpose and Summary of the Test	1
2	Occupant and Vehicle Information	3

Data Sheet		Page No.
1	Test Vehicle Information and Options	3
2	General Test and Vehicle Parameter Data	4
3	Vehicle Tire Information	5
4	Seat and Seat Belt Adjustment Data	6
5	Fuel Systems and Steering Wheel Position Data	7
6	Dummy Longitudinal Clearance Dimensions	8
7	Dummy Lateral Clearance Dimensions	9
8	High Speed Camera Locations and Data	10
9	Test Vehicle Accelerometer Locations	11
10	Test Vehicle Accelerometer Data Summary	12
11	Dummy Injury Response Data	13
12	Post Test Observations	14
13	Vehicle Pre Test and Post Test Measurements	15
14	Exterior Crush Measurements	16
15	Vehicle Exterior Crush Profiles	17
16	Summary of FMVSS 301 Fuel System Data	19
17	Temperature and Humidity Traces	20

Appendix		
A	Photographs	A-1
B	Dummy Response Data	B-1
C	Vehicle Accelerometer Response Data	C-1
D	Dummy Performance Calibration Test Data	D-1
E	Test Equipment and Instrumentation Calibration	E-1

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 Lexus RX350 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 Lexus RX350 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 May 10, 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	418	Upper	29.2	Front	293.7	1507.5
		Middle	22.7	Mid	396.7	
		Lower	24.4	Rear	579.8	
		Max.	29.2	Sum	1214.1	

GENERAL COMMENTS

There was no valid data collected for:

B Pillar Mid Y after 5 msec.
Seat Y after 40 msec.
Rear Deck X after 10 msec.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1

TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

VEHICLE INFORMATION	
Make	Lexus
Model	RX350
Body Style	MPV
VIN	JTJZK1BA6B2003342
Body Color	Tungsten Pearl
Engine Displacement (L)	3.5
# of Cylinders	6
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	Front
Odometer Reading	27 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 Pretentioners	Yes
Driver Seat Belt Load Limiters	Yes
Driver Power Seat	Yes
Rear Pass. Curtain Airbag	Yes
Rear Pass. Side Torso/Pelvis Airbag	Yes
Rear Pass. Seat Belt Pretentioners	Yes
Rear Pass. Seat Belt Load Limiters	Yes
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	Toyota Motor Corporation
Date of Manufacture	10/10

GVWR (kg)	2520
GAWR Front (kg)	1360
GAWR Rear (kg)	1385

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)				400
Cargo Weight (RCLW) (kg)				60

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

TIRE PRESSURES

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

TEST VEHICLE WEIGHTS

	Units	As Delivered			Fully Loaded			As Tested		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	543.0	410.5		568.4	464.5		572.9	460.4	
Right	kg	551.1	380.6		563.8	426.8		555.2	428.2	
Ratio	%	58.0	42.0		56.0	44.0		55.9	44.1	
Totals	kg	1094.1	791.1	1885.2	1132.2	891.3	2023.5	1128.1	888.6	2016.7

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	1885.2
Weight of 1 P572U ATD (ES-2re) Dummy	kg	77.1
Rated Cargo/Luggage Weight (RCLW)	kg	60
Calculated Target Vehicle Test Weight (TVTW)	kg	2022.3

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	799	808	804	810
As Tested	mm	804	808	808	818
Difference	mm	-5	0	-4	-8

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2741
Vertical Impact Reference Line (Aft of Front Axle)	mm	1365

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

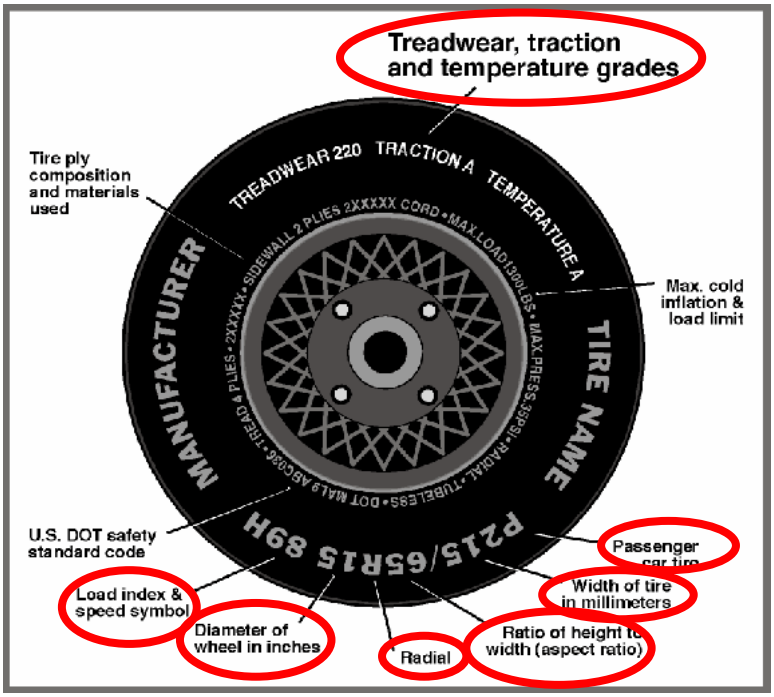
Description of Component	Weight (kg)
Ballast	20.0
No vehicle components removed to meet VTW	0

DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

VEHICLE TIRE INFORMATION

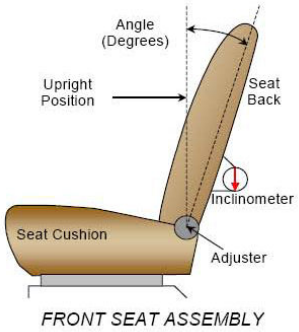


Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	220	220
Recommended Tire Size	P235/60R18	P235/60R18
Tire Size on Vehicle	P235/60R18	P235/60R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Name	Dueler	Dueler
Tire Type	Passenger	Passenger
Tire Width	235	235
Aspect Ratio	60	60
Radial	Yes	Yes
Wheel Diameter	18	18
Load Index/Speed Symbol	102V	102V
Treadwear	260	260
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 4

SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011



FRONT SEAT ASSEMBLY

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 3 degrees. Zero inclinometer at door sill. Measure the seat angle at headrest post.

SEAT BACK ANGLE

	Degrees	Detents
Driver with Seated Dummy	3.0° 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	260 mm	130 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 0 detent for the 50th percentile male.

SEAT BELT UPPER ANCHORAGE

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

HEADREST RESTRAINT

The headrest was placed in the uppermost position.

DATA SHEET NO. 5

FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

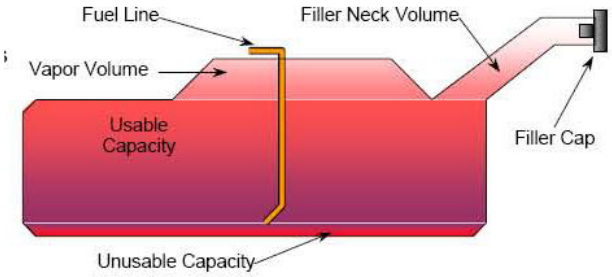
Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	72.7
Useable Capacity (Owner's Manual)	72.5
92-94% of Usable Capacity	66.9 to 68.3
Actual Amount of Solvent Used	67.6

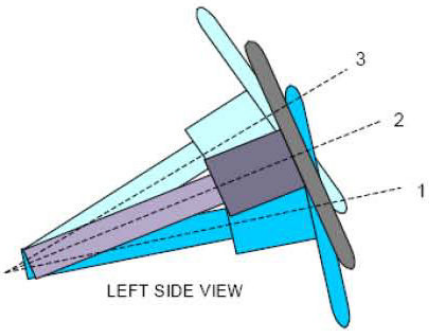
FUEL PUMP

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 is activated when the ignition is turned on. 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

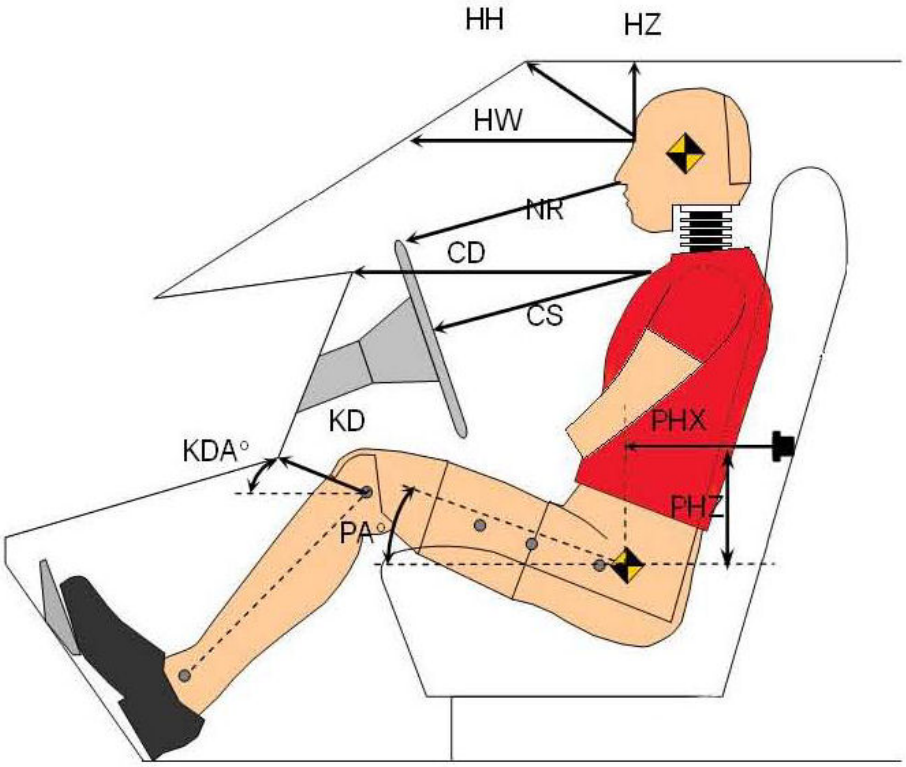
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	65.7	170
Geometric Center – Position 2	63.6	151
Uppermost – Position 3	61.4	132
Telescoping Steering Wheel Travel		38
Test Position	63.6	151

.DATA SHEET NO. 6

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

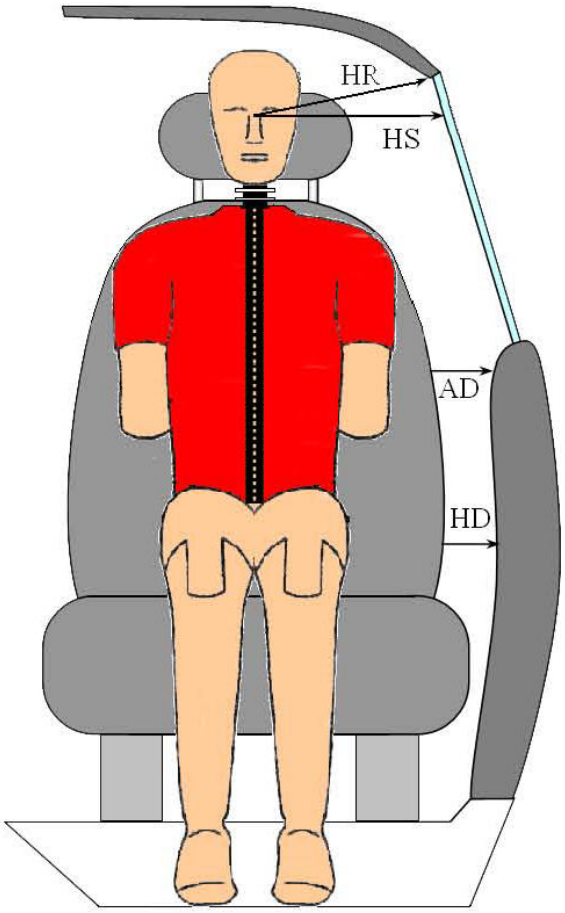


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	474	
HW	Head to Windshield	792	
HZ	Head to Roof	205	
NR	Nose to Rim	543	
CD	Chest to Dash	596	
CS	Chest to Steering Wheel	430	
KDL	Left Knee to Dash	173	35.2
KDR	Right Knee to Dash	146	38.9
PA	Pelvis Angle X		26.2
	Torso Angle Y		0.6
PHX	H-Point to Striker (X-Axis)	213	
PHZ	H-Point to Striker (Z-Axis)	172	

DATA SHEET NO. 7

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

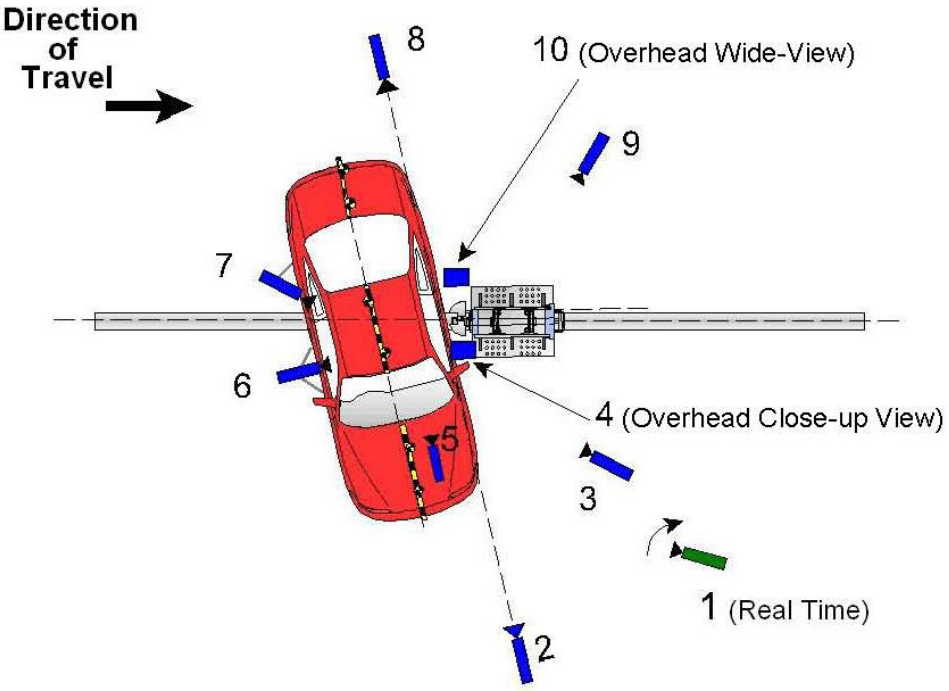


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	202
HS	Head to Side Window	mm	340
AD	Arm to Door	mm	112
HD	H-Point to Door	mm	159

DATA SHEET NO. 8

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011



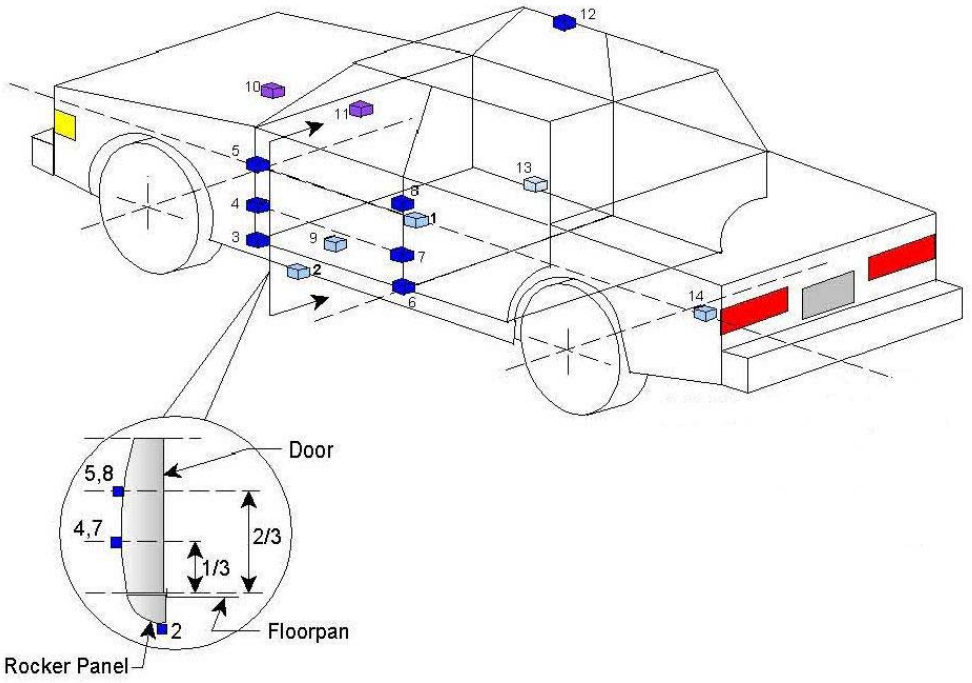
Reference: From Point of Impact for X and Y; from Ground for Z):
+X = Right of Impact, + Y = Forward of Impact, +Z = Up

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5510	-40	1760	24	1000
3	Impact Side 45° Forward	4190	2150	1900	20	1000
4	Overhead Closeup	0	60	4460	50	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-6100	-30	1770	24	1000
9	Impact Side 45° Rearward	-3120	3690	1910	20	1000
10	Overhead Wide	130	280	4960	14	1000

DATA SHEET NO. 9

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2533	0	-380
2	Left Floor Sill	2702	-763	-280
3	A Pillar Sill	3249	-763	-270
4	A Pillar Low	3180	-751	-696
5	A Pillar Mid	3240	-860	-890
6	B Pillar Sill	2000	-768	-295
7	B Pillar Low	2115	-748	-725
8	B Pillar Mid	2115	-748	-960
9	Seat	2239	-575	-509
10	Engine	4063	0	-840
11	Firewall	3878	0	-1045
12	Roof	2038	590	-1645
13	Floor Sill	1902	763	-300
14	Rear Deck	700	0	-562

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 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	14.0	33.6	-12.5	23.4
	Vehicle CG (Y)	13.9	46.8	-0.6	229.7
	Vehicle CG (Z)	14.0	34.0	-5.1	95.5
	Resultant	21.9	33.7		
2	Left Floor Sill (Y)	47.9	21.3	-9.6	102.6
3	A Pillar Sill (Y)	16.3	28.4	-0.6	3.5
4	A Pillar Low (Y)	31.8	21.5	-2.7	12.4
5	A Pillar Mid (Y)	28.9	24.4	-0.7	1.3
6	B Pillar Sill (Y)	40.7	27.0	-15.9	33.0
7	B Pillar Low (Y)	52.4	14.9	-8.8	45.5
8	B Pillar Mid (Y)	(1)	(1)	(1)	(1)
9	Seat (Y)	(2)	(2)	(2)	(2)
10	Engine (X)	7.9	113.6	-11.5	44.7
	Engine (Y)	11.3	90.7	-1.8	25.9
11	Firewall (Y)	12.4	66.6	-1.3	5.0
12	Roof (Y)	25.3	51.2	-1.3	17.1
13	Floor Sill (Y)	19.4	43.2	-1.3	201.9
14	Rear Deck (X)	(3)	(3)	(3)	(3)
	Rear Deck (Y)	17.6	61.7	-1.9	212.8

(1) No valid data collected for B Pillar Mid Y after 5 msec.
(2) No valid data collected for Seat Y after 40 msec.
(3) No valid data collected for Rear Deck X after 10 msec.

DATA SHEET NO. 11

DUMMY INJURY RESPONSE DATA

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

Dummy S/N	Positive		Negative	
	MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (G)				
Longitudinal (X)	9.7	203.0	18.8	49.1
Lateral (Y)	58.9	55.4	7.2	79.1
Vertical (Z)	6.7	41.2	15.5	52.0
Resultant (R)	61.6	54.7		
HIC36 (t1, t2)	418		t1 = 44.9	t2 = 67.3
THORAX DEFLECTION (mm)				
Upper Rib			29.2	52.7
Middle Rib			22.7	52.0
Lower Rib			24.4	52.4
ABDOMINAL FORCES (N)				
Front	293.7	44.6		
Middle	396.7	48.0		
Rear	579.8	49.8		
Sum	1214.1	46.1		
PELVIS FORCE (N)				
Pubic Symphysis			1507.5	63.5

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

DATA SHEET NO. 12

POST TEST OBSERVATIONS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

TEST DUMMY INFORMATION AND CONTACT

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

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Left Side Doors	Remained closed and jammed shut	Remained closed and jammed shut
Right Side Doors	Remained closed and operational	Remained closed and operational
Hatch and Other Doors		Remained closed and operational
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

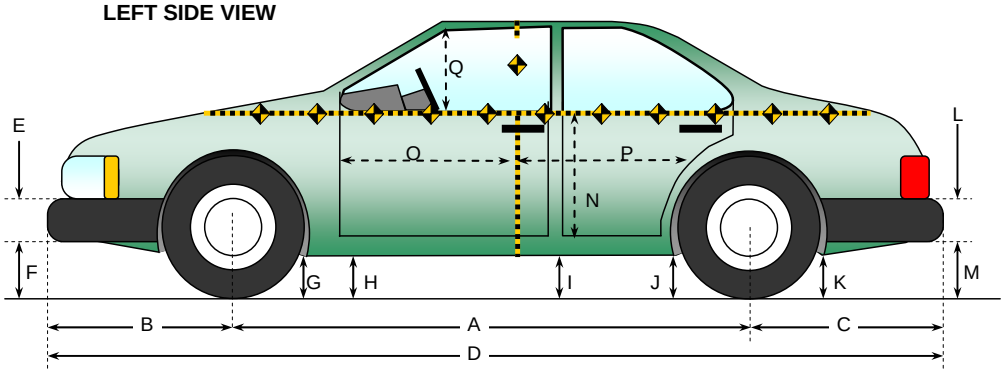
Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso/Pelvis Airbag	Yes	Yes
Head Airbag	No	
Curtain Airbag	Yes	Yes
Knee Airbag	Yes	No
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	

DATA SHEET NO. 13

VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

LEFT SIDE VIEW

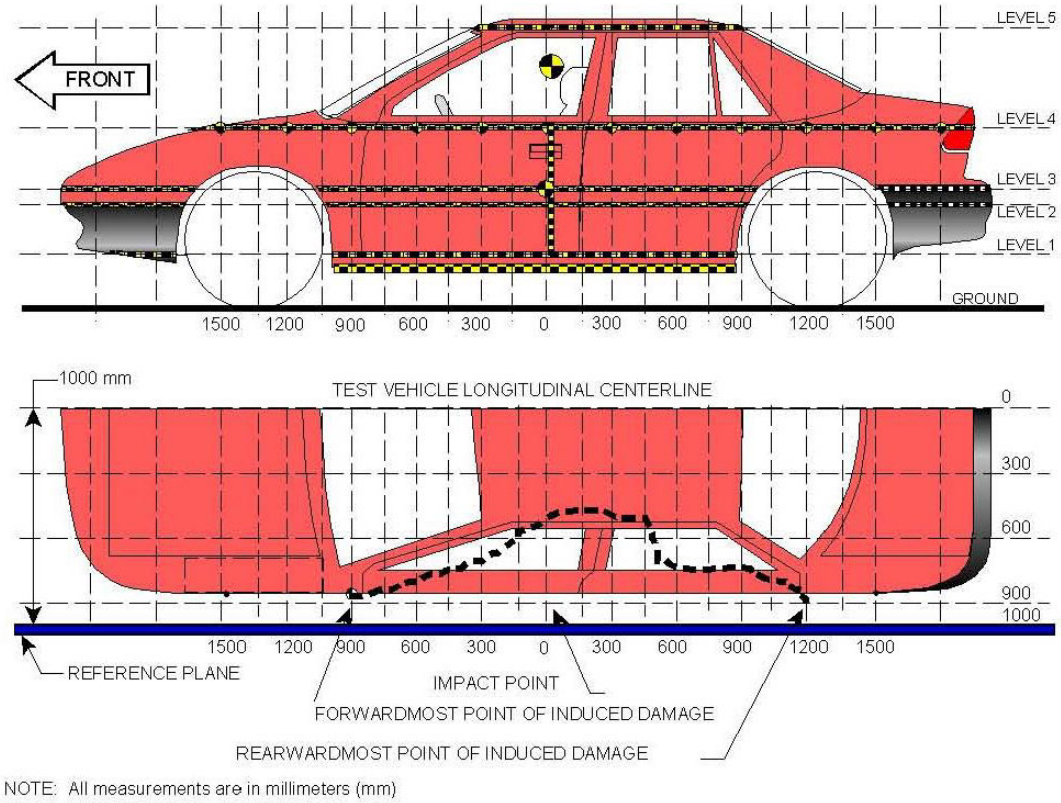


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2741	2670	71
B	Front Axle to FSOV	975	975	0
C	Rear Axle to RSOV	1045	1045	0
D	Total Vehicle Length at Centerline	4761	4690	71
E	Front Bumper Thickness	120	120	0
F	Front Bumper Bottom to Ground	377	392	-15
G	Sill Height at Front Wheel Well	271	278	-7
H	Sill Height at Front Door Leading Edge	271	275	-4
I	Sill Height at B Pillar	282	280	2
J1	Sill Height at Rear Wheel Well	287	303	-16
J2	Pinch Weld Height at Rear Wheel Well	290	297	-7
K	Sill Height Aft of Rear Wheel Well	305	290	15
L	Rear Bumper Thickness	120	120	0
M	Rear Bumper Bottom to Ground	355	344	11
N	Sill Height to Window Bottom Sill	910	908	2
O	Front Door Leading Edge to Impact CL	755	753	2
P	Rear Door Trailing Edge to Impact CL	1271	1335	-64
Q	Front Window Opening	475	448	27
R	Right Side Length	3641	3655	-14
S	Left Side Length	3641	3568	73
T	Vehicle Width at B Post	1880	1715	165

DATA SHEET NO. 14

EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011



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	290	-75	362
2	Occupant H-Point	352	0	712
3	Mid-Door	356	0	747
4	Window Sill	269	0	1155
5	Window Top	81	-75	1630

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

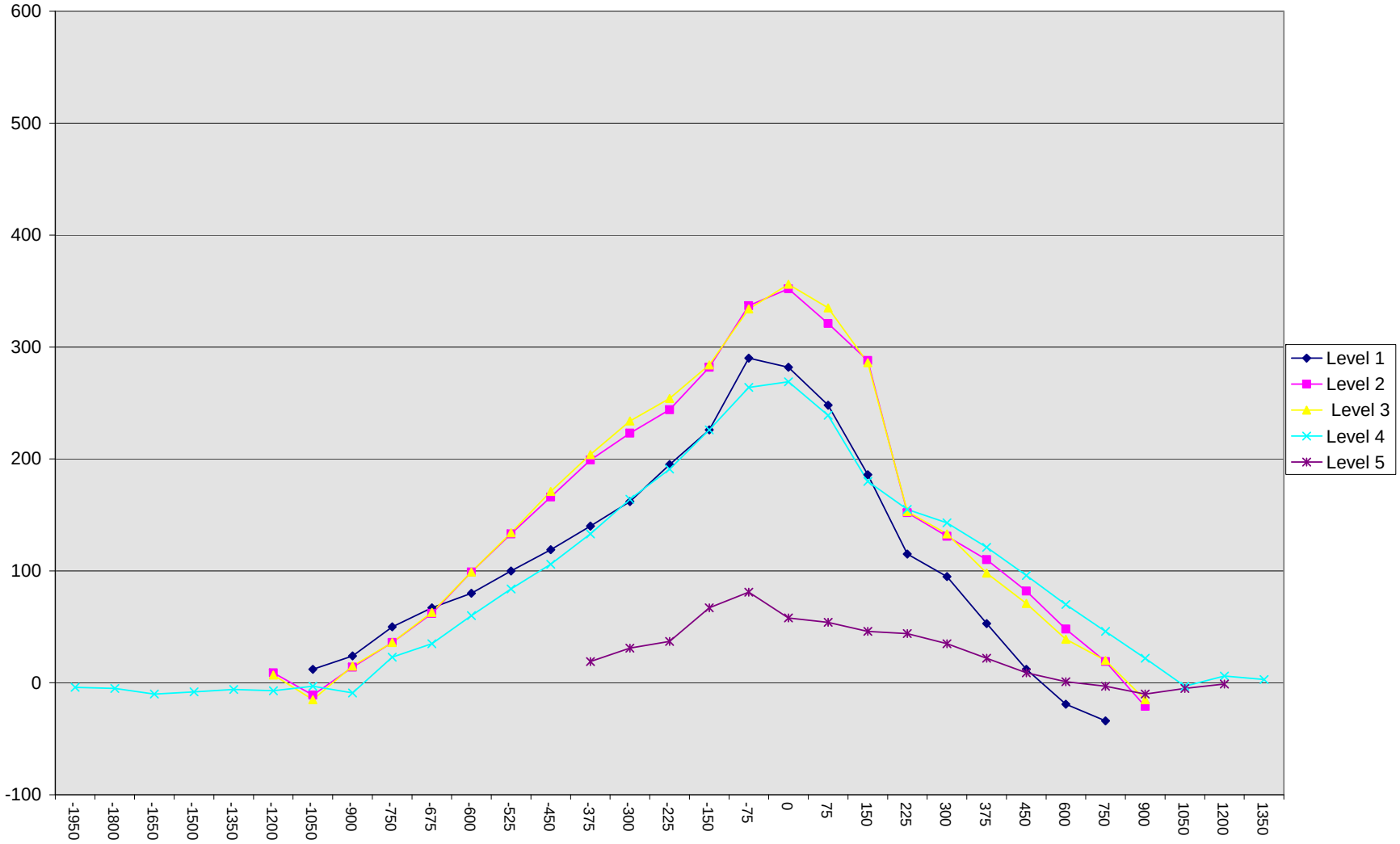
	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	290	352	356	269	81
Distance From Impact (mm)	-75	0	0	0	-75

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1950				360					356					-4	
-1800				333					328					-5	
-1650				318					308					-10	
-1500				306					298					-8	
-1350				295					289					-6	
-1200		155	154	285			164	161	278			9	7	-7	
-1050	172	155	155	281		184	144	140	278		12	-11	-15	-3	
-900	172	155	156	275		196	169	171	266		24	14	15	-9	
-750	172	156	156	274		222	192	192	297		50	36	36	23	
-675	173	157	156	272		240	219	219	307		67	62	63	35	
-600	175	158	156	265		255	257	255	325		80	99	99	60	
-525	176	158	157	262		276	291	291	346		100	133	134	84	
-450	177	158	157	260		296	324	328	366		119	166	171	106	
-375	178	158	157	258	498	318	357	361	391	517	140	199	204	133	19
-300	179	158	156	254	492	341	381	390	418	523	162	223	234	164	31
-225	180	158	156	251	490	375	402	410	442	527	195	244	254	191	37
-150	180	159	157	250	486	406	441	441	476	553	226	282	284	226	67
-75	181	159	157	249	485	471	496	491	513	566	290	337	334	264	81
0	181	160	158	248	484	463	512	514	517	542	282	352	356	269	58
75	182	160	158	246	484	430	481	493	485	538	248	321	335	239	54
150	183	161	159	246	483	369	449	445	426	529	186	288	286	180	46
225	183	162	160	246	482	298	314	313	401	526	115	152	153	155	44
300	184	163	161	246	482	279	294	294	389	517	95	131	133	143	35
375	184	165	164	249	481	237	275	262	370	503	53	110	98	121	22
450	184	166	165	250	482	196	248	236	346	491	12	82	71	96	9
600	180	162	162	254	485	161	210	201	324	486	-19	48	39	70	1
750	179	156	157	259	490	145	175	177	305	487	-34	19	20	46	-3
900		155	154	262	497		134	139	284	487		-21	-15	22	-10
1050				267	504				264	499				-3	-5
1200				272	514				278	513				6	-1
1350				276					279					3	

DATA SHEET NO. 15 (CONTINUED)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011



DATA SHEET NO. 16

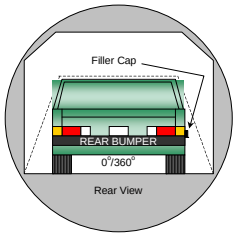
SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

Test Vehicle: 2011 Lexus RX350 SUV
Test Program: FMVSS 214 Pole
NHTSA No. CB5108
Test Date: 5/10/2011

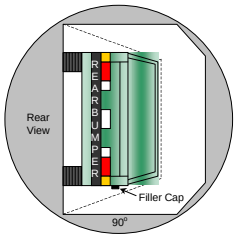
FUEL SYSTEM INTEGRITY POST IMPACT DATA

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



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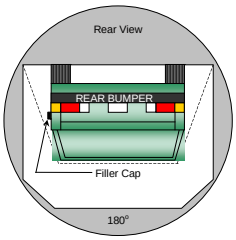

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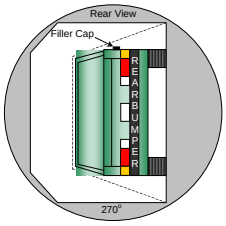


270

REAR VIEW

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	minutes	58	seconds	5	minutes	6	minutes	68	seconds	7	minutes
90° - 180°	1	minutes	54	seconds	5	minutes	6	minutes	54	seconds	7	minutes
180° - 270°	1	minutes	53	seconds	5	minutes	6	minutes	53	seconds	7	minutes
270° - 360°	1	minutes	58	seconds	5	minutes	6	minutes	58	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

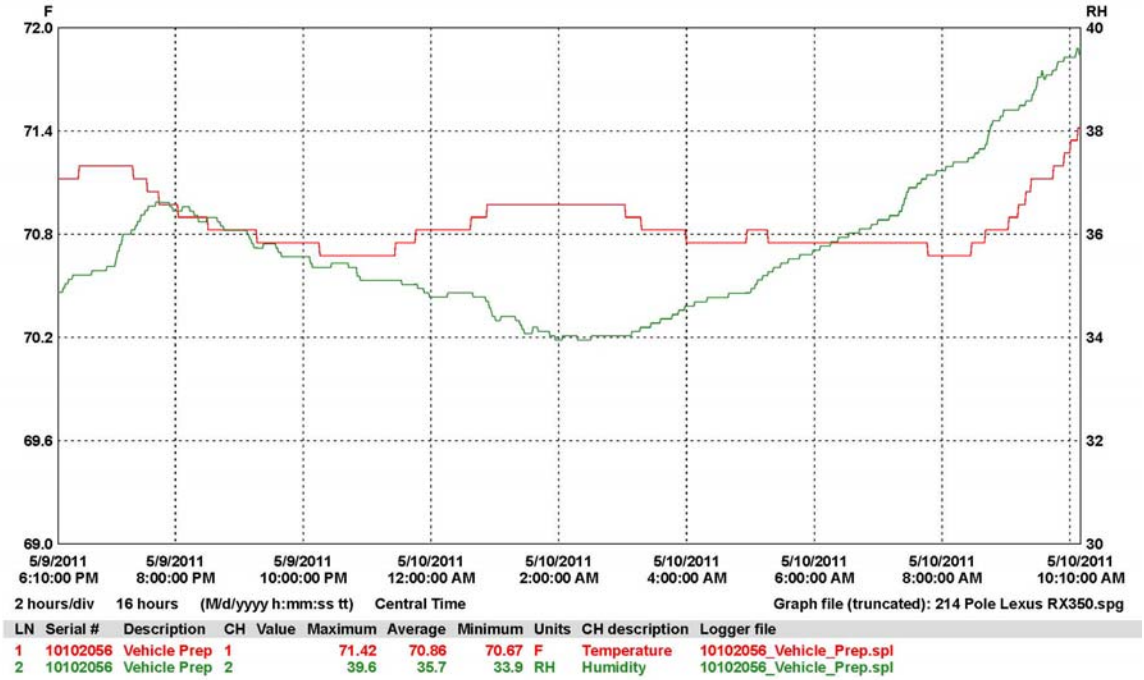
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17

TEMPERATURE AND HUMIDITY TRACES

Test Vehicle: 2011 Lexus RX350 SUV NHTSA No. CB5108
Test Program: FMVSS 214 Pole Test Date: 5/10/2011

Time of Impact: 10:10 am



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	10102056	Vehicle Prep	1		71.42	70.86	70.67	F	Temperature	10102056_Vehicle_Prep.spl
2	10102056	Vehicle Prep	2		39.6	35.7	33.9	RH	Humidity	10102056_Vehicle_Prep.spl

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

		Page No.
Photo No. 1.	Pre-Test Frontal View of Test Vehicle	A-1
Photo No. 2.	Post-Test Frontal View of Test Vehicle	A-1
Photo No. 3.	Pre-Test Rear View of Test Vehicle	A-2
Photo No. 4.	Post-Test Rear View of Test Vehicle	A-2
Photo No. 5.	Pre-Test Impacted Side View of Test Vehicle	A-3
Photo No. 6.	Post-Test Impacted Side View of Test Vehicle	A-3
Photo No. 7.	Pre-Test Left ¾ Front View of Vehicle and Pole	A-4
Photo No. 8.	Pre-Test Left ¾ Rear View of Vehicle and Pole	A-4
Photo No. 9.	Pre-Test Overhead View of Test Vehicle	A-5
Photo No. 10.	Post-Test Overhead View of Test Vehicle	A-5
Photo No. 11.	Pre-Test Dummy Through Opposite Window	A-6
Photo No. 12.	Post-Test Dummy Through Opposite Window	A-6
Photo No. 13.	Pre-Test Close-up of Dummy with Door Closed (Impact Side)	A-7
Photo No. 14.	Post-Test Dummy with Door Closed (Impact Side)	A-7
Photo No. 15.	Pre-Test Dummy Door Open	A-8
Photo No. 16.	Pre-Test Dummy Shoulder and Door Top View	A-9
Photo No. 17.	Post-Test Dummy Shoulder and Door Top View	A-9
Photo No. 18.	Pre-Test Interior of Front Door Closed	A-10
Photo No. 19.	Post-Test Interior of Front Door Showing Dummy Impact Locations	A-10
Photo No. 20.	Impact Event	A-11
Photo No. 21.	Post-Test Impact Zone Close-up View	A-11
Photo No. 22.	Post-Test ¾ Front View of Impact Zone	A-12
Photo No. 23.	Post-Test ¾ Rear View of Impact Zone	A-12
Photo No. 24.	Post-Test Close-up View of Impact Point Target	A-13
Photo No. 25.	Close-up View of Vehicle’s Certification Label	A-14
Photo No. 26.	Close-up View of Vehicle’s Tire Placard Label	A-14
Photo No. 27.	Post-Test Vehicle at 90 Degree Rollover	A-15
Photo No. 28.	Post-Test Vehicle at 180 Degree Rollover	A-15
Photo No. 29.	Post-Test Vehicle at 270 Degree Rollover	A-16
Photo No. 30.	Post-Test Vehicle at 360 Degree Rollover	A-16

Pre-Test Frontal View of Test Vehicle

Post-Test Frontal View of Test Vehicle

Pre-Test Rear View of Test Vehicle

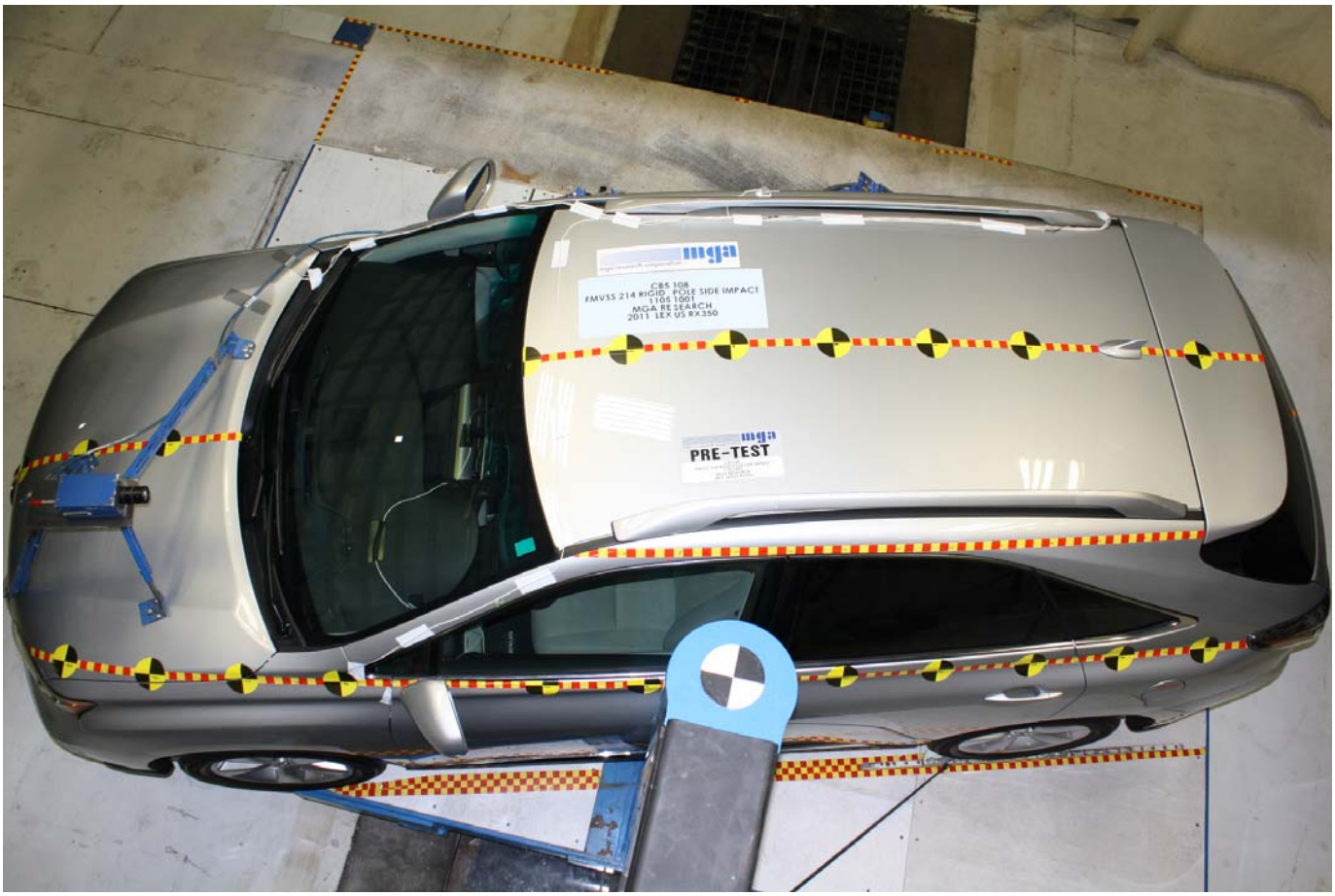
Post-Test Rear View of Test Vehicle

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

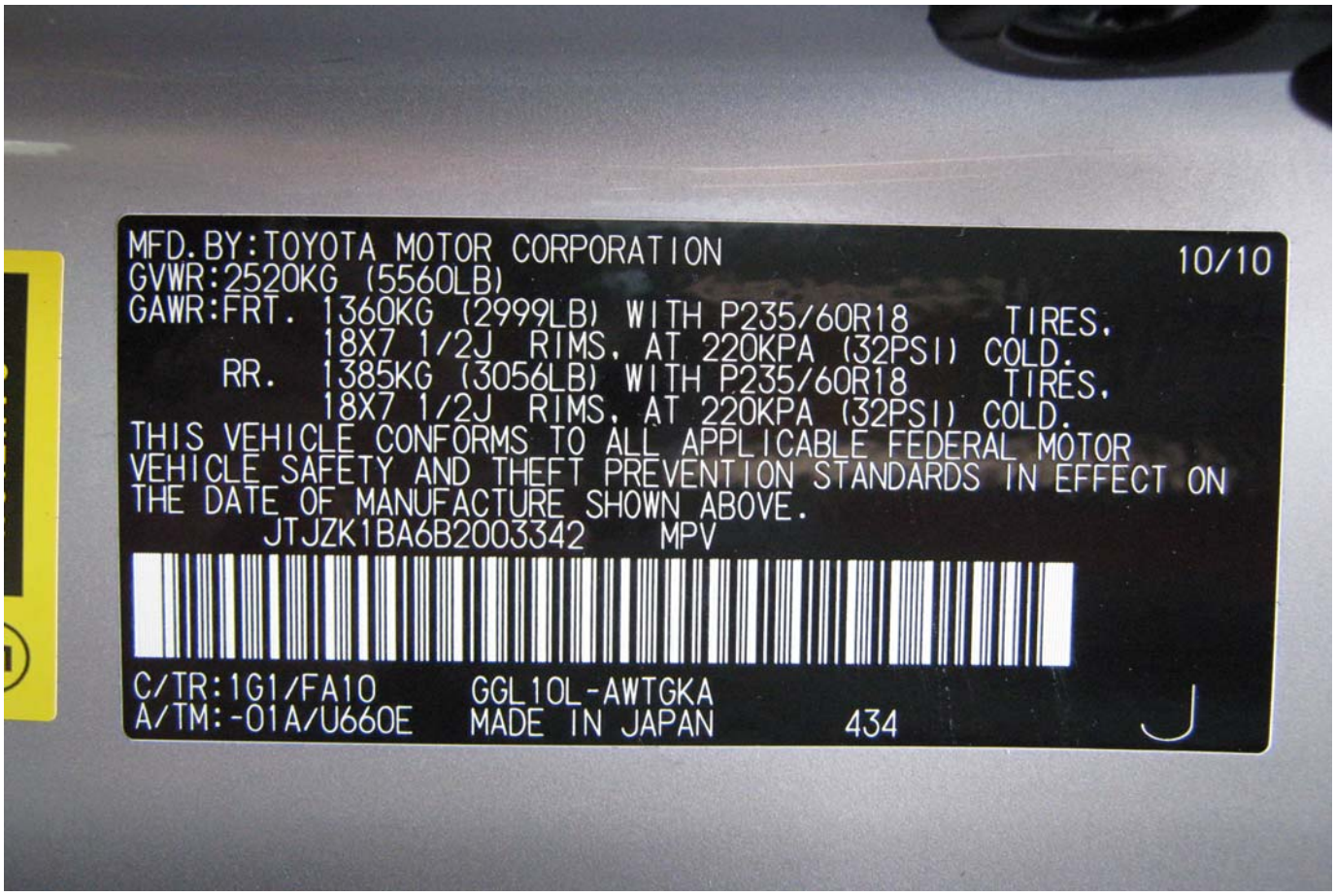
Impact Event

Post-Test Impact Zone Close-up View

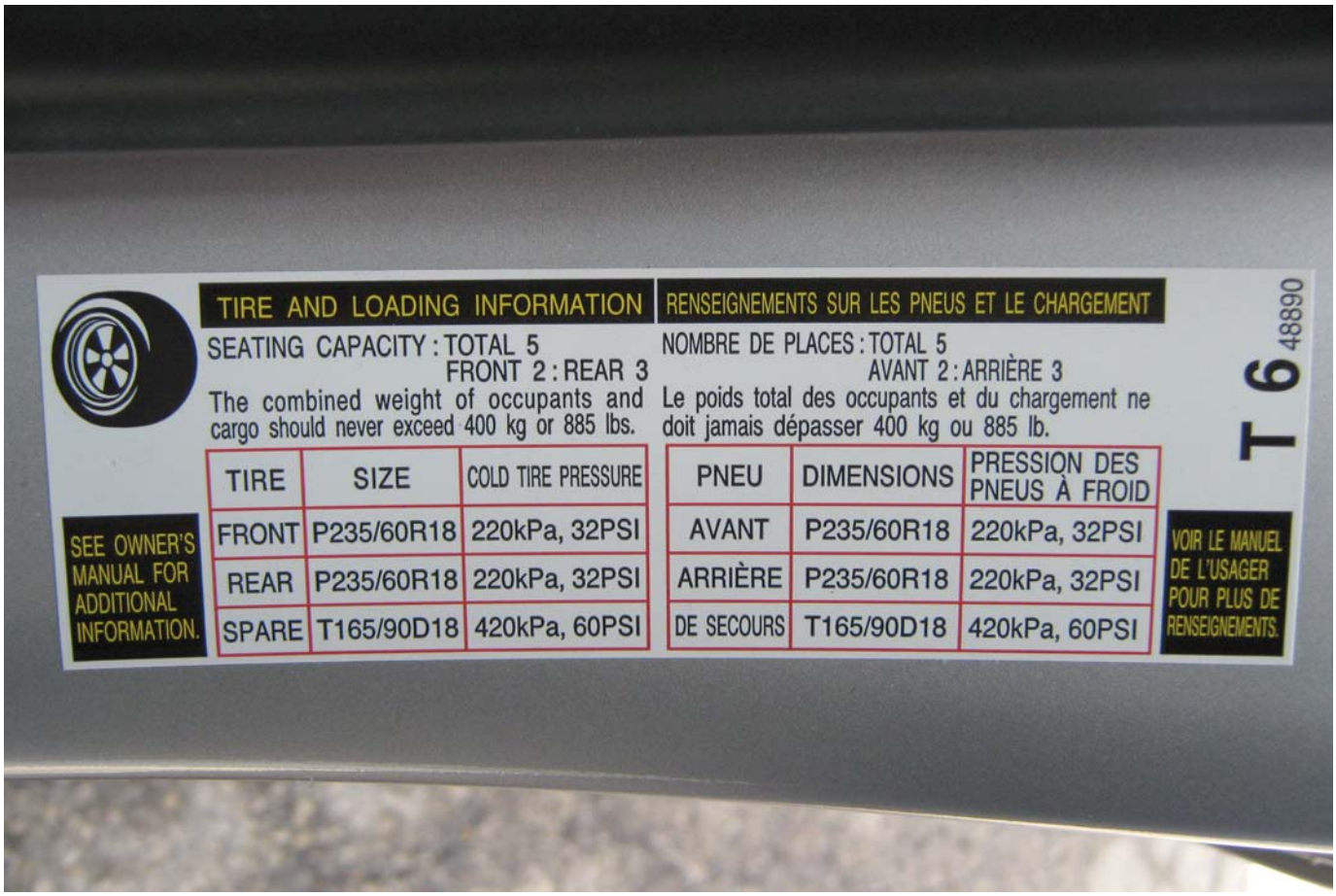
Post-Test ¾ Front View of Impact Zone

Post-Test ¾ Rear View of Impact Zone

Post-Test Close-up View of Impact Point Target



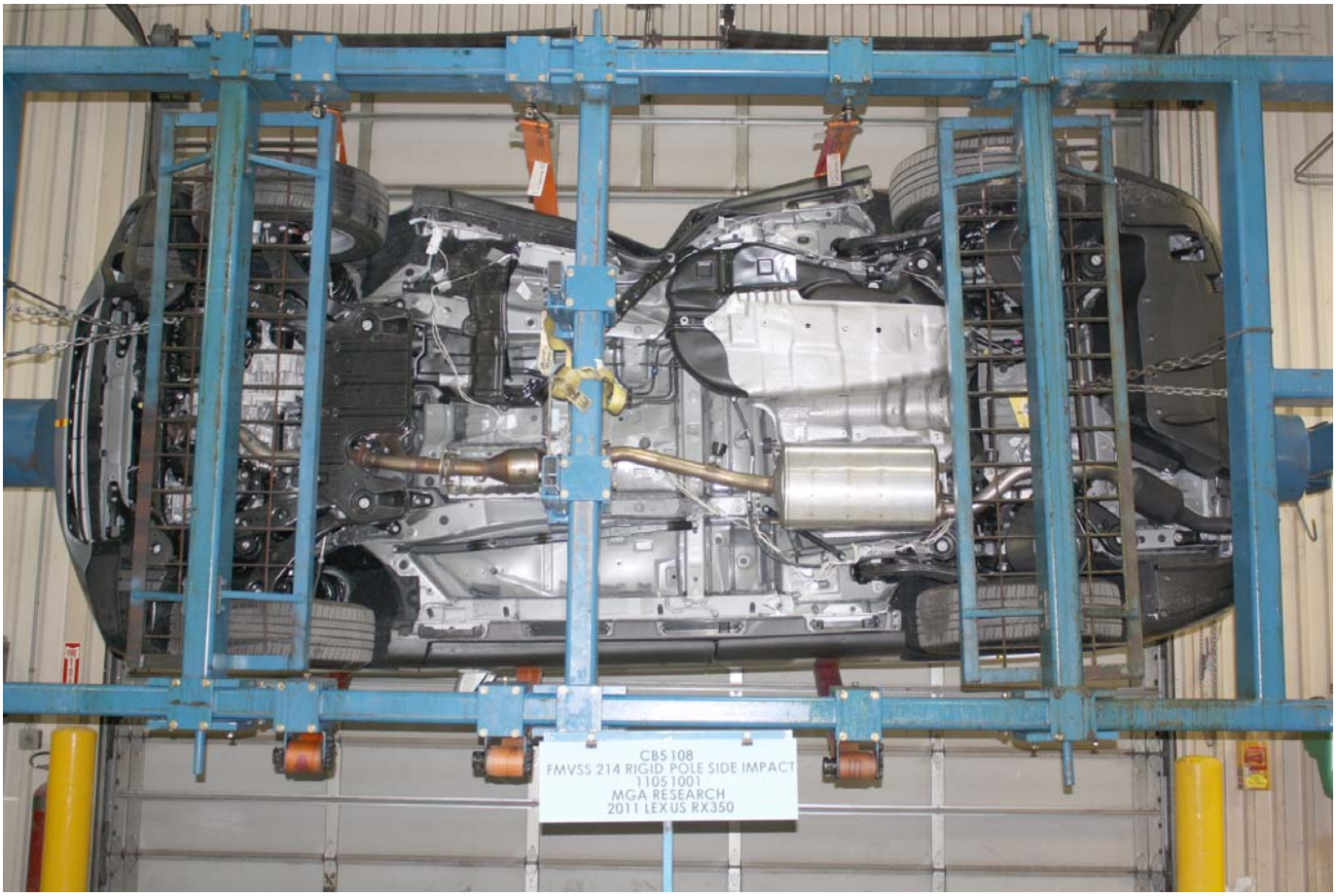
Close-up View of Vehicle's Certification Label



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

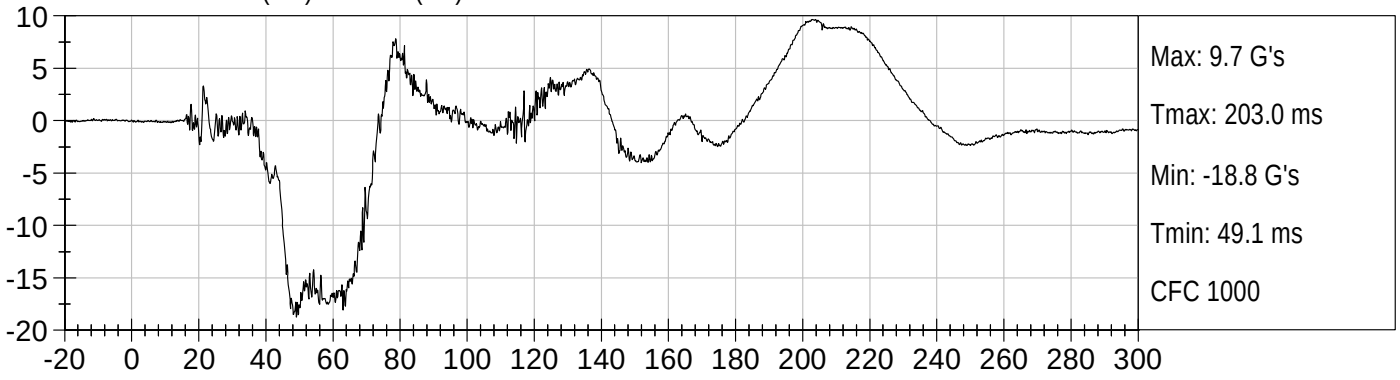
Dummy Instrumentation Plots
FILTERED DATA

		Page No.
Figure No. 1.	ES-2re Head (X) Acceleration vs. Time	B-1
Figure No. 2.	ES-2re Head (Y) Acceleration vs. Time	B-1
Figure No. 3.	ES-2re Head (Z) Acceleration vs. Time	B-1
Figure No. 4.	ES-2re Head Resultant Acceleration vs. Time	B-1
Figure No. 5.	ES-2re Head (X) Velocity vs. Time	B-2
Figure No. 6.	ES-2re Head (Y) Velocity vs. Time	B-2
Figure No. 7.	ES-2re Head (Z) Velocity vs. Time	B-2
Figure No. 8.	ES-2re Upper Thorax Rib Deflection Rate vs. Time	B-3
Figure No. 9.	ES-2re Upper Thorax Rib Deflection (Y) vs. Time	B-3
Figure No. 10.	ES-2re Middle Thorax Rib Deflection Rate vs. Time	B-3
Figure No. 11.	ES-2re Middle Thorax Rib Deflection (Y) vs. Time	B-3
Figure No. 12.	ES-2re Lower Thorax Rib Deflection Rate vs. Time	B-4
Figure No. 13.	ES-2re Lower Thorax Rib Deflection (Y) vs. Time	B-4
Figure No. 14.	ES-2re Front Abdomen Force (Y) vs. Time	B-5
Figure No. 15.	ES-2re Middle Abdomen Force (Y) vs. Time	B-5
Figure No. 16.	ES-2re Rear Abdomen Force (Y) vs. Time	B-5
Figure No. 17.	ES-2re Sum of the Abdominal Forces vs. Time	B-5
Figure No. 18.	ES-2re Pubic Symphysis Force (Y) vs. Time	B-6

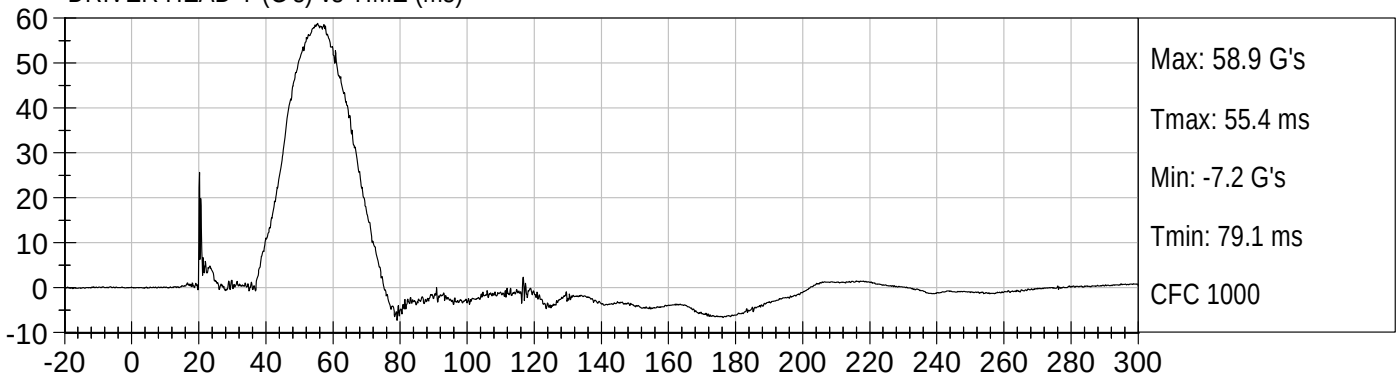
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

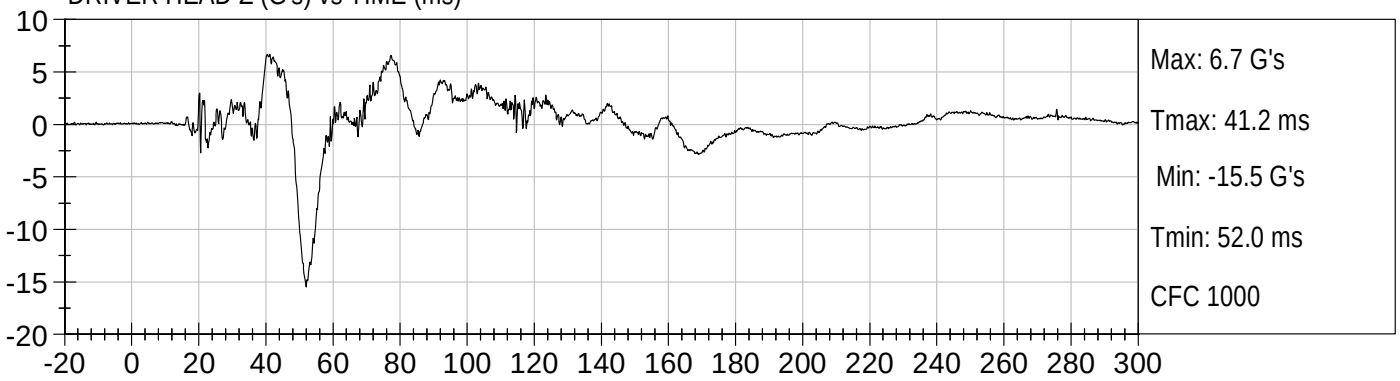
DRIVER HEAD X (G's) vs TIME (ms)



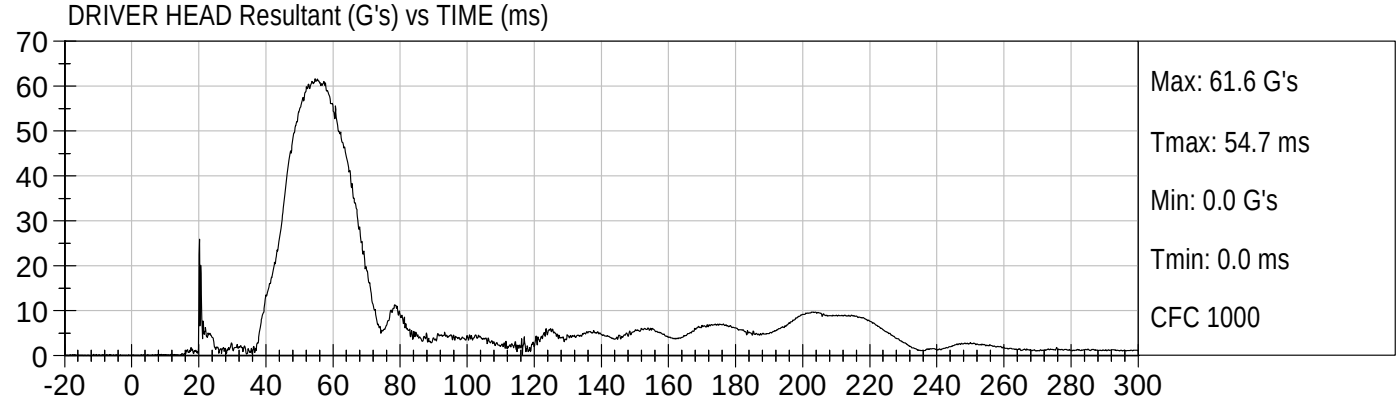
DRIVER HEAD Y (G's) vs TIME (ms)



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



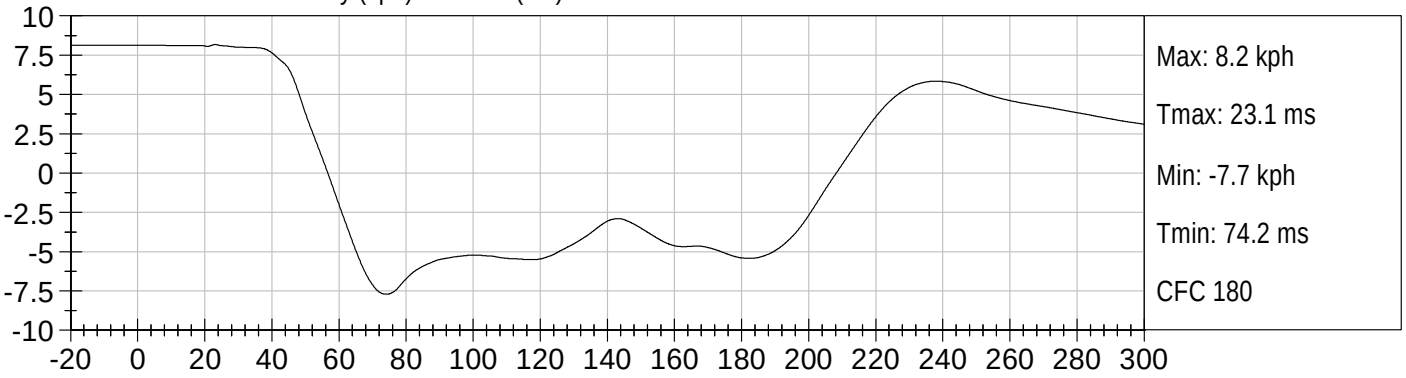
DRIVER HEAD Resultant (G's) vs TIME (ms)



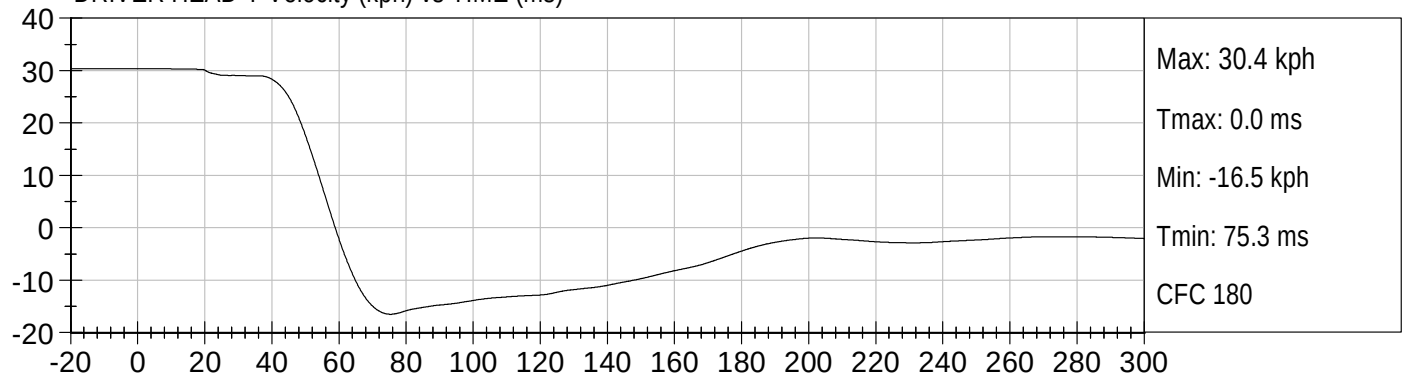
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

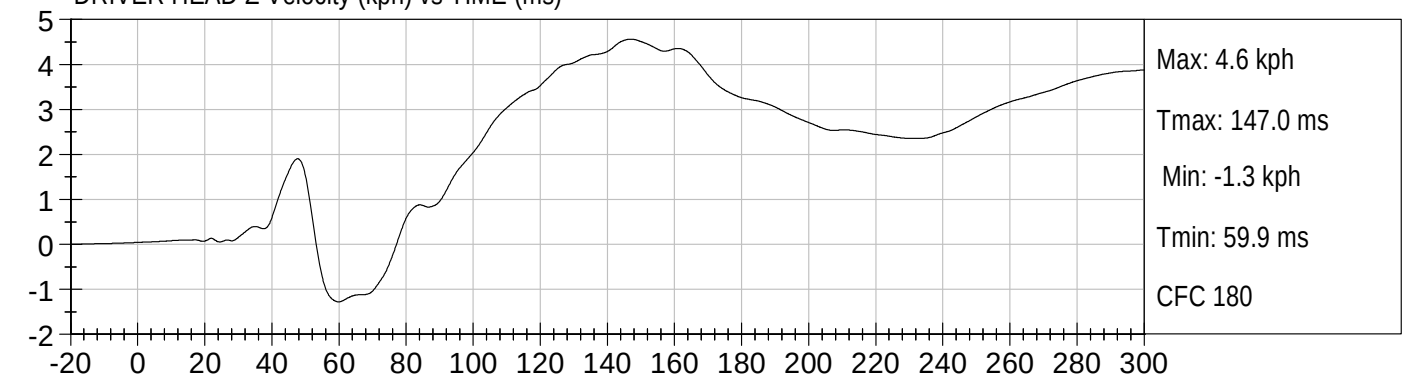
DRIVER HEAD X Velocity (kph) vs TIME (ms)



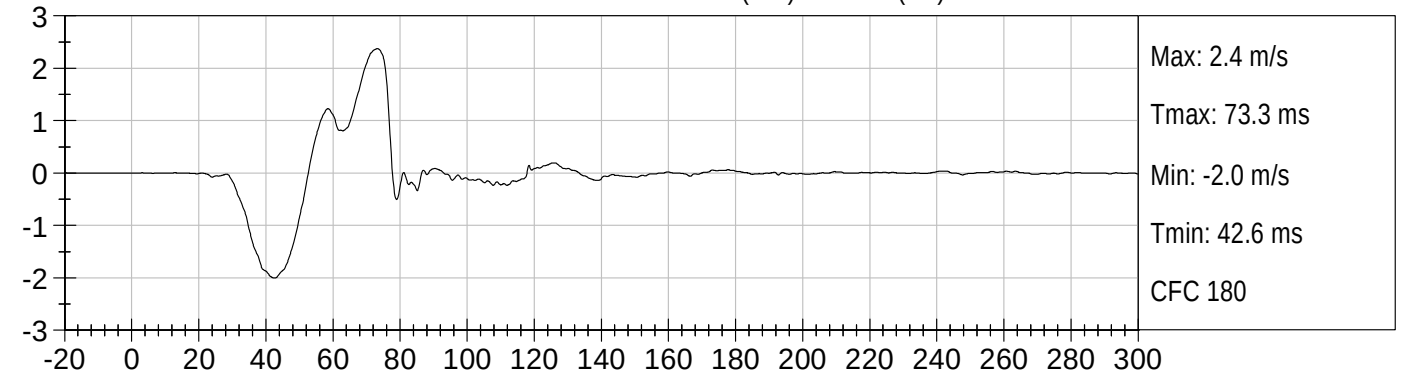
DRIVER HEAD Y Velocity (kph) vs TIME (ms)



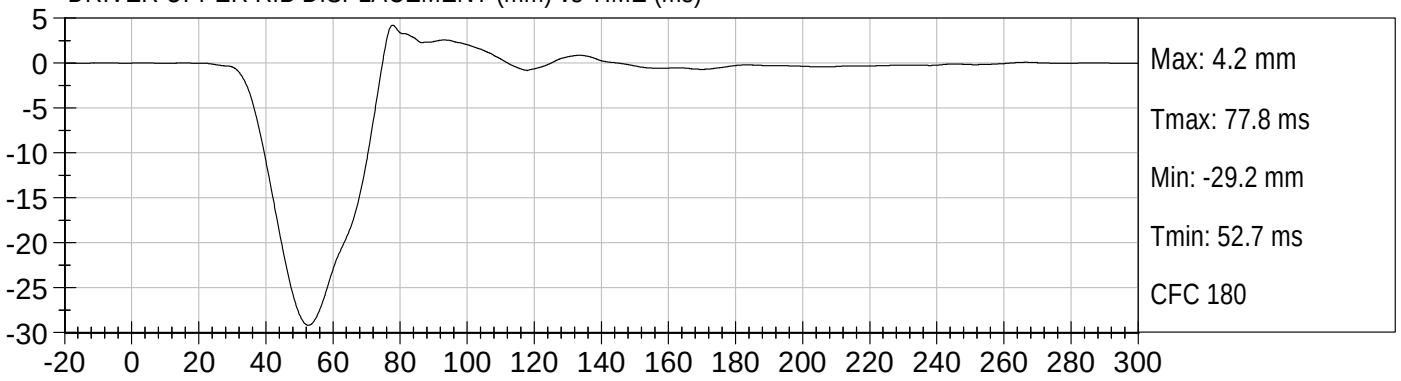
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



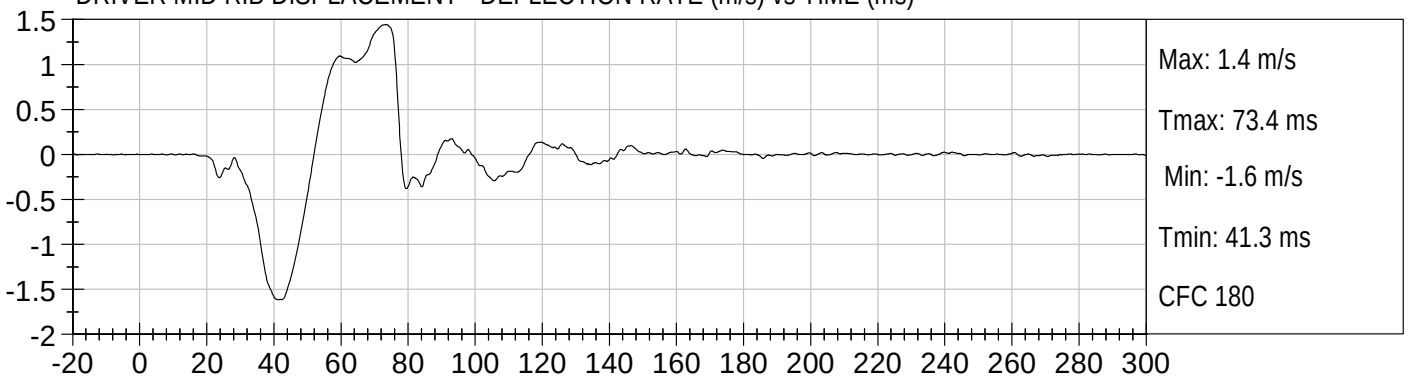
DRIVER UPPER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



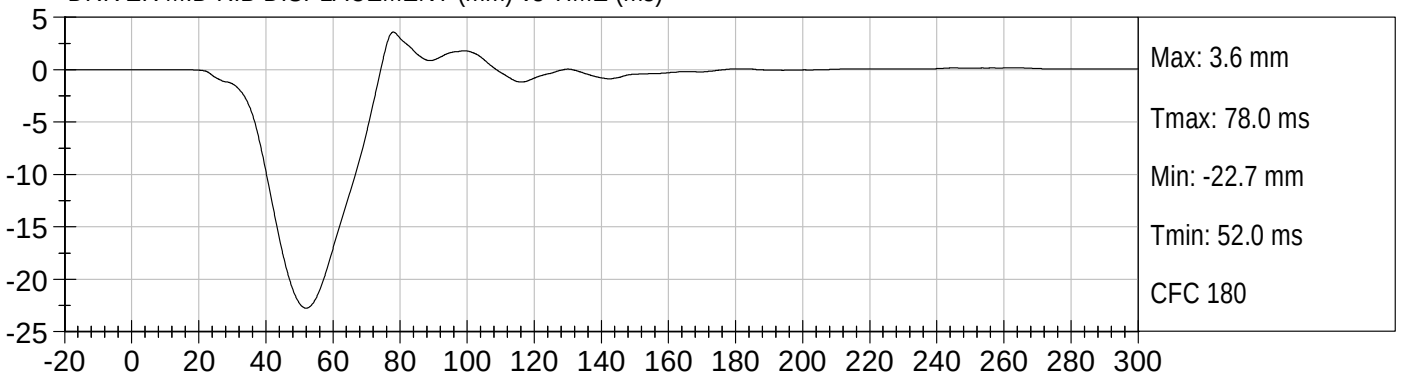
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



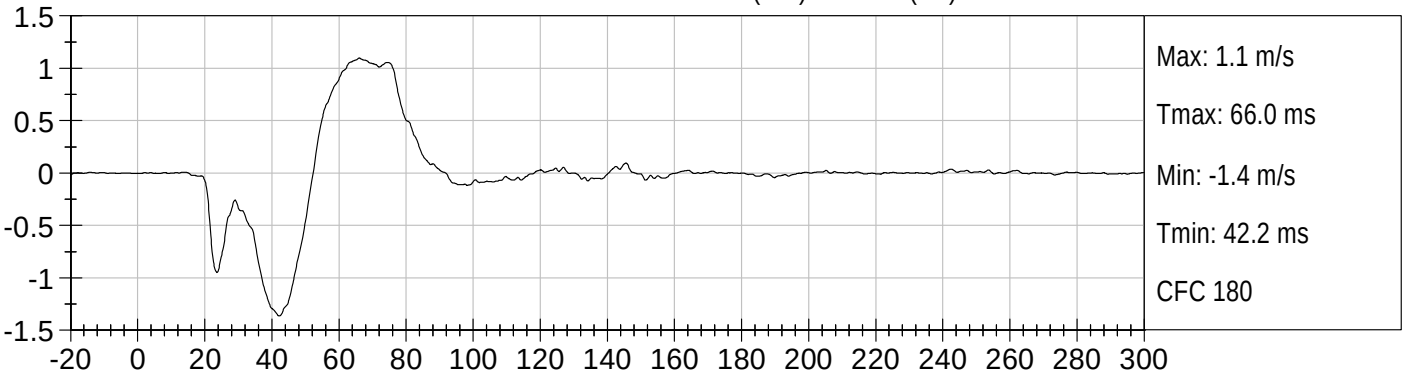
DRIVER MID RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



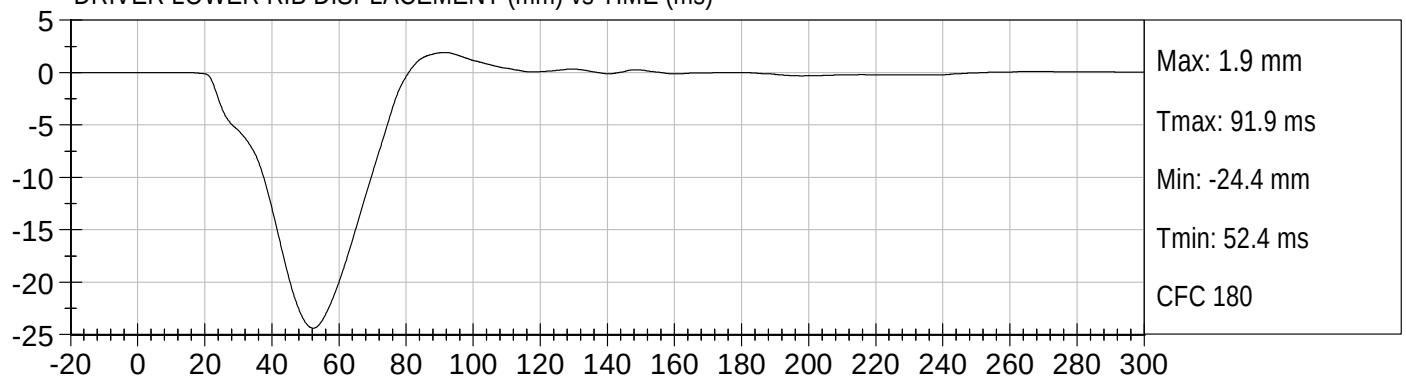
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



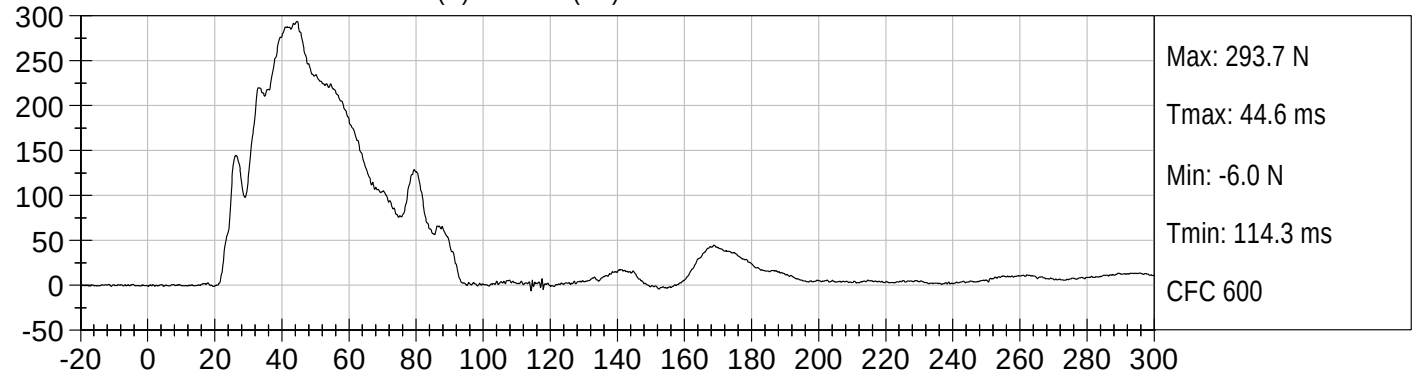
DRIVER LOWER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



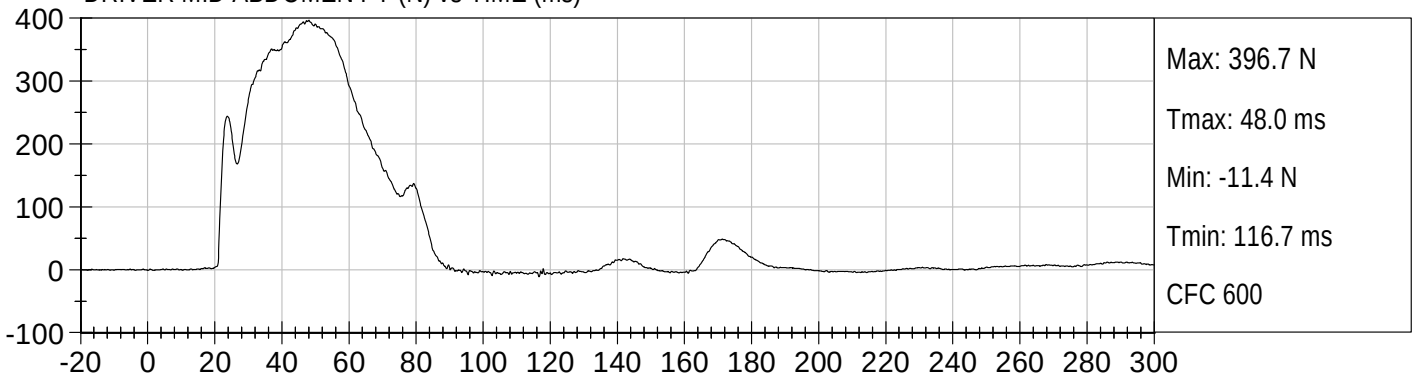
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



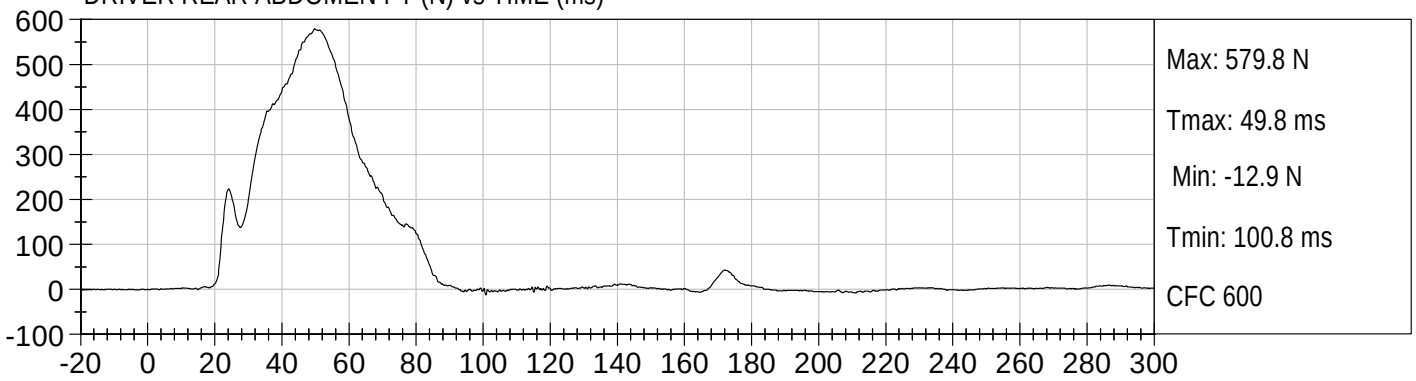
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



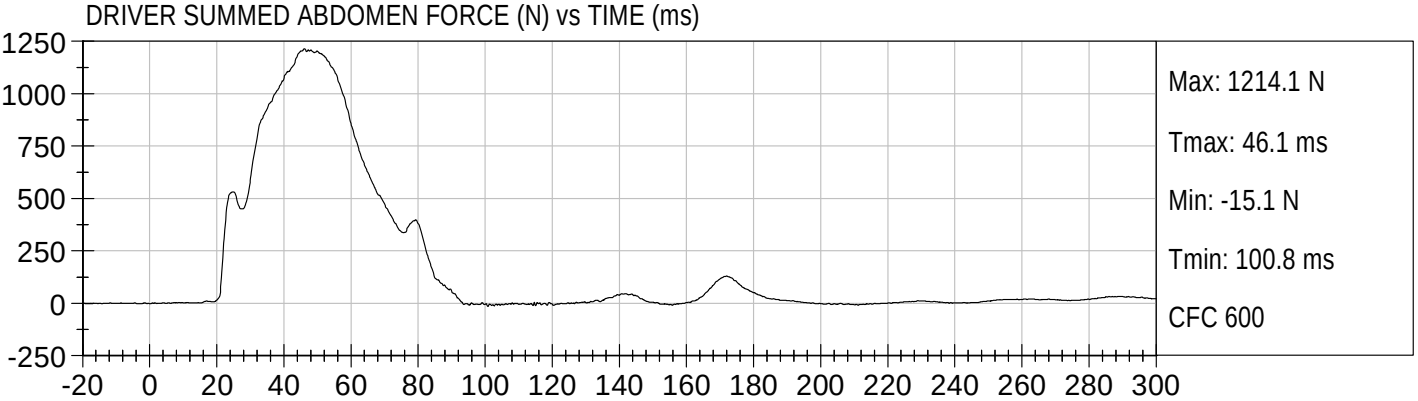
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



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

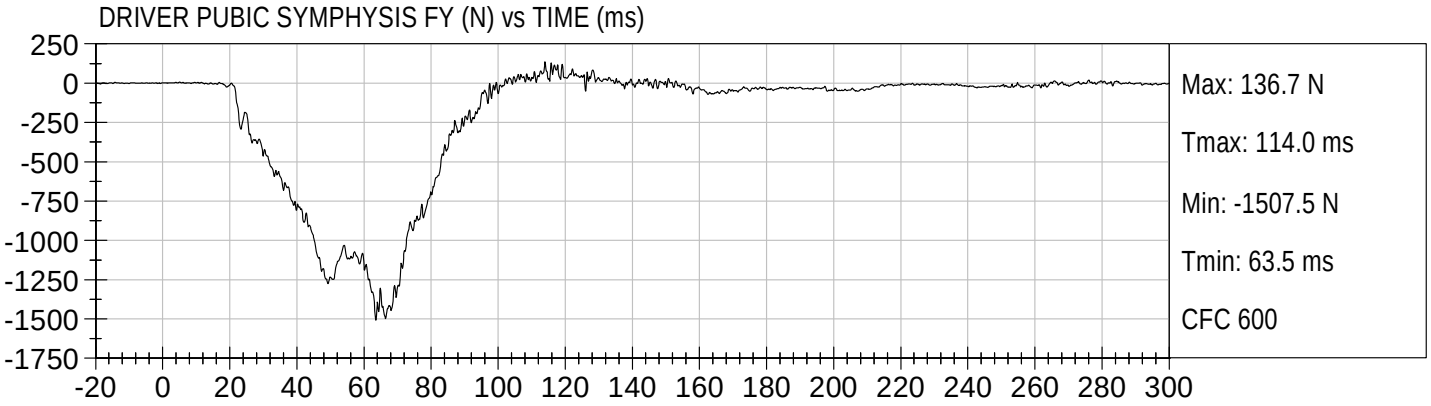


DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)



APPENDIX C

VEHICLE ACCELEROMETER RESPONSE DATA

TABLE OF DATA PLOTS

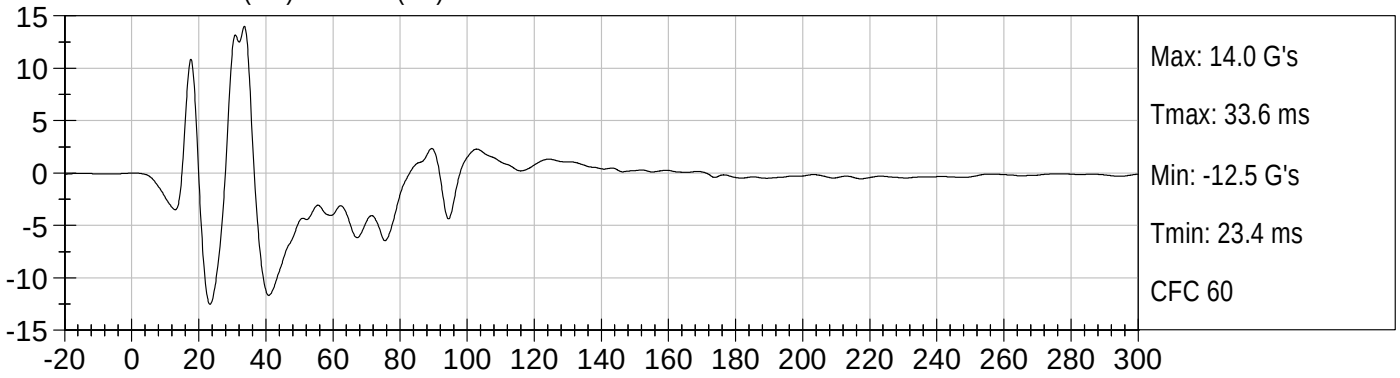
		Page No.
Figure No. 1.	Vehicle Center of Gravity (X) Acceleration vs. Time	C-1
Figure No. 2.	Vehicle Center of Gravity (X) Velocity vs. Time	C-1
Figure No. 3.	Vehicle Center of Gravity (Y) Acceleration vs. Time	C-1
Figure No. 4.	Vehicle Center of Gravity (Y) Velocity vs. Time	C-1
Figure No. 5.	Vehicle Center of Gravity (Z) Acceleration vs. Time	C-2
Figure No. 6.	Vehicle Center of Gravity (Z) Velocity vs. Time	C-2
Figure No. 7.	Vehicle Center of Gravity Resultant Acceleration vs. Time	C-2
Figure No. 8.	Left Floor Sill (Y) Acceleration vs. Time	C-3
Figure No. 9.	Left Floor Sill (Y) Velocity vs. Time	C-3
Figure No. 10.	Left Floor Sill (Y) Displacement vs. Time	C-3
Figure No. 11.	Left A-Pillar Sill (Y) Acceleration vs. Time	C-4
Figure No. 12.	Left A-Pillar Sill (Y) Velocity vs. Time	C-4
Figure No. 13.	Left A-Pillar Sill (Y) Displacement vs. Time	C-4
Figure No. 14.	Left Lower A-Pillar (Y) Acceleration vs. Time	C-5
Figure No. 15.	Left Lower A-Pillar (Y) Velocity vs. Time	C-5
Figure No. 16.	Left Lower A-Pillar (Y) Displacement vs. Time	C-5
Figure No. 17.	Left Mid A-Pillar (Y) Acceleration vs. Time	C-6
Figure No. 18.	Left Mid A-Pillar (Y) Velocity vs. Time	C-6
Figure No. 19.	Left Mid A-Pillar (Y) Displacement vs. Time	C-6
Figure No. 20.	Left B-Pillar Sill (Y) Acceleration vs. Time	C-7
Figure No. 21.	Left B-Pillar Sill (Y) Velocity vs. Time	C-7
Figure No. 22.	Left B-Pillar Sill (Y) Displacement vs. Time	C-7
Figure No. 23.	Left Lower B-Pillar (Y) Acceleration vs. Time	C-8
Figure No. 24.	Left Lower B-Pillar (Y) Velocity vs. Time	C-8
Figure No. 25.	Left Lower B-Pillar (Y) Displacement vs. Time	C-8
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

		Page No.
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
Figure No. 32.	Engine Top (X) Acceleration vs. Time	C-11
Figure No. 33.	Engine Top (X) Velocity vs. Time	C-11
Figure No. 34.	Engine Top (Y) Acceleration vs. Time	C-11
Figure No. 35.	Engine Top (Y) Velocity vs. Time	C-11
Figure No. 36.	Firewall Center (Y) Acceleration vs. Time	C-12
Figure No. 37.	Firewall Center (Y) Velocity vs. Time	C-12
Figure No. 38.	Right Roof at Vertical Impact Reference Line (Y) Acceleration vs. Time	C-13
Figure No. 39.	Right Roof at Vertical Impact Reference Line (Y) Velocity vs. Time	C-13
Figure No. 40.	Right Floor Sill (Y) Acceleration vs. Time	C-13
Figure No. 41.	Right Floor Sill (Y) Velocity vs. Time	C-13
Figure No. 42.	Rear Deck (X) Acceleration vs. Time	C-14
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

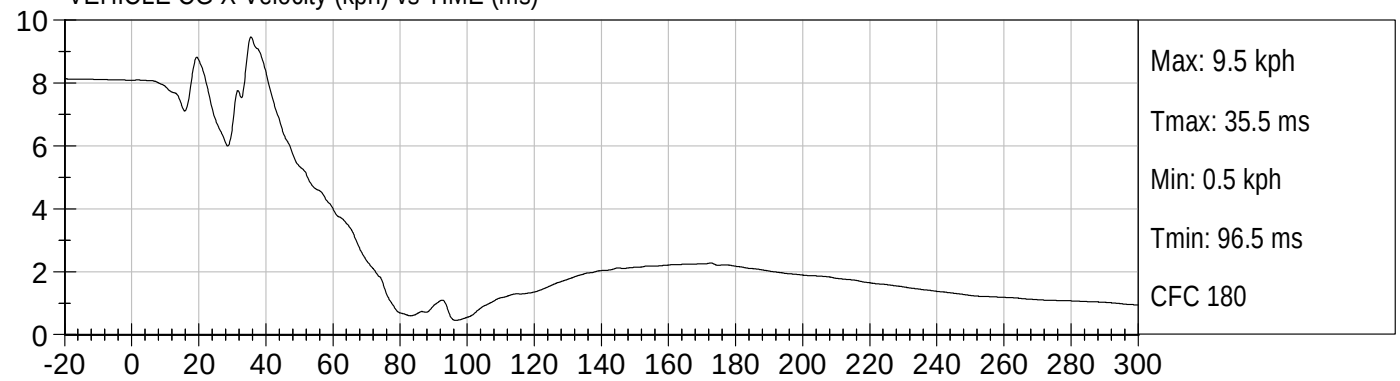
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

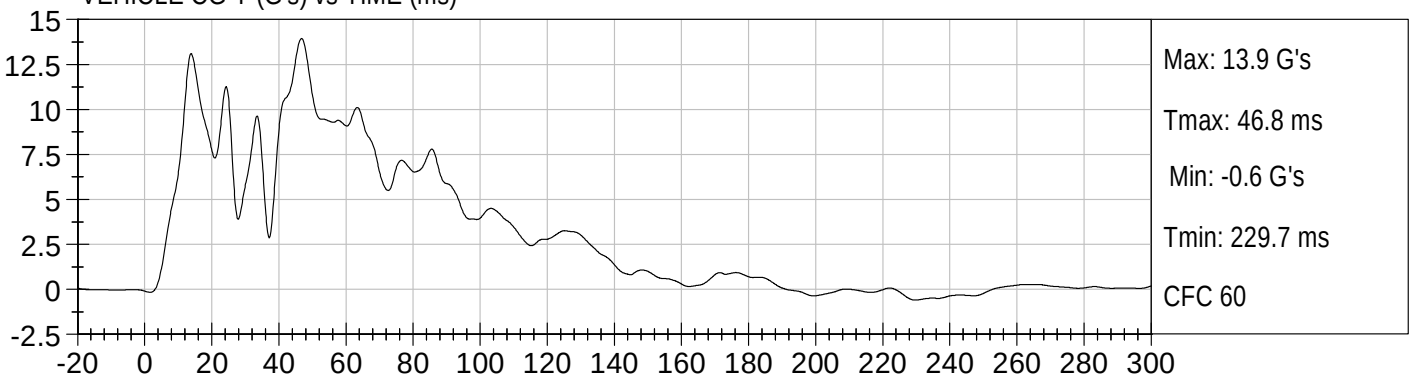
VEHICLE CG X (G's) vs TIME (ms)



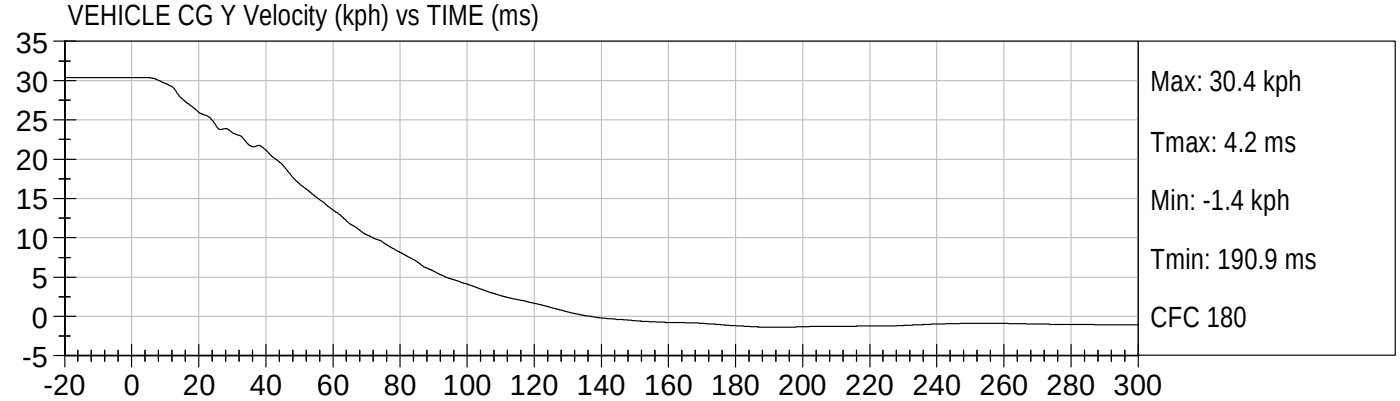
VEHICLE CG X Velocity (kph) vs TIME (ms)



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



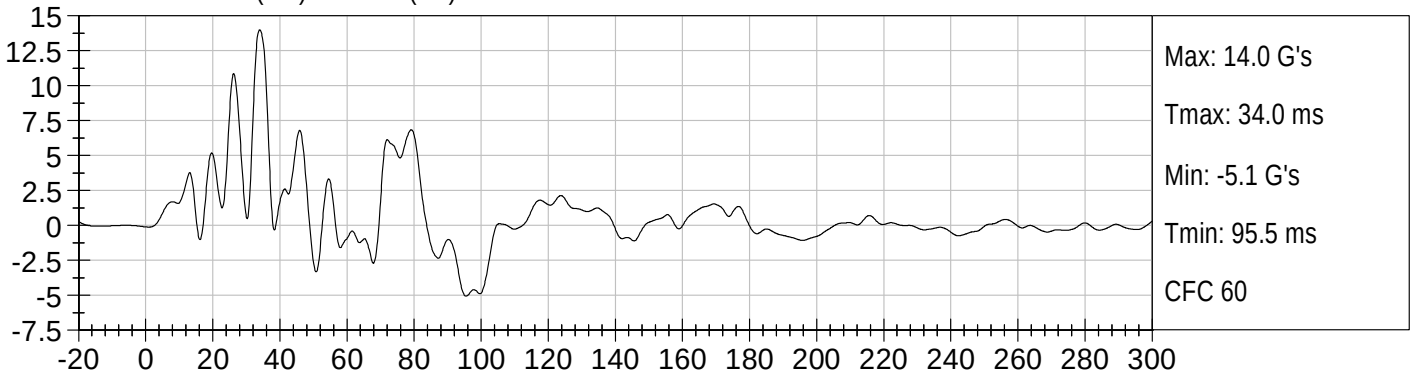
VEHICLE CG Y Velocity (kph) vs TIME (ms)



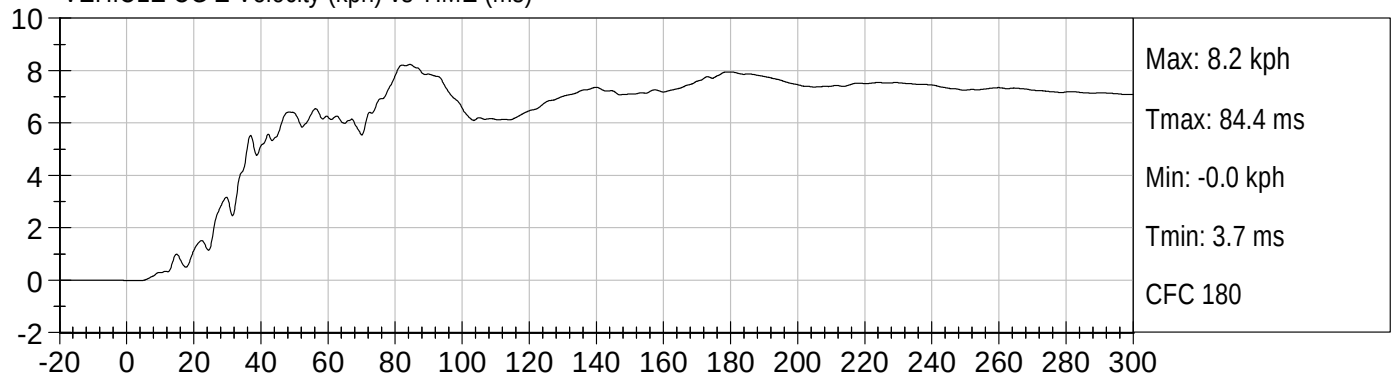
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

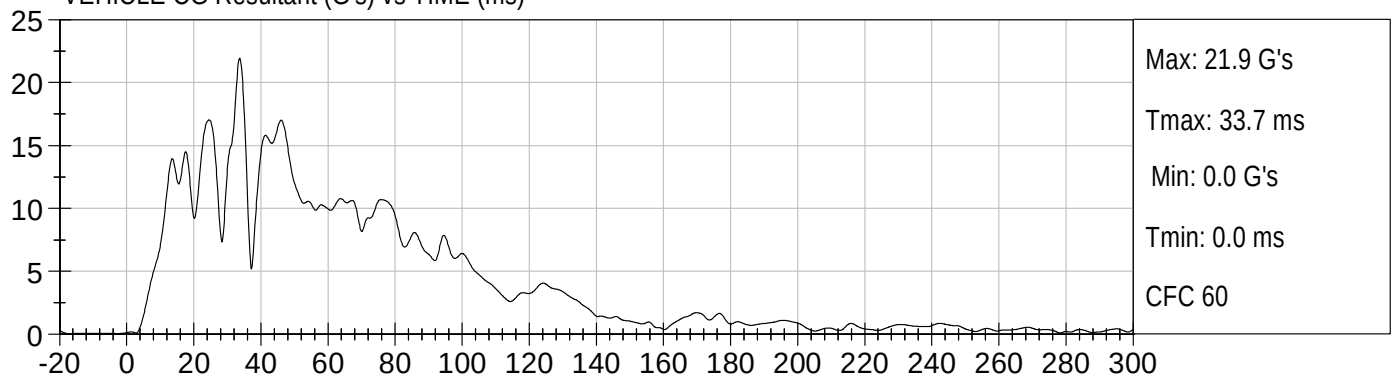
VEHICLE CG Z (G's) vs TIME (ms)



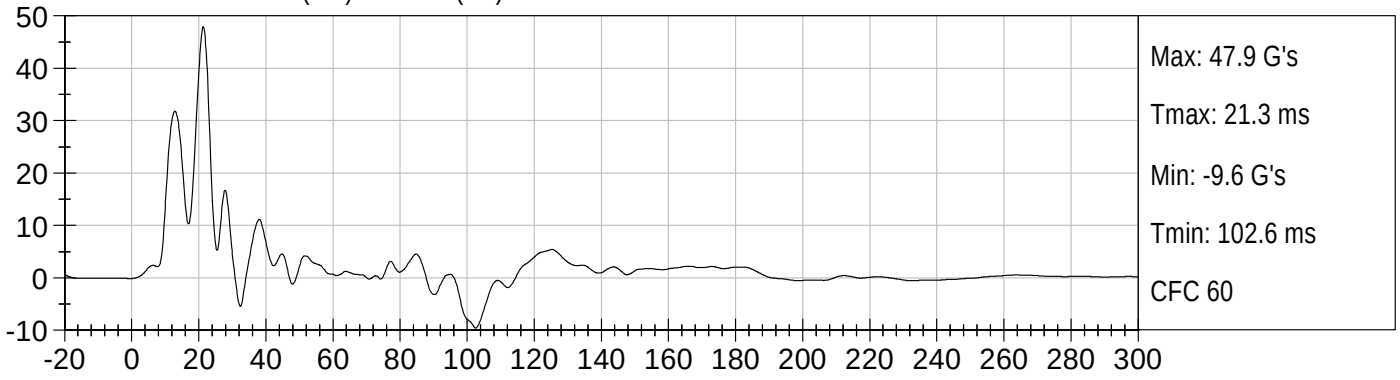
VEHICLE CG Z Velocity (kph) vs TIME (ms)



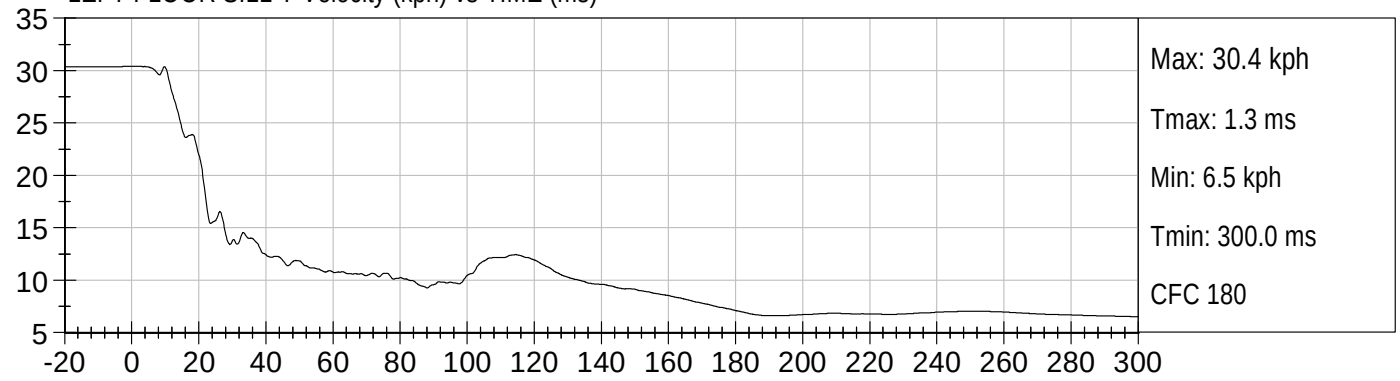
VEHICLE CG Resultant (G's) vs TIME (ms)



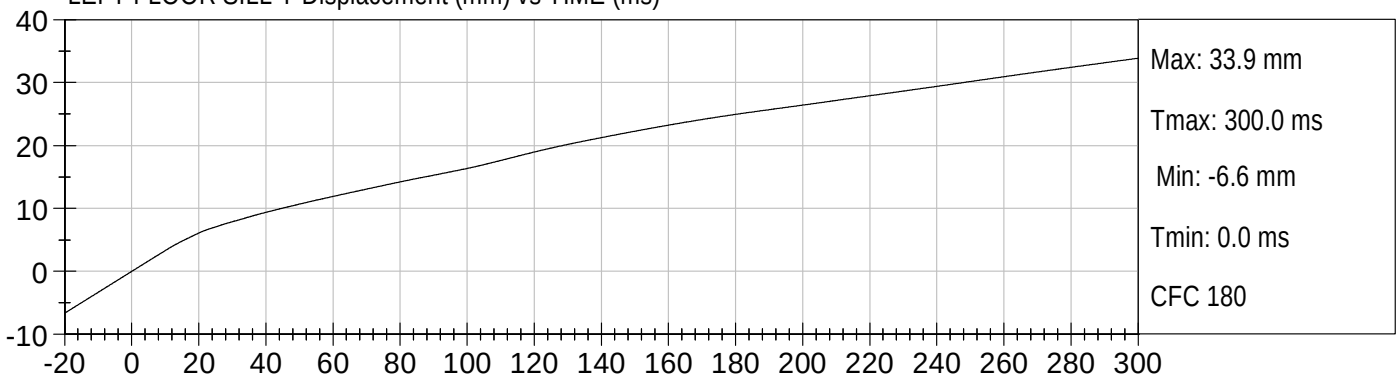
LEFT FLOOR SILL Y (G's) vs TIME (ms)



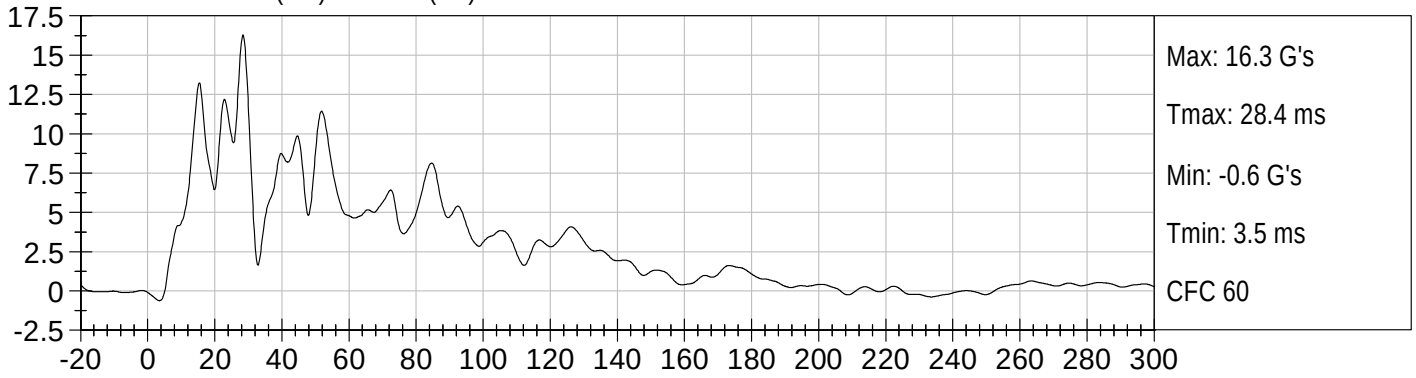
LEFT FLOOR SILL Y Velocity (kph) vs TIME (ms)



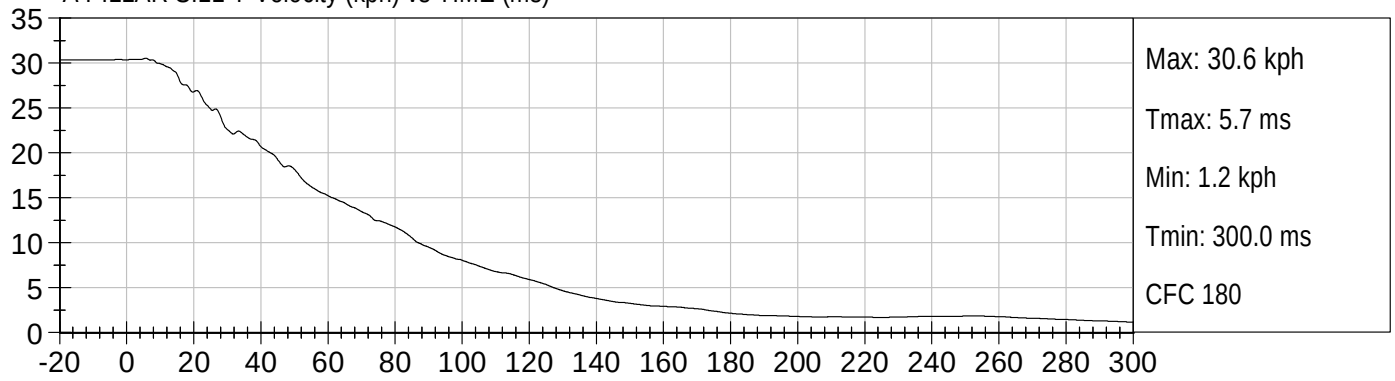
LEFT FLOOR SILL Y Displacement (mm) vs TIME (ms)



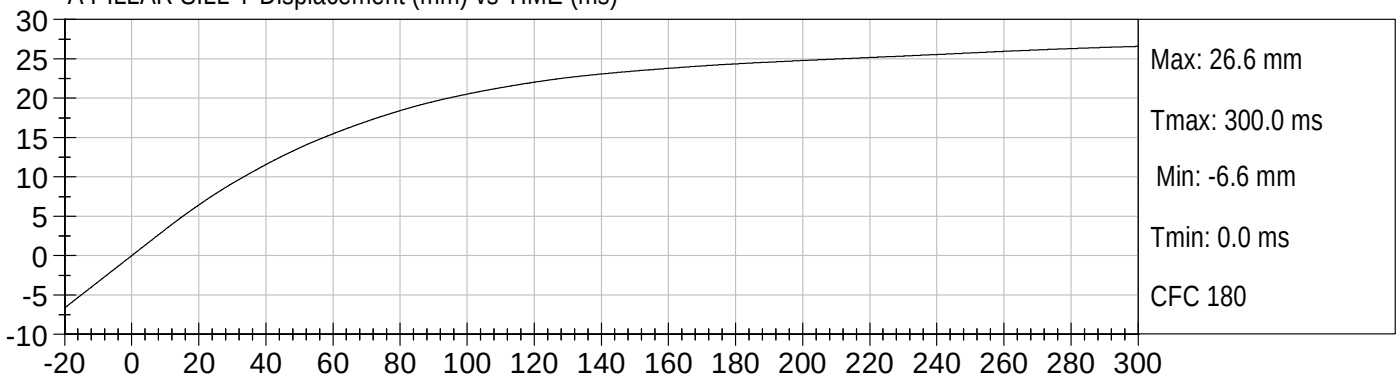
A PILLAR SILL Y (G's) vs TIME (ms)



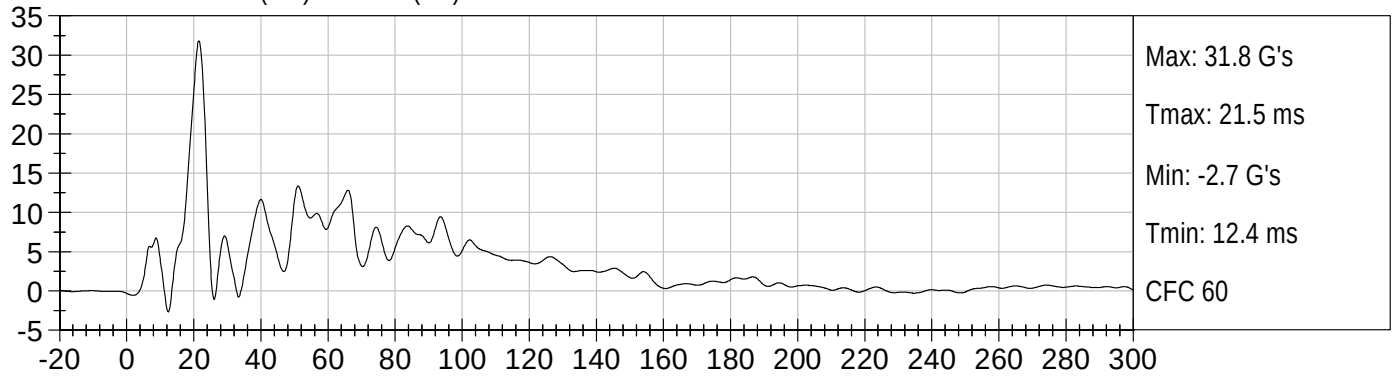
A PILLAR SILL Y Velocity (kph) vs TIME (ms)



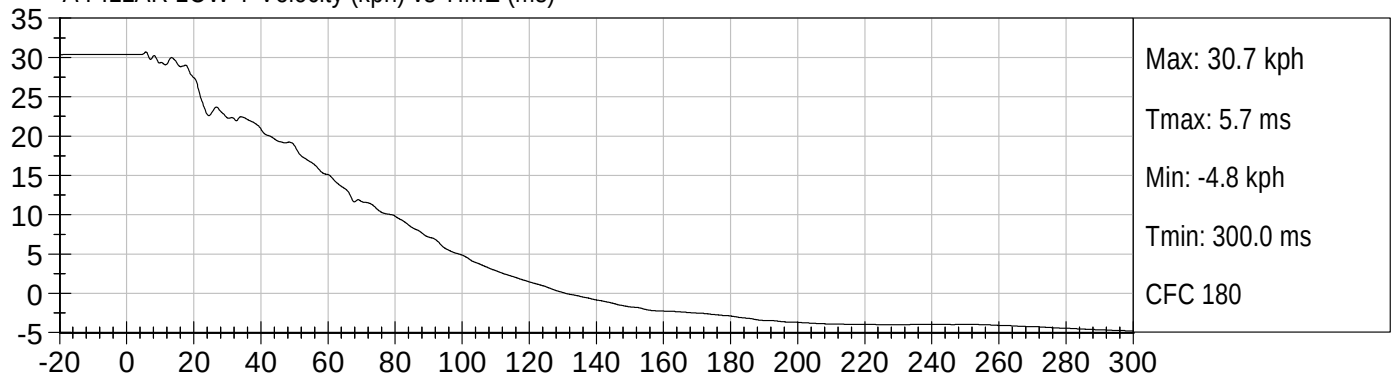
A PILLAR SILL Y Displacement (mm) vs TIME (ms)



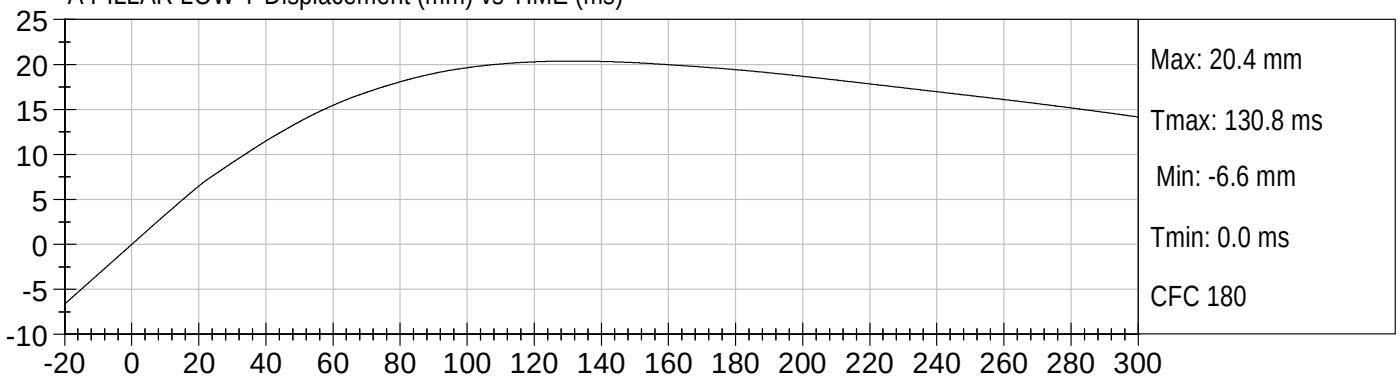
A PILLAR LOW Y (G's) vs TIME (ms)



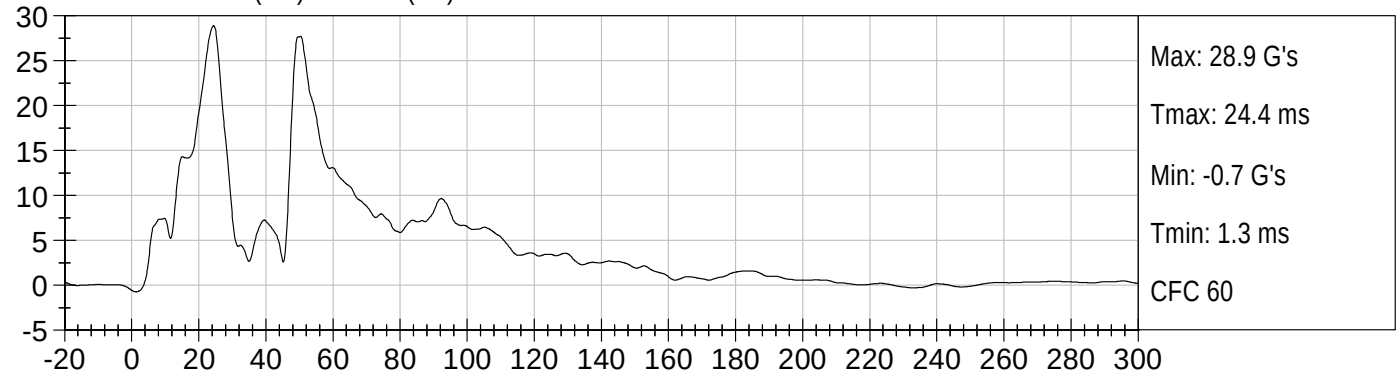
A PILLAR LOW Y Velocity (kph) vs TIME (ms)



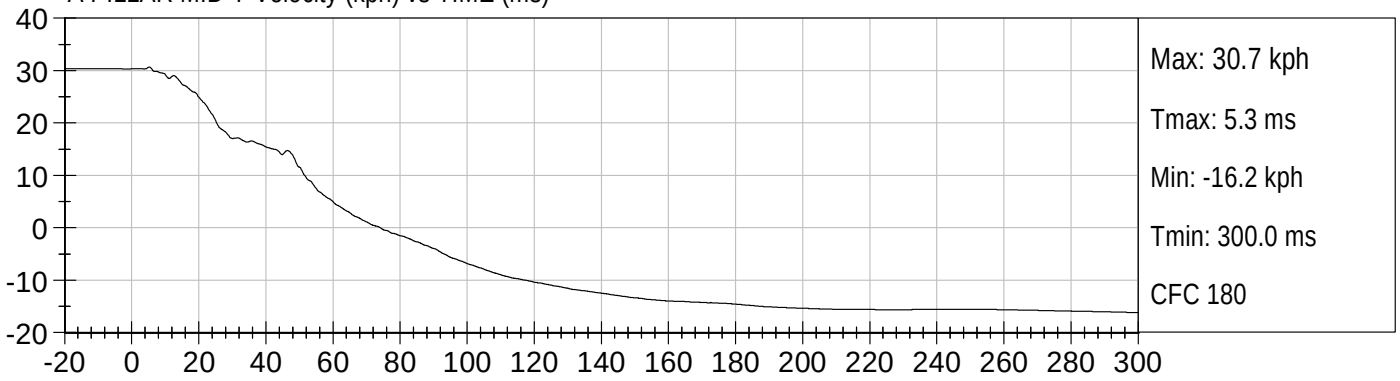
A PILLAR LOW Y Displacement (mm) vs TIME (ms)



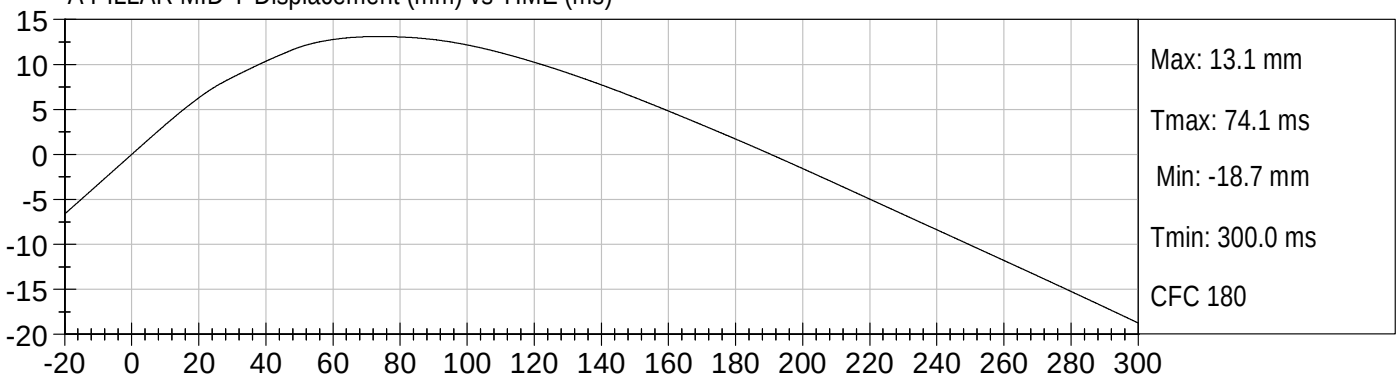
A PILLAR MID Y (G's) vs TIME (ms)



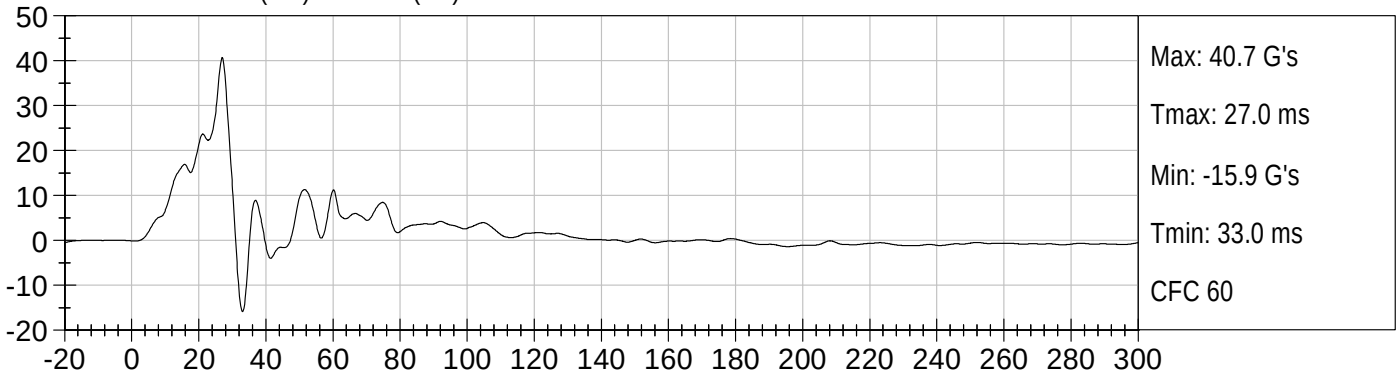
A PILLAR MID Y Velocity (kph) vs TIME (ms)



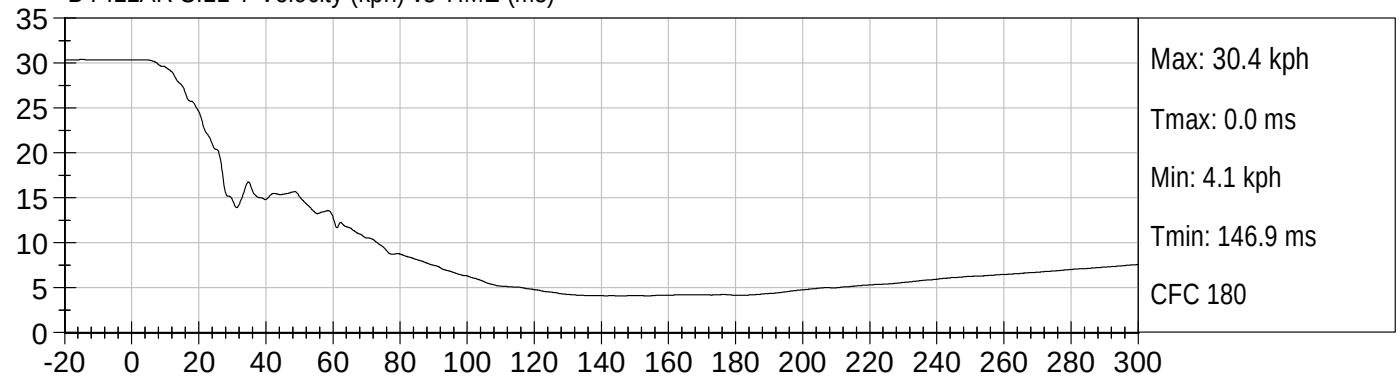
A PILLAR MID Y Displacement (mm) vs TIME (ms)



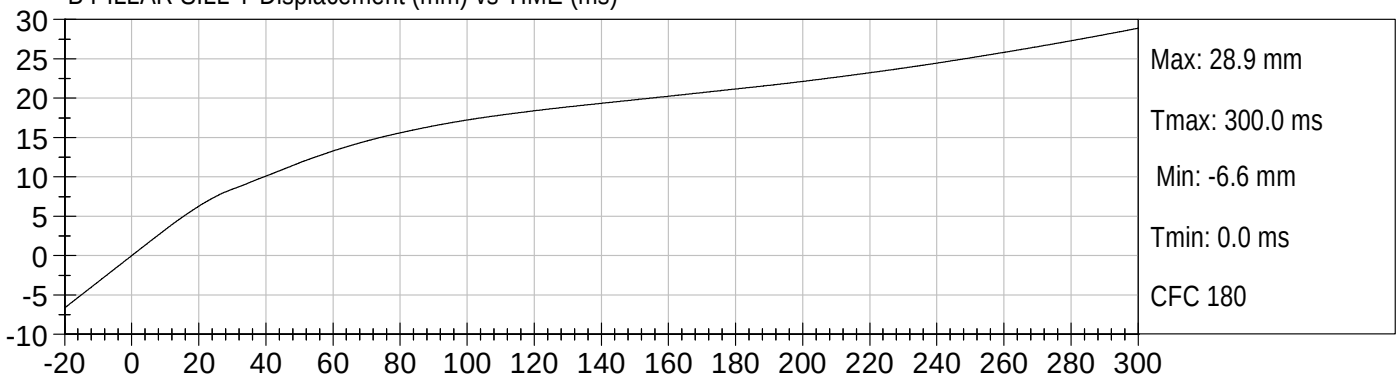
B PILLAR SILL Y (G's) vs TIME (ms)



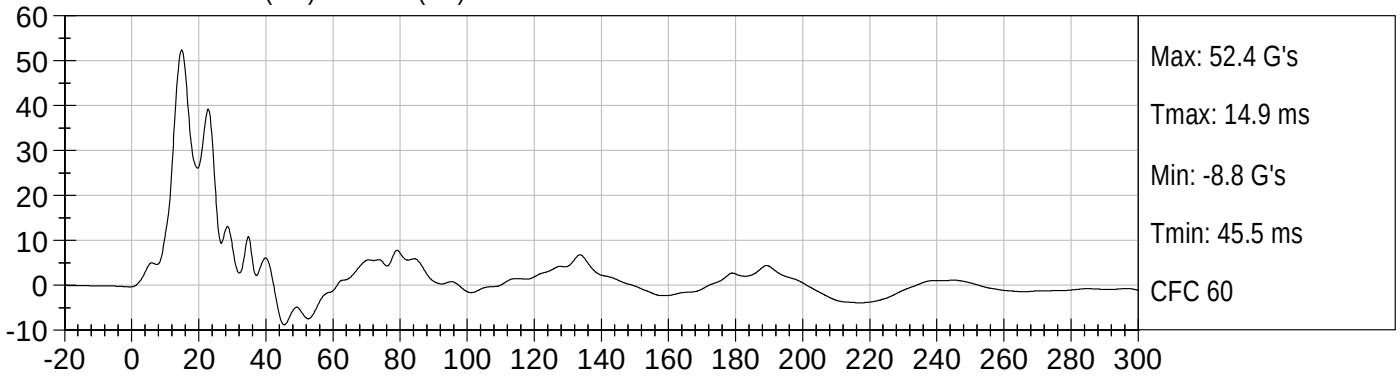
B PILLAR SILL Y Velocity (kph) vs TIME (ms)



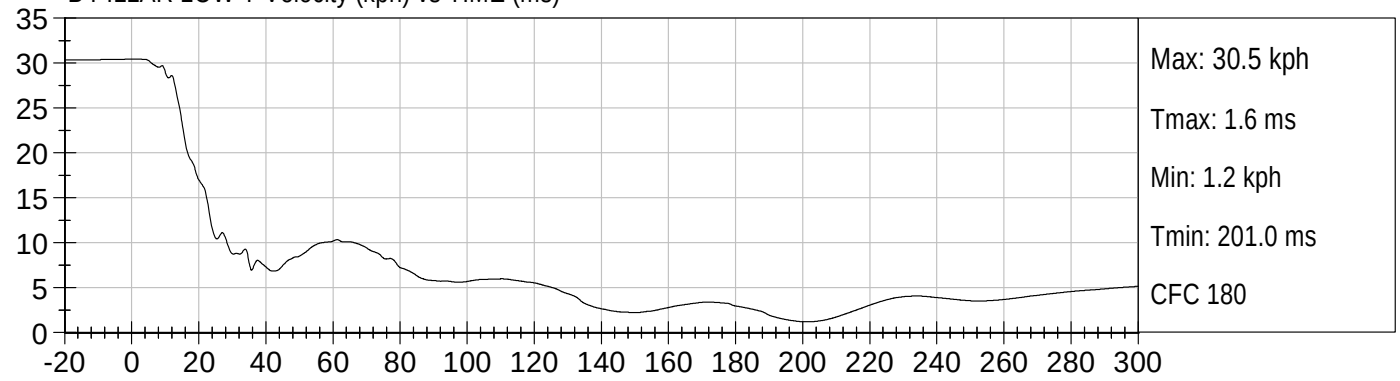
B PILLAR SILL Y Displacement (mm) vs TIME (ms)



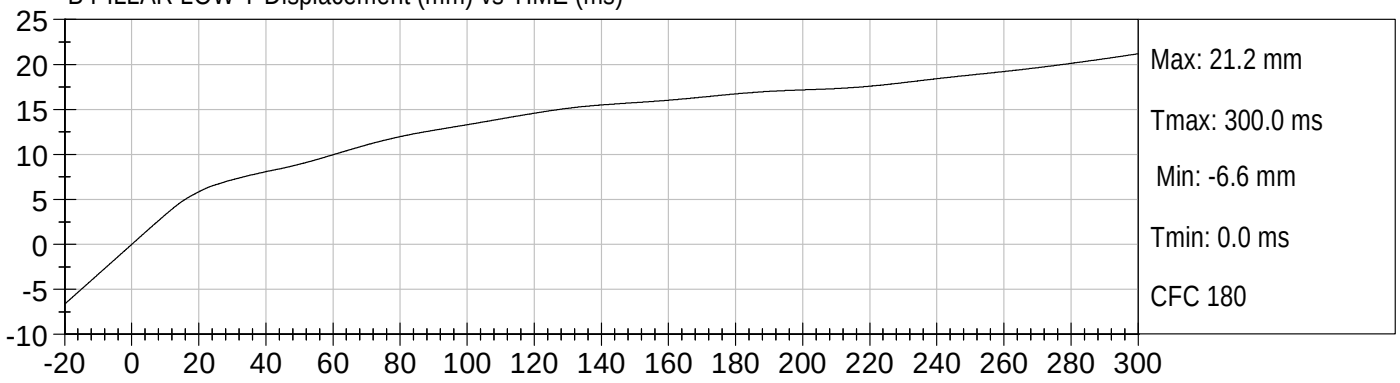
B PILLAR LOW Y (G's) vs TIME (ms)



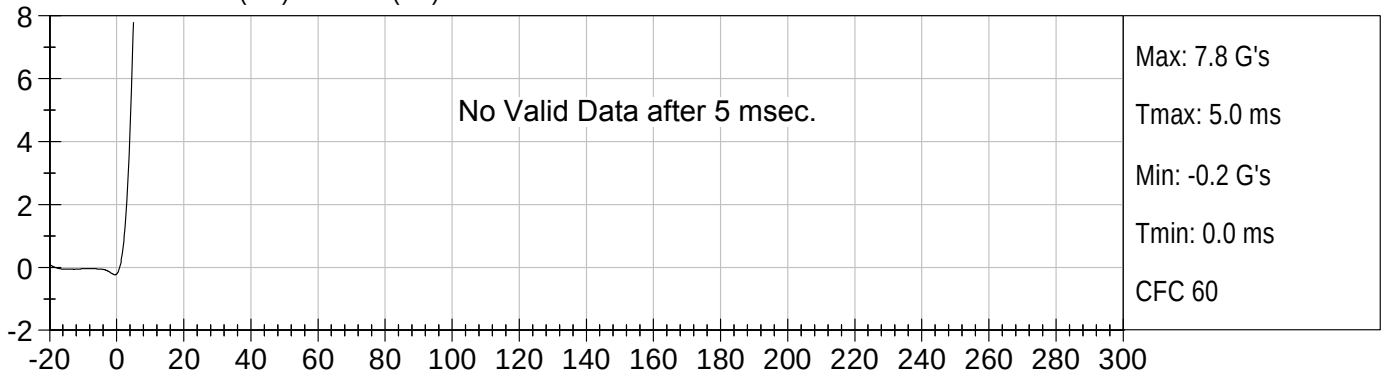
B PILLAR LOW Y Velocity (kph) vs TIME (ms)



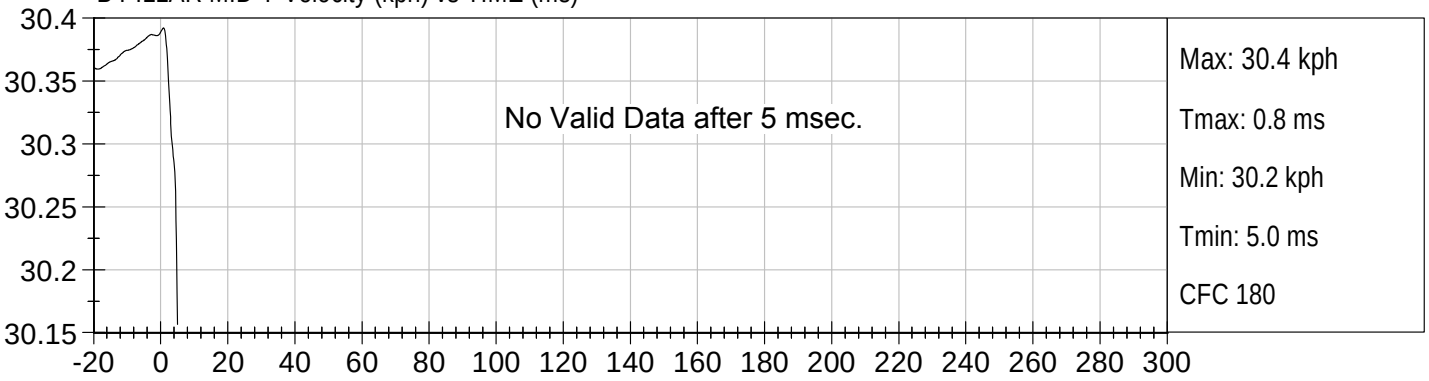
B PILLAR LOW Y Displacement (mm) vs TIME (ms)



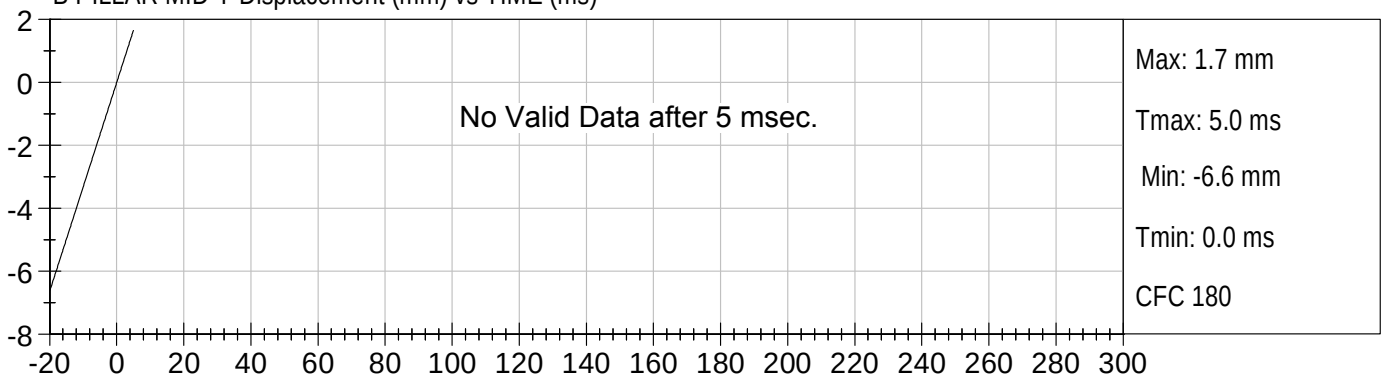
B PILLAR MID Y (G's) vs TIME (ms)



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



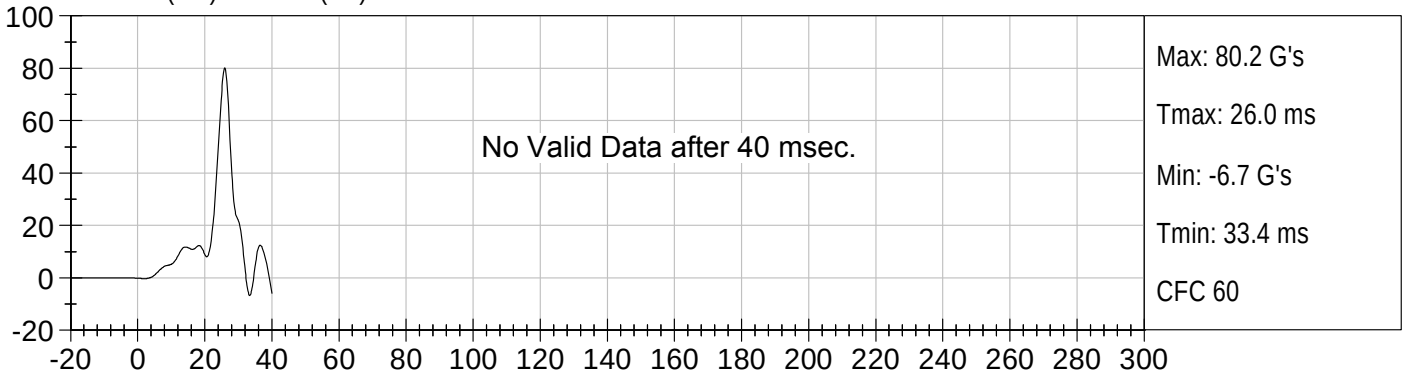
B PILLAR MID Y Displacement (mm) vs TIME (ms)



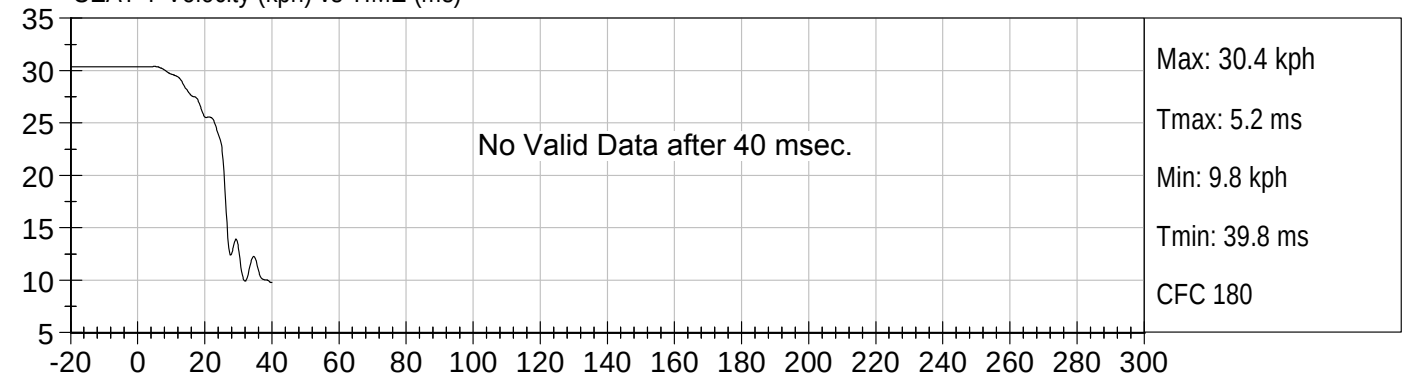
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

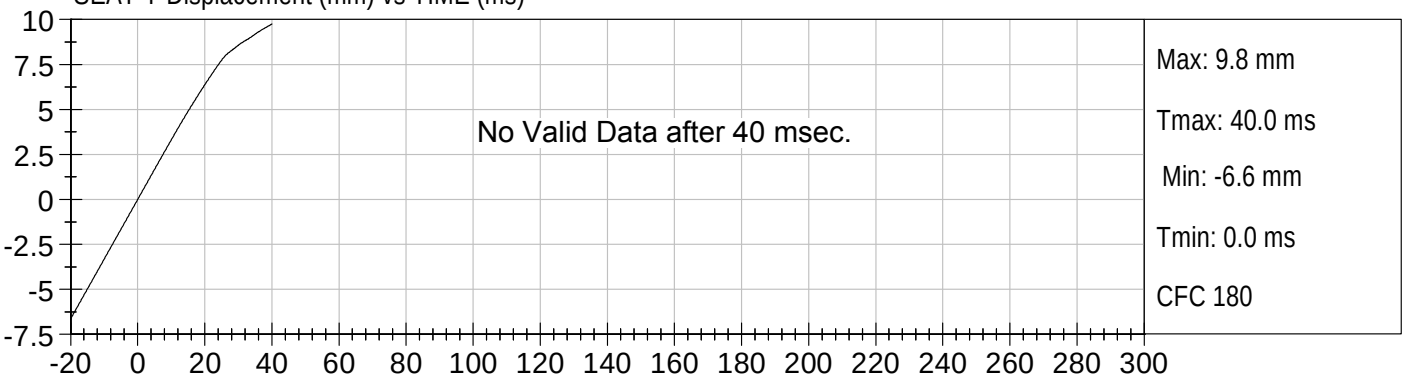
SEAT Y (G's) vs TIME (ms)



SEAT Y Velocity (kph) vs TIME (ms)



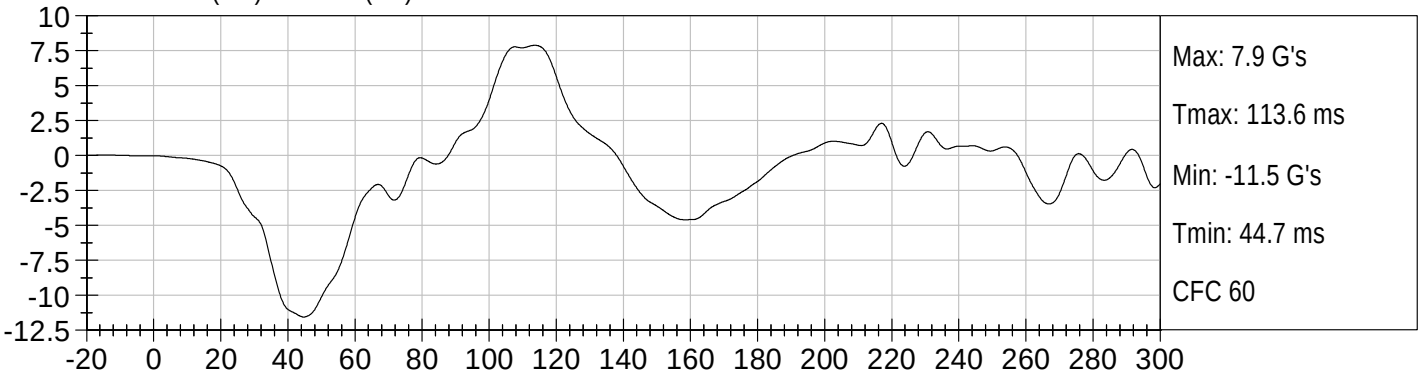
SEAT Y Displacement (mm) vs TIME (ms)



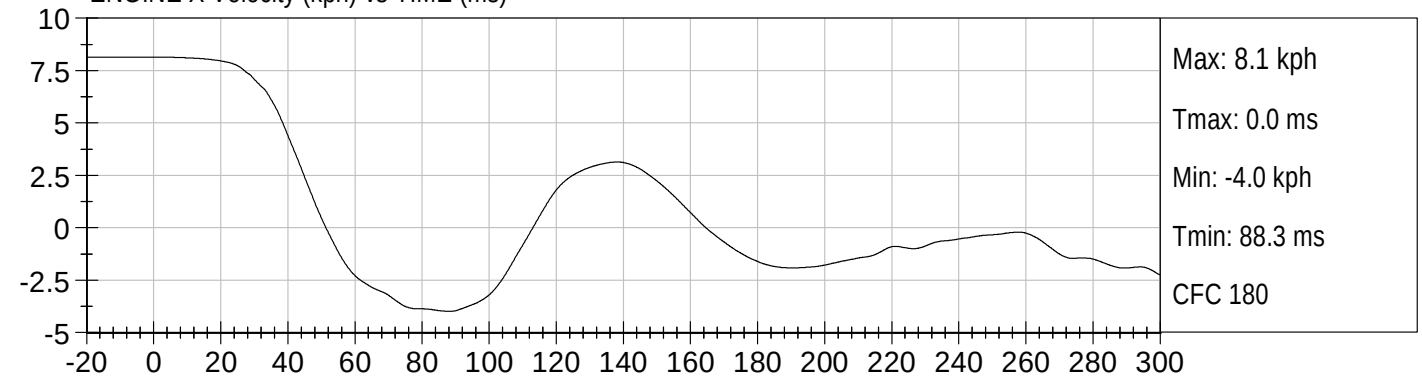
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

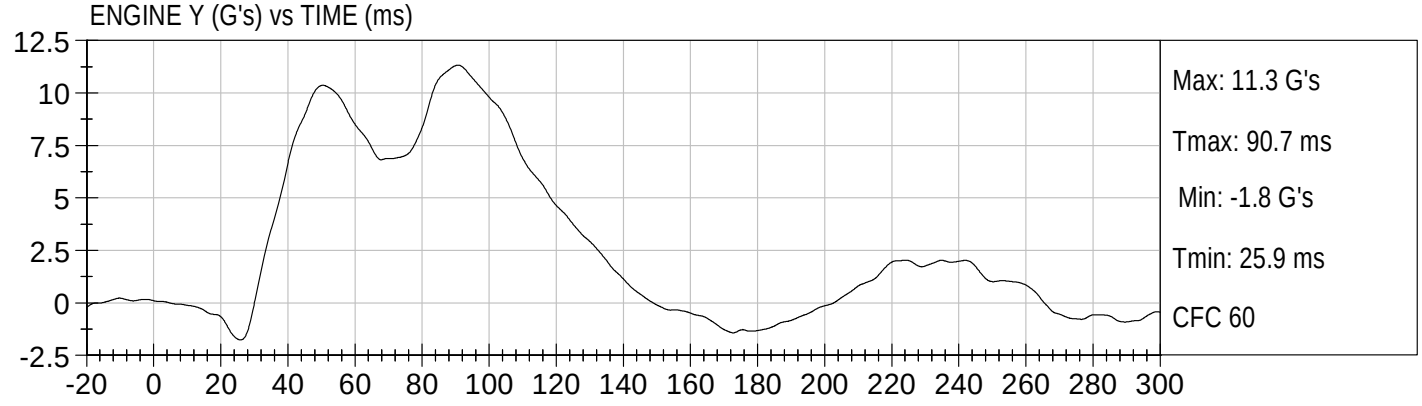
ENGINE X (G's) vs TIME (ms)



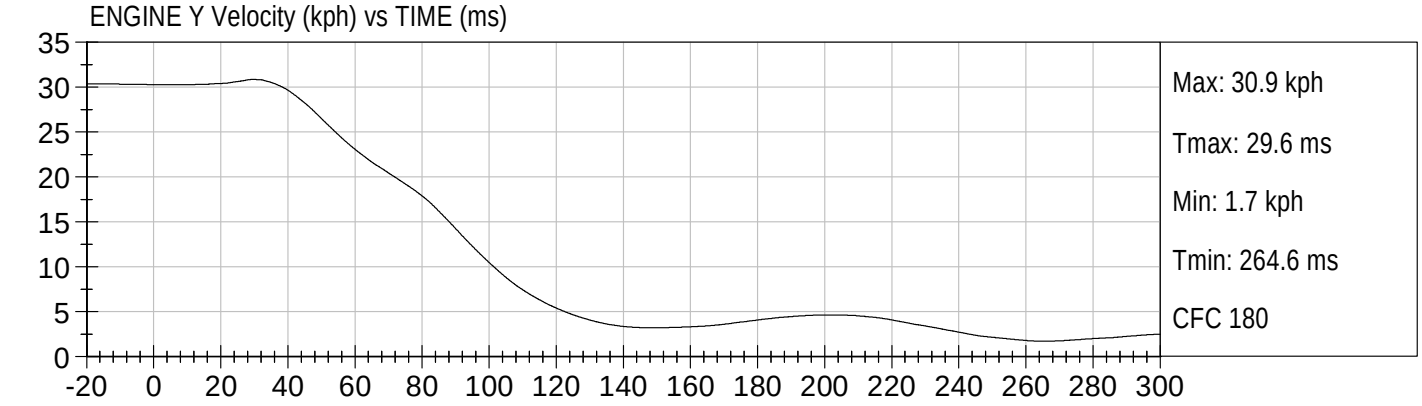
ENGINE X Velocity (kph) vs TIME (ms)



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

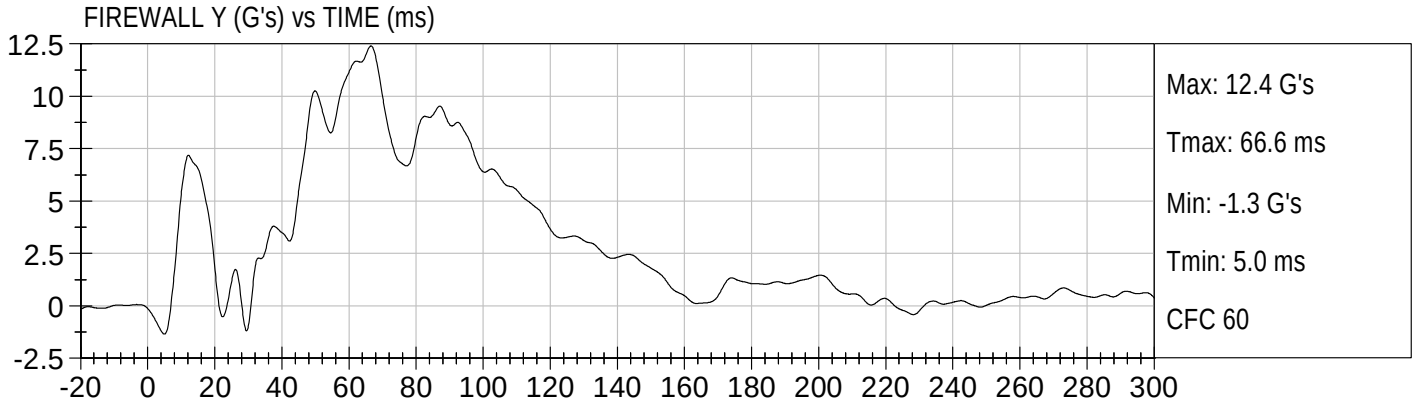


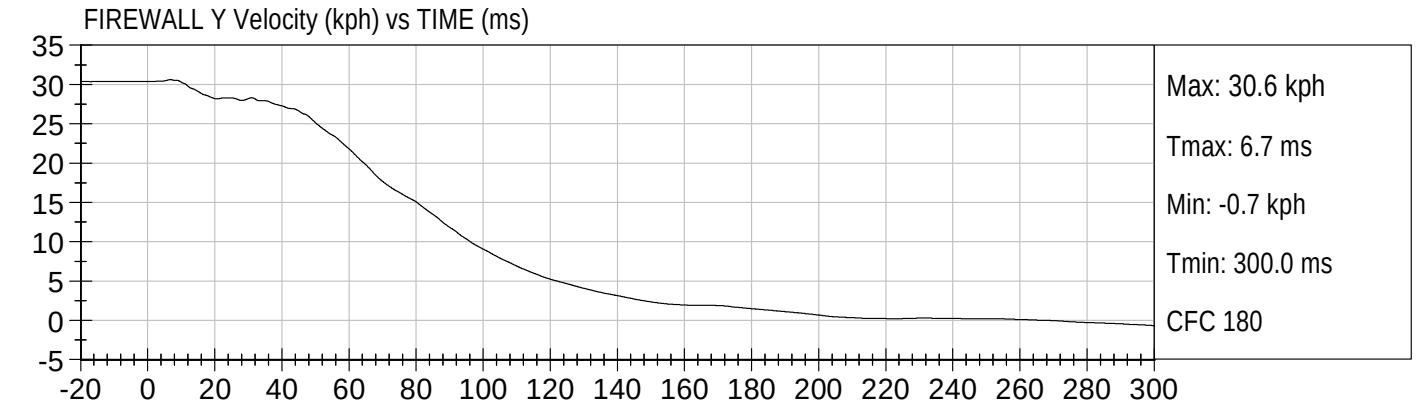
ENGINE Y Velocity (kph) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

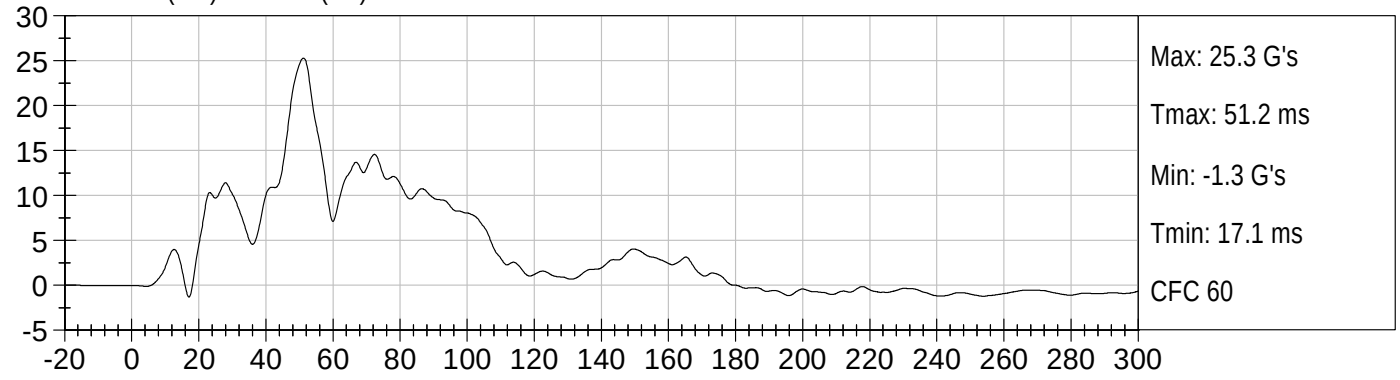




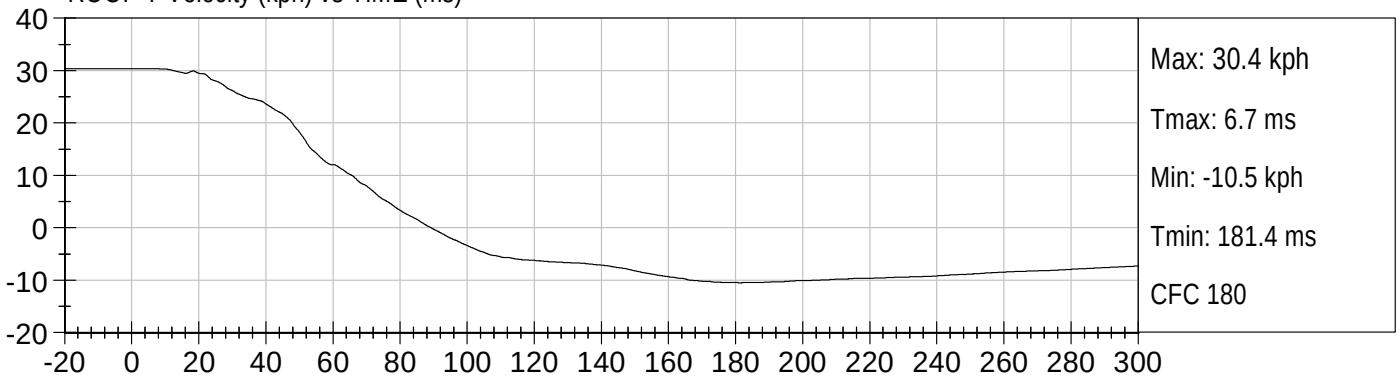
FMVSS 214 Rigid Pole Side Impact
2011 Lexus RX350 - CB5108

Test Date: 05/10/2011
Speed: 19.5 mph (31.4 km/h)

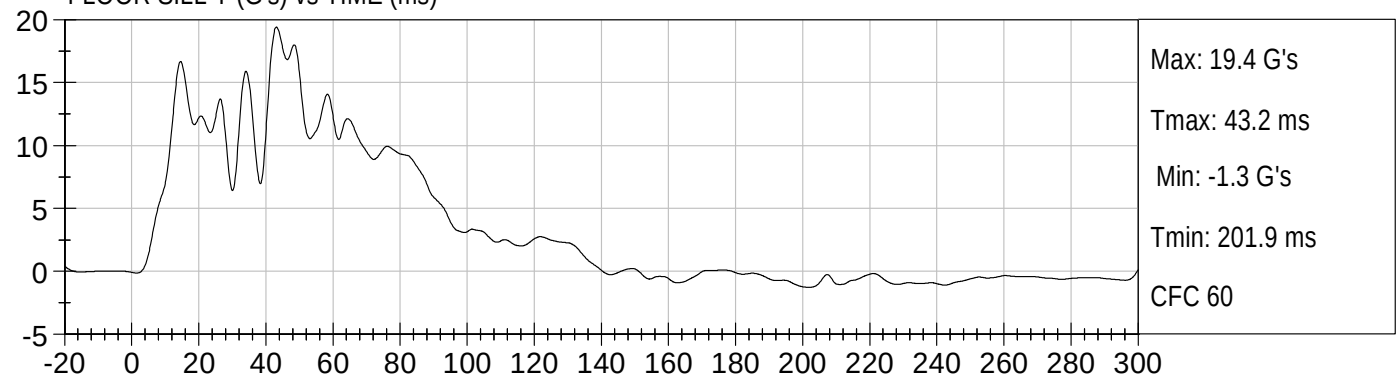
ROOF Y (G's) vs TIME (ms)



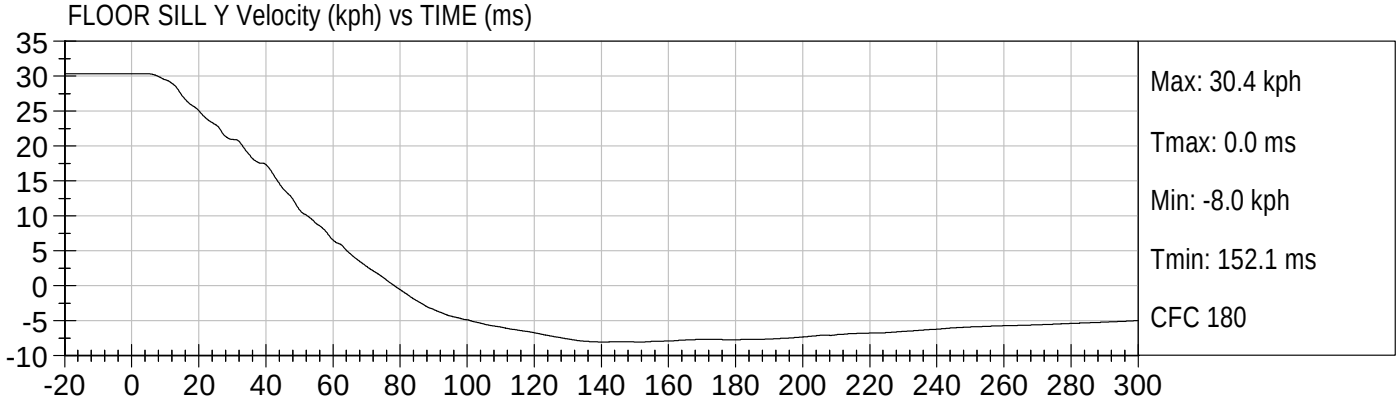
ROOF Y Velocity (kph) vs TIME (ms)



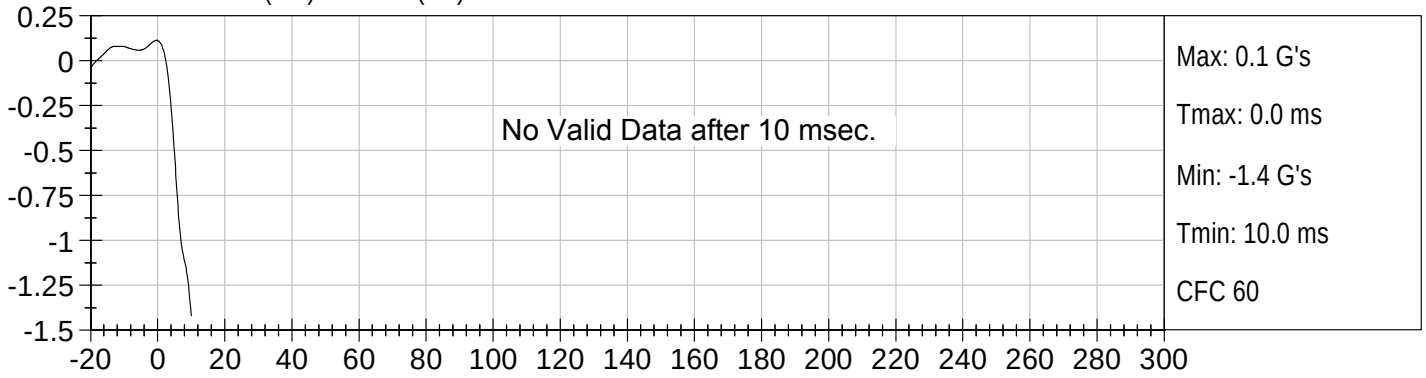
FLOOR SILL Y (G's) vs TIME (ms)



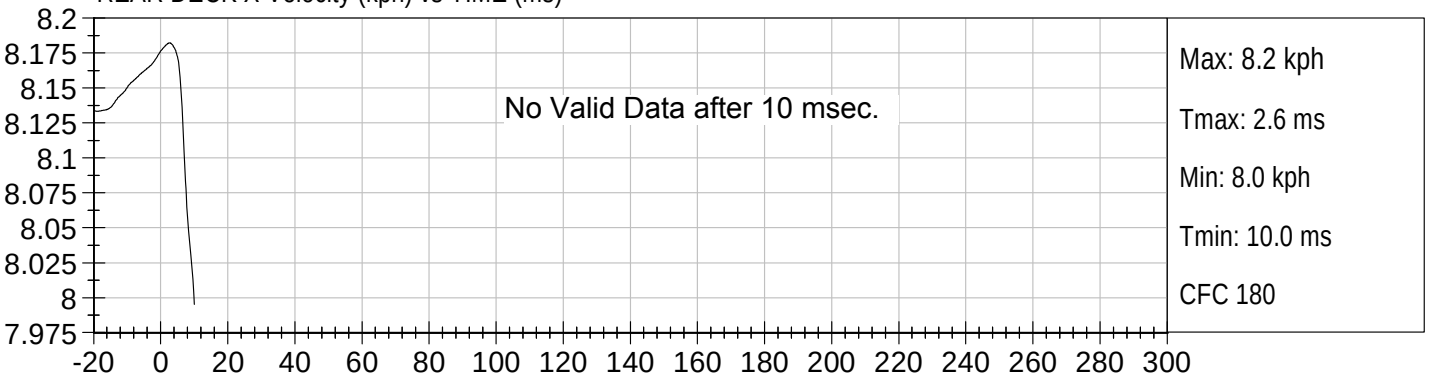
FLOOR SILL Y Velocity (kph) vs TIME (ms)



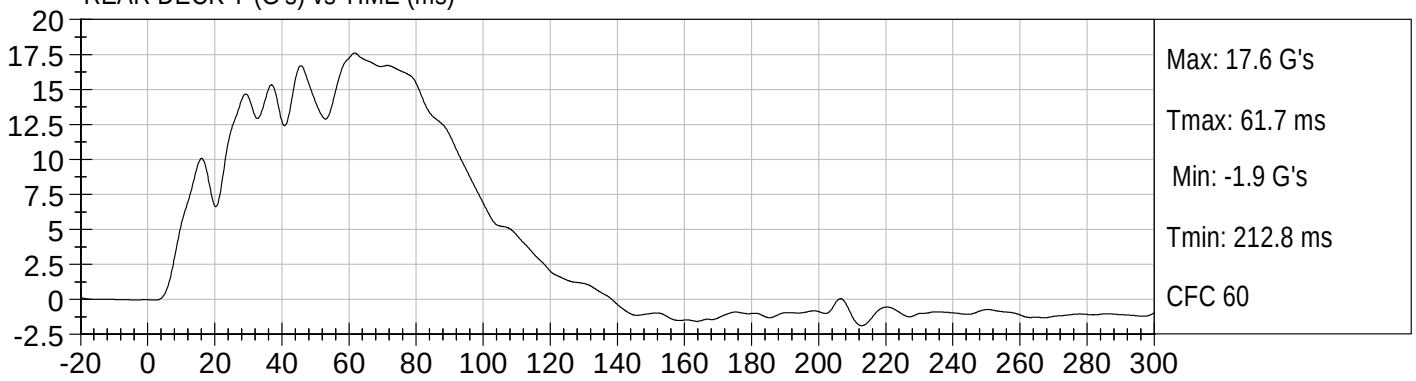
REAR DECK X (G's) vs TIME (ms)



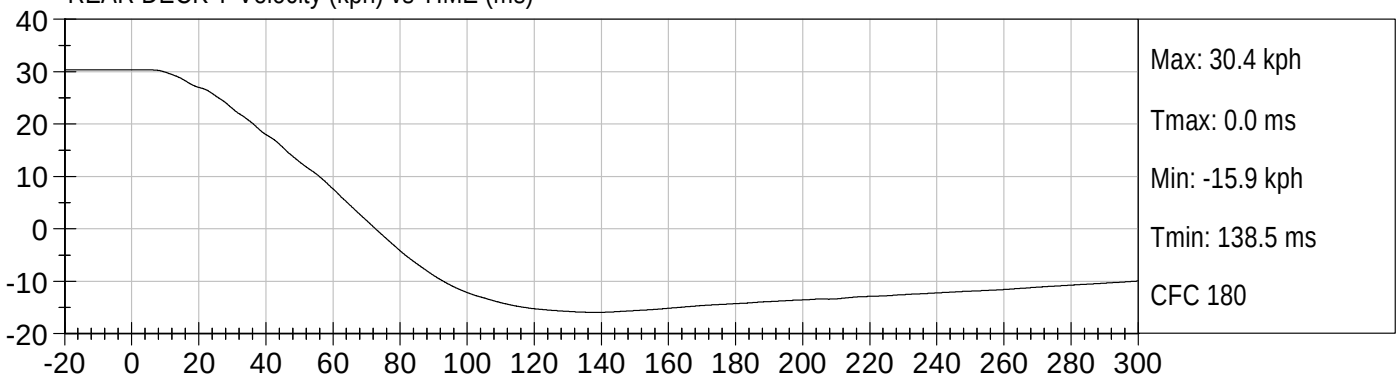
REAR DECK X Velocity (kph) vs TIME (ms)



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



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



APPENDIX D

DUMMY PERFORMANCE CALIBRATION TEST DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D111671

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Peak Resultant Acceleration	G's	125 to 155	146	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 Hall
Laboratory Technician

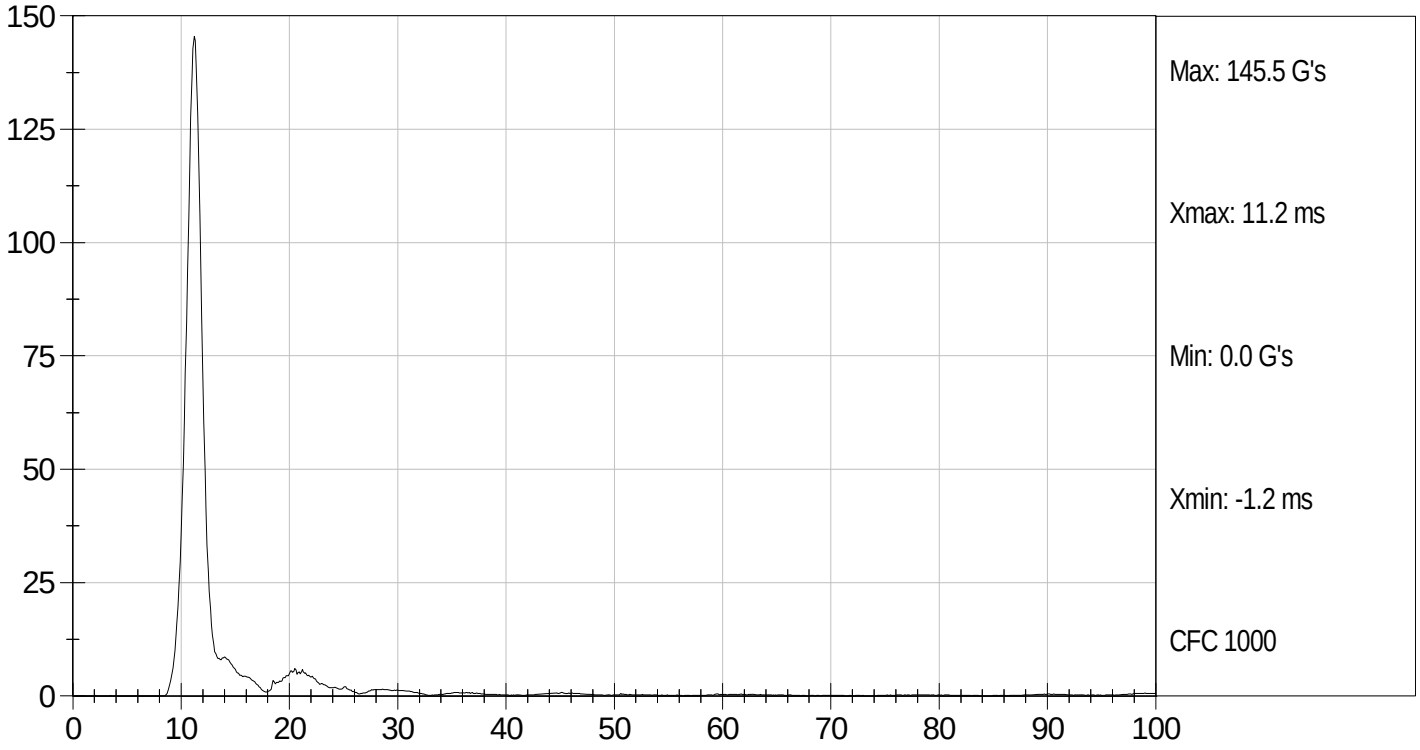
5/5/11
Test Date

David Winkelbauer
Approved By

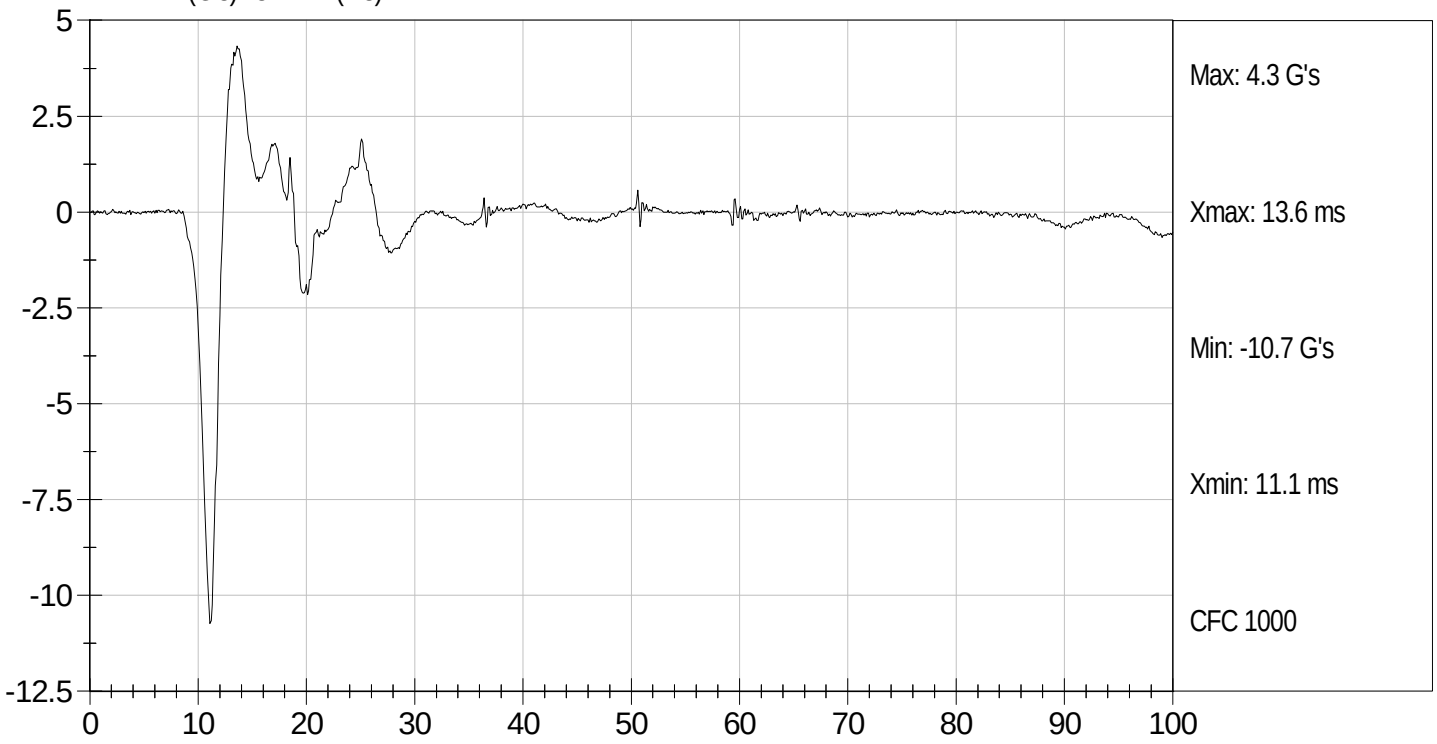
Test Desc: Head Drop
Component ID: D111671

Test Date: 5/5/11
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:** D111672

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	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	-0.03	Pass
	3 ms	m/s	-0.25 to -0.375	-0.34	Pass
	14 ms	m/s	-3.20 to -3.70	-3.32	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.4	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	60.6	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	59.8	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

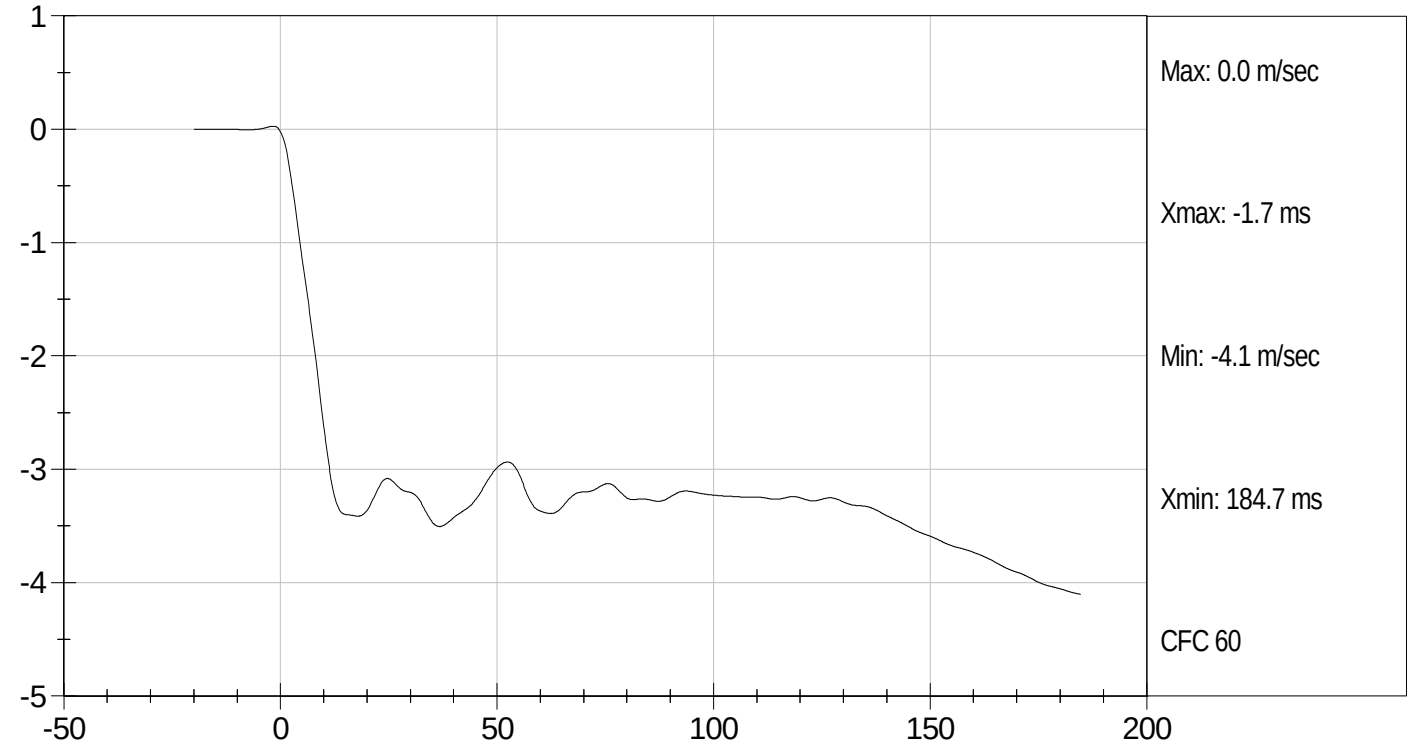
5/5/11
Test Date

David Winkelbauer
Approved By

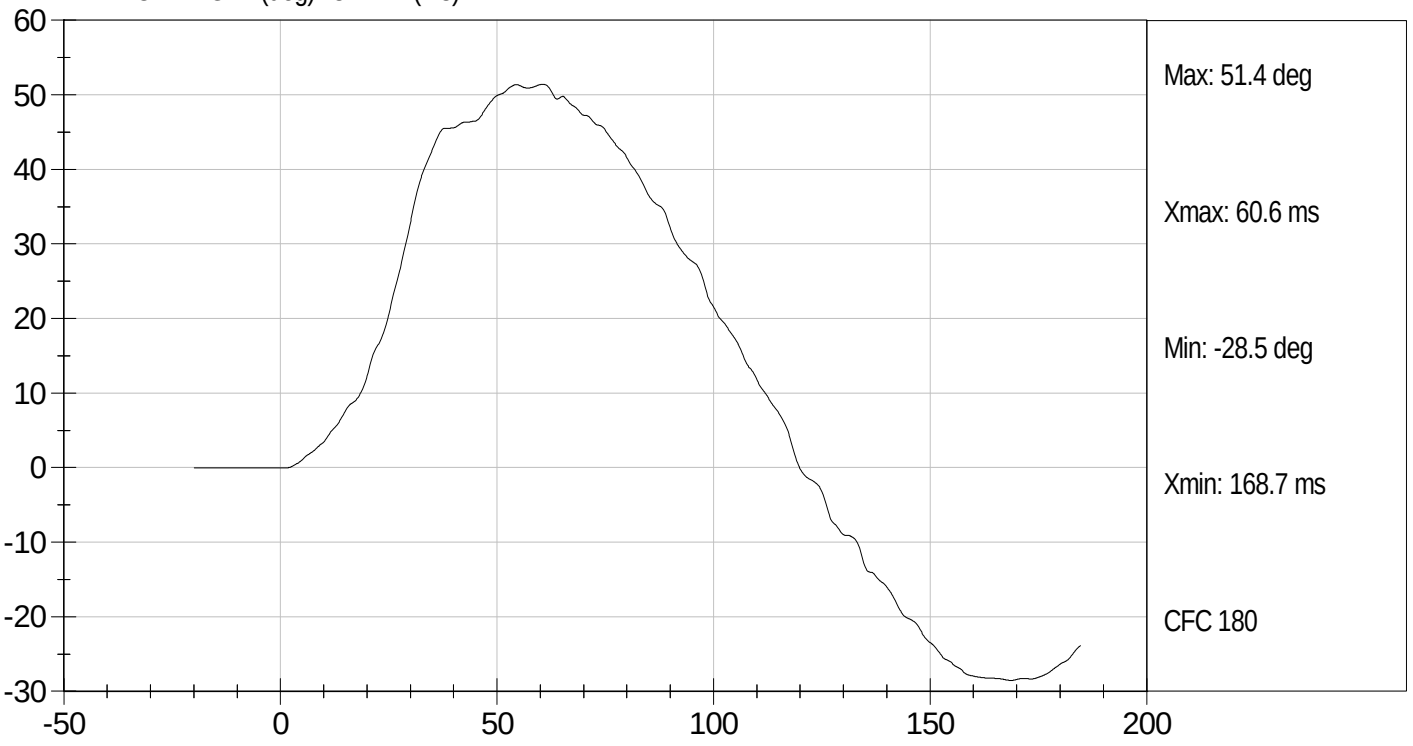
Test Desc: Neck Bending
Component ID: D111672

Test Date: 5/5/11
Velocity: 11.42 ft/s, 3.5 m/s

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



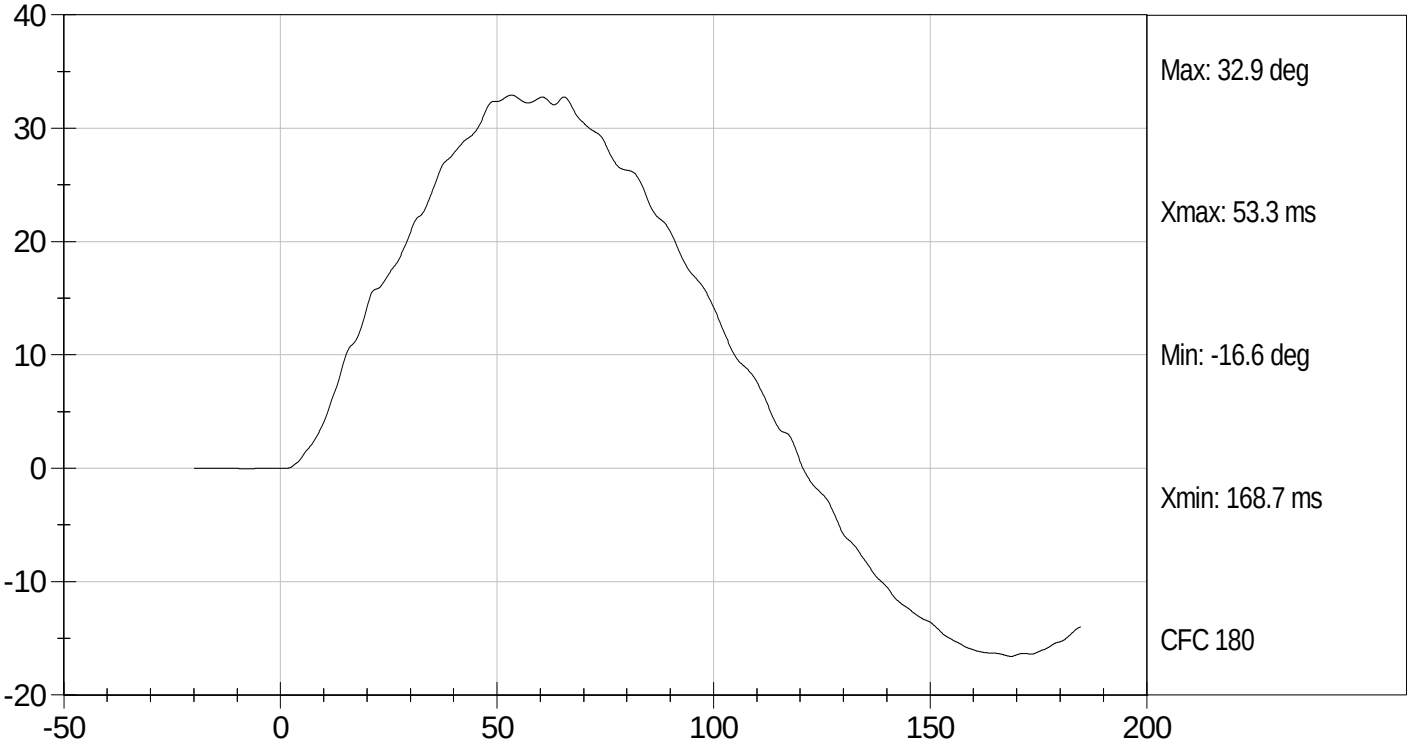
FLEXION ANGLE (deg) vs TIME (ms)



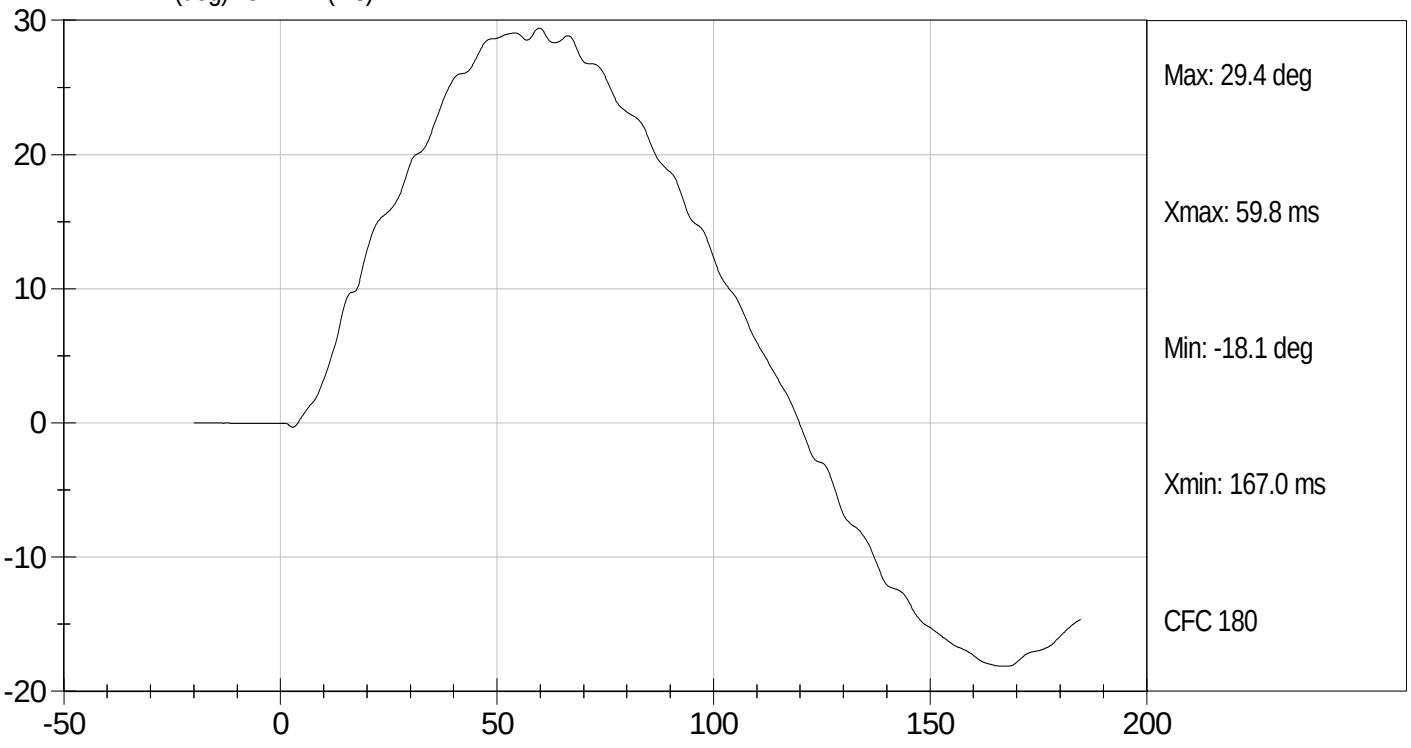
Test Desc: Neck Bending
Component ID: D111672

Test Date: 5/5/11
Velocity: 11.42 ft/s, 3.5 m/s

THETA A (deg) vs TIME (ms)



THETA B (deg) vs TIME (ms)



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111673

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	37	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	8.7	Pass
Time of Peak Shoulder Acceleration	ms	NA	18.4	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

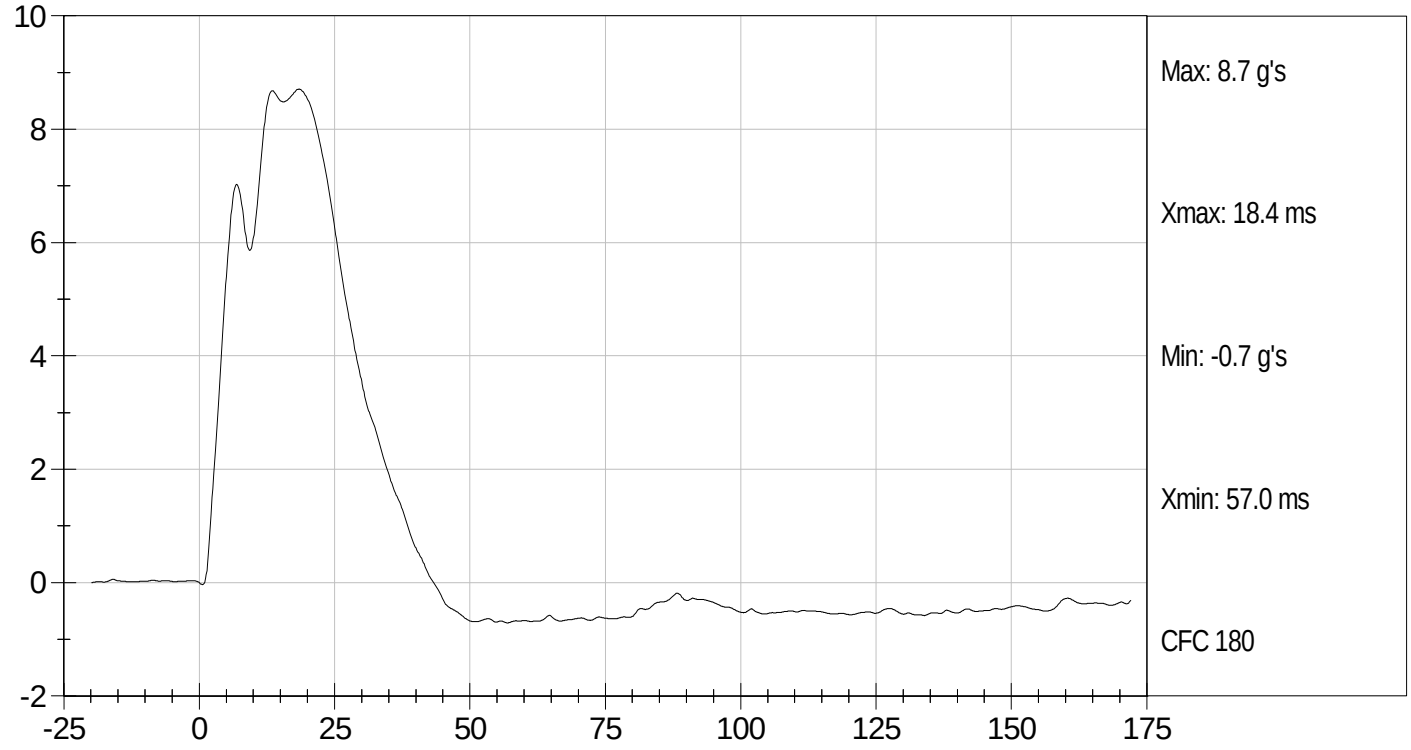
5/5/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111673

Test Date: 5/5/11
Velocity: 14.24 ft/s, 4.3 m/s

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



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111674

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
Displacement at 3 m/s	mm	36.0 to 40.0	38.9	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.8	Pass
		Overall Test Results		Pass

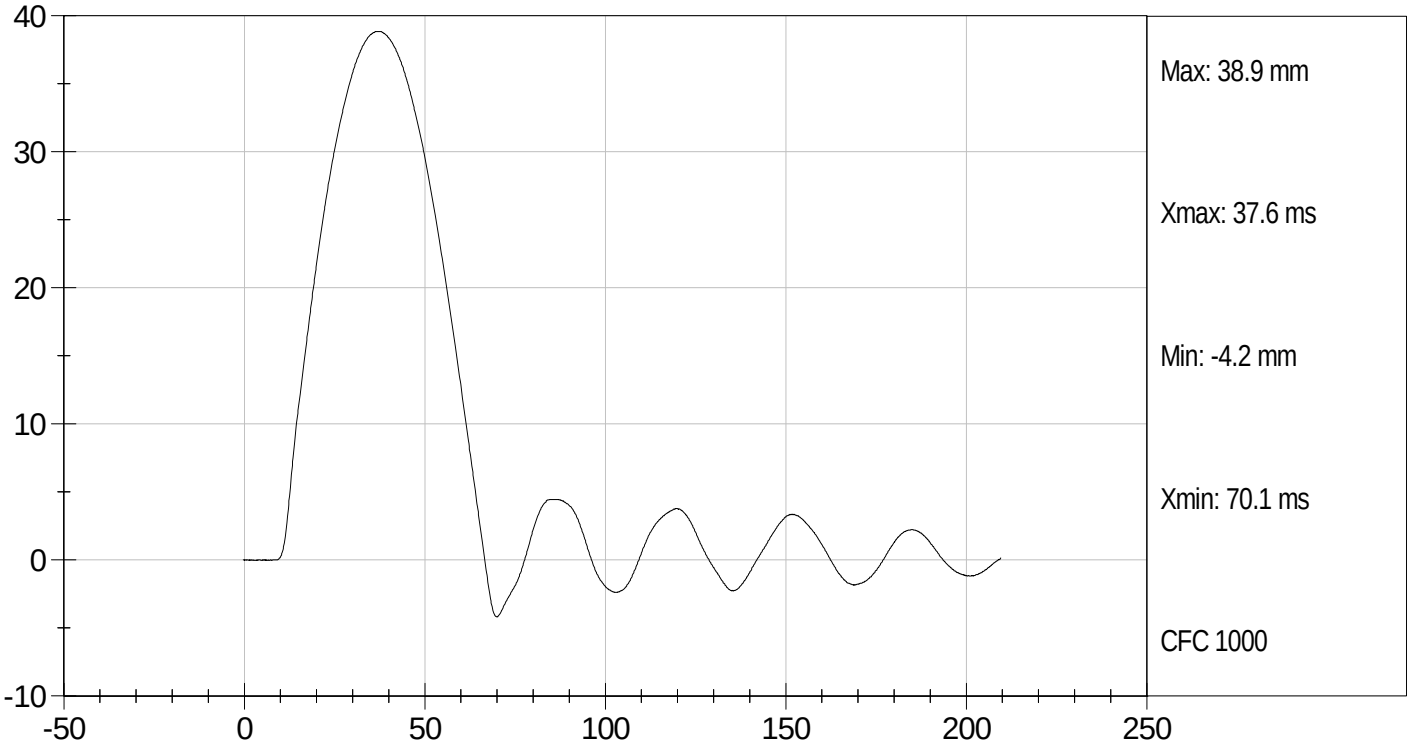
Jessica Hall
Laboratory Technician

5/5/11
Test Date

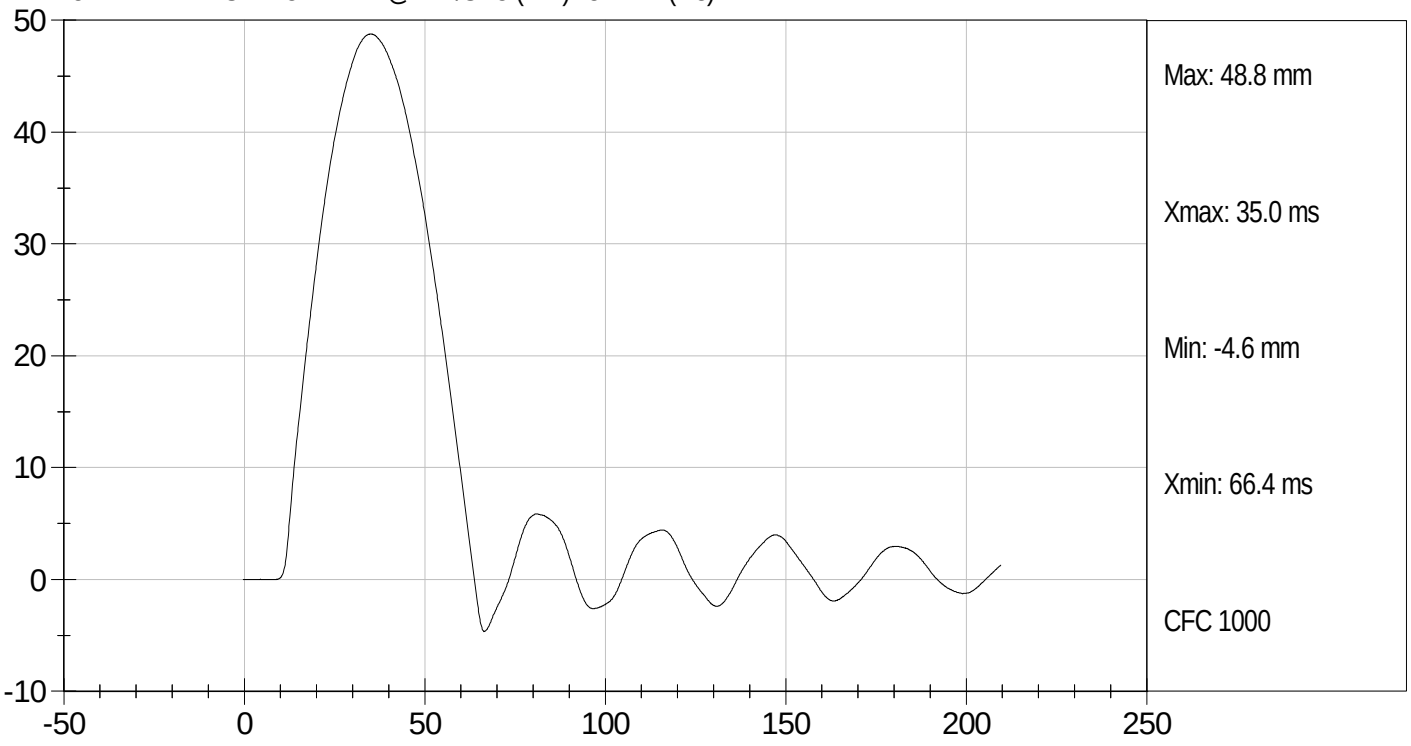
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111674
Test Date: 5/5/11

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:** D111675

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
Displacement at 3 m/s	mm	36.0 to 40.0	38.1	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	47.1	Pass
		Overall Test Results		Pass

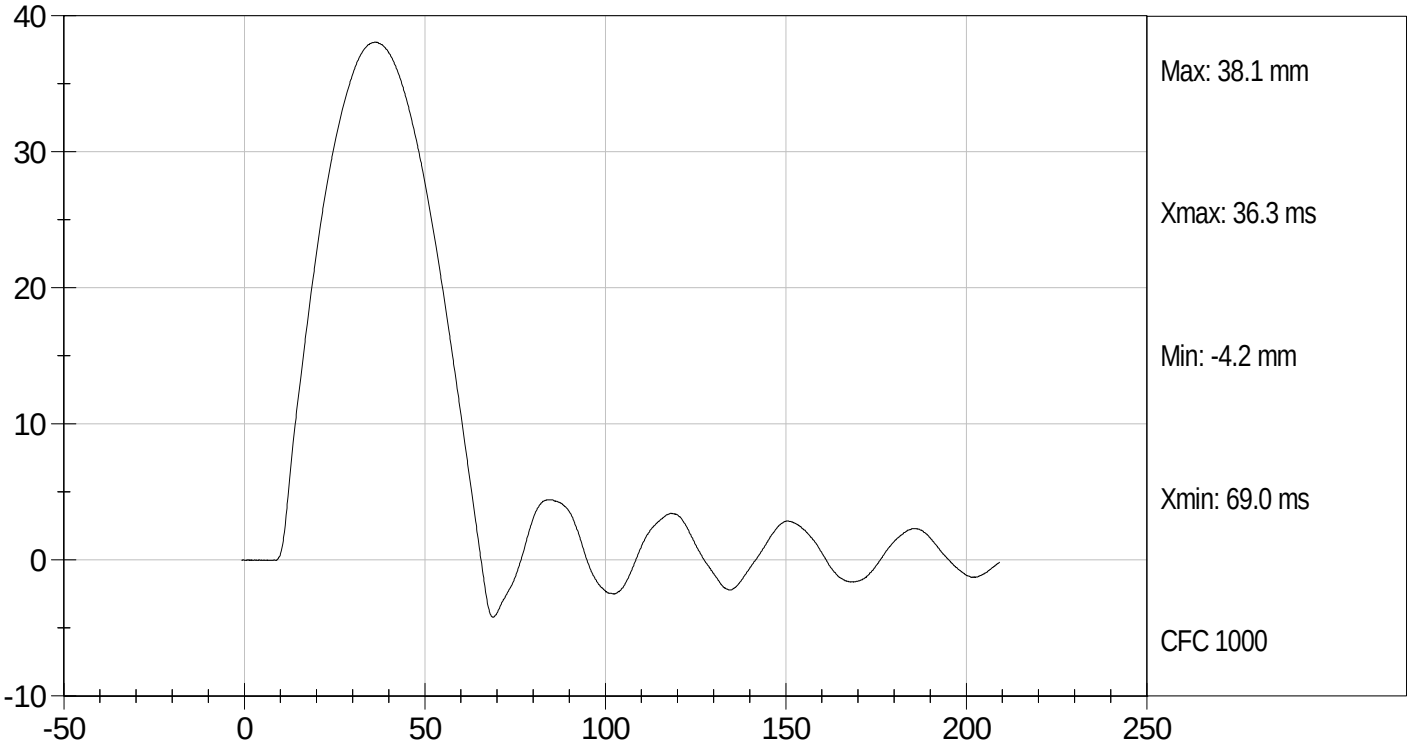
Jessica Gall
Laboratory Technician

5/5/11
Test Date

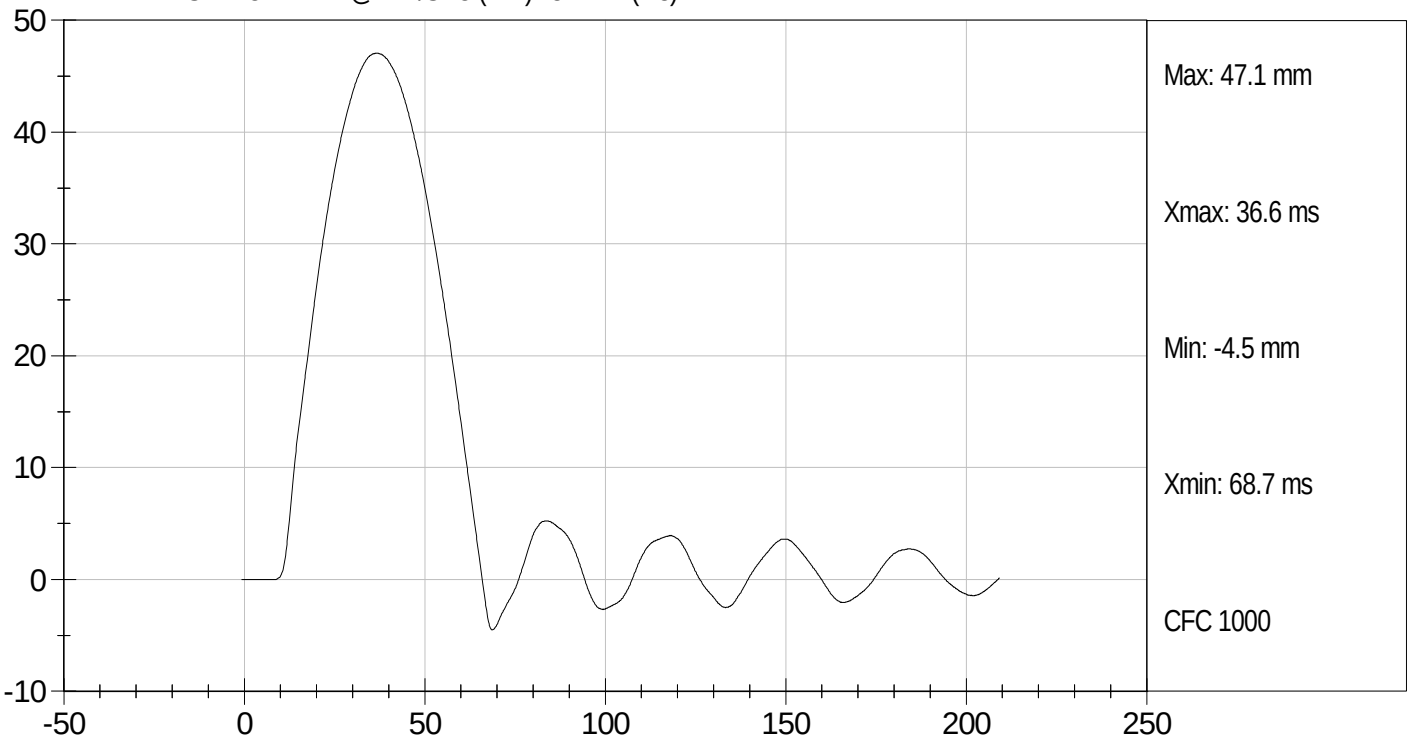
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111675
Test Date: 5/5/11

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:** D111676

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
Displacement at 3 m/s	mm	36.0 to 40.0	39.3	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.6	Pass
		Overall Test Results		Pass

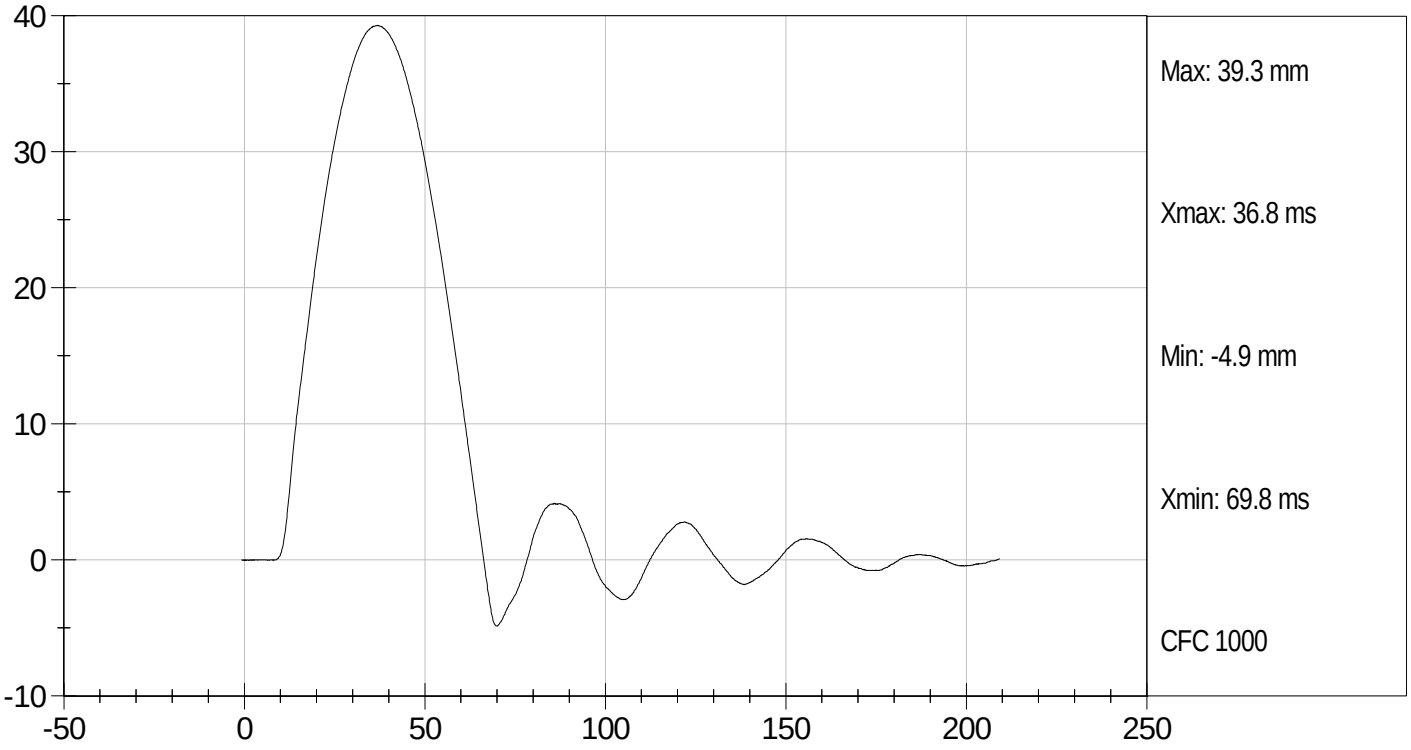
Jessica Hall
Laboratory Technician

5/5/11
Test Date

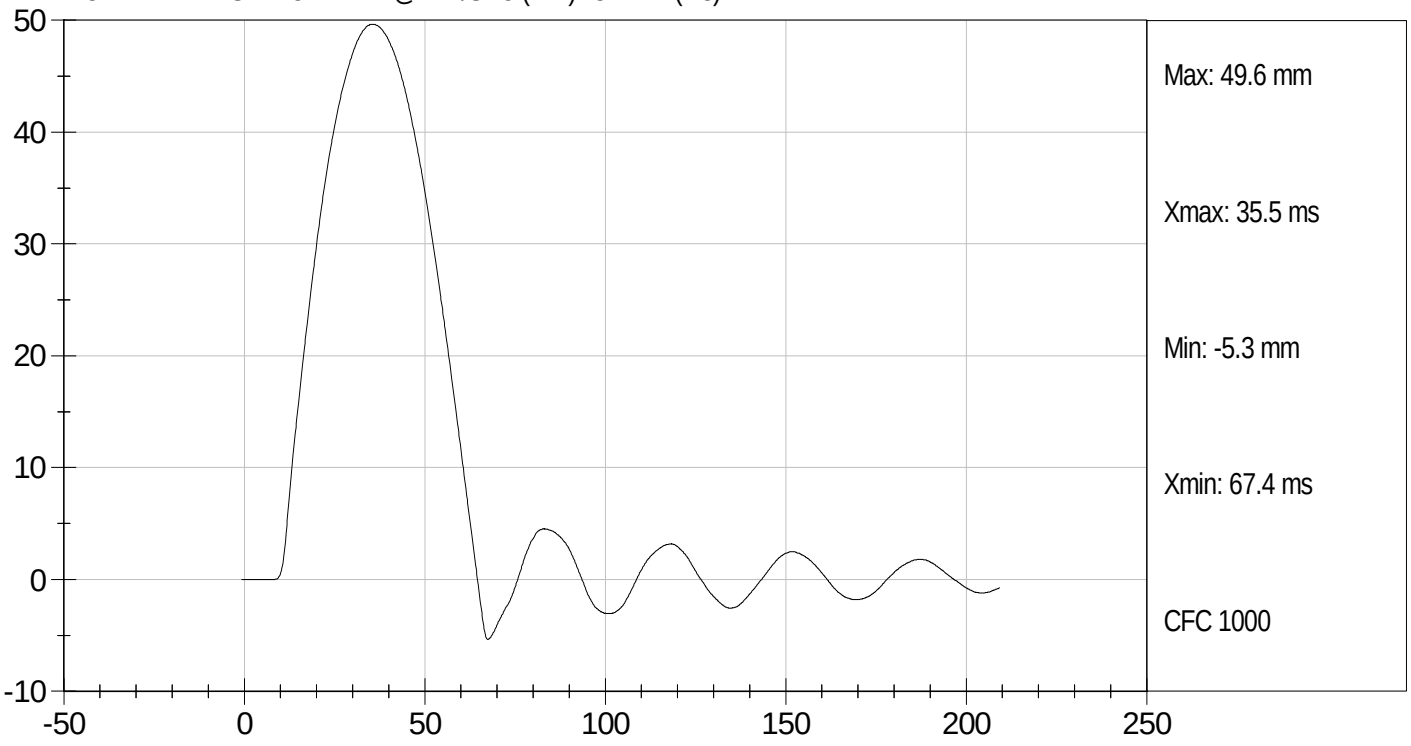
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111676
Test Date: 5/5/11

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:** D111677

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	37	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.24	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	11.10	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.62	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.90	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

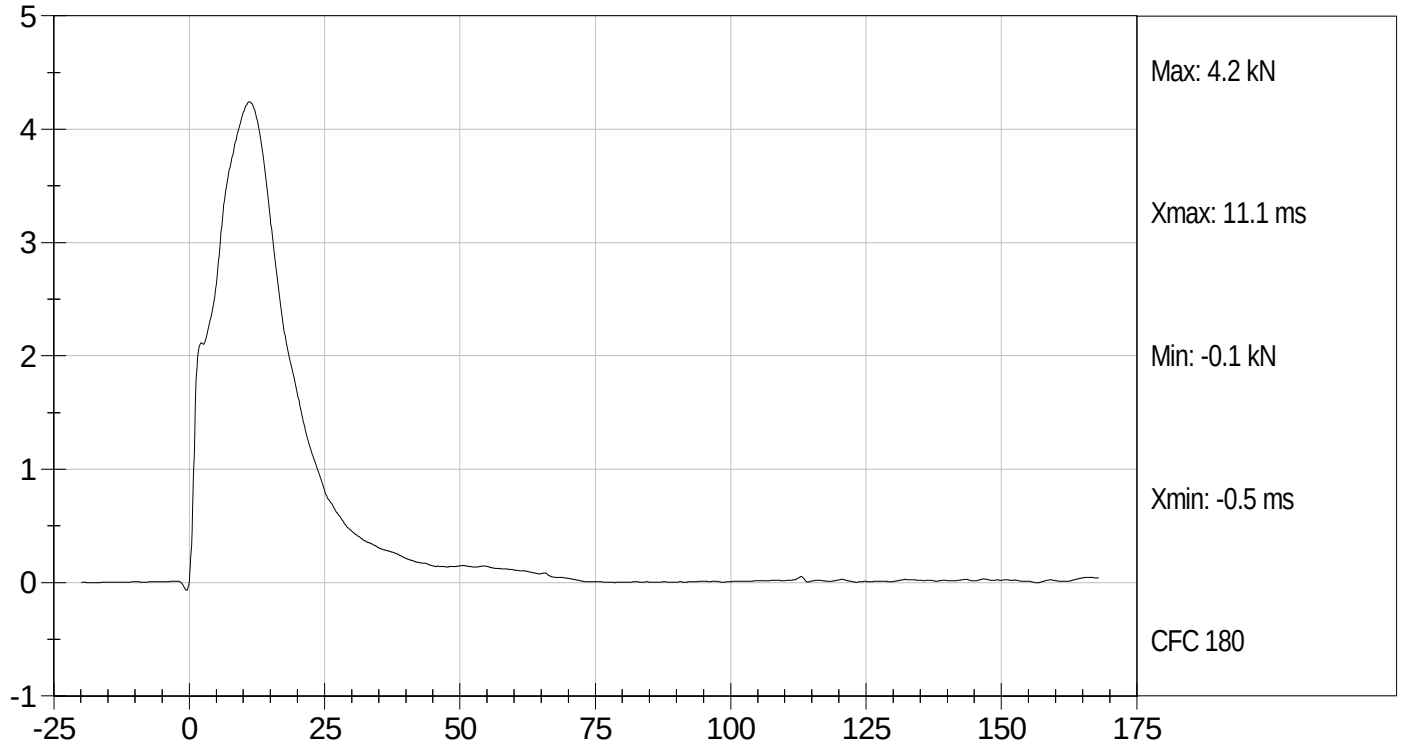
5/5/11
Test Date

David Winkelbauer
Approved By

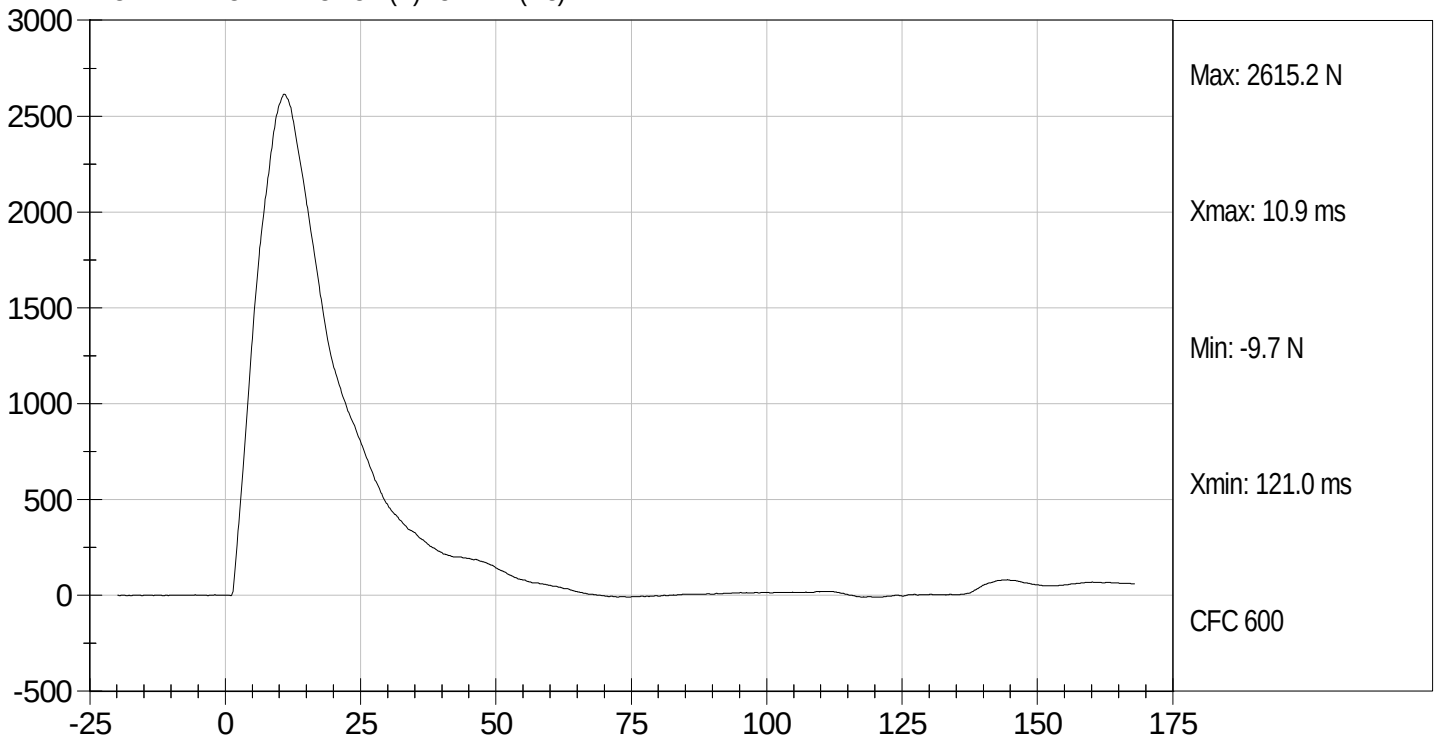
Test Desc: Abdomen Impact
Component ID: D111677

Test Date: 5/5/11
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:** D111678

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	32	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.05	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	-5.81	Pass
	30 ms	m/s	>= -6.5	-6.03	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	46.4	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	49.0	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	46	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

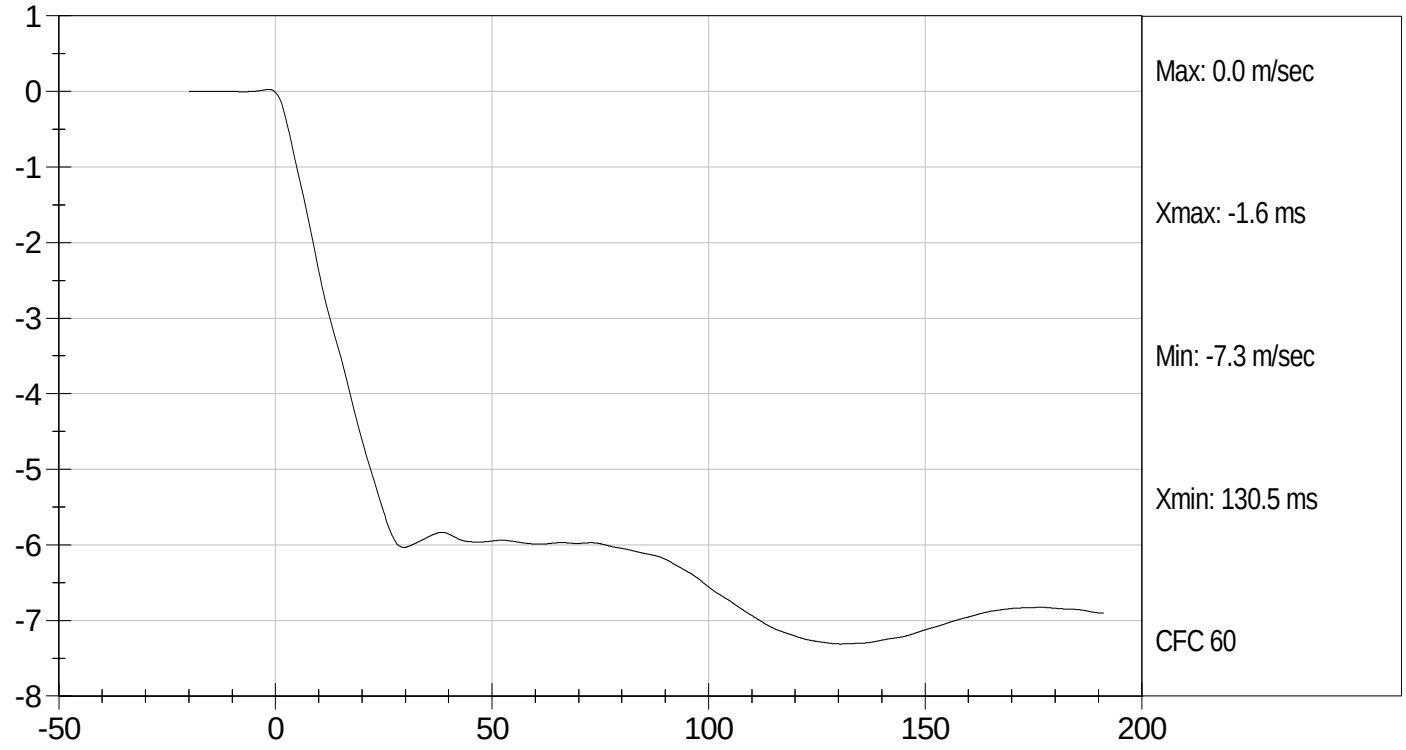
5/5/11
Test Date

David Winkelbauer
Approved By

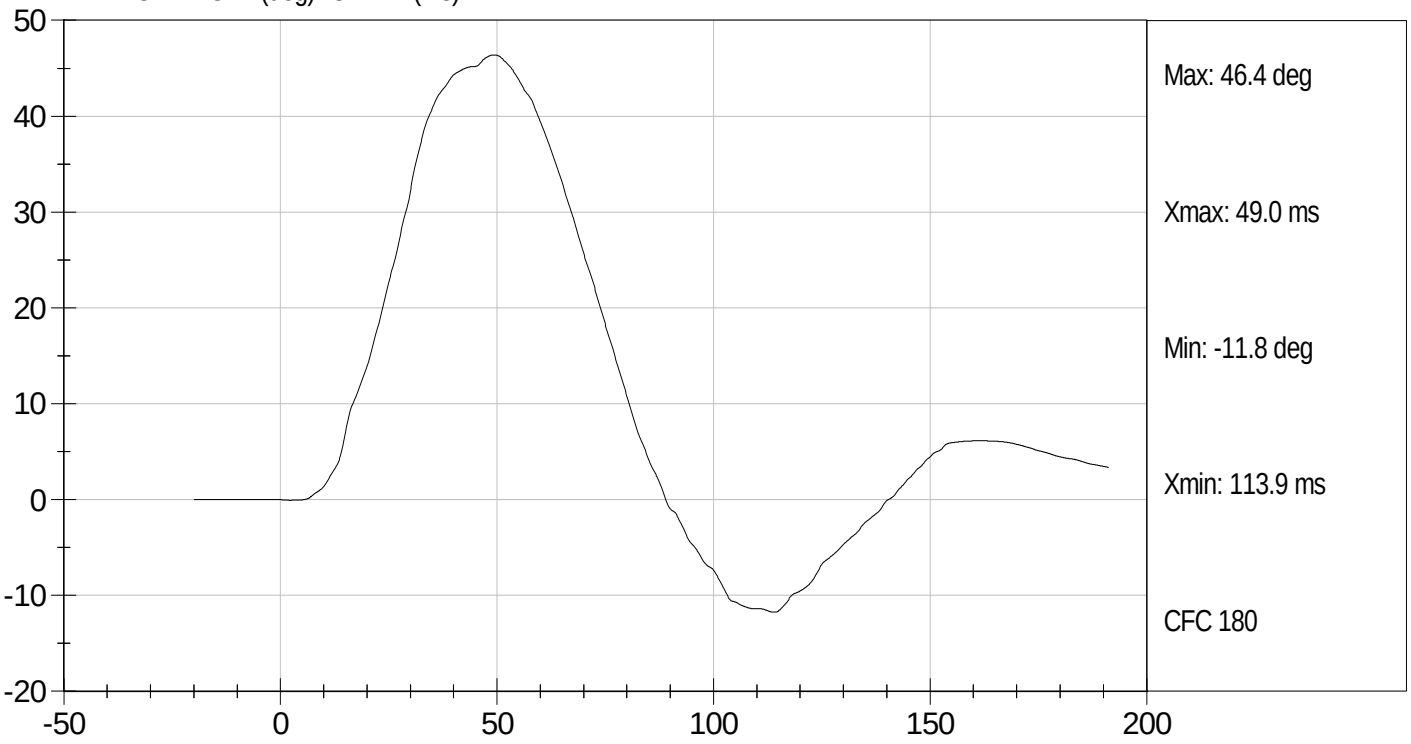
Test Desc: Lumbar Bending
Component ID: D111678

Test Date: 5/5/11
Velocity: 19.84 ft/s, 6.05 m/s

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



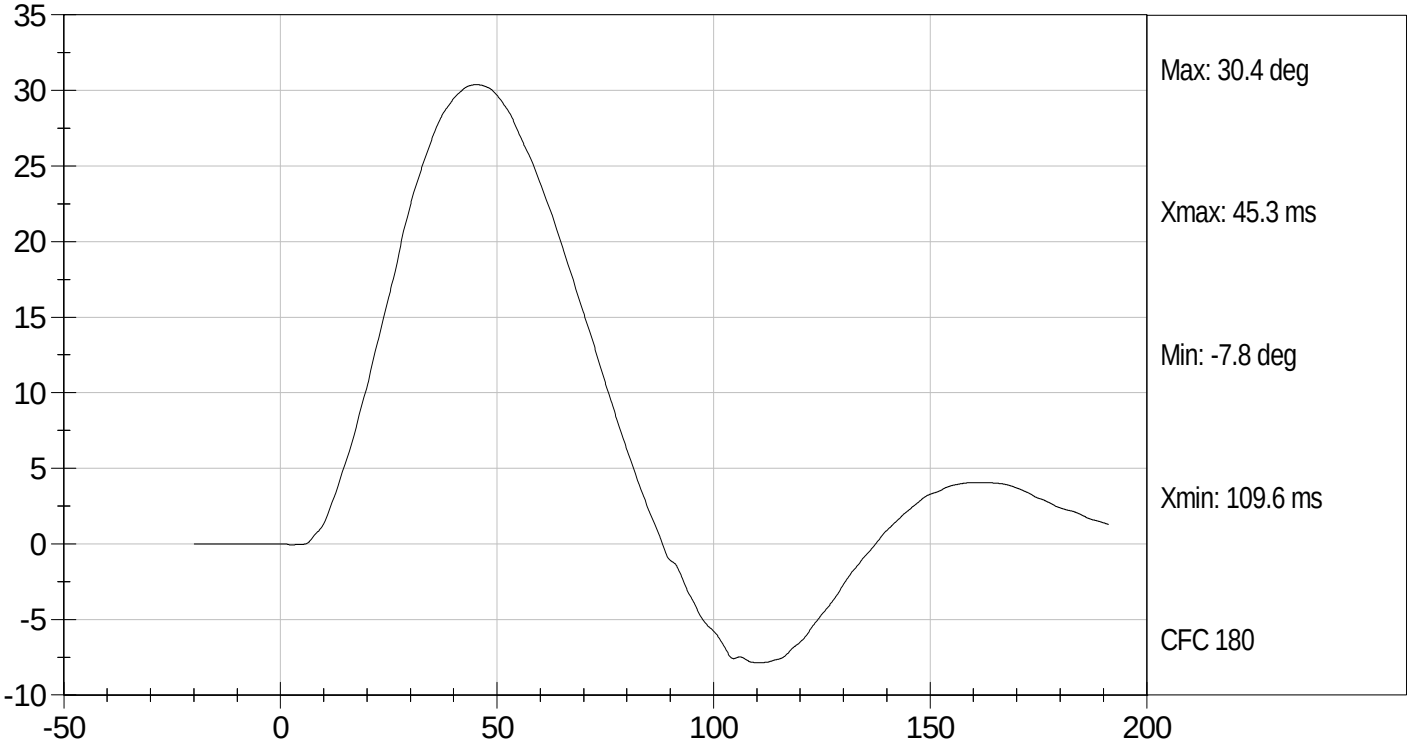
FLEXION ANGLE (deg) vs TIME (ms)



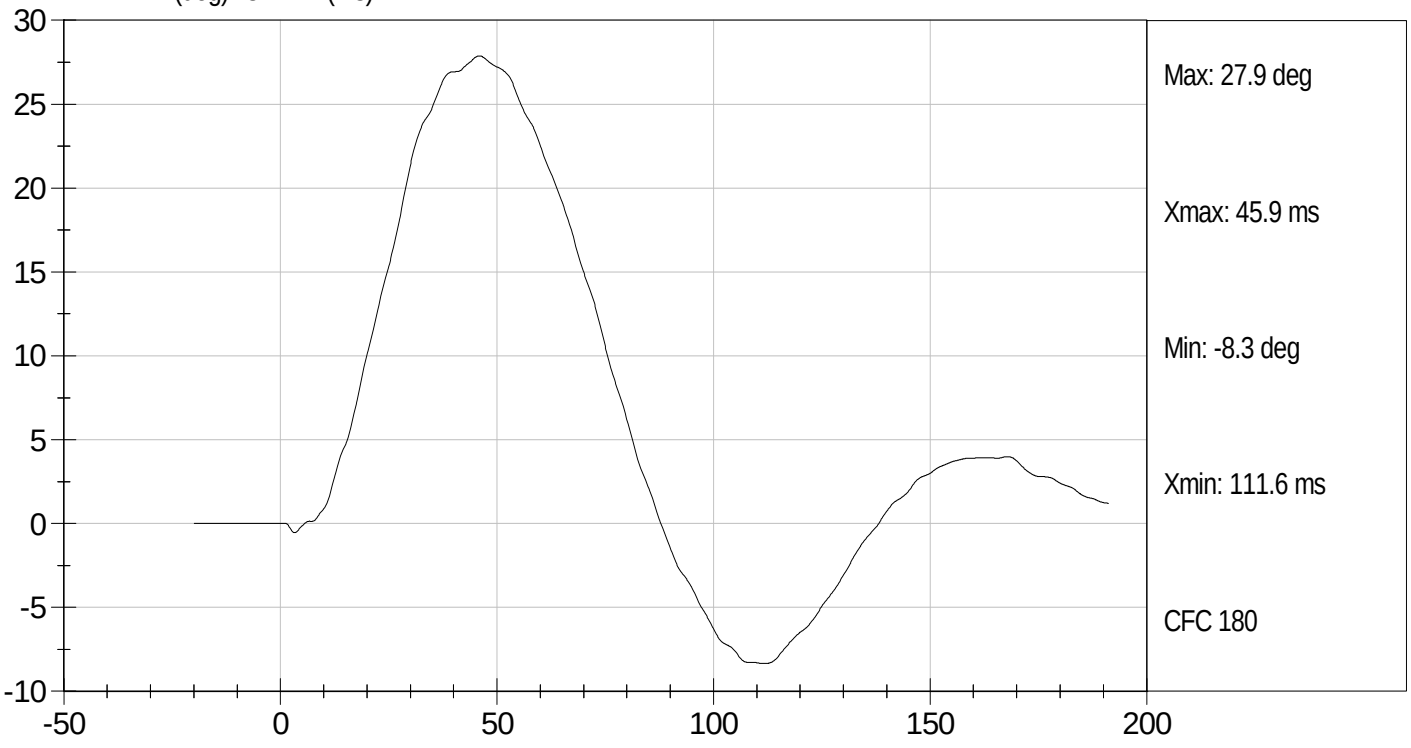
Test Desc: Lumbar Bending
Component ID: D111678

Test Date: 5/5/11
Velocity: 19.84 ft/s, 6.05 m/s

THETA A (deg) vs TIME (ms)



THETA B (deg) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111679

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	37	Pass
Probe Speed	m/s	4.20 to 4.40	4.30	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.80	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.80	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.37	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.60	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

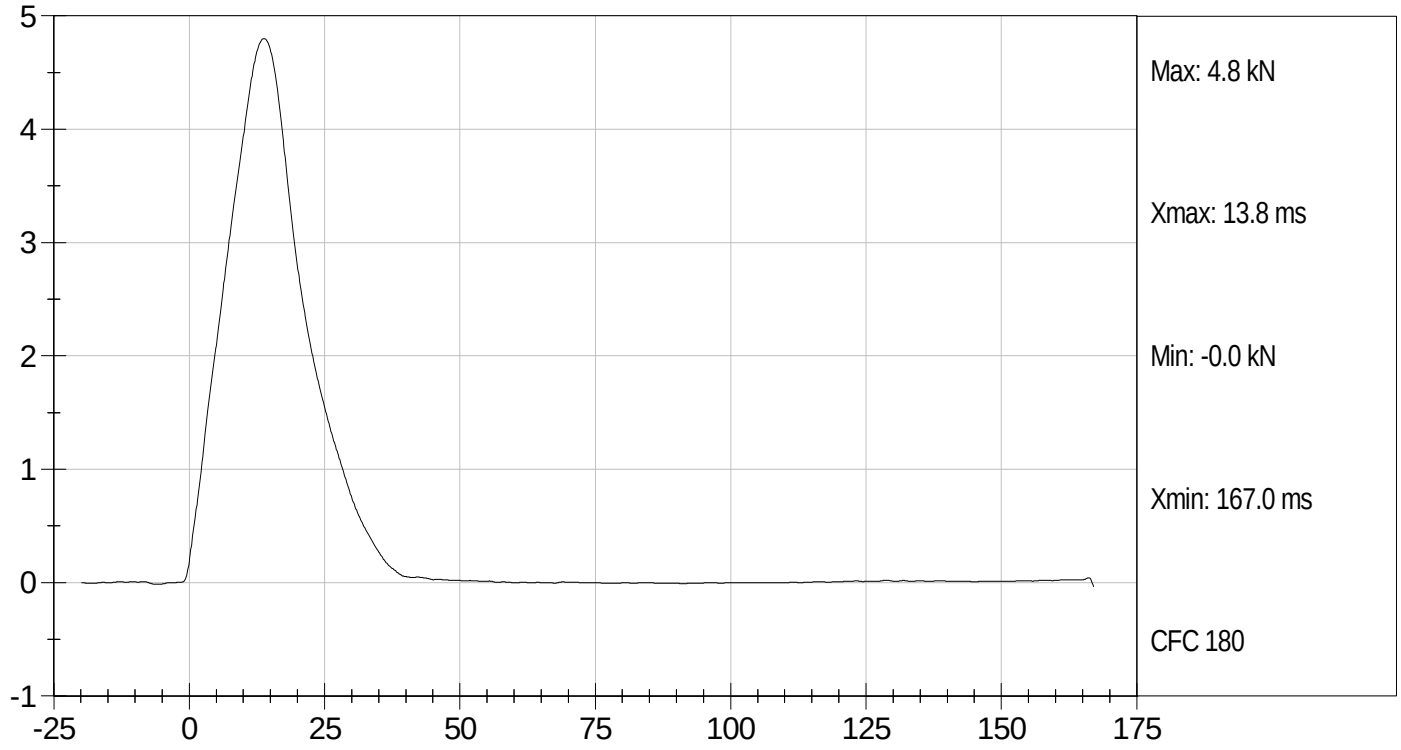
5/5/11
Test Date

David Winkelbauer
Approved By

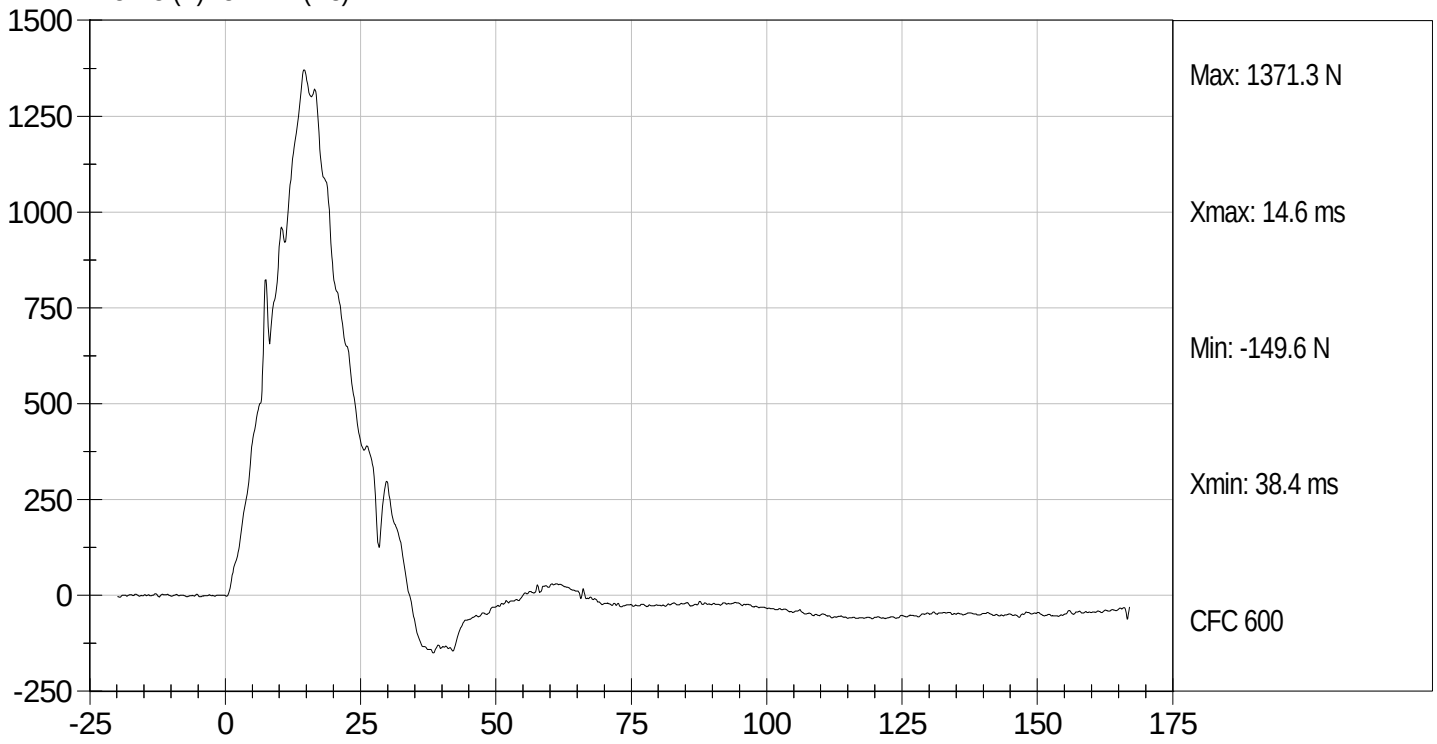
Test Desc: Pelvis Impact
Component ID: D111679

Test Date: 5/5/11
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:** D111670

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	37	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	5.19	Pass
Upper Rib Displacement	mm	34.0 to 41.0	38.7	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.2	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.9	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

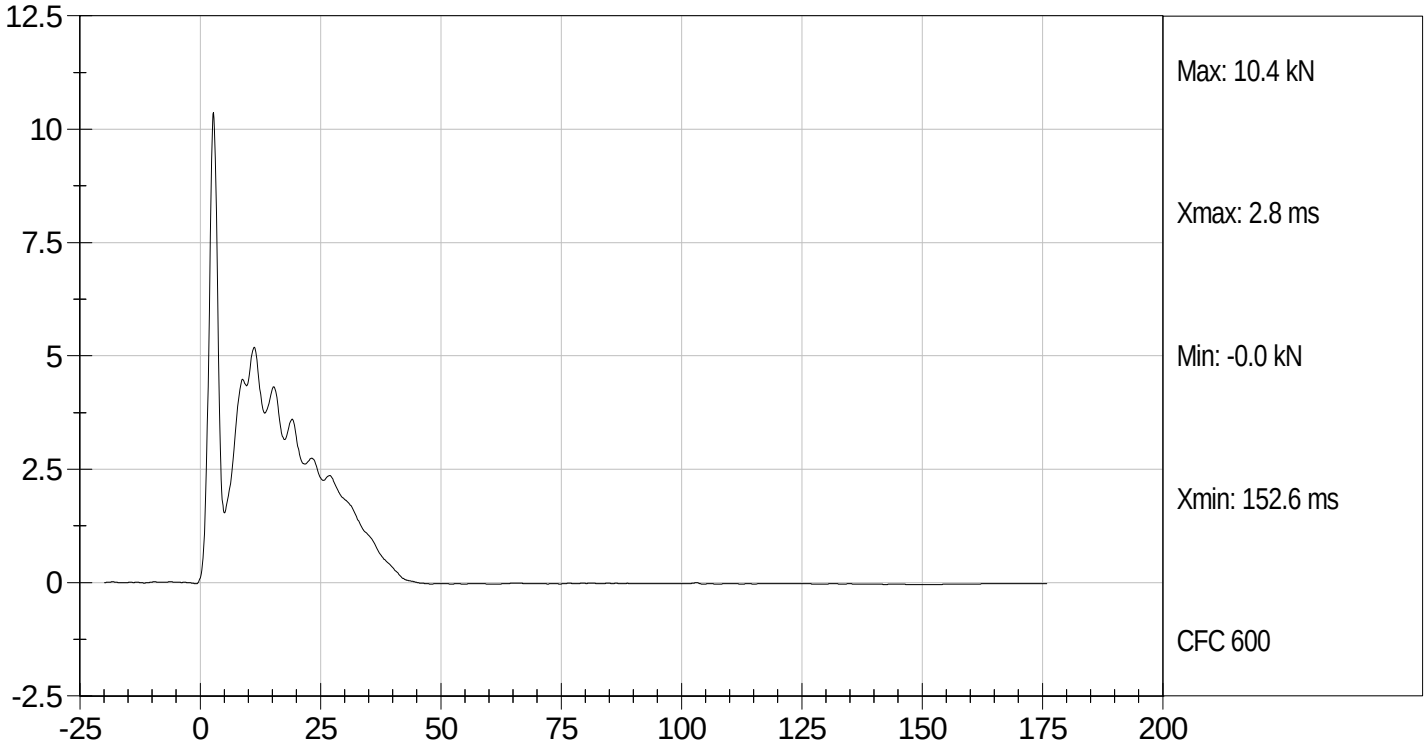
5/5/11
Test Date

David Winkelbauer
Approved By

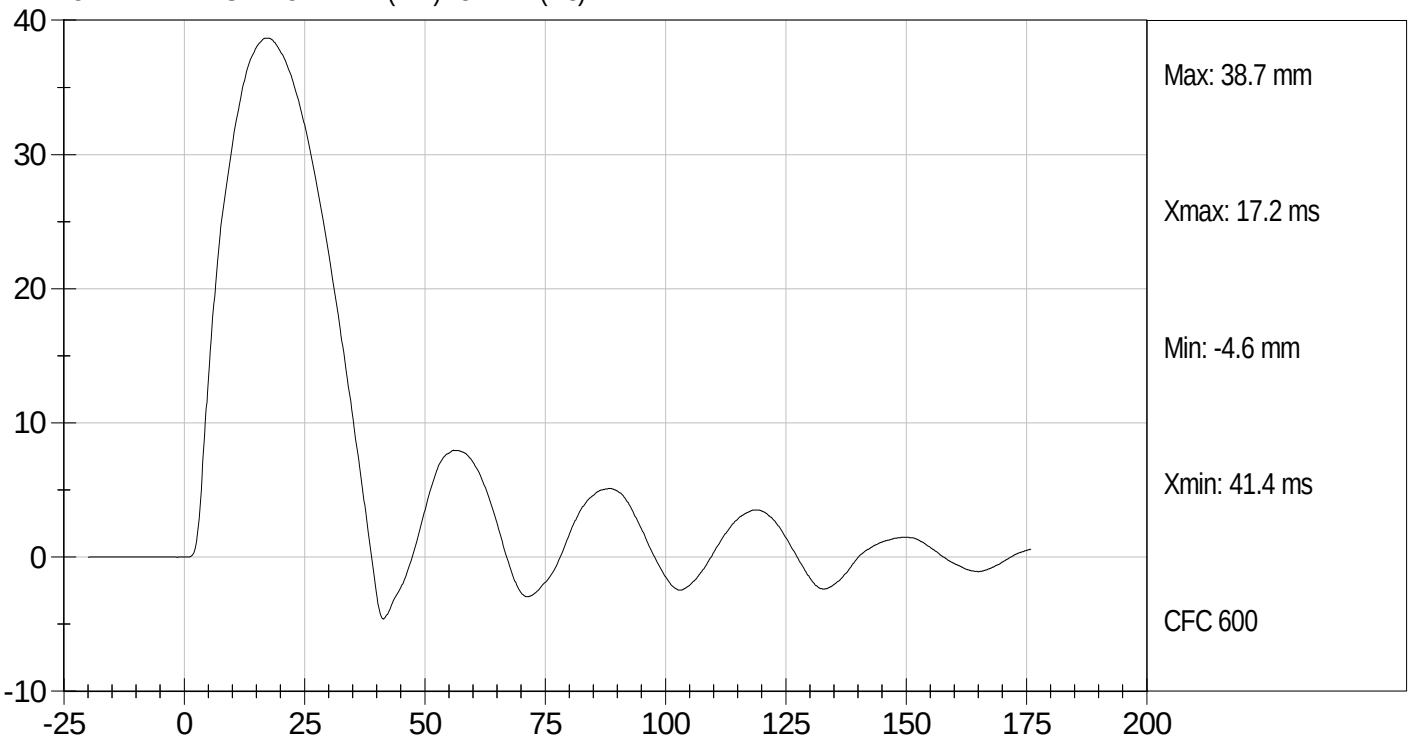
Test Desc: Thorax Impact
Component ID: D111670

Test Date: 5/5/11
Velocity: 18.31 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



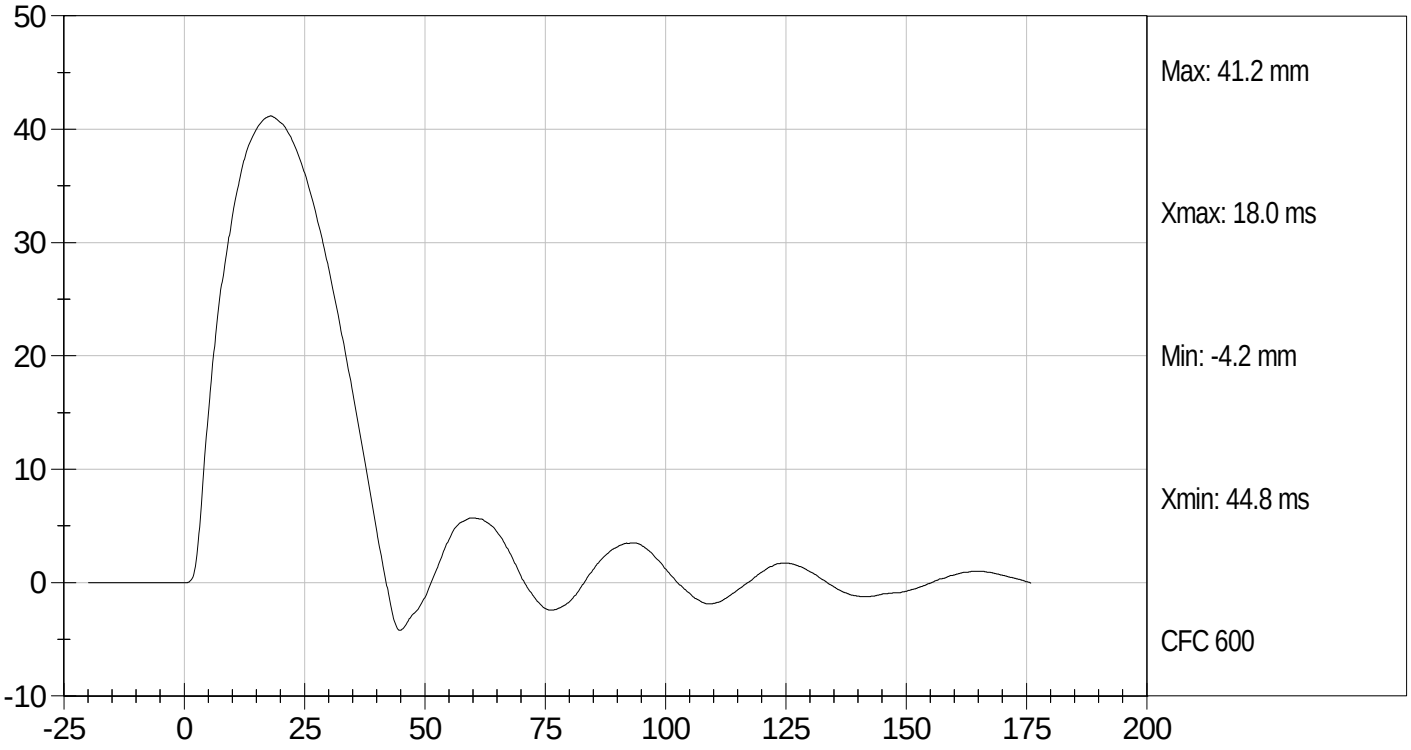
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



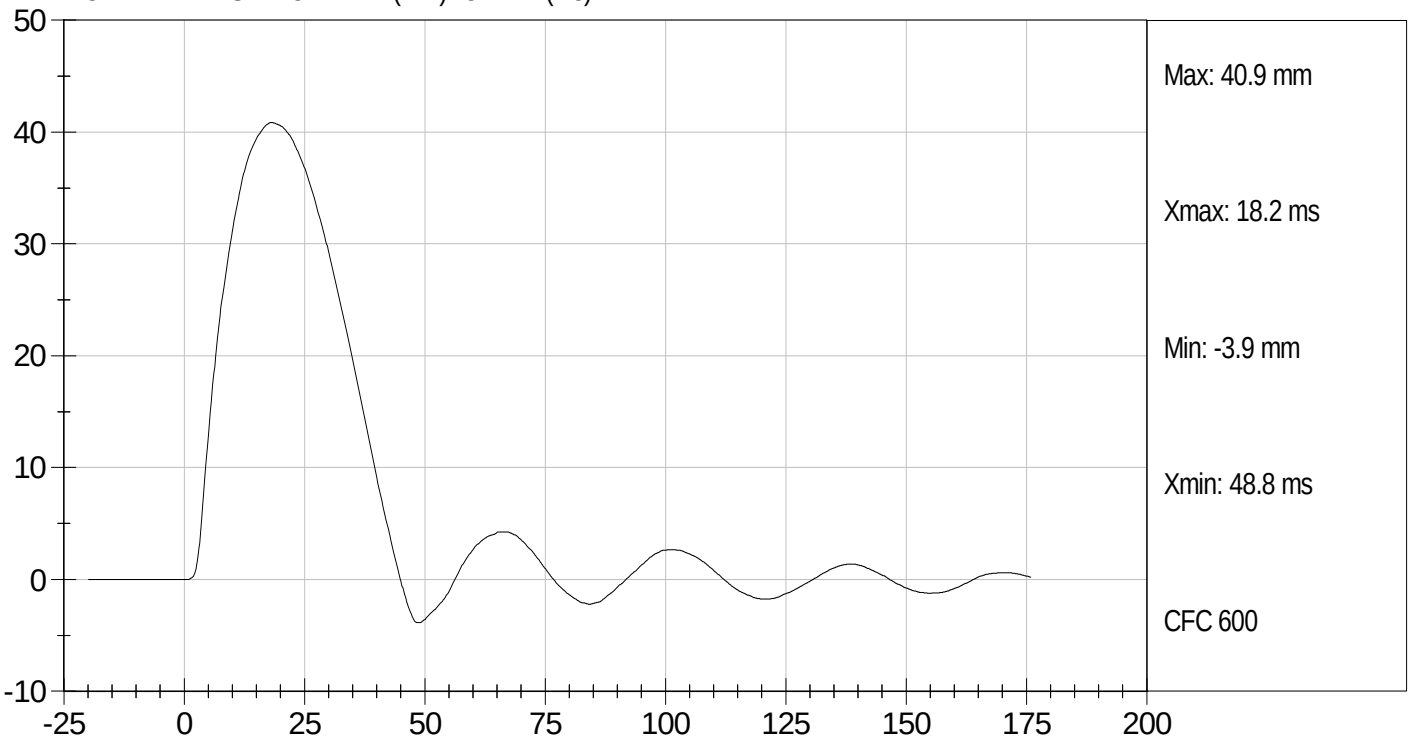
Test Desc: Thorax Impact
Component ID: D111670

Test Date: 5/5/11
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:** D111721

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	50	Pass
Peak Resultant Acceleration	G's	125 to 155	147	Pass
Peak Lateral Acceleration	G's	+/- 15	-10.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

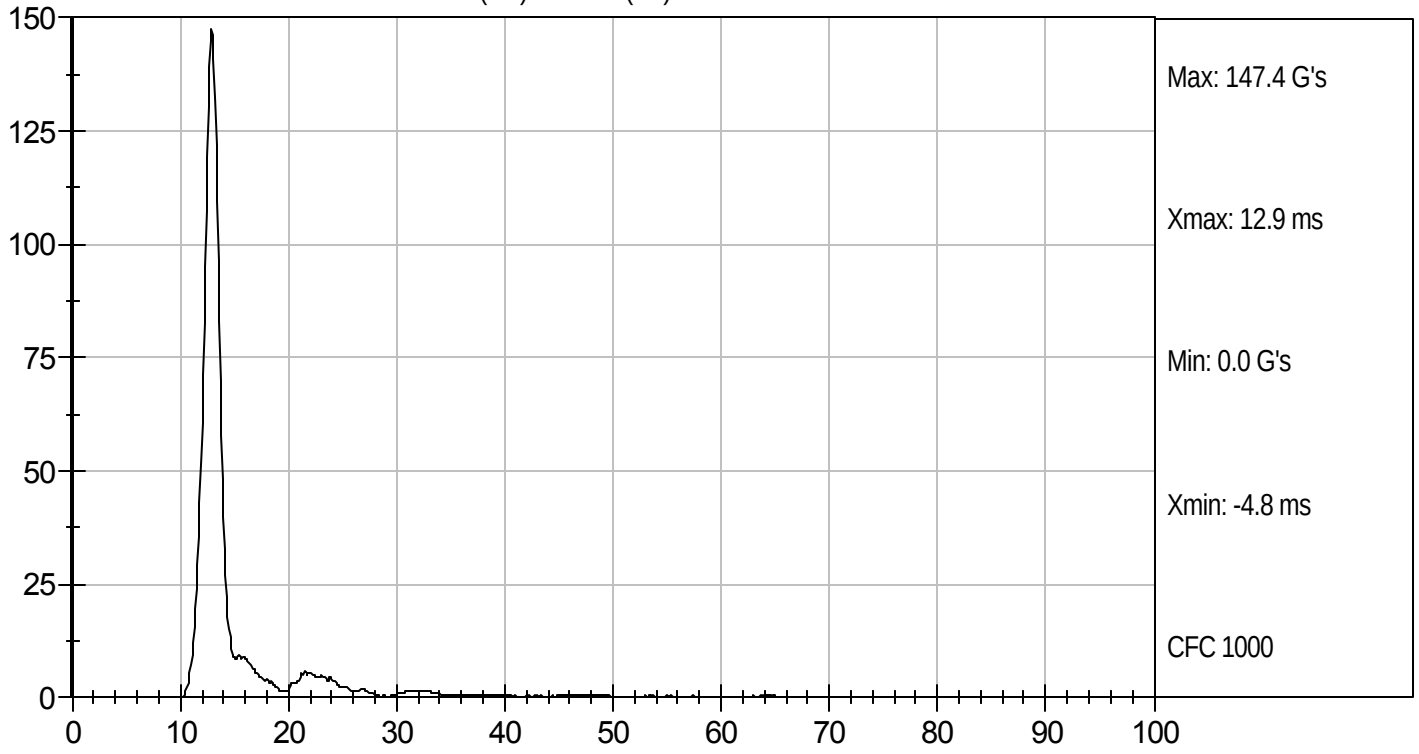
5/10/11
Test Date

David Winkelbauer
Approved By

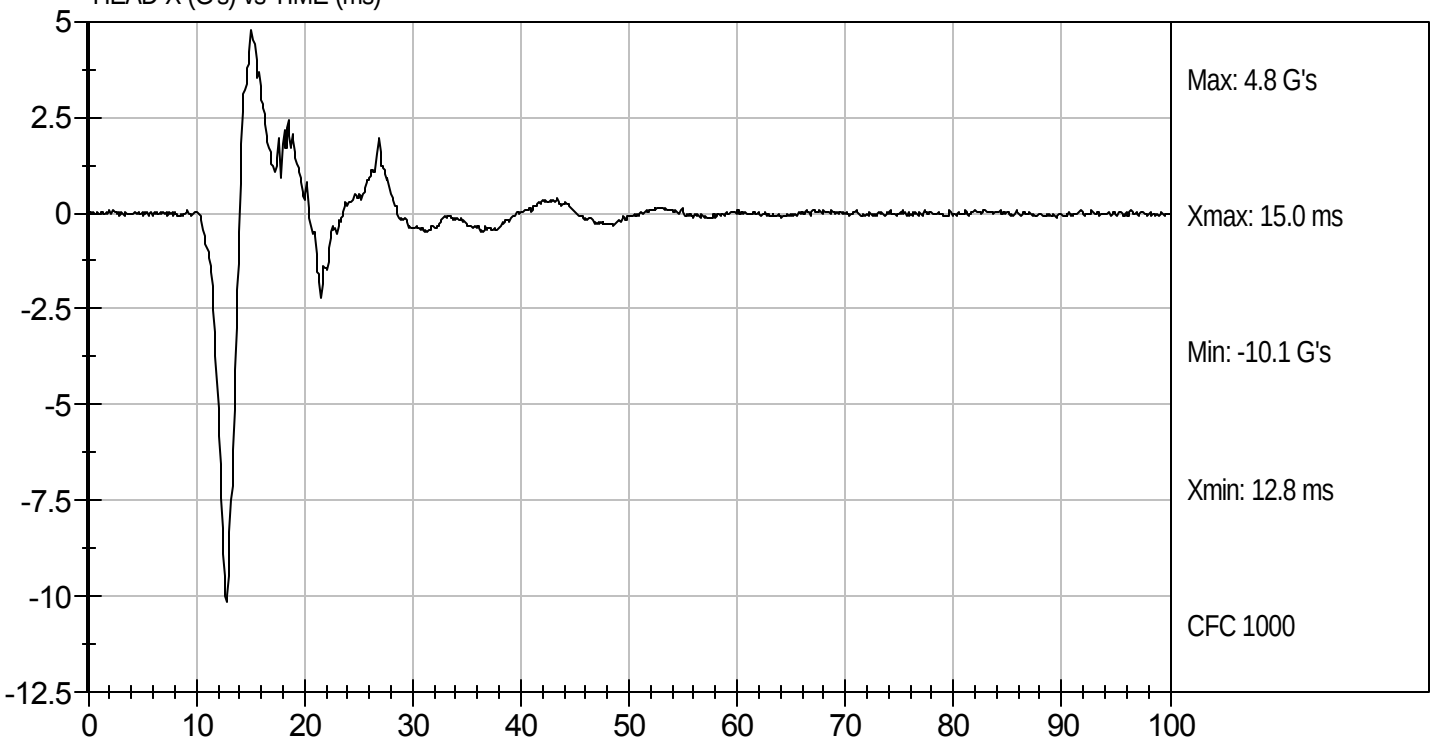
Test Desc: Head Drop
Component ID: D111721

Test Date: 5/10/11
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:** D111722

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	47	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	-0.32	Pass
	14 ms	m/s	-3.20 to -3.70	-3.29	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.7	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.4	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	55.1	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

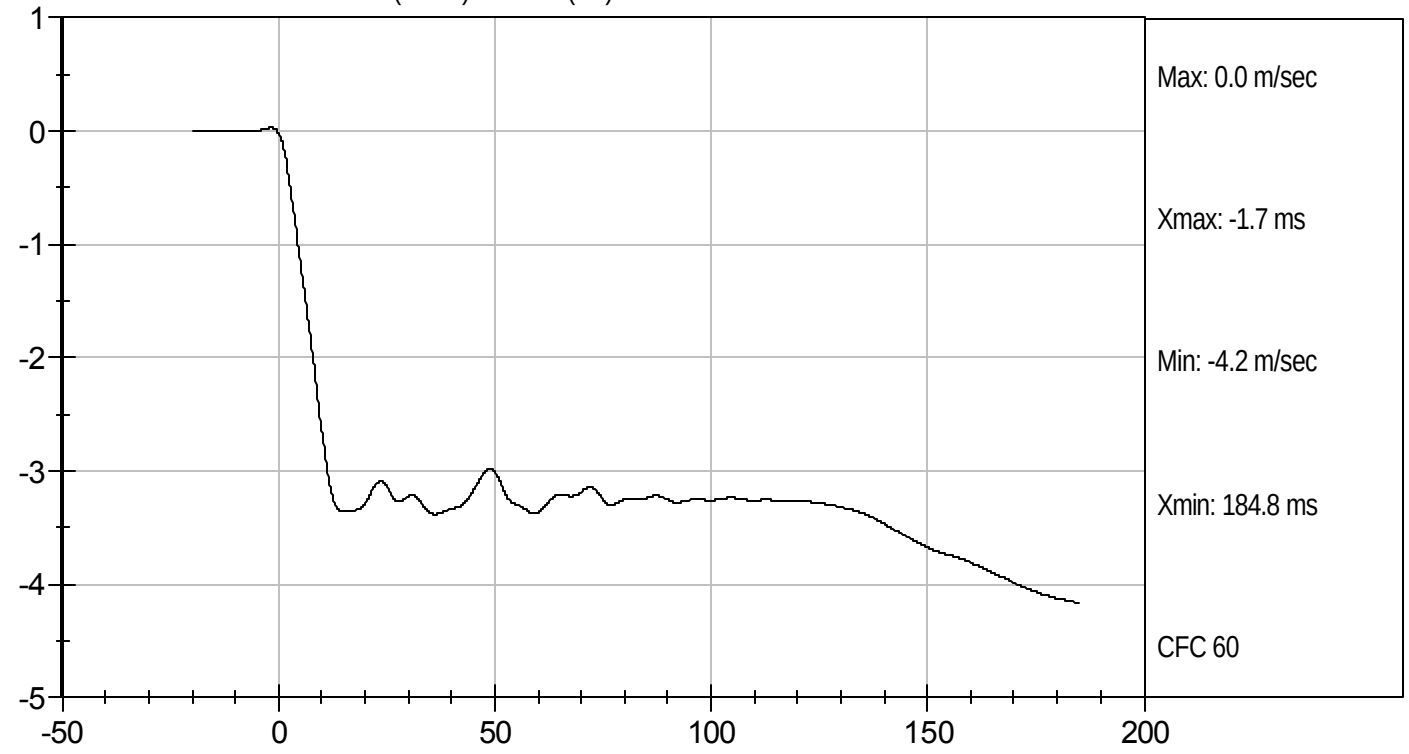
5/10/11
Test Date

David Winkelbauer
Approved By

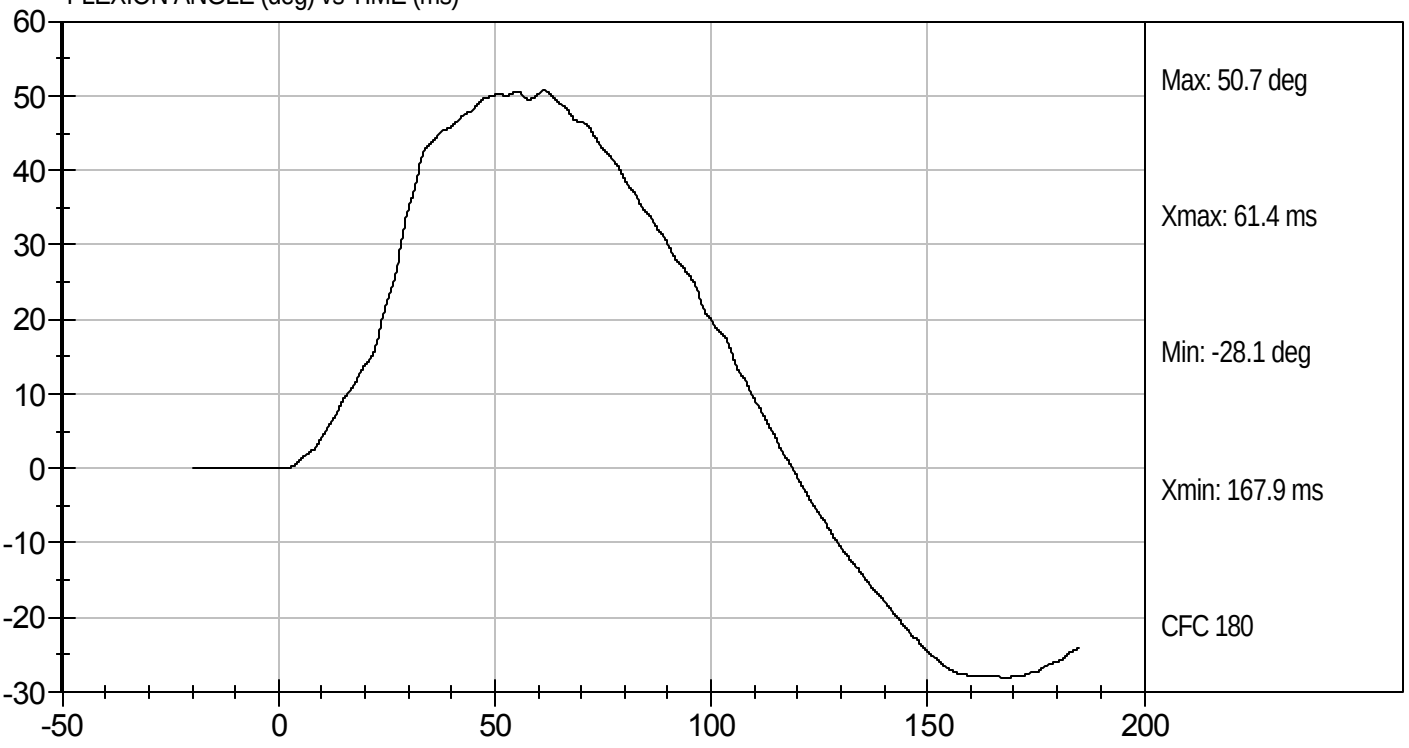
Test Desc: Neck Bending
Component ID: D111722

Test Date: 5/10/11
Velocity: 11.42 ft/s, 3.48 m/s

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

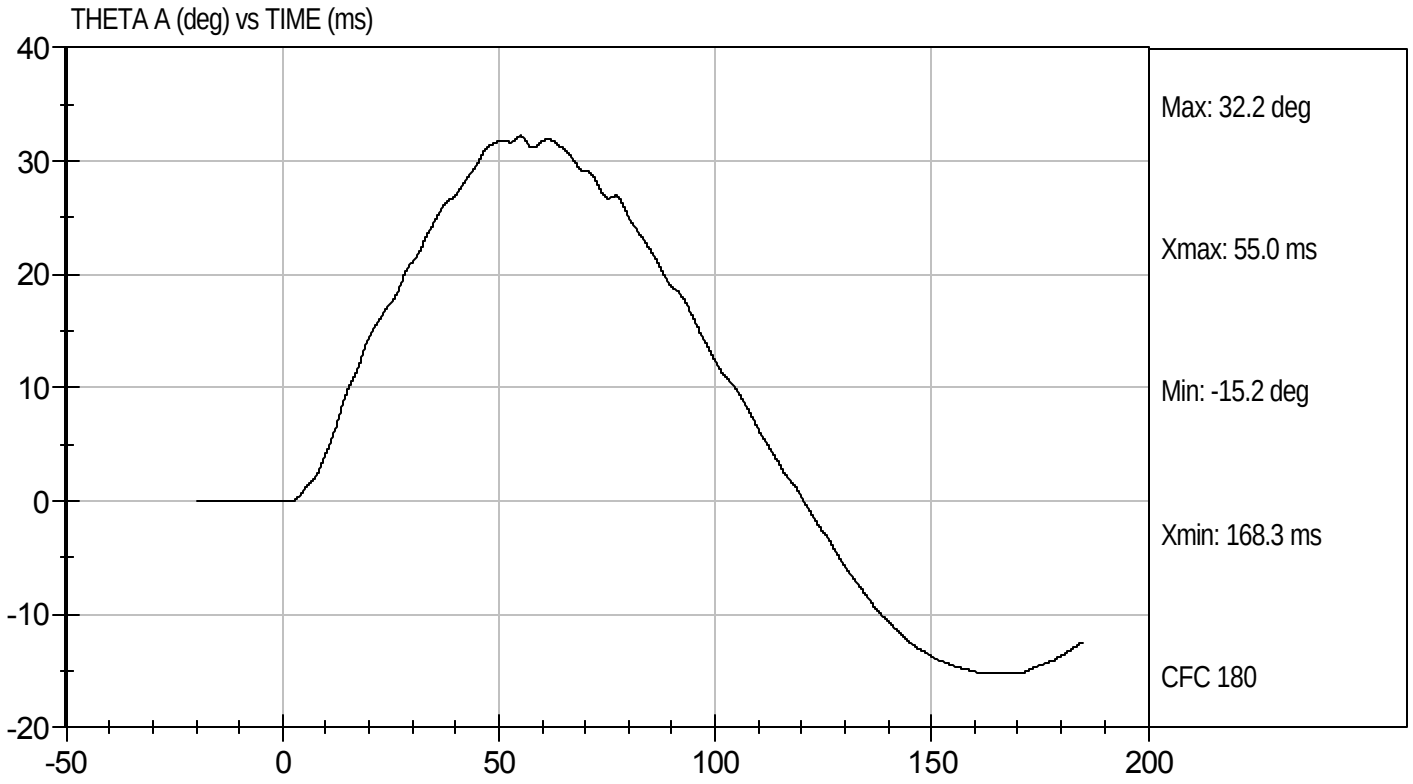


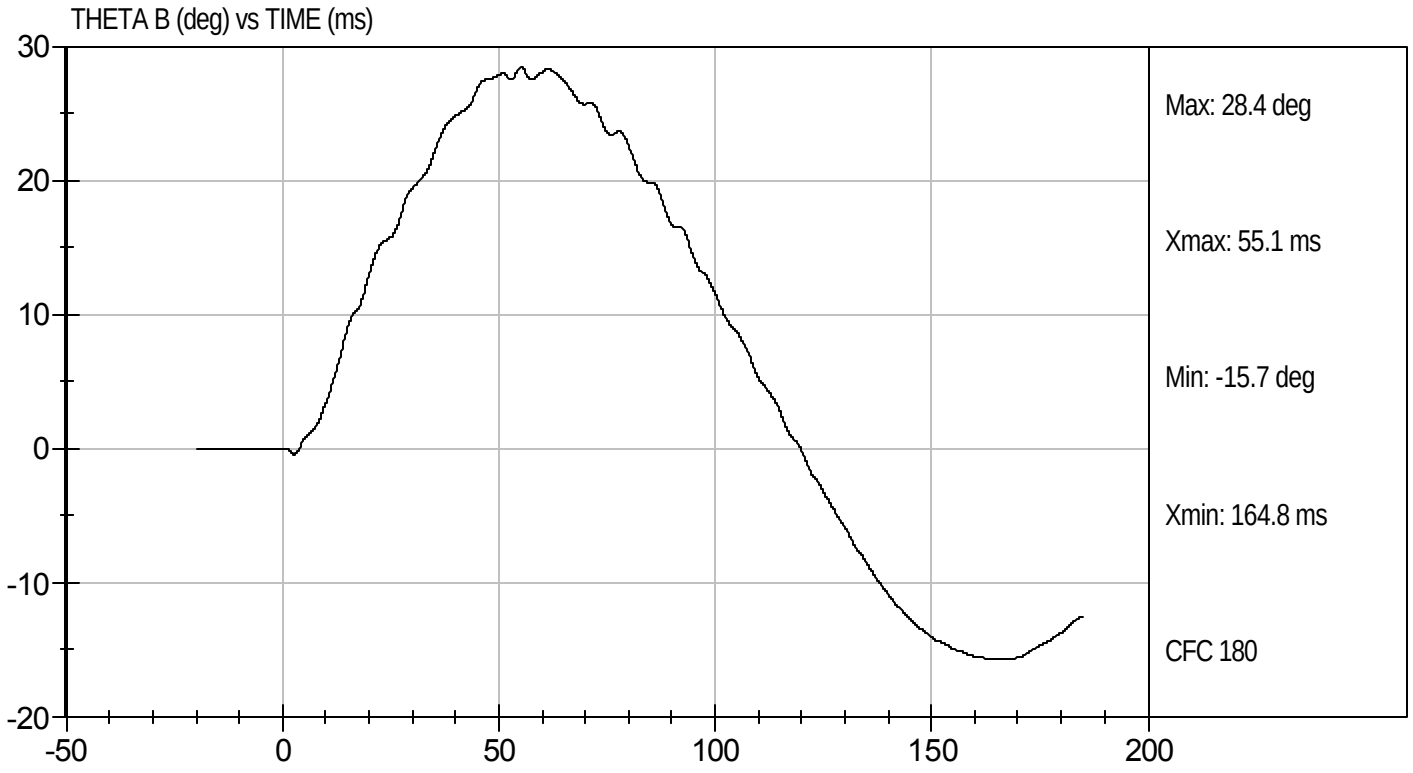
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D111722

Test Date: 5/10/11
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:** D111723

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	44	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	18.6	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

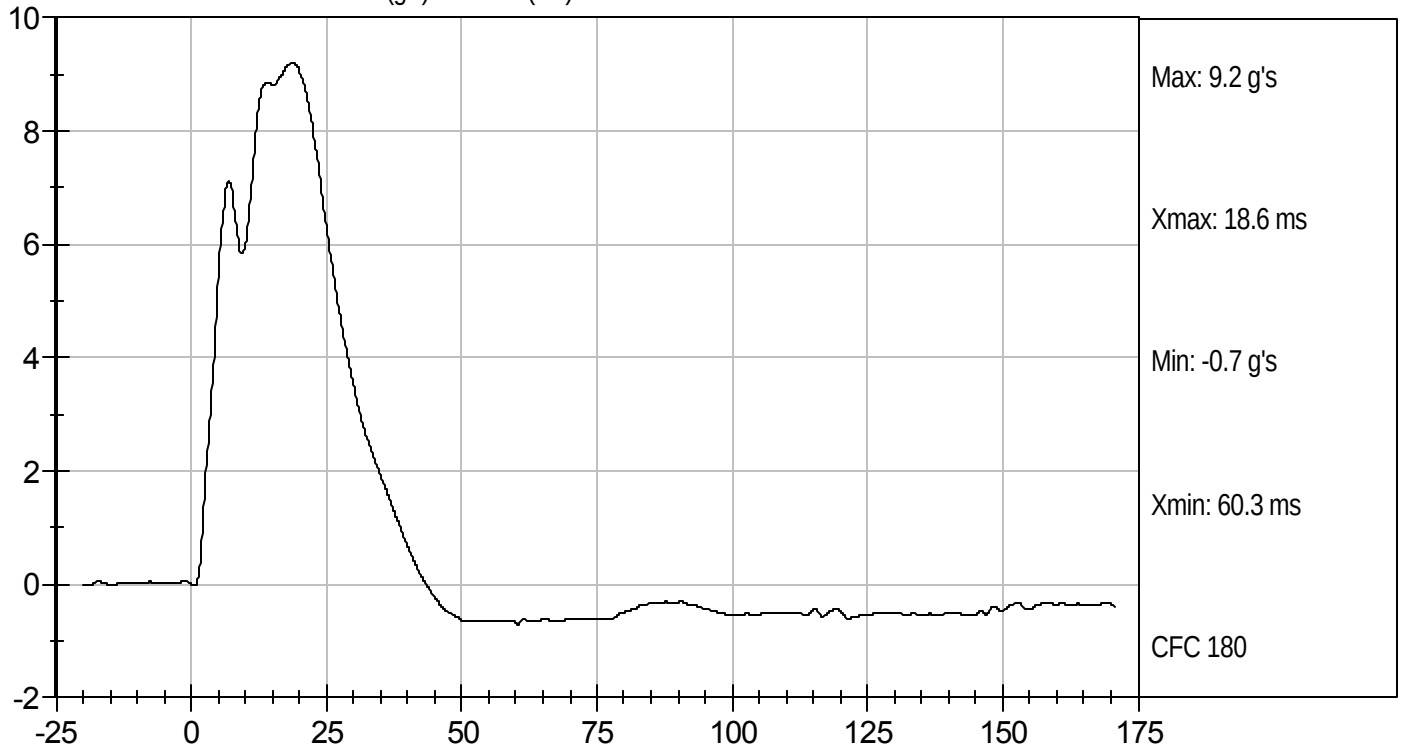
5/10/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D111723

Test Date: 5/10/11
Velocity: 14.36 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:** D111724

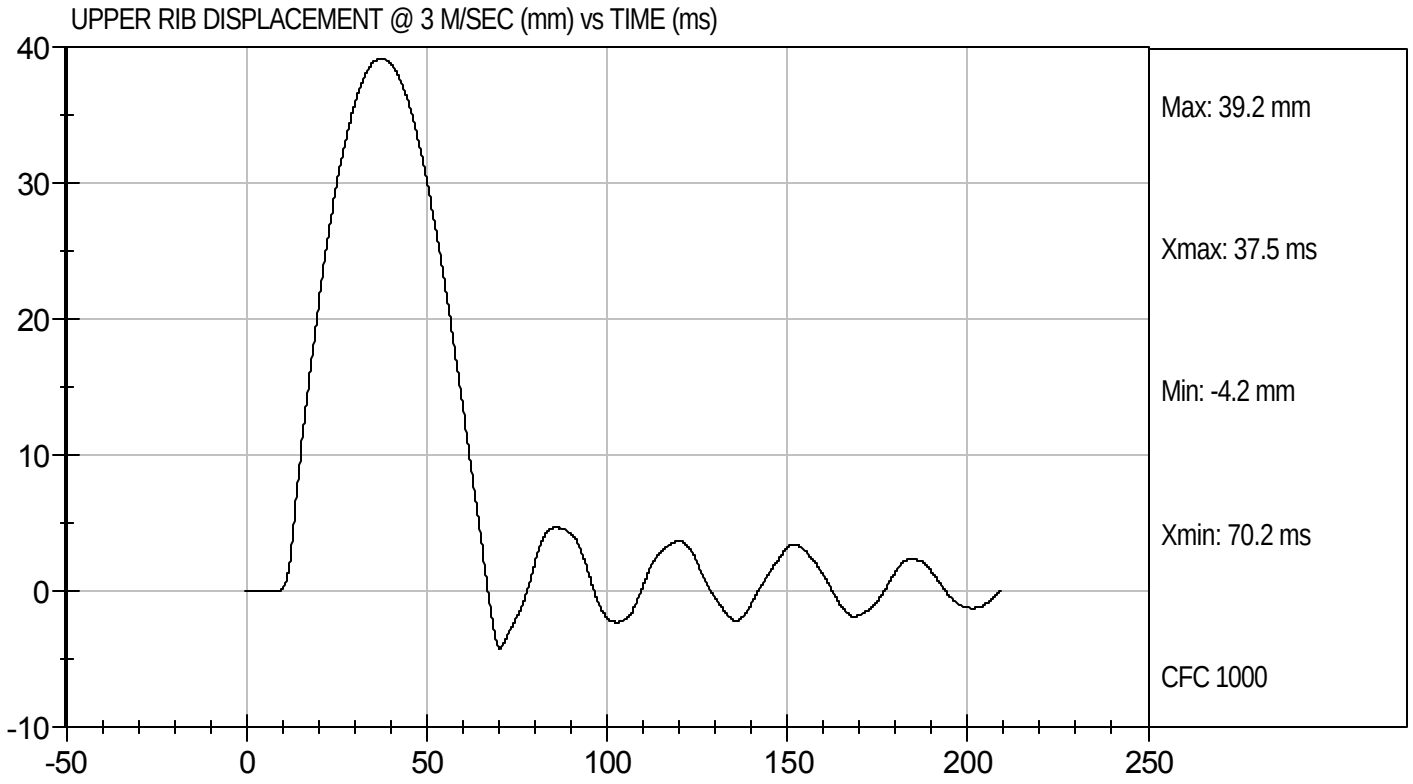
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.2	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	47.9	Pass
		Overall Test Results		Pass

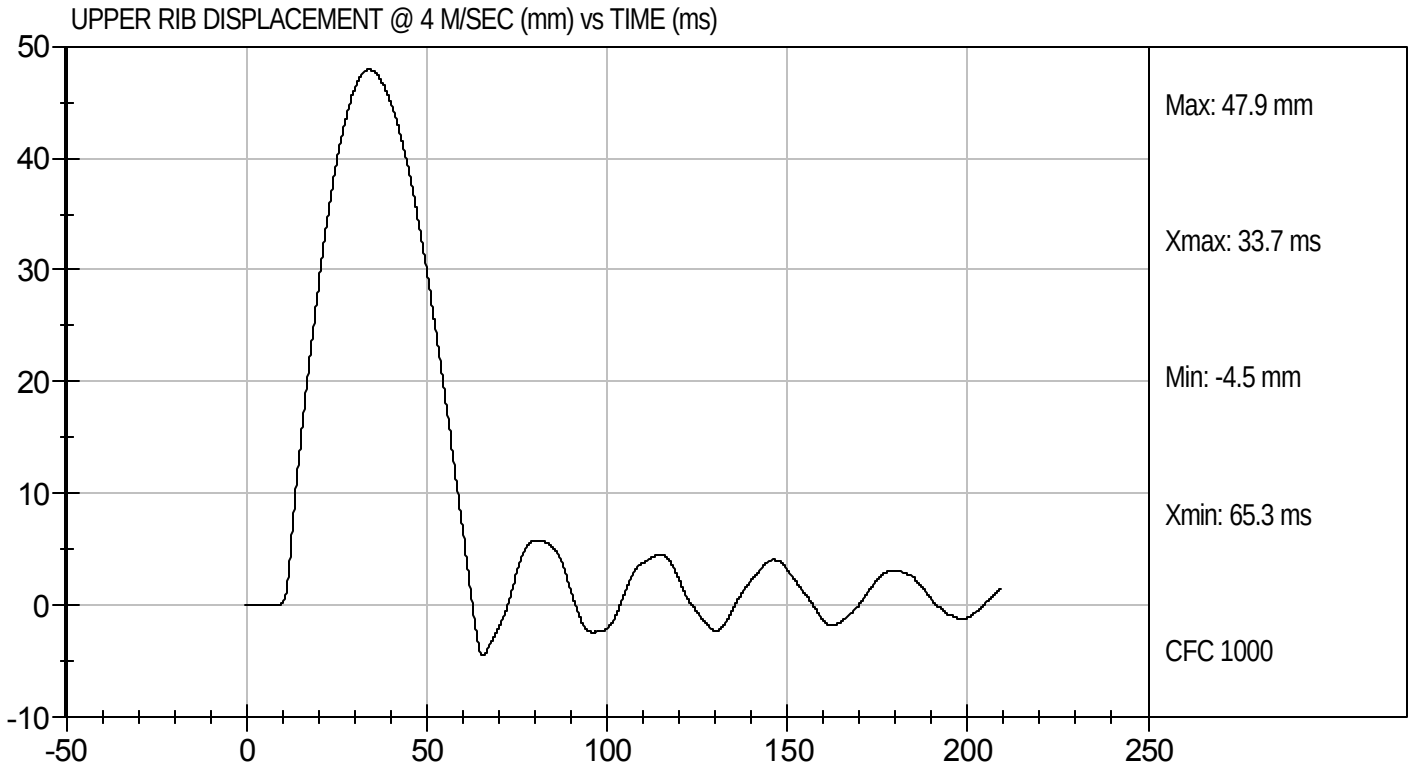
Jessica Gall
Laboratory Technician

5/10/11
Test Date

David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D111724
Test Date: 5/10/11





MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111725

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	50	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.3	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.7	Pass
		Overall Test Results		Pass

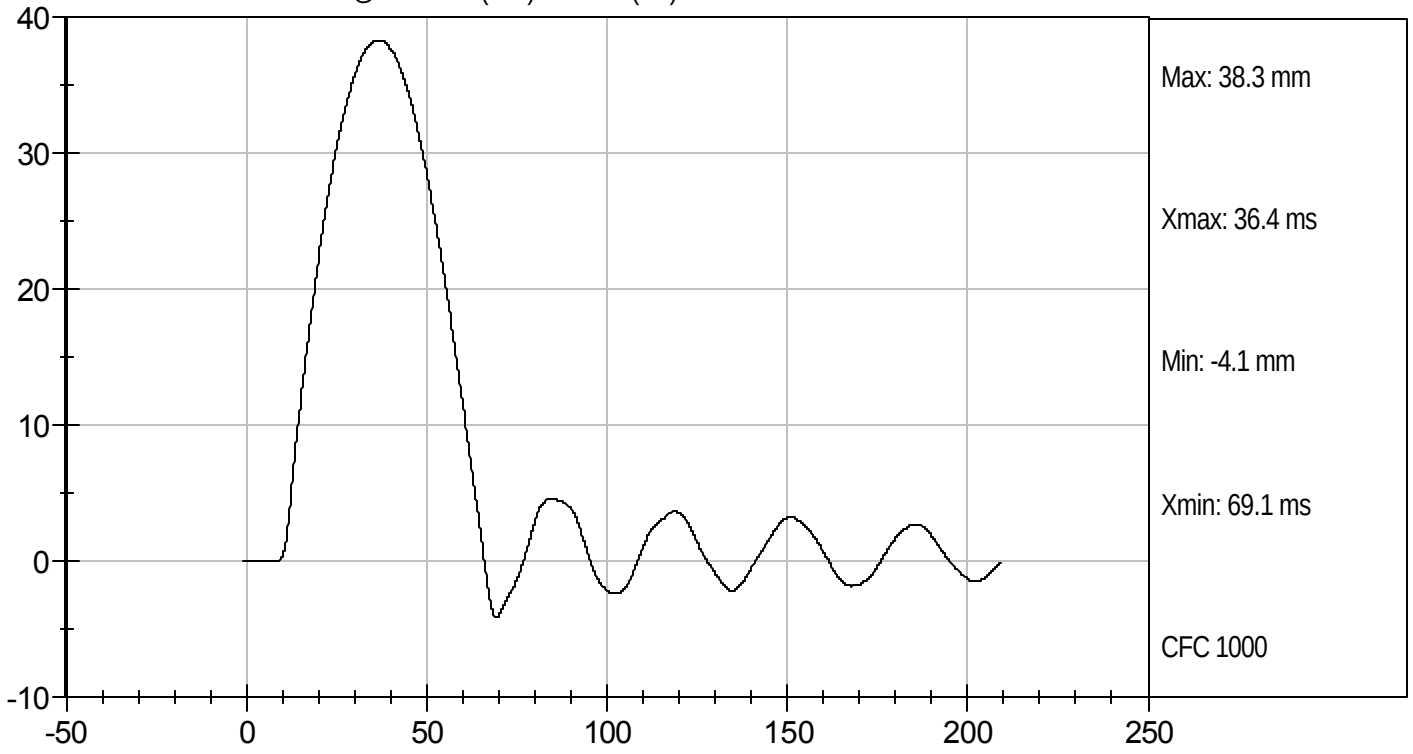
Jessica Gall
Laboratory Technician

5/10/11
Test Date

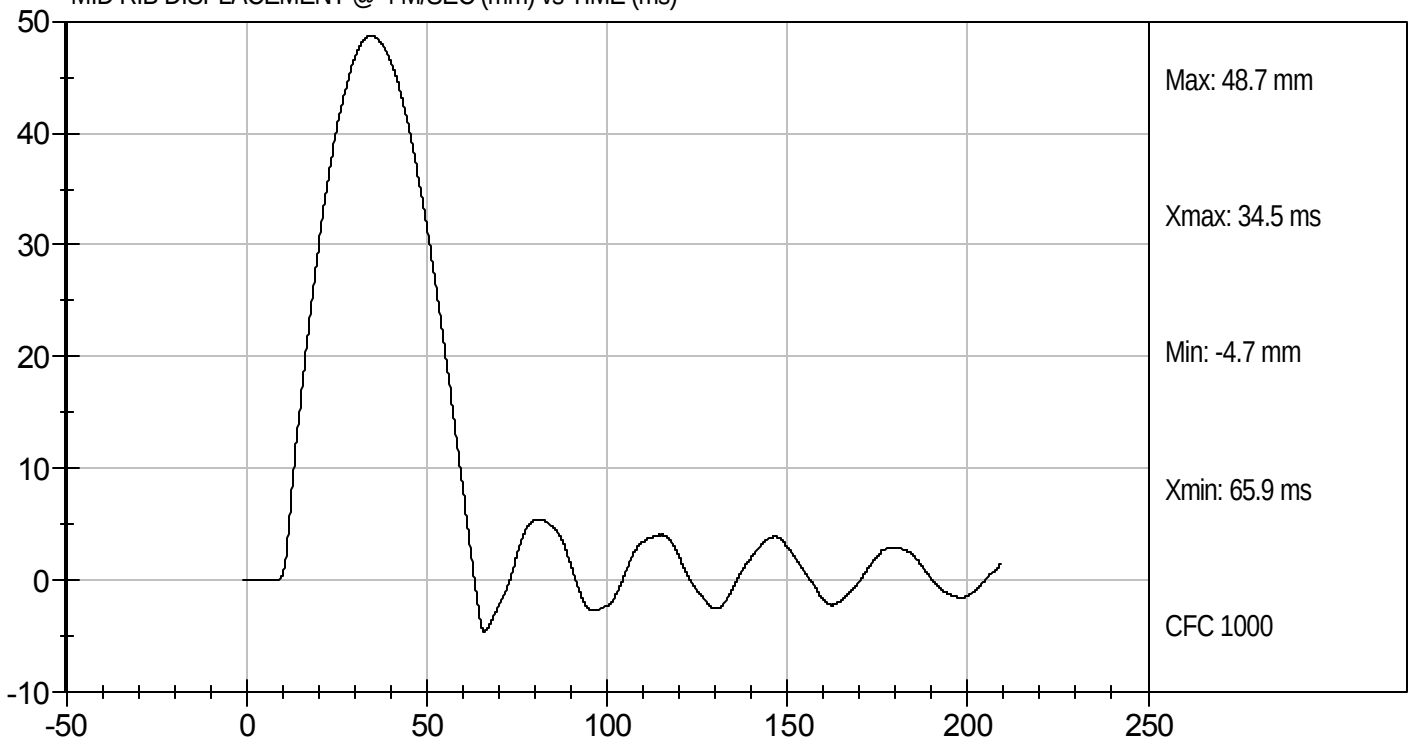
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D111725
Test Date: 5/10/11

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:** D111726

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	50	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.3	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.7	Pass
		Overall Test Results		Pass

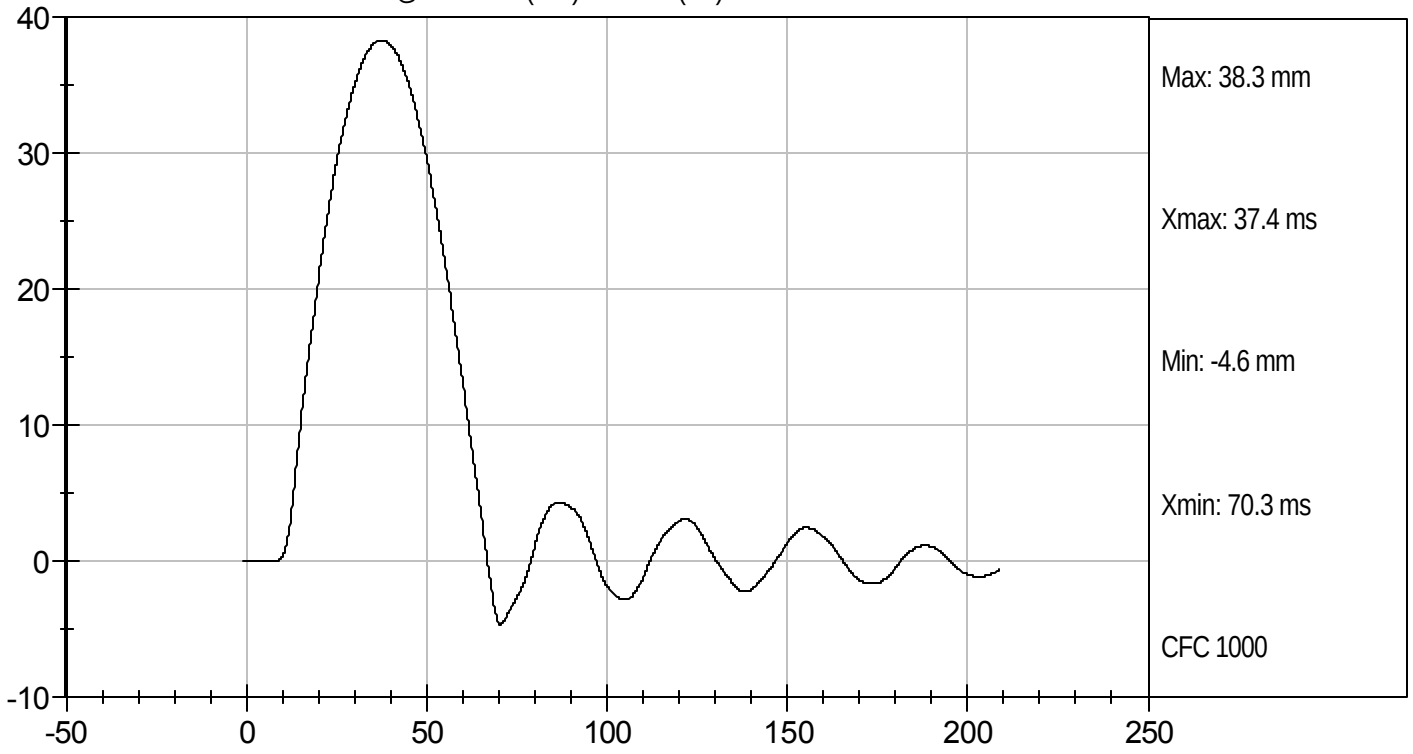
Jessica Hall
Laboratory Technician

5/10/11
Test Date

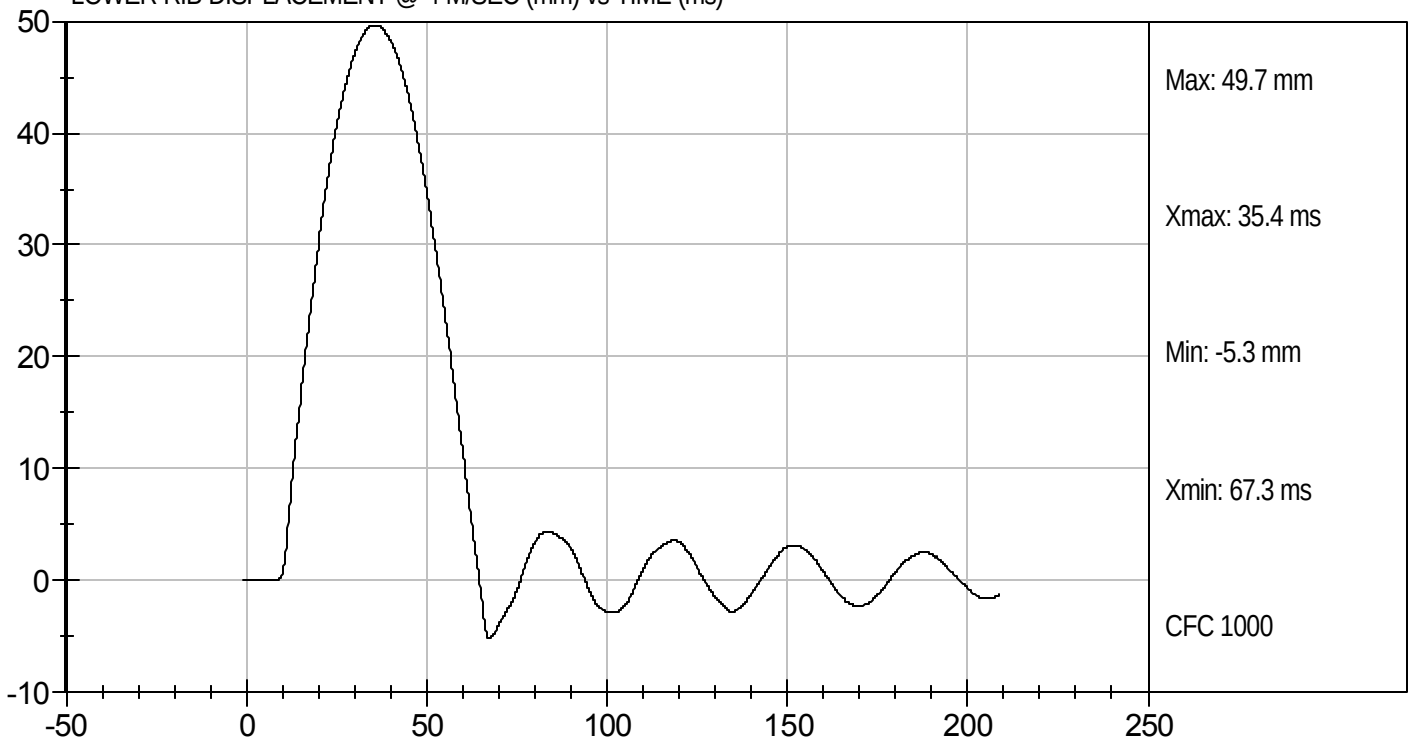
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D111726
Test Date: 5/10/11

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:** D111727

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	44	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.25	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	2.61	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	11.10	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

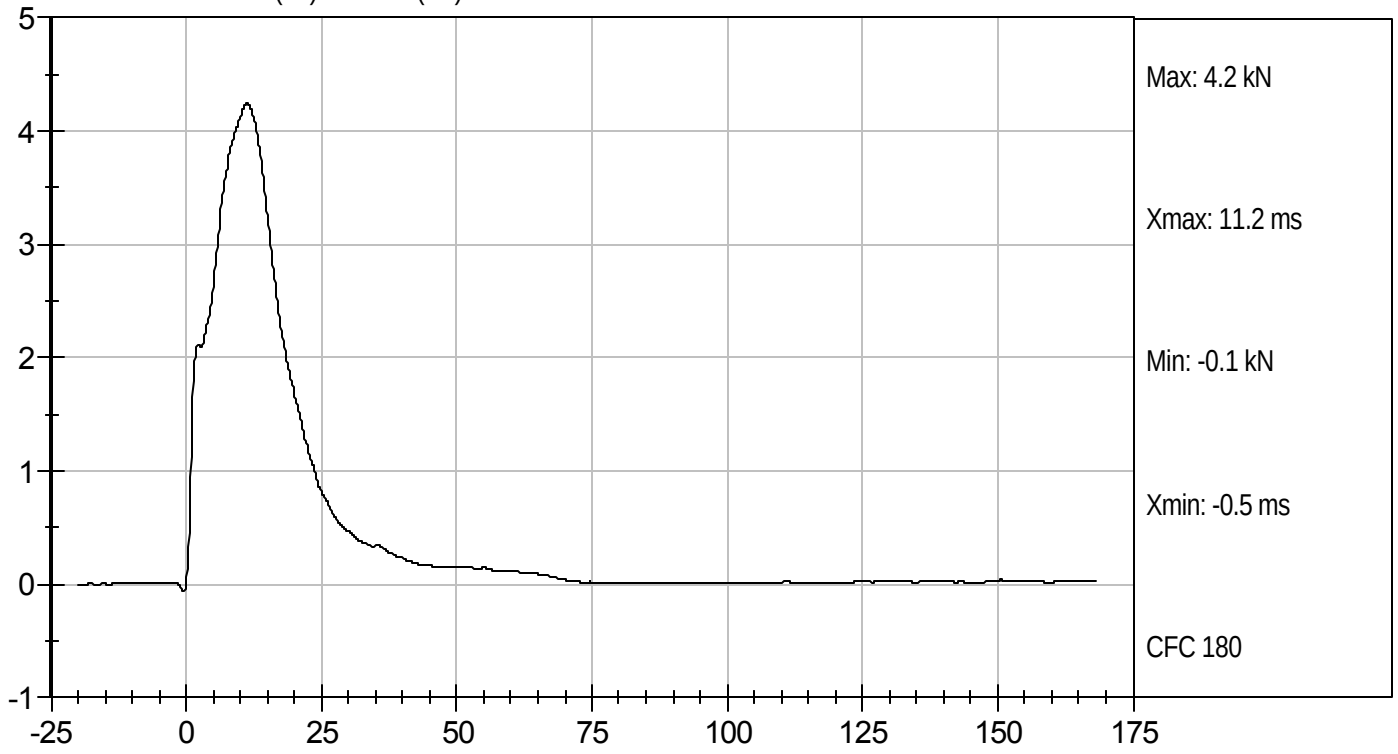
5/10/11
Test Date

David Winkelbauer
Approved By

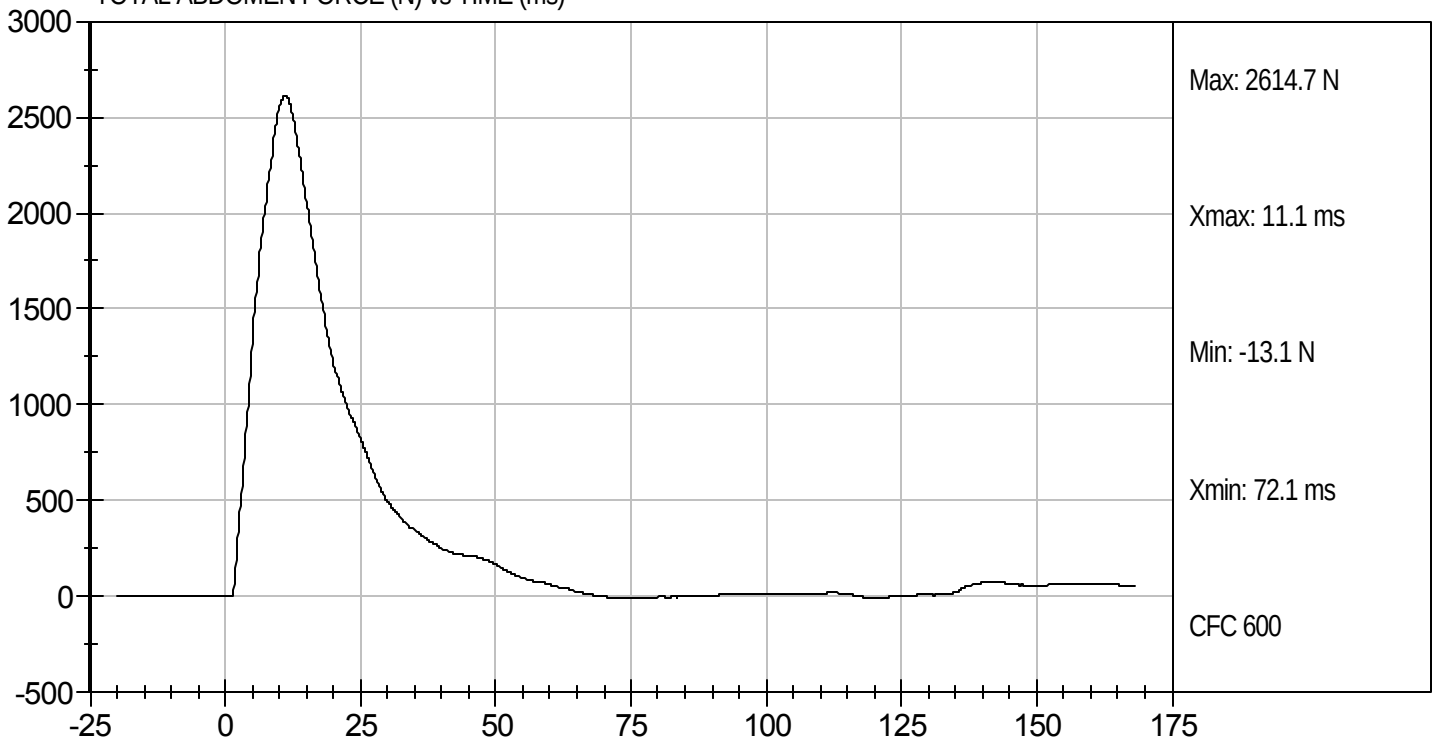
Test Desc: Abdomen Impact
Component ID: D111727

Test Date: 5/10/11
Velocity: 13.44 ft/s, 4.1 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111728

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	47	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	-6.03	Pass
	30 ms	m/s	>= -6.5	-6.01	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	47.9	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	42.4	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	45	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

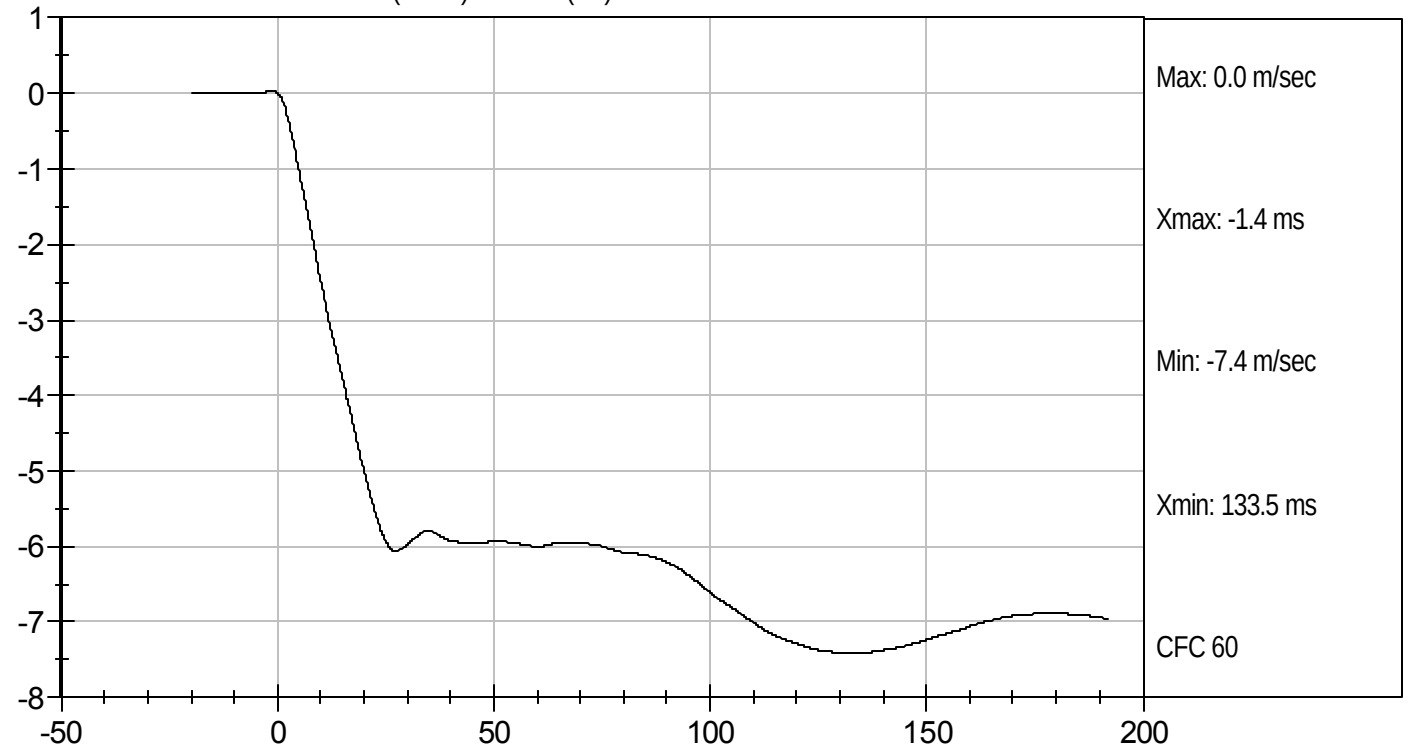
5/10/11
Test Date

David Winkelbauer
Approved By

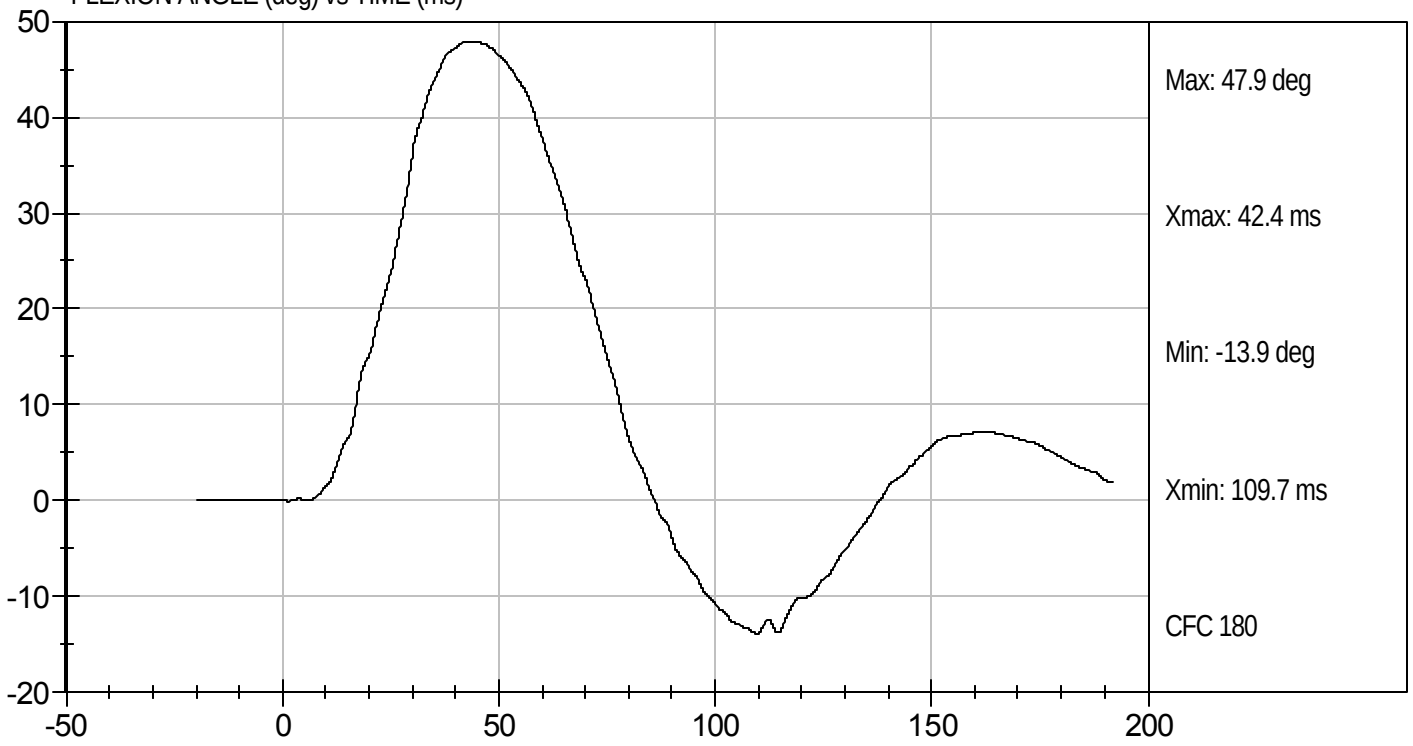
Test Desc: Lumbar Bending
Component ID: D111728

Test Date: 5/10/11
Velocity: 20.08 ft/s, 6.12 m/s

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

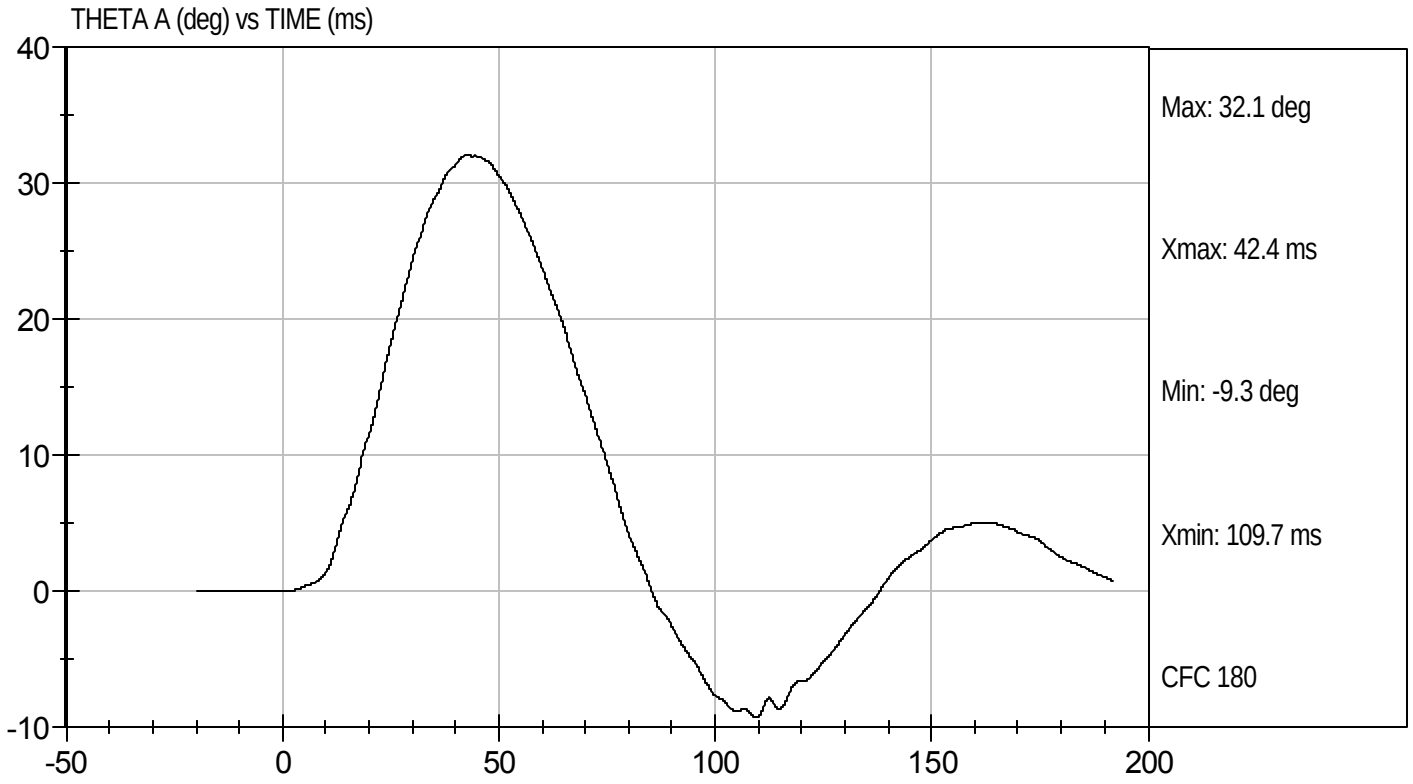


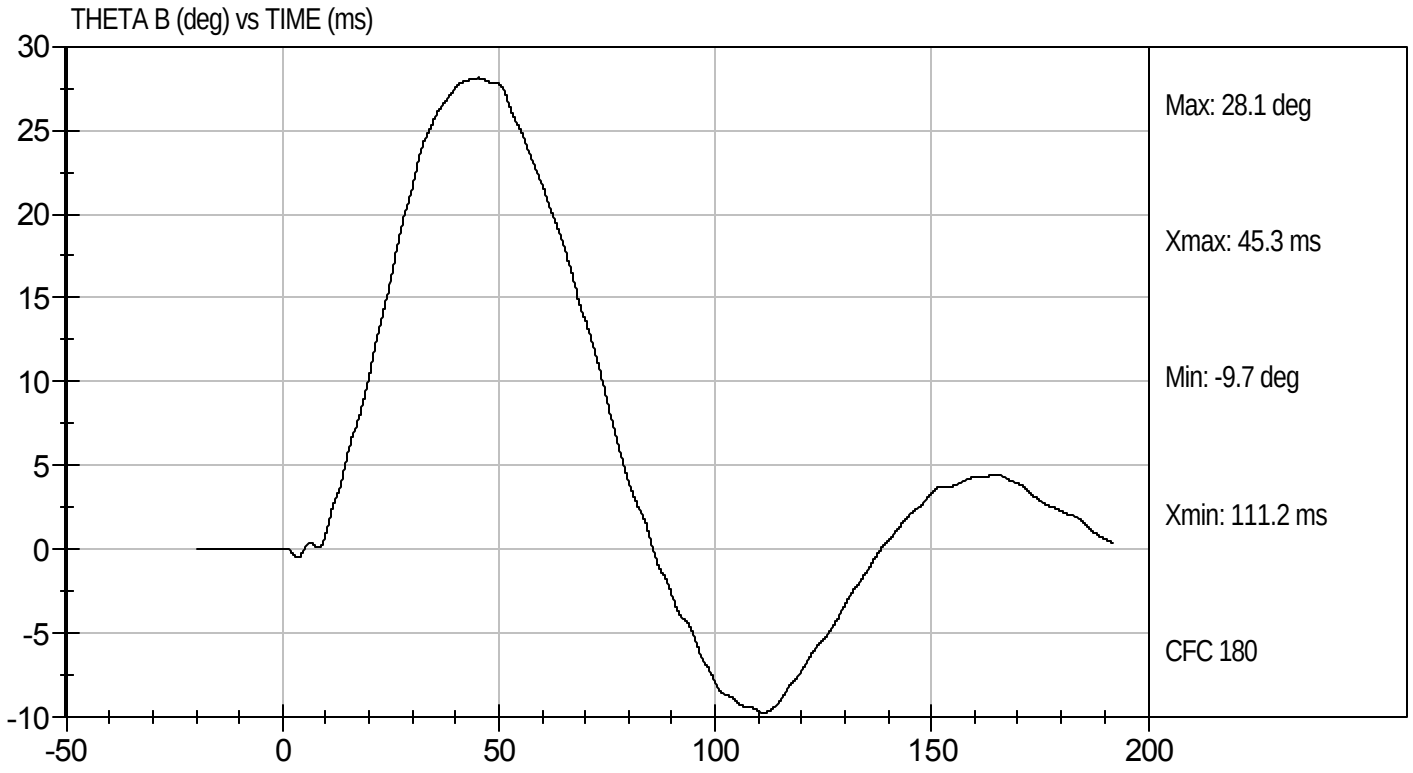
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D111728

Test Date: 5/10/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D111729

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	44	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.85	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.70	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.34	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	16.20	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

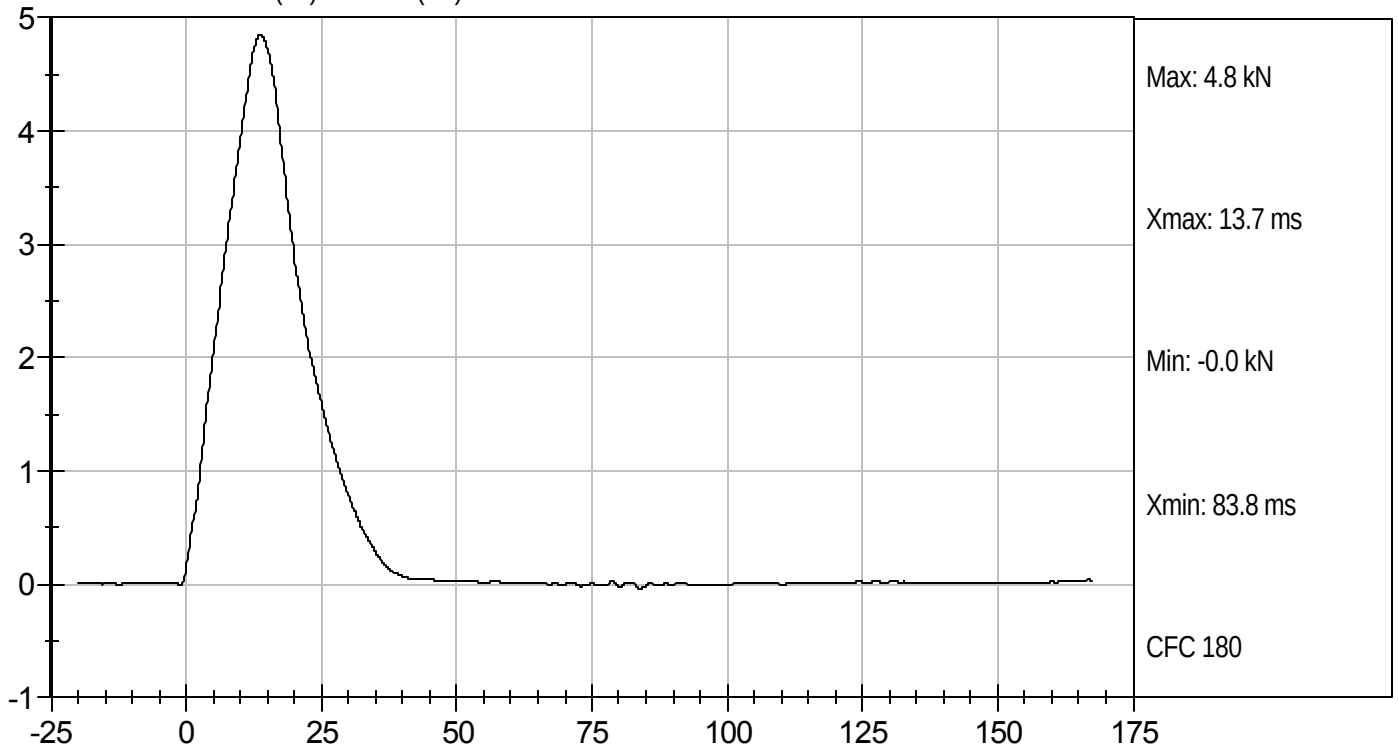
5/10/11
Test Date

David Winkelbauer
Approved By

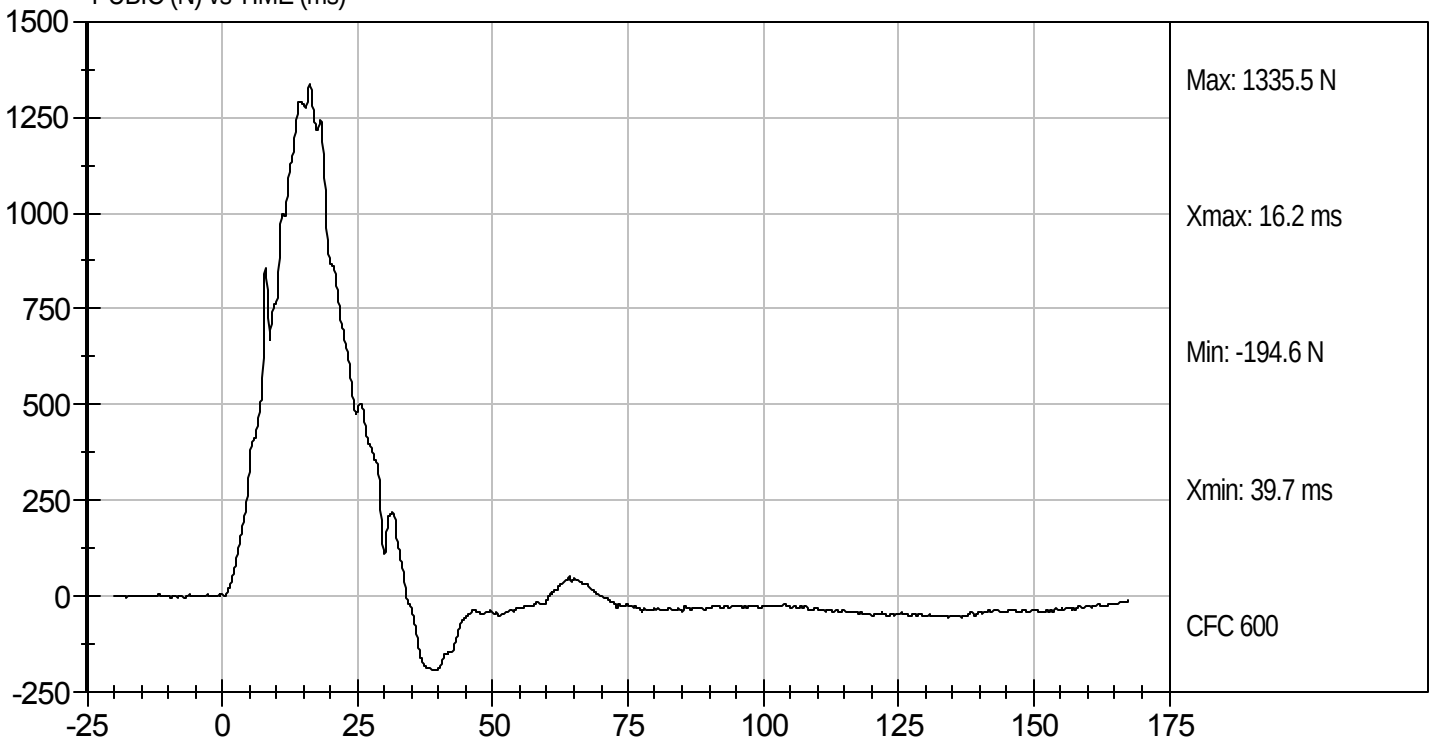
Test Desc: Pelvis Impact
Component ID: D111729

Test Date: 5/10/11
Velocity: 14.24 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:** D111720

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.0	Pass
Humidity	%	10 to 70	44	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	5.20	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.2	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.1	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.2	Pass
		Overall Test Results		Pass

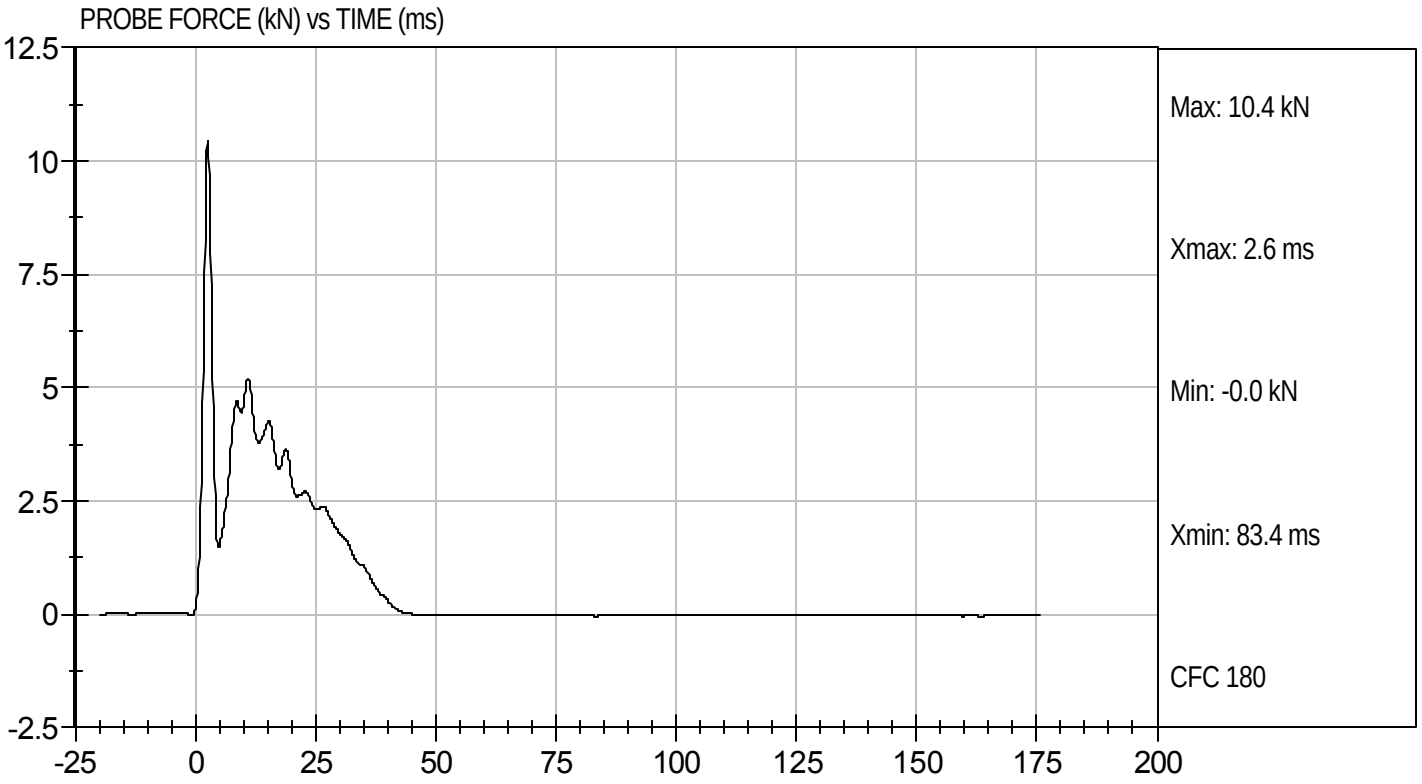
Jessica Hall
Laboratory Technician

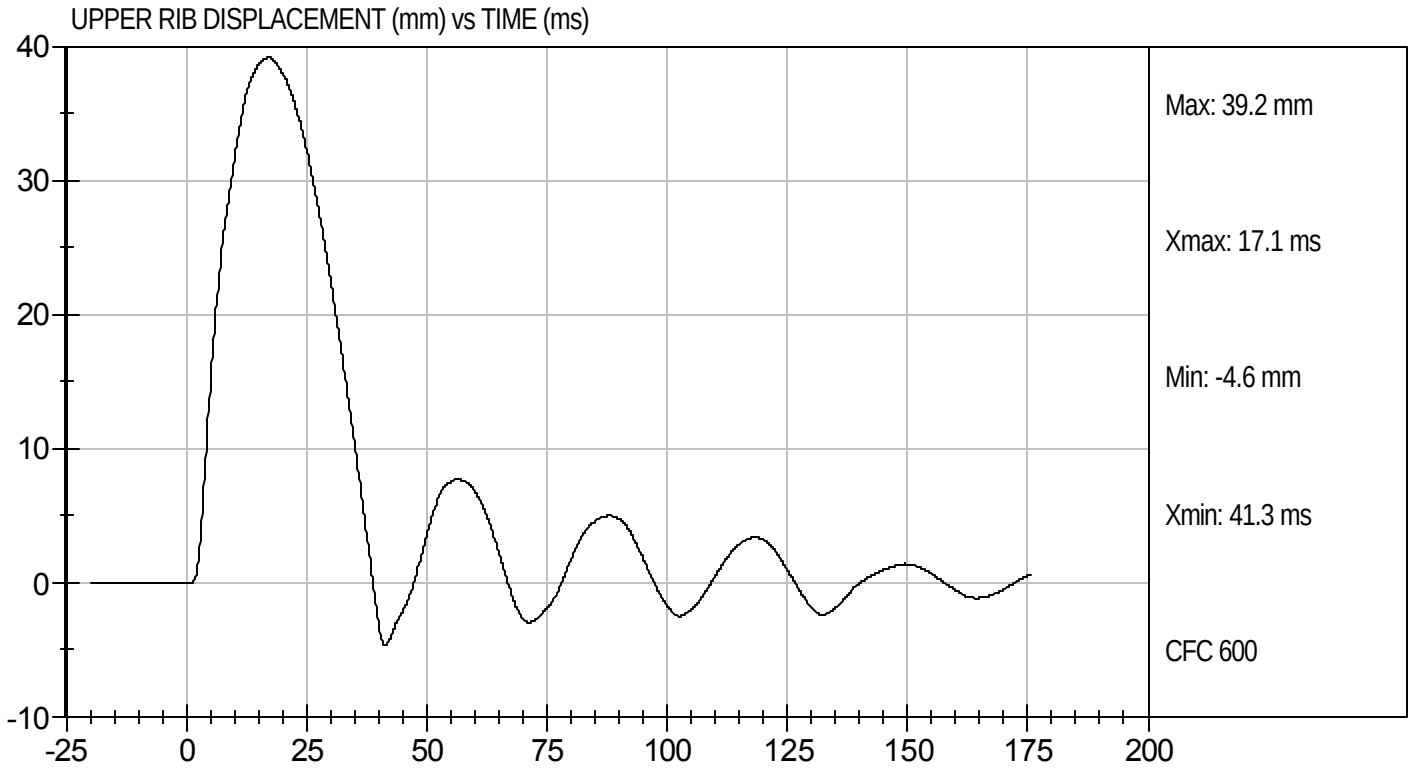
5/10/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D111720

Test Date: 5/10/11
Velocity: 18.31 ft/s, 5.58 m/s

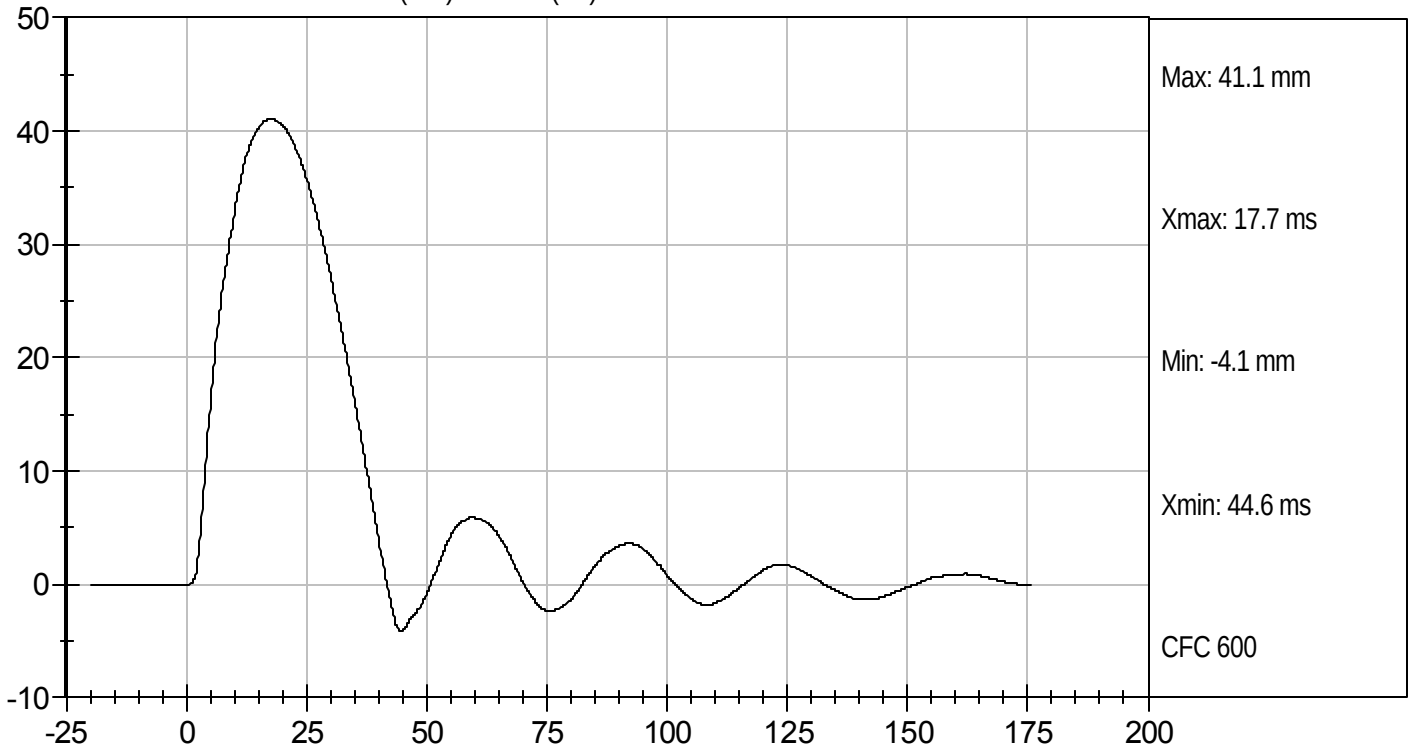




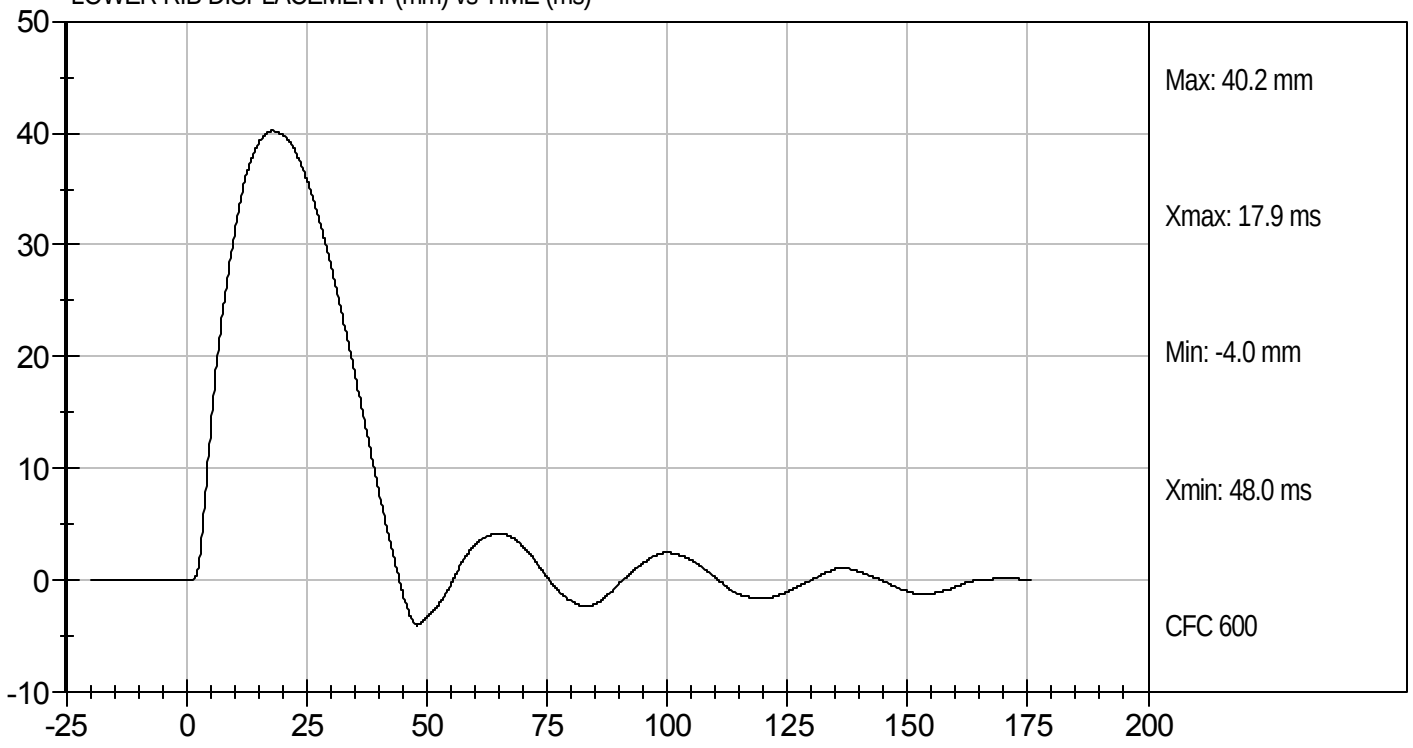
Test Desc: Thorax Impact
Component ID: D111720

Test Date: 5/10/11
Velocity: 18.31 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)	ABG1667	Denton	3/31/2011
	Middle (Y)	ABG1668	Denton	3/31/2011
	Rear (Y)	ABG1669	Denton	3/31/2011
Pubic Symphysis Load Cell (Y)		PG431	Denton	11/01/2010

Table 2 – Vehicle Instrumentation

	Serial Number	Manufacturer	Calibration Date
Vehicle CG (X)	P55688	Endevco	12/13/2010
Vehicle CG (Y)	P55689	Endevco	12/13/2010
Vehicle CG (Z)	P55690	Endevco	12/13/2010
Left Floor Sill (Y)	P48388	Endevco	4/27/2011
A Pillar Sill (Y)	P49469	Endevco	12/13/2010
A Pillar Low (Y)	P59251	Endevco	12/13/2010
A Pillar Mid (Y)	P52177	Endevco	12/22/2010
B Pillar Sill (Y)	P55684	Endevco	4/27/2011
B Pillar Low (Y)	P59244	Endevco	12/03/2010
B Pillar Mid (Y)	P59626	Endevco	2/19/2011
Seat (Y)	P59631	Endevco	12/22/2010
Engine (X)	P48167	Endevco	12/03/2010
Engine (Y)	P48166	Endevco	12/03/2010
Firewall (Y)	P49510	Endevco	1/14/2011
Roof (Y)	P52142	Endevco	3/15/2011
Floor Sill (Y)	P55682	Endevco	4/27/2011
Rear Deck (X)	P47091	Endevco	1/13/2011
Rear Deck (Y)	P47092	Endevco	1/13/2011