REPORT NUMBER: 214P-MGA-2011-004

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

TOYOTA MOTOR MANUFACTURING, KENTUCKY, INC.
2011 TOYOTA VENZA SUV
NHTSA NUMBER: CB5106

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

Test Date: March 14, 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
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Approval Date: June 6, 2011

FINAL REPORT ACCEPTANCE BY OVSC:

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Acceptance Date: 6/14/2011

Technical Report Documentation Page

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7. Author(s) Donna Janovicz, Project Manager Joe Fleck, Project Engineer		*8. Performing Organization Report No.* 214P-MGA-2011-004
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-07-D-00062
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance (NVS-220) 1200 New Jersey Ave, SE Washington, DC 20590		*13. Type of Report and Period Covered:* Final Test Report 3/14/2011 to 6/06//2011 *14. Sponsoring Agency Code* NVS-220
15. Supplementary Notes		

16. Abstract

A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 2011 Toyota Venza SUV in accordance with the specifications of the Office of Vehicle Safety Compliance TP-214P-01 for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on March 14, 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 393 mm at level 3. The test vehicle's performance follows:

Measurement Description	Units	Result
Head Injury Criteria (HIC_{36})	N/A	417
Max. Rib Deflection	mm	32
Sum of Abdomen Forces	N	1309
Pubic Symphysis Force	N	2806

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

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

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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 Toyota Venza 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 Toyota Venza SUV. 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 14, 2011. Pre-test and post-test photographs of the test vehicle and side impact dummy are included in Appendix A of this report.

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

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

A summary of the test results follows:

DUMMY INJURY VALUES

Dummy	HIC (36ms)	Thorax Deflection (mm)		Abdomen Forces (N)		Pubic Symphysis (N)
ES-2re 50th Percentile Male	471	Upper	32.1	Front	210.0	2806.0
		Middle	19.9	Mid	608.8	
		Lower	11.1	Rear	720.6	
		Max.	32.1	Sum	1308.5	

GENERAL COMMENTS

There was no valid data collected for:

Vehicle CG X after 75 msec.
Vehicle CG Y after 75 msec.
Left Floor Sill Y after 25 msec.
A Pillar Mid Y after 25 msec.
B Pillar Mid Y after 60 msec.

The Onboard – Driver Front high speed video did not run.

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 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

VEHICLE INFORMATION	
Make	Toyota
Model	Venza
Body Style	MPV
VIN	4T3ZA3BB3BU041838
Body Color	Barcelona Red Met.
Engine Displacement (L)	2.7
# of Cylinders	4
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	Front
Odometer Reading	38 miles

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

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing, Kentucky, Inc.
Date of Manufacture	01/11

GVWR (kg)	2245
GAWR Front (kg)	1400
GAWR Rear (kg)	1230

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)				398
Cargo Weight (RCLW) (kg)				58

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

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	504.8	365.1		532.5	424.1		529.8	417.3	
Right	kg	472.7	367.9		475.8	413.2		485.8	406.0	
Ratio	%	57.1	42.9		54.6	45.4		55.2	44.8	
Totals	kg	977.5	733.0	1710.5	1008.3	837.3	1845.6	1015.6	823.3	1838.9

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	1710.6
Weight of 1 P572U ATD (ES-2re) Dummy	kg	77.1
Rated Cargo/Luggage Weight (RCLW)	kg	58
Calculated Target Vehicle Test Weight (TVTW)	kg	1845.6

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	821	823	826	820
As Tested	mm	821	823	826	823
Difference	mm	0	0	0	-3

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2765
Vertical Impact Reference Line (Aft of Front Axle)	mm	1265

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

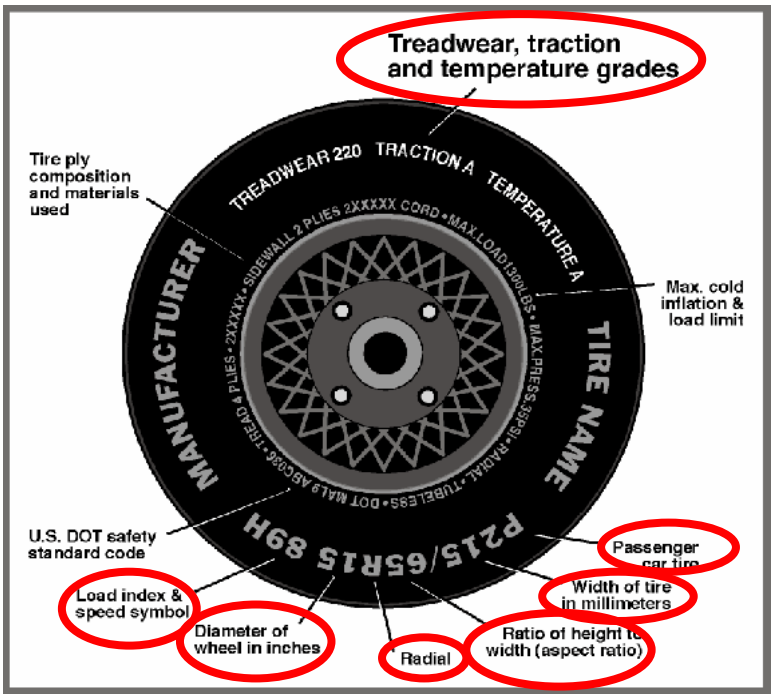
Description of Component	Weight (kg)
Ballast	0
No vehicle components removed to meet VTW	0

DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	220
Recommended Tire Size	P245/55R19	P245/55R19
Tire Size on Vehicle	P245/55R19	P245/55R19
Tire Manufacturer	Bridgestone	Bridgestone
Tire Name	Dueler	Dueler
Tire Type	Passenger	Passenger
Tire Width	245	245
Aspect Ratio	55	55
Radial	Yes	Yes
Wheel Diameter	19	19
Load Index/Speed Symbol	103S	103S
Treadwear	400	400
Traction Grade	B	B
Temperature Grade	B	B

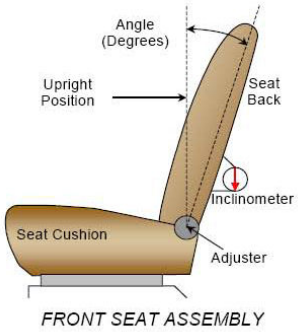
DATA SHEET NO. 4

SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

NORMAL DESIGN RIDING POSITION

The driver seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Seat back angle is measured at the headrest post by using an inclinometer zeroed at the door sill. Set the seat back angle at 3 degrees.



FRONT SEAT ASSEMBLY

SEAT BACK ANGLE

	Degrees	Detents
Driver with Seated Dummy	3.1° at headrest post	

SEAT FORE/AFT POSITION

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

SEAT FORE/AFT POSITIONING

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

SEAT BELT UPPER ANCHORAGE

The method of positioning the seat belt upper anchorage is as follows: Detents to the nominal design position are measured with respect to the uppermost detent. Place at 1st detent for the 50th percentile male.

SEAT BELT UPPER ANCHORAGE

	Total # of Positions	Placed in Position #
Driver Seat	4 detents	1st 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

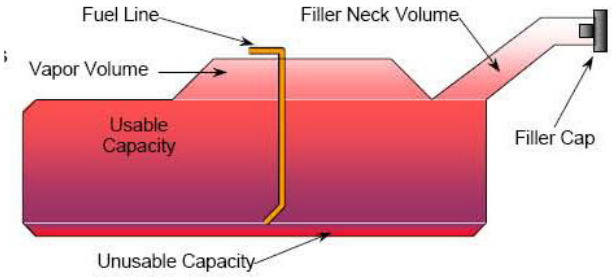
Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	67.0
Usable Capacity (Owner's Manual)	67.0
92-94% of Usable Capacity	61.6 to 63.0
Actual Amount of Solvent Used	62.1

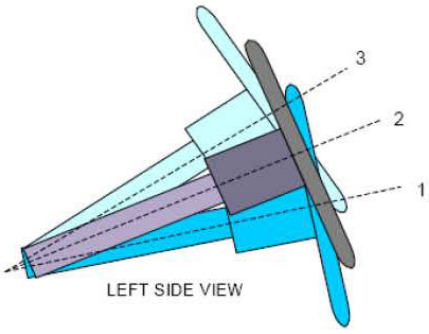
FUEL PUMP

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

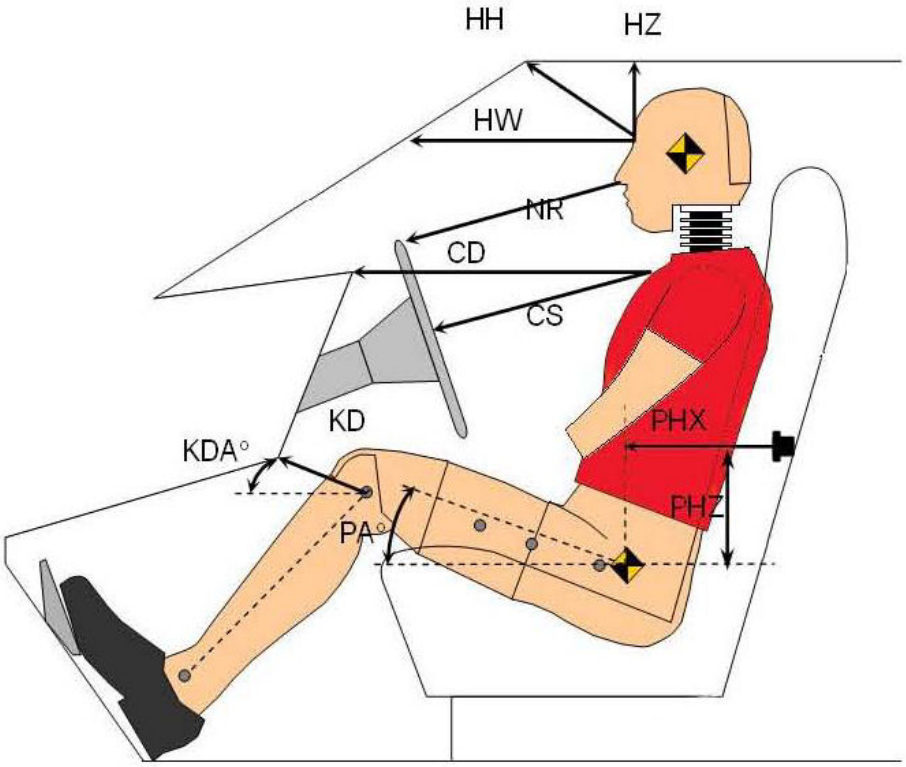
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	67.2	218
Geometric Center – Position 2	65.2	198
Uppermost – Position 3	63.2	178
Telescoping Steering Wheel Travel		40
Test Position	65.2	198

.DATA SHEET NO. 6

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

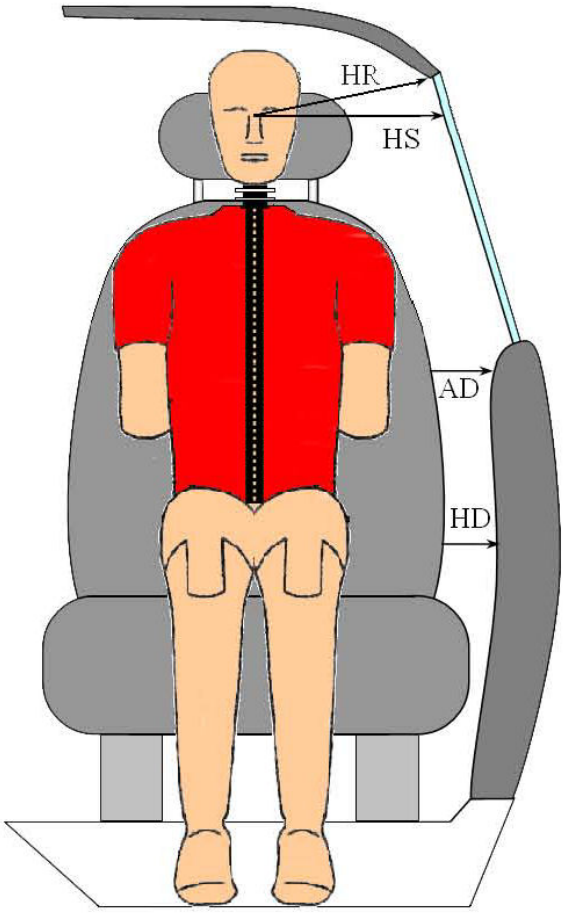


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	404	
HW	Head to Windshield	670	
HZ	Head to Roof	186	
NR	Nose to Rim	425	
CD	Chest to Dash	525	
CS	Chest to Steering Wheel	334	
KDL	Left Knee to Dash	188	27.5
KDR	Right Knee to Dash	166	28.7
PA	Pelvic Angle		
PHX	H-Point to Striker (X-Axis)	208	
PHZ	H-Point to Striker (Z-Axis)	229	

DATA SHEET NO. 7

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

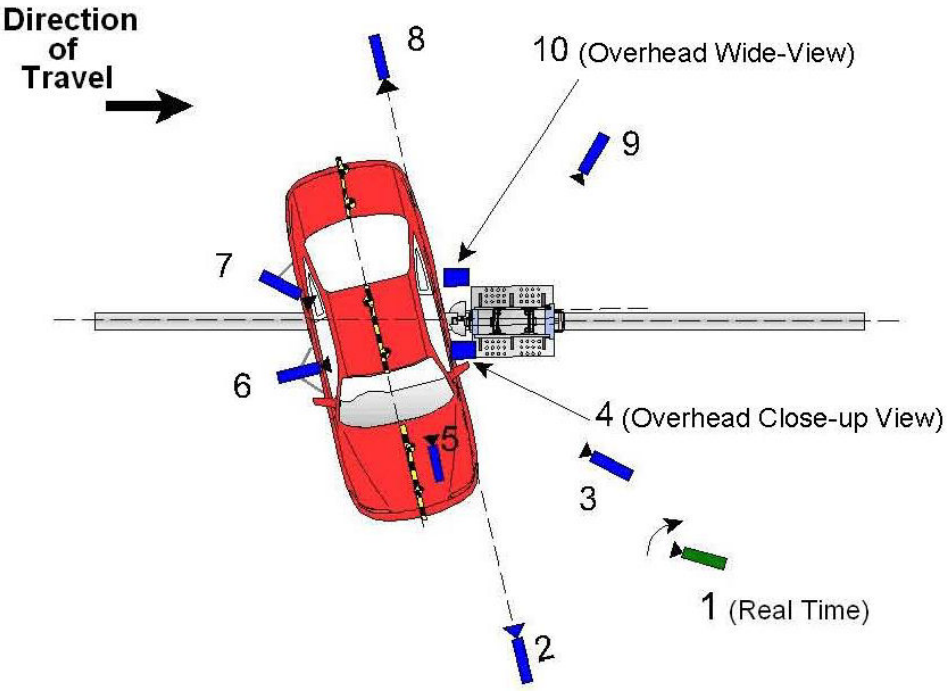


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	220
HS	Head to Side Window	mm	363
AD	Arm to Door	mm	130
HD	H-Point to Door	mm	141

DATA SHEET NO. 8

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011



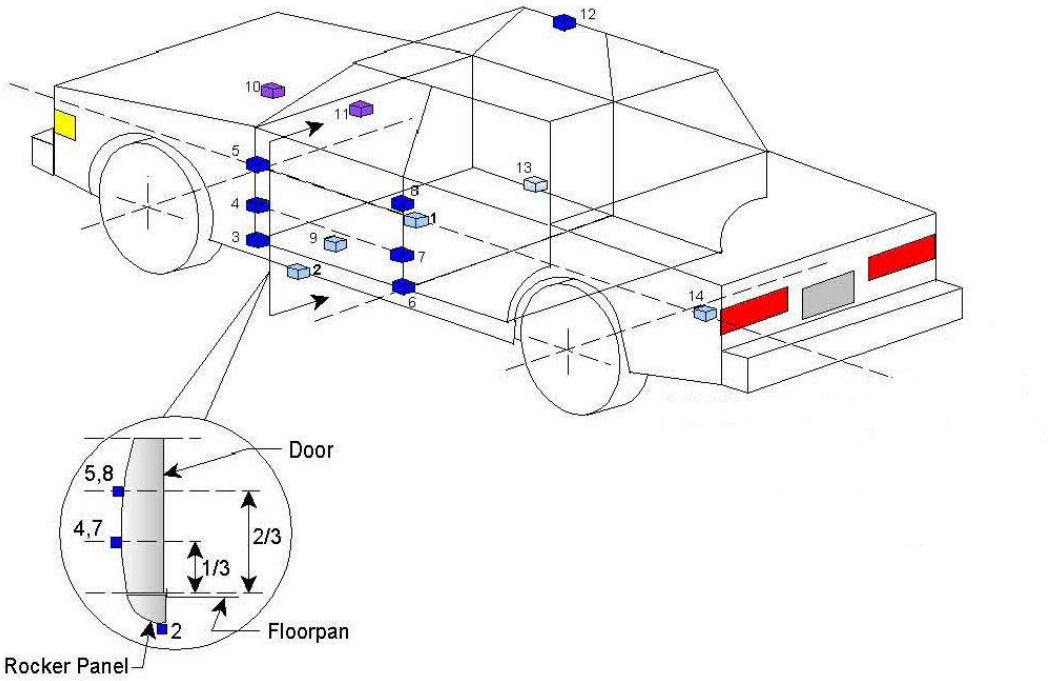
Reference: From Point of Impact for X and Y; from Ground for Z):
+X = Right of Impact, + Y = Forward of Impact, +Z = Up

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5990	50	1760	24	1000
3	Impact Side 45° Forward	4510	2180	1840	20	1000
4	Overhead Closeup	0	50	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	-5720	60	1750	24	1000
9	Impact Side 45° Rearward	-3890	3890	1830	20	1000
10	Overhead Wide	0	-340	4610	14	1000

DATA SHEET NO. 9

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2715	0	-420
2	Left Floor Sill	2708	-762	-250
3	A Pillar Sill	3157	-762	-245
4	A Pillar Low	3255	-744	-600
5	A Pillar Mid	3295	-858	-880
6	B Pillar Sill	2162	-762	-250
7	B Pillar Low	2180	-743	-634
8	B Pillar Mid	2180	-743	-904
9	Seat	2404	-553	-417
10	Engine	4052	-60	-884
11	Firewall	3845	0	-994
12	Roof	2142	605	-1606
13	Floor Sill	2228	762	-255
14	Rear Deck	850	0	-539

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 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	(1)	(1)	(1)	(1)
	Vehicle CG (Y)	(1)	(1)	(1)	(1)
	Vehicle CG (Z)	10.4	39.7	-18.4	17.3
	Resultant	(1)	(1)		
2	Left Floor Sill (Y)	(2)	(2)	(2)	(2)
3	A Pillar Sill (Y)	35.5	16.9	-1.1	255.7
4	A Pillar Low (Y)	21.5	19.1	-7.3	42.8
5	A Pillar Mid (Y)	(2)	(2)	(2)	(2)
6	B Pillar Sill (Y)	70.2	16.9	-2.9	11.9
7	B Pillar Low (Y)	40.9	18.3	-6.8	30.4
8	B Pillar Mid (Y)	(3)	(3)	(3)	(3)
9	Seat (Y)	40.9	19.8	-20.2	55.3
10	Engine (X)	2.6	102.1	-14.8	48.8
	Engine (Y)	14.6	60.0	-3.2	239.8
11	Firewall (Y)	13.1	67.6	-1.4	7.1
12	Roof (Y)	21.3	45.5	-2.3	21.4
13	Floor Sill (Y)	13.8	49.3	-1.1	200.8
14	Rear Deck (X)	2.6	153.7	-6.1	72.0
	Rear Deck (Y)	12.6	71.0	-1.8	217.2

(1) No valid data collected for Vehicle CG X after 75 msec.
(1) No valid data collected for Vehicle CG Y after 75 msec.
(2) No valid data collected for Left Floor Sill Y after 25 msec.
(2) No valid data collected for A Pillar Mid Y after 25 msec.
(3) No valid data collected for B Pillar Mid Y after 60 msec.

DATA SHEET NO. 11

DUMMY INJURY RESPONSE DATA

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

Dummy S/N	Positive		Negative	
	MAX	**TIME (ms)**	**MAX**	**TIME (ms)**
HEAD ACCELERATION (G)				
Longitudinal (X)	5.4	84.3	28.9	57.7
Lateral (Y)	56.4	57.5	16.3	107.4
Vertical (Z)	18.3	50.3	1.3	170.9
Resultant (R)	64.4	57.6		
HIC36 (t1, t2)	471		t1 = 48.4	t2 = 73.0
THORAX DEFLECTION (mm)				
Upper Rib			32.1	58.0
Middle Rib			19.9	59.2
Lower Rib			11.1	58.8
ABDOMINAL FORCES (N)				
Front	210.0	82.9		
Middle	608.8	51.1		
Rear	720.6	52.7		
Sum	1308.5	50.9		
PELVIS FORCE (N)				
Pubic Symphysis			2806.0	46.5

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

DATA SHEET NO. 12

POST TEST OBSERVATIONS

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Front Occupant
Dummy Type / Serial No.	ES-2re / 016
Head Contact	Curtain Airbag, Headrest
Upper Torso Contact	Side Airbag, Door Panel
Lower Torso Contact	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	Remained closed and operational	Remained closed and operational
Seat Movement	None	None
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

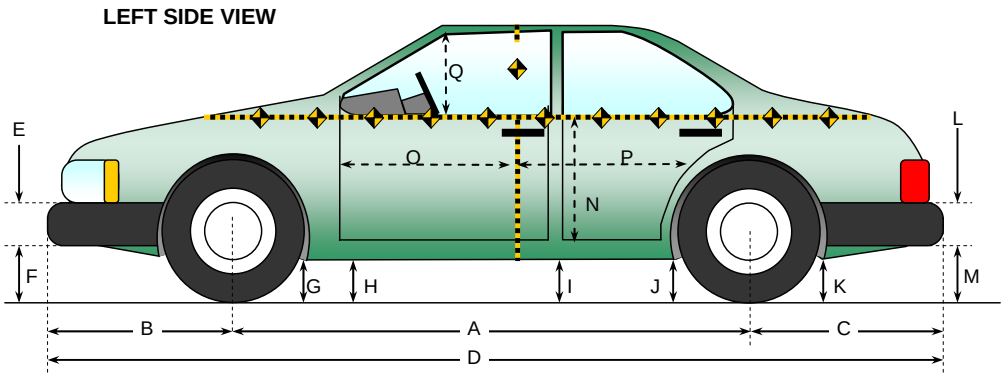
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso Airbag	Yes	Yes
Knee Airbag	Yes	No
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 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

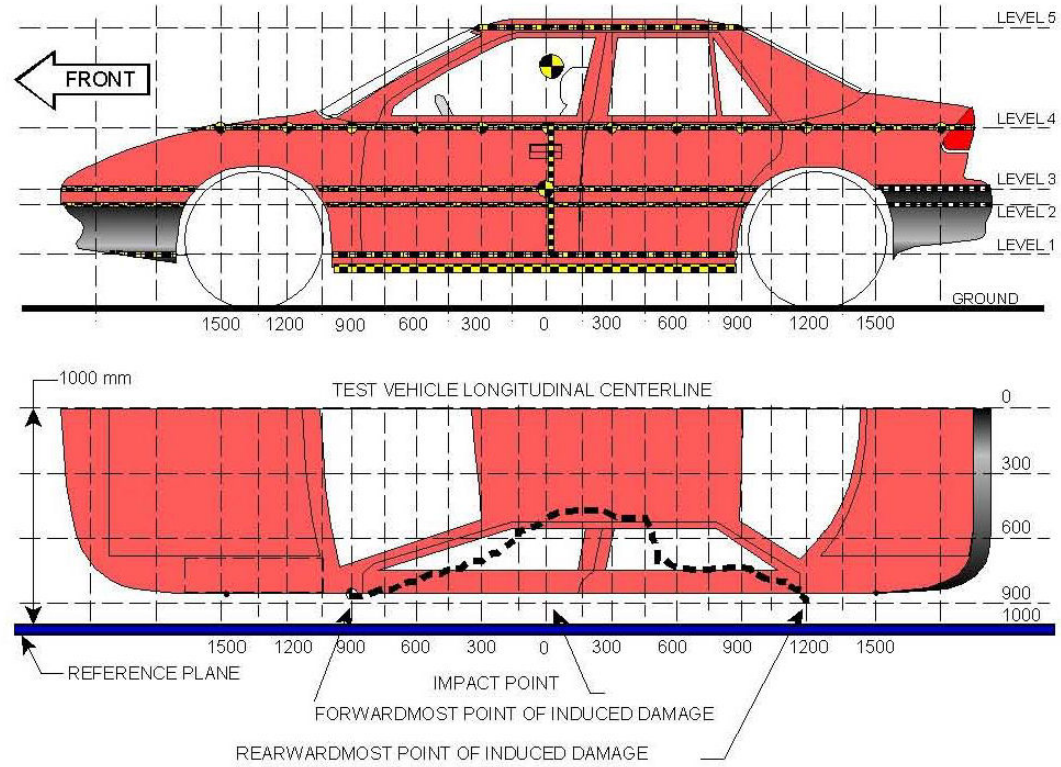


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2765	2670	95
B	Front Axle to FSOV	925	930	-5
C	Rear Axle to RSOV	1110	1120	-10
D	Total Vehicle Length at Centerline	4800	4720	80
E	Front Bumper Thickness	115	115	0
F	Front Bumper Bottom to Ground	233	239	-6
G	Sill Height at Front Wheel Well	208	227	-19
H	Sill Height at Front Door Leading Edge	210	234	-24
I	Sill Height at B Pillar	223	242	-19
J1	Sill Height at Rear Wheel Well	228	268	-40
J2	Pinch Weld Height at Rear Wheel Well	227	258	-31
K	Sill Height Aft of Rear Wheel Well	282	314	-32
L	Rear Bumper Thickness	90	90	0
M	Rear Bumper Bottom to Ground	352	360	8
N	Sill Height to Window Bottom Sill	905	895	10
O	Front Door Leading Edge to Impact CL	864	855	9
P	Rear Door Trailing Edge to Impact CL	1057	1100	-43
Q	Front Window Opening	458	355	103
R	Right Side Length	3630	3650	-20
S	Left Side Length	3630	3495	135
T	Vehicle Width at B Post	1900	1742	158

DATA SHEET NO. 14

EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011



NOTE: All measurements are in millimeters (mm)

Maximum Exterior Crush Measurements

Level	Measurement Description	Maximum Exterior Static Crush	Distance from Impact	Height Above Ground (mm)
1	Sill Top	343	75	355
2	Occupant H-Point	389	75	654
3	Mid-Door	393	75	678
4	Window Sill	338	75	1082
5	Window Top	174	0	1548

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

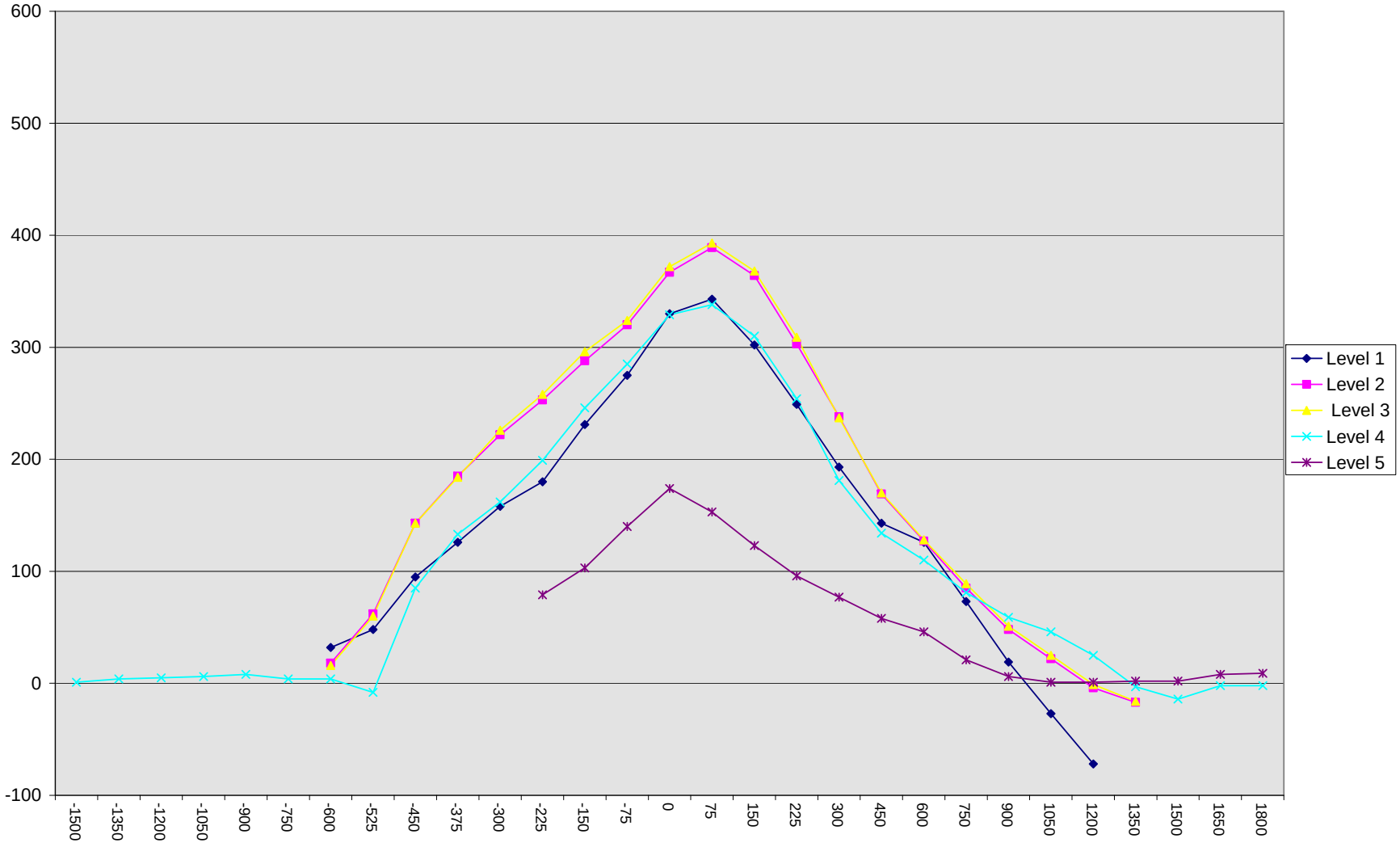
	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	343	389	393	338	174
Distance From Impact (mm)	75	75	75	75	0

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500				288					289					1	
-1350				273					277					4	
-1200				260					265					5	
-1050				250					256					6	
-900				238					246					8	
-750				232					236					4	
-600	183	151	150	229		215	169	166	233		32	18	16	4	
-525	187	154	152	227		235	216	212	219		48	62	60	-8	
-450	188	154	151	220		283	297	294	305		95	143	143	85	
-375	190	154	151	217		316	339	335	350		126	185	184	133	
-300	190	154	151	216		348	376	377	378		158	222	226	162	
-225	190	155	152	214	451	370	408	410	413	530	180	253	258	199	79
-150	190	156	152	213	450	421	444	448	459	553	231	288	296	246	103
-75	190	156	153	213	448	465	476	477	498	588	275	320	324	285	140
0	190	157	153	212	447	520	524	525	541	621	330	367	372	329	174
75	189	159	155	211	446	532	548	548	549	599	343	389	393	338	153
150	188	161	157	212	445	490	525	525	522	568	302	364	368	310	123
225	189	162	158	212	447	438	465	467	466	543	249	303	309	254	96
300	189	163	160	212	448	382	401	397	393	525	193	238	237	181	77
450	190	166	162	210	448	333	335	332	344	506	143	169	170	134	58
600	190	167	163	211	448	316	294	291	321	494	126	127	128	110	46
750	191	171	167	212	449	264	256	256	293	470	73	85	89	81	21
900	192	175	172	214	453	211	223	223	273	459	19	48	51	59	6
1050	191	175	173	217	456	164	197	198	263	457	-27	22	25	46	1
1200	188	163	162	222	460	116	159	161	247	461	-72	-4	-1	25	1
1350		156	155	228	464		139	139	225	465		-17	-16	-3	2
1500				234	472				220	474				-14	2
1650				241	480				239	488				-2	8
1800				252	487				250	496				-2	9

DATA SHEET NO. 15 (CONTINUED)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011



DATA SHEET NO. 16

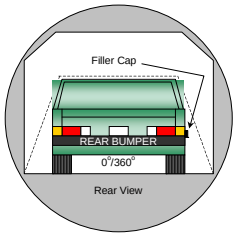
SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

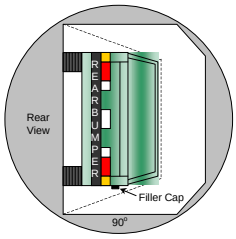
FUEL SYSTEM INTEGRITY POST IMPACT DATA

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

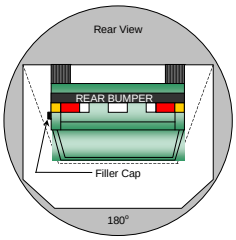
STATIC ROLLOVER DATA



0/360



90



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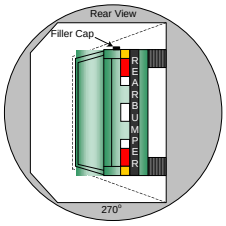


270

REAR VIEW

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	2	minutes	00	seconds	5	minutes	7	minutes	00	seconds	8	minutes
90° - 180°	1	minutes	56	seconds	5	minutes	6	minutes	56	seconds	7	minutes
180° - 270°	1	minutes	48	seconds	5	minutes	6	minutes	48	seconds	7	minutes
270° - 360°	1	minutes	59	seconds	5	minutes	6	minutes	59	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

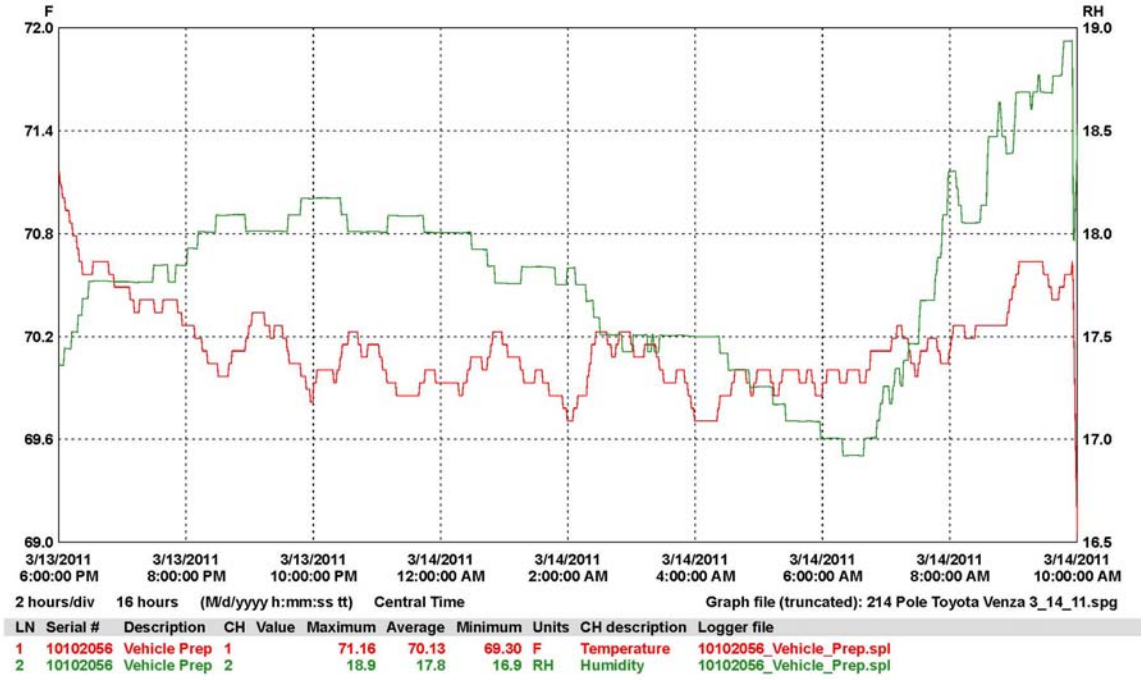
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17

TEMPERATURE AND HUMIDITY TRACES

Test Vehicle: 2011 Toyota Venza SUV NHTSA No. CB5106
Test Program: FMVSS 214 Pole Test Date: 3/14/2011

Time of Impact: 9:53 am



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	10102056	Vehicle Prep	1		71.16	70.13	69.30	F	Temperature	10102056_Vehicle_Prep.spl
2	10102056	Vehicle Prep	2		18.9	17.8	16.9	RH	Humidity	10102056_Vehicle_Prep.spl

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Pre-Test Frontal View of Test Vehicle

Post-Test Frontal View of Test Vehicle

Pre-Test Rear View of Test Vehicle

Post-Test Rear View of Test Vehicle

Pre-Test Impacted Side View of Test Vehicle

Post-Test Impacted Side View of Test Vehicle

Pre-Test Left ¾ Front View of Vehicle and Pole

Pre-Test Left ¾ Rear View of Vehicle and Pole

Pre-Test Overhead View of Test Vehicle

Post-Test Overhead View of Test Vehicle

Pre-Test Dummy Through Opposite Window

Post-Test Dummy Through Opposite Window

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

Post-Test Dummy with Door Closed (Impact Side)

Pre-Test Dummy Door Open

Pre-Test Dummy Shoulder and Door Top View

Post-Test Dummy Shoulder and Door Top View

Pre-Test Interior of Front Door Closed

Post-Test Interior of Front Door Showing Dummy Impact Locations

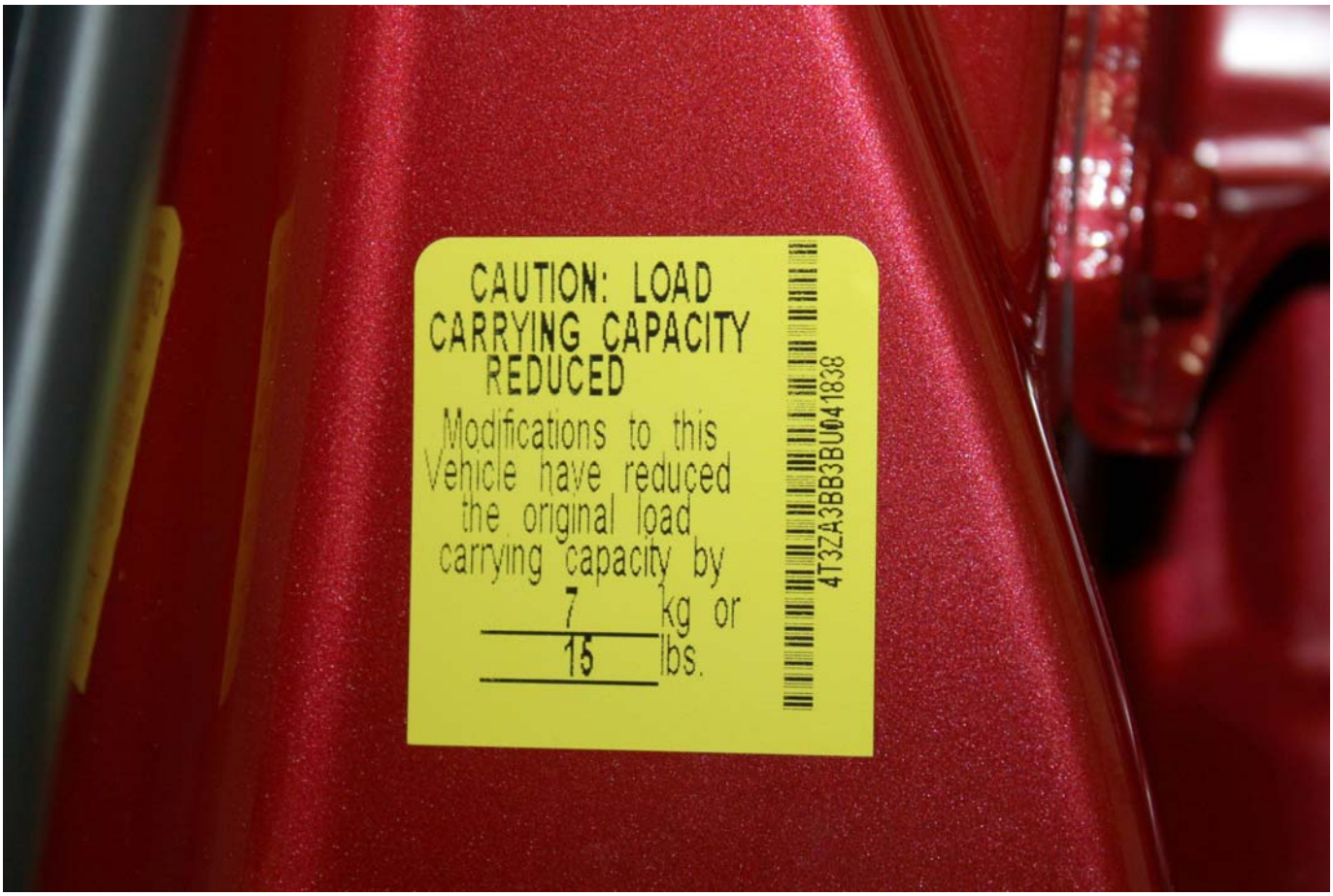
Impact Event

Post-Test Impact Zone Close-up View

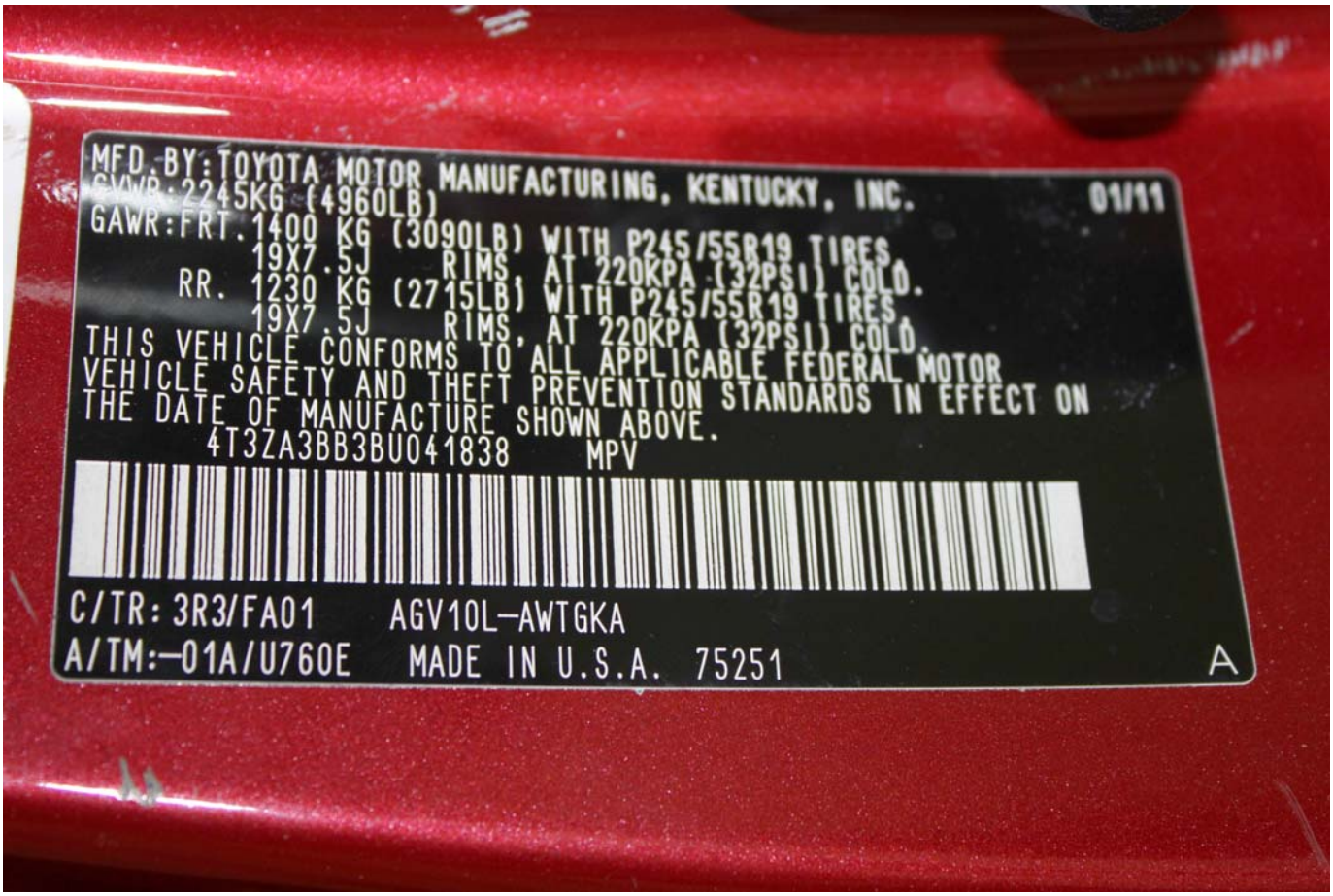
Post-Test ¾ Front View of Impact Zone

Post-Test ¾ Rear View of Impact Zone

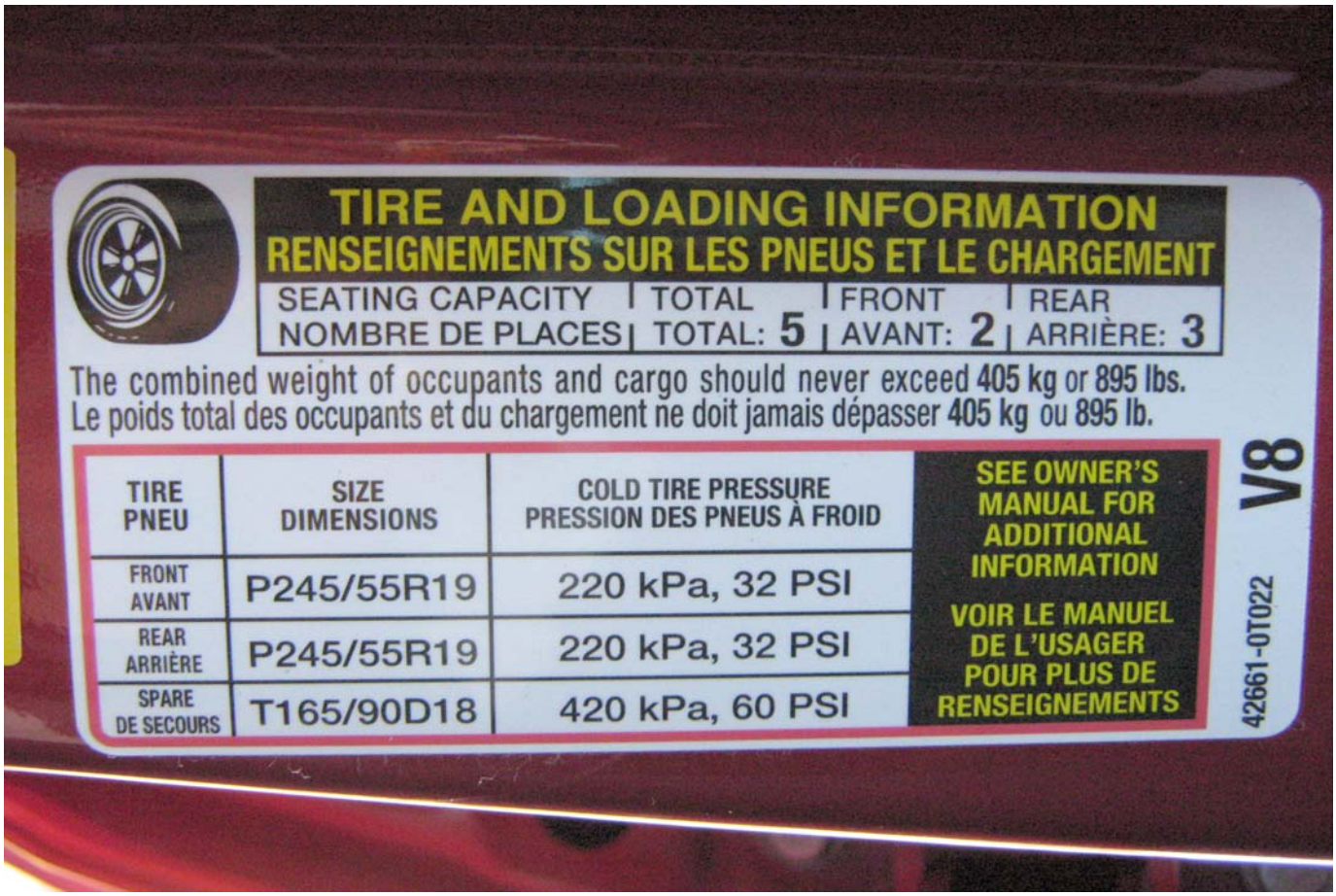
Post-Test Close-up View of Impact Point Target



Close-up View of Vehicle's Load Carrying Capacity Reduced Label



Close-up View of Vehicle's Certification Label



Close-up View of Vehicle's Tire Placard Label

Post-Test Vehicle at 90 Degree Rollover

Post-Test Vehicle at 180 Degree Rollover

Post-Test Vehicle at 270 Degree Rollover

Post-Test Vehicle at 360 Degree Rollover

APPENDIX B

DUMMY RESPONSE DATA

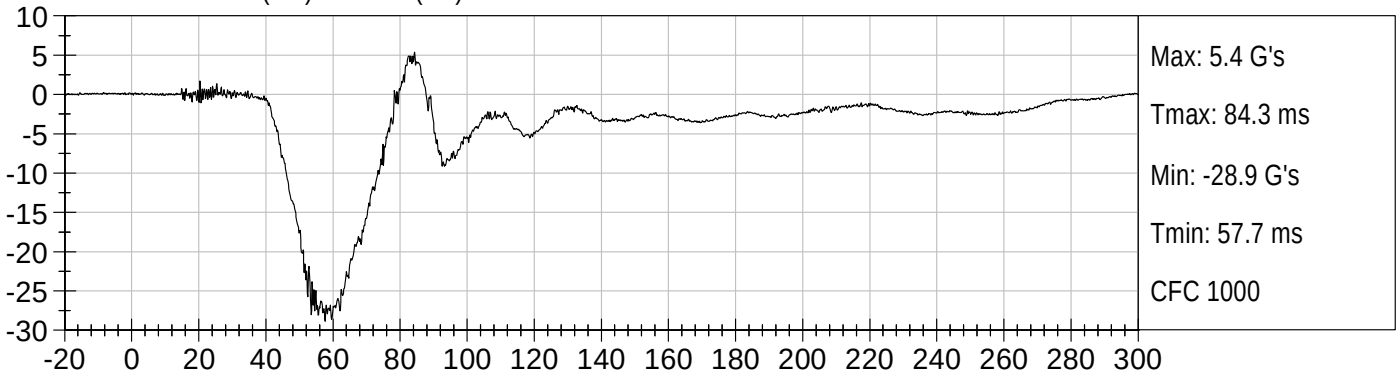
TABLE OF DATA PLOTS

Dummy Instrumentation Plots
FILTERED DATA

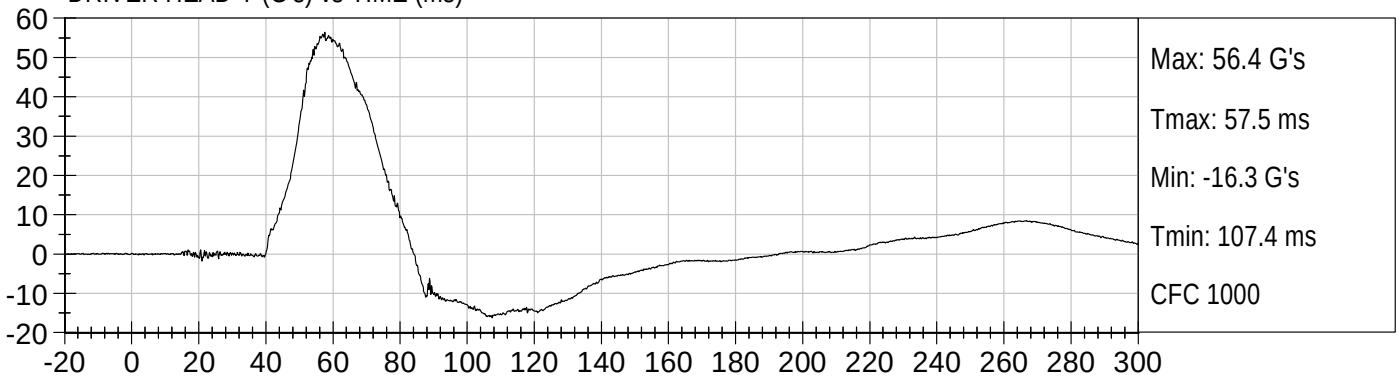
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

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

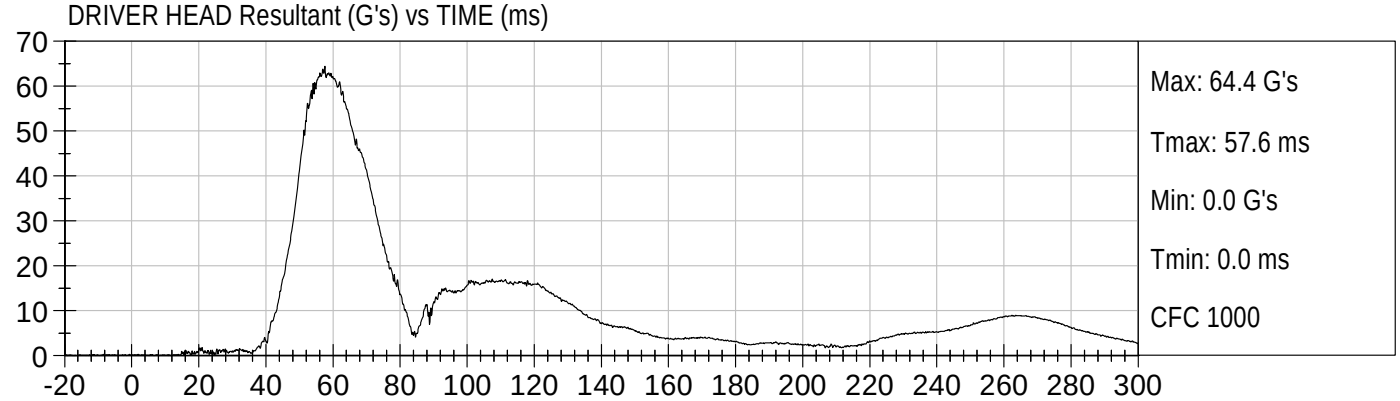


DRIVER HEAD Y (G's) vs TIME (ms)

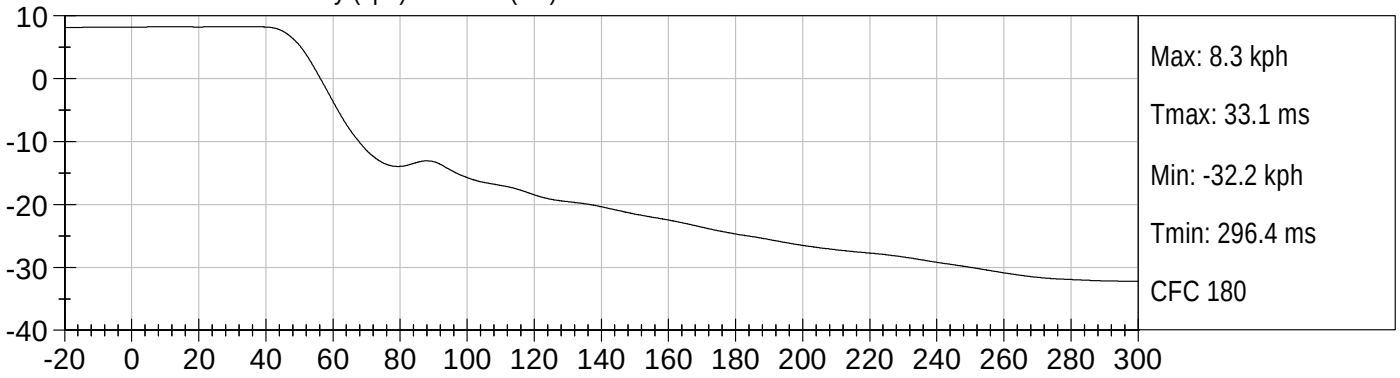


DRIVER HEAD Z (G's) vs TIME (ms)

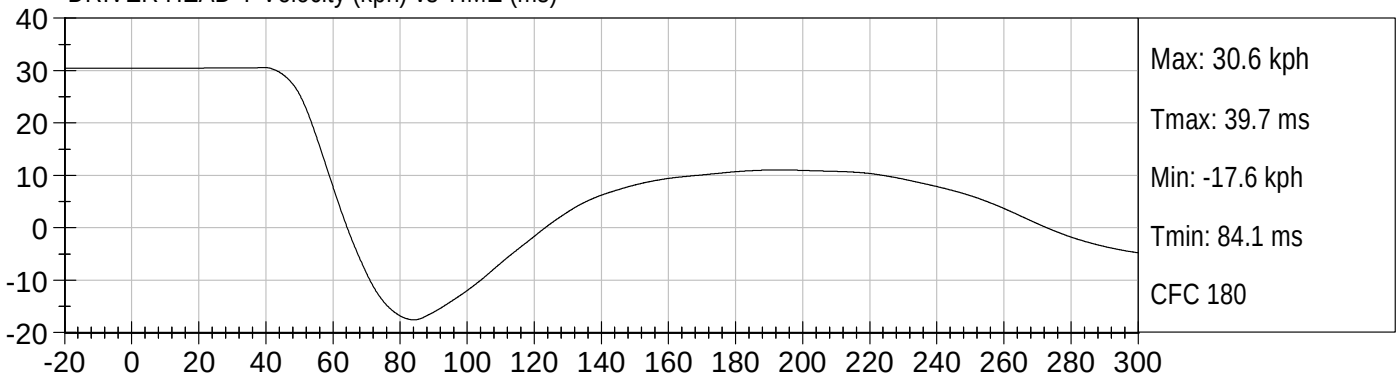
DRIVER HEAD Resultant (G's) vs TIME (ms)



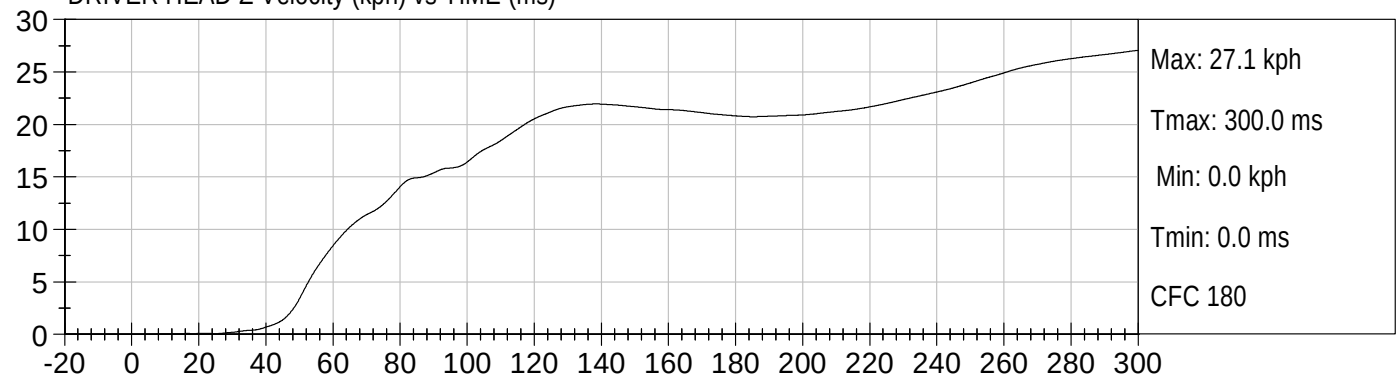
DRIVER HEAD X Velocity (kph) vs TIME (ms)



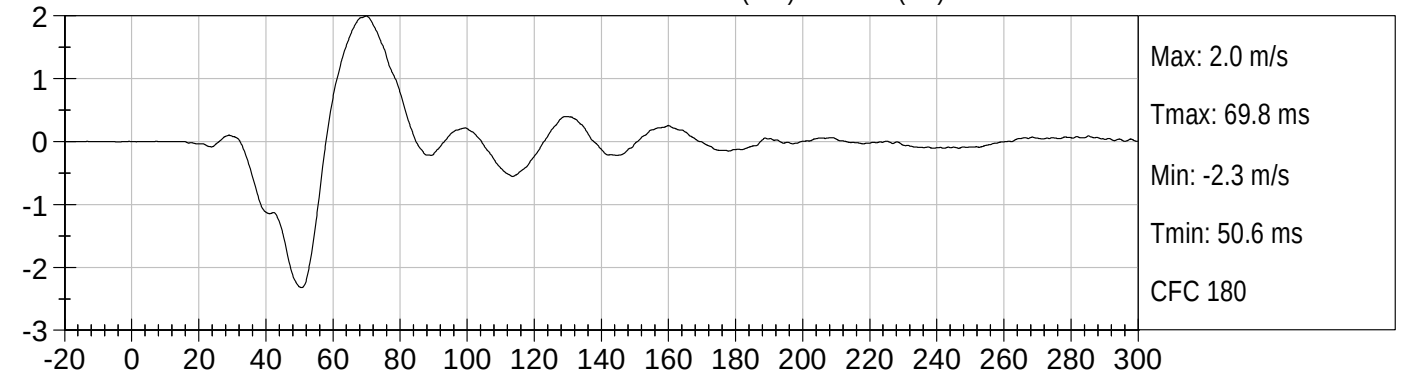
DRIVER HEAD Y Velocity (kph) vs TIME (ms)



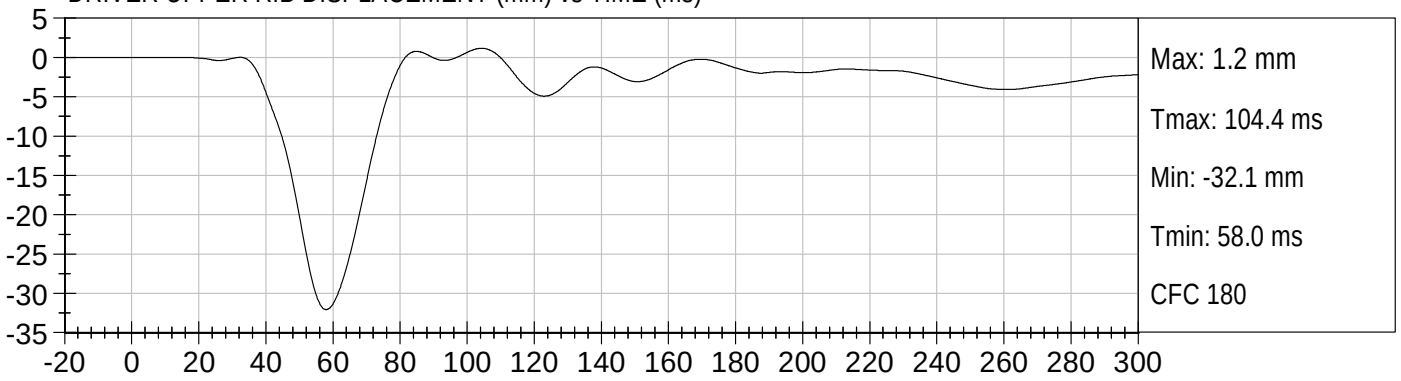
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



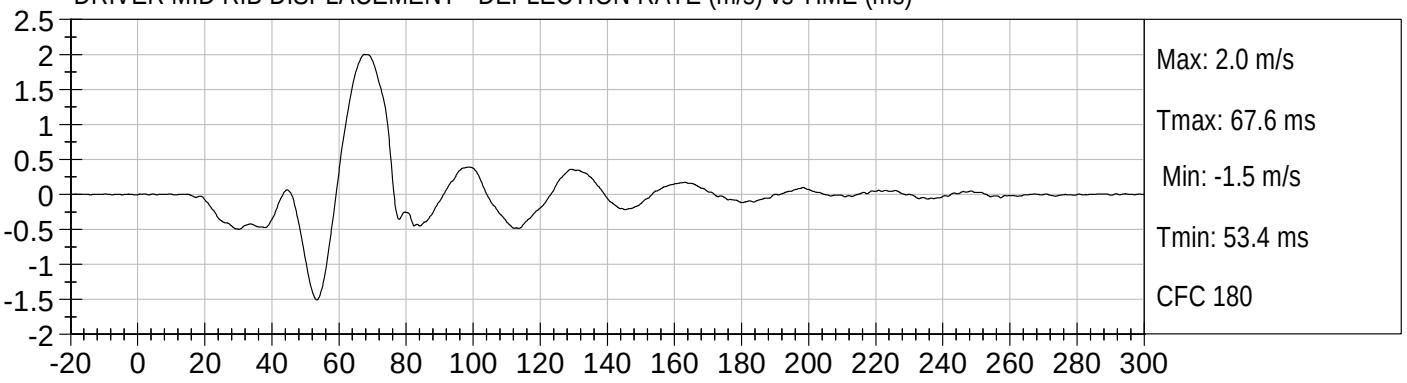
DRIVER UPPER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



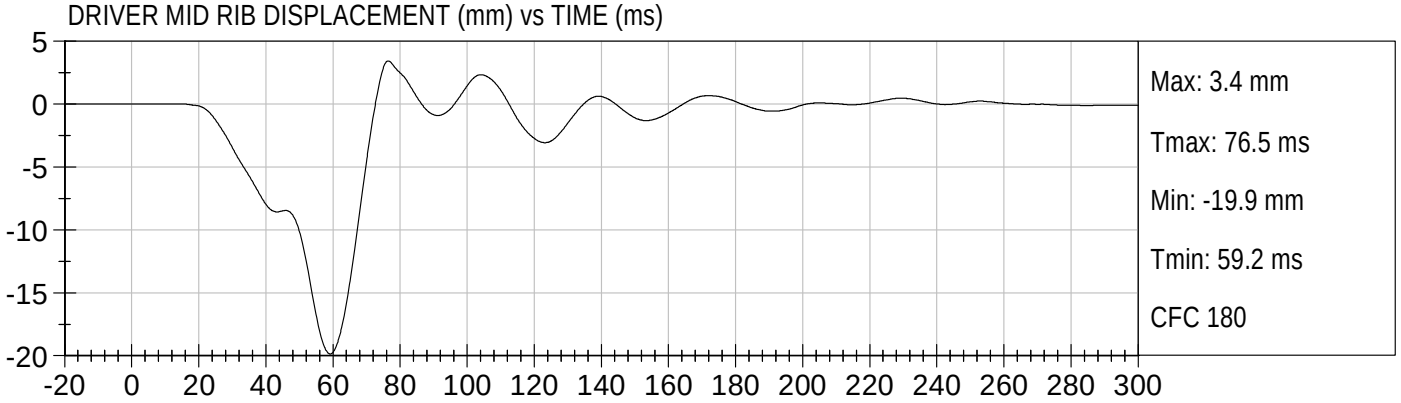
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



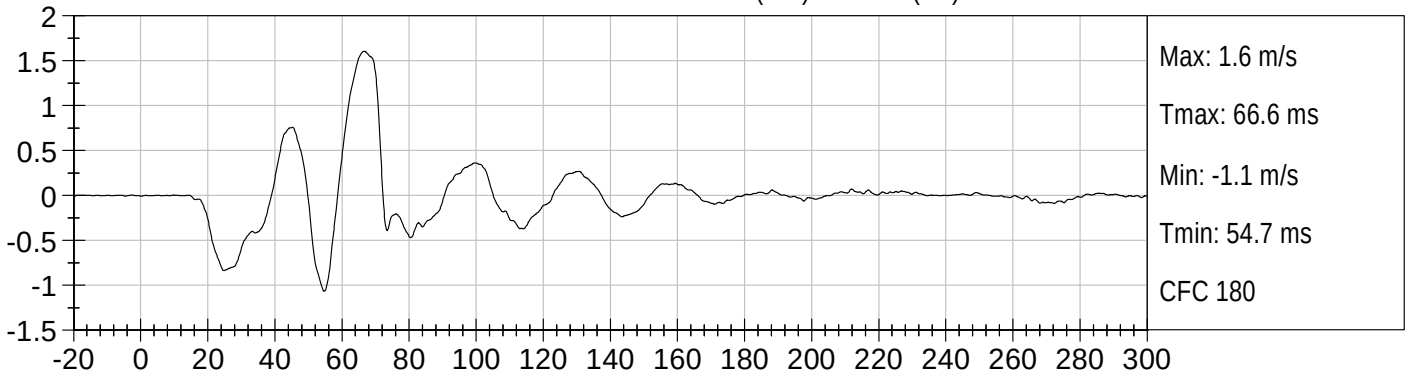
DRIVER MID RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



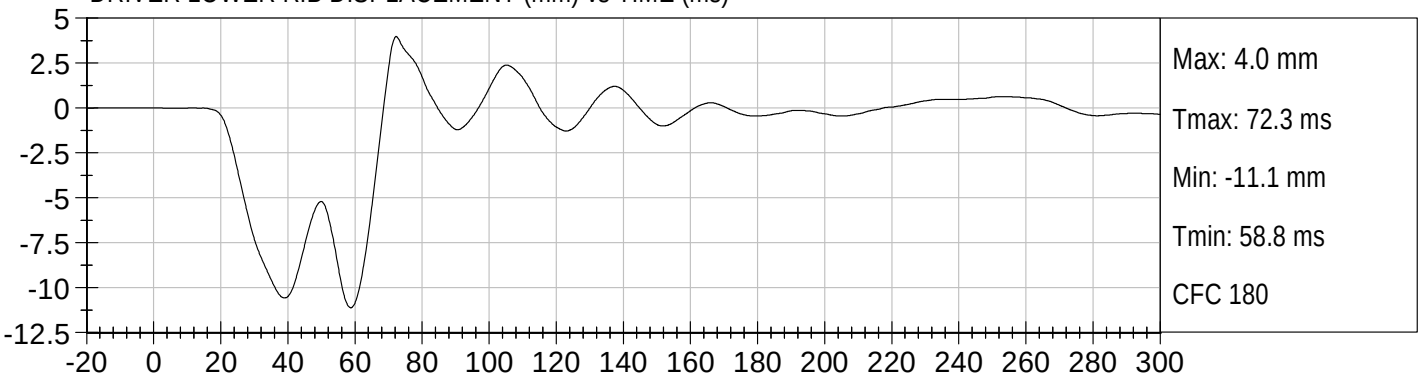
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



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



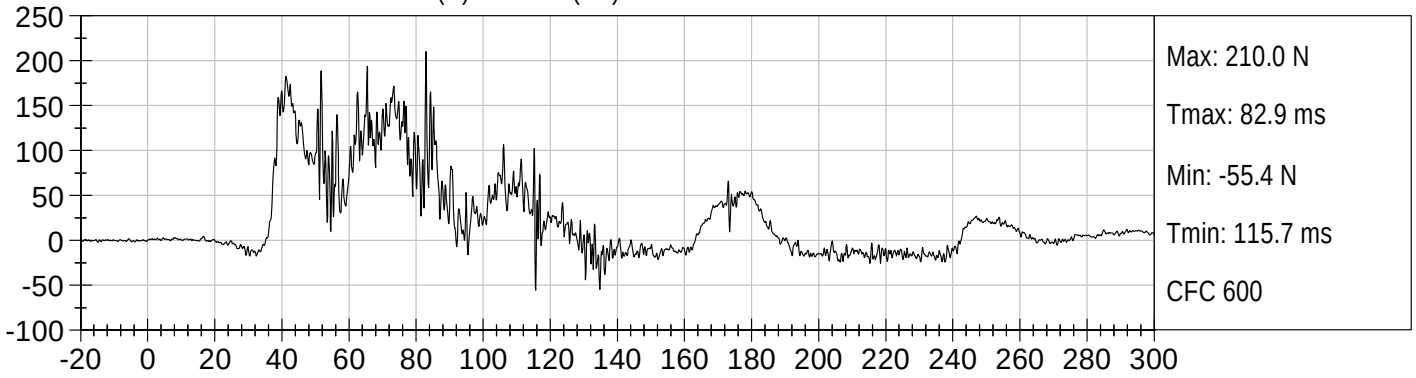
DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



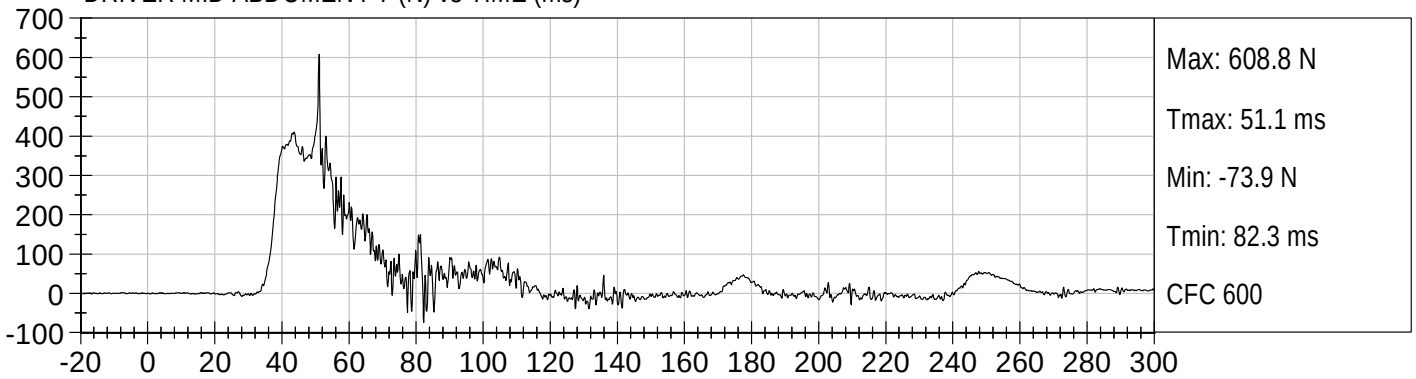
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

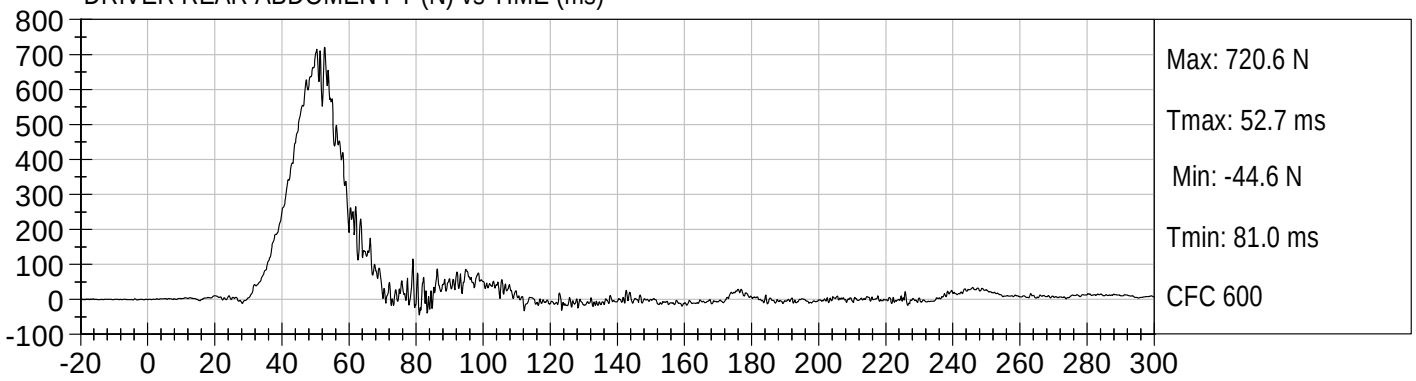
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



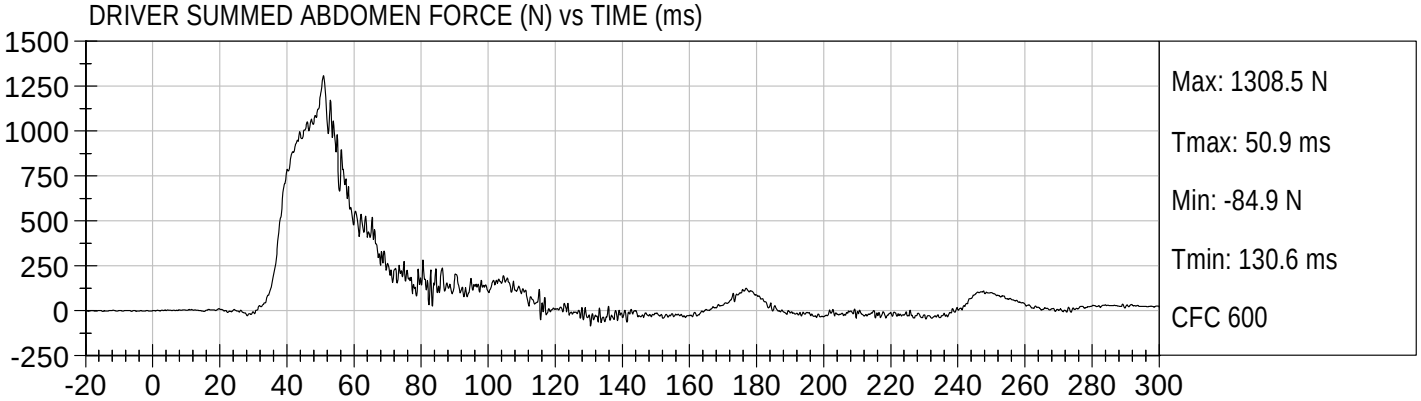
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



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

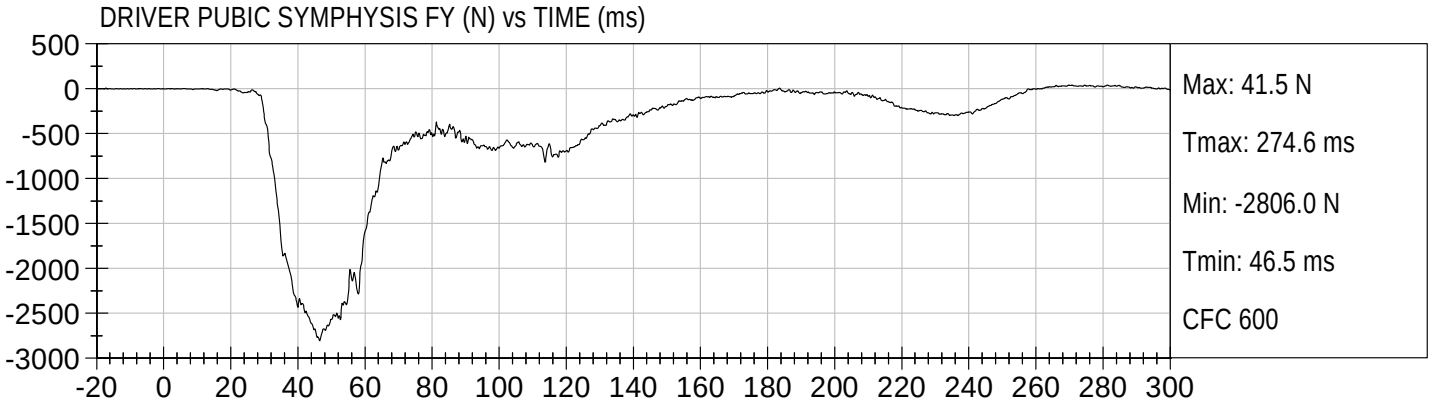


DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)



APPENDIX C

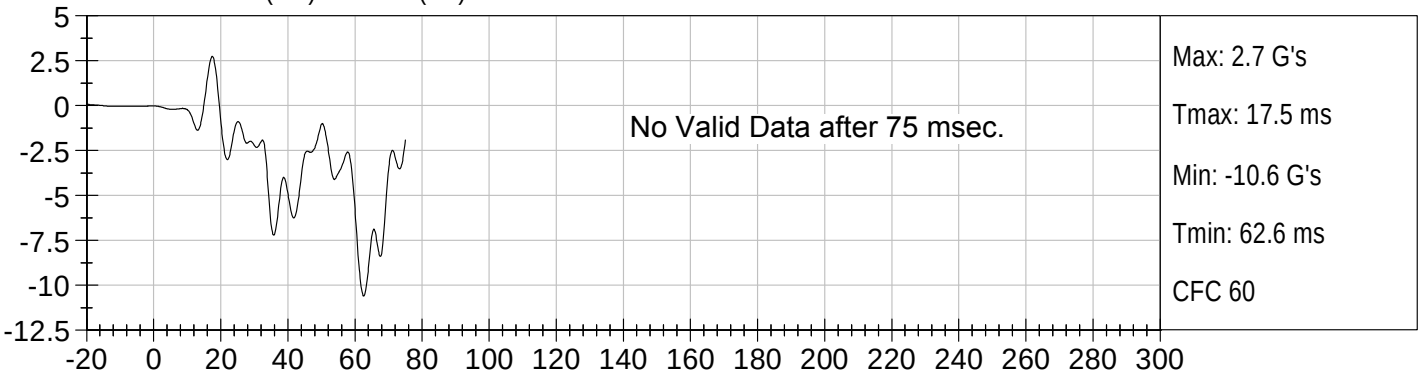
VEHICLE ACCELEROMETER RESPONSE DATA

TABLE OF DATA PLOTS

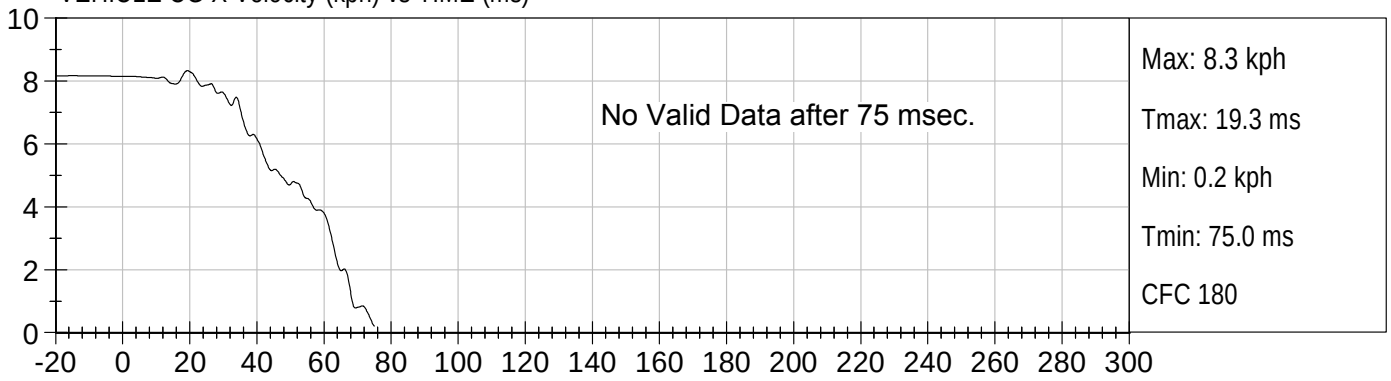
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

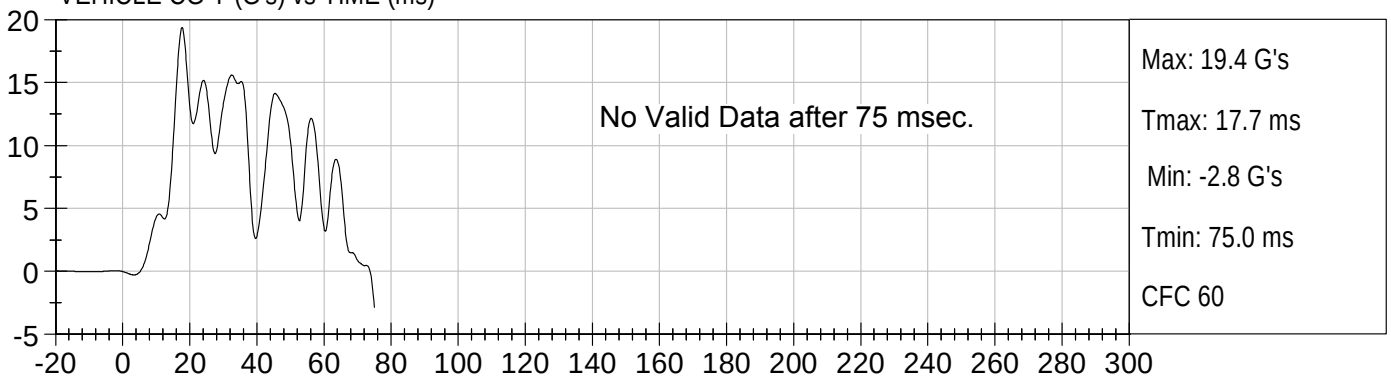
VEHICLE CG X (G's) vs TIME (ms)



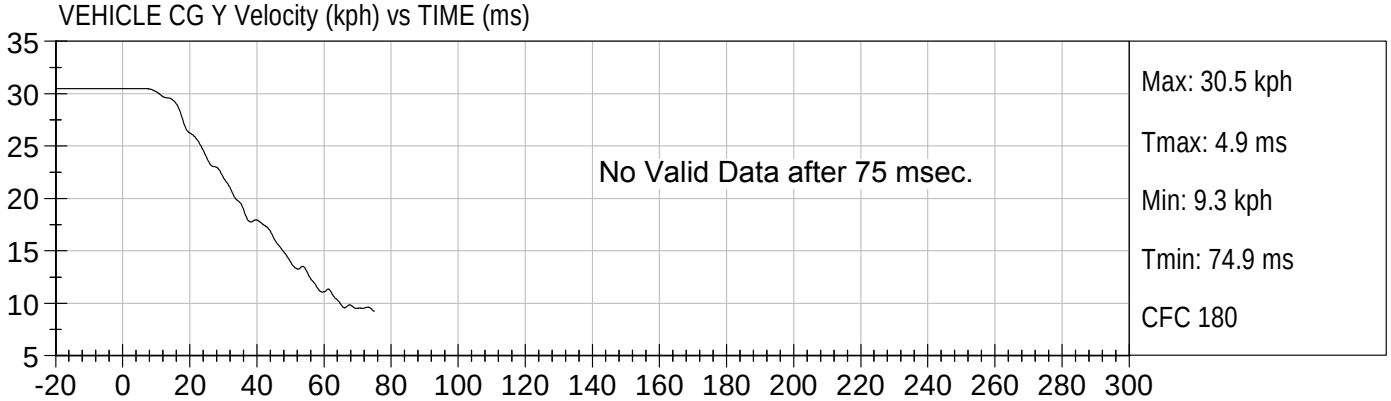
VEHICLE CG X Velocity (kph) vs TIME (ms)



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



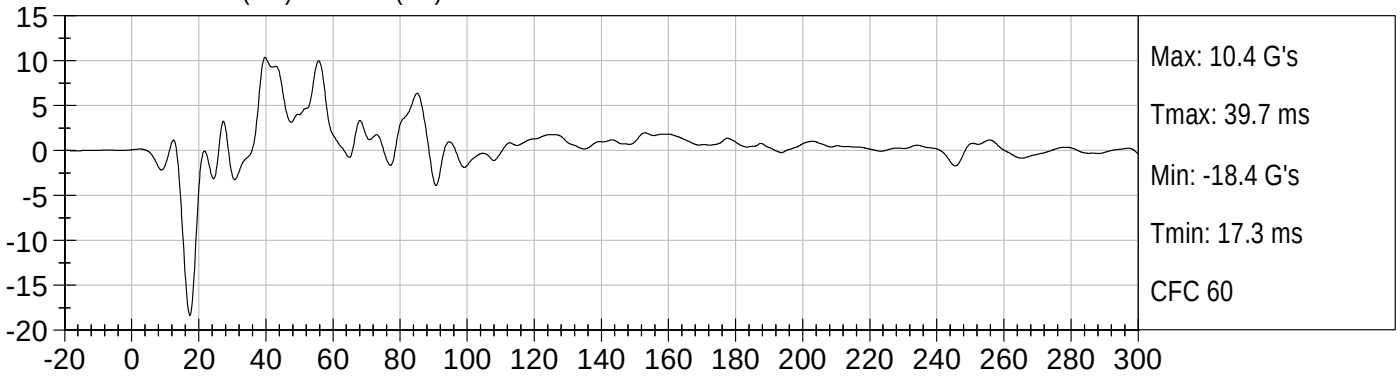
VEHICLE CG Y Velocity (kph) vs TIME (ms)



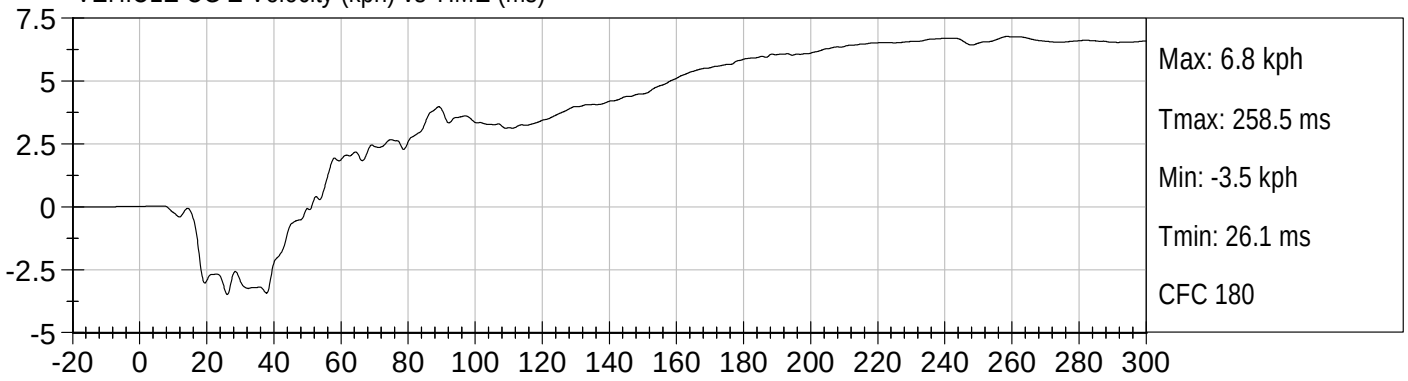
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

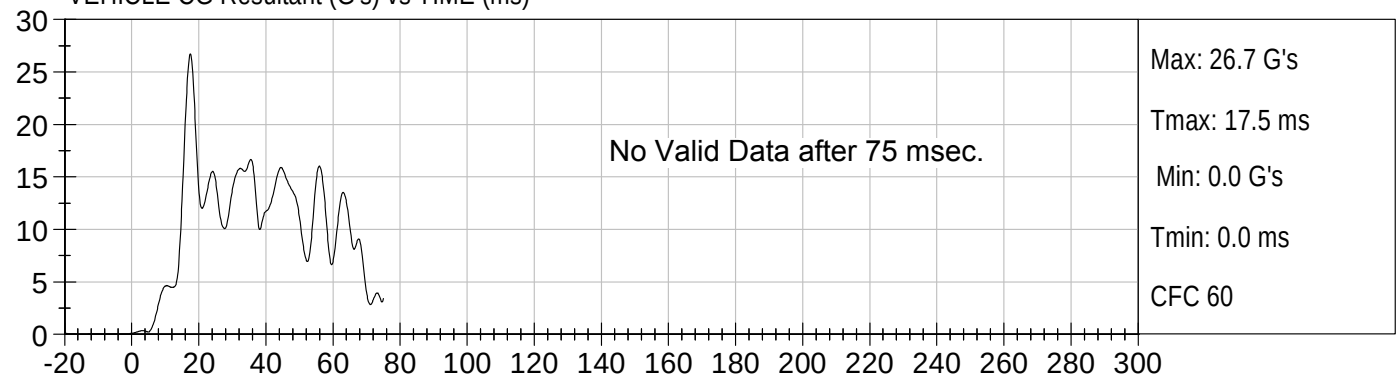
VEHICLE CG Z (G's) vs TIME (ms)



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



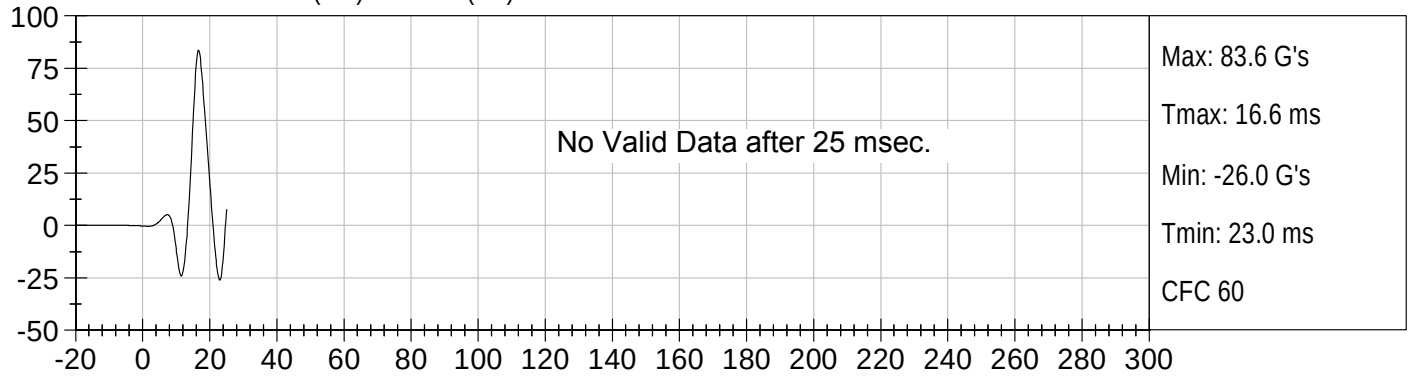
VEHICLE CG Resultant (G's) vs TIME (ms)



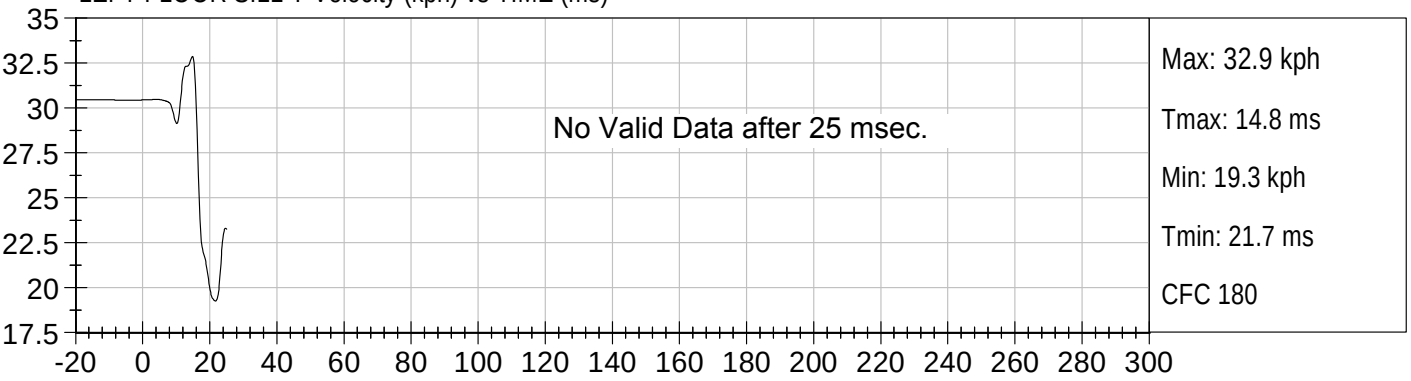
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

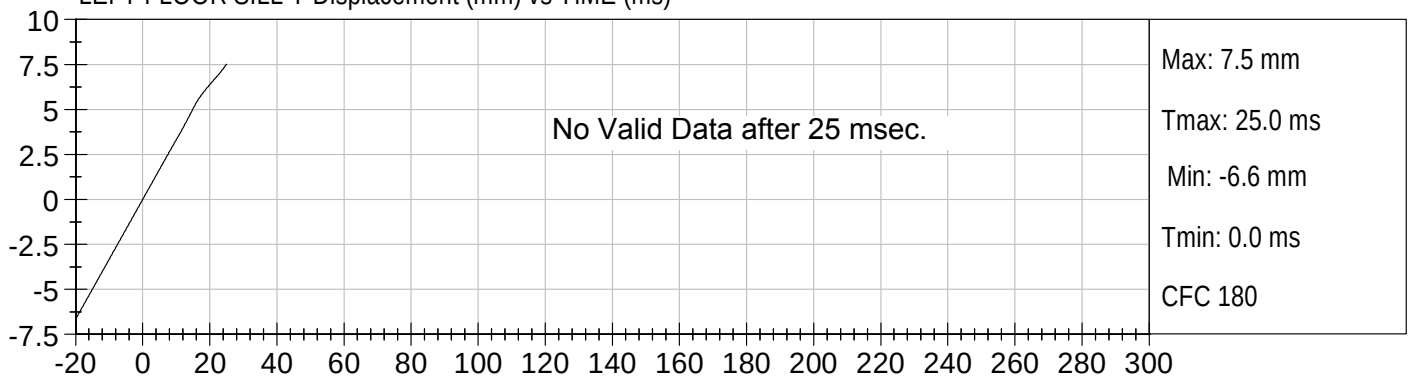
LEFT FLOOR SILL Y (G's) vs TIME (ms)



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



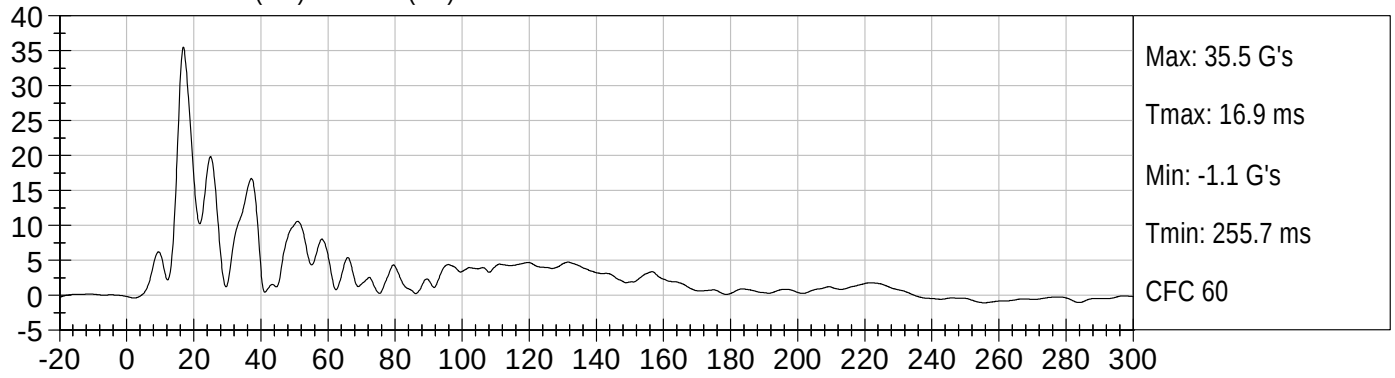
LEFT FLOOR SILL Y Displacement (mm) vs TIME (ms)



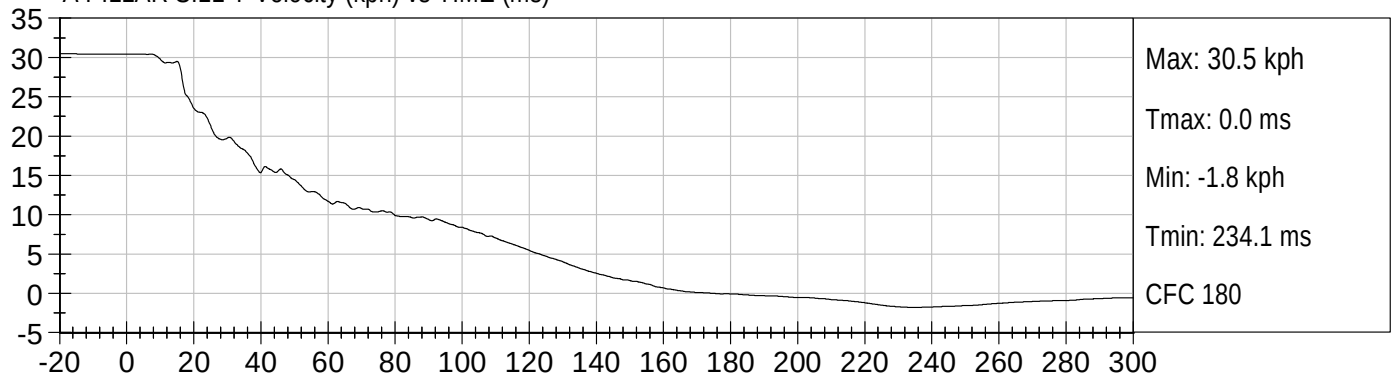
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

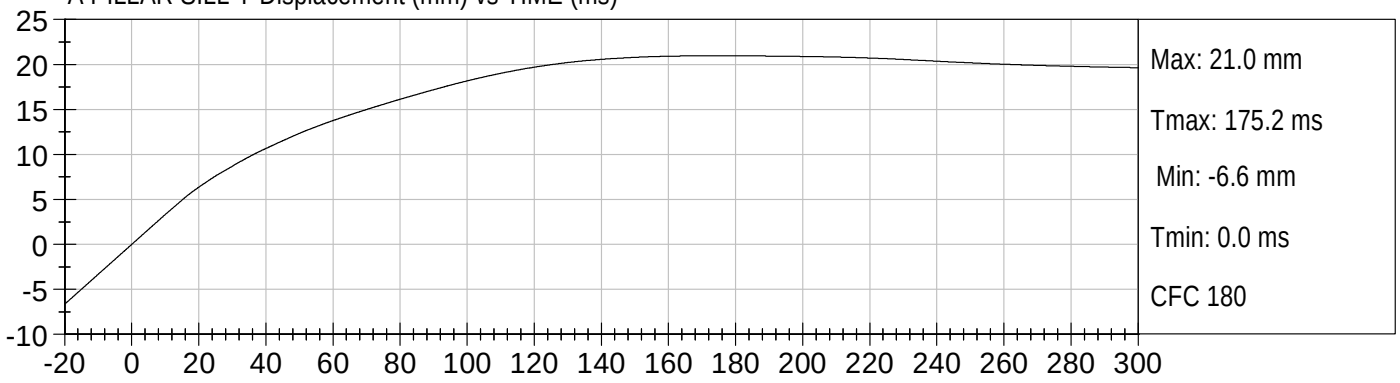
A PILLAR SILL Y (G's) vs TIME (ms)



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



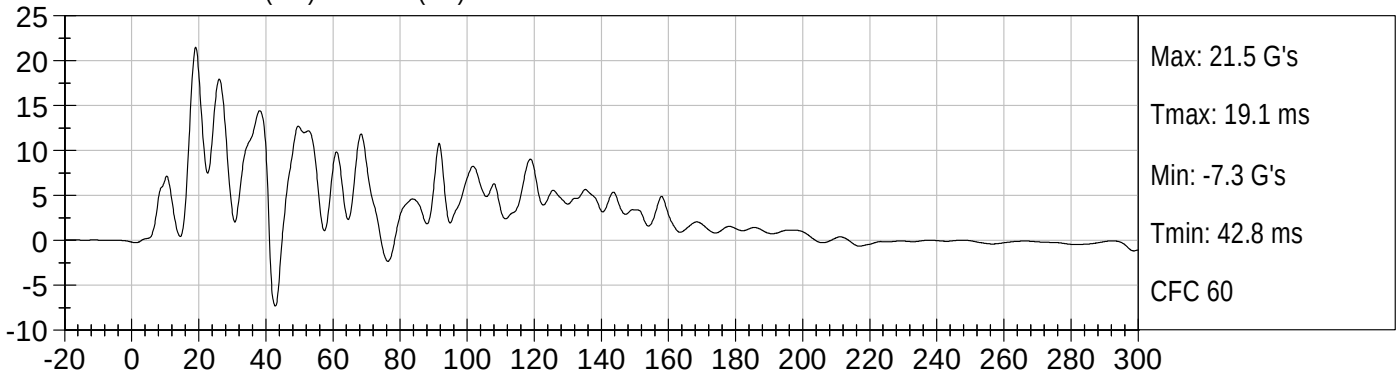
A PILLAR SILL Y Displacement (mm) vs TIME (ms)



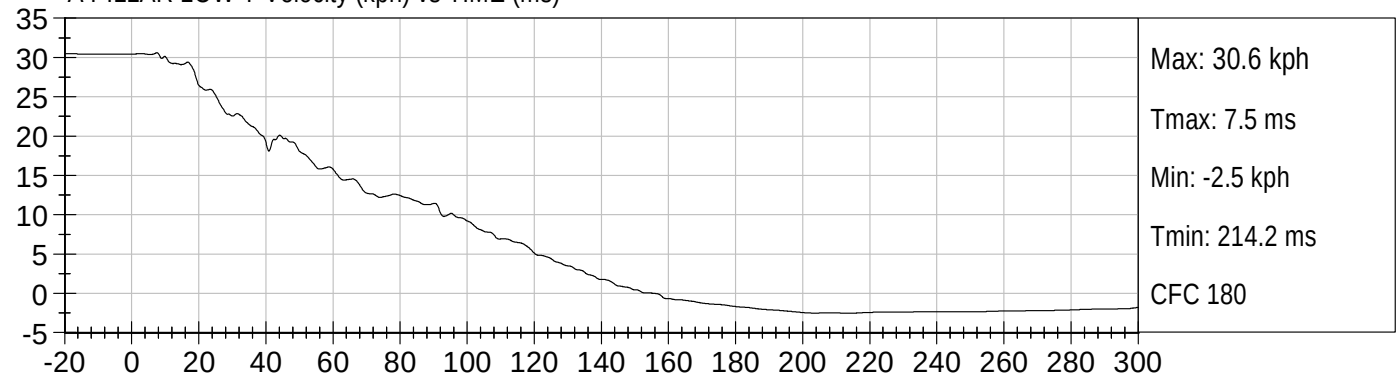
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

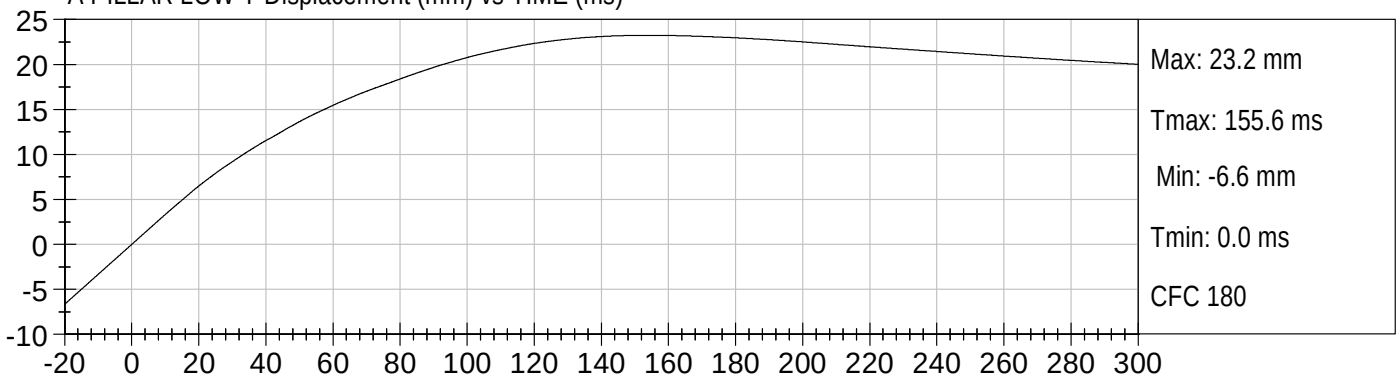
A PILLAR LOW Y (G's) vs TIME (ms)



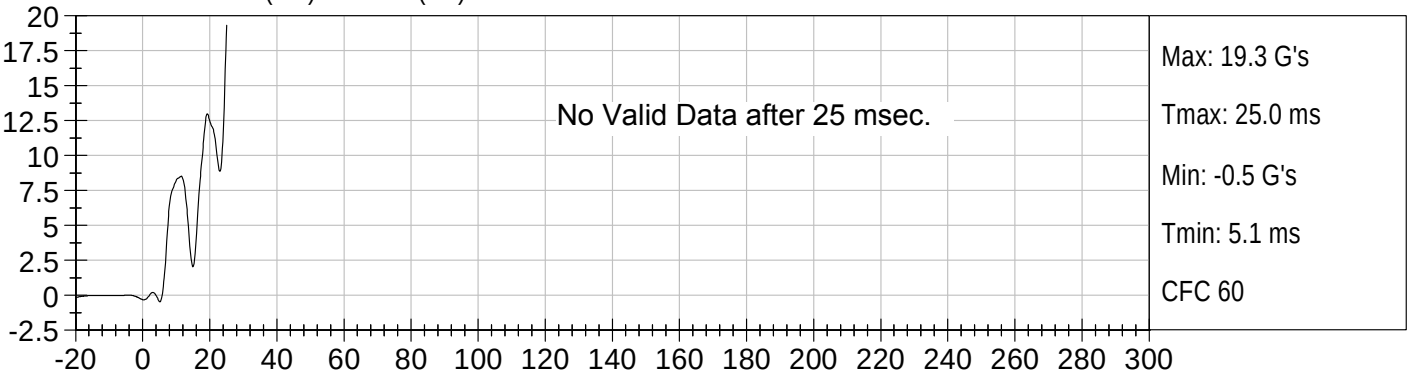
A PILLAR LOW Y Velocity (kph) vs TIME (ms)



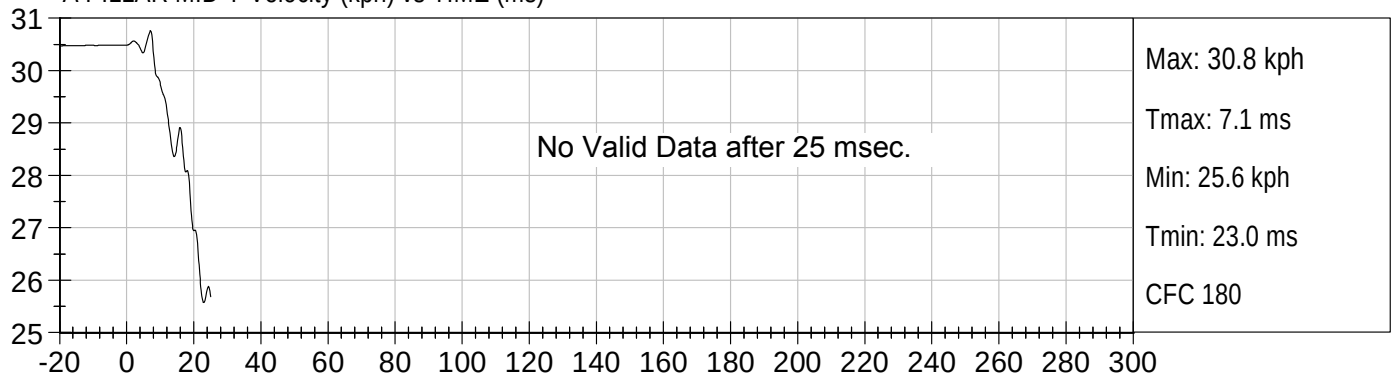
A PILLAR LOW Y Displacement (mm) vs TIME (ms)



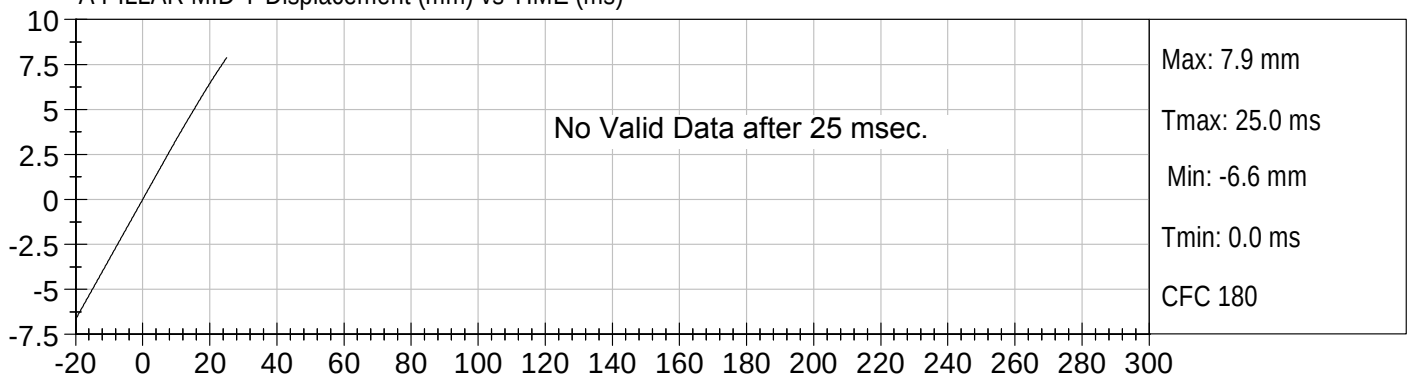
A PILLAR MID Y (G's) vs TIME (ms)



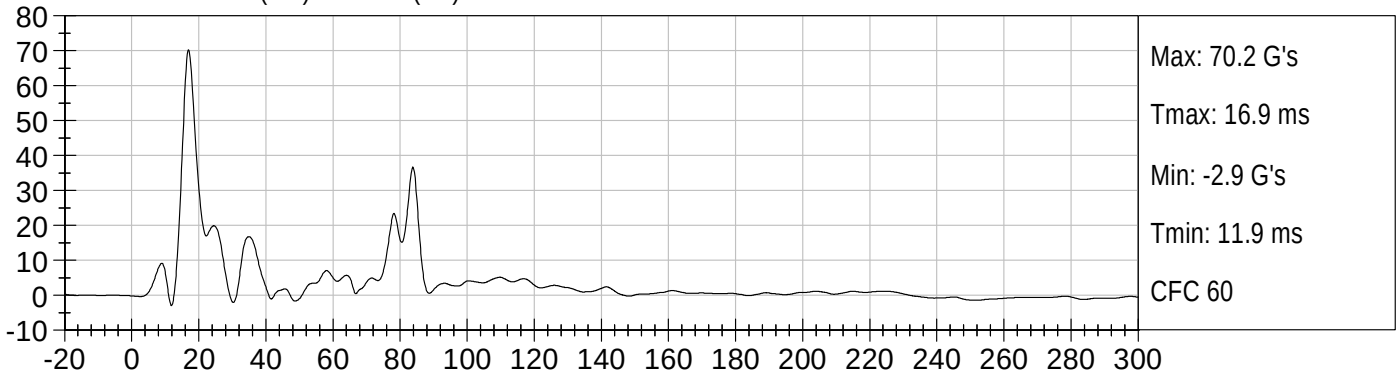
A PILLAR MID Y Velocity (kph) vs TIME (ms)



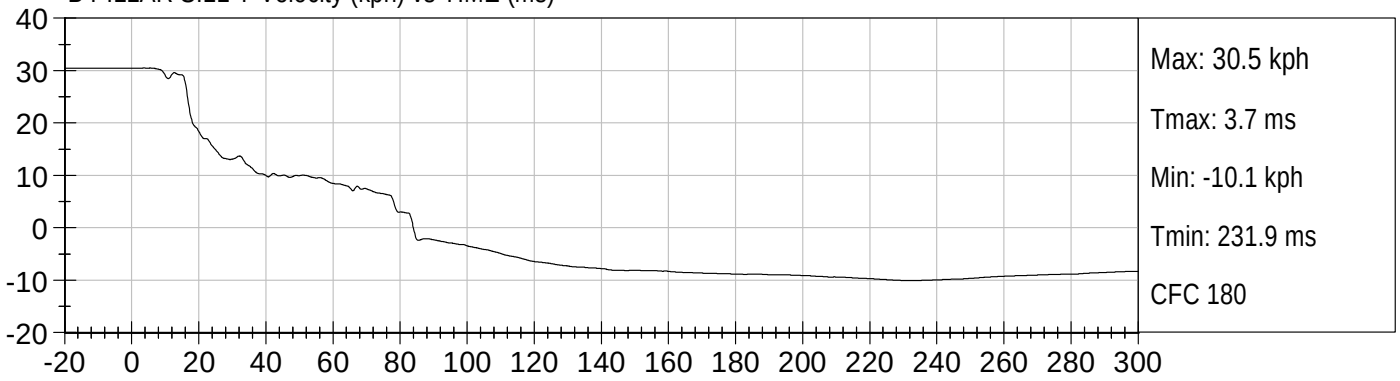
A PILLAR MID Y Displacement (mm) vs TIME (ms)



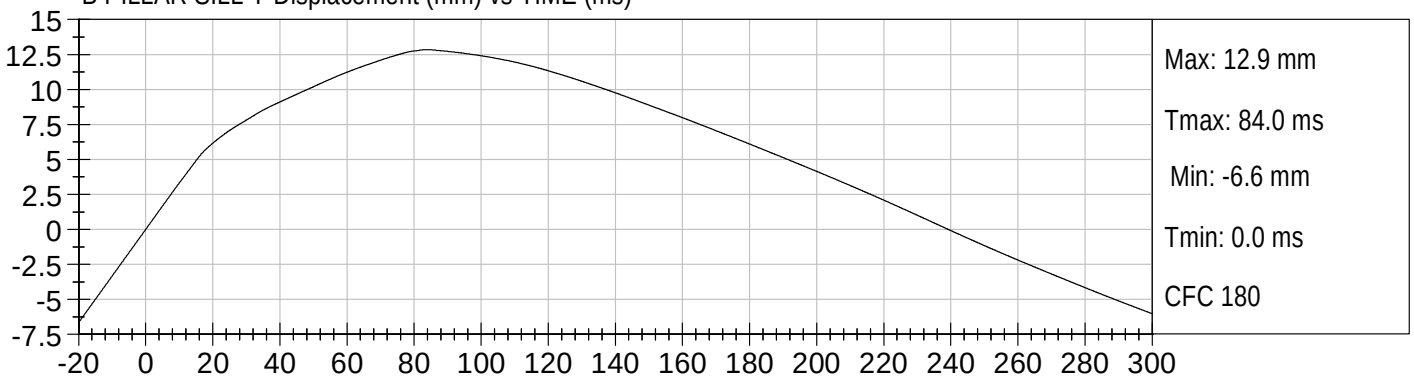
B PILLAR SILL Y (G's) vs TIME (ms)



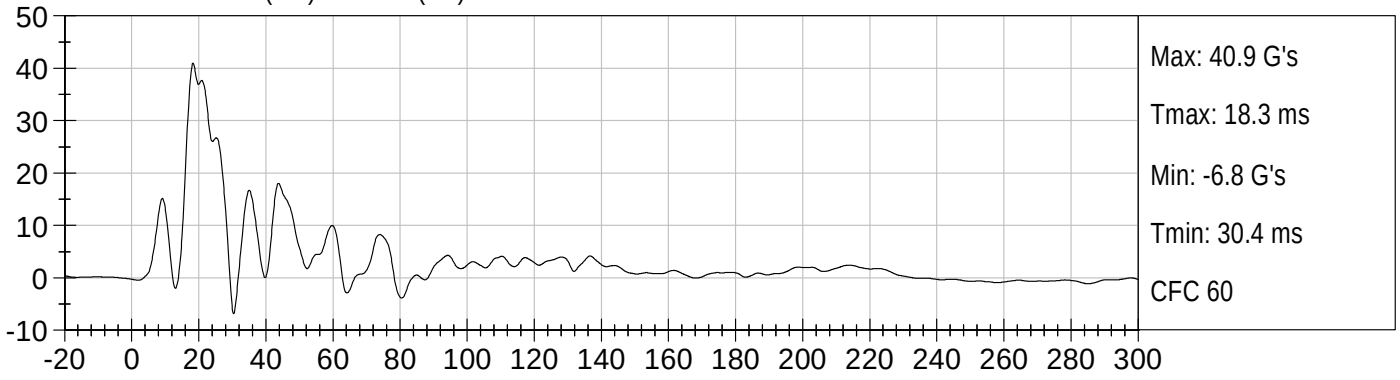
B PILLAR SILL Y Velocity (kph) vs TIME (ms)



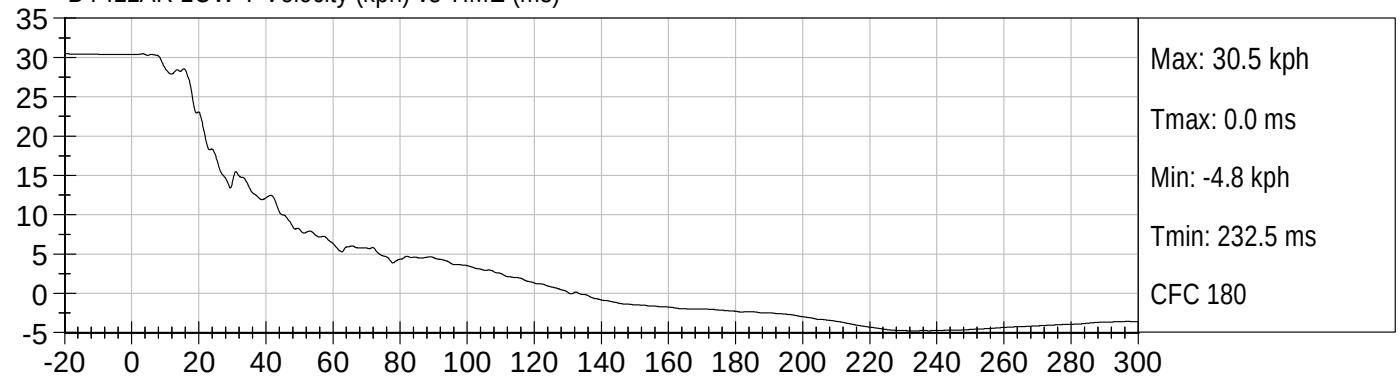
B PILLAR SILL Y Displacement (mm) vs TIME (ms)



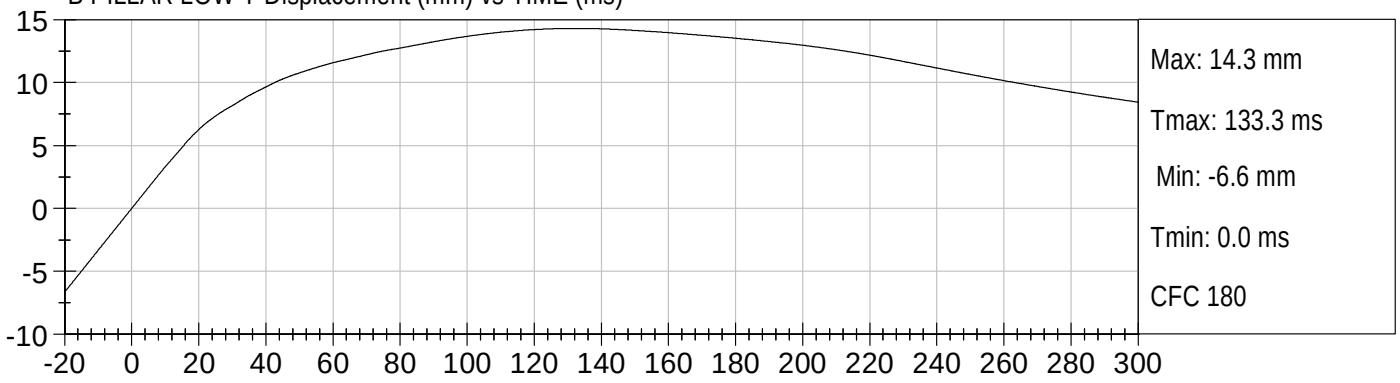
B PILLAR LOW Y (G's) vs TIME (ms)



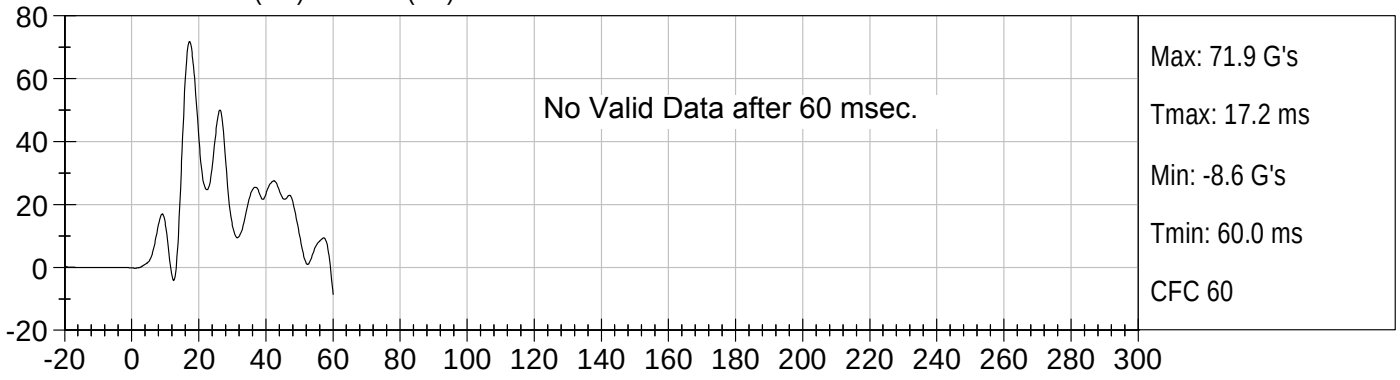
B PILLAR LOW Y Velocity (kph) vs TIME (ms)



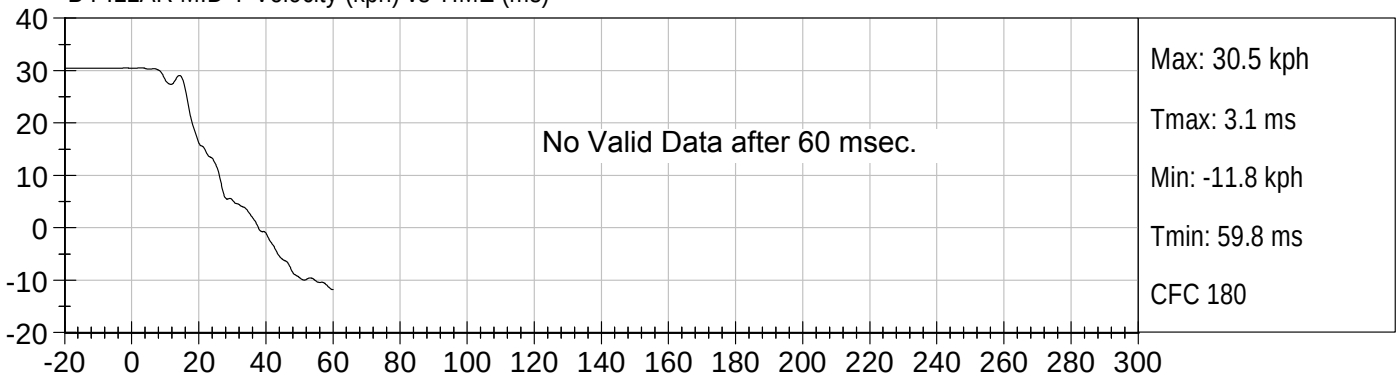
B PILLAR LOW Y Displacement (mm) vs TIME (ms)



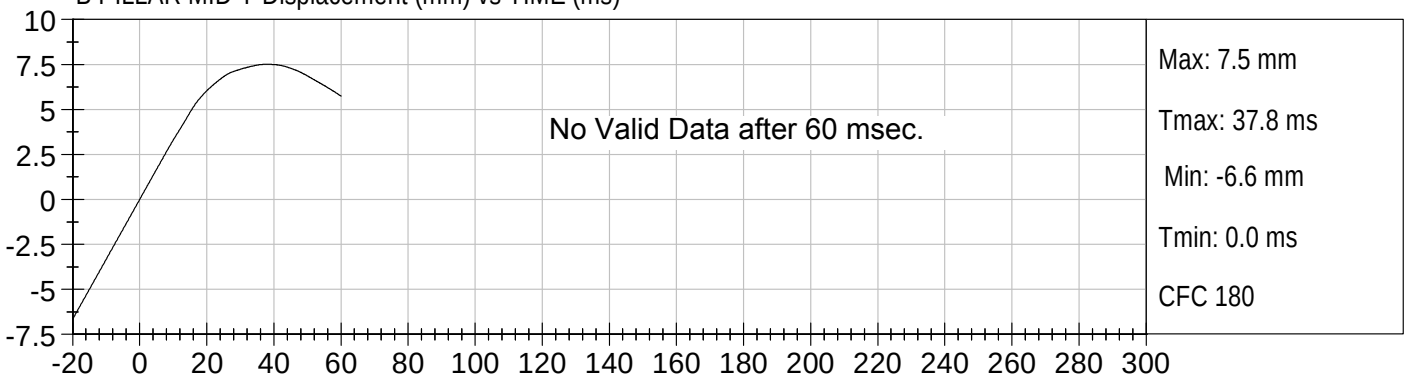
B PILLAR MID Y (G's) vs TIME (ms)



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



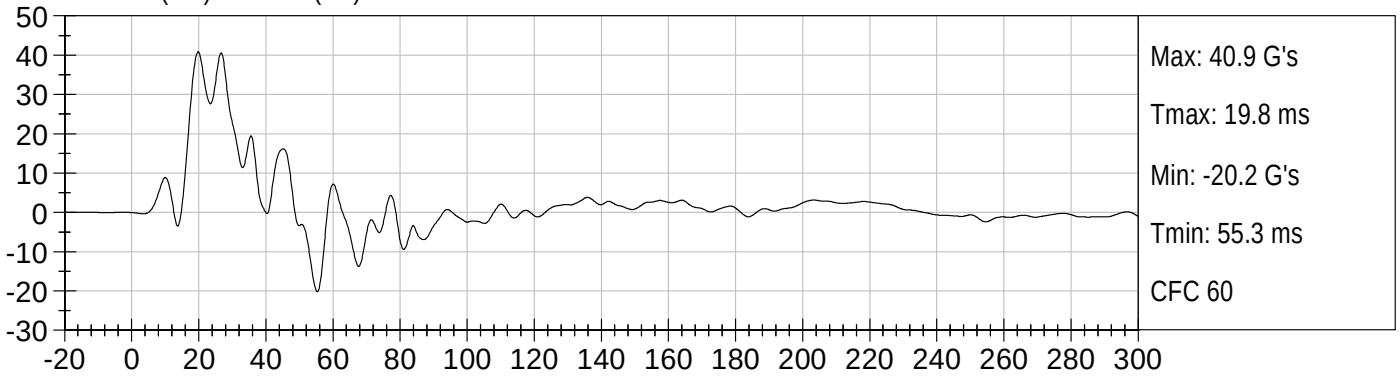
B PILLAR MID Y Displacement (mm) vs TIME (ms)



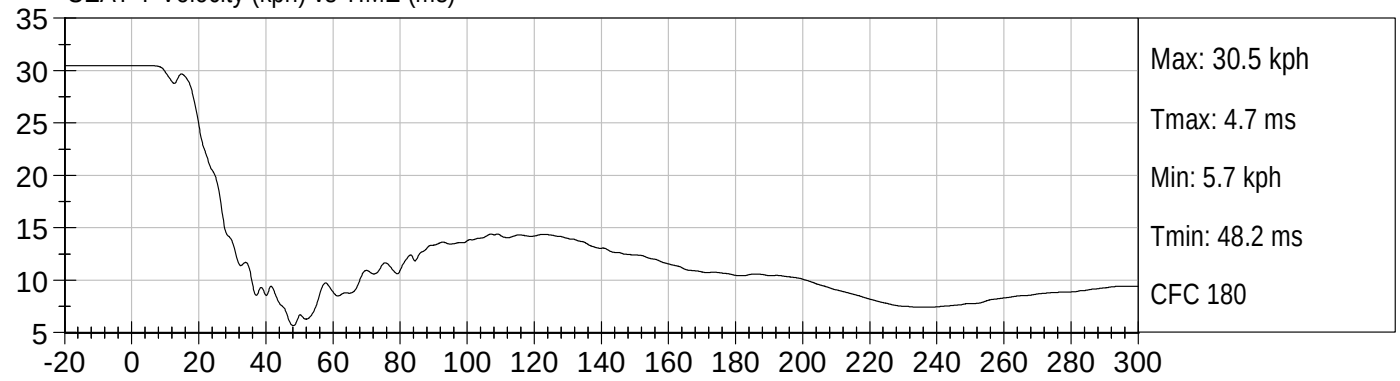
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

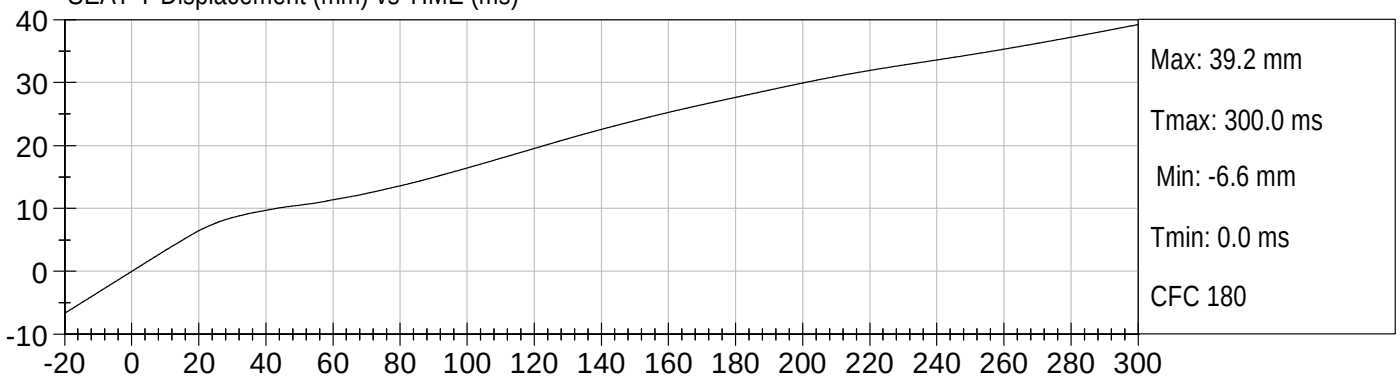
SEAT Y (G's) vs TIME (ms)



SEAT Y Velocity (kph) vs TIME (ms)



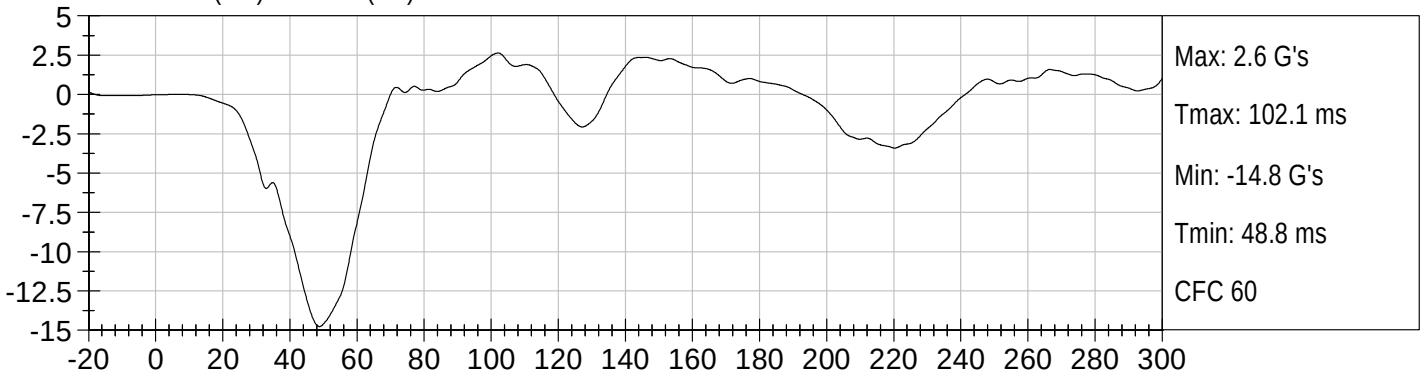
SEAT Y Displacement (mm) vs TIME (ms)



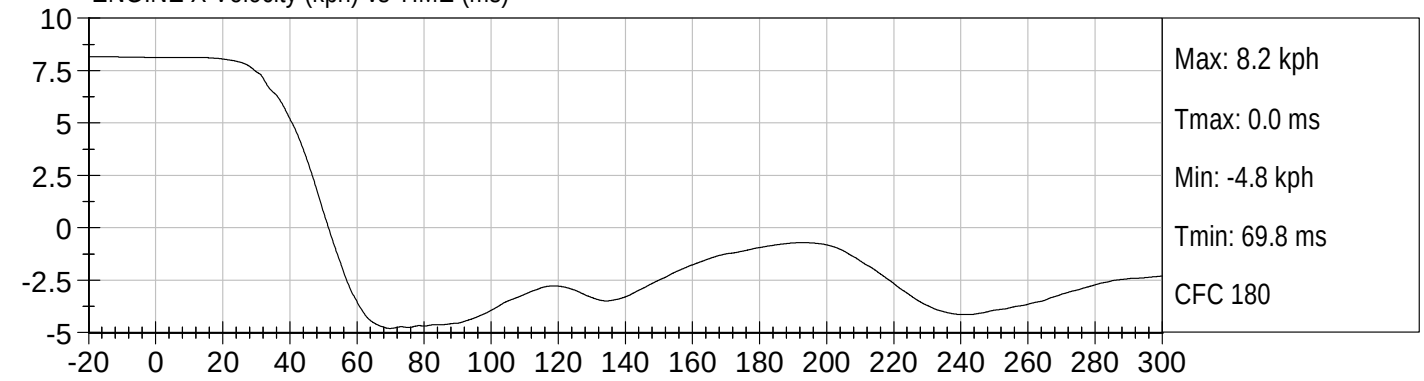
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

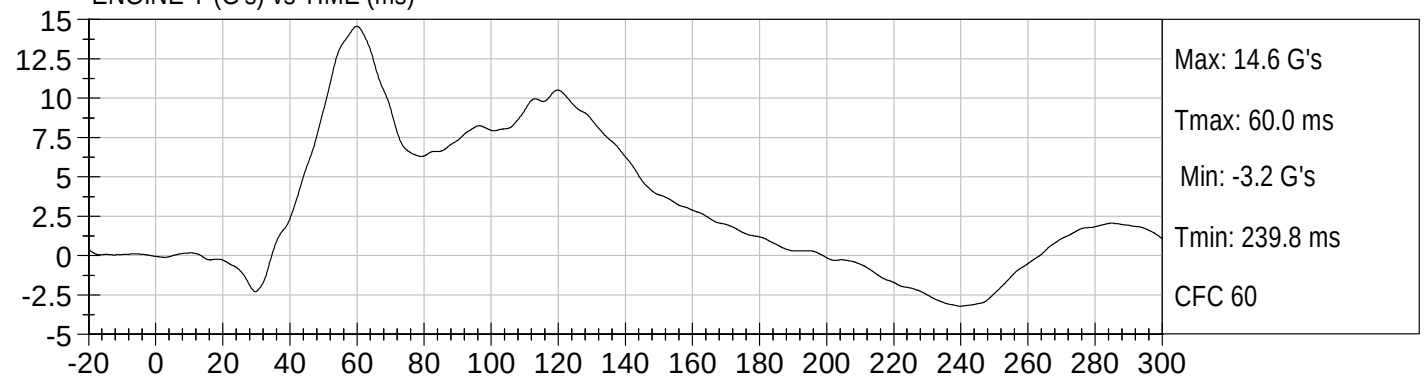
ENGINE X (G's) vs TIME (ms)



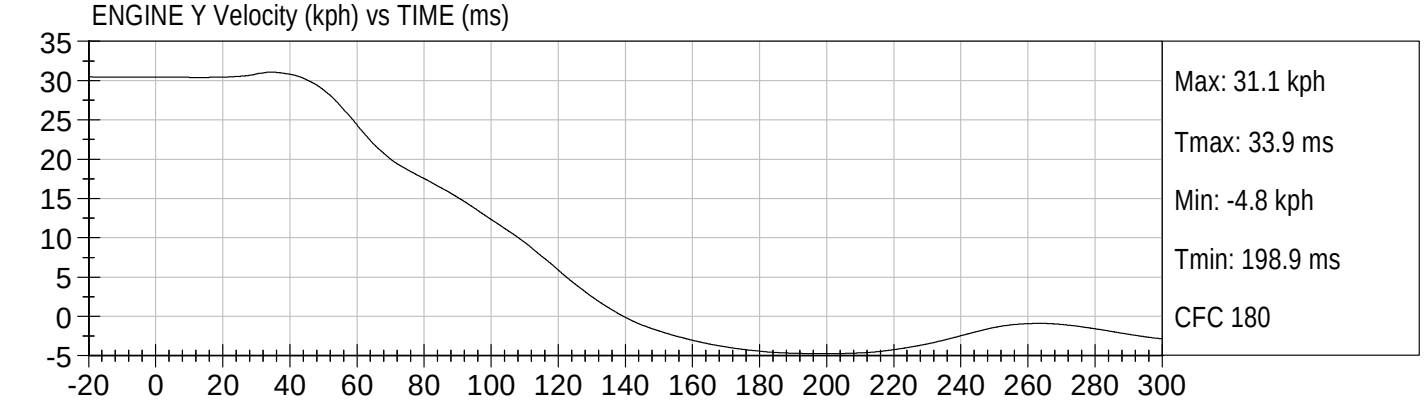
ENGINE X Velocity (kph) vs TIME (ms)



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



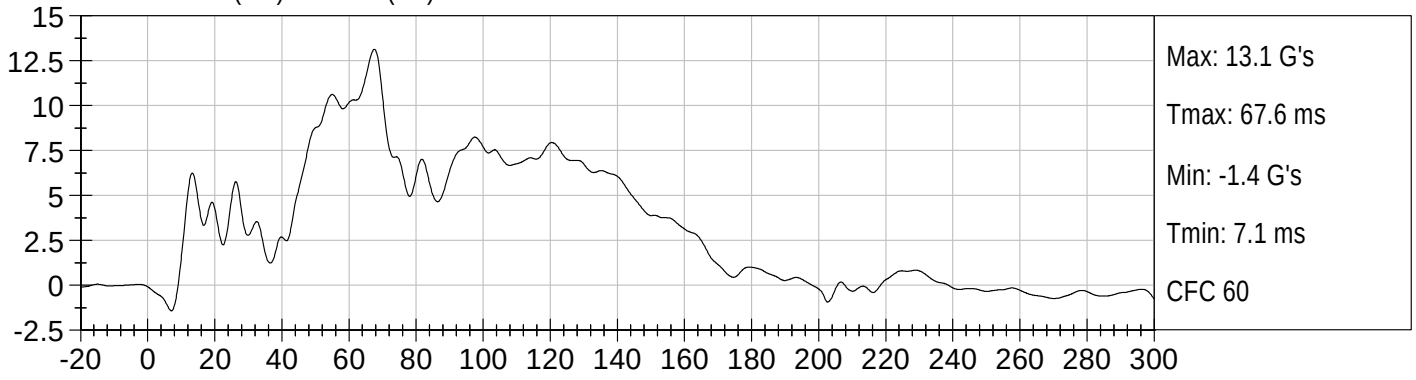
ENGINE Y Velocity (kph) vs TIME (ms)



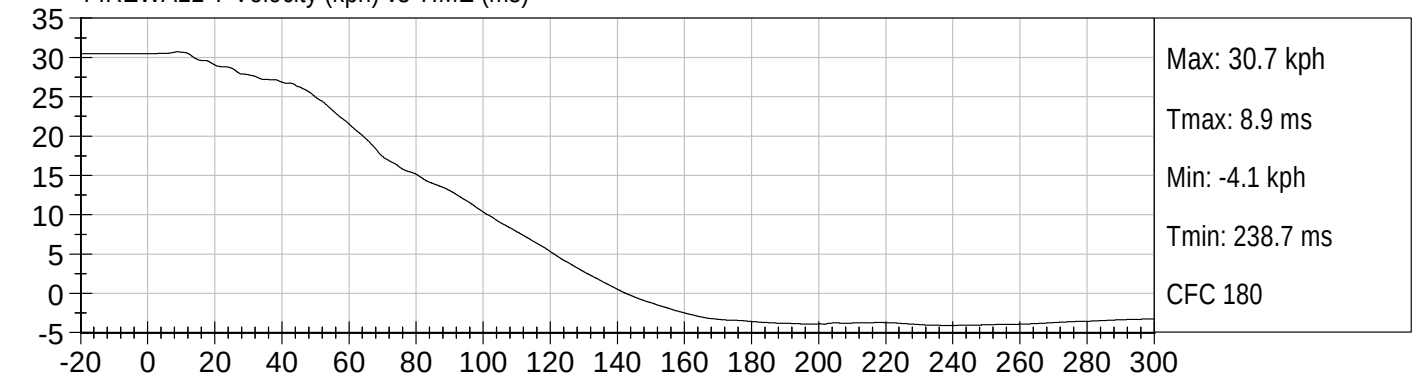
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

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



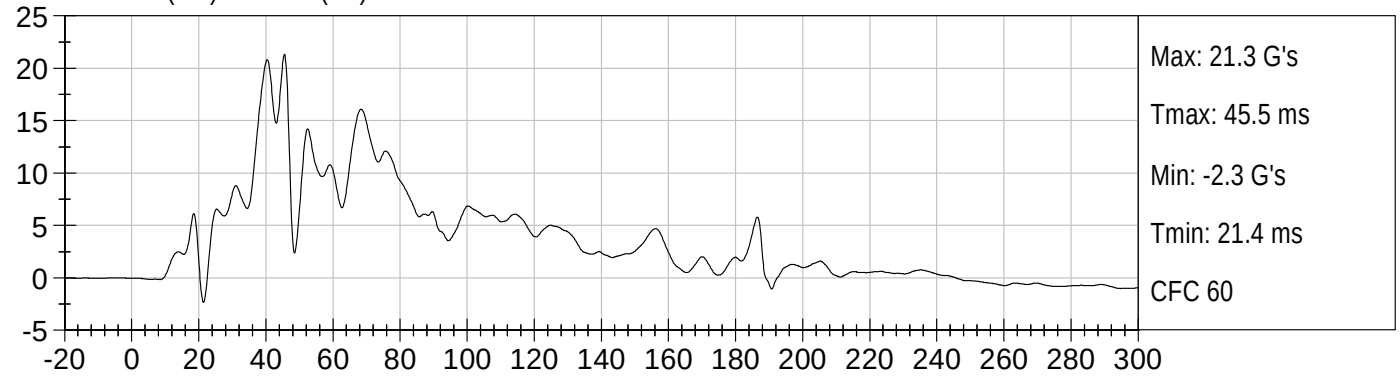
FIREWALL Y Velocity (kph) vs TIME (ms)



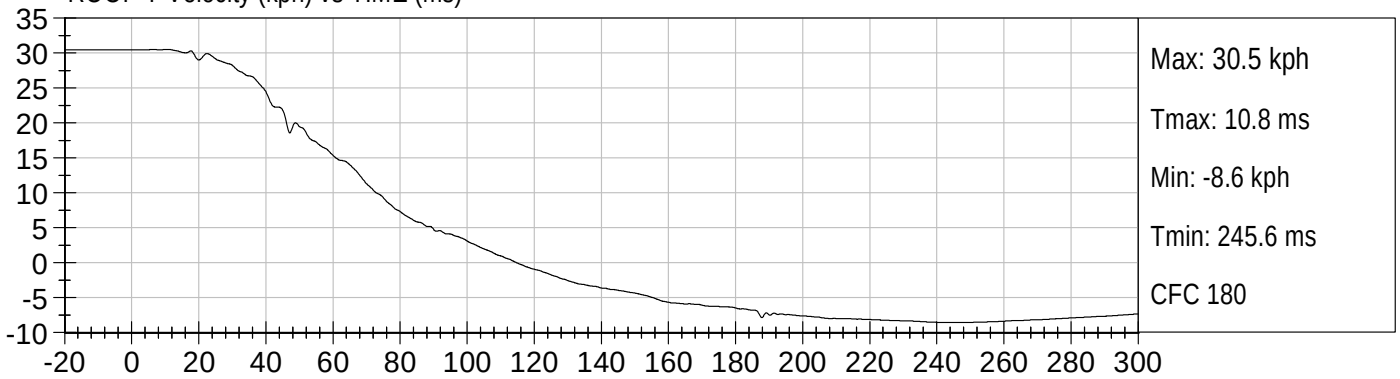
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

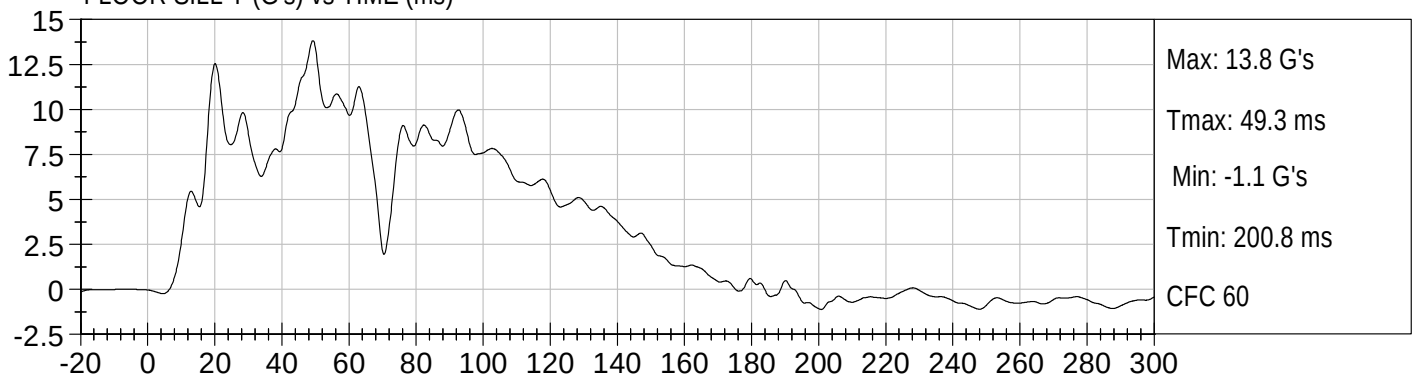
ROOF Y (G's) vs TIME (ms)



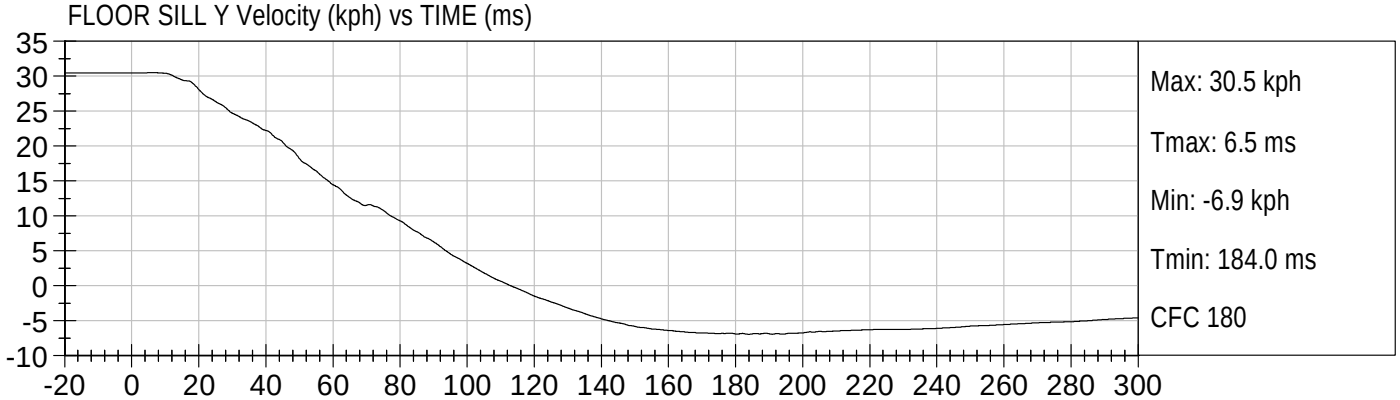
ROOF Y Velocity (kph) vs TIME (ms)



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



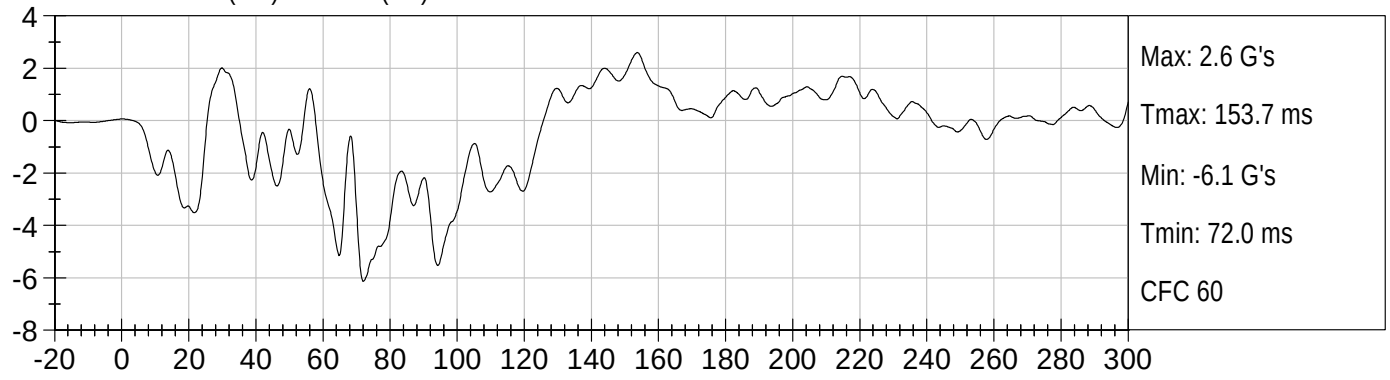
FLOOR SILL Y Velocity (kph) vs TIME (ms)



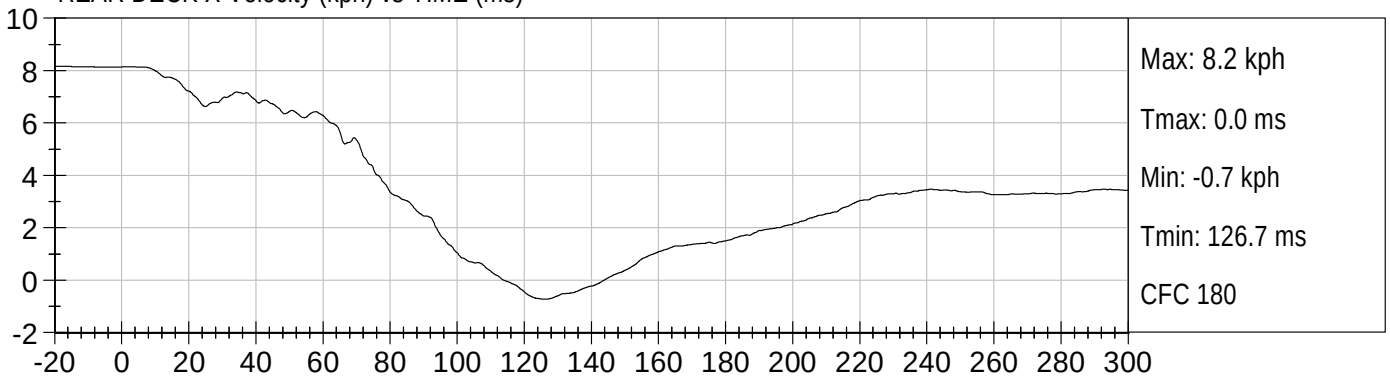
FMVSS 214 Rigid Pole Side Impact
2011 Toyota Venza - CB5106

Test Date: 03/14/2011
Speed: 19.6 mph (31.5 km/h)

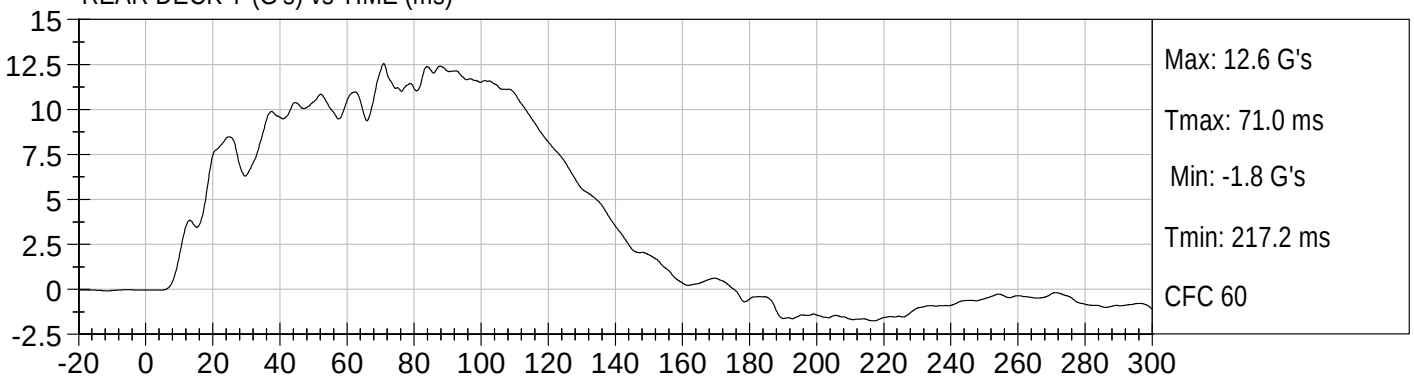
REAR DECK X (G's) vs TIME (ms)



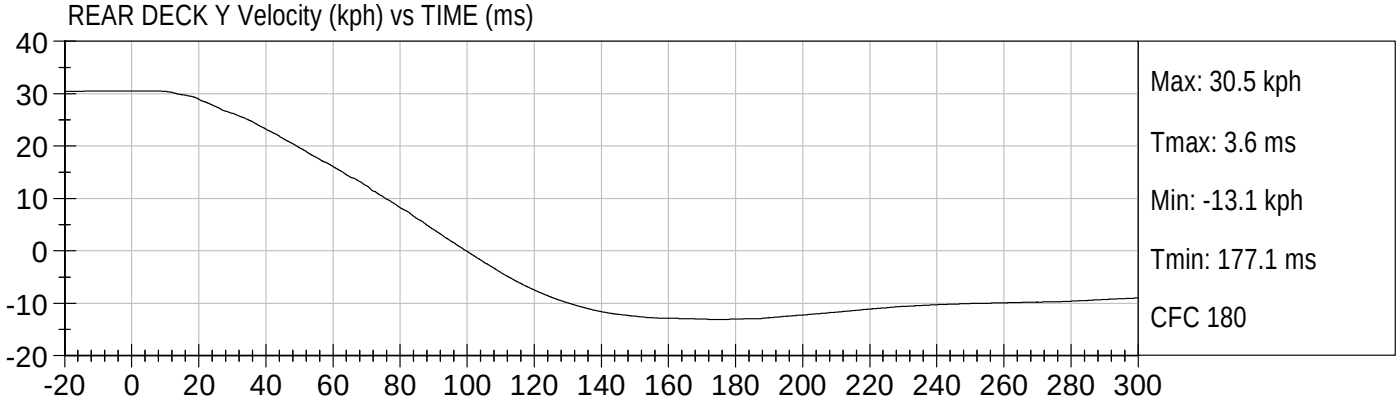
REAR DECK X Velocity (kph) vs TIME (ms)



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



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



APPENDIX D

DUMMY PERFORMANCE CALIBRATION TEST DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D11931

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	22	Pass
Peak Resultant Acceleration	G's	125 to 155	149	Pass
Peak Lateral Acceleration	G's	+/- 15	-8.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

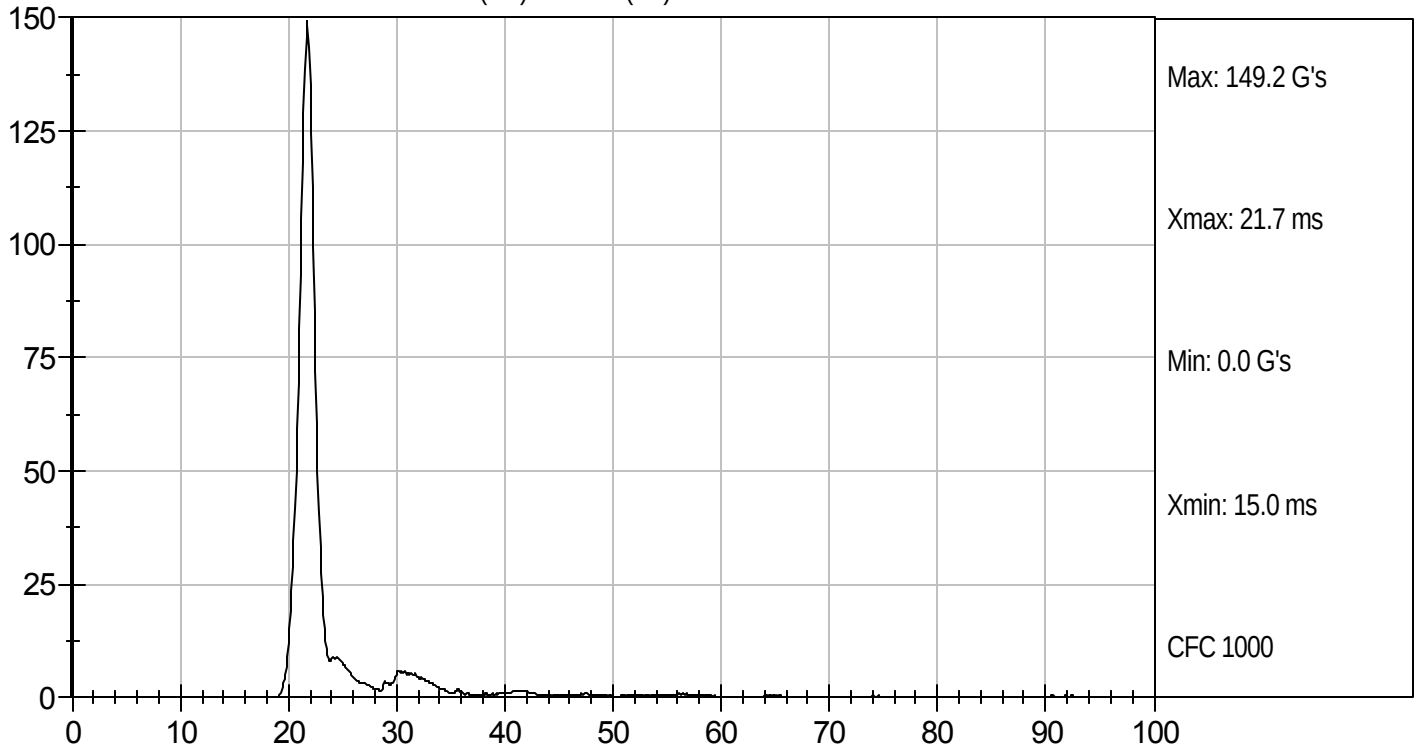
3/11/11
Test Date

David Winkelbauer
Approved By

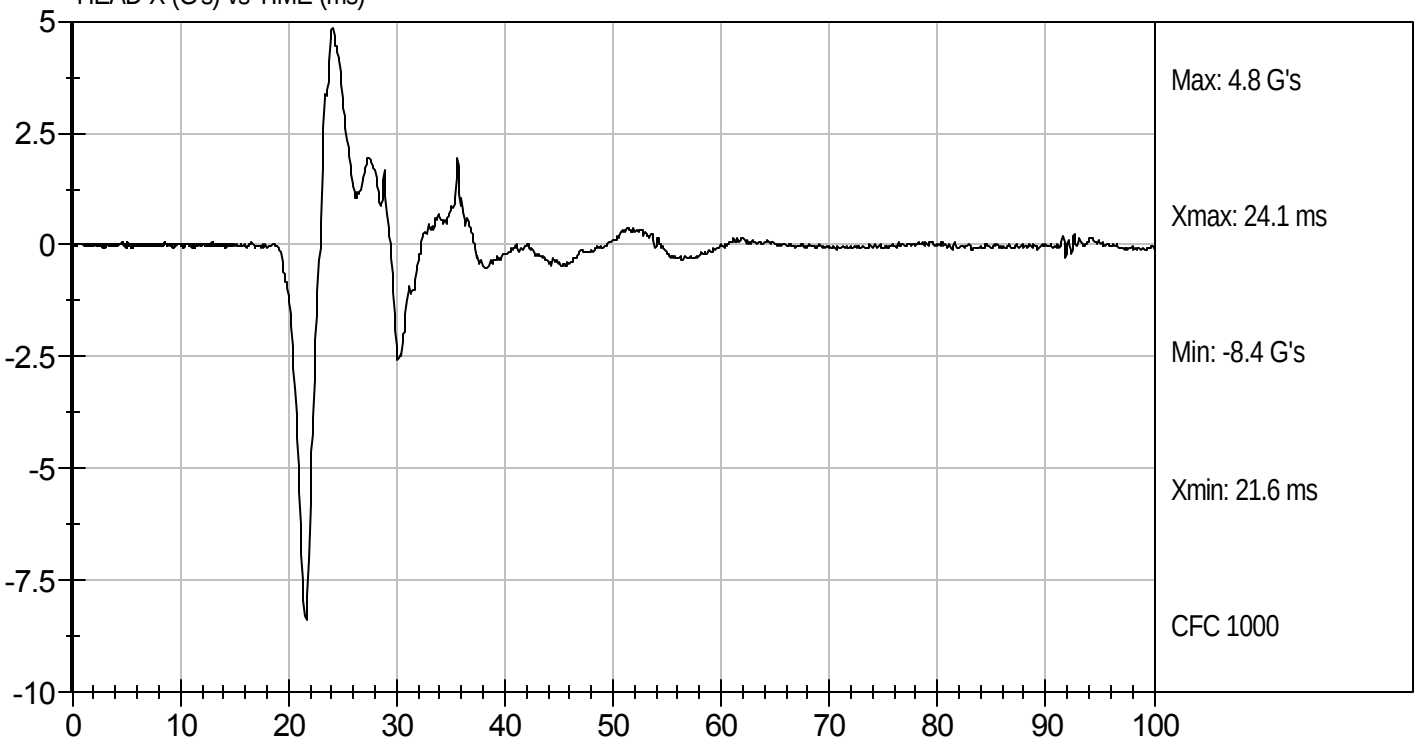
Test Desc: Head Drop
Component ID: D11931

Test Date: 3/11/11
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:** D11932

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.8	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	-0.03	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.33	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.9	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	62.1	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	57.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

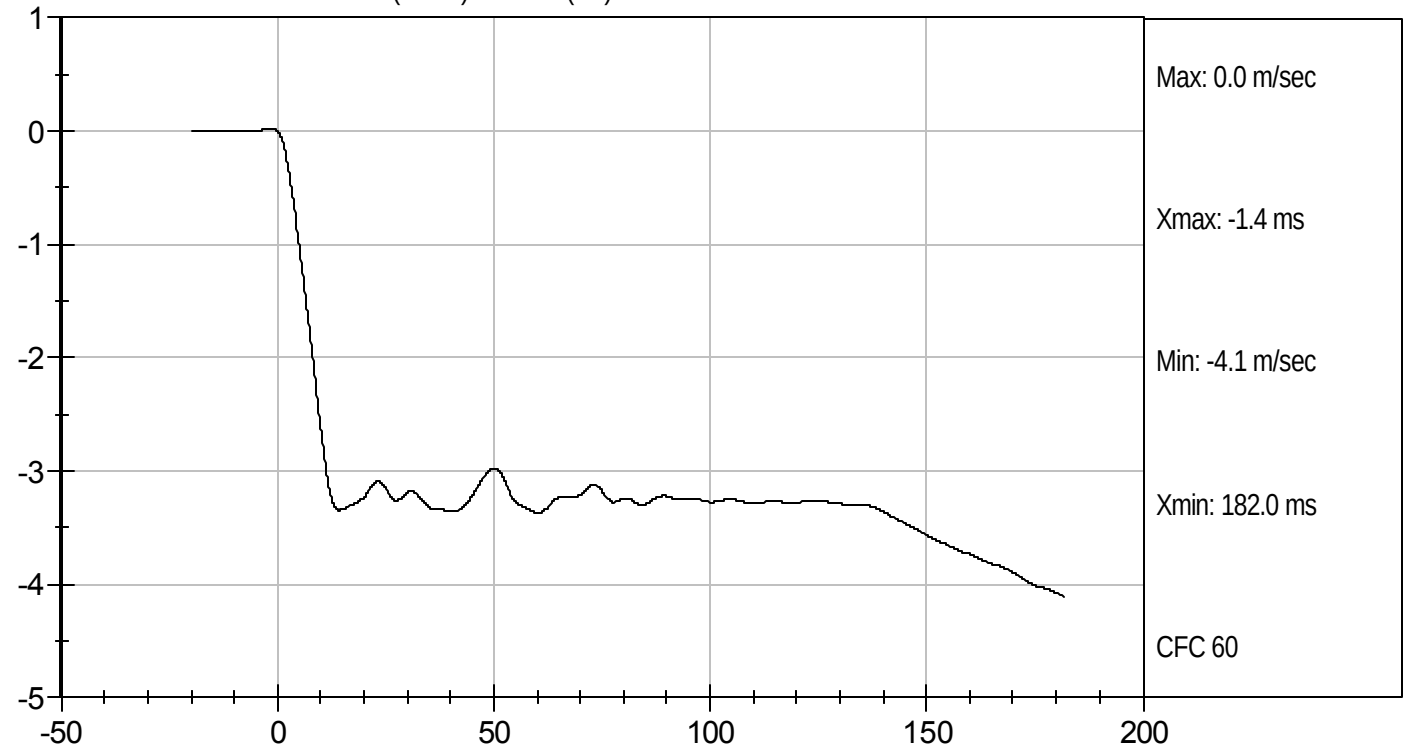
3/11/11
Test Date

David Winkelbauer
Approved By

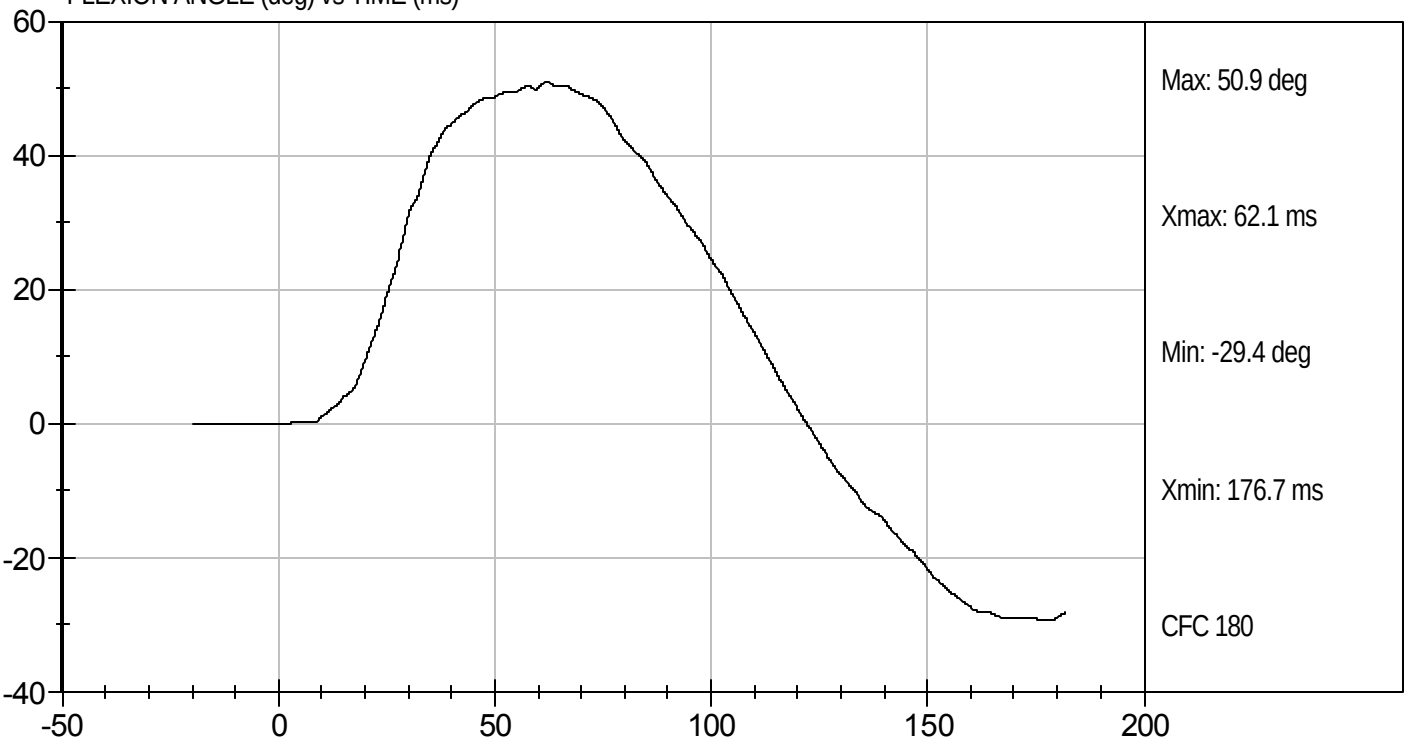
Test Desc: Neck Bending
Component ID: D11932

Test Date: 3/11/11
Velocity: 11.42 ft/s, 3.48 m/s

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

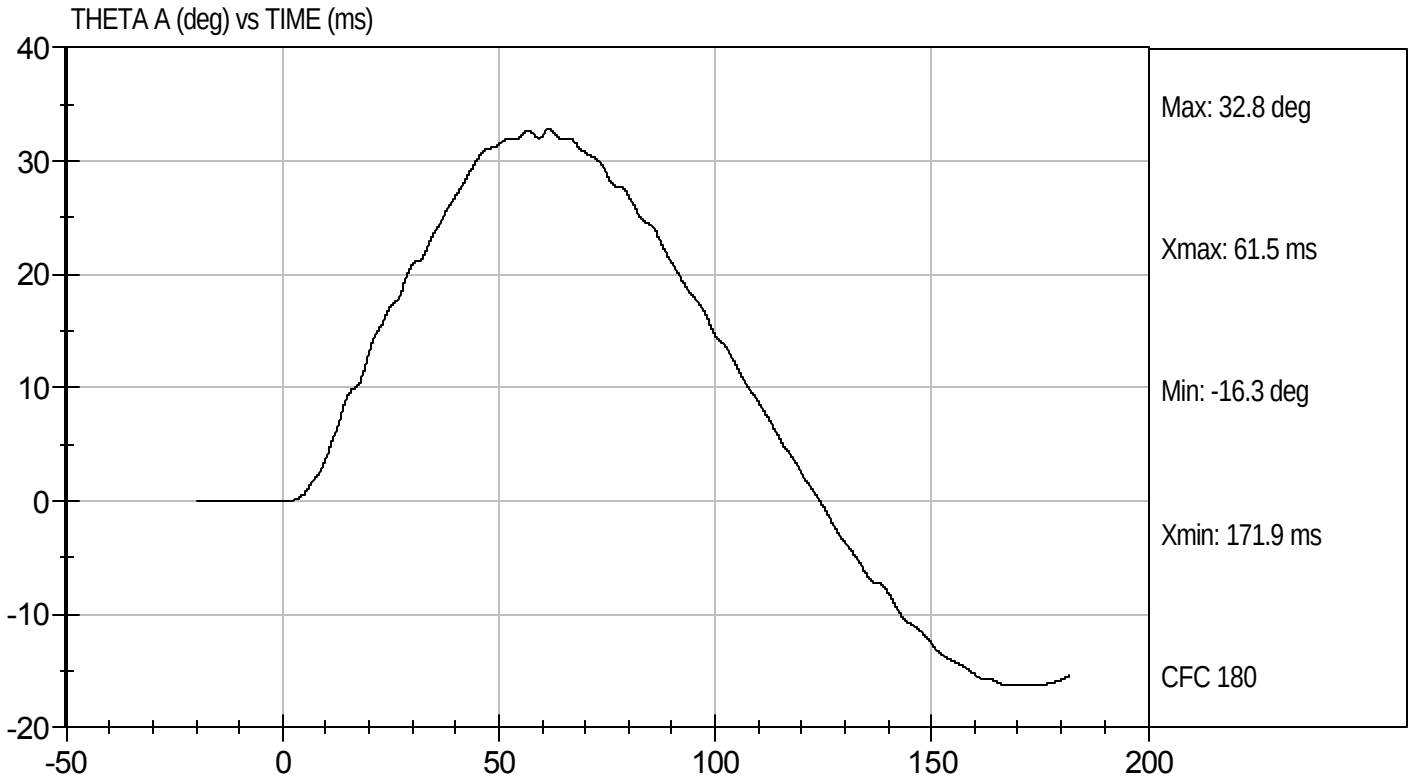


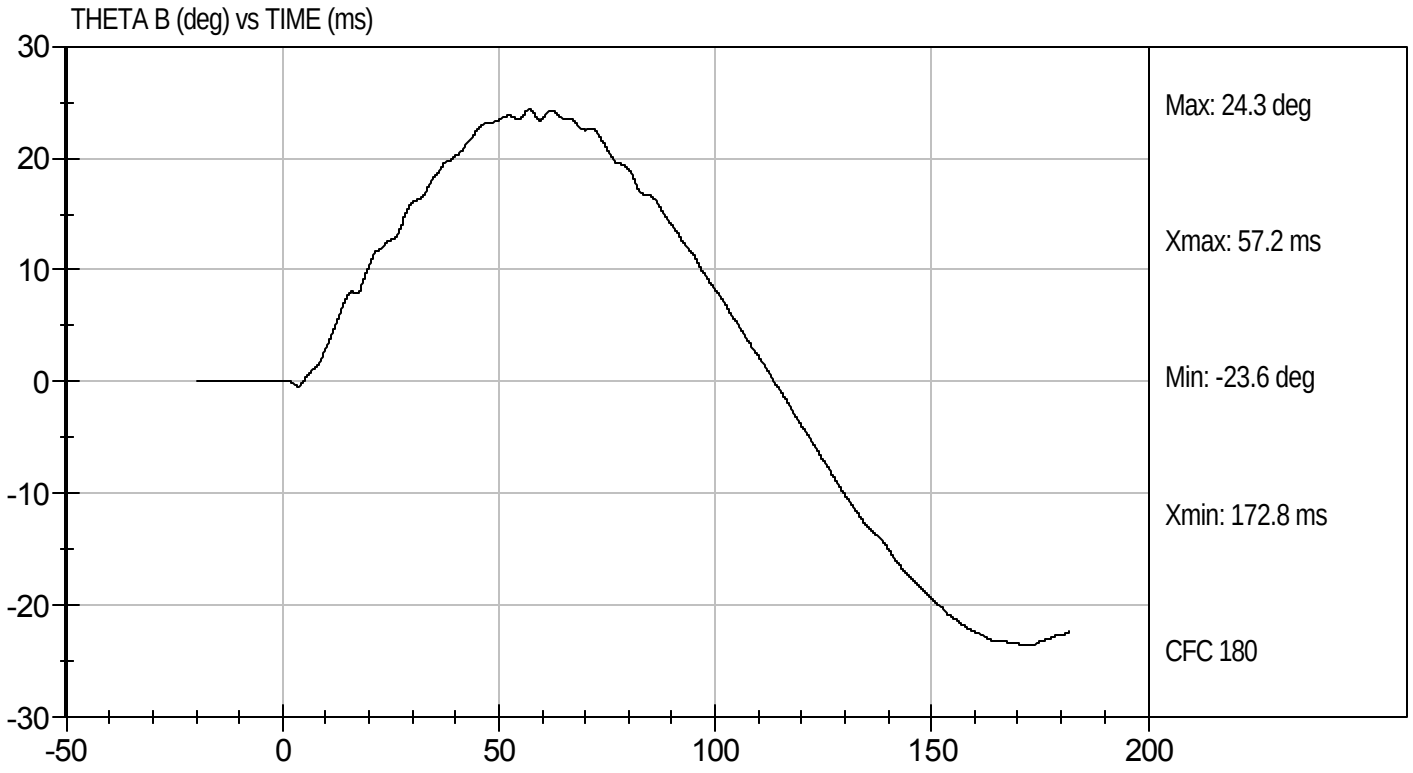
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D11932

Test Date: 3/11/11
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:** D11933

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	7.8	Pass
Time of Peak Shoulder Acceleration	ms	NA	12.6	Pass
		Overall Test Results		Pass

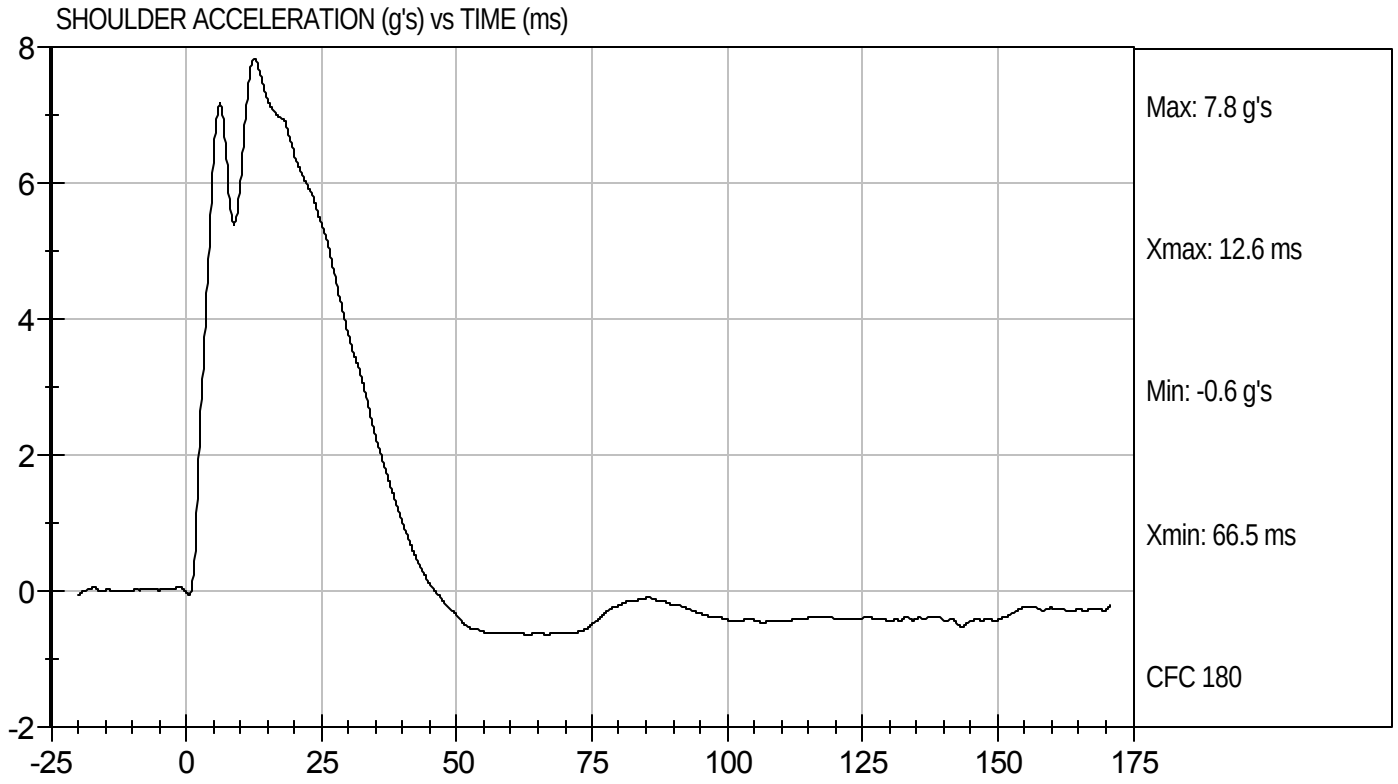
Jessica Gall
Laboratory Technician

3/11/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D11933

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



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11934

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	28	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	48.7	Pass
		Overall Test Results		Pass

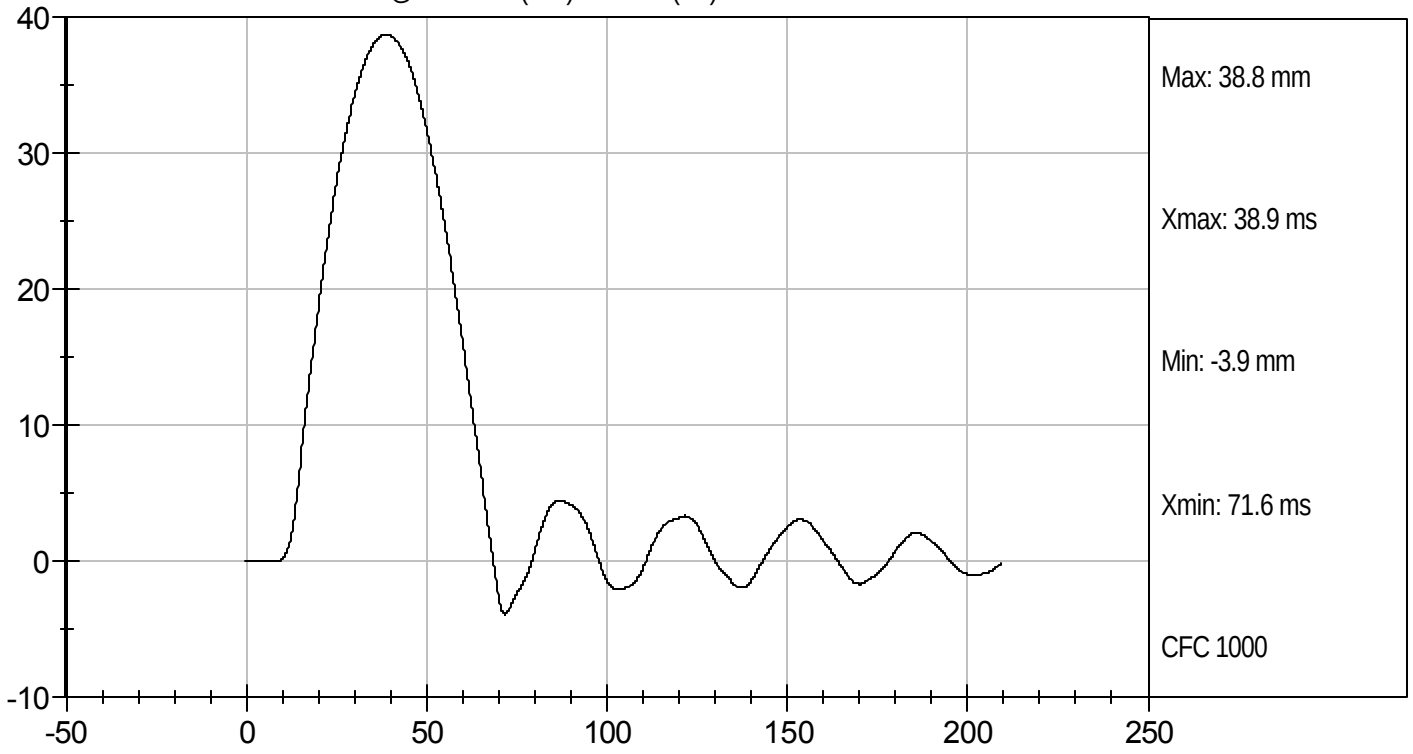
Jessica Hall
Laboratory Technician

3/11/11
Test Date

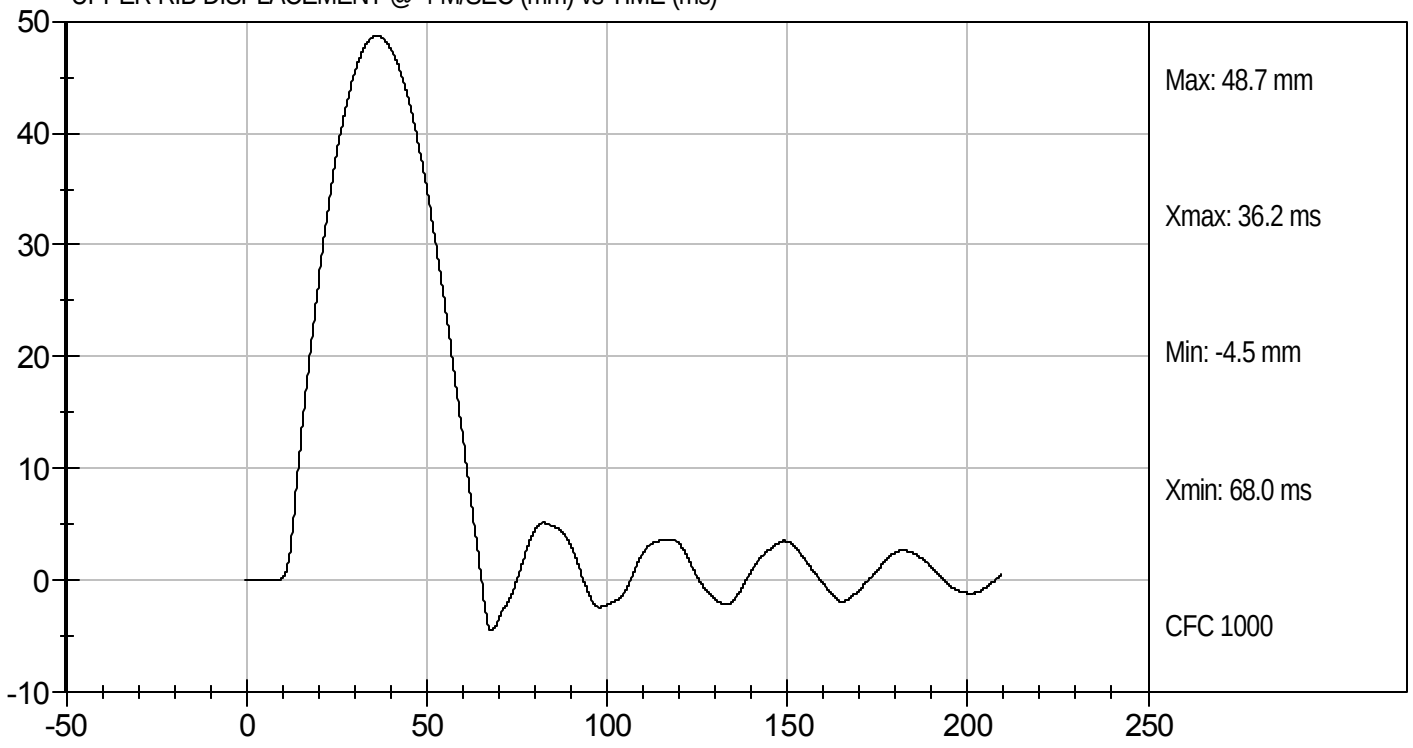
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D11934
Test Date: 3/11/11

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:** D11935

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.8	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.8	Pass
		Overall Test Results		Pass

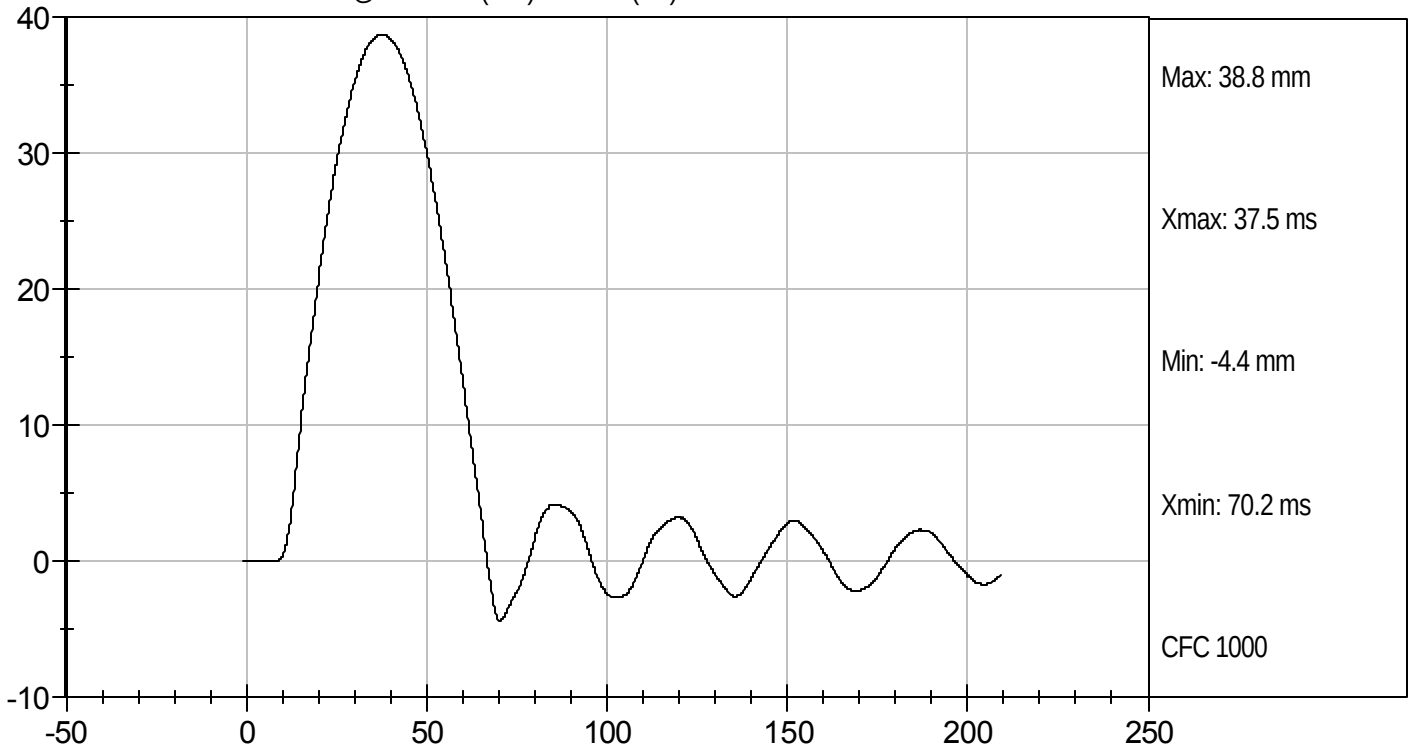
Jessica Hall
Laboratory Technician

3/11/11
Test Date

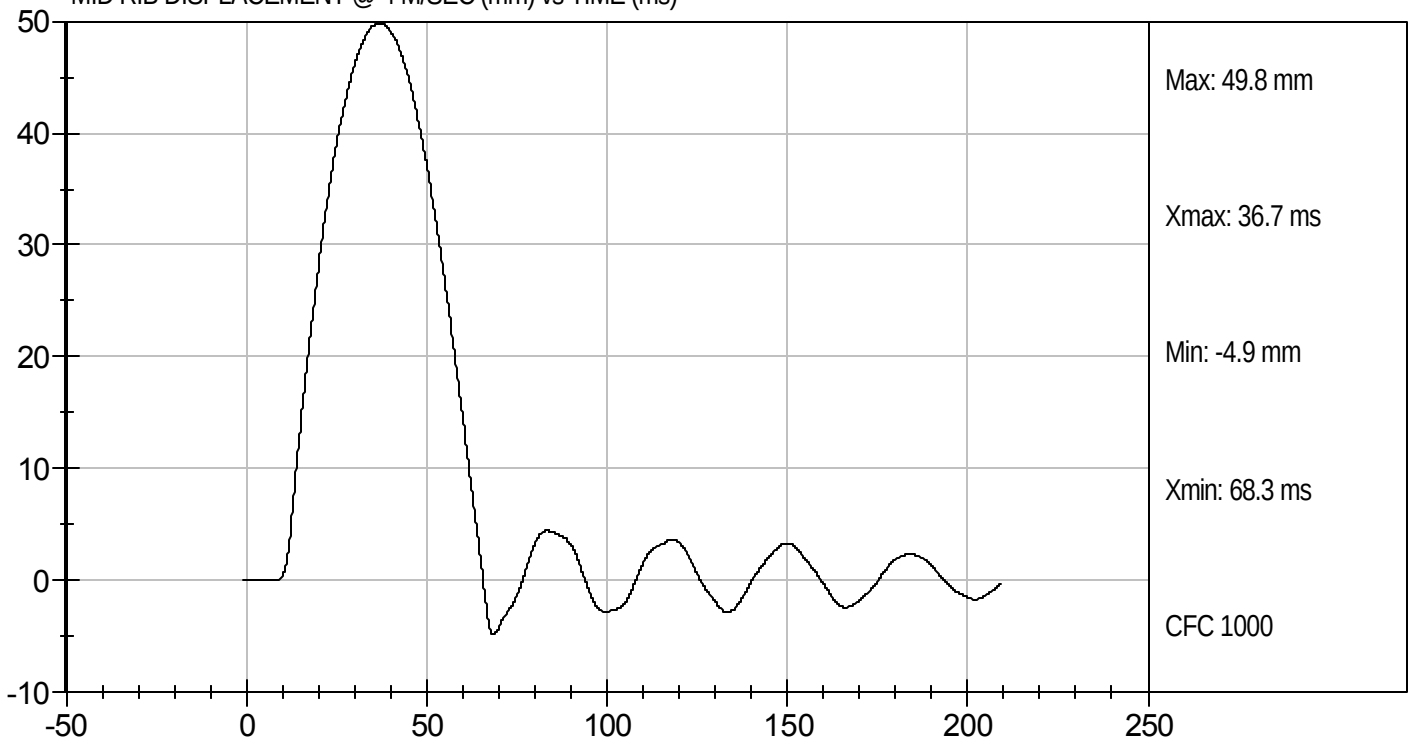
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D11935
Test Date: 3/11/11

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:** D11936

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.2	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.5	Pass
		Overall Test Results		Pass

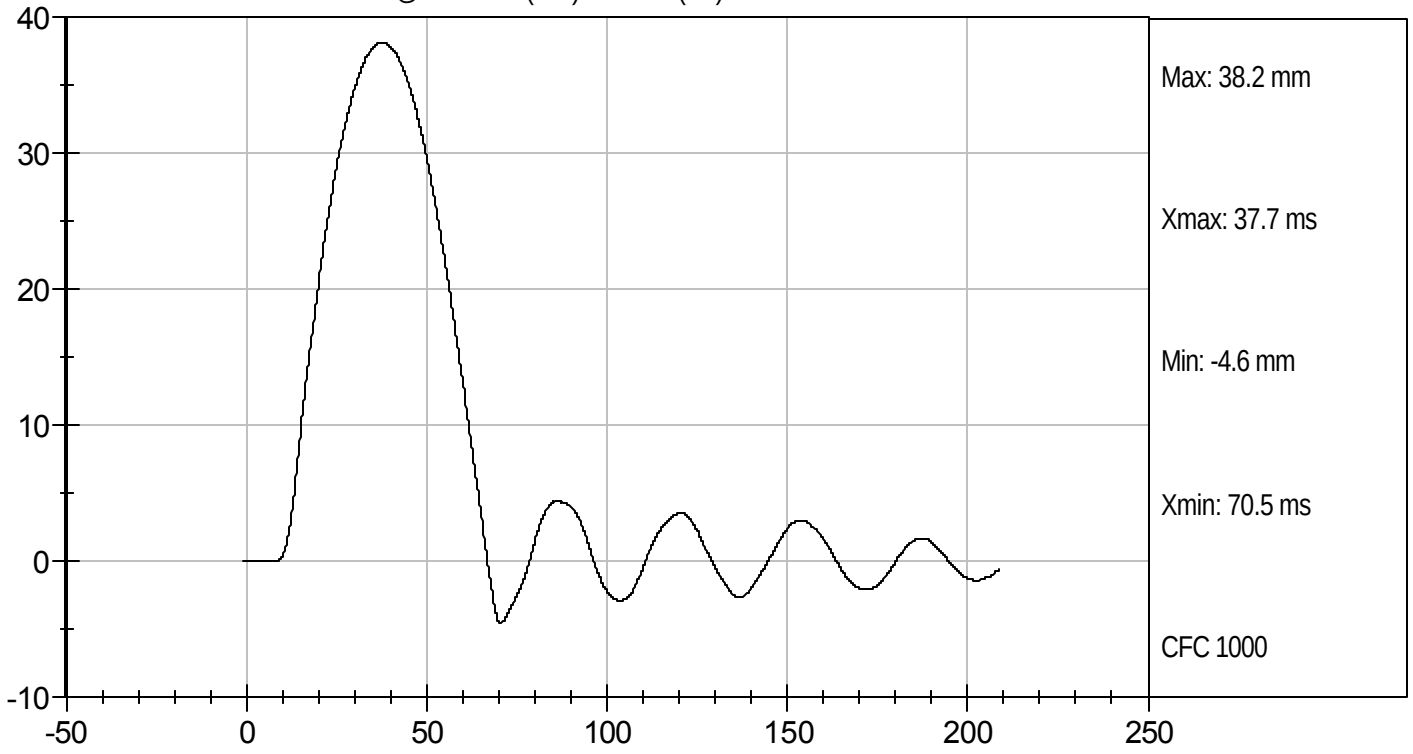
Jessica Gall
Laboratory Technician

3/11/11
Test Date

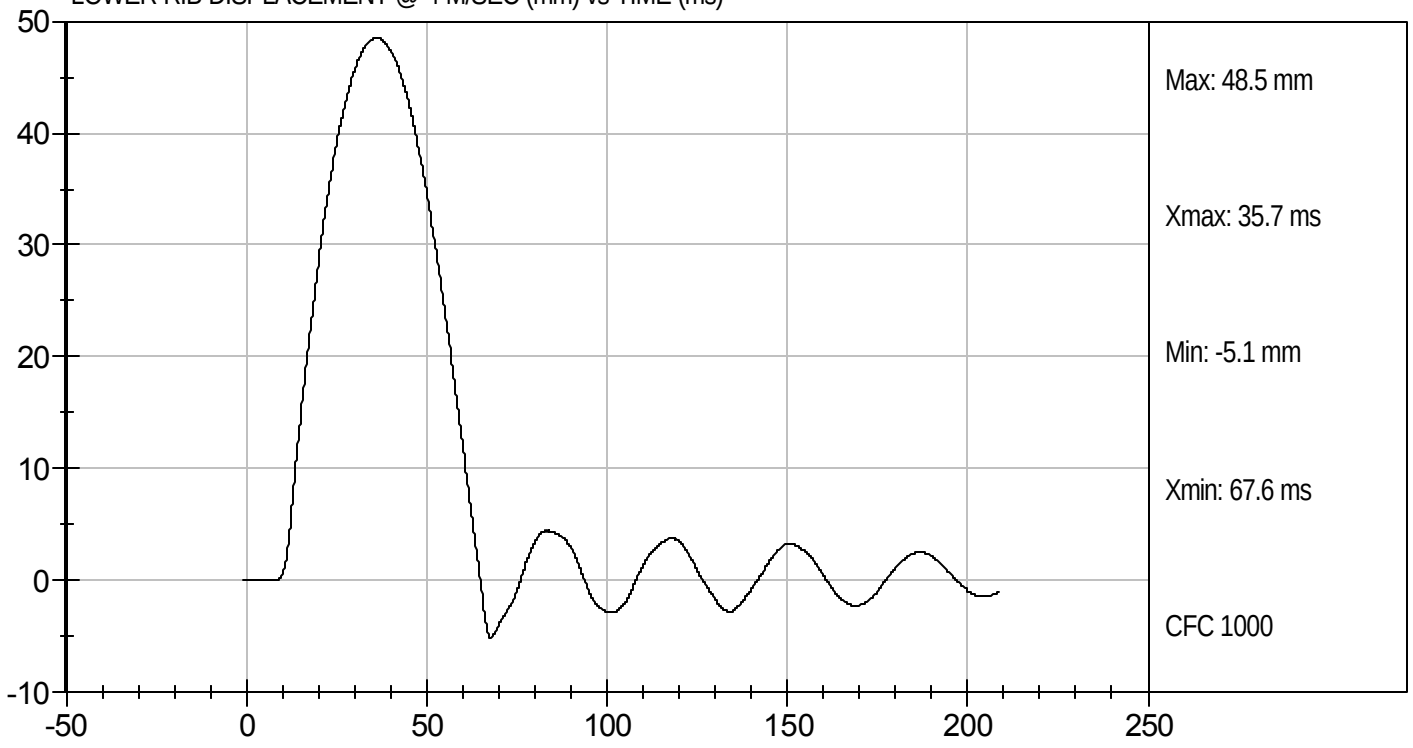
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D11936
Test Date: 3/11/11

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:** D11937

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	3.90 to 4.10	4.03	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.04	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.90	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.48	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.60	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

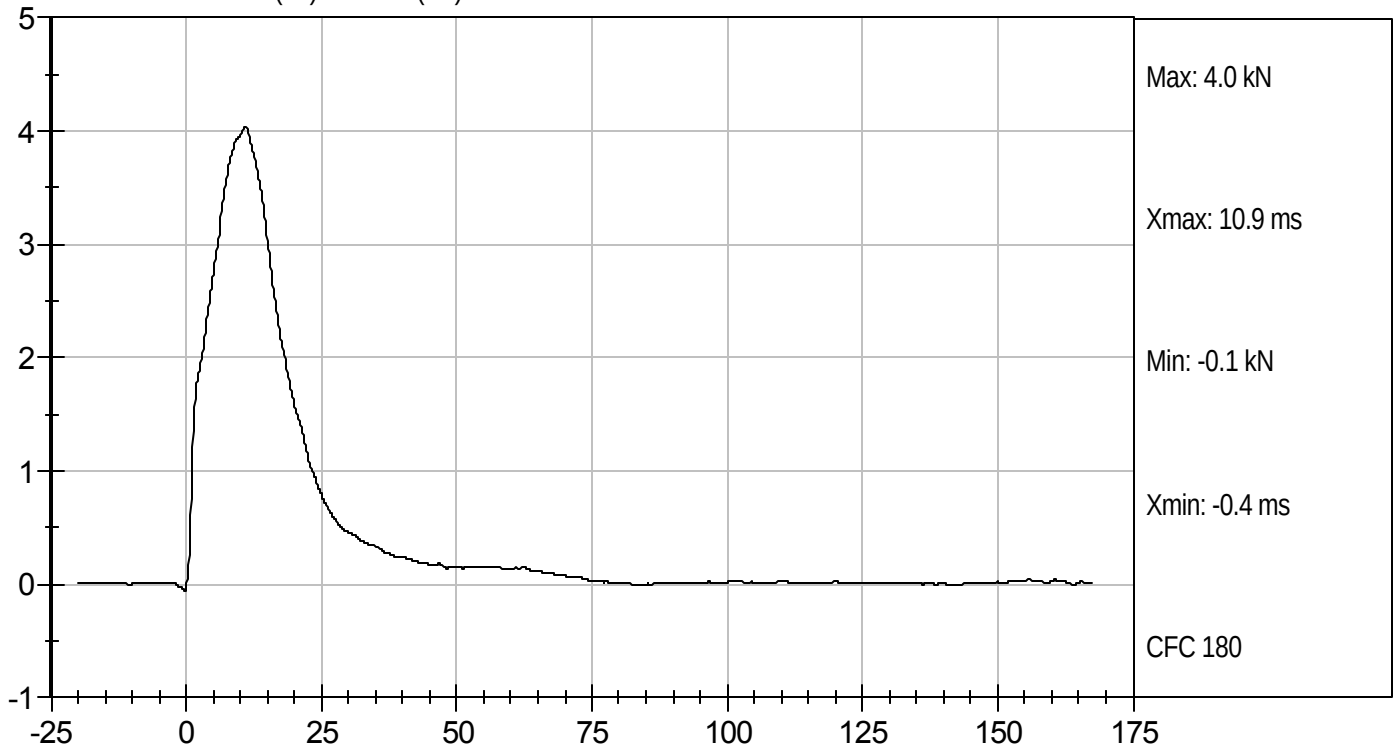
3/11/11
Test Date

David Winkelbauer
Approved By

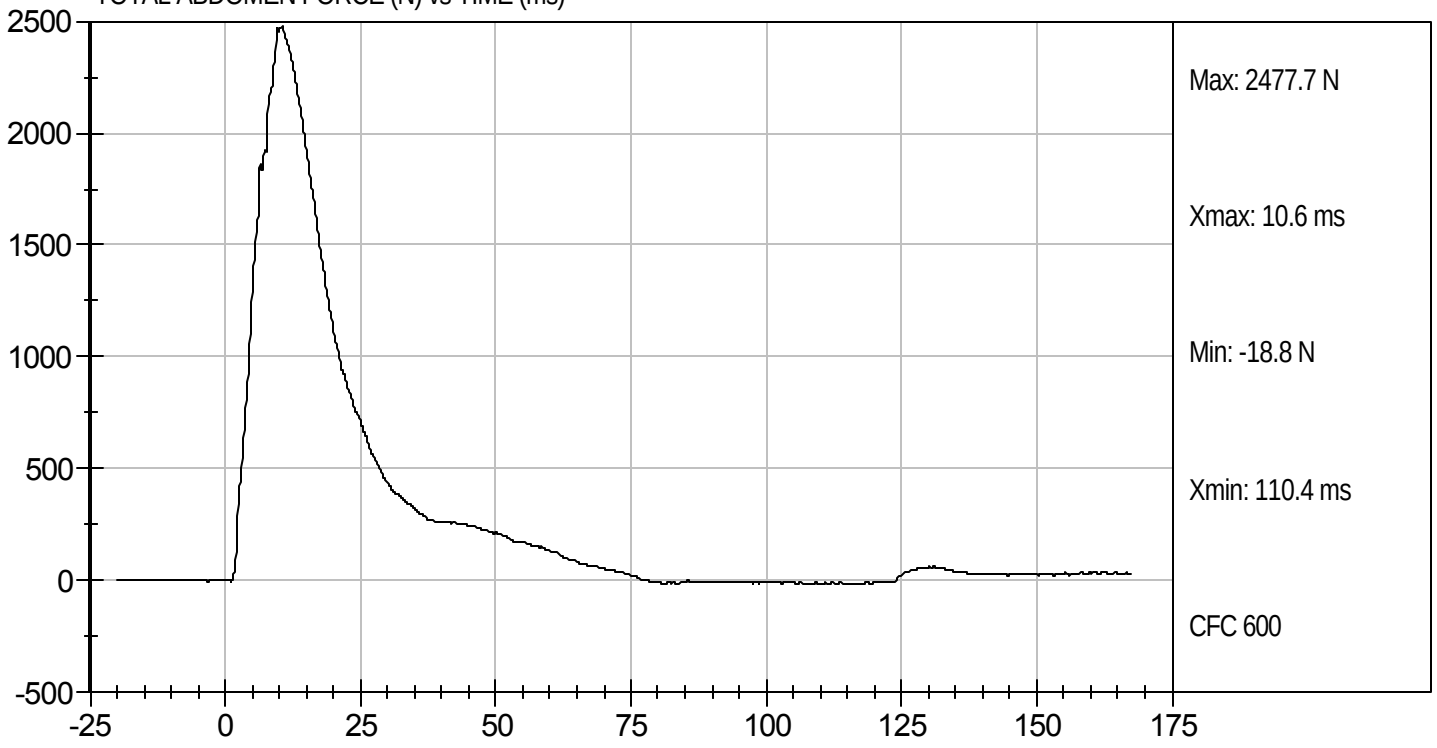
Test Desc: Abdomen Impact
Component ID: D11937

Test Date: 3/11/11
Velocity: 13.23 ft/s, 4.03 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:** D11938

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	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	-0.41	Pass
	27 ms	m/s	-6.50 to -5.80	-5.82	Pass
	30 ms	m/s	>= -6.5	-6.0	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	45.2	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	46.9	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	44	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

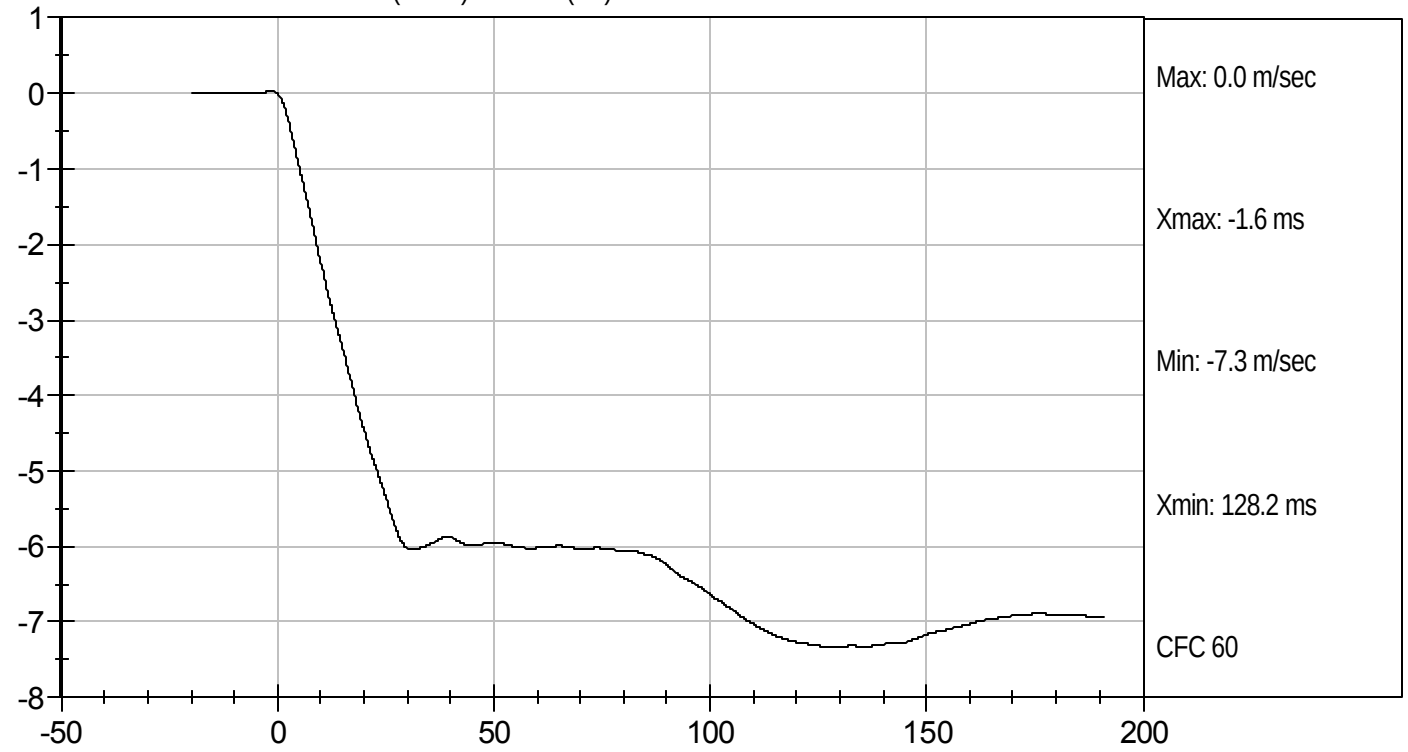
3/11/11
Test Date

David Winkelbauer
Approved By

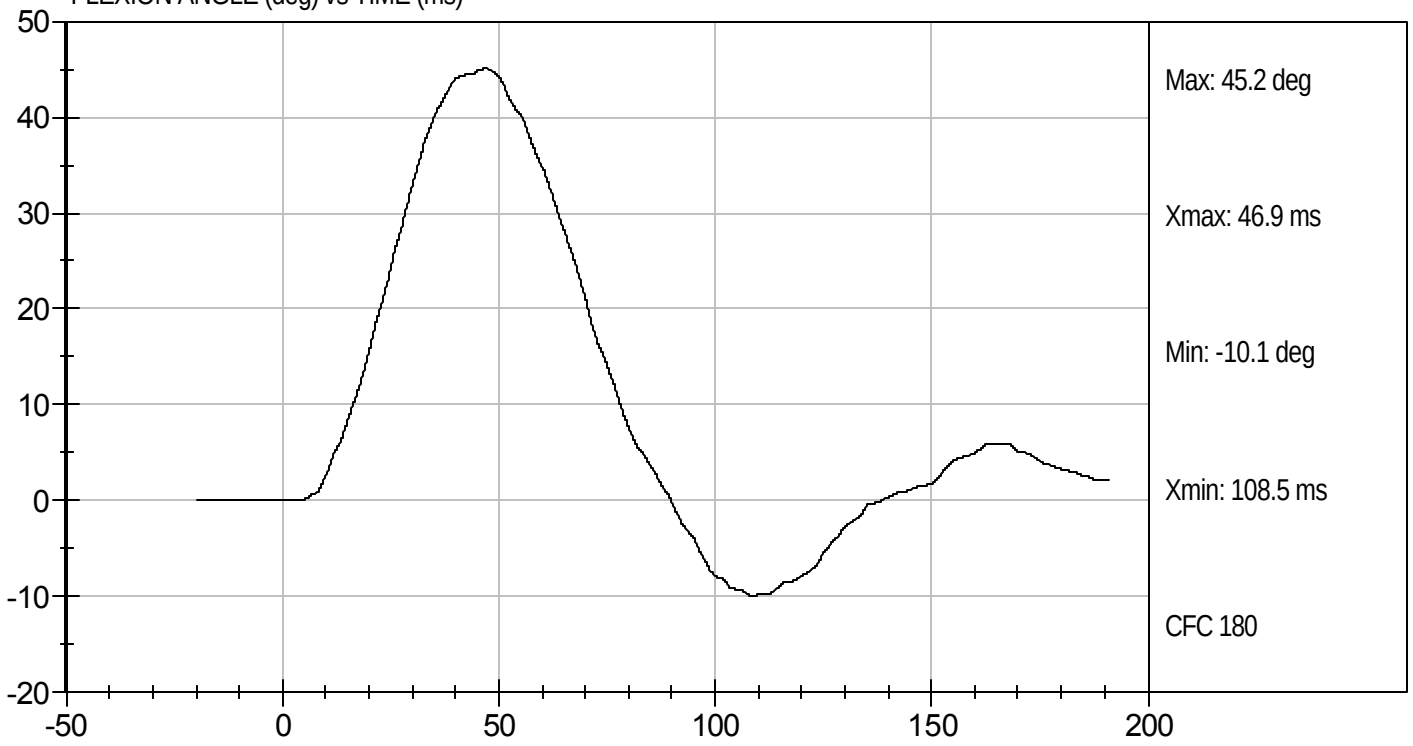
Test Desc: Lumbar Bending
Component ID: D11938

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

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

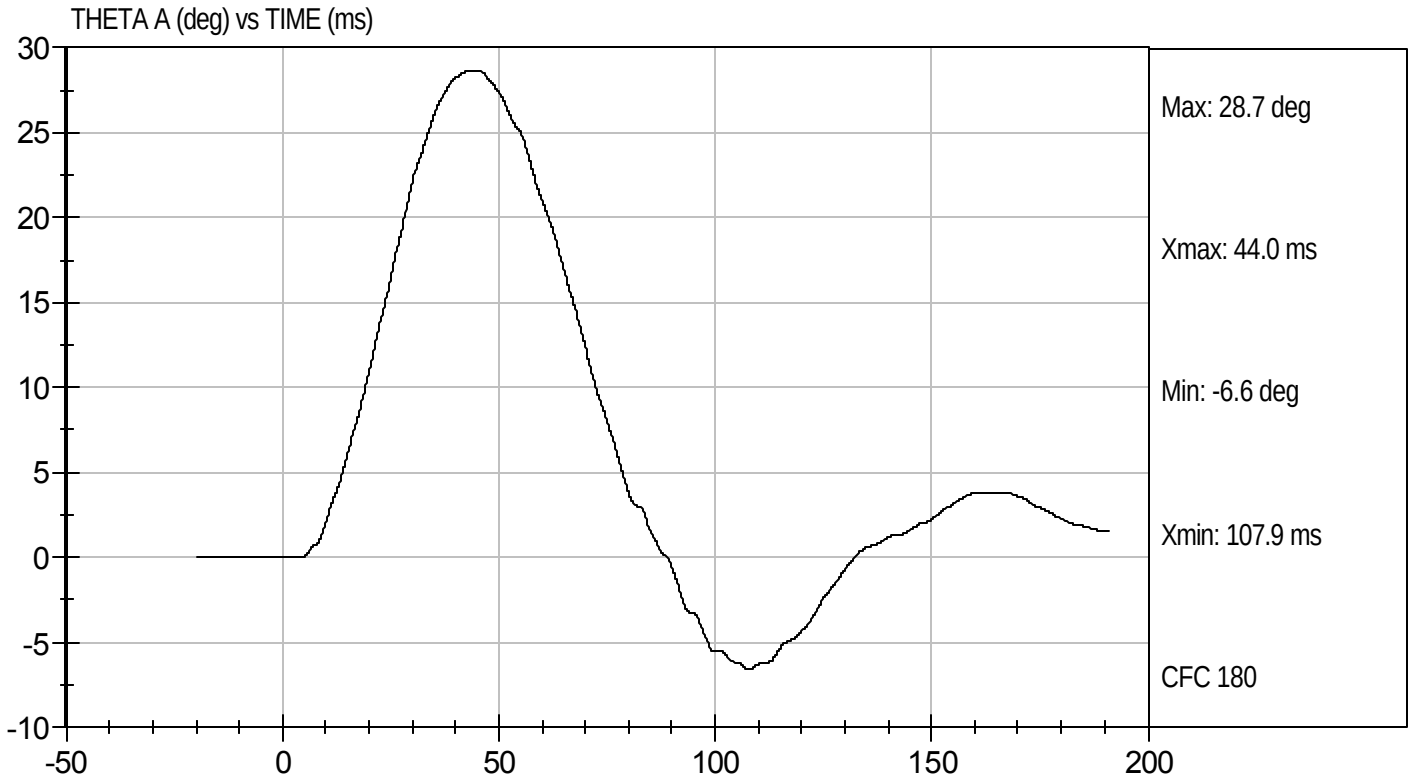


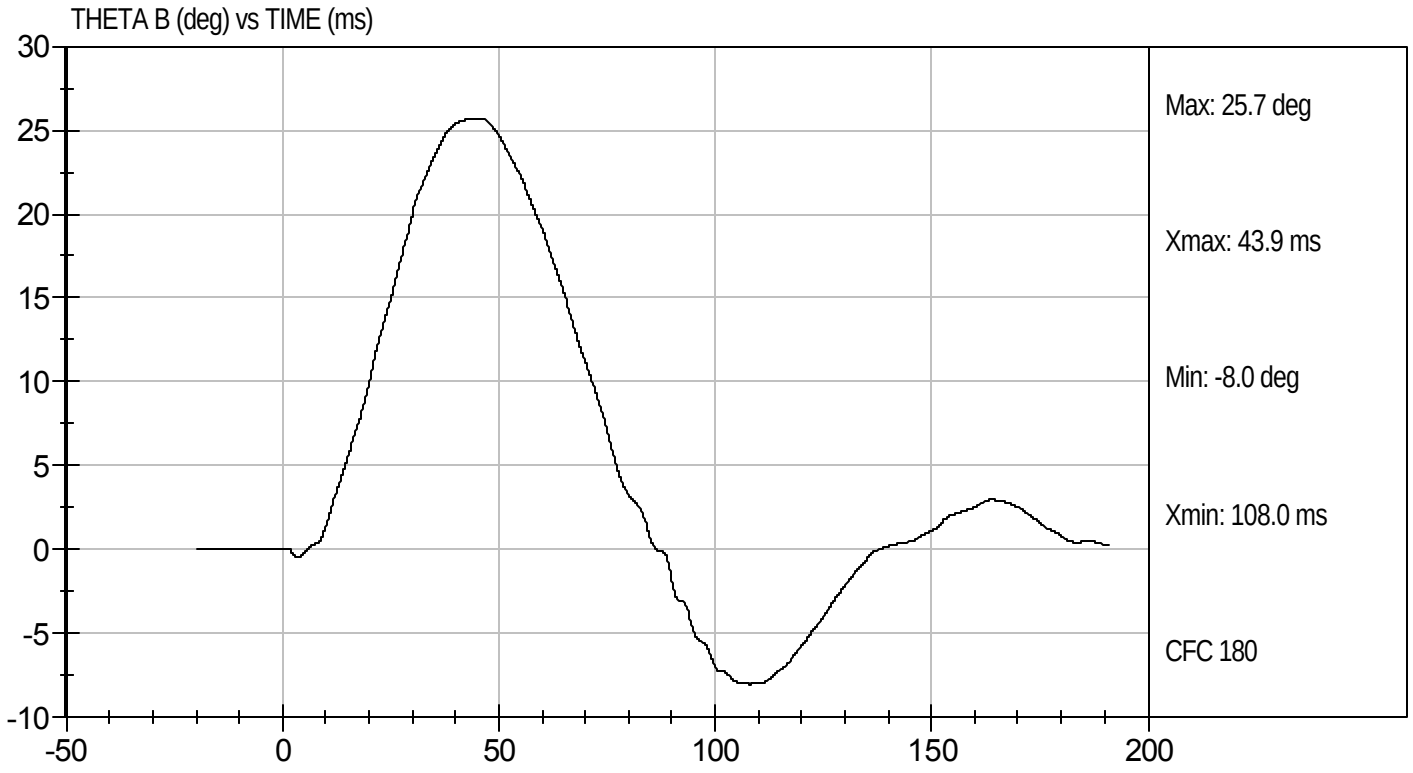
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D11938

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





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11939

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.75	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.20	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.44	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	13.70	Pass
		Overall Test Results		Pass

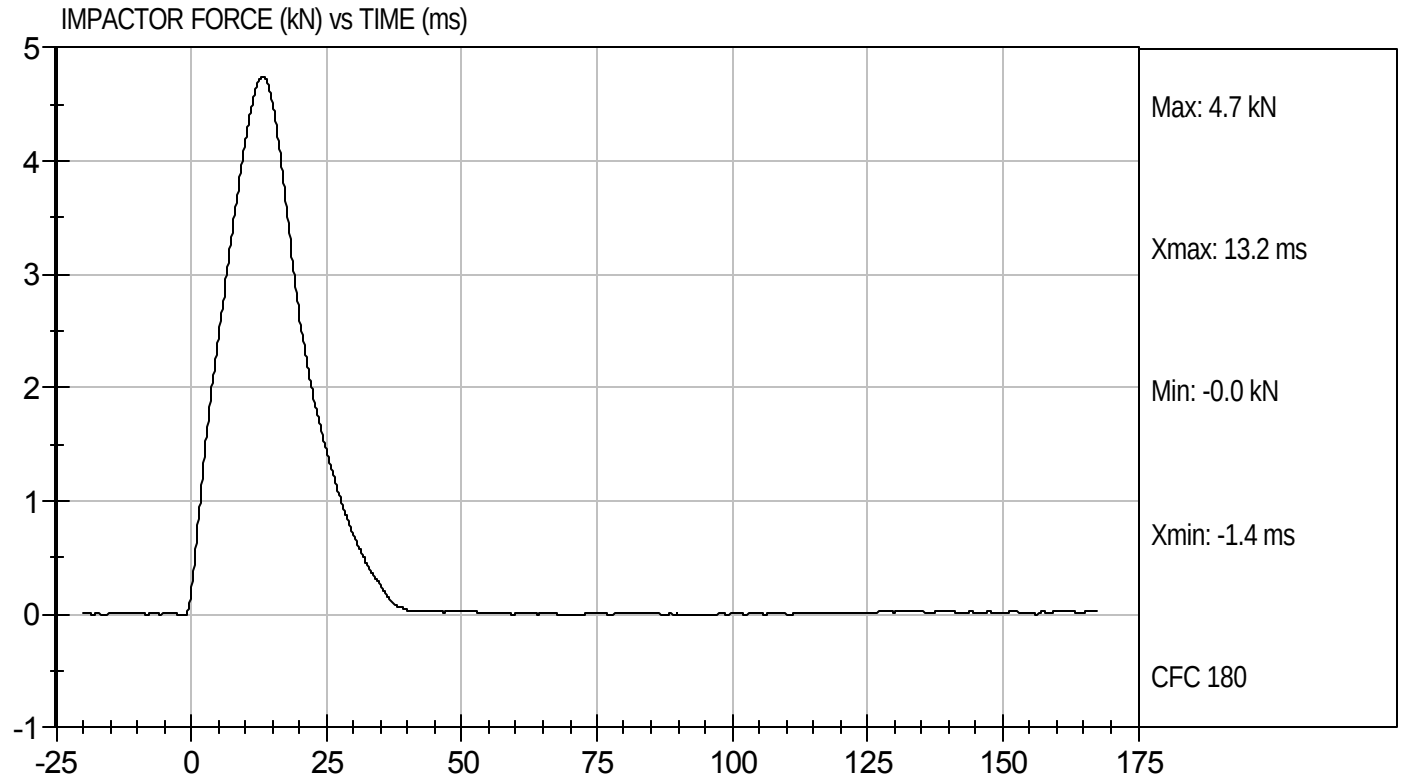
Jessica Hall
Laboratory Technician

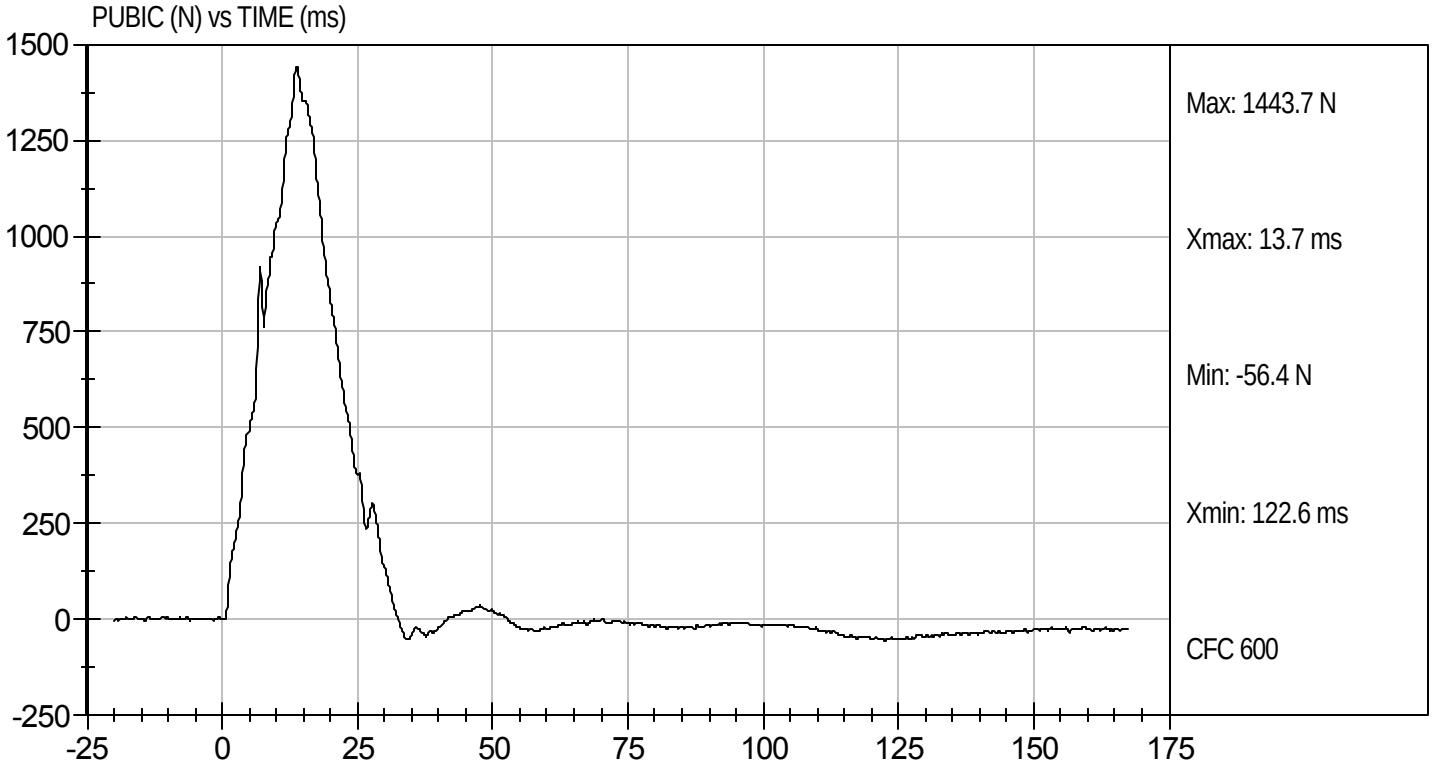
3/11/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D11939

Test Date: 3/11/11
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:** D11930

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.17	Pass
Upper Rib Displacement	mm	34.0 to 41.0	40.0	Pass
Middle Rib Displacement	mm	37.0 to 45.0	42.0	Pass
Lower Rib Displacement	mm	37.0 to 44.0	41.1	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

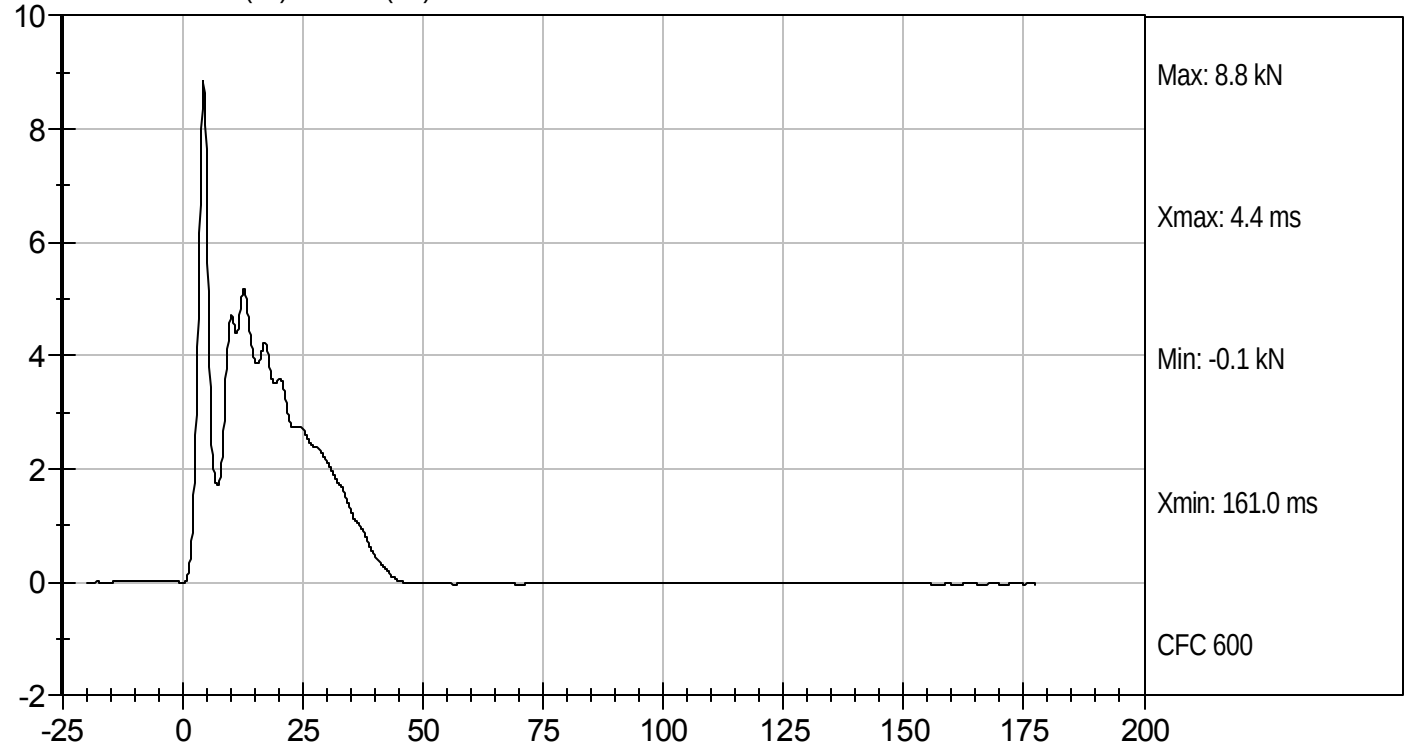
3/11/11
Test Date

David Winkelbauer
Approved By

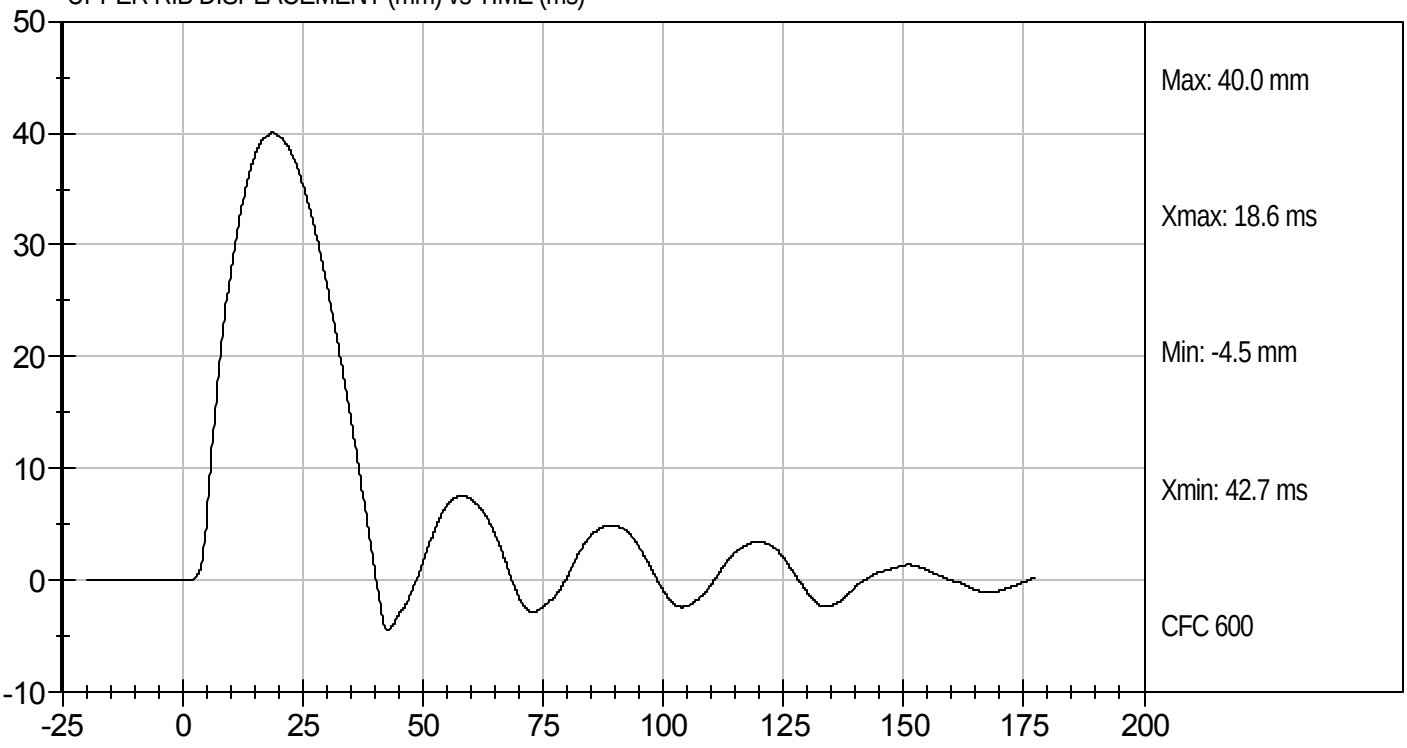
Test Desc: Thorax Impact
Component ID: D11930

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

PROBE FORCE (kN) vs TIME (ms)



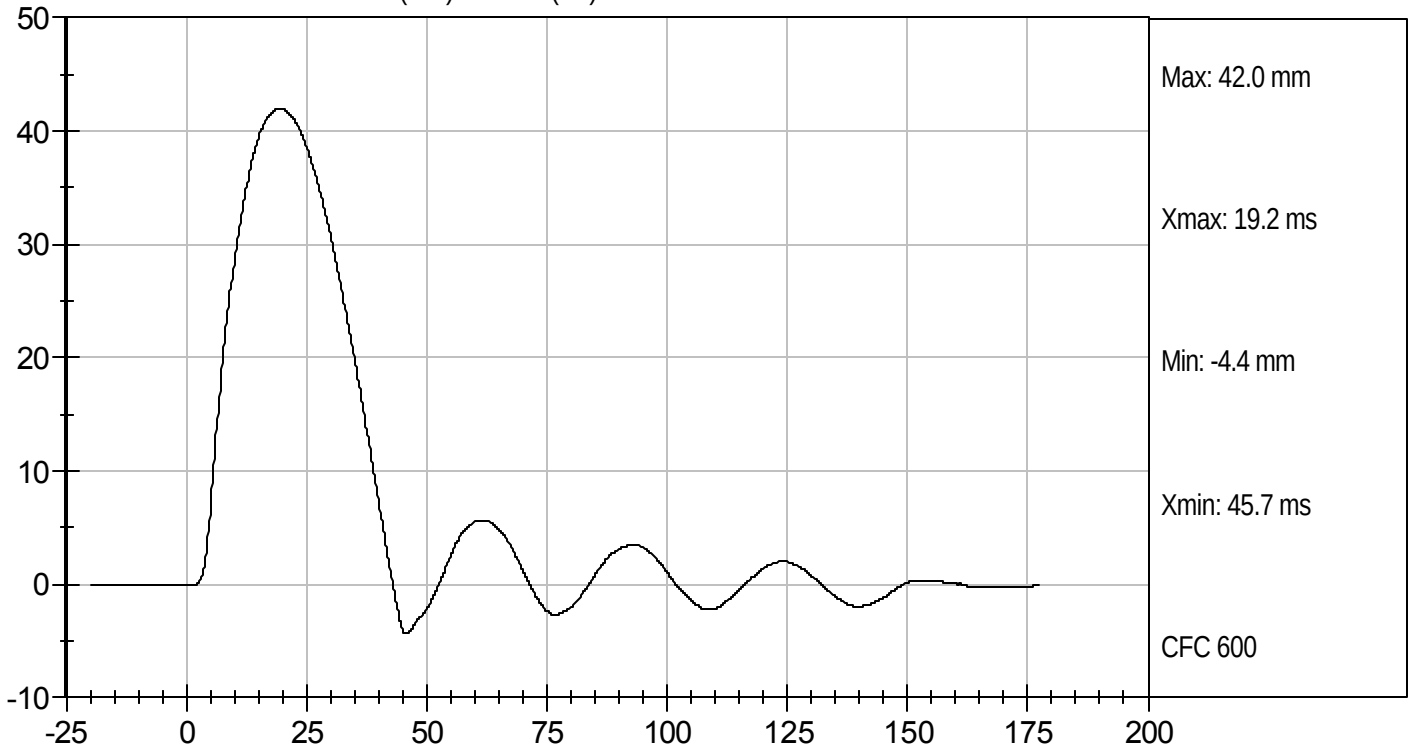
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



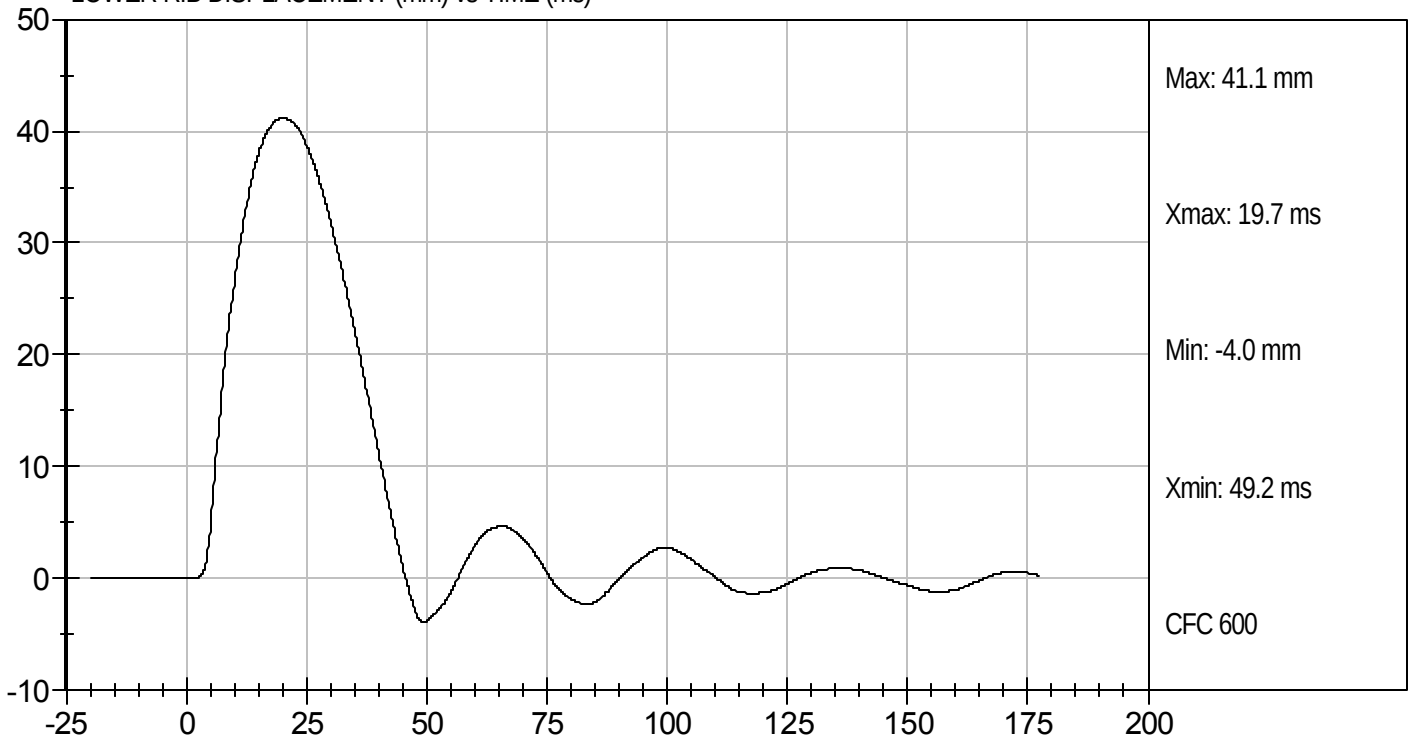
Test Desc: Thorax Impact
Component ID: D11930

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

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D11961

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Peak Resultant Acceleration	G's	125 to 155	147	Pass
Peak Lateral Acceleration	G's	+/- 15	-9.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

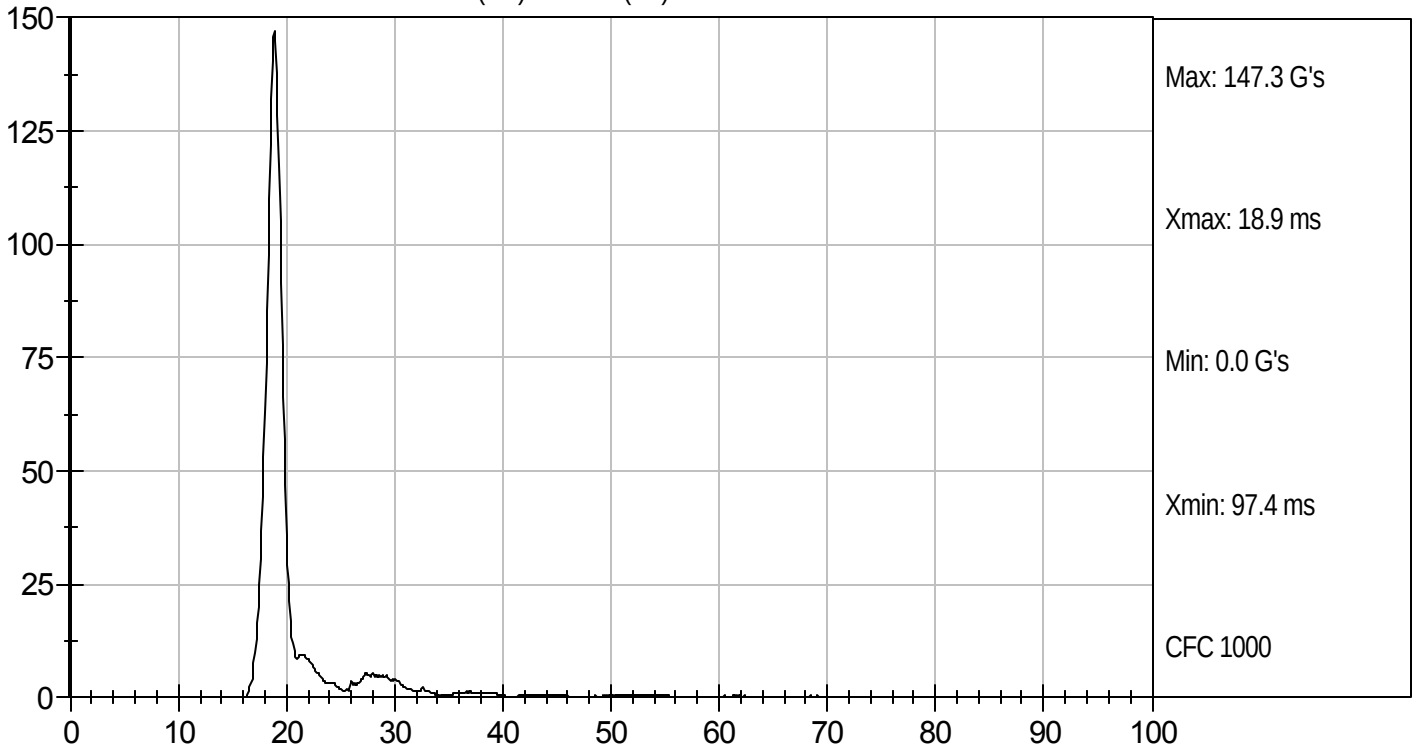
3/14/11
Test Date

David Winkelbauer
Approved By

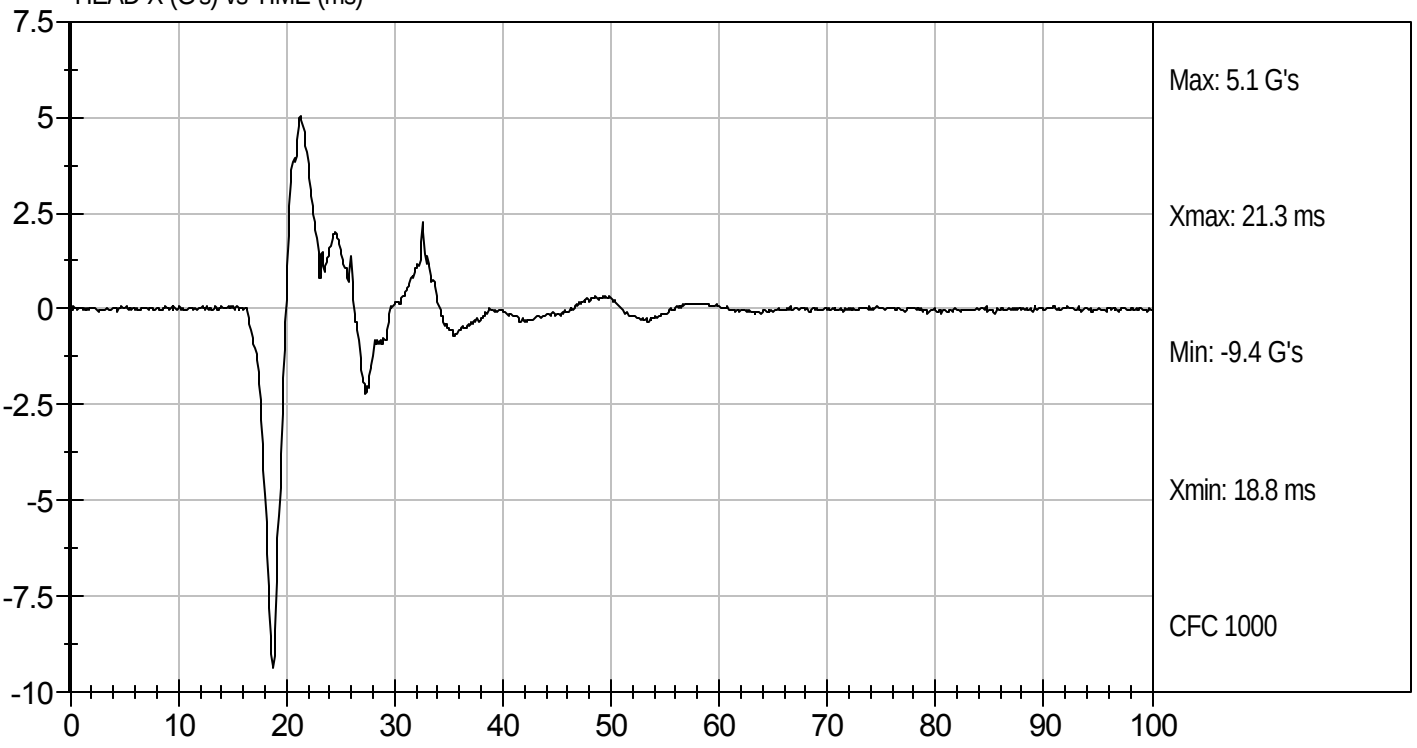
Test Desc: Head Drop
Component ID: D11961

Test Date: 3/14/11
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:** D11962

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	20.6	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	-3.44	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	61.0	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	55.8	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

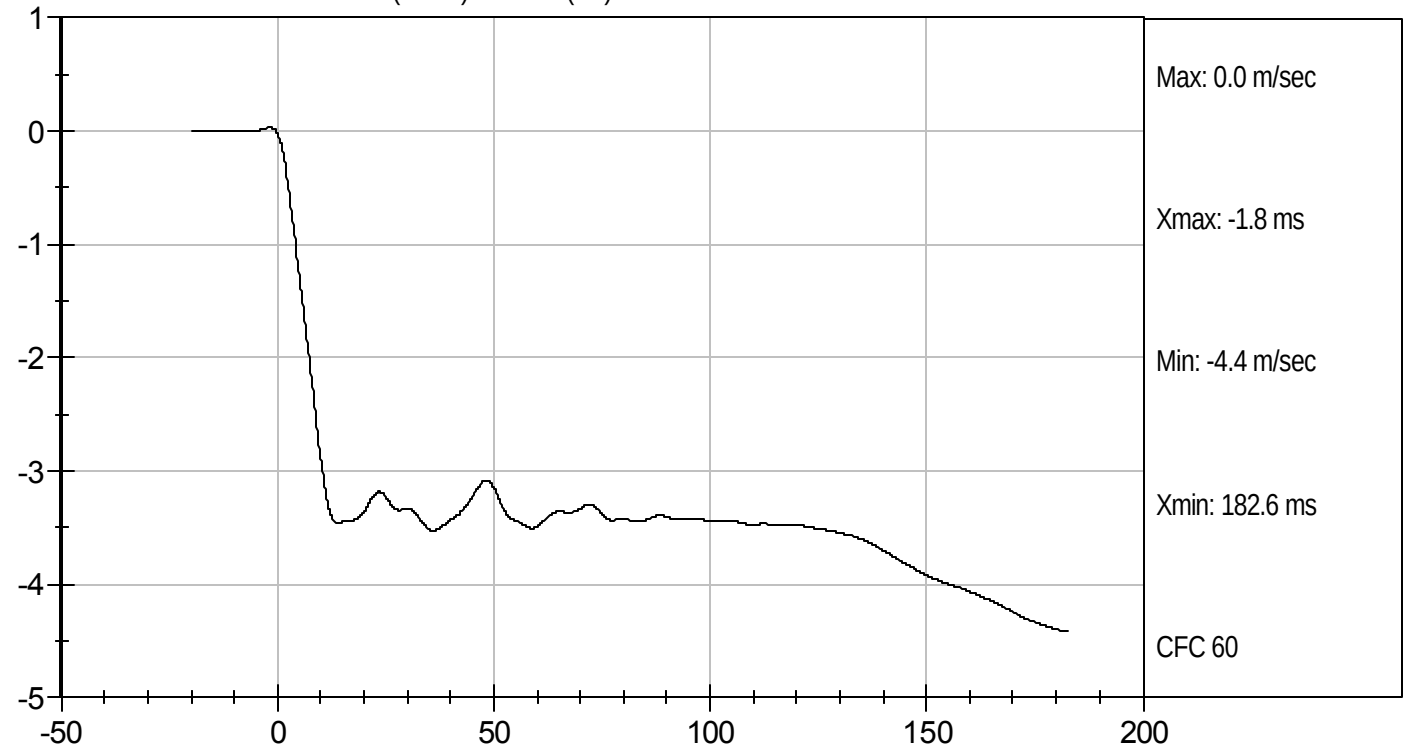
3/15/11
Test Date

David Winkelbauer
Approved By

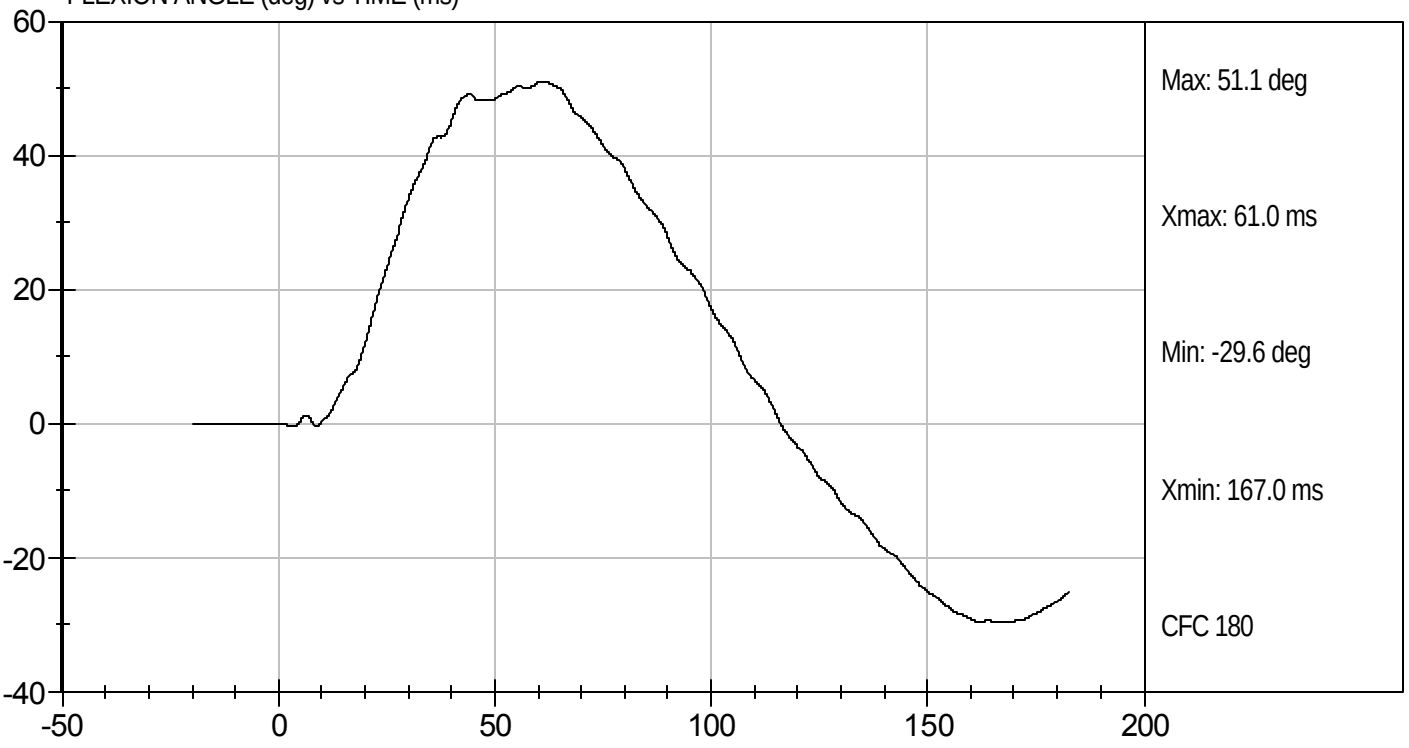
Test Desc: Neck Bending
Component ID: D11962

Test Date: 3/15/11
Velocity: 11.42 ft/s, 3.5 m/s

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

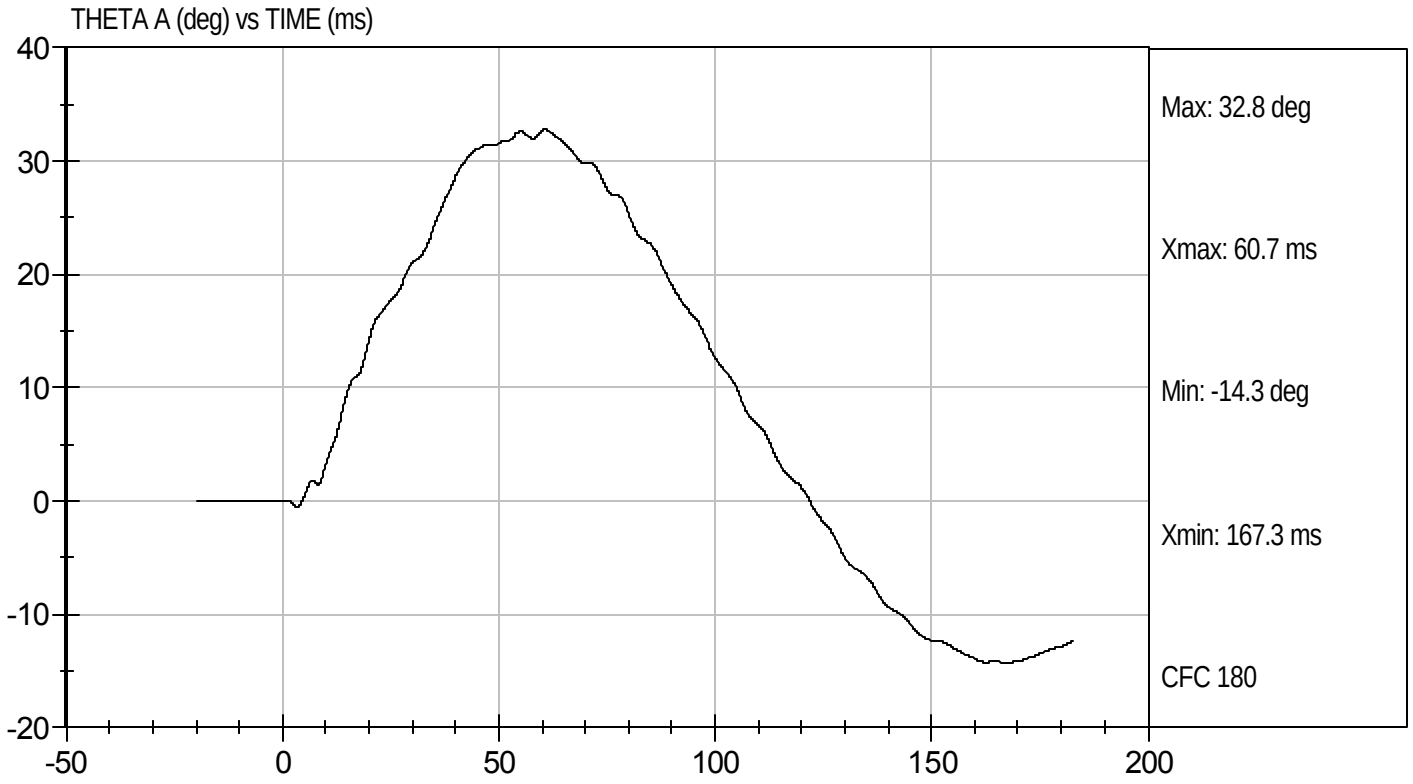


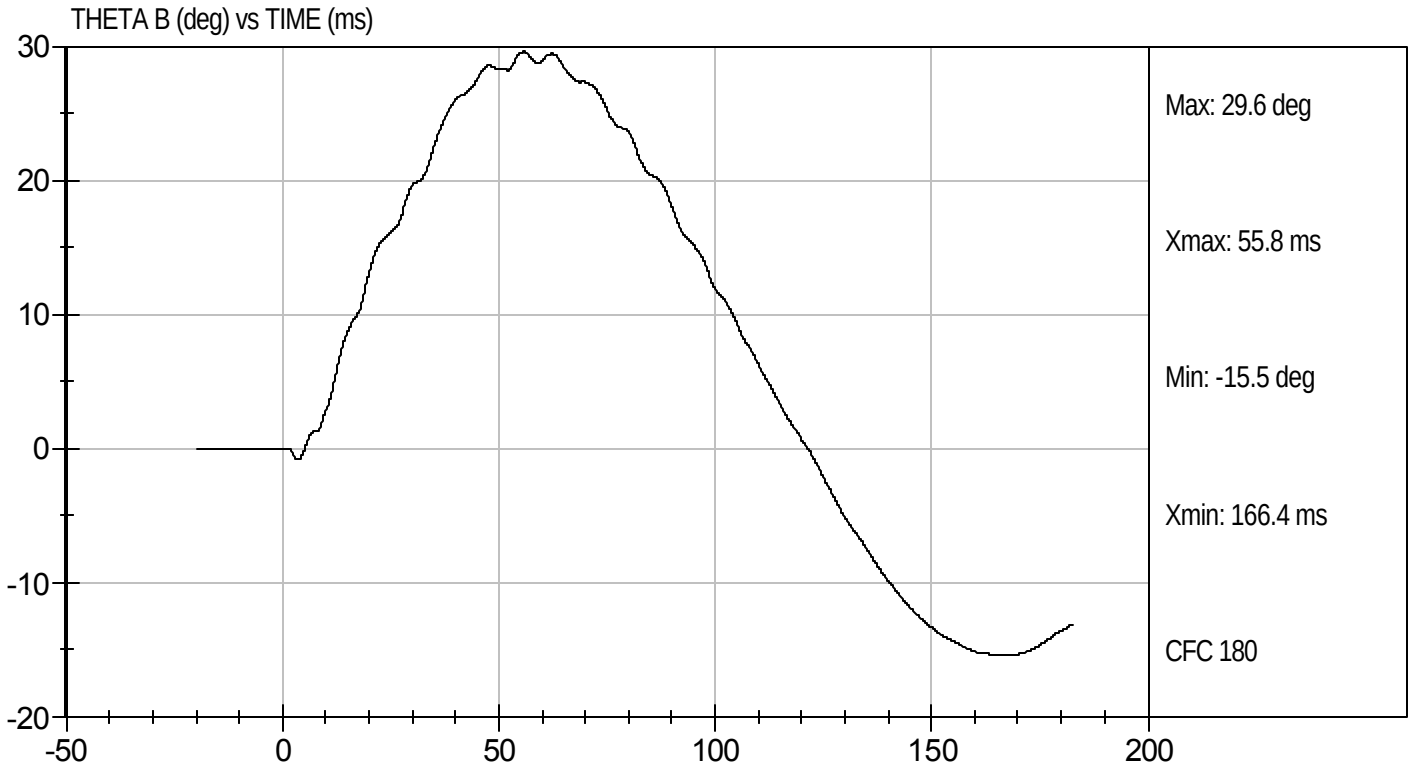
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D11962

Test Date: 3/15/11
Velocity: 11.42 ft/s, 3.5 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11963

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	7.9	Pass
Time of Peak Shoulder Acceleration	ms	NA	12.5	Pass
		Overall Test Results		Pass

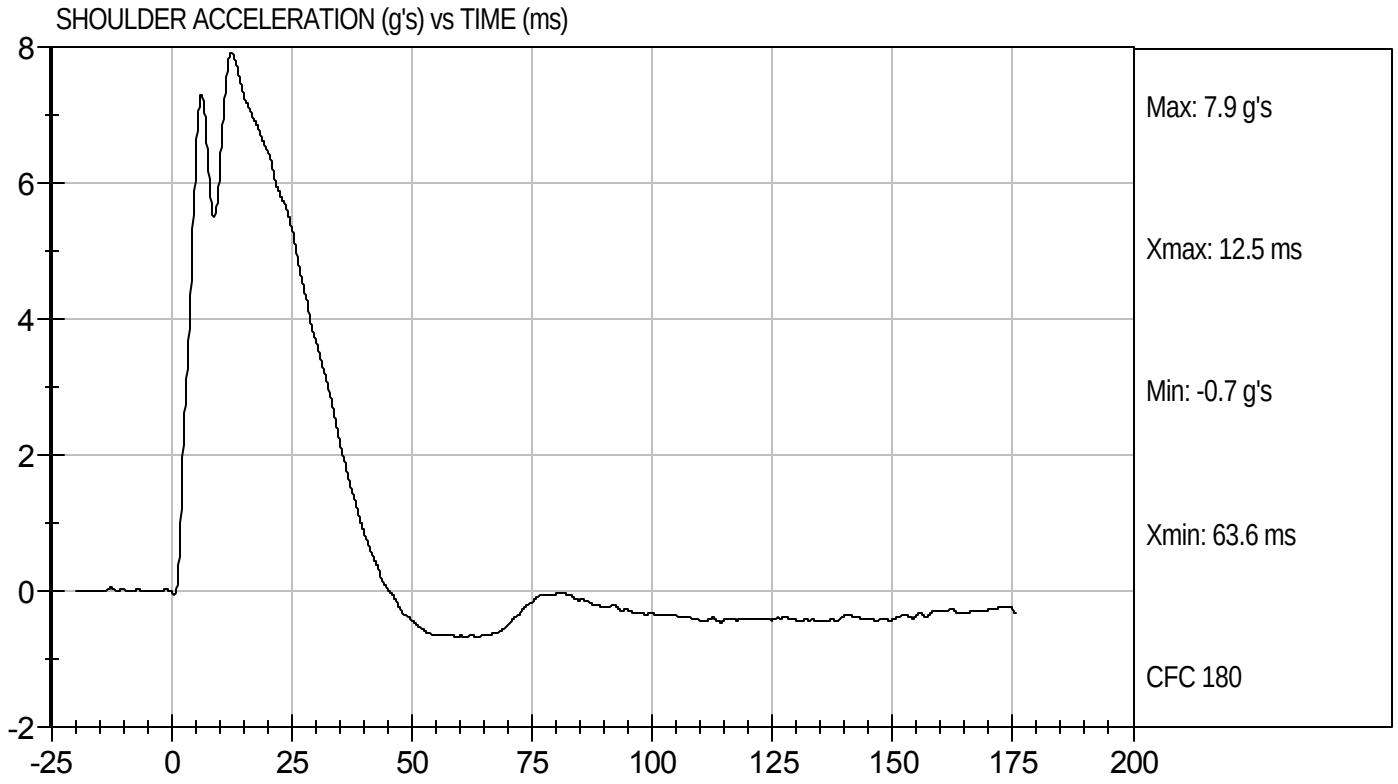
Jessica Gall
Laboratory Technician

3/15/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D11963

Test Date: 3/15/11
Velocity: 14.25 ft/s, 4.3 m/s



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11964

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	23	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.2	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.0	Pass
		Overall Test Results		Pass

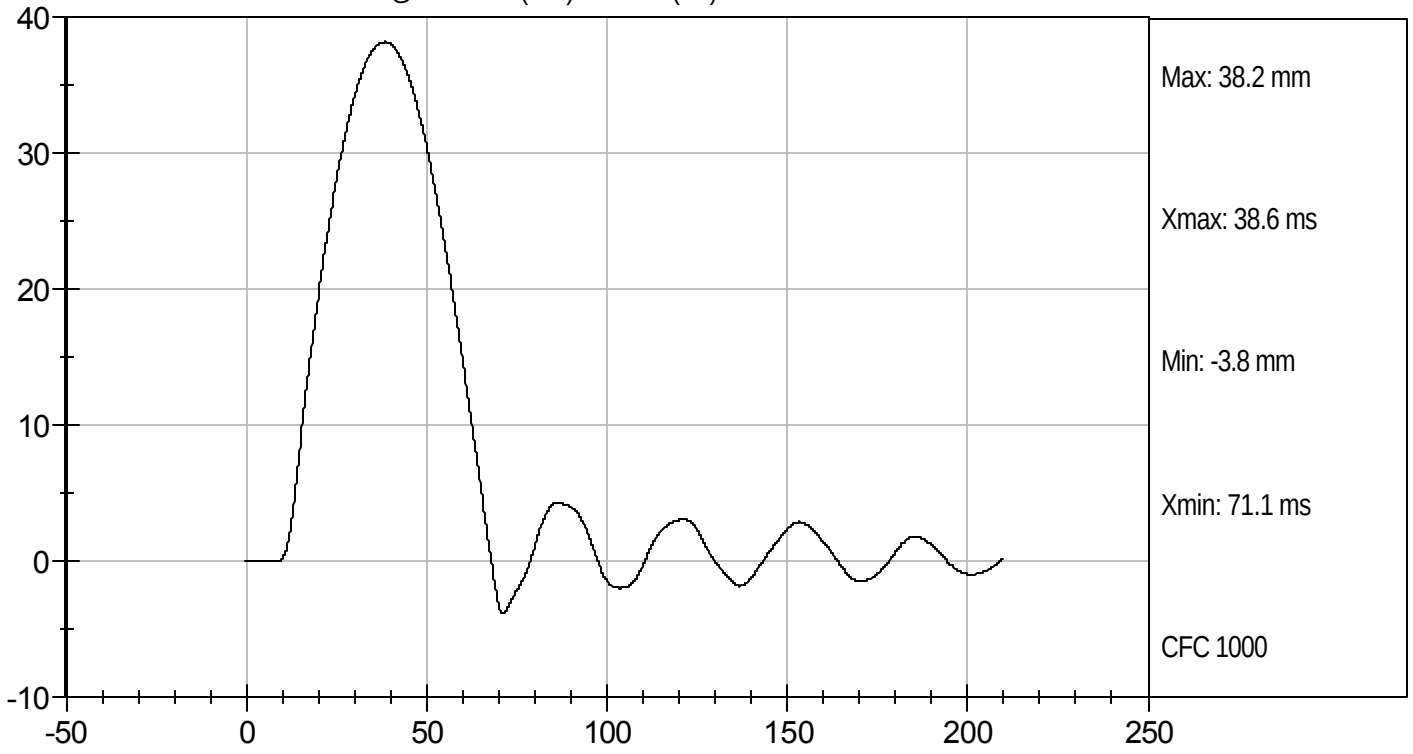
Jessica Gall
Laboratory Technician

3/14/11
Test Date

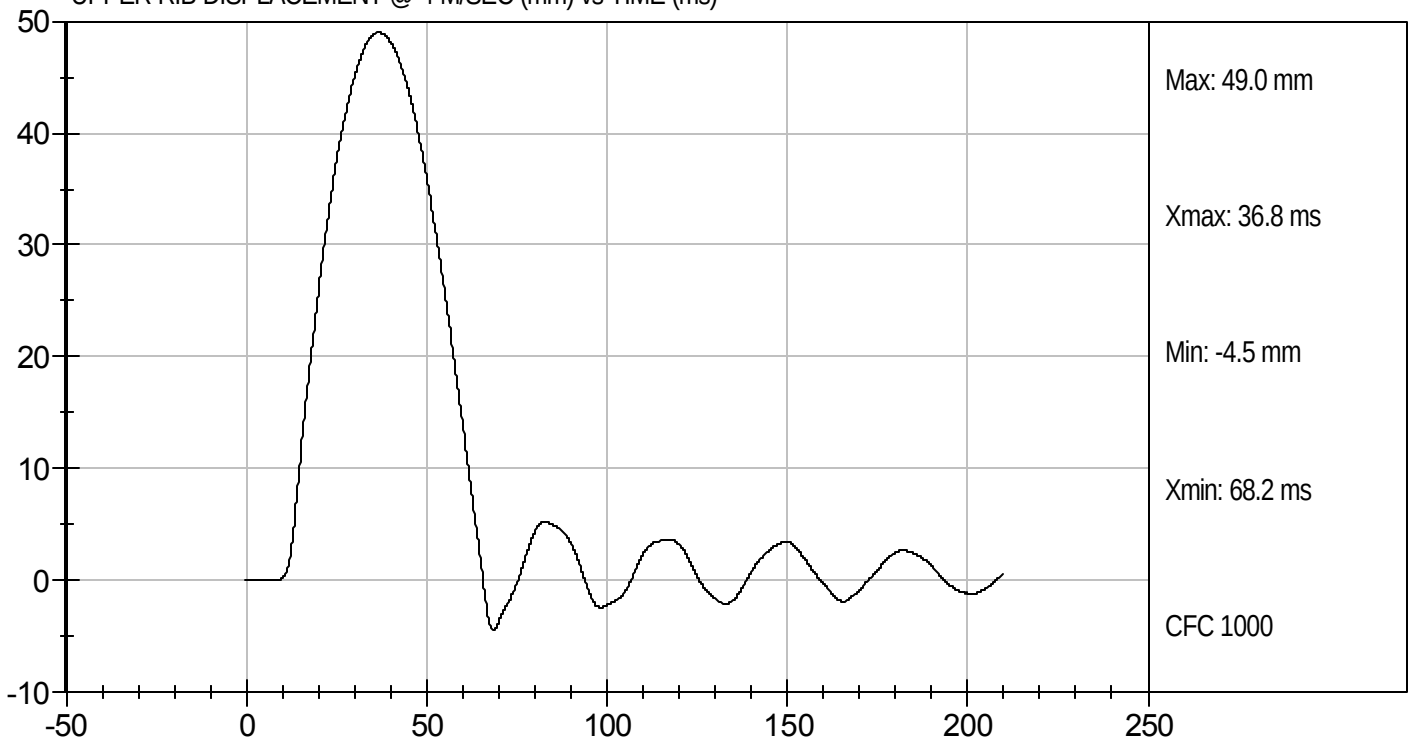
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D11964
Test Date: 3/14/11

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:** D11965

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	23	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.0	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.3	Pass
		Overall Test Results		Pass

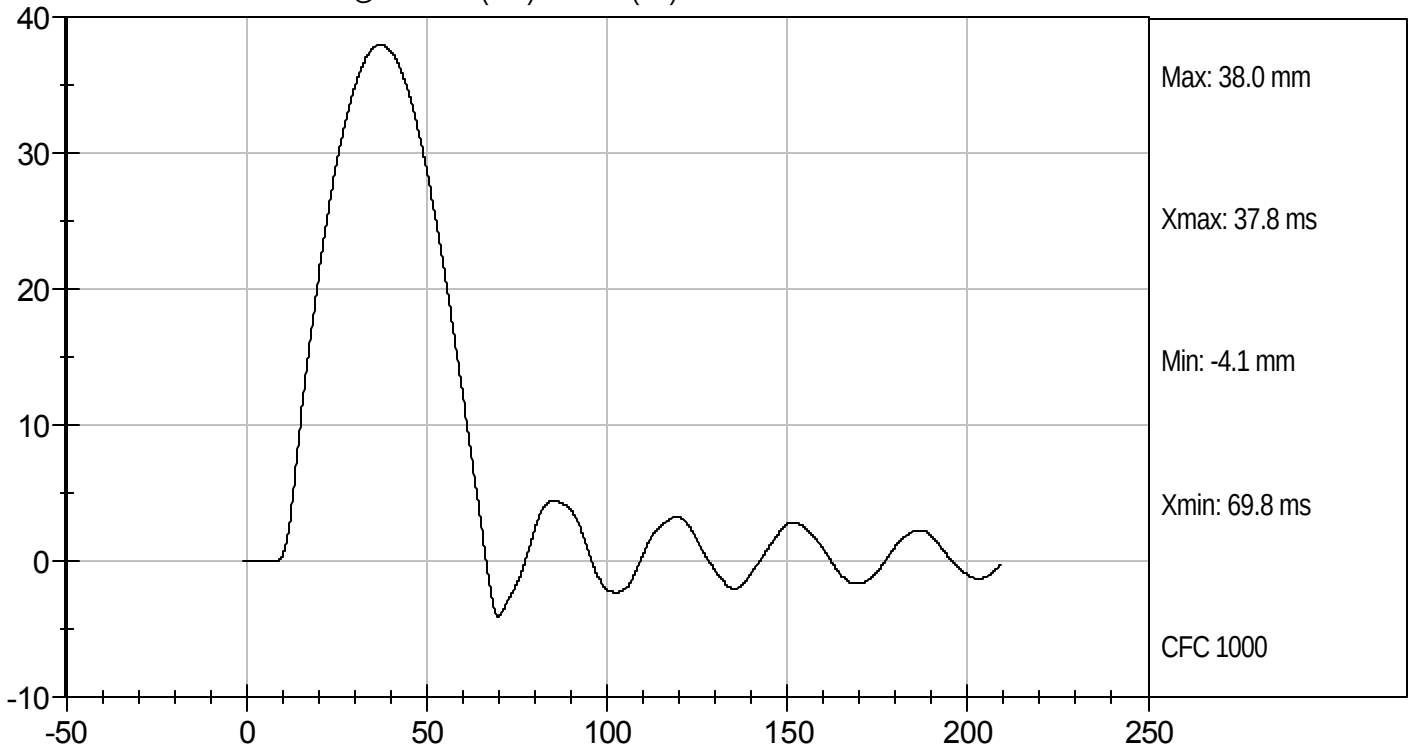
Jessica Gall
Laboratory Technician

3/14/11
Test Date

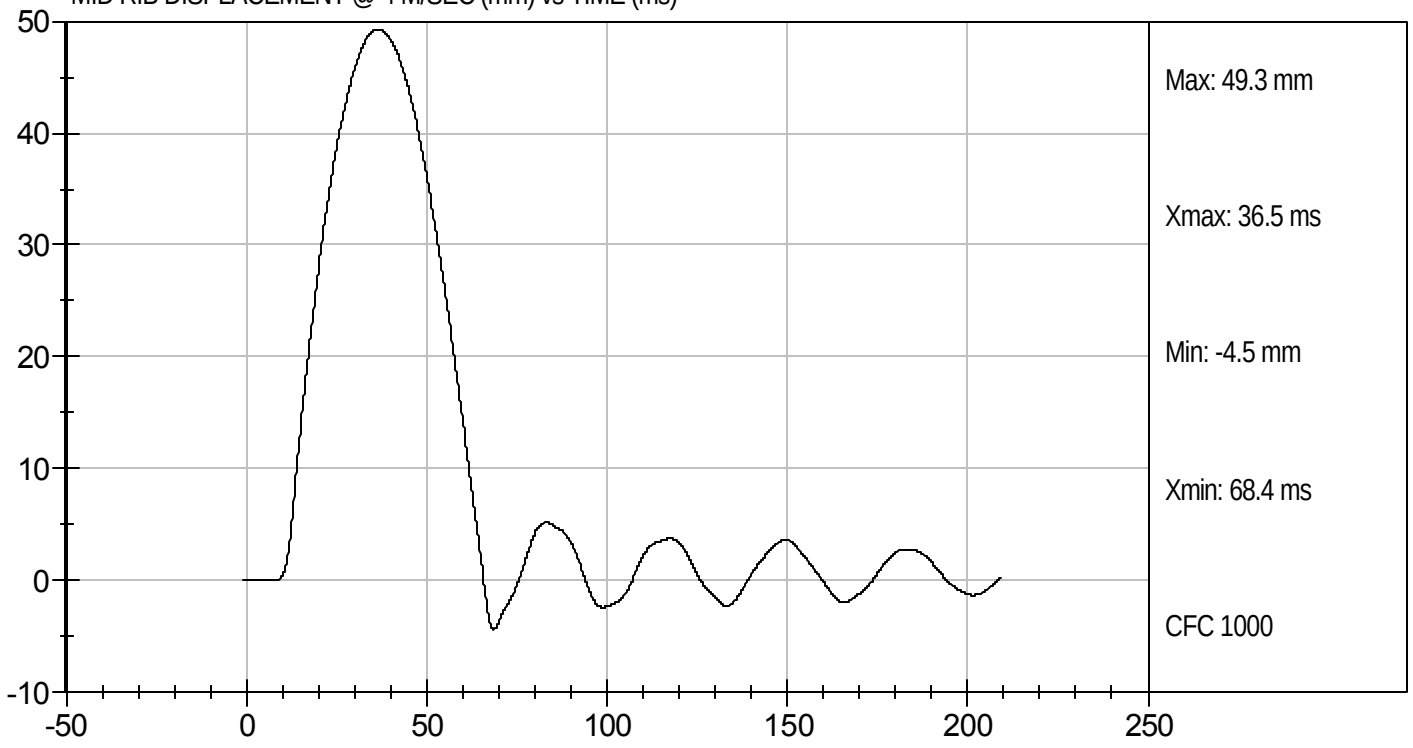
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D11965
Test Date: 3/14/11

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:** D11966

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	23	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	48.5	Pass
		Overall Test Results		Pass

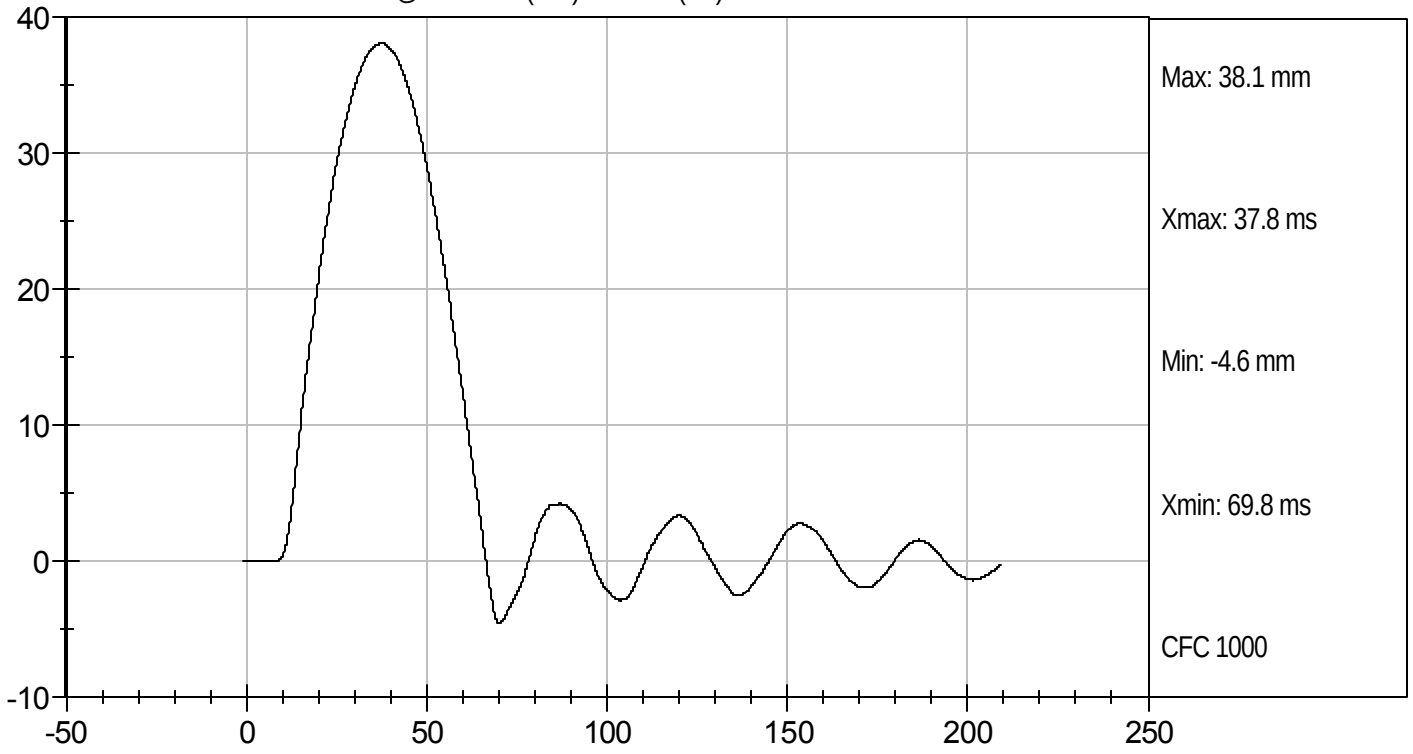
Jessica Gall
Laboratory Technician

3/14/11
Test Date

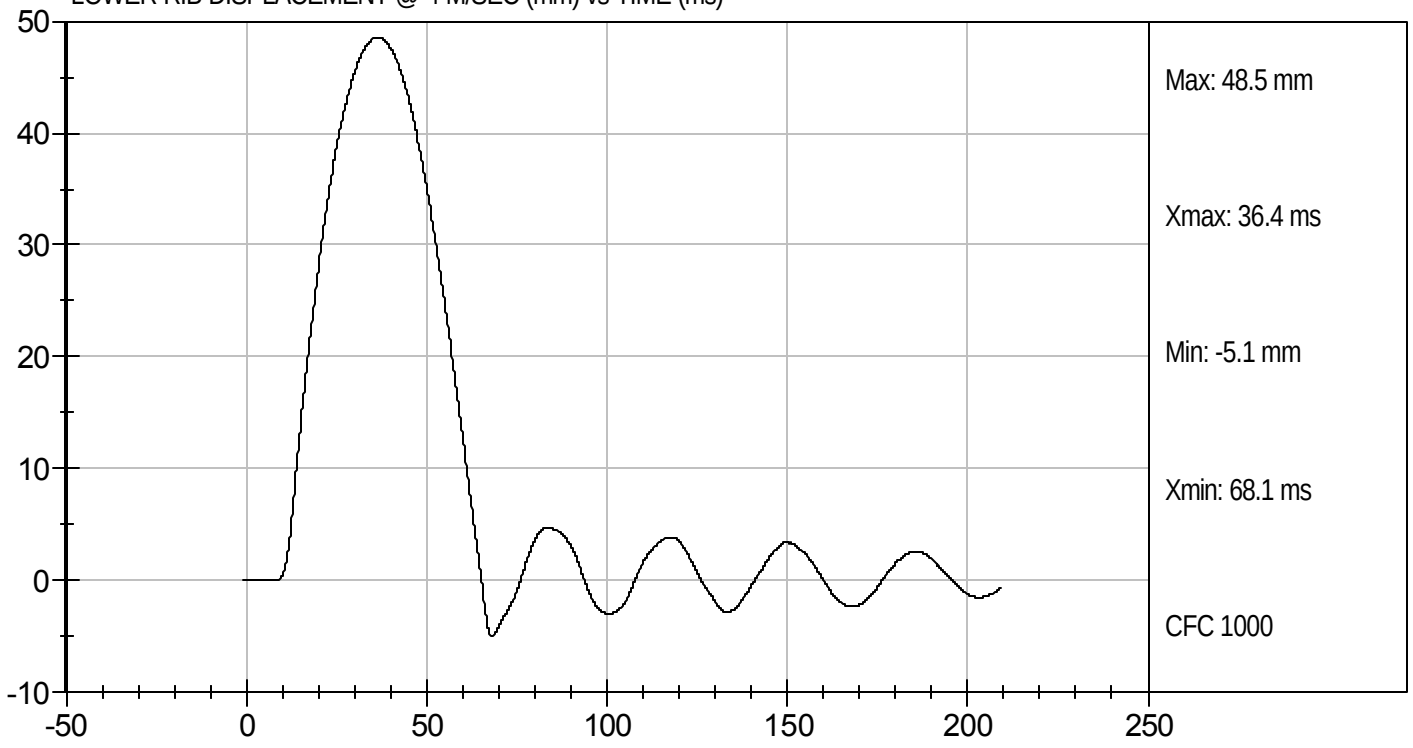
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D11966
Test Date: 3/14/11

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:** D11967

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.30	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.70	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.51	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.10	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

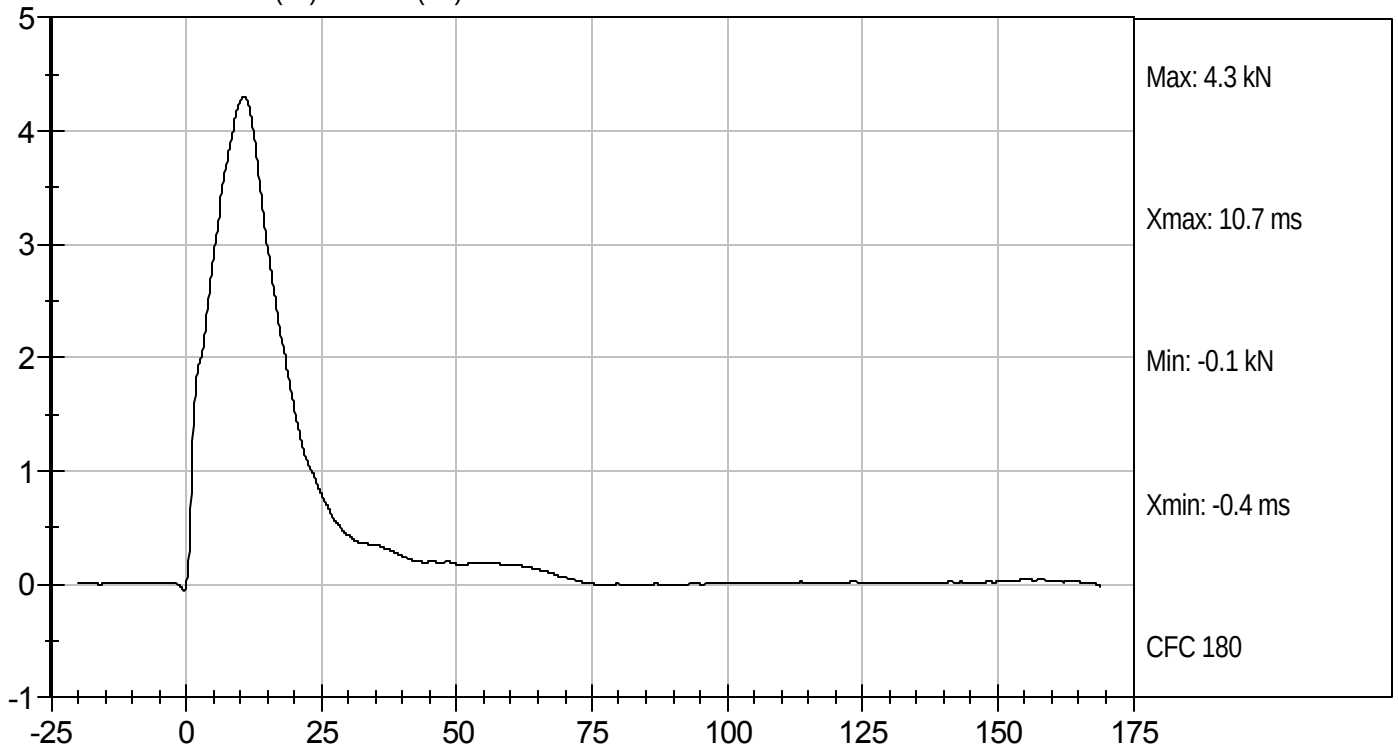
3/15/11
Test Date

David Winkelbauer
Approved By

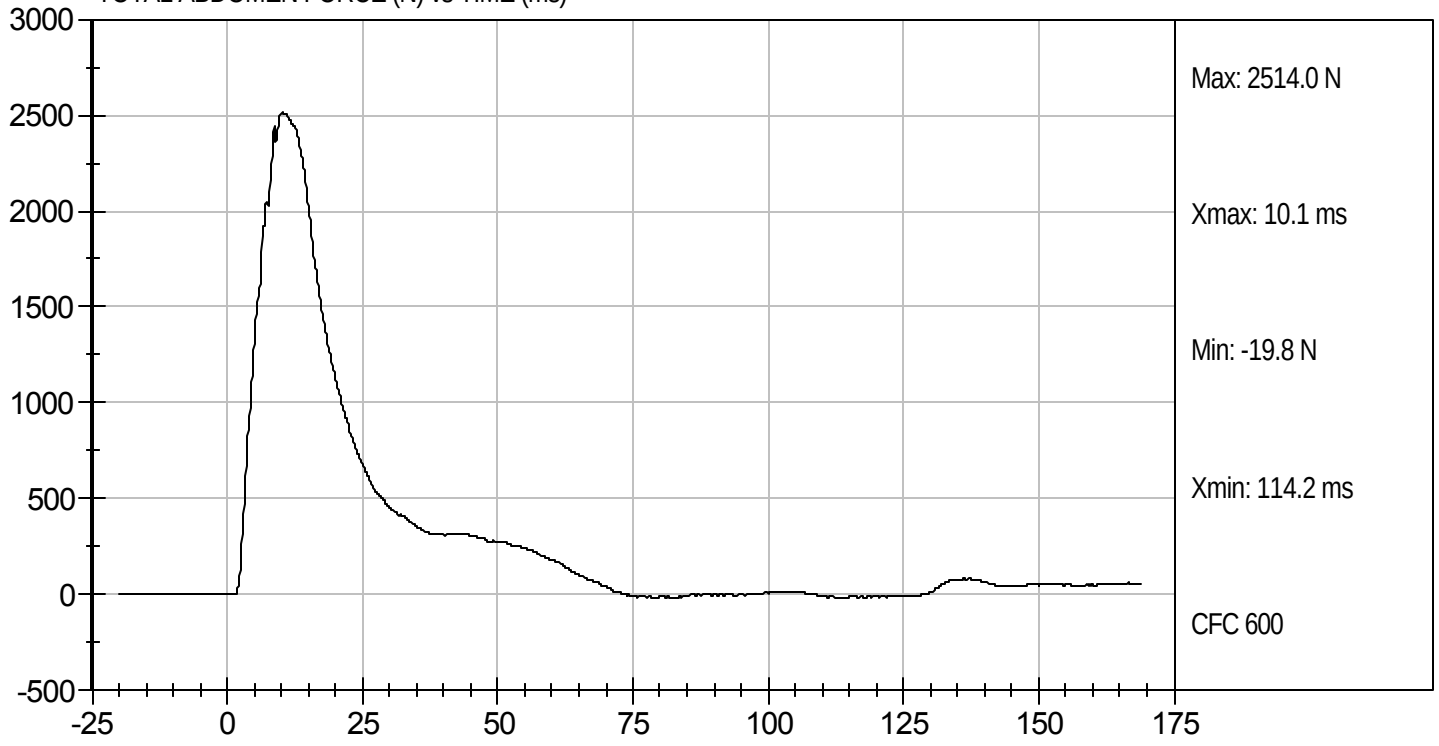
Test Desc: Abdomen Impact
Component ID: D11967

Test Date: 3/15/11
Velocity: 13.33 ft/s, 4.06 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11968

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.03	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.41	Pass
	27 ms	m/s	-6.50 to -5.80	-5.81	Pass
	30 ms	m/s	>= -6.5	-5.81	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	48.0	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	45.1	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	45	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

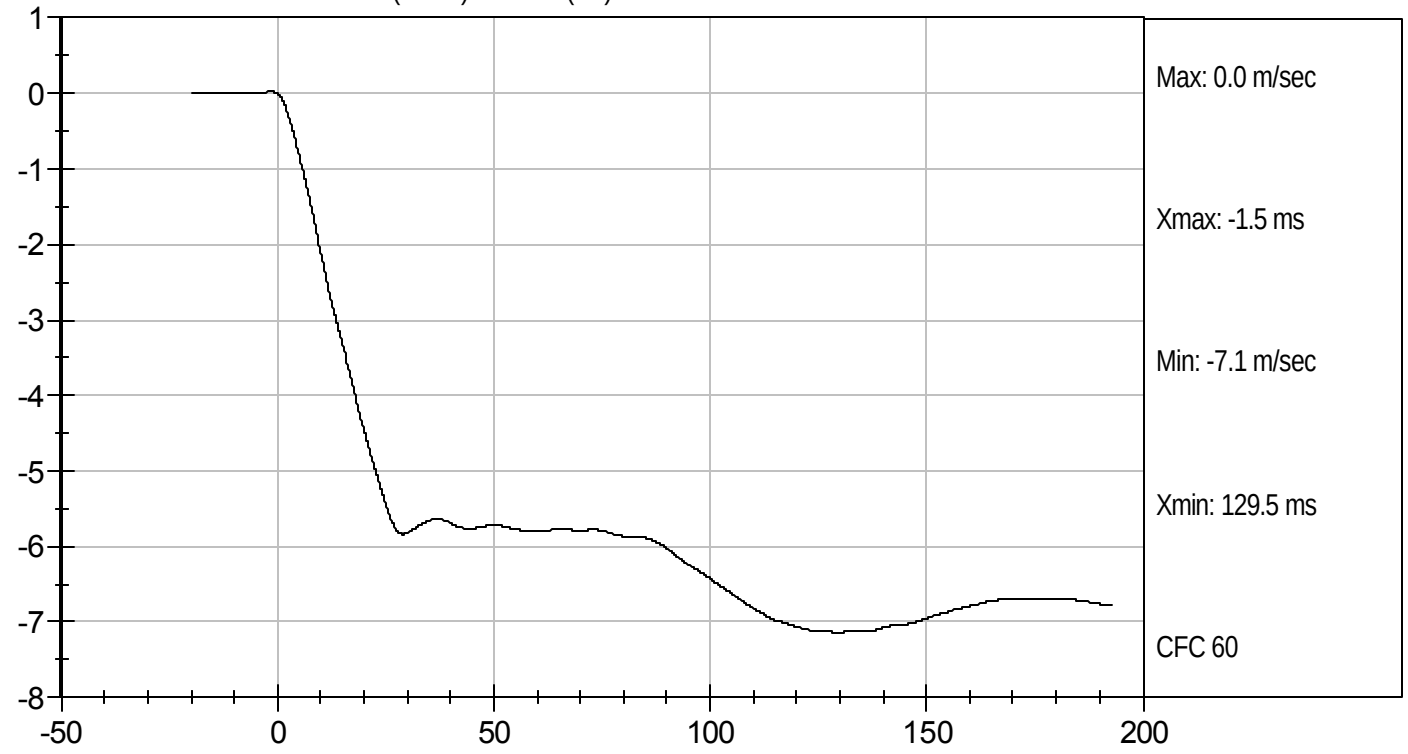
3/14/11
Test Date

David Winkelbauer
Approved By

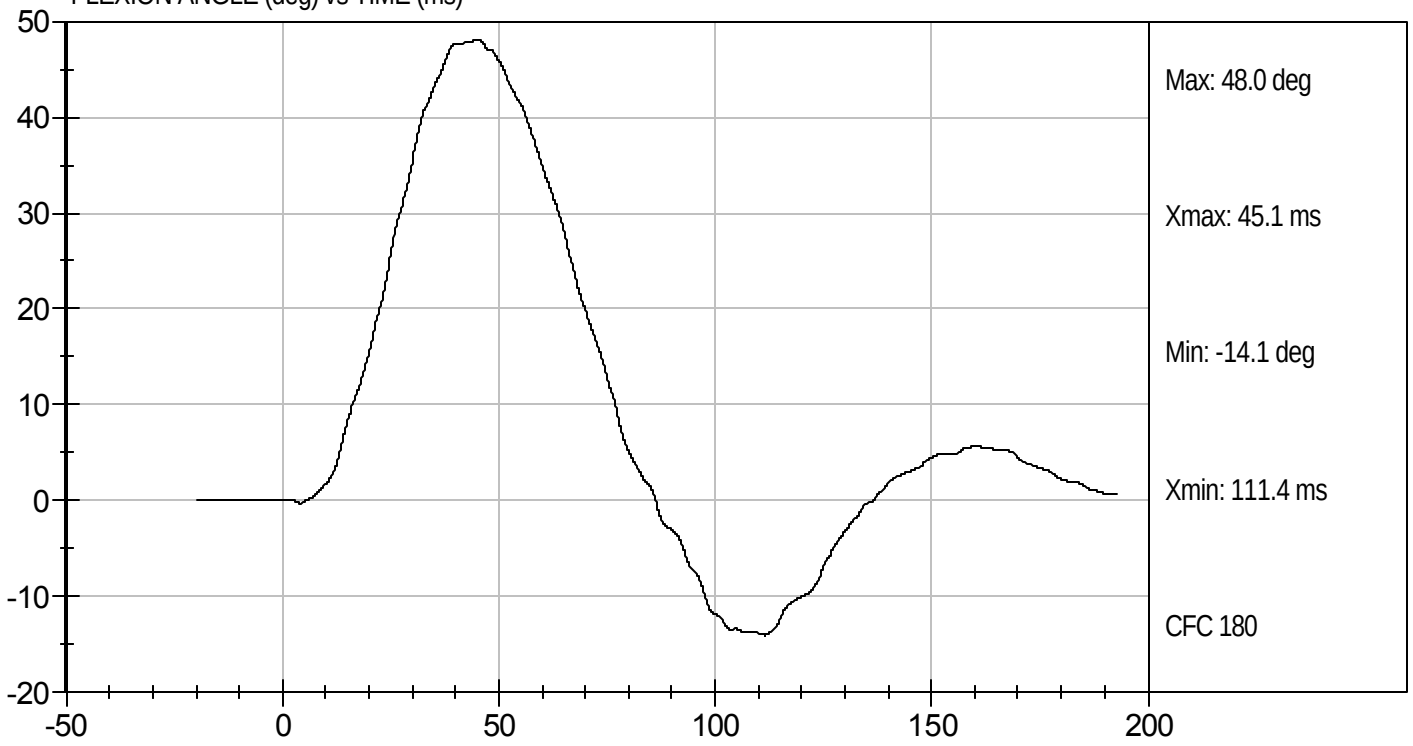
Test Desc: Lumbar Bending
Component ID: D11968

Test Date: 3/14/11
Velocity: 20.08 ft/s, 6.12 m/s

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

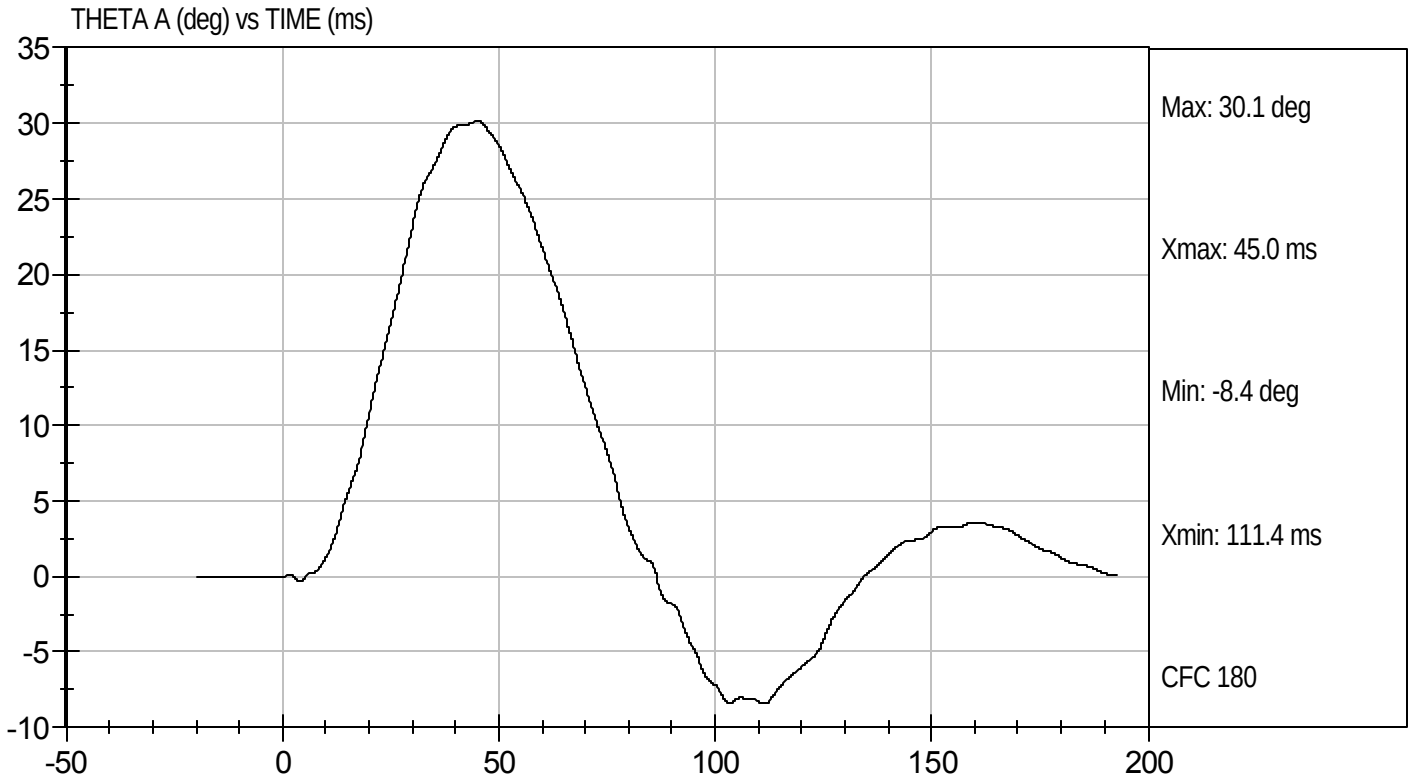


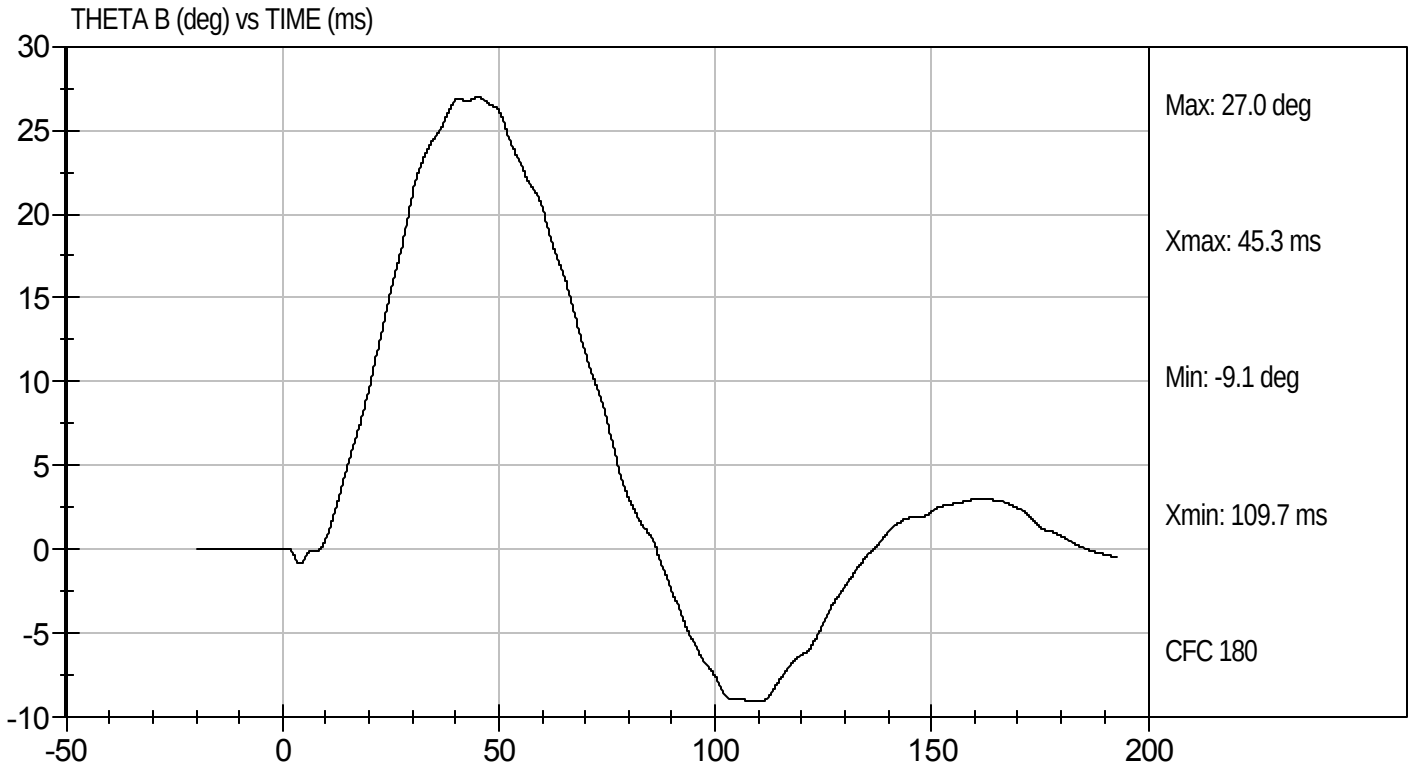
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D11968

Test Date: 3/14/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11969

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	22	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.74	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	12.90	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.31	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	13.90	Pass
		Overall Test Results		Pass

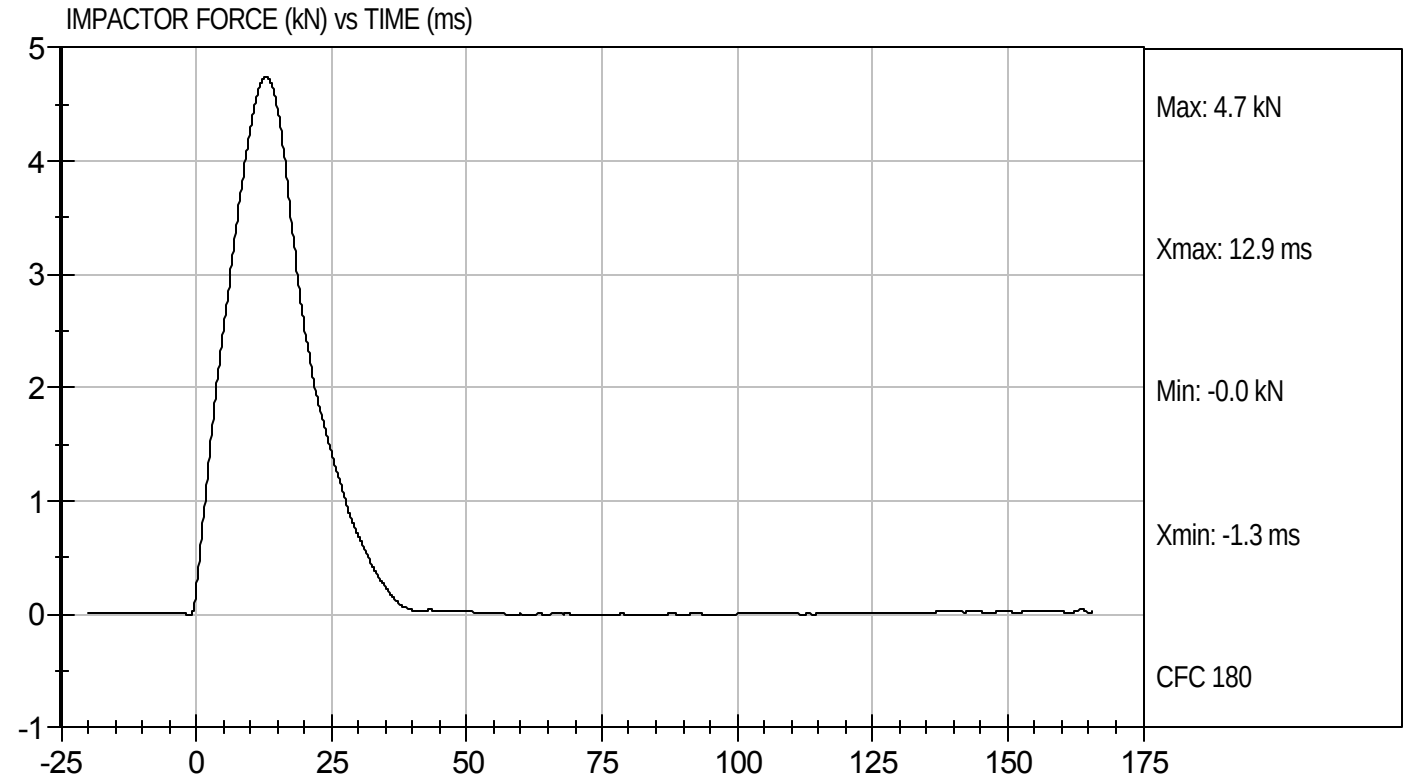
Jessica Gall
Laboratory Technician

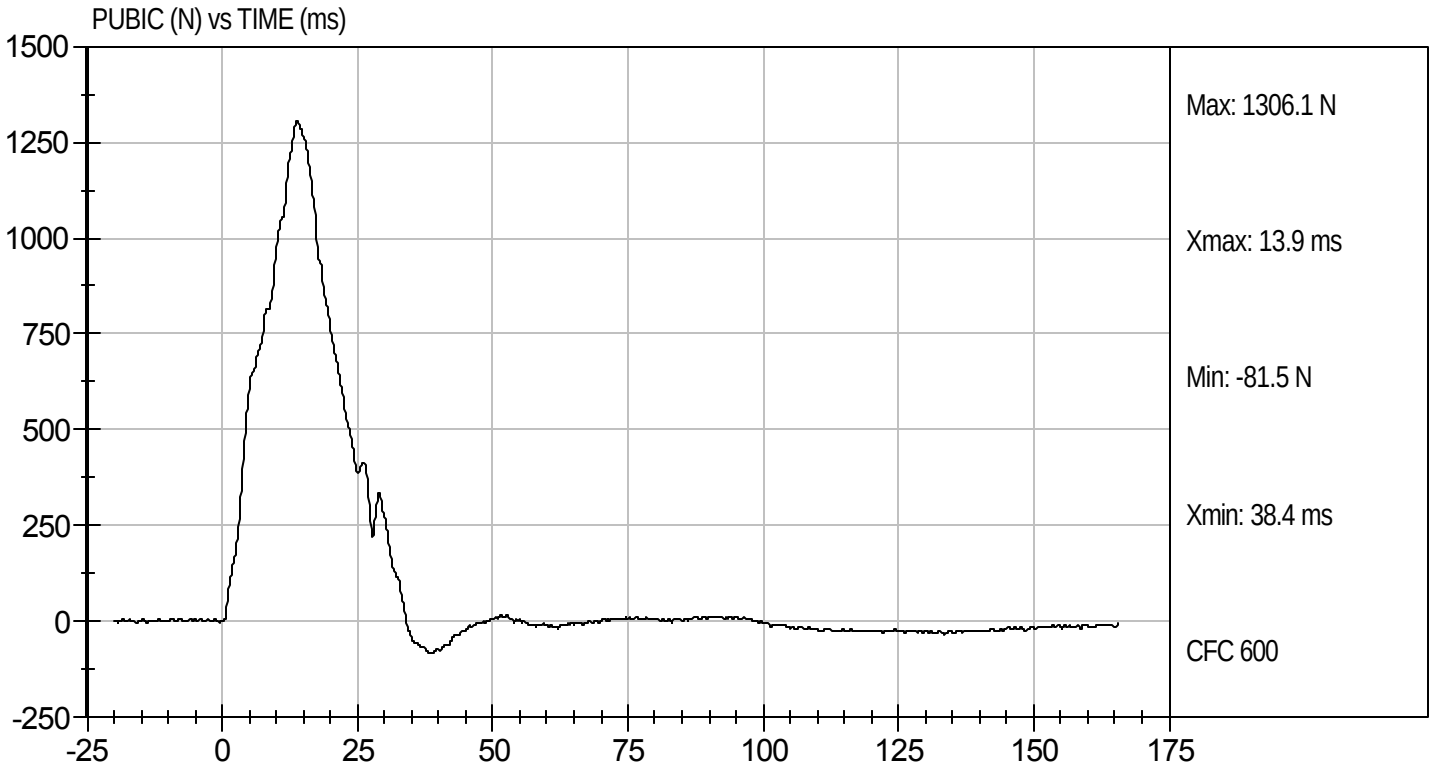
3/15/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D11969

Test Date: 3/15/11
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:** D11960

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	21	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.18	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.6	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.7	Pass
Lower Rib Displacement	mm	37.0 to 44.0	39.8	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

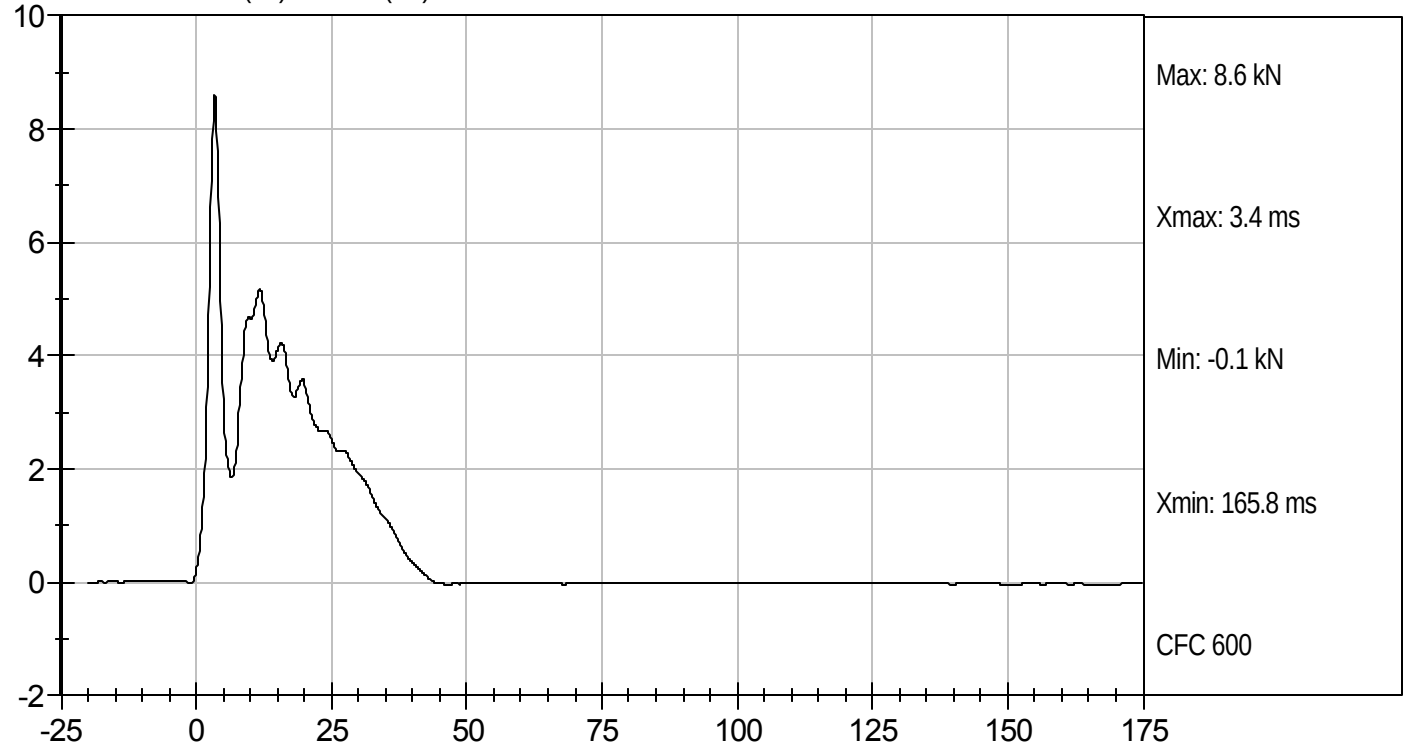
3/15/11
Test Date

David Winkelbauer
Approved By

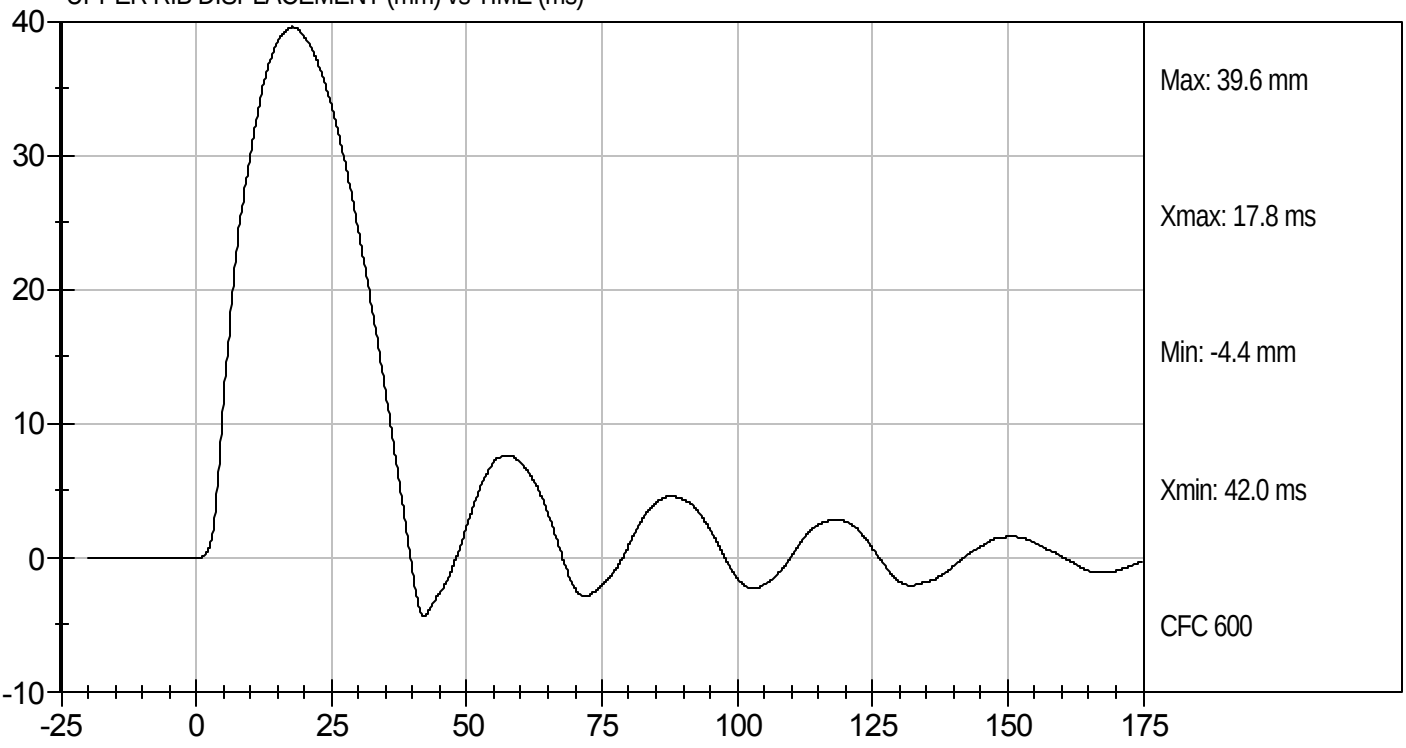
Test Desc: Thorax Impact
Component ID: D11960

Test Date: 3/15/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



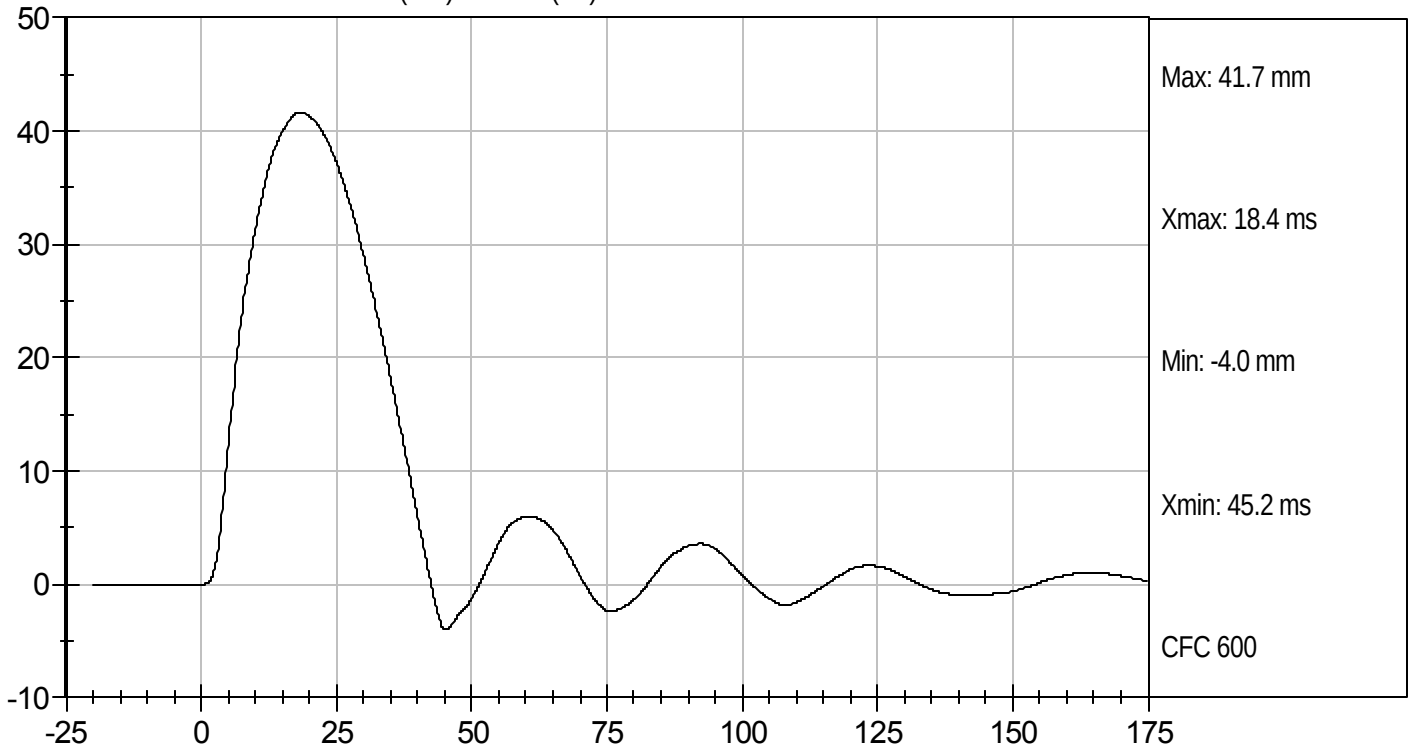
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



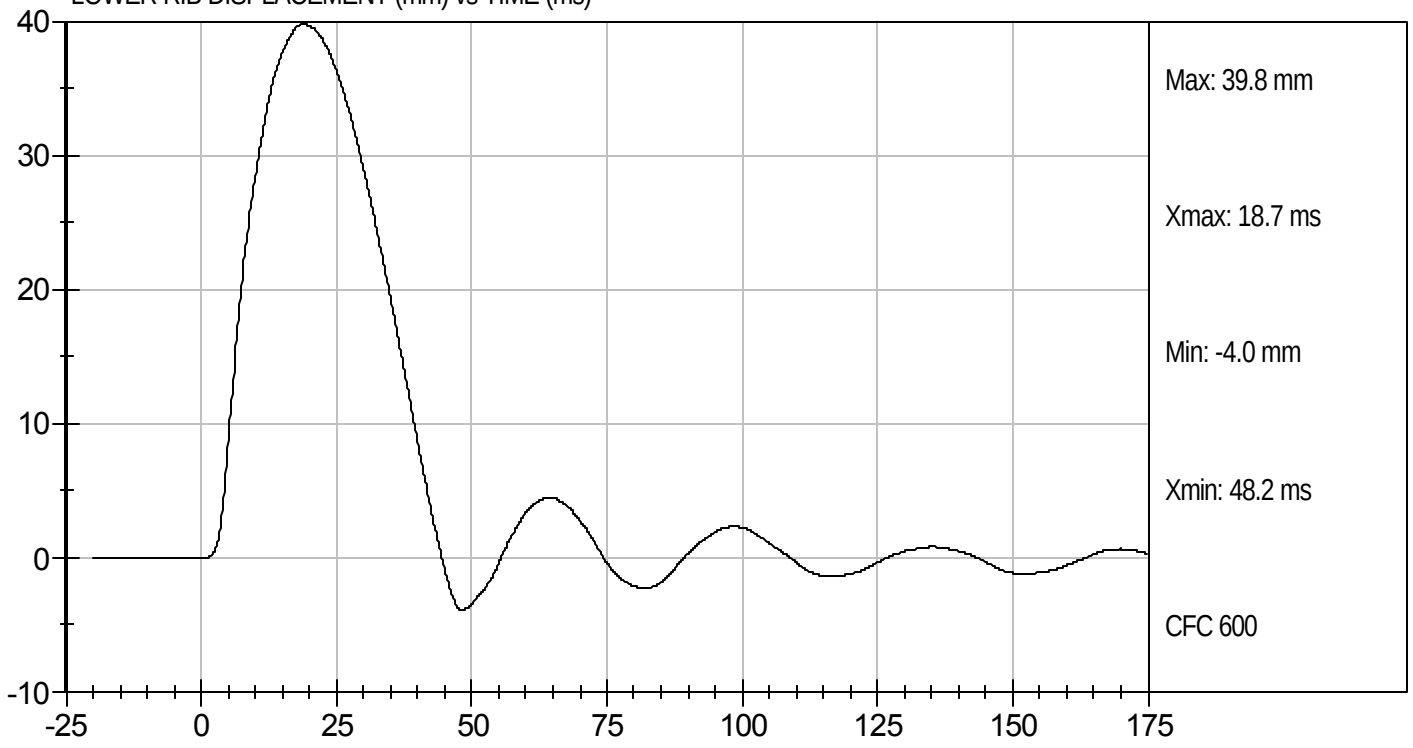
Test Desc: Thorax Impact
Component ID: D11960

Test Date: 3/15/11
Velocity: 18.32 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



APPENDIX E

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

Table 1 – Dummy Instrumentation

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

Table 2 – Vehicle Instrumentation

	Serial Number	Manufacturer	Calibration Date
Vehicle CG (X)	P49473	Endevco	12/03/2010
Vehicle CG (Y)	P49474	Endevco	12/03/2010
Vehicle CG (Z)	P49475	Endevco	12/03/2010
Left Floor Sill (Y)	P37910	Endevco	1/13/2011
A Pillar Sill (Y)	P59217	Endevco	11/05/2010
A Pillar Low (Y)	P47810	Endevco	2/19/2011
A Pillar Mid (Y)	P52212	Endevco	2/19/2011
B Pillar Sill (Y)	P59244	Endevco	12/03/2010
B Pillar Low (Y)	P53288	Endevco	1/13/2011
B Pillar Mid (Y)	P47893	Endevco	12/13/2010
Seat (Y)	P47118	Endevco	9/15/2010
Engine (X)	P48167	Endevco	12/03/2010
Engine (Y)	P48166	Endevco	12/03/2010
Firewall (Y)	D12-X26	Entran	1/13/2011
Roof (Y)	P52226	Endevco	11/05/2010
Floor Sill (Y)	P59283	Endevco	1/13/2011
Rear Deck (X)	P59241	Endevco	12/22/2010
Rear Deck (Y)	P59240	Endevco	12/22/2010