REPORT NUMBER: TO1-MGA-2004-028

OBLIQUE RIGID SIDE POLE IMPACT
SIDIIsD DRIVER POSITION
TEST DATE: August 18, 2005
Task Order #T0001 / RFP #0004

2005 Saturn Ion
NHTSA NUMBER: R50170

PREPARED BY:
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This final test report was prepared for the U.S. Department of Transportation, Volpe National Transportation System Center, in response to Contract Number DTRS57-04-D-30001.

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TABLE OF CONTENTS

SECTION 1
PURPOSE AND TEST PROCEDURE

This Side Impact test is conducted as part of Contract No. DTRS57-04-D-30001, RFP 4, Task Order 1, sponsored by the U.S. Department of Transportation, Volpe National Transportation System Center. The purpose of this test is to evaluate the responses of the SIDIIsD in a 2005 Saturn Ion, when subjected to a rigid pole side impact at 285 degrees.

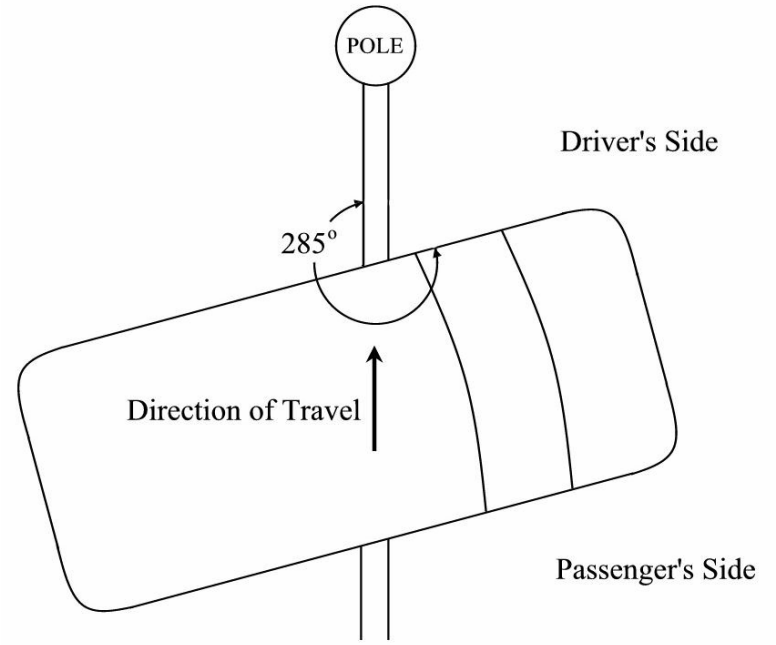
MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
SUMMARY OF SIDE IMPACT TEST

A rigid pole side impact test at 285 degrees was performed on a 2005 Saturn Ion. The subject vehicle was towed into a rigid pole at a velocity of 32.3 km/h. The weight of the vehicle as tested was 1405.5 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on August 18, 2005. Pre- and post-test photographs of the test vehicle and the dummies are included in Appendix A.

One SIDIIsD side impact dummy was placed in the left front designated seating position according to instructions specified in TP-214P-00 dated May 21, 2004. The side impact event was documented by twelve high speed cameras and one real time camera. Camera locations and other pertinent camera information can be found in this report.

Appendix B contains the vehicle and dummy response data traces. A summary of the dummy configuration and performance verification test data is shown in Appendix C. Dummy and vehicle calibration data can be found in Appendix D of this report.



SECTION 2...continued

SUMMARY OF SIDE IMPACT TEST

The following tables summarize the results of the Left Side Impact Test:

Rib Deflection (mm) CFC 180	
Upper Thorax Rib	-32.4
Mid Thorax Rib	-25.8
Lower Thorax Rib	-19.9
Upper Abdominal Rib	-44.6
Lower Abdominal Rib	-52.3

.

Abdominal Forces (N) CFC 600	
Left Acetabulum Force	2991
Left Ilium Crest Force	2778
Sum of Left Acetabulum and Left Ilium	5755

Lower Spine (CFC180)	
Lower Spine Resultant	109.6

		Left Front
HIC 15 & HIC 36	T1 (msec)	55.3
	T2 (msec)	56.4
	T2 – T1 (msec)	1.1
	HIC	5203

TEST NOTES

Left Rear Sill Y – No data collected after 50 msec
Left B Post at Sill Y – No data collected after 80 msec

SECTION 3
SIDE IMPACT DUMMY (SIDIIsD) AND TEST VEHICLE DATA

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

TEST VEHICLE INFORMATION

Make	Saturn
Model	Ion
Body Style	4 door
VIN	1G8AJ54F55Z165701
Odometer Reading (mile)	177
Transmission	Automatic
Final Drive	Front
Number of Cylinders	4
Engine Displacement (L)	2.2
Engine Placement	Lateral

TEST VEHICLE OPTIONS

Front Airbag	Yes
Side Airbags	Curtain
Power Windows	Yes
Power Steering/Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Power Brakes	Yes
Anti-lock Brakes	Yes
AM/FM/CD	Yes
Cruise Control	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Saturn Corporation
Date of Manufacture	04/05

GVWR (kg)	1717
GAWR Front (kg)	898
GAWR Rear (kg)	819

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Cold Pressure (kPa)	210	210
Recommended Tire Size	P195/60R15	P195/60R15
Tire Size on Vehicle	P195/60R15	P195/60R15
Tire Manufacturer	Firestone	Firestone

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				408
Cargo Wt. (RCLW) (kg)				67.6

DATA SHEET NO. 1… (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	391.0	255.0		429.0	292.0	
Right	kg	390.5	251.0		409.5	275.0	
Ratio	%	60.7	39.3		59.7	40.3	
Totals	kg	781.5	506.0	1287.5	838.5	567.0	1405.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1287.5
Weight of SIDIIsD Side Impact Dummy	kg	54.4
Rated Cargo/Luggage Weight (RCLW)	kg	67.6
Calculated Vehicle Target Weight (TVTW)	kg	1409.5

TEST VEHICLE ATTITUDES

	Unit	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	Deg	0.6 BD	0.1 BD	0.1 BD
Left Door Sill Angle	Deg	0.8 BD	0.1 BD	0.1 BD
Front Bumper Angle	Deg	0.1 RD	0.4 RD	0.4 RD
Rear Bumper Angle	Deg	0.2 RD	0.4 RD	0.4 RD

ND=Nose down, BD = Back Down, LD = Left Down, RD = Right Down

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2632
Total Vehicle Length at Centerline	mm	4681
Total Vehicle Width	mm	1709
Weight of Ballast in Cargo Area	kg	0
Amount of Water in Fuel Tank	liters	49.2

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Impact Reference Line From Front Axle	mm	1050
Impact Point	mm	24 forward
Impact Angle Difference	deg	1

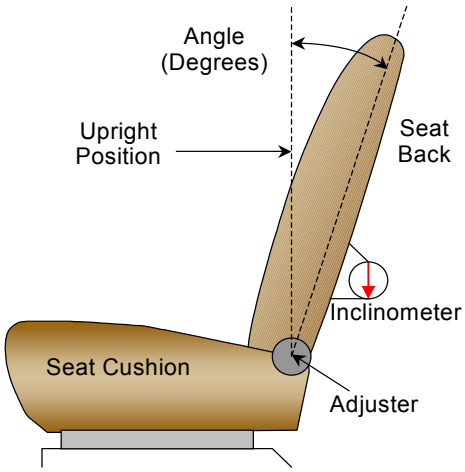
DATA SHEET NO. 1… (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

SID IIs RIDING POSITION

Driver seat back angle: 7.3° forward on head rest post



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

Driver seat fore/aft total travel: 27 positions

Driver seat fore/aft position: Full forward

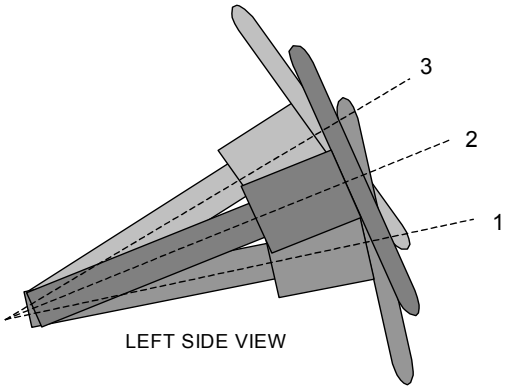
SEAT BELT UPPER ANCHORAGE

The test vehicle "D" ring anchorage for the driver's seat position was placed in the lowest position.

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position of travel.

Steering column position: 18.5°



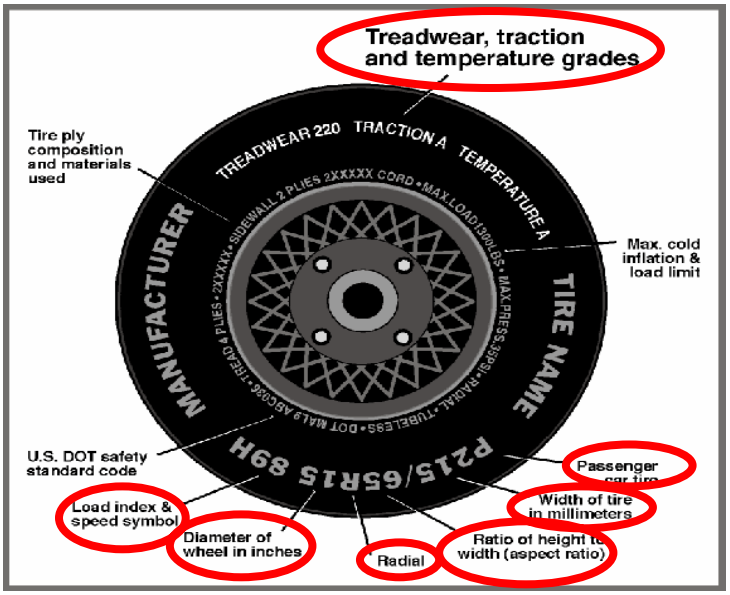
STEERING COLUMN ASSEMBLY

DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

Vehicle Year	2005	Vehicle Make	Saturn
VIN	1G8AJ54F55Z165701	Vehicle Model	Ion



	Front	Rear
Tire Manufacturer	Firestone	Firestone
Tire Name	Affinity	Affinity
Tire Type	M+S	M+S
Tire Width (mm)	195	195
Ratio of Height to Width (aspect ratio)	60	60
Radial	R	R
Wheel Diameter	15	15
Load Index & Speed Symbol	875	875
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	B	B

DATA SHEET NO. 3

POST TEST OBSERVATIONS

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front
Dummy Type	SIDIIsD
Head Contact	Curtain, Headrest
Upper Torso Contact	Door Panel
Lower Torso Contact	Door Panel
Left Knee Contact	Door Panel
Right Knee Contact	Left Knee

POST TEST DOOR OPENING

Description	Left Front	Left Rear
Left Side Door Opening	Remained latched and closed	Remained latched and closed
Right Side Door Opening	Remained latched and closed	Remained latched and closed

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No failures
Sill Separation	None
Windshield Damage	Windshield broke
Window Damage	Left side windows up for test, left front broke
Other Notable Effects	Upper left corner of windshield separated 497mm (see photograph ..... in Appendix A)

AIRBAG DEPLOYMENT

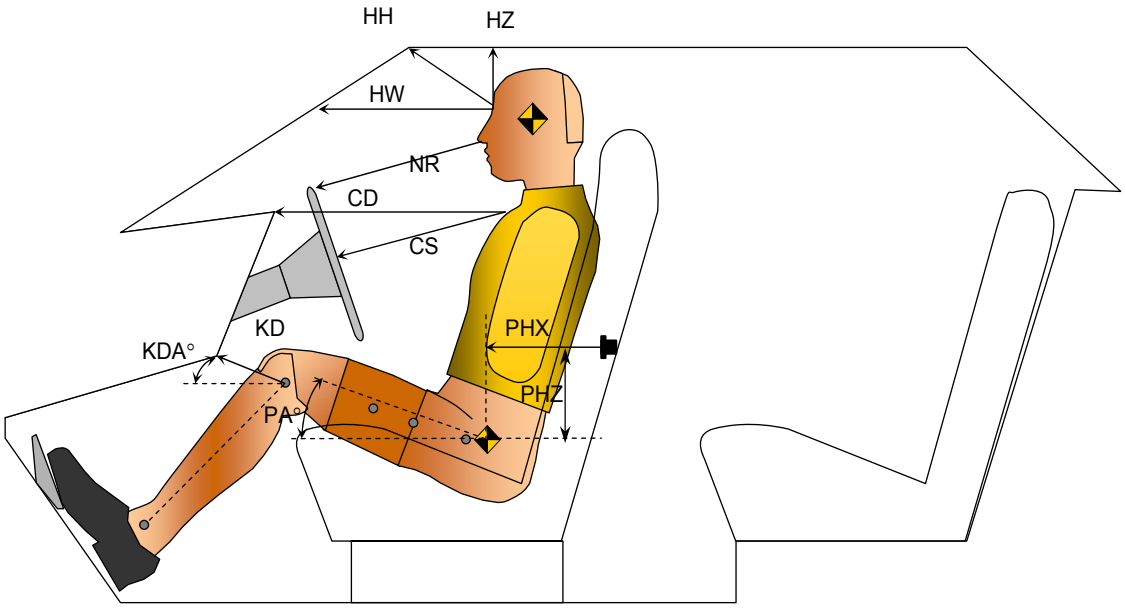
	Driver	Passenger
Front	No	No
Side	N/A	No
Curtain	Yes	No

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 4

SIDIIsD CLEARANCE DIMENSIONS

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

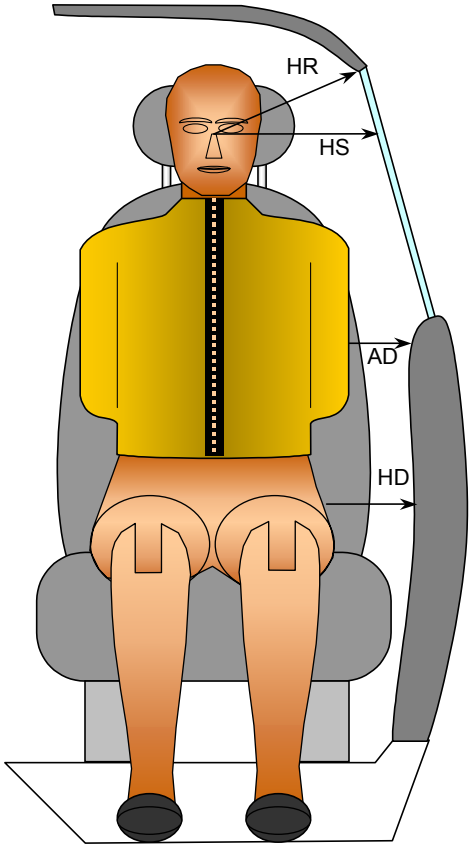


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	250	
HW	Head to Windshield	561	
HZ	Head to Roof	168	
NR	Nose to Rim	183	
CD	Chest to Dash (Top of Rib)	551	
CS	Chest to Steering Wheel (Top of Rib)	158	
KDL	Left Knee to Dash	101	43
KDR	Right Knee to Dash	91	31
PA	Pelvic Angle (Longitudinal)		19.9
PHX	H-Point to Striker (X-Axis)	341	
PHZ	H-Point to Striker (Z-Axis)	101	

DATA SHEET NO. 4 (continued…)

SIDIIsD CLEARANCE DIMENSIONS

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005



FRONT VIEW OF DUMMY

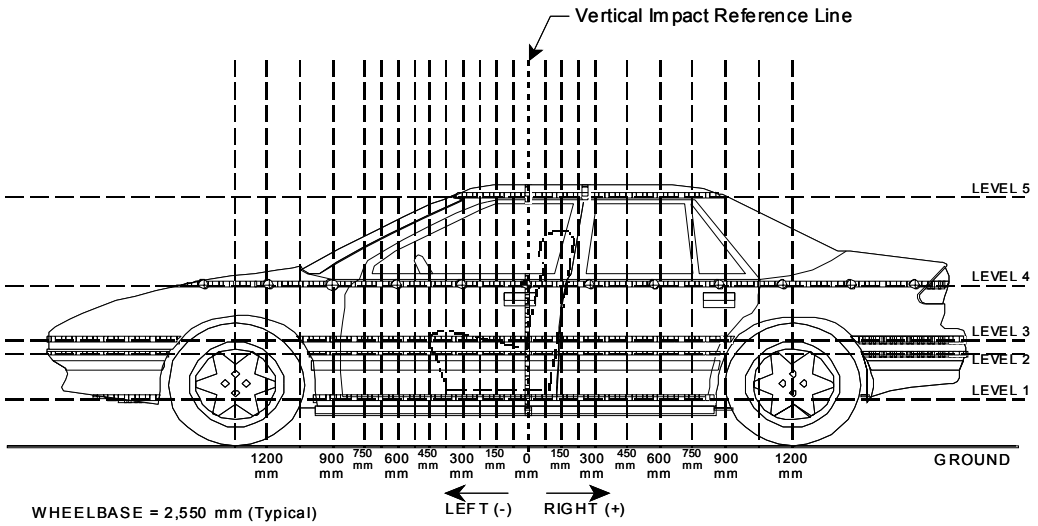
Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	229
HS	Head to Side Window	mm	377
AD	Arm to Door	mm	132
HD	H-Point to Door	mm	127

DATA SHEET NO. 5

VEHICLE SIDE MEASUREMENTS

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

PRETEST AND POST TEST EXTERIOR PROFILE MEASUREMENTS



LEFT SIDE VIEW

Measurements are taken with vehicle in the as tested condition.
Measurements along the vertical 0 mm.
All measurements below in mm.

Level	Measurement Description	Height Above Ground
5	Window	1432
4	Window Sill	920
3	Mid Door	635
2	Occupant H-Point	525
1	Sill Top	280

DATA SHEET NO. 6

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

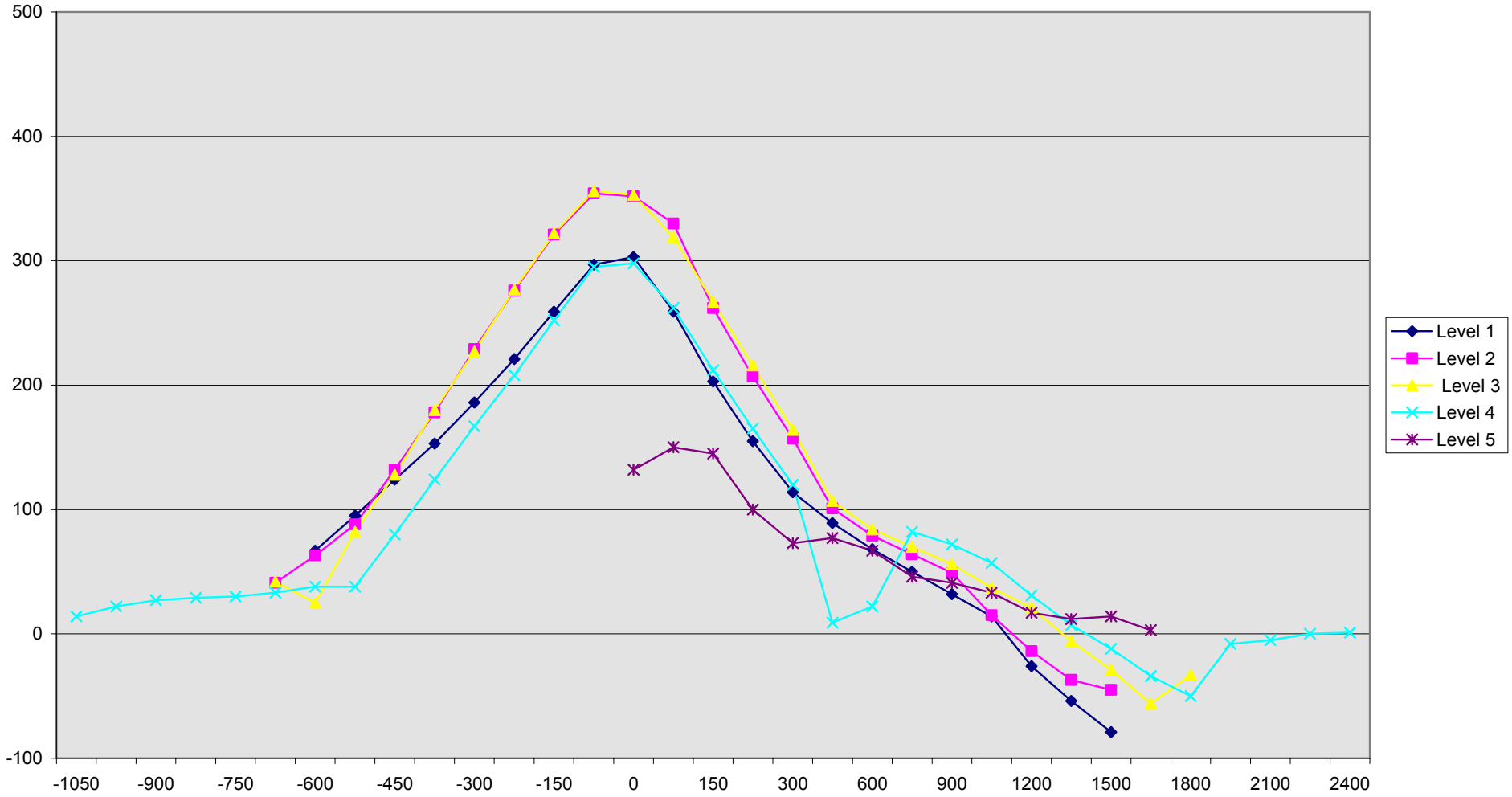
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1050				325					339					14	
-975				316					338					22	
-900				312					339					27	
-825				311					340					29	
-750				308					338					30	
-675		258	252	305			299	294	338			41	42	33	
-600	296	259	258	303		363	322	283	341		67	63	25	38	
-525	297	259	258	303		392	347	340	341		95	88	82	38	
-450	297	257	256	304		421	389	384	384		124	132	128	80	
-375	296	255	253	304		449	433	433	428		153	178	180	124	
-300	295	252	252	304		481	481	479	471		186	229	227	167	
-225	294	251	250	305		515	527	527	513		221	276	277	208	
-150	292	250	249	305		551	571	571	557		259	321	322	252	
-75	292	249	249	305		589	603	605	600		297	354	356	295	
0	292	249	248	306	507	595	601	601	604	639	303	352	353	298	132
75	292	248	248	307	503	551	578	567	569	653	259	330	319	262	150
150	292	248	249	308	500	495	510	516	520	645	203	262	267	212	145
225	292	249	249	309	500	447	456	465	474	600	155	207	216	165	100
300	292	249	249	310	500	406	406	413	430	573	114	157	164	120	73
450	292	250	250	311	500	381	351	357	379	577	89	101	107	68	77
600	293	250	250	311	501	361	328	334	333	568	68	79	84	22	67
750	293	249	250	311	504	343	313	320	393	550	50	64	70	82	46
900	293	249	250	312	506	325	298	306	384	547	32	49	56	72	41
1050	293	249	250	313	508	307	265	287	370	541	14	15	37	57	33
1200	295	250	252	316	509	269	239	273	347	526	-26	-14	21	31	17
1350	298	253	255	320	510	244	216	249	327	522	-54	-37	-6	7	12
1500	297	253	257	325	511	218	202	228	313	525	-79	-45	-29	-12	14
1650			250	327	528			194	293	531			-56	-34	3
1800			242	329				209	279				-33	-50	
1950				335					327					-8	
2100				342					337					-5	
2250				350					350					0	
2400				363					364					1	

Reference plane is parallel to test vehicle longitudinal centerline.
Given dimensions = Reference plane to car body. Measurements are in mm.

DATA SHEET NO. 6... (continued)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

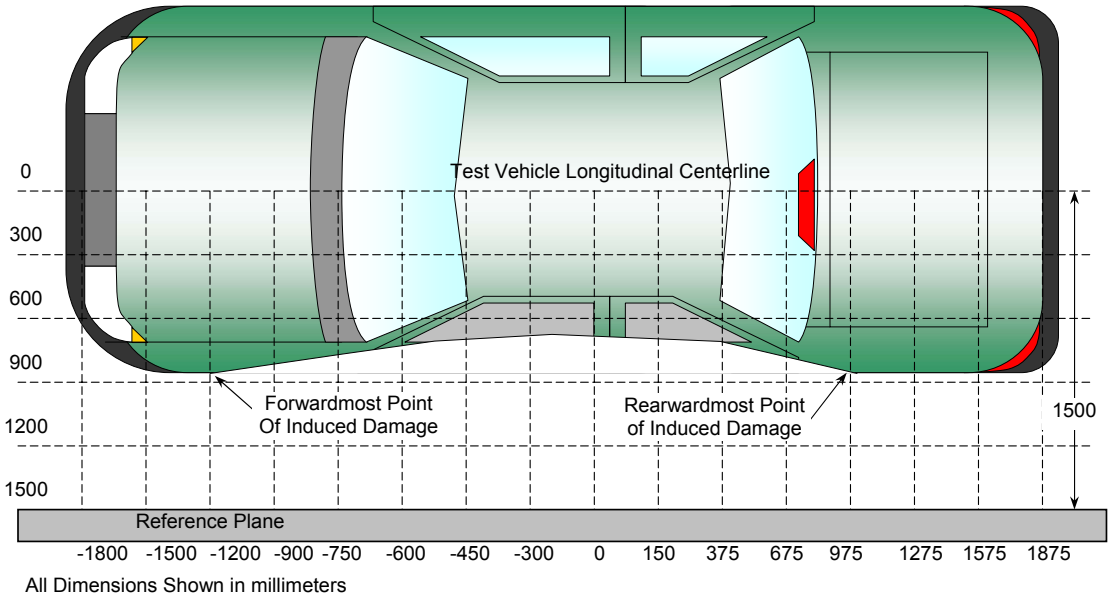


Measurement in mm.

DATA SHEET NO. 7

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005



TOP VIEW

Damage Profile Distances

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	1650 mm	5	528	531	3
2	1105 mm	4	314	363	49
3	545 mm	3	250	342	92
4	5 mm	3	248	598	350
5	-560 mm	3	258	308	50
6	-1050 mm	4	325	339	14

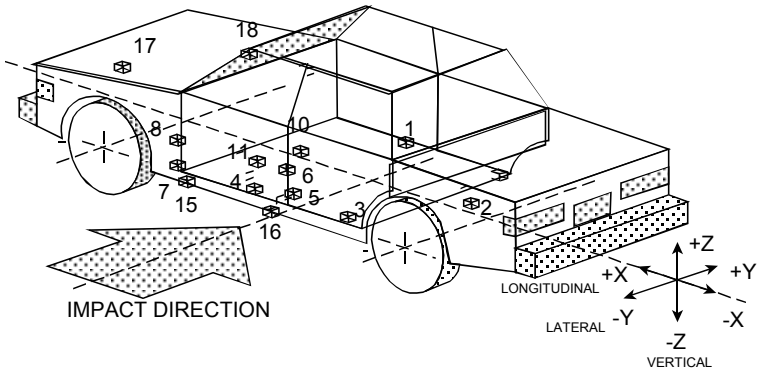
Reference plane is parallel to test vehicle longitudinal centerline.

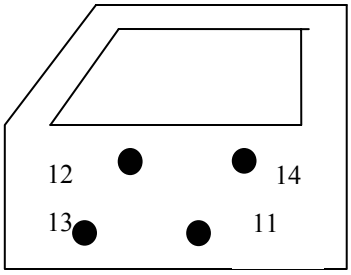
Given dimensions = Reference plane to car body.

DATA SHEET NO. 8

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005





No.	Location
1	Right Side Sill at Front Seat
2	Rear Floorpan Above Axle
3	Left Side Sill at Rear Door
4	Left Side Sill at Front Door
5	Left Lower B-Post
6	Left Mid B-Post
7	Left Lower A-Post
8	Left Mid A-Post
9	Driver Seat Track
10	Vehicle CG
11	Left Front Door @ Pelvis

No.	Location
12	Left Front Door @ Arm
13	Left Front Door @ Knee
14	Left Front Door @ Mid Rib
15	Left A-Post @ Sill
16	Left B-Post @ Sill
17	Upper Engine
18	Firewall

DATA SHEET NO. 8... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

Loc. No.	Accelerometer Location	Long (X) Maximums (g's) (CFC 60)		Lat. (Y) Maximums (g's) (CFC 60)		Vert. (Z) Maximums (g's) (CFC 60)		Resultant (g's) (CFC 60)
		Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Max.
1	Right Side Sill at Front Seat	3.5	-3.7	17.2	-1.0	10.4	-3.8	17.3
2	Rear Floorpan Above Axle	2.6	-6.1	14.1	-1.6	10.3	-12.5	16.5
3	Left Side Sill at Rear Door			*	*			
4	Left Side Sill at Front Door			52.3	-21.7			
5	Left Lower B-Post			51.8	-19.0			
6	Left Mid B-Post			37.9	-9.6			
7	Left Lower A-Post			38.0	-8.6			
8	Left Mid A-Post			25.8	-9.6			
9	Driver Left Seat Track			51.2	-19.5			
10	Vehicle CG	14.0	-16.3	48.7	-13.6	29.9	-9.5	57.3
11	Left Front Door at Pelvis			68.2	-26.6			
12	Left Front Door at Arm			165.3	-8.9			
13	Left Front Door at Knee			195.8	-47.7			
14	Left Front Door at Rib			67.7	-23.8			
15	Left A-post @ Sill			41.8	-6.8			
16	Left B-post @ Sill			**	**			
17	Upper Engine	4.1	-14.4	13.2	-3.2			
18	Firewall			19.2	-1.3			

*No valid data collected after 50 msec
**No valid data collected after 80 msec

Sign Convention X - + forward
Y - + to right
Z - + down

DATA SHEET NO. 8... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005

VEHICLE ACCELEROMETER COORDINATES

Loc. No.	Description	Coordinates (mm)		
		X	Y	Z
1	Right Side Sill at Front Seat	2638	700	232
2	Rear Floorpan Above Axle	1149	-45	515
3	Left Side Sill at Rear Door	1898	-708	235
4	Left Side Sill at Front Door	2825	-705	225
5	Left Lower B-Post	2084	-668	335
6	Left Mid B-Post	2088	-668	335
7	Left Lower A-Post	3131	-690	379
8	Left Mid A-Post	3141	-745	877
9	Driver Left Seat Track	2420	569	461
10	Vehicle CG	2457	0	348
11	Left Door @ Pelvis	2245	-730	598
12	Left Door @ Arm	2551	-732	884
13	Left Door @ Knee	2743	-704	625
14	Left Door @ Rib	2274	-722	911
15	Left A Pillar Sill	3226	-716	226
16	Left B Pillar Sill	2134	-710	230
17	Engine	3908	0	830
18	Firewall	3649	-153	917

Sign Convention X – Rear Bumper (+ forward)

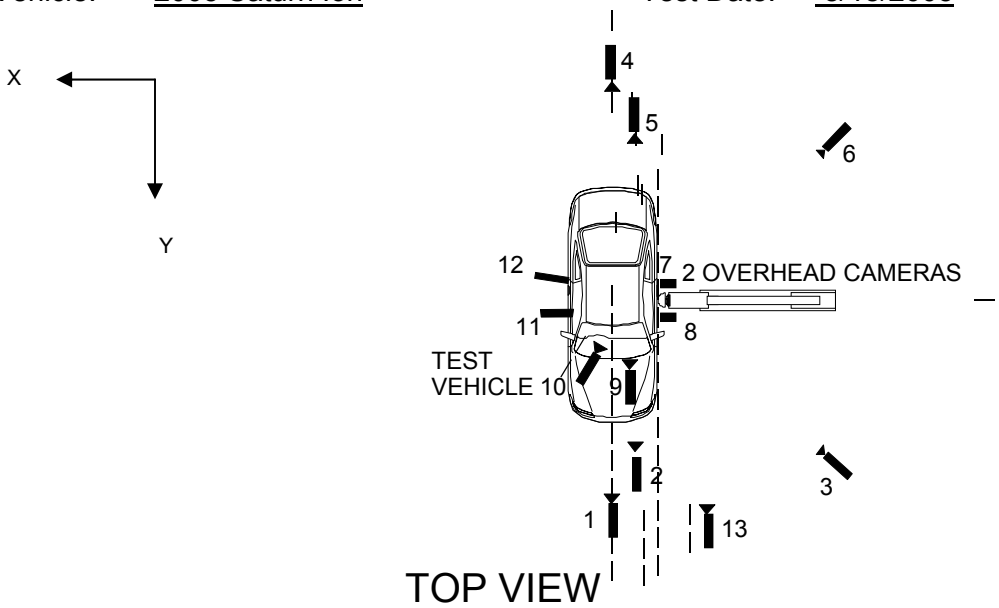
Y – Vehicle Centerline (+ to right)

Z – Ground Plane (+ up)

DATA SHEET NO. 9

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2005 Saturn Ion Test Date: 8/18/2005



TOP VIEW

No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Front Overall	-895	5755	1260	24	1000
2	Front Close Up	-1630	7505	1660	35	1000
3	Front Angle	-2195	2510	1470	24	1000
4	Rear Overall	3225	-9130	1230	24	1000
5	Rear Close Up	1865	-7605	1570	35	1000
6	Rear Angle	-2335	-2690	1510	24	1000
7	Overhead View	495	-1160	5725	14	1000
8	Overhead Close Up	35	0	5050	19	1000
9	Onboard Driver Front				13	500
10	Onboard Driver Hip				10	500
11	Onboard Driver Side				8	500
12	Onboard Rear Curtain				8	500
13	Real Time				13	24

Reference Points X - + Forward of Impact
Y - + Right of Impact
Z - + Up from Ground

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Pre-Test Front View of Test Vehicle

Post-Test Front View of Test Vehicle

Pre-Test Rear View of Test Vehicle

Post-Test Rear View of Test Vehicle

Pre-Test Left Side View of Test Vehicle

Post-Test Left Side View of Test Vehicle

Post-Test Left Side View of Test Vehicle (Close Up)

Pre-Test Left ¾ Front View of Test Vehicle

Post-Test Left ¾ Front View of Test Vehicle

Pre-Test Left ¾ Rear View of Test Vehicle

Post-Test Left ¾ Rear View of Test Vehicle

Pre-Test Vehicle and Pole Overhead View

Post-Test Vehicle Overhead View

Pre-Test Vehicle Overhead View (Close Up)

Post-Test Vehicle Overhead View (Close Up)

Pre-Test Driver Seat Position

Pre-Test Driver Dummy Left Side View (Door open)

Pre-Test Driver Dummy Left Side View

Post-Test Driver Dummy Left Side View

Pre-Test Driver Dummy Right Side View

Post-Test Driver Dummy Right Side View

Pre-Test Driver Shoulder and Door Top View

Post-Test Driver Shoulder and Door Top View

Post-Test Driver Dummy Head Contact

Post-Test Driver Dummy Contact

Post-Test Driver Dummy Arm Contact

Post-Test Impact Point on Vehicle

Post-Test Windshield Retention

Post-Test Windshield Retention

Vehicle Certification Label

Tire Placard

Pre-Test Point of Impact View

Post-Test Point of Impact View

Vehicle Impact

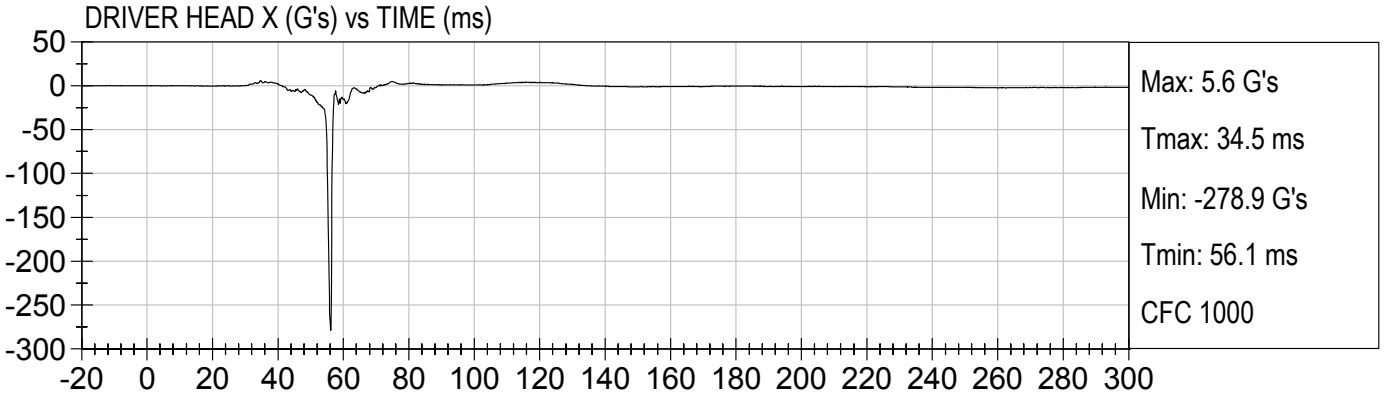
APPENDIX B

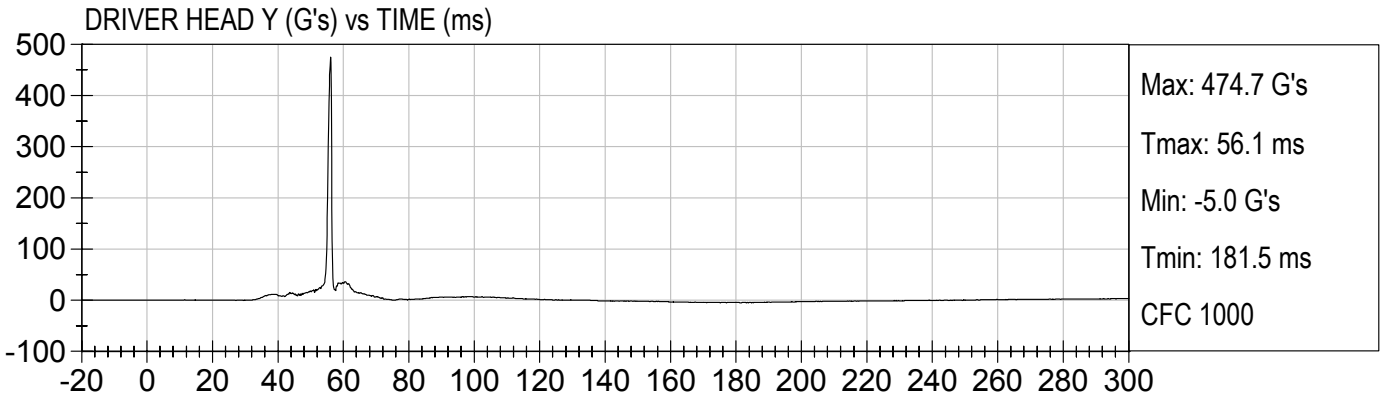
VEHICLE AND DUMMY RESPONSE DATA TRACES

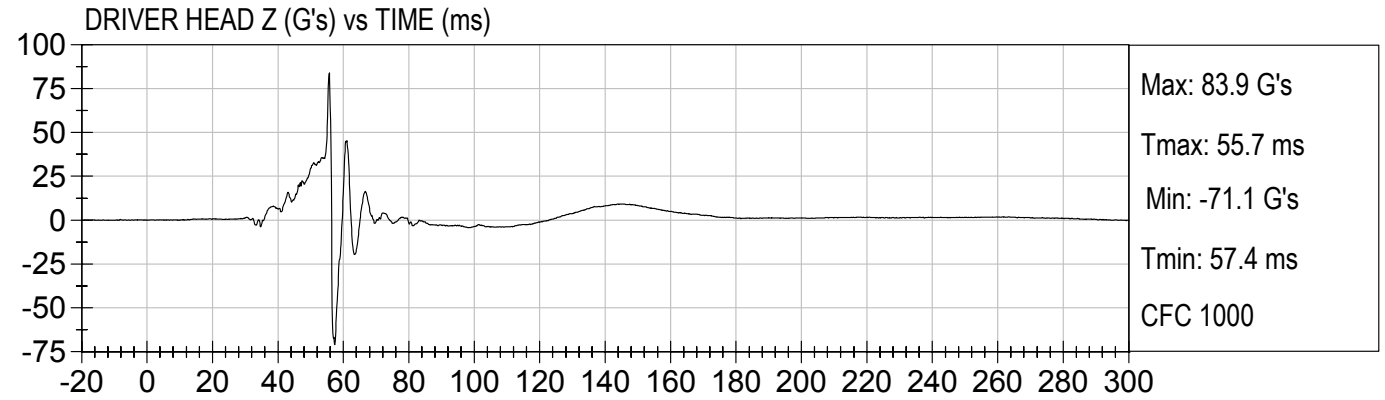
TABLE OF DATA PLOTS

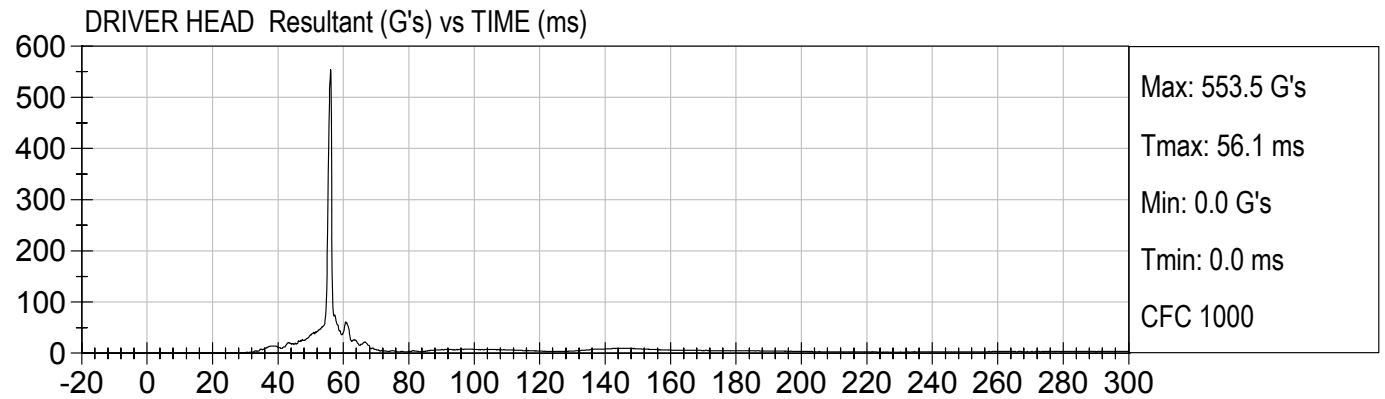
20 MPH OBLIQUE POLE
2005 SATURN ION R50170

Test Date: 08/18/2005
Speed: 20.1 mph (32.3 km/h)

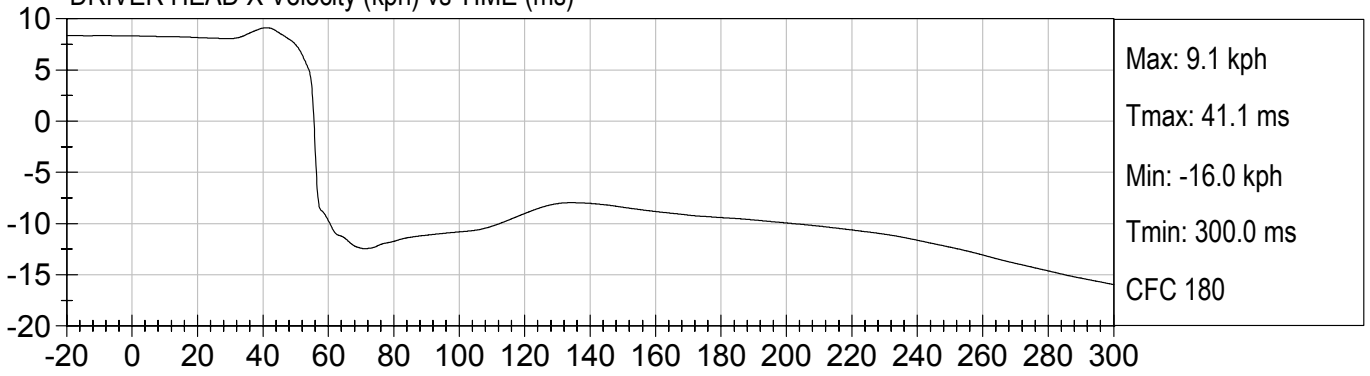




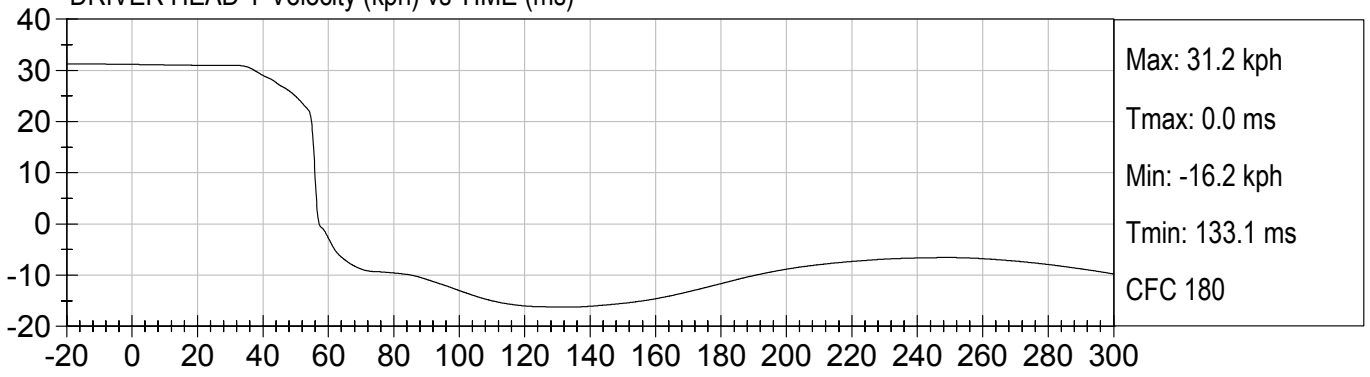




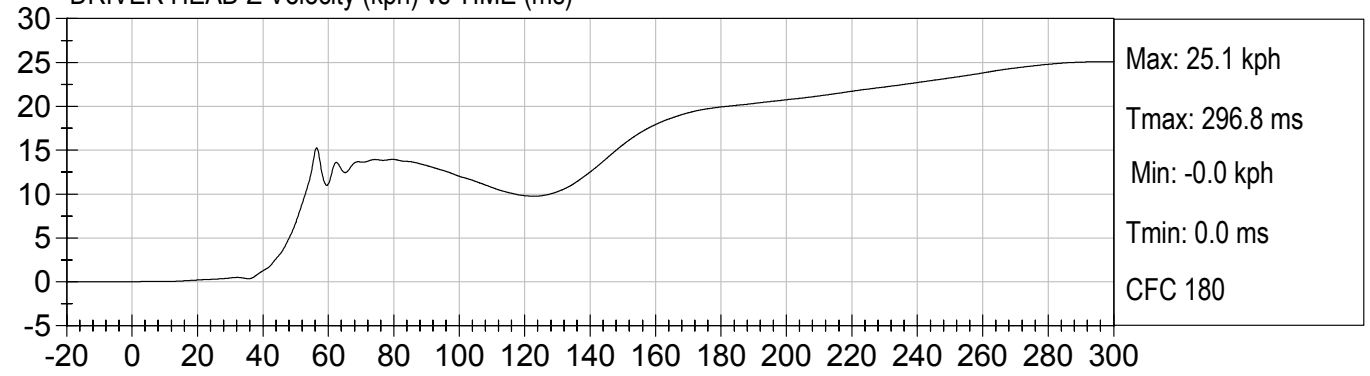
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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

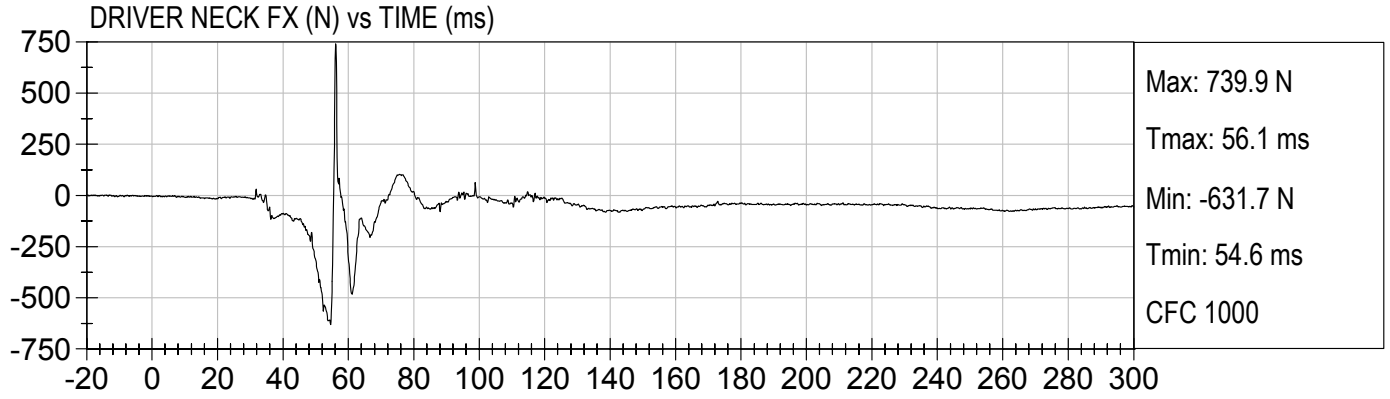


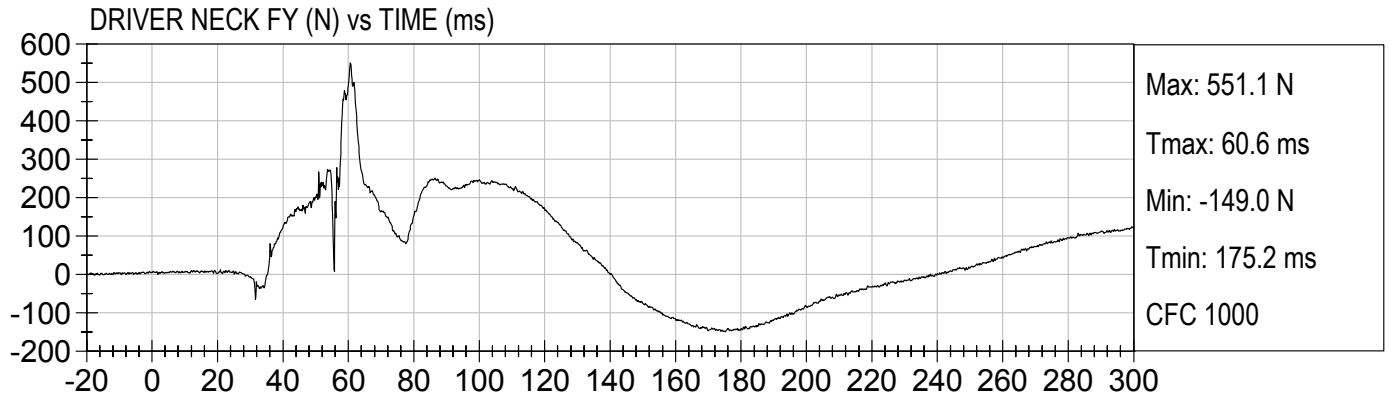
DRIVER HEAD Z Velocity (kph) vs TIME (ms)

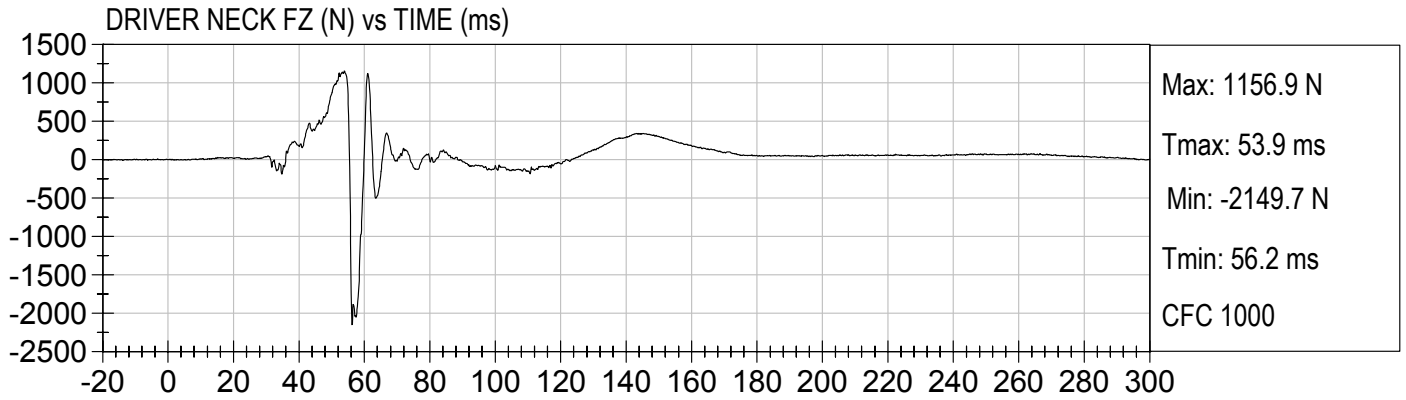


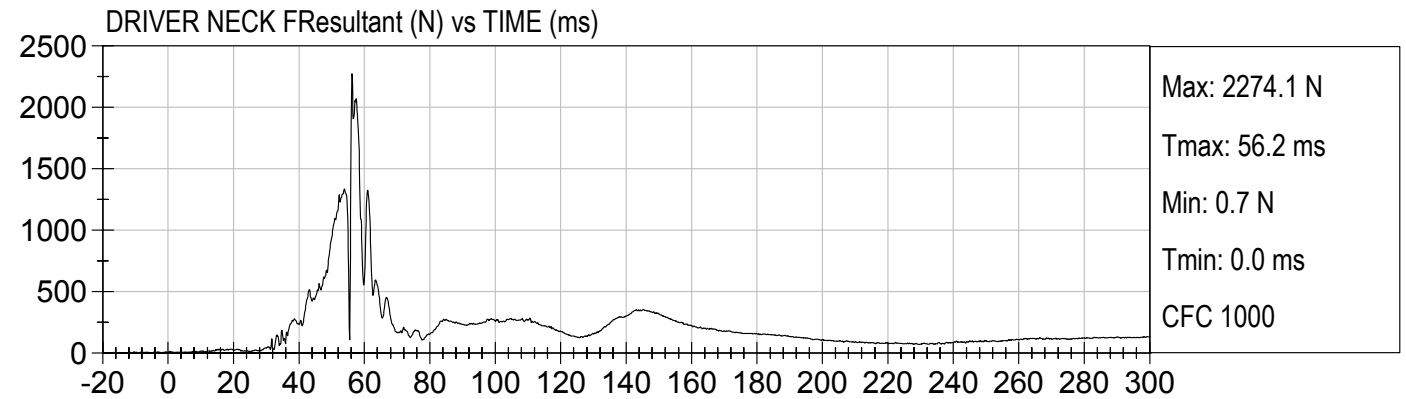
20 MPH OBLIQUE POLE
2005 SATURN ION R50170

Test Date: 08/18/2005
Speed: 20.1 mph (32.3 km/h)

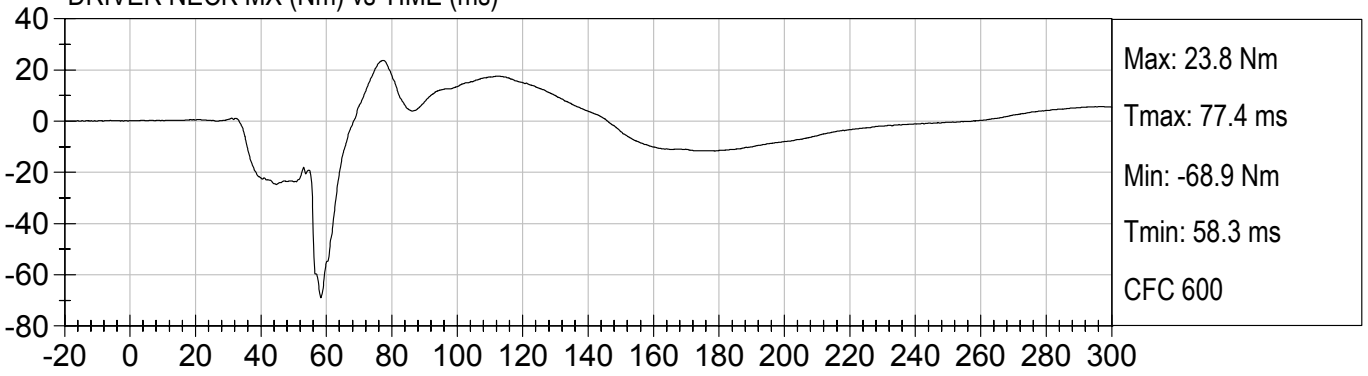




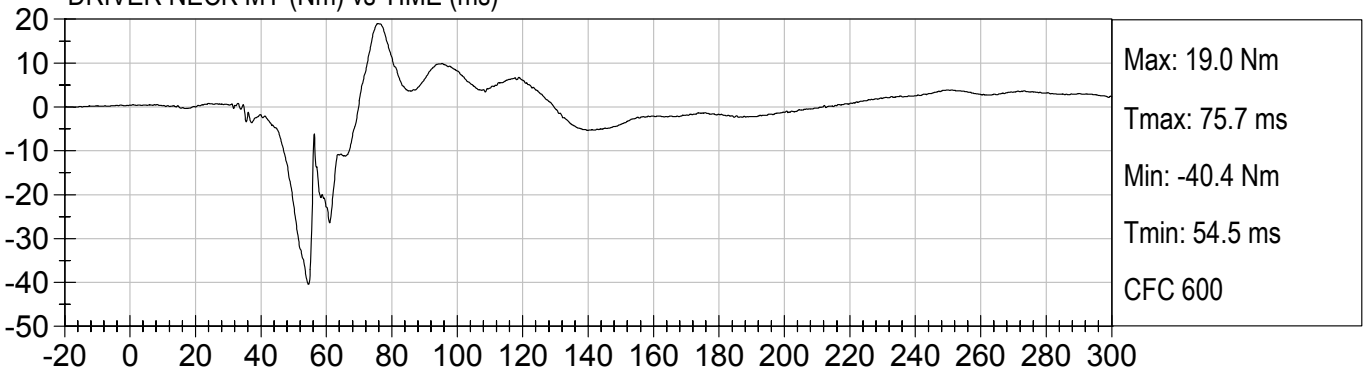




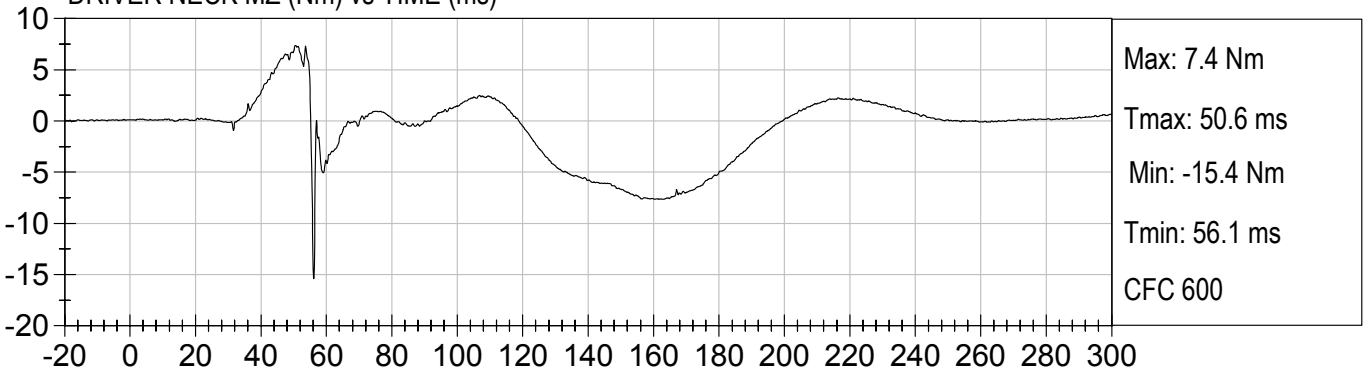
DRIVER NECK MX (Nm) vs TIME (ms)



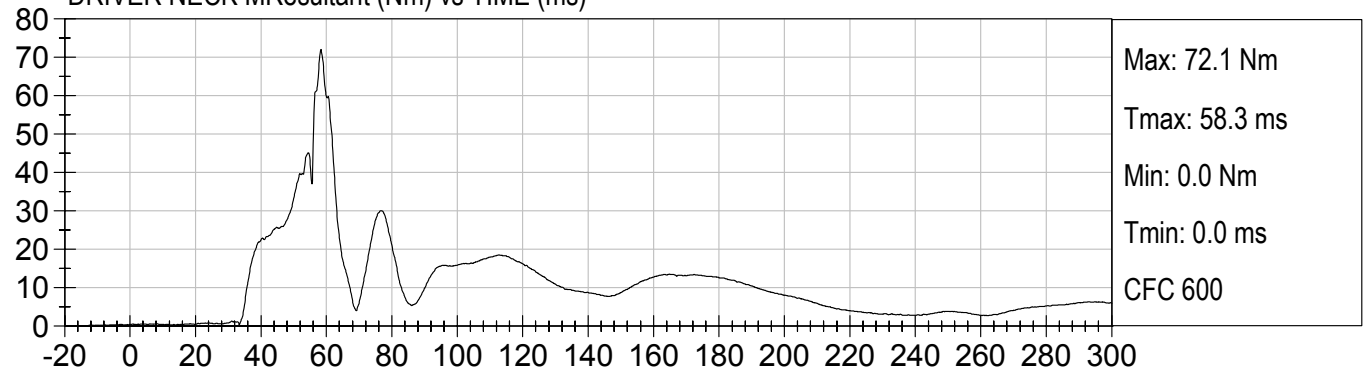
DRIVER NECK MY (Nm) vs TIME (ms)



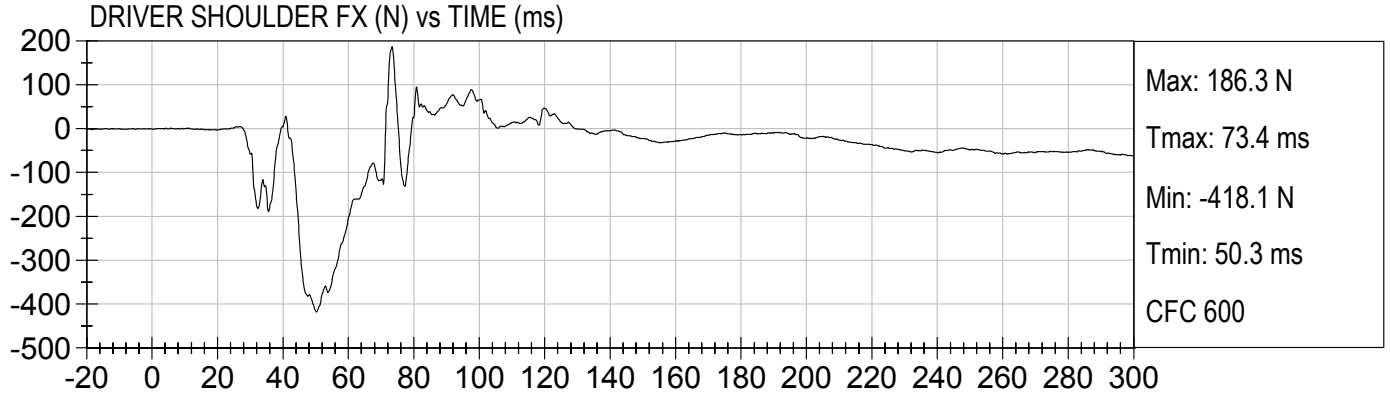
DRIVER NECK MZ (Nm) vs TIME (ms)



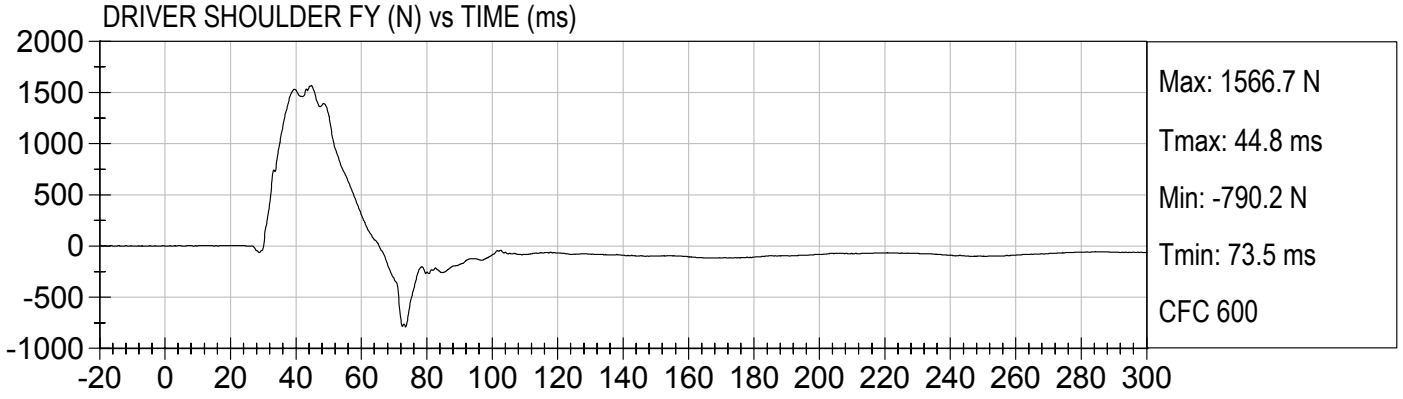
DRIVER NECK MResultant (Nm) vs TIME (ms)



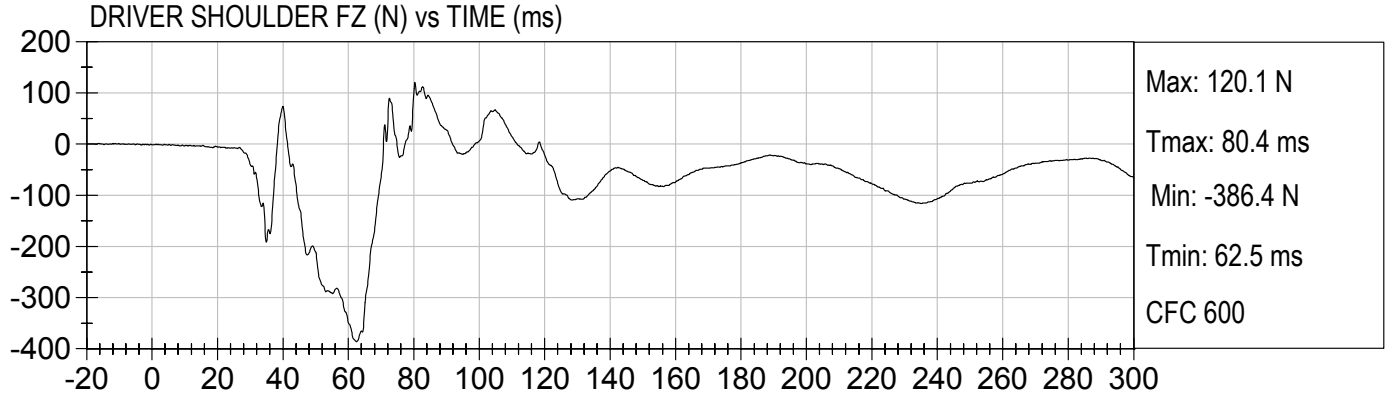
DRIVER SHOULDER FX (N) vs TIME (ms)



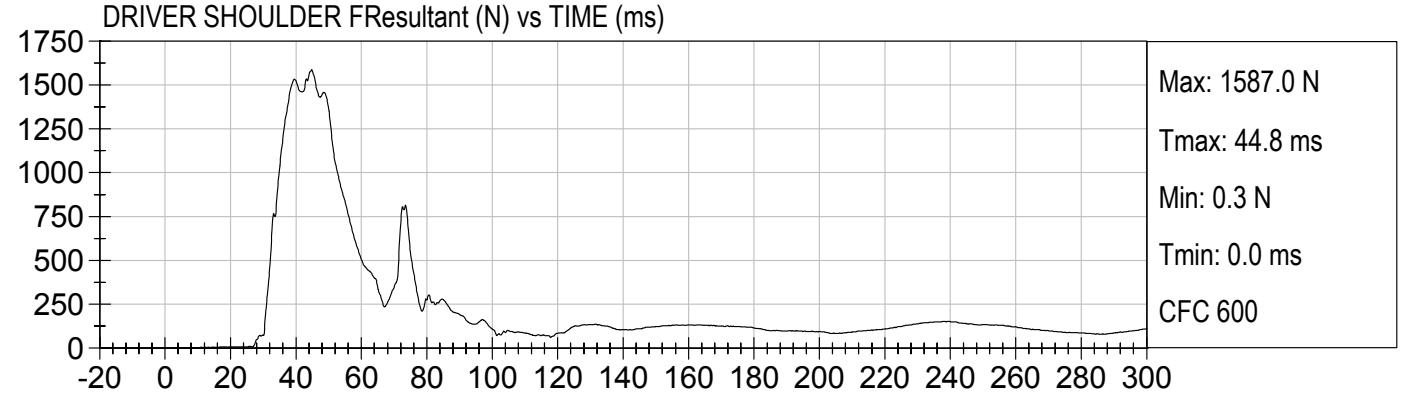
DRIVER SHOULDER FY (N) vs TIME (ms)



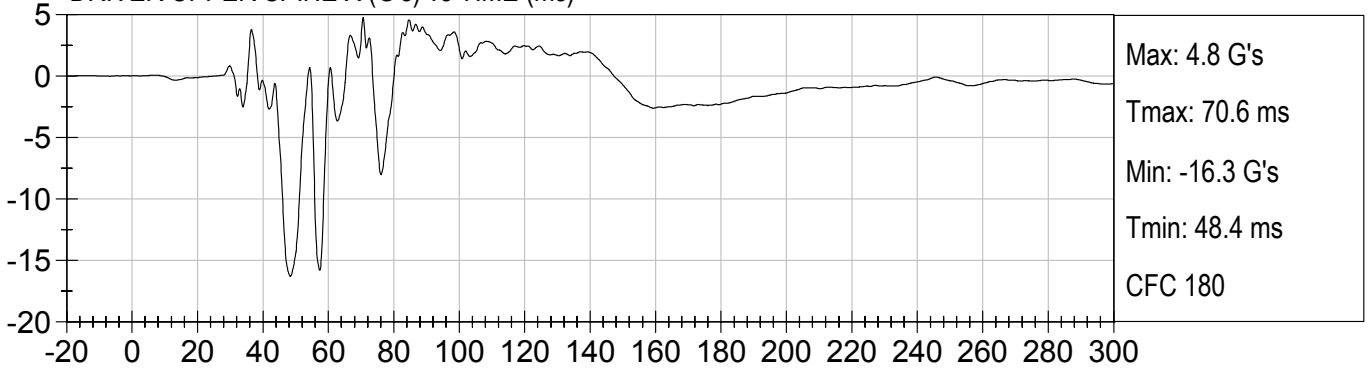
DRIVER SHOULDER FZ (N) vs TIME (ms)



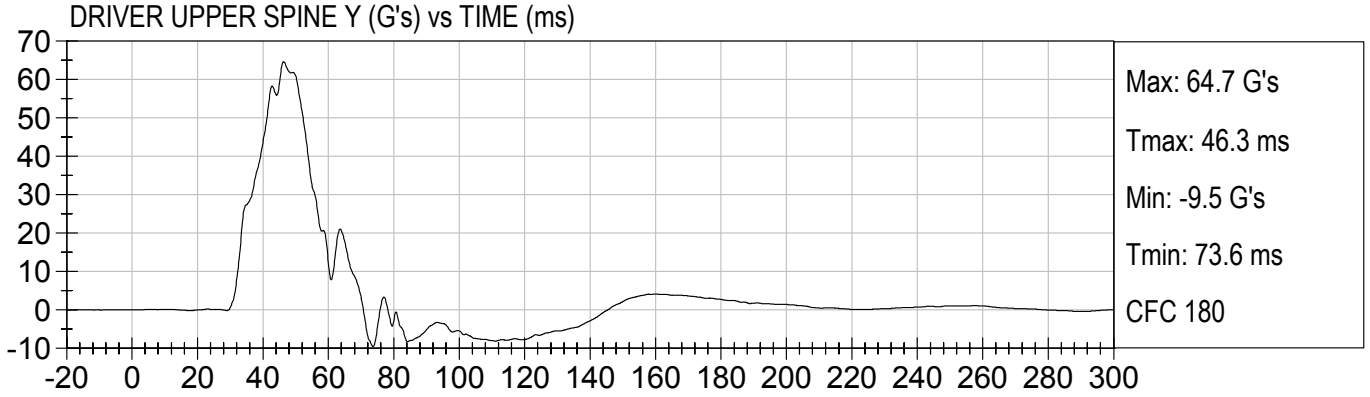
DRIVER SHOULDER FResultant (N) vs TIME (ms)



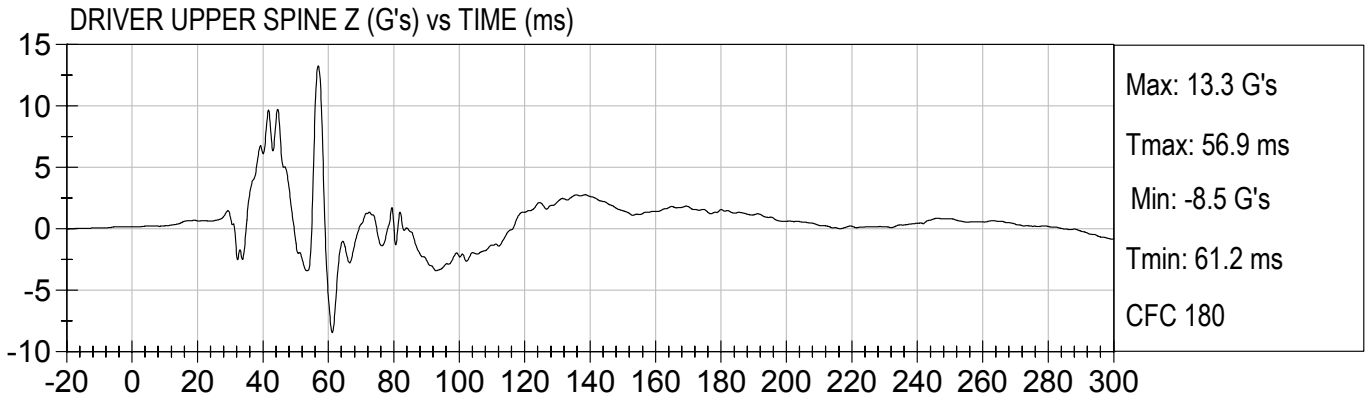
DRIVER UPPER SPINE X (G's) vs TIME (ms)



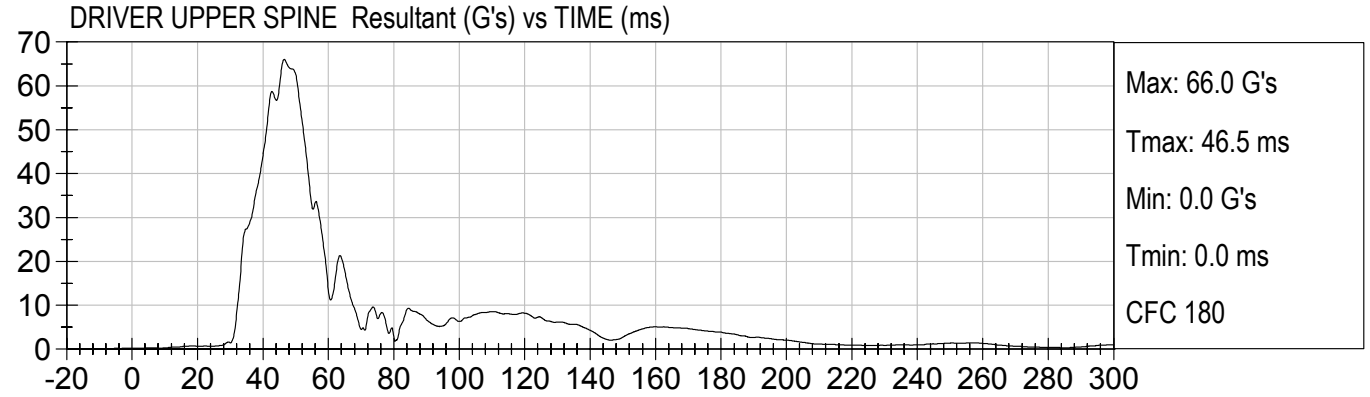
DRIVER UPPER SPINE Y (G's) vs TIME (ms)

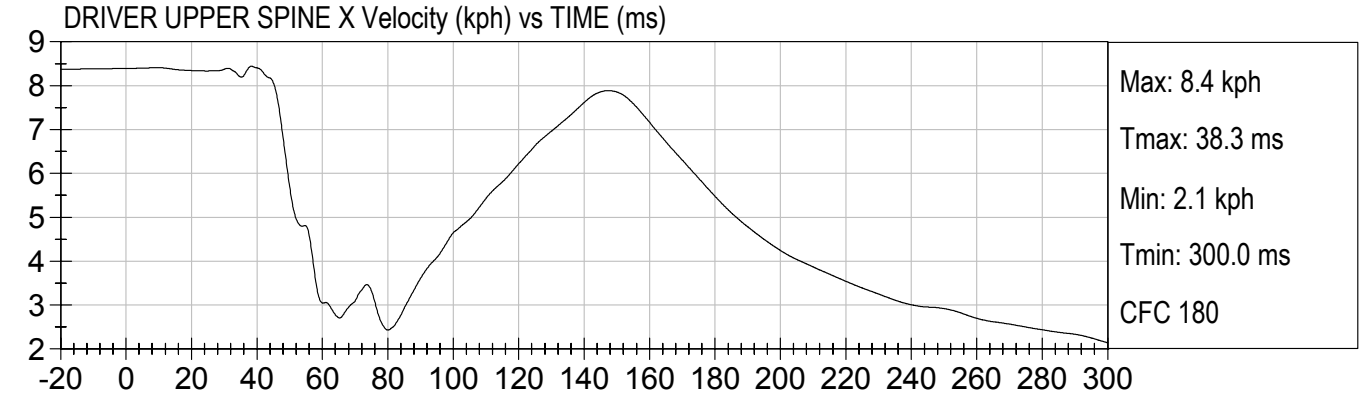


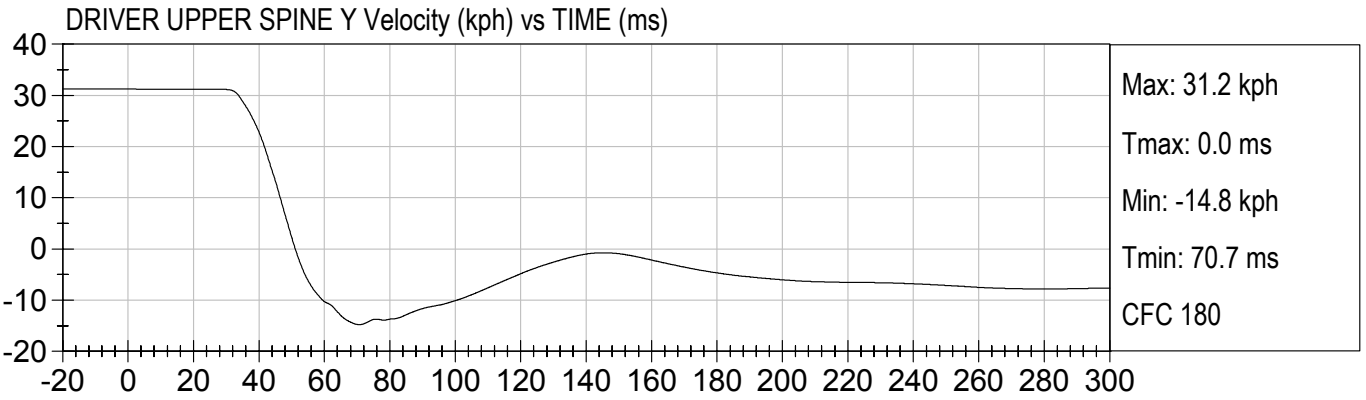
DRIVER UPPER SPINE Z (G's) vs TIME (ms)

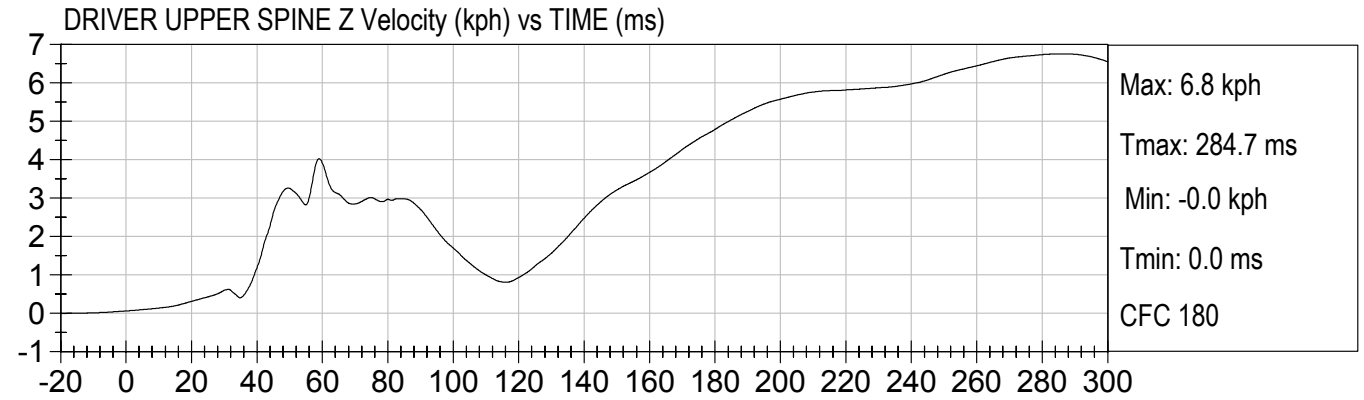


DRIVER UPPER SPINE Resultant (G's) vs TIME (ms)

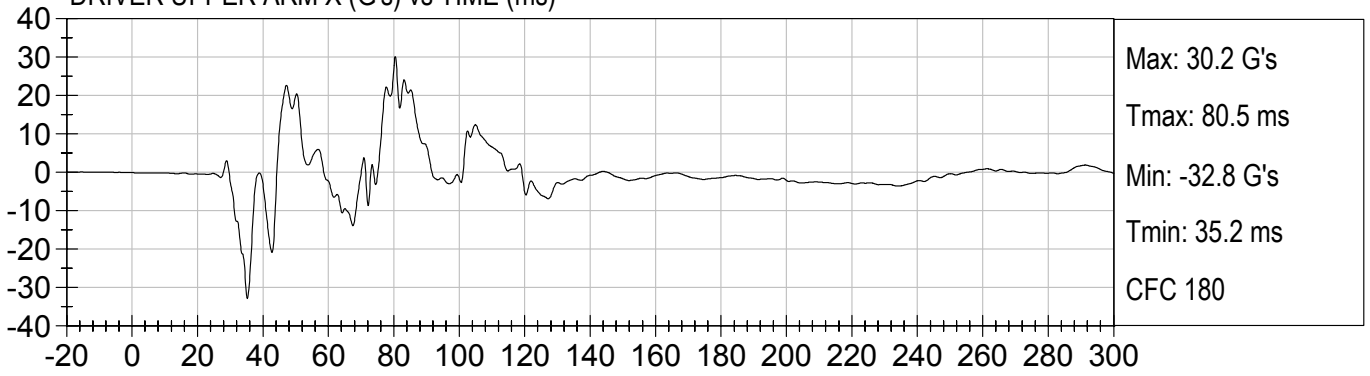



DRIVER UPPER SPINE X Velocity (kph) vs TIME (ms)
9
8
7
6
5
4
3
2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 38.3 ms
Min: 2.1 kph
Tmin: 300.0 ms
CFC 180

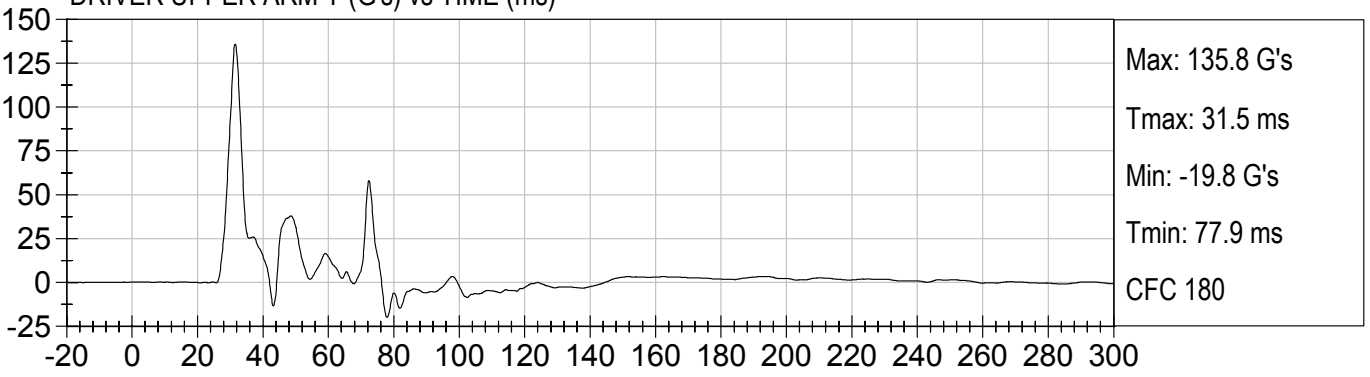

DRIVER UPPER SPINE Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.2 kph
Tmax: 0.0 ms
Min: -14.8 kph
Tmin: 70.7 ms
CFC 180


DRIVER UPPER SPINE Z Velocity (kph) vs TIME (ms)
7
6
5
4
3
2
1
0
-1
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 6.8 kph
Tmax: 284.7 ms
Min: -0.0 kph
Tmin: 0.0 ms
CFC 180

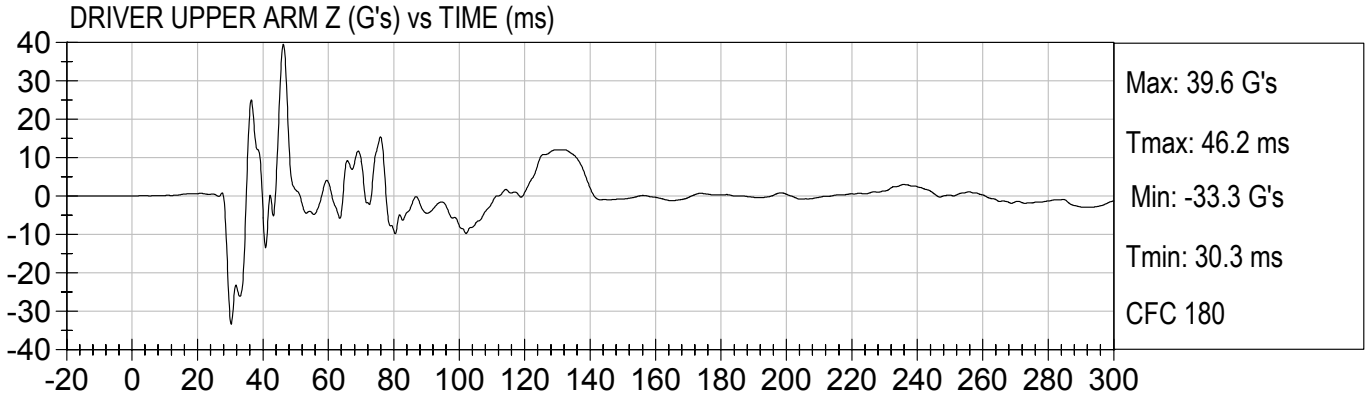
DRIVER UPPER ARM X (G's) vs TIME (ms)



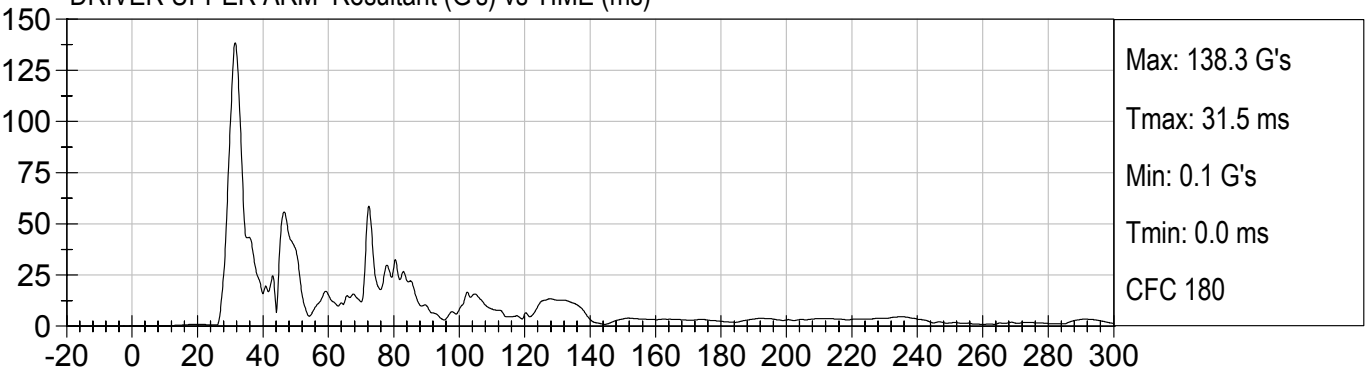
DRIVER UPPER ARM Y (G's) vs TIME (ms)



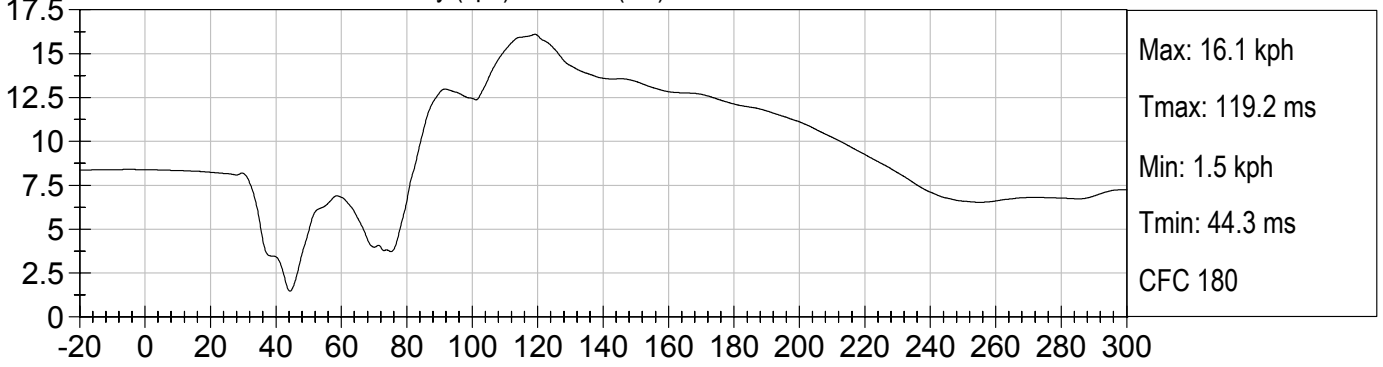
DRIVER UPPER ARM Z (G's) vs TIME (ms)



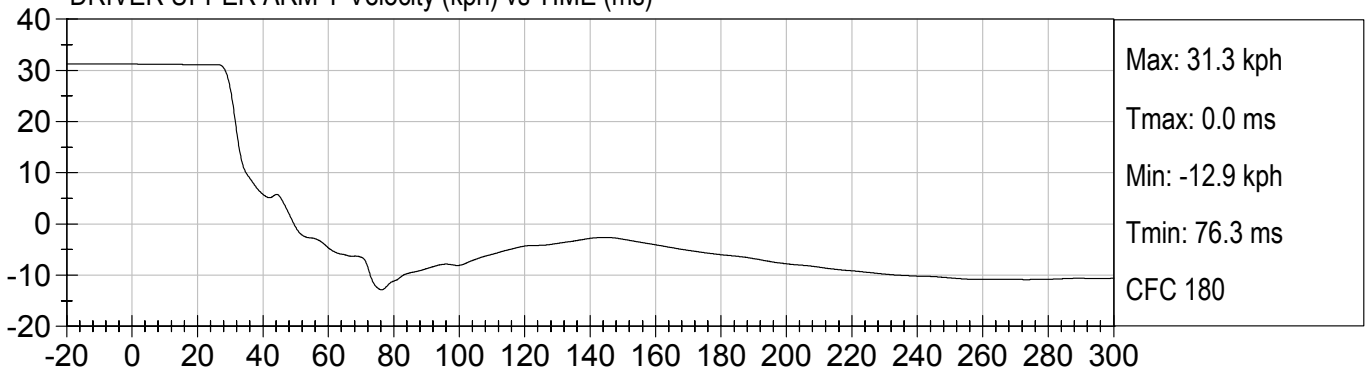
DRIVER UPPER ARM Resultant (G's) vs TIME (ms)



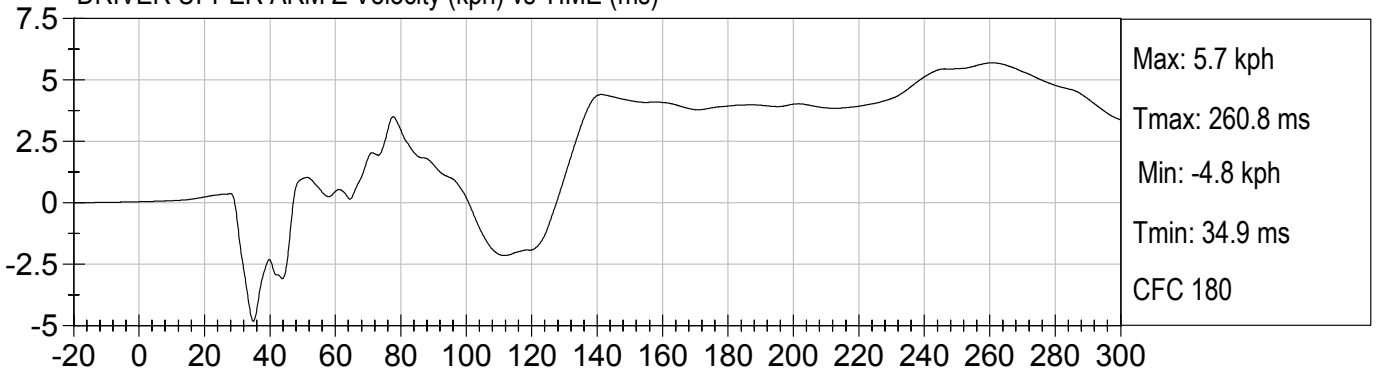
DRIVER UPPER ARM X Velocity (kph) vs TIME (ms)



DRIVER UPPER ARM Y Velocity (kph) vs TIME (ms)

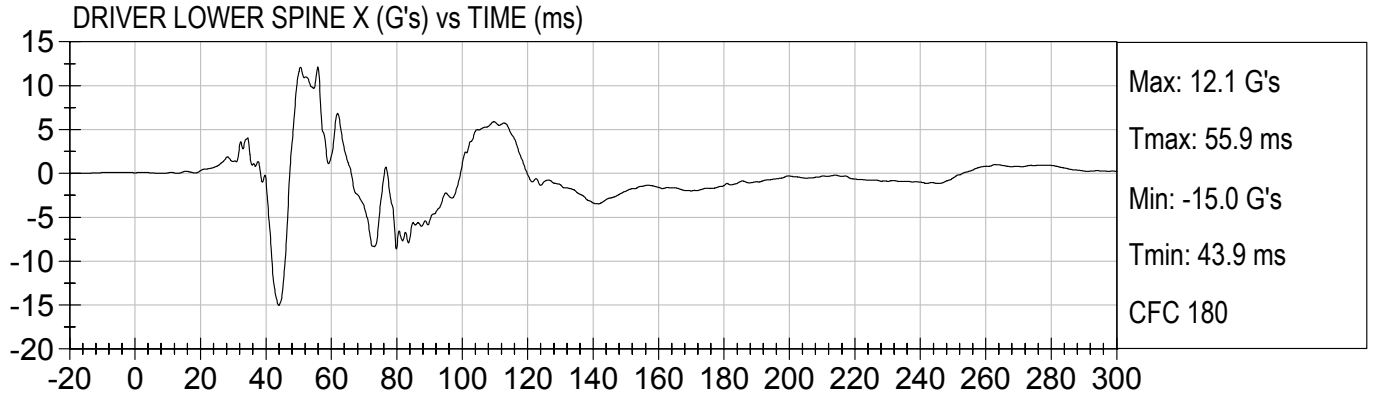


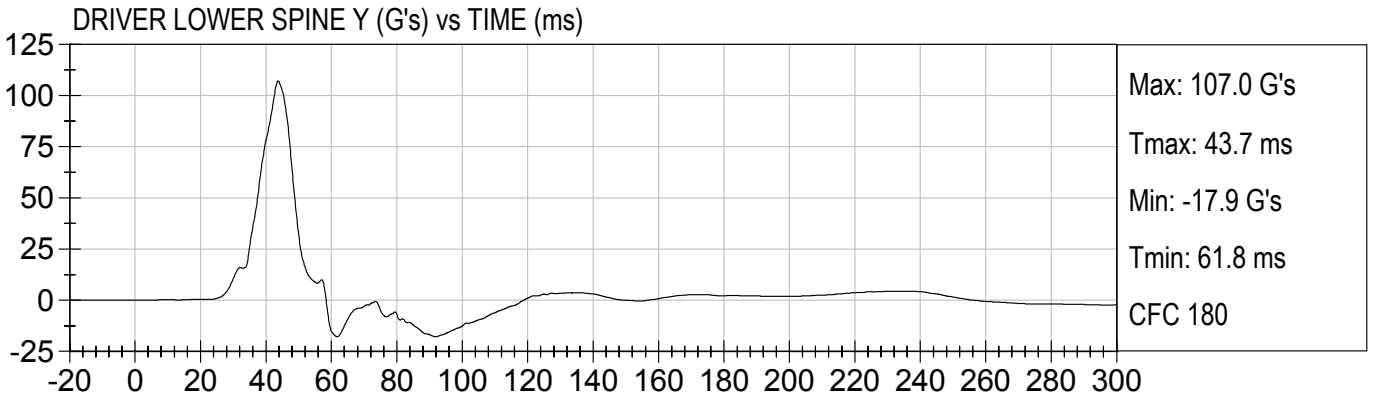
DRIVER UPPER ARM Z Velocity (kph) vs TIME (ms)

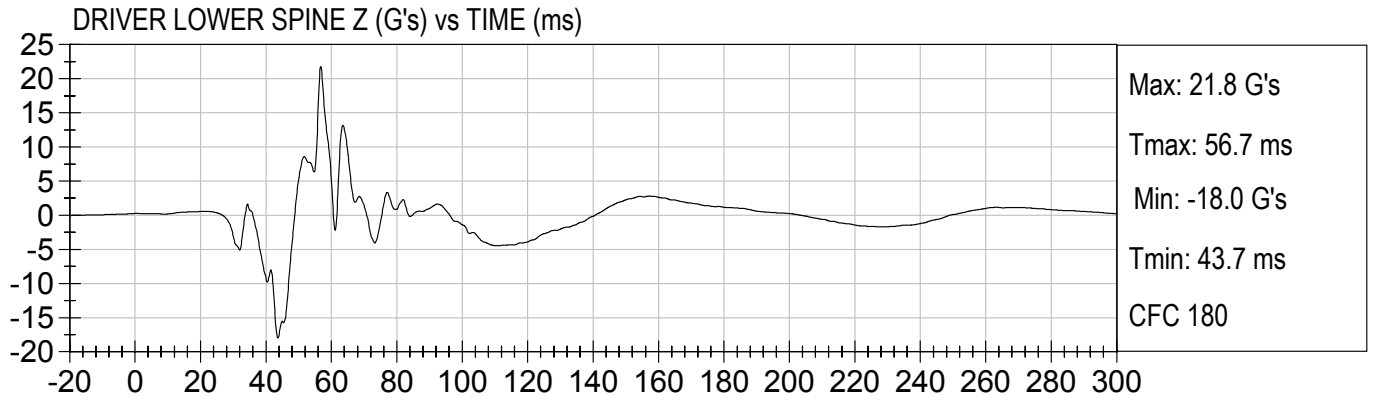


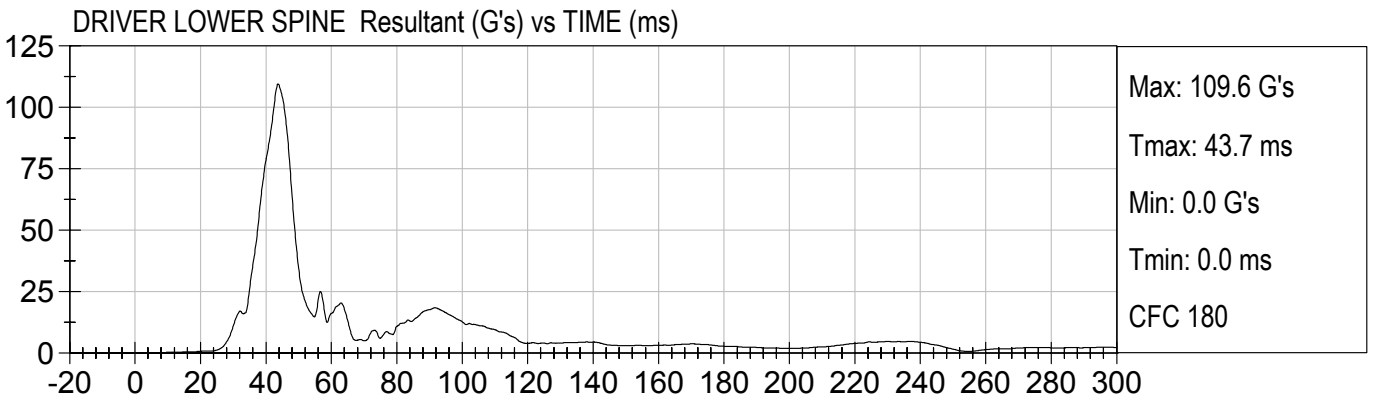
20 MPH OBLIQUE POLE
2005 SATURN ION R50170

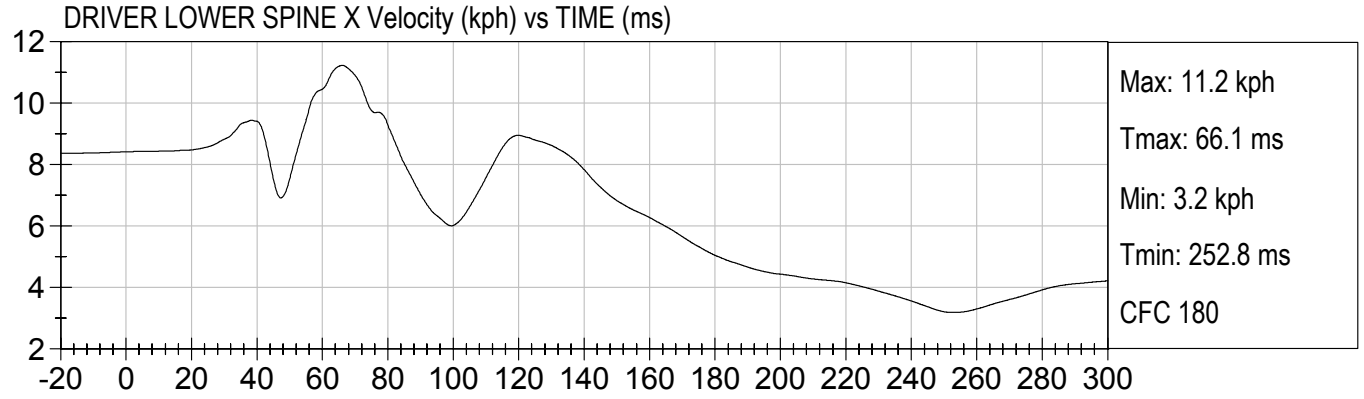
Test Date: 08/18/2005
Speed: 20.1 mph (32.3 km/h)

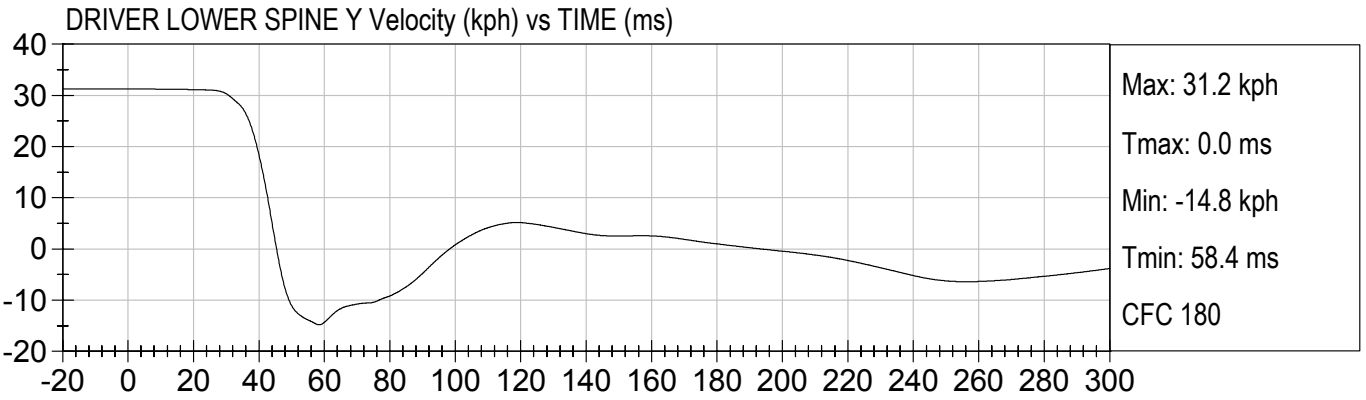


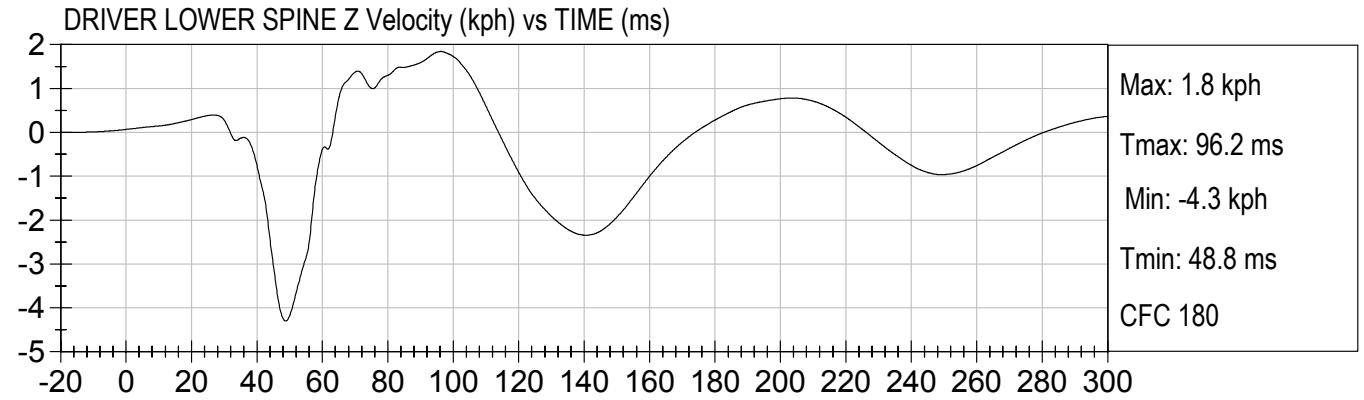




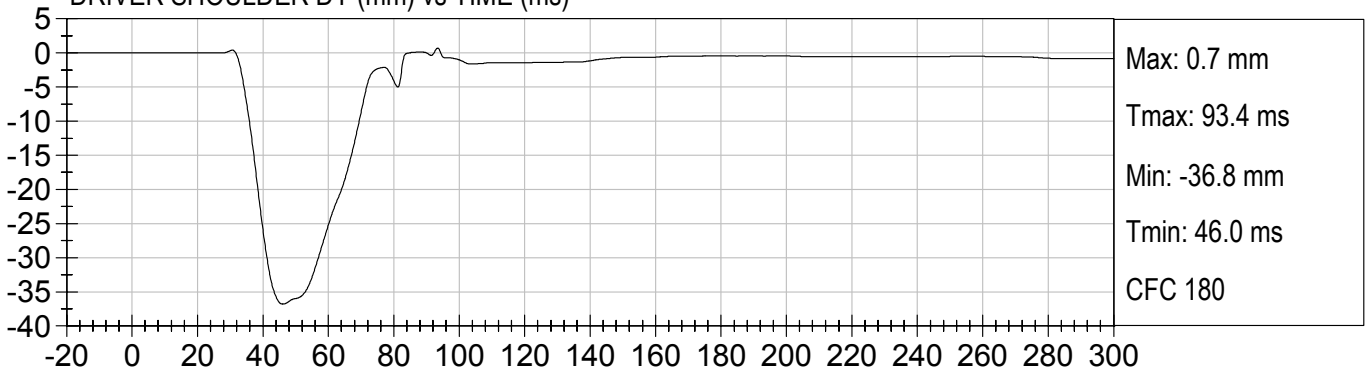



DRIVER LOWER SPINE X Velocity (kph) vs TIME (ms)
12
10
8
6
4
2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 11.2 kph
Tmax: 66.1 ms
Min: 3.2 kph
Tmin: 252.8 ms
CFC 180

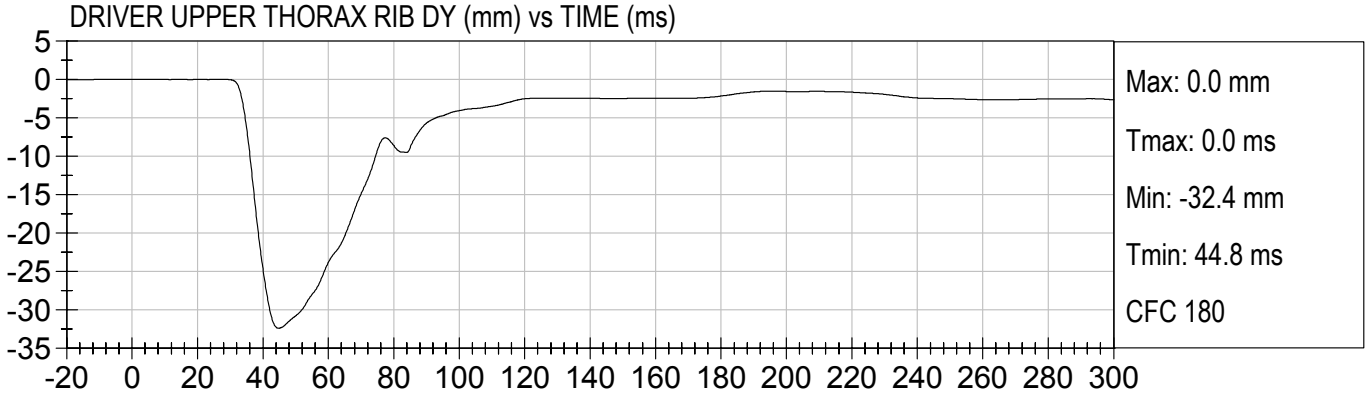

DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.2 kph
Tmax: 0.0 ms
Min: -14.8 kph
Tmin: 58.4 ms
CFC 180


DRIVER LOWER SPINE Z Velocity (kph) vs TIME (ms)
2
1
0
-1
-2
-3
-4
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 1.8 kph
Tmax: 96.2 ms
Min: -4.3 kph
Tmin: 48.8 ms
CFC 180

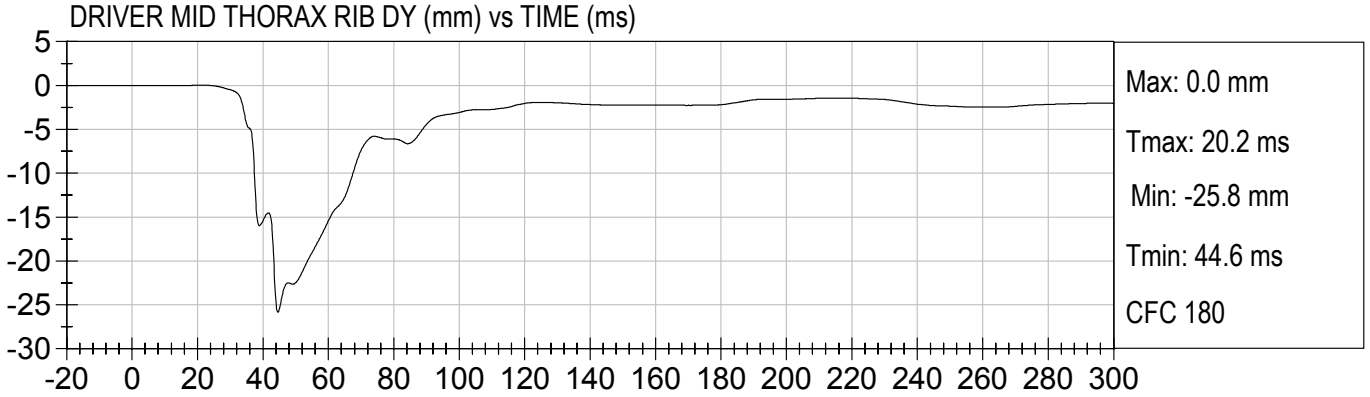
DRIVER SHOULDER DY (mm) vs TIME (ms)



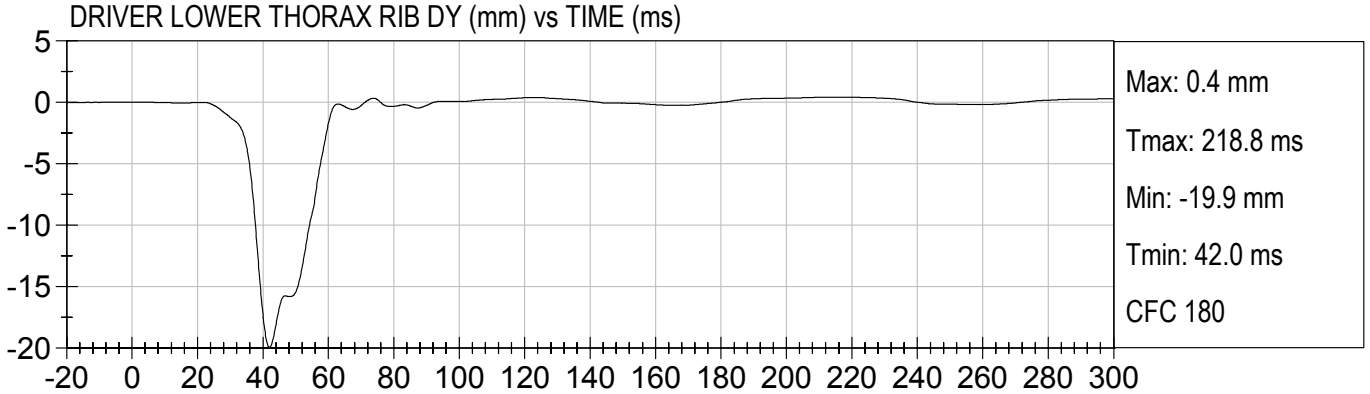
DRIVER UPPER THORAX RIB DY (mm) vs TIME (ms)



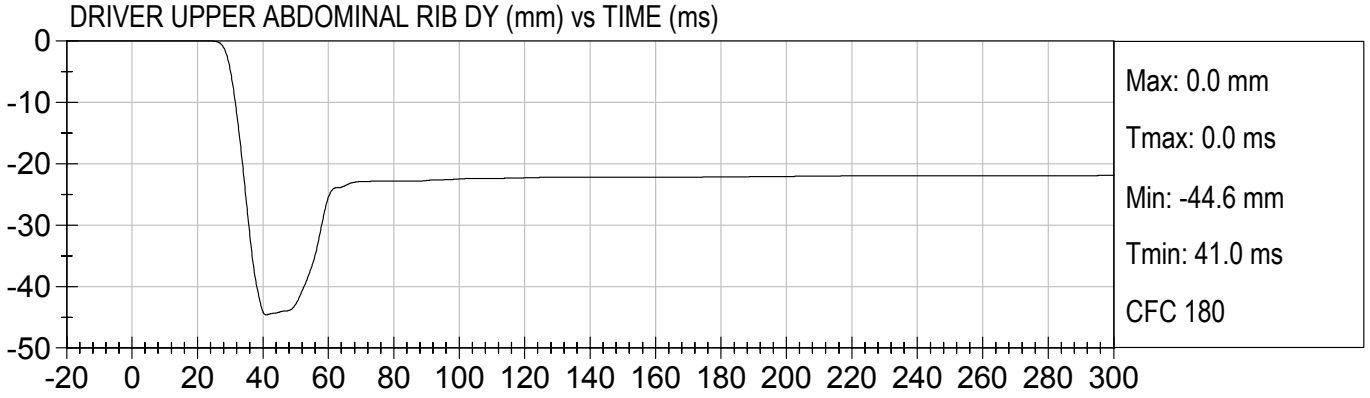
DRIVER MID THORAX RIB DY (mm) vs TIME (ms)



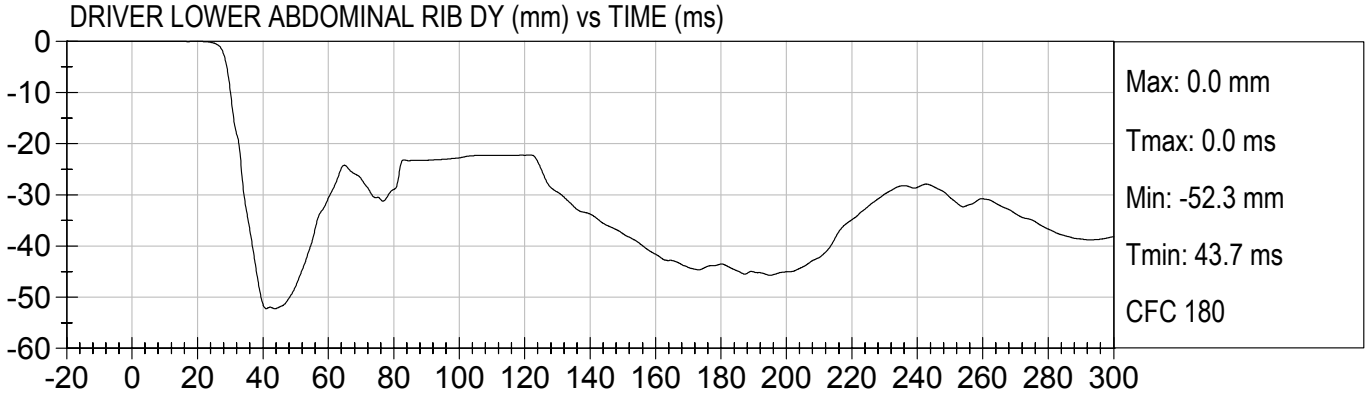
DRIVER LOWER THORAX RIB DY (mm) vs TIME (ms)



DRIVER UPPER ABDOMINAL RIB DY (mm) vs TIME (ms)



DRIVER LOWER ABDOMINAL RIB DY (mm) vs TIME (ms)



20 MPH OBLIQUE POLE
2005 SATURN ION R50170

Test Date: 08/18/2005
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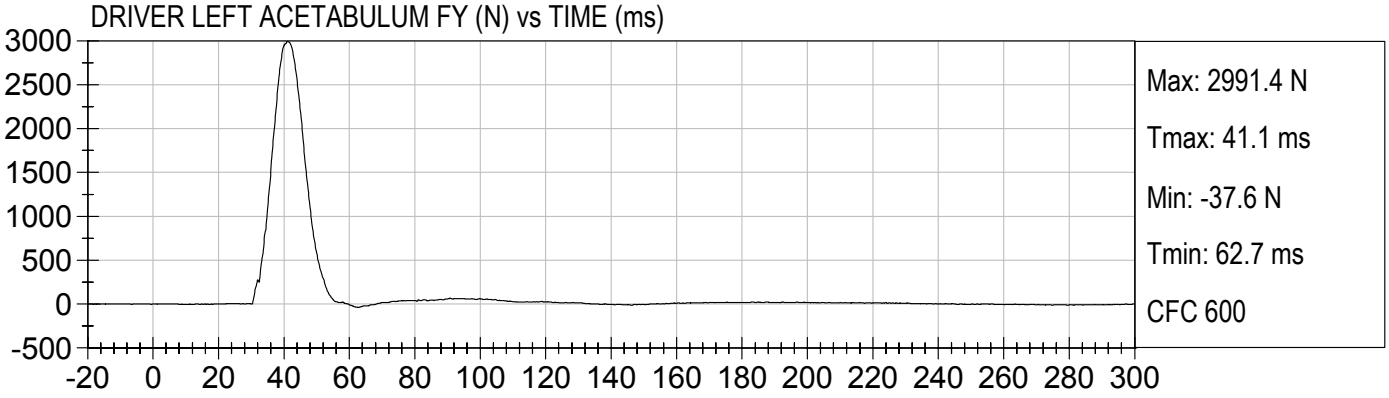
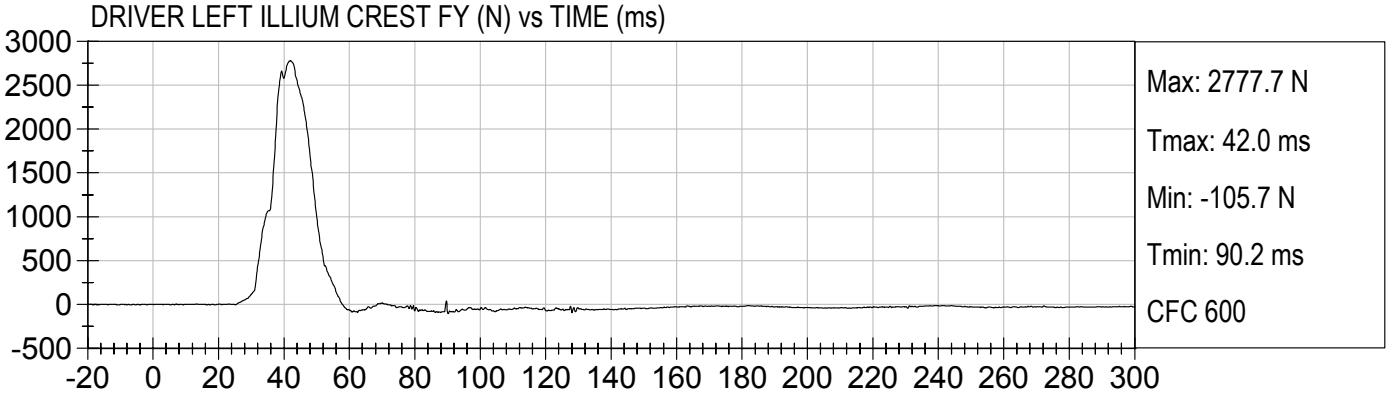
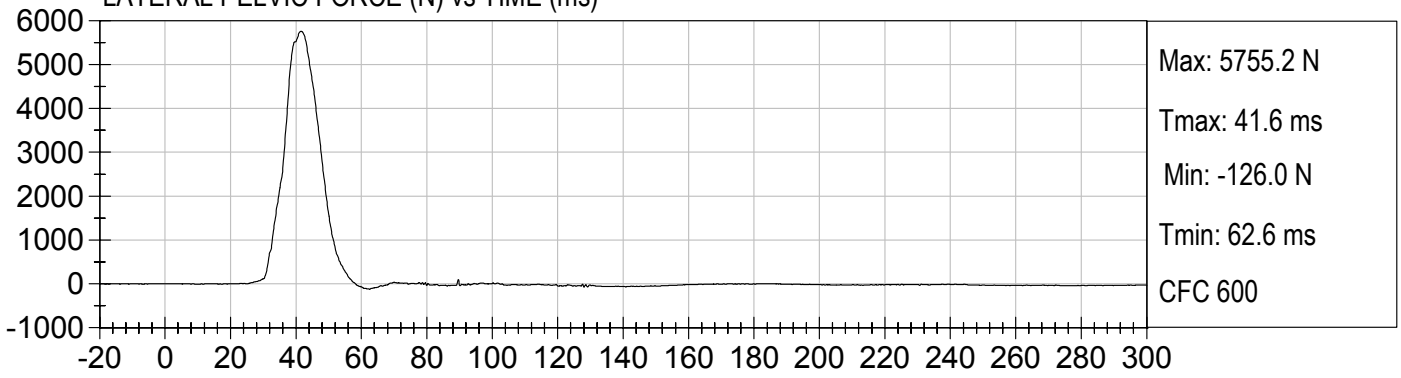
DRIVER LEFT ACETABULUM FY (N) vs TIME (ms)



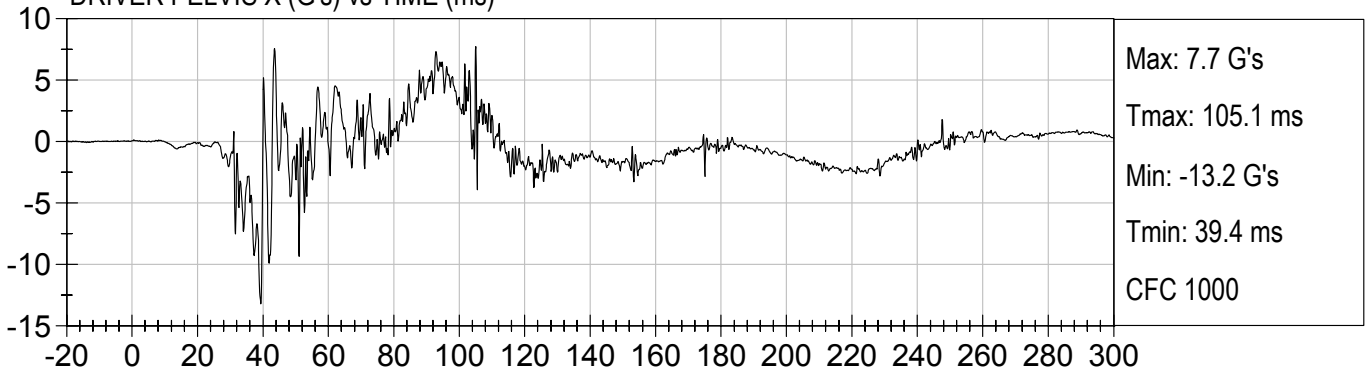
DRIVER LEFT ILLIUM CREST FY (N) vs TIME (ms)



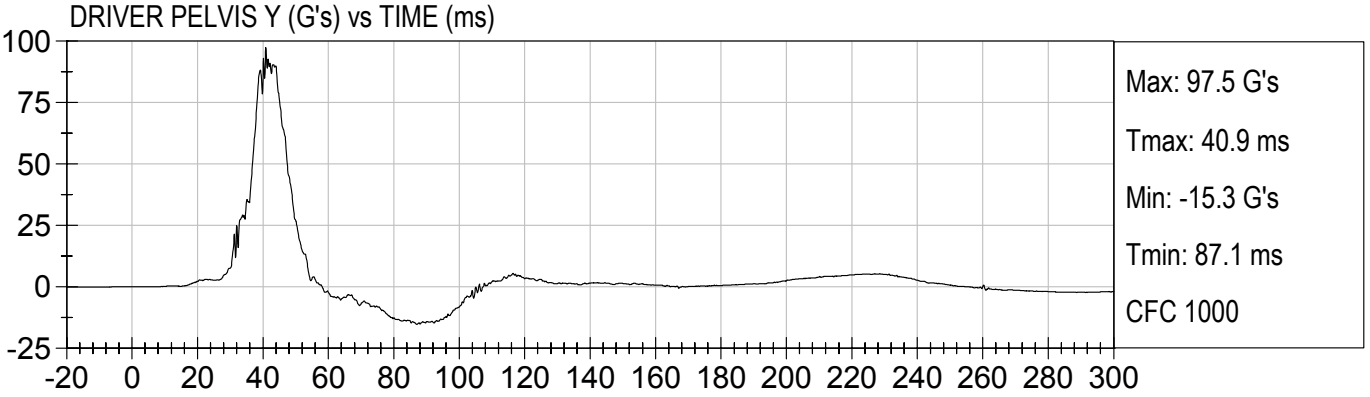
LATERAL PELVIC FORCE (N) vs TIME (ms)



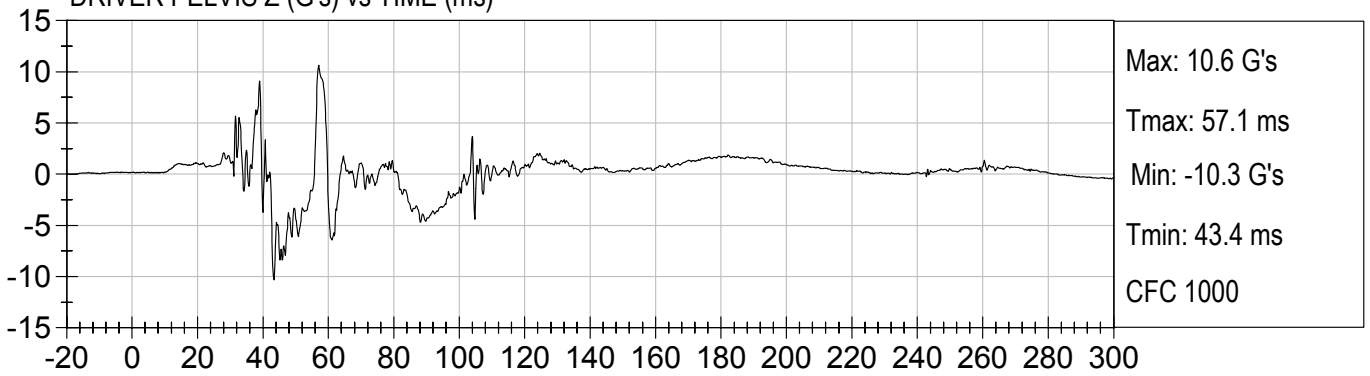
DRIVER PELVIS X (G's) vs TIME (ms)



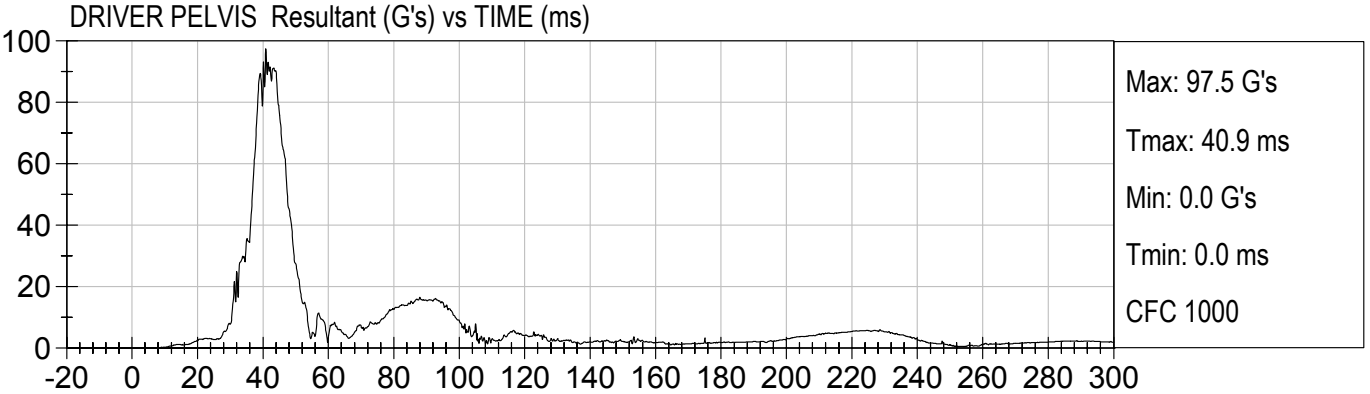
DRIVER PELVIS Y (G's) vs TIME (ms)

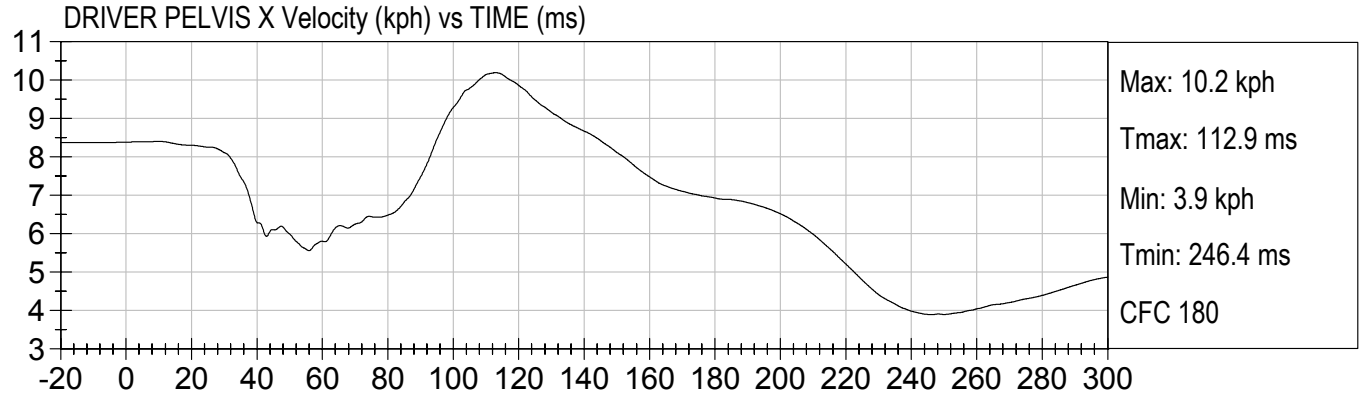


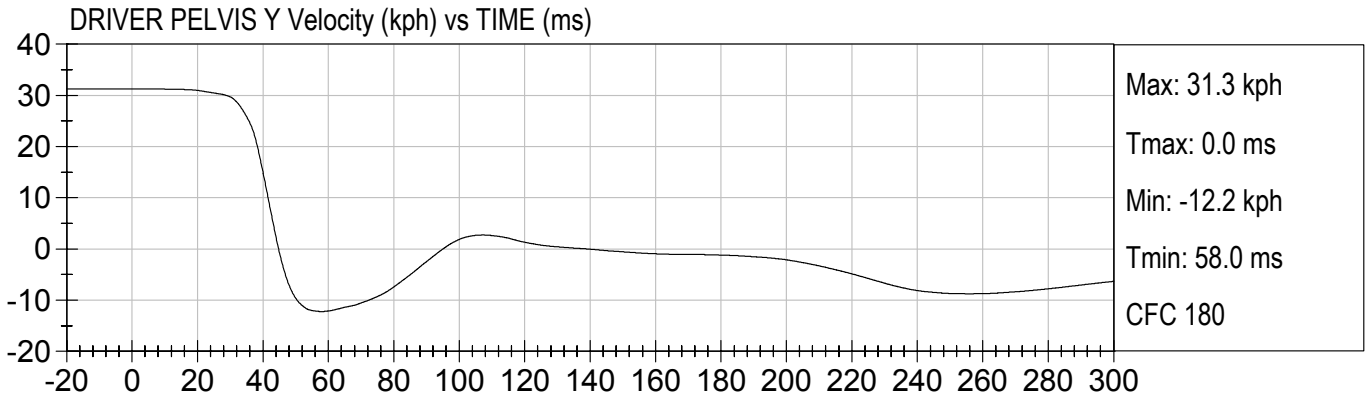
DRIVER PELVIS Z (G's) vs TIME (ms)

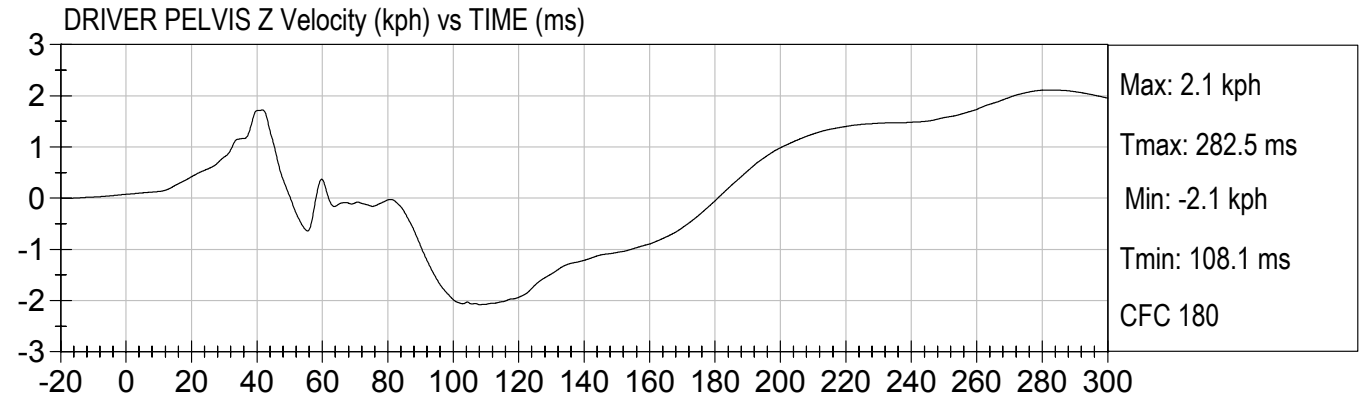


DRIVER PELVIS Resultant (G's) vs TIME (ms)



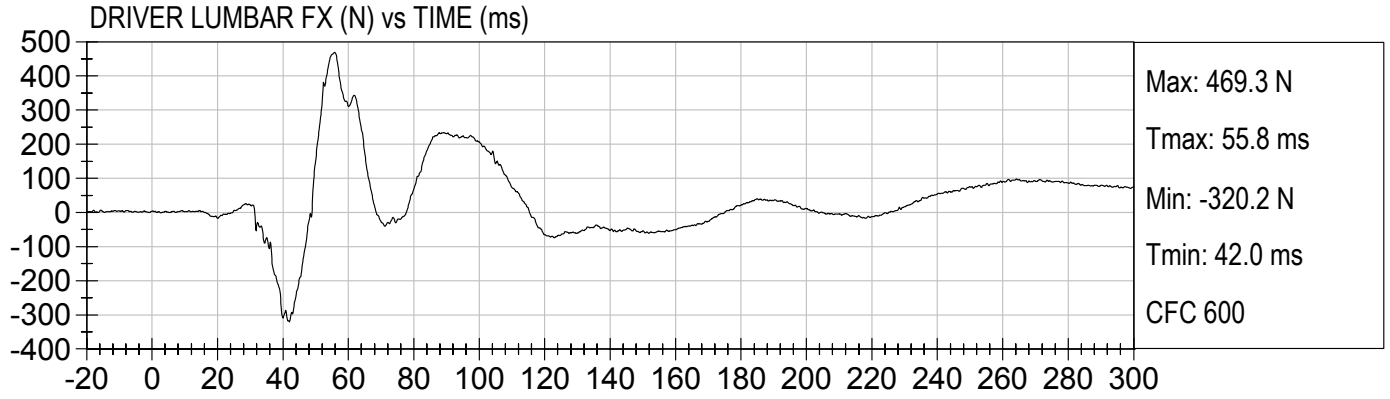

DRIVER PELVIS X Velocity (kph) vs TIME (ms)
11
10
9
8
7
6
5
4
3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 10.2 kph
Tmax: 112.9 ms
Min: 3.9 kph
Tmin: 246.4 ms
CFC 180

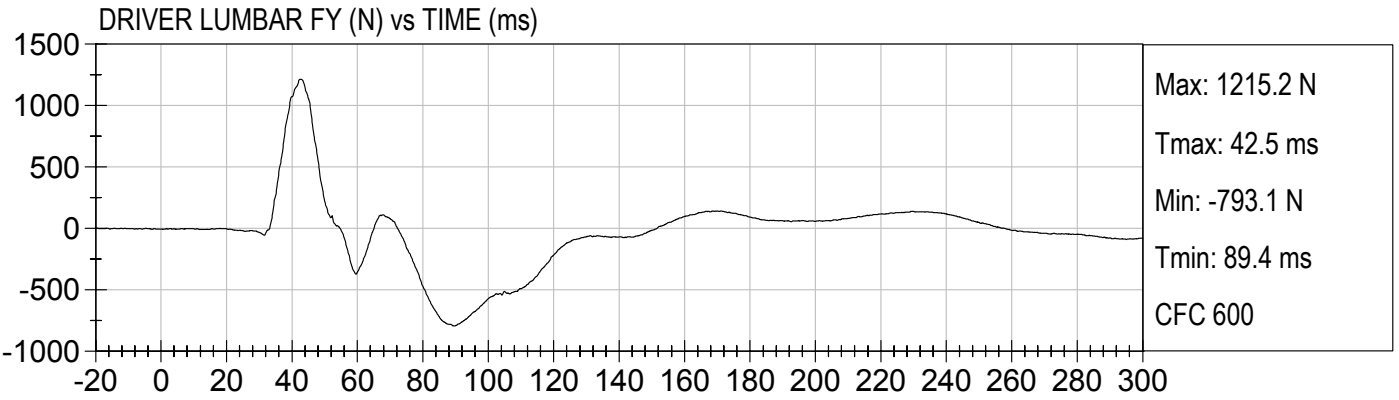

DRIVER PELVIS Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.3 kph
Tmax: 0.0 ms
Min: -12.2 kph
Tmin: 58.0 ms
CFC 180

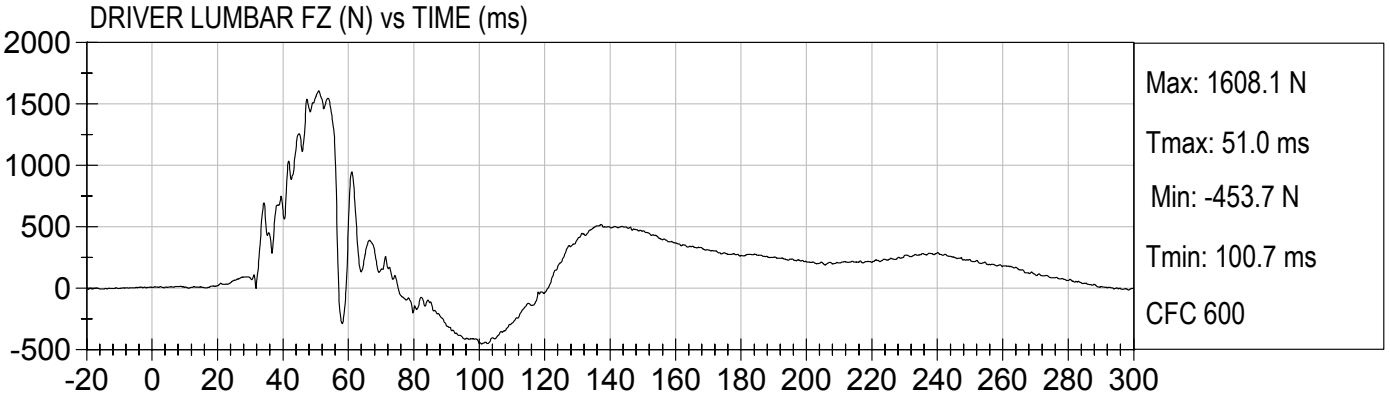

DRIVER PELVIS Z Velocity (kph) vs TIME (ms)
3
2
1
0
-1
-2
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 2.1 kph
Tmax: 282.5 ms
Min: -2.1 kph
Tmin: 108.1 ms
CFC 180

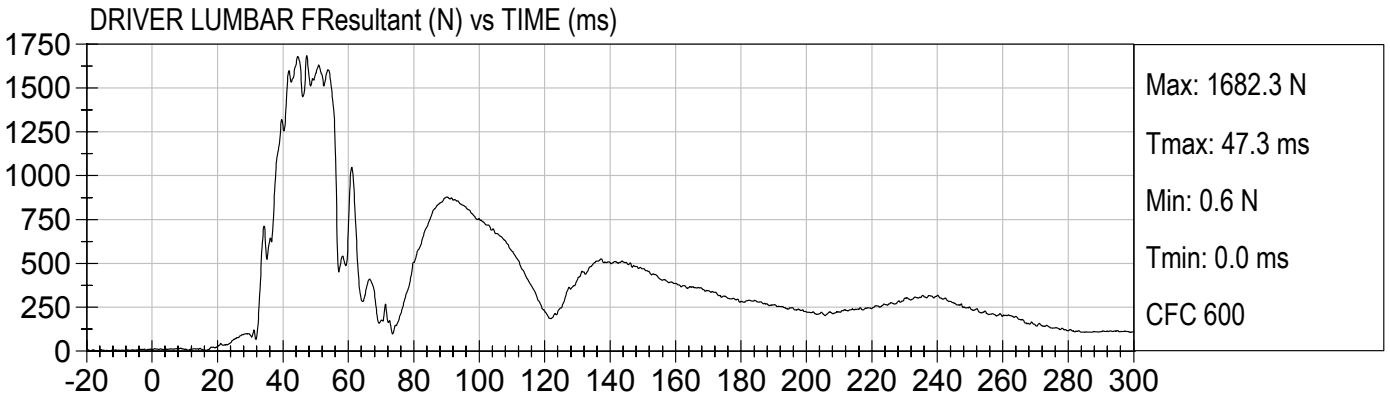
20 MPH OBLIQUE POLE
2005 SATURN ION R50170

Test Date: 08/18/2005
Speed: 20.1 mph (32.3 km/h)

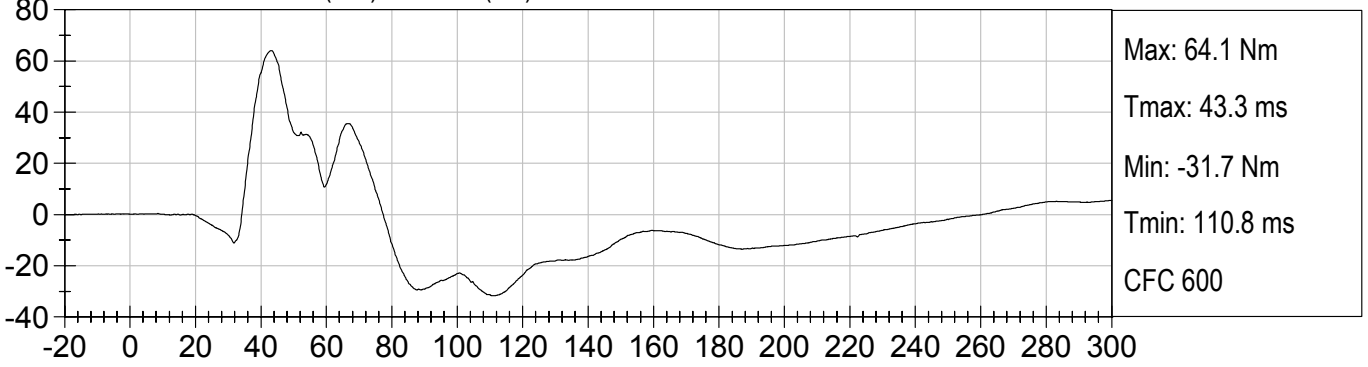




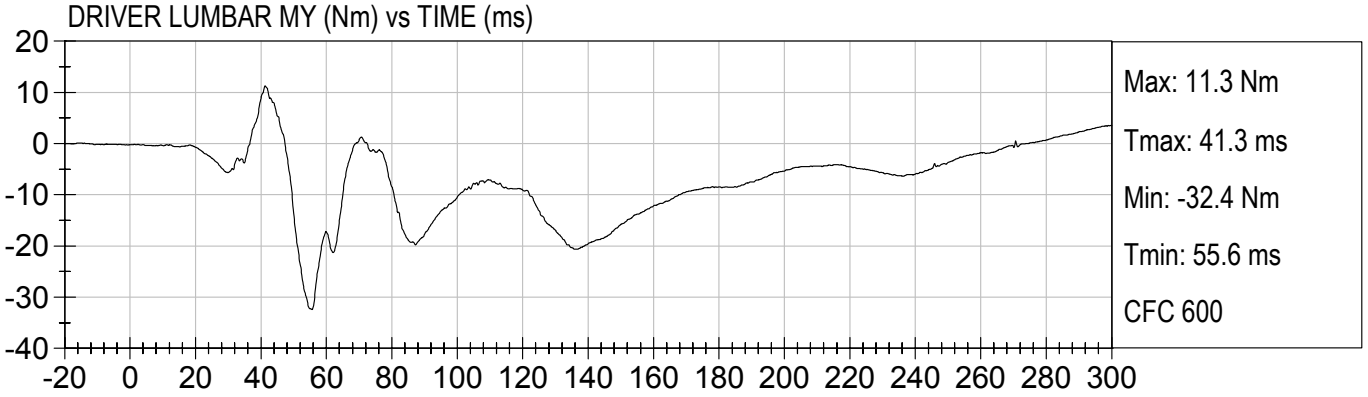




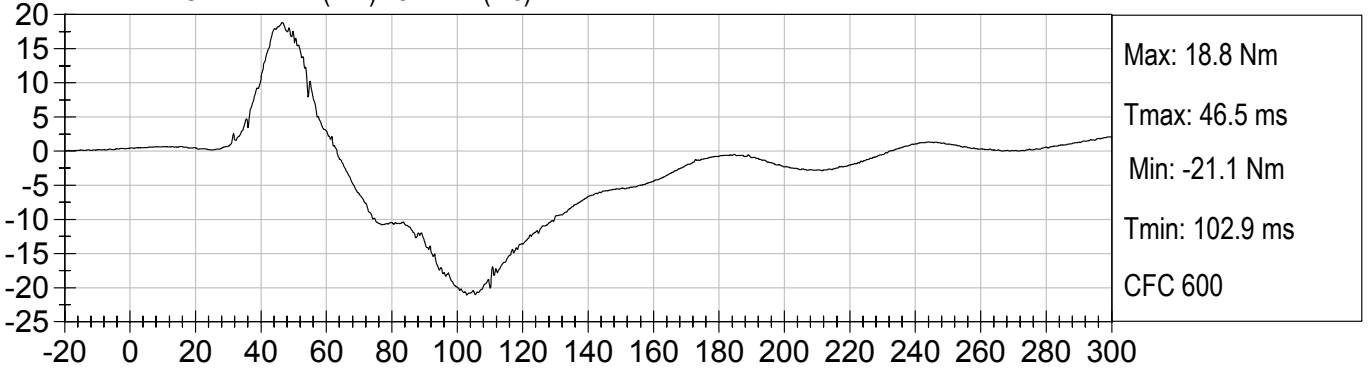
DRIVER LUMBAR MX (Nm) vs TIME (ms)



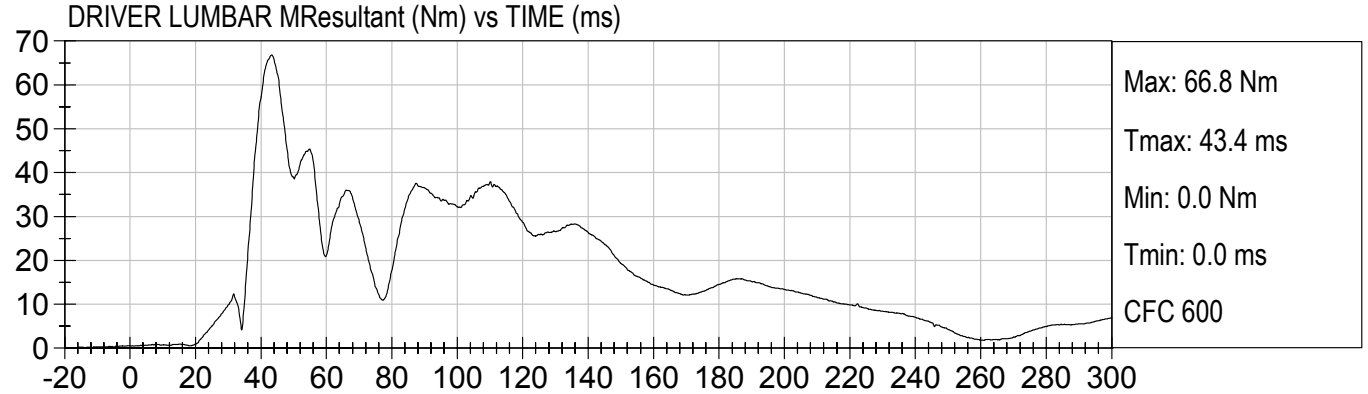
DRIVER LUMBAR MY (Nm) vs TIME (ms)

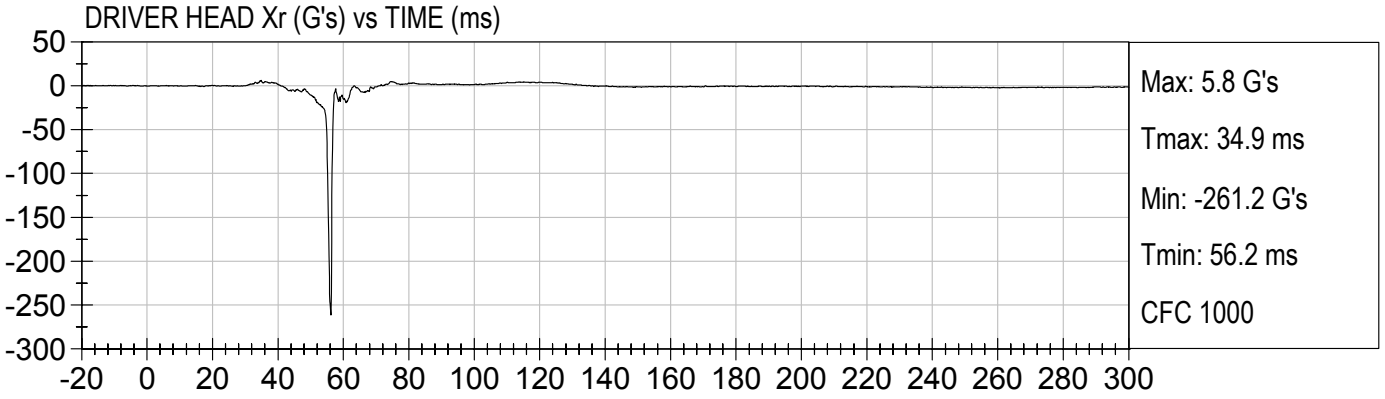


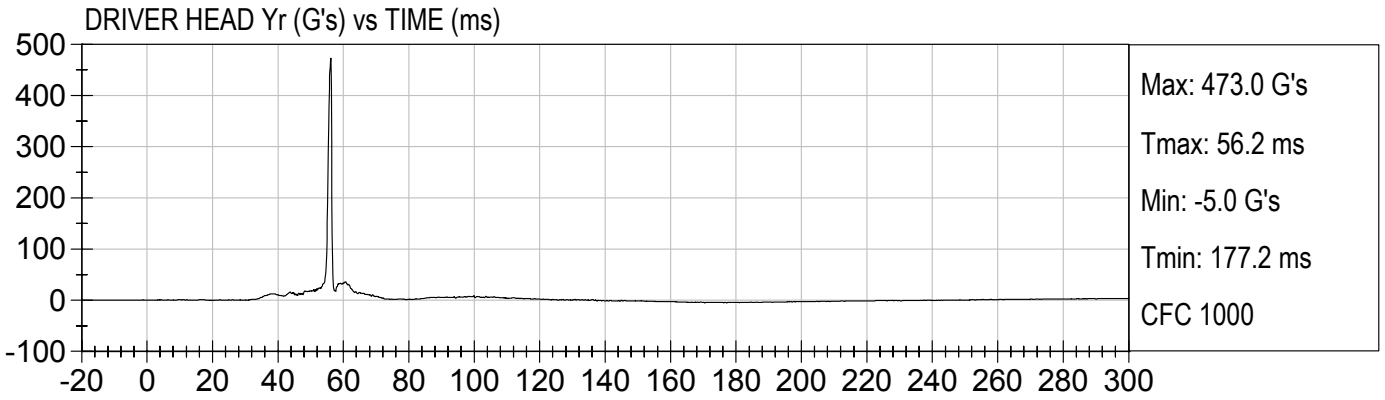
DRIVER LUMBAR MZ (Nm) vs TIME (ms)

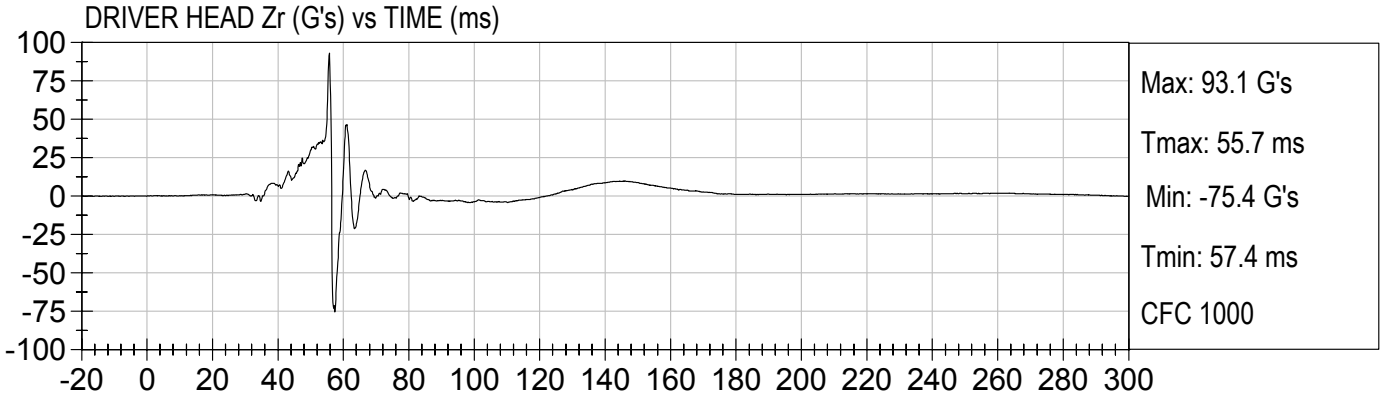


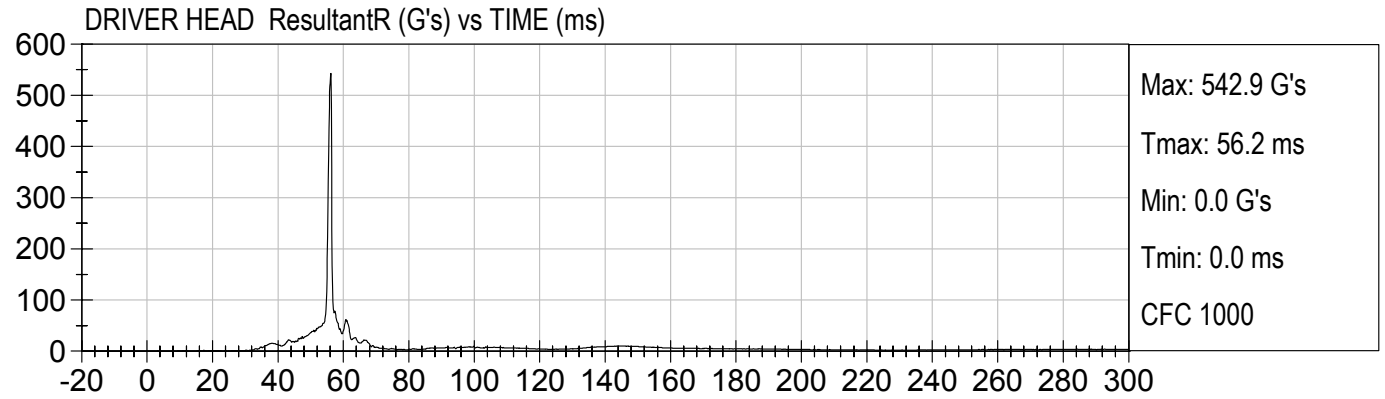
DRIVER LUMBAR MResultant (Nm) vs TIME (ms)

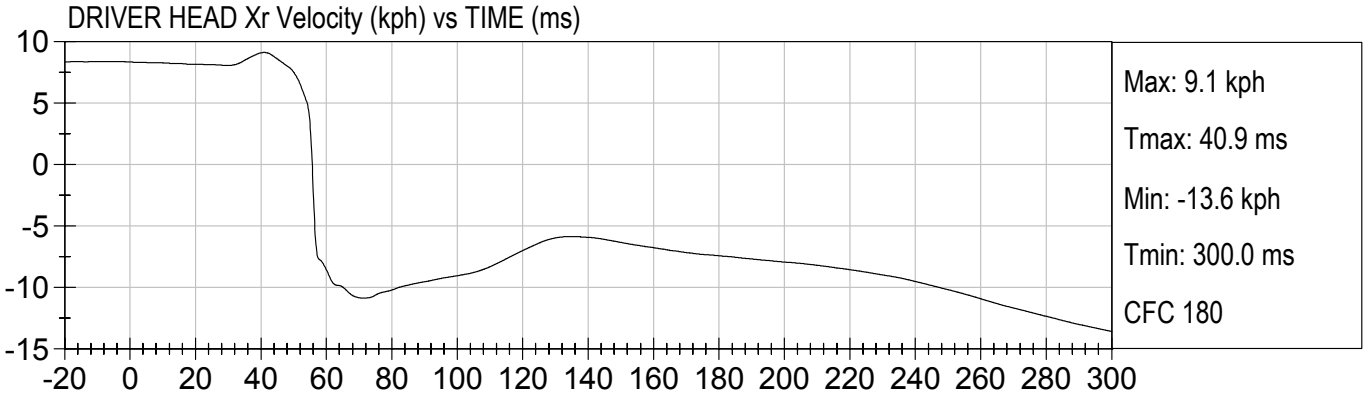


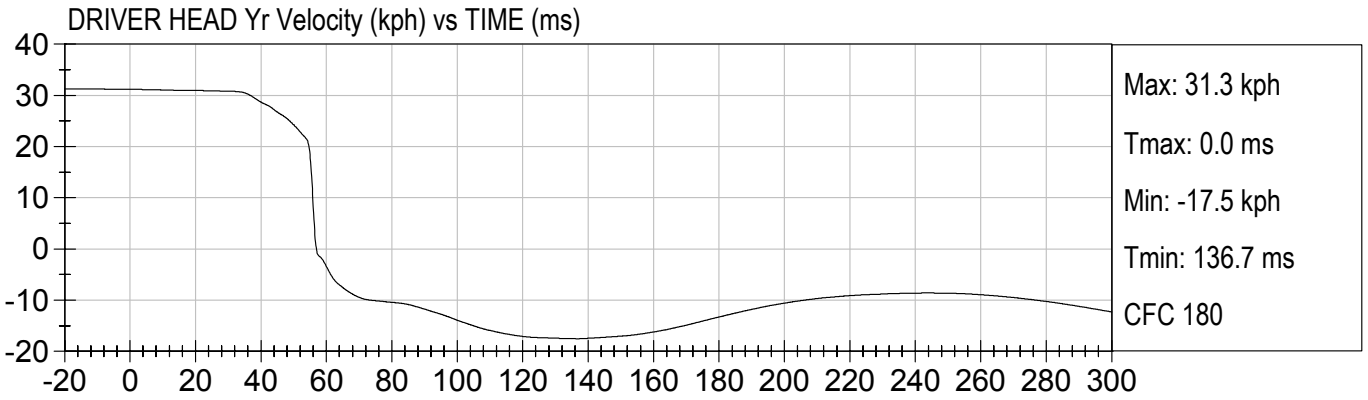

DRIVER HEAD Xr (G's) vs TIME (ms)
50
0
-50
-100
-150
-200
-250
-300
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 5.8 G's
Tmax: 34.9 ms
Min: -261.2 G's
Tmin: 56.2 ms
CFC 1000

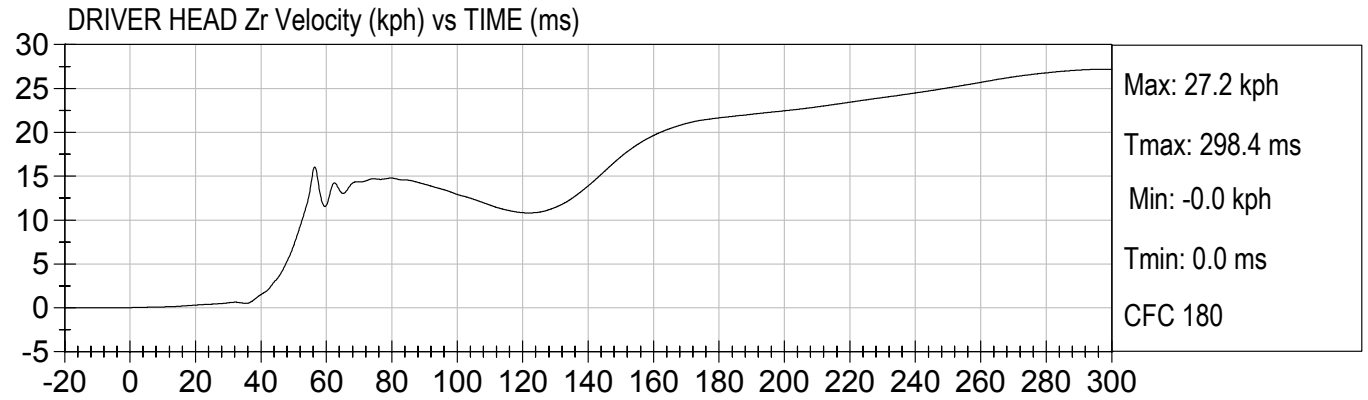

DRIVER HEAD Yr (G's) vs TIME (ms)
500
400
300
200
100
0
-100
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 473.0 G's
Tmax: 56.2 ms
Min: -5.0 G's
Tmin: 177.2 ms
CFC 1000


DRIVER HEAD Zr (G's) vs TIME (ms)
100
75
50
25
0
-25
-50
-75
-100
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 93.1 G's
Tmax: 55.7 ms
Min: -75.4 G's
Tmin: 57.4 ms
CFC 1000

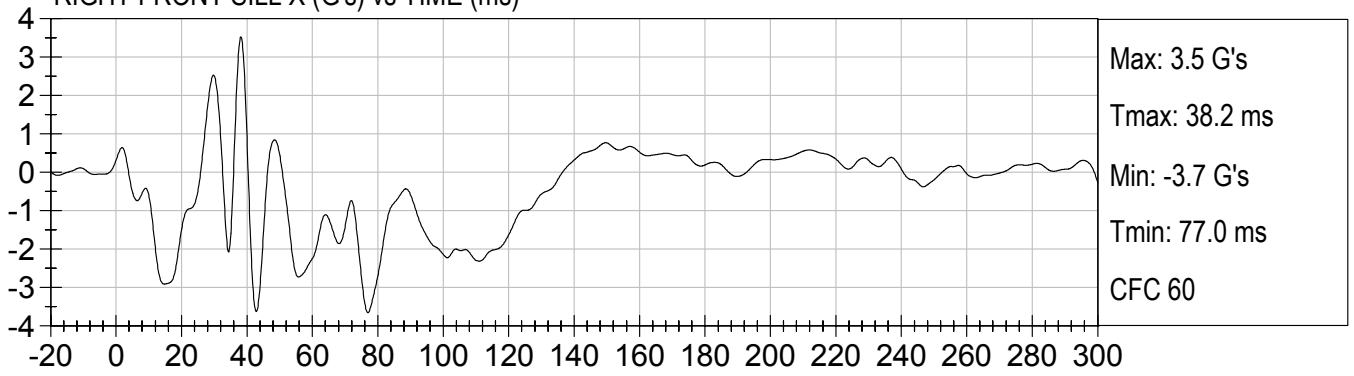

DRIVER HEAD ResultantR (G's) vs TIME (ms)
600
500
400
300
200
100
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 542.9 G's
Tmax: 56.2 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 1000


DRIVER HEAD Xr Velocity (kph) vs TIME (ms)
10
5
0
-5
-10
-15
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 9.1 kph
Tmax: 40.9 ms
Min: -13.6 kph
Tmin: 300.0 ms
CFC 180

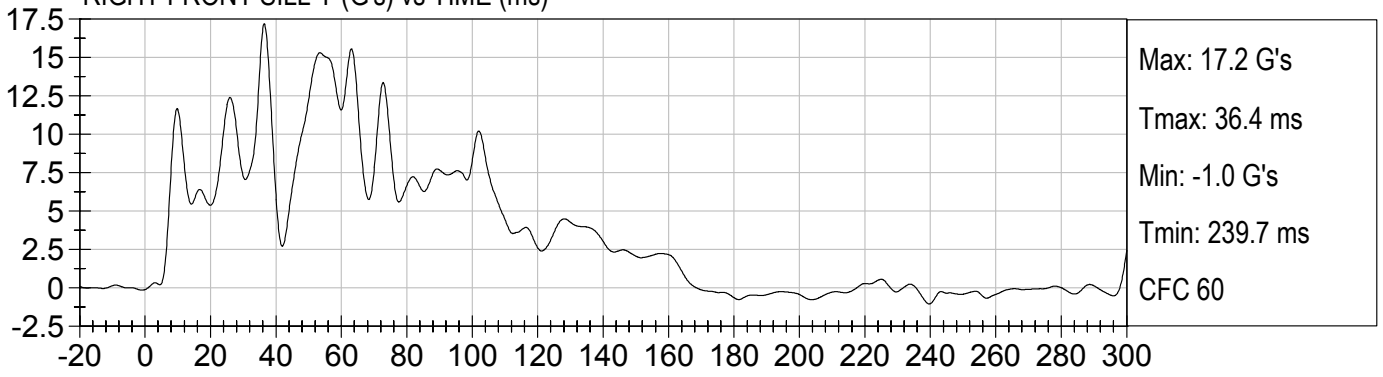

DRIVER HEAD Yr Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.3 kph
Tmax: 0.0 ms
Min: -17.5 kph
Tmin: 136.7 ms
CFC 180


DRIVER HEAD Zr Velocity (kph) vs TIME (ms)
30
25
20
15
10
5
0
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 27.2 kph
Tmax: 298.4 ms
Min: -0.0 kph
Tmin: 0.0 ms
CFC 180

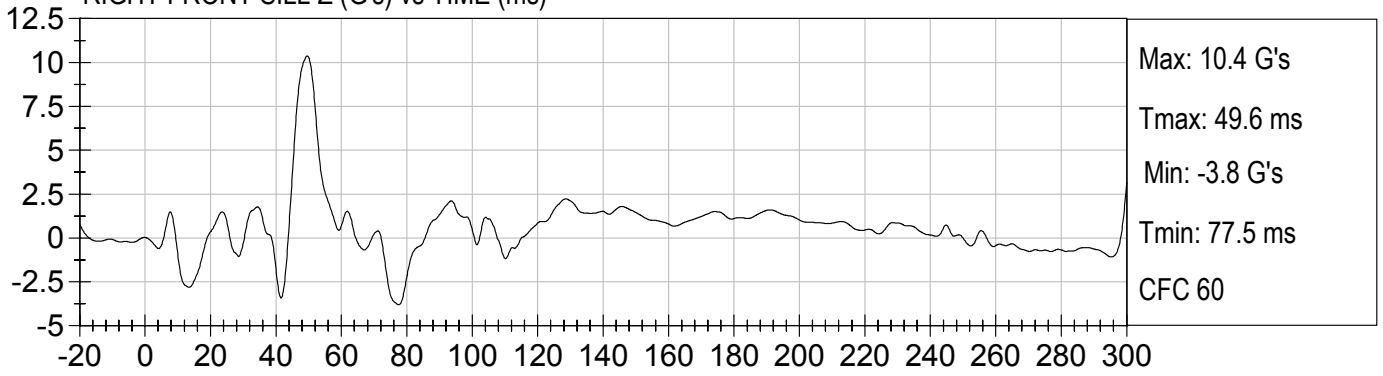
RIGHT FRONT SILL X (G's) vs TIME (ms)



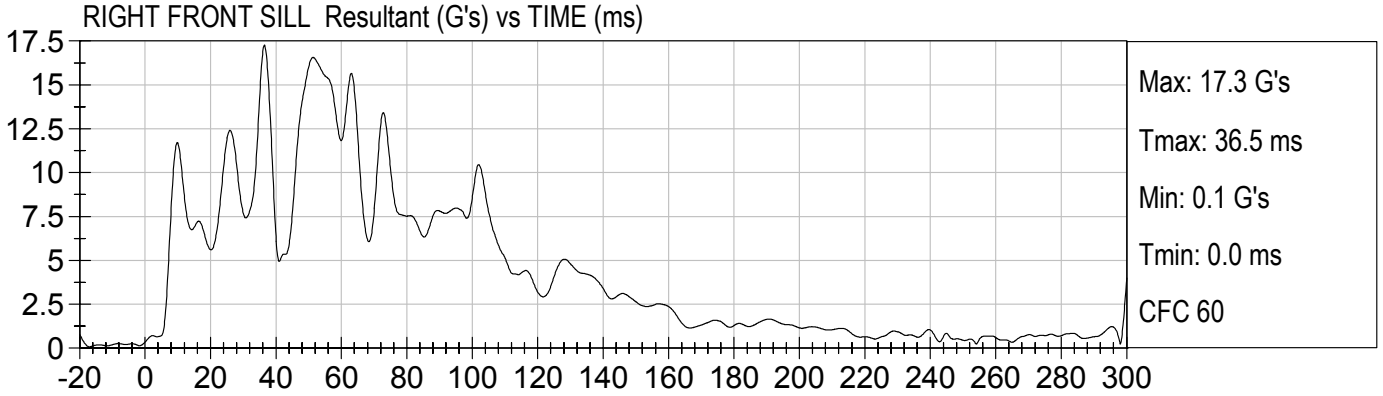
RIGHT FRONT SILL Y (G's) vs TIME (ms)

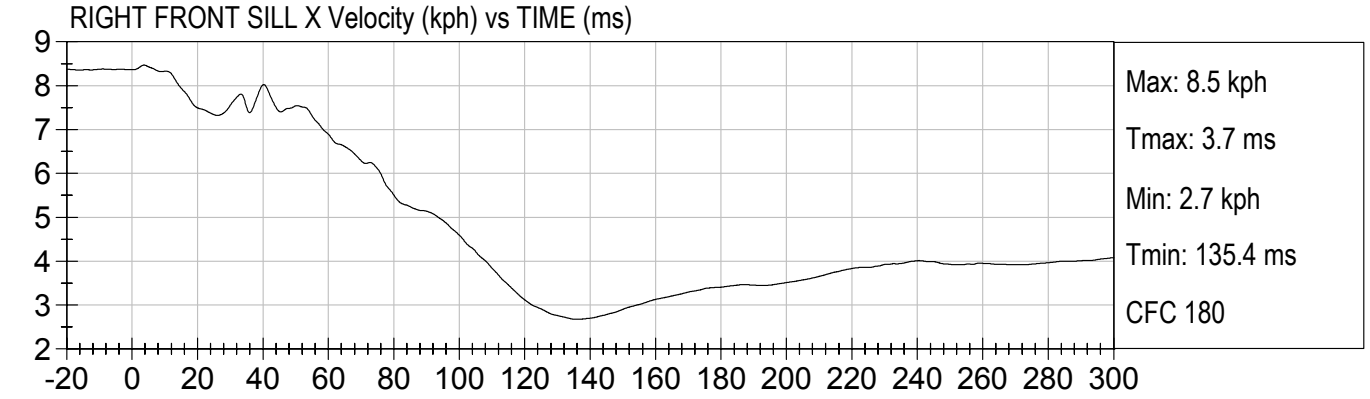


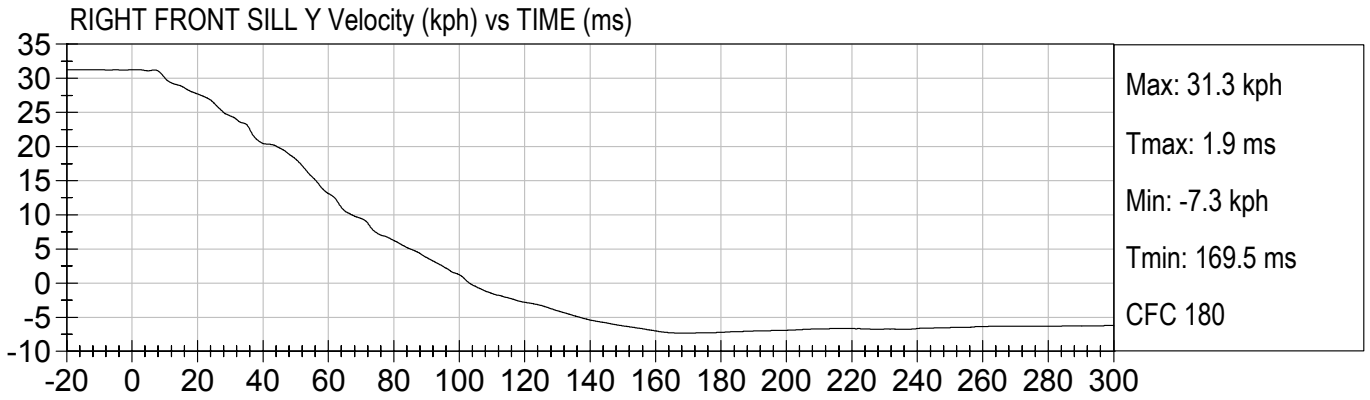
RIGHT FRONT SILL Z (G's) vs TIME (ms)

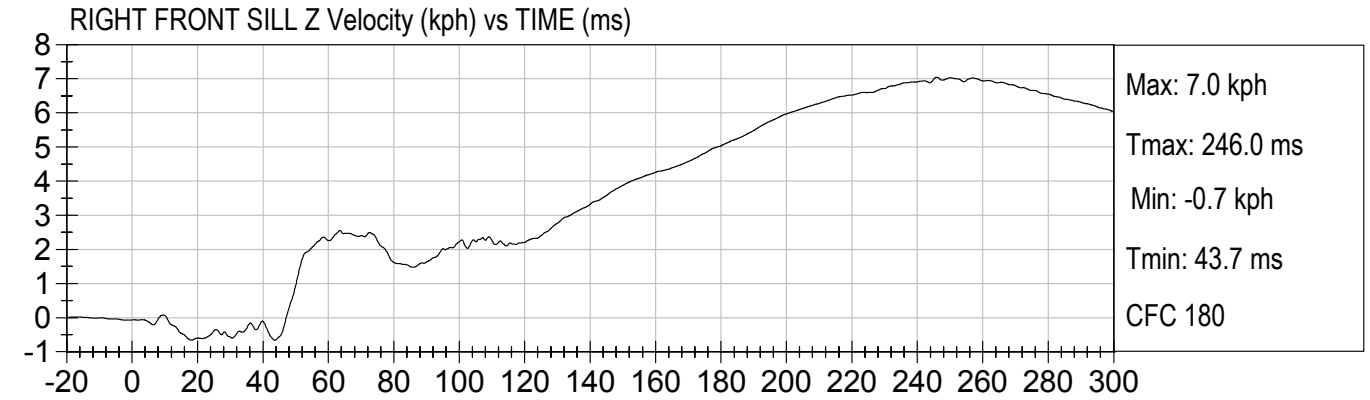


RIGHT FRONT SILL Resultant (G's) vs TIME (ms)

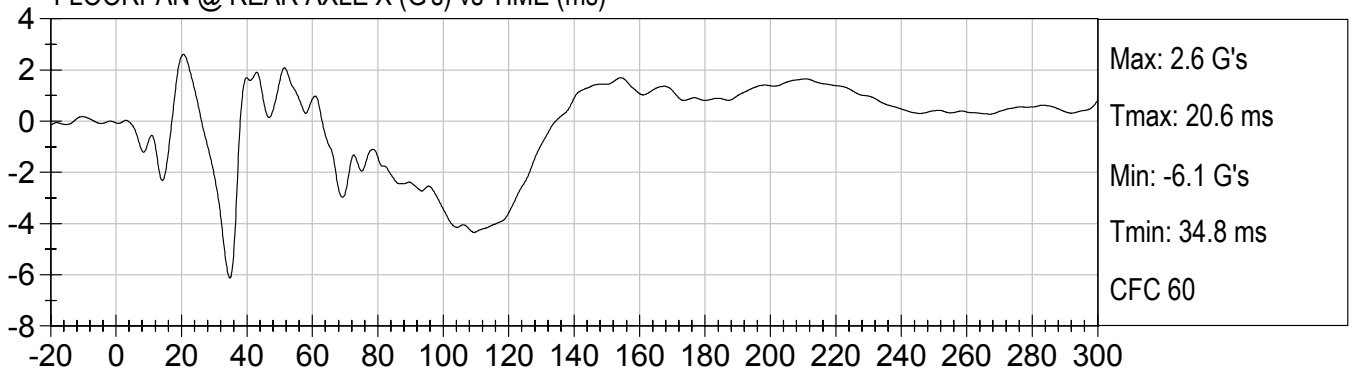



RIGHT FRONT SILL X Velocity (kph) vs TIME (ms)
Max: 8.5 kph
Tmax: 3.7 ms
Min: 2.7 kph
Tmin: 135.4 ms
CFC 180

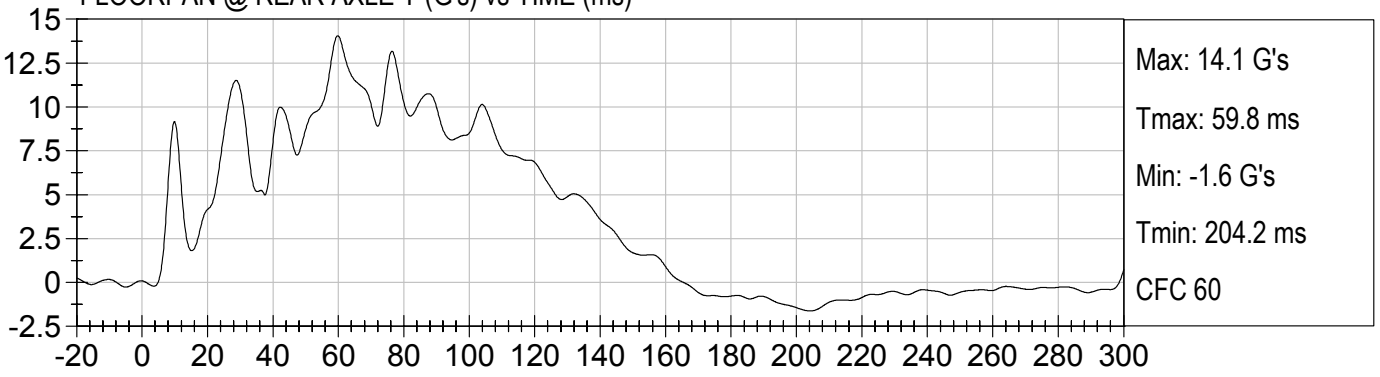

RIGHT FRONT SILL Y Velocity (kph) vs TIME (ms)
Max: 31.3 kph
Tmax: 1.9 ms
Min: -7.3 kph
Tmin: 169.5 ms
CFC 180


RIGHT FRONT SILL Z Velocity (kph) vs TIME (ms)
Max: 7.0 kph
Tmax: 246.0 ms
Min: -0.7 kph
Tmin: 43.7 ms
CFC 180

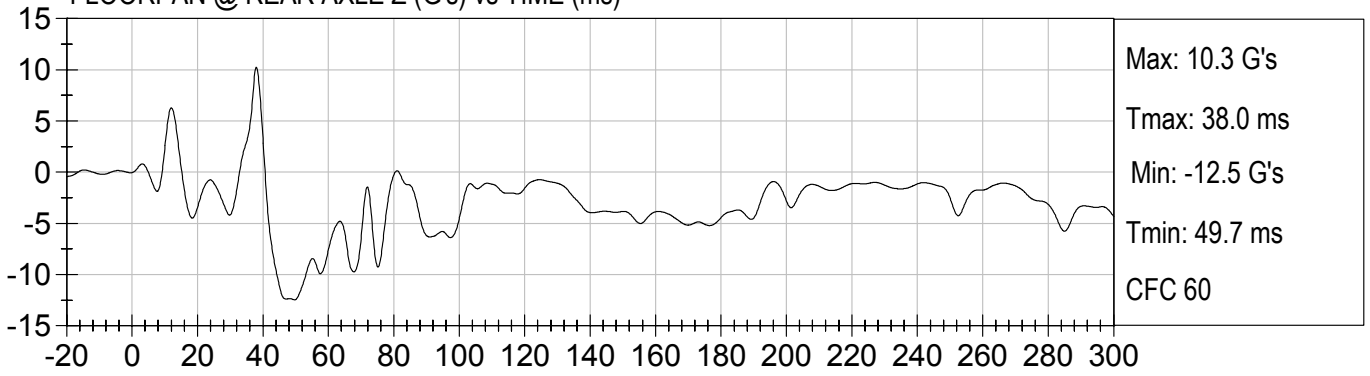
FLOORPAN @ REAR AXLE X (G's) vs TIME (ms)



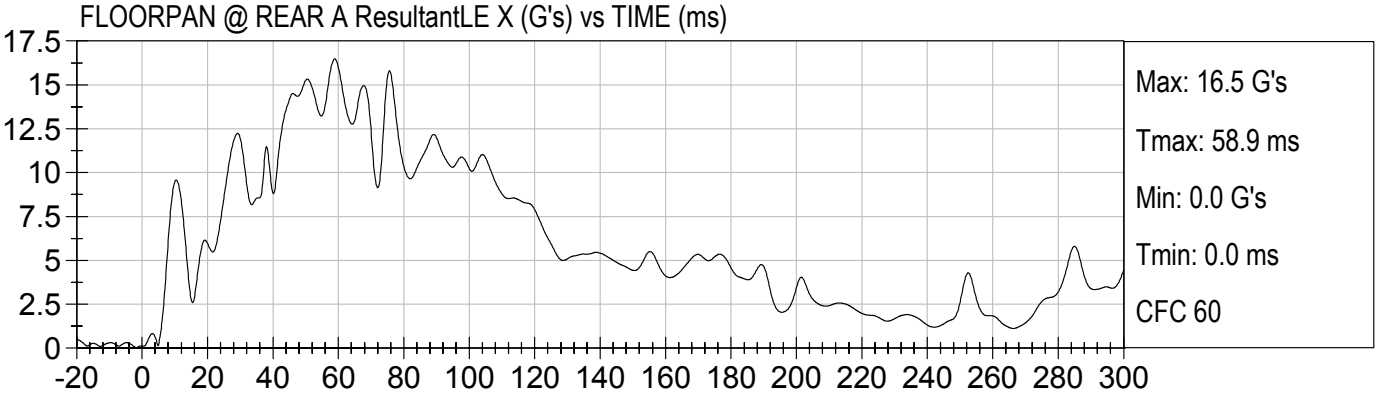
FLOORPAN @ REAR AXLE Y (G's) vs TIME (ms)

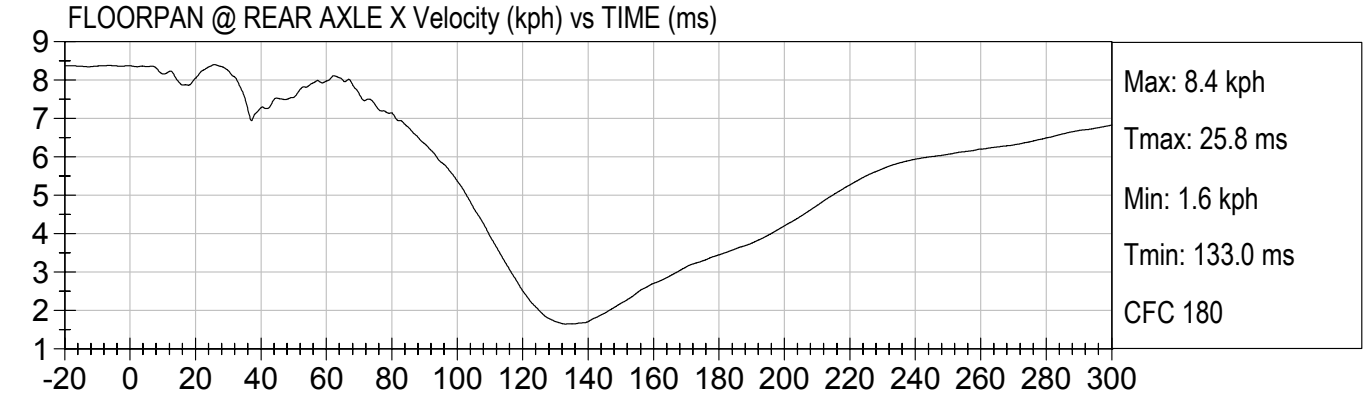


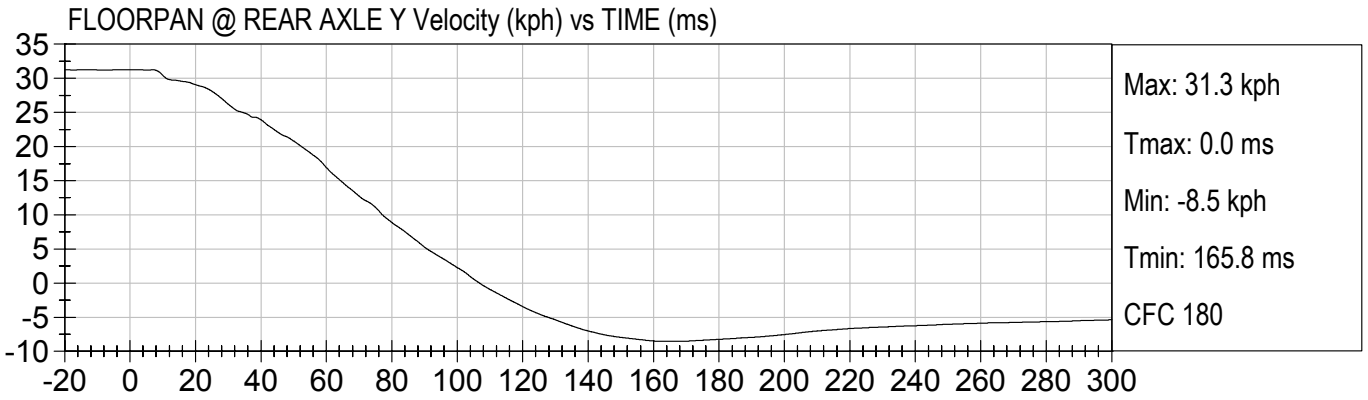
FLOORPAN @ REAR AXLE Z (G's) vs TIME (ms)

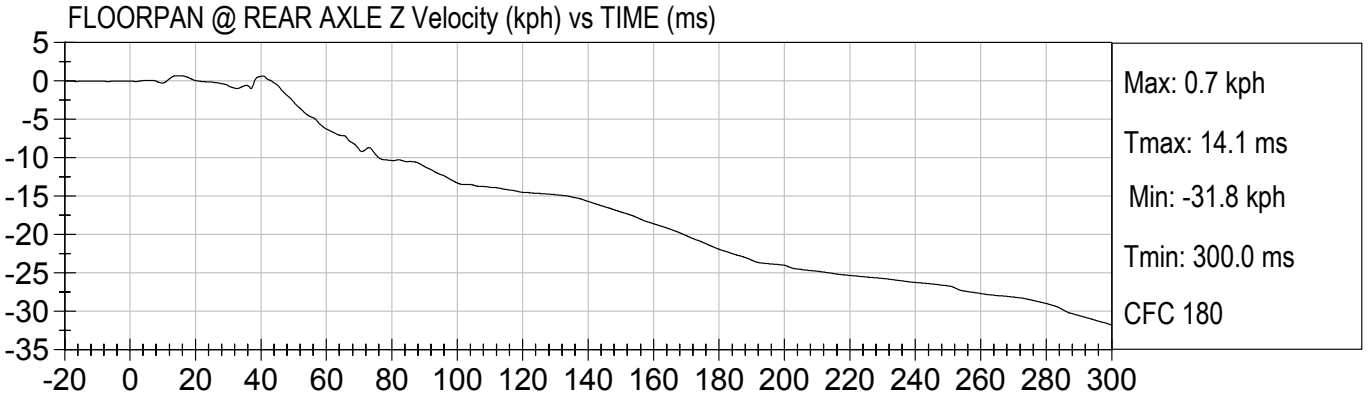


FLOORPAN @ REAR A ResultantLE X (G's) vs TIME (ms)



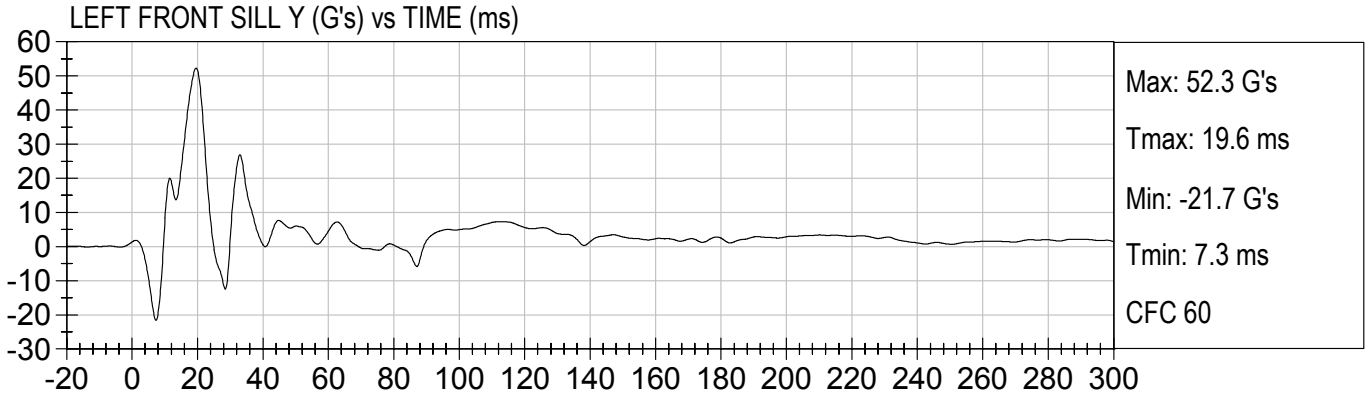

FLOORPAN @ REAR AXLE X Velocity (kph) vs TIME (ms)
9
8
7
6
5
4
3
2
1
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 25.8 ms
Min: 1.6 kph
Tmin: 133.0 ms
CFC 180

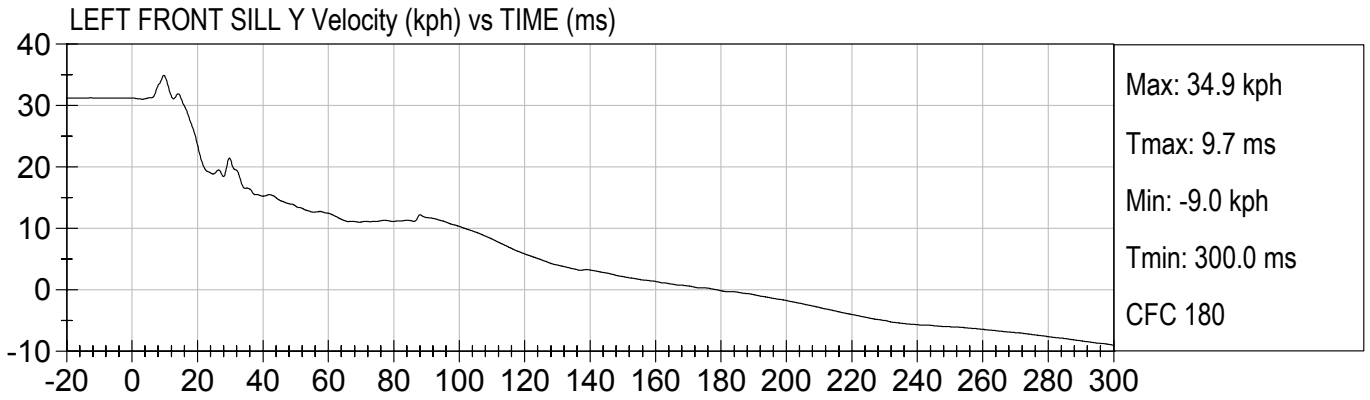

FLOORPAN @ REAR AXLE Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.3 kph
Tmax: 0.0 ms
Min: -8.5 kph
Tmin: 165.8 ms
CFC 180

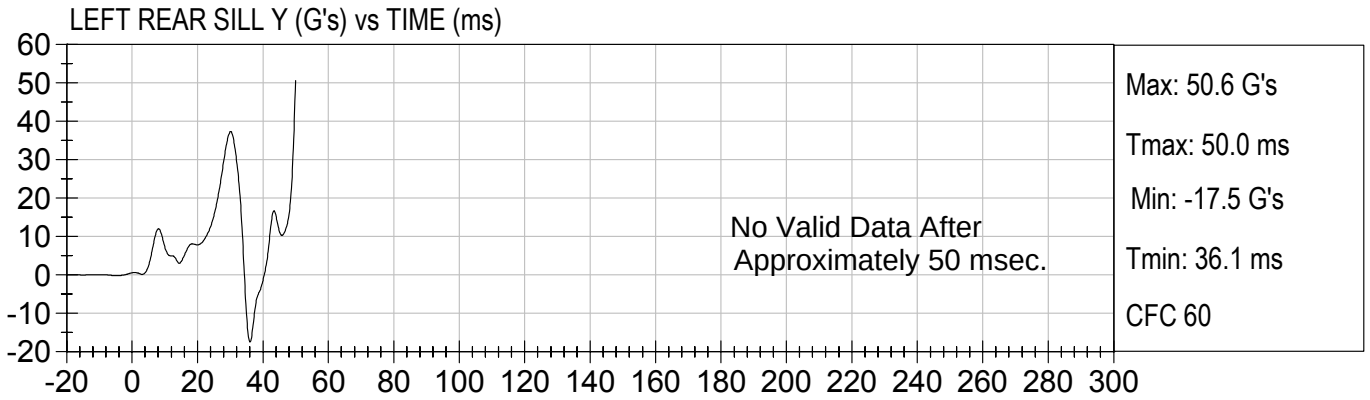

FLOORPAN @ REAR AXLE Z Velocity (kph) vs TIME (ms)
5
0
-5
-10
-15
-20
-25
-30
-35
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.7 kph
Tmax: 14.1 ms
Min: -31.8 kph
Tmin: 300.0 ms
CFC 180

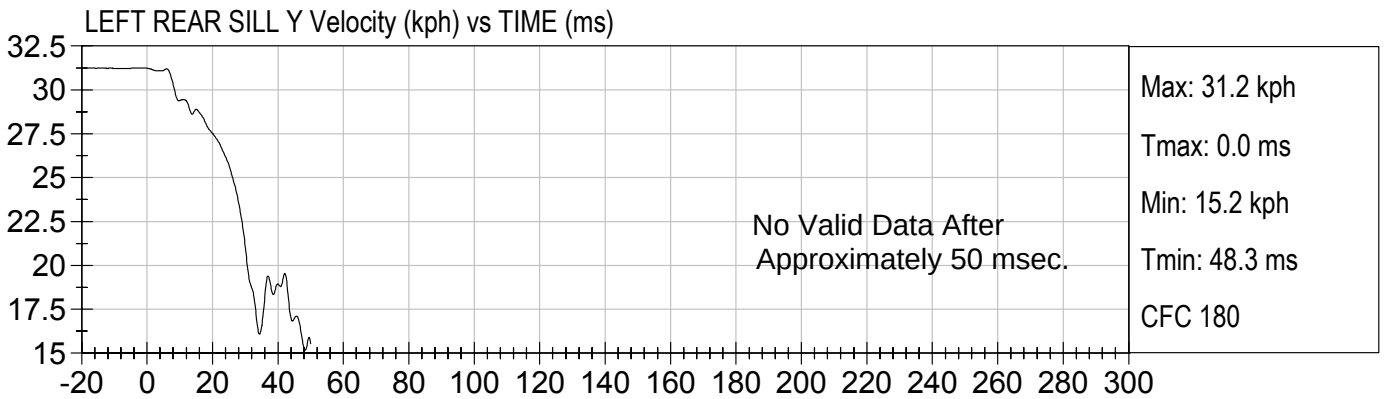
20 MPH OBLIQUE POLE
2005 SATURN ION R50170

Test Date: 08/18/2005
Speed: 20.1 mph (32.3 km/h)

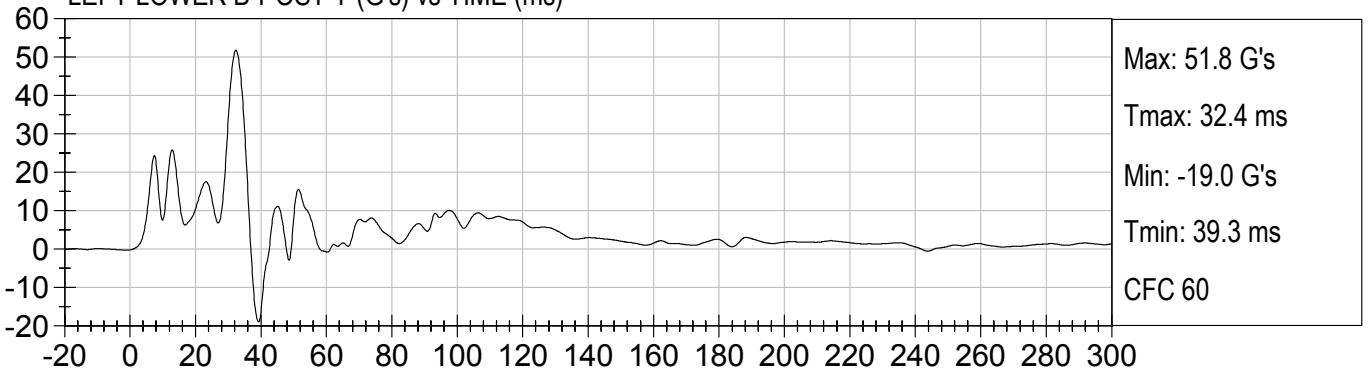




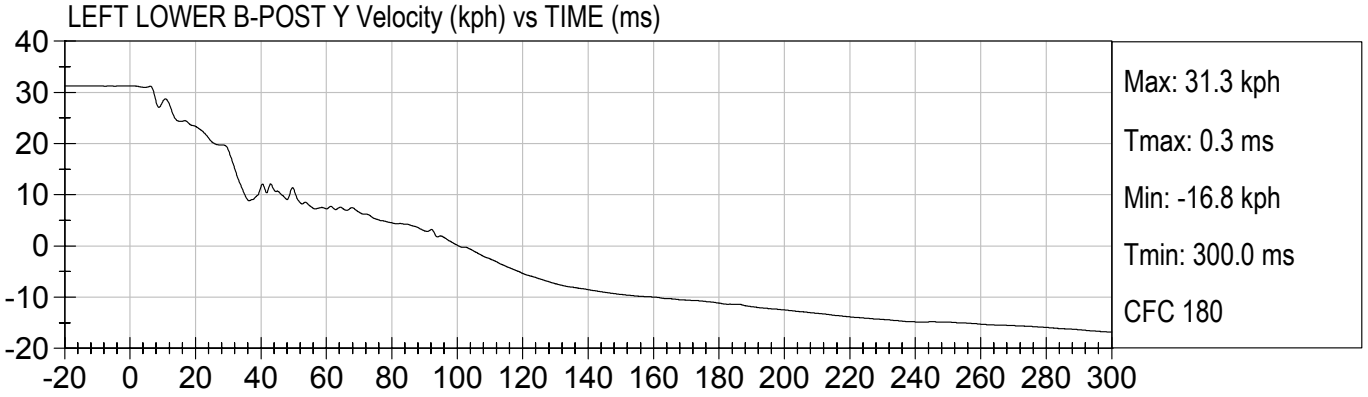




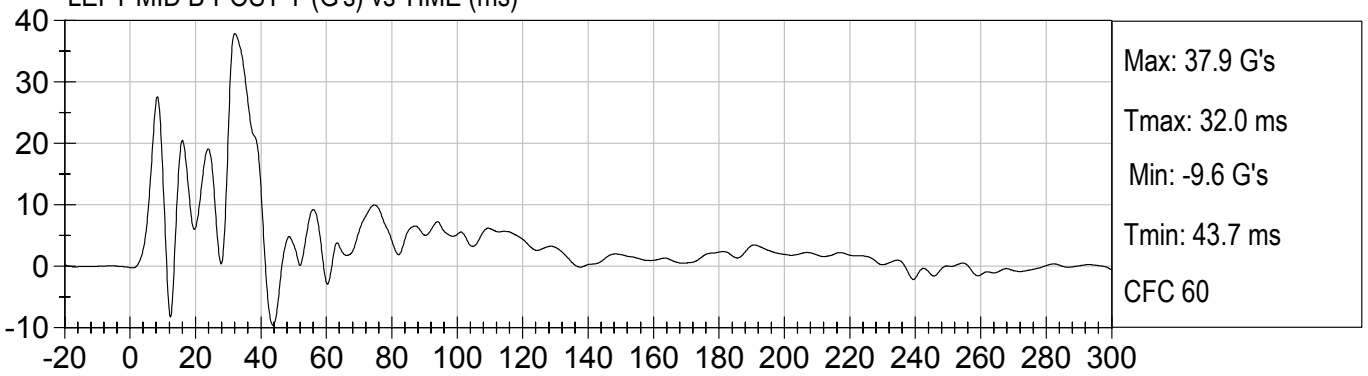
LEFT LOWER B-POST Y (G's) vs TIME (ms)



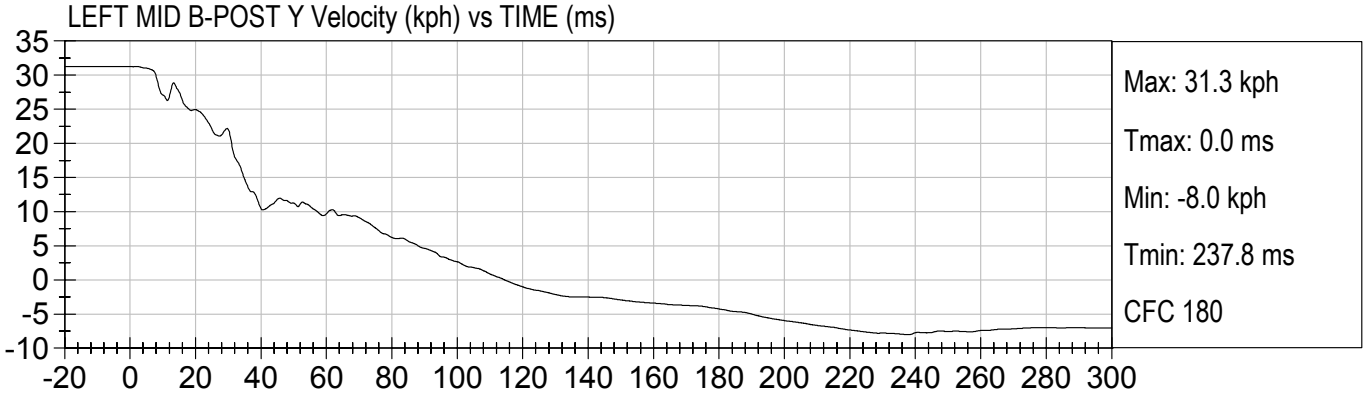
LEFT LOWER B-POST Y Velocity (kph) vs TIME (ms)



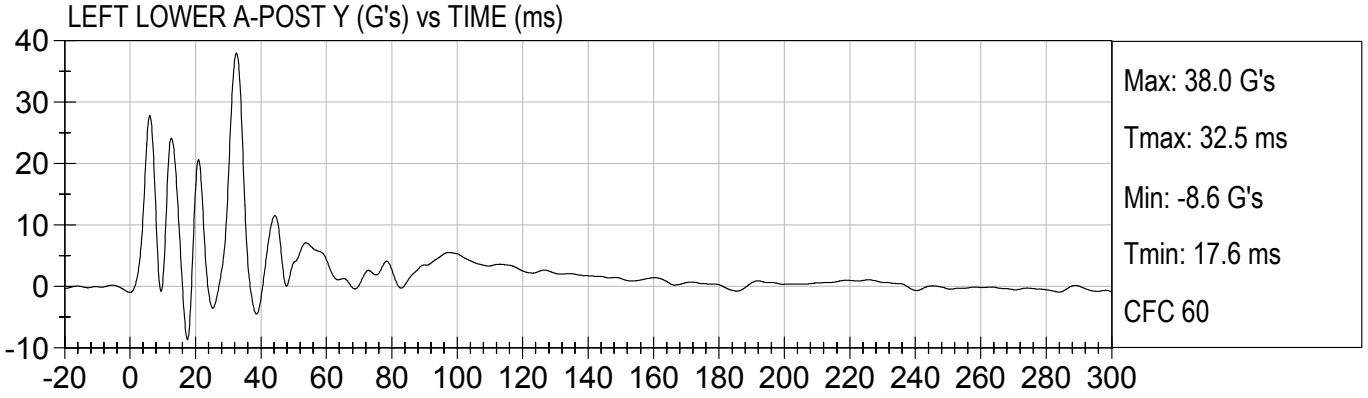
LEFT MID B-POST Y (G's) vs TIME (ms)



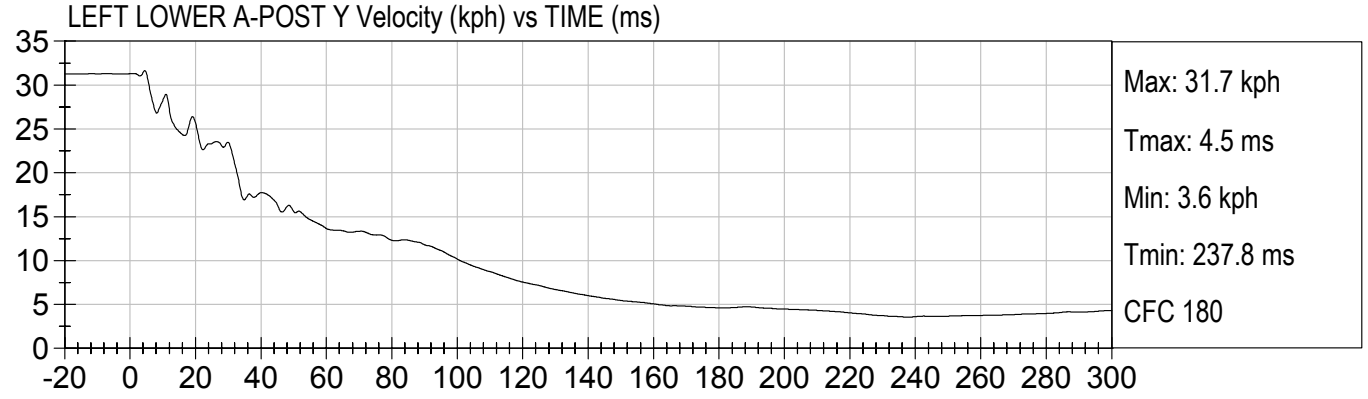
LEFT MID B-POST Y Velocity (kph) vs TIME (ms)



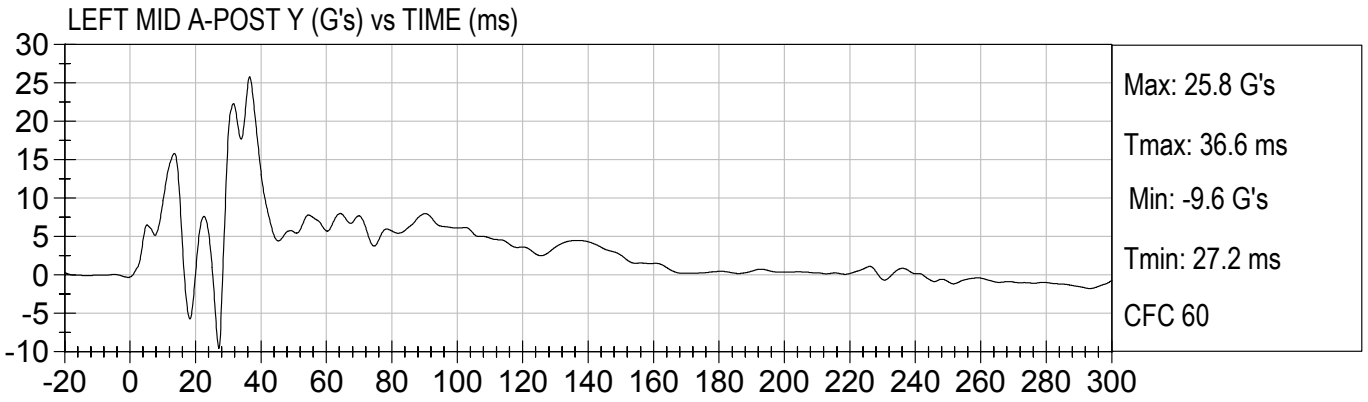
LEFT LOWER A-POST Y (G's) vs TIME (ms)



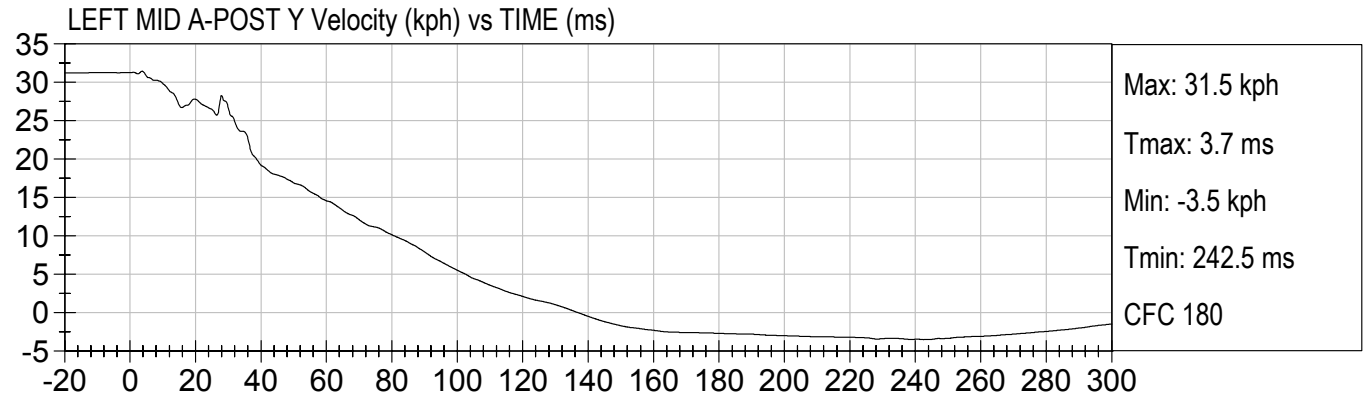
LEFT LOWER A-POST Y Velocity (kph) vs TIME (ms)



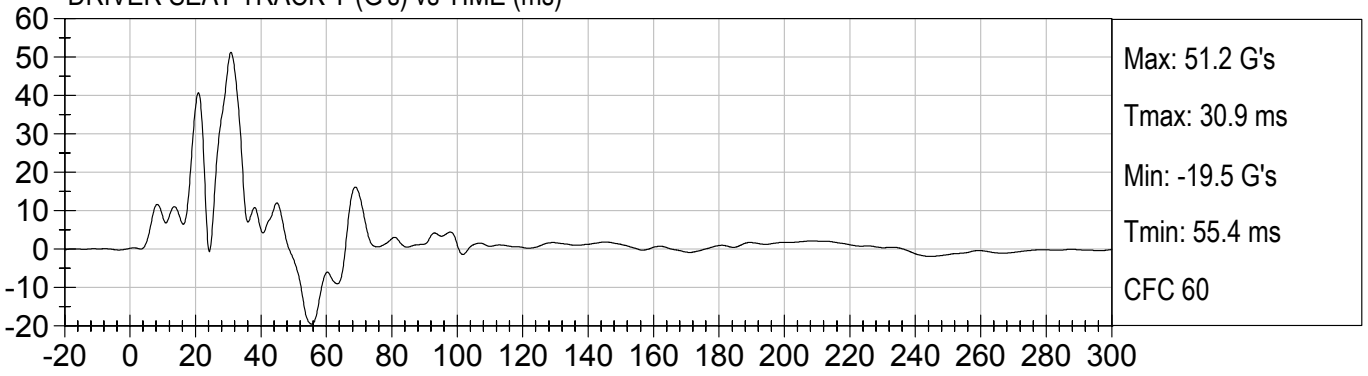
LEFT MID A-POST Y (G's) vs TIME (ms)



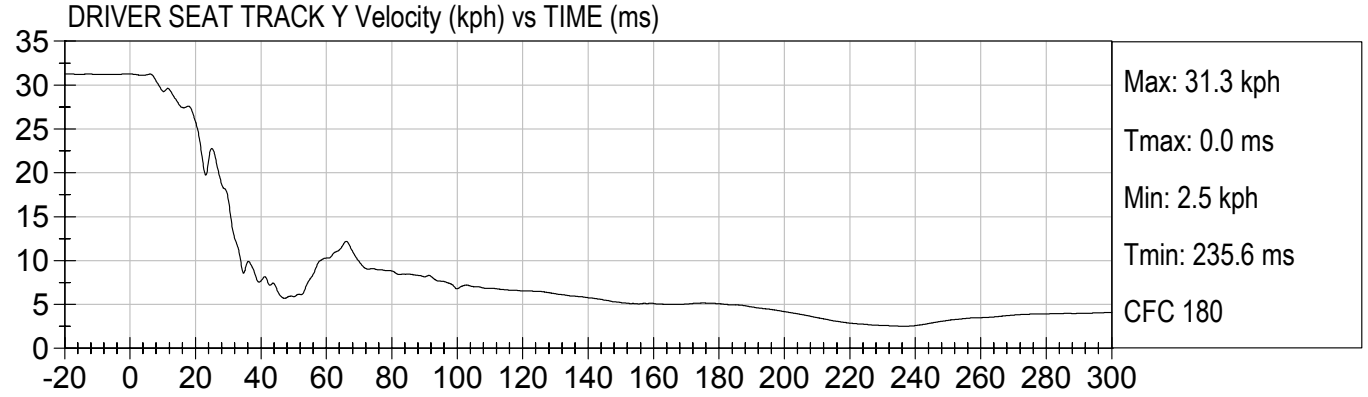
LEFT MID A-POST Y Velocity (kph) vs TIME (ms)



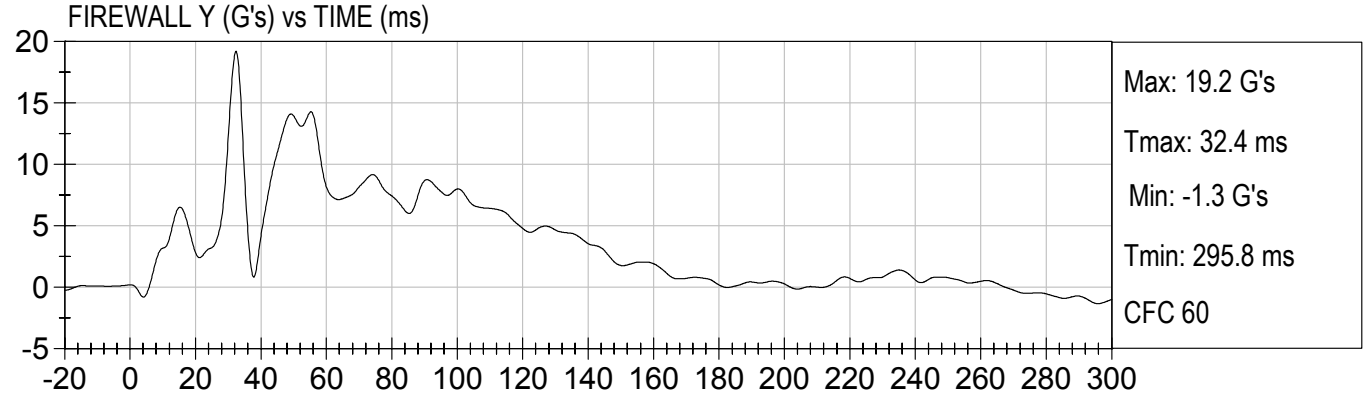
DRIVER SEAT TRACK Y (G's) vs TIME (ms)



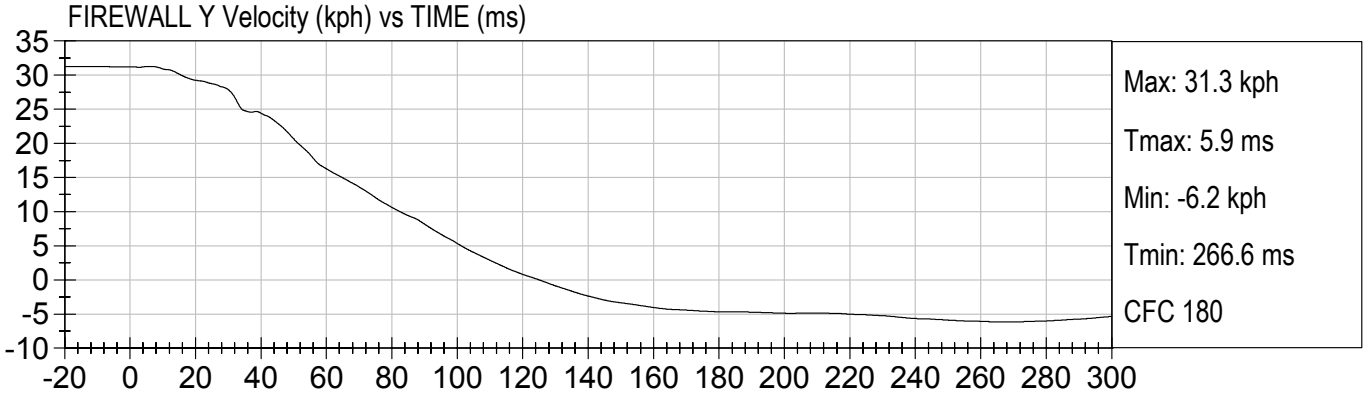
DRIVER SEAT TRACK Y Velocity (kph) vs TIME (ms)

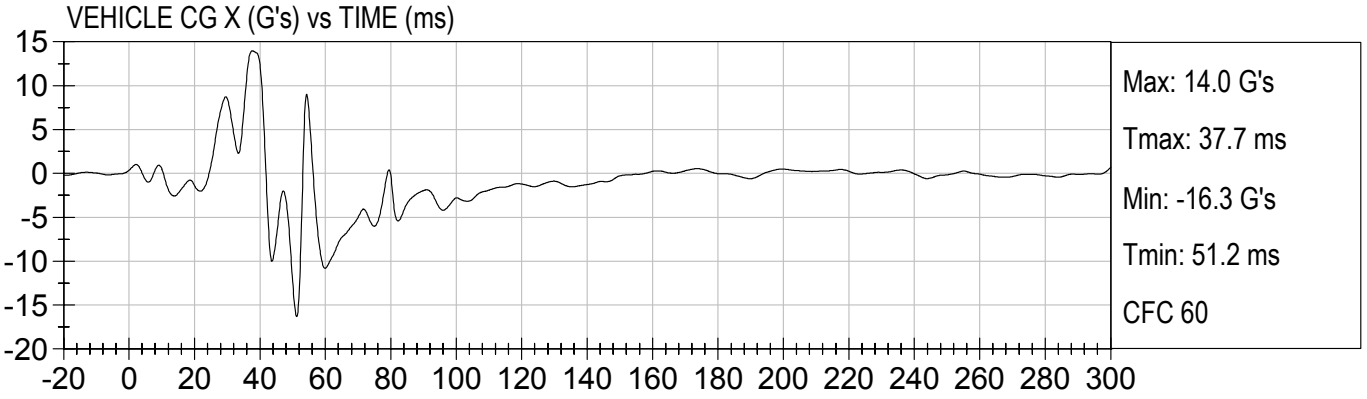


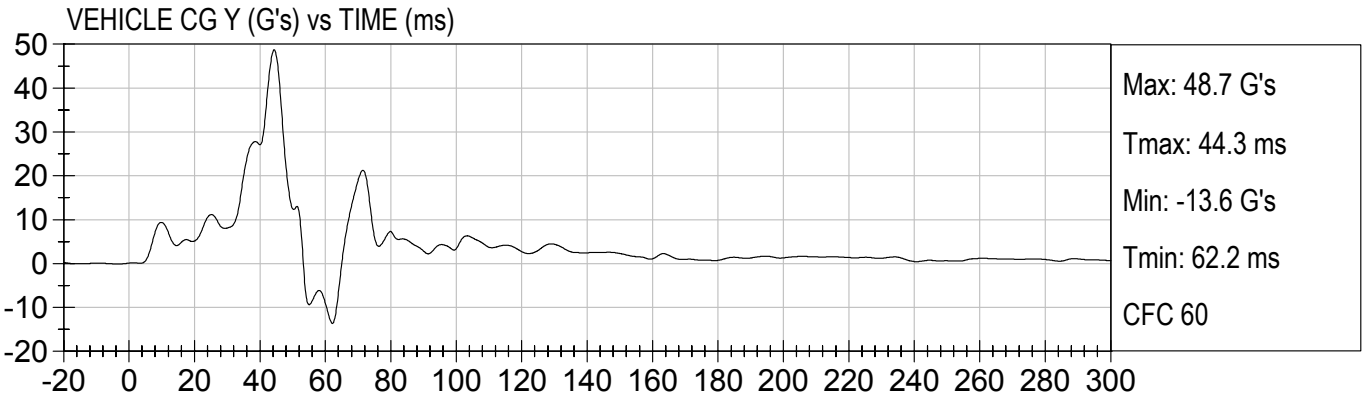
FIREWALL Y (G's) vs TIME (ms)

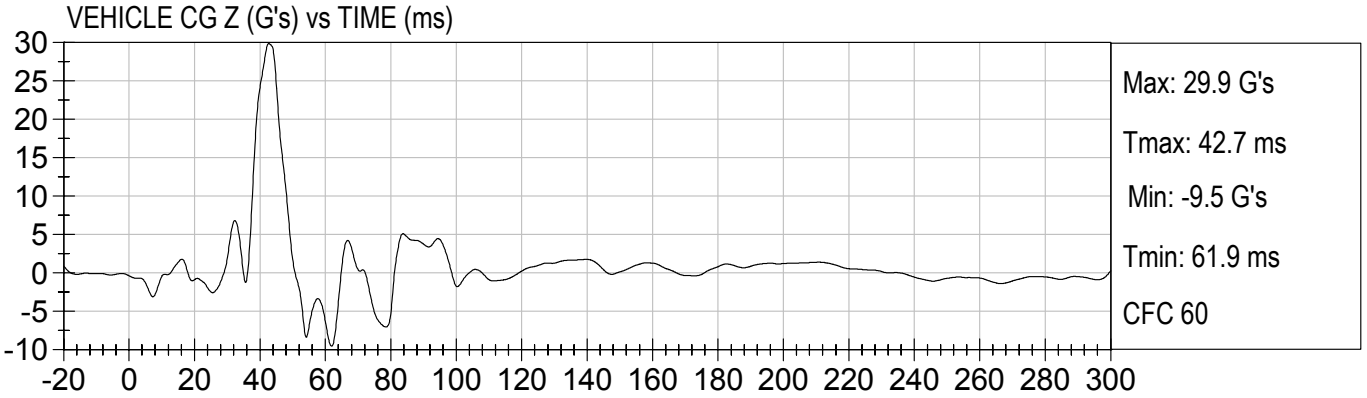


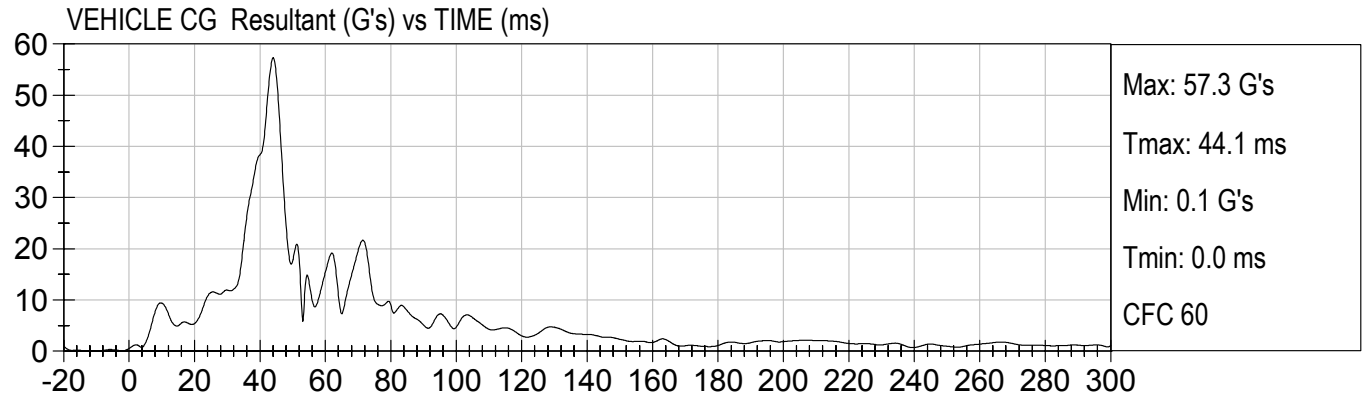
FIREWALL Y Velocity (kph) vs TIME (ms)

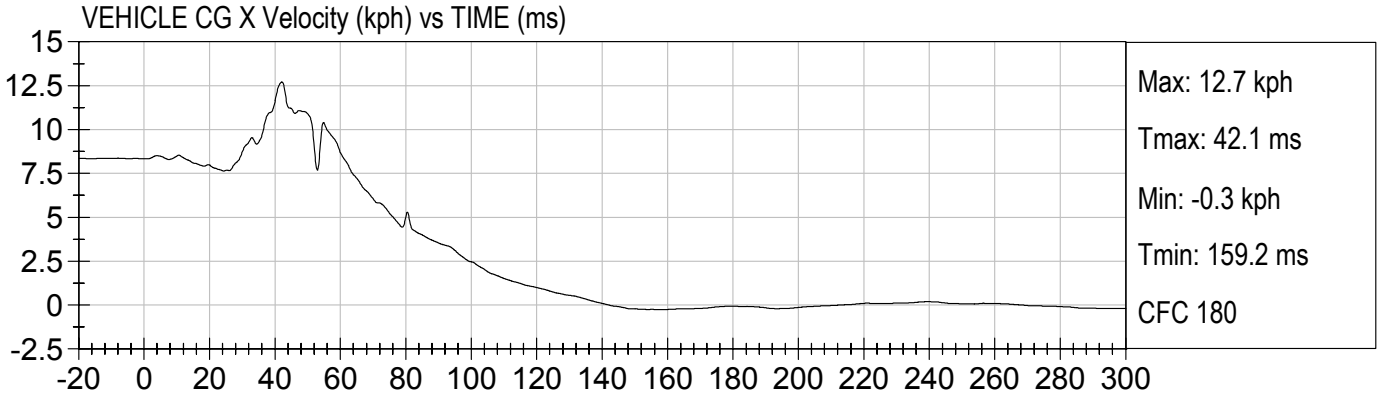


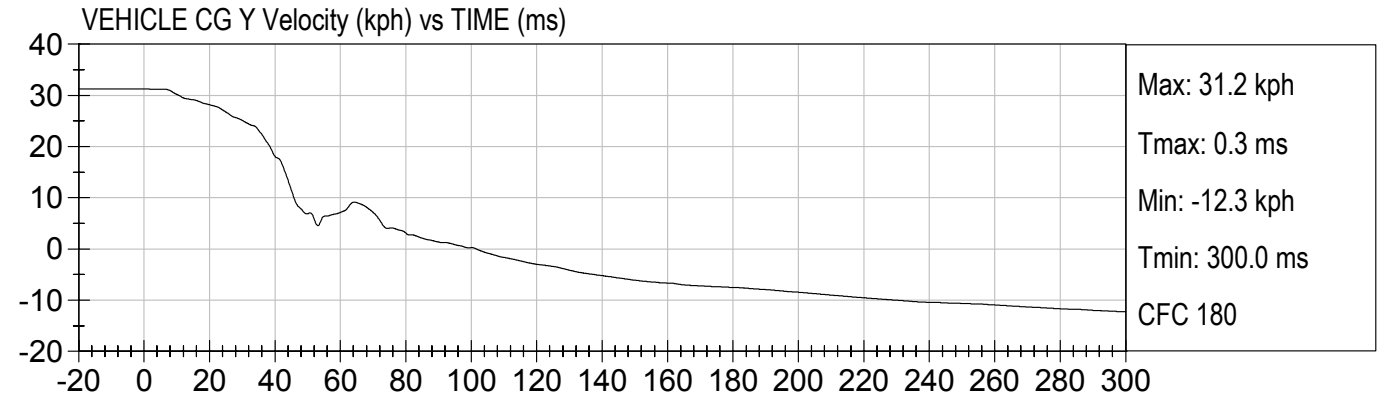

VEHICLE CG X (G's) vs TIME (ms)
15
10
5
0
-5
-10
-15
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 14.0 G's
Tmax: 37.7 ms
Min: -16.3 G's
Tmin: 51.2 ms
CFC 60

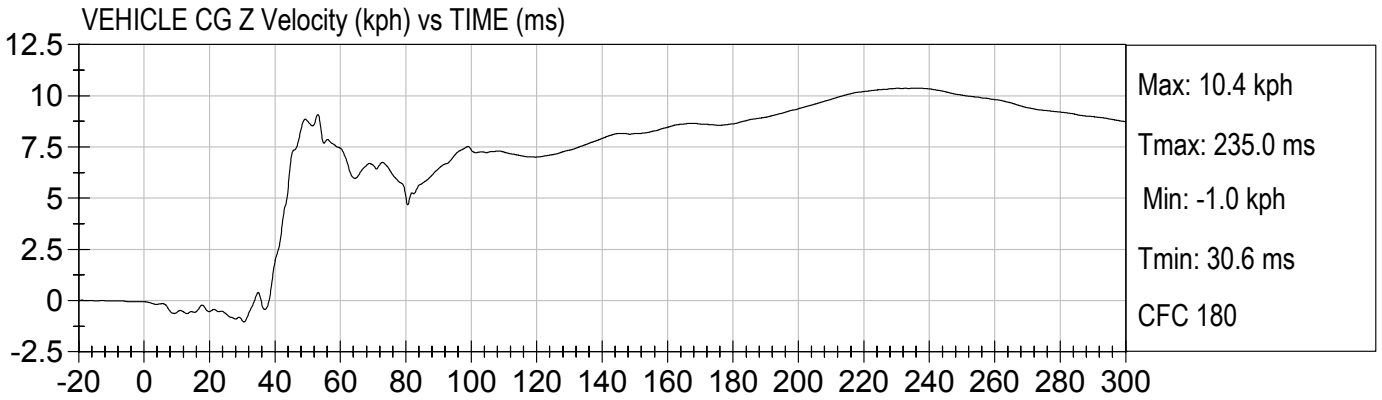

VEHICLE CG Y (G's) vs TIME (ms)
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 48.7 G's
Tmax: 44.3 ms
Min: -13.6 G's
Tmin: 62.2 ms
CFC 60


VEHICLE CG Z (G's) vs TIME (ms)
30
25
20
15
10
5
0
-5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 29.9 G's
Tmax: 42.7 ms
Min: -9.5 G's
Tmin: 61.9 ms
CFC 60

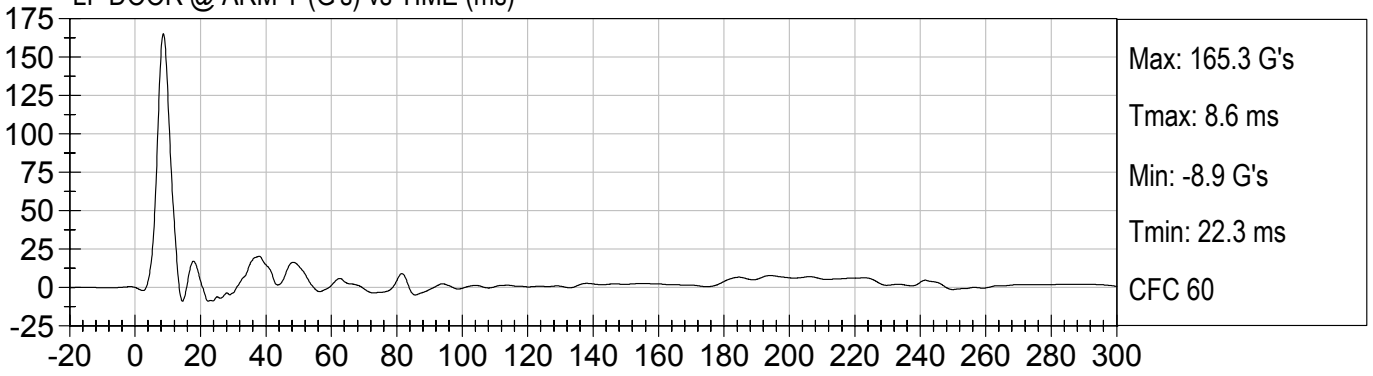

VEHICLE CG Resultant (G's) vs TIME (ms)
60
50
40
30
20
10
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 57.3 G's
Tmax: 44.1 ms
Min: 0.1 G's
Tmin: 0.0 ms
CFC 60


VEHICLE CG X Velocity (kph) vs TIME (ms)
15
12.5
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 12.7 kph
Tmax: 42.1 ms
Min: -0.3 kph
Tmin: 159.2 ms
CFC 180

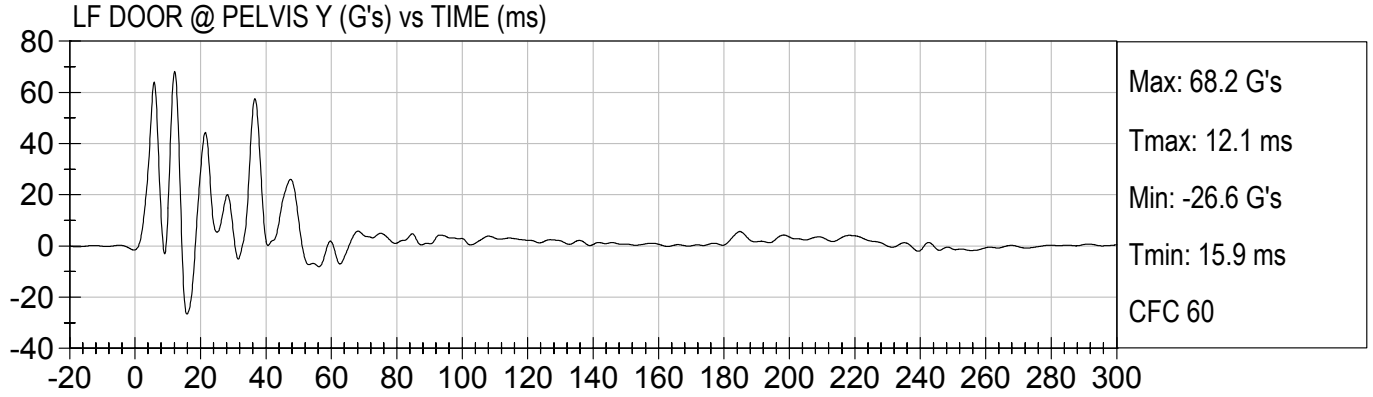

VEHICLE CG Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.2 kph
Tmax: 0.3 ms
Min: -12.3 kph
Tmin: 300.0 ms
CFC 180


VEHICLE CG Z Velocity (kph) vs TIME (ms)
12.5
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 10.4 kph
Tmax: 235.0 ms
Min: -1.0 kph
Tmin: 30.6 ms
CFC 180

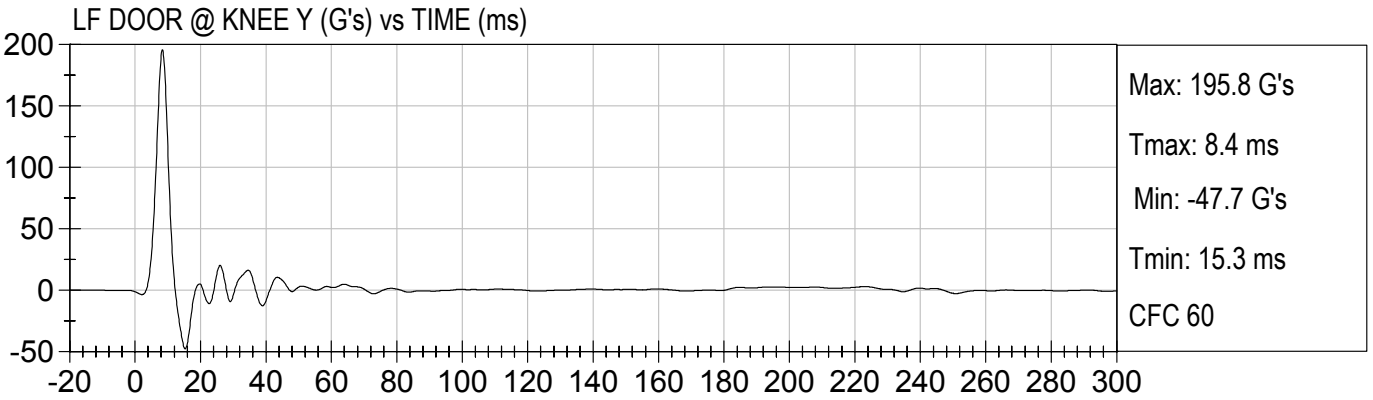
LF DOOR @ ARM Y (G's) vs TIME (ms)



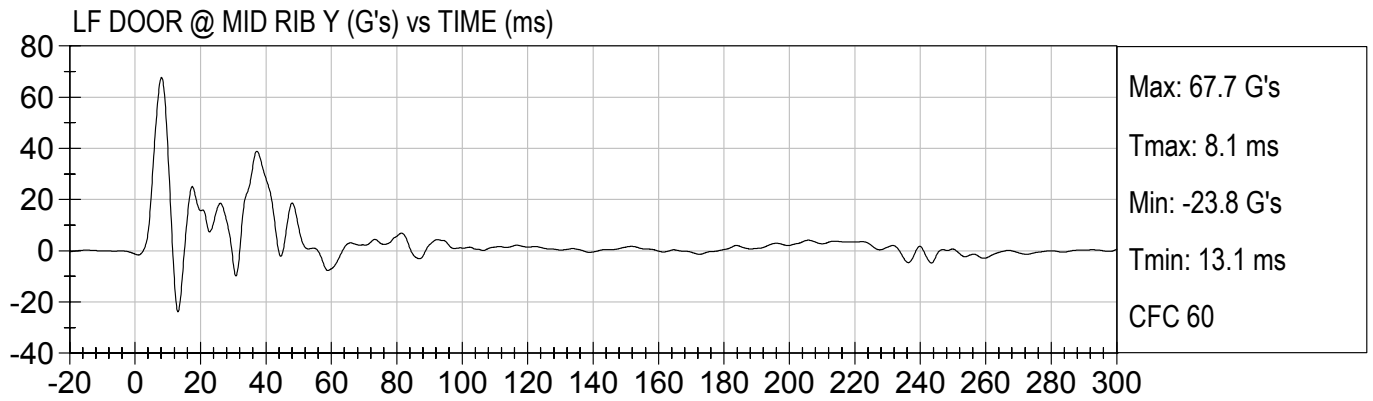
LF DOOR @ PELVIS Y (G's) vs TIME (ms)



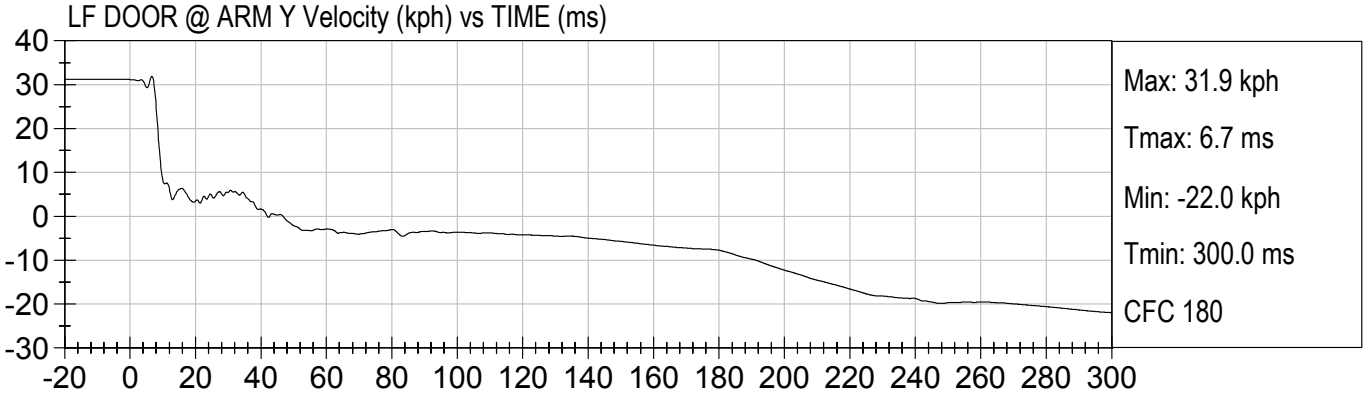
LF DOOR @ KNEE Y (G's) vs TIME (ms)



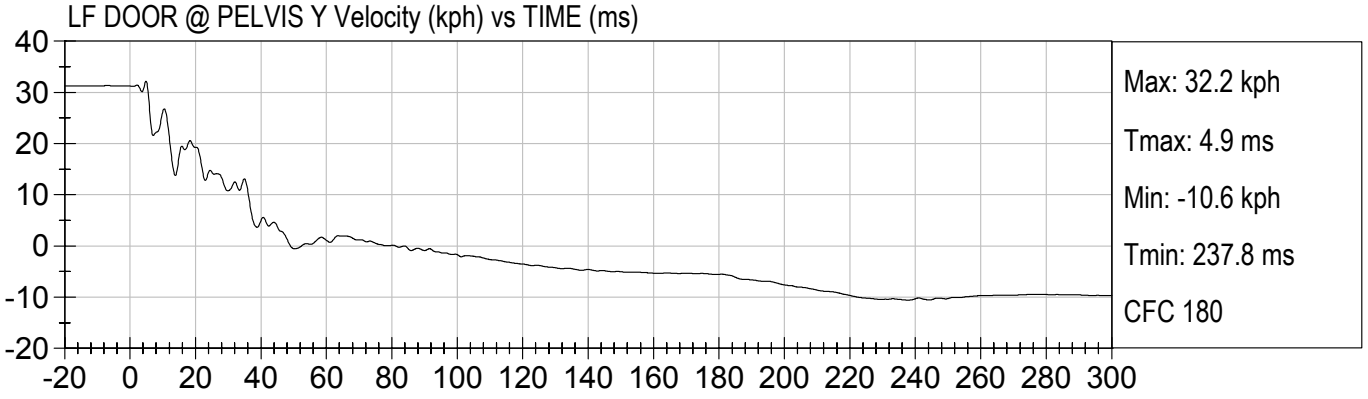
LF DOOR @ MID RIB Y (G's) vs TIME (ms)



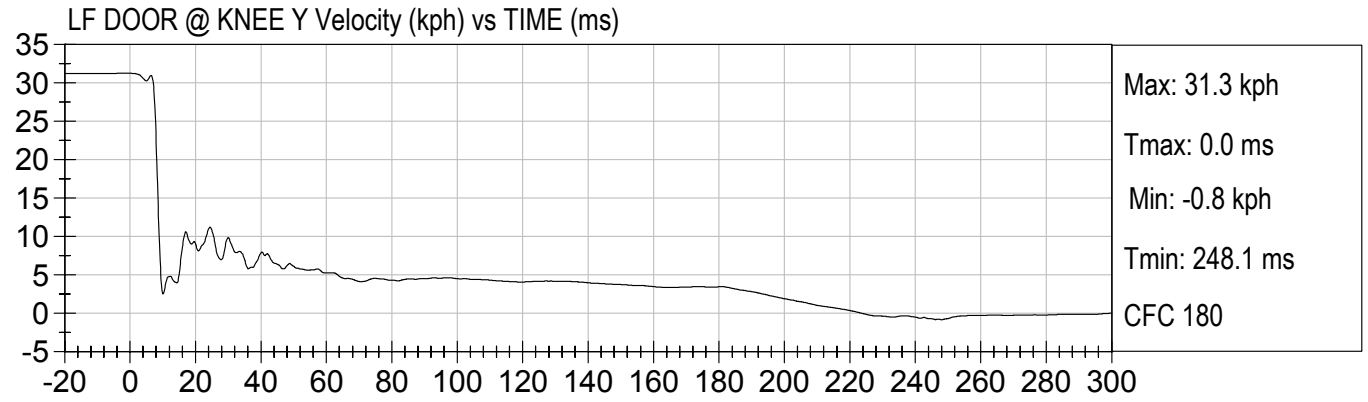
LF DOOR @ ARM Y Velocity (kph) vs TIME (ms)



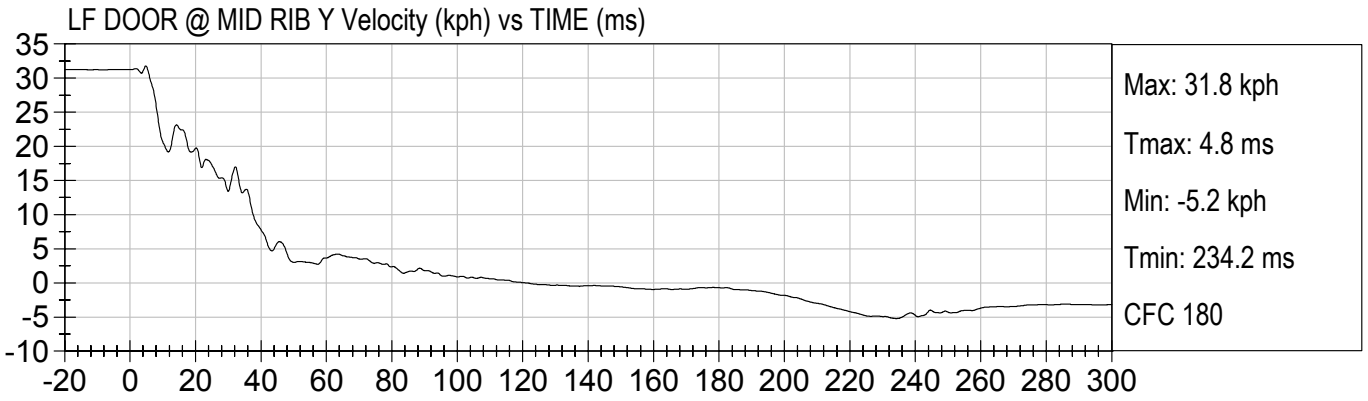
LF DOOR @ PELVIS Y Velocity (kph) vs TIME (ms)

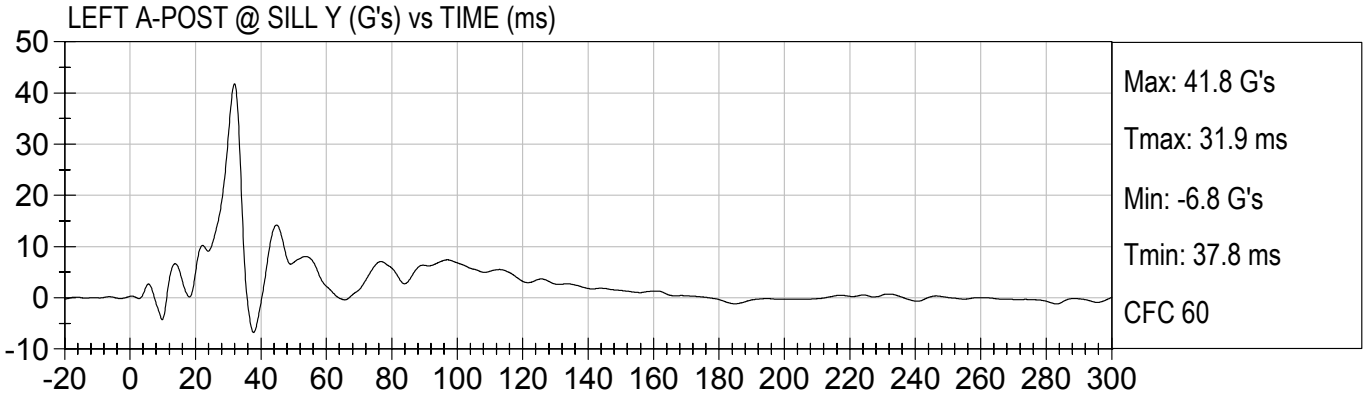


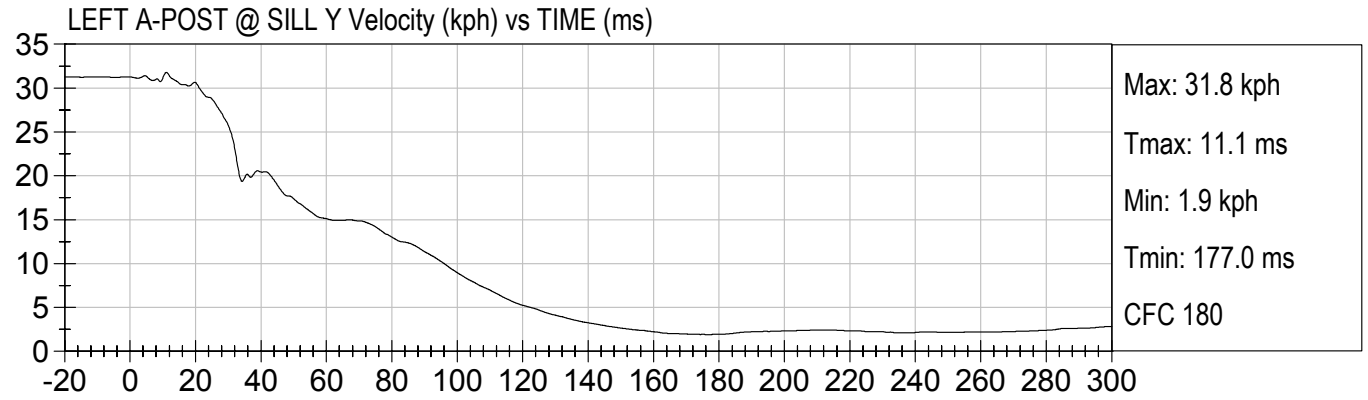
LF DOOR @ KNEE Y Velocity (kph) vs TIME (ms)

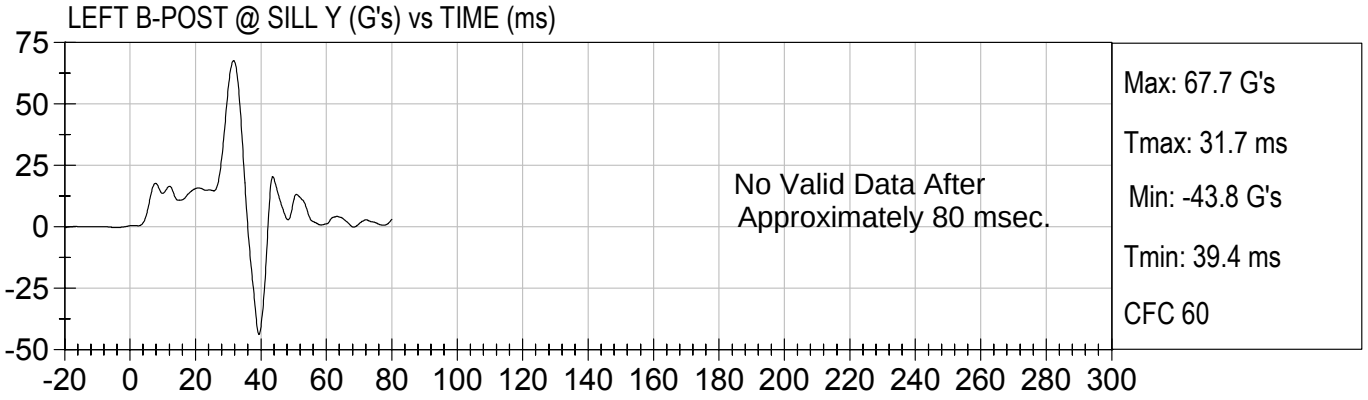


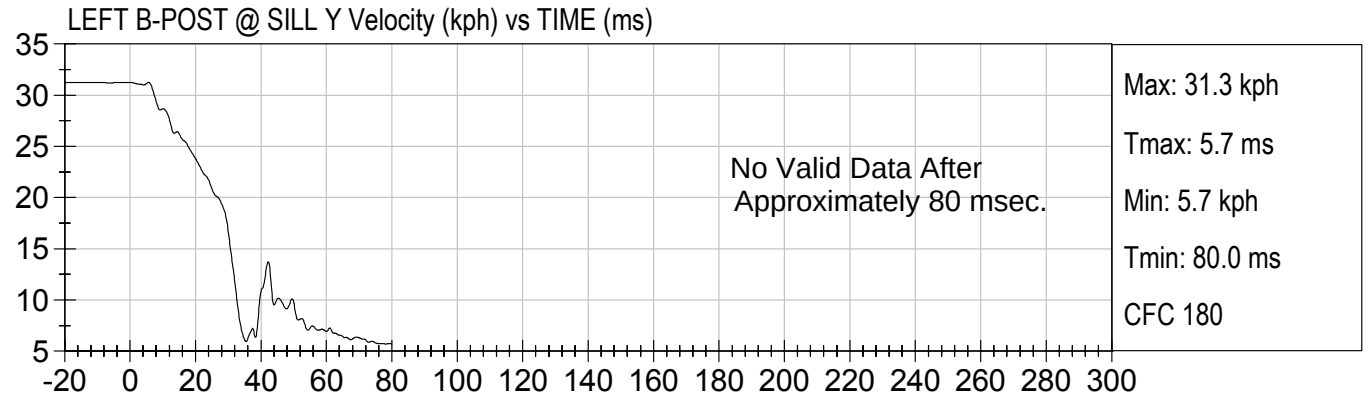
LF DOOR @ MID RIB Y Velocity (kph) vs TIME (ms)

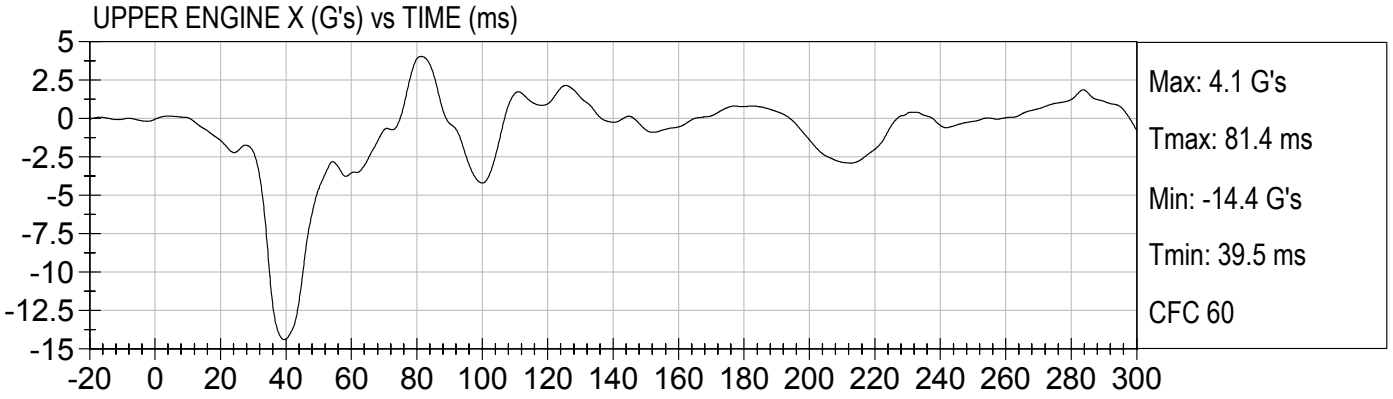


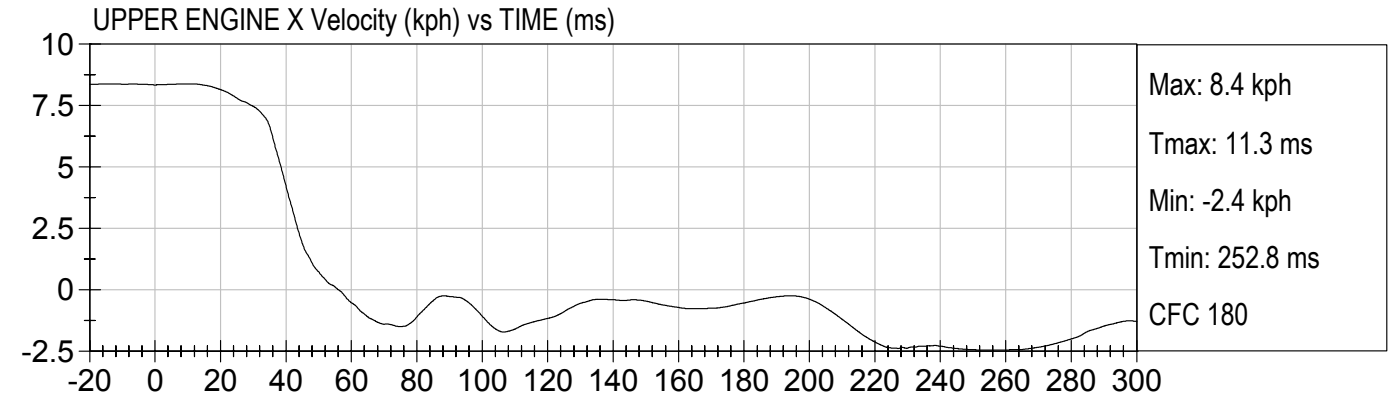

LEFT A-POST @ SILL Y (G's) vs TIME (ms)
Max: 41.8 G's
Tmax: 31.9 ms
Min: -6.8 G's
Tmin: 37.8 ms
CFC 60

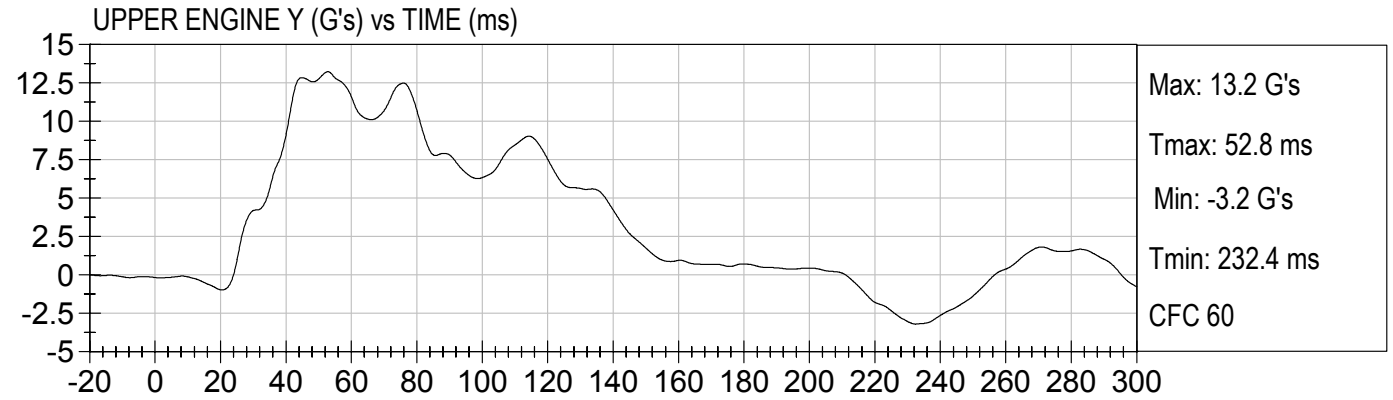

LEFT A-POST @ SILL Y Velocity (kph) vs TIME (ms)
Max: 31.8 kph
Tmax: 11.1 ms
Min: 1.9 kph
Tmin: 177.0 ms
CFC 180

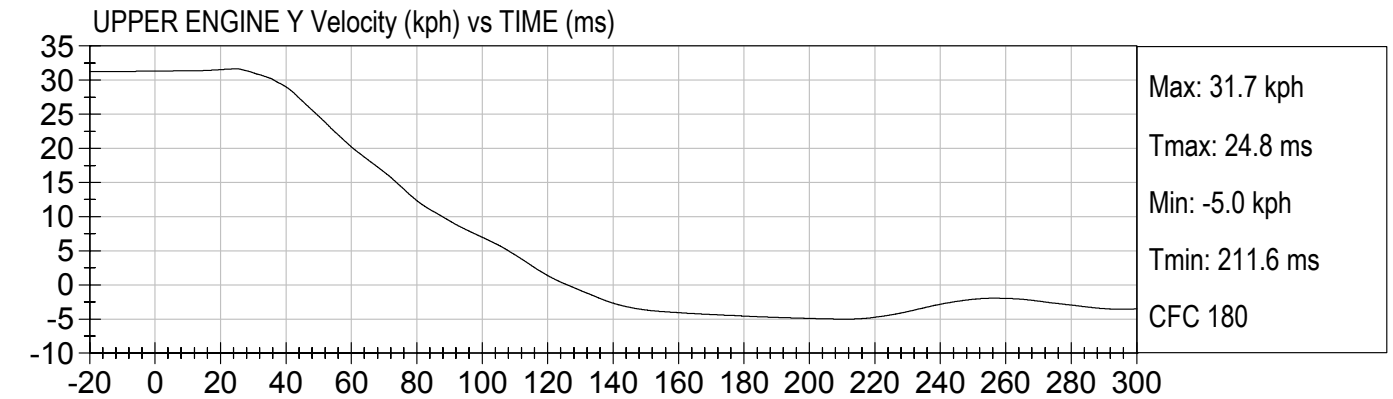

LEFT B-POST @ SILL Y (G's) vs TIME (ms)
No Valid Data After
Approximately 80 msec.
Max: 67.7 G's
Tmax: 31.7 ms
Min: -43.8 G's
Tmin: 39.4 ms
CFC 60

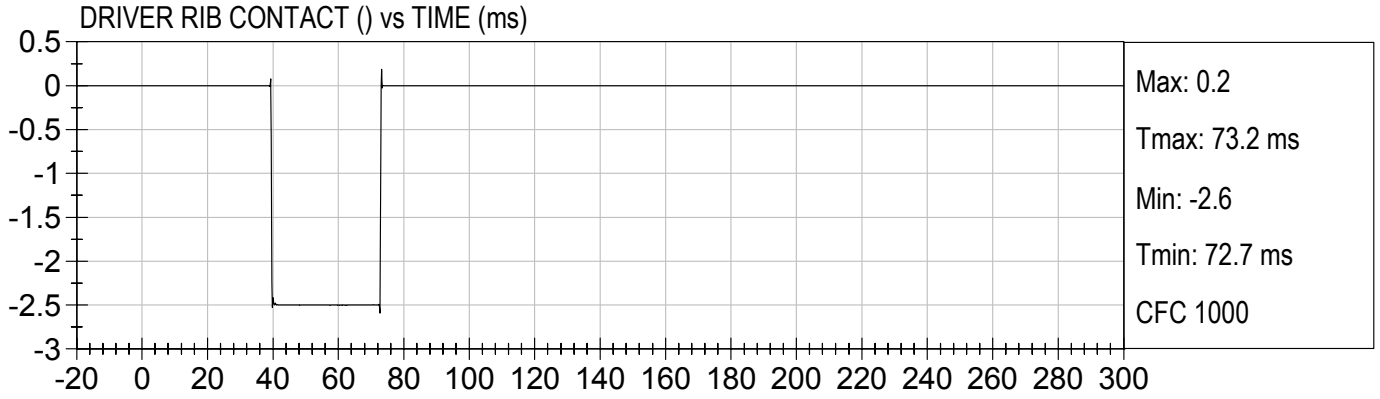

LEFT B-POST @ SILL Y Velocity (kph) vs TIME (ms)
No Valid Data After
Approximately 80 msec.
Max: 31.3 kph
Tmax: 5.7 ms
Min: 5.7 kph
Tmin: 80.0 ms
CFC 180

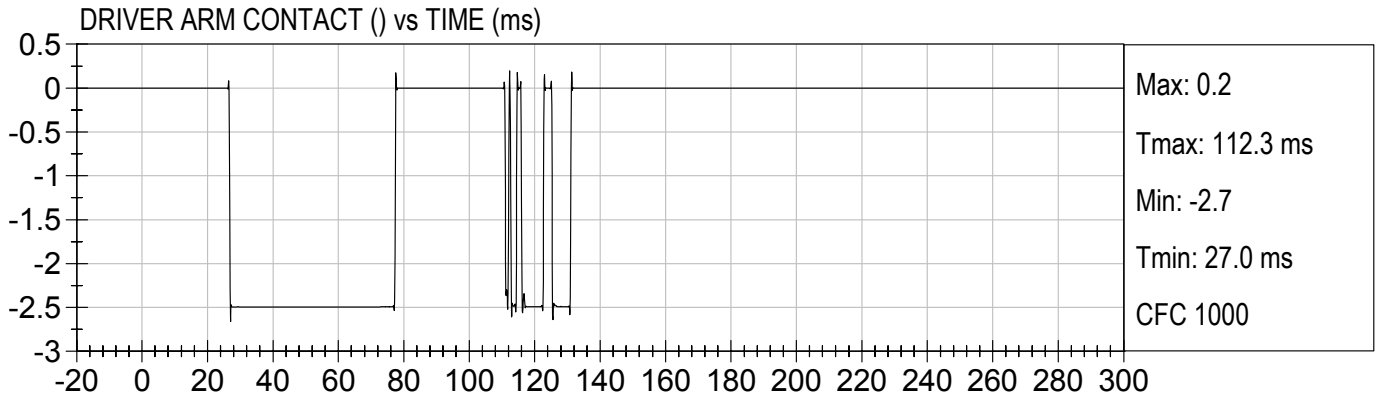

UPPER ENGINE X (G's) vs TIME (ms)
5
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 4.1 G's
Tmax: 81.4 ms
Min: -14.4 G's
Tmin: 39.5 ms
CFC 60

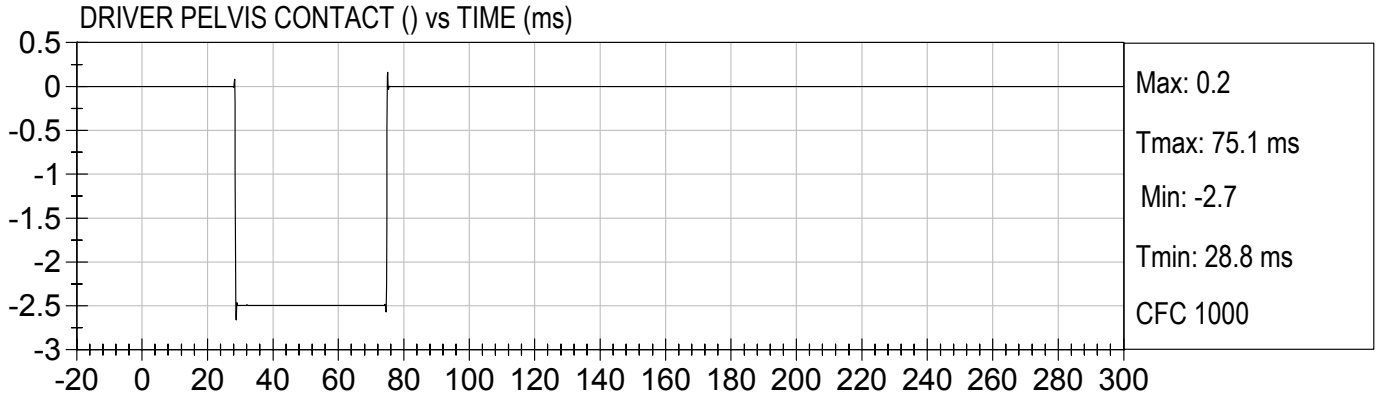

UPPER ENGINE X Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 11.3 ms
Min: -2.4 kph
Tmin: 252.8 ms
CFC 180


UPPER ENGINE Y (G's) vs TIME (ms)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 13.2 G's
Tmax: 52.8 ms
Min: -3.2 G's
Tmin: 232.4 ms
CFC 60


UPPER ENGINE Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.7 kph
Tmax: 24.8 ms
Min: -5.0 kph
Tmin: 211.6 ms
CFC 180


DRIVER RIB CONTACT () vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.2
Tmax: 73.2 ms
Min: -2.6
Tmin: 72.7 ms
CFC 1000


DRIVER ARM CONTACT () vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.2
Tmax: 112.3 ms
Min: -2.7
Tmin: 27.0 ms
CFC 1000


DRIVER PELVIS CONTACT () vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.2
Tmax: 75.1 ms
Min: -2.7
Tmin: 28.8 ms
CFC 1000

APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CERTIFICATION DATA

Dummy Serial Number: 032

PRE-TEST CALIBRATION

MGA RESEARCH CORPORATION

HEAD DROP TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test ID:** D052231

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	125 to 145	126	Pass
Peak Lateral Acceleration	G's	+/- 15	8.5	Pass
Unimodal	Yes/No	<10%	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

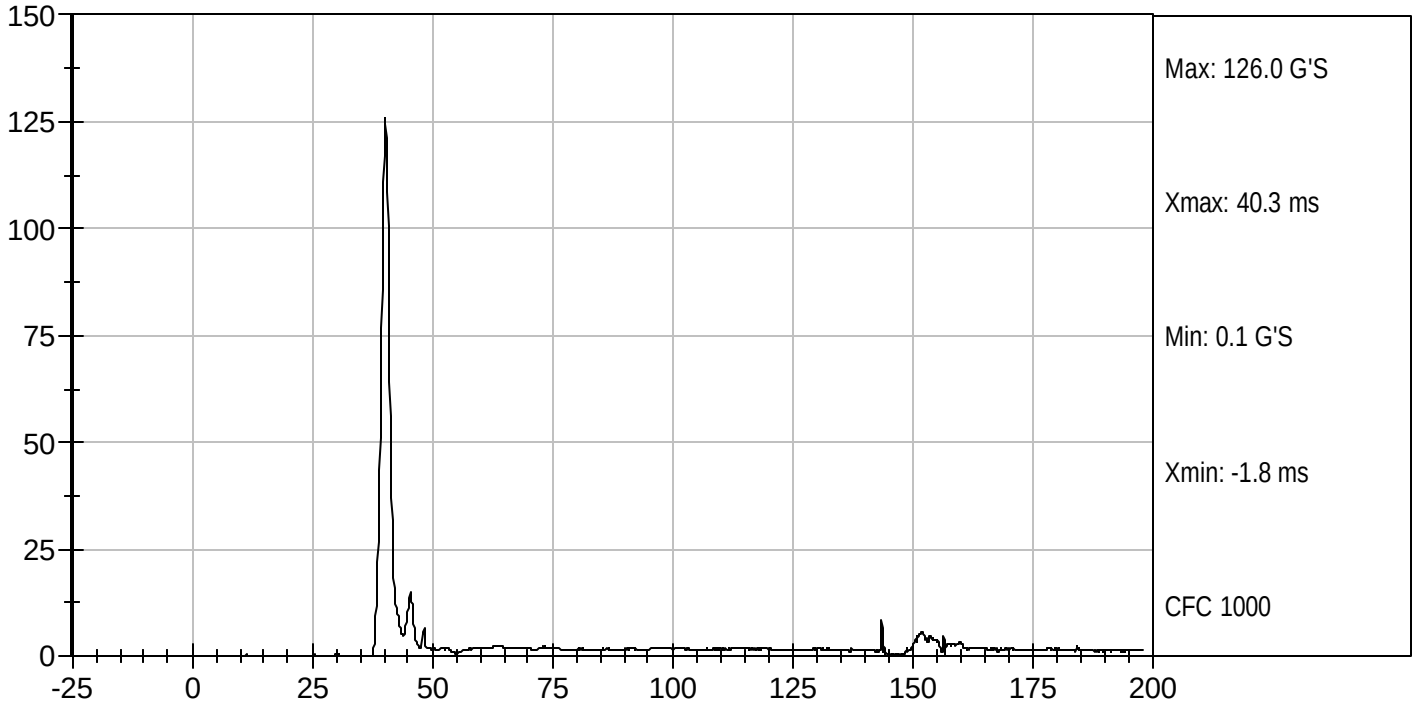
08/10/2005
Test Date

David Winkelbauer
Approved By

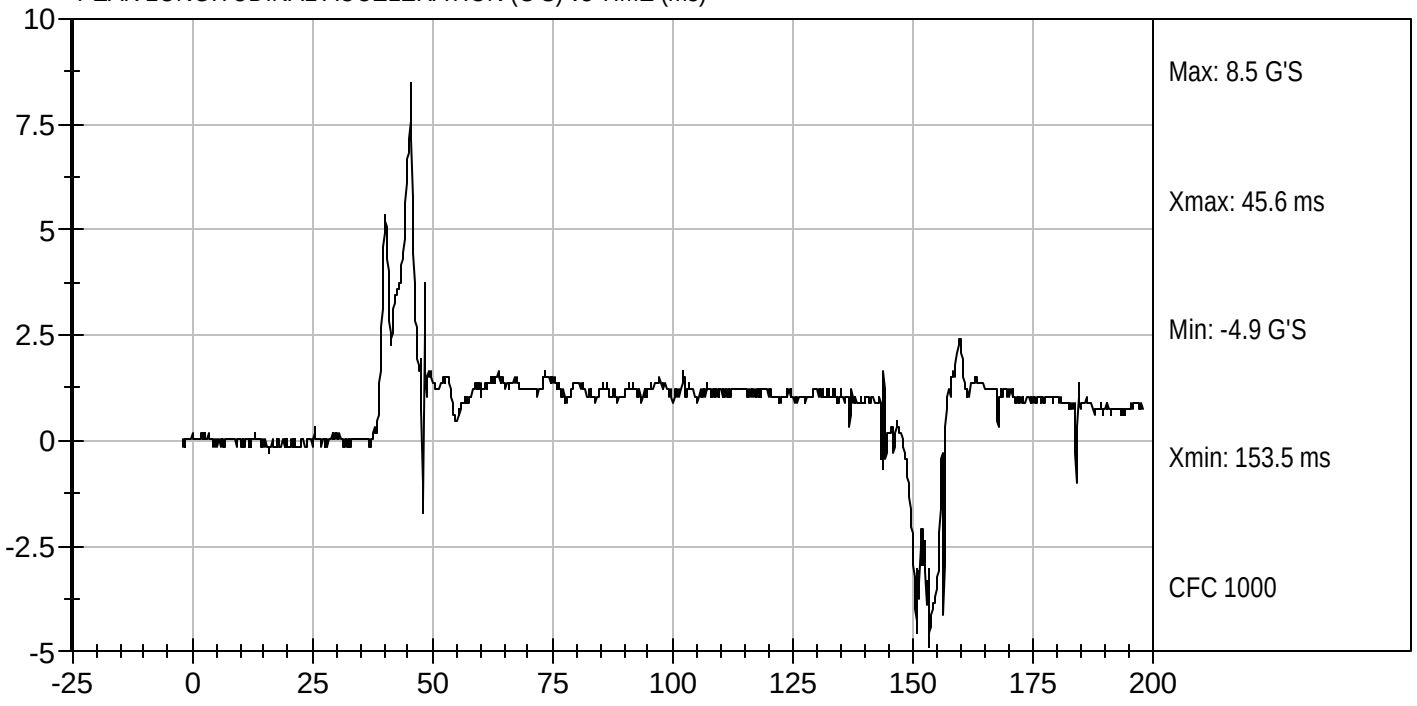
Test Desc: Head Drop
Componet ID: D052231

Test Date: 08/10/2005
Velocity: 0 ft/s, 0 m/s

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



PEAK LONGITUDINAL ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052232

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.5	Pass
Humidity		%	10 to 70	44	Pass
Impact Velocity		m/s	5.51 to 5.63	5.62	Pass
Delta Velocity	10 msec	m/s	2.20 to 2.80	2.47	Pass
	15 msec	m/s	3.40 to 4.10	3.59	Pass
	20 msec	m/s	4.50 to 5.40	4.79	Pass
	25 msec	m/s	5.50 to 6.10	5.73	Pass
	25-100 msec	m/s	5.20 to 6.20	5.81	Pass
Maximum D-Plane Rotation		deg	74 to 79	75	Pass
Time of Maximum D-Plane Rotation		Nm	50 to 70	64	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-45 to -40	-43	Pass
Time of Moment Decay to 0 Nm		msec	113 to 123	114	Pass
			Overall Test Results		Pass

Jessica Gall

Laboratory Technician

08/10/2005

Test Date

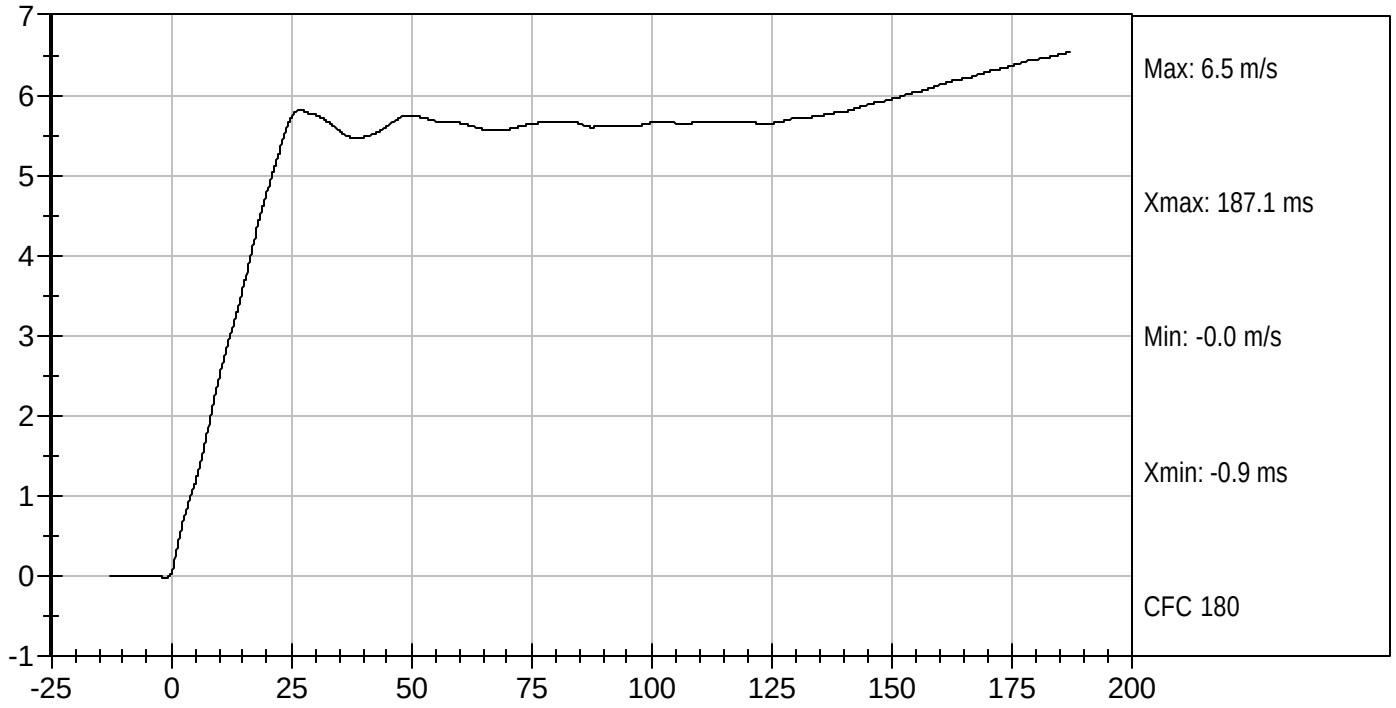
David Winkelbauer

Approved By

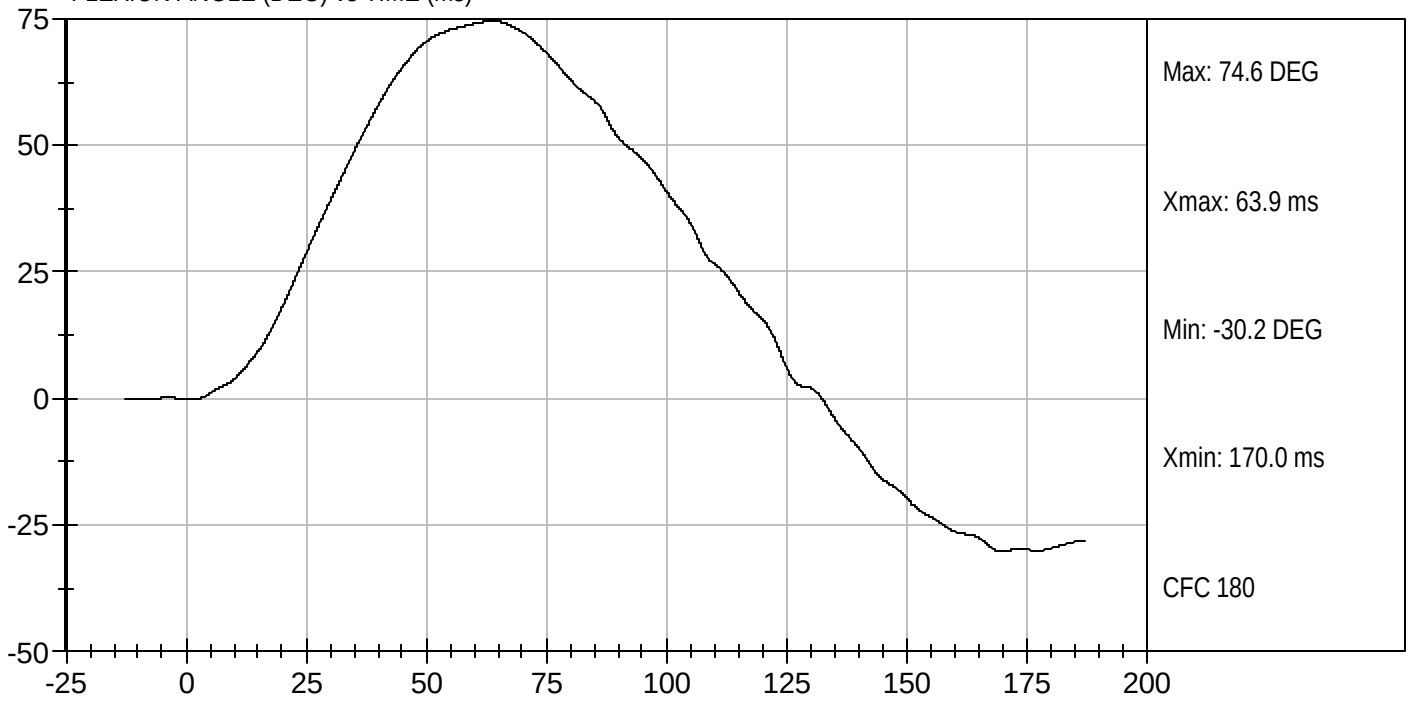
Test Desc: Neck Bending
Componet ID: D052232

Test Date: 08/10/2005
Velocity: 18.44 ft/s, 5.62 m/s

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

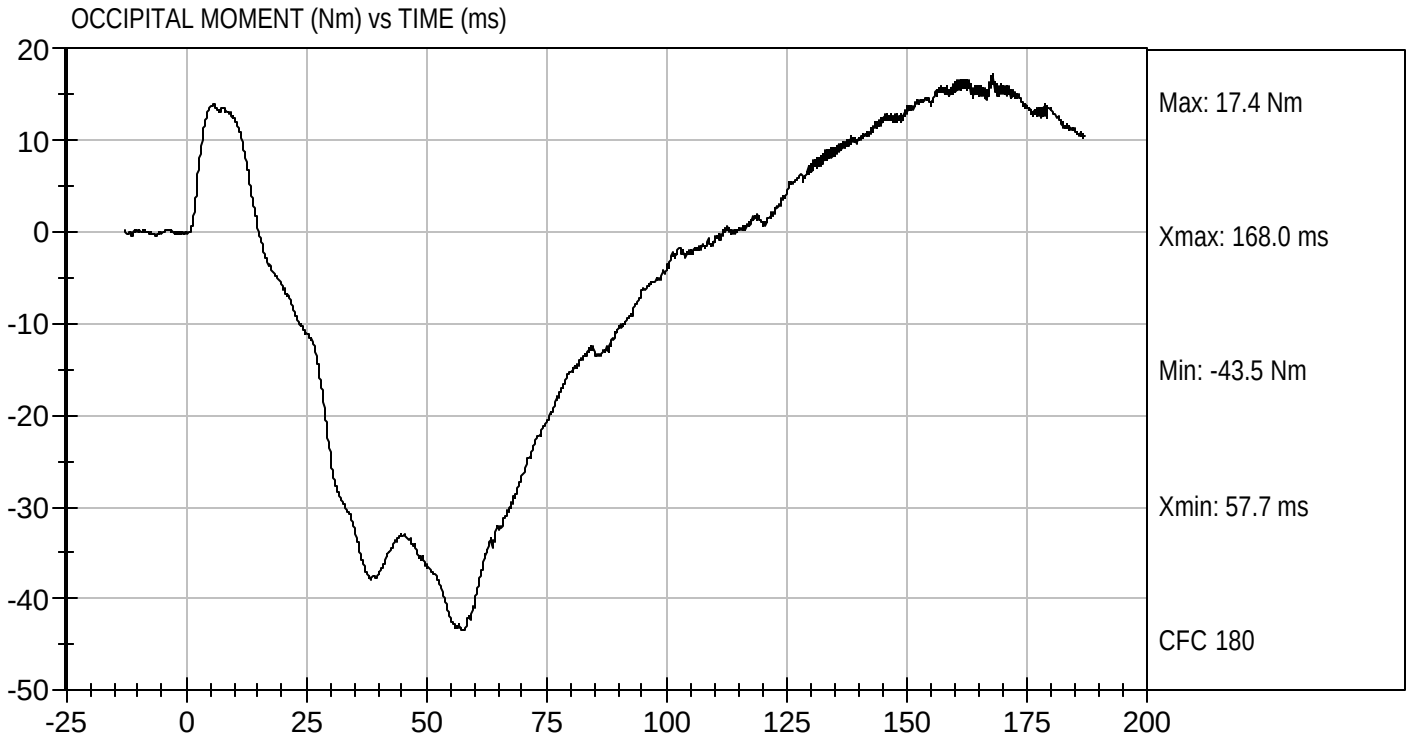


FLEXION ANGLE (DEG) vs TIME (ms)



Test Desc: Neck Bending
Componet ID: D052232

Test Date: 08/10/2005
Velocity: 18.44 ft/s, 5.62 m/s



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test ID:** D052233

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	44	Pass
Impact Velocity	m/s	4.41 to 4.59	4.49	Pass
Maximum Probe Force	kN	1.6 to 2.4	2.2	Pass
Shoulder Displacement	mm	27 to 39	34	Pass
		Overall Test Results		Pass

Joe Fleck

Laboratory Technician

08/09/2005

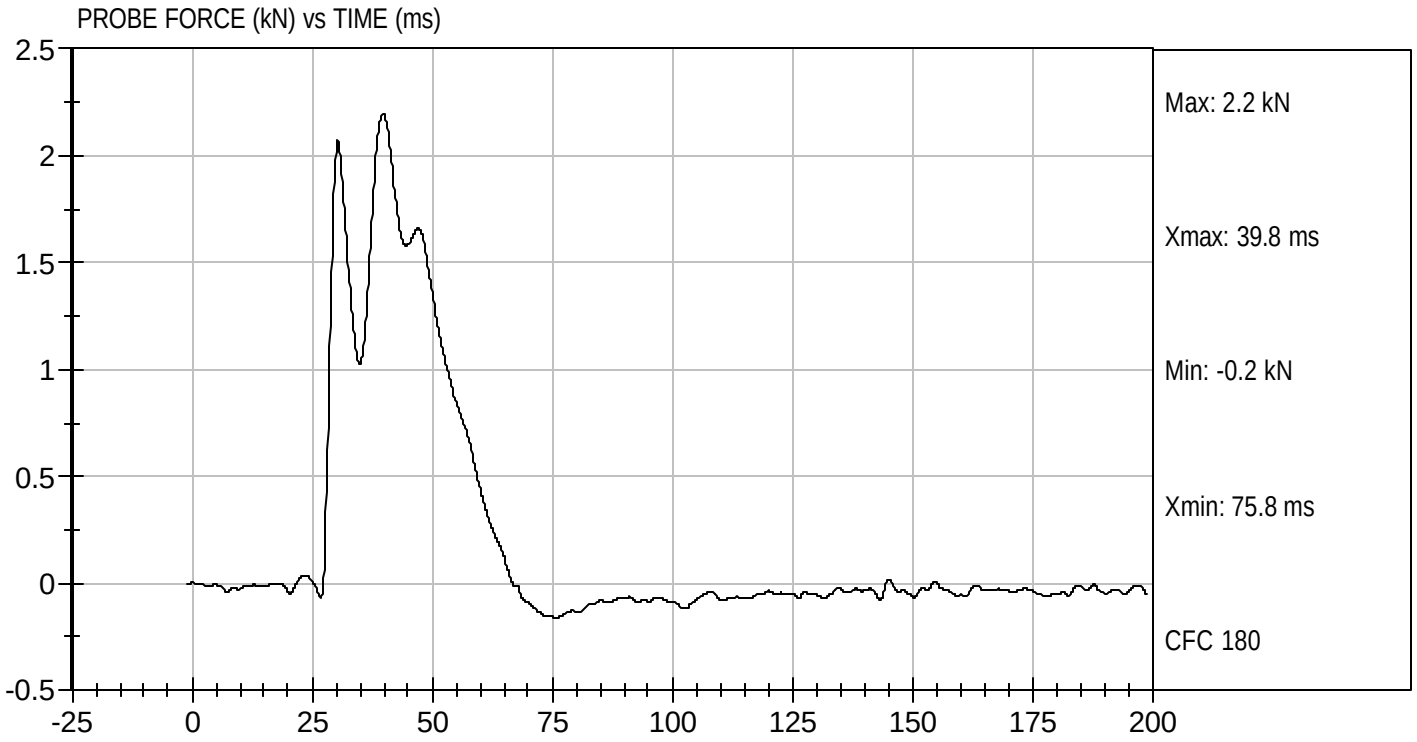
Test Date

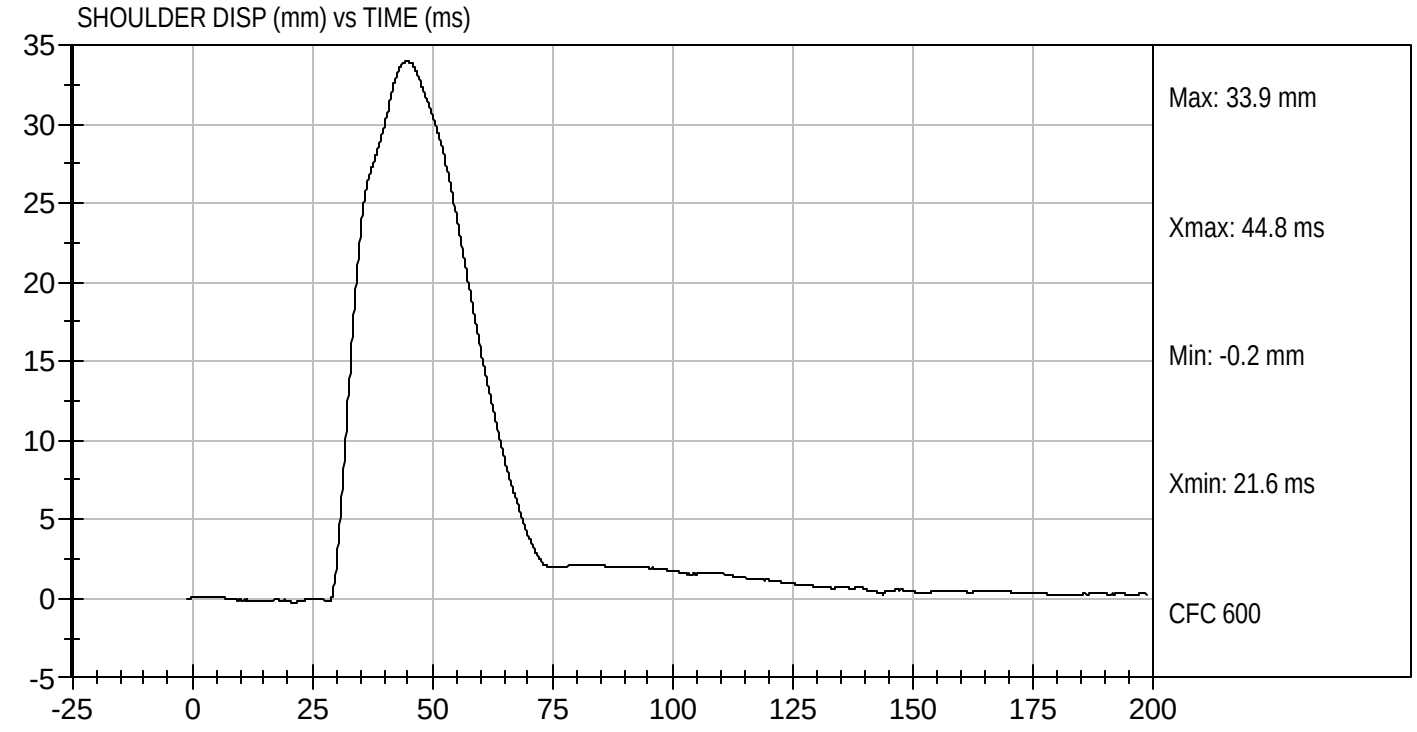
David Winkelbauer

Approved By

Test Desc: Shoulder Impact
Componet ID: D052233

Test Date: 08/09/2005
Velocity: 14.73 ft/s, 4.49 m/s





MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052234

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	6.57 to 6.84	6.68	Pass
Peak Impactor Force	kN	4.1 to 4.7	4.6	Pass
Shoulder Displacement	mm	30 to 42	37	Pass
Upper Rib Displacement	mm	23 to 35	29	Pass
Middle Rib Displacement	mm	29 to 44	32	Pass
Lower Rib Displacement	mm	33 to 40	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 48	39	Pass
Lower Spine (T12) Y Acceleration	G's	30 to 38	32	Pass
		Overall Test Results		Pass

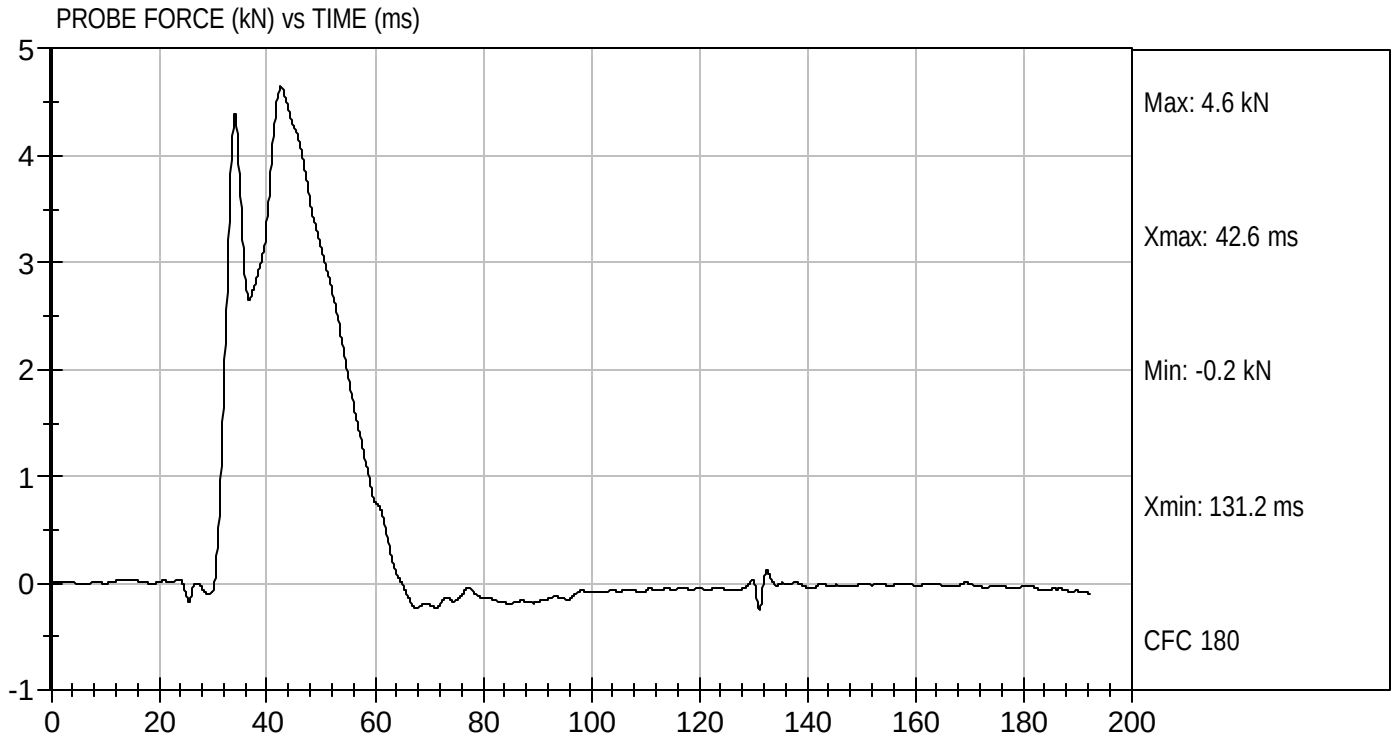
Laboratory Technician

08/09/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax With Arm
Componet ID: D052234

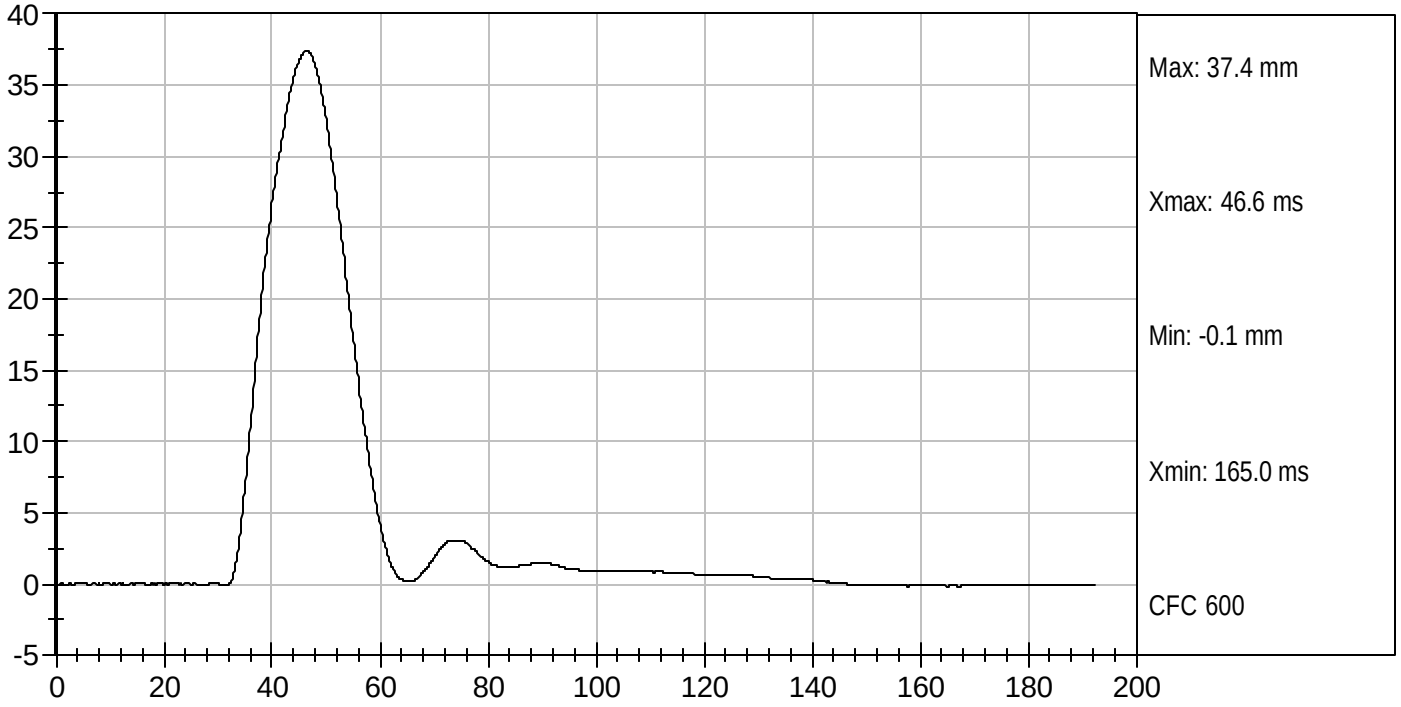
Test Date: 08/09/2005
Velocity: 21.92 ft/s, 6.68 m/s



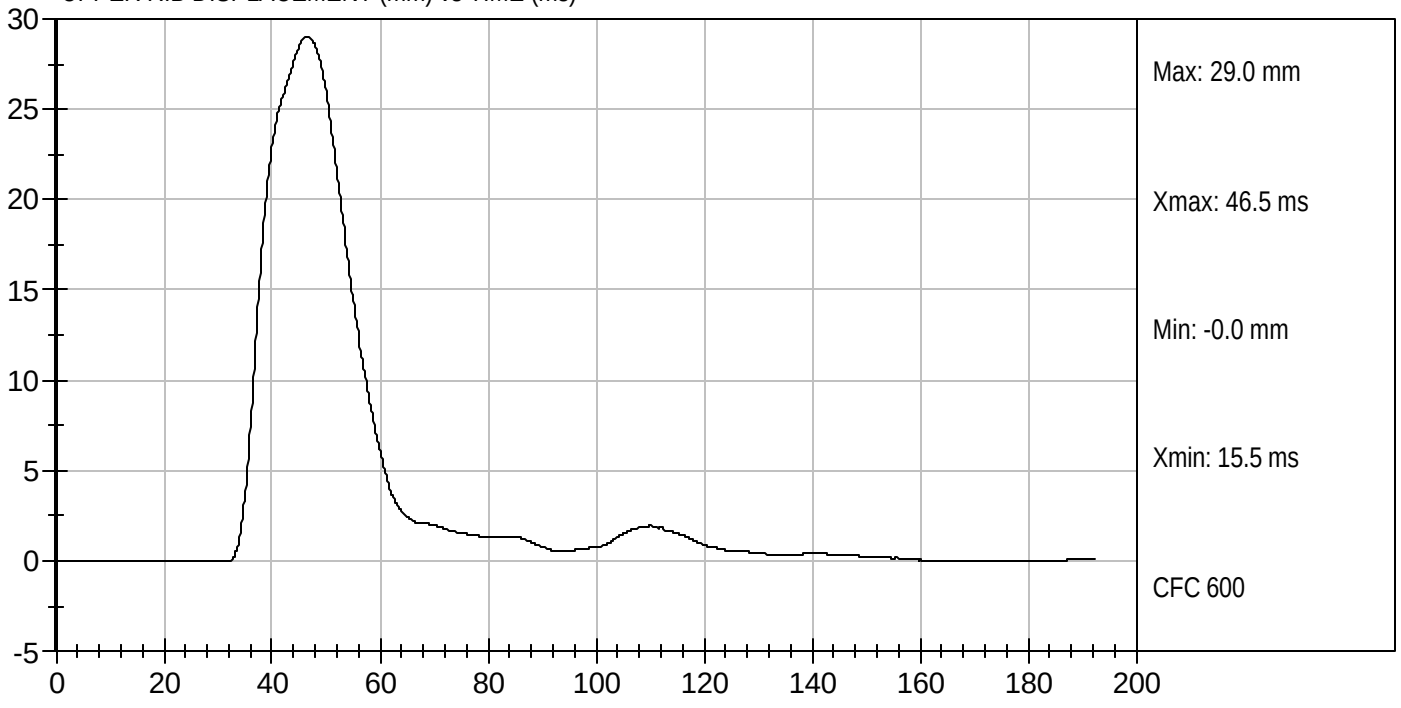
Test Desc: Thorax With Arm
Componet ID: D052234

Test Date: 08/09/2005
Velocity: 21.92 ft/s, 6.68 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



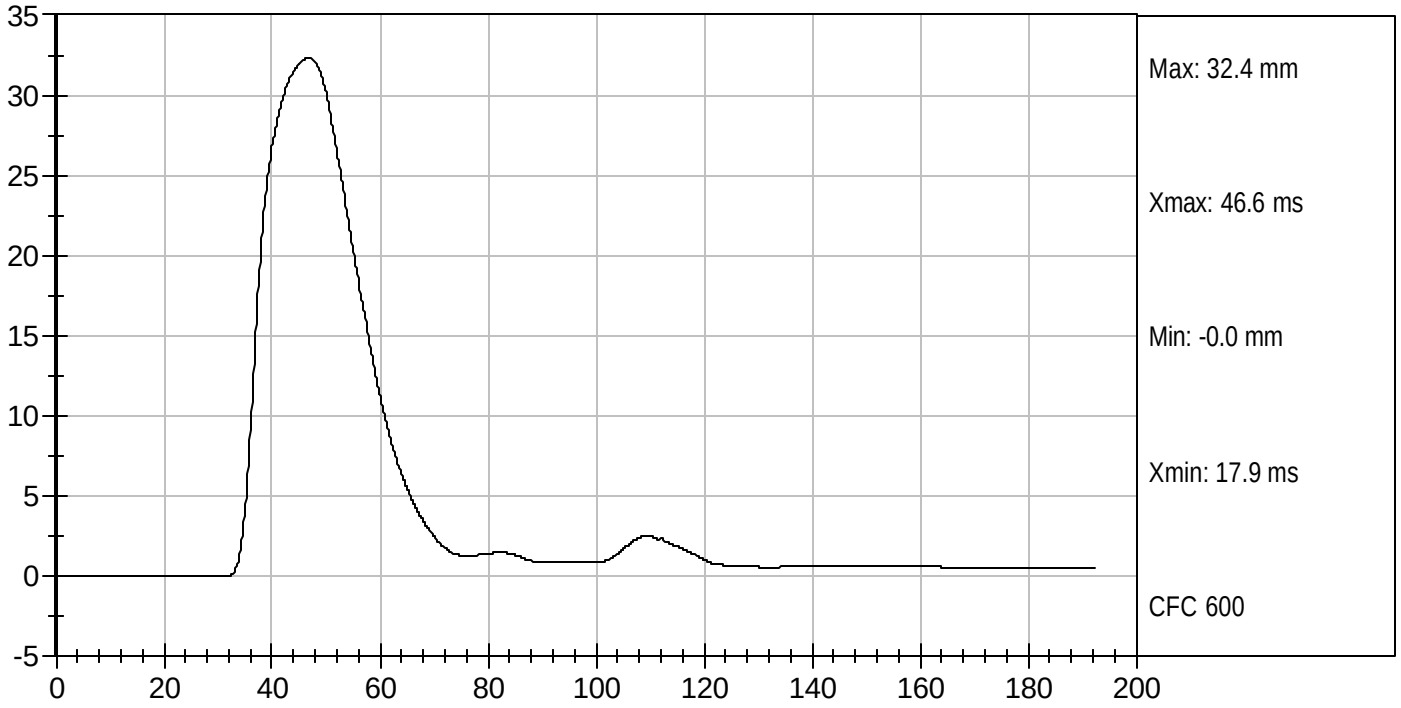
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



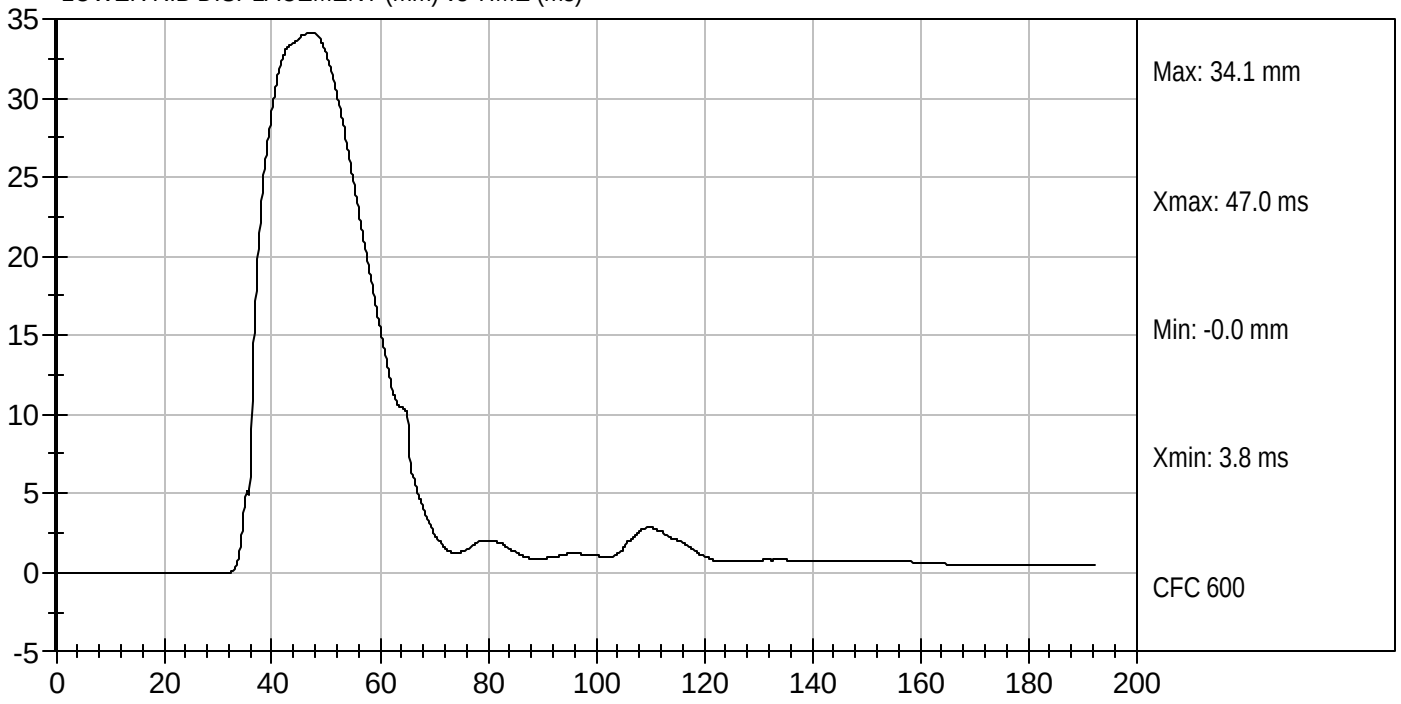
Test Desc: Thorax With Arm
Componet ID: D052234

Test Date: 08/09/2005
Velocity: 21.92 ft/s, 6.68 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



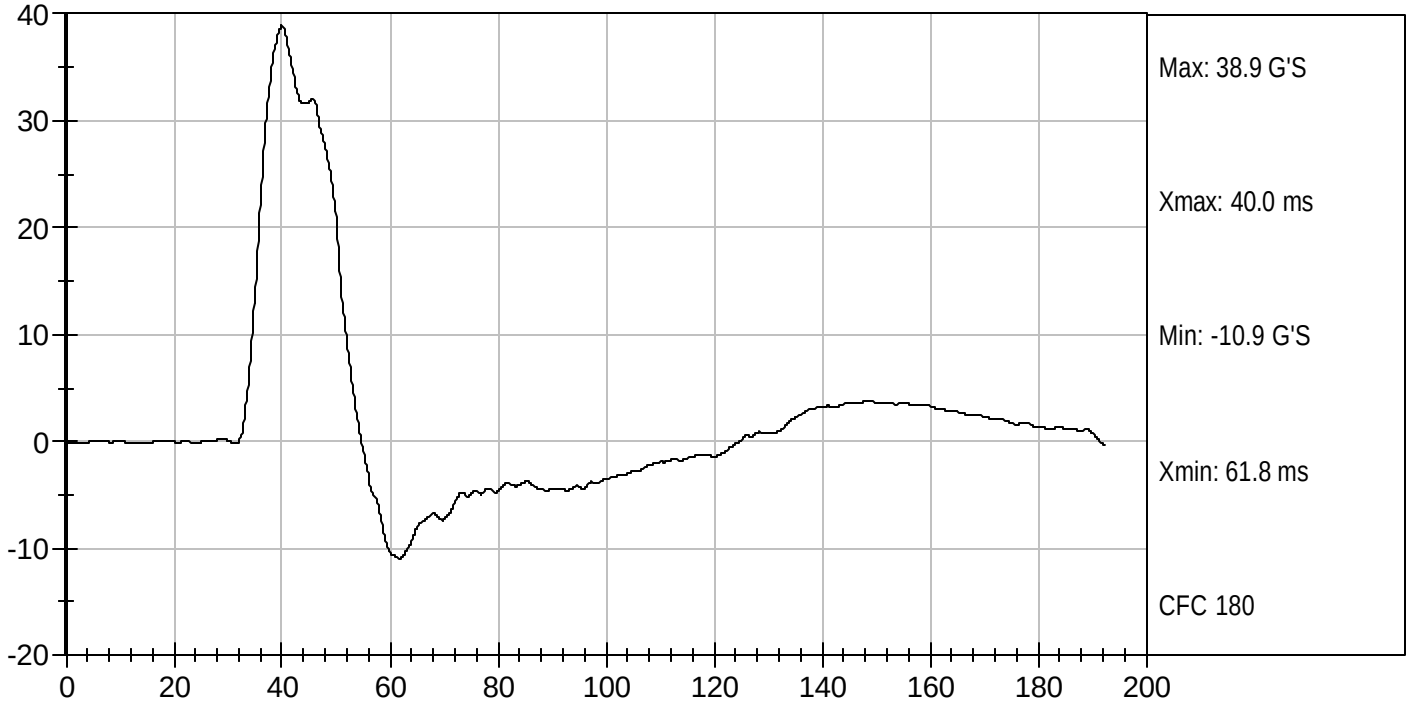
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



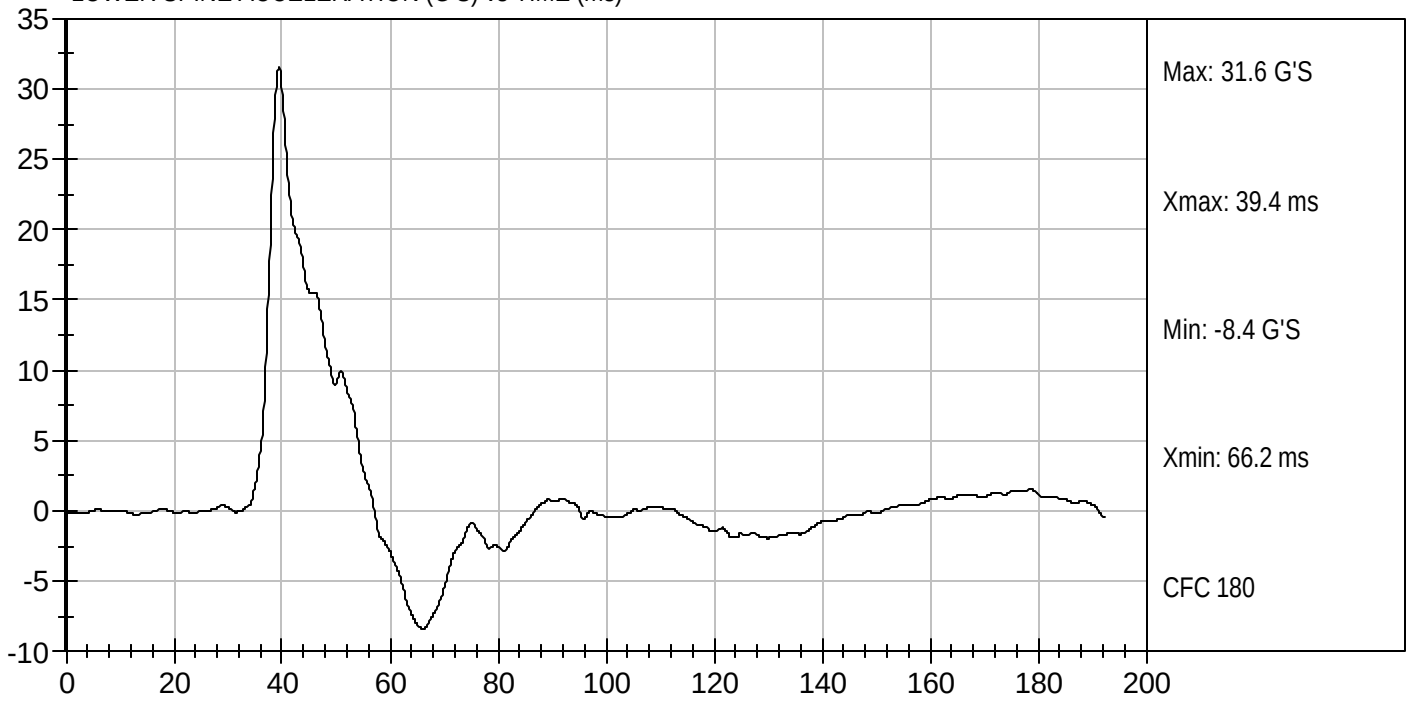
Test Desc: Thorax With Arm
Componet ID: D052234

Test Date: 08/09/2005
Velocity: 21.92 ft/s, 6.68 m/s

UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



LOWER SPINE ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052235

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Peak Impactor Force	kN	1.8 to 2.3	2.2	Pass
Upper Rib Displacement	mm	32 to 41	37	Pass
Middle Rib Displacement	mm	40 to 51	42	Pass
Lower Rib Displacement	mm	34 to 47	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 18	16	Pass
Lower Spine (T12) Y Acceleration	G's	8 to 13	9	Pass
		Overall Test Results		Pass

Joe Fleck
Laboratory Technician

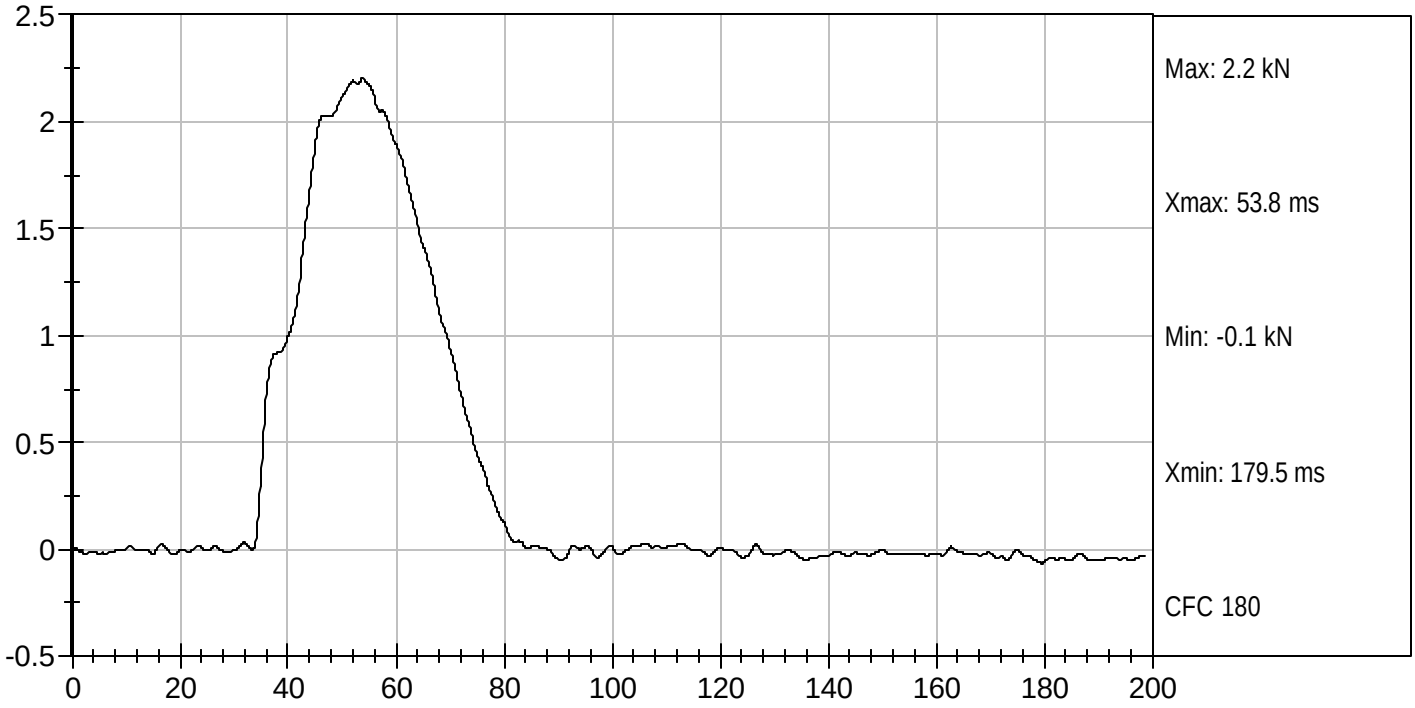
08/09/2005
Test Date

David Winkelbauer
Approved By

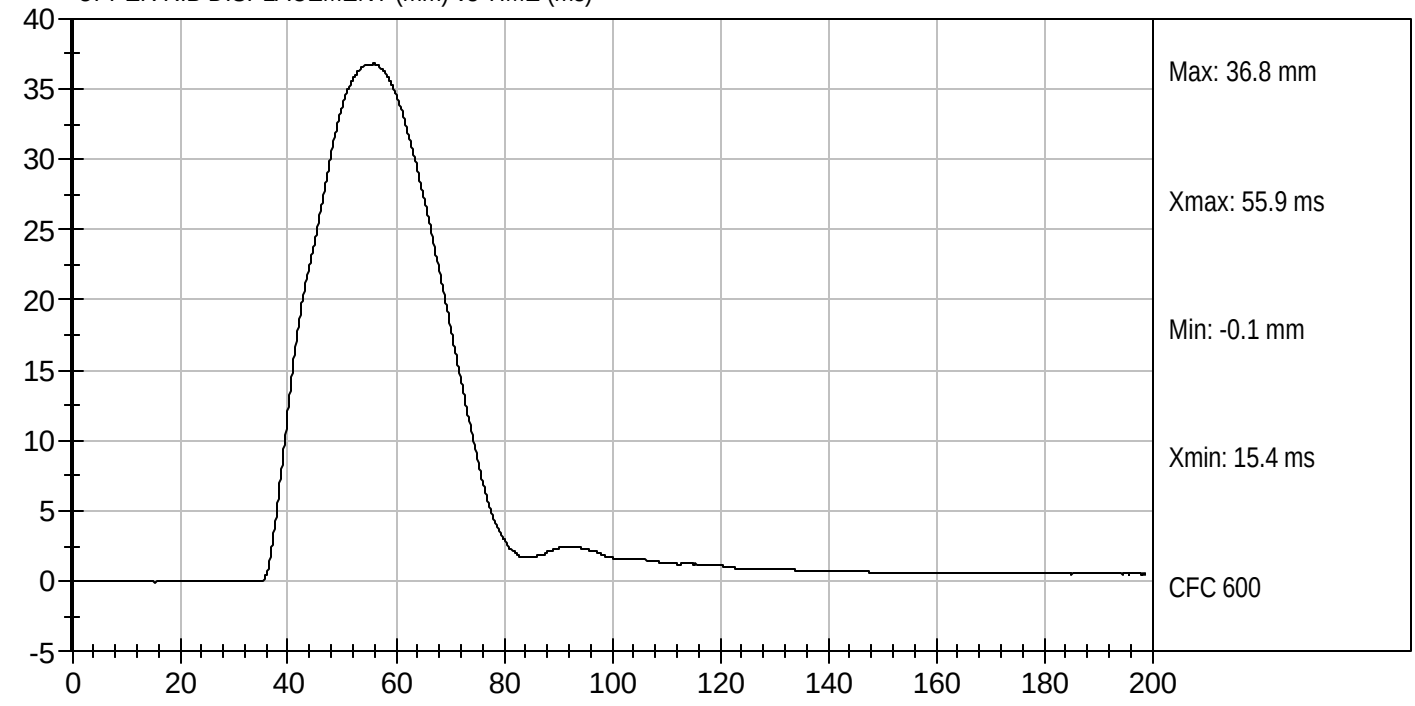
Test Desc: Thorax Without Arm
Componet ID: D052235

Test Date: 08/09/2005
Velocity: 14.0 ft/s, 4.27 m/s

PROBE FORCE (kN) vs TIME (ms)



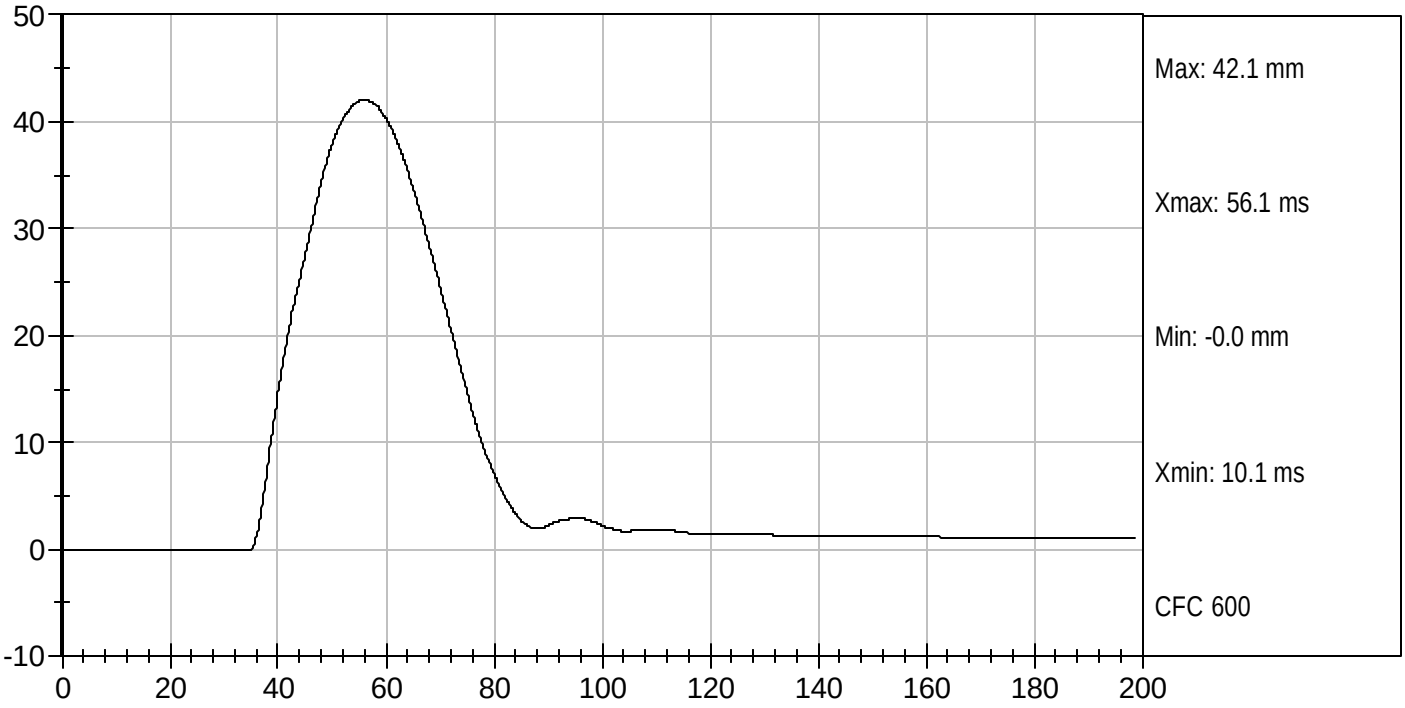
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



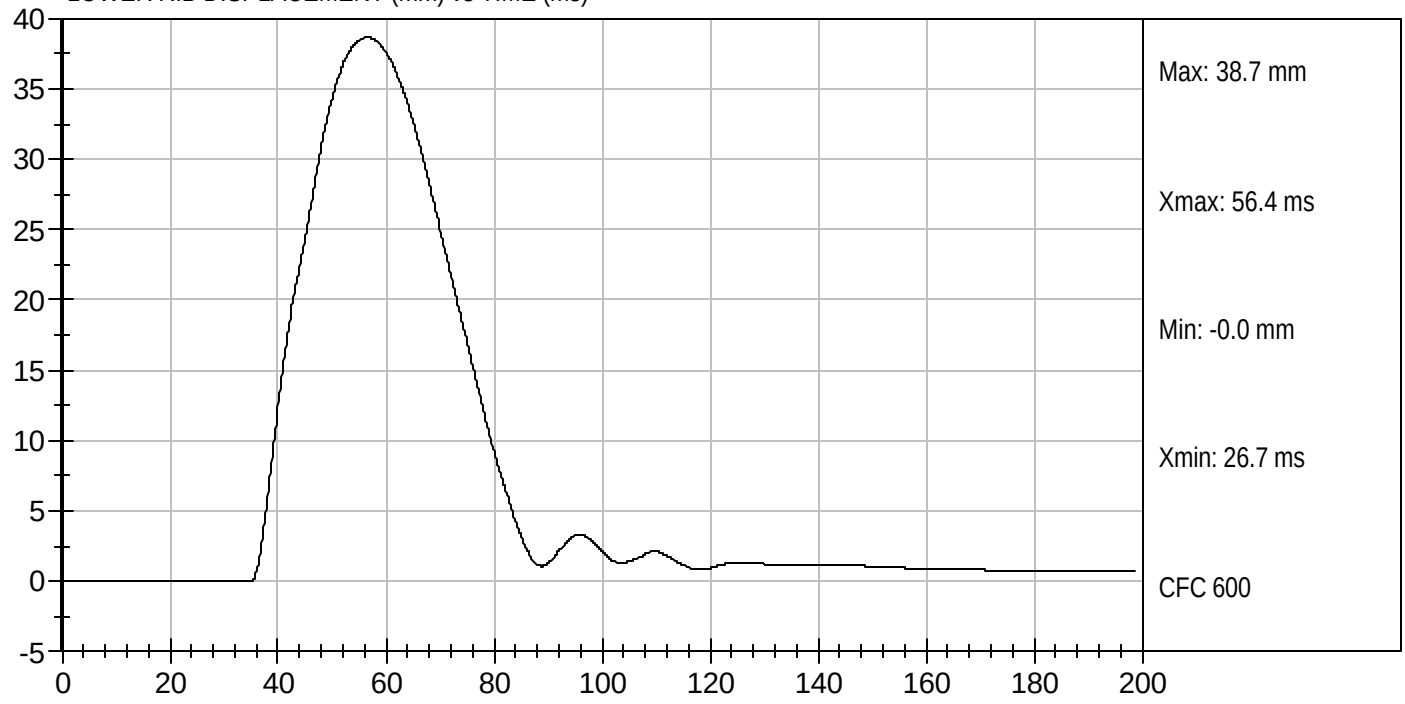
Test Desc: Thorax Without Arm
Componet ID: D052235

Test Date: 08/09/2005
Velocity: 14.0 ft/s, 4.27 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



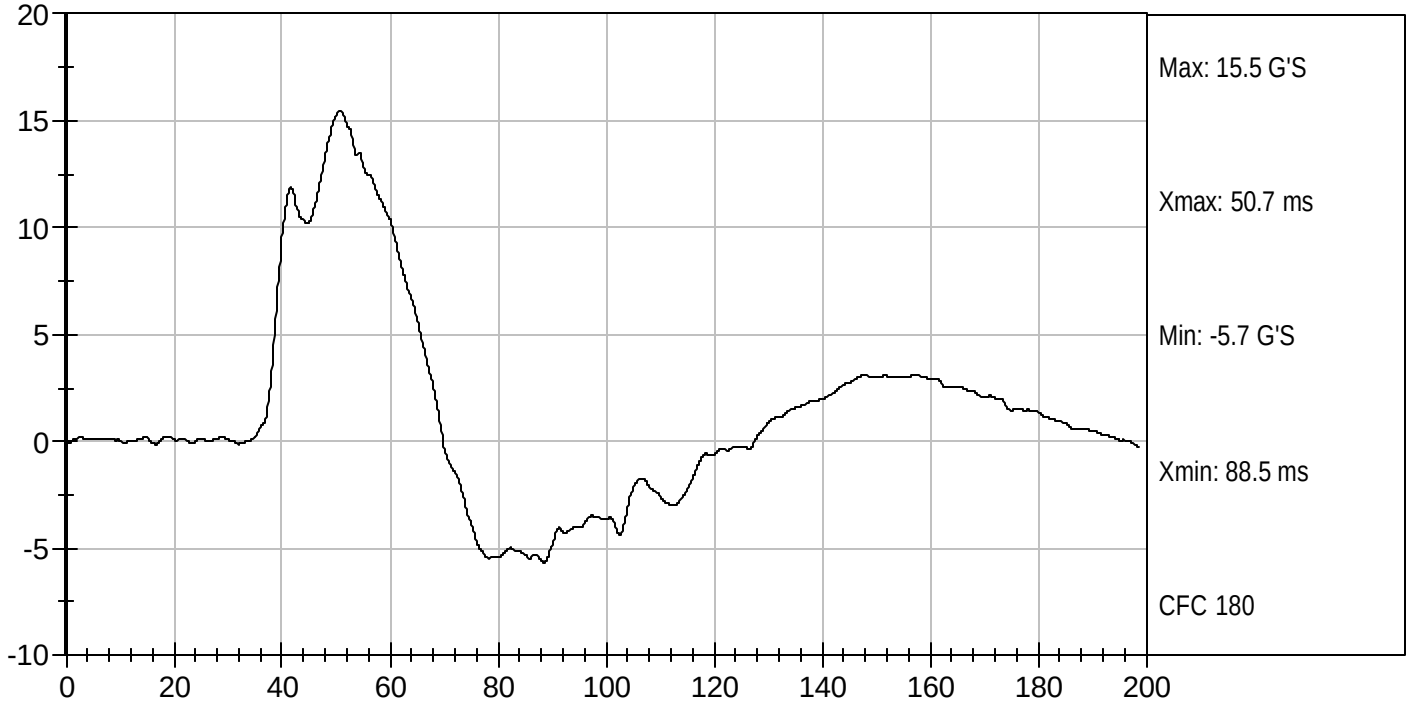
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



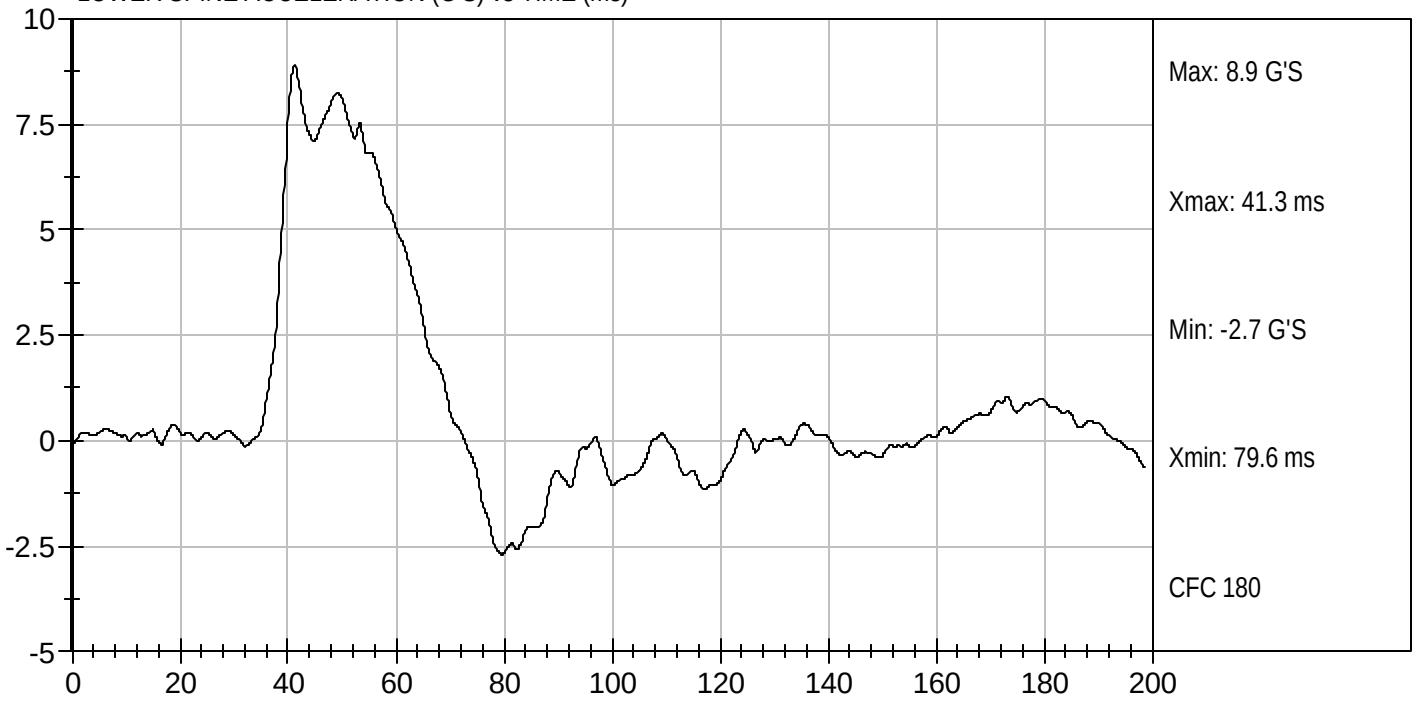
Test Desc: Thorax Without Arm
Componet ID: D052235

Test Date: 08/09/2005
Velocity: 14.0 ft/s, 4.27 m/s

UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



LOWER SPINE ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052236

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.41 to 4.59	4.48	Pass
Peak Impactor Force	kN	1.3 to 1.9	1.9	Pass
Upper Rib Displacement	mm	44 to 55	44	Pass
Lower Rib Displacement	mm	44 to 56	46	Pass
Upper Spine (T1) Y Acceleration	G's	5 to 9	6	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 13	12	Pass
		Overall Test Results		Pass

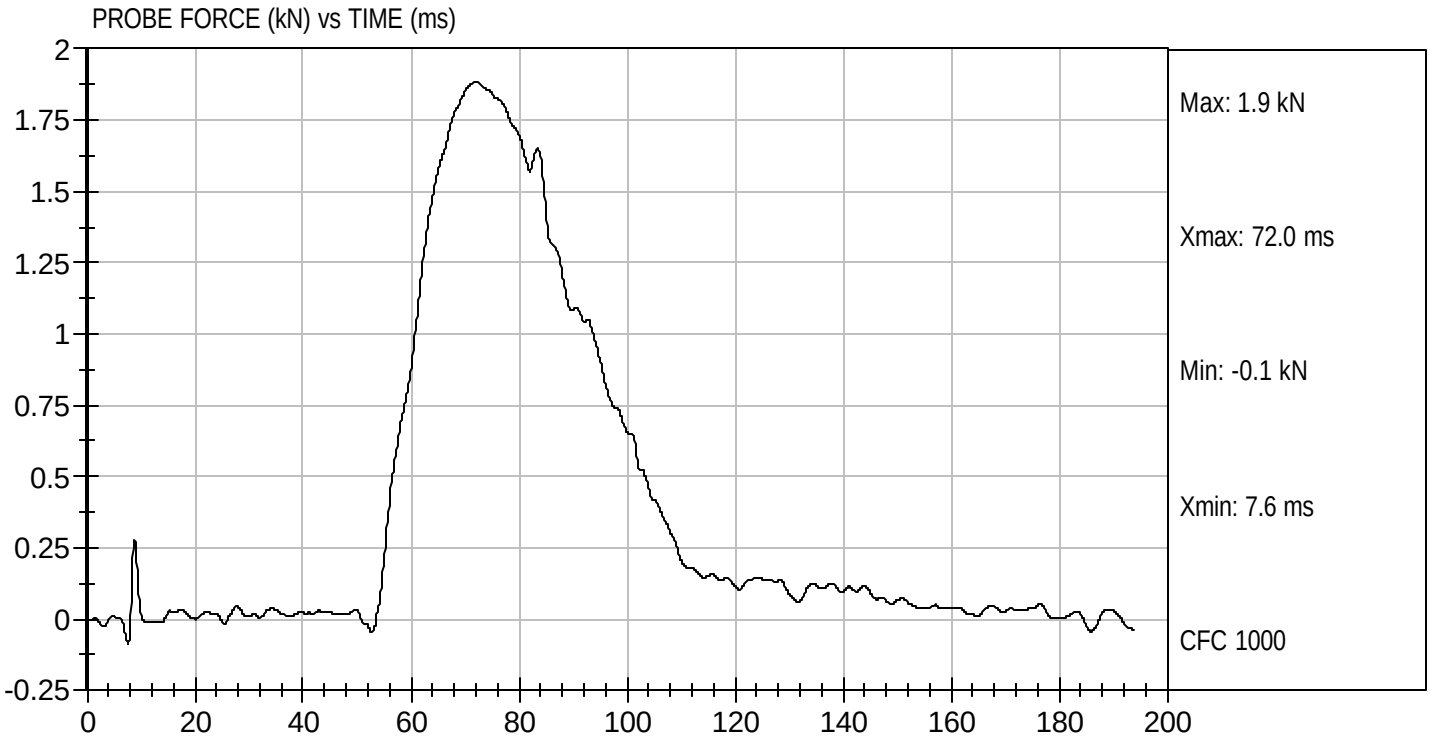
Laboratory Technician

08/09/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Abdomen Impact
Componet ID: D052236

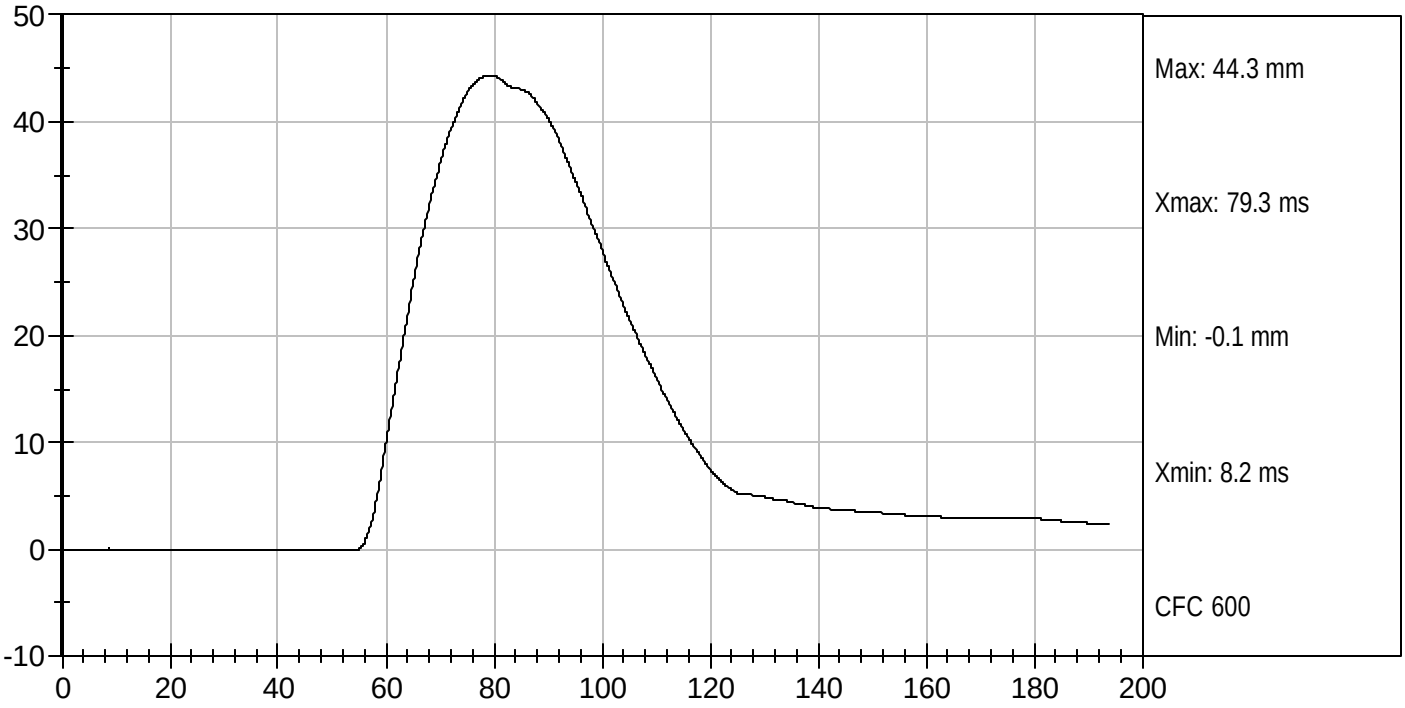
Test Date: 08/09/2005
Velocity: 14.69 ft/s, 4.48 m/s



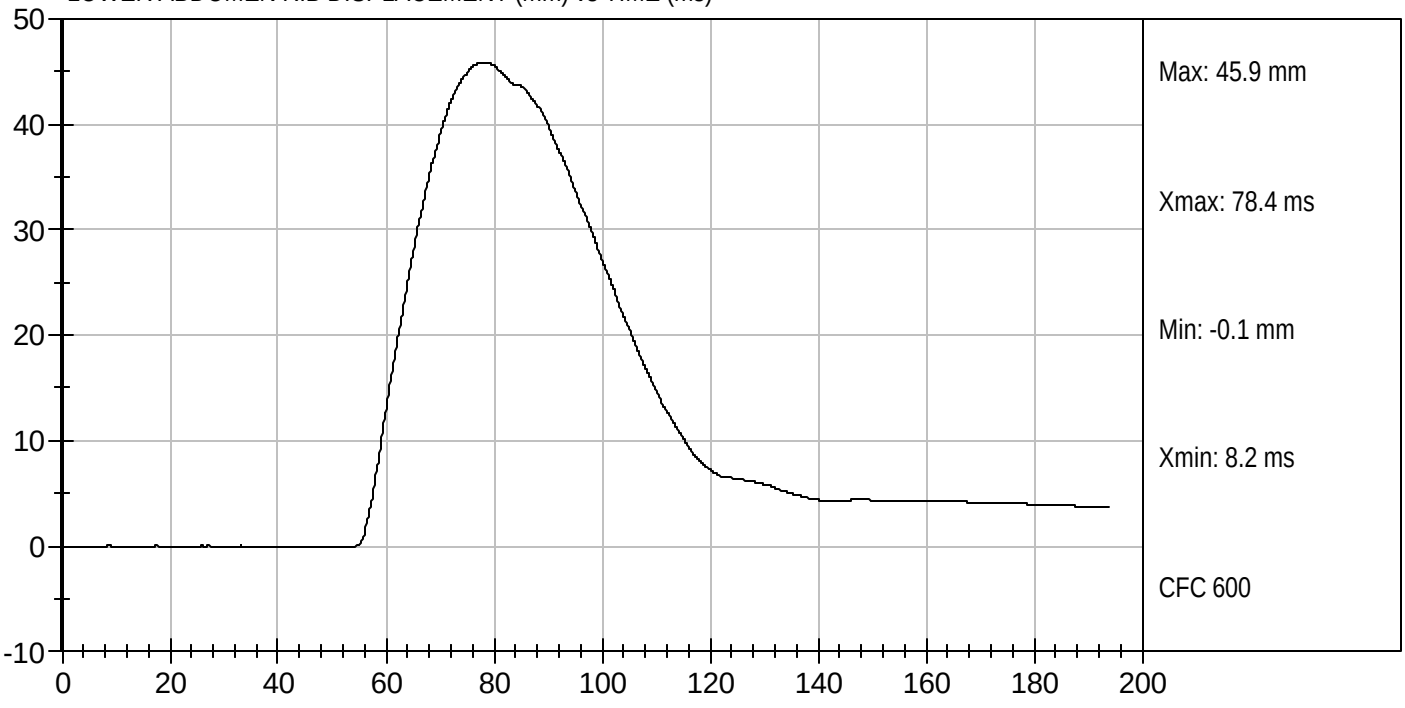
Test Desc: Abdomen Impact
Componet ID: D052236

Test Date: 08/09/2005
Velocity: 14.69 ft/s, 4.48 m/s

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

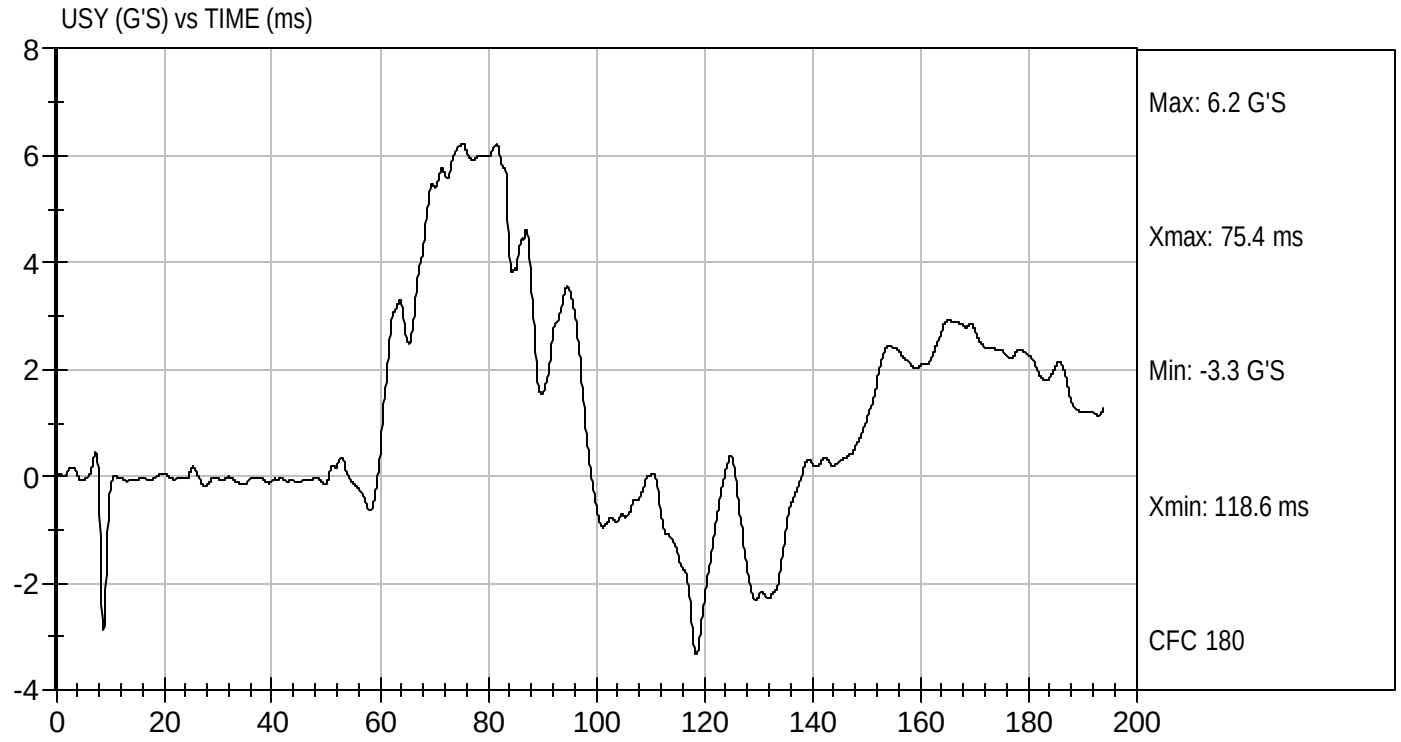


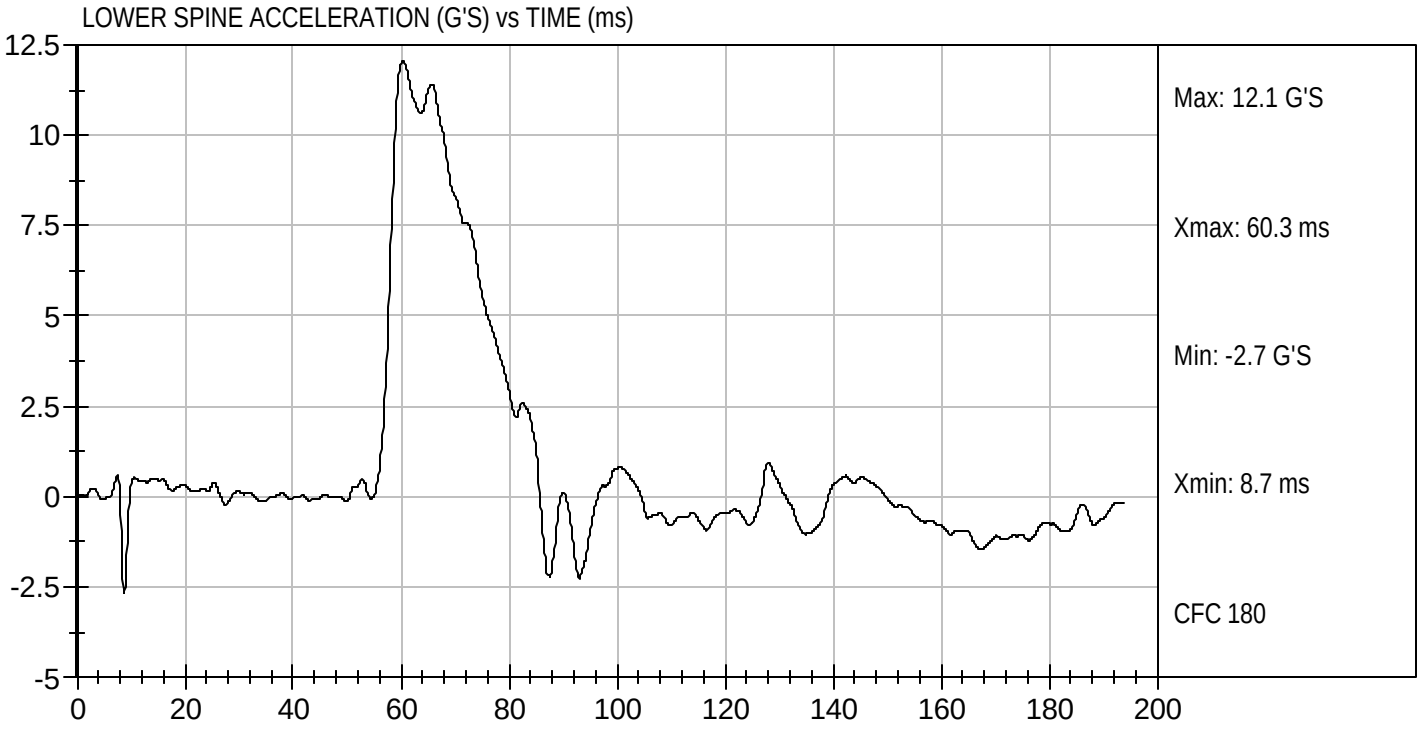
LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



Test Desc: Abdomen Impact
Componet ID: D052236

Test Date: 08/09/2005
Velocity: 14.69 ft/s, 4.48 m/s





MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052237

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	40 to 48	42	Pass
Pelvis Y Acceleration	G's	40 to 48	46	Pass
Peak Acetabulum Force	N	3803 to 4505	3838	Pass
		Overall Test Results		Pass

Laboratory Technician

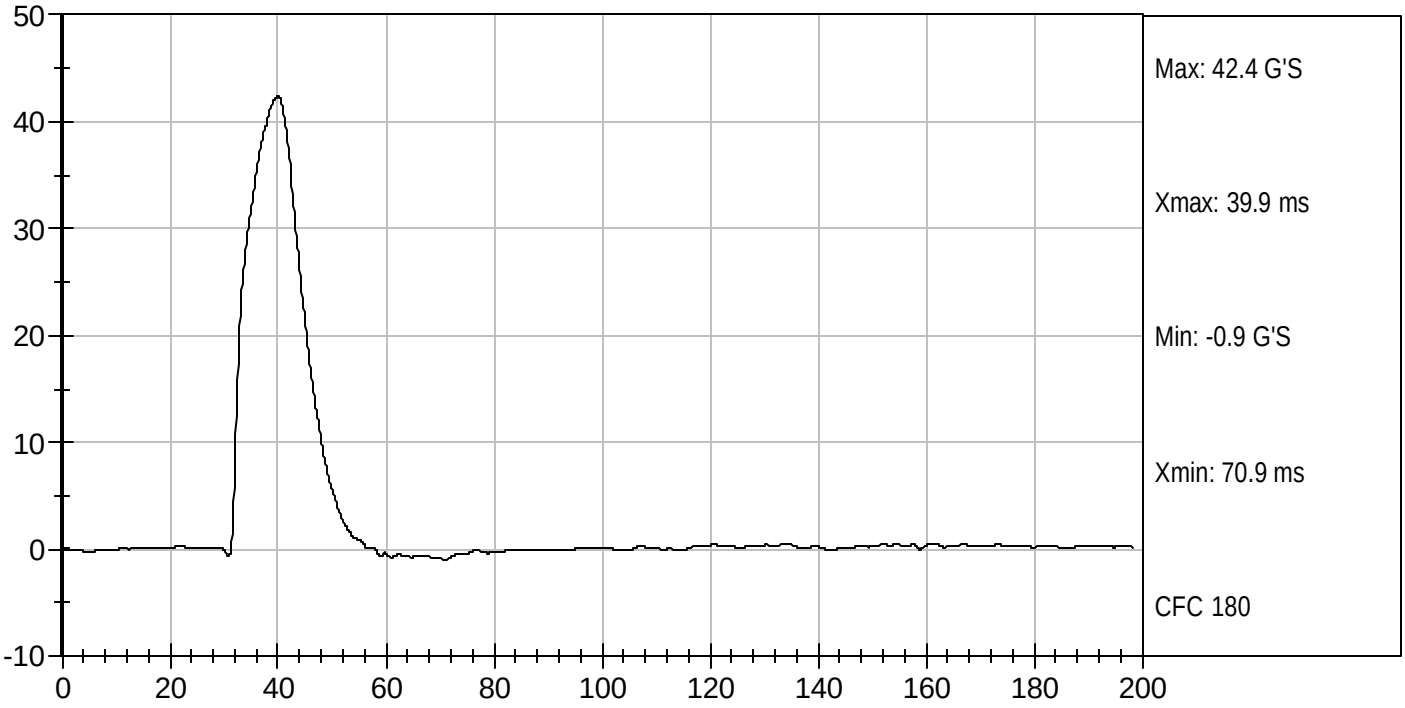
08/09/2005
Test Date

David Winkelbauer
Approved By

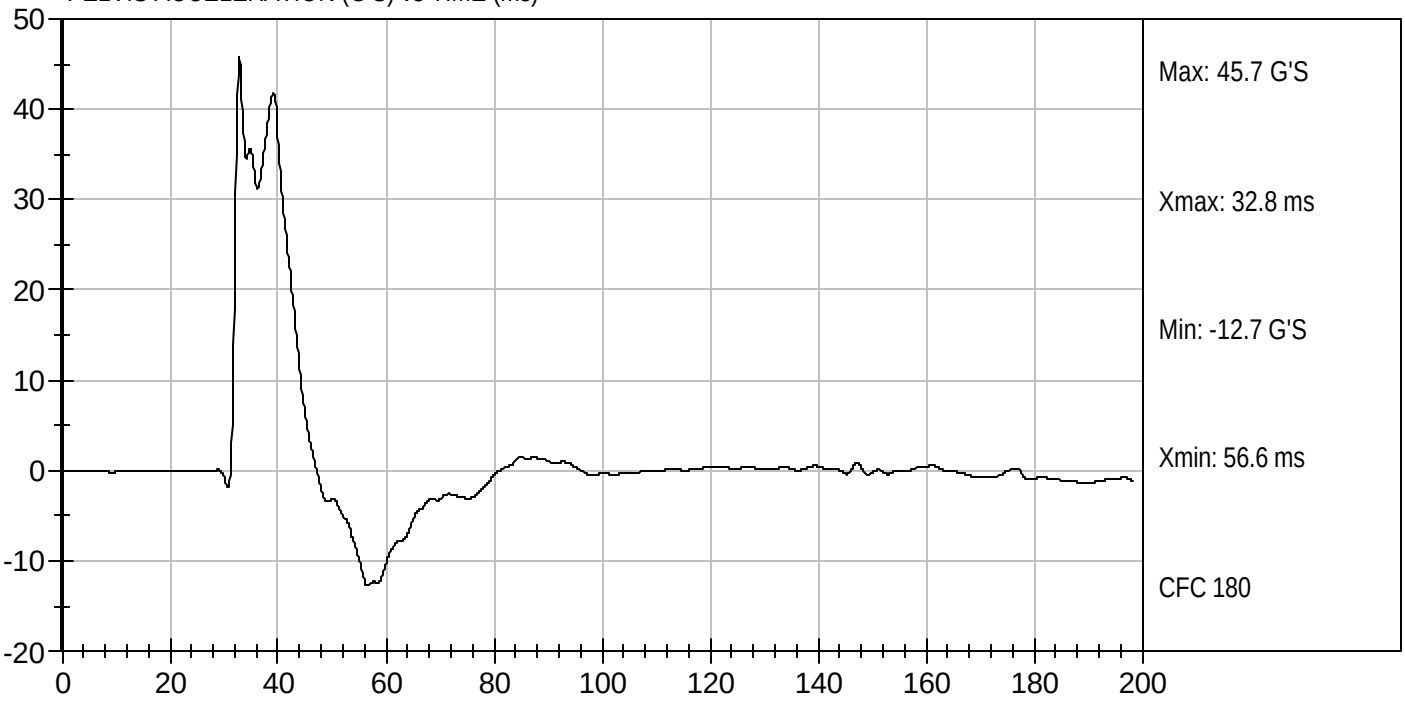
Test Desc: Pelvis Impact
Componet ID: D052237

Test Date: 08/09/2005
Velocity: 21.9 ft/s, 6.68 m/s

PROBE (G'S) vs TIME (ms)

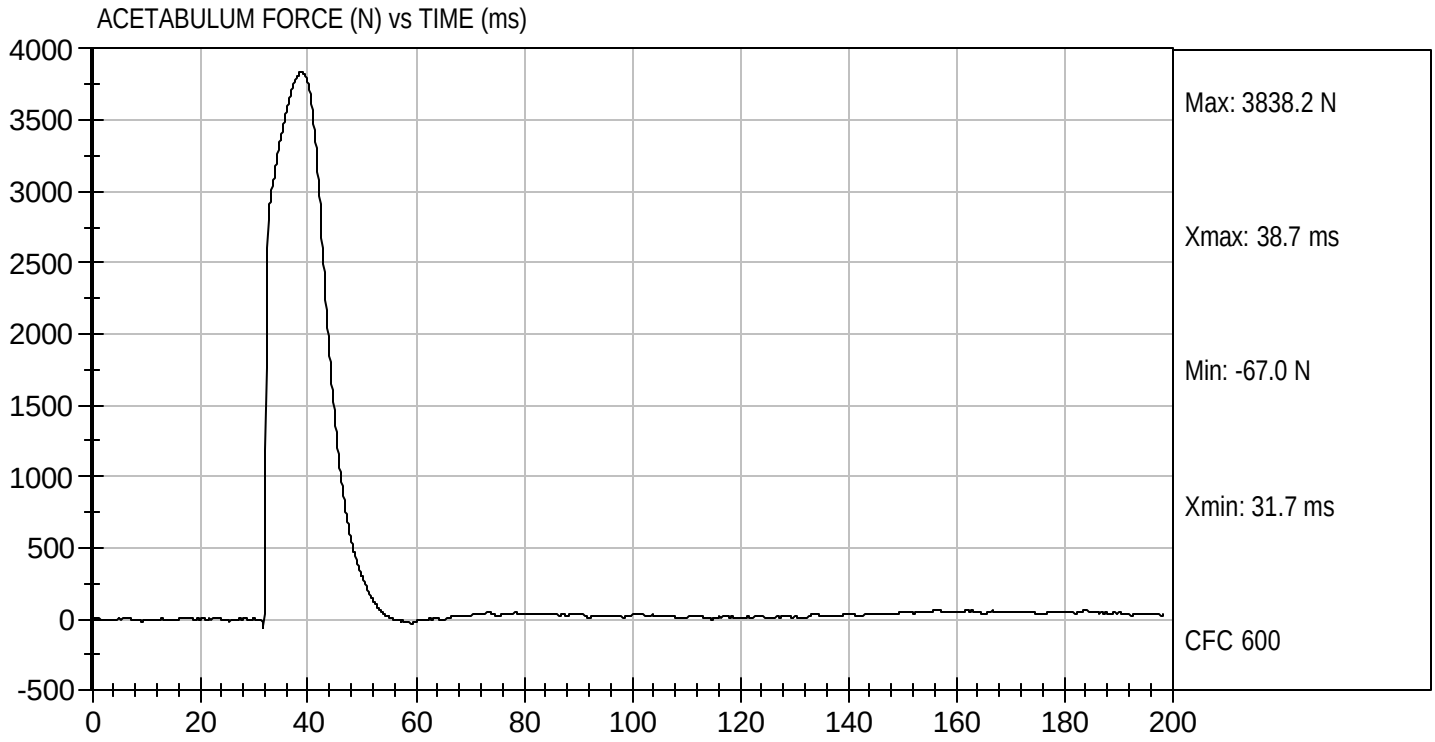


PELVIS ACCELERATION (G'S) vs TIME (ms)



Test Desc: Pelvis Impact
Componet ID: D052237

Test Date: 08/09/2005
Velocity: 21.9 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052238

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.32	Pass
Peak Impactor Acceleration	G's	41 to 47	41	Pass
Pelvis Y Acceleration	G's	32 to 40	36	Pass
Peak Pelvis Iliac Force	N	4841 to 5491	5143	Pass
		Overall Test Results		Pass

Laboratory Technician

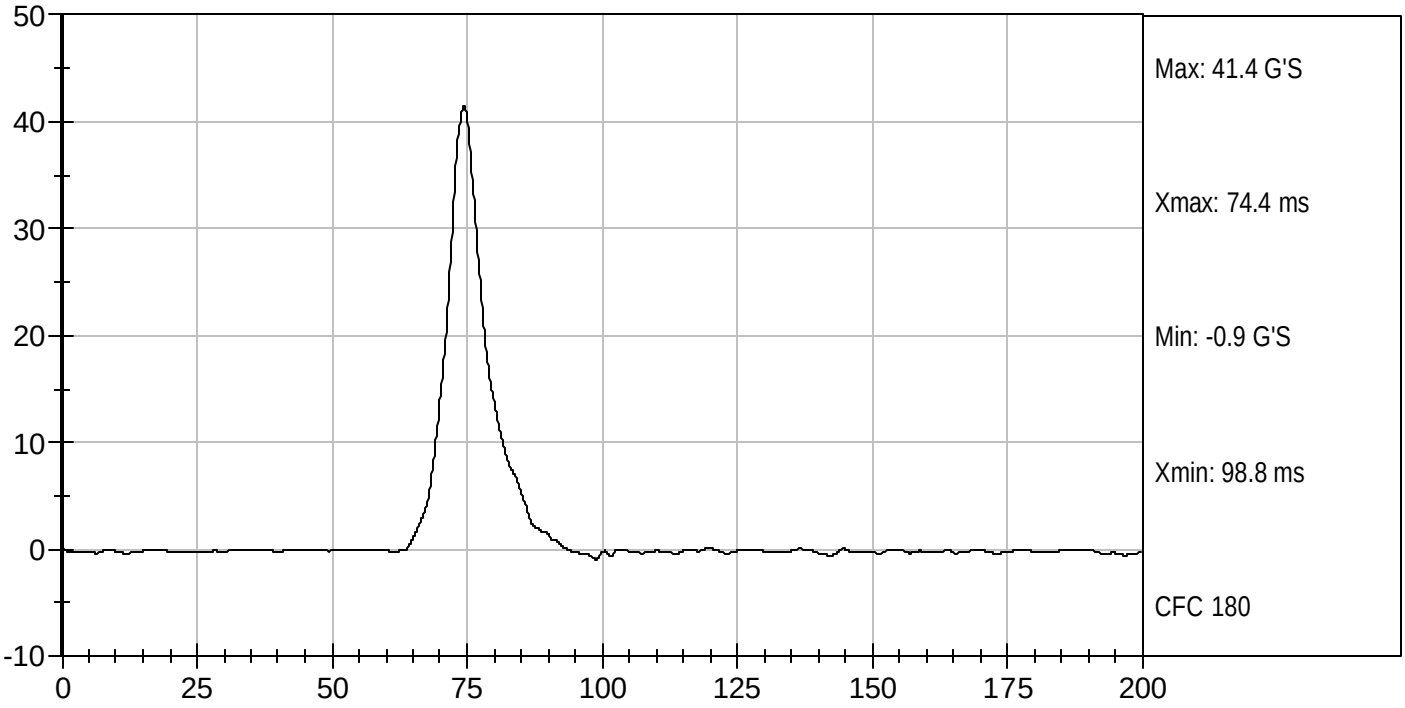
08/10/2005
Test Date

David Winkelbauer
Approved By

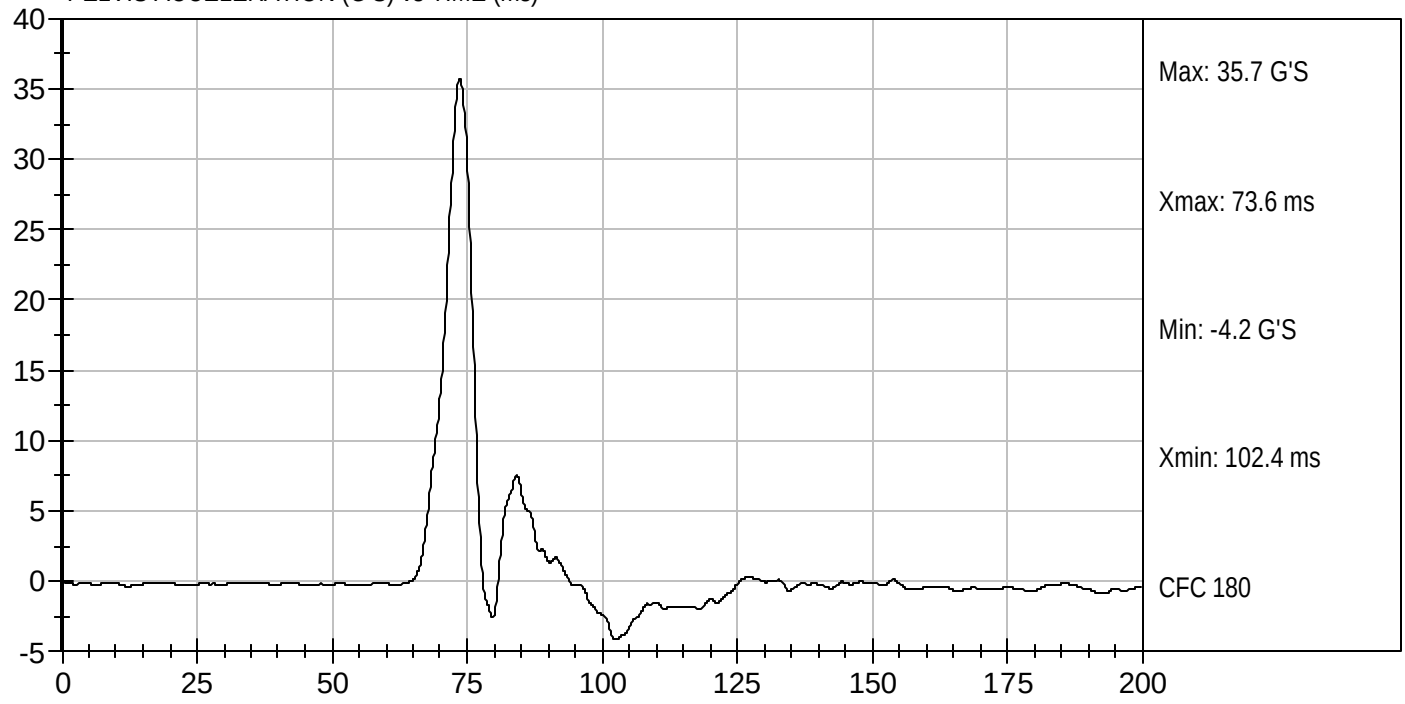
Test Desc: Iliac Impact
Componet ID: D052238

Test Date: 08/10/2005
Velocity: 14.17 ft/s, 4.32 m/s

PROBE (G'S) vs TIME (ms)

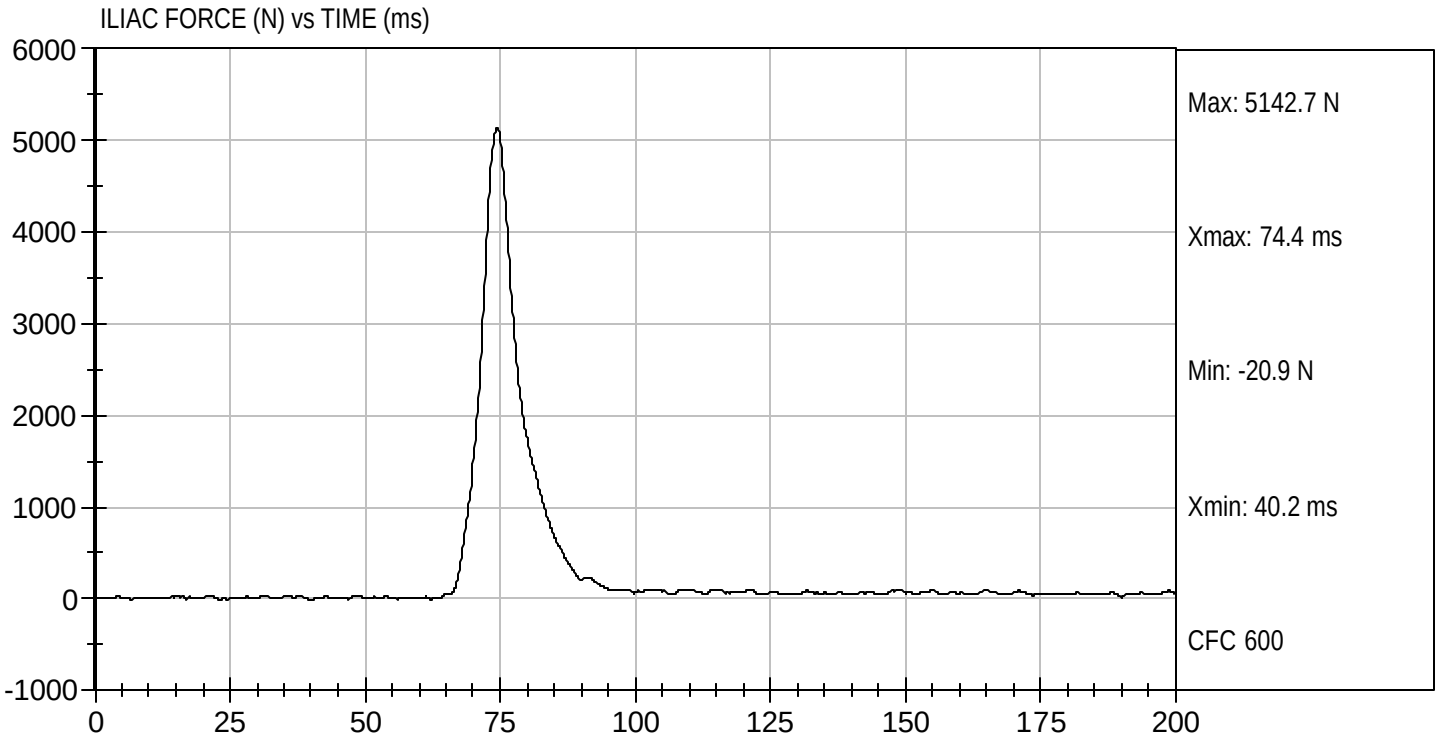


PELVIS ACCELERATION (G'S) vs TIME (ms)



Test Desc: Iliac Impact
Componet ID: D052238

Test Date: 08/10/2005
Velocity: 14.17 ft/s, 4.32 m/s



CERTIFICATION DATA

Dummy Serial Number: 032

POST-TEST CALIBRATION

MGA RESEARCH CORPORATION

HEAD DROP TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test ID:** D052331

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	125 to 145	128	Pass
Peak Lateral Acceleration	G's	+/- 15	12	Pass
Unimodal	Yes/No	<10%	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

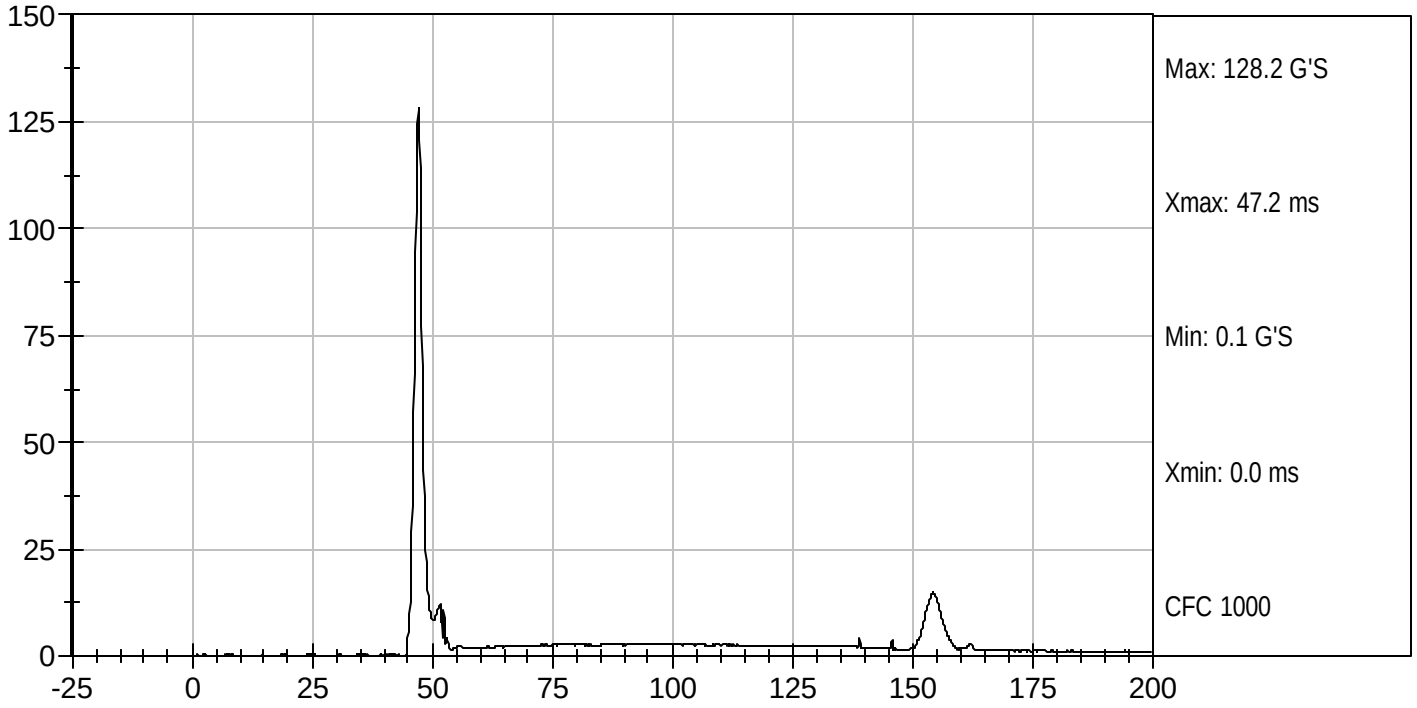
08/19/2005
Test Date

David Winkelbauer
Approved By

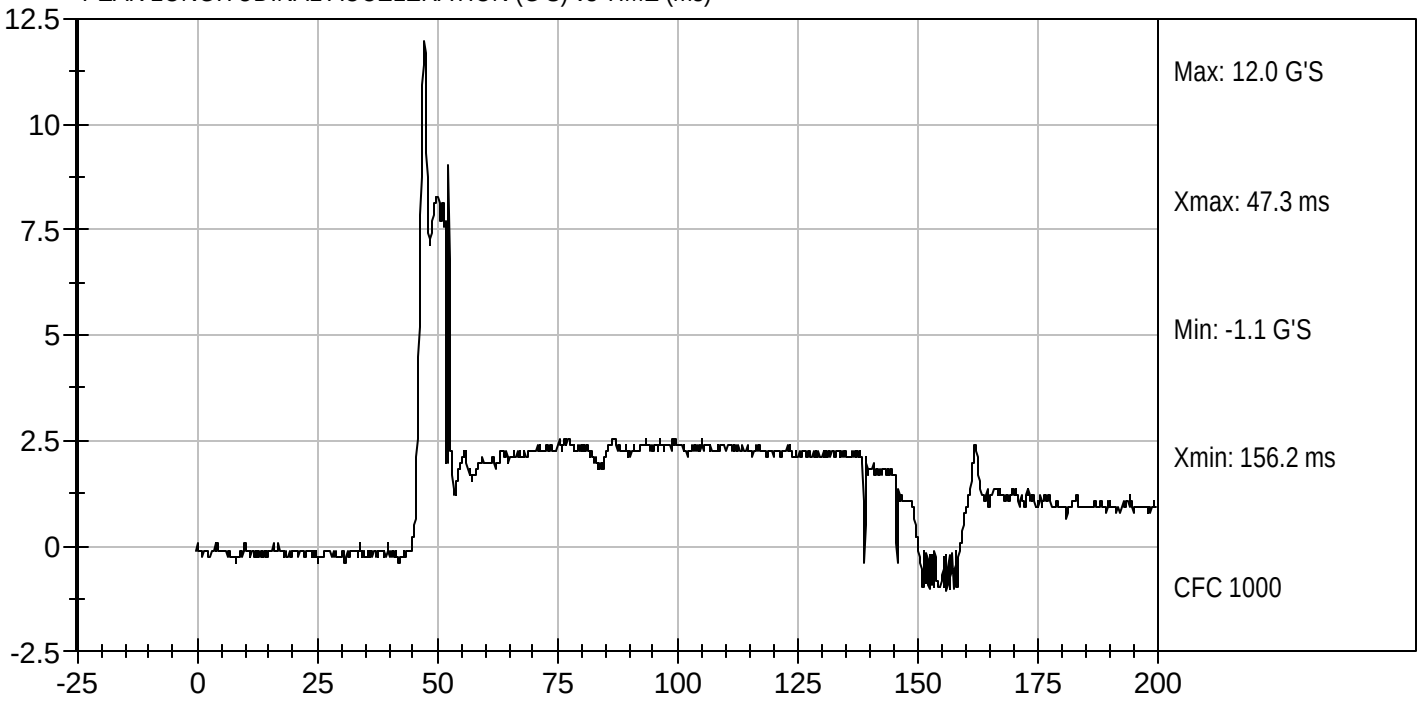
Test Desc: Head Drop
Componet ID: D052331

Test Date: 08/19/2005
Velocity: 0 ft/s, 0 m/s

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



PEAK LONGITUDINAL ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052332

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.7	Pass
Humidity		%	10 to 70	45	Pass
Impact Velocity		m/s	5.51 to 5.63	5.63	Pass
Delta Velocity	10 msec	m/s	2.20 to 2.80	2.57	Pass
	15 msec	m/s	3.40 to 4.10	3.69	Pass
	20 msec	m/s	4.50 to 5.40	4.93	Pass
	25 msec	m/s	5.50 to 6.10	5.79	Pass
	25-100 msec	m/s	5.20 to 6.20	5.85	Pass
Maximum D-Plane Rotation		deg	74 to 79	75	Pass
Time of Maximum D-Plane Rotation		Nm	50 to 70	66	Pass
Maximum Occipital Condyle Moment during Rotation Interval		Nm	-45 to -40	-41	Pass
Time of Moment Decay to 0 Nm		msec	113 to 123	114	Pass
			Overall Test Results		Pass

Jessica Gall

Laboratory Technician

08/19/2005

Test Date

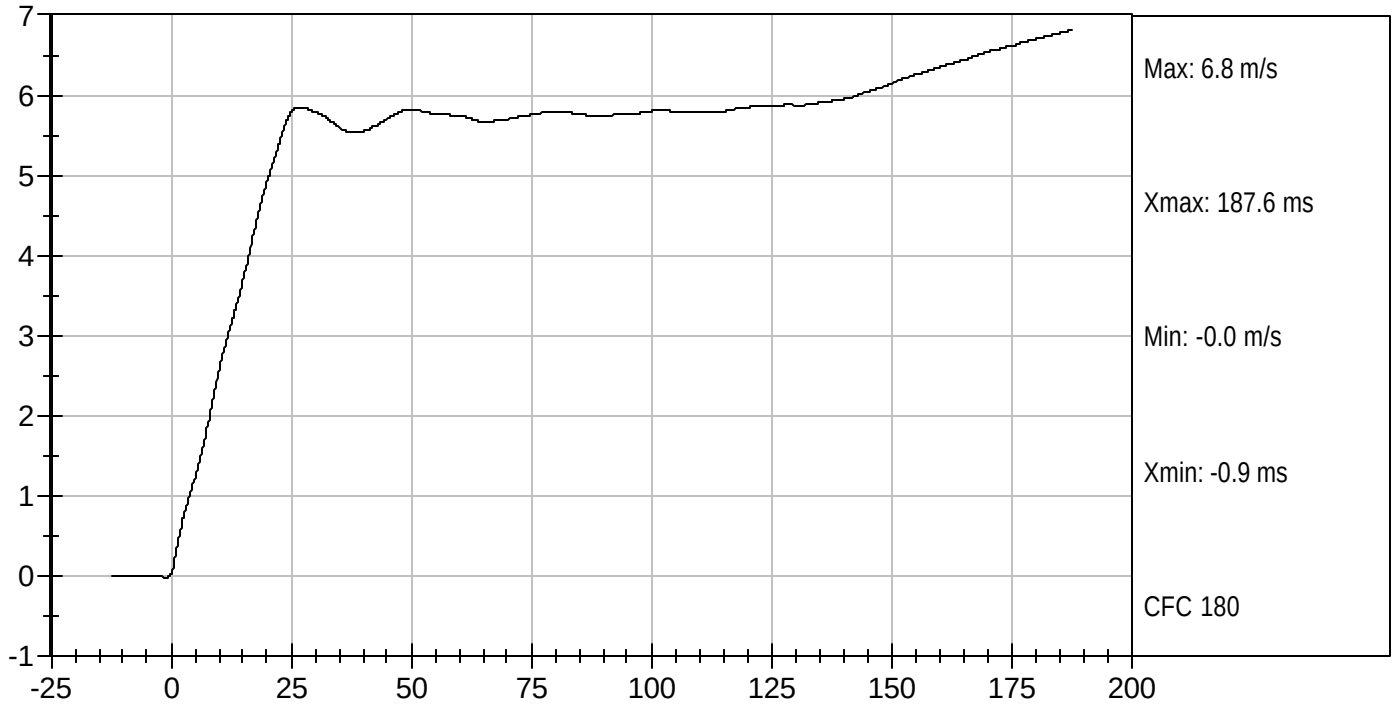
David Winkelbauer

Approved By

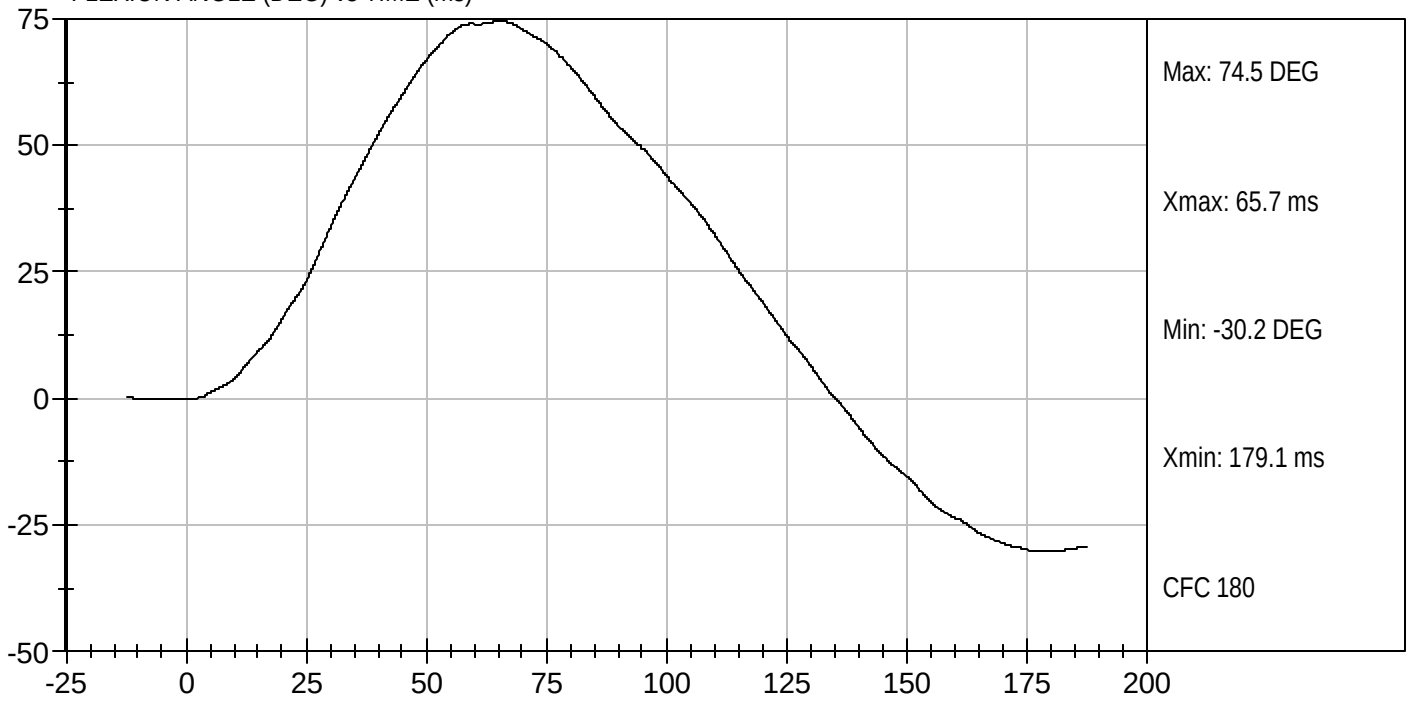
Test Desc: Neck Bending
Componet ID: D052332

Test Date: 08/19/2005
Velocity: 18.46 ft/s, 5.63 m/s

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

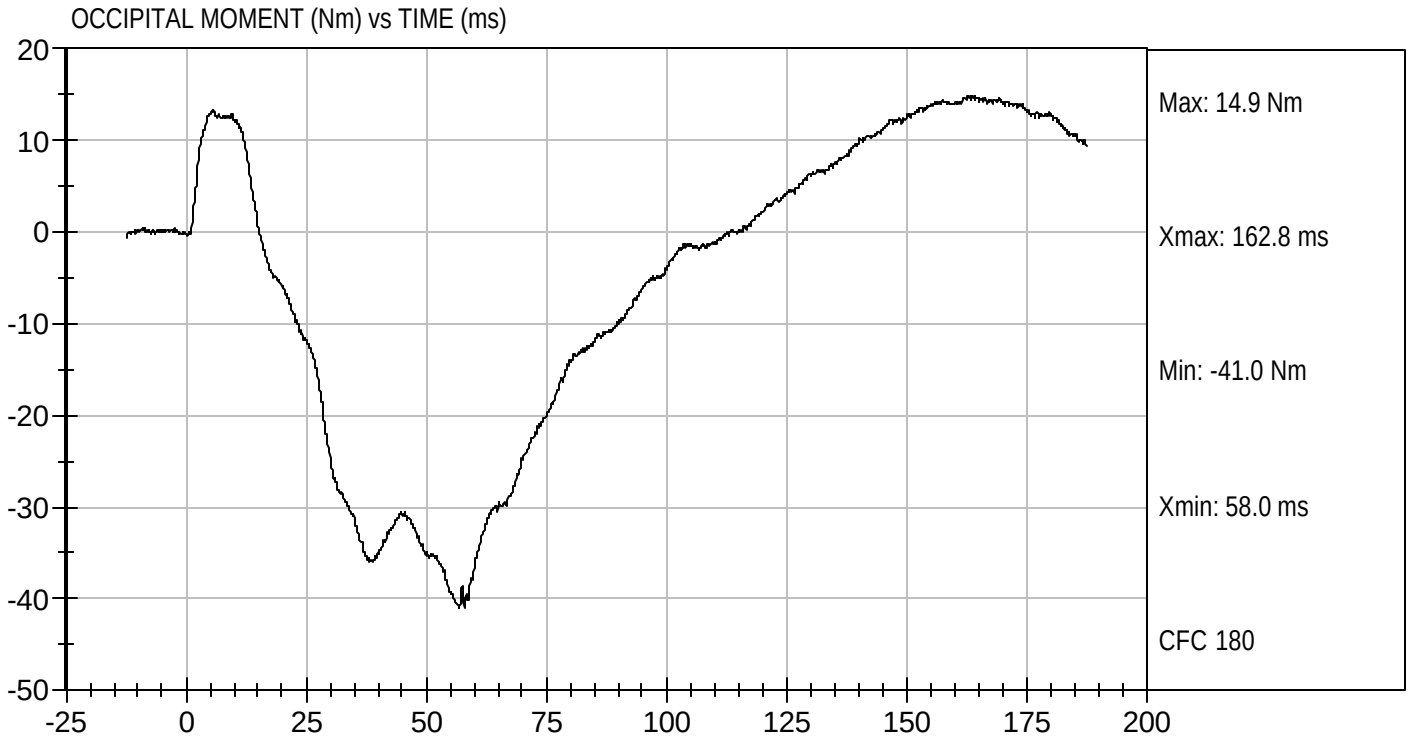


FLEXION ANGLE (DEG) vs TIME (ms)



Test Desc: Neck Bending
Componet ID: D052332

Test Date: 08/19/2005
Velocity: 18.46 ft/s, 5.63 m/s



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test ID:** D052333

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.41 to 4.59	4.49	Pass
Maximum Probe Force	kN	1.6 to 2.4	2.2	Pass
Shoulder Displacement	mm	27 to 39	34	Pass
		Overall Test Results		Pass

Joe Fleck

Laboratory Technician

08/19/2005

Test Date

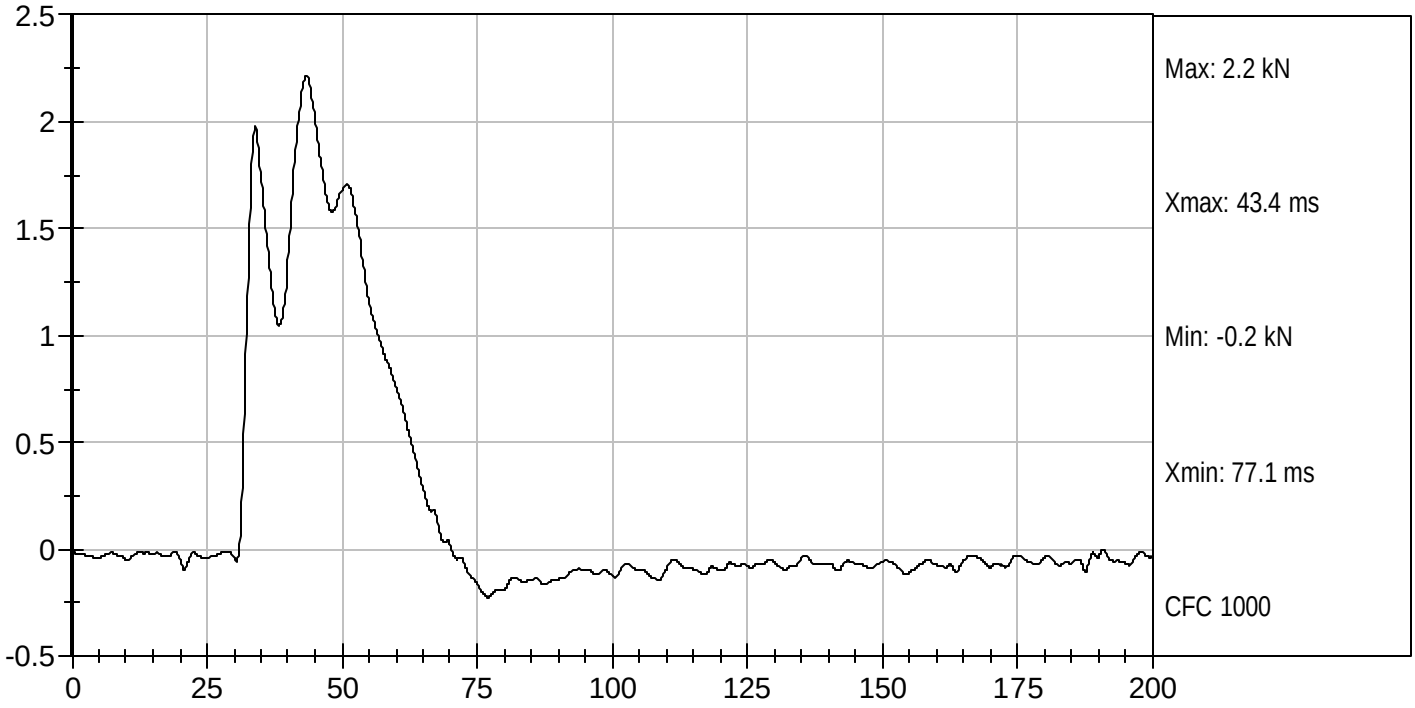
David Winkelbauer

Approved By

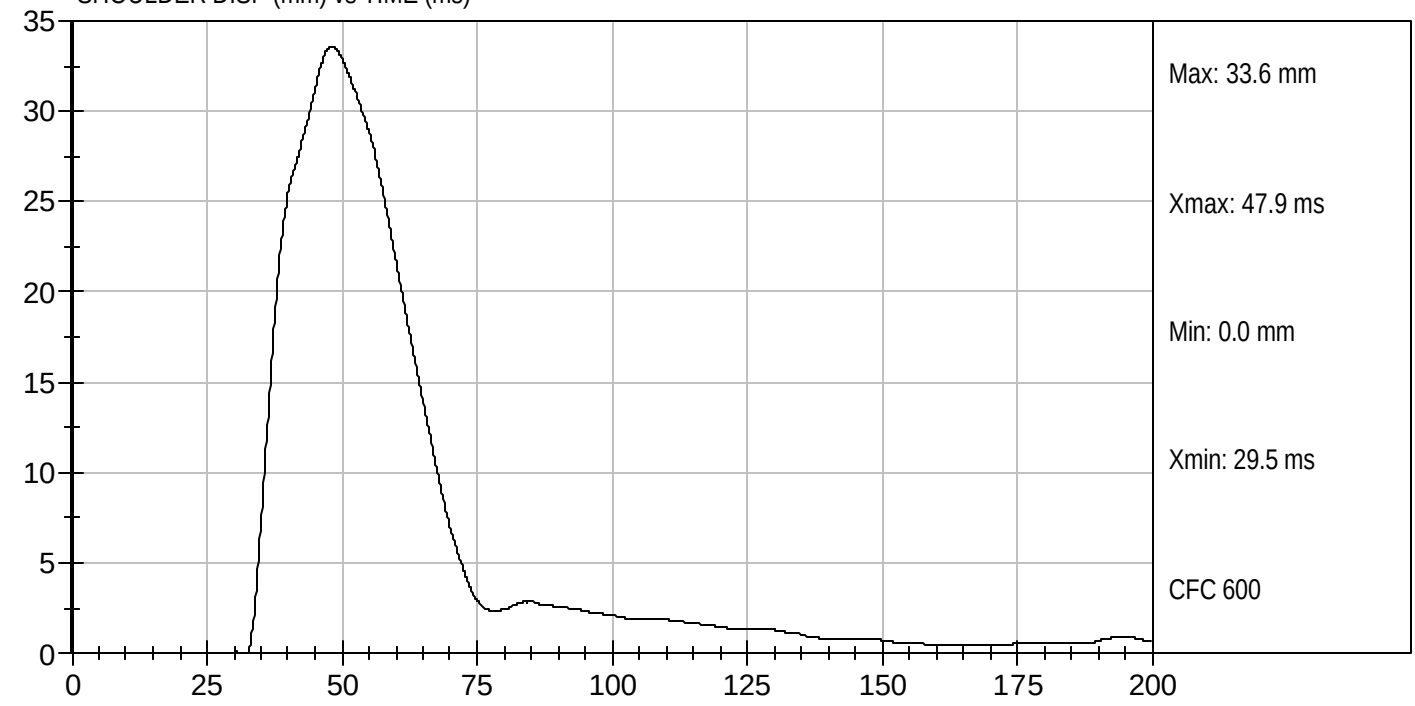
Test Desc: Shoulder Impact
Componet ID: D052333

Test Date: 08/19/2005
Velocity: 14.74 ft/s, 4.49 m/s

PROBE FORCE (kN) vs TIME (ms)



SHOULDER DISP (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052334

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	6.57 to 6.84	6.78	Pass
Peak Impactor Force	kN	4.1 to 4.7	4.6	Pass
Shoulder Displacement	mm	30 to 42	36	Pass
Upper Rib Displacement	mm	23 to 35	28	Pass
Middle Rib Displacement	mm	29 to 44	32	Pass
Lower Rib Displacement	mm	33 to 40	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 48	41	Pass
Lower Spine (T12) Y Acceleration	G's	30 to 38	30	Pass
		Overall Test Results		Pass

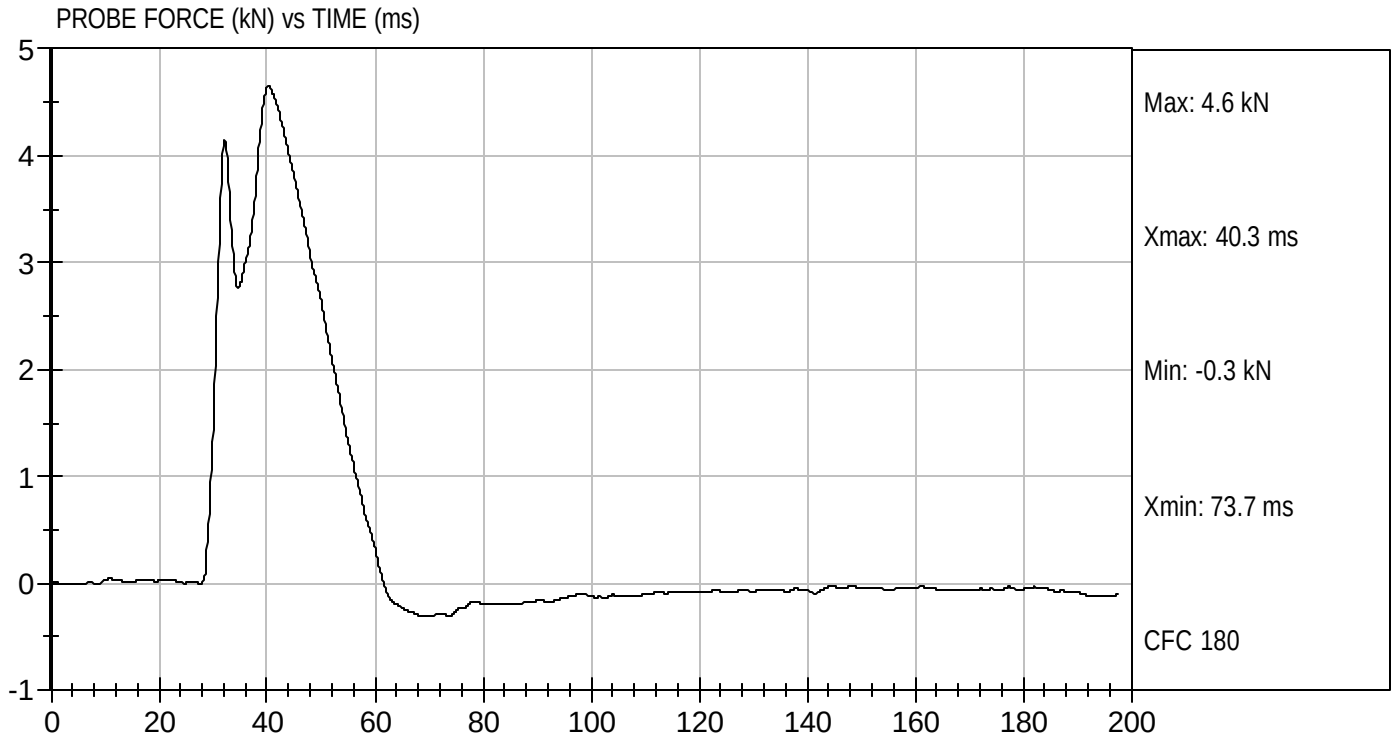
Joe Fleck
Laboratory Technician

08/19/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax With Arm
Componet ID: D052334

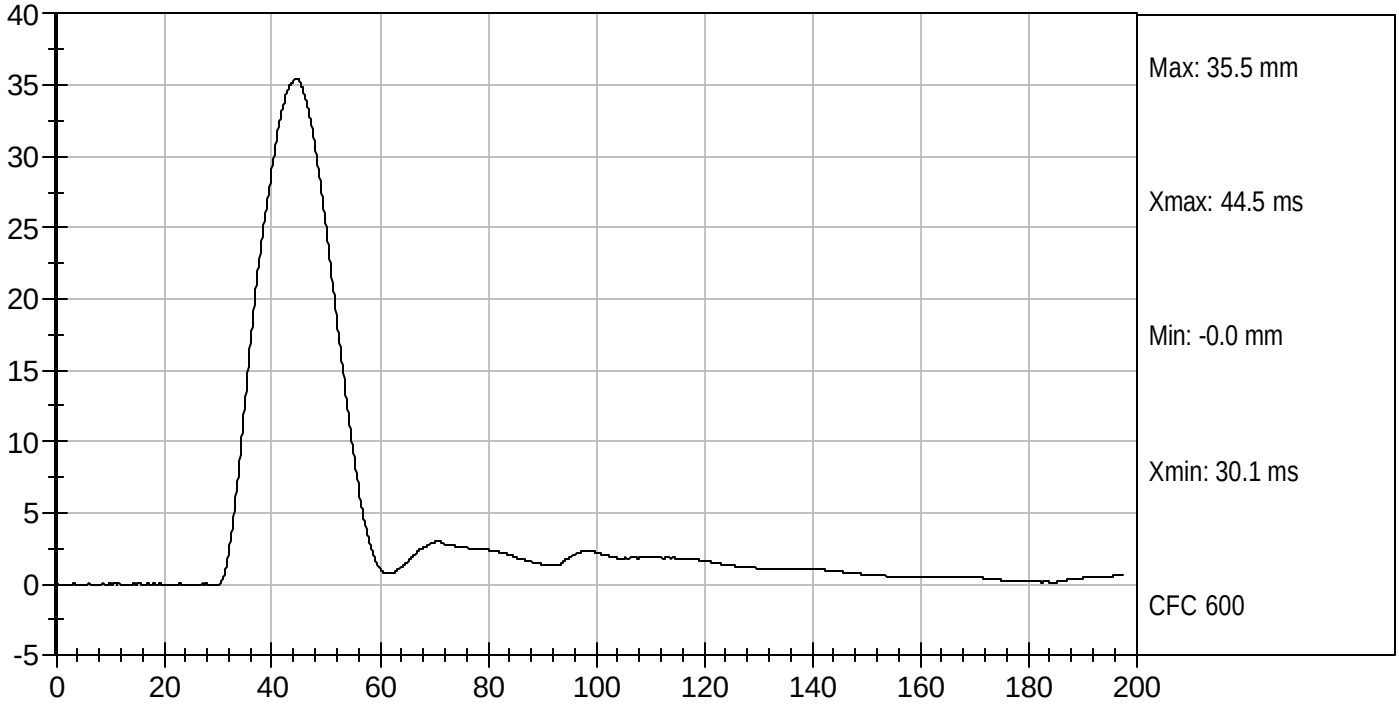
Test Date: 08/19/2005
Velocity: 22.25 ft/s, 6.78 m/s



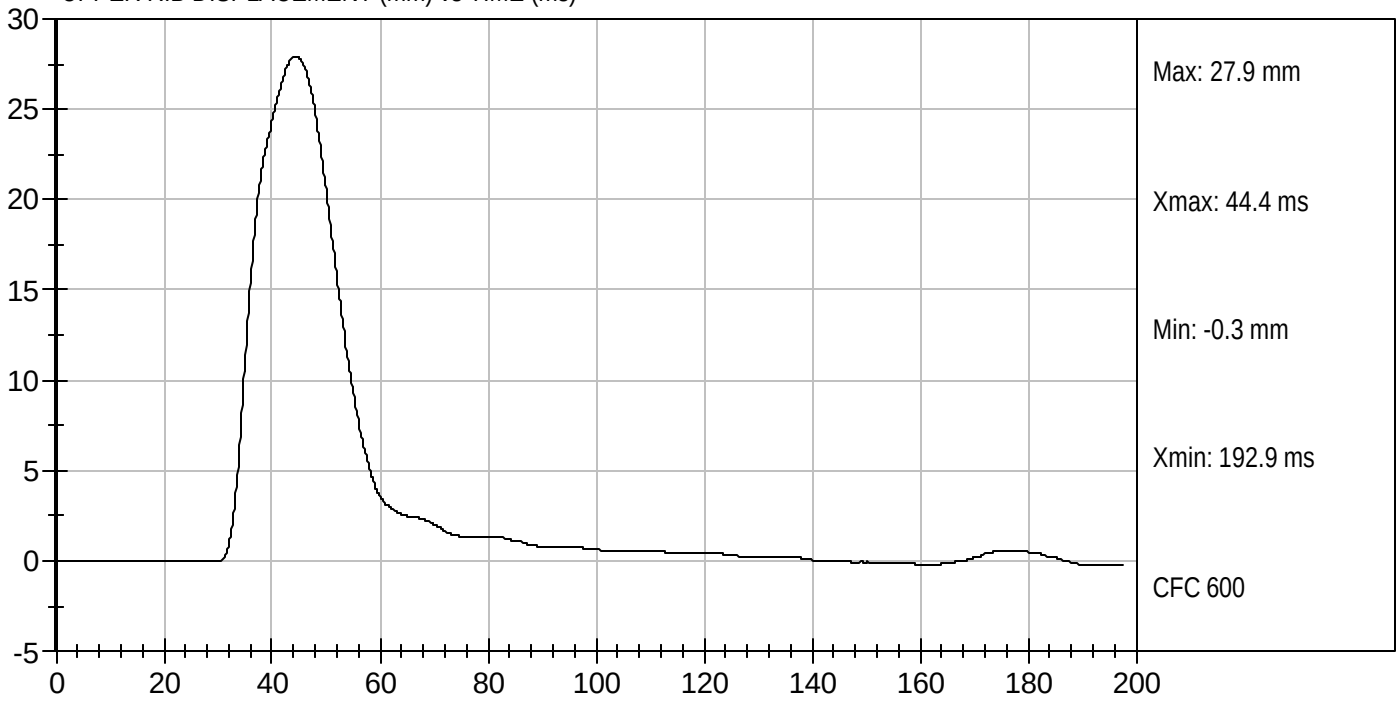
Test Desc: Thorax With Arm
Componet ID: D052334

Test Date: 08/19/2005
Velocity: 22.25 ft/s, 6.78 m/s

SHOULDER DISPLACEMENT (mm) vs TIME (ms)



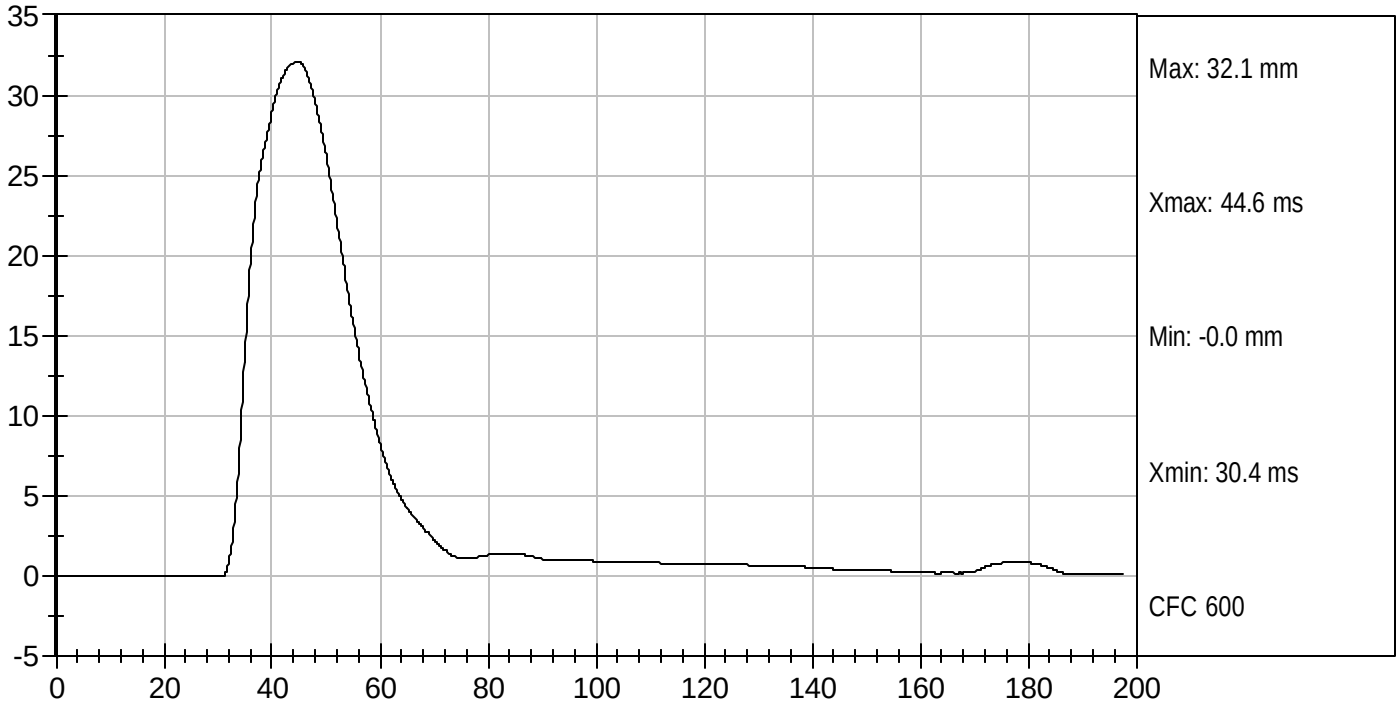
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



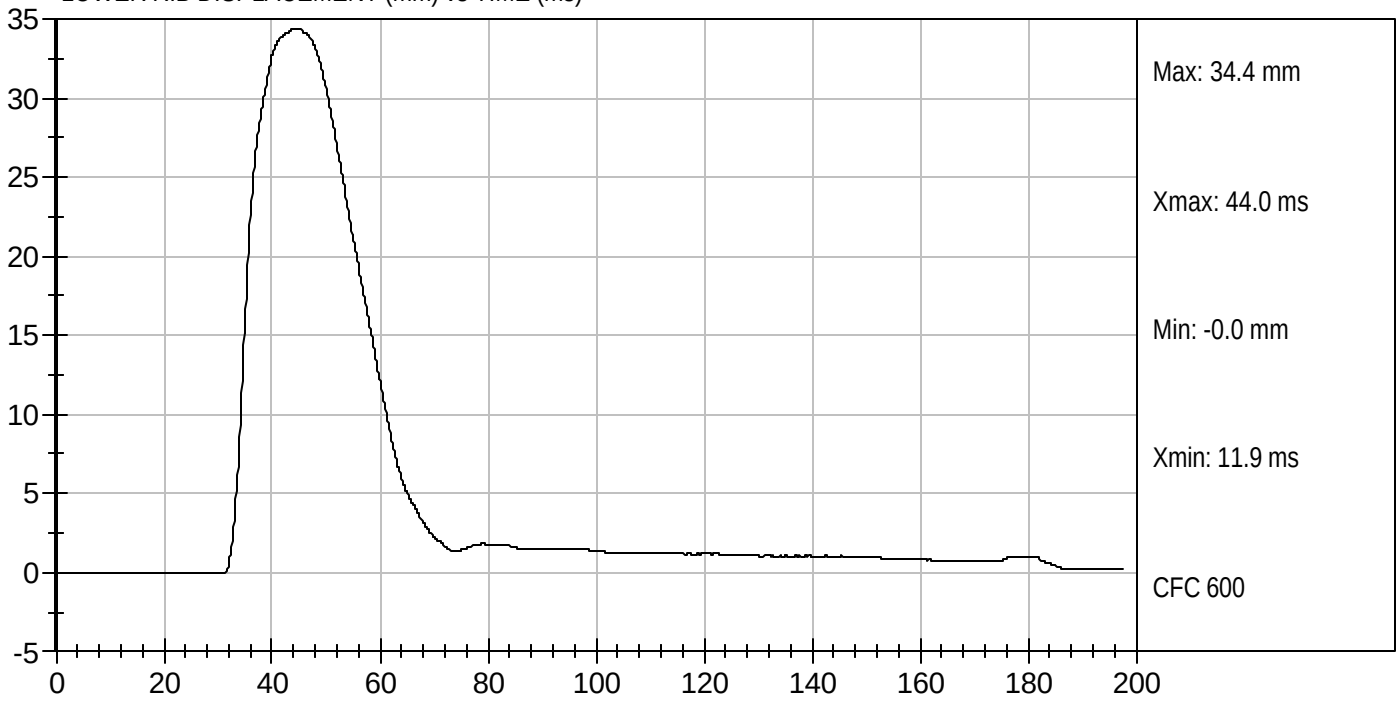
Test Desc: Thorax With Arm
Componet ID: D052334

Test Date: 08/19/2005
Velocity: 22.25 ft/s, 6.78 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



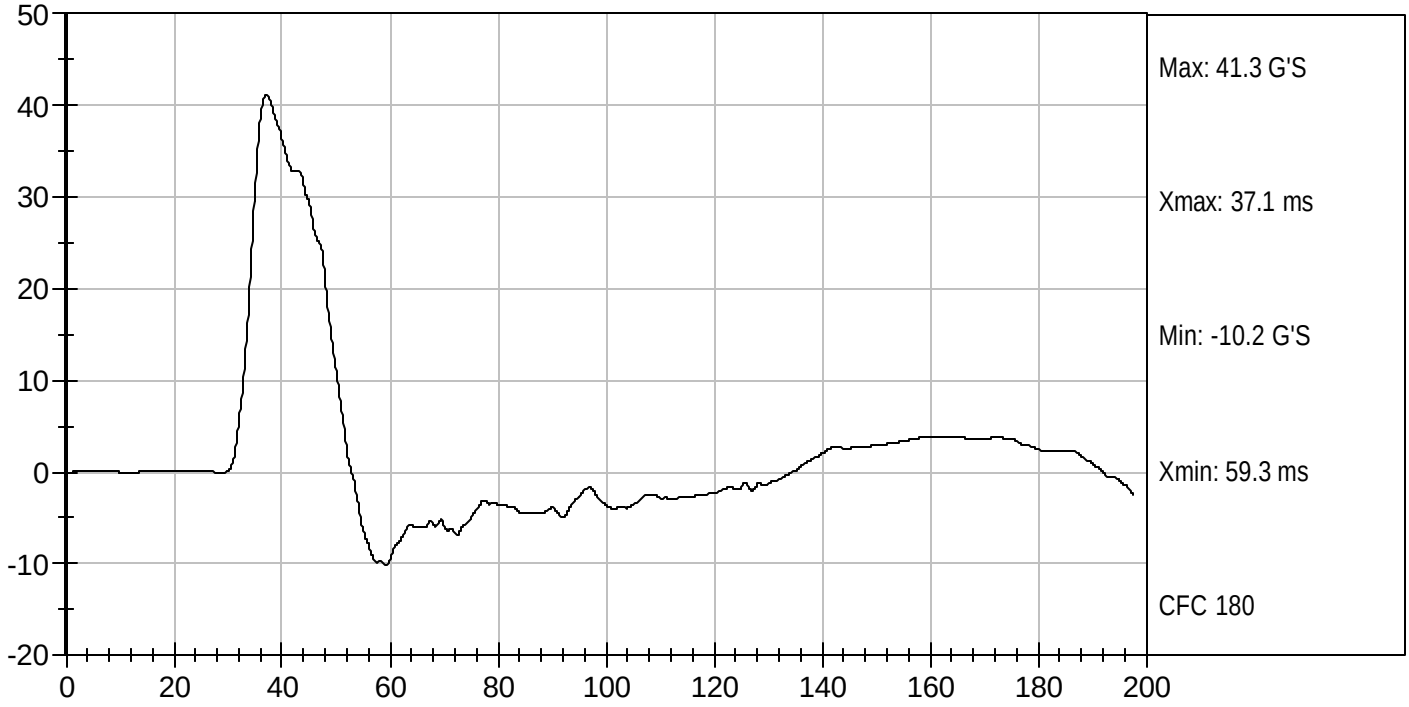
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



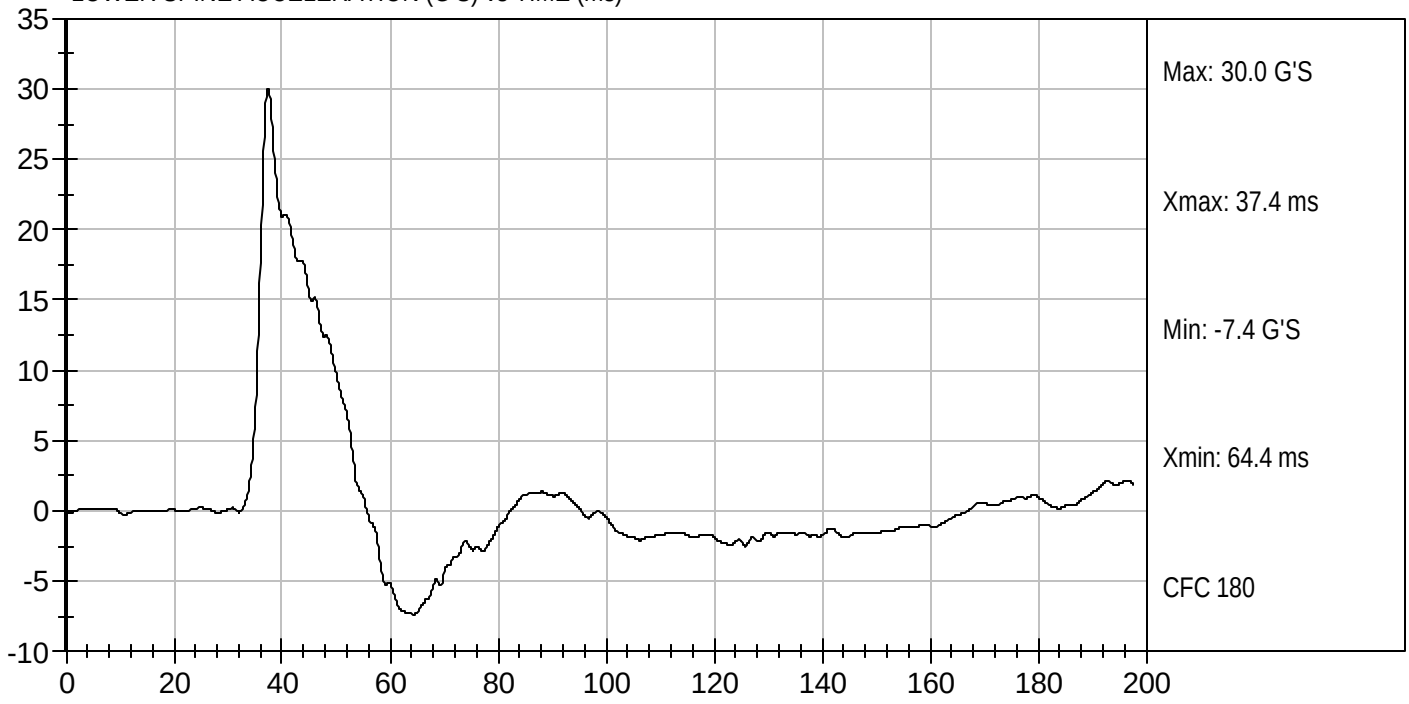
Test Desc: Thorax With Arm
Componet ID: D052334

Test Date: 08/19/2005
Velocity: 22.25 ft/s, 6.78 m/s

UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



LOWER SPINE ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052335

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	45	Pass
Impact Velocity	m/s	4.20 to 4.40	4.29	Pass
Peak Impactor Force	kN	1.8 to 2.3	2.2	Pass
Upper Rib Displacement	mm	32 to 41	37	Pass
Middle Rib Displacement	mm	40 to 51	40	Pass
Lower Rib Displacement	mm	34 to 47	35	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 18	15	Pass
Lower Spine (T12) Y Acceleration	G's	8 to 13	8	Pass
		Overall Test Results		Pass

Joe Fleck
Laboratory Technician

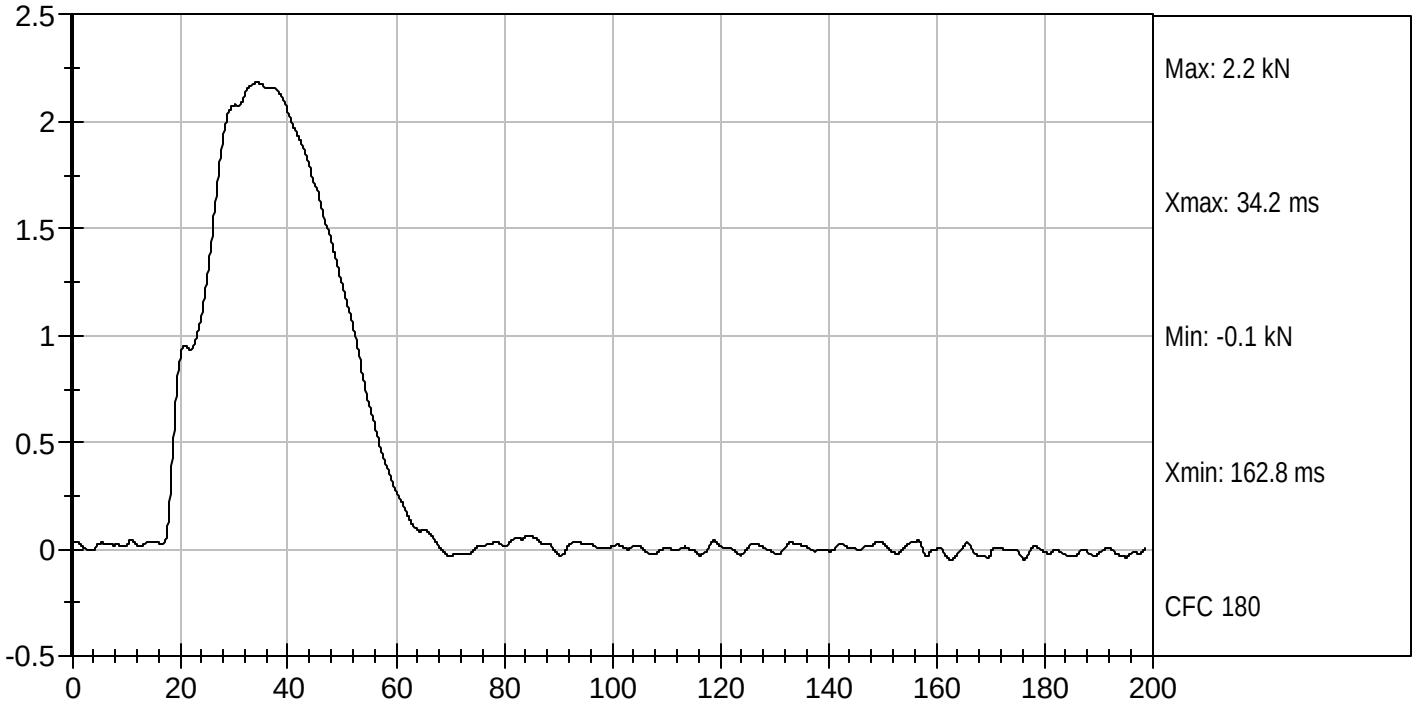
08/19/2005
Test Date

David Winkelbauer
Approved By

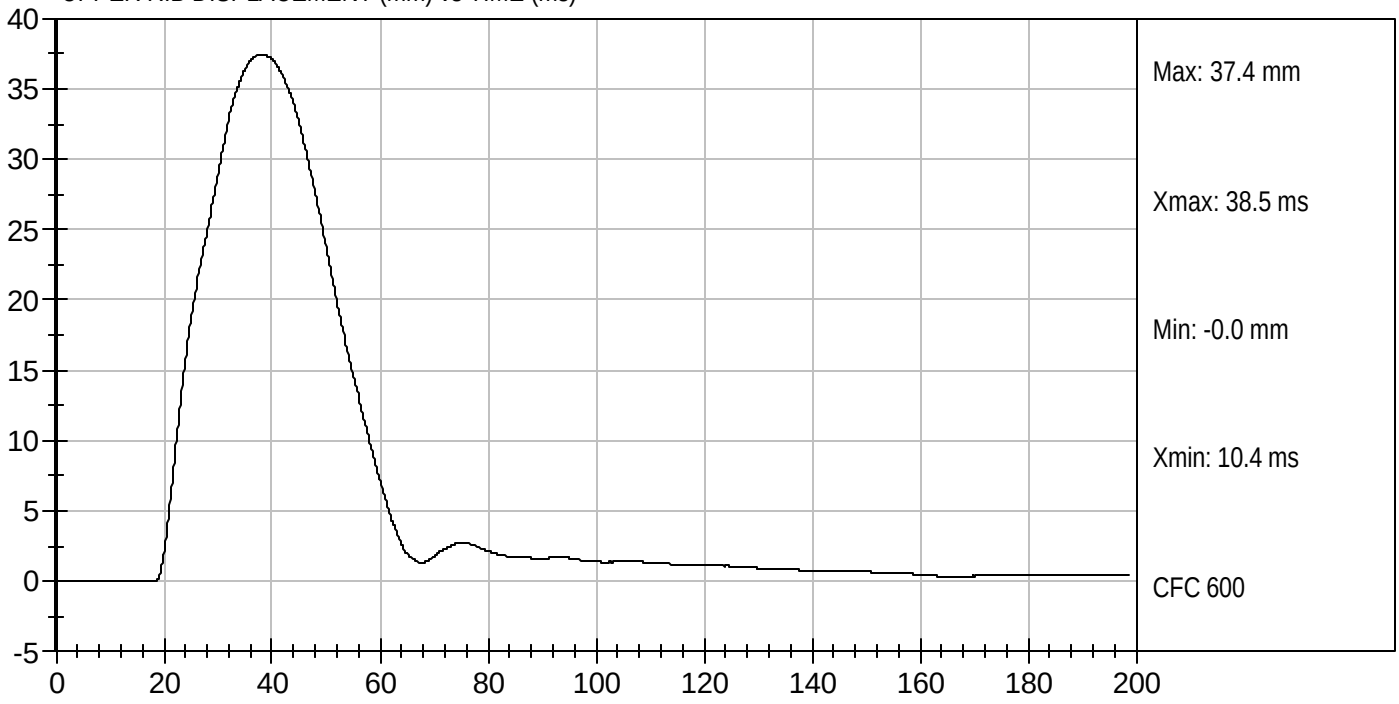
Test Desc: Thorax Without Arm
Componet ID: D052335

Test Date: 08/19/2005
Velocity: 14.09 ft/s, 4.29 m/s

PROBE FORCE (kN) vs TIME (ms)



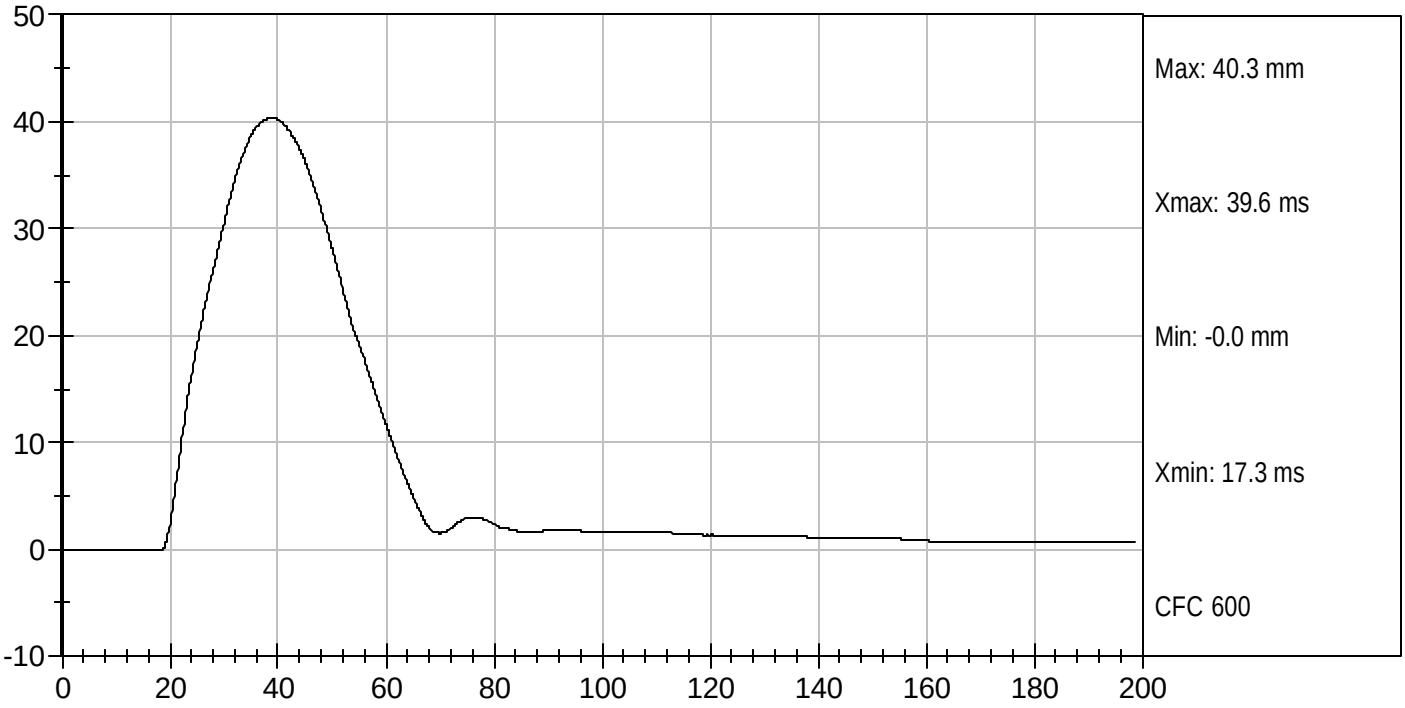
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



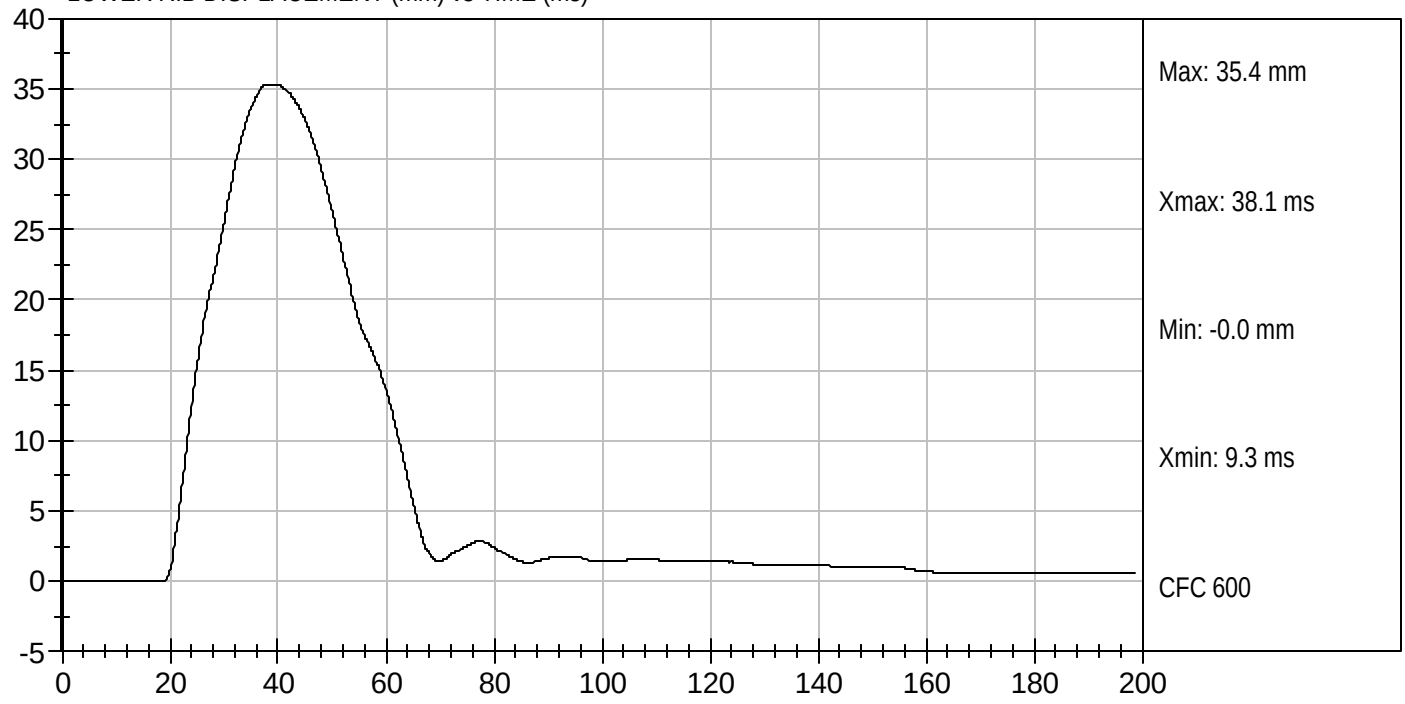
Test Desc: Thorax Without Arm
Componet ID: D052335

Test Date: 08/19/2005
Velocity: 14.09 ft/s, 4.29 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



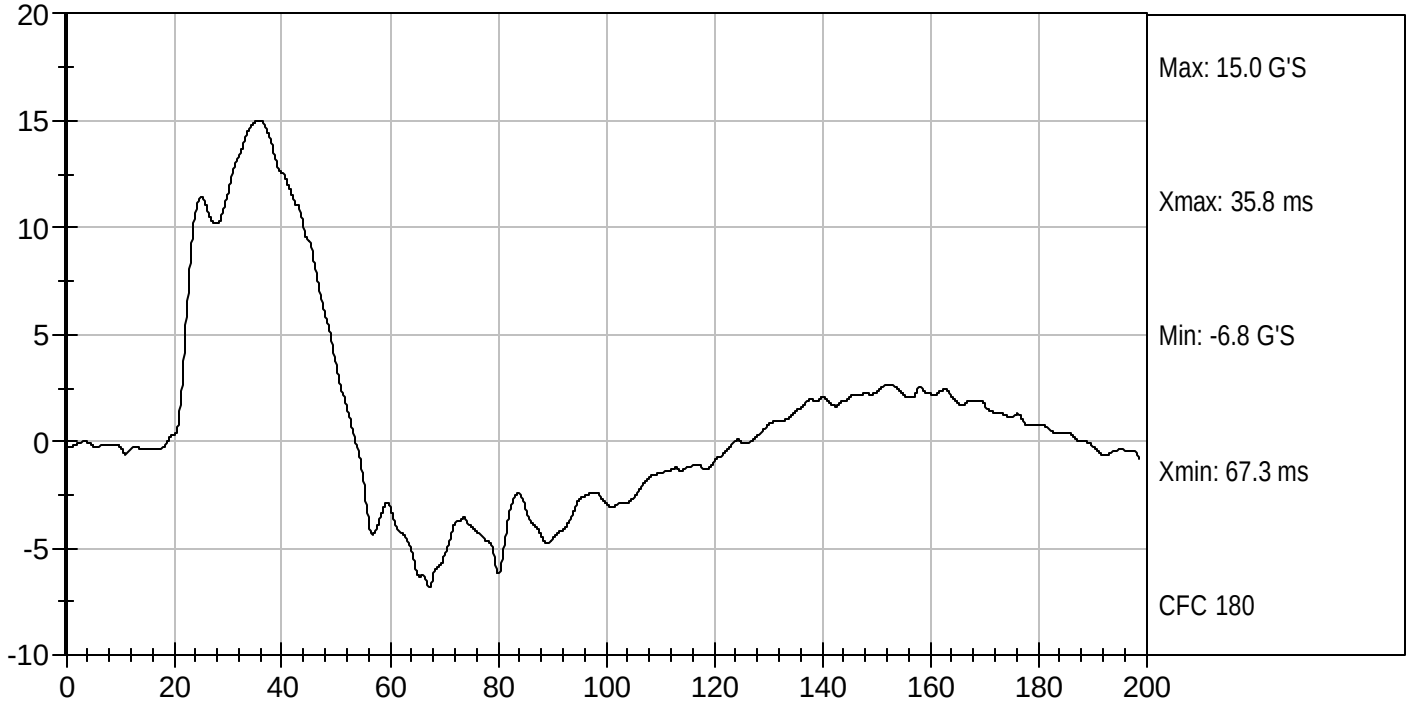
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



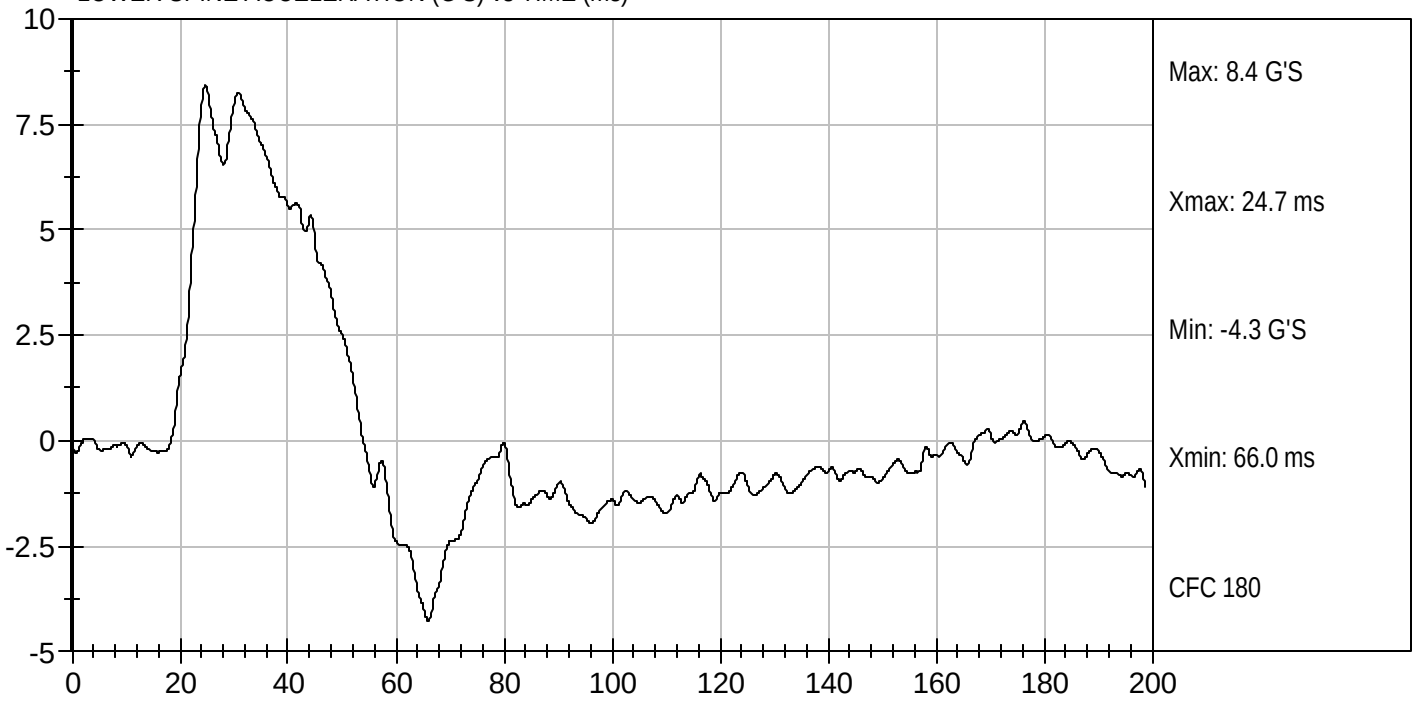
Test Desc: Thorax Without Arm
Componet ID: D052335

Test Date: 08/19/2005
Velocity: 14.09 ft/s, 4.29 m/s

UPPER SPINE ACCELERATION (G'S) vs TIME (ms)



LOWER SPINE ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** d052336

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	44	Pass
Impact Velocity	m/s	4.41 to 4.59	4.46	Pass
Peak Impactor Force	kN	1.3 to 1.9	1.8	Pass
Upper Rib Displacement	mm	44 to 55	46	Pass
Lower Rib Displacement	mm	44 to 56	46	Pass
Upper Spine (T1) Y Acceleration	G's	5 to 9	7	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 13	13	Pass
		Overall Test Results		Pass

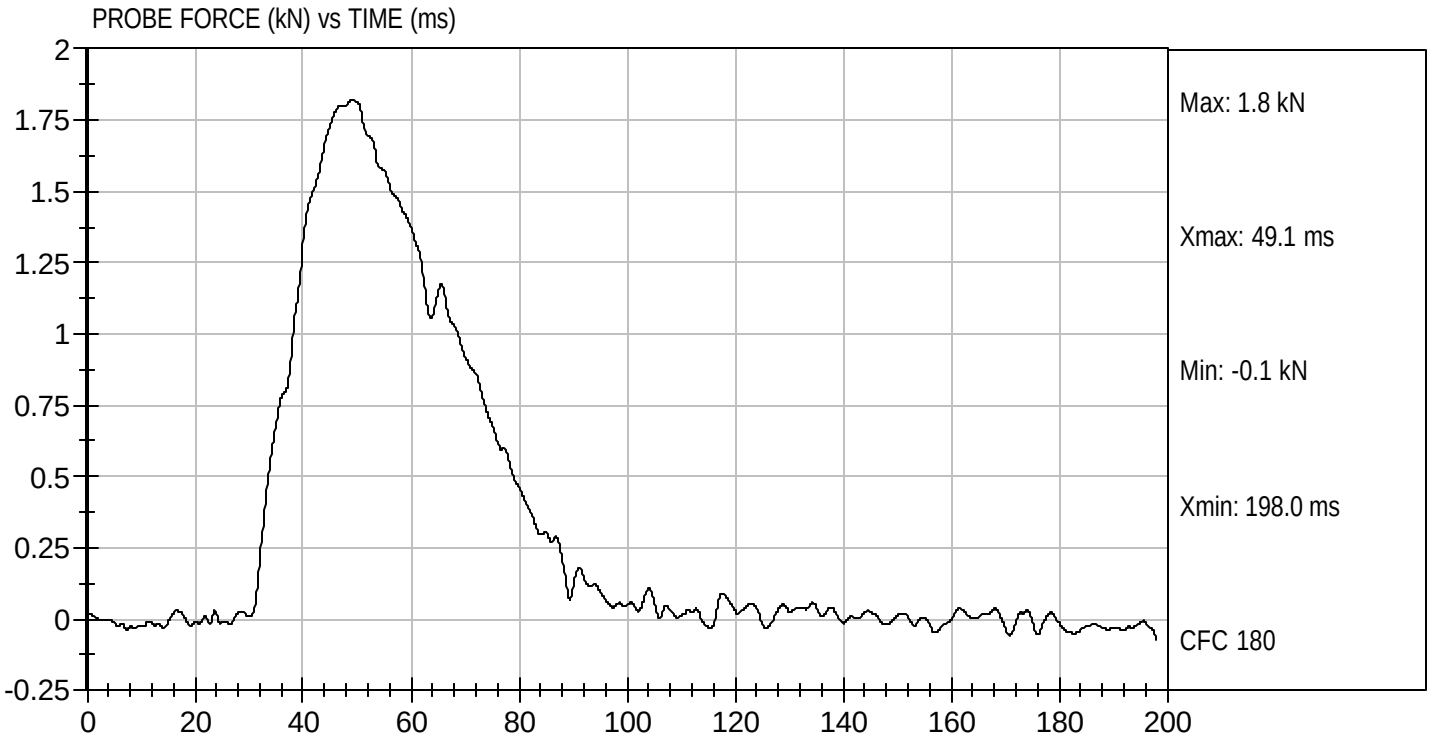
Jessica Hall
Laboratory Technician

08/22/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Abdomen Impact
Componet ID: D052336

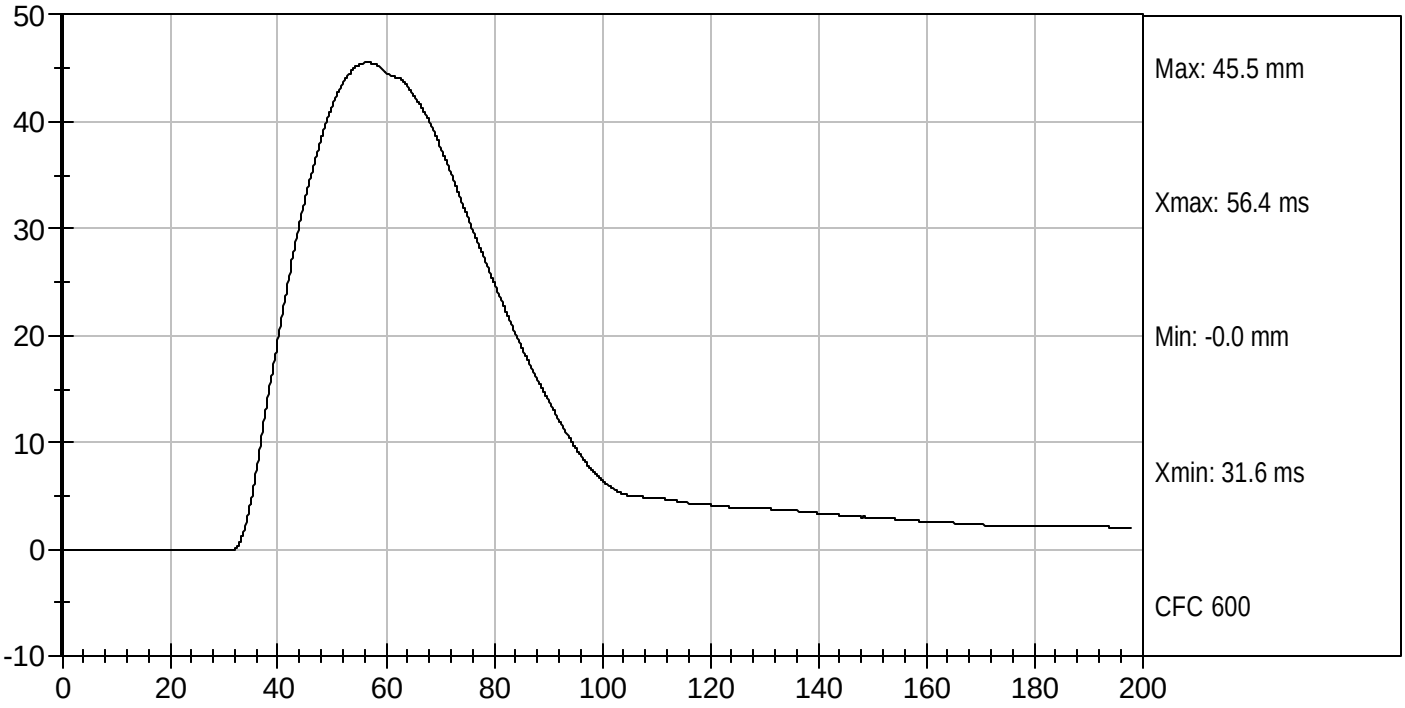
Test Date: 08/22/2005
Velocity: 14.63 ft/s, 4.46 m/s



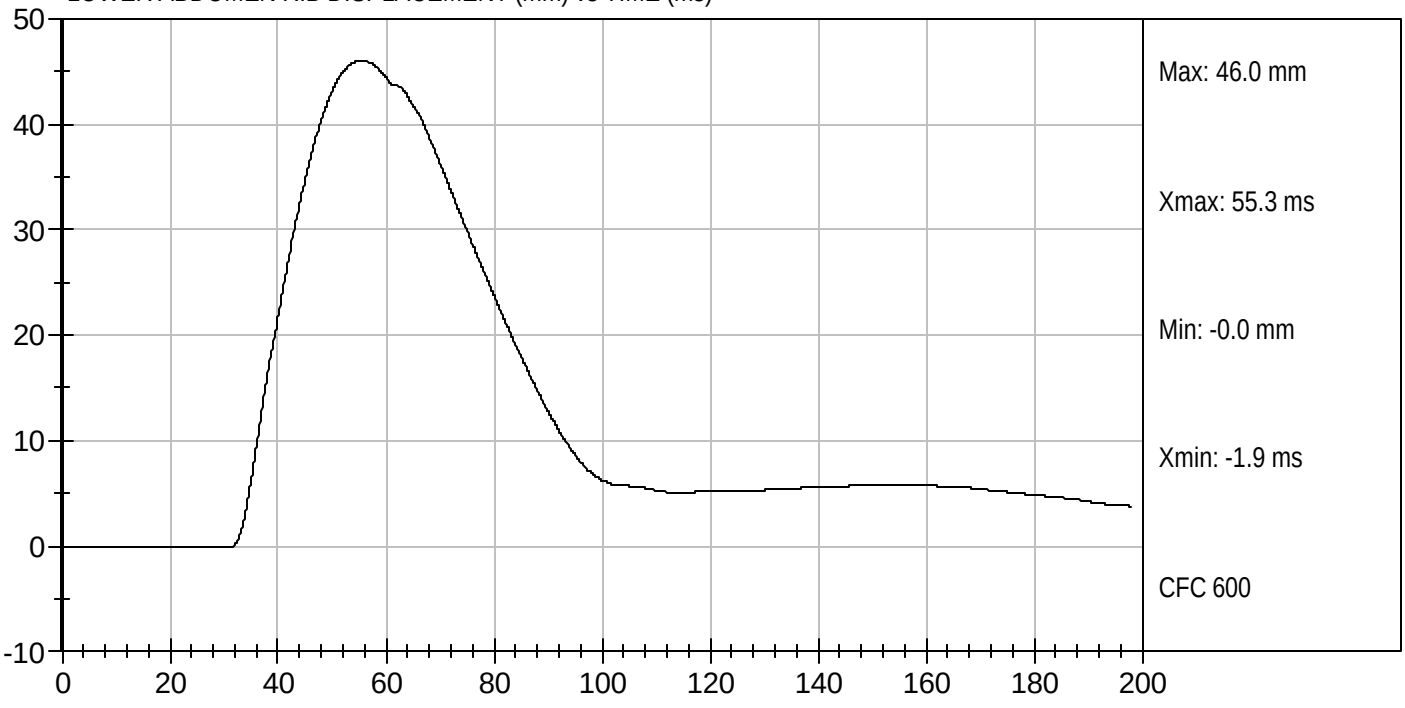
Test Desc: Abdomen Impact
Componet ID: D052336

Test Date: 08/22/2005
Velocity: 14.63 ft/s, 4.46 m/s

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

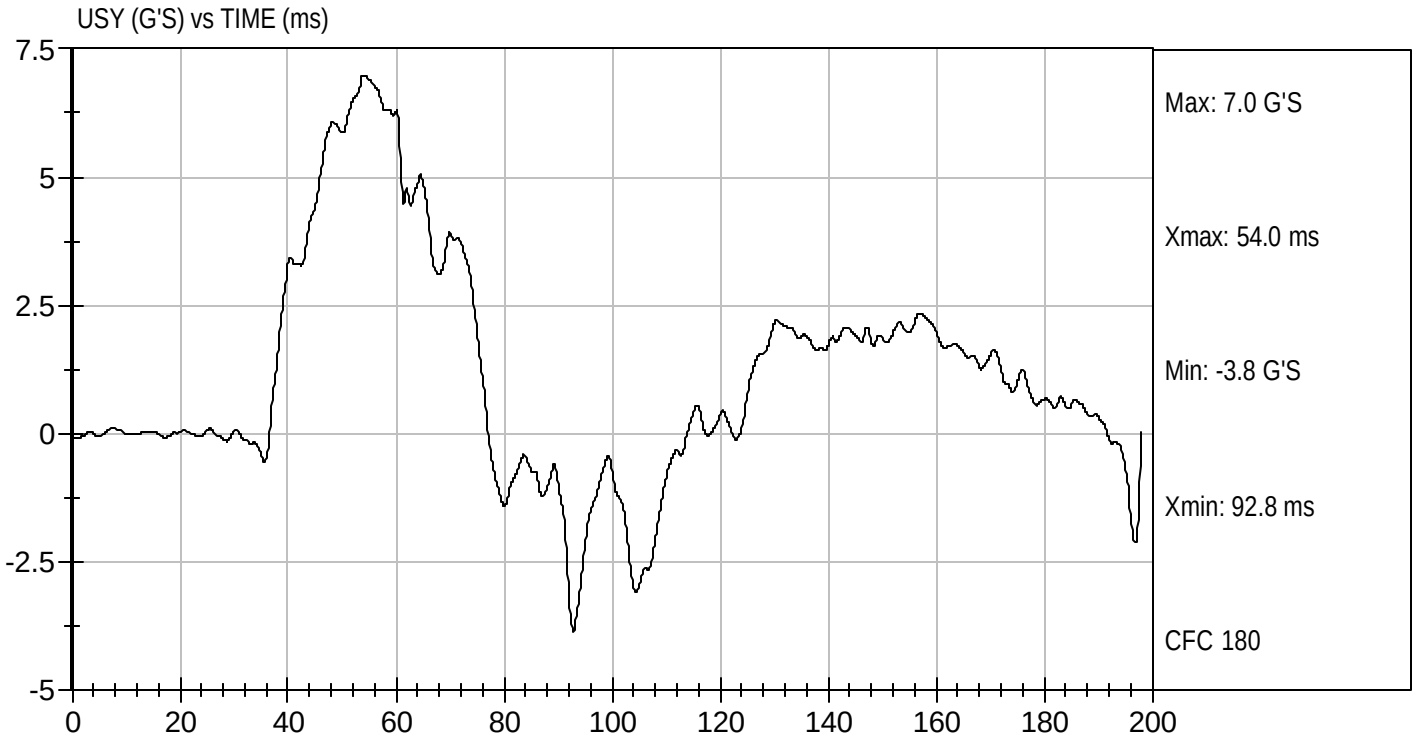


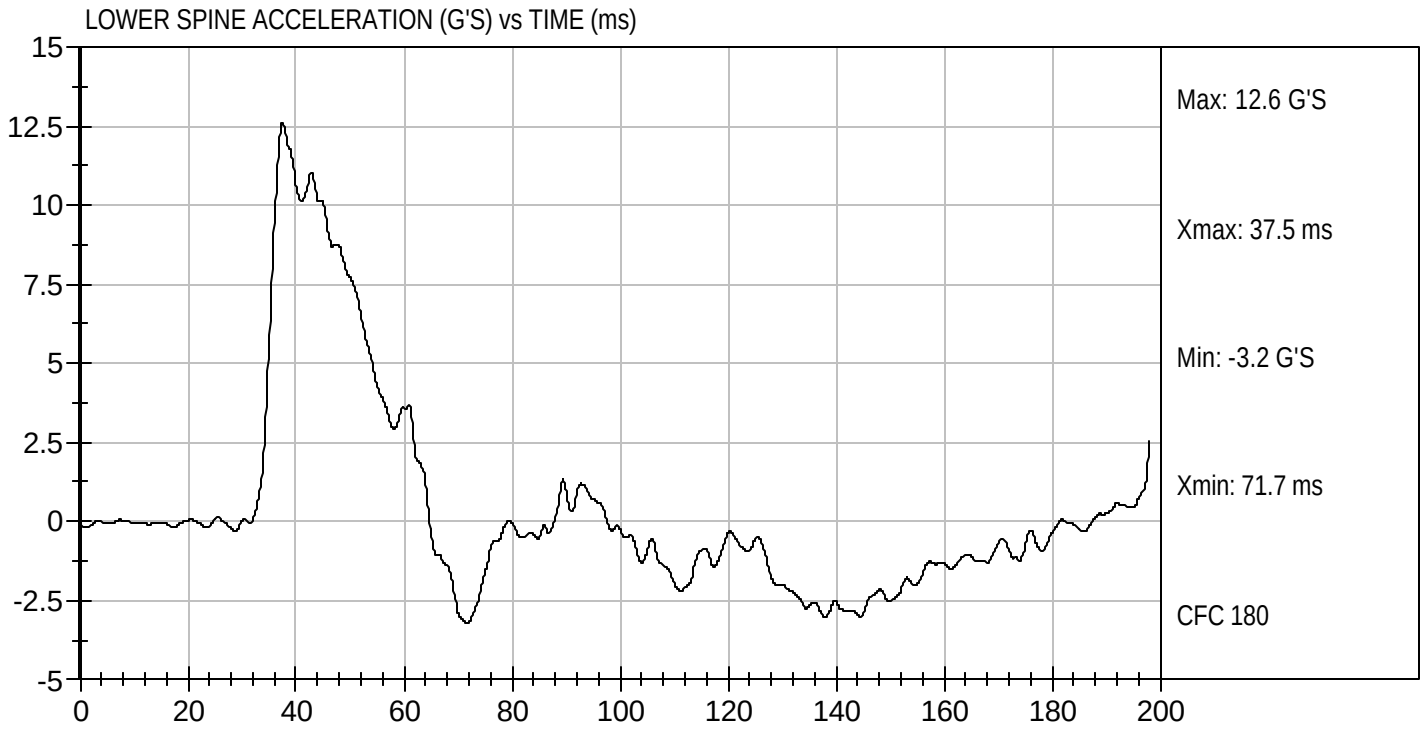
LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



Test Desc: Abdomen Impact
Componet ID: D052336

Test Date: 08/22/2005
Velocity: 14.63 ft/s, 4.46 m/s





MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052337

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	6.60 to 6.80	6.68	Pass
Peak Impactor Acceleration	G's	40 to 48	44	Pass
Pelvis Y Acceleration	G's	40 to 48	45	Pass
Peak Acetabulum Force	N	3803 to 4505	3832	Pass
		Overall Test Results		Pass

Laboratory Technician

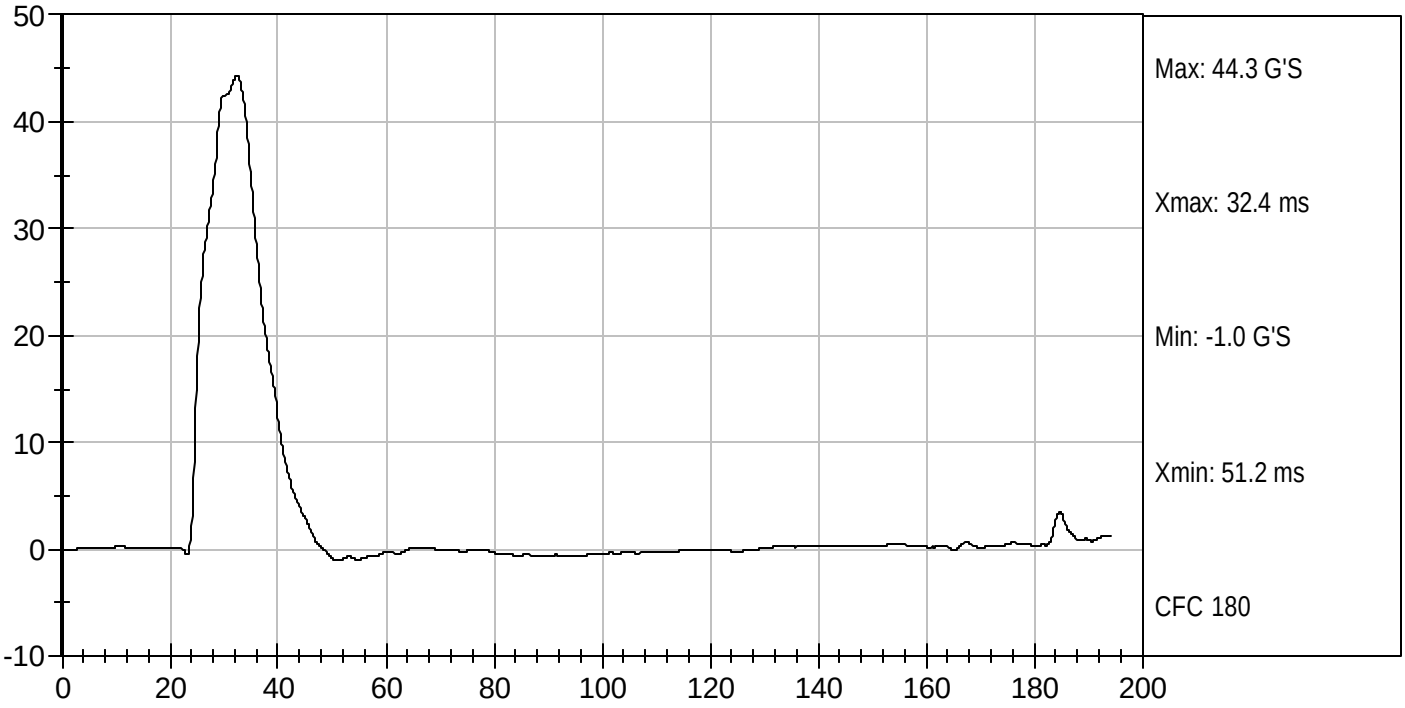
08/19/2005
Test Date

David Winkelbauer
Approved By

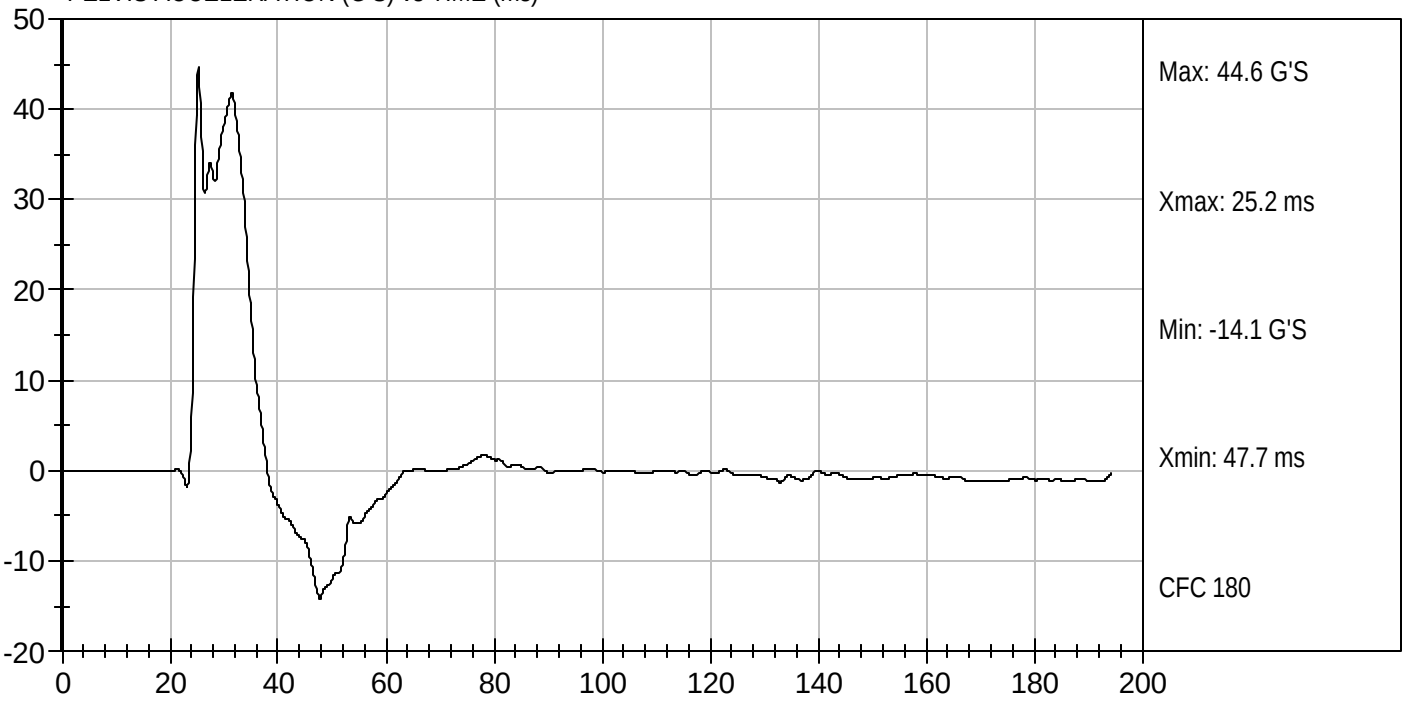
Test Desc: Pelvis Impact
Componet ID: D052337

Test Date: 08/19/2005
Velocity: 21.93 ft/s, 6.68 m/s

PROBE (G'S) vs TIME (ms)

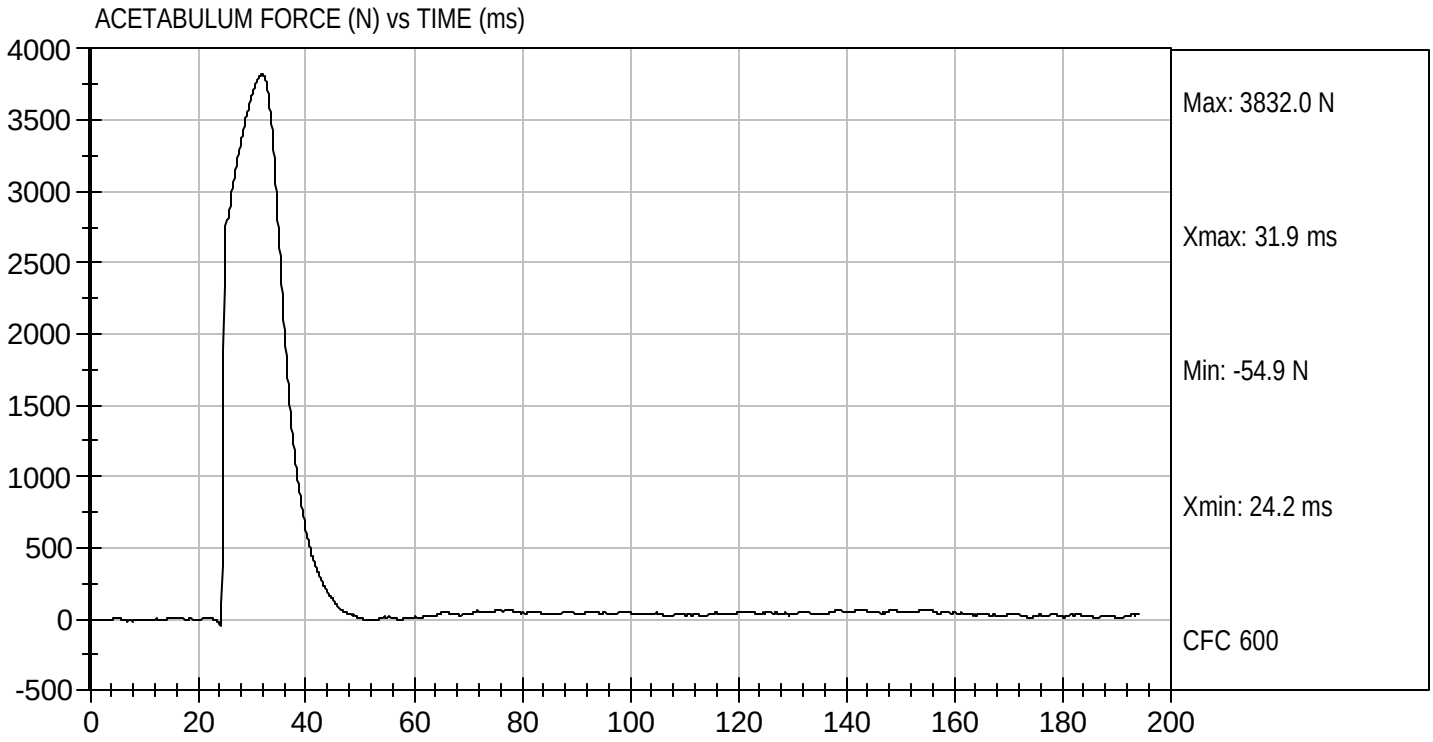


PELVIS ACCELERATION (G'S) vs TIME (ms)



Test Desc: Pelvis Impact
Componet ID: D052337

Test Date: 08/19/2005
Velocity: 21.93 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SIDIIsD DUMMY

ATD Serial No: 032 **Test I.D:** D052338

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	43	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Peak Impactor Acceleration	G's	41 to 47	42	Pass
Pelvis Y Acceleration	G's	32 to 40	36	Pass
Peak Pelvis Iliac Force	N	4841 to 5491	4975	Pass
		Overall Test Results		Pass

Laboratory Technician

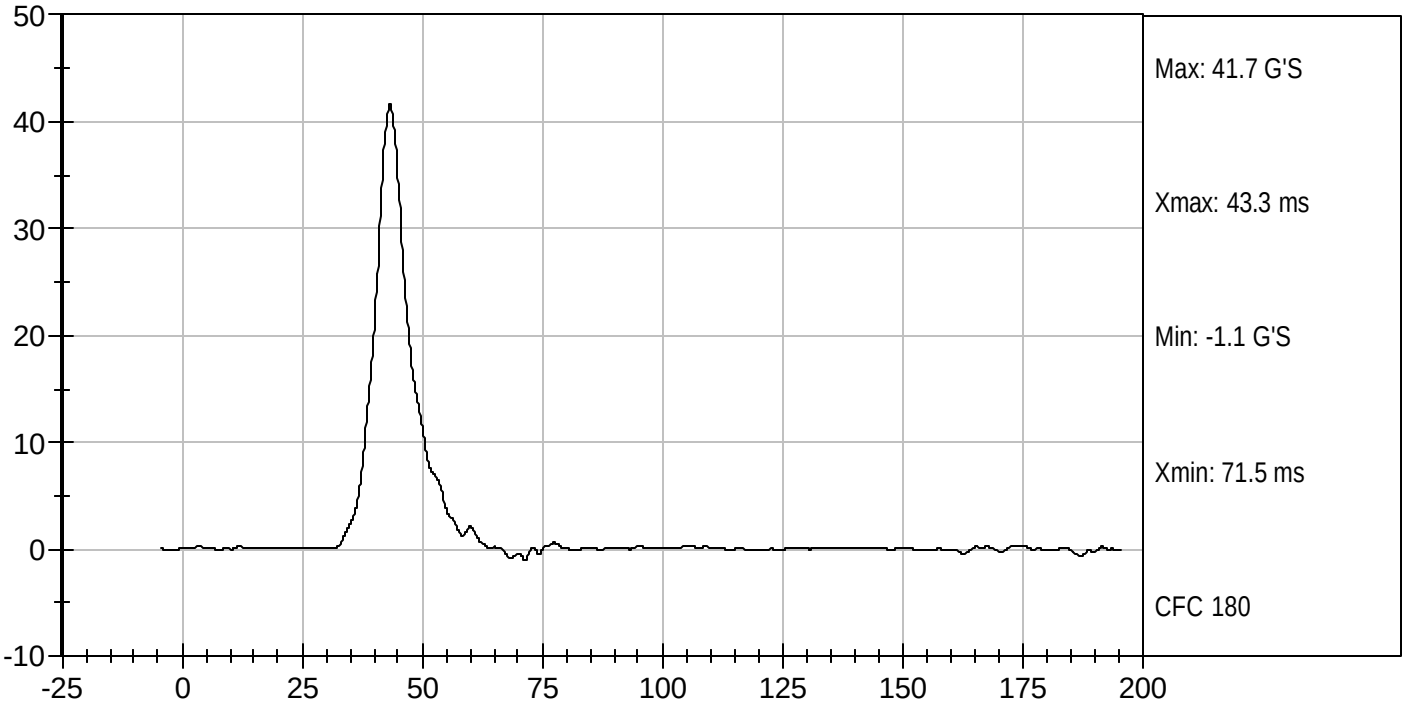
08/19/2005
Test Date

David Winkelbauer
Approved By

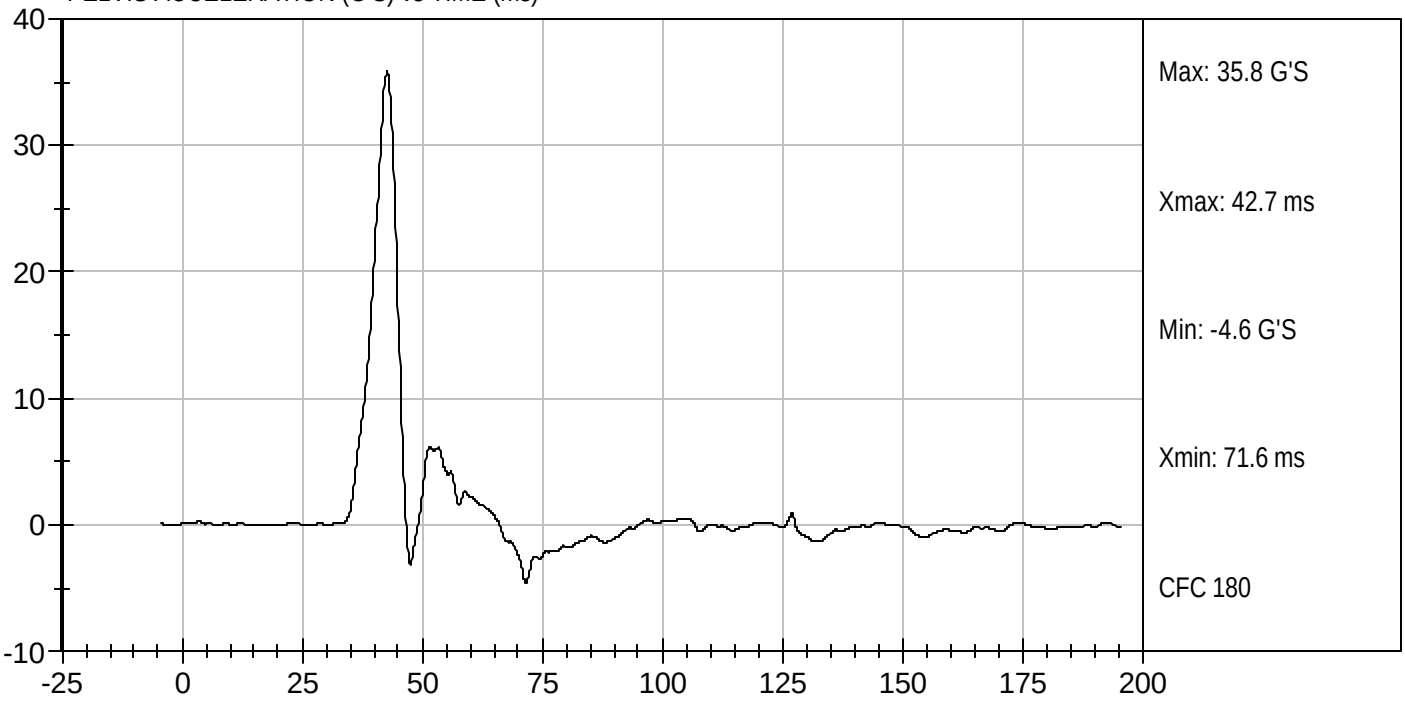
Test Desc: Iliac Impact
Componet ID: D052338

Test Date: 08/19/2005
Velocity: 14.02 ft/s, 4.27 m/s

PROBE (G'S) vs TIME (ms)

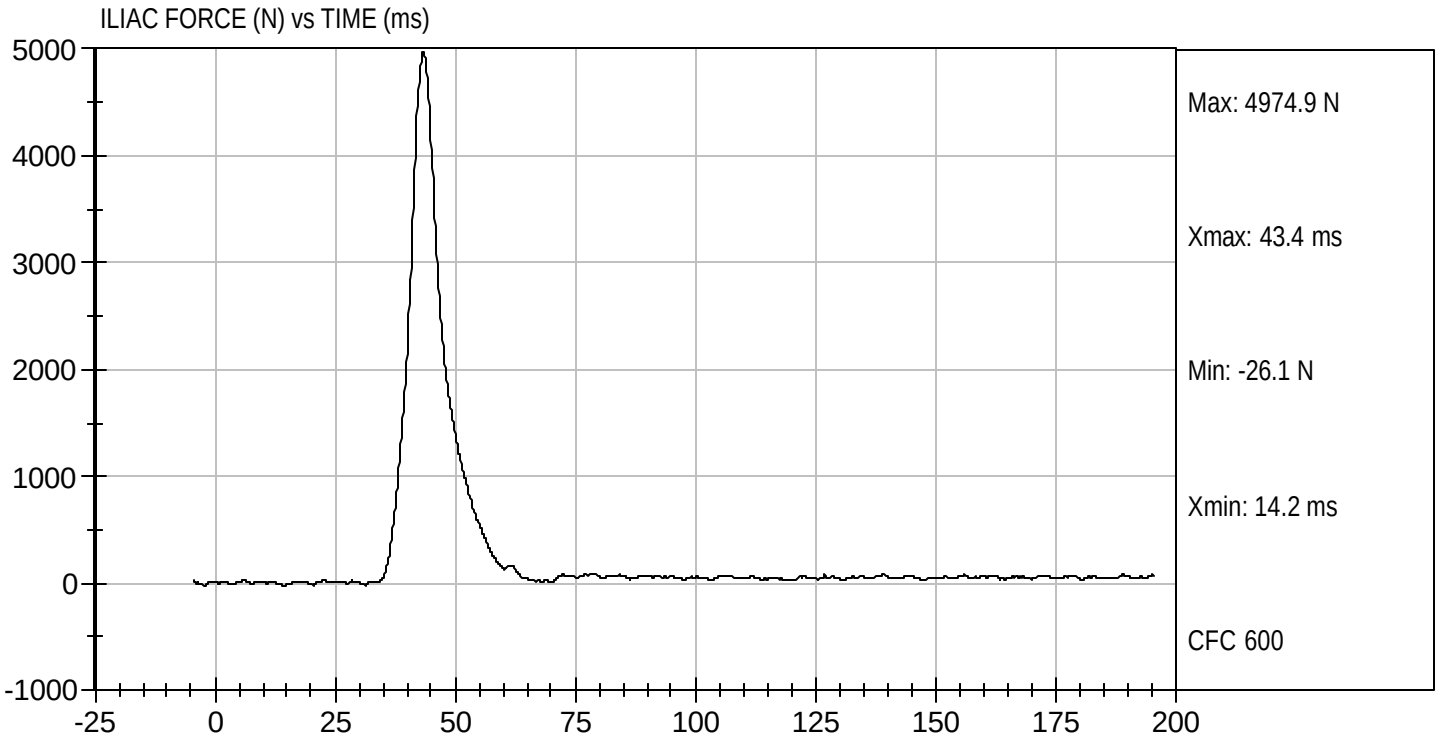


PELVIS ACCELERATION (G'S) vs TIME (ms)



Test Desc: Iliac Impact
Componet ID: D052338

Test Date: 08/19/2005
Velocity: 14.02 ft/s, 4.27 m/s



APPENDIX D
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY CALIBRATION DATA

	INSTRUMENTS FOR LEFT FRONT DUMMY SIDIIsD: 032		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	L20-B17	Entran	5/24/05
Head Y Accelerometer	AJ621	Endevco	5/24/05
Head Z Accelerometer	P22203	Endevco	5/24/05
Head X Redundant	L20-B14	Entran	5/24/05
Head Y Redundant	AJ9F3	Endevco	5/24/05
Head Z Redundant	P22695	Endevco	5/24/05
Upper Neck Load Cell	287	FTSS	5/03/05
Upper Arm X	J23808	Endevco	7/07/05
Upper Arm Y	J18260	Endevco	7/07/05
Upper Arm Z	J13658	Endevco	7/07/05
Shoulder DY	032SHLD	Servo	5/10/05
Shoulder Force Load Cell	171	FTSS	5/25/05
Upper Thorax Rib DY	032RIB1	Servo	5/26/05
Mid Thorax Rib DY	032RIB2	Servo	5/26/05
Lower Thorax Rib DY	032RIB3	Servo	5/26/05
Upper Abdominal Rib DY	032RIB4	Servo	5/26/05
Lower Abdominal Rib DY	032RIB5	Servo	5/26/05
Upper Spine X	J10411	Endevco	5/24/05
Upper Spine Y	AJ9D6	Endevco	5/24/05
Upper Spine Z	J13772	Endevco	5/24/05
Lower Spine X	AJ8T5	Endevco	5/24/05
Lower Spine Y	J20965	Endevco	5/24/05
Lower Spine Z	J12439	Endevco	5/24/05
Left Acetabulum FY	ACG114FY	FTSS	5/02/05
Left Illium Crest FY	IWG102FY	FTSS	5/02/05
Pelvis X Accelerometer	AJ4J3	Endevco	5/24/05
Pelvis Y Accelerometer	AF0M3	Endevco	5/24/05
Pelvis Z Accelerometer	AJ9D8	Endevco	5/24/05
Lumbar Load Cell	135	FTSS	5/03/05

VEHICLE INSTRUMENTS CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Lower A-Post Y	B16-Z04	Entran	3/03/05
Left Mid A-Post Y	B16-Z10	Entran	3/03/05
Left Lower B-Post Y	C15-L03	Entran	4/22/05
Left Mid B-Post Y	B19-Z12	Entran	3/03/05
Floorpan @ Rear Axle X	C04-L12	Entran	3/24/05
Floorpan @ Rear Axle Y	C04-L11	Entran	3/24/05
Floorpan @ Rear Axle Z	C04-L13	Entran	3/24/05
Driver Seat Track Y	E05-Z24	Entran	6/28/05
Right Front Sill X	C29-L32	Entran	4/25/05
Right Front Sill Y	F04-R22	Entran	3/17/05
Right Front Sill Z	C29-L17	Entran	4/25/05
Left Rear Sill Y	B19-Z14	Entran	3/03/05
Left Front Sill Y	B28-Z12	Entran	3/17/05
Vehicle CG X	C09-Y09	Entran	3/31/05
Vehicle CG Y	B19-Z01	Entran	3/03/05
Vehicle CG Z	C11-Z13	Entran	3/31/05
Left Front Door @ Pelvis	C29-L15	Entran	4/28/05
Left Front Door @ Arm	C29-L28	Entran	4/28/05
Left Front Door @ Knee	C29-L21	Entran	4/28/05
Left Front Door @ Mid Rib	D01-Z16	Entran	4/25/05
Left A-Post @ Sill Y	B29-Z01	Entran	3/17/05
Left B-Post @ Sill Y	B28-Z11	Entran	3/17/05
Upper Engine X	D01-Z12	Entran	4/28/05
Upper Engine Y	D01-Z20	Entran	4/28/05
Firewall Y	D01-Z10	Entran	4/28/05