REPORT NUMBER: 201-MGA-2006-002

SAFETY COMPLIANCE TESTING FOR FMVSS 201
RIGID POLE SIDE IMPACT TEST

GENERAL MOTORS CORPORATION
2006 SATURN ION 4-DR SEDAN
NHTSA NUMBER: C60107

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

TEST DATE: SEPTEMBER 6, 2006

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW, ROOM 6111 (NVS-220)
WASHINGTON, D.C. 20590

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-01-D-01033.

Prepared by: _____ Date: September 13, 2006
Ben Fischer, Project Engineer

Reviewed by: David Winkelbauer Date: September 13, 2006
David Winkelbauer, Director of Operations

FINAL REPORT ACCEPTED BY:

_____
COTR, Side Impact

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15. Supplementary Notes			

16. Abstract

A rigid pole side impact test was conducted on a 2006 Saturn Ion 4-Dr. Sedan in accordance with FMVSS 201, "Occupant Protection in Interior Impact", S6.2(b)(3) and the Office of Vehicle Safety Compliance Test Procedure No. TP-201P-02 "Rigid Pole Side Impact Test". The test was conducted at MGA Research Corporation in Burlington, Wisconsin on September 6, 2006.

The impact velocity of the vehicle was 28.3 kph, and the ambient temperature at the struck side (driver's) of the target vehicle at the time of impact was 21°C. The post-test maximum crush was 375 mm at level 3. The test vehicle's occupant performance is as follows:

	REQUIREMENT	DRIVER
HIC	≤ 1000	178

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

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SECTION 1
PURPOSE AND TEST PROCEDURE

1.1 PURPOSE

This rigid pole side impact test is conducted as part of the FY' 2006 test program sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract No. DTNH22-01-D-01033. The purpose of this test was to evaluate occupant protection in interior impact in a 2006 Saturn Ion 4-Dr. Sedan manufactured by General Motors Corporation.

1.2 TEST PROCEDURE

The rigid pole side impact test was conducted in accordance with the current National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC), laboratory test procedure TP-201P-02, dated October 21, 2001 and the corresponding MGA Research Corporation Test Procedure MGA-NHTSA8. The procedures for receiving, inspection, testing, and reporting of test results are described in the test procedures and are not repeated in this report.

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

SECTION 2
SUMMARY OF RIGID POLE SIDE IMPACT TEST

2.1 SUMMARY OF RIGID POLE SIDE IMPACT TEST

A rigid pole side impact test was performed on a 2006 Saturn Ion 4-Dr. Sedan. The subject vehicle was towed into a rigid pole at a velocity of 28.3 km/h. The specified impact velocity range is from 27.2 to 28.8 km/h. The test vehicle was positioned 90° to the line of forward motion. The weight of the vehicle as tested was 1434.7 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on September 6, 2006.

One (1) real-time motion picture camera and eleven (11) high-speed motion picture cameras were used to document the impact event. Camera locations and pertinent camera information are documented in the data sheets. Pre- and post-test photographs of the vehicle and SID/HIII can be found in Appendix A. One SID/HIII was placed in the left front outboard designated seating position according to instructions specified in the TP-201P-02 dated October 21, 2001. The SID/HIII was instrumented in the following locations:

- Head Center of Gravity (CG) tri-axial accelerometers (X, Y, and Z axis)
- Upper Neck 6 channel load cell (X, Y, Z force and moment)
- Left Upper Rib (LUR) uni-axial accelerometer (Y-axis primary and redundant)
- Left Lower Rib (LLR) uni-axial accelerometer (Y-axis primary and redundant)
- Lower Thoracic Spine (T12) uni-axial accelerometer (Y-axis primary and redundant)
- Pelvic (PEV) section uni-axial accelerometer (Y-axis primary and redundant)

The test vehicle was instrumented with twenty (20) structural accelerometers. All data channels were recorded with a fully self contained on-board DTS TDAS Pro. The data was digitally sampled at 10,000 samples per second and processed per Section 12.2 of the Test Procedure.

2.2 GENERAL COMMENTS

The test vehicle sustained a maximum static crush of 375 mm at level 3, at the vertical impact line. The driver SID/HIII, Serial No. 037, was calibrated just prior to this test. The SID/HIII's injury criteria are summarized as follows:

Measurements	Units	Driver
HIC		178
TTI*	G's	84.5
Pelvis*	G's	52.1
Neck Force X*	N	-455
Neck Force Y*	N	-416
Neck Force Z*	N	-1044
Neck Moment X*	Nm	-71.5
Neck Moment Y*	Nm	-37.1
Neck Moment Z*	Nm	26.1

* For Information Purposes Only

Test summaries and post-test observations are presented in Section 3. The vehicle, camera, and occupant measurements are presented in Section 4. Appendix A contains the still photograph prints. Appendix B contains the SID/HIII and vehicle data traces. Appendix C contains the SID/HIII's configuration and performance verification data. Appendix D contains the calibration information data.

TEST NOTES

The following channels were not used in test:

- A Pillar Upper Y
- B Pillar Upper Y
- Left Roof Y
- Right Roof Y

There was no valid data collected for LF Door Accel. #3 Y.

SECTION 3
SIDE IMPACT DUMMY (SID/HIII) AND VEHICLE TEST DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	English Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609
Length or Distance	Measurements	in	mm	25.4
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressure	lbf/in^2	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	=(tf -32)/1.8
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

*Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

TEST VEHICLE INFORMATION

Make	Saturn
Model	Ion
Body Style	Sedan
NHTSA No.	C60107
VIN	1G8AJ58FX6Z148582
Color	Silver Nickel
Delivery Date	4/21/06
Odometer Reading (mile)	118
Dealer	Saturn of Waukesha
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	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Power Brakes	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	No
Anti-lock Brakes	Yes
AM/FM/CD	Yes
Anti-theft System	Yes
Cruise Control	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors Corporation
Date of Manufacture	10/05

GVWR (kg)	1714
GAWR Front (kg)	896
GAWR Rear (kg)	818

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	210	210
Recommended Tire Size	P195/60R15	P195/60R15
Tire Size on Vehicle	P195/60R15	P195/60R15
Tire Manufacturer	Goodyear	Goodyear

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Buckets	Bench		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				408
Cargo Wt. (RCLW) (kg)				68

DATA SHEET NO. 1... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	390.1	250.8		423.6	302.5	
Right	kg	396.0	258.1		411.9	296.7	
Ratio	%	60.7	39.3		58.2	41.8	
Totals	kg	786.1	508.9	1295.0	835.5	599.2	1434.7

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1295.0
Weight of SID/HIII Side Impact Dummy	kg	80.7
Rated Cargo/Luggage Weight (RCLW)	kg	68
Calculated Vehicle Target Weight (TVTW)	kg	1443.7

TEST VEHICLE ATTITUDES

	Units	As Delivered	Fully Loaded	Ready For Test
Right Front	mm	689	678	741
Left Front	mm	682	667	748
Right Rear	mm	698	674	777
Left Rear	mm	698	669	786
Right Door Sill Angle	deg	0.7 ND	0.4 ND	0.5 ND
Left Door Sill Angle	deg	0.6 ND	0.3 ND	0.6 ND
Front Bumper Angle	deg	0.8 RD	0.6 RD	0.6 RD
Rear Bumper Angle	deg	0.5 RD	0.3 RD	0.4 RD

ND = NOSE DOWN, BD = BACK DOWN, LD = LEFT DOWN, RD = RIGHT DOWN, RU = RIGHT UP

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2628
Total Vehicle Length at Left Side	mm	3890
Total Vehicle Length at Centerline	mm	4618
Total Vehicle Length at Right Side	mm	3890
Total Vehicle Width at B-Post	mm	1715
Weight of Ballast in Cargo Area	kg	0
Amount of Stoddard Solvent in Fuel Tank	liters	46.2

DATA SHEET NO. 1… (Continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

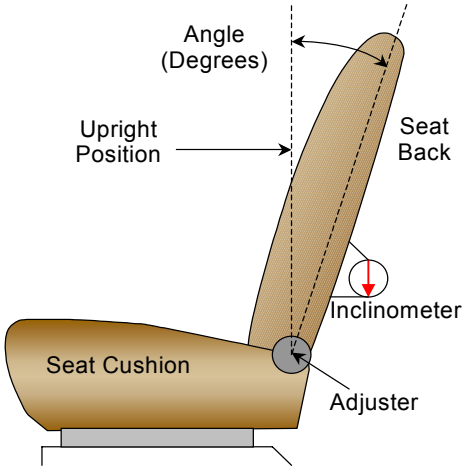
TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Target Impact Point Aft of Front Axle	mm	1318
Actual Impact Point Aft of Front Axle	mm	1313

NORMAL DESIGN RIDING POSITION

The driver's seat back is positioned to the manufacturer's designated angle. The procedure for the seat is as follows: The design position 24 degrees = 9.5 degrees as measured on the headrest post with the ATD in the seat.

Initial driver seat back angle: 9.5 degrees on headrest post.
Final driver seat back angle: 5.5 degrees on headrest post.



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

Manufacturer: Manual adjustable, 27 total detents
Seat position: The fore/aft was set to 5th position from the full forward locking position, 1st as 1.

SEAT BELT UPPER ANCHORAGE

The test vehicle is equipped with adjustable "D" ring anchorage for the driver's seat position. The driver's "D" ring anchorage was placed in the mid position, position 2 out of 5, top notch as 0.

DATA SHEET NO. 1… (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

FUEL TANK CAPACITY DATA

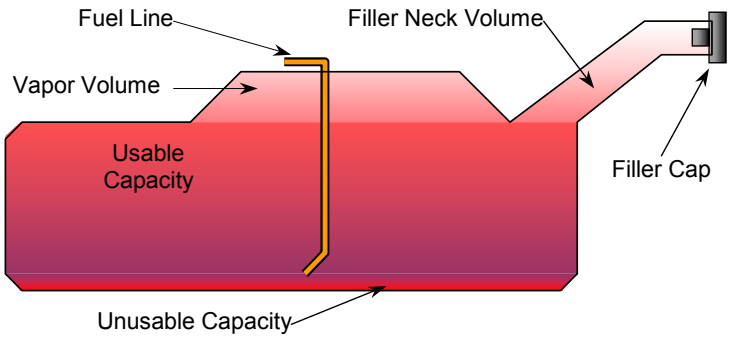
The "Usable Capacity" of the standard equipment fuel tank is: 49.8 liters

The "Usable Capacity" of any optional equipment fuel tank is: N/A liters

92-94% of "Usable Capacity" for certification to FMVSS 301 requirements: 45.8 – 46.8 liters

Actual amount of Stoddard solvent added to vehicle for certification test 46.2 liters

The vehicle is equipped with electric fuel pump. On while engine is running; On until system pressure achieved for providing fuel during starter motor activation when key/ignition is "on" position (engine not running); On for approx. 10 seconds when ignition set to one detent short of "on".

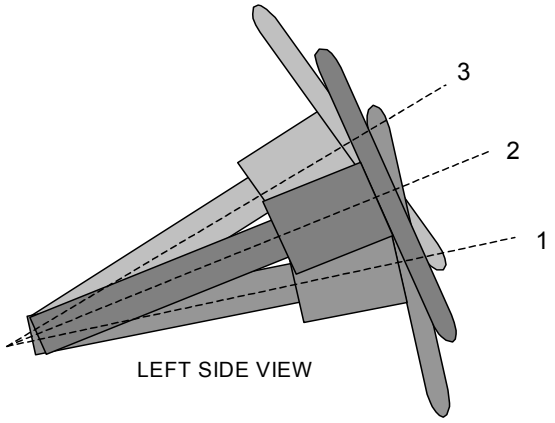


VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes, when it is moved through its full range of motion.

The steering column was placed at 18.4 degrees.



STEERING COLUMN ASSEMBLY

DATA SHEET NO. 2

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	390.1	250.8		423.6	302.5	
Right	kg	396.0	258.1		411.9	296.7	
Weight Ratio	%	60.7	39.3		58.2	41.8	
Totals	kg	786.1	508.9	1295.0	835.5	599.2	1434.7

MAXIMUM EXTERIOR STATIC CRUSH

Level	Measured Parameter	Units	Maximum Crush	Above Ground
Level 1	Sill Top Height	mm	310	280
Level 2	Occupant H-Point	mm	365	500
Level 3	Mid Door	mm	375	655
Level 4	Window Sill	mm	322	915
Level 5	Window Top	mm	160	1380
N/A	Maximum Penetration	mm	375	655

INSTRUMENTATION

SID/HIII Instrumentation	17
Vehicle Structure Accelerometers	20
Total	37

CAMERAS

Onboard Vehicle	3
Offboard Vehicle	8
Total	11

IMPACT POINT DATA

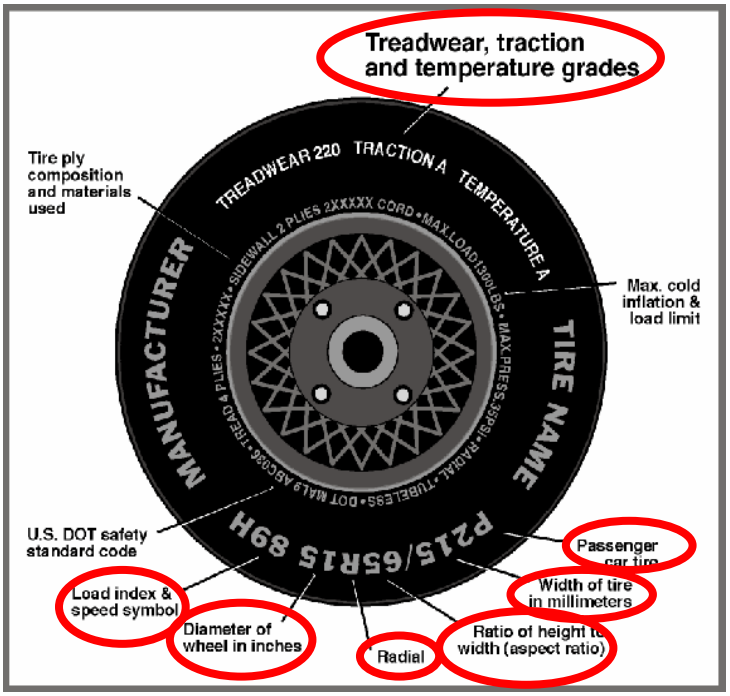
Measured Parameter	Units	Requirement	Value
Horizontal Offset	mm	+/- 38	5 forward

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

Vehicle Year	2006	Vehicle Make	Saturn
VIN	1G8AJ58FX6Z148582	Vehicle Model	Ion



	Front	Rear
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Assurance	Assurance
Tire Type	PASS	PASS
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	87T	87T
Treadwear	700	700
Traction Grade	A	A
Temperature Grade	B	B

DATA SHEET NO. 4

POST TEST OBSERVATIONS

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front Seating Position
Dummy Type / Serial No.	SID/HIII / 037
Head Contact	Curtain Airbag, Headliner, 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 AND SEAT TRACK INFORMATION

Description	Front	Rear
Left Side Door Opening	Door remained closed and latched	Door remained closed and latched
Right Side Door Opening	Door remained closed and latched	Door remained closed and latched
Seat Movement	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No failures
Sill Separation	None
Windshield Damage	Cracked
Window Damage	Left side windows down for test
Other Notable Effects	None

AIRBAG DEPLOYMENT

	Driver
Front	No
Side	None
Curtain	Yes

ARMREST LOCATION AND SEAT CRUSH

	Driver
Front Armrest (from bottom of window)	272
Front Seat Back Crush	60
Front Seat Cushion Crush	60

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 5

SID/HIII INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

THORAX AND PELVIS PEAK ACCELERATIONS (FIR 100 Filtered)

Location	Axis	Units	Driver			
			Max	Time	Min	Time
Upper Rib (LUR)	Y	G's	91.0	41	-6.8	98
Upper Rib (LUR) (R)	Y	G's	89.7	41	-6.6	98
Lower Rib (LLR)	Y	G's	75.9	42	-7.6	97
Lower Rib (LLR) (R)	Y	G's	75.2	42	-7.7	84
Lower Spine (T_{12})	Y	G's	78.0	46	-21.0	76
Lower Spine (T_{12}) (R)	Y	G's	77.8	46	-17.5	76
Pelvis (PEV)	Y	G's	52.1	43	-6.4	65
Pelvis (PEV) (R)	Y	G's	51.7	43	-6.2	65

THORACIC TRAUMA INDEX (TTI) AND PELVIC ACCELERATION (FIR 100 Filtered)

Location	Driver			
	LUR	T_{12}	TTI(g)	PEV(g)
Rib, Spine, and Pelvis	91.0	78.0	84.5	52.1
Rib, Spine, and Pelvis (R)	89.7	77.8	83.8	51.7

UPPER NECK FORCES AND MOMENTS (SAE CLASS 1000/600 Filtered)

Location	Axis	Units	Driver			
			Max	Time	Min	Time
Neck Force	X	N	76	182	-455	60
Neck Force	Y	N	219	60	-416	41
Neck Force	Z	N	585	41	-1044	34
Neck Moment	X	Nm	14.4	115	-71.5	54
Neck Moment	Y	Nm	15.2	105	-37.1	56
Neck Moment	Z	Nm	26.1	76	-7.7	114

HEAD CG PEAK ACCELERATIONS (SAE CLASS 1000 Filtered)

Location	Axis	Units	Driver			
			Max	Time	Min	Time
Head CG	X	G's	18.0	32	-21.1	33
Head CG	Y	G's	48.7	31	-6.2	222
Head CG	Z	G's	5.7	70	-36.6	31
Head CG Resultant		G's	59.4	31		

HEAD INJURY CRITERIA (SAE CLASS 1000 Filtered)

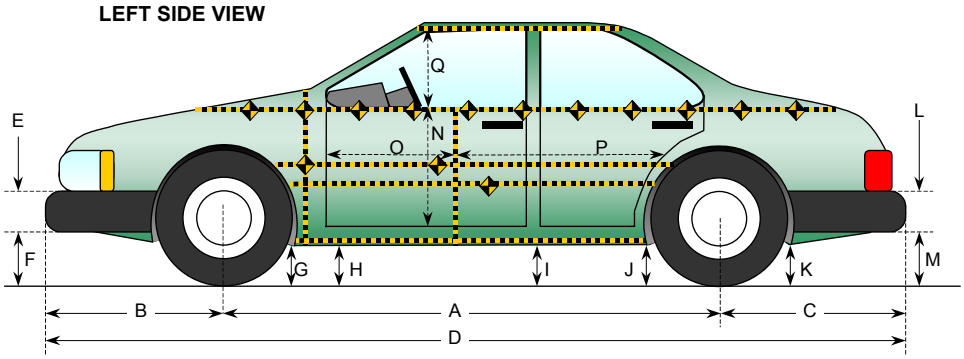
Location	Driver		
	HIC	T1	T2
Head CG Resultant	178	54.0	77.4

Positive Acceleration Polarities: Longitudinal (X) = + Forward
(Conforms to SAE J211) Lateral (Y) = + Right
Vertical (Z) = + Down

DATA SHEET NO. 6

VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006



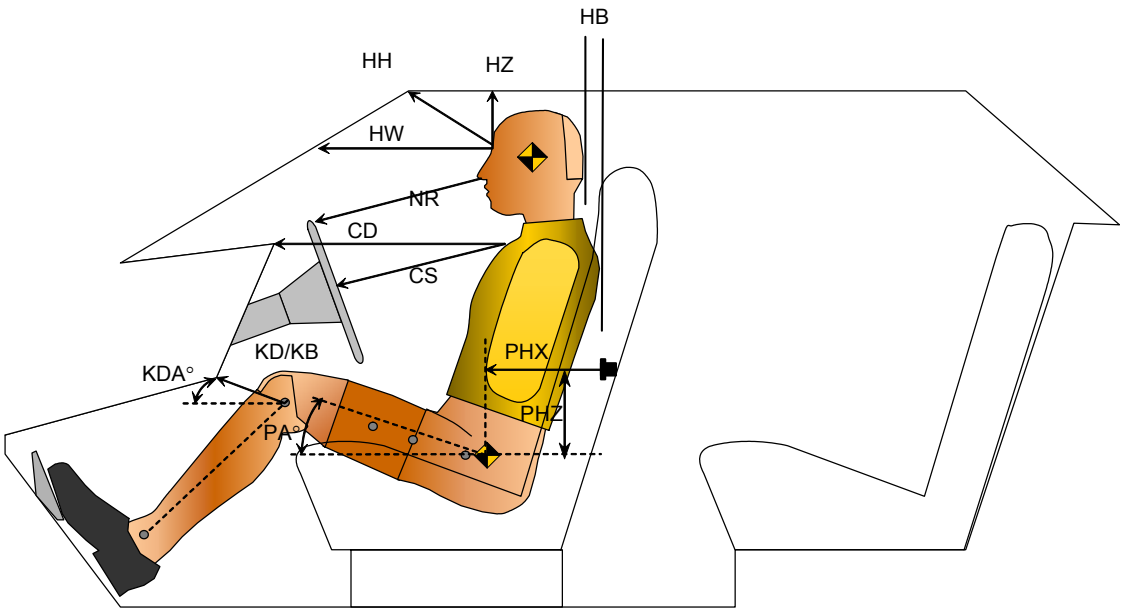
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2628	2529	99
B	Front Axle to FSOV	960	985	-25
C	Rear Axle to RSOV	1030	1057	-27
D	Total Length at Centerline	4618	4571	47
E	Front Bumper Thickness	170	170	0
F	Front Bumper Bottom to Ground	439	492	-53
G	Sill Height at Front Wheel Well	277	260	17
H	Sill Height at Front Door Leading Edge	279	259	20
I	Sill Height at "B" Pillar	297	292	5
J1	Sill Height at Rear Wheel Well	293	292	1
J2	Pinch Weld Height at Rear Wheel Well	288	292	-4
K	Sill Height Aft of Rear Wheel Well	344	347	-3
L	Rear Bumper Thickness	170	170	0
M	Rear Bumper Bottom to Ground	559	535	24
N	Sill Height to Window Bottom Sill	695	685	10
O	Front Door Leading Edge to Impact CL	850	849	1
P	Rear Door Trailing Edge to Impact CL	1160	1178	-18
Q	Front Window Opening	400	377	23
R	Right Side Length	3890	3893	-3
S	Left Side Length	3890	3774	116
T	Vehicle Width at "B" Post	1715	1621	94

DATA SHEET NO. 7

SID/HIII LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

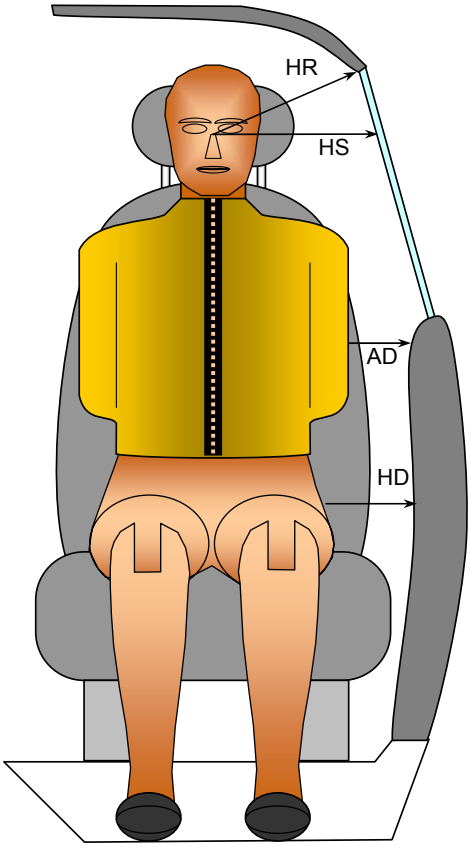


Driver Code	Measurement Description	Driver	
		Length(mm)	Angle(°)
HH	Head to Header	339	
HW	Head to Windshield	573	
HZ	Head to Roof	174	
NR	Nose to Rim	349	
CD	Chest to Dash	650	
CS	Chest to Steering Wheel	288	
KDL	Left Knee to Dash	92	39.9
KDR	Right Knee to Dash	89	34.6
PA	Pelvic Angle		27.2
PHX	H-Point to Striker (X-Axis)	256	
PHZ	H-Point to Striker (Z-Axis)	134	
HB	Head to Seatback Clearance	52	

DATA SHEET NO. 8

SID/HIII LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006



FRONT VIEW OF DUMMY

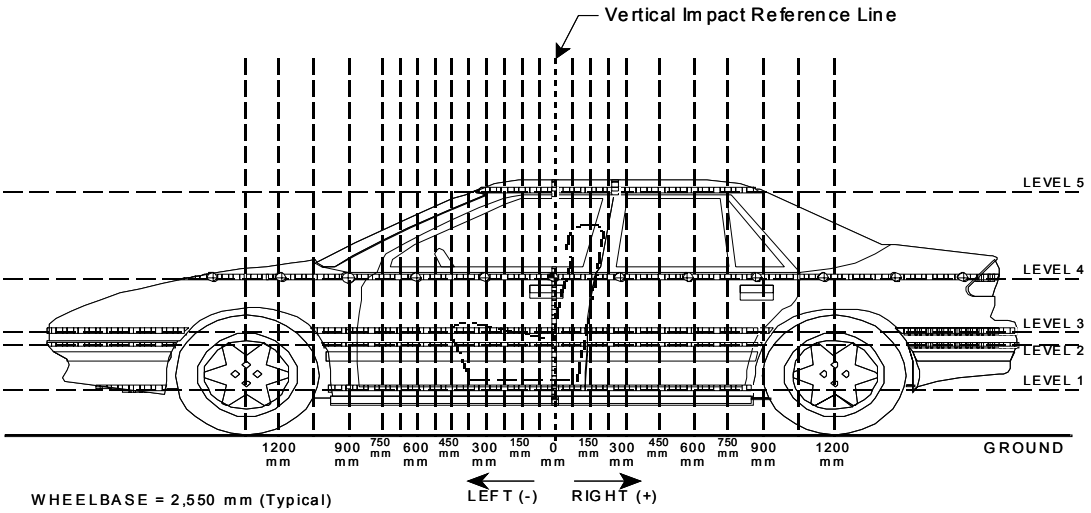
Code	Measurement Description	Units	Driver
HR	Head to Side Header	mm	188
HS	Head to Side Window	mm	356
AD	Arm to Door	mm	115
HD	H-Point to Door	mm	129

DATA SHEET NO. 9

VEHICLE SIDE MEASUREMENTS

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

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.

Level	Measurement Description	Units	Height Above Ground
5	Window	mm	1380
4	Window Sill	mm	915
3	Mid Door	mm	655
2	Occupant H-Point	mm	500
1	Sill Top	mm	280

DATA SHEET NO. 10

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1800				335					336					1	
-1650				325					329					4	
-1500				315					323					8	
-1350				308					320					12	
-1200				304					317					13	
-1125				302					315					13	
-1050			248	298				282	311				34	13	
-975		252	255	298			294	282	310			42	27	12	
-900	288	255	258	298		329	289	275	310		41	34	17	12	
-825	289	257	258	296		347	273	267	282		58	16	9	-14	
-750	288	254	255	295		364	295	291	310		76	41	36	15	
-675	288	253	254	294		383	319	317	340		95	66	63	46	
-600	286	252	252	294		399	346	343	367		113	94	91	73	
-525	285	250	250	294		417	371	371	396		132	121	121	102	
-450	285	249	250	298		436	400	405	427		151	151	155	129	
-375	285	249	249	294	514	456	433	442	456	552	171	184	193	162	38
-300	285	249	249	295	513	476	471	482	489	560	191	222	233	194	47
-225	285	250	249	295	507	494	511	522	520	570	209	261	273	225	63
-150	284	250	250	295	506	516	560	564	557	583	232	310	314	262	77
-75	285	250	250	295	507	539	598	596	590	627	254	348	346	295	120
0	286	251	251	296	510	596	616	616	618	670	310	365	375	322	160
75	285	251	252	296	514	552	577	589	586	626	267	326	337	290	112
150	286	252	251	297	516	511	543	545	543	612	225	291	294	246	96
225	287	251	251	300	516	480	464	479	515	598	193	213	228	215	82
300	288	252	252	300	518	453	438	458	487	579	165	186	206	187	61
375	288	252	253	301	517	429	413	433	467	568	141	161	180	166	51
450	289	253	254	303	517	407	393	411	450	560	118	140	157	147	43
600	290	256	256	306	517	365	350	366	413	547	75	94	110	107	30
750	293	259	258	308	520	321	306	324	378	533	28	47	66	70	13
900	290	257	261	314	523	277	262	287	350	533	-22	5	26	36	10
1050			254	316	528			238	317	529			-16	1	1
1200			243	325	536			252	331	536			9	6	0
1350			245	332				252	337				7	5	
1500			254	341				259	342				5	1	
1650			281	354				283	351				2	-3	
1800			304	368				307	367				3	-1	
1950			327					335					8		

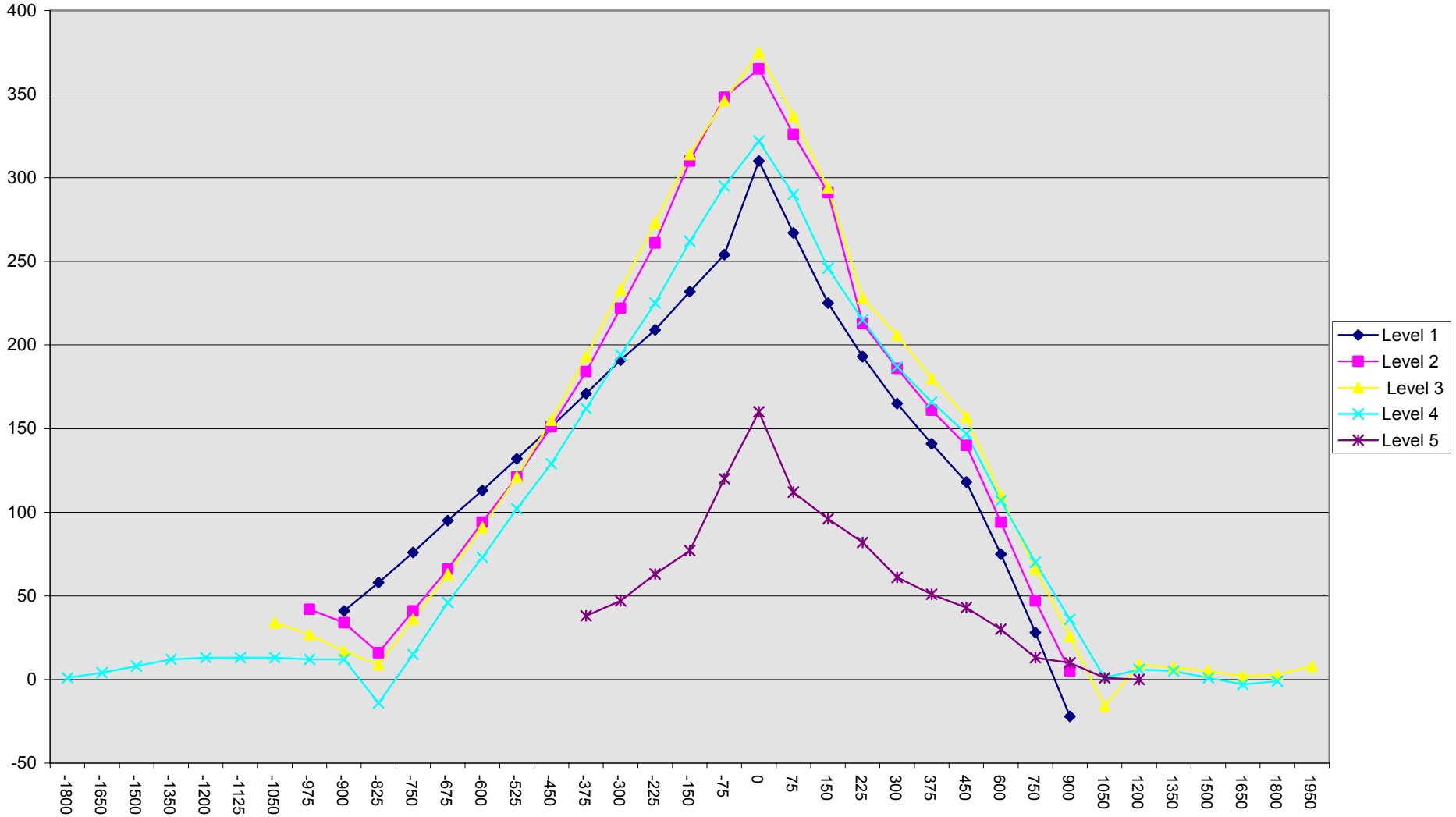
Reference plane is parallel to test vehicle longitudinal centerline Units = mm

Given dimensions = Reference plane to car body

DATA SHEET NO. 10... (continued)

VEHICLE EXTERIOR CRUSH PROFILES

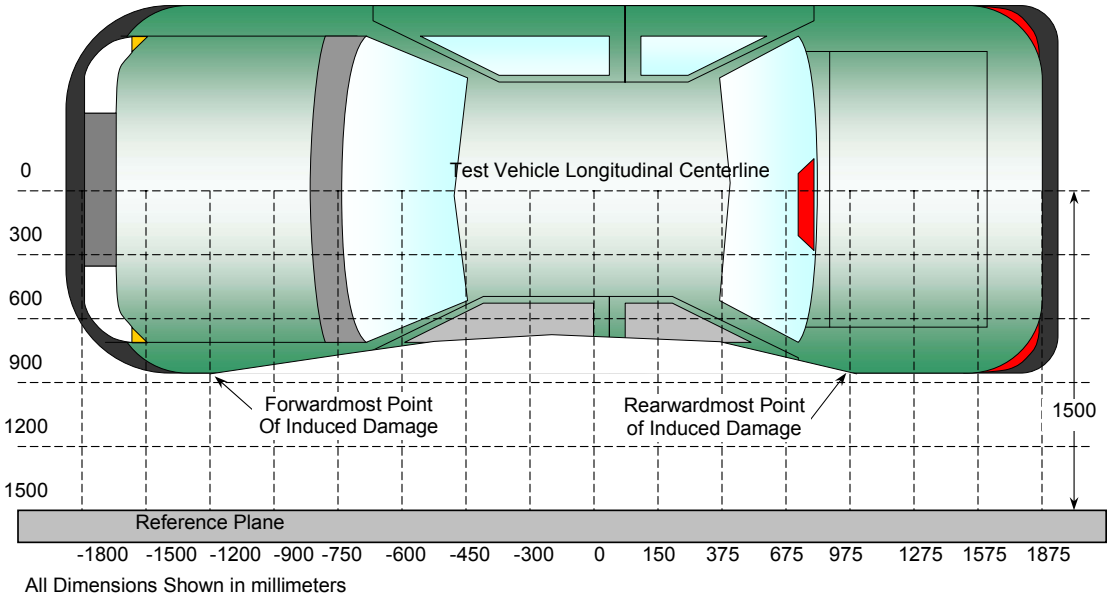
Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006



DATA SHEET NO. 11

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006



TOP VIEW

Damage Profile Distances

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	1050 mm	4	316	317	1
2	624 mm	4	306	407	101
3	202 mm	3	251	500	249
4	-206 mm	3	250	551	251
5	-625 mm	1	286	393	107
6	-1050 mm	3	248	282	34

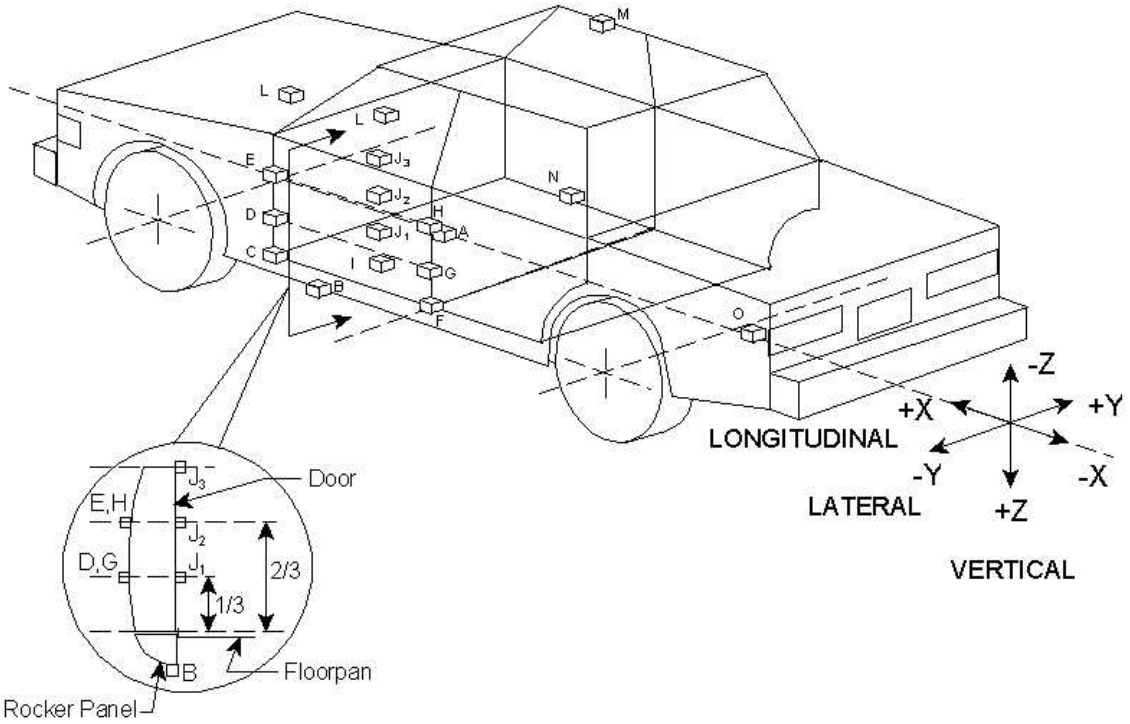
Reference plane is parallel to test vehicle longitudinal centerline

Given dimensions = Reference plane to car body

DATA SHEET NO. 12

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006



No.	Location
A	Vehicle CG
B	Left Floor Sill
C	A Pillar Sill
D	A Pillar Low
E	A Pillar Mid
G	B Pillar Sill
H	B Pillar Low
I	B Pillar Mid

No.	Location
L	Driver Seat
M1	Driver Door Rib
M2	Driver Door Pelvis
M3	Driver Door Knee
N	Engine
O	Firewall
Q	Right Floor Sill
R	Rear Deck

DATA SHEET NO. 12... (continued)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

Loc. No.	Accelerometer Location	Peak Values (G's)				
		Axis	Max	Time	Min	Time
A	Vehicle CG	X	4.9	45	-3.5	125
		Y	22.6	48	-47.5	38
		Z	12.3	34	-13.8	59
		RES	47.7	38		
B	Left Floor	Y	26.8	42	-6.2	11
C	A Pillar Sill	Y	37.9	23	-15.0	31
D	A Pillar Low	Y	34.5	26	-22.6	10
E	A Pillar Mid	Y	17.5	26	-7.6	11
G	B Pillar Sill	Y	54.1	44	-38.1	70
H	B Pillar Low	Y	69.3	12	-27.3	19
I	B Pillar Mid	Y	50.1	25	-39.3	20
L	Driver Seat	Y	69.0	26	-6.0	32
M1	Driver Door Upper	Y	69.9	11	-34.0	23
M2	Driver Door Mid	Y	86.0	10	-30.8	24
M3	Driver Door Lower	Y	*	*	*	*
N	Engine	X	4.0	66	-6.5	43
		Y	12.1	64	-1.7	215
O	Firewall	Y	11.9	44	-2.1	274
Q	Right Floor Sill	Y	15.9	48	-0.6	173
R	Rear Deck	X	6.2	108	-2.8	116
		Y	16.1	107	-2.0	187

* No valid data collected

Positive Acceleration Polarities: Longitudinal (X) = + Forward
(Conforms to SAE J211) Lateral (Y) = + Right
Vertical (Z) = + Down

DATA SHEET NO. 12... (continued)

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

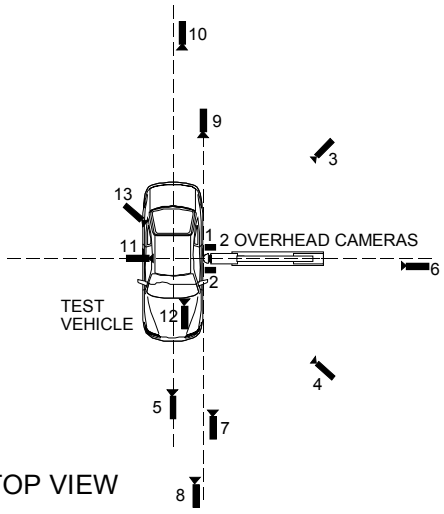
Loc. No.	Accelerometer Location	Measurements (mm)			
		Axis	Pre-Test	Post-Test	Difference
A	Vehicle CG	X	2617	2624	7
		Y	0	35	35
		Z	350	354	-4
B	Left Floor Sill	X	2543	2446	-97
		Y	-702	-645	57
		Z	217	215	2
C	A Pillar Sill	X	3236	3108	-128
		Y	-702	-530	172
		Z	218	200	18
D	A Pillar Low	X	3120	3033	-87
		Y	-770	-781	-11
		Z	512	508	4
E	A Pillar Mid	X	3152	3042	-110
		Y	-775	-780	-5
		Z	735	736	-1
G	B Pillar Sill	X	2131	2069	-62
		Y	-702	-570	132
		Z	217	253	-36
H	B Pillar Low	X	2222	2177	-45
		Y	-695	-510	185
		Z	530	535	-5
I	B Pillar Mid	X	2146	2083	-63
		Y	-706	-530	176
		Z	855	858	-3
L	Driver Seat	X	2203	2144	-57
		Y	-539	-455	84
		Z	398	376	22
M1	Driver Door Rib	X	2820	2746	-74
		Y	-735	-665	70
		Z	865	869	-4
M2	Driver Door Pelvis	X	2812	2740	-72
		Y	-705	-663	42
		Z	620	627	-7
M3	Driver Door Knee	X	2805	2737	-68
		Y	-728	-649	79
		Z	450	456	-6
N	Engine	X	3910	3744	-166
		Y	0	0	0
		Z	800	805	-5
O	Firewall	X	3575	3466	-109
		Y	0	0	0
		Z	842	844	-2
Q	Right Floor Sill	X	2410	2403	-7
		Y	702	655	47
		Z	216	233	-17
R	Rear Deck	X	980	1043	63
		Y	0	0	0
		Z	340	340	0

Ref. Points: X-Rear of Vehicle (+ forward); Y-Vehicle Centerline (+ to right); Z-Ground Plane (+ down)

DATA SHEET NO. 13

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006



TOP VIEW

No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Overall	205	260	5050	14	1000
2	Overhead Close-Up	15	15	5050	19	1000
3	Left Side 45° Rearward Pole View	-2070	-3225	1165	24	1000
4	Right Side 45° Forward Pole View	-1885	2920	1100	24	1000
5	Real Time				13	24
6*	Left Side Rear Pole View					
7	Front Ground Level Vehicle/Pole Impact	-110	6820	1270	35	1000
8	Front Ground Level Vehicle Roof Targets and Vehicle/Pole Impact	545	6340	1250	24	1000
9	Rear Ground Level Vehicle/Pole Impact	190	-6495	1230	35	1000
10	Rear Ground Level	585	-6445	1235	24	1000
11	Test Vehicle Onboard Driver Side View				8	1000
12	Test Vehicle Onboard Driver Front View				12.5	1000
13	Test Vehicle Onboard Driver ¾ Rear View				8	1000

Reference Points X - + Forward of Impact
Y - + Right of Impact
Z - + Ground Plane Down

* Camera 6 was not used for this test.

DATA SHEET NO. 14

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Vehicle:	2006 Saturn Ion 4-Dr. Sedan	NHTSA No.	C60107
Test Program:	FMVSS 201P	Test Date:	September 6, 2006

Test Time: 10:15 AM Temperature at Time of Impact: 21°C

Stoddard Solvent Spillage Measurements

A. From impact until vehicle motion ceases: 0
(Maximum Allowable = 1 ounce)

B. For the 5 minute period after motion ceases: 0
(Maximum allowable = 5 ounces)

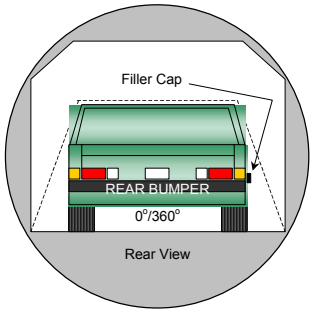
C. For the following 25 minutes: 0
(Maximum allowable = 1 oz./minute)

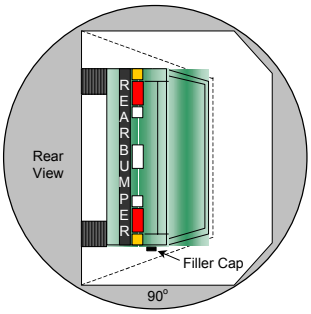
D. Spillage Details: None

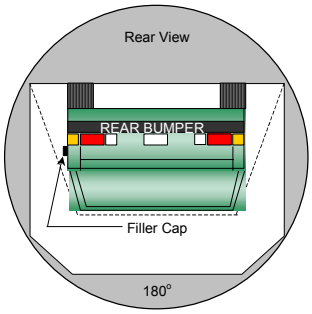
DATA SHEET NO. 15

FMVSS 301 STATIC ROLLOVER DATA SHEET

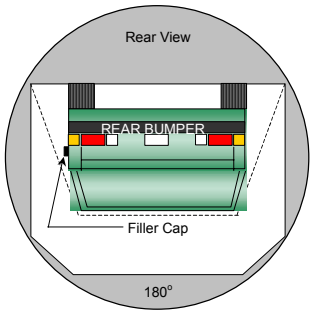
Test Vehicle: 2006 Saturn Ion 4-Dr. Sedan NHTSA No. C60107
Test Program: FMVSS 201P Test Date: September 6, 2006

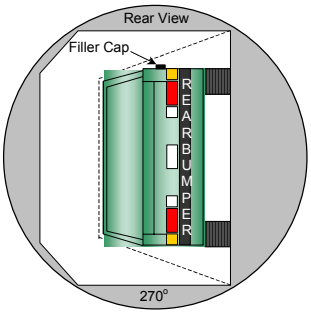


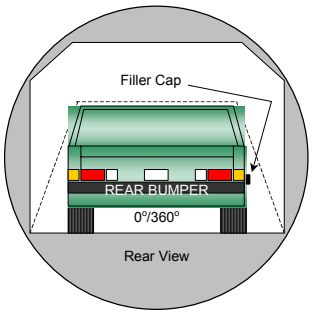




0° to 90° 90° to 180°







180° to 270° 270° to 360°

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent Spillage locations: None

Rollover Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	123	300	0
90° to 180°	117	300	0
180° to 270°	110	300	0
270° to 360°	118	300	0

APPENDIX A

PHOTOGRAPHS

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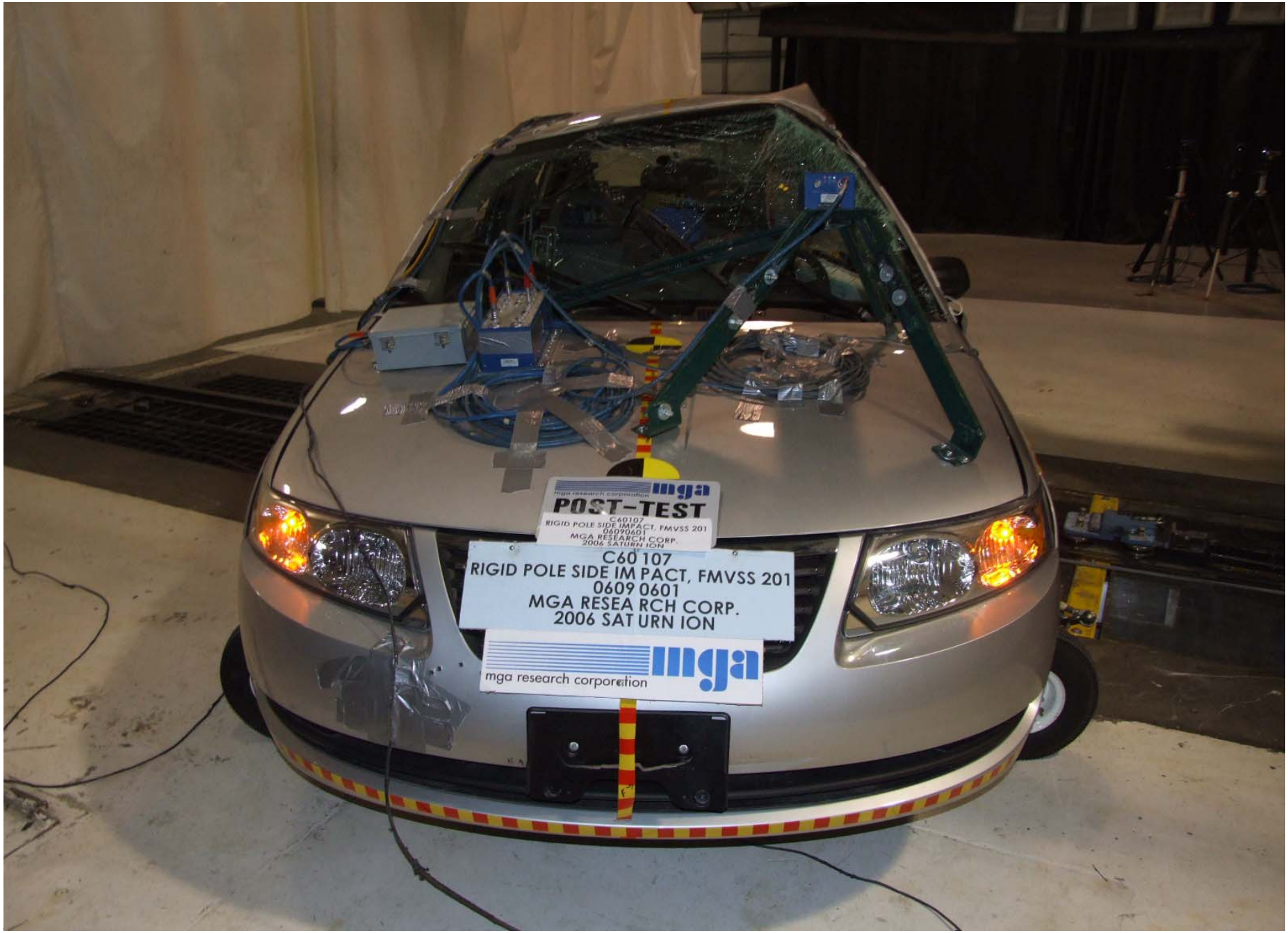
Pre-Test Front View of Test Vehicle



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

Pre-Test Right Side View of Test Vehicle

Post-Test Right Side View of Test Vehicle

Pre-Test Left Rear Three-Quarter View

Post-Test Left Rear Three-Quarter View

Pre-Test Left Front Three-Quarter View

Post-Test Left Front Three-Quarter View

Pre-Test Right Rear Three-Quarter View

Post-Test Right Rear Three-Quarter View

Pre-Test Right Front Three-Quarter View

Post-Test Right Front Three-Quarter View

Pre-Test Overhead View of Test Vehicle

Post-Test Overhead View of Test Vehicle

Pre-Test Driver Dummy Right Side View

Post-Test Driver Dummy Right Side View

Pre-Test Driver Dummy Left Side View

Post-Test Driver Dummy Left Side View

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

Post-Test Driver Dummy Head Contact

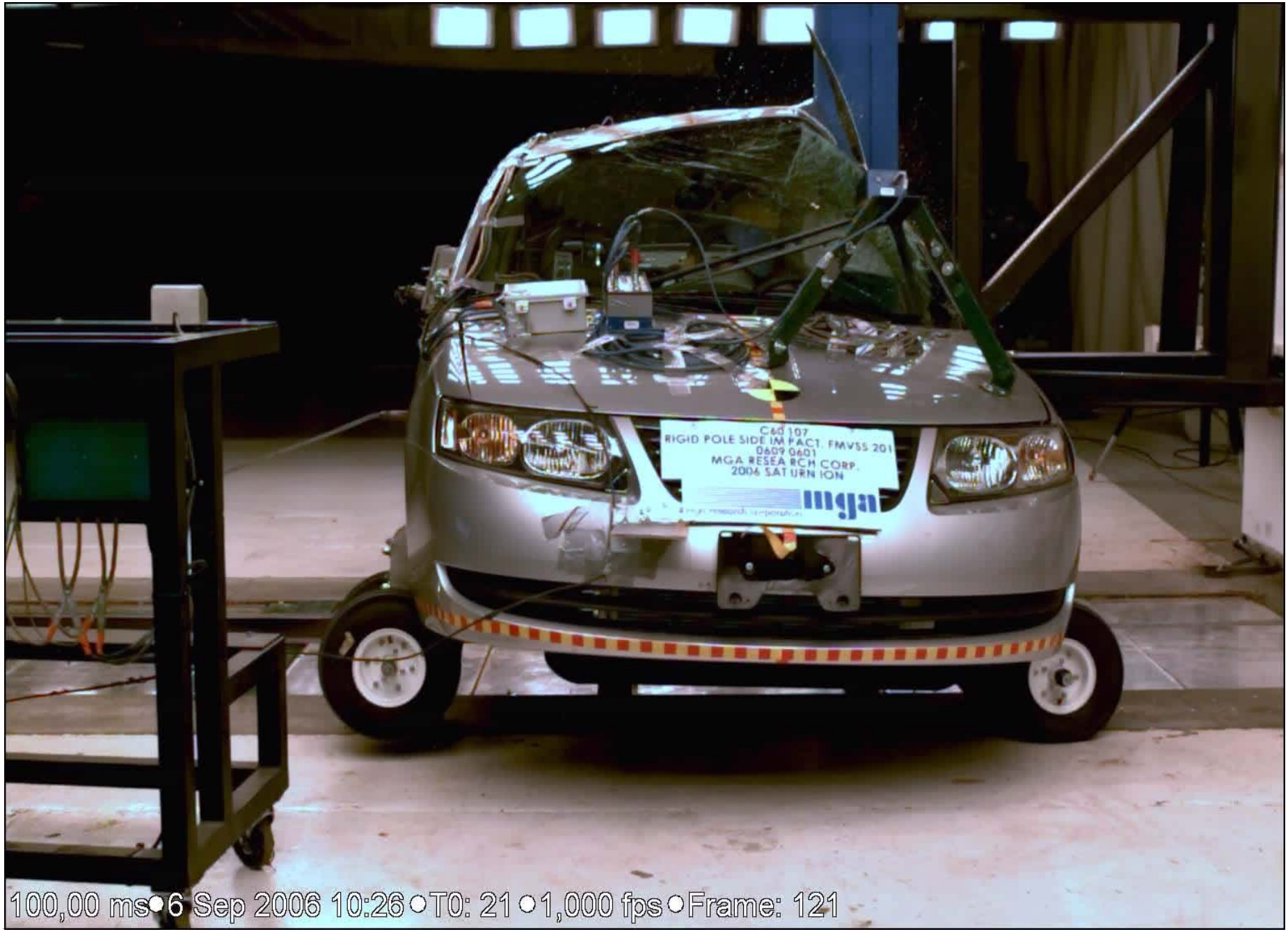
Post-Test Driver Dummy Thorax Contact

Post-Test Driver Dummy Contact

Post-Test Impact Point on Vehicle

Pre-Test Impact Zone Close-up View

Post-Test Impact Zone Close-up View

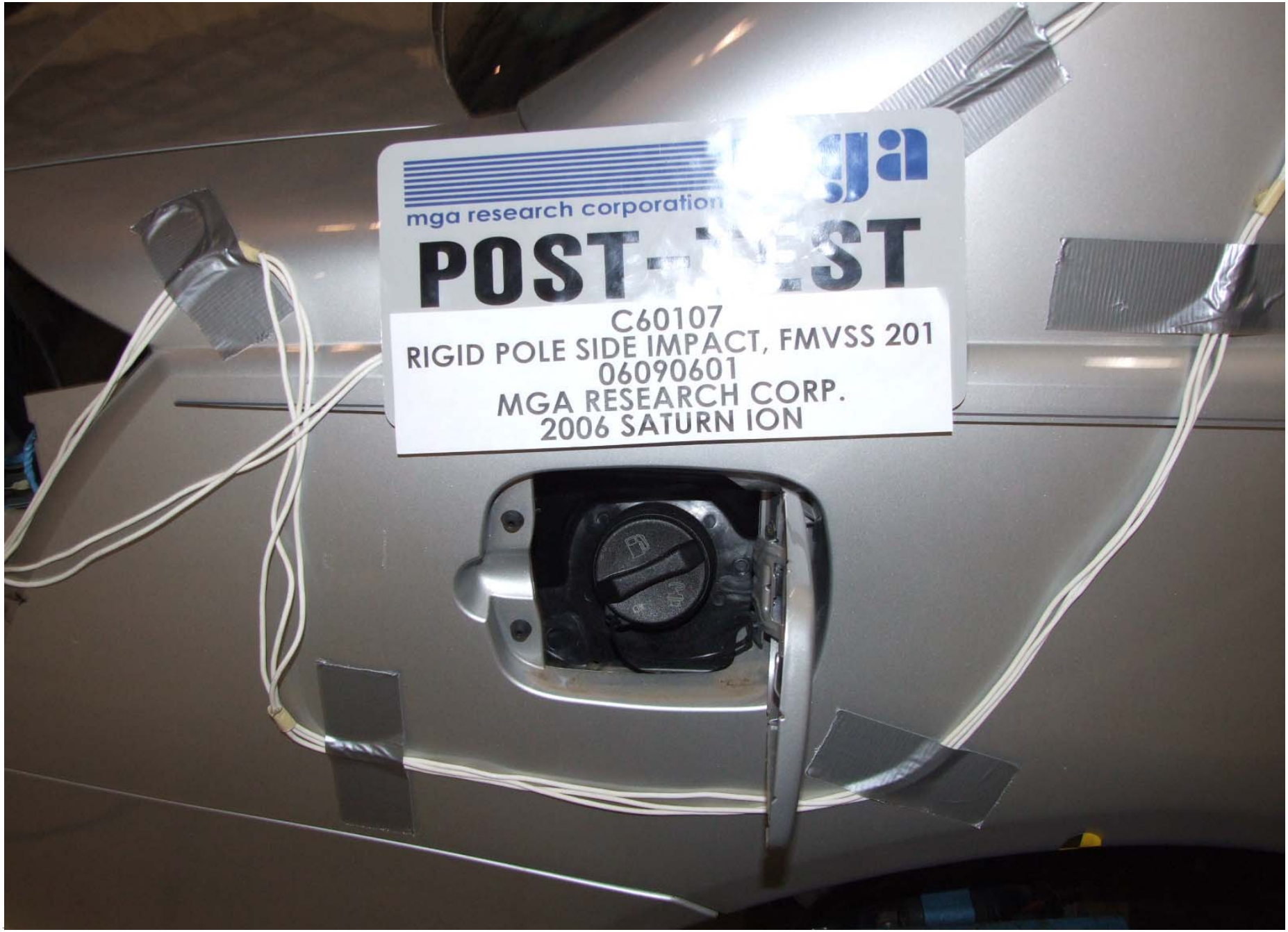


Vehicle Impact

Vehicle Certification Label

Tire Placard

Pre-Test Fuel Filler Cap



Post-Test Fuel Filler Cap

Pre-Test Left Front Wheel Dolly

Post-Test Left Front Wheel Dolly

Pre-Test Right Front Wheel Dolly

Post-Test Right Front Wheel Dolly

Pre-Test Left Rear Wheel Dolly

Post-Test Left Rear Wheel Dolly

Pre-Test Right Rear Wheel Dolly

Post-Test Right Rear Wheel Dolly

Rollover 90 Degrees

Rollover 180 Degrees

Rollover 270 Degrees

Rollover 360 Degrees

APPENDIX B

SID/HIII AND VEHICLE RESPONSE DATA

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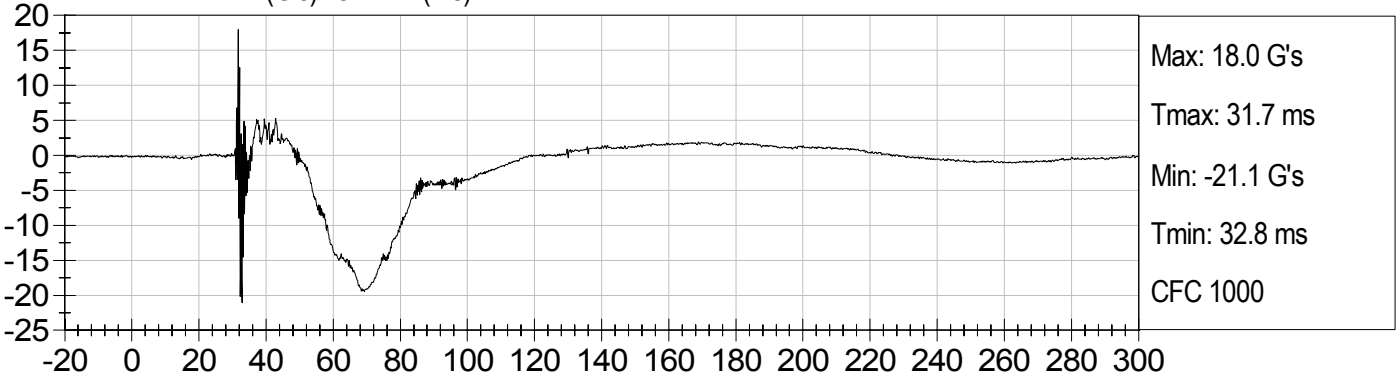
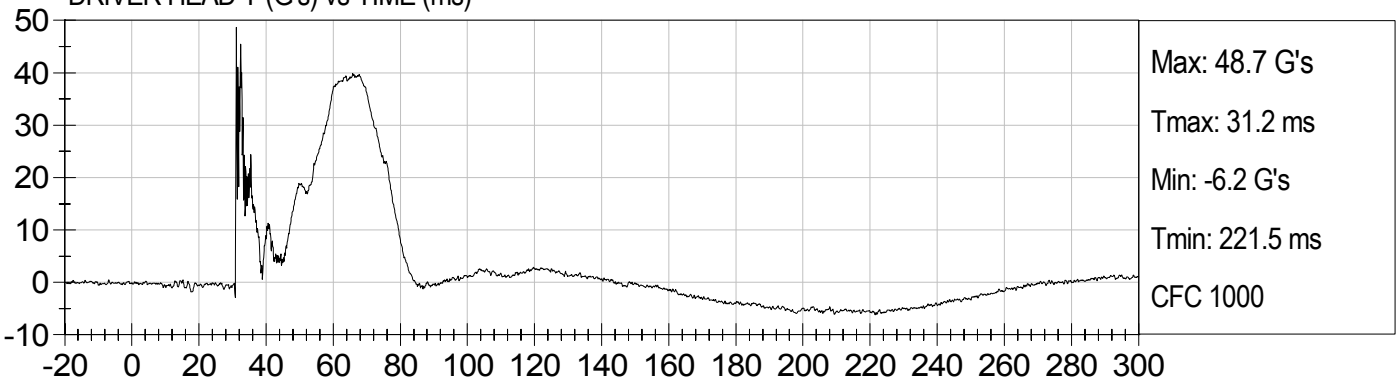
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

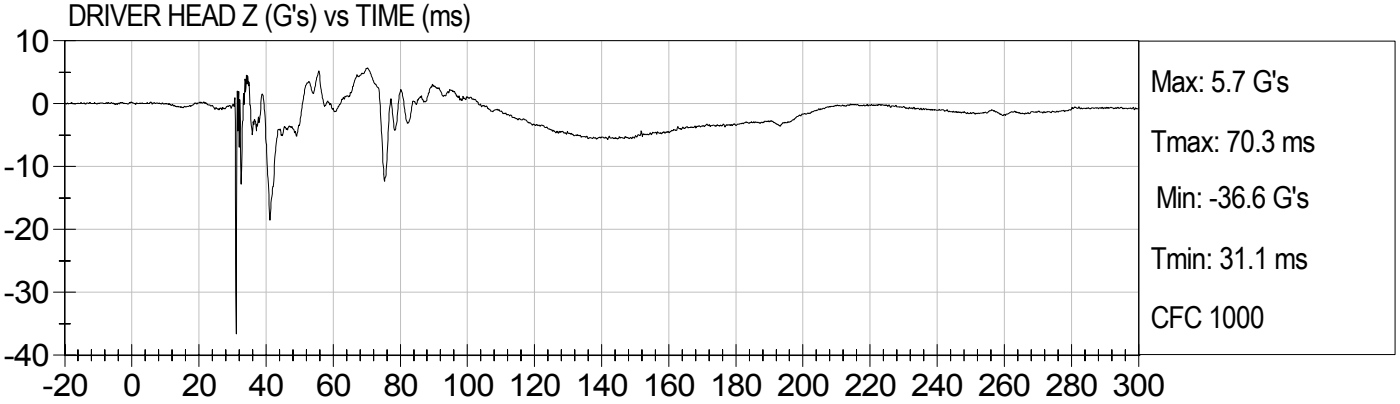
DRIVER HEAD X (G's) vs TIME (ms)



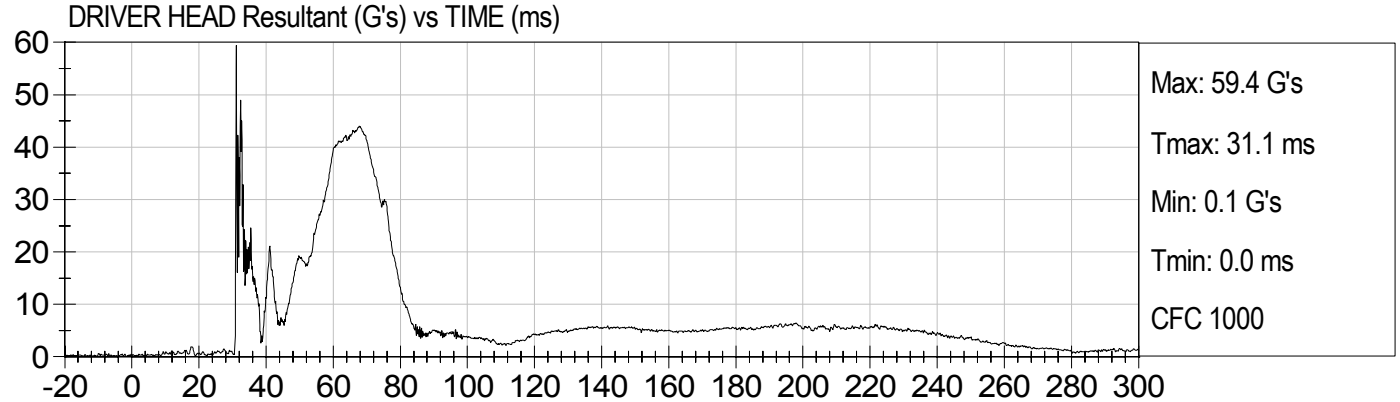
DRIVER HEAD Y (G's) vs TIME (ms)



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



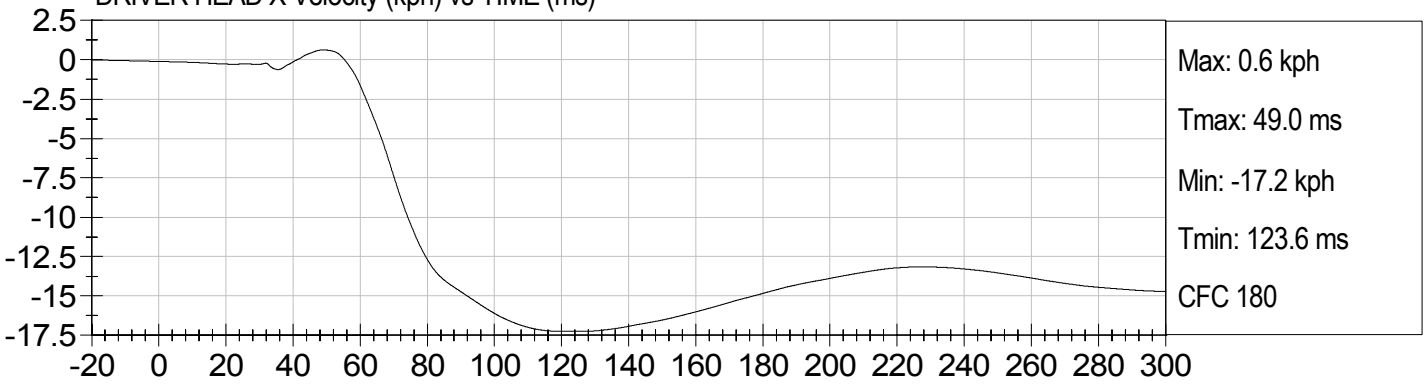
DRIVER HEAD Resultant (G's) vs TIME (ms)



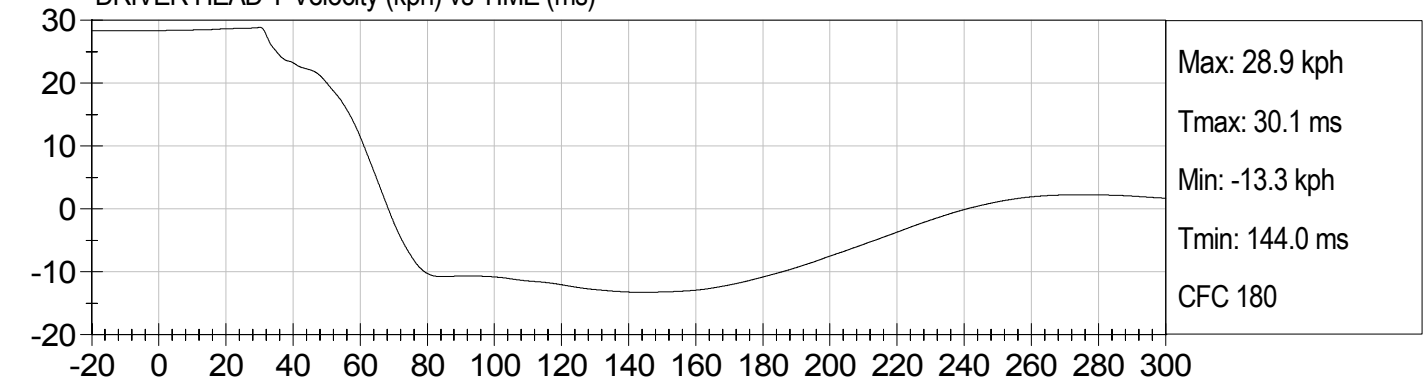
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

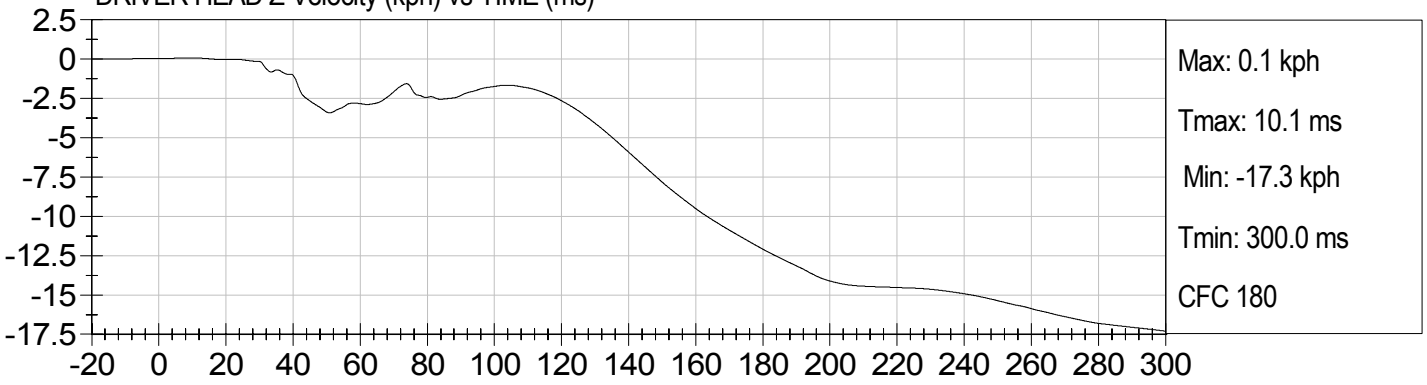
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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



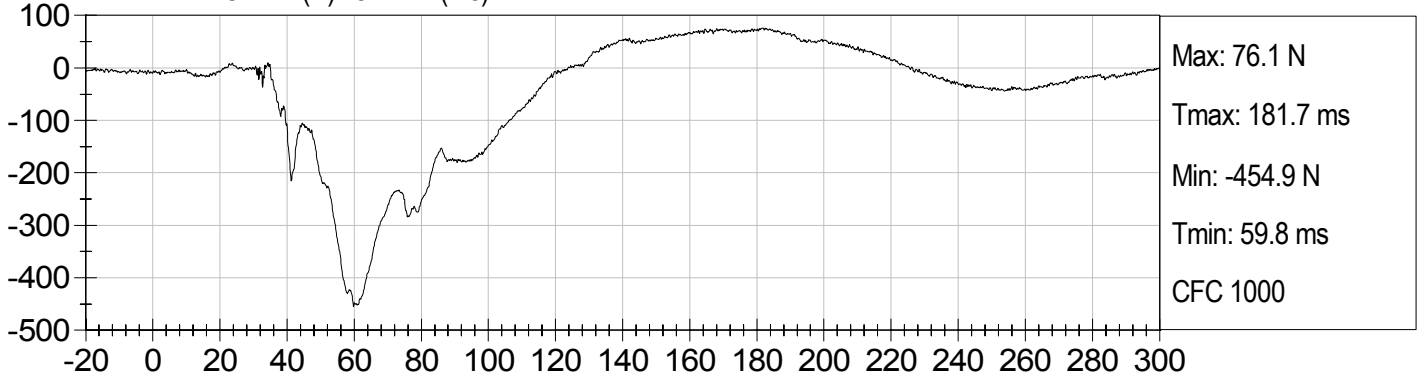
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



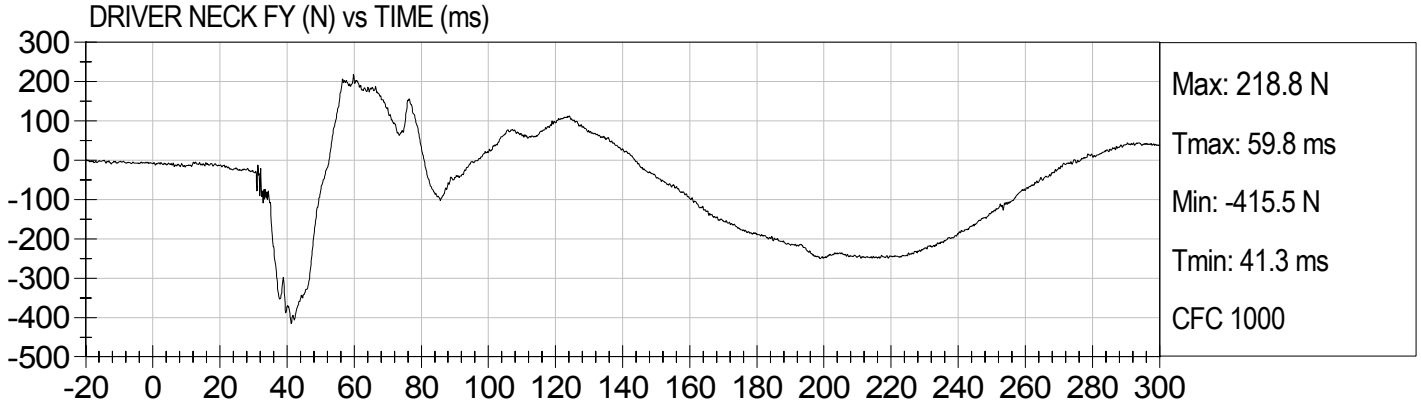
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

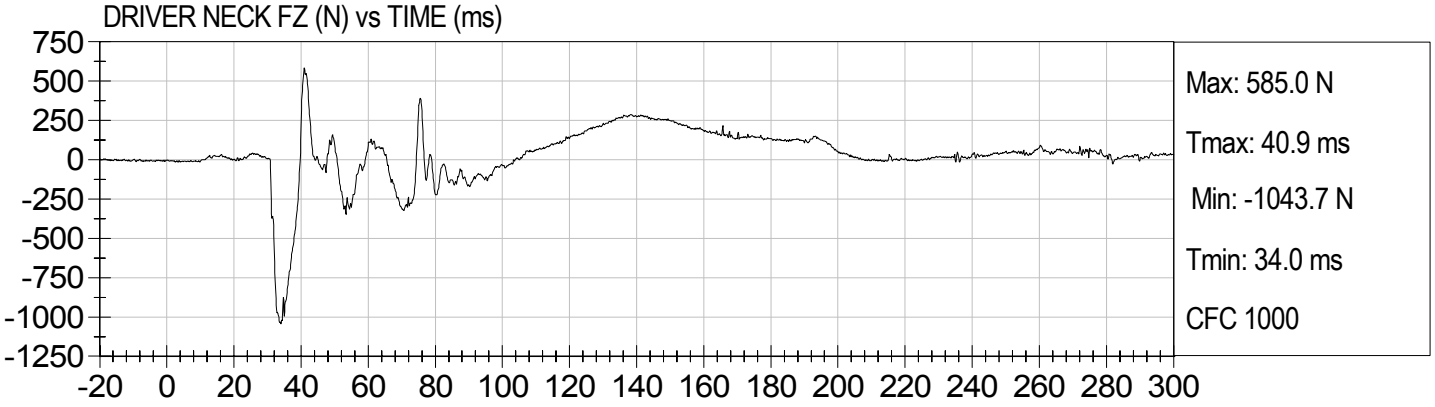
DRIVER NECK FX (N) vs TIME (ms)



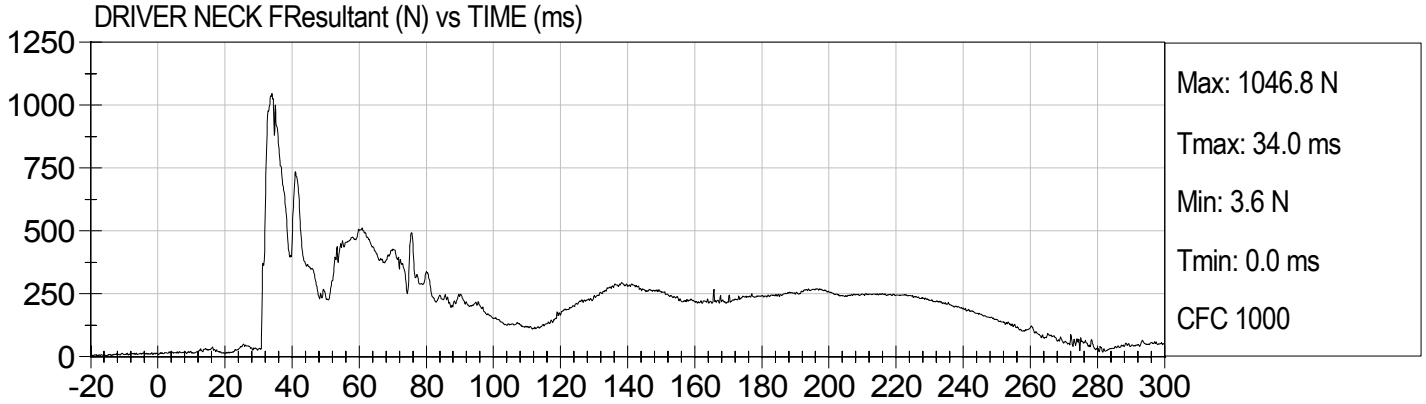
DRIVER NECK FY (N) vs TIME (ms)



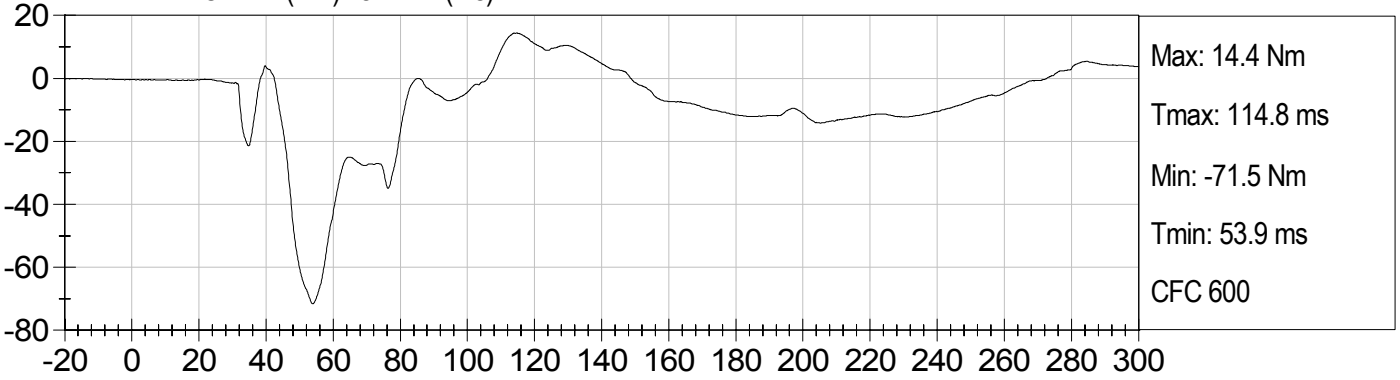
DRIVER NECK FZ (N) vs TIME (ms)



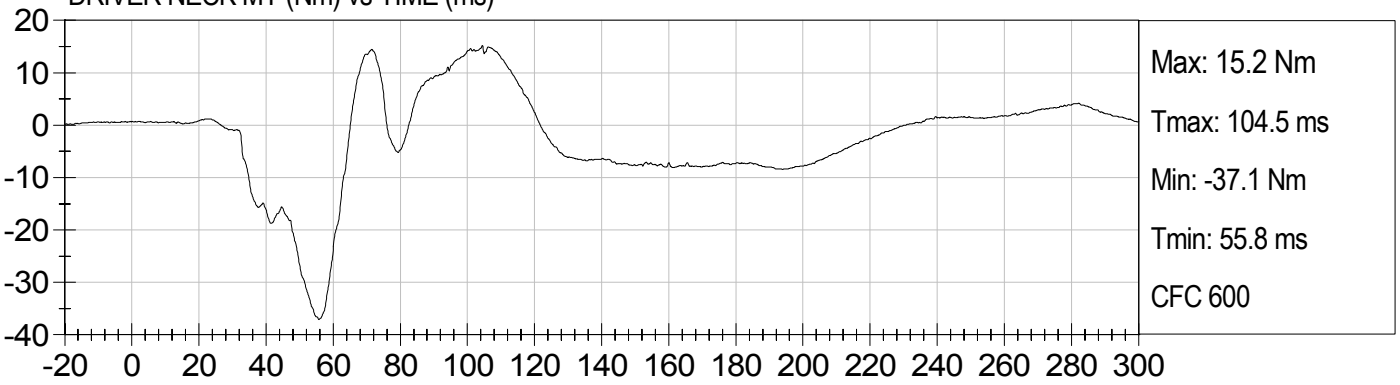
DRIVER NECK FResultant (N) vs TIME (ms)



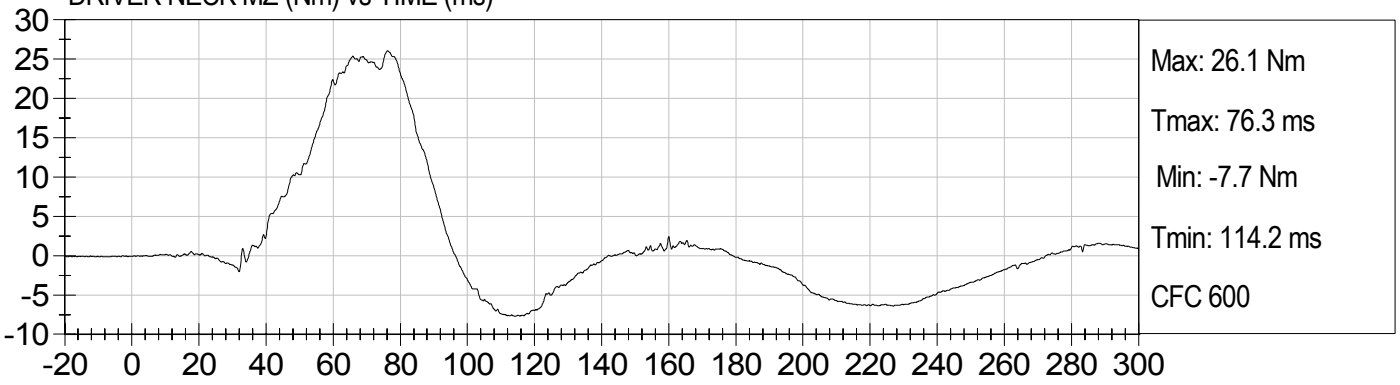
DRIVER NECK MX (Nm) vs TIME (ms)



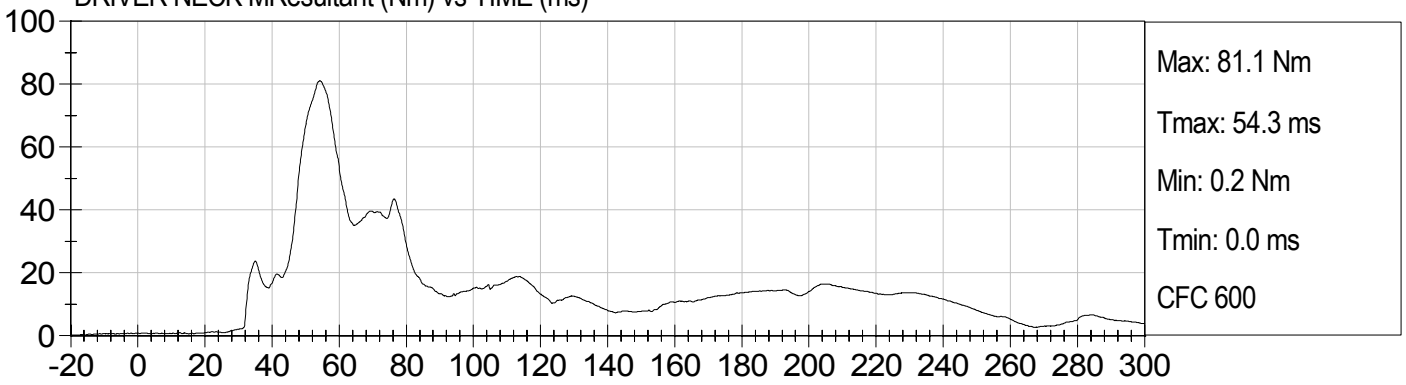
DRIVER NECK MY (Nm) vs TIME (ms)



DRIVER NECK MZ (Nm) vs TIME (ms)



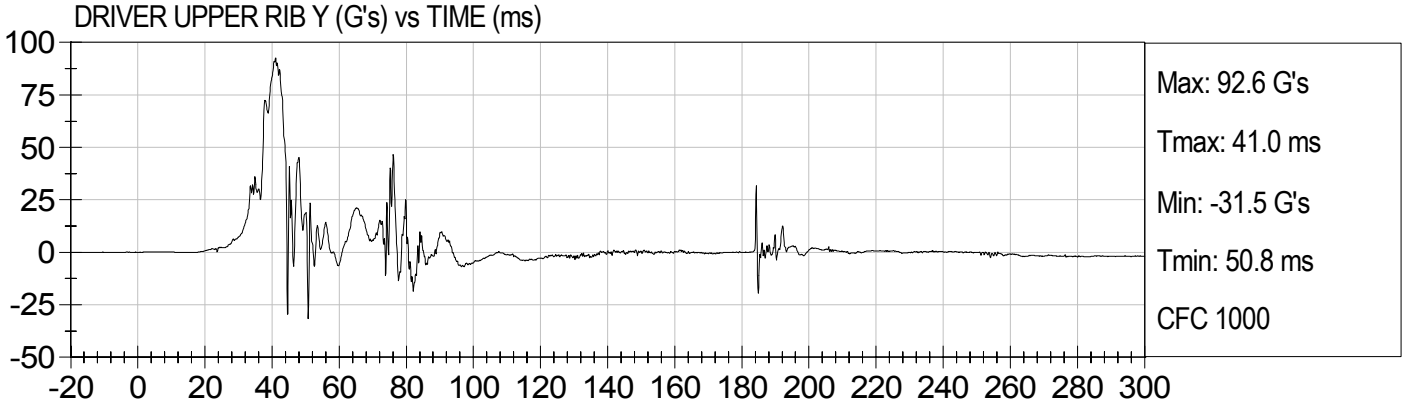
DRIVER NECK MResultant (Nm) vs TIME (ms)



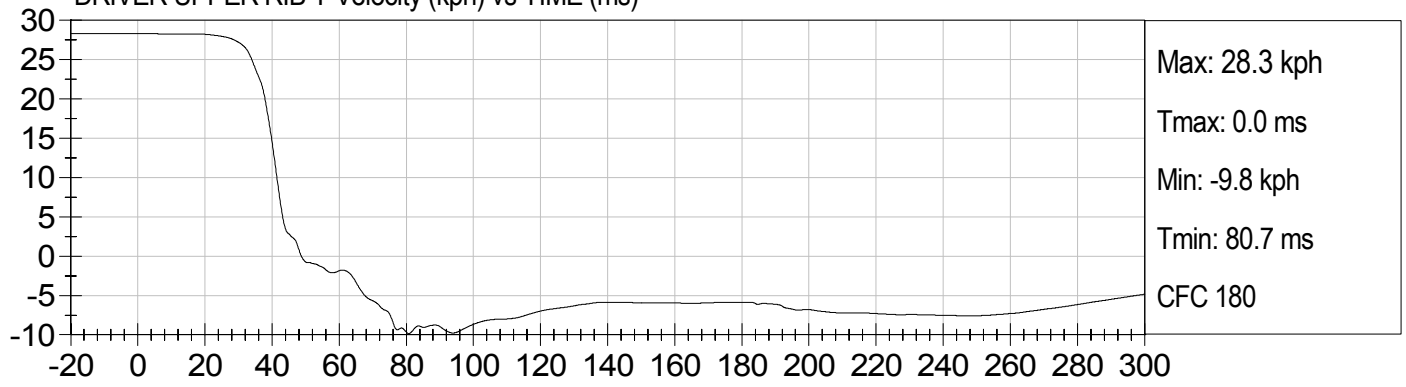
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

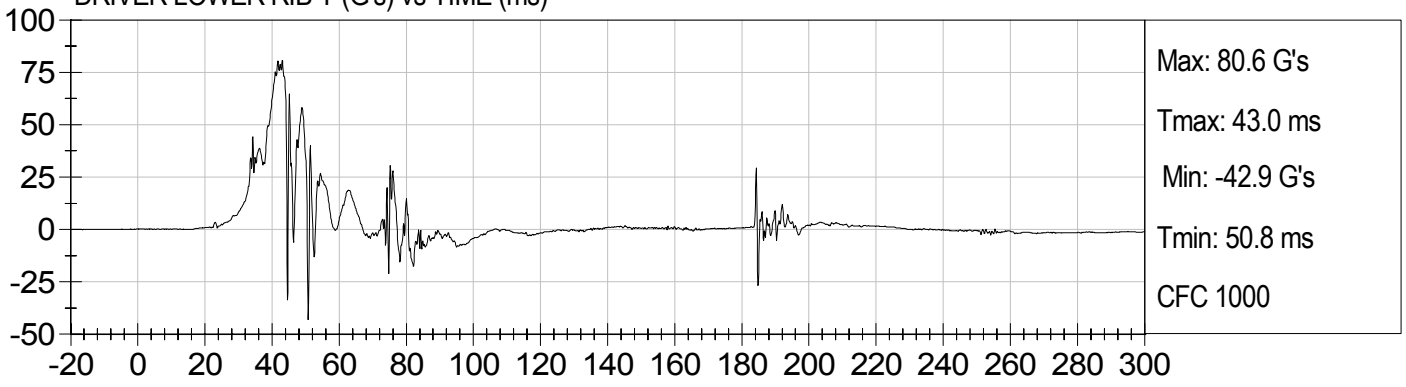
DRIVER UPPER RIB Y (G's) vs TIME (ms)



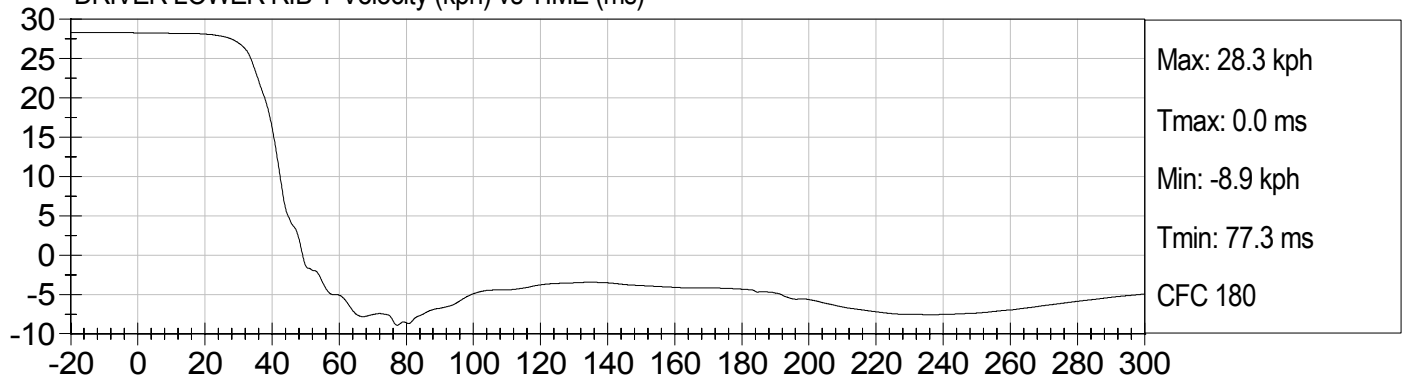
DRIVER UPPER RIB Y Velocity (kph) vs TIME (ms)



DRIVER LOWER RIB Y (G's) vs TIME (ms)



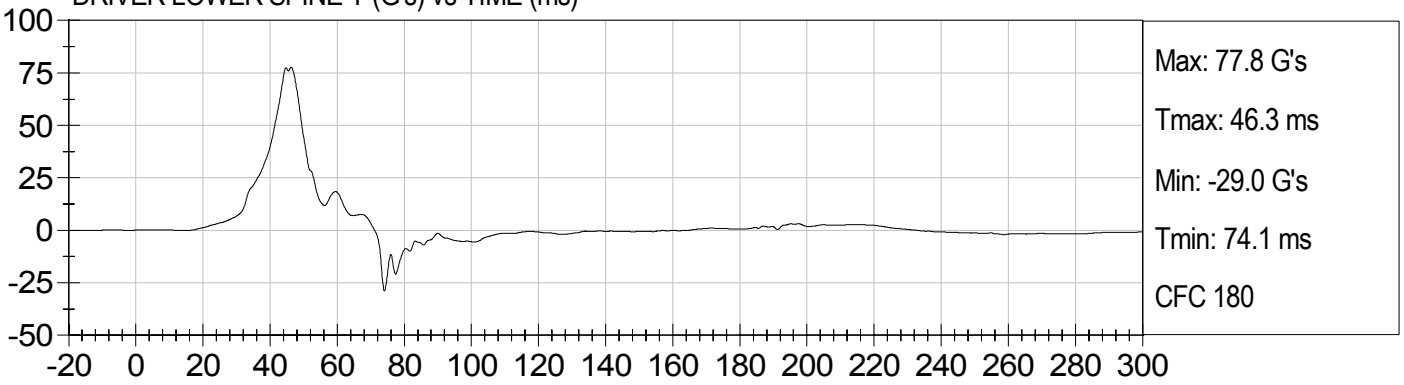
DRIVER LOWER RIB Y Velocity (kph) vs TIME (ms)



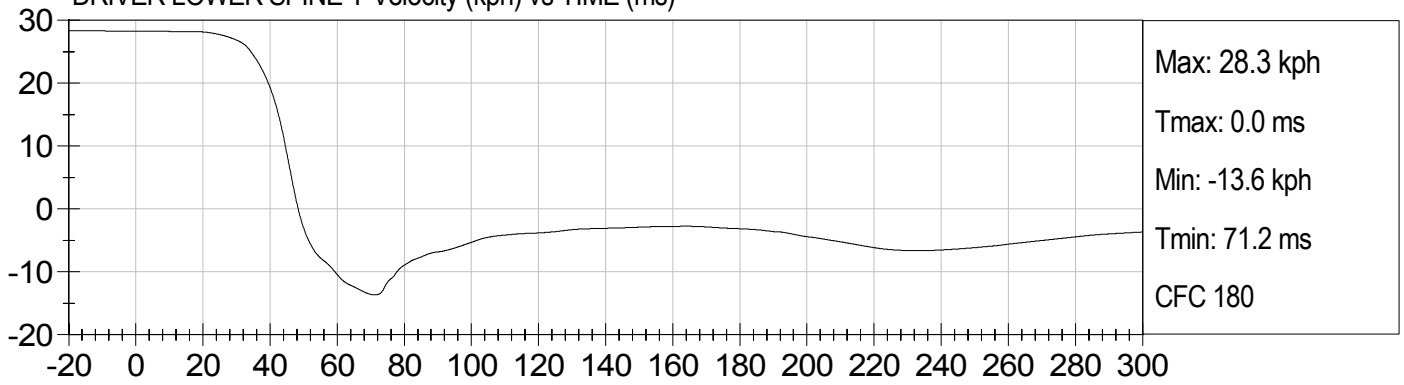
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

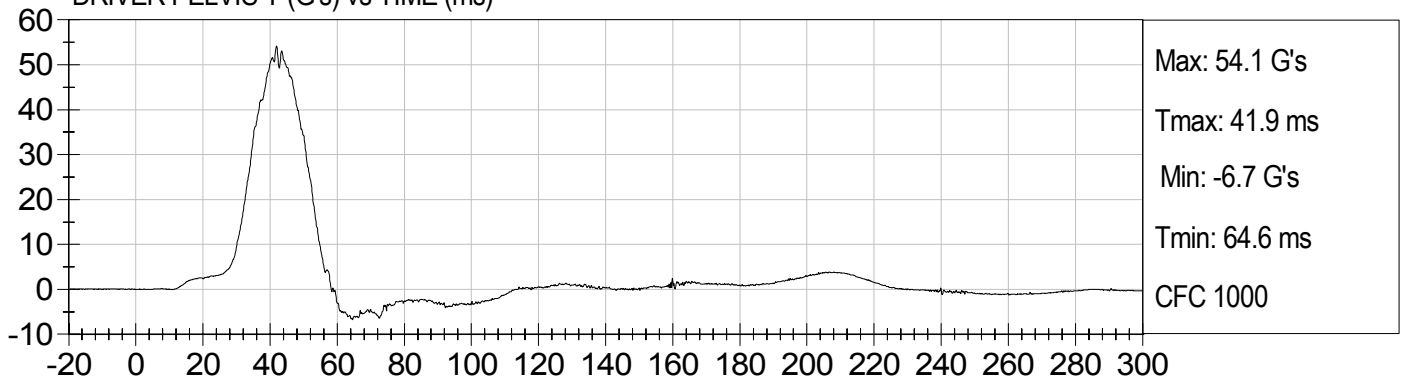
DRIVER LOWER SPINE Y (G's) vs TIME (ms)



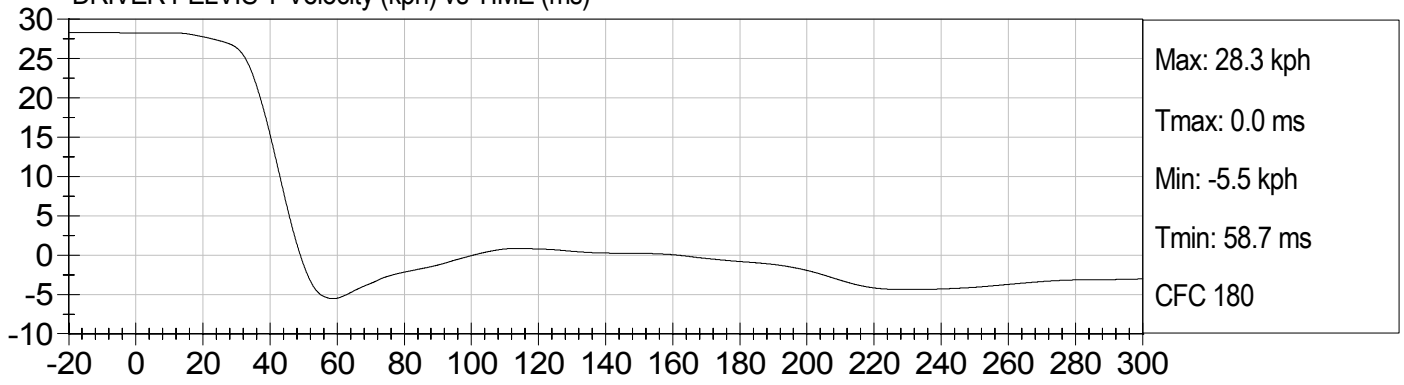
DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)



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



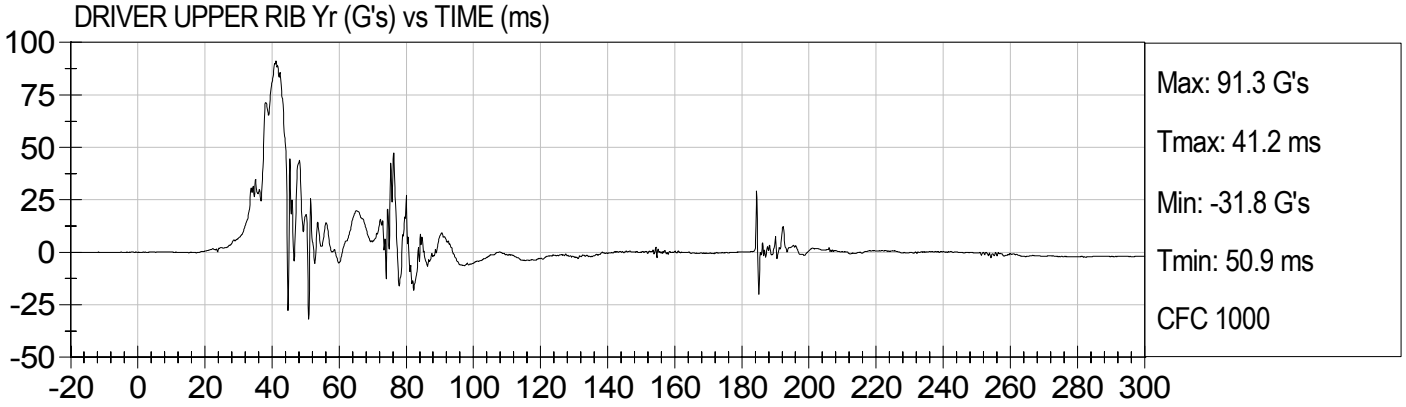
DRIVER PELVIS Y Velocity (kph) vs TIME (ms)



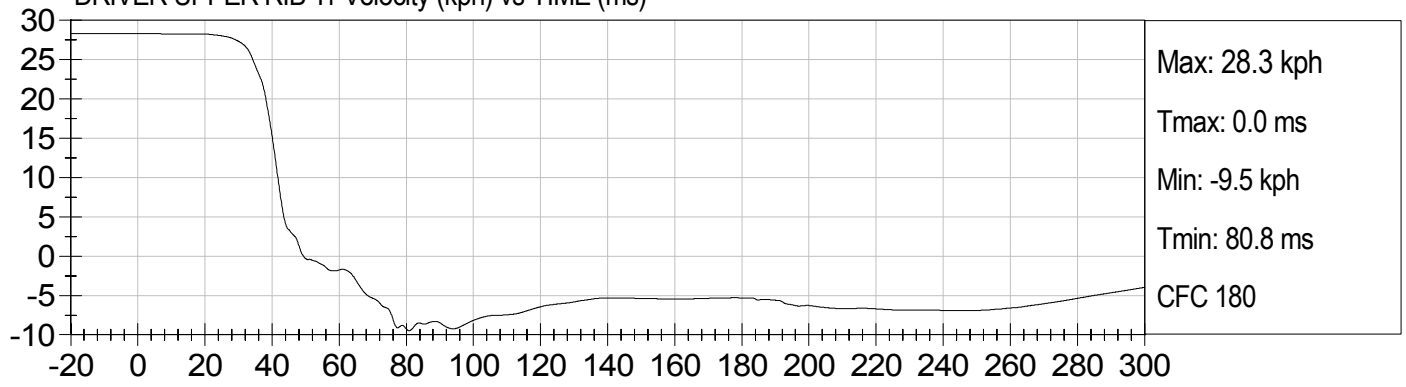
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

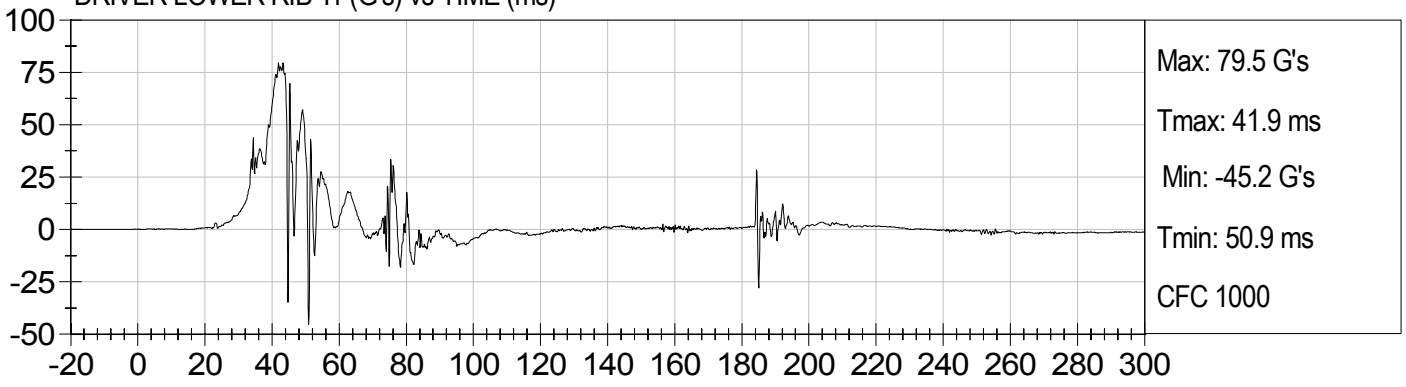
DRIVER UPPER RIB Yr (G's) vs TIME (ms)



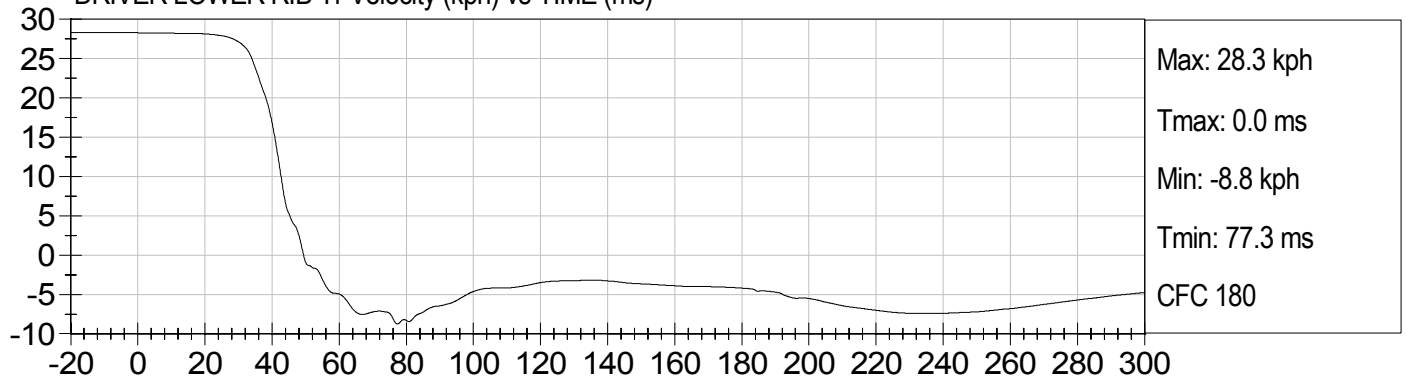
DRIVER UPPER RIB Yr Velocity (kph) vs TIME (ms)



DRIVER LOWER RIB Yr (G's) vs TIME (ms)



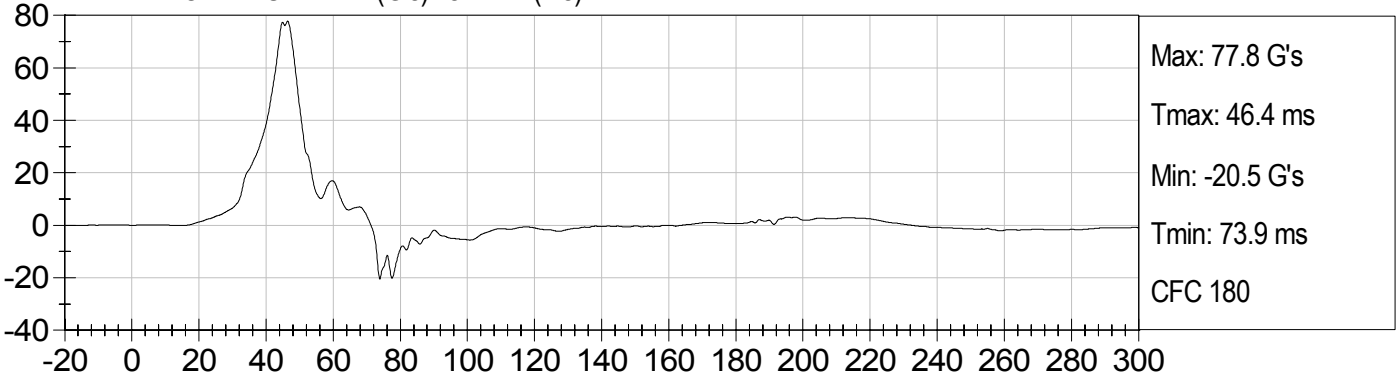
DRIVER LOWER RIB Yr Velocity (kph) vs TIME (ms)



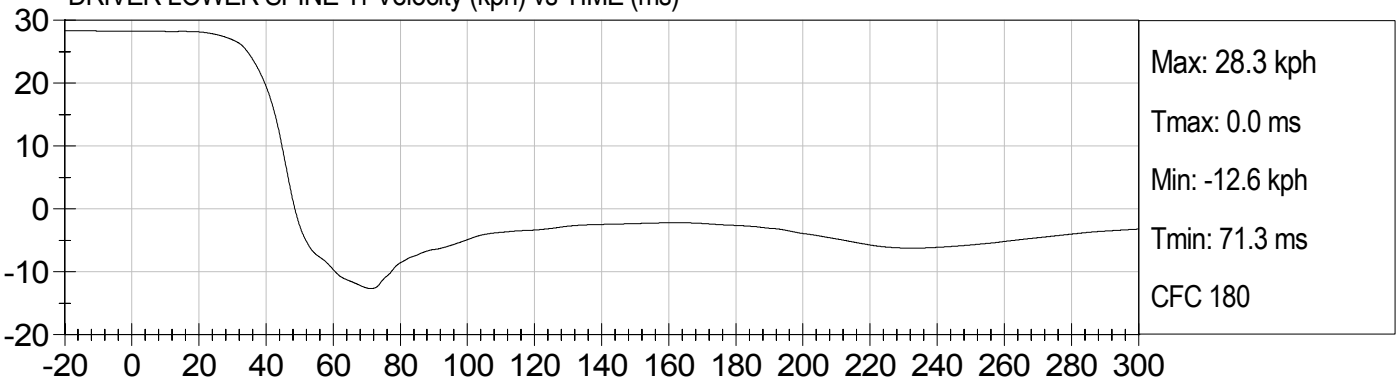
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

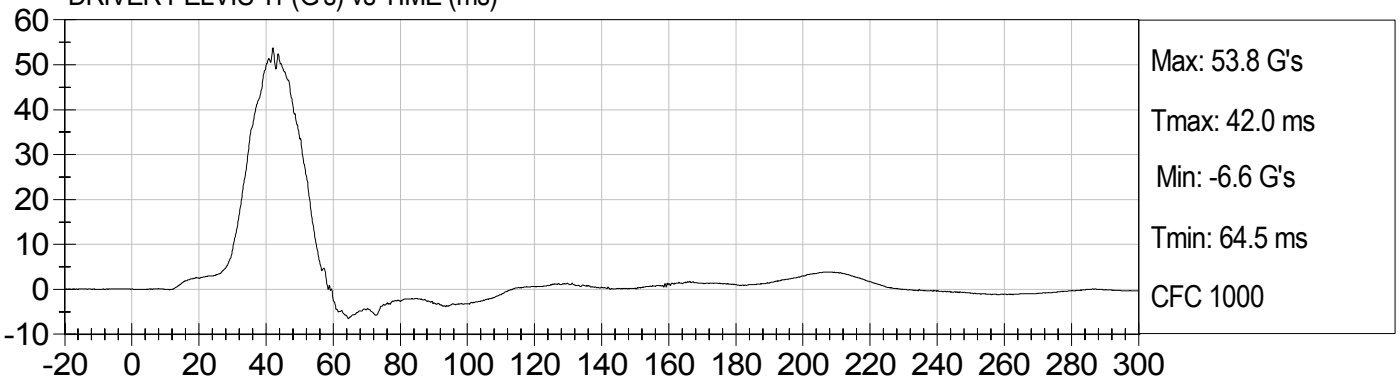
DRIVER LOWER SPINE Yr (G's) vs TIME (ms)



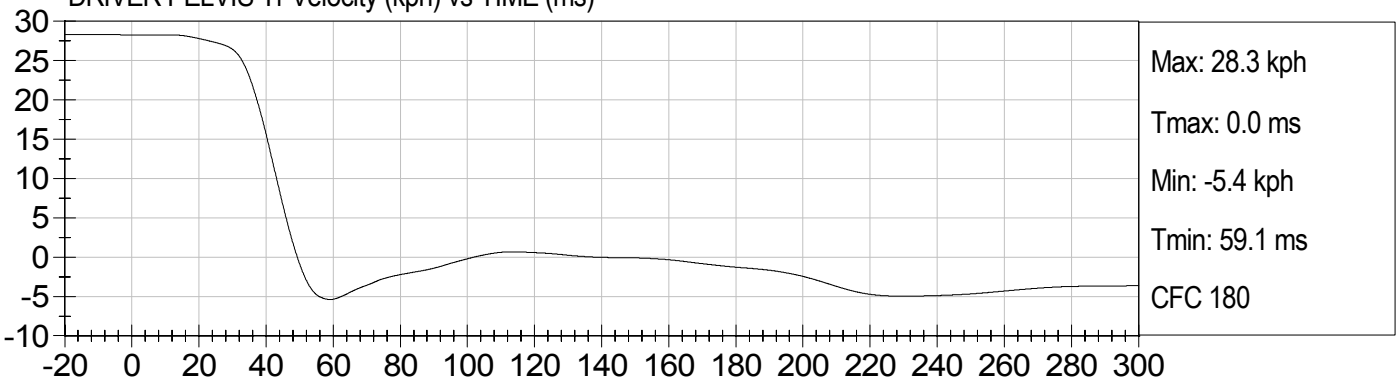
DRIVER LOWER SPINE Yr Velocity (kph) vs TIME (ms)



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



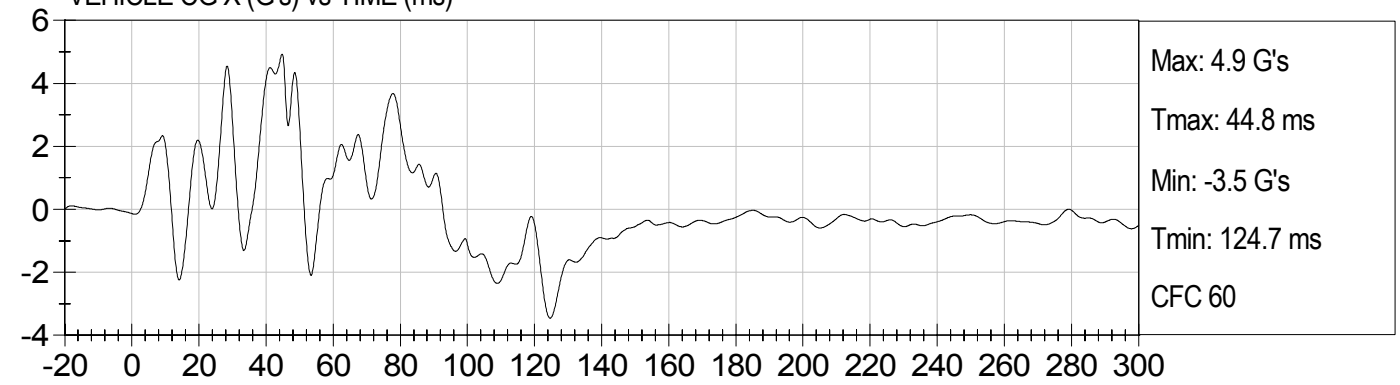
DRIVER PELVIS Yr Velocity (kph) vs TIME (ms)



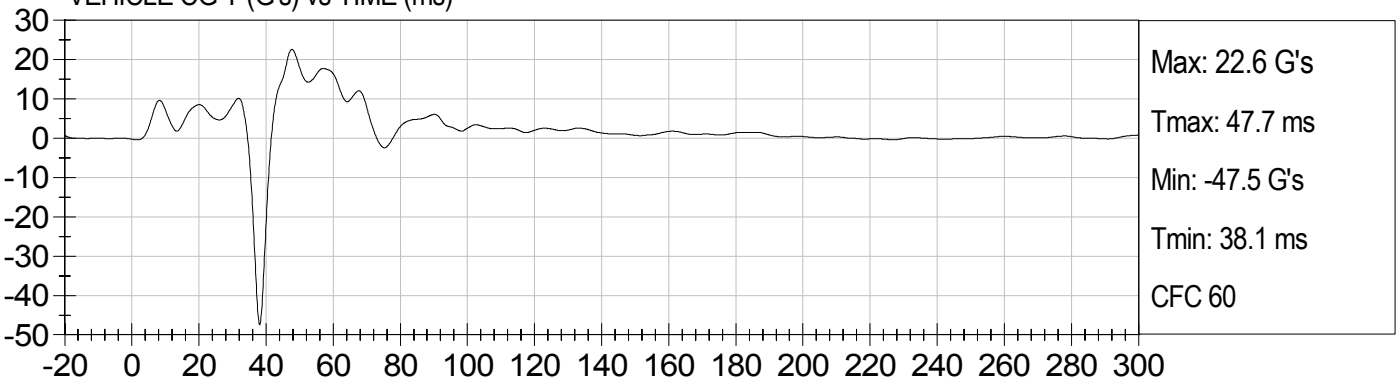
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

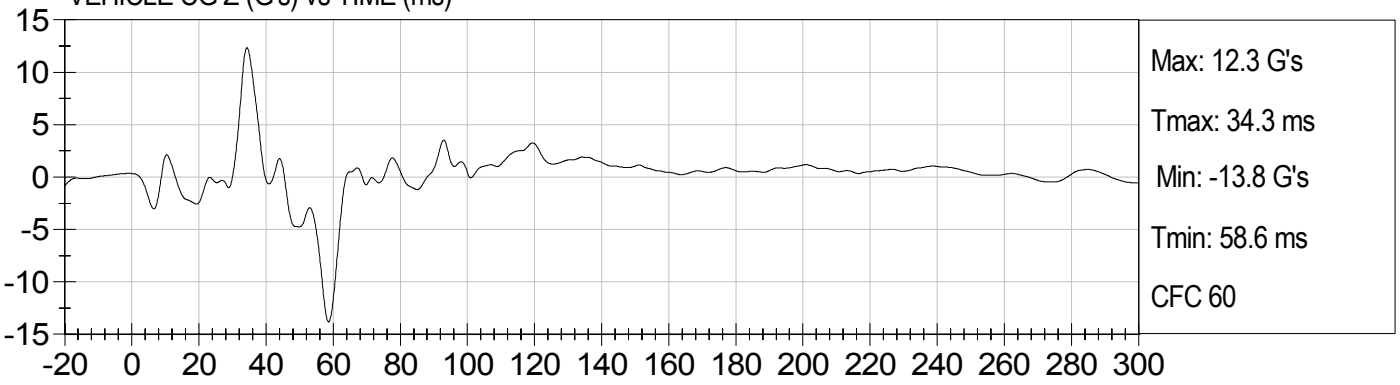
VEHICLE CG X (G's) vs TIME (ms)



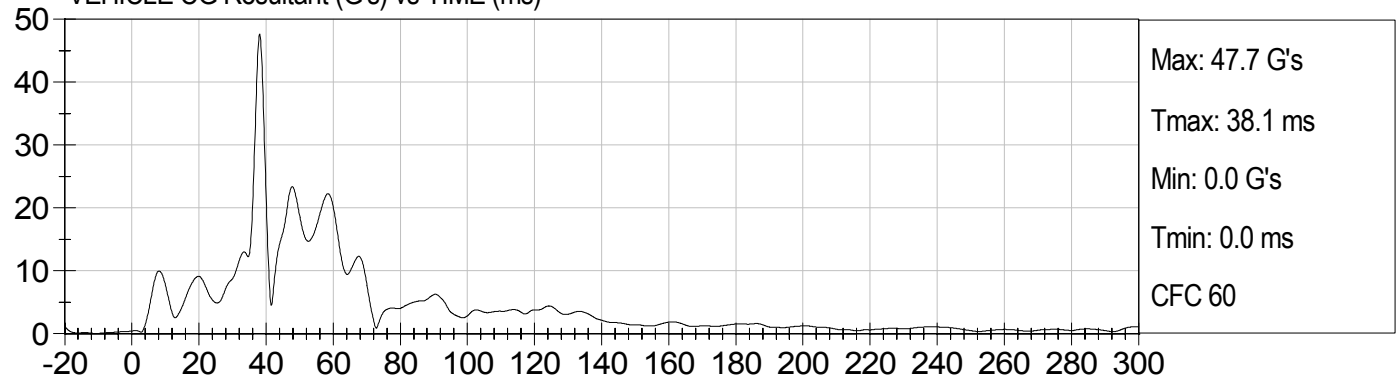
VEHICLE CG Y (G's) vs TIME (ms)

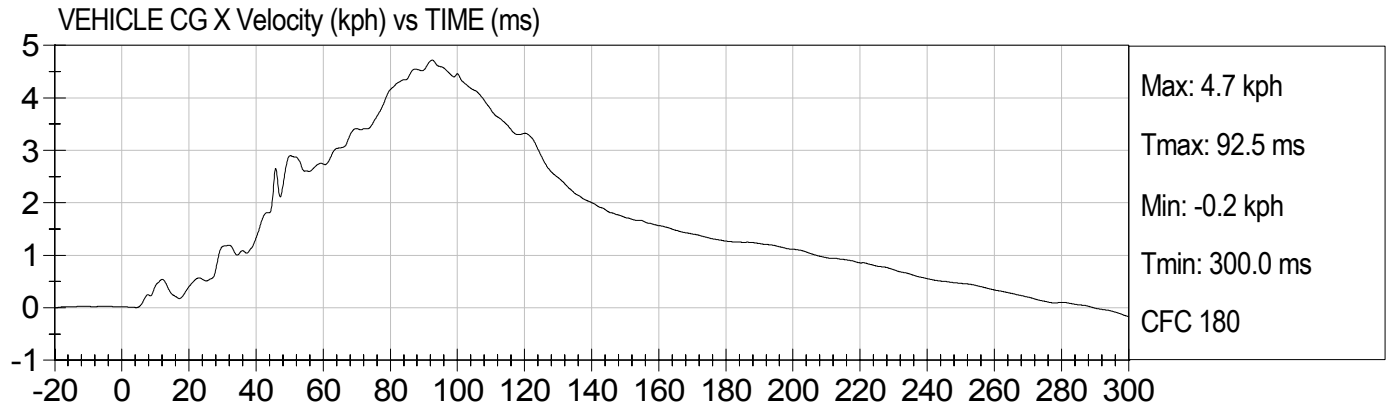


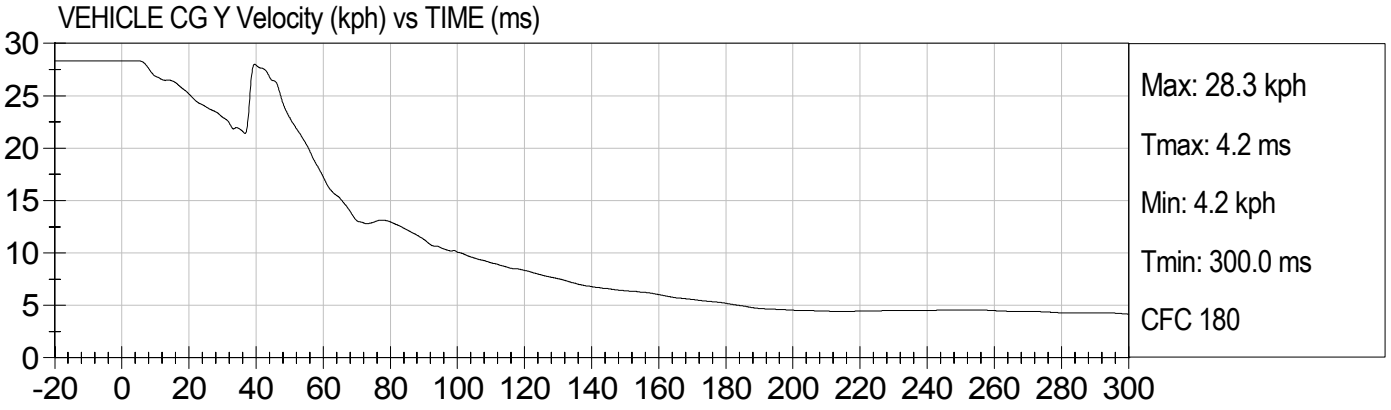
VEHICLE CG Z (G's) vs TIME (ms)

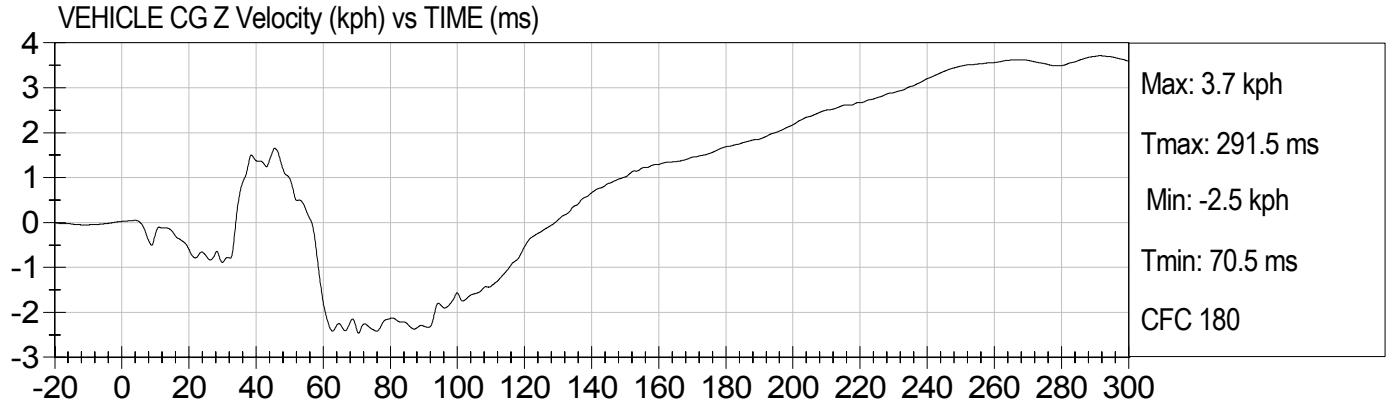


VEHICLE CG Resultant (G's) vs TIME (ms)




VEHICLE CG X Velocity (kph) vs TIME (ms)
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: 4.7 kph
Tmax: 92.5 ms
Min: -0.2 kph
Tmin: 300.0 ms
CFC 180

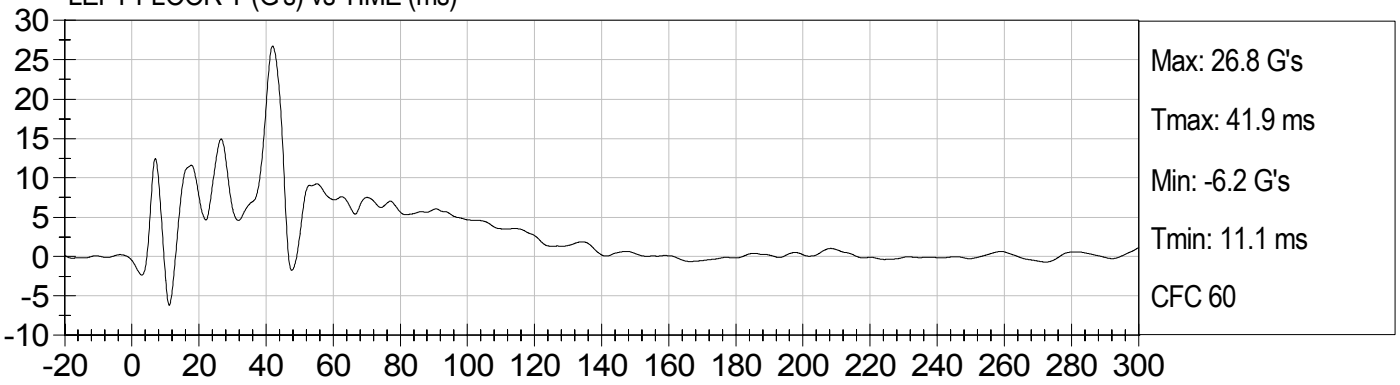

VEHICLE CG Y Velocity (kph) vs TIME (ms)
30
25
20
15
10
5
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 28.3 kph
Tmax: 4.2 ms
Min: 4.2 kph
Tmin: 300.0 ms
CFC 180


VEHICLE CG Z Velocity (kph) vs TIME (ms)
4
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: 3.7 kph
Tmax: 291.5 ms
Min: -2.5 kph
Tmin: 70.5 ms
CFC 180

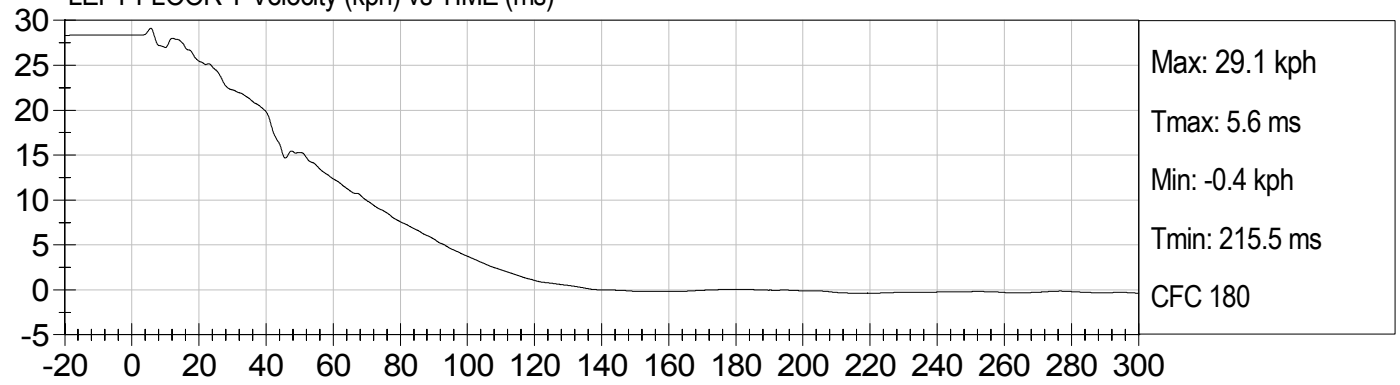
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

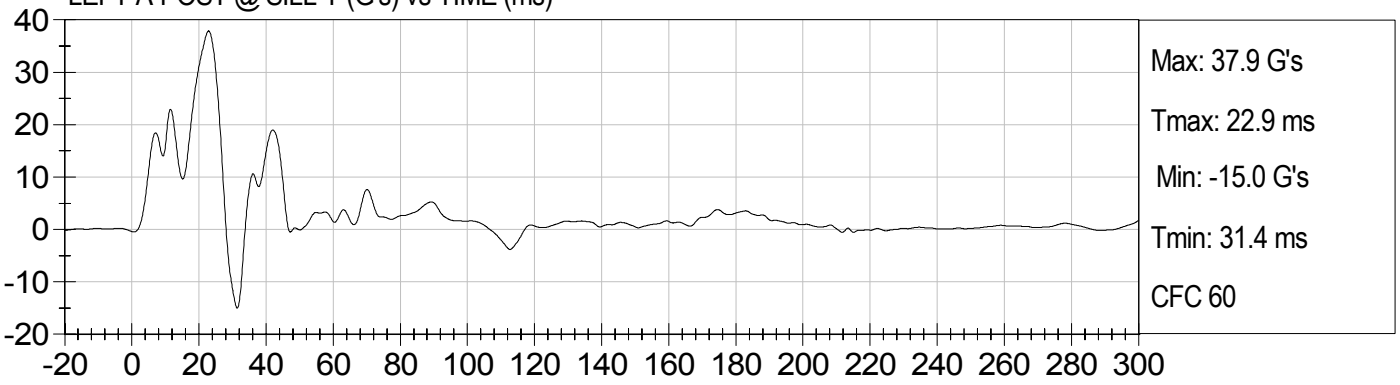
LEFT FLOOR Y (G's) vs TIME (ms)



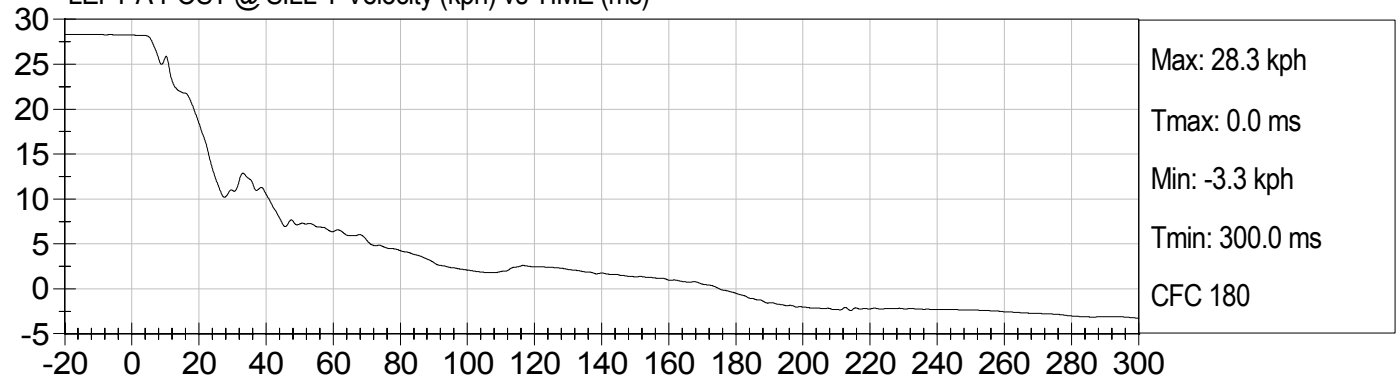
LEFT FLOOR Y Velocity (kph) vs TIME (ms)



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



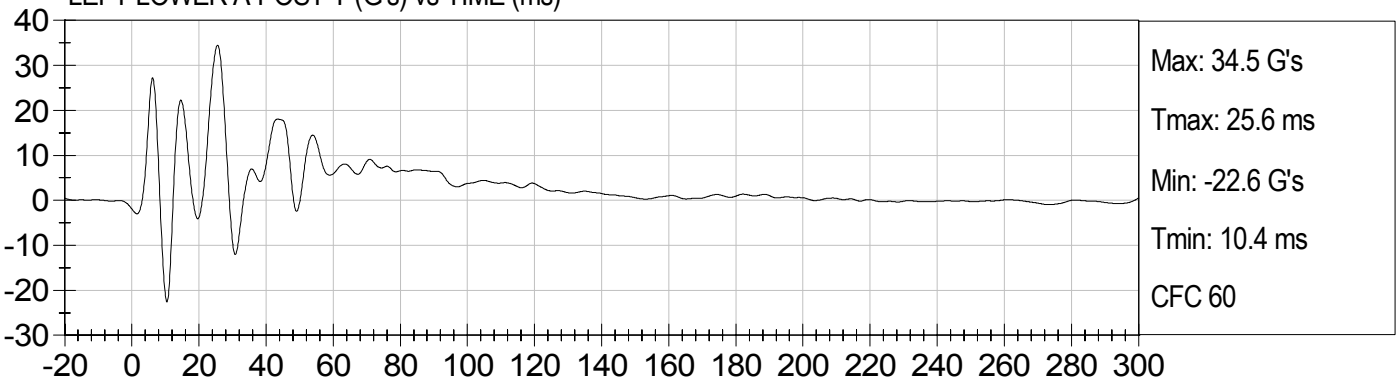
LEFT A-POST @ SILL Y Velocity (kph) vs TIME (ms)



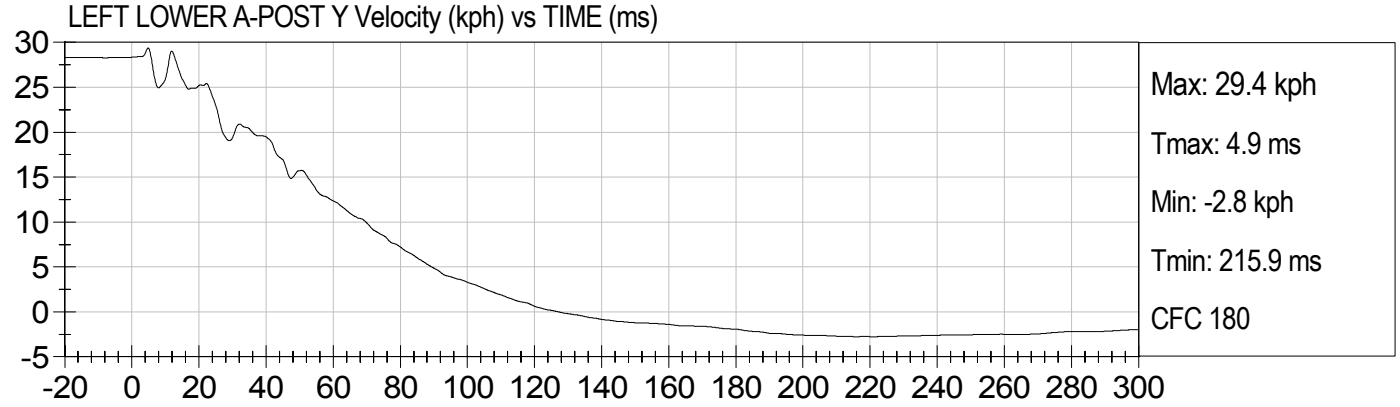
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

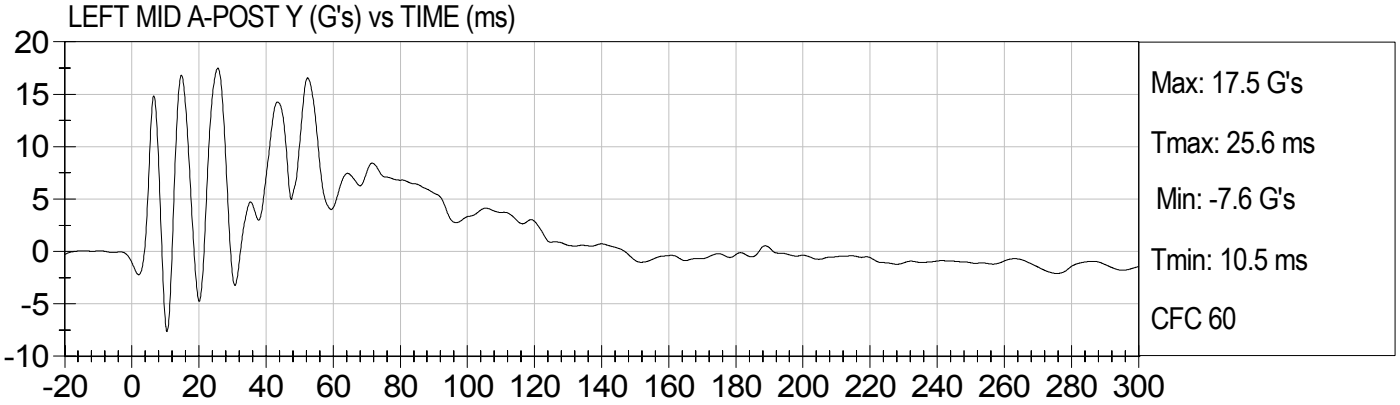
LEFT LOWER A-POST Y (G's) vs TIME (ms)



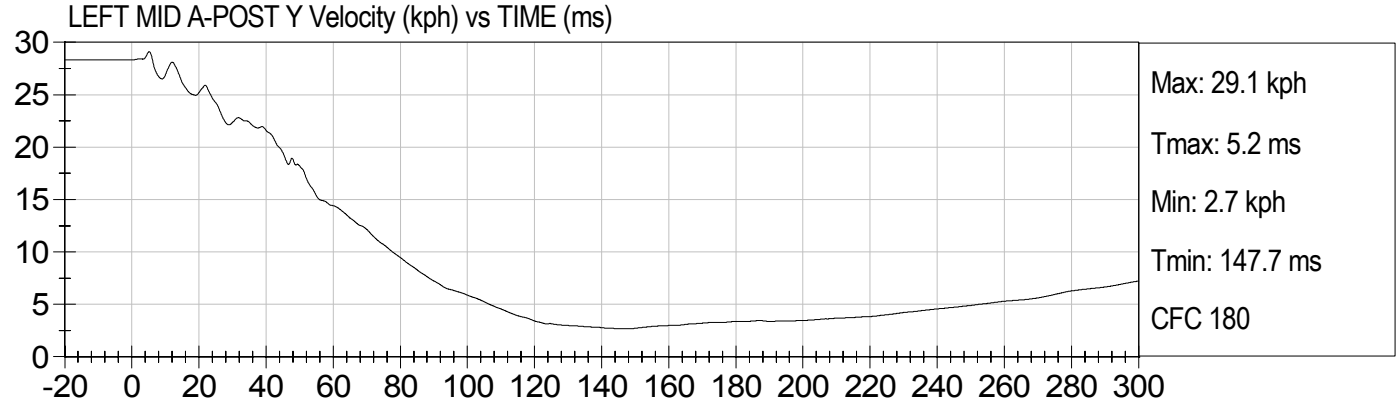
LEFT LOWER A-POST Y Velocity (kph) vs TIME (ms)



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



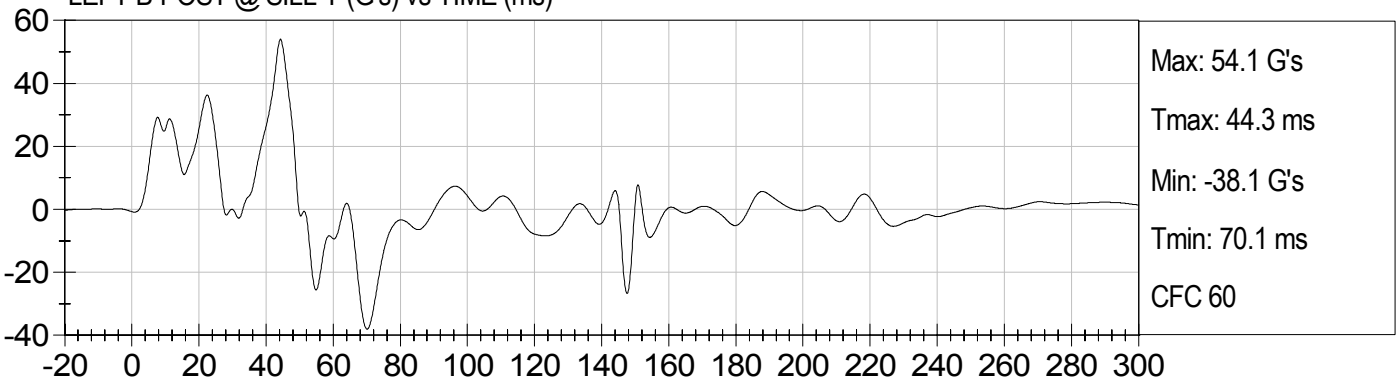
LEFT MID A-POST Y Velocity (kph) vs TIME (ms)



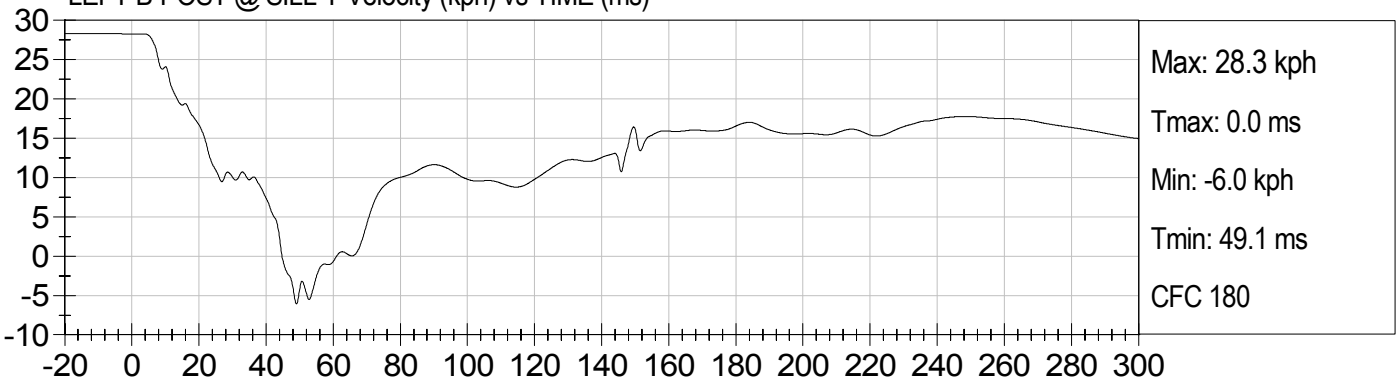
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

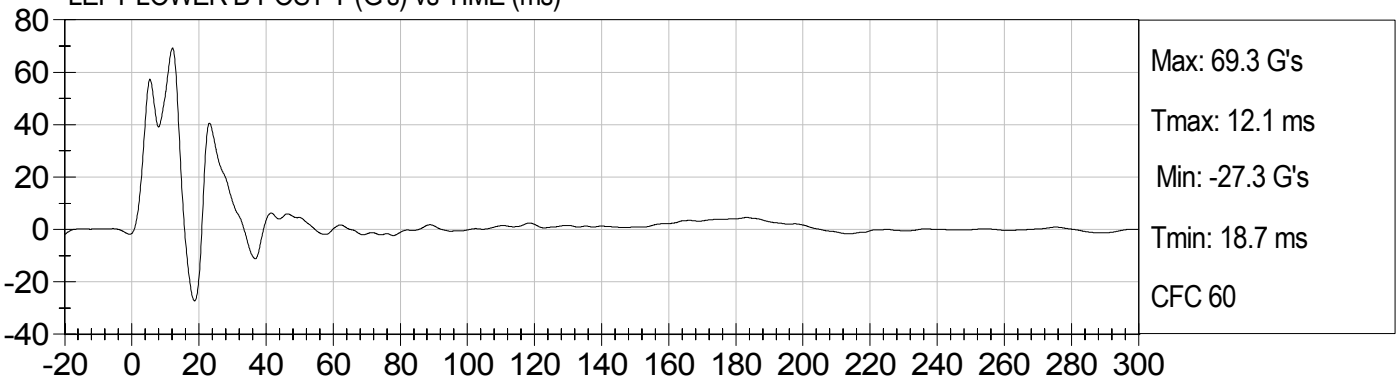
LEFT B-POST @ SILL Y (G's) vs TIME (ms)



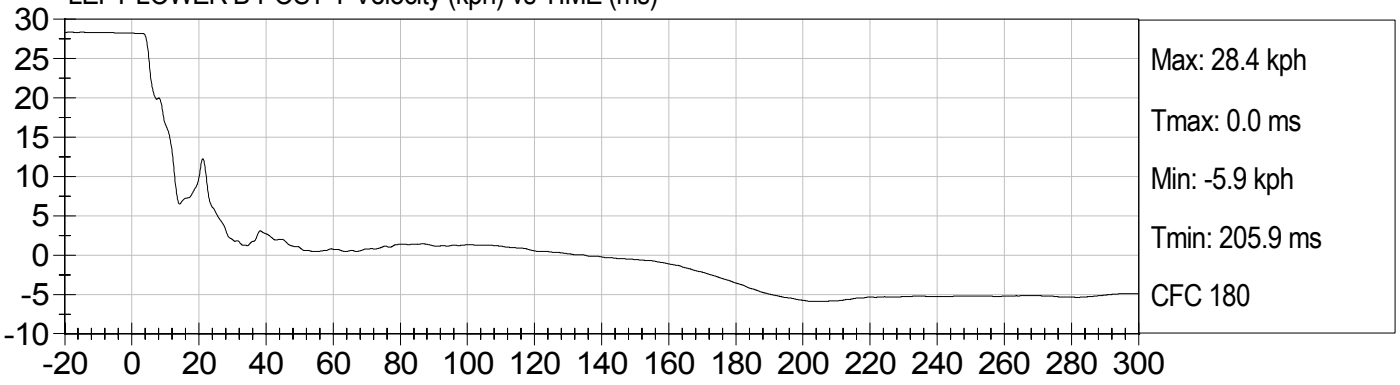
LEFT B-POST @ SILL Y Velocity (kph) vs TIME (ms)



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



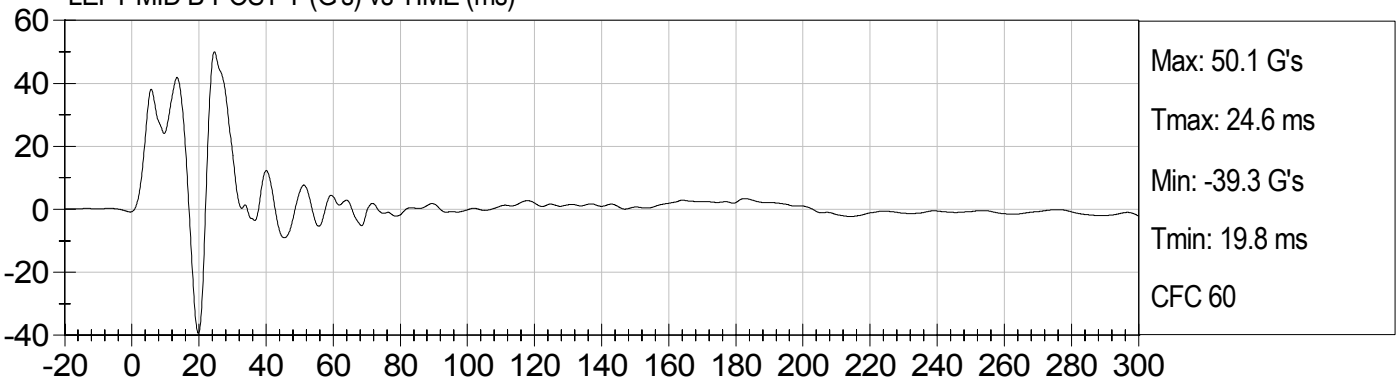
LEFT LOWER B-POST Y Velocity (kph) vs TIME (ms)



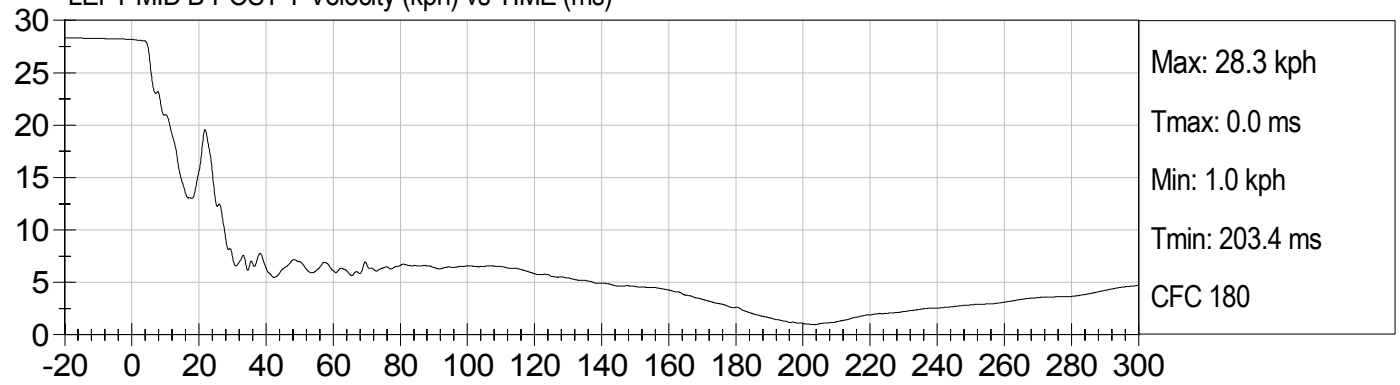
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

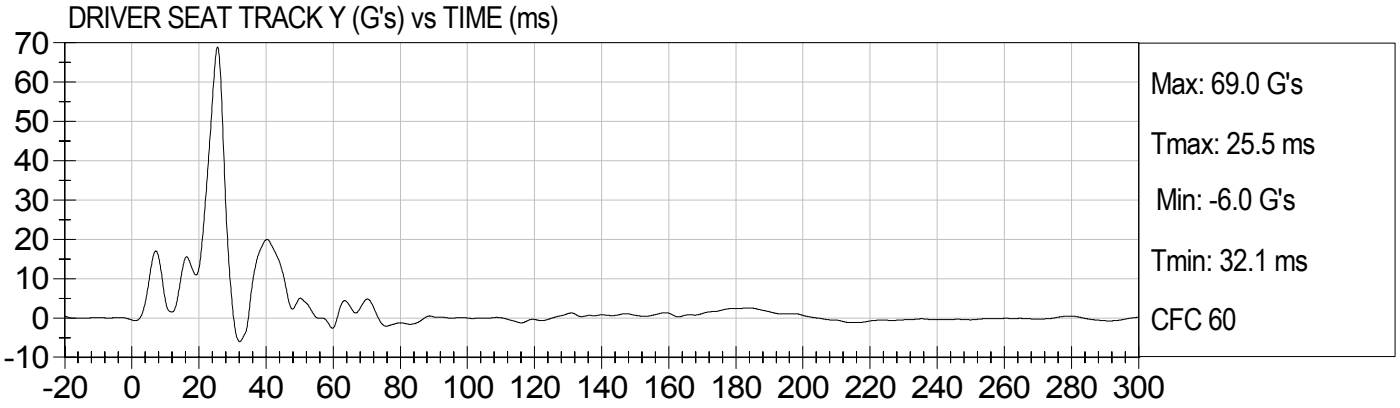
LEFT MID B-POST Y (G's) vs TIME (ms)



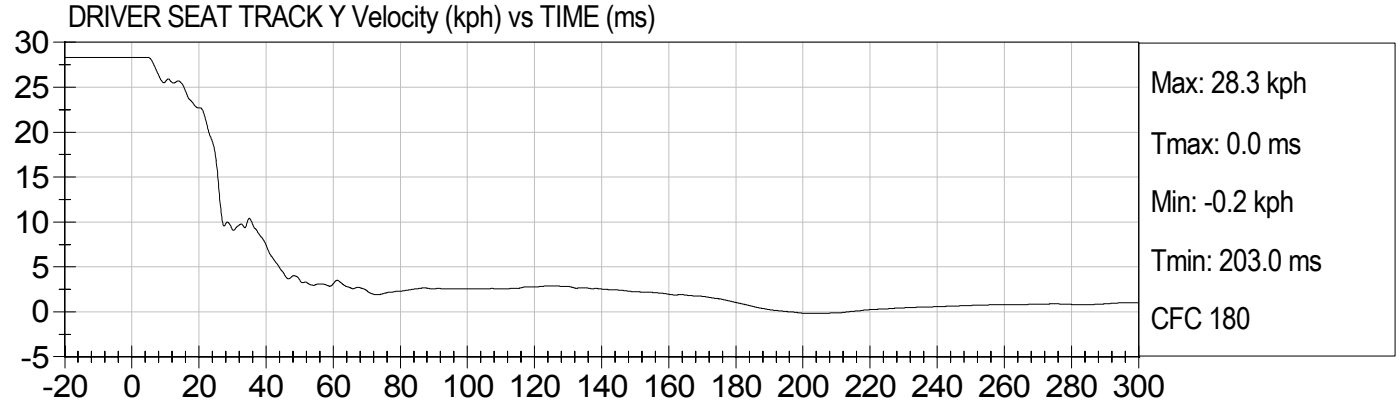
LEFT MID B-POST Y Velocity (kph) vs TIME (ms)



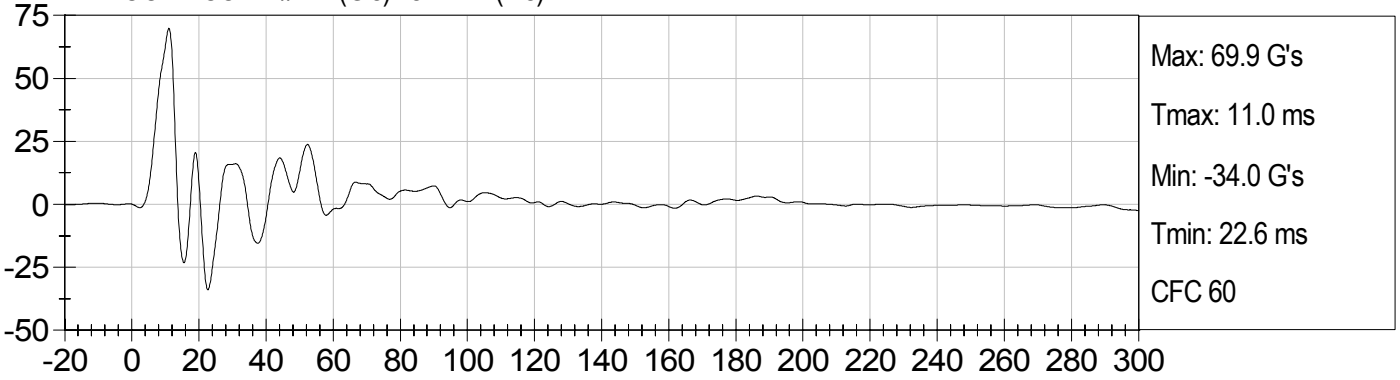
DRIVER SEAT TRACK Y (G's) vs TIME (ms)



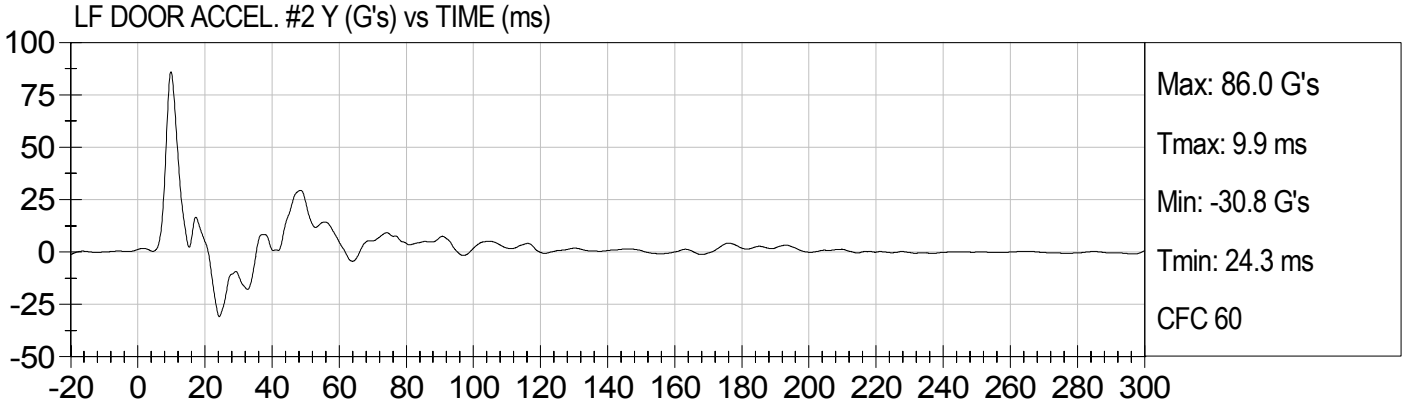
DRIVER SEAT TRACK Y Velocity (kph) vs TIME (ms)



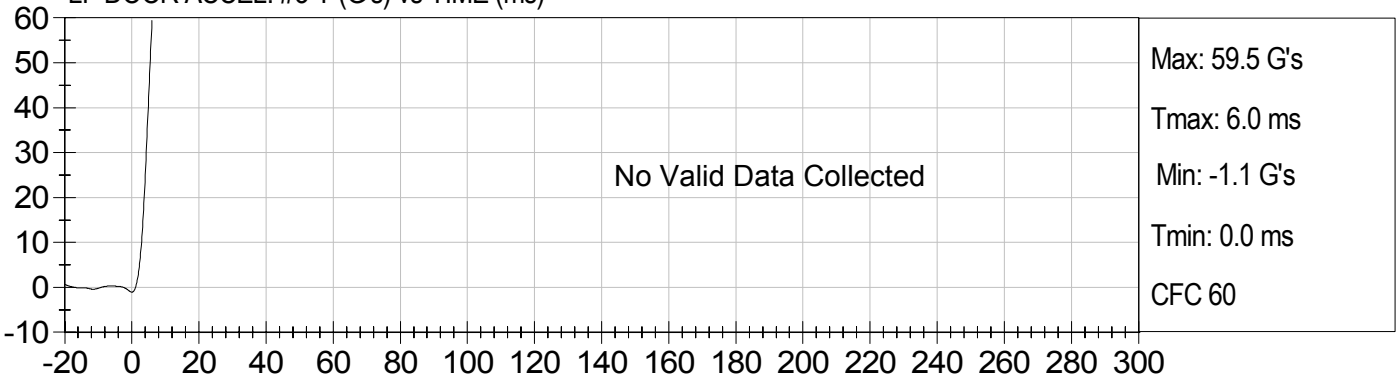
LF DOOR ACCEL. #1 Y (G's) vs TIME (ms)



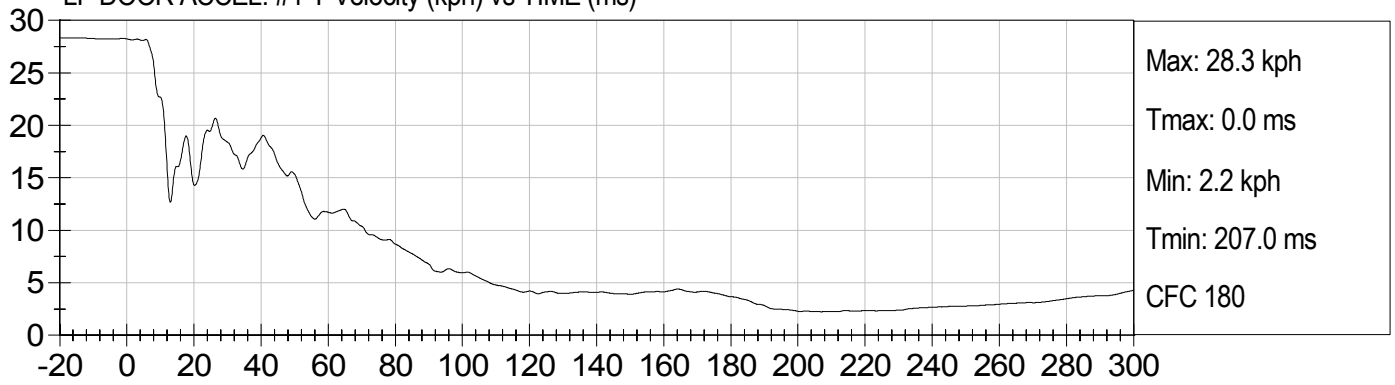
LF DOOR ACCEL. #2 Y (G's) vs TIME (ms)



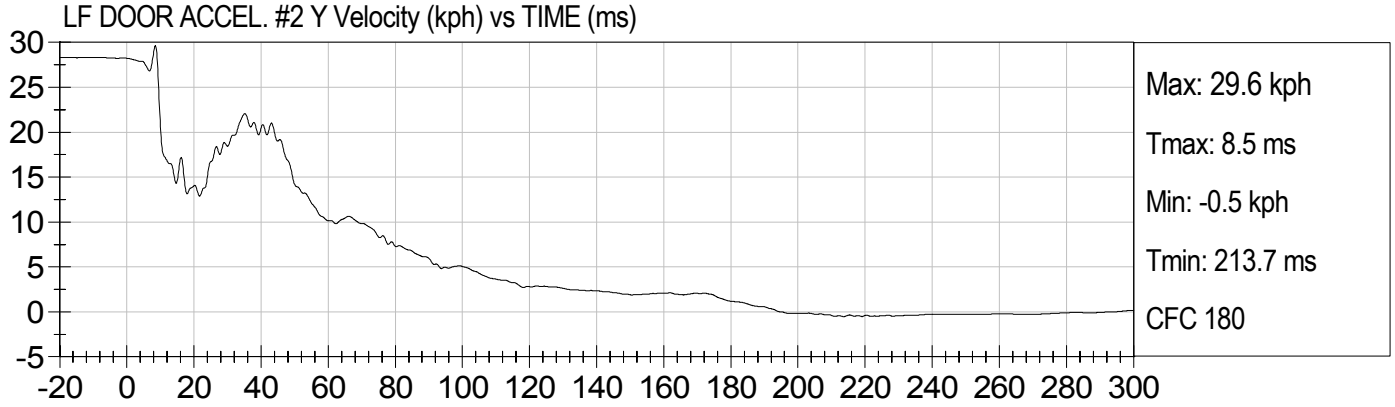
LF DOOR ACCEL. #3 Y (G's) vs TIME (ms)



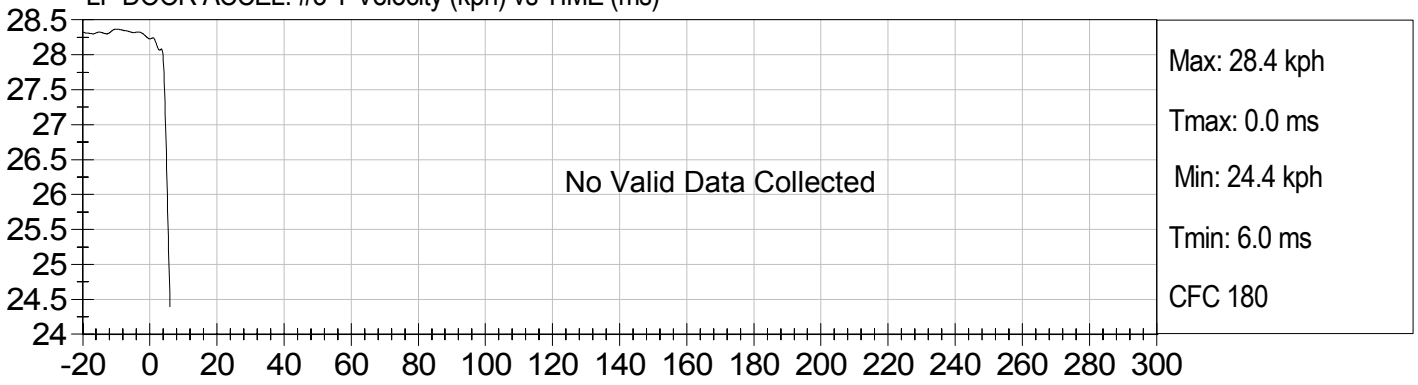
LF DOOR ACCEL. #1 Y Velocity (kph) vs TIME (ms)



LF DOOR ACCEL. #2 Y Velocity (kph) vs TIME (ms)



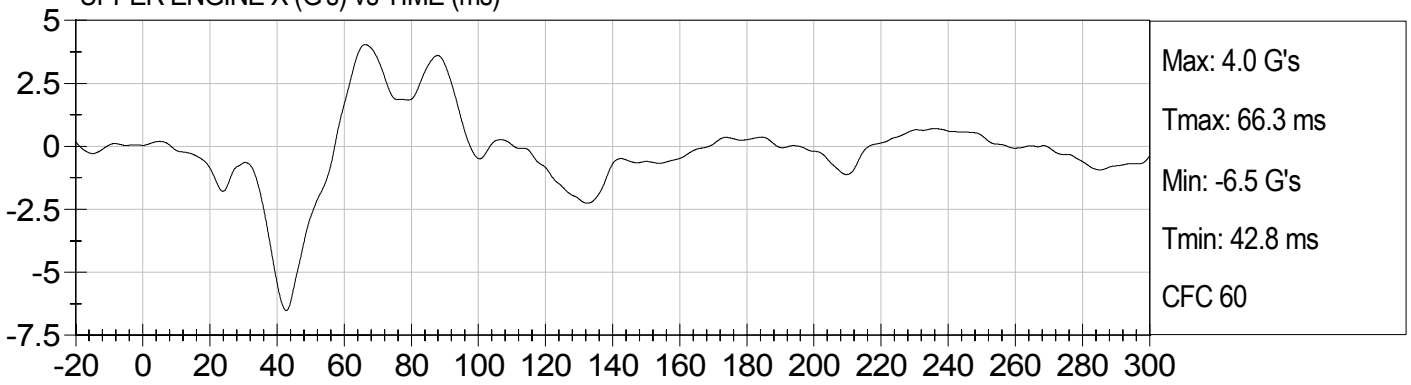
LF DOOR ACCEL. #3 Y Velocity (kph) vs TIME (ms)



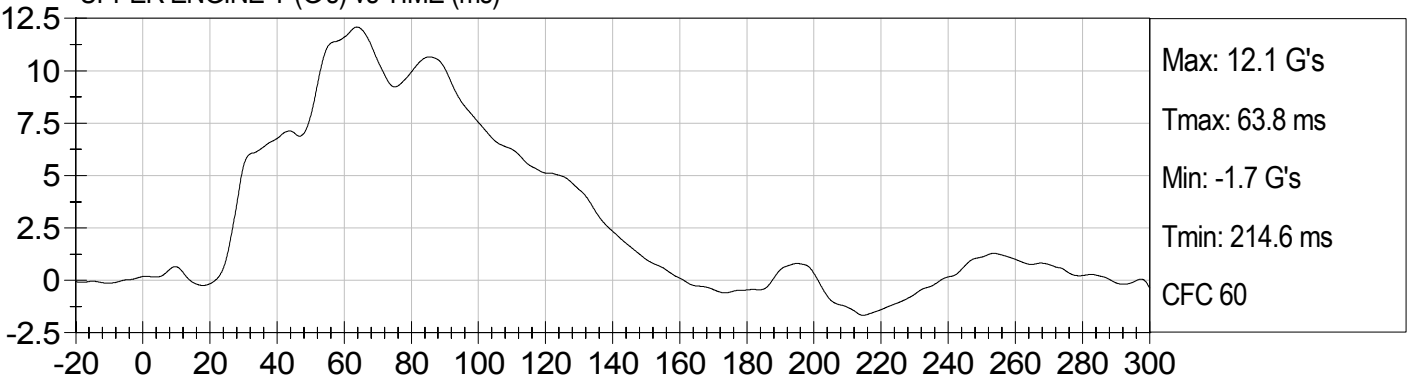
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

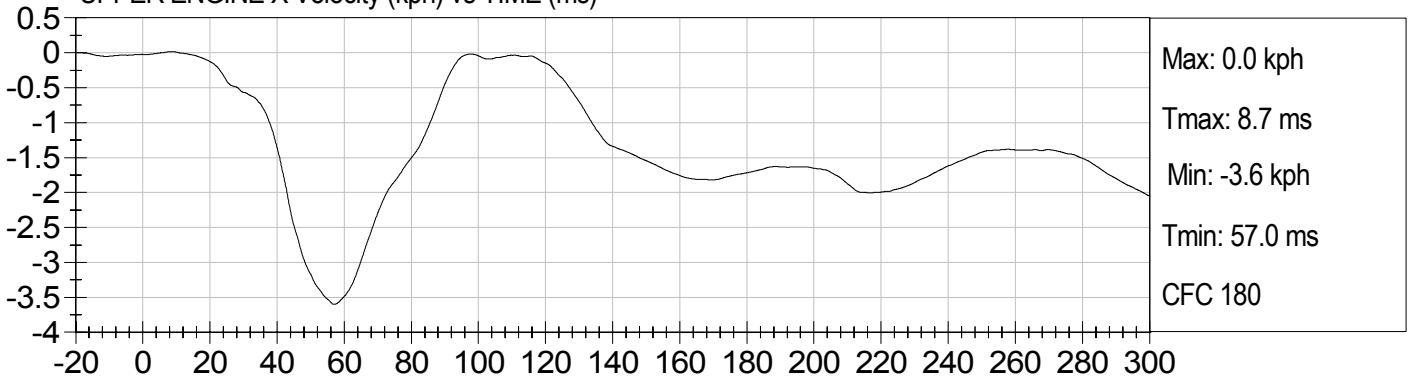
UPPER ENGINE X (G's) vs TIME (ms)



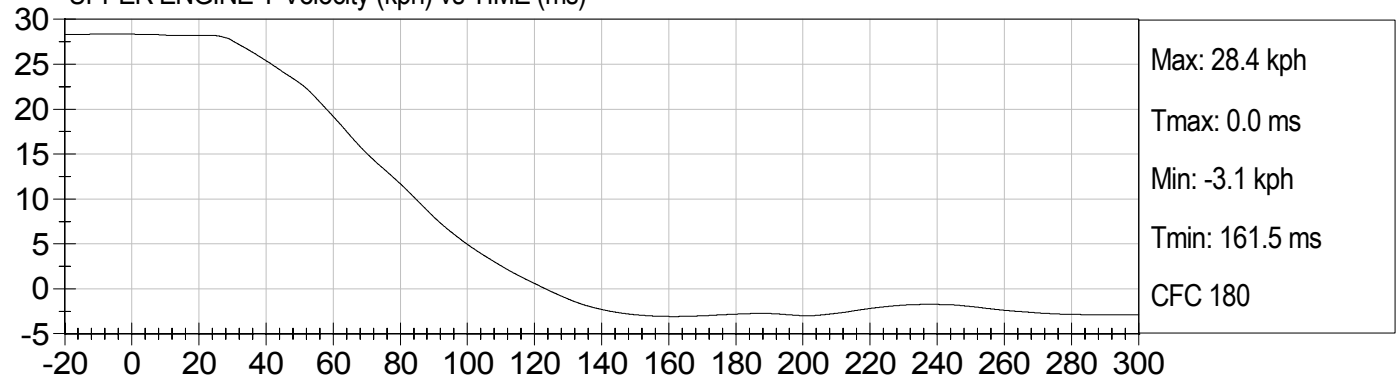
UPPER ENGINE Y (G's) vs TIME (ms)



UPPER ENGINE X Velocity (kph) vs TIME (ms)



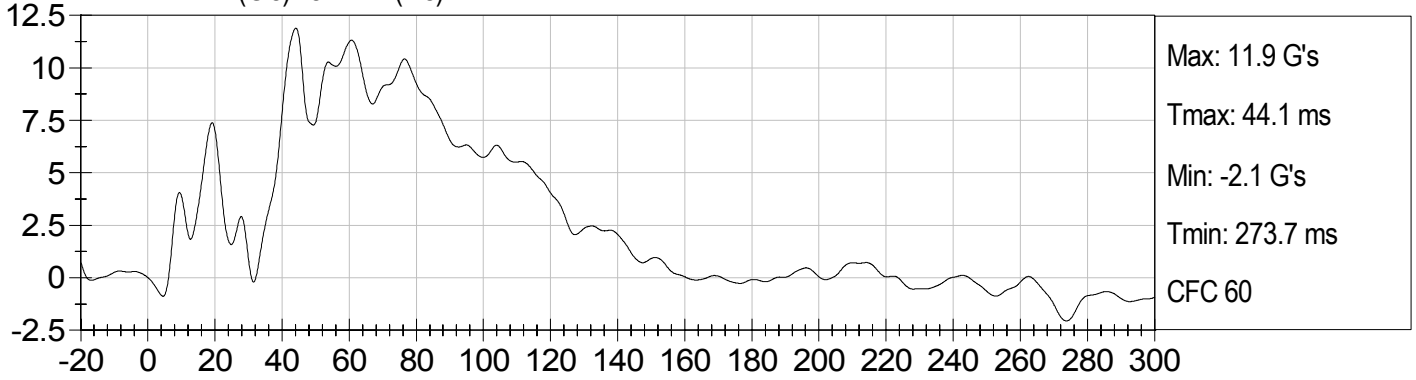
UPPER ENGINE Y Velocity (kph) vs TIME (ms)



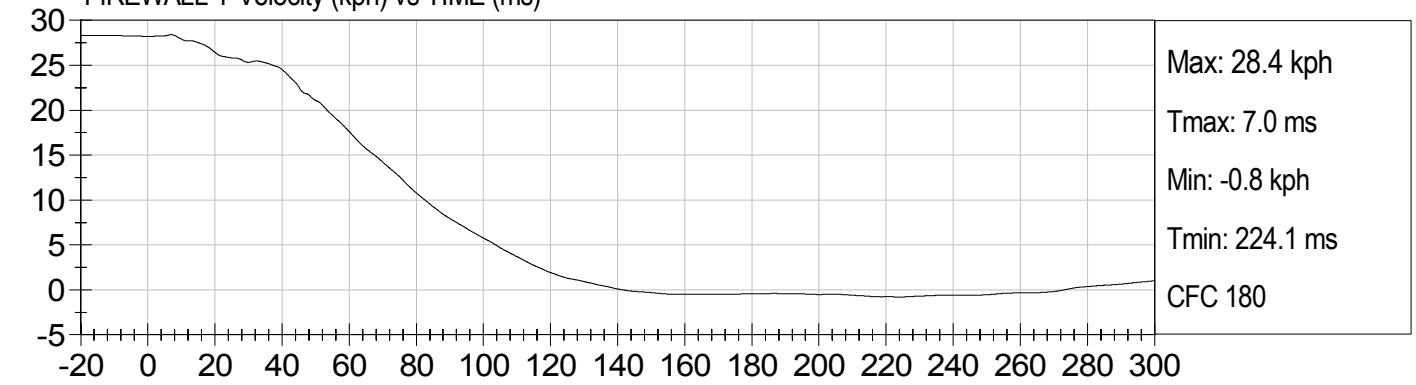
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

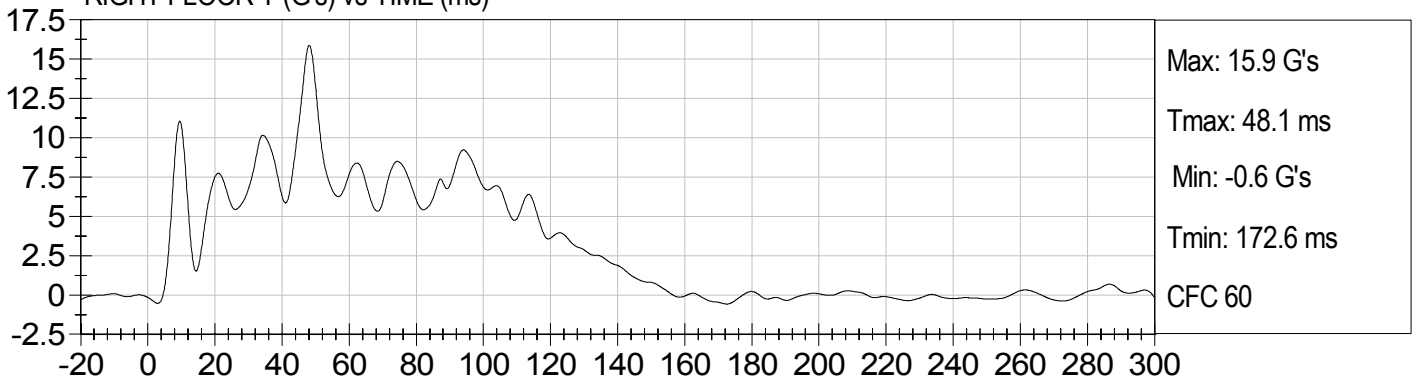
FIREWALL Y (G's) vs TIME (ms)



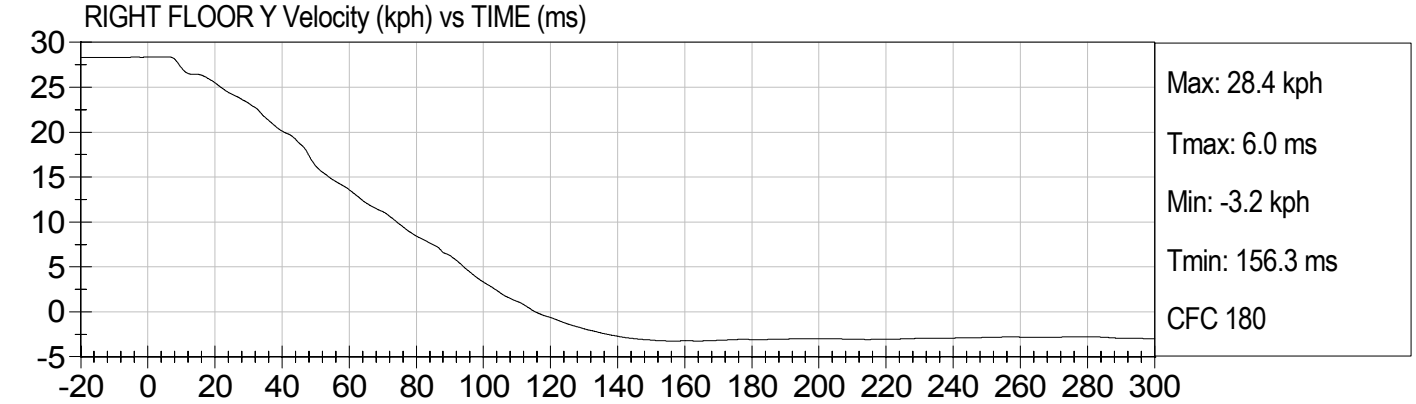
FIREWALL Y Velocity (kph) vs TIME (ms)



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

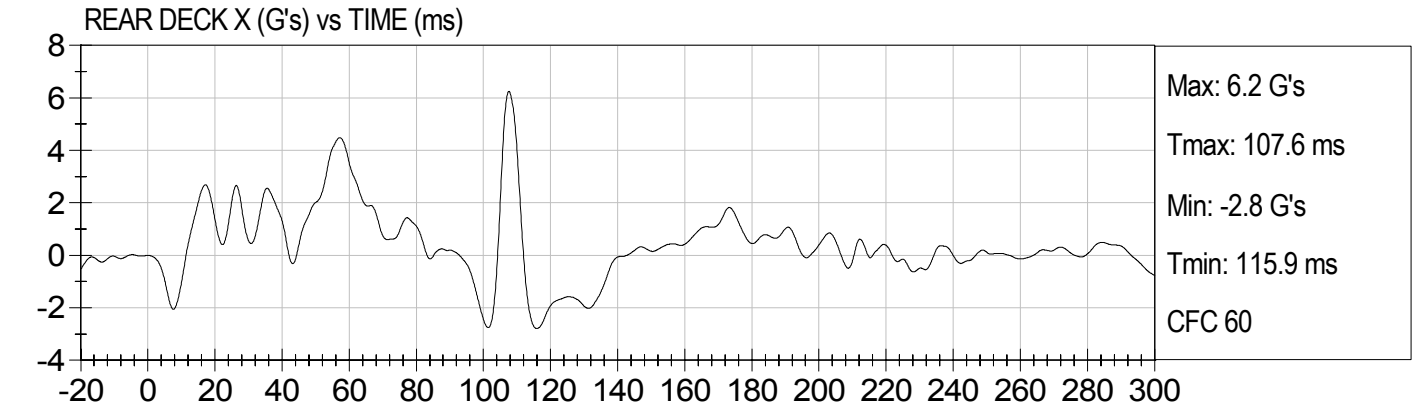


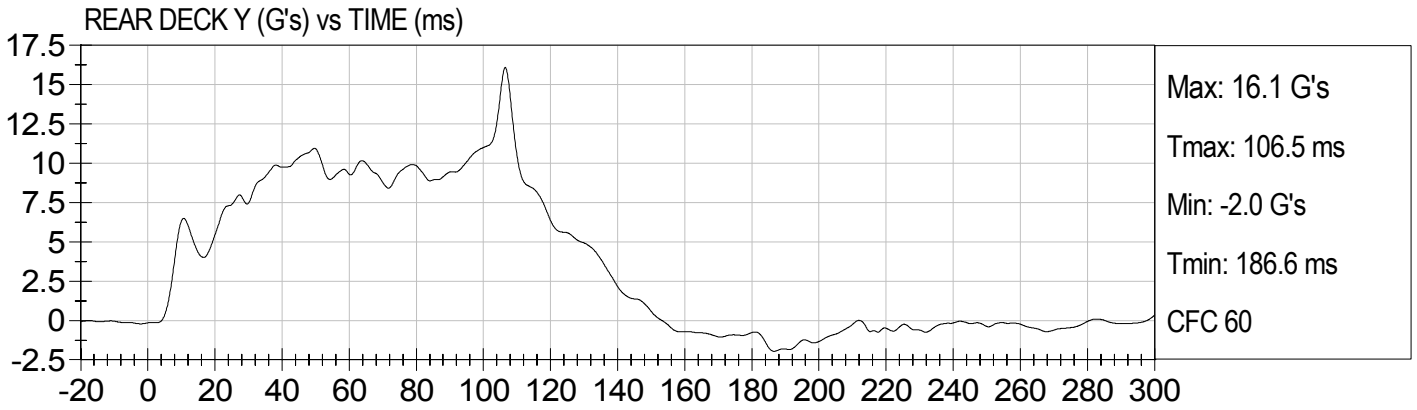
RIGHT FLOOR Y Velocity (kph) vs TIME (ms)

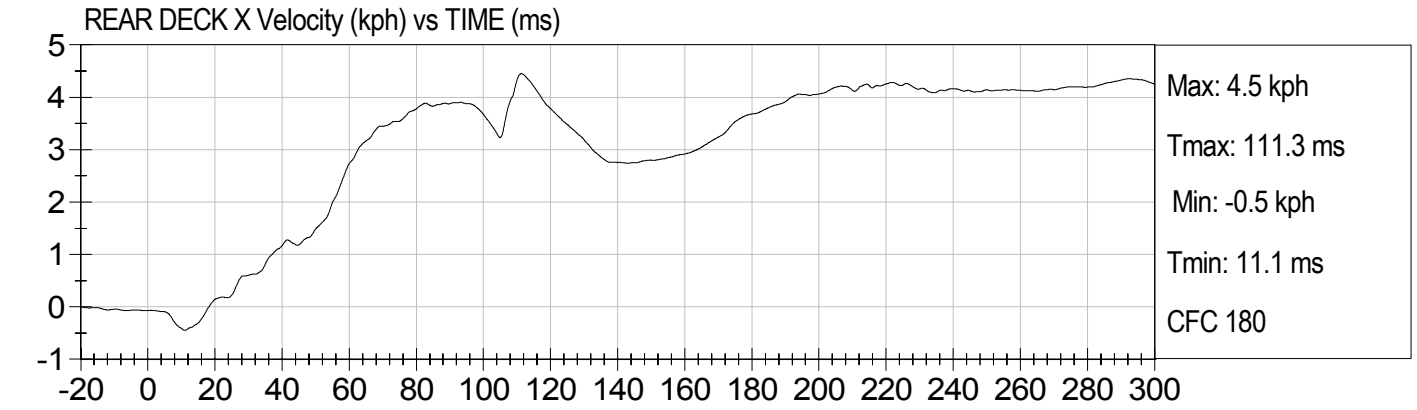


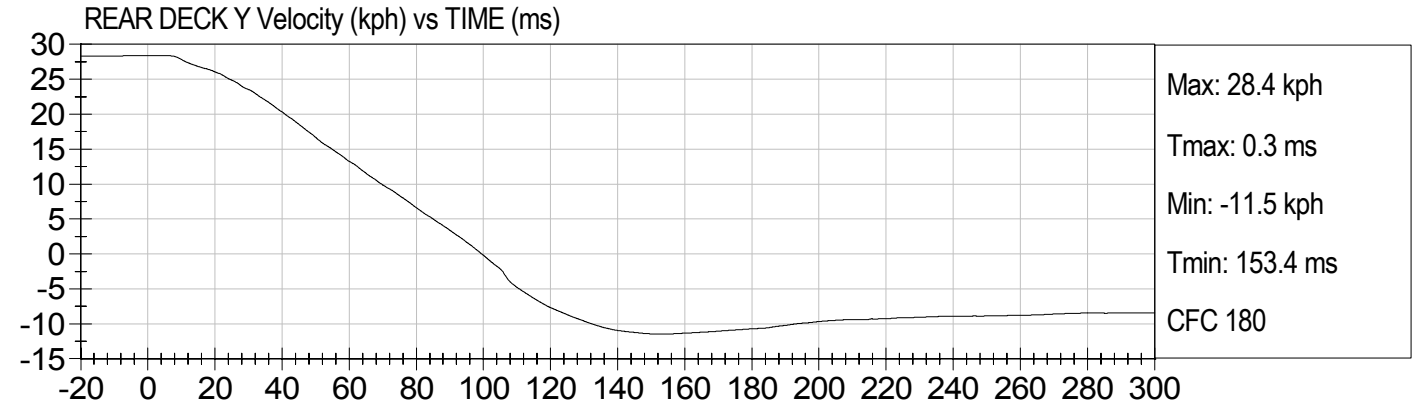
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)





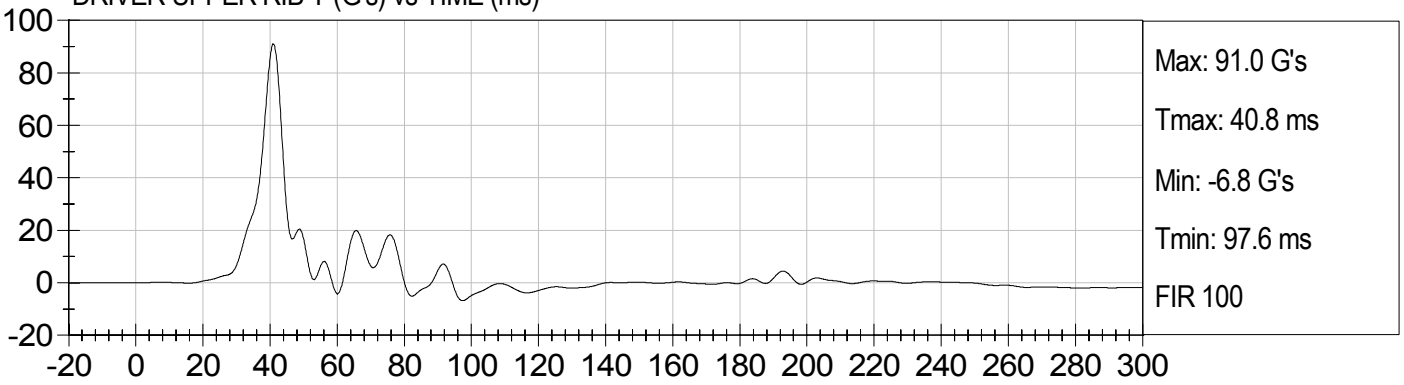




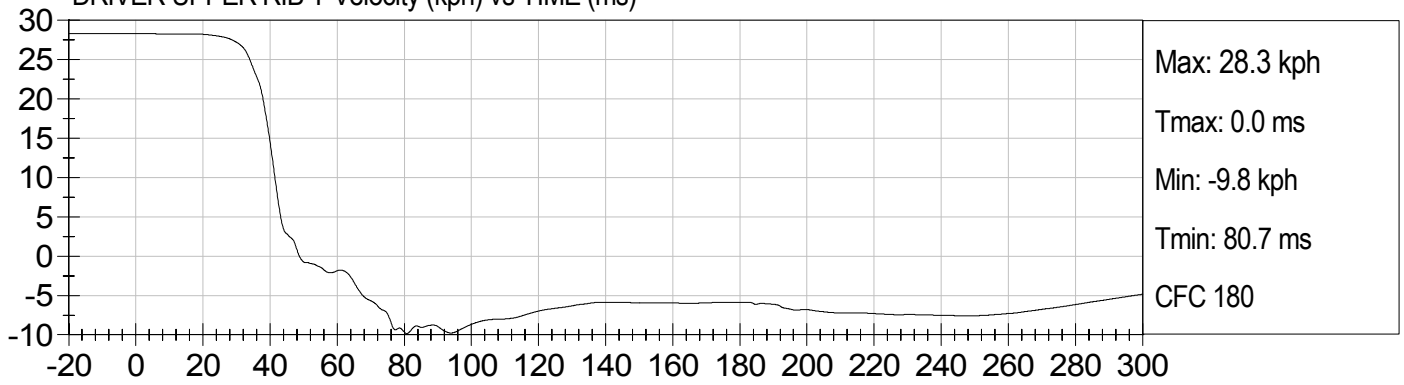
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

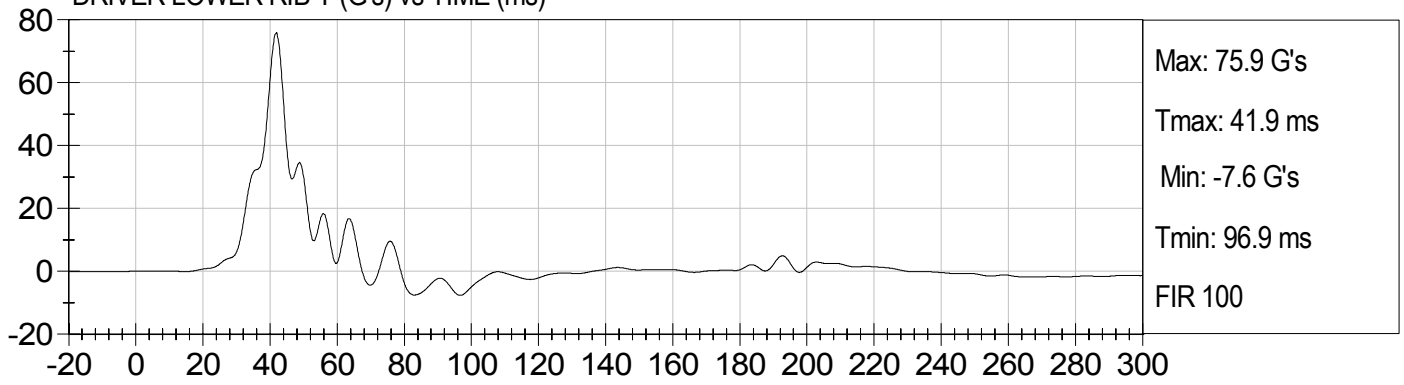
DRIVER UPPER RIB Y (G's) vs TIME (ms)



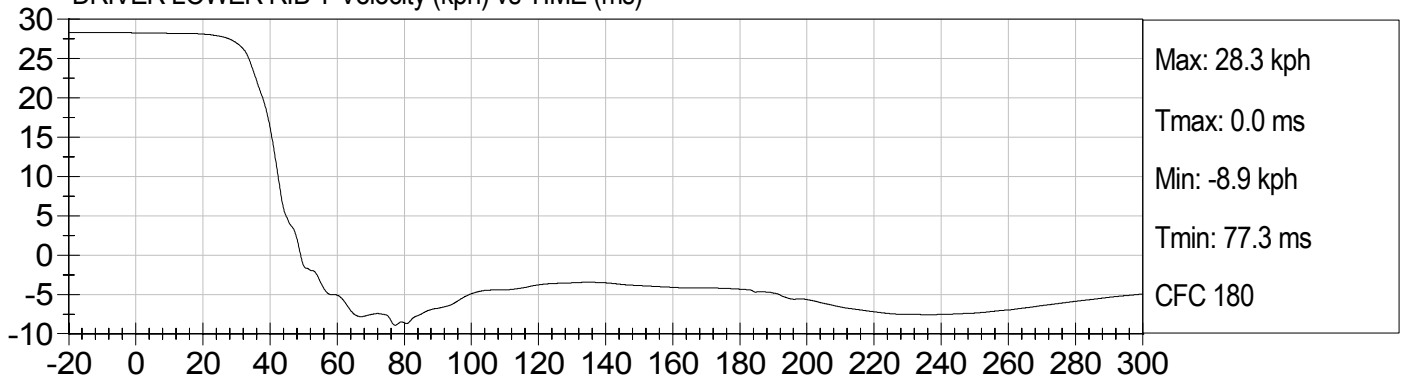
DRIVER UPPER RIB Y Velocity (kph) vs TIME (ms)



DRIVER LOWER RIB Y (G's) vs TIME (ms)



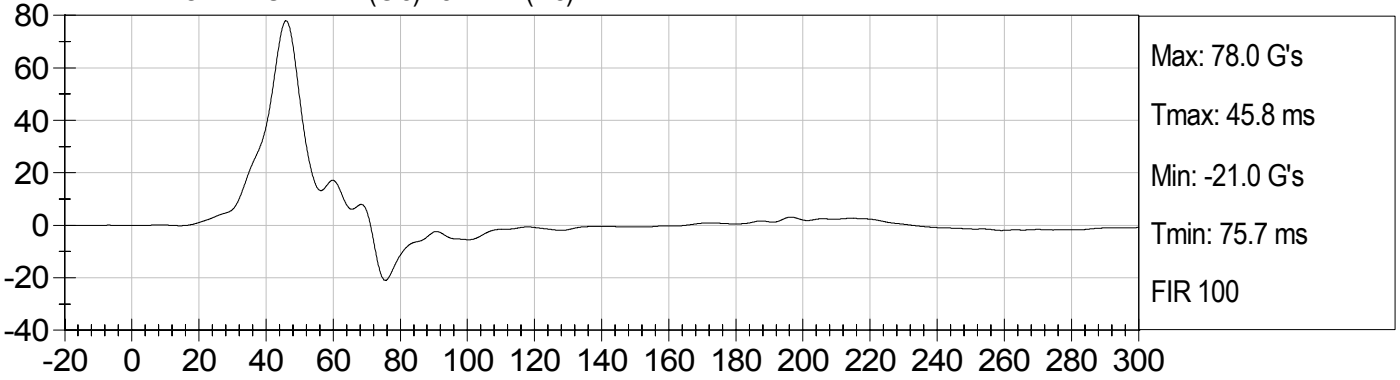
DRIVER LOWER RIB Y Velocity (kph) vs TIME (ms)



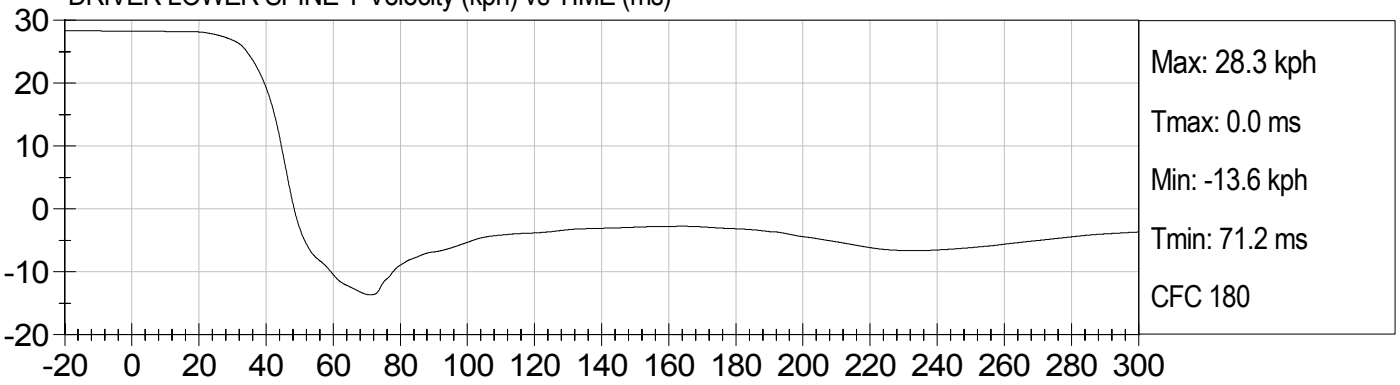
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

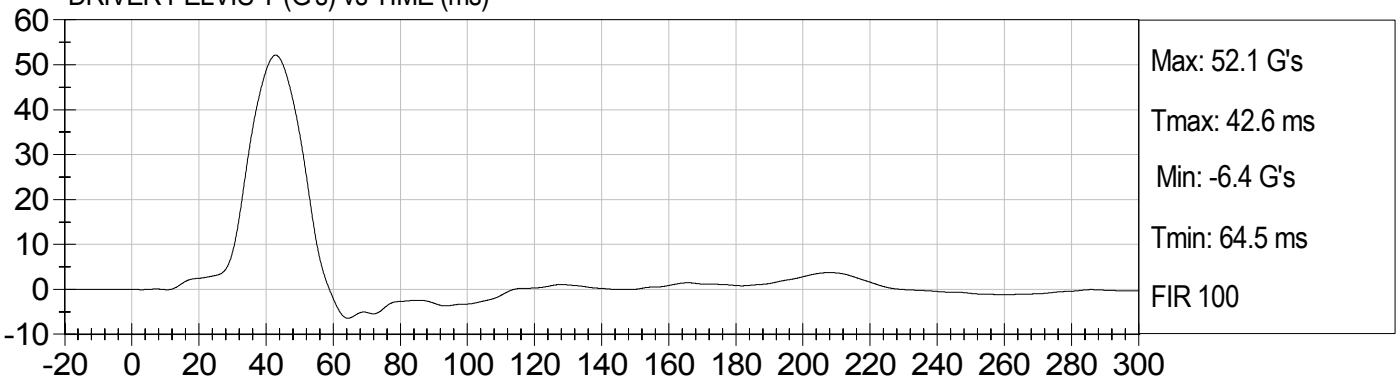
DRIVER LOWER SPINE Y (G's) vs TIME (ms)



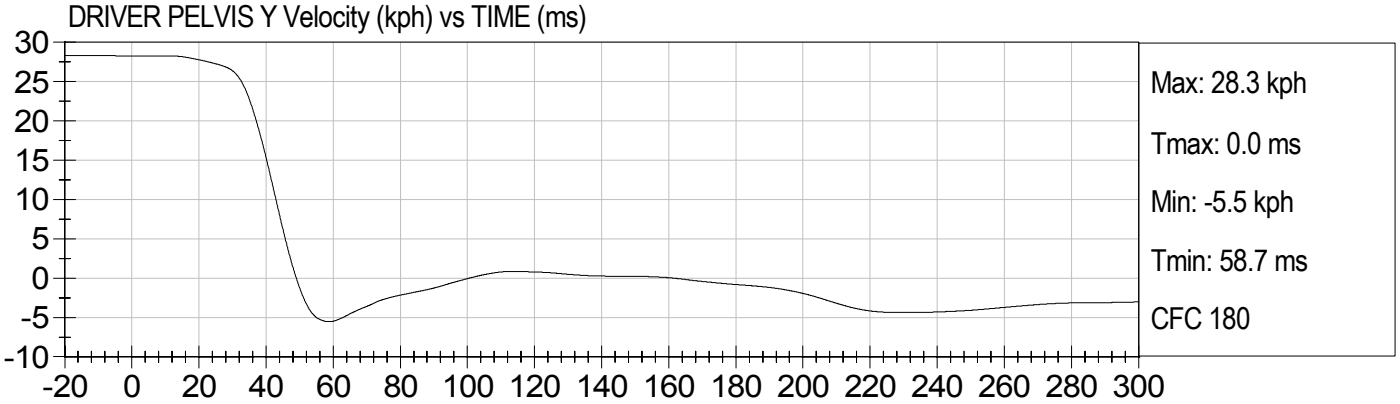
DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)



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



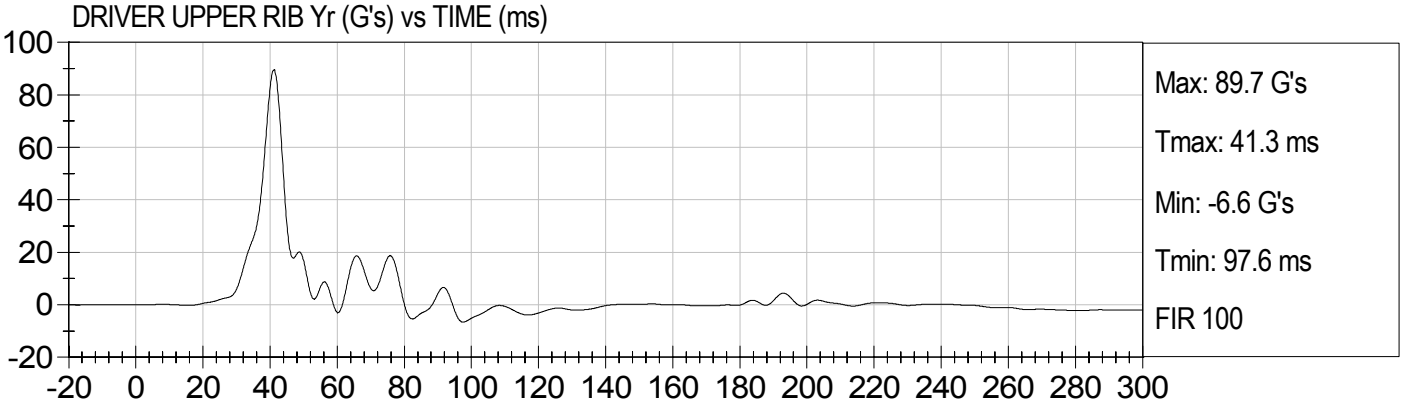
DRIVER PELVIS Y Velocity (kph) vs TIME (ms)



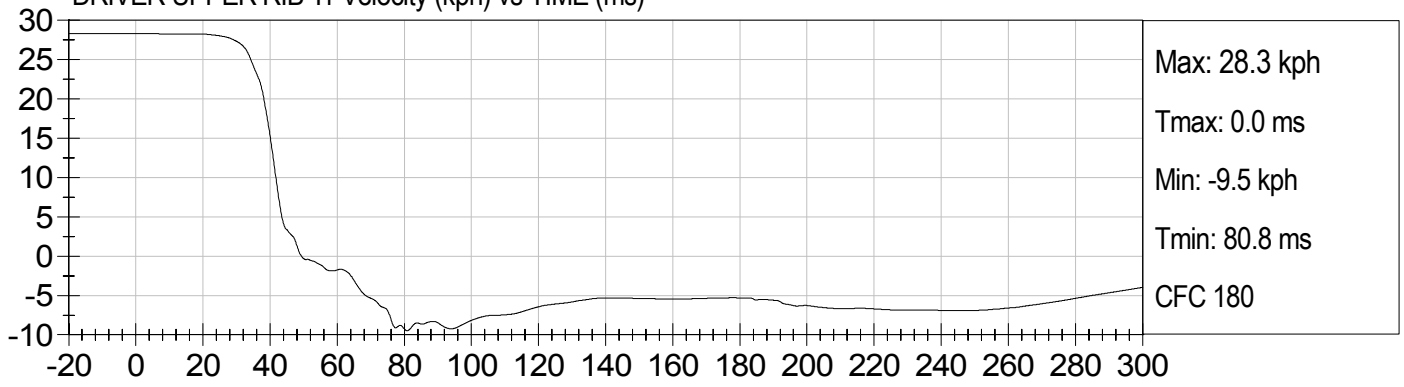
FMVSS 201P RIGID POLE SIDE IMPACT
2006 SATURN ION

Test Date: 09/06/2006
Speed: 17.6 mph (28.3 km/h)

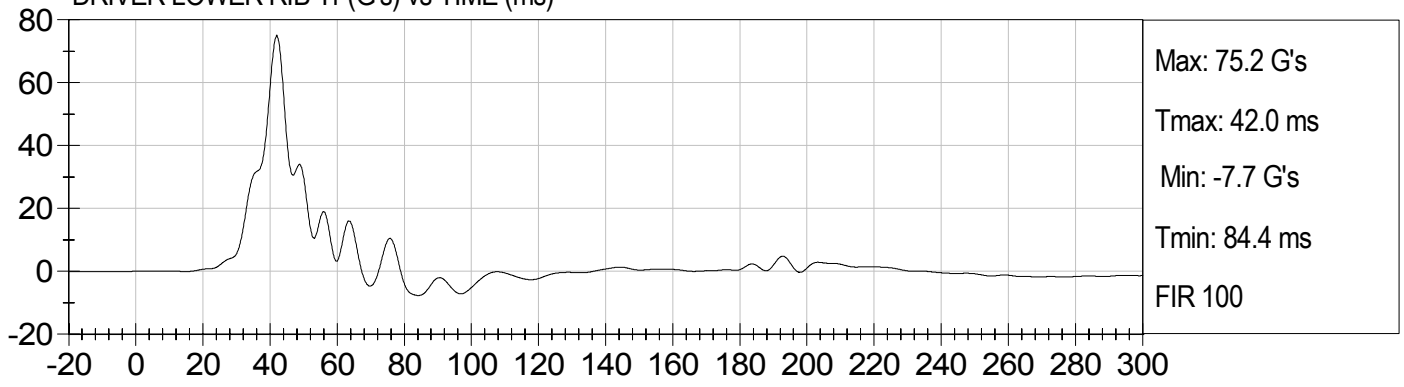
DRIVER UPPER RIB Yr (G's) vs TIME (ms)



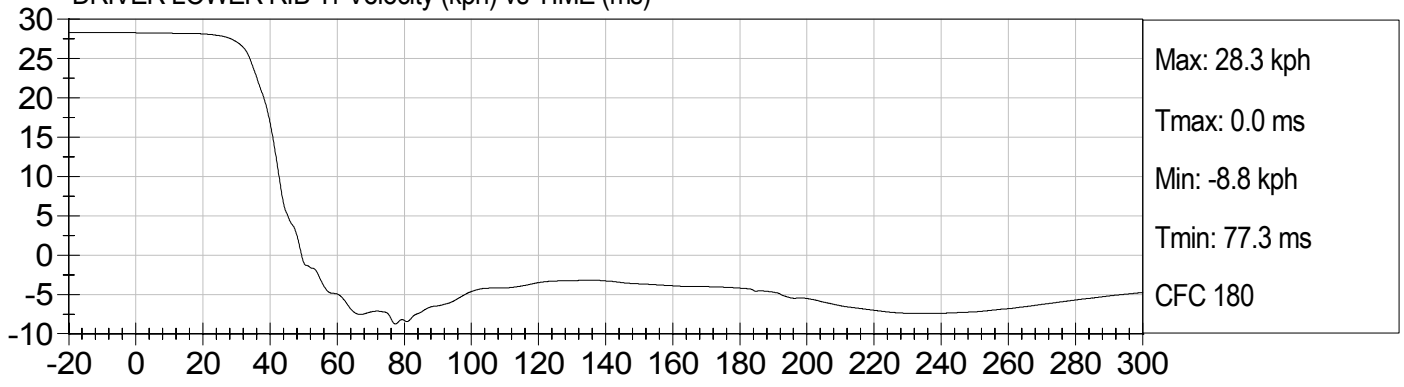
DRIVER UPPER RIB Yr Velocity (kph) vs TIME (ms)



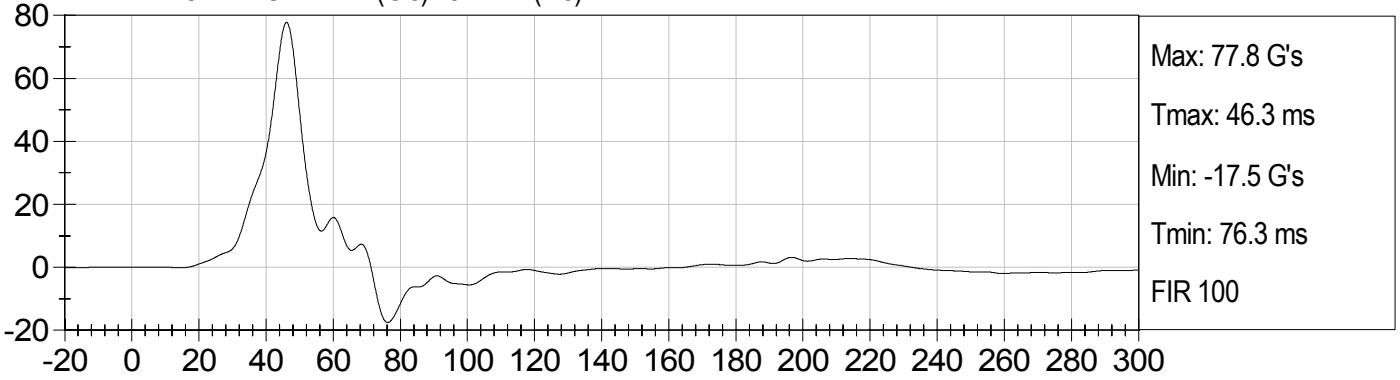
DRIVER LOWER RIB Yr (G's) vs TIME (ms)



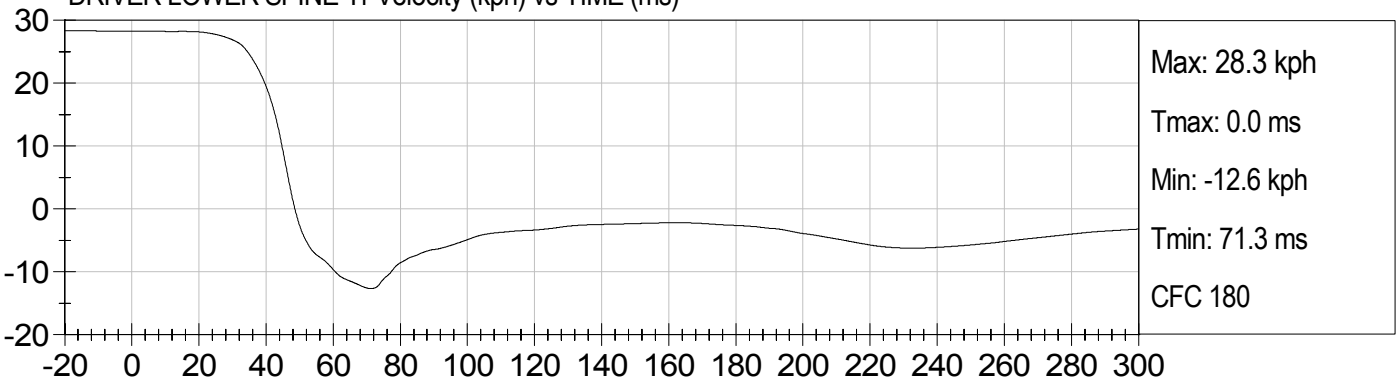
DRIVER LOWER RIB Yr Velocity (kph) vs TIME (ms)



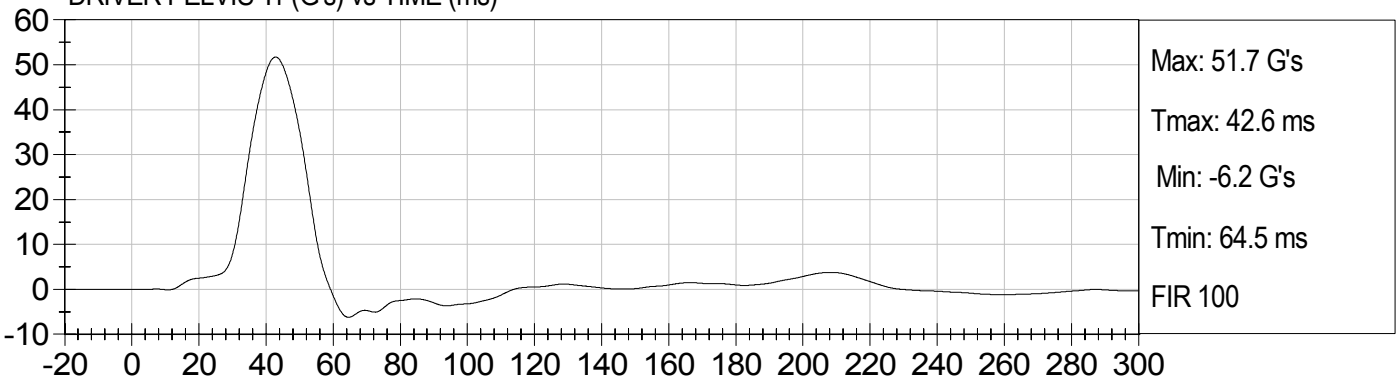
DRIVER LOWER SPINE Yr (G's) vs TIME (ms)



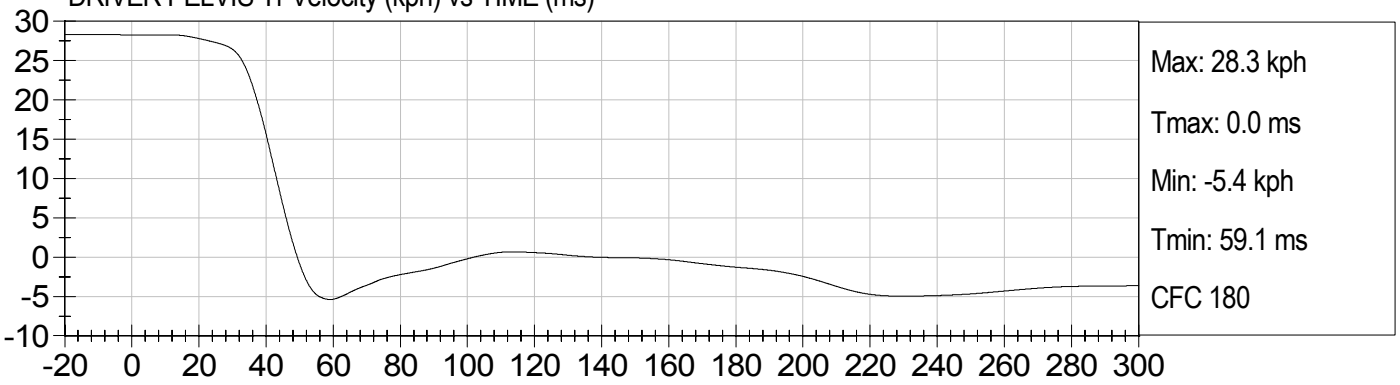
DRIVER LOWER SPINE Yr Velocity (kph) vs TIME (ms)



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



DRIVER PELVIS Yr Velocity (kph) vs TIME (ms)

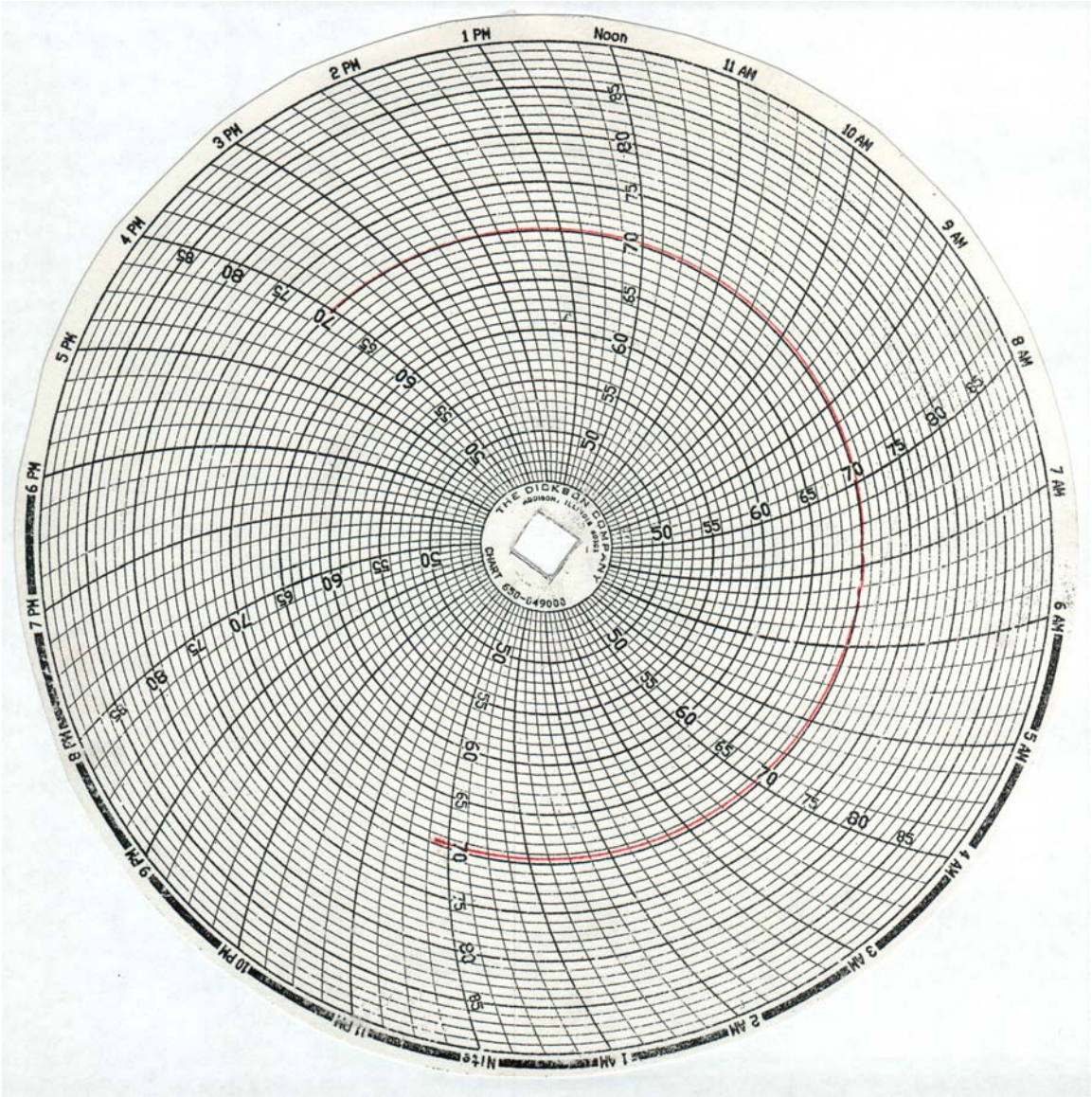


APPENDIX C

SID/HIII CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Vehicle and Dummy Temperature

Test Vehicle:	2006 Saturn Ion 4-Dr. Sedan	NHTSA No.	C60107
Test Program:	FMVSS 201P	Test Date:	September 6, 2006



SID Calibration Data Sheet

Side Impact Dummy

Head Drop Calibration (Lateral)

ATD Serial No: 037 **Test I.D:** D061721

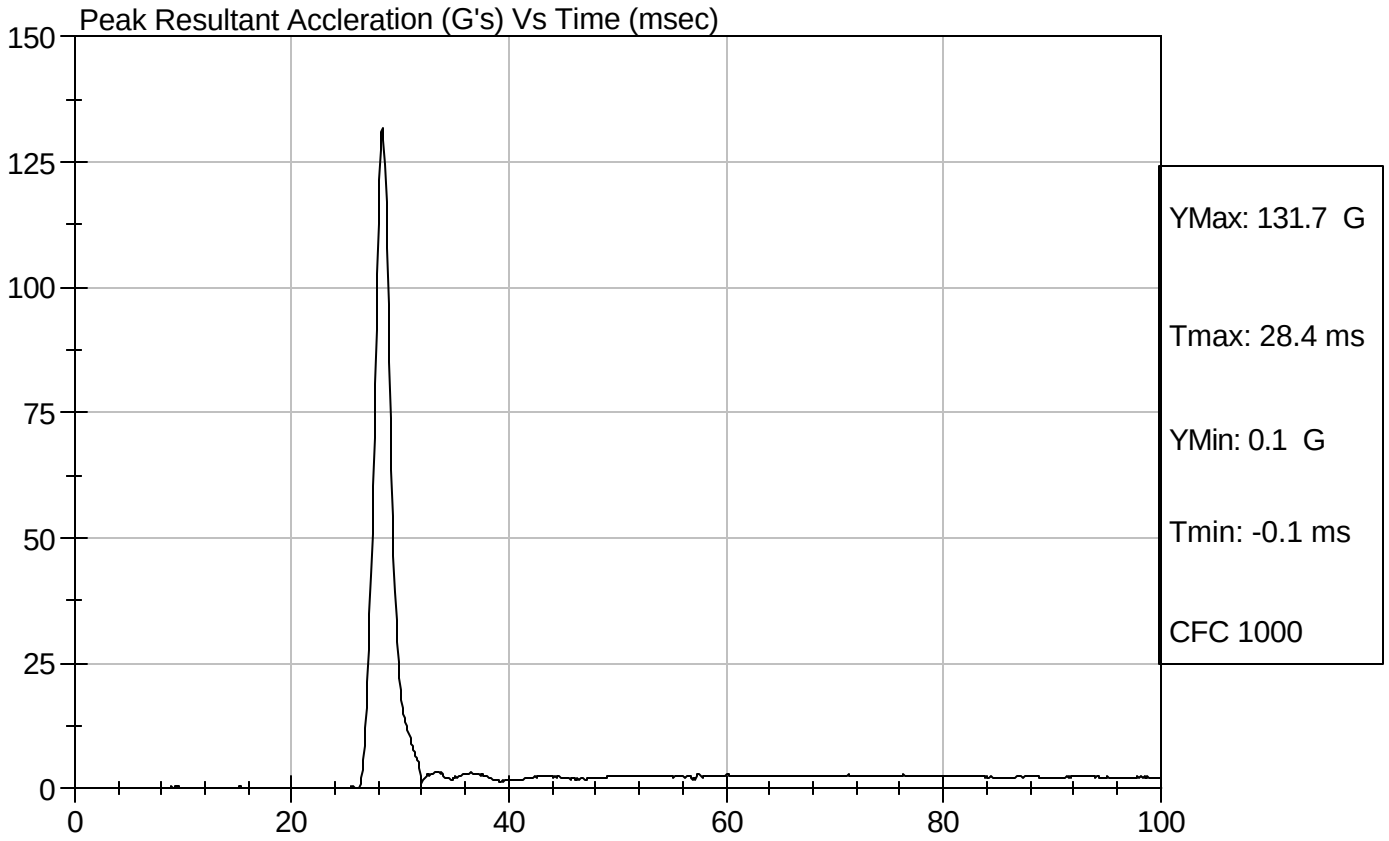
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Peak Resultant Acceleration	G's	120 to 150	132	Pass
Is Resultant Curve Unimodal?	Yes/No	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-6.7	Pass
		Overall Test Results		Pass

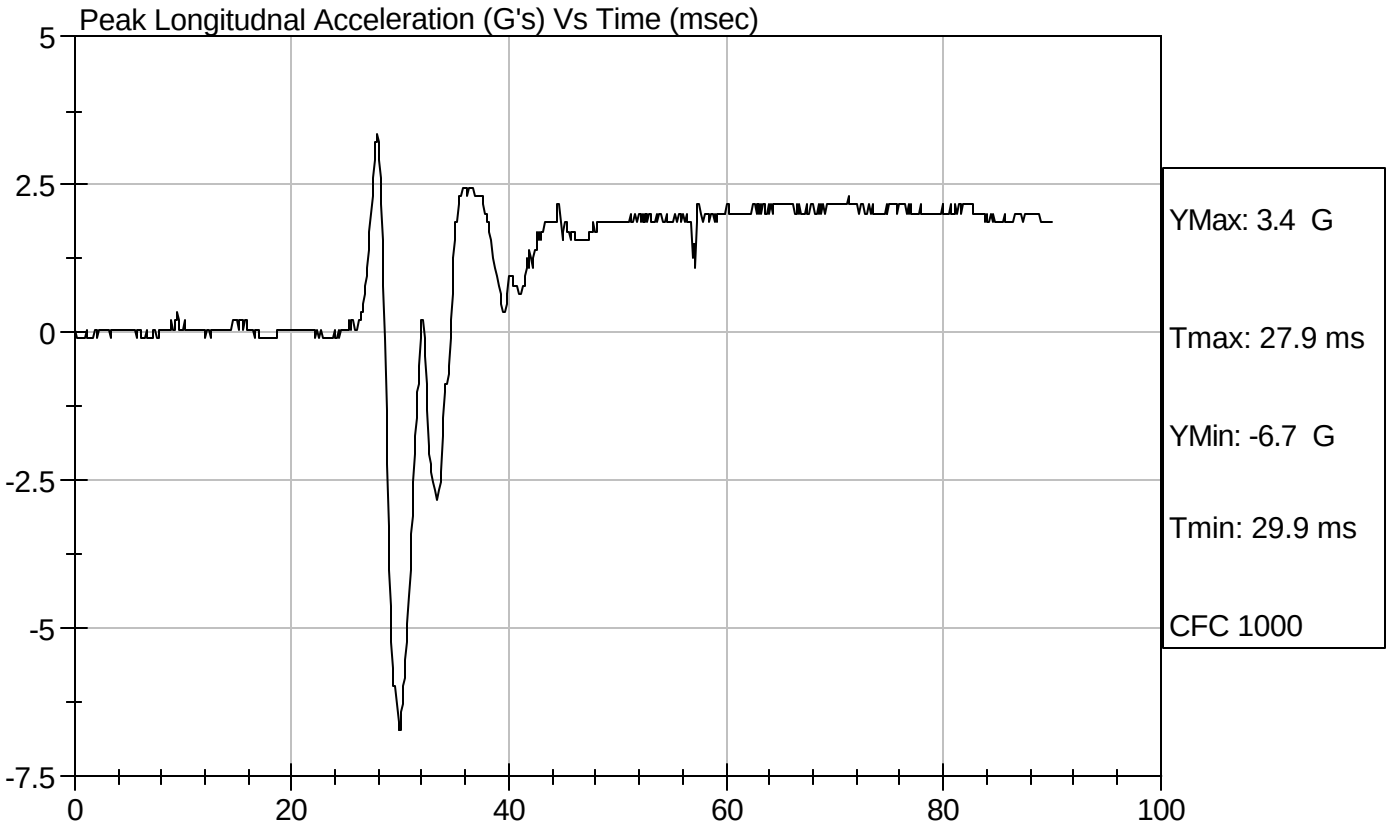
Jessica Hall
Laboratory Technician

06/13/2006
Test Date

David Winkelbauer
Approved By

	Test Description: Head Drop	Test Date: 06/13/2006
	Component: D061721	Speed: 0 ft/s, 0.00 m/s





SID/HIII Calibration Data Sheet

Side Impact Dummy

Thorax Impact Test

ATD Serial No: 037 **Test I.D:** D061722

Tested Parameter	Units	Specification	Pass/Fail	
Laboratory Temperature	deg C	18.9 - 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/s	4	4.30	Pass
Upper Rib	G's	37 - 46	40	Pass
Lower Rib	G's	37 - 46	41	Pass
Lower Spine	G's	15 - 22	22	Pass
		Overall Test Results		Pass

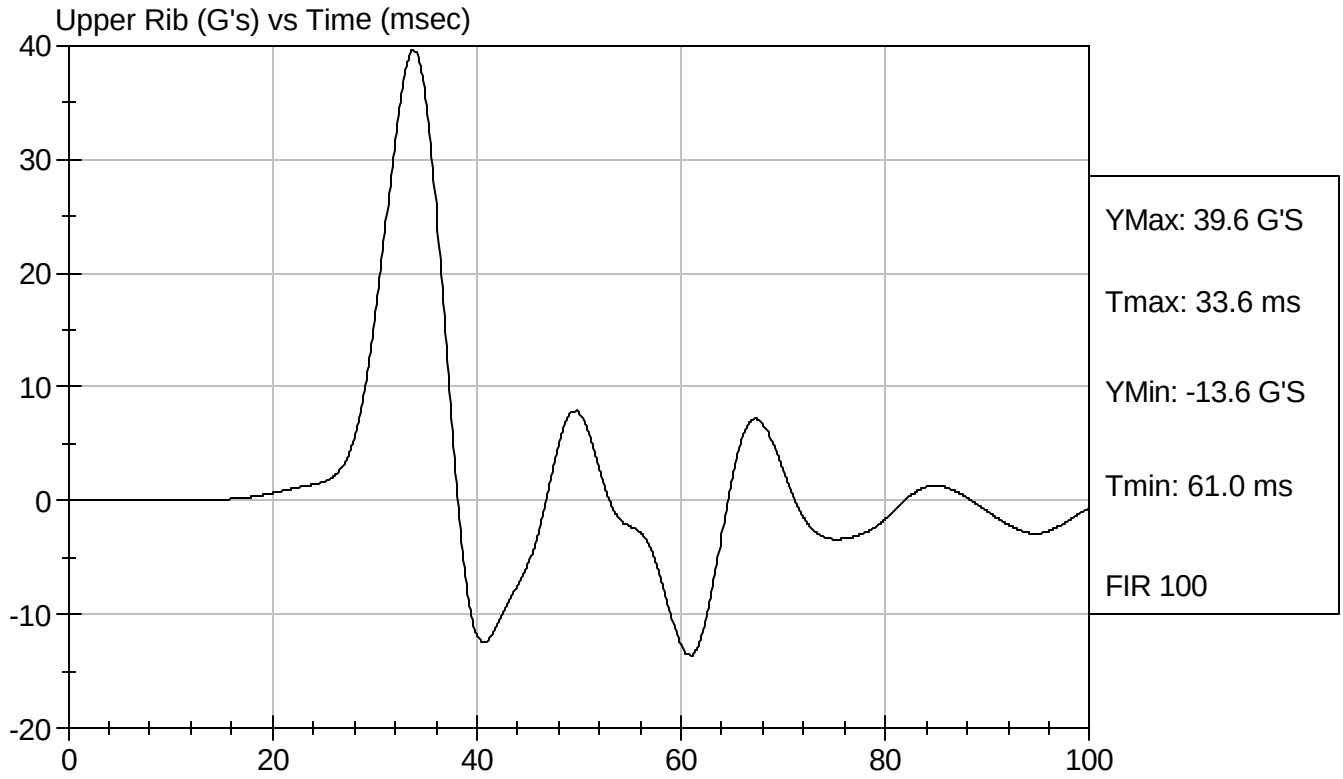
Jessica Hall
Laboratory Technician

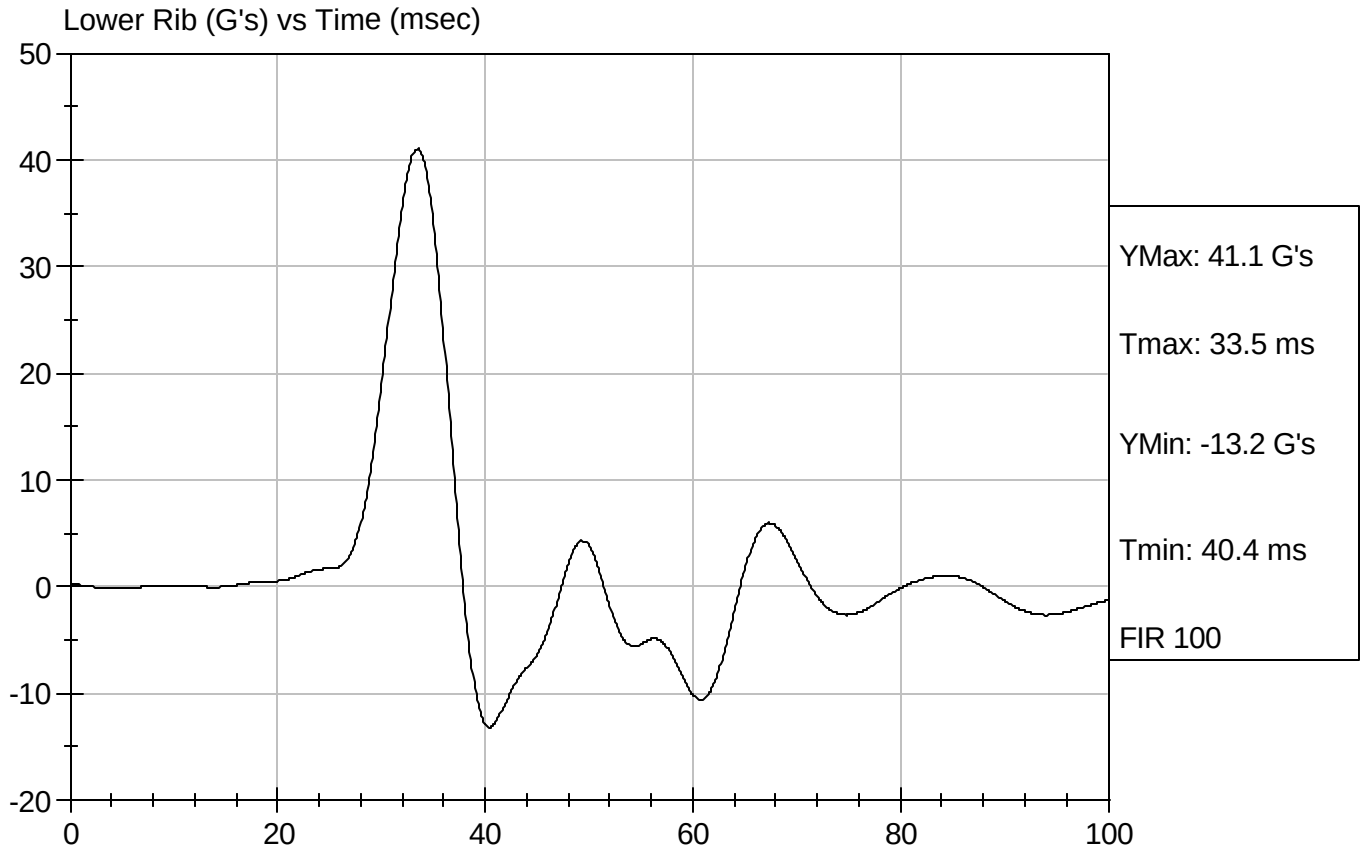
06/14/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D061722

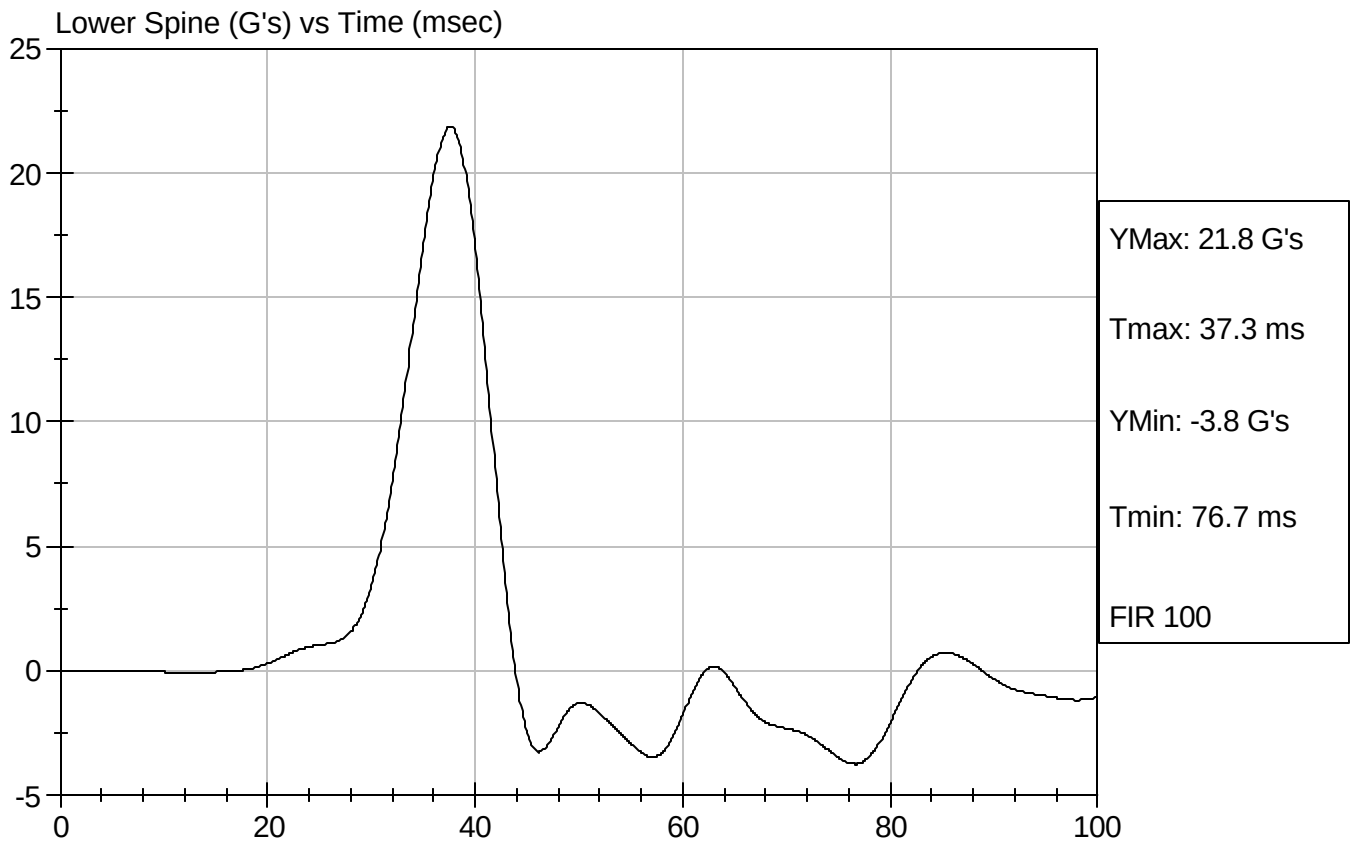
Test Date: 06/14/2006
Speed: 14.11 ft/sec, 4.30 m/sec





Test Desc: Thorax Impact
Component ID: D061722

Test Date: 06/14/2006
Speed: 14.11 ft/sec, 4.30 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy

Pelvis Impact Test

ATD Serial No: 037 **Test I.D:** D061723

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	44	Pass
		Overall Test Results		Pass

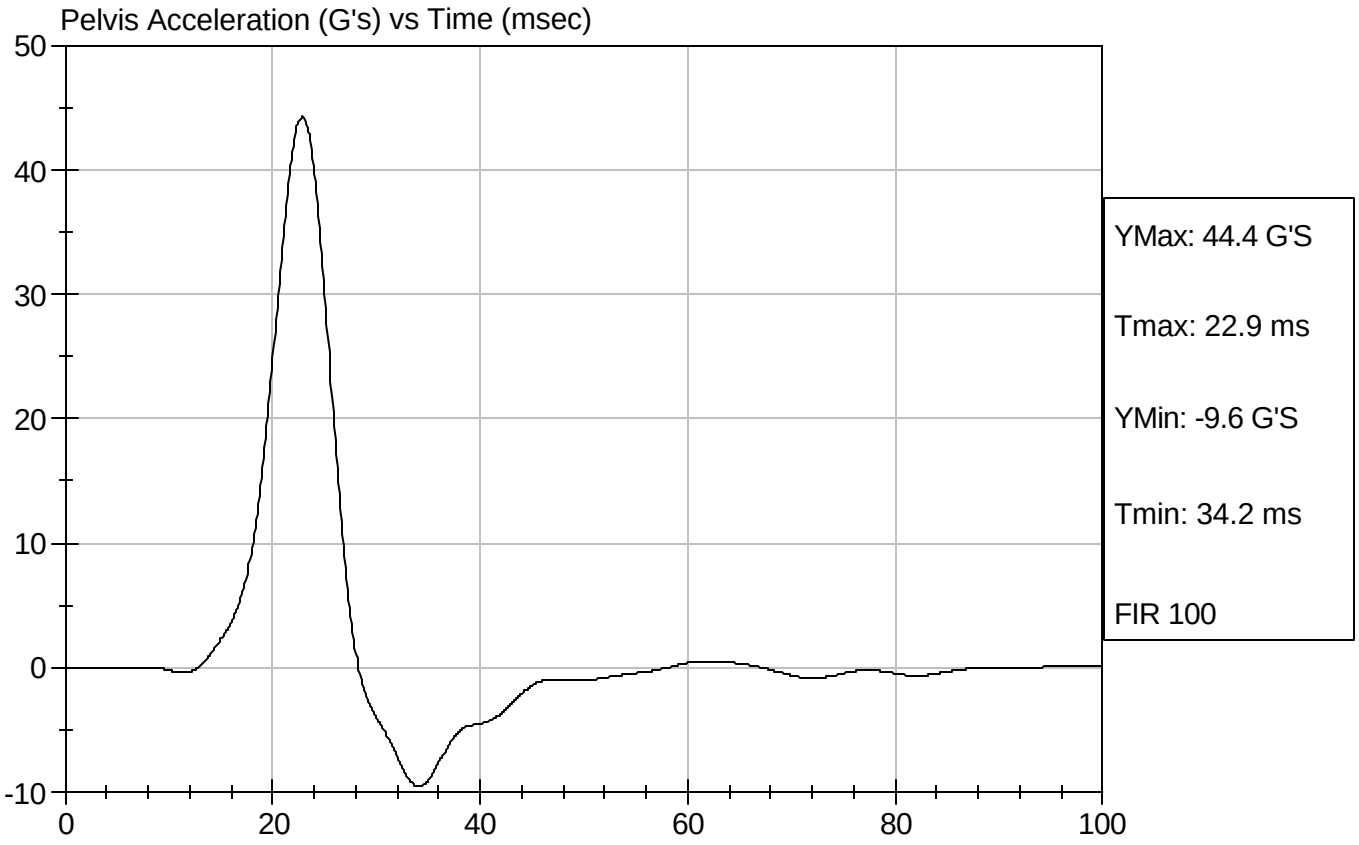
Jessica Hall
Laboratory Technician

06/14/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D061723

Test Date: 06/14/2006
Speed: 14.11 ft/sec, 4.30 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy

Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 037 **Test I.D:** D061724

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Force At 12.7 mm	N	104 -162	155	Pass
Force At 19 mm	N	163 - 222	211	Pass
Force At 25.4 mm	N	222 - 280	271	Pass
Force At 33 mm	N	325 - 391	377	Pass
		Overall Test Results		Pass

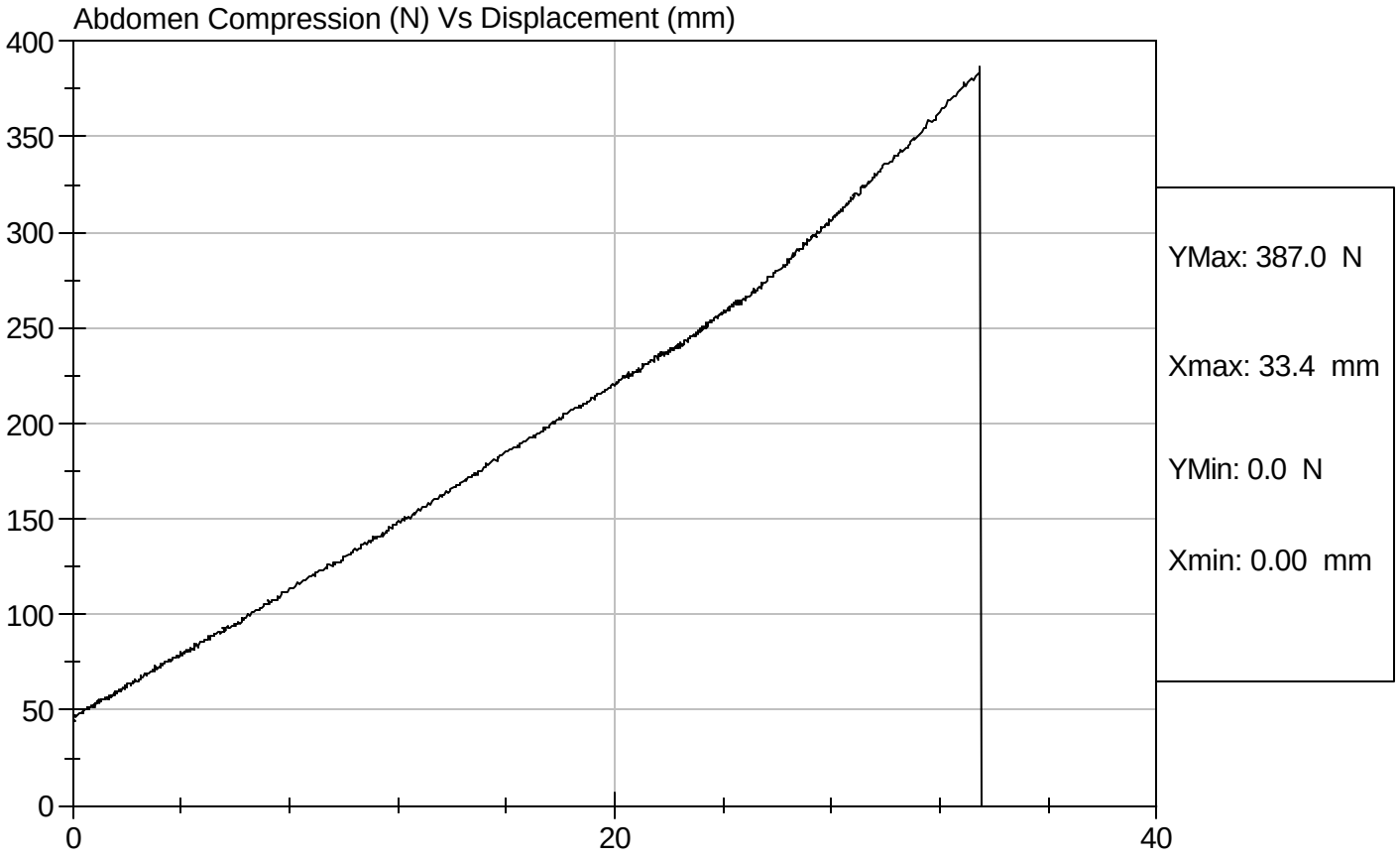
Jessica Hall
Laboratory Technician

06/13/2006
Test Date

David Winkelbauer
Approved By

Test Description: Abdomen Compression Test Date: 06/13/2006

Component: D061724 Speed: 0 ft/sec, 0 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy

Lumbar Flexion Calibration

ATD Serial No: 037 **Test I.D:** D061725

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Force At 0 deg	N	0 - 26.7	0.0	Pass
Force At 20 deg	N	97.9 - 151.2	106.3	Pass
Force At 30 deg	N	151.2 - 204.6	180.8	Pass
Force At 40 deg	N	204.6 - 258.0	238.7	Pass
Return Angle	Deg	12 Maximum	3	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

06/13/2006
Test Date

David Winkelbauer
Approved By

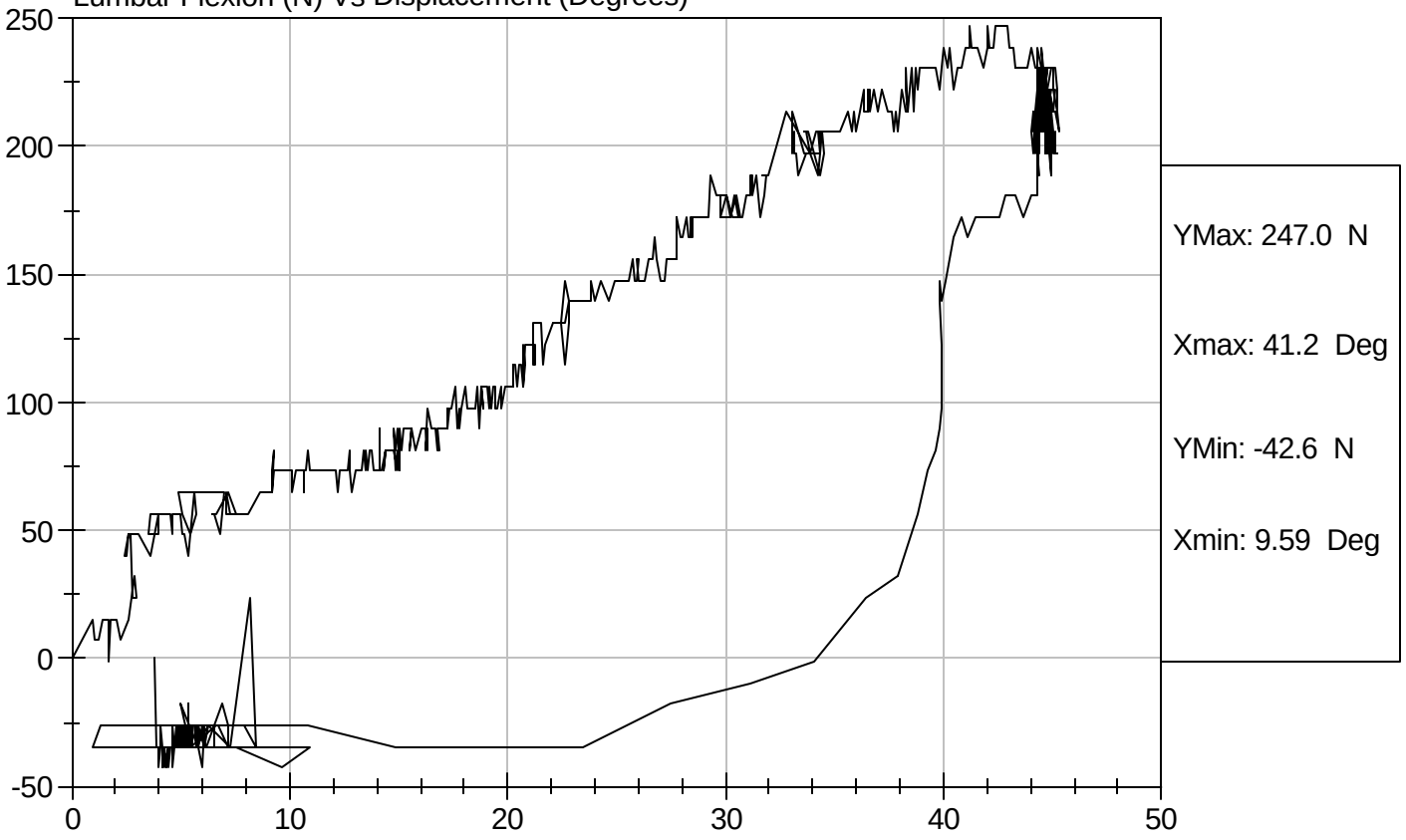
Test Description: Lumbar Flexion

Test Date: 06/13/2006

Component: D061725

Speed: 0 ft/sec, 0 m/sec

Lumbar Flexion (N) Vs Displacement (Degrees)



SID/HIII Calibration Data Sheet

Side Impact Dummy (SID)

Neck Pendulum Test

ATD Serial No: 037 **Test I.D:** D061729

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Impact Velocity		m/s	6.89 to 7.13	6.93	Pass
Pendulum Deceleration	10 msec	m/s	1.96 to 2.55	2.22	Pass
	20 msec	m/s	4.12 to 5.10	4.33	Pass
	30 msec	m/s	5.73 to 7.01	5.99	Pass
	40 to 70 msec	m/s	6.27 to 7.64	7.18	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	68	Pass
Head Rotation Peak to Zero - Decay Time		msec	58 to 67	59	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	78	Pass
Mx Peak To Zero - Decay Time		msec	49 to 64	55	Pass
Mx Peak to Max. Head Rotation		msec	2 to 16	10	Pass

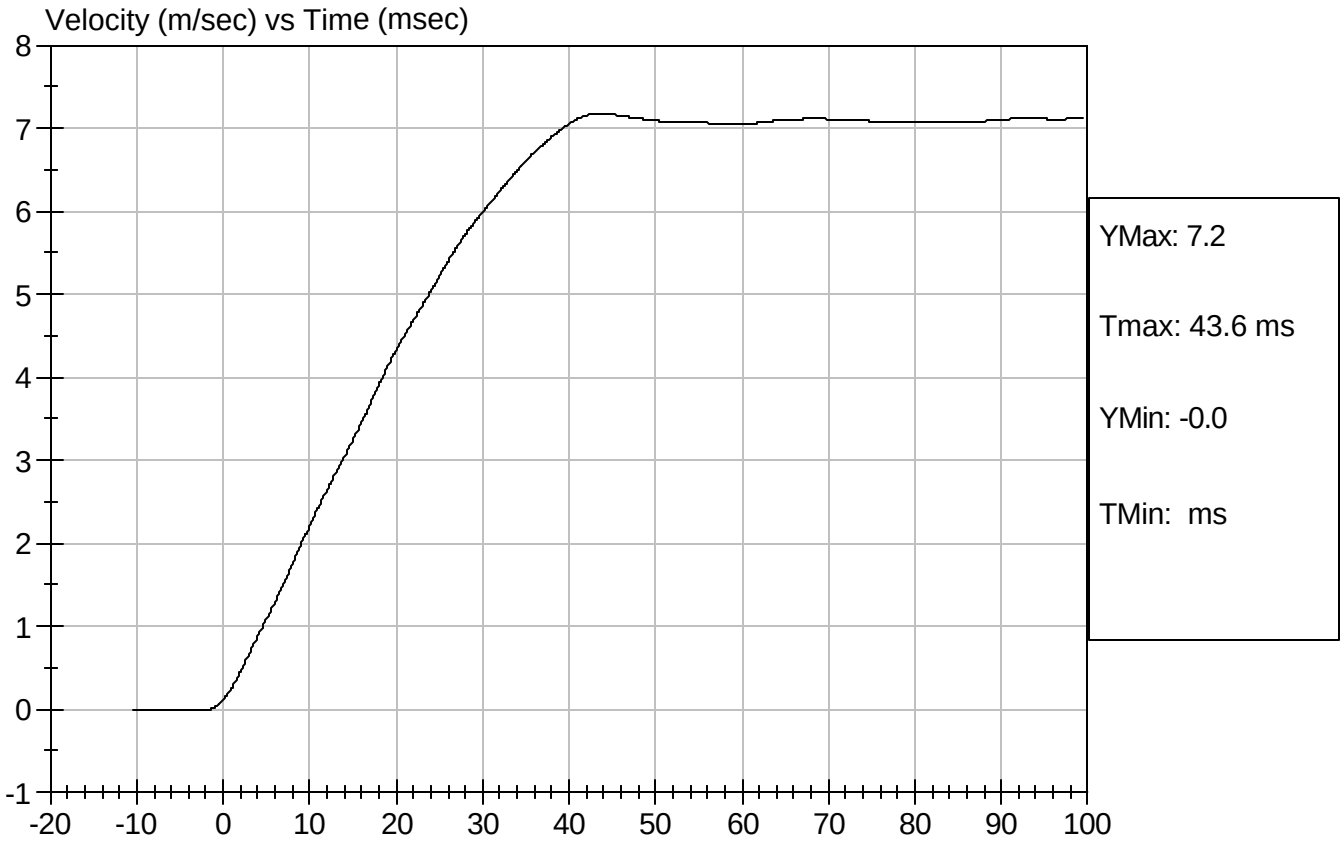
Jessica Hall
Laboratory Technician

06/13/2006
Test Date

David Winkelbauer
Approved By

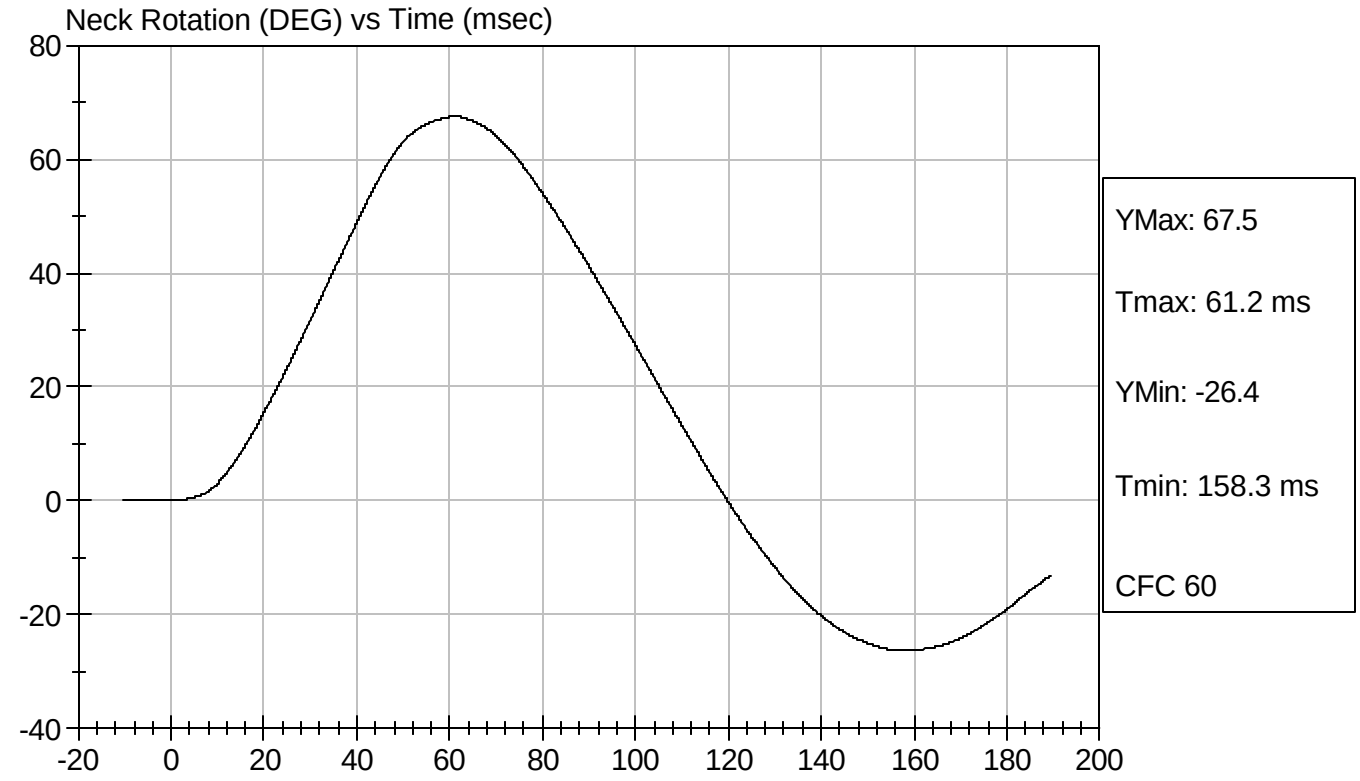
Test Desc: Neck Bending
Component ID: D061729

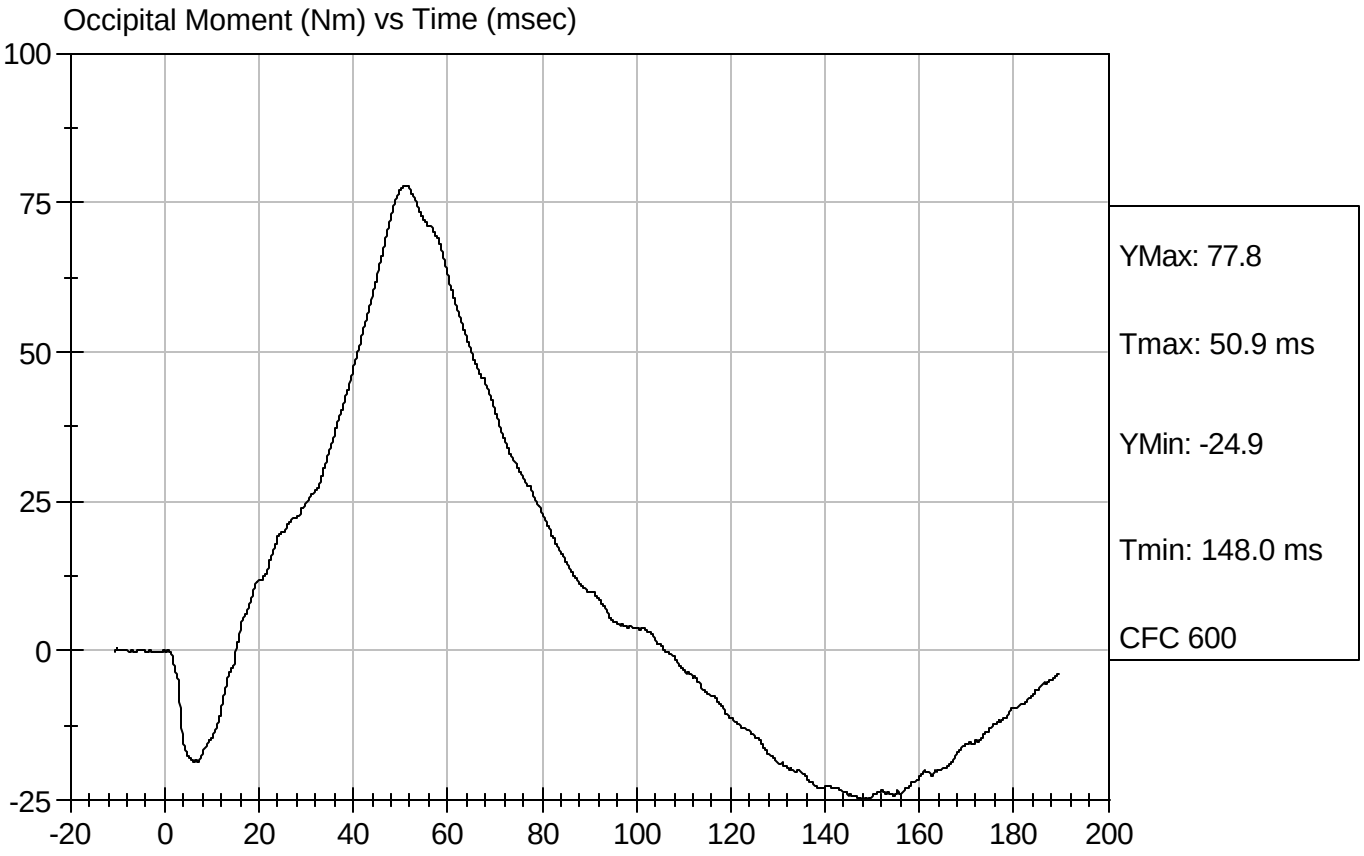
Test Date: 06/13/2006
Speed: 22.75 ft/sec, 6.93 m/sec



Test Desc: Neck Bending
Component ID: D061729

Test Date: 06/13/2006
Speed: 22.75 ft/sec, 6.93 m/sec





SID/HIII Calibration Data Sheet

Side Impact Dummy

Head Drop Calibration (Lateral)

ATD Serial No: 037 **Test I.D:** D062681

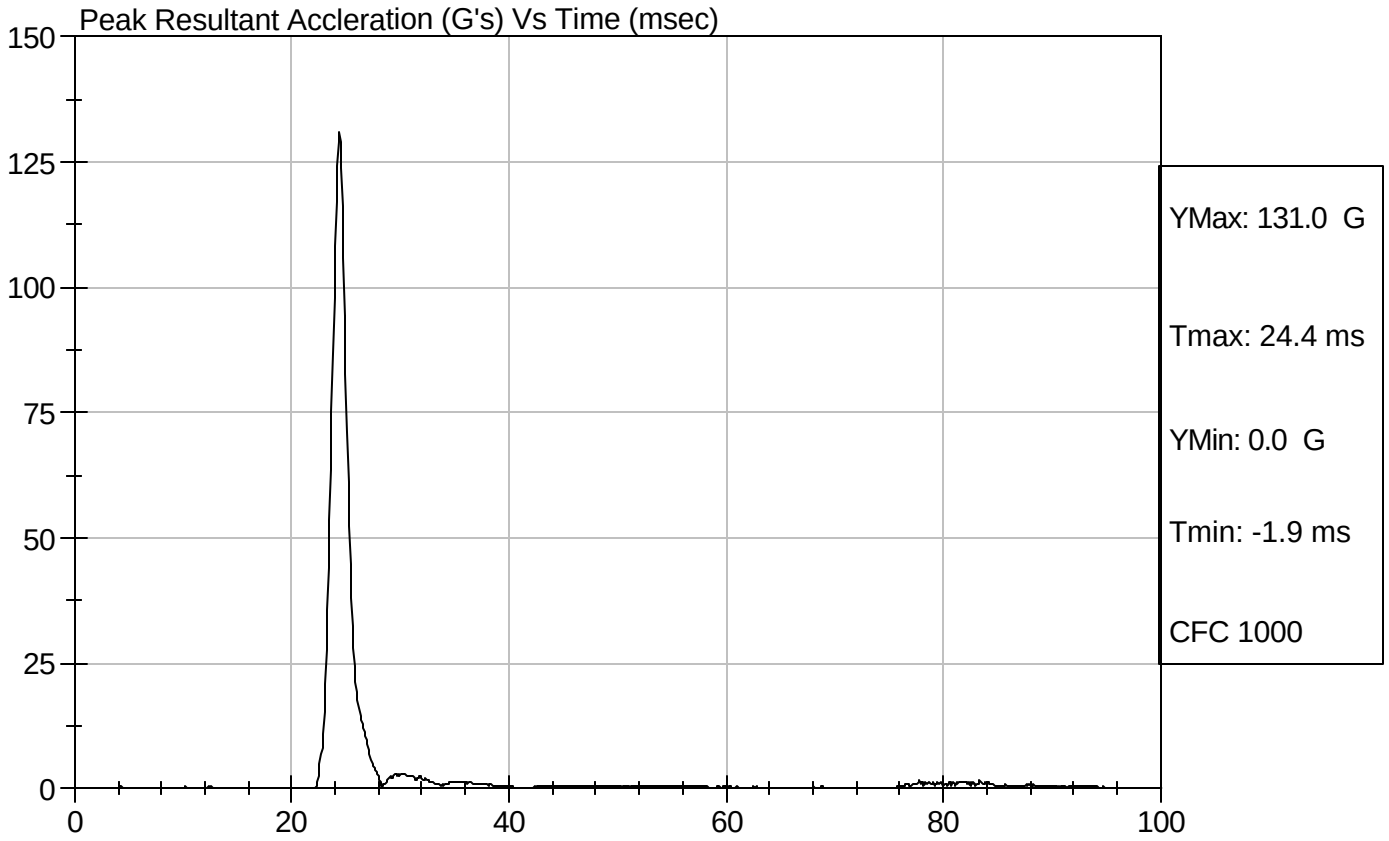
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Peak Resultant Acceleration	G's	120 to 150	131	Pass
Is Resultant Curve Unimodal?	Yes/No	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-5.6	Pass
		Overall Test Results		Pass

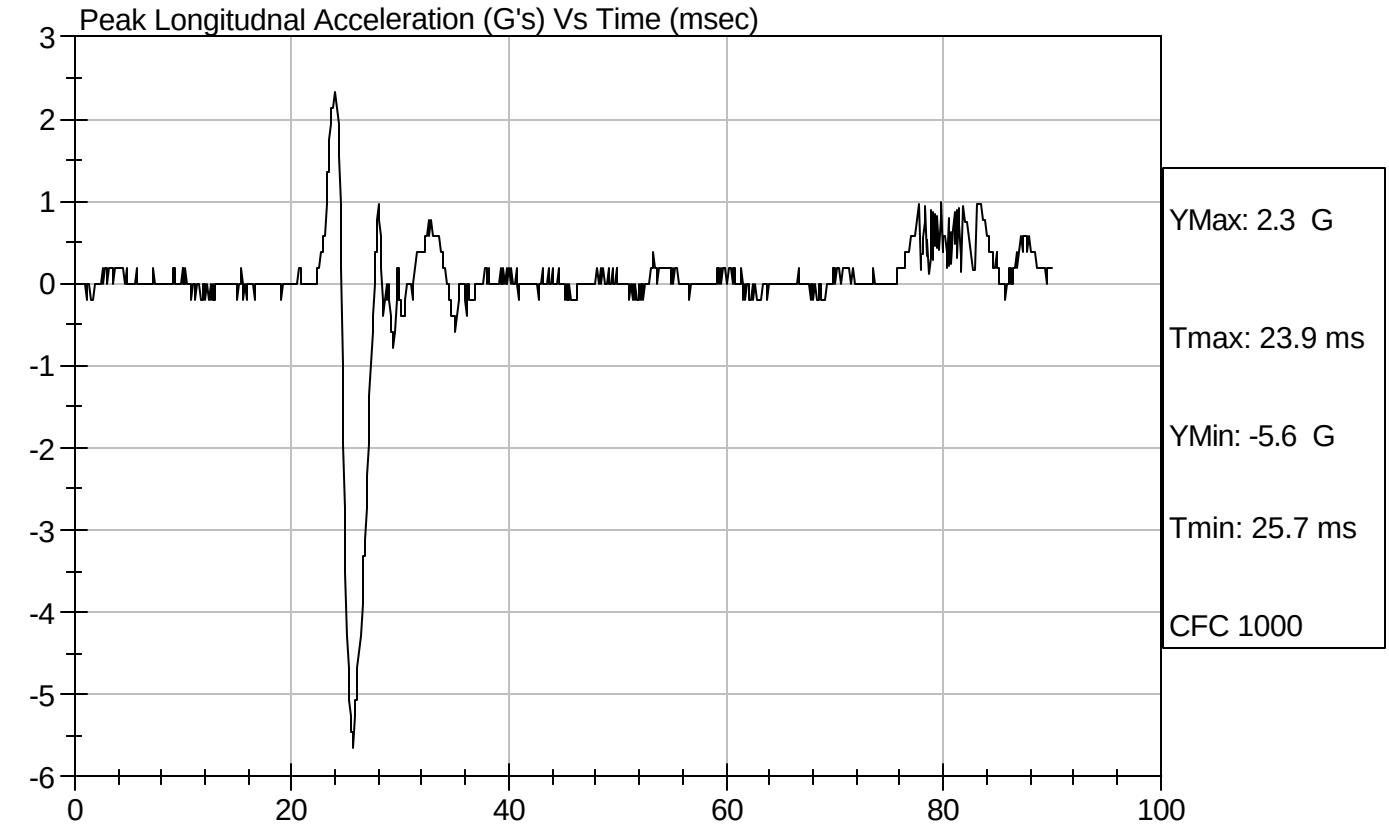
Jessica Hall
Laboratory Technician

09/06/2006
Test Date

David Winkelbauer
Approved By

	Test Description: Head Drop	Test Date: 09/06/2006
	Component: D062681	Speed: 0 ft/s, 0.00 m/s





SID/HIII Calibration Data Sheet

Side Impact Dummy

Thorax Impact Test

ATD Serial No: 037 **Test I.D:** D062682

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/s	4.22 - 4.31	4.22	Pass
Upper Rib	G's	37 - 46	39	Pass
Lower Rib	G's	37 - 46	38	Pass
Lower Spine	G's	15 - 22	21	Pass
		Overall Test Results		Pass

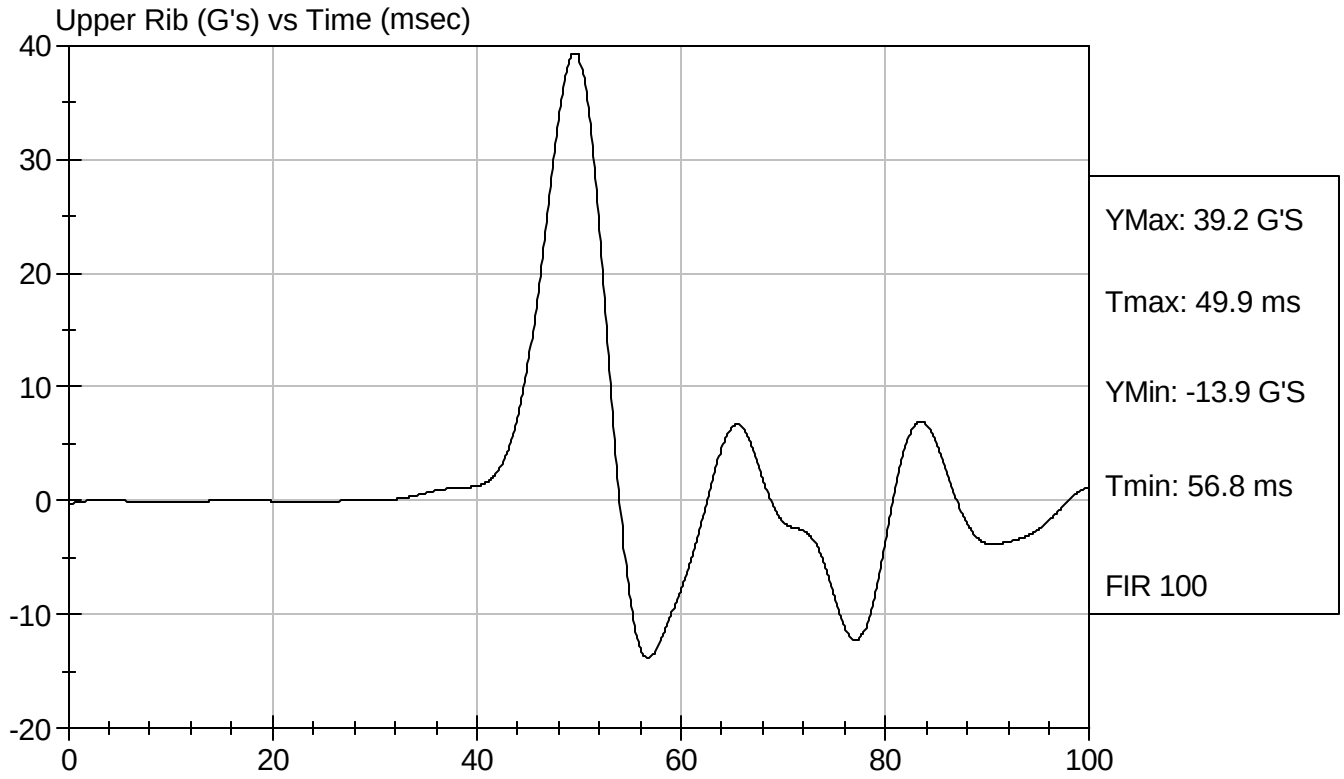
Jessica Hall
Laboratory Technician

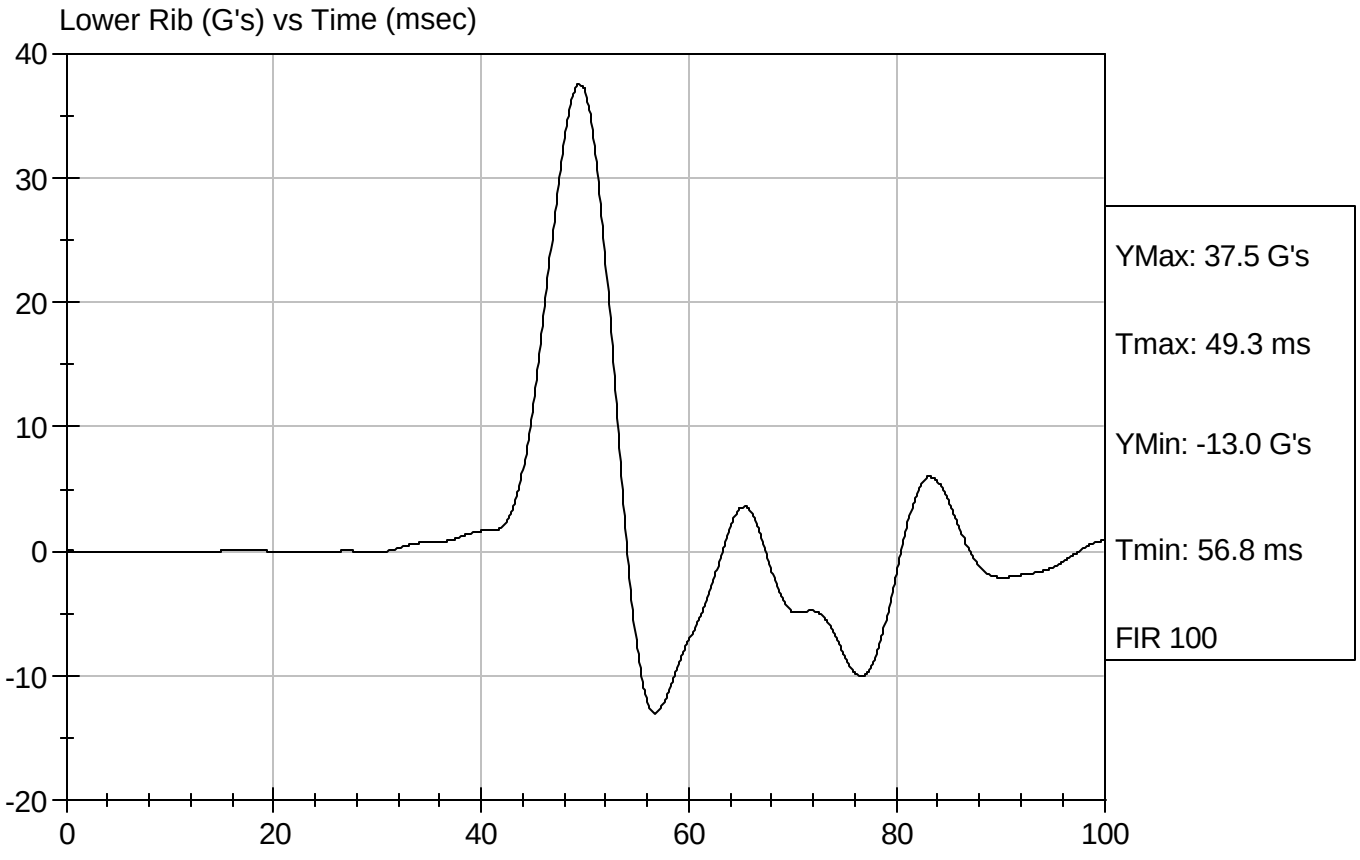
09/06/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D062682

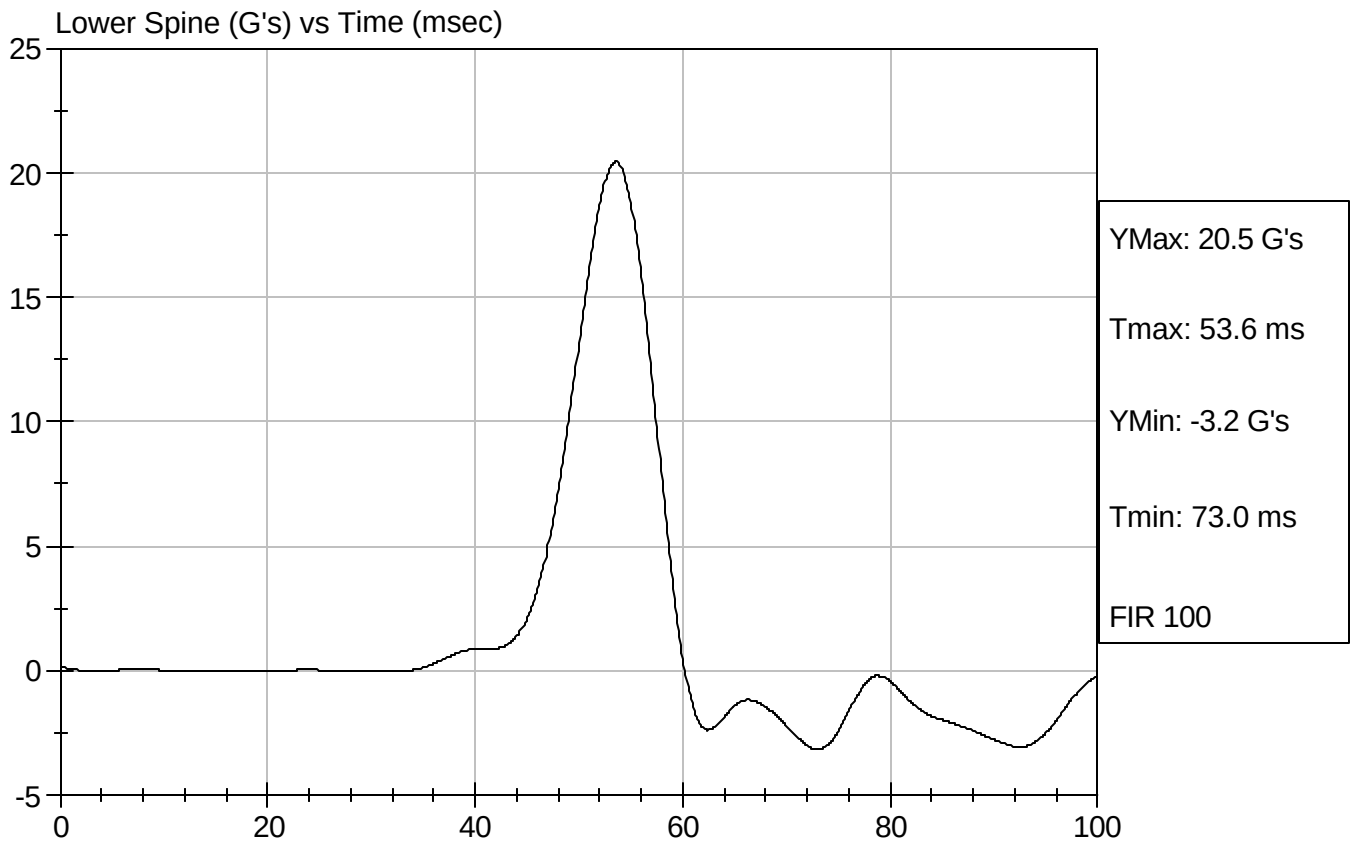
Test Date: 09/06/2006
Speed: 13.85 ft/sec, 4.22 m/sec





Test Desc: Thorax Impact
Component ID: D062682

Test Date: 09/06/2006
Speed: 13.85 ft/sec, 4.22 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy

Pelvis Impact Test

ATD Serial No: 037 **Test I.D:** D062683

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	4.27 - 4.33	4.29	Pass
Pelvis Acceleration	G's	40 - 60	45	Pass
		Overall Test Results		Pass

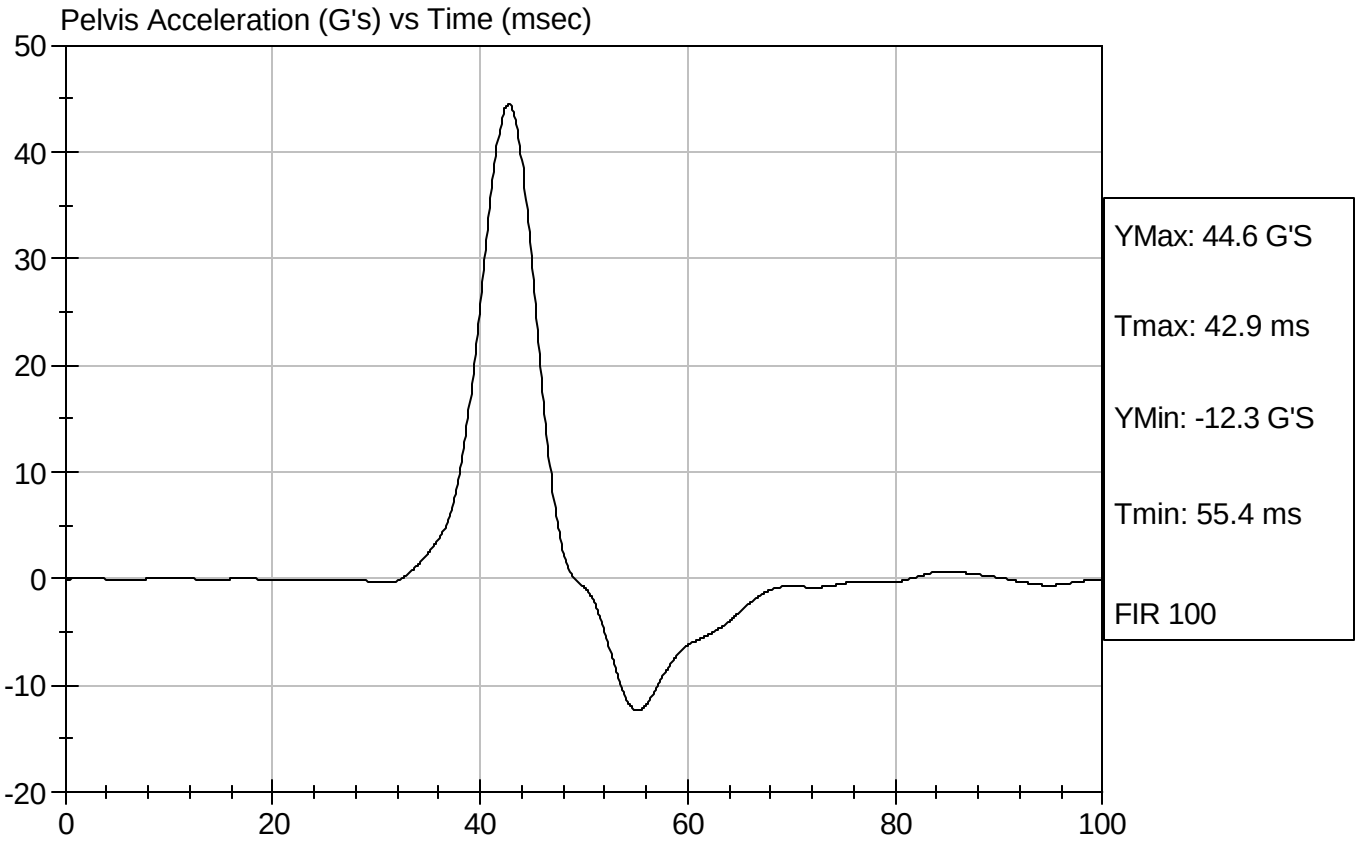
Jessica Hall
Laboratory Technician

09/06/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D062683

Test Date: 09/06/2006
Speed: 14.07 ft/sec, 4.29 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy

Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 037 **Test I.D:** D062684

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Force At 12.7 mm	N	104 -162	136	Pass
Force At 19 mm	N	163 - 222	191	Pass
Force At 25.4 mm	N	222 - 280	255	Pass
Force At 33 mm	N	325 - 391	349	Pass
		Overall Test Results		Pass

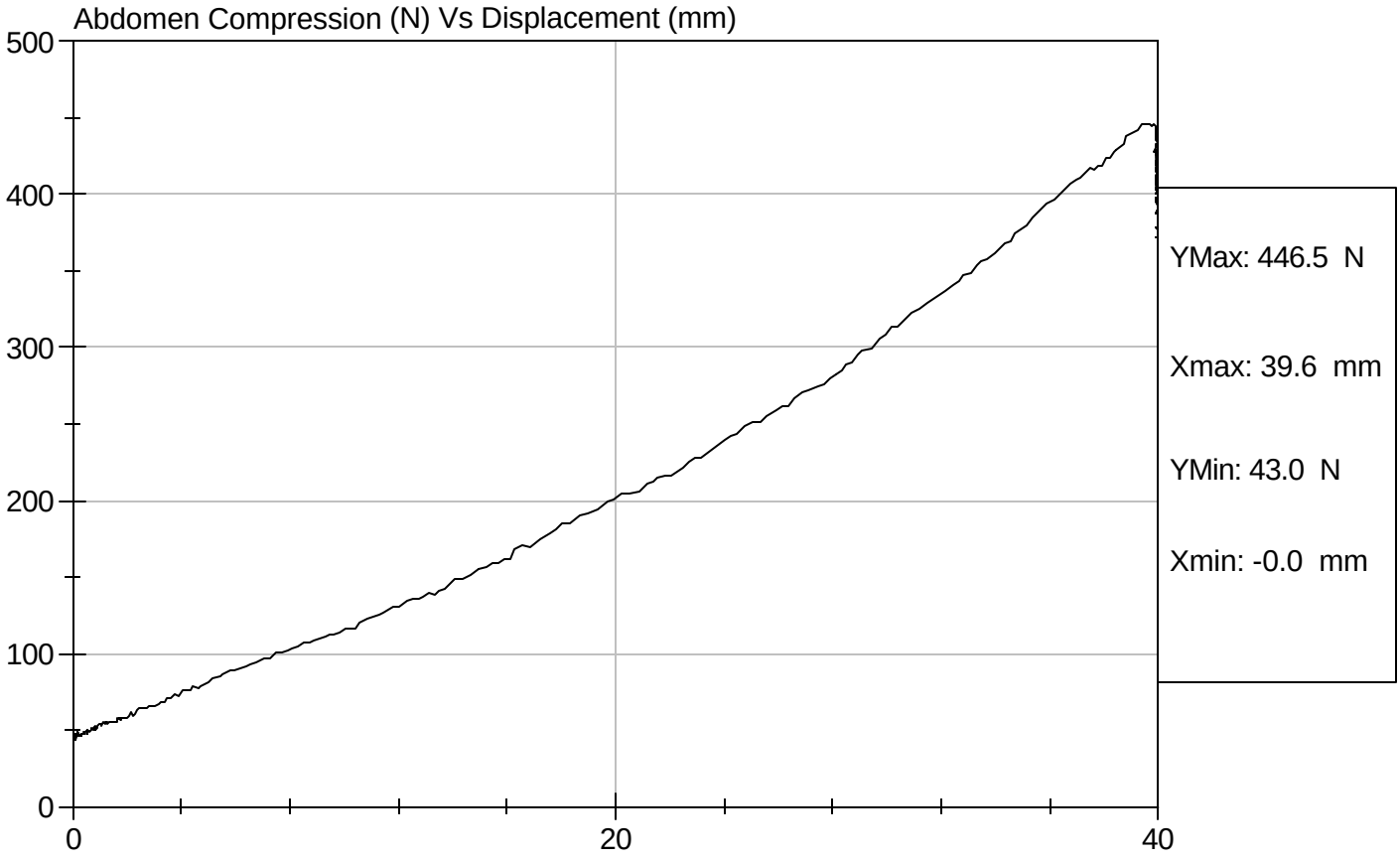
Jessica Hall
Laboratory Technician

09/07/2006
Test Date

David Winkelbauer
Approved By

Test Description: Abdomen Compression Test Date: 09/07/2006

Component: D062684 Speed: 0 ft/sec, 0 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy

Lumbar Flexion Calibration

ATD Serial No: 037 **Test I.D:** D062685

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Force At 0 deg	N	0 - 26.7	0.0	Pass
Force At 20 deg	N	97.9 - 151.2	115.8	Pass
Force At 30 deg	N	151.2 - 204.6	163.9	Pass
Force At 40 deg	N	204.6 - 258.0	228.1	Pass
Return Angle	Deg	12 Maximum	3	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

09/07/2006
Test Date

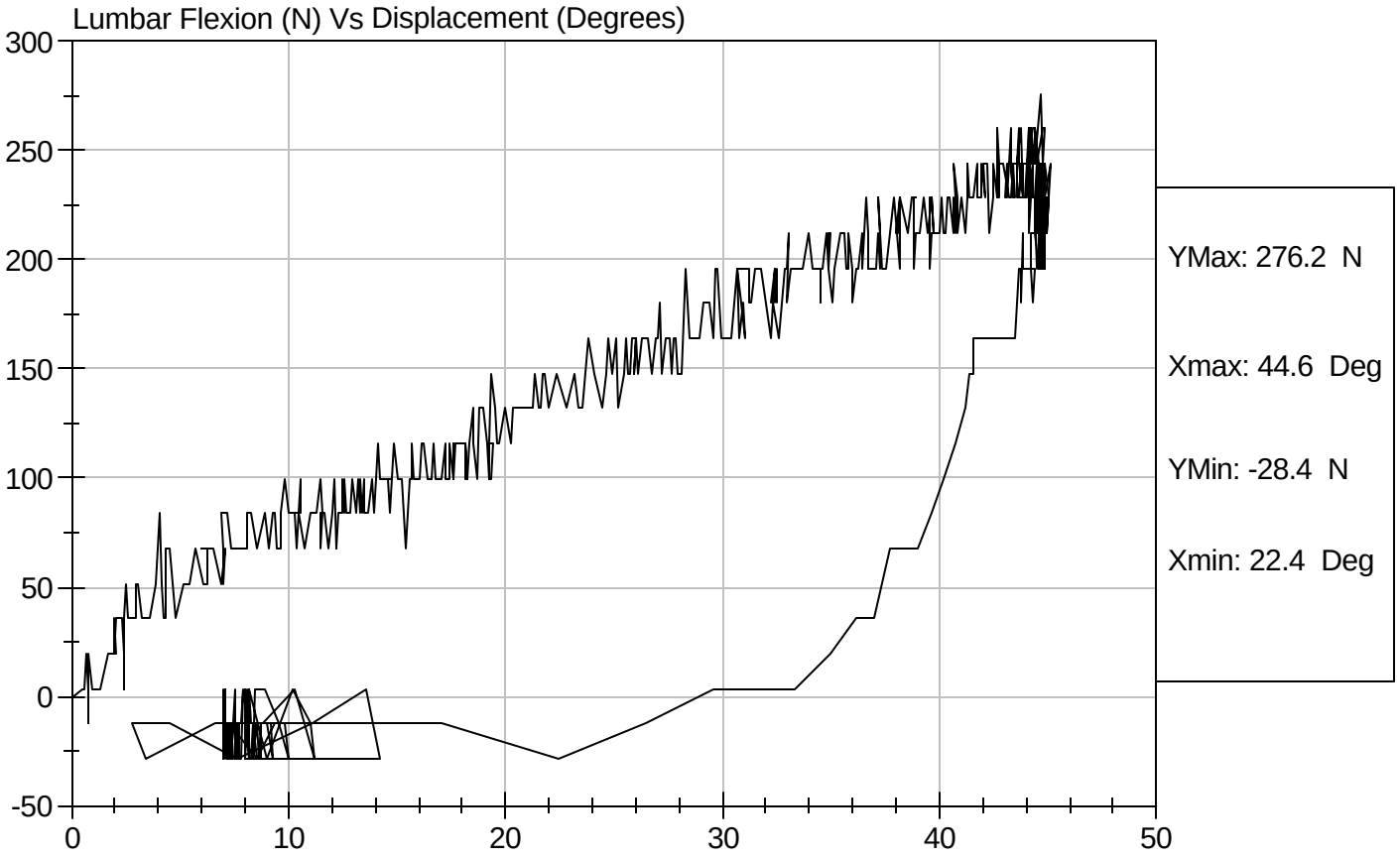
David Winkelbauer
Approved By

Test Description: Lumbar Flexion

Test Date: 09/07/2006

Component: D062685

Speed: 0 ft/sec, 0 m/sec



SID/HIII Calibration Data Sheet

Side Impact Dummy (SID)

Neck Pendulum Test

ATD Serial No: 037 **Test I.D:** D062689

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Impact Velocity		m/s	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	m/s	1.96 to 2.55	2.24	Pass
	20 msec	m/s	4.12 to 5.10	4.48	Pass
	30 msec	m/s	5.73 to 7.01	6.27	Pass
	40 to 70 msec	m/s	6.27 to 7.64	7.22	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	70	Pass
Head Rotation Peak to Zero - Decay Time		msec	58 to 67	59	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	79	Pass
Mx Peak To Zero - Decay Time		msec	49 to 64	57	Pass
Mx Peak to Max. Head Rotation		msec	2 to 16	12	Pass

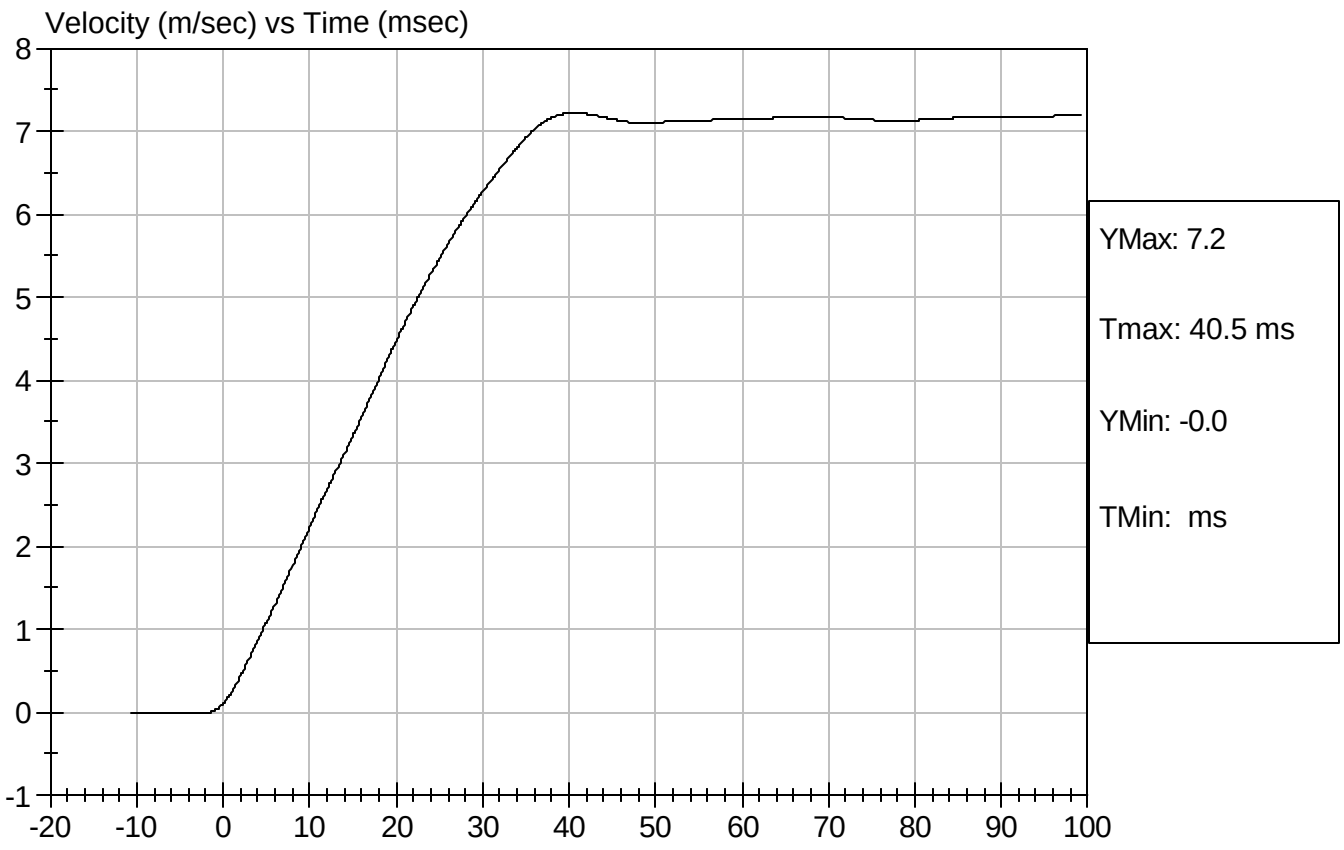
Jessica Hall
Laboratory Technician

09/07/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Neck Bending
Component ID: D062689

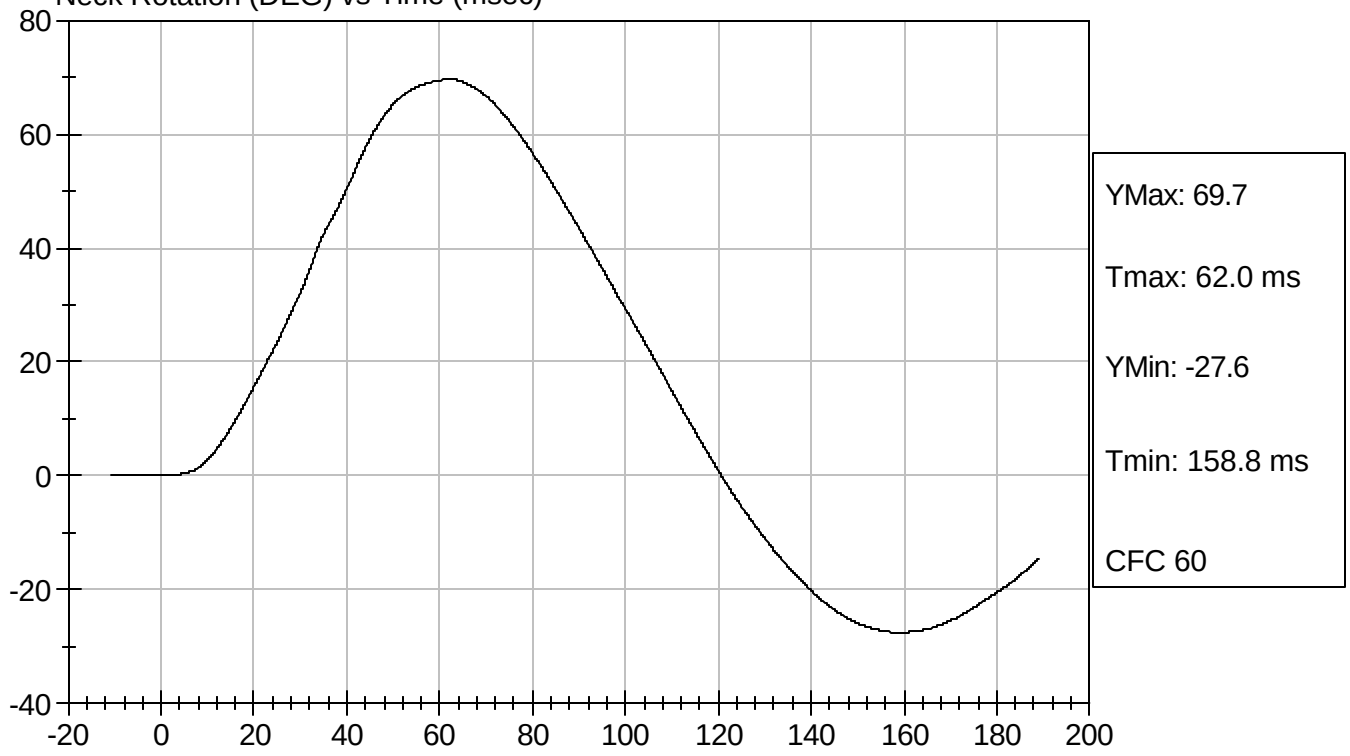
Test Date: 09/07/2006
Speed: 23.06 ft/sec, 7.03 m/sec



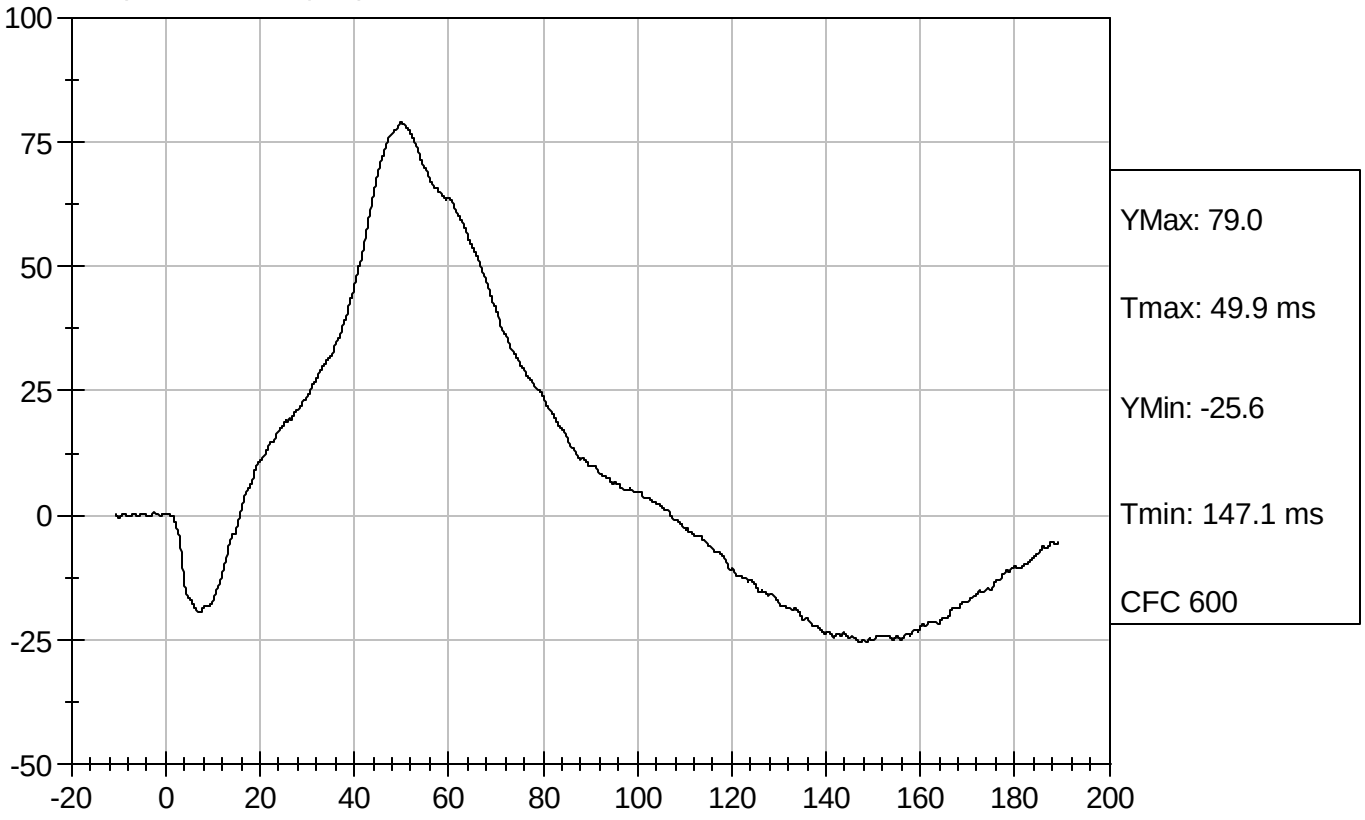
Test Desc: Neck Bending
Component ID: D062689

Test Date: 09/07/2006
Speed: 23.06 ft/sec, 7.03 m/sec

Neck Rotation (DEG) vs Time (msec)



Occipital Moment (Nm) vs Time (msec)



APPENDIX D

CALIBRATION INFORMATION DATA

DUMMY AND VEHICLE CALIBRATION DATA

	INSTRUMENTS FOR DRIVER S/N 037		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head CG X	AGH70	Endevco	04/11/06
Head CG Y	C10727	Endevco	04/11/06
Head CG Z	AGH78	Endevco	04/12/06
Neck Load Cell	106	Denton	04/26/06
Upper Rib Y	P50057	Endevco	07/14/06
Lower Rib Y	P49500	Endevco	06/07/06
Lower Spine Y	G04-Z29	Entran	05/24/06
Pelvis Y	P39512	Endevco	06/07/06
Upper Rib Redundant Y	ET21333	Entran	05/31/06
Lower Rib Redundant Y	P49456	Endevco	06/07/06
Lower Spine Redundant Y	G06-X05	Entran	05/24/06
Pelvis Redundant Y	C15-Z02	Entran	06/07/06

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Vehicle CG X	P47831	Endevco	07/27/06
Vehicle CG Y	P47822	Endevco	07/27/06
Vehicle CG Z	P47823	Endevco	07/27/06
Left Floor Y	J10431	Endevco	04/11/06
Left A-Post @ Sill Y	J14006	Endevco	05/15/06
Left Lower A-Post Y	A07-R11	Entran	08/03/06
Left Mid A-Post Y	H10-M18	Entran	06/21/06
Left B-Post @ Sill Y	ANAT6	Endevco	05/15/06
Left Lower B-Post Y	D11-Z12	Entran	07/13/06
Left Mid B-Post Y	C21-G07	Entran	07/13/06
Driver Seat Track Y	J20392	Endevco	08/03/06
LF Door Accel. #1 Y	C29-L11	Entran	04/10/06
LF Door Accel. #2 Y	AP2A4	Endevco	05/15/06
LF Door Accel. #3 Y	P22659	Endevco	08/03/06
Upper Engine X	E05-Z48	Entran	06/21/06
Upper Engine Y	H06-L01	Entran	06/21/06
Firewall Y	H10-L03	Entran	06/21/06
Right Floor Sill Y	L02-Z34	Entran	08/03/06
Rear Deck X	P47970	Endevco	08/02/06
Rear Deck Y	P47969	Endevco	08/02/06