REPORT NUMBER: TO11-MGA-2003-003

FULL SCALE SIDE IMPACT POLE TESTS OF BASELINE VEHICLES
Task Order #T0007 / RFP #0011

Volvo
1999 Volvo S80 Sedan
NHTSA NUMBER: RX5907

PREPARED BY:
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BURLINGTON, WI 53105

TEST DATE: JANUARY 30, 2003

FINAL REPORT SUBMITTED: September 2, 2003

PREPARED FOR:
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VOLPE NATIONAL TRANSPORTATION SYSTEM CENTER
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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 DTRS57-98-D-00041.

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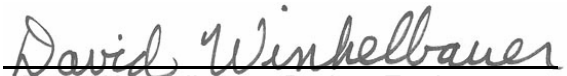
Prepared by: 
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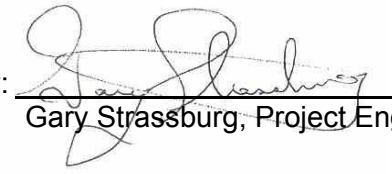
Reviewed by: 
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SECTION 1
PURPOSE AND TEST PROCEDURE

This Side Impact test is conducted as part of Contract No. DTRS57-98-D-00041, task order 11, 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 ES-2 and SID/HIII dummies in a 1999 Volvo S80, when subjected to a rigid pole side impact at 285 degrees.

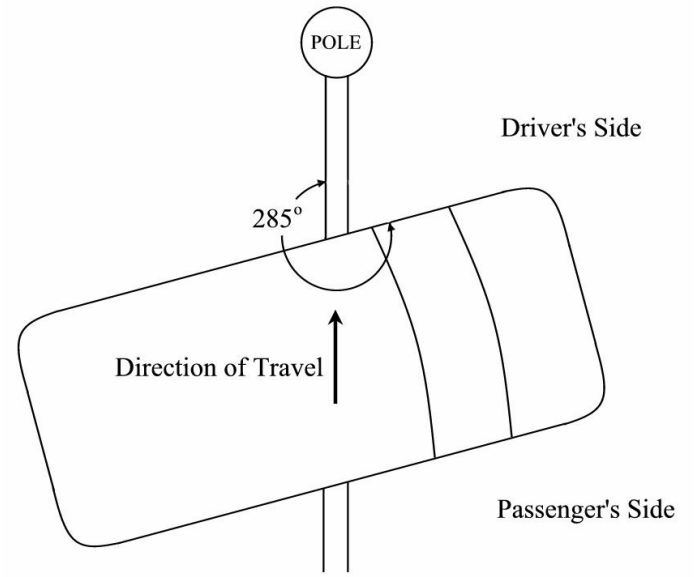
MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
SUMMARY OF SIDE IMPACT TEST

A rigid pole side impact test at 285 degrees was performed on a 1999 Volvo S80. The subject vehicle was towed into a rigid pole at a velocity of 31.9 km/h. The weight of the vehicle as tested was 1797.6 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on January 30, 2003. Pre- and post-test photographs of the test vehicle and the dummies are included in Appendix A.

One SID/HIII side impact dummy was placed in the left front designated seating position according to instructions specified in the NHTSA Office of Vehicle Safety Compliance Laboratory Test Procedure TP-214D-06, dated July 26, 2001. The side impact event was documented by ten high speed cameras. 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. Appendix E contains the dummy peak responses.



SECTION 2...continued

SUMMARY OF SIDE IMPACT TEST

The following table summarizes the results of the Left Side Impact Test:

		Left Front
HIC	T1 (msec)	48.5
	T2 (msec)	69.2
	T2 – T1 (msec)	20.7
	HIC	395

Fir Filtered	Left Front
Upper Rib Y (g's)	45.2
Lower Rib Y (g's)	36.2
Upper Spine Y (g's)	39.4
Lower Spine Y (g's)	52.9
Pelvis Y (g's)	59.1
TTI (g's)	49

Contacts	Left Front
Rib (msec)	11.7
Pelvis (msec)	30.2

TEST NOTES

The dummy and vehicle X and Y velocities presented in this report do not contain the correct initial velocity. The correct initial velocities should be:

X – Test Speed * Sine 15 Degrees
Y – Test Speed * Cosine 15 Degrees

The following data channels were found to have Questionable Data:

Left Front Door at Pelvis Y Acceleration

Previous tests in this series used the FMVSS 201P dummy seating procedure.

SECTION 3

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

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

TEST VEHICLE INFORMATION

Make	Volvo
Model	S80
Body Style	Sedan
VIN	YVITS97D3X1009178
Color	Painted Orange
Odometer Reading (mile)	58,242
Transmission	Automatic
Final Drive	Front
Number of Cylinders	6
Engine Displacement (L)	2.9
Engine Placement	lateral

TEST VEHICLE OPTIONS

Front Airbag	Yes
Side Airbags	Curtain/seat side
Power Windows	Yes
Power Steering	Yes
Power Door	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	Volvo Gothenburg Sweden
Date of Manufacture	9-98

GVWR (kg)	2090.2
GAWR Front (kg)	1129.9
GAWR Rear (kg)	1040.1

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	273	273
Cold Pressure (kPa)	203	203
Recommended Tire Size	P215/55R16	P215/55R16
Tire Size on Vehicle	P215/55R16	P215/55R16
Tire Manufacturer	Michelin	MIchelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contour		
Number Of Occupants x 68.04 kg.	136.1	204.1		340.2
Capacity Wt. (VCW) (kg)				405.1
Cargo Wt. (RCLW) (kg)				64.9

DATA SHEET NO. 1... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	487.2	344.7		522.5	398.3	
Right	kg	479.0	335.2		509.4	367.4	
Ratio	%	58.7	41.3		57.4	42.6	
Totals	kg	966.2	679.9	1646.1	1031.9	765.7	1797.6

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Calculated Vehicle Target Weight (TVTW)	kg	1797

TEST VEHICLE ATTITUDES

	Unit	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	Deg	0.4 ND	0.1 ND	0.2 ND
Left Door Sill Angle	Deg	0.1 ND	0.1 BD	0
Front Bumper Angle	Deg	0.3 LD	0.4 LD	0.3 LD
Rear Bumper Angle	Deg	0.0	0.2 LD	0

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	2794
Total Vehicle Length at Left Side	mm	4114
Total Vehicle Length at Centerline	mm	4760
Total Vehicle Length at Right Side	mm	4116
Total Vehicle Width	mm	1830
Weight of Ballast in Cargo Area	kg	0
Amount of water in Fuel Tank	liters	69.8

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Actual Impact Point	mm	15 rear

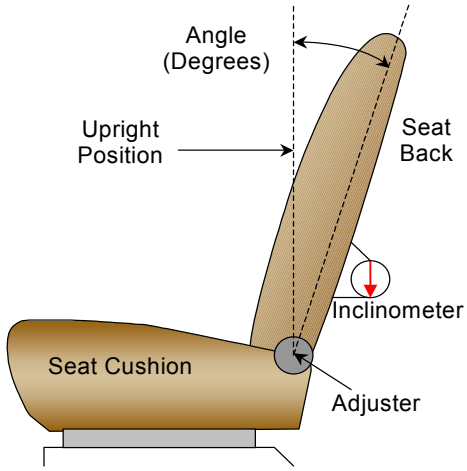
DATA SHEET NO. 1… (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

NORMAL DESIGN RIDING POSITION

Driver seat back angle: 20 degrees



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The driver's seat is electronically operated.

The fore/aft is set to the middle position for the driver's seat.

Driver seat fore/aft total travel: 280 mm

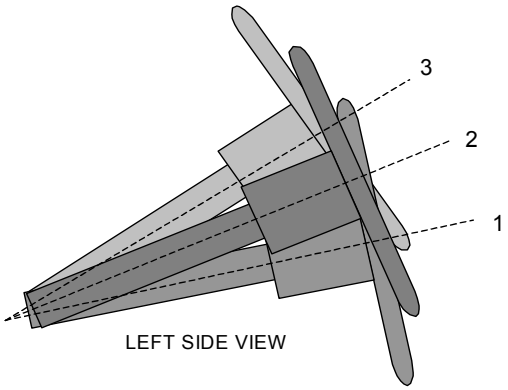
Driver seat fore/aft position: 140 mm

SEAT BELT UPPER ANCHORAGE

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

STEERING COLUMN ADJUSTMENT

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



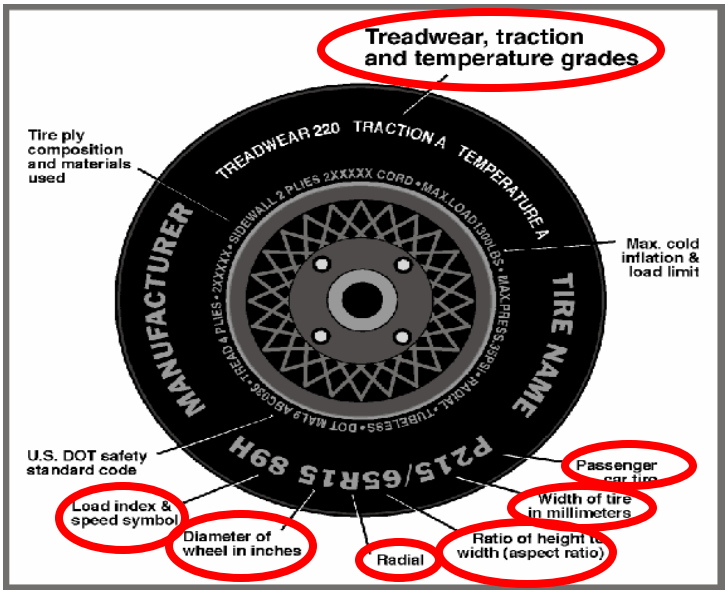
STEERING COLUMN ASSEMBLY

DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

Vehicle Year	1999	Vehicle Make	Volvo
Vin	YVITS97D3X1009178	Vehicle Model	S80



	Front	Rear
Tire Manufacturer	Michelin	Michelin
Tire Name	Energy MXV 4 Plus	Energy MXV 4 Plus
Tire Type	Passenger Car	Passenger Car
Tire Width (mm)	215	215
Ratio of Height to Width (aspect ratio)	55	55
Radial	Radial	Radial
Wheel Diameter	16	16
Load Index & Speed Symbol	93H	93H
Treadwear	400	400
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 3

POST TEST OBSERVATIONS

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front
Dummy Type	SID III
Head Contact	Curtain airbag
Upper Torso Contact	Side seat airbag
Lower Torso Contact	Side seat airbag
Left Knee Contact	Lower 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	Left side shattered
Window Damage	Left side windows down for test / Sunroof shattered
Other Notable Effects	None

AIRBAG DEPLOYMENT

	Driver
Front	No
Side	Yes
Curtain	Yes

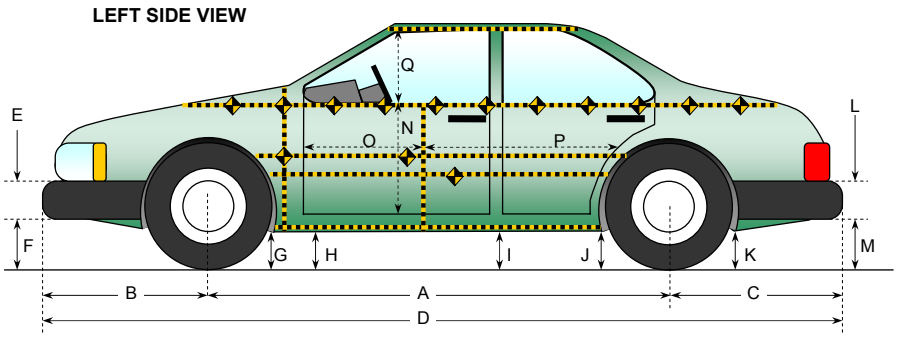
SECTION 4

OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 4

VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003



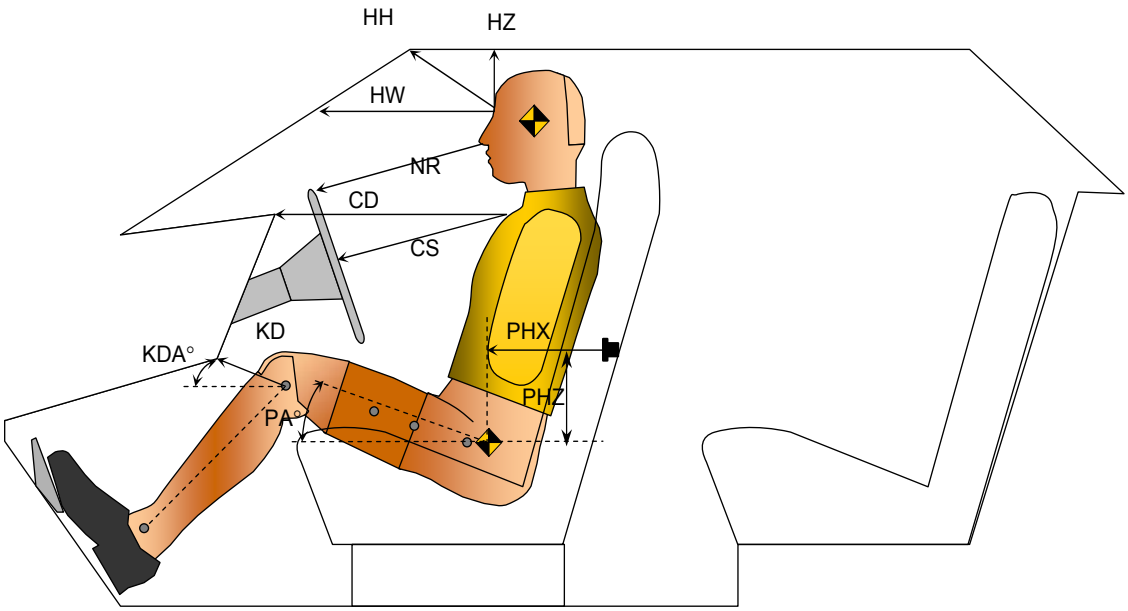
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2794	2604	-190
B	Front Axle to FSOV	935	1058	123
C	Rear Axle to RSOV	1031	1037	6
D	Total Length at Centerline	4760	4699	-61
E	Front Bumper Thickness	155	155	0
F	Front Bumper Bottom to Ground	510	525	15
G	Sill Height at Front Wheel Well	343	326	-17
H	Sill Height at Front Door Leading Edge	313	304	-9
I	Sill Height at "B" Pillar	335	347	12
J1	Sill Height at Rear Wheel Well	335	268	-67
J2	Pinch Weld Height at Rear Wheel Well	314	335	21
K	Sill Height Aft of Rear Wheel Well	363	378	15
L	Rear Bumper Thickness	264	264	0
M	Rear Bumper Bottom to Ground	461	451	-10
N	Sill Height to Window Bottom Sill	704	648	-56
O	Front Door Leading Edge to Impact CL	907	901	-6
P	Rear Door Trailing Edge to Impact CL	1048	1046	-2
Q	Front Window Opening	444	431	-13
R	Right Side Length	4116	4141	25
S	Left Side Length	4114	3909	-205
T	Vehicle Width at "B" Post	1830	1629	-201

DATA SHEET NO. 5

SID/HIII LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

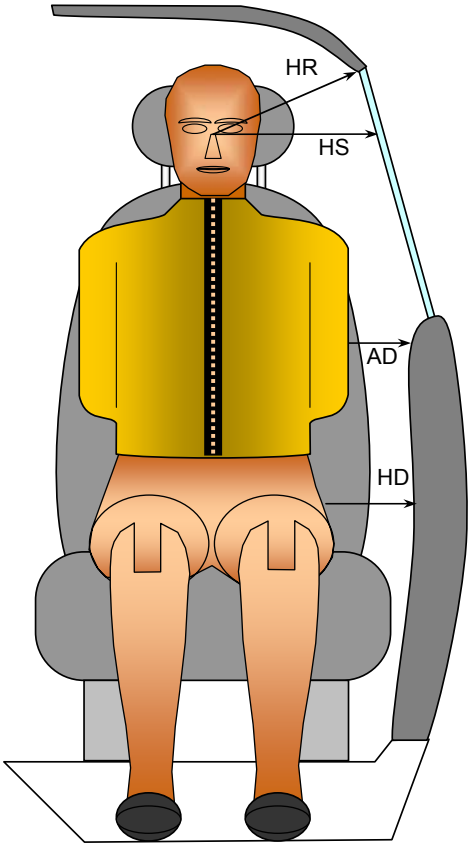


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	384	
HW	Head to Windshield	645	
HZ	Head to Roof	168	
NR	Nose to Rim	454	
CD	Chest to Dash	550	
CS	Chest to Steering Wheel	330	
KDL	Left Knee to Dash	210	0
KDR	Right Knee to Dash	195	0
PA	Pelvic Angle (Longitudinal)		24.5
PHX	H-Point to Striker (X-Axis)	215	
PHZ	H-Point to Striker (Z-Axis)	235	

DATA SHEET NO. 6

SID/HIII LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003



FRONT VIEW OF DUMMY

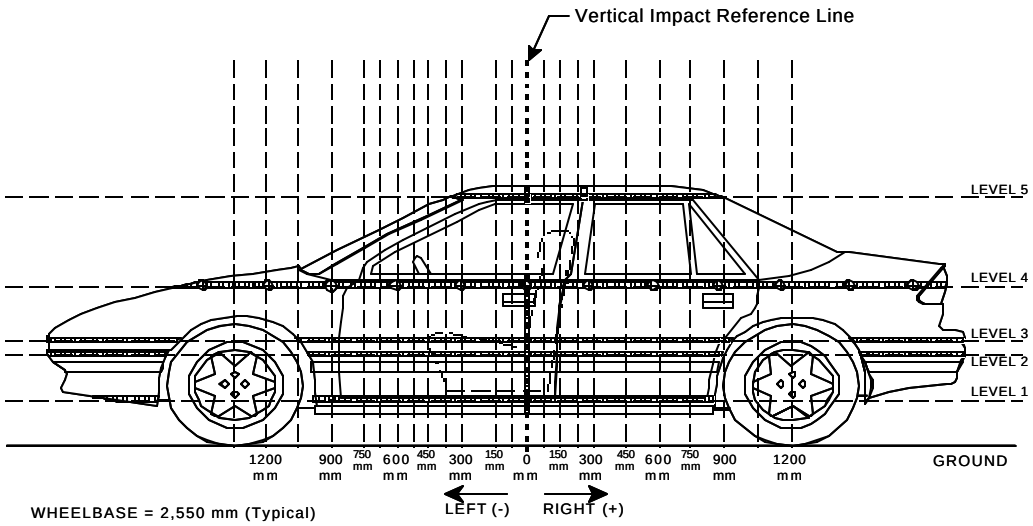
Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	206
HS	Head to Side Window	mm	330
AD	Arm to Door	mm	108
HD	H-Point to Door	mm	144

DATA SHEET NO. 7

VEHICLE SIDE MEASUREMENTS

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

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.

Note: Target impact point was 48mm forward of 0.

Level	Measurement Description	Height Above Ground
5	Window	1495
4	Window Sill	1061
3	Mid Door	754
2	Occupant H-Point	668
1	Sill Top	428

DATA SHEET NO. 8

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

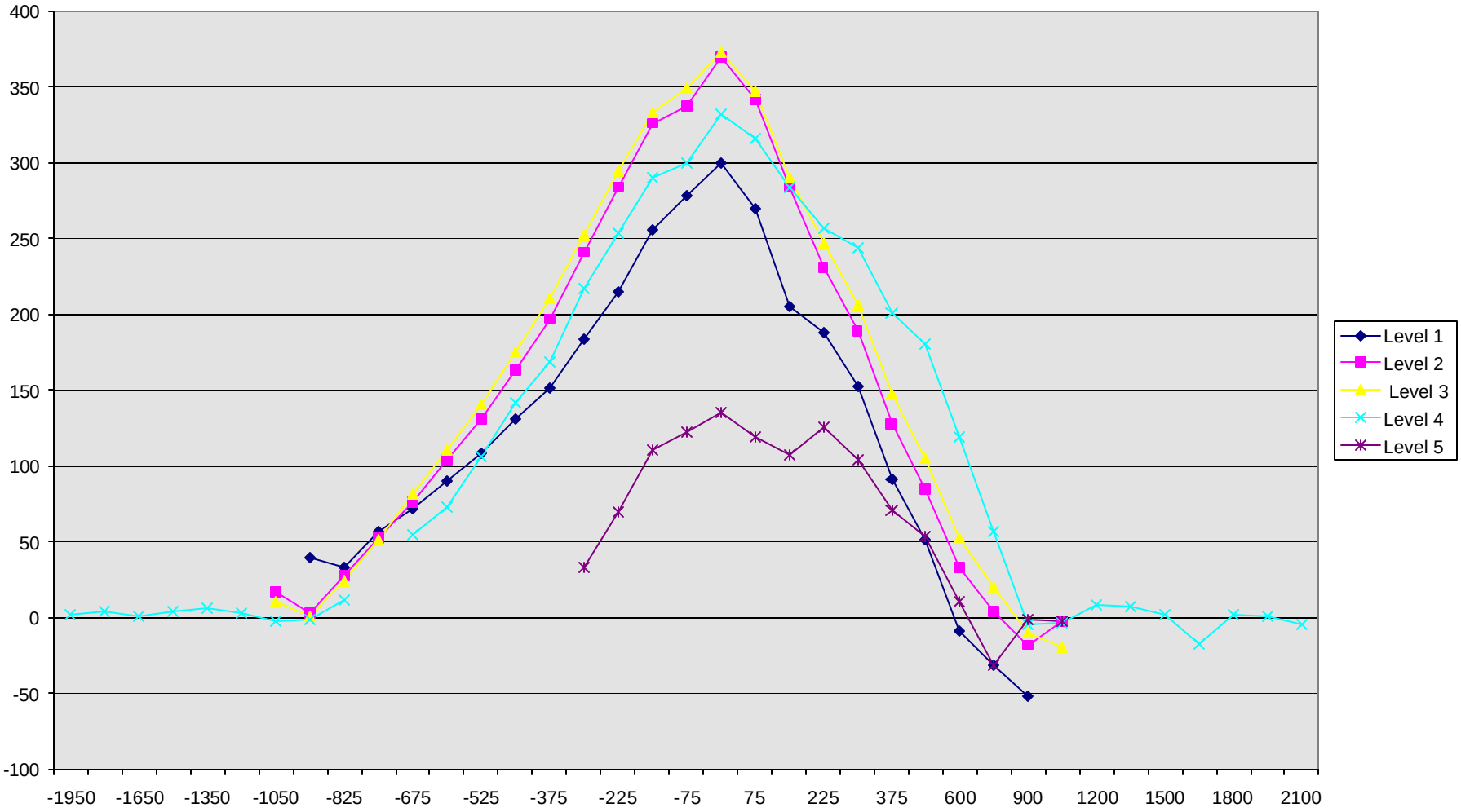
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1950				312					314					2	
-1800				287					291					4	
-1650				272					273					1	
-1500				261					265					4	
-1350				256					262					6	
-1200				256					259					3	
-1050		200	198	265			217	209	263			17	11	-2	
-900	250	202	196	266		290	205	197	265		40	3	1	-1	
-825	255	202	195	262		288	230	219	274		33	28	24	12	
-750	254	200	194			311	252	245			57	52	51		
-675	255	200	192	252		327	276	273	307		72	76	81	55	
-600	255	198	190	252		345	302	300	325		90	104	110	73	
-525	256	198	190	252		364	329	331	358		108	131	141	106	
-450	256	197	189	249		387	360	364	391		131	163	175	142	
-375	258	197	189	256		409	394	399	425		151	197	210	169	
-300	257	196	189	249	469	441	437	441	466	502	184	241	252	217	33
-225	256	195	188	250	463	471	479	482	504	533	215	284	294	254	70
-150	255	195	188	250	459	511	521	521	540	570	256	326	333	290	111
-75	255	195	188	250	462	533	532	537	550	584	278	337	349	300	122
0	252	195	188	250	462	552	565	561	582	597	300	370	373	332	135
75	253	196	189	250	463	523	538	536	566	582	270	342	347	316	119
150	250	194	189	250	464	455	478	479	534	571	205	284	290	284	107
225	248	195	189	251	468	436	426	436	508	594	188	231	247	257	126
300	249	195	190	253	468	402	384	396	497	572	153	189	206	244	104
375	248	195	190	254	469	339	323	337	455	540	91	128	147	201	71
450	247	195	191	256	469	298	280	296	436	523	51	85	105	180	54
600	246	195	192	258	469	237	228	245	377	480	-9	33	53	119	11
750	244	196	194	262	472	213	200	214	319	441	-31	4	20	57	-31
900	244	194	196	264	474	192	176	186	260	473	-52	-18	-10	-4	-1
1050		196	196	271	489		194	177	269	487		-2	-19	-3	-2
1200				278					286					8	
1350				283					290					7	
1500				290					292					2	
1650				300					273					-17	
1800				312					314					2	
1950				323					324					1	
2100				335					331					-4	

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

DATA SHEET NO. 8... (continued)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

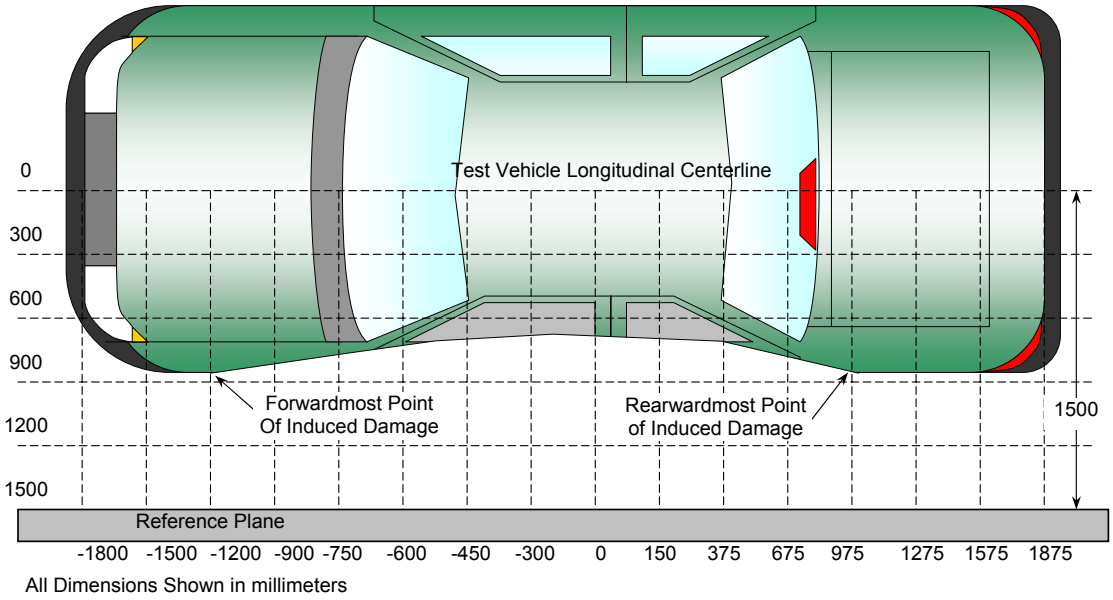


Measurement in mm.

DATA SHEET NO. 9

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003



TOP VIEW

Damage Profile Distances

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	2100 mm	4	335	352	17
2	1320 mm	4	282	357	75
3	475 mm	4	256	557	301
4	-365 mm	4	255	563	308
5	-1175 mm	4	255	334	79
6	-1950 mm	4	312	335	23

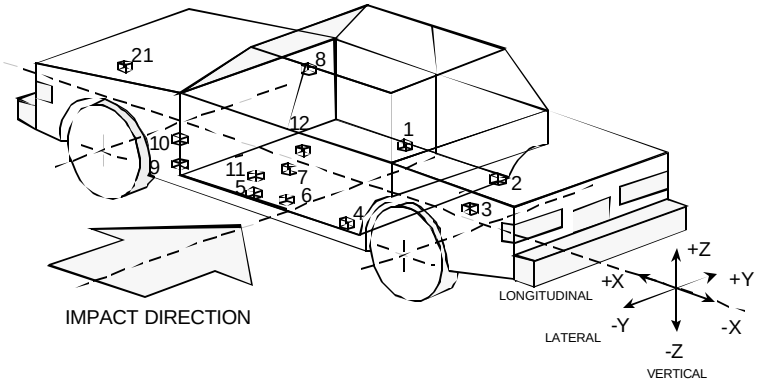
Reference plane is parallel to test vehicle longitudinal centerline.

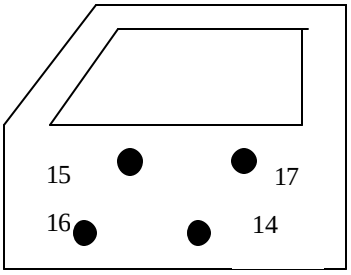
Given dimensions = Reference plane to car body.

DATA SHEET NO. 10

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003





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

No.	Location
12	Vehicle CG
13	Left A-Pillar @ Roof
14	Left Front Door @ Pelvis
15	Left Front Door @ Arm
16	Left Front Door @ Knee
17	Left Front Door @ Rib
19	Left Driver Seat Frame
20	Right Driver Seat Frame
21	Lower Center Radiator Support

DATA SHEET NO. 10... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

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	2.0	1.9	17.0	0.2	4.5	2.0	17.3
2	Right Side Sill at Rear Seat	2.8	1.6	16.4	0.2	1.1	3.5	16.4
3	Rear Floorpan Above Axle	13.1	2.8	14.0	0.7	3.9	3.0	17.0
4	Left Side Sill at Rear Door			17.1	0.6			
5	Left Side Sill at Front Door			17.6	3.9			
6	Left Lower B-Post			57.3	15.5			
7	Left Mid B-Post			84.2	45.0			
8	Left Upper B-Post			*	*			
9	Left Lower A-Post			14.2	0.0			
10	Left Mid A-Post			15.7	1.3			
11	Driver Left Seat Track			56.0	19.1			
12	Vehicle CG	3.2	11.0	45.4	15.5	22.9	9.7	47.6
13	Left A- Pillar at Roof			*	*			
14	Left Front Door at Pelvis			**	**			
15	Left Front Door at Arm			108.5	24.9			
16	Left Front Door at Knee			97.3	37.2			
17	Left Front Door at Rib			77.8	74.6			
19	Left Driver Seat Frame			*	*			
20	Right Driver Seat Frame			*	*			
21	Lower Center Radiator Support	2.4	9.3	10.5	1.9	7.1	6.9	10.6

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

* = Not used to avoid interference with restraint system.

** No valid data collected

DATA SHEET NO. 10... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003

VEHICLE ACCELEROMETER COORDINATES

Loc. No.	Description	Coordinates (mm)		
		X	Y	Z
1	Right Side Sill at Front Seat	2525	675	227
2	Right Side Sill at Rear Seat	1760	690	230
3	Rear Floorpan Above Axle	1100	0	590
4	Left Side Sill at Rear Door	1467	-715	232
5	Left Side Sill at Front Door	2858	-715	224
6	Left Lower B-Post	2215	-695	3301
7	Left Mid B-Post	2148	-733	1000
8	Left Upper B-Post	*	*	*
9	Left Lower A-Post	3275	-720	400
10	Left Mid A-Post	3292	-854	855
11	Driver Left Seat Track	2420	-560	295
12	Vehicle CG	2850	0	165
13	Left A-Pillar @ Roof	*	*	*
14	Left Door @ Pelvis	2560	-763	552
15	Left Door @ Arm	2720	-783	858
16	Left Door @ Knee	2454	-796	628
17	Left Door @ Rib	1947	-786	858
19	Left Driver Seat Frame	*	*	*
20	Right Driver Seat Frame	*	*	*
21	Lower Center Radiator Support	4485	-440	388

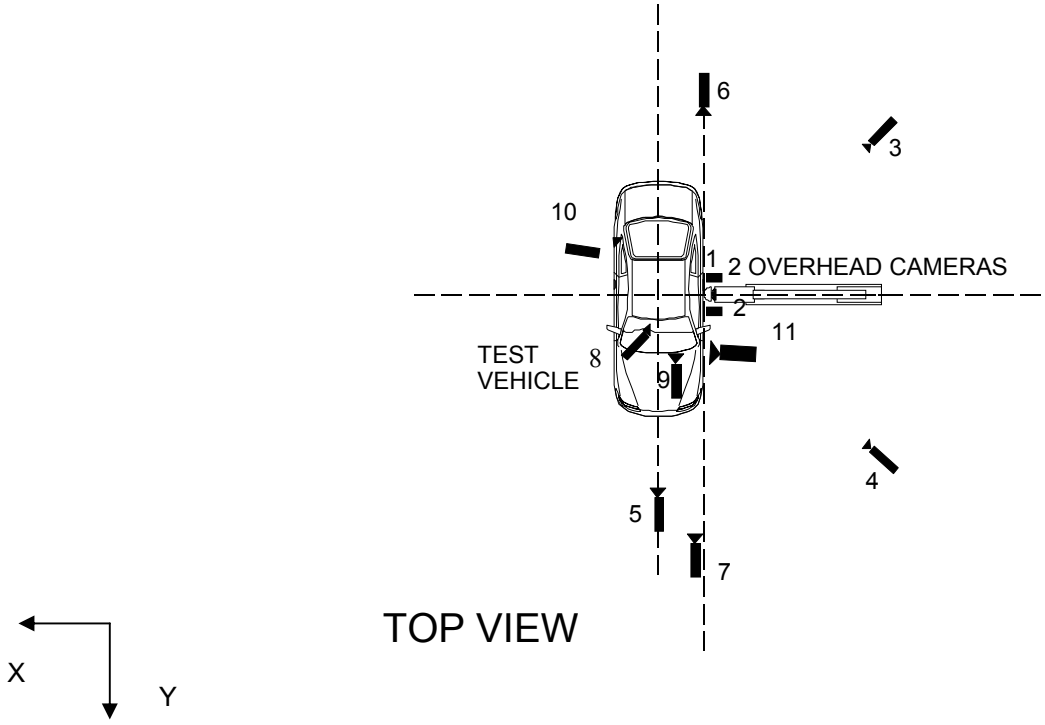
Sign Convention X – Rear Bumper (+ forward)
Y – Vehicle Centerline (+ to right)
Z – Ground Plane (+ up)

* = Not used to avoid interference with restraint system.

DATA SHEET NO. 11

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 1999 Volvo S80 Sedan Test Date: January 30, 2003



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Overall	820	0	5000	8	1036
2	Overhead Close-up	0	0	5000	13	1000
3	Left Side 45 deg. Rearward Pole View	-3000	-7000	1380	50	1036
4	Left Side 45 deg. Forward Pole View	-3720	5000	1330	50	957
5	Real Time					
6	Left Side Rear Pole View	340	-9000	1600	25	1042
7	Front Ground Level Vehicle/Pole Impact	930	9300	1500	25	913
8	Test Vehicle Onboard Driver Side View				13	524
9	Test Vehicle Onboard Driver Front View				13	513
10	Test Vehicle Onboard Driver ¾ Rear View				13	518
11	Test Vehicle Onboard Driver Door				13	515

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

APPENDIX A

PHOTOGRAPHS

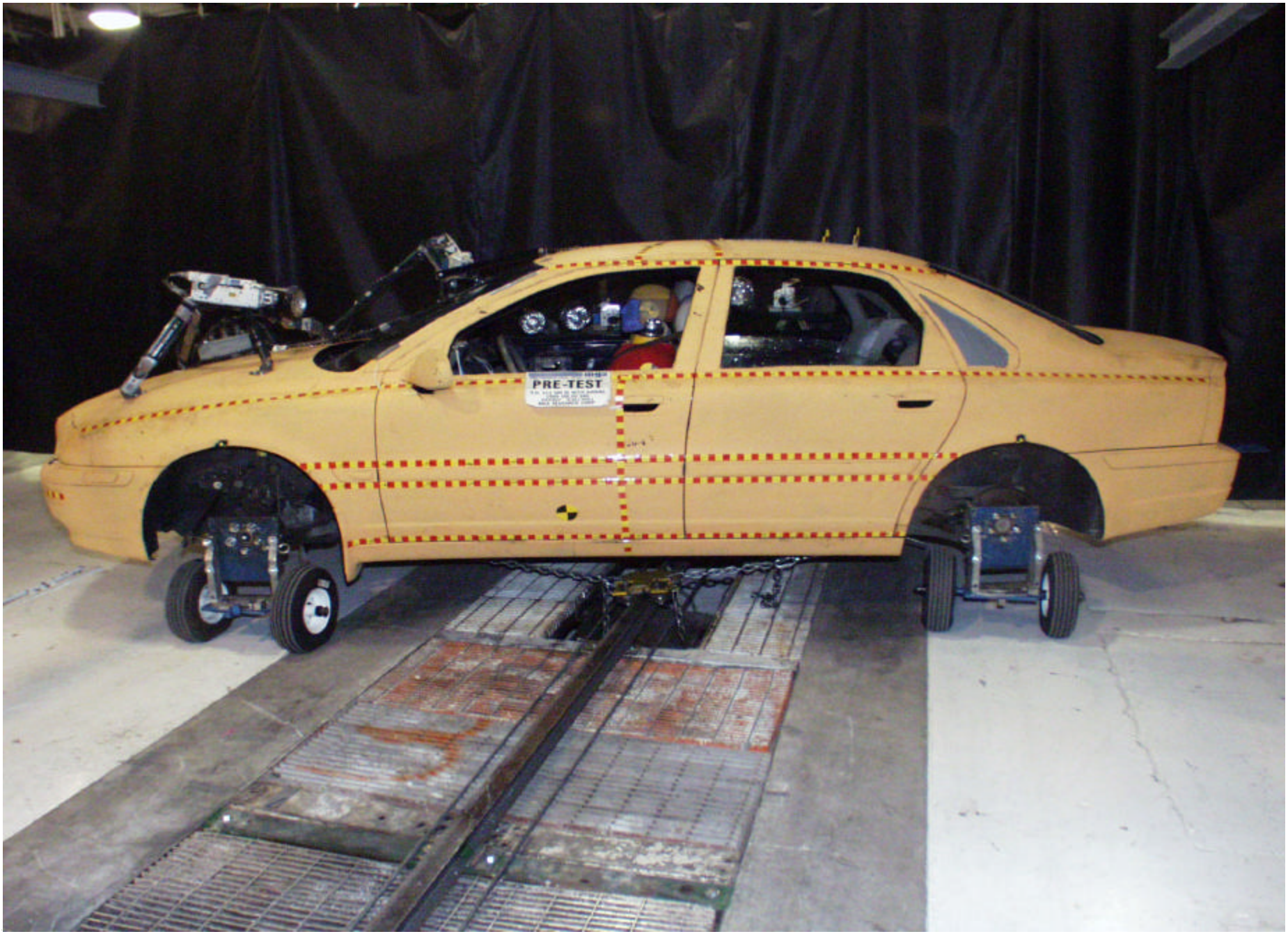
TABLE OF PHOTOGRAPHS

Pre-Test Front View of Test Vehicle

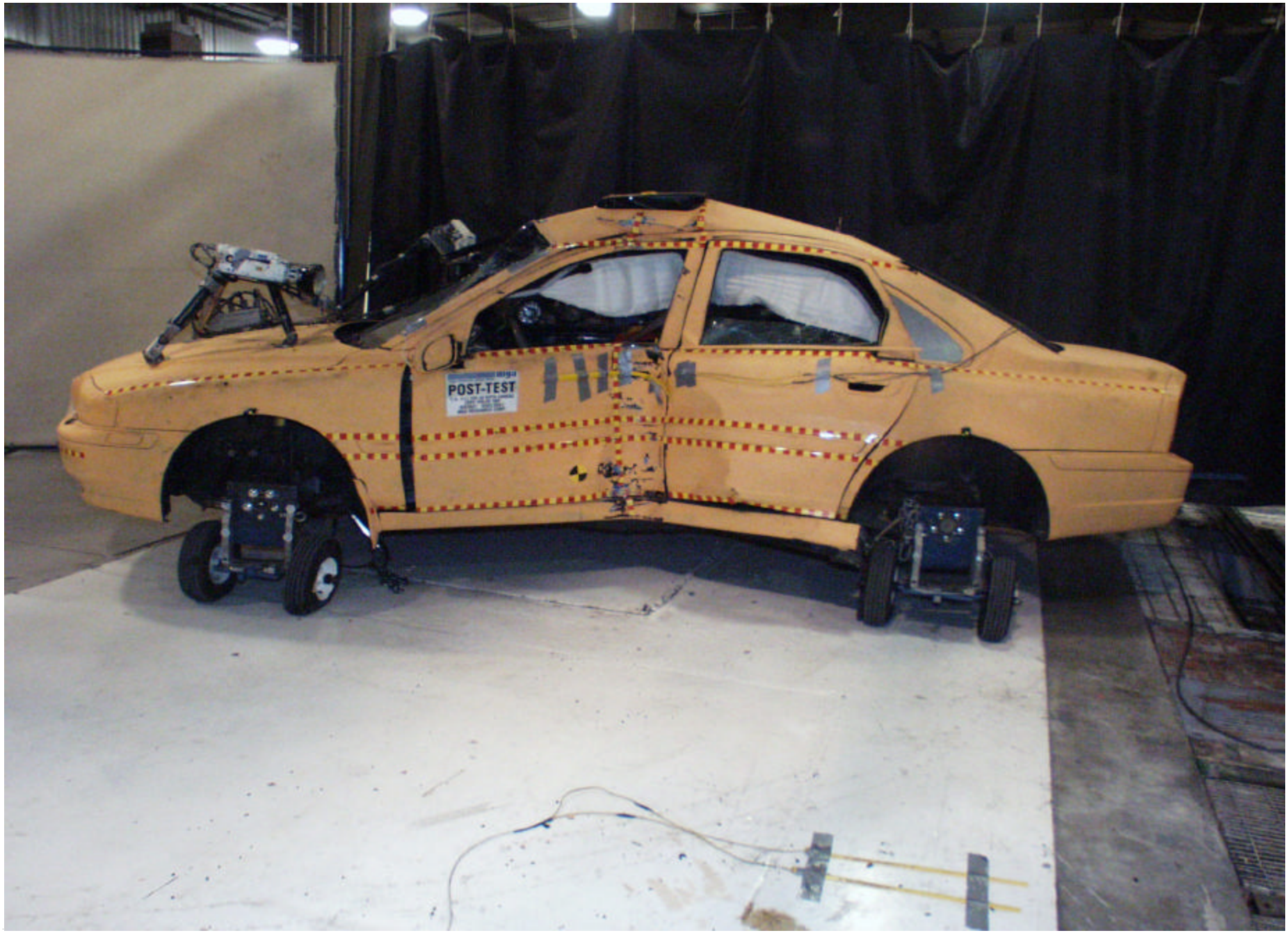
Post-Test Front View of Test Vehicle

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

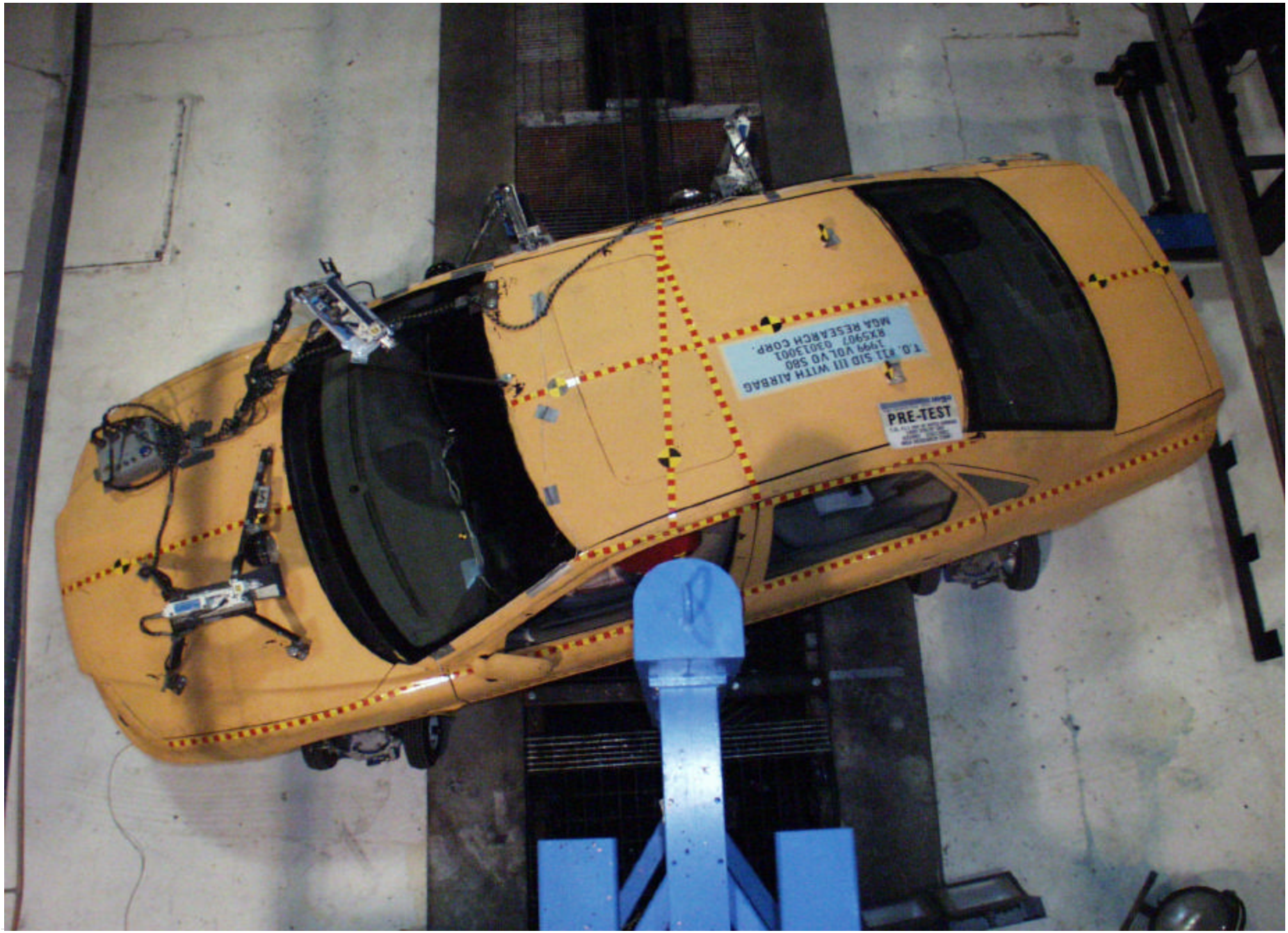
Post-Test Left ¾ Rear View of Test Vehicle

Pre-Test Vehicle Positioned Against Pole (left side)

Post-Test Pole and Vehicle (left side)

Pre-Test Vehicle Positioned Against Pole (right side)

Post-Test Pole and Vehicle



Pre-Test Vehicle Positioned Against Pole Overhead View

Post-Test Pole and Vehicle Overhead View

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

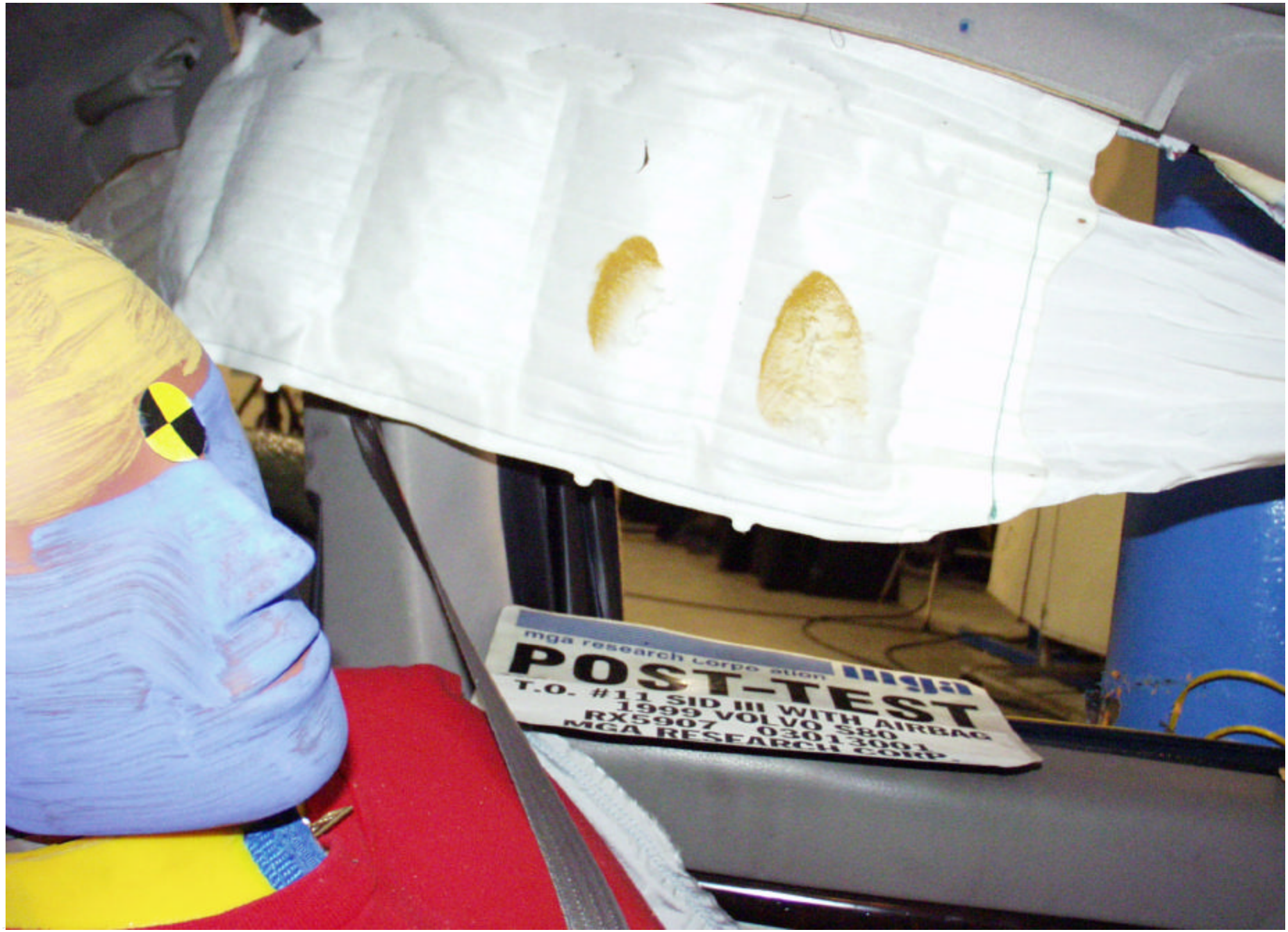
Pre-Test Driver Dummy Right Side View

Post-Test Driver Dummy Right Side View

Pre-Test Driver Dummy Shoulder and Door Top View

Post Test Driver Dummy Shoulder And Door Top View

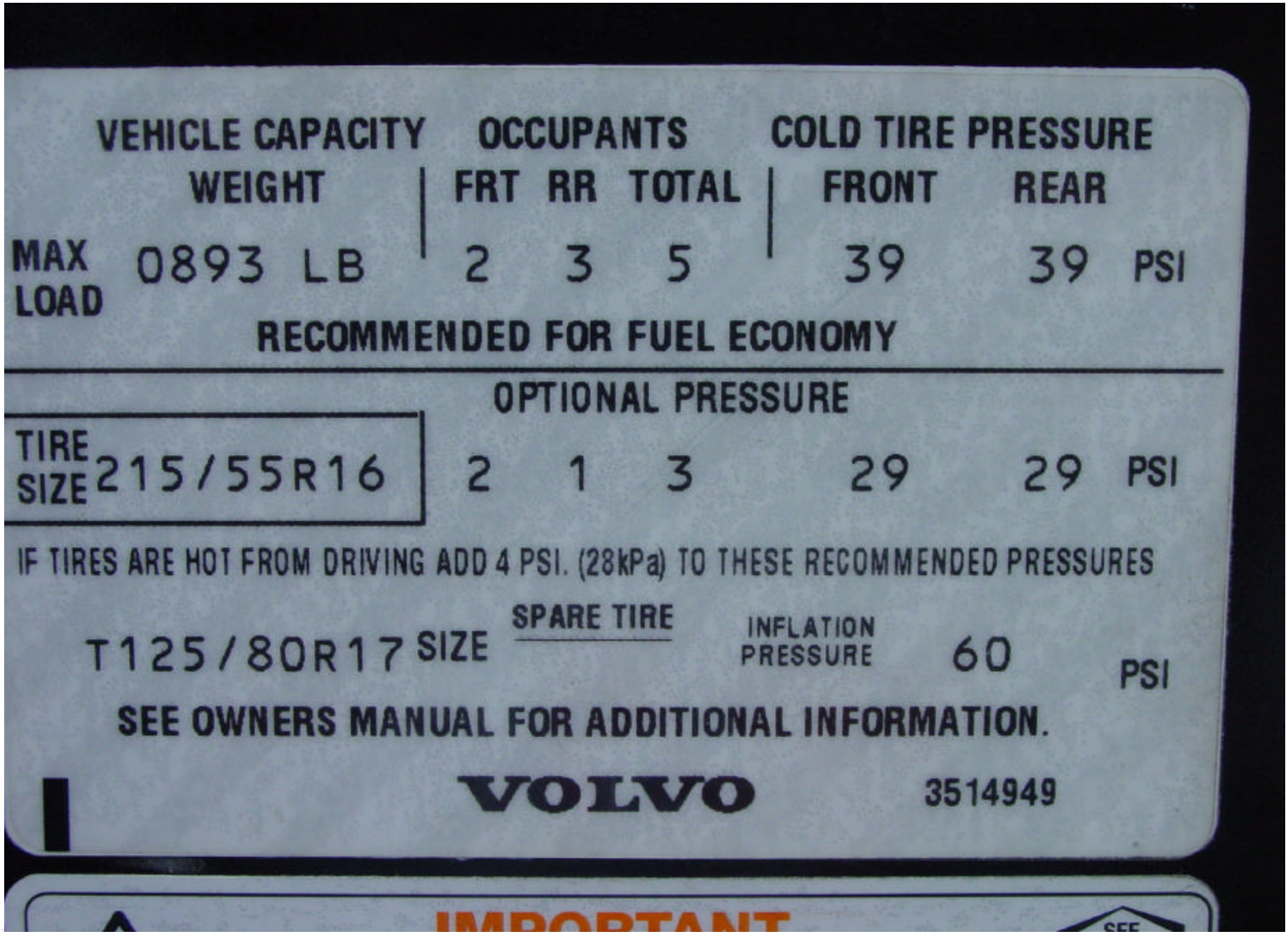
Post-Test Driver Dummy Contact



Post-Test Driver Dummy Head Contact

Pre-Test Impact Point on Vehicle

Post-Test Impact Point on Vehicle



Tire Placard

Impact

APPENDIX B

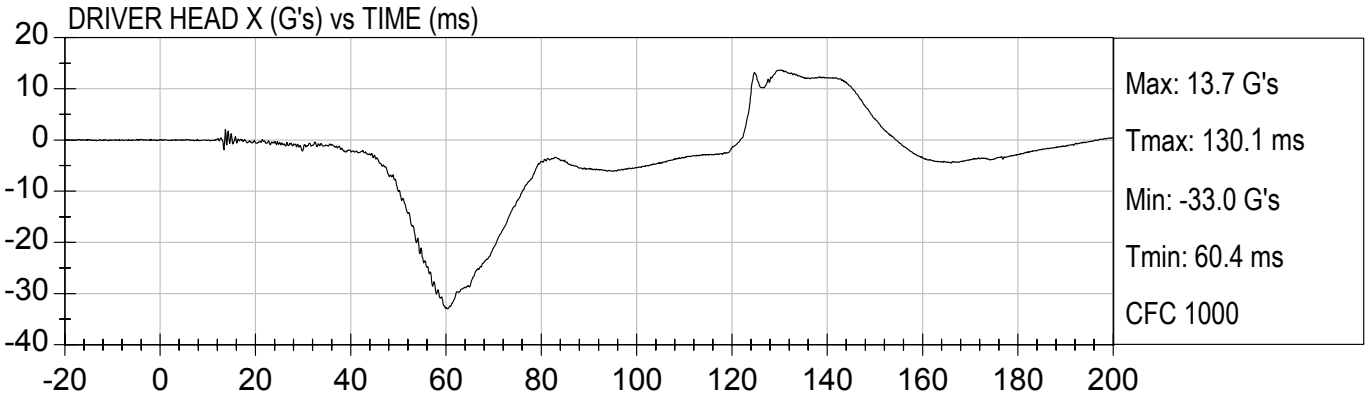
VEHICLE AND DUMMY RESPONSE DATA TRACES

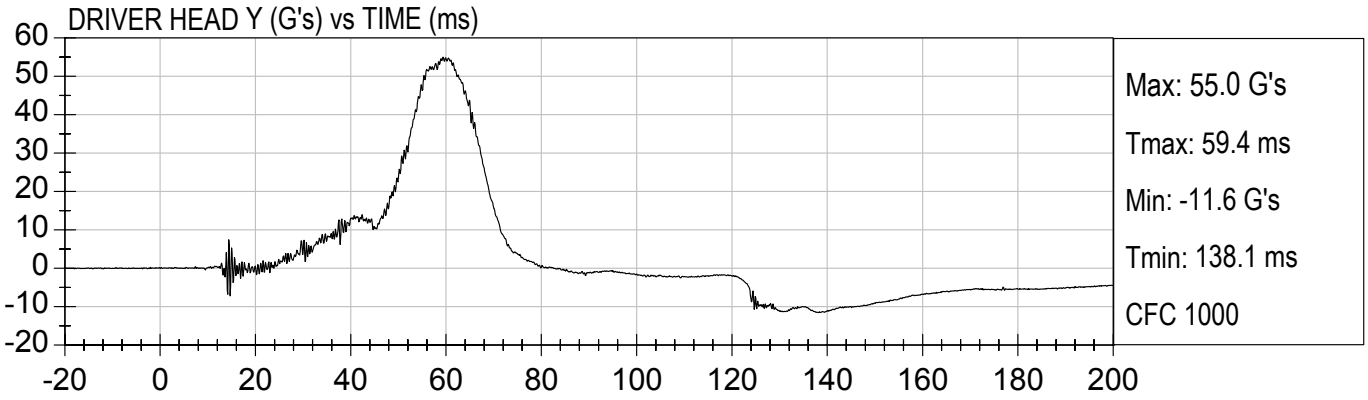
TABLE OF DATA PLOTS

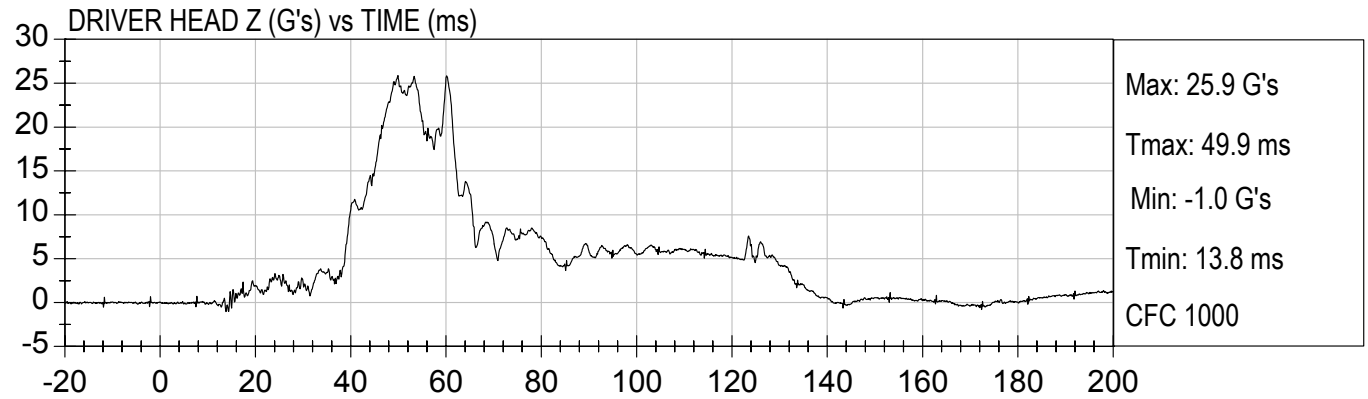
The dummy and vehicle X and Y velocities presented in this report do not contain the correct initial velocity. The correct initial velocities should be:
X – Test Speed * Sine 15 Degrees
Y – Test Speed * Cosine 15 Degrees

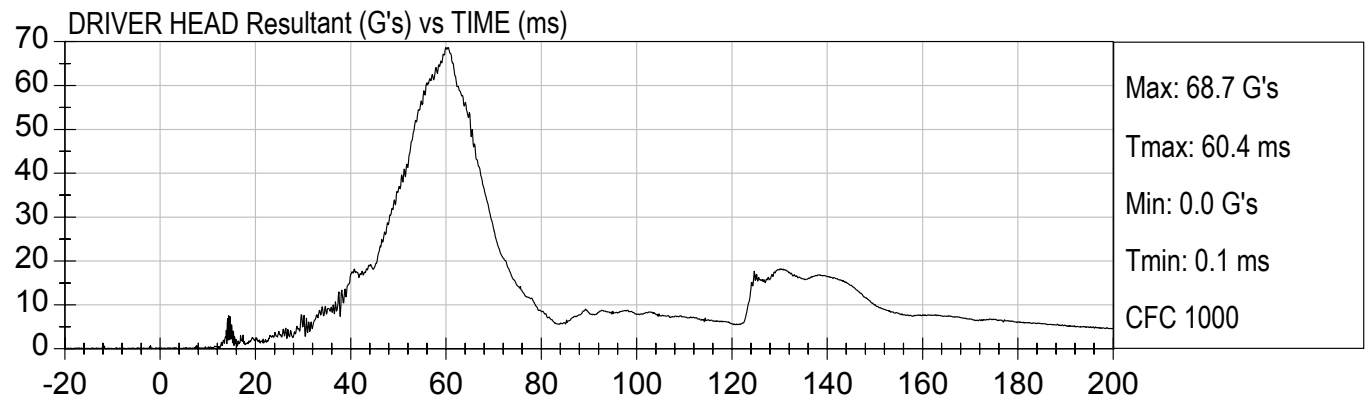
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



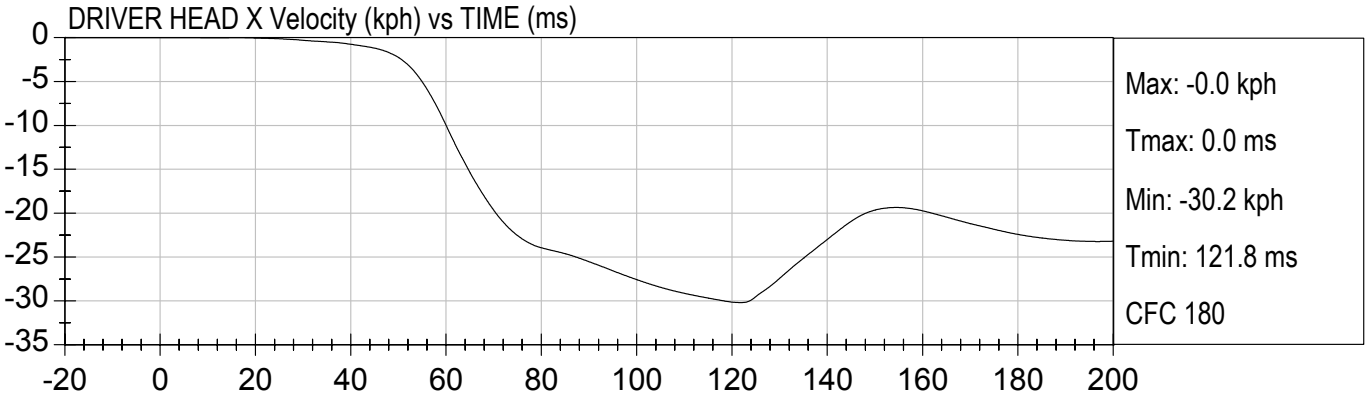


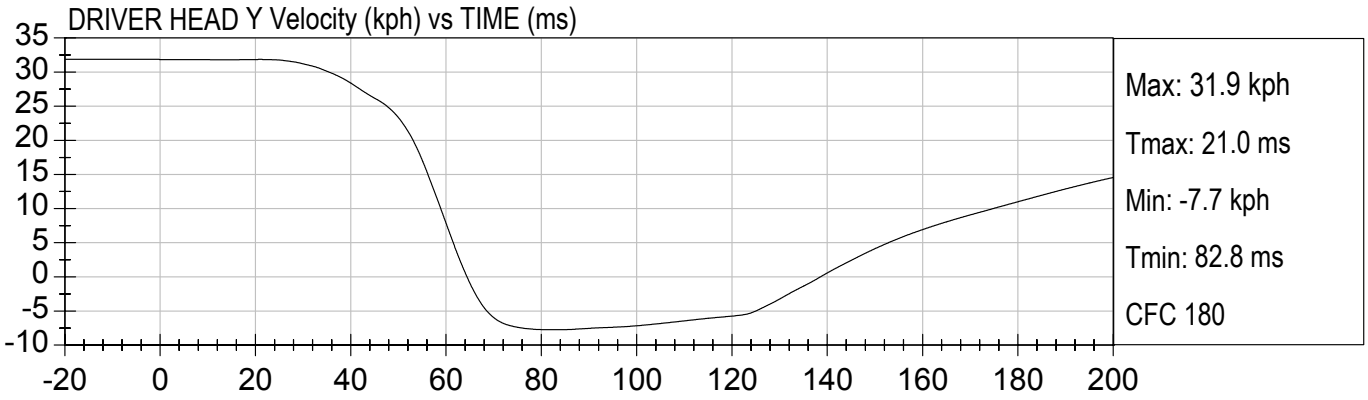


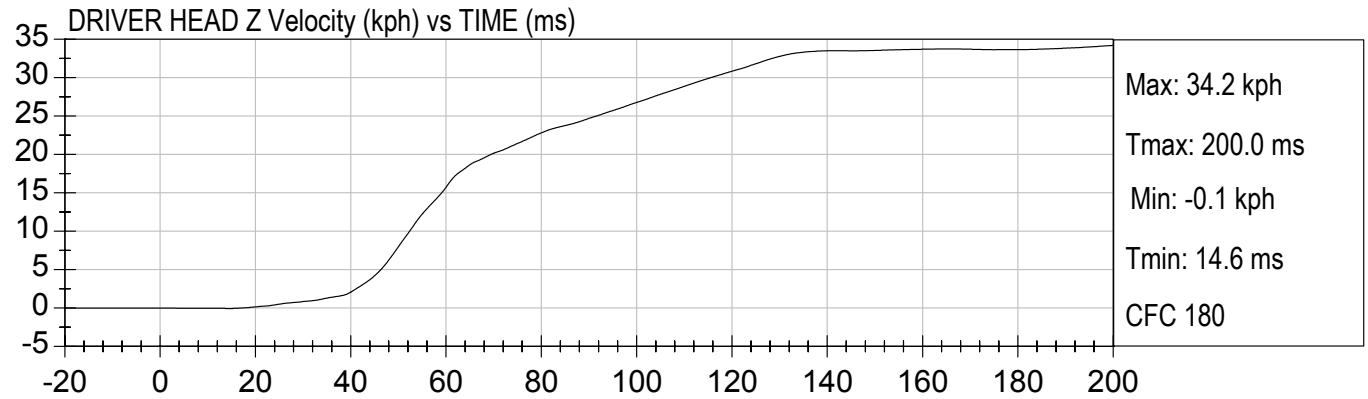


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

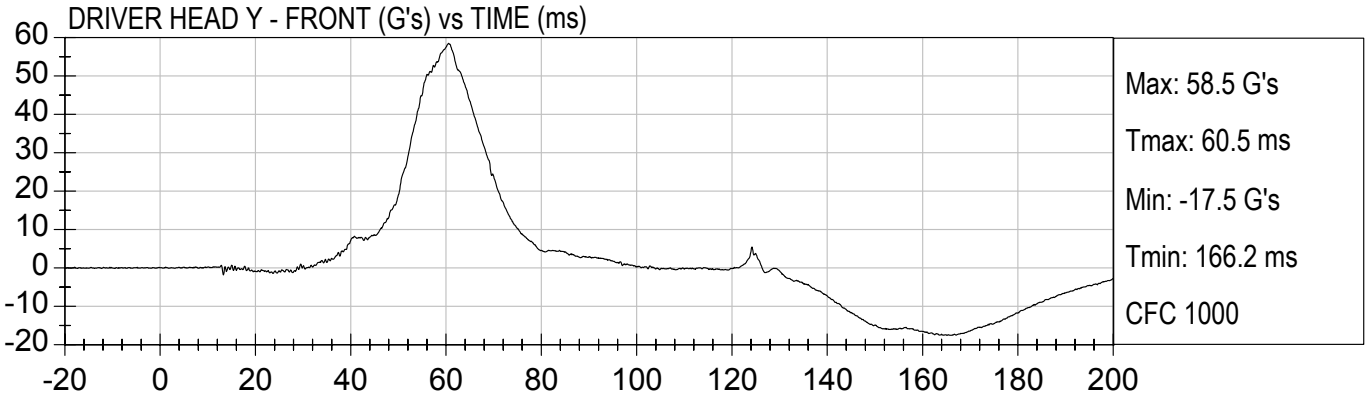


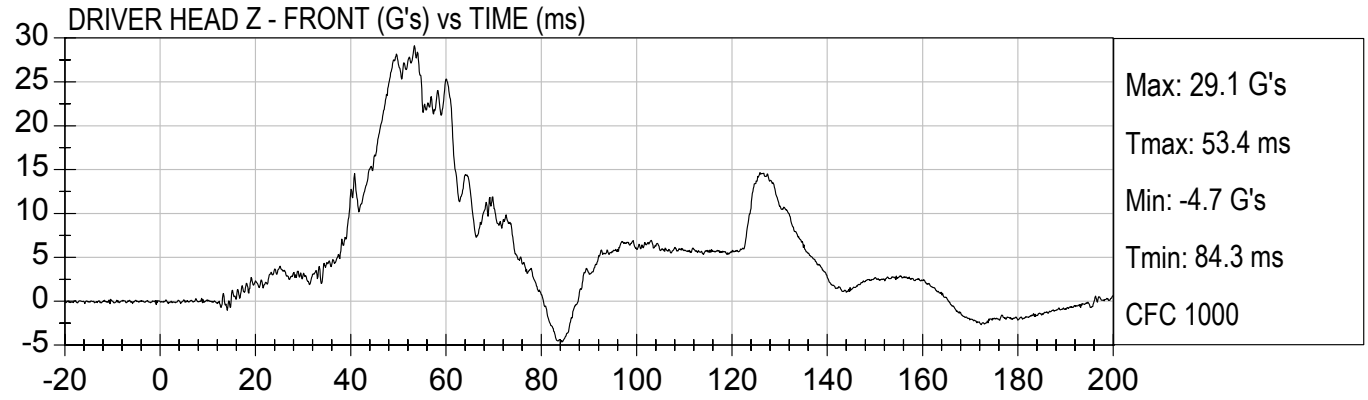


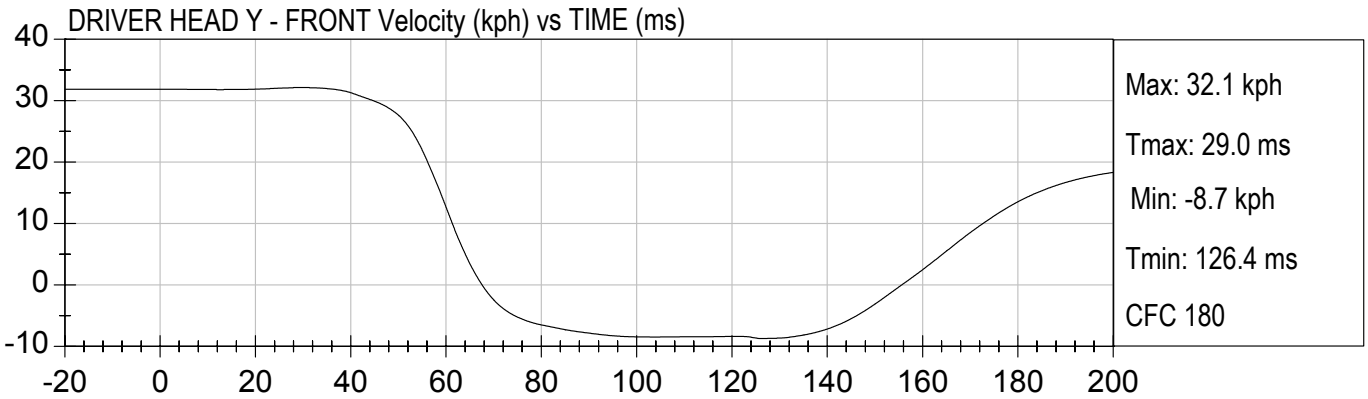


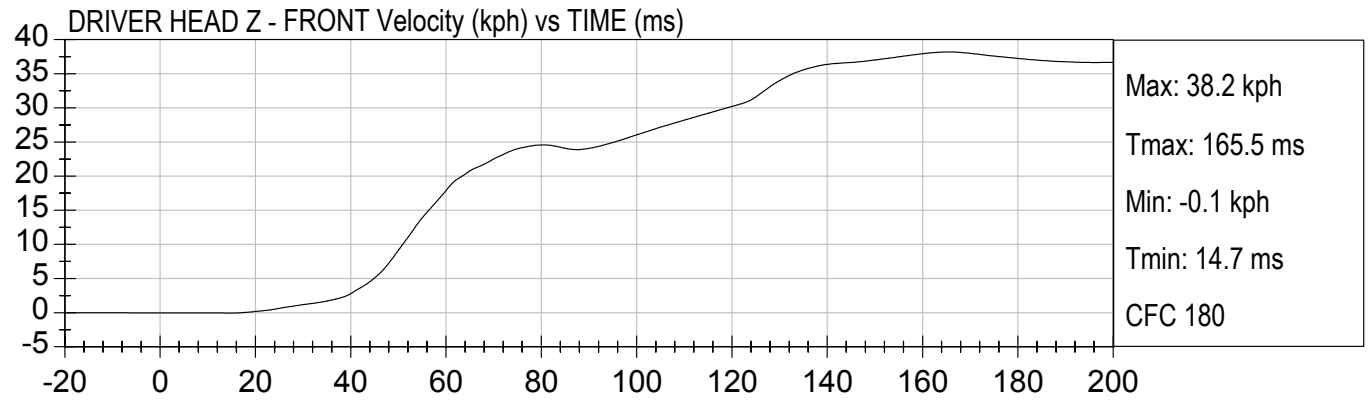
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



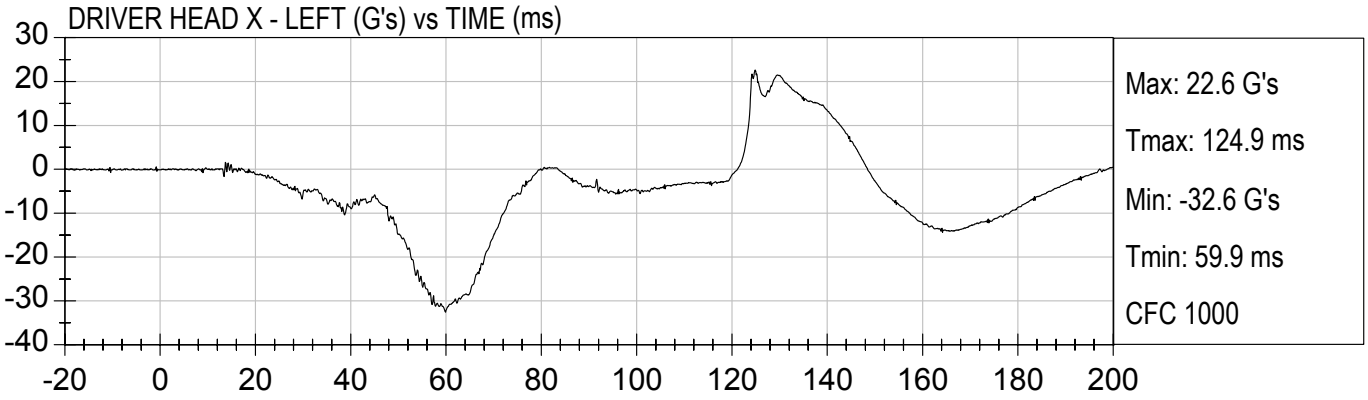


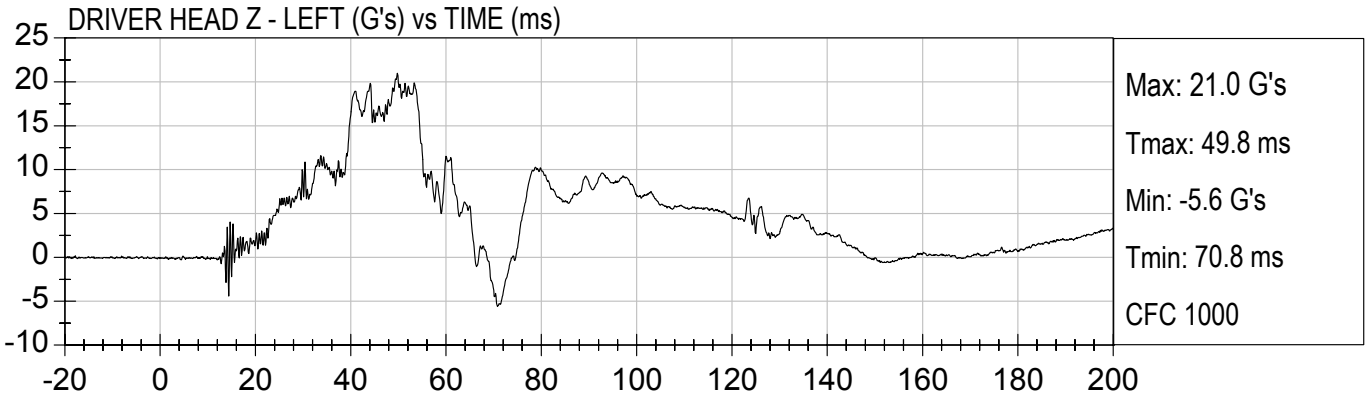


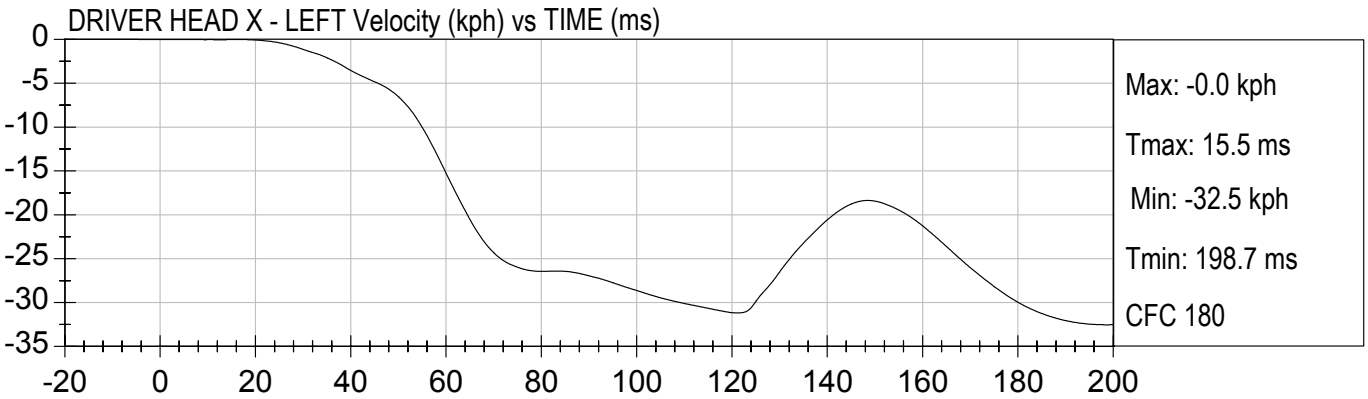


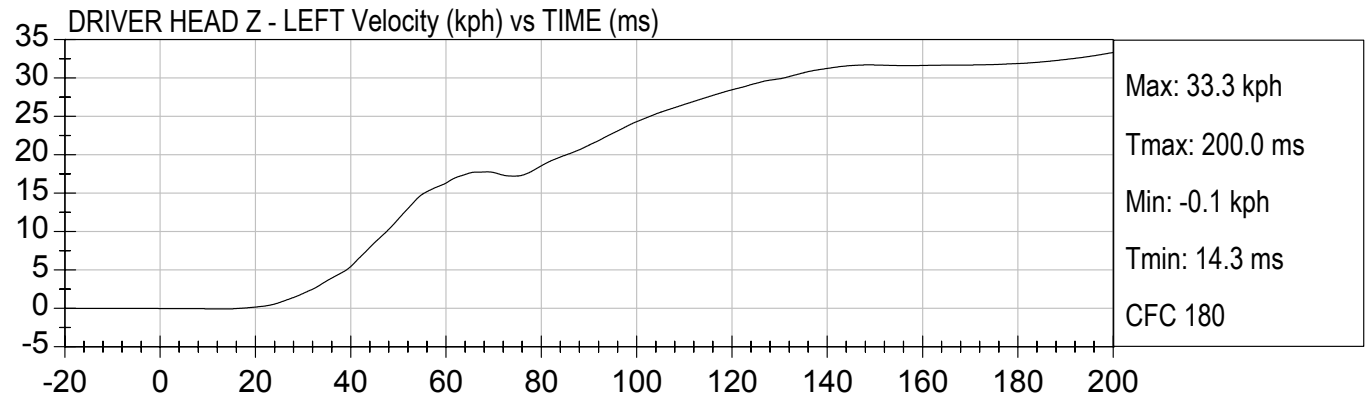
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



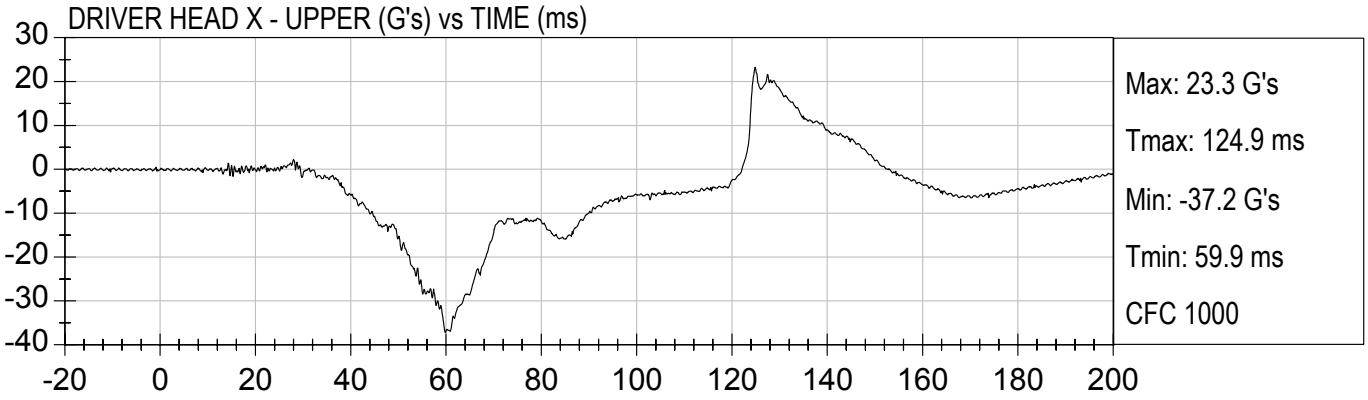


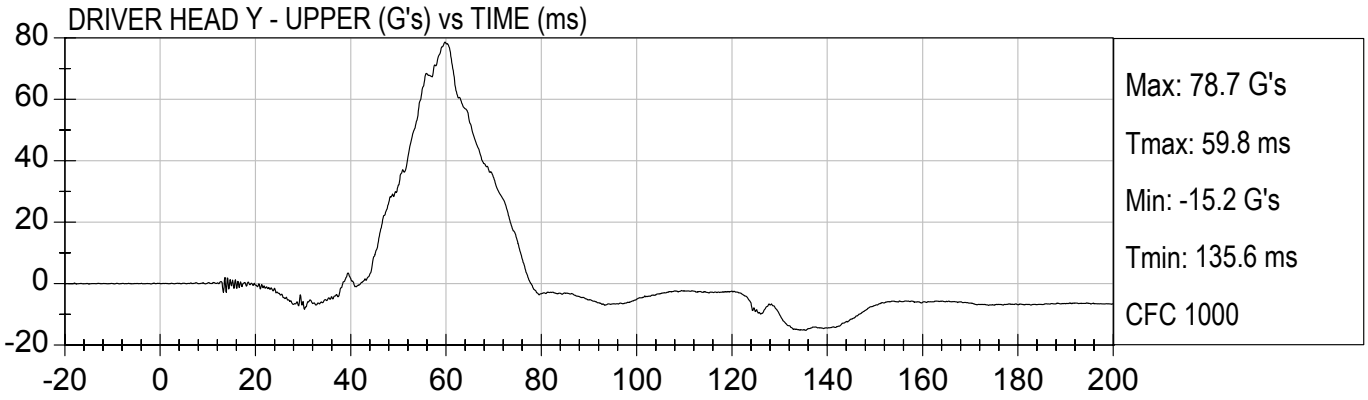


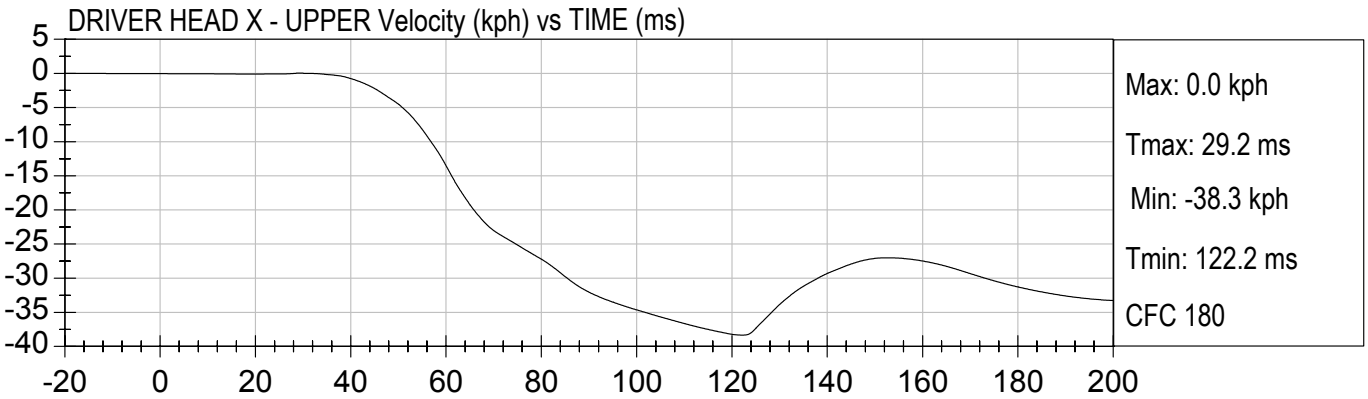


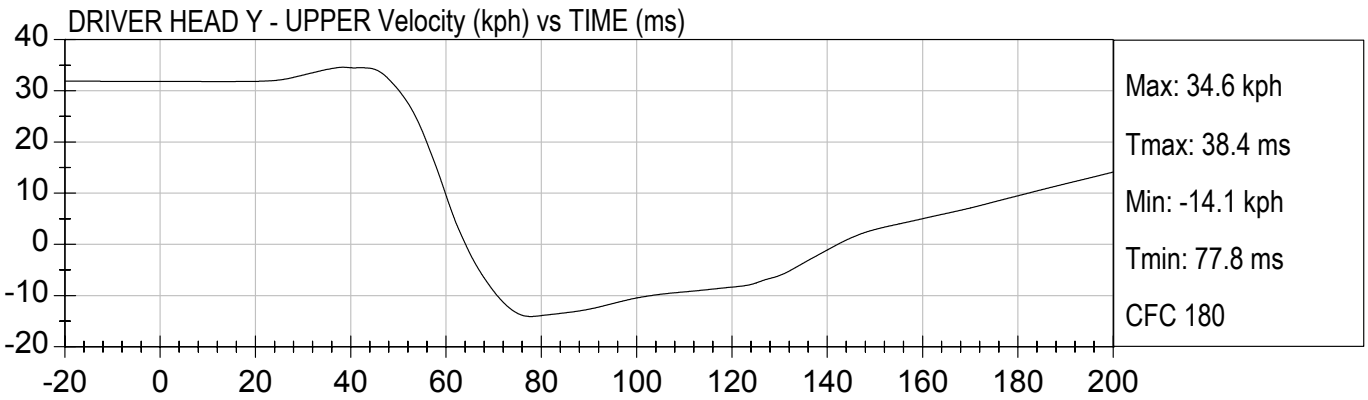
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)









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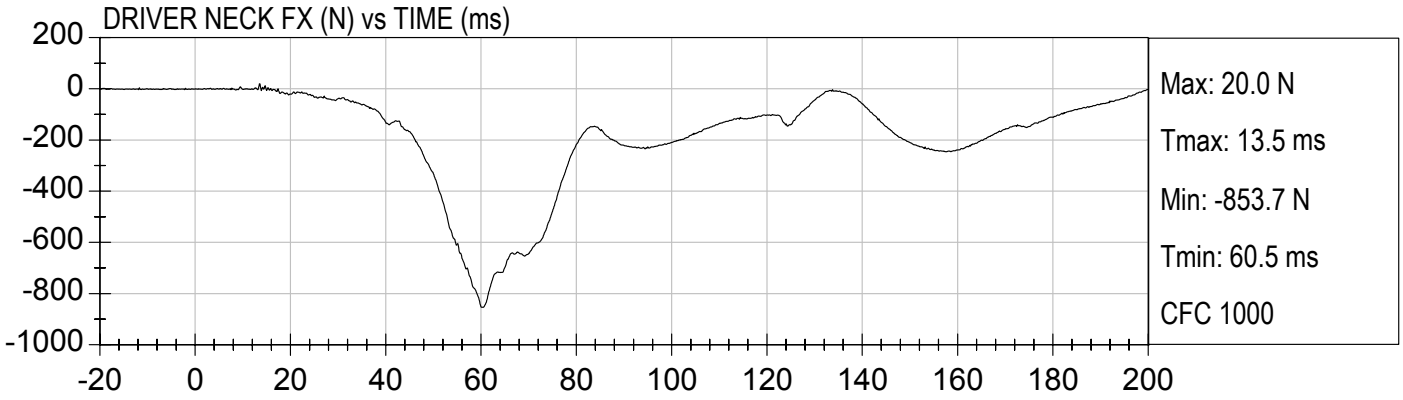
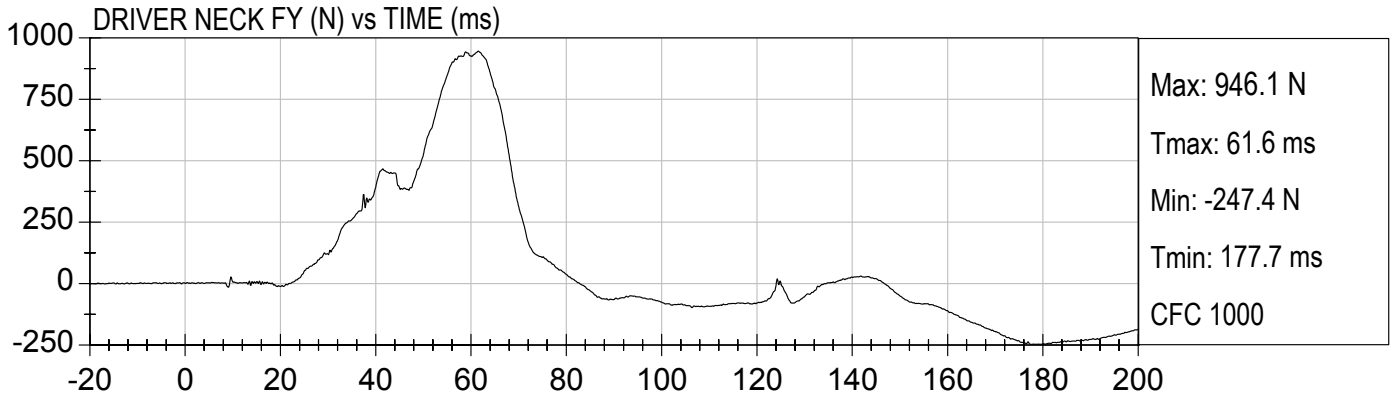
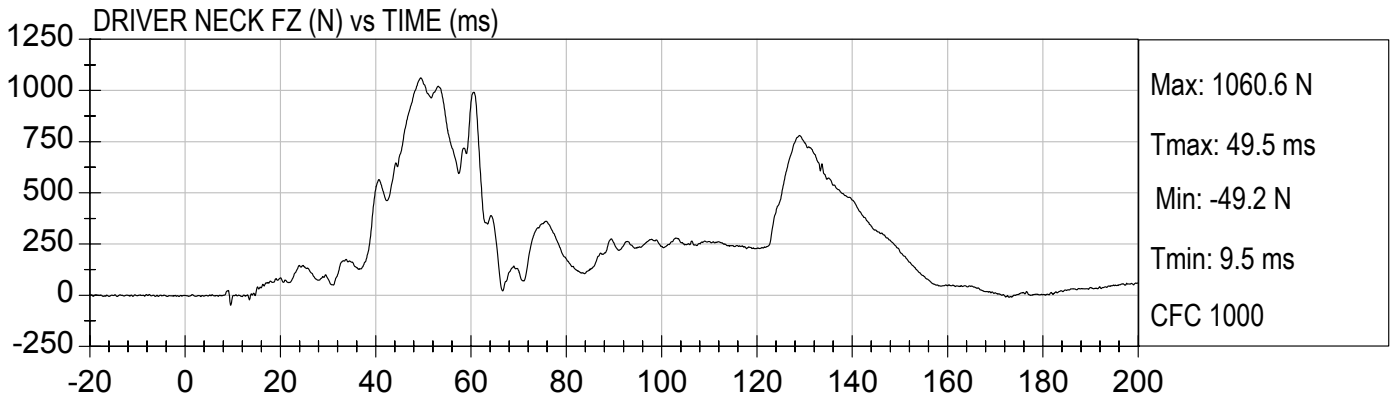
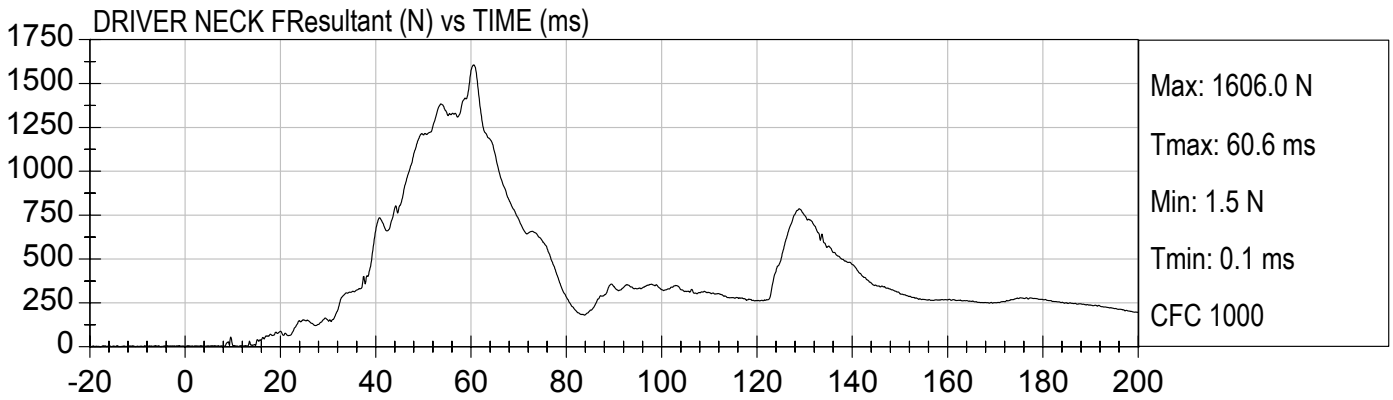
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



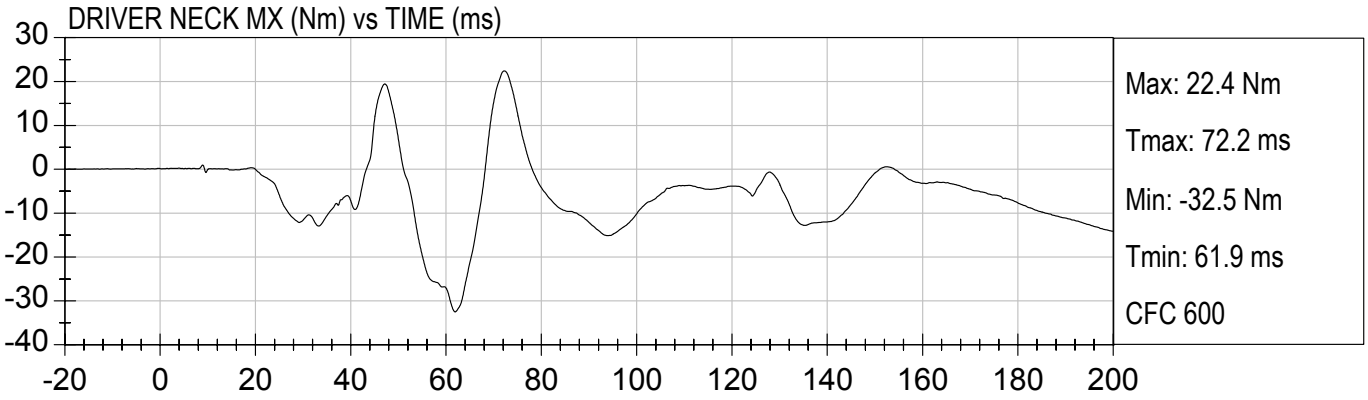


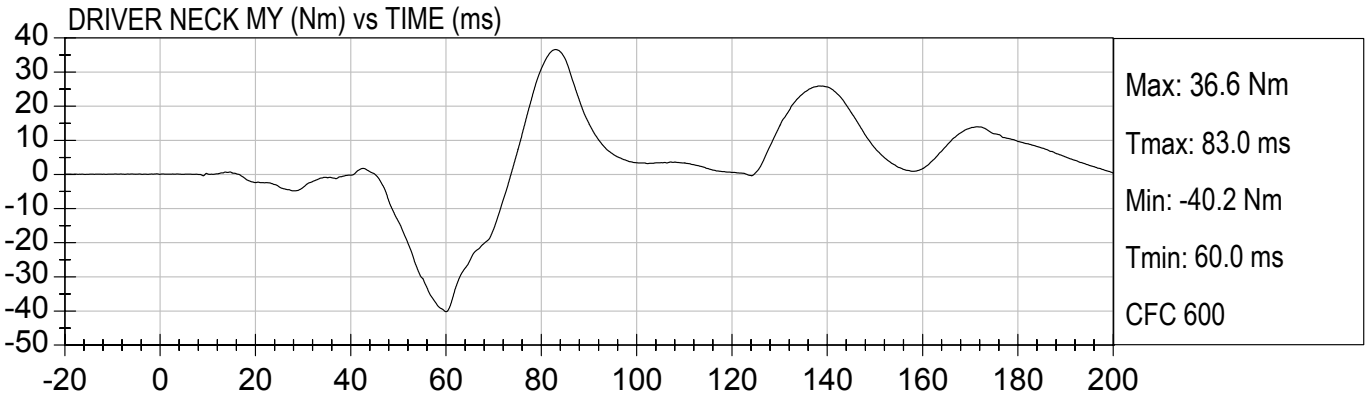


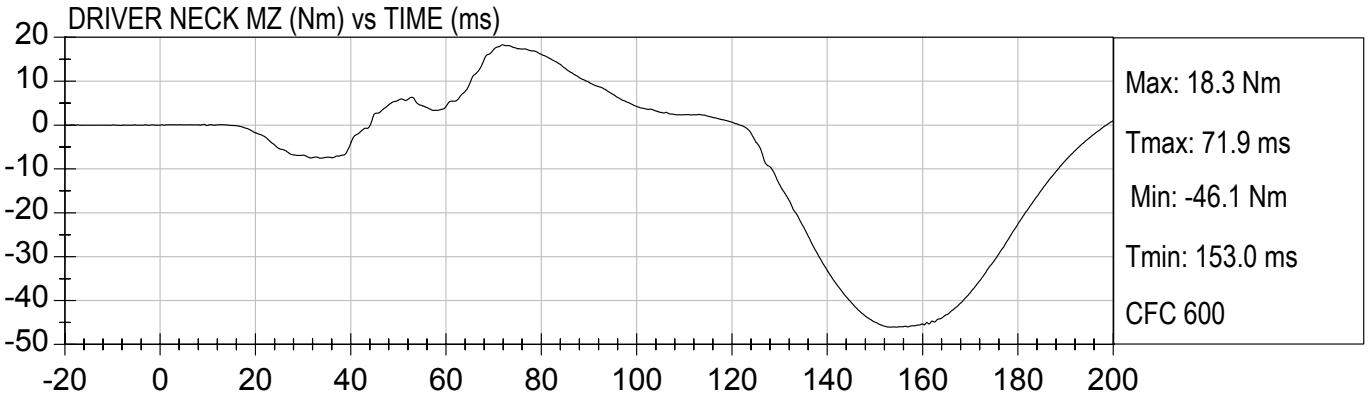


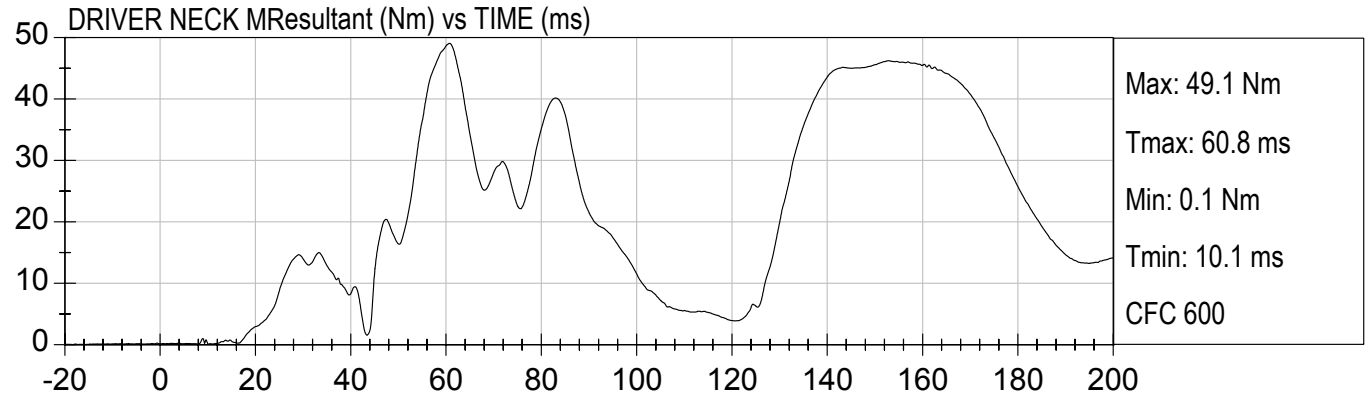
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



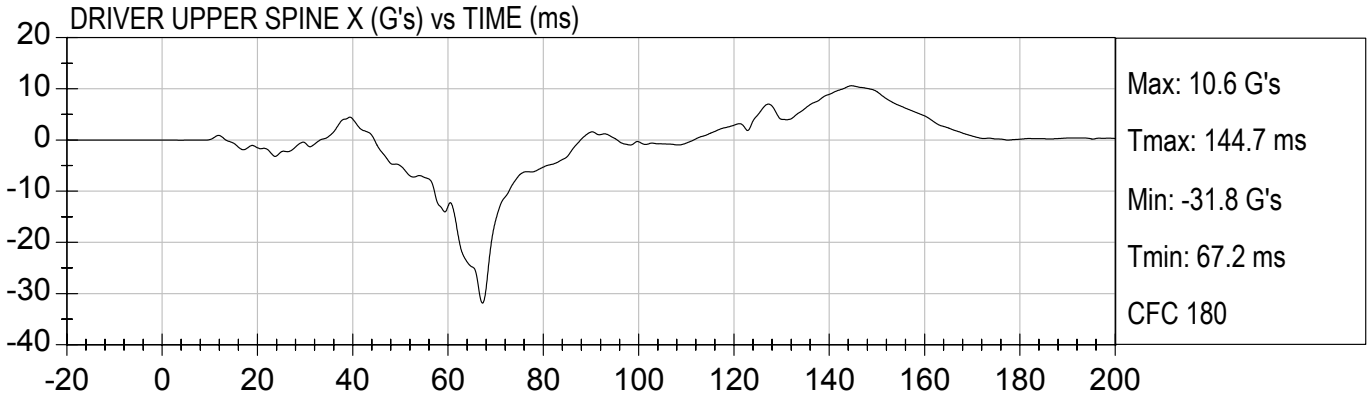


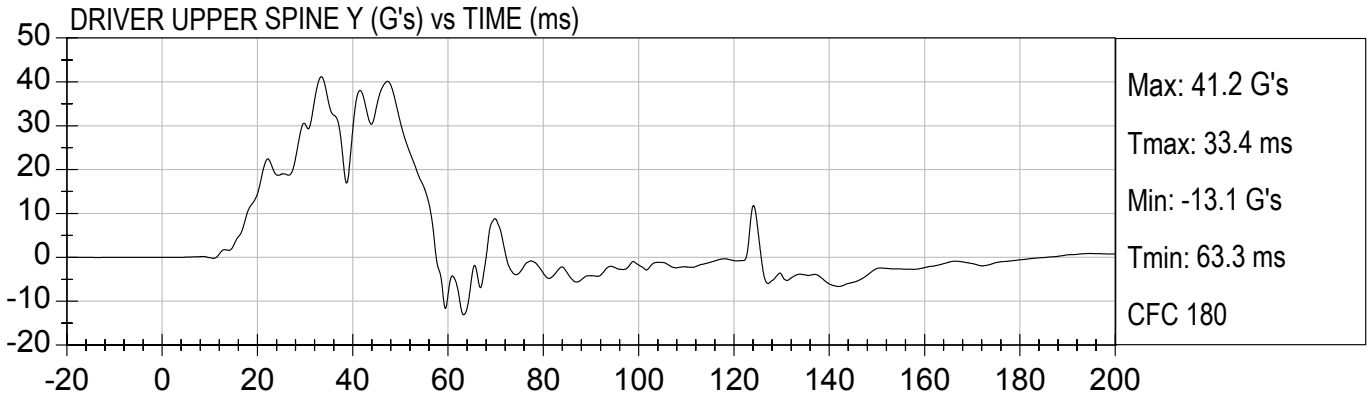


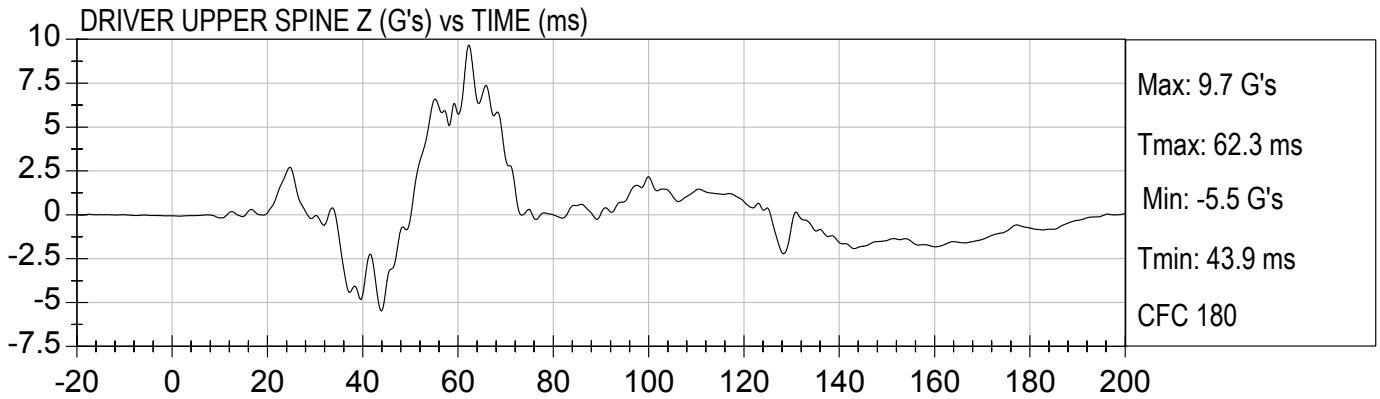


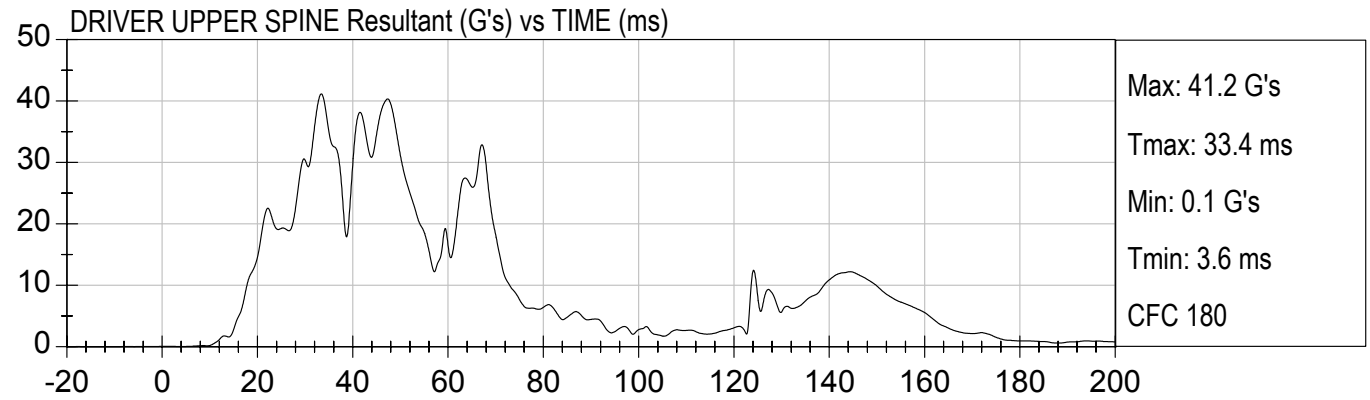
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

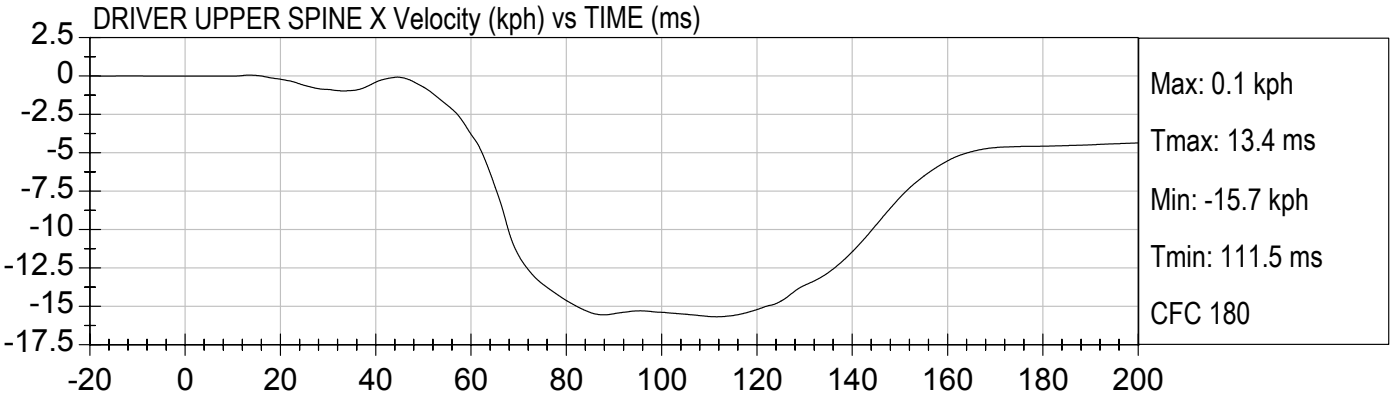
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

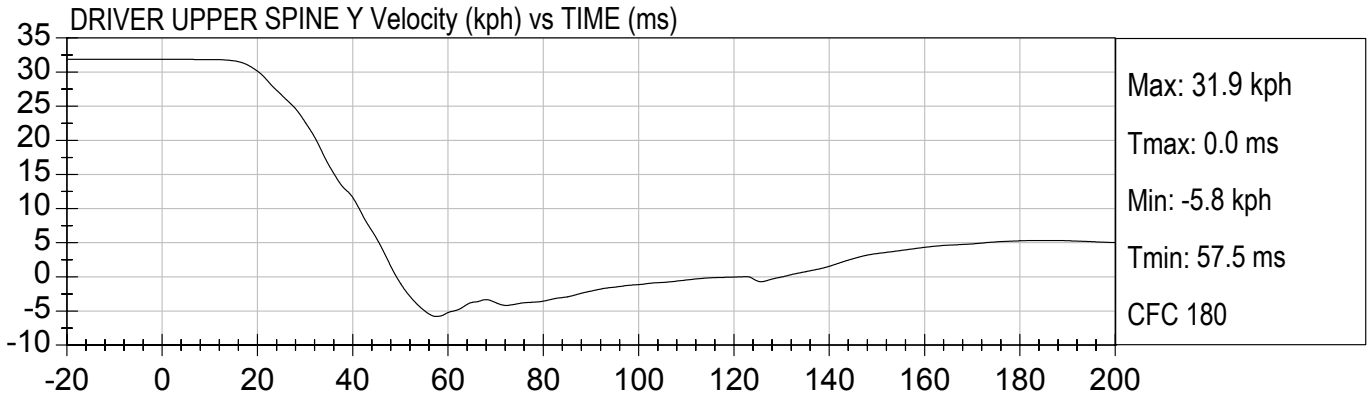


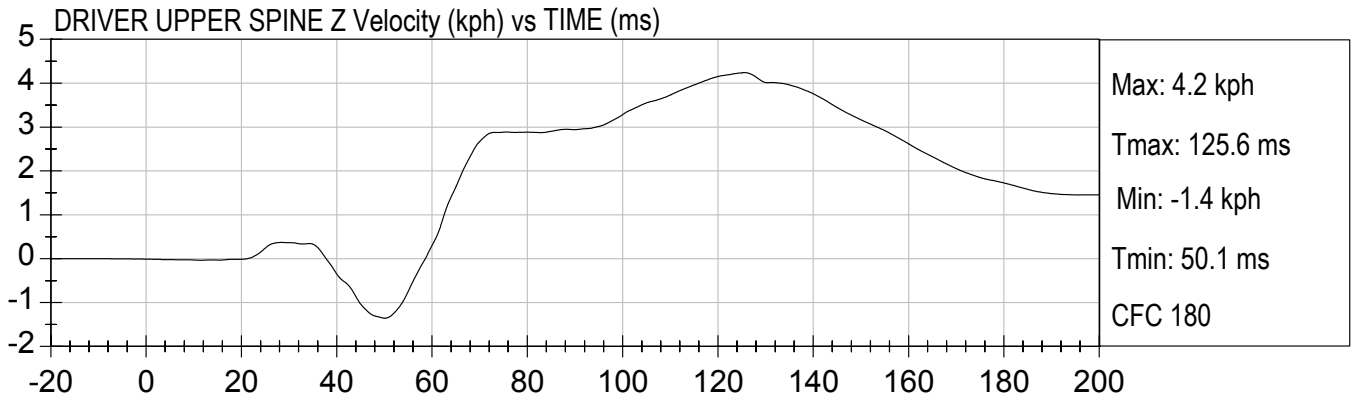






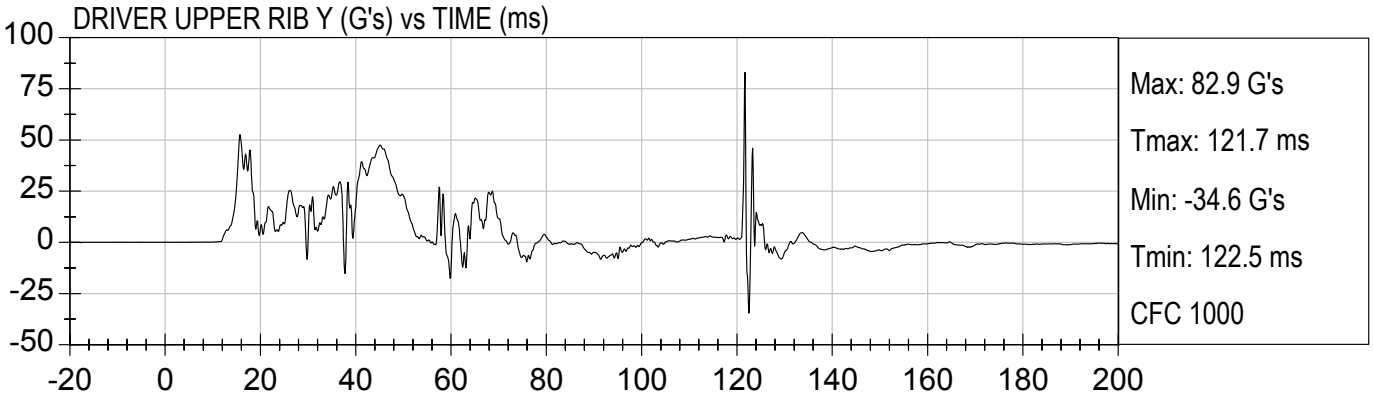

DRIVER UPPER SPINE X Velocity (kph) vs TIME (ms)
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-17.5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 0.1 kph
Tmax: 13.4 ms
Min: -15.7 kph
Tmin: 111.5 ms
CFC 180

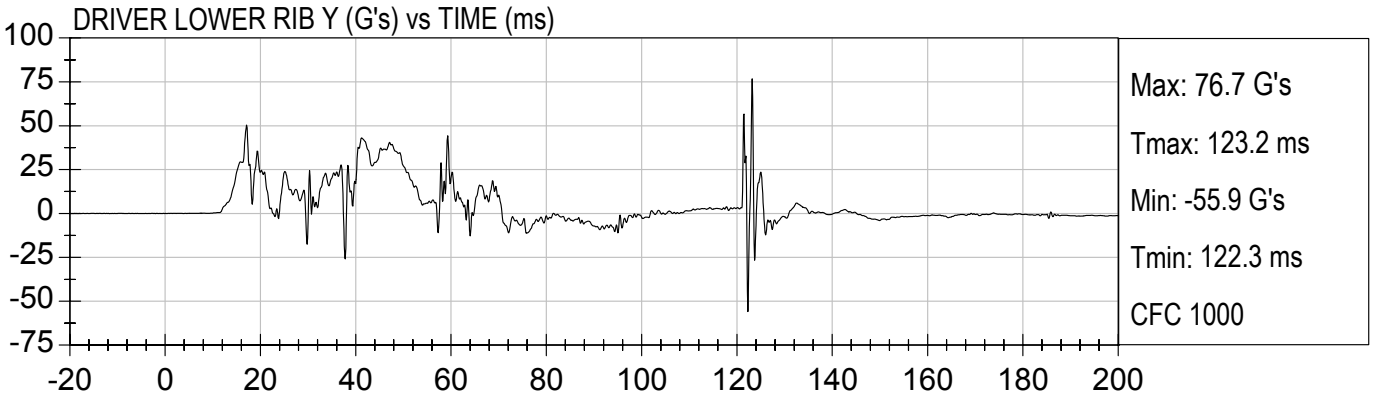

DRIVER UPPER SPINE Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.9 kph
Tmax: 0.0 ms
Min: -5.8 kph
Tmin: 57.5 ms
CFC 180

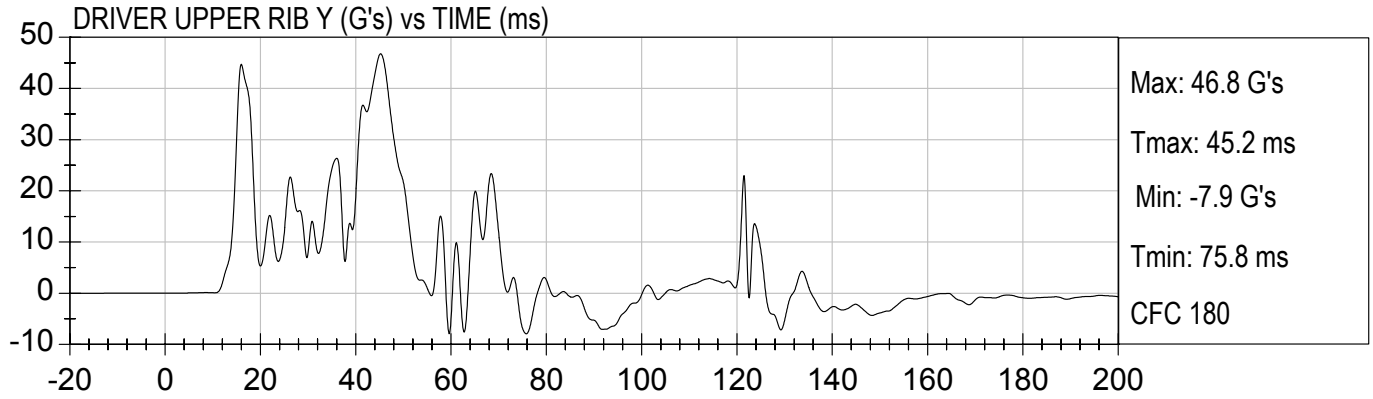

DRIVER UPPER SPINE Z Velocity (kph) vs TIME (ms)
5
4
3
2
1
0
-1
-2
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 4.2 kph
Tmax: 125.6 ms
Min: -1.4 kph
Tmin: 50.1 ms
CFC 180

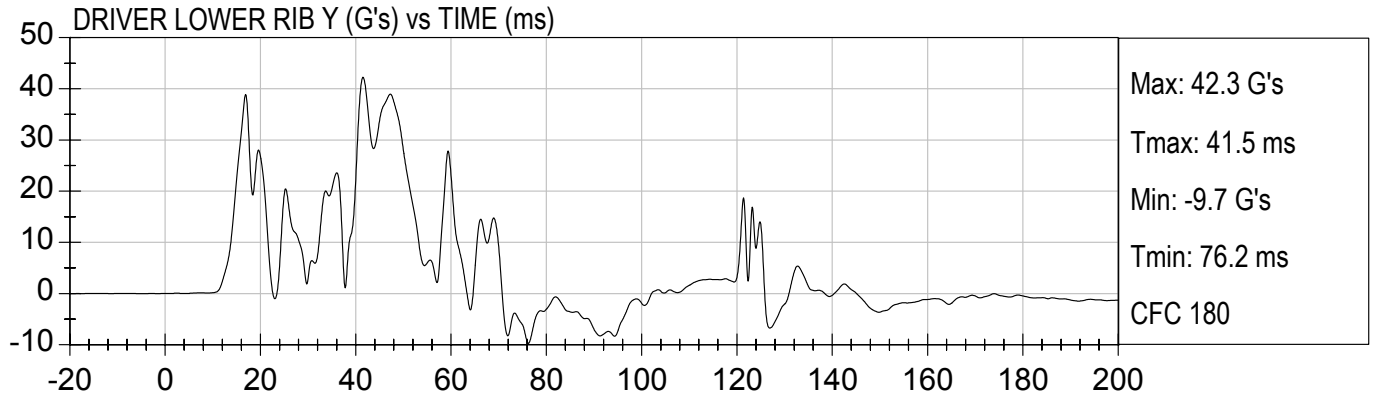
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



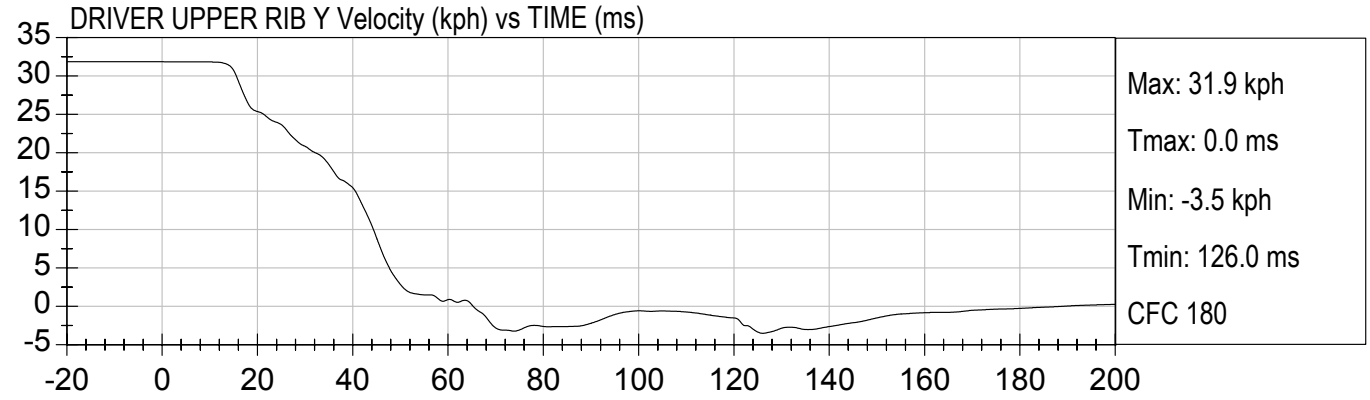


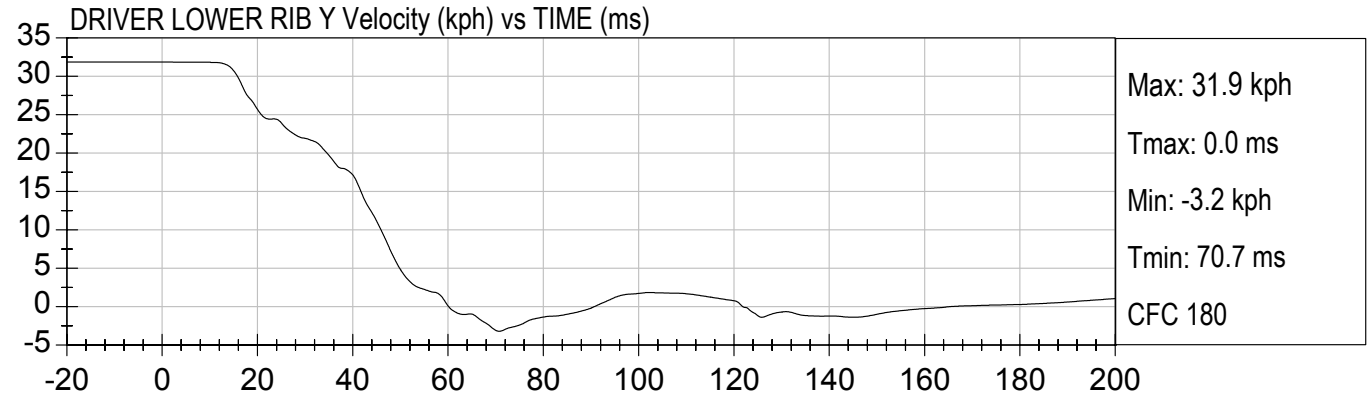


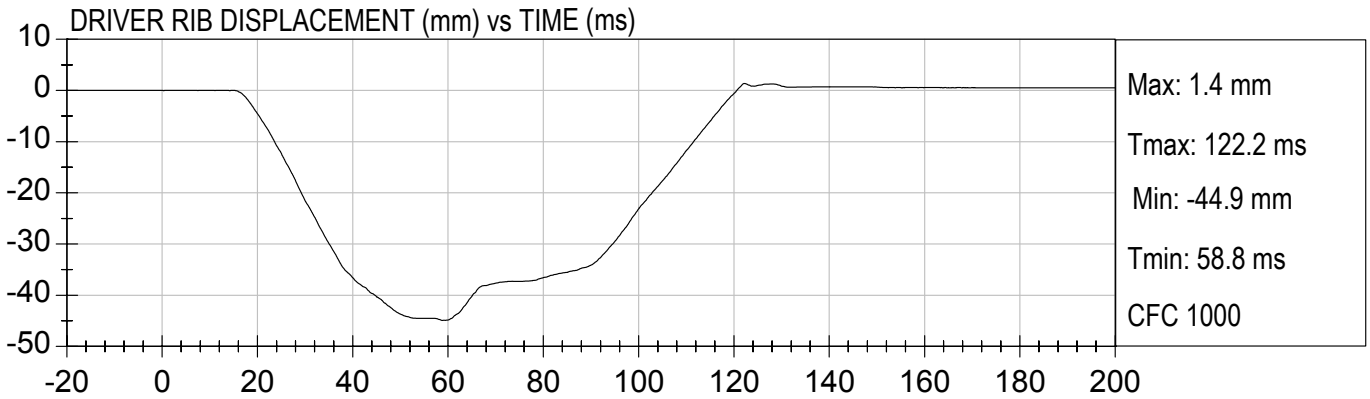


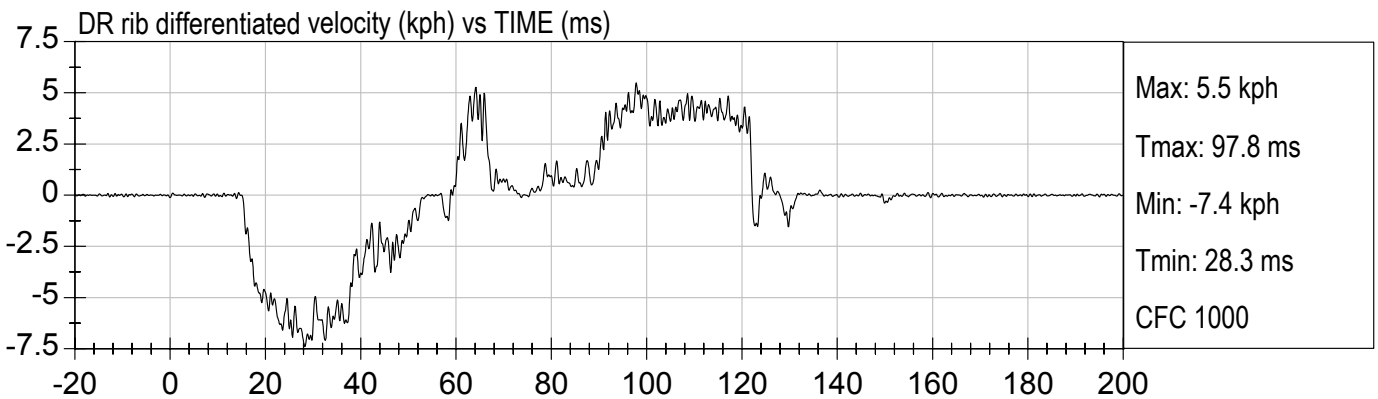
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



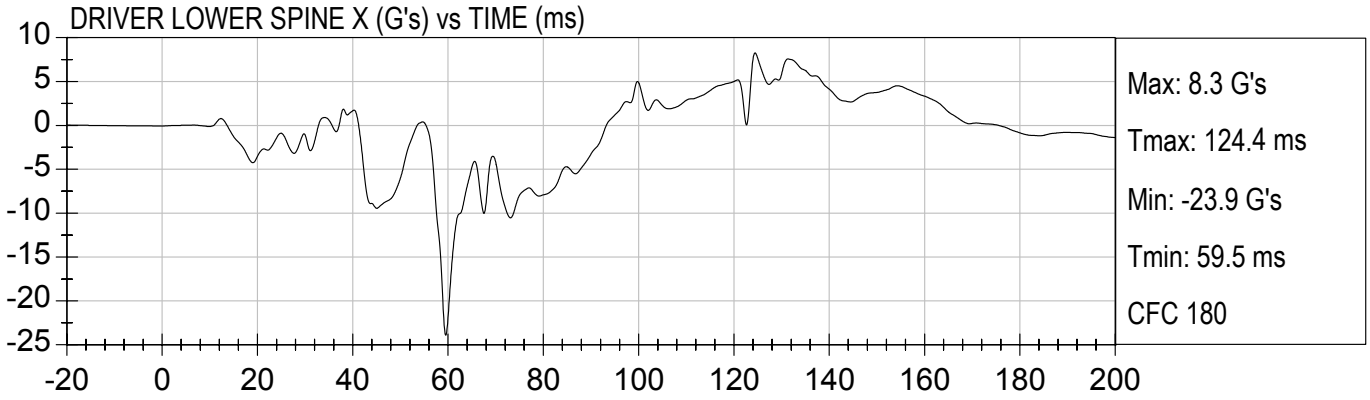


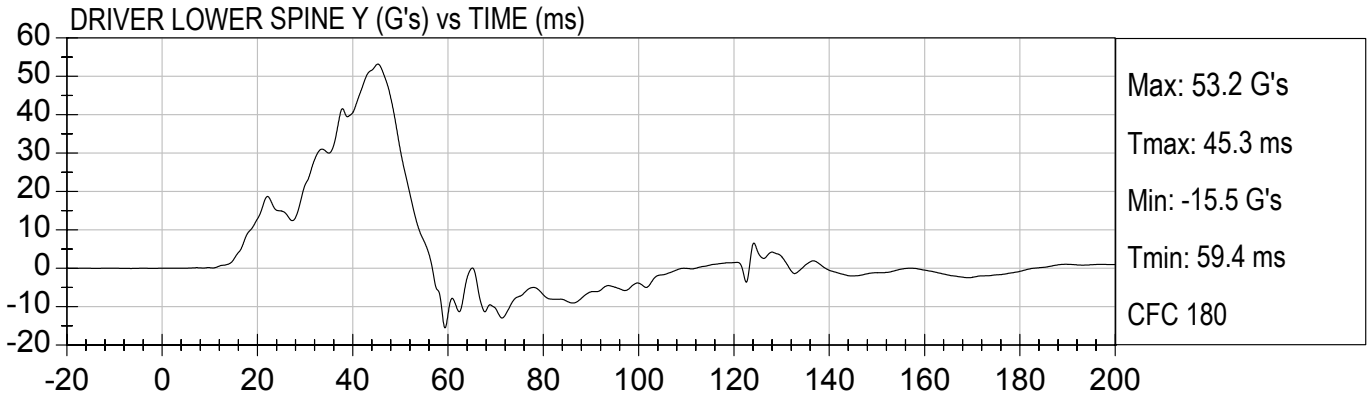


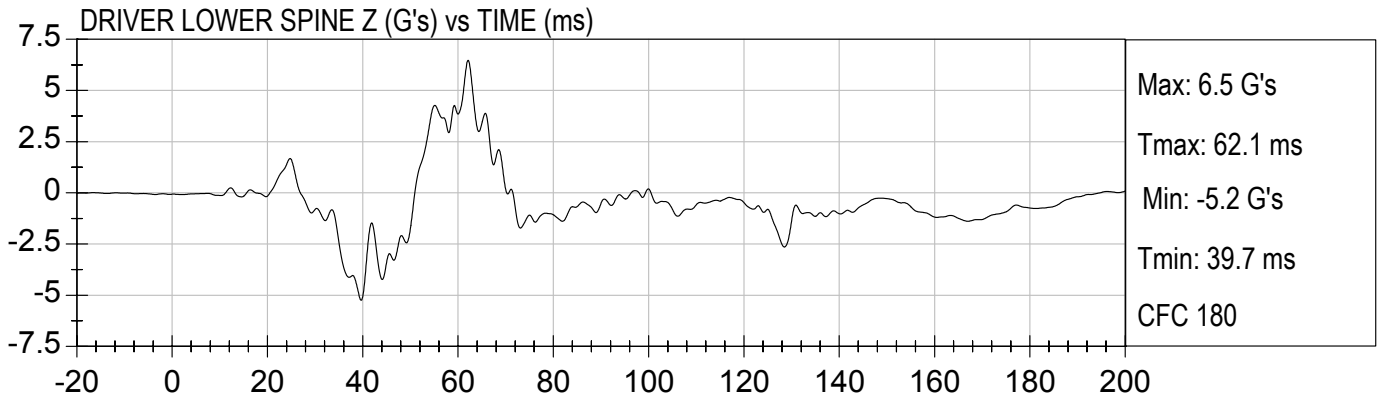


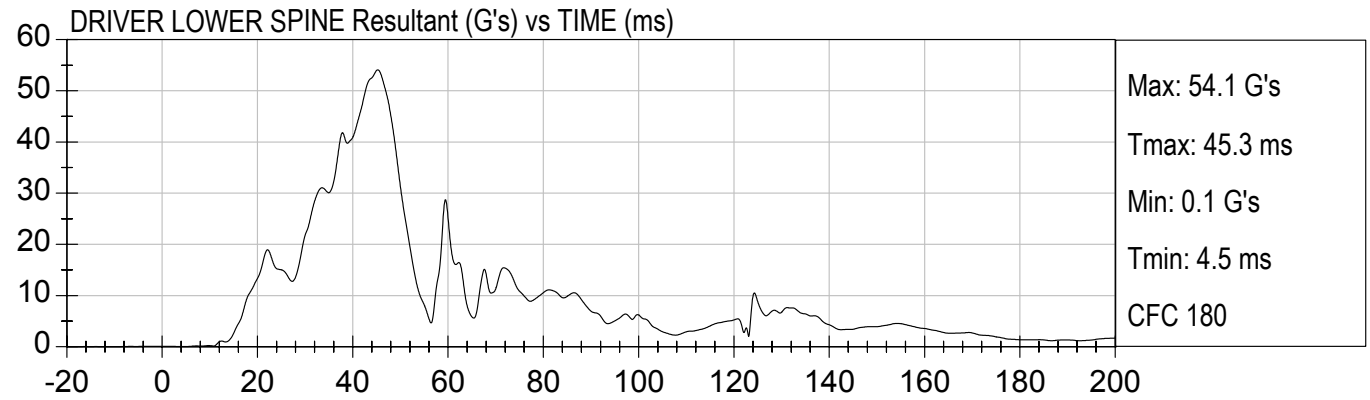
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



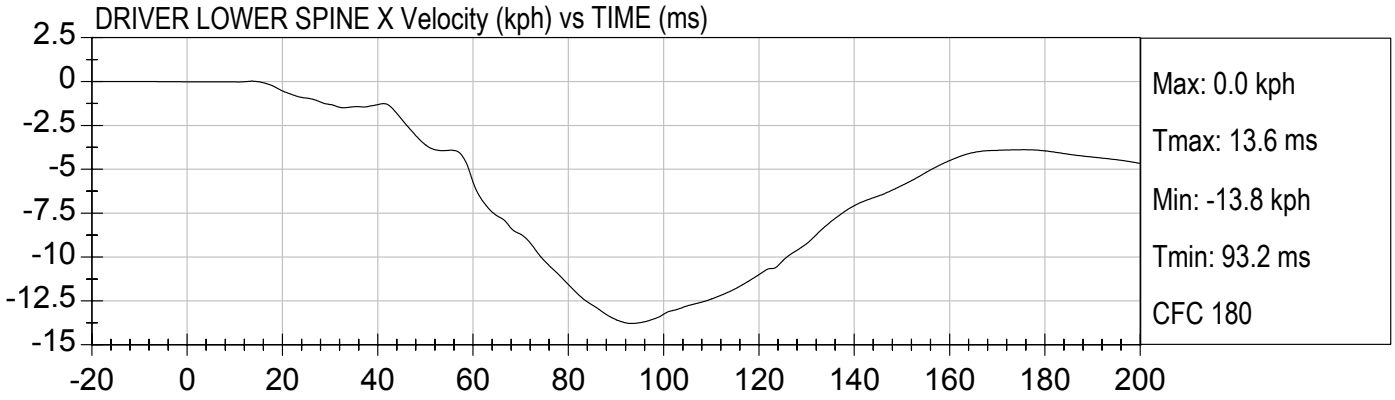


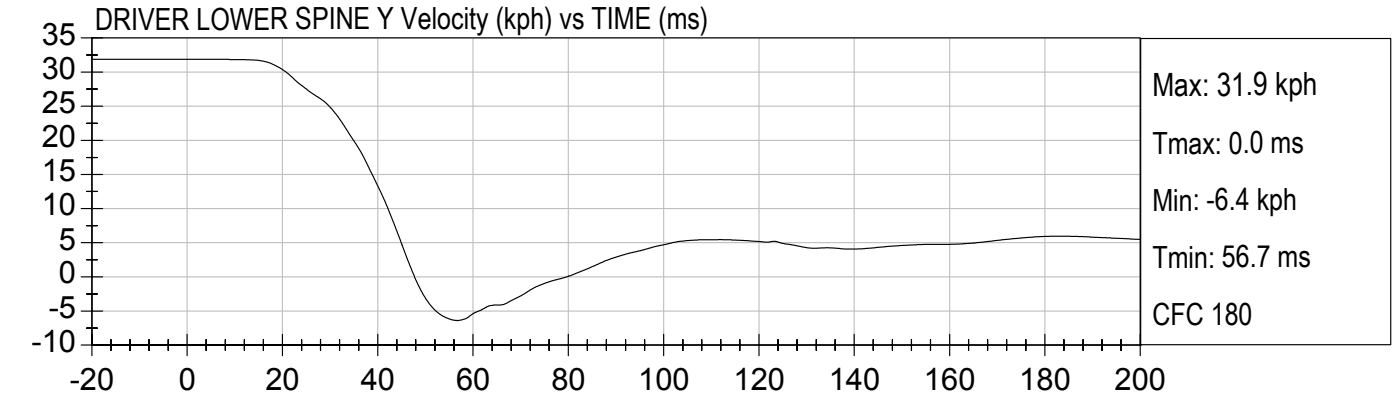


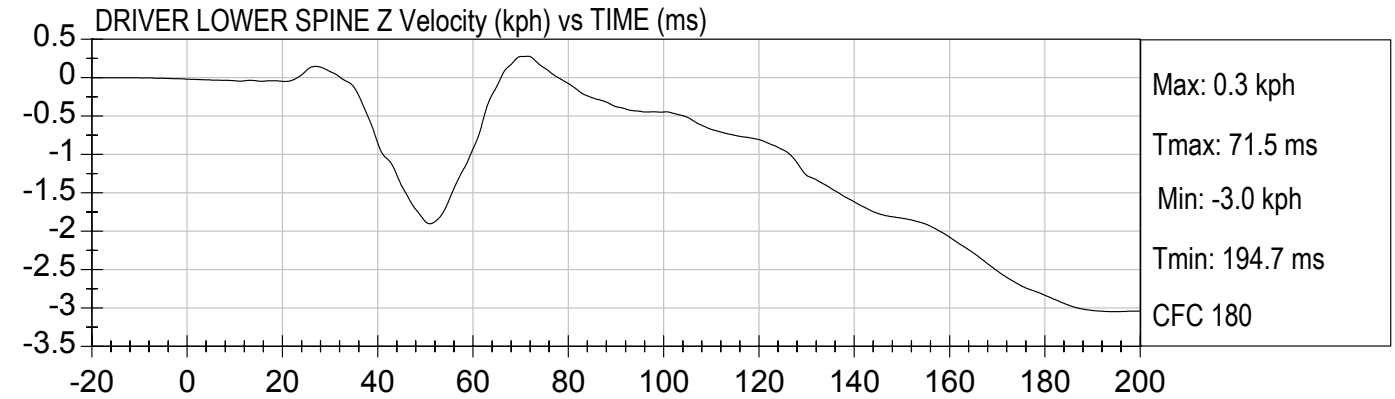


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

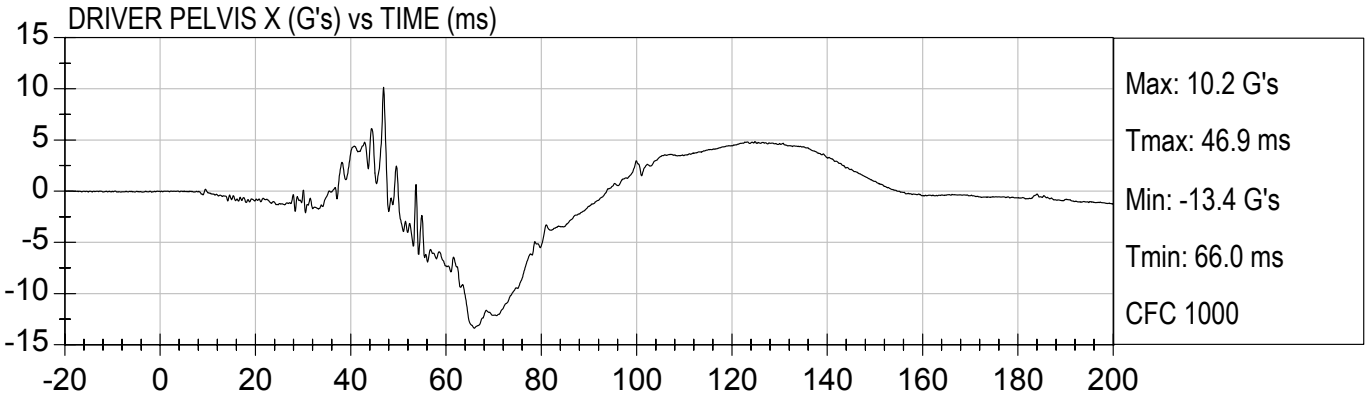


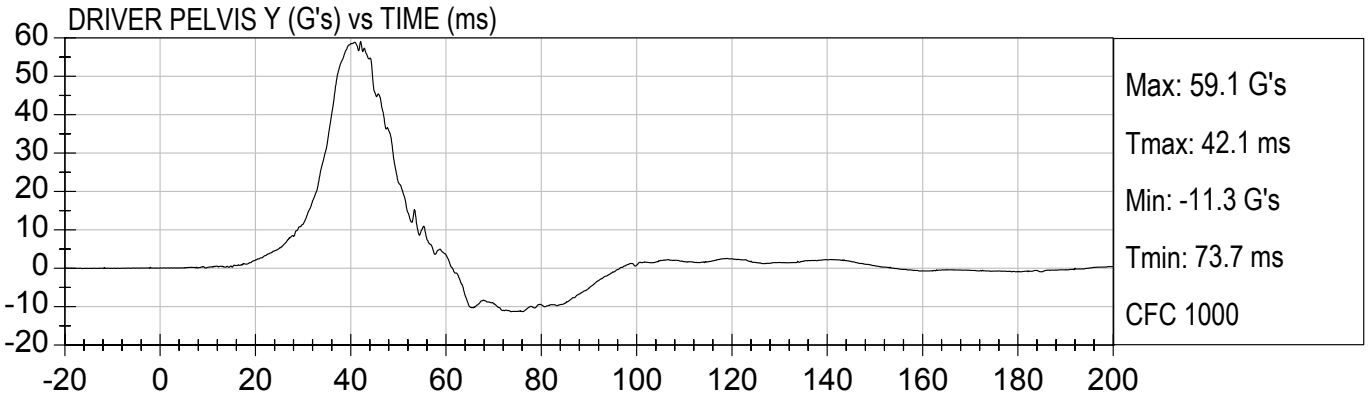


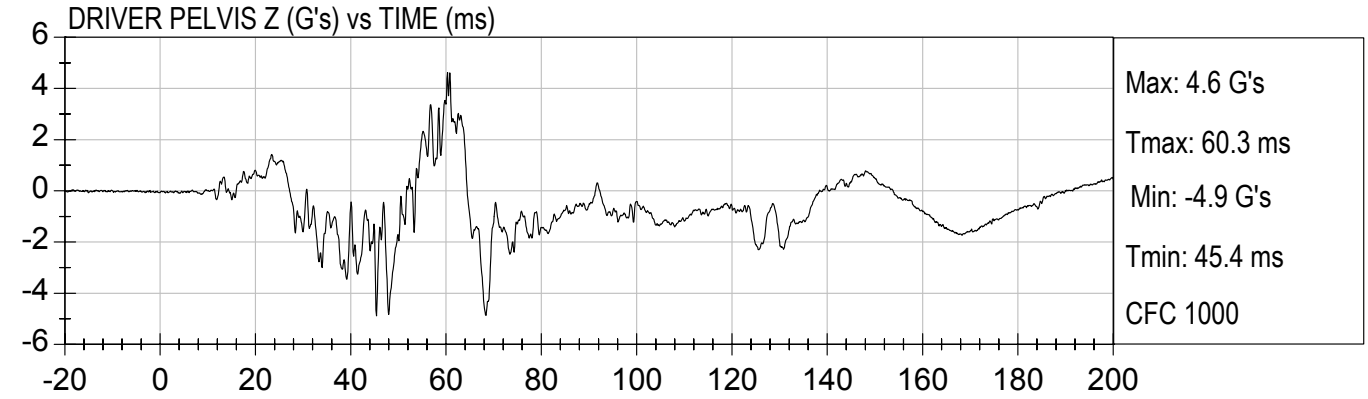


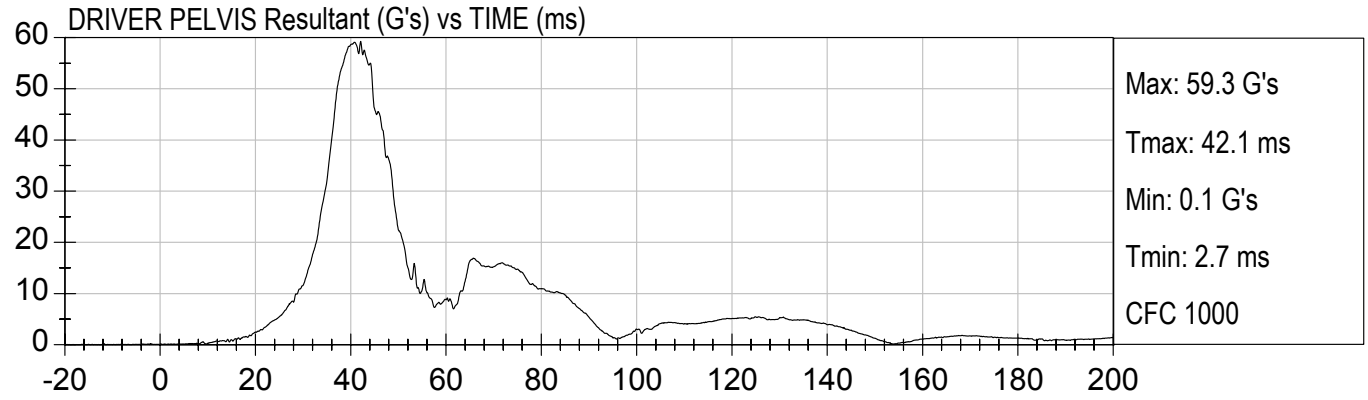
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

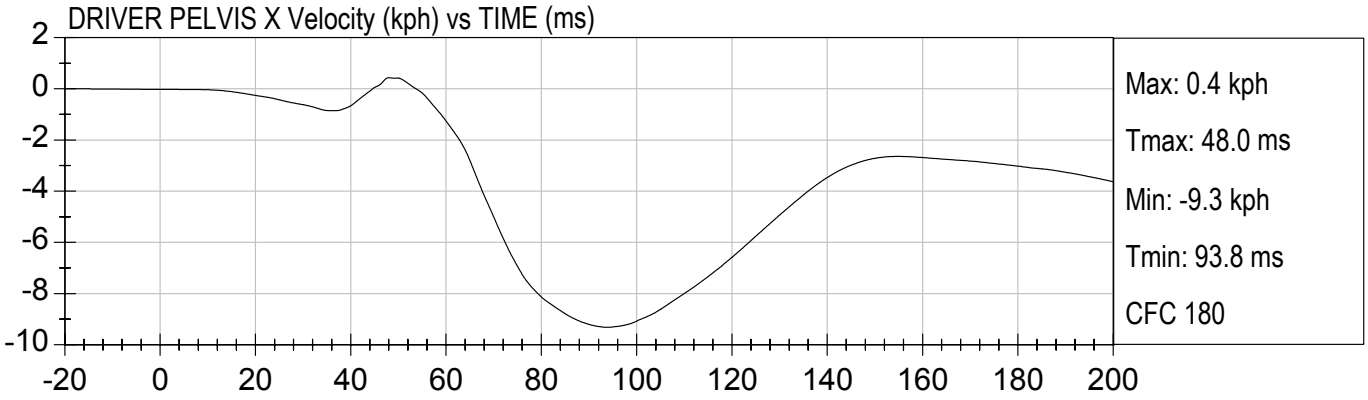
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

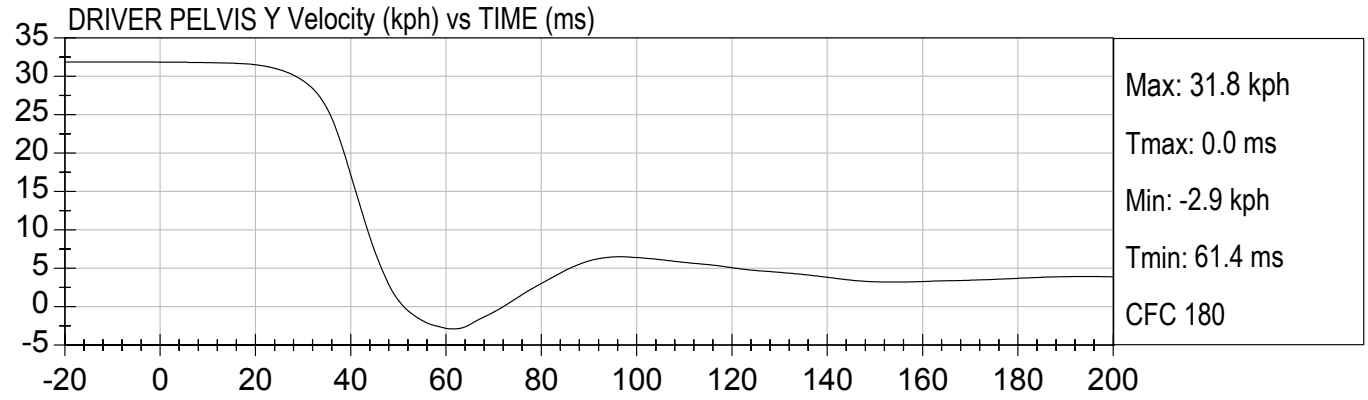


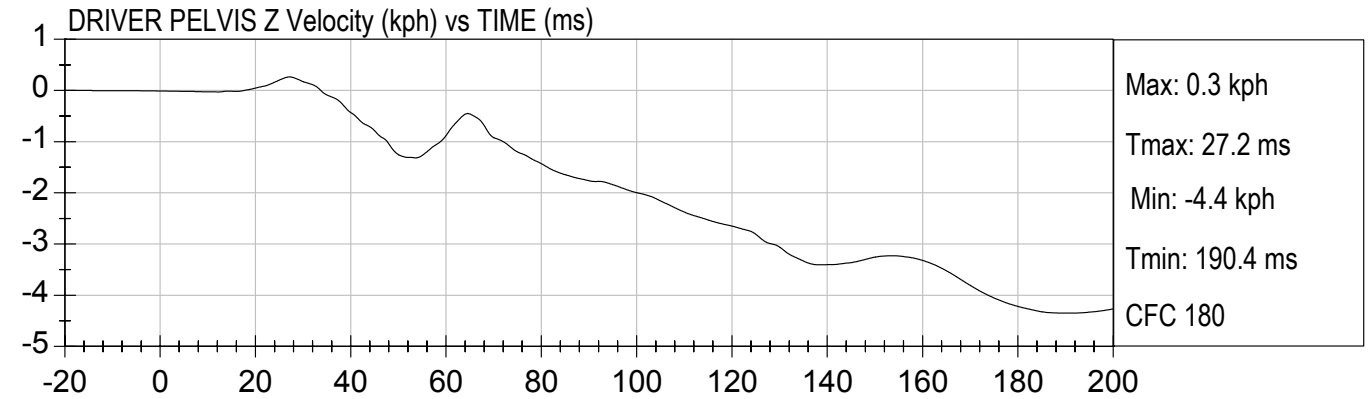







DRIVER PELVIS X Velocity (kph) vs TIME (ms)
2
0
-2
-4
-6
-8
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 0.4 kph
Tmax: 48.0 ms
Min: -9.3 kph
Tmin: 93.8 ms
CFC 180

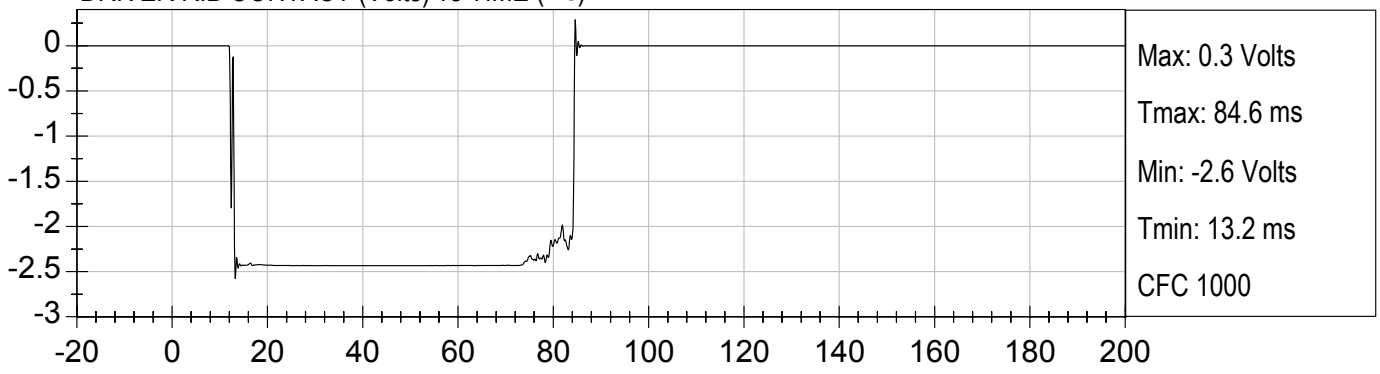

DRIVER PELVIS Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.8 kph
Tmax: 0.0 ms
Min: -2.9 kph
Tmin: 61.4 ms
CFC 180


DRIVER PELVIS Z Velocity (kph) vs TIME (ms)
1
0
-1
-2
-3
-4
-5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 0.3 kph
Tmax: 27.2 ms
Min: -4.4 kph
Tmin: 190.4 ms
CFC 180

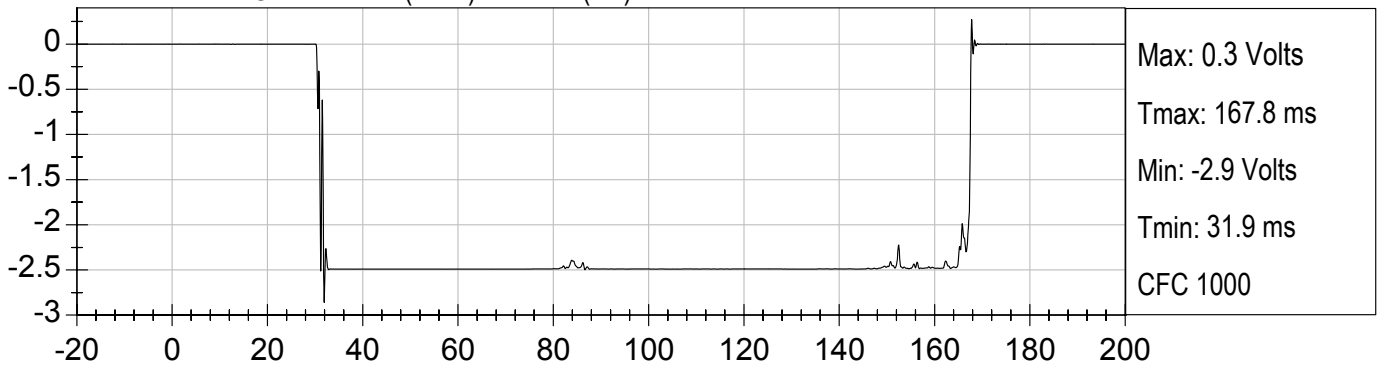
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

DRIVER RIB CONTACT (Volts) vs TIME (ms)

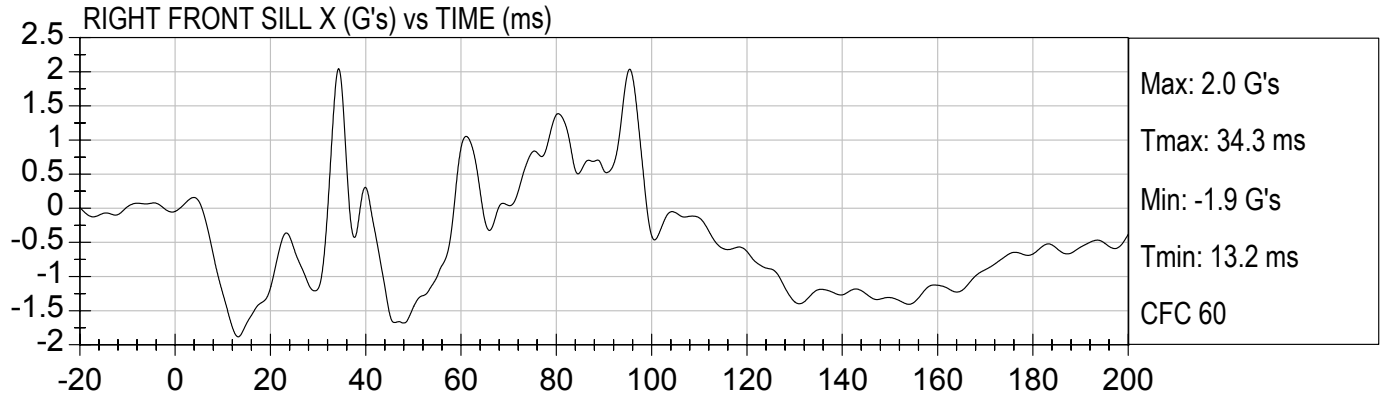


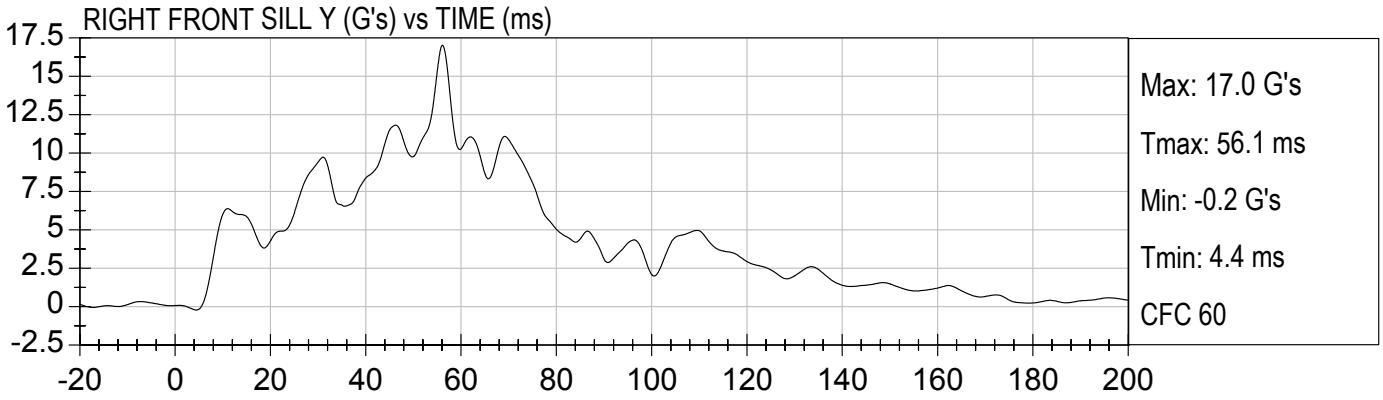
DRIVER PELVIS CONTACT (Volts) vs TIME (ms)

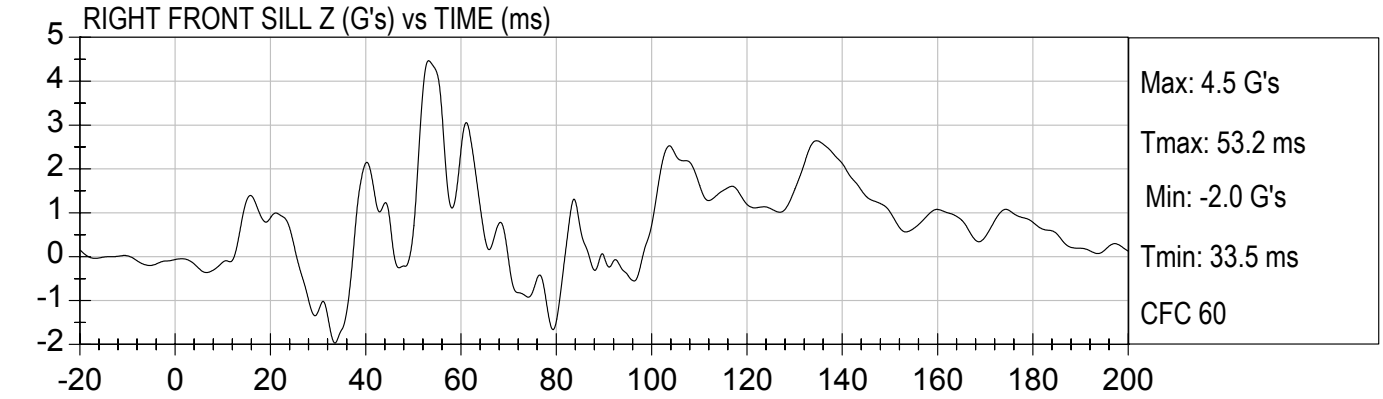


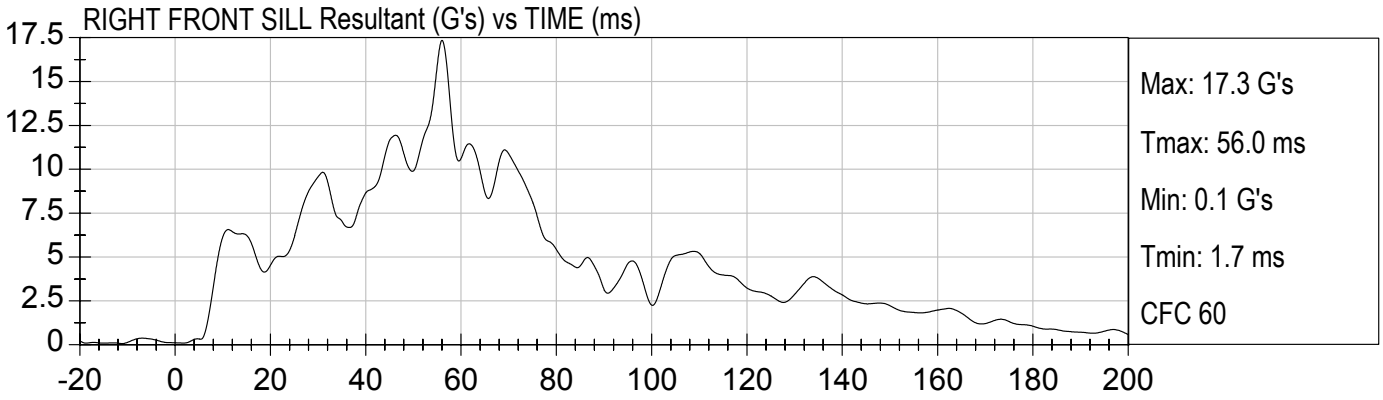
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

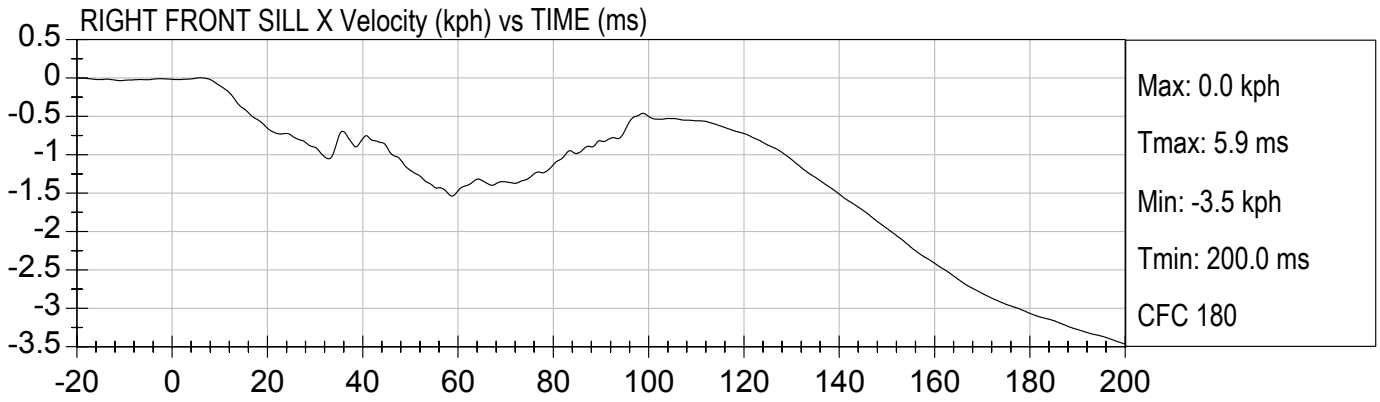
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

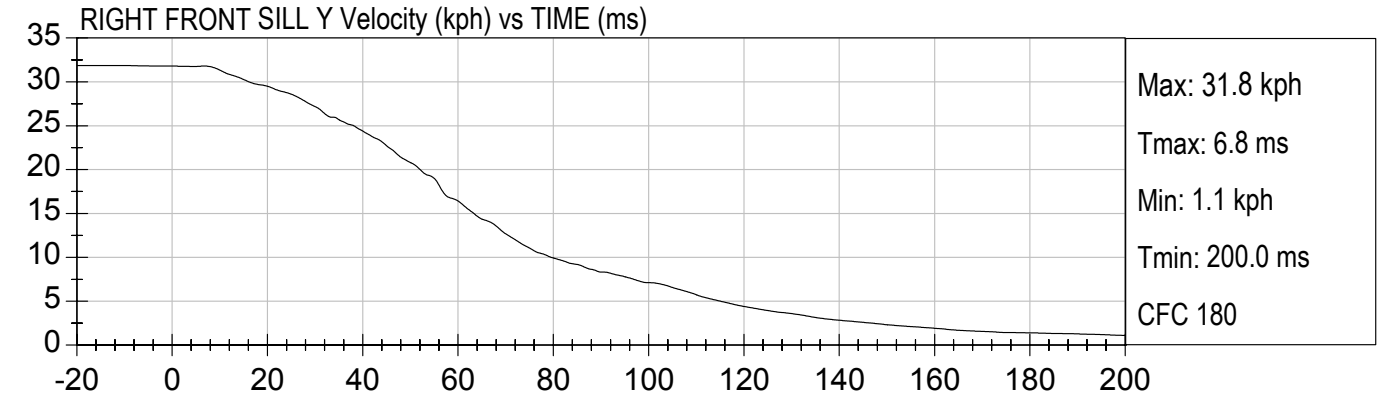


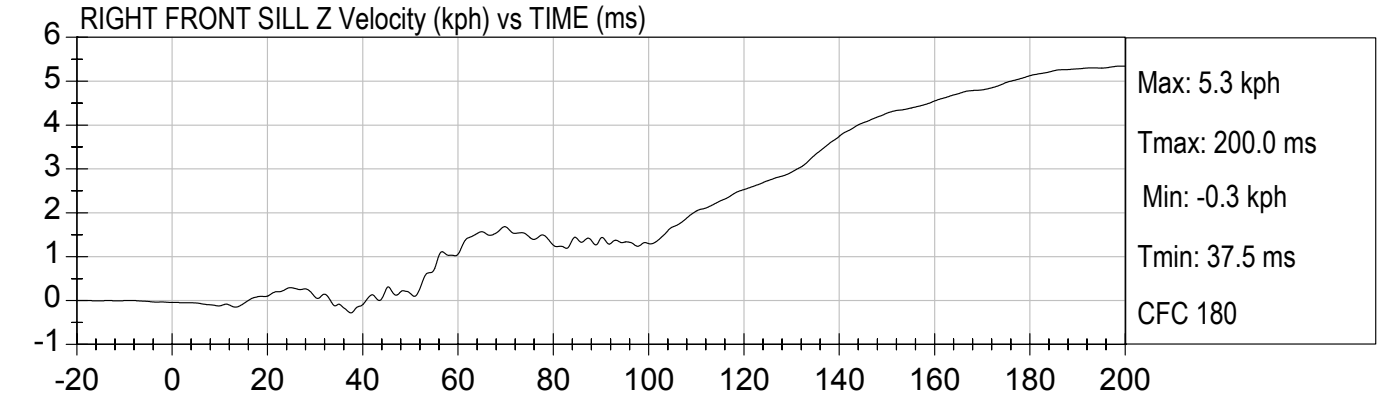






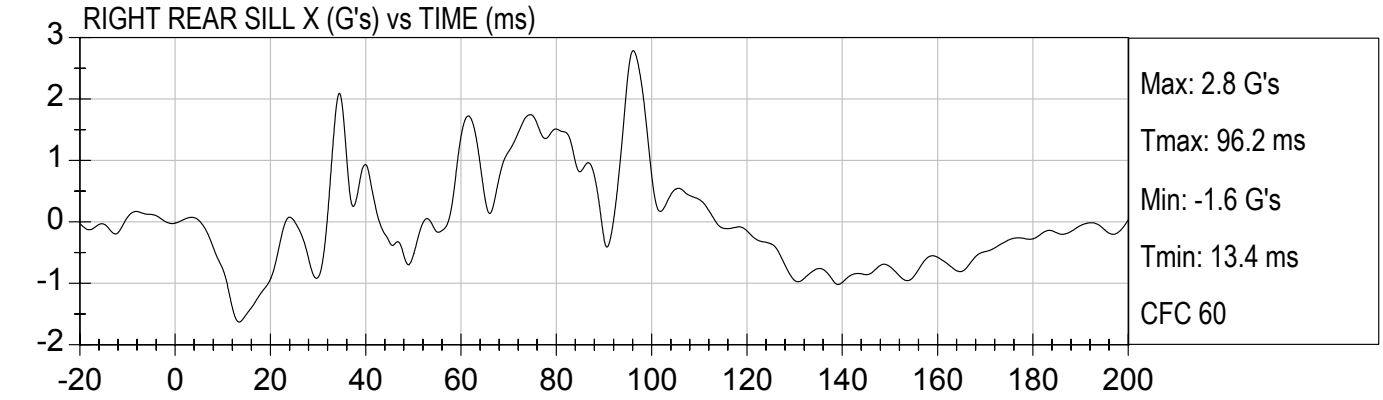

RIGHT FRONT SILL X Velocity (kph) vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 0.0 kph
Tmax: 5.9 ms
Min: -3.5 kph
Tmin: 200.0 ms
CFC 180

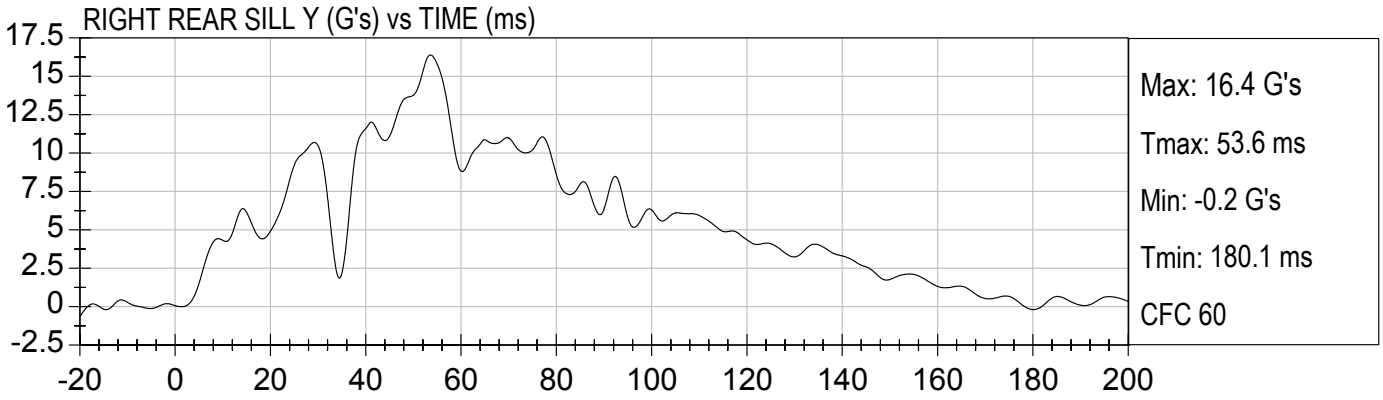

RIGHT FRONT SILL Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.8 kph
Tmax: 6.8 ms
Min: 1.1 kph
Tmin: 200.0 ms
CFC 180

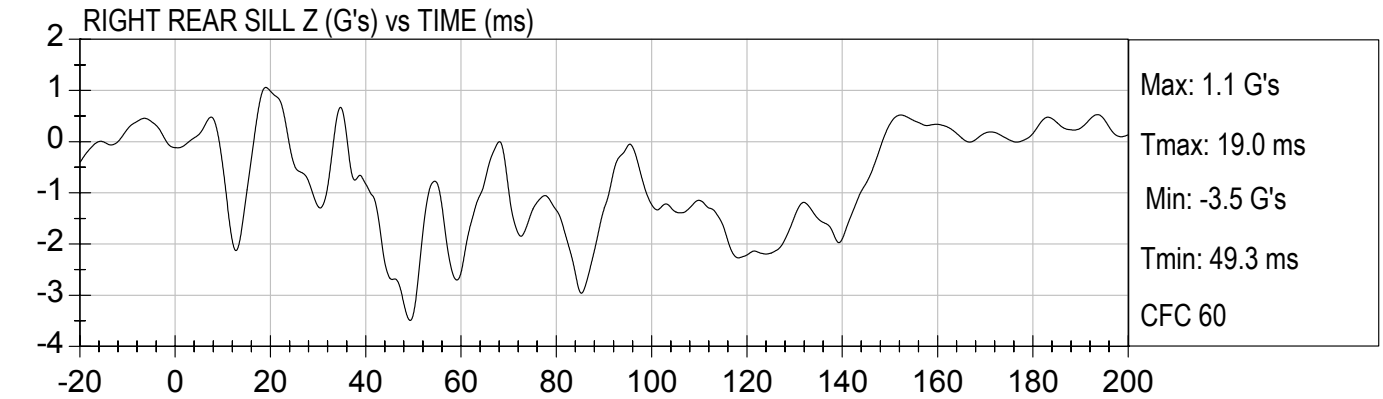

RIGHT FRONT SILL Z Velocity (kph) vs TIME (ms)
6
5
4
3
2
1
0
-1
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 5.3 kph
Tmax: 200.0 ms
Min: -0.3 kph
Tmin: 37.5 ms
CFC 180

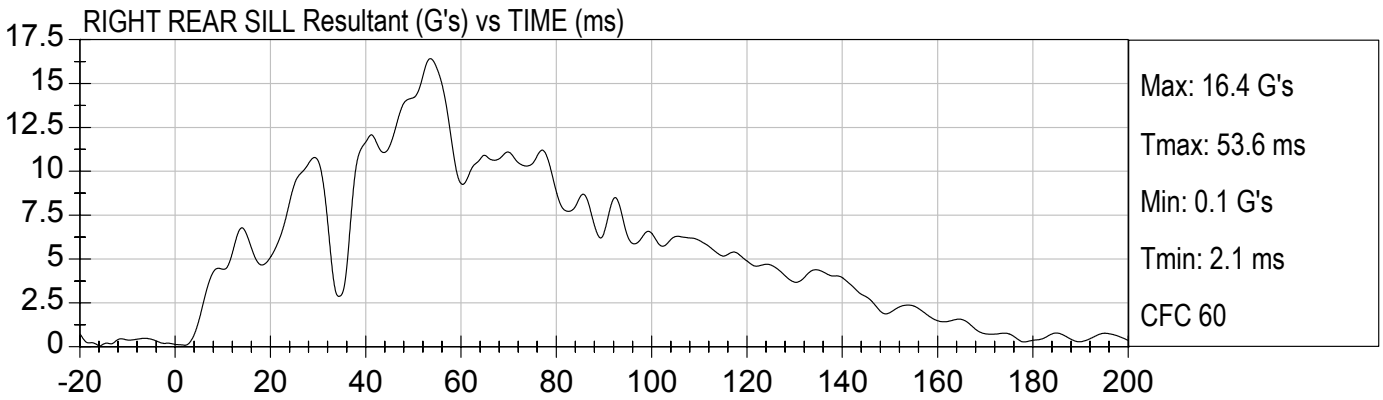
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



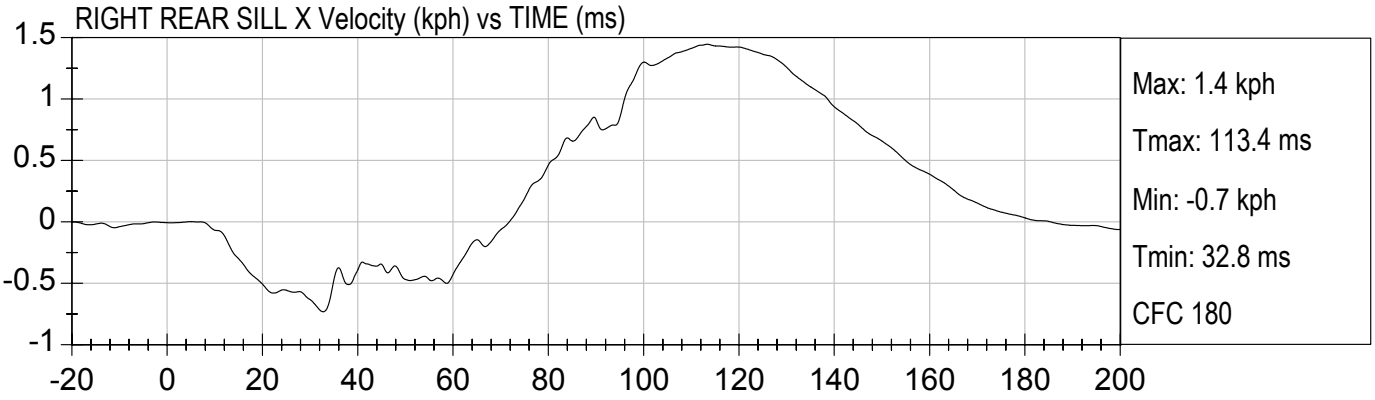


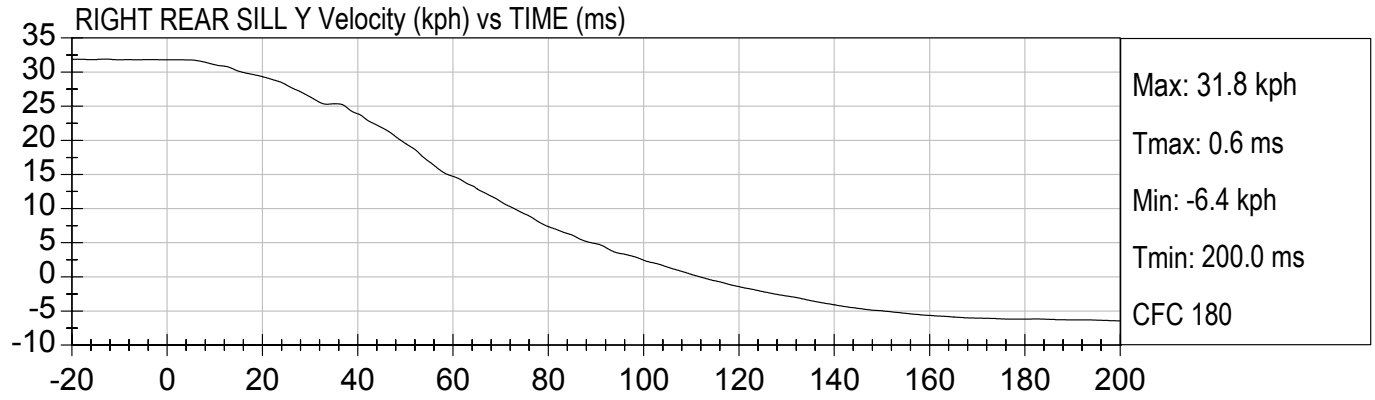


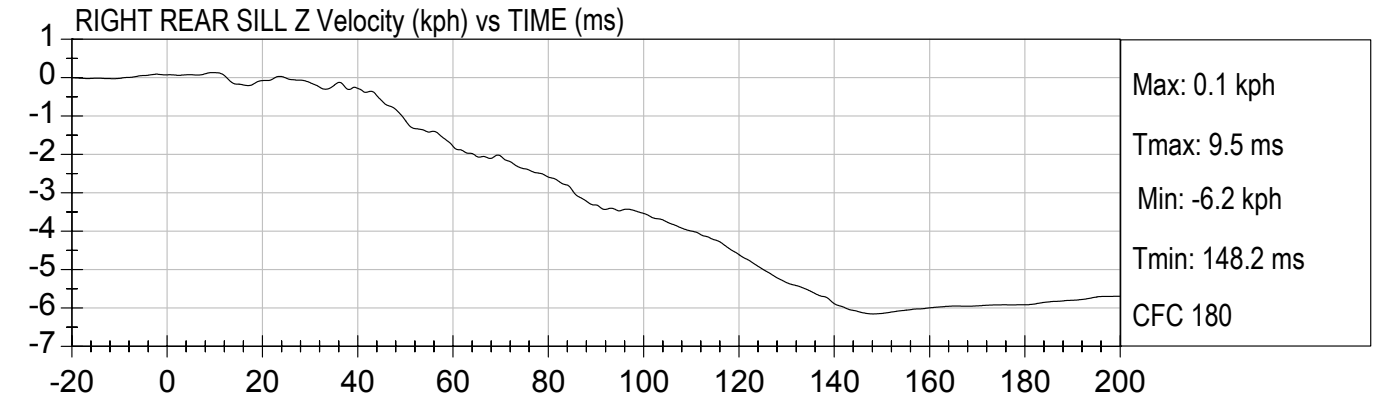


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

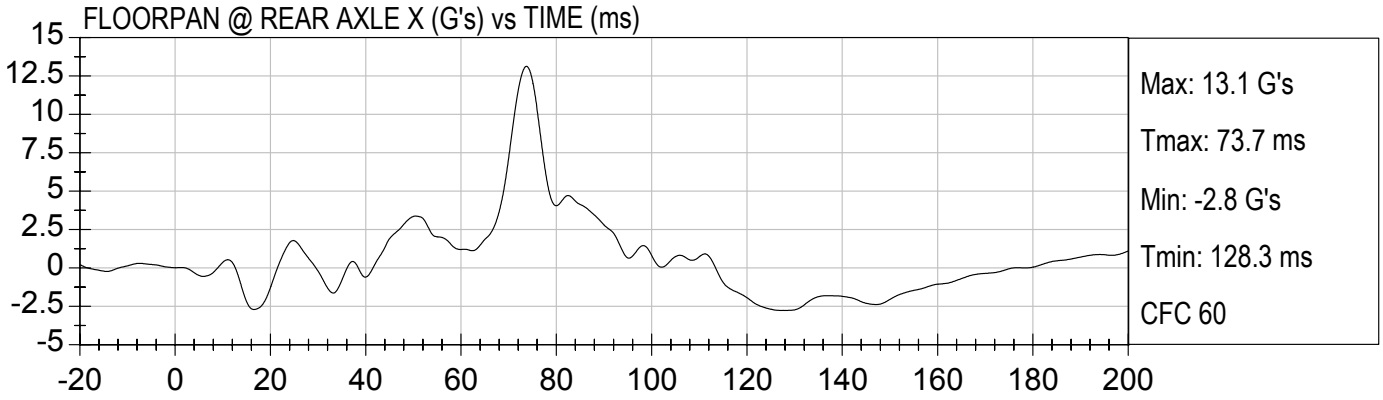


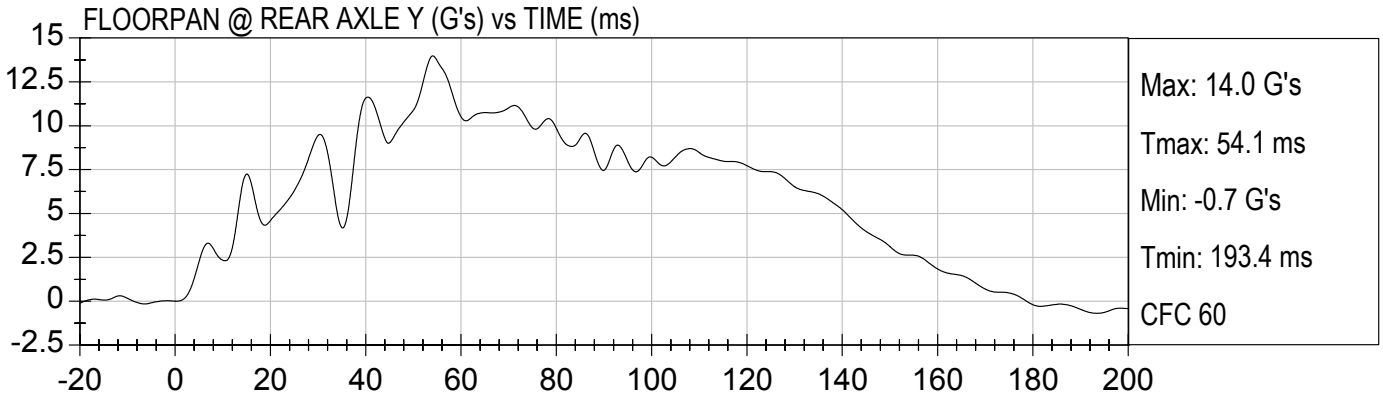


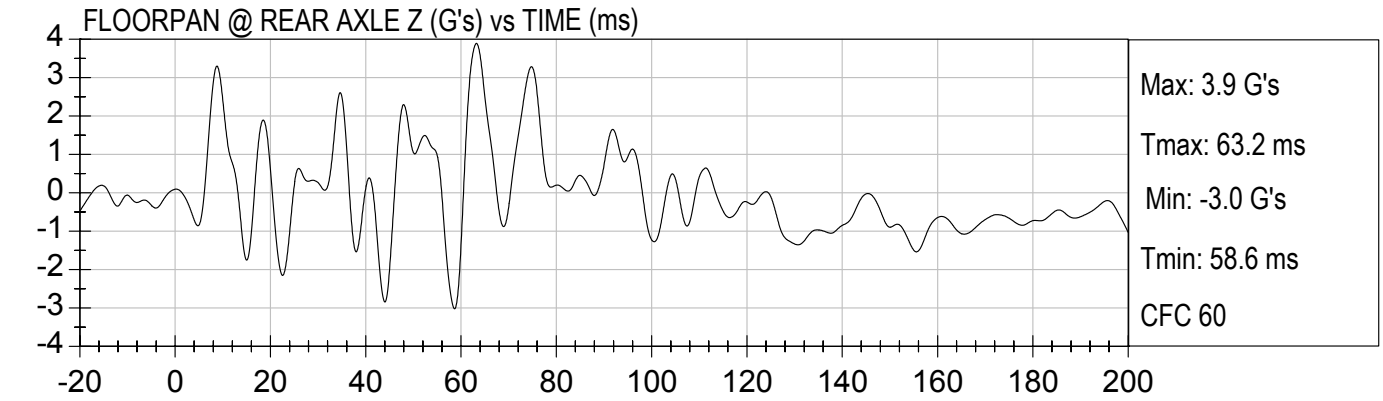


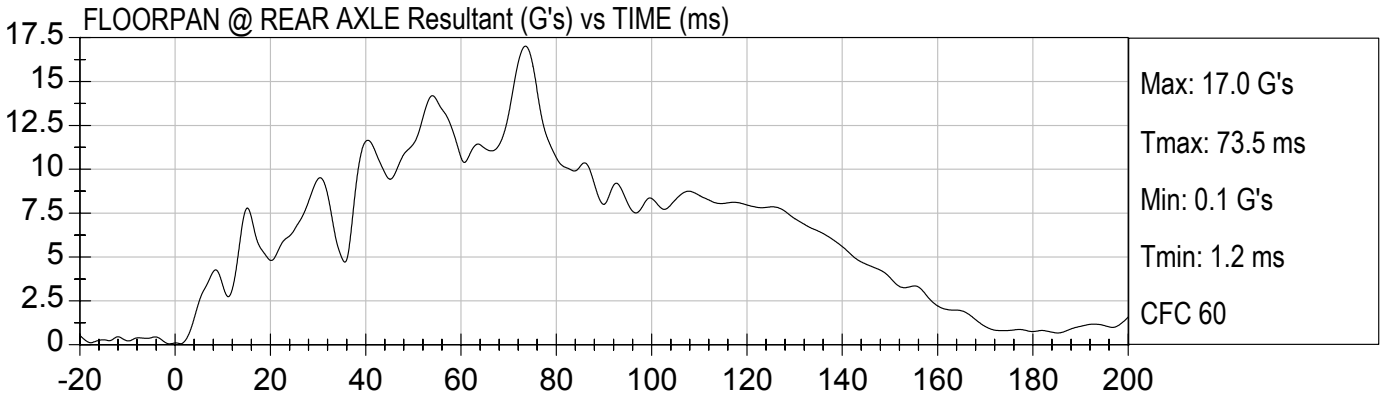
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

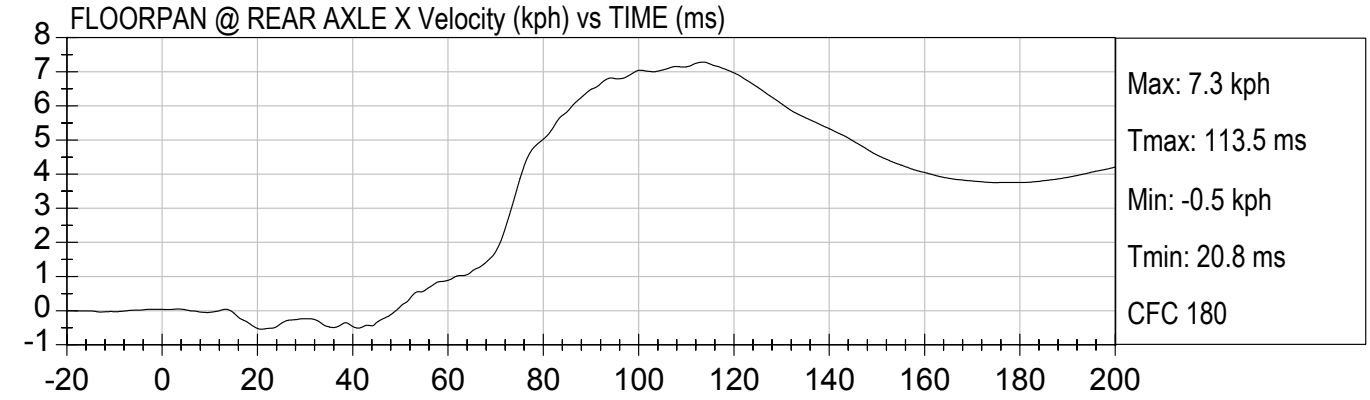
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

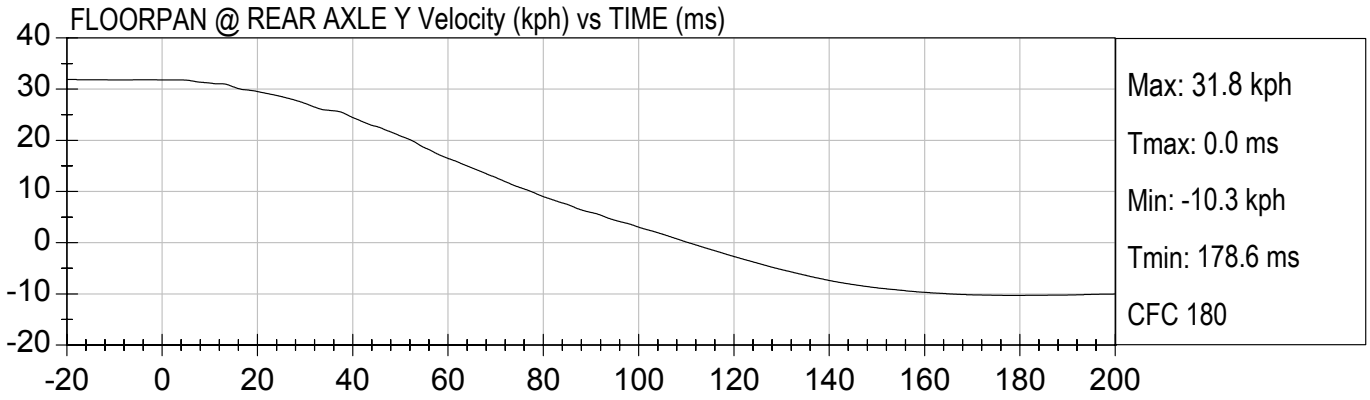


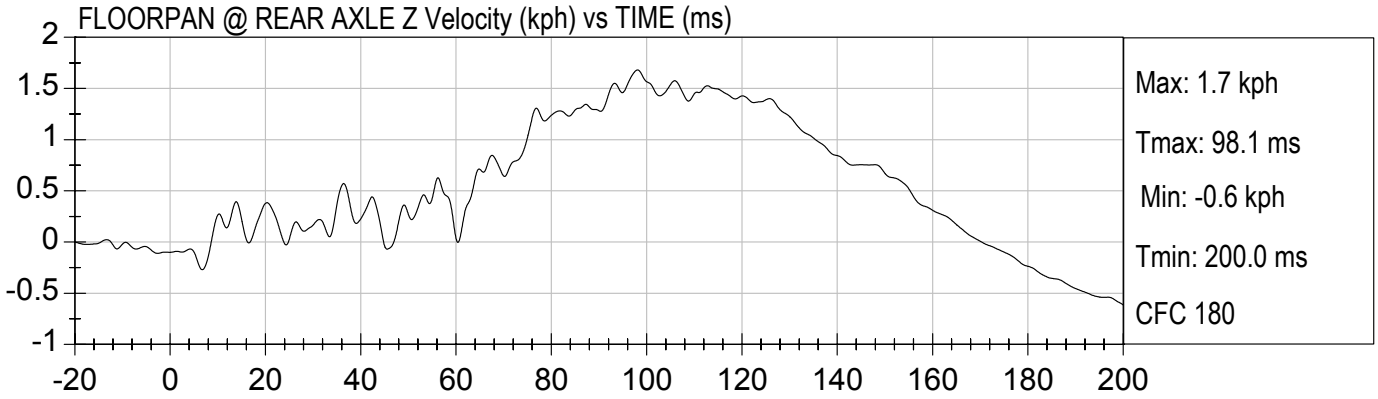






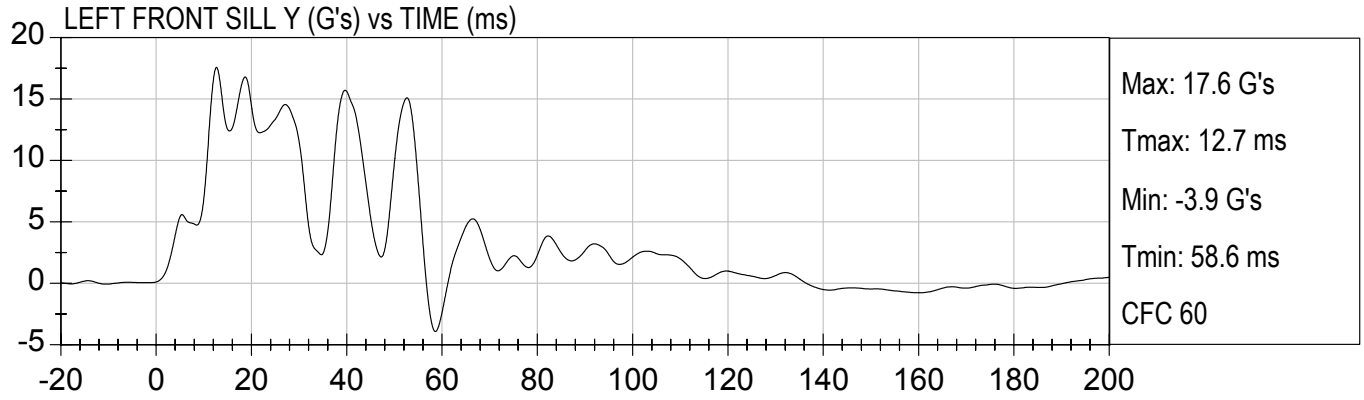

FLOORPAN @ REAR AXLE X Velocity (kph) vs TIME (ms)
8
7
6
5
4
3
2
1
0
-1
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 7.3 kph
Tmax: 113.5 ms
Min: -0.5 kph
Tmin: 20.8 ms
CFC 180

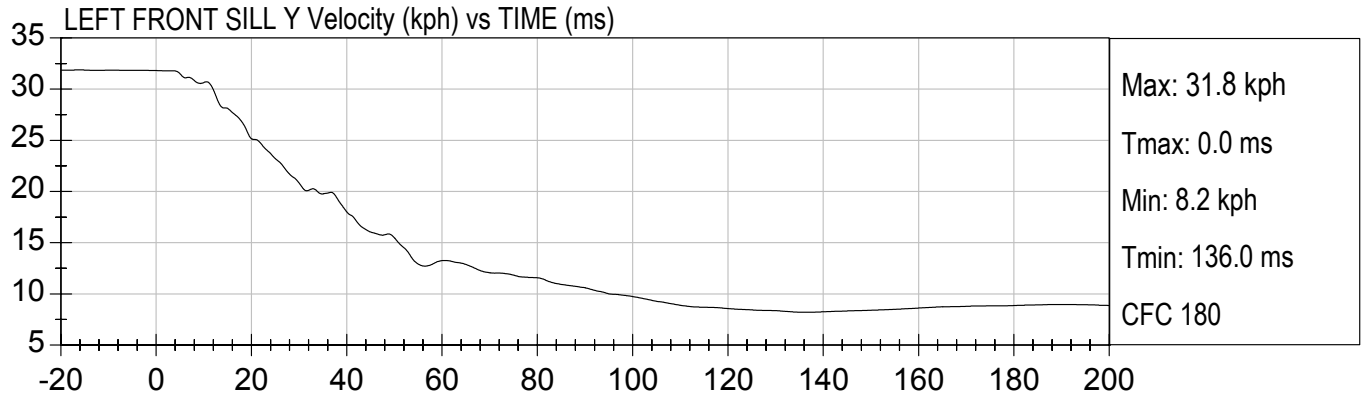

FLOORPAN @ REAR AXLE Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.8 kph
Tmax: 0.0 ms
Min: -10.3 kph
Tmin: 178.6 ms
CFC 180

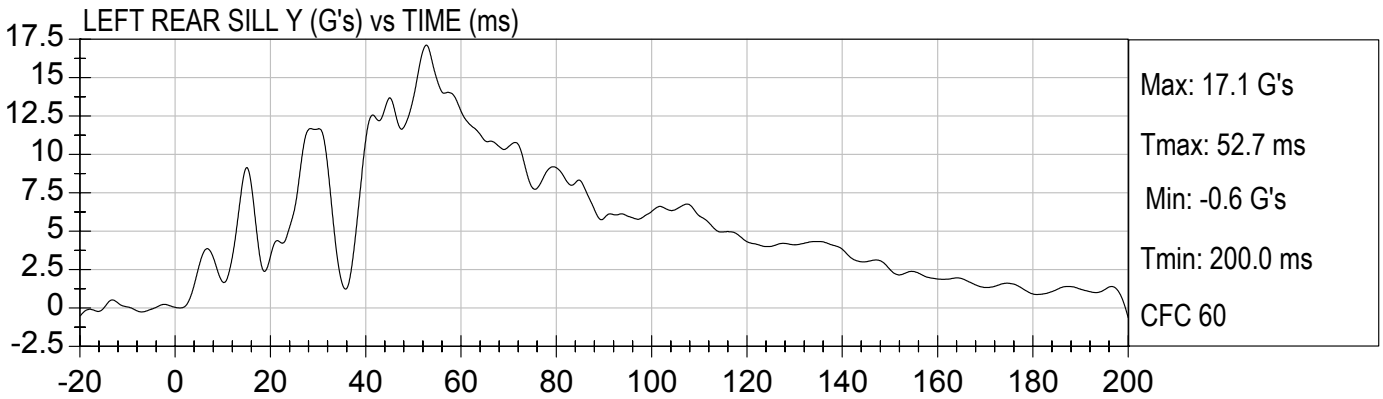

FLOORPAN @ REAR AXLE Z Velocity (kph) vs TIME (ms)
2
1.5
1
0.5
0
-0.5
-1
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 1.7 kph
Tmax: 98.1 ms
Min: -0.6 kph
Tmin: 200.0 ms
CFC 180

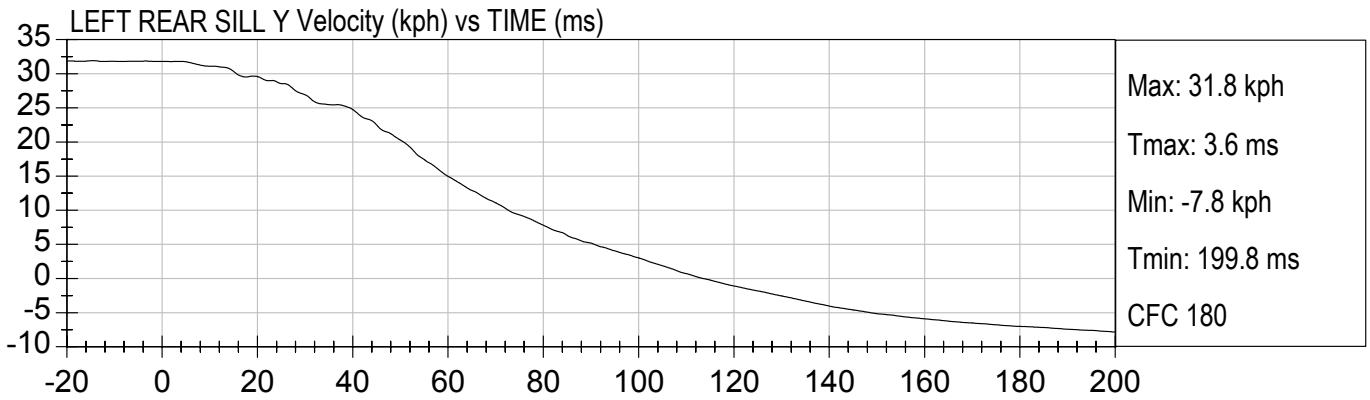
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



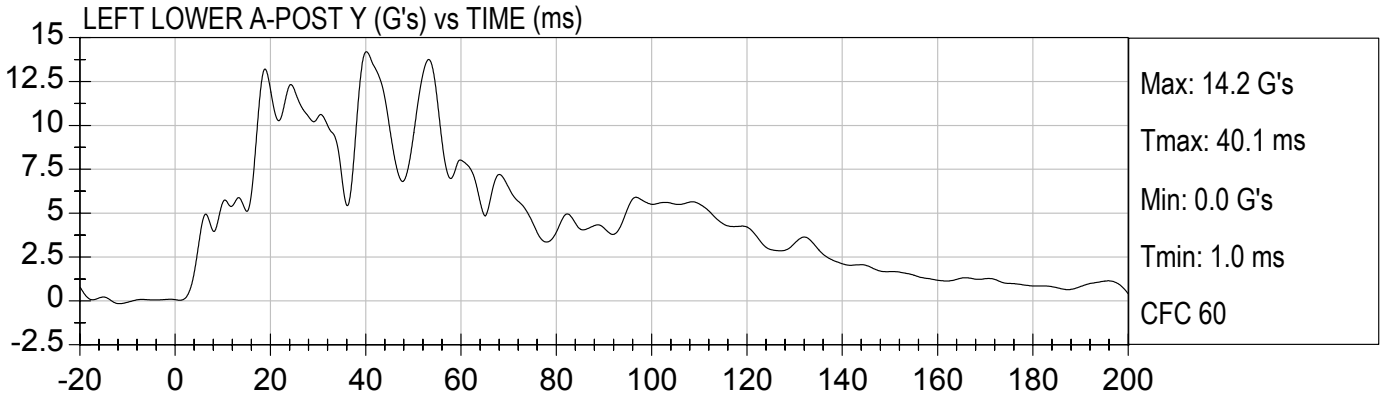


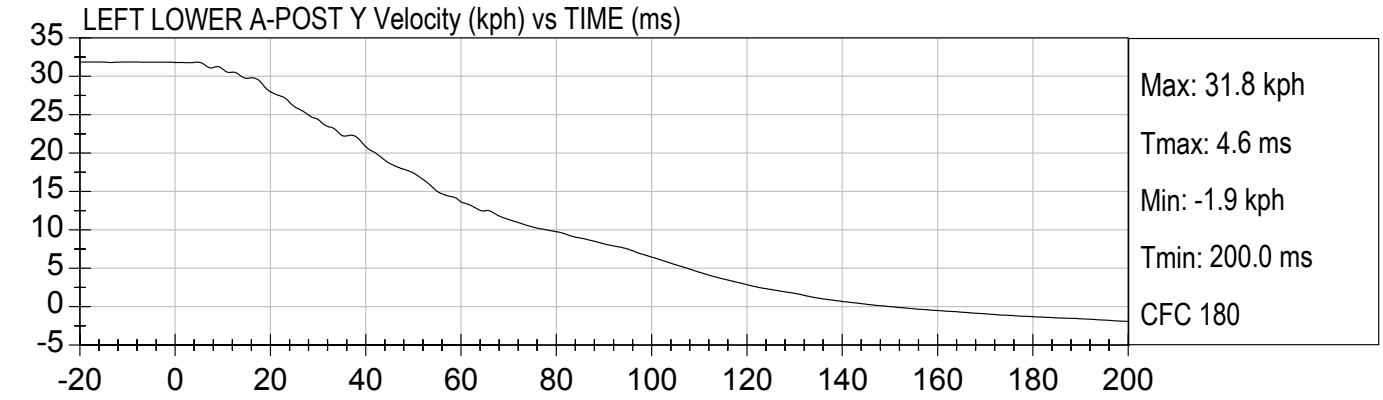


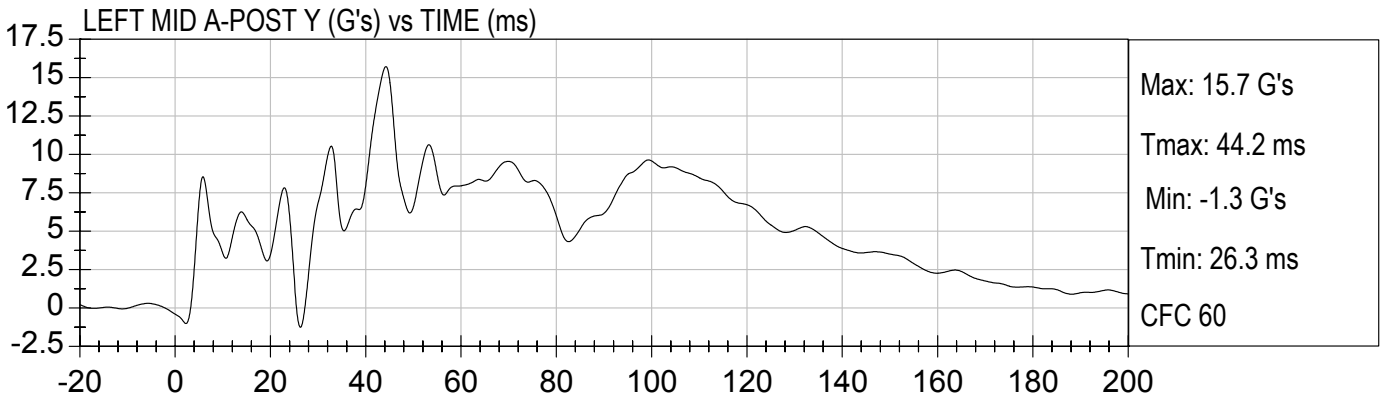


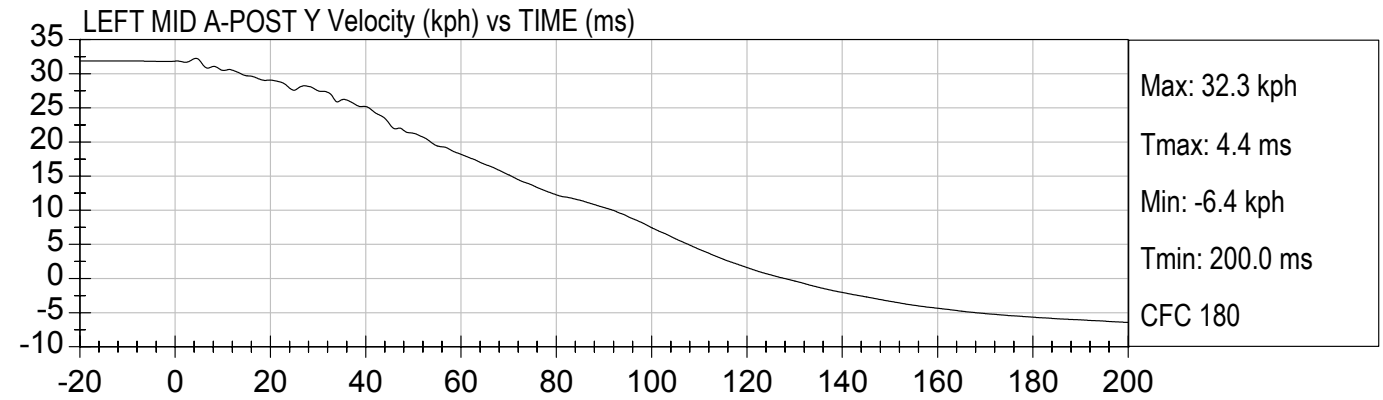
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



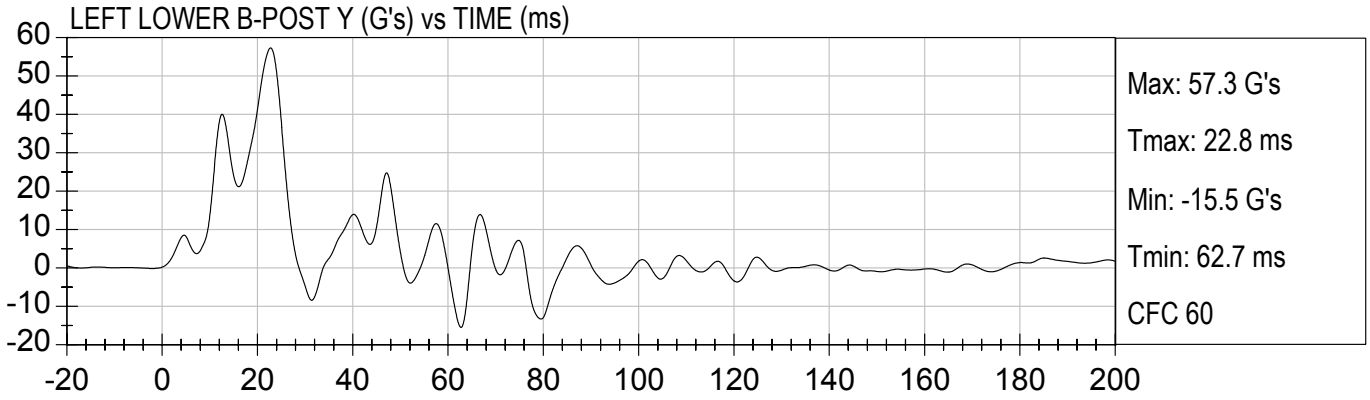


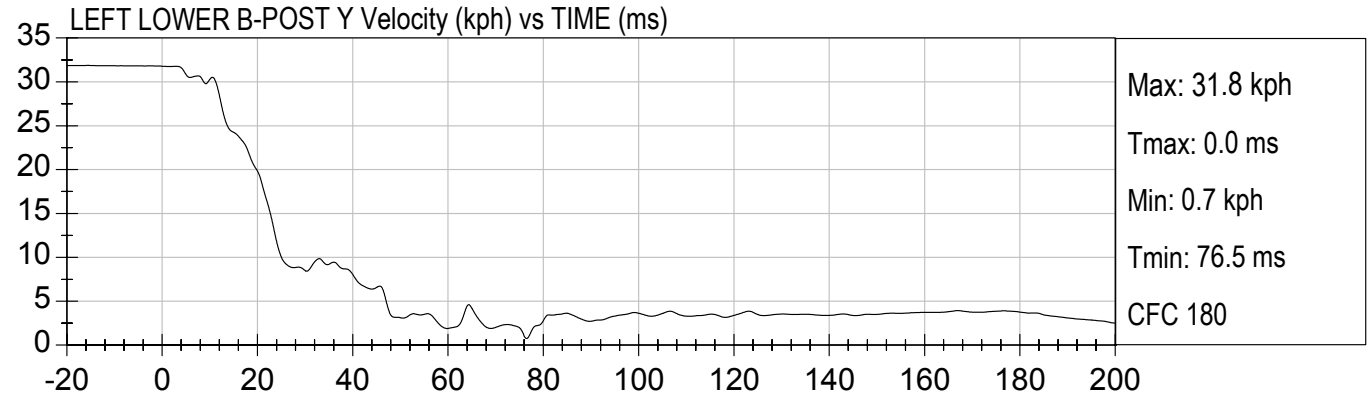


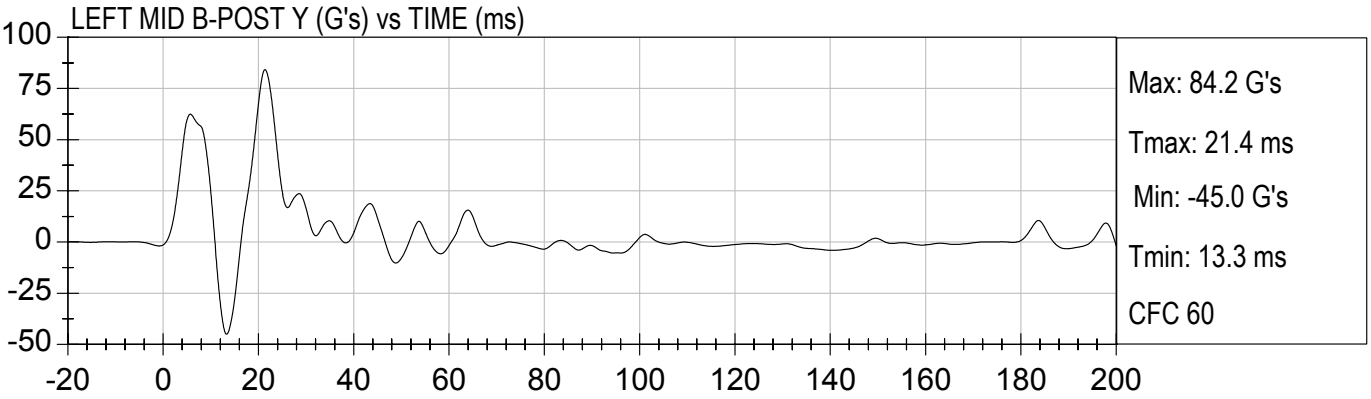


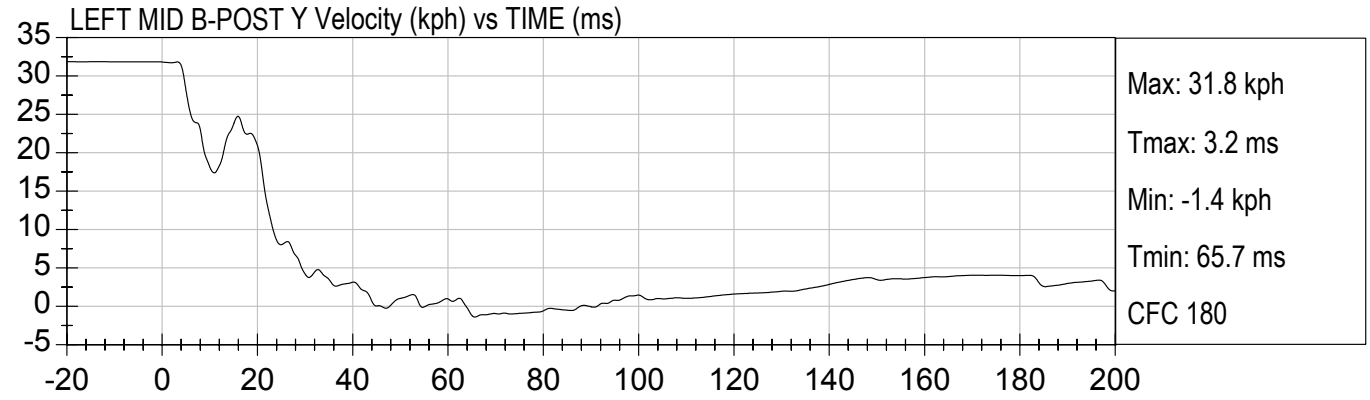
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



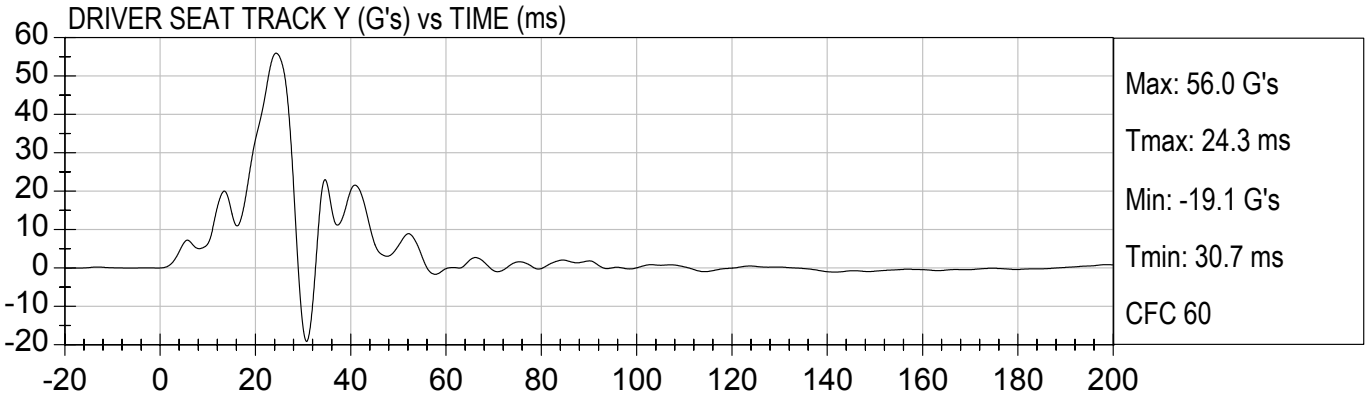


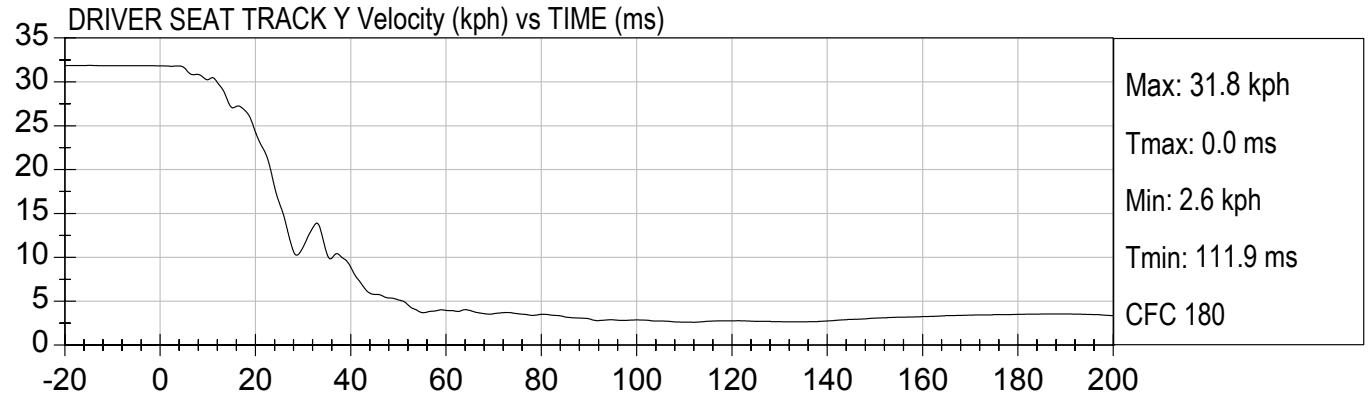




20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

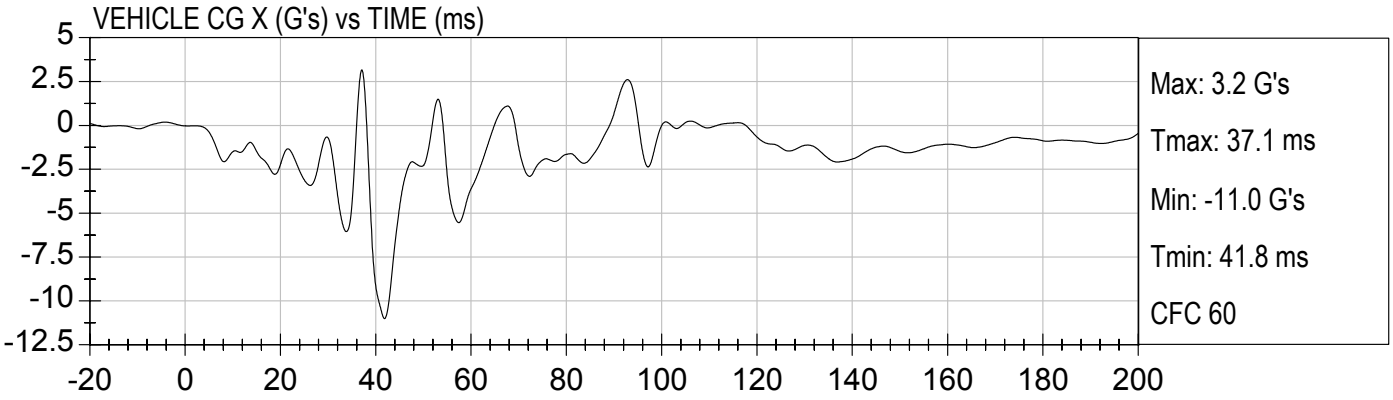
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

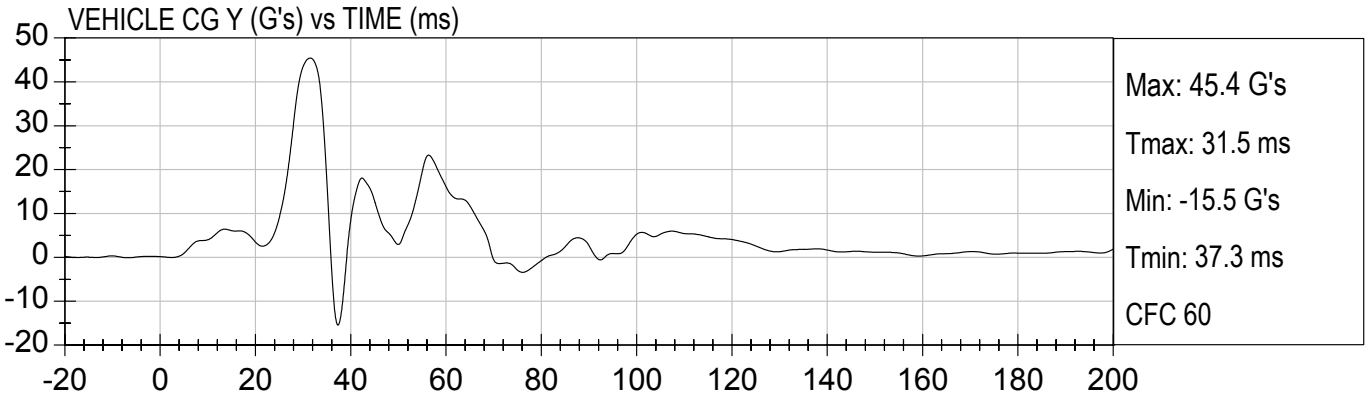


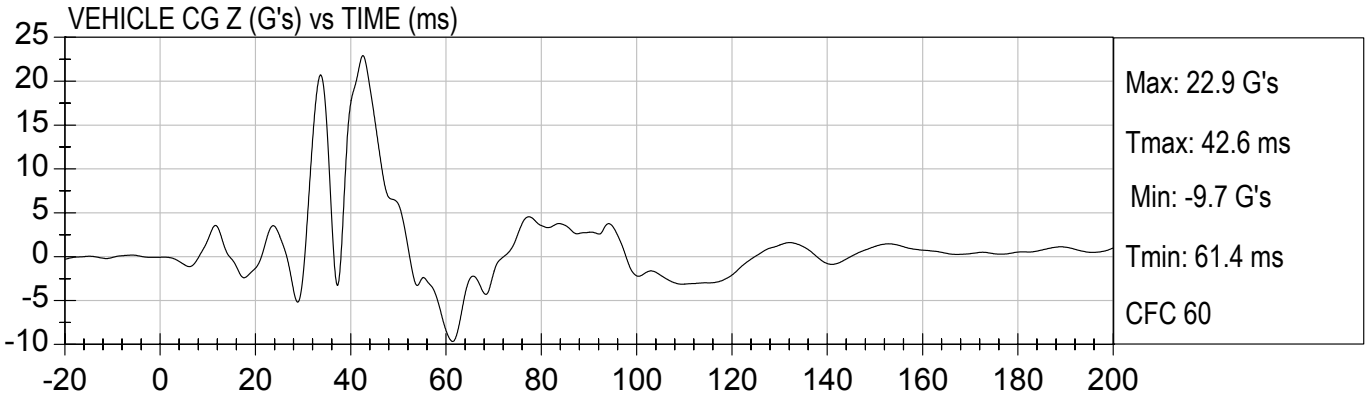


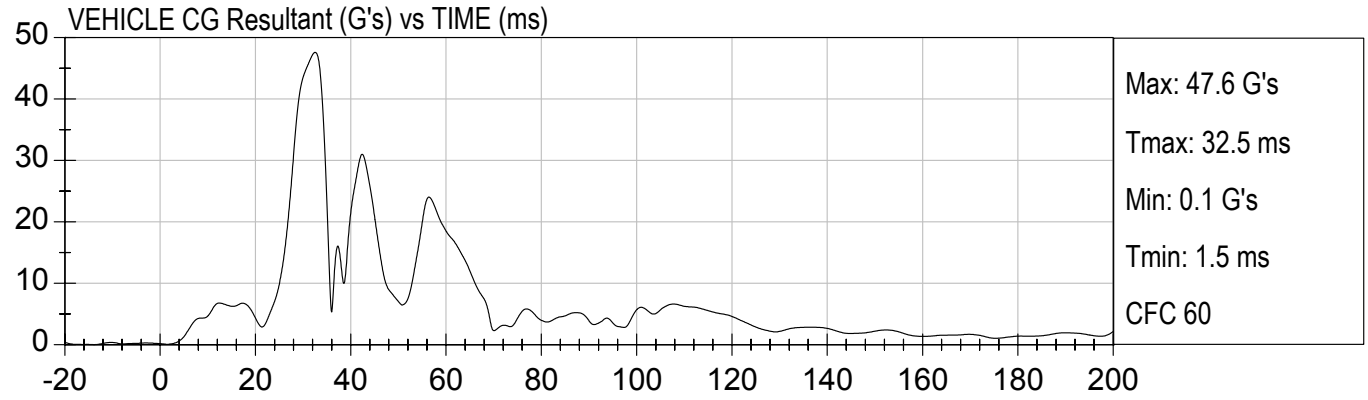
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



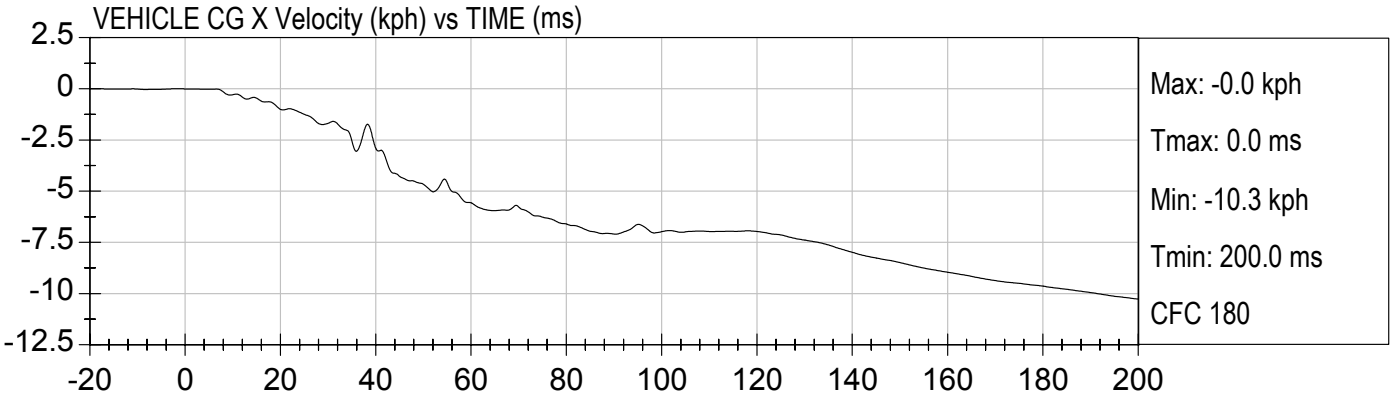


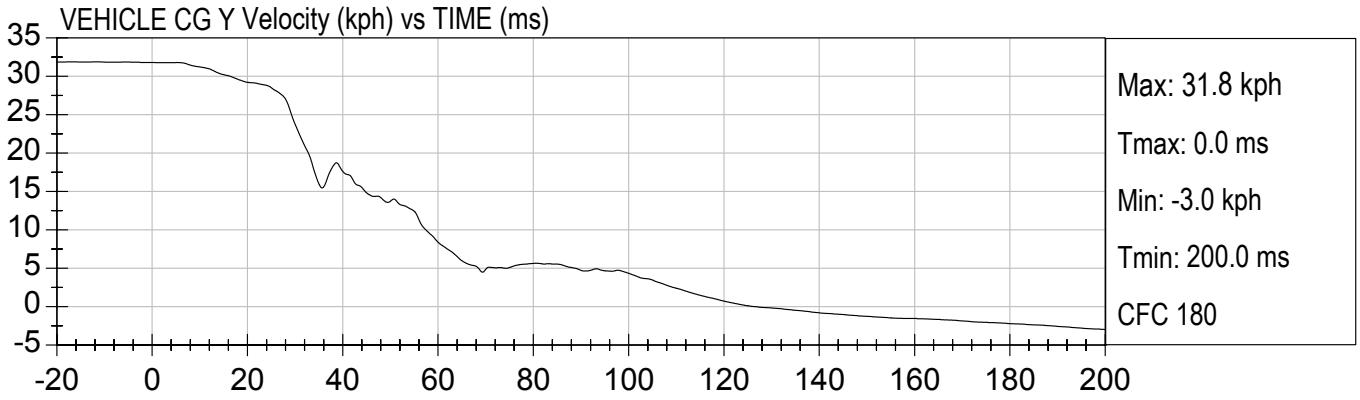


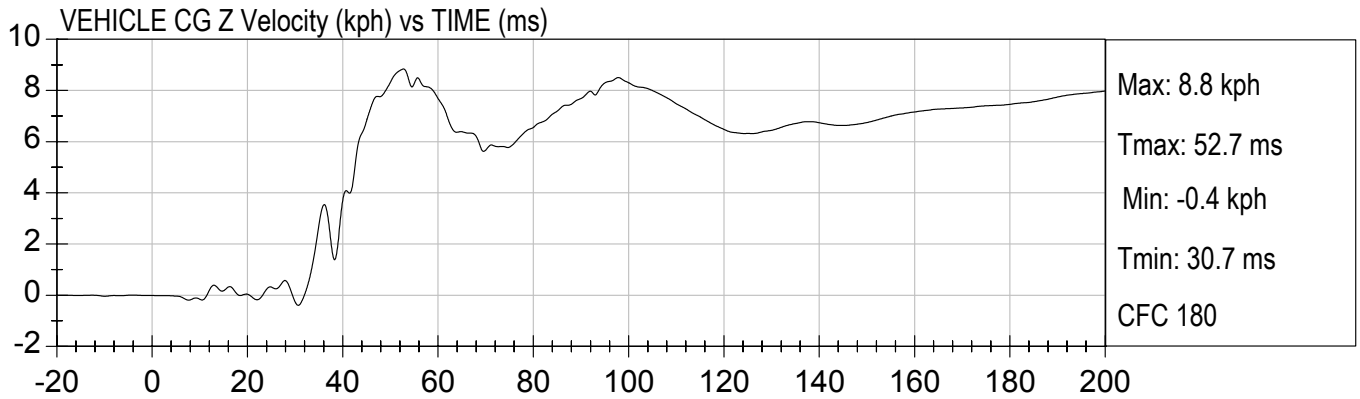


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

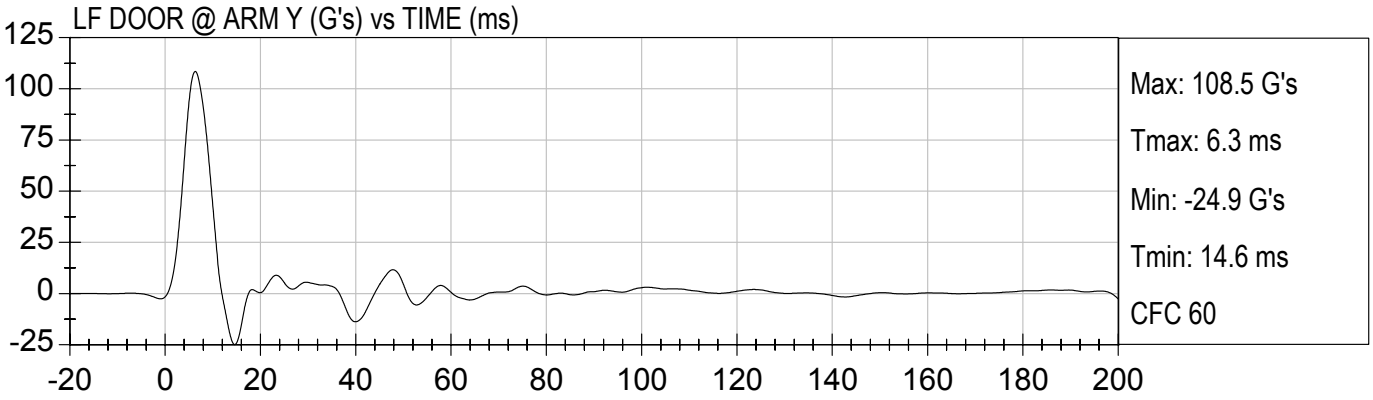


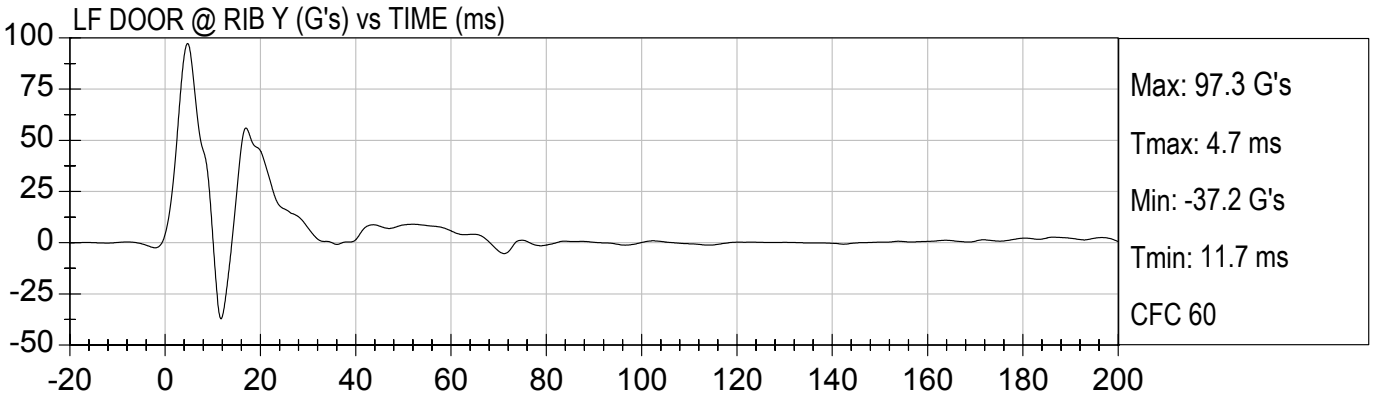


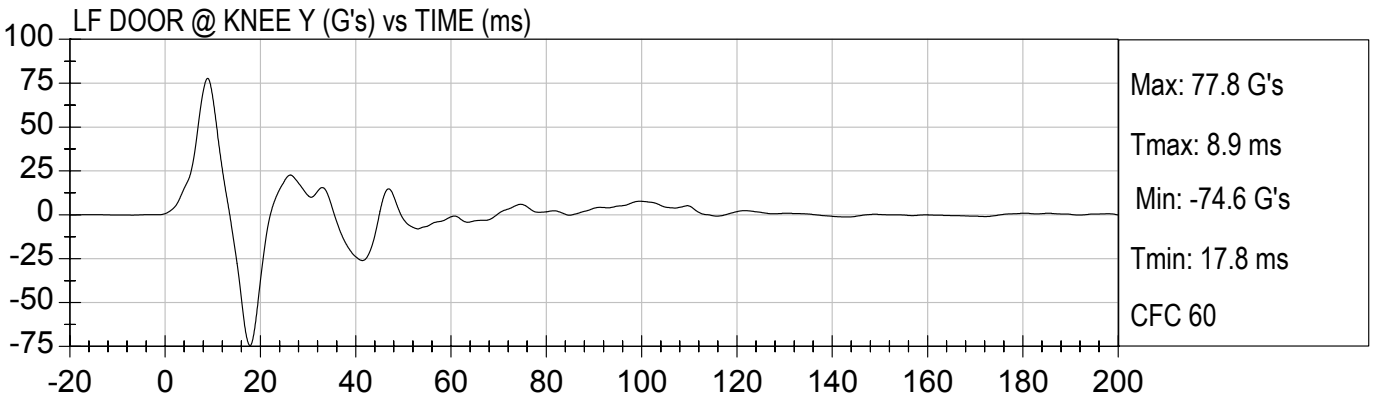


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

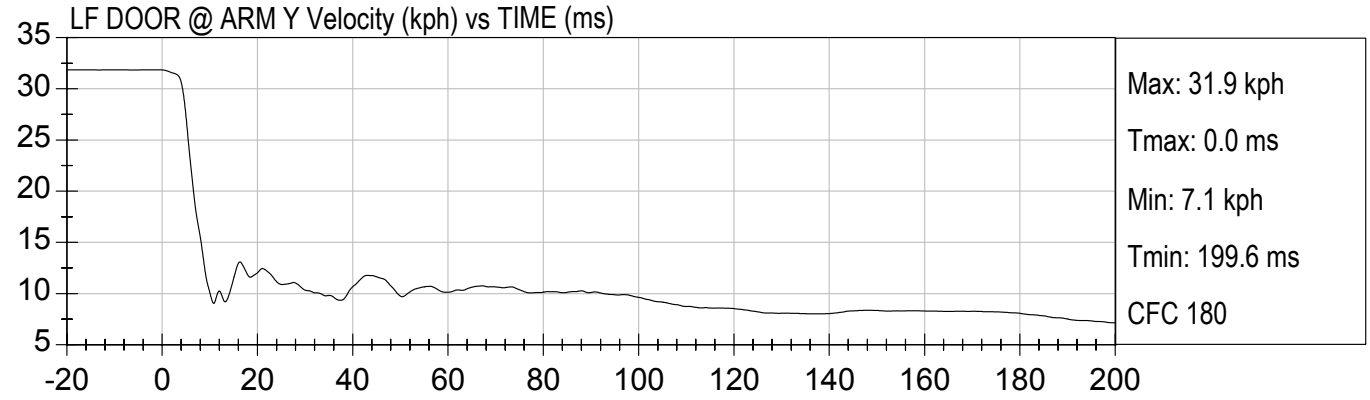


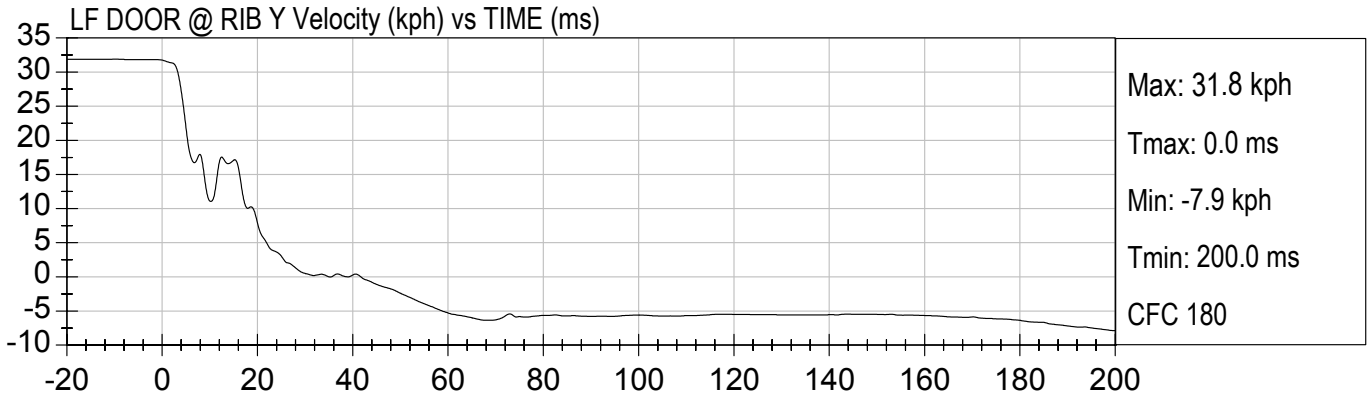


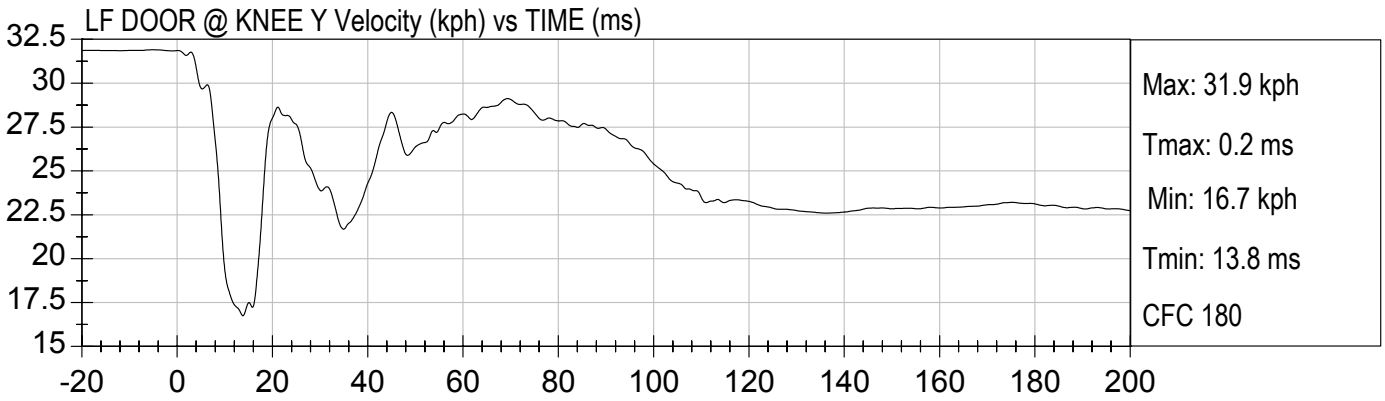


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

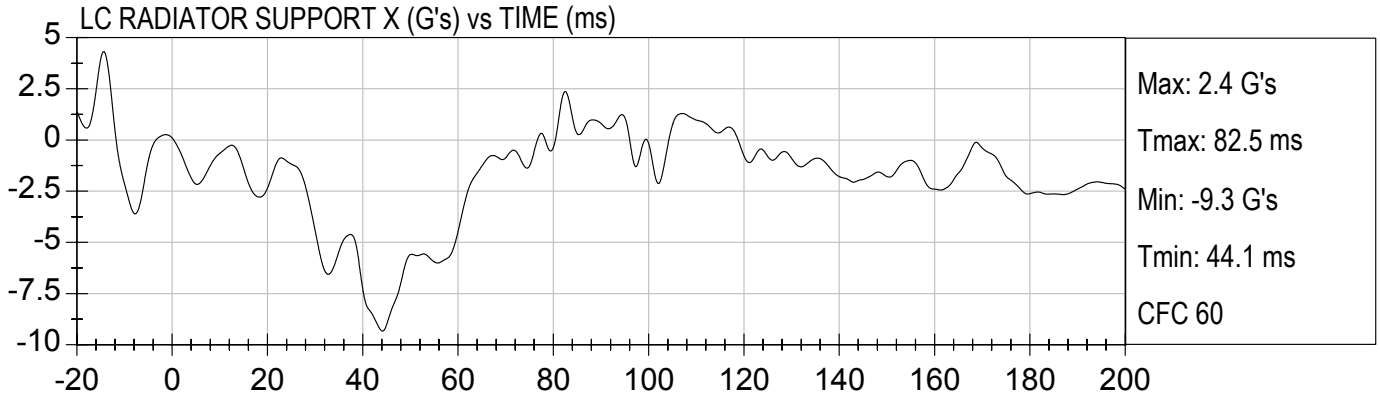


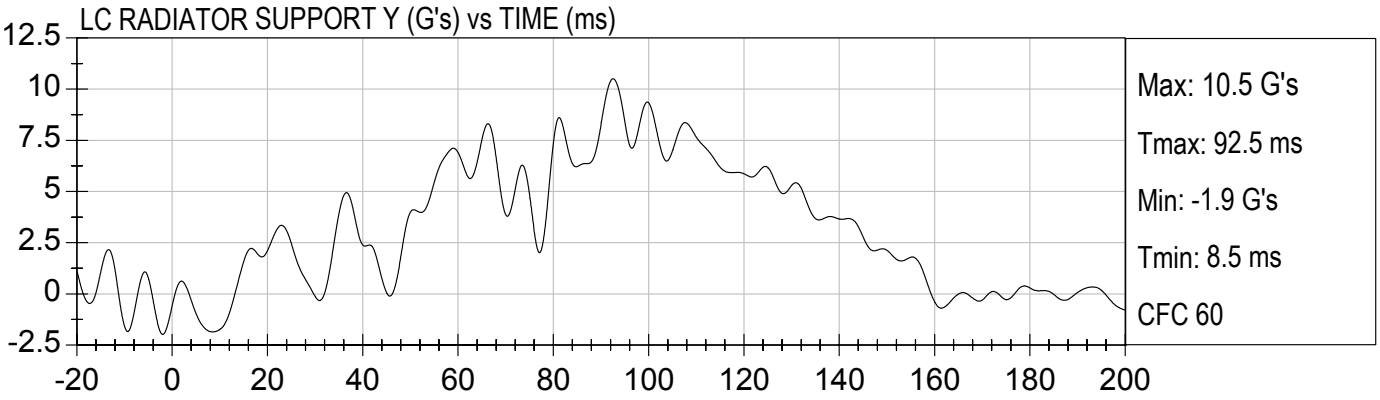


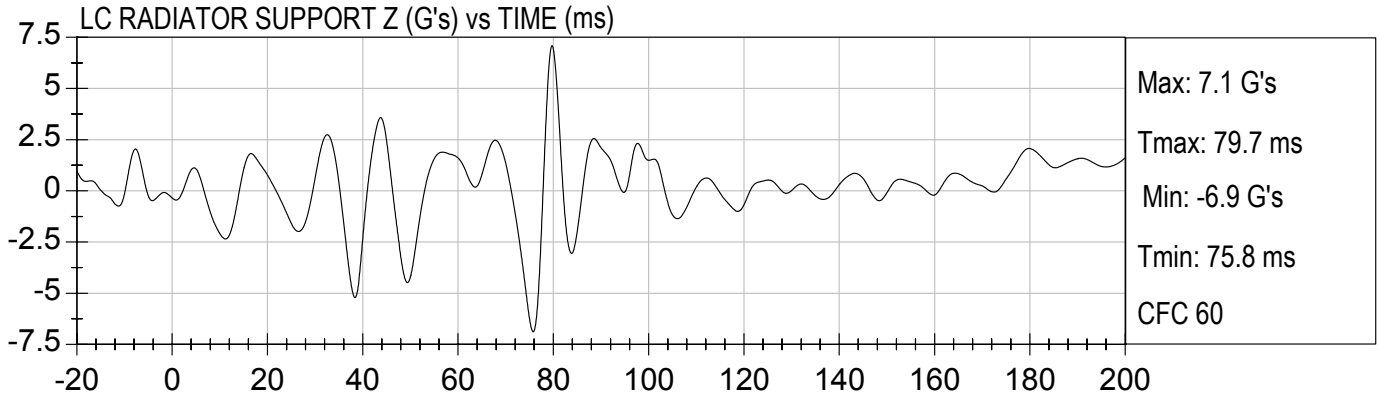


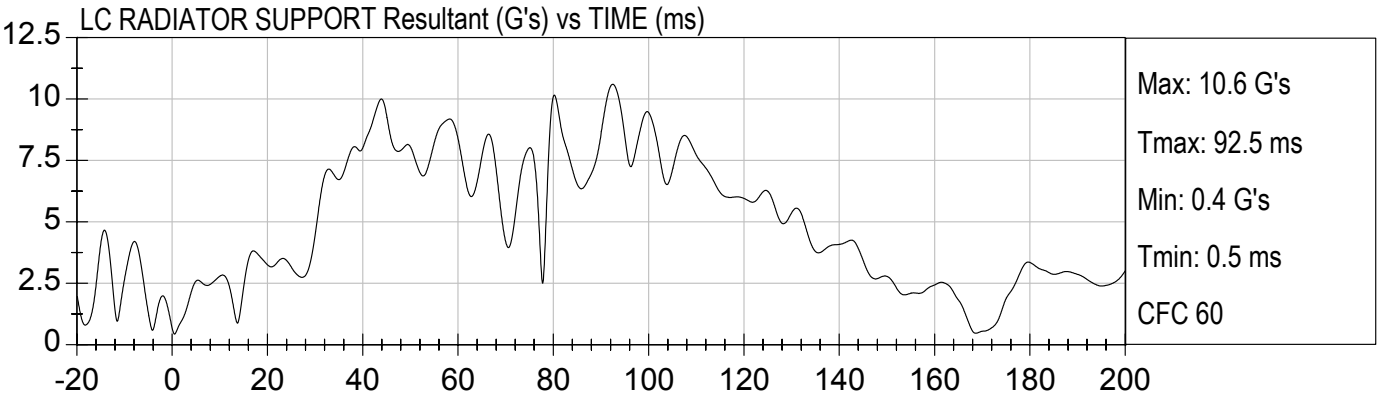
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



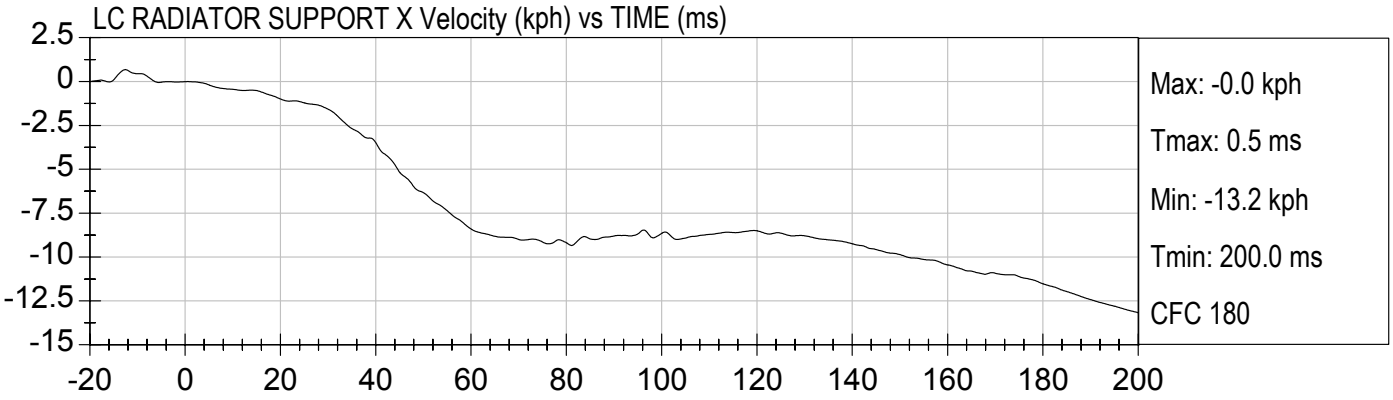


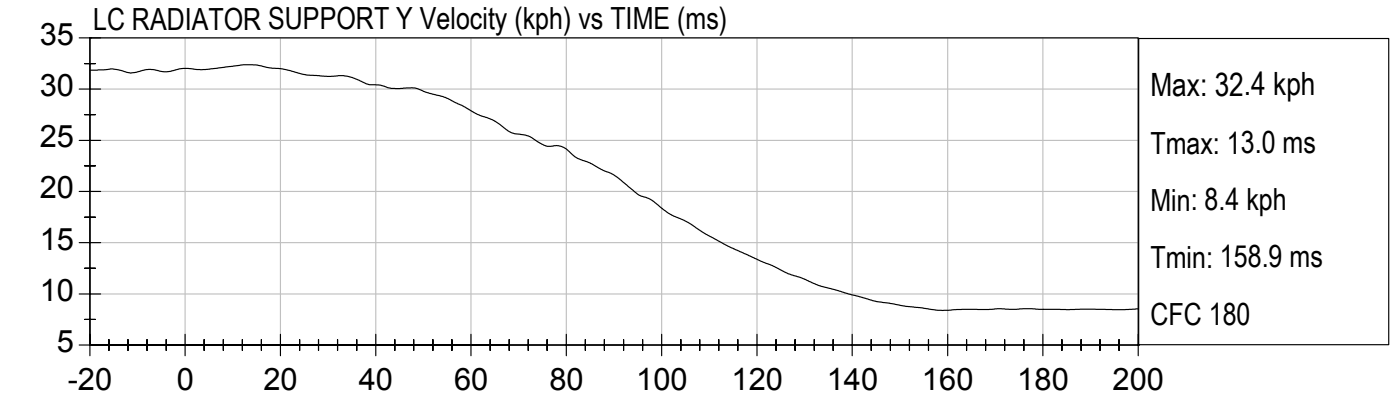


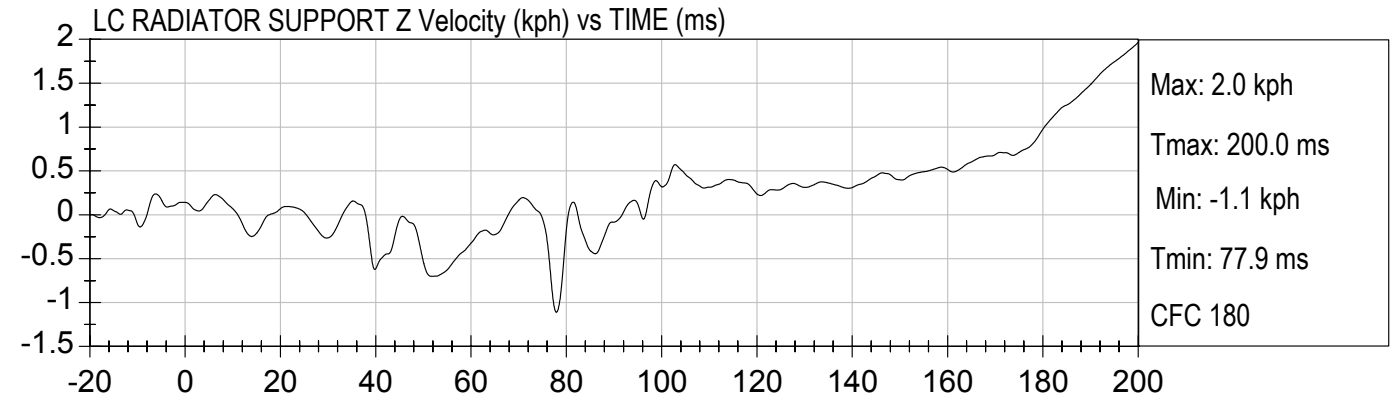


20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

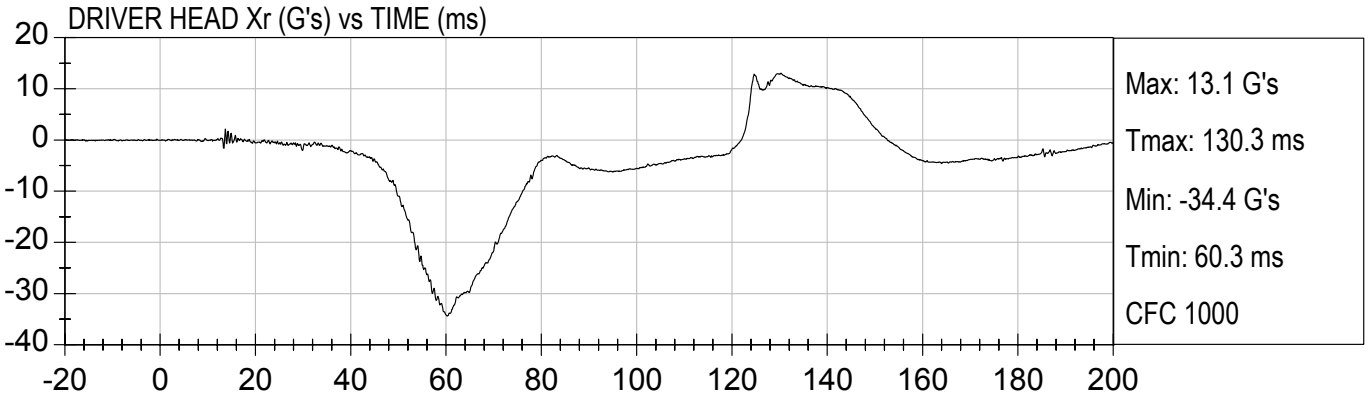


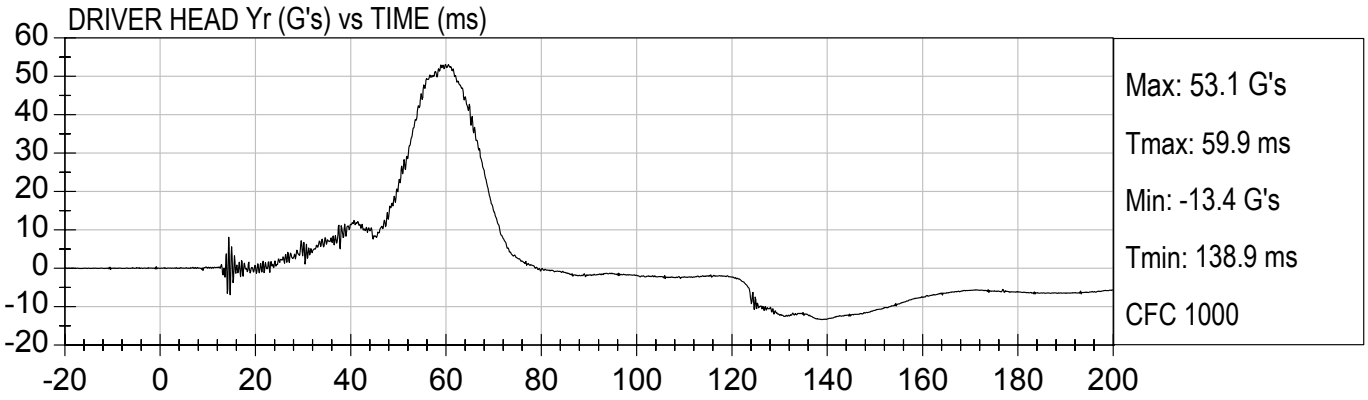


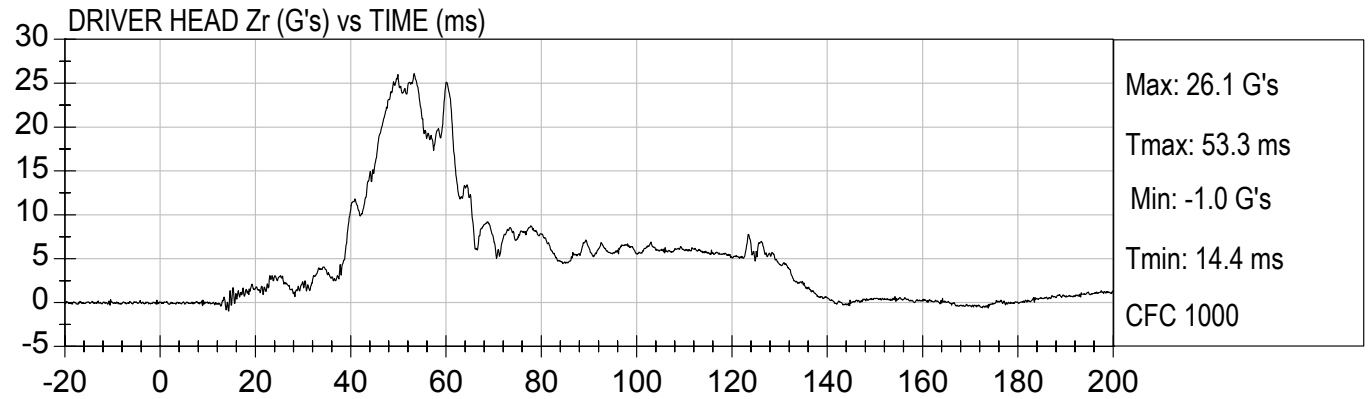


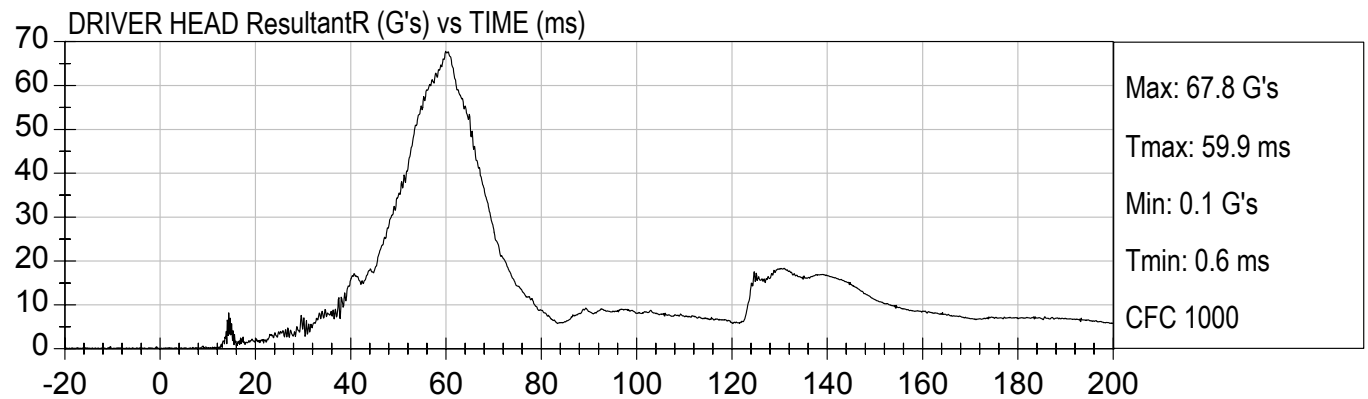
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

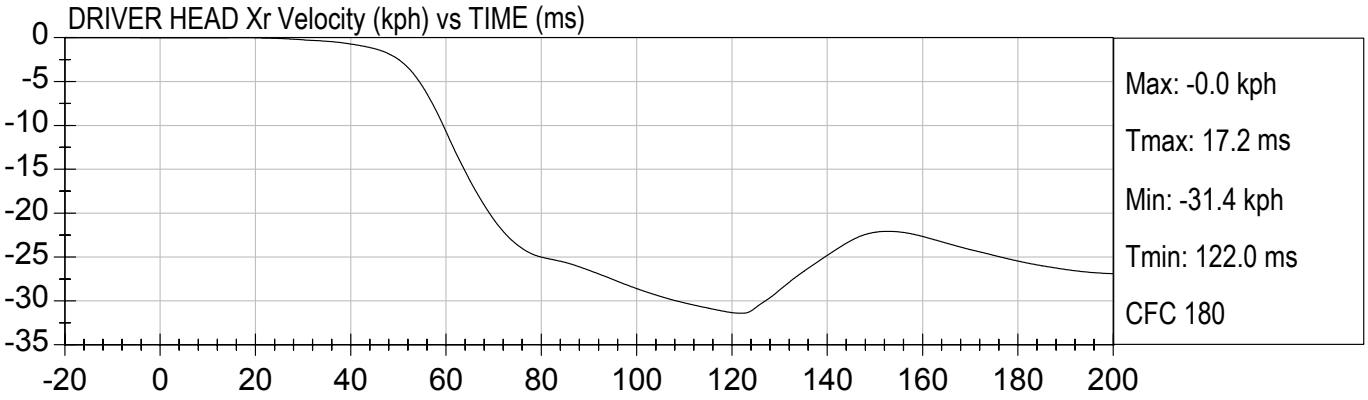
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

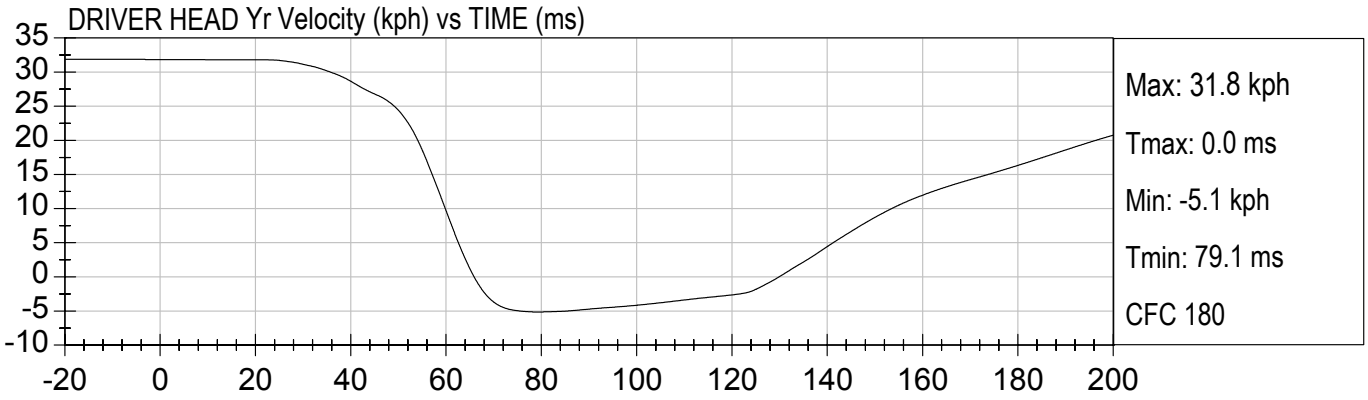


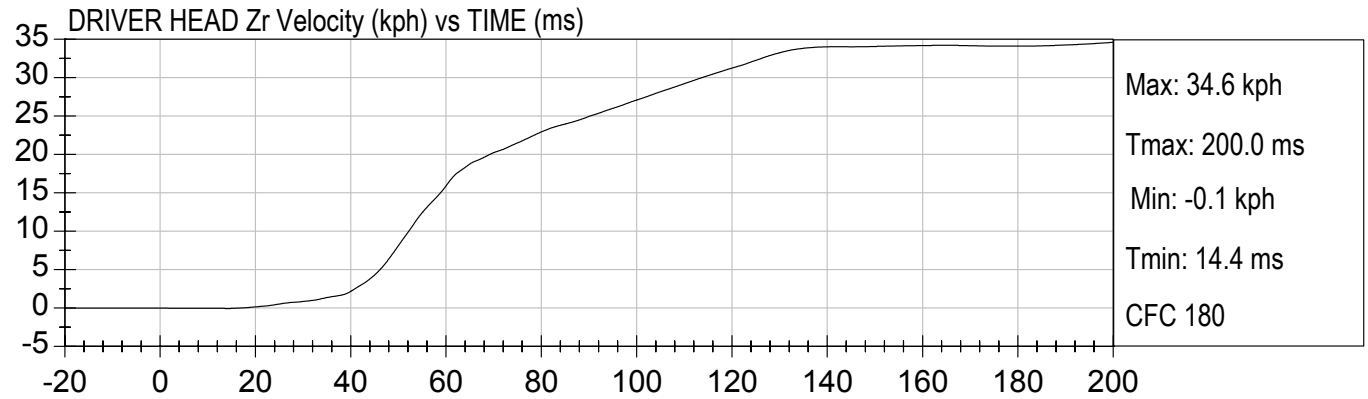






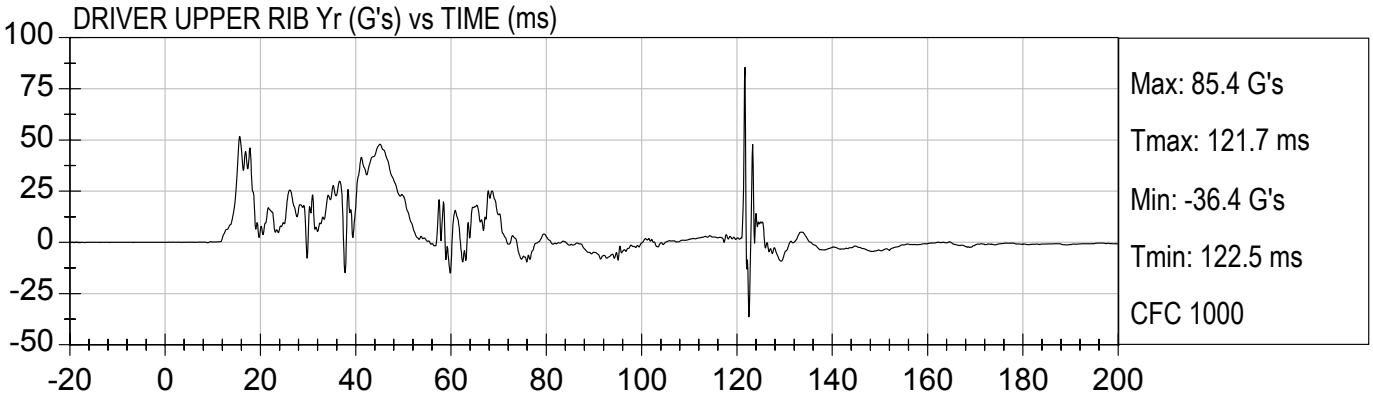

DRIVER HEAD Xr Velocity (kph) vs TIME (ms)
0
-5
-10
-15
-20
-25
-30
-35
-20
0
20
40
60
80
100
120
140
160
180
200
Max: -0.0 kph
Tmax: 17.2 ms
Min: -31.4 kph
Tmin: 122.0 ms
CFC 180

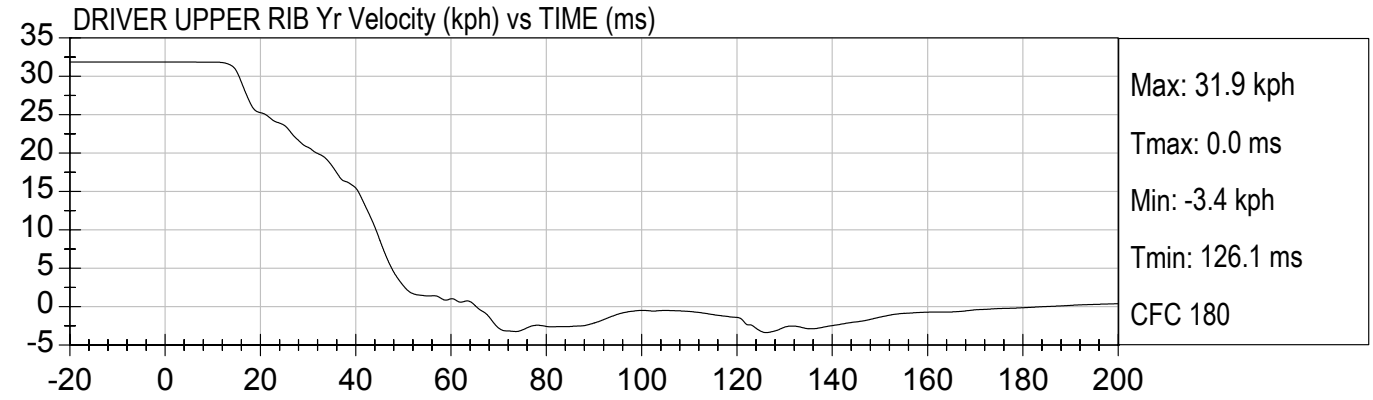

DRIVER HEAD Yr Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.8 kph
Tmax: 0.0 ms
Min: -5.1 kph
Tmin: 79.1 ms
CFC 180

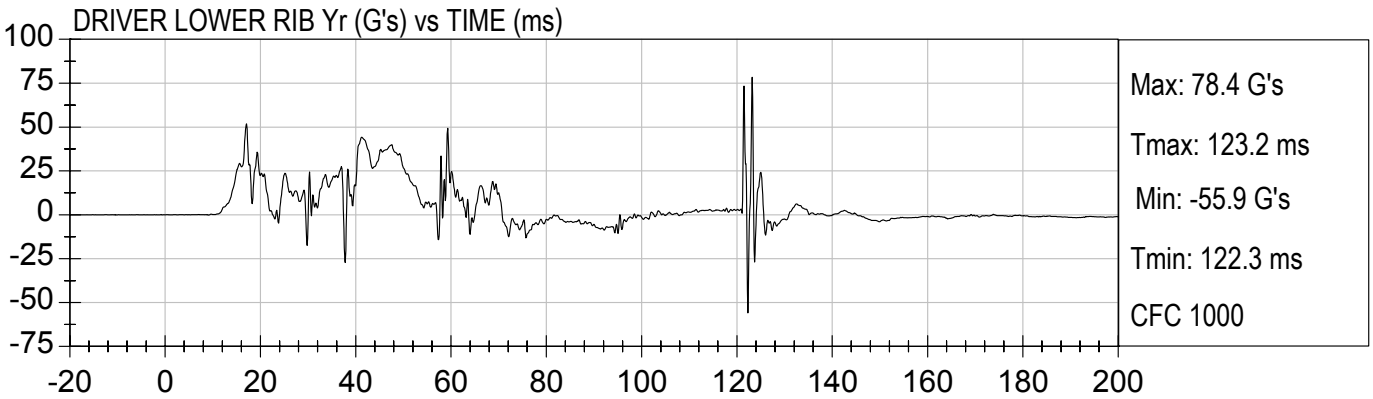

DRIVER HEAD Zr Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 34.6 kph
Tmax: 200.0 ms
Min: -0.1 kph
Tmin: 14.4 ms
CFC 180

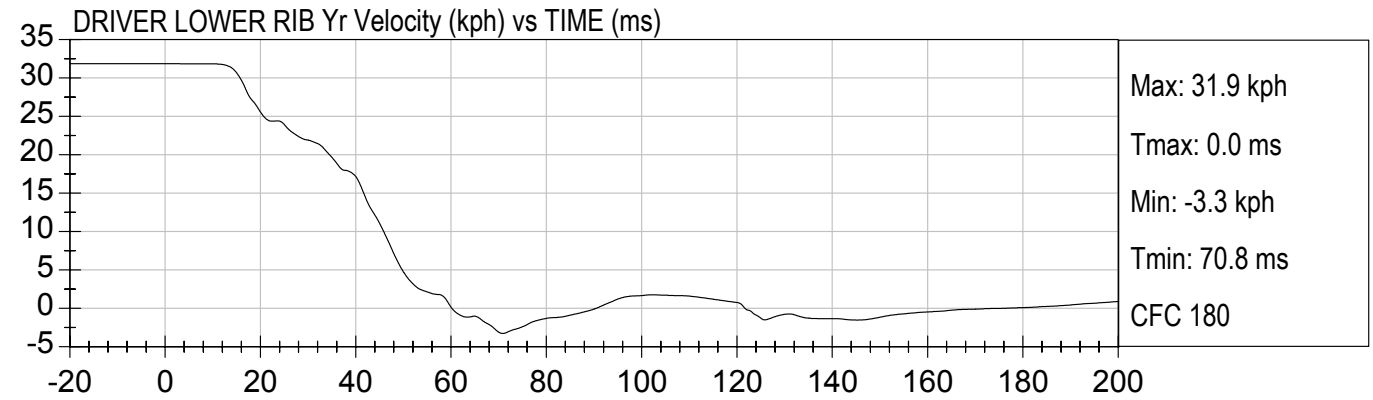
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



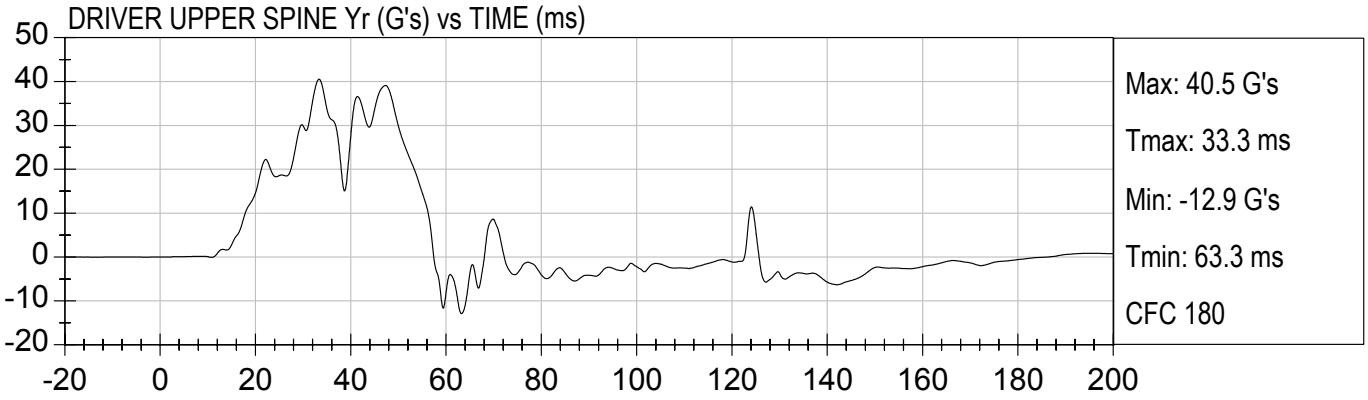


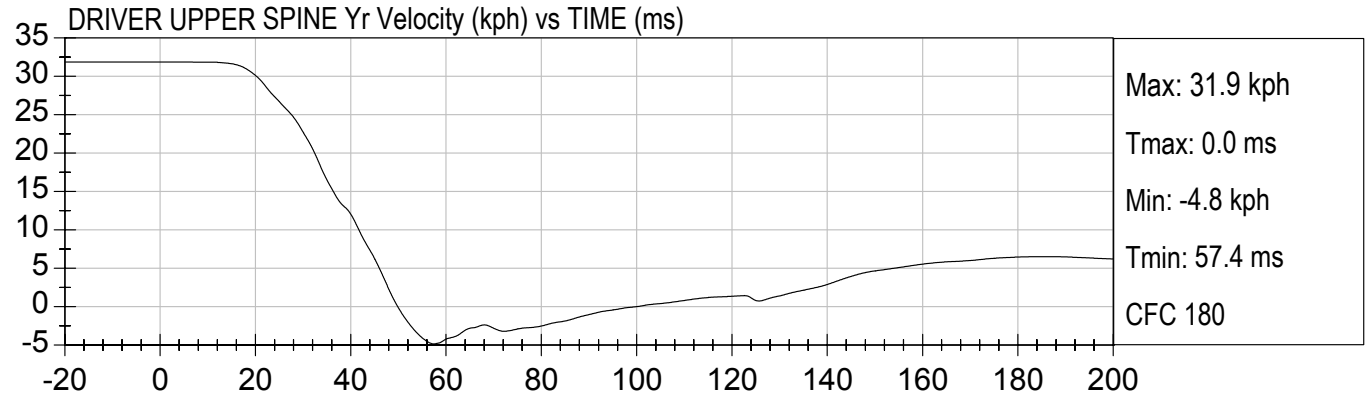


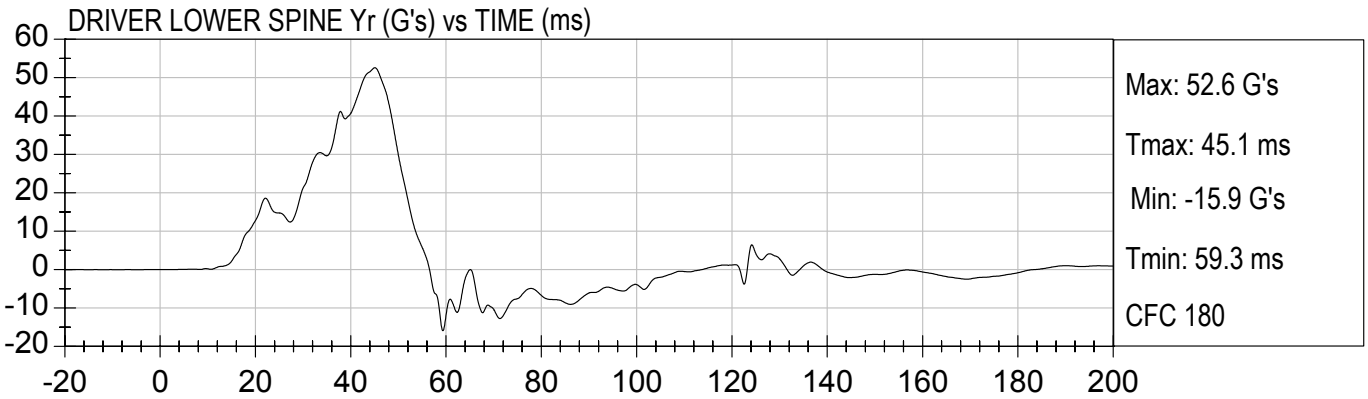


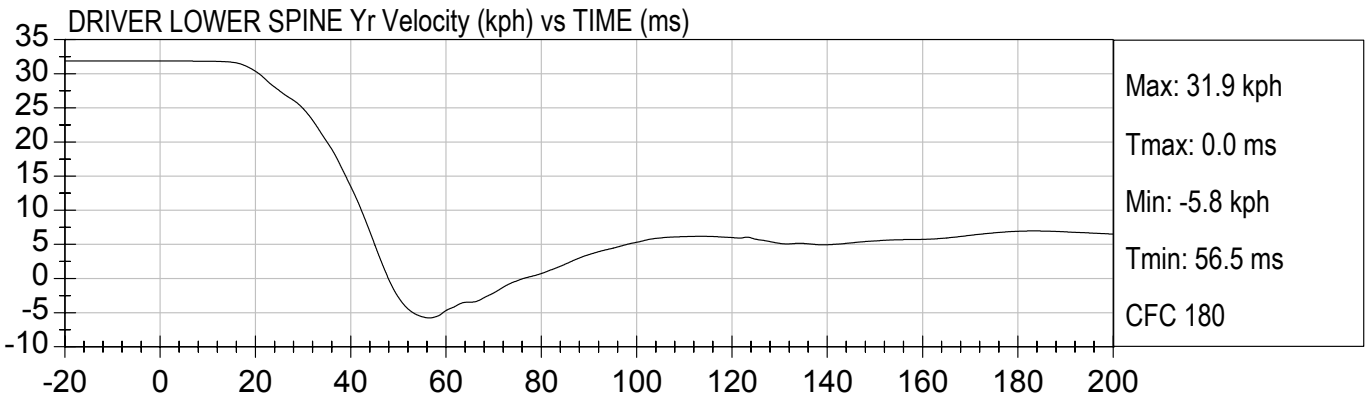
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

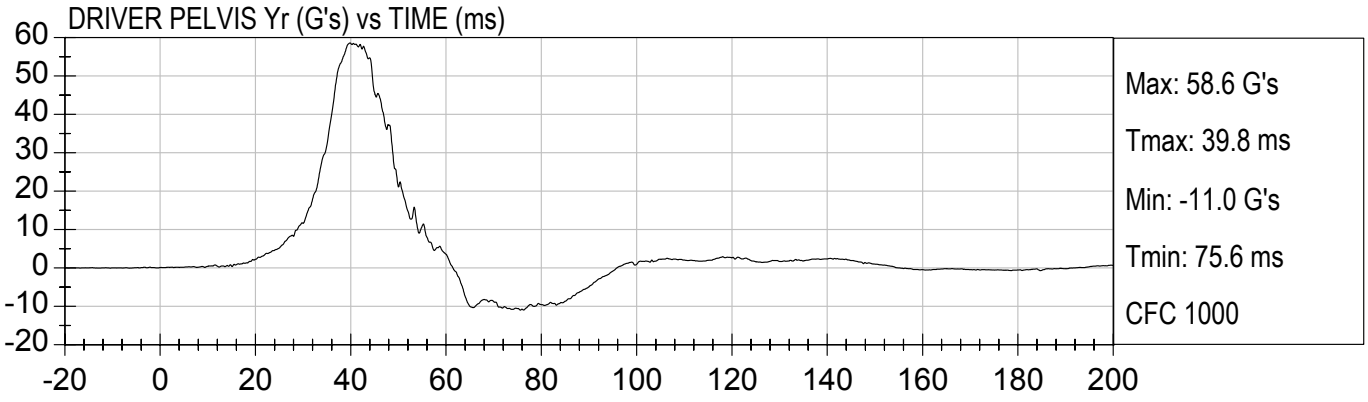
Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)

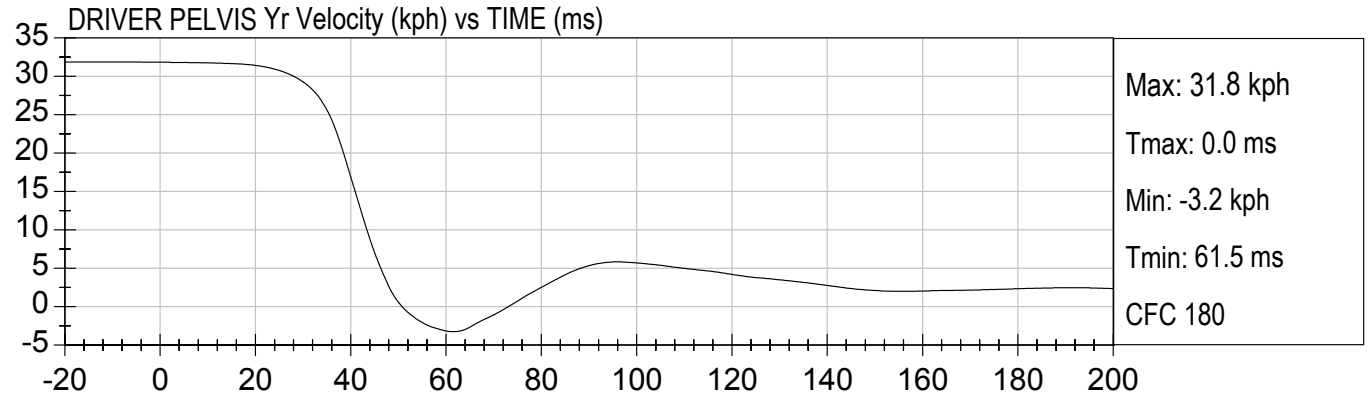






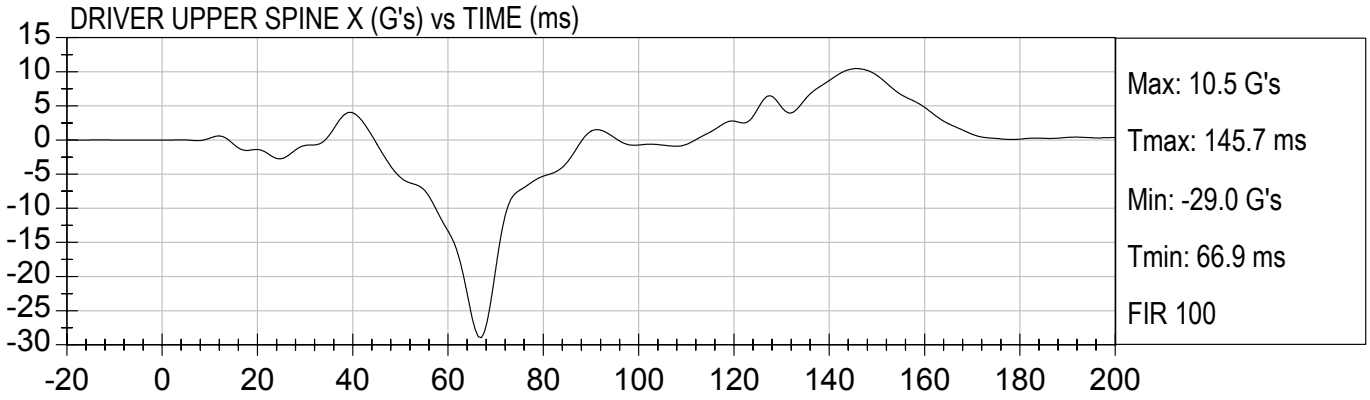


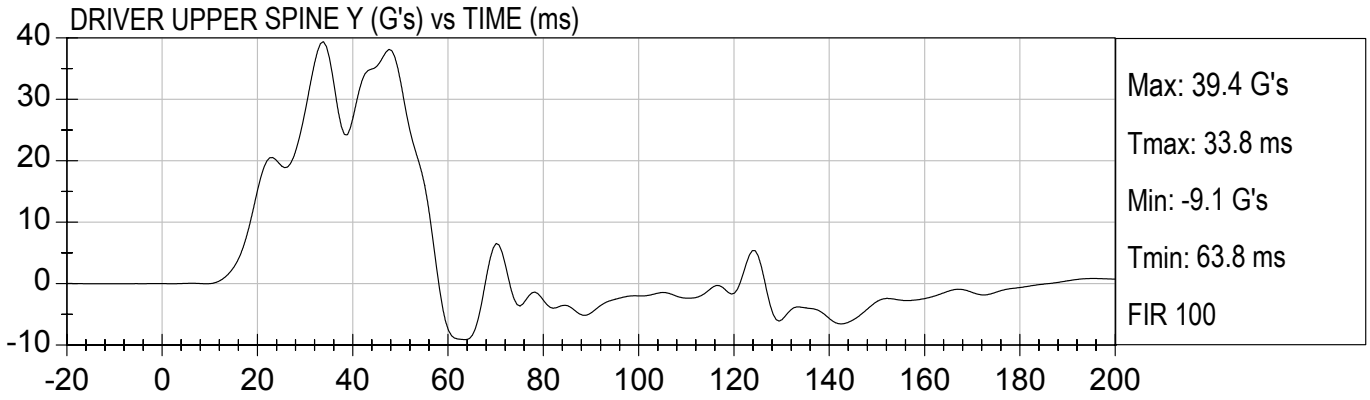

DRIVER PELVIS Yr (G's) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 58.6 G's
Tmax: 39.8 ms
Min: -11.0 G's
Tmin: 75.6 ms
CFC 1000

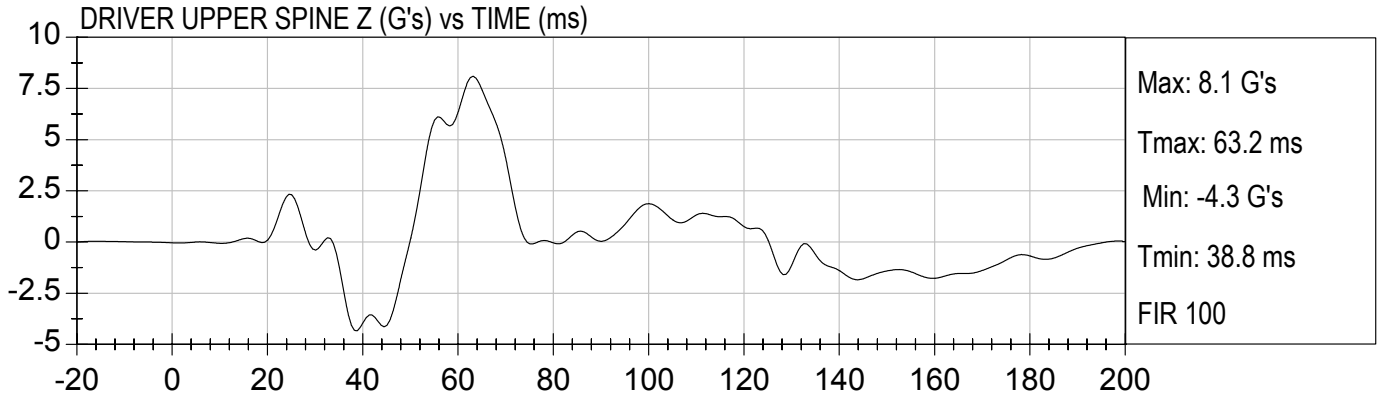

DRIVER PELVIS Yr Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 31.8 kph
Tmax: 0.0 ms
Min: -3.2 kph
Tmin: 61.5 ms
CFC 180

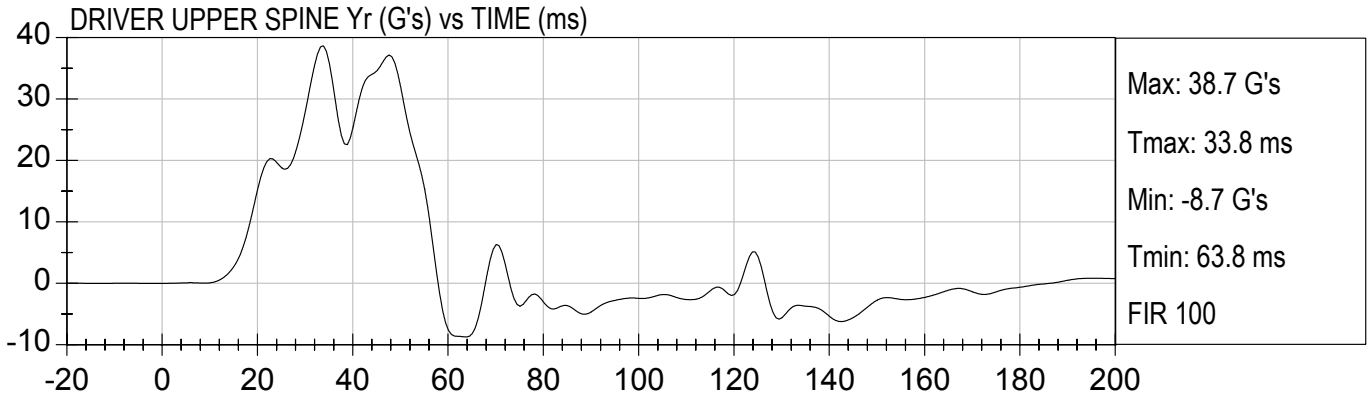
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



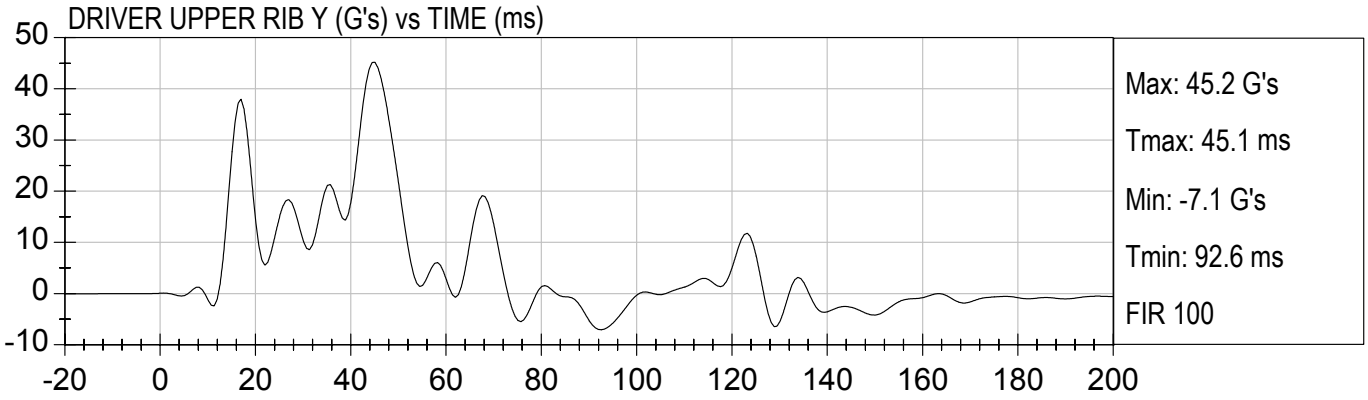


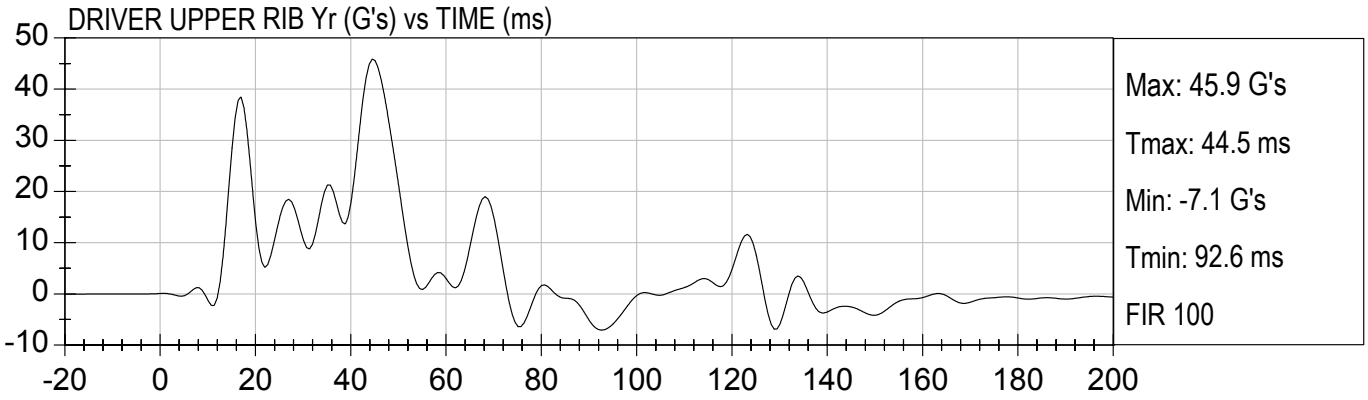


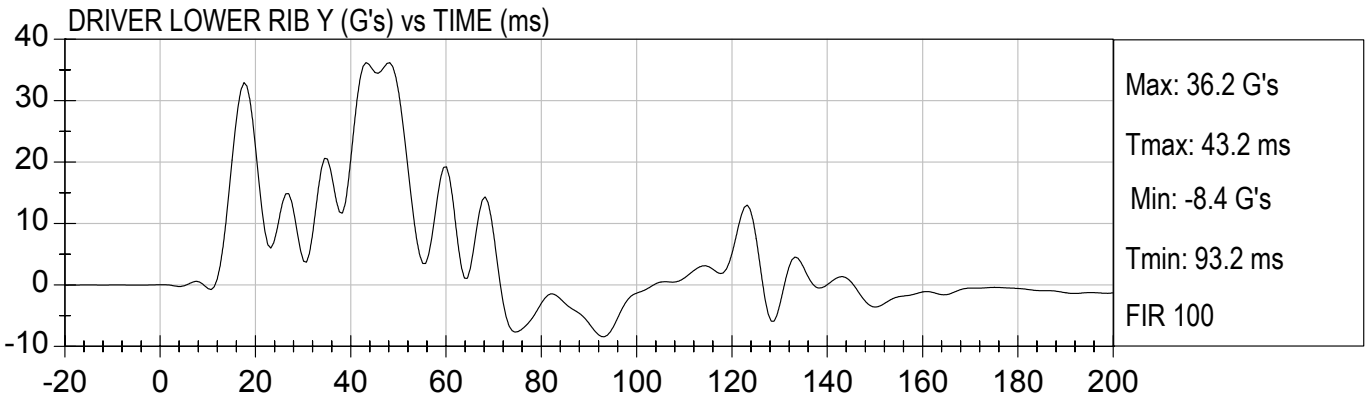


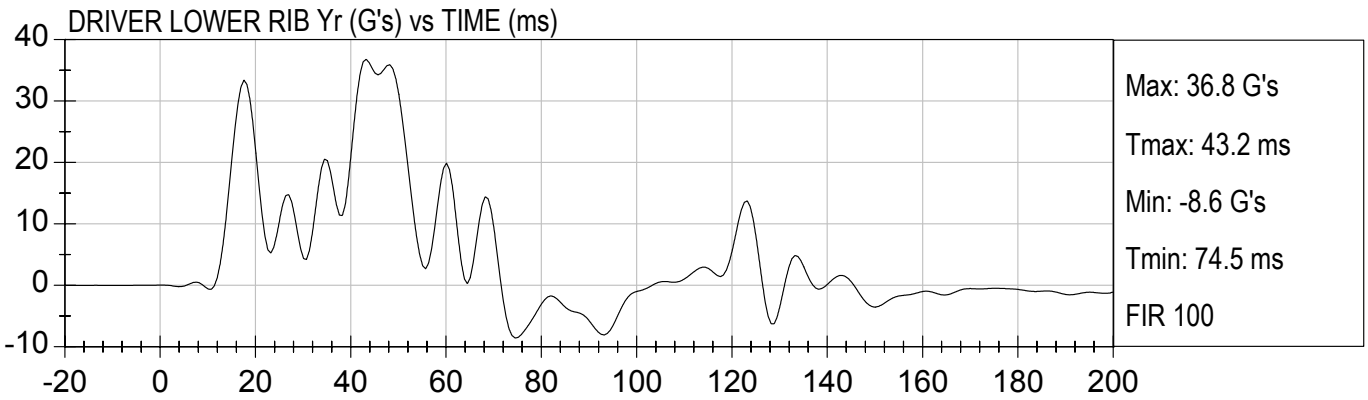
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



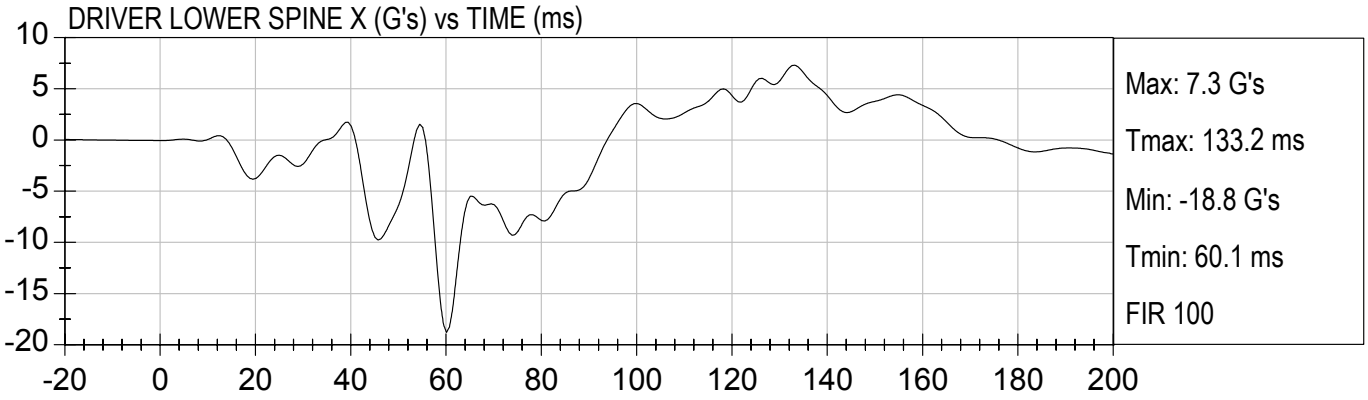


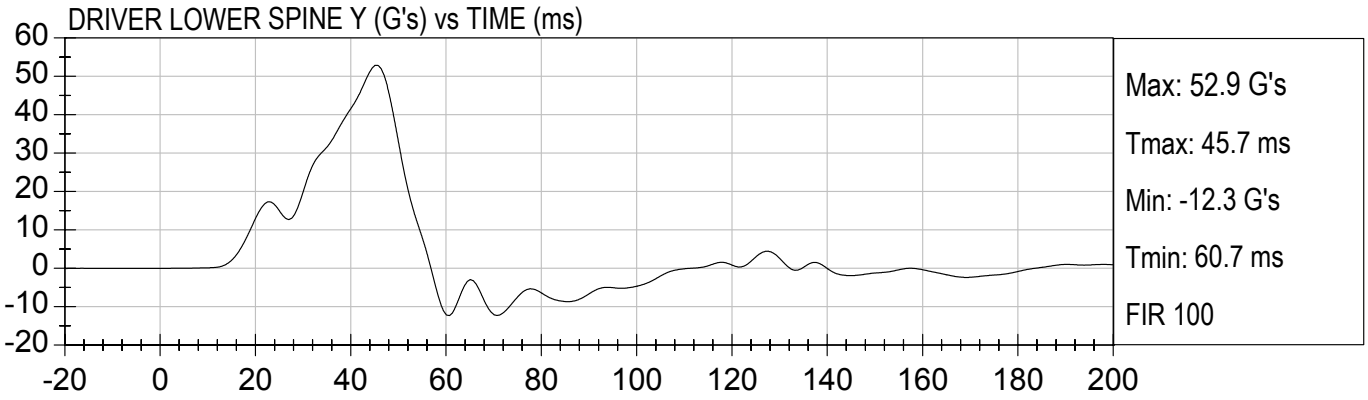


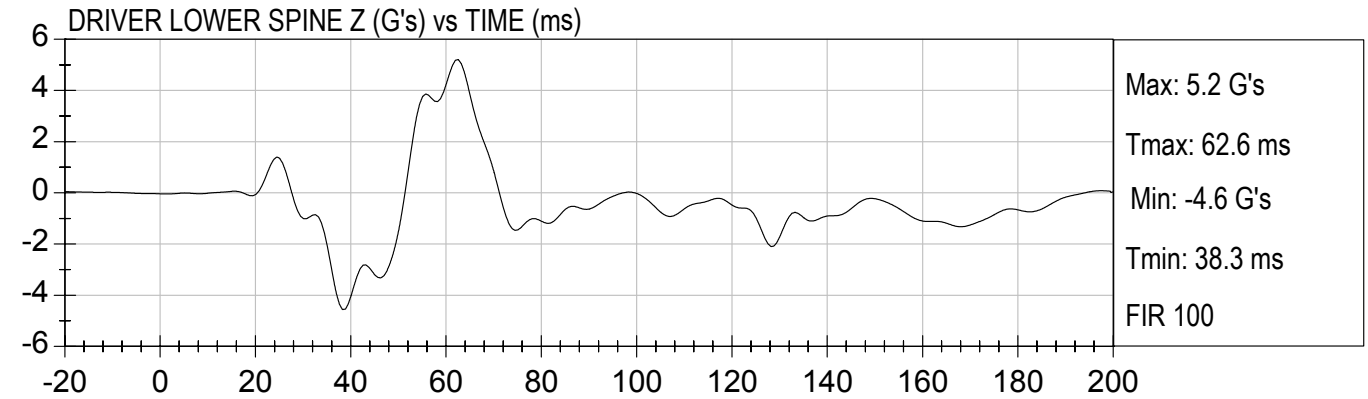


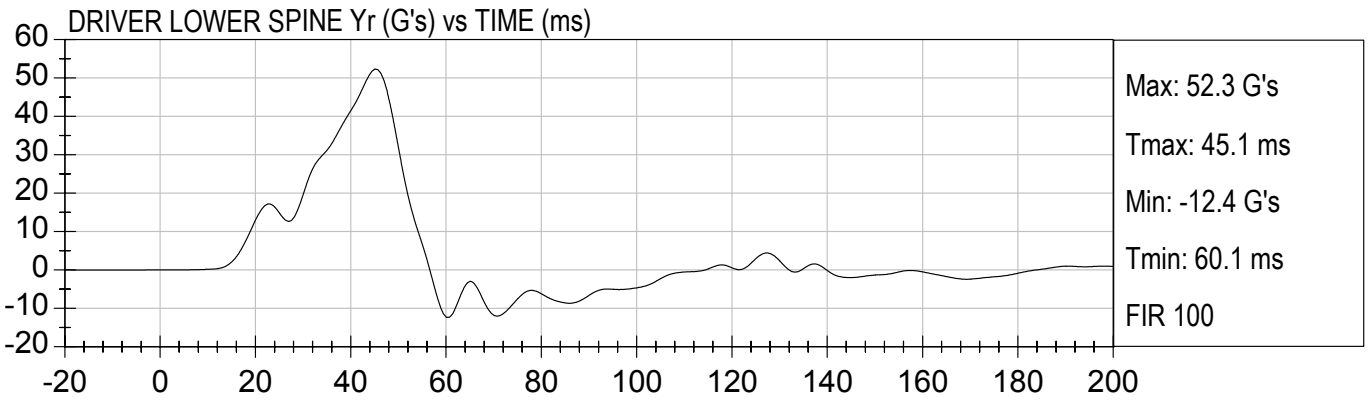
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)



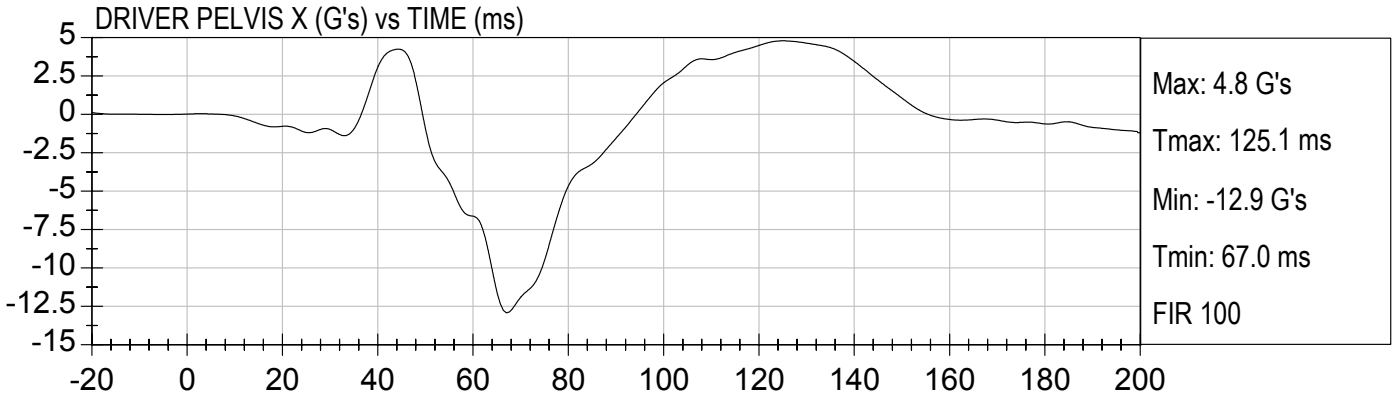


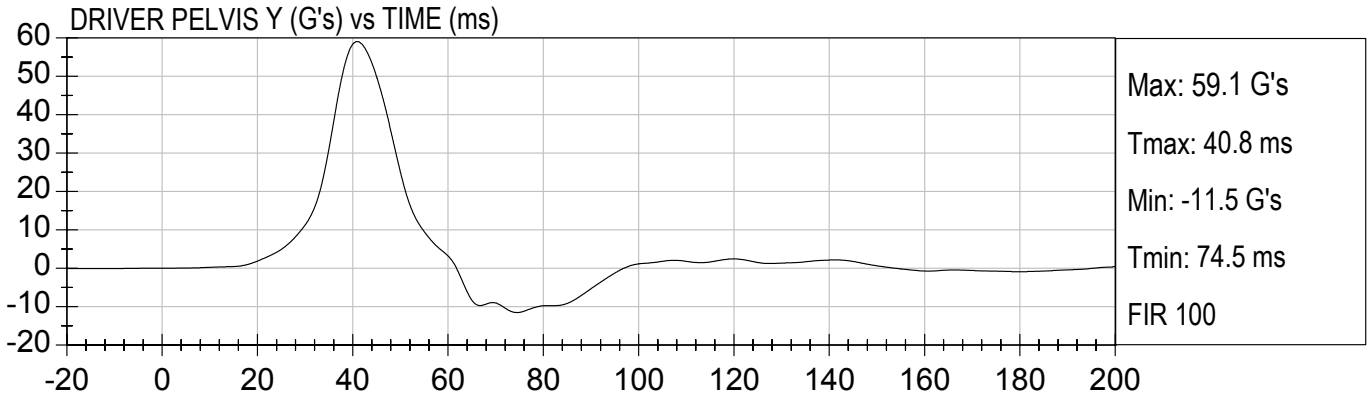


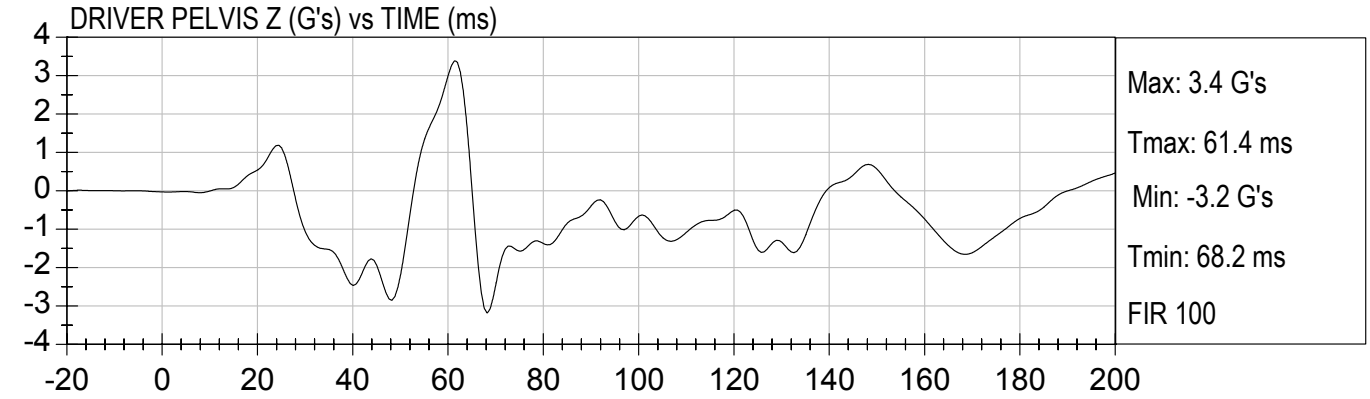


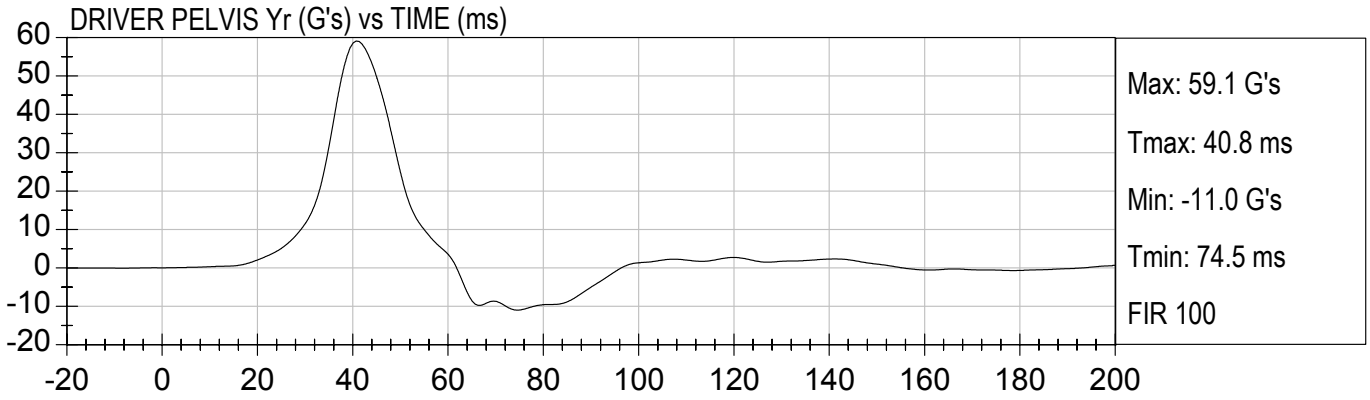
20 MPH SIDE POLE
1999 VOLVO S80 W/AIRBAG (RX5907)

Test Date: 1/30/2003
Speed: 19.8 mph (31.9 km/h)









APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

SID Calibration Data Sheet

Side Impact Dummy

Head Drop Calibration (Lateral)

ATD Serial No: 037 **Test I.D:** D021241

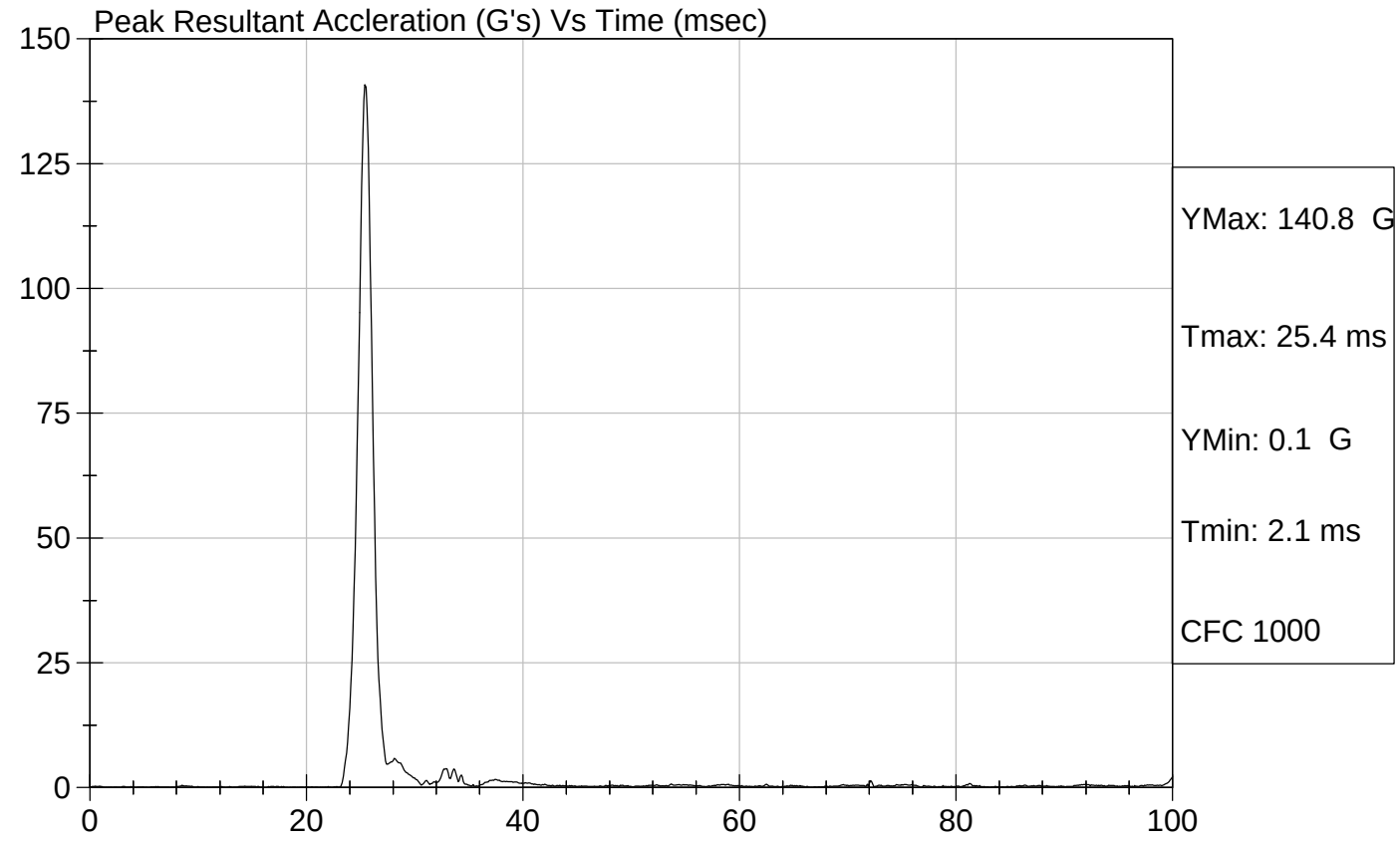
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	120 to 150	141	Pass
Is Resultant Curve Unimodal?	Yes/No	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-14	Pass
		Overall Test Results		Pass

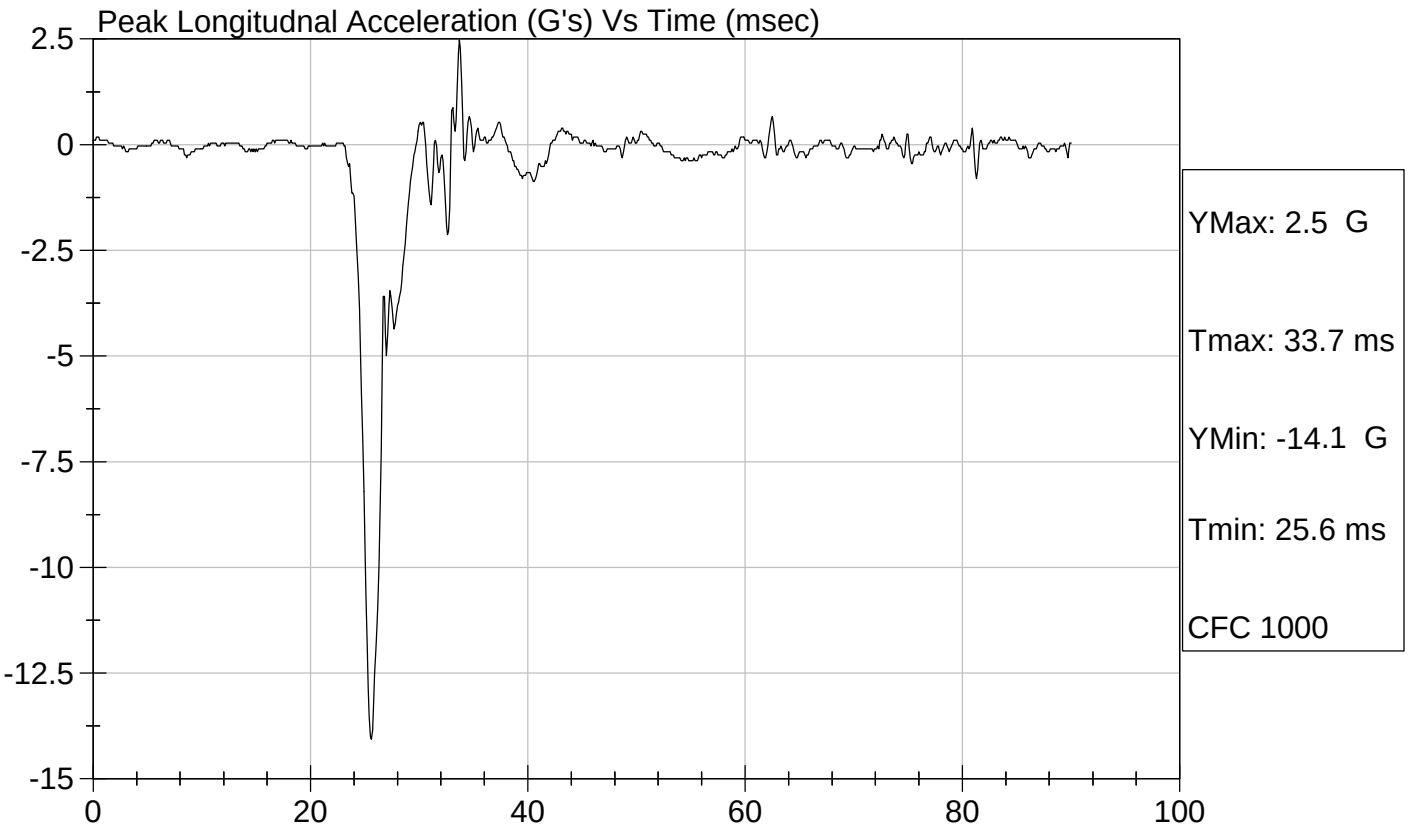
Laboratory Technician

09/24/2002
Test Date

Approved By

	Test Description: Head Drop	Test Date: 09/24/2002
	Component: D021241	Speed: 0 ft/s, 0.00 m/s





SID Calibration Data Sheet

Side Impact Dummy (SID)

Neck Pendulum Test

ATD Serial No: 037 **Test I.D:** D021249

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	34	Pass
Impact Velocity		m/s	6.89 to 7.13	6.95	Pass
Pendulum Deceleration	10 msec	m/s	1.96 to 2.55	2.39	Pass
	20 msec	m/s	4.12 to 5.10	4.68	Pass
	30 msec	m/s	5.73 to 7.01	6.52	Pass
	40 to 70 msec	m/s	6.27 to 7.64	6.91	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	72	Pass
Head Rotation Peak to Zero - Decay Time		msec	58 to 67	62	Pass
Max. Mx at Occipital Condyles		Nm	73 to 88	79	Pass
Mx Peak To Zero - Decay Time		msec	49 to 64	54	Pass
Mx Peak to Max. Head Rotation		msec	2 to 16	10	Pass

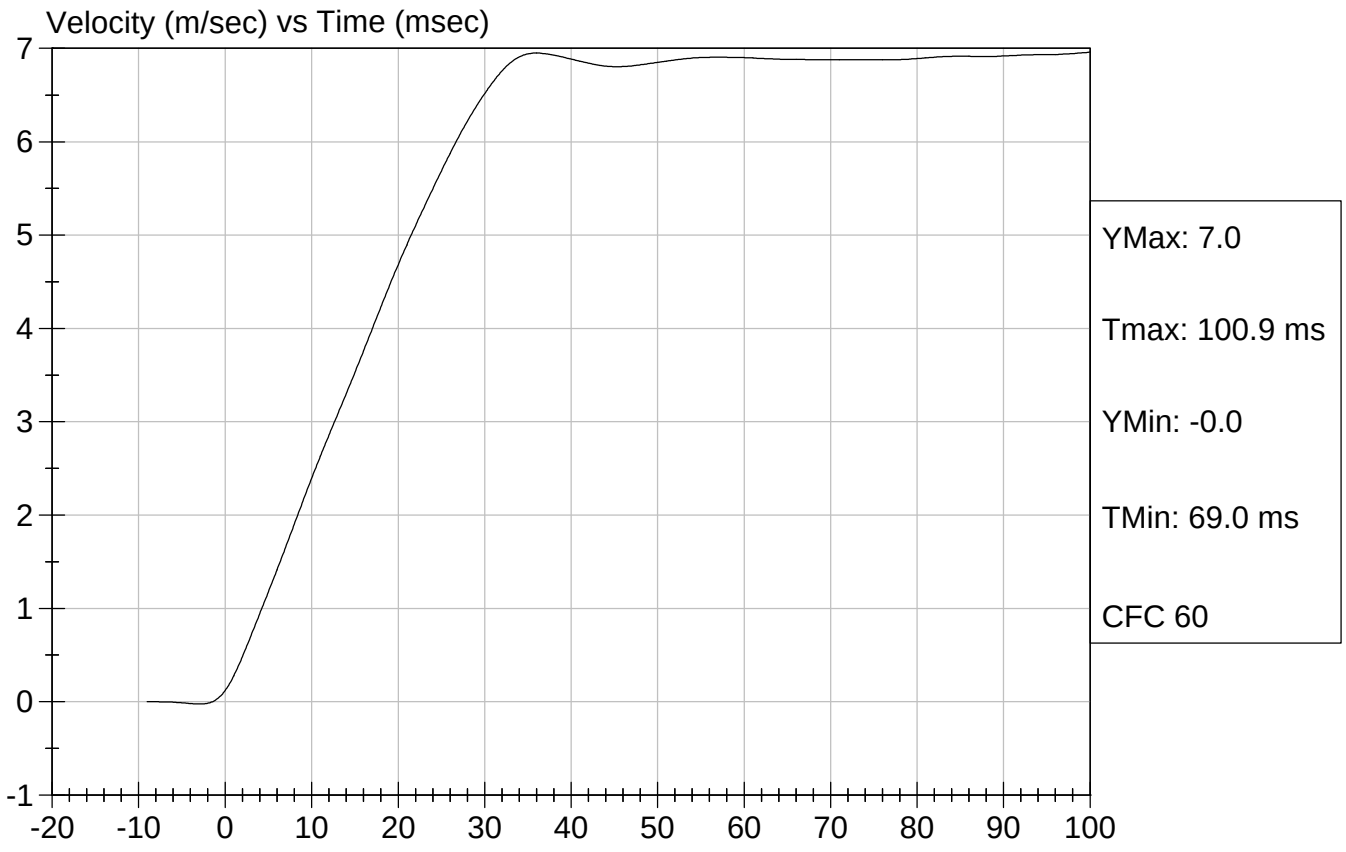
Laboratory Technician

09/24/2002
Test Date

Approved By

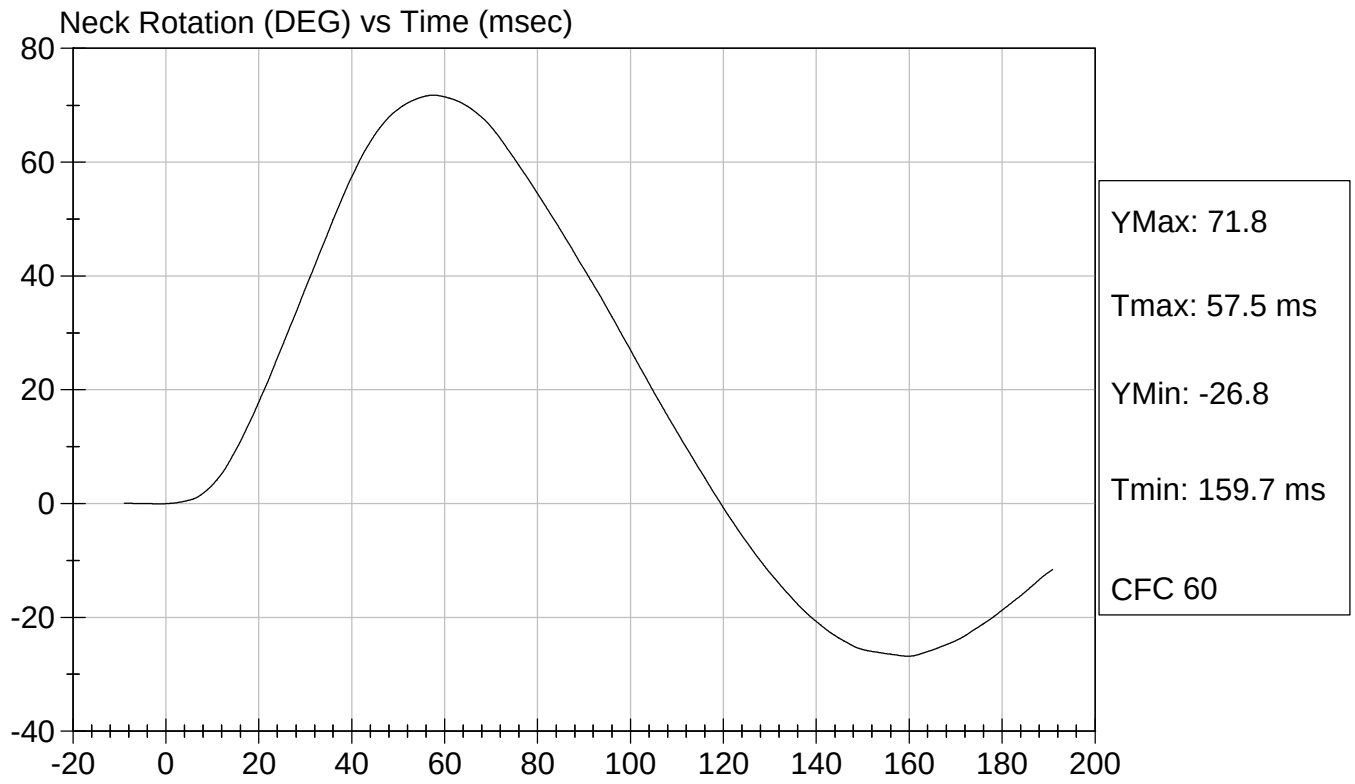
Test Desc: Neck Bending
Component ID: D021249

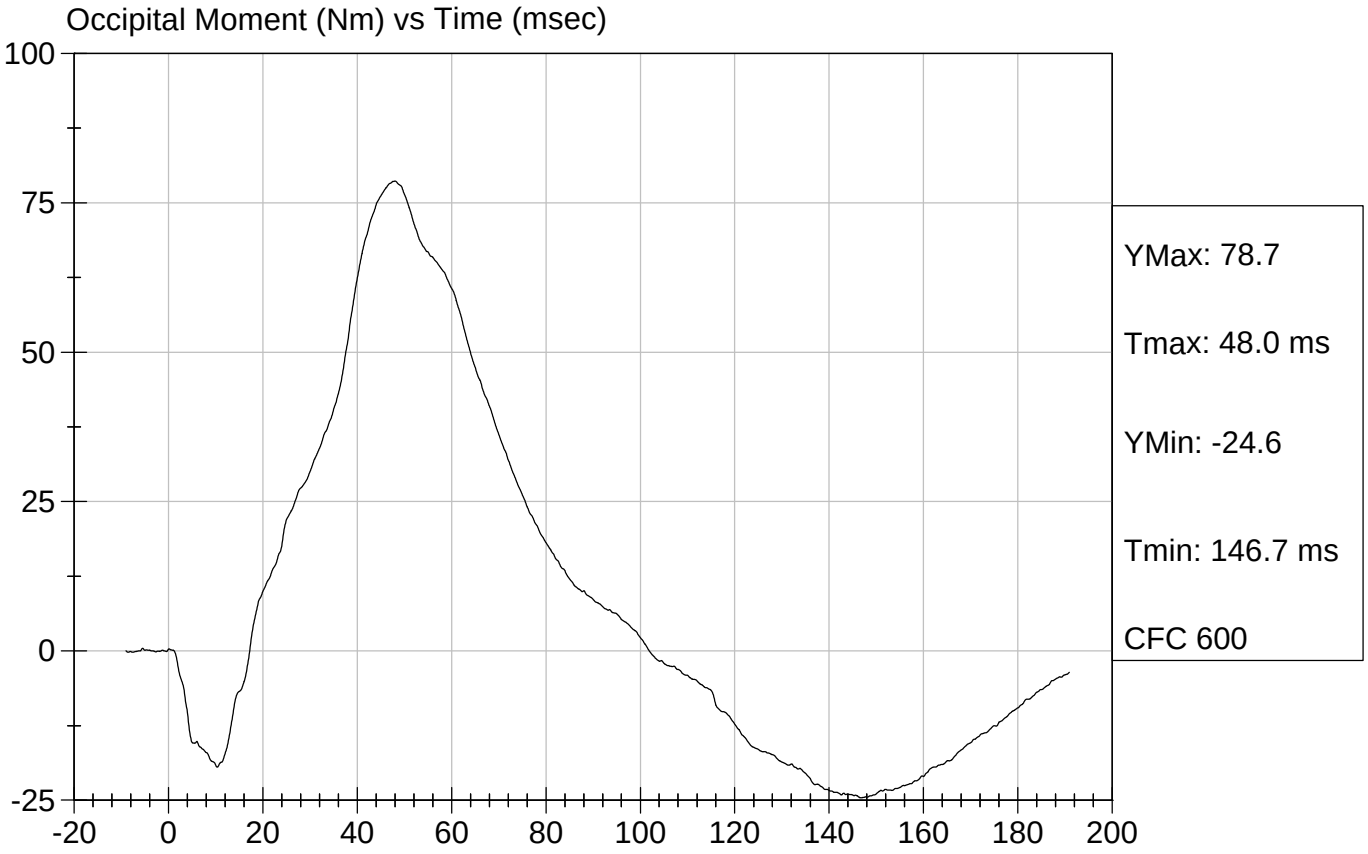
Test Date: 09/24/2002
Speed: 22.81 ft/sec, 6.95 m/sec



Test Desc: Neck Bending
Component ID: D021249

Test Date: 09/24/2002
Speed: 22.81 ft/sec, 6.95 m/sec





SID Calibration Data Sheet

Side Impact Dummy

Thorax Impact Test

ATD Serial No: 037 **Test I.D:** D021242

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Velocity	m/s	4.27 - 4.33	4.29	Pass
Upper Rib	G's	37 - 46	38	Pass
Lower Rib	G's	37 - 46	42	Pass
Lower Spine	G's	15 - 22	19	Pass
		Overall Test Results		Pass

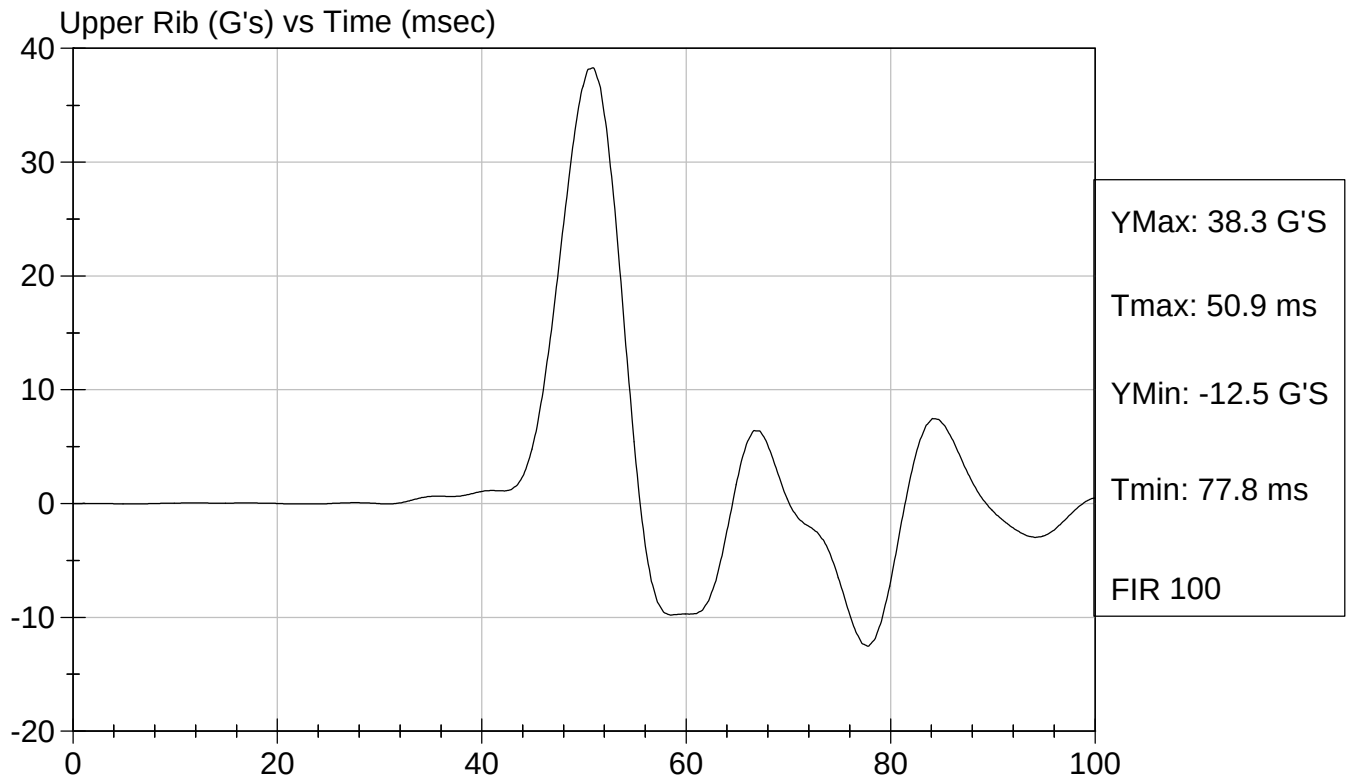
Laboratory Technician

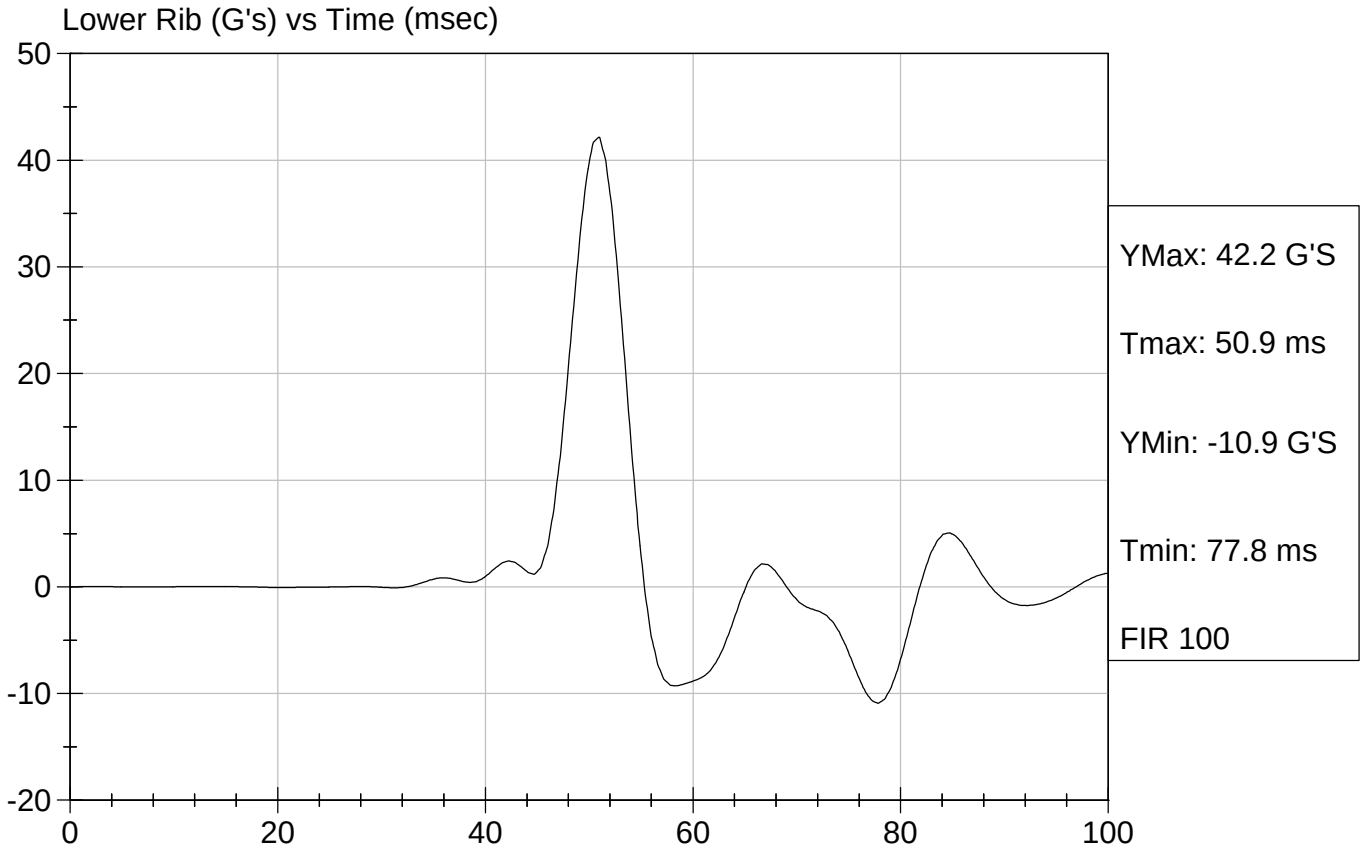
09/24/2002
Test Date

Approved By

Test Desc: Thorax Impact
Component ID: D021242

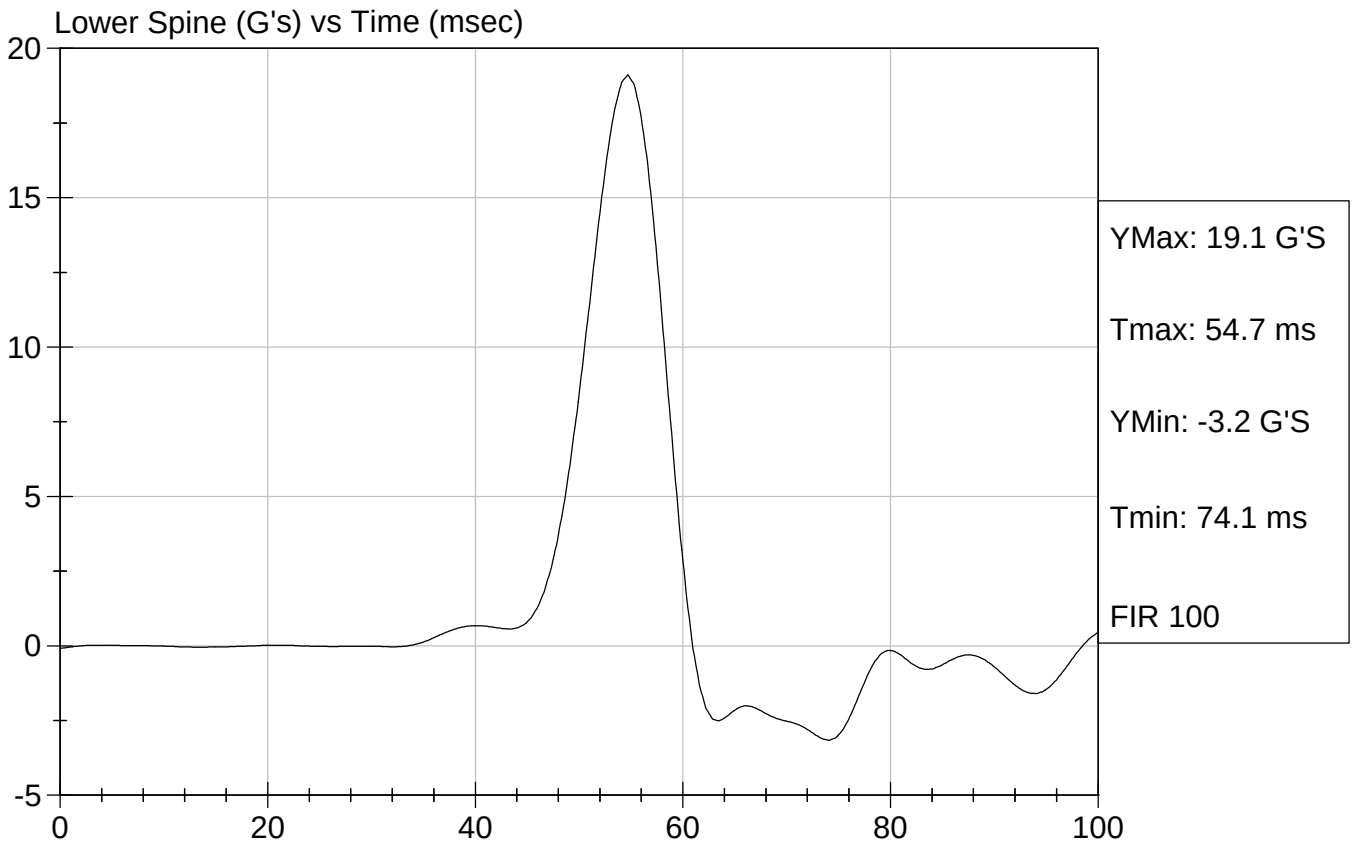
Test Date: 09/24/2002
Speed: 14.07 ft/sec, 4.29 m/sec





Test Desc: Thorax Impact
Component ID: D021242

Test Date: 09/24/2002
Speed: 14.07 ft/sec, 6.95 m/sec



SID Calibration Data Sheet

Side Impact Dummy

Pelvis Impact Test

ATD Serial No: 037 **Test I.D:** D021243

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Velocity	m/s	4.27 - 4.33	4.27	Pass
Pelvis Acceleration	G's	40 - 60	41	Pass
		Overall Test Results		Pass

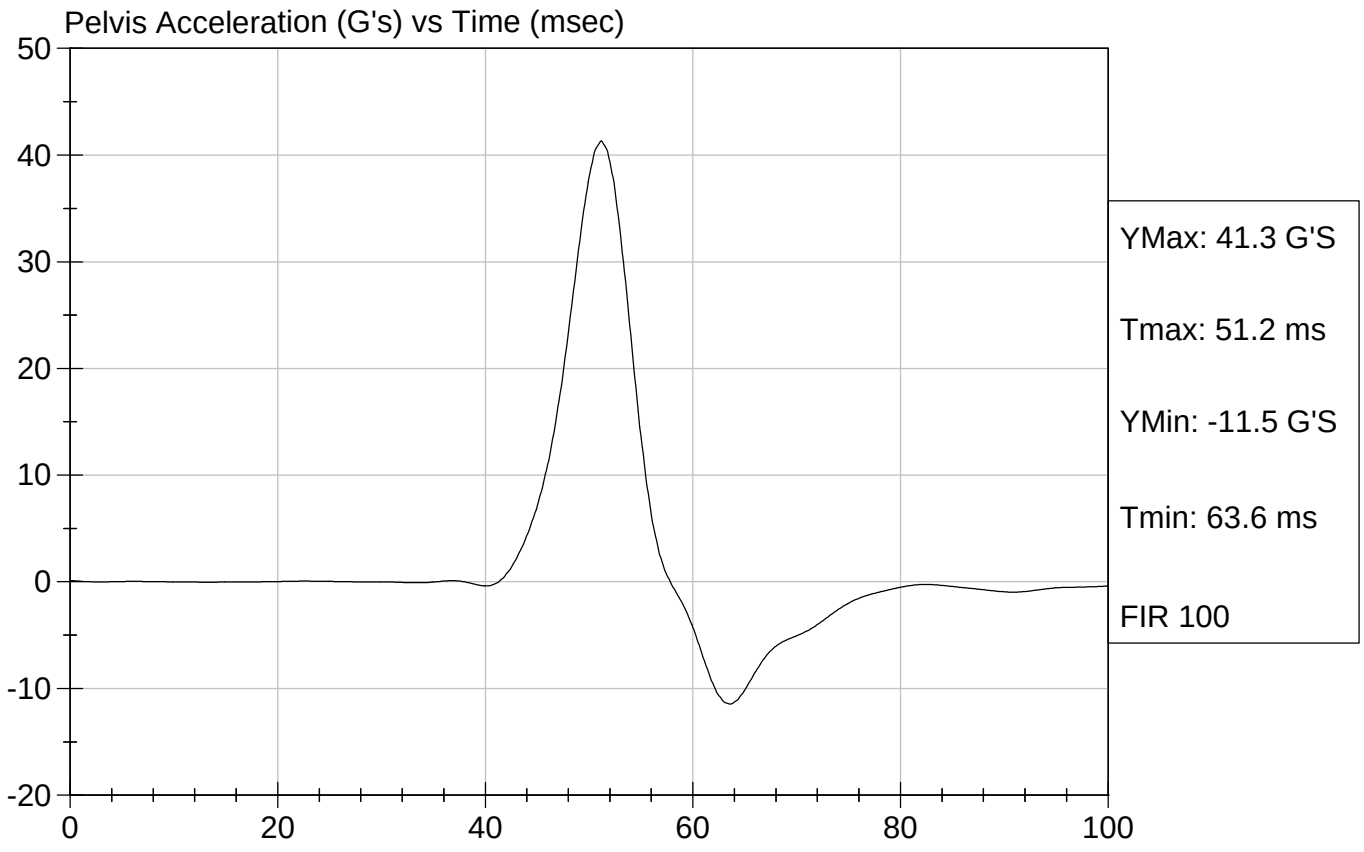
Laboratory Technician

09/24/2002
Test Date

Approved By

Test Desc: Pelvis Impact
Component ID: D021243

Test Date: 09/24/2002
Speed: 14 ft/sec, 4.27 m/sec



SID Calibration Data Sheet

Side Impact Dummy

Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 037 **Test I.D:** D021244

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Force At 12.7 mm	N	104 -162	155	Pass
Force At 19 mm	N	163 - 222	214	Pass
Force At 25.4 mm	N	222 - 280	278	Pass
Force At 33 mm	N	325 - 391	371	Pass
		Overall Test Results		Pass

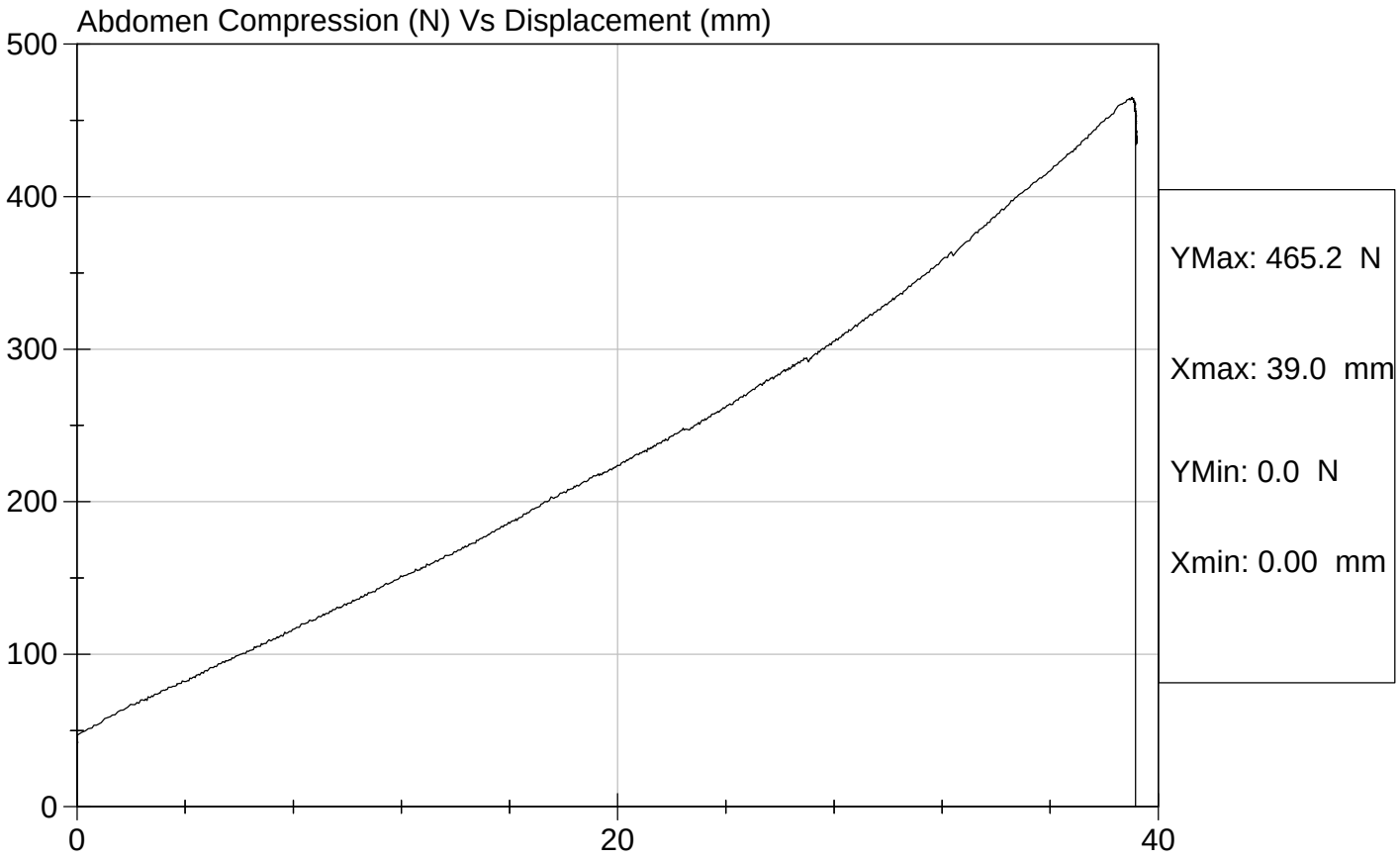
Laboratory Technician

09/25/2002
Test Date

Approved By

Test Description: Abdomen Compression Test Date: 09/25/2002

Component: D021244 Speed: 0 ft/sec, 0 m/sec



SID Calibration Data Sheet

Side Impact Dummy

Lumbar Flexion Calibration

ATD Serial No: 037 **Test I.D:** D021245

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Force At 0 deg	N	0 - 26.7	0.0	Pass
Force At 20 deg	N	97.9 - 151.2	106.0	Pass
Force At 30 deg	N	151.2 - 204.6	162.4	Pass
Force At 40 deg	N	204.6 - 258.0	230.8	Pass
Return Angle	Deg	12 Maximum	4	Pass
		Overall Test Results		Pass

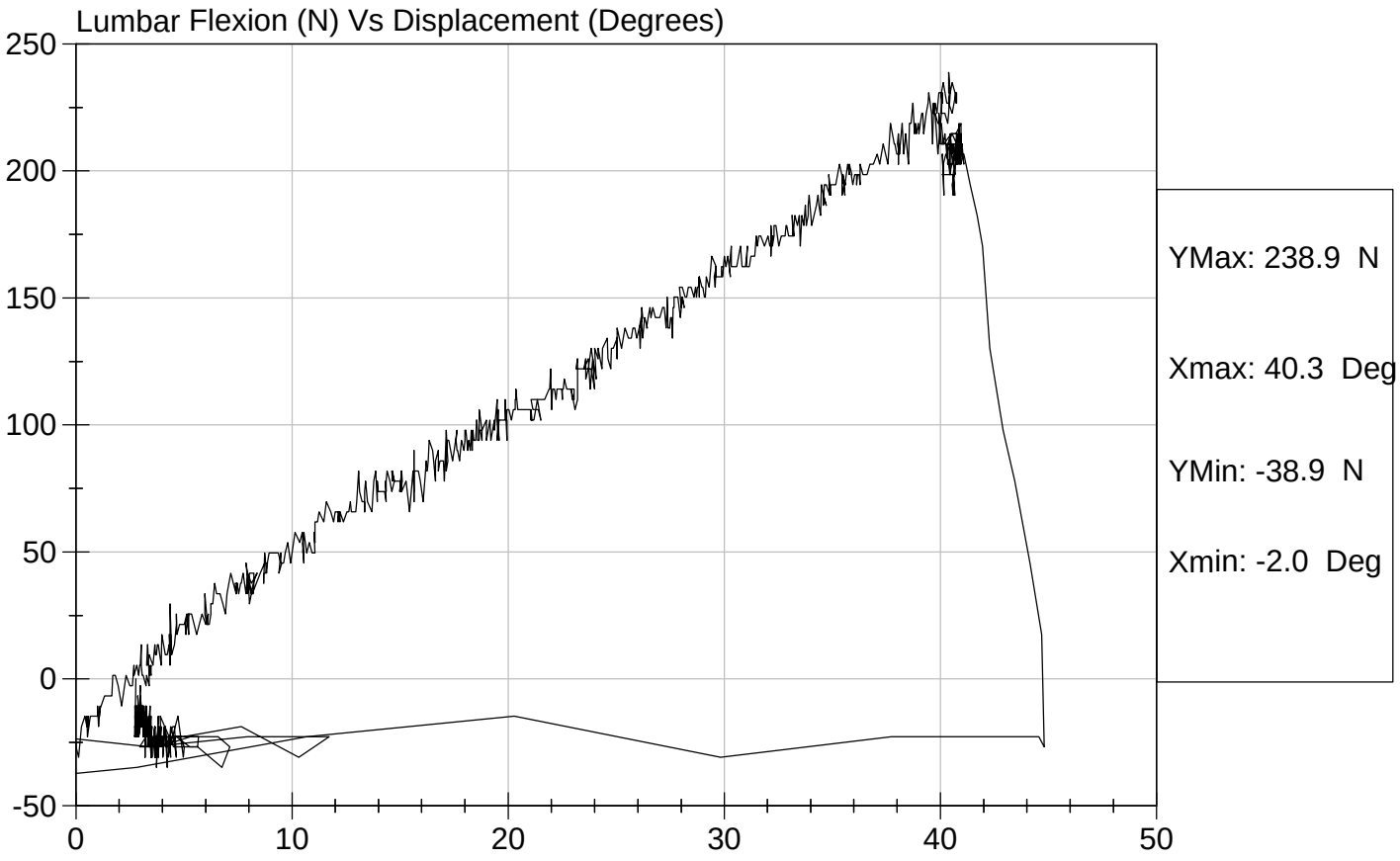
Laboratory Technician

09/24/2002
Test Date

Approved By

Test Description: Lumbar Flexion | Test Date: 09/24/2002

Component: D021245 | Speed: 0 ft/sec, 0 m/sec



SID Calibration Data Sheet

Side Impact Dummy

Head Drop Calibration (Lateral)

ATD Serial No: 037 **Test I.D:** D03121

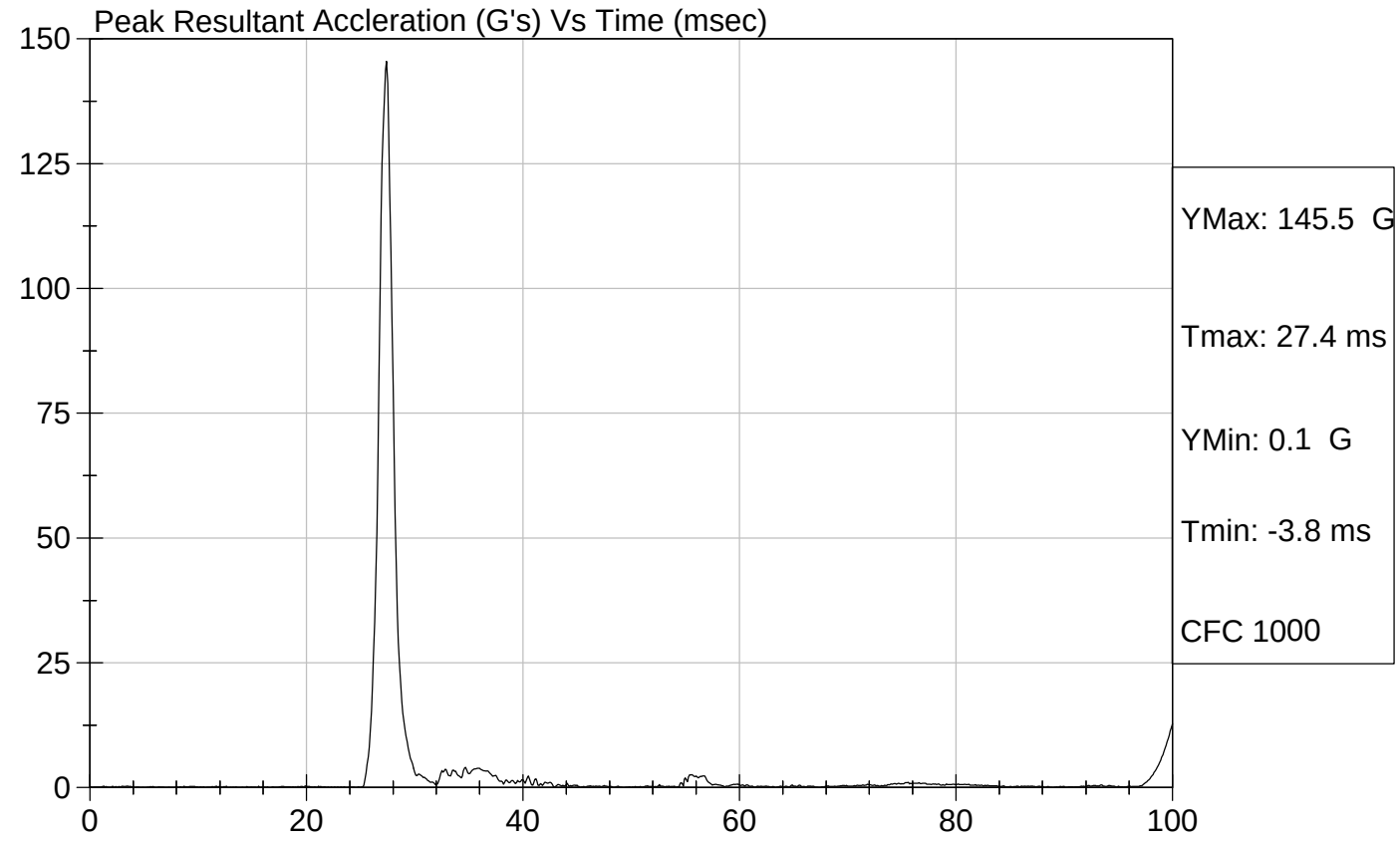
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.3	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Peak Resultant Acceleration	G's	120 to 150	145	Pass
Is Resultant Curve Unimodal?	Yes/No	15% of peak	Yes	Pass
Peak Longitudnal Acceleration	G's	+/- 15	-13	Pass
		Overall Test Results		Pass

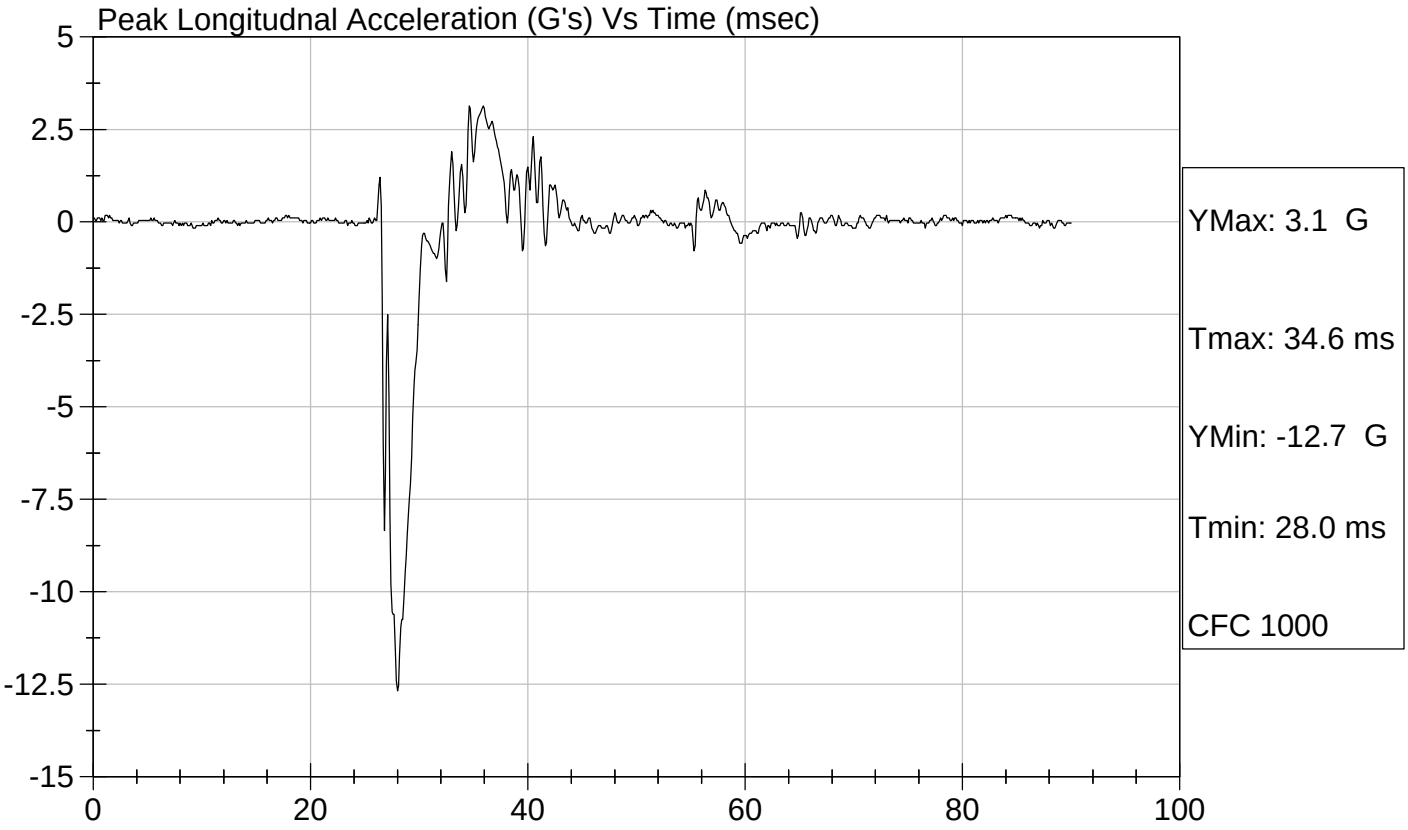
Laboratory Technician

02/04/2003
Test Date

Approved By

	Test Description: Head Drop	Test Date: 02/04/2003
	Component: D03121	Speed: 0 ft/s, 0.00 m/s





SID Calibration Data Sheet
Side Impact Dummy (SID)
Neck Pendulum Test

ATD Serial No: 037 **Test I.D:** D03129

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity		%	10 to 70	14	Pass
Impact Velocity		m/s	6.89 to 7.13	6.97	Pass
Pendulum Deceleration	10 msec	m/s	1.96 to 2.55	2.22	Pass
	20 msec	m/s	4.12 to 5.10	4.41	Pass
	30 msec	m/s	5.73 to 7.01	6.31	Pass
	40 to 70 msec	m/s	6.27 to 7.64	6.84	Pass
Midsaggital Plane Max Rotation		deg	66 to 82	72	Pass
Head Rotation Peak to Zero - Decay Time		msec	58 to 67	60	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	14	Pass

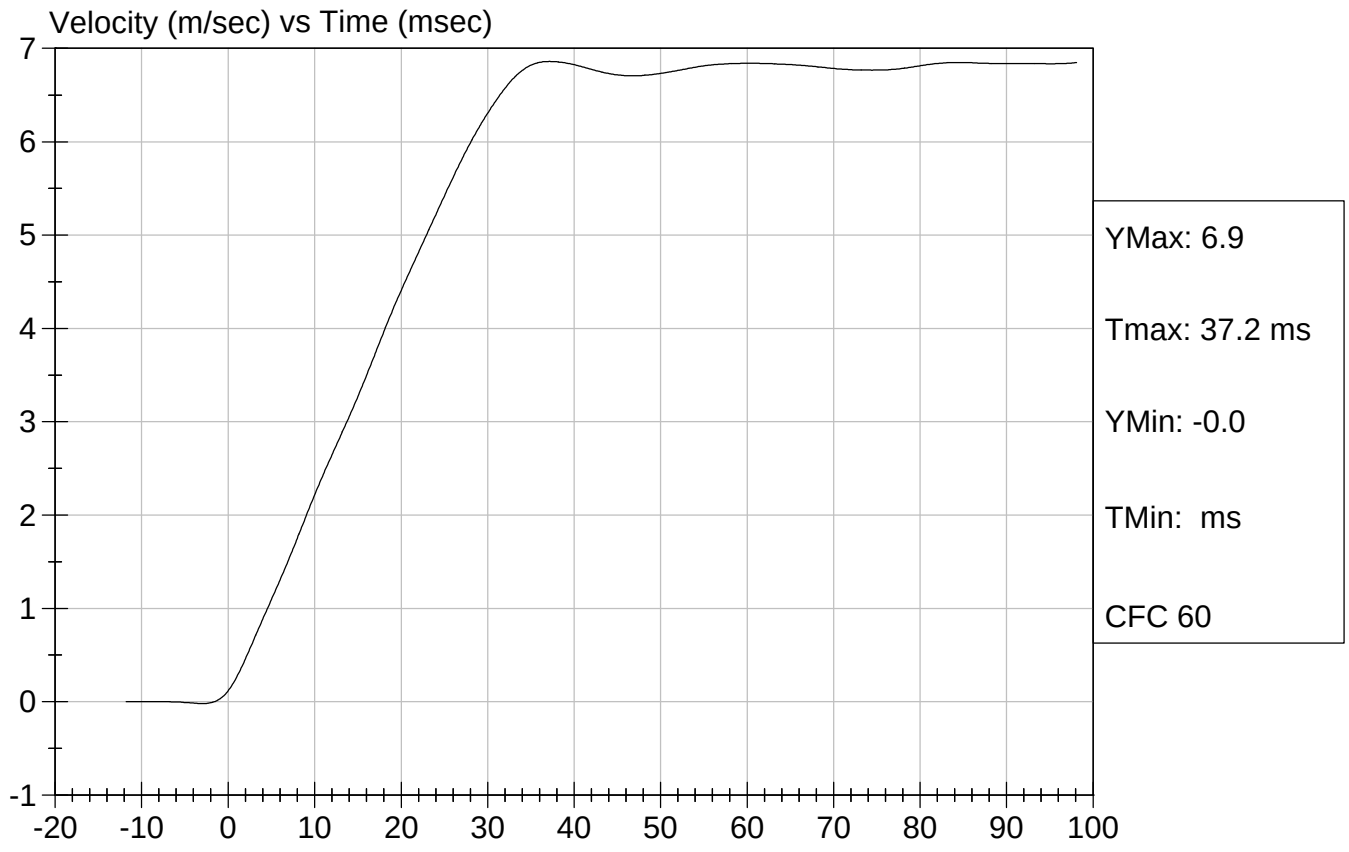
Laboratory Technician

02/04/2003
Test Date

Approved By

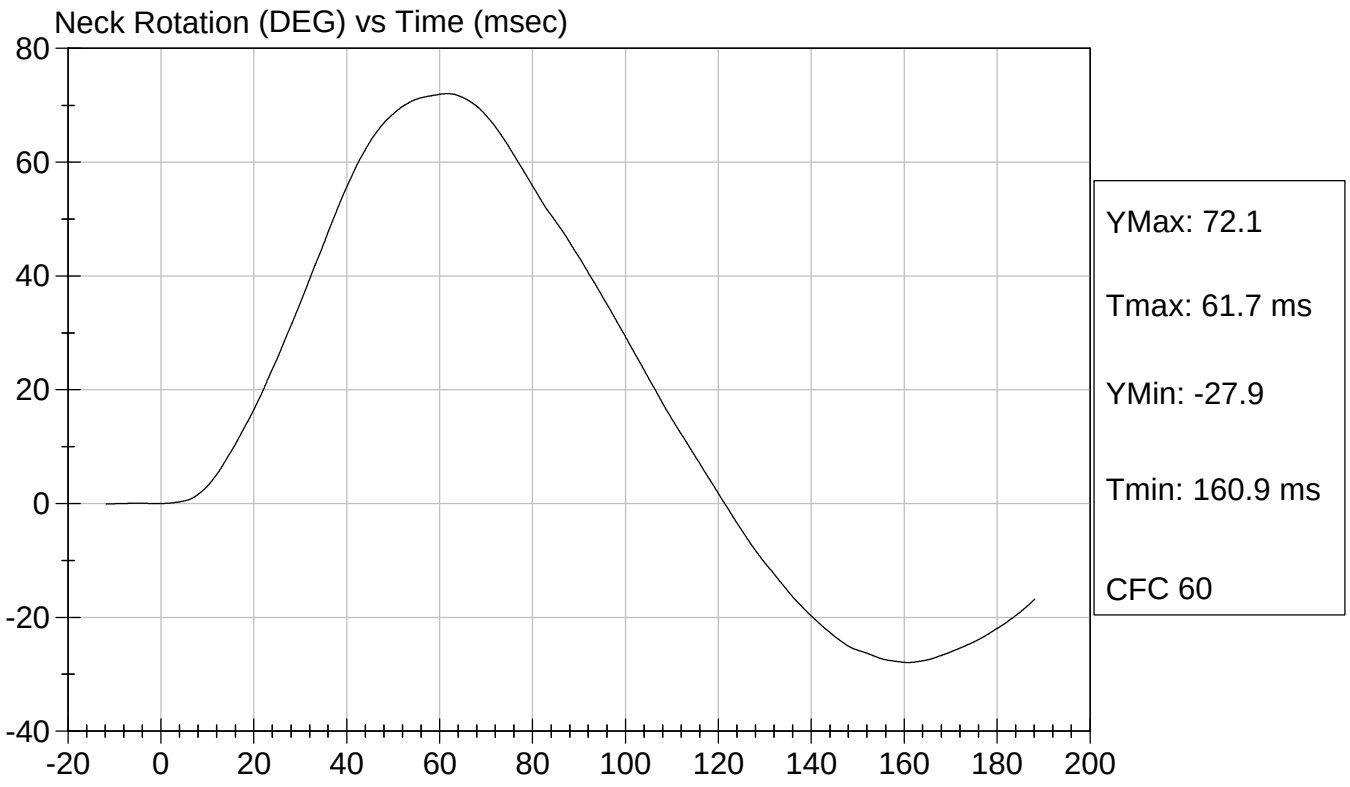
Test Desc: Neck Bending
Component ID: D03129

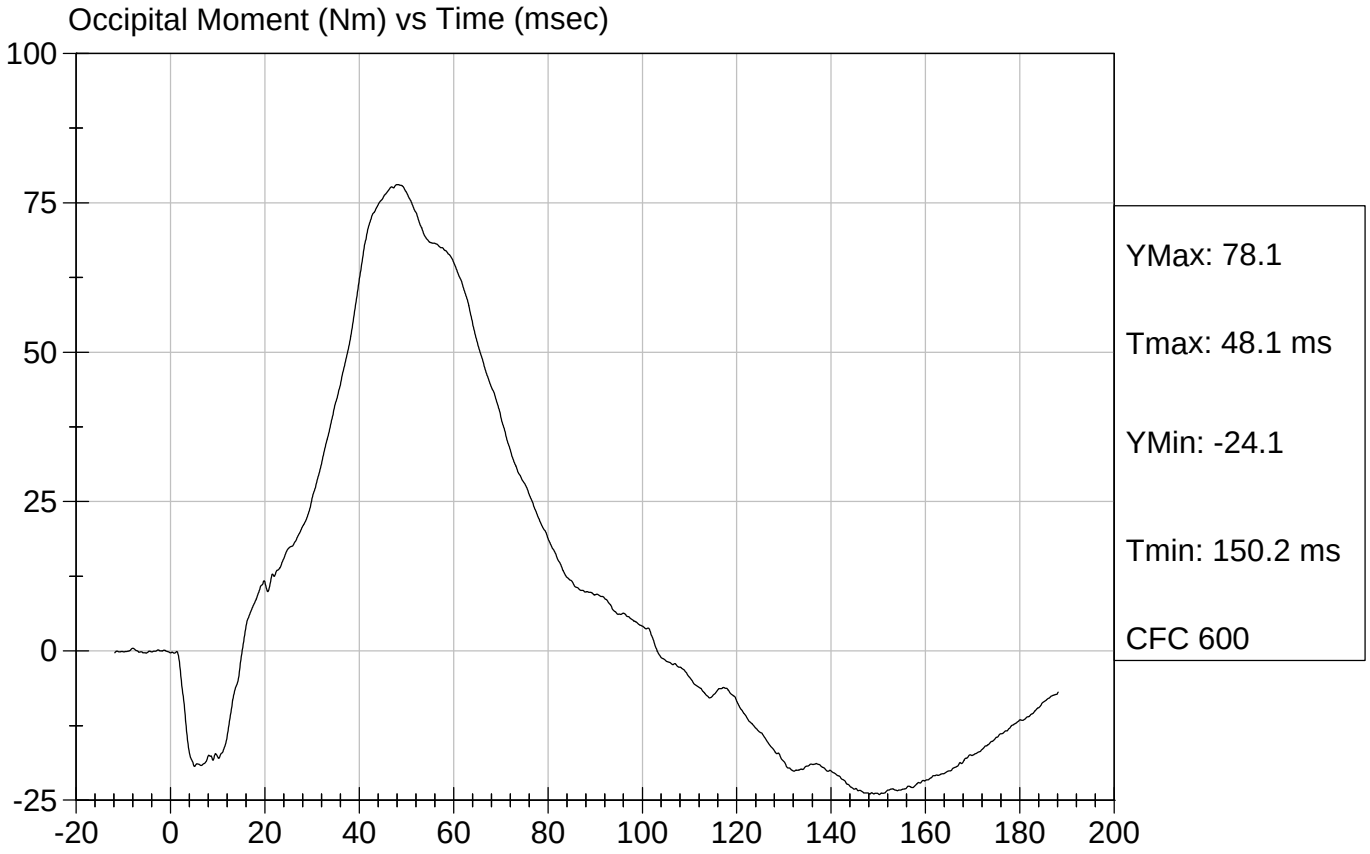
Test Date: 02/04/2003
Speed: 22.87 ft/sec, 6.97 m/sec



Test Desc: Neck Bending
Component ID: D03129

Test Date: 02/04/2003
Speed: 22.87 ft/sec, 6.97 m/sec





SID Calibration Data Sheet

Side Impact Dummy

Thorax Impact Test

ATD Serial No: 037 **Test I.D:** D03122

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	20.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	4.27 - 4.33	4.32	Pass
Upper Rib	G's	37 - 46	39	Pass
Lower Rib	G's	37 - 46	44	Pass
Lower Spine	G's	15 - 22	22	Pass
		Overall Test Results		Pass

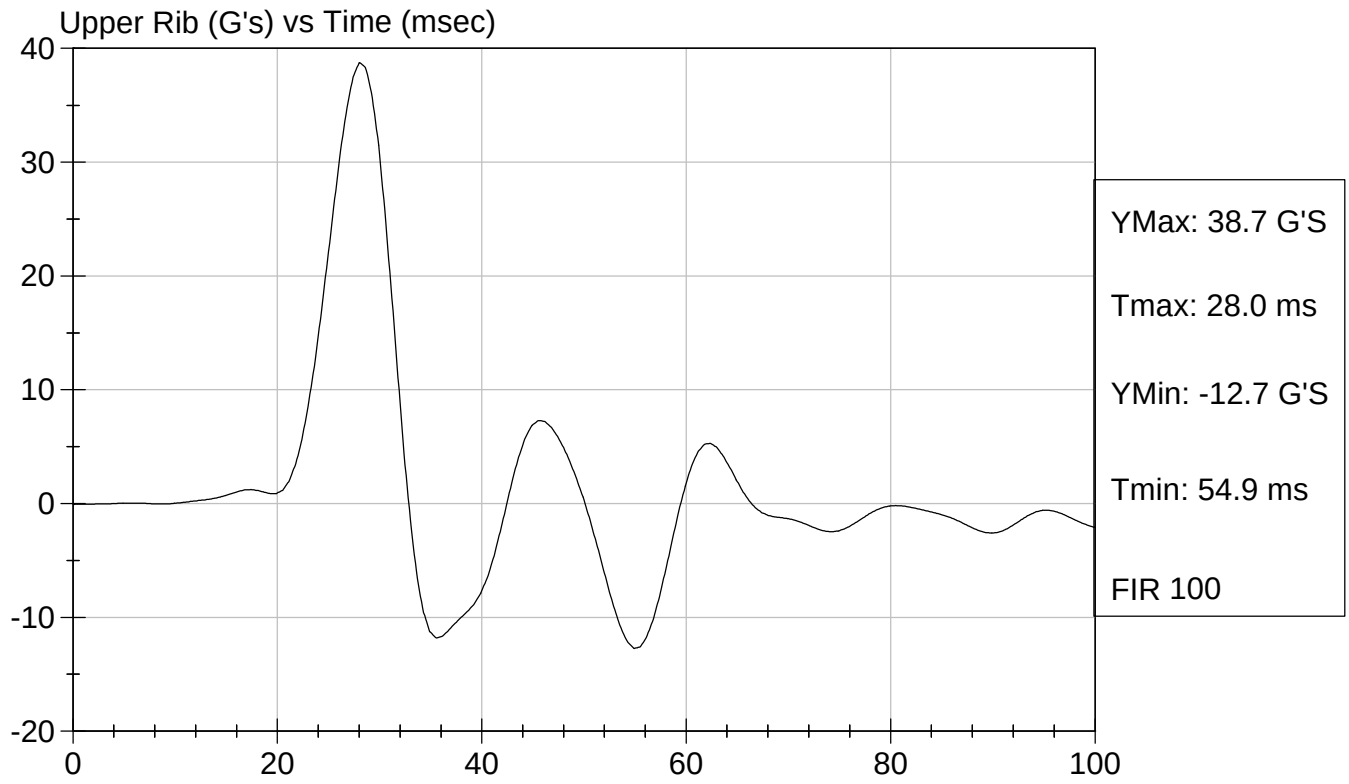
Laboratory Technician

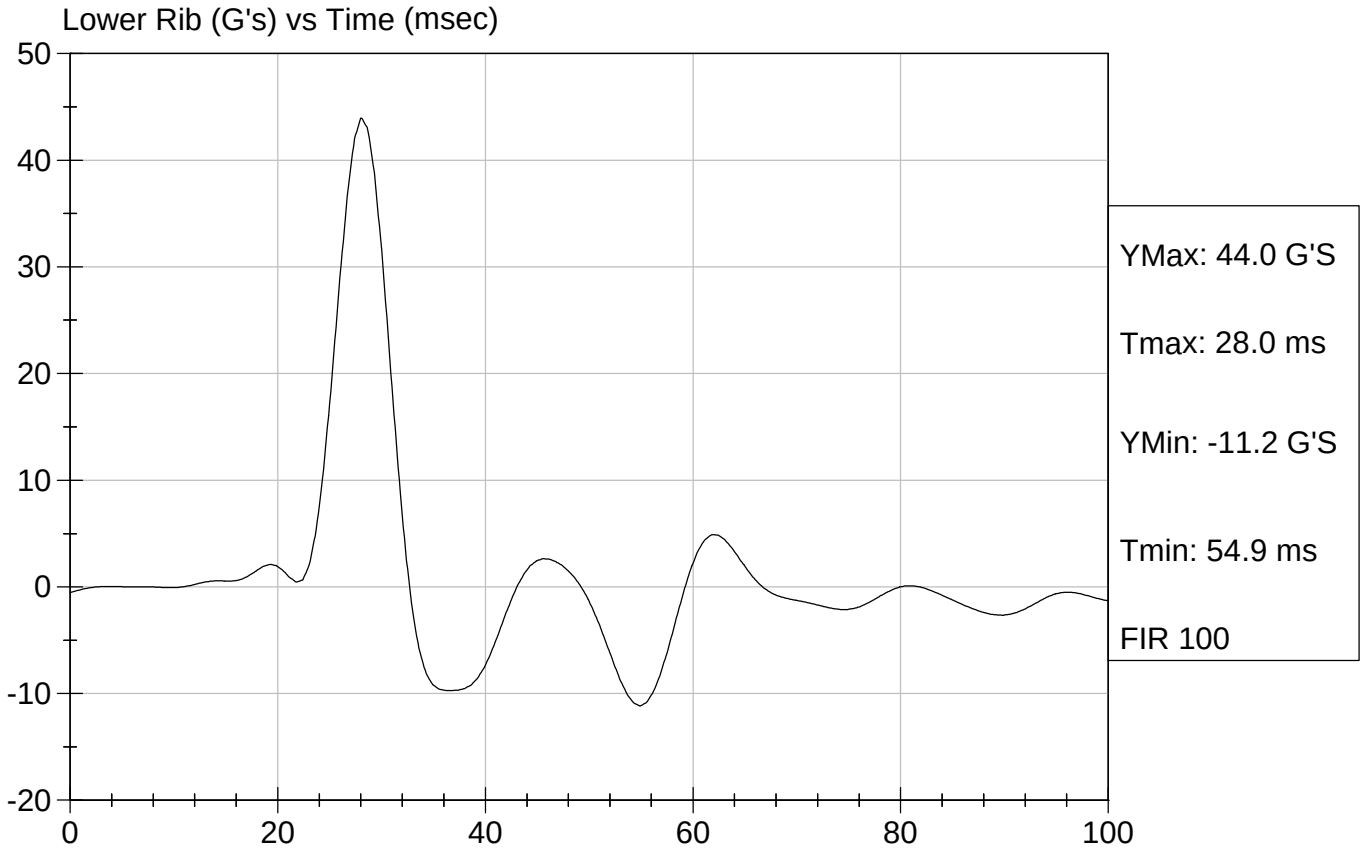
02/05/2003
Test Date

Approved By

Test Desc: Thorax Impact
Component ID: D03122

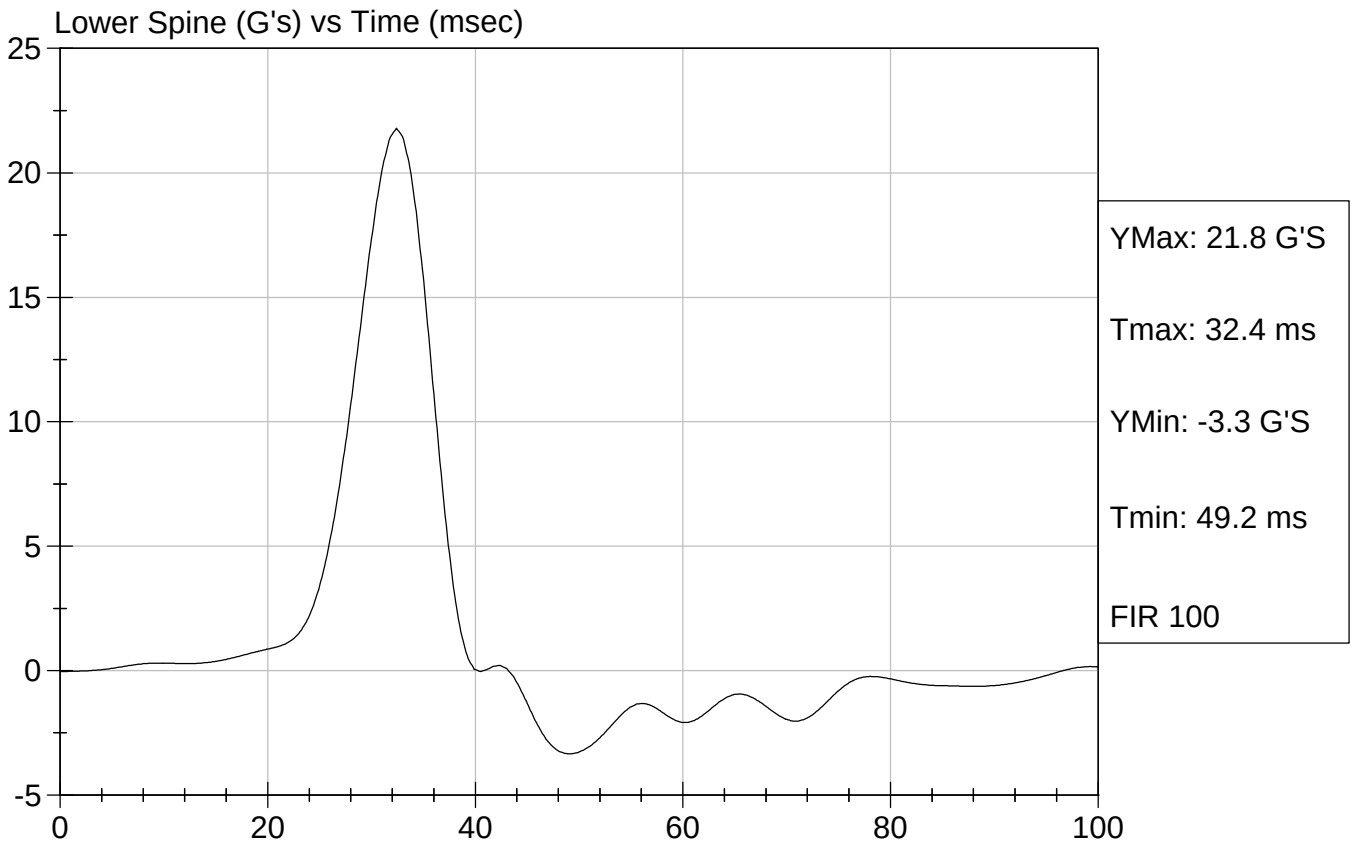
Test Date: 02/05/2003
Speed: 14.17 ft/sec, 4.32 m/sec





Test Desc: Thorax Impact
Component ID: D03122

Test Date: 02/05/2003
Speed: 14.17 ft/sec, m/sec



SID Calibration Data Sheet

Side Impact Dummy

Pelvis Impact Test

ATD Serial No: 037 **Test I.D:** D03123

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	4.27 - 4.33	4.30	Pass
Pelvis Acceleration	G's	40 - 60	45	Pass
		Overall Test Results		Pass

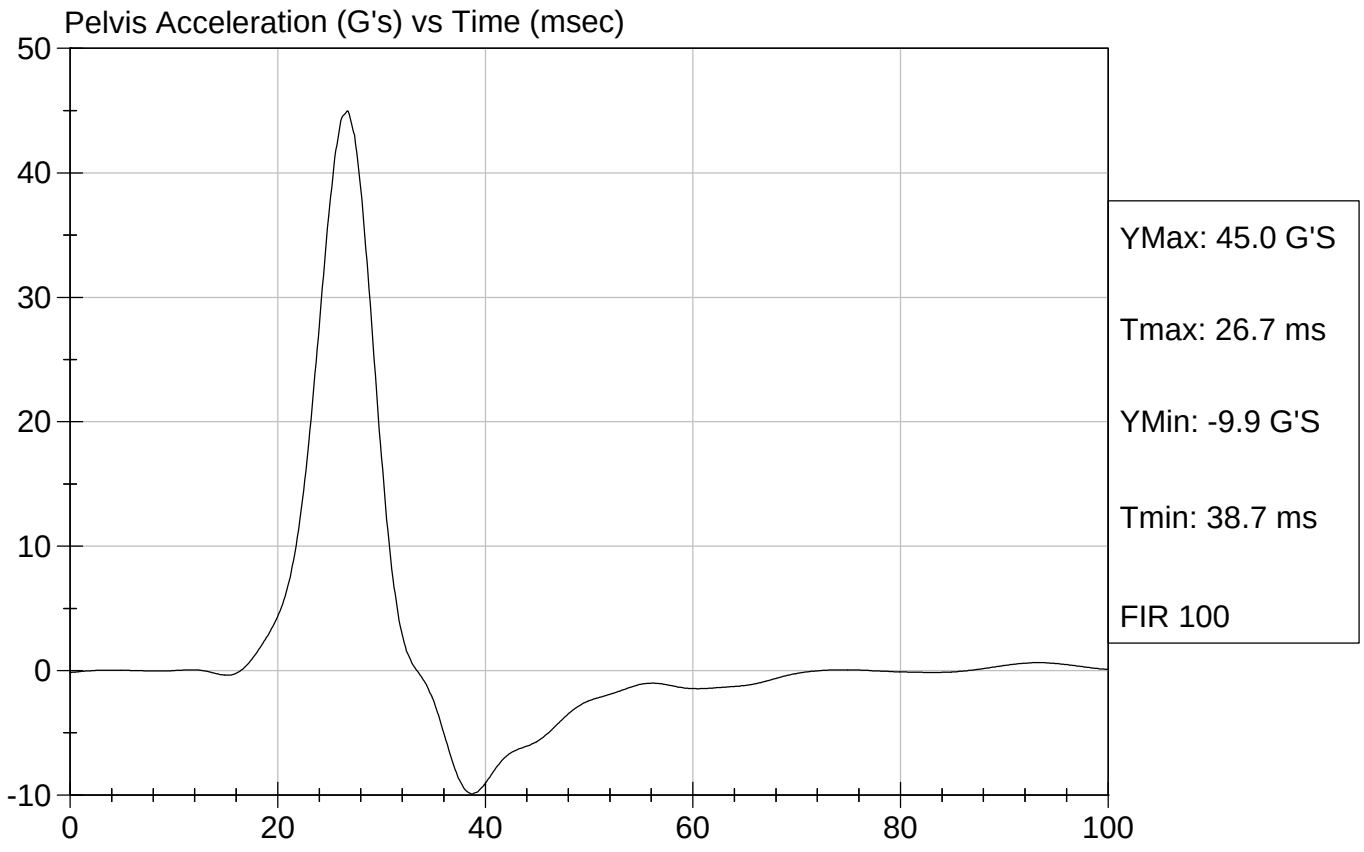
Laboratory Technician

02/06/2003
Test Date

Approved By

Test Desc: Pelvis Impact
Component ID: D03123

Test Date: 02/06/2003
Speed: 14.12 ft/sec, 4.30 m/sec



SID Calibration Data Sheet

Side Impact Dummy

Abdominal Compression Calibration (Pre-Load = 10 lbs)

ATD Serial No: 037 **Test I.D:** D03124

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Force At 12.7 mm	N	104 -162	154	Pass
Force At 19 mm	N	163 - 222	211	Pass
Force At 25.4 mm	N	222 - 280	274	Pass
Force At 33 mm	N	325 - 391	370	Pass
		Overall Test Results		Pass

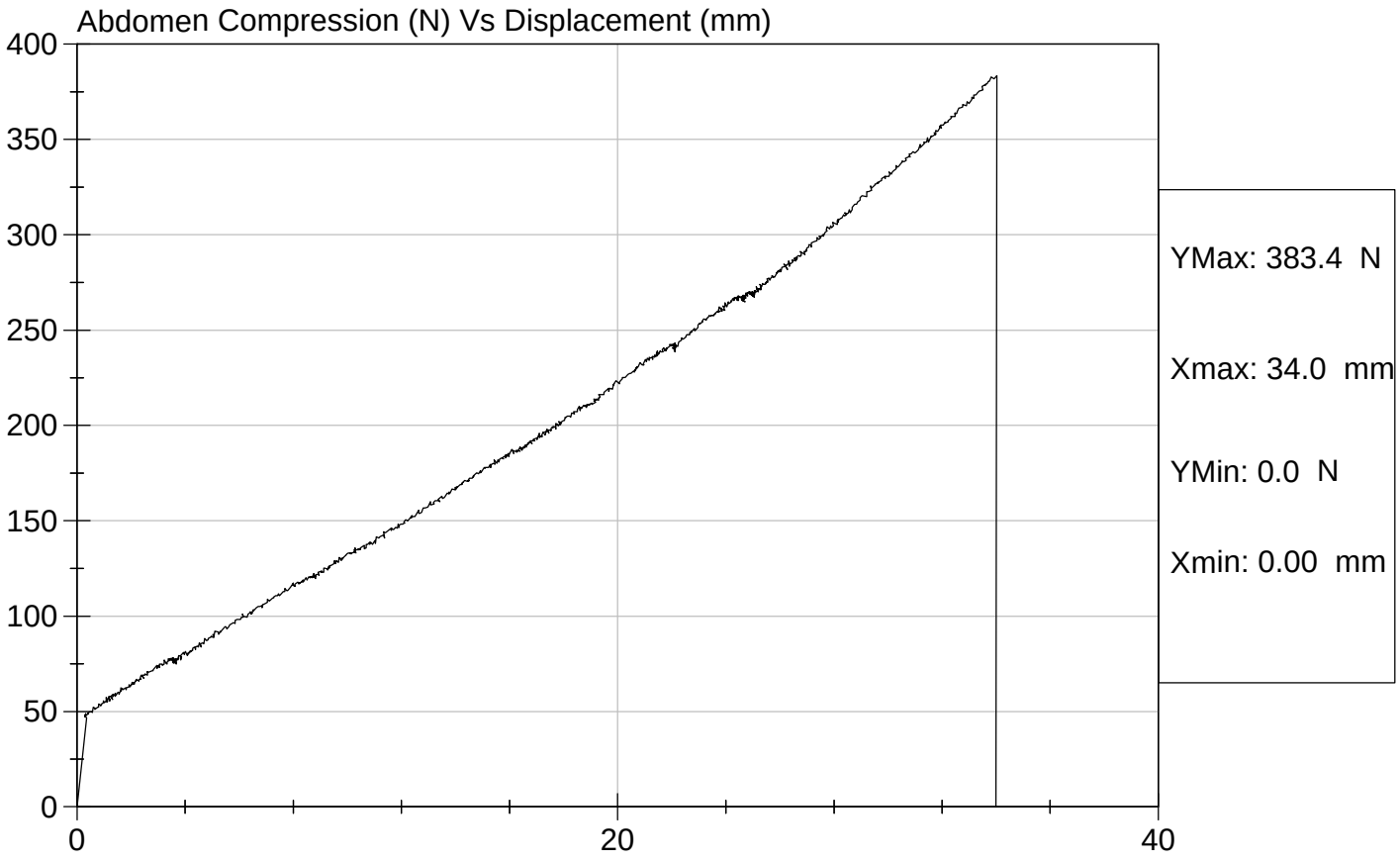
Laboratory Technician

02/05/2003
Test Date

Approved By

Test Description: Abdomen Compression Test Date: 02/05/2003

Component: D03124 Speed: 0 ft/sec, 0 m/sec



SID Calibration Data Sheet

Side Impact Dummy

Lumbar Flexion Calibration

ATD Serial No: 037 **Test I.D:** D03125

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.5	20.3	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Force At 0 deg	N	0 - 26.7	0.0	Pass
Force At 20 deg	N	97.9 - 151.2	126.1	Pass
Force At 30 deg	N	151.2 - 204.6	191.3	Pass
Force At 40 deg	N	204.6 - 258.0	242.0	Pass
Return Angle	Deg	12 Maximum	4	Pass
		Overall Test Results		Pass

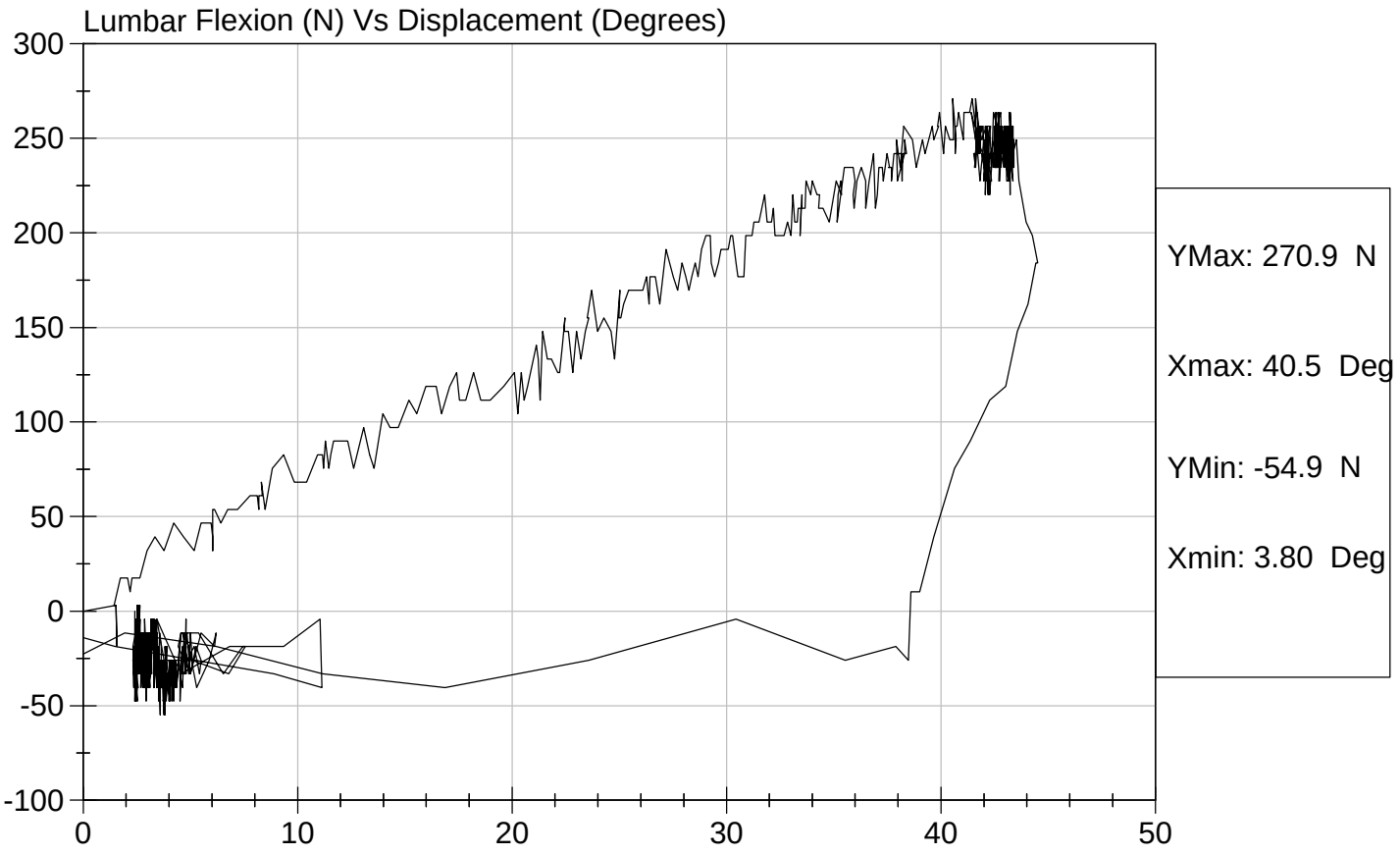
Laboratory Technician

02/05/2003
Test Date

Approved By

Test Description: Lumbar Flexion | Test Date: 02/05/2003

Component: D03125 | Speed: 0 ft/sec, 0 m/sec



APPENDIX D
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY AND VEHICLE CALIBRATION DATA

	INSTRUMENTS FOR LEFT FRONT DUMMY NO. 009		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	J13530	Endevco	8/6/02
Head Y Accelerometer	AHTB2	Endevco	8/6/02
Head Z Accelerometer	J13927	Endevco	8/6/02
Driver Head Y – Front	J11548	Endevco	1/15/03
Driver Head Z – Front	AK972	Endevco	1/15/03
Driver Head X – Left	J10866	Endevco	1/15/03
Driver Head Z – Left	J13780	Endevco	1/24/03
Driver Head X – Upper	AGTB5	Endevco	1/24/03
Driver Head Y – Upper	AM749	Endevco	1/24/03
Driver Head X – Redundant	J33416	Endevco	8/6/02
Driver Head Y – Redundant	J13535	Endevco	8/6/02
Driver Head Z – Redundant	AP2E1	Endevco	8/6/02
Upper Neck Force X Load Cell	N1562FX	Denton	12/17/02
Upper Neck Force Y Load Cell	N1562FY	Denton	12/17/02
Upper Neck Force Z Load Cell	N156FZ	Denton	12/17/02
Upper Neck Moment X	N1562MX	Denton	12/17/02
Upper Neck Moment Y	N1562MY	Denton	12/17/02
Upper Neck Moment Z	N1562MZ	Denton	12/17/02
Upper Spine X Accelerometer	AMTL6	Endevco	1/15/03
Upper Spine Y Accelerometer	ALC37	Endevco	1/15/03
Upper Spine Z Accelerometer	AMTG3	Endevco	1/15/03
Upper Spine Y– Redundant	AGTM2	Endevco	9/9/02
Upper Rib Y Accelerometer	AN8L6	Endevco	1/8/03
Rib Displacement	036	Servco	9/9/02
Upper Rib Y – Redundant	APY13	Endevco	1/8/02
Lower Rib Y Accelerometer	AJ420	Endevco	1/8/03
Lower Rib Y – Redundant	AMTA3	Endevco	1/8/03
Lower Spine X Accelerometer	AMP82	Endevco	1/15/03
Lower Spine Y Accelerometer	J18953	Endevco	1/15/03
Lower Spine Z Accelerometer	J18843	Endevco	1/15/03
Lower Spine Y– Redundant	AGTY4	Endevco	1/8/03
Pelvis X Accelerometer	AJ411	Endevco	1/24/03
Pelvis Y Accelerometer	AGTM8	Endevco	1/24/03
Pelvis Z Accelerometer	J13943	Endevco	1/24/03
Pelvis Y– Redundant	AGTY6	Endevco	1/8/03

VEHICLE INSTRUMENT CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Mid A-Post Y	H01-N11	ENTRAN	10/31/02
Left Lower A-Post Y	I25-F09	ENTRAN	1/16/03
Left Mid B-Post Y	K21-N09	ENTRAN	1/24/03
Left Lower B-Post Y	G03-N04	ENTRAN	1/24/03
Floorpan @ Rear Axle X	H14-N06	ENTRAN	1/24/03
Floorpan @ Rear Axle Y	K21-N01	ENTRAN	1/24/03
Floorpan @ Rear Axle Z	G13-F03	ENTRAN	1/24/03
Driver Seat Track Y	G13-F15	ENTRAN	1/24/03
Right Front Sill X	D11-F14	ENTRAN	11/19/02
Right Front Sill Y	99F251	ENTRAN	1/15/03
Right Front Sill Z	I25-J09	ENTRAN	10/7/02
Right Rear Sill X	L23-A05	ENTRAN	11/19/02
Right Rear Sill Y	F04-N08	ENTRAN	10/18/02
Right Rear Sill Z	A08-A11	ENTRAN	10/7/02
Left Front Sill Y	H01-N19	ENTRAN	10/31/02
Left Rear Sill Y	H01-N25	ENTRAN	10/30/02
Vehicle CG X	H02-J14	ENTRAN	10/18/02
Vehicle CG Y	I25-F07	ENTRAN	10/8/02
Vehicle CG Z	K11-J07	ENTRAN	10/18/02
Left Front Door @ Rib Y	H01-N13	ENTRAN	10/30/02
Left Front Door @ Pelvis Y	H01-N12	ENTRAN	10/30/02
Left Front Door @ Knee Y	H01-N31	ENTRAN	11/19/02
Left Front Door @ Arm Y	H01-N14	ENTRAN	10/31/02
Lower Center Radiator Support X	J07-X16	ENTRAN	1/16/03
Lower Center Radiator Support Y	G13-F18	ENTRAN	1/16/03
Lower Center Radiator Support Z	G01-N21	ENTRAN	1/16/03

Note: All Endevco accelerometers are Model No. 7264-2000
All Entran accelerometers are Model No. EGE-72

APPENDIX E
SID/HIII PEAK RESPONSES

DRIVER PEAK RESPONSE TABLE

Location	Peak Responses								
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ESII 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time
Head	1000	X	G	177.1	62.9	22.8	-55.3	-33.0	60.4
	1000	Y	G	384.7	62.9	63.9	61.4	55.0	59.4
	1000	Z	G	62.5	62.7	35.9	62.9	25.9	49.9
	1000	RES	G	427.2	62.9	72.6	61.4	68.7	60.4
Head Injury Criteria (HIC)				2213		465		395	
t1				62.3		51.9		48.5	
t2				63.4		70.6		69.2	
Upper Neck Force	1000	X	N	485	67.9	519	-64	-854	60.5
	1000	Y	N	545	60.6	412	59.6	946	61.6
	1000	Z	N	1997	63.3	1020	56.1	1061	49.5
	1000	RES	N	2034	63.3	1104	57.5	1606	60.6
Upper Neck Moment	600	X	Nm	95.4	63.4	51.7	-64.3	-32.5	61.9
	600	Y	Nm	41.5	68.0	54.8	-65.0	-40.2	60.0
	600	Z	Nm	25.2	63.2	26.6	-174.3	-46.1	153.0
	600	RES	Nm	99.7	63.4	77.6	65.1	49.1	60.8

DRIVER PEAK RESPONSE TABLE (CONTINUED)

Location				Peak Response					
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ESII 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time
Lower Neck Force	1000	X	N			699	-66		
	1000	Y	N			807	60		
	1000	Z	N			963	56		
	1000	RES	N			1294	57		
Lower Neck Moment	600	X	Nm			100.8	60.6		
	600	Y	Nm			73.1	64.9		
	600	Z	Nm			32.6	180.9		
	600	RES	Nm			121	62.4		
Shoulder Force	600	X	N			410	87		
	600	Y	N			431	55		
	600	Z	N			439	-59		
	600	RES	N						
Upper Spine	180	X	G	29.8	70.1	10.5	-67.5	-31.8	67.2
	180	Y	G	42.6	57.0	36.6	50.5	41.2	33.4
	180	Z	G	20.9	63.5	9.2	63.3	9.7	62.3
	180	Res	G	44.9	56.9	37.1	50.5	41.2	33.4

DRIVER PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Response								
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ESII 8/27/02		1999 Volvo S80 SID III Seating 1/30/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time
Lower Spine	180	X	G	23.8	69.8	11.5	76.0	-23.9	59.5
	180	Y	G	58.3	48.0	51.2	43.9	53.2	45.3
	180	Z	G	17.4	63.5	8.4	63.3	6.5	62.1
	180	Res	G	58.4	48.0	51.3	43.9	54.1	45.3
Upper Rib	180	Y	G	59.8	50.3	55.8	14.2	46.8	45.2
Mid Rib	180	Y	G			61.8	17.0		
Lower Rib	180	Y	G	61.1	50.7	59.2	14.2	42.3	41.5
Upper Rib Deflection	180	Y	mm	37.6	67.4	40.7	42.4		
Mid Rib Deflection	180	Y	mm			39.0	43.2		
Lower Rib Deflection	180	Y	mm			36.2	44.0		
Upper Rib VC	180	Y	m/sec			0.4	36.3		
Mid Rib VC	180	Y	m/sec			0.4	35.9		
Lower Rib VC	180	Y	m/sec			0.4	60.4		
Torso Force	600	X	N			495	47.4		
	600	Y	N			254	32.0		
Torso Moment	600	Y	Nm			16.3	141.5		
	600	Z	Nm			24.3	50.0		

DRIVER PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Response								
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ESII 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time
T12 Force	600	X	N			1158	63		
	600	Y	N			1370	51		
T12 Moment	600	X	Nm			130.2	68.1		
	600	Y	Nm			154.3	63.2		
Abdomen Front Force	600	Y	N			281	45		
Abdomen Mid Force	600	Y	N			648	45		
Abdomen Rear Force	600	Y	N			629	44		
Abdomen Summed Force	600	Y	N			1553	45		
Pubic Symphysis Force	600	Y	N			1701	46		
Right Femur Force	600	X	N			257	112		
	600	Y	N			1082	90		
	600	Z	N			1248	89		
	600	RES	N			1615	93		
Right Femur Moment	600	X	Nm			93.2	74.4		
	600	Y	Nm			43.1	81.4		
	600	Z	Nm			31.8	102.3		
	600	RES	Nm			94.3	74.7		

DRIVER PEAK RESPONSE TABLE (CONTINUED)

Location				Peak Response					
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ESII 8/27/02		1999 Volvo S80 SID III 214 seating 1/30/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time
Left Femur Force	600	X	N			238	89		
	600	Y	N			1003	85		
	600	Z	N			5471	88		
	600	RES	N			5513	88		
Left Femur Moment	600	X	Nm			72.8	75.0		
	600	Y	Nm			38.1	113.1		
	600	Z	Nm			43.7	86.0		
	600	RES	Nm			75.4	75.5		
Pelvis	1000	X	G			16.2	73.4	-13.4	66.0
	1000	Y	G			64.5	44.7	59.1	42.1
	1000	Z	G			9.9	64.8	-4.9	45.4