

REPORT NUMBER: NCAP-MGA-2005-004

**NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST**

**VOLVO GOTHENBURG SWEDEN
2005 Volvo V70 Station Wagon
NHTSA NUMBER: M55900**

**PREPARED BY:
MGA RESEARCH CORPORATION
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BURLINGTON, WI 53105**



Test Date: October 19, 2004

Final Report Date: November 29, 2004

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
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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-12005.

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Manager, New Car Assessment Program

Date of Acceptance

COTR, NCAP Frontal Impact Program

Date of Acceptance

Technical Report Documentation Page

1. Report No. NCAP-MGA-2005-004	2. Government Accession No.	3. Recipient's Catalog No.																										
4. Title and Subtitle Final Report of New Car Assessment Program Testing of a 2005 Volvo V70 Station Wagon NHTSA No.: M55900		5. Report Date November 29, 2004																										
		6. Performing Organization Code MGA																										
7. Author(s) Shefalika Naik, Project Engineer		8. Performing Organization Report No. NCAP-MGA-2005-004																										
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No.																										
		11. Contract or Grant No. DTNH22-01-D-12005																										
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Rulemaking, Office of Crashworthiness Standards 400 Seventh Street, SW, Room 5311 Washington, D.C. 20590		13. Type of Report and Period Covered 10/19/04 to 11/29/04																										
		14. Sponsoring Agency Code NVS-111																										
15. Supplementary Notes																												
16. Abstract A 35.3 mph (56.8 km/h) frontal barrier impact was conducted on a 2005 Volvo V70 Station Wagon at MGA Research Corporation on October 19, 2004. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The impact velocity was 56.8 km/h. The ambient temperature at the barrier face at the time of impact was 21 degrees Celsius. The vehicle's maximum post test static crush is 569 mm located at the vehicle centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows: <table border="1" style="width: 100%; margin-top: 10px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Measurement Description</u></th> <th style="text-align: left;"><u>Units</u></th> <th style="text-align: left;"><u>Threshold</u></th> <th style="text-align: left;"><u>Driver ATD</u></th> <th style="text-align: left;"><u>Pass. ATD</u></th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC)</td> <td>N/A</td> <td>1000</td> <td>367</td> <td>282</td> </tr> <tr> <td>Max. Thorax Accel. (3ms Clip)</td> <td>G's</td> <td>60</td> <td>43</td> <td>46</td> </tr> <tr> <td>Left Femur Force</td> <td>Newton</td> <td>10009</td> <td>-2330</td> <td>-2540</td> </tr> <tr> <td>Right Femur Force</td> <td>Newton</td> <td>10009</td> <td>-2241</td> <td>-3914</td> </tr> </tbody> </table>				<u>Measurement Description</u>	<u>Units</u>	<u>Threshold</u>	<u>Driver ATD</u>	<u>Pass. ATD</u>	Head Injury Criteria (HIC)	N/A	1000	367	282	Max. Thorax Accel. (3ms Clip)	G's	60	43	46	Left Femur Force	Newton	10009	-2330	-2540	Right Femur Force	Newton	10009	-2241	-3914
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19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 213	22. Price																									

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-01-D-12005. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier consisting of 30 load cells was impacted by a 2005 Volvo V70 Station Wagon at a velocity of 56.8 kph. The test was performed at MGA Research Corporation on October 19, 2004. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and sixteen high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

Two Part 572E, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometer, upper neck transducers, right/left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 066) and right-front passenger (position 2) ATD (Serial No. 065) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 169 channels of data were recorded on an on-board data acquisition system. Appendix B contains the vehicle and dummy response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 569 mm and both the driver and passenger side doors remained closed and latched during the impact event and were operable after the impact.

The driver's head, chest, and abdomen contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the bolster and the steering column. The passenger's head, chest and abdomen contacted the airbag. The passenger's head contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC	Clip (g)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver	366.6	43.3	-28.8	-2330	-2241
Passenger	282.4	45.7	-35.0	-2540	-3914

TEST NOTES

The following channels did not collect any data:

Top of Engine X after 40ms

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

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	Fuel Systems	gal	liter	3.785
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
CRASH TEST SUMMARY**

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
Velocity at Impact	km/hr	56.8
Test Weight	kg	1802.1
Average Rebound	mm	1031
Maximum Static Crush	mm	569
Impact Angle	degrees	0.0

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None
Glazing Damage	The windshield cracked.	

TEST DUMMY INFORMATION

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50 th / 066	HIII 50 th / 065
Head Contact	Airbag, Headrest	Airbag, Headrest
Chest Contact	Airbag	Airbag
Abdomen Contact	Airbag	Airbag
Left Knee Contact	Knee Bolster, Steering Column	Glove Box
Right Knee Contact	Knee Bolster, Steering Column	Glove Box

16mm MOVIE COVERAGE

High Speed	16
Real Time	1
Total	17

Driver ATD Sensors	42
Passenger ATD Sensors	46
Belt Assessment Sensors	6
Vehicle Structure Accelerometers	9
Total	103

DATA SHEET NO. 2**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

TEST VEHICLE INFORMATION

Manufacturer	Volvo
Model	V70
Body Style	Station wagon
NHTSA No.	M55900
VIN	YV1SW612452461928
Color	Black
Delivery Date	9/13/04
Odometer Reading (mile)	60
Dealer	Sesi Volvo
Transmission	Automatic
Final Drive	Front
Number of Cylinders	5
Engine Displacement (L)	2.4
Engine Placement	Lateral
Automatic Door Lock (ADL)	No
Owner's Manual Details Instructions on Disabling ADLs	NA

TEST VEHICLE OPTIONS

Driver Airbag	Yes
Passenger Airbag	Yes
Force Limiter	Yes
Pretensioner	Yes
Power Windows	Yes
Power Steering	Yes
Power Door Locks	Yes
Telescope Wheel	Yes
Air Conditioning	Yes
Power Brakes	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	Yes
Anti-lock Brakes	Yes
AM/FM/CD	Yes
Anti-theft System	Yes
Cruise Control	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Volvo Gothenburg Sweden	GVWR (kg)	2127
Date of Manufacture	07/04	GAWR Front (kg)	1057
		GAWR Rear (kg)	1120

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	360	360
Cold Pressure (kPa)	260	260
Recommended Tire Size	195/65R15	195/65R15
Tire Size on Vehicle	195/65R15	195/65R15
Tire Manufacturer	Michelin	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				420
Cargo Wt. (RCLW) (kg)				81.6

DATA SHEET NO. 2... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	428.2	347.0		500.3	417.3	
Right	kg	448.6	347.0		473.1	411.4	
Ratio	%	55.8	44.2		54.0	46.0	
Totals	kg	876.8	694.0	1570.8	973.4	828.7	1802.1

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1570.8
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	81.6
Calculated Vehicle Target Weight (TVTW)	kg	1808.4

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG(aft of front axle)
As Delivered	mm	680	683	702	698	1218
As Tested	mm	662	669	677	680	1267
Post Test	mm	687	728	637	666	

Vehicle Wheelbase (mm): 2756

Weight of Ballast secured in cargo area (kg): 0.0

Vehicle Components Removed: Spare tire, jack and tools, rear deck lids, rear wiper, rear tail lights, partial exhaust, rear bumper

Ballast weight does not include instrumentation and data acquisition system.

FUEL SYSTEM DATA

Fuel System Capacity From Owner's Manual (L): 69.6

Usable Capacity Figure Furnished by COTR (L): 69.6

Actual Test Volume (L): 49.2

Test Fluid Type: Stoddard Solvent; Specific Gravity: 0.77

Is Vehicle Fuel Pump Electric or Mechanical? Electric

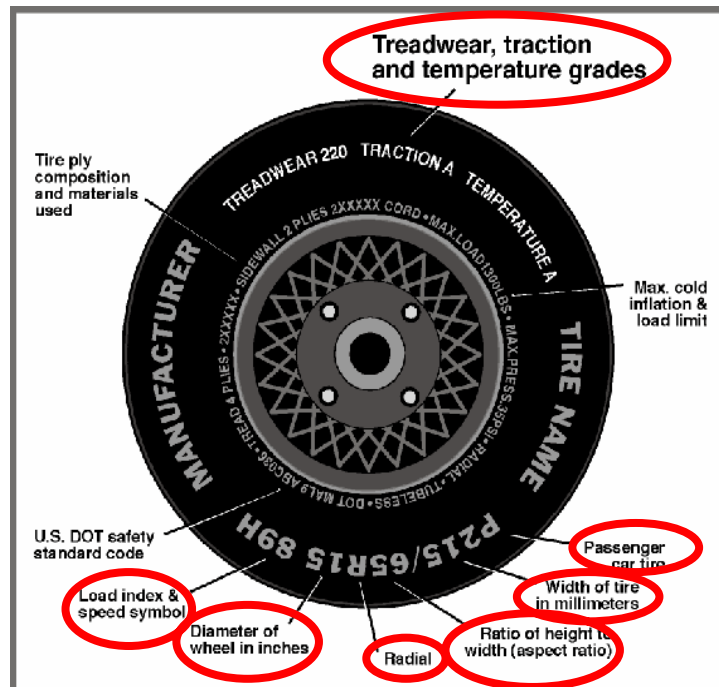
If electric, does pump operate with ignition switch "ON" & engine "OFF"? Yes

DATA SHEET NO. 3
TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

Vehicle Year	2005	Vehicle Make	Volvo
VIN	YV1SW612452461928	Vehicle Model	V70 Station wagon



	Front	Rear
Tire Manufacturer	Michelin	Michelin
Tire Name	Energy MXV4 Plus	Energy MXV4 Plus
Tire Type	P	P
Tire Width (mm)	195	195
Ratio of Height to Width (aspect ratio)	65	65
Radial	R	R
Wheel Diameter	15	15
Load Index & Speed Symbol	91H	91H
Treadwear	400	400
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 4
POST IMPACT DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	55.5 – 57.1	56.8
Trap No. 1 Entry Distance	mm	<1524	1300
Trap No. 1 Exit Distance	mm	<1524	300
Trap No. 2 Velocity (Redundant)	km/h	55.5 – 57.1	56.8
Trap No. 2 Entry Distance	mm	<1524	1425
Trap No. 2 Exit Distance	mm	<1524	425

VEHICLE STATIC CRUSH

Measured Parameter	Units	Pre-Test	Post-Test	Difference
Left Side	mm	4512	4102	410
Center	mm	4687	4118	569
Right Side	mm	4511	4089	422

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1162
Center	mm	930
Right Side	mm	1002
Average	mm	1031

DATA SHEET NO. 5
TEST VEHICLE INFORMATION

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

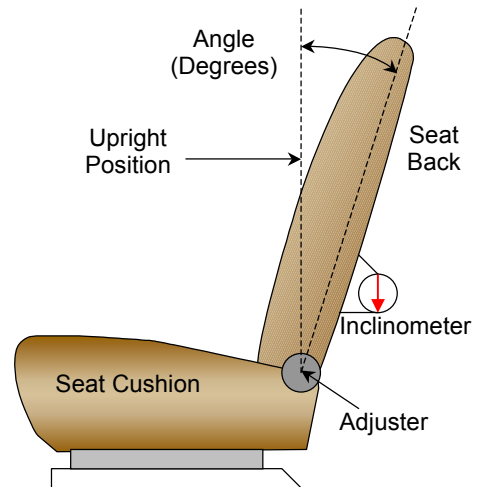
NHTSA No.: M55900
Test Date: 10/19/04

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows:

Driver seat back angle: 19° from upright position

Passenger seat back angle: 19° from upright position



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The driver and the passenger seat were manually operated.

Driver seat fore/aft total travel:	<u>288 mm</u>
Driver seat fore/aft position:	<u>144 of 288 mm</u>
Passenger seat fore/aft total travel:	<u>288 mm</u>
Passenger seat fore/aft position:	<u>144 of 288 mm</u>

DATA SHEET NO. 5... (continued)

TEST VEHICLE INFORMATION

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

FUEL TANK CAPACITY DATA

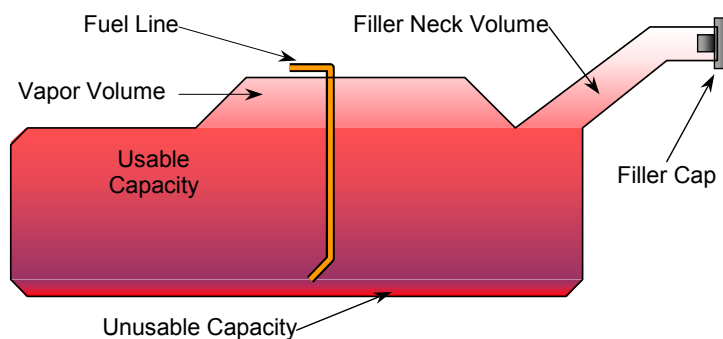
The "Usable Capacity" of the standard equipment fuel tank is: 69.6 liters

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

The "Usable Capacity" used for certification to FMVSS 301 requirements: 69.6 liters

Actual amount of Stoddard solvent added to vehicle for certification test: 49.2 liters

The fuel pump will pump fuel when the ignition key is turned two notches from initial position.



VEHICLE FUEL TANK ASSEMBLY

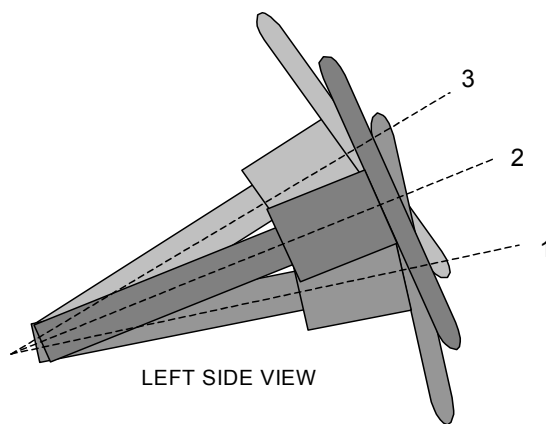
STEERING COLUMN ADJUSTMENT

Adjustable steering controls 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 driving positions.

Lowermost. Position 1: 22.5°

Geometric Center, Position 2: 23.9°

Uppermost, Position 3: 25.4°



LEFT SIDE VIEW

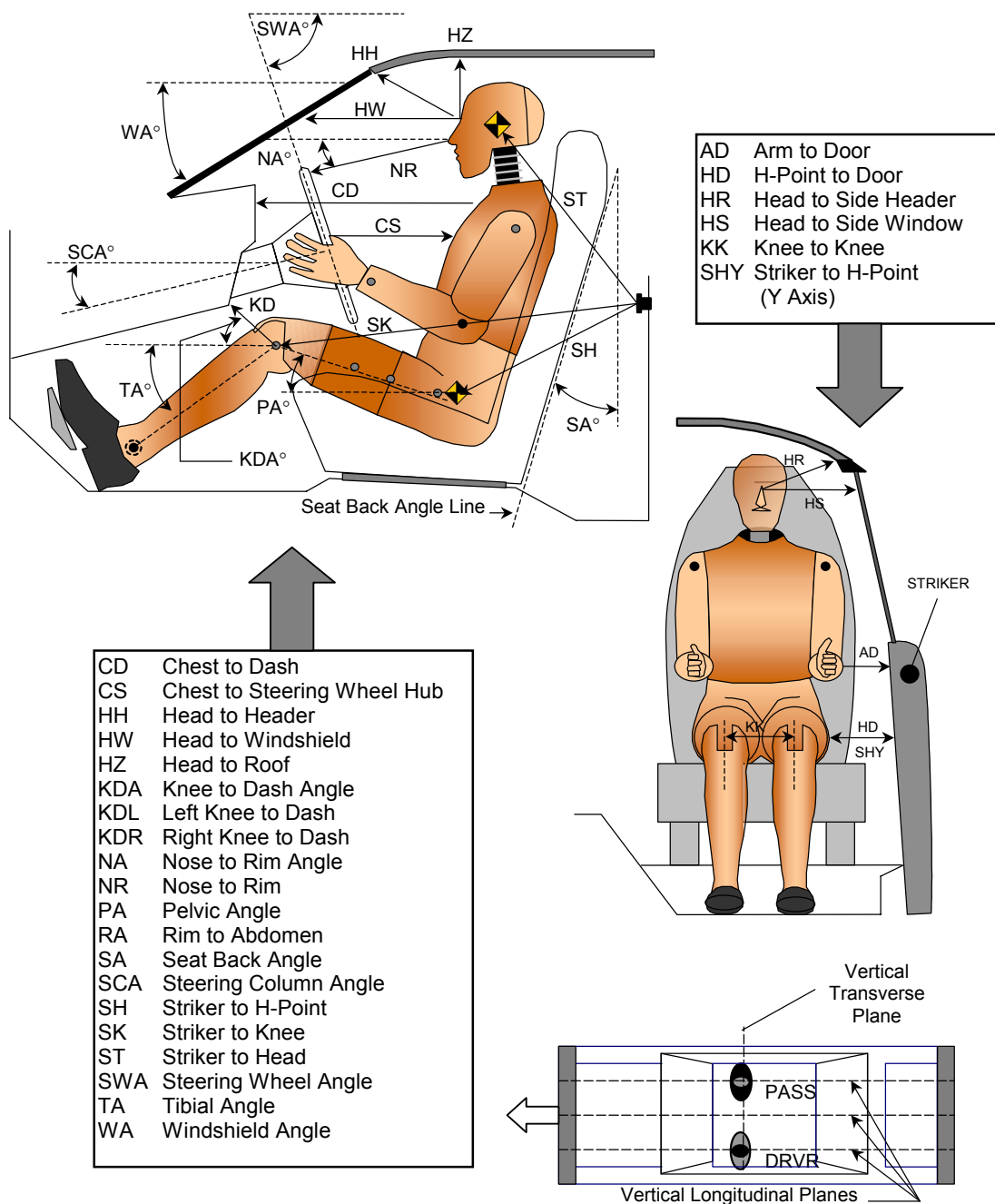
STEERING COLUMN ASSEMBLY

DATA SHEET NO. 6 **DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



DATA SHEET NO. 6... (continued)
DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

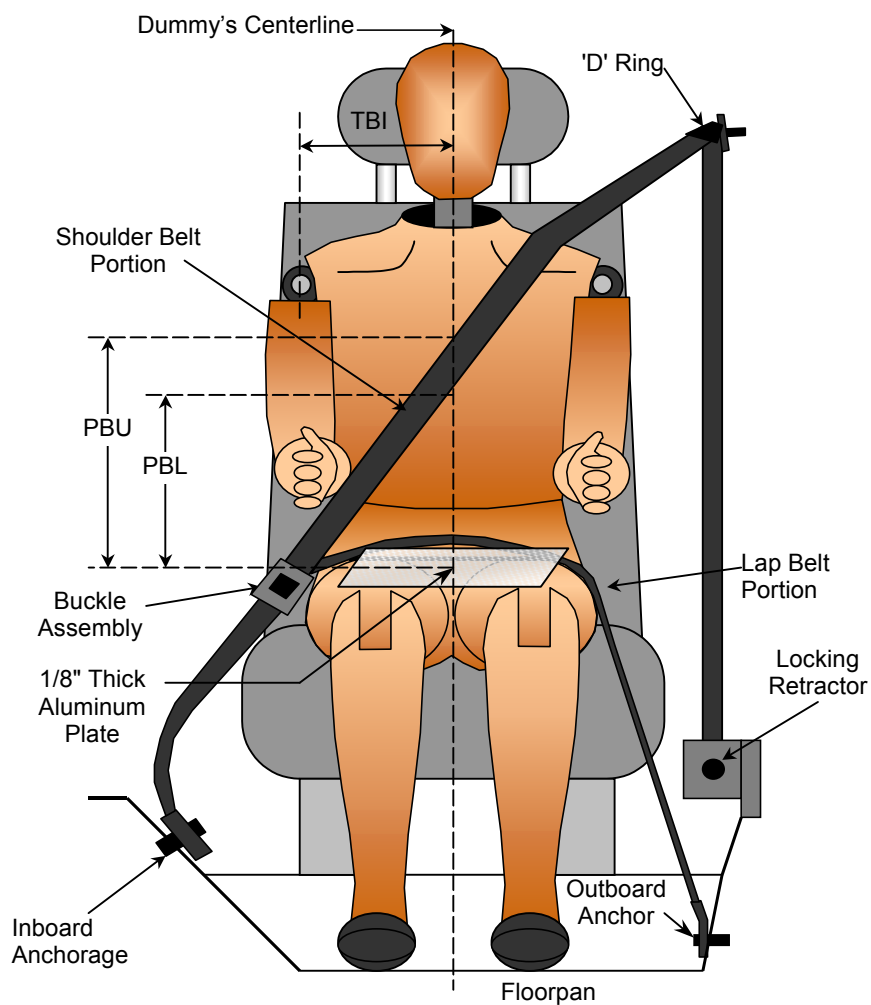
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		26.7		
SWA	Steering Wheel Angle		65.9		
SCA	Steering Column Angle		25.3		
SA	Seat Back Angle (headrest post)		19.0		19.0
HZ	Head to Roof (Z)	188	90.0	170	90.0
HH	Head to Header	357	24.1	335	25.8
HW	Head to Windshield	669	0.0	629	0.0
HR	Head to Side Header (Y)	228		216	
NR	Nose to Rim	388	8.7		
CD	Chest to Dash	533		557	
CS	Chest to Steering Hub	295	13.5		
RA	Rim to Abdomen	181	0.0		
KDL	Left Knee to Dash	159	25.5	132	
KDR	Right Knee to Dash	164		160	34.3
PA	Pelvic Angle		23.1		23.9
TA	Tibia Angle		50.2		44.8
KK	Knee to Knee (Y)	269		261	
SK	Striker to Knee	602	96.2	620	100.3
ST	Striker to Head	445	14.3	455	15.3
SH	Striker to H-Point	330	129.5	332	129.7
SHY	Striker to H-Point (Y)	241		224	
HS	Head to Side Window	344		298	
HD	H-Point to Door (Y)	142		110	
AD	Arm to Door (Y)	124		90	
AA	Ankle to Ankle	344		211	

DATA SHEET NO. 7 **SEAT BELT POSITIONING DATA**

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
TBI - Dummy centerline to shoulder bolt	mm	170	170
PBU - Top surface of reference to belt upper edge	mm	322	386
PBL - To surface of reference to belt lower edge	mm	242	292

DATA SHEET NO. 8

VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

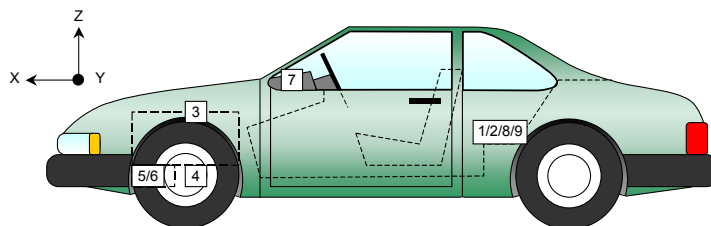
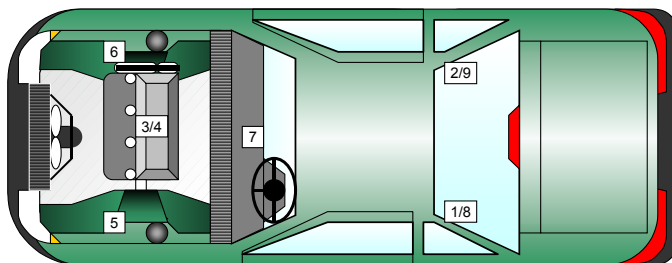
NHTSA No.: M55900
 Test Date: 10/19/04

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)			Peak Values				
		X	Y	Z	Units	Max	Time	Min	Time
1	Left Rear X-Member X	1885	-593	370	G's	0.8	168	-41.8	43
2	Right Rear X-Member X	1883	593	368	G's	1.0	154	-35.0	56
3	Engine Top X	3953	20	791	G's	*	*	*	*
4	Engine Bottom X	4072	10	180	G's	59.6	38	-165.0	29
5	Left Brake Caliper X	3855	682	247	G's	9.1	71	-93.0	40
6	Right Brake Caliper X	3853	-682	256	G's	10.0	66	-75.3	28
7	Instrument Panel X	3260	0	1004	G's	11.3	88	-47.8	41
8	Left Rear X-Member Z	1885	-593	370	G's	8.2	37	-16.4	46
9	Right Rear X-Member Z	1885	593	368	G's	7.5	75	-12.2	39

* No valid data collected after 40ms

Reference Points: X - Rear Surface of Vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ up)



DATA SHEET NO. 9
HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	13.0	200	-45.2	70	7.2	260	-38.8	73
Head CG	Y	G's	4.2	66	-5.7	93	4.4	44	-8.6	76
Head CG	Z	G's	23.5	52	-4.1	100	25.7	54	-1.4	16
Head CG Resultant	N/A	G's	47.0	70			41.5	73		

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	2.9	126	-45.9	59	1.5	143	-48.6	60
Chest CG	Y	G's	3.4	95	-2.1	35	2.6	52	-8.7	68
Chest CG	Z	G's	7.3	47	-7.5	67	10.5	55	-8.0	107
Chest CG Resultant	N/A	G's	46.2	59			48.8	60		

FEMUR PEAK FORCES

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Femur	Z	Newtons	1397	46	-2330	56	316	19	-2540	50
Right Femur	Z	Newtons	424	23	-2241	60	203	23	-3914	62

SEAT BELT SENSOR PEAK VALUES

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Lap Belt Force	N/A	Newtons	7588	58			5859	57		
Shoulder Belt Force	N/A	Newtons	4568	50			6019	51		

HEAD INJURY CRITERIA (HIC)

Location	Driver				Passenger			
	HIC	Avg. G's	T ¹	T ²	HIC	Avg. G's	T ¹	T ²
Head CG Primary	366.6	40.1	52.0	88.0	282.4	36.1	49.4	85.4

CHEST CLIP (3MSEC)

Location	Driver			Passenger		
	CLIP	T ¹	T ²	CLIP	T ¹	T ²
Chest CG Primary	43.3	57.6	60.6	45.7	59.2	62.2

DATA SHEET NO. 9... (continued)

HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Pelvis	X	G's	6.4	101	-65.2	56	4.2	114	-68.5	54
Pelvis	Y	G's	11.1	87	-8.0	59	2.9	48	-3.7	83
Pelvis	Z	G's	2.4	252	-31.9	64	1.9	224	-23.7	68

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Neck Force	X	Newtons	751	75	-334	148	455	69	-499	140
Neck Force	Y	Newtons	157	67	-106	102	105	50	-184	152
Neck Force	Z	Newtons	1122	52	-249	251	1214	54	-238	152
Neck Moment	X	N•m	5.9	95	-7.7	117	9.4	93	-6.9	169
Neck Moment	Y	N•m	76.9	65	-18.9	252	52.9	62	-14.1	49
Neck Moment	Z	N•m	9.4	112	-7.3	252	11.7	82	-6.7	135

FOOT PEAK ACCELERATIONS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Foot Aft	X	G's	17.8	73	-35.5	32	11.9	91	-64.3	46
Left Foot Aft	Z	G's	4.9	134	-77.2	46	6.6	66	-53.0	45
Left Foot Fore	Z	G's	6.0	136	-73.3	41	20.3	66	-67.5	51
Right Foot Aft	X	G's	25.8	58	-229.1	45	13.9	93	-51.3	31
Right Foot Aft	Z	G's	15.9	63	-162.5	44	3.5	173	-53.0	35
Right Foot Fore	Z	G's	61.4	52	-527.9	43	23.3	45	-78.9	35

UPPER AND LOWER TIBIA PEAK FORCES AND MOMENTS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Lower Moment	X	N•m	7.2	31	-66.2	74	64.0	51	-26.8	131
Left Lower Moment	Y	N•m	211.1	74	-17.1	29	28.3	116	-165.7	51
Left Lower Force	Z	Newtons	68	165	-2534	47	190	119	-3464	51
Left Upper Moment	X	N•m	50.0	57	-30.8	76	28.7	47	-67.9	59
Left Upper Moment	Y	N•m	25.5	110	-91.9	57	68.6	76	-32.8	49
Left Upper Force	Z	Newtons	107	166	-2116	71	118	119	-3442	51
Right Lower Moment	X	N•m	33.2	49	-47.3	52	18.7	47	-41.1	57
Right Lower Moment	Y	N•m	168.2	61	-123.9	44	103.2	70	-23.0	32
Right Lower Force	Z	Newtons	353	24	-4223	48	161	128	-2964	56
Right Upper Moment	X	N•m	20.2	143	-51.2	49	29.3	46	-50.1	64
Right Upper Moment	Y	N•m	28.0	101	-197.3	46	17.9	107	-144.2	56
Right Upper Force	Z	Newtons	240	24	-3083	49	210	118	-2813	56

DATA SHEET NO. 9... (continued)

HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

CHEST PEAK DISPLACEMENTS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest	X	mm			-28.8	62			-35.0	63

HEAD REDUNDANT PEAK ACCELERATIONS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	12.9	200	-44.2	70	7.4	260	-39.5	74
Head CG	Y	G's	3.8	66	-6.0	93	4.7	44	-8.4	77
Head CG	Z	G's	22.9	52	-4.6	99	26.5	54	-2.0	107
Head CG Resultant	N/A	G's	45.7	70			42.6	74		

CHEST REDUNDANT PEAK ACCELERATIONS

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	3.1	252	-47.9	59	2.0	139	-47.2	61
Chest CG	Y	G's	3.7	97	-2.0	42	3.0	51	-8.1	67
Chest CG	Z	G's	6.9	47	-7.5	67	10.5	55	-7.7	107
Chest CG Resultant	N/A	G's	48.2	59			47.3	61		

REDUNDANT HEAD INJURY CRITERIA (HIC)

Location	Driver				Passenger			
	HIC	Avg.	T ¹	T ²	HIC	Avg.	T ¹	T ²
Head CG Primary Redundant	335.4	38.7	52.7	88.7	300.0	37.0	49.3	85.3

REDUNDANT CHEST CLIP (3MSEC)

Location	Driver			Passenger		
	CLIP	T ¹	T ²	CLIP	T ¹	T ²
Chest CG Primary Redundant	43.7	64.8	68.0	44.3	59.3	62.3

DATA SHEET NO. 10
SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

SEAT BELT PLACEMENT MEASUREMENTS

Measurement Description	Units	Driver	Passenger
TBI - Dummy centerline to shoulder bolt	mm	170	170
PBU - Top surface of reference to belt upper edge	mm	322	386
PBL - Top surface of reference to belt lower edge	mm	242	292

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	888	888
Lap belt length as measured on ATD	mm	618	587
Remainder of belt on reel	mm	615	715
Total belt length for continuous webbing systems	mm	2190	2190

SHOULDER BELT SPOOL-OUT DATA

Measurement Description	Units	Driver	Passenger
As determined mechanically	mm	Not recorded	
As determined electronically	mm	Not recorded	

DATA SHEET NO. 11
SUMMARY OF FMVSS 212 DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

Windshield Mounting Details:

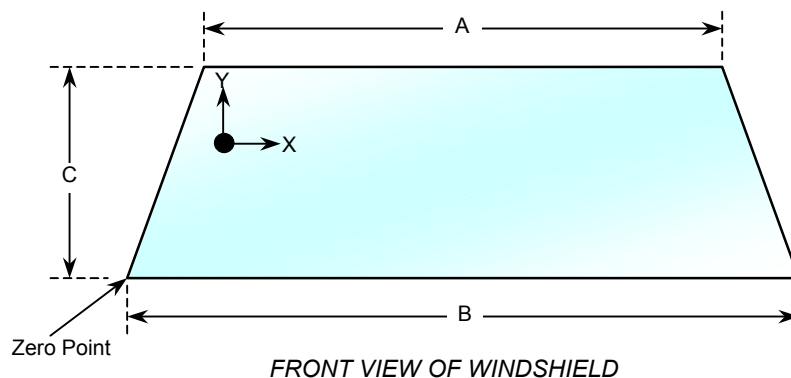
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pretest total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles, which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21 °C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2188	2188	100
Right Side	2180	2180	100
Total	4368	4368	100



WINDSHIELD DIMENSIONS

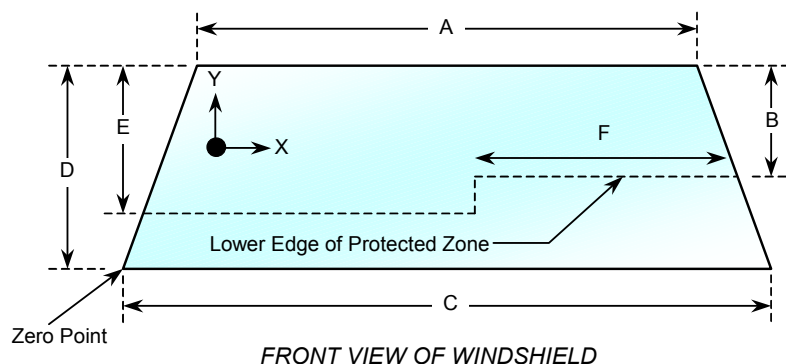
Item	Units	Segment Length	Molding Width
A	mm	21	1222
B	mm	11	1530
C	mm	10	812

DATA SHEET NO. 12

WINDSHIELD ZONE INTRUSION FMVSS 219 (Partial) DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04



Item	Units	Value
A	mm	1222
B	mm	453
C	mm	1530
D	mm	812
E	mm	545
F	mm	535

AREA OF PROTECTED ZONE FAILURES - NONE

- A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

X	Y

- B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 13

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

Temperature at Time of Impact: 21° C Test Time: 12:45 pm

Stoddard Solvent Spillage Measurements

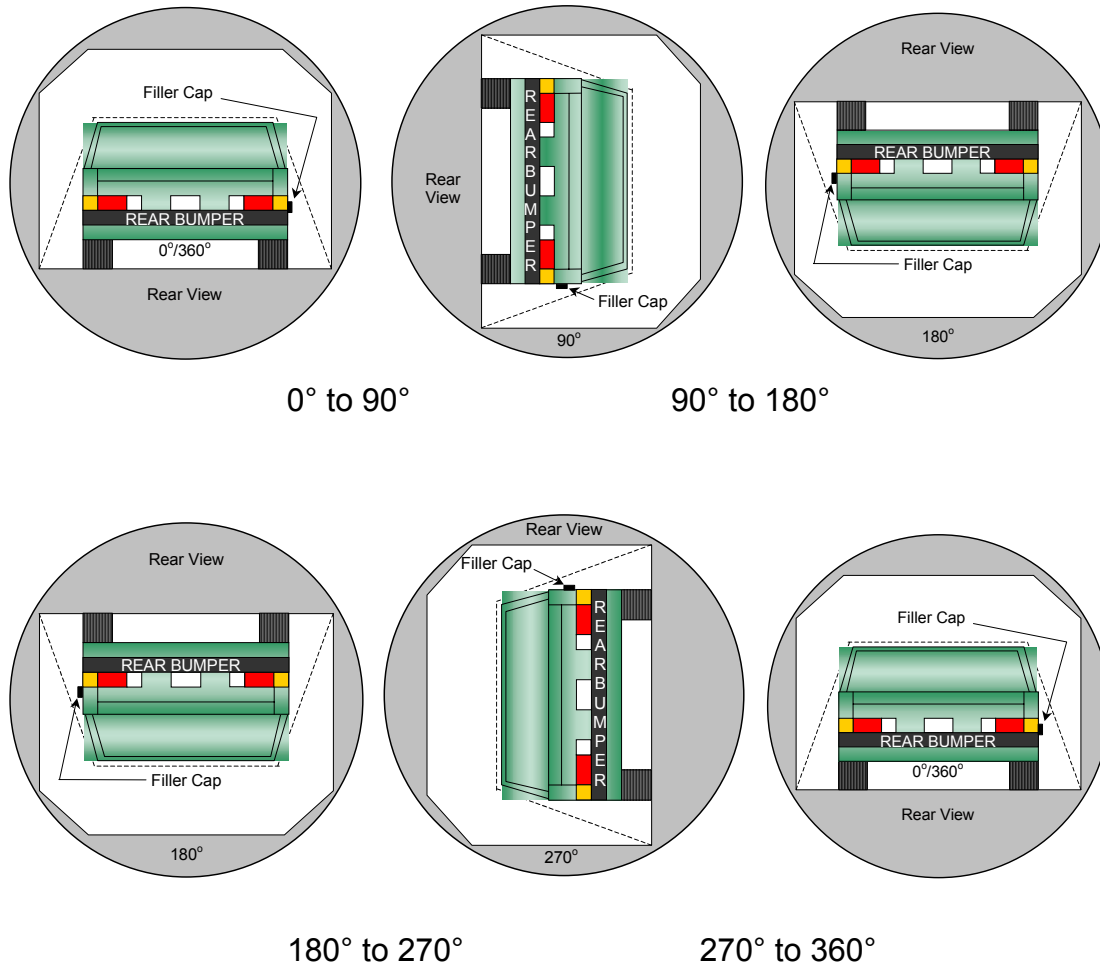
- A. From impact until vehicle motion ceases: 0 oz.
 (Maximum Allowable = 1 ounce)
- B. For the 5 minute period after motion ceases: 0 oz.
 (Maximum Allowable = 5 ounces)
- C. For the following 25 minutes: 0 oz.
 (Maximum Allowable = 1 oz. /minute)
- D. Spillage: None

DATA SHEET NO. 14
FMVSS 301 STATIC ROLLOVER DATA

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

Test Time: 12:45 pm



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

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	168	300	0
90° to 180°	167	300	0
180° to 270°	146	300	0
270° to 360°	173	300	0

DATA SHEET NO. 15
VEHICLE MEASUREMENTS

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

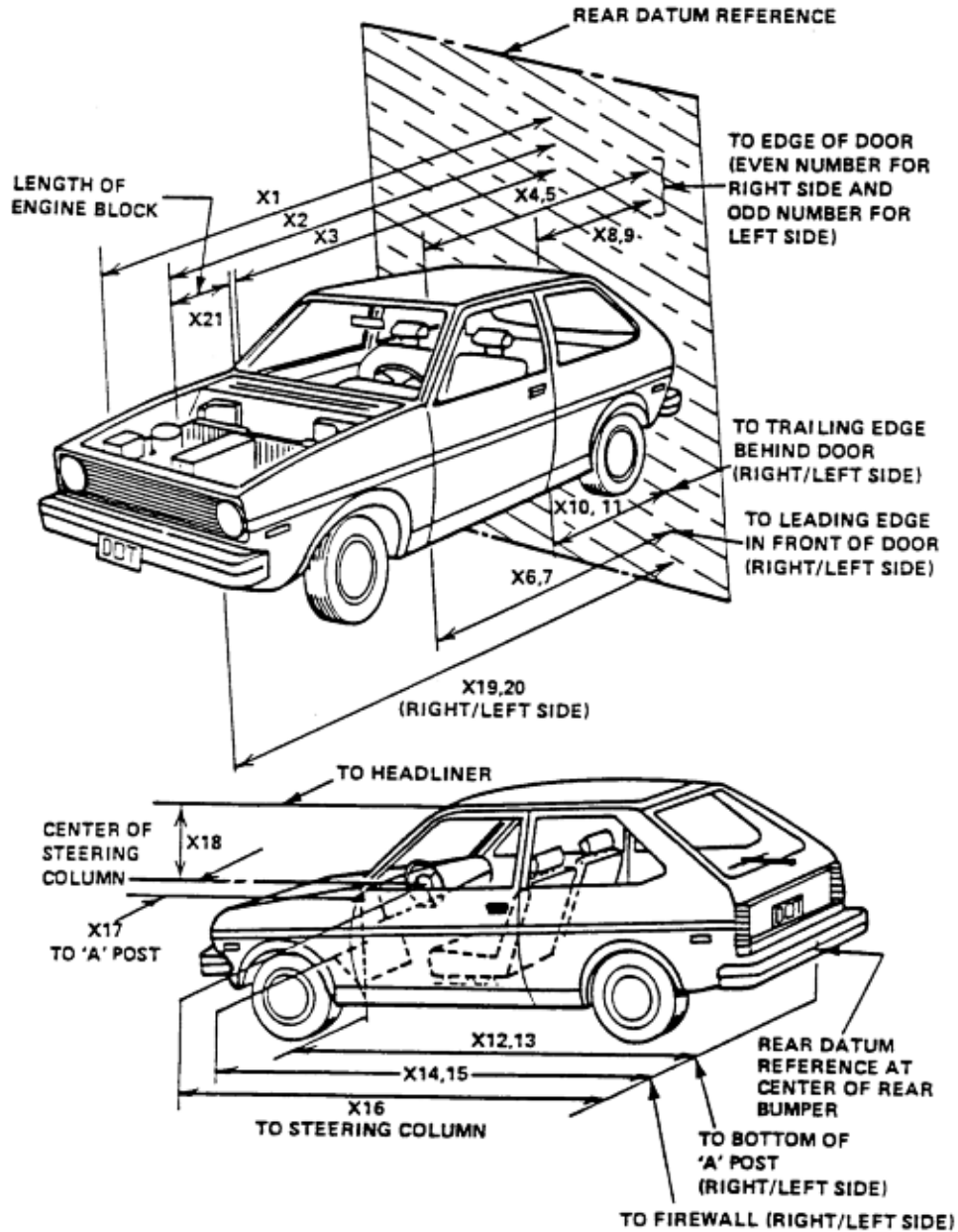
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4687	4118	569
2	RSOV to front of engine	mm	4196	3961	235
3	RSOV to firewall centerline	mm	3592	3499	93
4	RSOV to leading edge of right door	mm	3193	3193	0
5	RSOV to leading edge of left door	mm	3192	3194	-2
6	RSOV to lower leading edge of right door	mm	3197	3192	5
7	RSOV to lower leading edge of left door	mm	3185	3184	1
8	RSOV to upper leading edge of right door	mm	2122	2128	-6
9	RSOV to upper leading edge of left door	mm	2124	2122	2
10	RSOV to lower trailing edge of right door	mm	2158	2157	1
11	RSOV to lower trailing edge of left door	mm	2157	2149	8
12	RSOV to bottom of right 'A' pillar	mm	3185	3170	15
13	RSOV to bottom of left 'A' pillar	mm	3174	3190	-16
14	RSOV to firewall on right side	mm	3534	3469	65
15	RSOV to firewall on left side	mm	3538	3578	-40
16	RSOV to steering column	mm	2737	2748	-11
17	Center of steering column to left 'A' pillar	mm	370	365	5
18	Center of steering column to headlining	mm	450	455	-5
19	RSOV to right side of front bumper	mm	4511	4089	422
20	RSOV to left side of front bumper	mm	4512	4102	410
21	Length of engine block	mm	630	630	0
RD	RSOV to right side of dash panel	mm	3047	3065	-18
CD	RSOV to center of dash panel	mm	3210	3205	5
LD	RSOV to left side of dash panel	mm	3023	3028	-5

DATA SHEET NO. 15... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04



DATA SHEET NO. 15... (continued)**VEHICLE MEASUREMENTS**

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4687
2	Total Width	1910
3	Bumper Top Height	550
4	Bumper Bottom Height	365
5	Longitudinal Member Top Height	235
6	Distance between Longitudinal Members	1180
7	Longitudinal Member Width	110
8	Engine Top Height	770
9	Engine Bottom Height	155
10	Engine and gearbox width	1050
11	Front bumper-engine distance	300
12	Front shock absorber fixing height	905
13	Bonnet leading edge height	370
14	Front shock absorber fixing width	1170
15	Front bumper – front axle distance	890
16	Front axle – a pillar distance	545
17	A-pillar – B-pillar distance	1160
18	B-Pillar – rear axle distance	1170
19	B-pillar – C-pillar distance	910
20	Roof sill bottom height	1394
21	Roof sill top height	1428
22	Floor sill bottom height	220
23	Floor sill top height	272

DATA SHEET NO. 16
CAMERA LOCATIONS

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1030	-6810	1350	19	1000
3	Steering Column Top	2265	-5460	1560	19	1000
4	Steering Column Bottom	2255	-5450	1045	19	1000
5	Driver Close-up	1625	-6580	1450	35	1000
6	Driver Angle	6240	-4865	2030	50	1000
7	On board Driver Side				8	500
8	On board Passenger Side				8	500
9	Right Overall	2410	6720	1365	19	1000
10	Right Passenger Half	1125	8300	1265	25	1000
11	Right Close-up	1605	7625	1385	50	1000
12	Right Angle	6635	4655	1980	50	1000
13	Windshield	275	0	2826	14	1000
14	Top Driver	95	-455	1740	13	1000
15	Top Passenger	110	470	1750	13	1000
16	Pit Front	1090	0	-3150	24	1000
17	Pit Rear	3620	0	-3150	25	1000

***COORDINATES:**

+X = forward of impact plane
+Y = right of monorail centerline
+Z = above ground level

CAMERA LOCATIONS

NHTSA No.: M55900
Test Date: 10/19/04

The diagram illustrates the layout of the test facility, showing a top view and a left side view.

TOP VIEW: This view shows the overall layout of the test area. A central "TEST VEH." is positioned on a "TOW ROAD". To the left of the tow road is a "CONCRETE BARRIER". To the right is a "MONORAIL". A "COVERED PHOTO PIT" is located between the tow road and the monorail. Various numbered markers (1-15) and camera locations (1-6) are indicated. Camera 13 is positioned directly in front of the test vehicle. Camera 14 is positioned to the left of the vehicle, near the concrete barrier. Camera 15 is positioned to the right of the vehicle, near the monorail. Camera 12 is positioned to the right of the vehicle, near the covered photo pit. Camera 11 is positioned to the left of the vehicle, near the concrete barrier. Camera 10 is positioned to the left of the vehicle, near the concrete barrier. Camera 9 is positioned to the left of the vehicle, near the concrete barrier. Camera 8 is positioned to the left of the vehicle, near the concrete barrier. Camera 7 is positioned to the left of the vehicle, near the concrete barrier. Camera 6 is positioned to the left of the vehicle, near the concrete barrier. Camera 5 is positioned to the left of the vehicle, near the concrete barrier. Camera 4 is positioned to the left of the vehicle, near the concrete barrier. Camera 3 is positioned to the left of the vehicle, near the concrete barrier. Camera 2 is positioned to the left of the vehicle, near the concrete barrier. Camera 1 is positioned to the left of the vehicle, near the concrete barrier.

LEFT SIDE VIEW: This view shows the test vehicle from the side, positioned on the "TOW ROAD". The "CONCRETE BARRIER" is to the left, and the "MONORAIL" is to the right. The "COVERED PHOTO PIT" is located between the tow road and the monorail. Numbered markers (16, 17) and camera locations (13, 14) are indicated. Camera 13 is positioned directly in front of the test vehicle. Camera 14 is positioned to the left of the vehicle, near the concrete barrier.

CAMERA FRAME RATES:

- #1 = 24 fps
- All Others = 1,000 fps

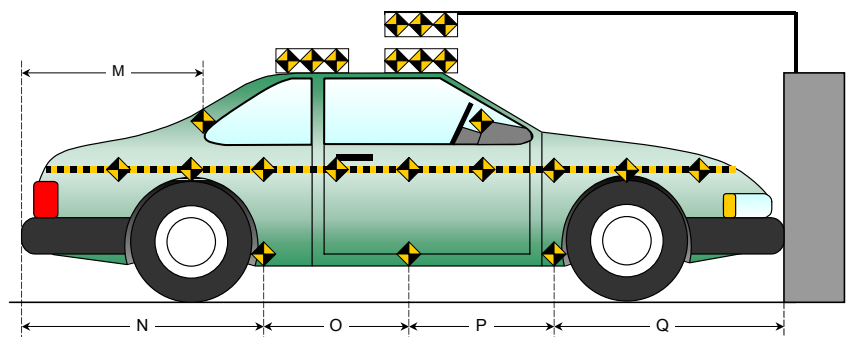
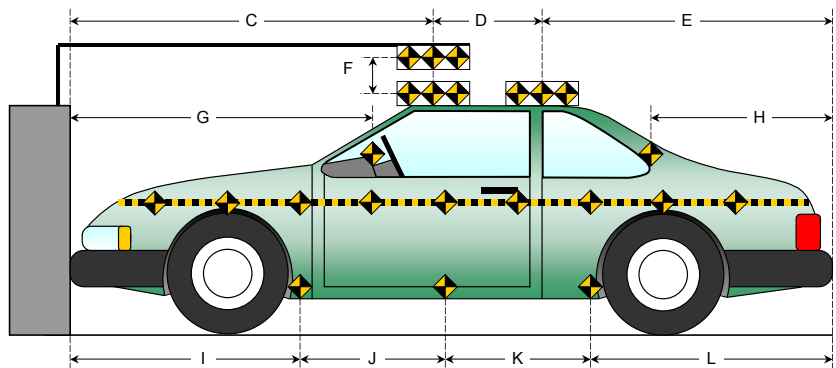
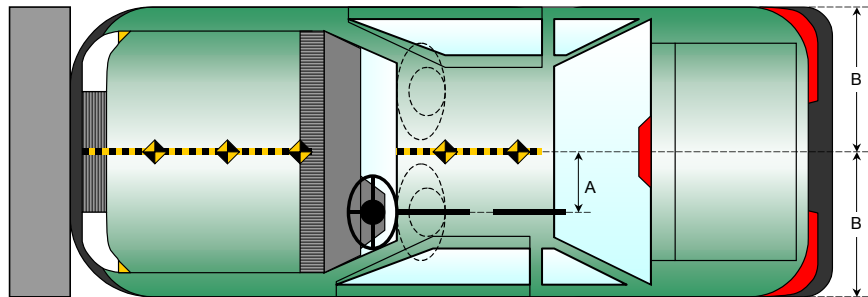
DATA SHEET NO. 17

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

Item	Value
A	375
B	955
C	2383
D	615
E	1689
F	
G	219
H	1247
I	1368
J	952
K	953
L	1414
M	1230
N	1423
O	953
P	953
Q	1358



DATA SHEET NO. 18
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

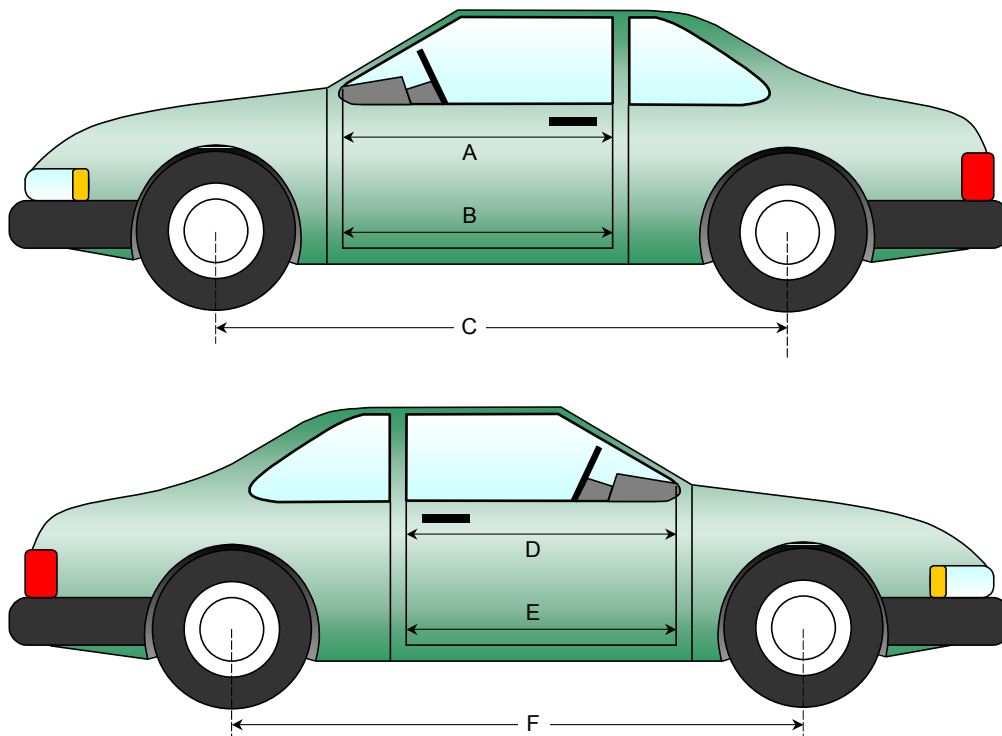
NHTSA No.: M55900
 Test Date: 10/19/04

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	967	953	14
B	Left Side Lower	mm	945	934	11
D	Right Side Upper	mm	973	965	8
E	Right Side Lower	mm	920	919	1

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2755	2663	92
F	Right Side Wheelbase	mm	2755	2644	111



DATA SHEET NO. 18... (continued)
VEHICLE INTRUSION MEASUREMENTS

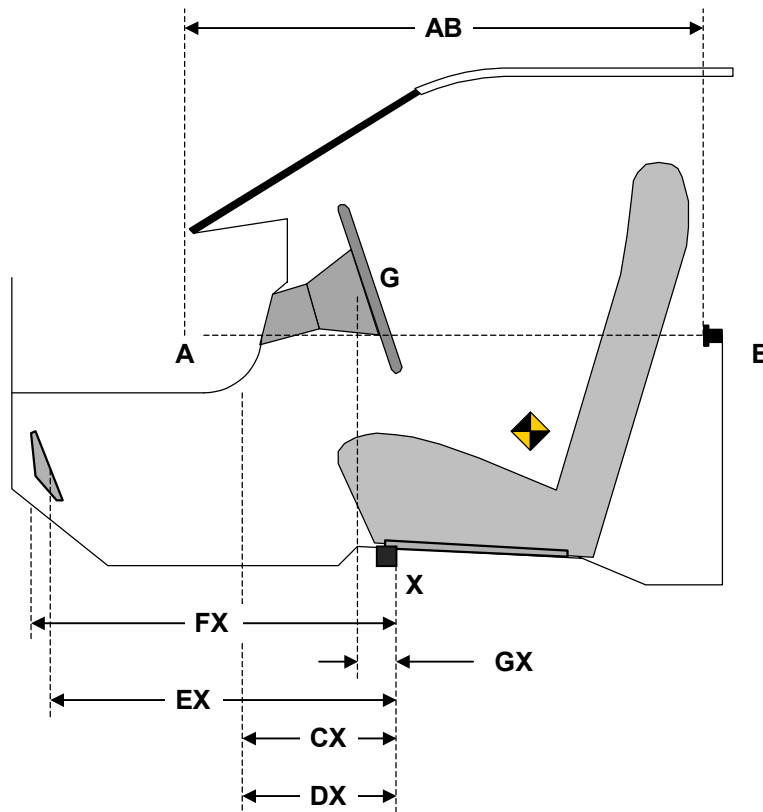
Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	963	955	8
CX	Left Knee Bolster to X	mm	276	288	-12
DX	Right Knee Bolster to X	mm	280	293	-13
EX	Brake Pedal to X	mm	576	528	48
FX	Foot Rest to X	mm	595	594	1
GX	Center of Steering Column Wheel Hub to X	mm	45	75	-30

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 18... (continued)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

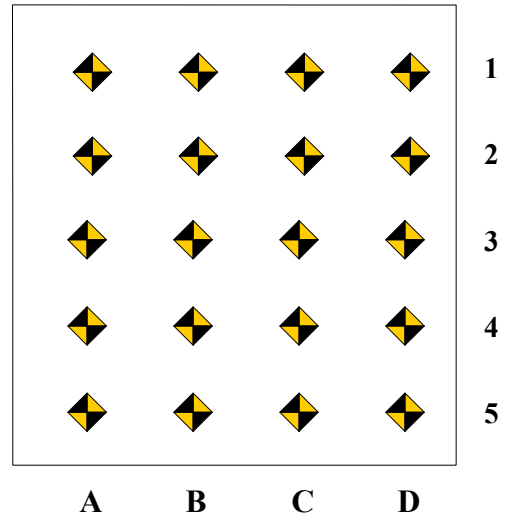
NHTSA No.: M55900
 Test Date: 10/19/04

Measurement reference point for X and Z axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3, 4, and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.



DRIVER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		710	698	711		642	617	642		68	81	69
2		643	632	651		592	577	602		51	55	49
3	576	575	569	573	536	534	531	538	40	41	38	35
4	435	435	437	432	414	412	409	409	21	23	28	23
5	294	294	294	297	275	270	271	273	19	24	23	24

DRIVER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		-3	-10	-25		-8	-18	-30		5	8	5
2		-62	-62	-80		-82	-84	-99		20	22	19
3	-109	-108	-107	-119	-138	-142	-151	-155	29	34	44	36
4	-116	-118	-118	-120	-142	-163	-178	-165	26	45	60	45
5	-121	-113	-113	-120	-140	-147	-157	-153	19	34	44	33

DATA SHEET NO. 18... (continued)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

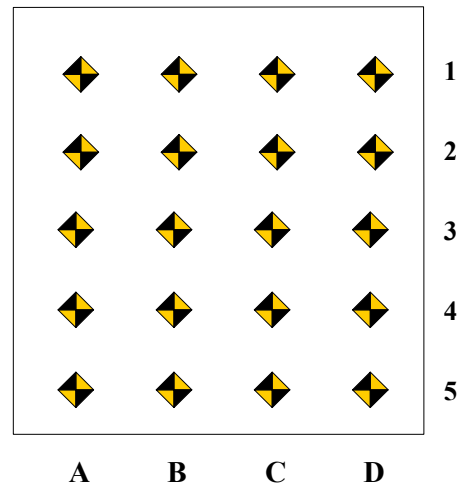
NHTSA No.: M55900
 Test Date: 10/19/04

Measurement reference point for X and Z axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3, 4, and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.



PASSENGER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	712	694	696		686	666	667		26	28	29	
2	664	649	651		644	626	630		20	23	21	
3	580	573	575	570	564	556	558	552	16	17	17	18
4	448	442	442	447	431	426	427	435	17	16	15	12
5	330	319	315	314	314	302	302	302	16	17	13	12

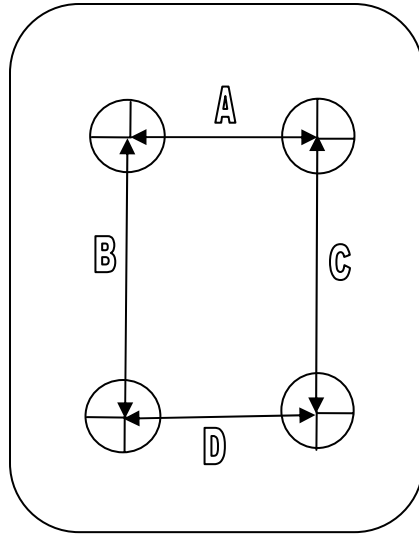
PASSENGER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-19	-11	-14		-17	-12	-17		-2	1	3	
2	-66	-48	-53		-68	-55	-66		2	7	13	
3	-120	-104	-108	-110	-125	-119	-123	-123	5	15	15	13
4	-121	-118	-116	-117	-130	-136	-137	-131	9	18	21	14
5	-119	-113	-112	-120	-130	-129	-129	-128	11	16	17	8

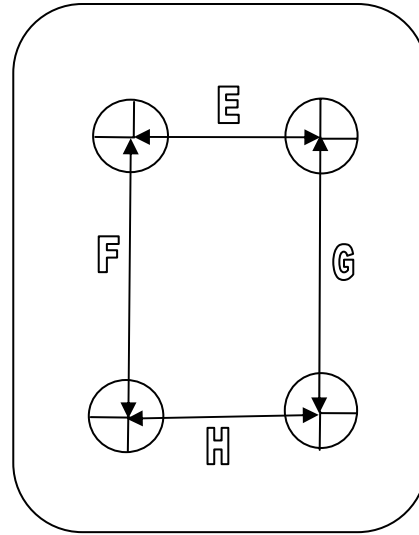
DATA SHEET NO. 18... (continued)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04



Driver



Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	307	311	-4
B	410	406	4
C	410	397	13
D	361	361	0
E	246	247	-1
F	392	393	-1
G	422	422	0
H	289	290	-1

DATA SHEET NO. 19

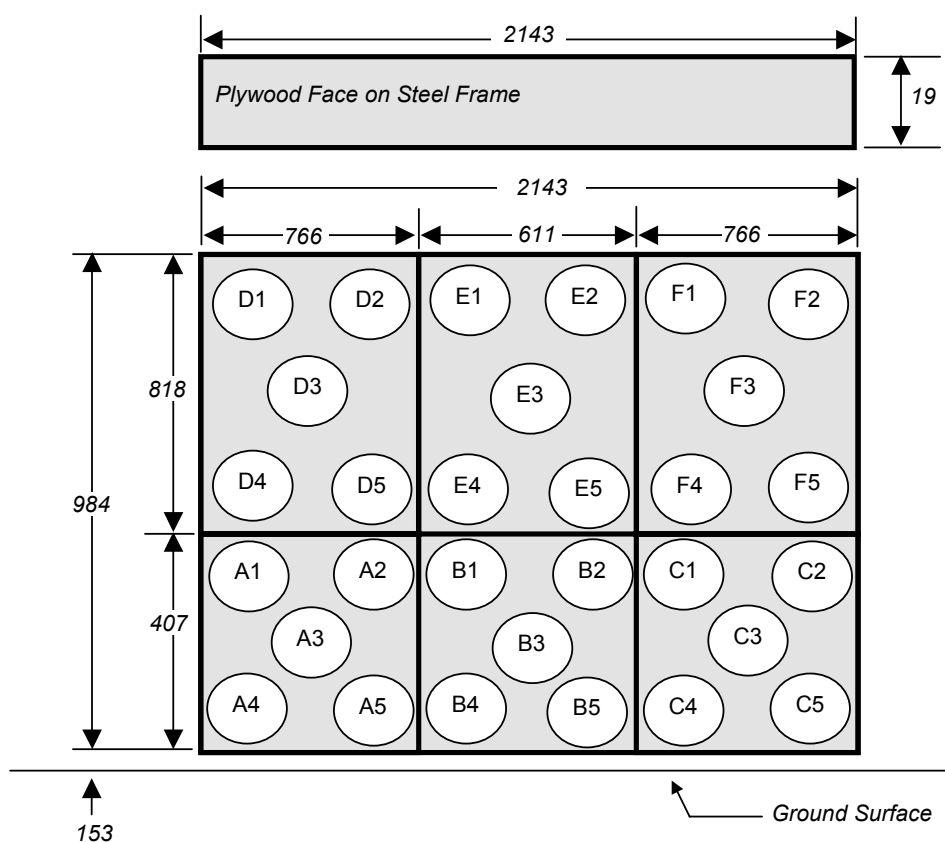
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2005 Volvo V70 Station Wagon
 Test Program: 35mph Frontal Impact

NHTSA No.: M55900
 Test Date: 10/19/04

30 Load Cell Rigid Barrier

Load Cell Locations on Fixed Barrier



Group 4 D1-D5	Group 5 E1-E5	Group 6 F1-F5
Group 1 A1-A5	Group 2 B1-B5	Group 3 C1-C5

6 Groups of 5 Load Cells Each

The Data is presented in Appendix B with the following requirements:

1. Sum data from 6 groupings shown above (5 cells/group)
2. Sum of left 2 groupings, center 2 groupings and right 2 groupings.
3. Total or sum of all 30 individual load cells.
4. Total versus average rear seat cross member displacement.

DATA SHEET NO. 20**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04

VEHICLE INFORMATION

VIN: YV1SW612452461928 Wheelbase (mm) : 2756
Vehicle Size Category: Station Wagon Test Weight (kg) : 1802.1

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 14
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal Linearity: > 99%
Impact Velocity (km/h): 56.8
Velocity Change (km/h): 63.1 Time of Separation (msec): 108

CRUSH PROFILE

Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1525 Impact Mode: Frontal

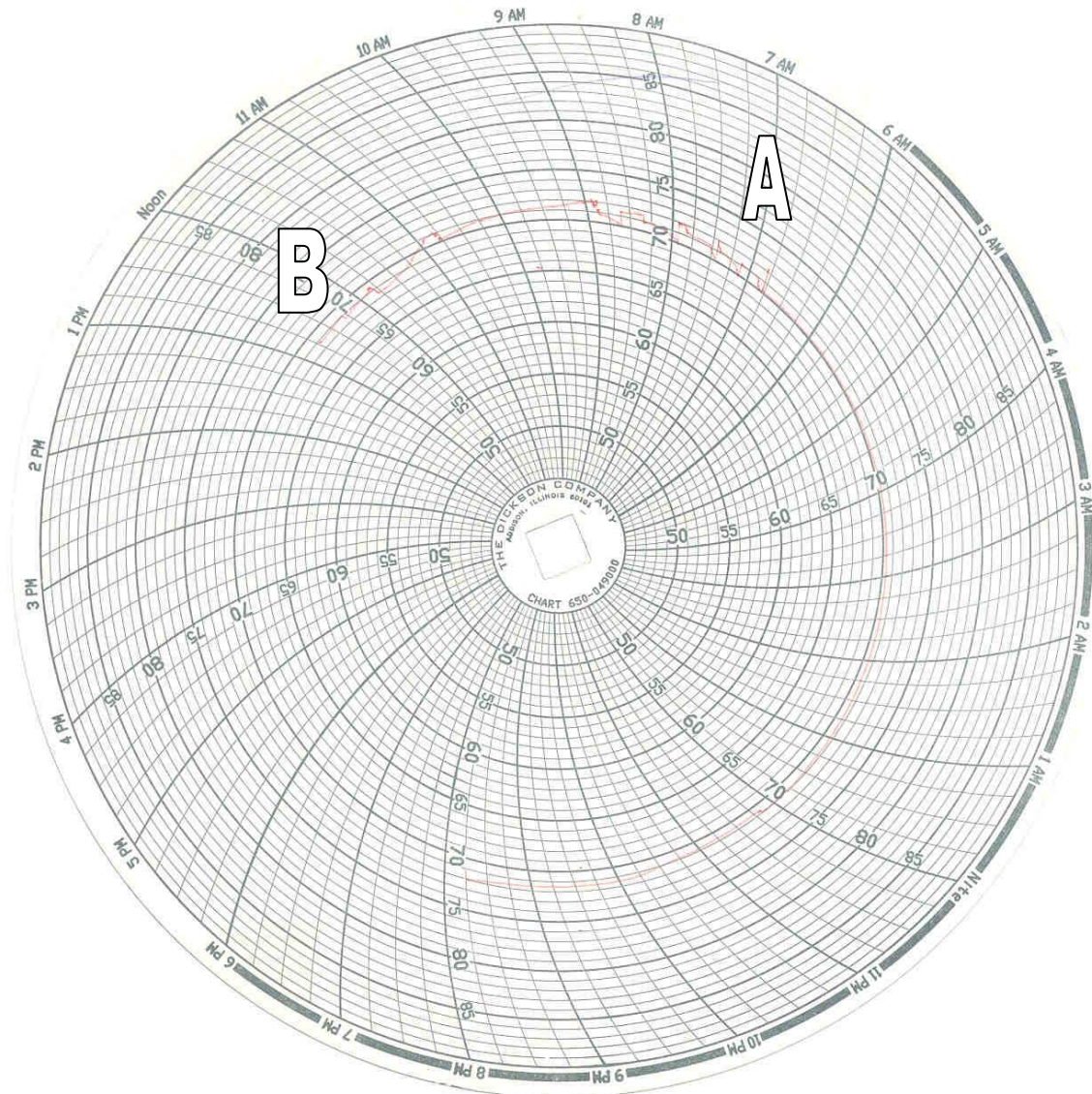
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4512	4102	410
C2	Crush zone 2 at left side	mm	4624	4086	538
C3	Crush zone 3 at left side	mm	4675	4126	549
C4	Crush zone 4 at right side	mm	4676	4109	567
C5	Crush zone 5 at right side	mm	4624	4088	536
C6	Crush zone 6 at right side	mm	4511	4089	422
L	C1 TO C6	mm	1525	1542	-17

DATA SHEET NO. 21

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2005 Volvo V70 Station Wagon
Test Program: 35mph Frontal Impact

NHTSA No.: M55900
Test Date: 10/19/04



A = Dummies installed in vehicle at 7:00 am

B = Test conducted at 12:45 pm

APPENDIX A
PHOTOGRAPHS

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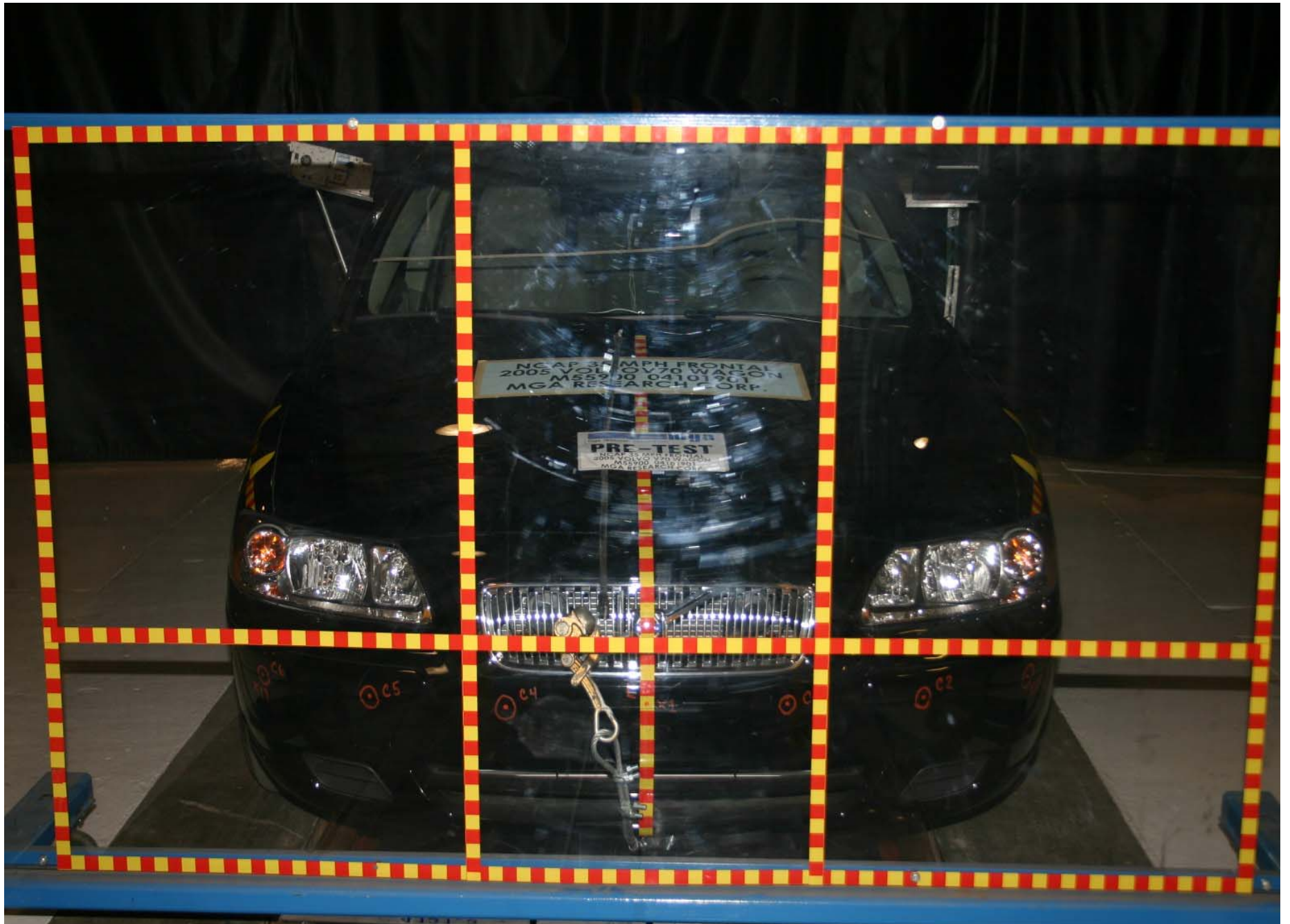
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Load Cell Location

MFD. BY VOLVO GOTHENBURG SWEDEN
DATE: 07/04 GV.W.R. 4690 GA.W.R.FRONT 2330 GA.W.R.REAR 2470 LB

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL
MOTOR VEHICLE SAFETY, BUMPER AND THEFT PROTECTION
STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE
SHOWN ABOVE.

VIN YV1SW612452461928 PASS.CAR

0641919



VOLVO

3514635

T



TIRE AND LOADING INFORMATION

SEATING CAPACITY | TOTAL 5 | FRONT 2 | REAR 3

The combined weight of occupants and cargo should never exceed 420 kg or 930 lbs.

ORIGINAL TIRE SIZE	COLD TIRE INFLATION PRESSURE	
195/65R15	FRONT	260 KPA, 38 PSI
	REAR	260 KPA, 38 PSI
COMPACT SPARE TIRE	COLD TIRE INFLATION PRESSURE	
T125/80R17	420 KPA, 61 PSI	

**SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION**

VOLVO

30651098

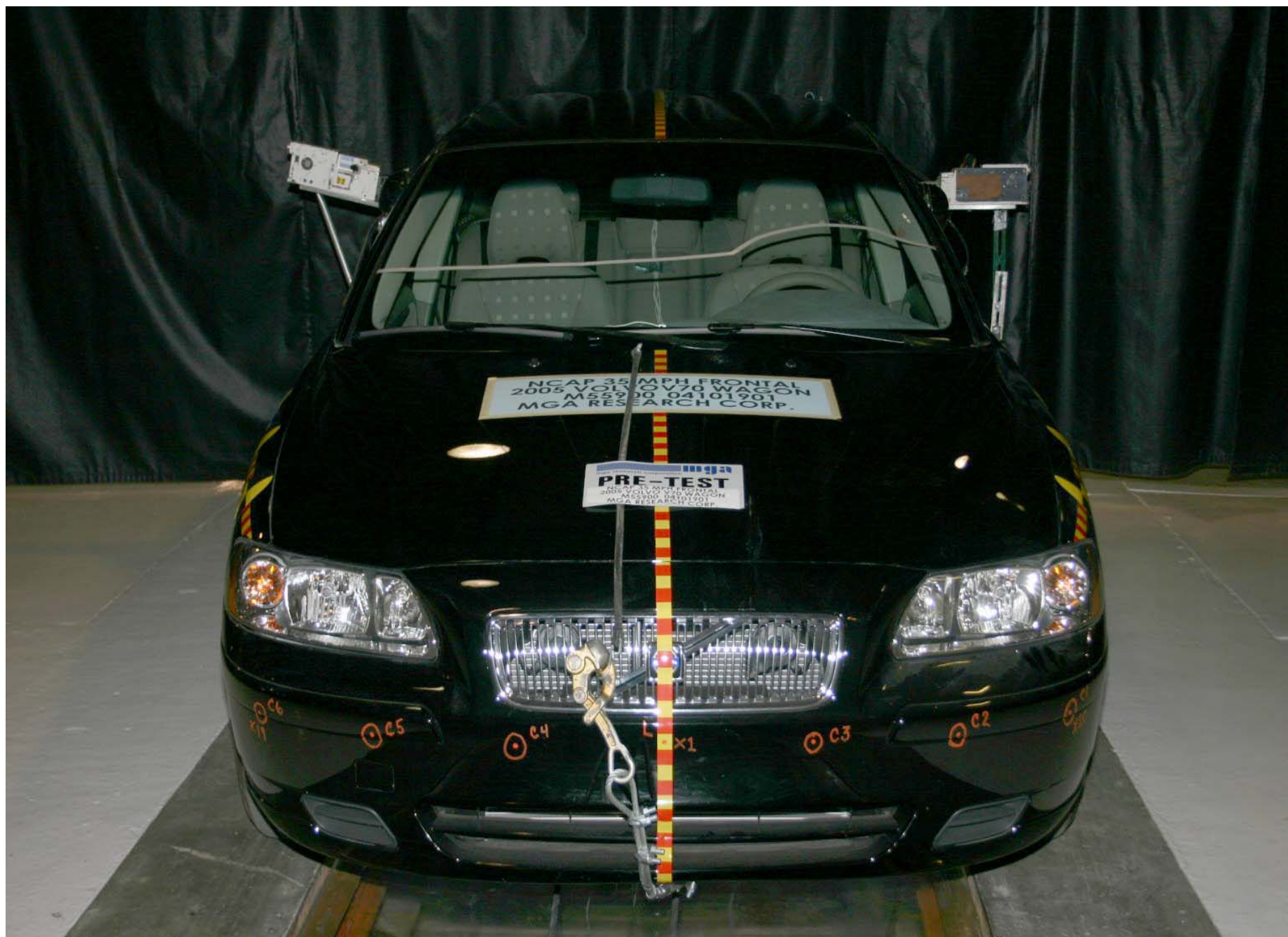
Tire Placard



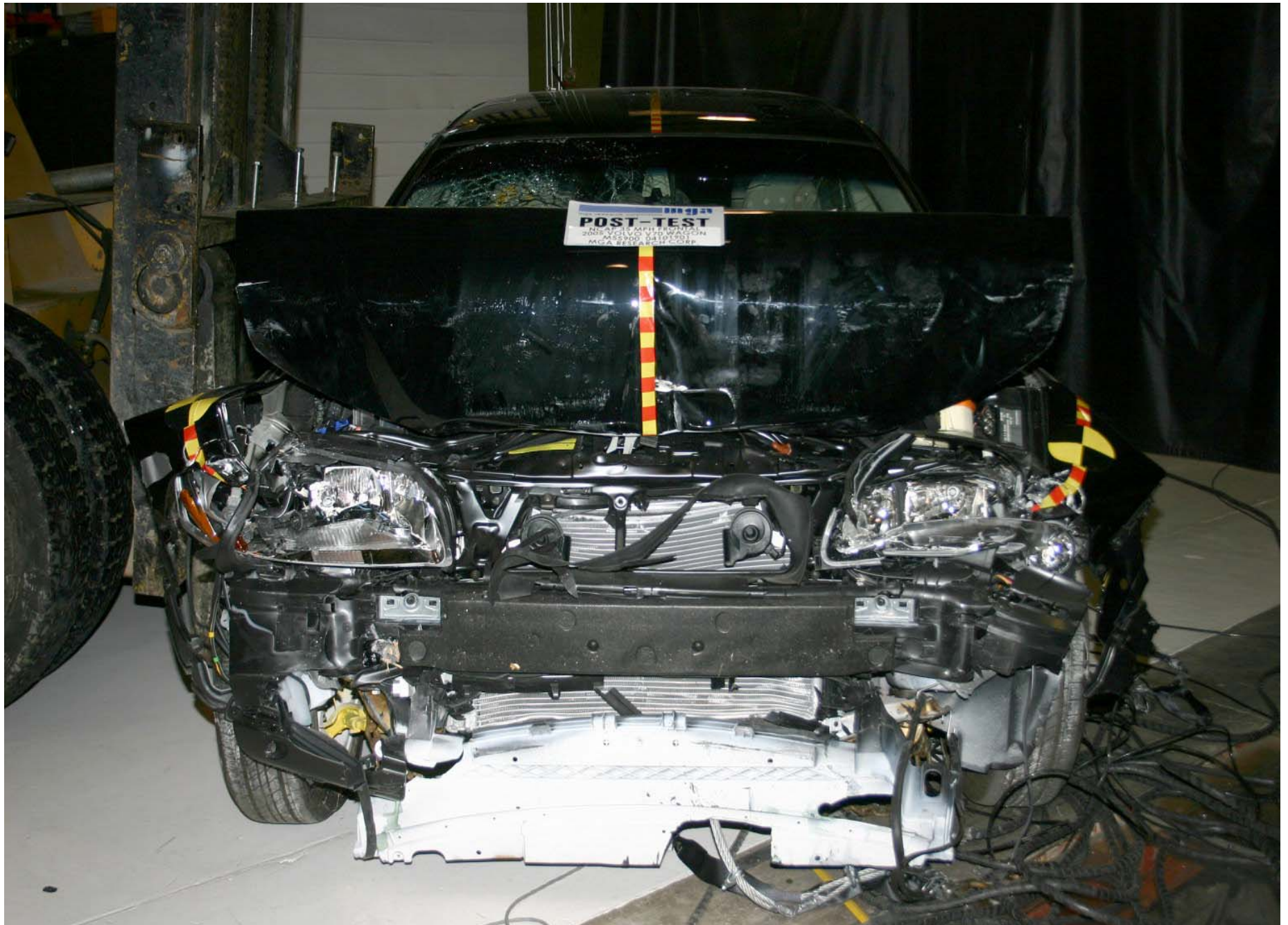
Right Front View of Test Vehicle, as received



Left Rear View of Test Vehicle, as received



Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle

A-8.



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 Right Front Three-Quarter View of Test Vehicle



Post-Test Right Front Three-Quarter View of Test Vehicle



Pre-Test Left Rear Three-Quarter View of Test Vehicle



Post-Test Left Rear Three-Quarter View of Test Vehicle



Post-Test Left Side Three-Quarter View of Doors After Impact



Post-Test Right Side Three-Quarter View of Doors After Impact



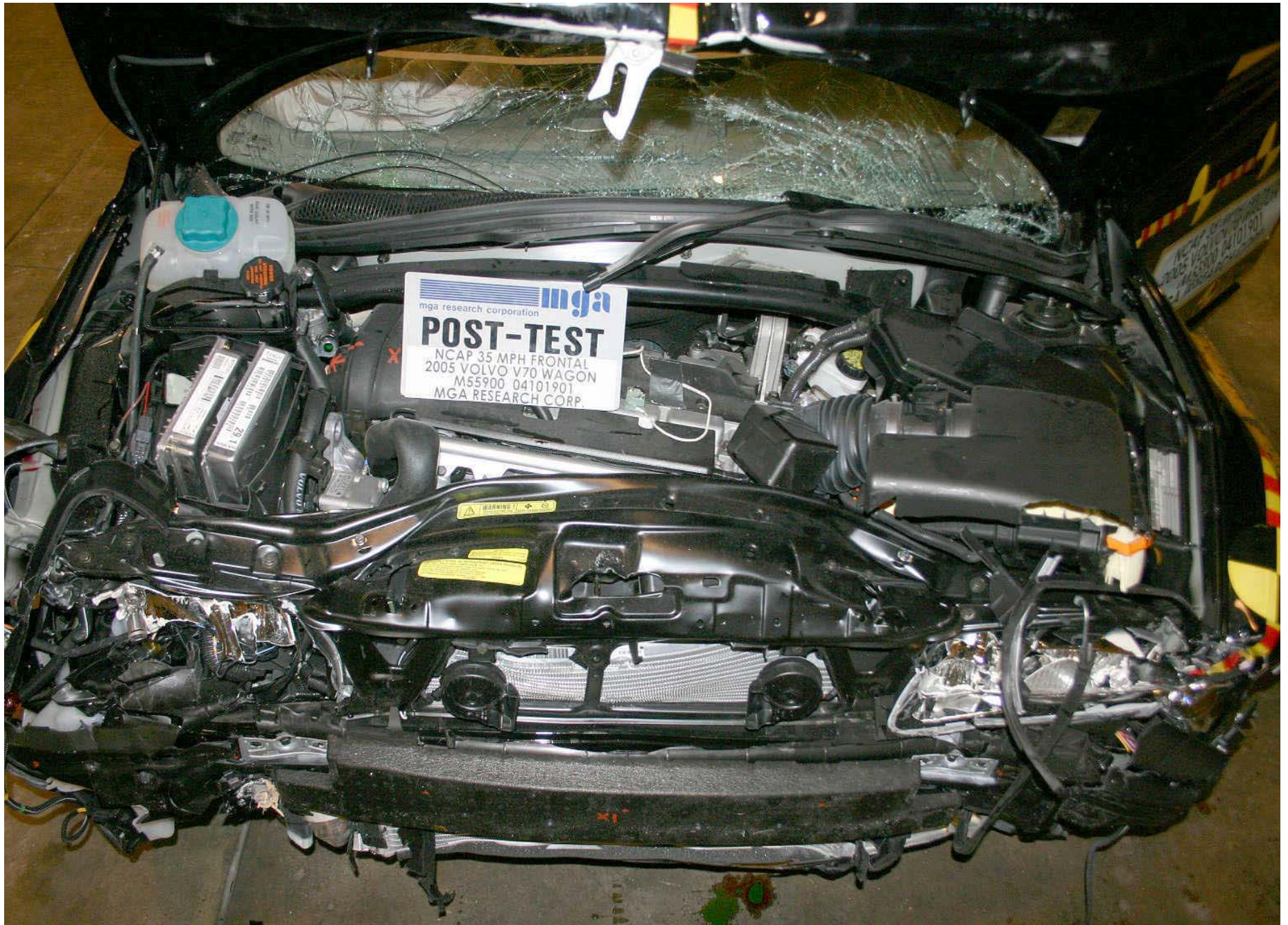
Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



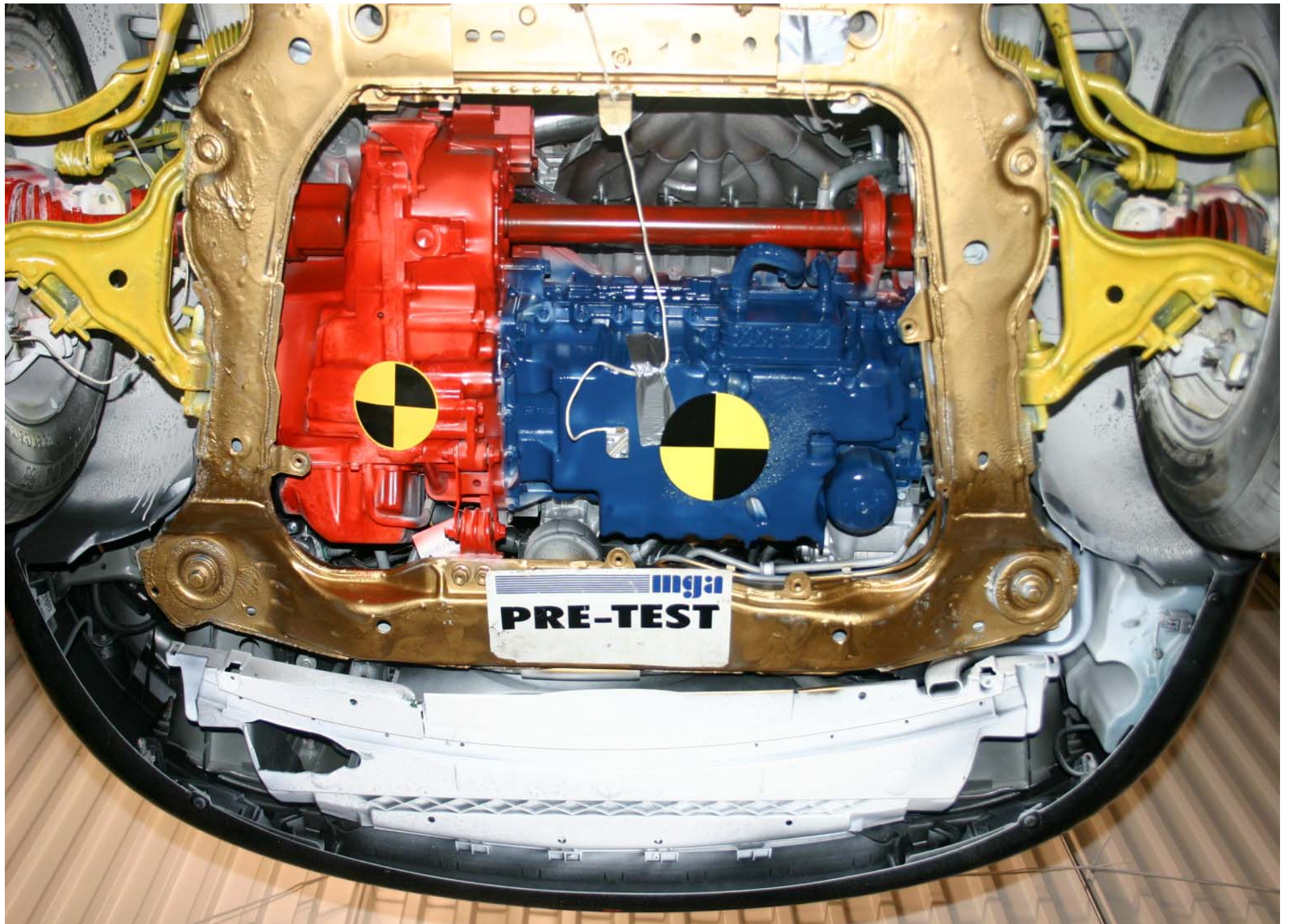
Post-Test Engine Compartment View



Pre-Test Fuel Filler Cap View



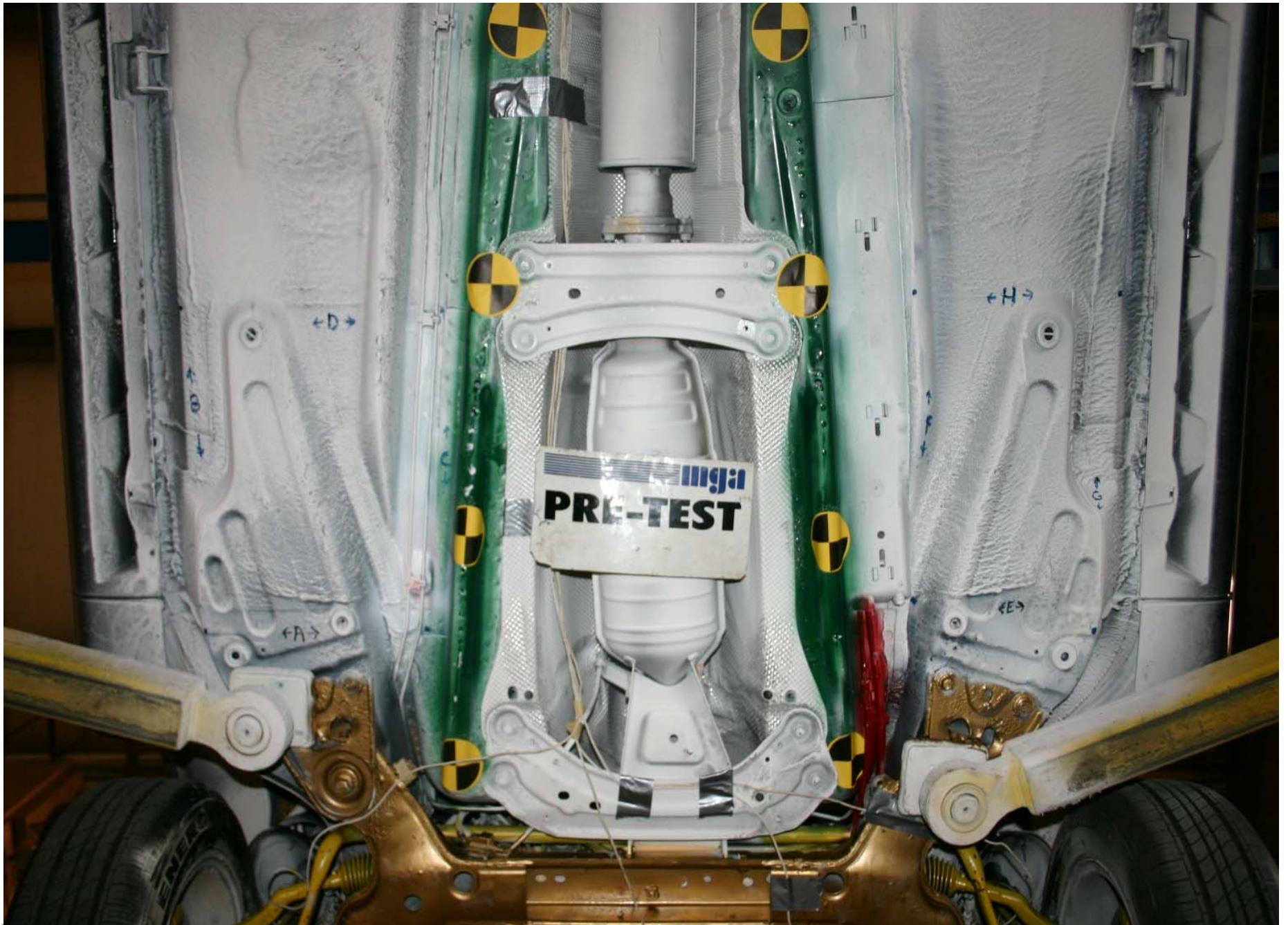
Post-Test Fuel Filler Cap View



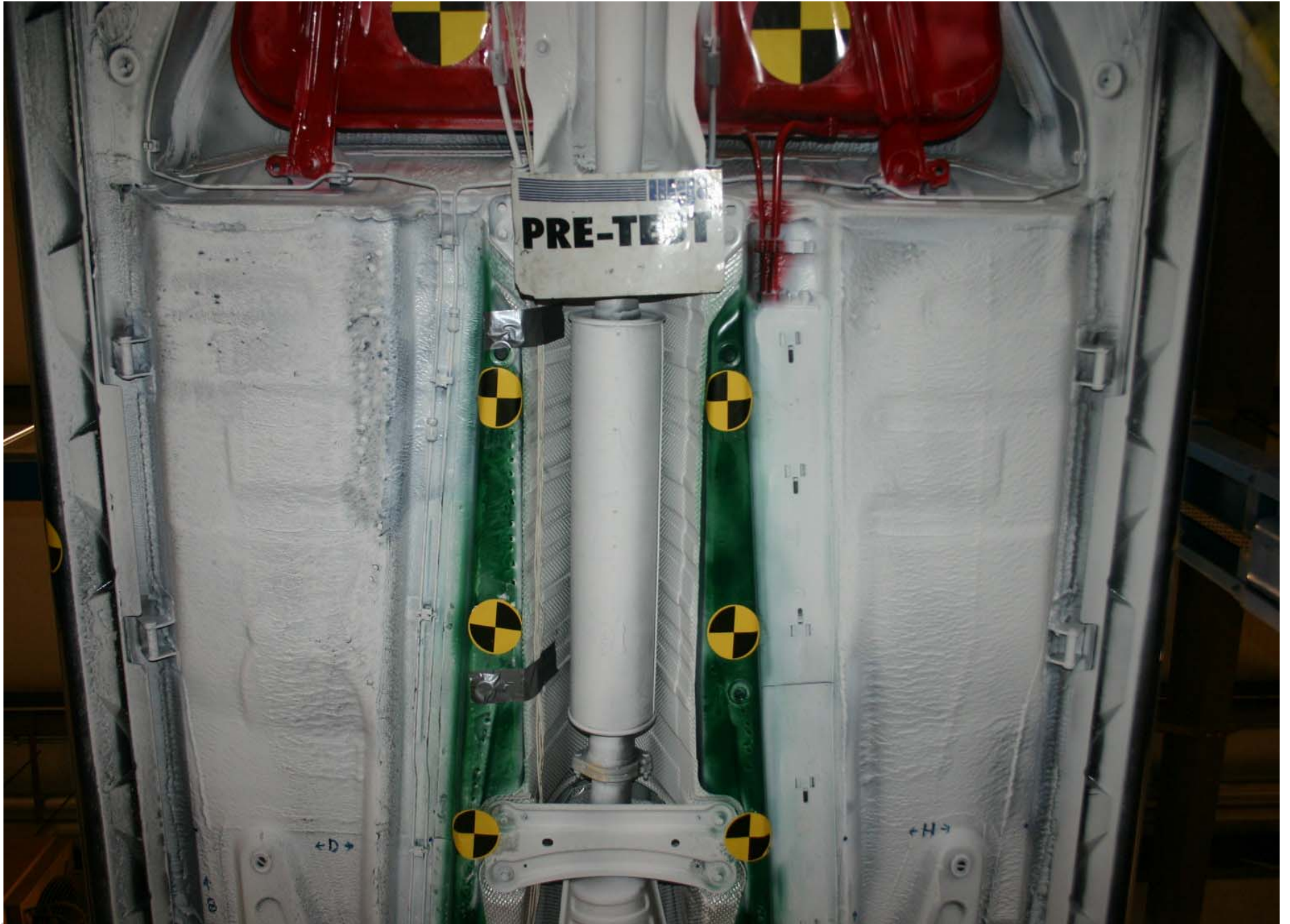
Pre-Test Front Underbody View



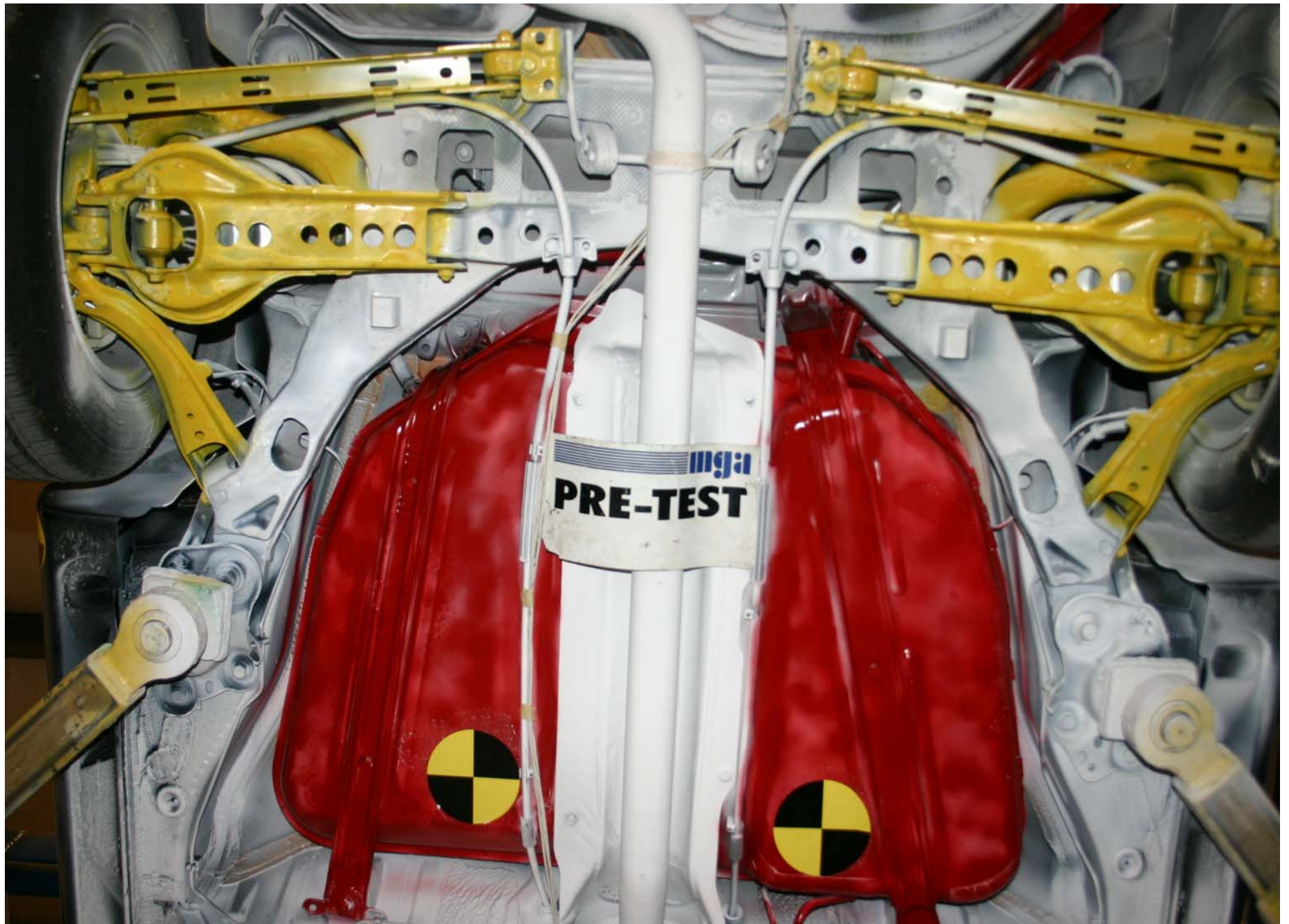
Post-Test Front Underbody View



Pre-Test Front Mid Underbody



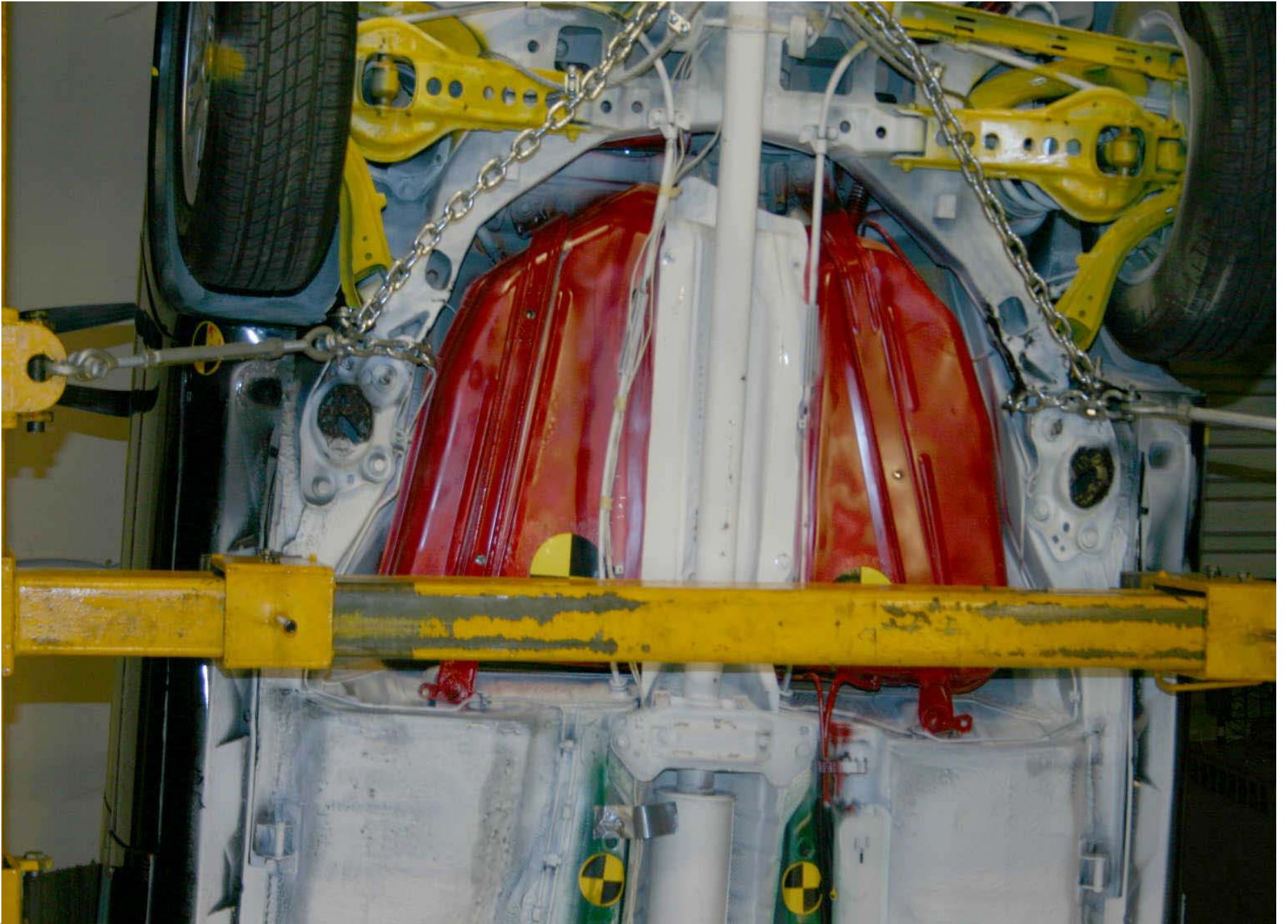
Pre-Test Mid Underbody



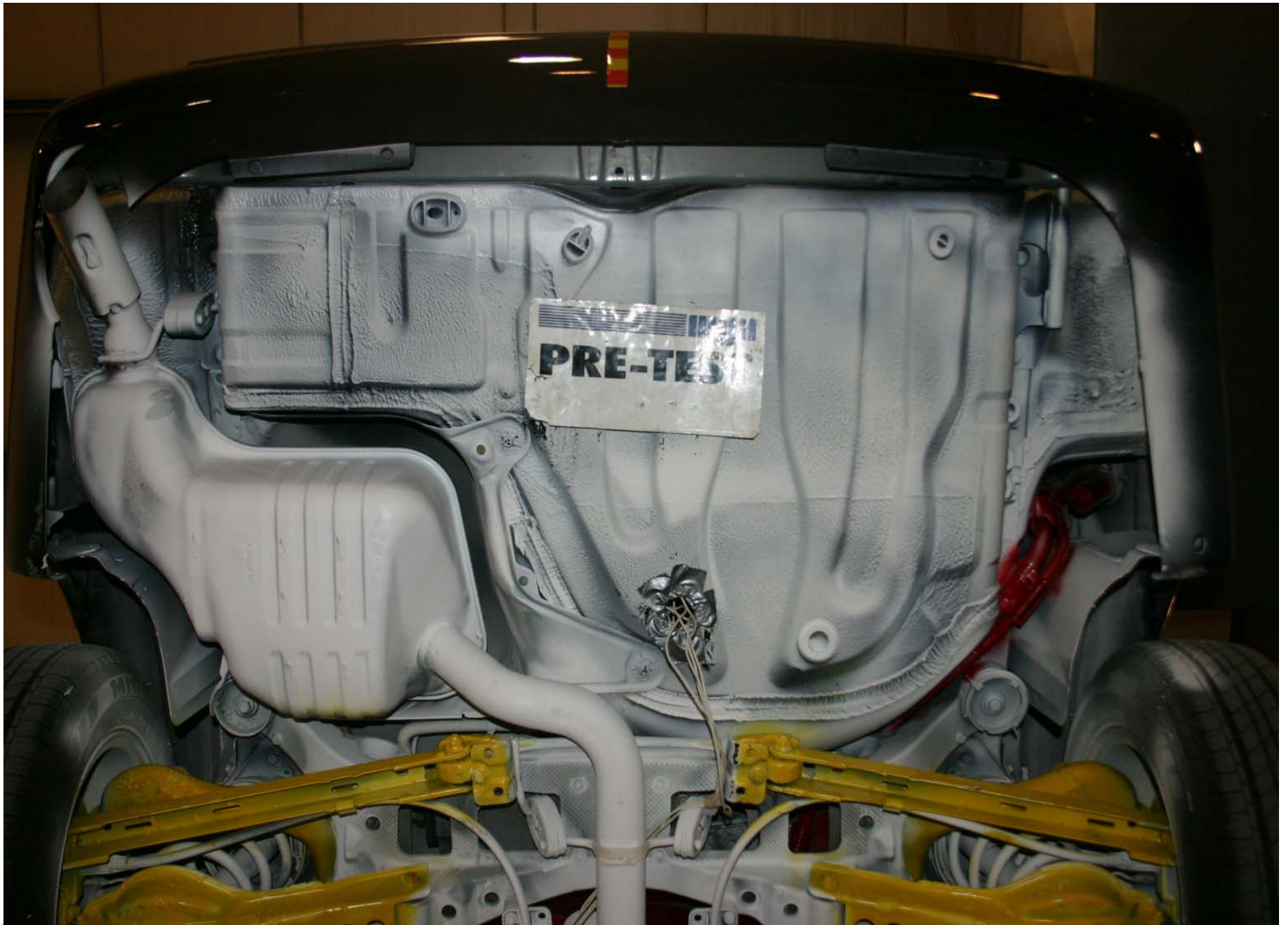
Pre-Test Rear Mid Underbody



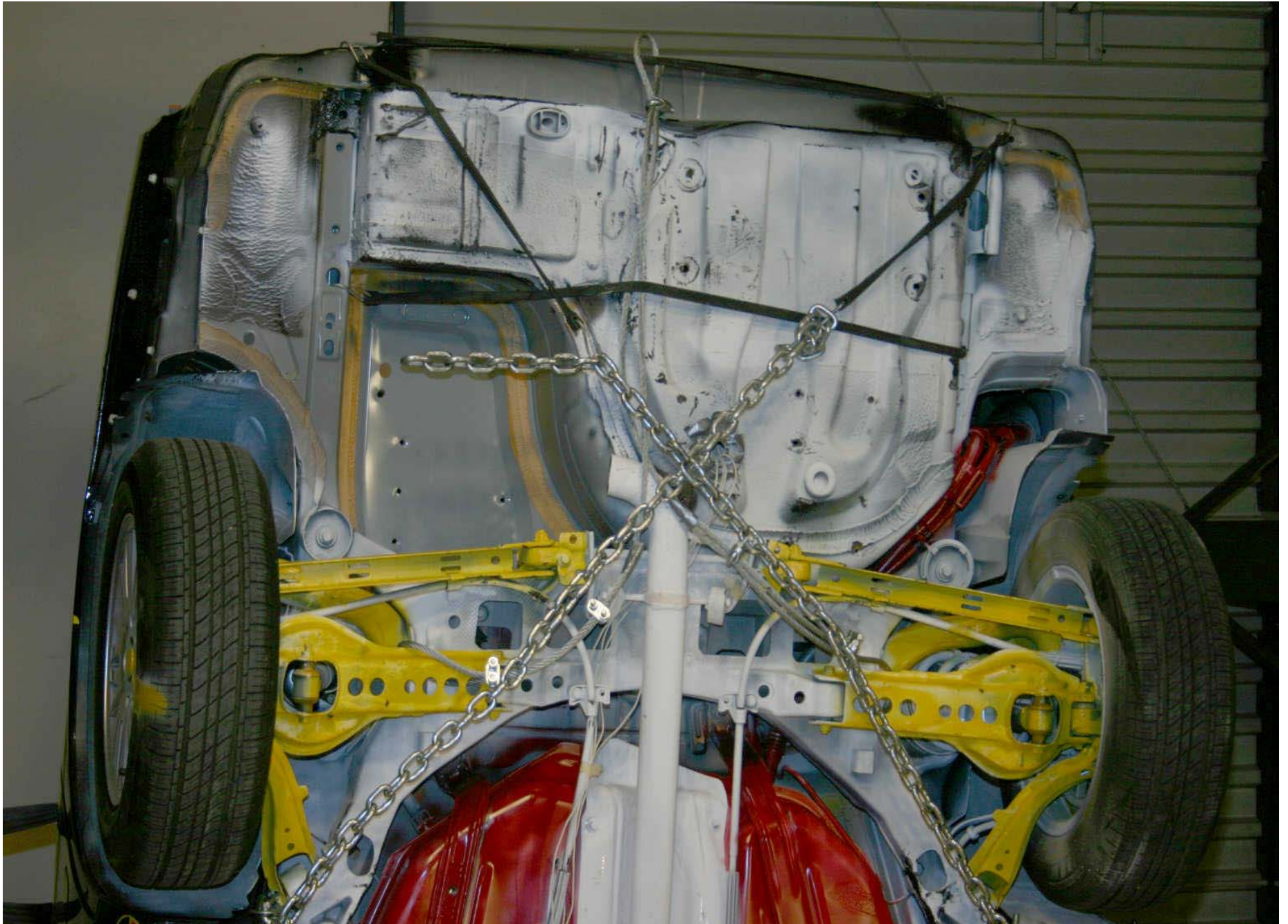
Post-Test Front Mid Underbody



Post-Test Rear Mid Underbody



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Driver Dummy Front View (head position)



Post-Test Driver Dummy Front View (head position)



Pre-Test Driver Dummy Position Left Side View



Post-Test Driver Dummy Position Left Side View

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



Post-Test Driver Dummy Position Left Side View (Door Open)



Pre-Test Driver Dummy Seat Position



Post-Test Driver Dummy Seat Position



Pre-Test Driver Dummy Feet Position



Post-Test Driver Dummy Feet Position



Pre-Test Driver Side Knee Bolster View

A photograph of a crash test dummy seated in the driver's seat of a vehicle. The dummy is wearing a white shirt and red pants. A white label is attached to the dummy's leg, reading: "mga research corporation POST-TEST NCAP 35 MPH FRONTAL 2005 VOLVO V70 WAGON M55900 04101901 MGA RESEARCH CORP." The dashboard and steering wheel are visible in the background.

Post-Test Driver Side Knee Bolster View

A-45.

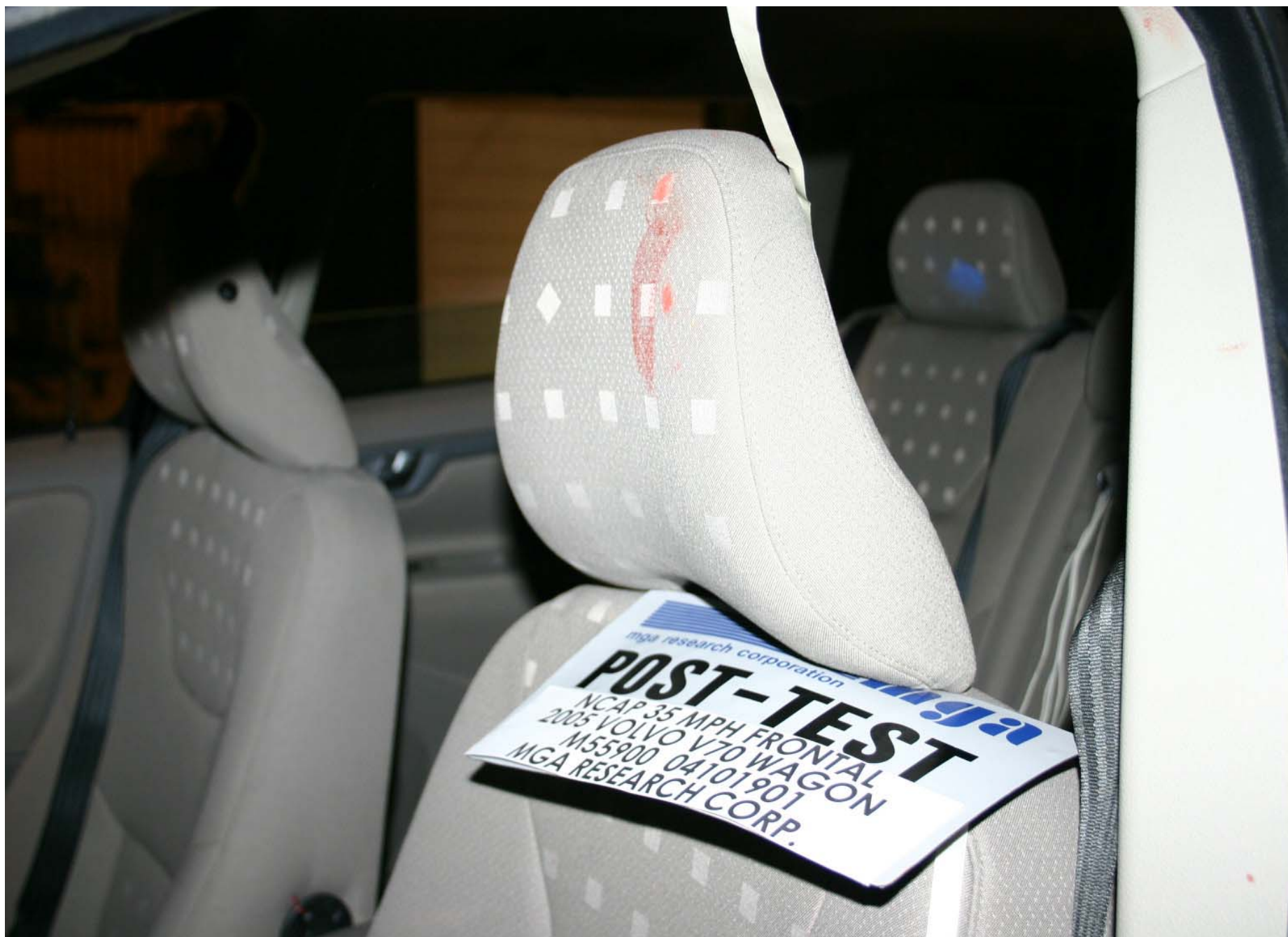


Pre-Test Driver Side Floor Pan View

A-46.



Post-Test Driver Side Floor Pan View



Post-Test Driver Dummy Head Contact



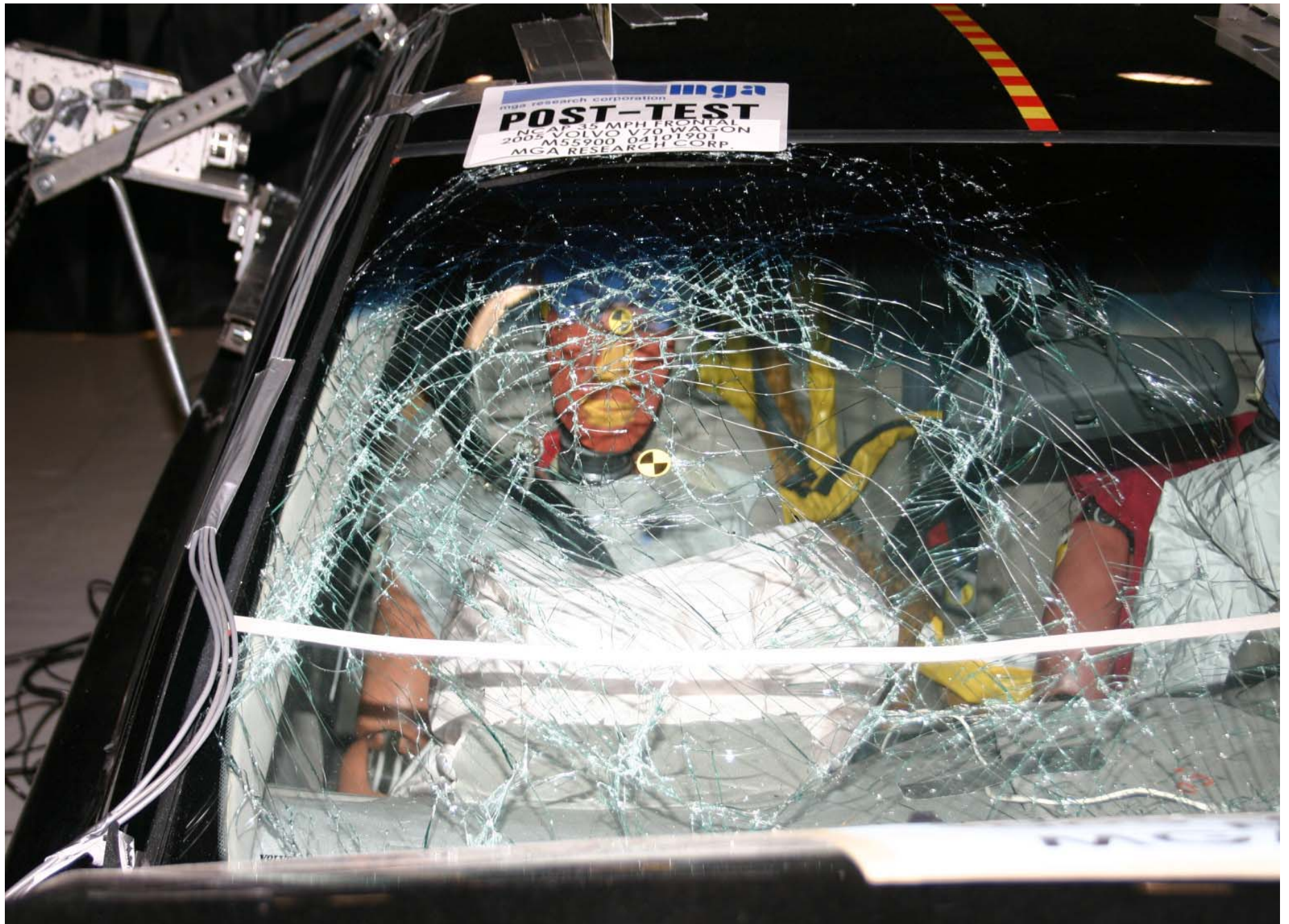
Post-Test Driver Dummy Knee Contact



Post-Test Driver Dummy Airbag Contact



Pre-Test Passenger Dummy Front View (head position)

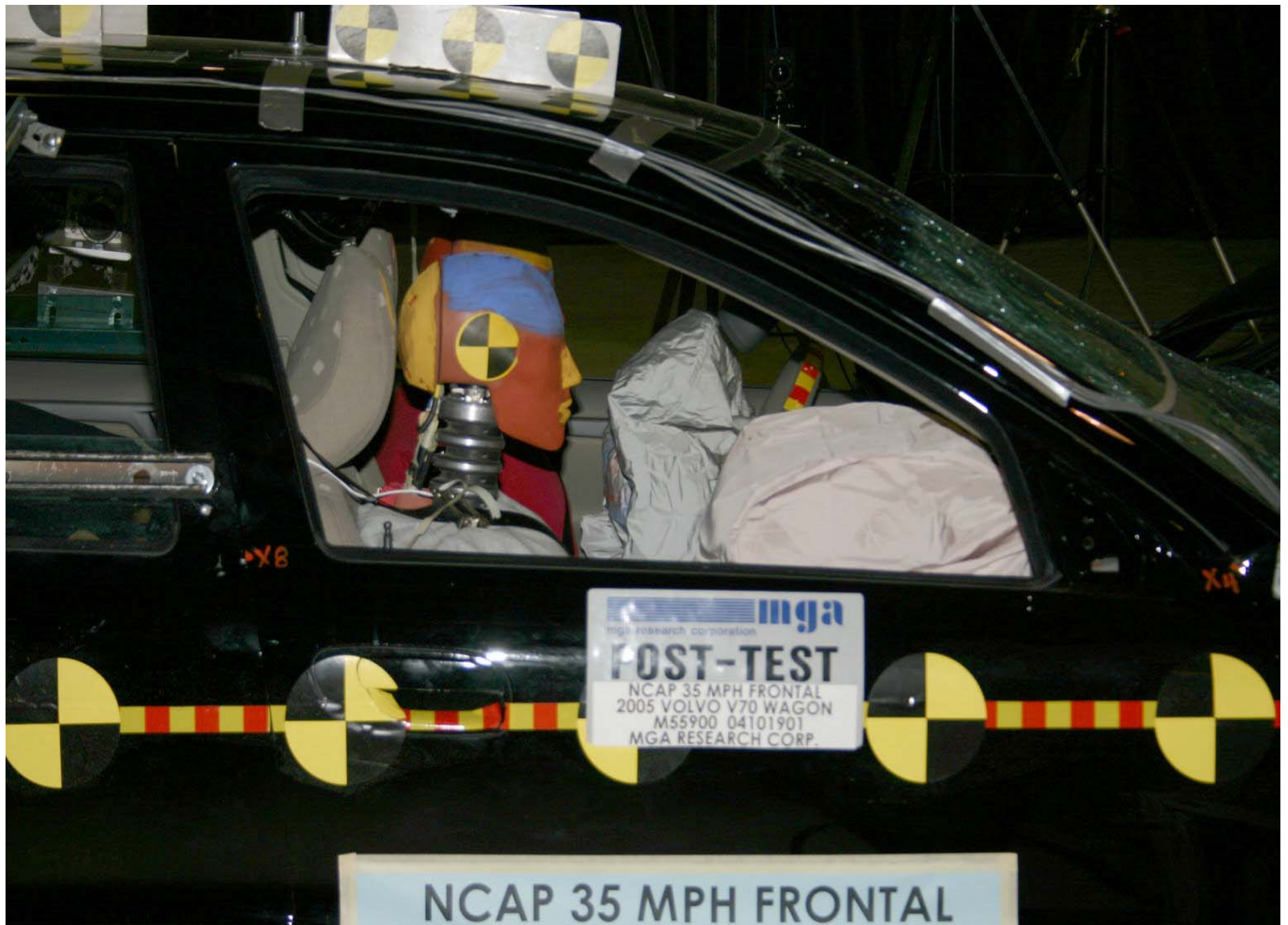


Post-Test Passenger Dummy Front View (head position)

A-52.



Pre-Test Passenger Dummy Position Right Side View



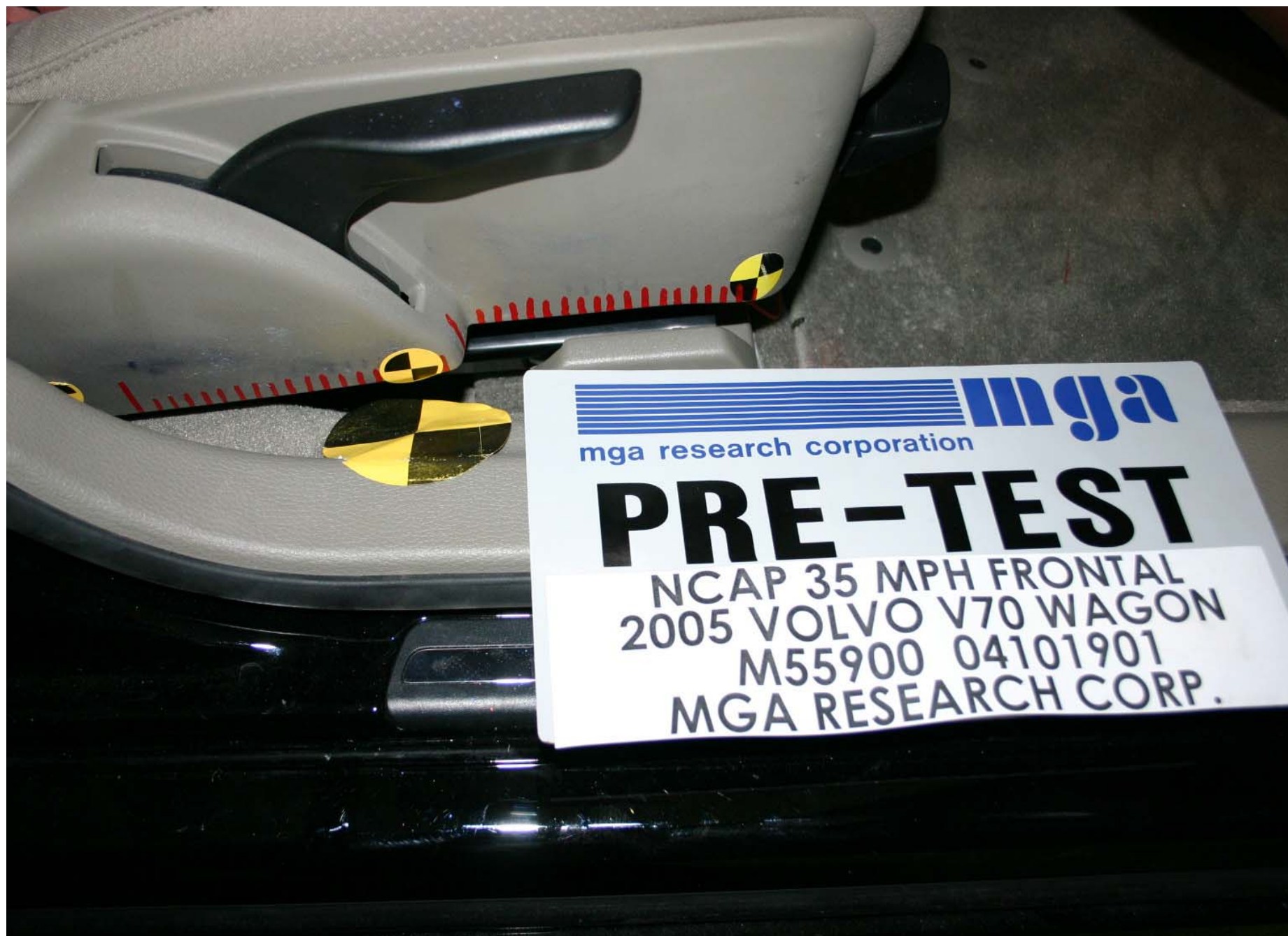
Post-Test Passenger Dummy Position Right Side View



Pre-Test Passenger Dummy Position Right Side View (Door Open)



Post-Test Passenger Dummy Position Right Side View (Door Open)



Pre-Test Passenger Dummy Seat Position



Post-Test Passenger Dummy Seat Position



Pre-Test Passenger Dummy Feet Position



Post-Test Passenger Dummy Feet Position



Pre-Test Passenger Side Knee Bolster View



Post-Test Passenger Side Knee Bolster View



Pre-Test Passenger Side Floor Pan View



Post-Test Passenger Side Floor Pan View

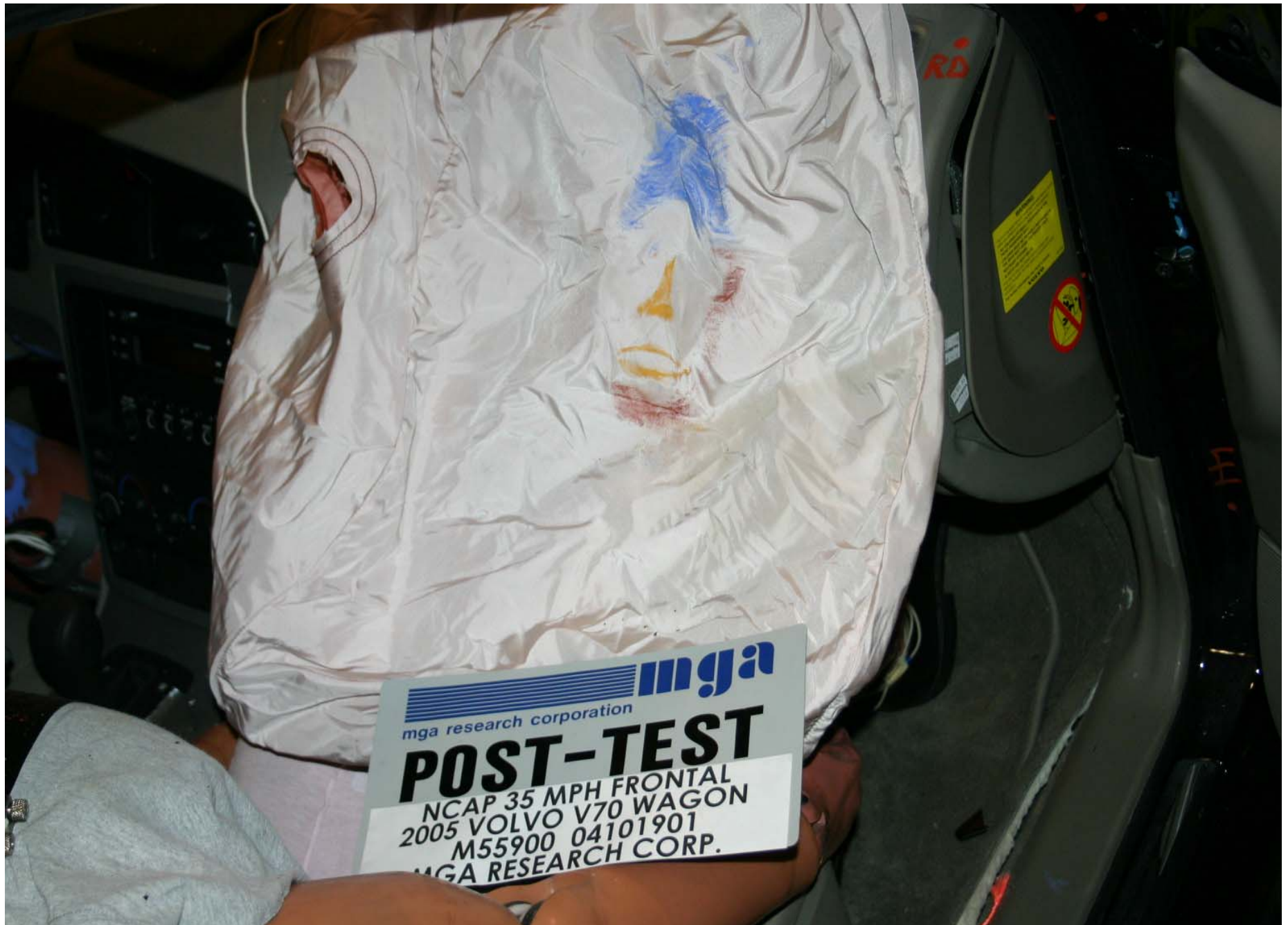
A-64.



Post-Test Passenger Dummy Head Contact



Post-Test Passenger Dummy Knee Contact



Post-Test Passenger Dummy Airbag Contact

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Rollover 90 Degrees



Rollover 180 Degrees



Rollover 270 Degrees



Rollover 360 Degrees



Vehicle Impact

APPENDIX B

DUMMY AND VEHICLE RESPONSE DATA TRACES

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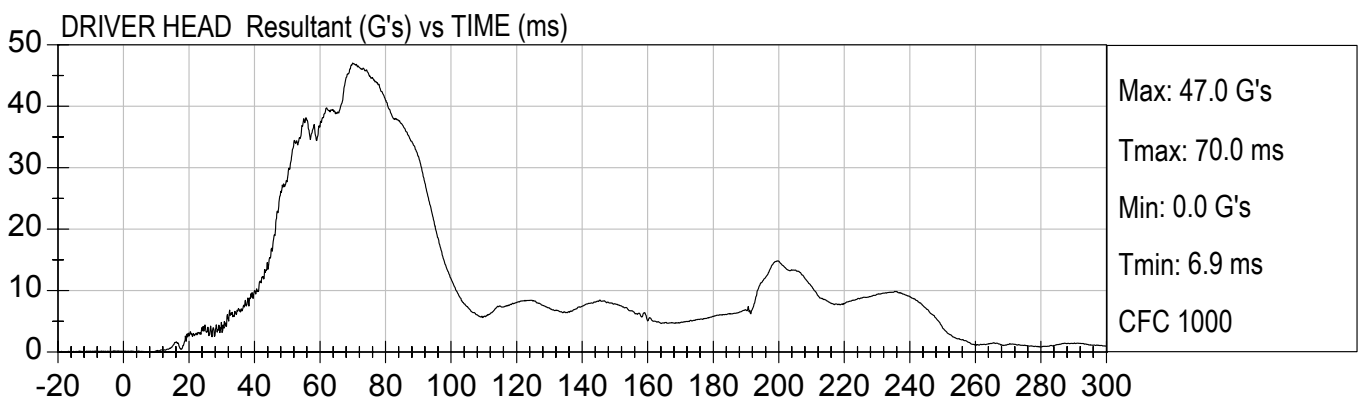
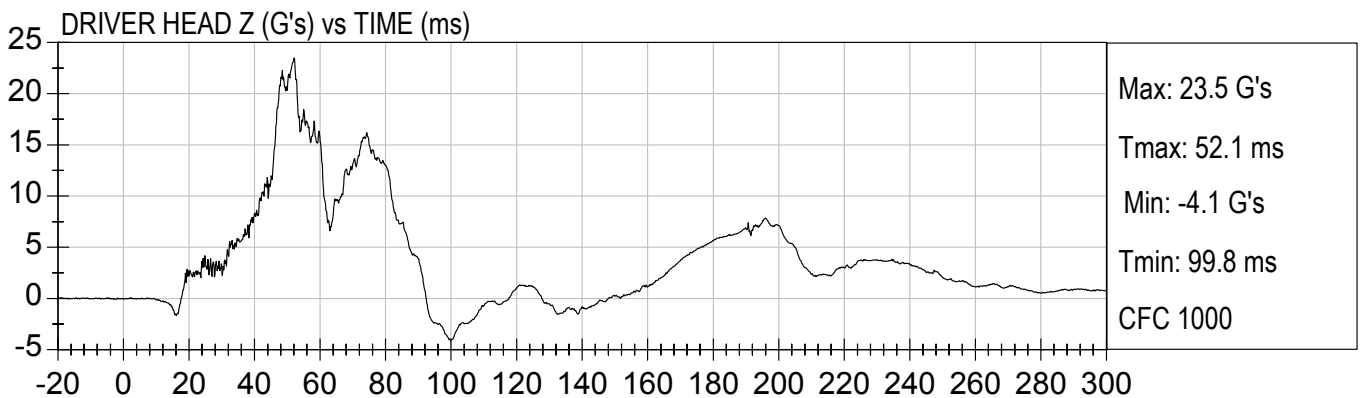
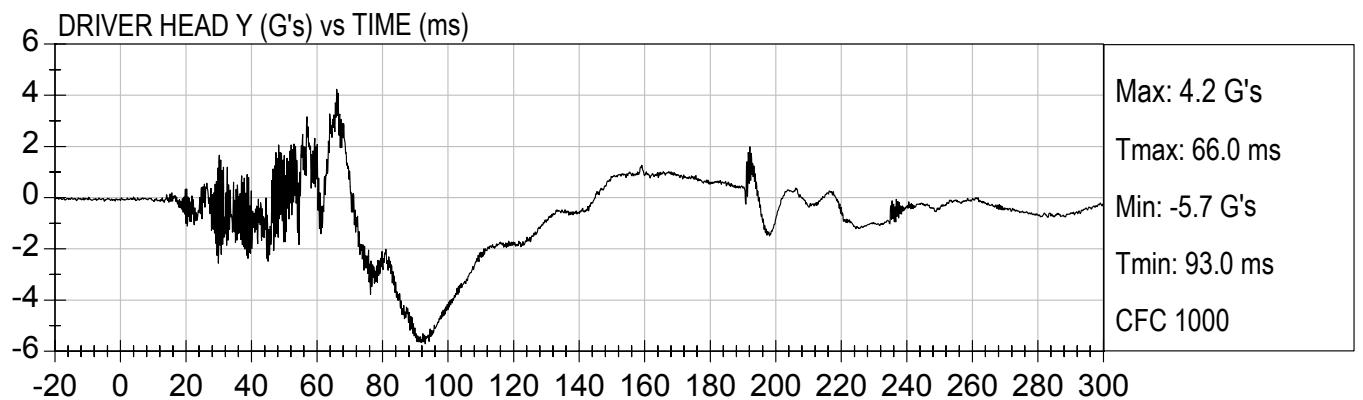
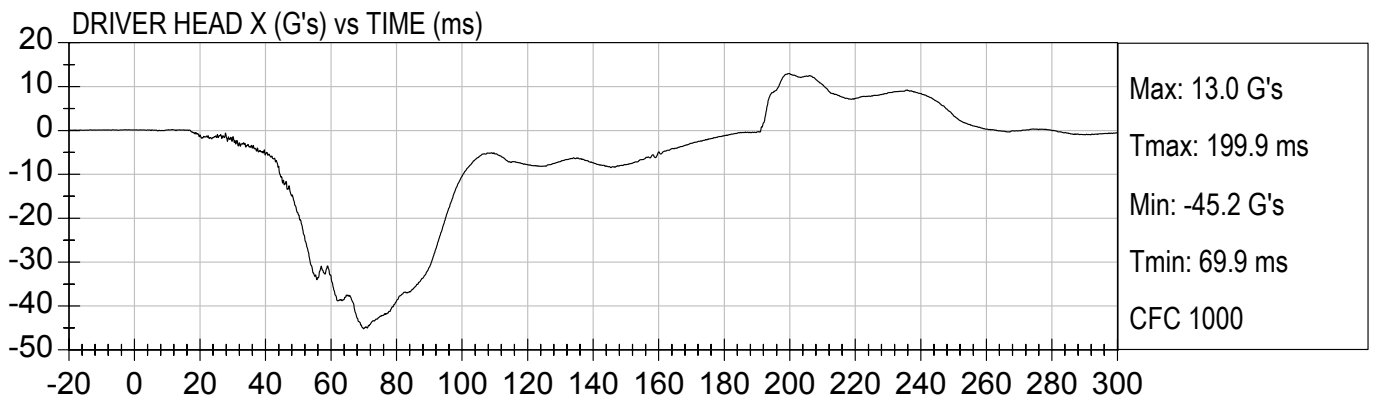
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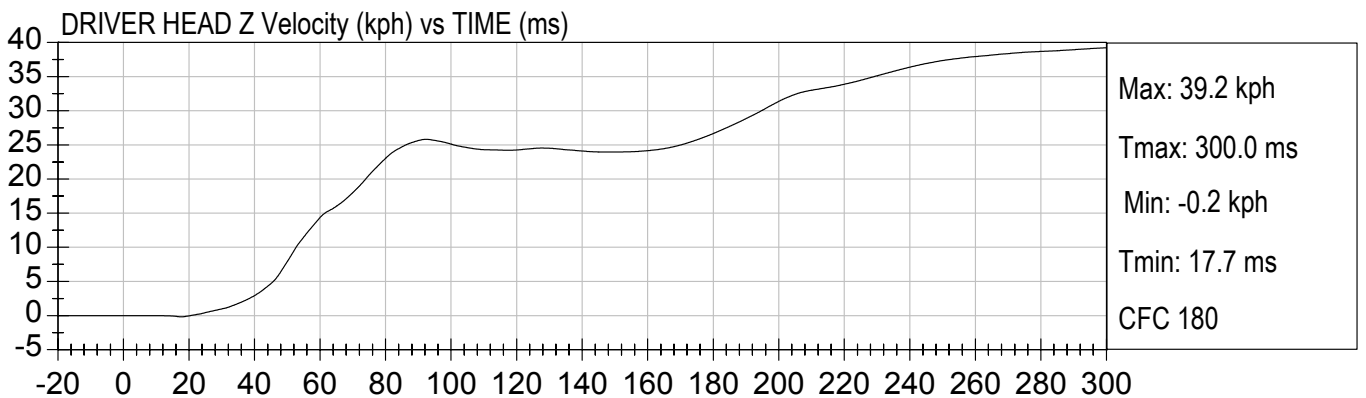
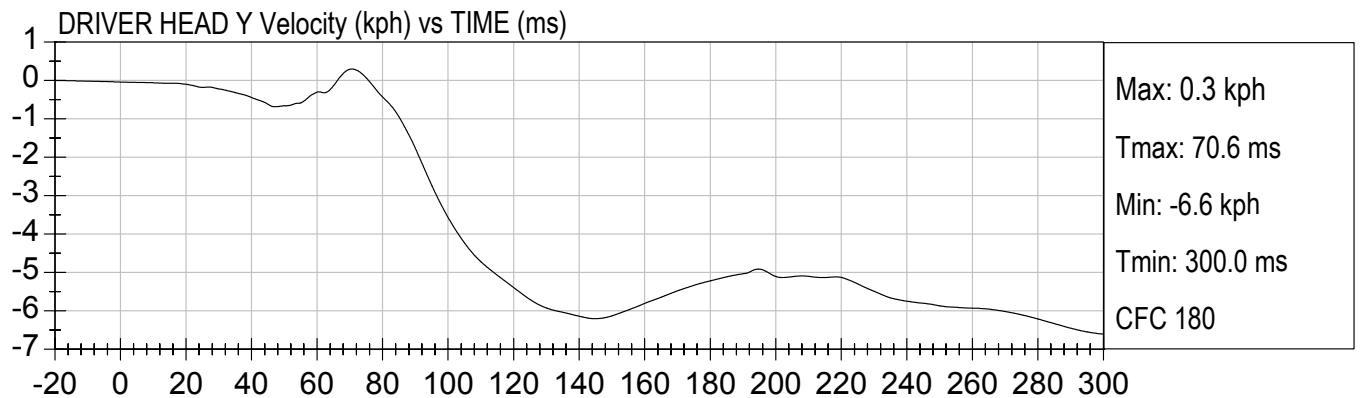
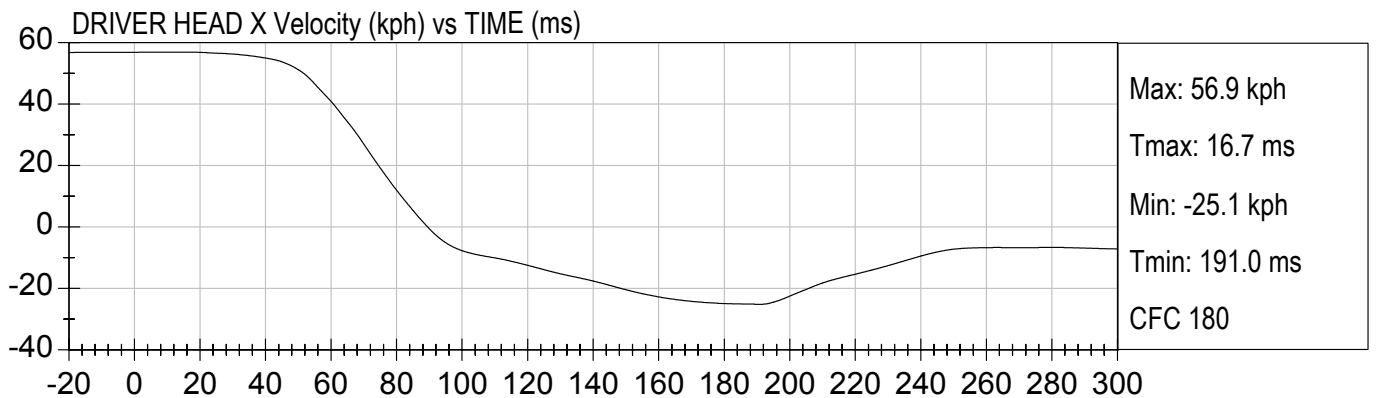
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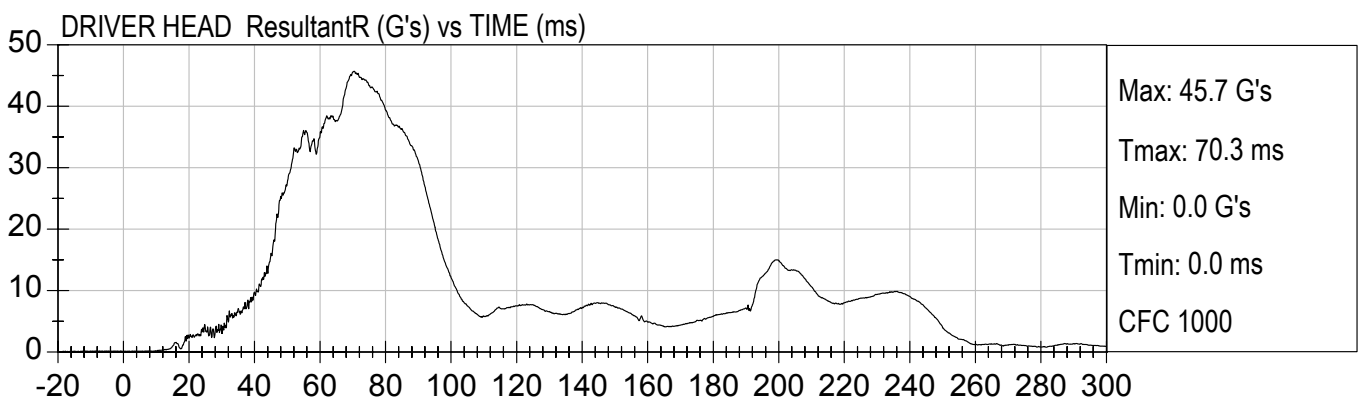
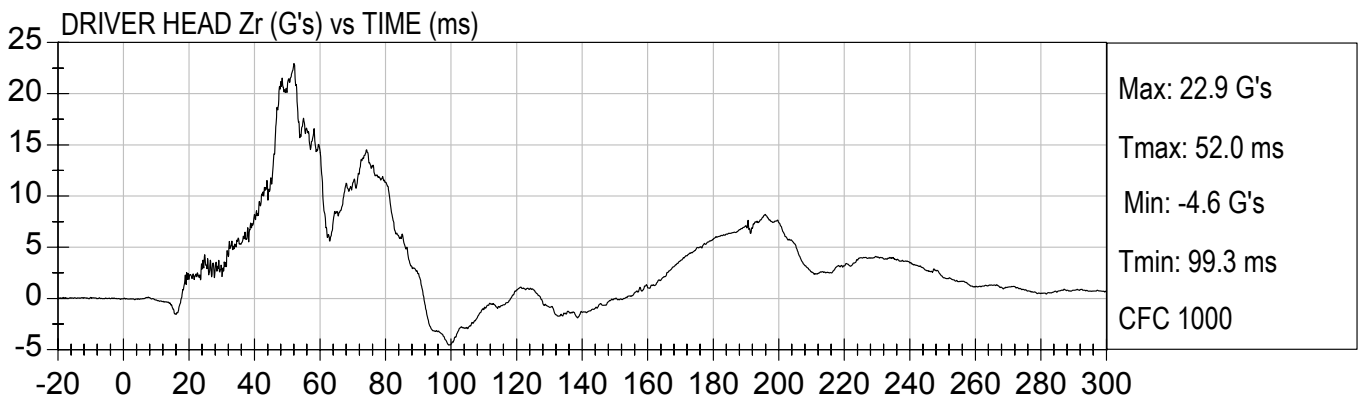
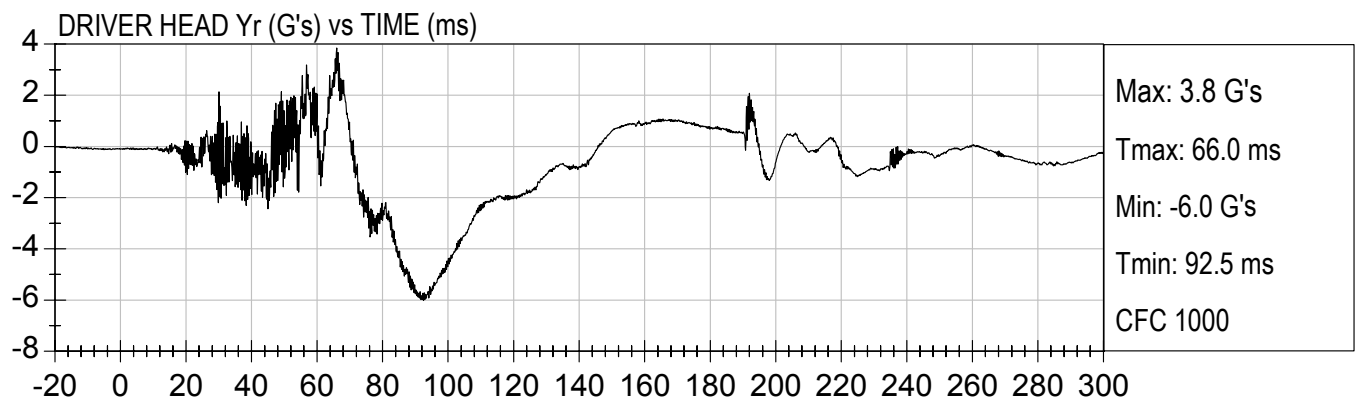
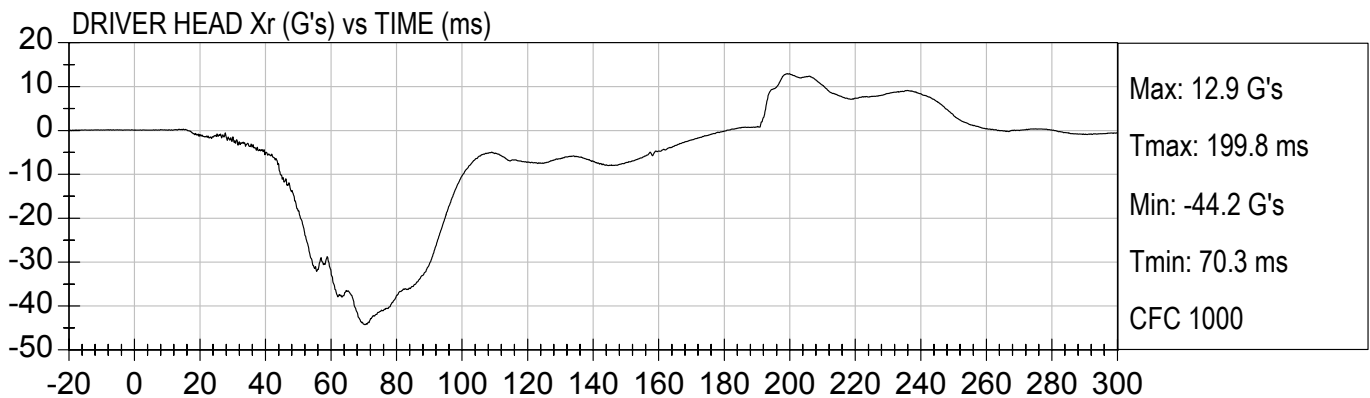


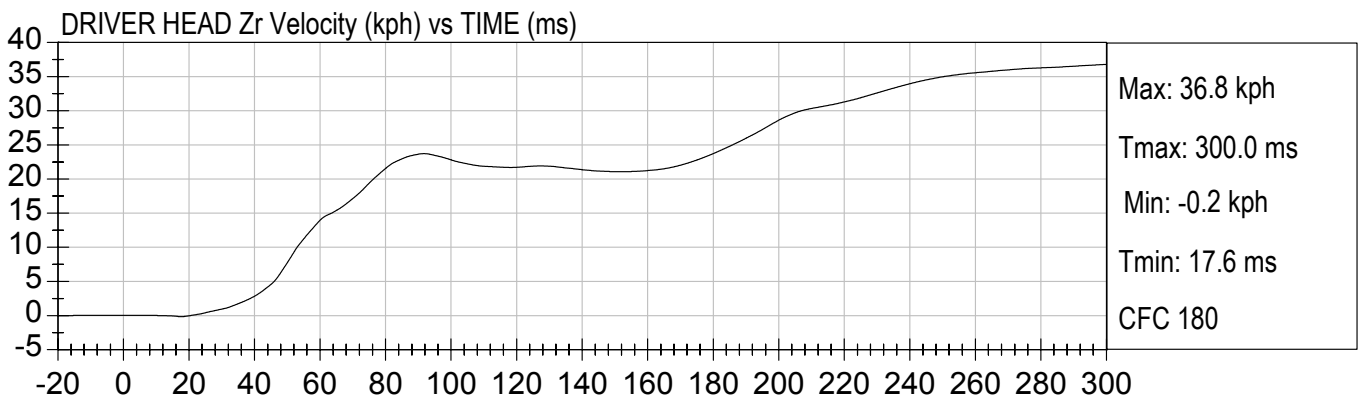
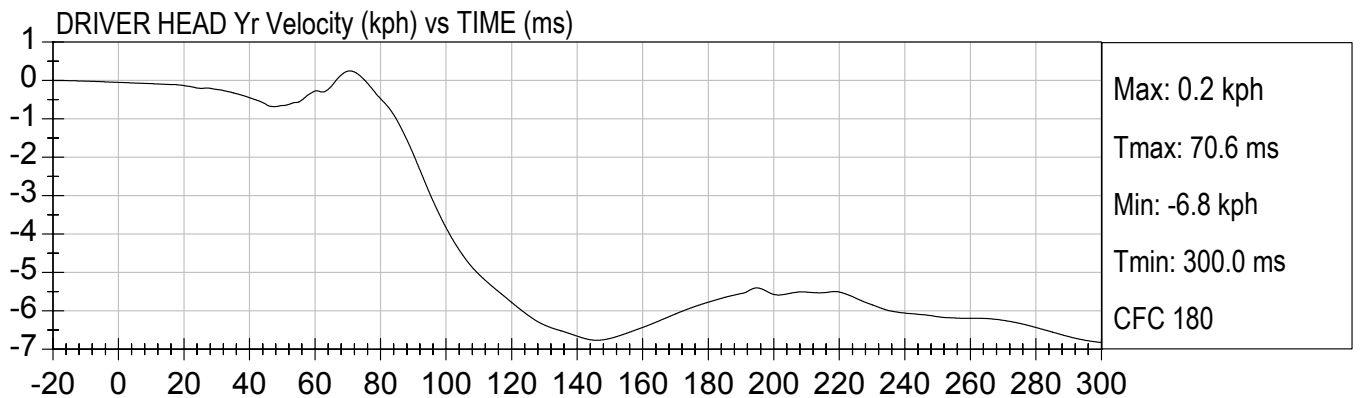
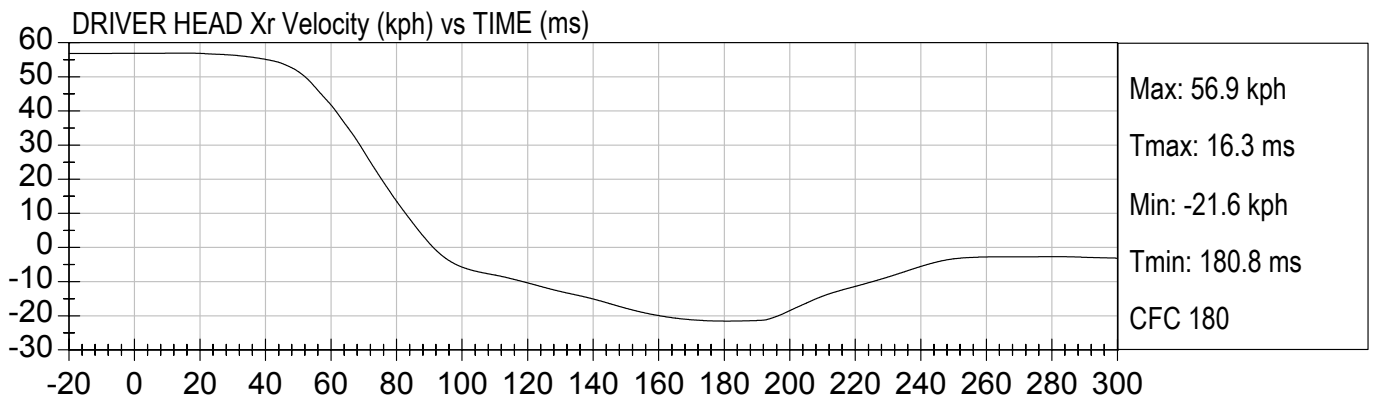
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)







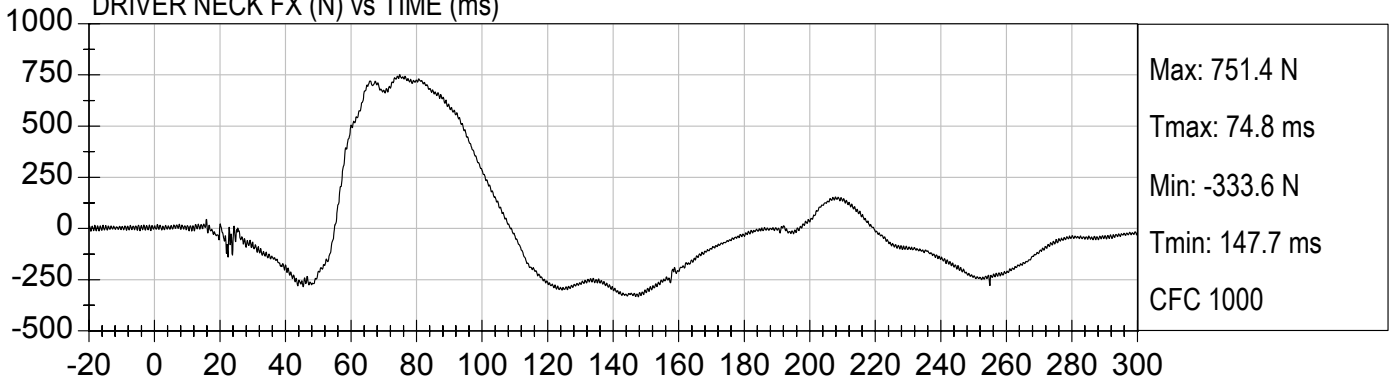




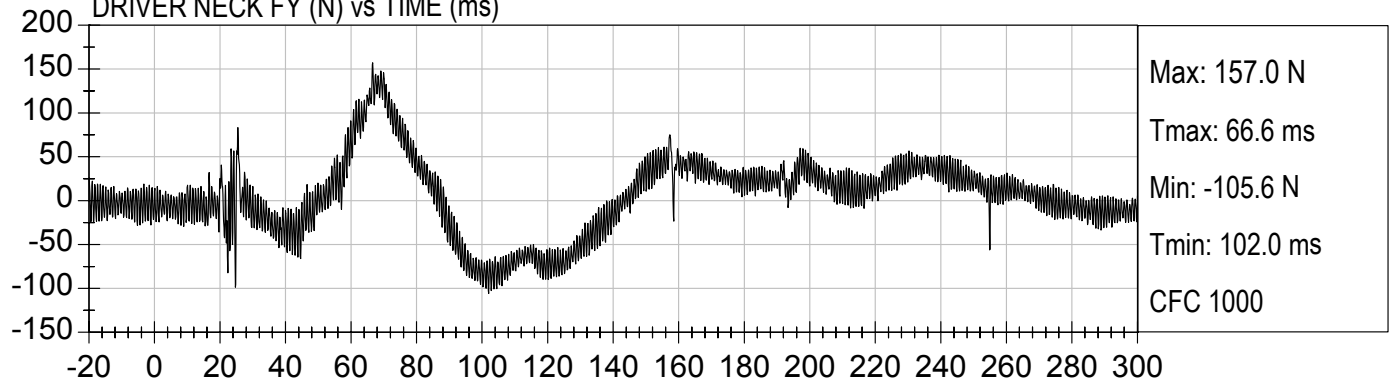
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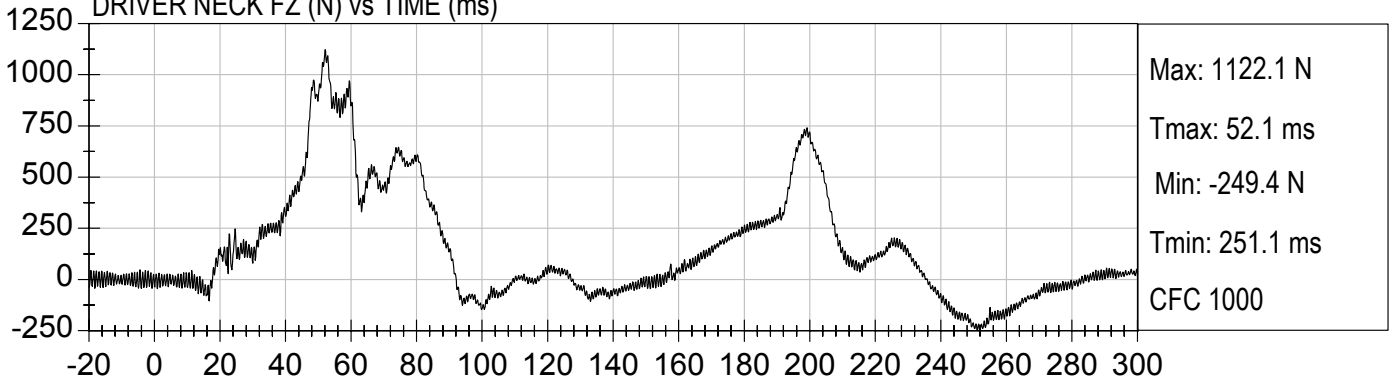
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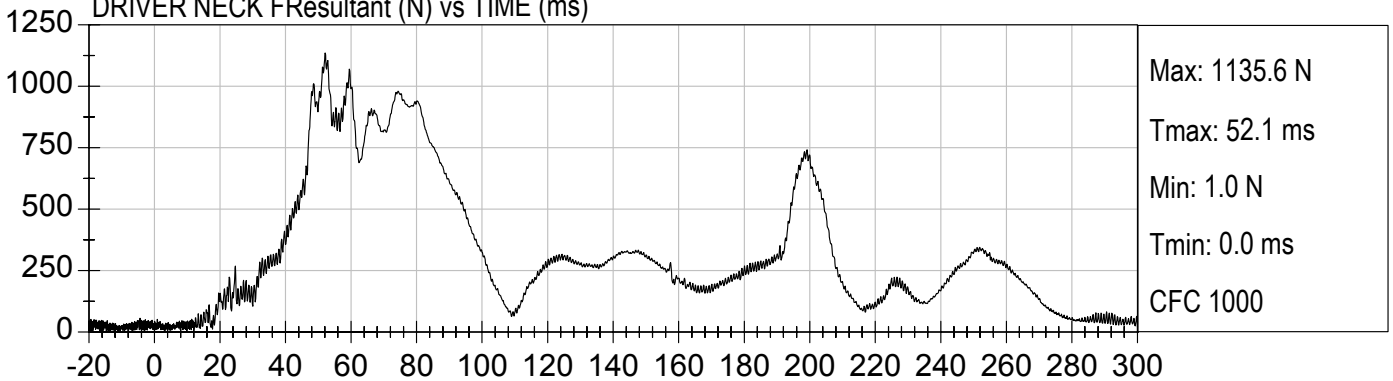
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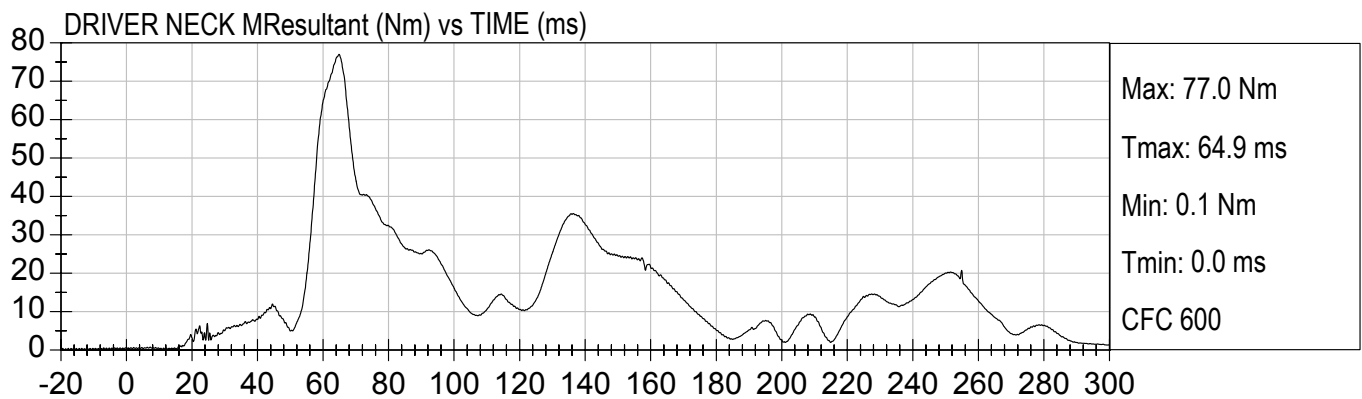
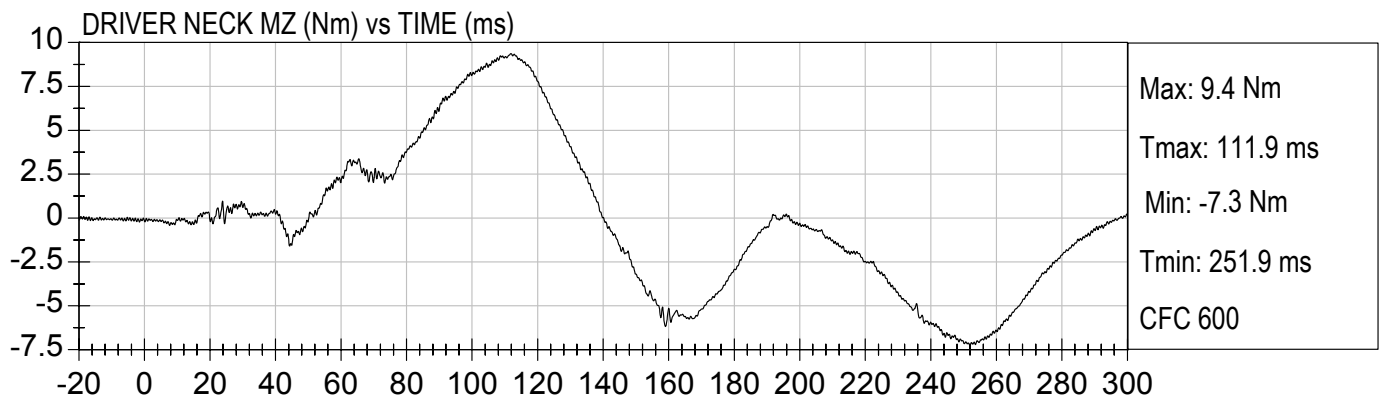
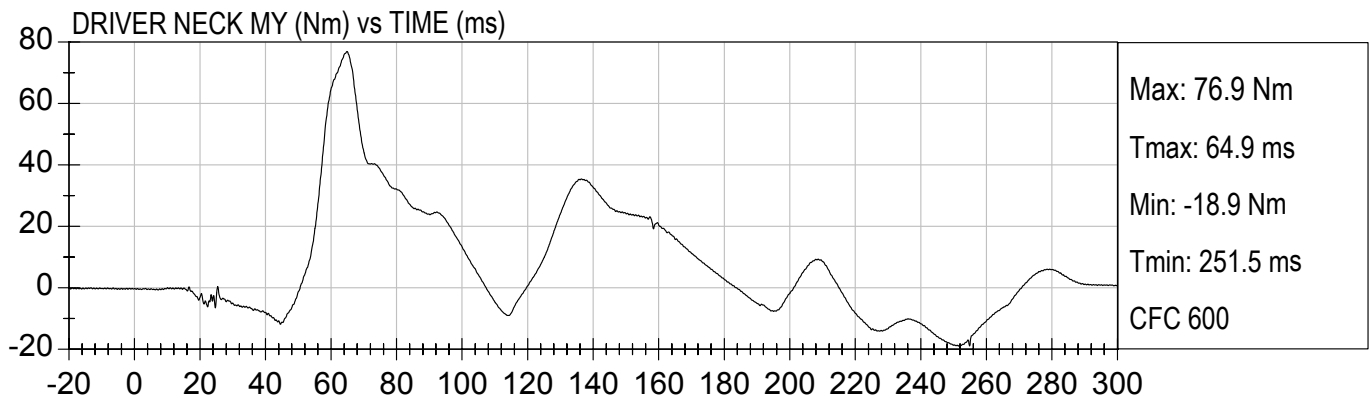
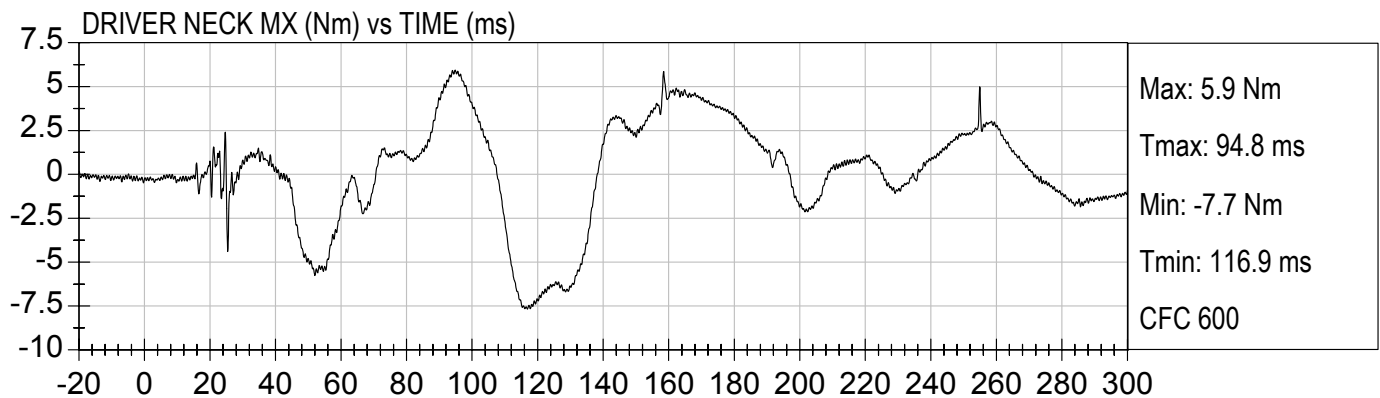
DRIVER NECK FResultant (N) vs TIME (ms)





35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

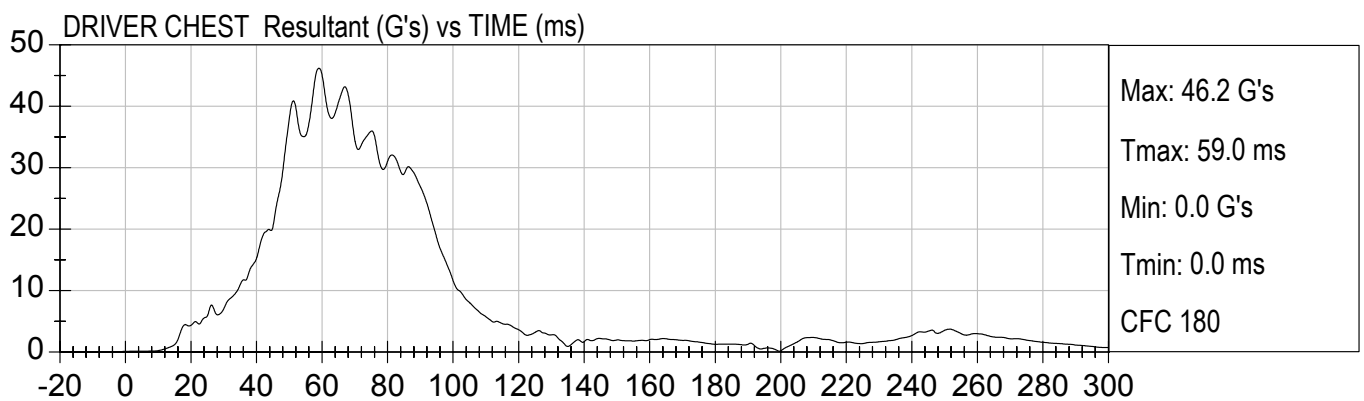
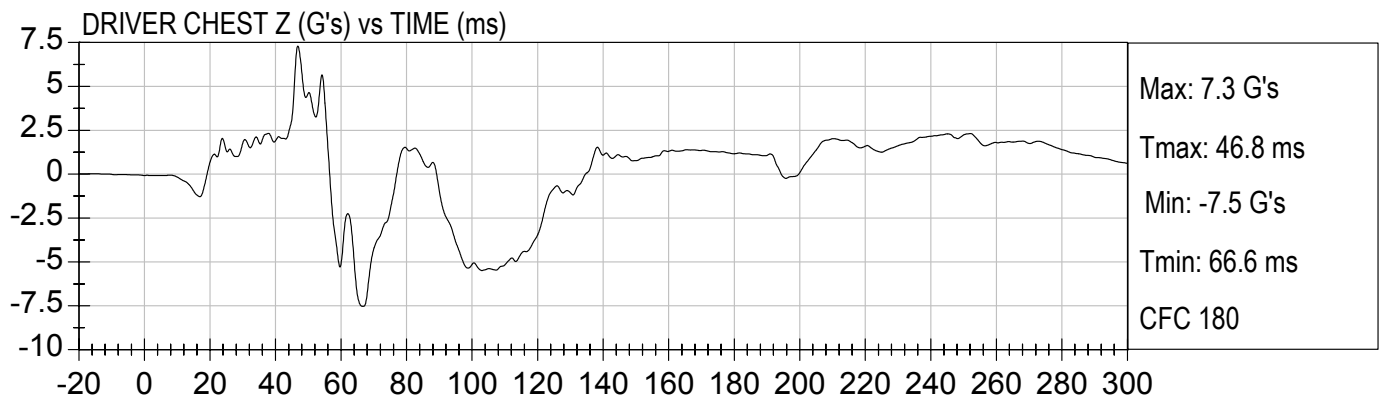
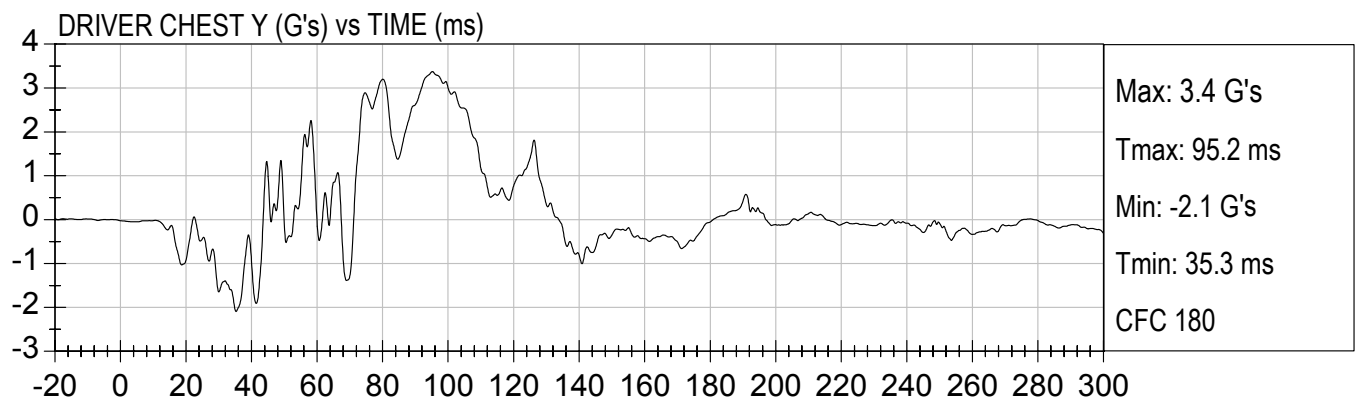
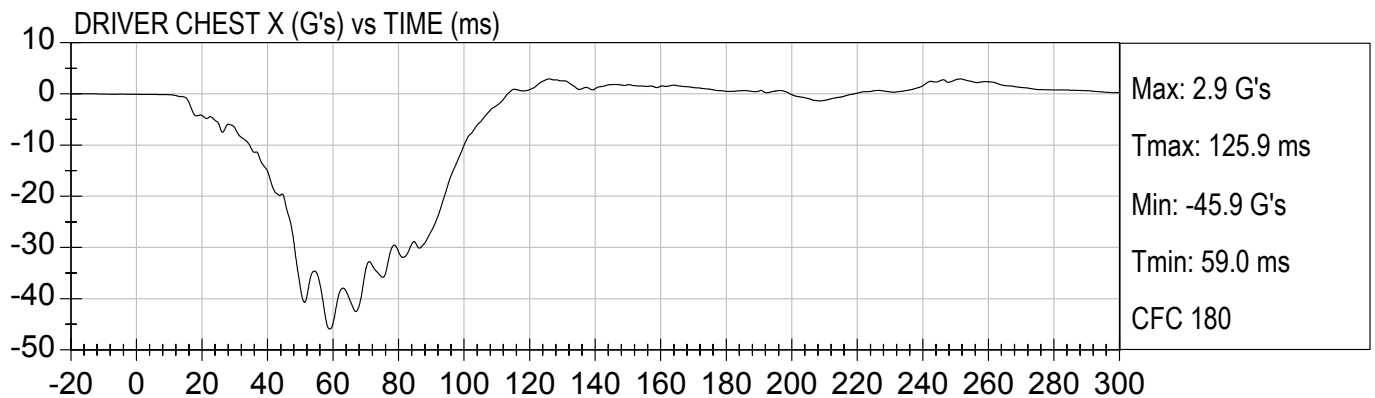
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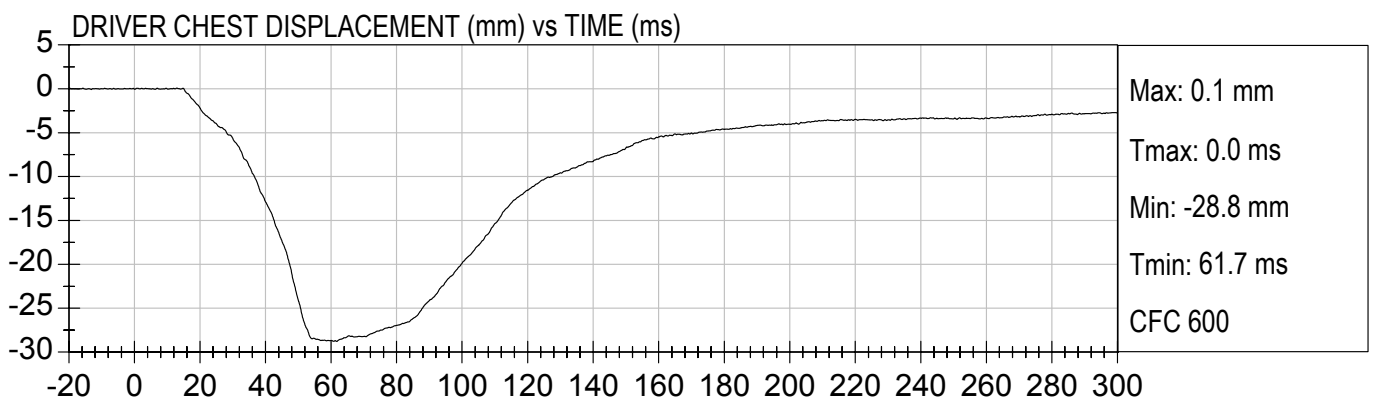
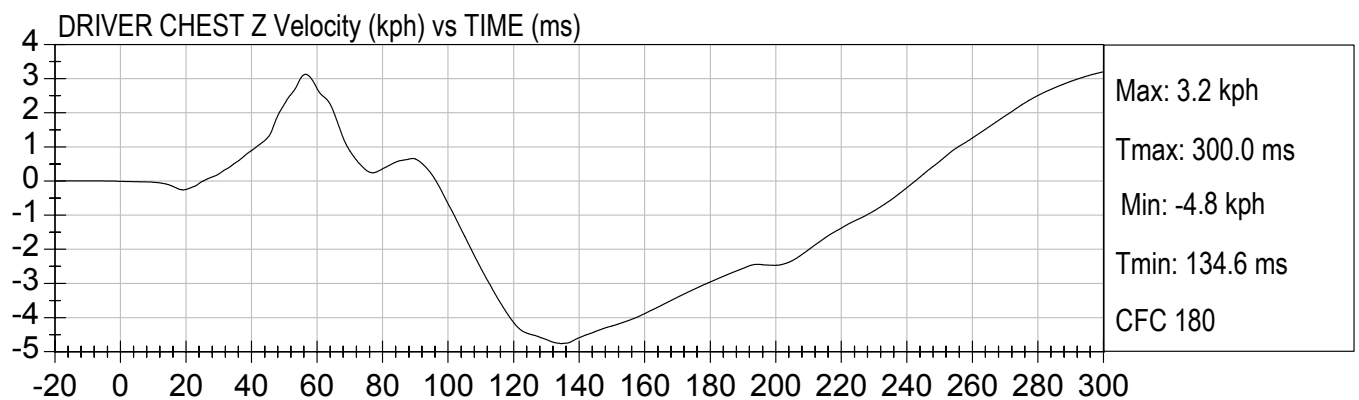
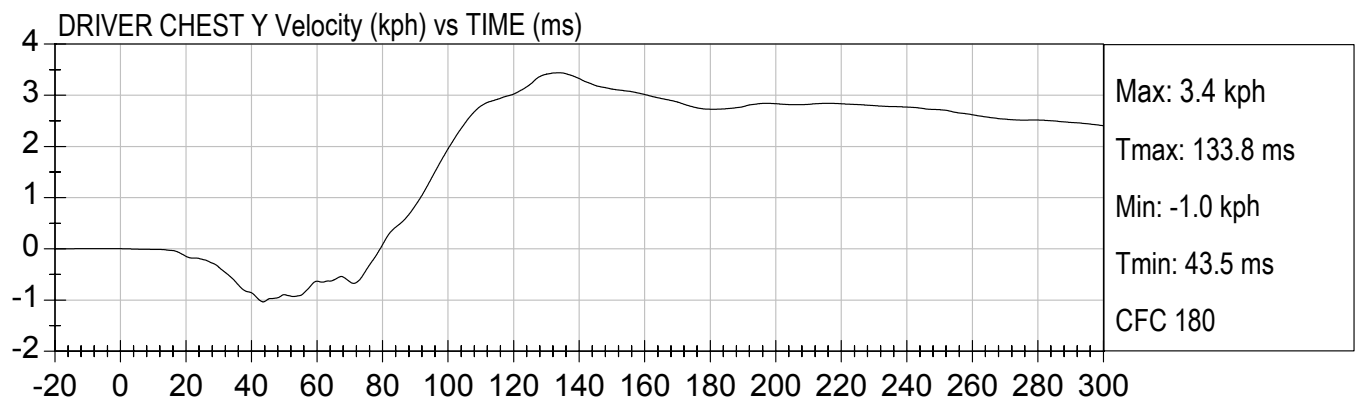
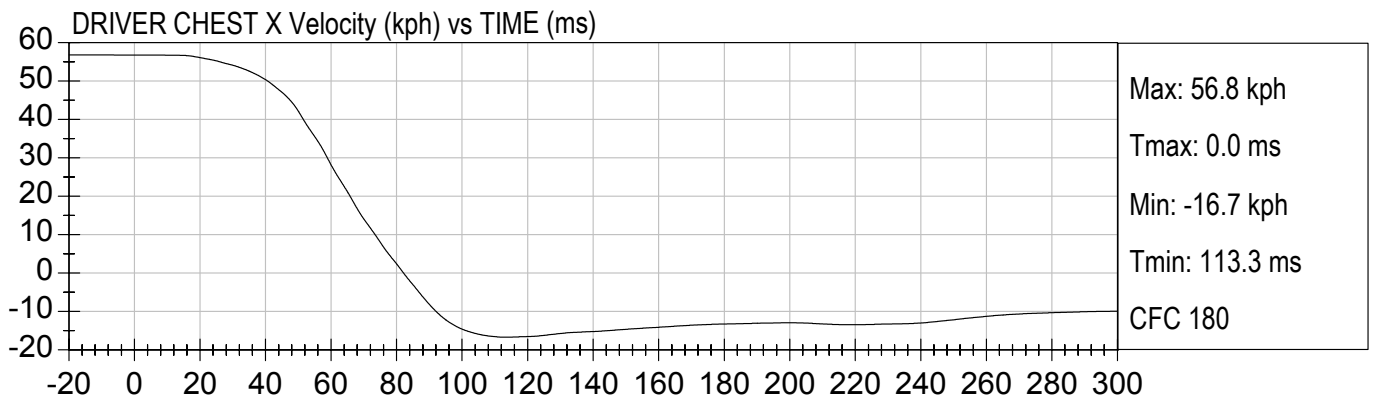


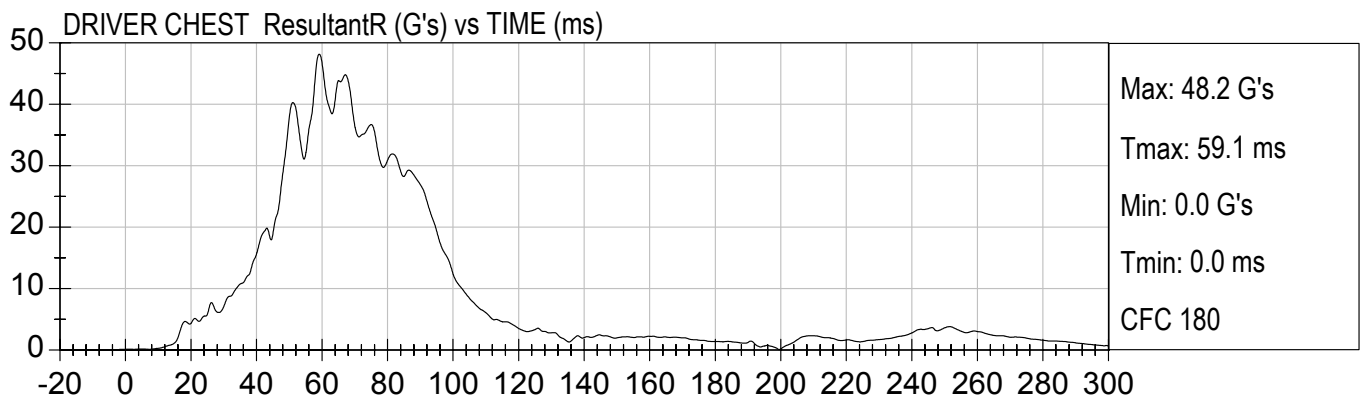
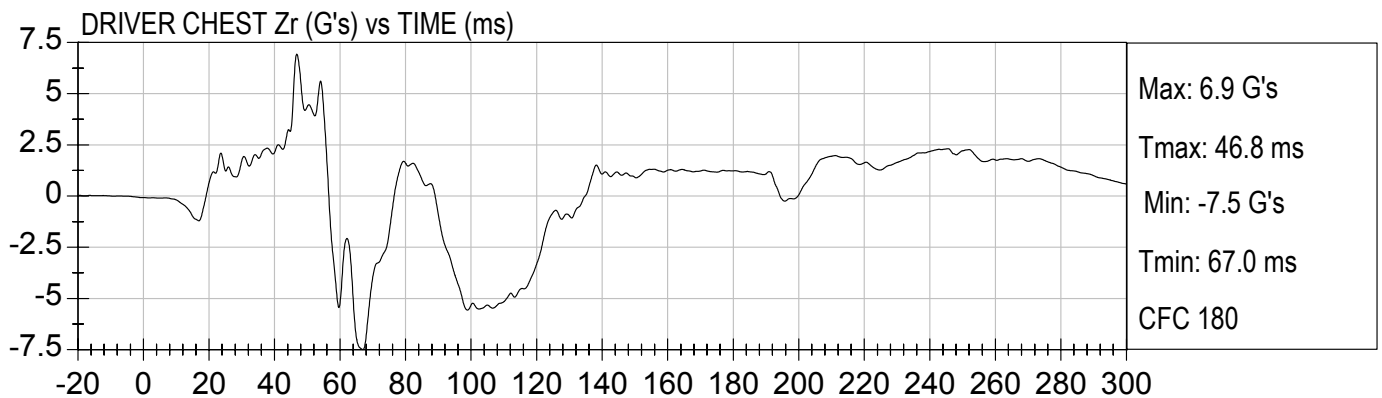
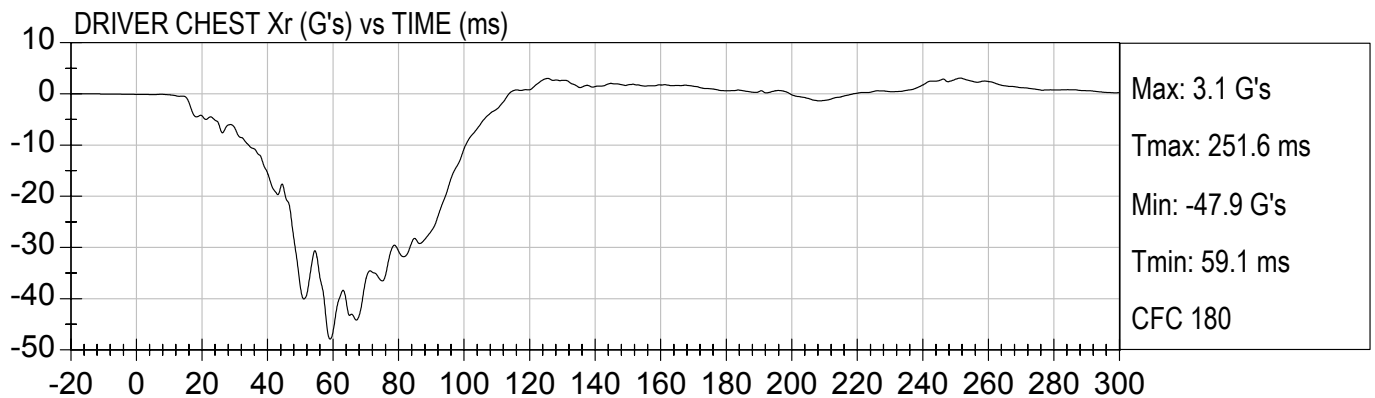


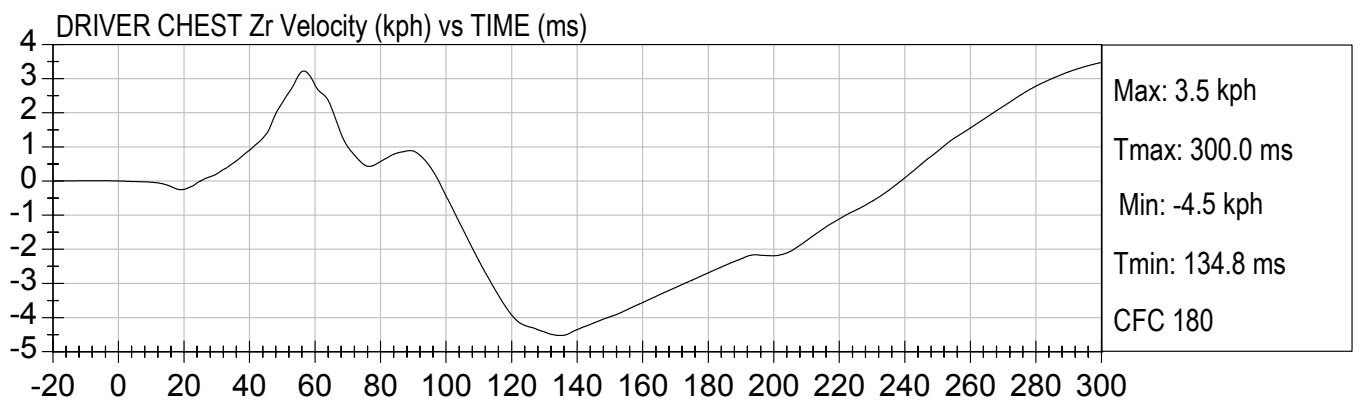
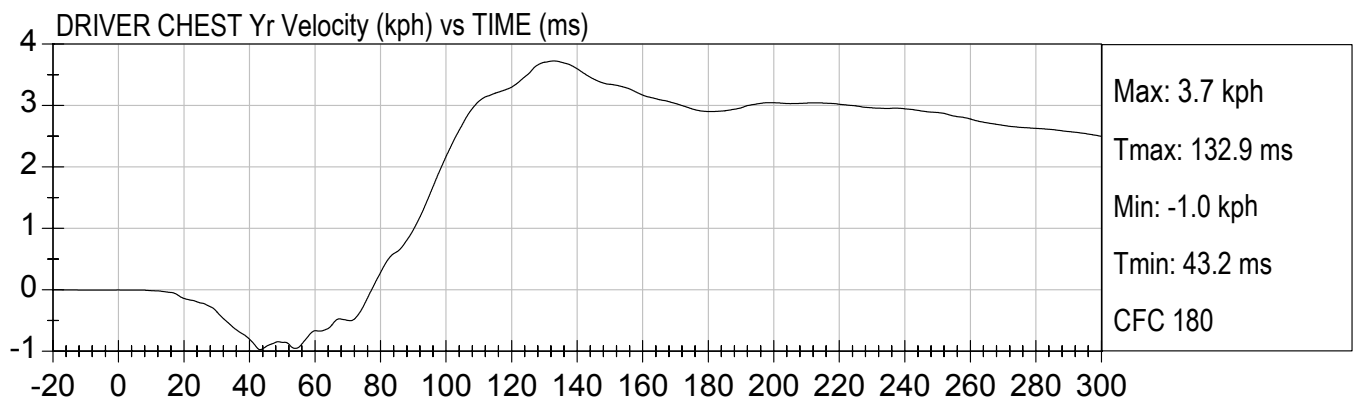
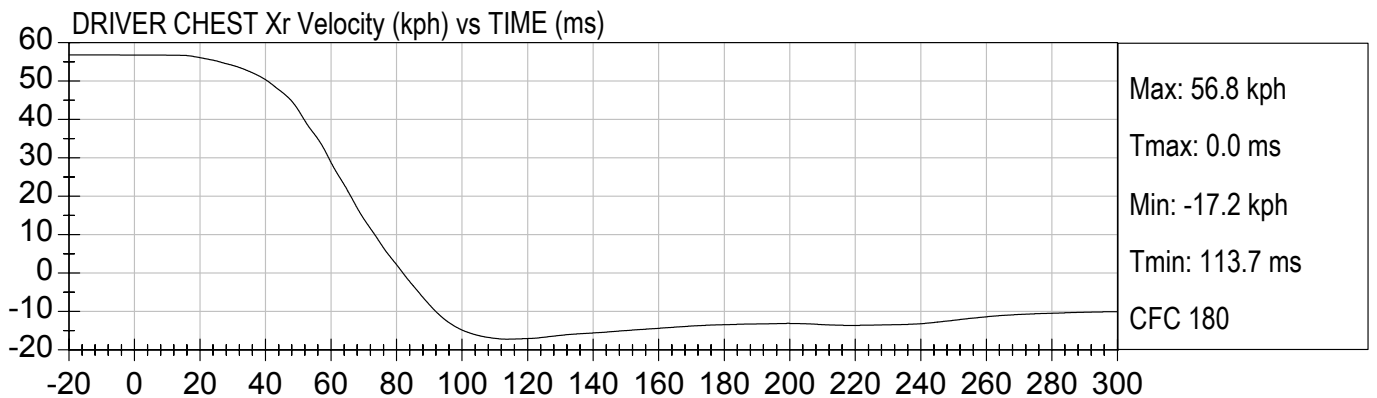
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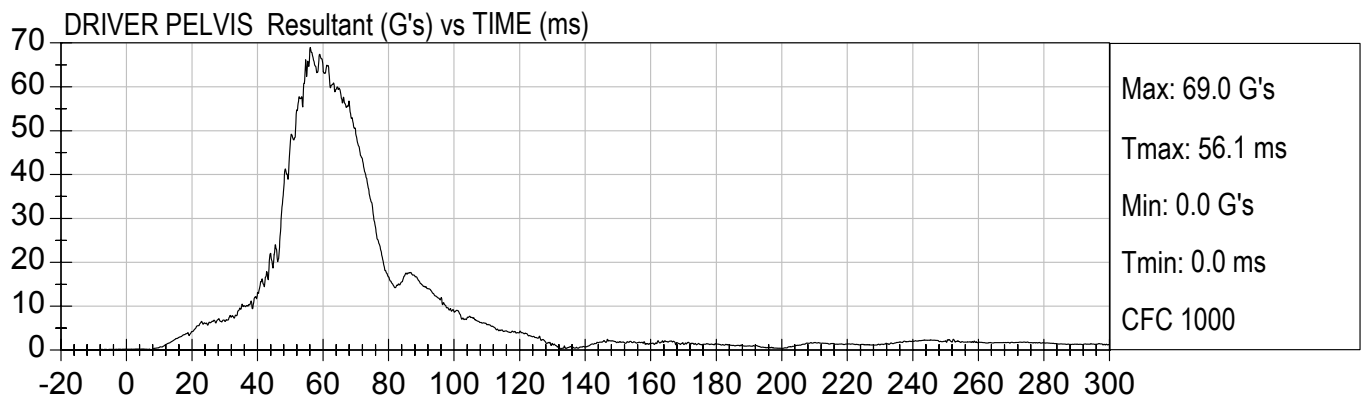
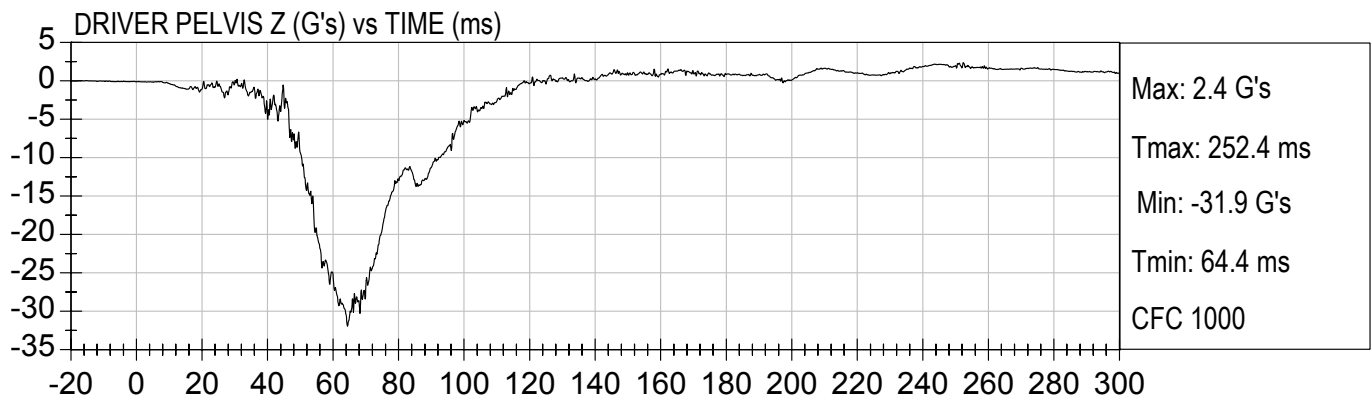
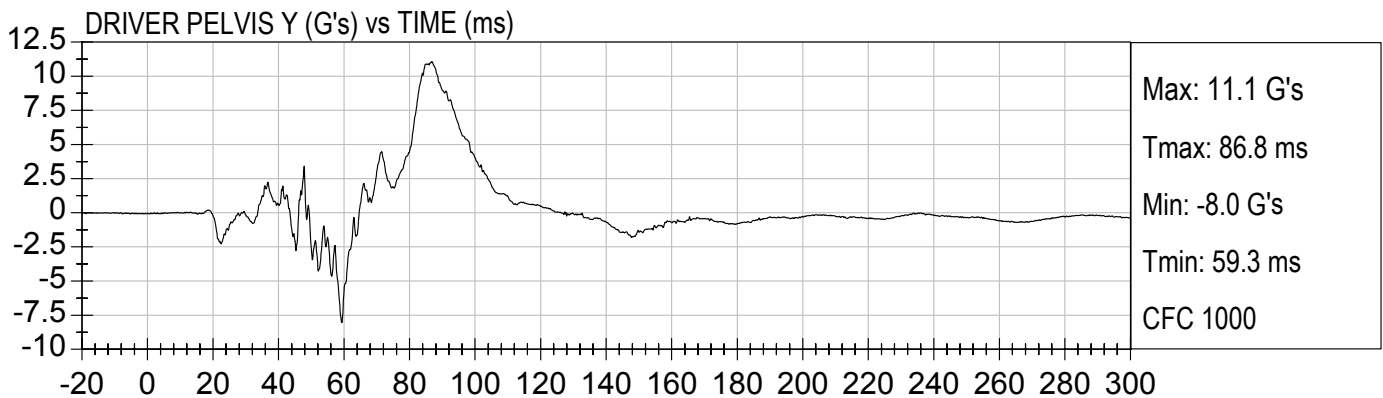
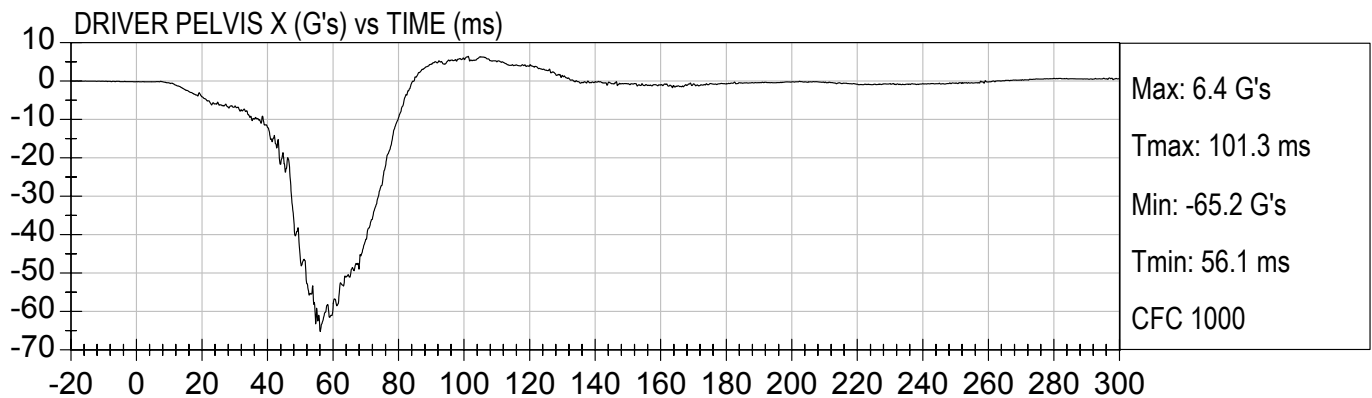


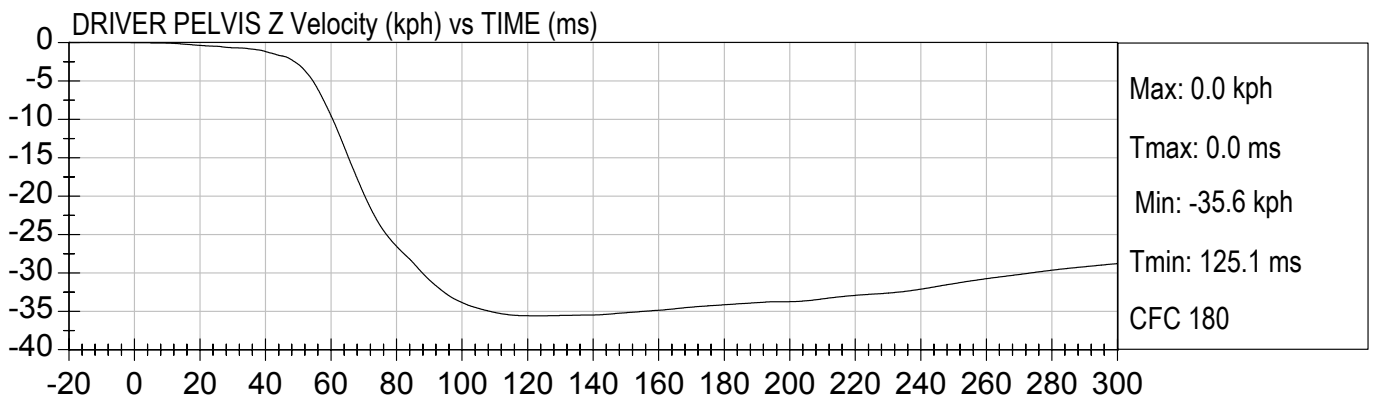
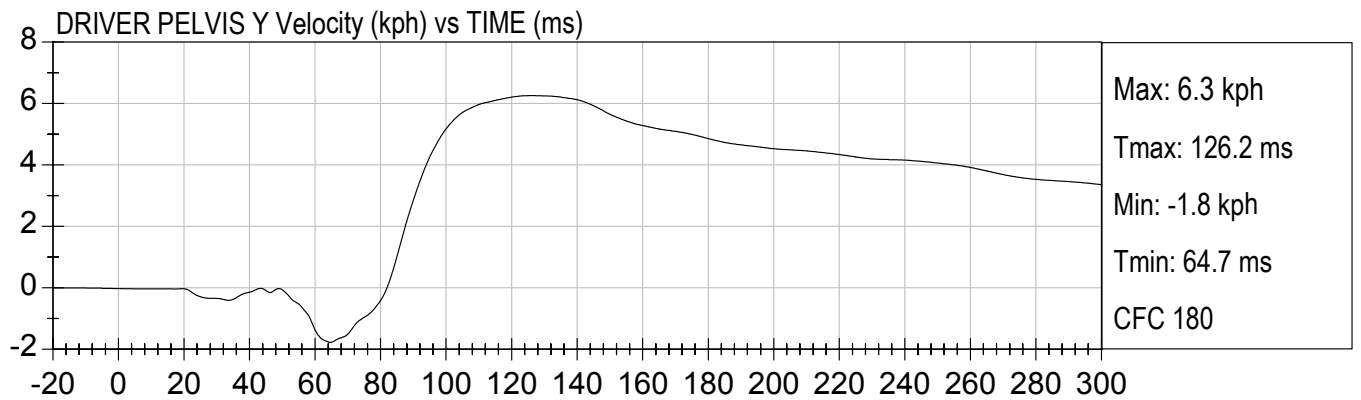
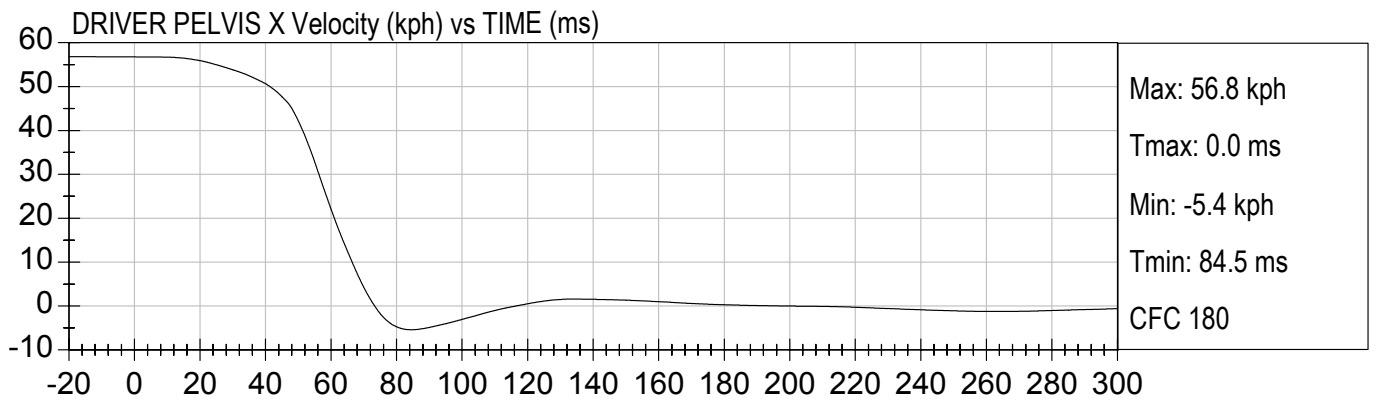




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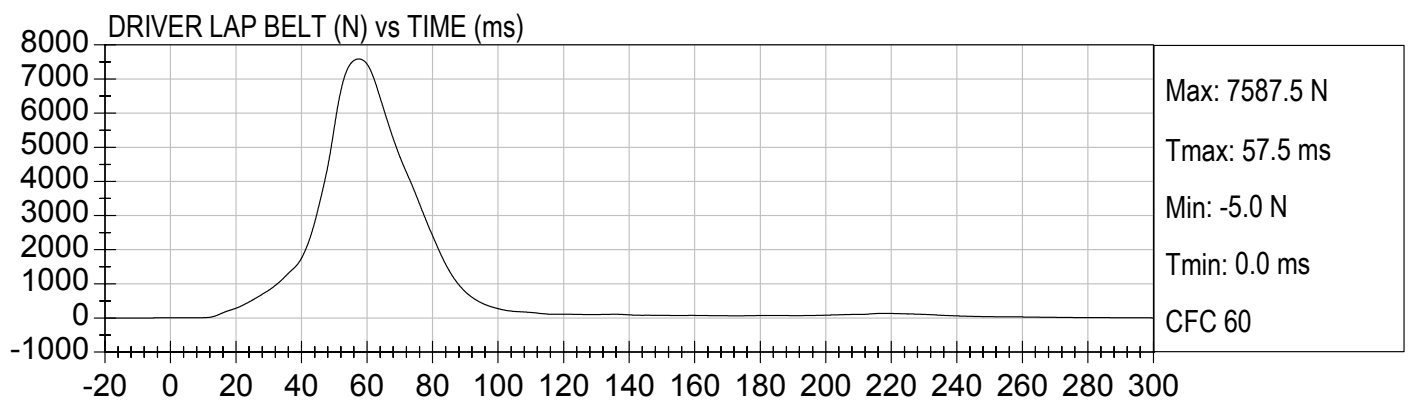
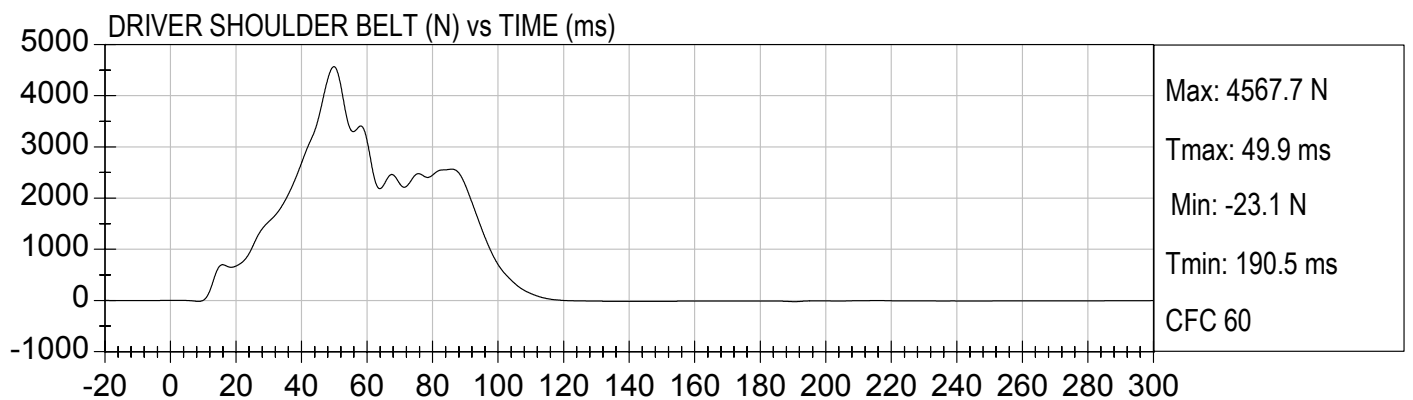
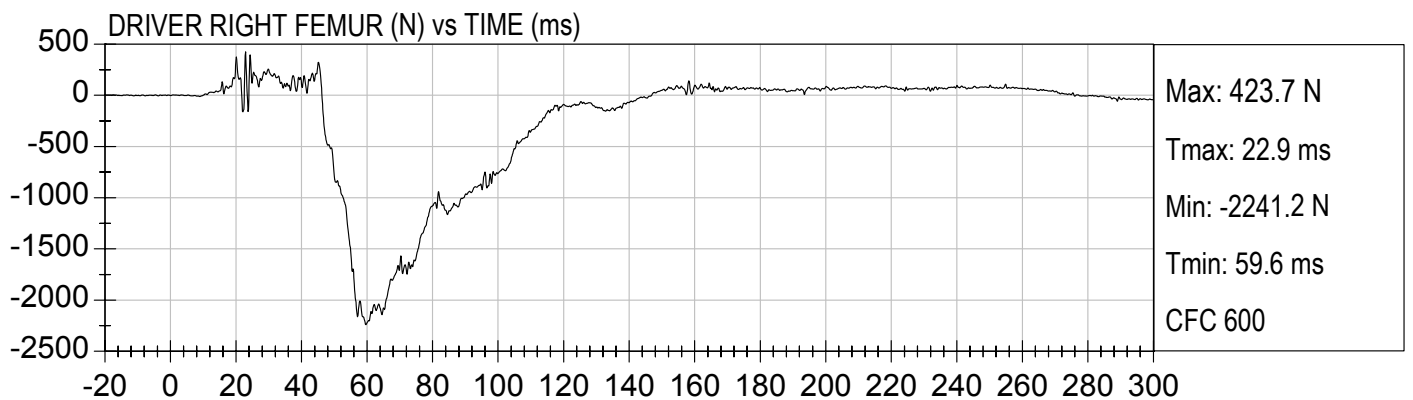
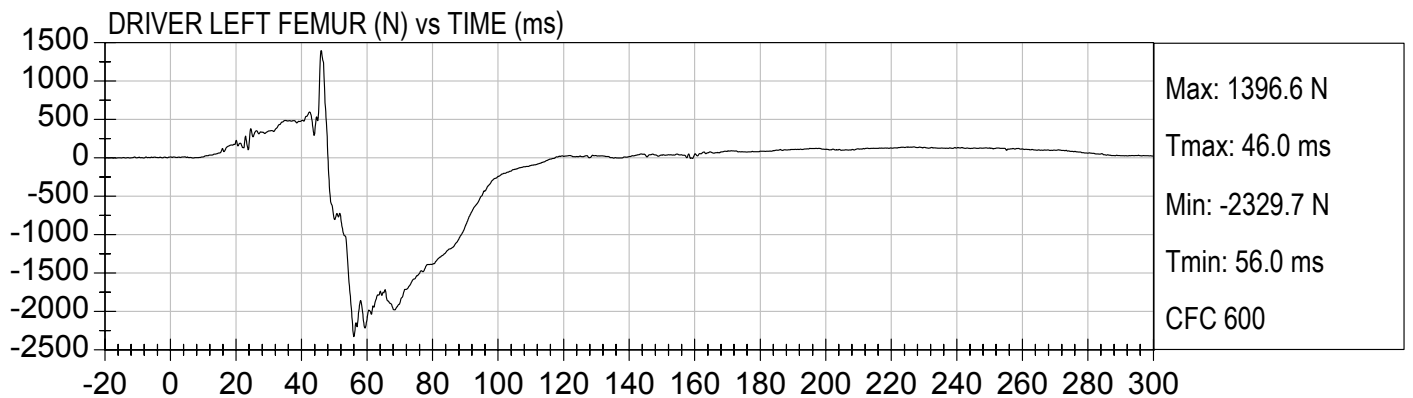


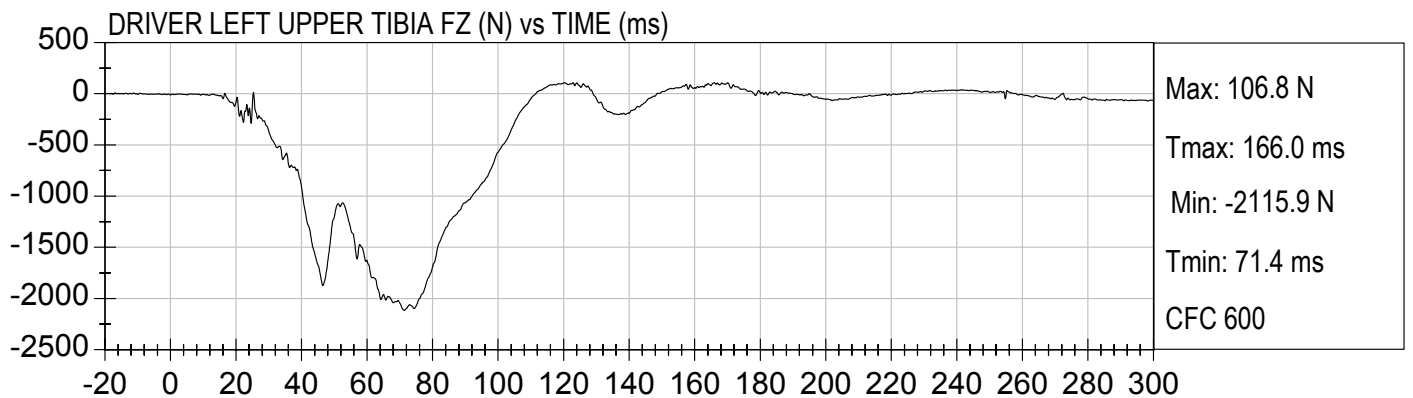
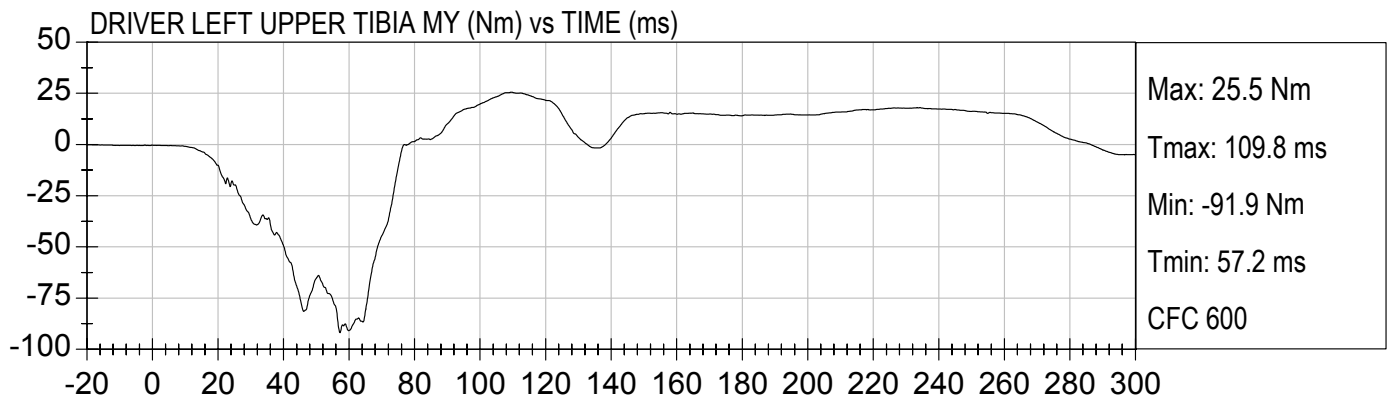
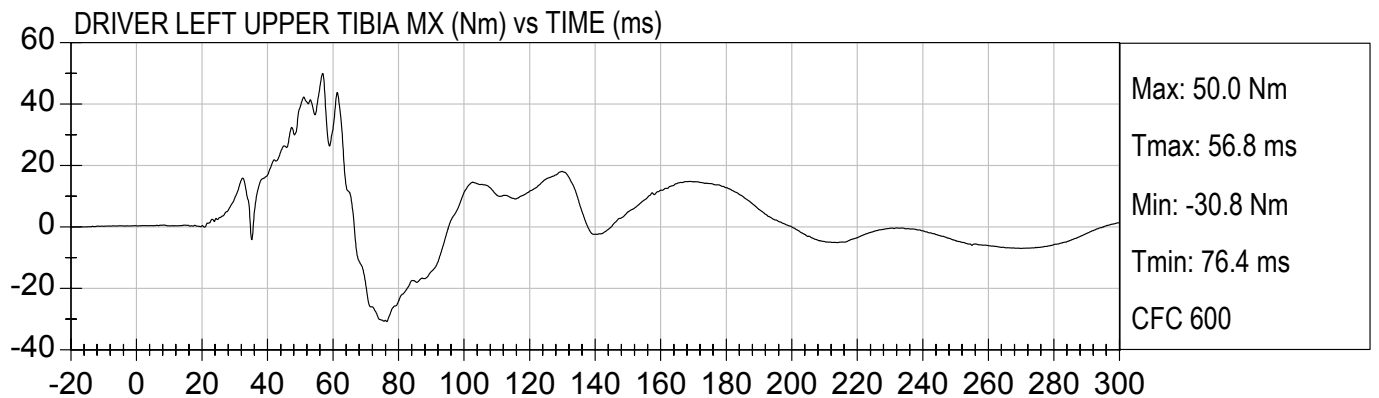




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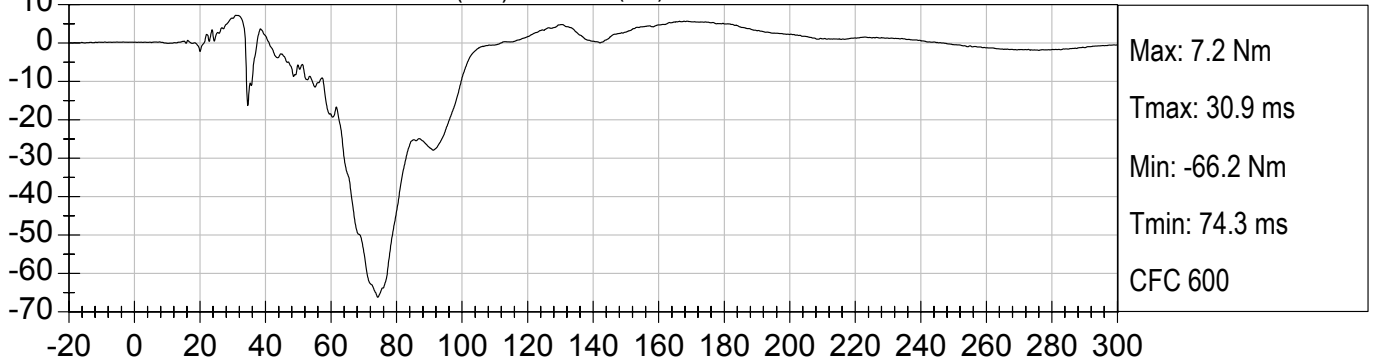
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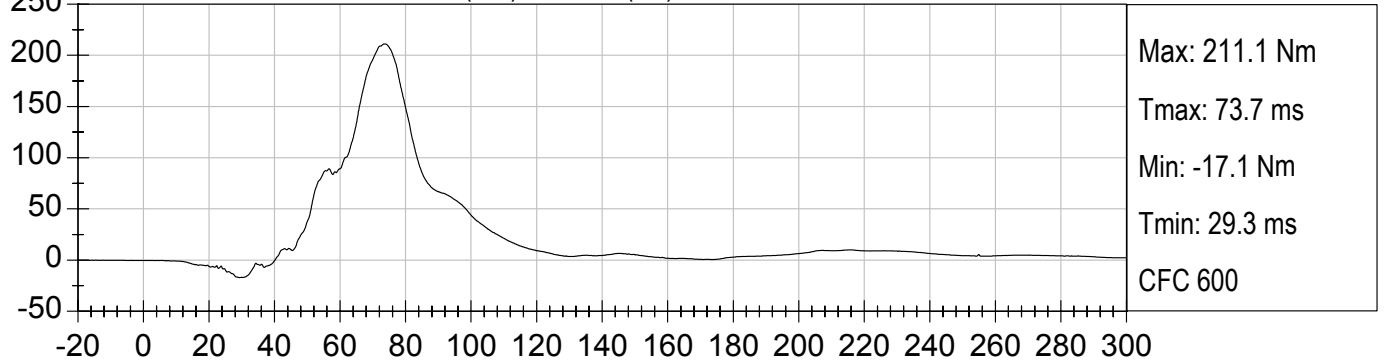




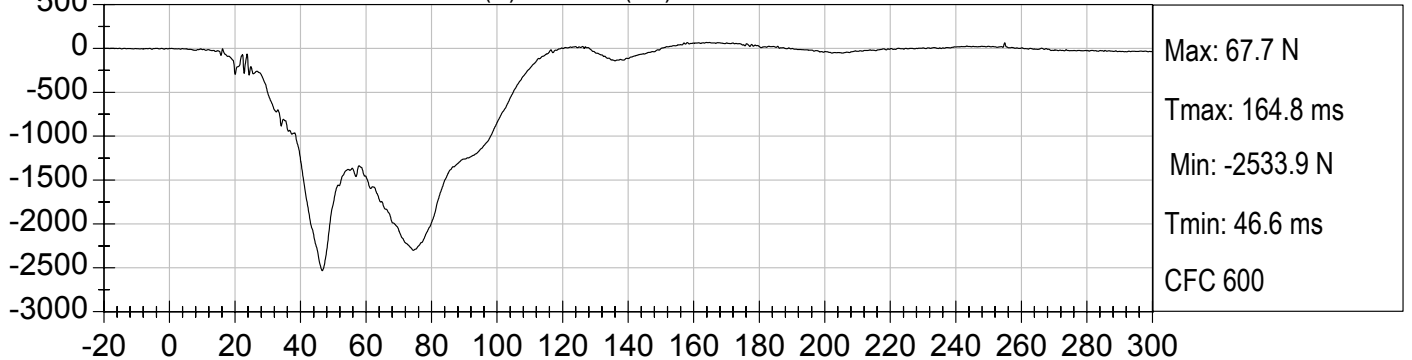
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DRIVER LEFT LOWER TIBIA MY (Nm) vs TIME (ms)

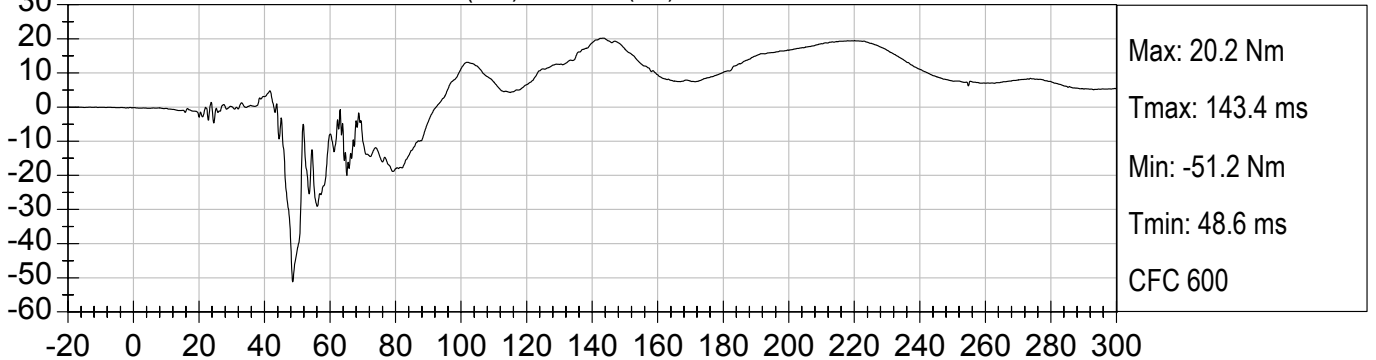


DRIVER LEFT LOWER TIBIA FZ (N) vs TIME (ms)

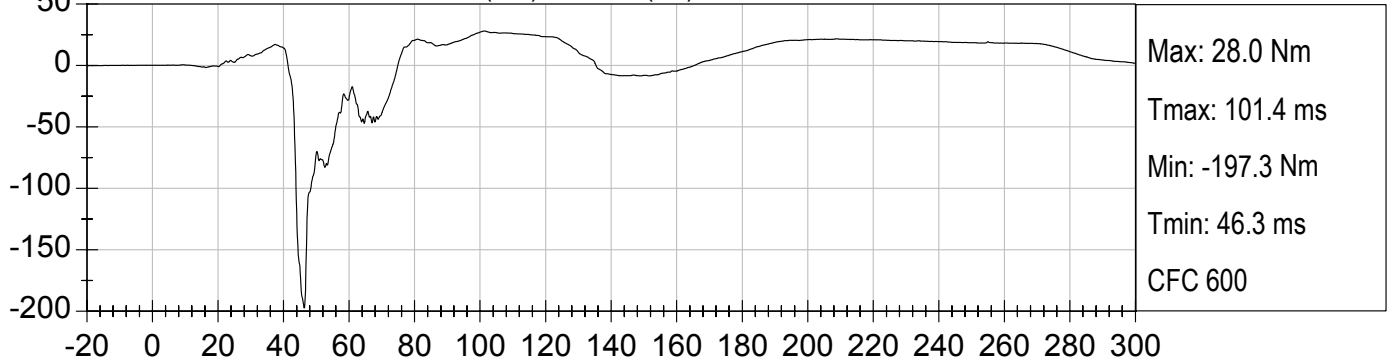




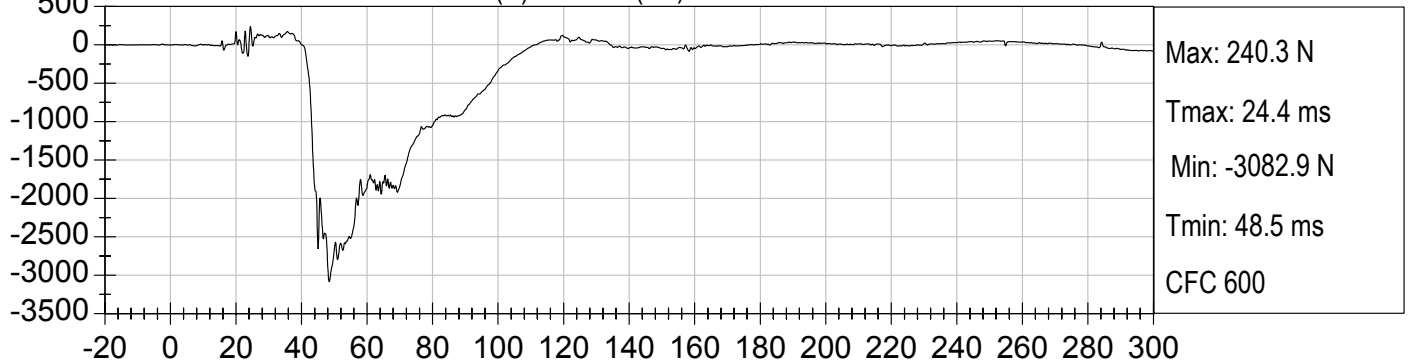
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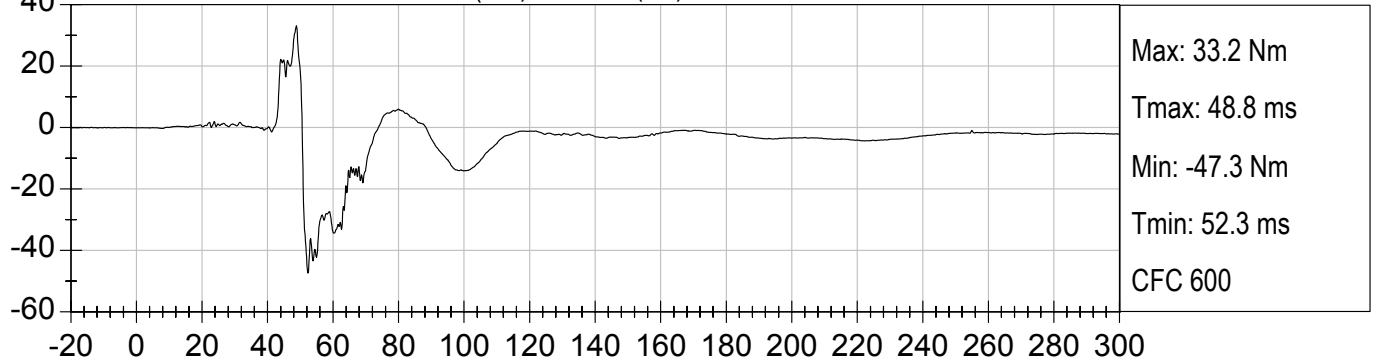


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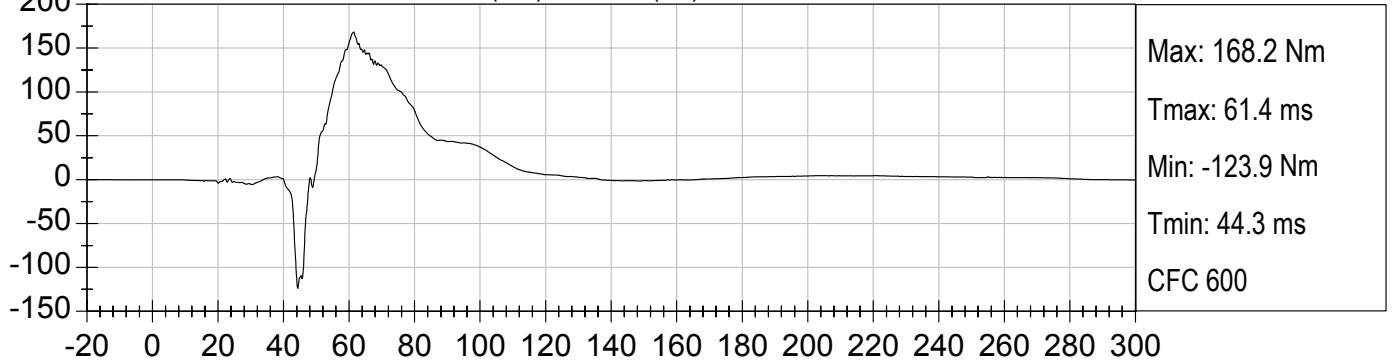




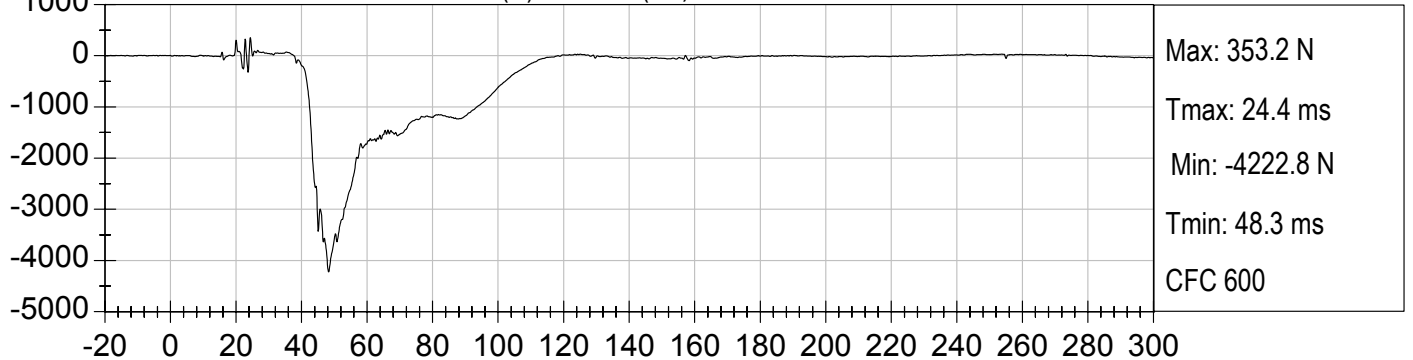
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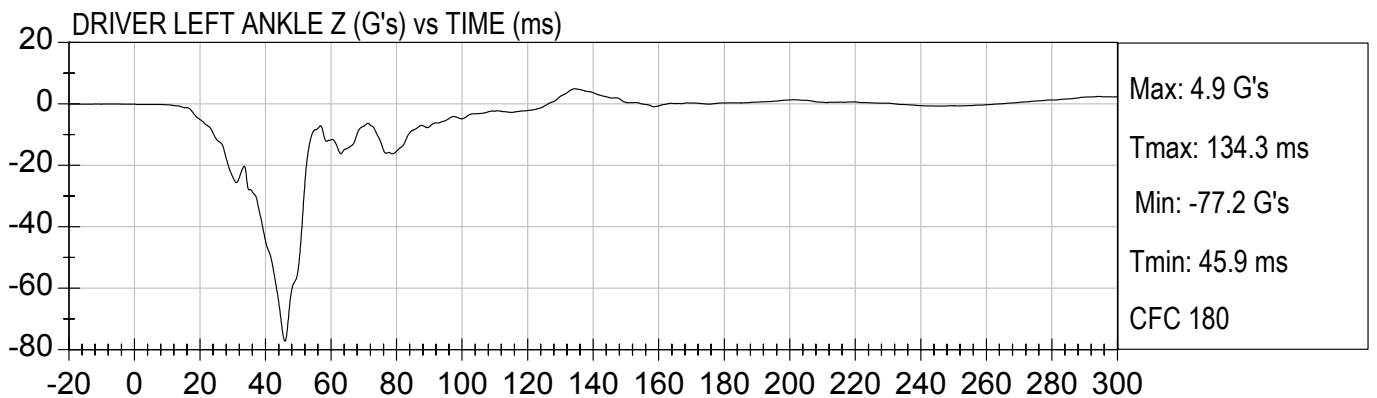
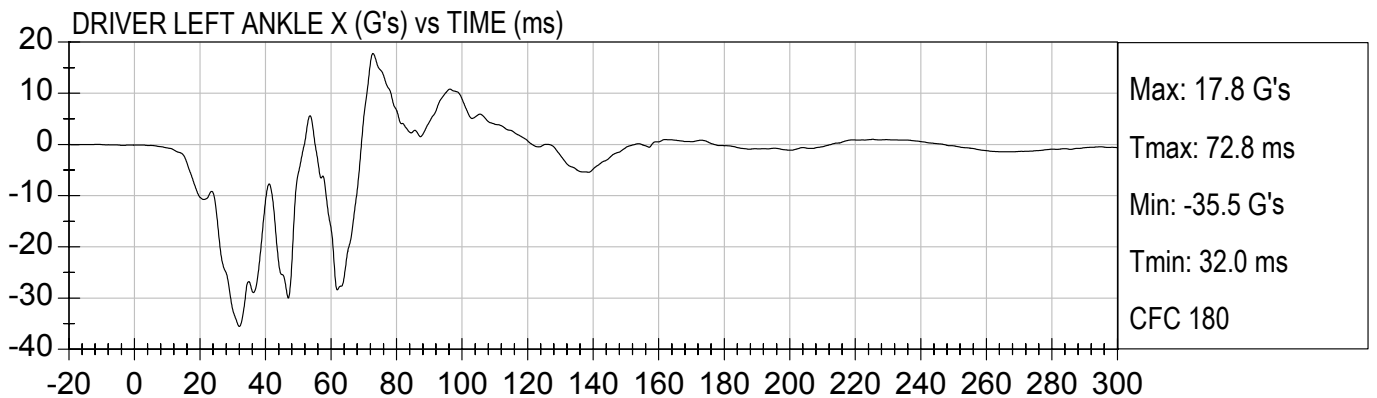
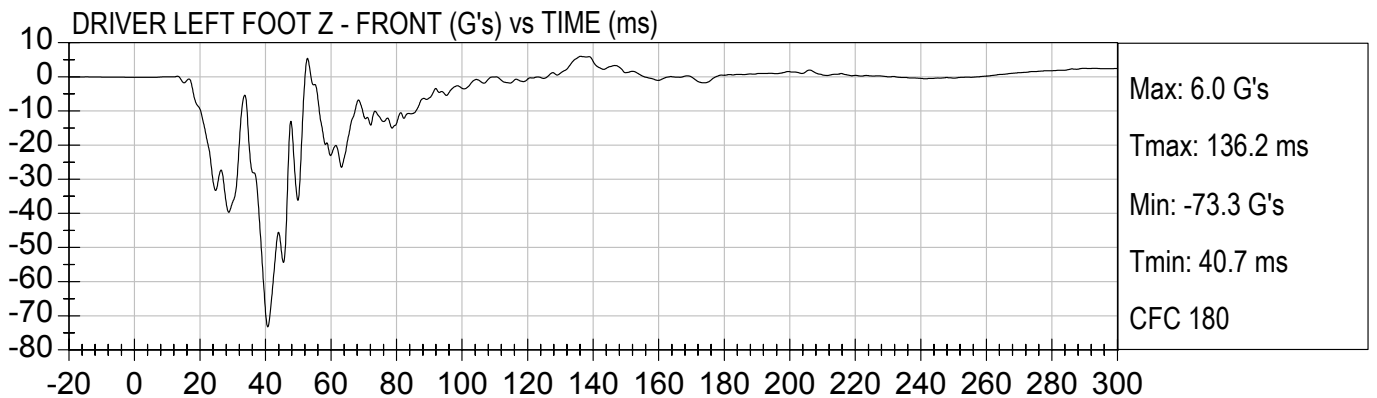


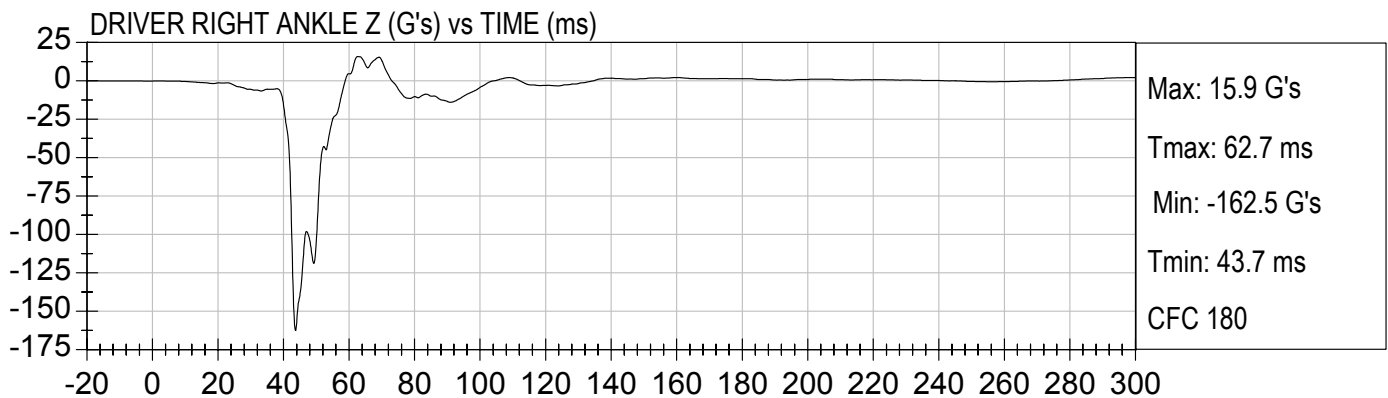
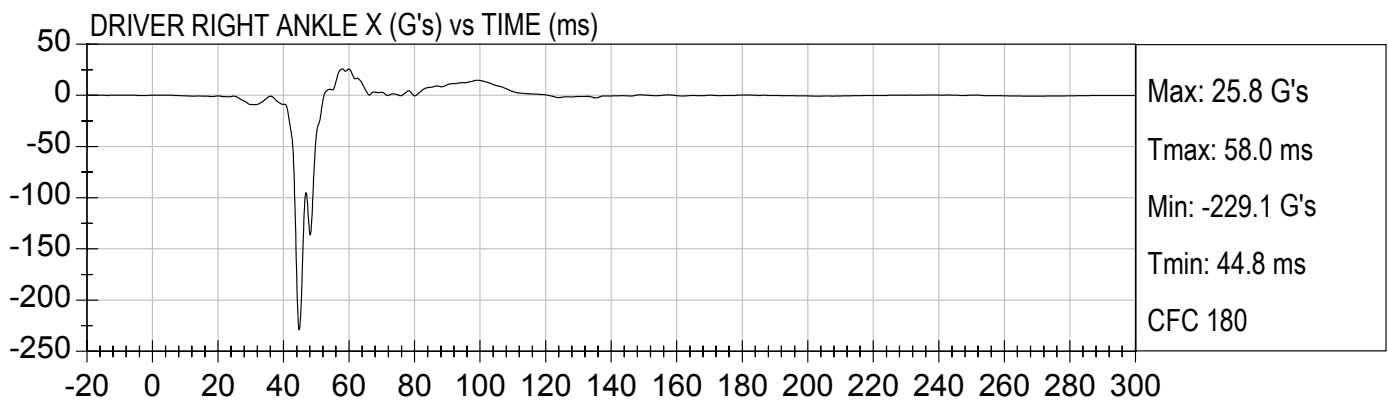
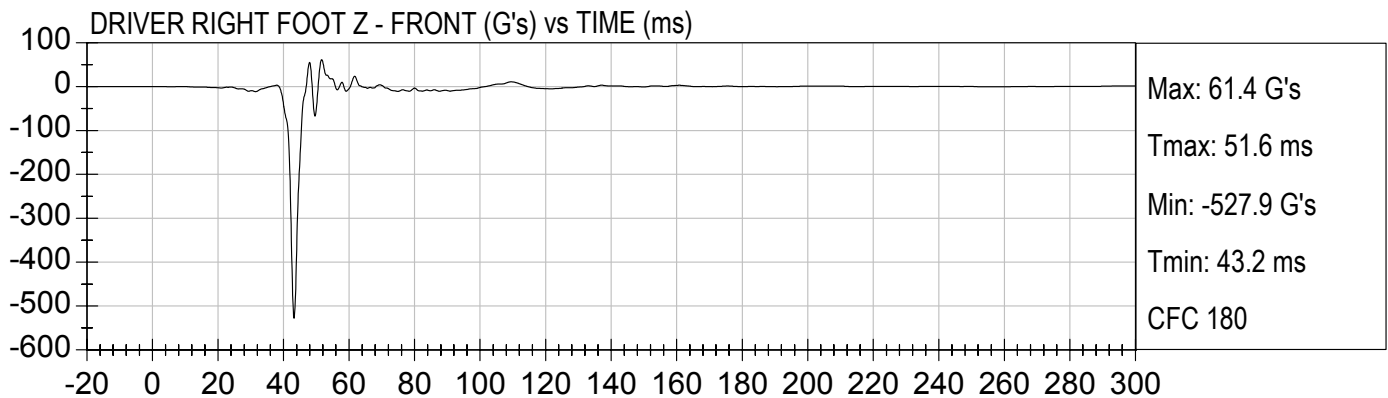
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DRIVER RIGHT LOWER TIBIA FZ (N) vs TIME (ms)



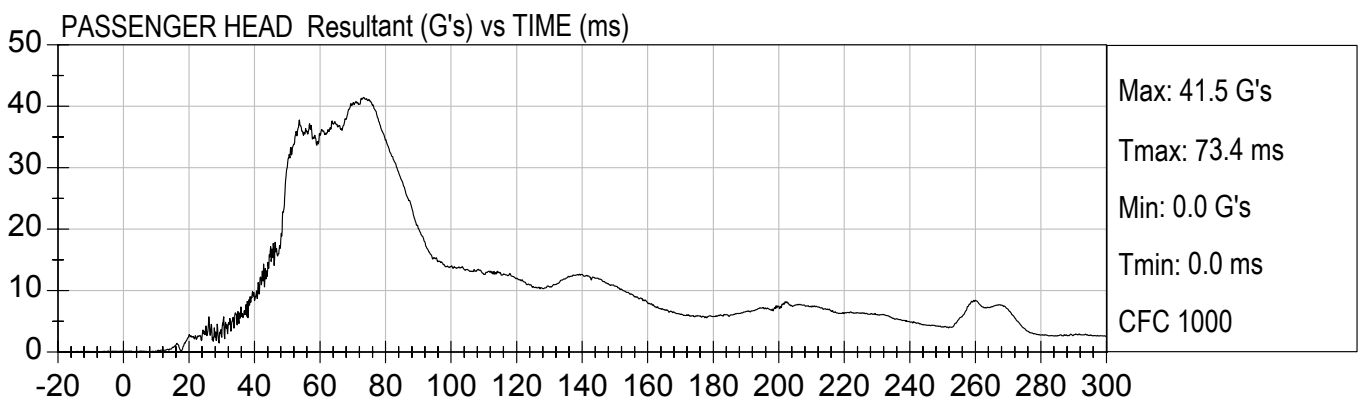
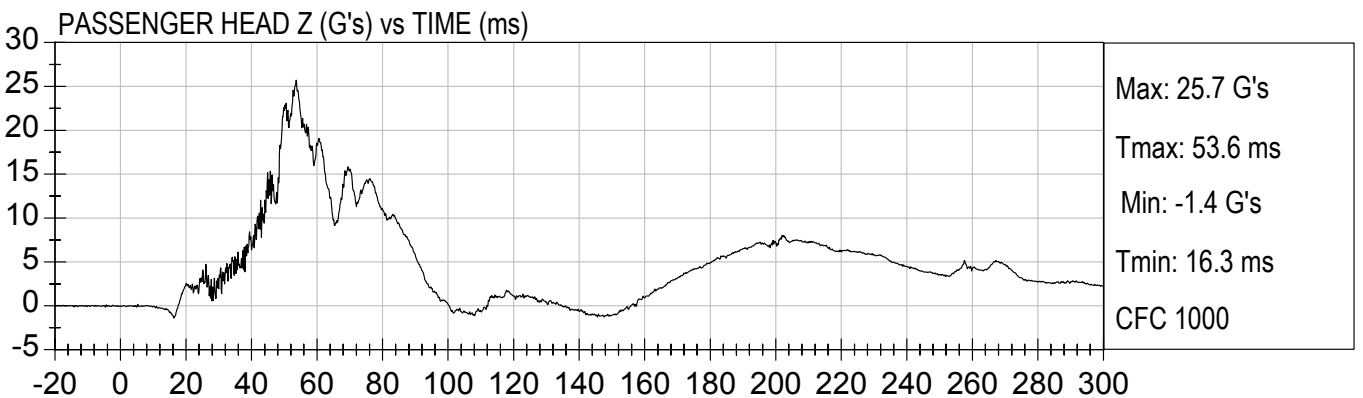
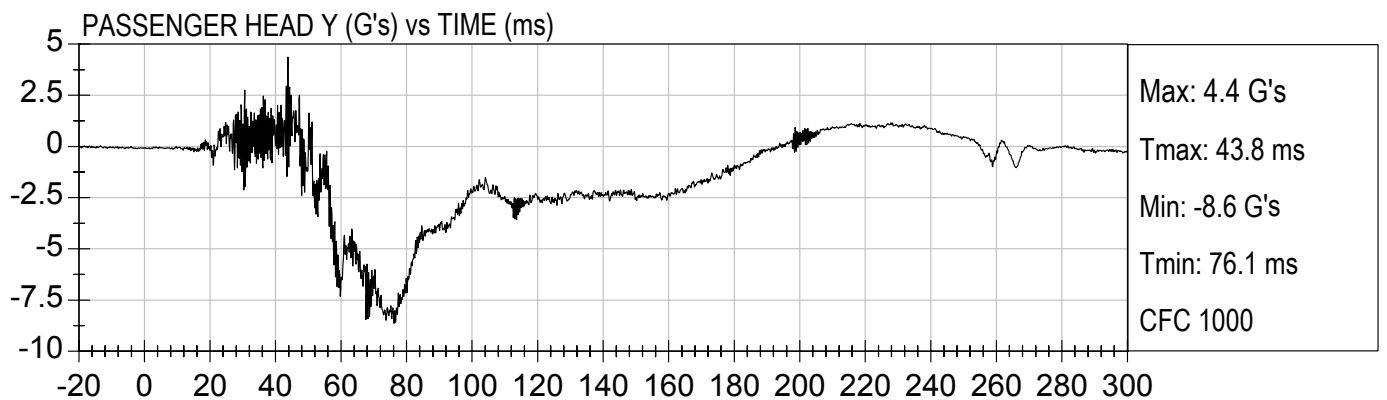
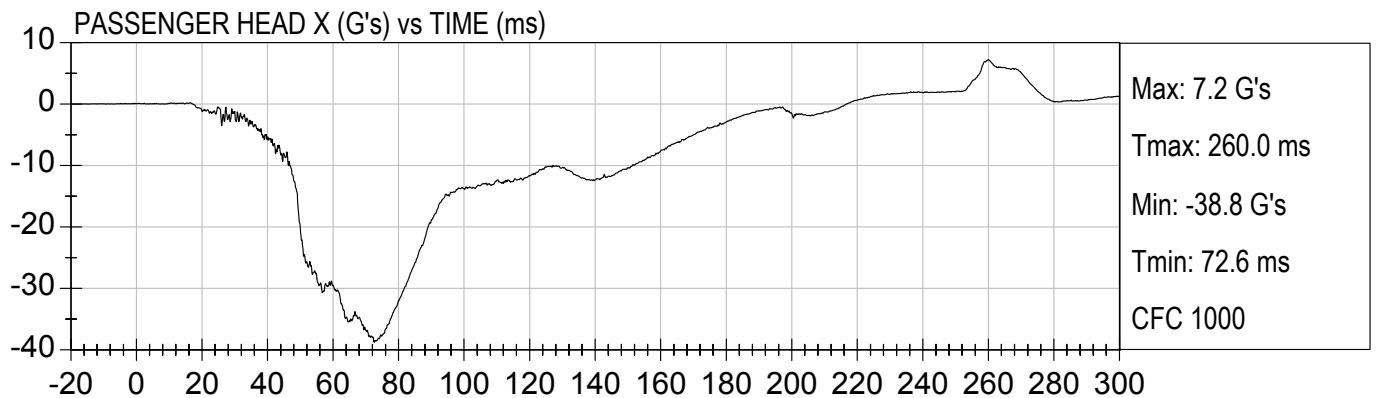






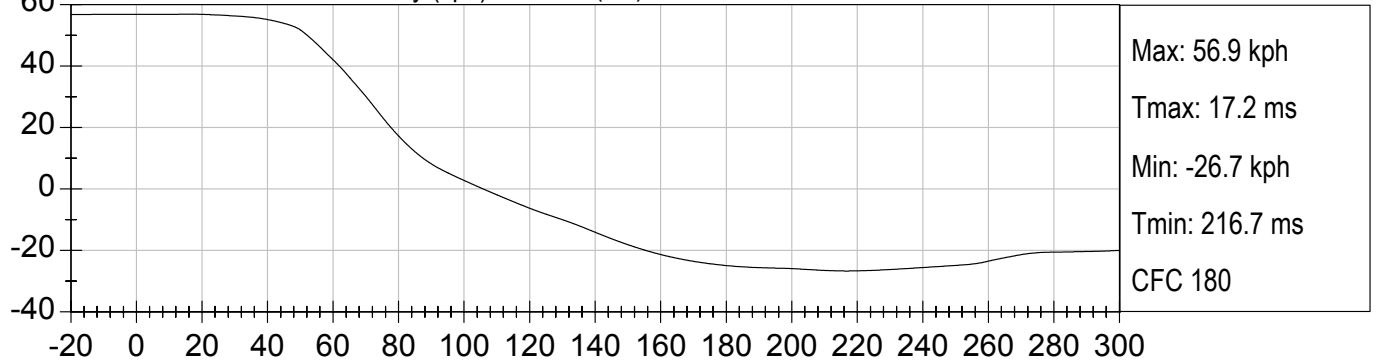
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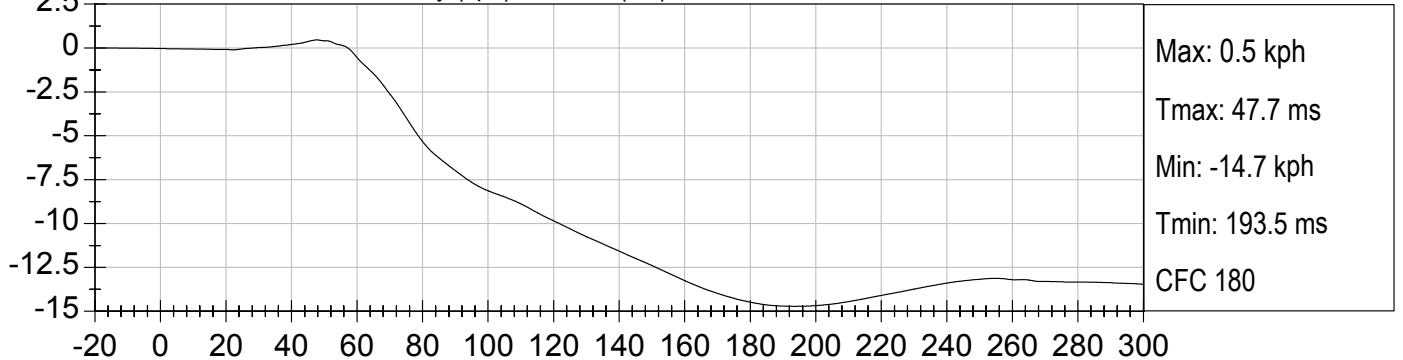




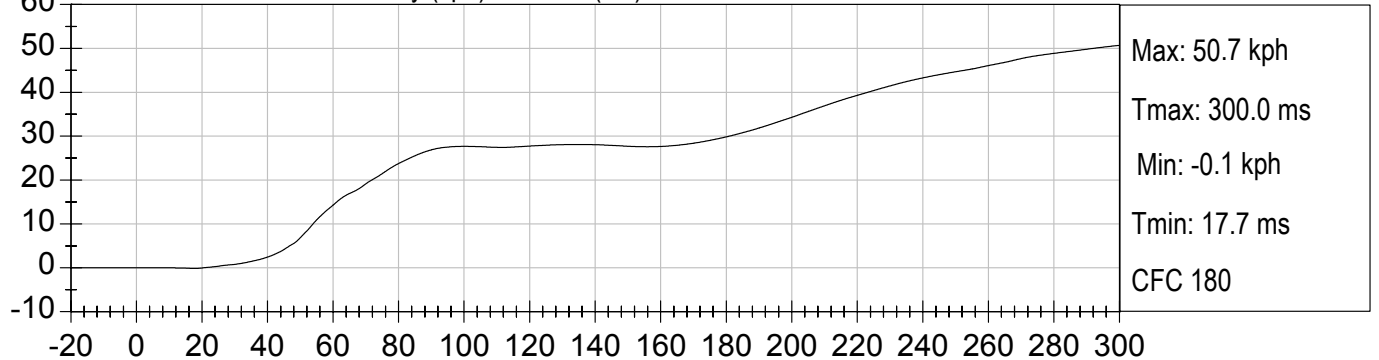
PASSENGER HEAD X Velocity (kph) vs TIME (ms)



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



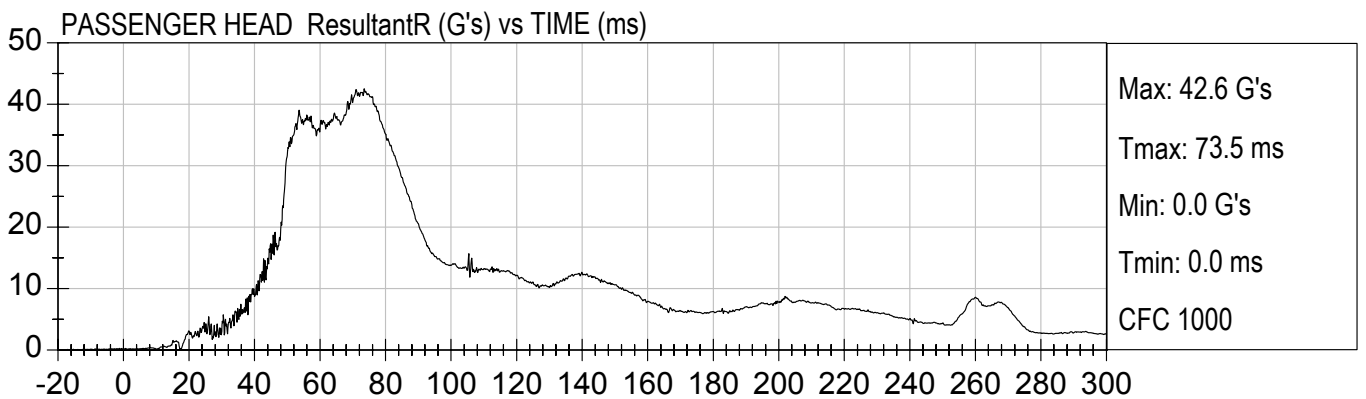
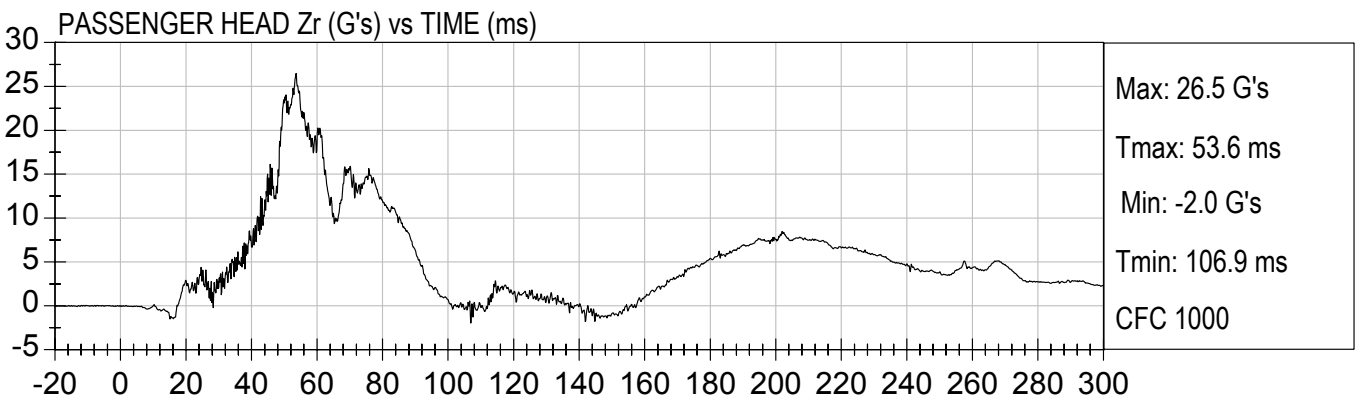
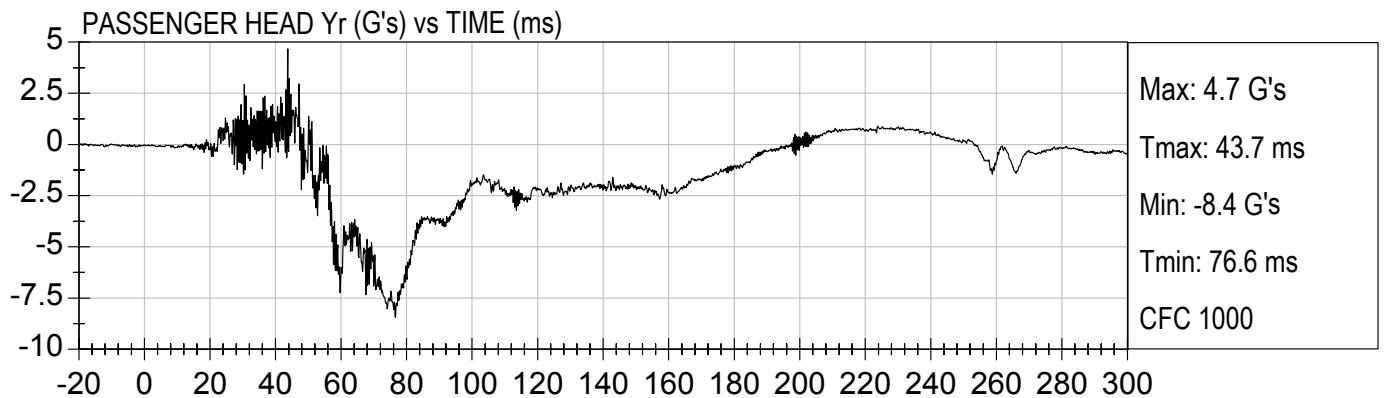
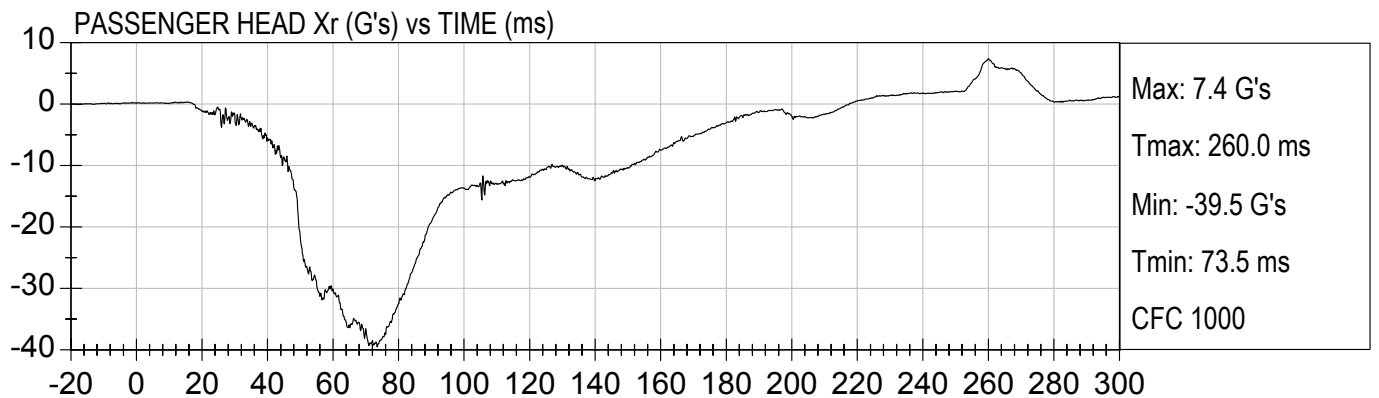
PASSENGER HEAD Z Velocity (kph) vs TIME (ms)

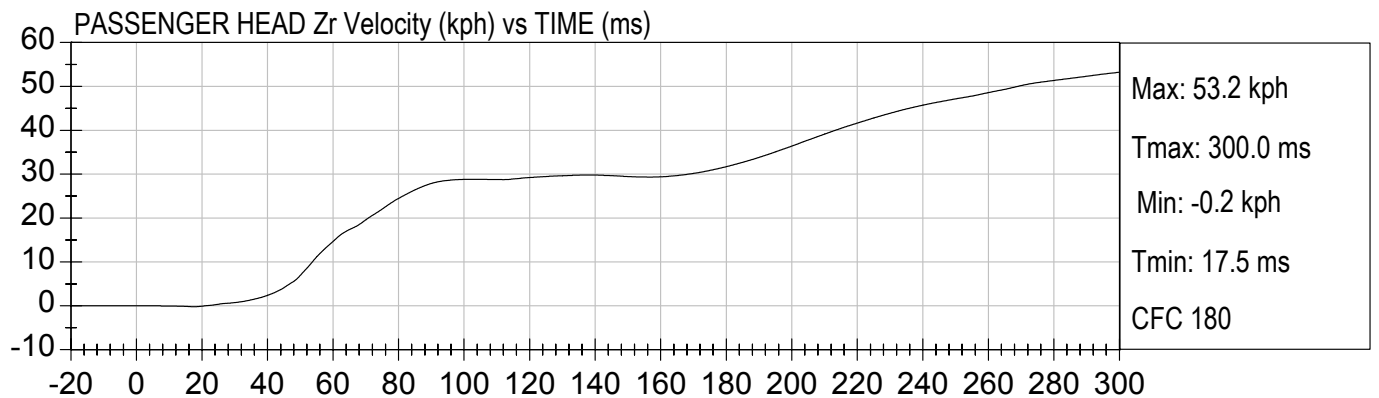
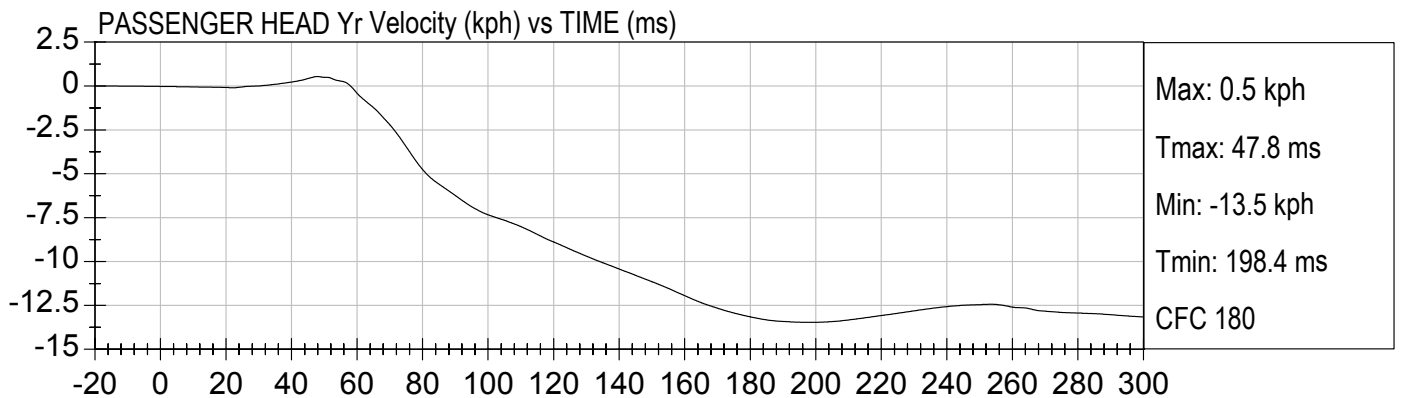
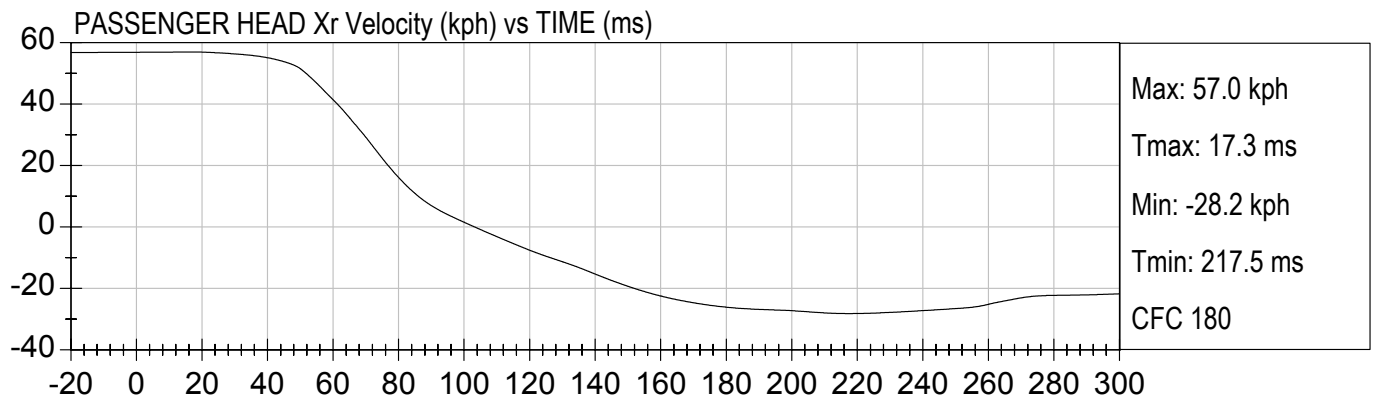




35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

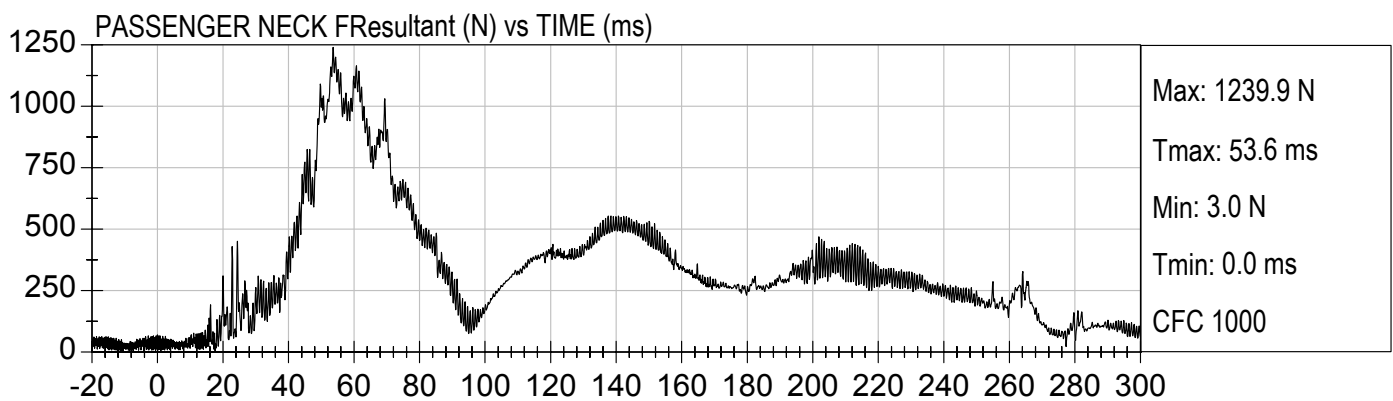
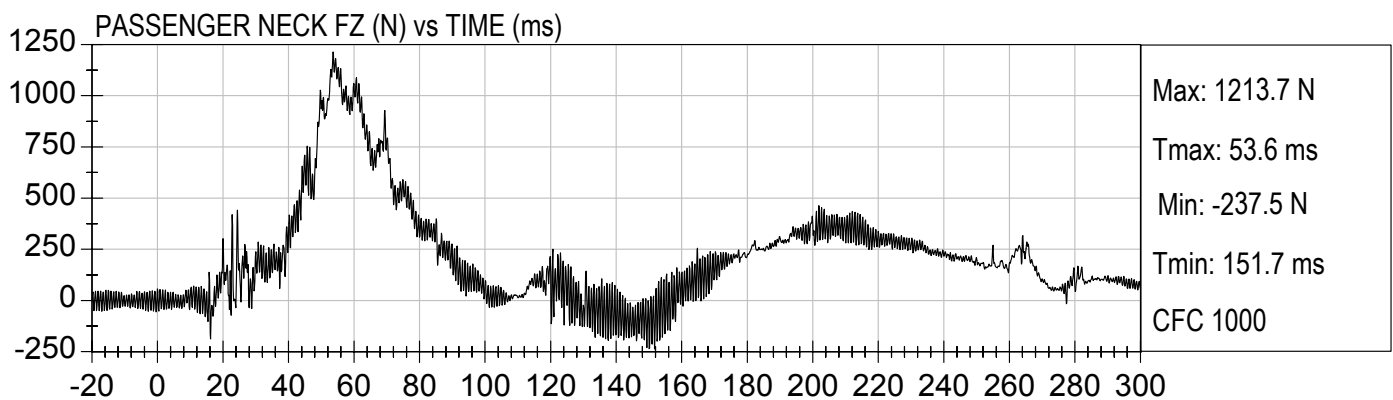
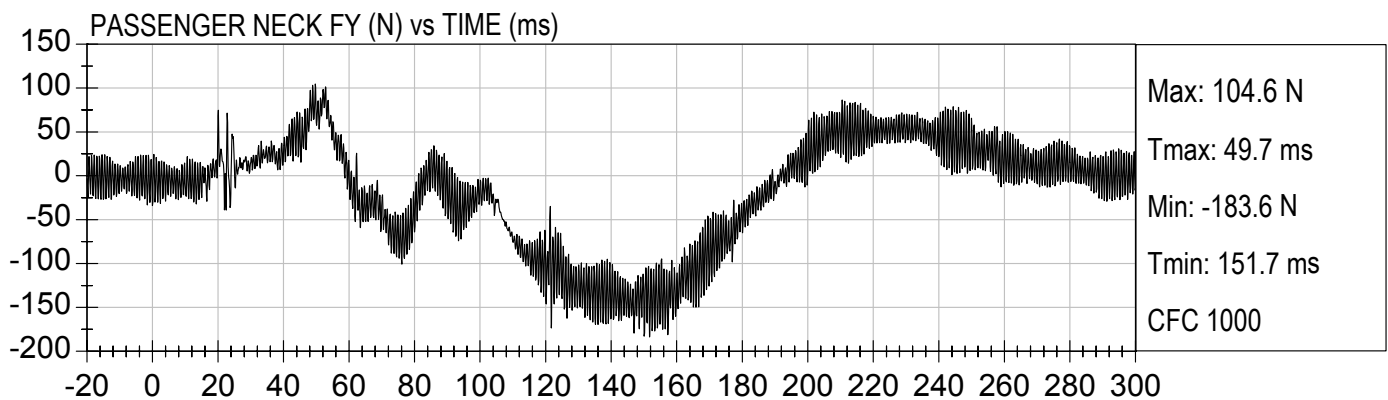
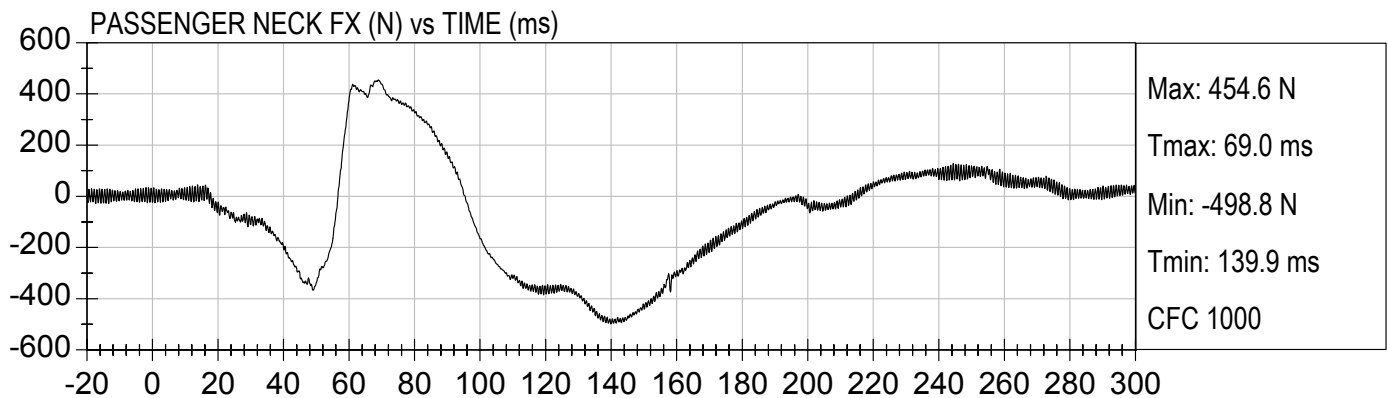






35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

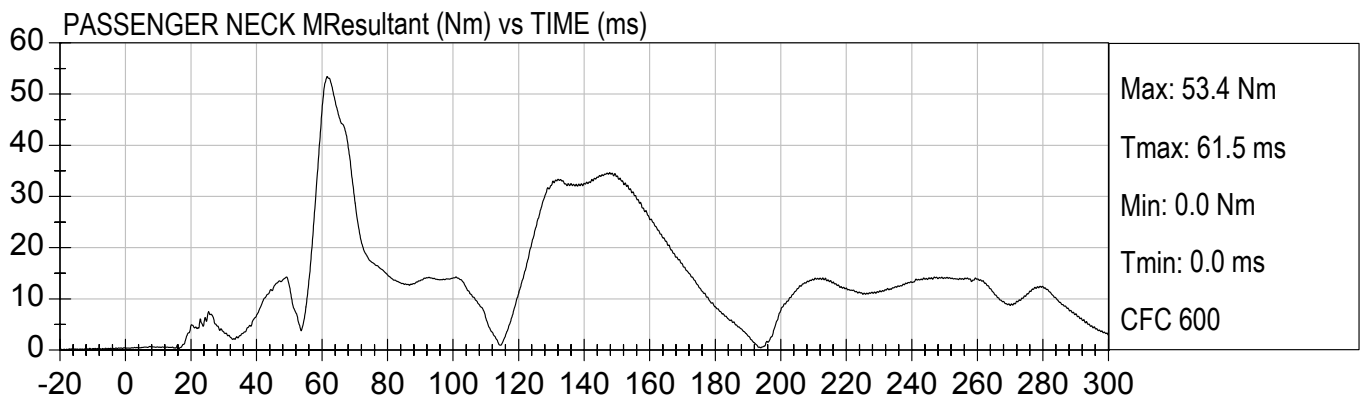
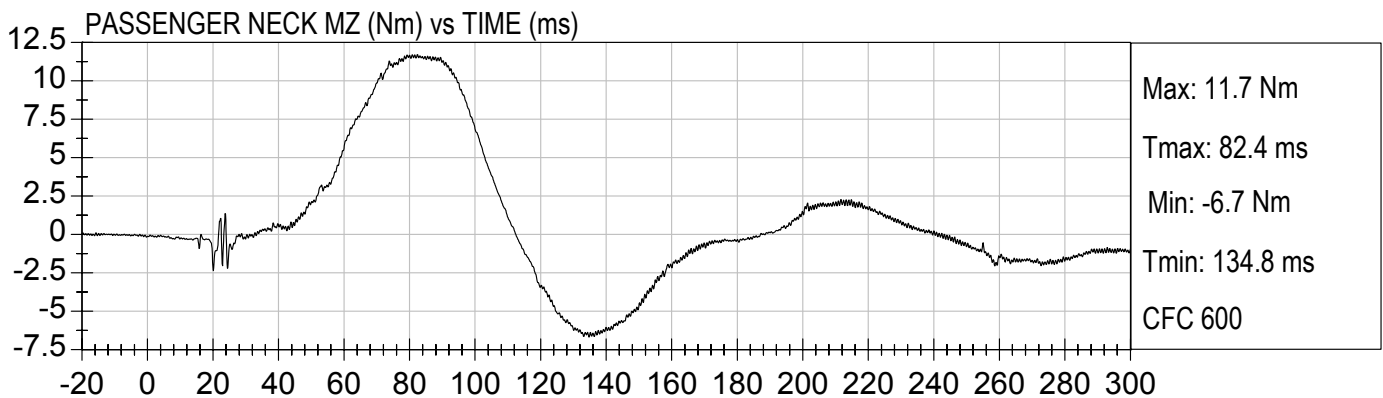
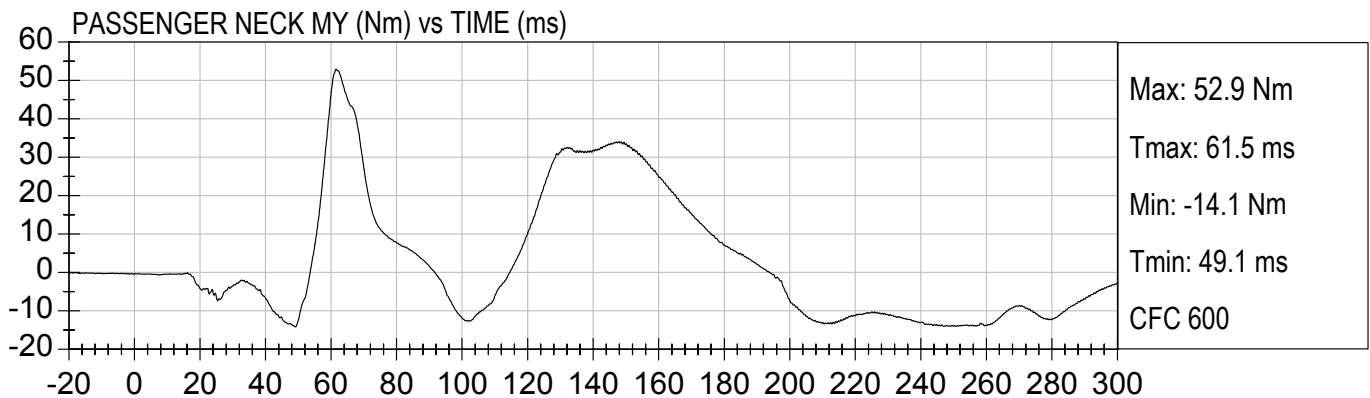
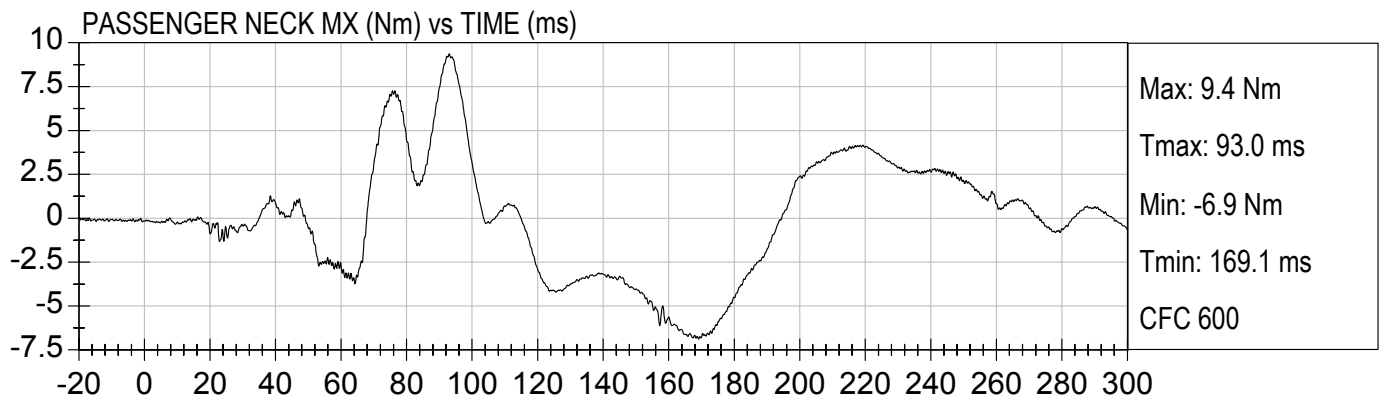
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)





35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

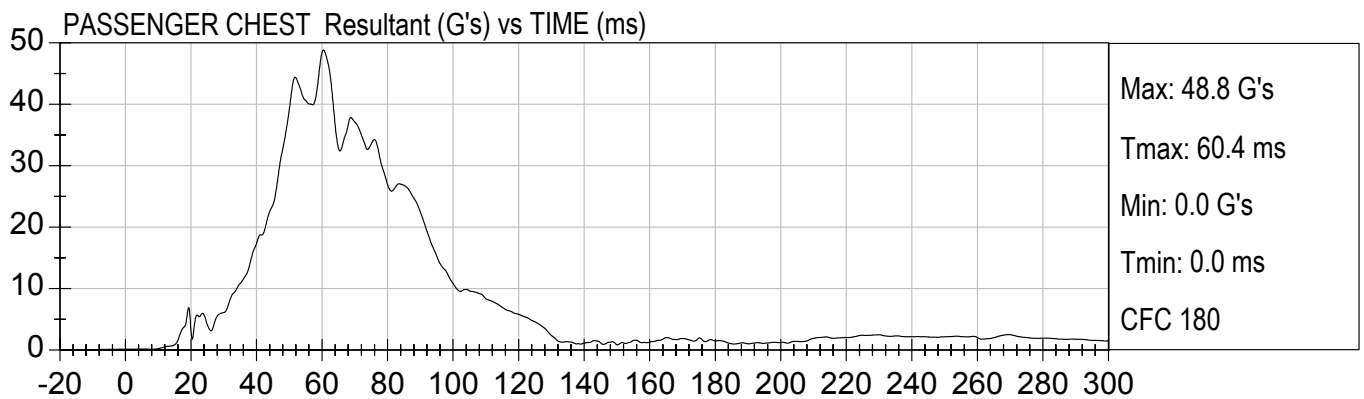
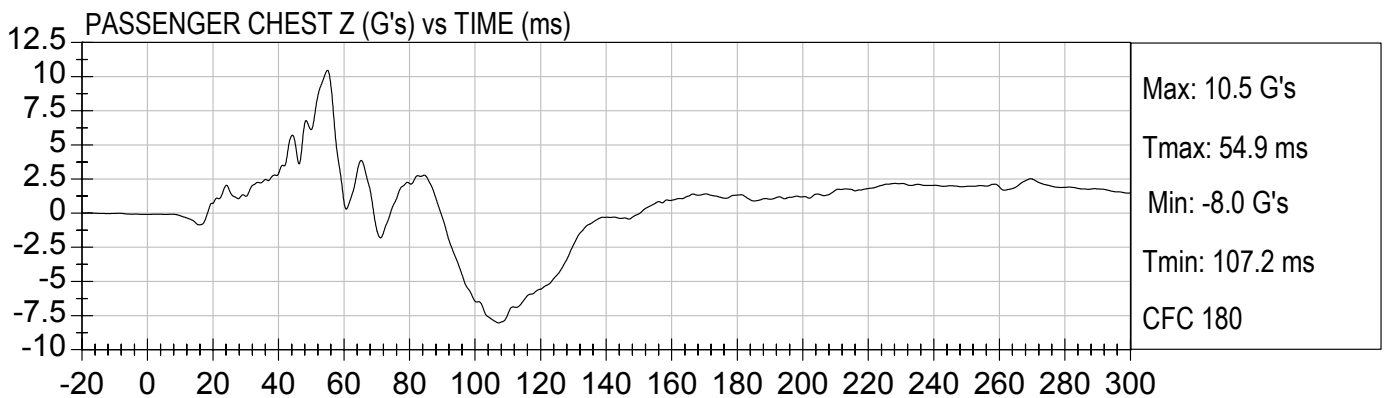
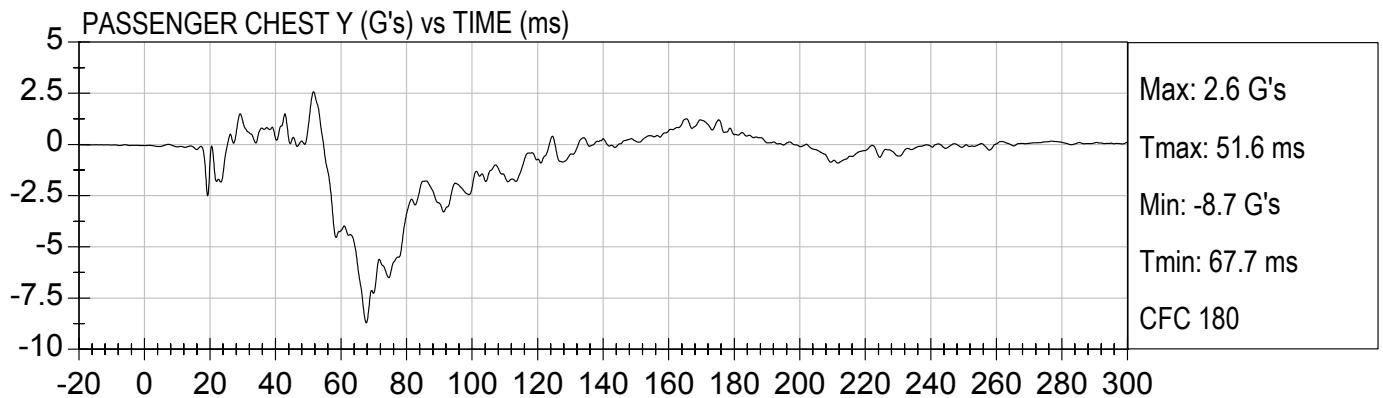
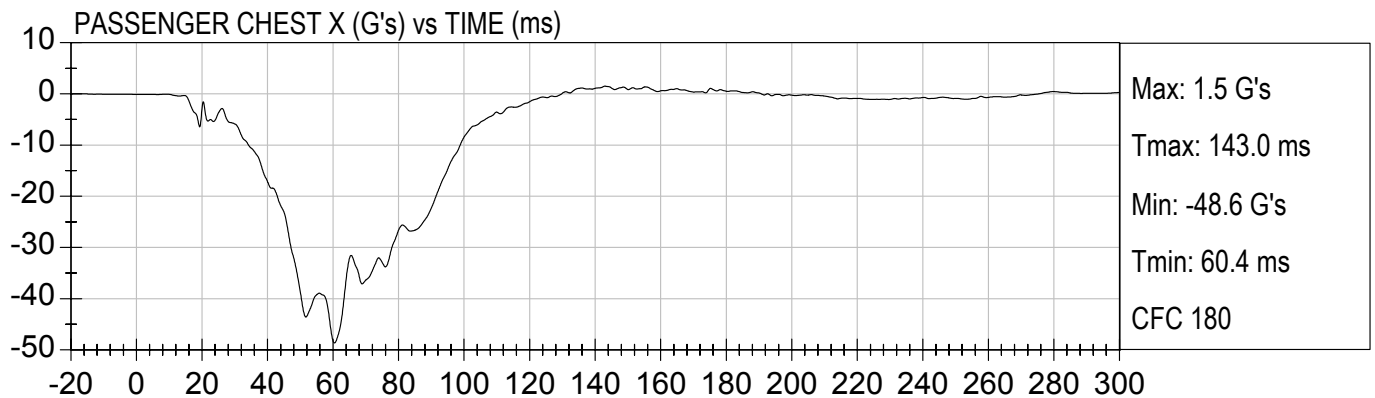
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

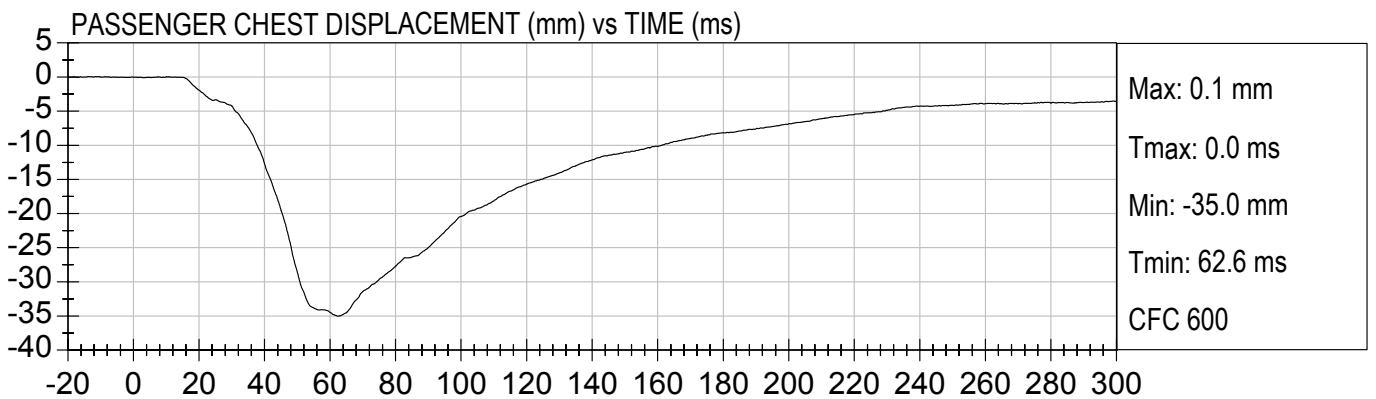
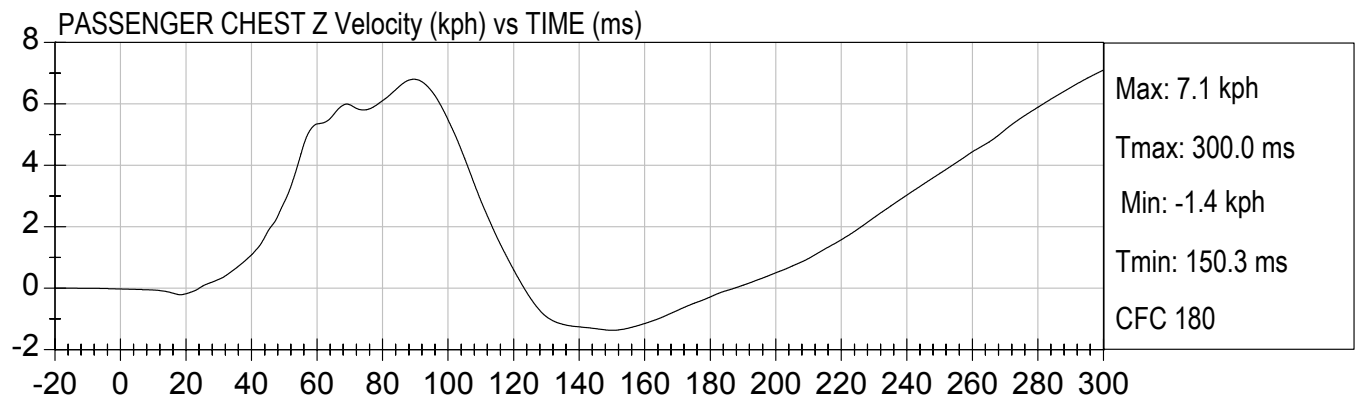
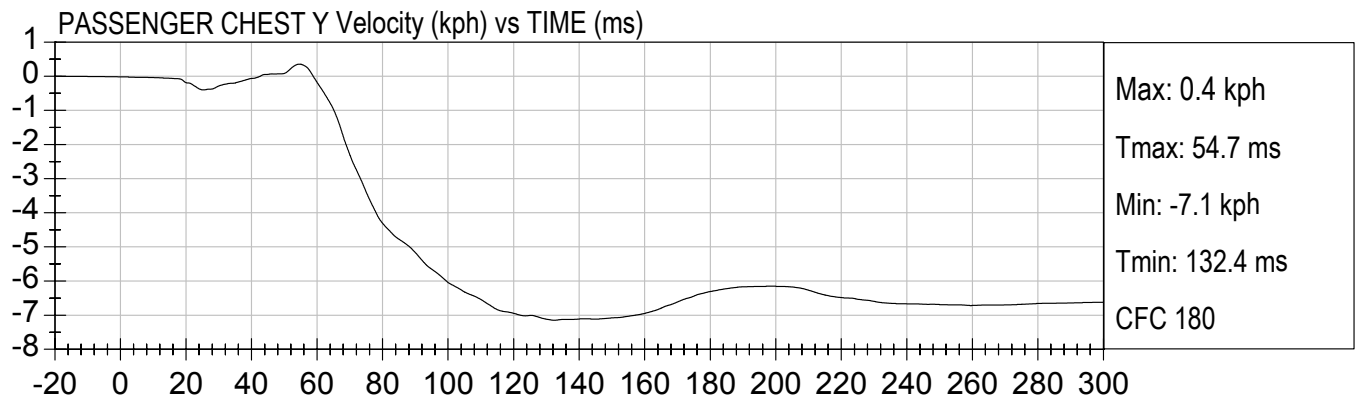
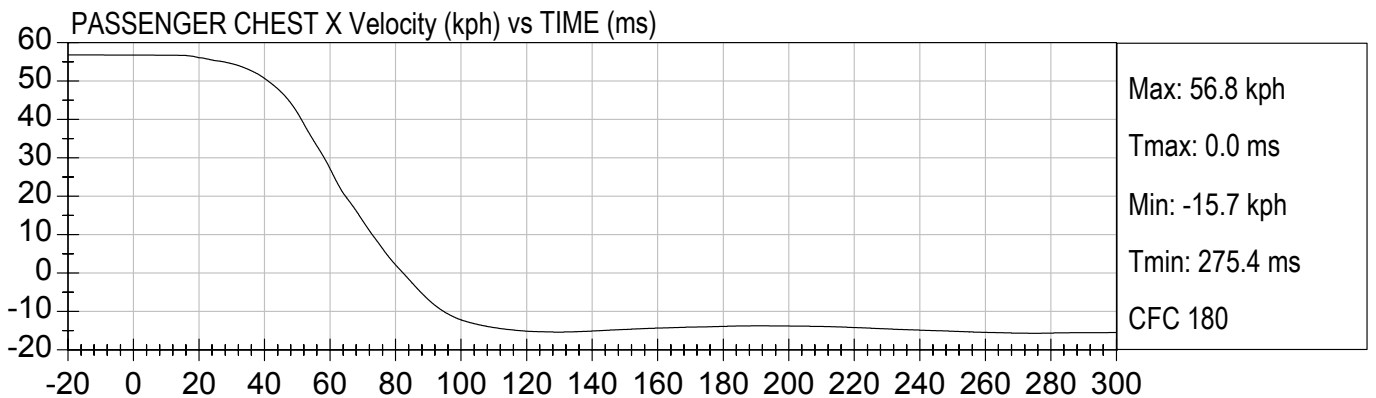




35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

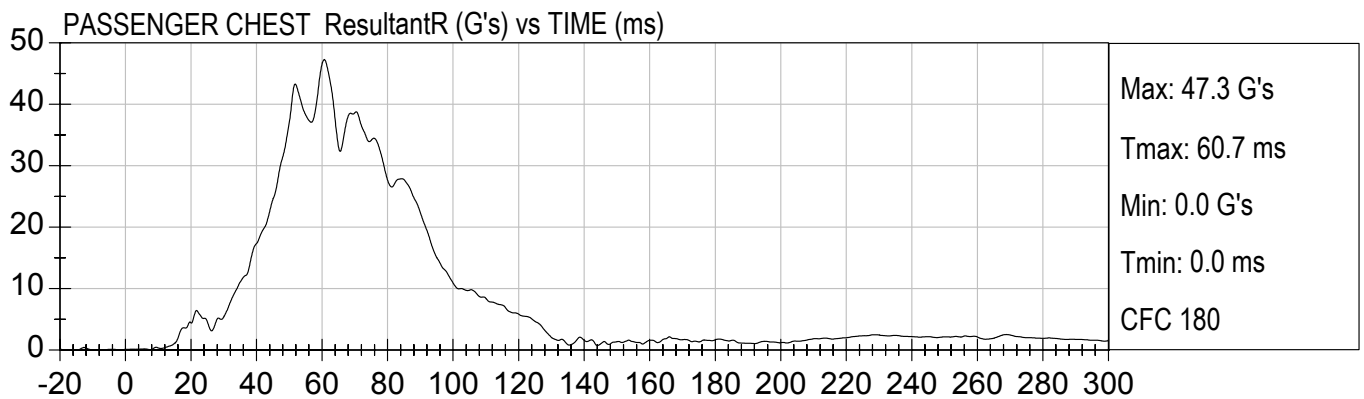
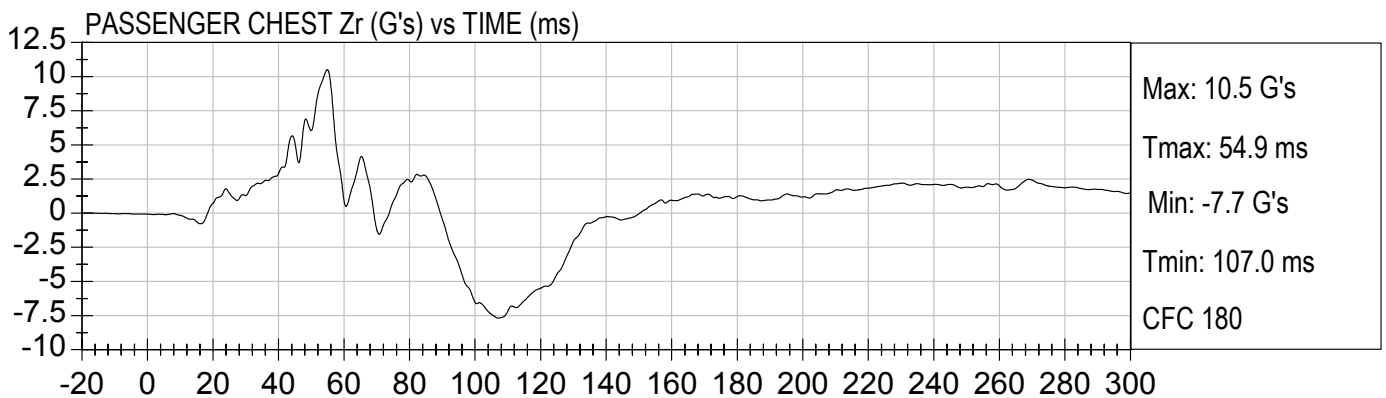
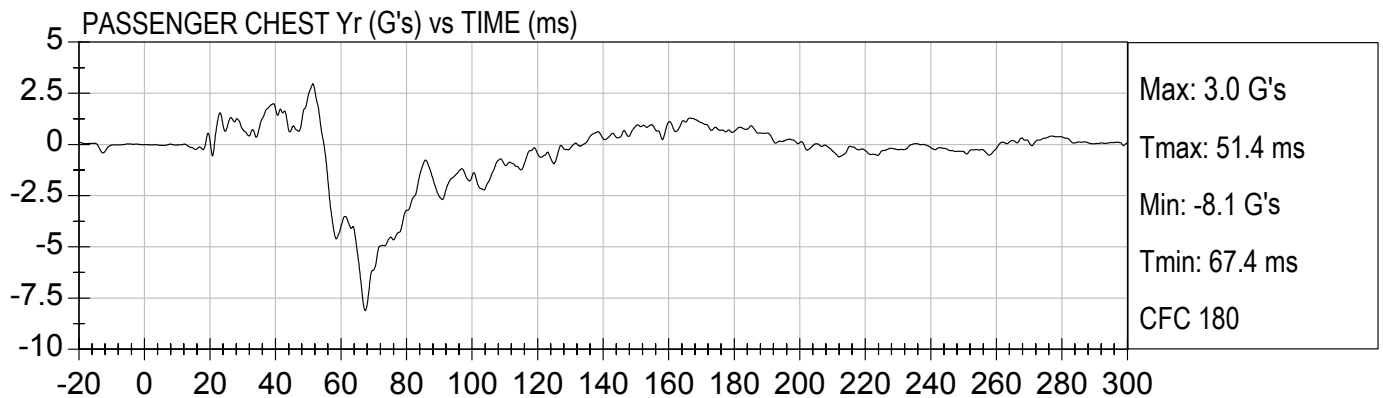
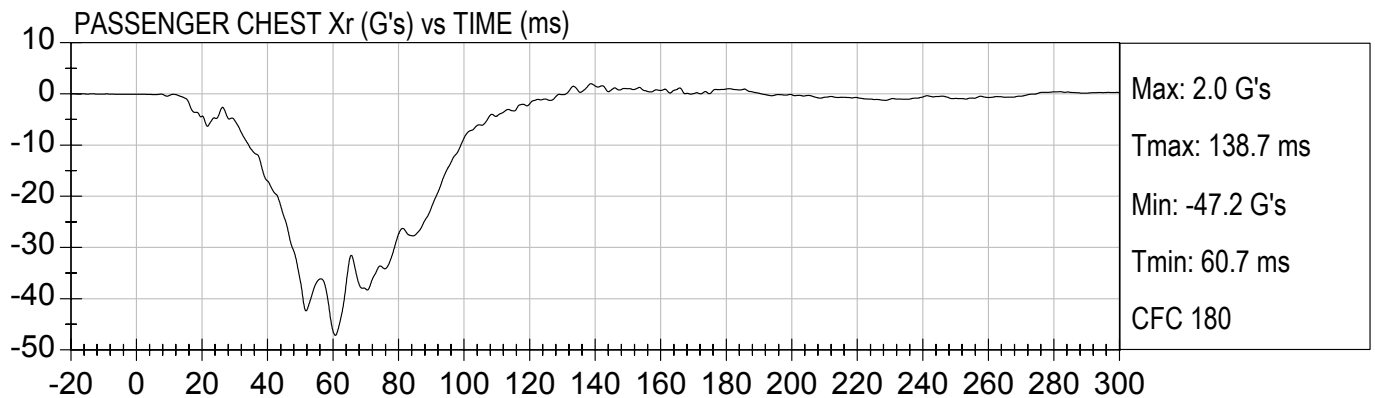


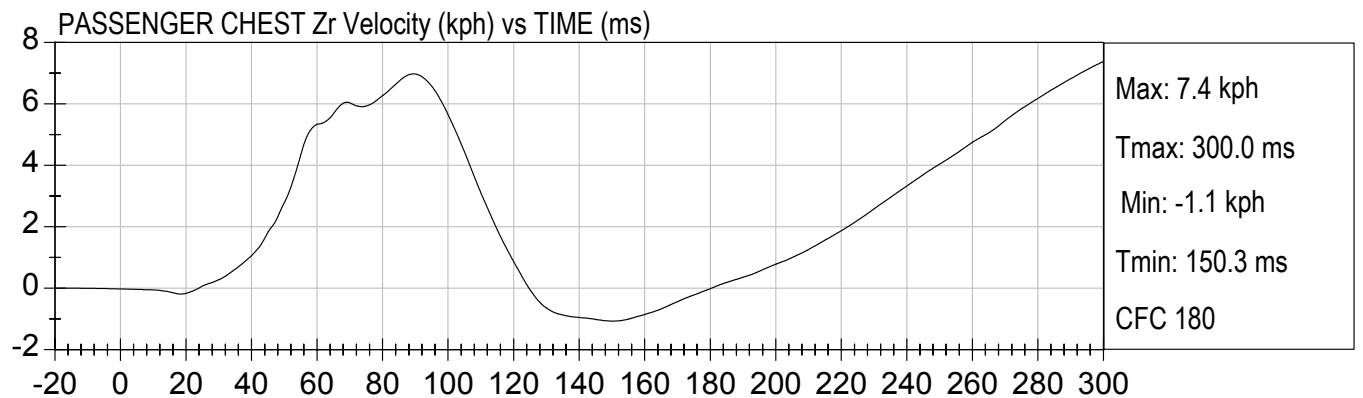
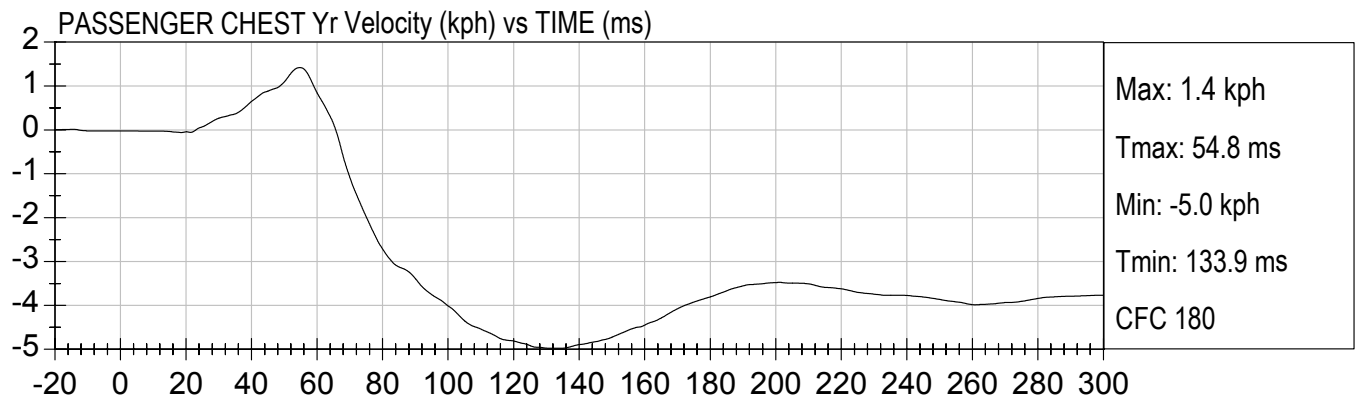
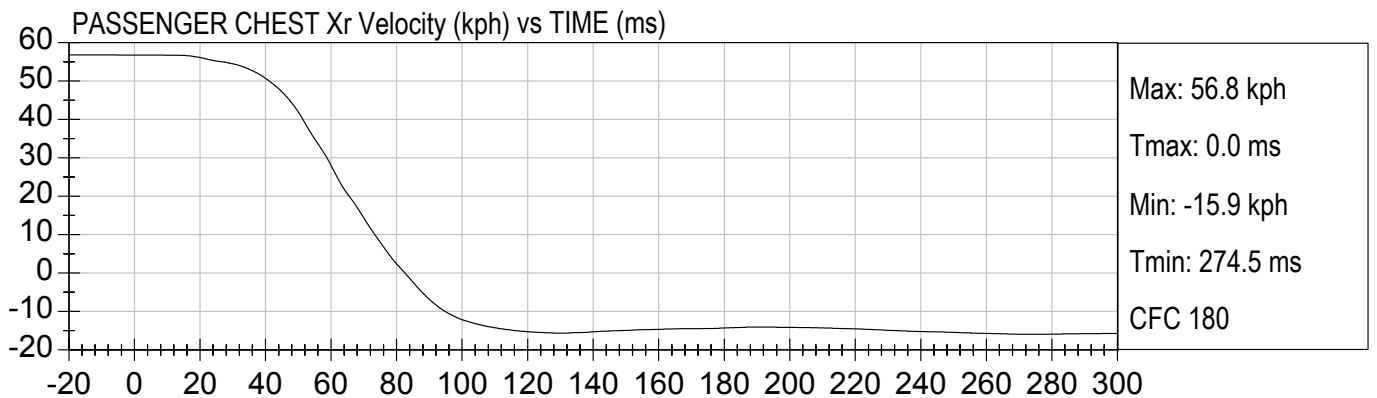




35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

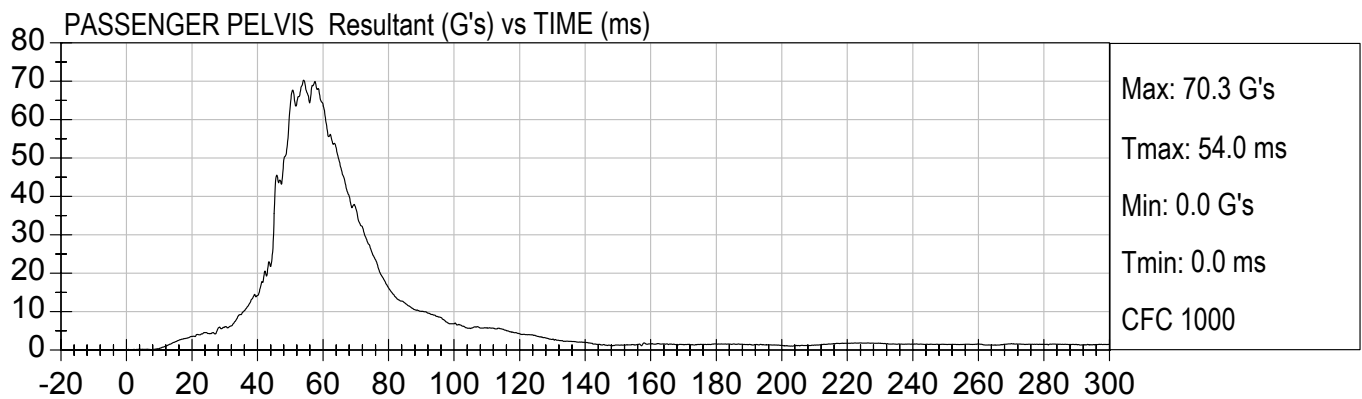
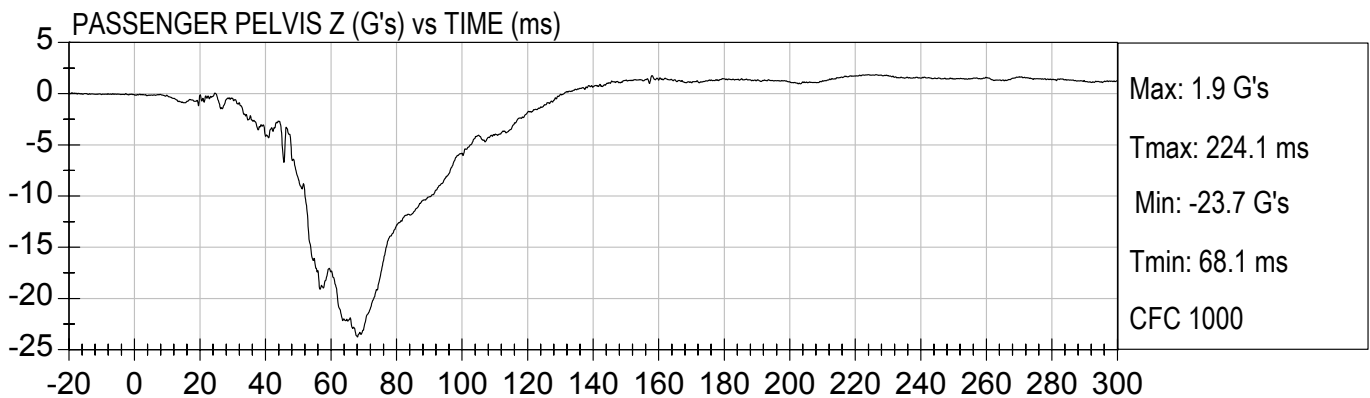
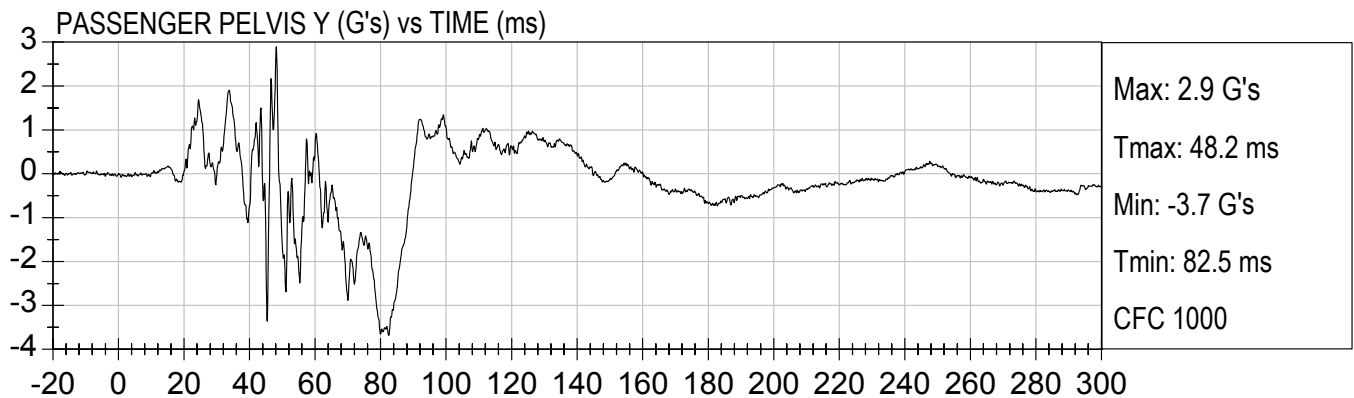
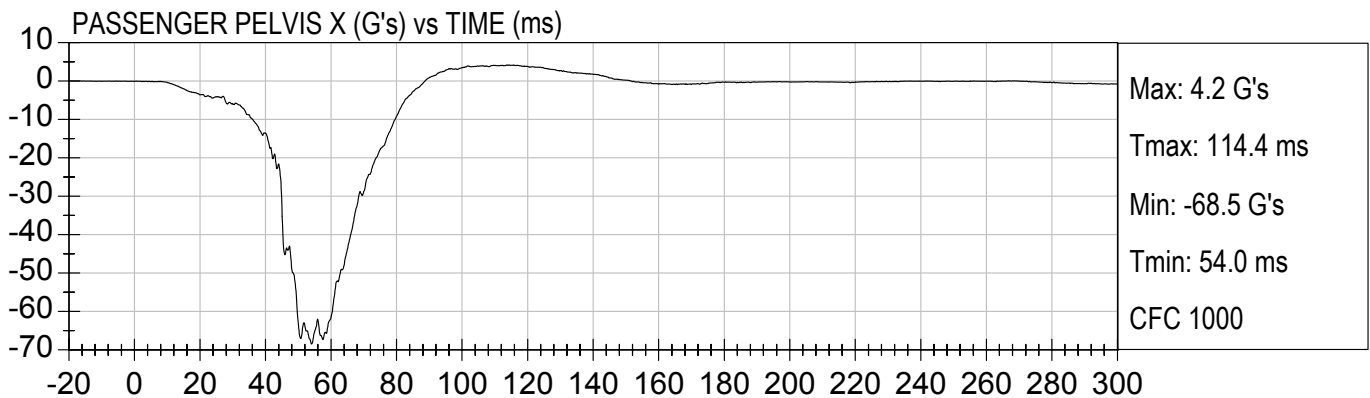


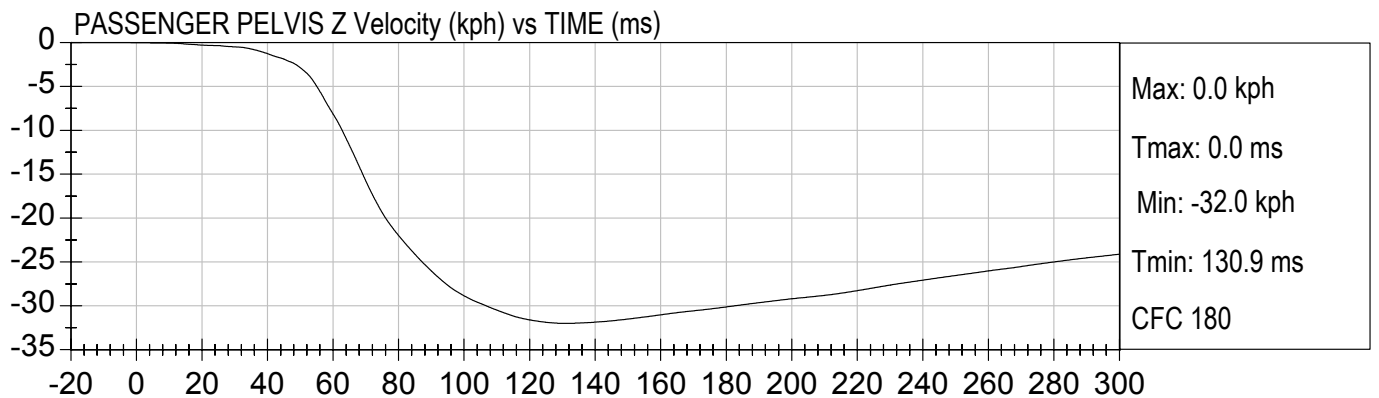
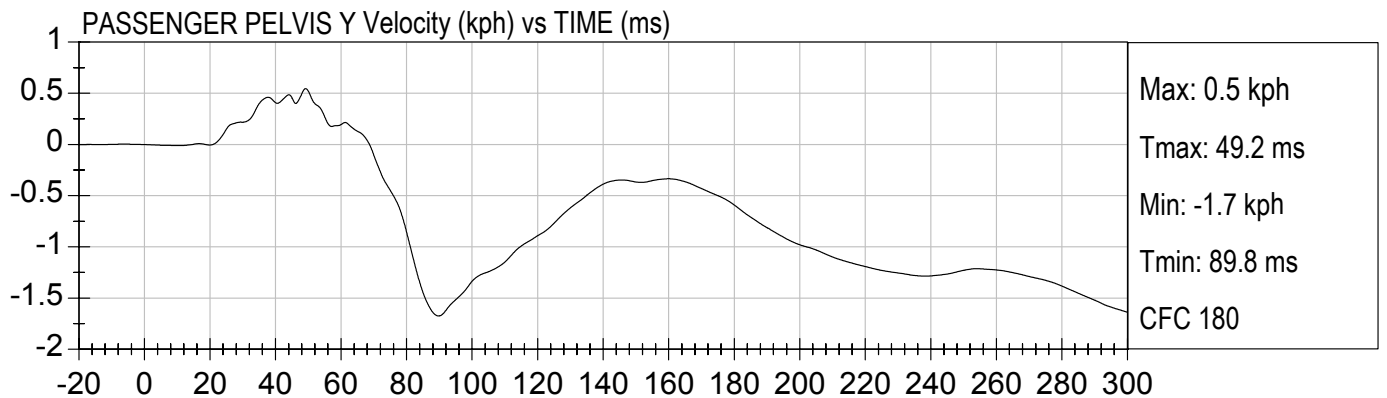
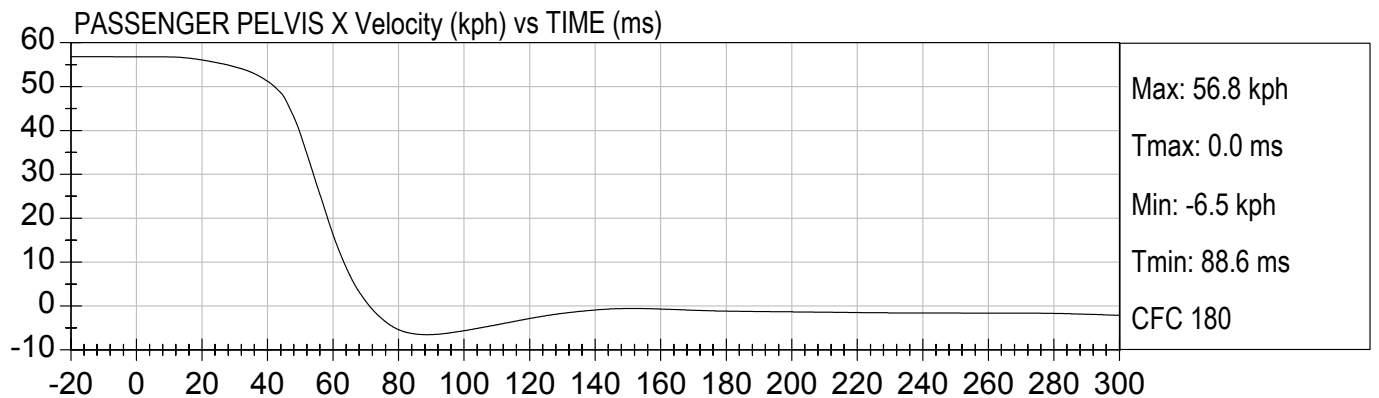


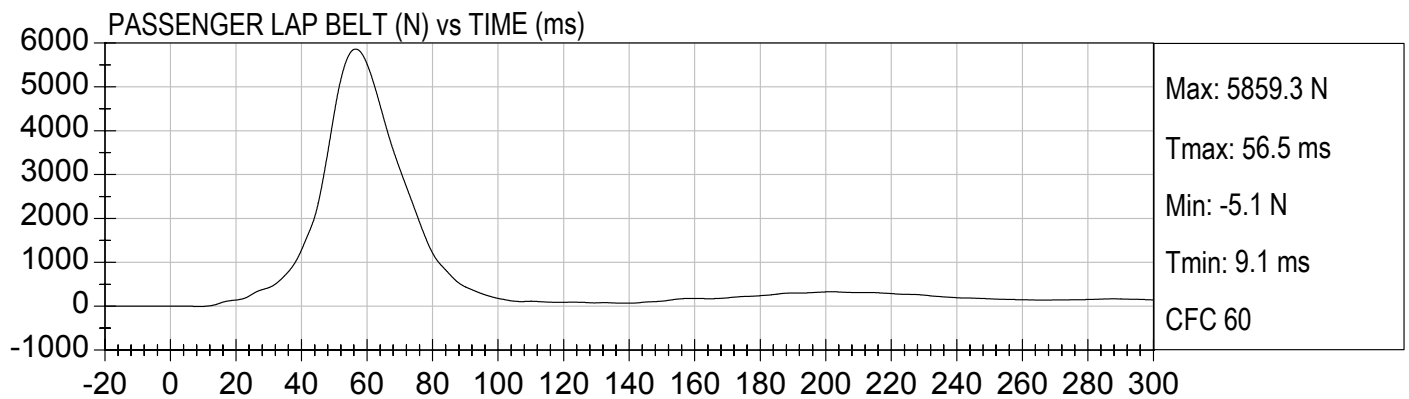
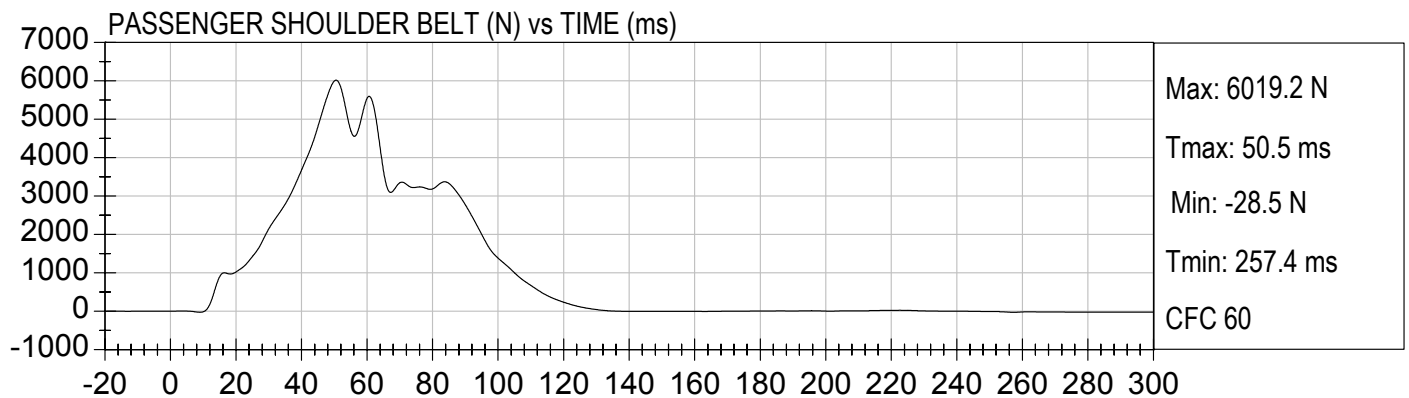
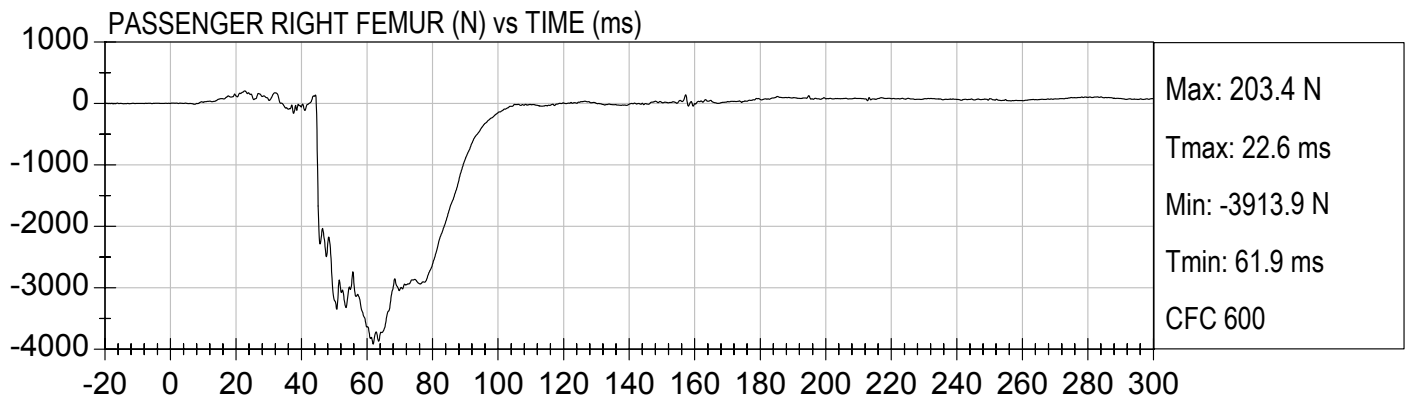
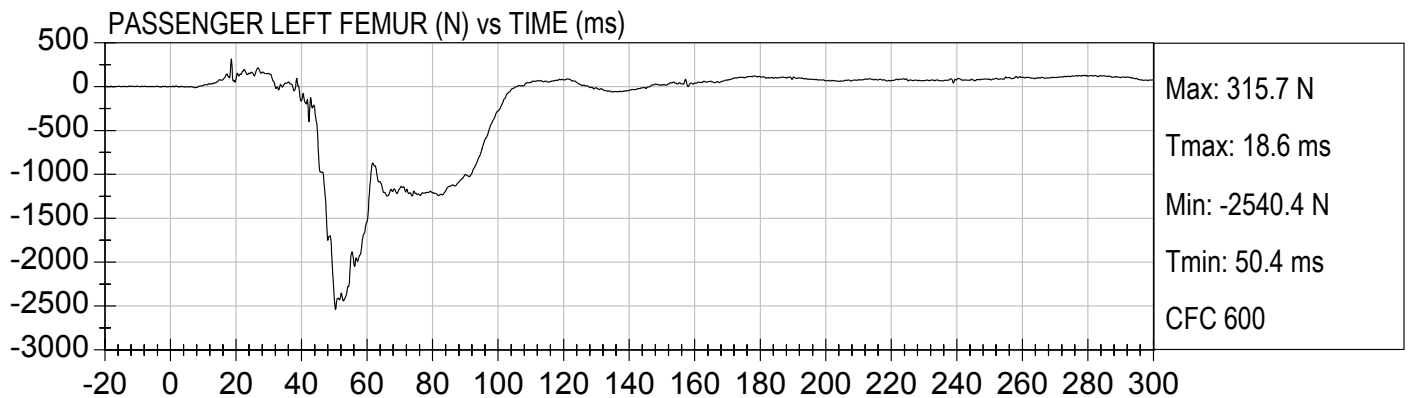


35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

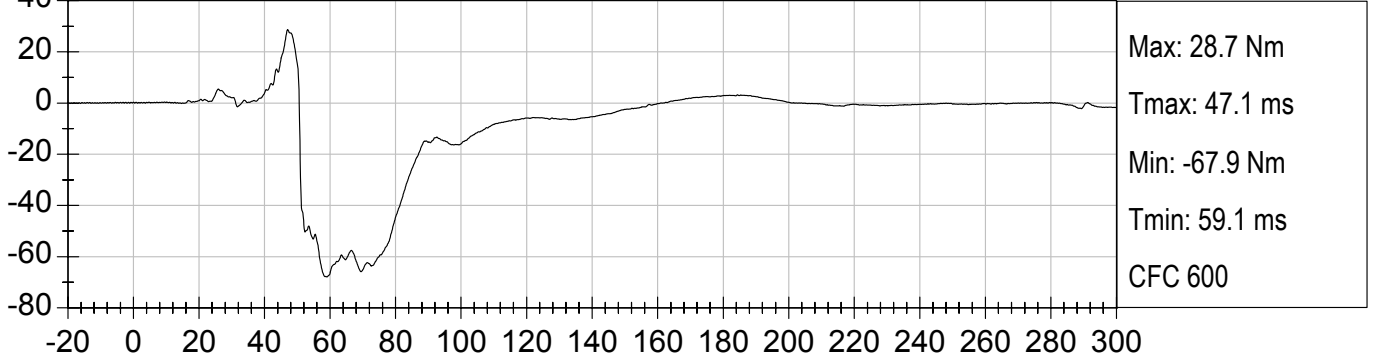




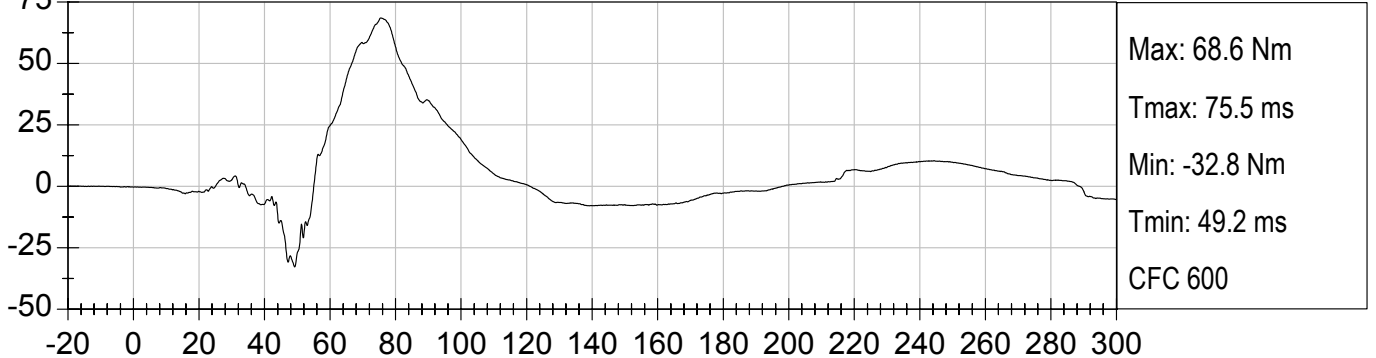




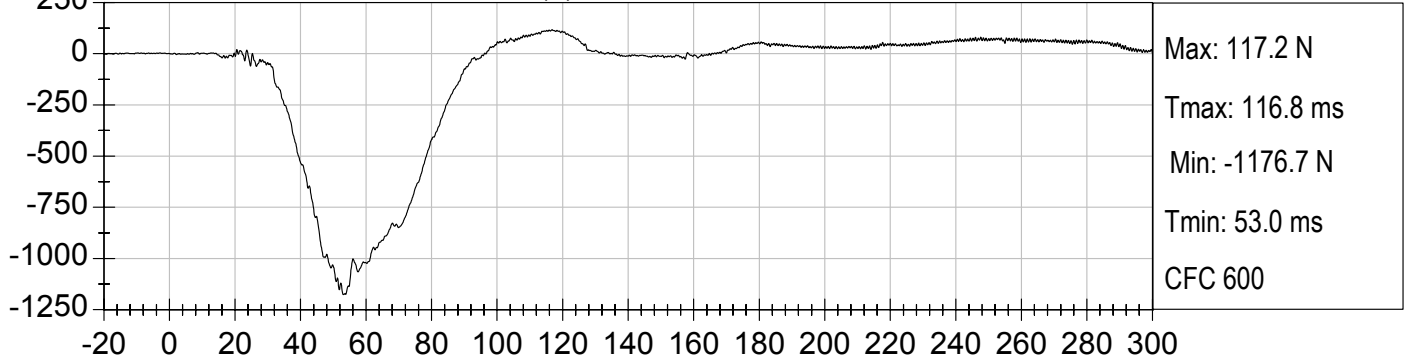
PASSENGER LEFT UPPER TIBIA MX (Nm) vs TIME (ms)



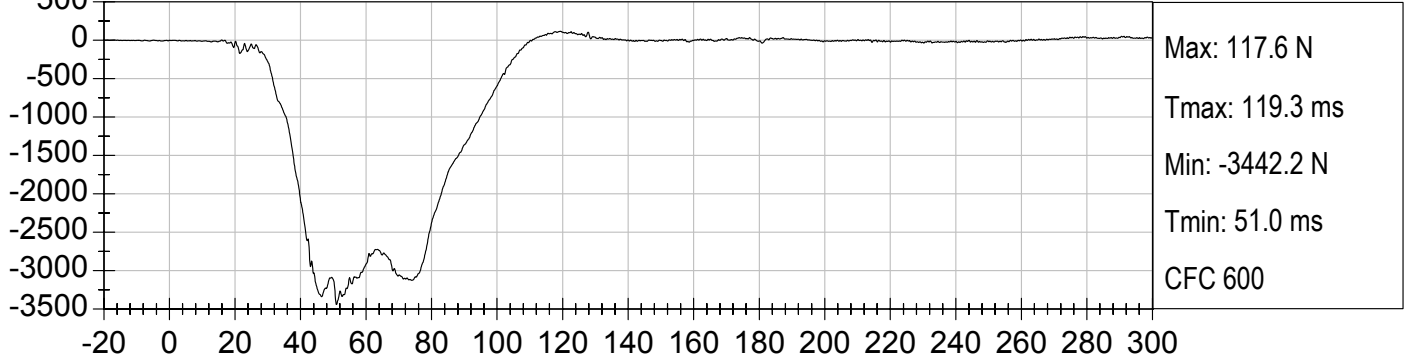
PASSENGER LEFT UPPER TIBIA MY (Nm) vs TIME (ms)



PASSENGER LEFT UPPER TIBIA FX (N) vs TIME (ms)

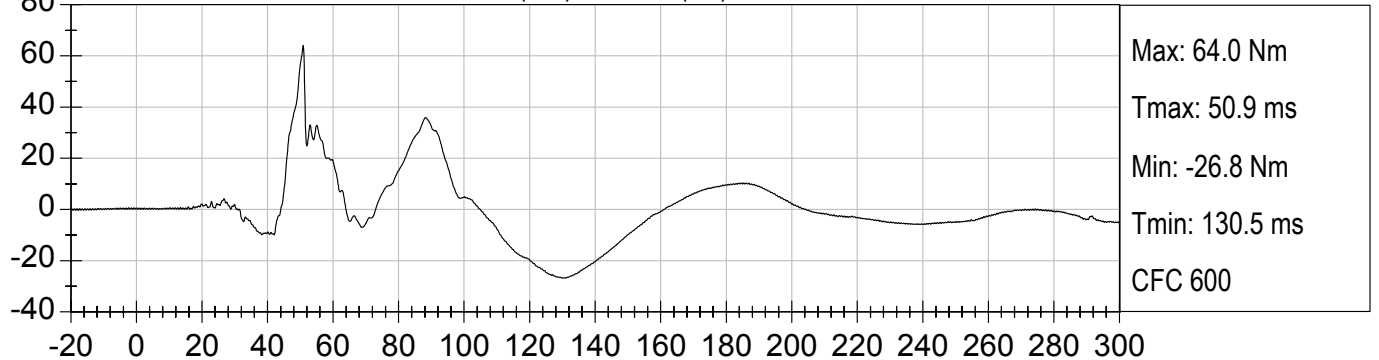


PASSENGER LEFT UPPER TIBIA FZ (N) vs TIME (ms)

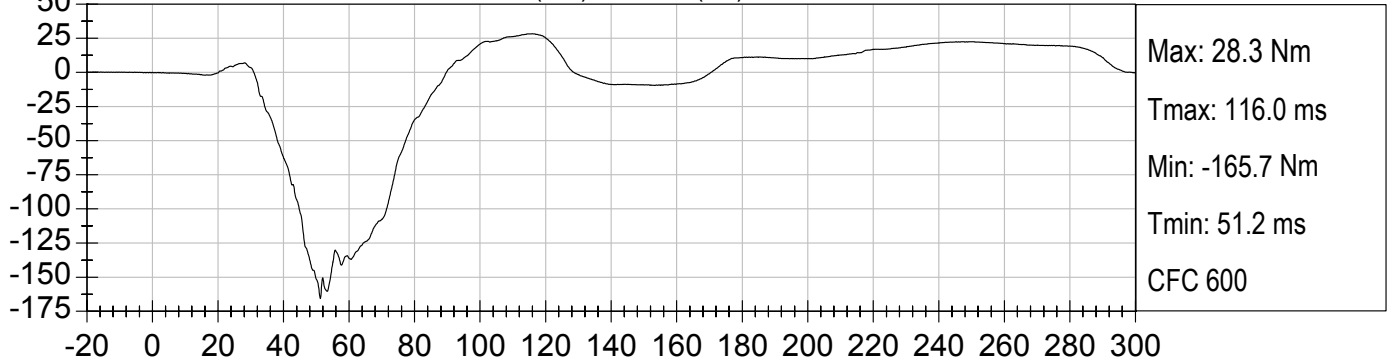




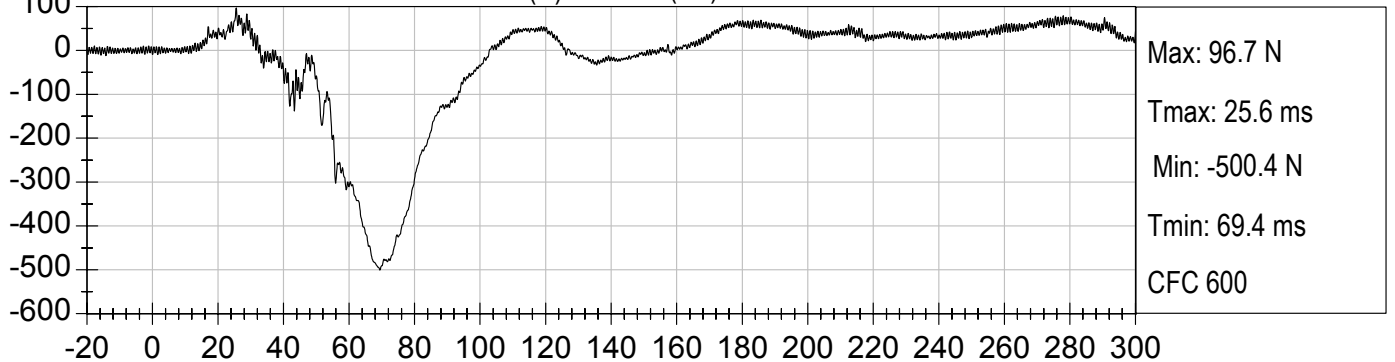
PASSENGER LEFT LOWER TIBIA MX (Nm) vs TIME (ms)



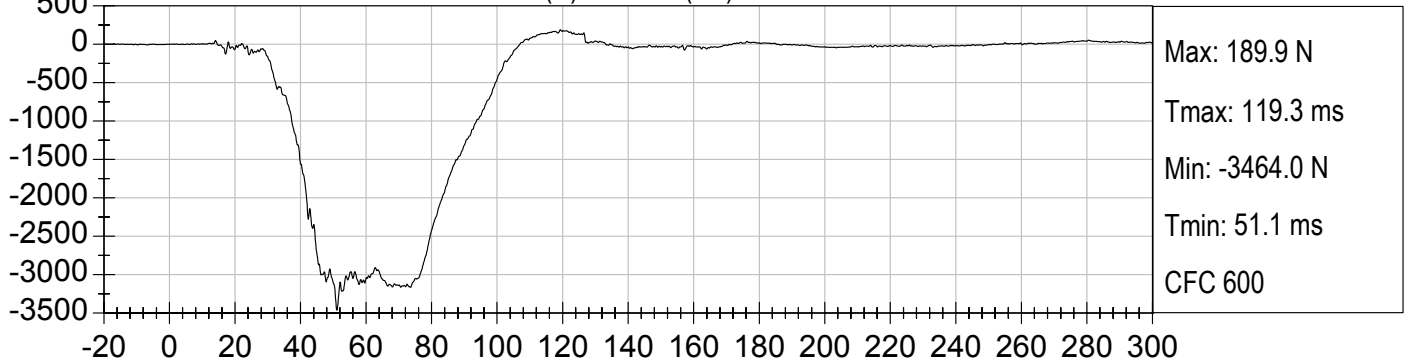
PASSENGER LEFT LOWER TIBIA MY (Nm) vs TIME (ms)



PASSENGER LEFT LOWER TIBIA FX (N) vs TIME (ms)



PASSENGER LEFT LOWER TIBIA FZ (N) vs TIME (ms)

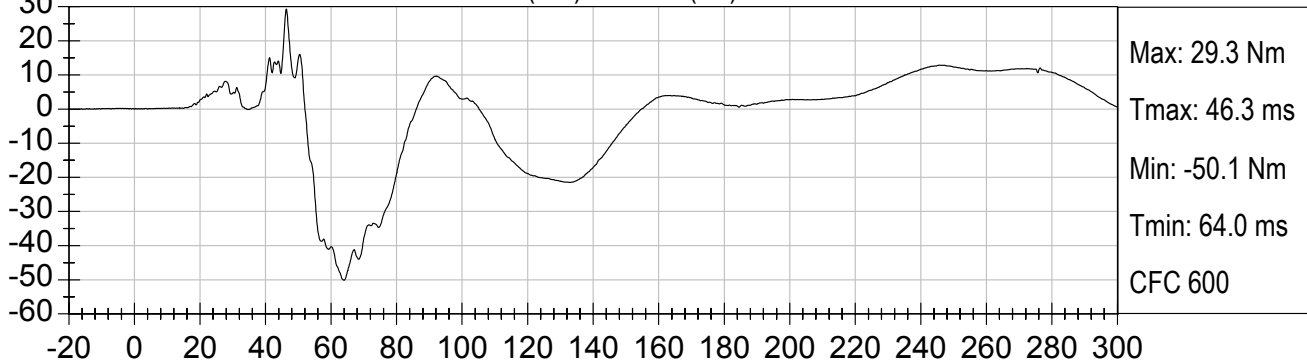




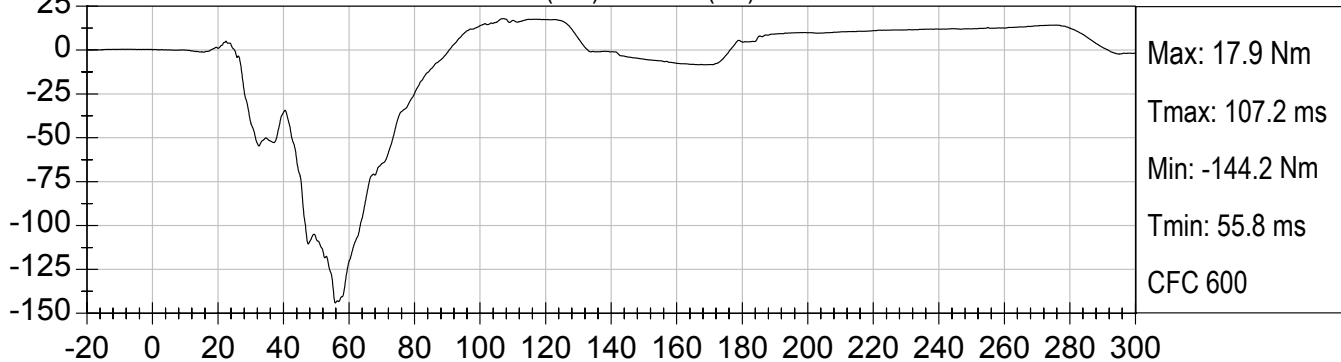
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

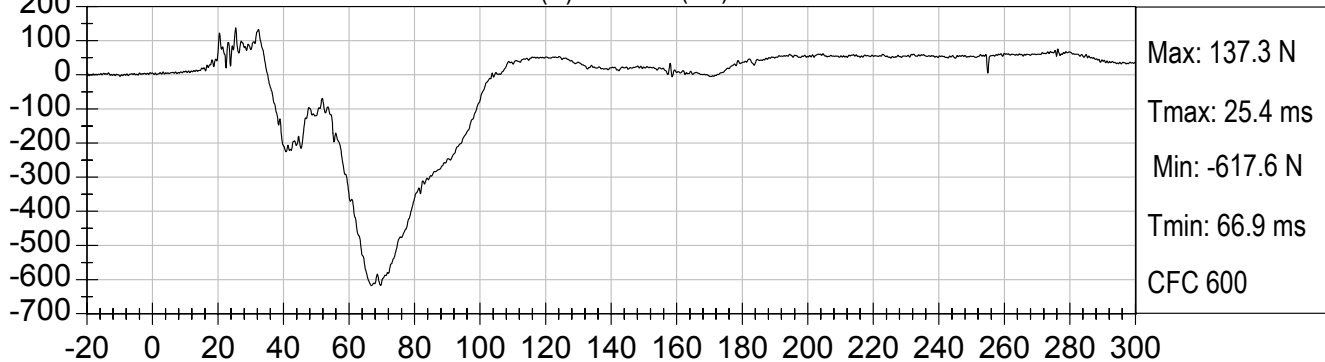
PASSENGER RIGHT UPPER TIBIA MX (Nm) vs TIME (ms)



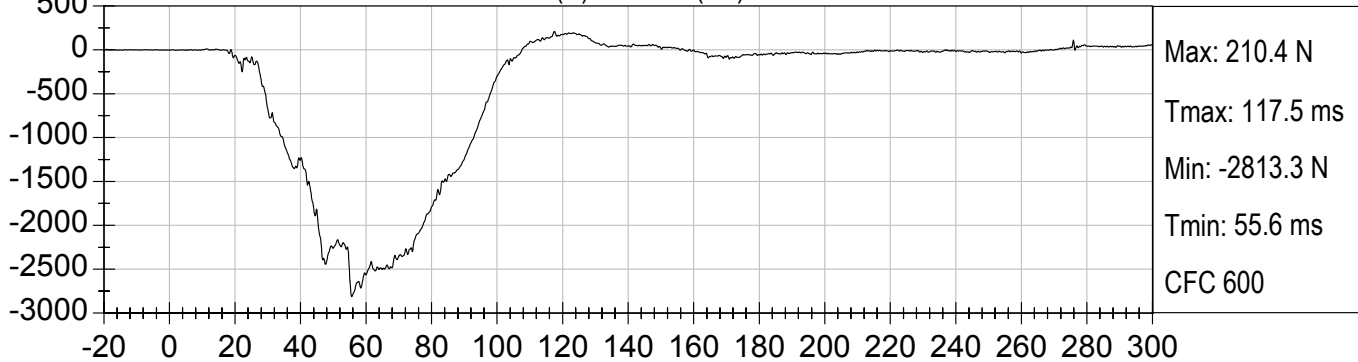
PASSENGER RIGHT UPPER TIBIA MY (Nm) vs TIME (ms)



PASSENGER RIGHT UPPER TIBIA FX (N) vs TIME (ms)

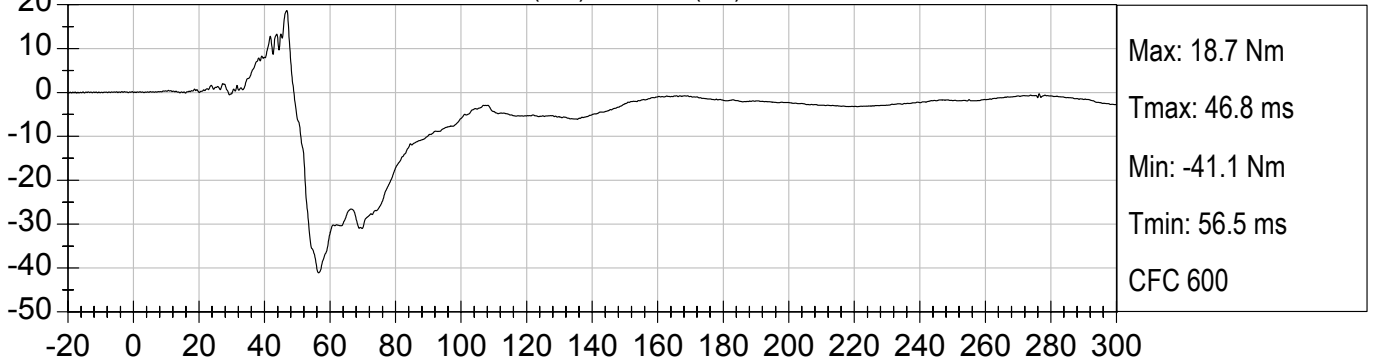


PASSENGER RIGHT UPPER TIBIA FZ (N) vs TIME (ms)

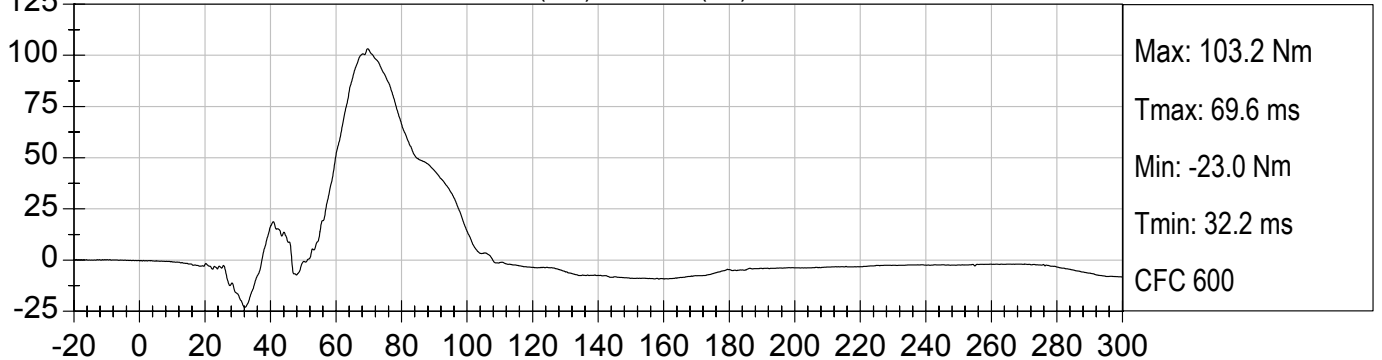




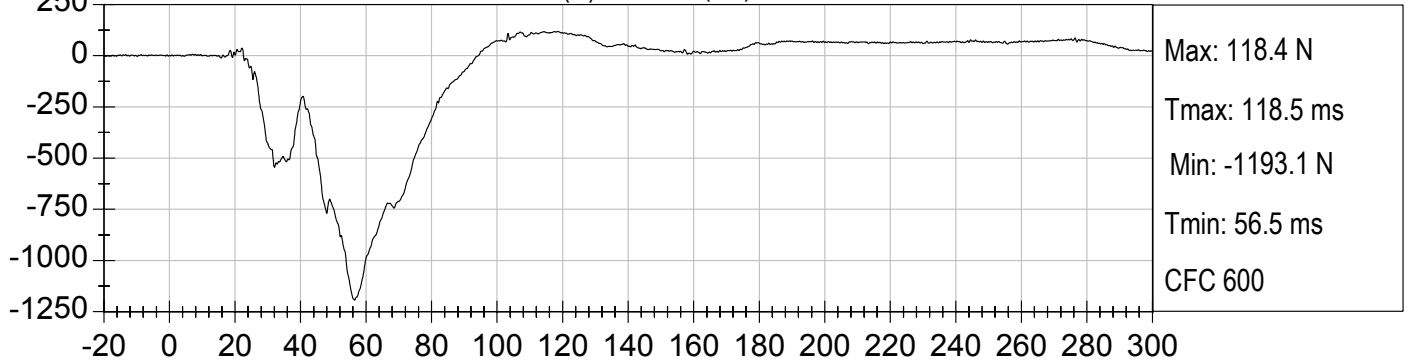
PASSENGER RIGHT LOWER TIBIA MX (Nm) vs TIME (ms)



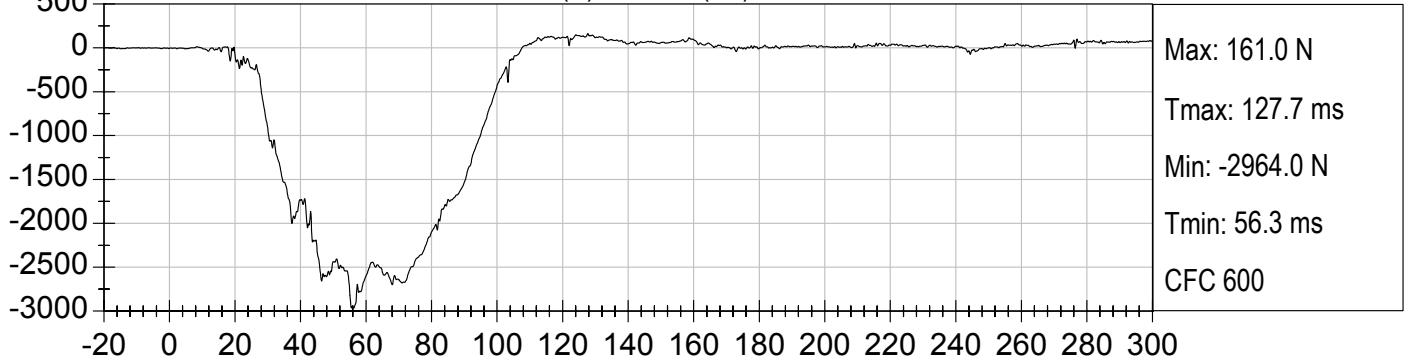
PASSENGER RIGHT LOWER TIBIA MY (Nm) vs TIME (ms)

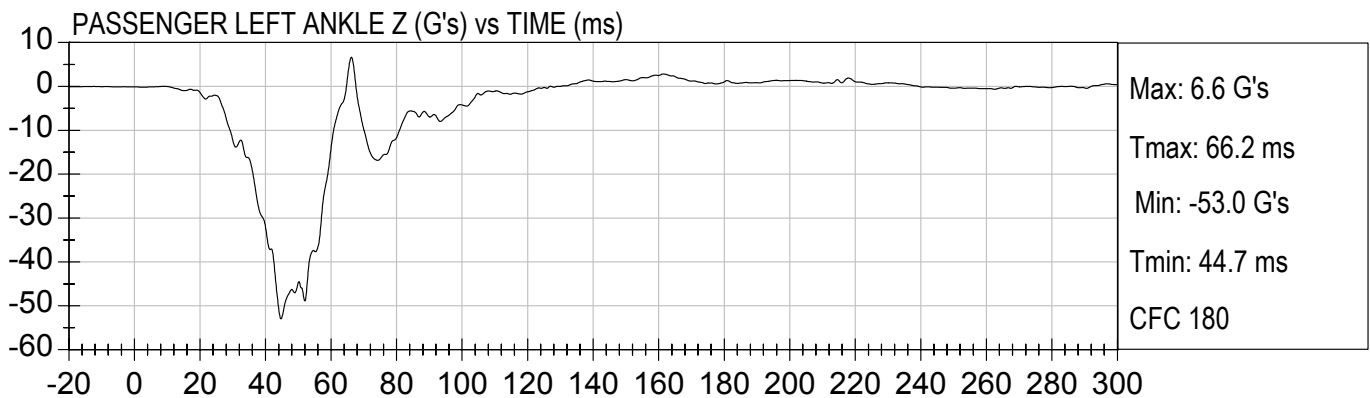
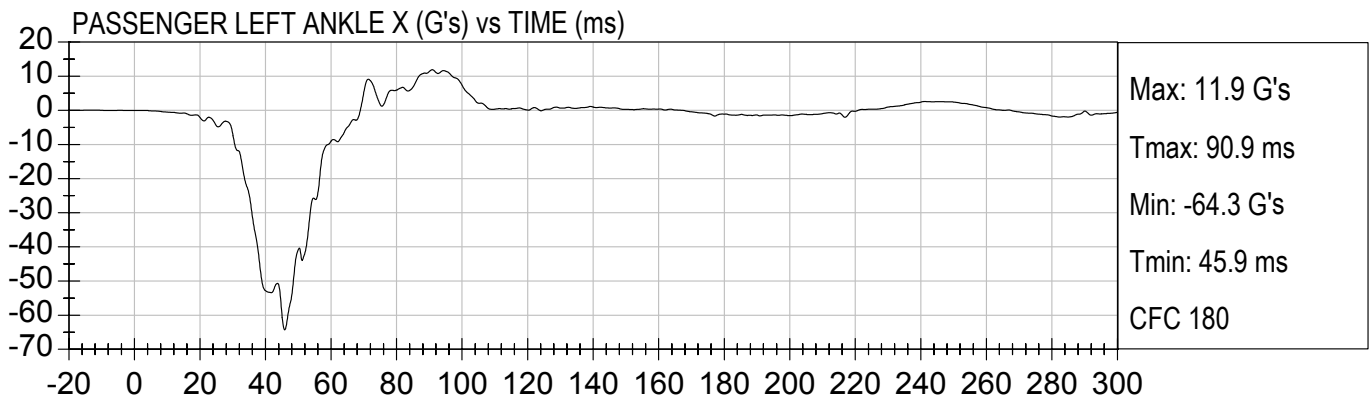
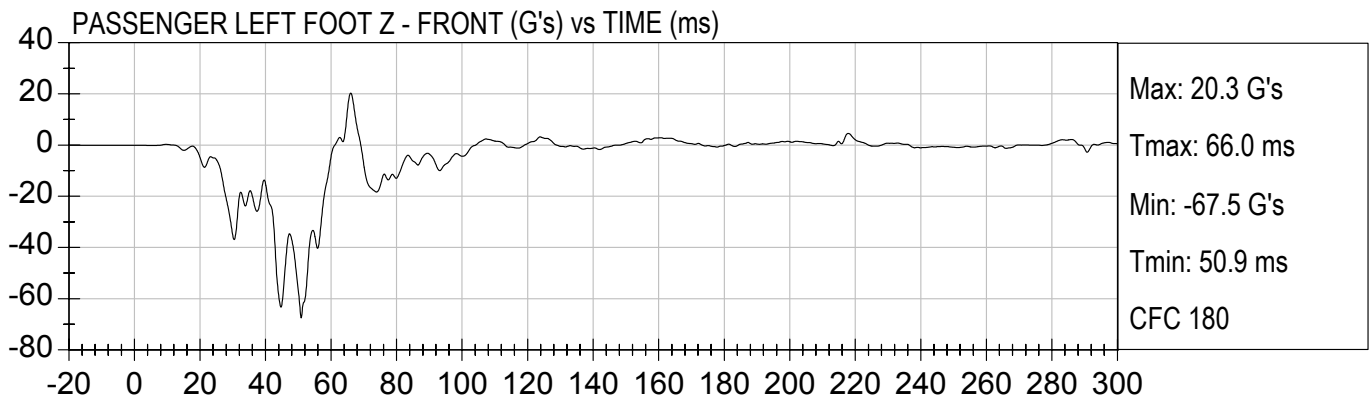


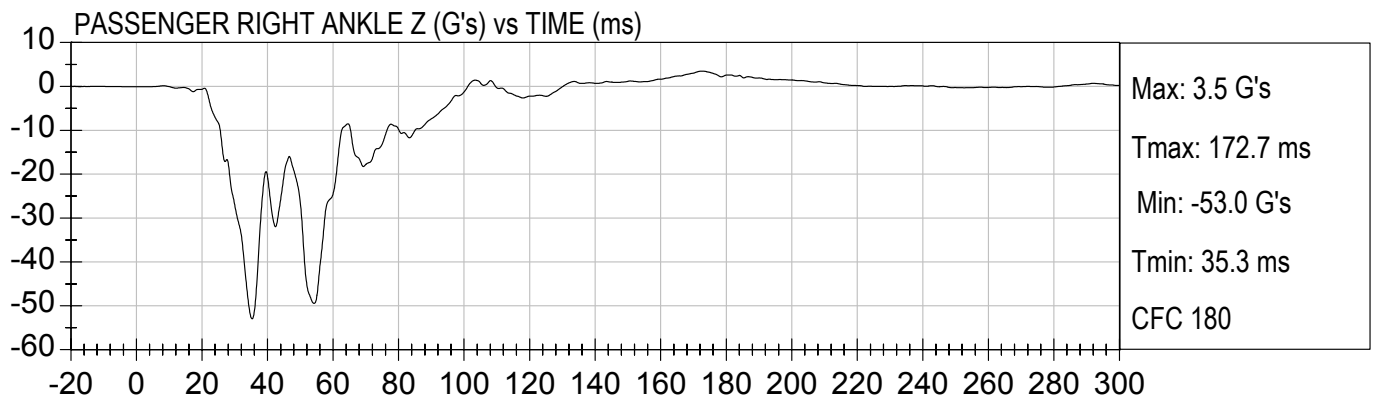
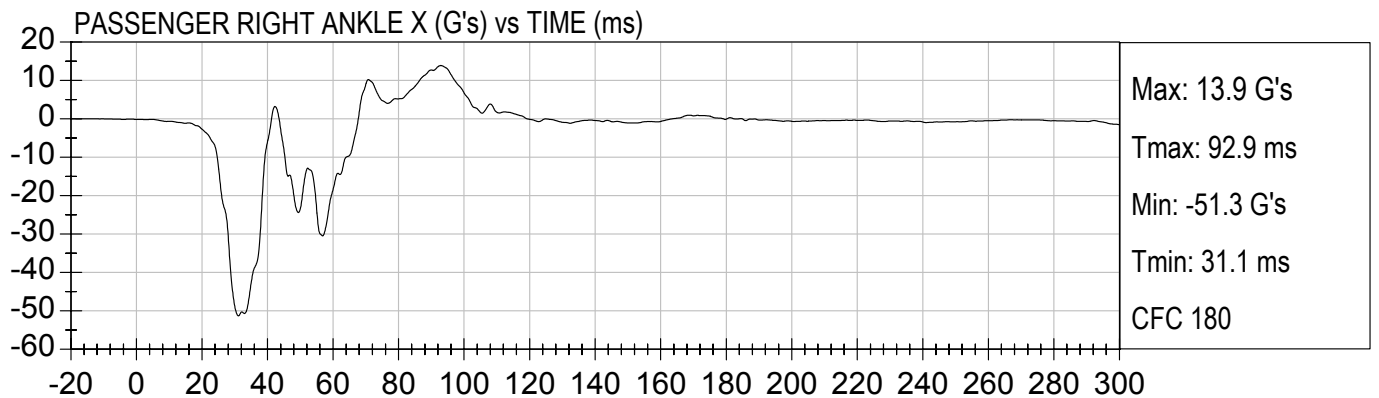
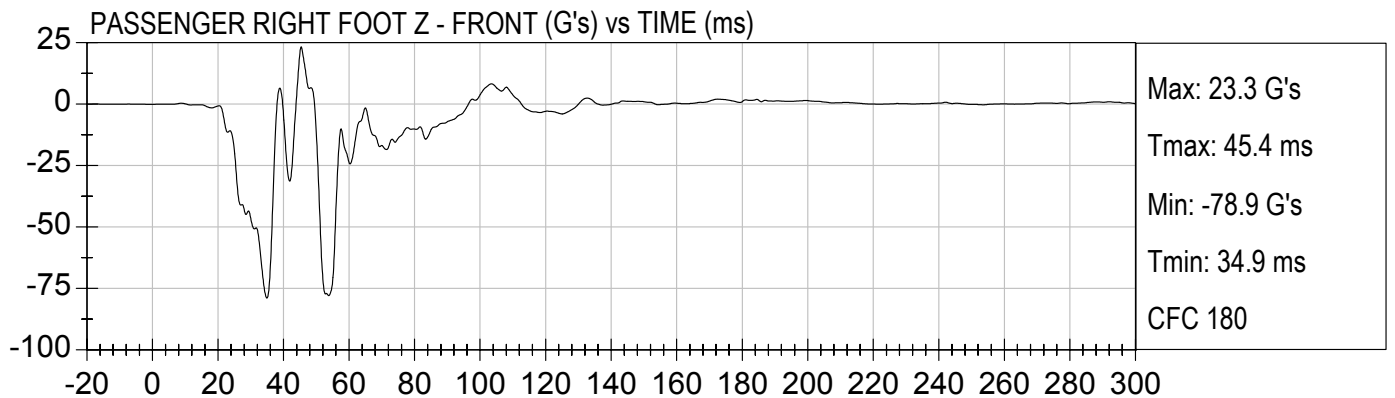
PASSENGER RIGHT LOWER TIBIA FX (N) vs TIME (ms)

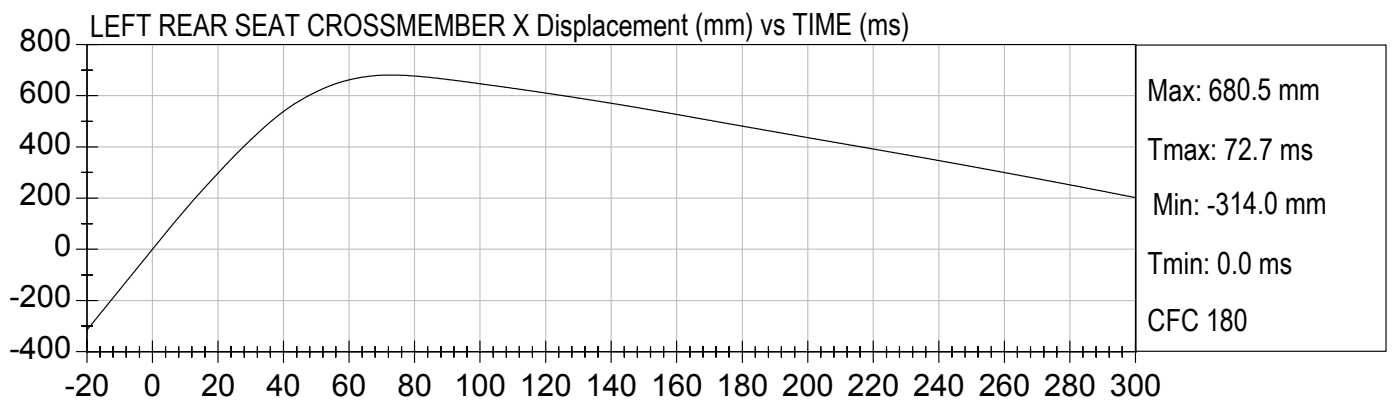
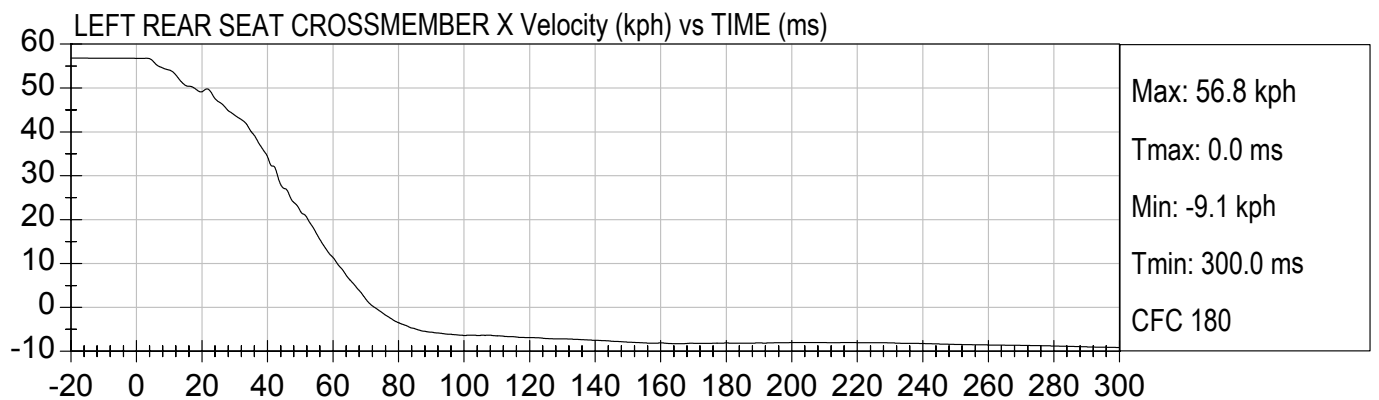
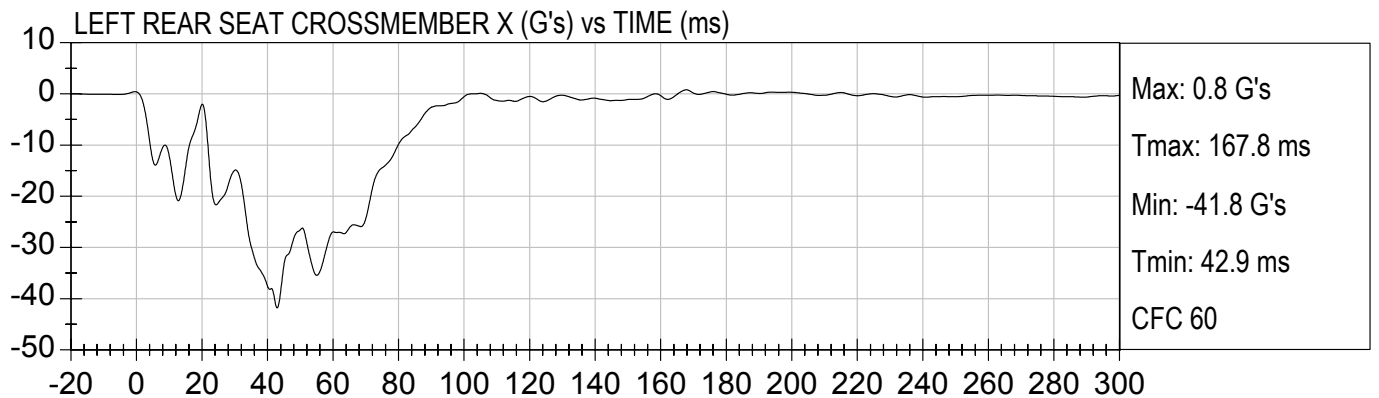


PASSENGER RIGHT LOWER TIBIA FZ (N) vs TIME (ms)



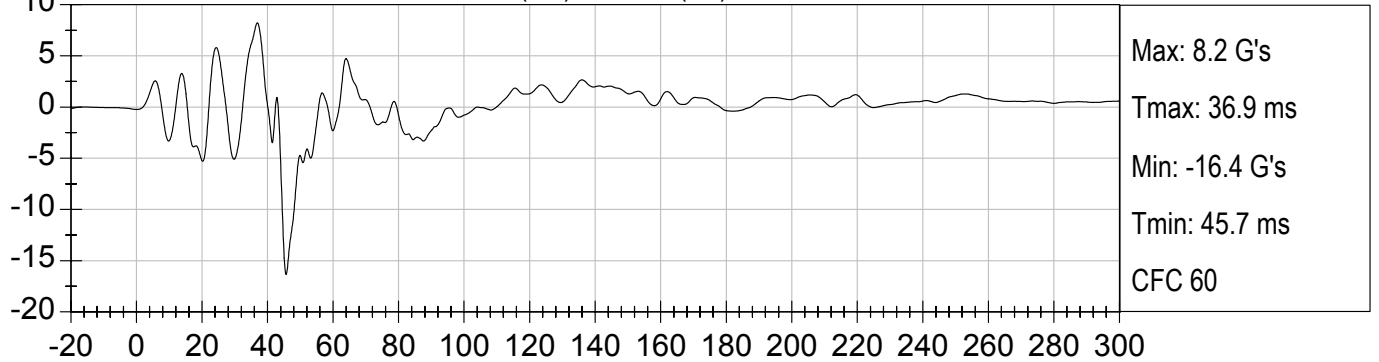




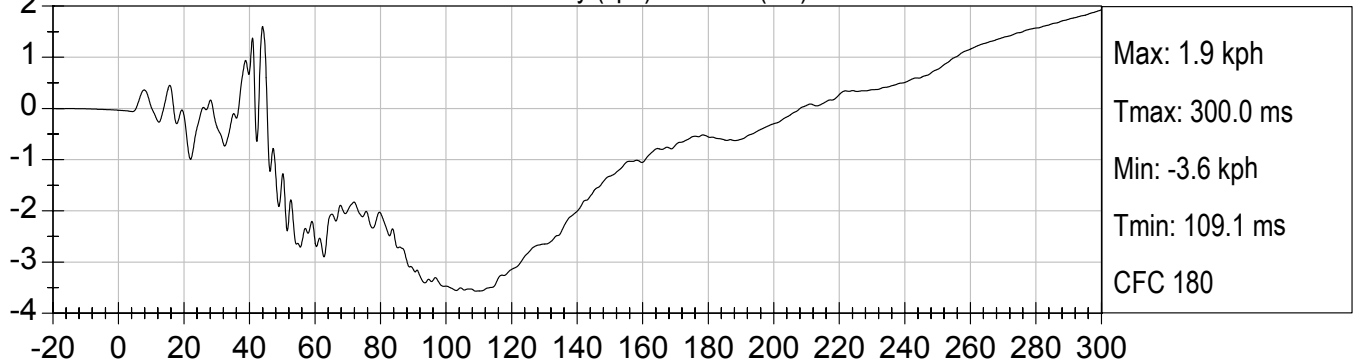




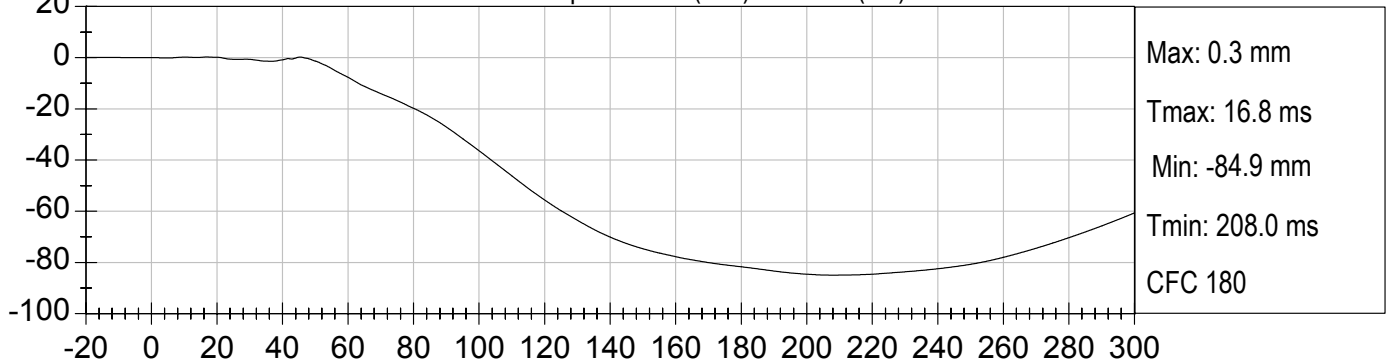
LEFT REAR SEAT CROSSMEMBER Z (G's) vs TIME (ms)

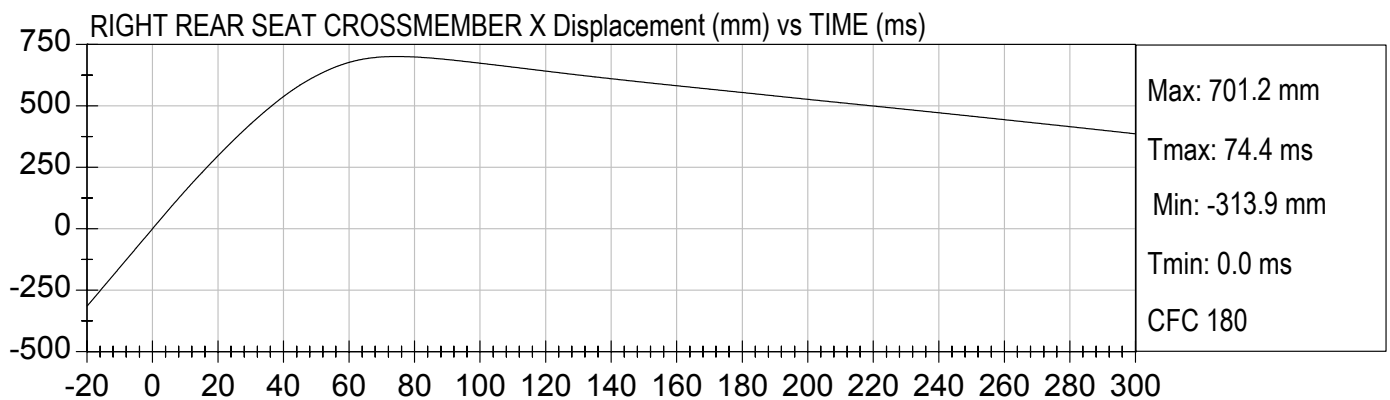
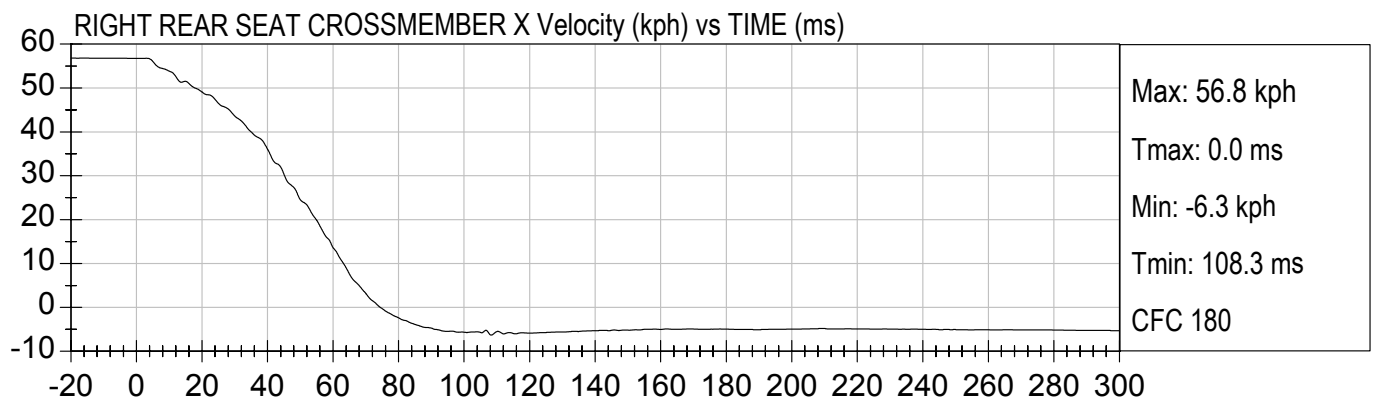
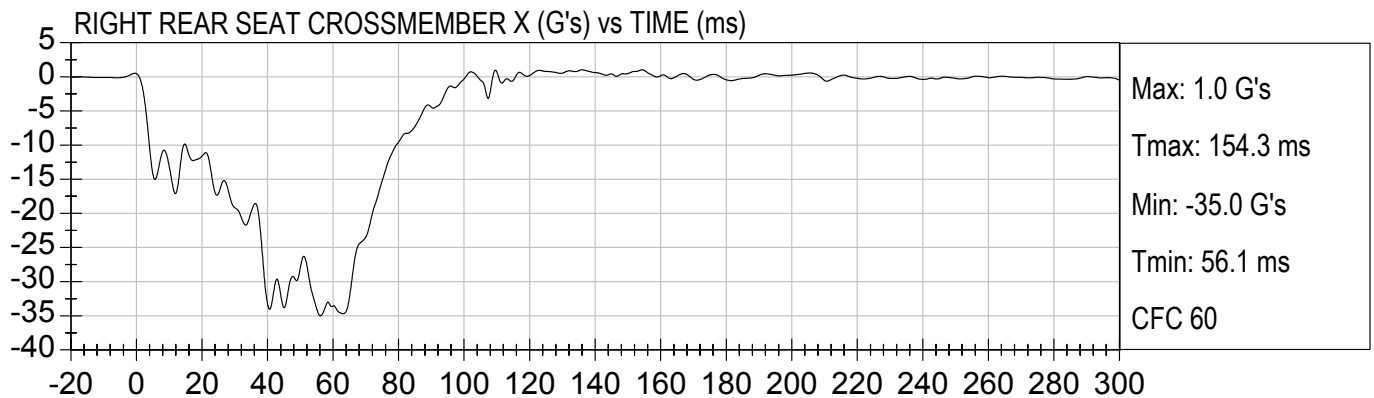


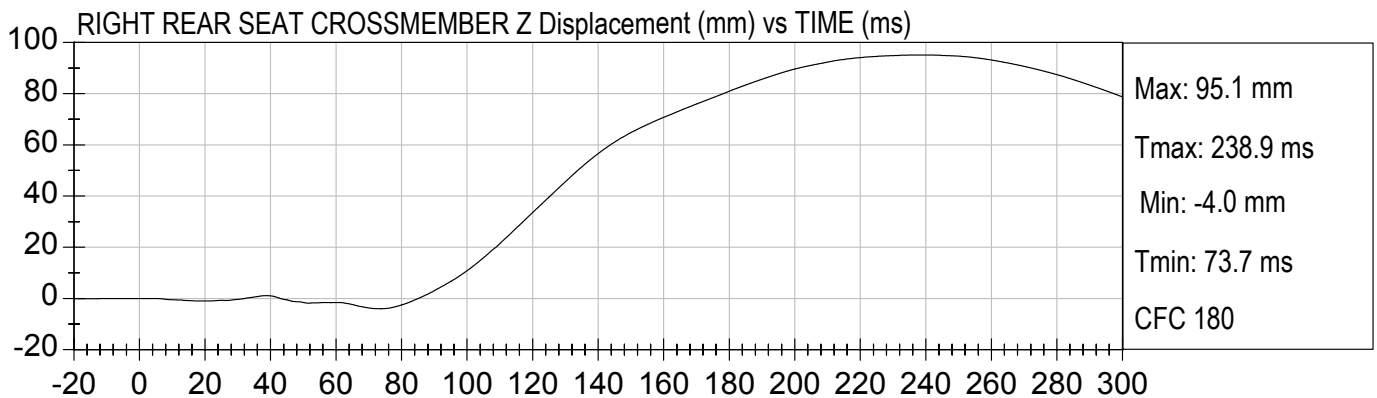
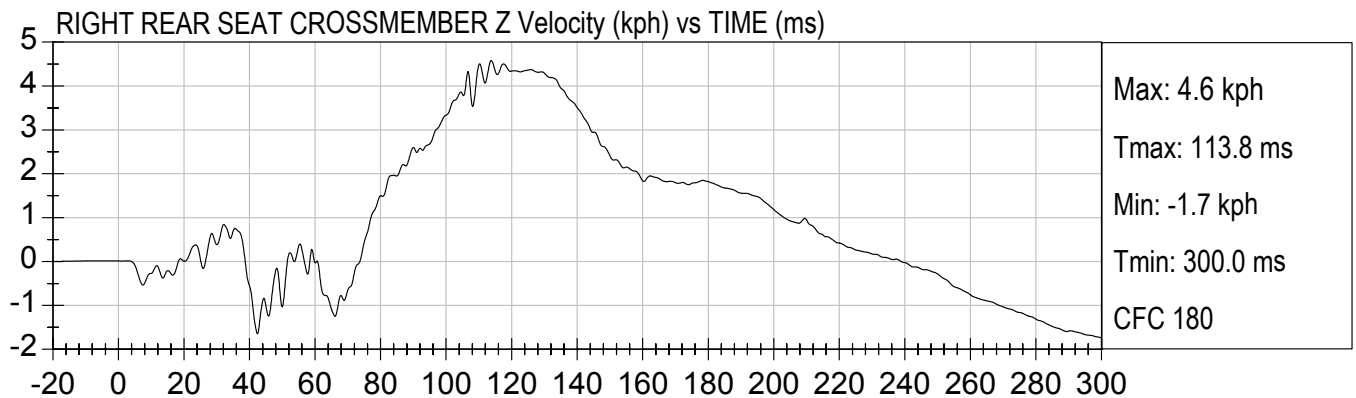
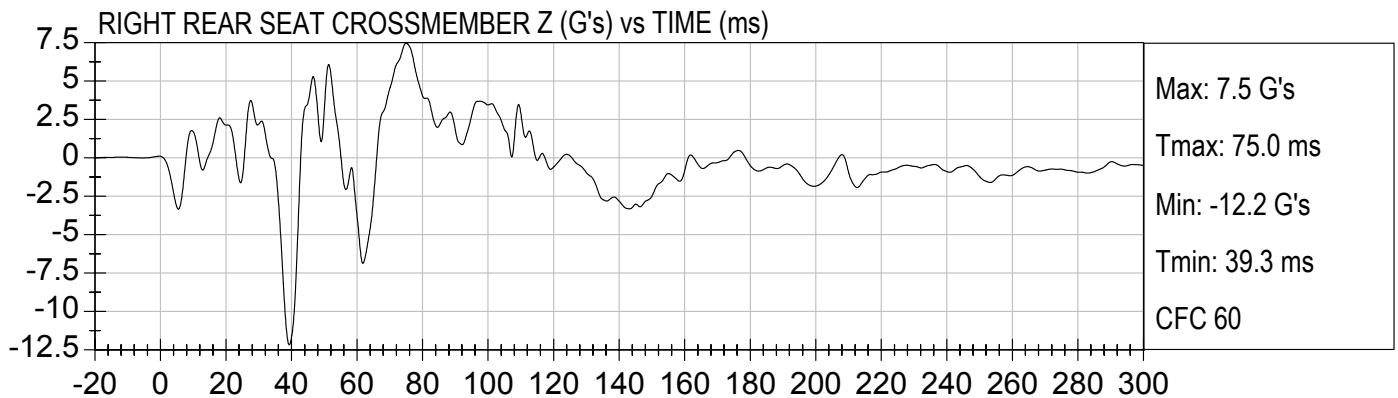
LEFT REAR SEAT CROSSMEMBER Z Velocity (kph) vs TIME (ms)

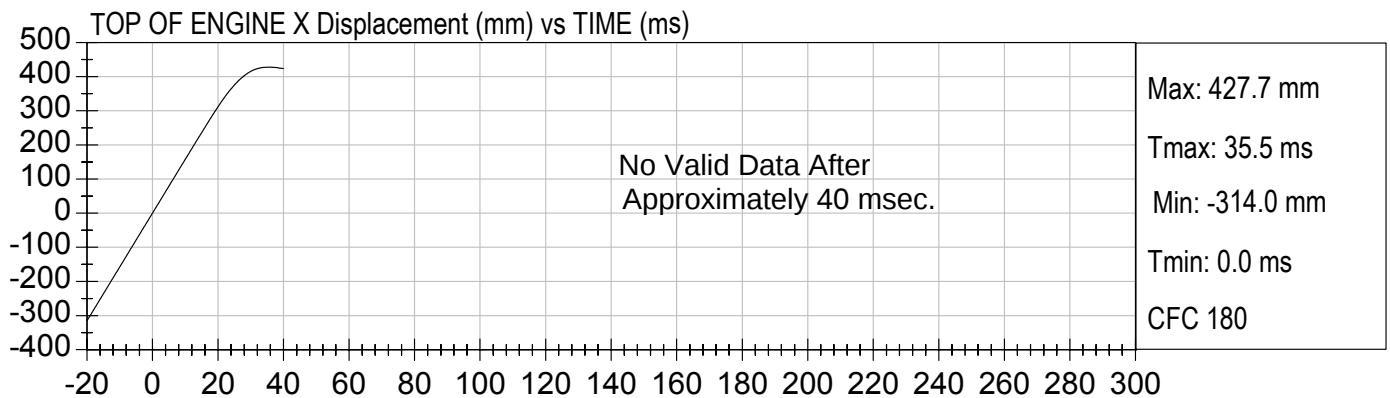
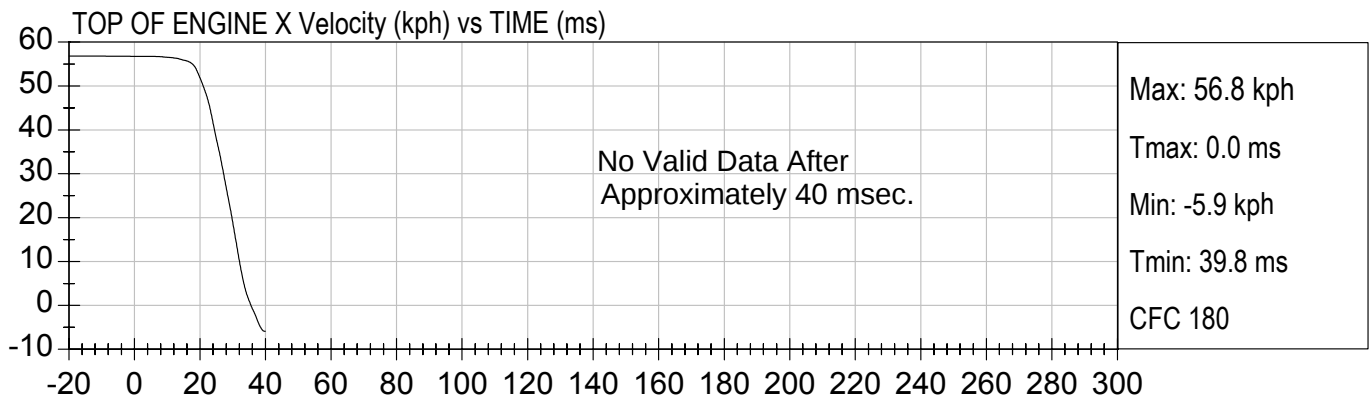
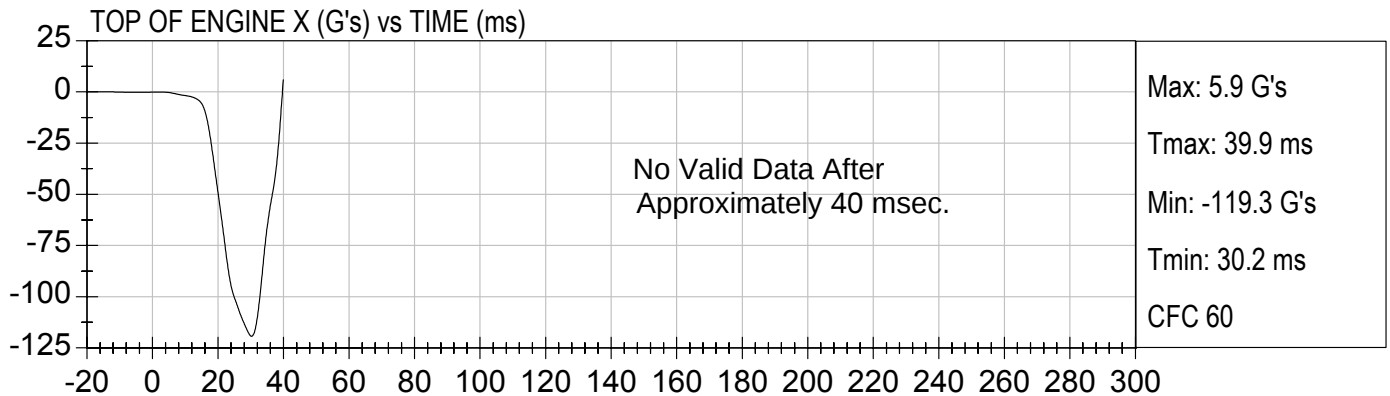


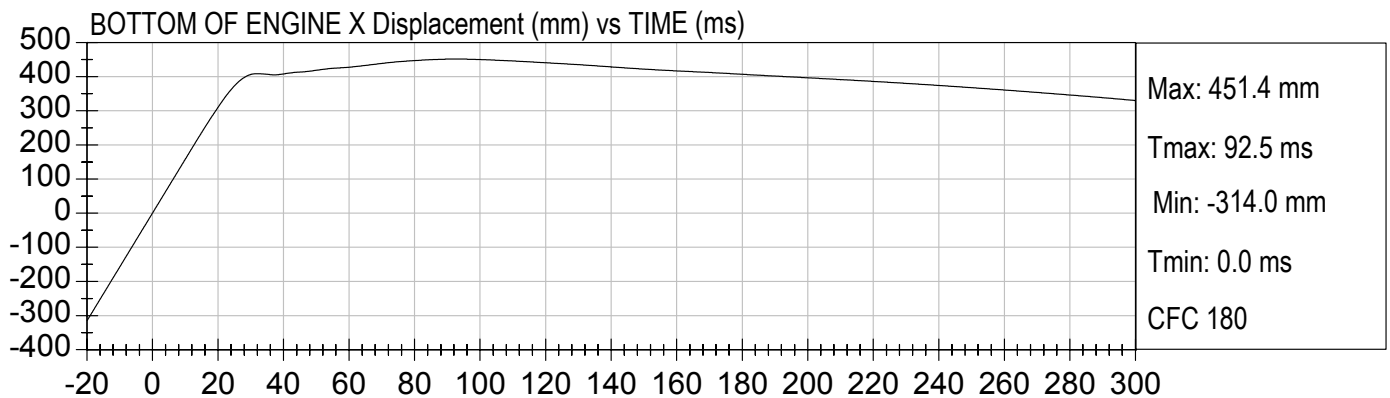
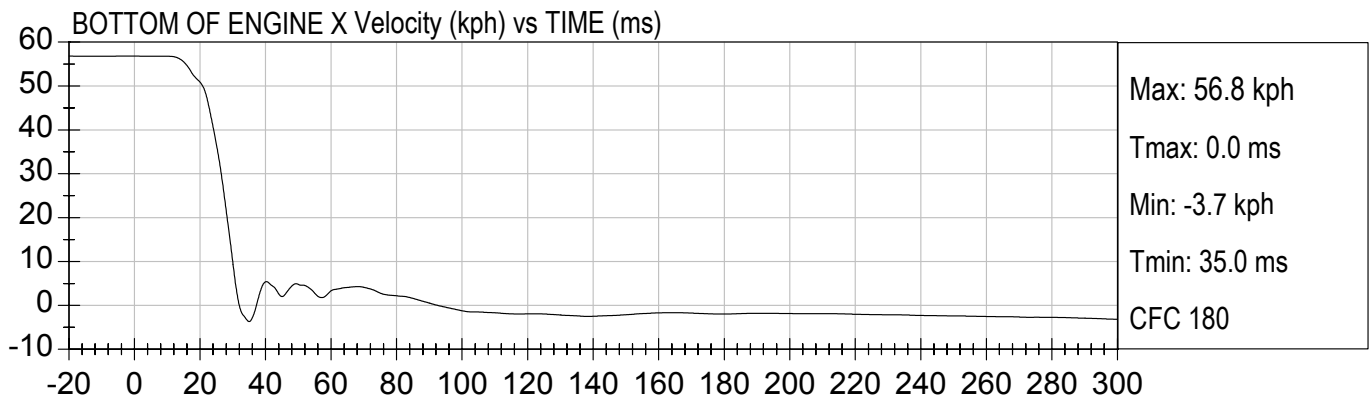
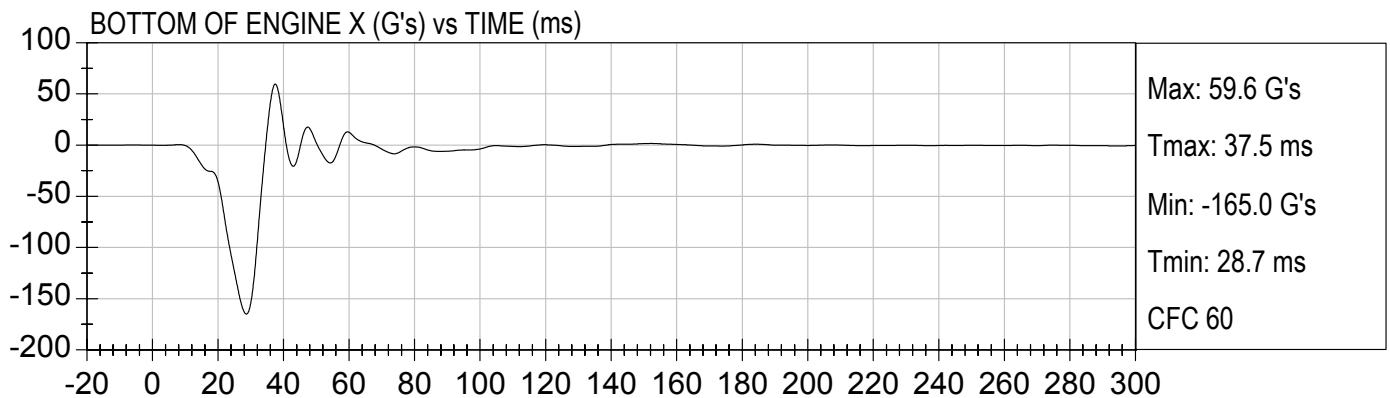
LEFT REAR SEAT CROSSMEMBER Z Displacement (mm) vs TIME (ms)

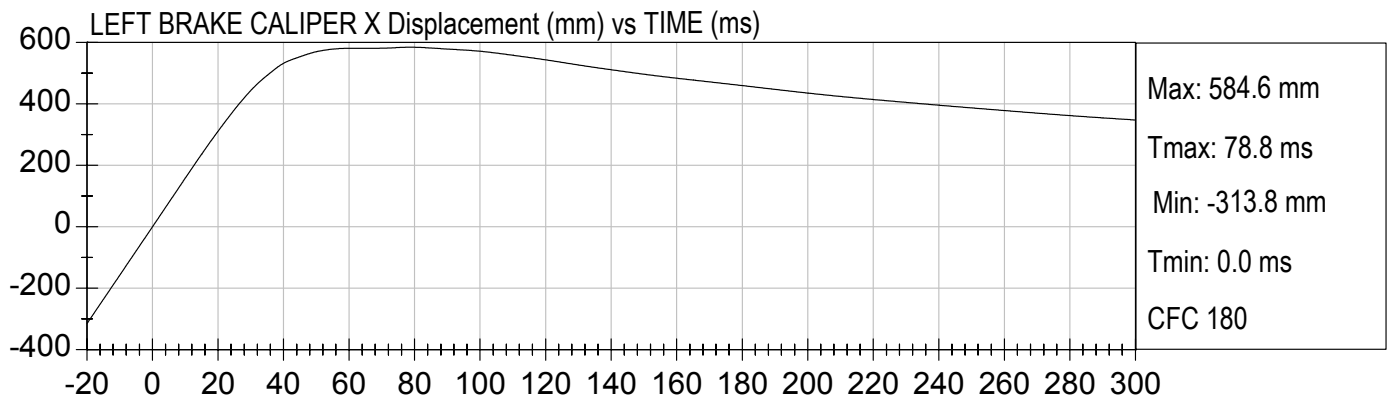
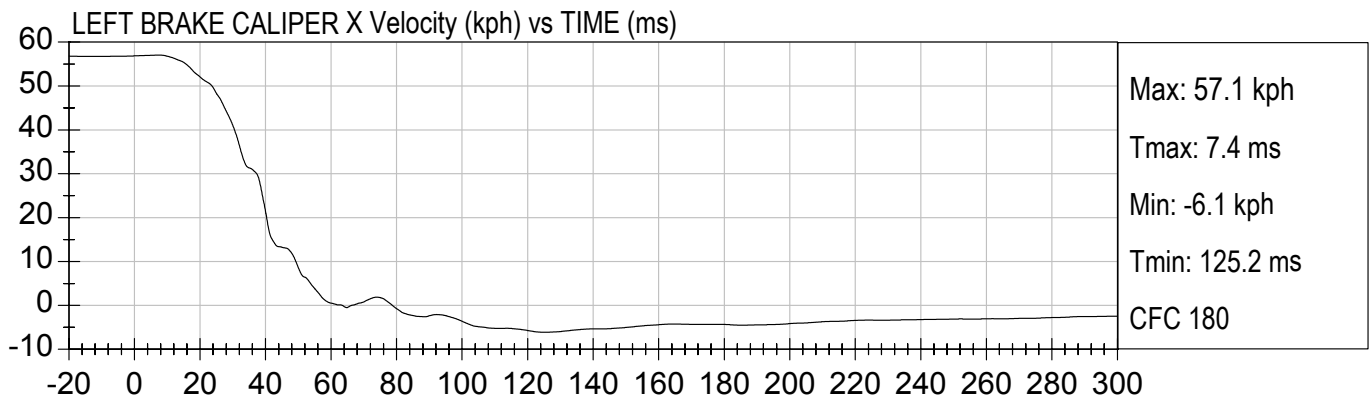
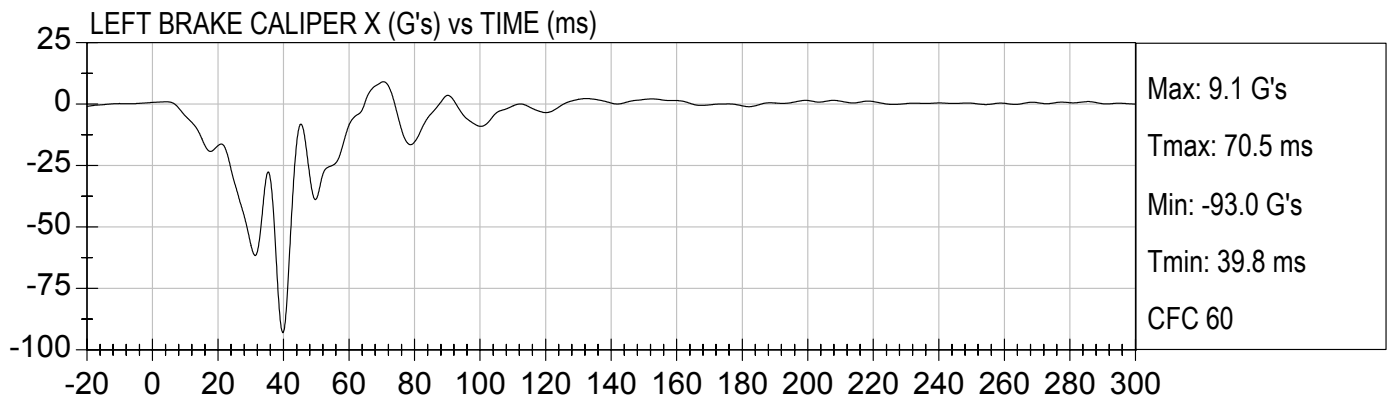


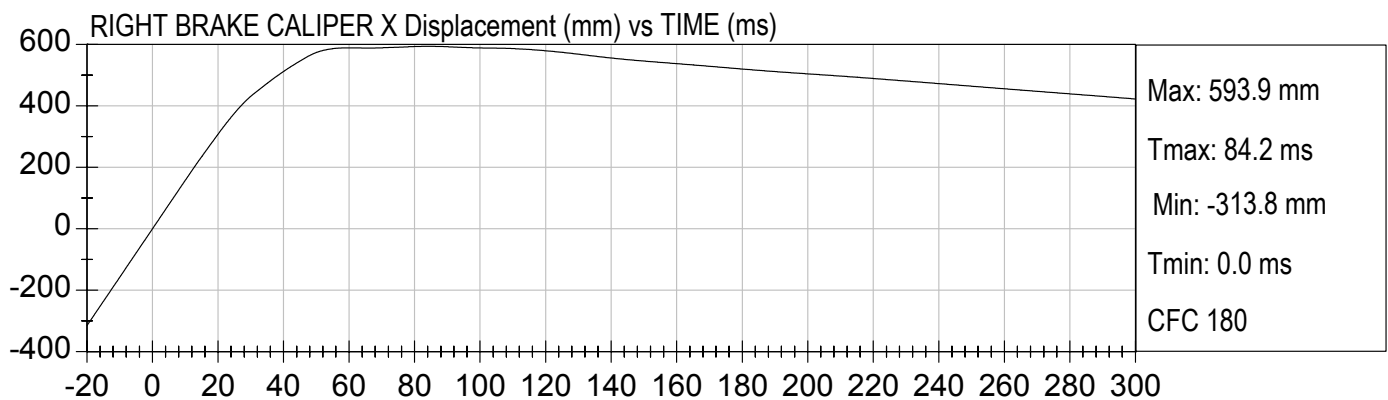
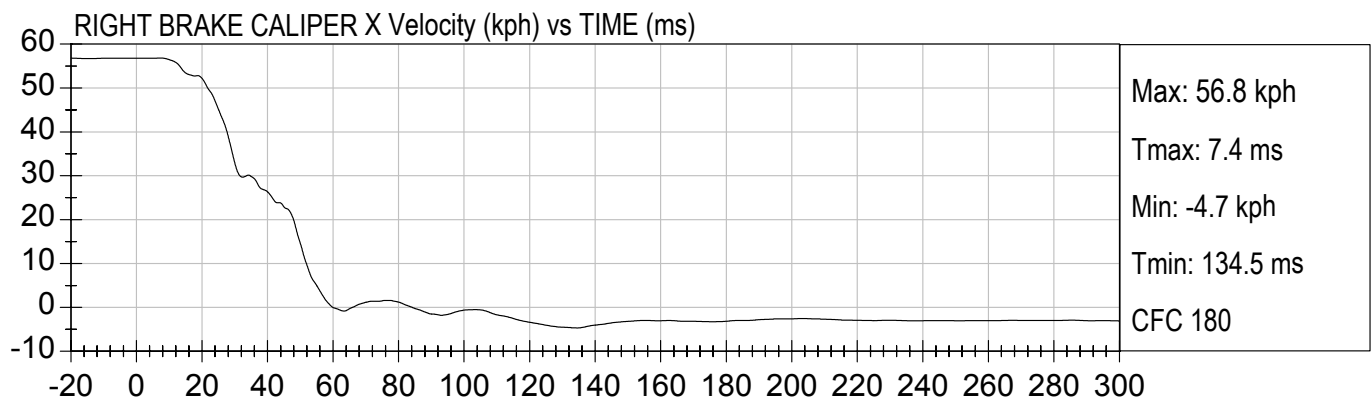
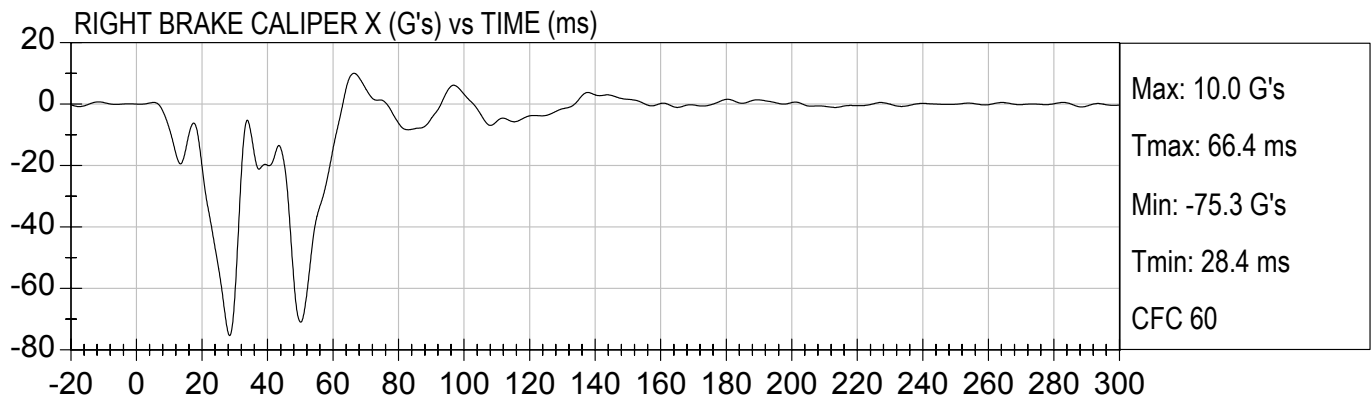


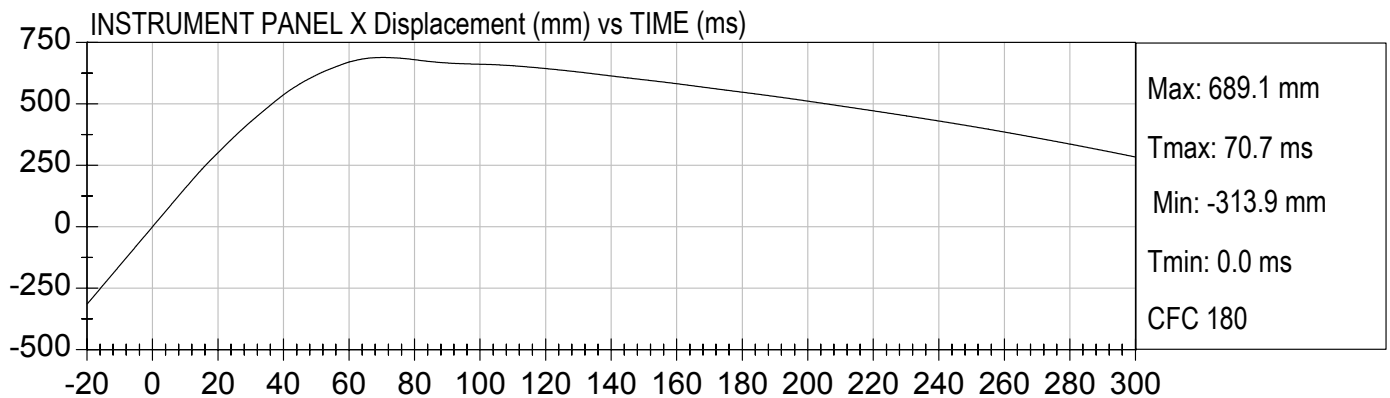
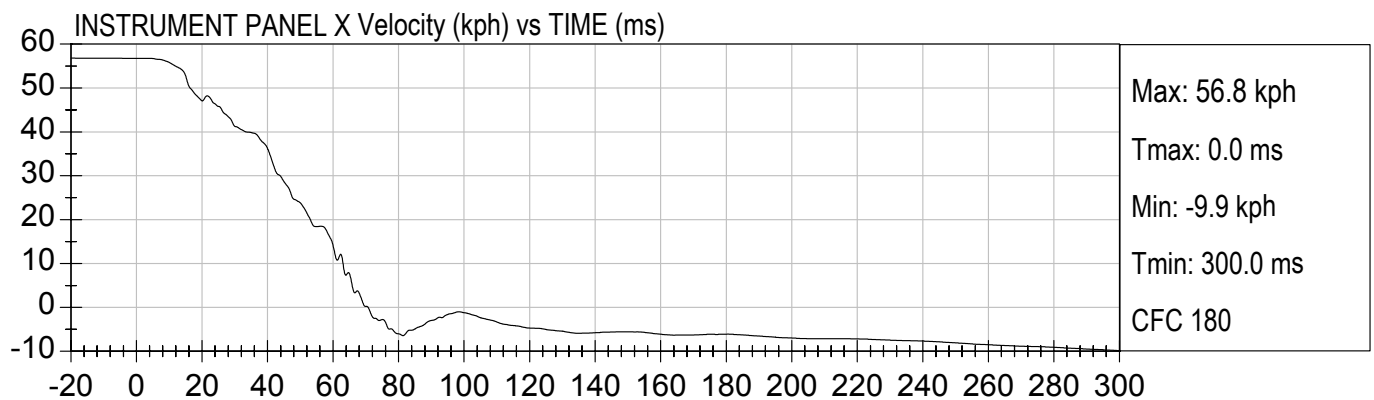
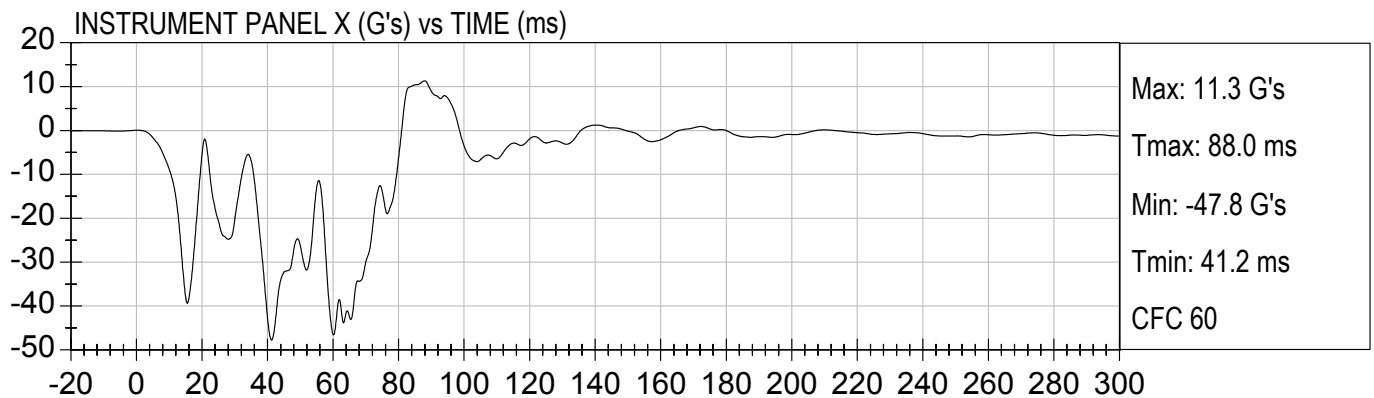










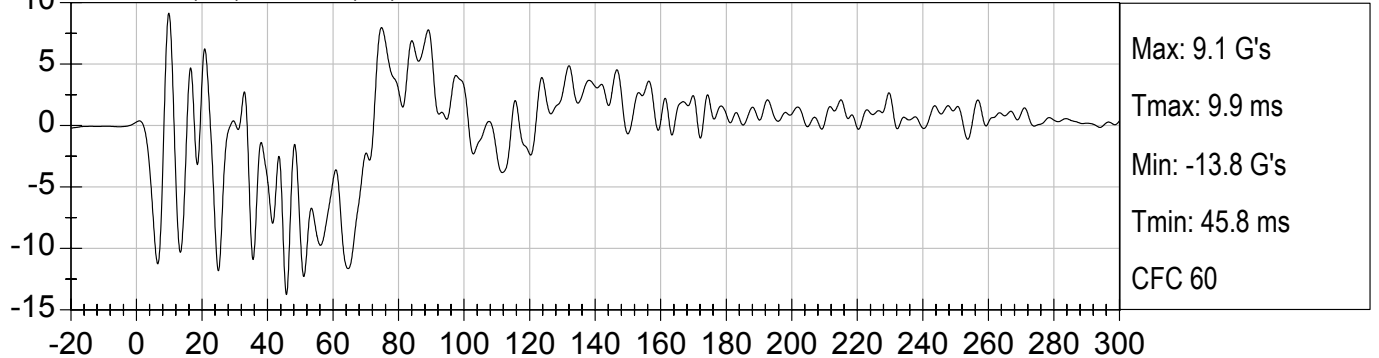




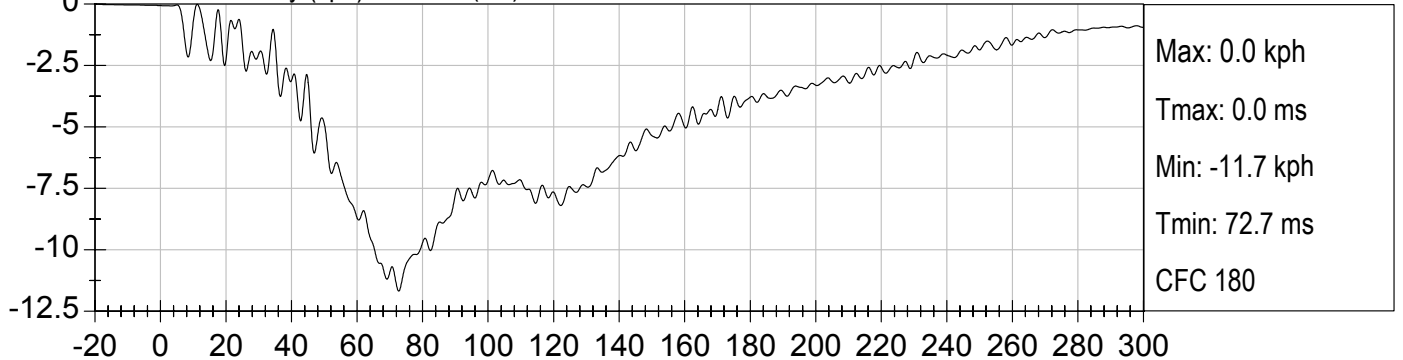
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/04
Speed: 35.3 mph (56.8 km/h)

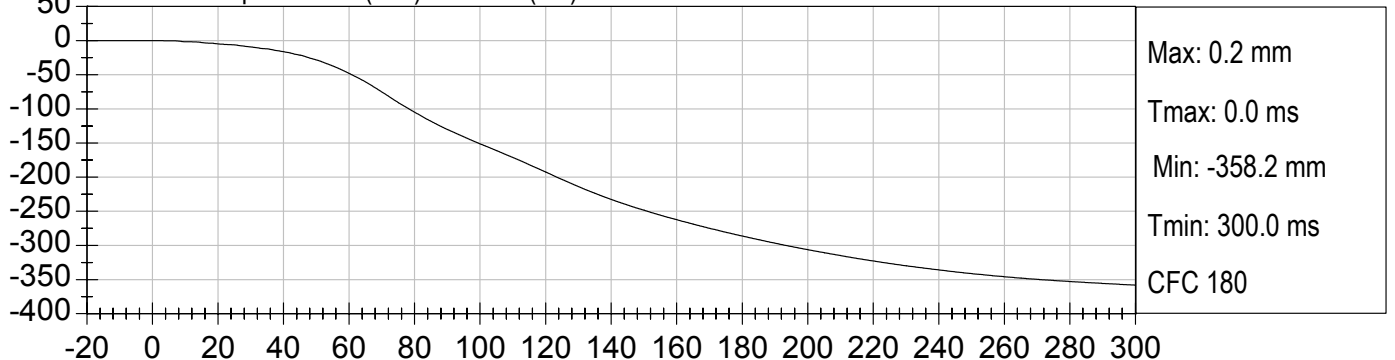
TRUNK Z (G's) vs TIME (ms)

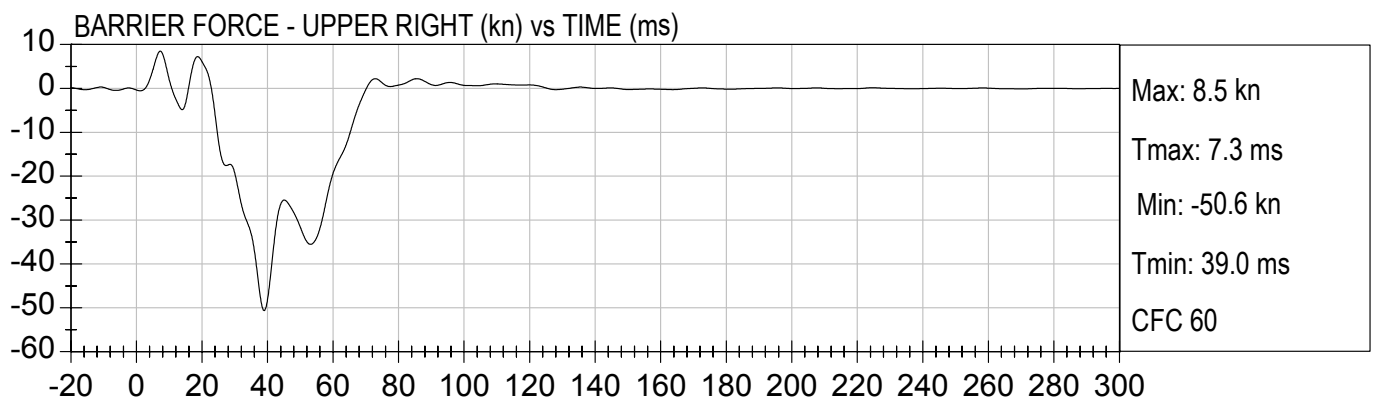
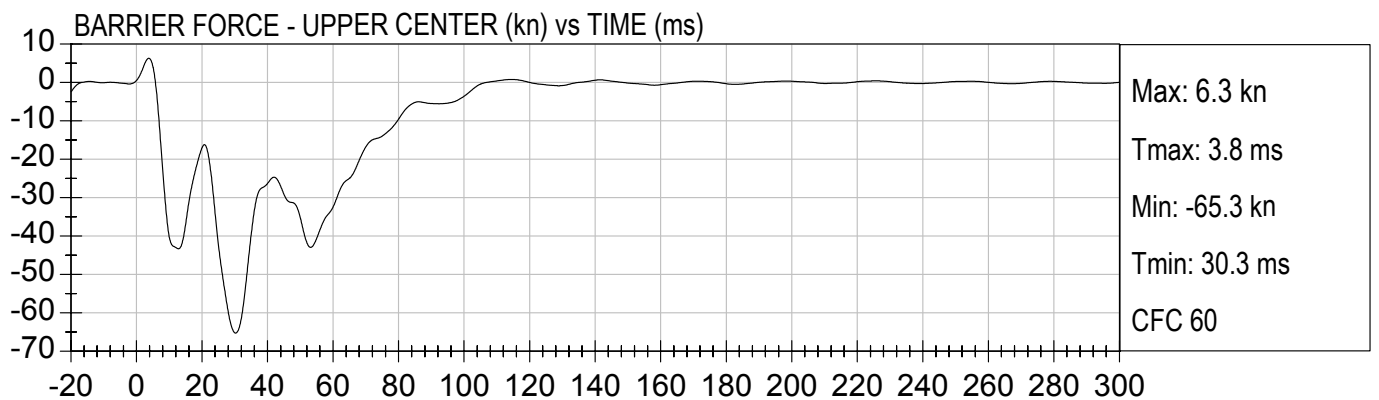
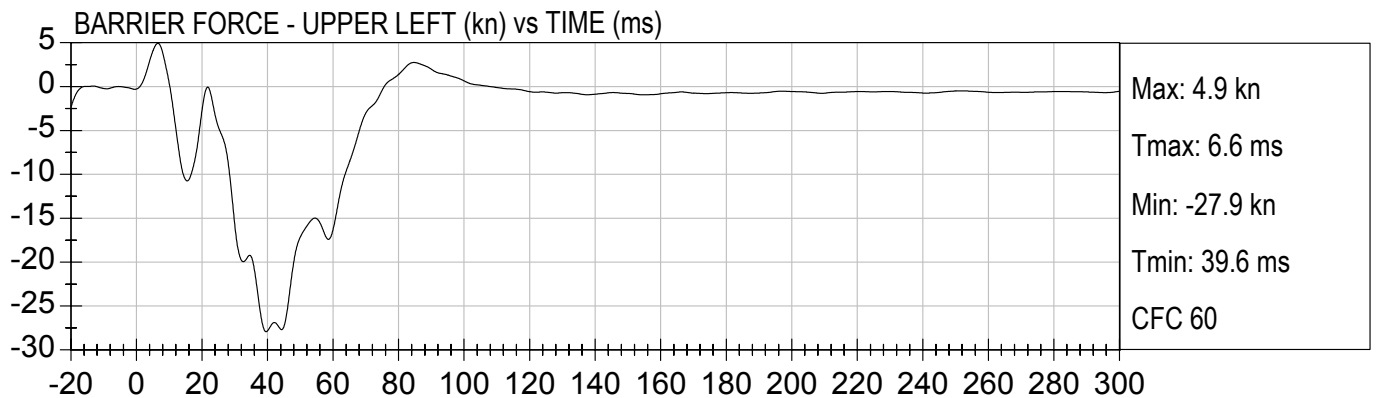


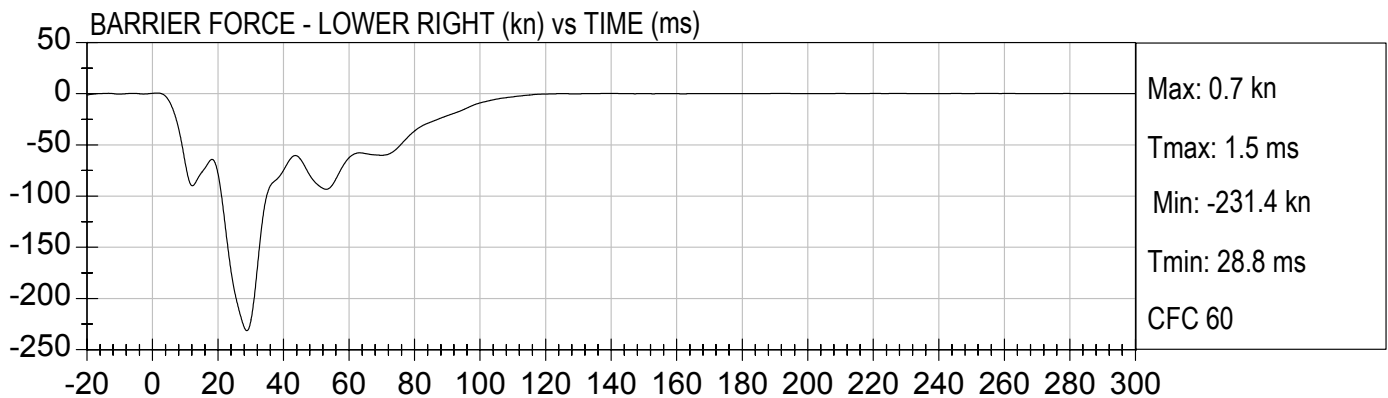
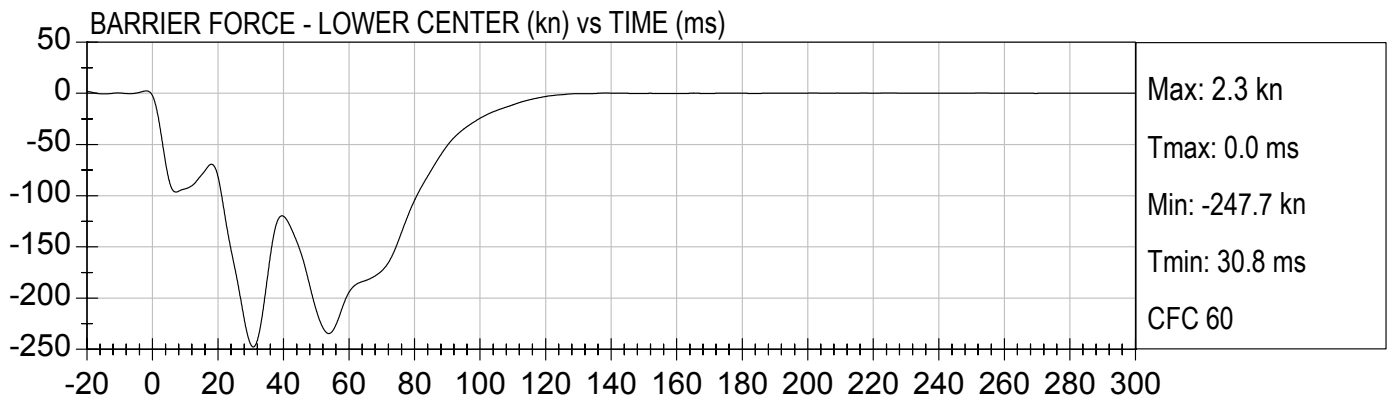
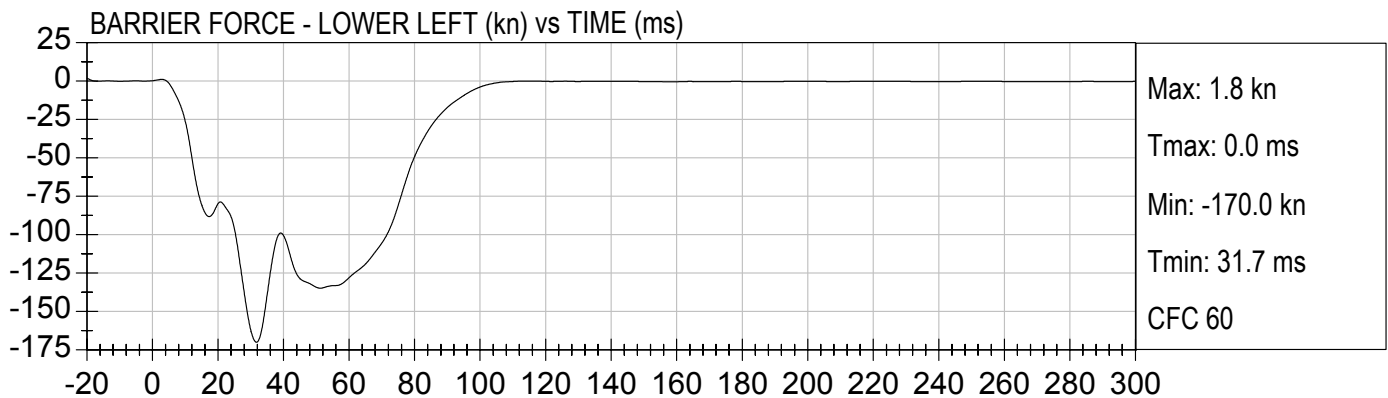
TRUNK Z Velocity (kph) vs TIME (ms)

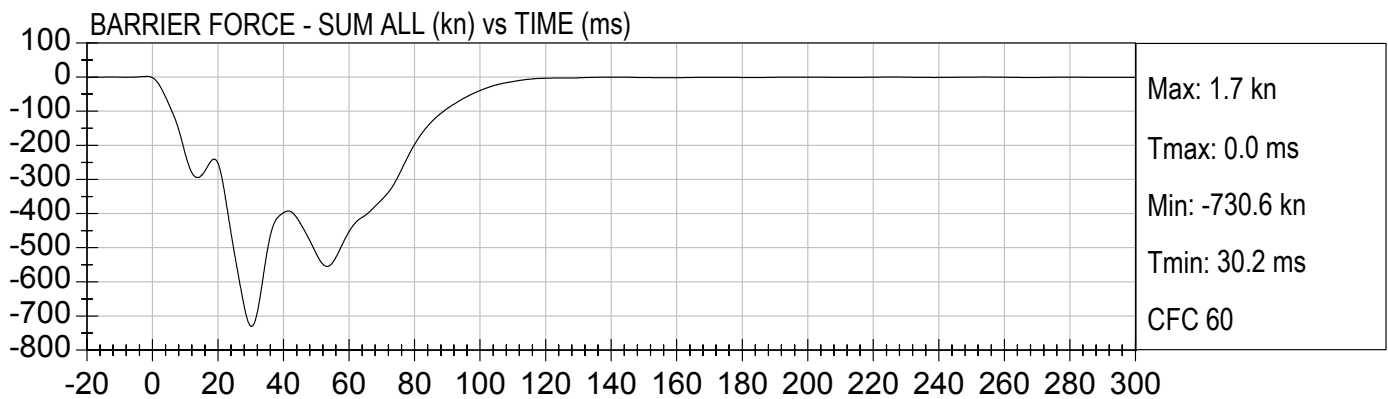
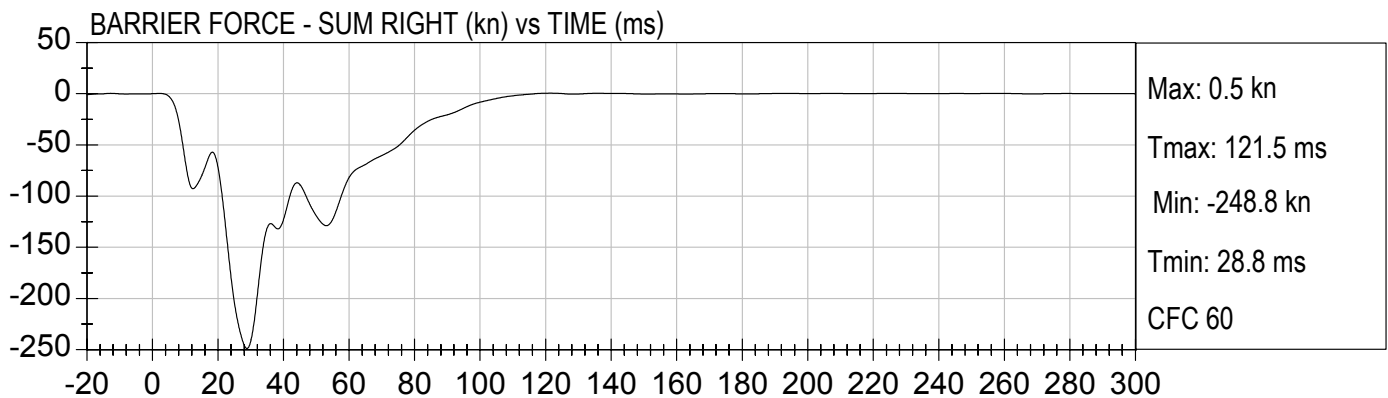
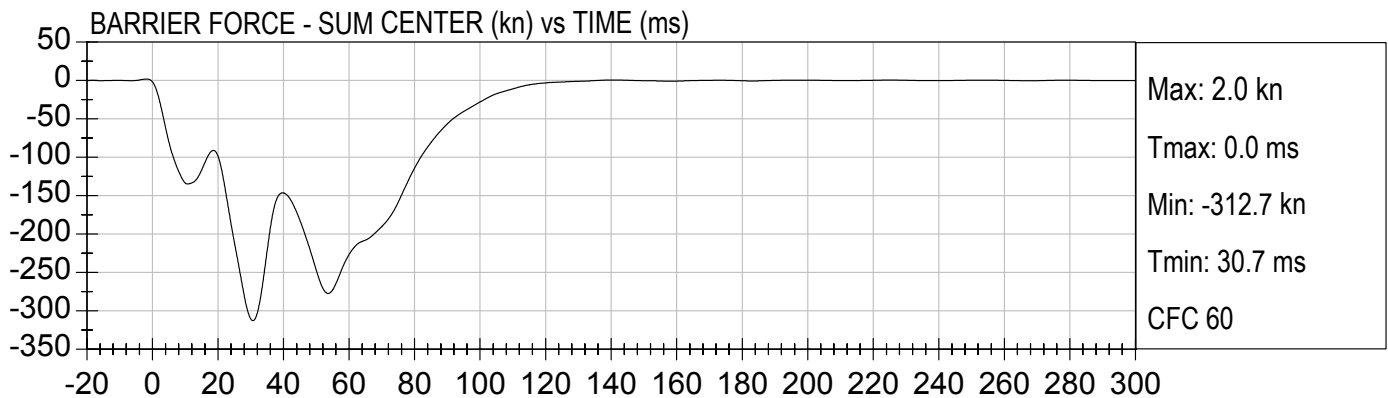
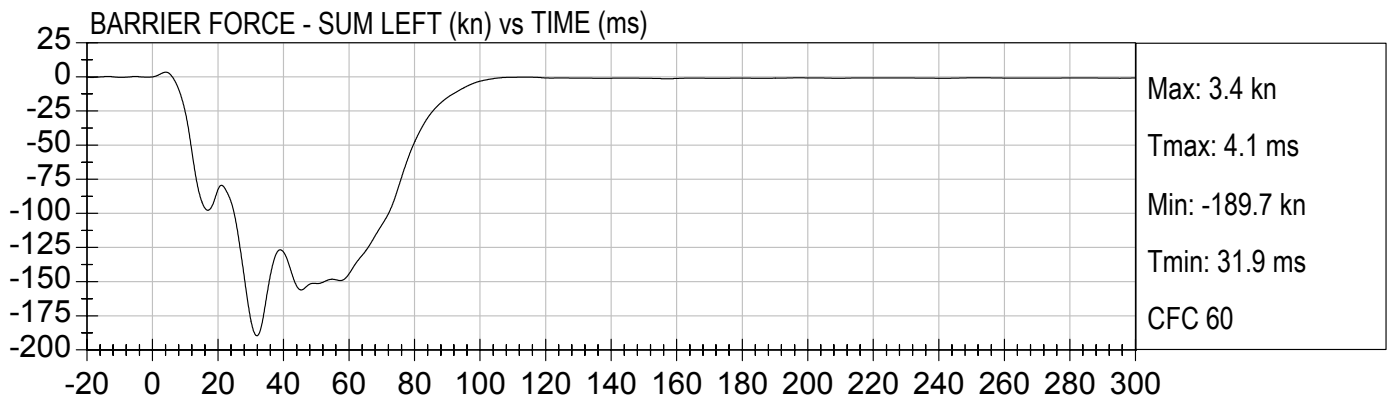


TRUNK Z Displacement (mm) vs TIME (ms)





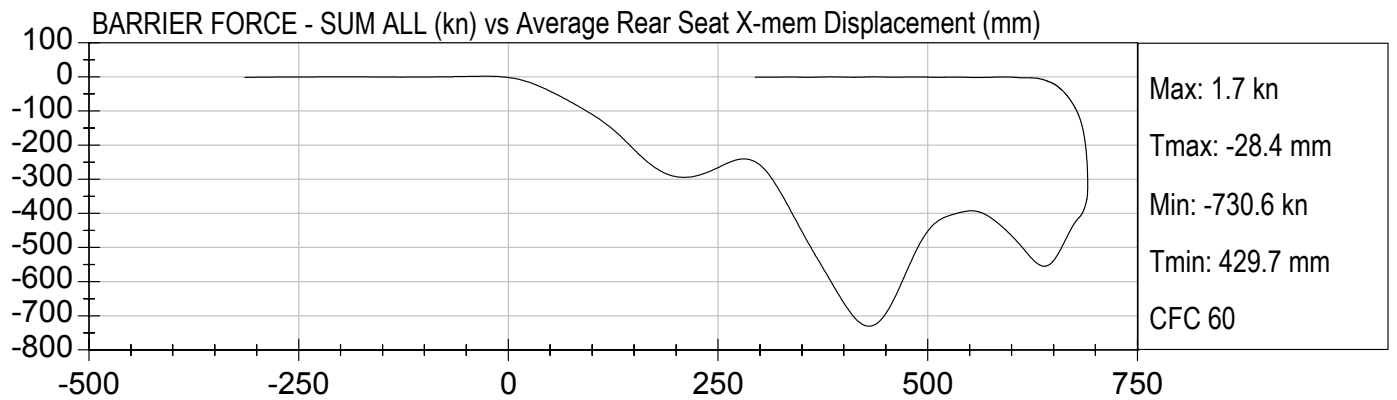






35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)



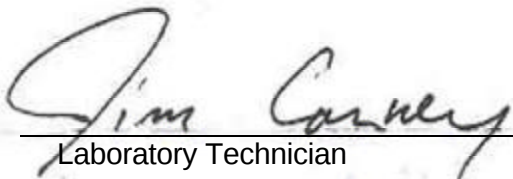
APPENDIX C
DUMMY CALIBRATION DATA TRACES AND TABLES

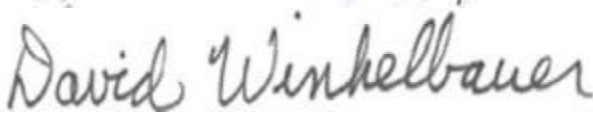
MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test ID: D042281

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	225 - 275	261	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.0	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

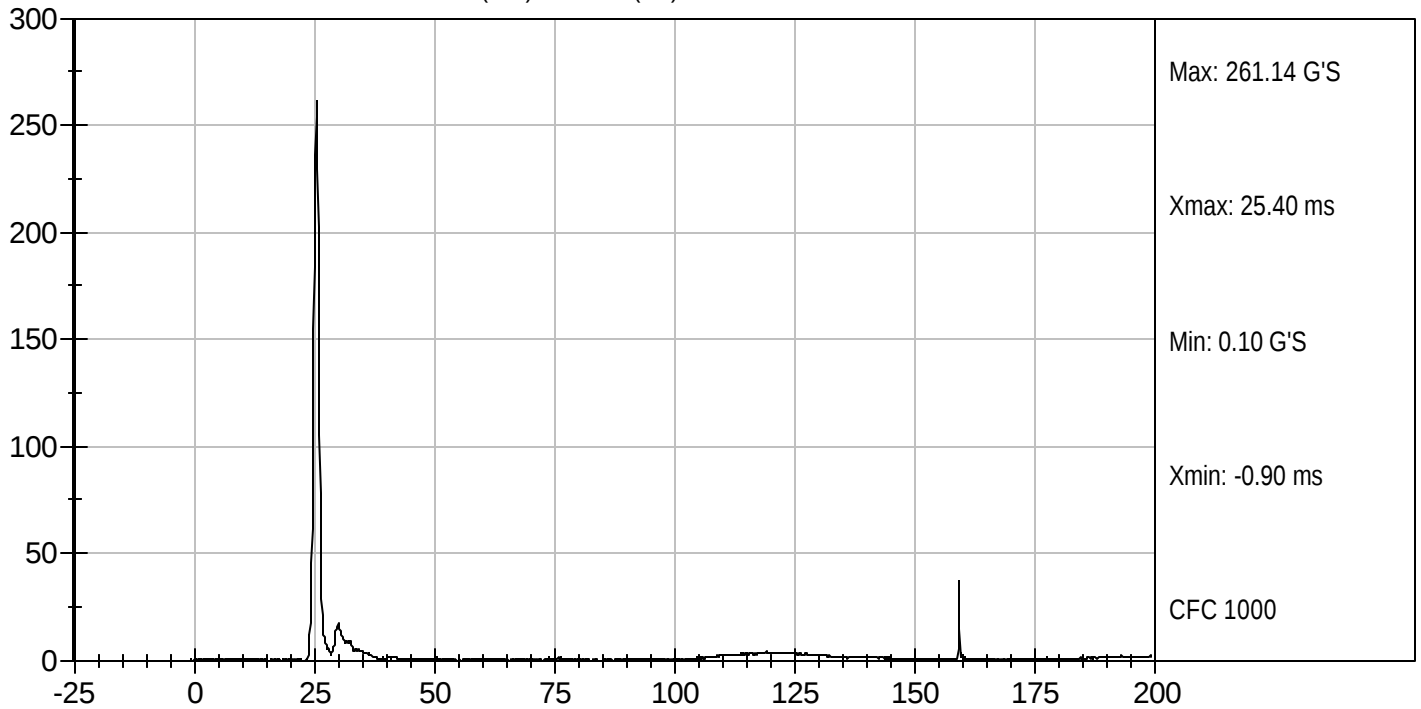
09/22/2004
Test Date



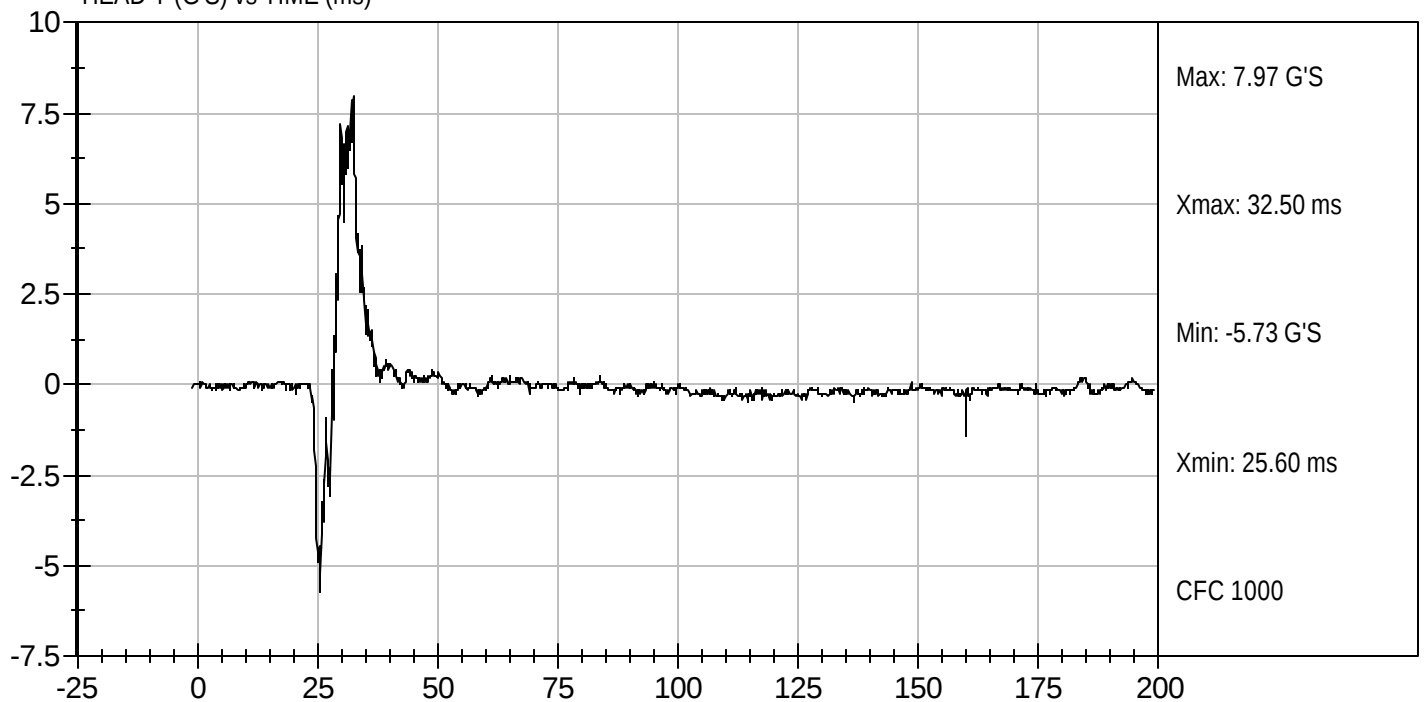
Test Desc: Head Drop
Componet ID: D042281

Test Date: 09/22/2004
Velocity: 0 ft/s, 0.00 m/s

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



HEAD Y (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D042282

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	40	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.02	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.57	Pass
	20 msec	G's	17.60 to 22.60	19.83	Pass
	30 msec	G's	12.50 to 18.50	13.97	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	13.92	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	40.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	69.7	Pass
	Time	msec	57.0 to 64.0	58.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	117.0	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	92.7	Pass
	Time	msec	47.0 to 58.0	54.2	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.5	Pass
Overall Test Results					Pass


 Laboratory Technician



Approved By

09/22/2004

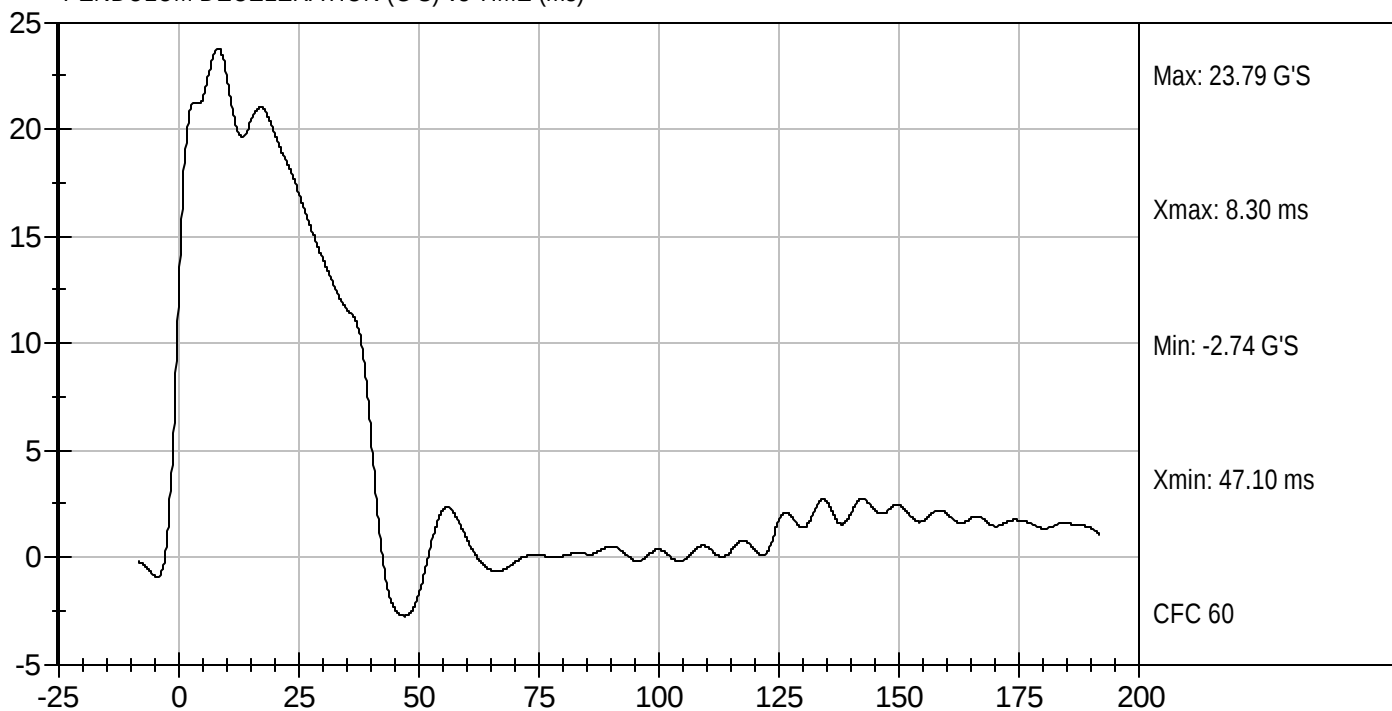
Test Date



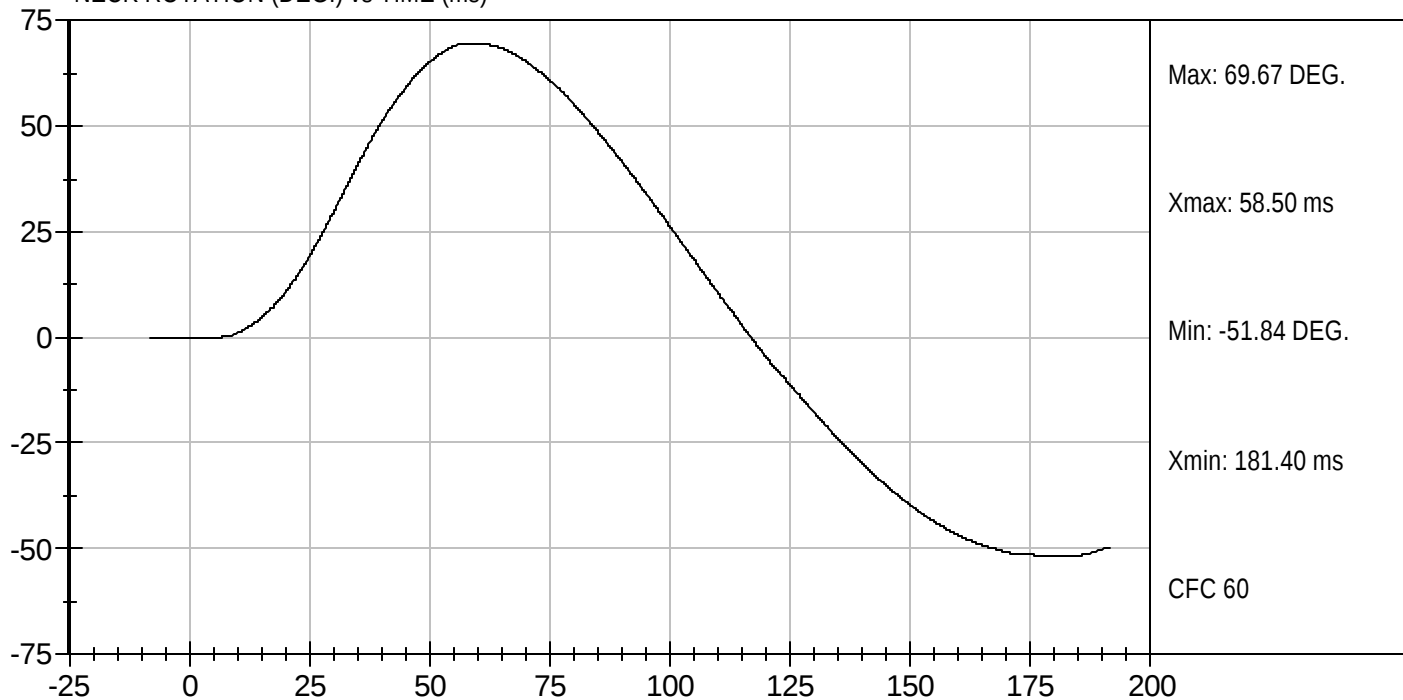
Test Desc: Neck Flexion
Componet ID: D042282

Test Date: 09/22/2004
Velocity: 23.02 ft/s, 7.02 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)



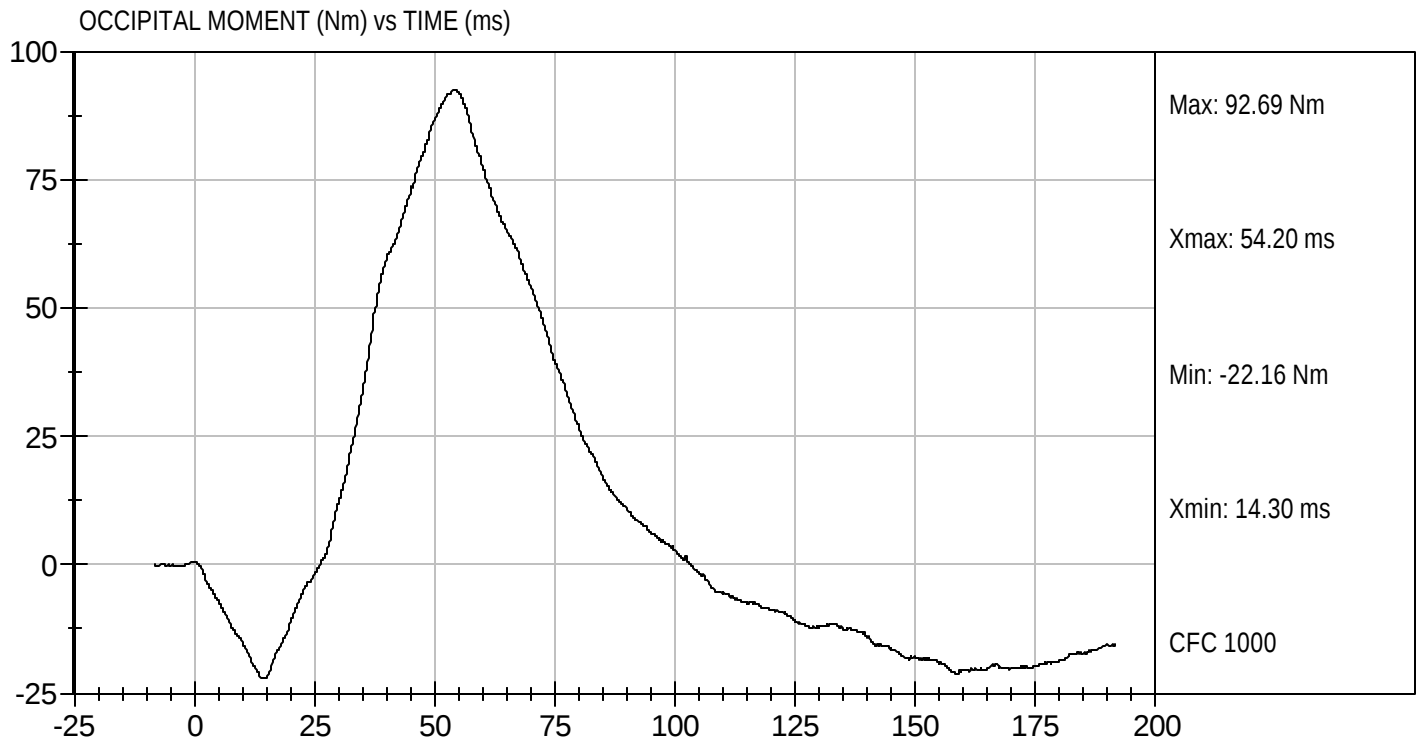
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion
Componet ID: D042282

Test Date: 09/22/2004
Velocity: 23.02 ft/s, 7.02 m/s

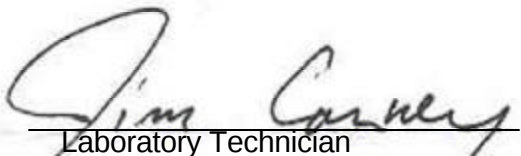


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D042283

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.10	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	18.05	Pass
	20 msec	G's	14.00 to 19.00	15.88	Pass
	30 msec	G's	11.00 to 16.00	12.15	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	12.14	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	42.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.2	Pass
	Time	msec	72.0 to 82.0	78.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	158.1	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-66.9	Pass
	Time	msec	65.0 to 79.0	74.3	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	145.2	Pass
Overall Test Results					Pass


 Laboratory Technician

09/22/2004
 Test Date



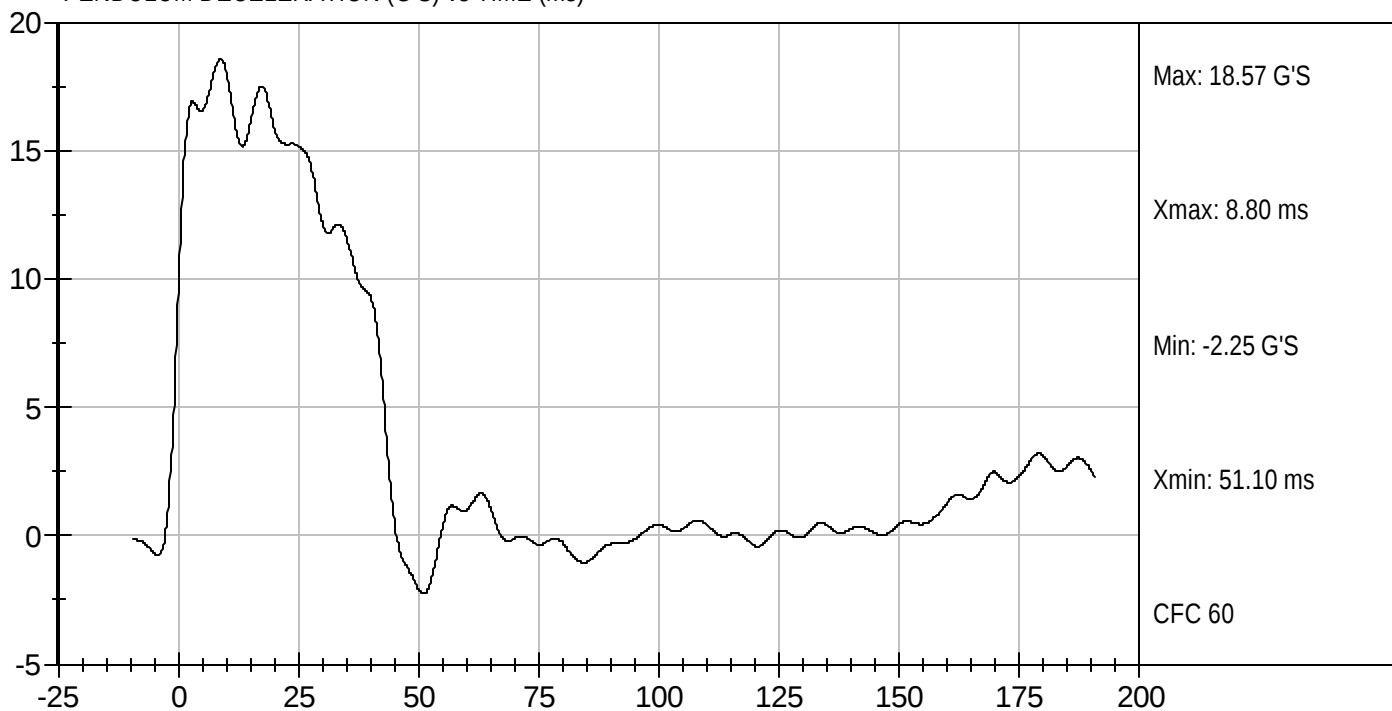
Approved By



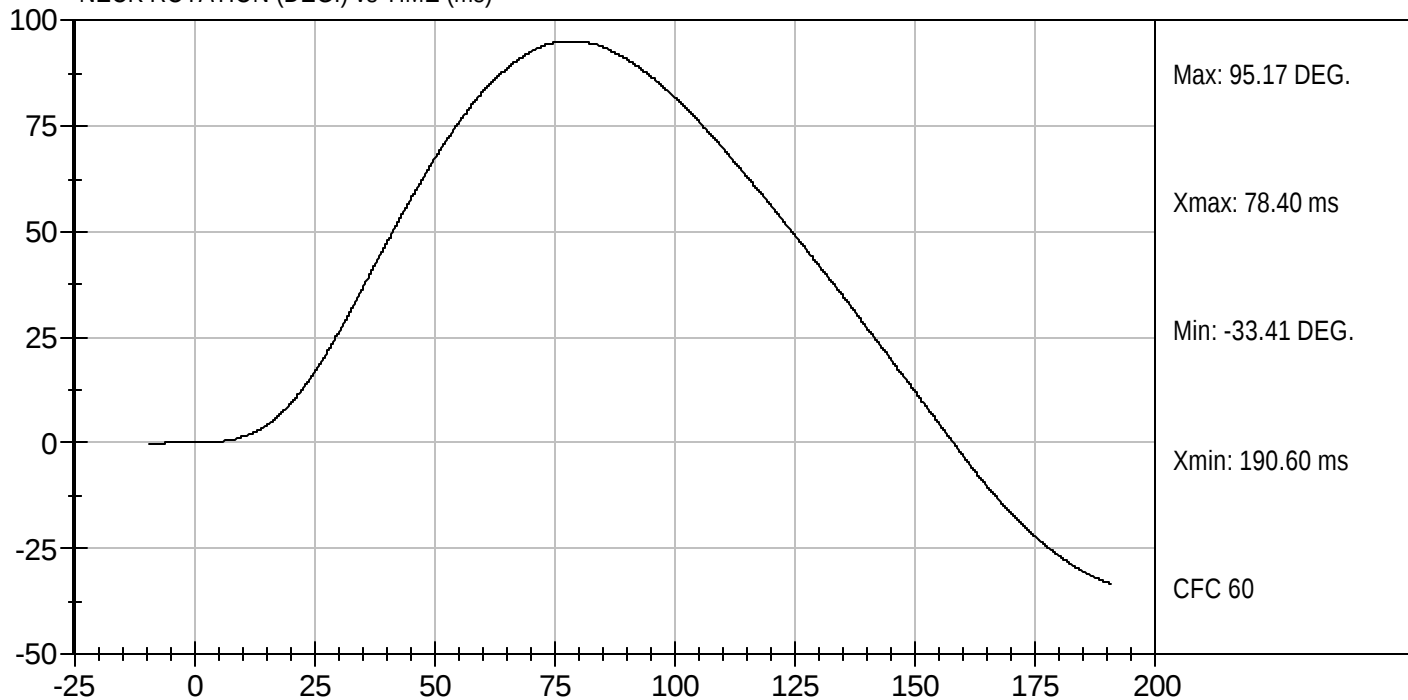
Test Desc: Neck Extension
Componet ID: D042283

Test Date: 09/22/2004
Velocity: 20.01 ft/s, 6.10 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)



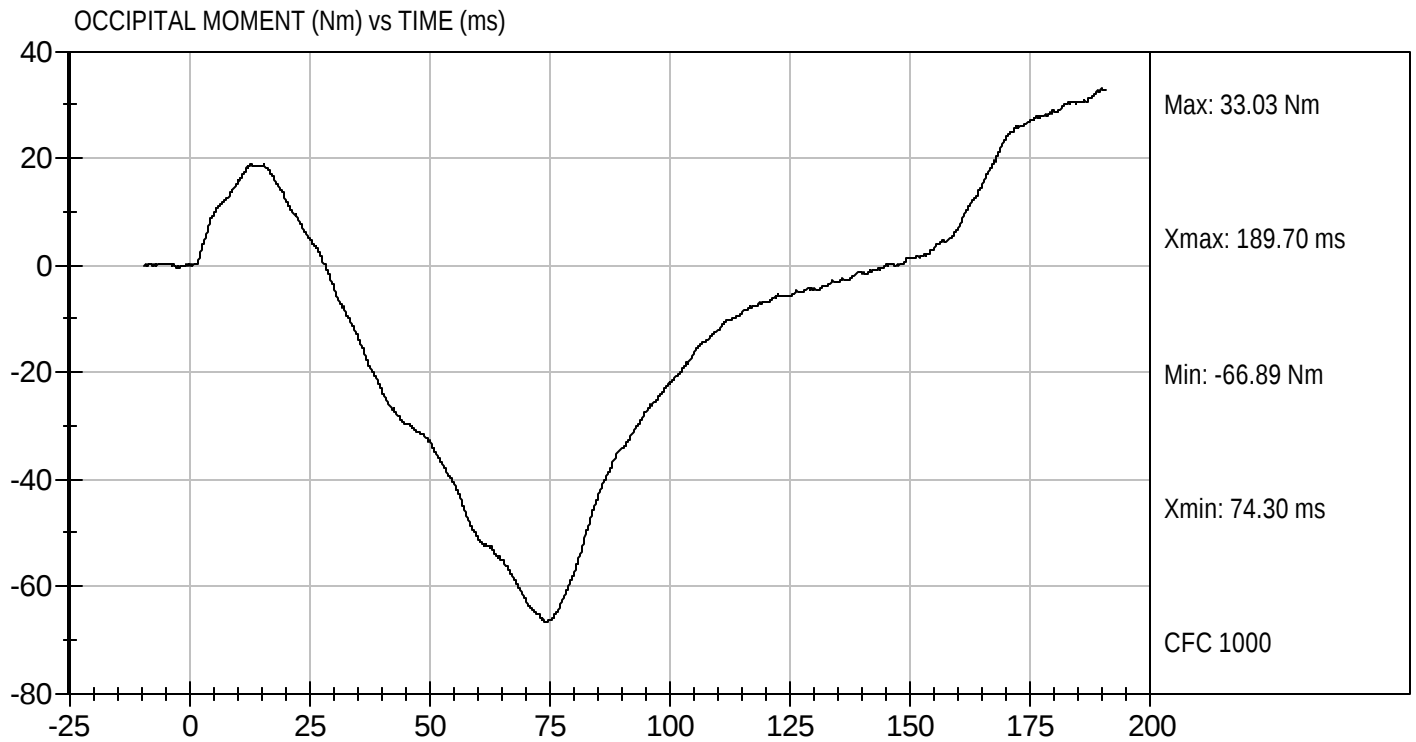
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension
Componet ID: D042283

Test Date: 09/22/2004
Velocity: 20.01 ft/s, 6.10 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D042284

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	6.58 to 6.82	6.71	Pass
Peak Probe Force	N	5159 to 5893	5,835	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.55	Pass
Internal Hysteresis	%	69 to 85	69	Pass
			Overall Test Results	Pass


Laboratory Technician

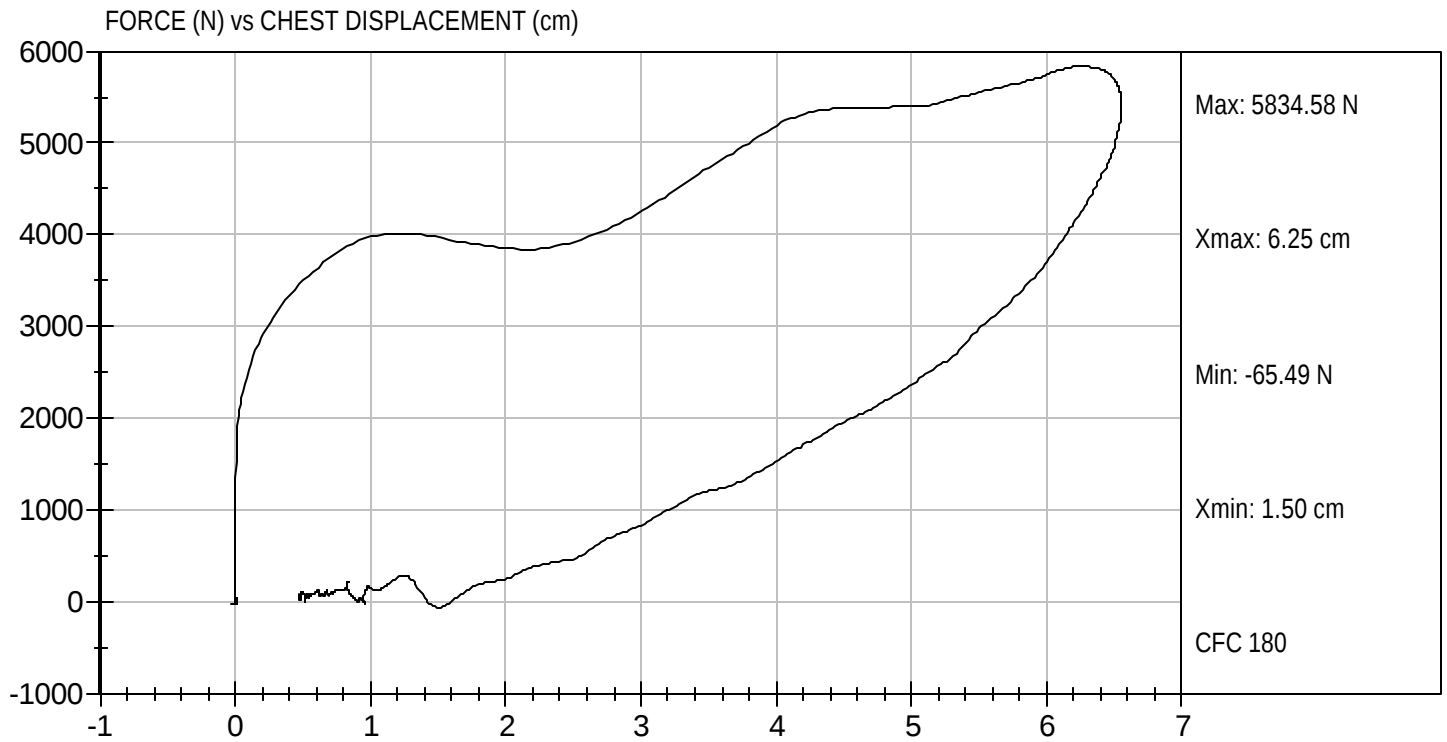

Approved By

09/22/2004
Test Date



Test Desc: Thorax Impact
Componet ID: D042284

Test Date: 09/22/2004
Velocity: 22.01 ft/s, 6.71 m/s

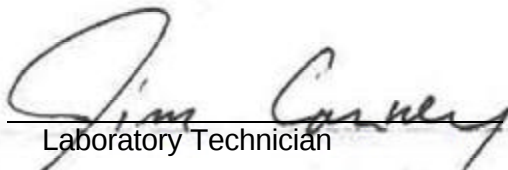


MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D042285

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	4,943	Pass
Overall Test Results				Pass


Laboratory Technician

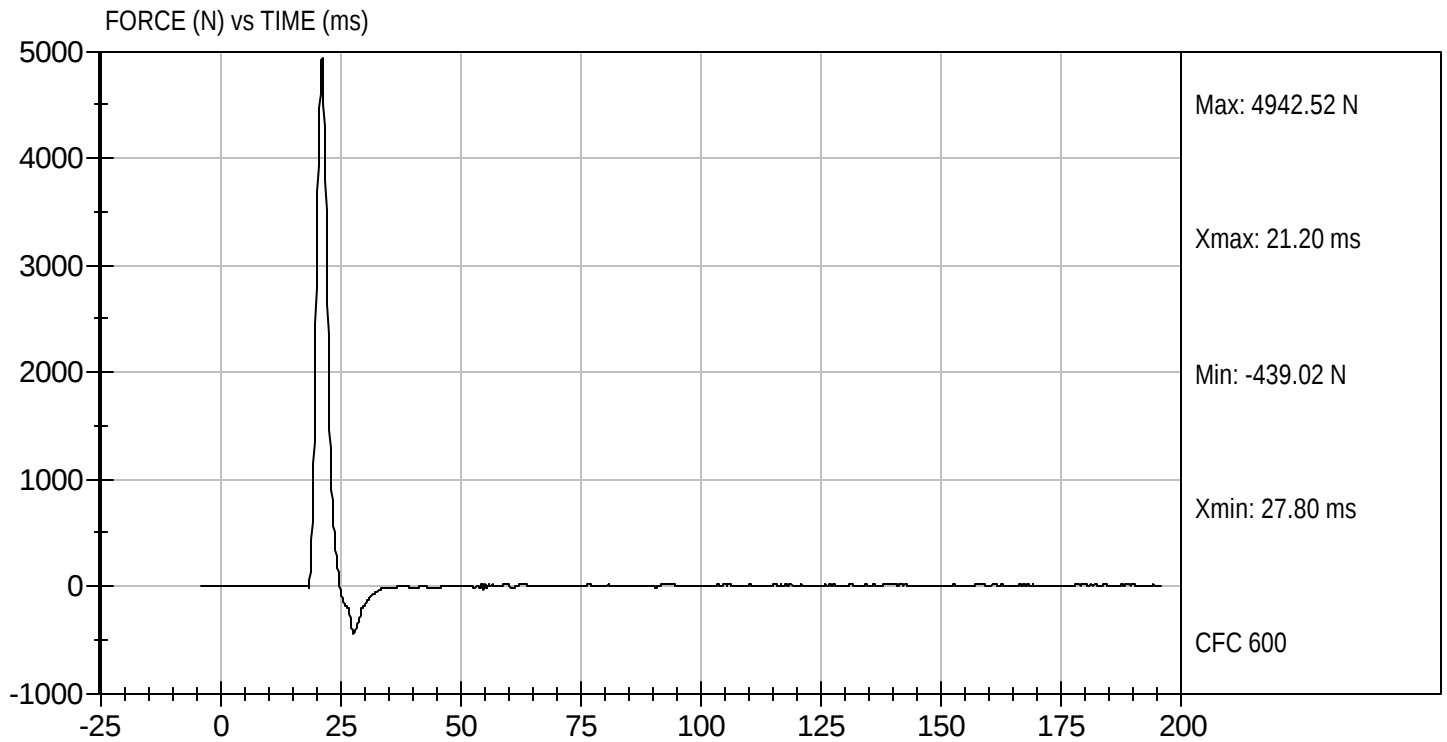

Approved By

09/22/2004
Test Date



Test Desc: Right Knee
Componet ID: D042285

Test Date: 09/22/2004
Velocity: 6.86 ft/s, 2.09 m/s

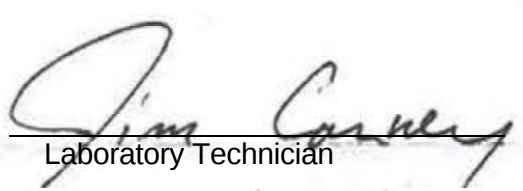


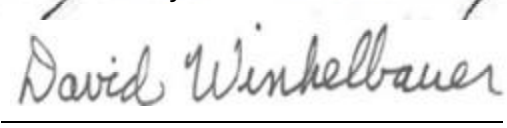
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D042286

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,190	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

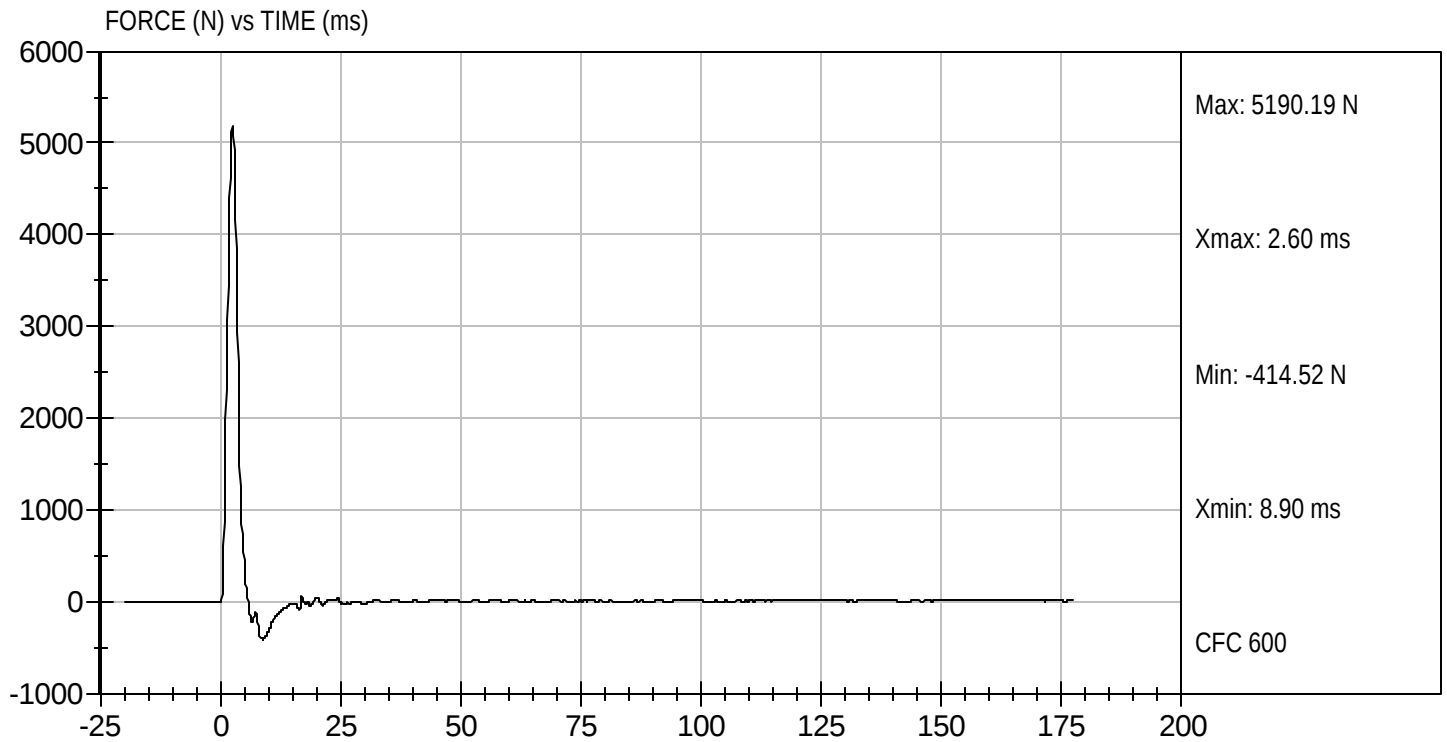
09/22/2004

Test Date



Test Desc: Left Knee
Componet ID: D042286

Test Date: 09/22/2004
Velocity: 6.81 ft/s, 2.08 m/s

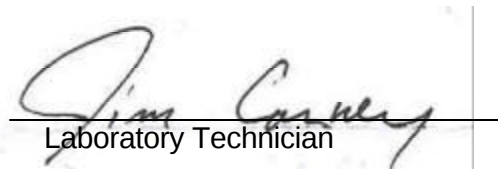


MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066

Test I.D: D042280

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.8	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	40	40	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	86.9	70.2	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	41	Pass
Overall Test Results					Pass


Laboratory Technician

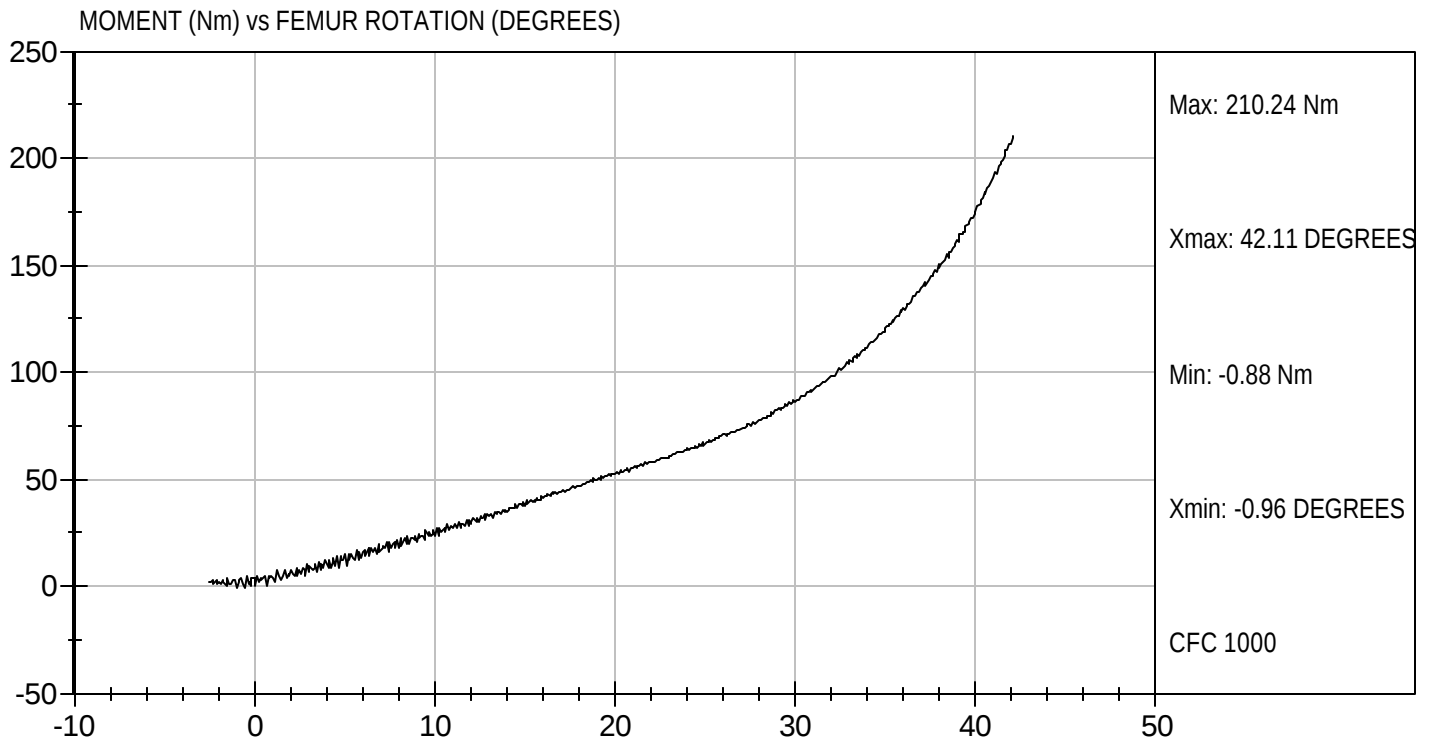
09/21/2004
Test Date


Approved By



Test Desc: Hip Femur Flexion
Componet ID: D042289

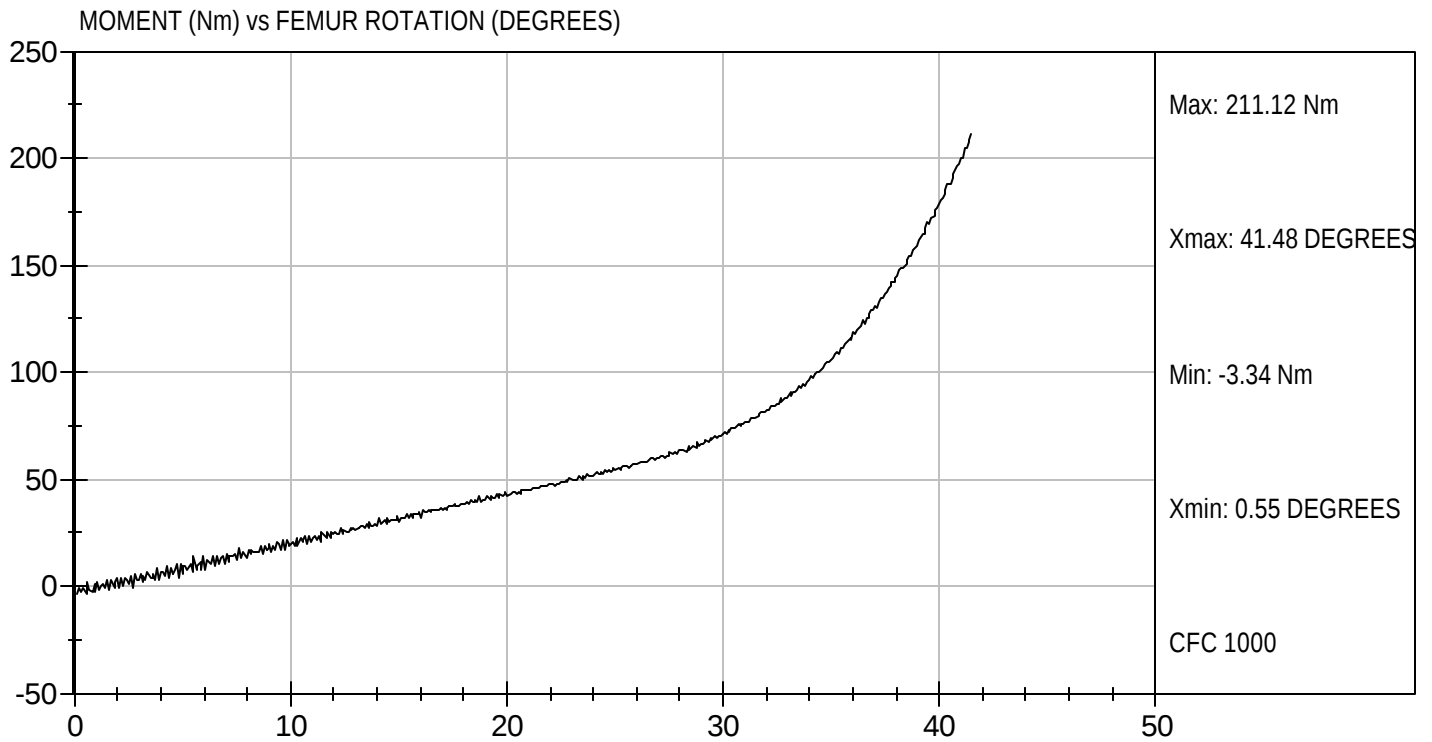
Test Date: 09/21/2004
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Componet ID: D042280

Test Date: 09/21/2004
Velocity: 0 ft/s, 0.00 m/s

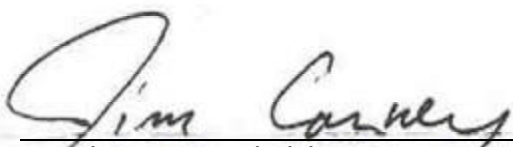


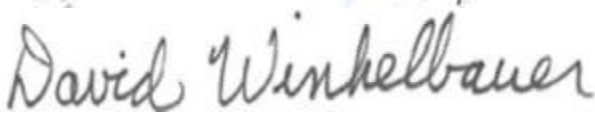
MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test ID: D042271

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	225 - 275	238	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.9	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

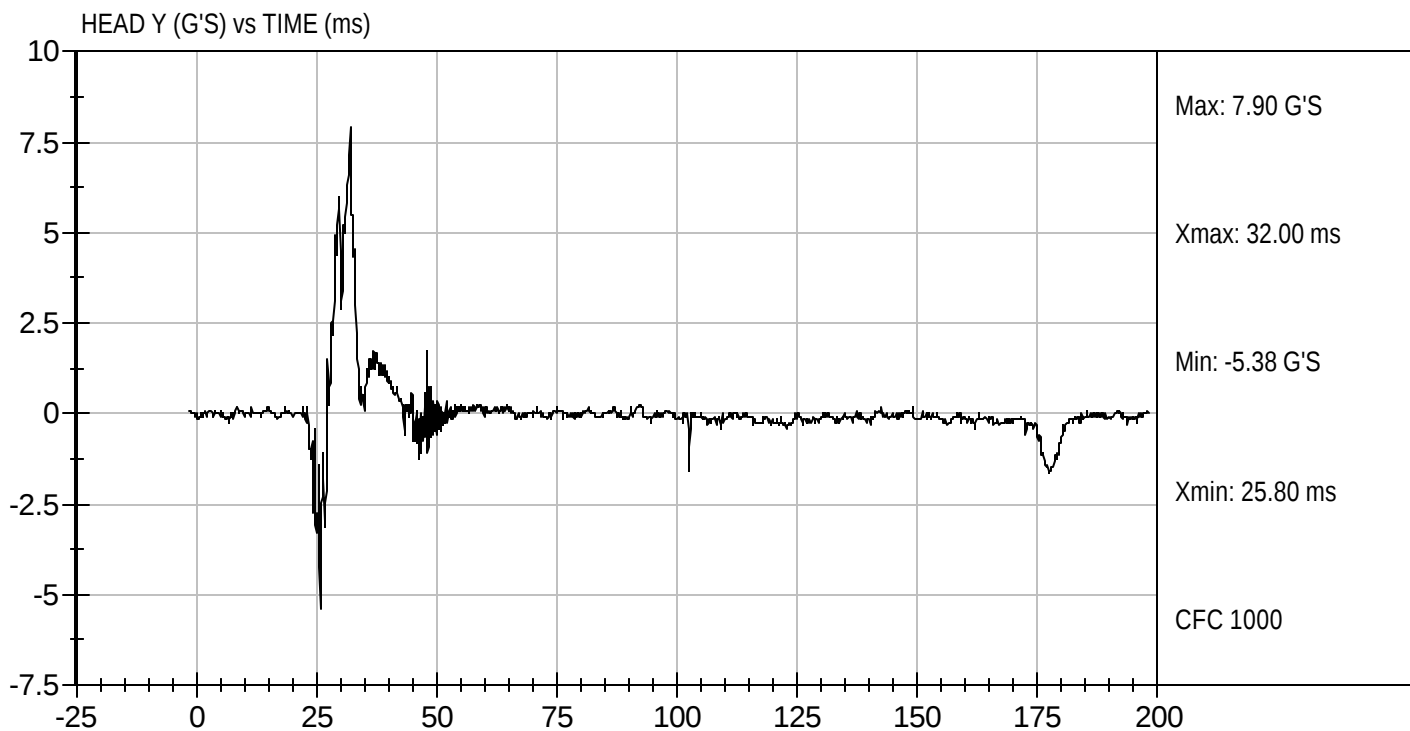
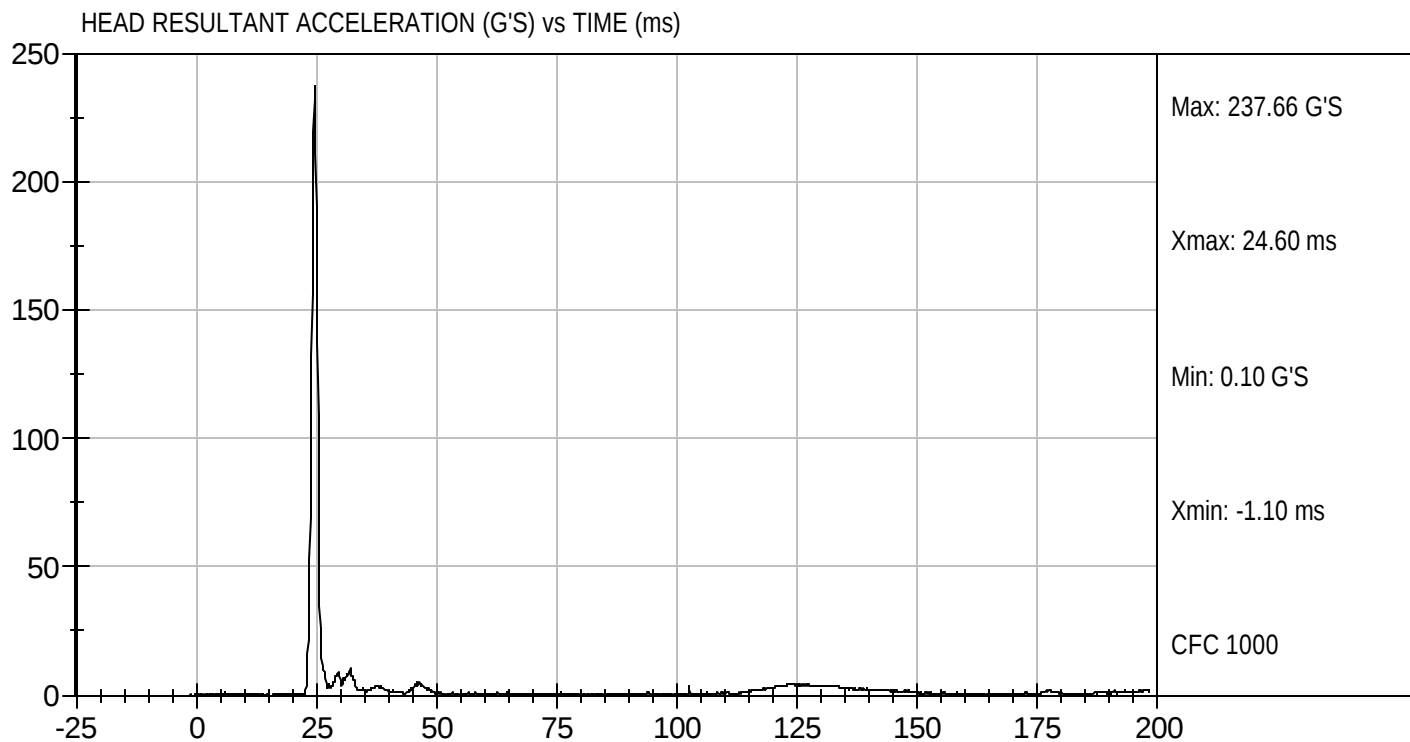

Approved By

09/22/2004
Test Date



Test Desc: Head Drop
Componet ID: D042271

Test Date: 09/22/2004
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D042272

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	40	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.88	Pass
	20 msec	G's	17.60 to 22.60	20.31	Pass
	30 msec	G's	12.50 to 18.50	14.93	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.87	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	39.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	72.4	Pass
	Time	msec	57.0 to 64.0	59.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	119.3	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.1	Pass
	Time	msec	47.0 to 58.0	51.7	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	106.7	Pass
Overall Test Results					Pass


 Laboratory Technician



Approved By

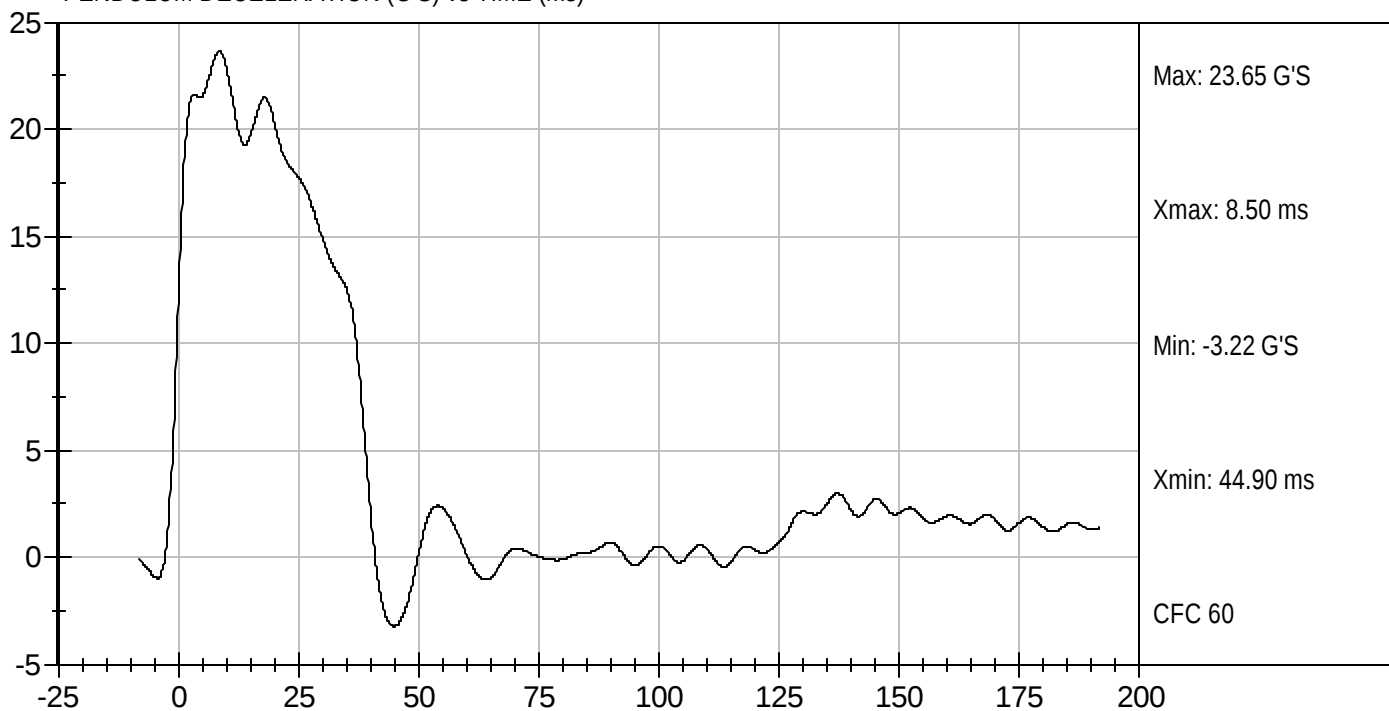
09/21/2004
 Test Date



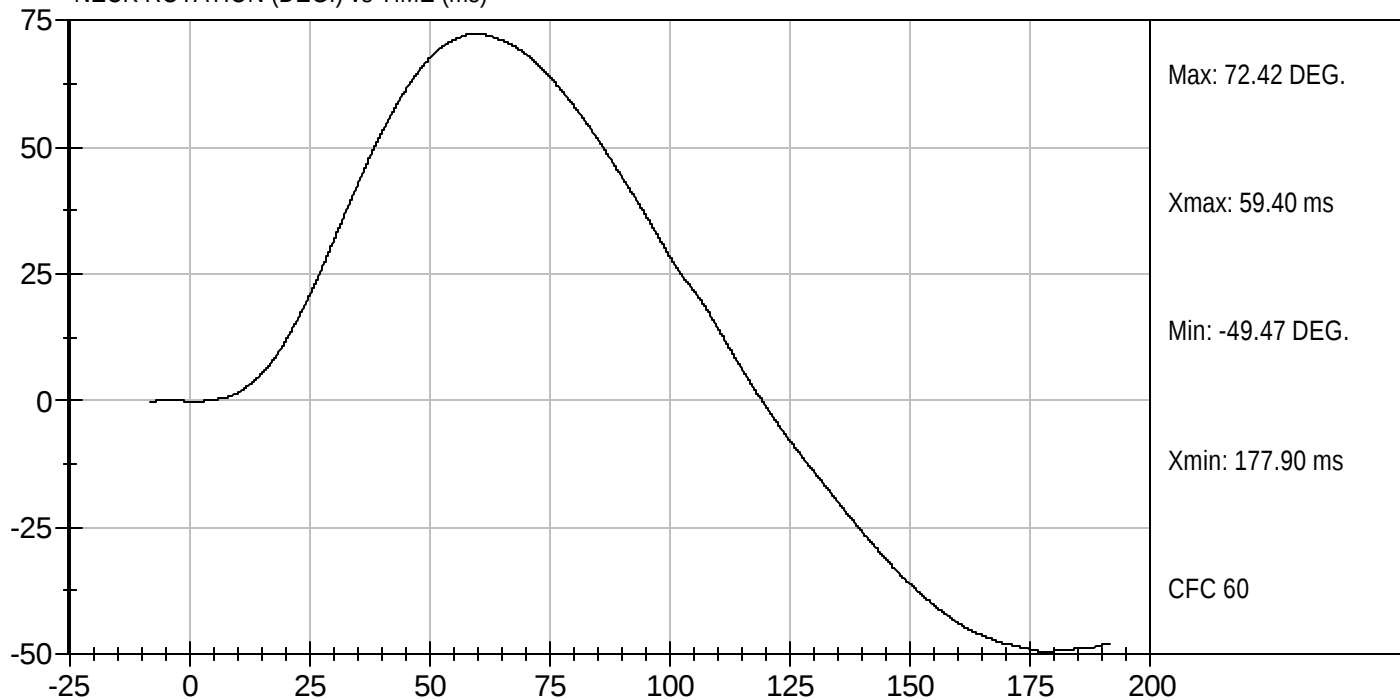
Test Desc: Neck Flexion
Componet ID: D042272

Test Date: 09/21/2004
Velocity: 23.05 ft/s, 7.03 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)



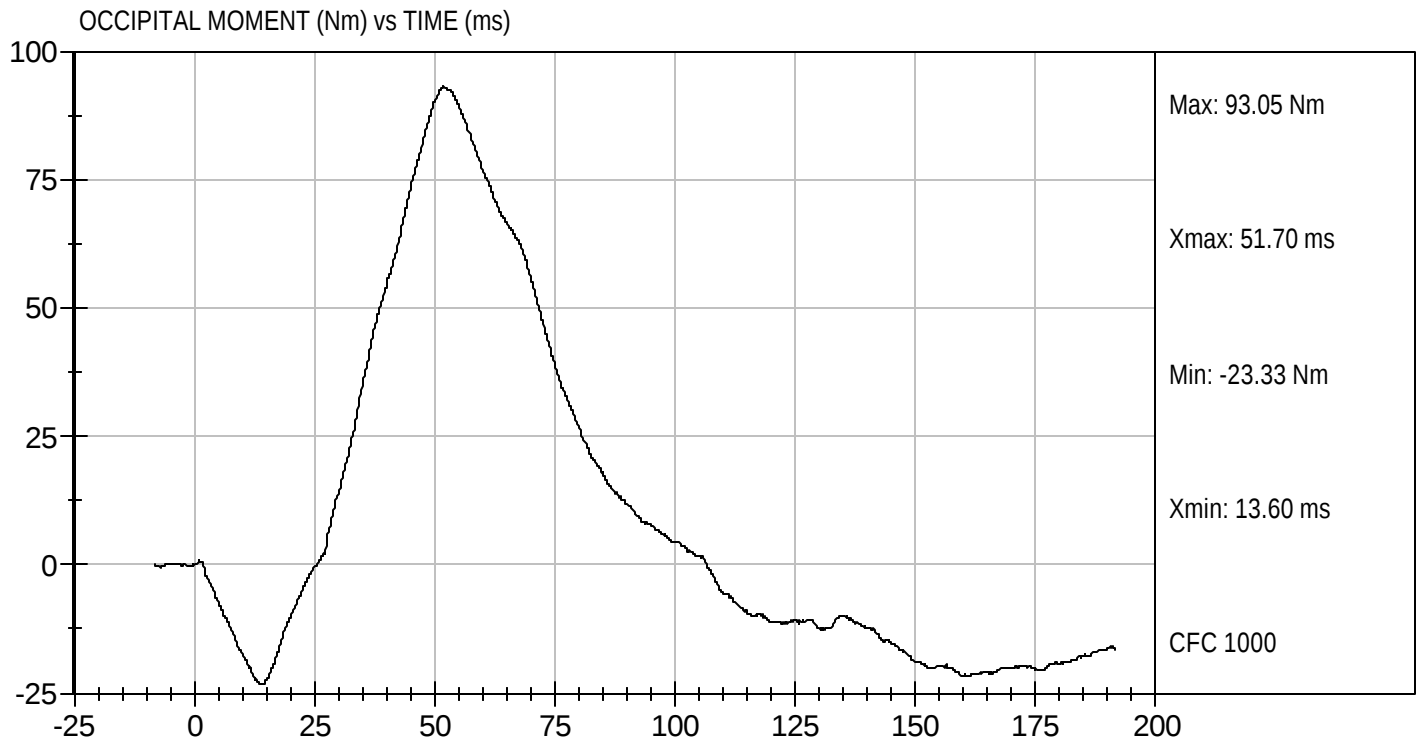
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Flexion
Componet ID: D042272

Test Date: 09/21/2004
Velocity: 23.05 ft/s, 7.03 m/s

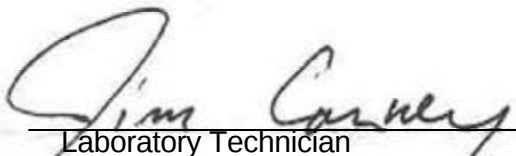


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D042273

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	40	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.10	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	18.44	Pass
	20 msec	G's	14.00 to 19.00	15.92	Pass
	30 msec	G's	11.00 to 16.00	11.28	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	12.33	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	43.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.7	Pass
	Time	msec	72.0 to 82.0	79.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	159.4	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-64.5	Pass
	Time	msec	65.0 to 79.0	74.8	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.2	Pass
Overall Test Results					Pass


 Laboratory Technician

09/22/2004
 Test Date



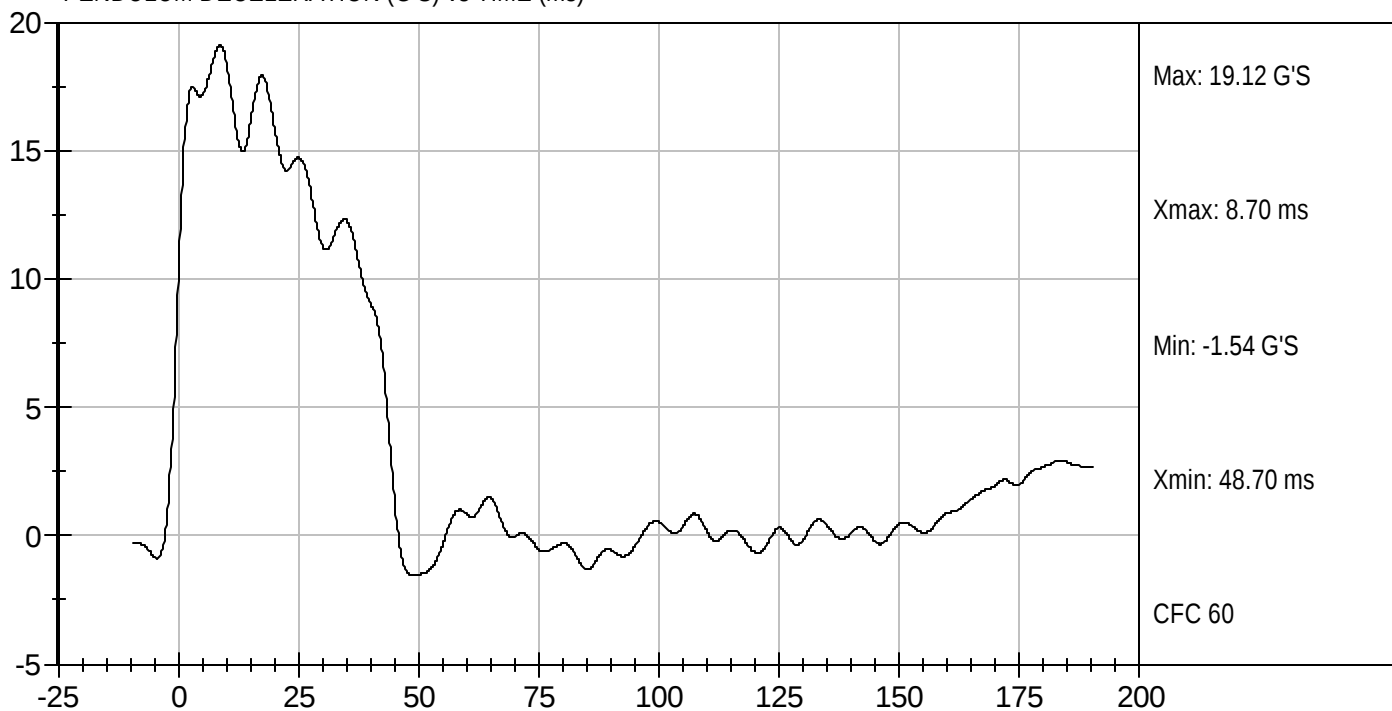
Approved By



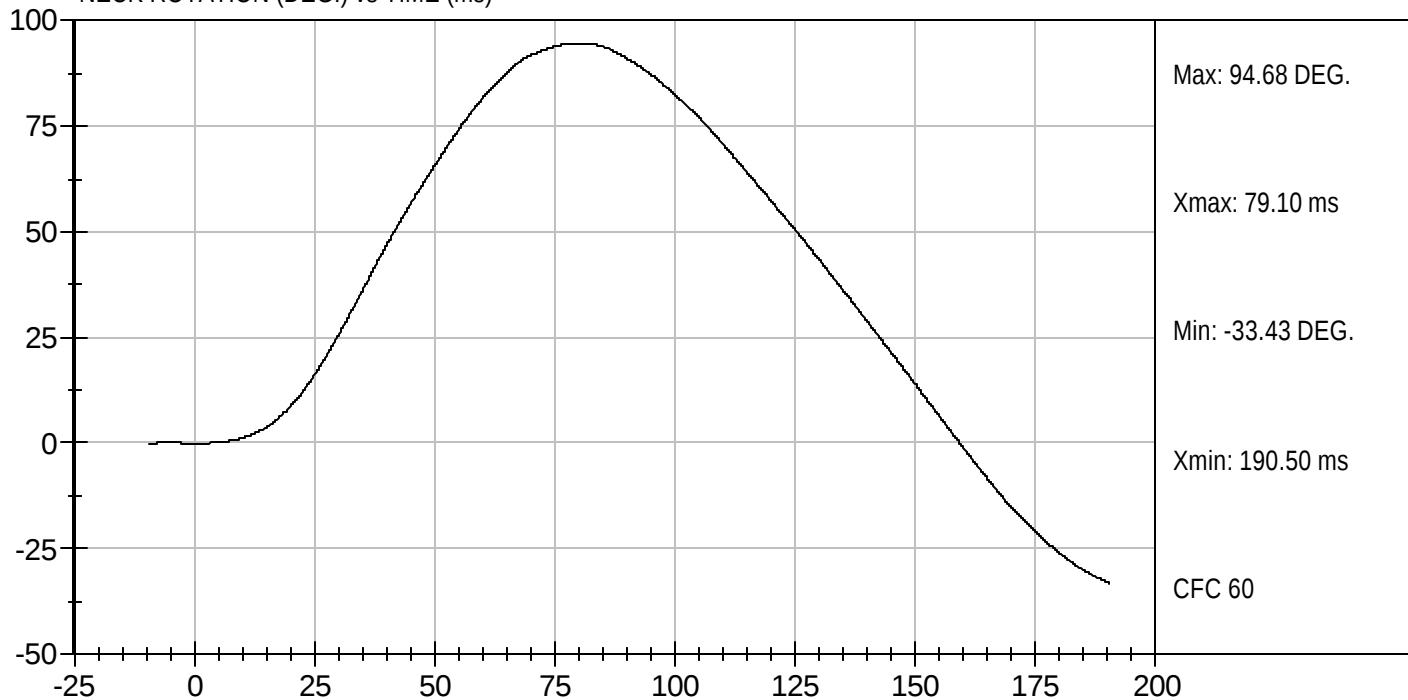
Test Desc: Neck Extension
Componet ID: D042273

Test Date: 09/22/2004
Velocity: 20.02 ft/s, 6.10 m/s

PENDULUM DECELERATION (G'S) vs TIME (ms)



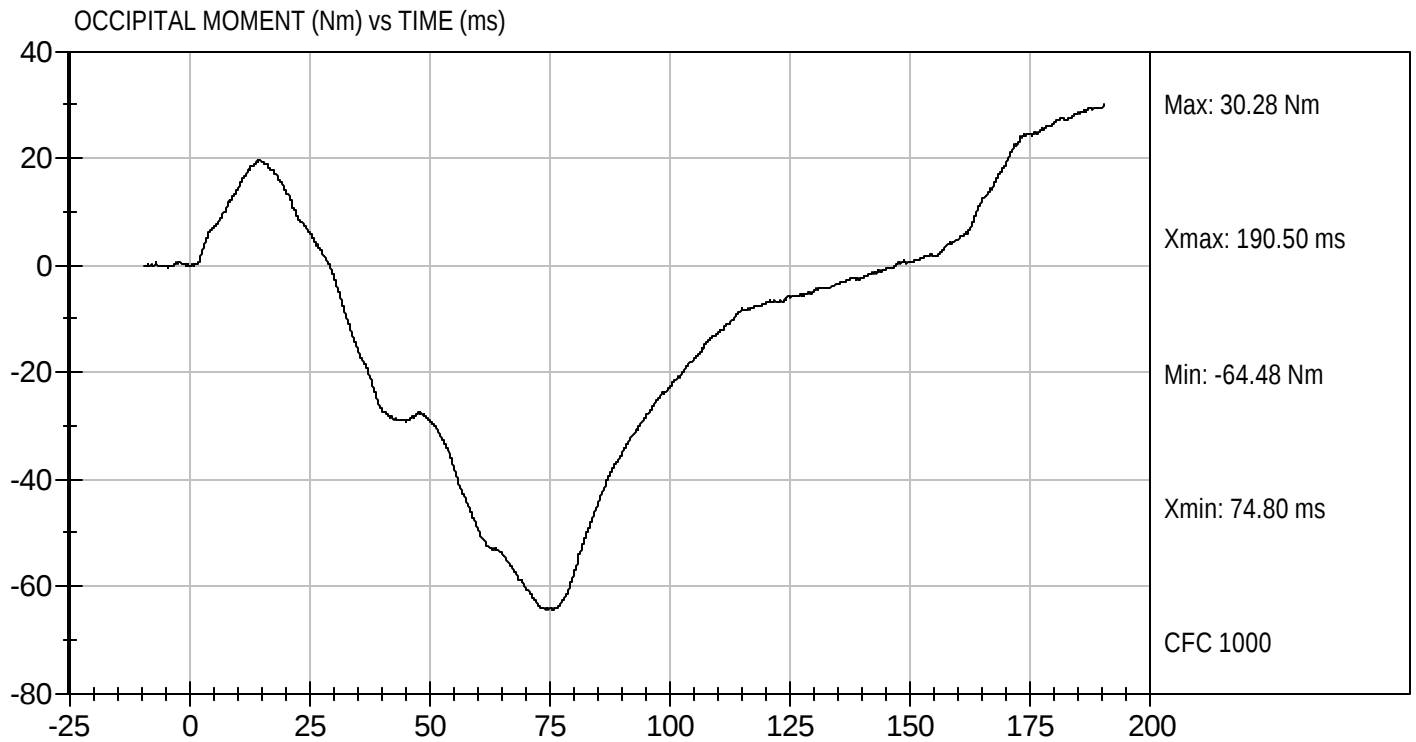
NECK ROTATION (DEG.) vs TIME (ms)





Test Desc: Neck Extension
Componet ID: D042273

Test Date: 09/22/2004
Velocity: 20.02 ft/s, 6.10 m/s



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D042274

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	6.58 to 6.82	6.65	Pass
Peak Probe Force	N	5159 to 5893	5,745	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.35	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Overall Test Results			Pass	


Laboratory Technician



Approved By

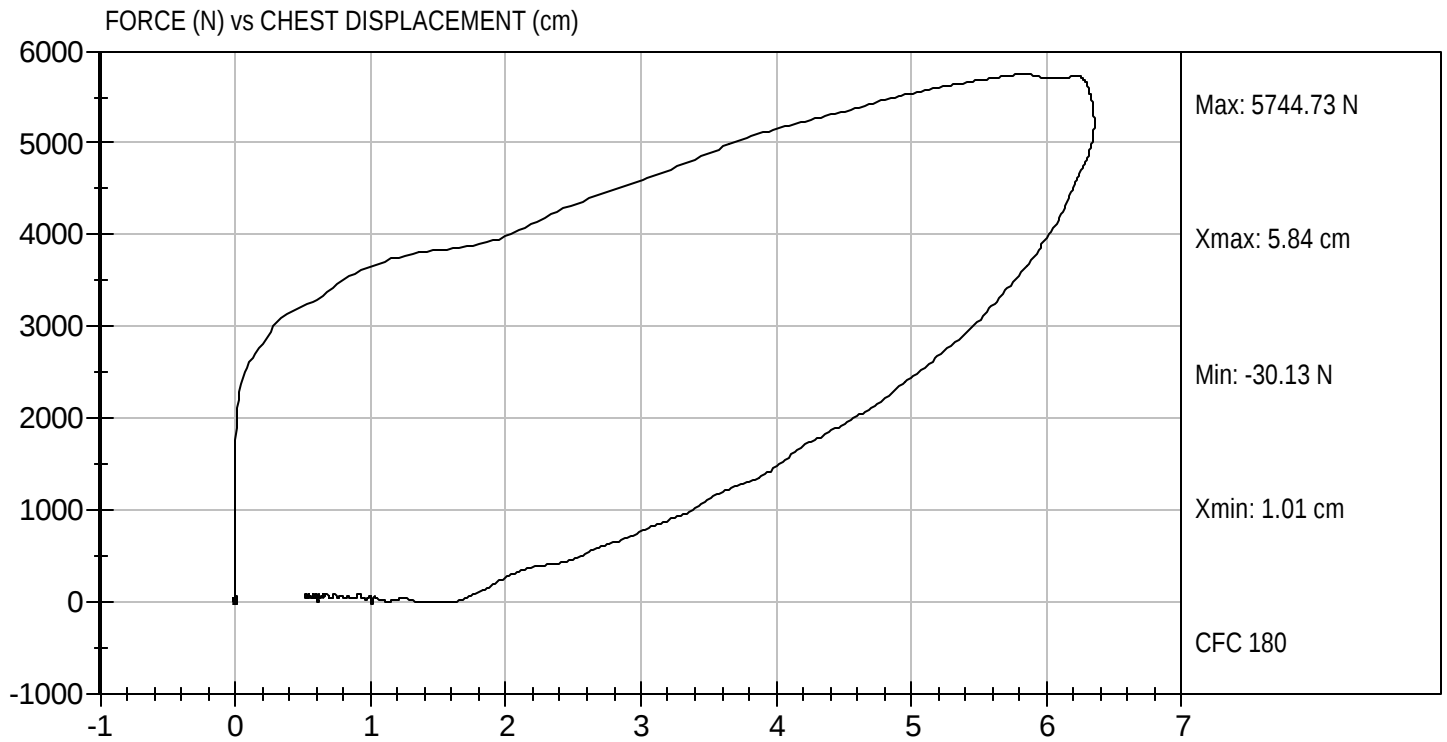
09/22/2004

Test Date



Test Desc: Thorax Impact
Componet ID: D042274

Test Date: 09/22/2004
Velocity: 21.82 ft/s, 6.65 m/s

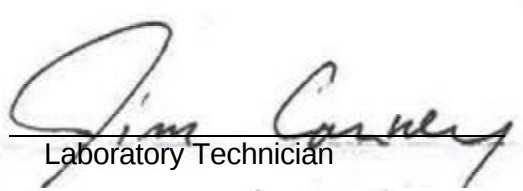


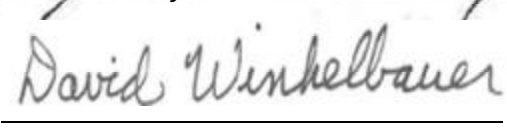
MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D042275

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,030	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

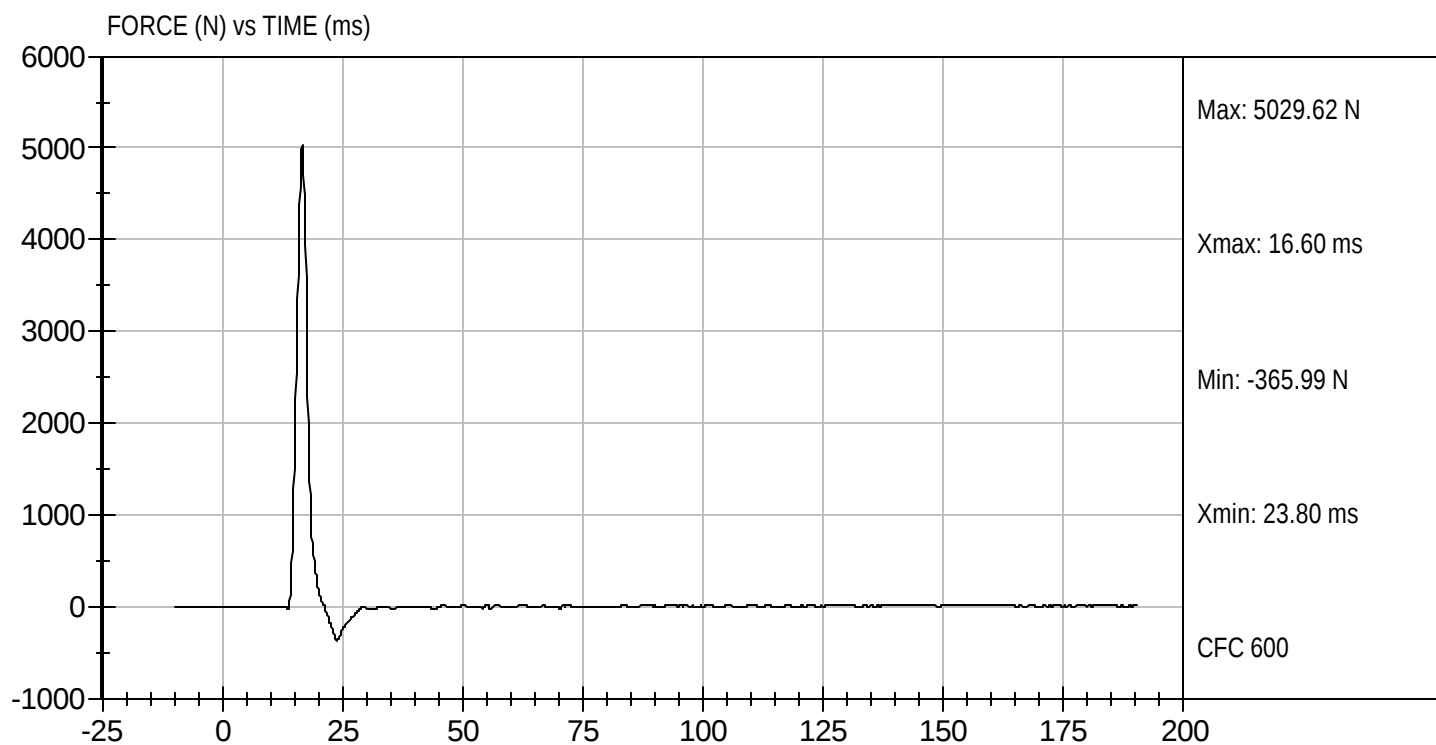
09/22/2004

Test Date



Test Desc: Right Knee
Componet ID: D042275

Test Date: 09/22/2004
Velocity: 6.82 ft/s, 2.08 m/s

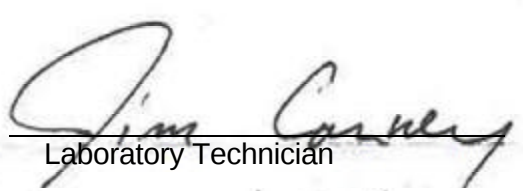


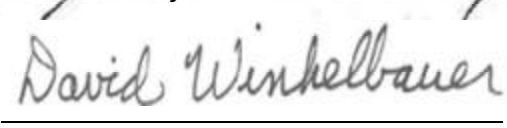
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D042276

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	5,446	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

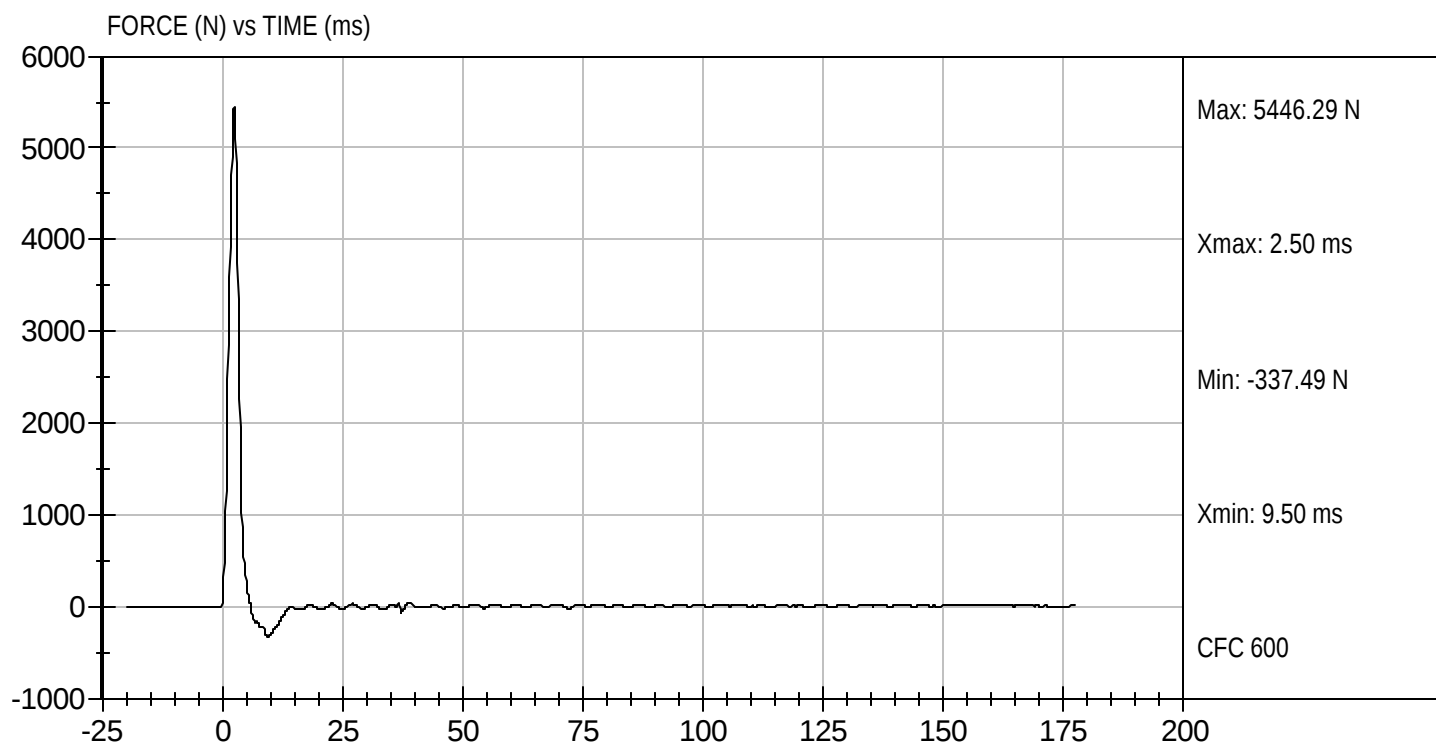
09/22/2004

Test Date



Test Desc: Left Knee
Componet ID: D042276

Test Date: 09/22/2004
Velocity: 6.85 ft/s, 2.09 m/s

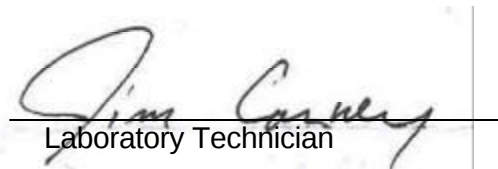


MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065

Test I.D: D042270

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.8	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	42	42	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	70.2	70.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	43	Pass
Overall Test Results					Pass


 Laboratory Technician

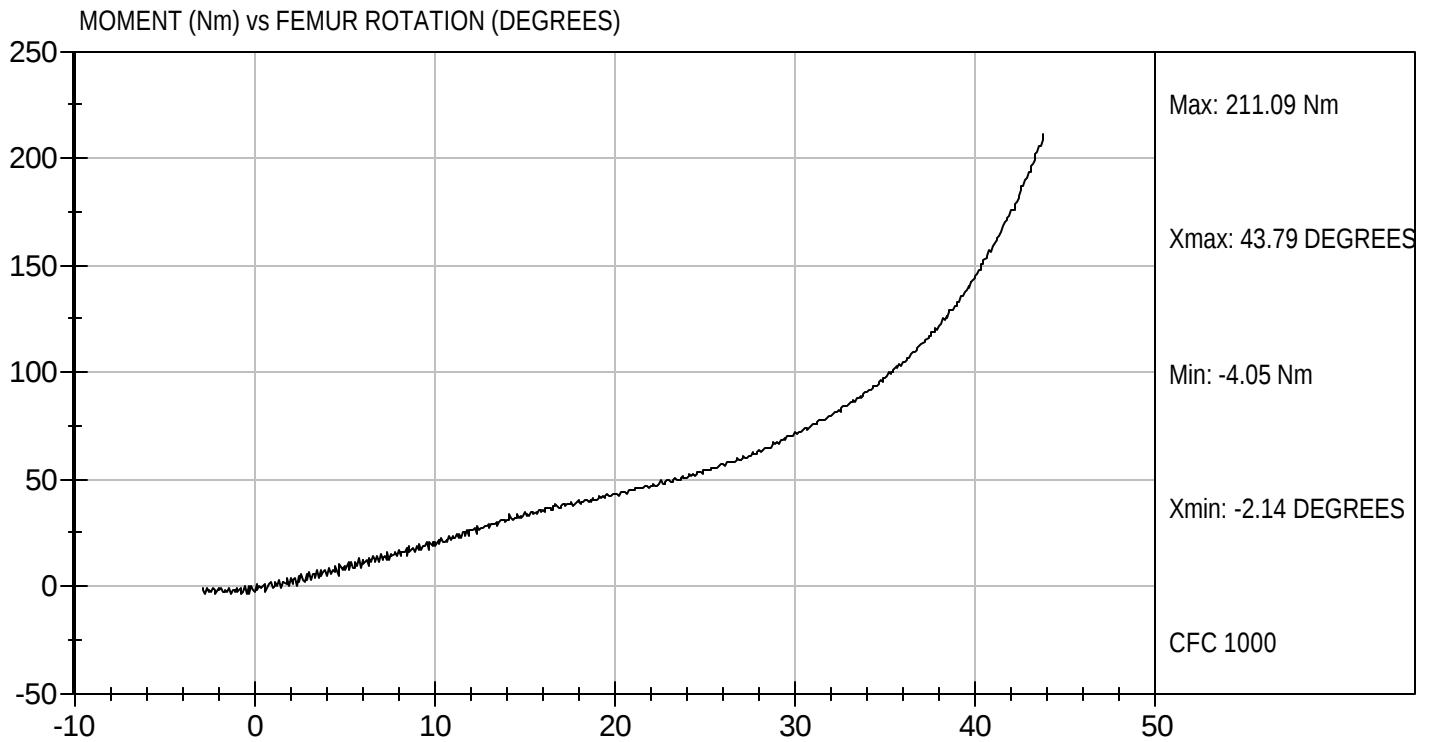
09/21/2004
 Test Date


 Approved By



Test Desc: Hip Femur Flexion
Componet ID: D042279

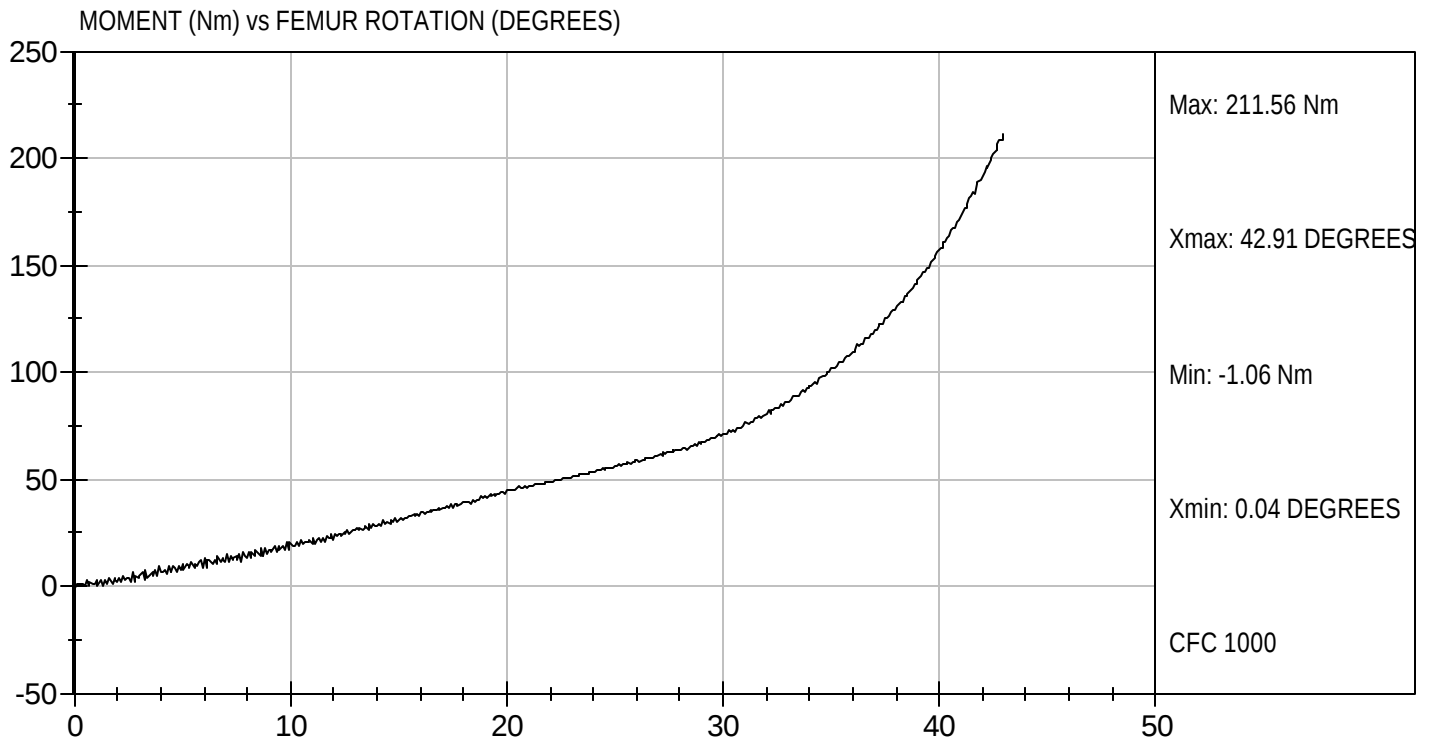
Test Date: 09/21/2004
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion
Componet ID: D042270

Test Date: 09/21/2004
Velocity: 0 ft/s, 0.00 m/s



APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

INSTRUMENTS FOR DRIVER DUMMY NO. 066

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	A28-H01	Entran	9/17/04
Head Y	A29-B07	Entran	9/17/04
Head Z	A28-H02	Entran	9/17/04
Head X Redundant	A27-Z12	Entran	9/17/04
Head Y Redundant	P10149	Endevco	8/23/04
Head Z Redundant	L17-Z14	Entran	9/17/04
Head Y - Front	J13938	Endevco	8/04/04
Head Z - Front	ANAT6	Endevco	8/04/04
Head X - Left	AP2A4	Endevco	8/04/04
Head Z - Left	AP2D8	Endevco	8/04/04
Head X - Upper	AP1T8	Endevco	8/04/04
Head Y- Upper	AP2D7	Endevco	8/04/04
Neck Load Cell	442	Denton	7/20/04
Chest X	P22086	Endevco	8/04/04
Chest Y	AJ9D2	Endevco	8/04/04
Chest Z	P24265	Endevco	8/04/04
Chest Deflection Gauge	066	Servo	8/03/04
Chest X Redundant	P22652	Endevco	8/04/04
Chest Y Redundant	AJ417	Endevco	8/04/04
Chest Z Redundant	P22150	Endevco	8/04/04
Pelvis X	J13851	Endevco	8/02/04
Pelvis Y	AJ808	Endevco	8/02/04
Pelvis Z	AH0F0	Endevco	8/02/04
Left Femur Load Cell	259	Denton	7/20/04
Right Femur Load Cell	256	Denton	7/20/04
Left Upper Tibia Load Cell	107	Denton	7/22/04
Left Lower Tibia Load Cell	136	Denton	7/22/04
Right Upper Tibia Load Cell	103	Denton	7/22/04
Right Lower Tibia Load Cell	133	Denton	7/22/04
Left Foot Z – Front	A05-A20	Entran	8/04/04
Left Ankle X	A05-A21	Entran	8/04/04
Left Ankle Z	A07-J01	Entran	8/04/04
Right Foot Z – Front	ANBP7	Endevco	7/23/04
Right Ankle X	L30-Z18	Entran	8/04/04
Right Ankle Z	A12-A11	Entran	8/40/04
Shoulder Belt Load Cell	158	Denton	6/08/04
Lap Belt Load Cell	166	Denton	6/08/04

INSTRUMENTS FOR PASSENGER DUMMY NO. 065

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	P27020	Endevco	8/04/04
Head Y	P27025	Endevco	8/04/04
Head Z	P22692	Endevco	8/04/04
Head X Redundant	J10431	Endevco	8/04/04
Head Y Redundant	P26986	Endevco	8/04/04
Head Z Redundant	AN9E3	Endevco	8/04/04
Head Y - Front	J19173	Endevco	8/04/04
Head Z - Front	J13656	Endevco	8/04/04
Head X - Left	J13424	Endevco	8/04/04
Head Z - Left	J14007	Endevco	8/04/04
Head X - Upper	J33415	Endevco	8/04/04
Head Y- Upper	J13630	Endevco	8/04/04
Neck Load Cell	443	Denton	7/20/04
Chest X	AMT78	Endevco	8/04/04
Chest Y	AP1Y8	Endevco	8/04/04
Chest Z	J11361	Endevco	8/04/04
Chest Deflection Gauge	065	Servo	8/03/04
Chest X Redundant	ALFP5	Endevco	8/04/04
Chest Y Redundant	AP138	Endevco	8/04/04
Chest Z Redundant	AJ9Y3	Endevco	8/04/04
Pelvis X	C29-N11	Entran	7/01/04
Pelvis Y	C23-M12	Entran	7/01/04
Pelvis Z	C12-R01	Entran	7/01/04
Left Femur Load Cell	262	Denton	7/20/04
Right Femur Load Cell	261	Denton	7/20/04
Left Upper Tibia Load Cell	266	Denton	7/22/04
Left Lower Tibia Load Cell	179	Denton	7/22/04
Right Upper Tibia Load Cell	263	Denton	7/22/04
Right Lower Tibia Load Cell	174	Denton	7/22/04
Left Foot Z – Front	AMTL6	Entran	9/17/04
Left Ankle X	AMTG3	Endevco	9/17/04
Left Ankle Z	ALC37	Endevco	9/17/04
Right Foot Z – Front	J21970	Endevco	9/17/04
Right Ankle X	J22033	Endevco	9/17/04
Right Ankle Z	J21691	Endevco	9/17/04
Shoulder Belt Load Cell	157	Denton	8/18/04
Lap Belt Load Cell	194	Denton	6/08/04

INSTRUMENTS FOR VEHICLE AND LABORATORY

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Rear Seat Crossmember X	A08-M09	Entran	9/24/04
Left Rear Seat Crossmember Z	L18-N10	Entran	8/24/04
Right Rear Seat Crossmember X	L17-D23	Entran	8/25/04
Right Rear Seat Crossmember Z	A08-M02	Entran	9/13/04
Top of Engine X	I15-Z01	Entran	6/04/04
Bottom of Engine X	K20-J09	Entran	9/13/04
Left Brake Caliper X	K18-D14	Entran	6/04/04
Right Brake Caliper X	L20-B12	Entran	7/02/04
Instrument Panel X	K07-R06	Entran	7/26/04
Trunk Z	L18-J03	Entran	8/25/04