

REPORT NUMBER: TO12-MGA-2003-001

FULL SCALE SIDE IMPACT TESTS OF BASELINE VEHICLES
Task Order #T0008 / RFP #0012

VOLVO
1999 VOLVO S80 SEDAN
NHTSA NUMBER: RX5908

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February 28, 2003

FINAL REPORT SUBMITTED: August 15, 2003

PREPARED FOR:
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This final test report was prepared for the U.S. Department of Transportation, Volpe National Transportation System Center, in response to Contract Number DTRS57-98-D-00041.

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SECTION 1
PURPOSE AND TEST PROCEDURE

This Side Impact test is conducted as part of Contract No. DTRS57-98-D-00041, RFP12, task order 8, sponsored by the U.S. Department of Transportation, Volpe National Transportation System Center. The purpose of this test is to evaluate the responses of the ES-2 and SID/HIII dummies in a 1999 Volvo S80 Sedan, when subjected to a rigid pole side impact at 285 degrees.

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

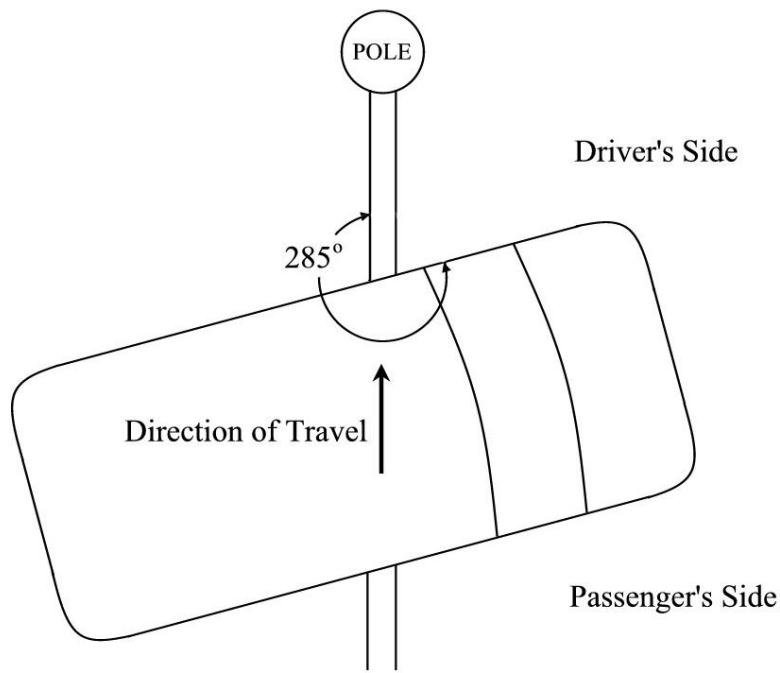
SECTION 2

SUMMARY OF SIDE IMPACT TEST

A rigid pole side impact test at 285 degrees was performed on a 1999 Volvo S80 Sedan. The subject vehicle was towed into a rigid pole at a velocity of 31.9 km/h. The weight of the vehicle as tested was 1798.2 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on February 28, 2003. Pre- and post-test photographs of the test vehicle and the dummies are included in Appendix A.

One ES-2 side impact dummy was placed in the left front designated seating position according to instructions specified in the NHTSA Office of Vehicle Safety Compliance Laboratory Test Procedure TP-214D-06, dated July 26, 2001. The side impact event was documented by ten high speed cameras. Camera locations and other pertinent camera information can be found in this report.

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



SECTION 2...continued
SUMMARY OF SIDE IMPACT TEST

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

Head Performance Criteria		Left Front
<1000	T1 (msec)	42.1
	T2 (msec)	68.6
	HPC	329
Thorax Performance Criteria		
Chest Deflection <42 mm	Upper Rib Deflection	49
	Mid Rib Deflection	46
	Lower Rib Deflection	46
Viscous Criteria <1.0 (m/sec.)	Upper Rib	0.7
	Mid Rib	0.6
	Lower Rib	0.4
Abdominal Protection Criteria		
Sum < 2500 N	Front Abdominal Force	215
	Mid Abdominal Force	535
	Rear Abdominal Force	821
	Sum of Abdominal Force	1547
Pelvis Performance Criteria		
< 6000 N	Pubic Symphysis Force	1127

HIC		Left Front
	T1 (msec)	42.1
	T2 (msec)	68.6
	T2 – T1 (msec)	26.5
	HIC	329

Fir Filtered	Left Front
Upper Rib Y (g's)	49.1
Mid Rib Y (g's)	34.9
Lower Rib Y (g's)	34.6
Upper Spine Y (g's)	38.0
Lower Spine Y (g's)	50.6
Pelvis Y (g's)	61.0
TTI (g's)	50

Contacts	Left Front
Arm (msec)	23.5
Rib (msec)	12.8
Pelvis (msec)	30.9

TEST NOTES

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

X – Test Speed * Sine 15 Degrees

Y – Test Speed * Cosine 15 Degrees

The ES-2 dummy contained production rib extensions.

SECTION 3
ES-2 SIDE IMPACT DUMMY AND VEHICLE TEST DATA

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

TEST VEHICLE INFORMATION

Make	Volvo
Model	S80
Body Style	Sedan
VIN	YV1TS97D1X1023578
Color	Painted Orange
Odometer Reading (mile)	47,011
Transmission	4 sp Automatic
Final Drive	Front
Number of Cylinders	6
Engine Displacement (L)	2.9
Engine Placement	Lateral

TEST VEHICLE OPTIONS

Front Airbag	Yes
Side Airbags	Curtain/Seat side
Power Windows	Yes
Power Steering	Yes
Power Door	No
Tilt Wheel	Yes
Air Conditioning	Yes
Power Brakes	Yes
Anti-lock Brakes	Yes
AM/FM/CD	Yes
Cruise Control	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Volvo	GVWR (kg)	2090.2
Date of Manufacture	11/98	GAWR Front (kg)	1129.9
		GAWR Rear (kg)	1040.1

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	273	273
Cold Pressure (kPa)	203	203
Recommended Tire Size	P225/50R17	P225/50R17
Tire Size on Vehicle	P215/55R16	P215/55R16
Tire Manufacturer	Michelin	Michelin

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

DATA SHEET NO. 1... (continued)**GENERAL TEST AND VEHICLE PARAMETER DATA**Test Vehicle: 1999 Volvo S80Test Date: February 28, 2003**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	485.8	347.5		536.2	375.6	
Right	kg	485.4	330.7		514.4	372.0	
Ratio	%	58.9	41.1		58.4	41.6	
Totals	kg	971.2	678.2	1649.4	1050.6	747.6	1798.2

TARGET TEST WEIGHT

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

TEST VEHICLE ATTITUDES

	Unit	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	Deg	0.5 ND	0.2 ND	0.4 ND
Left Door Sill Angle	Deg	0.5 ND	0.2 ND	0.2 ND
Front Bumper Angle	Deg	0.1 LD	0.4 LD	0.3 LD
Rear Bumper Angle	Deg	0.0	0.3 LD	0.2 LD

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

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2795
Total Vehicle Length at Left Side	mm	4115
Total Vehicle Length at Centerline	mm	4778
Total Vehicle Length at Right Side	mm	4115
Total Vehicle Width	mm	1835
Weight of Ballast in Cargo Area	kg	0
Amount of Water in Fuel Tank	liters	60.6

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Actual Impact Point	mm	18 rear

DATA SHEET NO. 1... (continued)

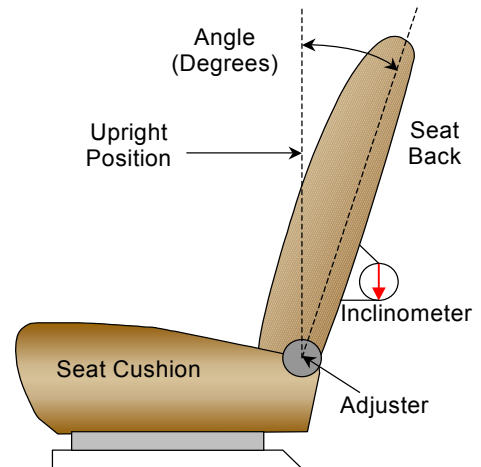
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

NORMAL DESIGN RIDING POSITION

Driver seat back angle: 18 degree on seat back frame



FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONS

The driver's seat is electronically operated.

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

Driver seat fore/aft total travel: 280 mm

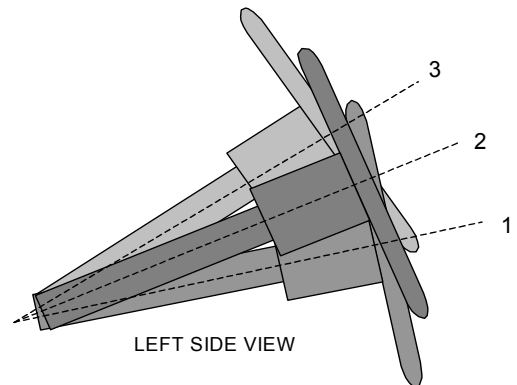
Driver seat fore/aft position: 140 mm

SEAT BELT UPPER ANCHORAGE

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

STEERING COLUMN ADJUSTMENT

The column was placed in the mid position of travel.



STEERING COLUMN ASSEMBLY

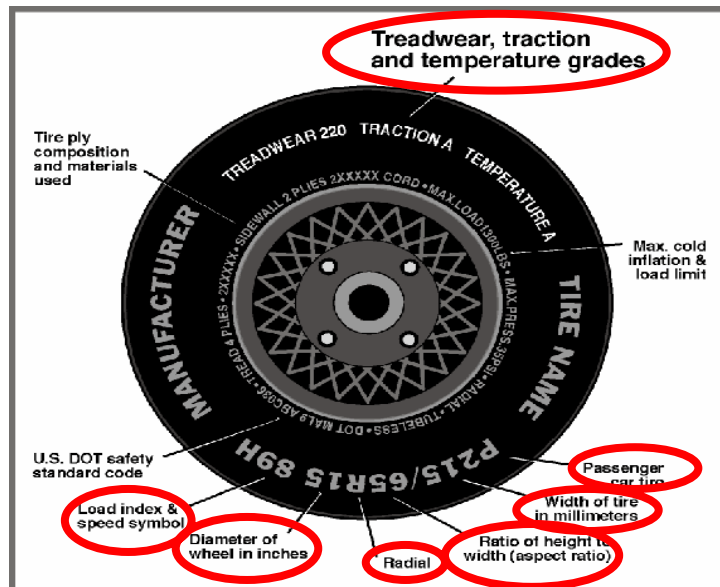
DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

Vehicle Year	1999	Vehicle Make	Volvo
Vin	YV1TS97D1X1023578	Vehicle Model	S80



	Front	Rear
Tire Manufacturer	Michelin	Michelin
Tire Name	Pilot MX	Pilot MX
Tire Type	Passenger	Passenger
Tire Width (mm)	215	215
Ratio of Height to Width (aspect ratio)	55	55
Radial	Radial	Radial
Wheel Diameter	16	16
Load Index & Speed Symbol	93H	93H
Treadwear	300	300
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 3
POST TEST OBSERVATIONS

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front
Dummy Type	ES II
Head Contact	Curtain bag
Upper Torso Contact	Upper door / Side seat airbag
Lower Torso Contact	Lower door / Side seat airbag
Left Knee Contact	Lower door panel
Right Knee Contact	Left knee

POST TEST DOOR OPENING

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

POST TEST STRUCTURAL OBSERVATIONS

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

AIRBAG DEPLOYMENT

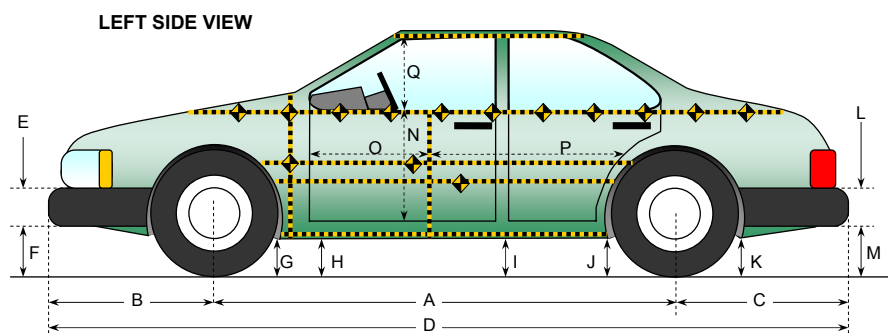
	Driver
Front	No
Side	Yes
Curtain	Yes

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 4
VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003



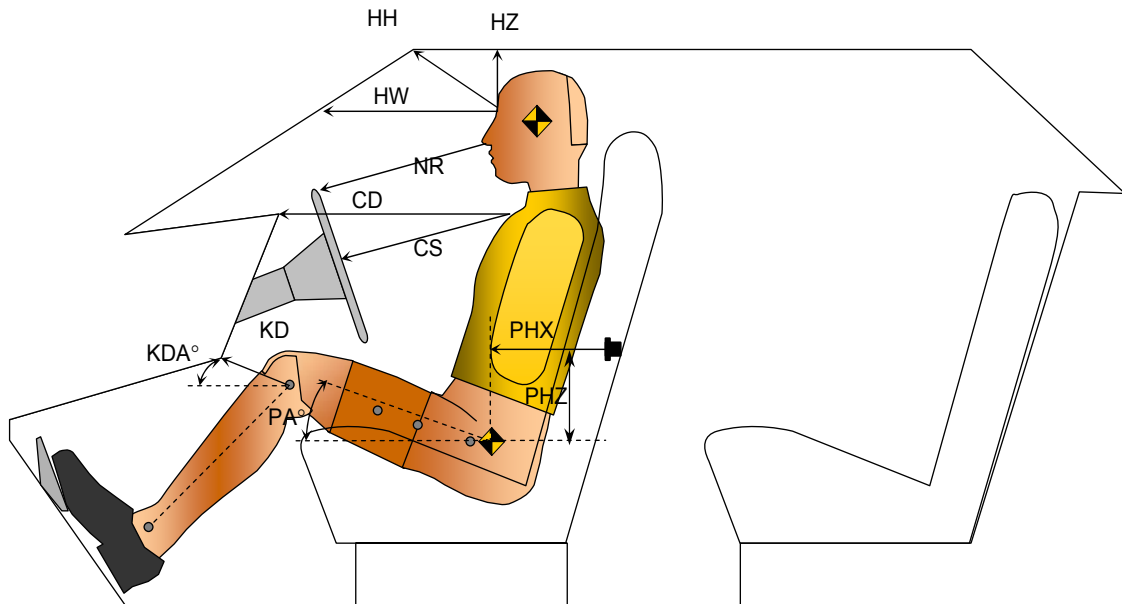
All Measurements in mm

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2795	2581	214
B	Front Axle to FSOV	942	990	-48
C	Rear Axle to RSOV	1041	1114	-73
D	Total Length at Centerline	4778	4685	93
E	Front Bumper Thickness	164	164	0
F	Front Bumper Bottom to Ground	477	504	-27
G	Sill Height at Front Wheel Well	316	306	10
H	Sill Height at Front Door Leading Edge	317	317	0
I	Sill Height at "B" Pillar	341	362	-21
J1	Sill Height at Rear Wheel Well	327	352	-25
J2	Pinch Weld Height at Rear Wheel Well	335	356	-21
K	Sill Height Aft of Rear Wheel Well	364	376	-12
L	Rear Bumper Thickness	257	257	0
M	Rear Bumper Bottom to Ground	475	460	15
N	Sill Height to Window Bottom Sill	704	710	-6
O	Front Door Leading Edge to Impact CL	906	904	2
P	Rear Door Trailing Edge to Impact CL	1064	1048	16
Q	Front Window Opening	444	418	26
R	Right Side Length	4115	4146	-31
S	Left Side Length	4115	3898	217
T	Vehicle Width at "B" Post	1835	1481	354

DATA SHEET NO. 5
ES-2 LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

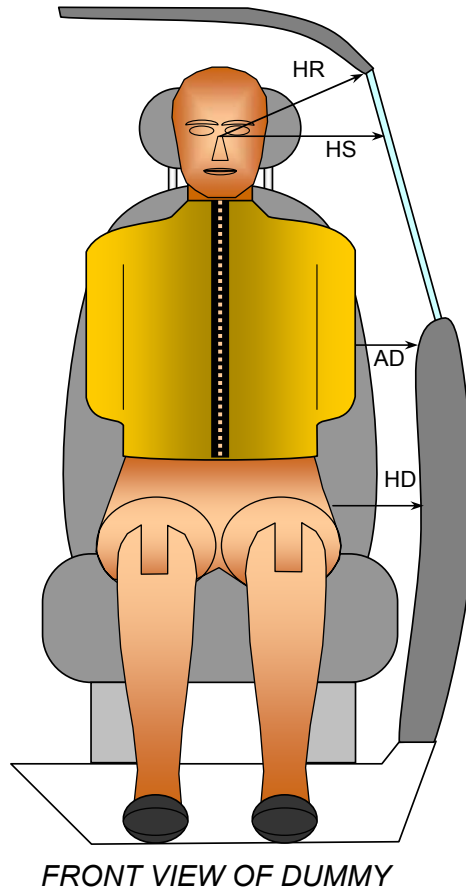


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	397	
HW	Head to Windshield	657	
HZ	Head to Roof	174	
NR	Nose to Rim	477	
CD	Chest to Dash	574	
CS	Chest to Steering Wheel	345	
KDL	Left Knee to Dash	188	0
KDR	Right Knee to Dash	185	0
PA	Pelvic Angle (Longitudinal)		29.0
PA	Pelvic Angle (Lateral)		0.0
SA	Spine Angle (Longitudinal)		28.6
SA	Spine Angle (Lateral)		0.6
PHX	H-Point to Striker (X-Axis)	229	
PHZ	H-Point to Striker (Z-Axis)	214	

DATA SHEET NO. 6
ES-2 LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003



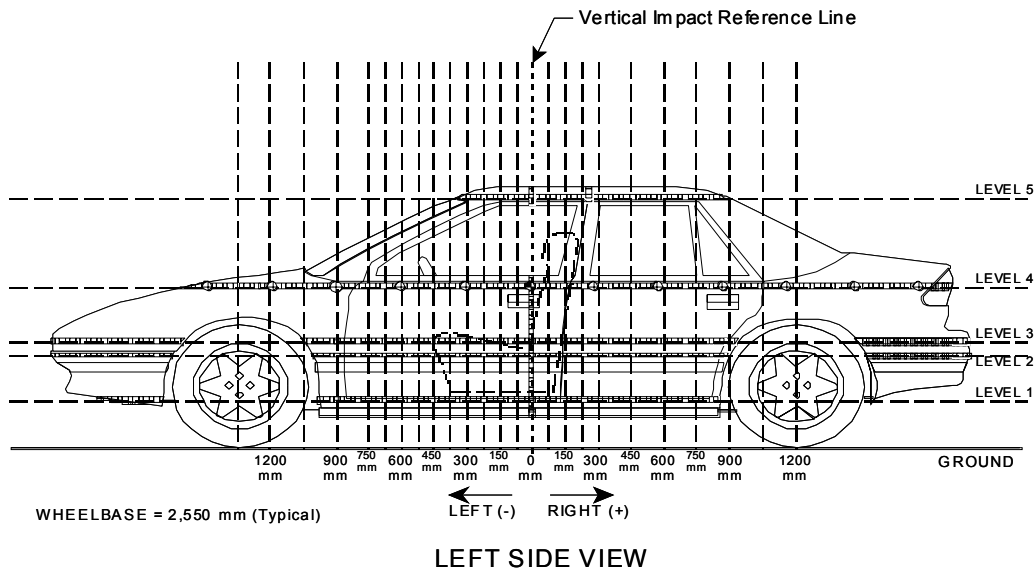
Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	210
HS	Head to Side Window	mm	324
AD	Arm to Door	mm	107
HD	H-Point to Door	mm	141

DATA SHEET NO. 7 **VEHICLE SIDE MEASUREMENTS**

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

PRETEST AND POST TEST EXTERIOR PROFILE MEASUREMENTS



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

Level	Measurement Description	Height Above Ground
5	Window	1494
4	Window Sill	1056
3	Mid Door	757
2	Occupant H-Point	702
1	Sill Top	424

DATA SHEET NO. 8
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1950				325					326					1	
-1800				301					284					-17	
-1650				280					284					4	
-1500				266					273					7	
-1350				257					263					6	
-1200				256					263					7	
-1050		196	199	256			221	221	269			25	22	13	
-975	248	185	198	260		292	211	220	270		44	26	22	10	
-900	253	195	197	260		297	211	210	269		44	16	13	9	
-825	251	194	196	264		297	234	237	287		46	40	41	23	
-750	253	193	195			315	230	264			62	37	69		
-675	253	192	194	263		332	287	291	326		79	95	97	63	
-600	254	192	193	260		354	314	321	346		100	122	128	86	
-525	255	190	192	256		373	341	349	376		118	151	157	120	
-450	254	190	192	255		394	370	379	408		140	180	187	153	
-375	255	190	191	254		415	401	411	439		160	211	220	185	
-300	255	190	191	253	461	446	448	450	480	515	191	258	259	227	54
-225	255	190	191	254	455	473	475	482	506	531	218	285	291	252	76
-150	255	190	190	253	461	515	516	523	542	564	260	326	333	289	103
-75	254	191	191	252	460	565	562	566	577	593	311	371	375	325	133
0	251	190	191	252	462	583	594	596	602	620	332	404	405	350	158
75	252	190	191	252	463	588	595	601	625	639	336	405	410	373	76
150	250	190	191	251	465	546	555	565	616	643	296	365	374	365	178
225	250	190	192	252	468	486	478	490	561	642	236	288	298	309	174
300	250	191	193	252	469	420	415	427	525	595	170	224	234	273	126
375	248	191	194	253	472	357	359	371	494	571	109	168	177	241	99
450	248	192	195	253	473	290	310	328	457	538	42	118	133	204	65
525	247	192	195	253	473	250	273	293	422	508	3	81	98	169	35
600	247	193	196	256	475	260	263	279	403	495	13	70	83	147	20
750	245	195	199	257	479	245	228	239	332	438	0	33	40	75	-41
900	245	197	201	261	480	232	199	208	261	488	-13	2	7	0	-8
1050		197	200	263	495		193	187	254	488		-4	-13	-7	-7
1200				273					270					-3	
1350				280					280					0	
1500				291					295					4	
1650				305					310					5	
1800				320					327					7	
1950				336					341					5	
2100				355					357					2	

Reference plane is parallel to test vehicle longitudinal centerline.

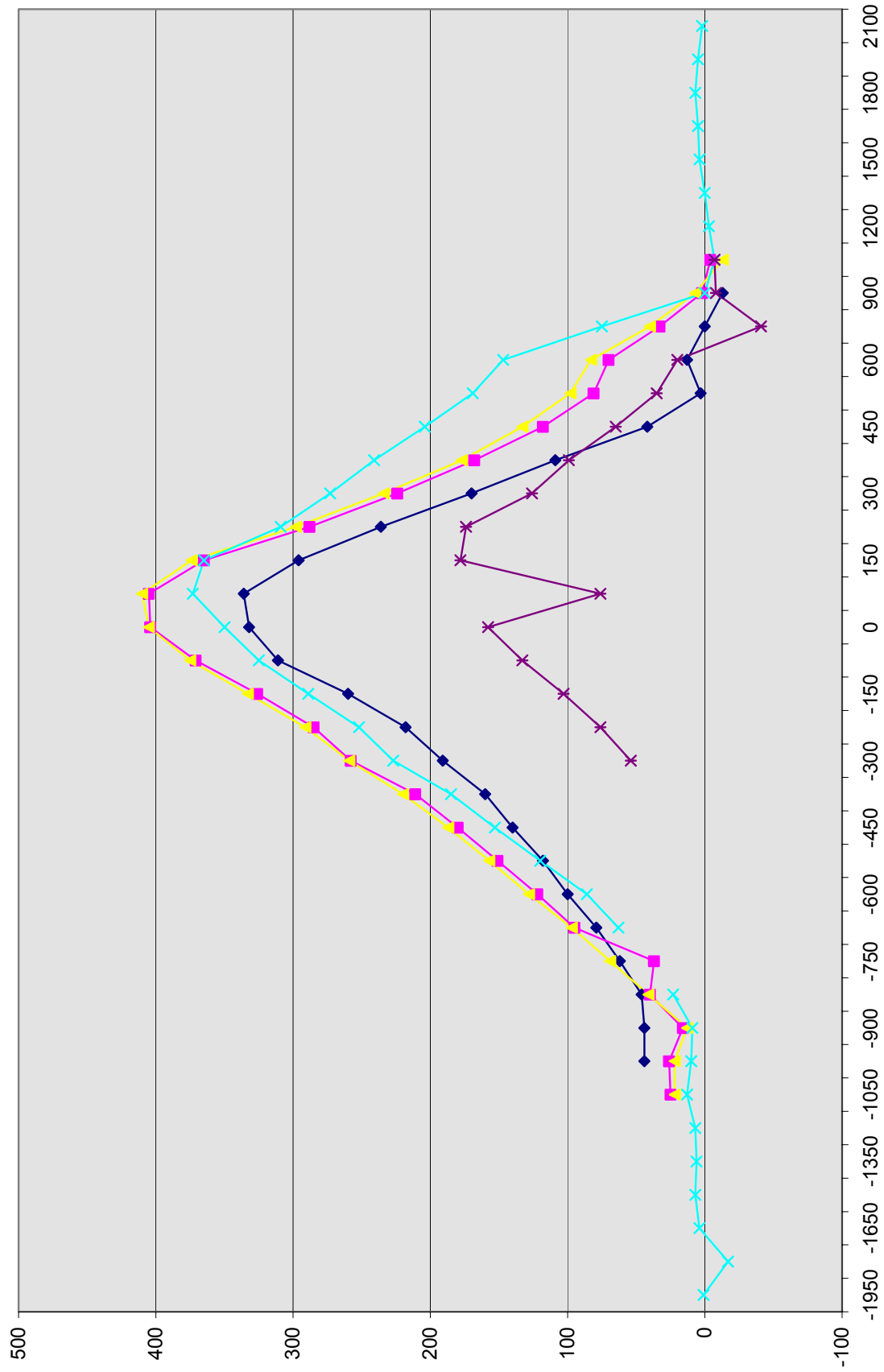
Given dimensions = Reference plane to car body.

Measurements in mm.

DATA SHEET NO. 8... (continued)
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

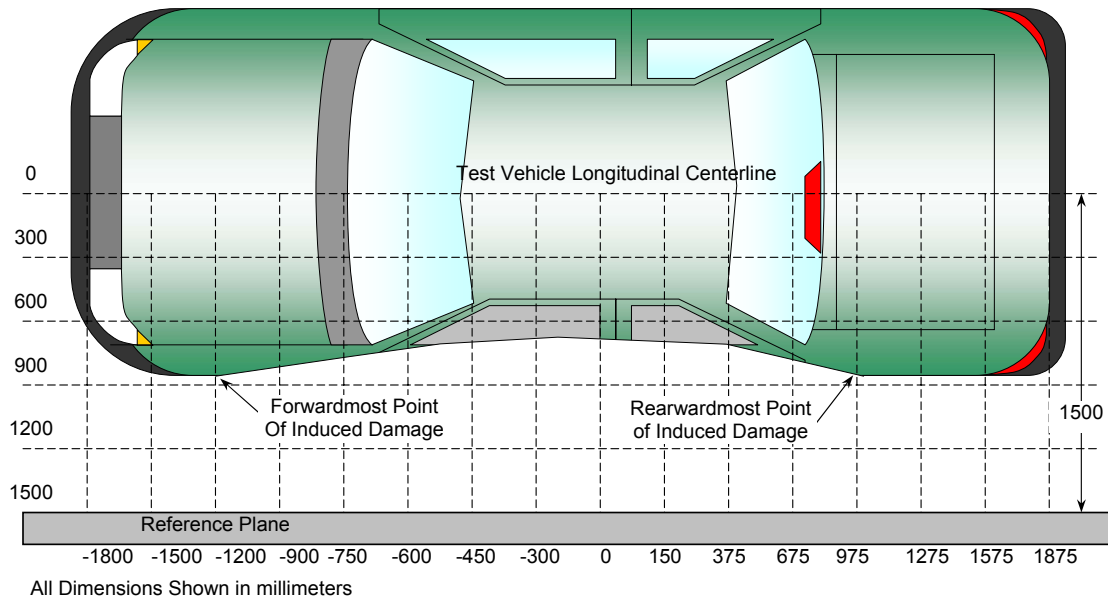


Measurement in mm.

DATA SHEET NO. 9
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003



TOP VIEW

Damage Profile Distances

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	1950 mm	4	336	341	5
2	1206 mm	4	273	273	0
3	395 mm	4	253	484	231
4	-500 mm	3	256	362	106
5	-1210 mm	4	256	262	6
6	-1950 mm	4	325	326	1

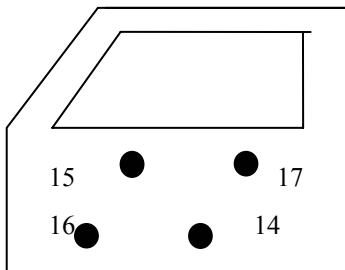
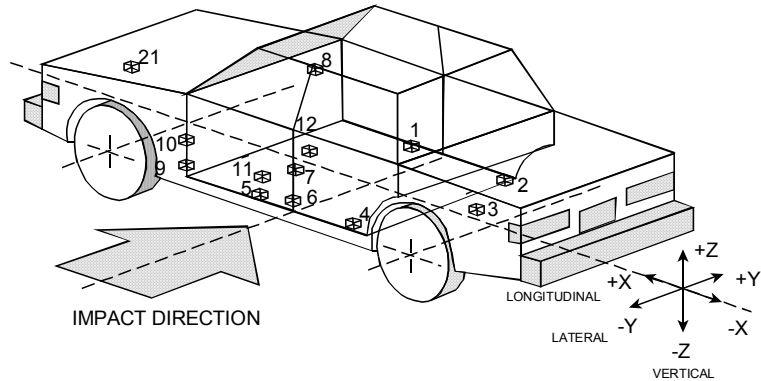
Reference plane is parallel to test vehicle longitudinal centerline.

Given dimensions = Reference plane to car body.

DATA SHEET NO. 10
VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003



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

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

DATA SHEET NO. 10... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

Loc. No.	Accelerometer Location	Long (X) Maximums (g's) (CFC 60)		Lat. (Y) Maximums (g's) (CFC 60)		Vert. (Z) Maximums (g's) (CFC 60)		Resultant (g's) (CFC 60)
		Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Max.
1	Right Side Sill at Front Seat	3.6	2.0	13.9	0.5	4.7	2.7	14.1
2	Right Side Sill at Rear Seat	4.2	1.9	14.2	1.9	4.8	2.5	14.2
3	Rear Floorpan Above Axle	4.0	3.9	13.2	1.7	4.4	3.2	13.2
4	Left Side Sill at Rear Door			58.8	19.3			
5	Left Side Sill at Front Door			22.2	5.1			
6	Left Lower B-Post			66.5	12.3			
7	Left Mid B-Post			74.5	37.0			
8	Left Upper B-Post **							
9	Left Lower A-Post *			36.3	0.5			
10	Left Mid A-Post			24.7	10.0			
11	Driver Left Seat Track			67.0	24.1			
12	Vehicle CG	2.8	9.7	41.7	8.8	19.5	9.1	43.0
13	Left A- Pillar at Roof **							
14	Left Front Door at Pelvis			83.7	43.7			
15	Left Front Door at Arm			144.3	58.1			
16	Left Front Door at Knee			80.4	88.3			
17	Left Front Door at Rib			113.4	57.3			
19	Left Driver Seat Frame **							
20	Right Driver Seat Frame **							
21	Lower Center Radiator Support	3.3	11.0	12.2	5.1	5.7	6.2	12.8

* = questionable data after 50 msec.

**= not used to avoid interference with airbags.

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

DATA SHEET NO. 10... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003

VEHICLE ACCELEROMETER COORDINATES

Loc. No.	Description	Coordinates (mm)		
		X	Y	Z
1	Right Side Sill at Front Seat	2525	675	227
2	Right Side Sill at Rear Seat	1760	690	230
3	Rear Floorpan Above Axle	1100	0	590
4	Left Side Sill at Rear Door	1467	-715	232
5	Left Side Sill at Front Door	2858	-715	224
6	Left Lower B-Post	2215	-695	330
7	Left Mid B-Post	2148	-733	1000
8	Left Upper B-Post	*	*	*
9	Left Lower A-Post	3275	-720	400
10	Left Mid A-Post	3292	-854	855
11	Driver Left Seat Track	2420	-560	295
12	Vehicle CG	2850	0	165
13	Left A-Pillar @ Roof	*	*	*
14	Left Door @ Pelvis	2560	-763	552
15	Left Door @ Arm	2720	-783	858
16	Left Door @ Knee	2454	-796	628
17	Left Door @ Rib	1947	-786	858
19	Left Driver Seat Frame	*	*	*
20	Right Driver Seat Frame	*	*	*
21	Lower Center Radiator Support	4485	-440	388

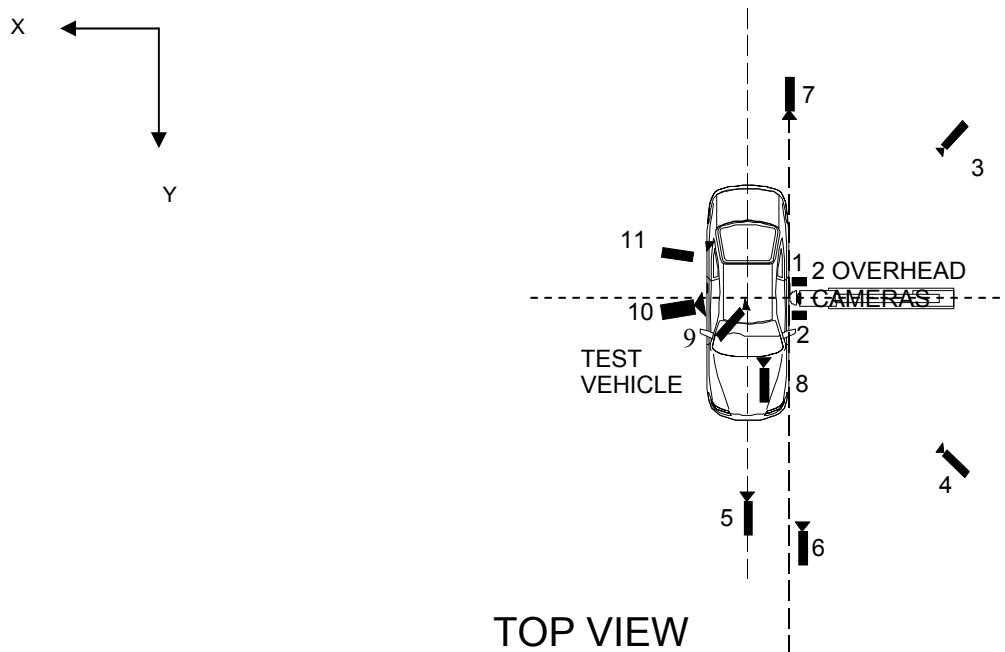
* = Not used to avoid interference with the restraint system

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

DATA SHEET NO. 11
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 1999 Volvo S80

Test Date: February 28, 2003



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Overhead Overall	-860	0	5000	8	1042
2	Overhead Close-up	0	0	5000	13	1031
3	Left Side 45 deg. Rearward Pole View	-2470	-5100	1420	50	1042
4	Left Side 45 deg. Forward Pole View	-2630	3580	1310	50	1036
5	Real Time					
6	Front Ground Level Vehicle/Pole Impact	-4500	9000	1560	25	840
7	Rear Ground Level Vehicle/Pole Impact	-70	-9370	1350	25	1047
8	Test Vehicle Onboard Driver Front View				13	526
9	Test Vehicle Onboard Driver Hip				13	521
10	Test Vehicle Onboard Driver Side View				13	515
11	Test Vehicle Onboard Driver ¾ Rear View				13	524

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

APPENDIX A
PHOTOGRAPHS

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Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle



Pre-Test Rear View of Test Vehicle



Post-Test Rear View of Test Vehicle



Pre-Test Left Side View of Test Vehicle



Post-Test Left Side View of Test Vehicle



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



Pre-Test Left $\frac{3}{4}$ Front View of Test Vehicle



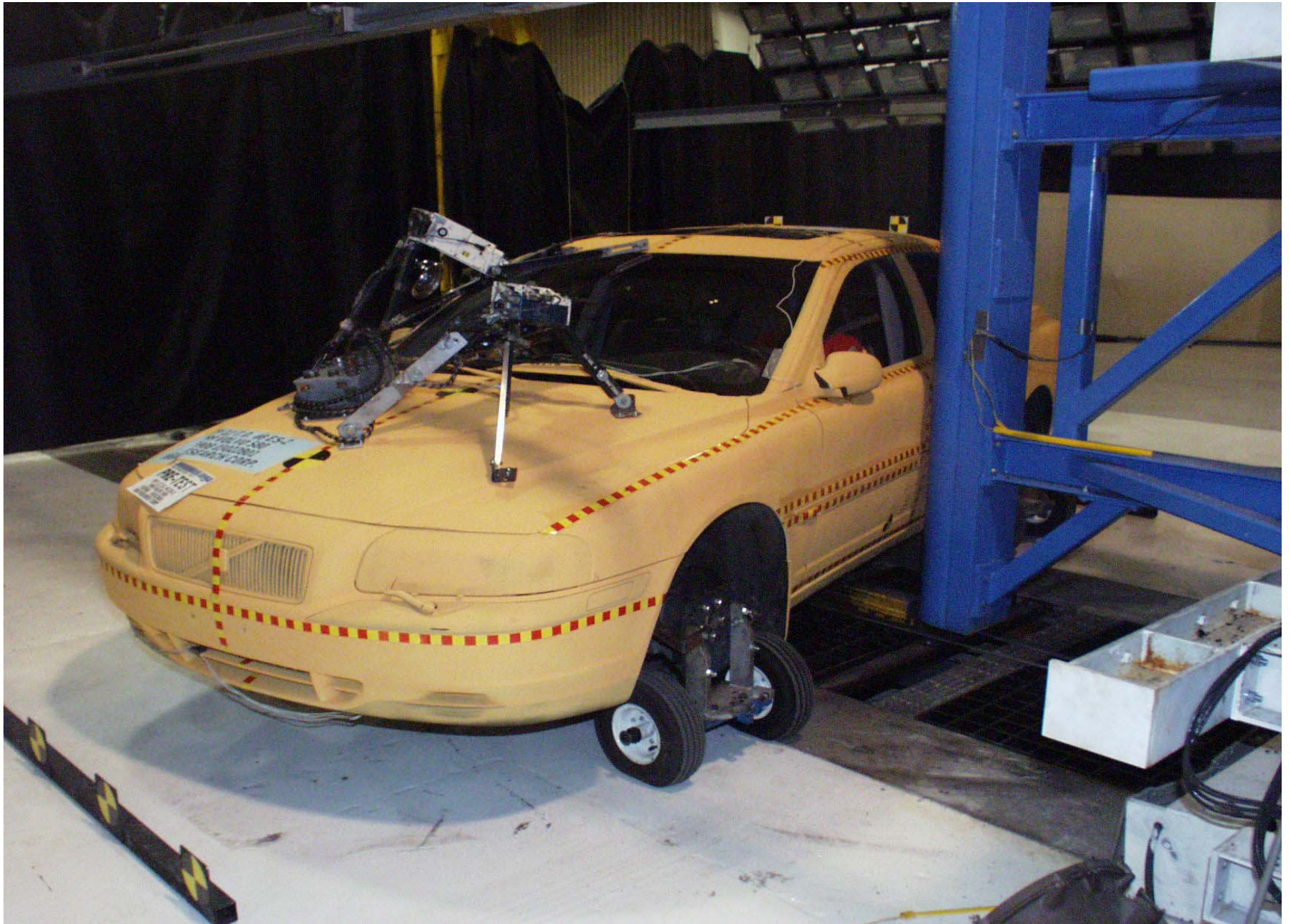
Post-Test Left $\frac{3}{4}$ Front View of Test Vehicle



Pre-Test Left $\frac{3}{4}$ Rear View of Test Vehicle



Post-Test Left $\frac{3}{4}$ Rear View of Test Vehicle



Pre-Test Vehicle Positioned Against Pole (left side)



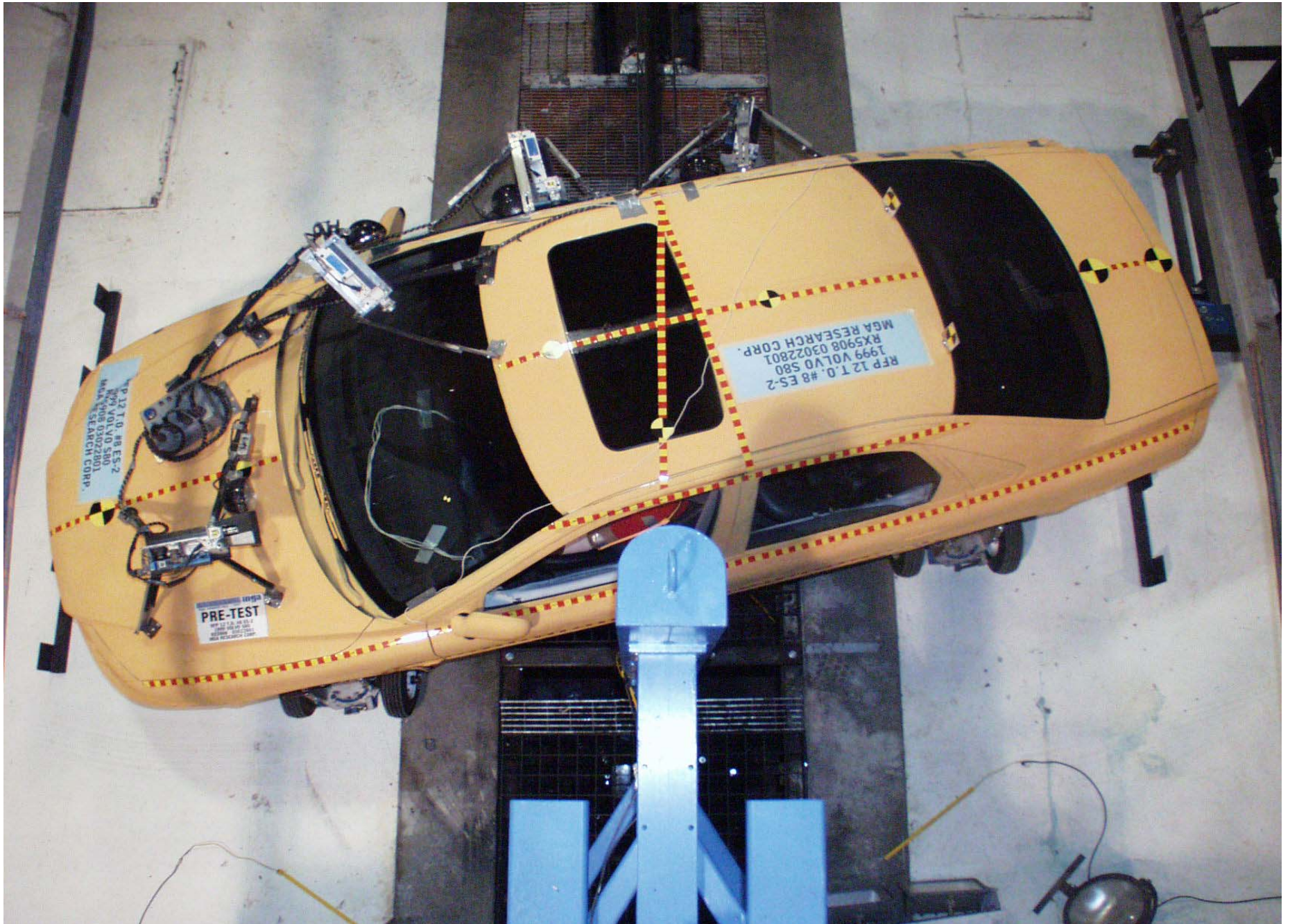
Post-Test Vehicle Positioned Against Pole (left side)



Pre-Test Vehicle Positioned Against Pole (right side)



Post-Test Vehicle Positioned Against Pole (right side)



Pre-Test Vehicle Positioned Against Pole Overhead View



Post-Test Vehicle Positioned Against Pole Overhead View



Pre-Test Driver Seat Postion



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



Pre-Test Driver Dummy Left Side View



Post-Test Driver Dummy Left Side View



Pre-Test Driver Dummy Right Side View



Post-Test Driver Dummy Right Side View



Pre-Test Driver Dummy Shoulder and Door Top View



Post-Test Driver Dummy Shoulder and Door Top View



Post-Test Driver Dummy Lower Body Contact



Post-Test Driver Dummy Head Contact



Pre-Test Impact Point on Vehicle



Post-Test Impact Point on Vehicle

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

The dummy and vehicle x and Y velocities presented in this report do not contain the correct initial velocity.

The correct initial velocities should be:

X – Test Speed * Sine 15 Degrees

Y – Test Speed * Cosine 15 Degrees

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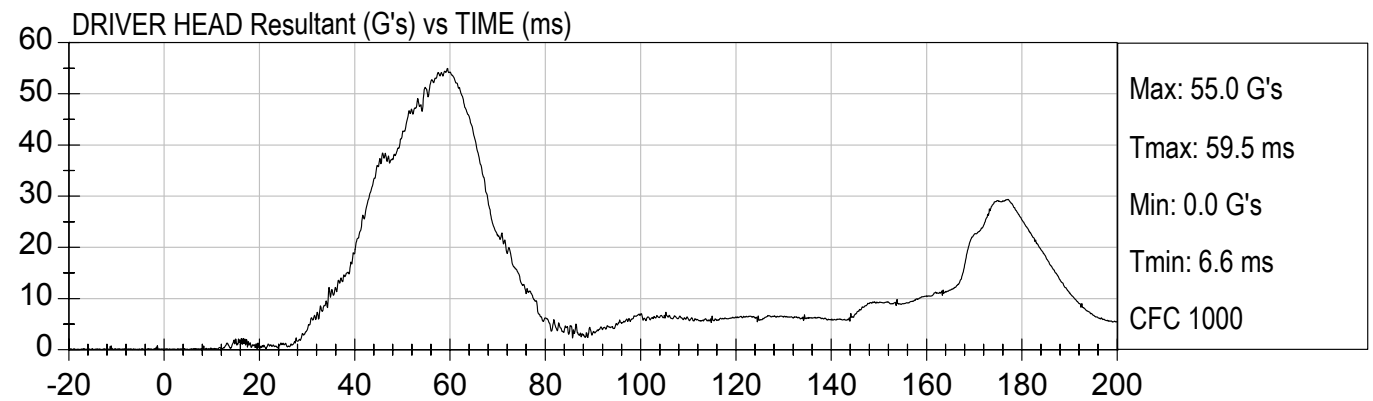
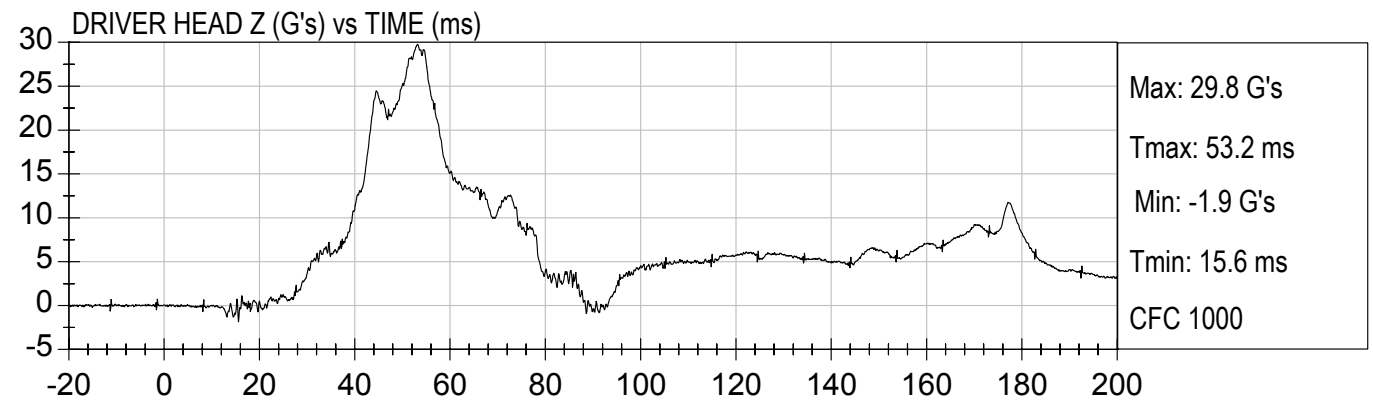
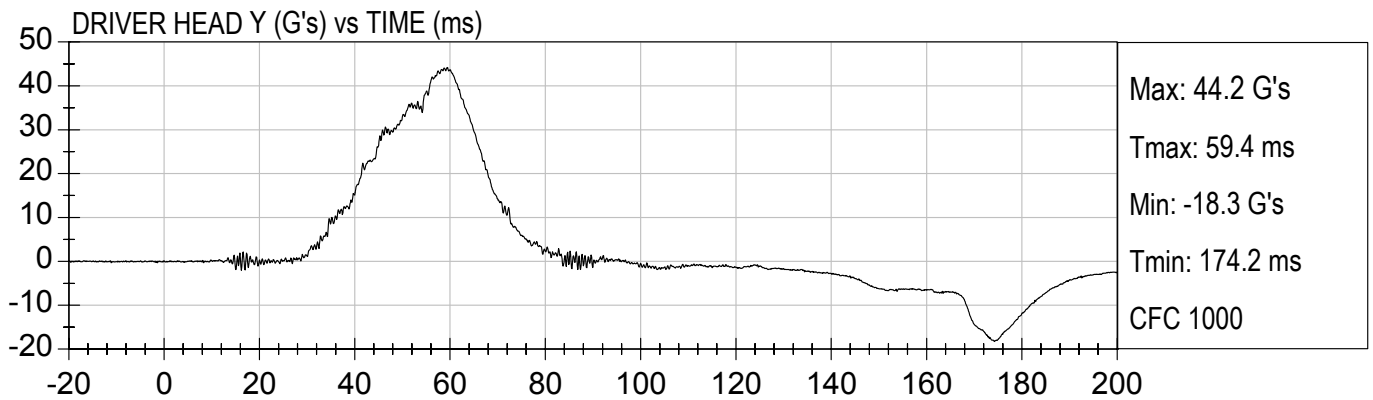
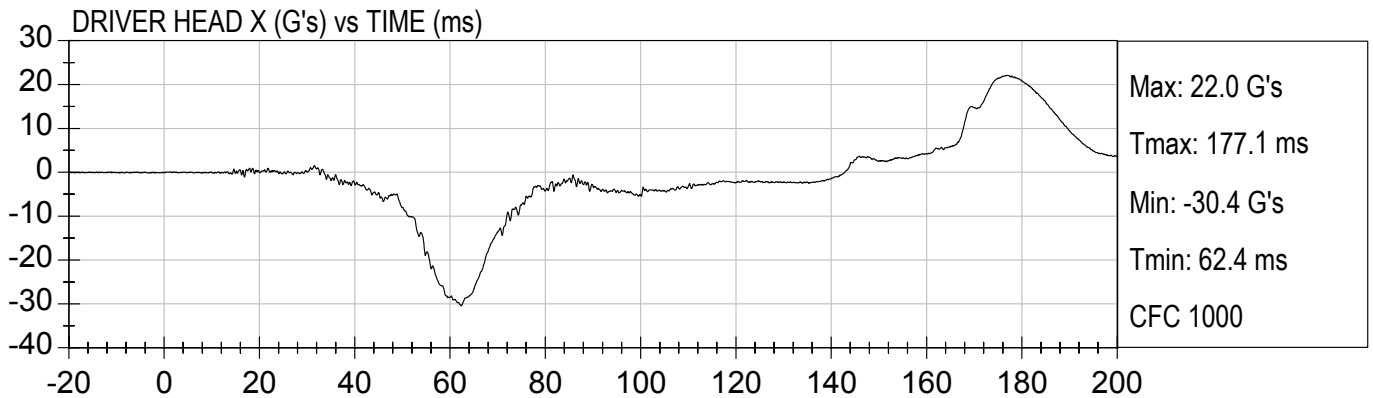
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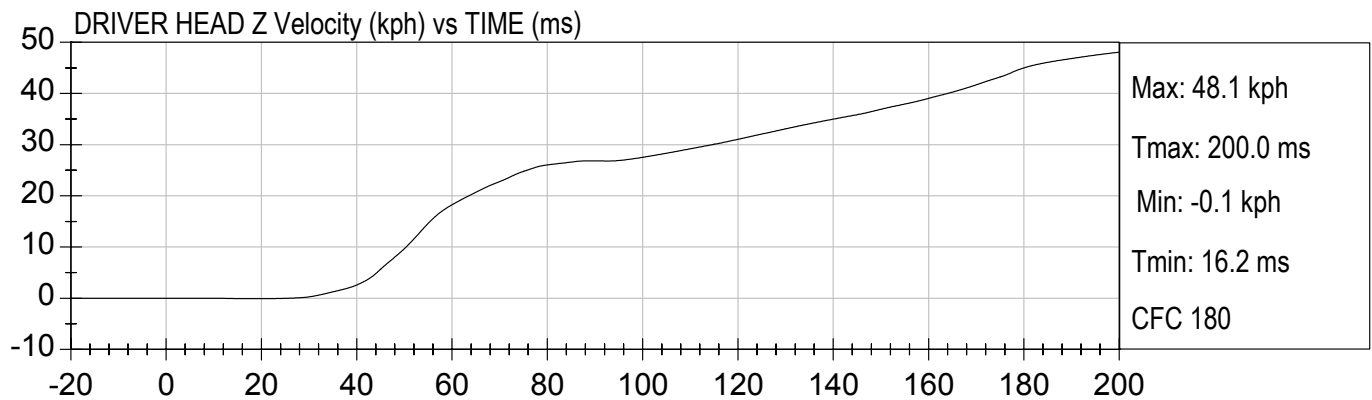
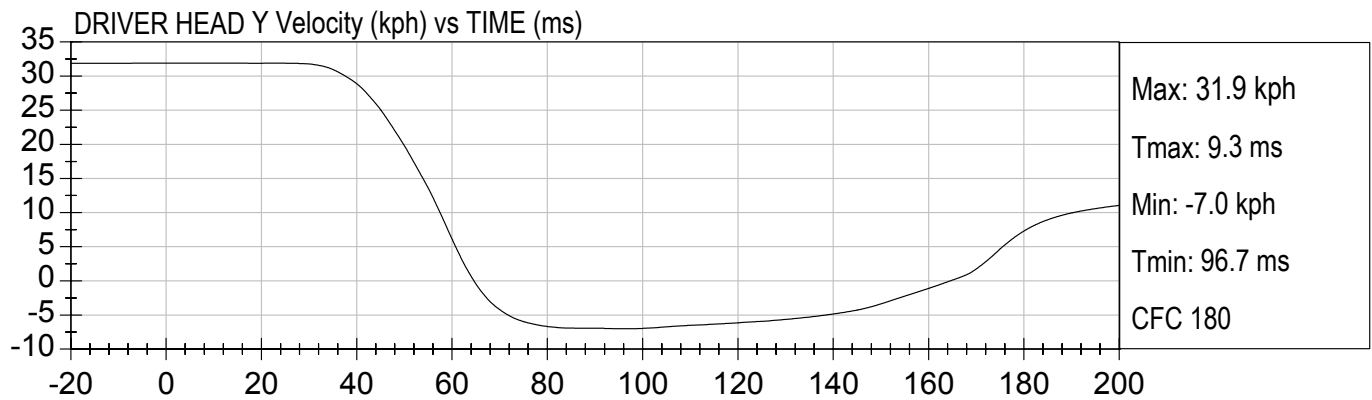
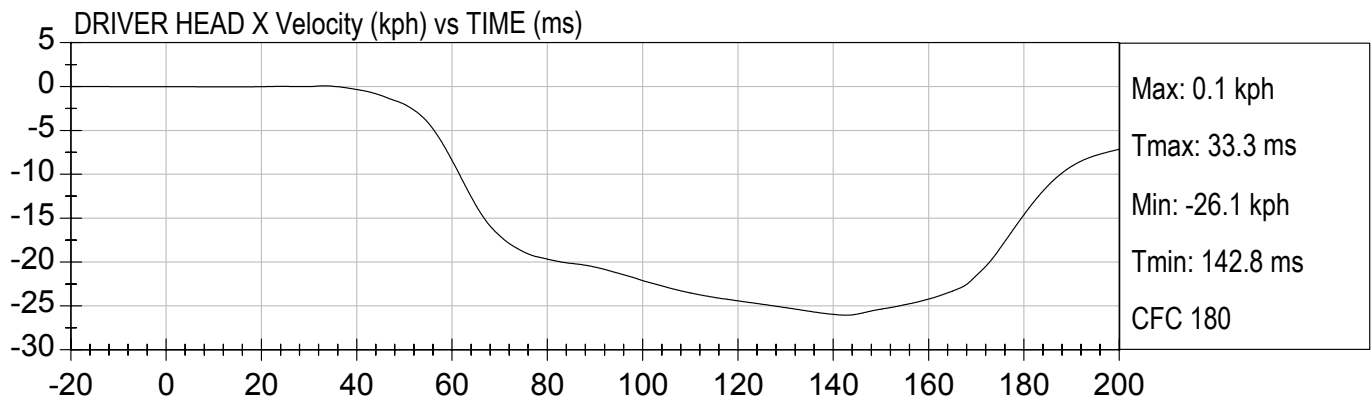
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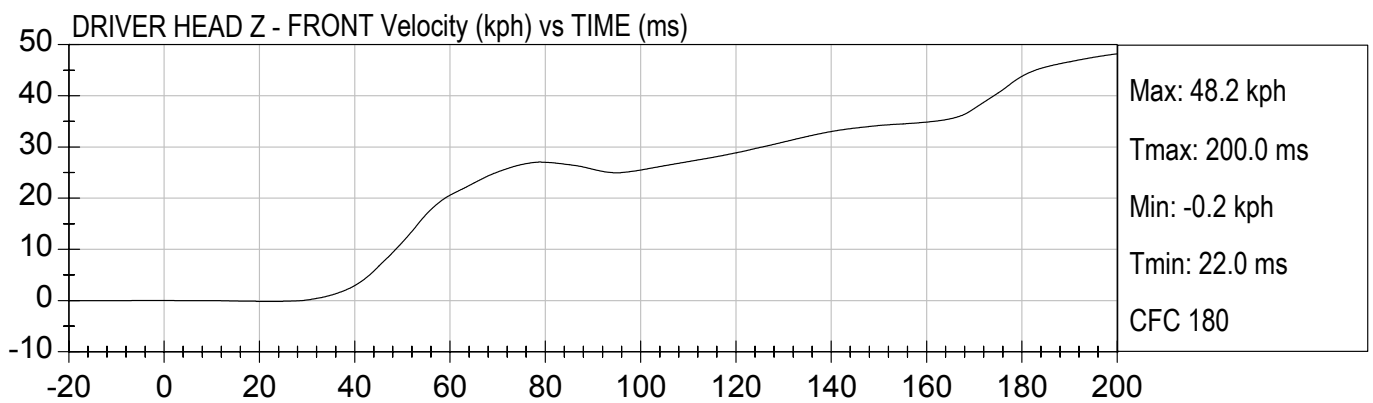
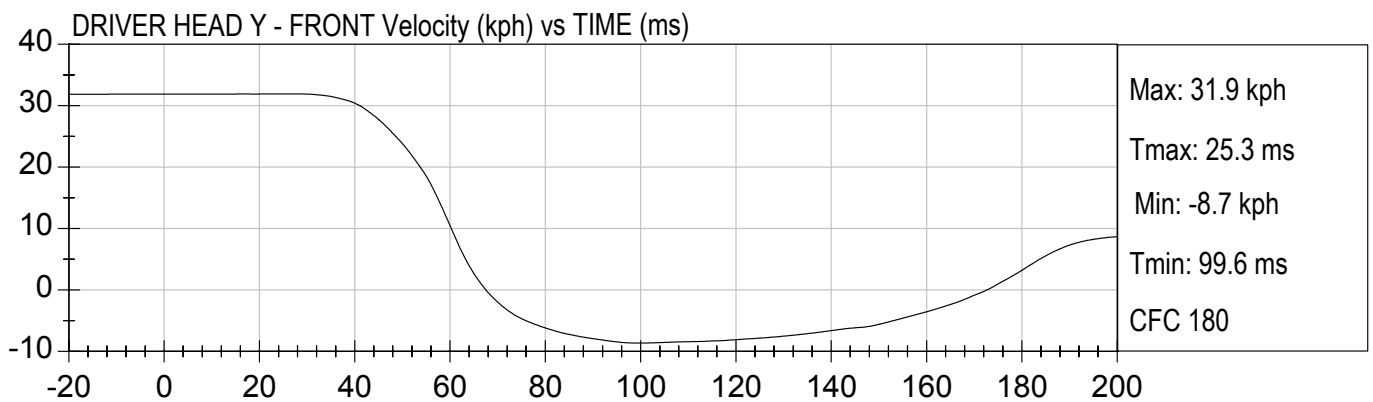
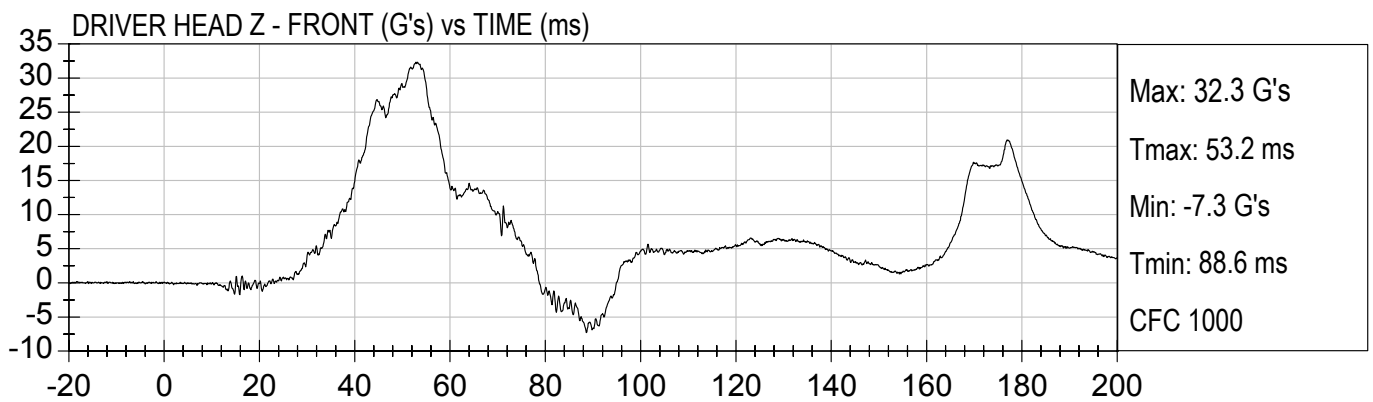
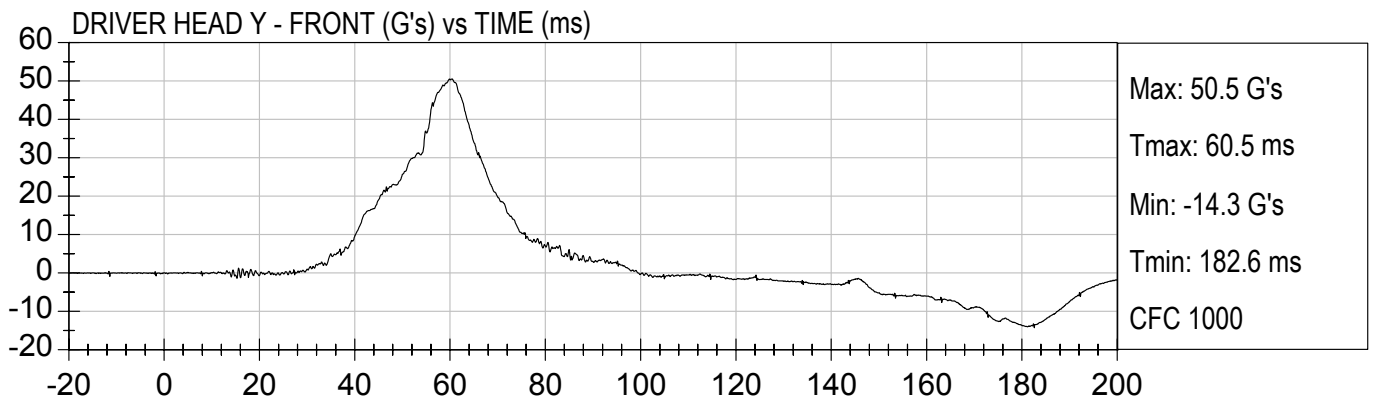
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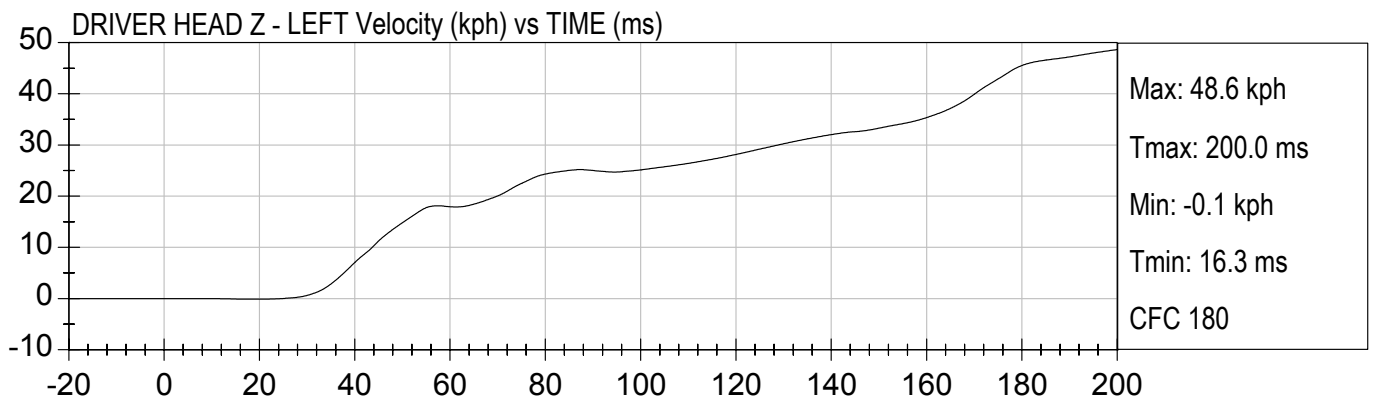
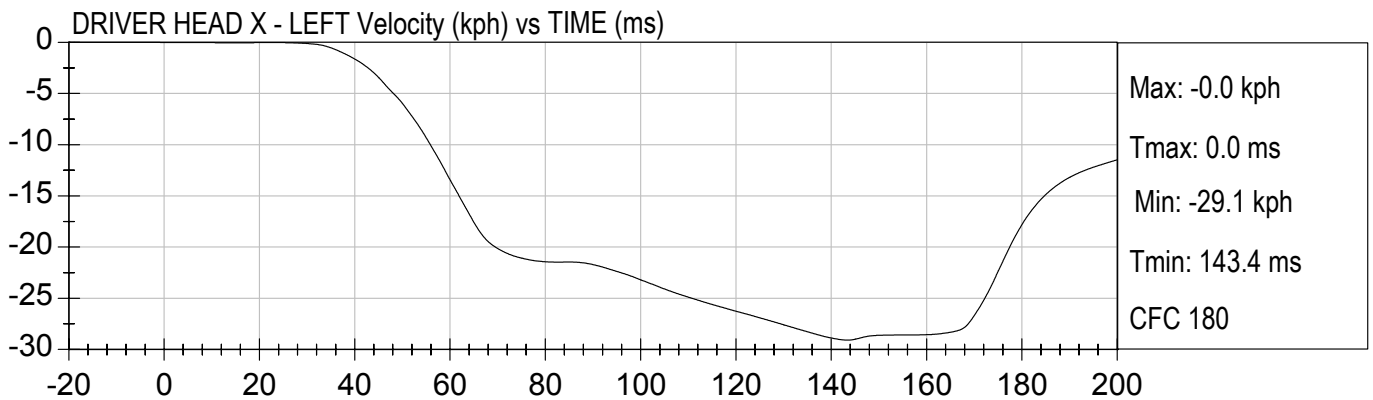
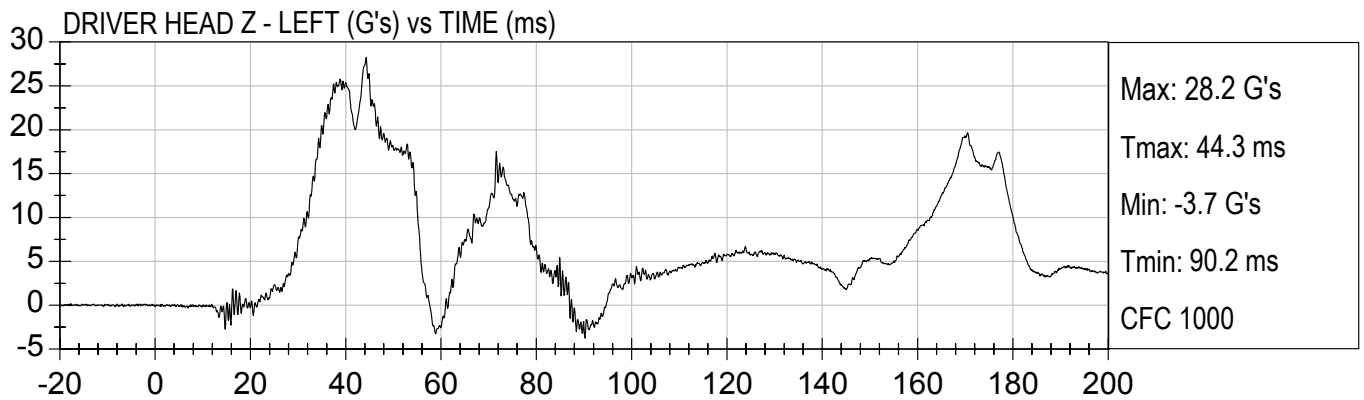
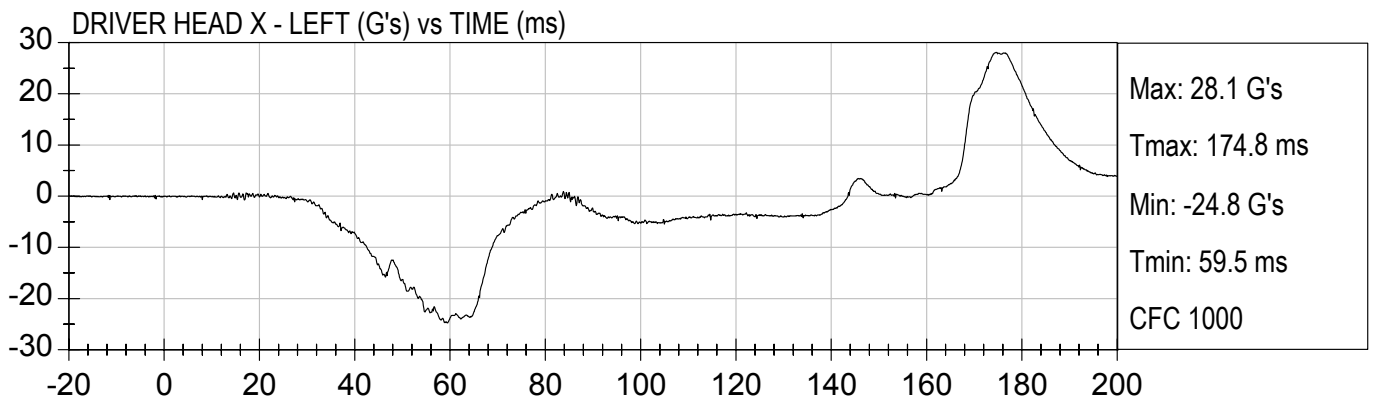
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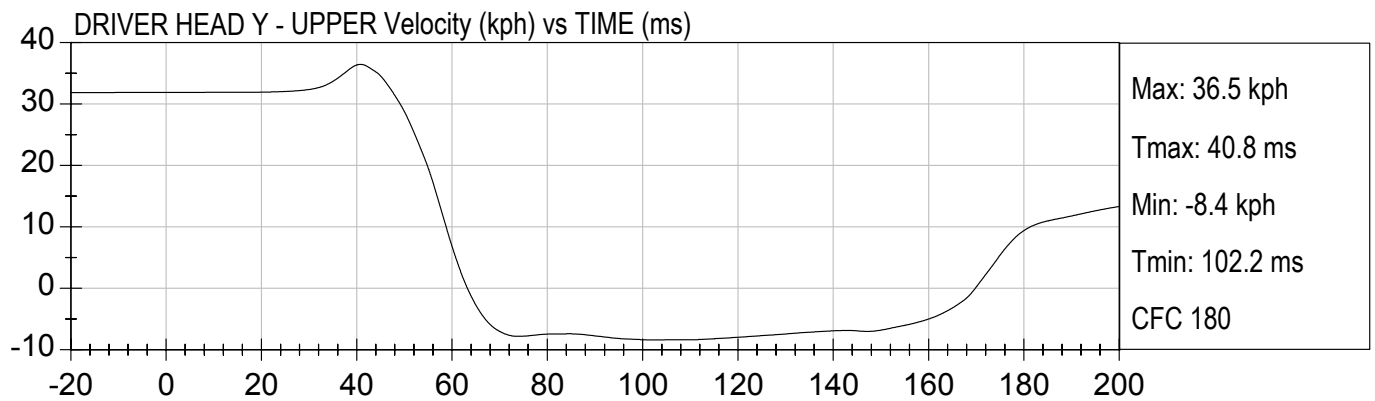
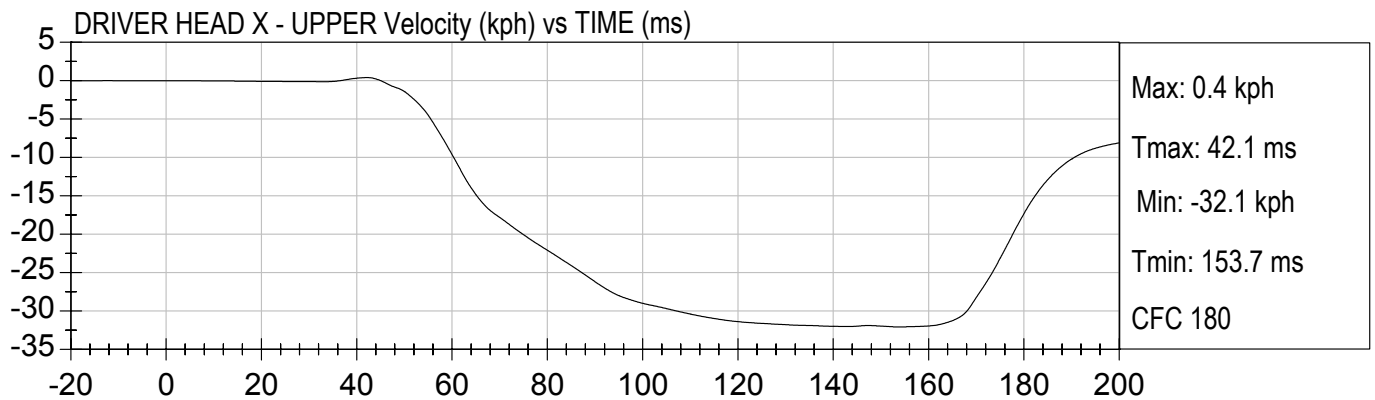
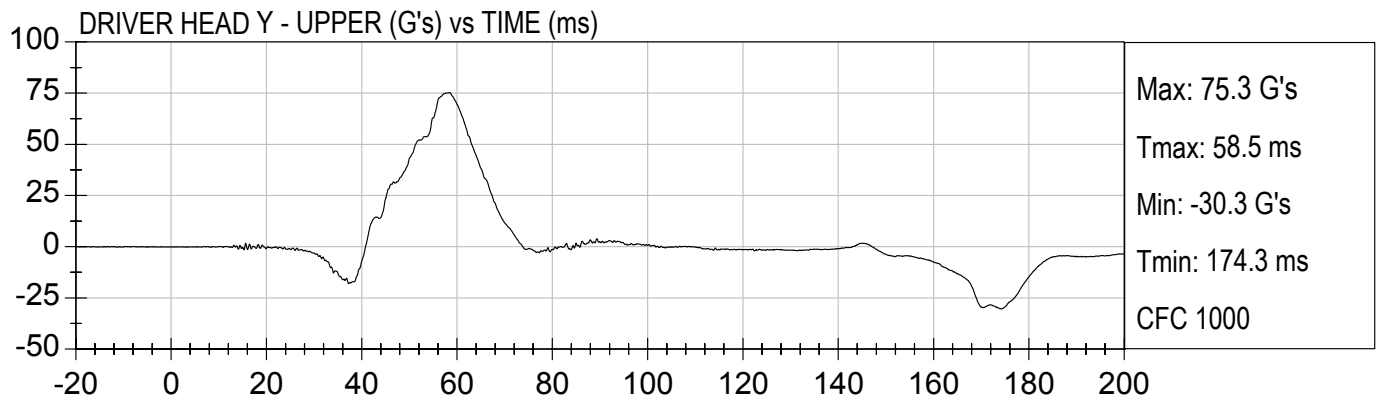
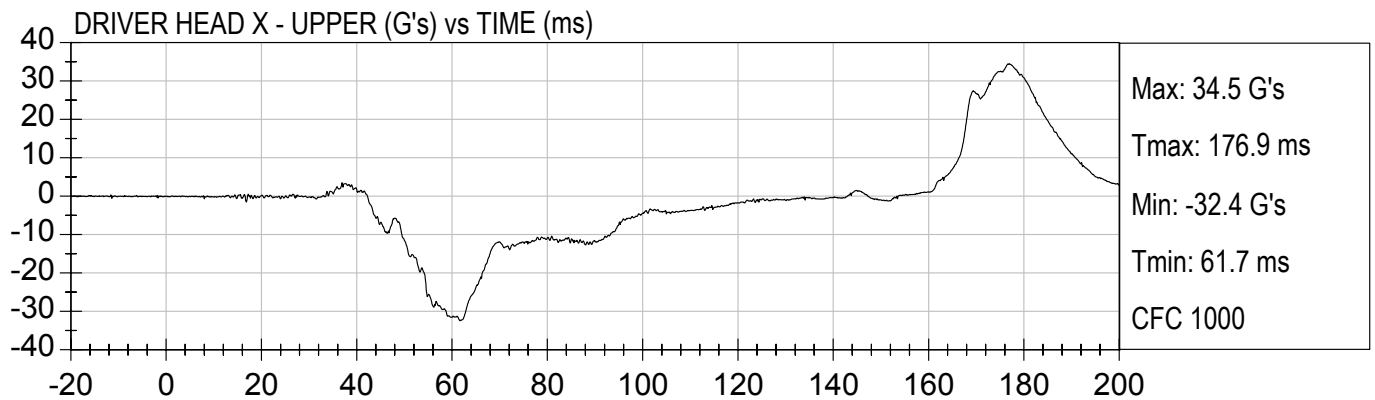
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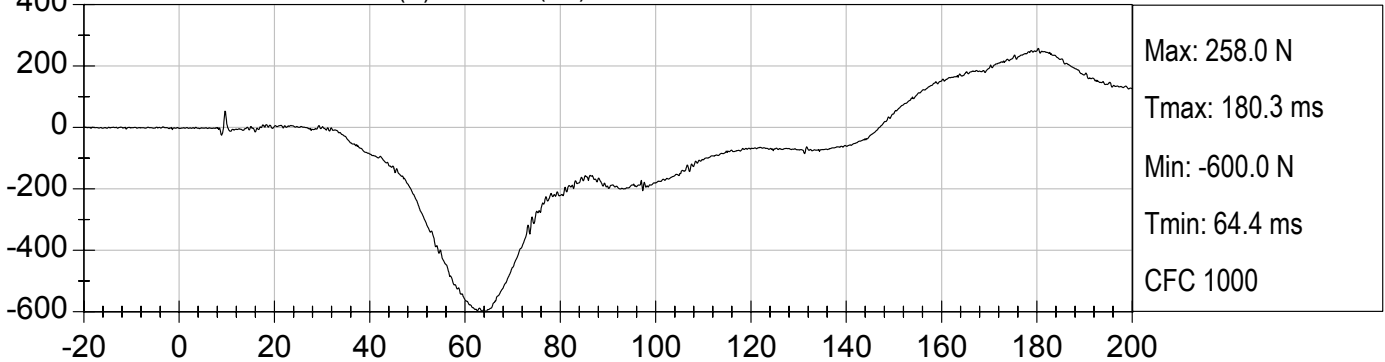




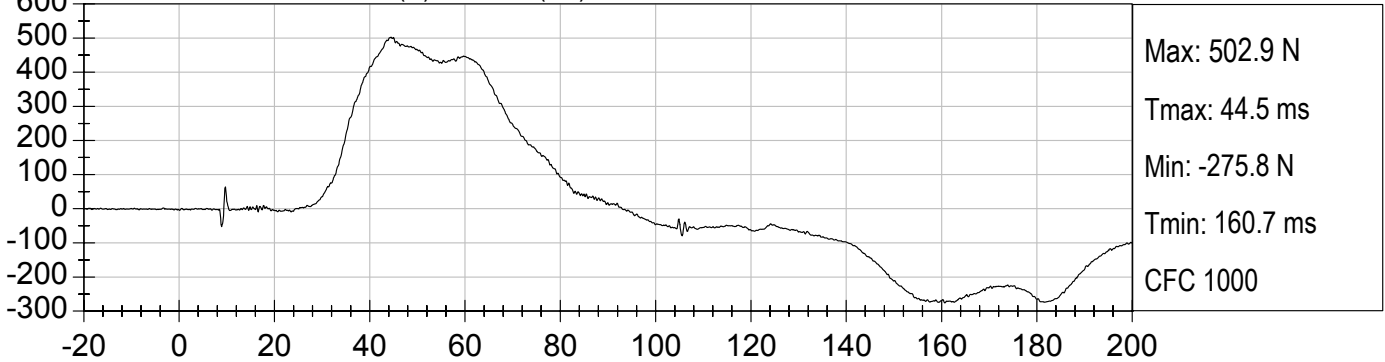




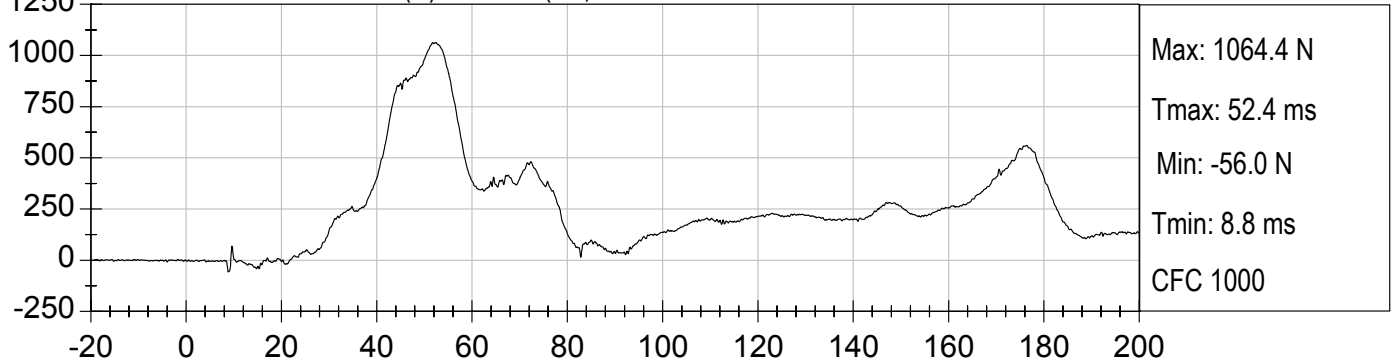
DRIVER UPPER NECK FX (N) vs TIME (ms)



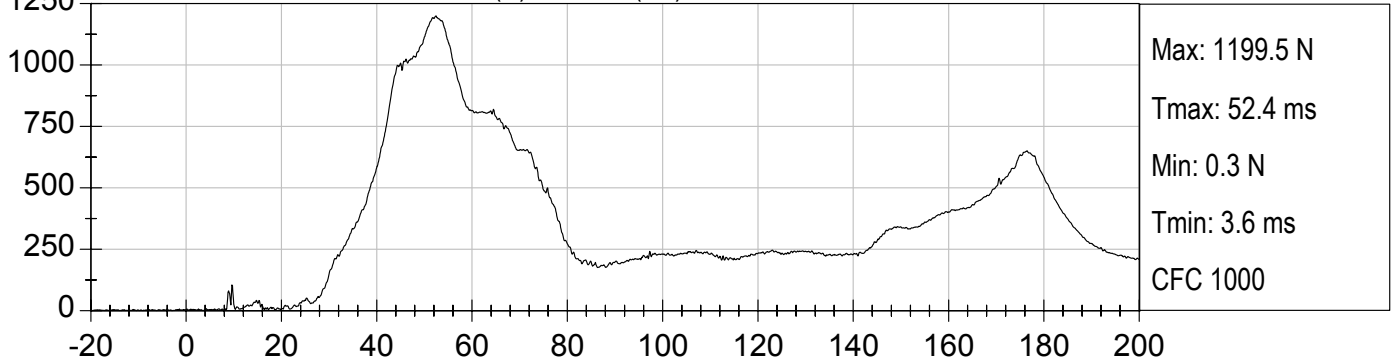
DRIVER UPPER NECK FY (N) vs TIME (ms)

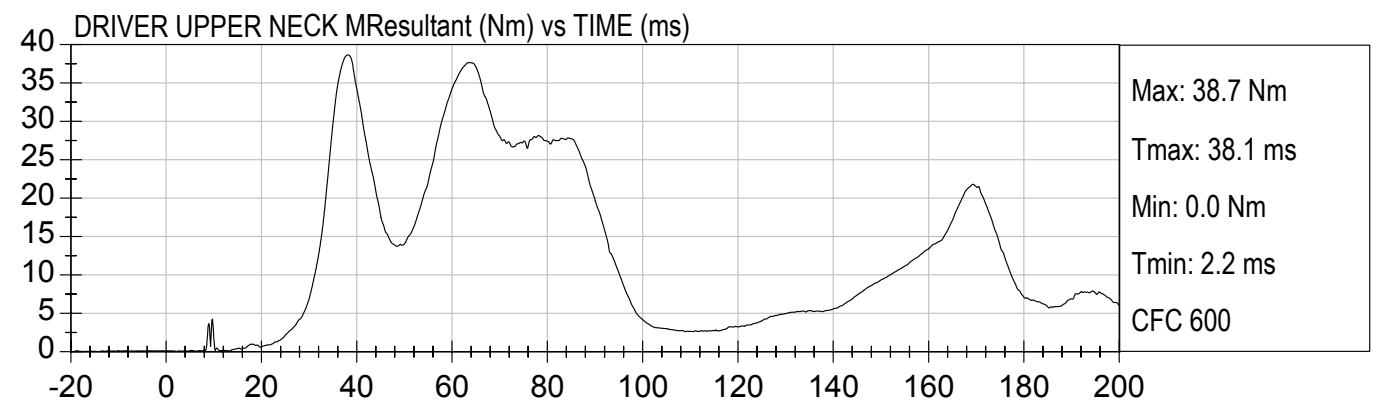
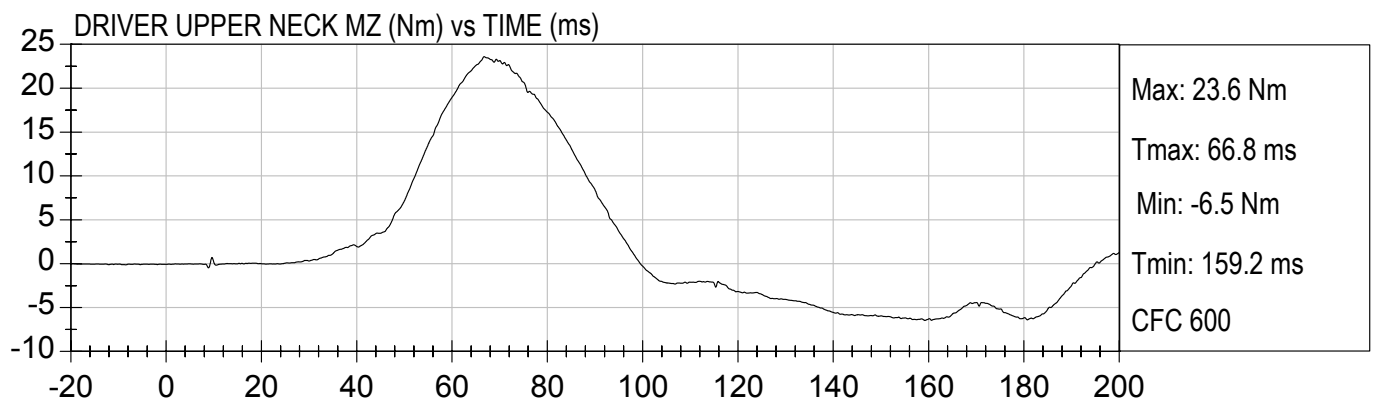
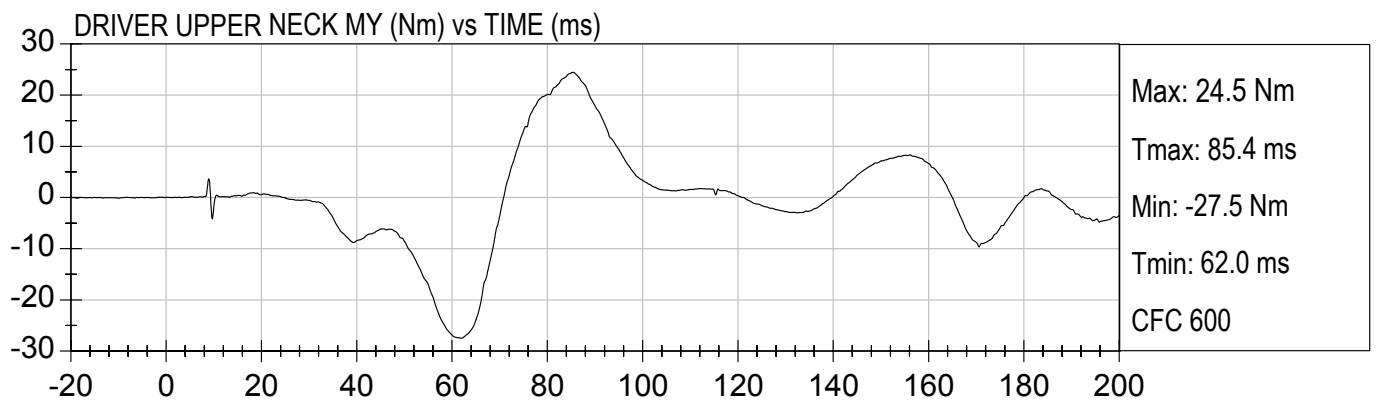
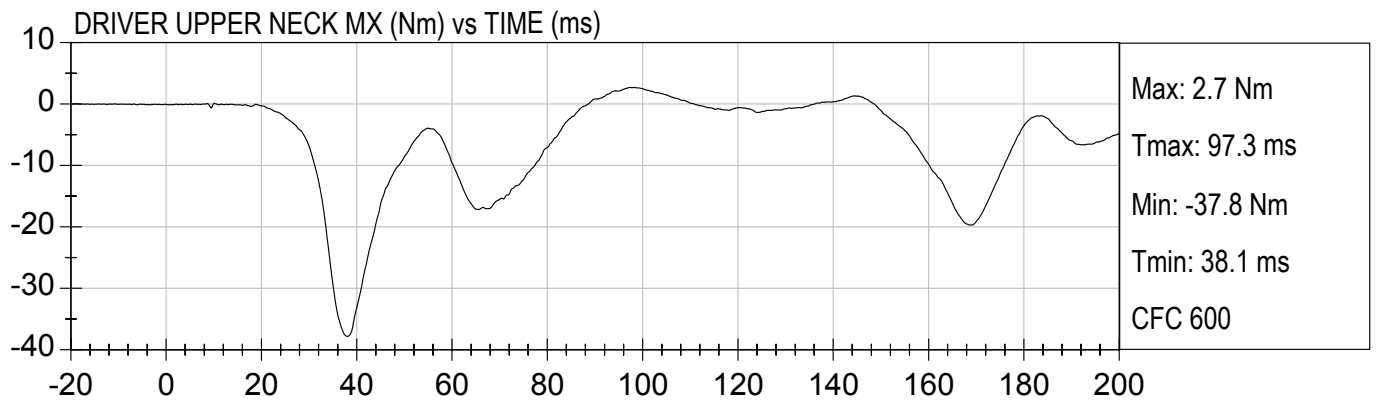


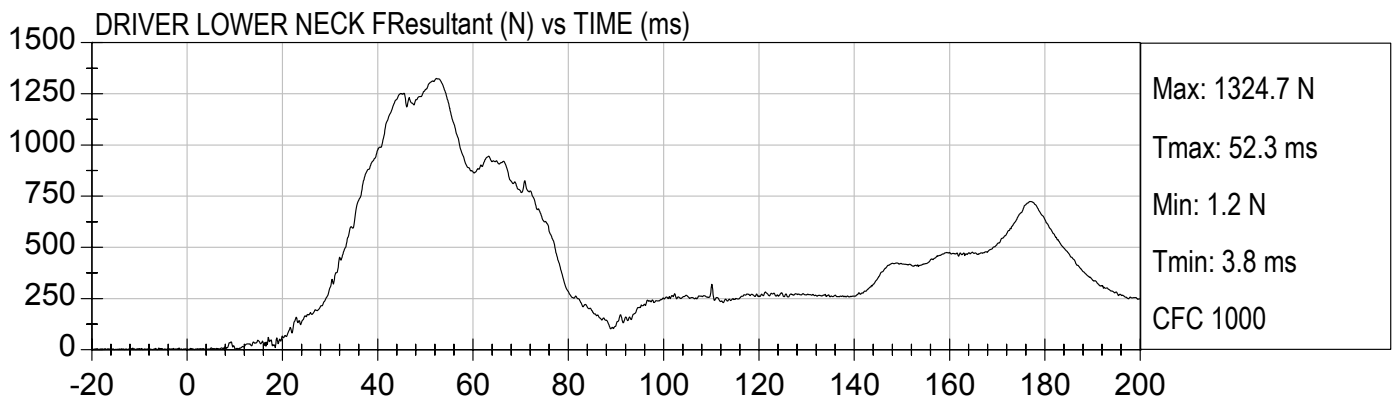
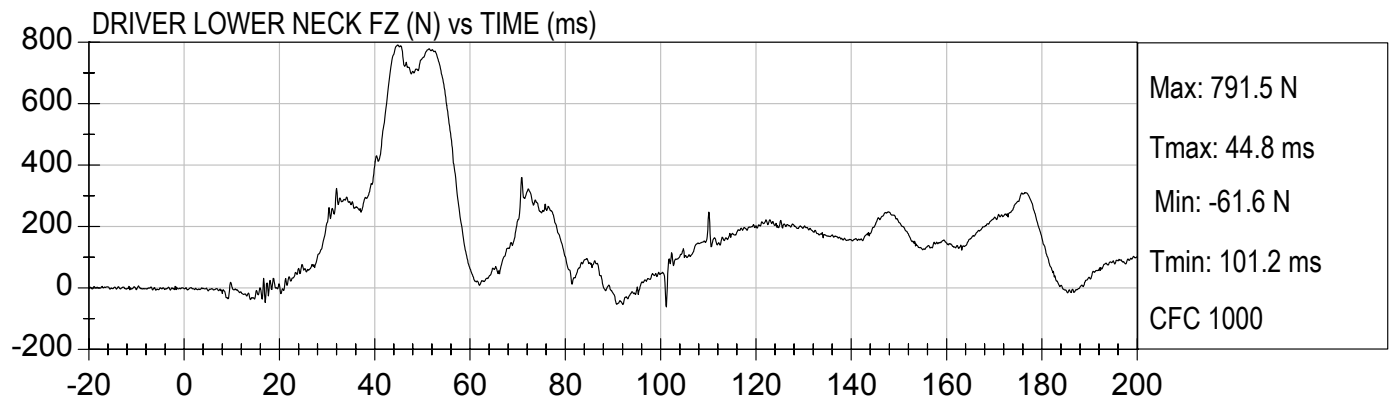
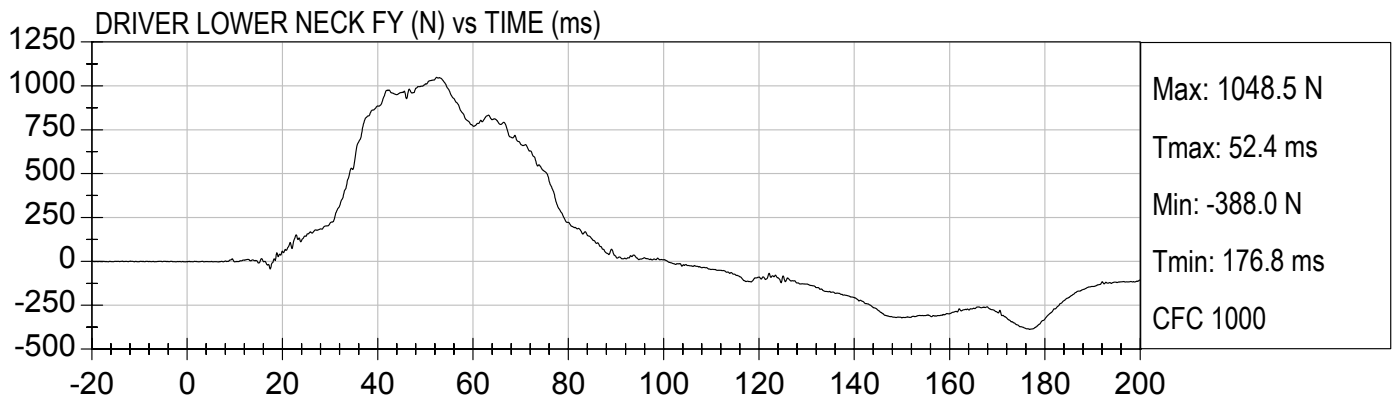
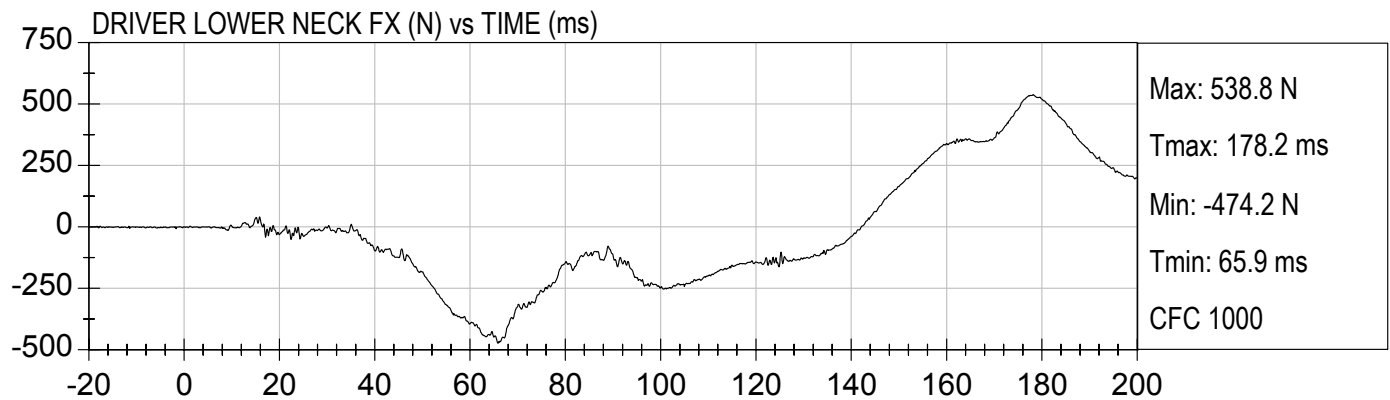
DRIVER UPPER NECK FZ (N) vs TIME (ms)



DRIVER UPPER NECK FResultant (N) vs TIME (ms)

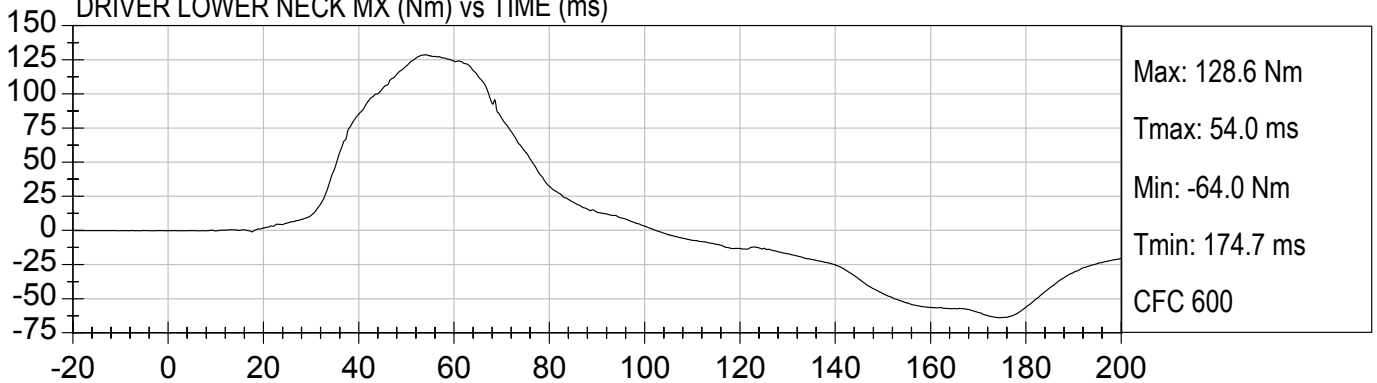




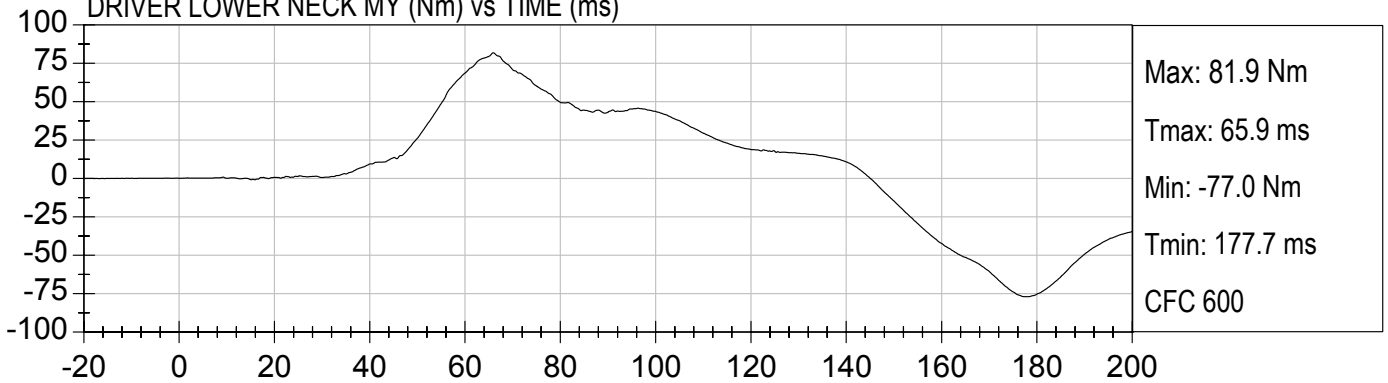




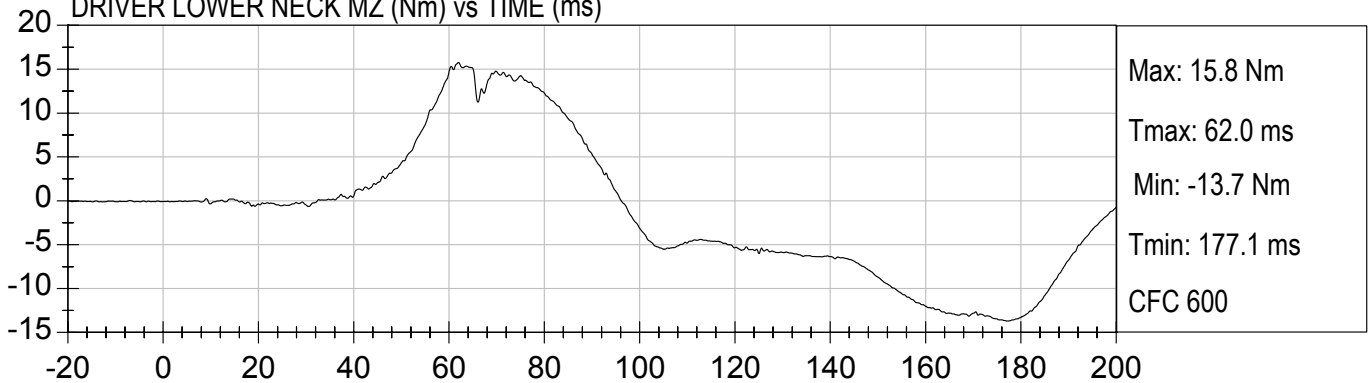
DRIVER LOWER NECK MX (Nm) vs TIME (ms)



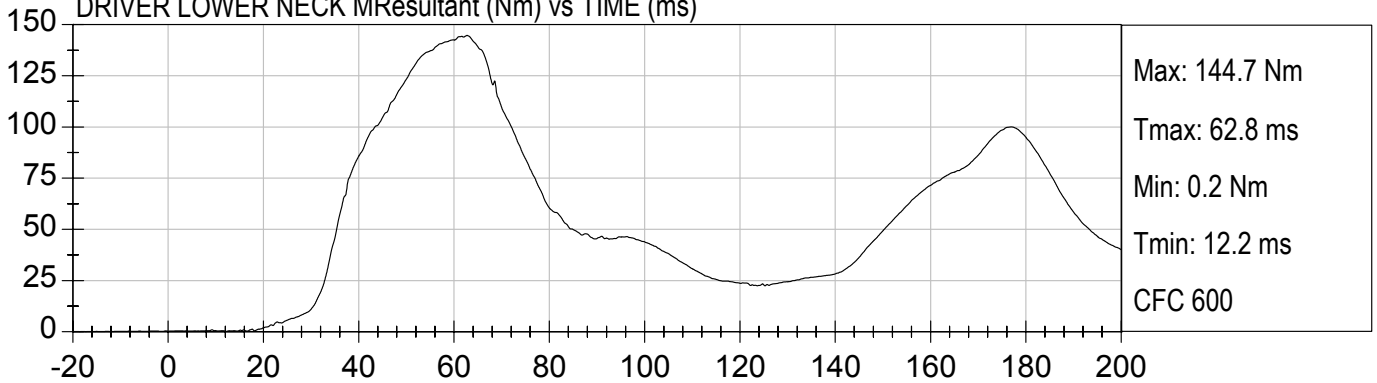
DRIVER LOWER NECK MY (Nm) vs TIME (ms)

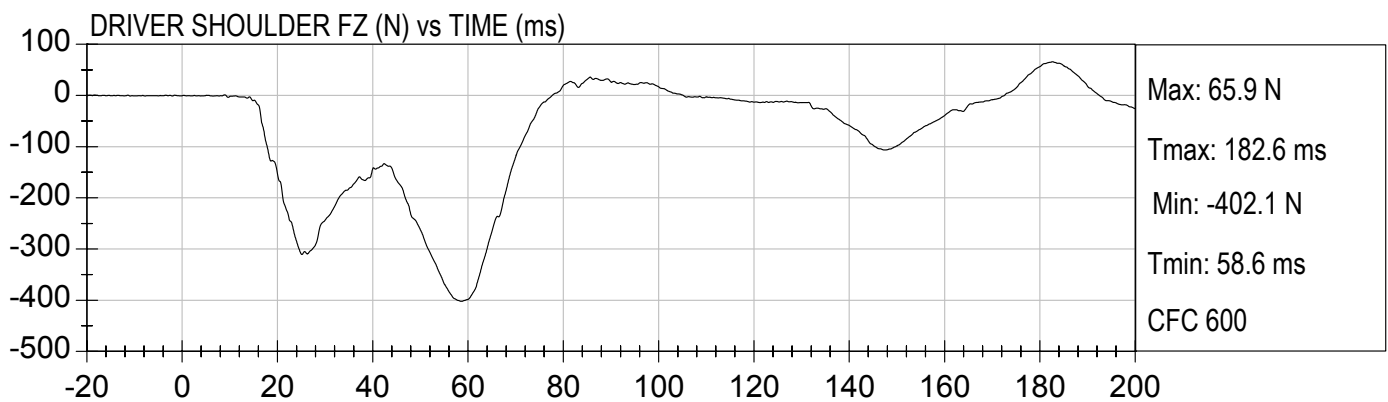
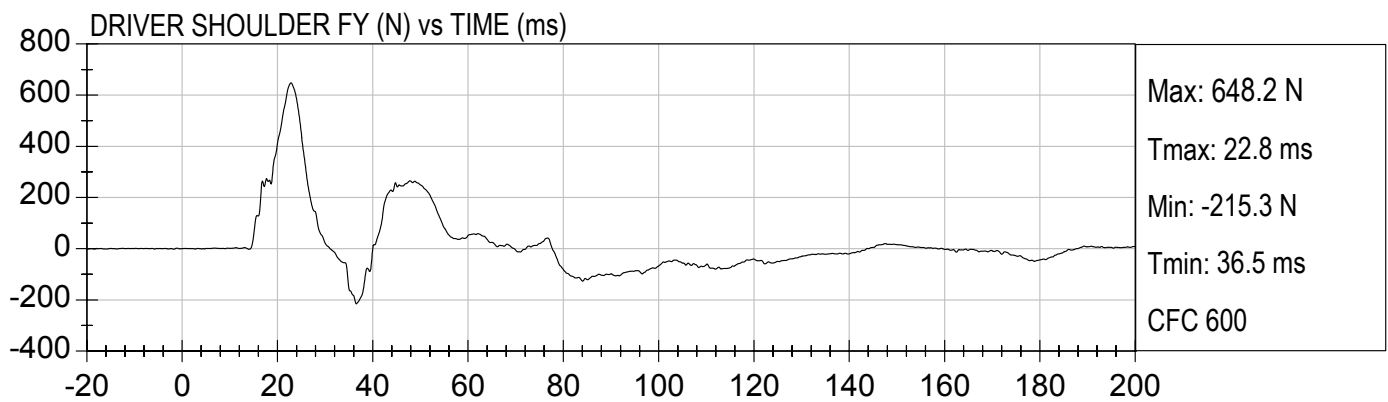
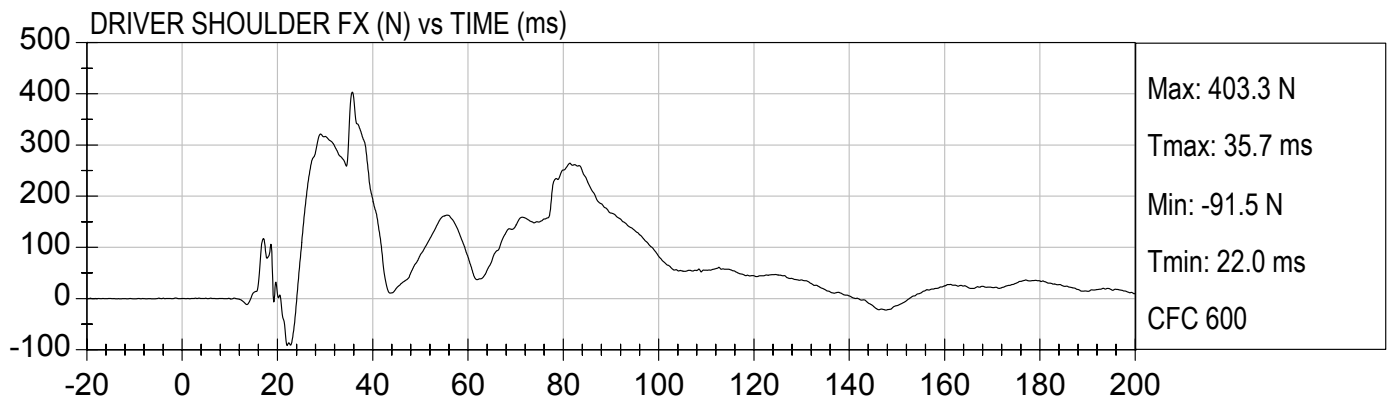


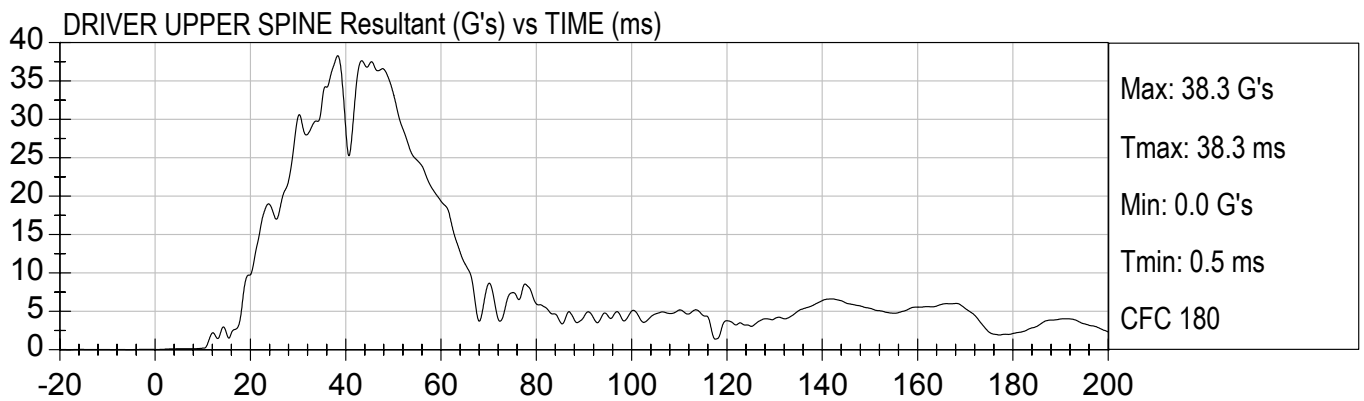
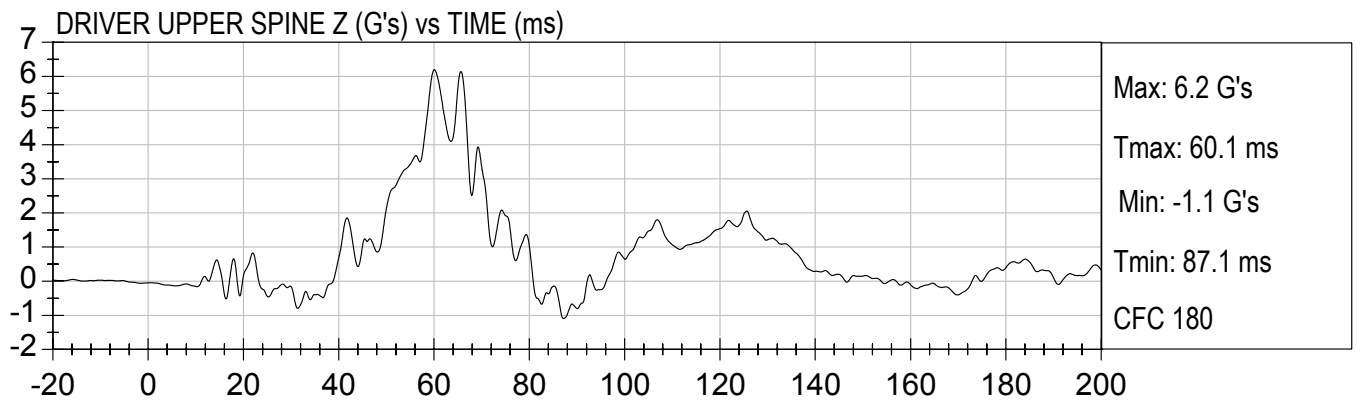
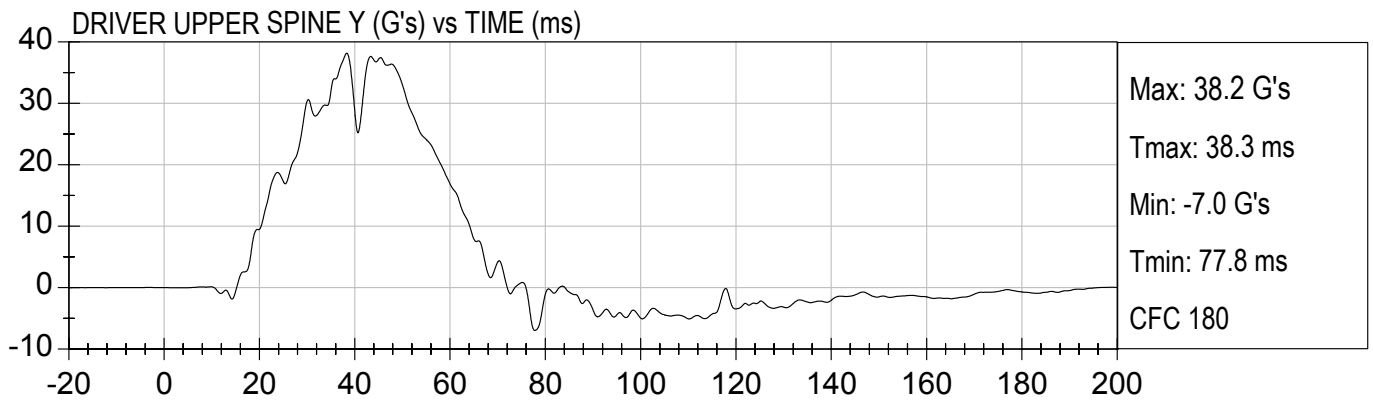
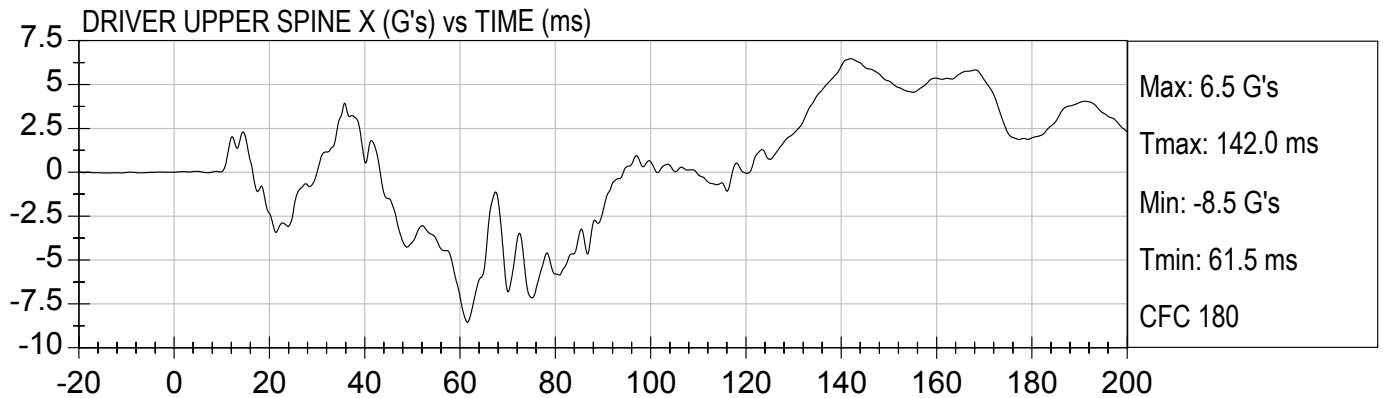
DRIVER LOWER NECK MZ (Nm) vs TIME (ms)

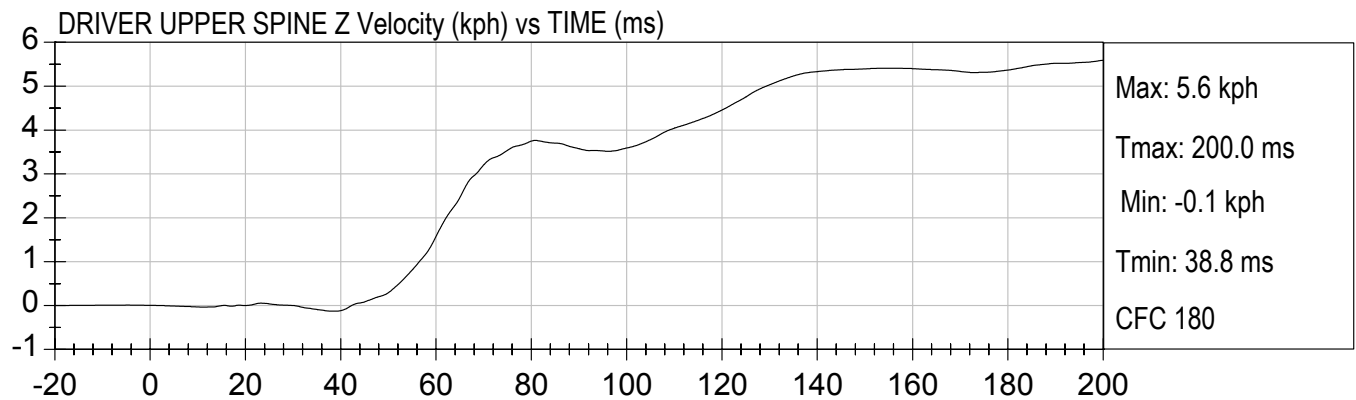
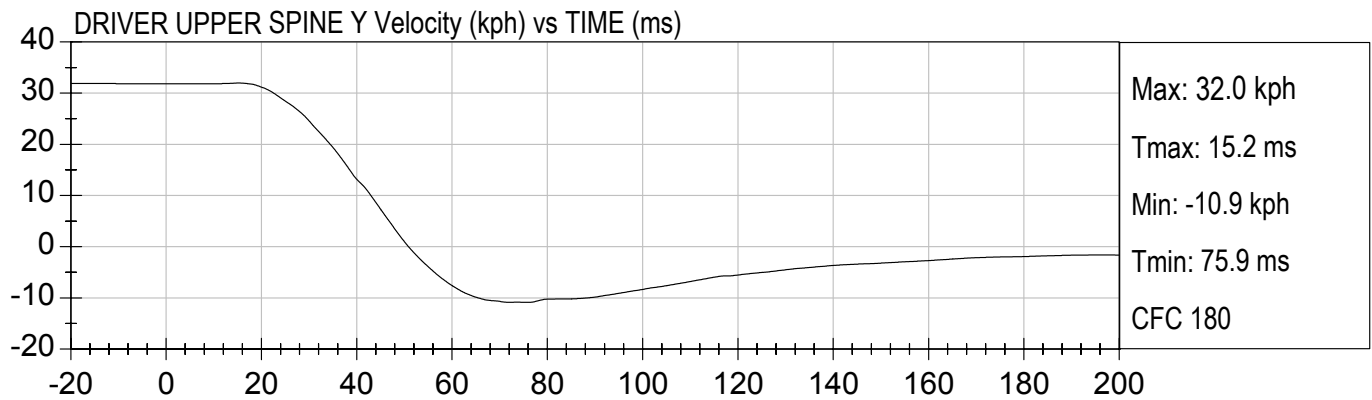
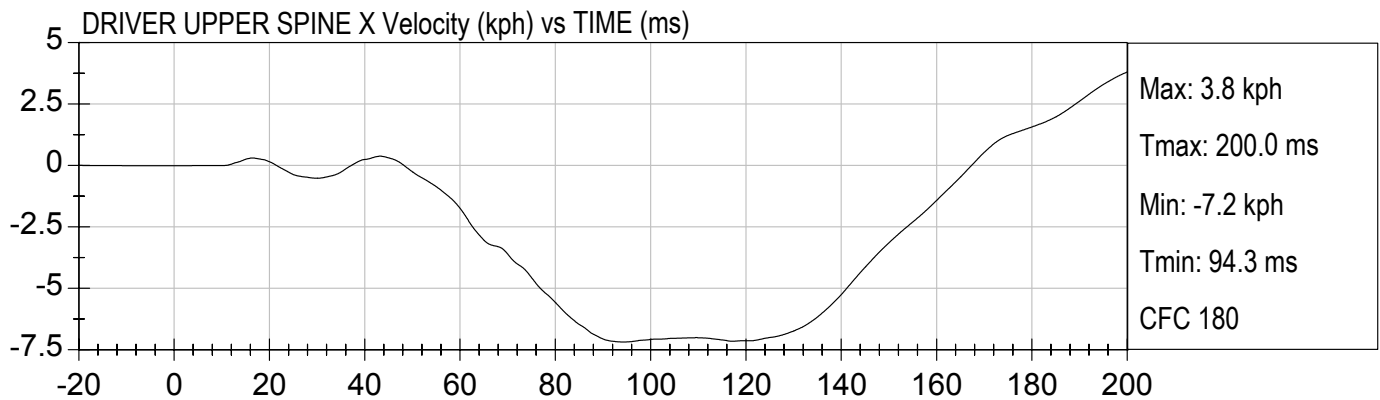


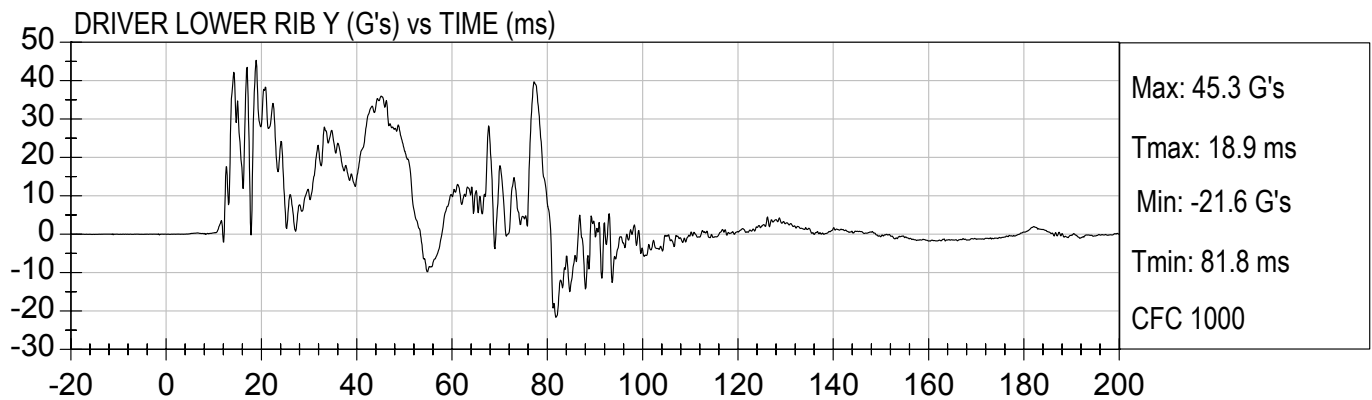
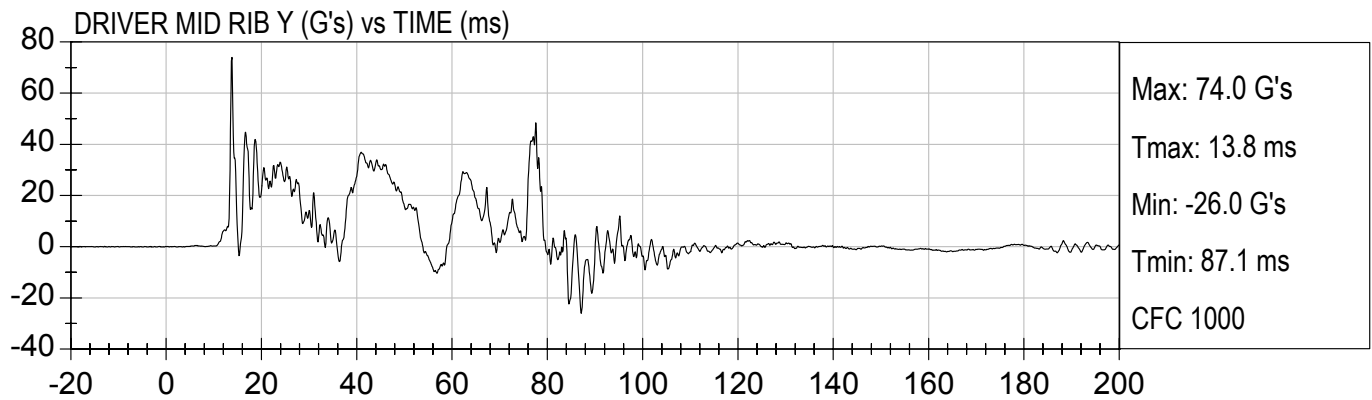
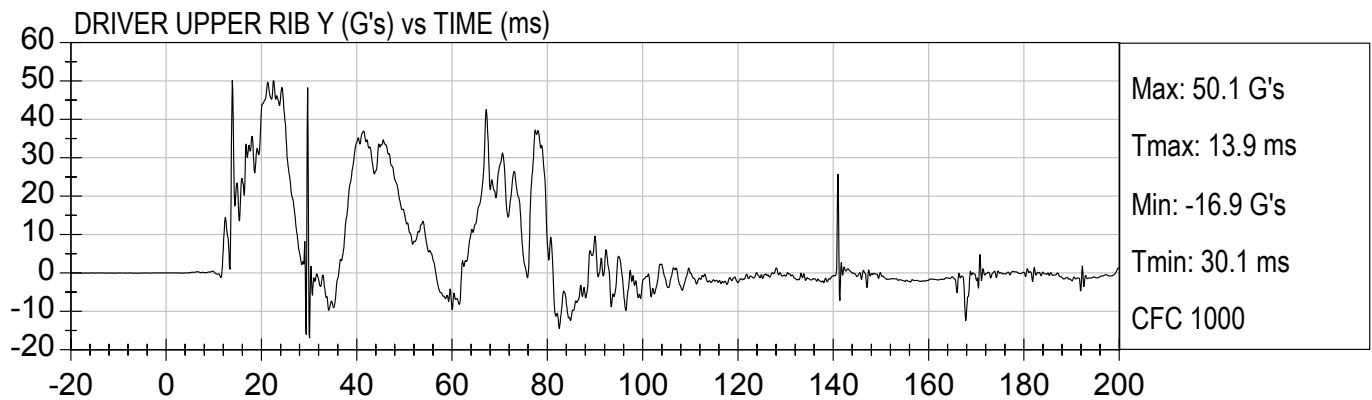
DRIVER LOWER NECK MResultant (Nm) vs TIME (ms)

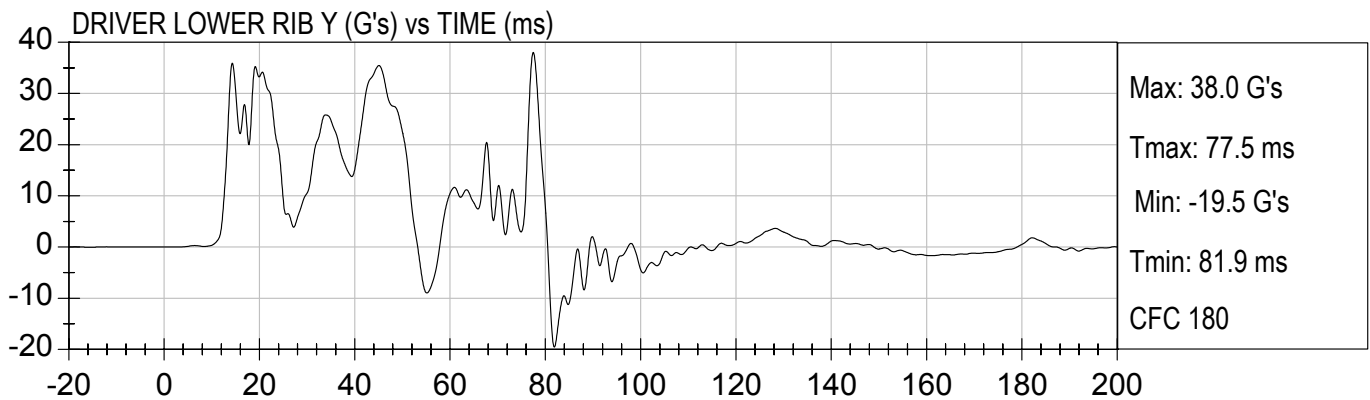
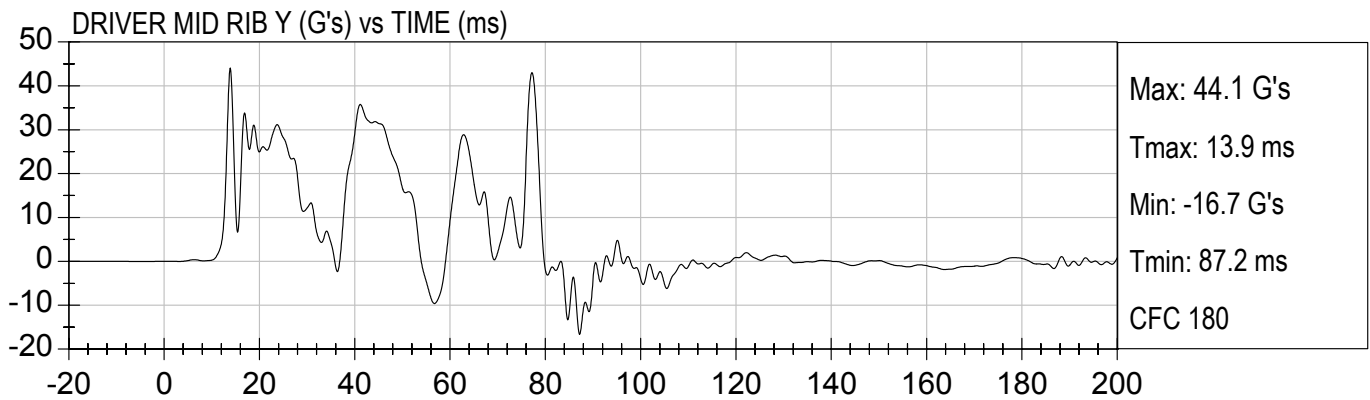
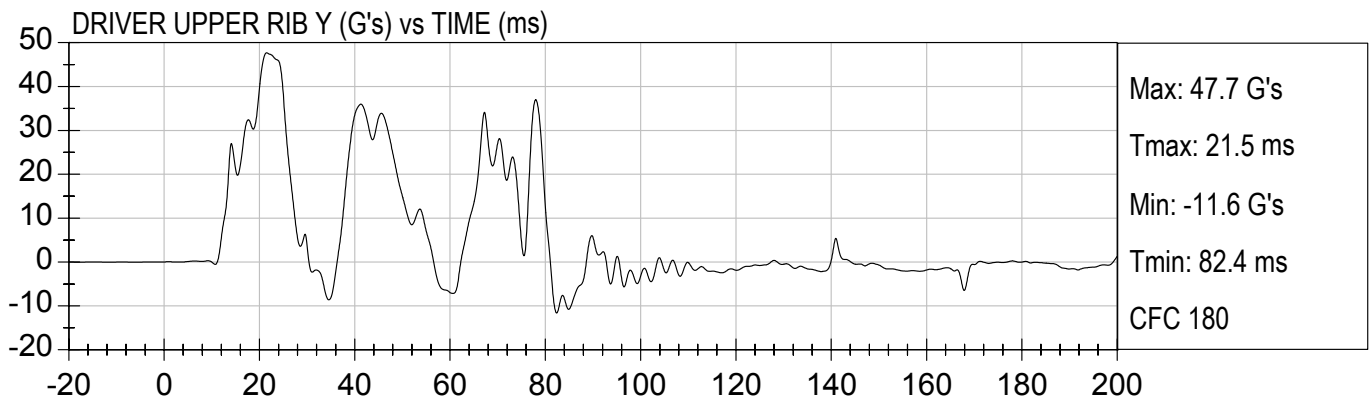


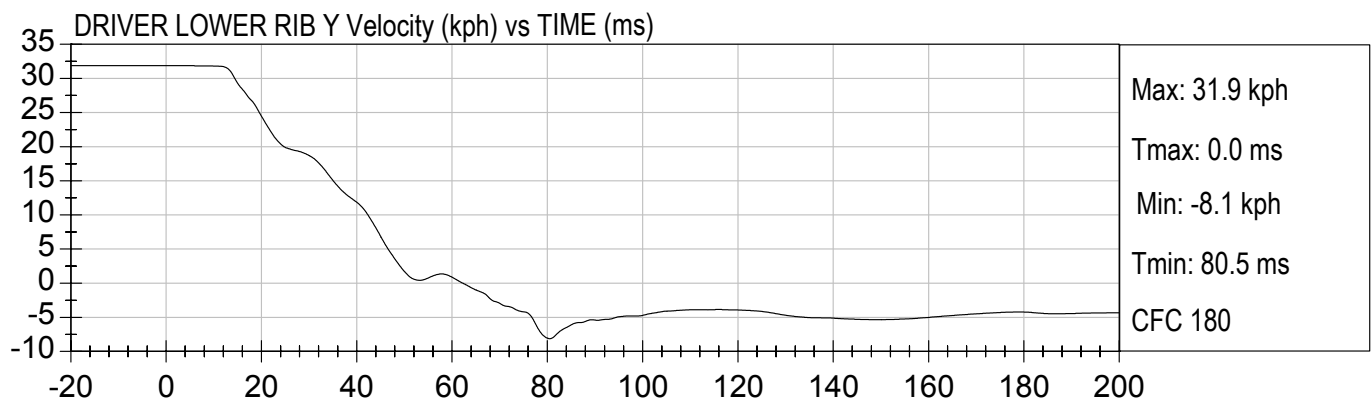
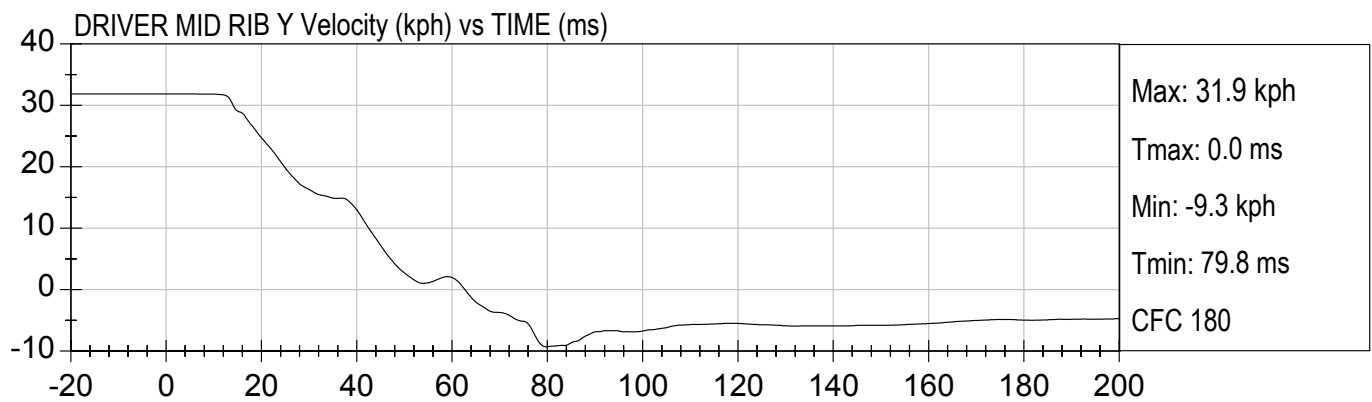
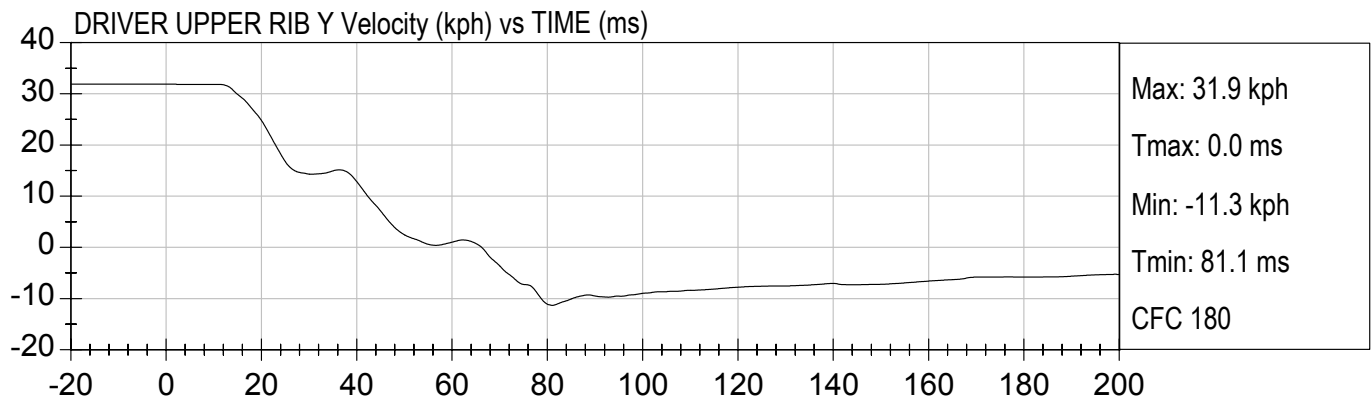


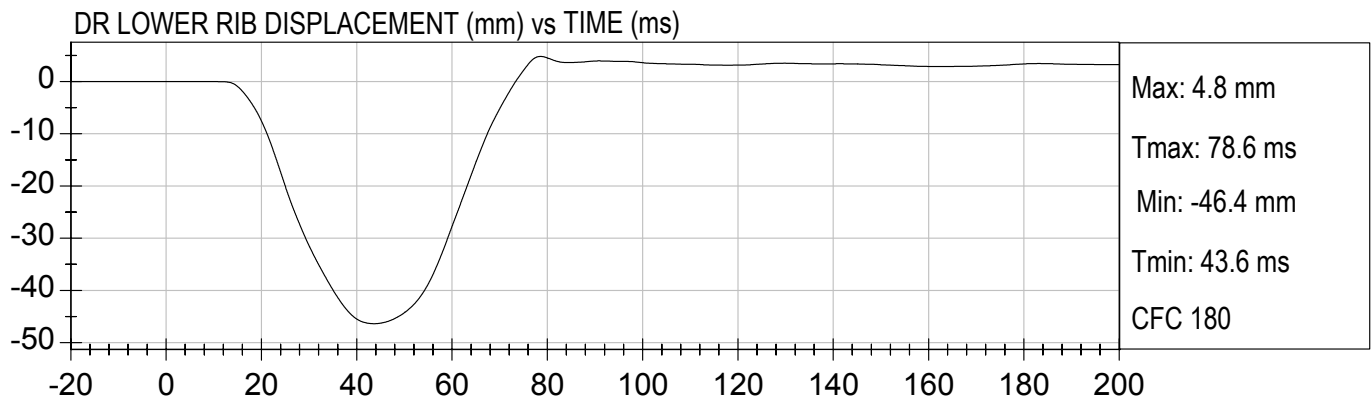
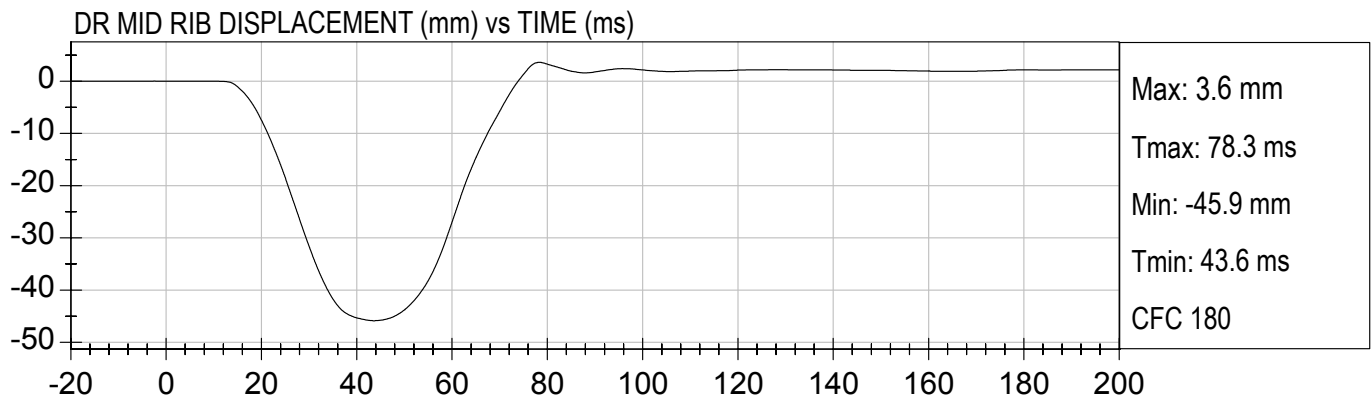
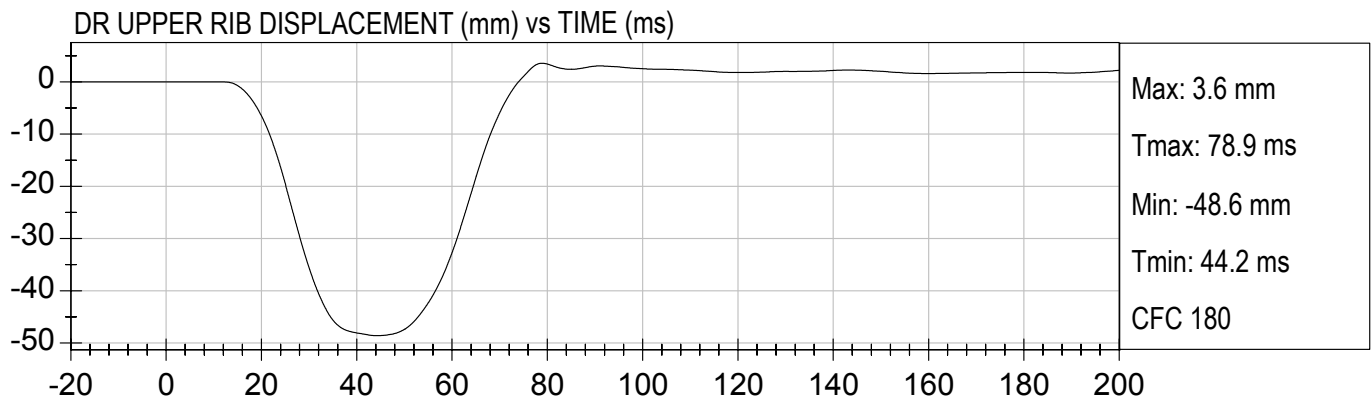






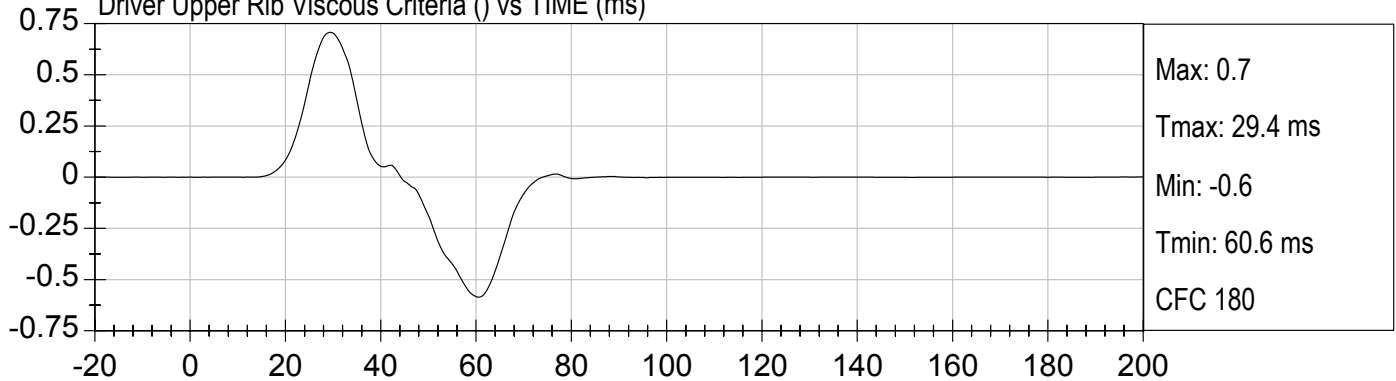




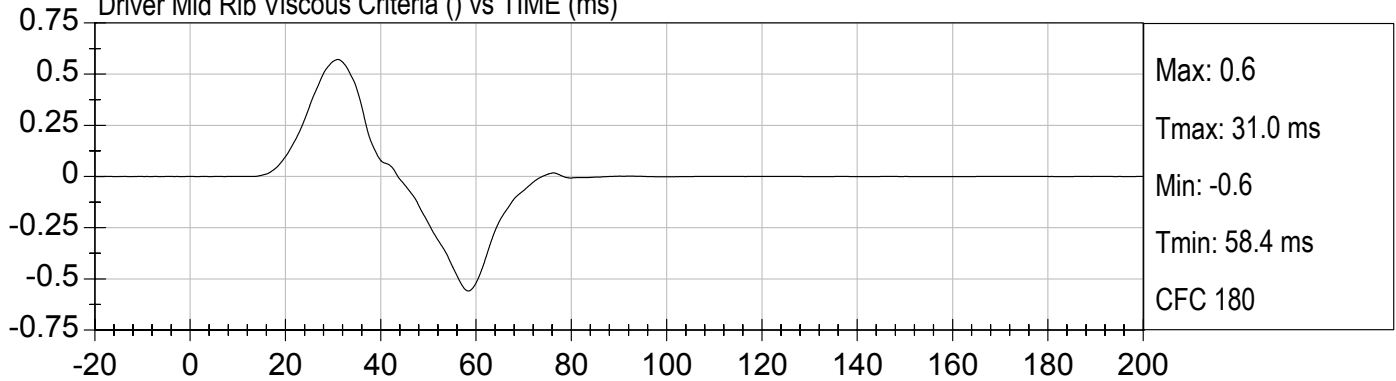




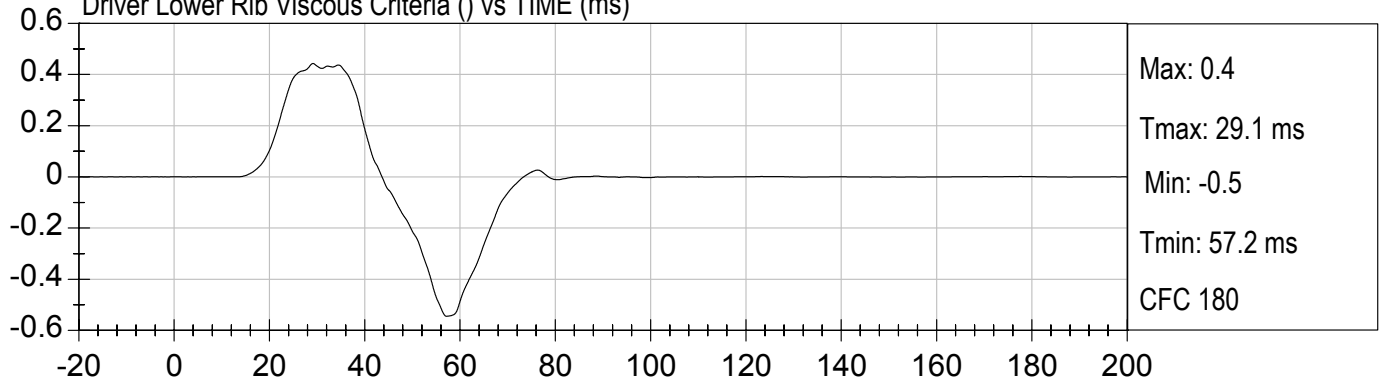
Driver Upper Rib Viscous Criteria () vs TIME (ms)



Driver Mid Rib Viscous Criteria () vs TIME (ms)

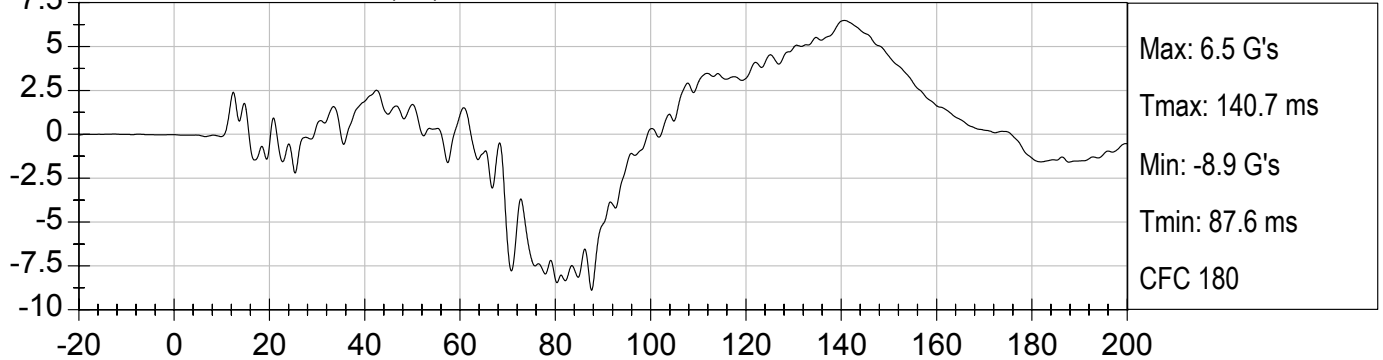


Driver Lower Rib Viscous Criteria () vs TIME (ms)

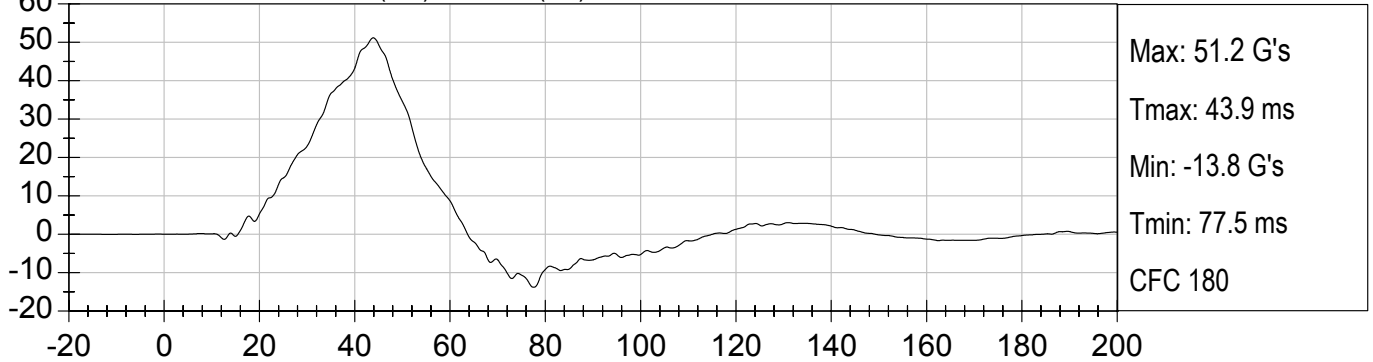




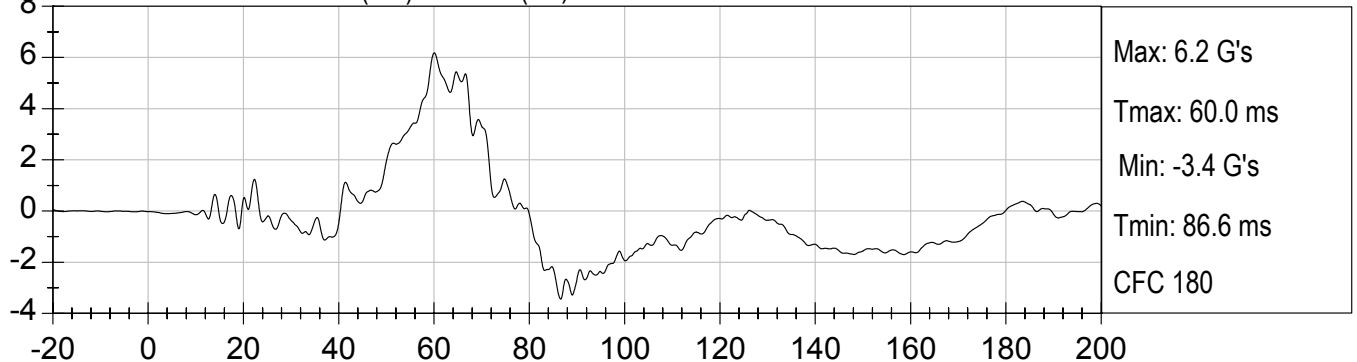
DRIVER LOWER SPINE X (G's) vs TIME (ms)



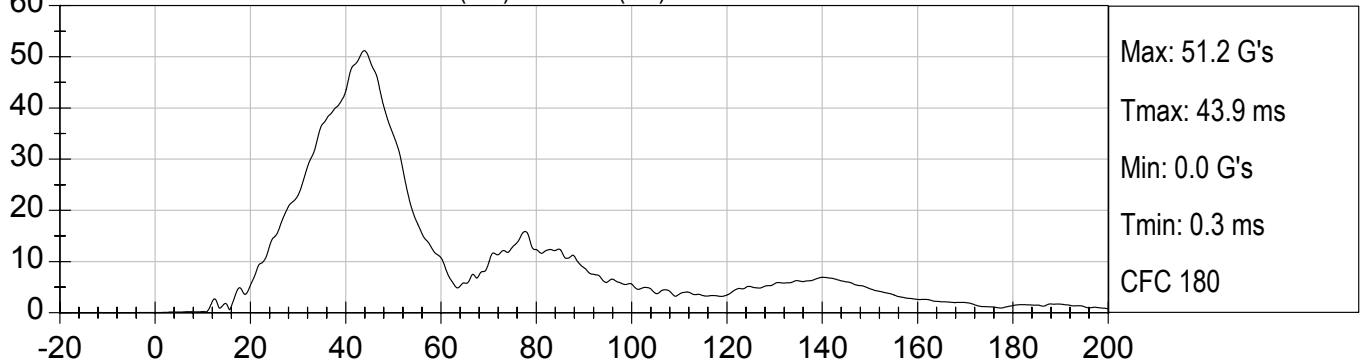
DRIVER LOWER SPINE Y (G's) vs TIME (ms)



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

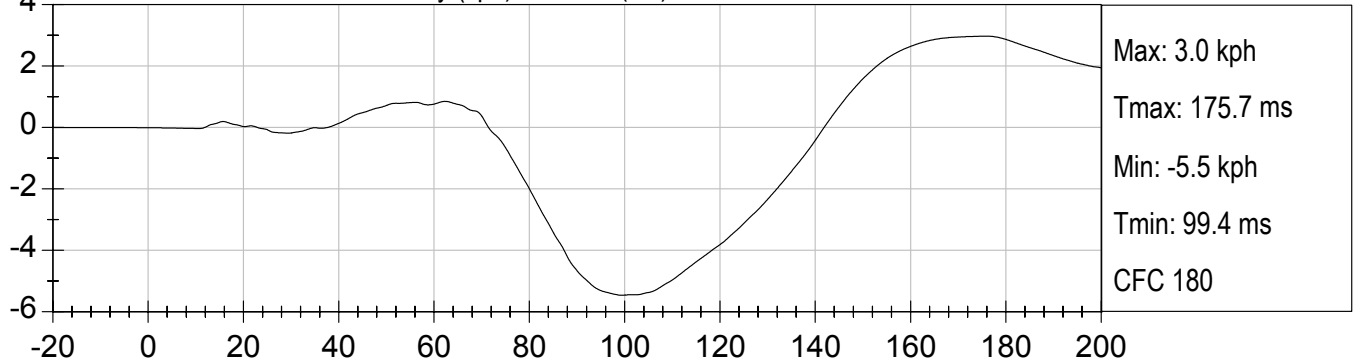


DRIVER LOWER SPINE Resultant (G's) vs TIME (ms)

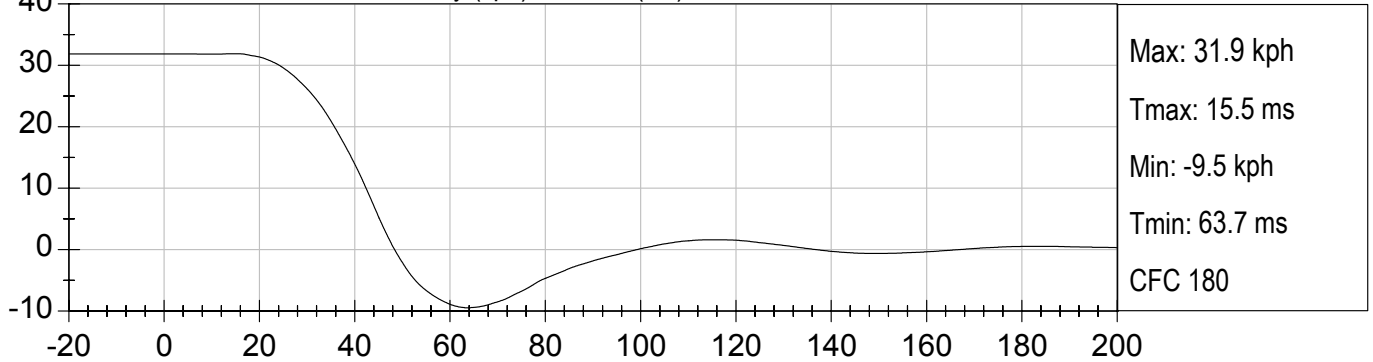




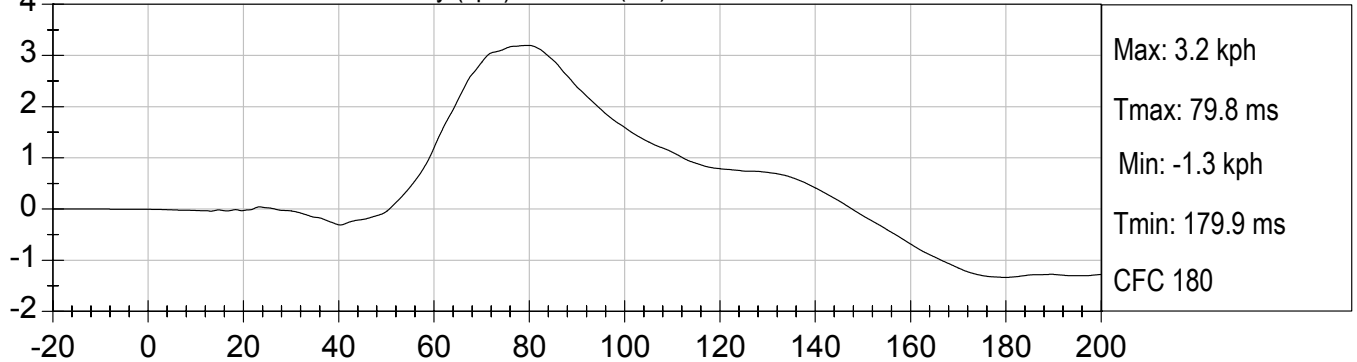
DRIVER LOWER SPINE X Velocity (kph) vs TIME (ms)



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

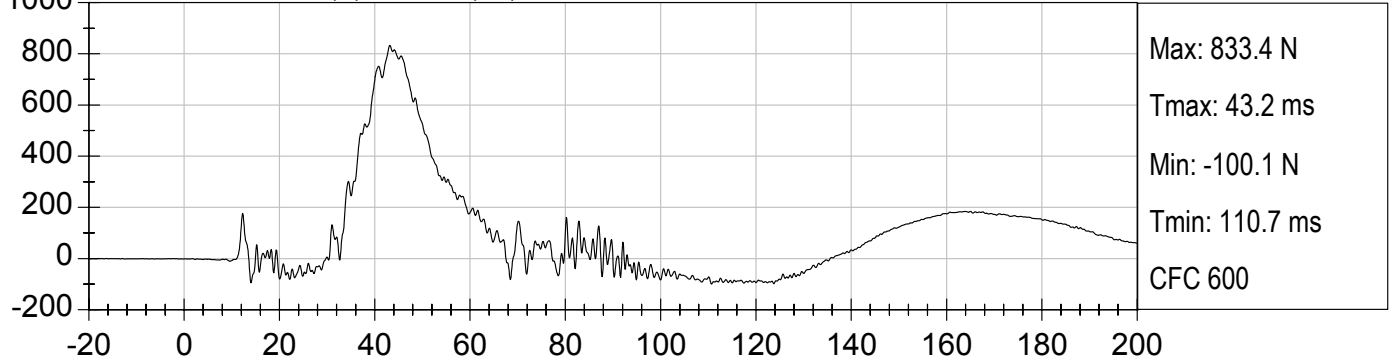


DRIVER LOWER SPINE Z Velocity (kph) vs TIME (ms)

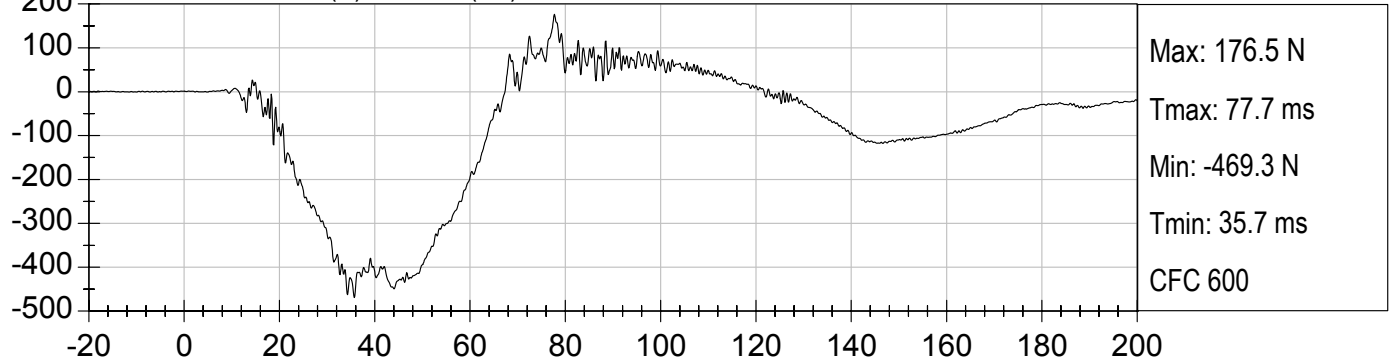




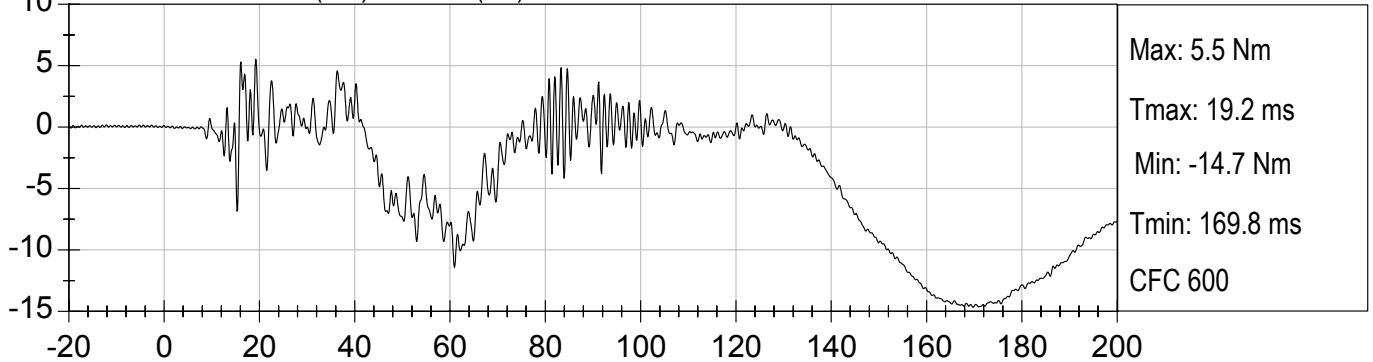
DRIVER TORSO FX (N) vs TIME (ms)



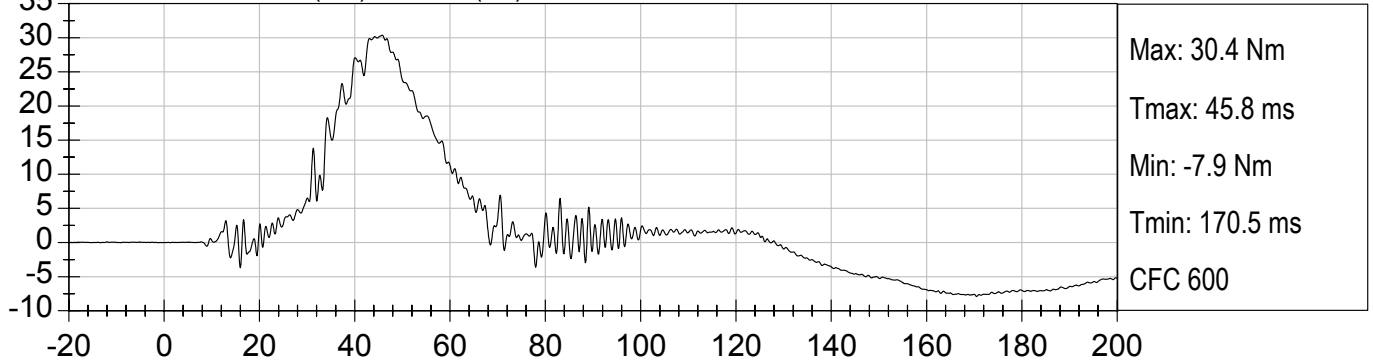
DRIVER TORSO FY (N) vs TIME (ms)



DRIVER TORSO MY (Nm) vs TIME (ms)

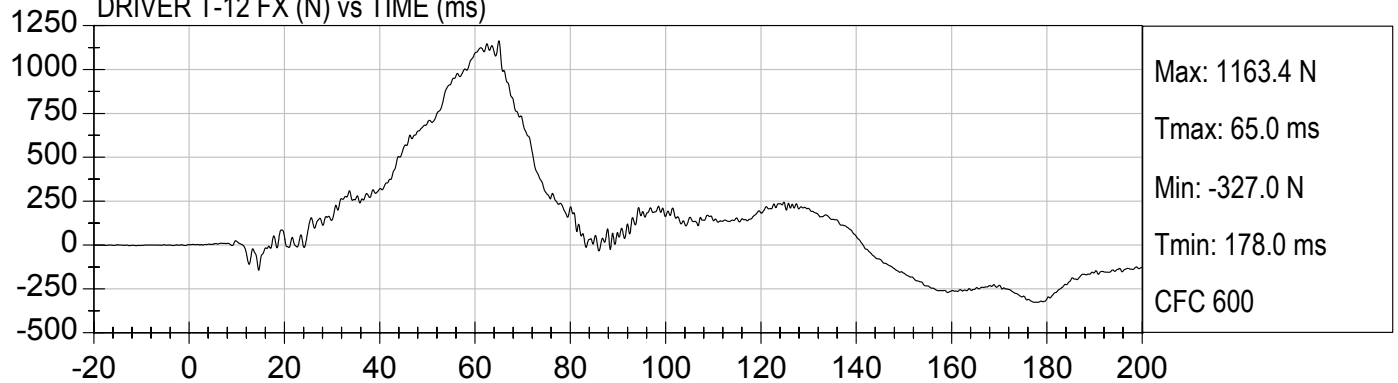


DRIVER TORSO MZ (Nm) vs TIME (ms)

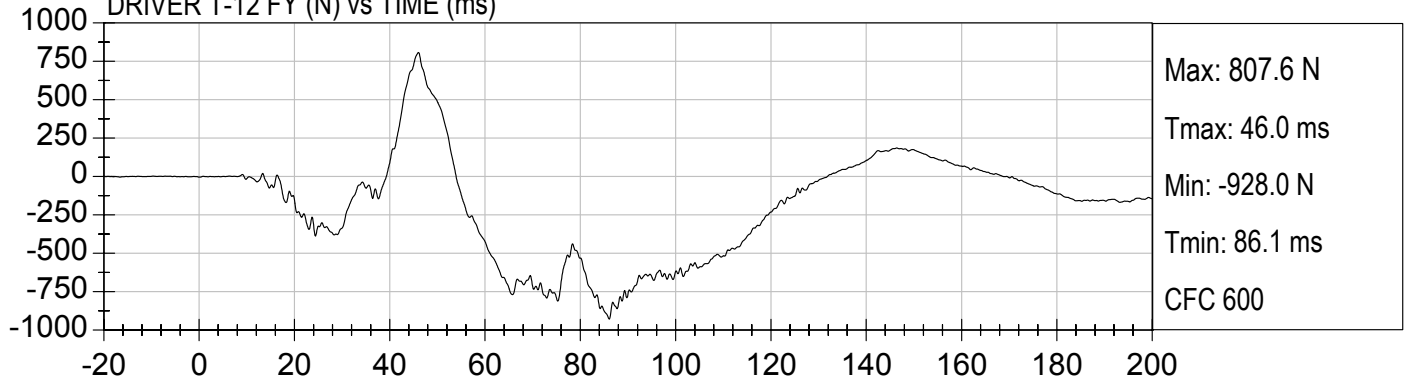




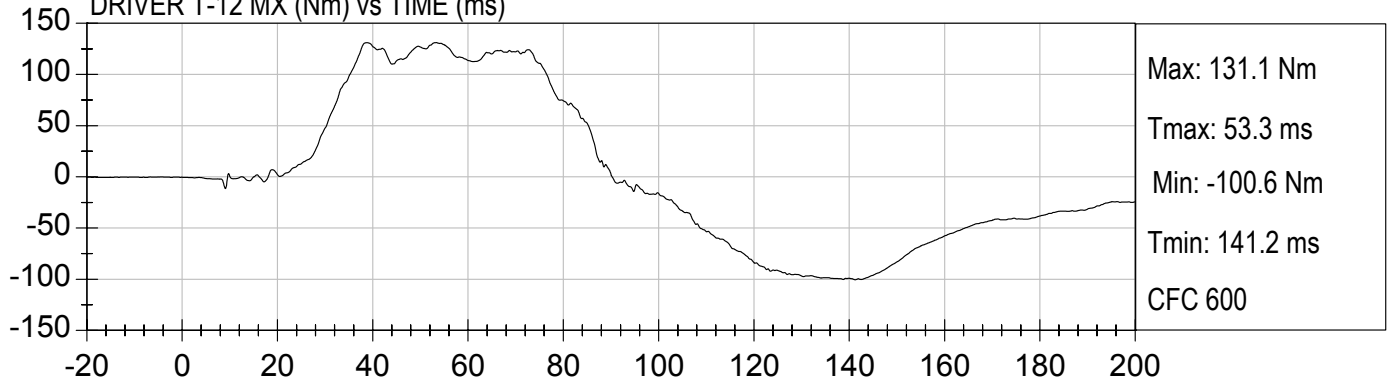
DRIVER T-12 FX (N) vs TIME (ms)



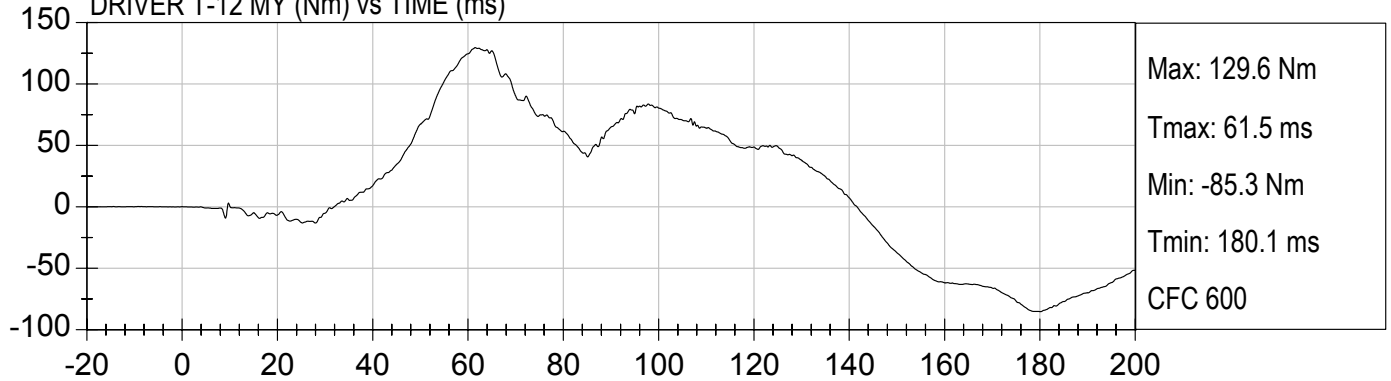
DRIVER T-12 FY (N) vs TIME (ms)



DRIVER T-12 MX (Nm) vs TIME (ms)

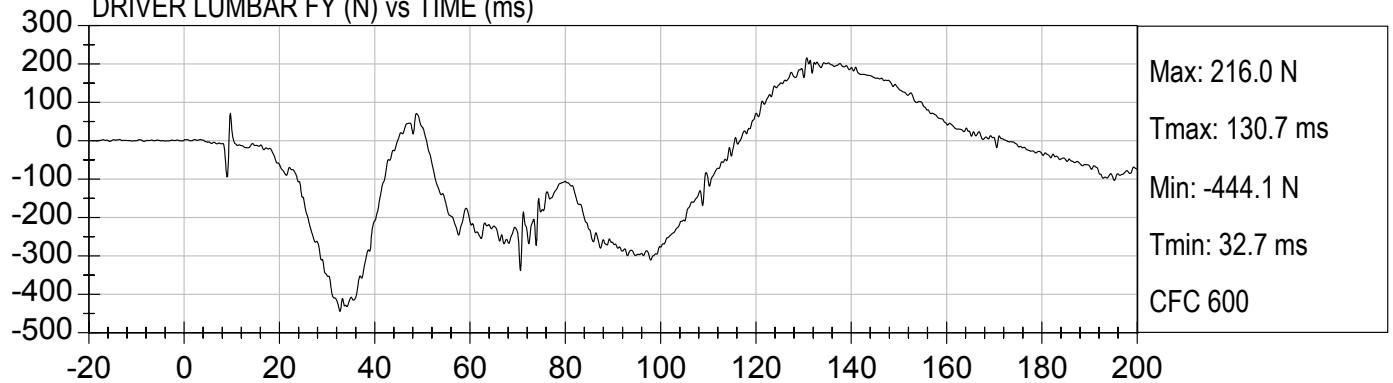


DRIVER T-12 MY (Nm) vs TIME (ms)

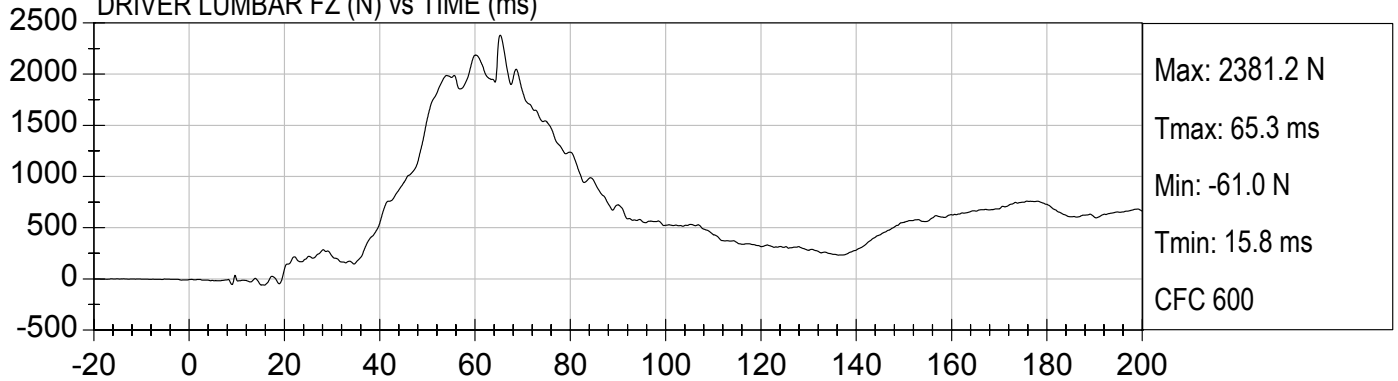




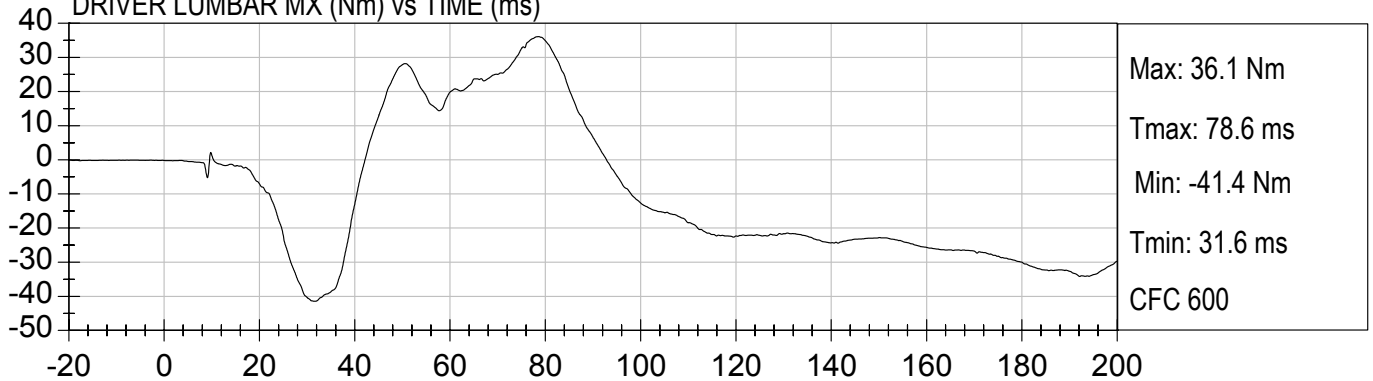
DRIVER LUMBAR FY (N) vs TIME (ms)



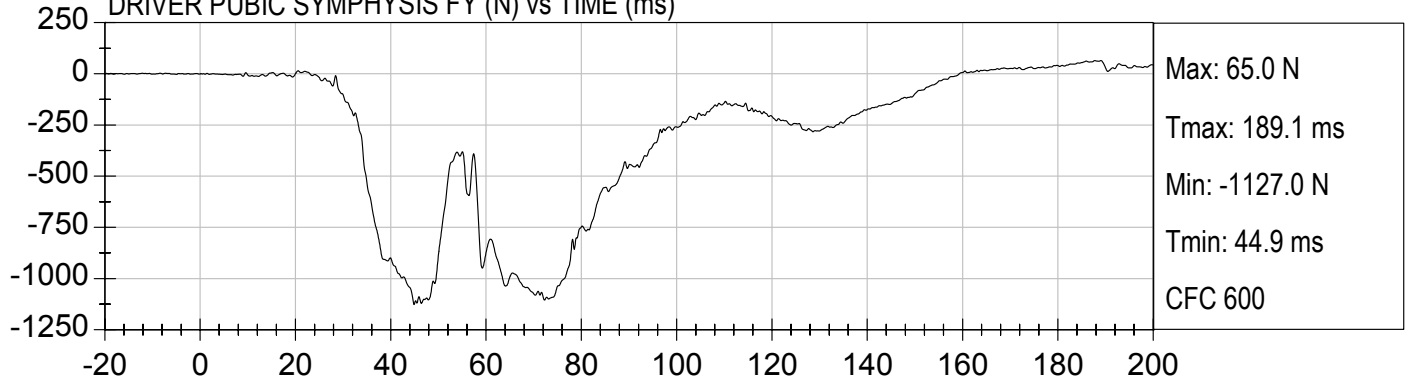
DRIVER LUMBAR FZ (N) vs TIME (ms)

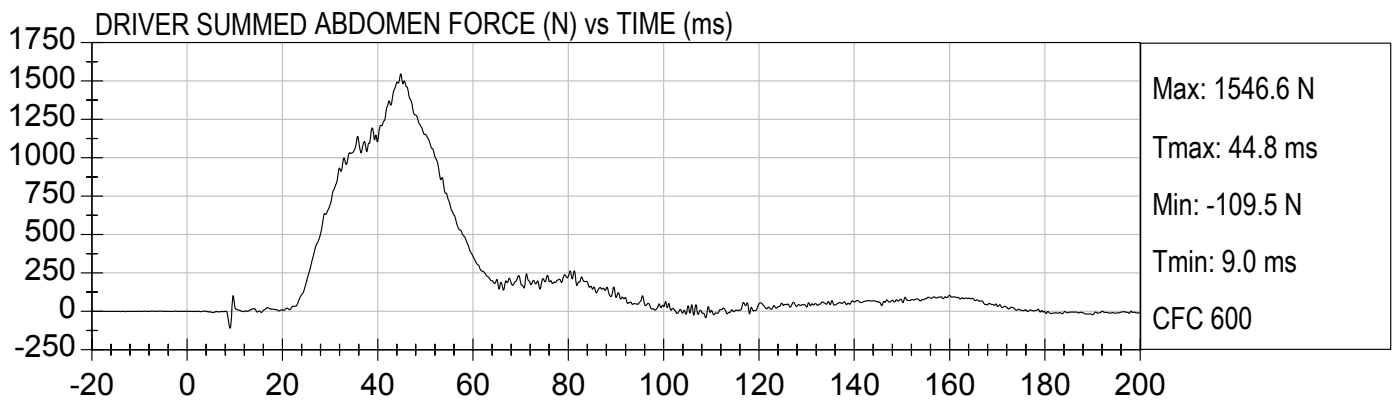
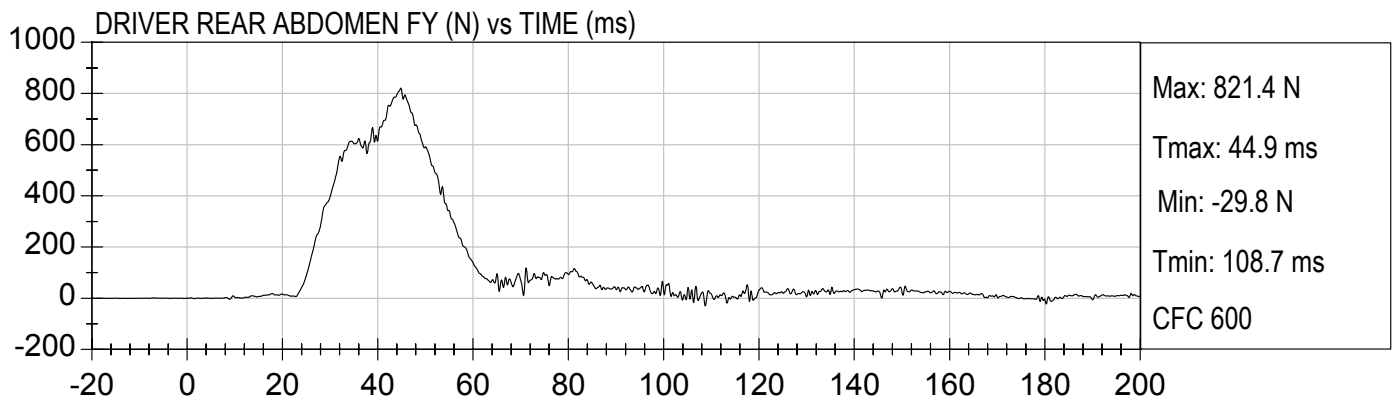
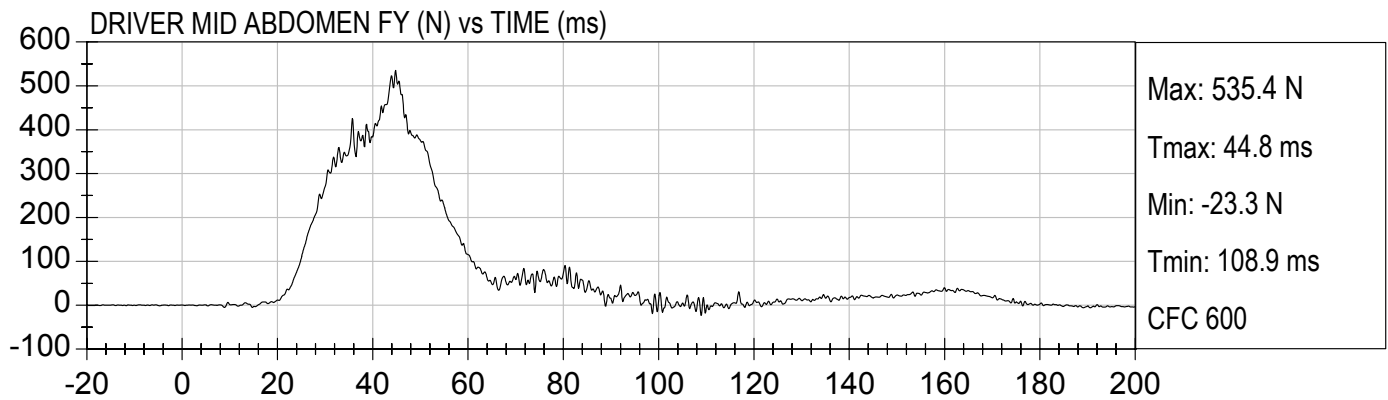
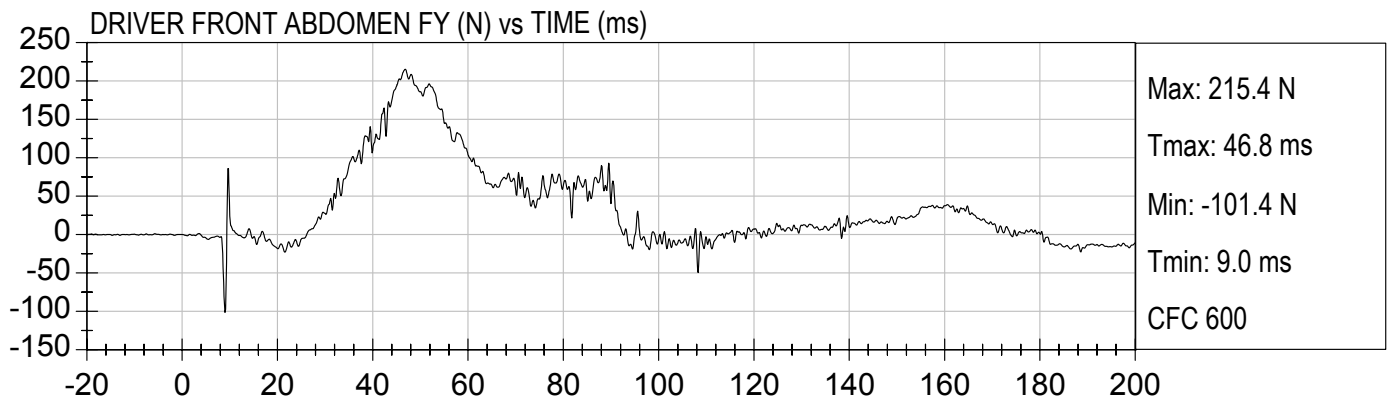


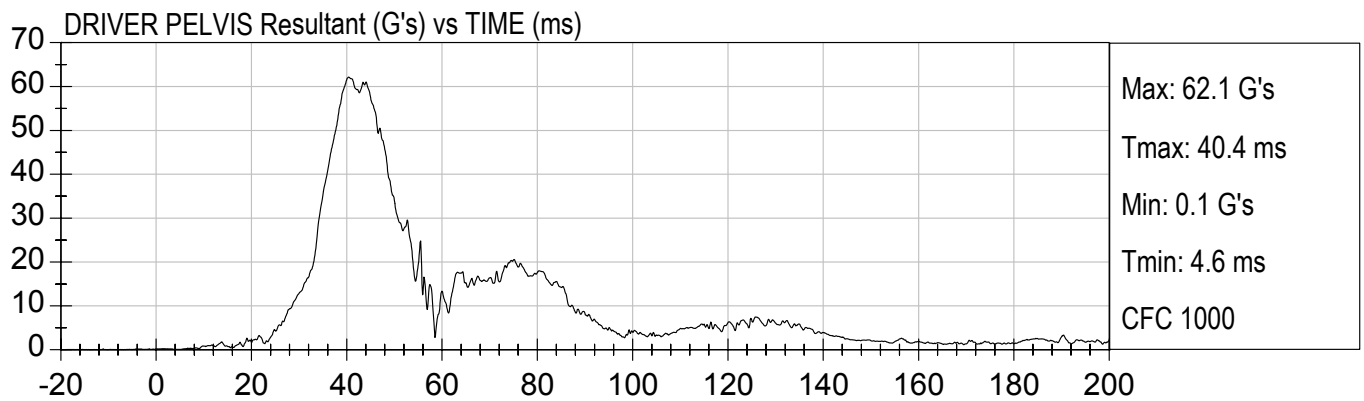
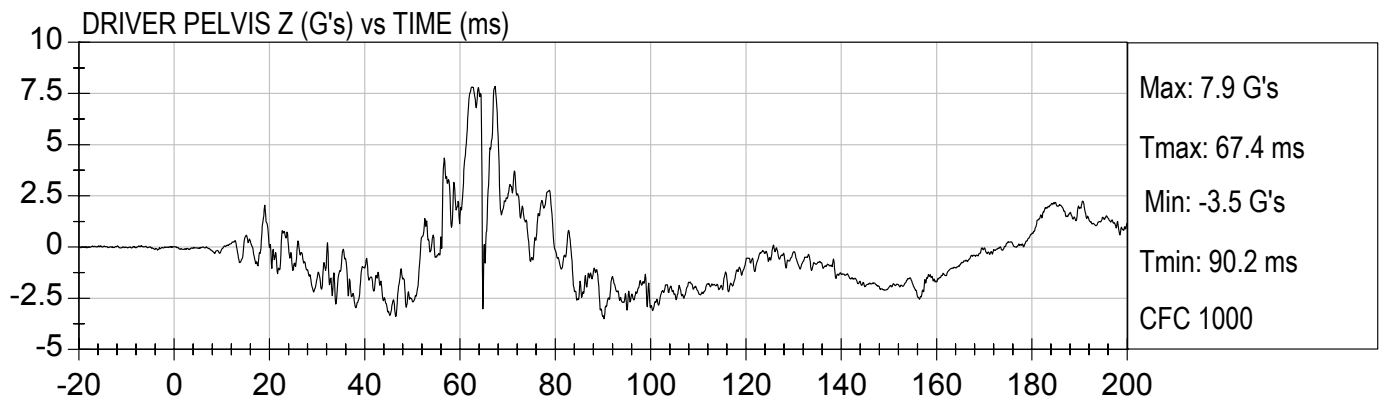
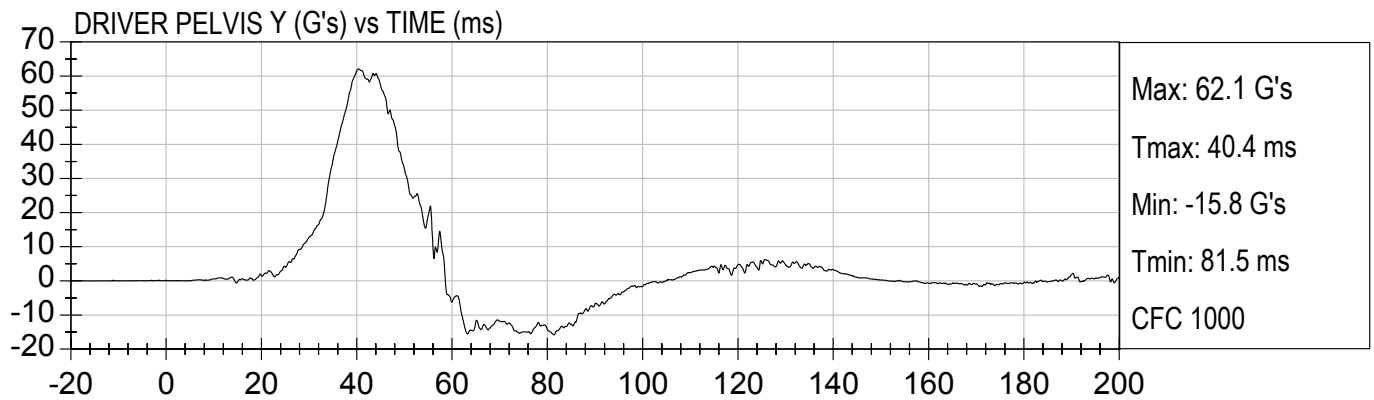
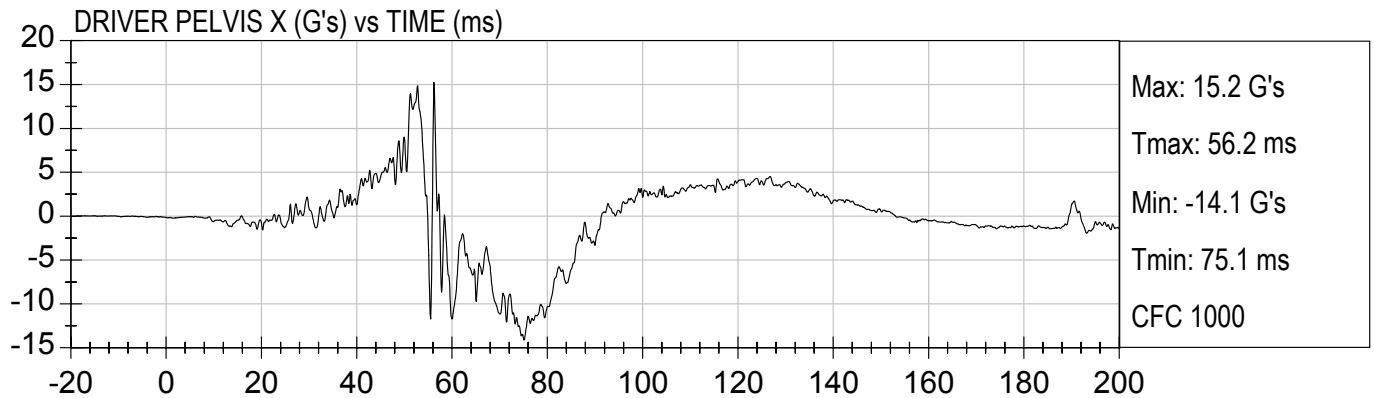
DRIVER LUMBAR MX (Nm) vs TIME (ms)



DRIVER PUBIC SYMPHYSIS FY (N) vs TIME (ms)

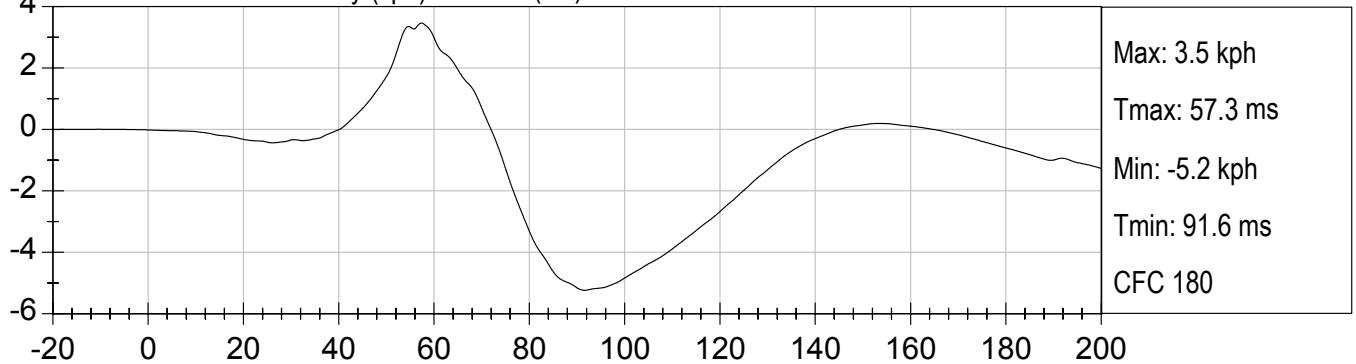




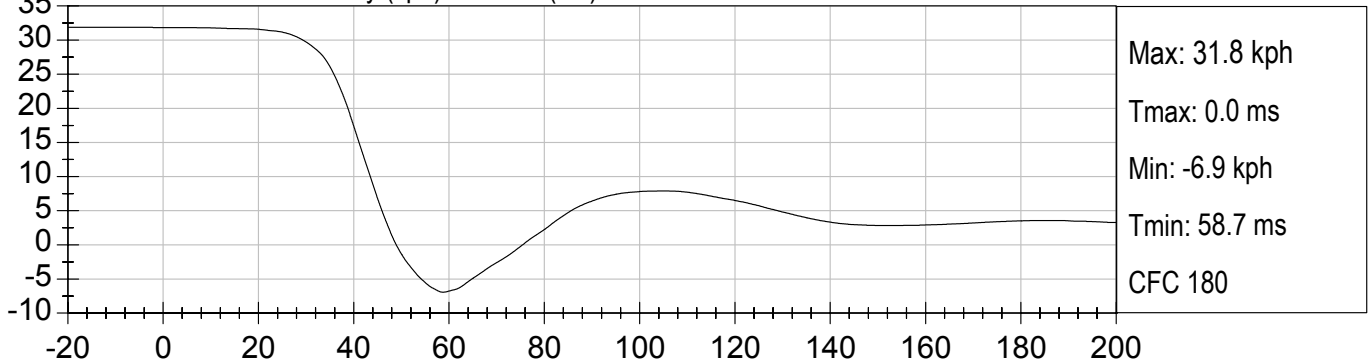




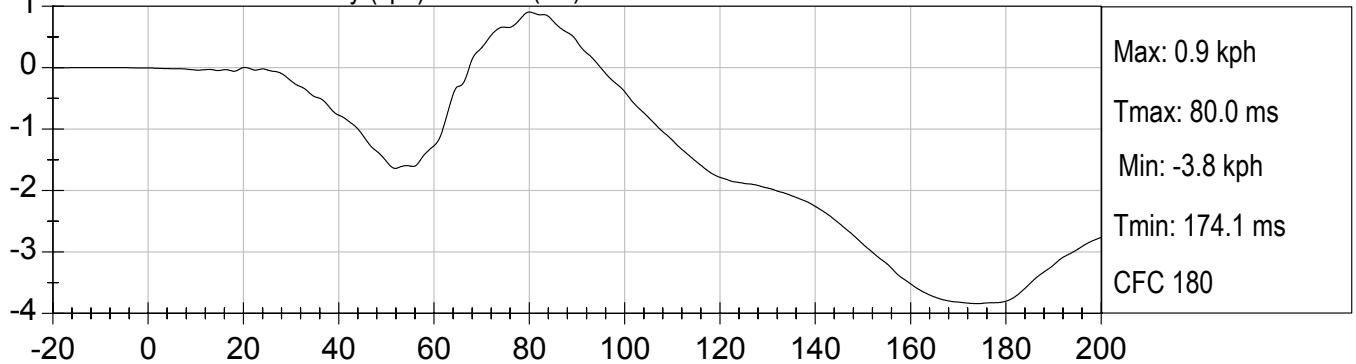
DRIVER PELVIS X Velocity (kph) vs TIME (ms)



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

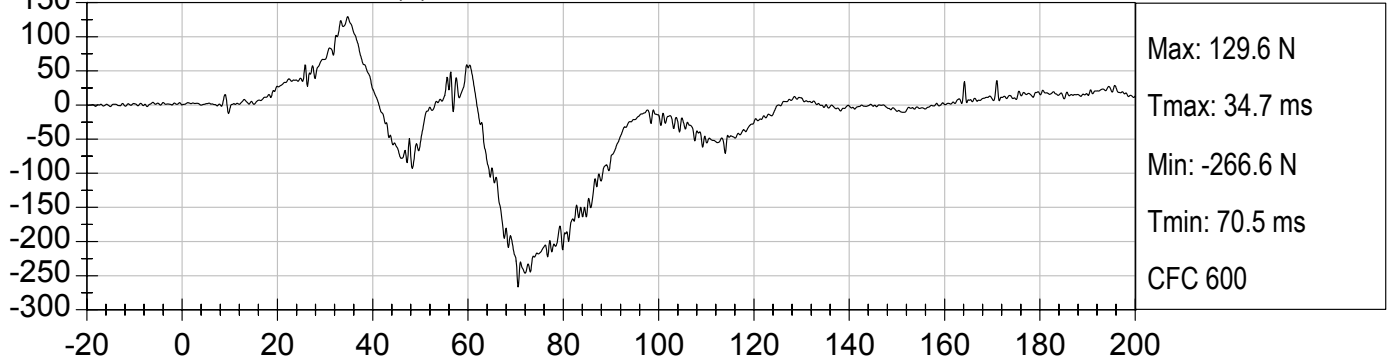


DRIVER PELVIS Z Velocity (kph) vs TIME (ms)

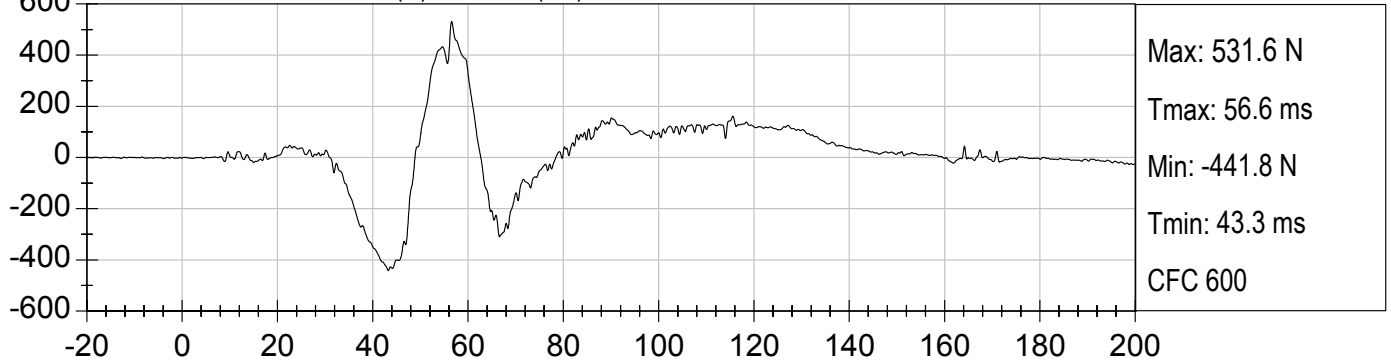




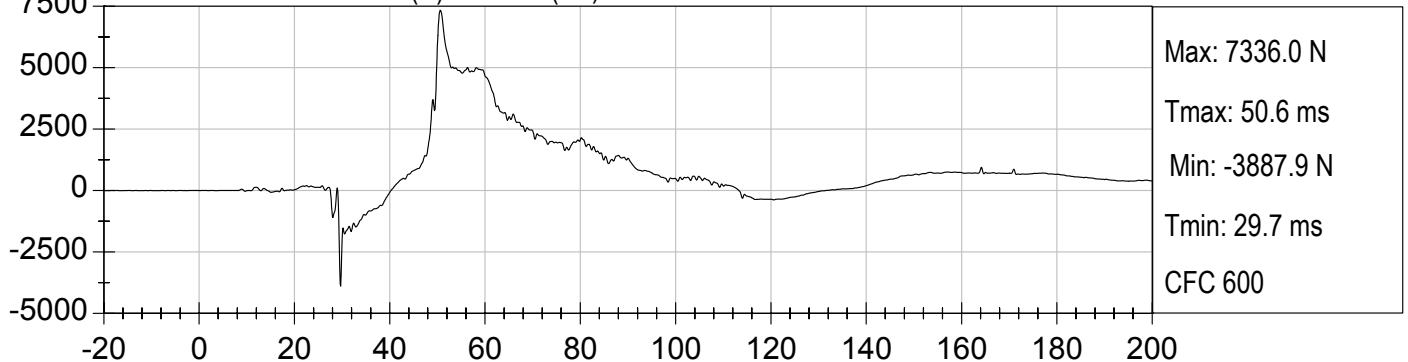
DRIVER LEFT FEMUR FX (N) vs TIME (ms)



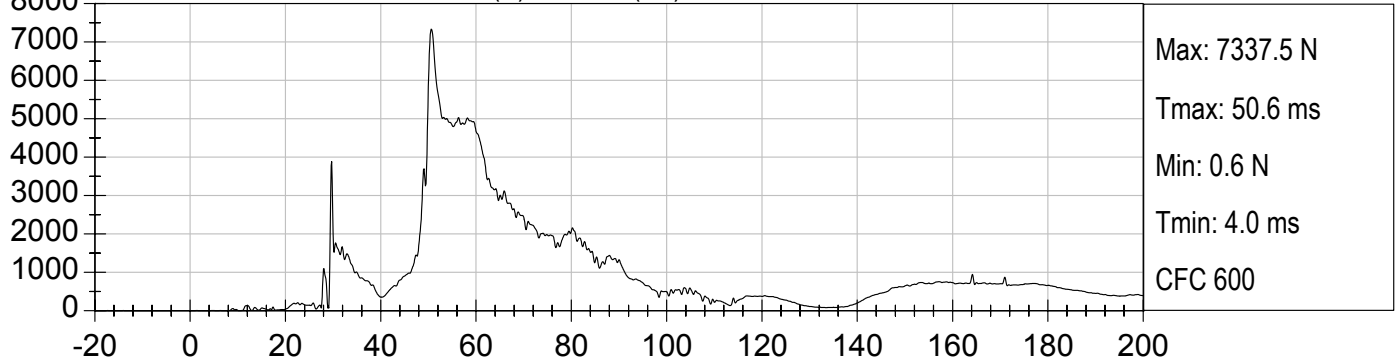
DRIVER LEFT FEMUR FY (N) vs TIME (ms)

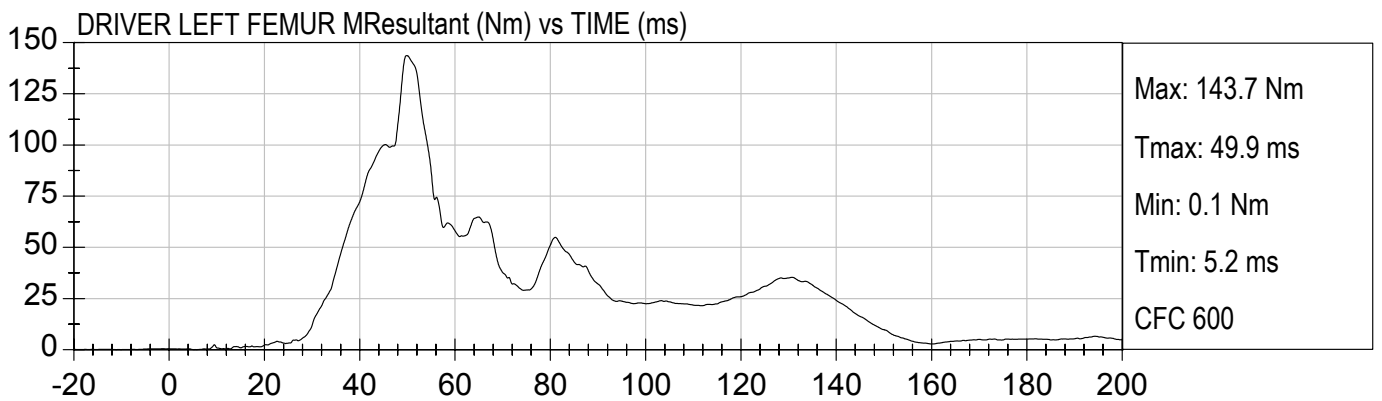
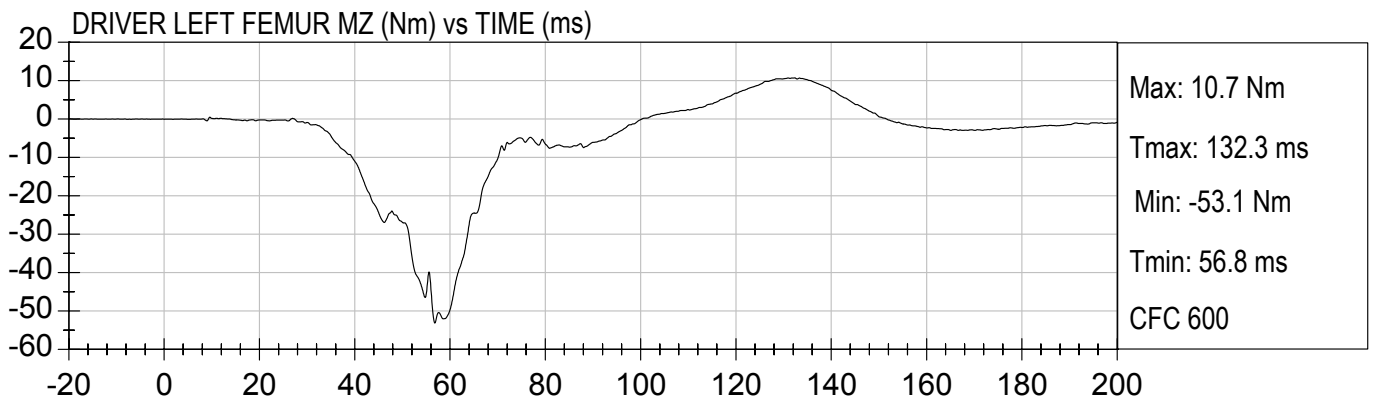
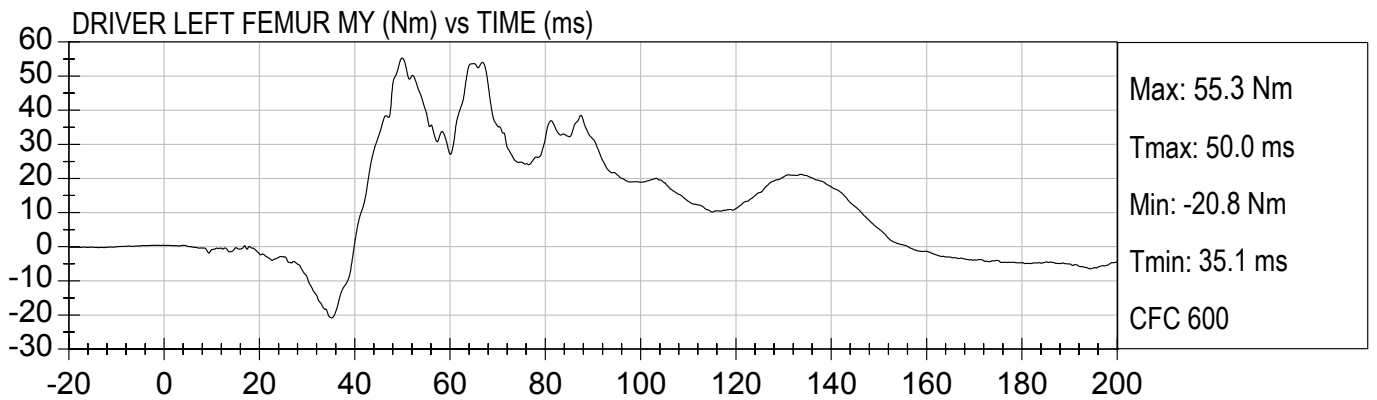
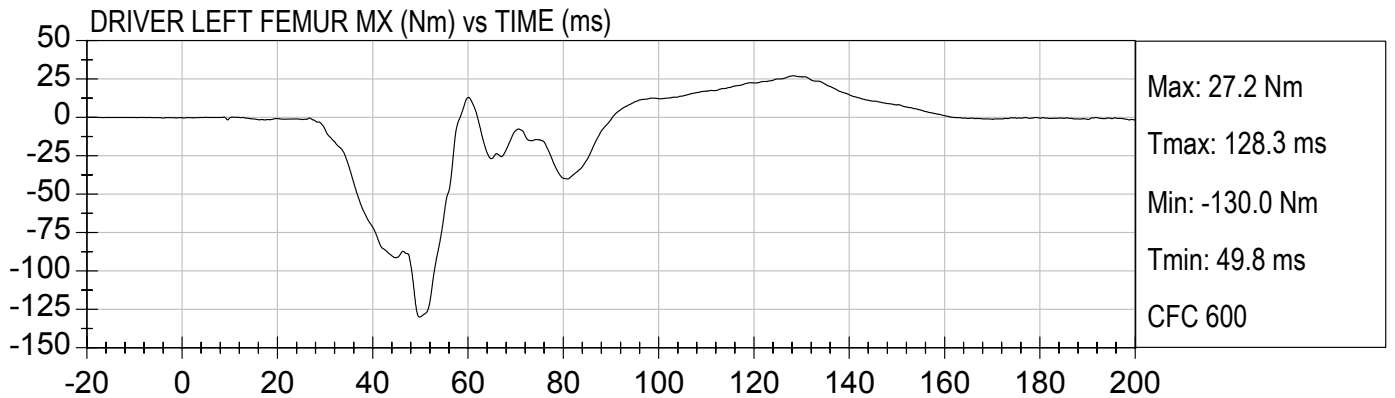


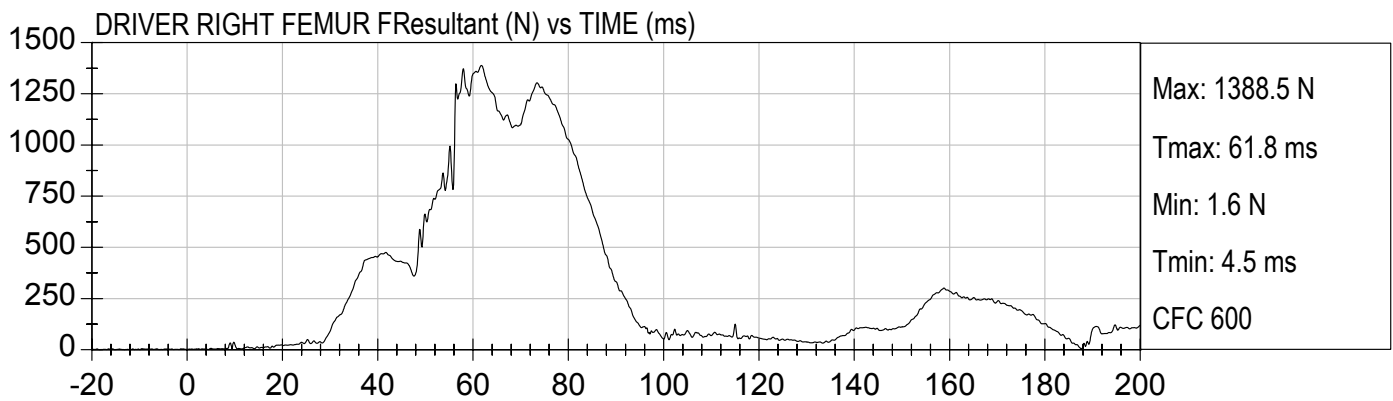
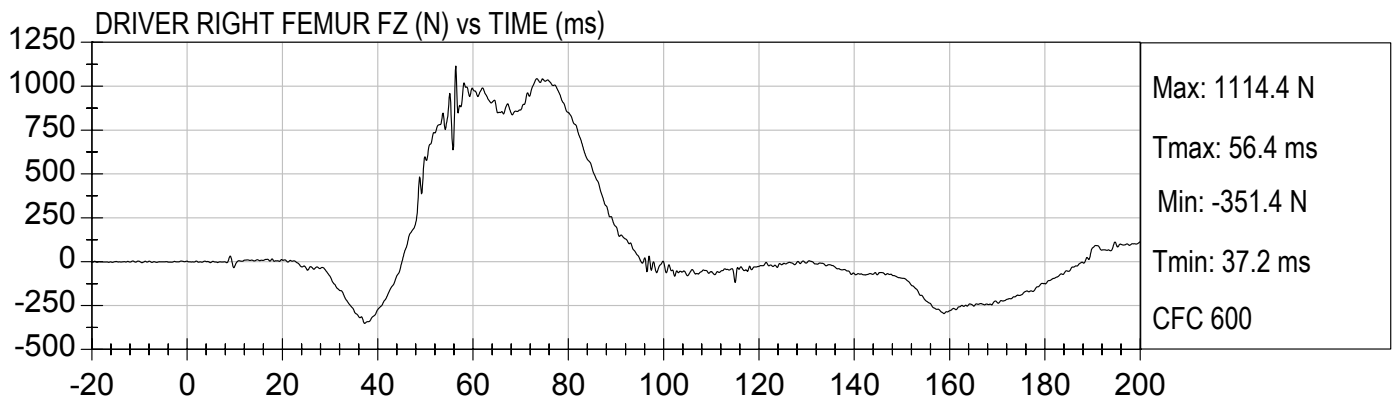
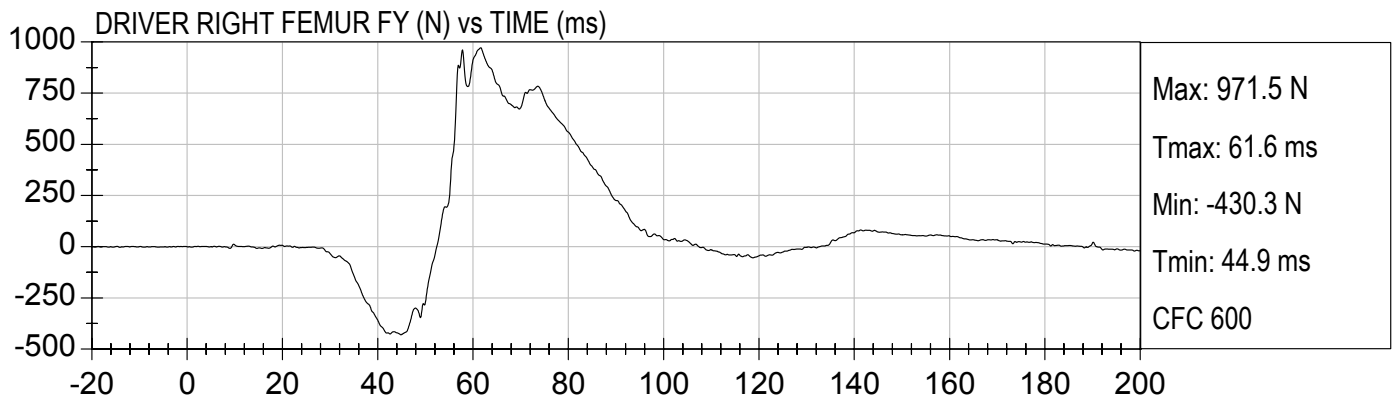
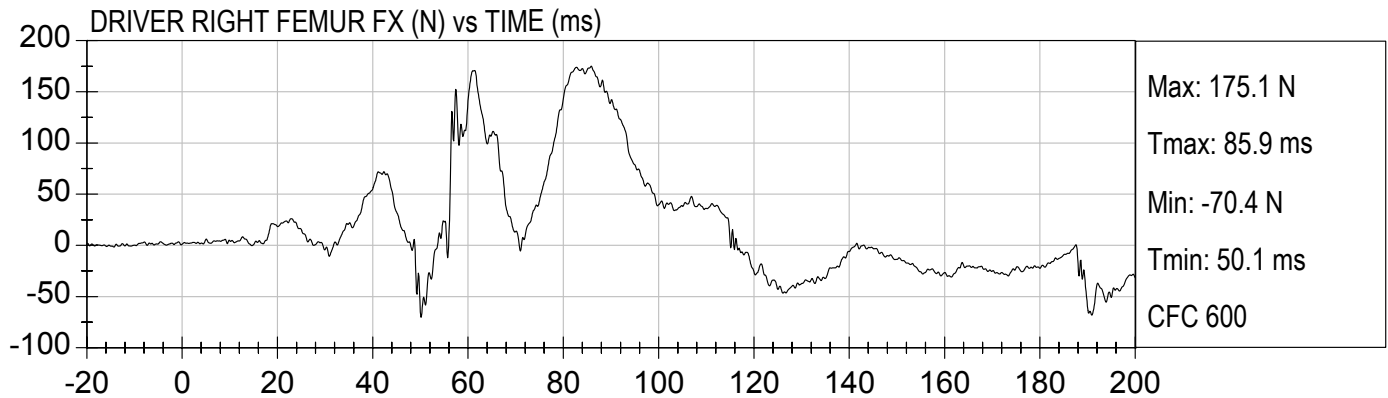
DRIVER LEFT FEMUR FZ (N) vs TIME (ms)

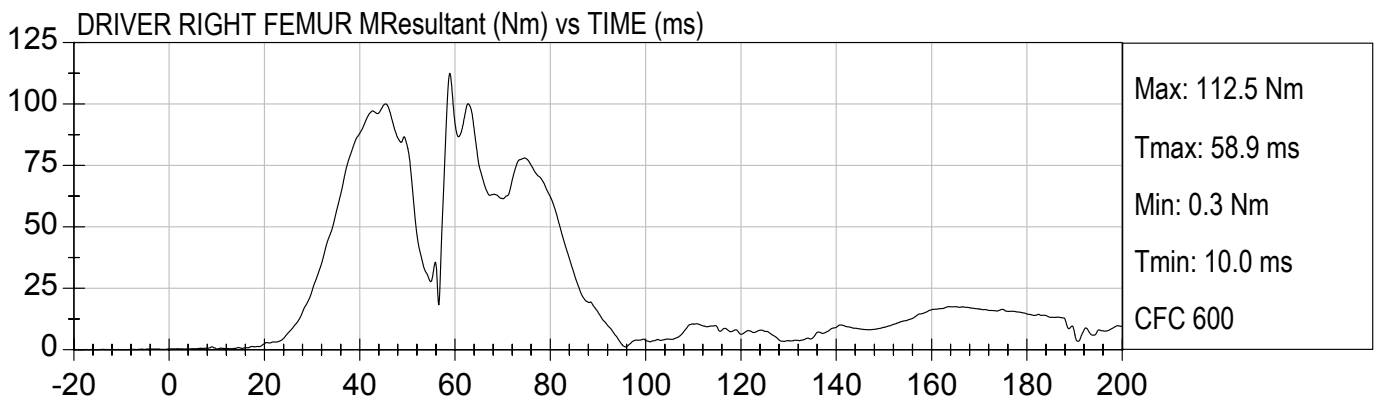
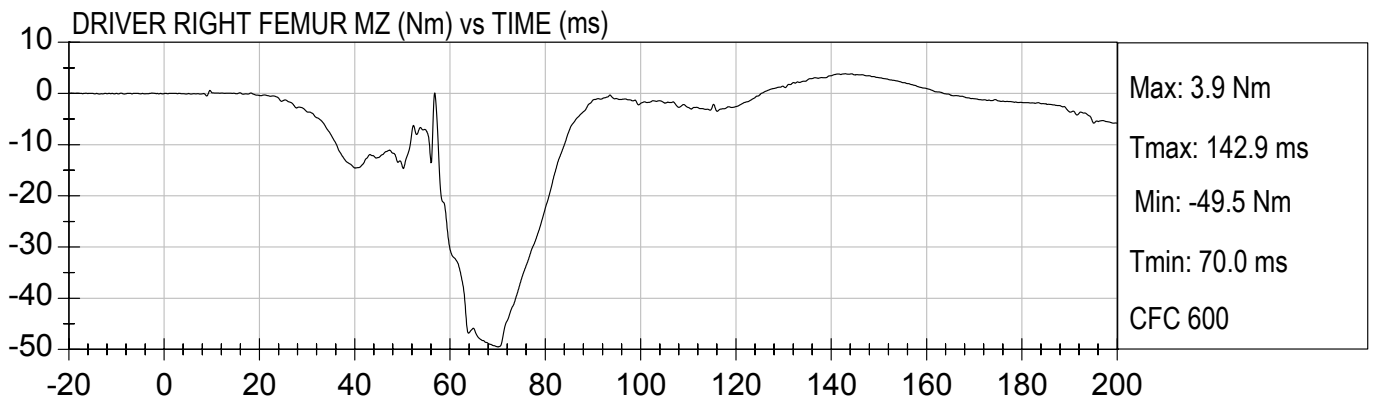
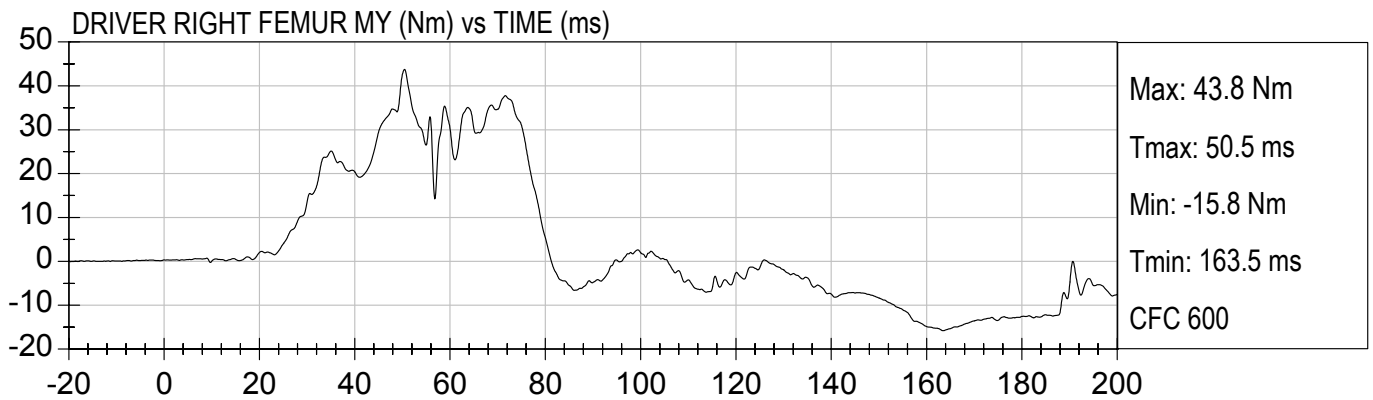
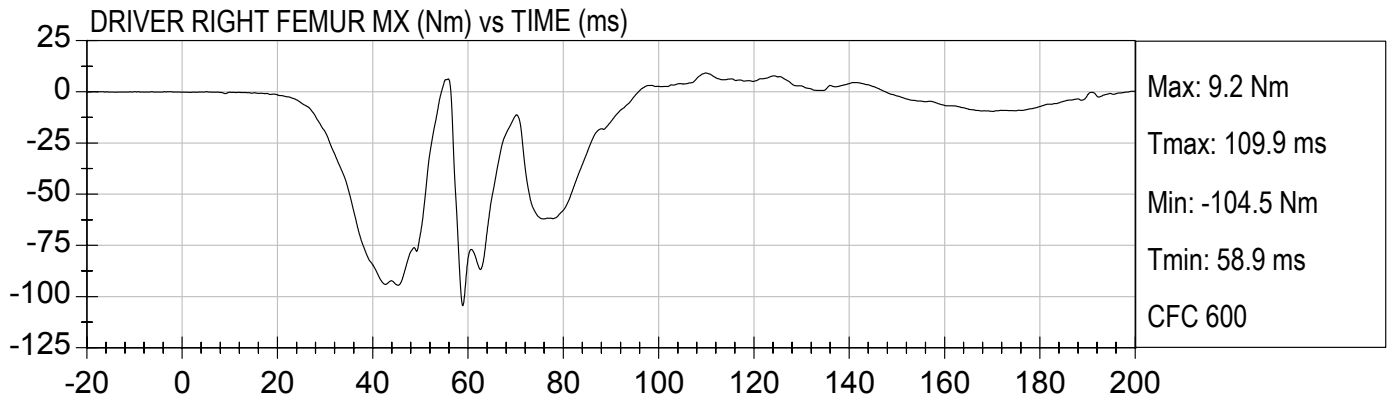


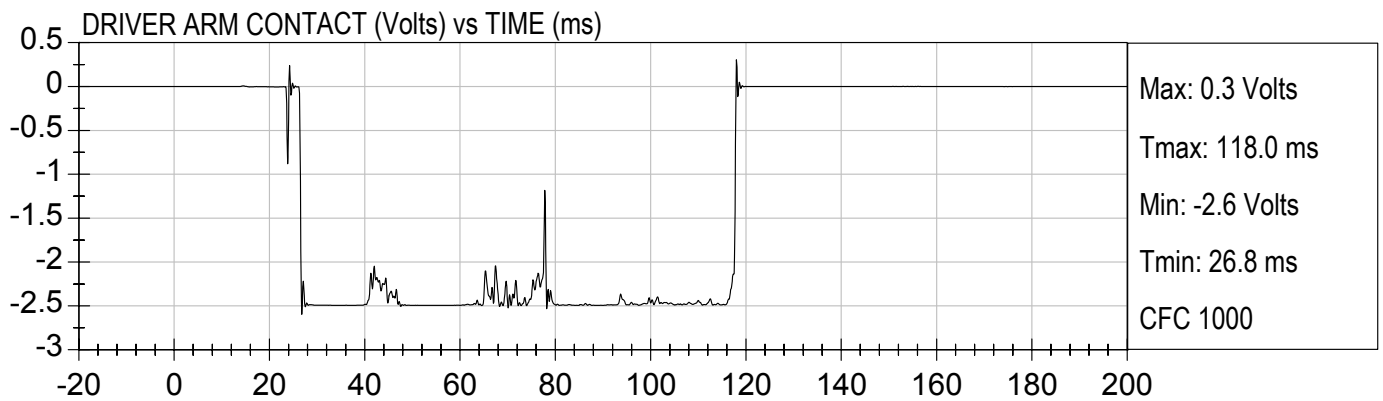
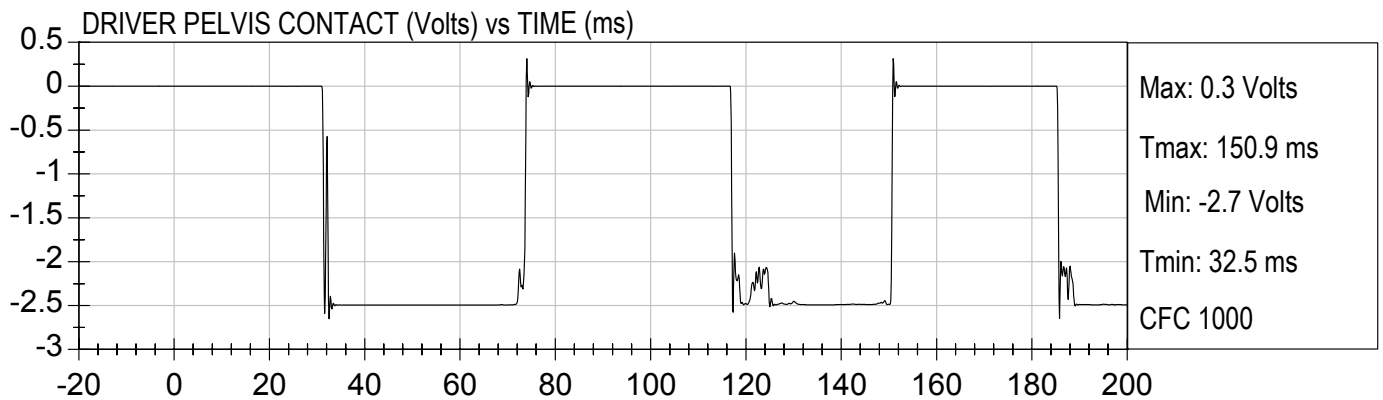
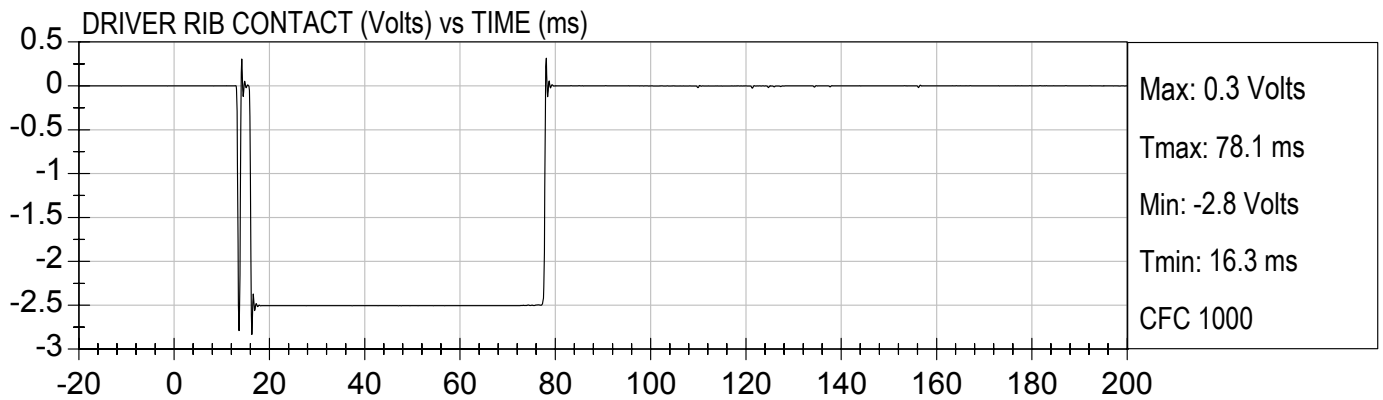
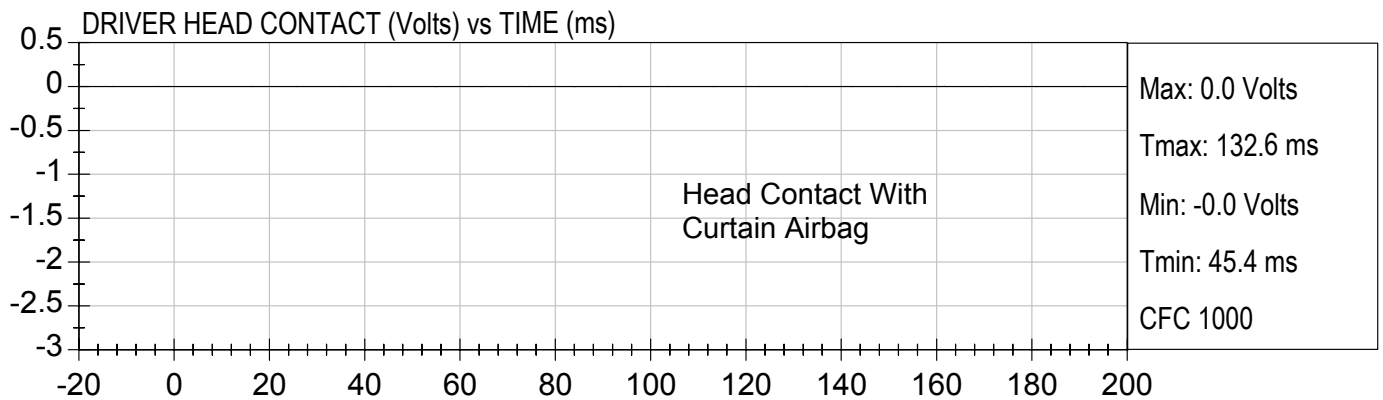
DRIVER LEFT FEMUR FResultant (N) vs TIME (ms)





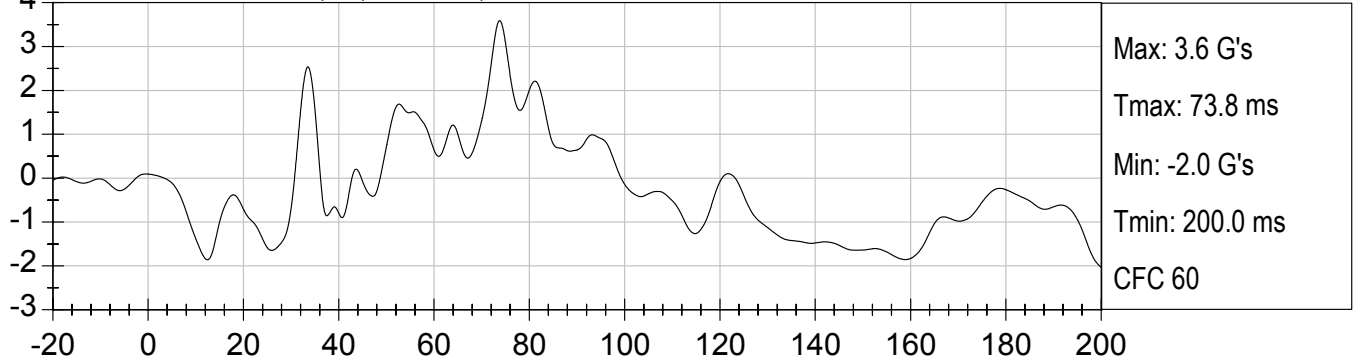




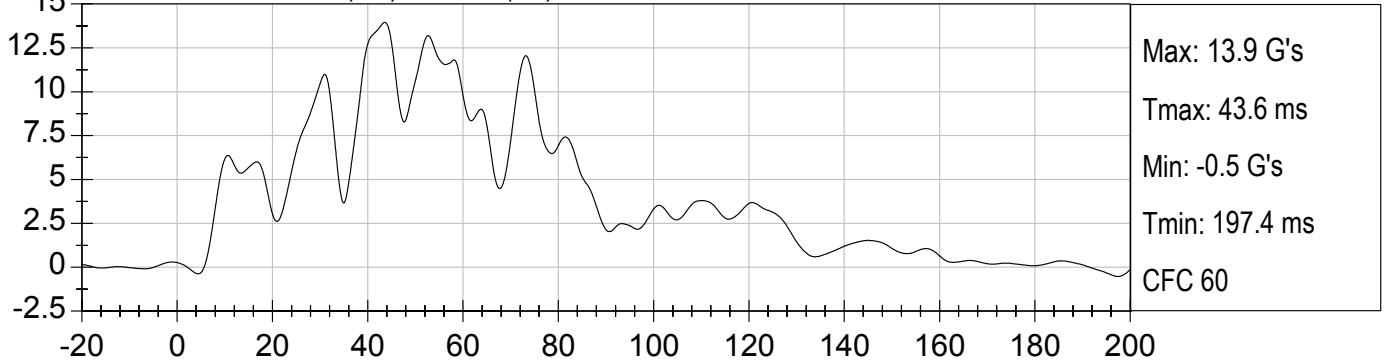




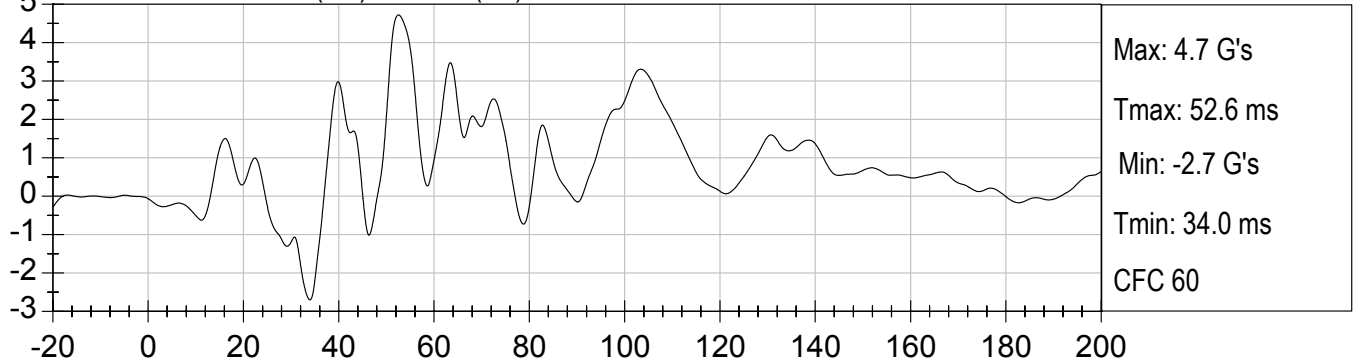
RIGHT FRONT SILL X (G's) vs TIME (ms)



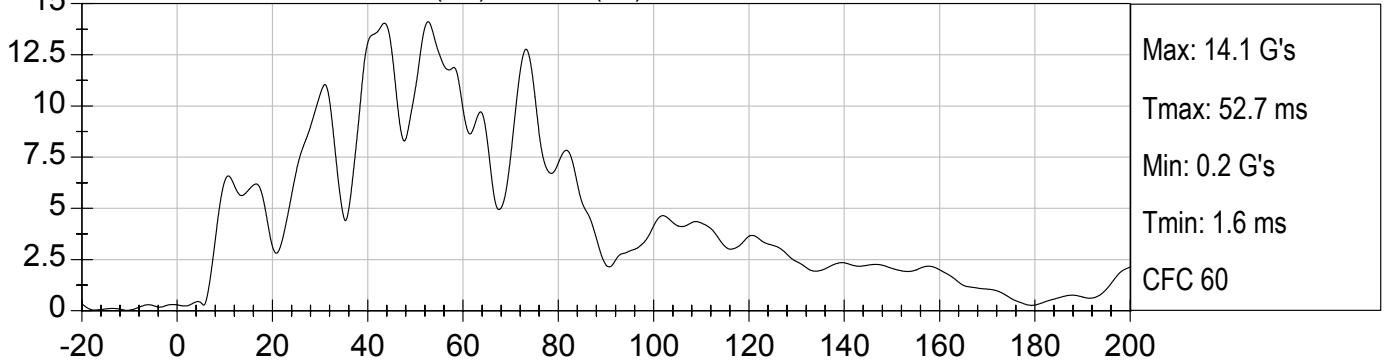
RIGHT FRONT SILL Y (G's) vs TIME (ms)

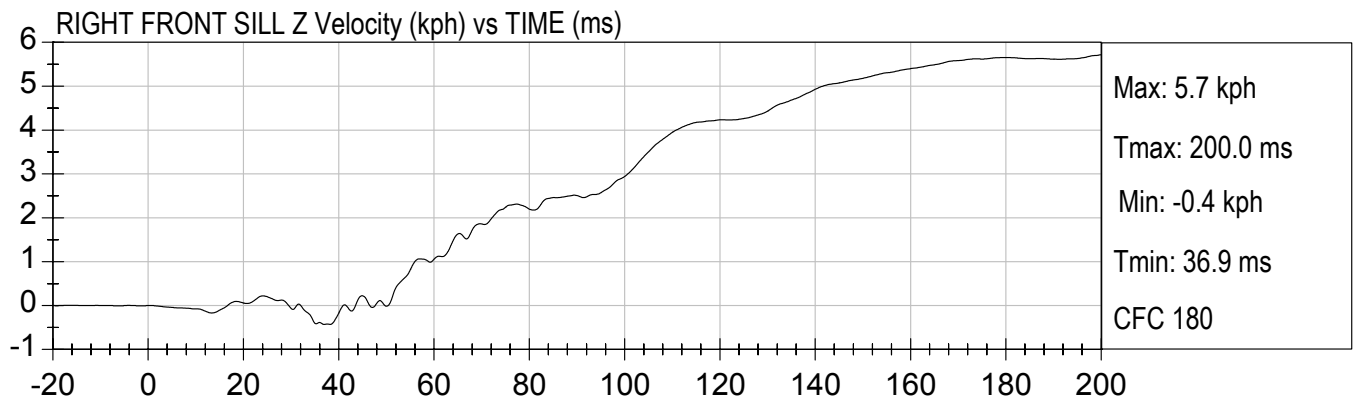
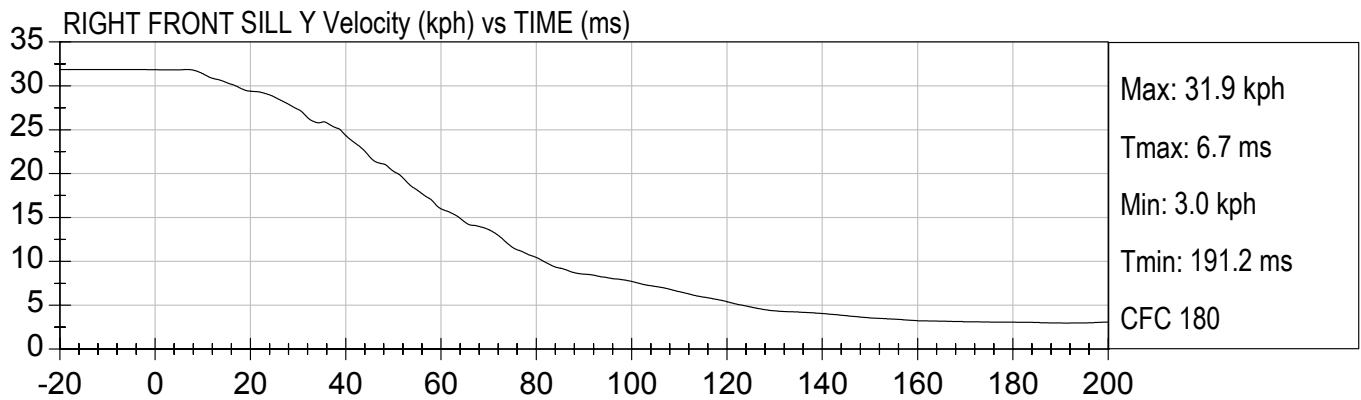
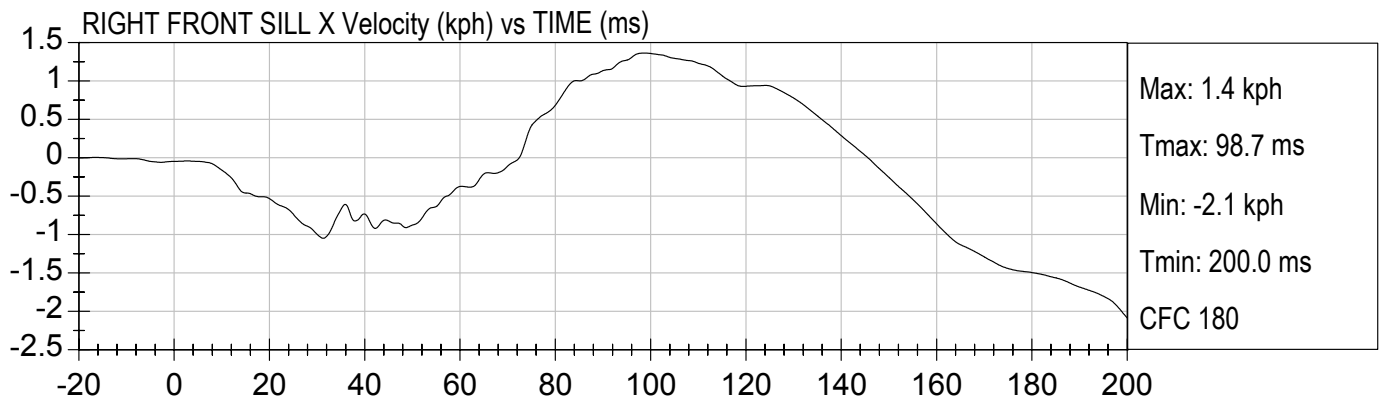


RIGHT FRONT SILL Z (G's) vs TIME (ms)



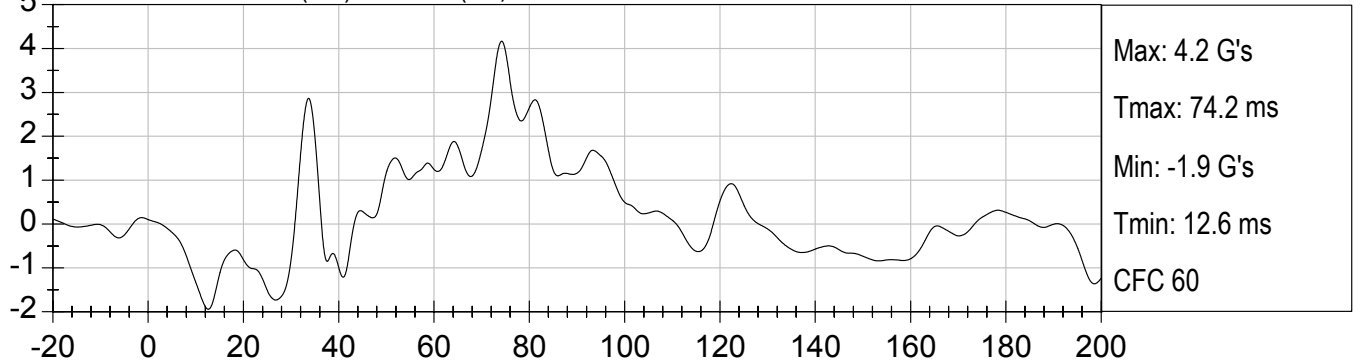
RIGHT FRONT SILL Resultant (G's) vs TIME (ms)



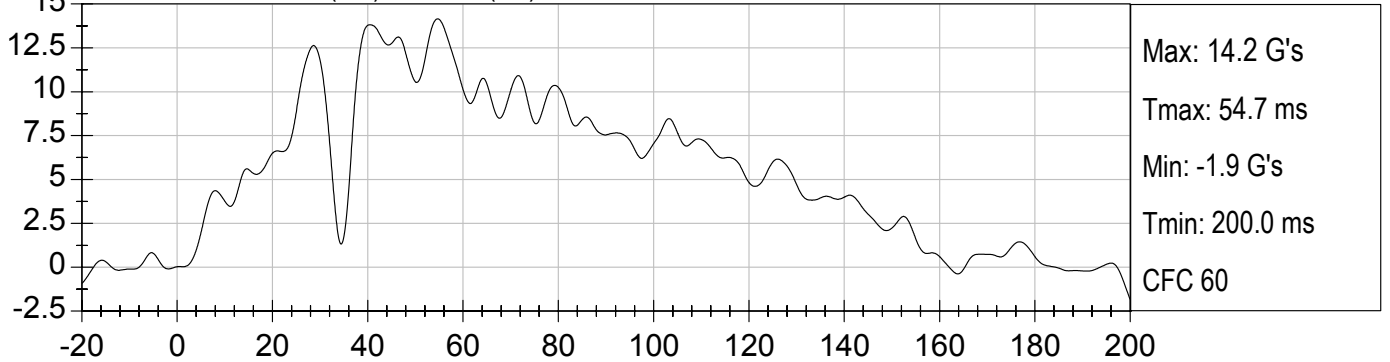




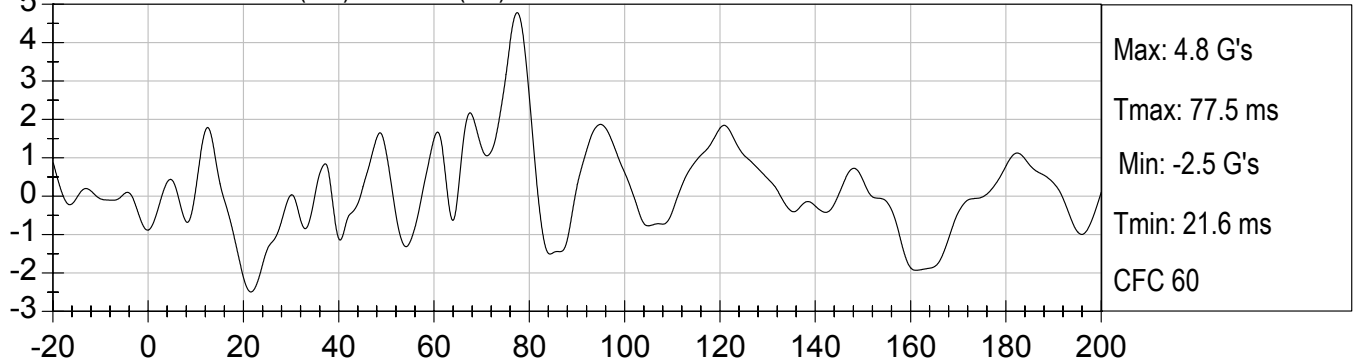
RIGHT REAR SILL X (G's) vs TIME (ms)



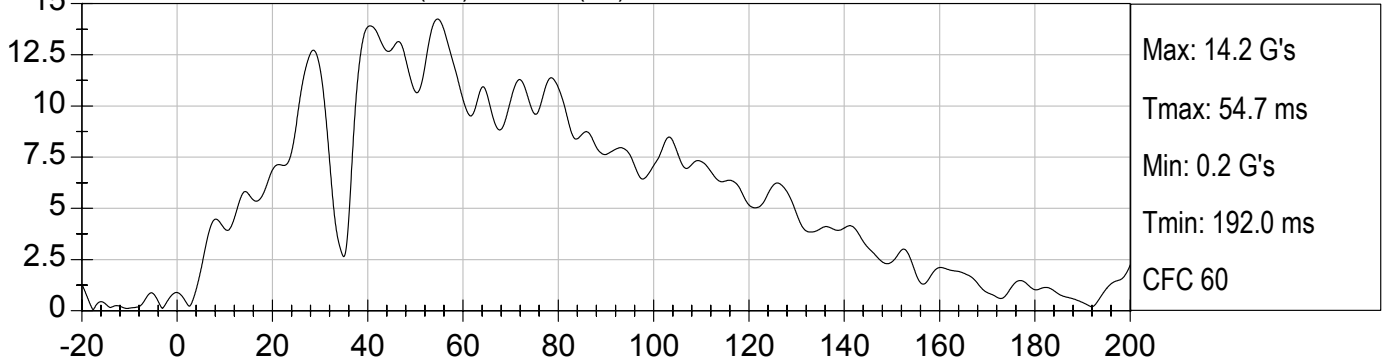
RIGHT REAR SILL Y (G's) vs TIME (ms)

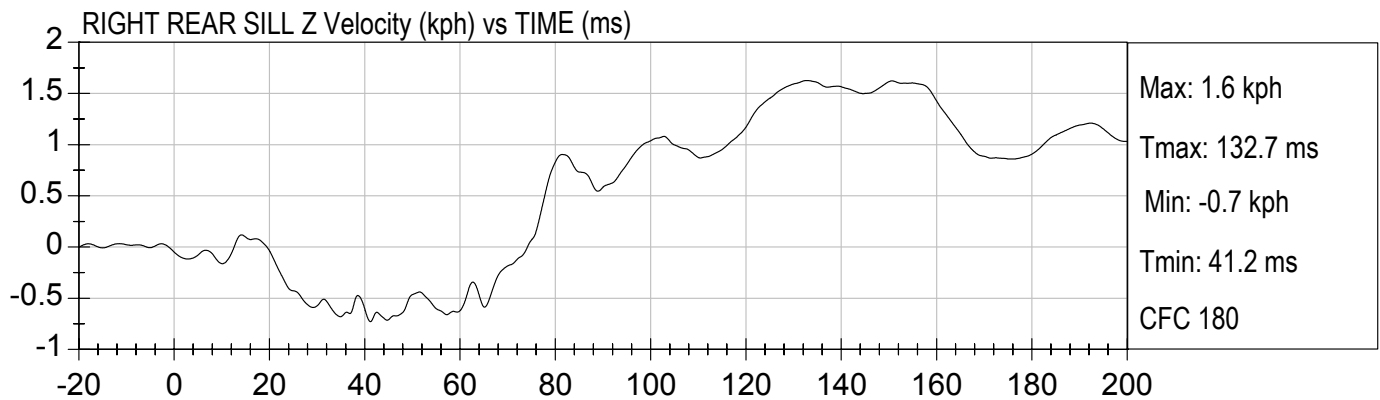
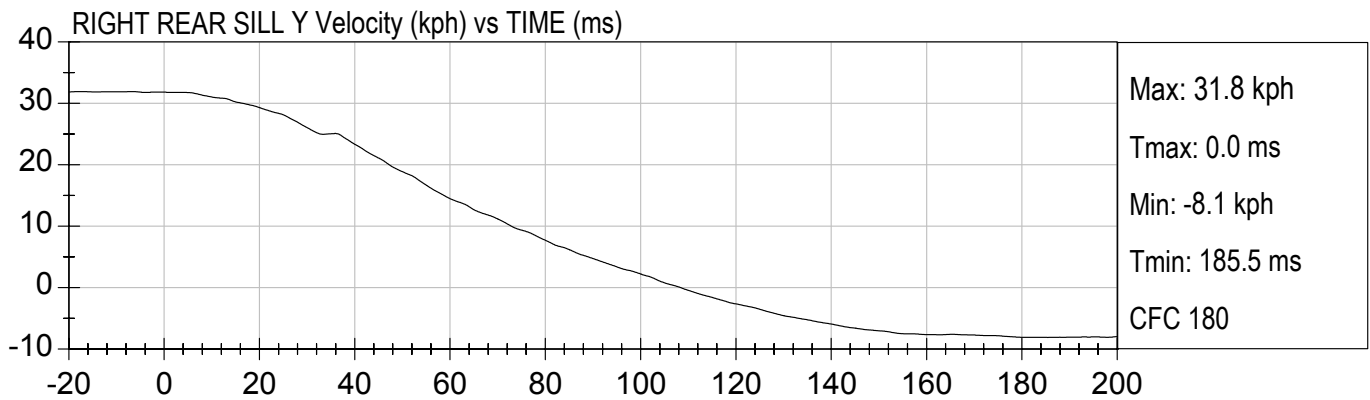
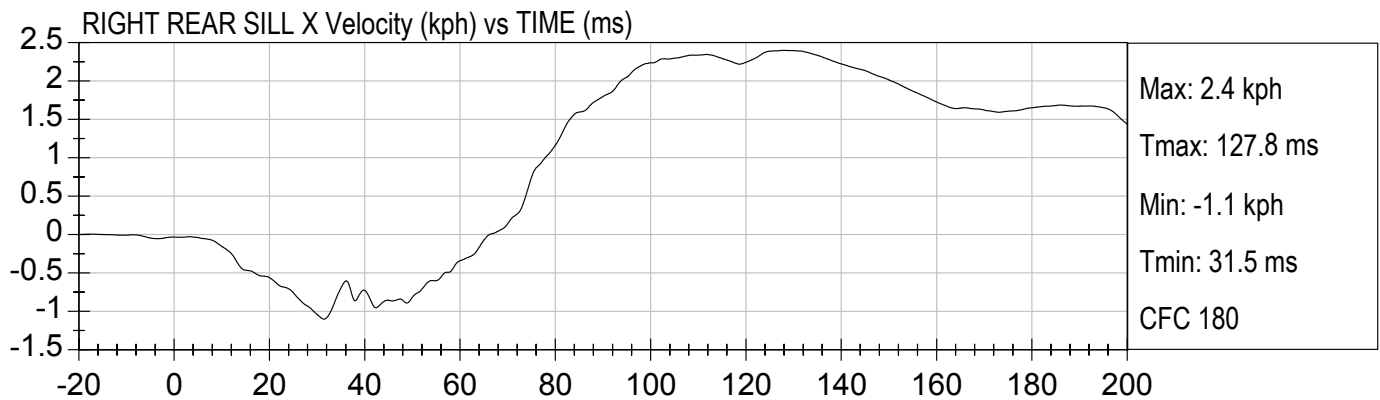


RIGHT REAR SILL Z (G's) vs TIME (ms)



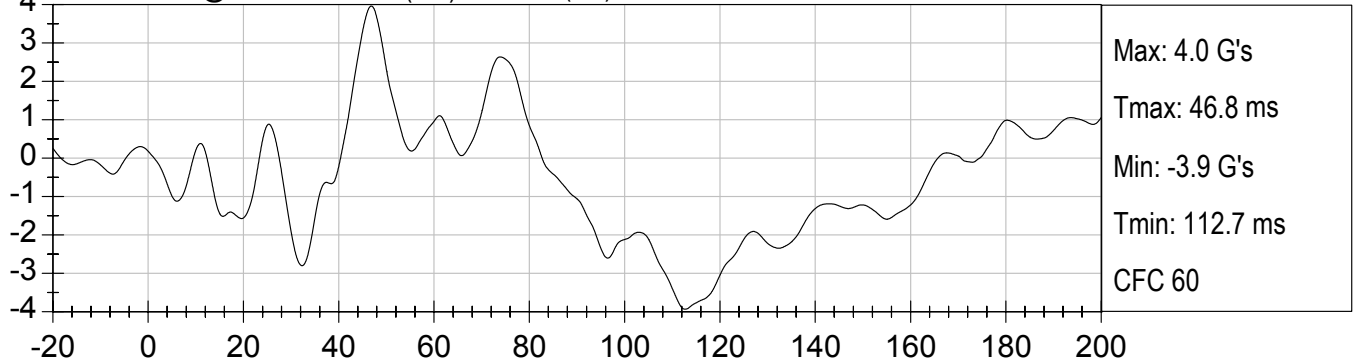
RIGHT REAR SILL Resultant (G's) vs TIME (ms)



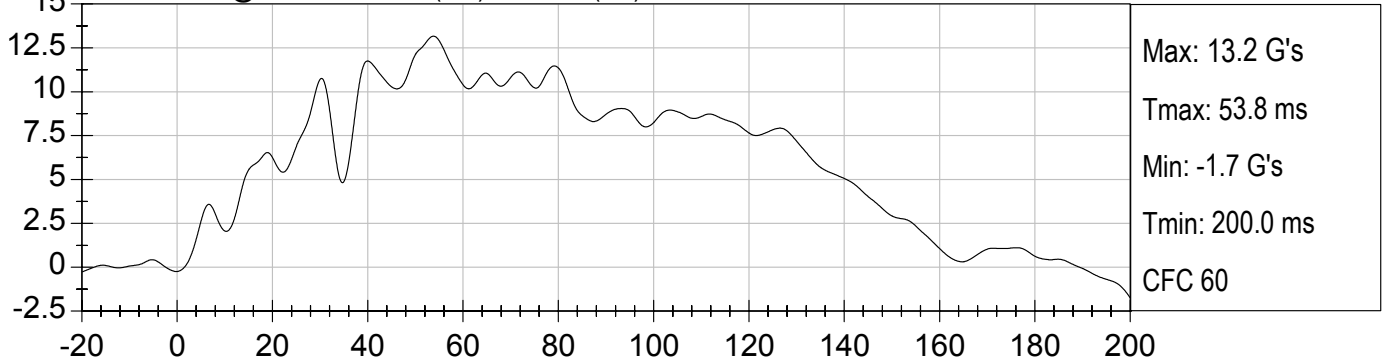




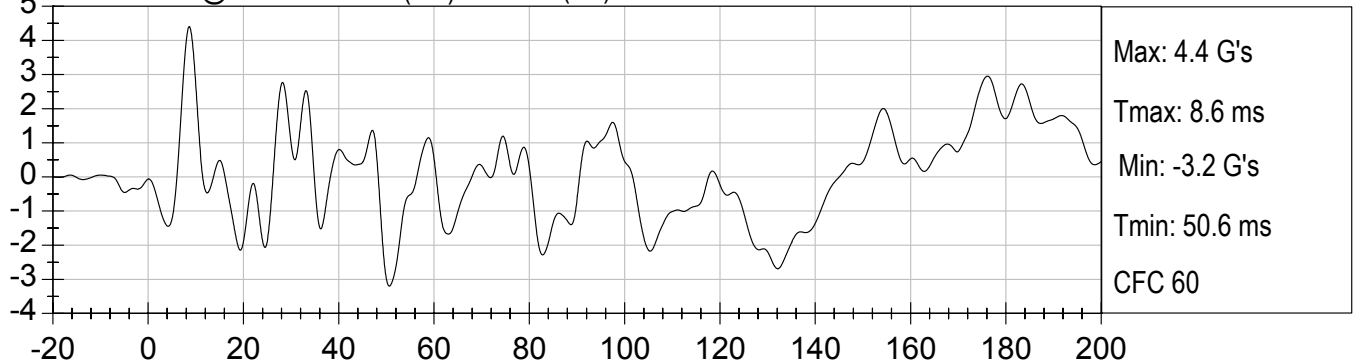
FLOORPAN @ REAR AXLE X (G's) vs TIME (ms)



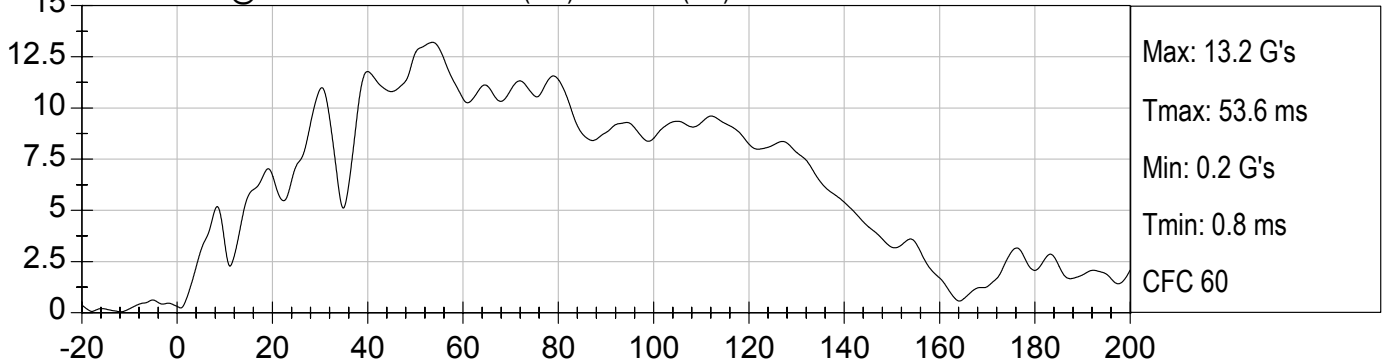
FLOORPAN @ REAR AXLE Y (G's) vs TIME (ms)



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

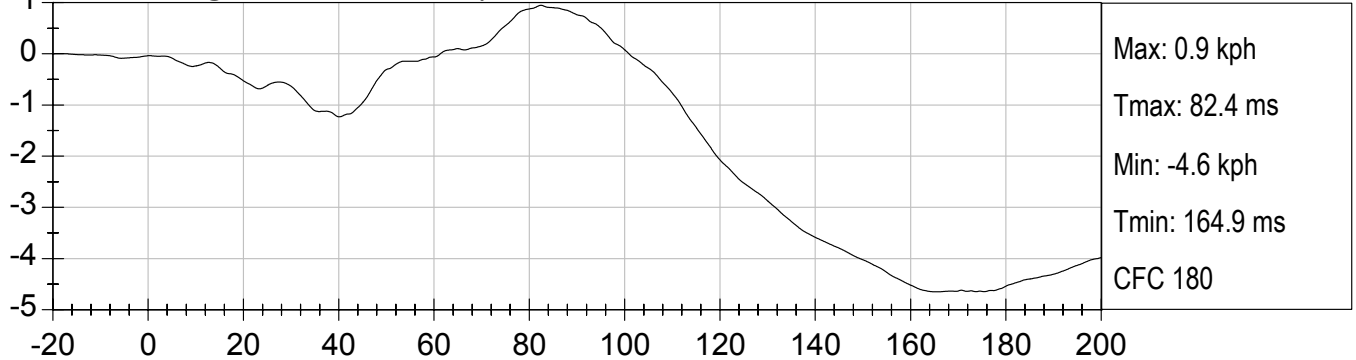


FLOORPAN @ REAR AXLE Resultant (G's) vs TIME (ms)

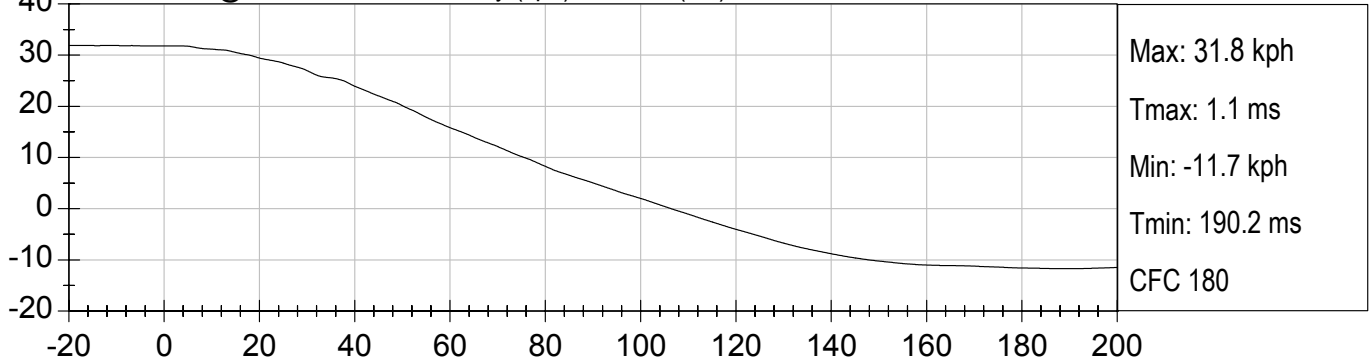




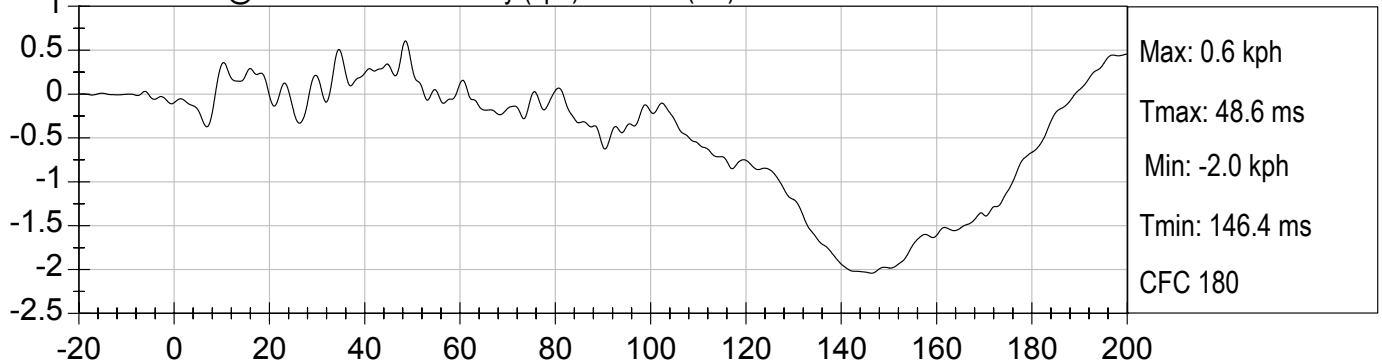
1 FLOORPAN @ REAR AXLE X Velocity (kph) vs TIME (ms)

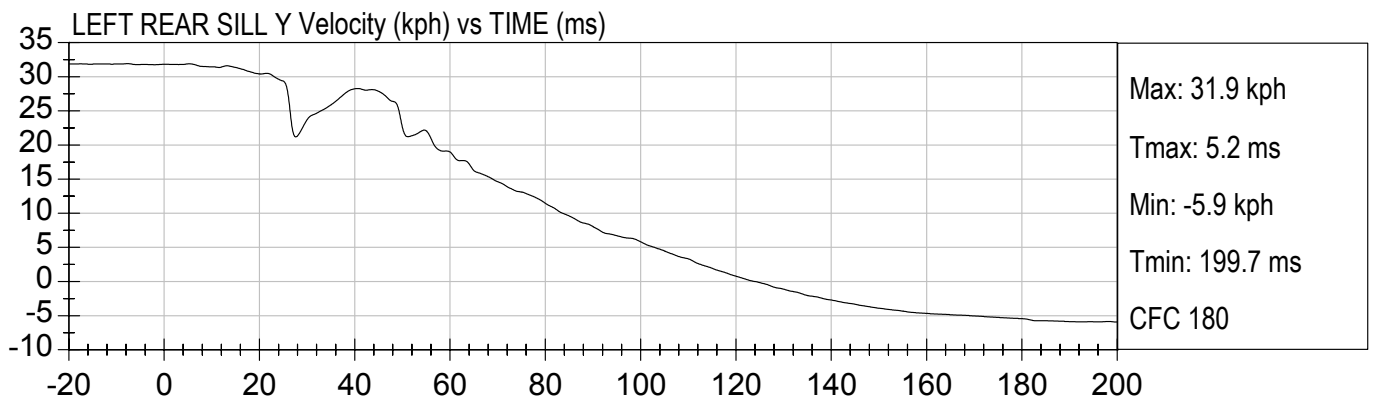
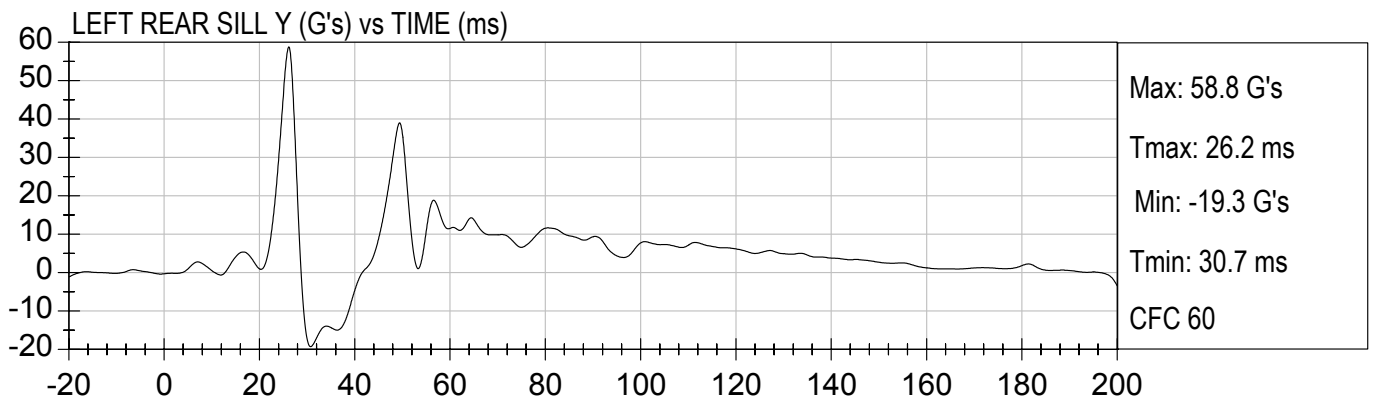
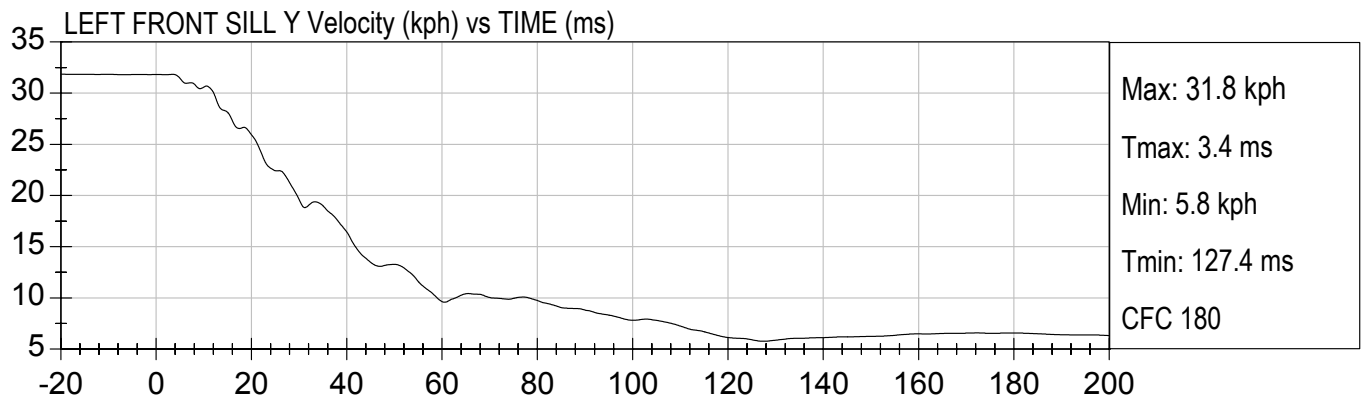
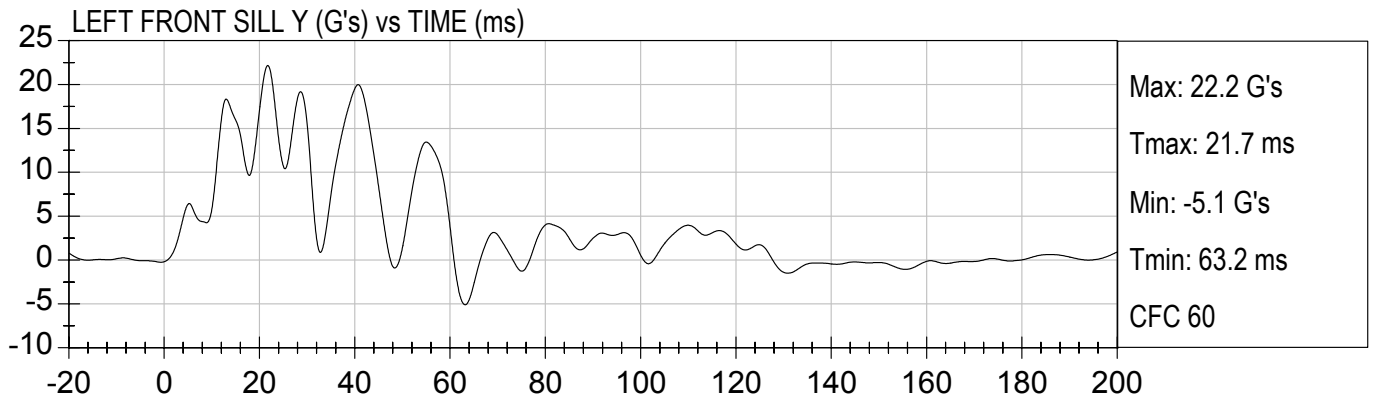


40 FLOORPAN @ REAR AXLE Y Velocity (kph) vs TIME (ms)



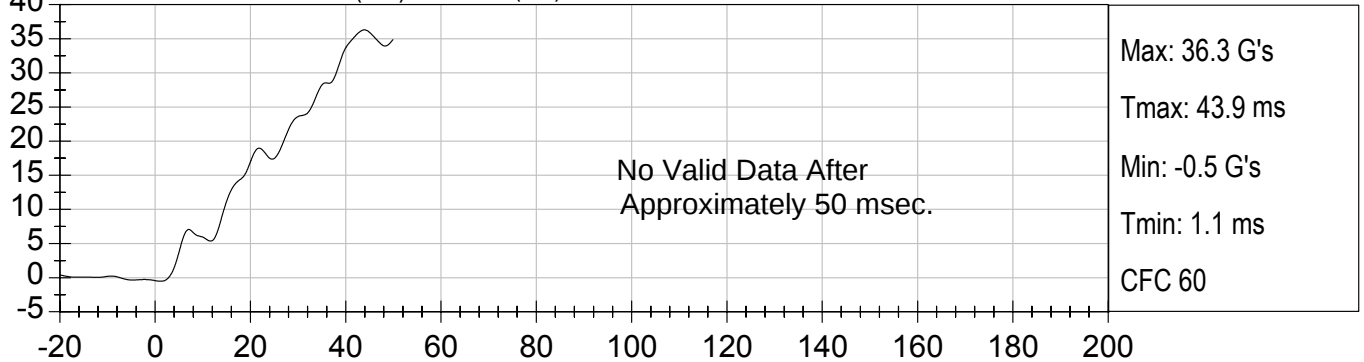
1 FLOORPAN @ REAR AXLE Z Velocity (kph) vs TIME (ms)



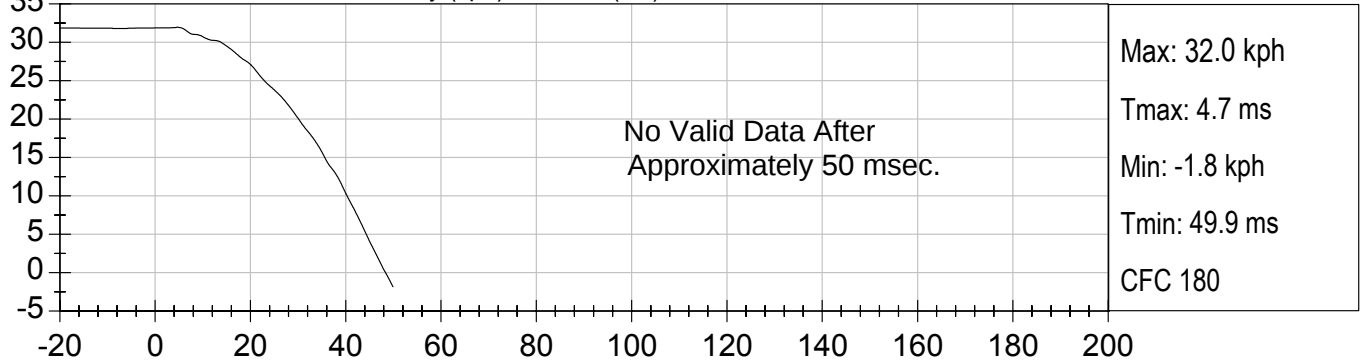




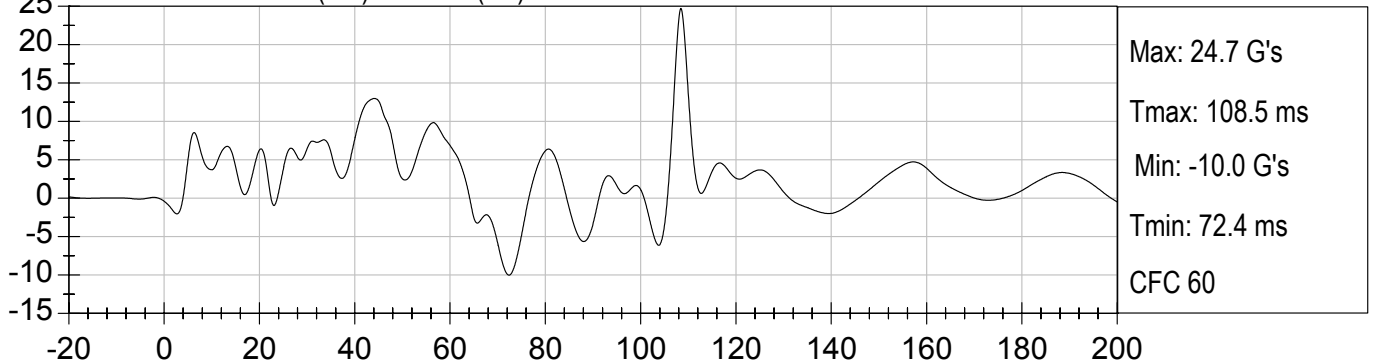
LEFT LOWER A-POST Y (G's) vs TIME (ms)



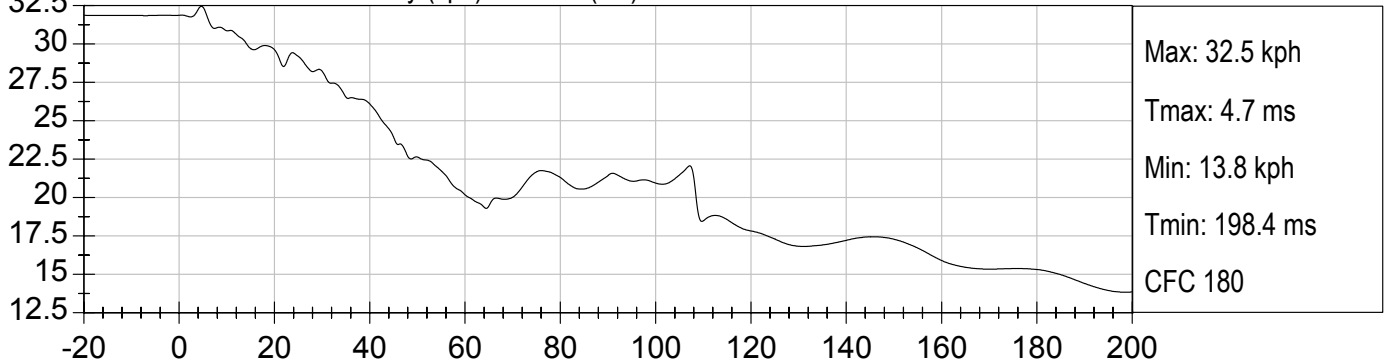
LEFT LOWER A-POST Y Velocity (kph) vs TIME (ms)

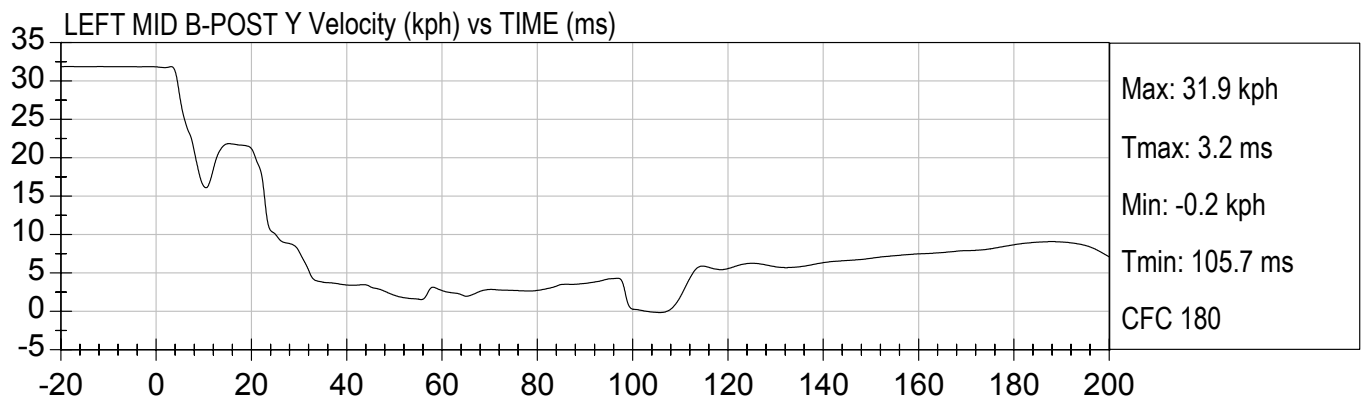
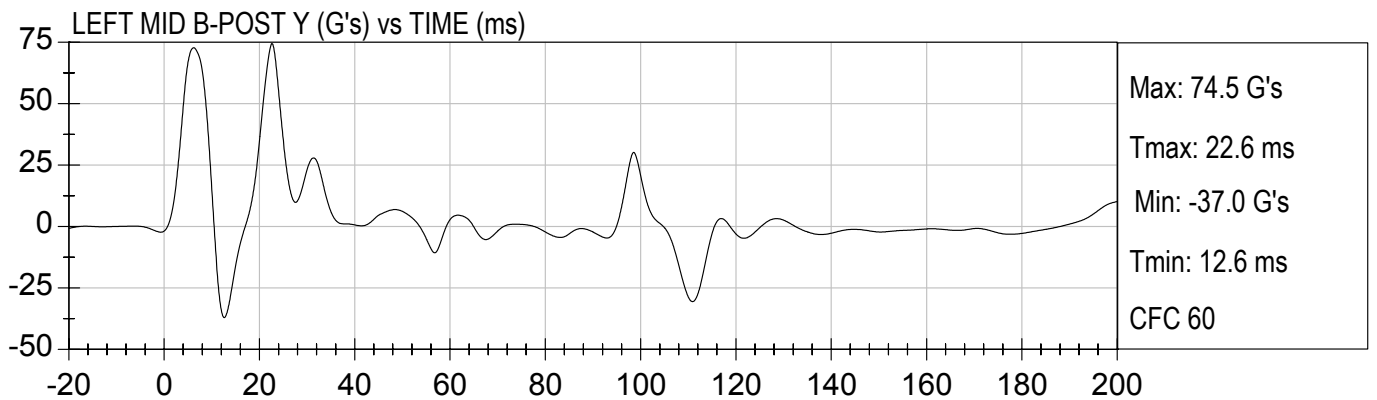
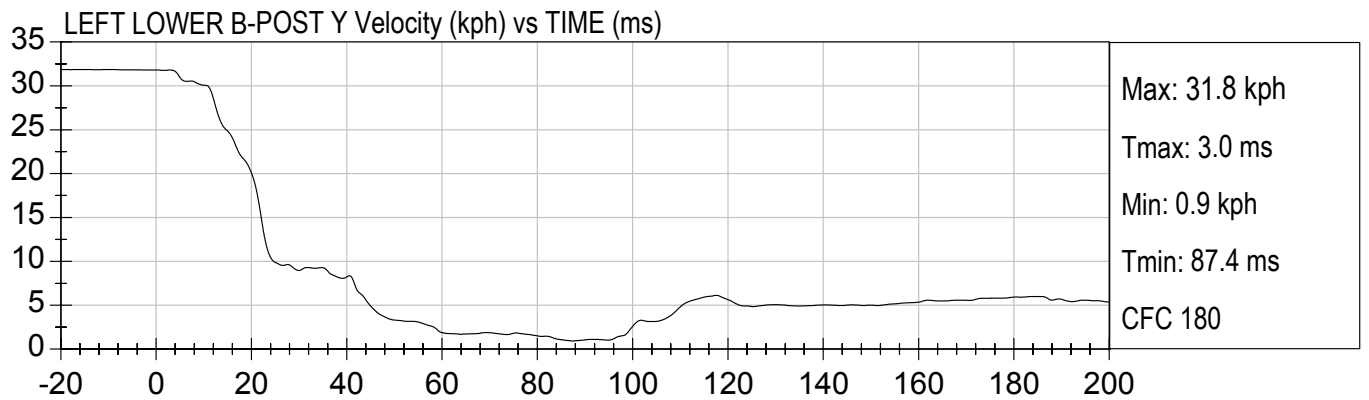
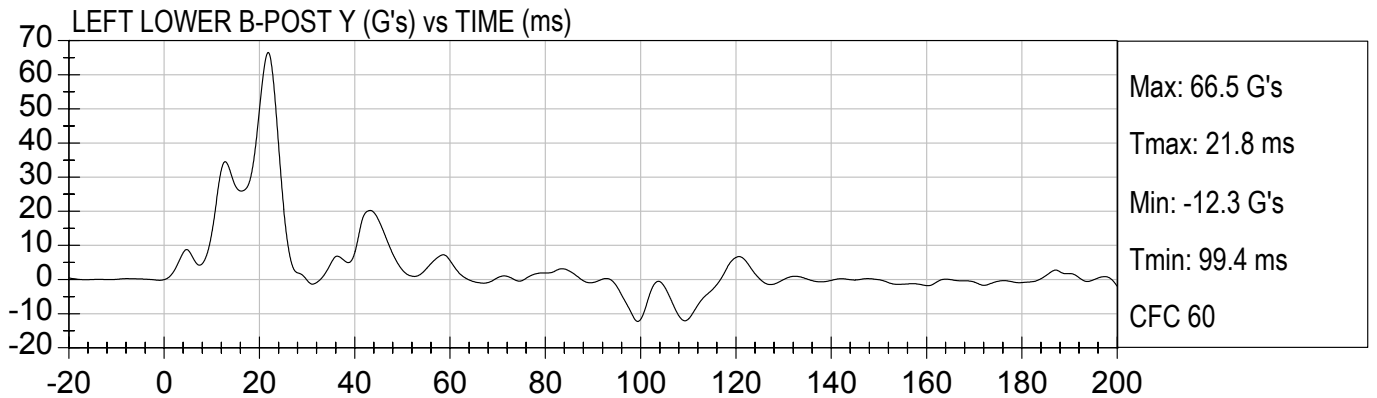


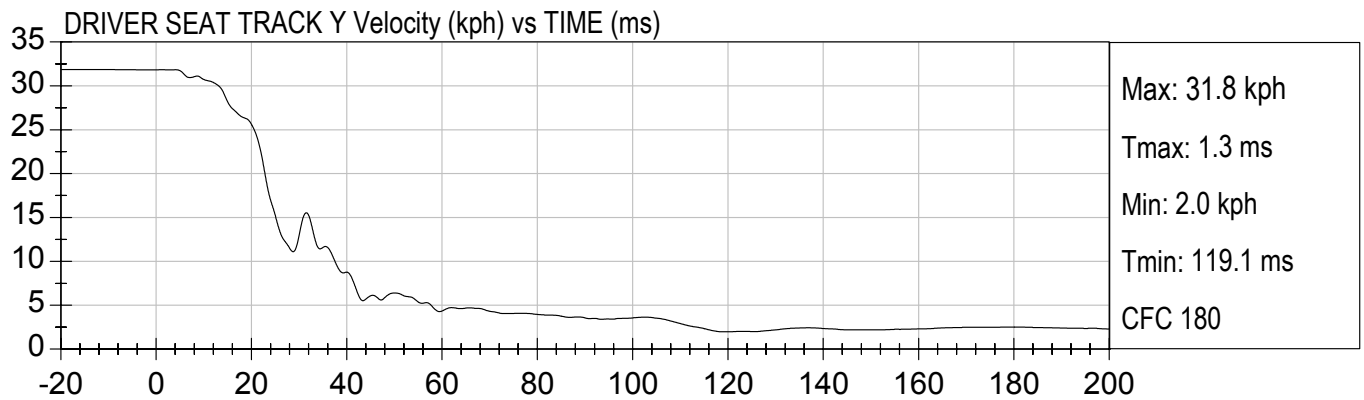
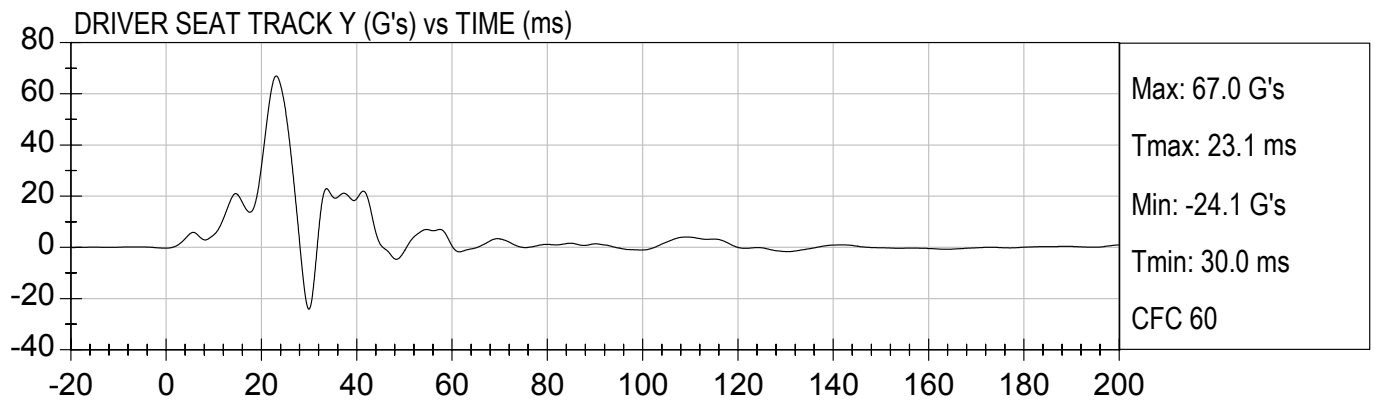
LEFT MID A-POST Y (G's) vs TIME (ms)

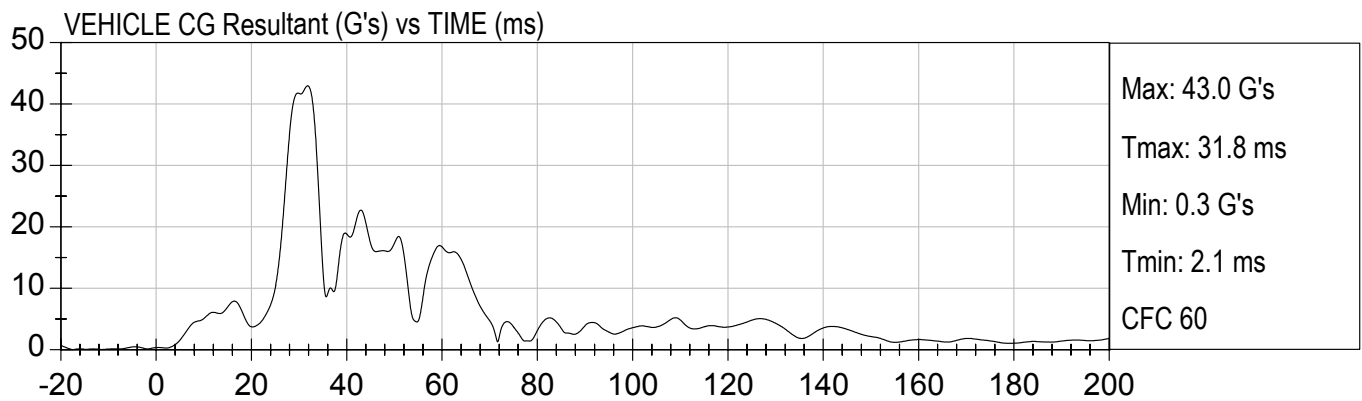
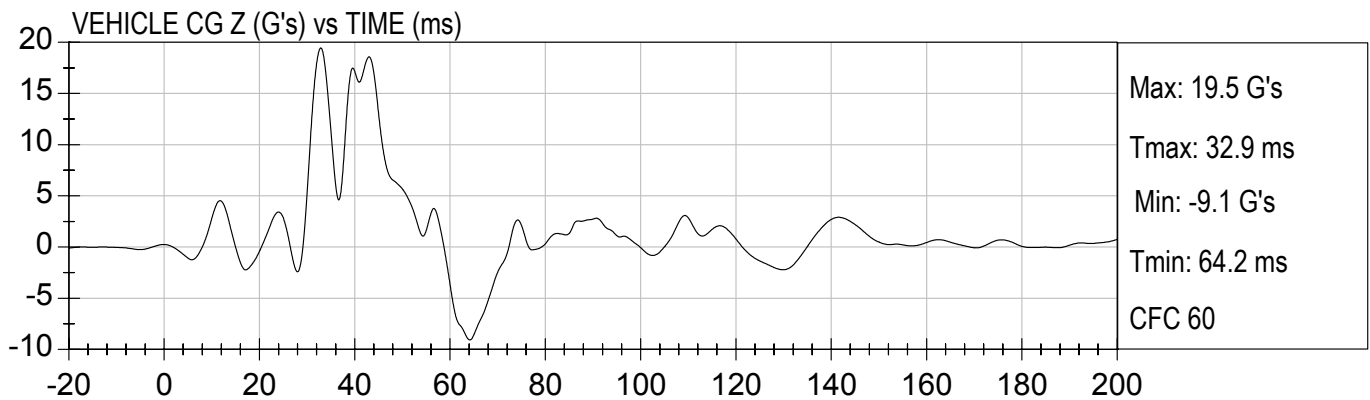
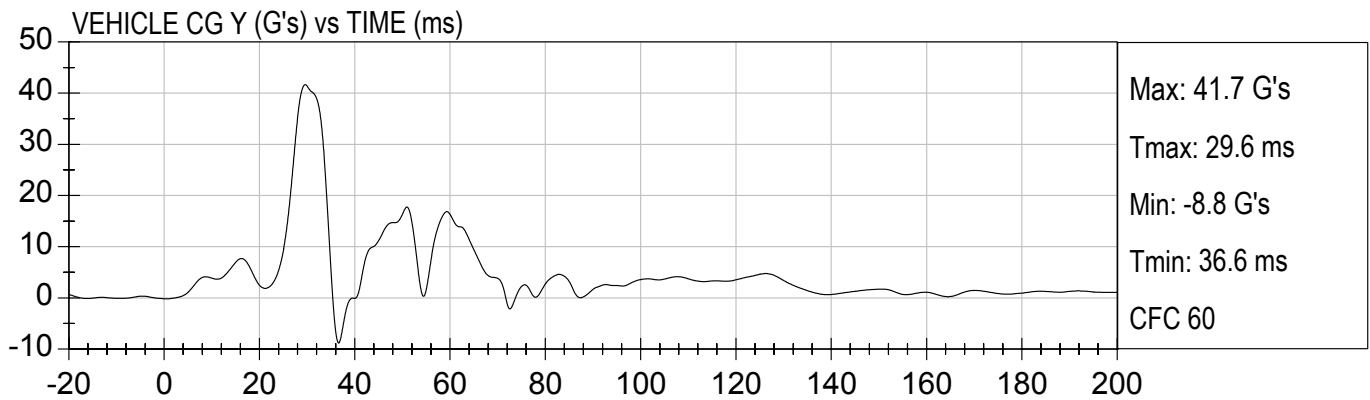
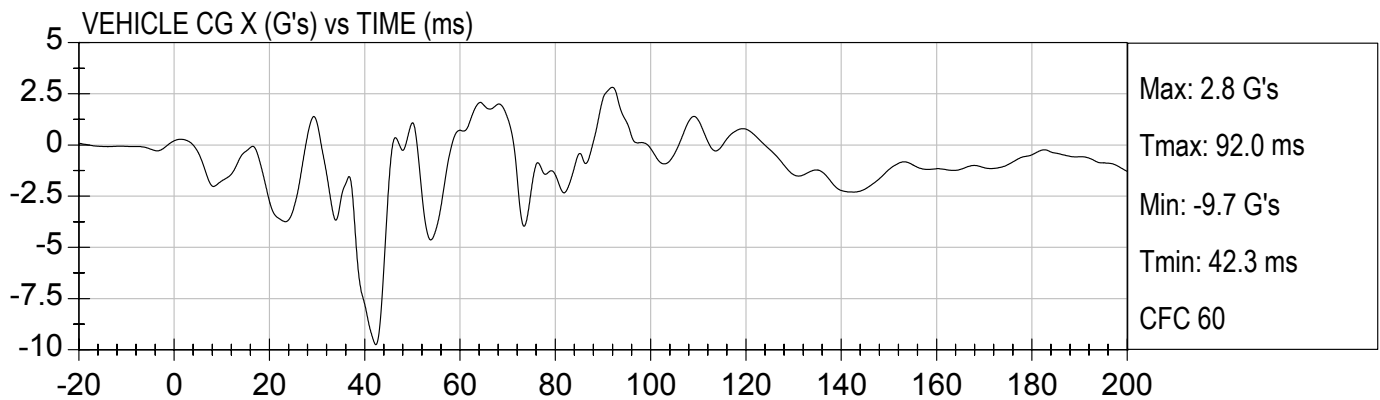


LEFT MID A-POST Y Velocity (kph) vs TIME (ms)



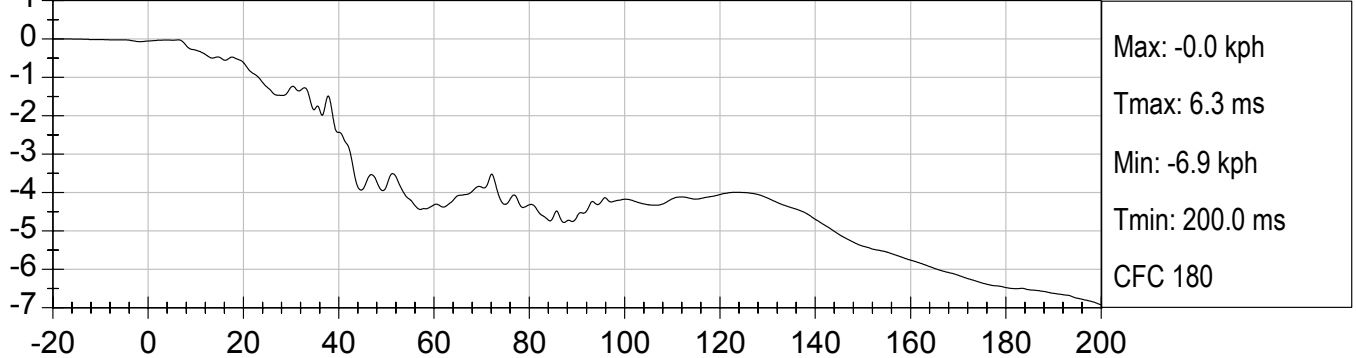




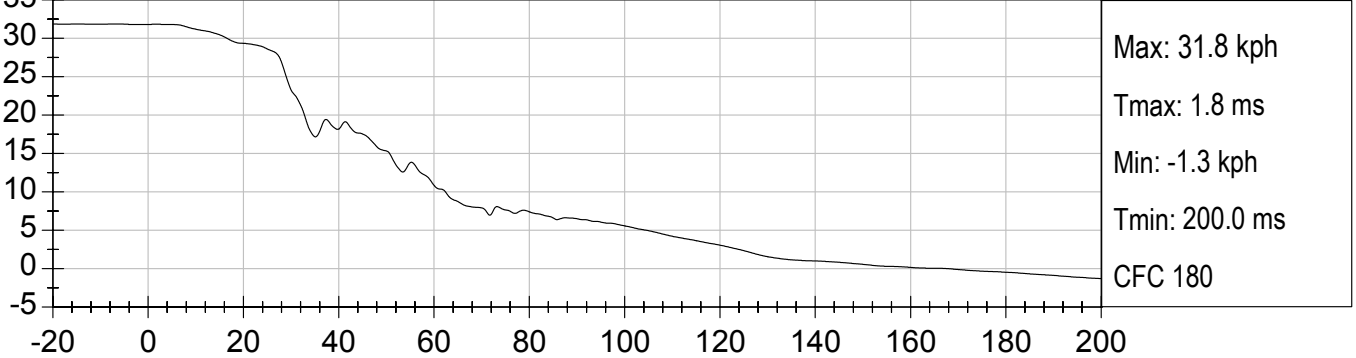




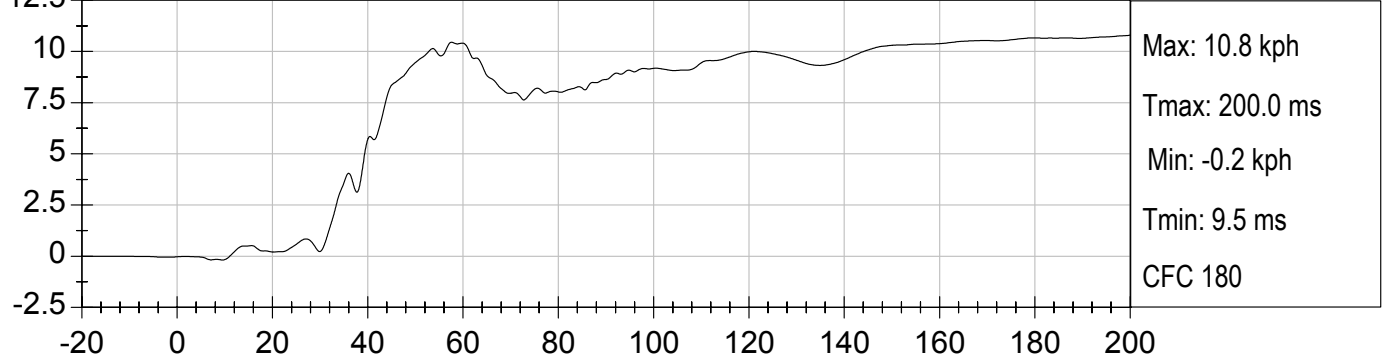
1 VEHICLE CG X Velocity (kph) vs TIME (ms)



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

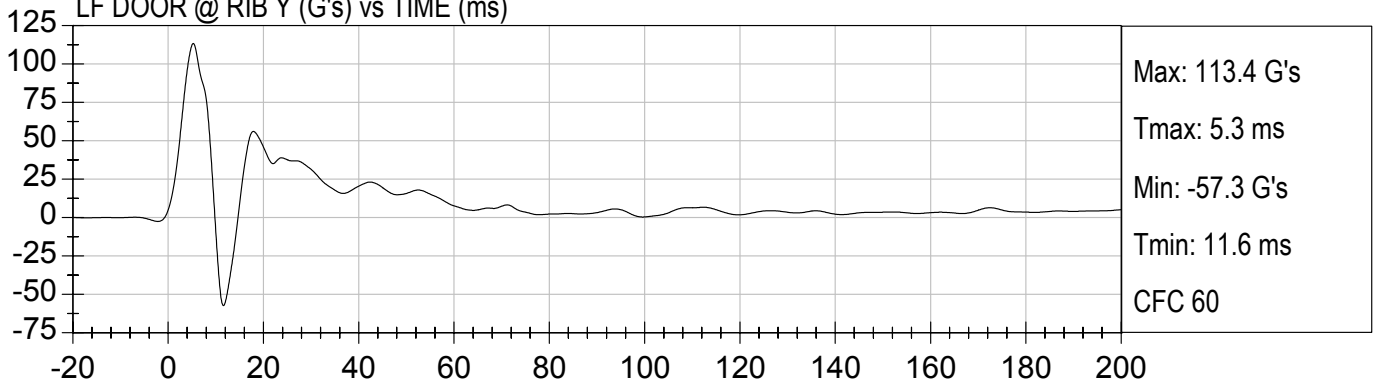


VEHICLE CG Z Velocity (kph) vs TIME (ms)

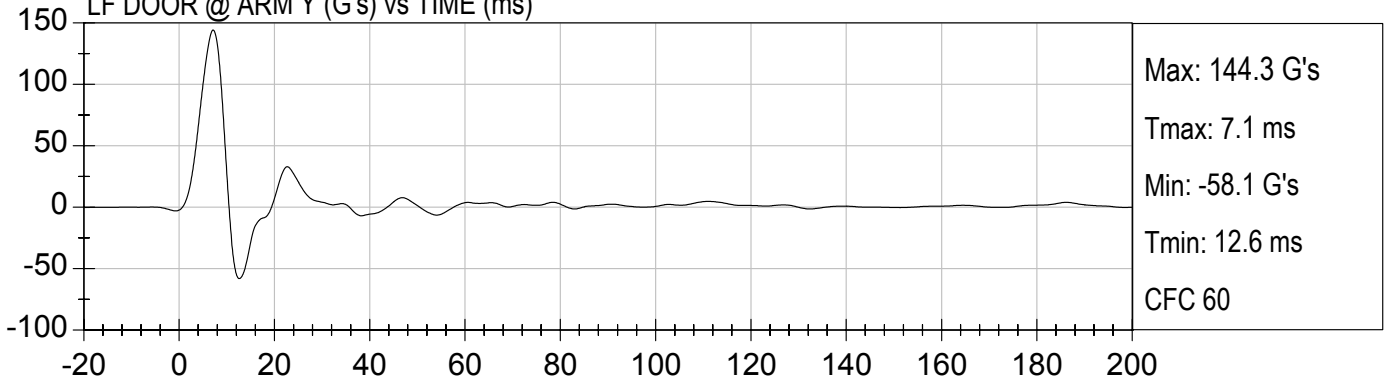




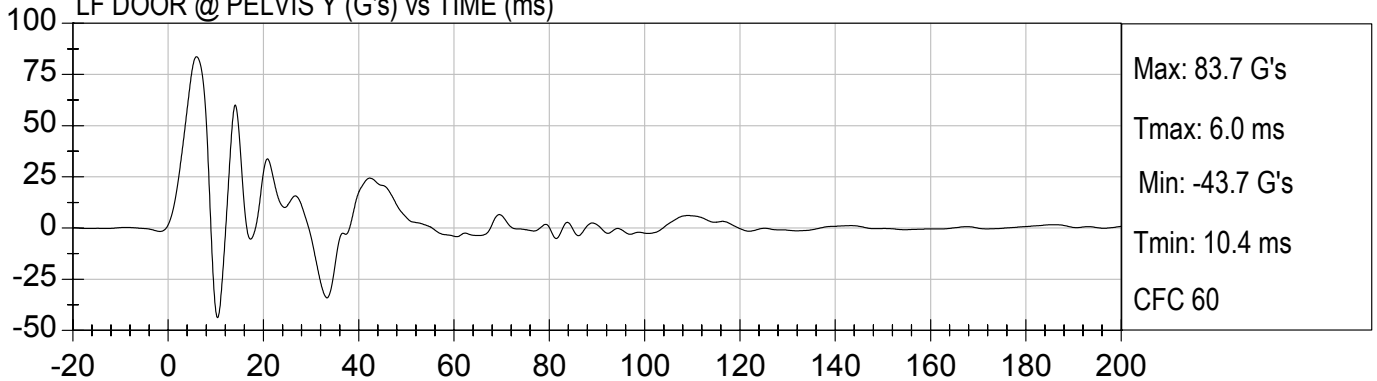
LF DOOR @ RIB Y (G's) vs TIME (ms)



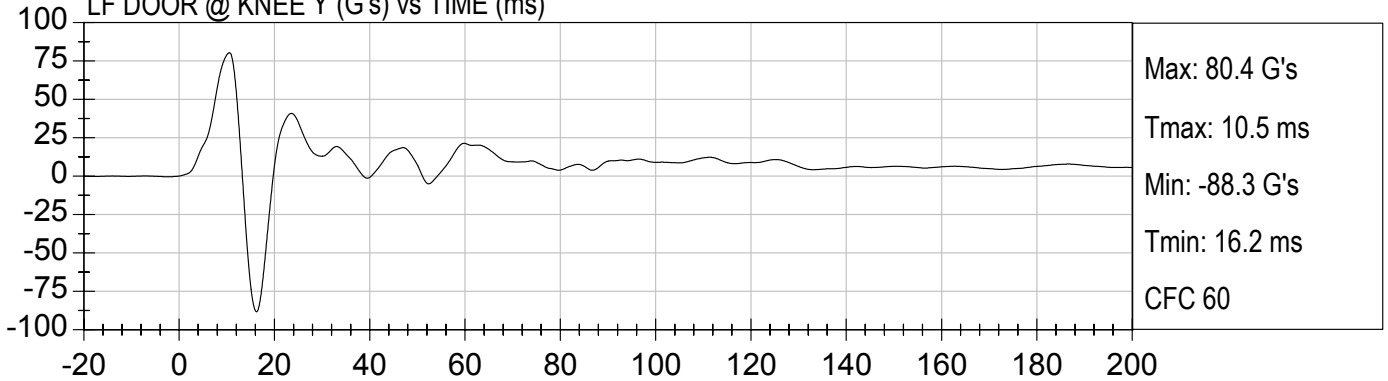
LF DOOR @ ARM Y (G's) vs TIME (ms)

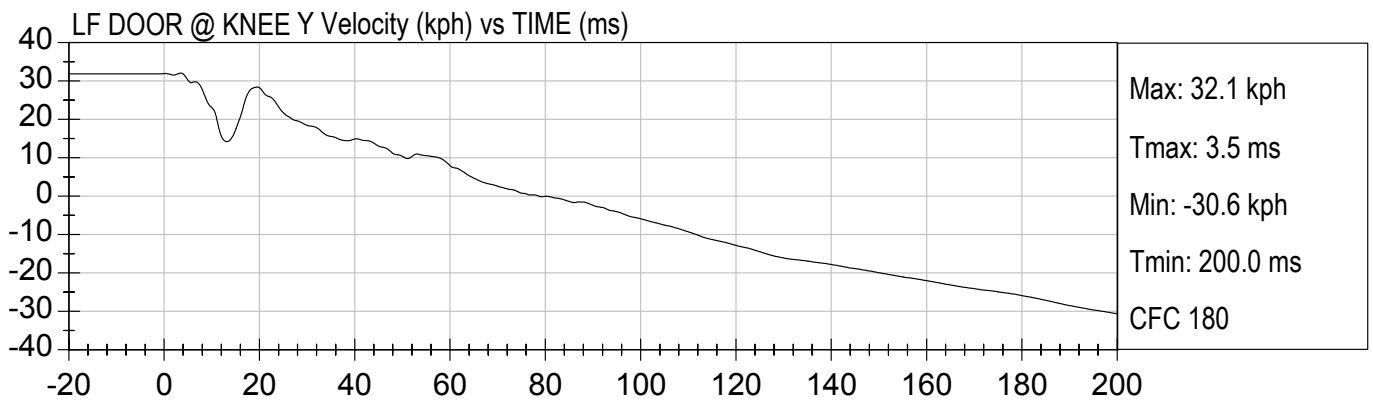
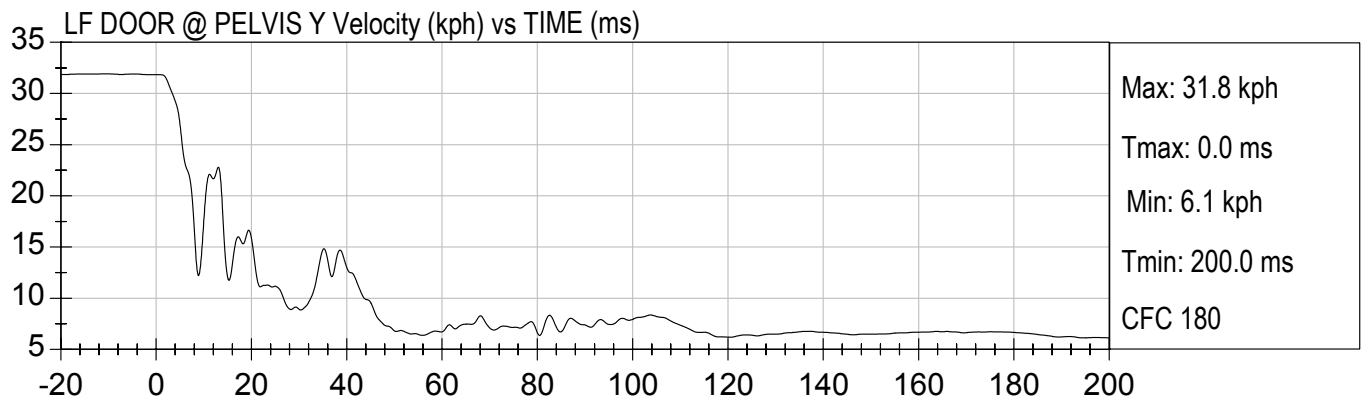
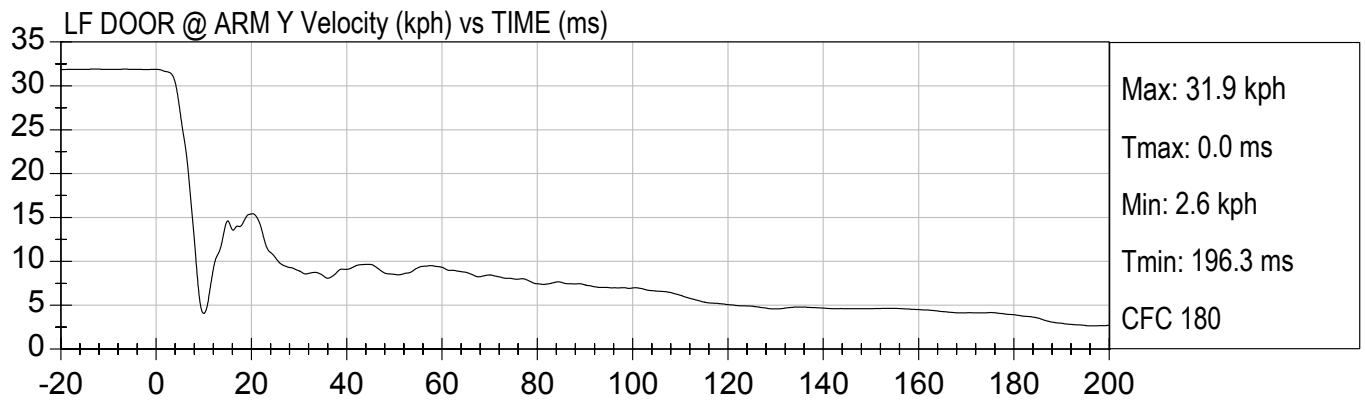
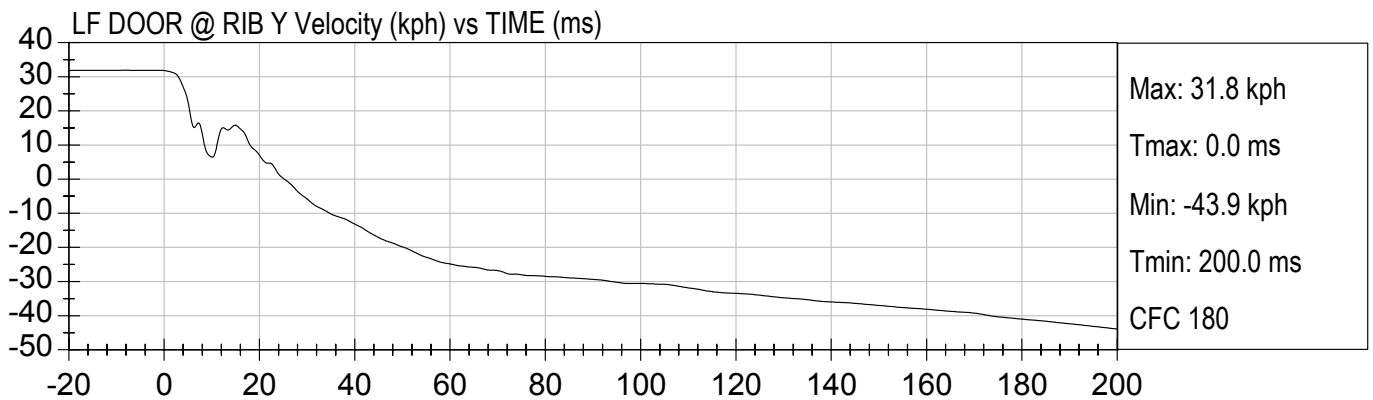


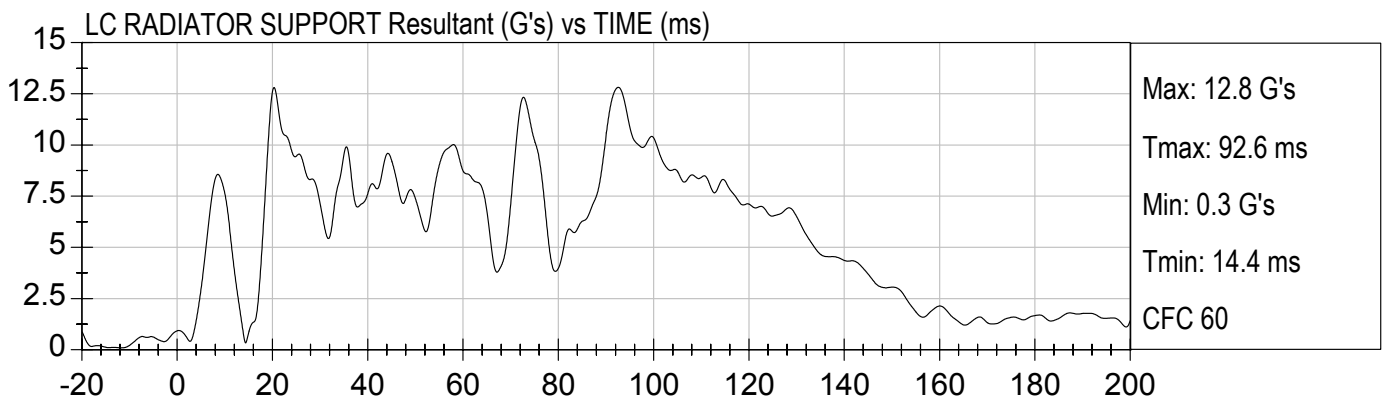
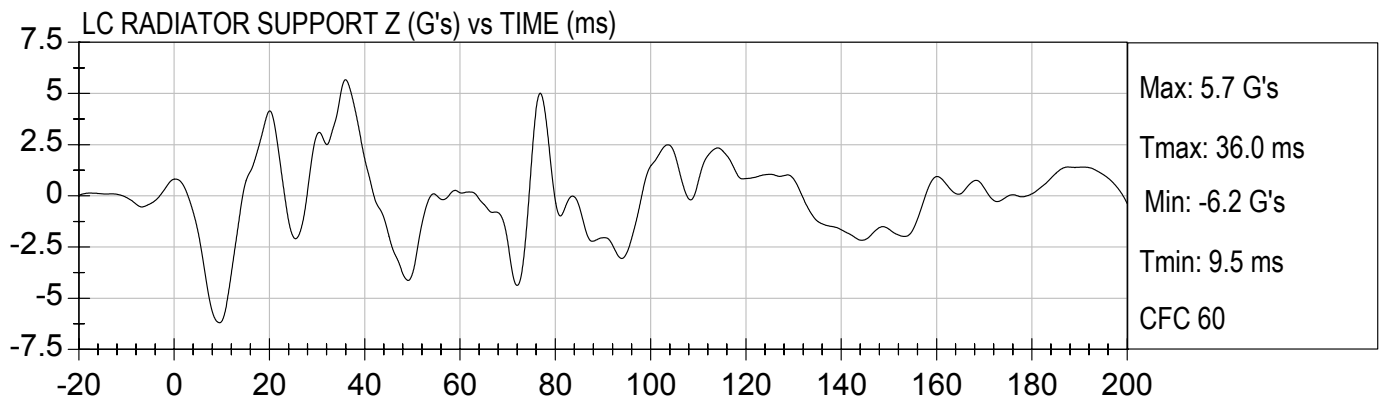
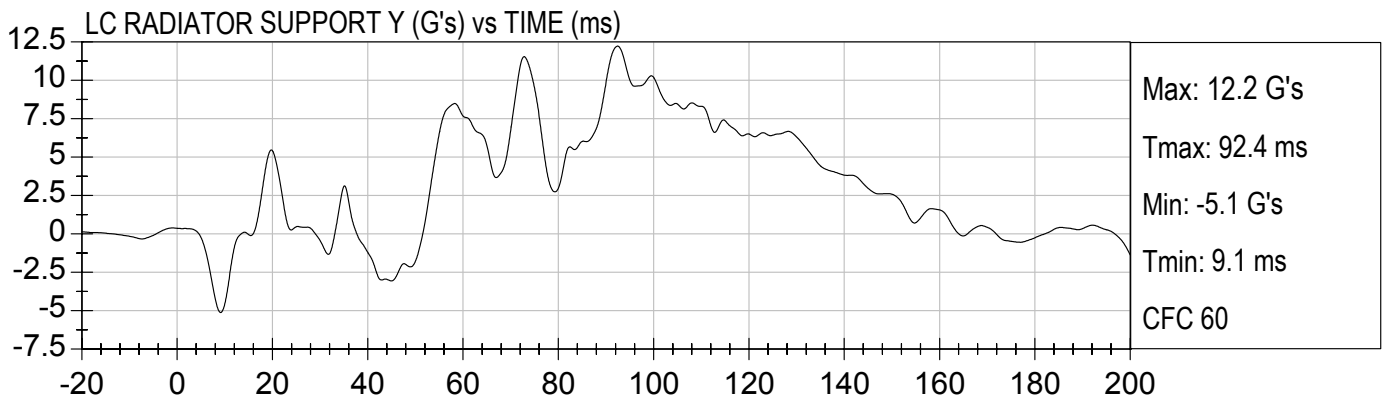
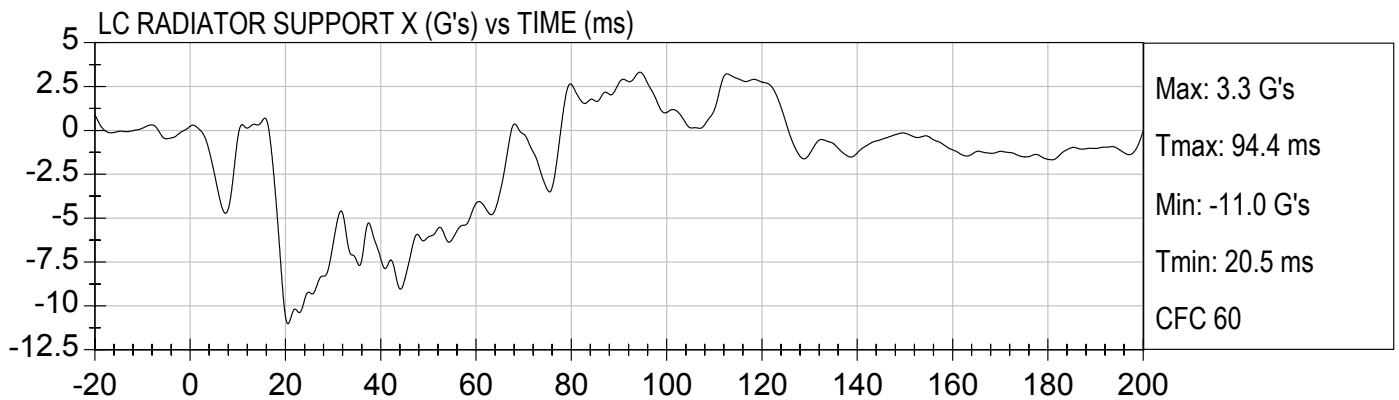
LF DOOR @ PELVIS Y (G's) vs TIME (ms)

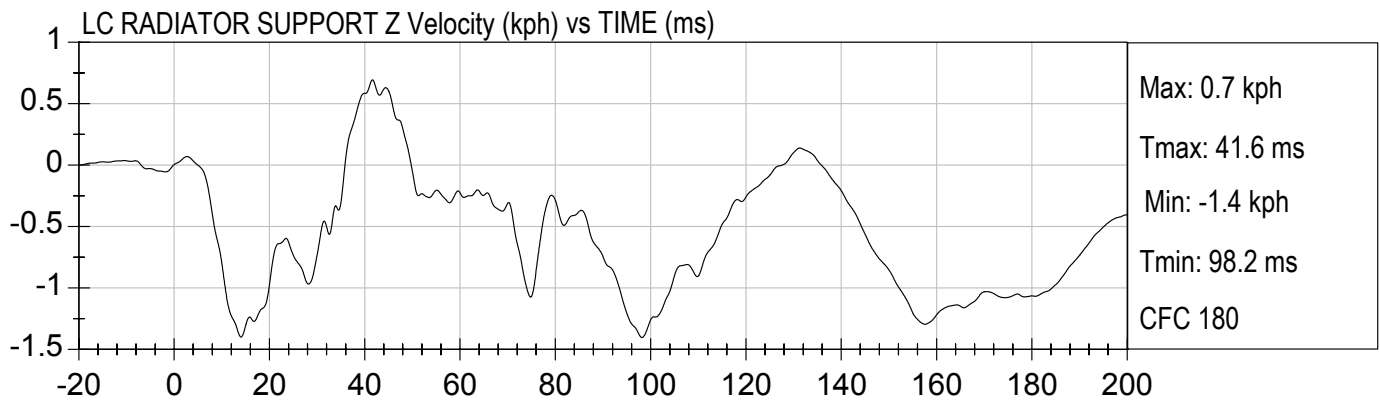
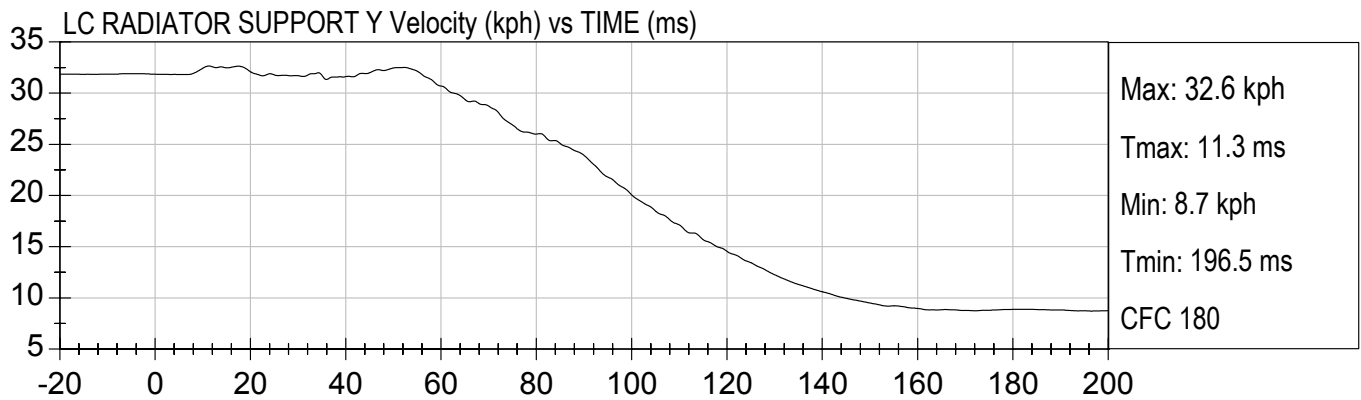
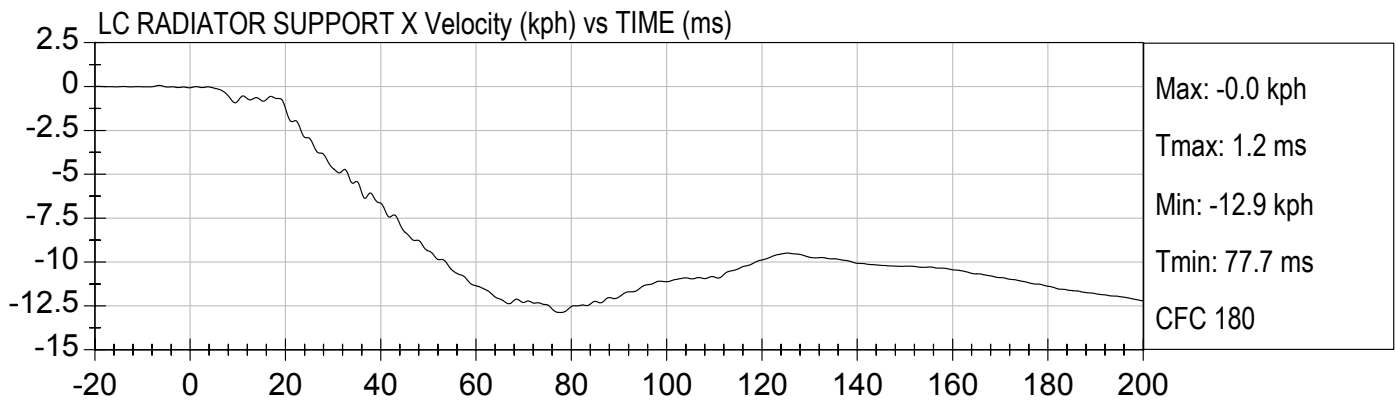


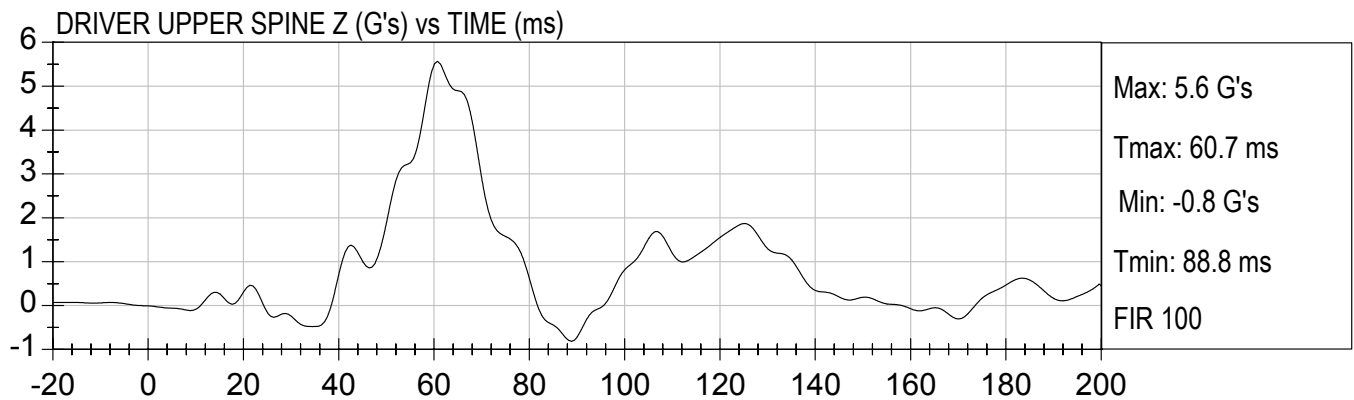
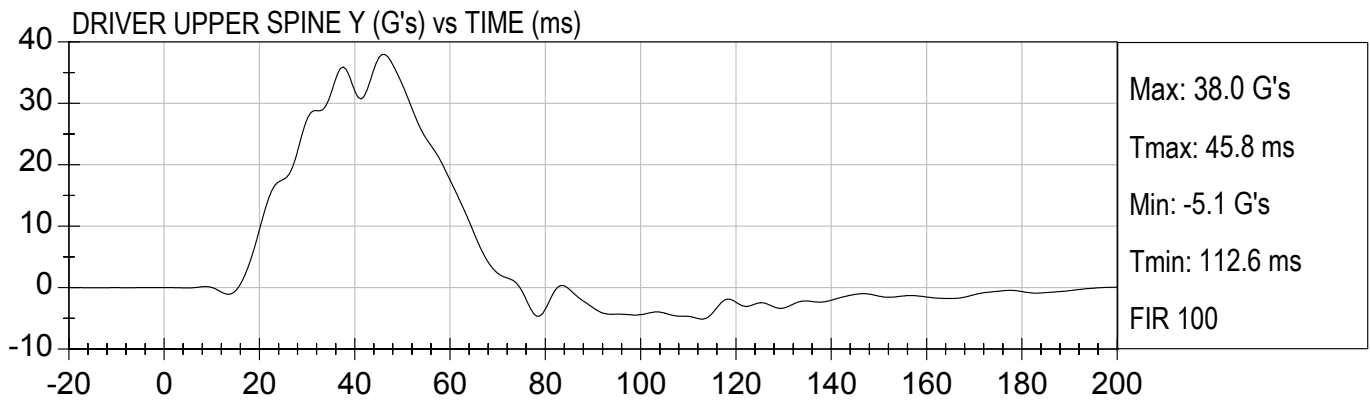
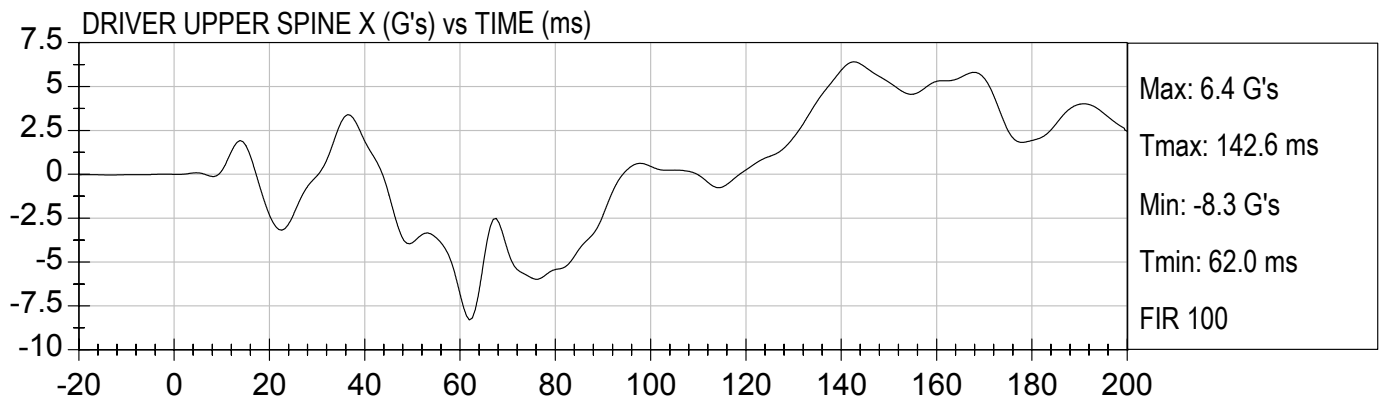
LF DOOR @ KNEE Y (G's) vs TIME (ms)

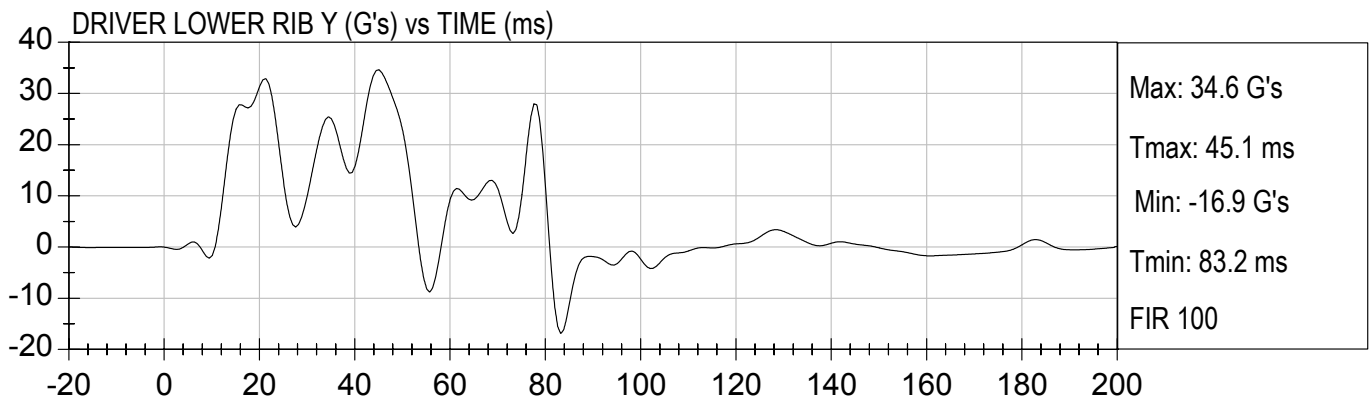
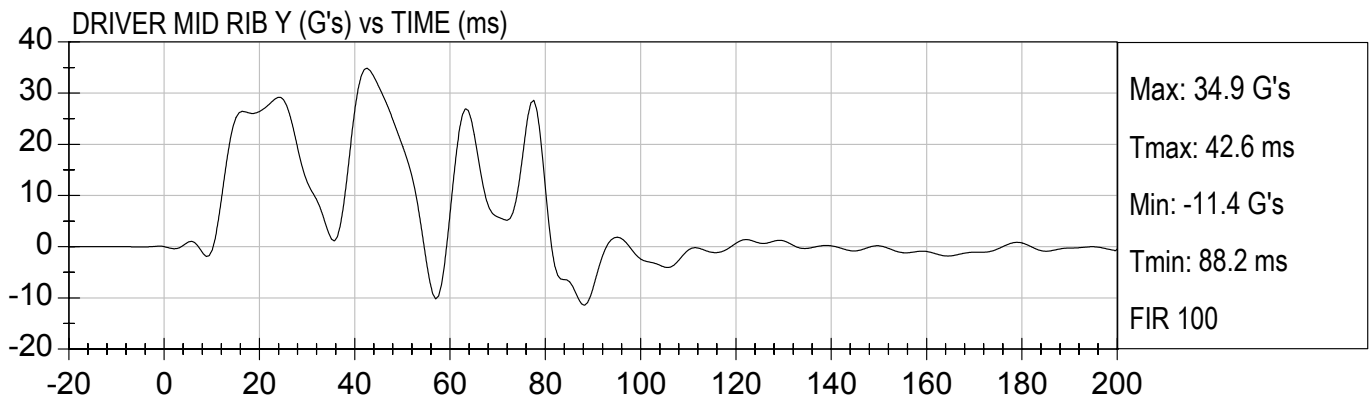
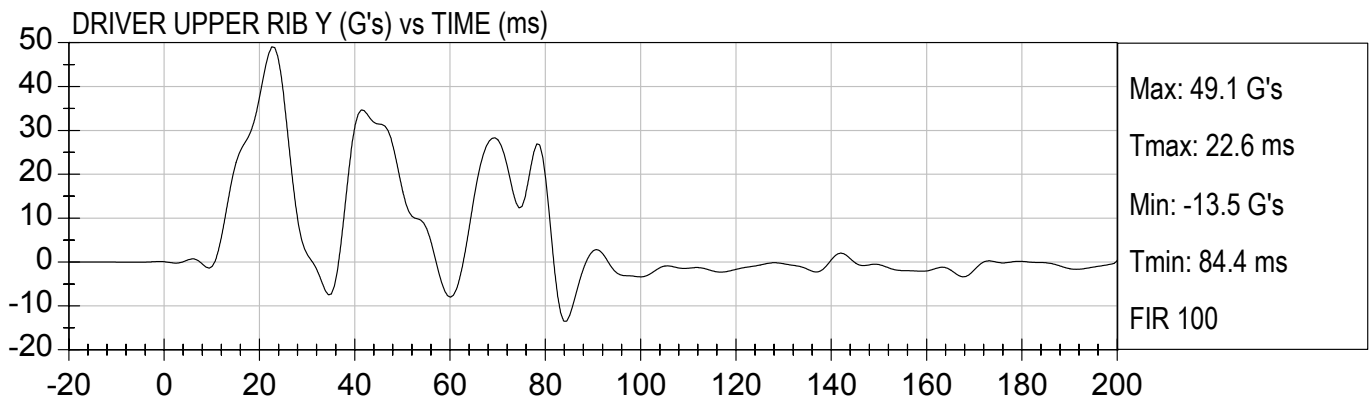


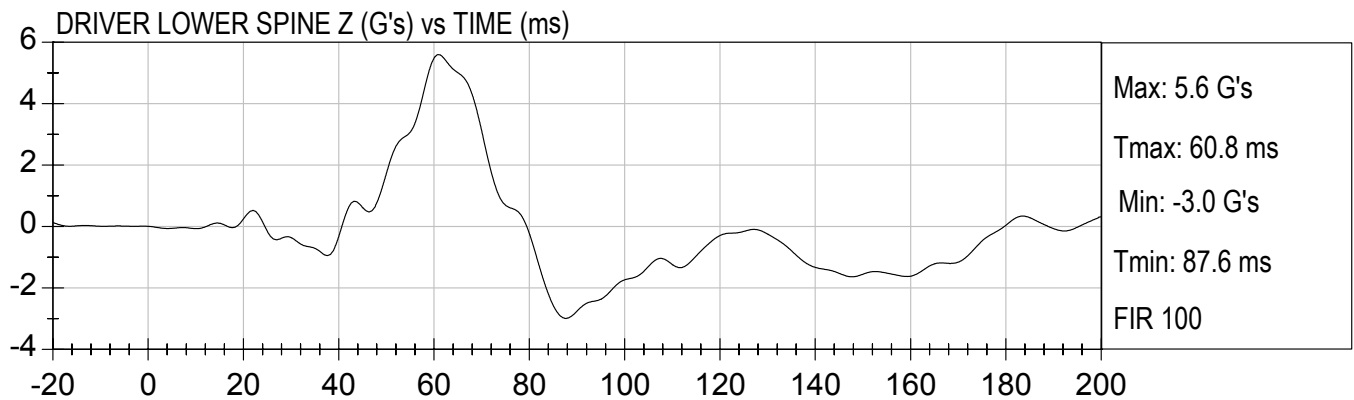
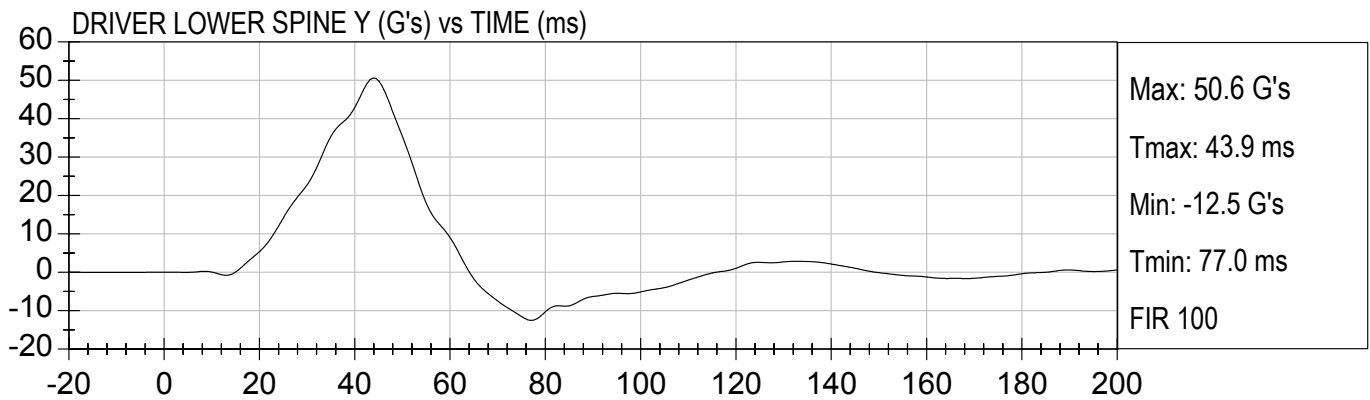
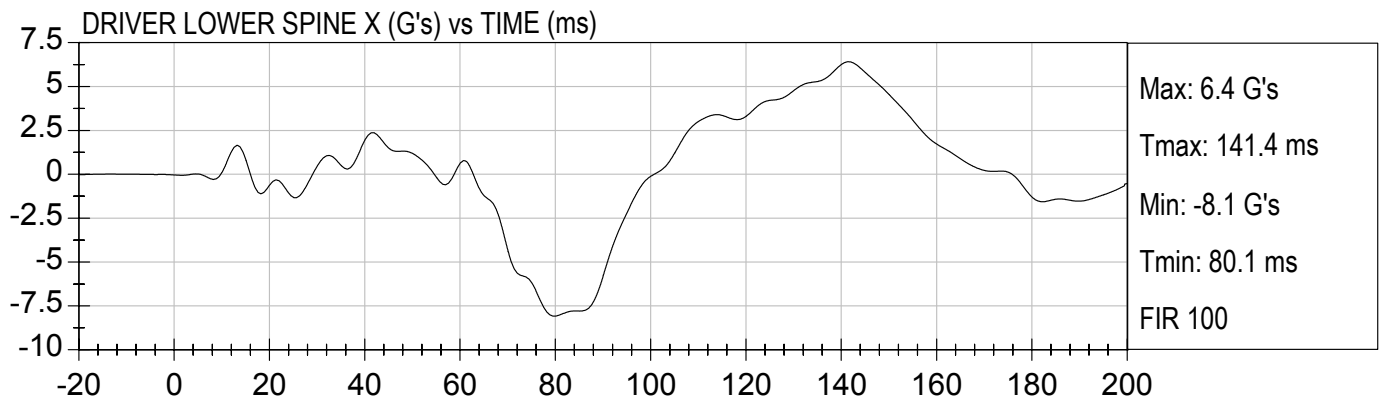


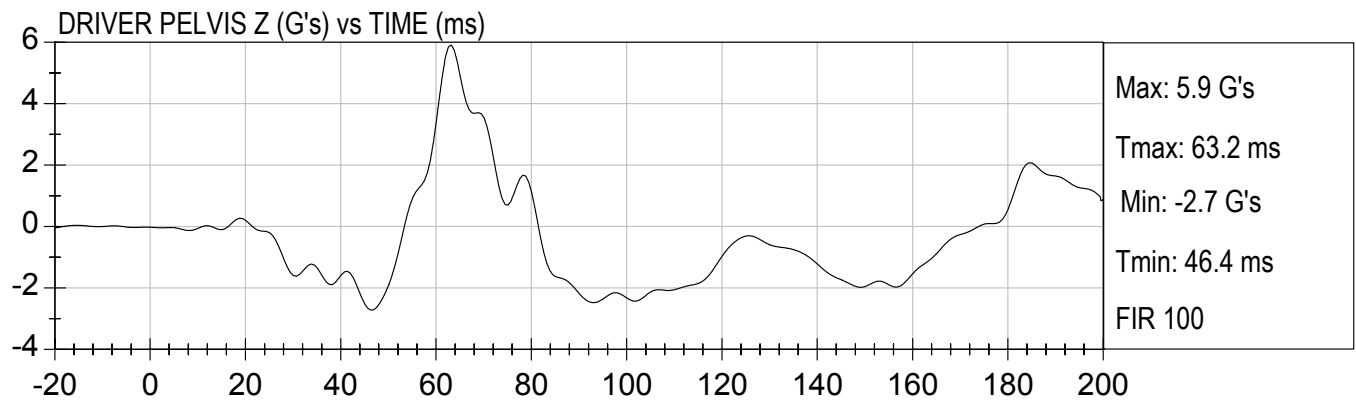
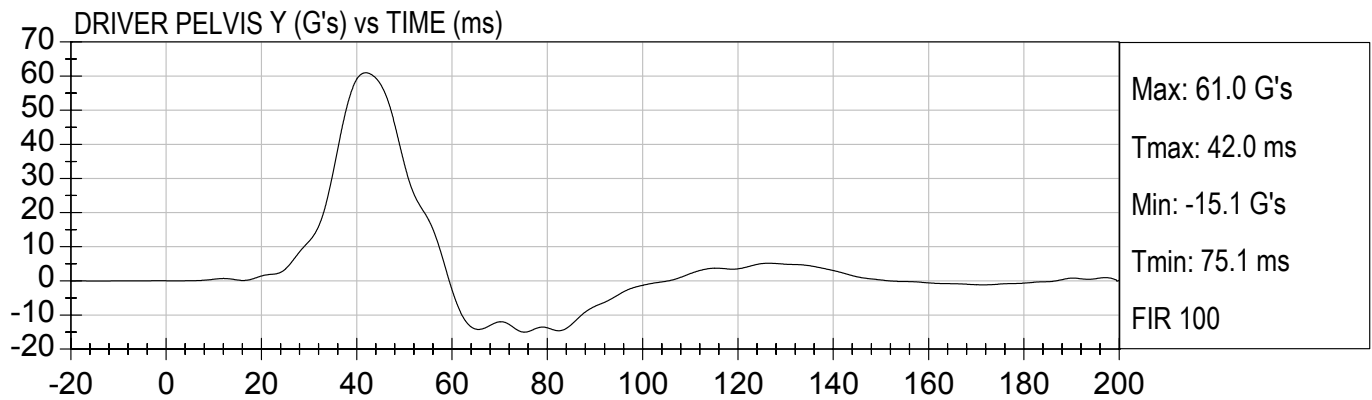
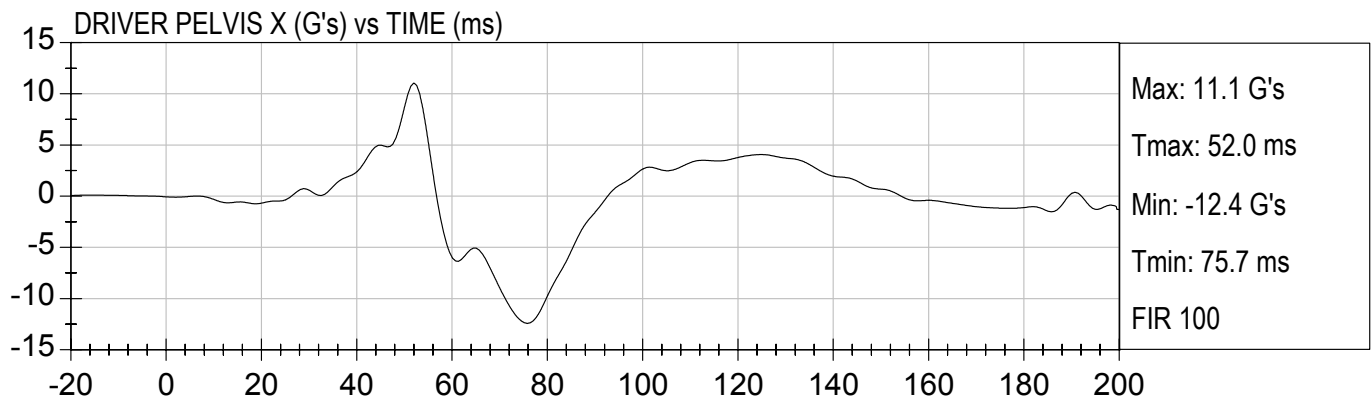


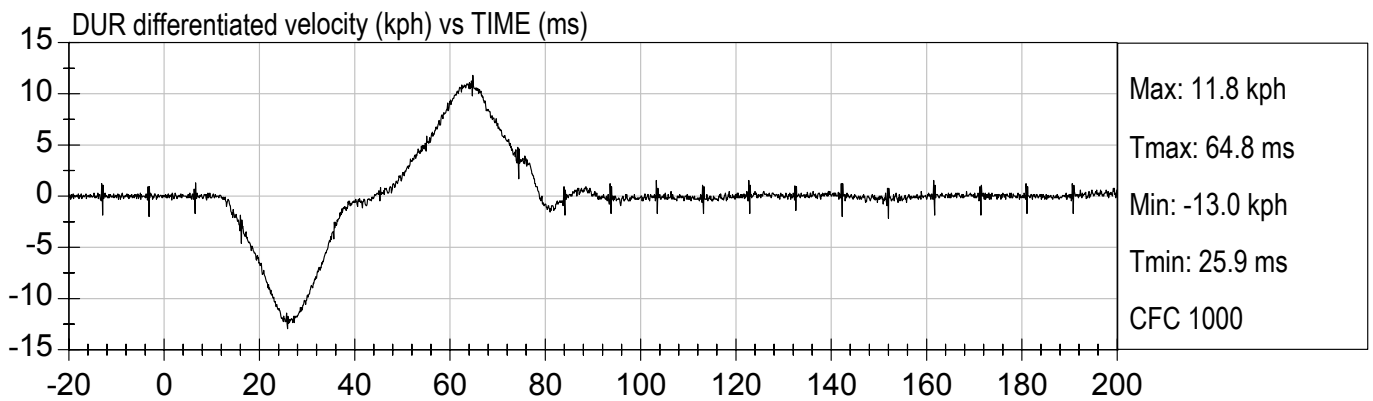
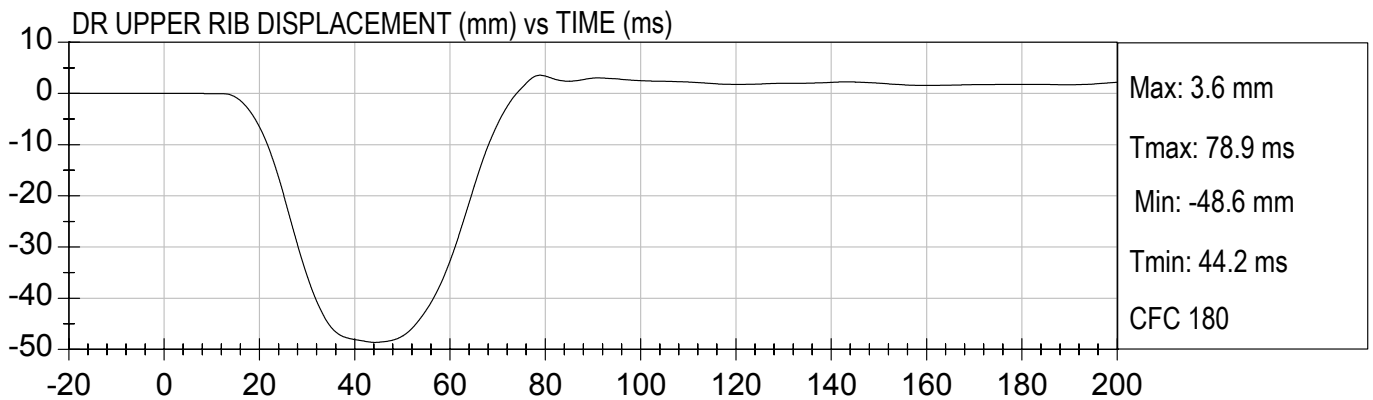
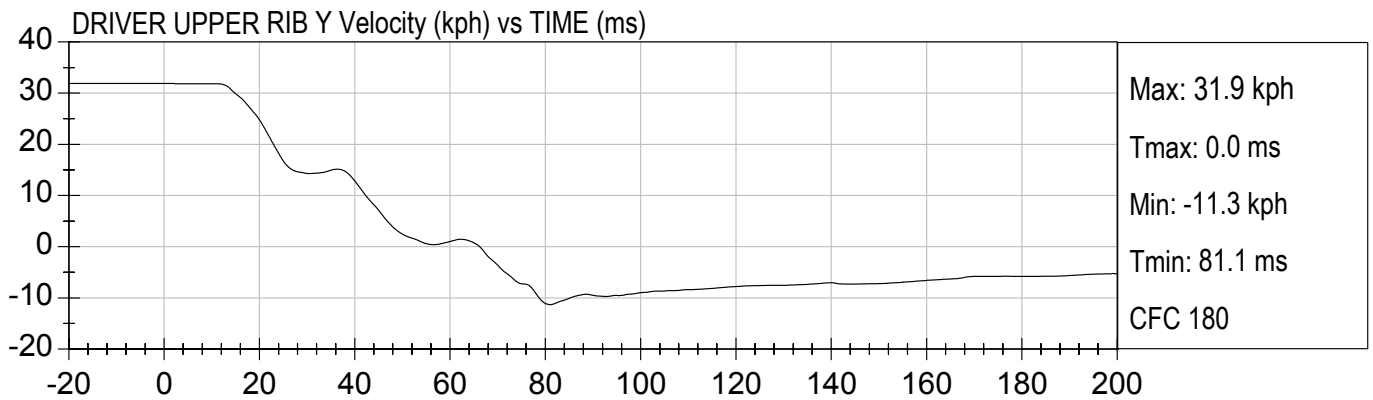
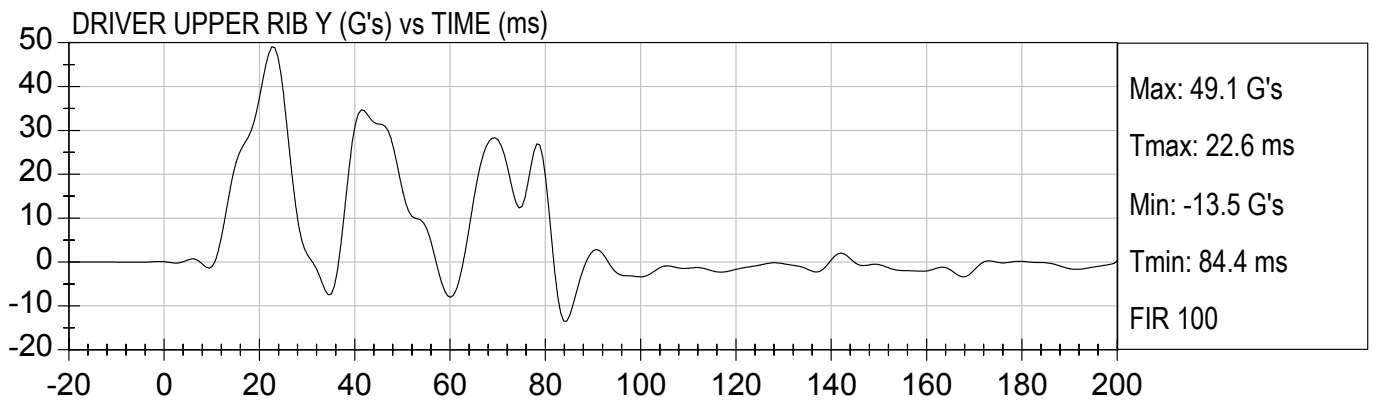


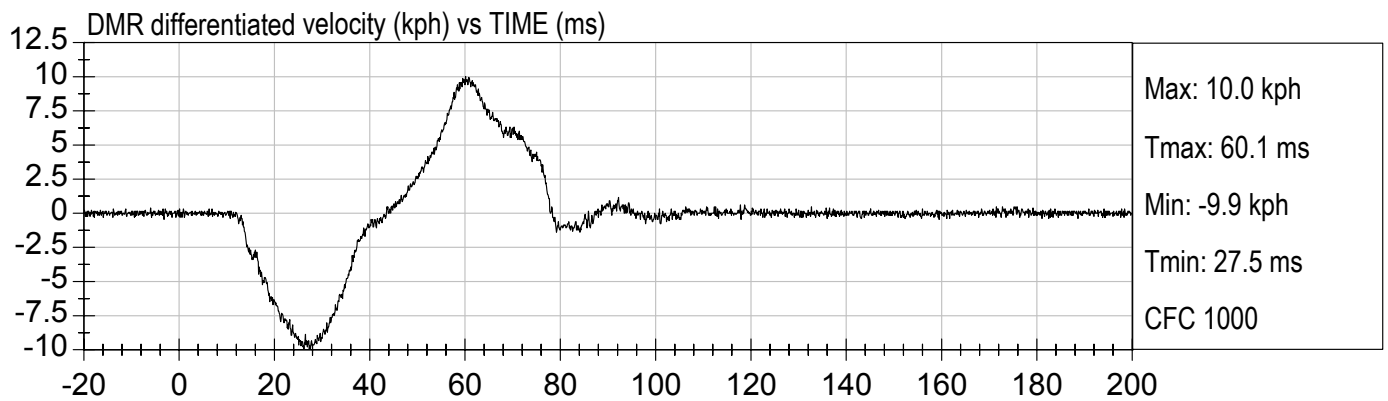
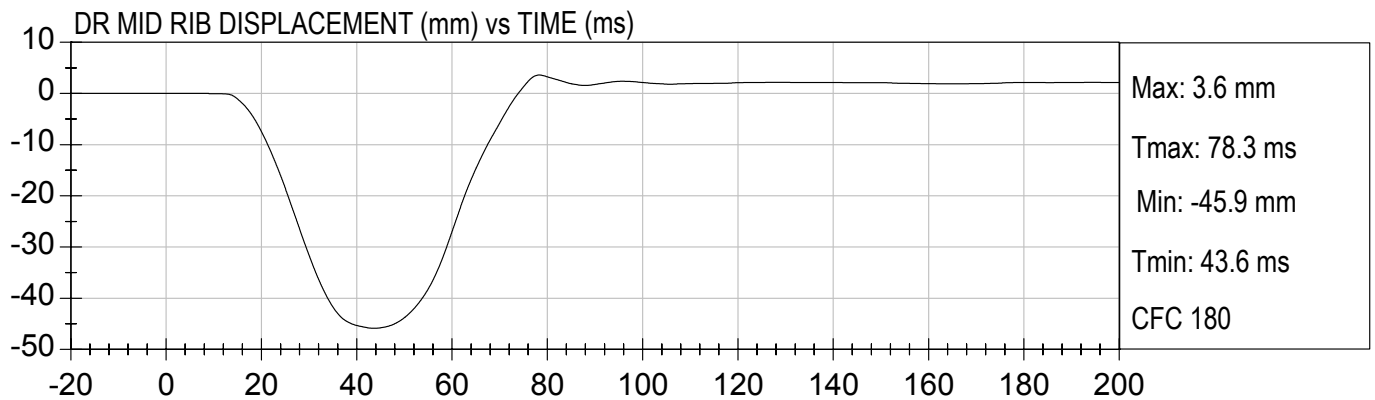
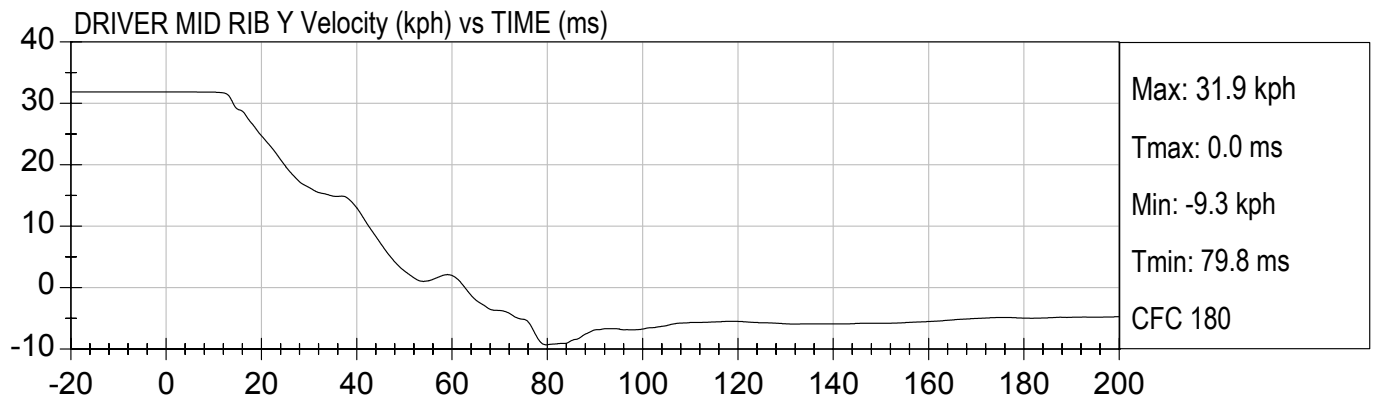
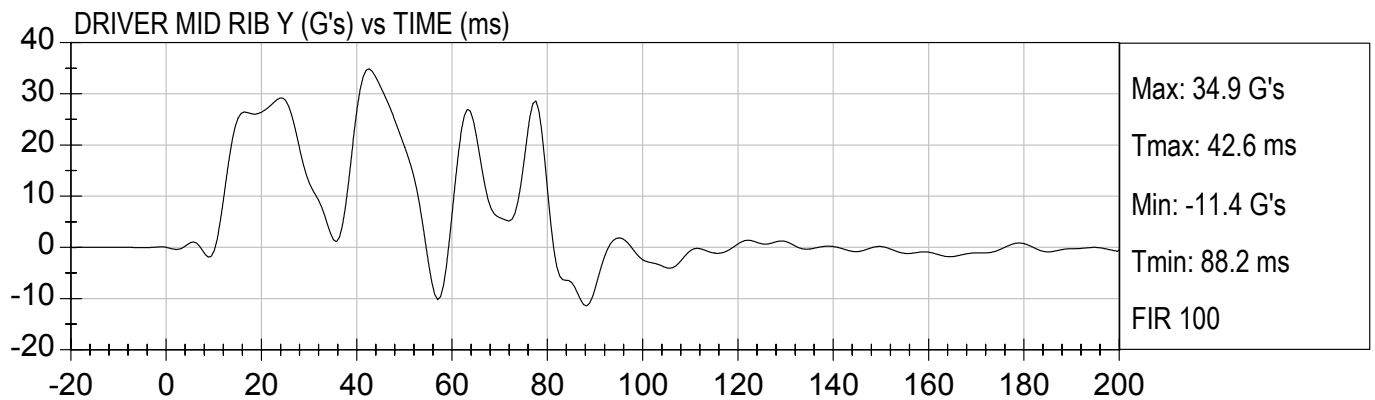


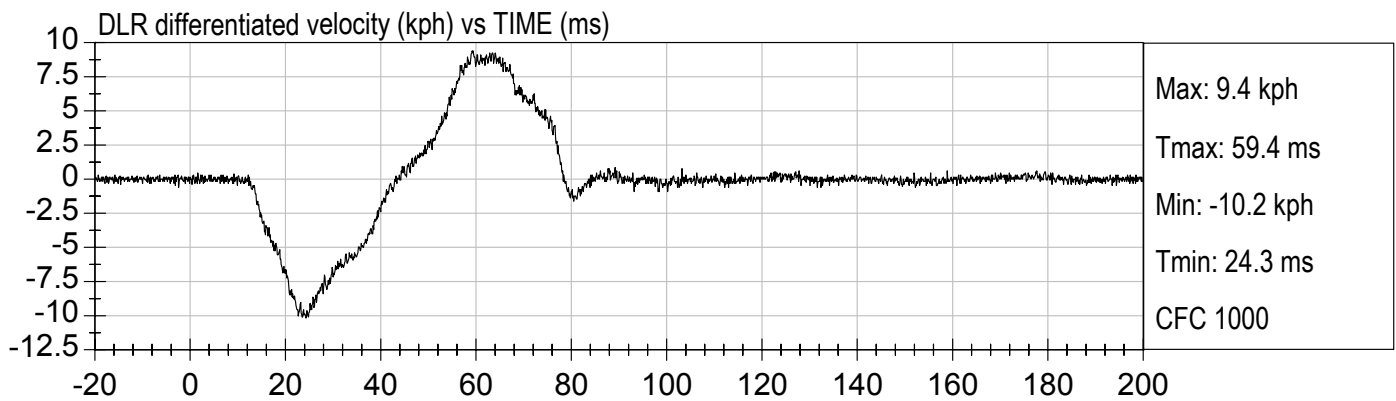
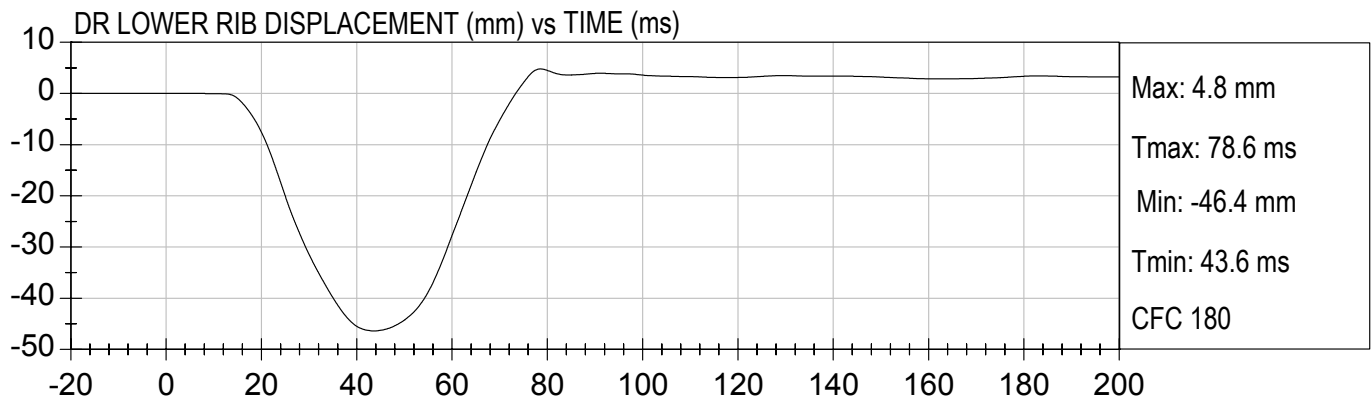
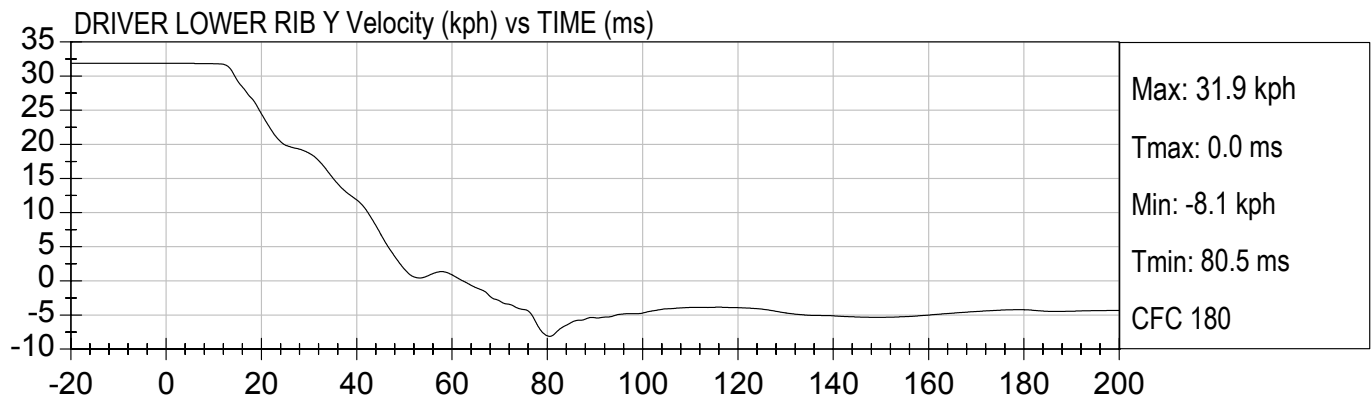
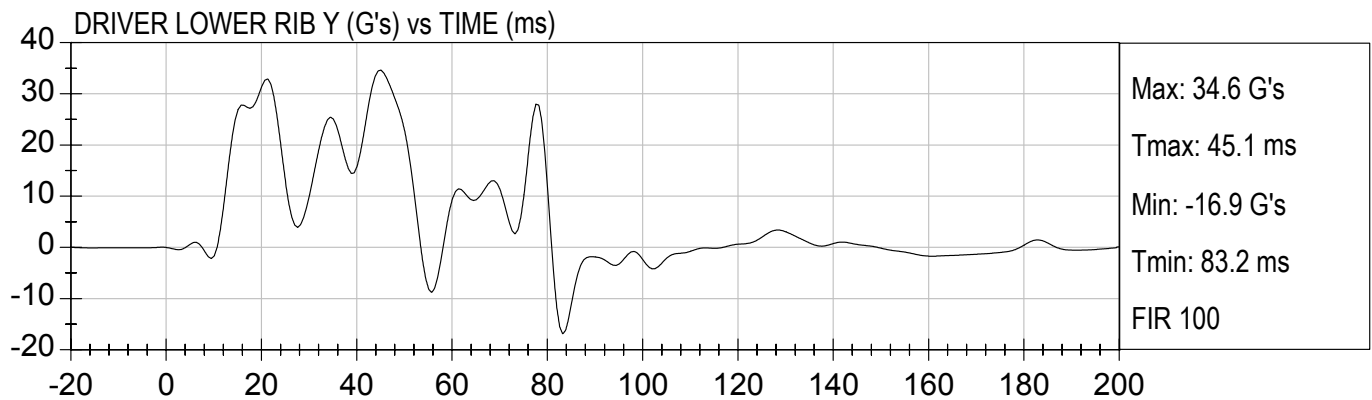












APPENDIX C

ES-2 CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CERTIFICATION DATA

Dummy Serial Number: 010

Calibration Test Results Summary

Dummy Serial Number: 010

Pre-Test Calibration

Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all impact test requirements.
Shoulder Impact Test:	The shoulder passed all impact test requirements.
Rib Tests:	All ribs passed all impact test requirements.
Abdomen Test:	The abdomen passed all impact test requirements.
Lumbar Spine Test:	The lumbar spine passed all impact test requirements.
Pelvis Test:	The pelvis passed all impact test requirements.

MGA RESEARCH CORPORATION
HEAD DROP TEST
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03141

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.9
Relative Humidity (%)	10 – 70	17.4
Peak Resultant Acceleration	100 – 150 g's	146
Time of Max. Res. Acceleration	msec	2.5

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

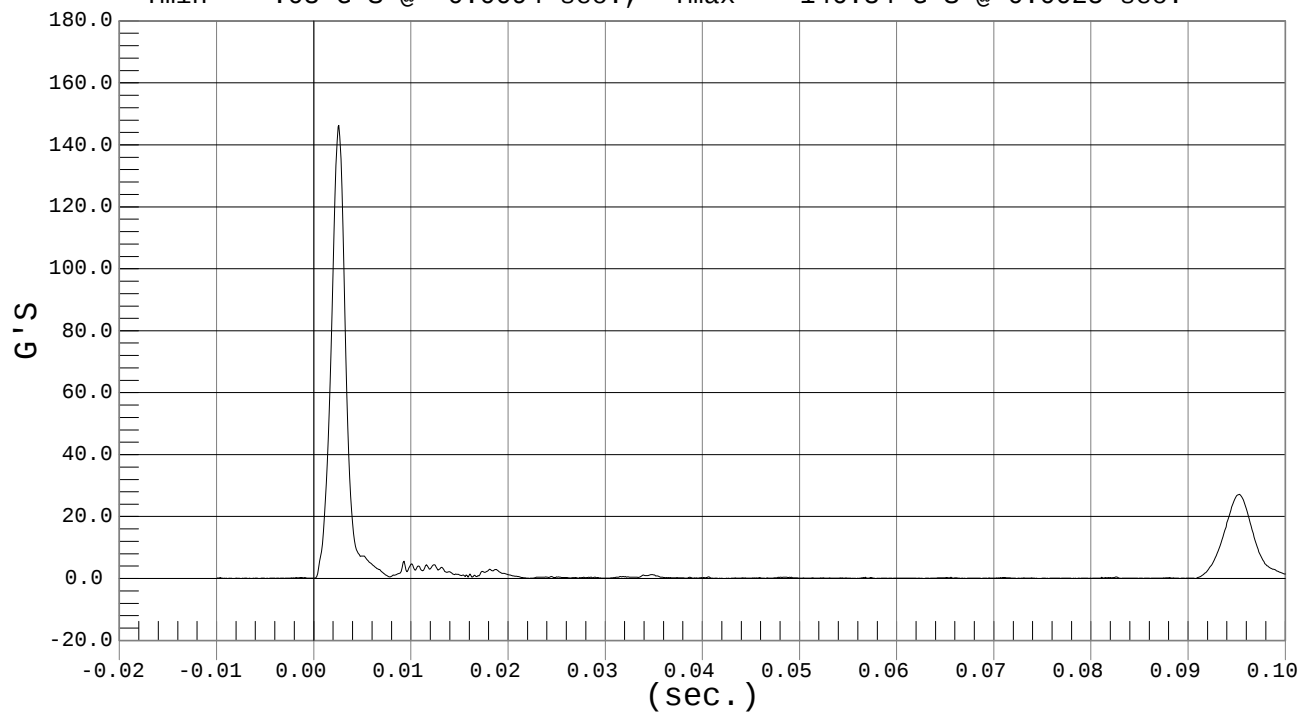


PEAK RESULTANT ACCELERATION

Test Desc.: Head Drop
Component: Dummy #010

Test Date: 02-07-03
Speed: 0.0 fps, 0.00 M/s

Ymin = .03 G'S @ -0.0094 sec., Ymax = 146.34 G'S @ 0.0025 sec.



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03142

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	20.8
Relative Humidity (%)		10 – 70	20
Pendulum Speed		3.3 - 3.5	3.4
Pendulum Deceleration	3 msec	~.25 - ~.53 m/sec	-.32
	8 msec	~1.59 - ~2.04 m/sec	-1.71
	14 msec	~3.20 - ~3.85 m/sec	-3.35
Maximum Flexion Angle		49.0 – 59.0 deg	56.8
Time of Max. Flexion Angle		54.0 – 66.0 ms	61.1
Maximum Angle Theta (A)		32.0 – 37.0 deg	35.0
Time of Max. Theta (A)		53.0 – 63.0 ms	54.0
Maximum Angle Theta (B)		30.10 – 32.60 deg	31.9
Time of Max. Theta (B)		54.0 – 64.0 ms	58.1

TEST MEETS SPECIFICATIONS

Technician: _____

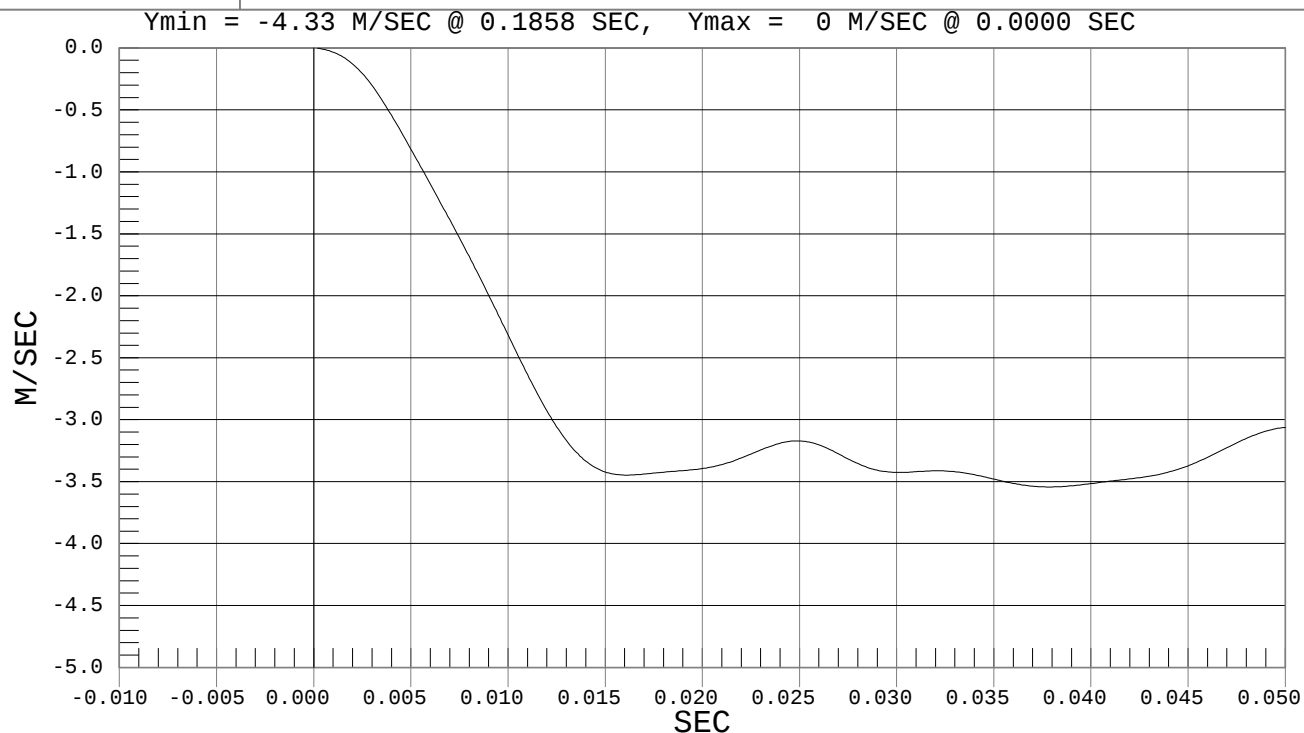
Approved By: _____



PENDULUM DECELERATION

Test Desc.: Neck Bending
Component: Dummy #010

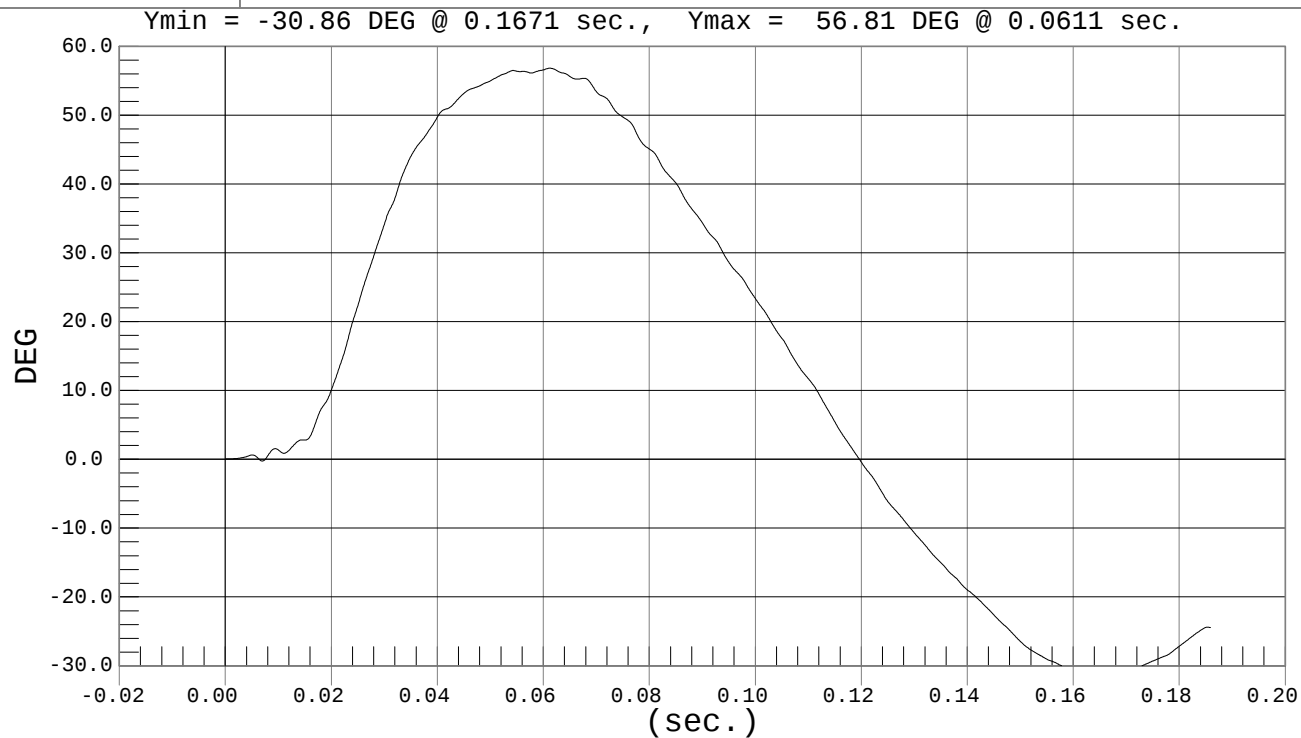
Test Date: 02-07-03
Speed: 11.1 fps, 3.38 M/s



FLEXION ANGLE

Test Desc.: Neck Bending
Component: Dummy #010

Test Date: 02-07-03
Speed: 11.1 fps, 3.38 M/s



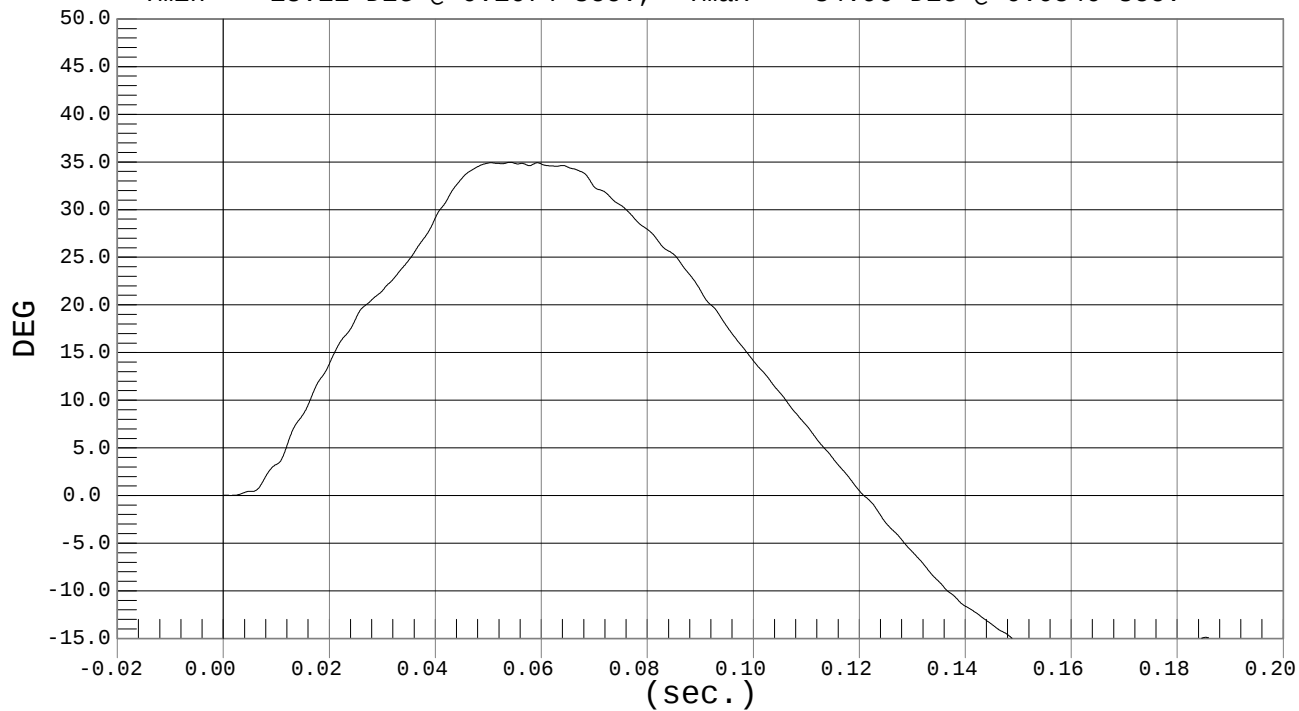


Test Desc.: Neck Bending
Component: Dummy #010

THETA A

Test Date: 02-07-03
Speed: 11.1 fps, 3.38 M/s

Ymin = -18.11 DEG @ 0.1674 sec., Ymax = 34.96 DEG @ 0.0540 sec.

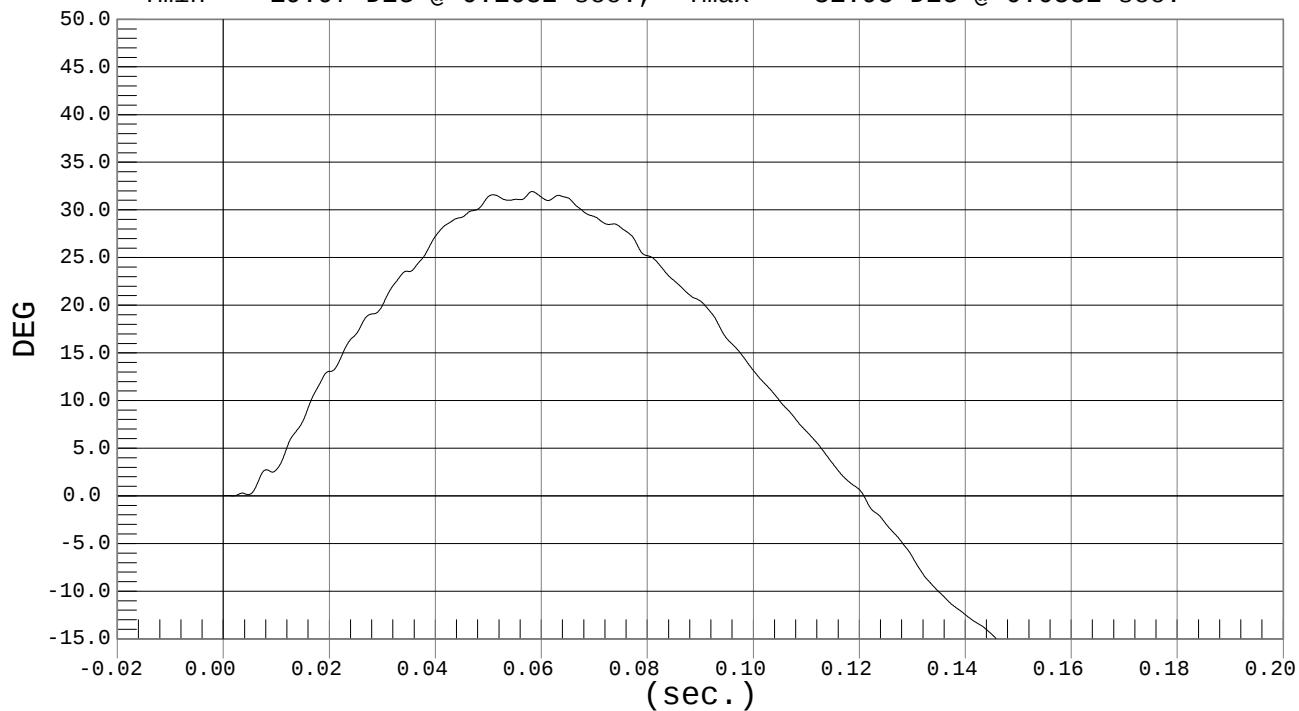


Test Desc.: Neck Bending
Component: Dummy #010

THETA B

Test Date: 02-07-03
Speed: 11.1 fps, 3.38 M/s

Ymin = -19.97 DEG @ 0.1682 sec., Ymax = 31.93 DEG @ 0.0581 sec.



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03143

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	20
Pendulum Speed	4.2 – 4.4 m/s	4.3
Max. Resultant Acceleration	7.5 – 10.5 g's	10.3
Time of Max. Pendulum Acceleration	msec	14.6

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

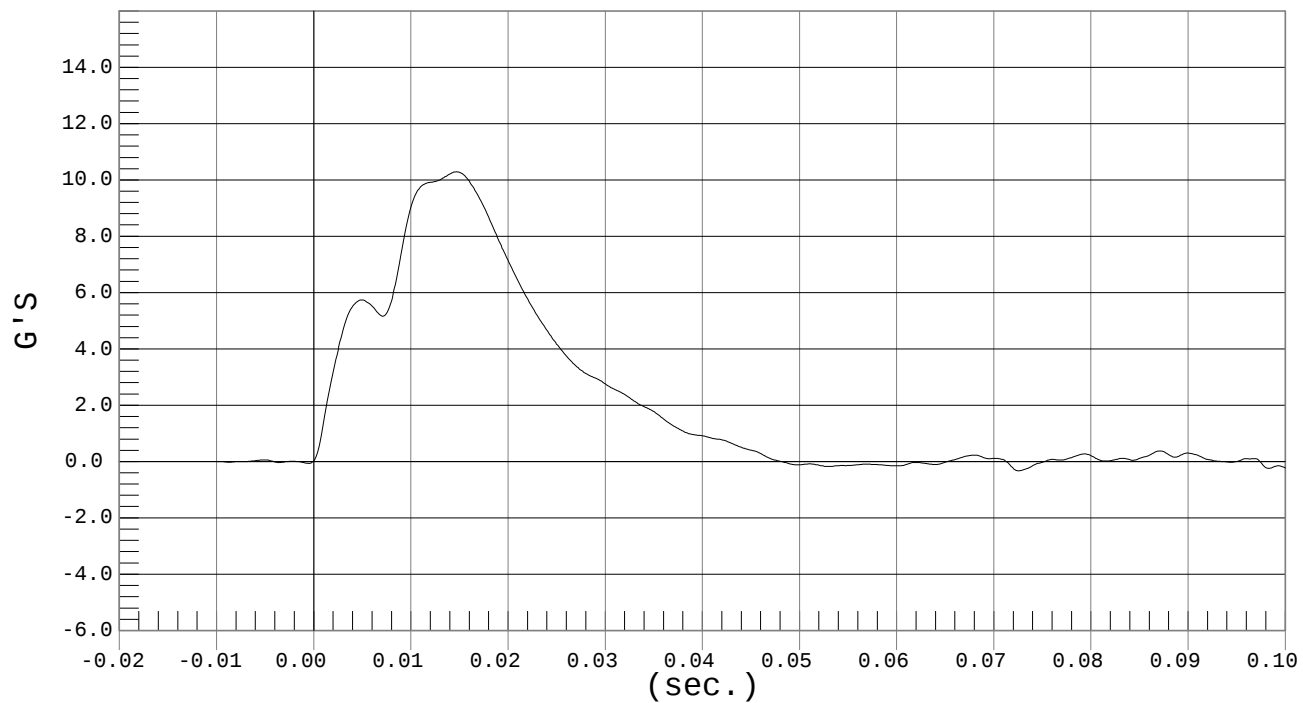


SHOULDER ACCELERATION

Test Desc.: Shoulder Impact
Component: Dummy #010

Test Date: 02-07-03
Speed: 14.1 fps, 4.30 M/s

Ymin = -.36 G'S @ 0.1020 sec., Ymax = 10.29 G'S @ 0.0146 sec.



MGA RESEARCH CORPORATION
UPPER/MIDDLE/LOWER RIB TESTS
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03144/5/6

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	18
Displacement at 2 m/s	23.5 – 27.5 mm	25.5
Displacement at 3 m/s	36.0 – 40.0 mm	38.5
Displacement at 4 m/s	46.0 – 51.0 mm	50.6

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	18
Displacement at 2 m/s	23.5 – 27.5 mm	25.0
Displacement at 3 m/s	36.0 – 40.0 mm	37.7
Displacement at 4 m/s	46.0 – 51.0 mm	48.1

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	18
Displacement at 2 m/s	23.5 – 27.5 mm	25.3
Displacement at 3 m/s	36.0 – 40.0 mm	38.0
Displacement at 4 m/s	46.0 – 51.0 mm	49.7

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

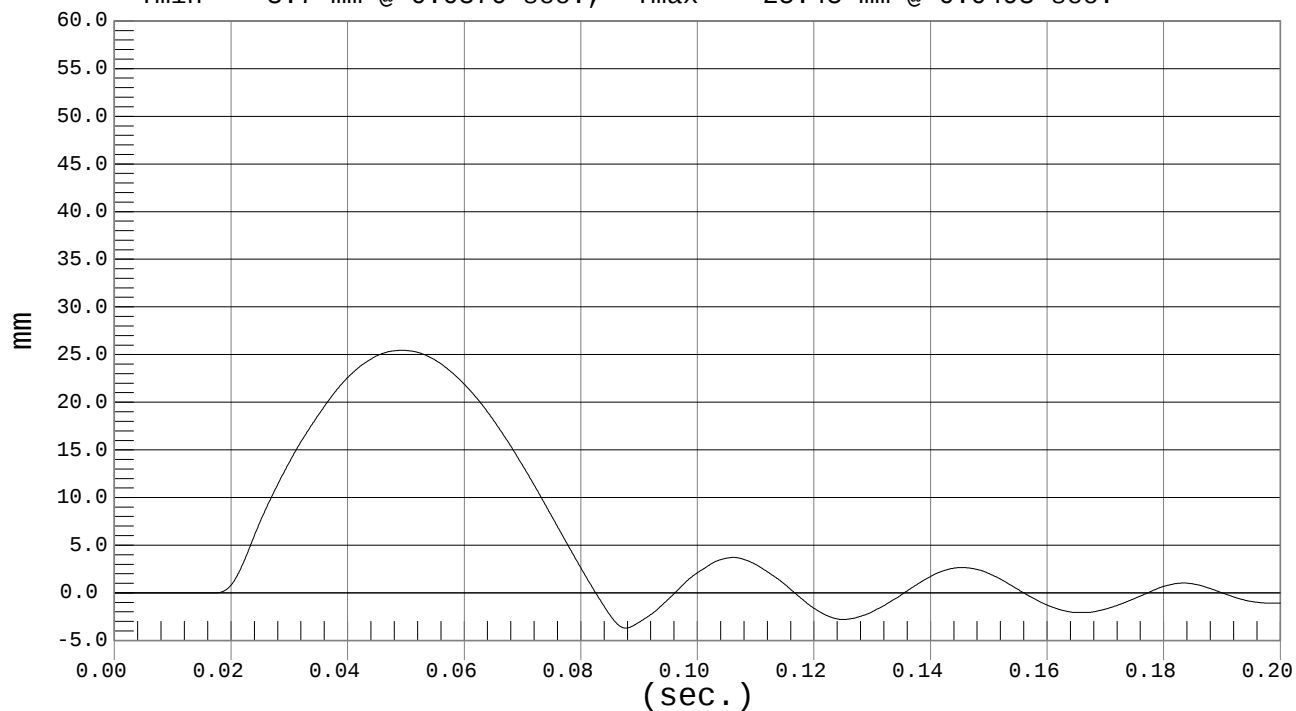


UPPER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 6.6 fps, 2.00 M/s

Ymin = -3.7 mm @ 0.0876 sec., Ymax = 25.45 mm @ 0.0493 sec.

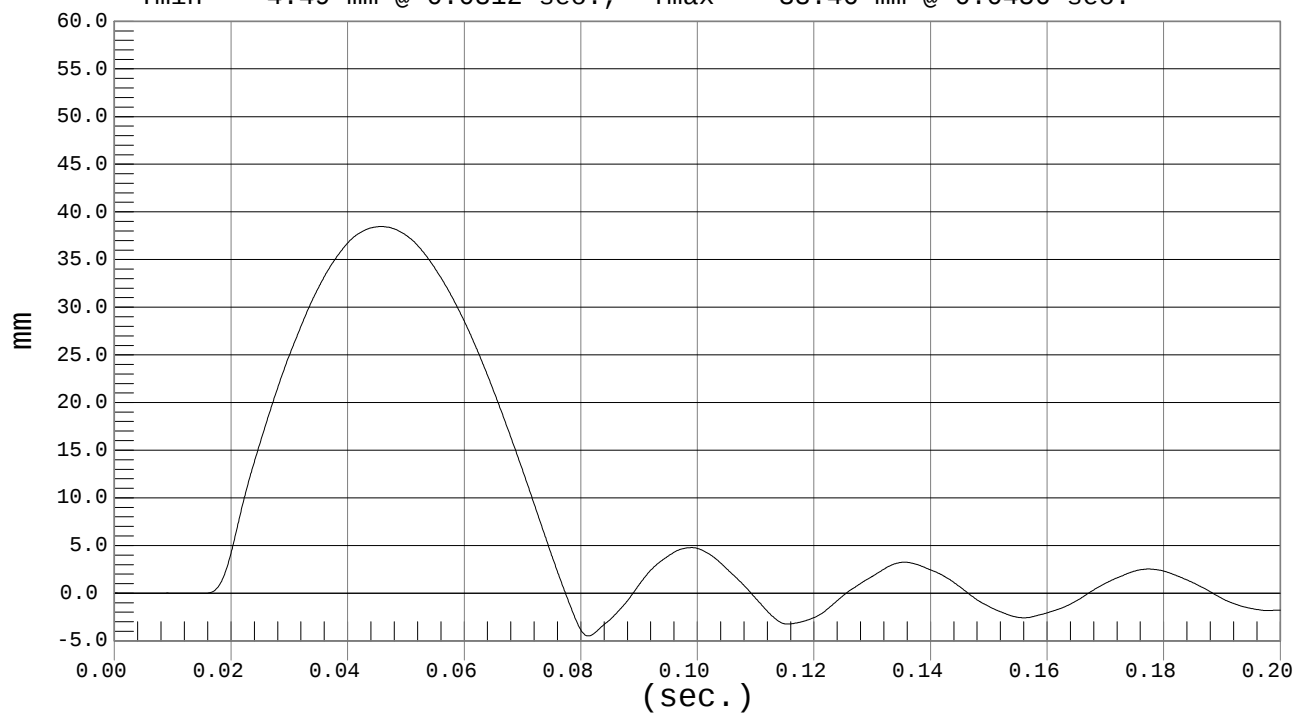


UPPER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 9.8 fps, 3.00 M/s

Ymin = -4.49 mm @ 0.0812 sec., Ymax = 38.46 mm @ 0.0456 sec.



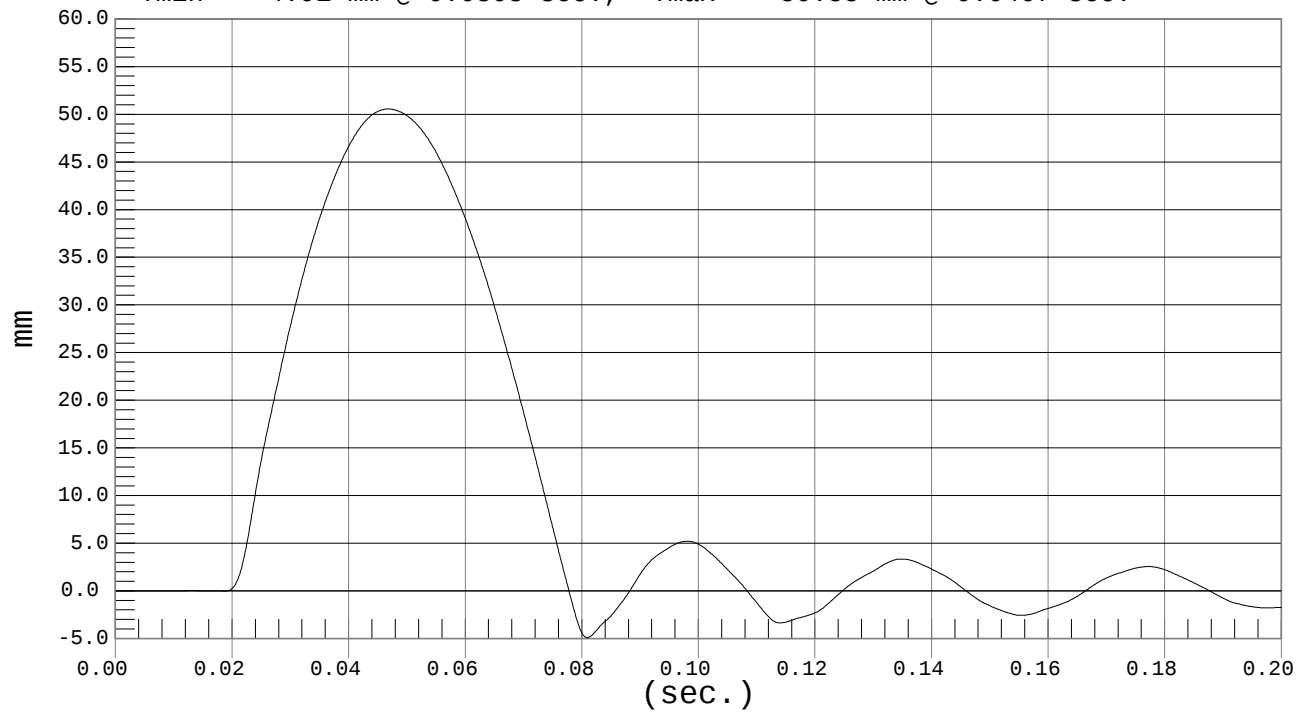


UPPER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -4.91 mm @ 0.0808 sec., Ymax = 50.55 mm @ 0.0467 sec.



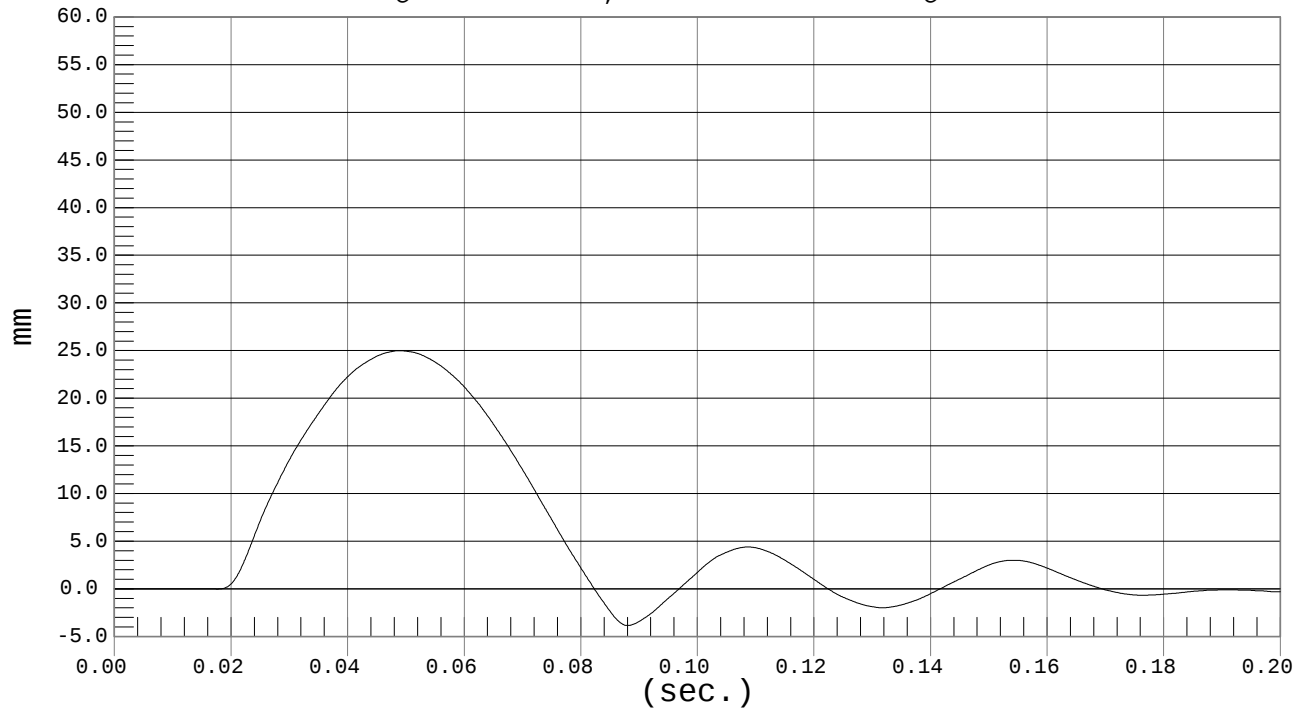


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 6.6 fps, 2.00 M/s

Ymin = -3.84 mm @ 0.0879 sec., Ymax = 24.98 mm @ 0.0488 sec.

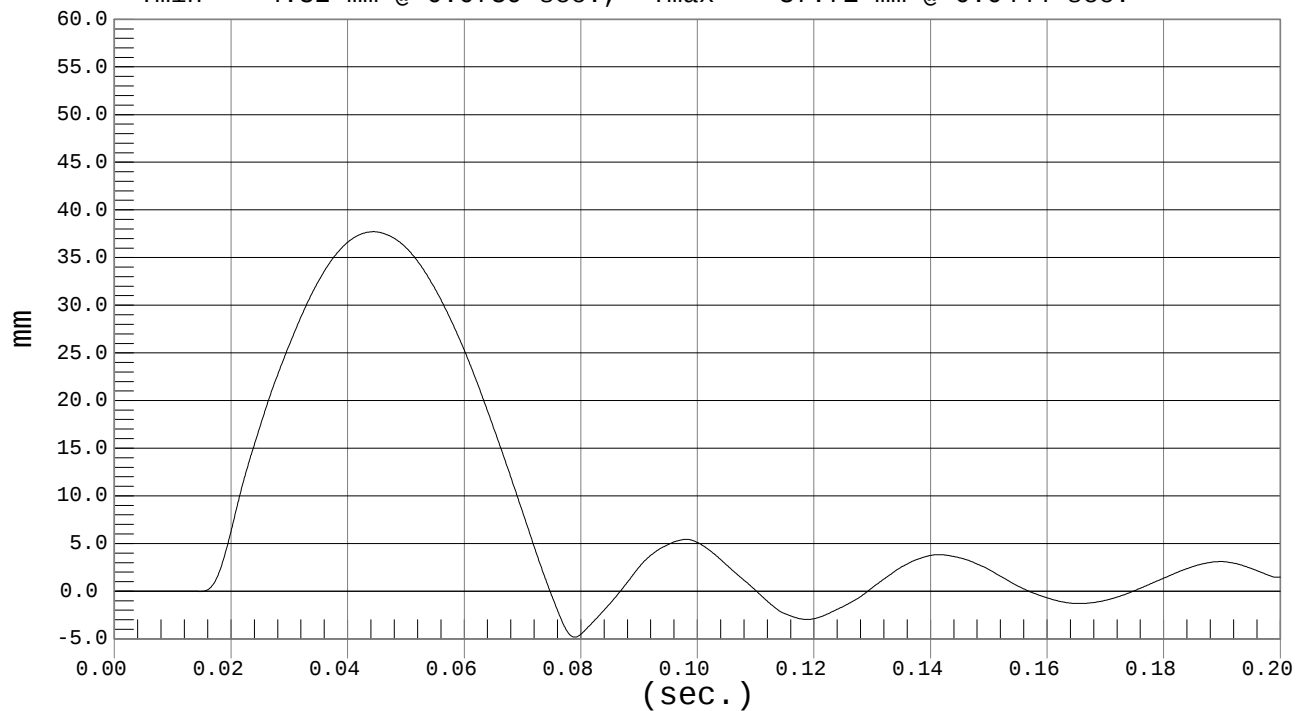


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 9.8 fps, 3.00 M/s

Ymin = -4.82 mm @ 0.0789 sec., Ymax = 37.71 mm @ 0.0444 sec.



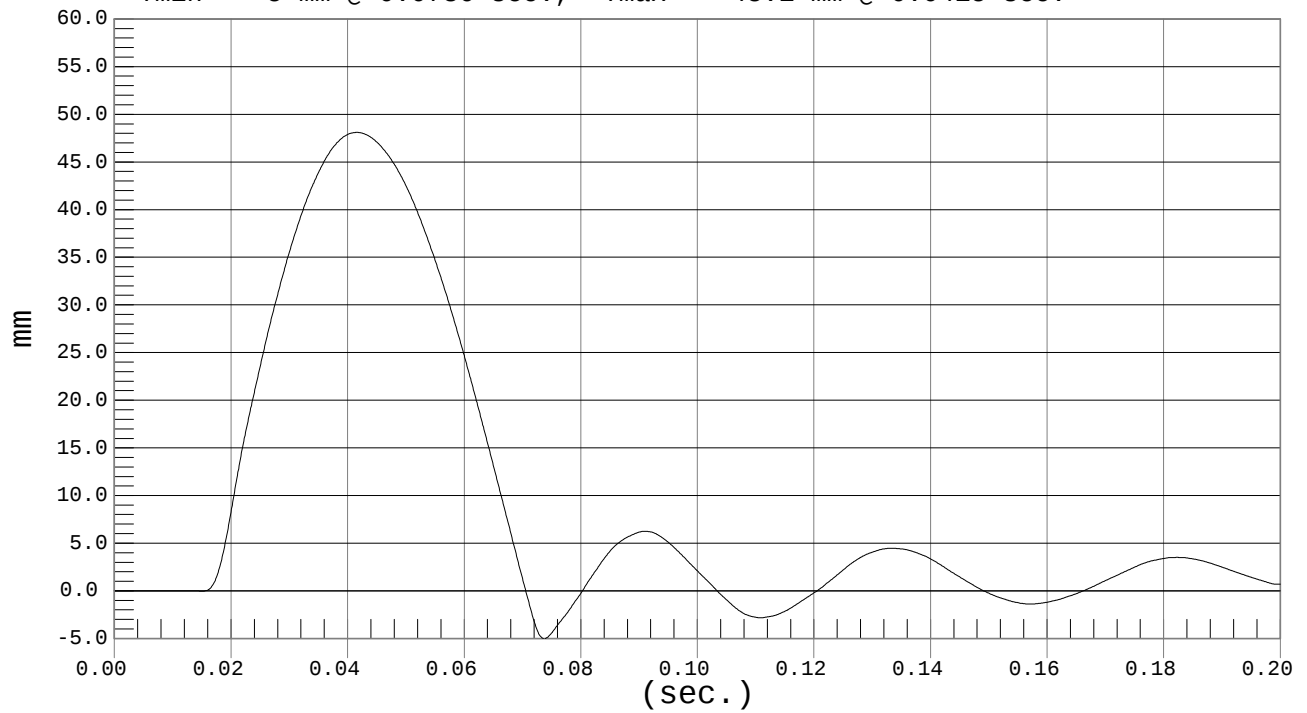


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -5 mm @ 0.0736 sec., Ymax = 48.1 mm @ 0.0415 sec.



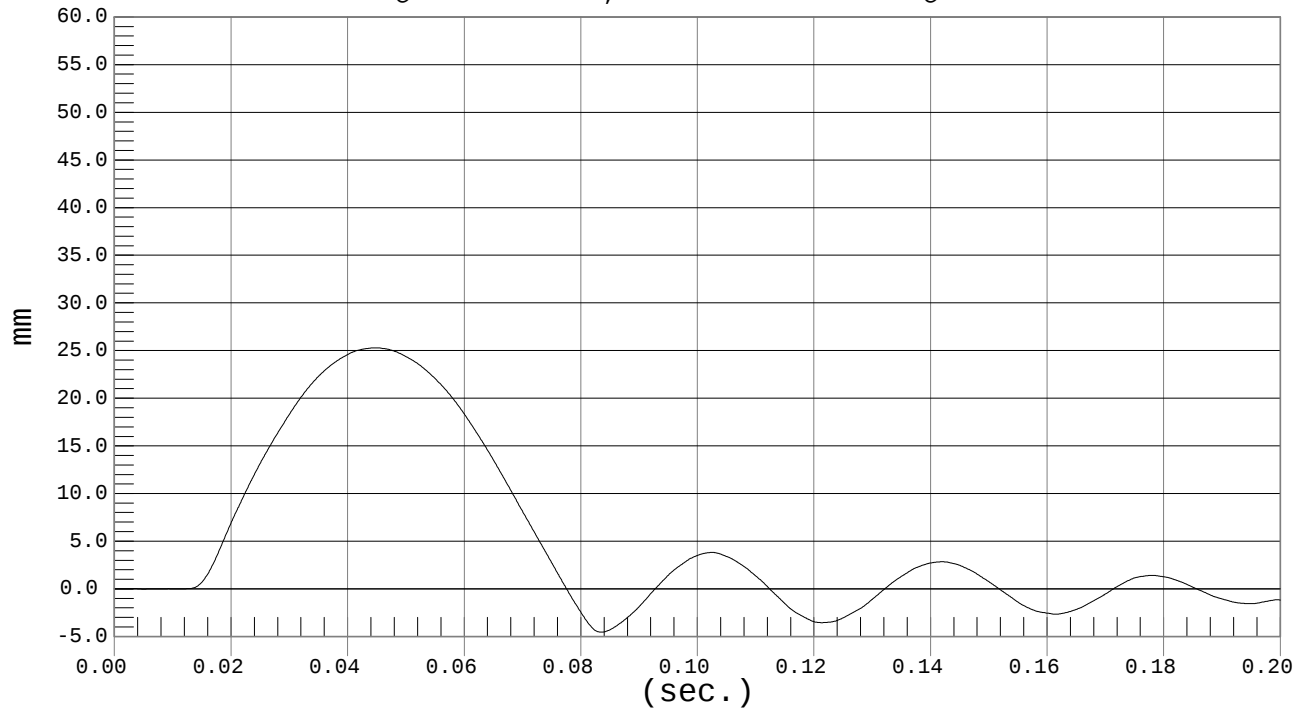


LOWER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 6.6 fps, 2.00 M/s

Ymin = -4.55 mm @ 0.0834 sec., Ymax = 25.29 mm @ 0.0447 sec.

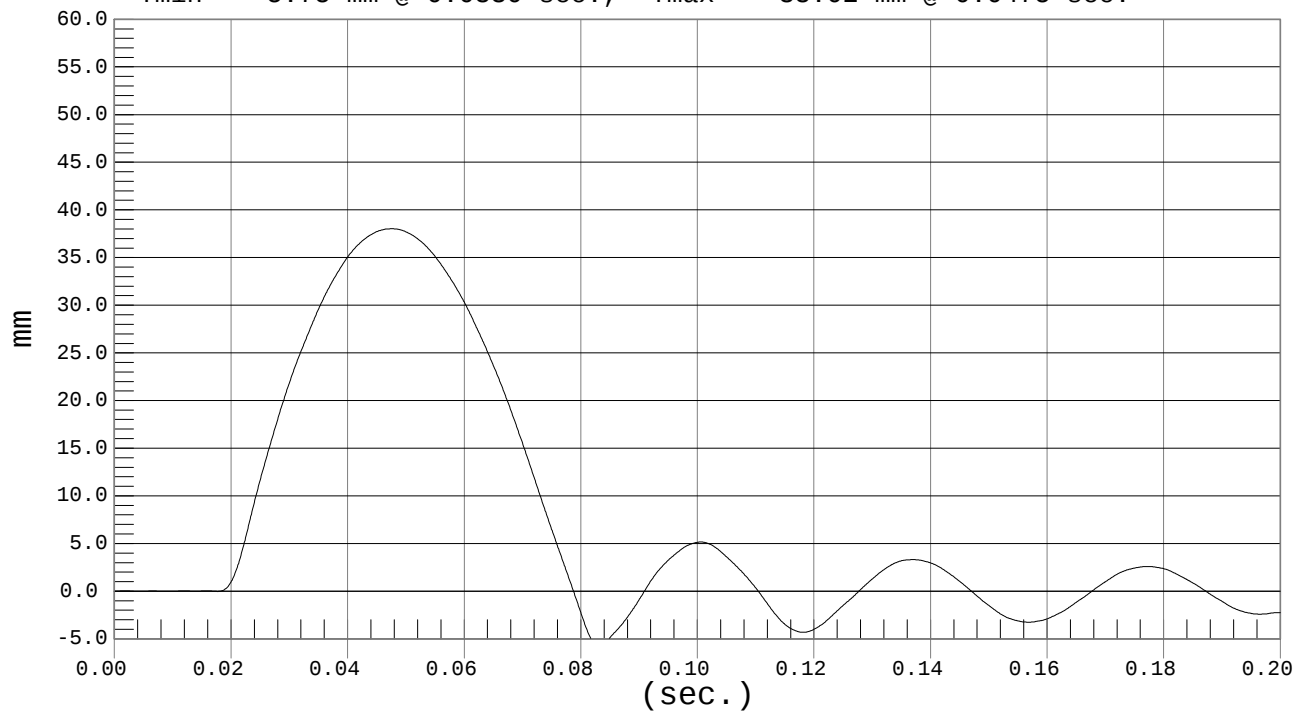


LOWER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 9.8 fps, 3.00 M/s

Ymin = -5.75 mm @ 0.0830 sec., Ymax = 38.02 mm @ 0.0475 sec.



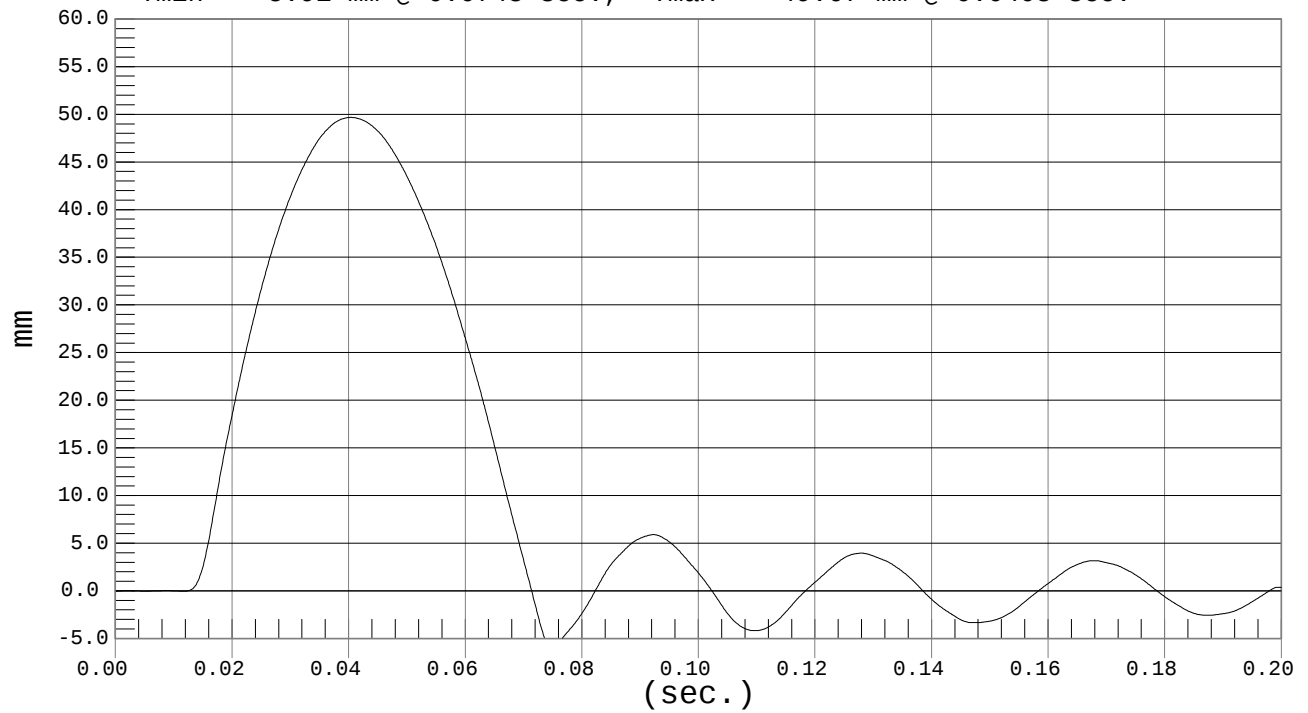


LOWER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 02-07-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -5.91 mm @ 0.0748 sec., Ymax = 49.67 mm @ 0.0403 sec.



MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03147

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.7
Relative Humidity (%)	10 – 70	16
Probe Speed (m/s)	3.90 – 4.10	4.00
Maximum Impact Force	4.00 – 4.80 kN	4.42
Time of Maximum Force	10.60 – 13.00 ms	10.60
Maximum Total Abdomen Force	2.20 – 2.70 kN	2.51
Time of Max. Total Force	10.00 – 12.30 ms	10.70

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

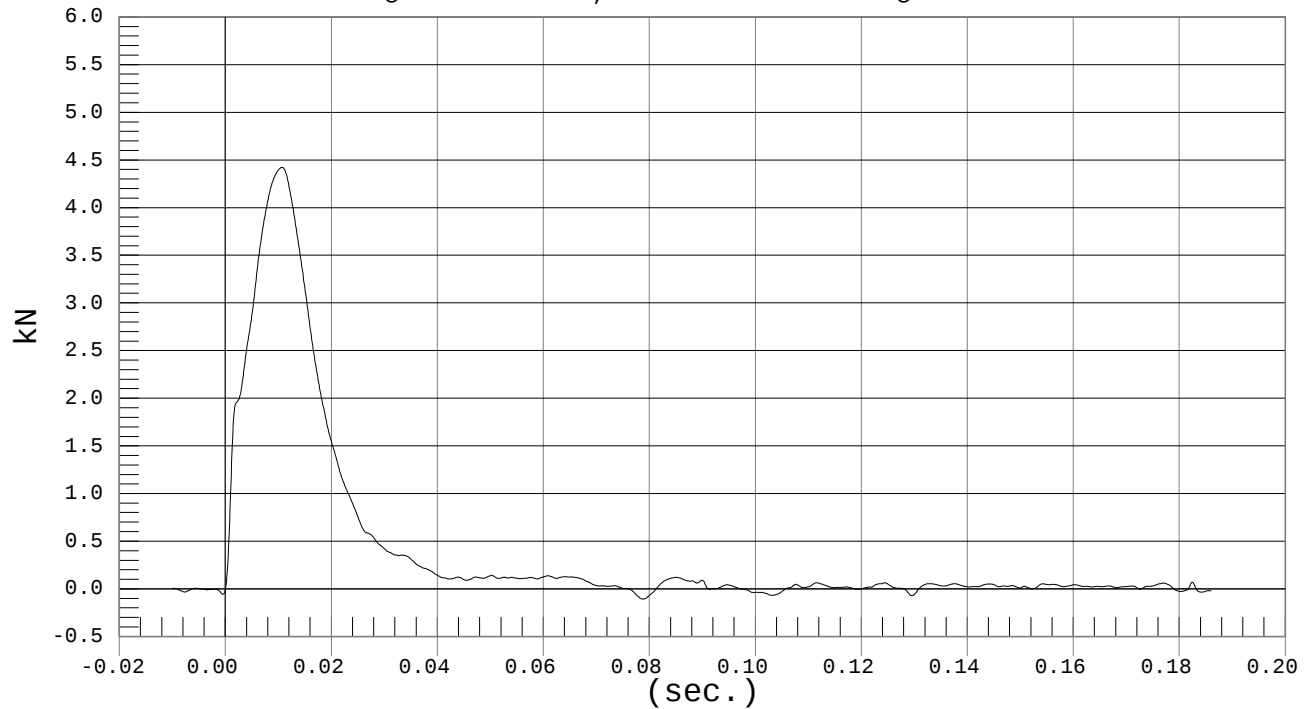


IMPACTOR FORCE

Test Desc.: Abdomen Impact
Component: Dummy #010

Test Date: 02-07-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -.11 kN @ 0.0787 sec., Ymax = 4.42 kN @ 0.0106 sec.

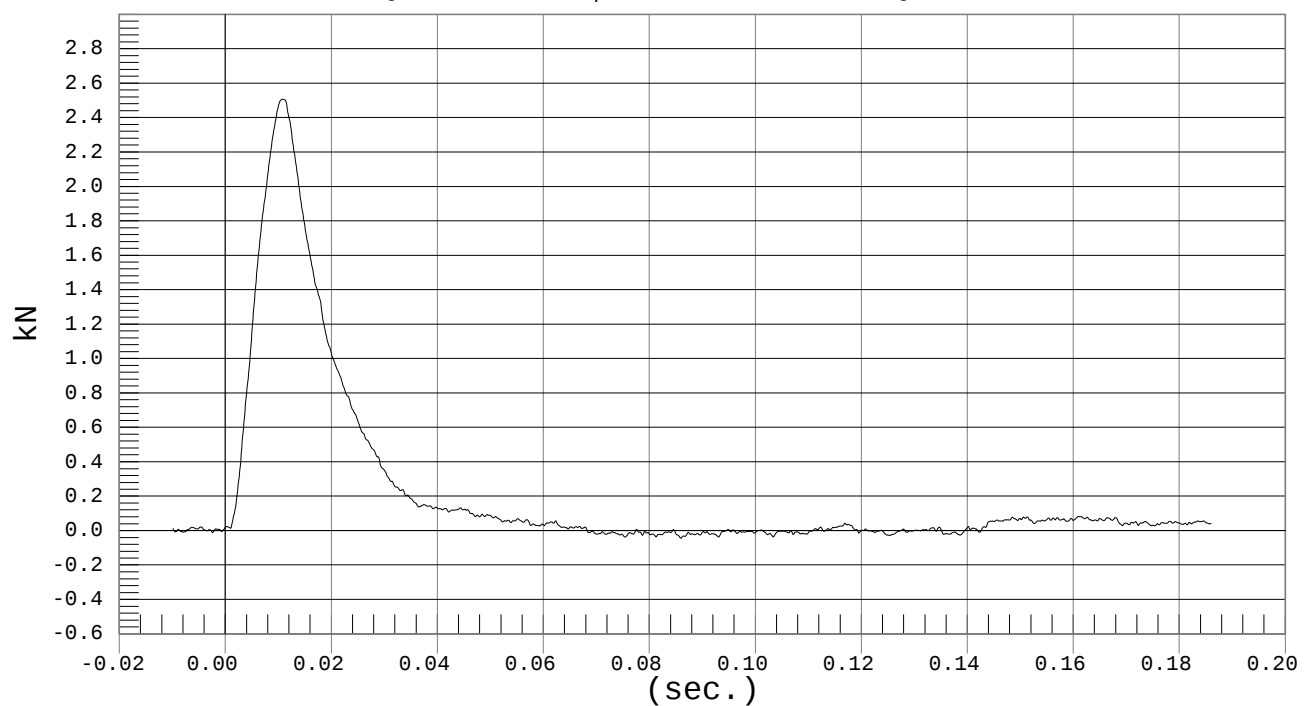


ABDOMEN FORCE

Test Desc.: Abdomen Impact
Component: Dummy #010

Test Date: 02-07-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -.04 kN @ 0.0859 sec., Ymax = 2.51 kN @ 0.0107 sec.



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03148

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	20.7
Relative Humidity (%)		10 – 70	19
Pendulum Speed		5.95 – 6.15	6.09
Pendulum Deceleration	10 msec	-2.46 - -1.59 m/sec	-1.93
	20 msec	-5.25 - -4.07 m/sec	-4.38
	25 msec	-6.64 - -5.30 m/sec	-5.44
	30 msec	≥ -6.5 m/sec	-6.10
Maximum Flexion Angle		45.0 – 55.0 deg	53.2
Time of Max. Flexion Angle		39.0 – 53.0 ms	46.4
Maximum Angle Theta (A)		31.0 – 35.0 deg	33.6
Time of Max. Theta (A)		44.0 – 52.0 ms	46.6
Maximum Angle Theta (B)		28.88– 31.38 deg	30.65
Time of Max. Theta (B)		44.0 – 52.0 ms	47.0

TEST MEETS SPECIFICATIONS

Technician: 

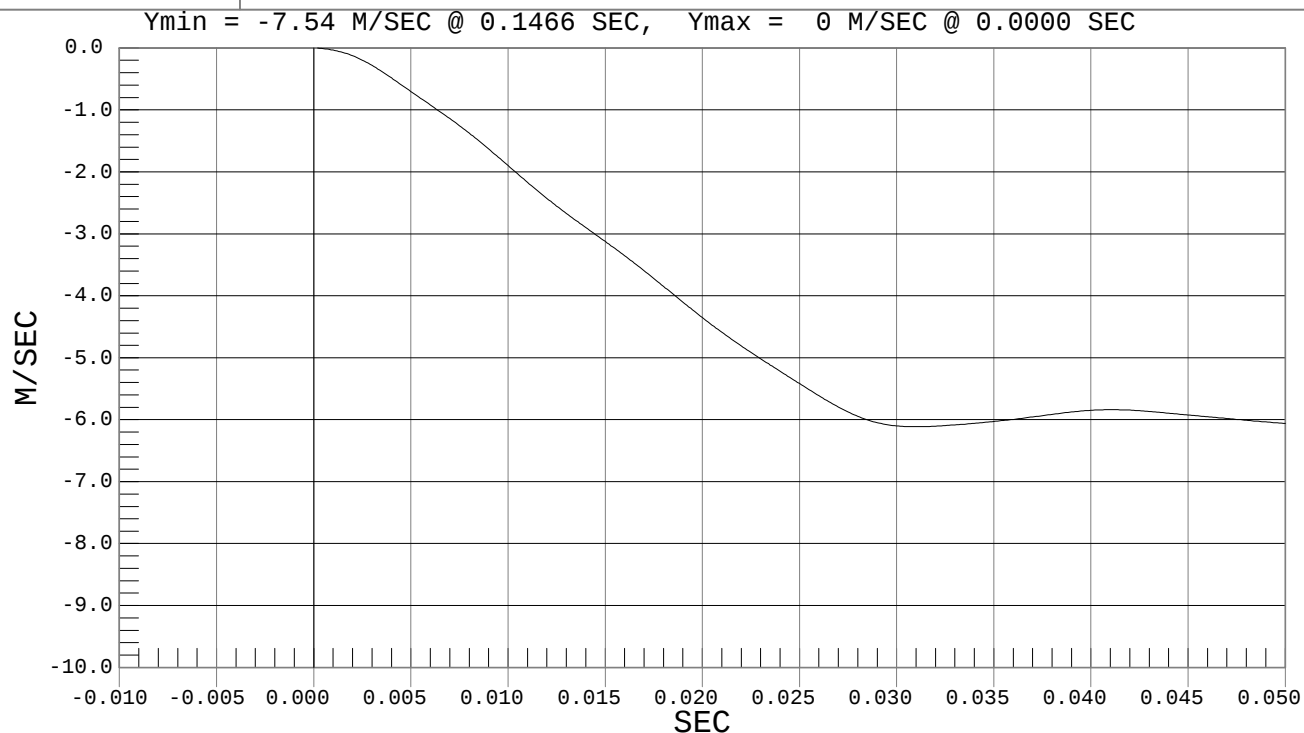
Approved By: 



PENDULUM DECELERATION

Test Desc.: Lumbar Flexion
Component: Dummy #010

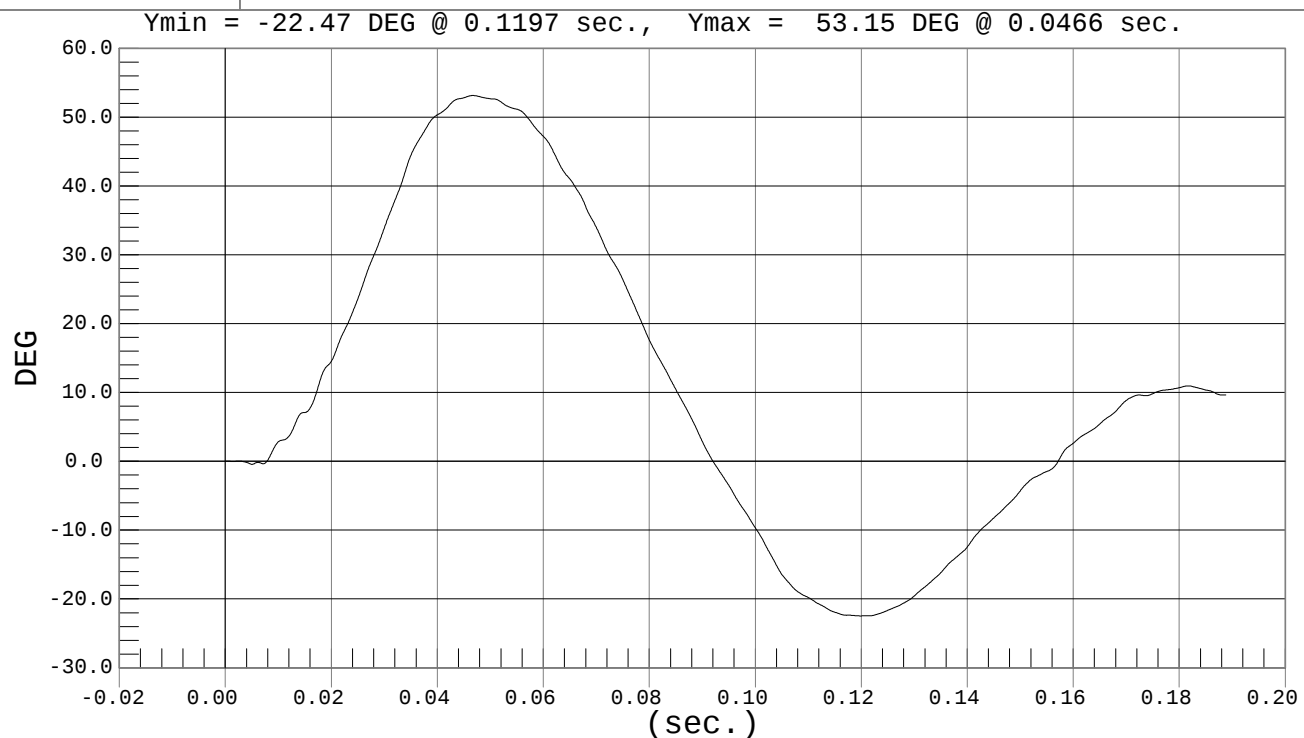
Test Date: 02-07-03
Speed: 20.0 fps, 6.09 M/s



FLEXION ANGLE

Test Desc.: Lumbar Flexion
Component: Dummy #010

Test Date: 02-07-03
Speed: 20.0 fps, 6.09 M/s



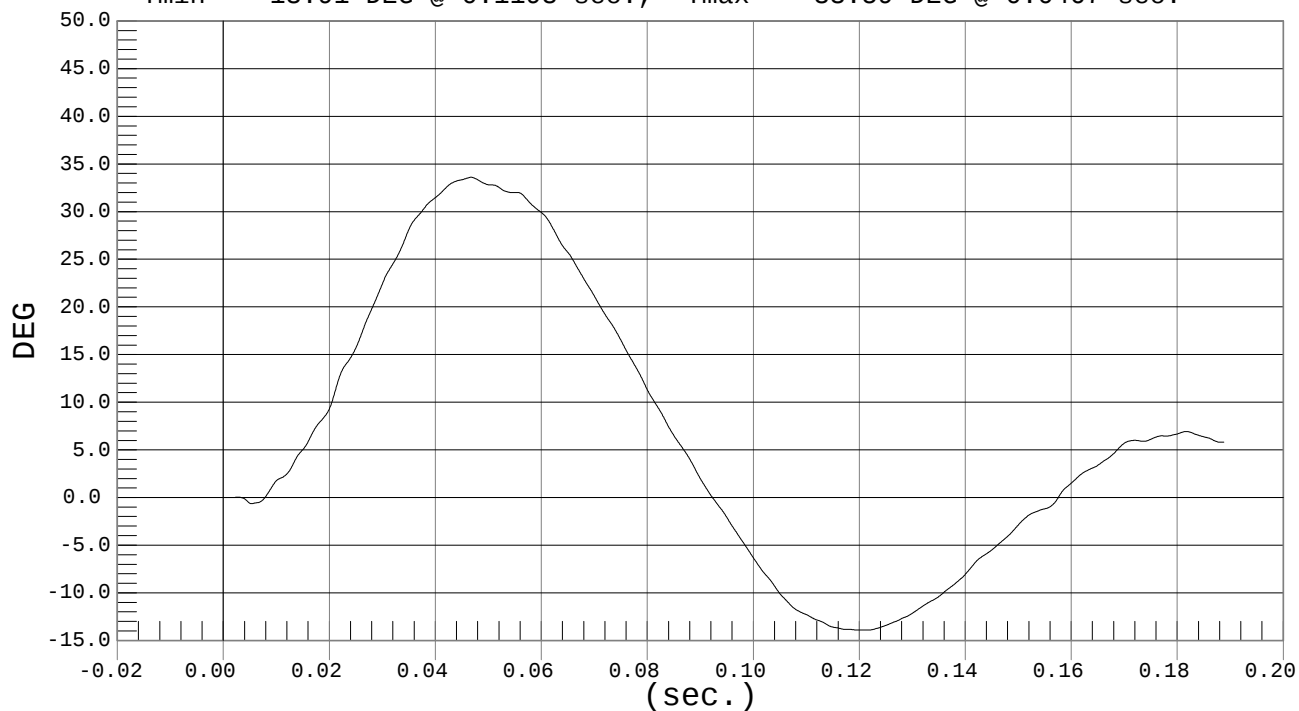


Test Desc.: Lumbar Flexion
Component: Dummy #010

THETA A

Test Date: 02-07-03
Speed: 20.0 fps, 6.09 M/s

Ymin = -13.91 DEG @ 0.1198 sec., Ymax = 33.59 DEG @ 0.0467 sec.

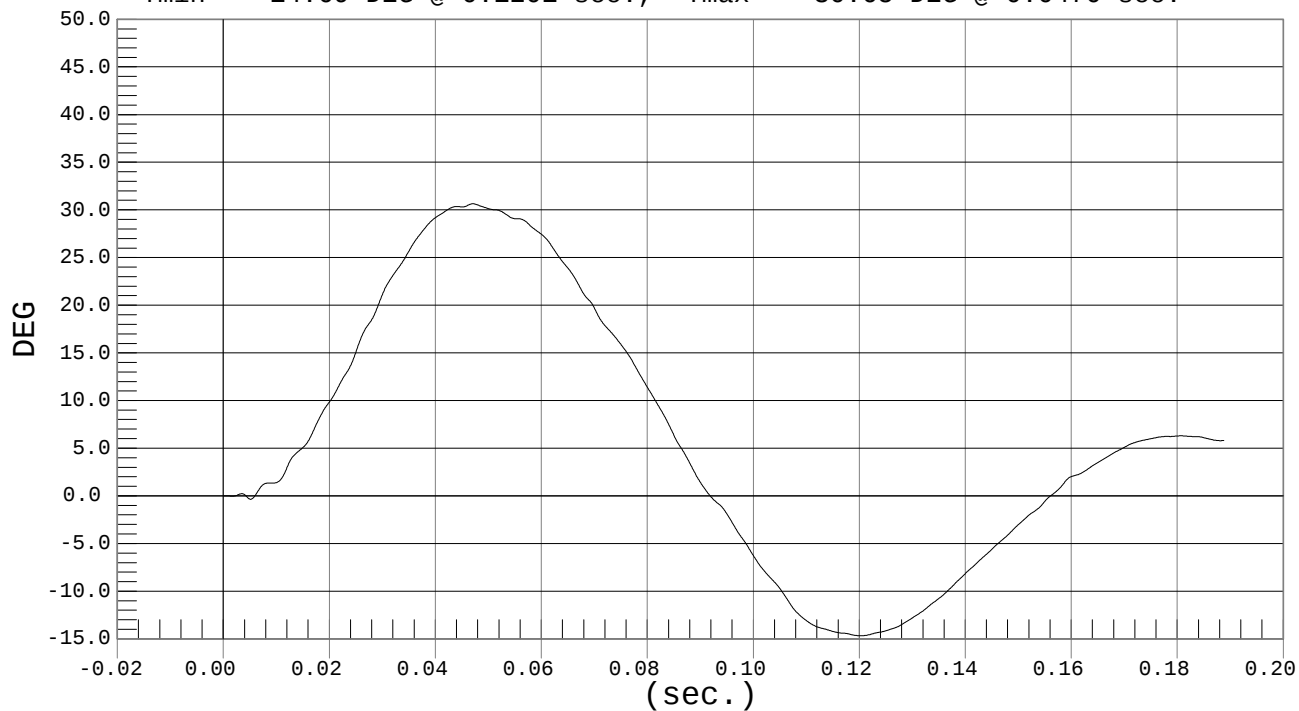


Test Desc.: Lumbar Flexion
Component: Dummy #010

THETA B

Test Date: 02-07-03
Speed: 20.0 fps, 6.09 M/s

Ymin = -14.69 DEG @ 0.1201 sec., Ymax = 30.65 DEG @ 0.0470 sec.



MGA RESEARCH CORPORATION
PELVIS TEST
EUROSID 2 DUMMY

Date: 2/7/03
Dummy Serial Number: 010
Test Number: D03149

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.7
Relative Humidity (%)	10 – 70	18
Pendulum Speed	4.20 – 4.40 m/s	4.30
Maximum Impactor Force	4.40 – 5.40 kN	4.85
Time of Max. Impactor Force	10.30 – 15.50 ms	13.30
Maximum Pubic Force	1.04 – 1.64 kN	1.40
Time of Max. Pubic Force	9.90 – 15.90 ms	13.50

TEST MEETS SPECIFICATIONS

Technician: _____

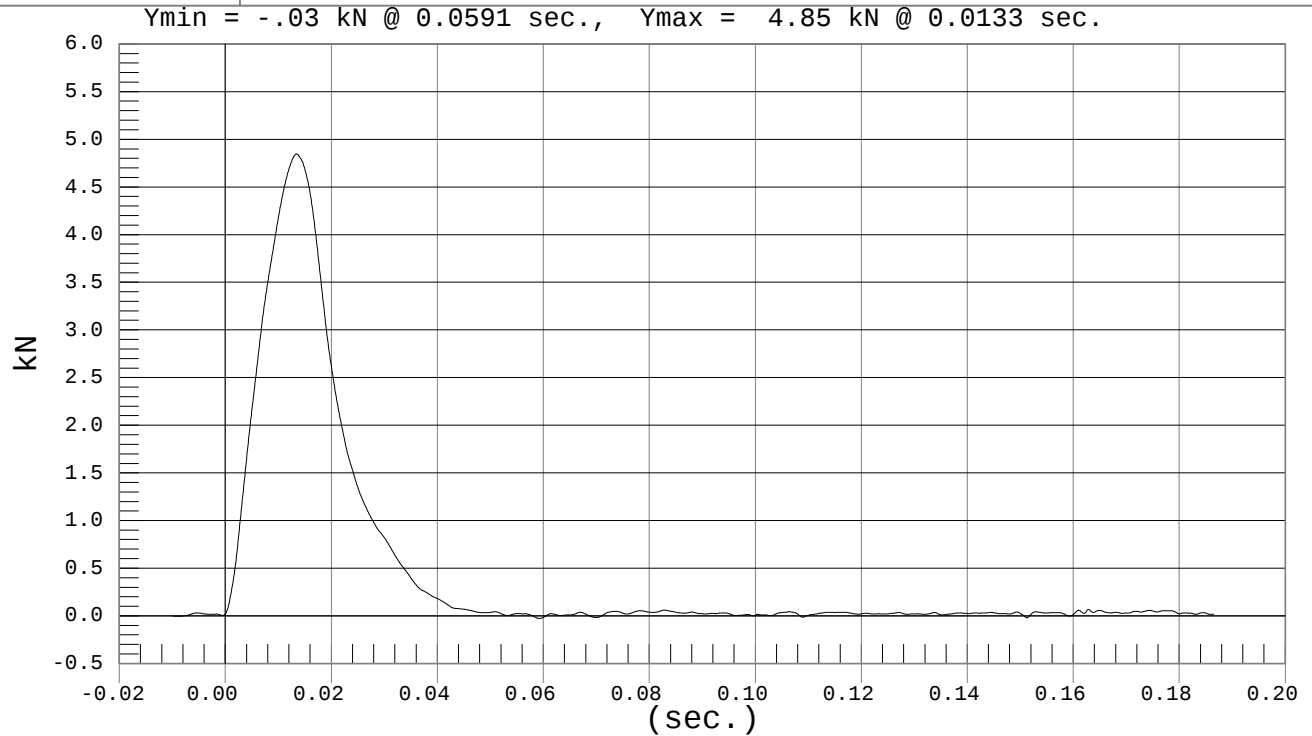
Approved By: _____



IMPACTOR FORCE

Test Desc.: Pelvis Impact
Component: Dummy #010

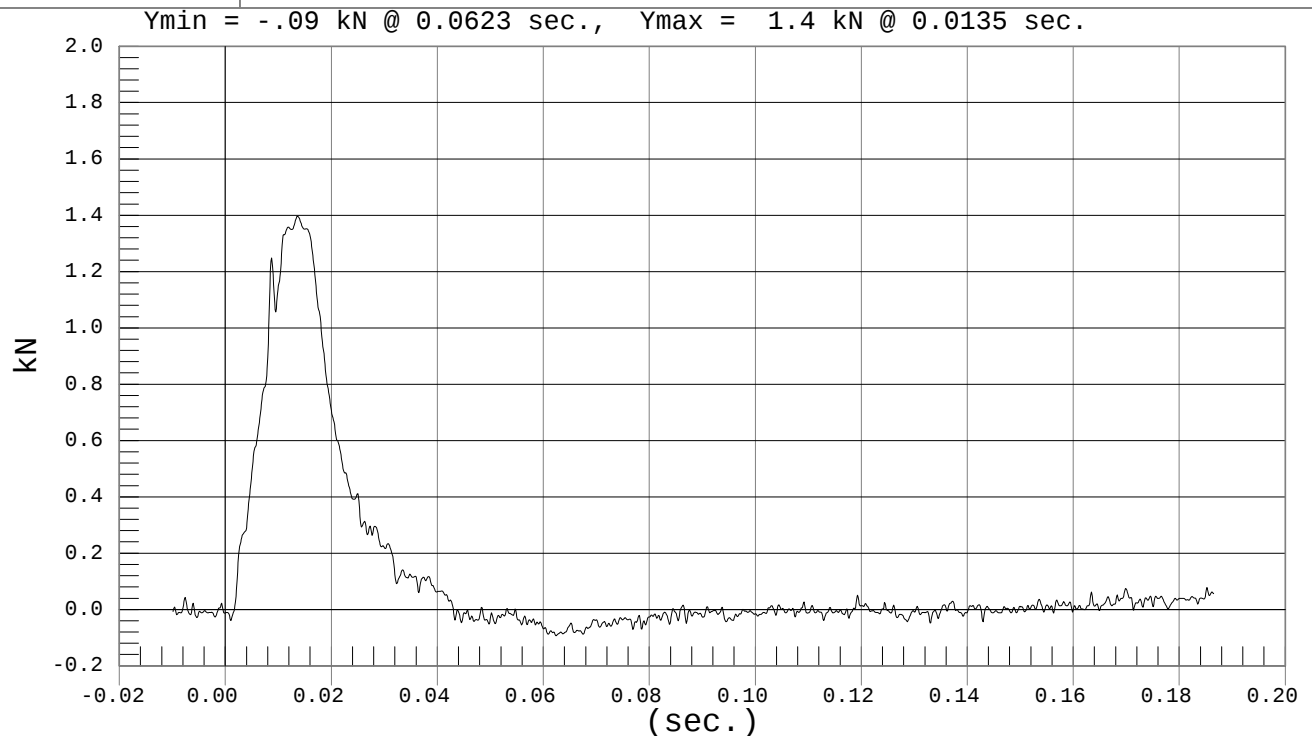
Test Date: 02-07-03
Speed: 14.1 fps, 4.30 M/s



PUBIC FORCE

Test Desc.: Pelvis Impact
Component: Dummy #010

Test Date: 02-07-03
Speed: 14.1 fps, 4.30 M/s



CERTIFICATION DATA

Dummy Serial Number: 010

Calibration Test Results Summary

Dummy Serial Number: 010

Post-Test Calibration

Head Drop Test:	The head passed all drop test requirements.
Neck Pendulum Test:	The neck passed all impact test requirements.
Shoulder Impact Test:	The shoulder passed all impact test requirements.
Rib Tests:	All ribs passed all impact test requirements.
Abdomen Test:	The abdomen passed all impact test requirements.
Lumbar Spine Test:	The lumbar spine passed all impact test requirements.
Pelvis Test:	The pelvis passed all impact test requirements.

MGA RESEARCH CORPORATION
HEAD DROP TEST
EUROSID 2 DUMMY

Date: 3/4/03
Dummy Serial Number: 010
Test Number: D03251

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.6
Relative Humidity (%)	10 – 70	21
Peak Resultant Acceleration	100 – 150 g's	141
Time of Max. Res. Acceleration	msec	22.1

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

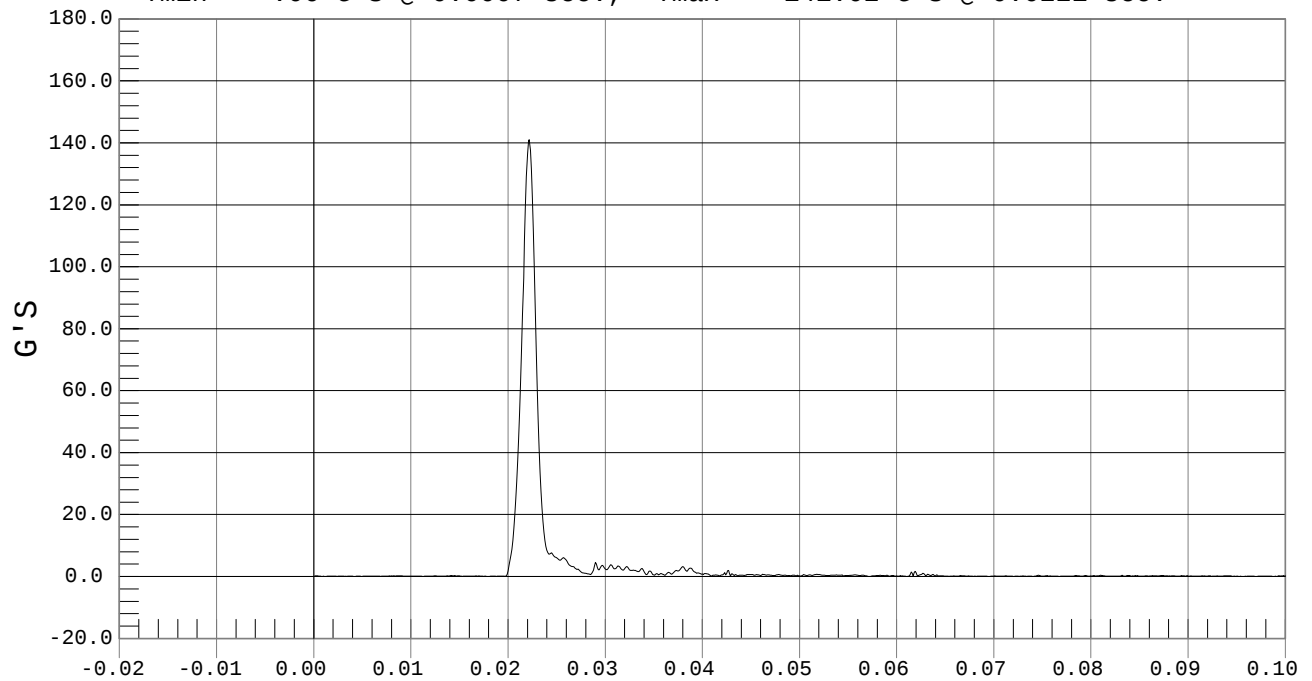


PEAK RESULTANT ACCELERATION

Test Desc.: Head Drop
Component: Dummy #010

Test Date: 03-04-03
Speed: 0.0 fps, 0.00 M/s

Ymin = .06 G'S @ 0.0007 sec., Ymax = 141.02 G'S @ 0.0221 sec.



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date: 3/4/03
Dummy Serial Number: 010
Test Number: D03252

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	20.7
Relative Humidity (%)		10 – 70	23
Pendulum Speed		3.3 - 3.5	3.4
Pendulum Deceleration	3 msec	~.25 - ~.53 m/sec	-.32
	8 msec	~1.59 - ~2.04 m/sec	-1.61
	14 msec	~3.20 - ~3.85 m/sec	-3.28
Maximum Flexion Angle		49.0 – 59.0 deg	57.0
Time of Max. Flexion Angle		54.0 – 66.0 ms	57.2
Maximum Angle Theta (A)		32.0 – 37.0 deg	34.5
Time of Max. Theta (A)		53.0 – 63.0 ms	54.2
Maximum Angle Theta (B)		29.70 – 32.20 deg	31.65
Time of Max. Theta (B)		54.0 – 64.0 ms	59.9

TEST MEETS SPECIFICATIONS

Technician: _____

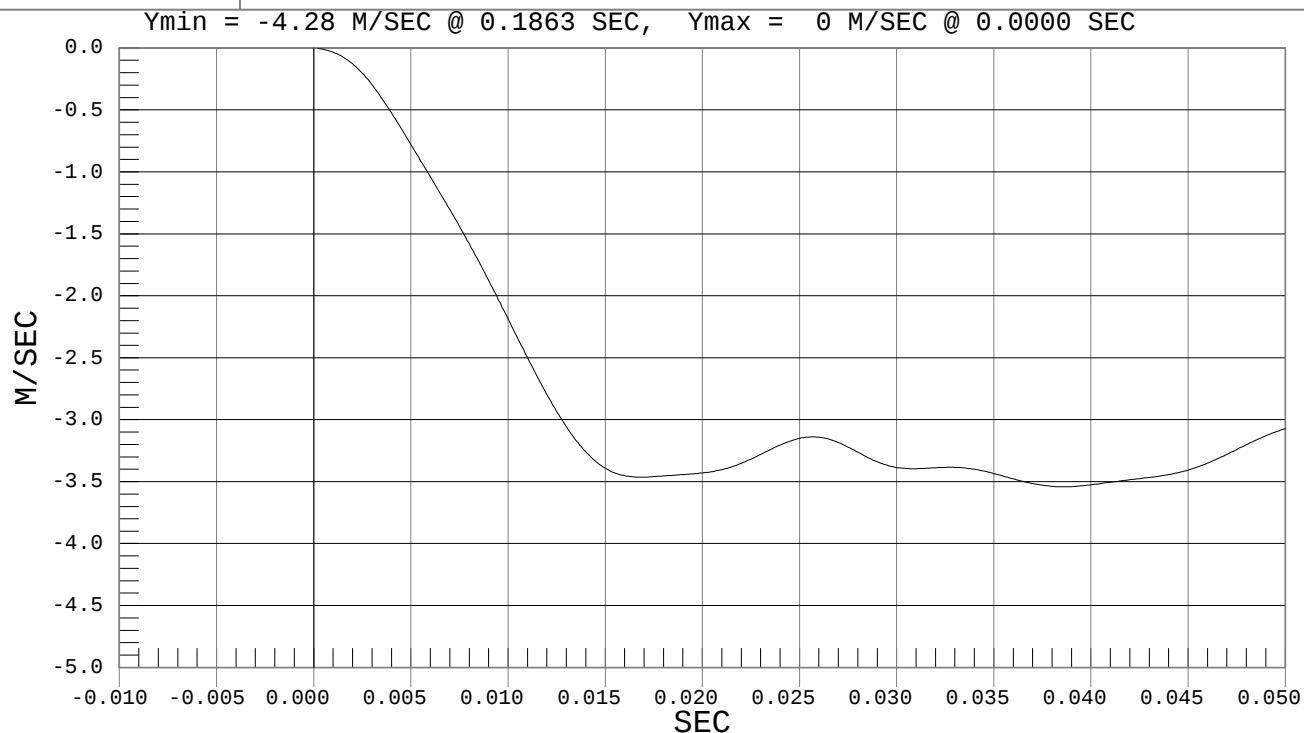
Approved By: _____



PENDULUM DECELERATION

Test Desc.: Neck Bending
Component: Dummy #010

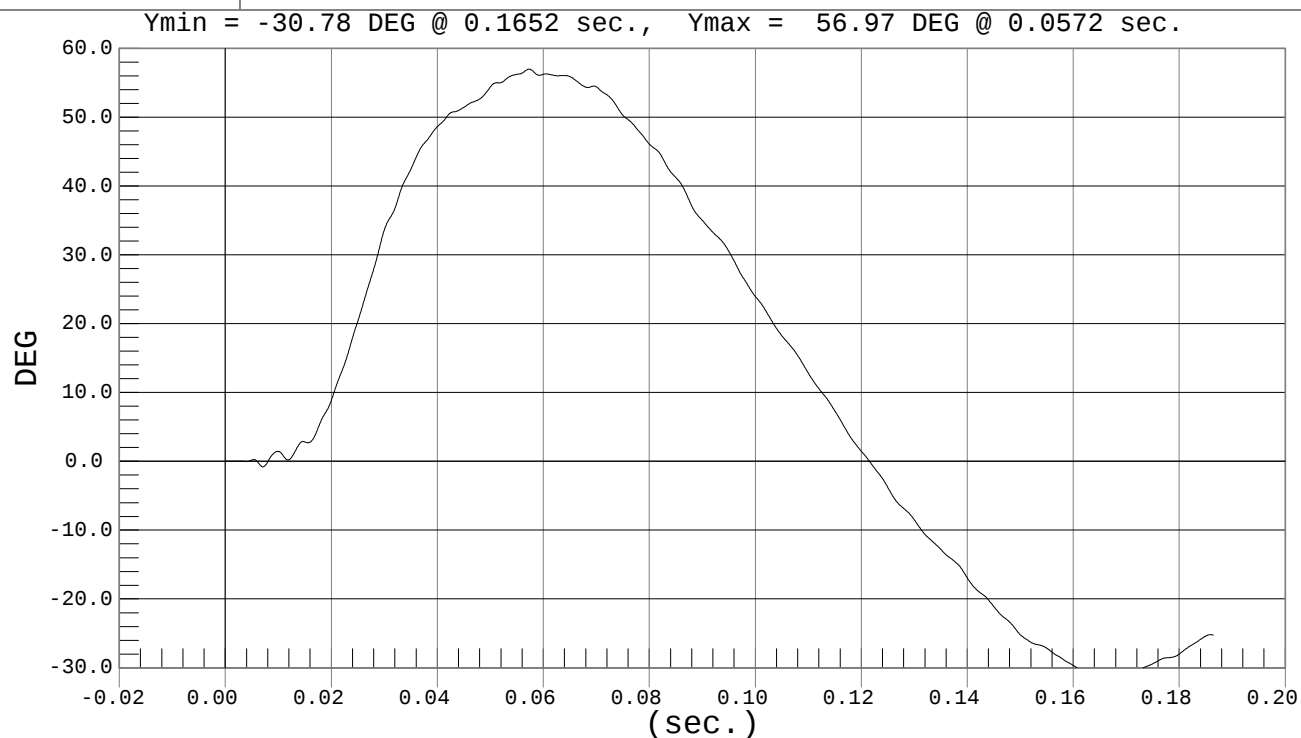
Test Date: 03-04-03
Speed: 11.0 fps, 3.36 M/s



FLEXION ANGLE

Test Desc.: Neck Bending
Component: Dummy #010

Test Date: 03-04-03
Speed: 11.0 fps, 3.36 M/s



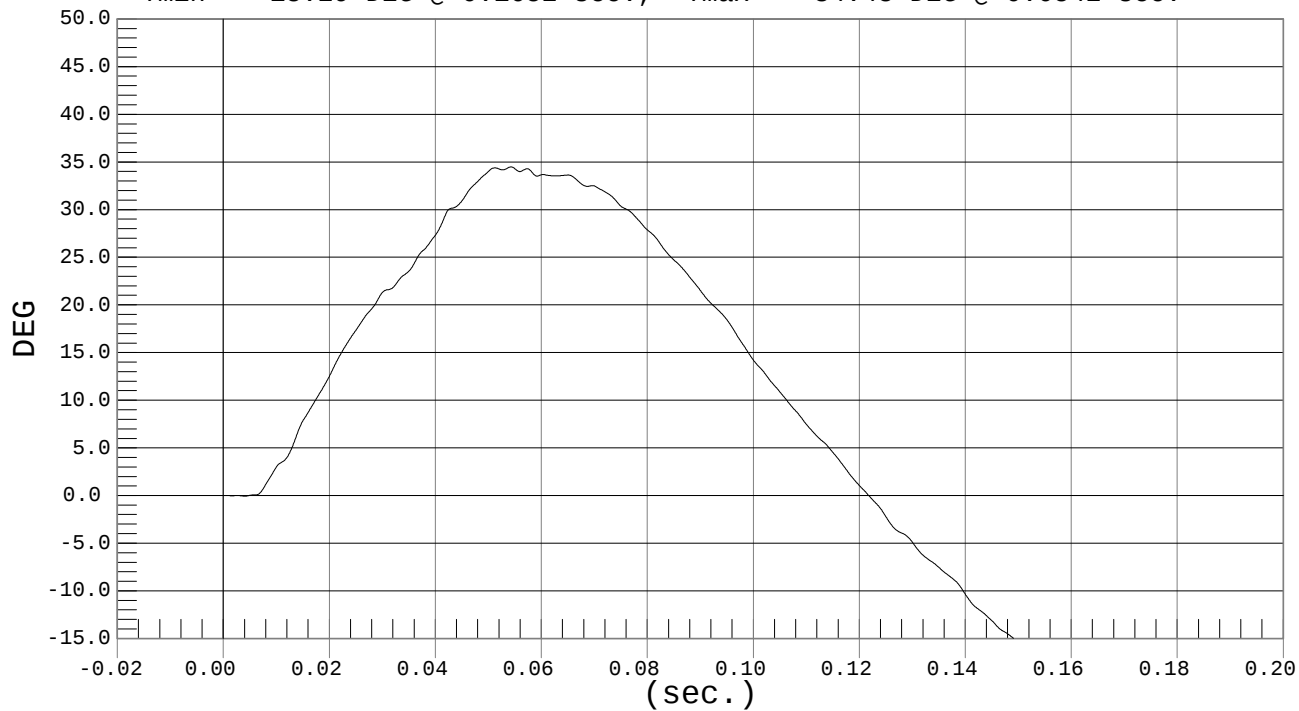


Test Desc.: Neck Bending
Component: Dummy #010

THETA A

Test Date: 03-04-03
Speed: 11.0 fps, 3.36 M/s

Ymin = -18.29 DEG @ 0.1652 sec., Ymax = 34.48 DEG @ 0.0542 sec.

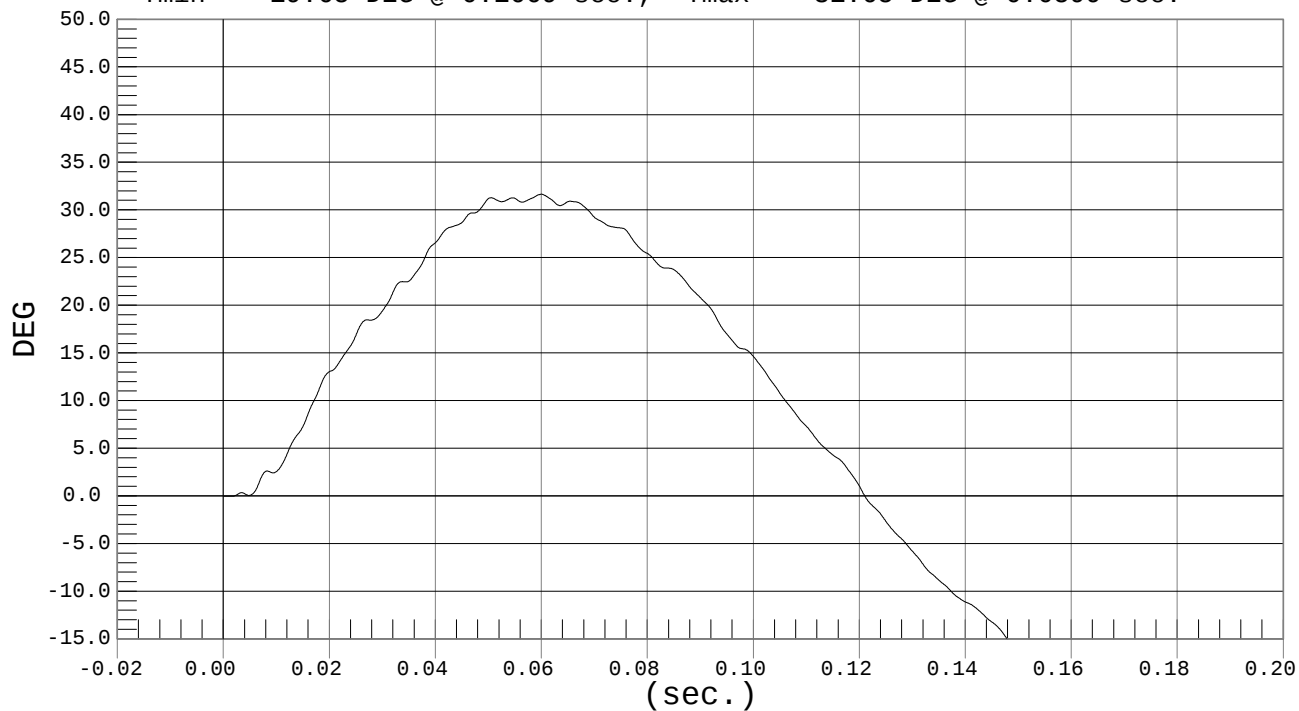


Test Desc.: Neck Bending
Component: Dummy #010

THETA B

Test Date: 03-04-03
Speed: 11.0 fps, 3.36 M/s

Ymin = -19.65 DEG @ 0.1669 sec., Ymax = 31.65 DEG @ 0.0599 sec.



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date: 3/5/03
Dummy Serial Number: 010
Test Number: D03253

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.6
Relative Humidity (%)	10 – 70	19
Pendulum Speed	4.2 – 4.4 m/s	4.3
Max. Resultant Acceleration	7.5 – 10.5 g's	10.1
Time of Max. Pendulum Acceleration	msec	10.9

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

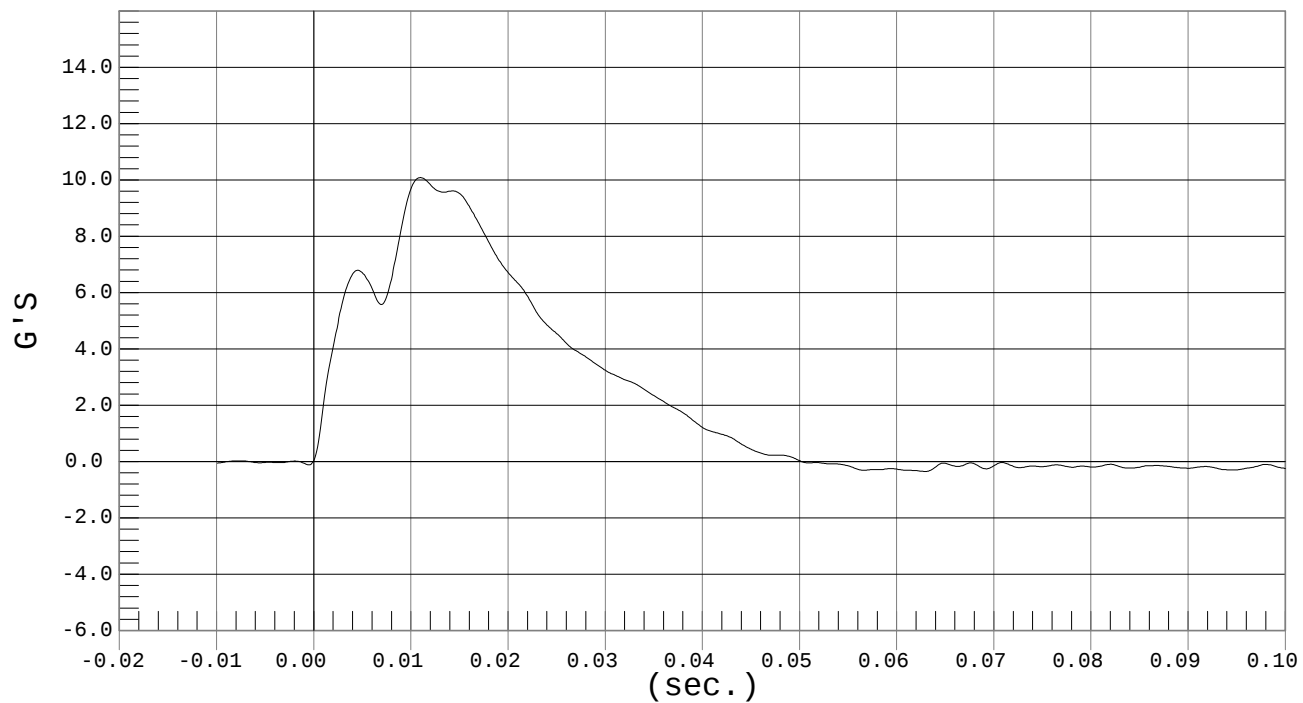


SHOULDER ACCELERATION

Test Desc.: Shoulder Impact
Component: Dummy #010

Test Date: 03-05-03
Speed: 14.1 fps, 4.29 M/s

Ymin = -.4 G'S @ 0.1141 sec., Ymax = 10.09 G'S @ 0.0109 sec.



MGA RESEARCH CORPORATION
UPPER/MIDDLE/LOWER RIB TESTS
EUROSID 2 DUMMY

Date: 3/4/03
Dummy Serial Number: 010
Test Number: D03254/5/6

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	20
Displacement at 2 m/s	23.5 – 27.5 mm	26.3
Displacement at 3 m/s	36.0 – 40.0 mm	38.9
Displacement at 4 m/s	46.0 – 51.0 mm	49.2

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	20
Displacement at 2 m/s	23.5 – 27.5 mm	25.9
Displacement at 3 m/s	36.0 – 40.0 mm	38.5
Displacement at 4 m/s	46.0 – 51.0 mm	49.4

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	20
Displacement at 2 m/s	23.5 – 27.5 mm	26.5
Displacement at 3 m/s	36.0 – 40.0 mm	38.9
Displacement at 4 m/s	46.0 – 51.0 mm	50.4

TEST MEETS SPECIFICATIONS

Technician: _____

Approved By: _____

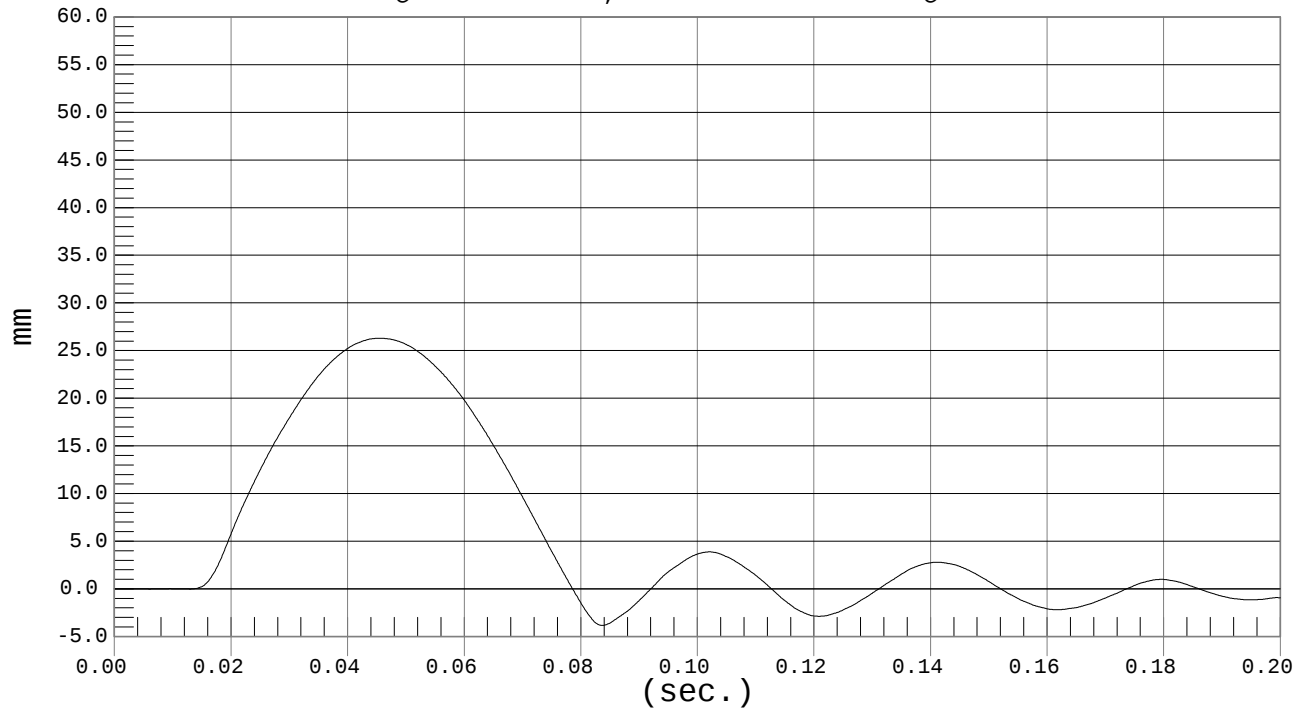


UPPER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 6.5 fps, 1.98 M/s

Ymin = -3.83 mm @ 0.0836 sec., Ymax = 26.28 mm @ 0.0451 sec.

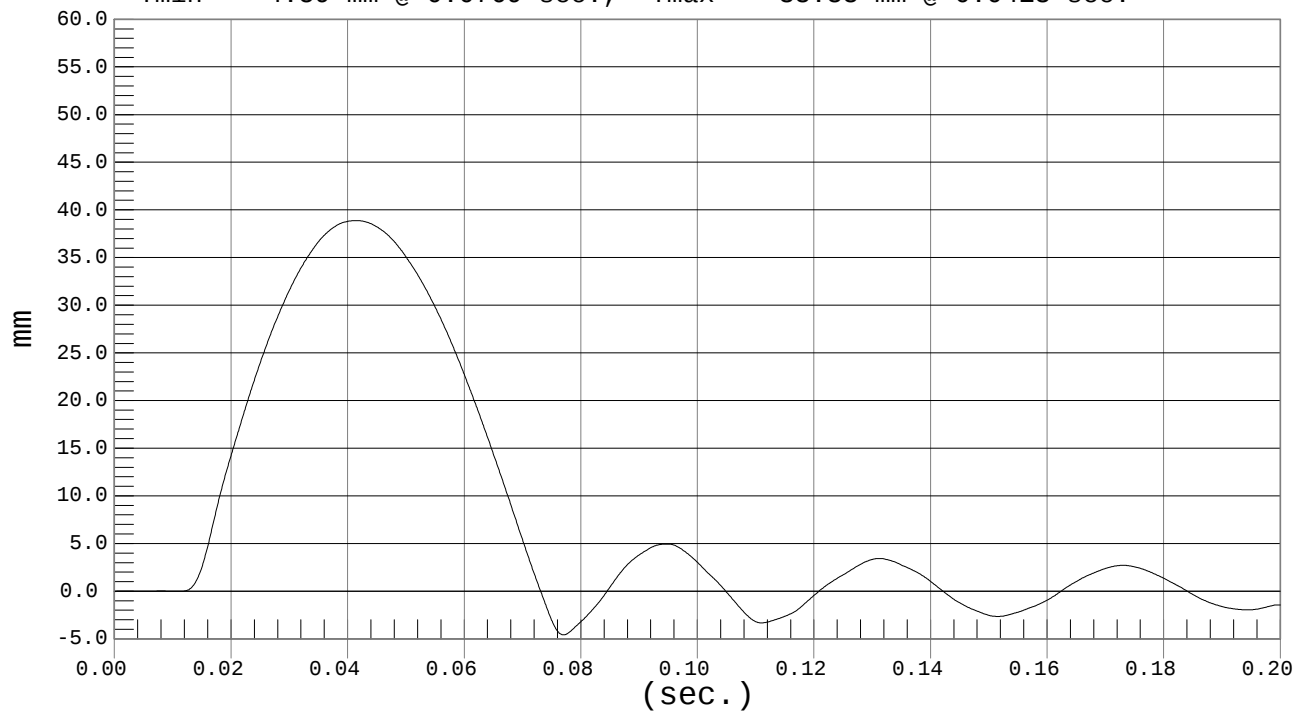


UPPER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 9.8 fps, 3.00 M/s

Ymin = -4.59 mm @ 0.0769 sec., Ymax = 38.88 mm @ 0.0413 sec.

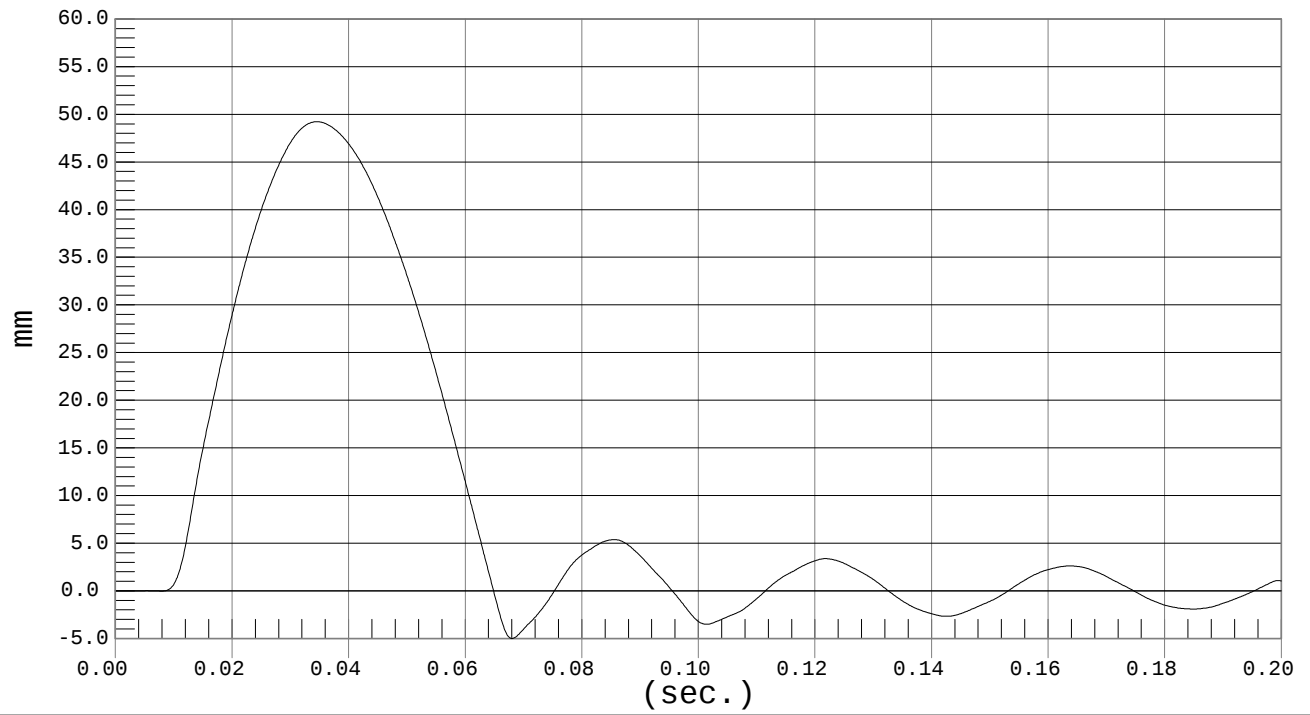




Test Desc.: Rib Module
Component: Dummy #010

UPPER RIB DISPLACEMENT

Test Date: 03-04-03
Speed: 13.1 fps, 4.00 M/s



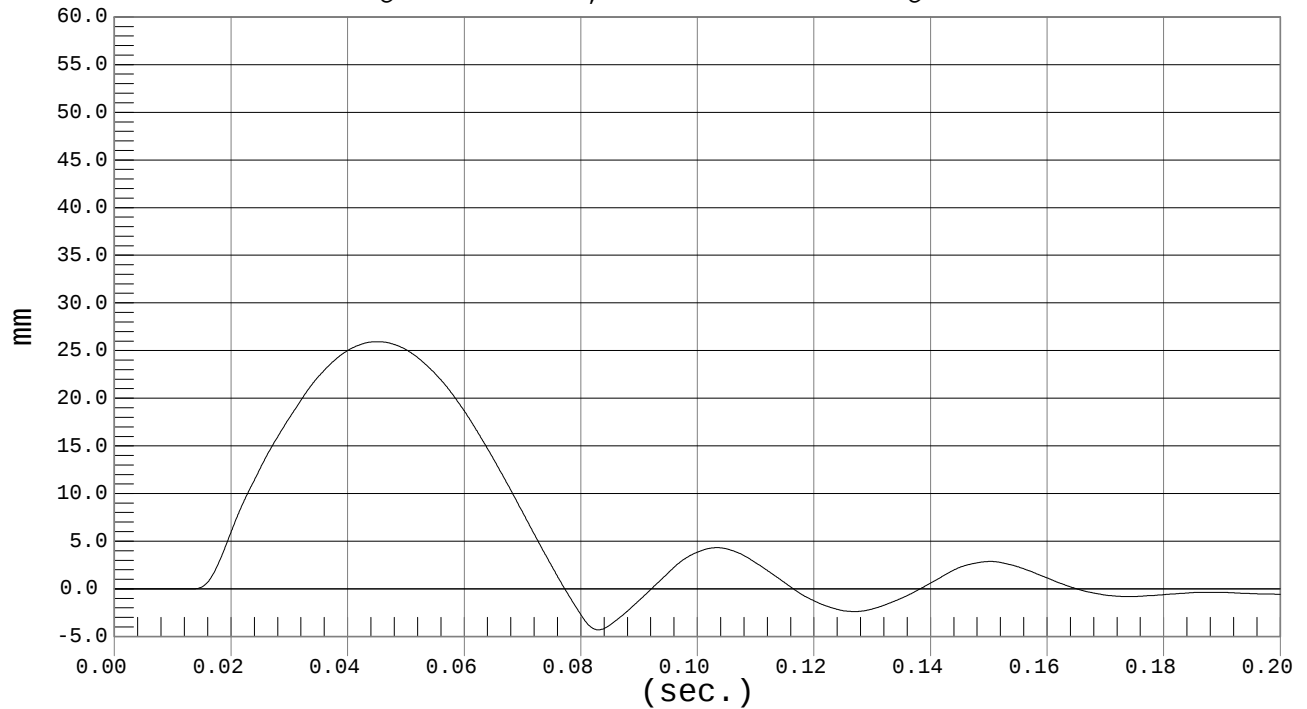


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 6.6 fps, 2.00 M/s

Ymin = -4.3 mm @ 0.0829 sec., Ymax = 25.93 mm @ 0.0450 sec.

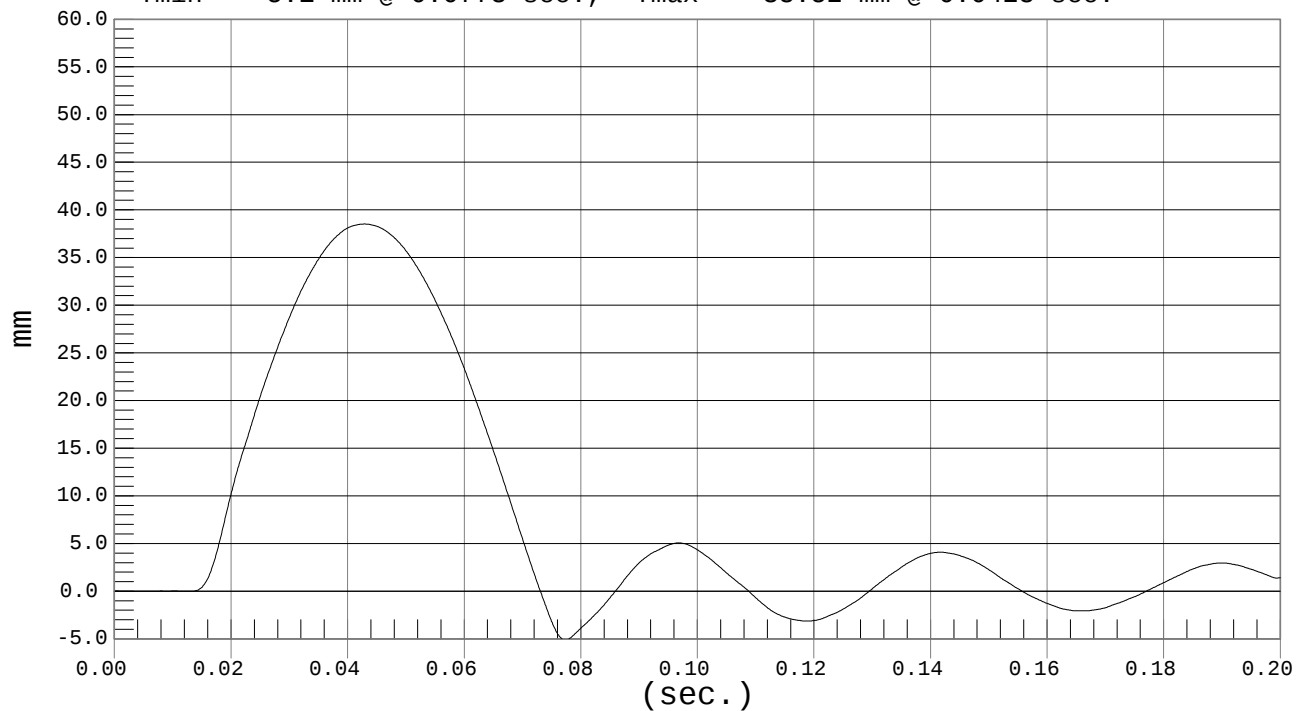


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 9.8 fps, 3.00 M/s

Ymin = -5.1 mm @ 0.0773 sec., Ymax = 38.52 mm @ 0.0428 sec.



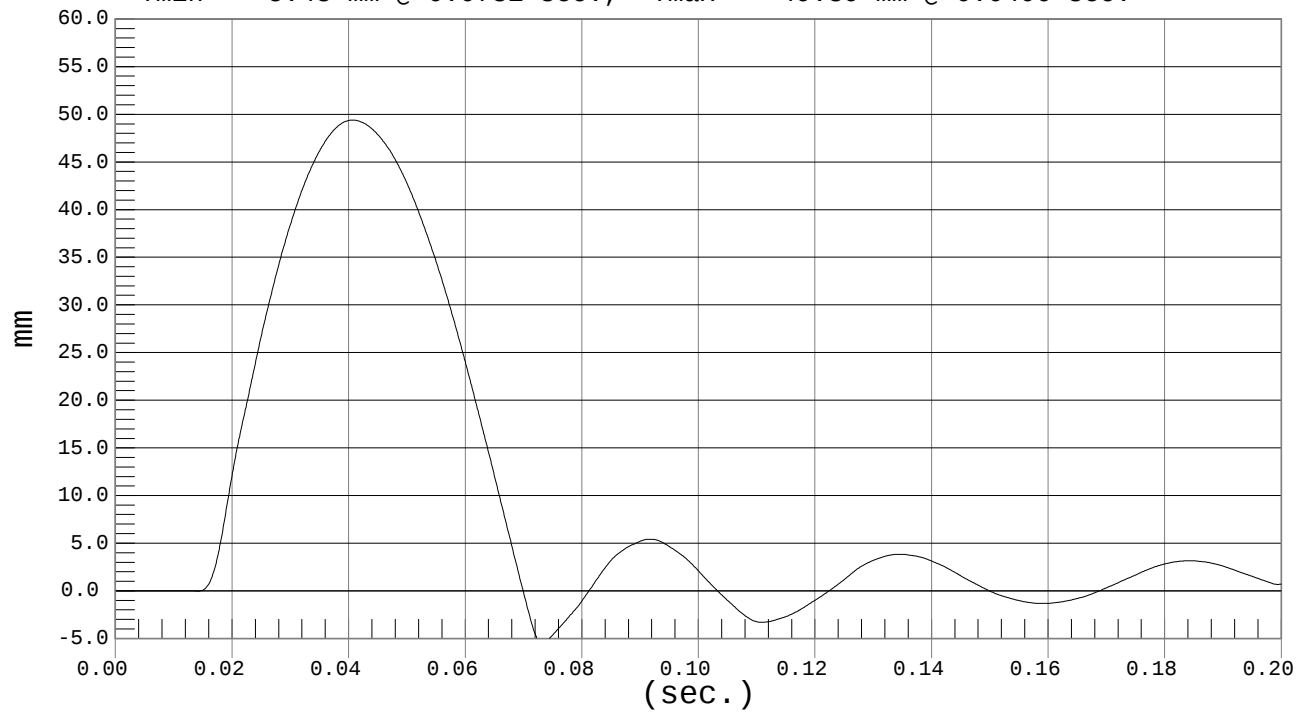


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -5.43 mm @ 0.0731 sec., Ymax = 49.39 mm @ 0.0406 sec.



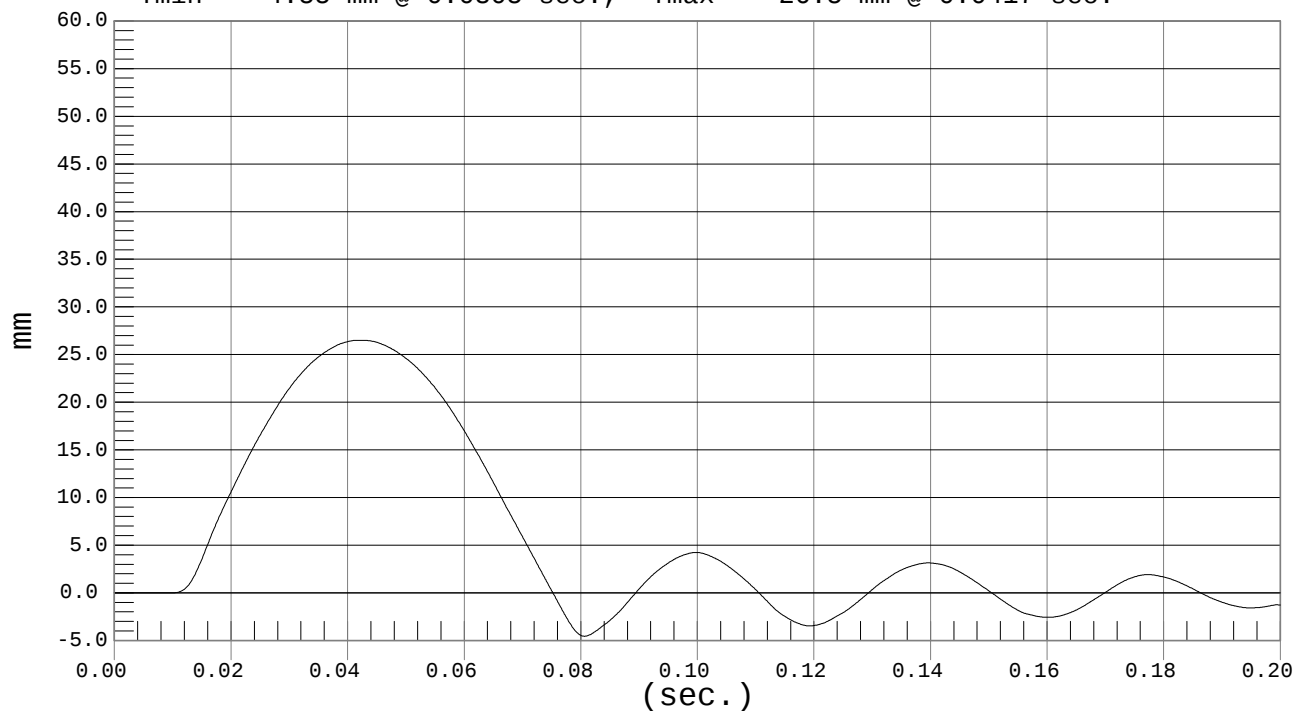


LOWER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 6.6 fps, 2.00 M/s

Ymin = -4.55 mm @ 0.0805 sec., Ymax = 26.5 mm @ 0.0417 sec.

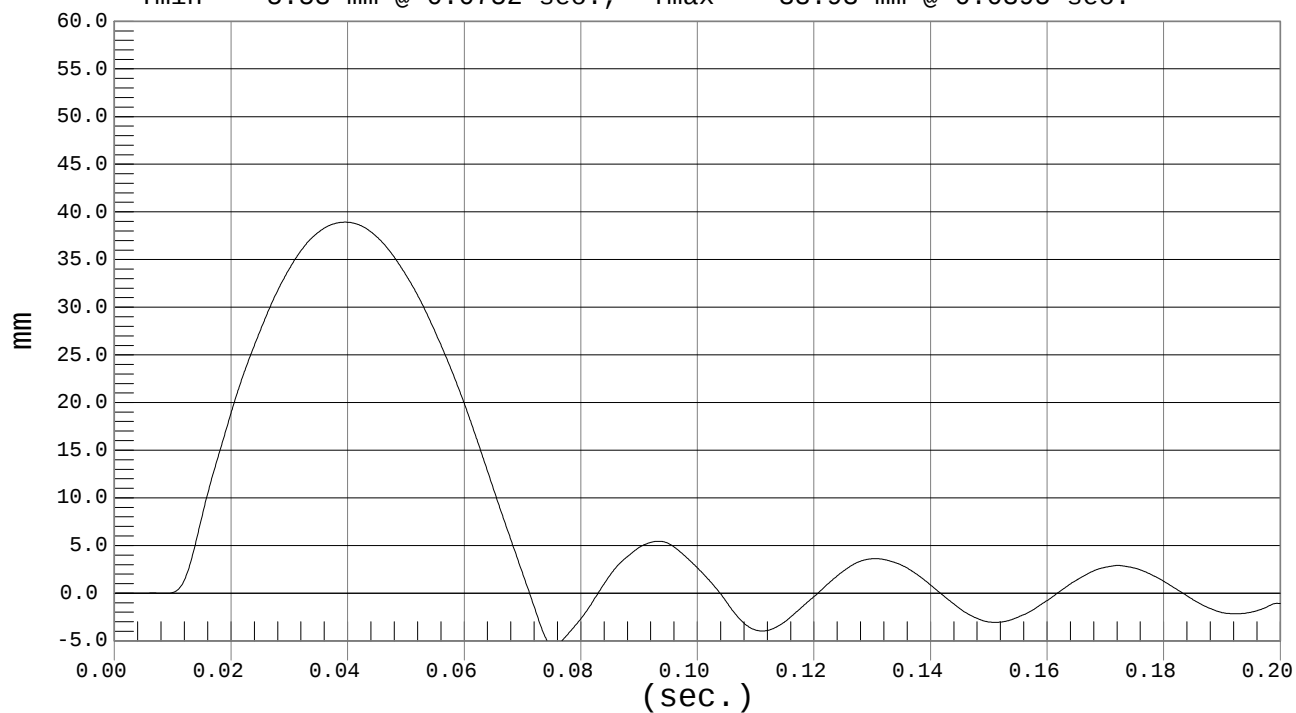


LOWER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 9.8 fps, 3.00 M/s

Ymin = -5.53 mm @ 0.0752 sec., Ymax = 38.93 mm @ 0.0395 sec.



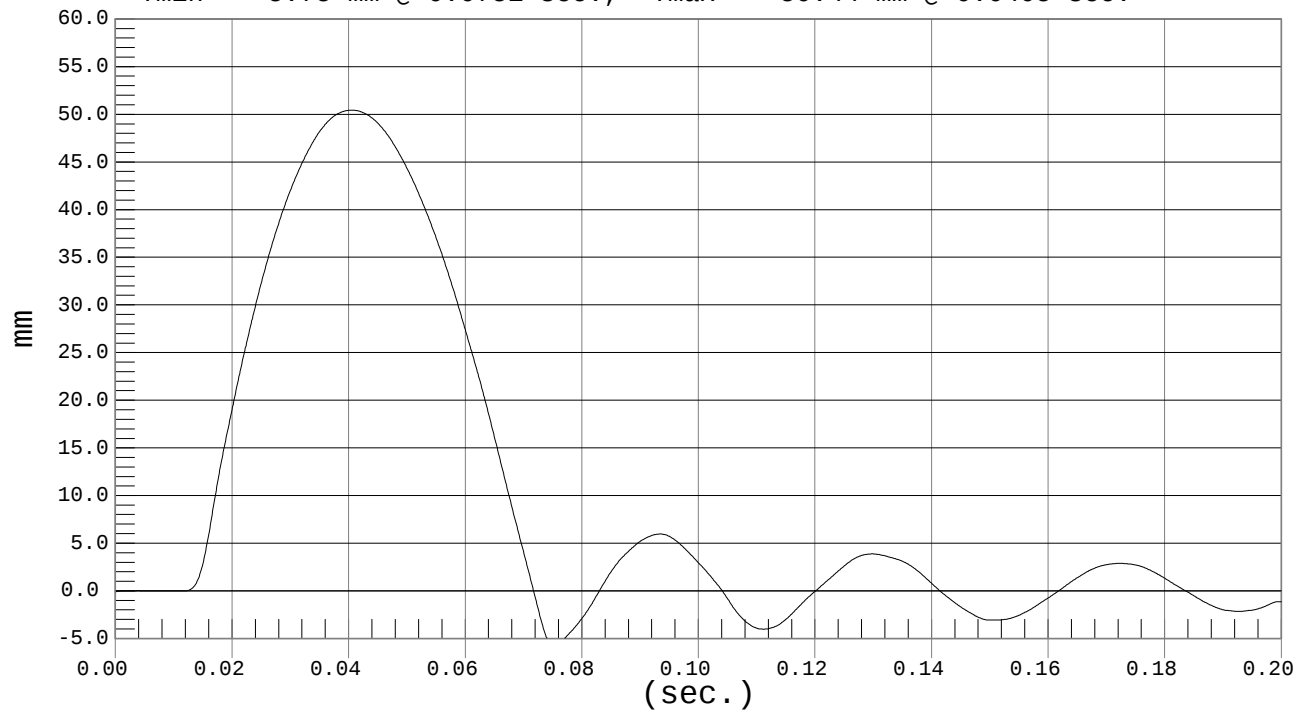


LOWER RIB DISPLACEMENT

Test Desc.: Rib Module
Component: Dummy #010

Test Date: 03-04-03
Speed: 13.1 fps, 4.00 M/s

Ymin = -5.75 mm @ 0.0751 sec., Ymax = 50.44 mm @ 0.0405 sec.

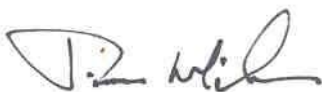


MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

Date: 3/5/03
Dummy Serial Number: 010
Test Number: D03257

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.7
Relative Humidity (%)	10 – 70	20
Probe Speed (m/s)	3.90 – 4.10	4.07
Maximum Impact Force	4.00 – 4.80 kN	4.52
Time of Maximum Force	10.60 – 13.00 ms	10.60
Maximum Total Abdomen Force	2.20 – 2.70 kN	2.60
Time of Max. Total Force	10.00 – 12.30 ms	10.80

TEST MEETS SPECIFICATIONS

Technician: 

Approved By: 

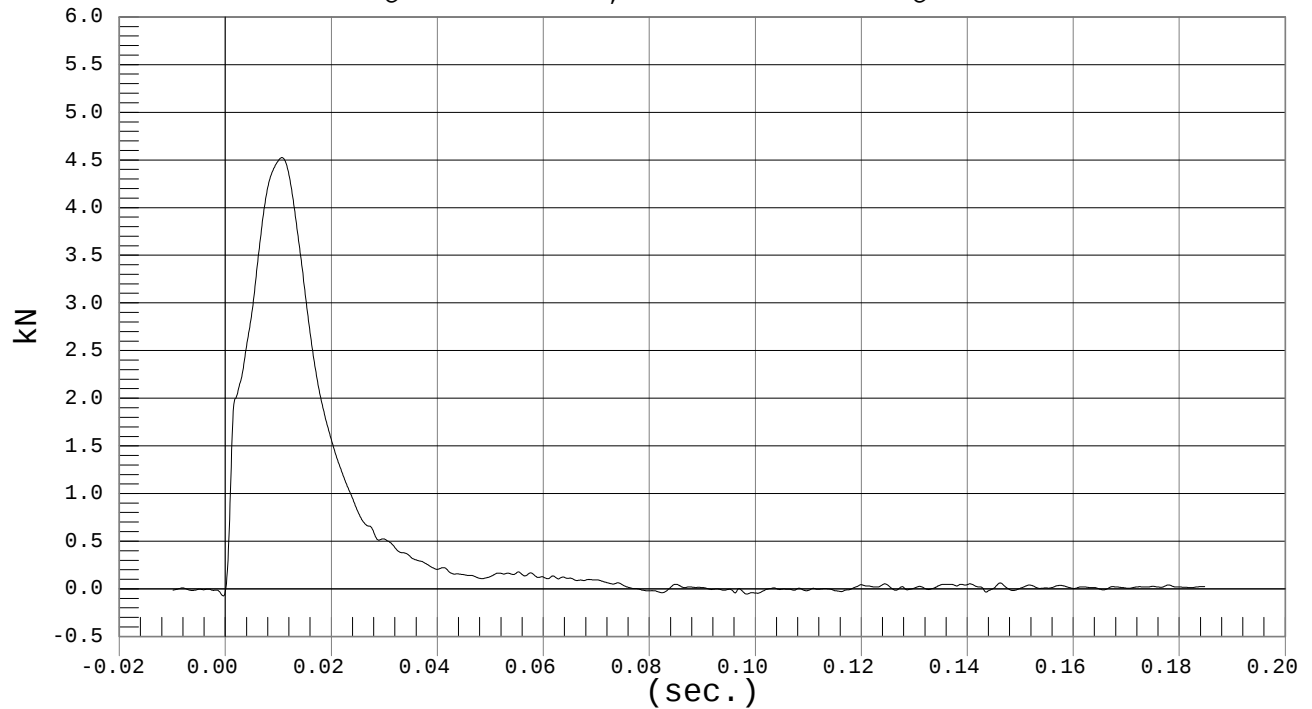


IMPACTOR FORCE

Test Desc.: Abdomen Impact
Component: Dummy #010

Test Date: 03-05-03
Speed: 13.3 fps, 4.07 M/s

Ymin = -.08 kN @ -0.0005 sec., Ymax = 4.52 kN @ 0.0106 sec.

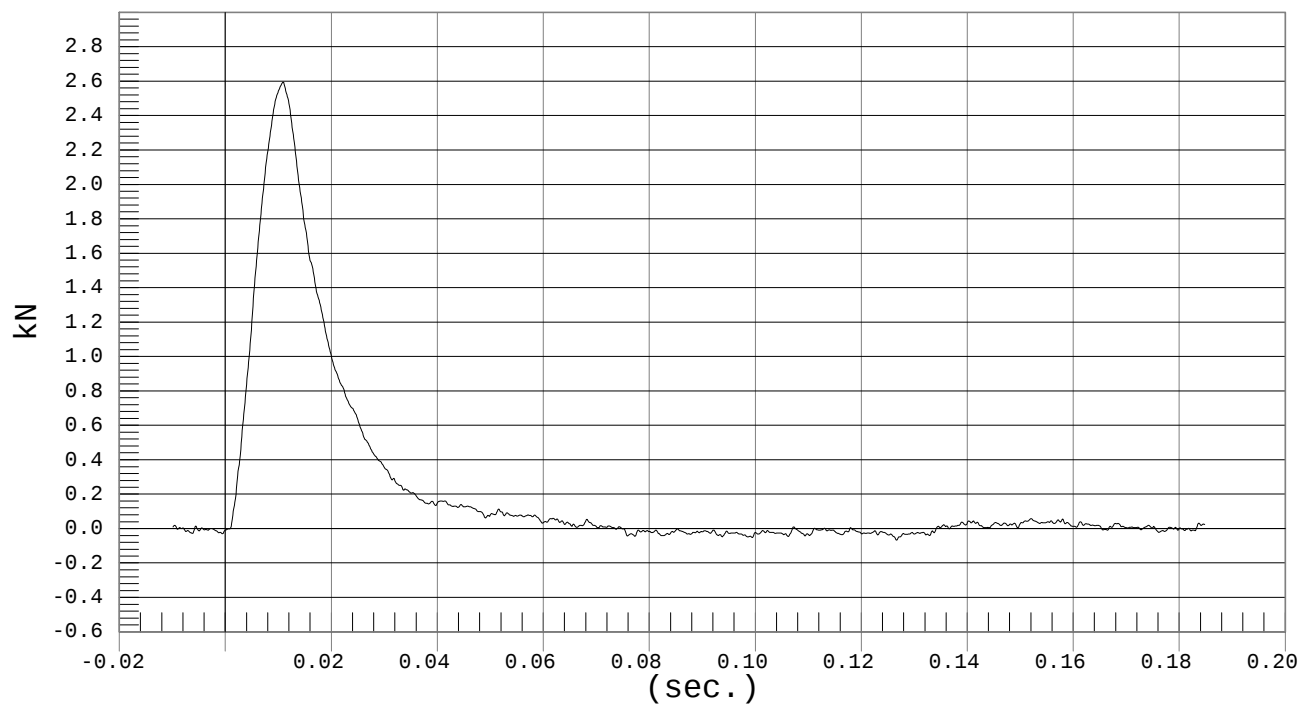


ABDOMEN FORCE

Test Desc.: Abdomen Impact
Component: Dummy #010

Test Date: 03-05-03
Speed: 13.3 fps, 4.07 M/s

Ymin = -.07 kN @ 0.1266 sec., Ymax = 2.6 kN @ 0.0108 sec.



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date: 3/4/03
Dummy Serial Number: 010
Test Number: D03258

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	20.7
Relative Humidity (%)		10 – 70	22
Pendulum Speed		5.95 – 6.15	6.11
Pendulum Deceleration	10 msec	-2.46 - -1.59 m/sec	-1.81
	20 msec	-5.25 - -4.07 m/sec	-4.07
	25 msec	-6.64 - -5.30 m/sec	-5.31
	30 msec	≥ -6.5 m/sec	-5.97
Maximum Flexion Angle		45.0 – 55.0 deg	51.7
Time of Max. Flexion Angle		39.0 – 53.0 ms	48.7
Maximum Angle Theta (A)		31.0 – 35.0 deg	32.7
Time of Max. Theta (A)		44.0 – 52.0 ms	48.7
Maximum Angle Theta (B)		28.16– 30.66 deg	30.16
Time of Max. Theta (B)		44.0 – 52.0 ms	48.6

TEST MEETS SPECIFICATIONS

Technician: _____

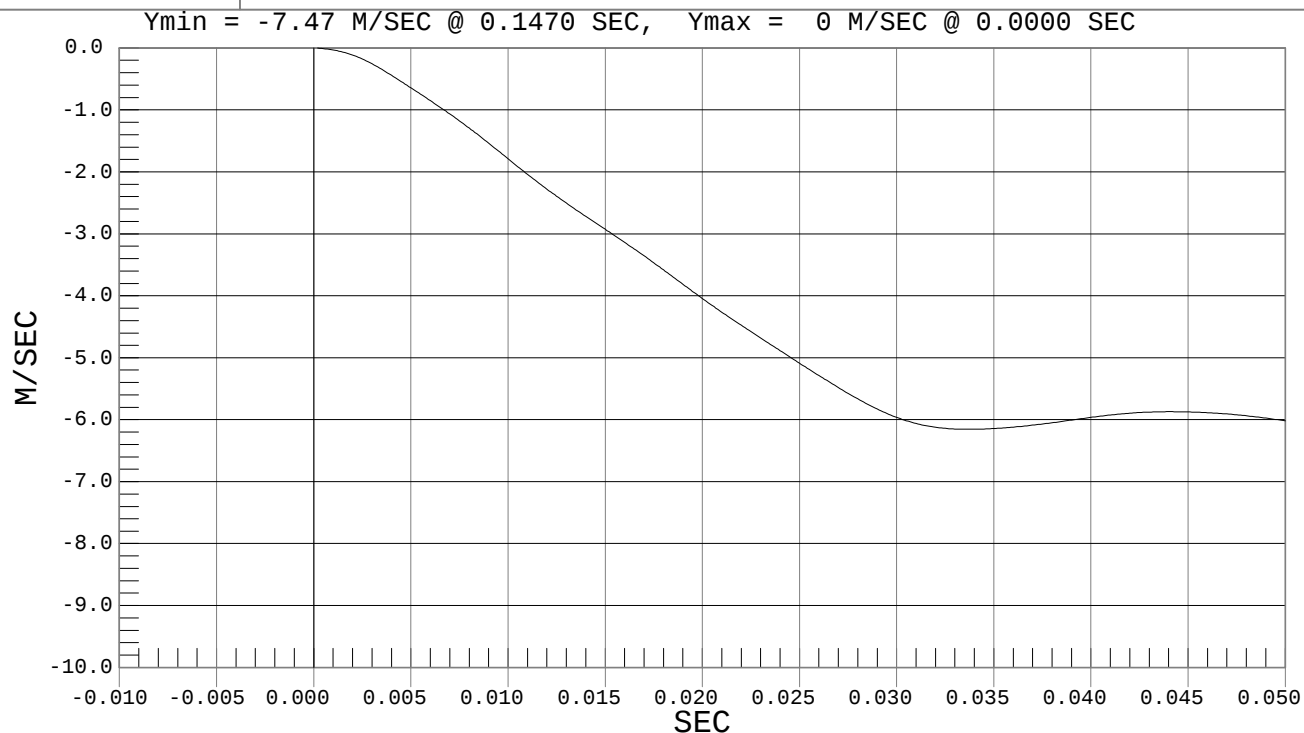
Approved By: _____



PENDULUM DECELERATION

Test Desc.: Lumbar Flexion
Component: Dummy #009

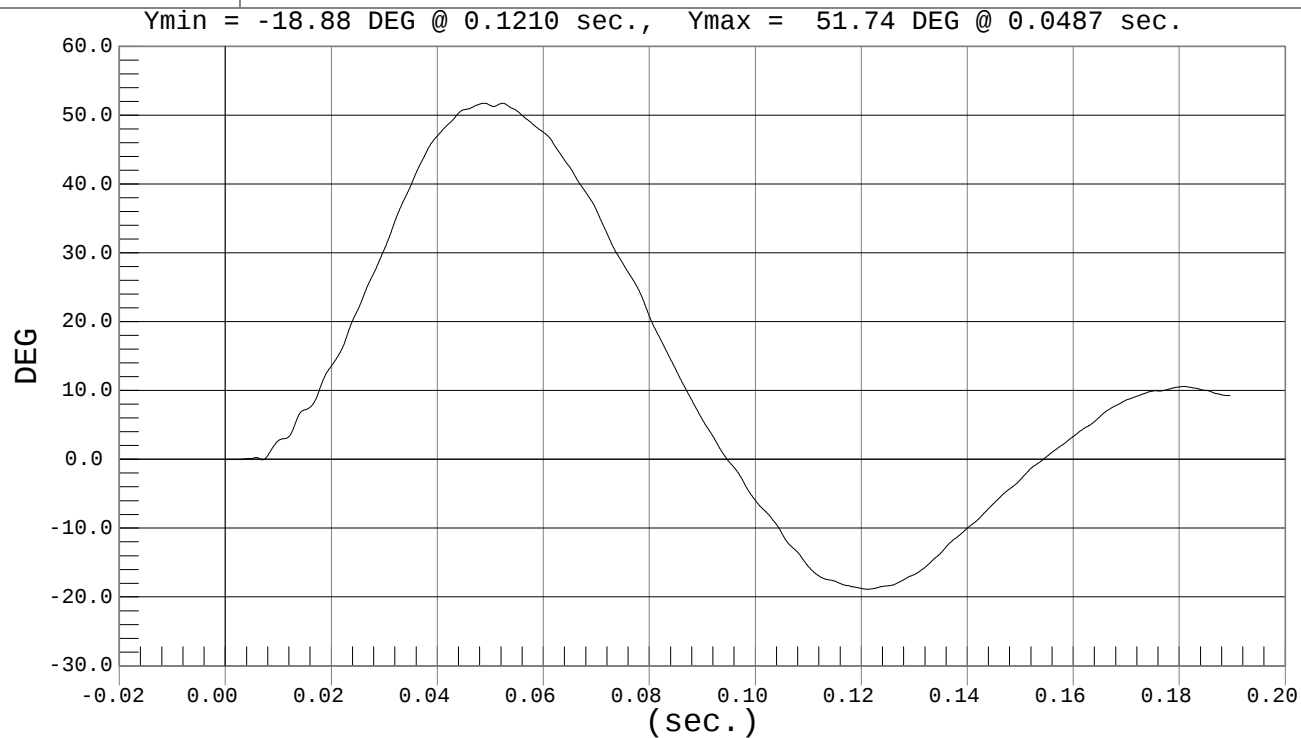
Test Date: 03-04-03
Speed: 20.0 fps, 6.11 M/s



FLEXION ANGLE

Test Desc.: Lumbar Flexion
Component: Dummy #009

Test Date: 03-04-03
Speed: 20.0 fps, 6.11 M/s



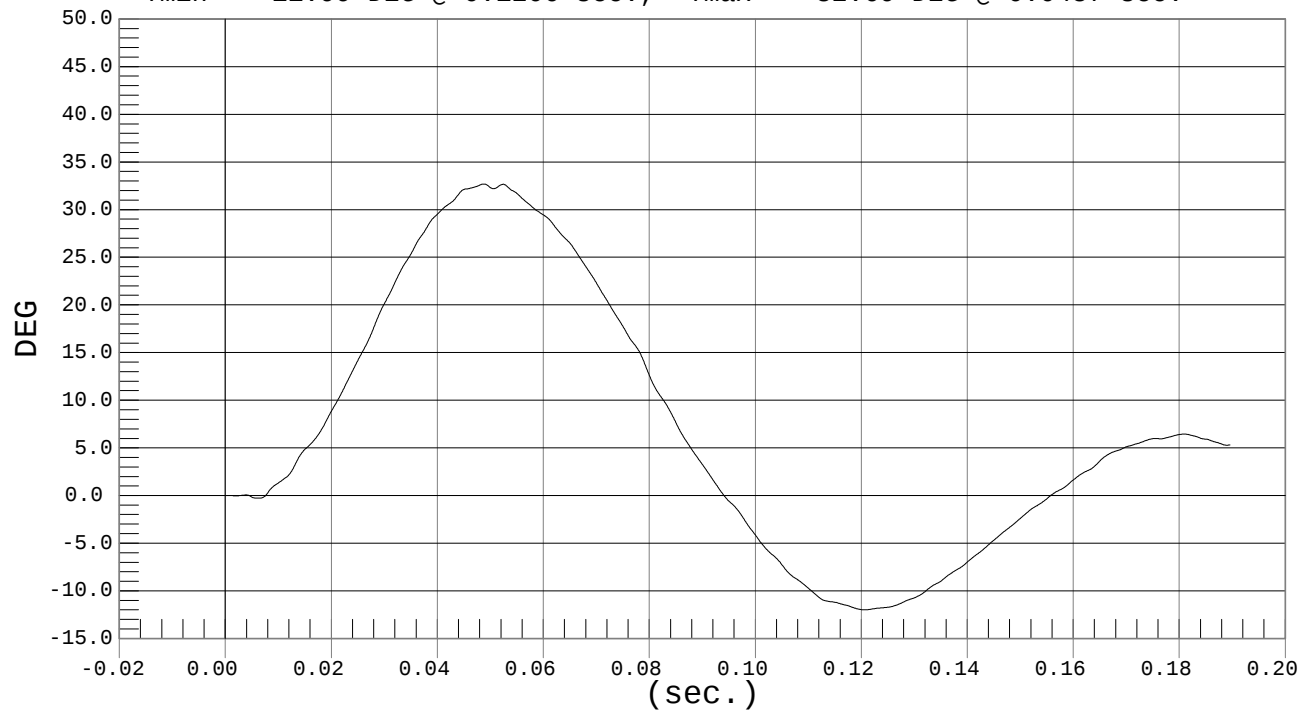


Test Desc.: Lumbar Flexion
Component: Dummy #009

THETA A

Test Date: 03-04-03
Speed: 20.0 fps, 6.11 M/s

Ymin = -11.99 DEG @ 0.1206 sec., Ymax = 32.69 DEG @ 0.0487 sec.

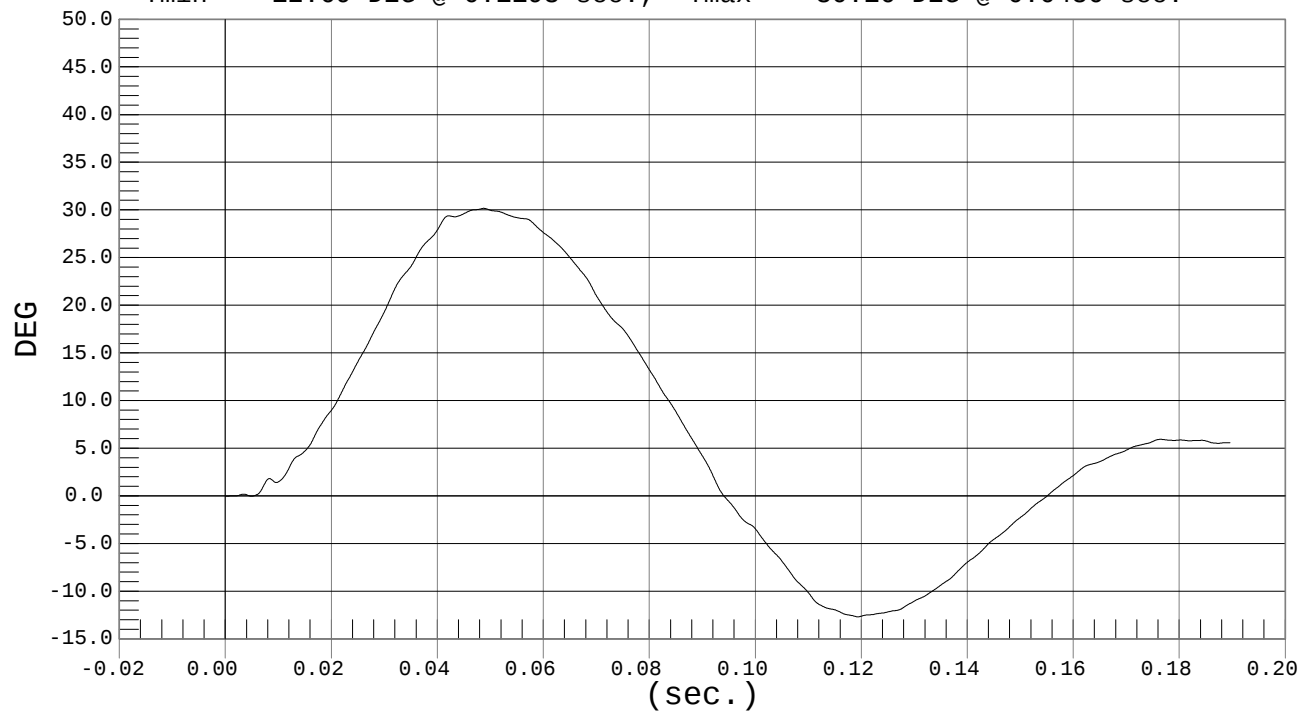


Test Desc.: Lumbar Flexion
Component: Dummy #009

THETA B

Test Date: 03-04-03
Speed: 20.0 fps, 6.11 M/s

Ymin = -12.69 DEG @ 0.1193 sec., Ymax = 30.16 DEG @ 0.0486 sec.



MGA RESEARCH CORPORATION
PELVIS TEST
EUROSID 2 DUMMY

Date: 3/5/03
Dummy Serial Number: 010
Test Number: D03259

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.8
Relative Humidity (%)	10 – 70	20
Pendulum Speed	4.20 – 4.40 m/s	4.30
Maximum Impactor Force	4.40 – 5.40 kN	4.81
Time of Max. Impactor Force	10.30 – 15.50 ms	13.00
Maximum Pubic Force	1.04 – 1.64 kN	1.37
Time of Max. Pubic Force	9.90 – 15.90 ms	14.10

TEST MEETS SPECIFICATIONS

Technician: _____

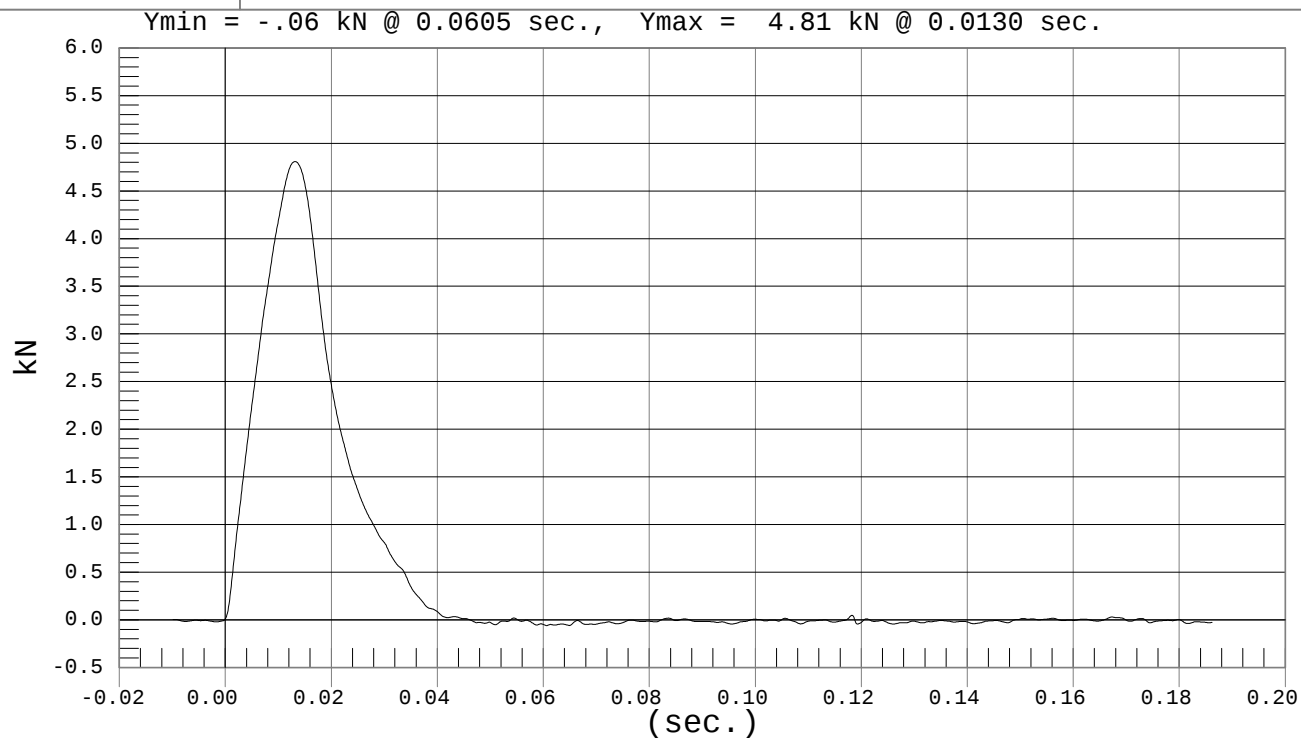
Approved By: _____



IMPACTOR FORCE

Test Desc.: Pelvis Impact
Component: Dummy #010

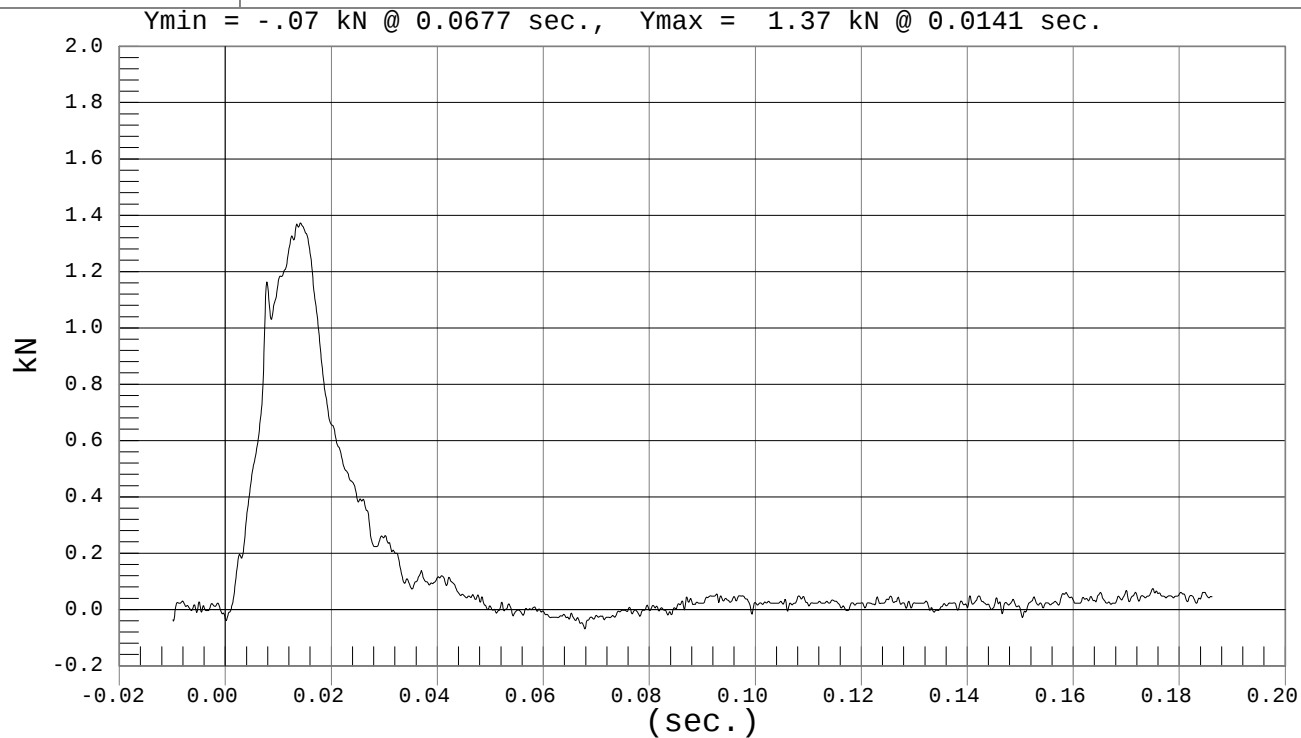
Test Date: 03-05-03
Speed: 14.1 fps, 4.30 M/s



PUBIC FORCE

Test Desc.: Pelvis Impact
Component: Dummy #010

Test Date: 03-05-03
Speed: 14.1 fps, 4.30 M/s



APPENDIX D
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY AND VEHICLE CALIBRATION DATA

	INSTRUMENTS FOR LEFT FRONT DUMMY NO. 010		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	J21724	Endevco	11/20/02
Head Y Accelerometer	AHWK8	Endevco	11/20/02
Head Z Accelerometer	J21612	Endevco	11/20/02
Driver Head Y – Front	J33415	Endevco	10/9/02
Driver Head Z – Front	J33394	Endevco	10/9/02
Driver Head X – Left	J13628	Endevco	1/24/03
Driver Head Z – Left	AHYE2	Endevco	10/9/02
Driver Head X – Upper	J14006	Endevco	1/24/03
Driver Head Y – Upper	J13652	Endevco	1/24/03
Upper Neck Force X Load Cell	N106FX	FTSS	6/5/02
Upper Neck Force Y Load Cell	N106FY	FTSS	6/5/02
Upper Neck Force Z Load Cell	N106FZ	FTSS	6/5/02
Upper Neck Moment X	N106MX	FTSS	6/5/02
Upper Neck Moment Y	N106MY	FTSS	6/5/02
Upper Neck Moment Z	N106MZ	FTSS	6/5/02
Lower Neck Force X Load Cell	N111FX	FTSS	6/5/02
Lower Neck Force Y Load Cell	N111FY	FTSS	6/2/02
Lower Neck Force Z Load Cell	N111FZ	FTSS	6/2/02
Lower Neck Moment X	N111MX	FTSS	6/2/02
Lower Neck Moment Y	N111MY	FTSS	6/2/02
Lower Neck Moment Z	N111MZ	FTSS	6/2/02
Shoulder Force X Load Cell	S120FX	FTSS	5/31/02
Shoulder Force Y Load Cell	S120FY	FTSS	5/31/02
Shoulder Force Z Load Cell	S120FZ	FTSS	5/31/02
Upper Spine X Accelerometer	AP1H2	Endevco	1/15/03
Upper Spine Y Accelerometer	AH0B0	Endevco	1/15/03
Upper Spine Z Accelerometer	ALE80	Endevco	1/15/03
Upper Rib Y Accelerometer	J12425	Endevco	1/24/03
Mid Rib Y Accelerometer	J12462	Endevco	1/24/03
Lower Rib Y Accelerometer	J12449	Endevco	1/24/03
Upper Rib Displacement	010U	Honeywell	5/22/01
Mid Rib Displacement	010M	Honeywell	5/22/01
Lower Rib Displacement	010L	Honeywell	10/18/01
Lower Spine X Accelerometer	AJ7A2	Endevco	1/24/03
Lower Spine Y Accelerometer	AJ819	Endevco	1/24/03
Lower Spine Z Accelerometer	AJ9J7	Endevco	1/24/03
Torso Force X Load Cell	ET104FX	FTSS	12/5/02
Torso Force Y Load Cell	ET104FY	FTSS	12/5/02
Torso Moment Y Load Cell	ET104MY	FTSS	12/5/02
Torso Moment Z Load Cell	ET104MZ	FTSS	12/5/02
T-12 Force X Load Cell	LS102FX	FTSS	6/5/02

INSTRUMENTS FOR LEFT FRONT DUMMY NO. 010			
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
T-12 Force Y Load Cell	LS102FY	FTSS	6/5/02
T-12 Moment X Load Cell	LS102MX	FTSS	6/5/02
T-12 Moment Y Load Cell	LS102MY	FTSS	6/5/02
Front Abdomen Load Cell	A119FY	FTSS	6/3/02
Mid Abdomen Load Cell	A120FY	FTSS	6/3/02
Rear Abdomen Load Cell	A121FY	FTSS	6/3/02
Pelvis X Accelerometer	AH0A2	Endevco	1/15/03
Pelvis Y Accelerometer	AJ9P7	Endevco	1/15/03
Pelvis Z Accelerometer	AJ462	Endevco	1/15/03
Right Femur Force X Load Cell	F137FX	FTSS	6/3/02
Right Femur Force Y Load Cell	F137FY	FTSS	6/3/02
Right Femur Force Z Load Cell	F137FZ	FTSS	6/3/02
Right Femur Moment X	F137MX	FTSS	6/3/02
Right Femur Moment Y	F137MY	FTSS	6/3/02
Right Femur Moment Z	F137MZ	FTSS	6/3/02
Left Femur Force X Load Cell	F138FX	FTSS	6/3/02
Left Femur Force Y Load Cell	F138FY	FTSS	6/3/02
Left Femur Force Z Load Cell	F138FZ	FTSS	6/3/02
Left Femur Moment X	F138MX	FTSS	6/3/02
Left Femur Moment Y	F138MY	FTSS	6/3/02
Left Femur Moment Z	F137MZ	FTSS	6/3/02
Lumbar Force Y Load Cell	L105FY	FTSS	5/31/02
Lumbar Force Z Load Cell	L105FZ	FTSS	5/31/02
Lumbar Moment X Load Cell	L105MX	FTSS	5/31/02
Pubic Symphysis Force Y	P113FY	FTSS	5/16/02

VEHICLE INSTRUMENT CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Mid A-Post Y	G01-N21	ENTRAN	1/16/03
Left Lower A-Post Y	99F348	ENTRAN	1/16/03
Left Mid B-Post Y	G01-N20	ENTRAN	2/24/03
Left Lower B-Post Y	L23-A01	ENTRAN	2/24/03
Floorpan @ Rear Axle X	A08-M01	ENTRAN	2/24/03
Floorpan @ Rear Axle Y	E10-F20	ENTRAN	1/30/03
Floorpan @ Rear Axle Z	A08-M08	ENTRAN	2/24/03
Driver Seat Track Y	J10-E12	ENTRAN	1/30/03
Right Front Sill X	D11-F14	ENTRAN	11/19/02
Right Front Sill Y	I25-J09	ENTRAN	10/07/02
Right Front Sill Z	99F251	ENTRAN	1/15/03
Right Rear Sill X	K04-A17	ENTRAN	11/19/02
Right Rear Sill Y	E13-D06	ENTRAN	9/6/02
Right Rear Sill Z	H14-N13	ENTRAN	10/8/02
Left Front Sill Y	H14-N08	ENTRAN	10/7/02
Left Rear Sill Y	E03-H14	ENTRAN	10/8/02
Vehicle CG X	A09-N37	ENTRAN	2/24/03
Vehicle CG Y	A08-M03	ENTRAN	2/24/03
Vehicle CG Z	A08-M11	ENTRAN	2/24/03
Left Front Door @ Pelvis Y	H01-N24	ENTRAN	10/30/02
Left Front Door @ Arm Y	H05-F03	ENTRAN	10/30/02
Left Front Door @ Knee Y	H01-N22	ENTRAN	10/30/02
Left Front Door @ Rib Y	H05-F17	ENTRAN	10/30/02
Lower Center Radiator Support X	L23-A05	ENTRAN	11/19/02
Lower Center Radiator Support Y	F04-N08	ENTRAN	10/18/02
Lower Center Radiator Support Z	A08-A11	ENTRAN	10/7/02

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

APPENDIX E
DUMMY PEAK RESPONSES

DRIVER (ES-2) PEAK RESPONSE TABLE

Location	Peak Response										
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ES2 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03		1999 Volvo S80 ES2 214 Seating 2/28/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time	Peak	Time
Head	1000	X	G	177.1	62.9	22.8	-55.3	-33.0	60.4	-30.4	62.4
	1000	Y	G	384.7	62.9	63.9	61.4	55.0	59.4	44.2	59.4
	1000	Z	G	62.5	62.7	35.9	62.9	25.9	49.9	29.8	53.2
	1000	RES	G	427.2	62.9	72.6	61.4	68.7	60.4	55.0	59.5
Head Injury Criteria (HIC)				2213		465		395		329	
t1				62.3		51.9		48.5		42.1	
t2				63.4		70.6		69.2		68.6	
Upper Neck Force	1000	X	N	485	67.9	519	-64	-854	61	-600	64.4
	1000	Y	N	545	60.6	412	59.6	946	62	503	44.5
	1000	Z	N	1997	63.3	1020	56.1	1061	50	1064	52.4
	1000	RES	N	2034	63.3	1104	57.5	1606	61	1200	52.4
Upper Neck Moment	600	X	Nm	95.4	63.4	51.7	-64.3	-32.5	61.9	-37.8	38.1
	600	Y	Nm	41.5	68.0	54.8	-65.0	-40.2	60.0	-27.5	62.0
	600	Z	Nm	25.2	63.2	26.6	-174.3	-46.1	153.0	23.6	66.8
	600	RES	Nm	99.7	63.4	77.6	65.1	49.1	60.8	38.7	38.1

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Response										
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ES2 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03		1999 Volvo S80 ES2 214 Seating 2/28/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time	Peak	Time
Lower Neck Force	1000	X	N			699	-66			539	178.2
	1000	Y	N			807	60			1049	52.4
	1000	Z	N			963	56			792	44.8
	1000	RES	N			1294	57			1325	52.3
Lower Neck Moment	600	X	Nm			100.8	60.6			128.6	54.4
	600	Y	Nm			73.1	64.9			81.9	65.9
	600	Z	Nm			32.6	180.9			15.8	62.0
	600	RES	Nm			121	62.4			144.7	62.8
Shoulder Force	600	X	N			410	87			403	35.7
	600	Y	N			431	55			648	22.8
	600	Z	N			439	-59			-402	58.6
	600	RES	N								
Upper Spine	180	X	G	29.8	70.1	10.5	-67.5			-8.5	61.5
	180	Y	G	42.6	57.0	36.6	50.5			38.2	38.3
	180	Z	G	20.9	63.5	9.2	63.3			6.2	60.1
	180	Res	G	44.9	56.9	37.1	50.5			38.3	38.3

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Response										
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ES2 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03		1999 Volvo S80 ES2 214 Seating 2/28/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time	Peak	Time
Lower Spine	180	X	G	23.8	69.8	11.5	76.0	-23.9	59.5	-9	87.6
	180	Y	G	58.3	48.0	51.2	43.9	53.2	45.3	51	43.9
	180	Z	G	17.4	63.5	8.4	63.3	6.5	62.1	6.2	60.0
	180	Res	G	58.4	48.0	51.3	43.9	54.1	45.3	51	43.9
Upper Rib	180	Y	G	59.8	50.3	55.8	14.2	46.8	45.2	48	21.5
Mid Rib	180	Y	G			61.8	17.0			44	13.9
Lower Rib	180	Y	G	61.1	50.7	59.2	14.2	42.3	41.5	38	77.5
Upper Rib Deflection	180	Y	mm	37.6	67.4	40.7	42.4			-49	44.2
Mid Rib Deflection	180	Y	mm			39.0	43.2			-46	43.6
Lower Rib Deflection	180	Y	mm			36.2	44.0			-46	43.6
Upper Rib VC	180	Y	m/sec			0.4	36.3			0.7	29.4
Mid Rib VC	180	Y	m/sec			0.4	35.9			0.6	31.0
Lower Rib VC	180	Y	m/sec			0.4	60.4			0.4	29.1
Torso Force	600	X	N			495	47.4			833	43.2
	600	Y	N			254	32.0			-469	35.7
Torso Moment	600	Y	Nm			16.3	141.5			-14.7	169.8
	600	Z	Nm			24.3	50.0			30.4	45.8

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Response										
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ES2 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03		1999 Volvo S80 ES2 214 Seating 2/28/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time	Peak	Time
T12 Force	600	X	N			1158	63			1163	65.0
	600	Y	N			1370	51			-928	86.1
T12 Moment	600	X	Nm			130.2	68.1			131.1	53.3
	600	Y	Nm			154.3	63.2			130	61.5
Abdomen Front Force	600	Y	N			281	45			215	46.8
Abdomen Mid Force	600	Y	N			648	45			535	44.8
Abdomen Rear Force	600	Y	N			629	44			821	44.9
Abdomen Summed Force	600	Y	N			1553	45			1547	44.8
Pubic Symphysis Force	600	Y	N			1701	46			-1127	44.9
Right Femur Force	600	X	N			257	112			175	85.9
	600	Y	N			1082	90			972	61.6
	600	Z	N			1248	89			1114	56.4
	600	RES	N			1615	93			13889	61.8
Right Femur Moment	600	X	Nm			93.2	74.4			-104.5	58.9
	600	Y	Nm			43.1	81.4			43.8	50.5
	600	Z	Nm			31.8	102.3			-49.5	70.0
	600	RES	Nm			94.3	74.7			112.5	58.9

DRIVER (ES-2) PEAK RESPONSE TABLE (CONTINUED)

Location	Peak Response										
				1999 Volvo S80 SID III 8/21/02		1999 Volvo S80 ES2 8/27/02		1999 Volvo S80 SID III 214 Seating 1/30/03		1999 Volvo S80 ES2 214 Seating 2/28/03	
	Class	Axis	Units	Peak	Time	Peak	Time	Peak	Time	Peak	Time
Left Femur Force	600	X	N			238	89			-266	70.5
	600	Y	N			1003	85			532	56.6
	600	Z	N			5471	88			7336.0	50.6
	600	RES	N			5513	88			7338	50.6
Left Femur Moment	600	X	Nm			72.8	75.0			-130	49.8
	600	Y	Nm			38.1	113.1			55	50.0
	600	Z	Nm			43.7	86.0			-53	56.8
	600	RES	Nm			75.4	75.5			144	49.9
Pelvis	1000	X	G			16.2	73.4	-13.4	66.0	15.2	56.2
	1000	Y	G			64.5	44.7	59.1	42.1	62.1	40.4
	1000	Z	G			9.9	64.8	-4.9	45.4	7.9	67.4