

REPORT NUMBER: TO1-MGA-2004-013

**OBLIQUE RIGID SIDE POLE IMPACT
ES-2RE DRIVER POSITION
TEST DATE: May 11, 2005
Task Order #T0001 / RFP #0004**

**2005 FORD EXPEDITION
NHTSA NUMBER: R50613**

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

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SECTION 1
PURPOSE AND TEST PROCEDURE

This Side Impact test is conducted as part of Contract No. DTRS57-04-D-30001, RFP 4, task order 1, sponsored by the U.S. Department of Transportation, Volpe National Transportation System Center. The purpose of this test is to evaluate the performance of the vehicle and restraint system when subjected to an oblique rigid pole side impact (75 degrees at 32 km/h impact speed). The ES-2RE dummy was positioned in the driver seat. (ES-2RE is an ES-2 with rib extensions including a modified back plate with linear bearings)

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

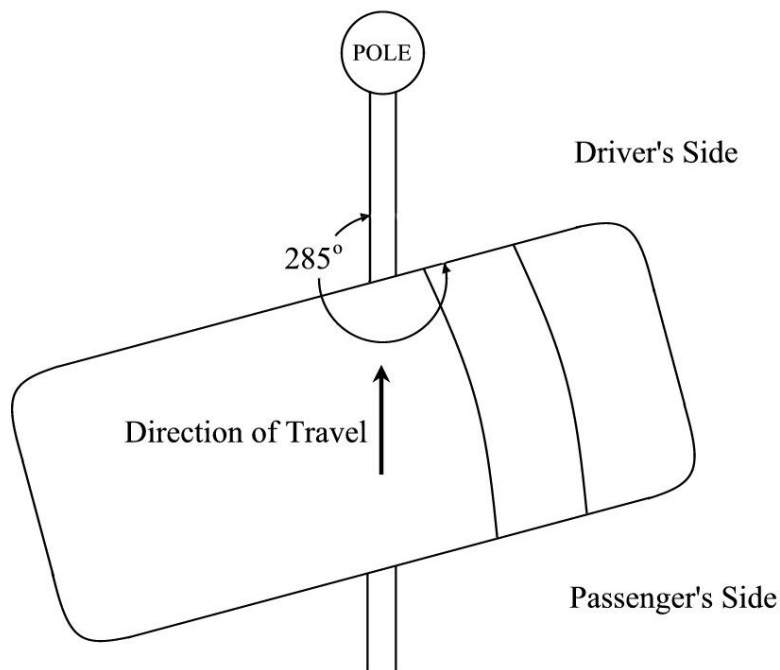
SECTION 2

SUMMARY OF SIDE IMPACT TEST

An oblique rigid side pole impact test at 75 degrees was performed on a 2005 Ford Expedition. The subject vehicle was towed into an oblique rigid pole at a velocity of 32.3 km/h. The weight of the vehicle as tested was 2702.5 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on May 11, 2005. Pre- and post-test photographs of the test vehicle and the dummies are included in Appendix A.

One ES-2RE side impact dummy was placed in the left front designated seating position according to Appendix B of the draft test procedure TP-214P-00 dated May 21, 2004. The side impact event was documented by twelve high speed cameras and one real time camera. Camera locations and other pertinent camera information can be found in this report.

Appendix B contains the vehicle and dummy response data. A summary of the dummy configuration and performance verification test data is shown in Appendix C. Dummy and vehicle instrument 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:

		Requirement	Test #s
HIC 36 (CFC 1000)	T1 (msec)		50.8
	T2 (msec)		65.2
	HIC 36	< 1000	689
Thorax (CFC 180)			
Chest Deflection	Upper Rib Deflection	< 42	-25.7
	Mid Rib Deflection	< 42	-18.5
	Lower Rib Deflection	< 42	-16.0
Lower Spine (CFC 180)			
	Lower Spine Resultant	< 82	75.3
Abdomen (CFC 600)			
	Front Abdominal Force		412
	Mid Abdominal Force		3557
	Rear Abdominal Force		3207
	Sum of Abdominal Force	< 2500	6973
Pelvis (CFC 600)			
	Pubic Symphysis Force	< 6000	-2575

Contact Times	Left Front
Head (msec)	**
Arm (msec)	35.2
Rib (msec)	40.8
Pelvis (msec)	43.6

** Not collected during test (due to side airbags)

TEST NOTES

Left Front Sill Y – No valid data collected after 80 msec
Left Lower B-Post Y – No valid data collected after 100 msec
LF Door @ Pelvis Y – No valid data collected after 20 msec
LF Door @ Knee Y – No valid data collected after 40 msec
LF Door @ Mid Rib Y – No valid data collected after 40 msec
Left A-Post @ Sill Y – No valid data collected after 40 msec

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

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

TEST VEHICLE INFORMATION

Make	Ford Motor Company
Model	Expedition
Body Style	SUV
VIN	1FMFU15545LA56386
Color	Red
Odometer Reading (mile)	498
Transmission	Automatic
Final Drive	2 WD
Number of Cylinders	8
Engine Displacement (L)	5.4
Engine Placement	Longitudinal

TEST VEHICLE OPTIONS

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

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company	GVWR (kg)	3220
Date of Manufacture	12/04	GAWR Front (kg)	1428
		GAWR Rear (kg)	1872

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Cold Pressure (kPa)	240	240
Recommended Tire Size	P265/70R17	P265/70R17
Tire Size on Vehicle	P265/70R17	P265/70R17
Tire Manufacturer	Continental	Continental

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench	Bench	
Number Of Occupants	2	3	3	8
Capacity Wt. (VCW) (kg)				724
Cargo Wt. (RCLW) (kg)				180.5

DATA SHEET NO. 1... (continued)**GENERAL TEST AND VEHICLE PARAMETER DATA**Test Vehicle: 2005 Ford ExpeditionTest Date: May 11, 2005**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	621.4	606.9		640.2	689.7	
Right	kg	585.1	636.4		605.3	737.3	
Ratio	%	49.3	50.7		46.6	53.4	
Totals	kg	1206.5	1243.3	2449.8	1245.5	1427.0	2672.5

TARGET TEST WEIGHT

Measured Parameter	Units	Value
As Delivered Vehicle Weight	kg	2449.8
Weight of 1 ES-2	kg	80.7
Rated Cargo Weight	kg	136.1
Vehicle Target Weight (TVTW)	kg	2666.6

TEST VEHICLE ATTITUDES

	Unit	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	Deg	1.2 ND	0.9 ND	0.9 ND
Left Door Sill Angle	Deg	1.9 ND	1.7 ND	1.7 ND
Front Bumper Angle	Deg	0.5 RD	0.3 RD	0.5 RD
Rear Bumper Angle	Deg	0.1 RD	0.0	0.1 RD

ND=Nose down, NU = Nose Up, LD = Left Down, RD = Right Down, LU = Left Up, RU =Right Up

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	3021
Total Vehicle Length at Centerline	mm	5166
Total Vehicle Width	mm	2074
Weight of Ballast in Cargo Area	kg	116.1
Amount of Water in Fuel Tank	liters	106.0

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Impact Reference Line from Front Axle	mm	1383
Impact Point	mm	4 forward
Impact Angle Difference	deg	0.0

DATA SHEET NO. 1... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

NORMAL DESIGN RIDING POSITION

The manufacturers procedure is as follows: The seat back angle is measured relative to the rocker sill. Remove the seat back panel and position inclinometer 13 inches above the back pivot point on the rear outboard seat frame. Avoid taking measurement on reinforcement plates

Driver seat back angle: 16.7° (measured on seat frame)

SEAT FORE/AFT POSITIONS

The driver's seat was manually operated. The manufacturer's procedure is as follows: position the seat in the mechanical mid position. Reference points are scribed on the seat and the seat track. The total seat travel is measured and the seat is then positioned in the center of the seat travel. On manual seats, position at the mid point track location (if available) or the next closest position to the rear of the mid point travel location.

Driver seat fore/aft total travel: 200mm

Driver seat fore/aft position: 100 of 200 mm

SEAT BELT UPPER ANCHORAGE

The test vehicle "D" ring anchorage for the driver's seat position was placed in the first position down from the most upright position.

STEERING COLUMN ADJUSTMENT

The column was placed in the mid position of travel.

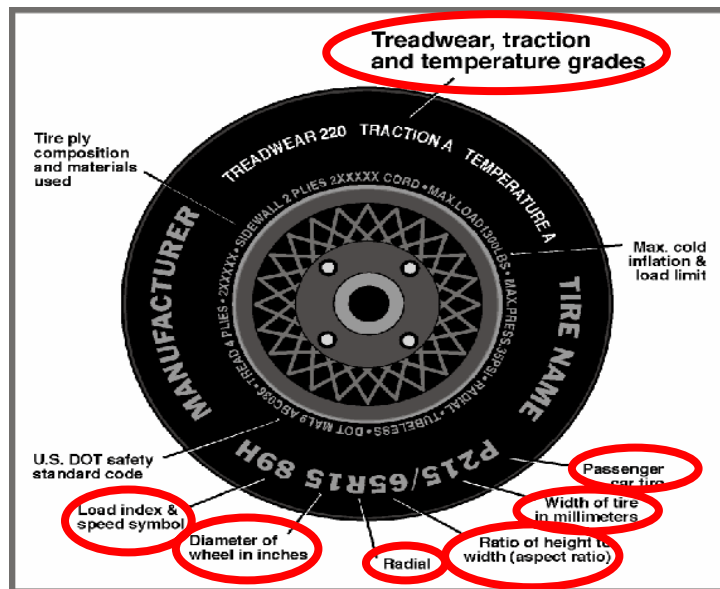
DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

Vehicle Year	2005	Vehicle Make	Ford Motor Company
VIN	1FMFU15545LA56386	Vehicle Model	Expedition



	Front	Rear
Tire Manufacturer	Continental	Continental
Tire Name	Contitrac SUV	Contitrac SUV
Tire Type	M+S	M+S
Tire Width (mm)	265	265
Ratio of Height to Width (aspect ratio)	70	70
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	113S	113S
Treadwear	520	520
Traction Grade	A	A
Temperature Grade	B	B

DATA SHEET NO. 3
POST TEST OBSERVATIONS

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front
Dummy Type	ES-2RE
Head Contact	Curtain bag, Overhead Center Console, Headrest
Upper Torso Contact	Curtain bag, Door Panel
Lower Torso Contact	Door Panel
Left Knee Contact	Door panel
Right Knee Contact	Left knee

POST TEST DOOR OPENING

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

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No failure
Sill Separation	None
Windshield Damage	Windshield Broke
Window Damage	Left side up for test, Left front broke
Other Notable Effects	None

AIRBAG DEPLOYMENT

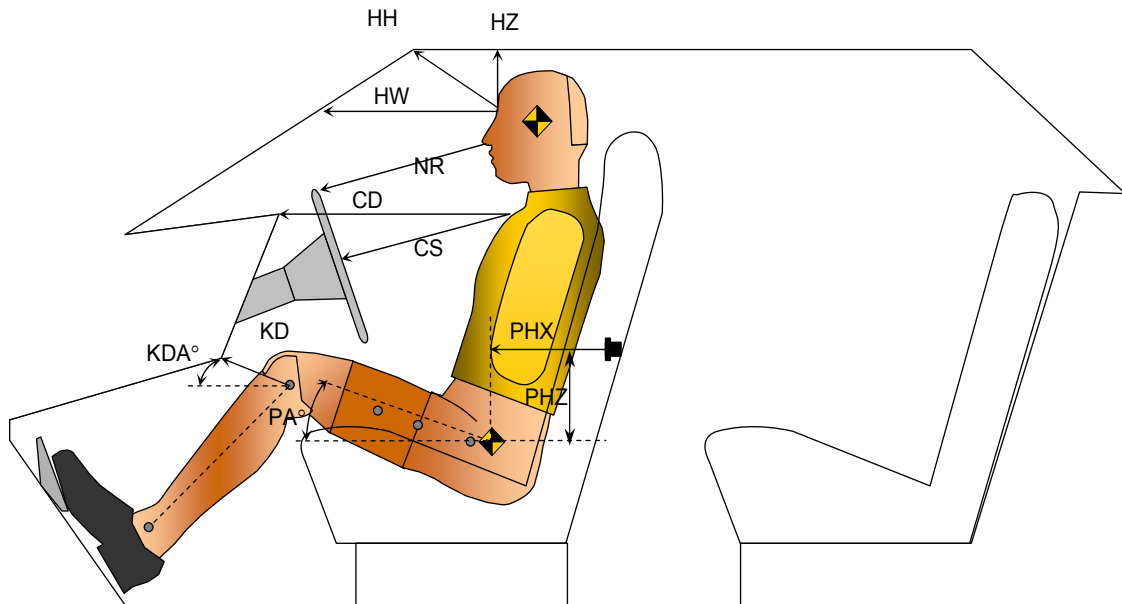
	Driver
Front	No
Side	NA
Curtain	Yes

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 4
ES-2RE LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

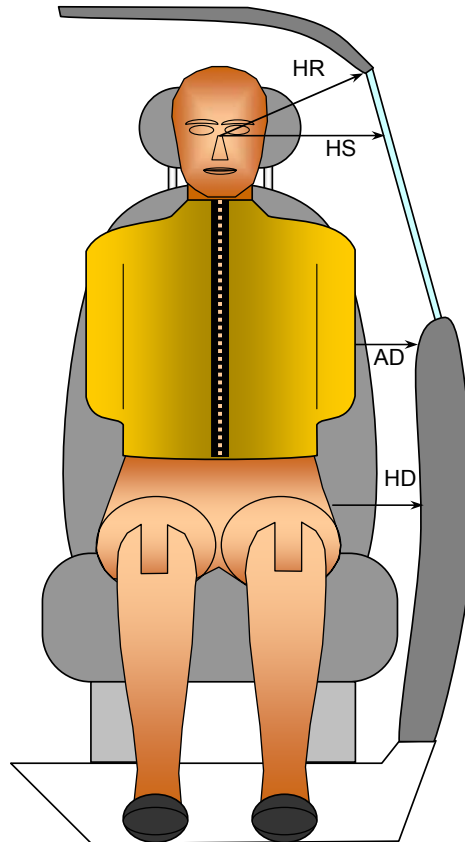


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	388	
HW	Head to Windshield	588	
HZ	Head to Roof	179	
NR	Nose to Rim	419	
CD	Chest to Dash (Top of Rib)	538	
CS	Chest to Steering Wheel (Top of Rib)	322	
KDL	Left Knee to Dash	163	26.9
KDR	Right Knee to Dash	163	29.0
PA	Pelvic Angle (Longitudinal)		19.2
PA	Pelvic Angle (Lateral)		3.1
SA	Spine Angle (Longitudinal)		27.0
SA	Spine Angle (Lateral)		0.2
PHX	H-Point to Striker (X-Axis)	237	
PHZ	H-Point to Striker (Z-Axis)	-4	

DATA SHEET NO. 5
ES-2RE LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005



FRONT VIEW OF DUMMY

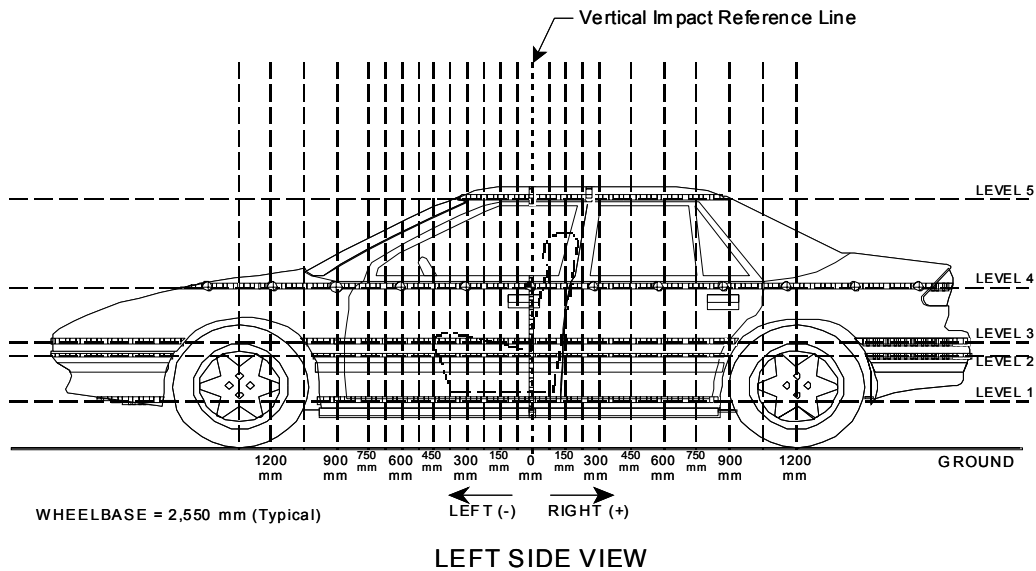
Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	191
HS	Head to Side Window	mm	322
AD	Arm to Door	mm	117
HD	H-Point to Door	mm	184

DATA SHEET NO. 6 **VEHICLE SIDE MEASUREMENTS**

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

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	1850
4	Window Sill	1160
3	Mid Door	920
2	Occupant H-Point	815
1	Sill Top	460

DATA SHEET NO. 7
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

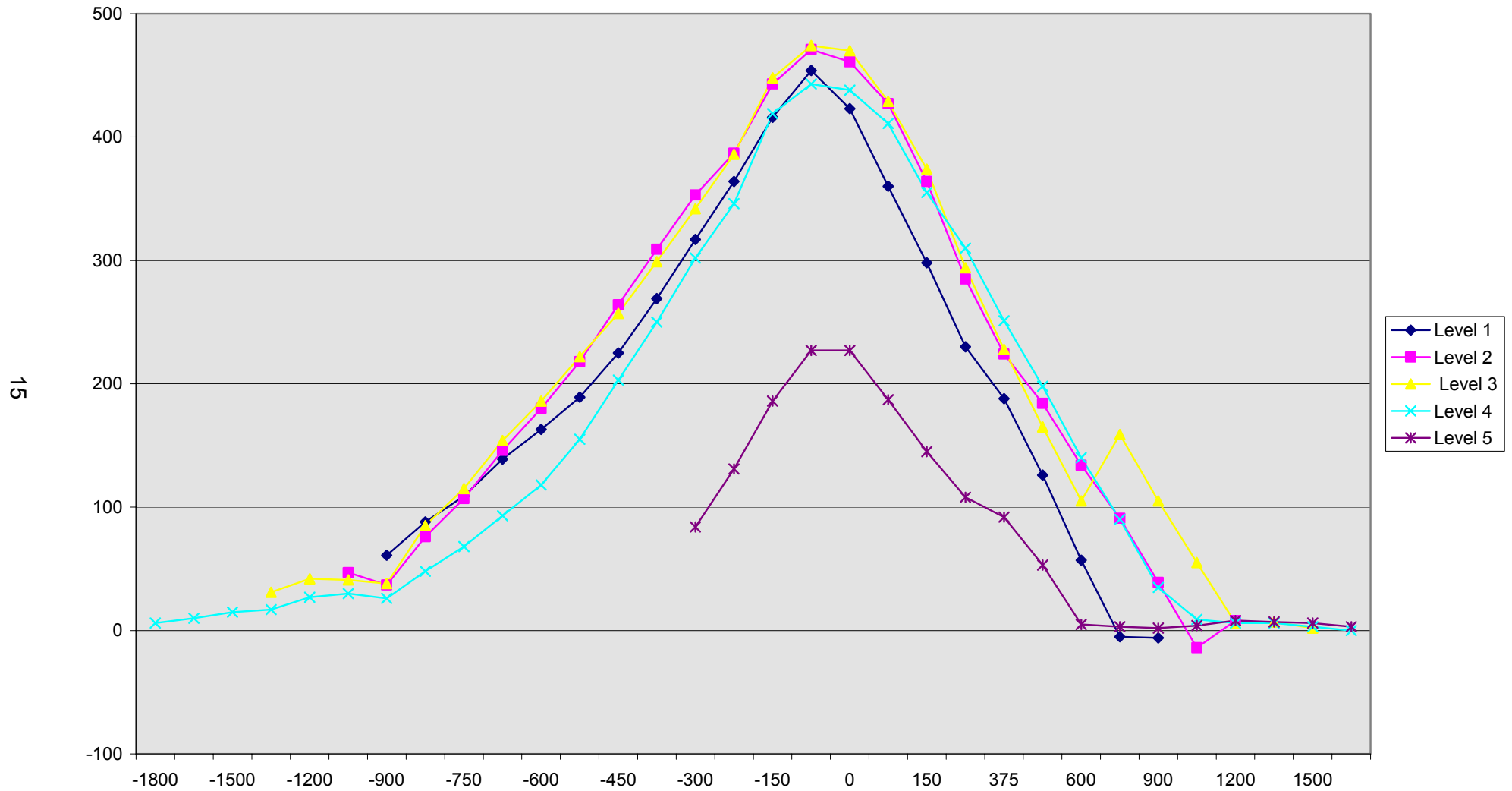
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1800				216					222					6	
-1650				204					214					10	
-1500				194					209					15	
-1350			120	187				151	204				31	17	
-1200			124	182				166	209				42	27	
-1050		127	135	178			174	176	208			47	41	30	
-900	133	133	133	174		194	170	171	200		61	37	38	26	
-825	137	130	130	173		225	206	215	221		88	76	85	48	
-750	127	128	128	170		236	235	243	238		109	107	115	68	
-675	122	125	125	169		261	271	279	262		139	146	154	93	
-600	122	124	123	167		285	304	309	285		163	180	186	118	
-525	123	122	121	164		312	340	343	319		189	218	222	155	
-450	123	120	120	162		348	384	377	365		225	264	257	203	
-375	121	119	118	160		390	428	417	410		269	309	299	250	
-300	119	117	116	157	415	436	470	458	459	499	317	353	342	302	84
-225	120	116	115	157	413	484	503	501	503	544	364	387	386	346	131
-150	121	115	114	155	411	537	558	562	574	597	416	443	448	419	186
-75	121	114	113	154	409	575	585	587	597	636	454	471	474	443	227
0	120	113	111	152	409	543	574	581	590	636	423	461	470	438	227
75	120	112	110	150	409	480	539	539	561	596	360	427	429	411	187
150	123	111	110	150	406	421	475	484	505	551	298	364	374	355	145
225	129	111	110	149	405	359	396	404	459	513	230	285	294	310	108
375	126	110	109	148	404	314	334	337	399	496	188	224	228	251	92
525	126	110	109	146	403	252	294	274	344	456	126	184	165	198	53
600	128	111	109	146	402	185	245	214	286	407	57	134	105	140	5
750	133	111	110	146	402	128	202	269	236	405	-5	91	159	90	3
900	137	112	110	146	403	131	151	215	181	405	-6	39	105	35	2
1050		104	111	147	402		90	166	156	406		-14	55	9	4
1200		96	103	149	403		104	109	155	411		8	6	6	8
1350			96	149	402			103	155	409			7	6	7
1500			99	152	403			101	155	409			2	3	6
1650				156	407				156	410				0	3

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

DATA SHEET NO. 7... (continued)
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

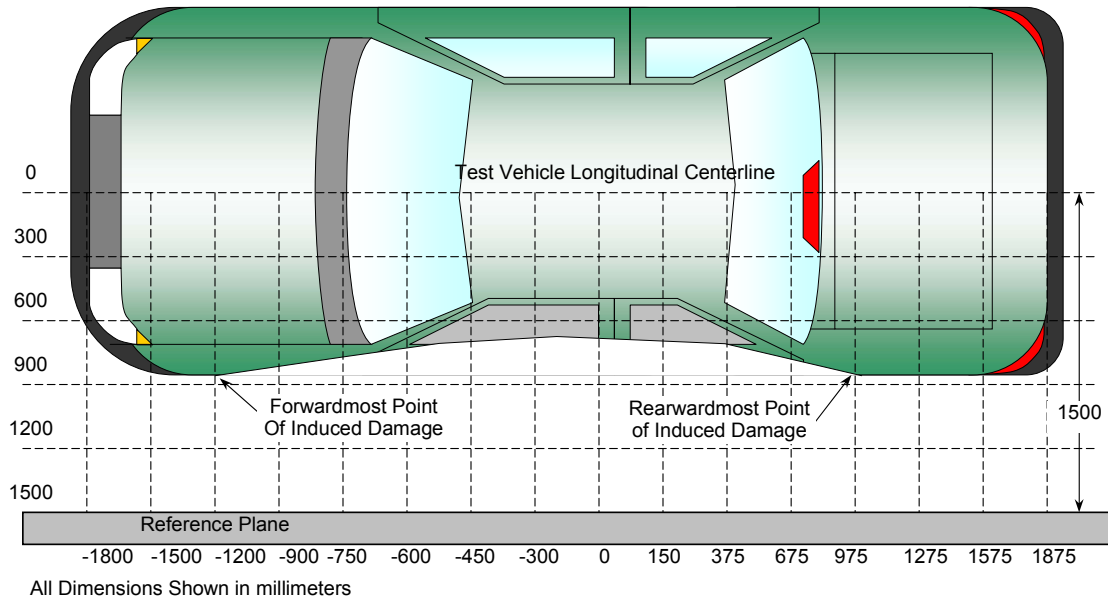


Measurement in mm.

DATA SHEET NO. 8
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005



TOP VIEW

Damage Profile Distances

DPD	Distance from Impact Point in mm	Level	Pre-Test (mm)	Post-Test (mm)	Max Static Crush (mm)
1	2325 mm	4	172	197	25
2	1487 mm	3	98	107	9
3	660 mm	2	111	299	188
4	-385 mm	2	119	428	309
5	-1267 mm	3	122	166	44
6	-2100 mm	4	263	296	33

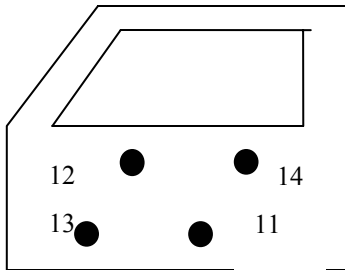
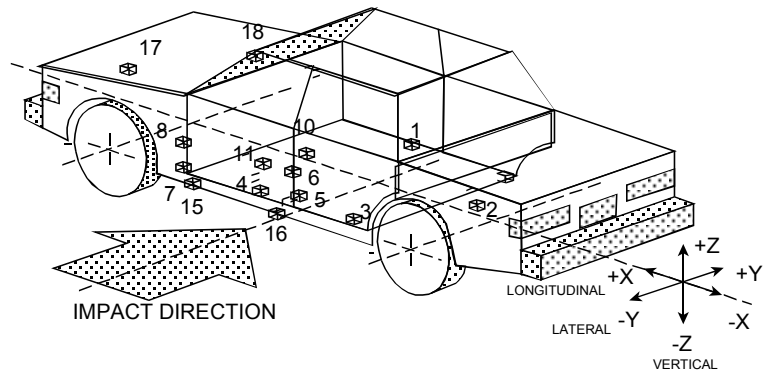
Reference plane is parallel to test vehicle longitudinal centerline.

Given dimensions = Reference plane to car body.

DATA SHEET NO. 9 **VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY**

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005



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

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

DATA SHEET NO. 9... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005

VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS

Loc. No.	Accelerometer Location	Long (X) Maximums (g's) (CFC 60)		Lat. (Y) Maximums (g's) (CFC 60)		Vert. (Z) Maximums (g's) (CFC 60)		Resultant (g's) (CFC 60)
		Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Max.
1	Right Side Sill at Front Seat	2.6	-10.5	15.7	-1.1	4.2	-3.1	16.4
2	Rear Floorpan Above Axle	0.6	-8.9	10.0	-0.8	4.4	-9.6	13.8
3	Left Side Sill at Rear Door			43.4	-5.6			
4	Left Side Sill at Front Door			*	*			
5	Left Lower B-Post			**	**			
6	Left Mid B-Post			44.7	-12.3			
7	Left Lower A-Post			46.4	-8.6			
8	Left Mid A-Post			22.1	-9.7			
9	Driver Left Seat Track			58.2	-51.2			
10	Vehicle CG	52.6	-15.5	65.4	-44.0	38.8	-39.7	77.4
11	Left Front Door at Pelvis			***	***			
12	Left Front Door at Arm			113.6	-58.8			
13	Left Front Door at Knee			****	****			
14	Left Front Door at Rib			*****	*****			
15	Left A-Post @ Sill			*****	*****			
16	Left B-Post @ Sill			76.0	-15.3			
17	Upper Engine	6.0	-10.6	18.7	-6.3			
18	Firewall			11.4	-0.9			

* No valid data collected after 80 msec

** No valid data collected after 100 msec

*** No valid data collected after 20 msec

**** No valid data collected after 40 msec

***** No valid data collected after 40 msec

***** No valid data collected after 40 msec

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

DATA SHEET NO. 9... (continued)**VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY**Test Vehicle: 2005 Ford ExpeditionTest Date: May 11, 2005**VEHICLE ACCELEROMETER COORDINATES**

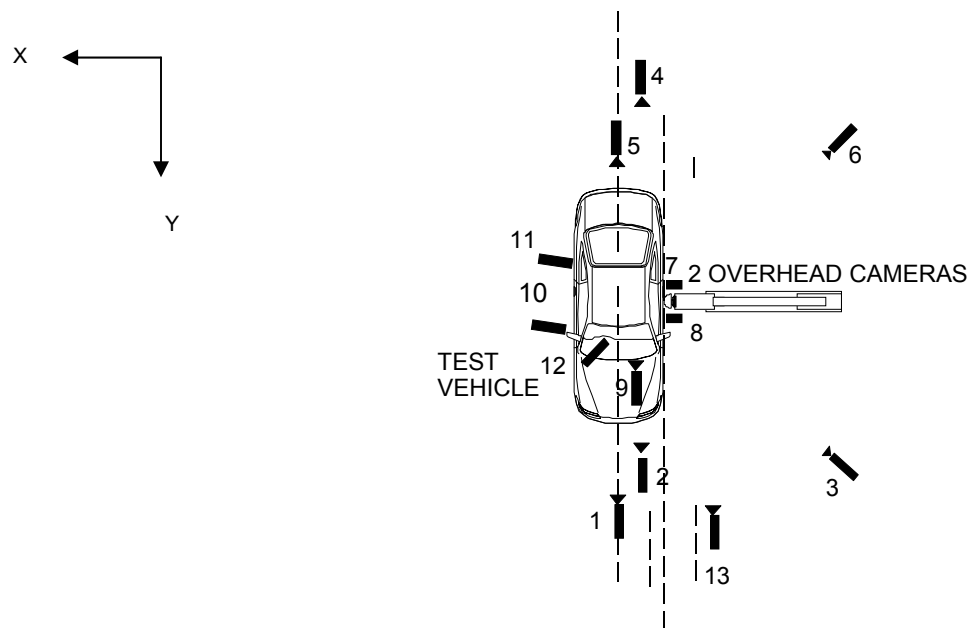
Loc. No.	Description	Coordinates (mm)		
		X	Y	Z
1	Right Side Sill at Front Seat	2887	903	400
2	Rear Floorpan Above Axle	1100	0	747
3	Left Side Sill at Rear Door	2084	-902	470
4	Left Side Sill at Front Door	2953	-904	432
5	Left Lower B-Post	2434	-820	690
6	Left Mid B-Post	2438	-806	1065
7	Left Lower A-Post	3478	-847	622
8	Left Mid A-Post	3551	-863	1212
9	Driver Left Seat Track			
10	Vehicle CG	2650	0	875
11	Left Door @ Pelvis	2789	-840	960
12	Left Door @ Arm	2985	-852	1233
13	Left Door @ Knee	3172	-795	1068
14	Left Door @ Rib	2730	-823	1232
15	Left A Pillar Sill	3972	-900	420
16	Left B Pillar Sill	2416	-906	460
17	Engine	4175	50	1221
18	Firewall	3969	70	1232

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

DATA SHEET NO. 10
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2005 Ford Expedition

Test Date: May 11, 2005



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Front Overall	1025	6150	1520	24	1000
2	Front Close Up	2185	6930	1495	24	1000
3	Front Angle	-2440	3320	1495	24	1000
4	Rear Overall	4190	-9340	1380	19	1000
5	Rear Close Up	3305	-9755	1390	35	1000
6	Rear Angle	-2435	-3310	1480	24	1000
7	Overhead View	-630	795	5725	14	1000
8	Overhead Close Up	0	100	5050	19	1000
9	Onboard Driver Front				13	1000
10	Onboard Driver				10	1000
11	Onboard Curtain				8	1000
12	Onboard Hip to Door				8	1000
13	Real Time				13	24

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 Overhead View Positioned Against Pole

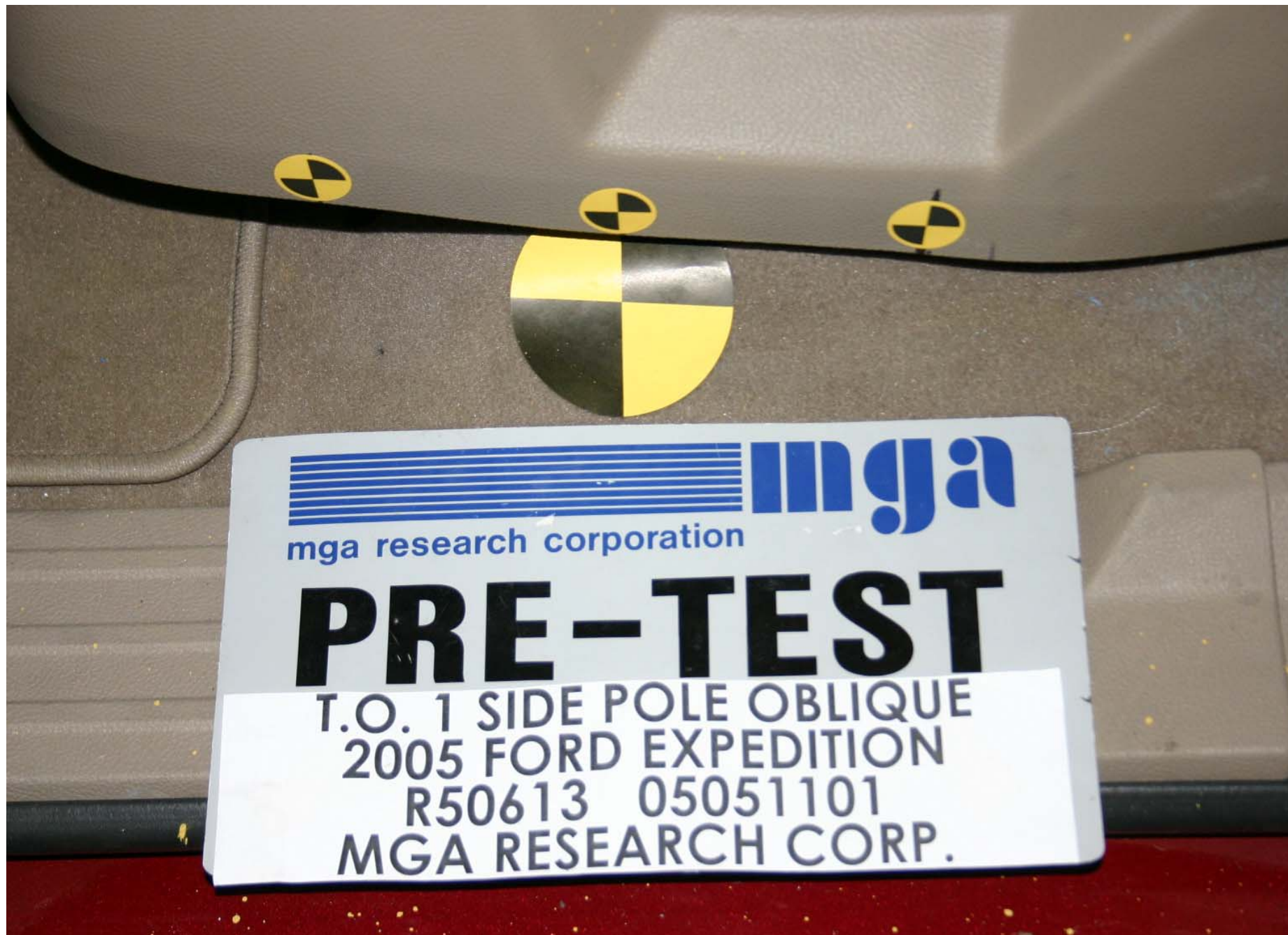


Post-Test Vehicle Overhead View



Pre-Test Vehicle Overhead View Positioned Against Pole

Post-Test Vehicle Overhead View



Pre-Test Driver Seat Position



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



Pre-Test Driver Dummy Left Side View



Post-Test Driver Dummy Left Side View



Pre-Test Driver Dummy Right Side View



Post-Test Driver Dummy Right Side View



Pre-Test Driver Shoulder and Door Top View



Post-Test Driver Dummy Contact



Post-Test Driver Dummy Head Contact



Post-Test Driver Dummy Head Contact



Post-Test Impact Point on Vehicle



TIRE AND LOAD INFORMATION

SEE OWNERS MANUAL FOR ADDITIONAL INFORMATION

The combined weight of occupants and cargo should never exceed 0724 kg or 1598 lbs.

SEATING CAPACITY	TOTAL : 08	FRONT: 2	REAR: 06
------------------	------------	----------	----------

ORIGINAL TIRE SIZE		COLD TIRE INFLATION PRESSURE	
FRONT	P265/70R17	FRONT	240 KPA, 35 PSI
REAR	P265/70R17	REAR	240 KPA, 35 PSI

SPARE TIRE SIZE		COLD TIRE INFLATION PRESSURE	
P265/70R17		240 KPA, 35 PSI	


 1FMFU15545LA56386

4U5A-1532-AA (TLU)

Tire Placard

MFD. BY FORD MOTOR CO.

DATE: 12/04	GVWR: 7100LB / 3220KG	
FRONT GAWR: 3150LB	REAR GAWR: 4128LB	
1428KG	WITH 1872KG	WITH
P265/70R17	TIRES P265/70R17	TIRES
17X7.5J	RIMS 17X7.5J	RIMS
AT 240 kPa/35	PSI COLD	AT 240 kPa/35
		PSI COLD

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

VIN: 1FMFU15545LA56386
TYPE: MPV

F0101
T0378



EXT PNT:	G2		RC: 23	DSO:	
WB	INT TR	TP/PS	R	AXLE	TR
119	FH		1	H6	B
					FF11
					5B714
					DOA
					1200412012362 UTC
					205A-1520472-AA



Pre-Test Point of Impact View

11 May 2005 10:12 • -36,00 ms • 1,000 fps • T0: 37 • Frame: 1

Post-Test Point of Impact View



11 May 2005 10:12 • 45,00 ms • 1,000 fps • T0: 1 • Frame: 46

Impact

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA

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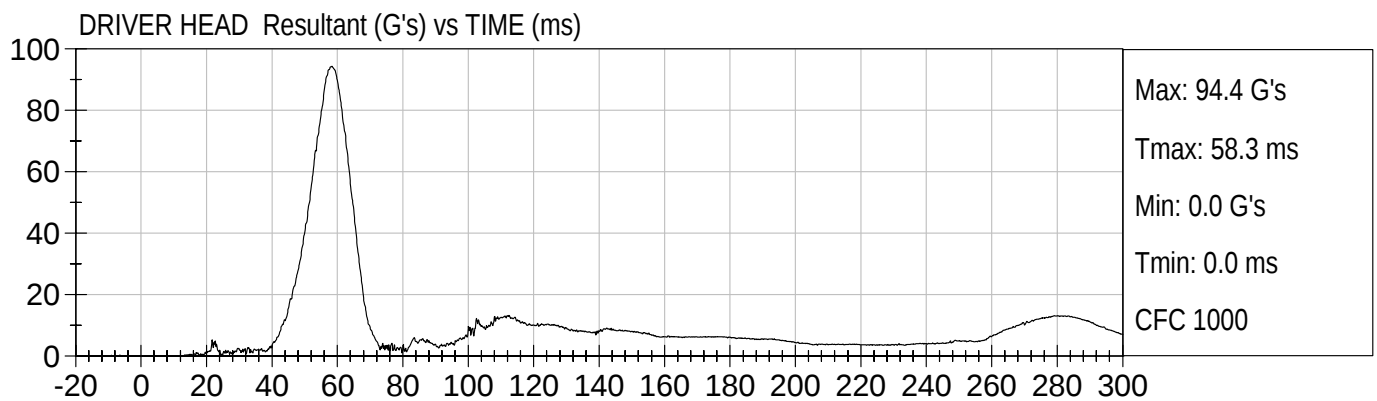
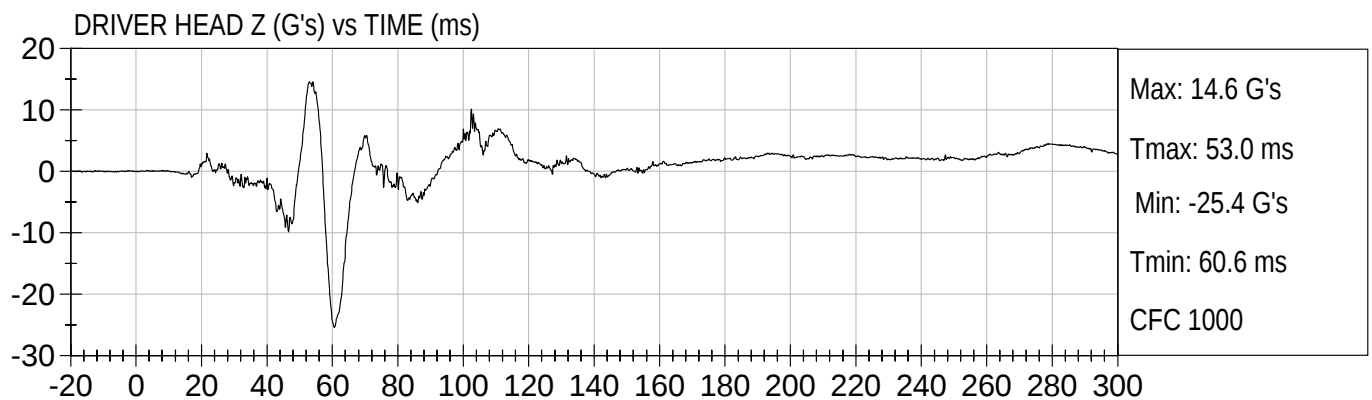
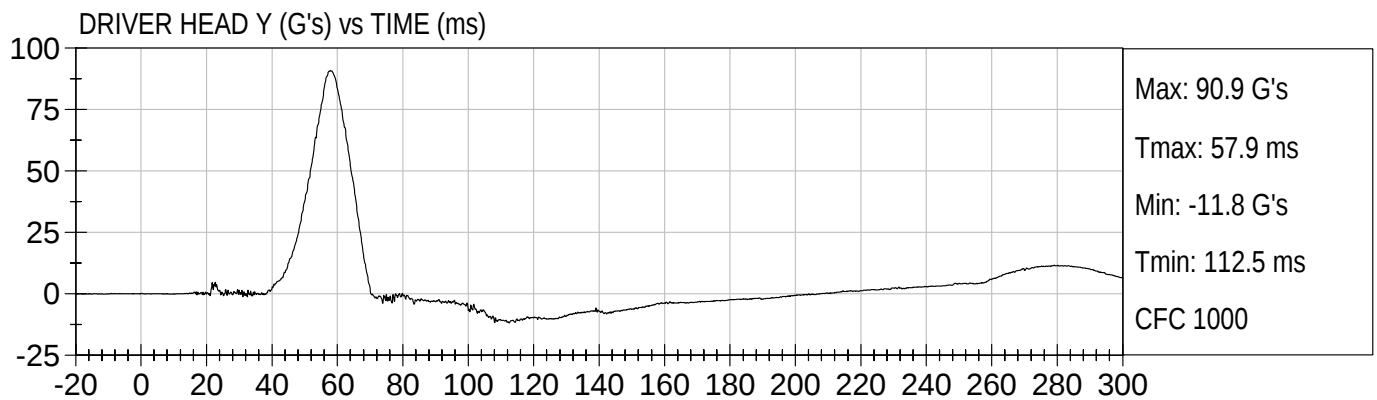
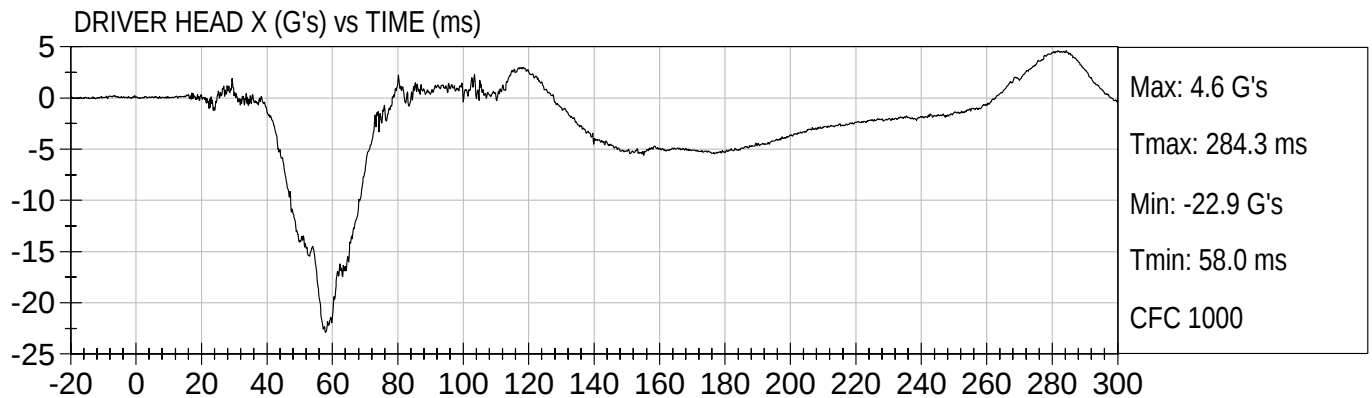
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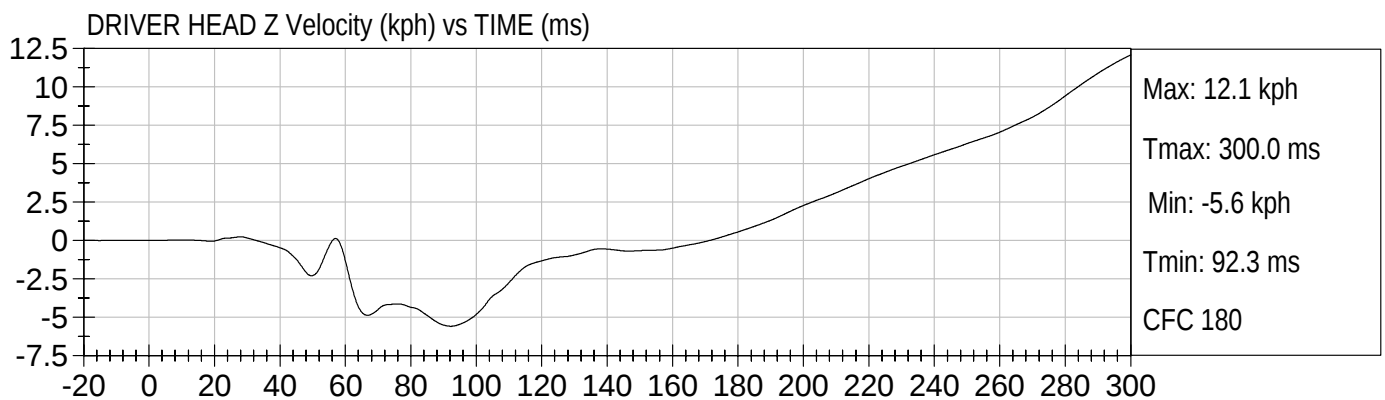
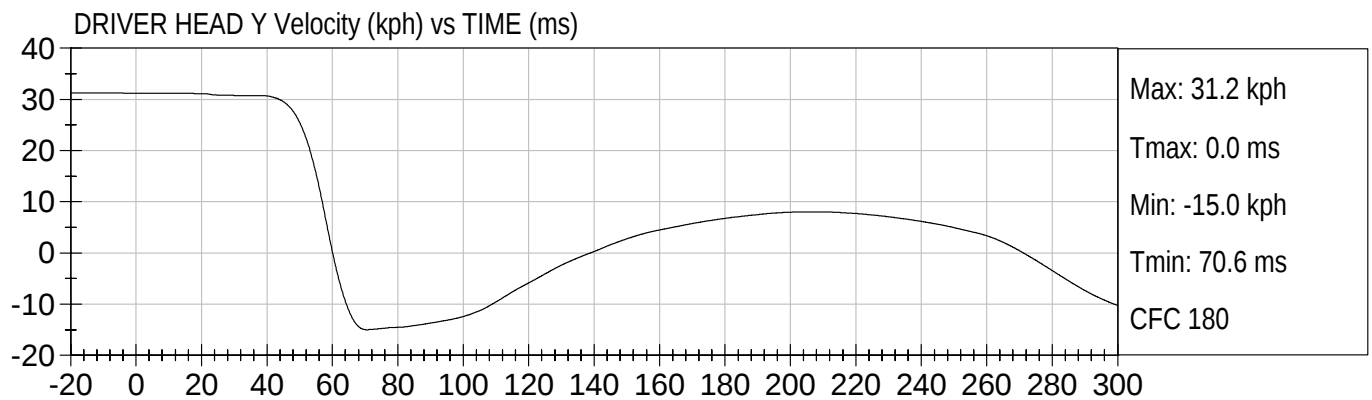
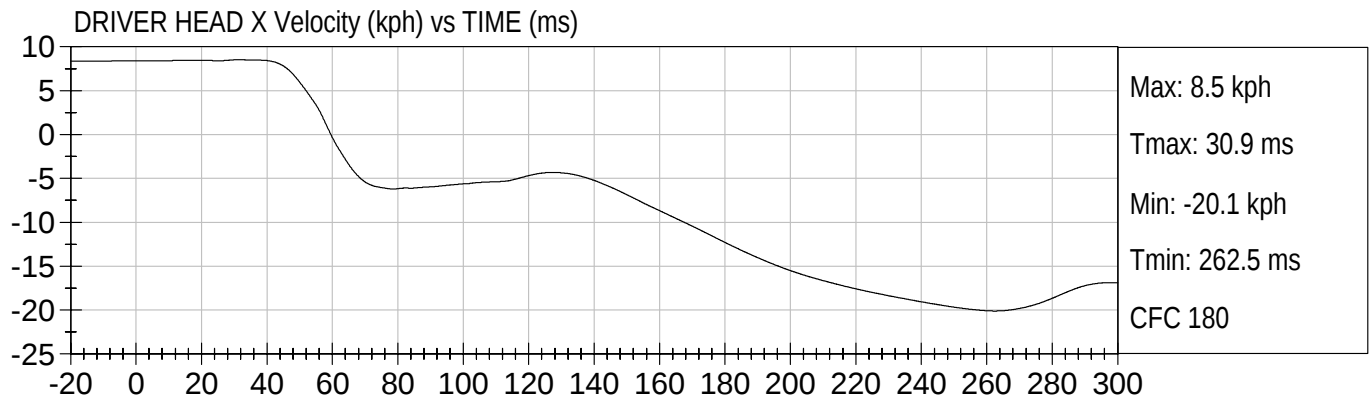
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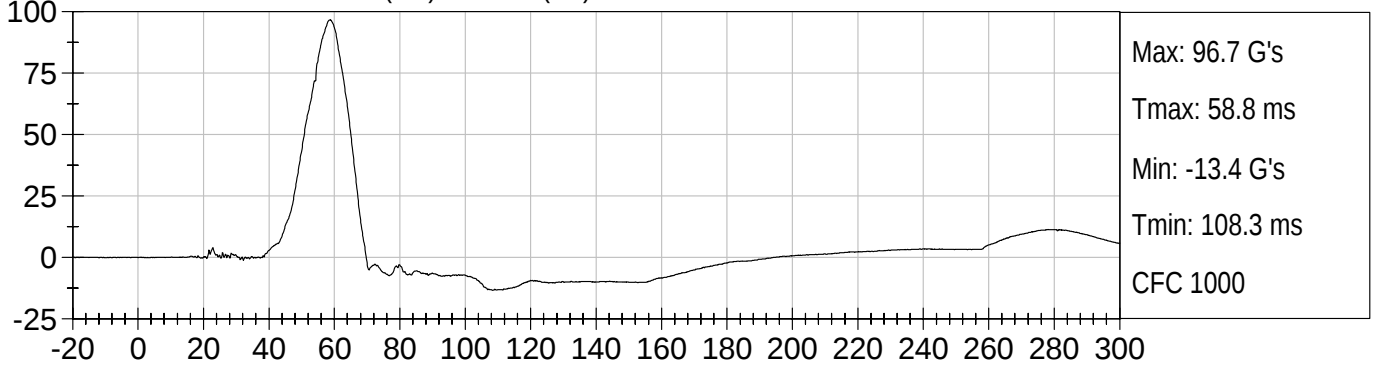
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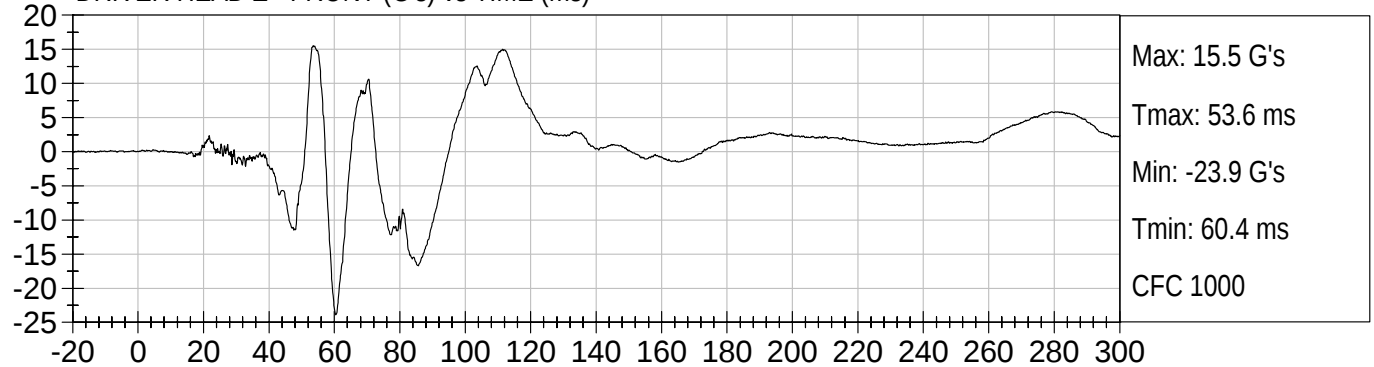




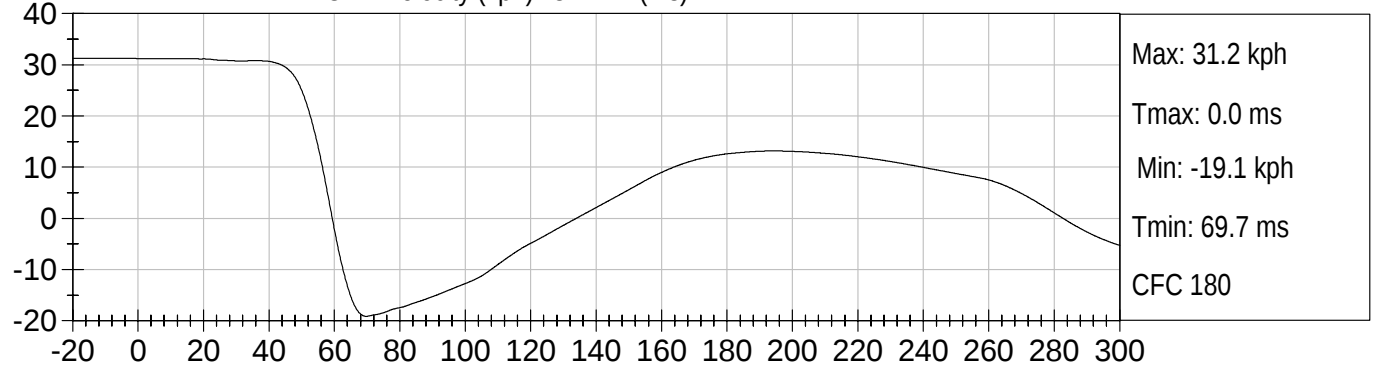
DRIVER HEAD Y - FRONT (G's) vs TIME (ms)



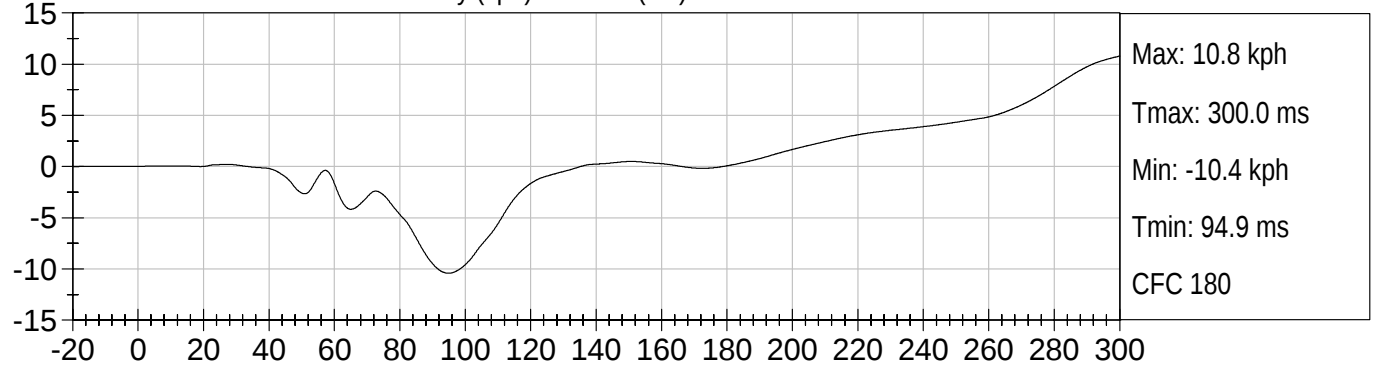
DRIVER HEAD Z - FRONT (G's) vs TIME (ms)

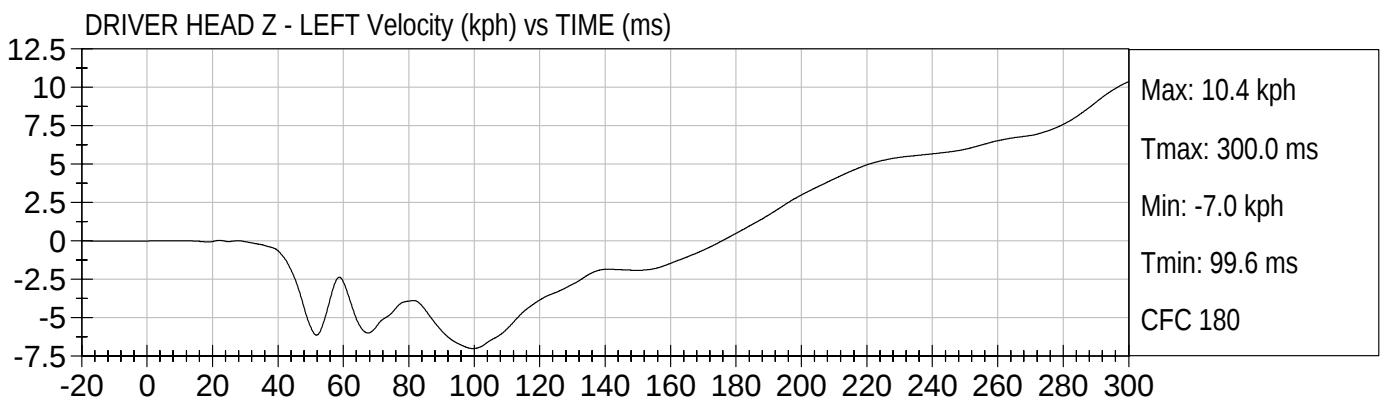
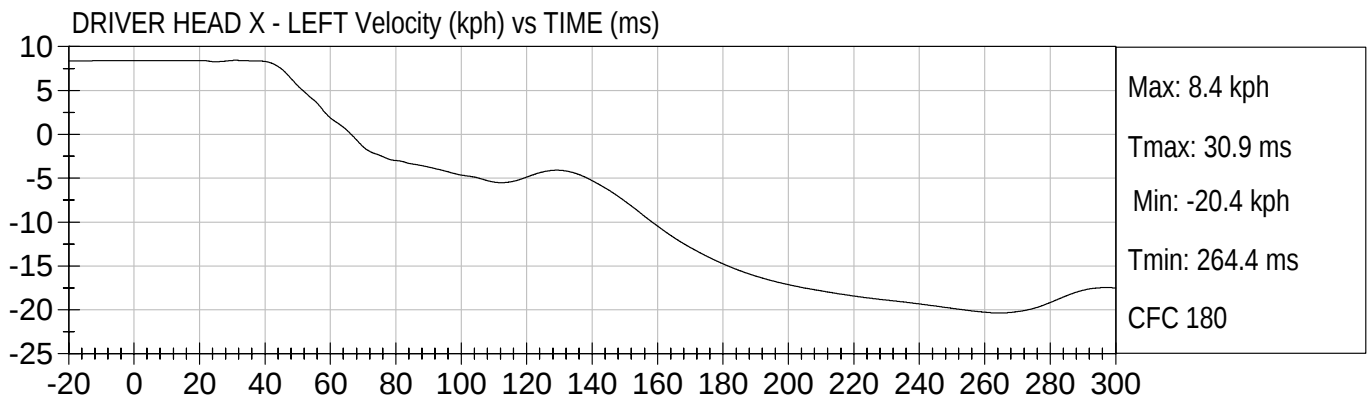
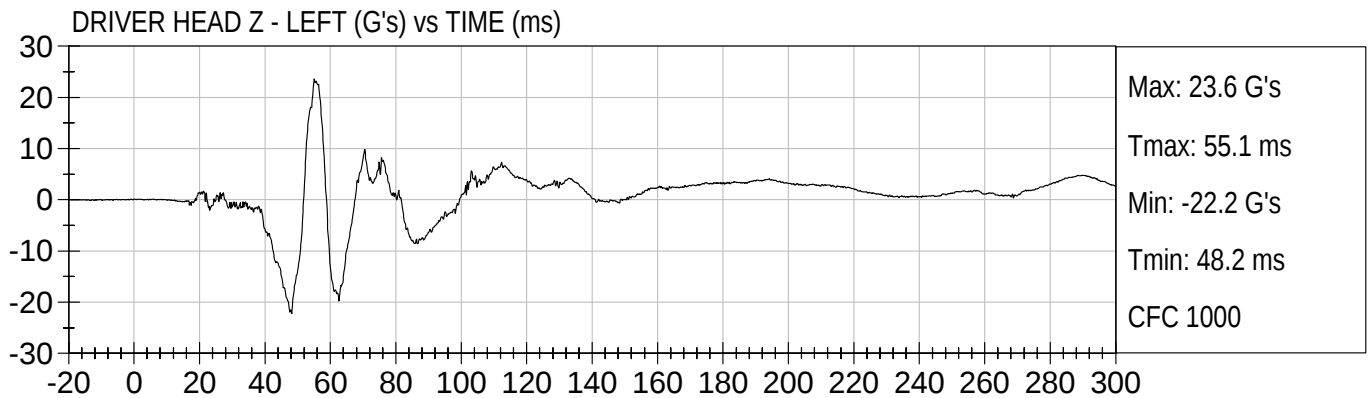
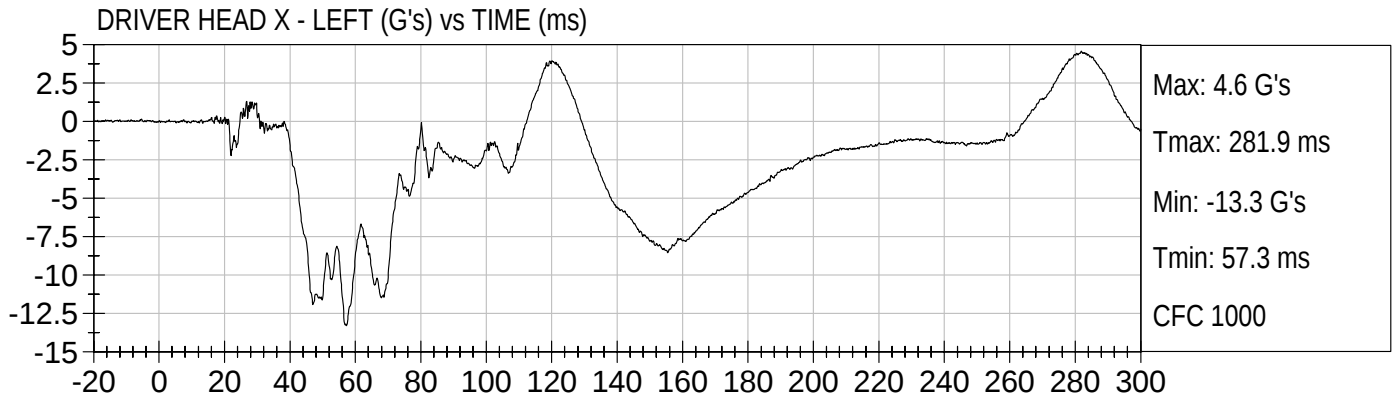


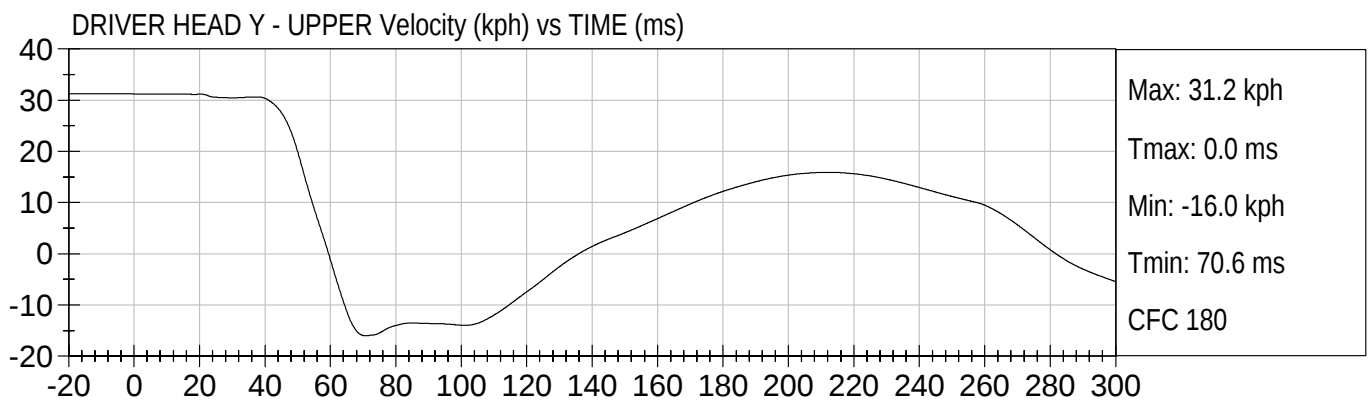
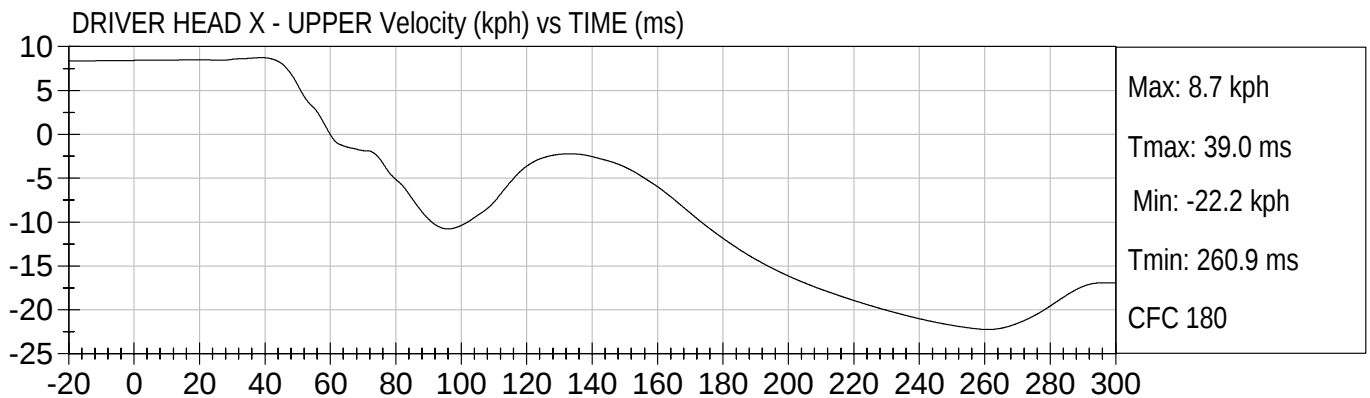
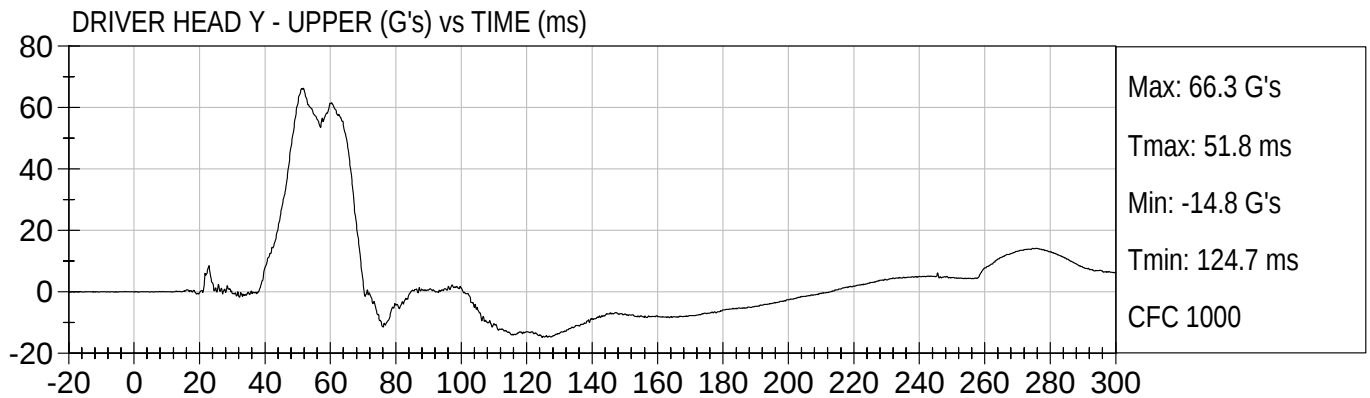
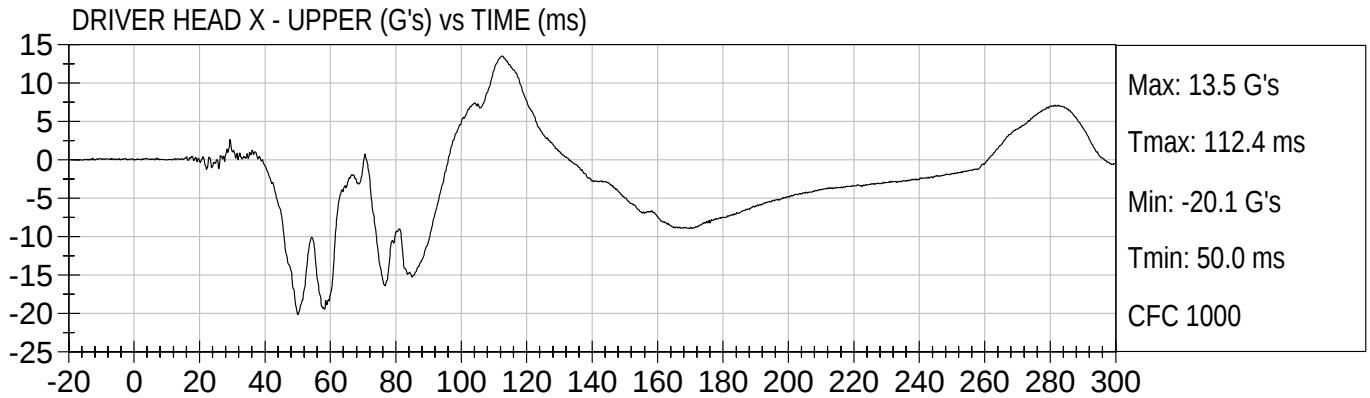
DRIVER HEAD Y - FRONT Velocity (kph) vs TIME (ms)

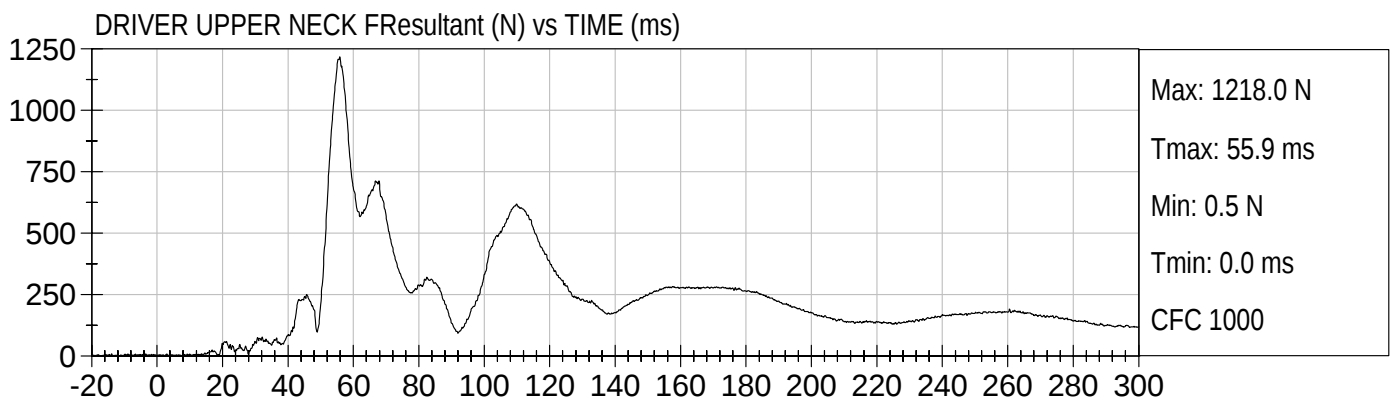
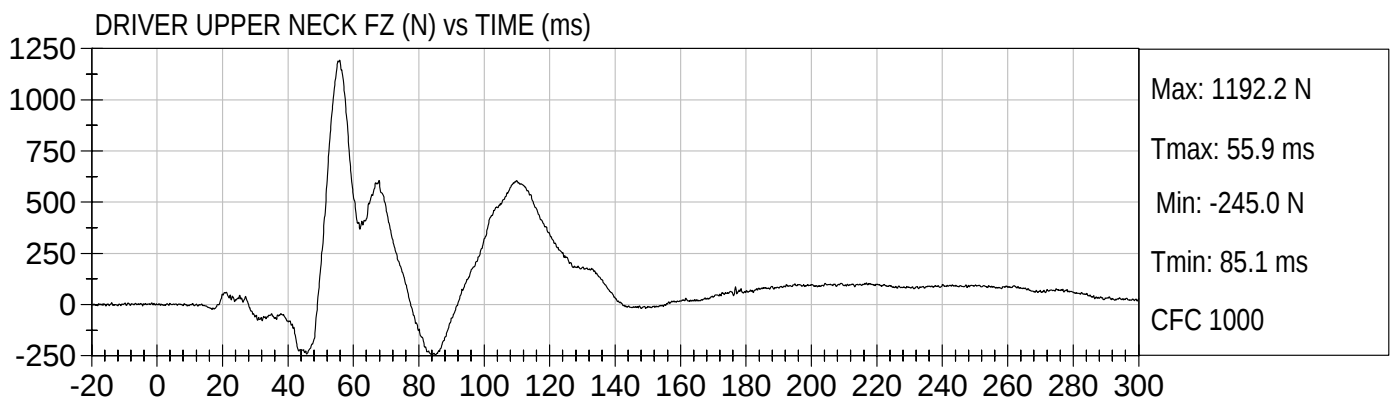
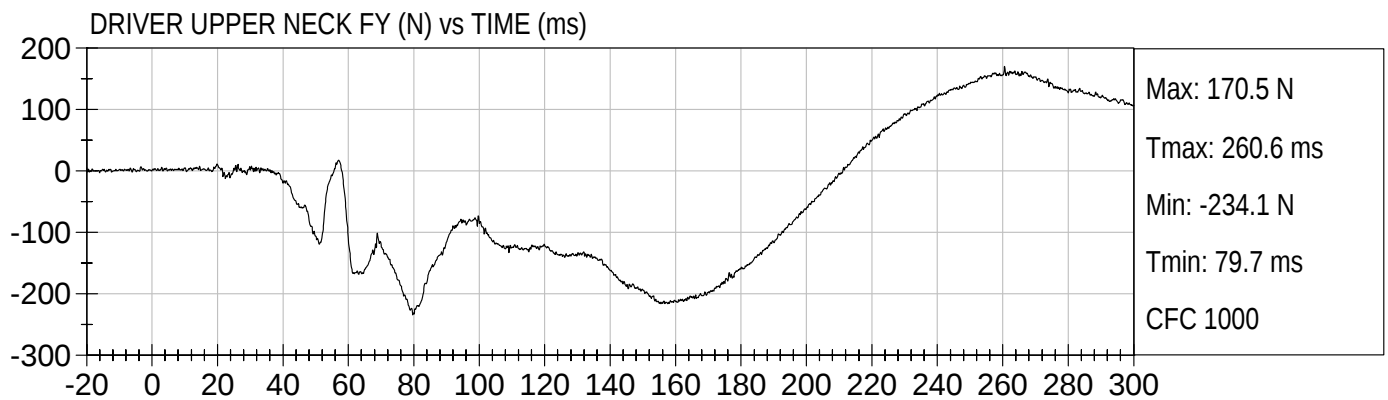
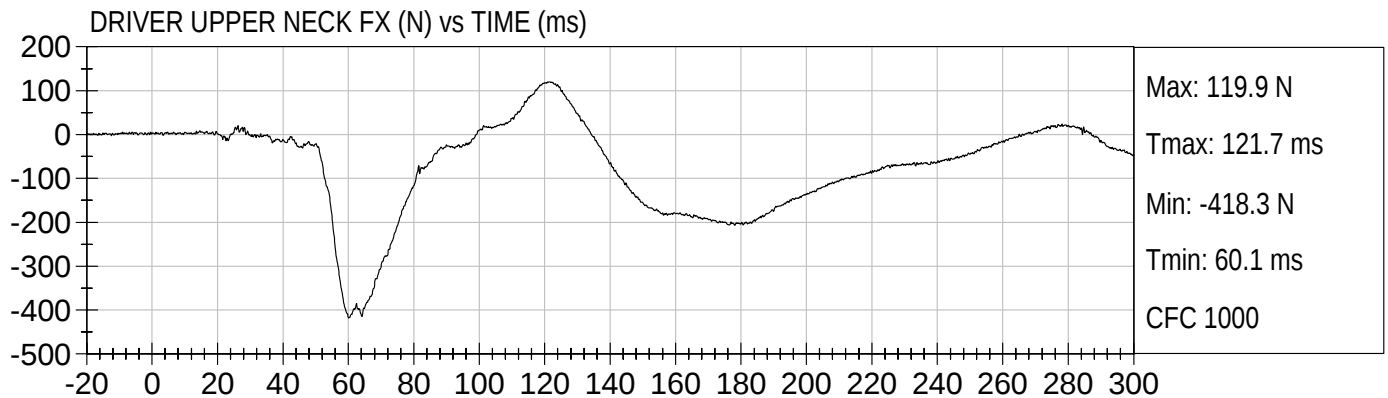


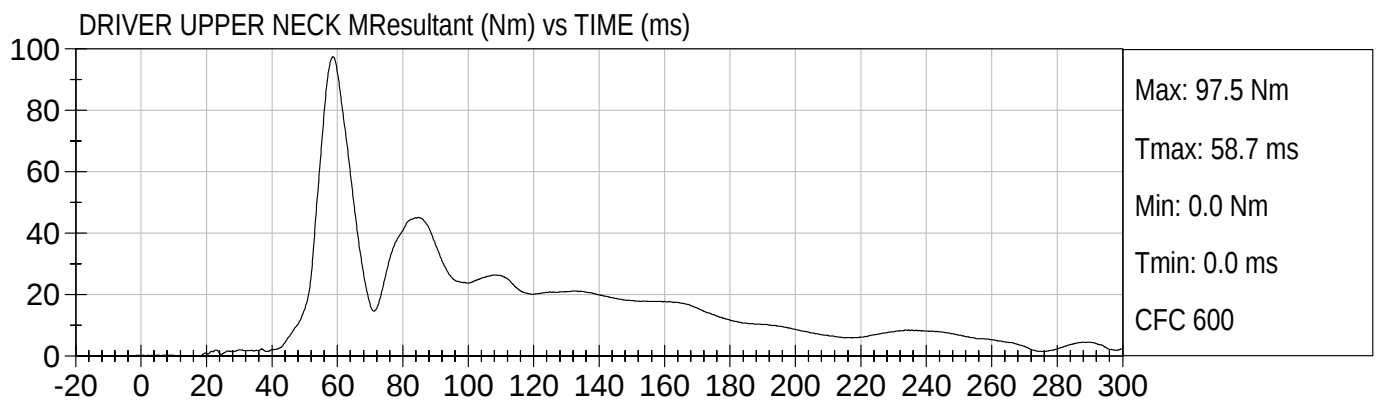
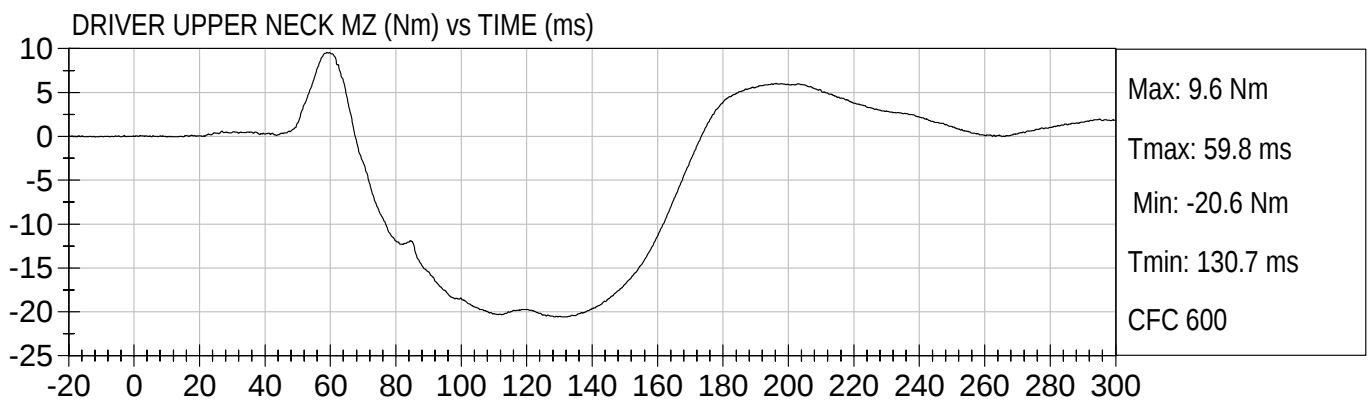
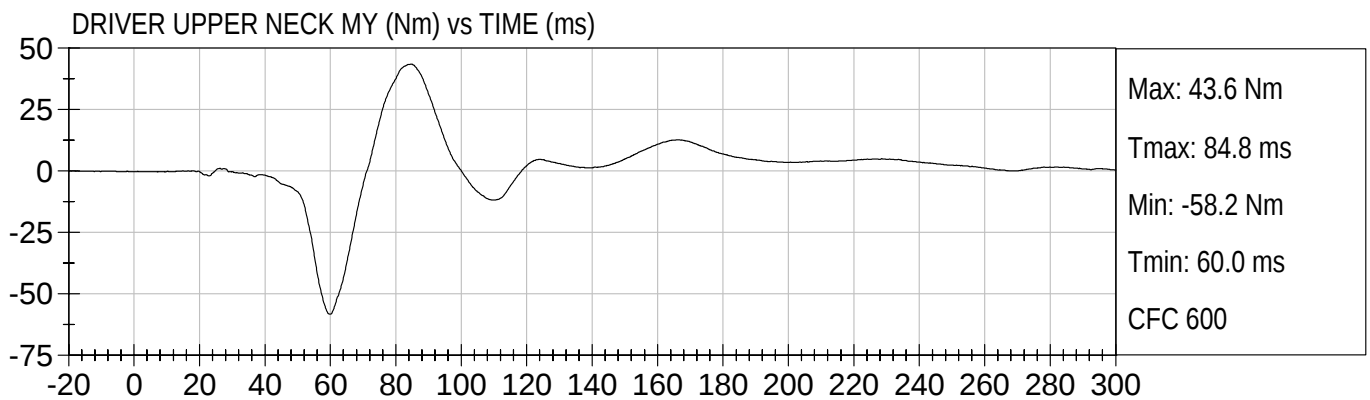
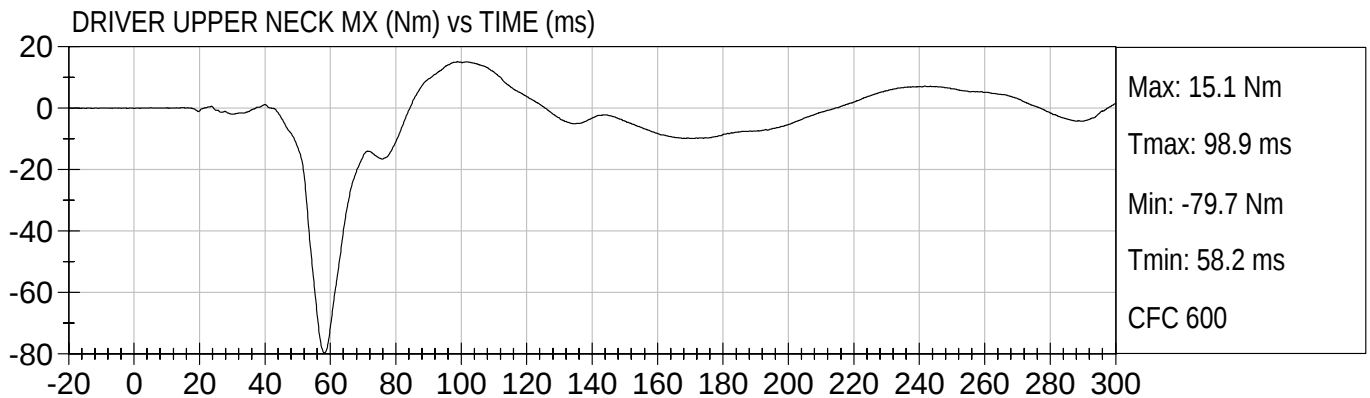
DRIVER HEAD Z - FRONT Velocity (kph) vs TIME (ms)

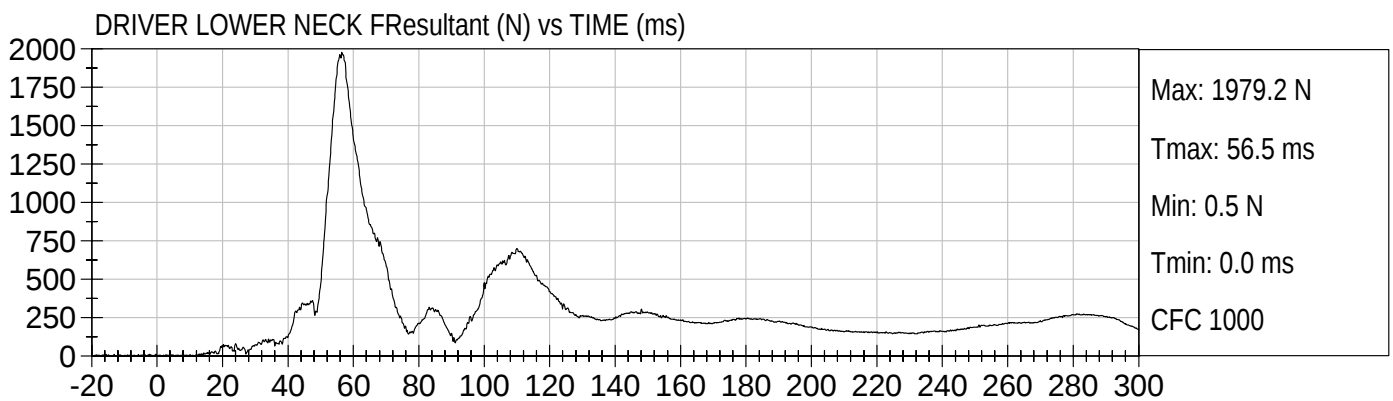
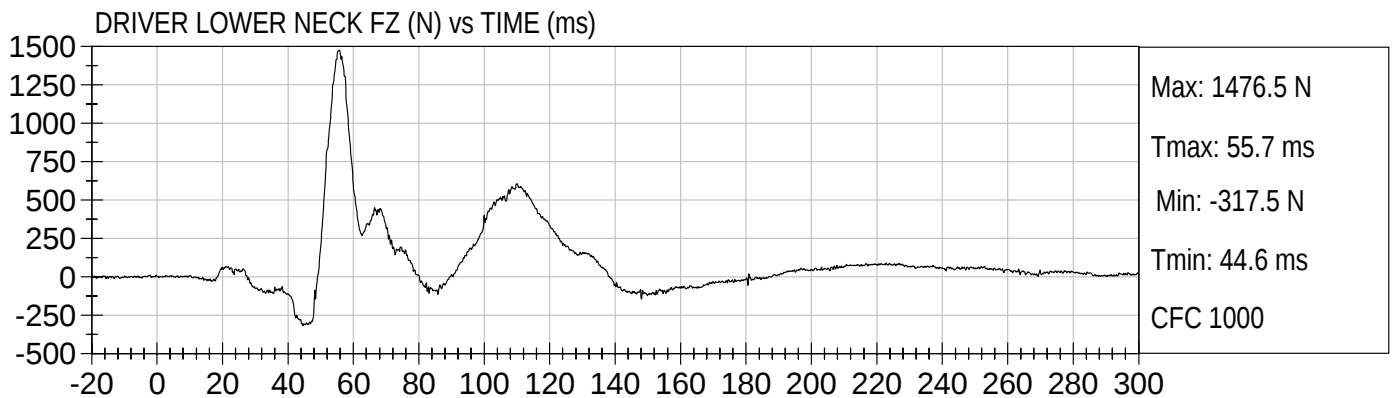
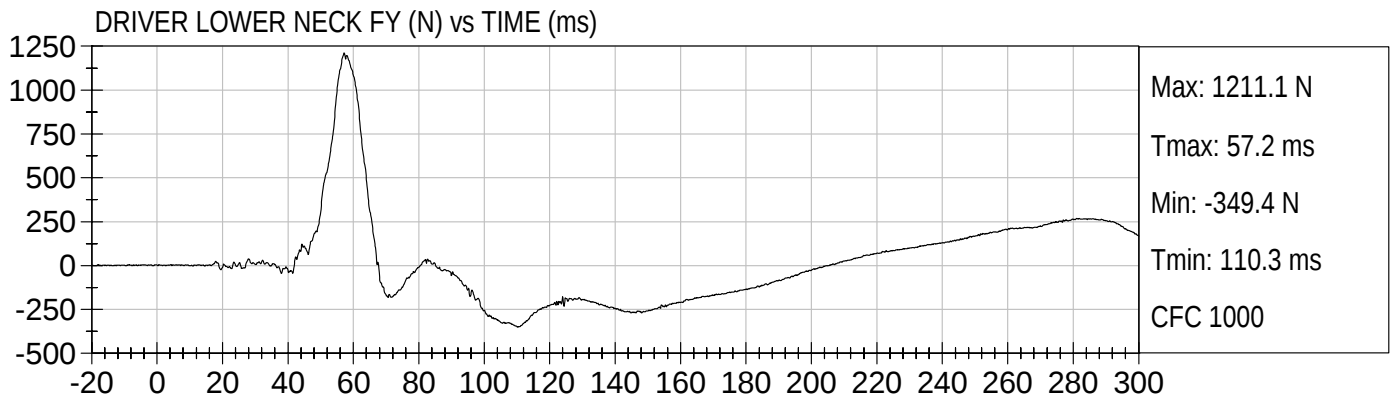
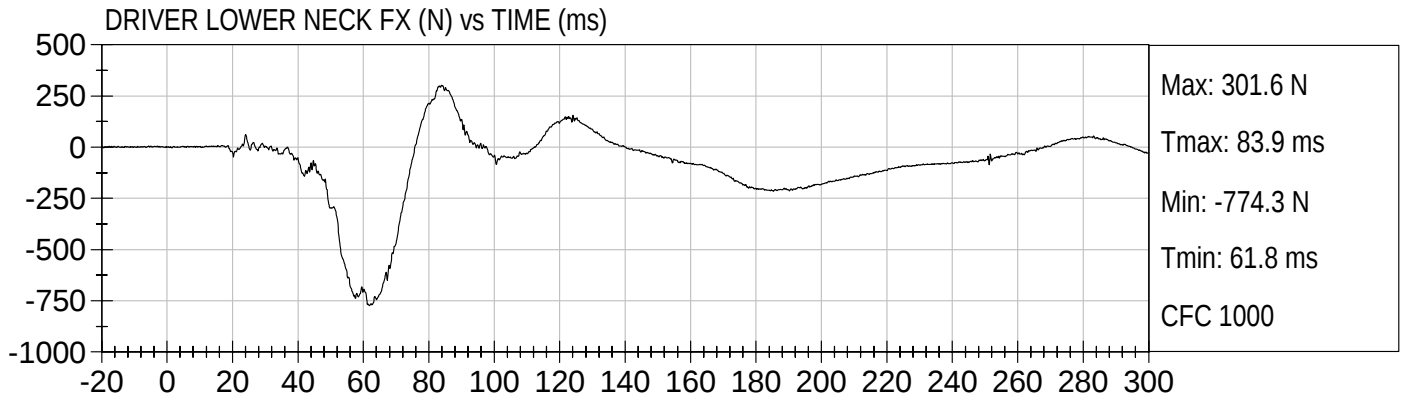


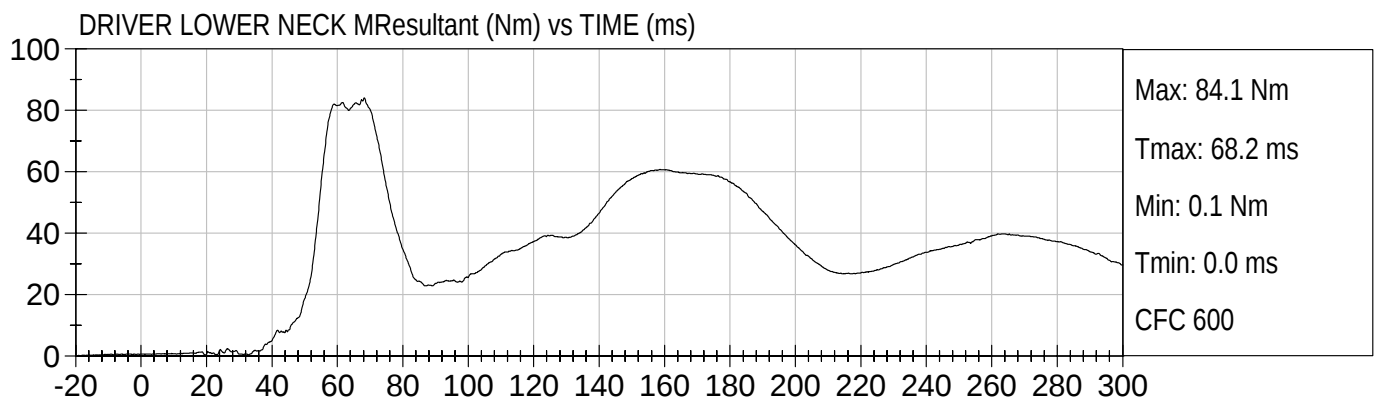
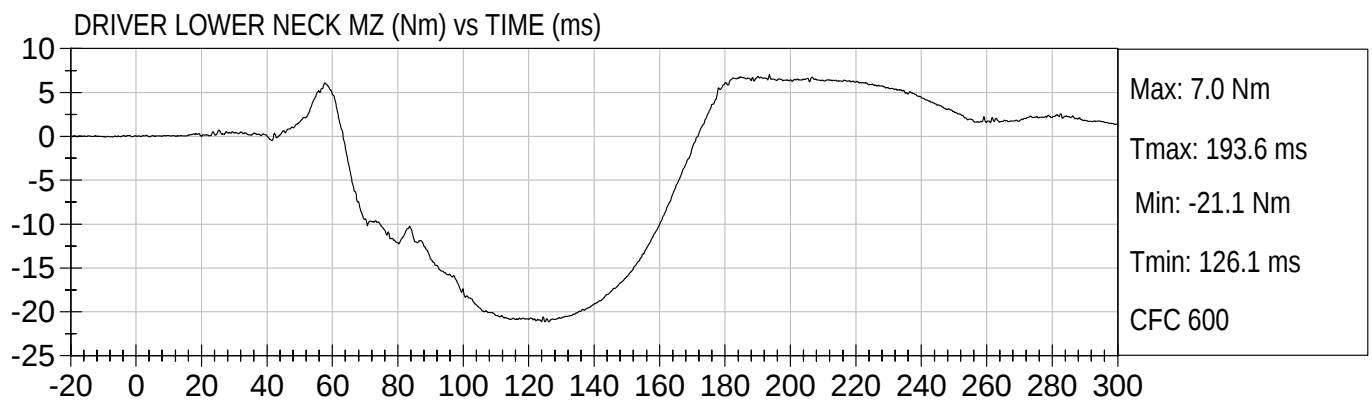
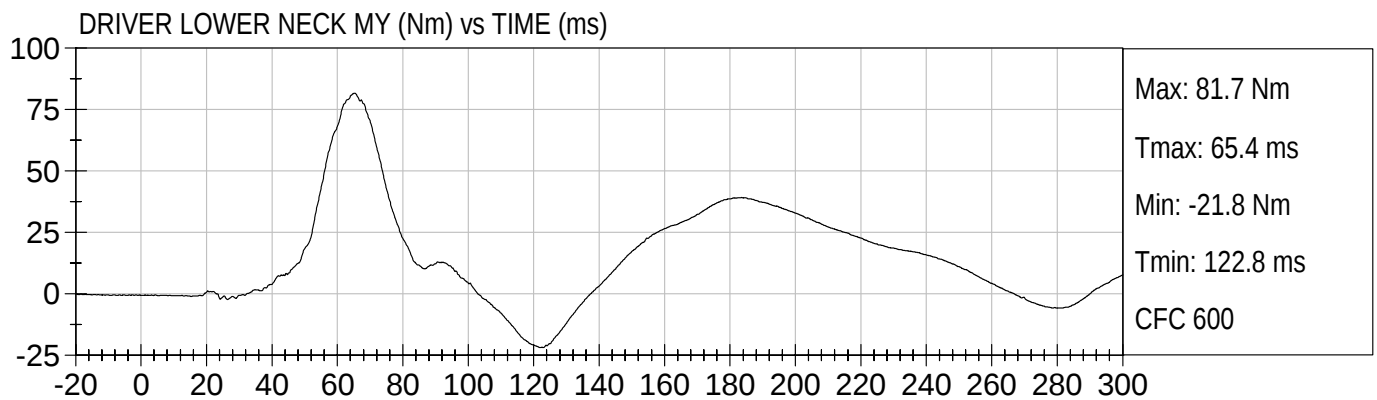
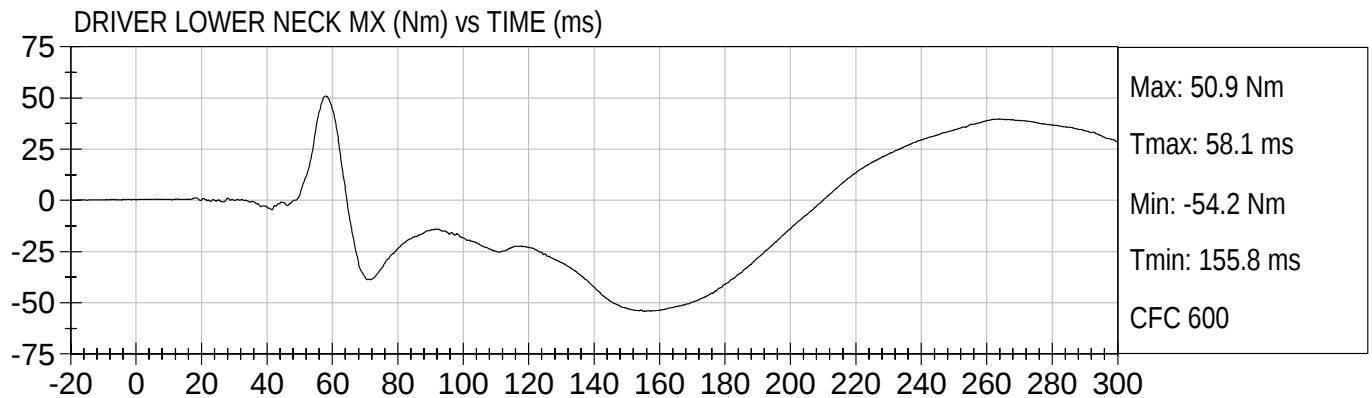


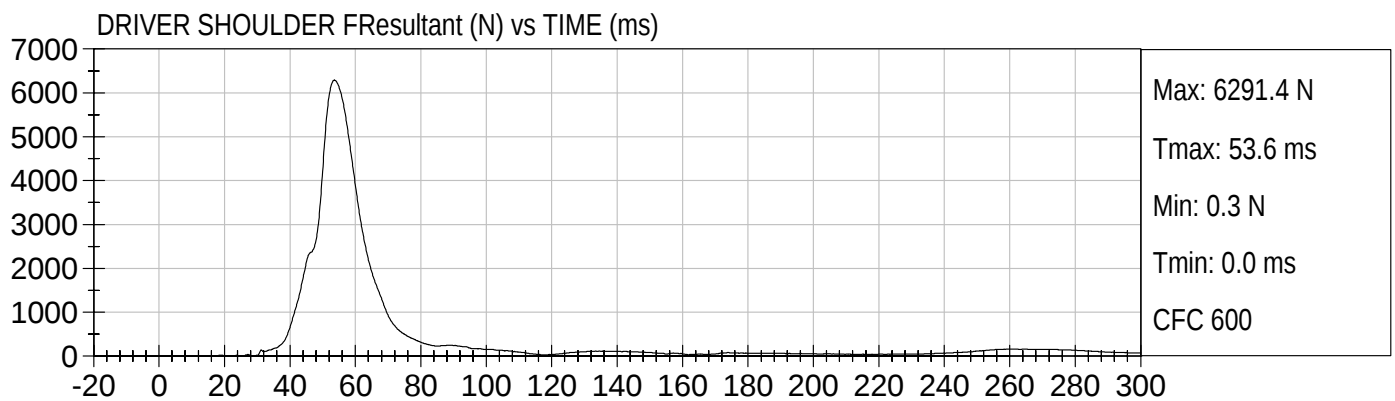
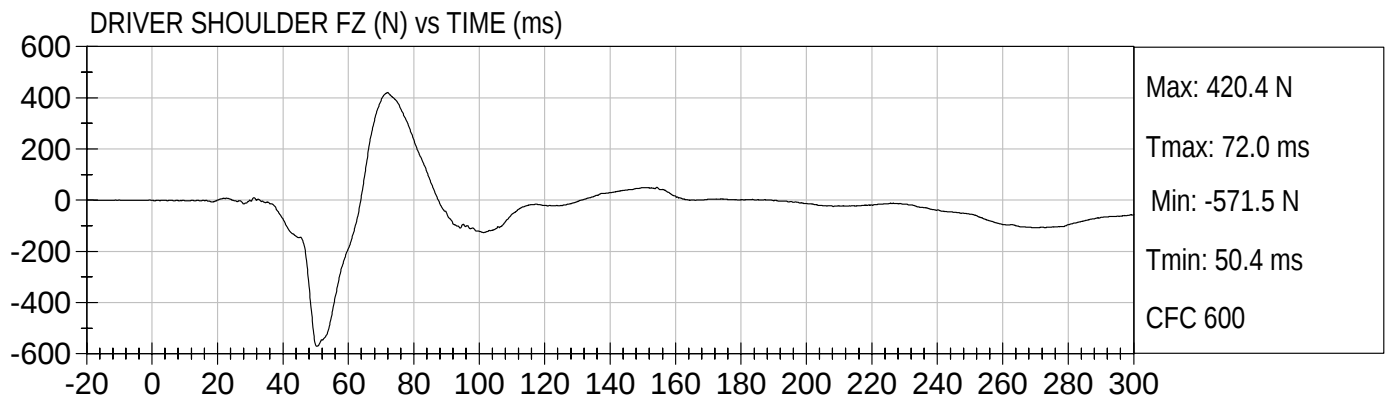
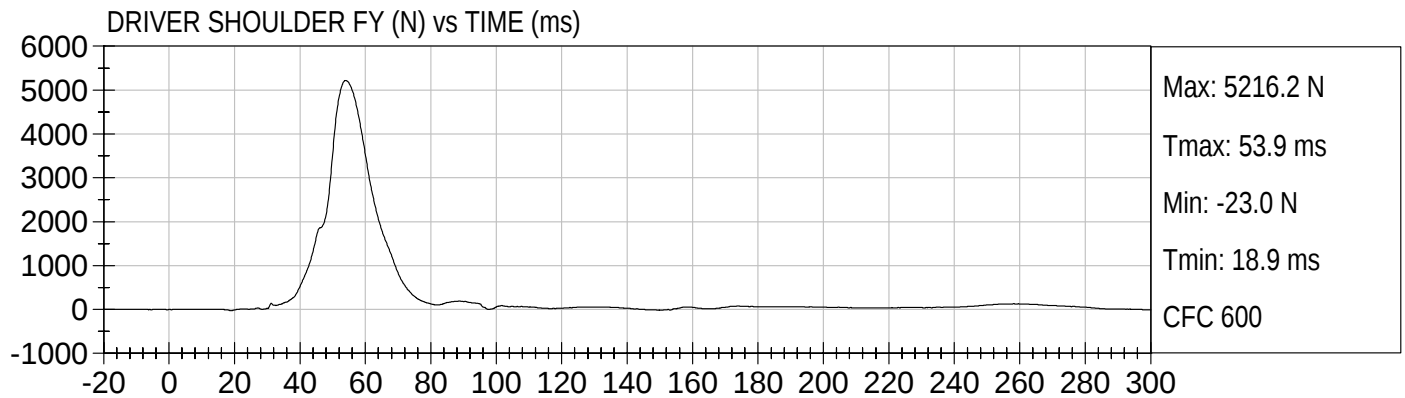
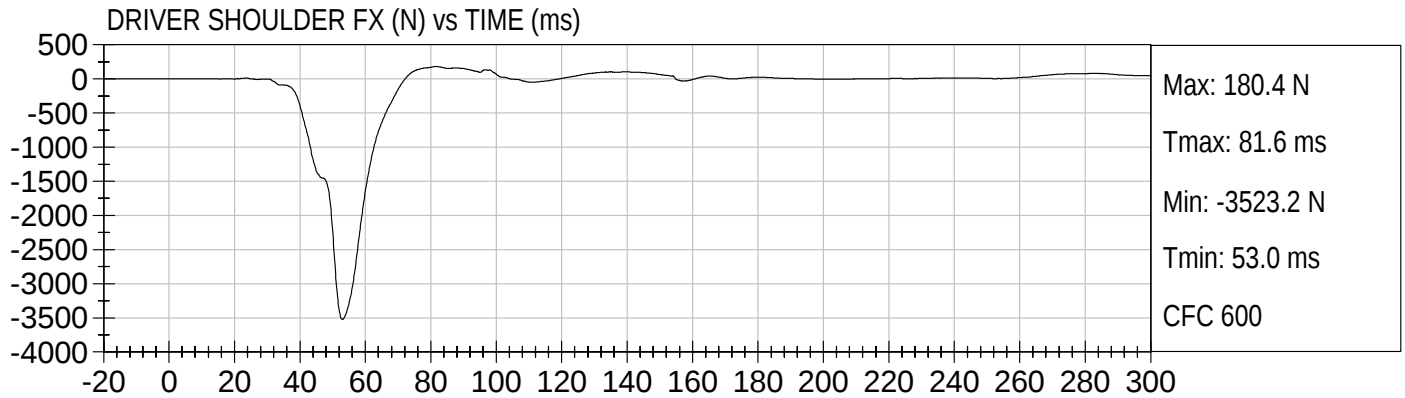


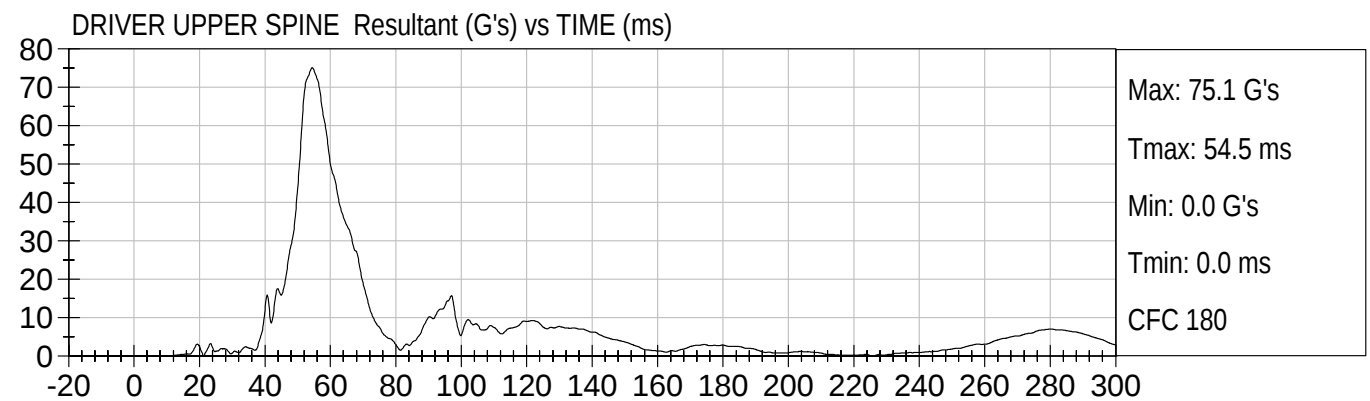
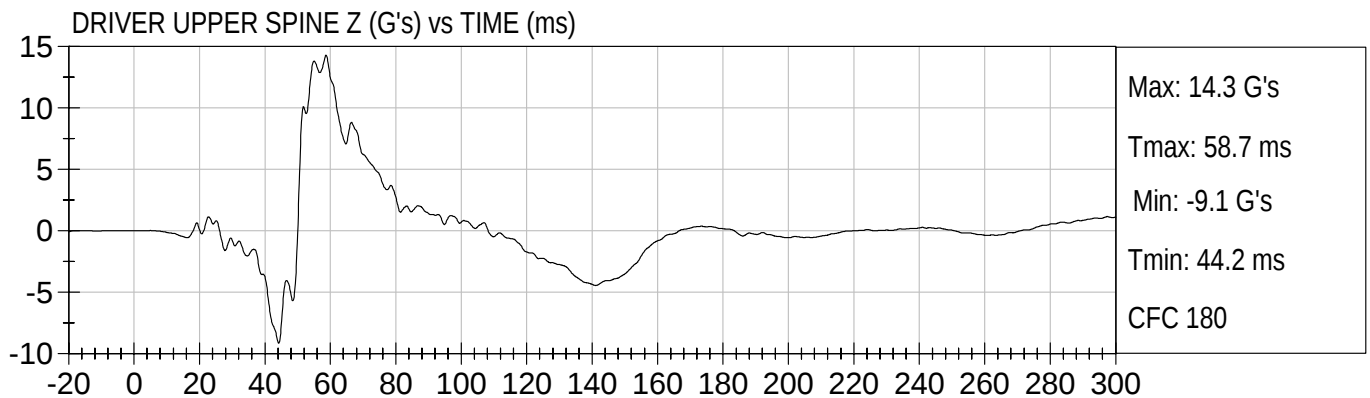
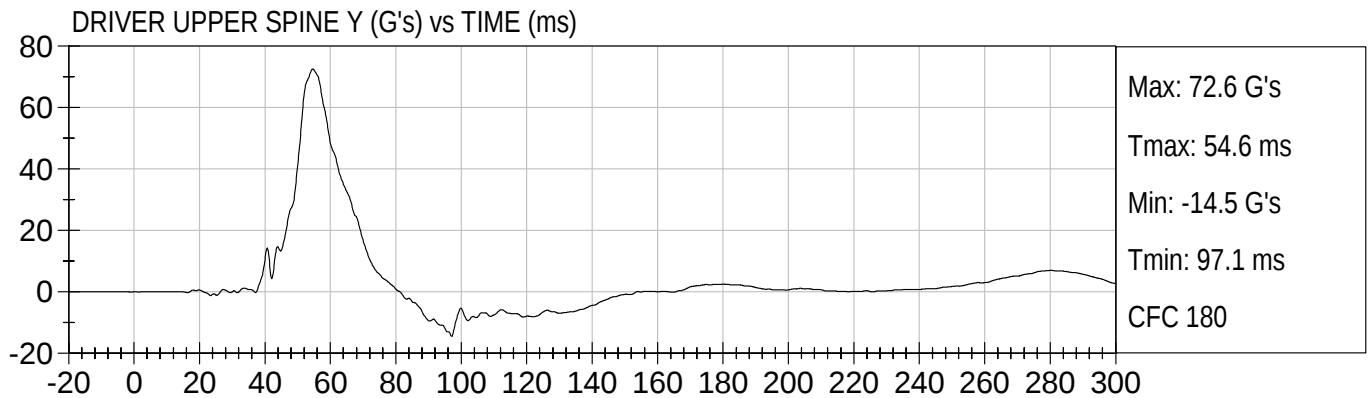
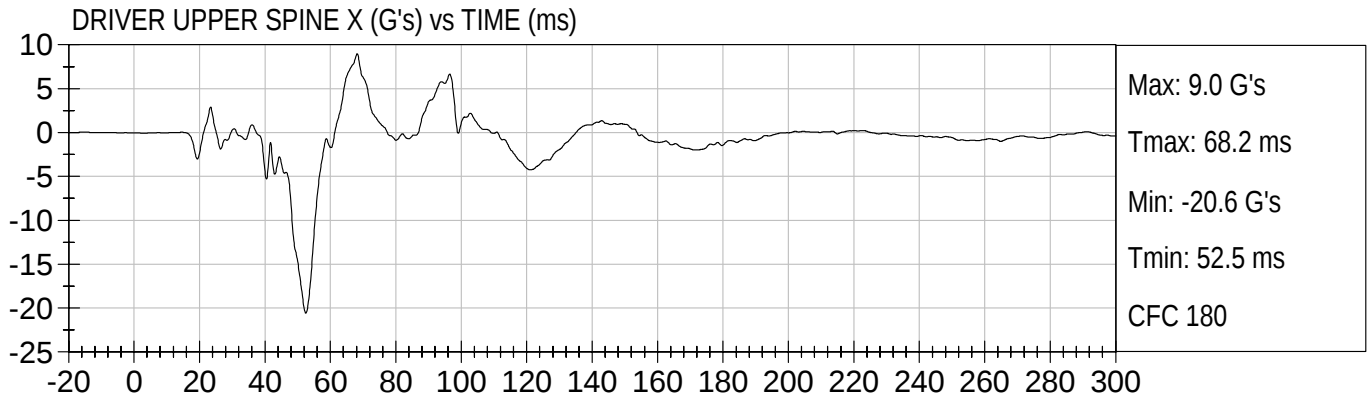






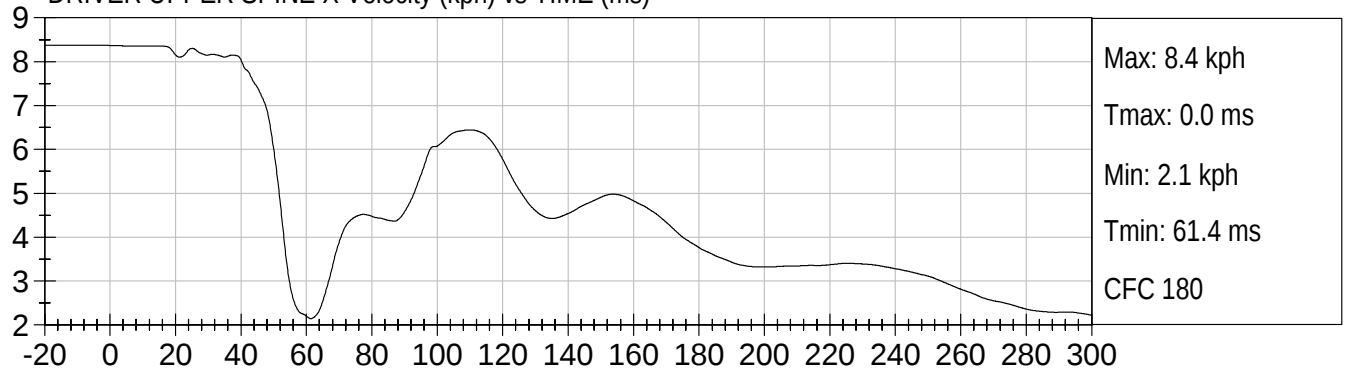




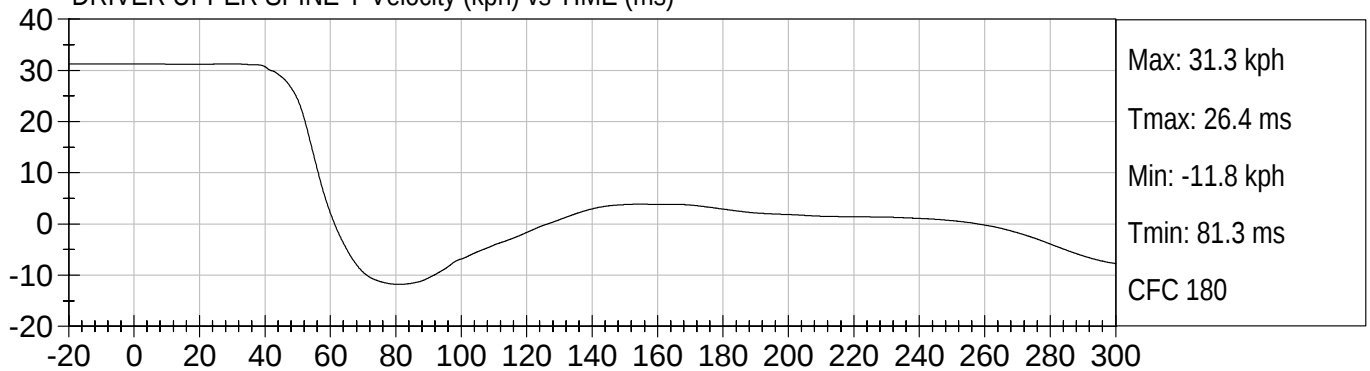




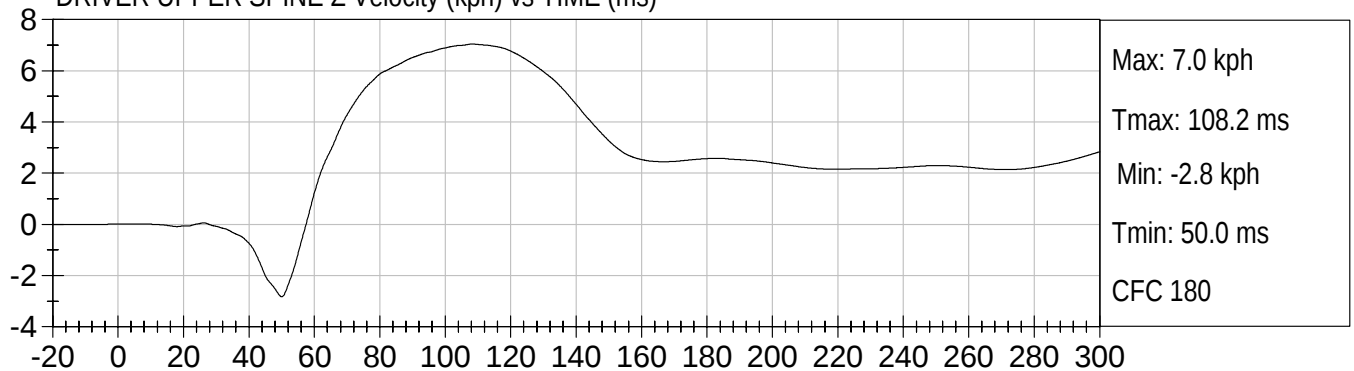
DRIVER UPPER SPINE X Velocity (kph) vs TIME (ms)

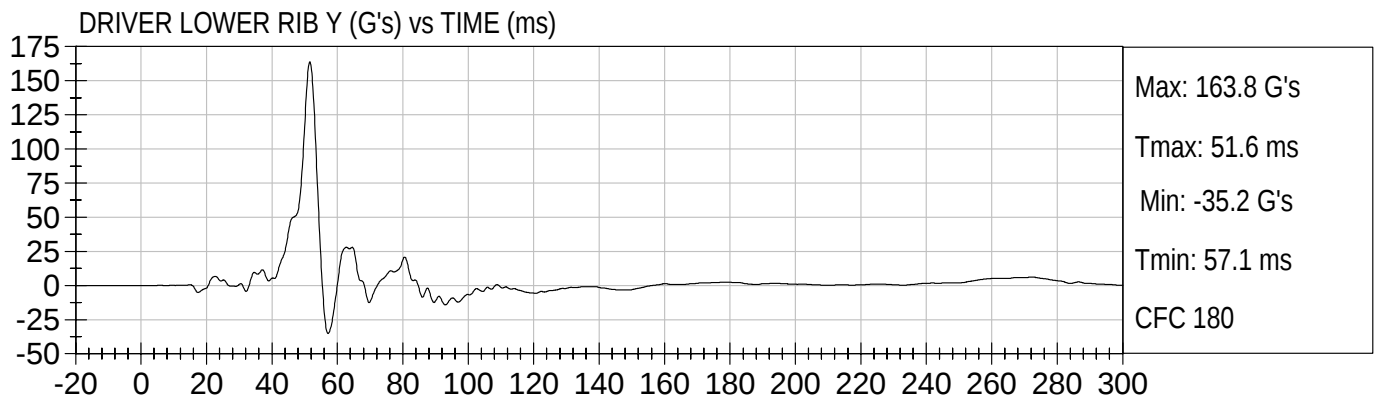
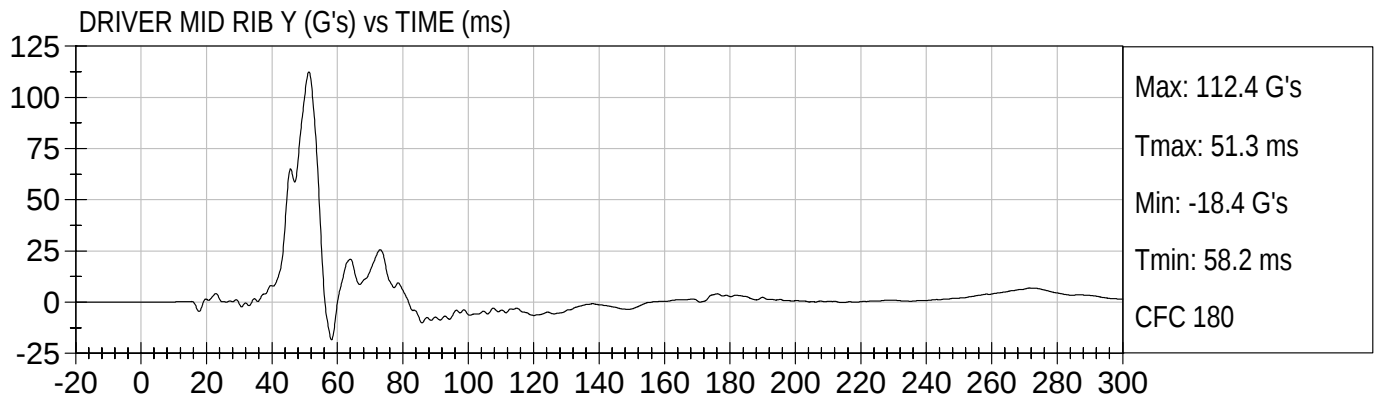
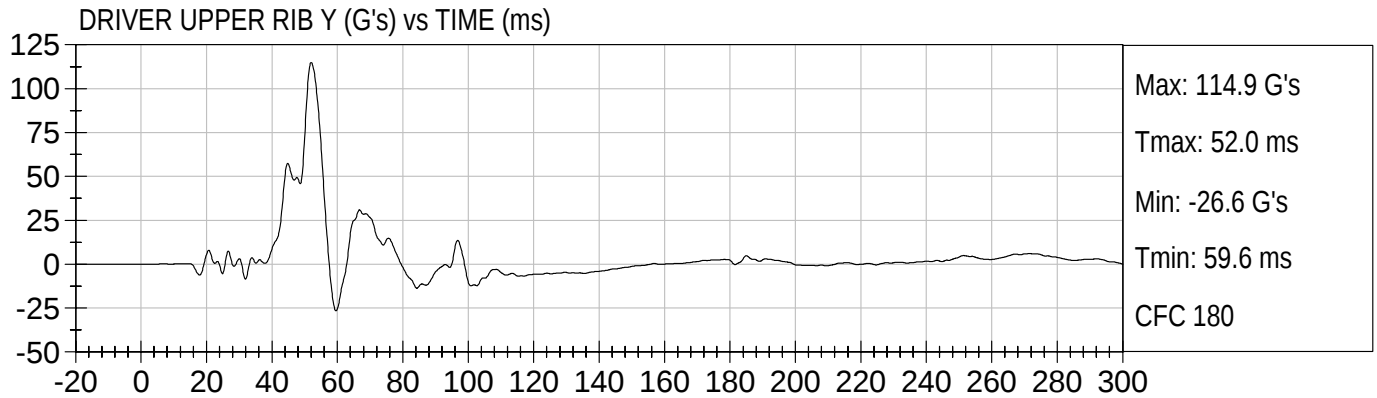


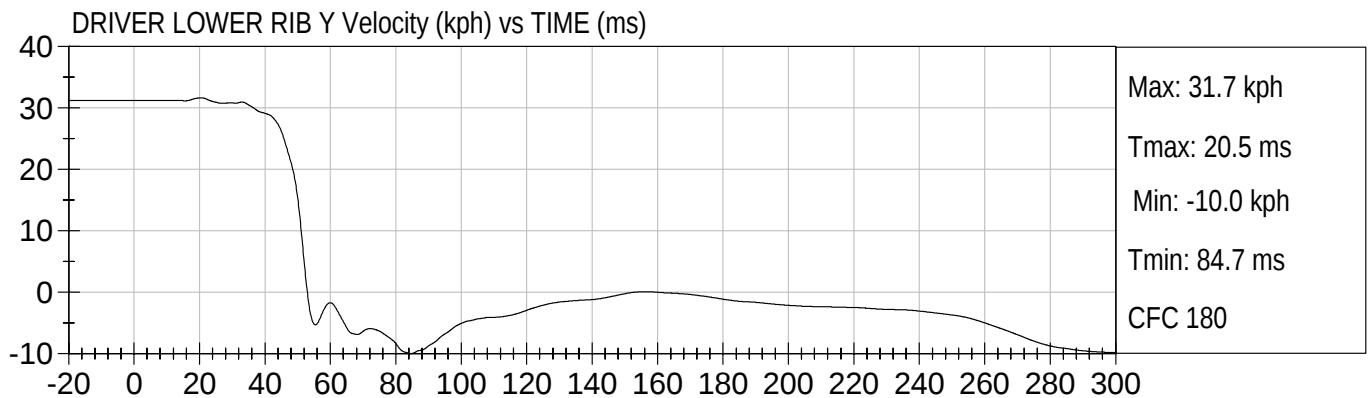
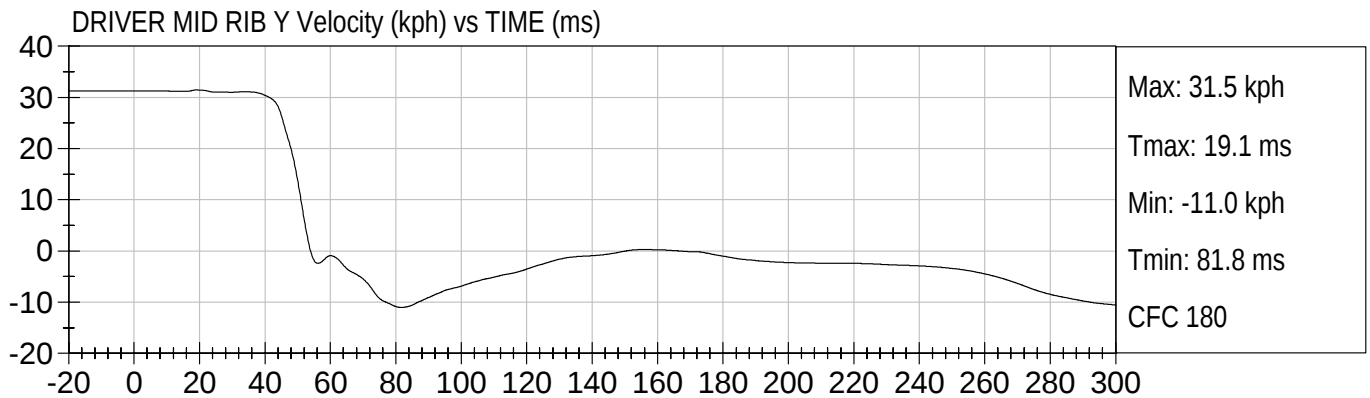
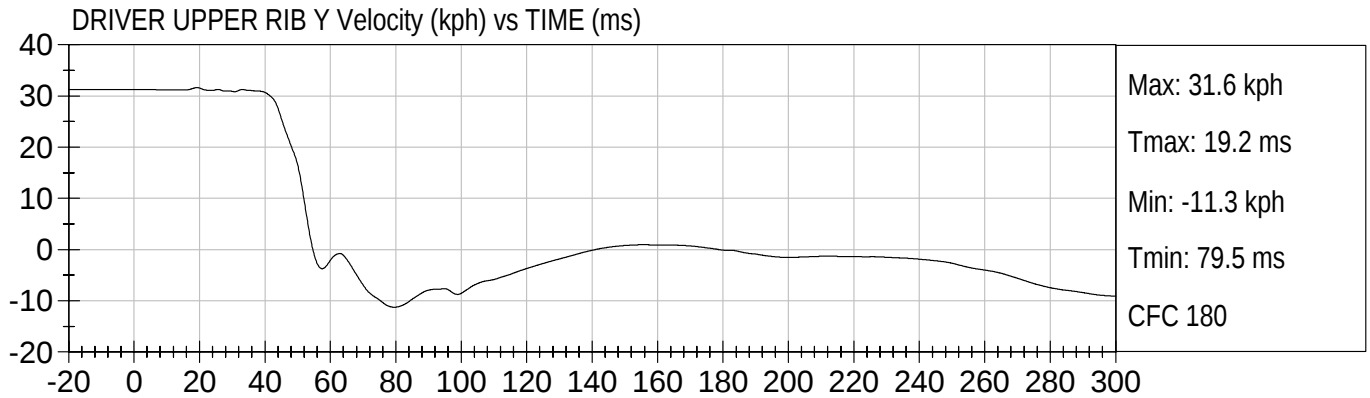
DRIVER UPPER SPINE Y Velocity (kph) vs TIME (ms)

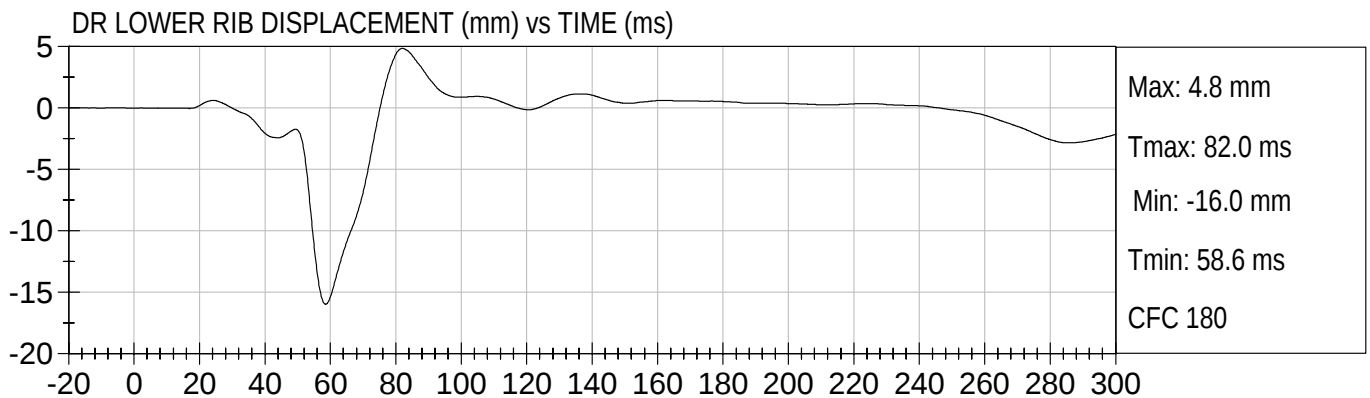
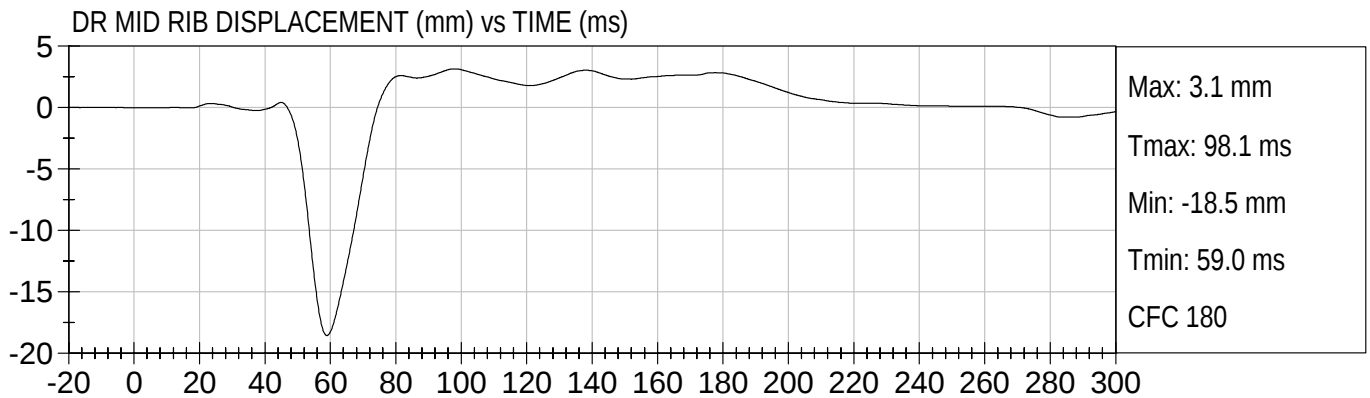
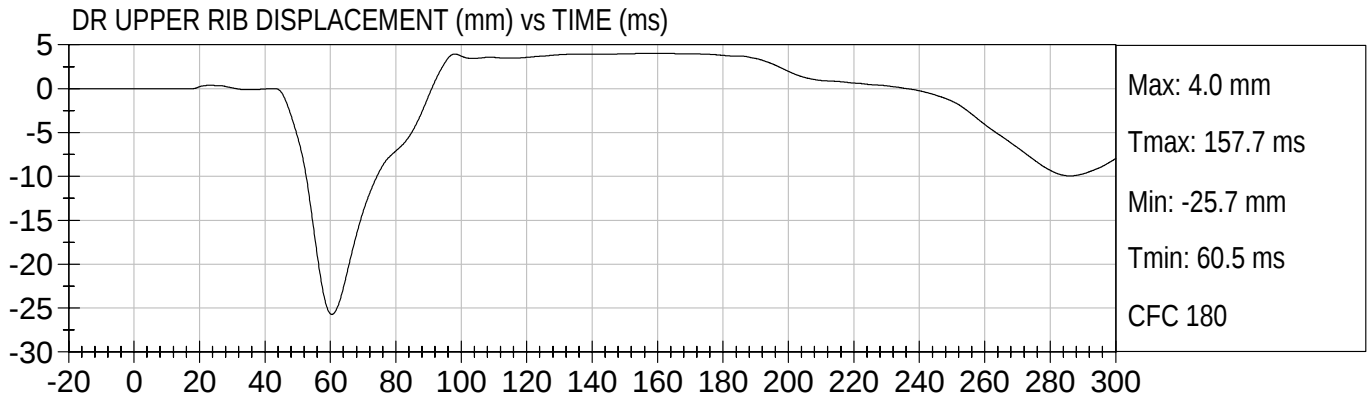


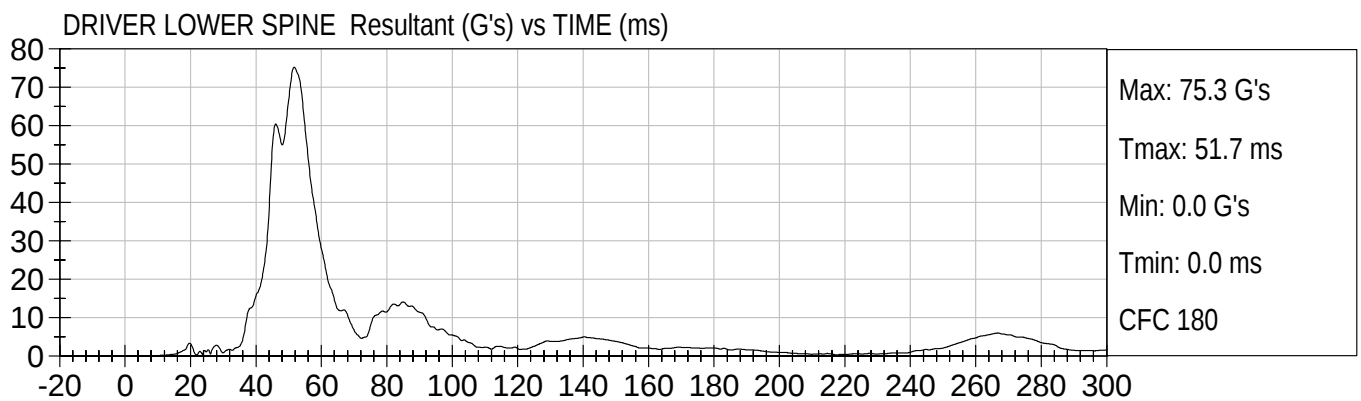
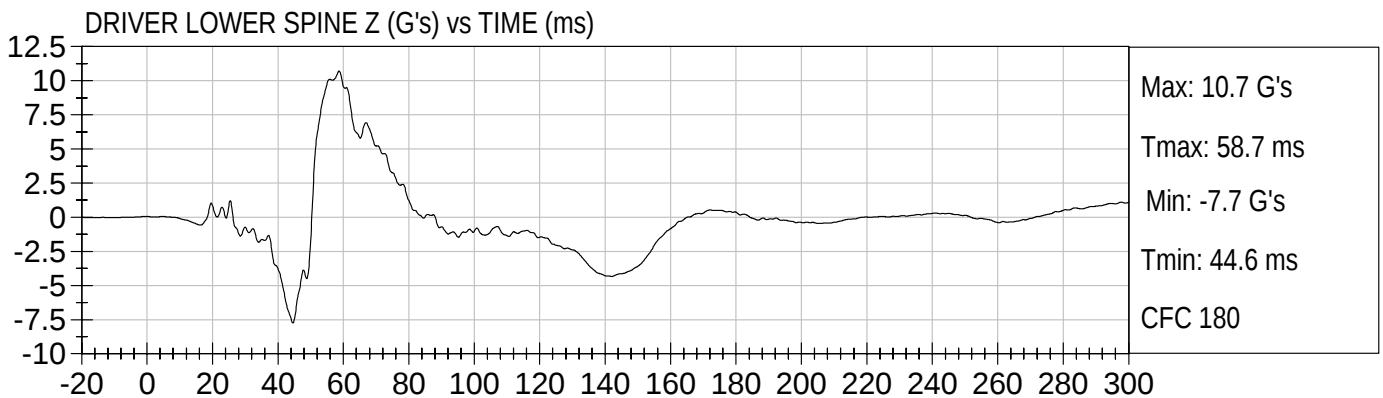
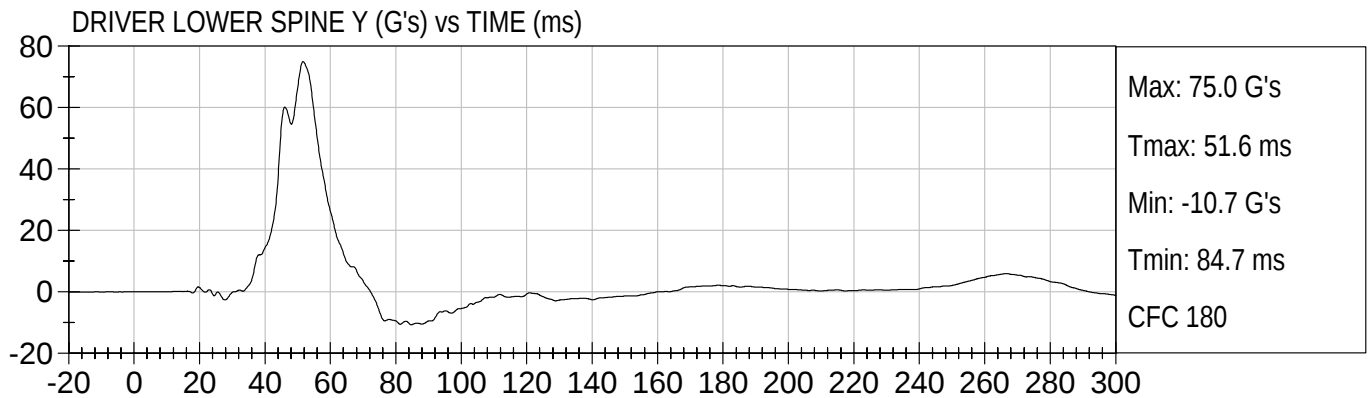
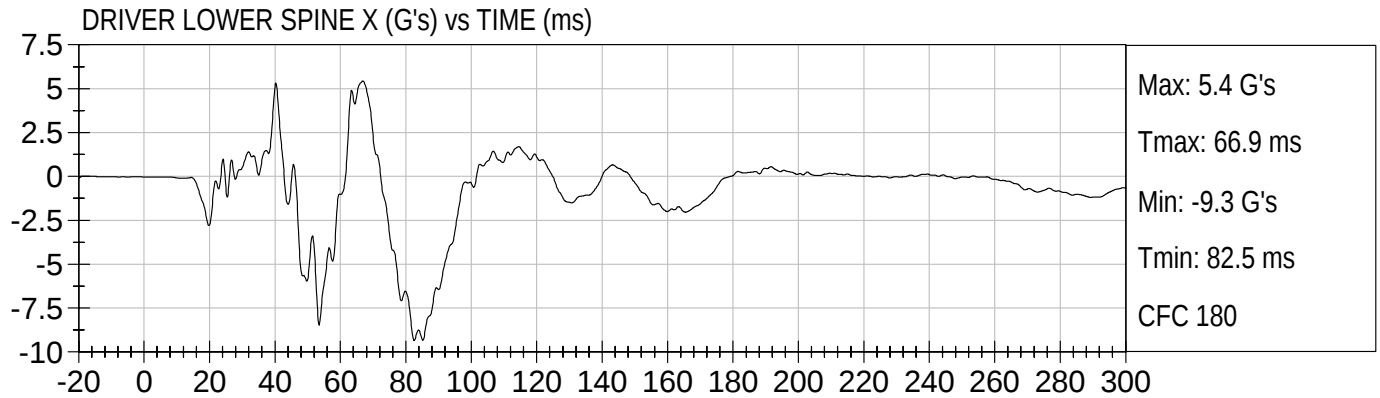
DRIVER UPPER SPINE Z Velocity (kph) vs TIME (ms)





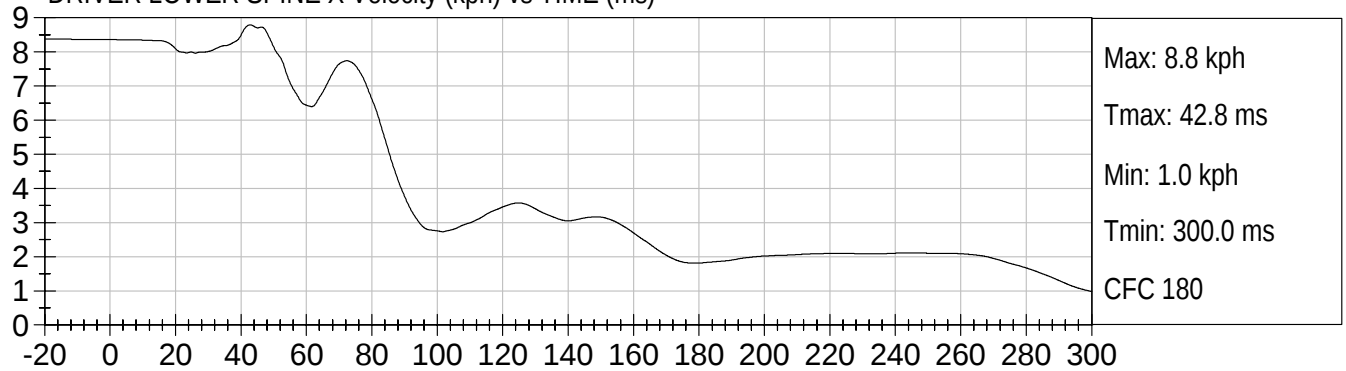




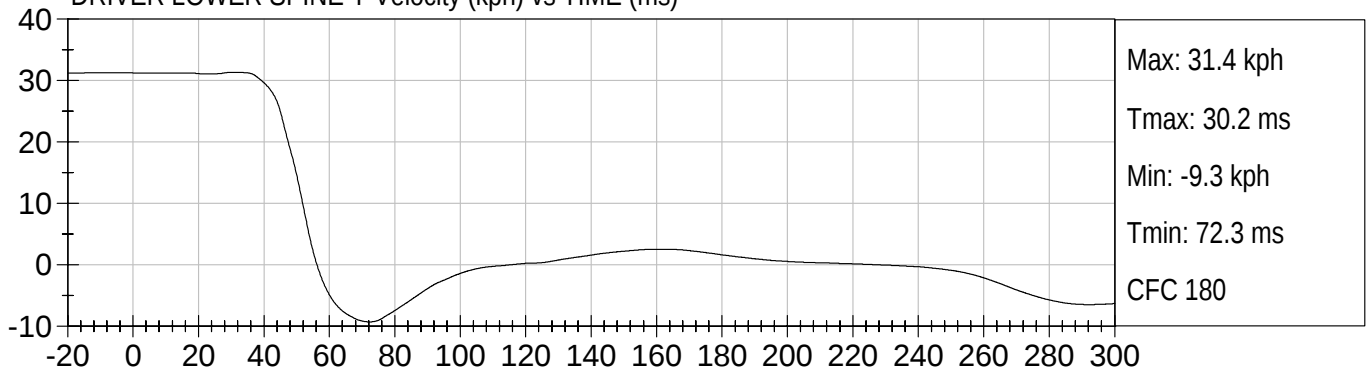




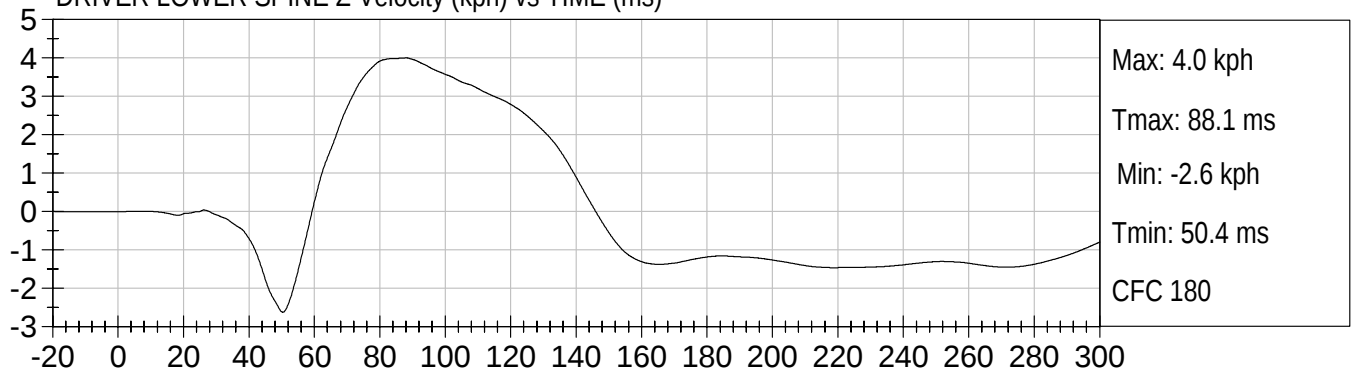
DRIVER LOWER SPINE X Velocity (kph) vs TIME (ms)

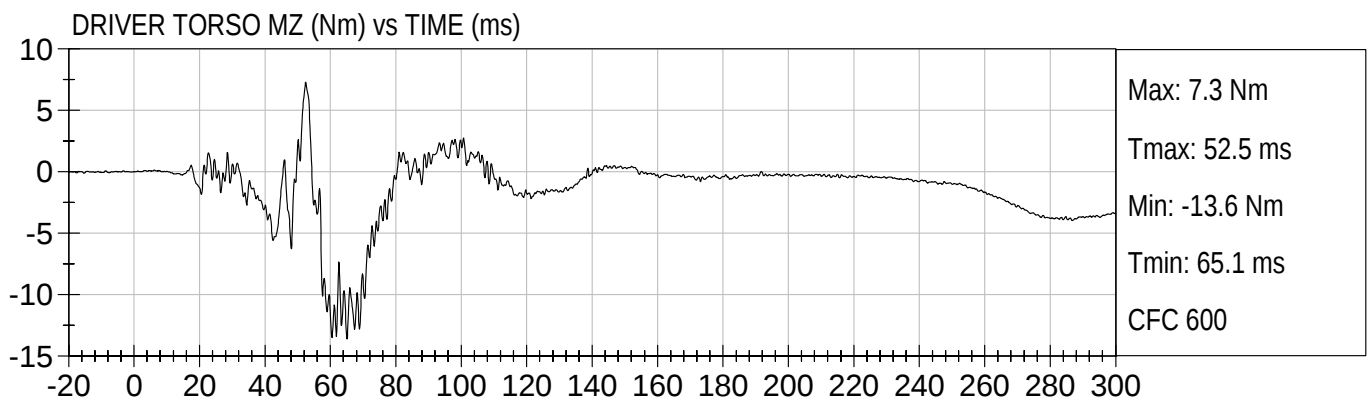
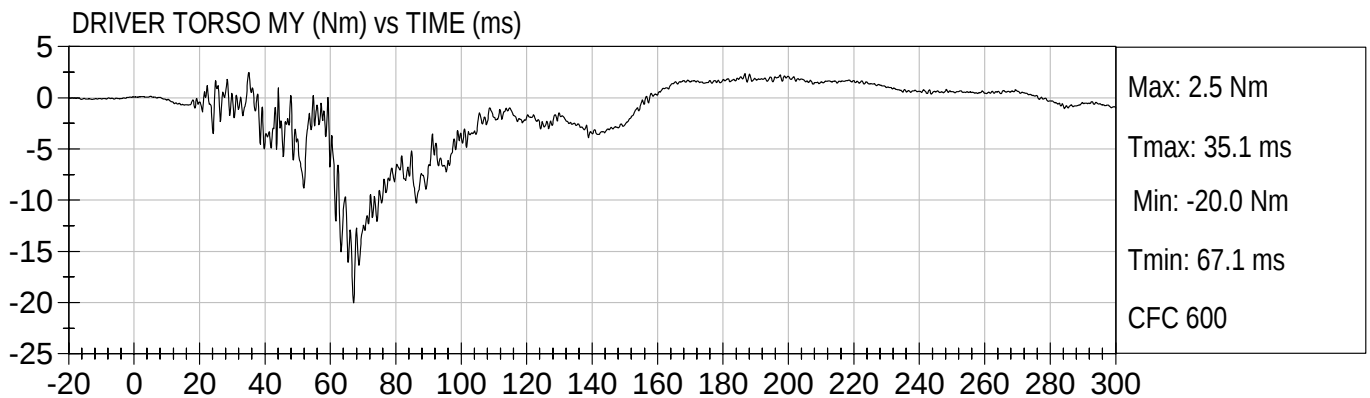
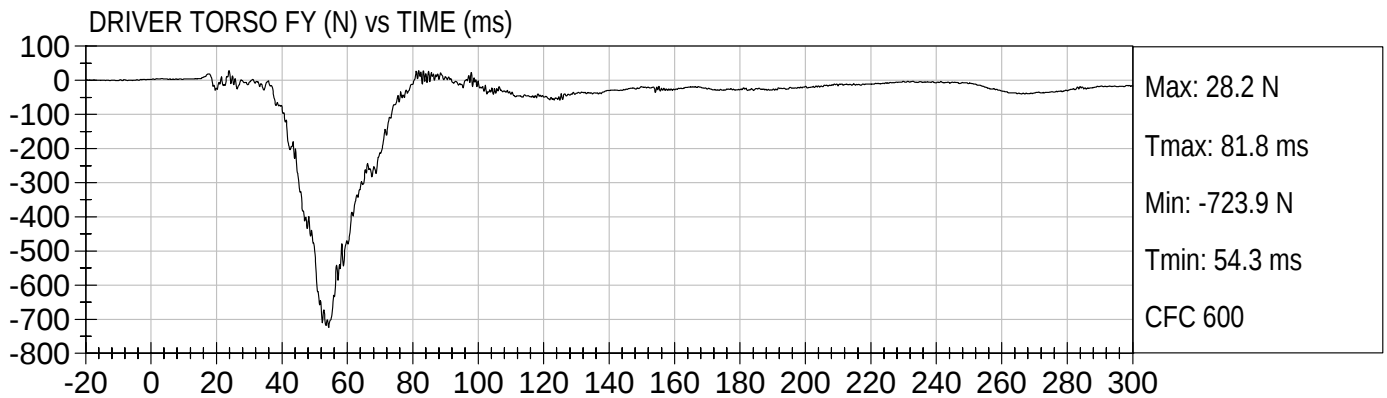
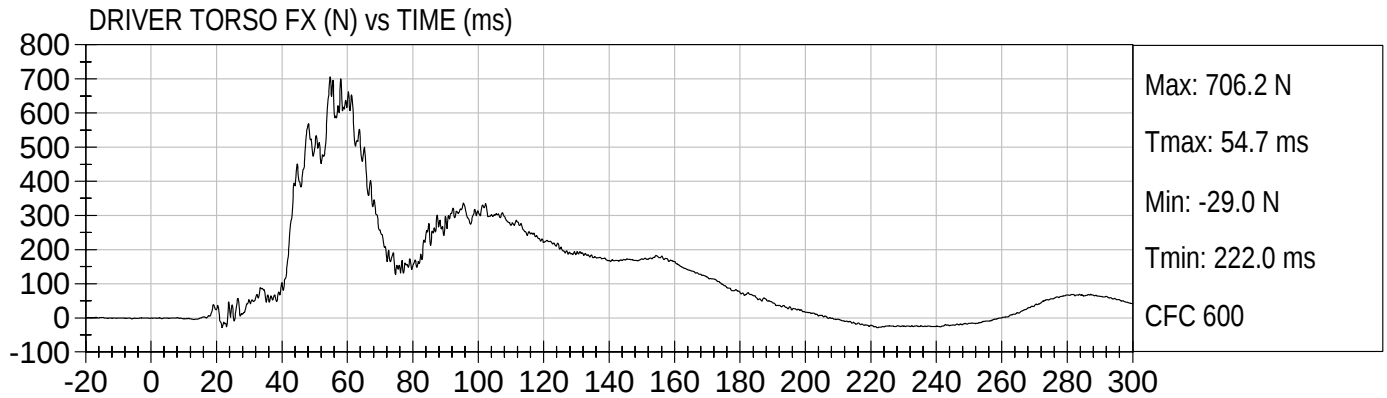


DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)



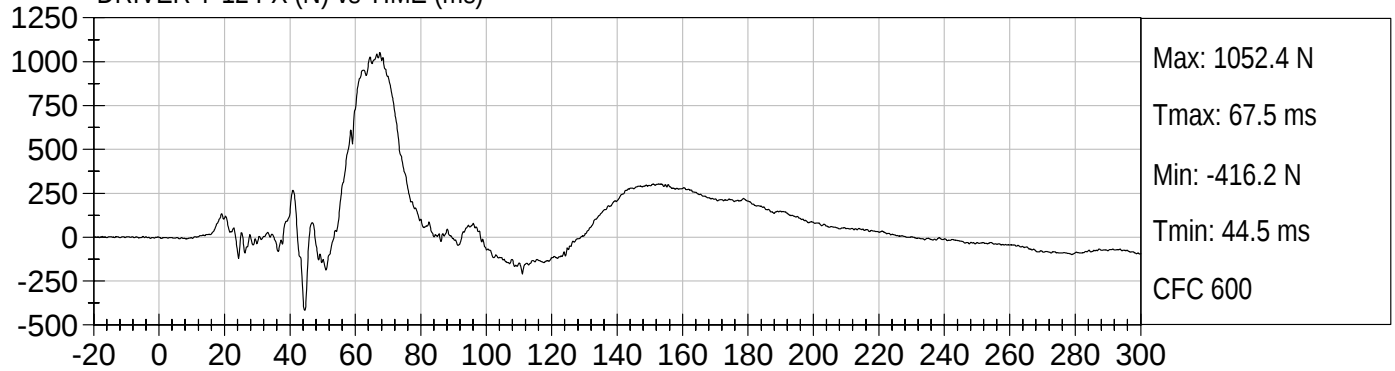
DRIVER LOWER SPINE Z Velocity (kph) vs TIME (ms)



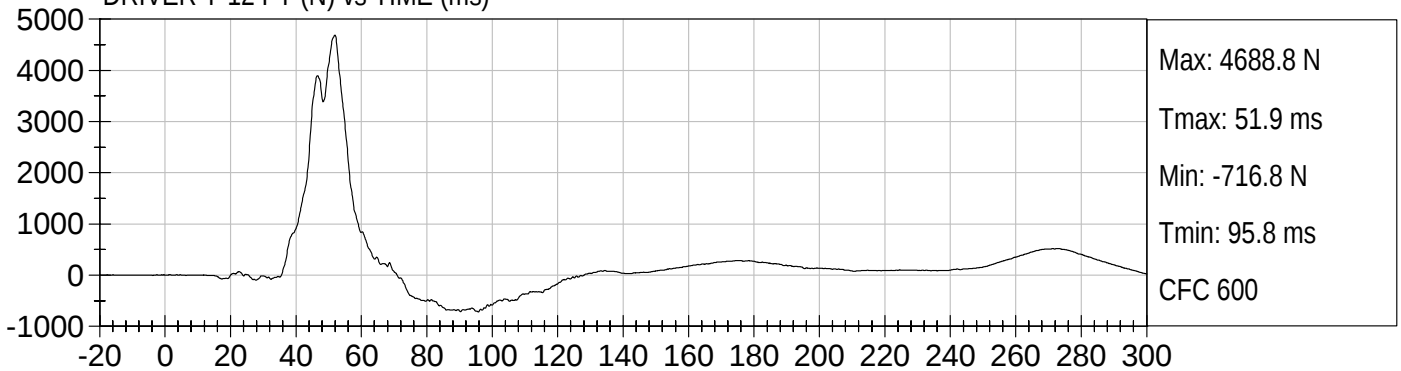




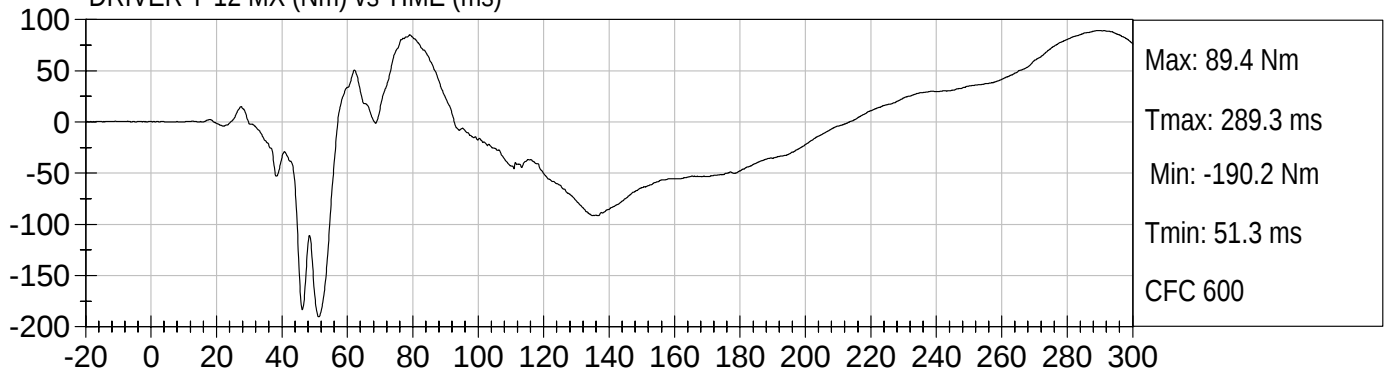
DRIVER T-12 FX (N) vs TIME (ms)



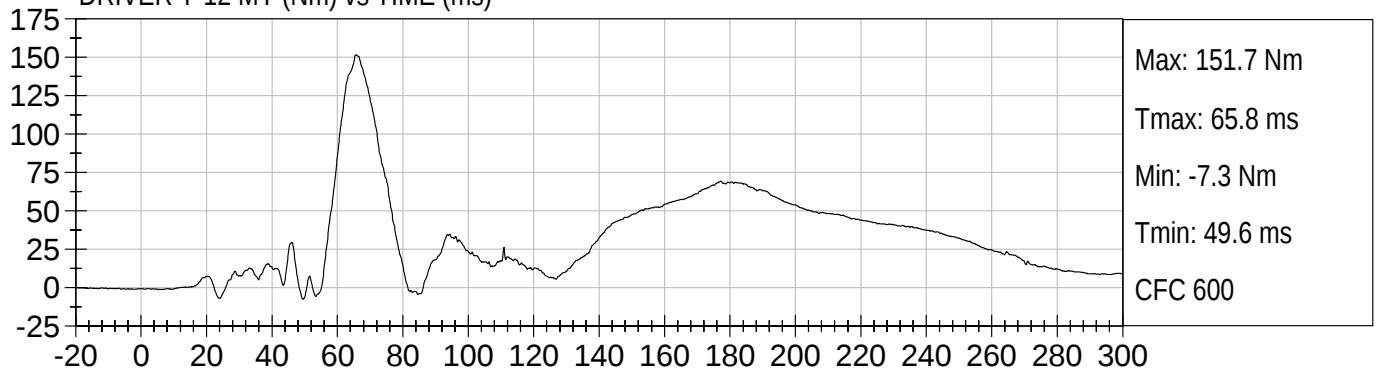
DRIVER T-12 FY (N) vs TIME (ms)

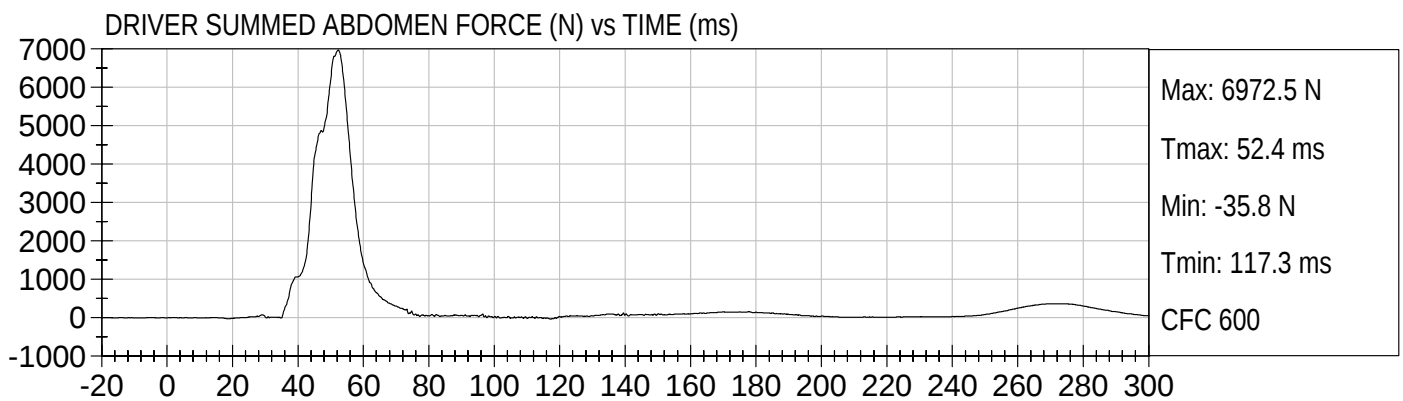
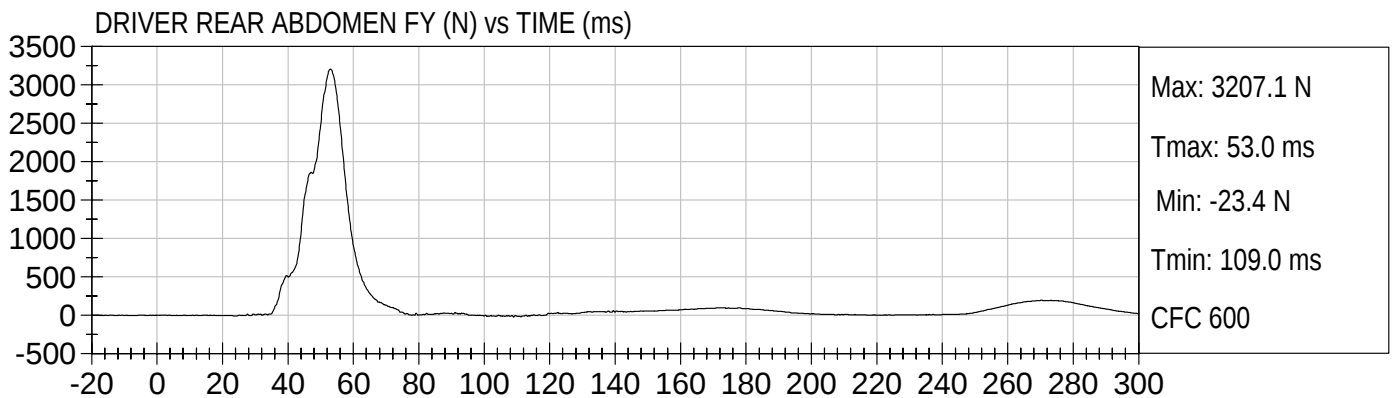
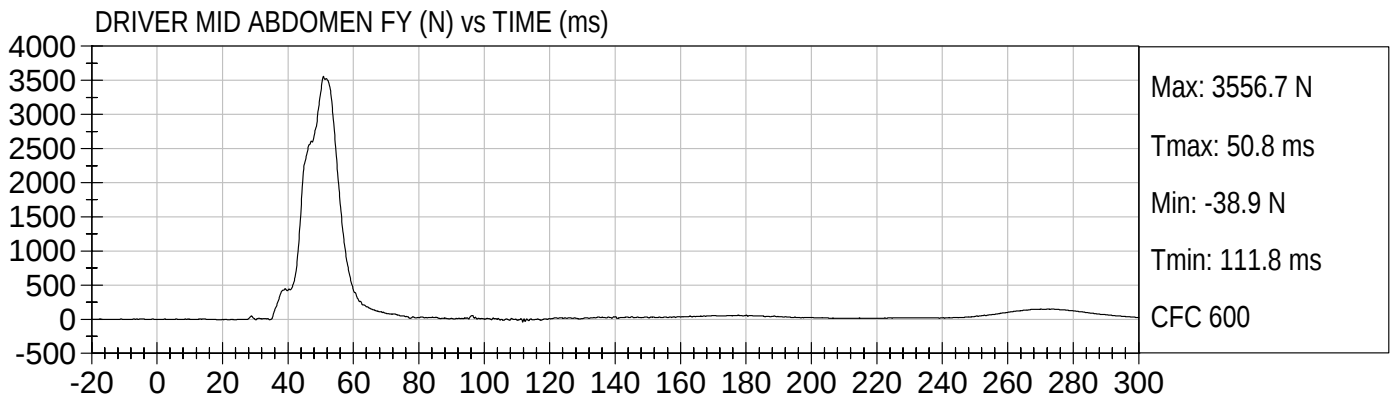
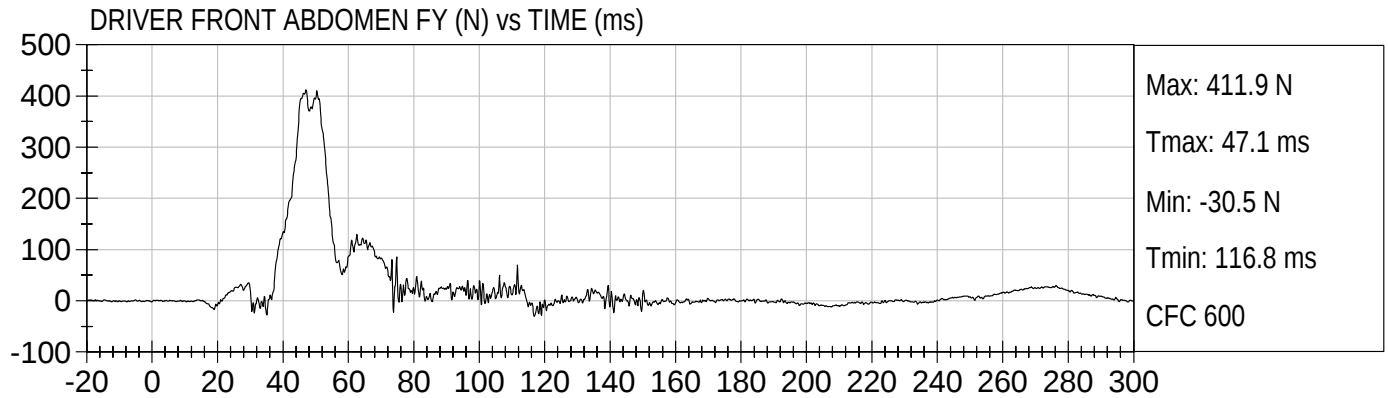


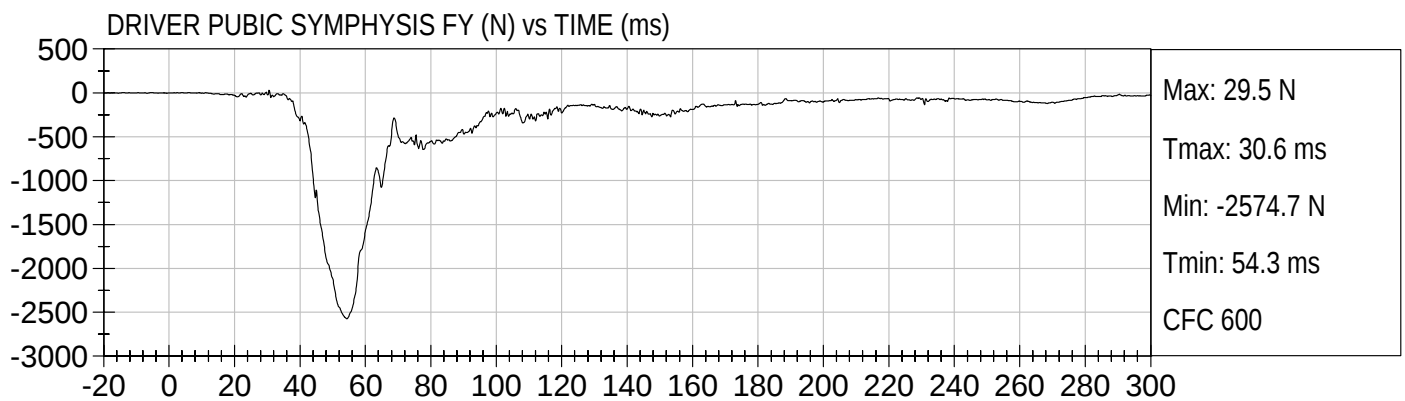
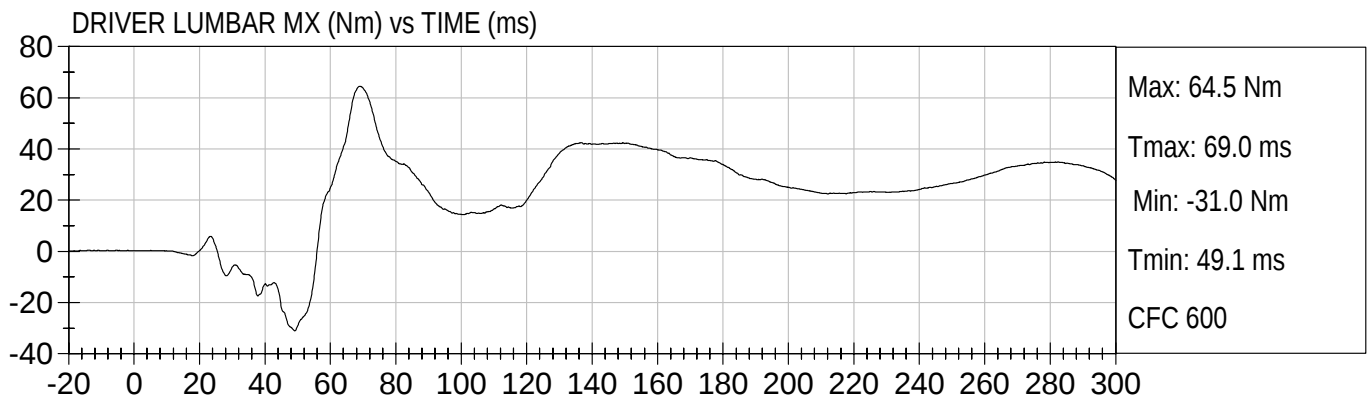
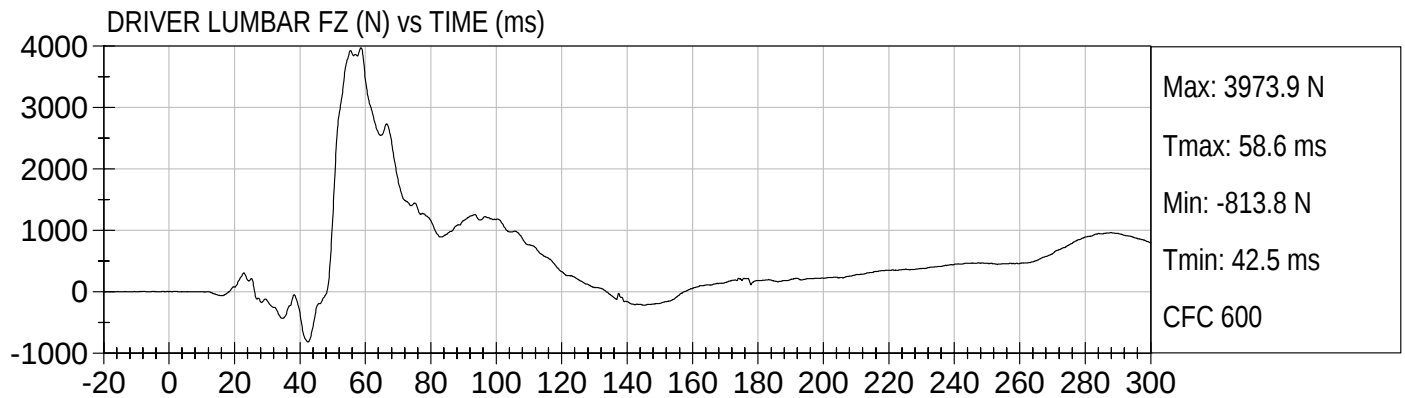
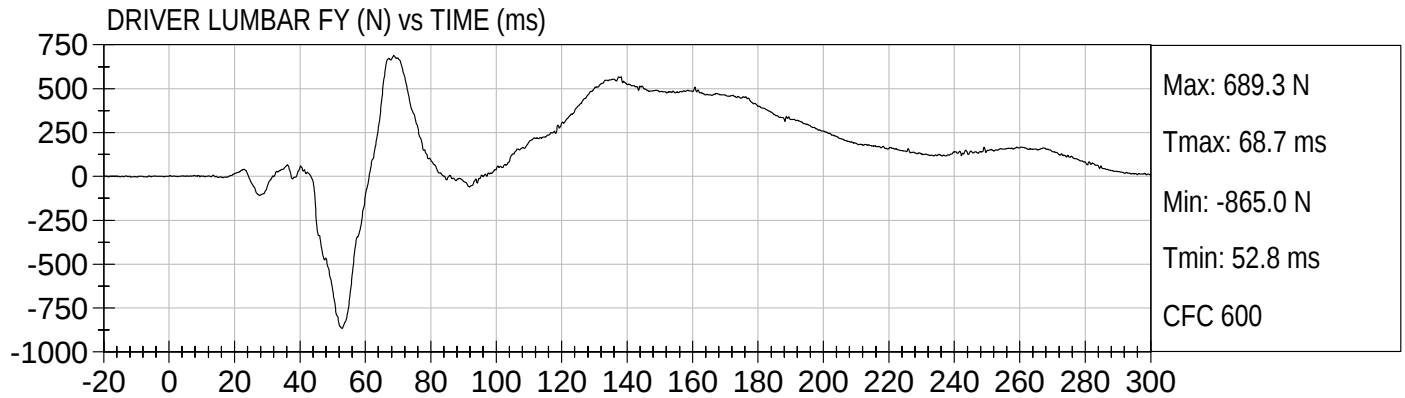
DRIVER T-12 MX (Nm) vs TIME (ms)

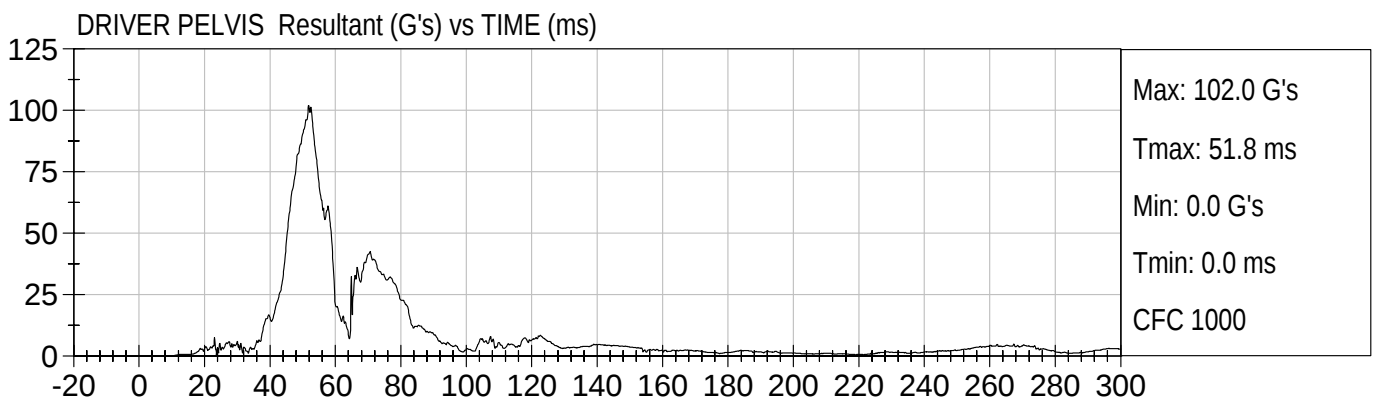
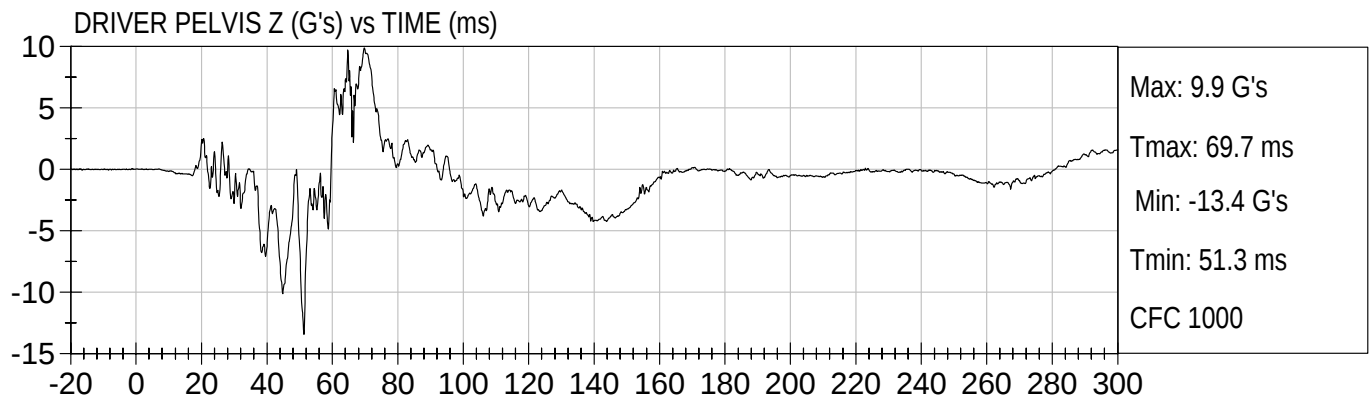
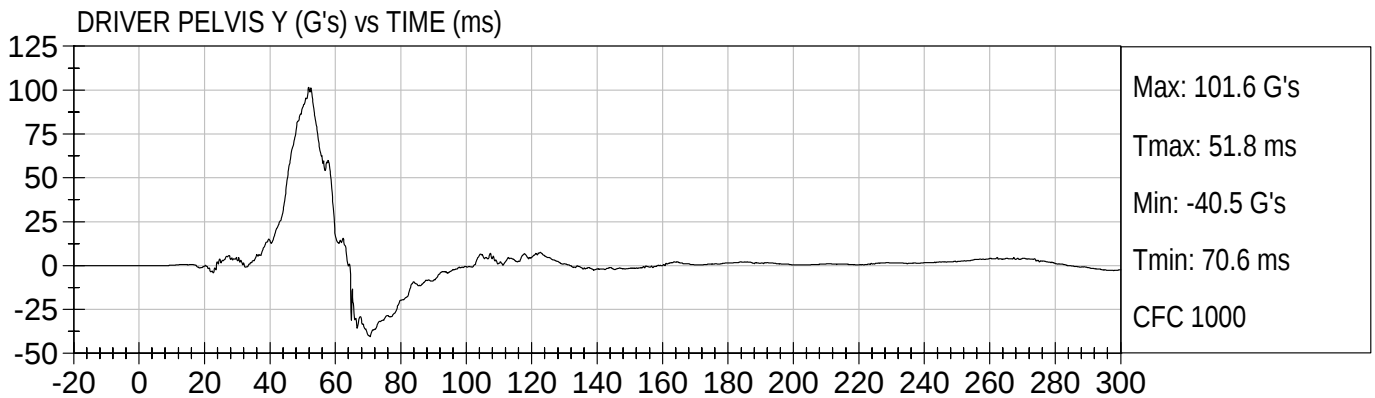


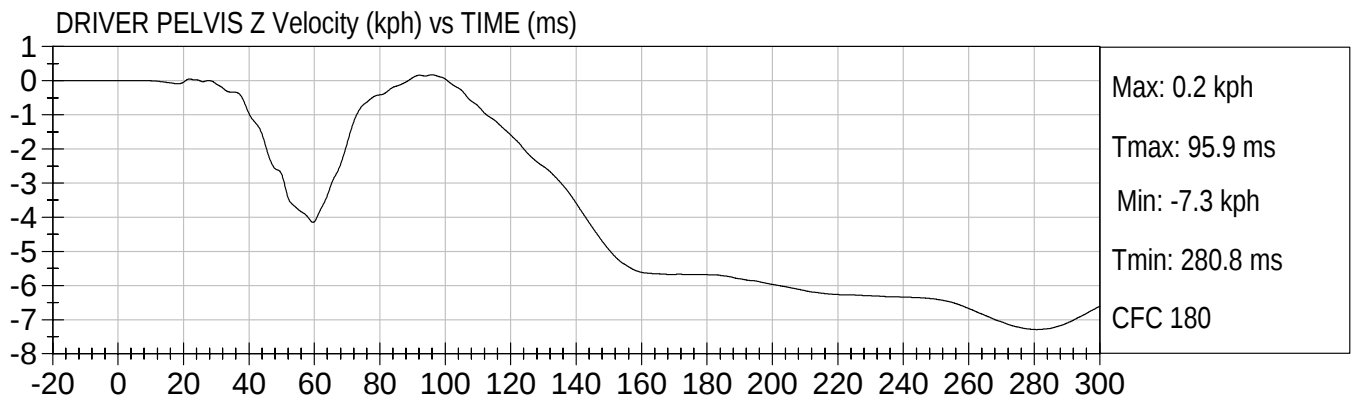
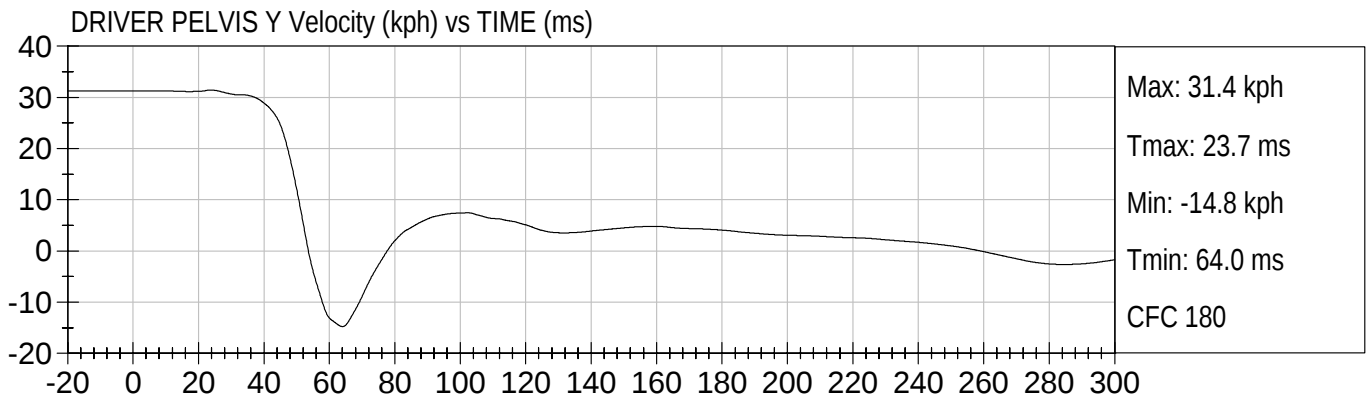
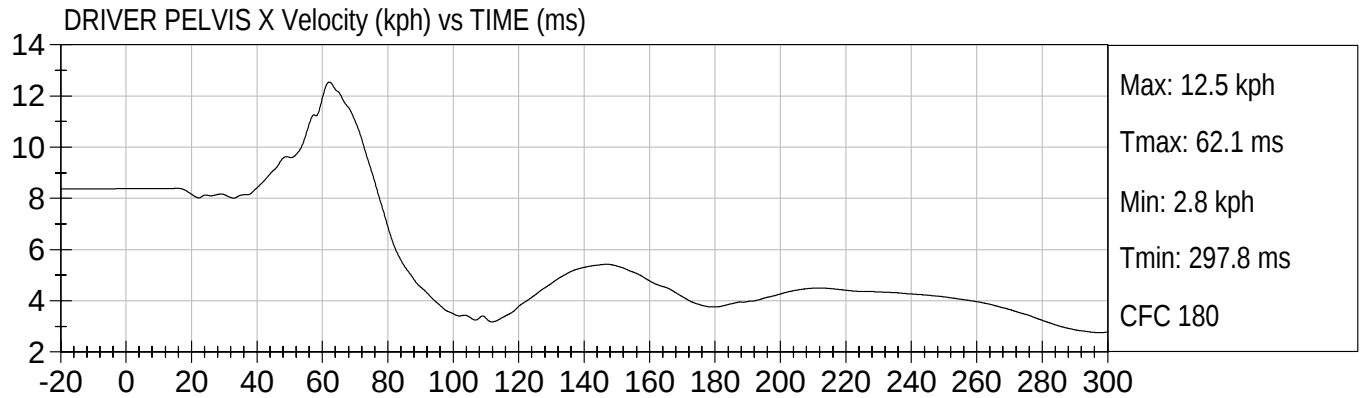
DRIVER T-12 MY (Nm) vs TIME (ms)

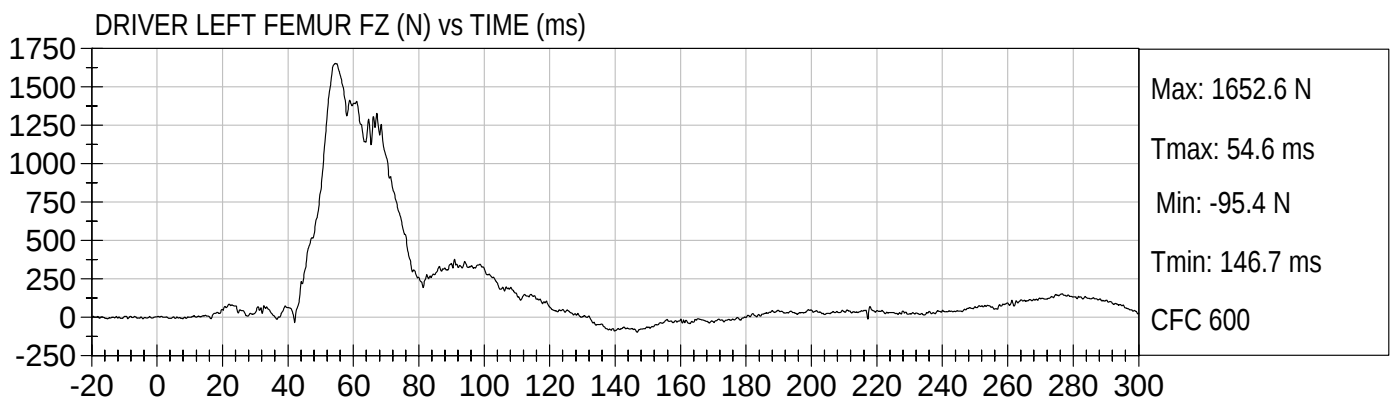
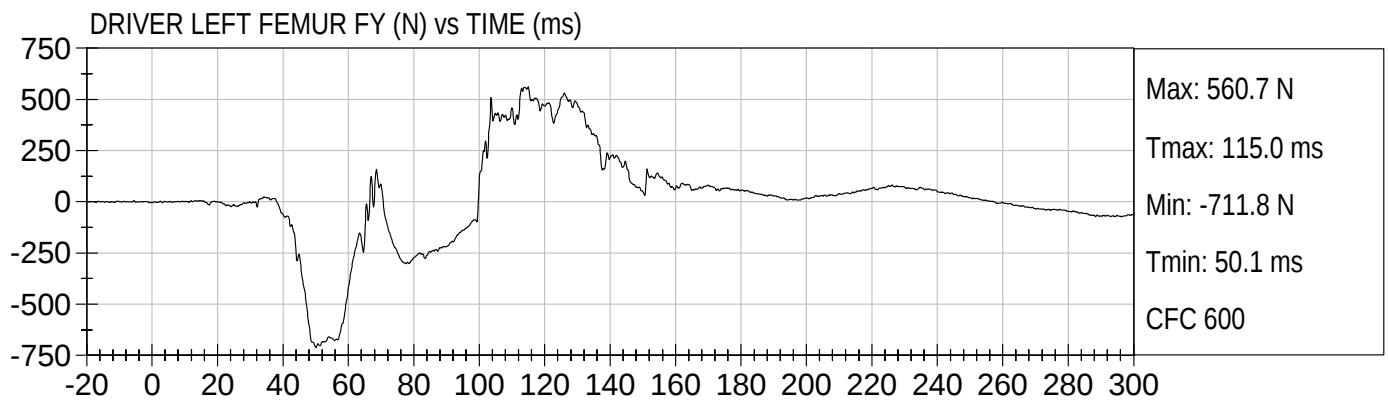
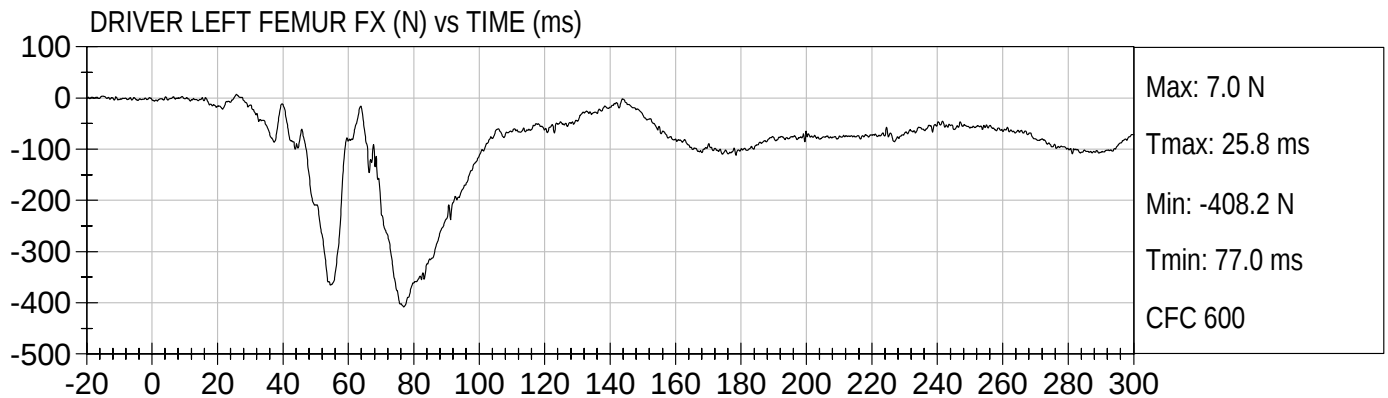


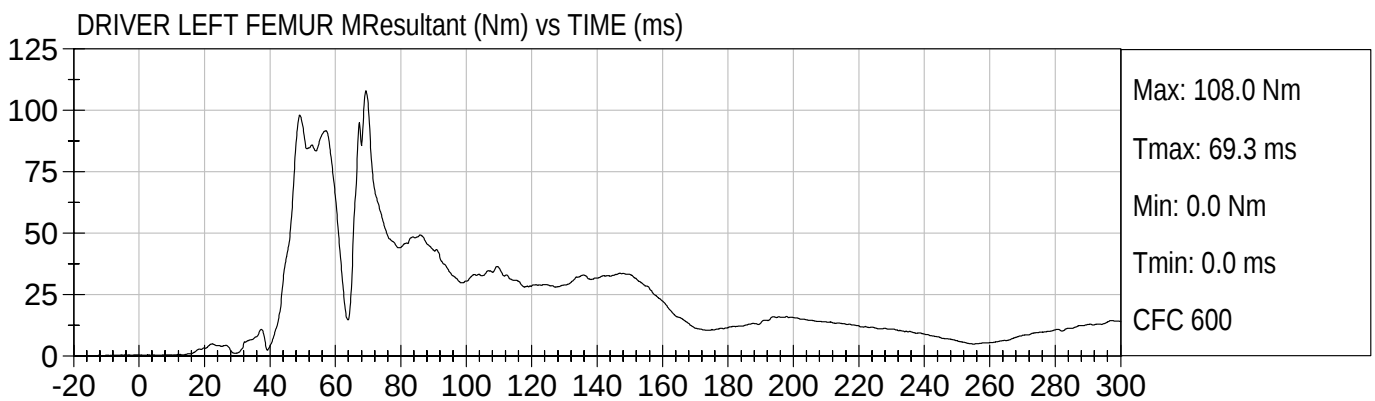
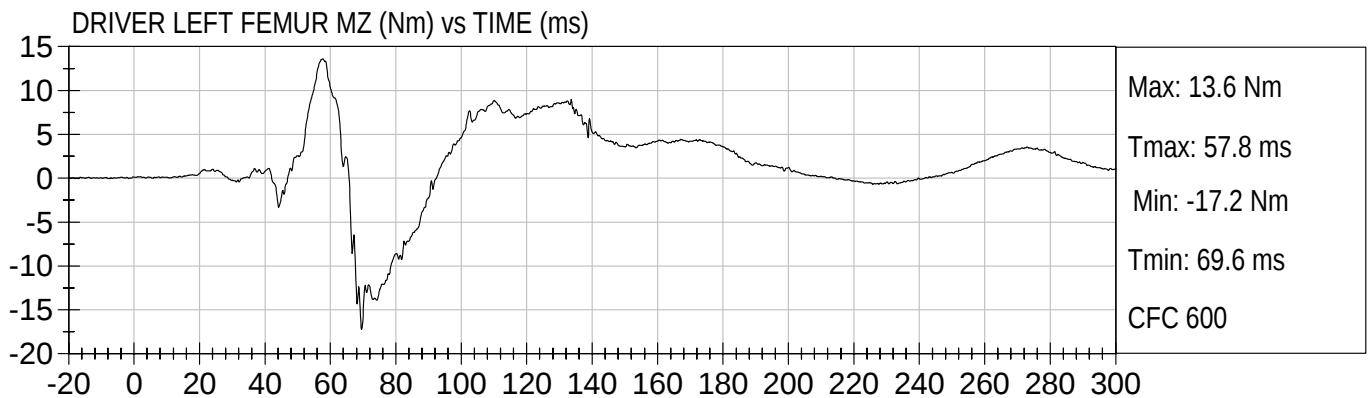
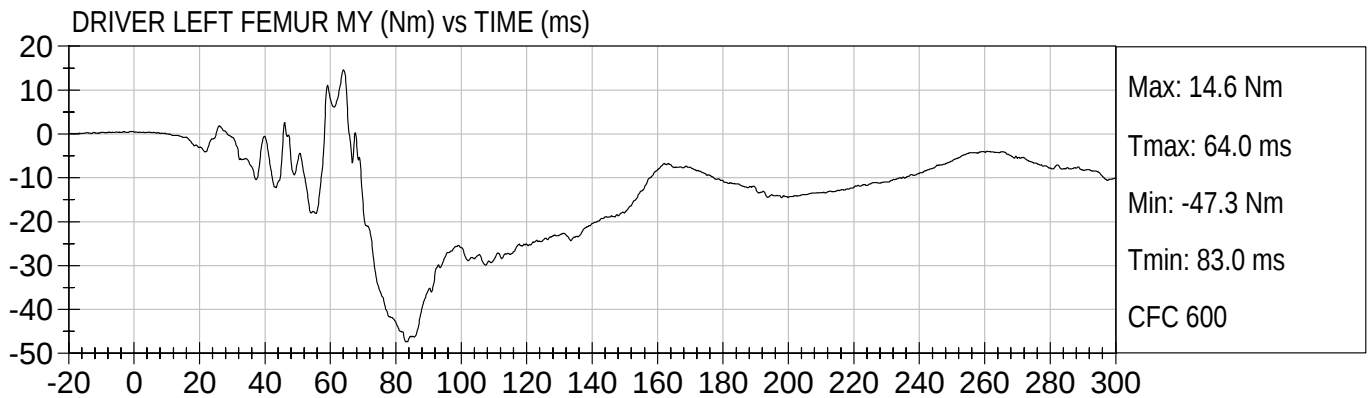
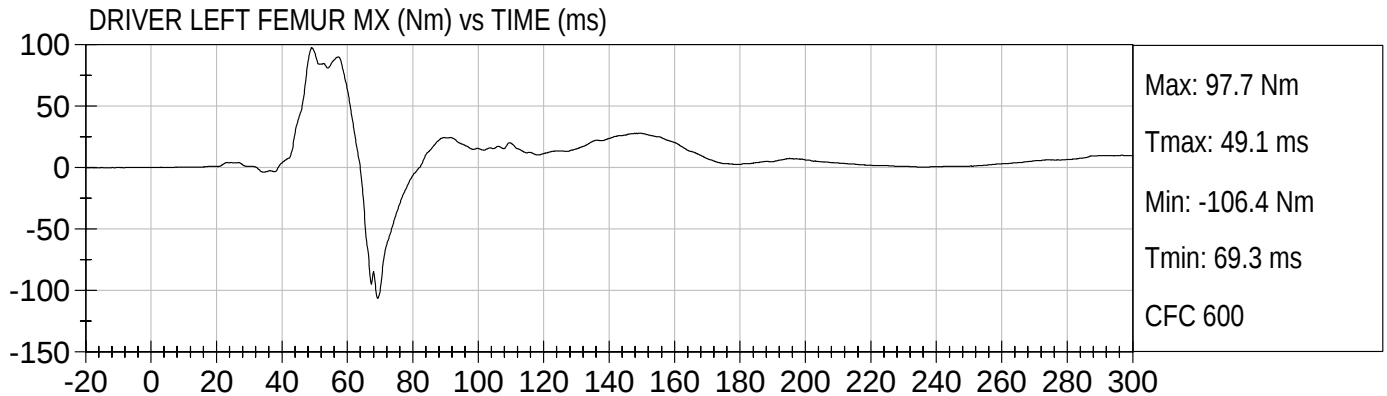


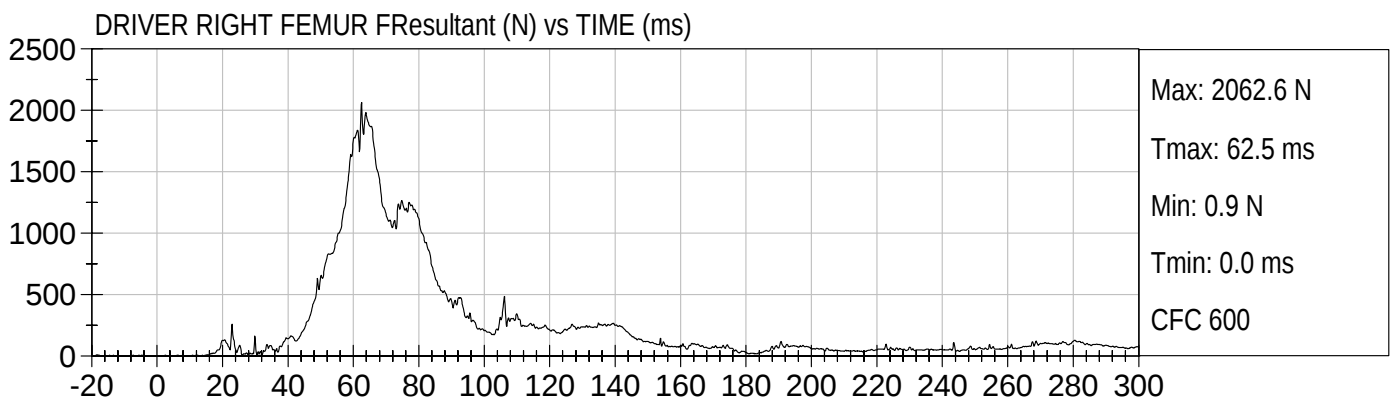
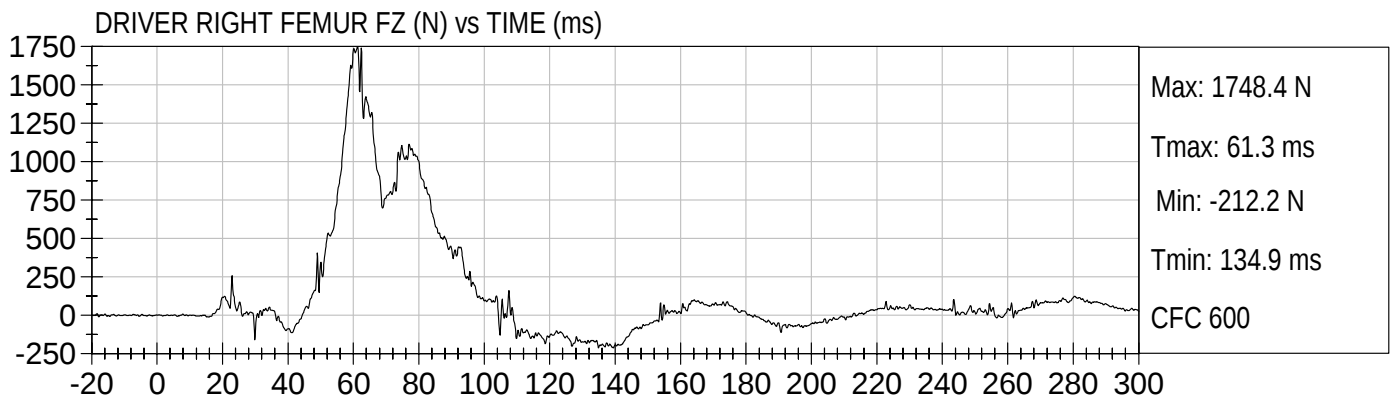
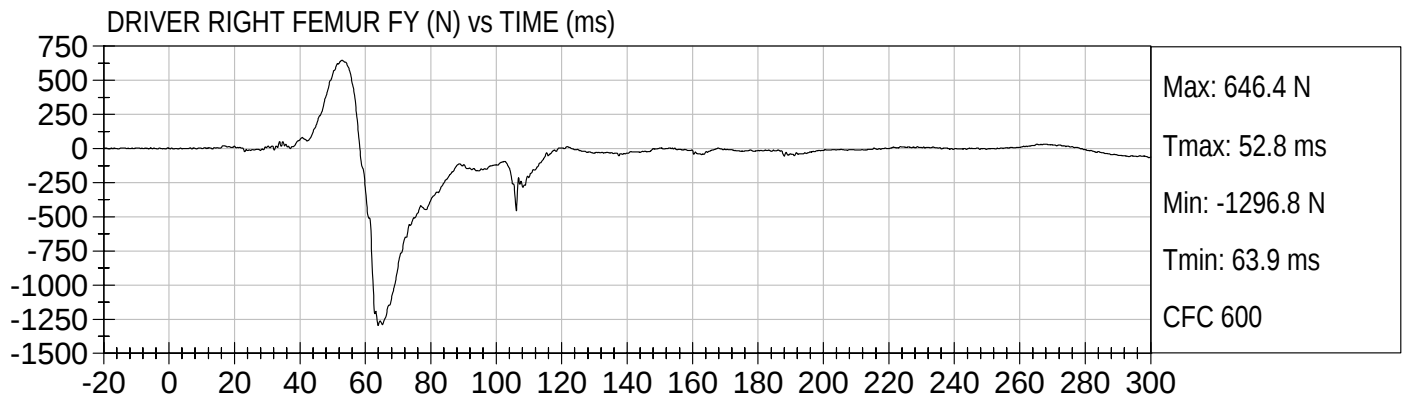
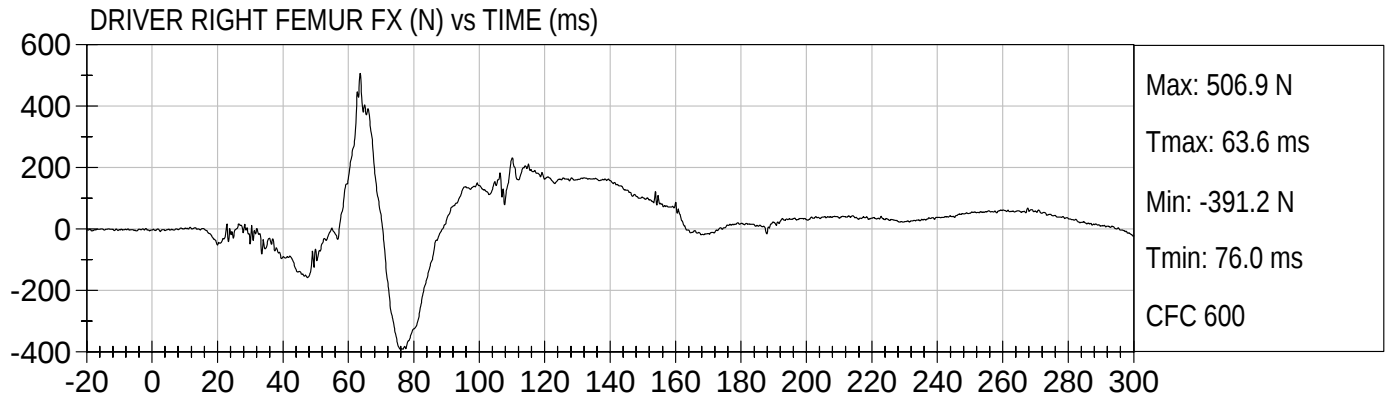


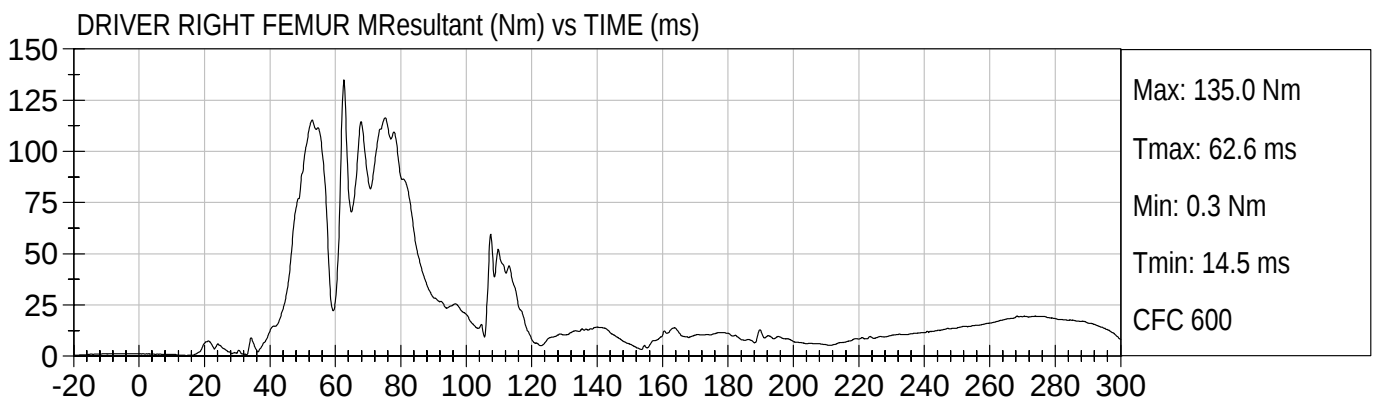
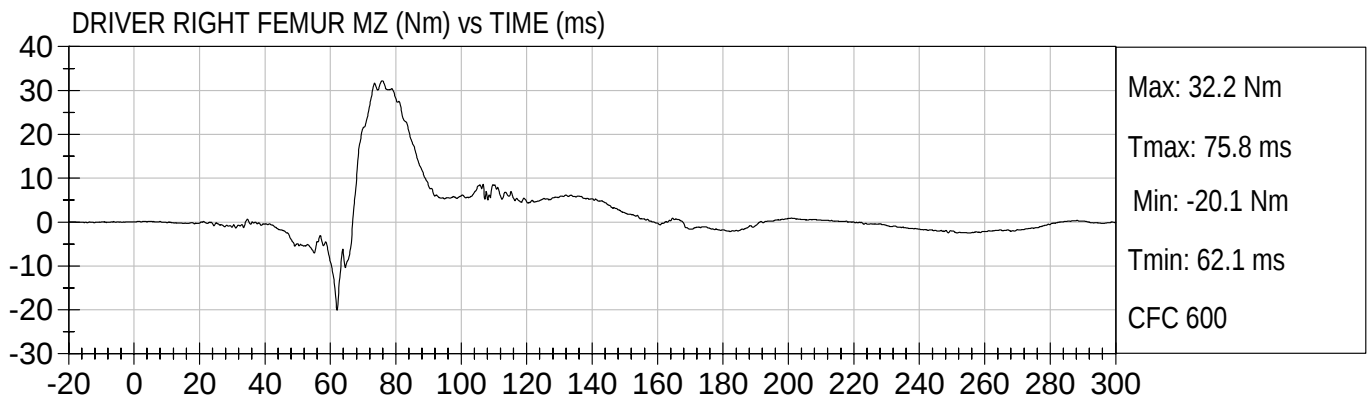
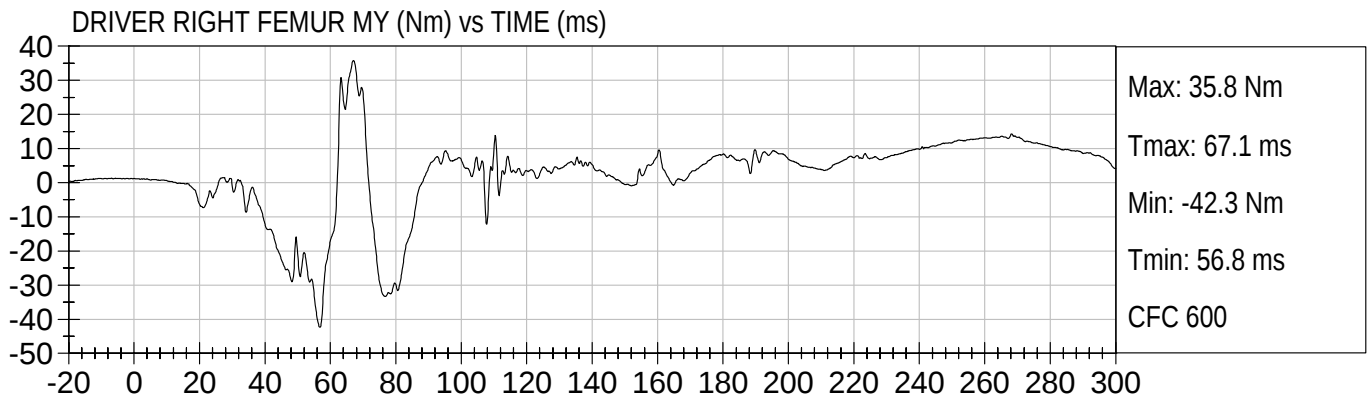
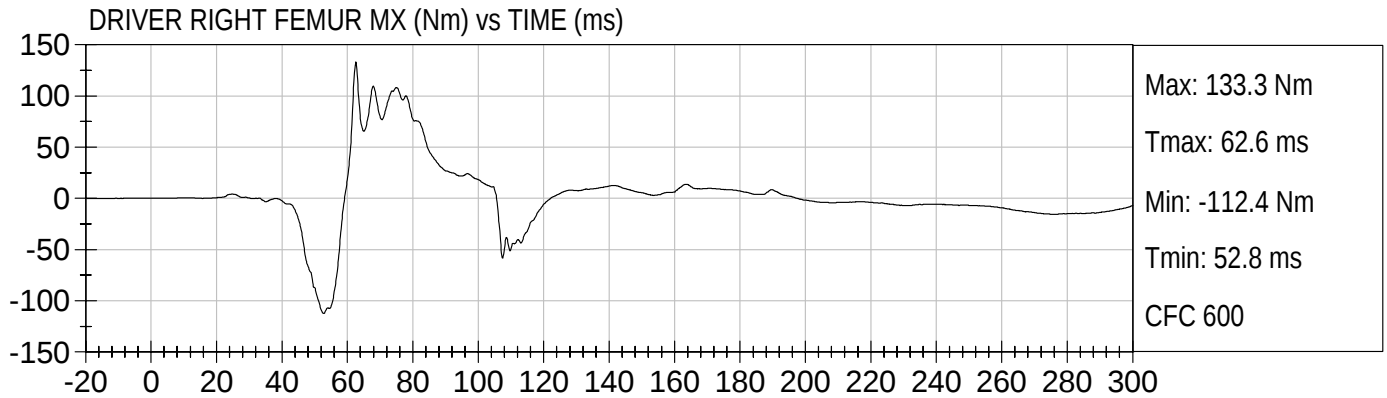


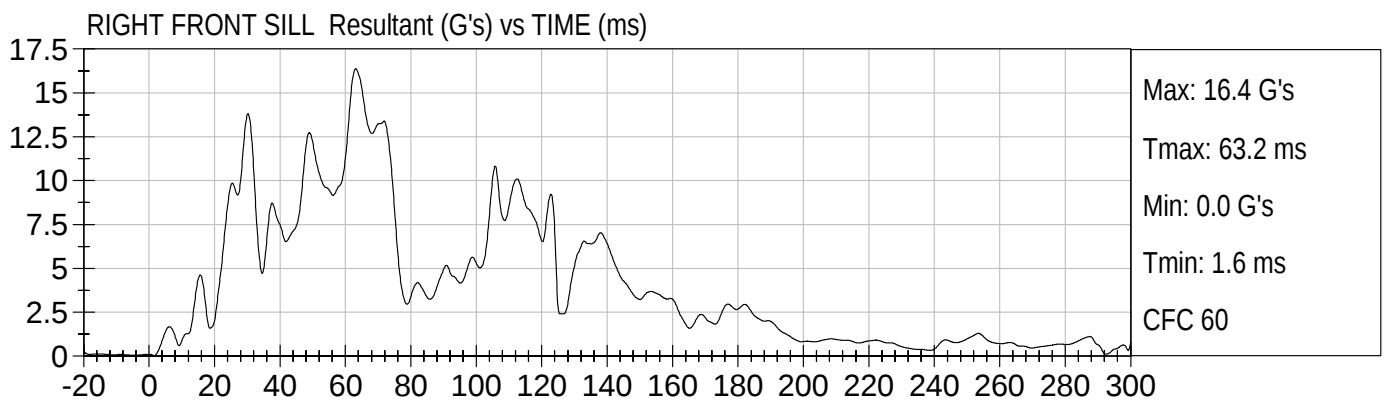
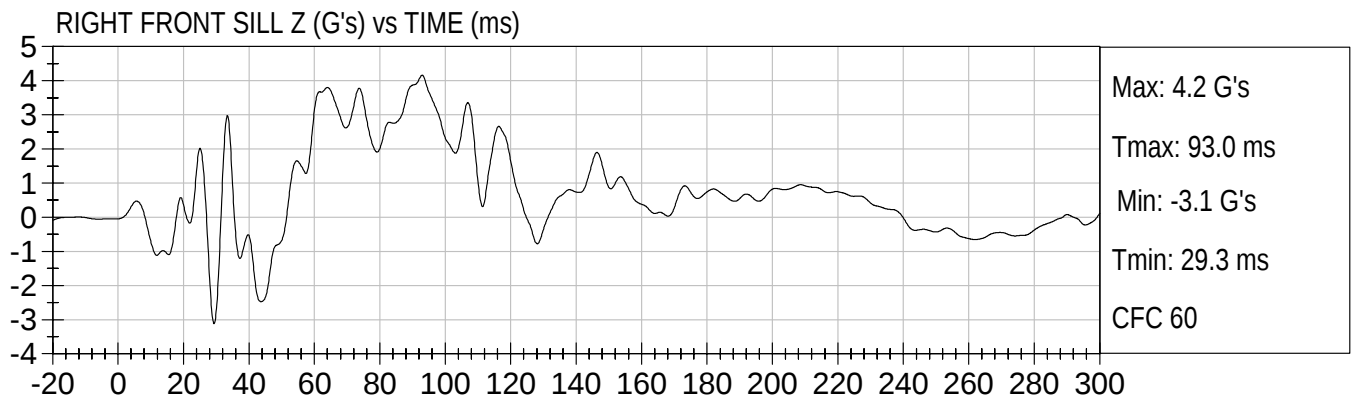
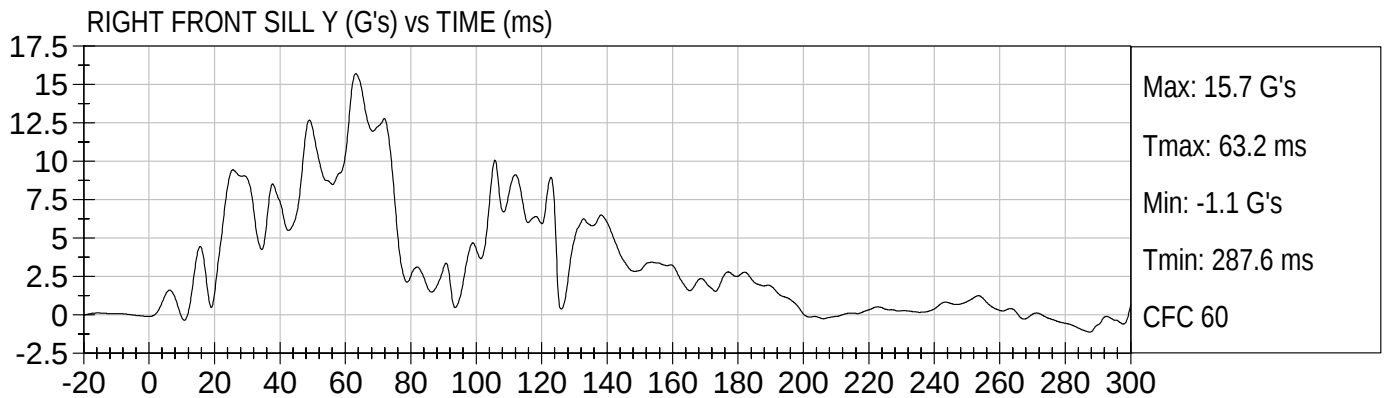
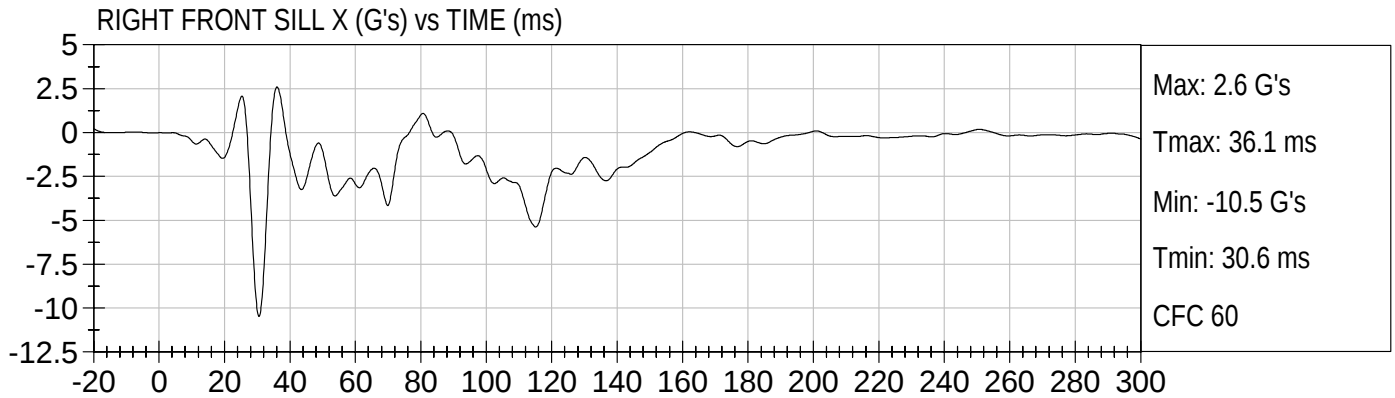


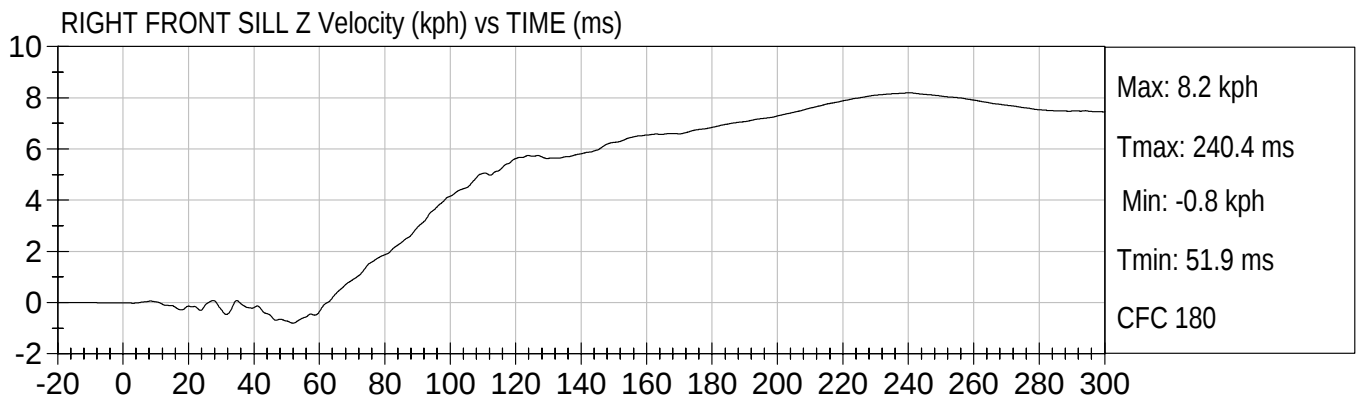
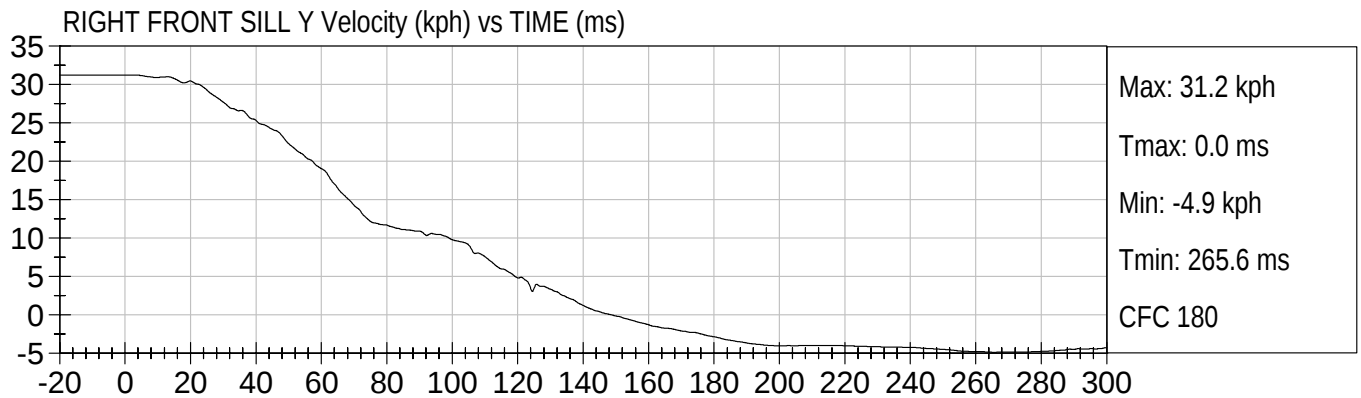
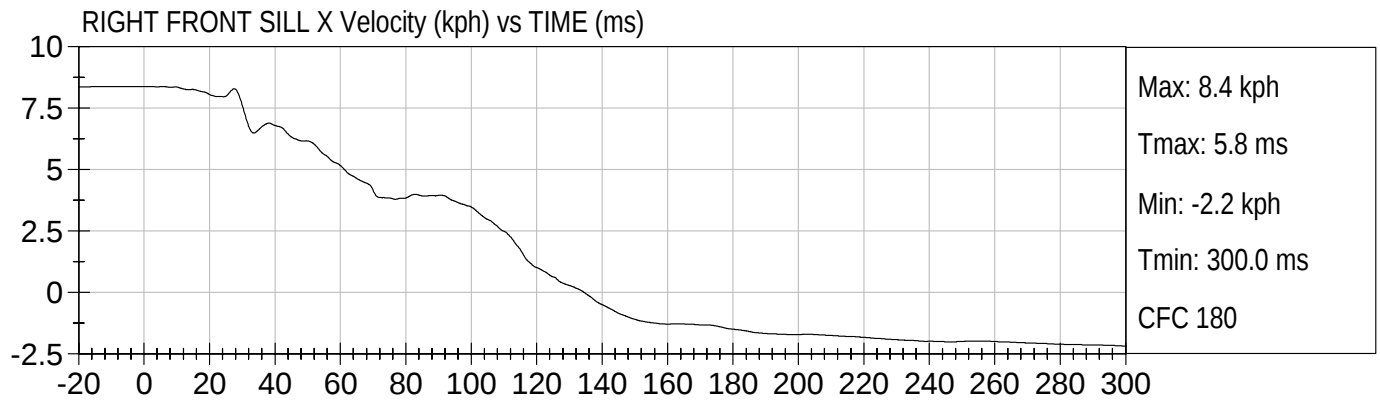


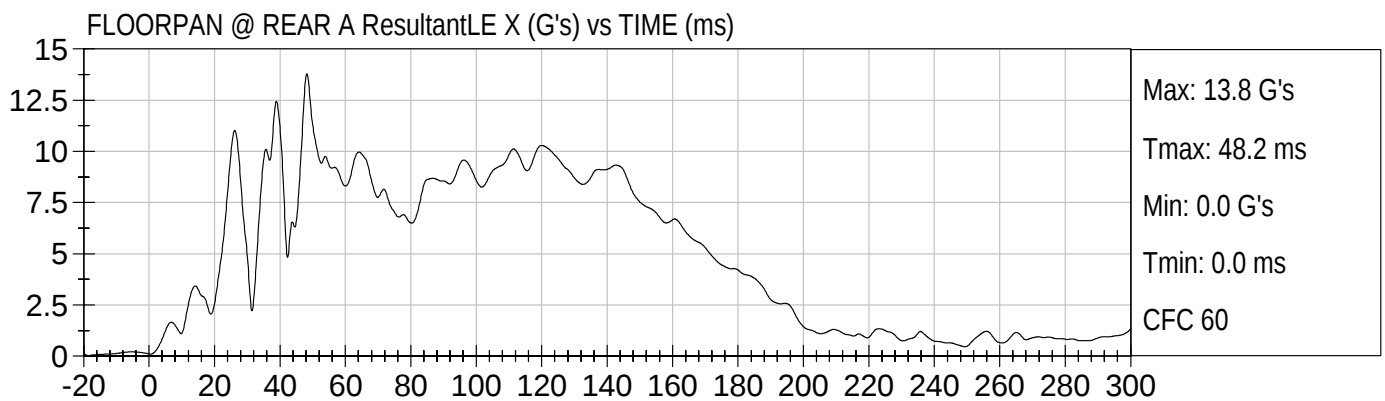
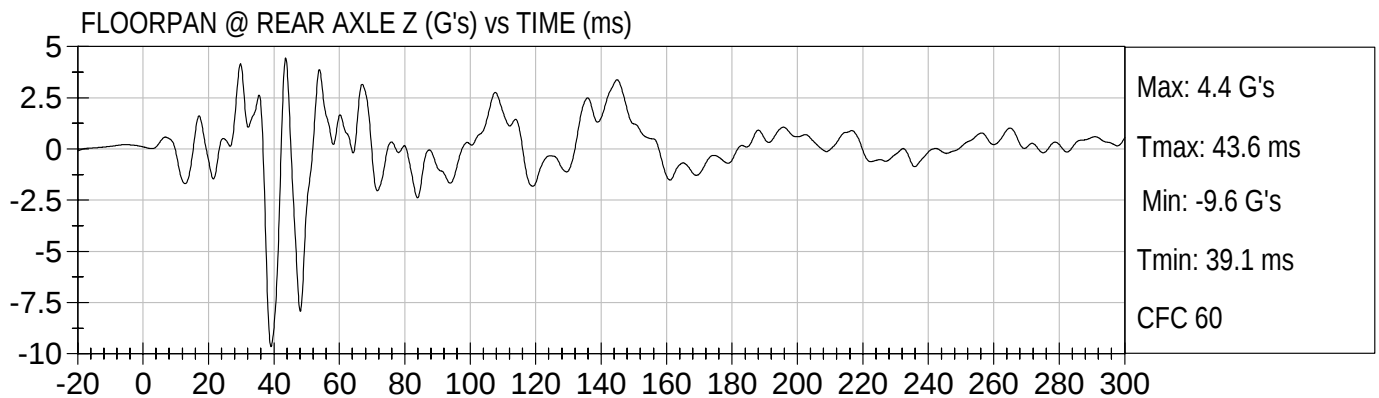
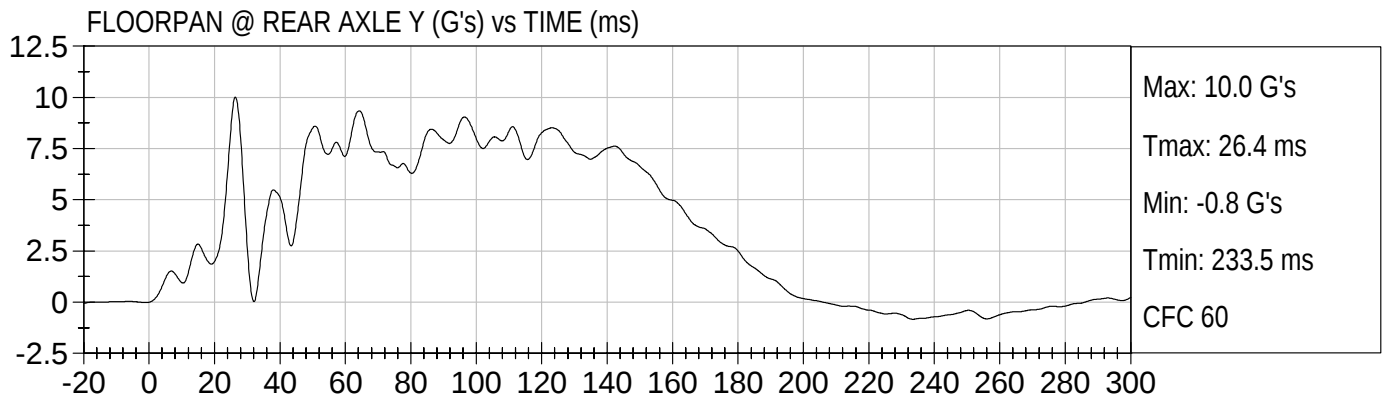
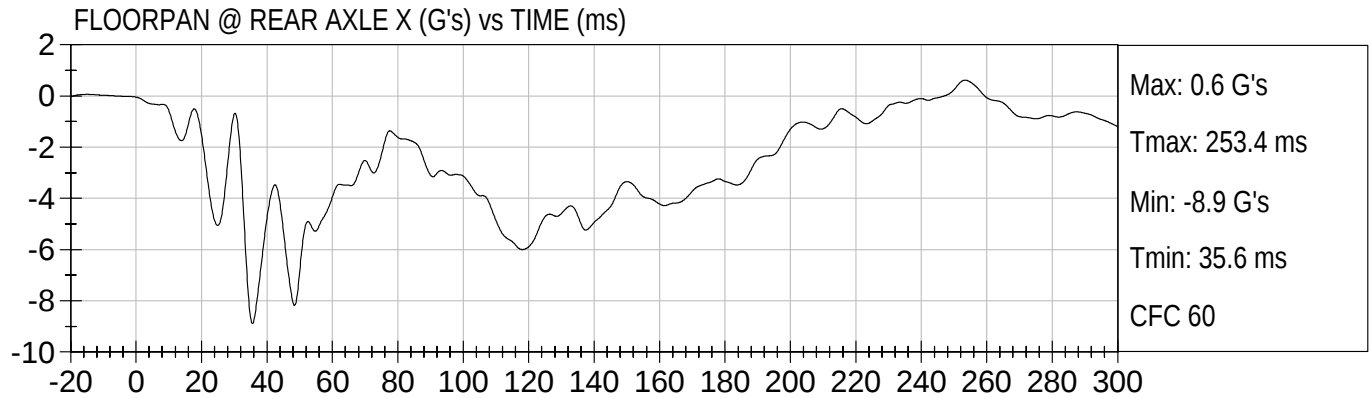


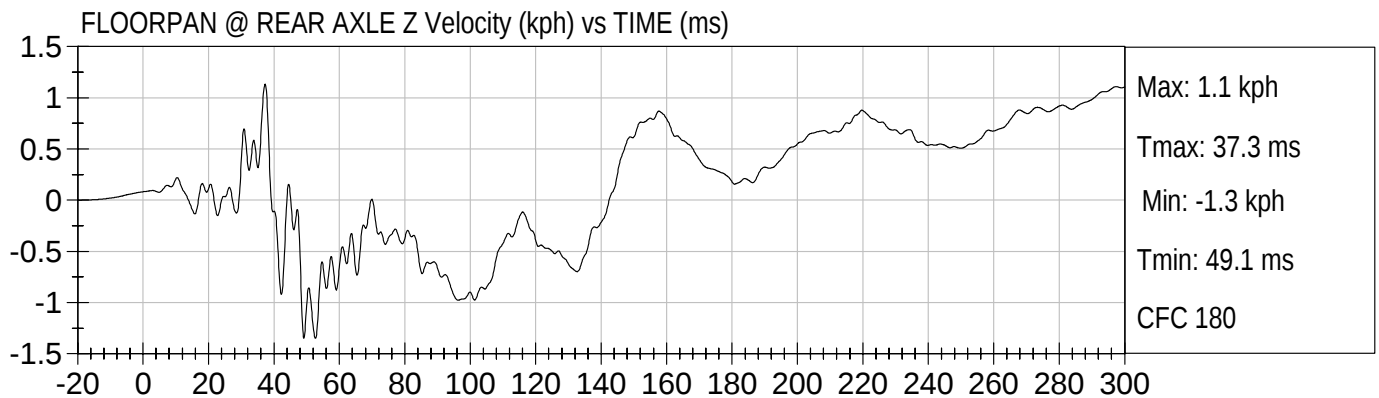
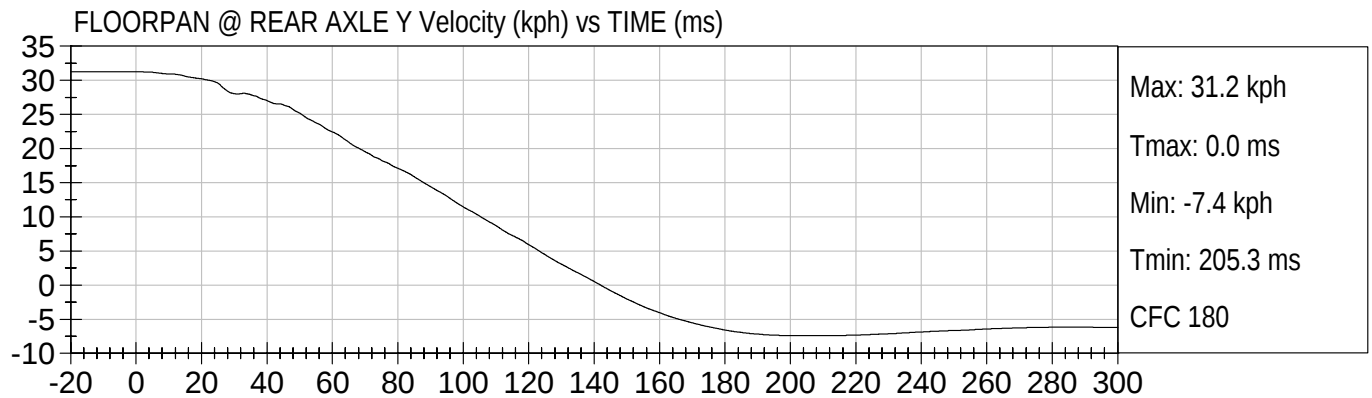
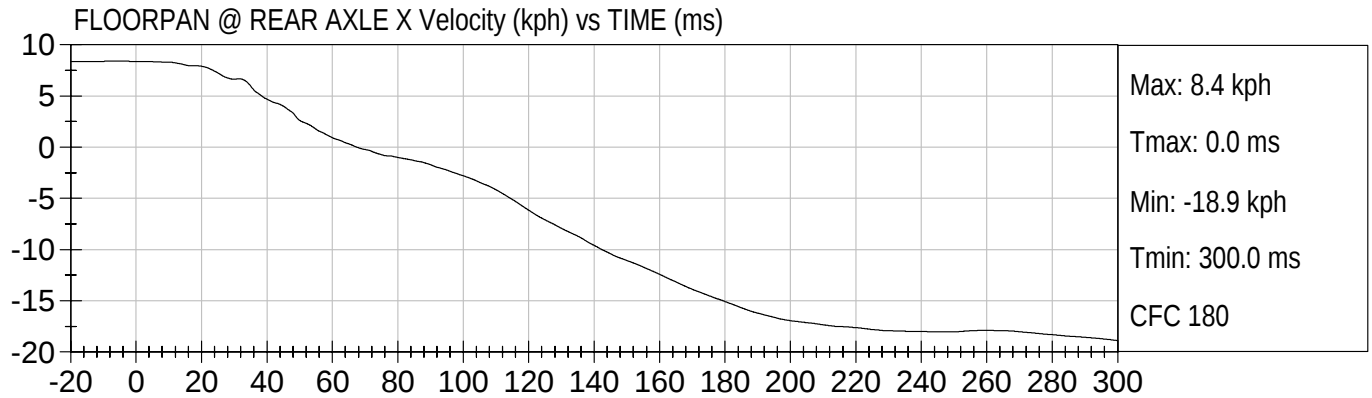






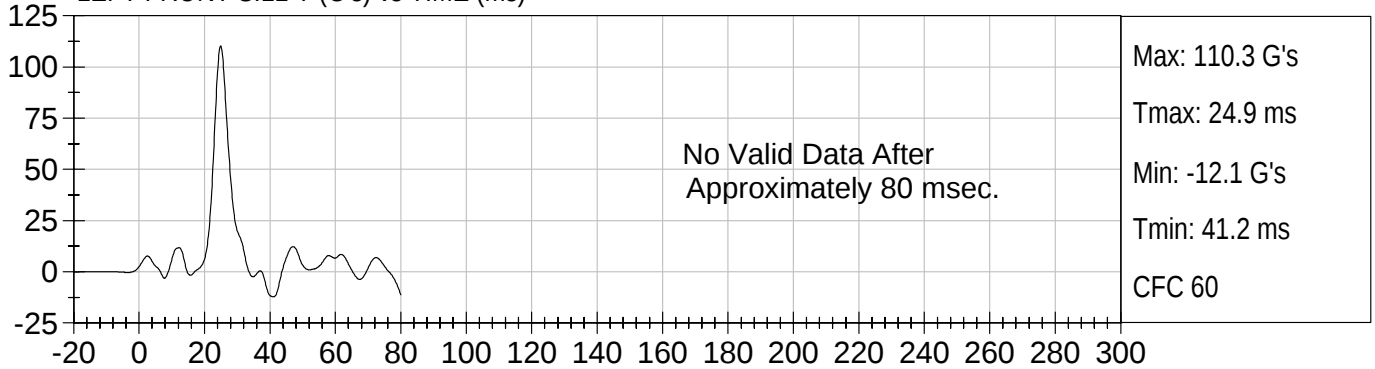




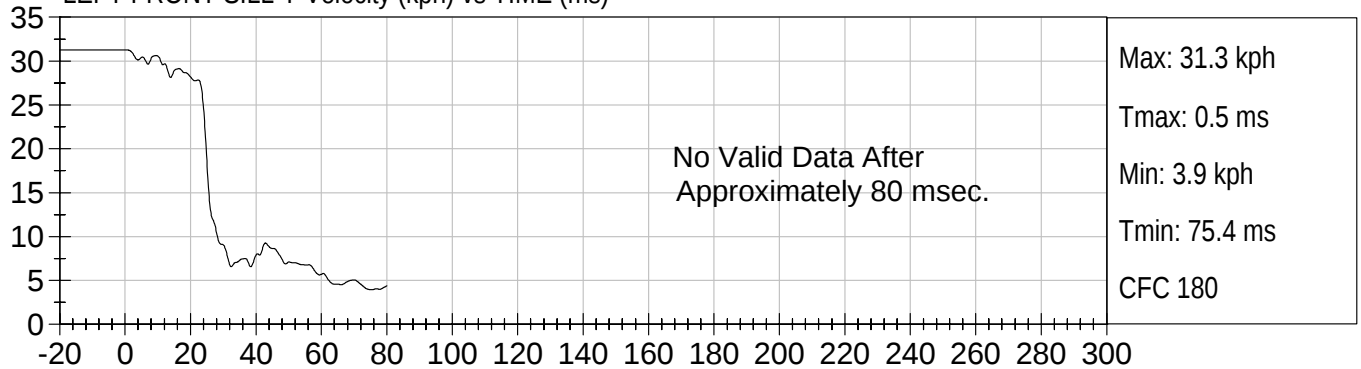




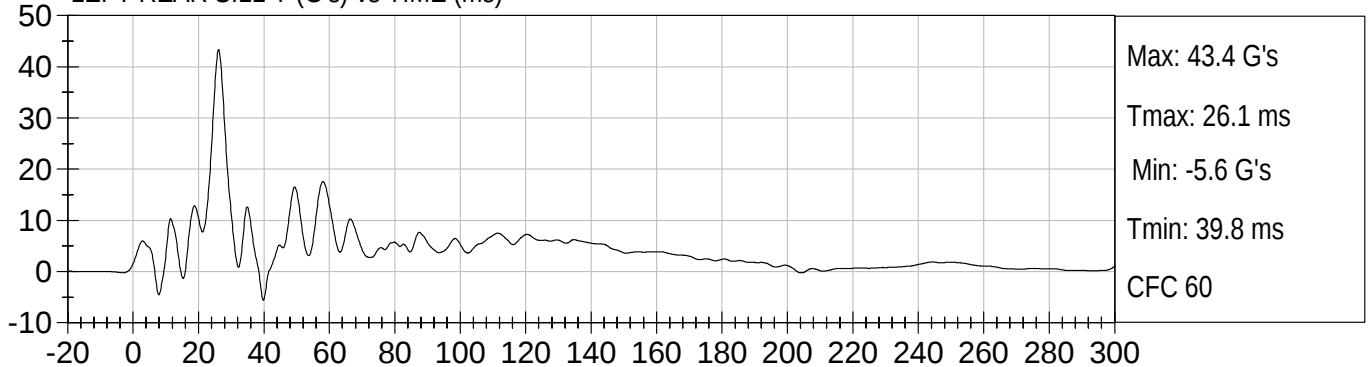
LEFT FRONT SILL Y (G's) vs TIME (ms)



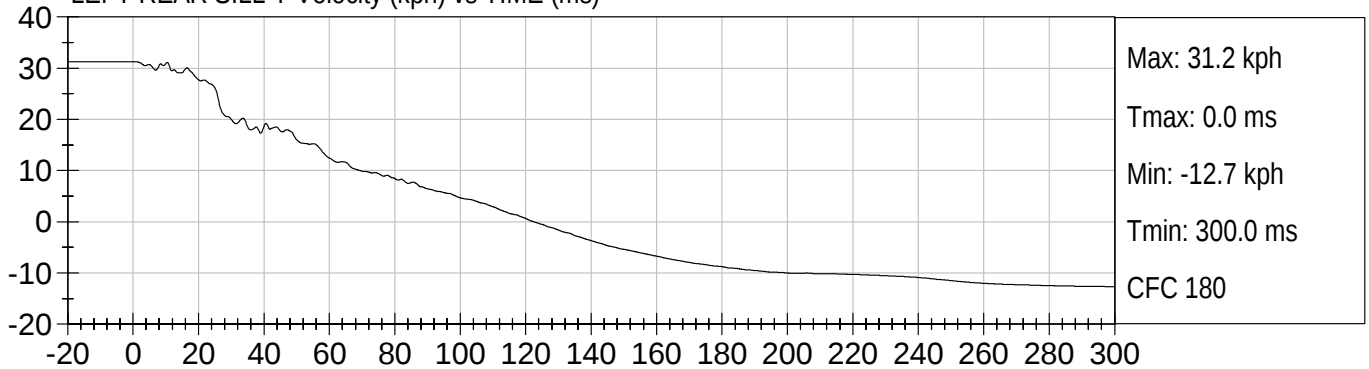
LEFT FRONT SILL Y Velocity (kph) vs TIME (ms)

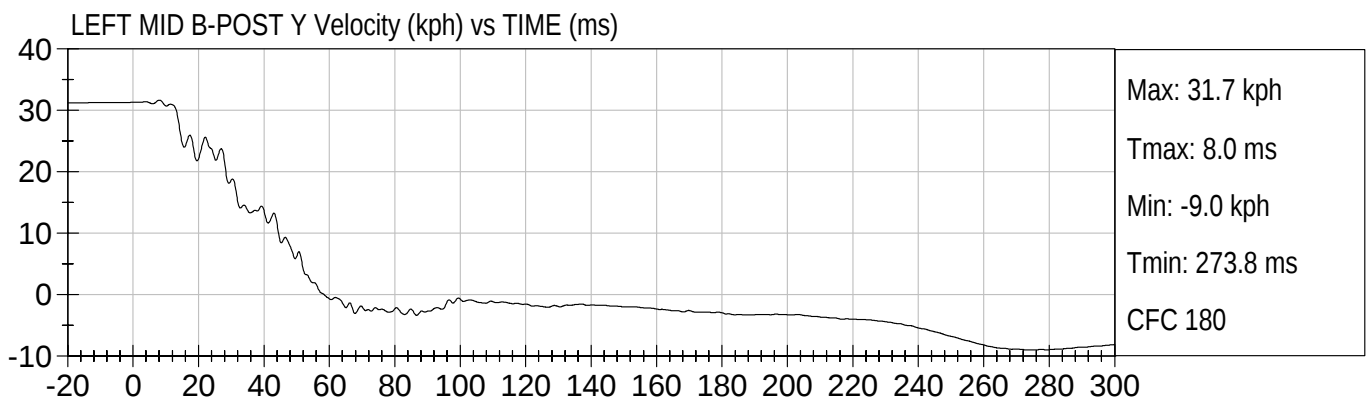
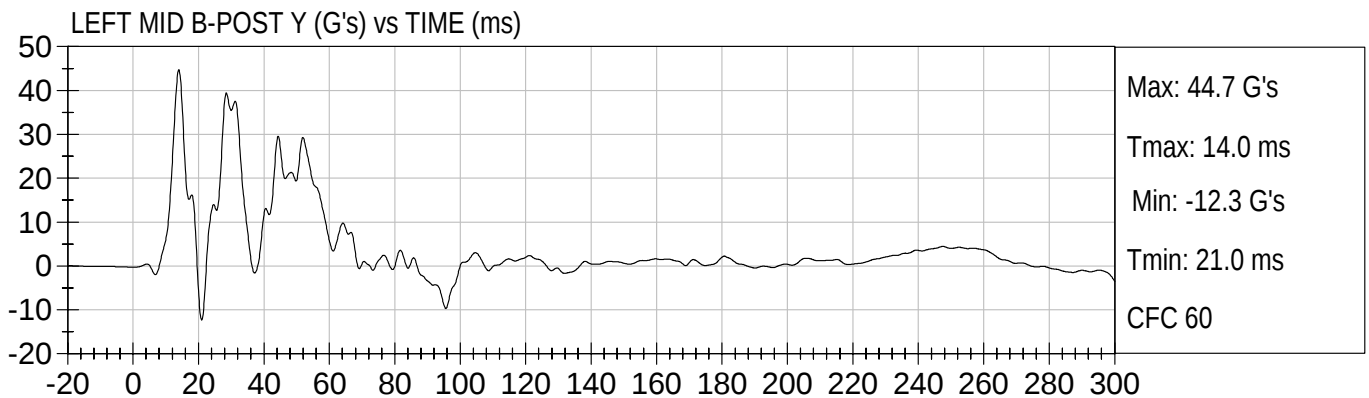
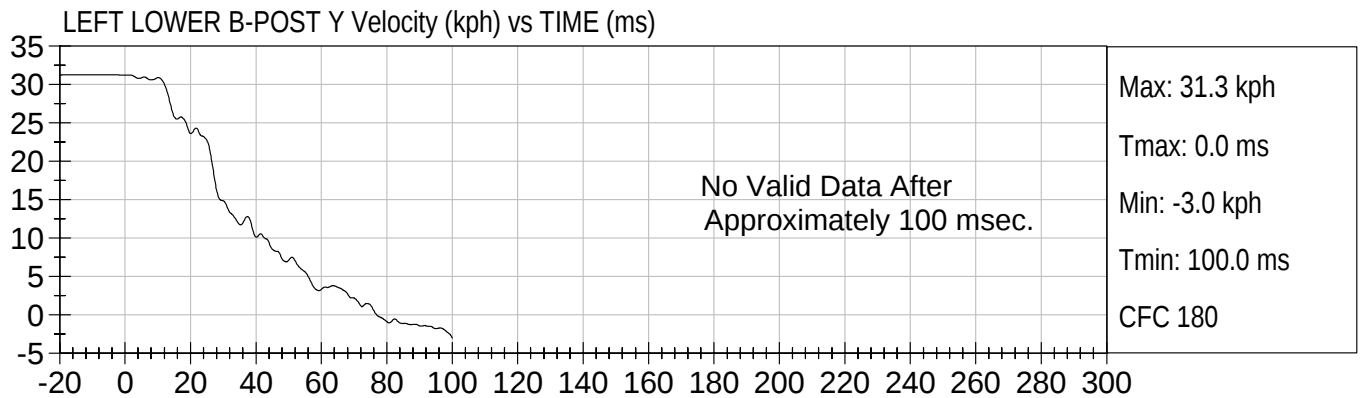
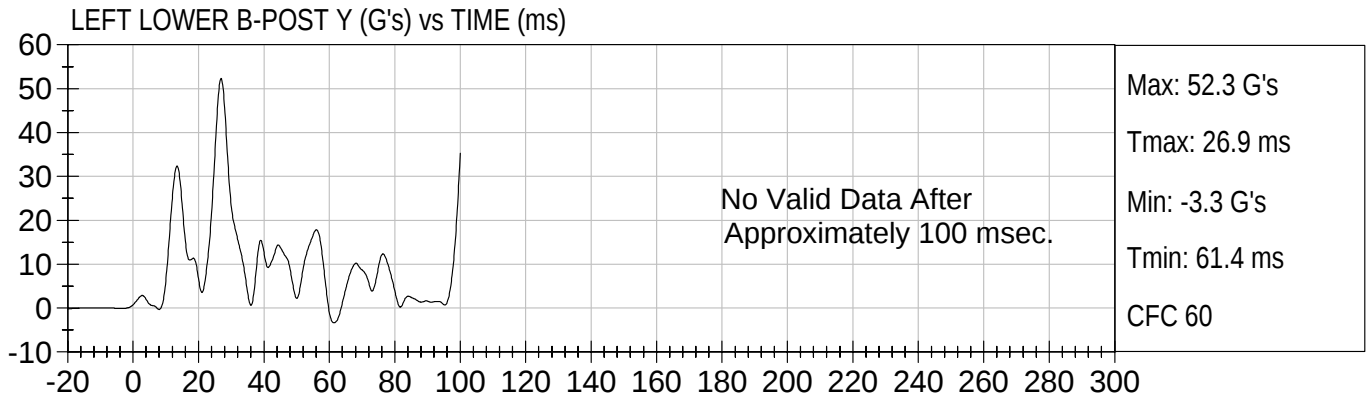


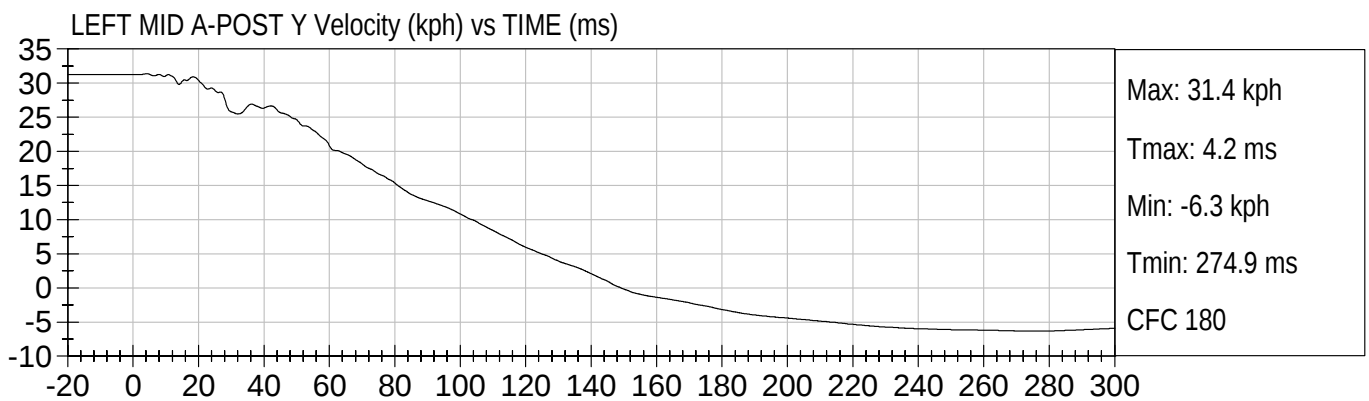
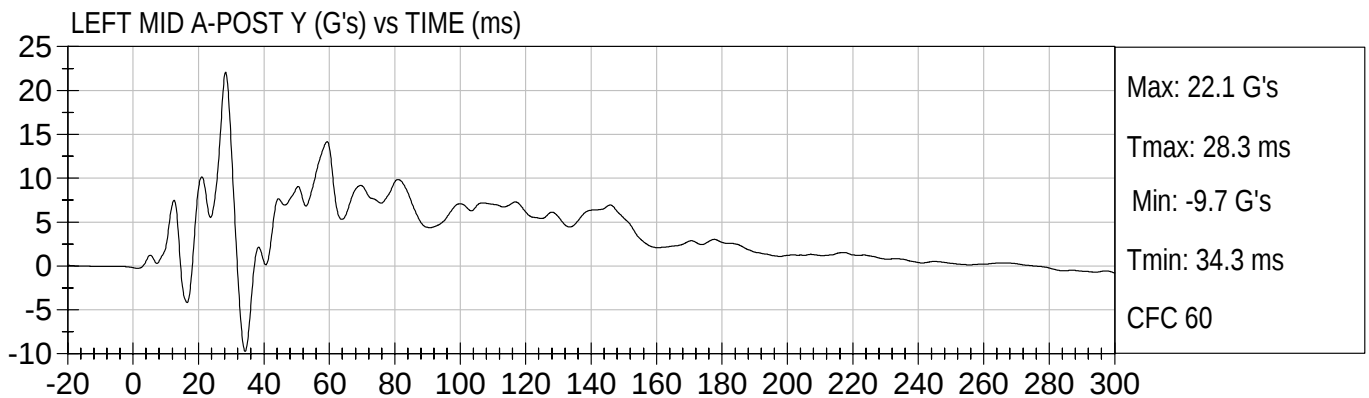
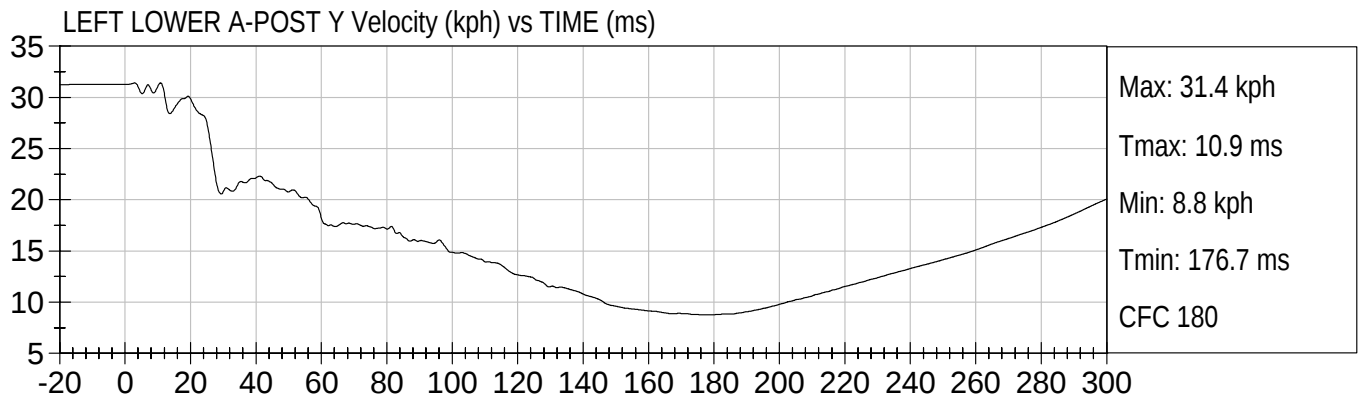
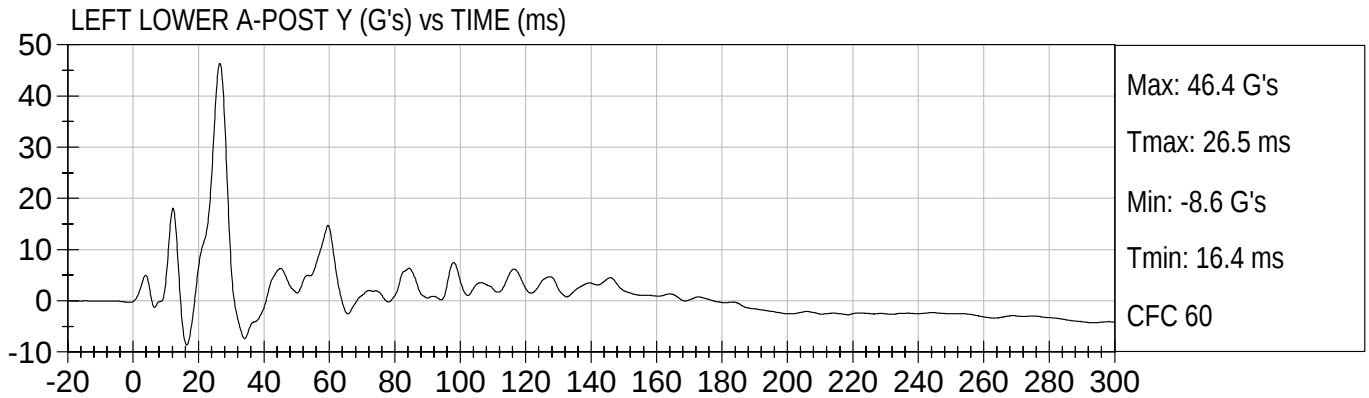
LEFT REAR SILL Y (G's) vs TIME (ms)

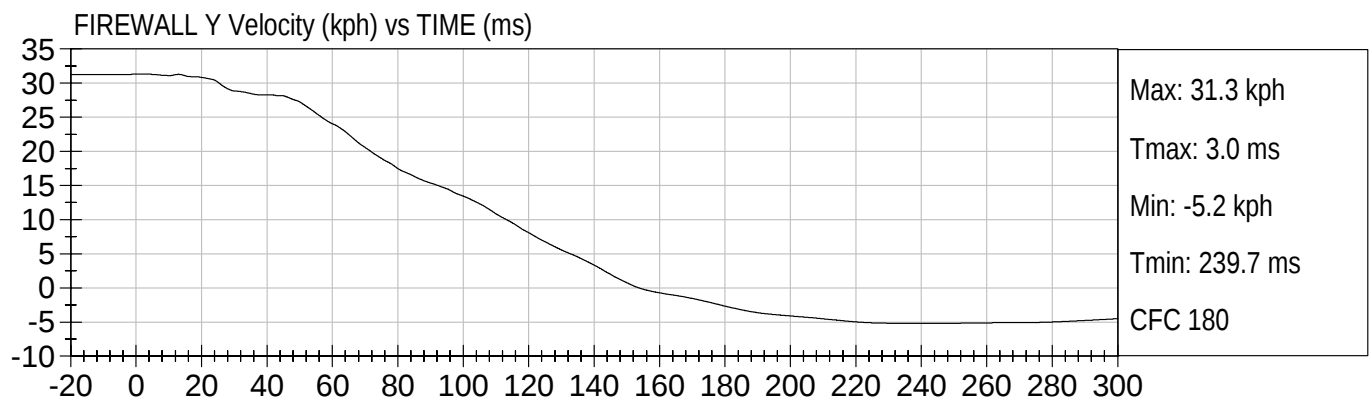
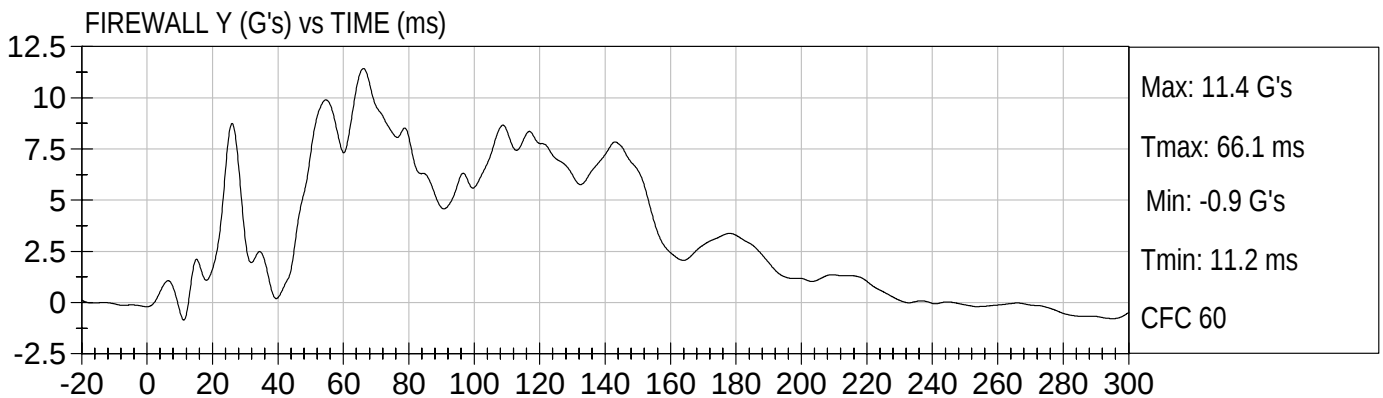
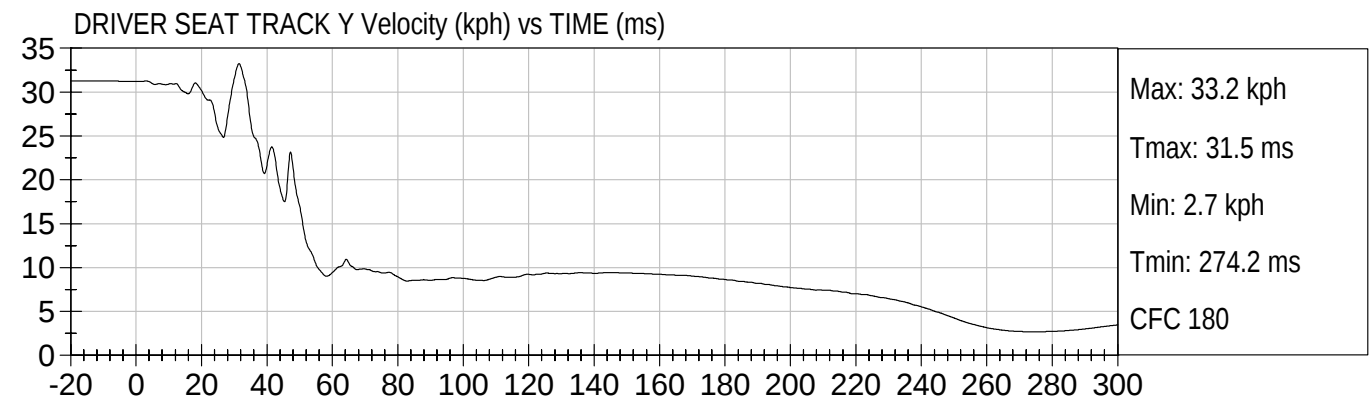
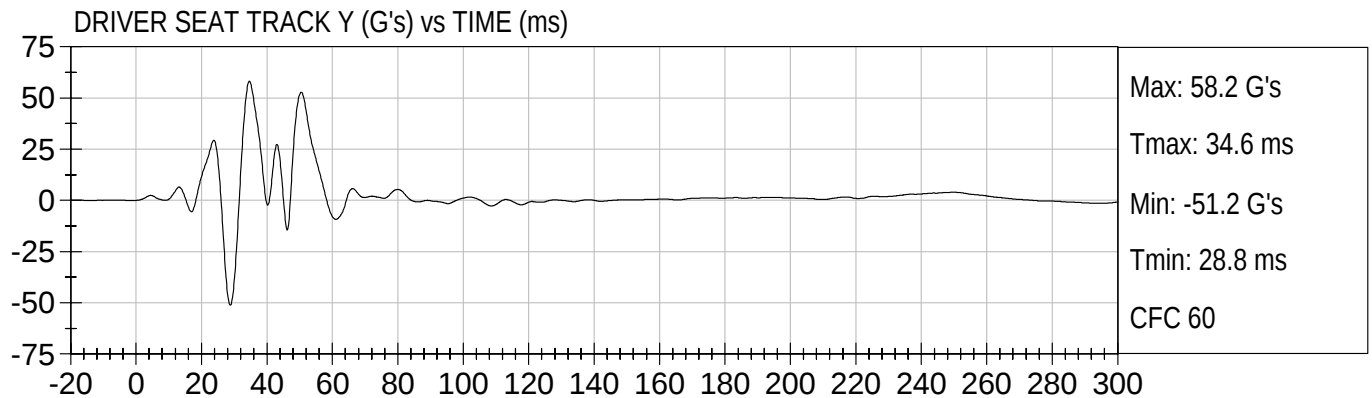


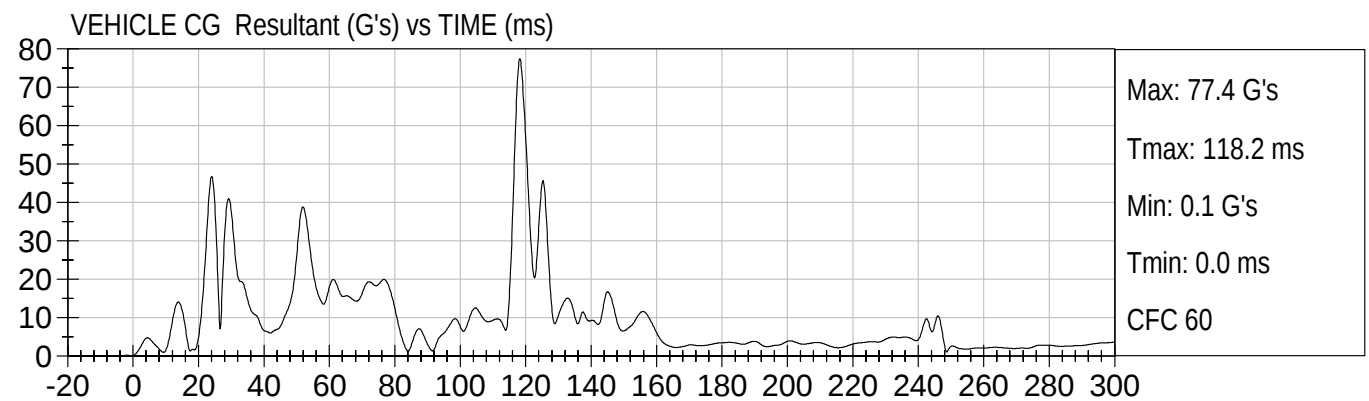
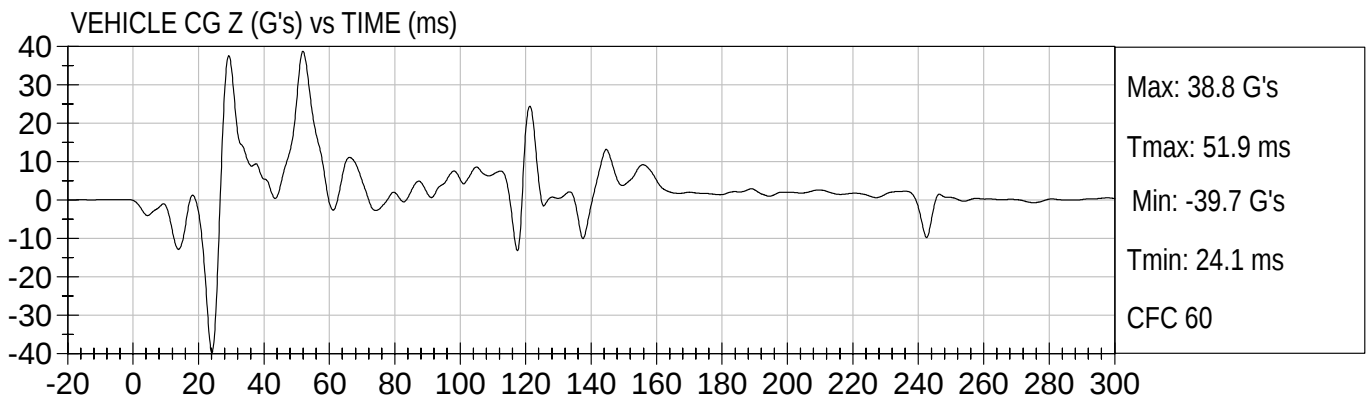
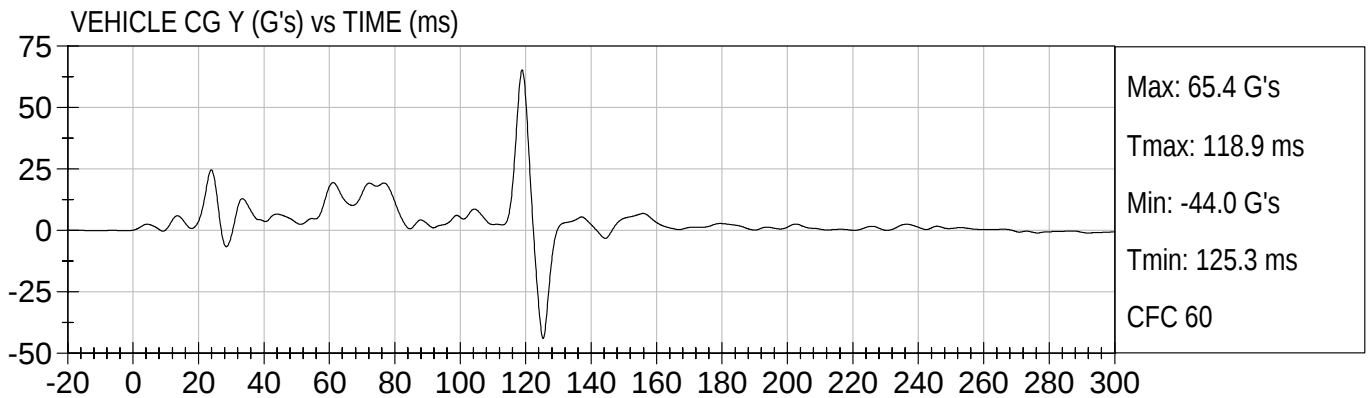
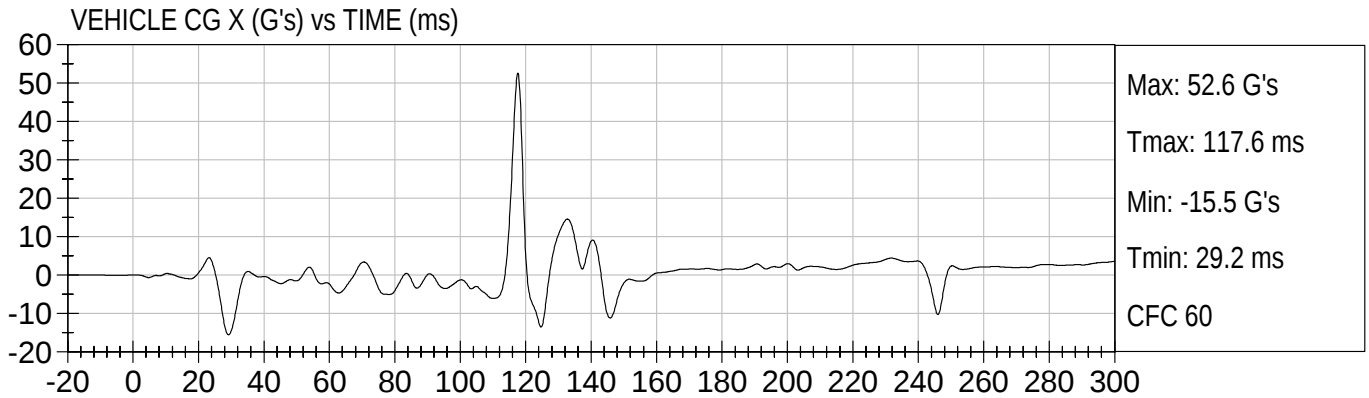
LEFT REAR SILL Y Velocity (kph) vs TIME (ms)

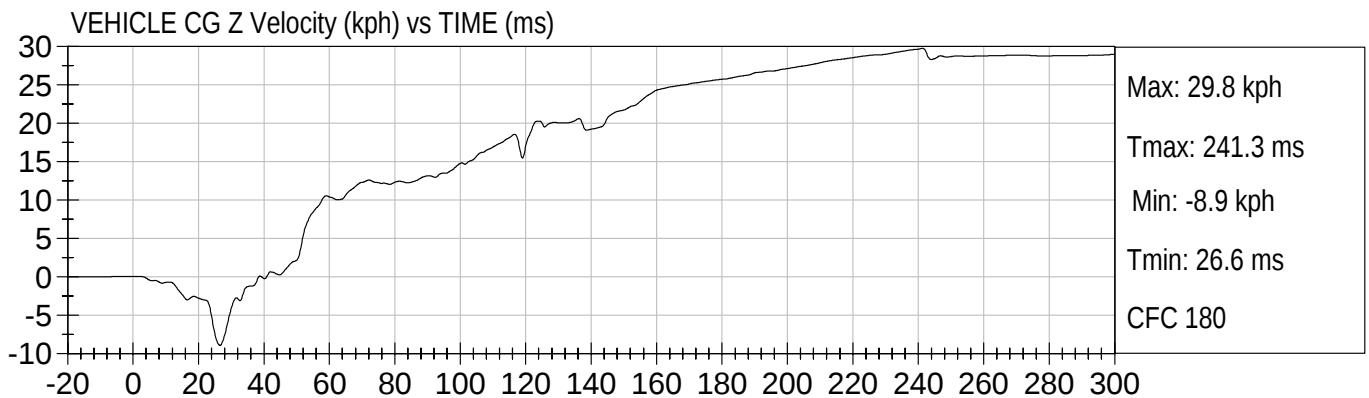
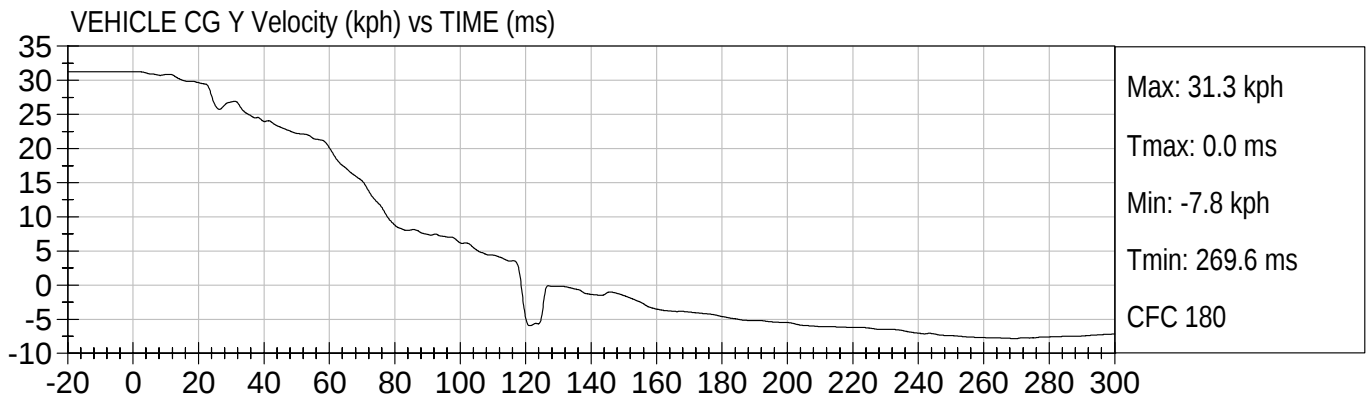
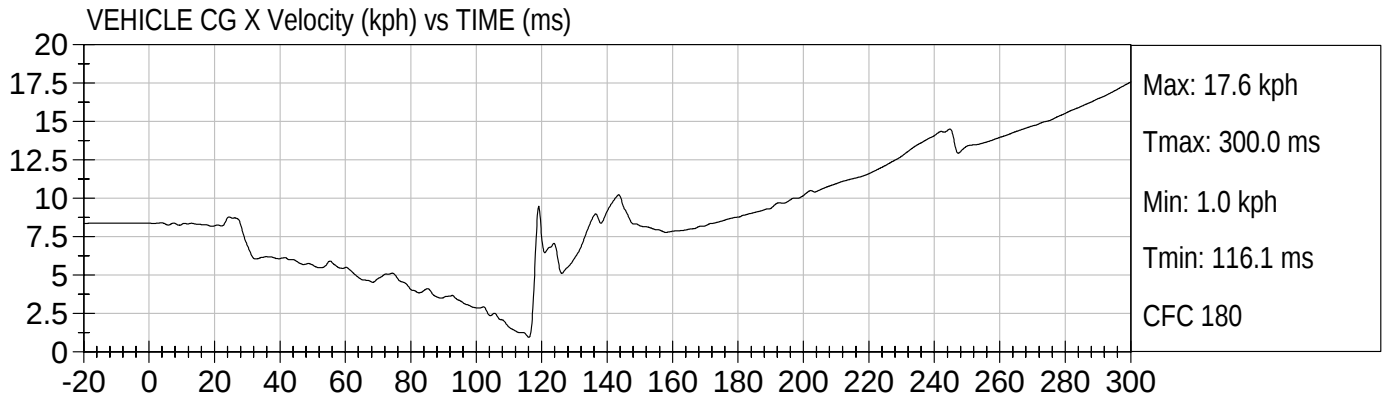






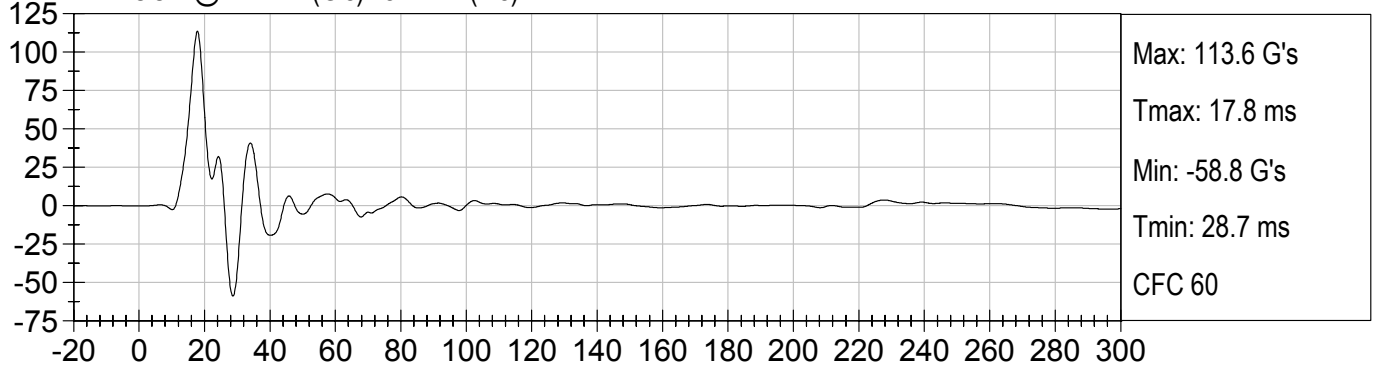




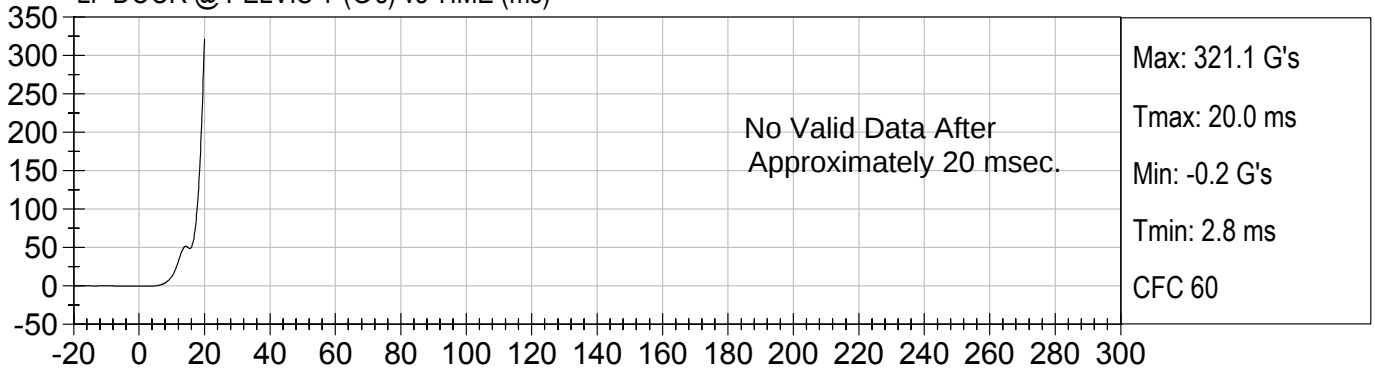




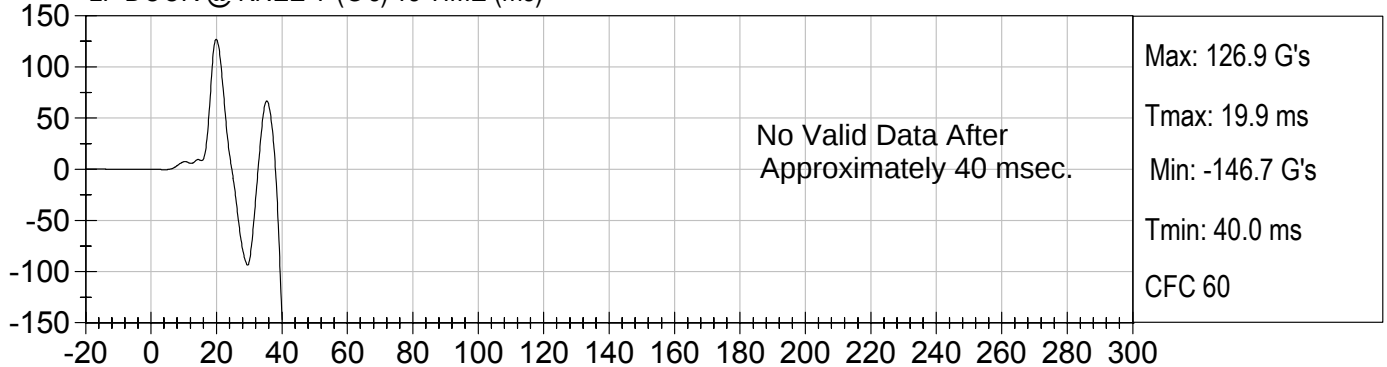
LF DOOR @ ARM Y (G's) vs TIME (ms)



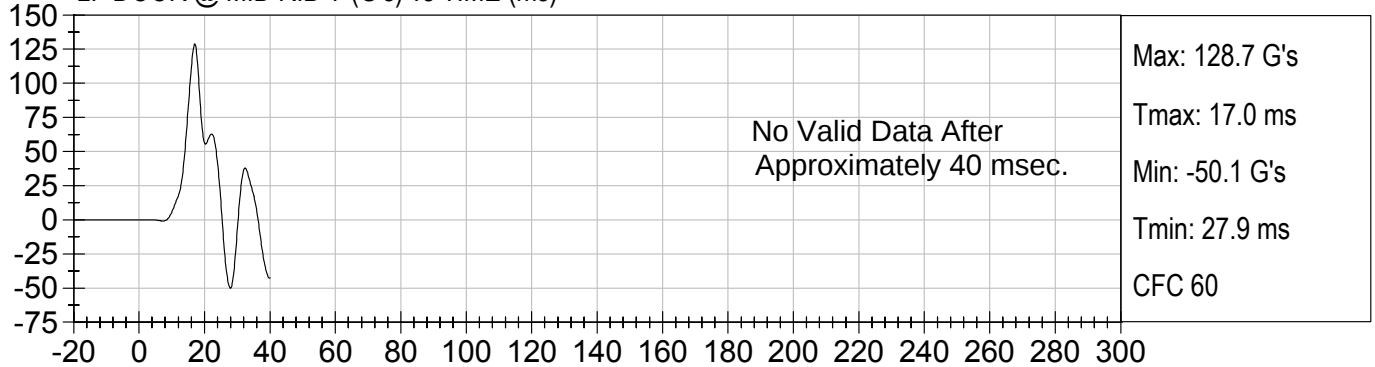
LF DOOR @ PELVIS Y (G's) vs TIME (ms)



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

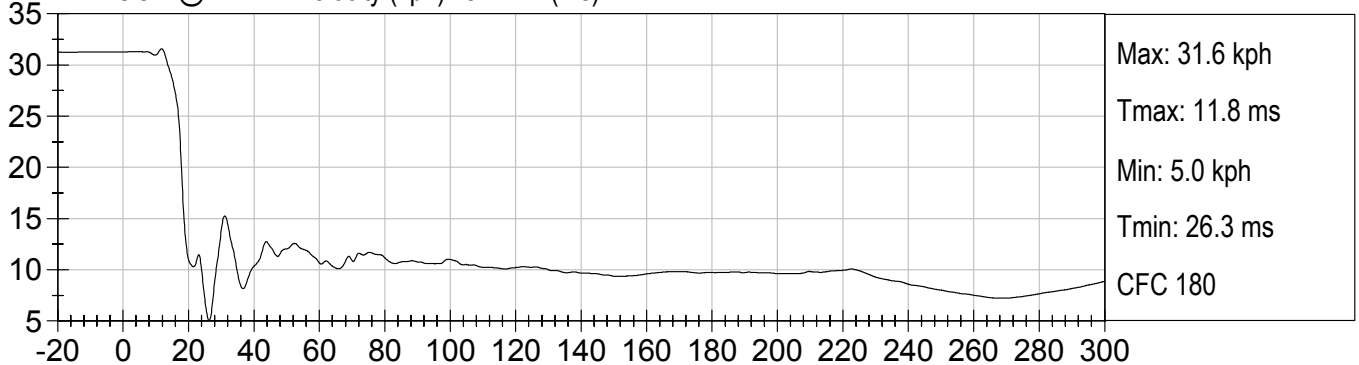


LF DOOR @ MID RIB Y (G's) vs TIME (ms)

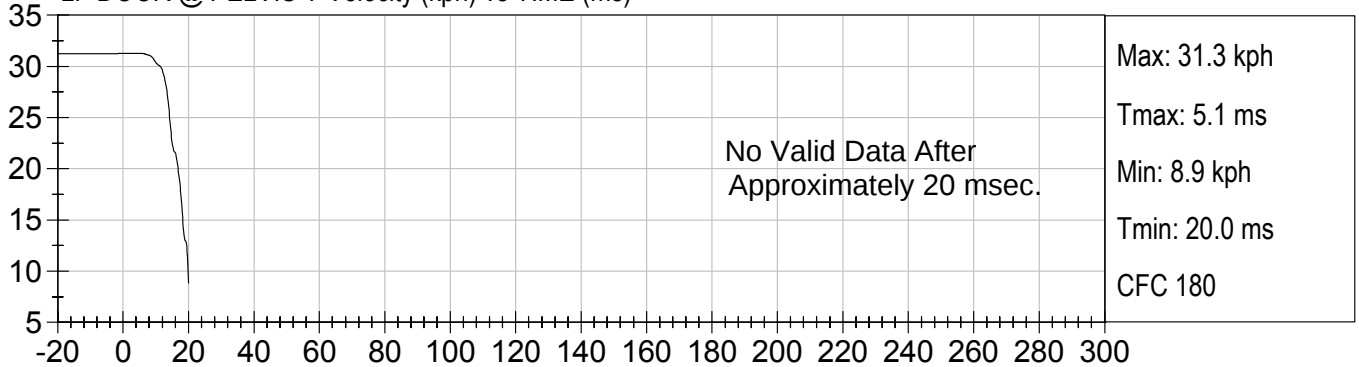




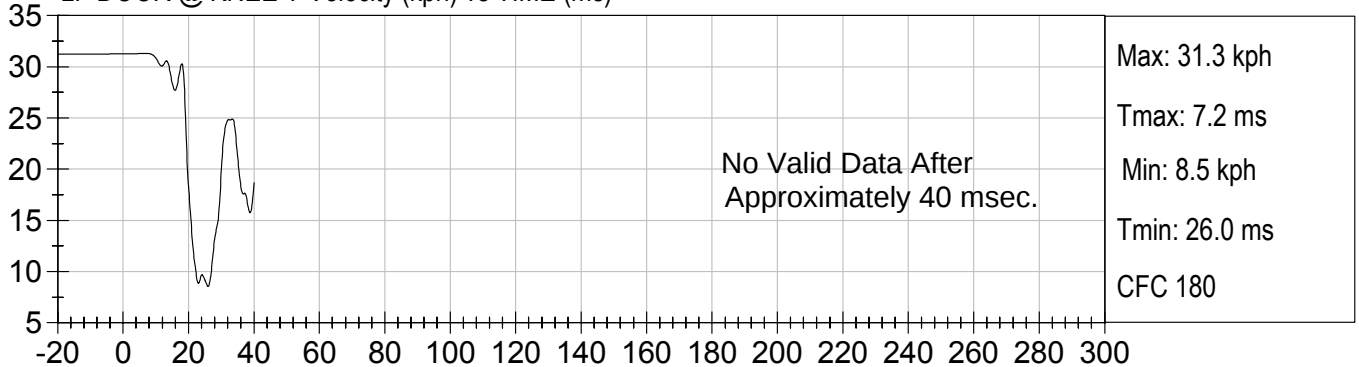
LF DOOR @ ARM Y Velocity (kph) vs TIME (ms)



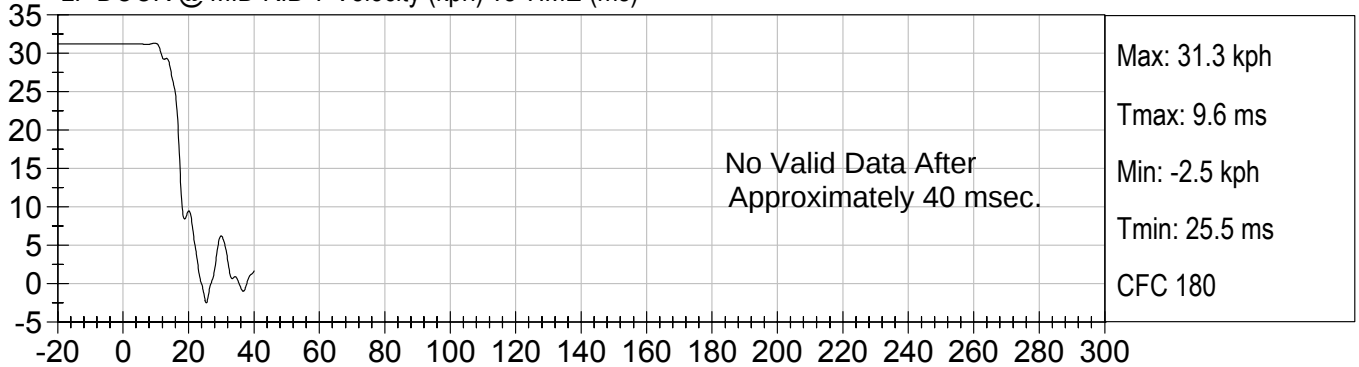
LF DOOR @ PELVIS Y Velocity (kph) vs TIME (ms)

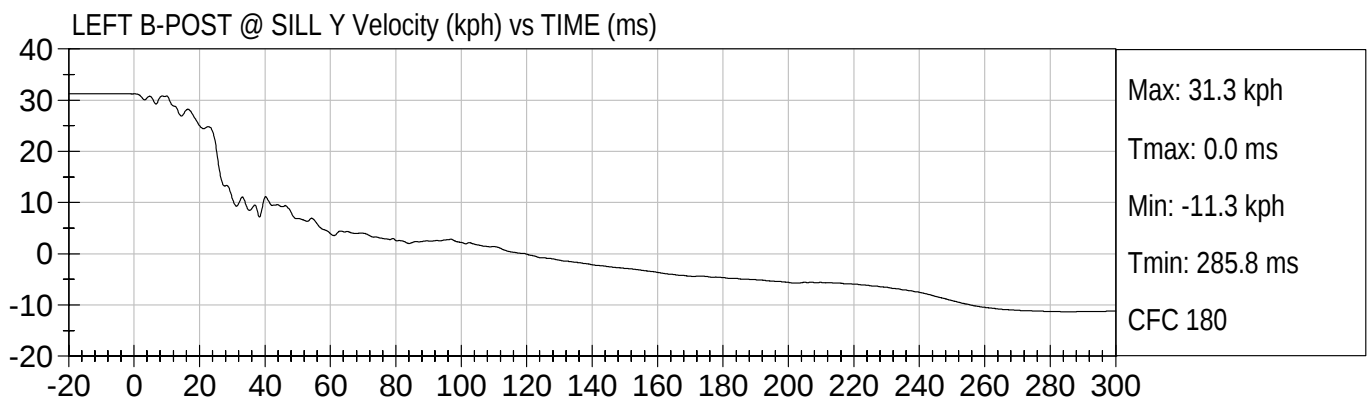
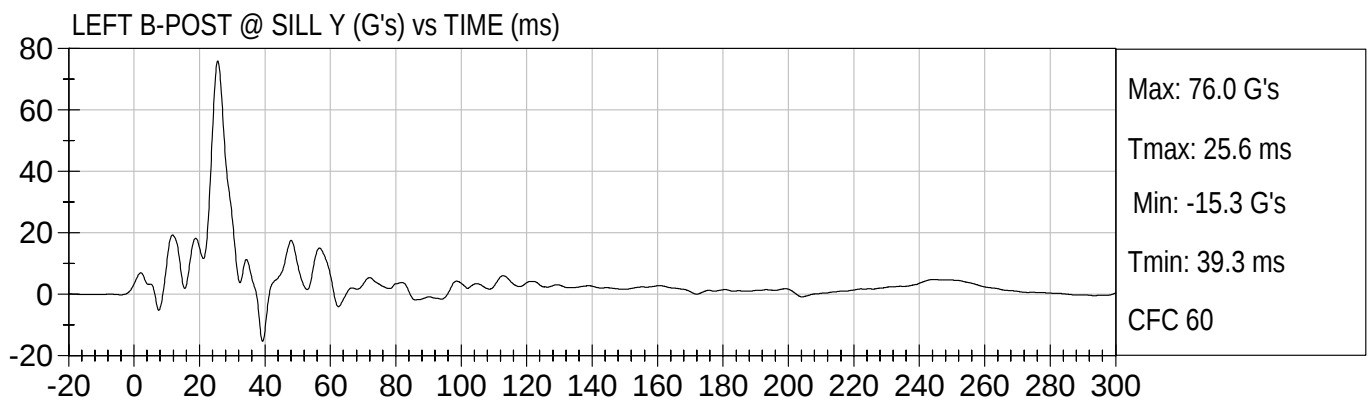
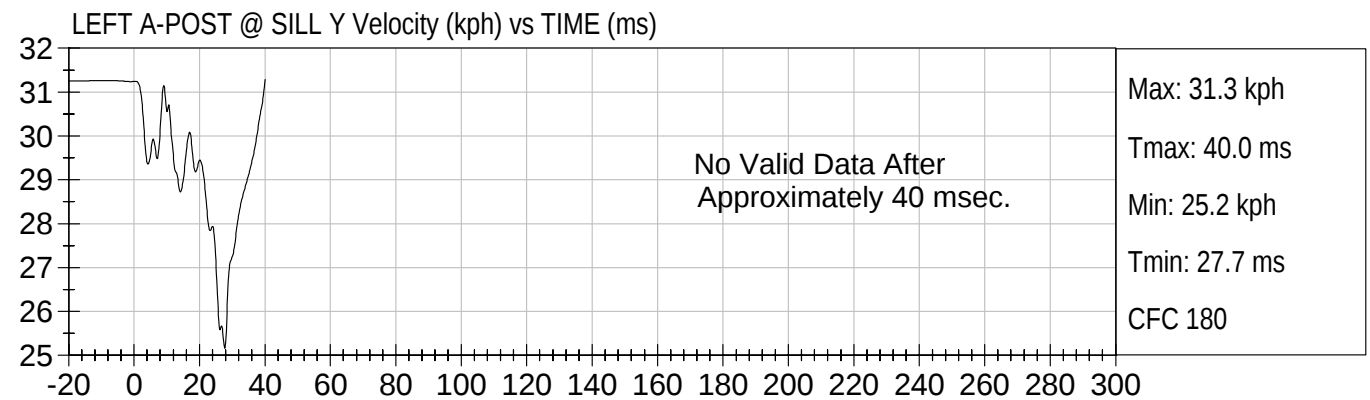
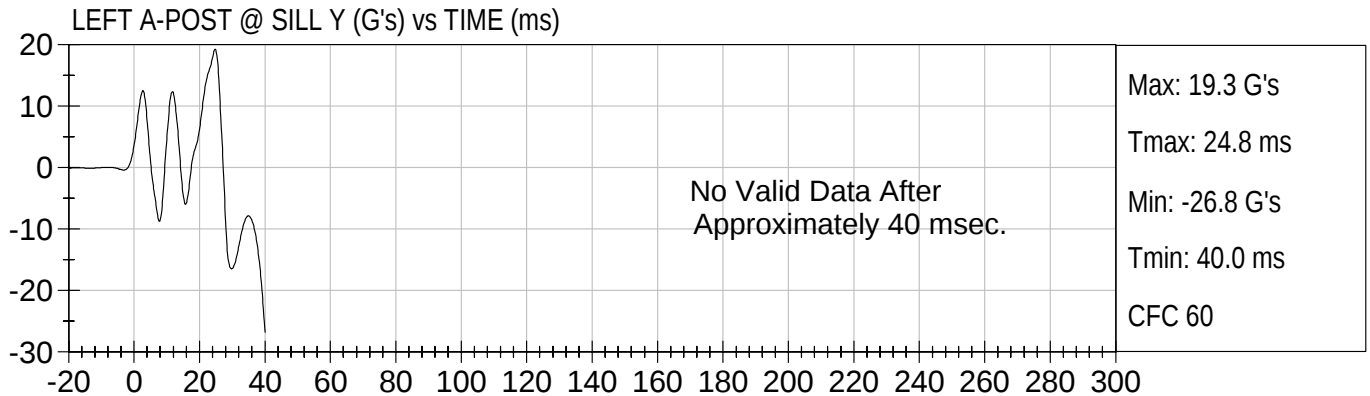


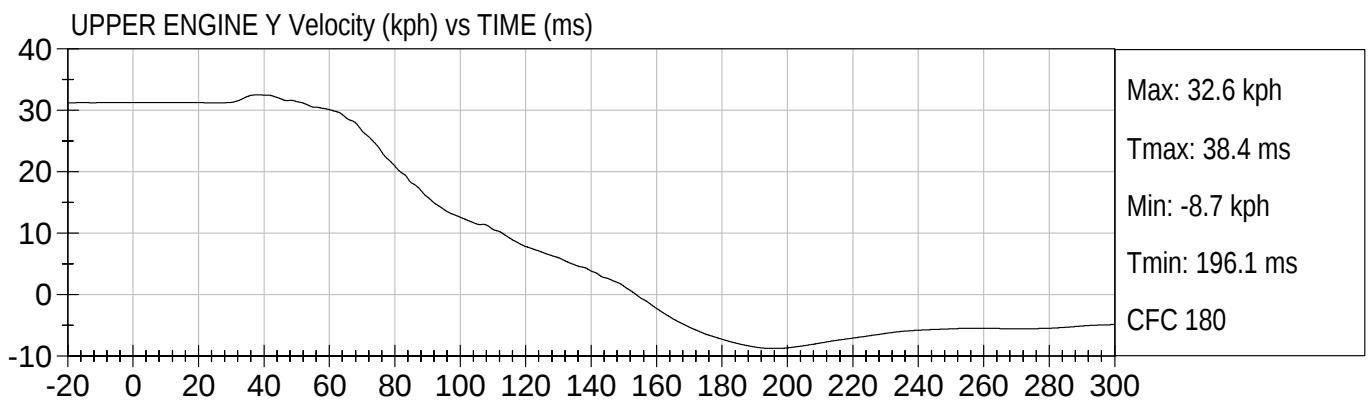
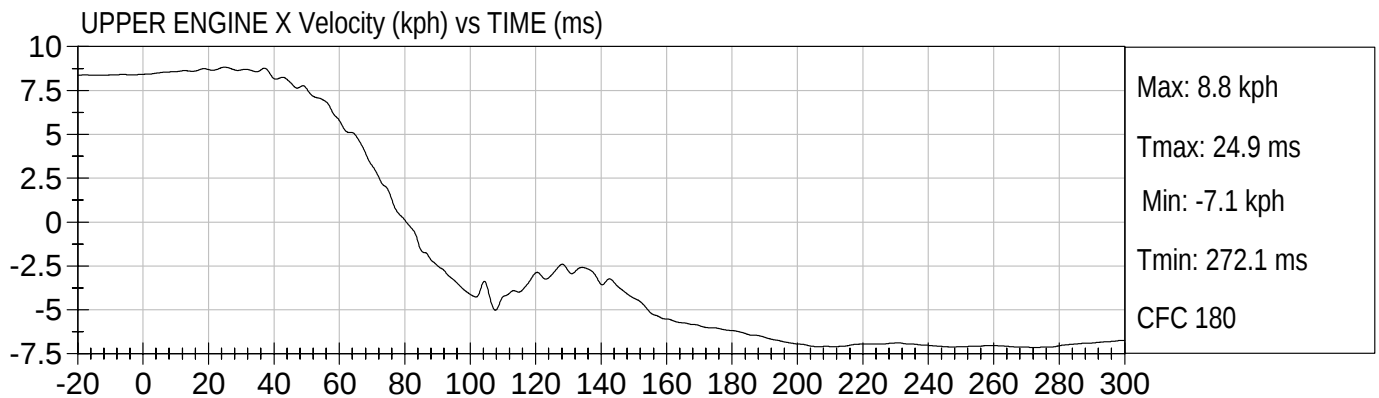
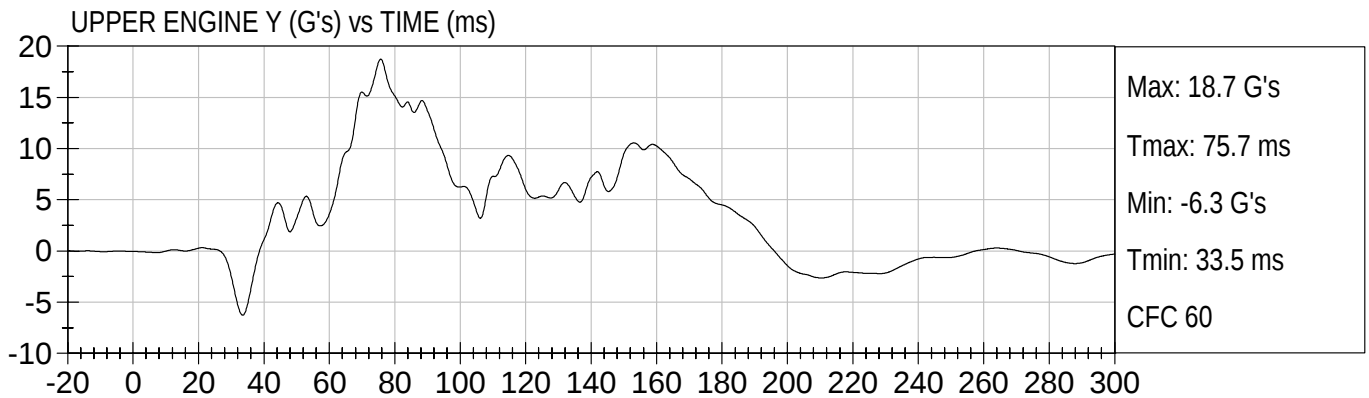
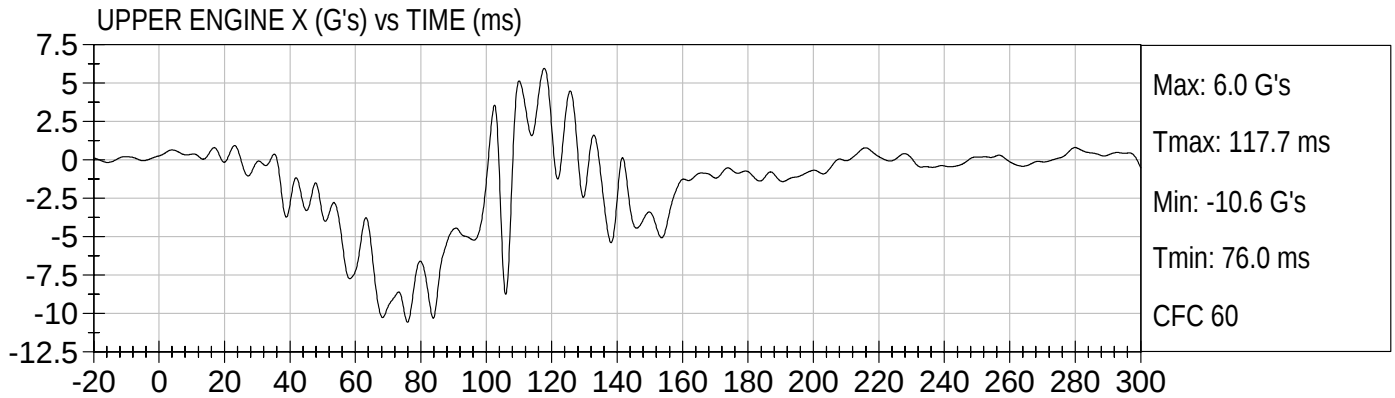
LF DOOR @ KNEE Y Velocity (kph) vs TIME (ms)

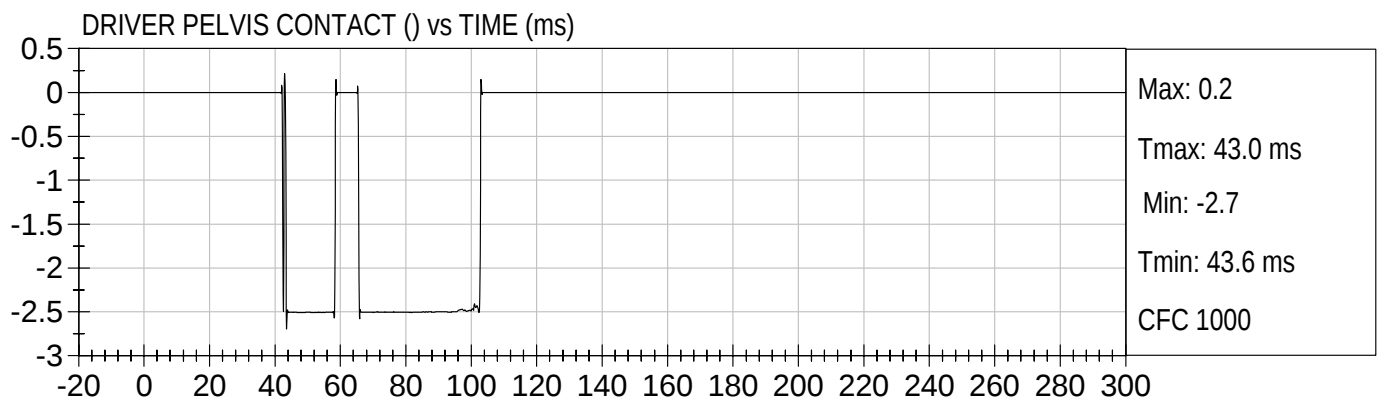
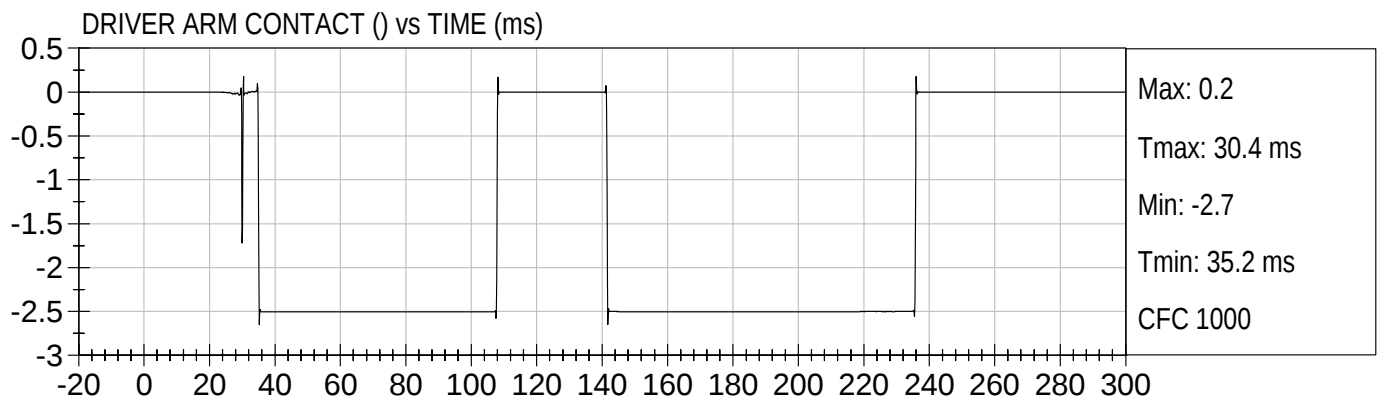
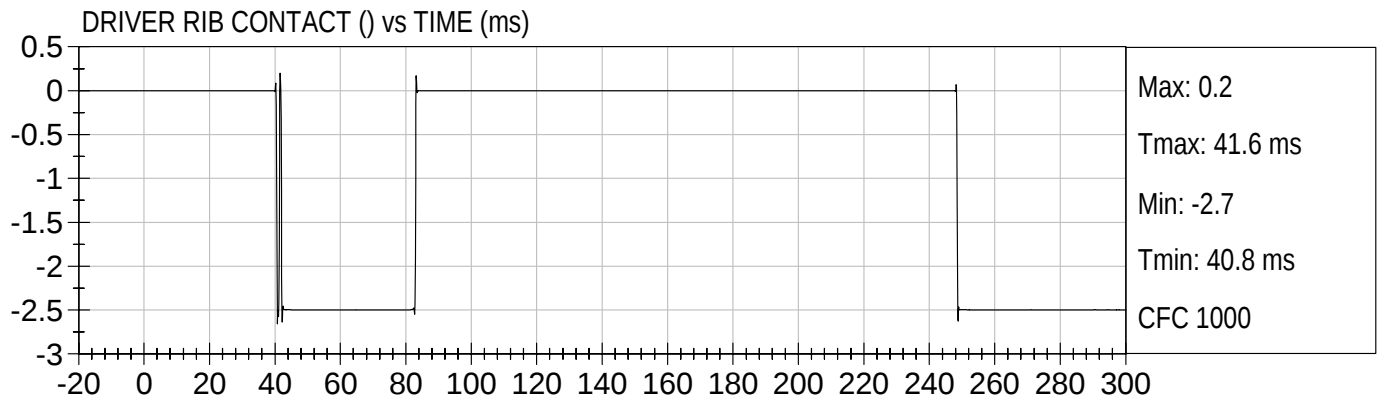


LF DOOR @ MID RIB Y Velocity (kph) vs TIME (ms)









APPENDIX C

ES-2RE CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CERTIFICATION DATA

Dummy Serial Number: 009

Calibration Test Results Summary

Dummy Serial Number: 009

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: 5/5/05
Dummy Serial Number: 009
Test Number: D051221

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.4
Relative Humidity (%)	10 – 70	20
Peak Resultant Acceleration	100 – 150 g's	145
Time of Max. Res. Acceleration	msec	29.7

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

Approved By: David Winkelbauer

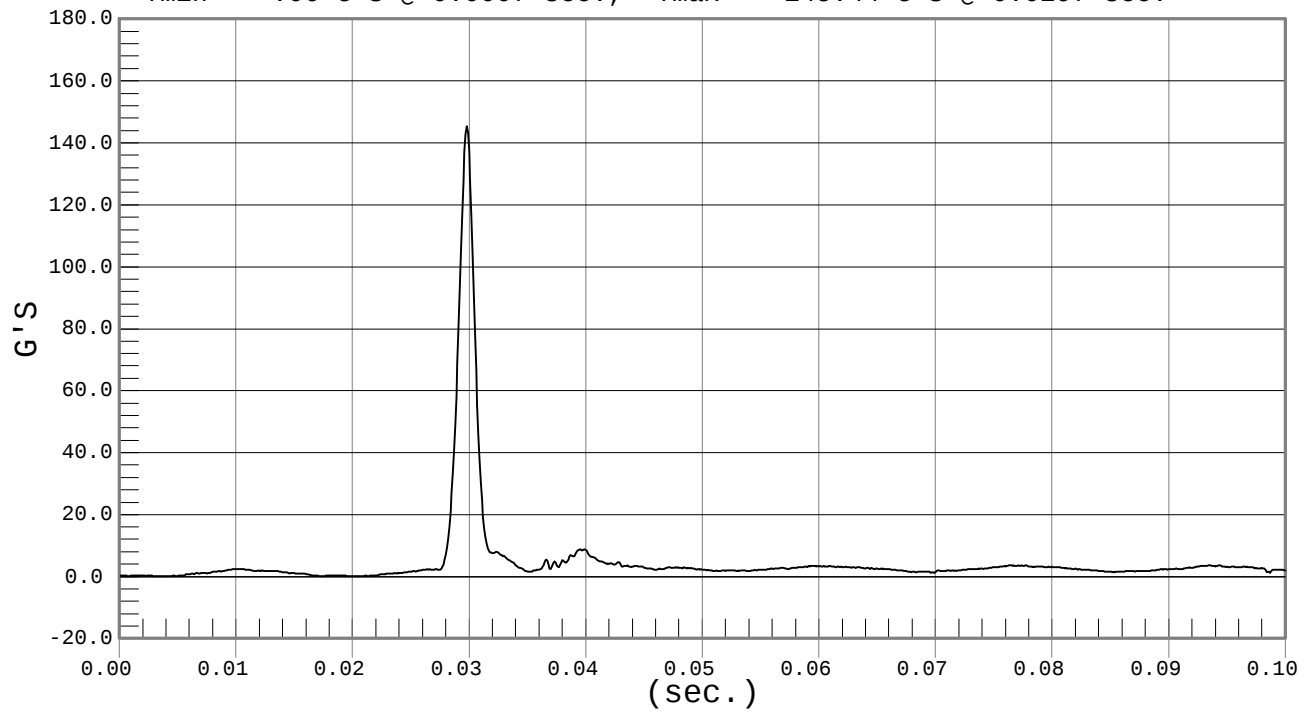


PEAK RESULTANT ACCELERATION

Test Desc.: Head Drop
Component: Dummy #009

Test Date: 05-05-05
Speed: 0.0 fps, 0.00 M/s

Ymin = .06 G'S @ 0.0007 sec., Ymax = 145.44 G'S @ 0.0297 sec.



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date: 5/6/05
Dummy Serial Number: 009
Test Number: D051222

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.9
Relative Humidity (%)		10 – 70	22
Pendulum Speed		3.3 - 3.5	3.5
Pendulum Deceleration	3 msec	1.25 - 1.53 m/sec	-.36
	8 msec	1.59 - 2.04 m/sec	-1.96
	14 msec	3.20 - 3.85 m/sec	-3.65
Maximum Flexion Angle		49.0 – 59.0 deg	53.3
Time of Max. Flexion Angle		54.0 – 66.0 ms	59.2
Maximum Angle Theta (A)		32.0 – 37.0 deg	32.4
Time of Max. Theta (A)		53.0 – 63.0 ms	56.5
Maximum Angle Theta (B)		28.0 – 30.5	30.1
Time of Max. Theta (B)		54.0 – 64.0 ms	61.4

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

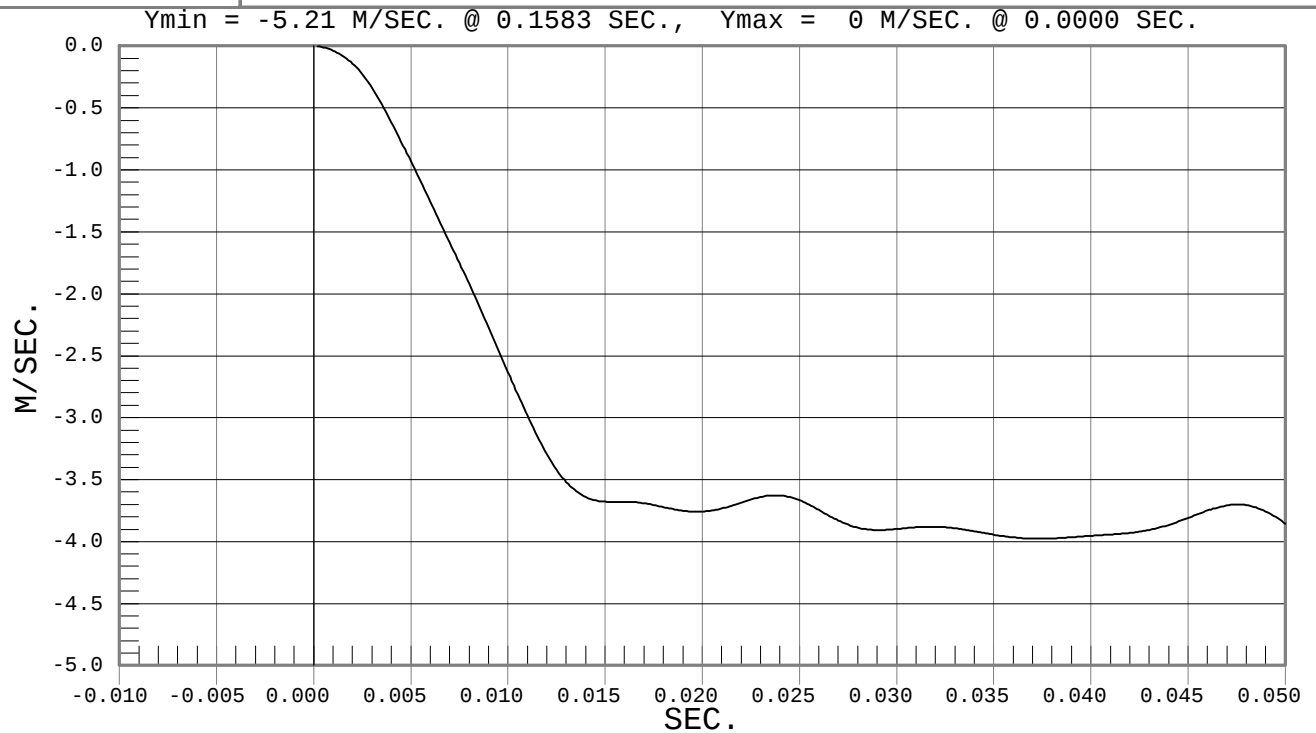
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Neck Bending
Component: Dummy #009

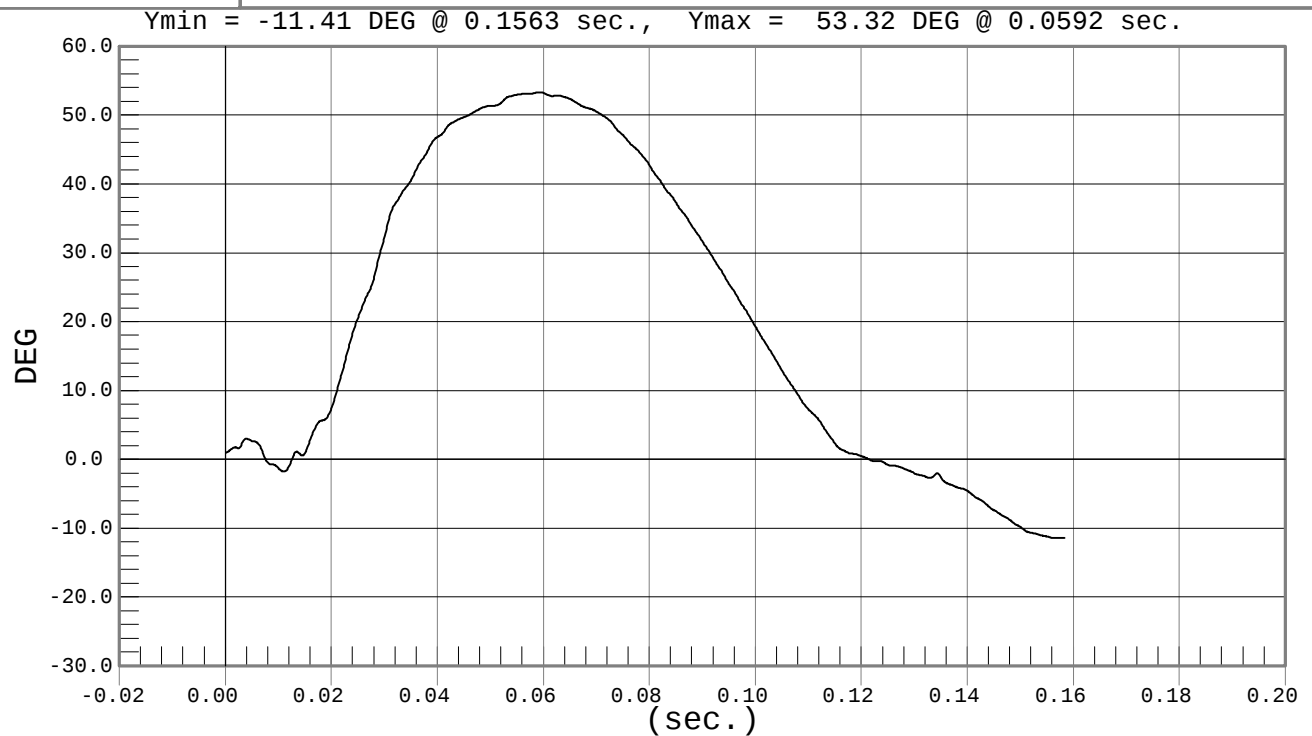
Test Date: 05-06-05
Speed: 11.4 fps, 3.47 M/s



FLEXION ANGLE

Test Desc.: Neck Bending
Component: Dummy #009

Test Date: 05-06-05
Speed: 11.4 fps, 3.47 M/s



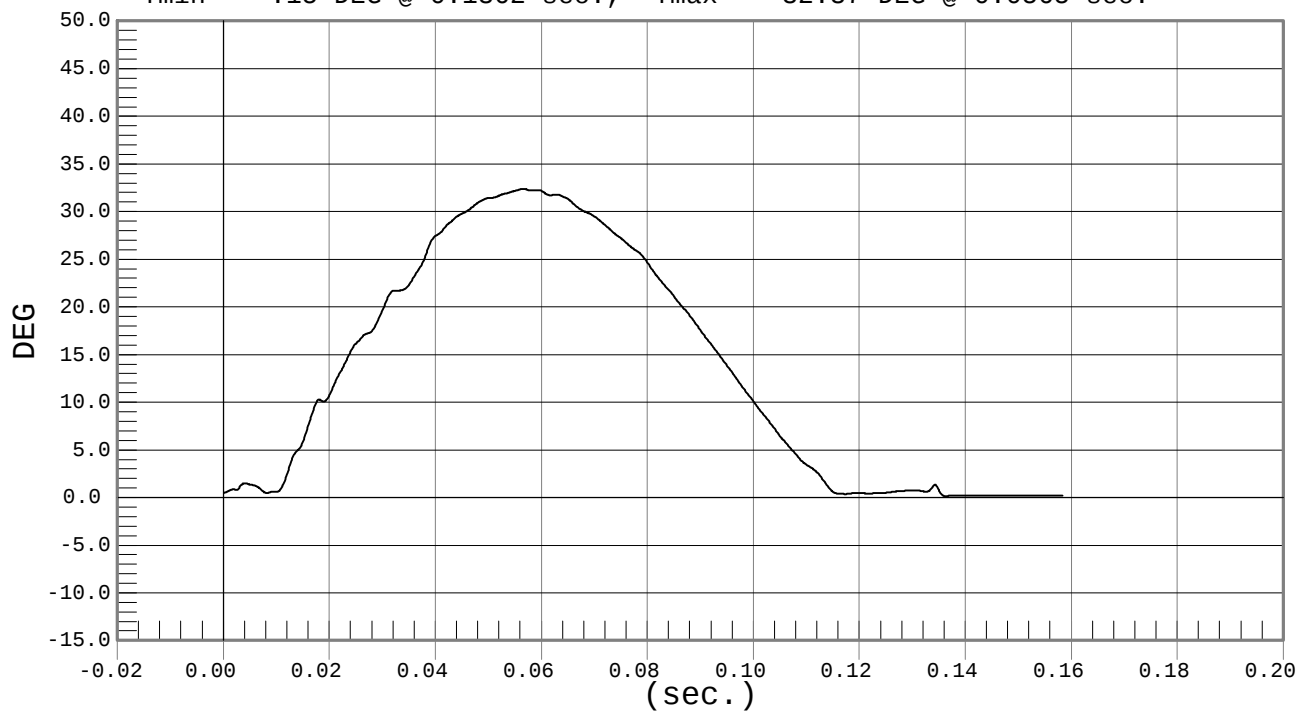


Test Desc.: Neck Bending
Component: Dummy #009

THETA A

Test Date: 05-06-05
Speed: 11.4 fps, 3.47 M/s

Ymin = .15 DEG @ 0.1362 sec., Ymax = 32.37 DEG @ 0.0565 sec.

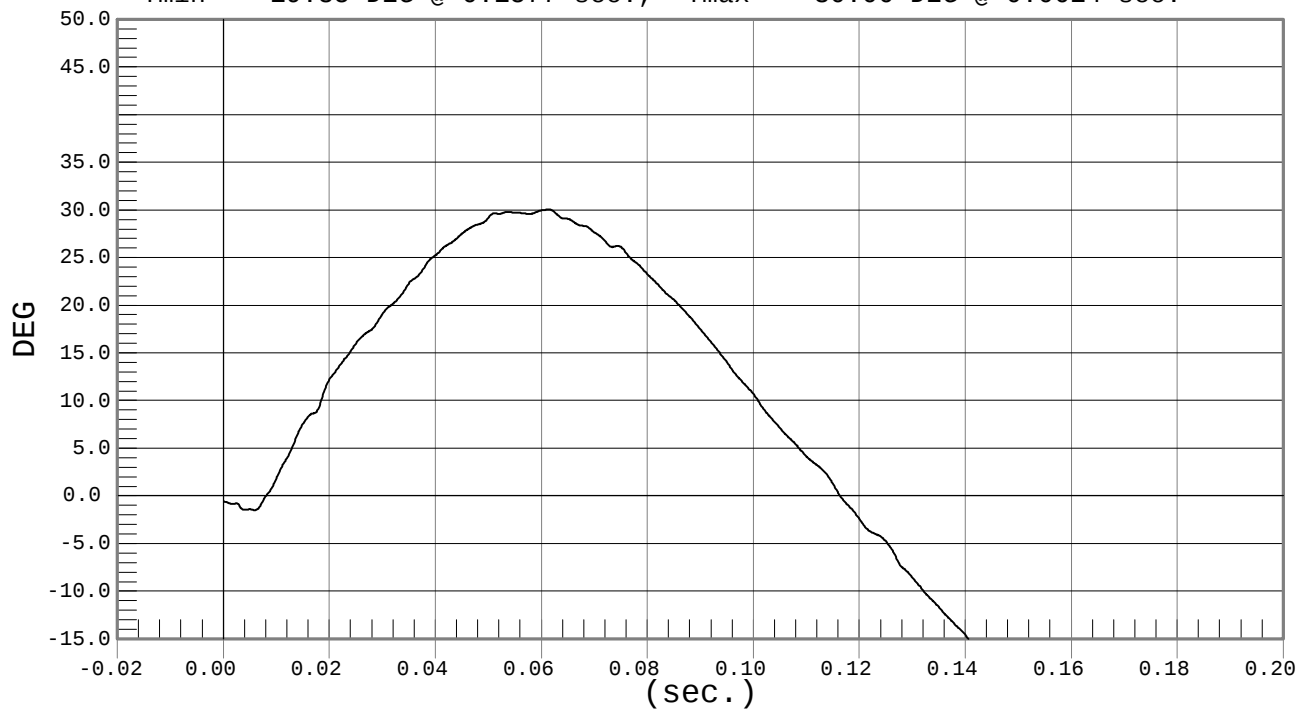


Test Desc.: Neck Bending
Component: Dummy #009

THETA B

Test Date: 05-06-05
Speed: 11.4 fps, 3.47 M/s

Ymin = -19.85 DEG @ 0.1577 sec., Ymax = 30.06 DEG @ 0.0614 sec.



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date: 5/6/05
Dummy Serial Number: 009
Test Number: D051223

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.2
Relative Humidity (%)	10 – 70	31
Pendulum Speed	4.2 – 4.4 m/s	4.3
Max. Resultant Acceleration	7.5 – 10.5 g's	9.8
Time of Max. Pendulum Acceleration	msec	50.9

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Gall

Approved By: _____

David Winkelbauer

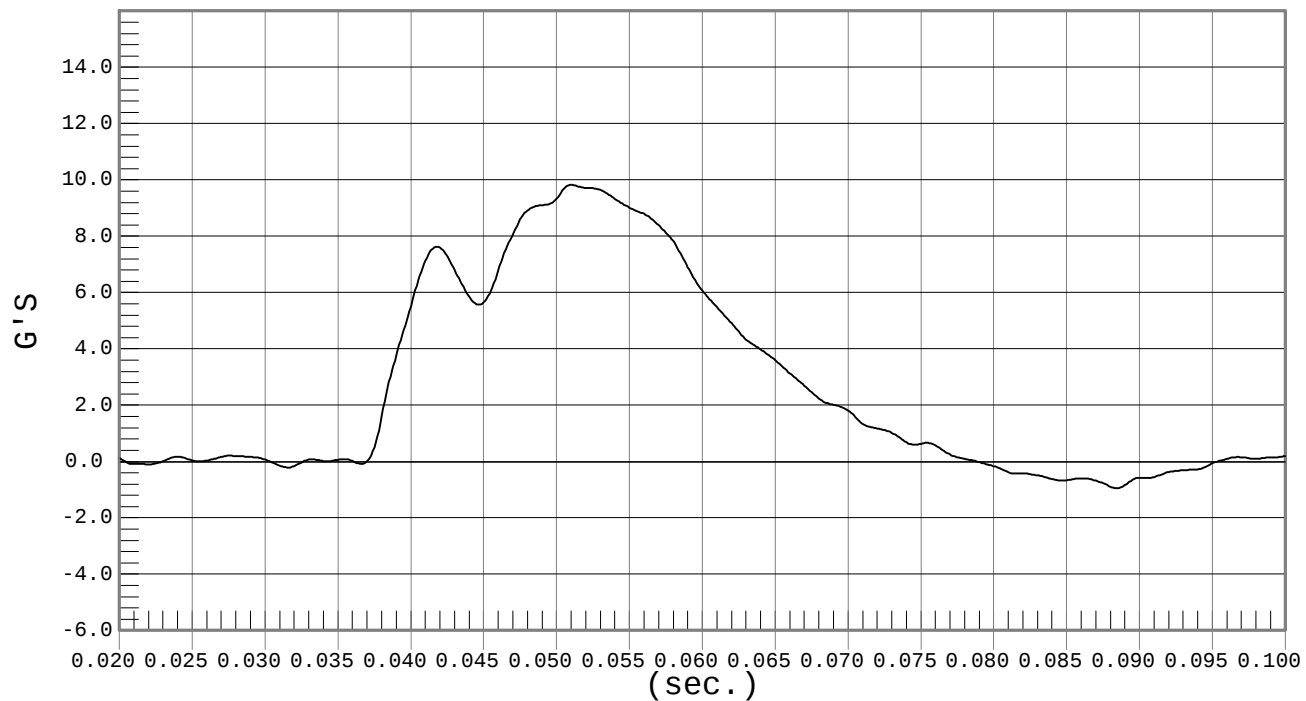


SHOULDER ACCELERATION

Test Desc.: Shoulder Impact
Component: Dummy #009

Test Date: 05-06-05
Speed: 14.1 fps, 4.30 M/s

Ymin = -.95 G'S @ 0.0883 sec., Ymax = 9.82 G'S @ 0.0509 sec.



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

Date: 5/5/05
Dummy Serial Number: 009
Test Number: D051224, D051225, D051226

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.4
Relative Humidity (%)	10 – 70	21
Displacement at 2 m/s	23.5 – 27.5 mm	26.4
Displacement at 3 m/s	36.0 – 40.0 mm	37.8
Displacement at 4 m/s	46.0 – 51.0 mm	49.3

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.4
Relative Humidity (%)	10 – 70	21
Displacement at 2 m/s	23.5 – 27.5 mm	26.3
Displacement at 3 m/s	36.0 – 40.0 mm	37.5
Displacement at 4 m/s	46.0 – 51.0 mm	48.7

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.4
Relative Humidity (%)	10 – 70	21
Displacement at 2 m/s	23.5 – 27.5 mm	27.3
Displacement at 3 m/s	36.0 – 40.0 mm	38.2
Displacement at 4 m/s	46.0 – 51.0 mm	49.9

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

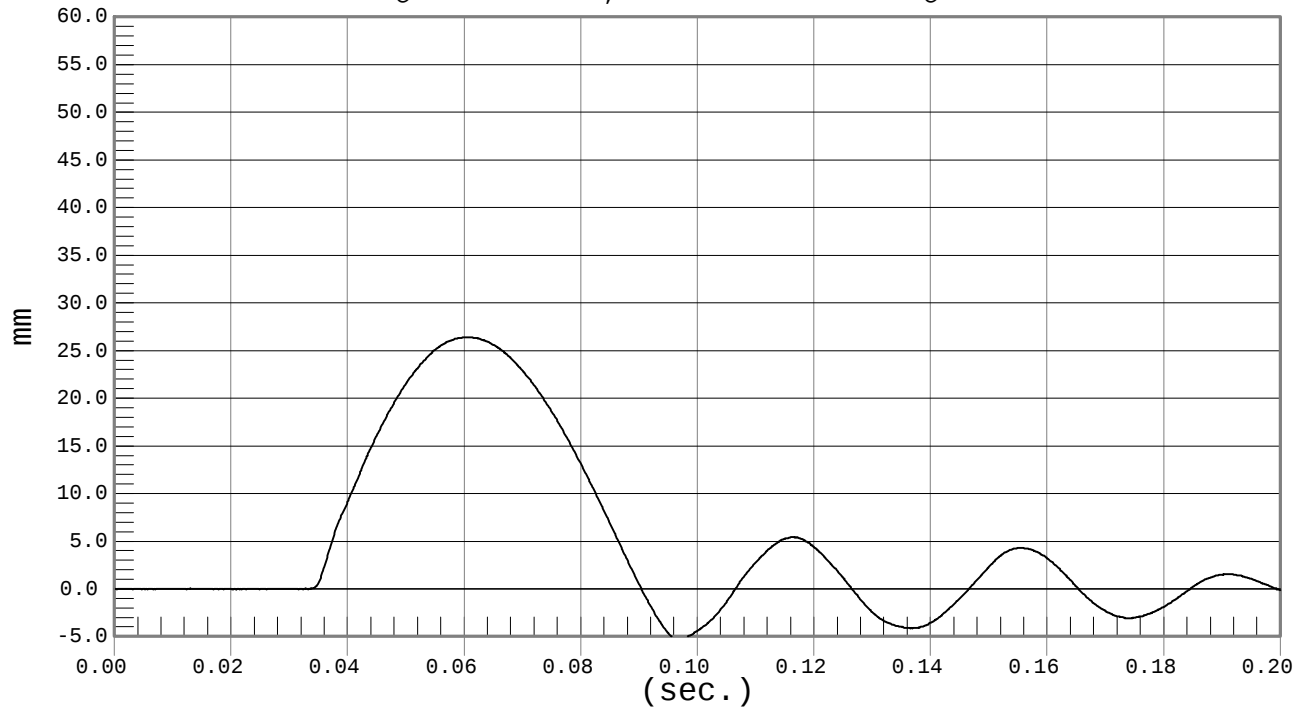


UPPER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.33 mm @ 0.0966 sec., Ymax = 26.41 mm @ 0.0599 sec.

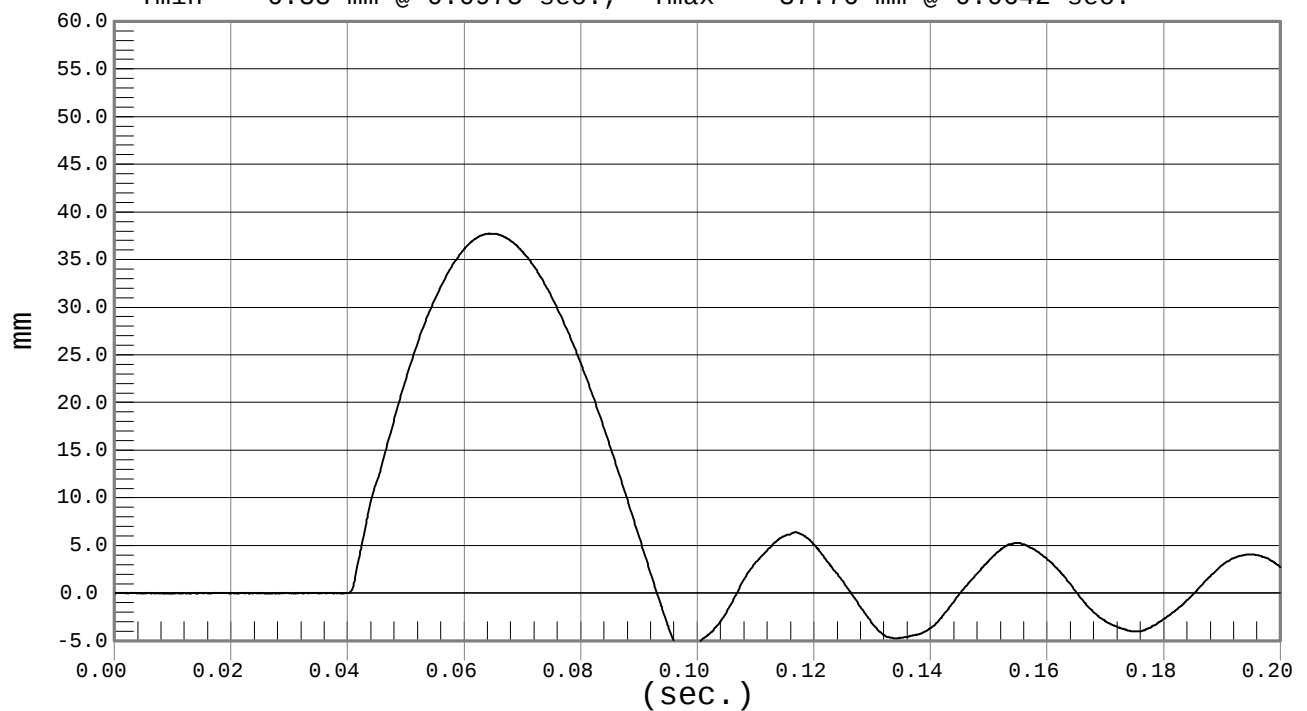


UPPER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.33 mm @ 0.0975 sec., Ymax = 37.76 mm @ 0.0642 sec.



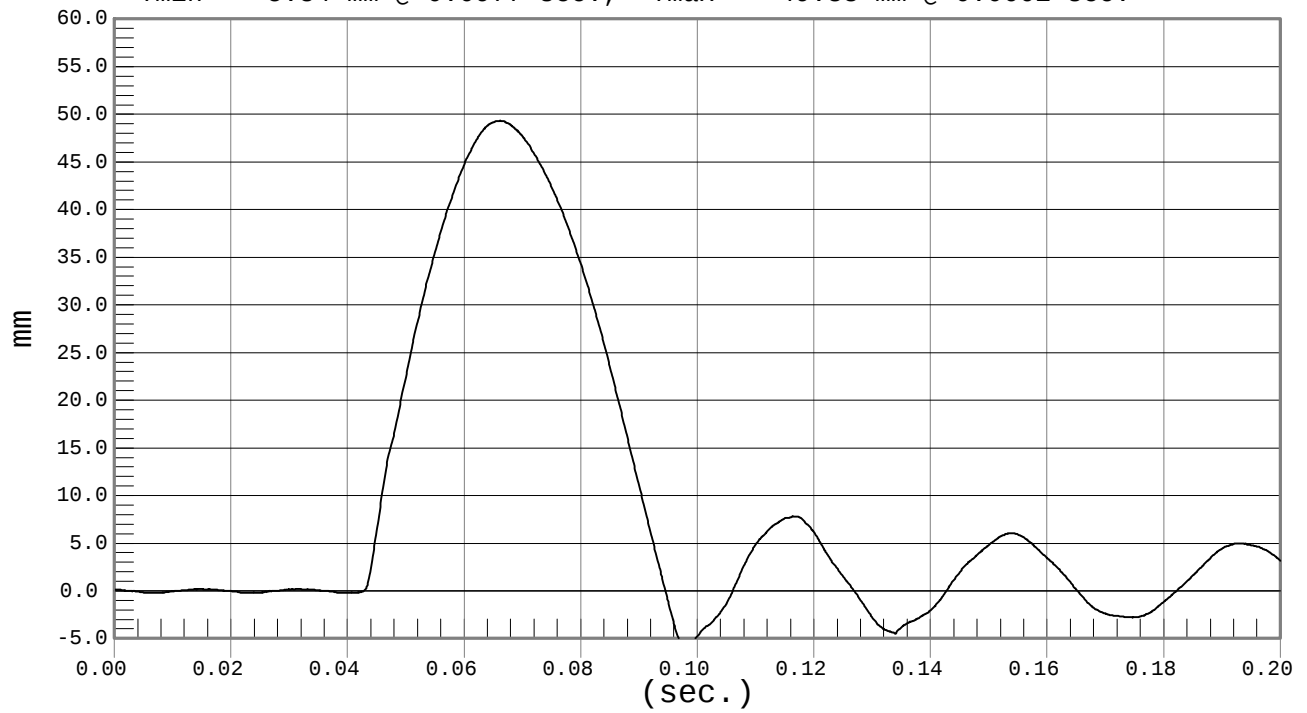


UPPER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -5.84 mm @ 0.0977 sec., Ymax = 49.33 mm @ 0.0661 sec.



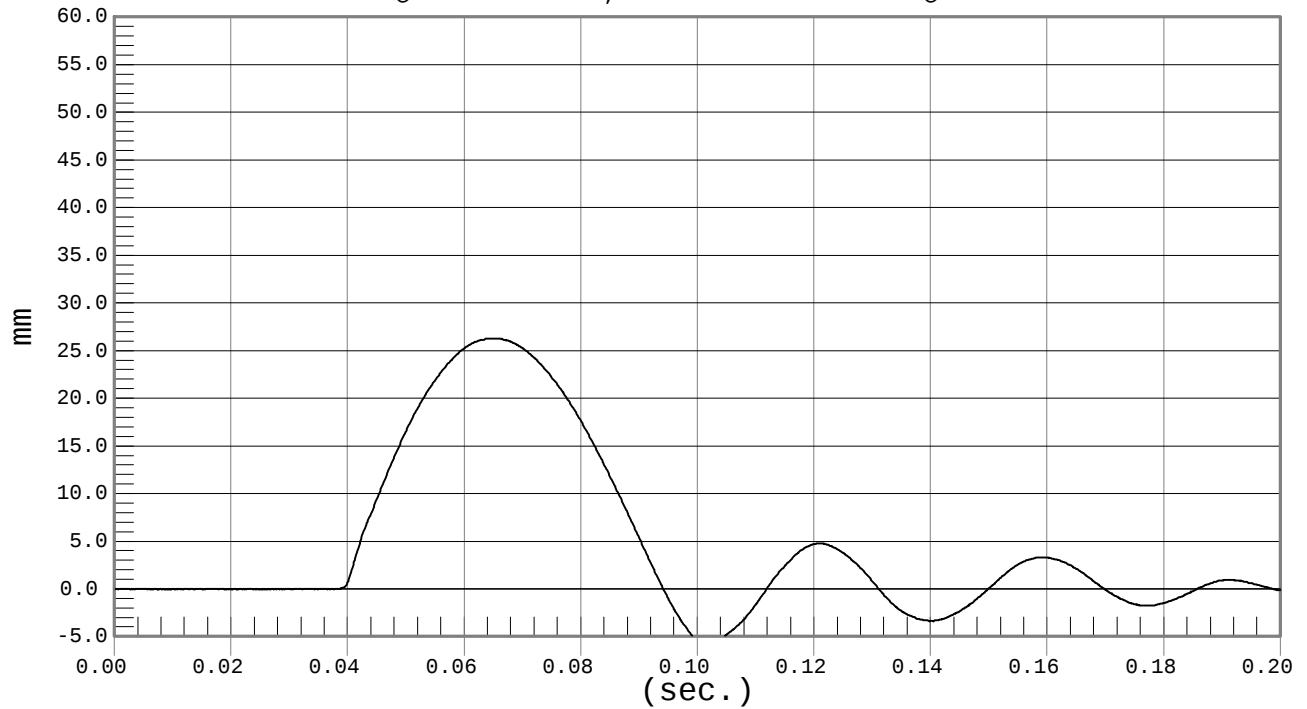


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.87 mm @ 0.1013 sec., Ymax = 26.26 mm @ 0.0637 sec.

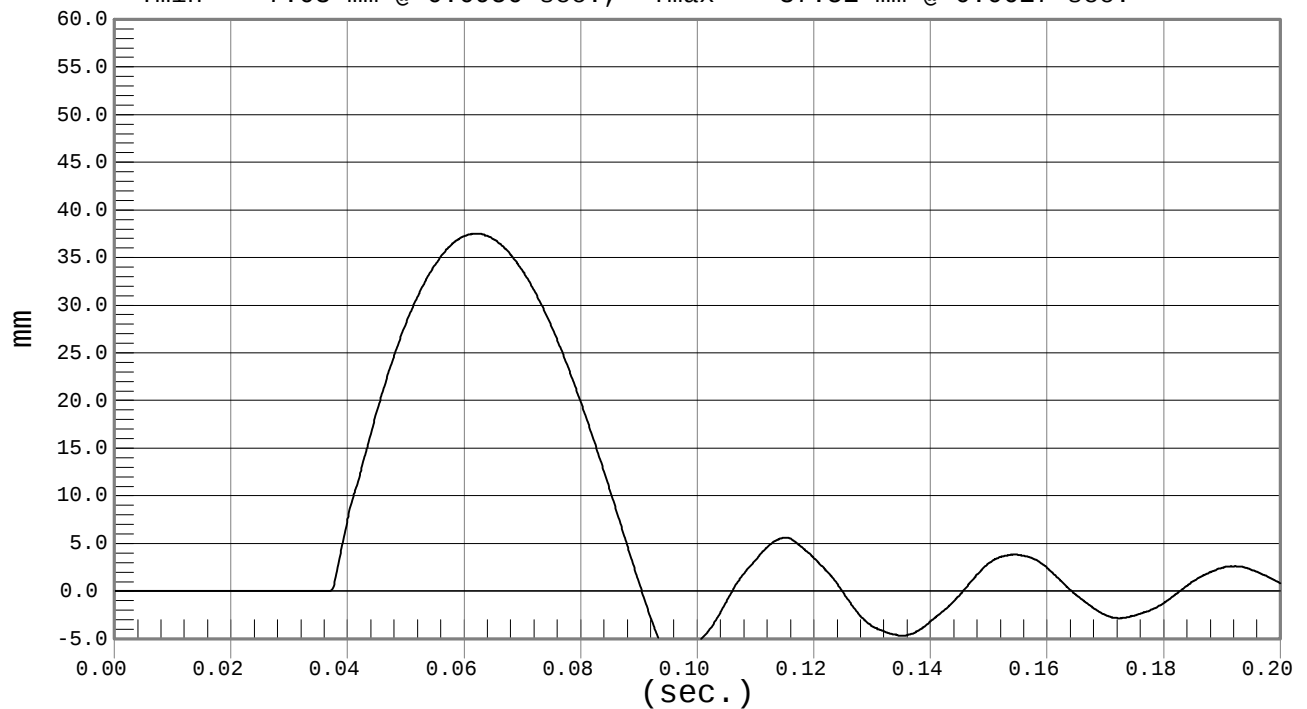


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -7.03 mm @ 0.0956 sec., Ymax = 37.51 mm @ 0.0617 sec.



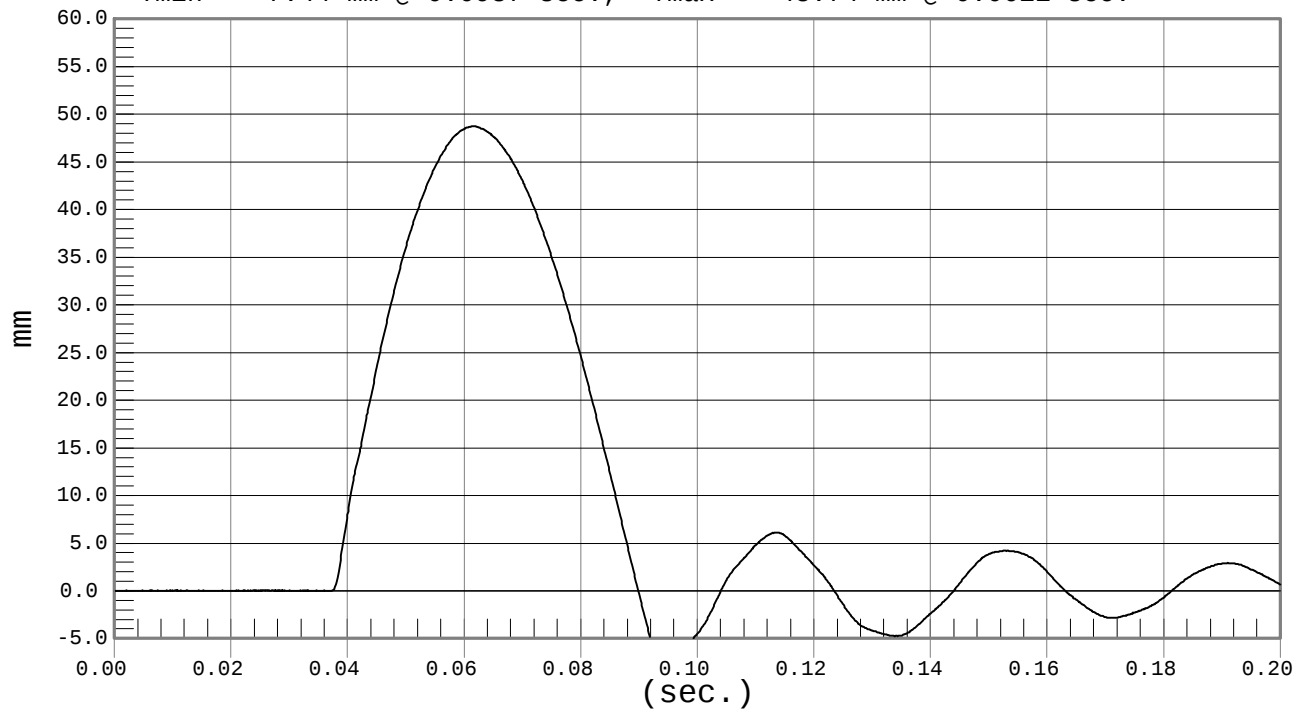


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.44 mm @ 0.0937 sec., Ymax = 48.74 mm @ 0.0611 sec.



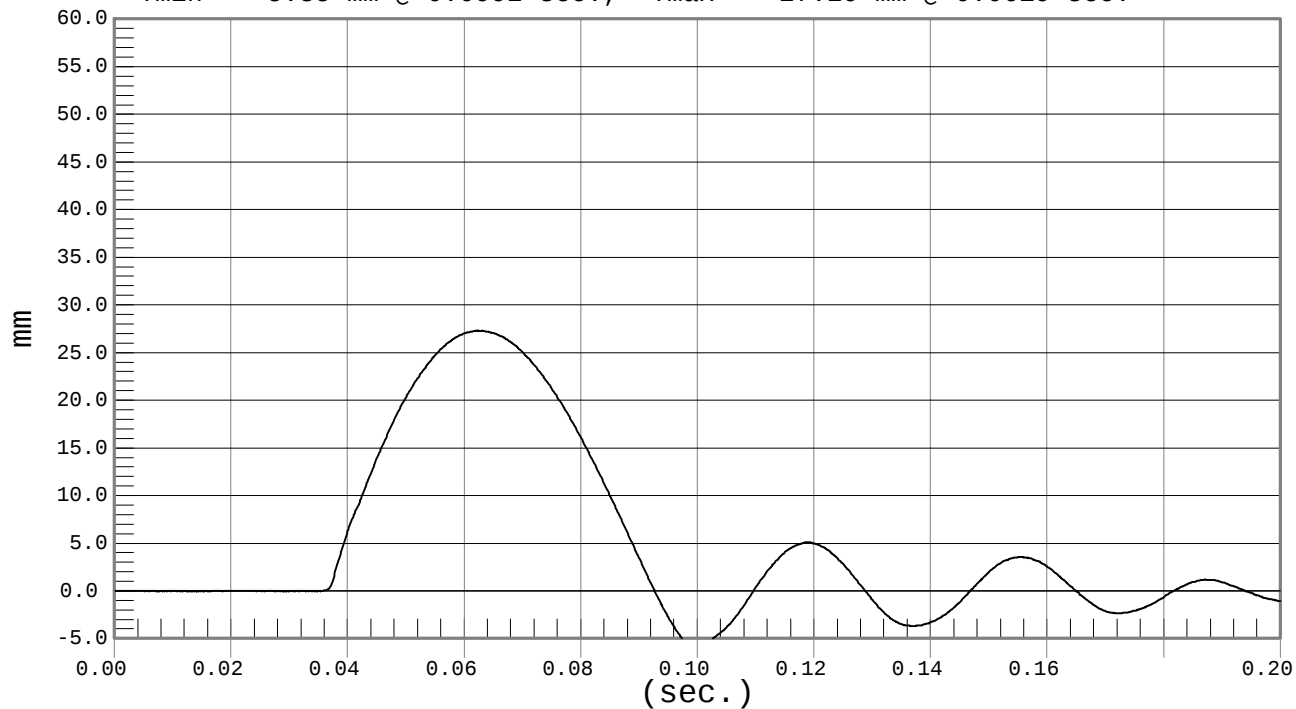


LOWER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.85 mm @ 0.0992 sec., Ymax = 27.29 mm @ 0.0619 sec.

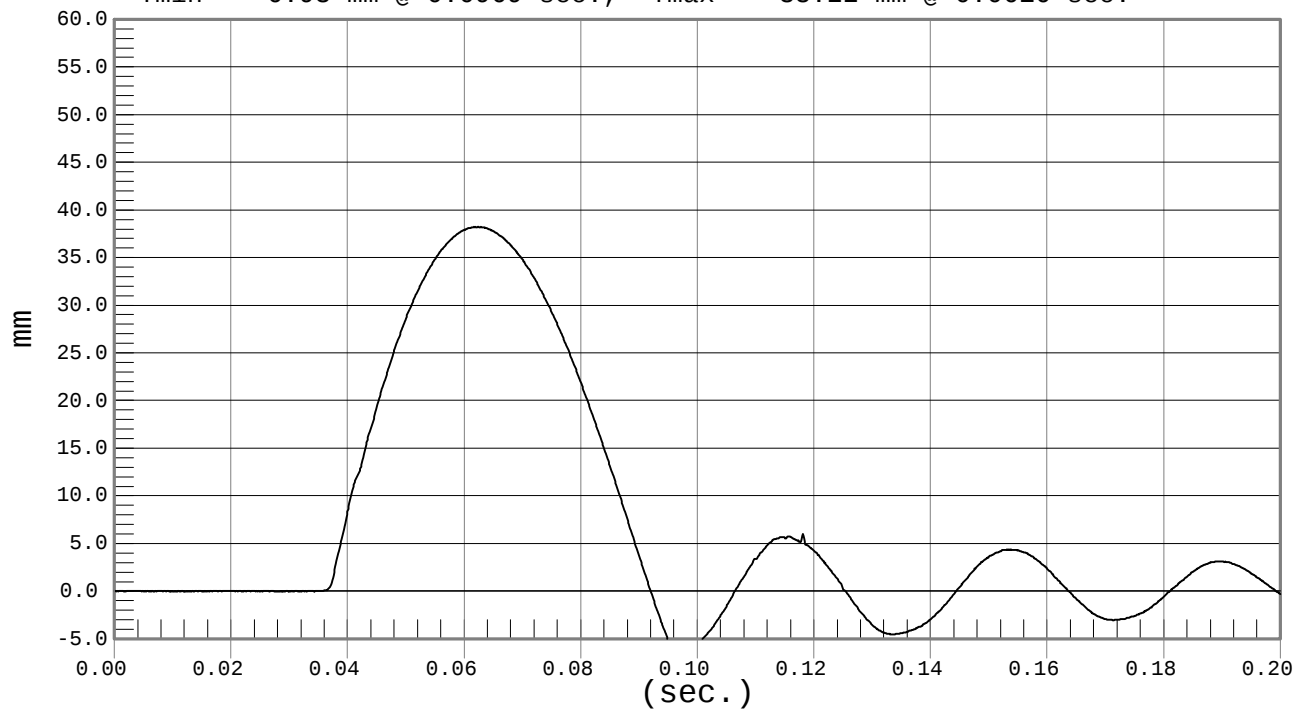


LOWER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 0.0 fps, 0.00 M/s

Ymin = -6.93 mm @ 0.0969 sec., Ymax = 38.22 mm @ 0.0616 sec.



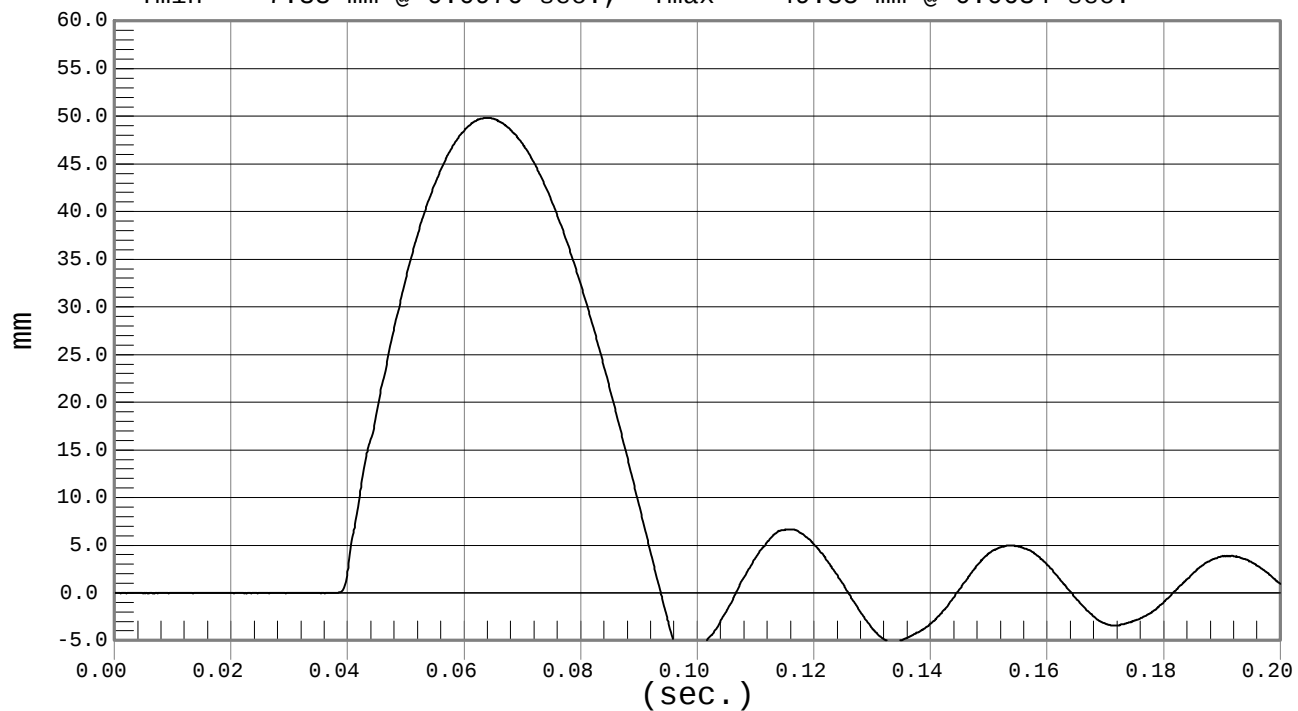


LOWER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-05-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.38 mm @ 0.0976 sec., Ymax = 49.85 mm @ 0.0634 sec.



MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

Date: 5/6/05
Dummy Serial Number: 009
Test Number: D051227

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.2
Relative Humidity (%)	10 – 70	36
Probe Speed (m/s)	3.90 – 4.10	4.10
Maximum Impact Force	4.00 – 4.80 kN	4.79
Time of Maximum Force	10.60 – 13.00 ms	10.80
Maximum Total Abdomen Force	2.20 – 2.70 kN	2.45
Time of Max. Total Force	10.00 – 12.30 ms	10.50

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Gall

Approved By: _____

David Winkelbauer

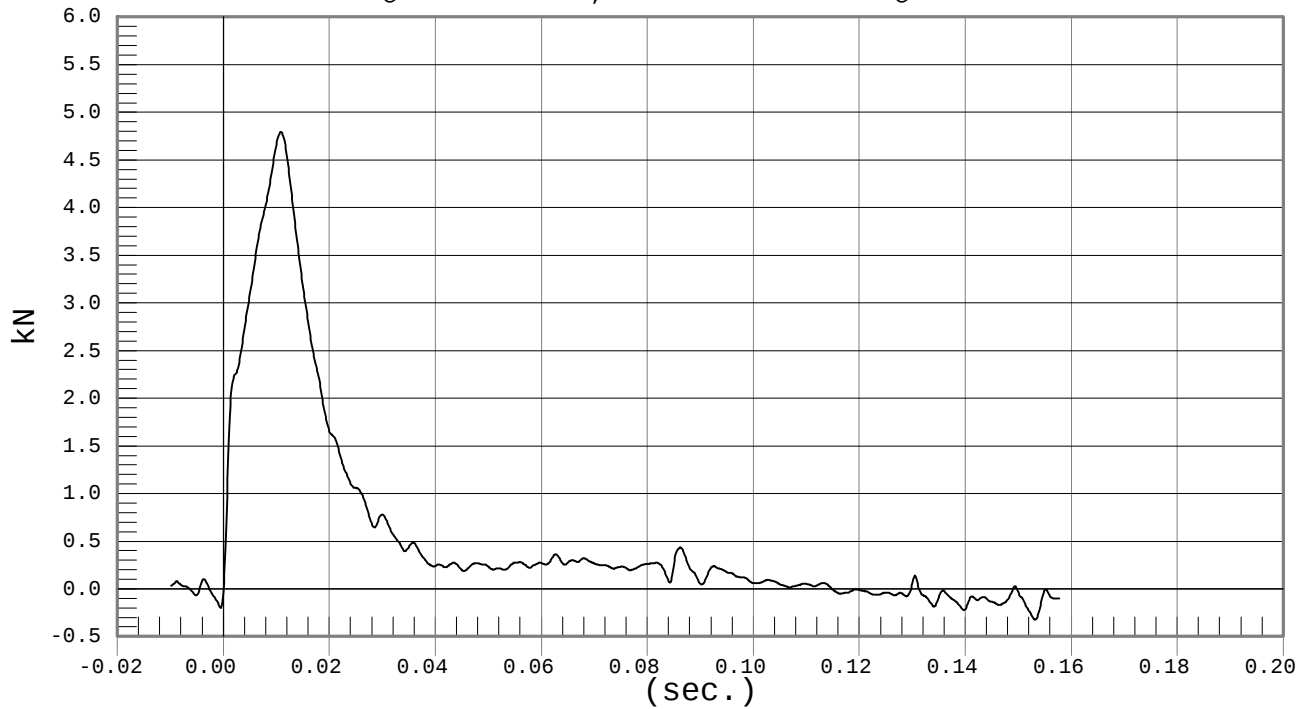


IMPACTOR FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

Test Date: 05-06-05
Speed: 13.4 fps, 4.10 M/s

Ymin = -.32 kN @ 0.1531 sec., Ymax = 4.79 kN @ 0.0108 sec.

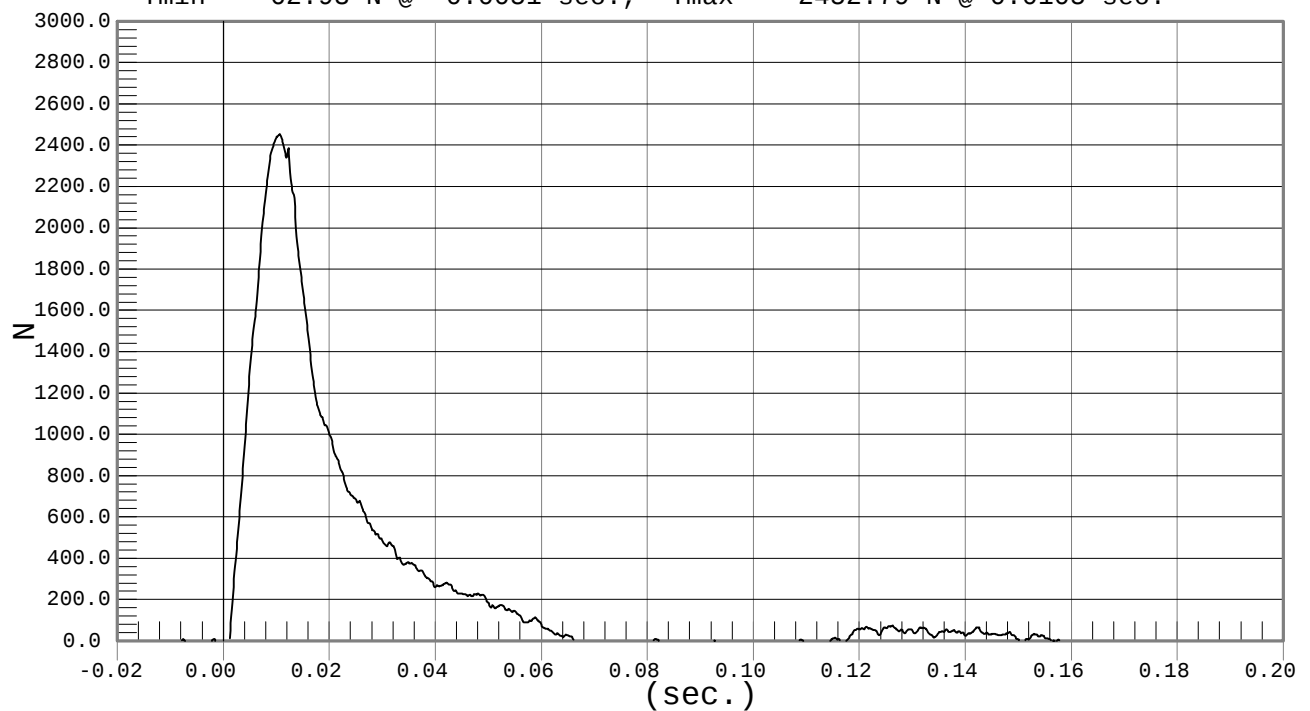


ABDOMEN FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

Test Date: 05-06-05
Speed: 13.4 fps, 4.10 M/s

Ymin = -62.93 N @ -0.0051 sec., Ymax = 2452.79 N @ 0.0105 sec.



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date: 5/6/05
Dummy Serial Number: 009
Test Number: D051228

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.8
Relative Humidity (%)		10 – 70	33
Pendulum Speed		5.95 – 6.15	6.14
Pendulum Deceleration	10 msec	-2.46 - -1.59 m/sec	-2.20
	20 msec	-5.25 - -4.07 m/sec	-5.09
	25 msec	-6.64 - -5.30 m/sec	-6.19
	30 msec	≥ -6.5 m/sec	-6.3
Maximum Flexion Angle		45.0 – 55.0 deg	53.7
Time of Max. Flexion Angle		39.0 – 53.0 ms	47.1
Maximum Angle Theta (A)		31.0 – 35.0 deg	34.4
Time of Max. Theta (A)		44.0 – 52.0 ms	44.4
Maximum Angle Theta (B)		29.5 – 32.0 deg	30.6
Time of Max. Theta (B)		44.0 – 52.0 ms	44.0

TEST MEETS SPECIFICATIONS

Technician: Jessica Gall

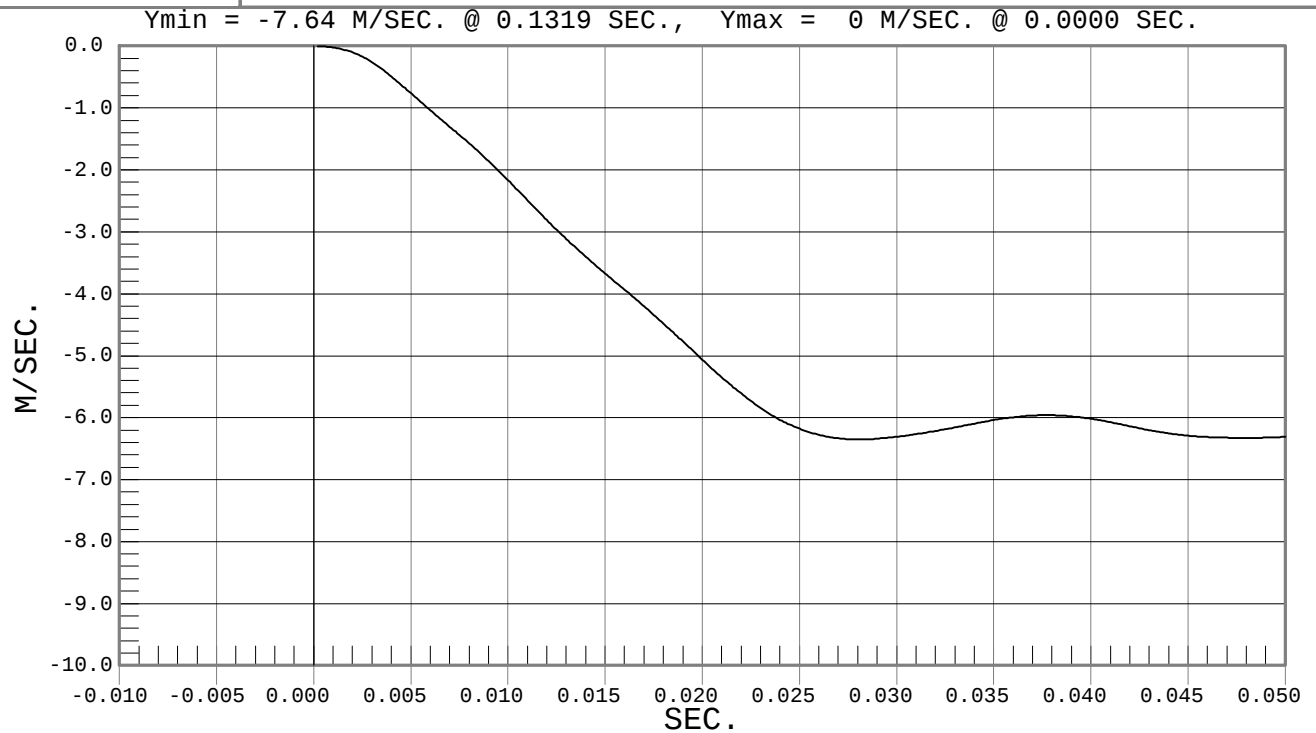
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Lumbar Bending
Component: Dummy #009

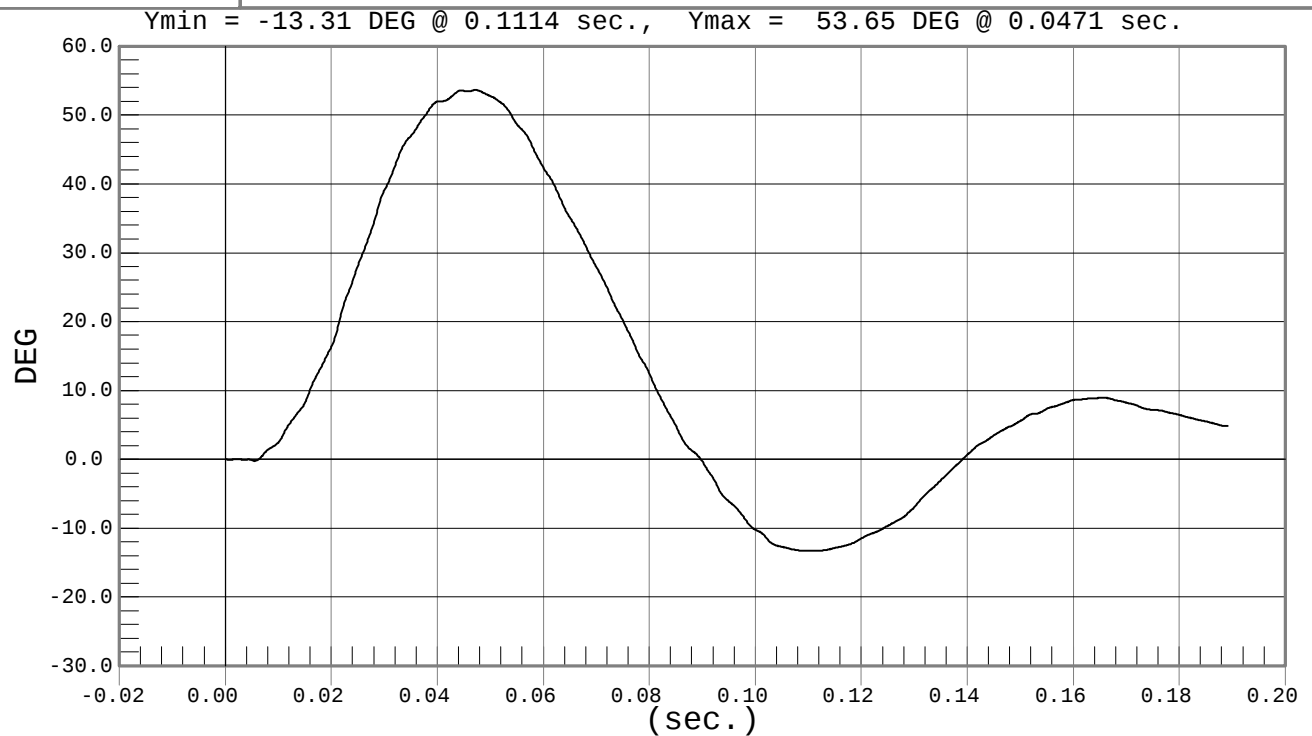
Test Date: 05-06-05
Speed: 20.2 fps, 6.14 M/s



FLEXION ANGLE

Test Desc.: Lumbar Bending
Component: Dummy #009

Test Date: 05-06-05
Speed: 20.2 fps, 6.14 M/s



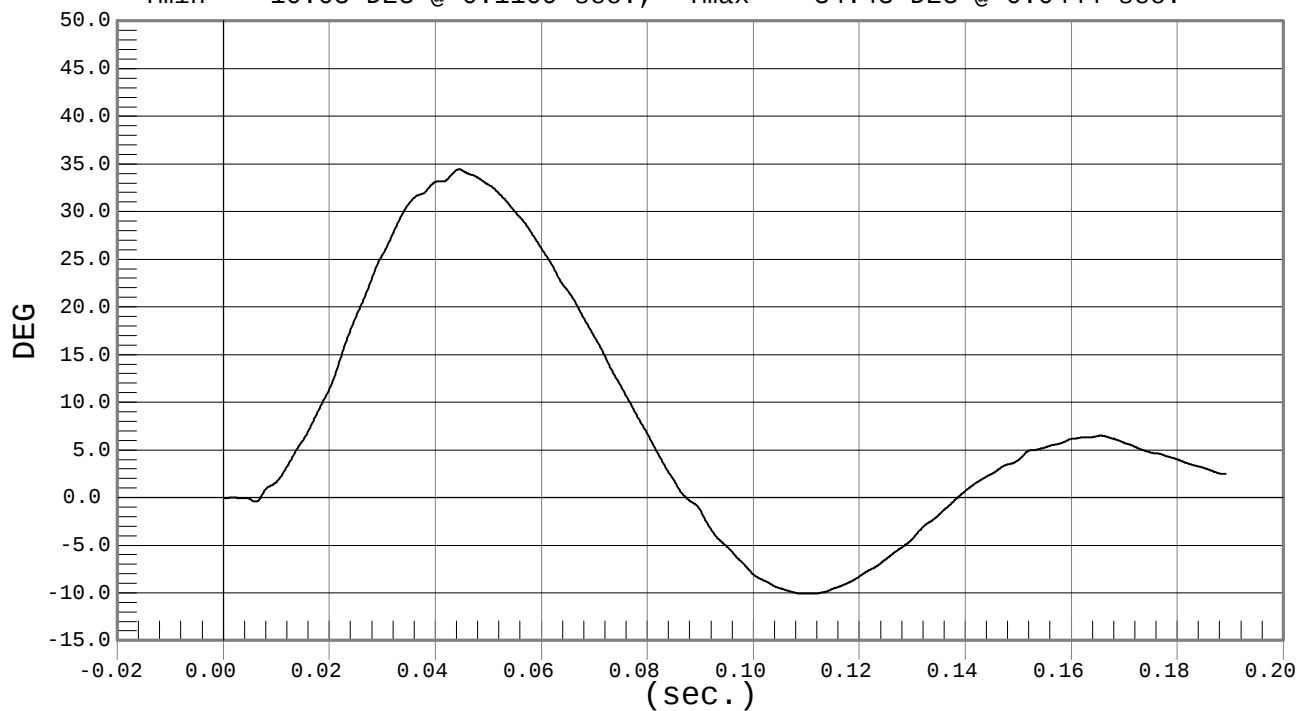


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA A

Test Date: 05-06-05
Speed: 20.2 fps, 6.14 M/s

Ymin = -10.08 DEG @ 0.1109 sec., Ymax = 34.43 DEG @ 0.0444 sec.

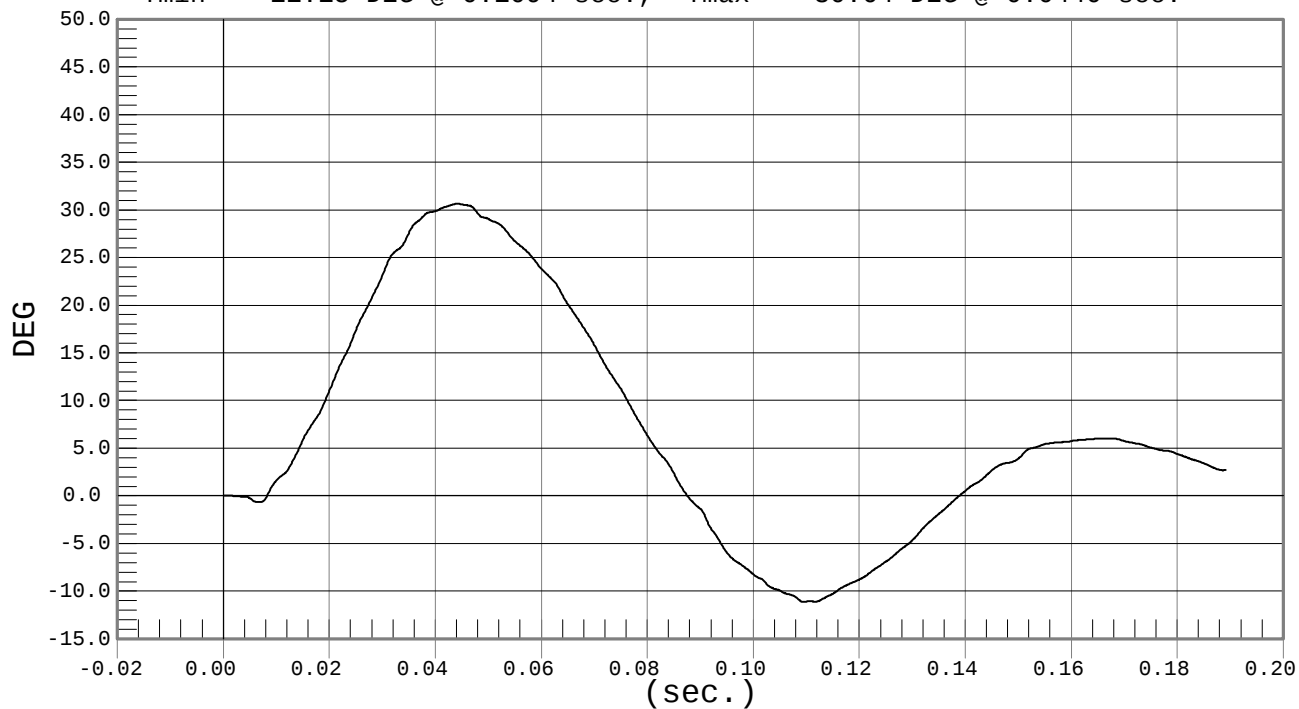


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA B

Test Date: 05-06-05
Speed: 20.2 fps, 6.14 M/s

Ymin = -11.15 DEG @ 0.1094 sec., Ymax = 30.64 DEG @ 0.0440 sec.



MGA RESEARCH CORPORATION
PELVIS TEST
EUROSID 2 DUMMY

Date: 5/6/05
Dummy Serial Number: 009
Test Number: D051229

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.3
Relative Humidity (%)	10 – 70	32
Pendulum Speed	4.20 – 4.40 m/s	4.30
Maximum Impactor Force	4.40 – 5.40 kN	4.75
Time of Max. Impactor Force	10.30 – 15.50 ms	14.40
Maximum Pubic Force	1.04 – 1.64 kN	1.32
Time of Max. Pubic Force	9.90 – 15.90 ms	14.60

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

Approved By: David Winkelbauer

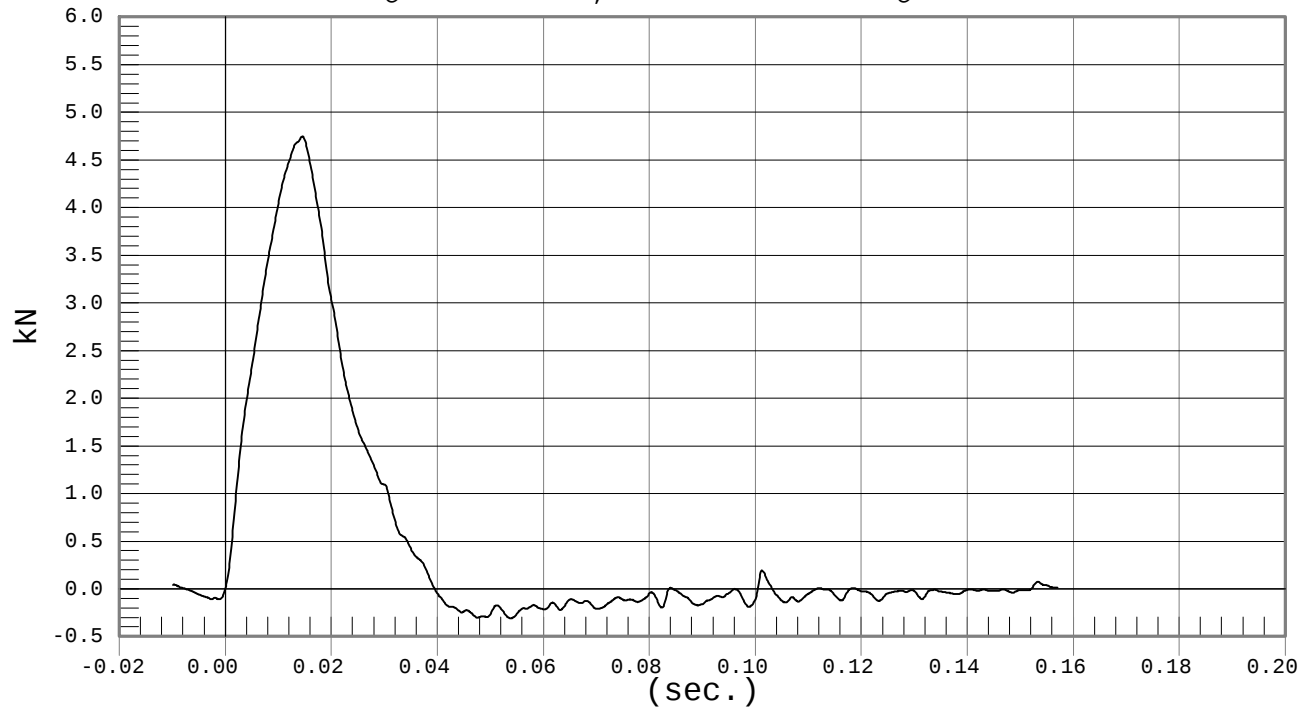


IMPACTOR FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 05-06-05
Speed: 14.1 fps, 4.30 M/s

Ymin = -.31 kN @ 0.0538 sec., Ymax = 4.75 kN @ 0.0144 sec.

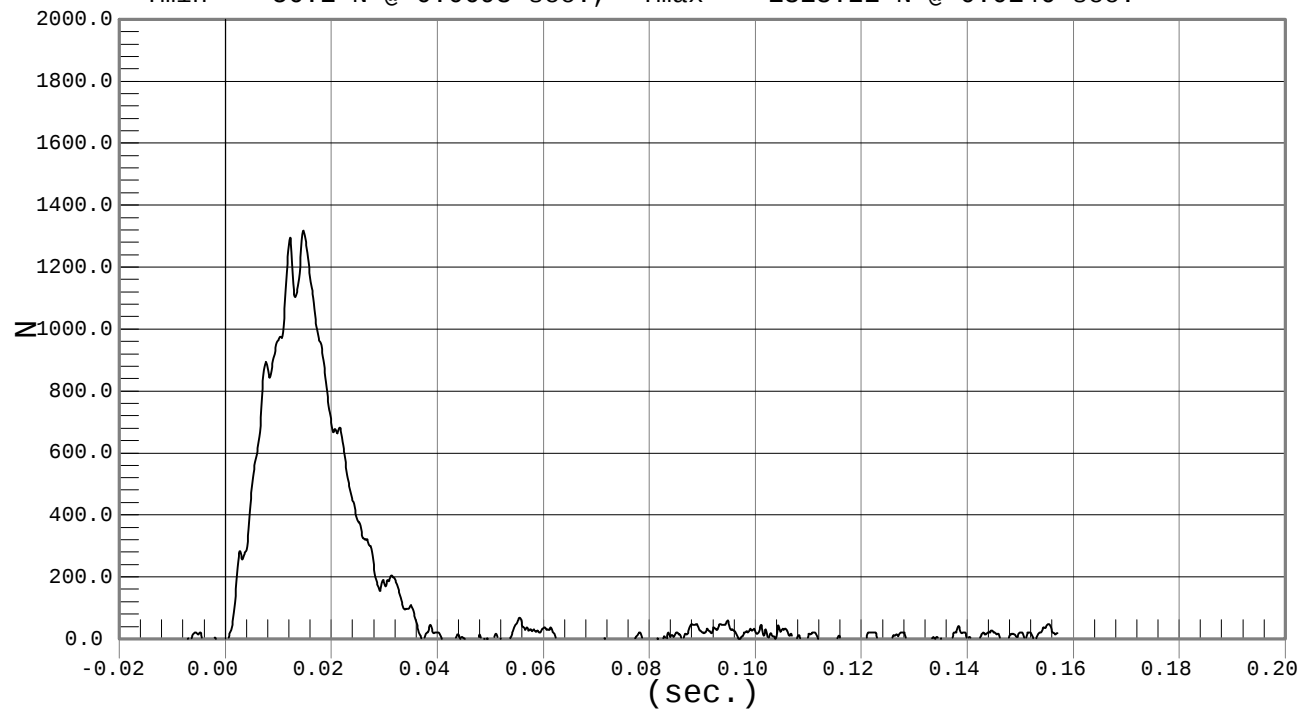


PUBIC FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 05-06-05
Speed: 14.1 fps, 4.30 M/s

Ymin = -56.1 N @ 0.0693 sec., Ymax = 1318.21 N @ 0.0146 sec.



CERTIFICATION DATA

Dummy Serial Number: 009

Calibration Test Results Summary

Dummy Serial Number: 009

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: 5/12/05
Dummy Serial Number: 009
Test Number: D051301

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.6
Relative Humidity (%)	10 – 70	30
Peak Resultant Acceleration	100 – 150 g's	135
Time of Max. Res. Acceleration	msec	40.1

TEST MEETS SPECIFICATIONS

Technician: Jessica Gall

Approved By: David Winkelbauer

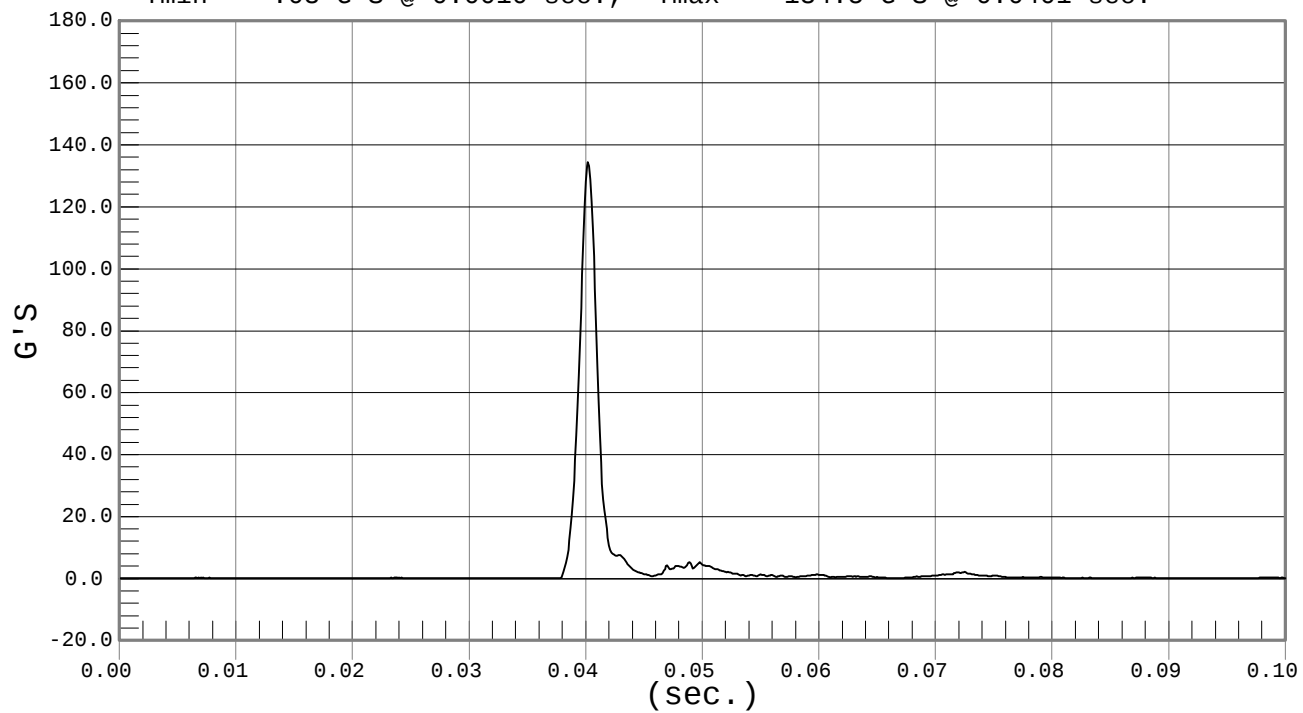


PEAK RESULTANT ACCELERATION

Test Desc.: Head Drop
Component: Dummy #009

Test Date: 05-12-05
Speed: 0.0 fps, 0.00 M/s

Ymin = .03 G'S @ 0.0010 sec., Ymax = 134.5 G'S @ 0.0401 sec.



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date: 5/13/05
Dummy Serial Number: 009
Test Number: D051302

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.5
Relative Humidity (%)		10 – 70	36
Pendulum Speed		3.3 - 3.5	3.5
Pendulum Deceleration	3 msec	~.25 - ~.53 m/sec	-.33
	8 msec	~1.59 - ~2.04 m/sec	-1.88
	14 msec	~3.20 - ~3.85 m/sec	-3.56
Maximum Flexion Angle		49.0 – 59.0 deg	54.8
Time of Max. Flexion Angle		54.0 – 66.0 ms	64.3
Maximum Angle Theta (A)		32.0 – 37.0 deg	33.5
Time of Max. Theta (A)		53.0 – 63.0 ms	61.3
Maximum Angle Theta (B)		30.5 – 33.0 deg	31.0
Time of Max. Theta (B)		54.0 – 64.0 ms	57.1

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

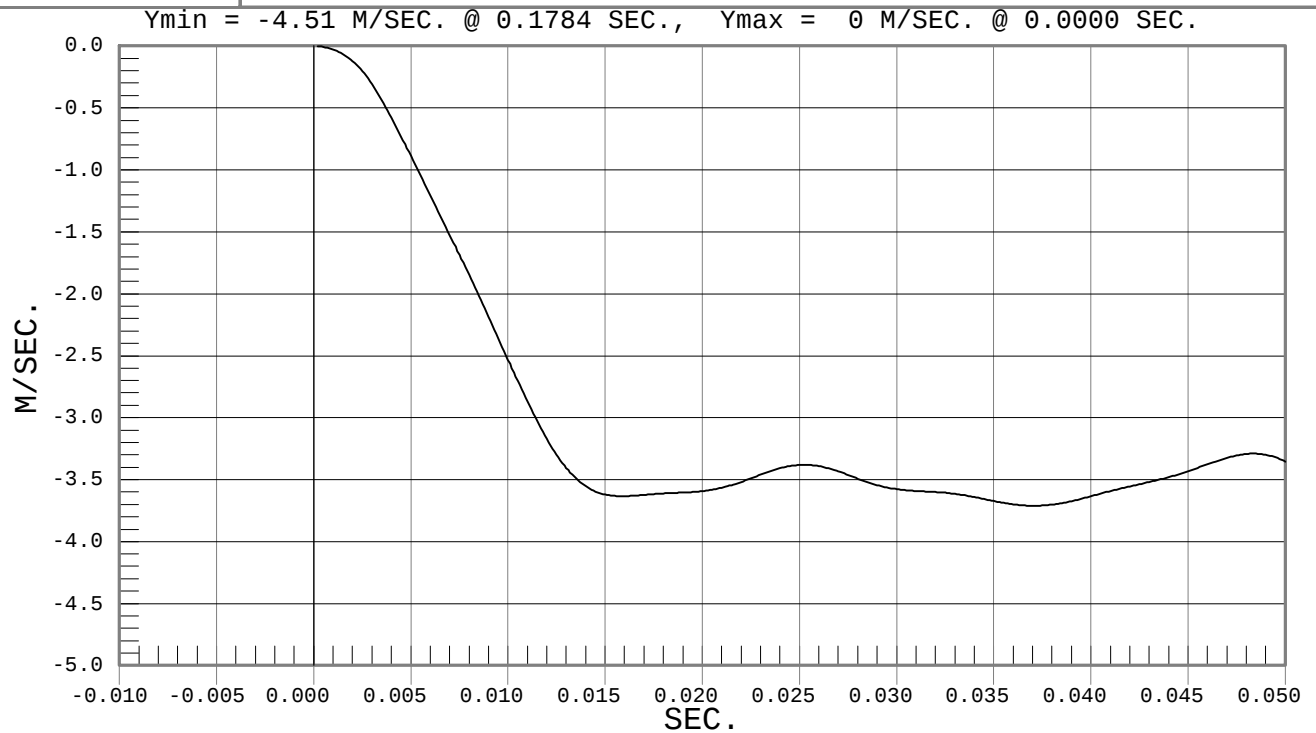
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Neck Bending
Component: Dummy #009

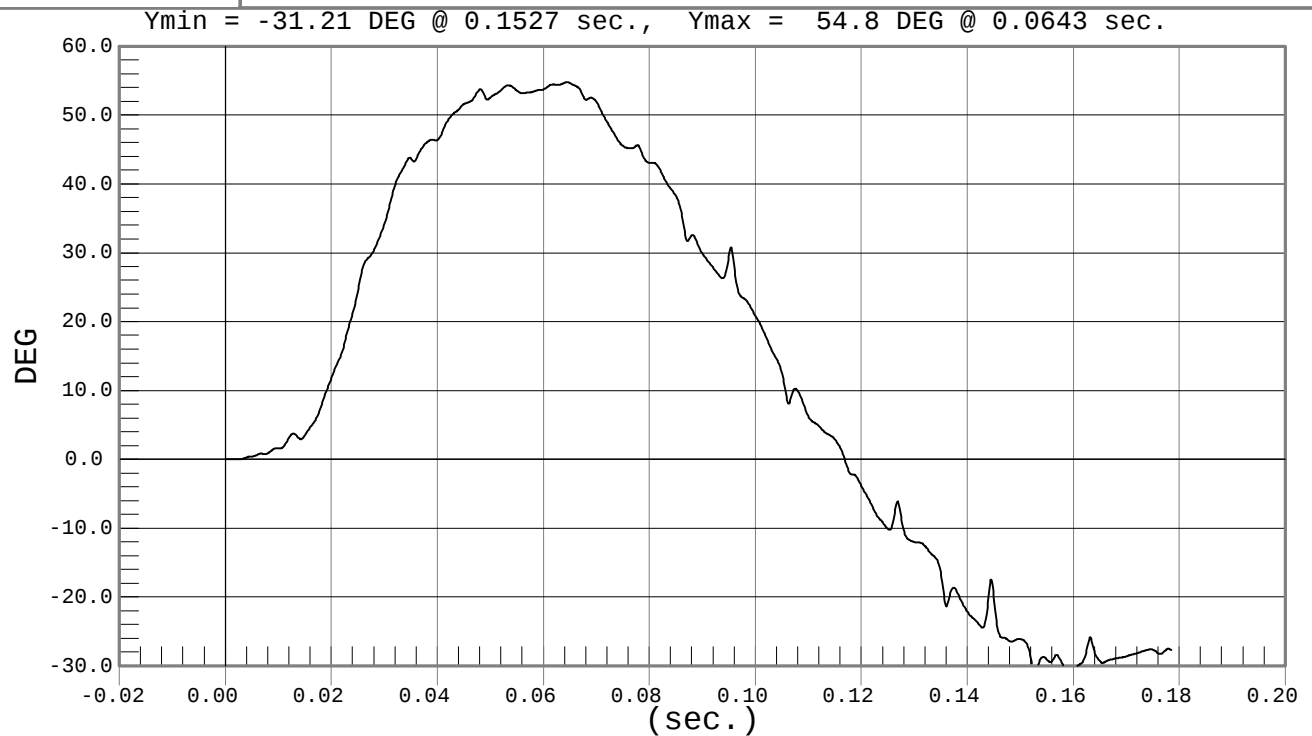
Test Date: 05-13-05
Speed: 11.5 fps, 3.49 M/s



FLEXION ANGLE

Test Desc.: Neck Bending
Component: Dummy #009

Test Date: 05-13-05
Speed: 11.5 fps, 3.49 M/s



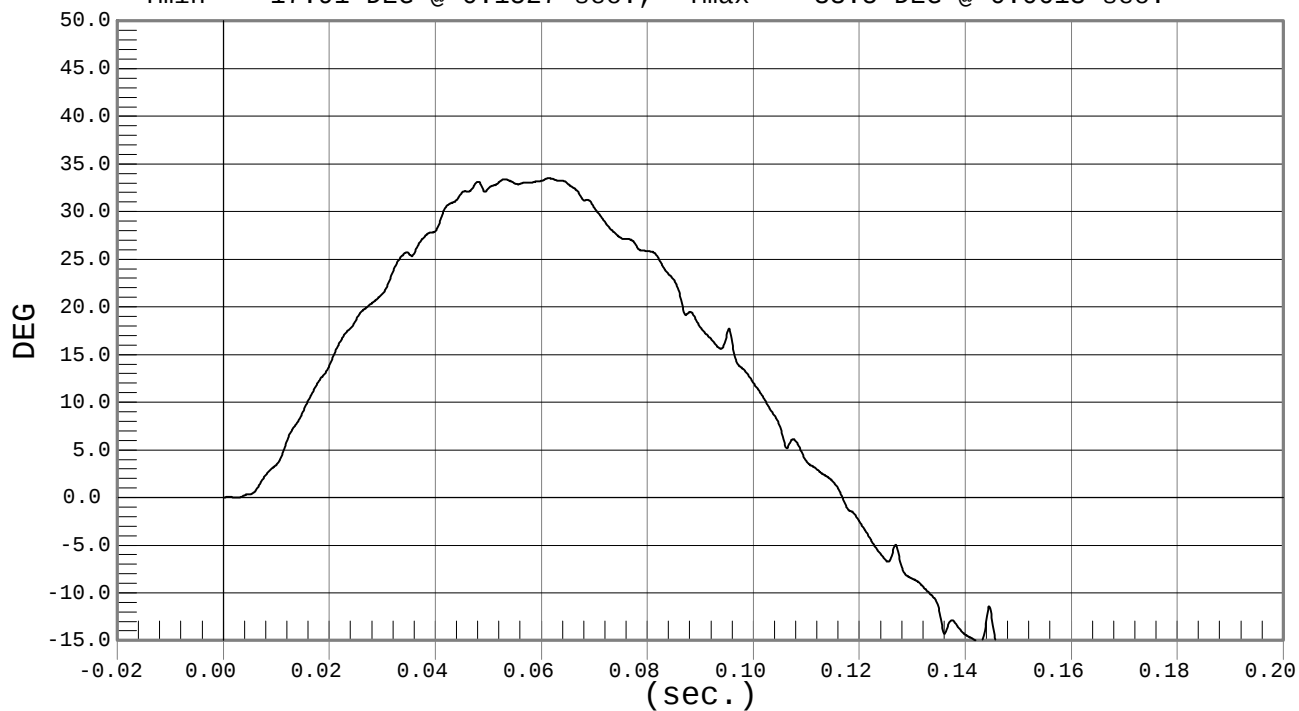


Test Desc.: Neck Bending
Component: Dummy #009

THETA A

Test Date: 05-13-05
Speed: 11.5 fps, 3.49 M/s

Ymin = -17.91 DEG @ 0.1527 sec., Ymax = 33.5 DEG @ 0.0613 sec.

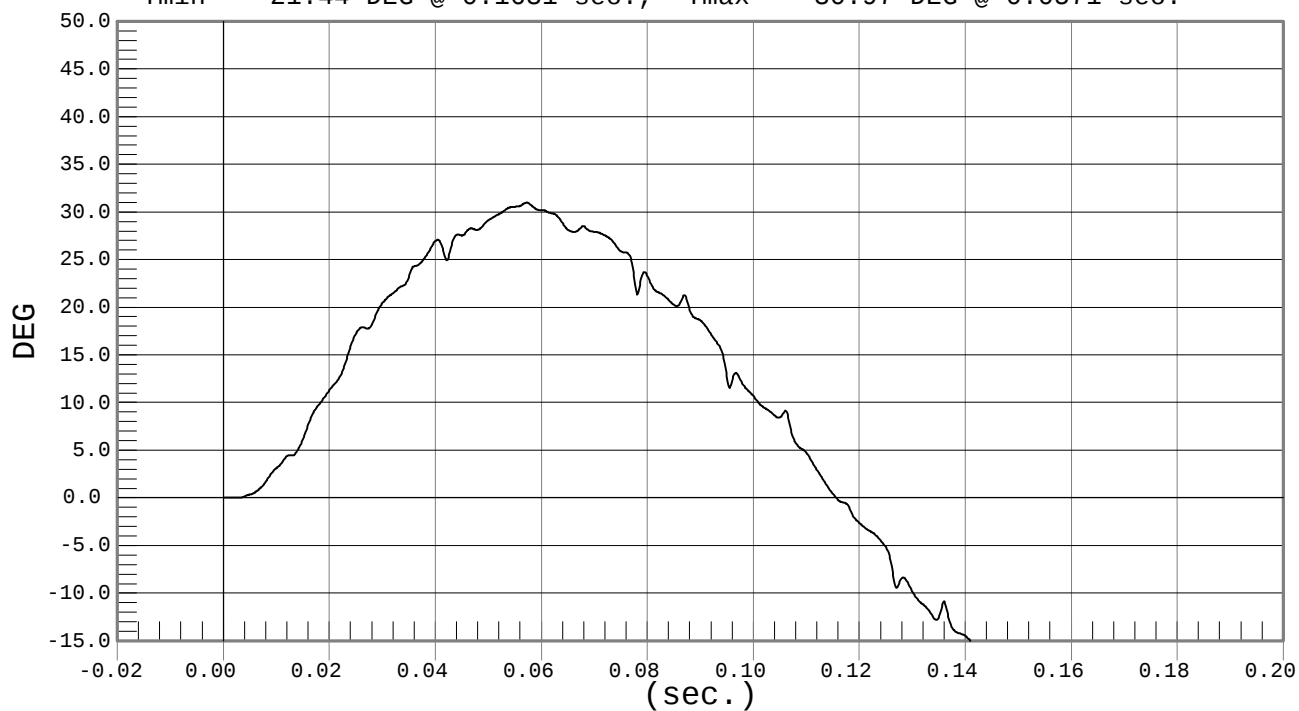


Test Desc.: Neck Bending
Component: Dummy #009

THETA B

Test Date: 05-13-05
Speed: 11.5 fps, 3.49 M/s

Ymin = -21.44 DEG @ 0.1631 sec., Ymax = 30.97 DEG @ 0.0571 sec.



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date: 5/16/05
Dummy Serial Number: 009
Test Number: D051303

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	30
Pendulum Speed	4.2 – 4.4 m/s	4.2
Max. Resultant Acceleration	7.5 – 10.5 g's	9.9
Time of Max. Pendulum Acceleration	msec	57.3

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

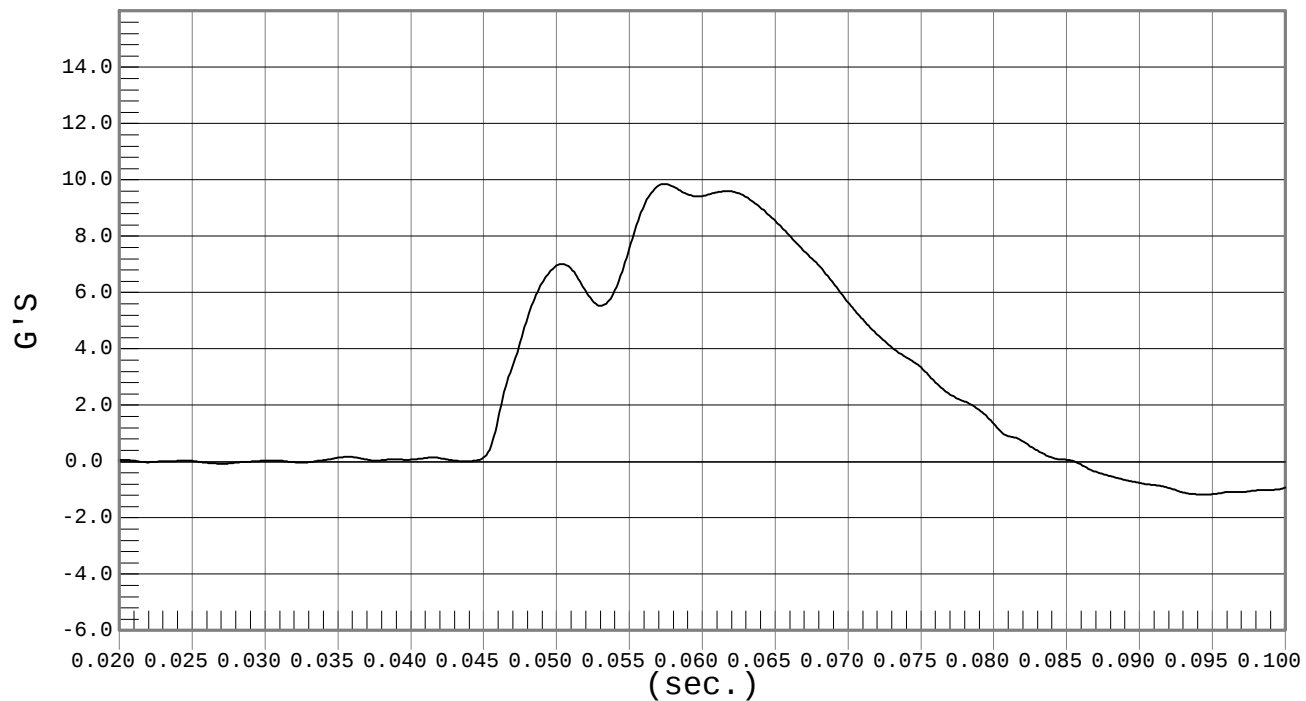


SHOULDER ACCELERATION

Test Desc.: Shoulder Impact
Component: Dummy #009

Test Date: 05-16-05
Speed: 13.8 fps, 4.22 M/s

Ymin = -1.17 G'S @ 0.0944 sec., Ymax = 9.86 G'S @ 0.0573 sec.



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

Date: 5/12/05
Dummy Serial Number: 009
Test Number: D051304, D051305, D051306

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	31
Displacement at 2 m/s	23.5 – 27.5 mm	26.7
Displacement at 3 m/s	36.0 – 40.0 mm	37.5
Displacement at 4 m/s	46.0 – 51.0 mm	48.5

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	31
Displacement at 2 m/s	23.5 – 27.5 mm	26.2
Displacement at 3 m/s	36.0 – 40.0 mm	37.7
Displacement at 4 m/s	46.0 – 51.0 mm	48.7

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	31
Displacement at 2 m/s	23.5 – 27.5 mm	27.1
Displacement at 3 m/s	36.0 – 40.0 mm	38.0
Displacement at 4 m/s	46.0 – 51.0 mm	49.9

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

Approved By: David Winkelbauer

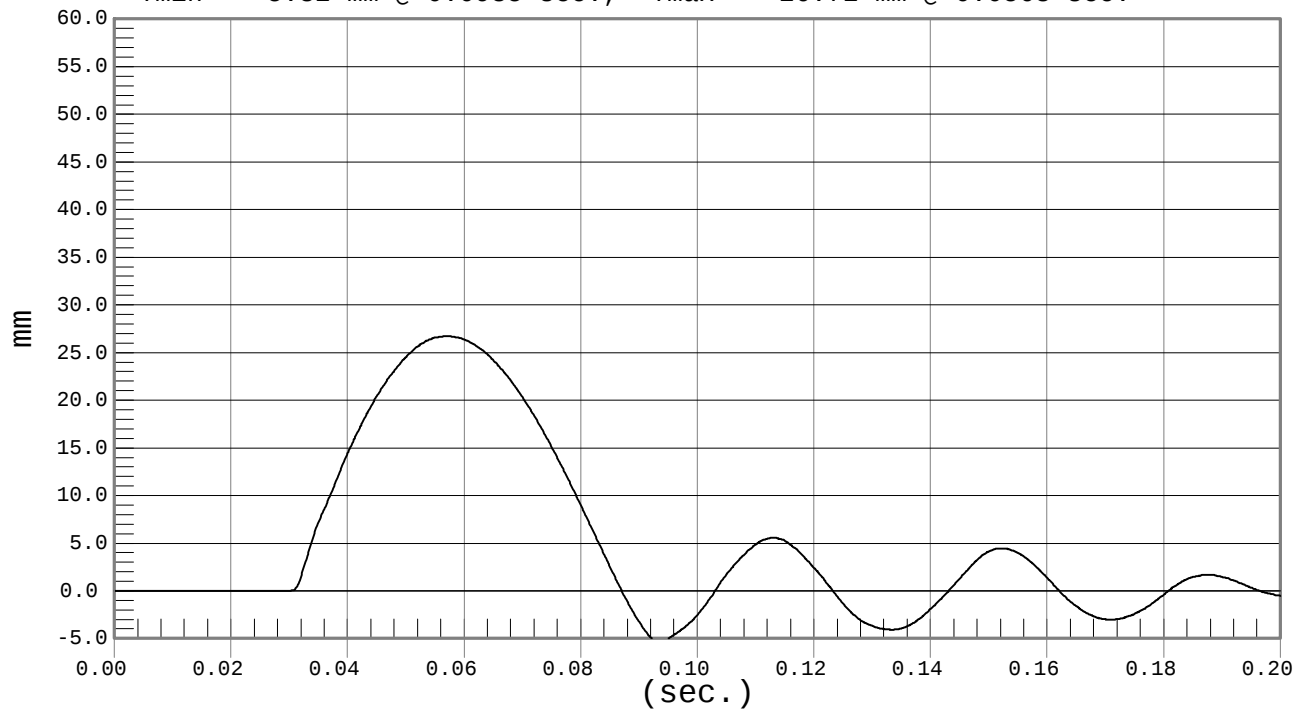


UPPER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.32 mm @ 0.0935 sec., Ymax = 26.72 mm @ 0.0563 sec.

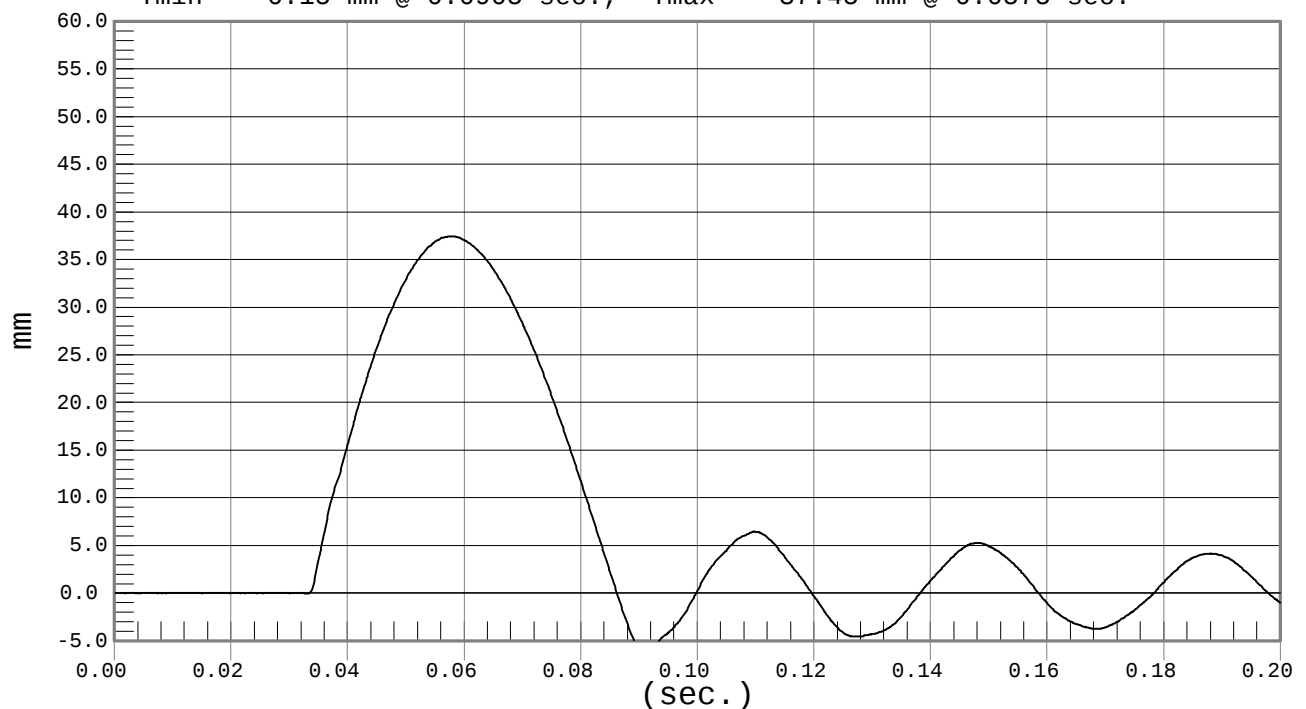


UPPER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.15 mm @ 0.0905 sec., Ymax = 37.45 mm @ 0.0575 sec.



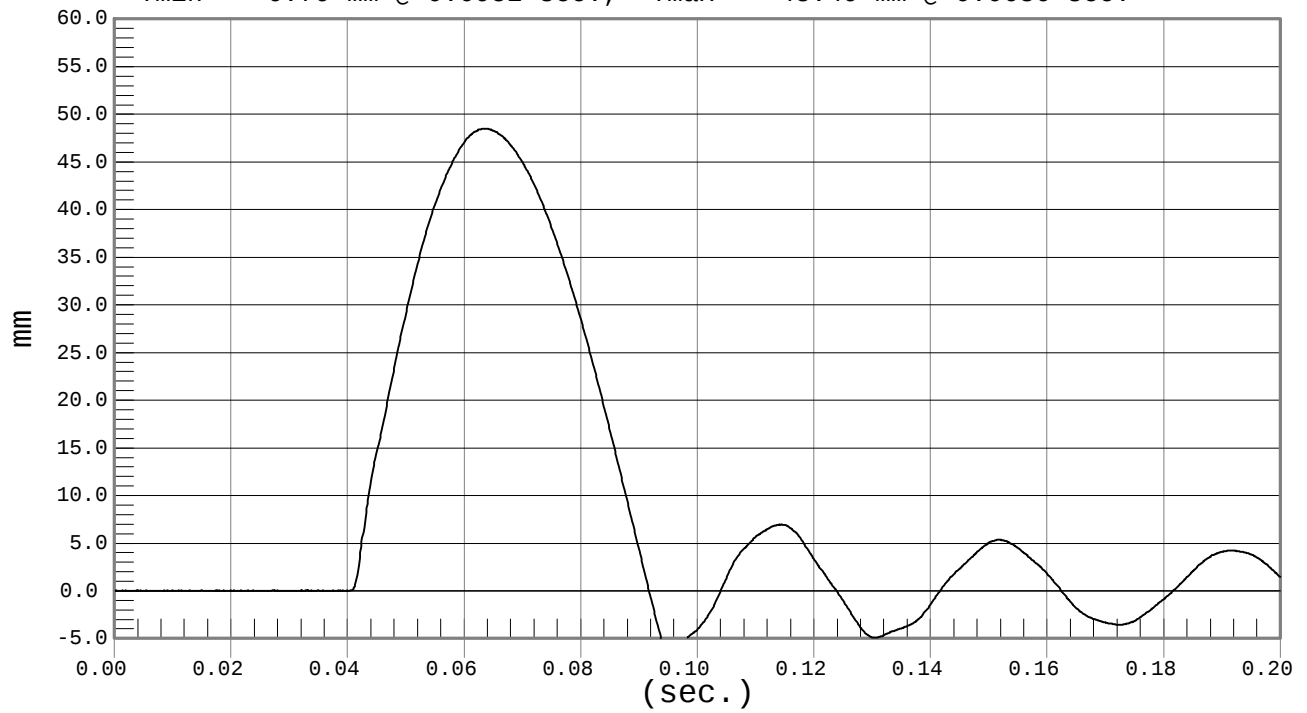


UPPER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -6.79 mm @ 0.0952 sec., Ymax = 48.49 mm @ 0.0636 sec.



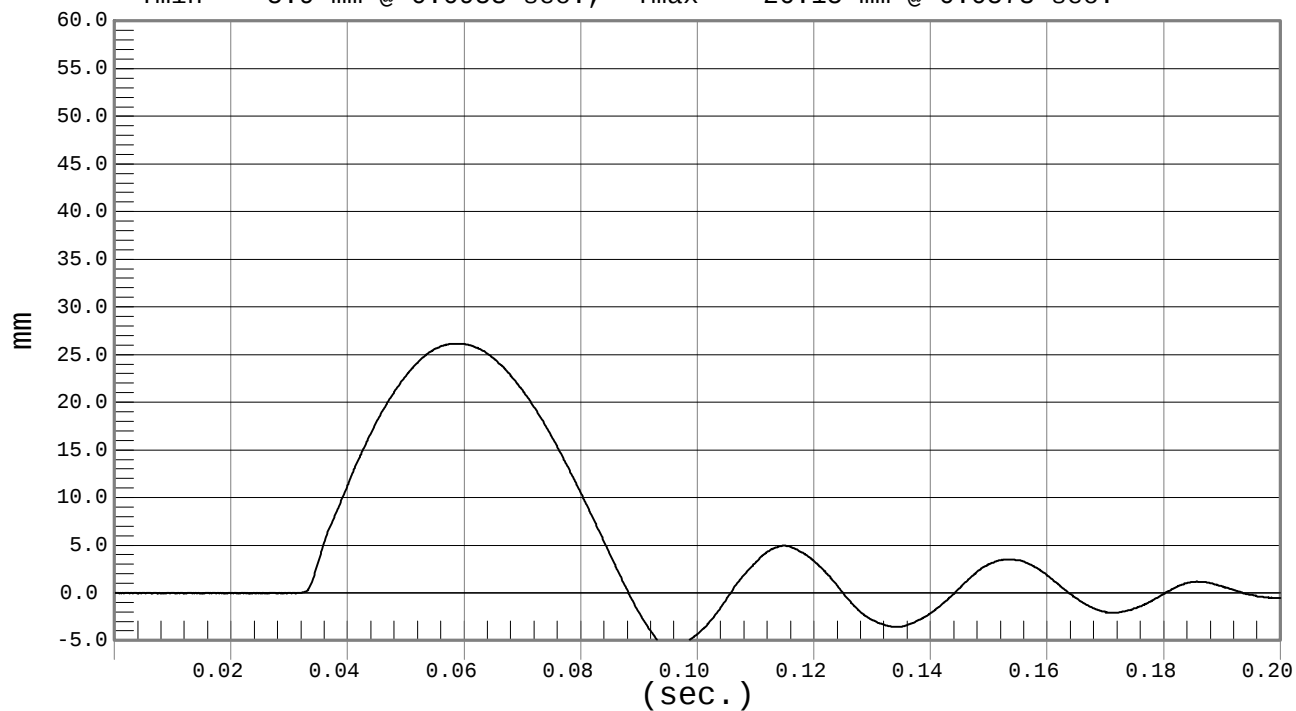


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.9 mm @ 0.0953 sec., Ymax = 26.15 mm @ 0.0578 sec.

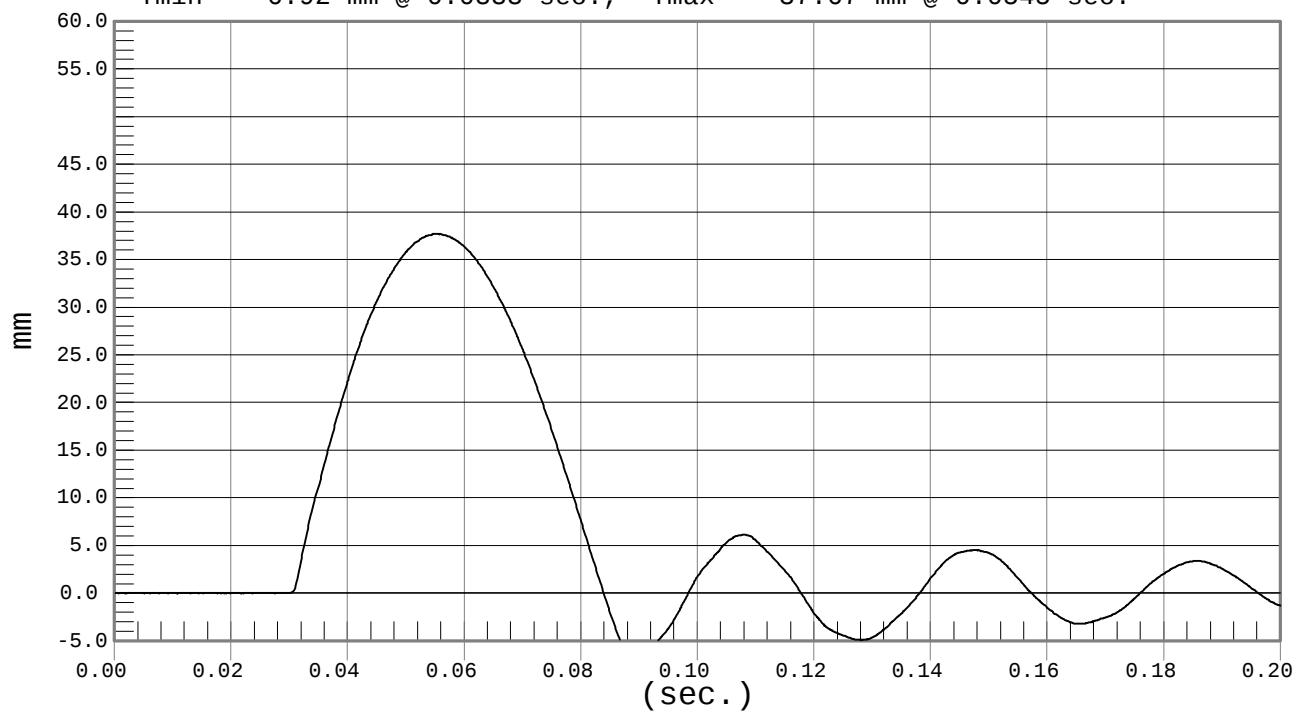


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.92 mm @ 0.0888 sec., Ymax = 37.67 mm @ 0.0545 sec.



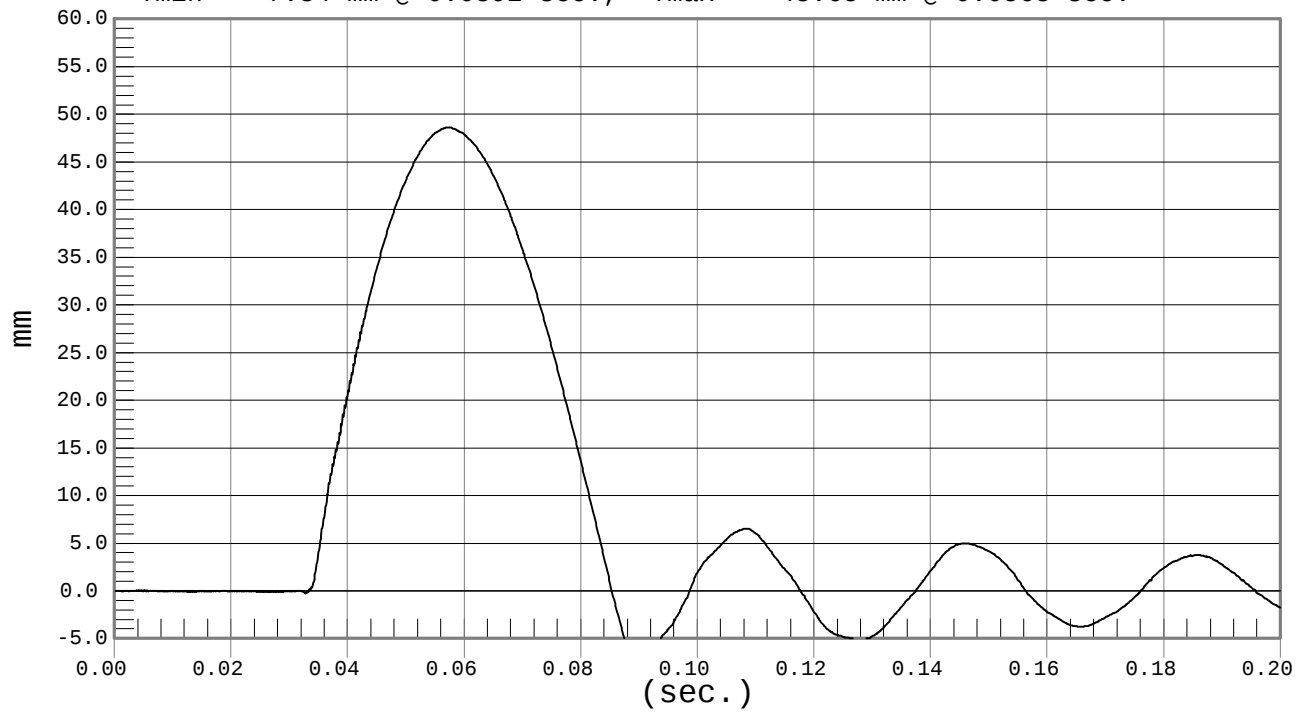


MIDDLE RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.34 mm @ 0.0892 sec., Ymax = 48.65 mm @ 0.0568 sec.



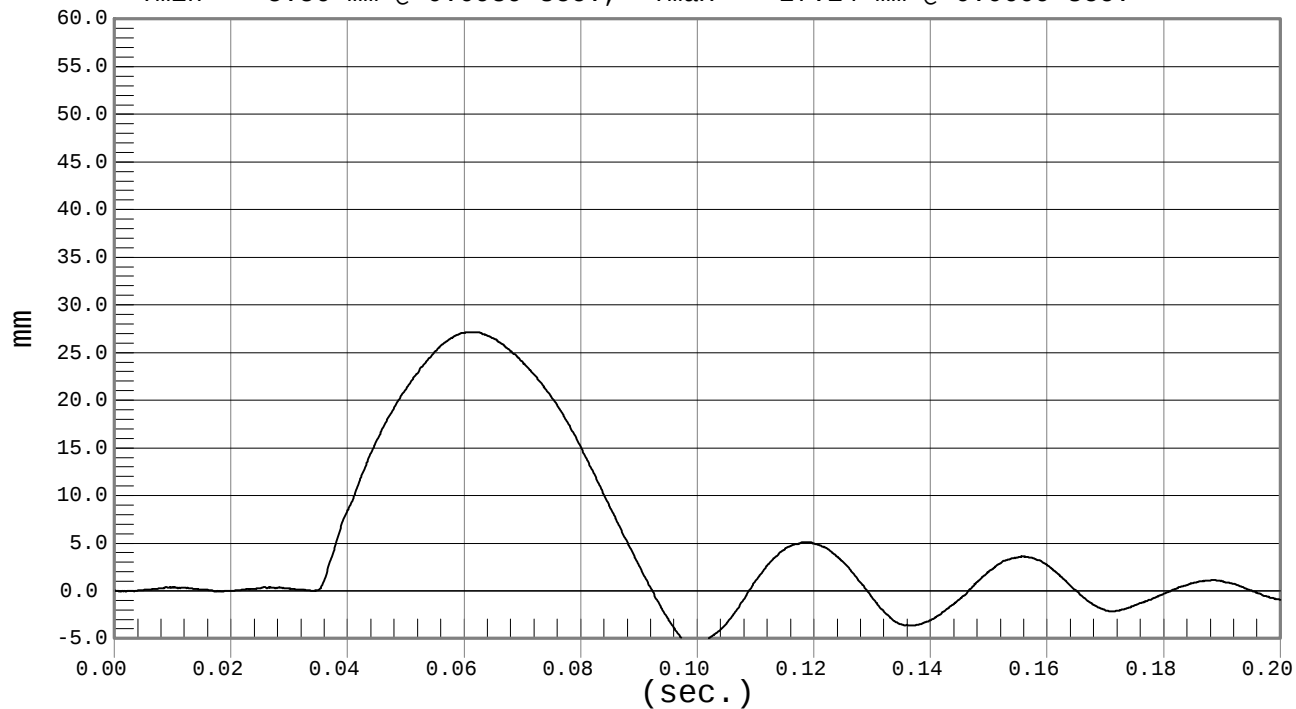


LOWER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.56 mm @ 0.0989 sec., Ymax = 27.14 mm @ 0.0609 sec.

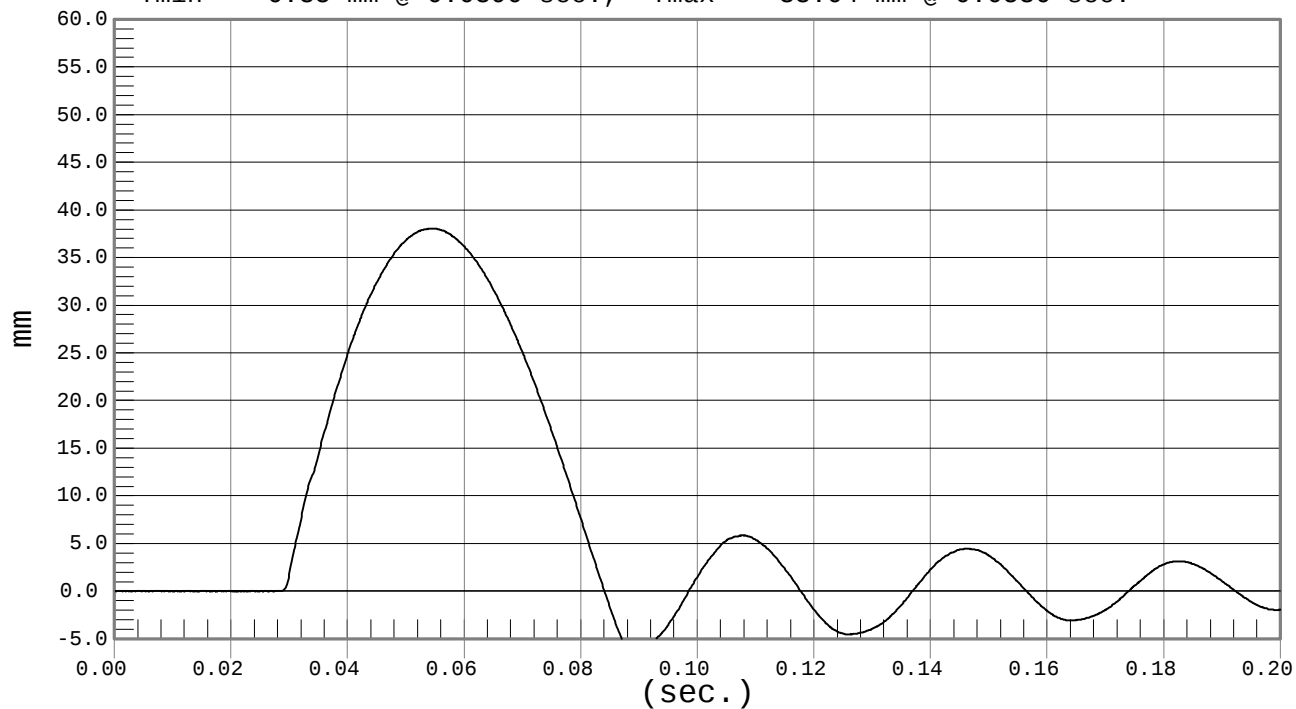


LOWER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.85 mm @ 0.0890 sec., Ymax = 38.04 mm @ 0.0536 sec.



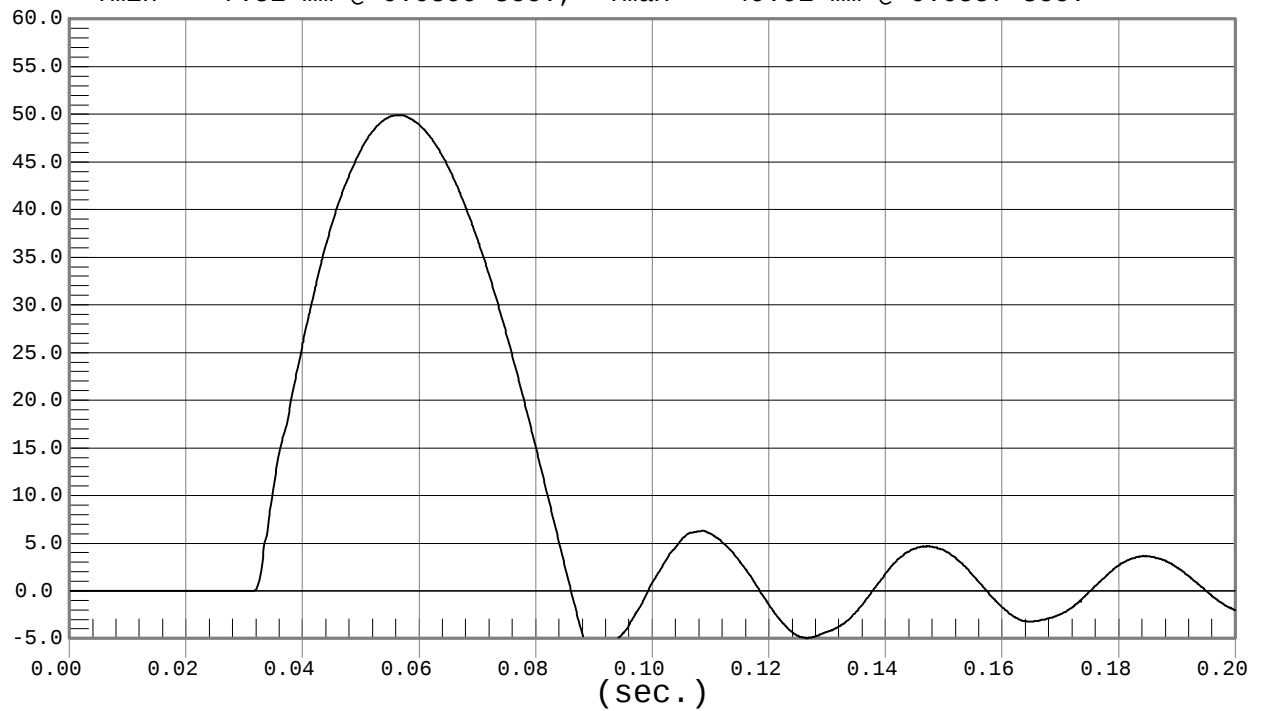


LOWER RIB DISPLACEMENT

Test Desc.: Rib Displacement
Component: Dummy #009

Test Date: 05-12-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.51 mm @ 0.0899 sec., Ymax = 49.91 mm @ 0.0557 sec.



MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

Date: 5/16/05
Dummy Serial Number: 009
Test Number: D051307

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.8
Relative Humidity (%)	10 – 70	31
Probe Speed (m/s)	3.90 – 4.10	4.02
Maximum Impact Force	4.00 – 4.80 kN	4.65
Time of Maximum Force	10.60 – 13.00 ms	11.00
Maximum Total Abdomen Force	2.20 – 2.70 kN	2.57
Time of Max. Total Force	10.00 – 12.30 ms	10.40

TEST MEETS SPECIFICATIONS

Technician: Jessica Gall

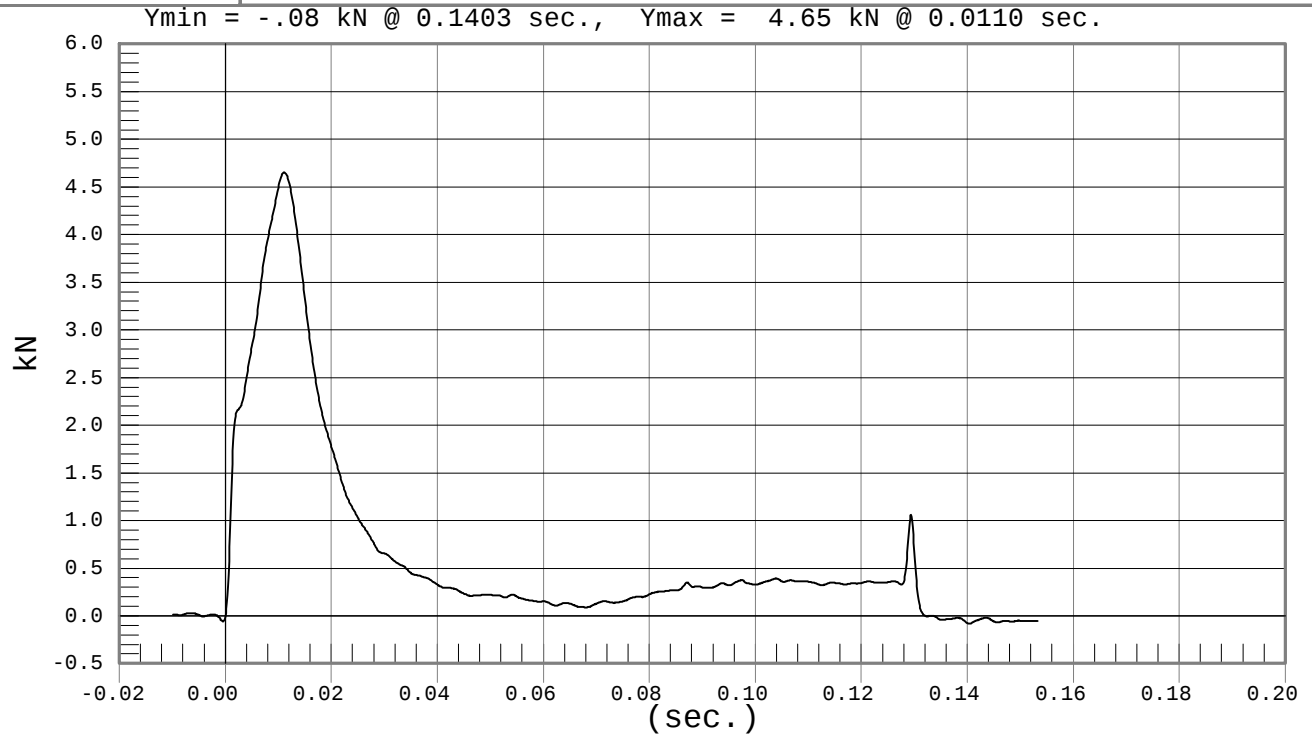
Approved By: David Winkelbauer



IMPACTOR FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

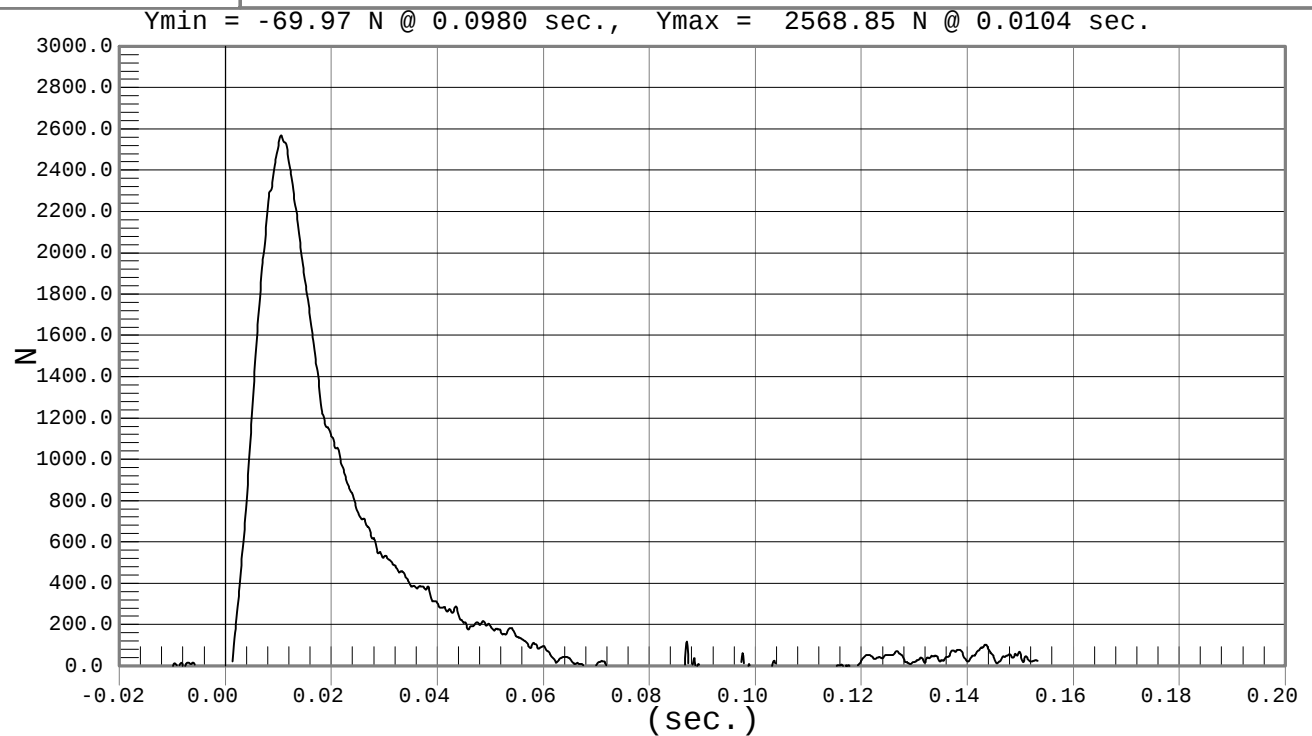
Test Date: 05-16-05
Speed: 13.2 fps, 4.02 M/s



ABDOMEN FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

Test Date: 05-16-05
Speed: 13.2 fps, 4.02 M/s



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date: 5/13/05
Dummy Serial Number: 009
Test Number: D051308

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.5
Relative Humidity (%)		10 – 70	35
Pendulum Speed		5.95 – 6.15	6.10
Pendulum Deceleration	10 msec	-2.46 - -1.59 m/sec	-2.06
	20 msec	-5.25 - -4.07 m/sec	-4.67
	25 msec	-6.64 - -5.30 m/sec	-5.81
	30 msec	≥ -6.5 m/sec	-6.3
Maximum Flexion Angle		45.0 – 55.0 deg	47.9
Time of Max. Flexion Angle		39.0 – 53.0 ms	45.5
Maximum Angle Theta (A)		31.0 – 35.0 deg	51.5
Time of Max. Theta (A)		44.0 – 52.0 ms	45.5
Maximum Angle Theta (B)		27.2– 29.7 deg	27.5
Time of Max. Theta (B)		44.0 – 52.0 ms	44.1

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

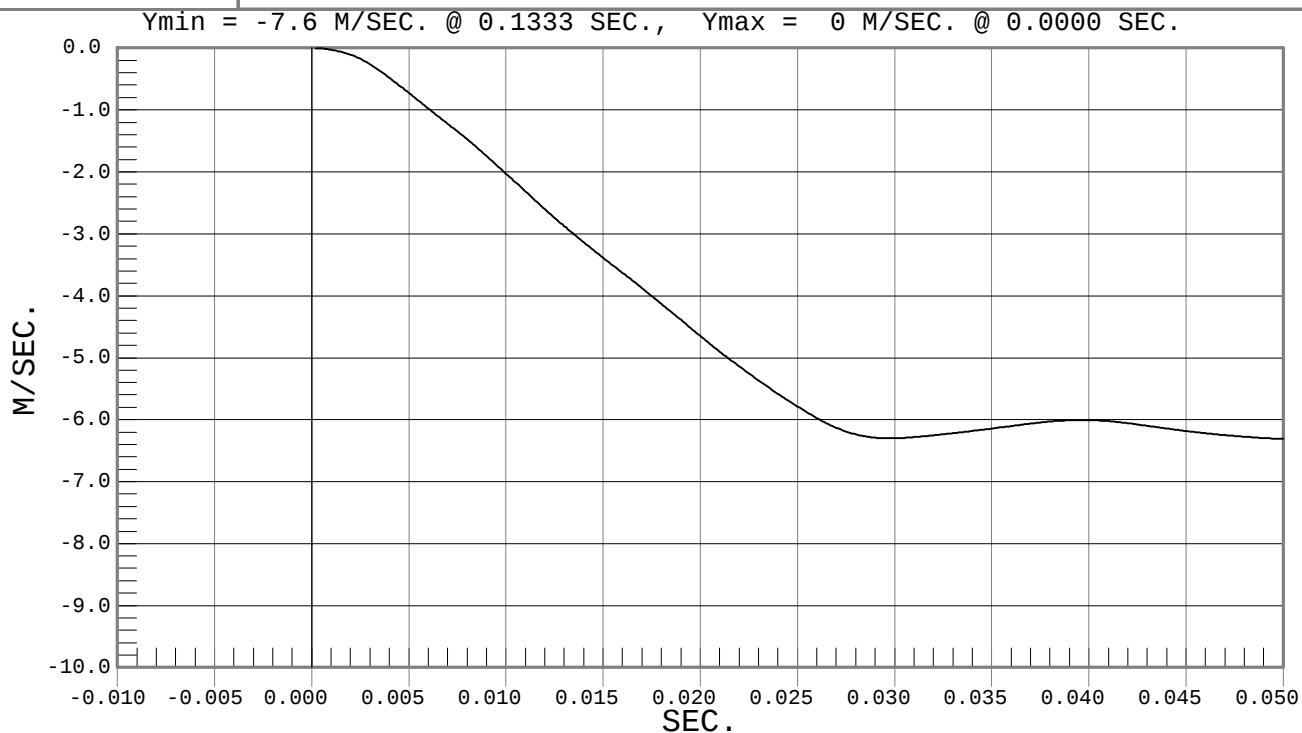
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Lumbar Bending
Component: Dummy #009

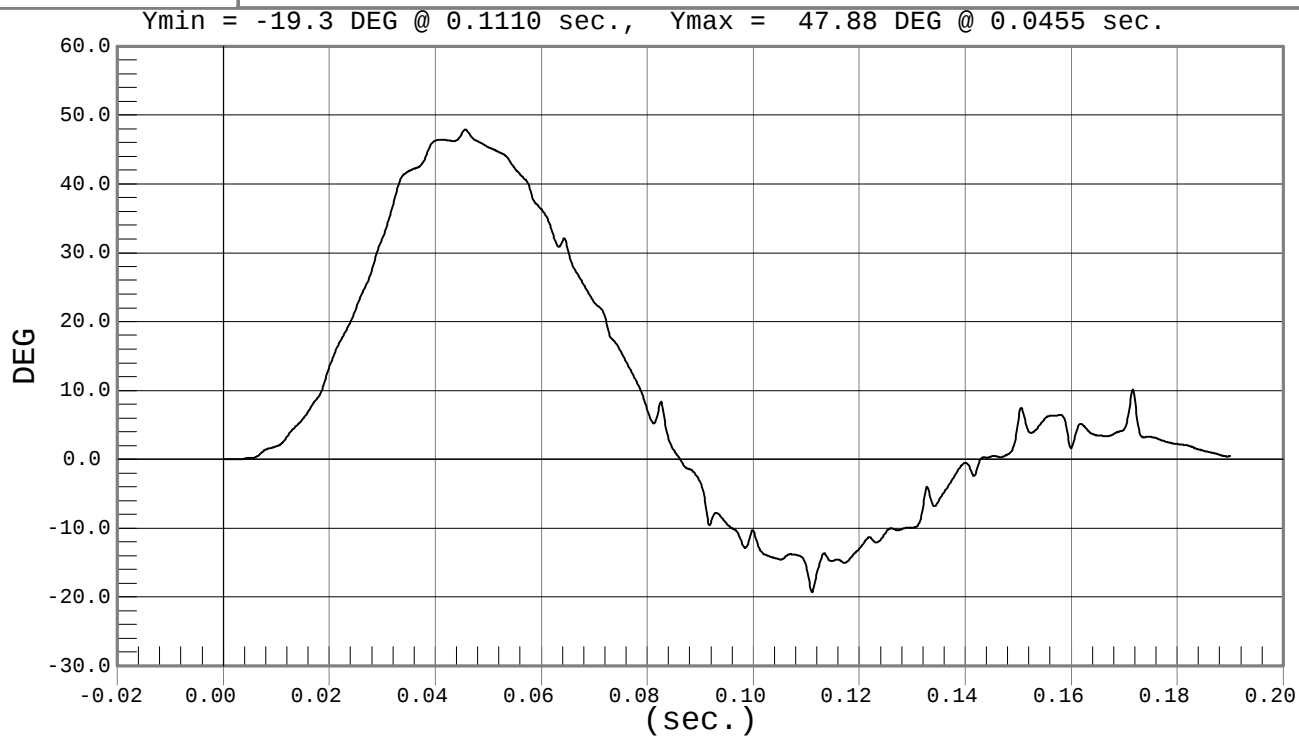
Test Date: 05-13-05
Speed: 20.0 fps, 6.10 M/s



FLEXION ANGLE

Test Desc.: Lumbar Bending
Component: Dummy #009

Test Date: 05-13-05
Speed: 20.0 fps, 6.10 M/s



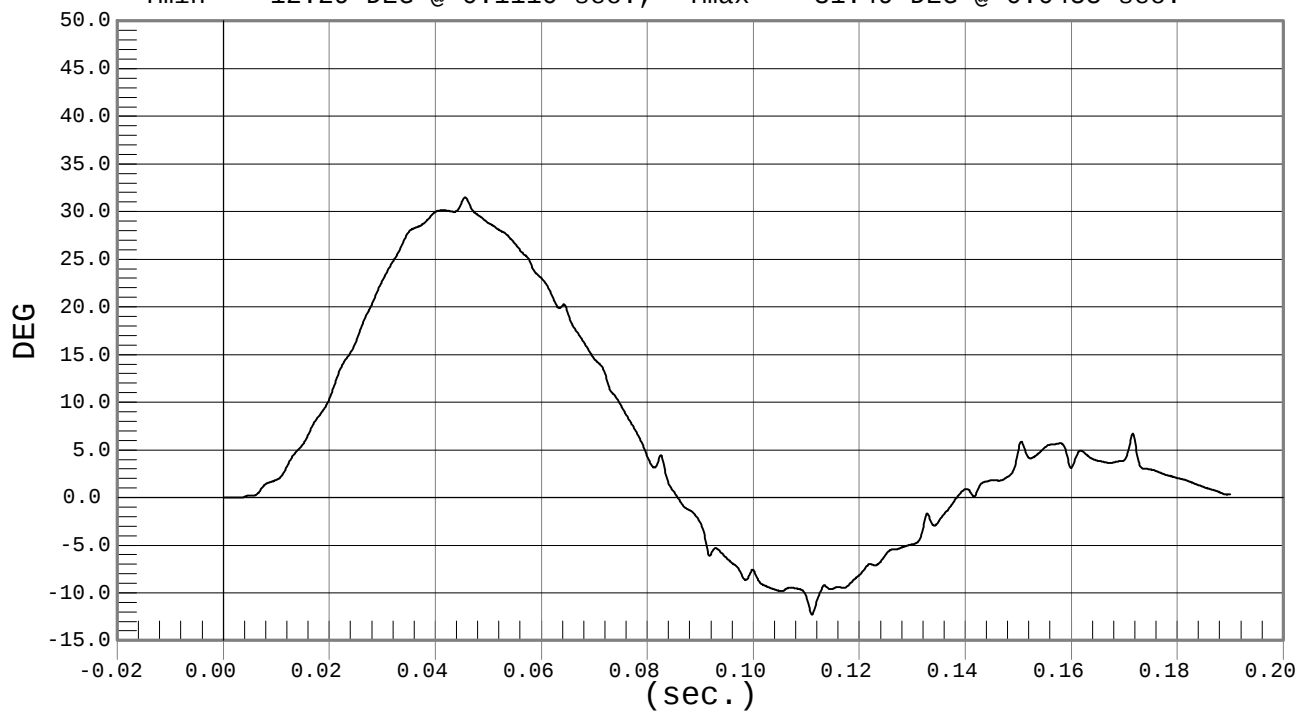


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA A

Test Date: 05-13-05
Speed: 20.0 fps, 6.10 M/s

Ymin = -12.29 DEG @ 0.1110 sec., Ymax = 31.49 DEG @ 0.0455 sec.

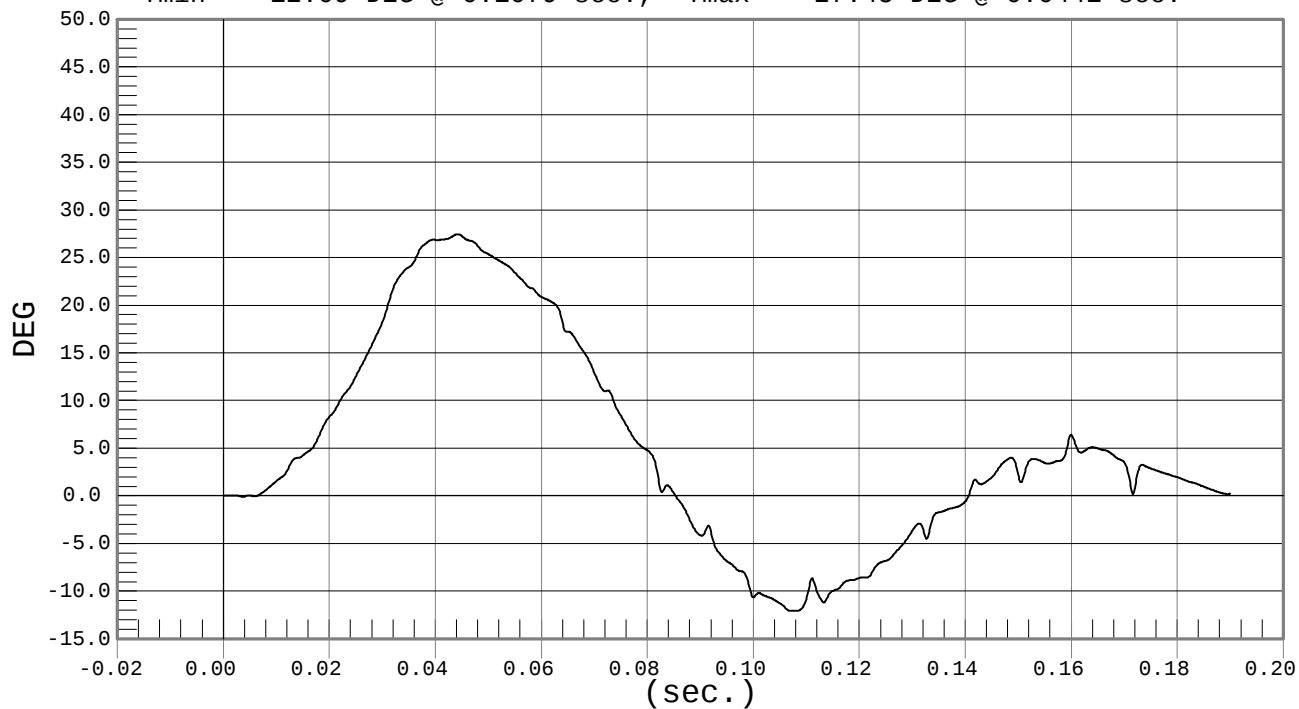


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA B

Test Date: 05-13-05
Speed: 20.0 fps, 6.10 M/s

Ymin = -12.09 DEG @ 0.1079 sec., Ymax = 27.45 DEG @ 0.0441 sec.



MGA RESEARCH CORPORATION
PELVIS TEST
EUROSID 2 DUMMY

Date: 5/16/05
Dummy Serial Number: 009
Test Number: D051309

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.8
Relative Humidity (%)	10 – 70	31
Pendulum Speed	4.20 – 4.40 m/s	4.27
Maximum Impactor Force	4.40 – 5.40 kN	5.18
Time of Max. Impactor Force	10.30 – 15.50 ms	14.60
Maximum Pubic Force	1.04 – 1.64 kN	1.45
Time of Max. Pubic Force	9.90 – 15.90 ms	15.50

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

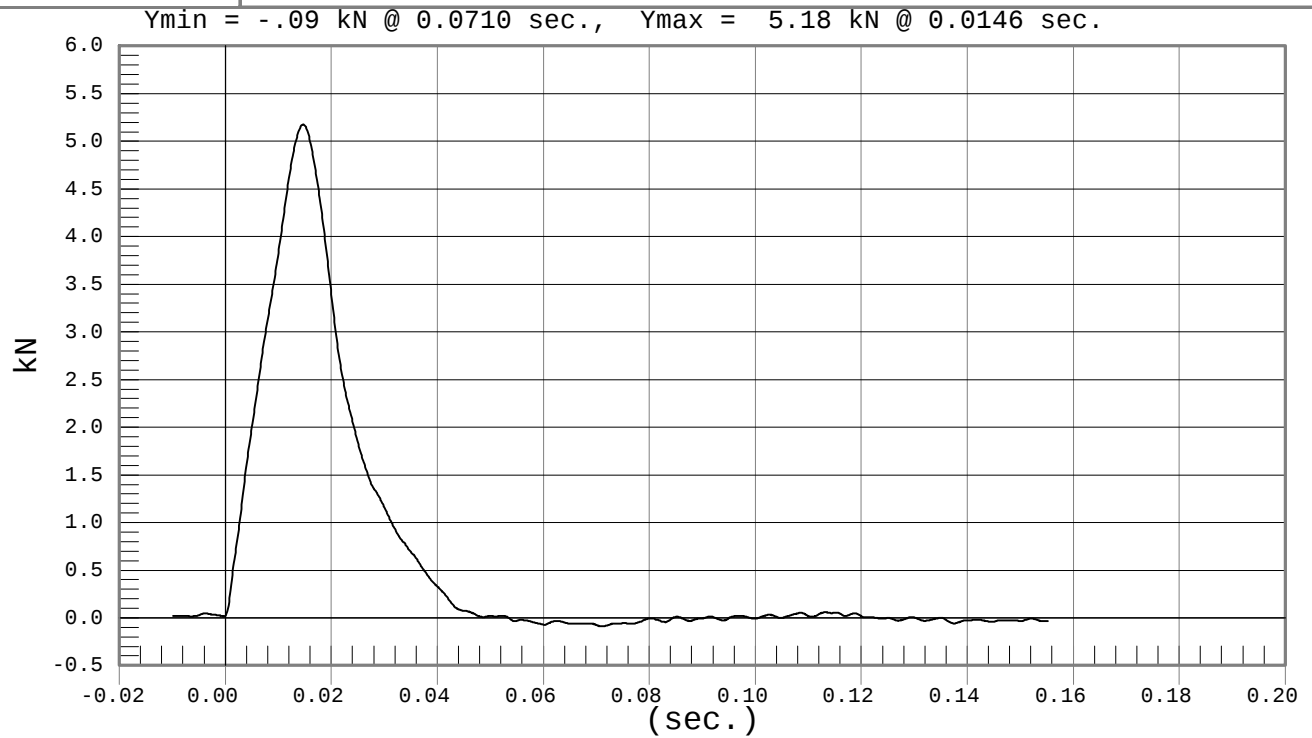
Approved By: David Winkelbauer



IMPACTOR FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

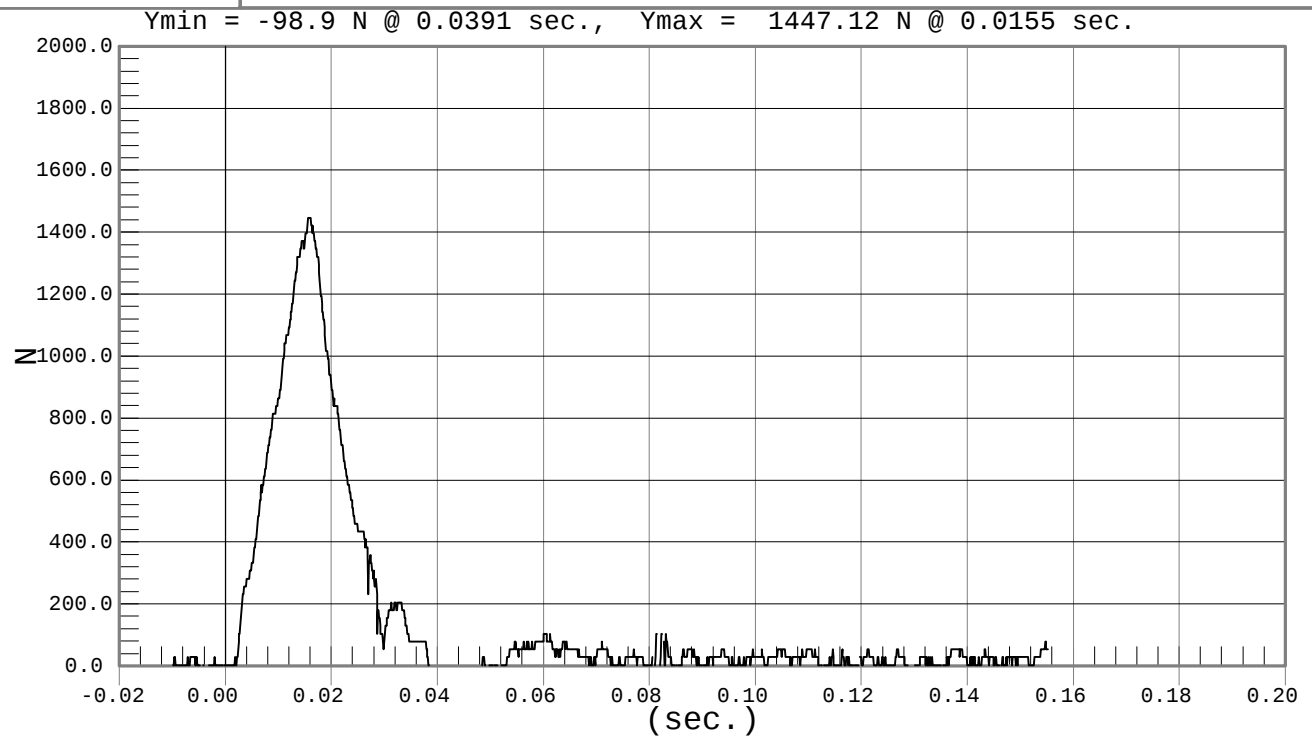
Test Date: 05-16-05
Speed: 14.0 fps, 4.27 M/s



PUBIC FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 05-16-05
Speed: 14.0 fps, 4.27 M/s



APPENDIX D
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY CALIBRATION DATA

	INSTRUMENTS FOR LEFT FRONT DUMMY ES2: 009		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	AGTB5	Endevco	1/03/05
Head Y Accelerometer	ANAN3	Endevco	1/03/05
Head Z Accelerometer	ANAN6	Endevco	1/03/05
Head Y - Front	F16-F14	Entran	11/23/04
Head Z - Front	F28-N03	Entran	11/23/04
Head X – Left	AH0D1	Endevco	11/16/04
Head Z – Left	J11014	Endevco	11/16/04
Head X – Upper	J10730	Endevco	11/16/04
Head Y – Upper	AP2G9	Endevco	11/16/04
Upper Neck Load Cell	105	FTSS	9/27/04
Lower Neck Load Cell	110	FTSS	9/27/04
Shoulder Load Cell	119	Endevco	9/24/04
T12 Load Cell	103	Endevco	9/24/04
Upper Spine X	J22034	Endevco	11/16/04
Upper Spine Y	AJ9T6	Endevco	1/03/05
Upper Spine Z	AH0M0	Endevco	11/16/04
Lower Spine X	AGM47	Endevco	1/03/05
Lower Spine Y	AJ9D9	Endevco	1/03/05
Lower Spine Z	AJ820	Endevco	1/03/05
Torso Load Cell	102	FTSS	9/29/04
Upper Rib Y	AN8D5	Endevco	1/03/05
Mid Rib Y	AC913	Endevco	1/03/05
Lower Rib Y	J12450	Endevco	1/03/05
Rib Displacement	009	Honeywell	1/03/05
Front Abdomen FY	ABG122FY	FTSS	9/30/04
Mid Abdomen FY	ABG123FY	FTSS	9/30/04
Rear Abdomen FY	ABG124FY	FTSS	9/30/04
Pubic Symphysis FY	PG115FY	FTSS	9/24/04
Pelvis X	C17-J01	Entran	3/11/05
Pelvis Y	A12-Z12	Entran	3/11/05
Pelvis Z	C15-Z02	Entran	3/11/05
Right Femur Load Cell	135	FTSS	9/28/04
Left Femur Load Cell	136	FTSS	9/28/04
Lumbar Load Cell	104	FTSS	9/27/04

VEHICLE INSTRUMENTS CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Mid A-Post Y	B28-Z01	Entran	3/17/05
Left Lower A-Post Y	K11-Z01	Entran	4/28/05
Left Mid B-Post Y	J23-M10	Entran	12/01/04
Left Lower B-Post Y	A08-M09	Entran	3/17/05
Left A-Post @ Sill Y	H20-R08	Entran	3/09/05
Left B-Post @ Sill Y	B28-Z02	Entran	3/17/05
Driver Seat Track Y	J25-R17	Entran	12/01/04
Right Front Sill X	C06-L08	Entran	3/24/05
Right Front Sill Y	F04-R22	Entran	3/17/05
Right Front Sill Z	C06-L16	Entran	3/24/05
Left Rear Sill Y	A09-N37	Entran	3/27/05
Left Front Sill Y	B28-Z22	Entran	3/17/05
Floorpan @ Rear Axle X	B28-Z17	Entran	3/24/05
Floorpan @ Rear Axle Y	C04-L01	Entran	3/24/05
Floorpan @ Rear Axle Z	B28-Z13	Entran	3.24/05
Vehicle CG X	C04-L12	Entran	3/24/05
Vehicle CG Y	C04-L11	Entran	3/24/05
Vehicle CG Z	C04-L13	Entran	3/24/05
Left Front Door @ Pelvis	C09-Y14	Entran	3/31/05
Left Front Door @ Arm	C09-Y13	Entran	3/31/05
Left Front Door @ Knee	J07-M13	Entran	4/28/05
Left Front Door @ Mid Rib	C09-Y07	Entran	3/31/05
Upper Engine X	B19-Z09	Entran	3/09/05
Upper Engine Y	K03-J17	Entran	1/21/05
Firewall Y	B19-Z02	Entran	3/09/05

APPENDIX E
DUMMY PEAK RESPONSES

DRIVER (ES-2) PEAK RESPONSE TABLE

Location	Peak Response				
				2005 Ford Expedition 5/11/2005	
	Class	Axis	Units	Peak	Time
Head	1000	X	G	-22.9	58
	1000	Y	G	90.9	58
	1000	Z	G	-25.4	61
	1000	RES	G	94.4	58
Head Injury Criteria (HIC)				688.5	
t1					50.8
t2					65.2
Upper Neck Force	1000	X	N	-418	60
	1000	Y	N	-234	80
	1000	Z	N	1192	56
	1000	RES	N	1218	56
Upper Neck Moment	600	X	Nm	-79.7	58
	600	Y	Nm	-58.2	60
	600	Z	Nm	-20.6	131
	600	RES	Nm	97.5	59
Lower Neck Force	1000	X	N	-774	62
	1000	Y	N	1211	57
	1000	Z	N	1477	56
	1000	RES	N	1979	57

Location	Peak Response				
				2005 Ford Expedition 5/11/2005	
	Class	Axis	Units	Peak	Time
Lower Neck Moment	600	X	Nm	-54.2	156
	600	Y	Nm	81.7	65
	600	Z	Nm	-21.1	126
	600	RES	Nm	84.1	68
Shoulder Force	600	X	N	-3523	53
	600	Y	N	5216	54
	600	Z	N	-572	50
Upper Spine	180	X	G	-20.6	53
	180	Y	G	72.6	55
	180	Z	G	14.3	59
	180	Res	G	75.1	55
Lower Spine	180	X	G	-9.3	83
	180	Y	G	75	52
	180	Z	G	10.7	59
	180	Res	G	75.3	52
Upper Rib	180	Y	G	114.9	52
Mid Rib	180	Y	G	112.4	51
Lower Rib	180	Y	G	163.8	52
Upper Rib Deflection	180	Y	mm	-25.7	61

Location	Peak Response				
				2005 Ford Expedition 5/11/2005	
	Class	Axis	Units	Peak	Time
Mid Rib Deflection	180	Y	mm	-18.5	59
Lower Rib Deflection	180	Y	mm	-16	59
Torso Force	600	X	N	706	55
	600	Y	N	-724	54
Torso Moment	600	Y	Nm	-20	67
	600	Z	Nm	-13.6	65
T12 Force	600	X	N	1052	68
	600	Y	N	4689	52
T12 Moment	600	X	Nm	-19051	73
	600	Y	Nm	152	66
Abdomen Front Force	600	Y	N	412	47
Abdomen Mid Force	600	Y	N	3557	51
Abdomen Rear Force	600	Y	N	3207	53
Abdomen Summed Force	600	Y	N	6973	52
Pubic Symphysis Force	600	Y	N	-2575	54

Location	Peak Response				
				2005 Ford Expedition 5/11/2005	
	Class	Axis	Units	Peak	Time
Right Femur Force	600	X	N	507	64
	600	Y	N	-1297	64
	600	Z	N	1748	61
	600	RES	N	2063	63
Right Femur Moment	600	X	Nm	133.3	63
	600	Y	Nm	-42.3	57
	600	Z	Nm	32.2	76
	600	RES	Nm	135	63
Left Femur Force	600	X	N	-408	77
	600	Y	N	-712	50
	600	Z	N	1653	55
	600	RES	N	1818	55
Left Femur Moment	600	X	Nm	-106.4	69
	600	Y	Nm	-47.3	83
	600	Z	Nm	-17.2	70
	600	RES	Nm	108	69
Pelvis	1000	X	G	16.2	59
	1000	Y	G	-40.5	71
	1000	Z	G	-13.4	51

Location	Peak Response				
				2005 Ford Expedition 5/11/2005	
	Class	Axis	Units	Peak	Time
AR (Arm to Door)			mm	117	
HP (H-Point to Door)			mm	184	
HR (Head to Roof)			mm	191	
HS (Head to Side)			mm	322	
Vehicle Weight			kg	2702.5	
Impact Speed			kph	32.2	
Impact Point Rearward			mm	4	