

REPORT NUMBER: TO1-MGA-2004-008

**OBLIQUE RIGID SIDE POLE IMPACT
ES-2RE DRIVER POSITION, HIII 6YO LEFT REAR POSITION
TEST DATE: MARCH 16, 2005
Task Order #T0001 / RFP #0004**

**2005 SUBARU FORESTER
NHTSA NUMBER: R55506**

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FINAL REPORT SUBMITTED:

**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 DTRS57-04-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 and a Hybrid III 6 year old was placed in the left rear passenger 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.

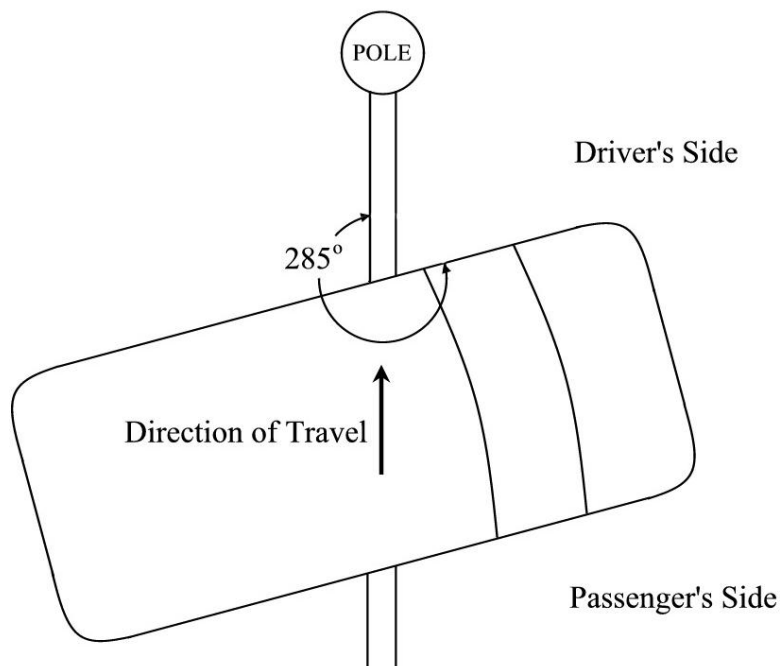
SECTION 2

SUMMARY OF SIDE IMPACT TEST

An oblique rigid side pole impact test at 75 degrees was performed on a 2005 Subaru Forester. The subject vehicle was towed into an oblique rigid pole at a velocity of 32.5 km/h. The weight of the vehicle as tested was 1560.4 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on March 16, 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. A Hybrid III 6 year old dummy was placed in the left rear seating position in a Graco Turbo Booster with the back of the booster seat removed. 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:

		Left Front
HIC 36 (CFC 1000)	T1 (msec)	54.7
	T2 (msec)	56.3
	HIC 36	2053.6
Thorax (CFC 180)		
Chest Deflection	Upper Rib Deflection	42.9
	Mid Rib Deflection	41.0
	Lower Rib Deflection	41.6
Lower Spine (CFC 180)		
	Lower Spine Resultant	46.0
Abdomen (CFC 600)		
	Front Abdominal Force	252
	Mid Abdominal Force	468
	Rear Abdominal Force	670
	Sum of Abdominal Force	1377
Pelvis (CFC 600)		
	Pubic Symphysis Force	-2291

Contact Times	Left Front
Head (msec)	**
Arm (msec)	18.8
Rib (msec)	20.2
Pelvis (msec)	24.8

** Not collected during test (due to combination airbag)

Test Notes

Driver T-12 MX – No valid data collected
Left Mid B-Post Y – No valid data after 18 msec
LF Door @ Mid Rib Y – No valid data after 20 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 Subaru Forester

Test Date: March 16, 2005

TEST VEHICLE INFORMATION

Make	Subaru
Model	Forester
Body Style	Passenger Car
VIN	JF1SG63645G729503
Color	Black
Odometer Reading (mile)	85
Transmission	Manual
Final Drive	Full Time All Wheel Drive
Number of Cylinders	4
Engine Displacement (L)	2.5
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	Fuji Heavy Ind. Ltd.	GVWR (kg)	1880
Date of Manufacture	9/04	GAWR Front (kg)	930
		GAWR Rear (kg)	1000

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Cold Pressure (kPa)	200	190
Recommended Tire Size	P215/60R16	P215/60R16
Tire Size on Vehicle	P215/60R16	P215/60R16
Tire Manufacturer	Yokohama	Yokohama

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				408
Cargo Wt. (RCLW) (kg)				68.0

DATA SHEET NO. 1... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	394.6	323.0		409.6	376.0	
Right	kg	390.1	313.0		427.3	347.5	
Ratio	%	55.2	44.8		53.6	46.4	
Totals	kg	784.7	636.0	1420.7	836.9	723.5	1560.4

TARGET TEST WEIGHT

Measured Parameter	Units	Value
As Delivered Vehicle Weight	kg	1420.7
Weight of 1 ES-2	kg	80.7
Rated Cargo Weight	kg	68.0
Vehicle Target Weight (TVTW)	kg	1569.4

TEST VEHICLE ATTITUDES

	Unit	As Delivered	Fully Loaded	Ready for Test
Right Door Sill Angle	Deg	0.0	0.3 ND	0.0
Left Door Sill Angle	Deg	0.5 NU	0.7 NU	0.3 NU
Front Bumper Angle	Deg	0.3 LU	0.5 LD	0.1 LD
Rear Bumper Angle	Deg	0.3 RU	0.5 RU	0.0

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

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2520
Weight of Ballast in Cargo Area	kg	0.0
Amount of Water in Fuel Tank	liters	28.4

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Impact Reference Line from Front Axle	mm	1238
Impact Point	mm	13 mm rear
Impact Angle Difference	deg	0.2

DATA SHEET NO. 1... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005

NORMAL DESIGN RIDING POSITION

Driver seat back angle: 11.5° from the seat back's most vertical position

SEAT FORE/AFT POSITIONS

The driver's seat was manual operated.

Driver seat fore/aft total travel: 17 notches

Driver seat fore/aft position: 9 of 17 notches

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.

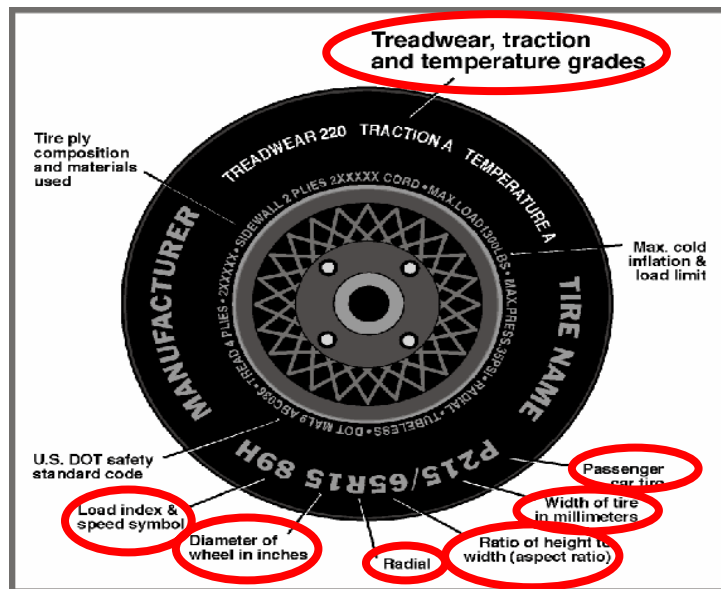
DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005

Vehicle Year	2005	Vehicle Make	Subaru
VIN	JF1SG63645G729503	Vehicle Model	Forester



	Front	Rear
Tire Manufacturer	Yokohama	Yokohama
Tire Name	Geolandar	Geolandar
Tire Type	M+S	M+S
Tire Width (mm)	215	215
Ratio of Height to Width (aspect ratio)	60	60
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	94H	94H
Treadwear	320	320
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 3
POST TEST OBSERVATIONS

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front	Left Rear
Dummy Type	ES-2RE	HIII 6 year old
Head Contact	Pole, Headrest	C Pillar, Seat Belt, seat back
Upper Torso Contact	Door Panel	
Lower Torso Contact	Door Panel	Booster Seat
Left Knee Contact	Door panel	Door Panel
Right Knee Contact	Left knee	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

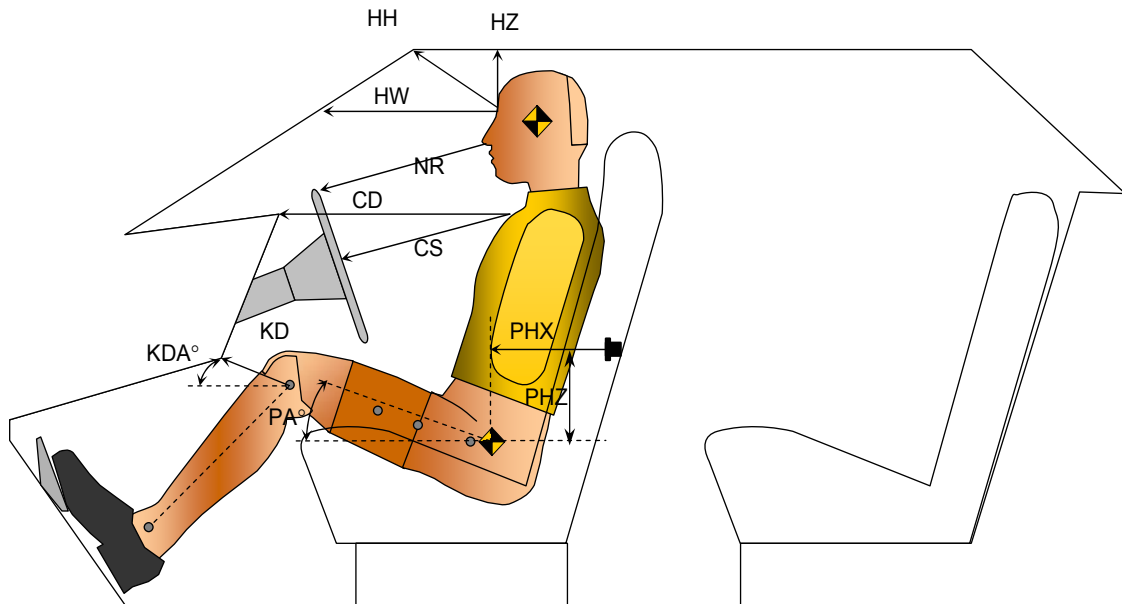
	Driver
Front	No
Side	Yes
Curtain	

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

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

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005

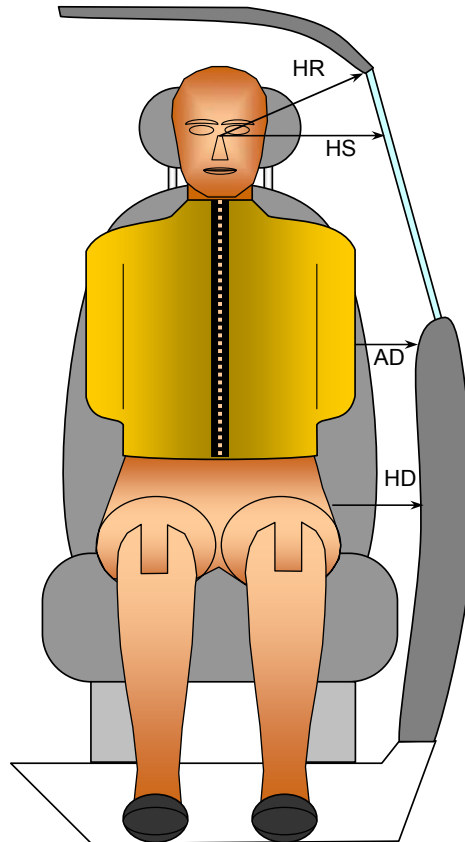


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	377	
HW	Head to Windshield	533	
HZ	Head to Roof	169	
NR	Nose to Rim	413	
CD	Chest to Dash (Top of Rib)	517	
CS	Chest to Steering Wheel (Top of Rib)	347	
KDL	Left Knee to Dash	149	28.3
KDR	Right Knee to Dash	161	29.3
PA	Pelvic Angle (Longitudinal)		22.7
PA	Pelvic Angle (Lateral)		-6.5
SA	Spine Angle (Longitudinal)		27.0
SA	Spine Angle (Lateral)		0.0
PHX	H-Point to Striker (X-Axis)	167	
PHZ	H-Point to Striker (Z-Axis)	61	

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

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005



FRONT VIEW OF DUMMY

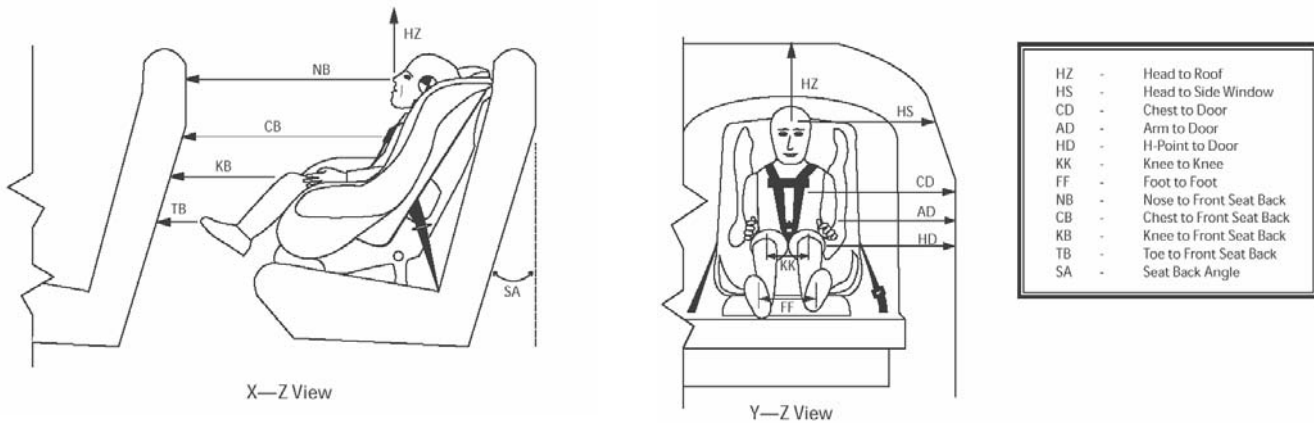
Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	205
HS	Head to Side Window	mm	302
AD	Arm to Door	mm	72
HD	H-Point to Door	mm	129

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

Child Restraint System

Graco Turbo Booster (Forward Facing) Without Back

Dummy Measurements for CRS Passengers



Measurement	Pre-Test (mm)
	CRS (144)
SA (deg)	11.6
HS	384
CD	357
AD	200
HD	219
HZ	354
NB	612
CB	582
KK	167
FF	156
KB - LEFT	341
KB - RIGHT	325
TB - LEFT	58
TB - RIGHT	58
Arm rest to door panel	2 (below armrest)
Bottom of window sill to top of head	165
Top of vehicle armrest to top of booster seat armrest	70

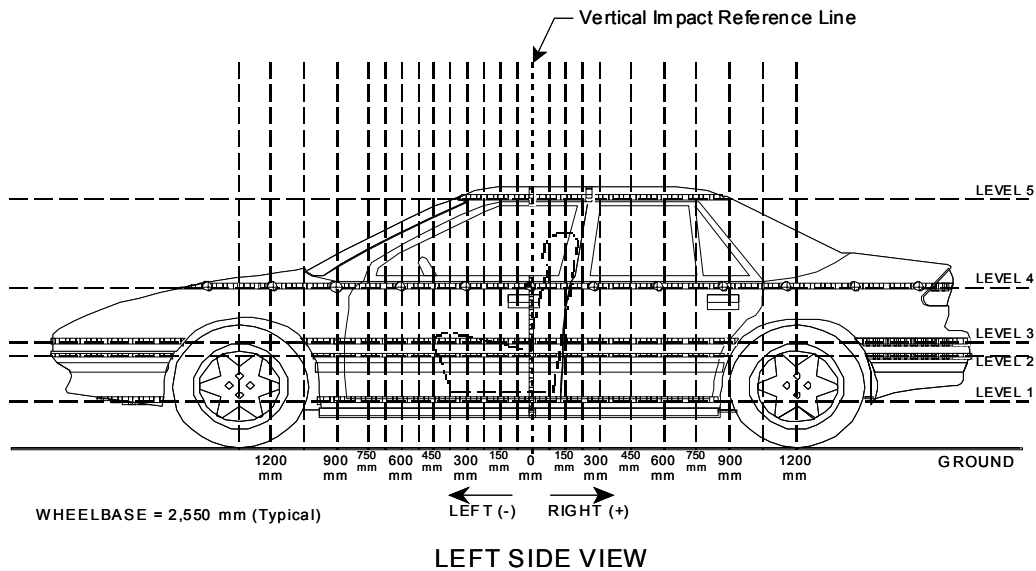
All dimensions in mm (unless noted)
Left Rear Passenger (Forward facing)

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

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 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	1622
4	Window Sill	1134
3	Mid Door	807
2	Occupant H-Point	740
1	Sill Top	425

DATA SHEET NO. 8
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 2005

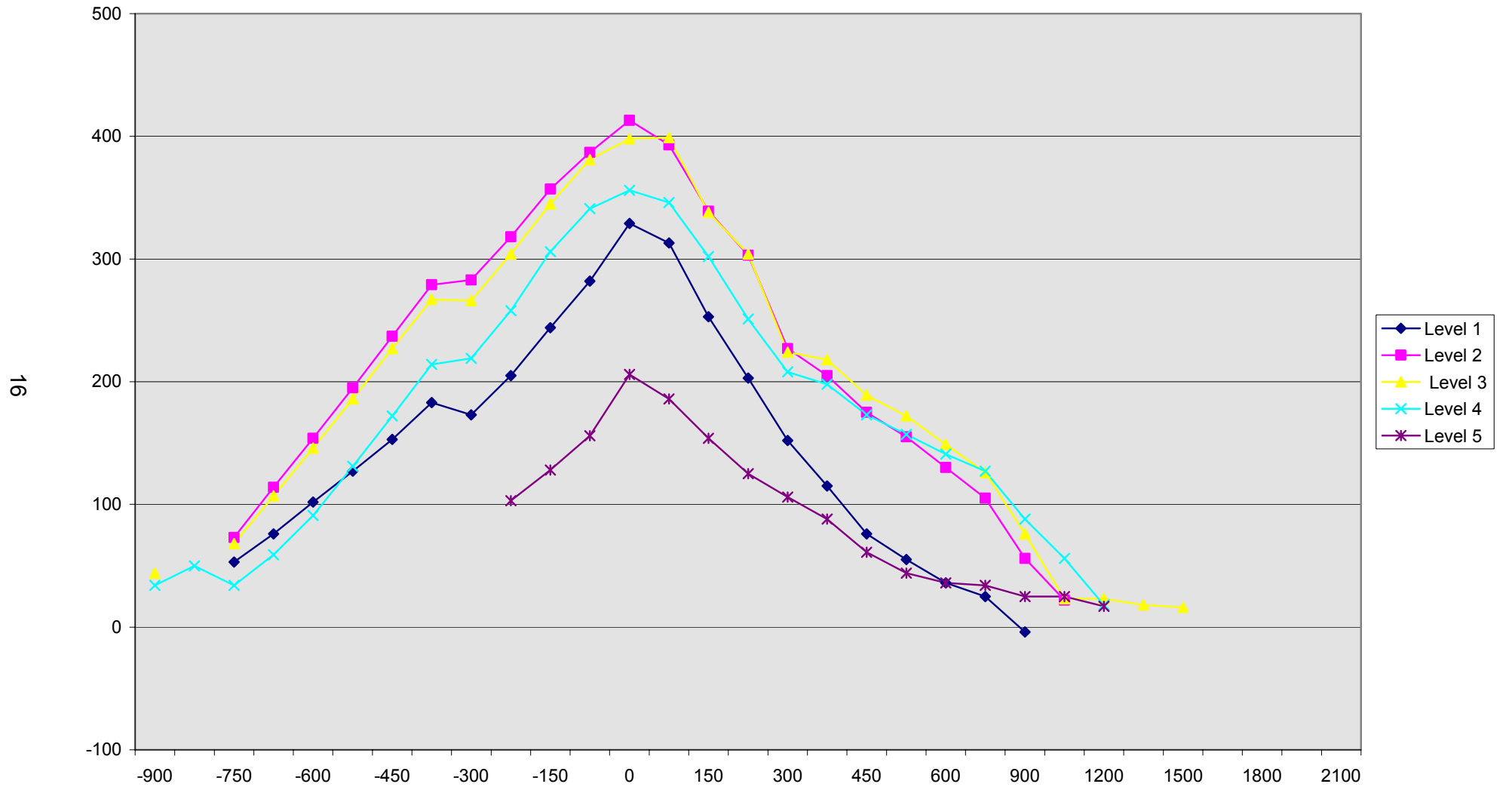
Pre-Test						Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900			228	290				272	324				44	34	
-825				285					335					50	
-750	308	241	245	285		361	314	313	319		53	73	68	34	
-675	319	242	245	285		395	356	352	344		76	114	107	59	
-600	323	243	245	286		425	397	391	377		102	154	146	91	
-525	325	242	244	284		452	437	430	415		127	195	186	131	
-450	326	241	243	285		479	478	470	457		153	237	227	172	
-375	325	241	243	285		508	520	510	499		183	279	267	214	
-300	325	240	243	285		498	523	509	504		173	283	266	219	
-225	324	240	242	286	512	529	558	546	544	615	205	318	304	258	103
-150	325	239	241	287	499	569	596	586	593	627	244	357	345	306	128
-75	326	239	241	290	500	608	626	622	631	656	282	387	381	341	156
0	325	240	242	293	498	654	653	640	649	704	329	413	398	356	206
75	325	240	241	293	501	638	633	640	639	687	313	393	399	346	186
150	324	240	241	292	501	577	579	579	594	655	253	339	338	302	154
225	324	240	241	293	503	527	543	545	544	628	203	303	304	251	125
300	325	239	242	293	503	477	466	466	501	609	152	227	224	208	106
375	325	240	242	295	505	440	445	460	493	593	115	205	218	198	88
450	324	240	243	296	505	400	415	432	469	566	76	175	189	173	61
525	324	240	243	298	506	379	395	415	455	550	55	155	172	157	44
600	324	241	244	298	507	360	371	393	439	543	36	130	149	141	36
750	322	241	245	298	508	347	346	371	425	542	25	105	126	127	34
900	307	237	246	302	512	303	293	322	390	537	-4	56	76	88	25
1050		234	236	305	513		256	259	361	538		22	23	56	25
1200			236	307	516			259	325	533			23	18	17
1350			236					254					18		
1500			236					252					16		
1650															
1800															
1950															
2100															

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: 2005 Subaru Forester

Test Date: March 16, 2005

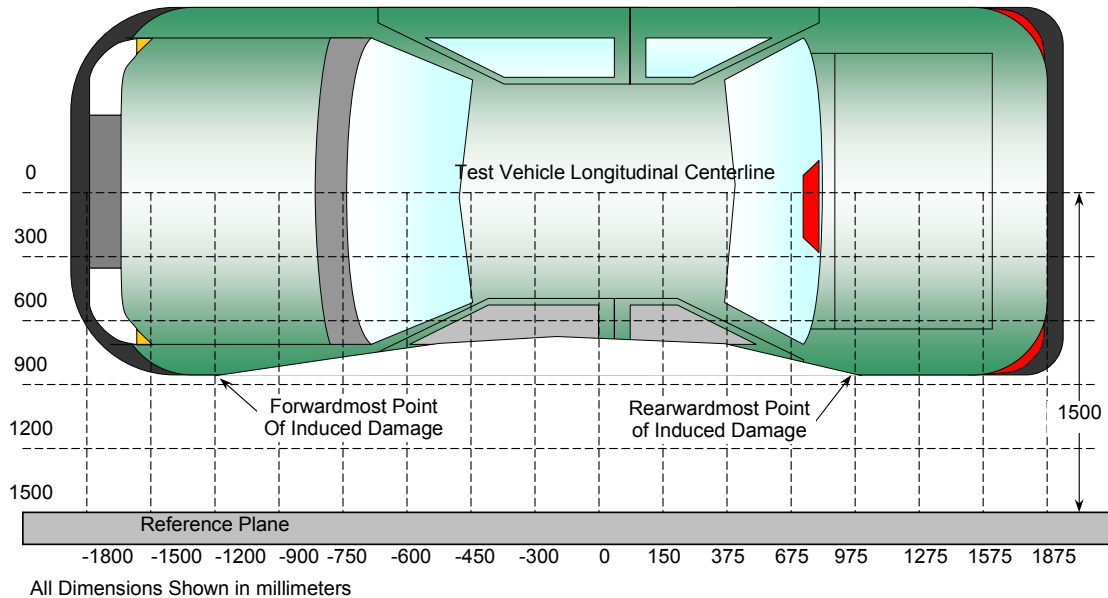


Measurement in mm.

DATA SHEET NO. 9 **VEHICLE DAMAGE PROFILE DISTANCES**

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 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	1725 mm	3	262	291	29
2	1049 mm	3	236	259	23
3	342 mm	3	243	440	197
4	-498 mm	2	241	495	254
5	-1187 mm	4	290	324	34
6	-1875 mm	4	372	350	-22

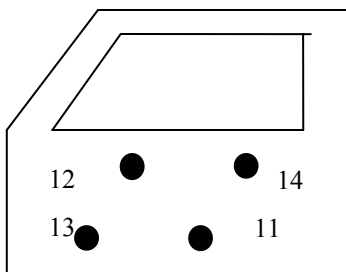
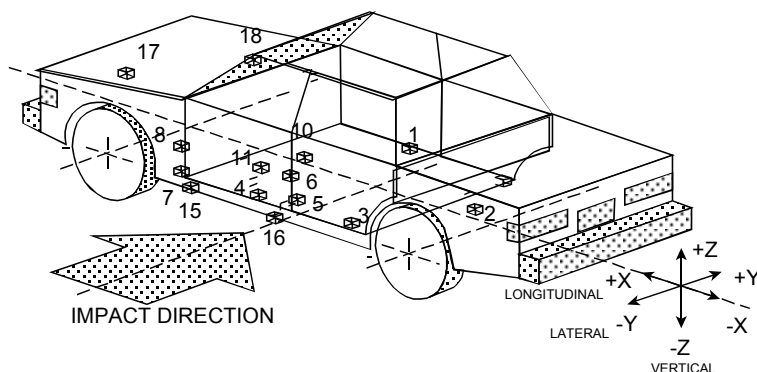
Reference plane is parallel to test vehicle longitudinal centerline.

Given dimensions = Reference plane to car body.

DATA SHEET NO. 10 **VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY**

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 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. 10... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Subaru Forester

Test Date: March 16, 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	2.2	-4.9	13.4	-0.7	4.0	-4.8	13.7
2	Rear Floorpan Above Axle	1.4	-7.2	12.4	-1.6	4.2	-4.8	13.0
3	Left Side Sill at Rear Door			18.3	-2.4			
4	Left Side Sill at Front Door			74.3	-5.8			
5	Left Lower B-Post			81.7	-6.2			
6	Left Mid B-Post			*	*			
7	Left Lower A-Post			20.1	-11.9			
8	Left Mid A-Post			18.1	-6.1			
9	Driver Left Seat Track			104.6	-28.6			
10	Vehicle CG	1.8	-7.4	24.8	-0.8	11.6	-9.7	25.4
11	Left Front Door at Pelvis			159.8	-60.8			
12	Left Front Door at Arm			156.8	-30.9			
13	Left Front Door at Knee			106.1	-38.3			
14	Left Front Door at Rib			**	**			
15	Left A-Post @ Sill			17.7	-26.6			
16	Left B-Post @ Sill			67.9	-3.9			
17	Upper Engine	5.9	-12.3	19.7	-5.3			
18	Firewall			12.4	-1.7			

* No valid data collected after 18 msec

** No valid data collected after 20 msec

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

DATA SHEET NO. 10... (continued)**VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY**Test Vehicle: 2005 Subaru ForesterTest Date: March 16, 2005**VEHICLE ACCELEROMETER COORDINATES**

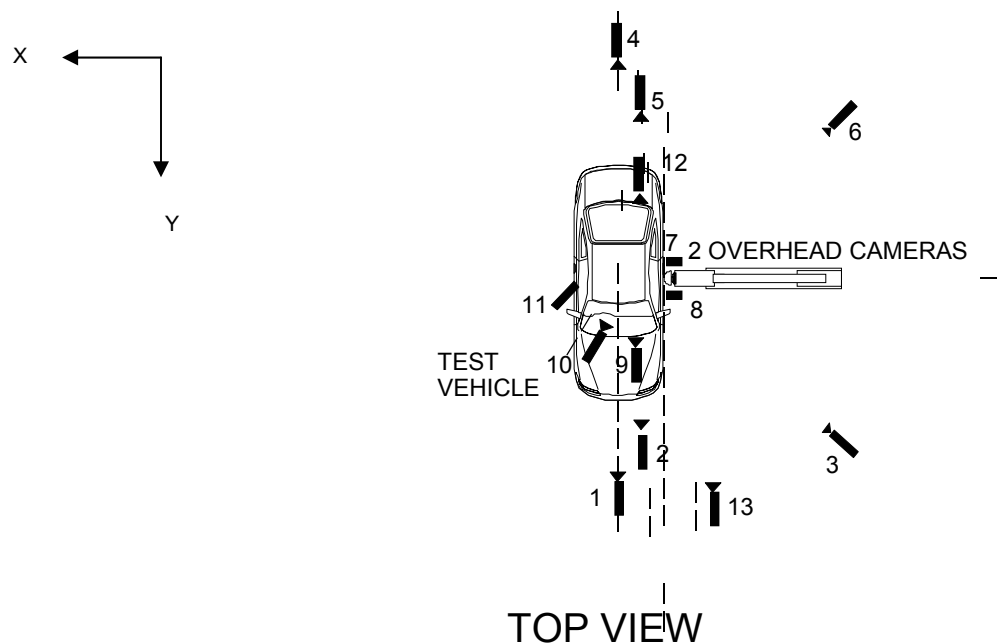
Loc. No.	Description	Coordinates (mm)		
		X	Y	Z
1	Right Side Sill at Front Seat	2417	-705	300
2	Rear Floorpan Above Axle	972	0	600
3	Left Side Sill at Rear Door	1660	-705	280
4	Left Side Sill at Front Door	2433	-705	275
5	Left Lower B-Post	2002	-690	445
6	Left Mid B-Post	1998	-701	1000
7	Left Lower A-Post	3010	-720	524
8	Left Mid A-Post	3025	-775	932
9	Driver Left Seat Track			
10	Vehicle CG	2390	-20	490
11	Left Door @ Pelvis	2303	-727	674
12	Left Door @ Arm	2455	-725	950
13	Left Door @ Knee	2698	-715	735
14	Left Door @ Rib	2213	-732	997
15	Left A Pillar Sill	3078	-705	270
16	Left B Pillar Sill	2038	-705	280
17	Engine	3730	15	890
18	Firewall	3360	-10	930

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: 2005 Subaru Forester

Test Date: March 16, 2005



No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Front Overall	1640	7850	1325	19	1000
2	Front Close Up	1645	5440	1340	25	1000
3	Front Angle	-2210	2955	1390	24	1000
4	Rear Overall	2400	-6795	1430	24	1000
5	Rear Close Up	2245	-7390	1495	25	1000
6	Rear Angle	-2570	-3090	1325	24	1000
7	Overhead View	-590	340	5340	14	1000
8	Overhead Close Up	25	160	5050	19	1000
9	Onboard Driver Front				16	1000
10	Onboard Driver				10	1000
11	Onboard Child				8	1000
12	Onboard Trunk				13	1000
13	Real Time				13	24

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

APPENDIX A
PHOTOGRAPHS

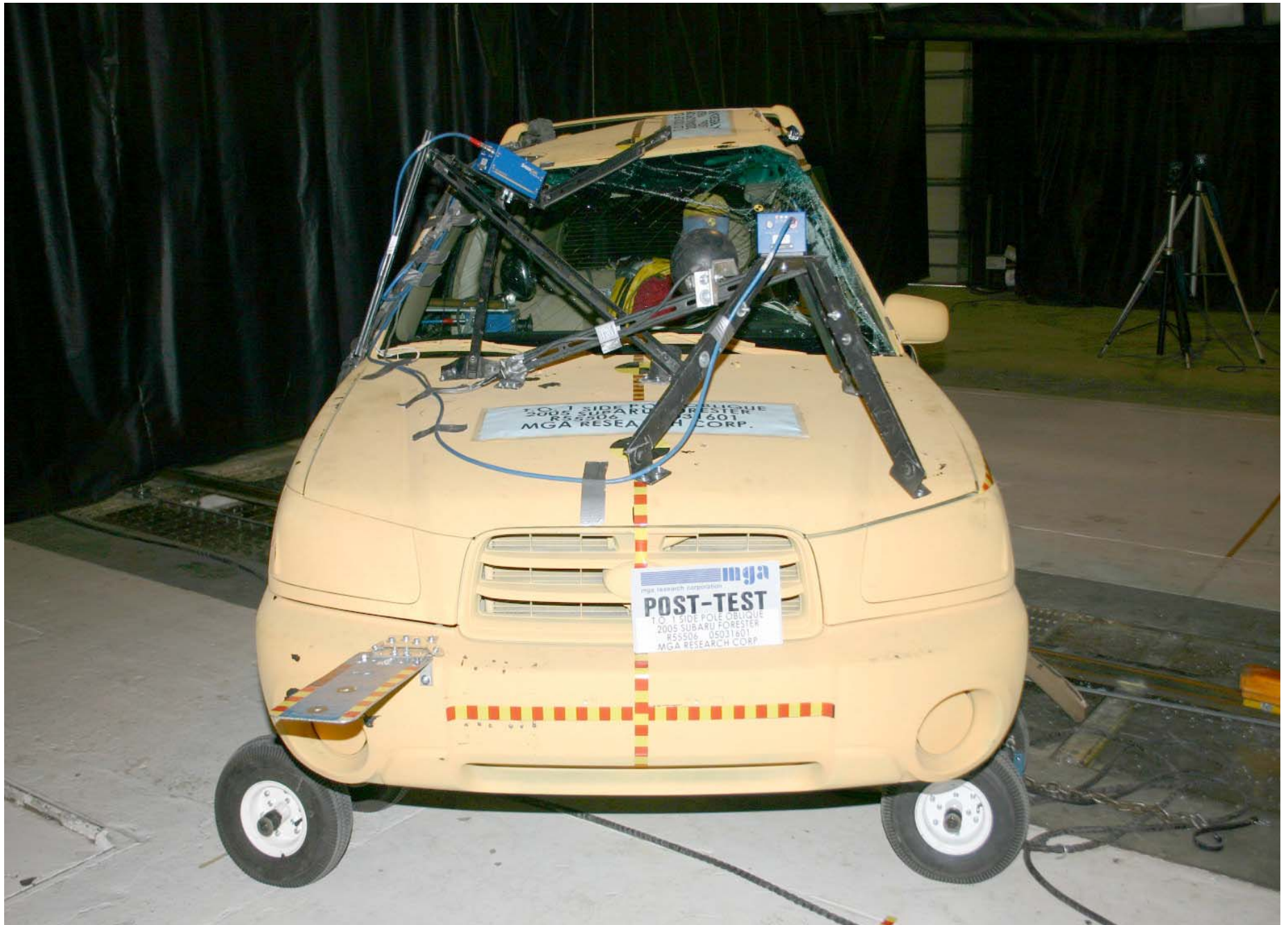
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Pre-Test Front View of Test Vehicle



Post-Test Front View of Test Vehicle



Pre-Test Rear View of Test Vehicle



Post-Test Rear View of Test Vehicle

A-5.



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



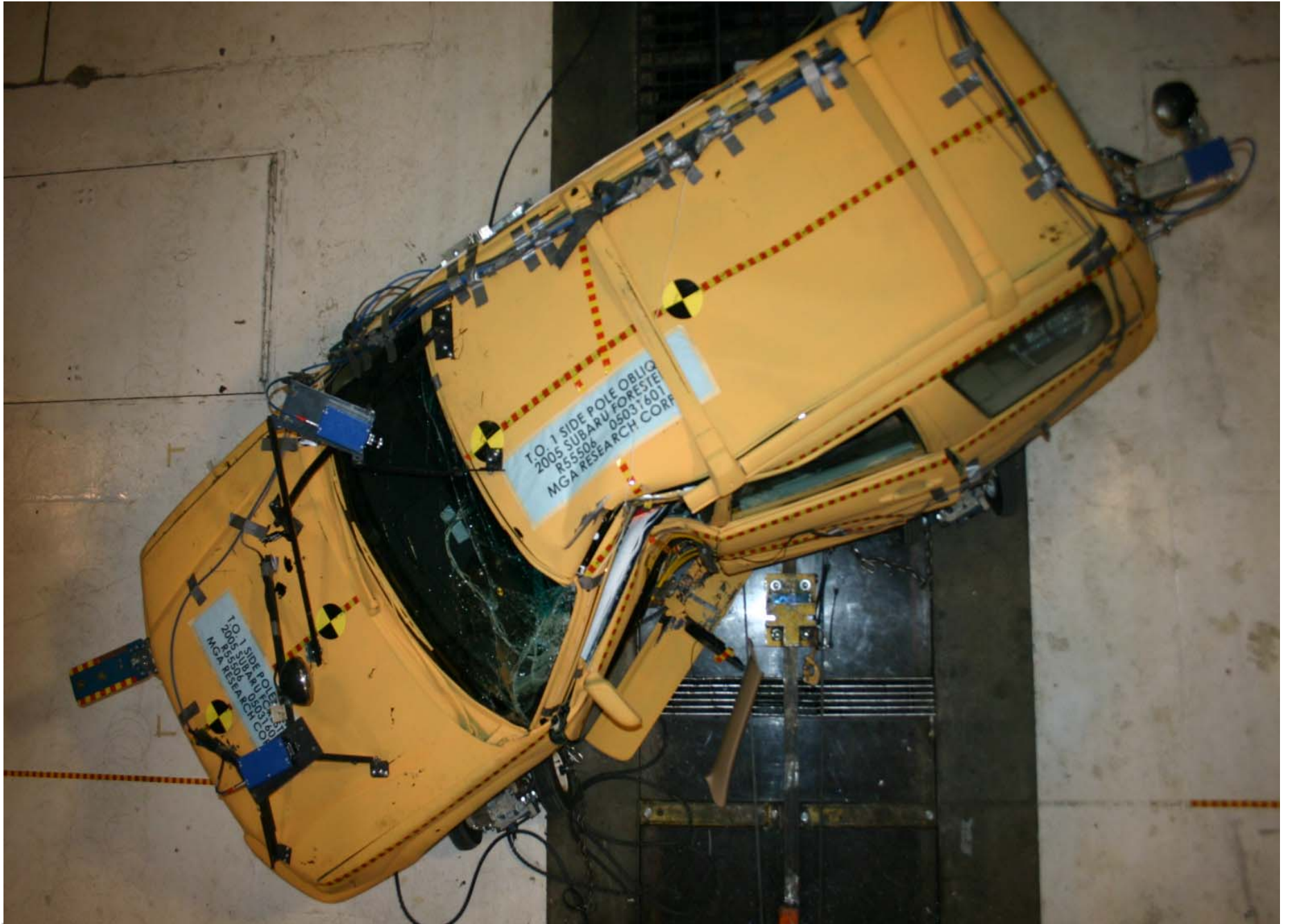
Pre-Test Left $\frac{3}{4}$ Rear View of Test Vehicle



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 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 Shoulder and Door Top View



Post-Test Driver Dummy Contact



Post-Test Driver Dummy Head Contact

A-23.



Post-Test Driver Dummy Head Contact with Pole



Pre-Test LRP Child Dummy Left Side View (Door open)

A-25.



Pre-Test LRP Child Dummy Left Side View



Post-Test LRP Child Dummy Left Side View



Pre-Test LRP Child Dummy Right Side View



Post-Test LRP Child Dummy Right Side View



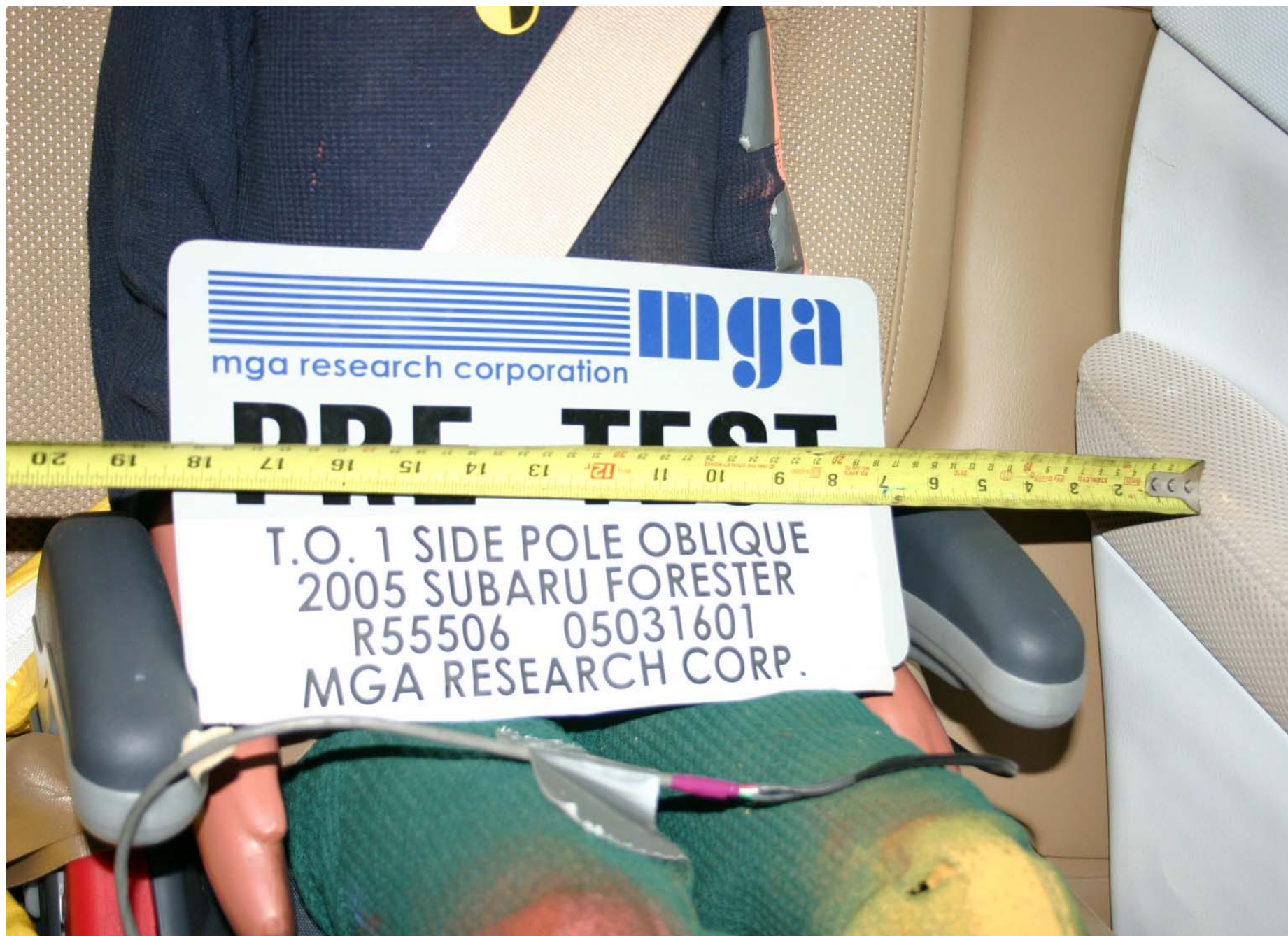
Pre-Test LRP Child Dummy Front Facing View



Post-Test LRP Child Dummy Front Facing View



Pre-Test LRP Child Dummy Lateral Clearance Measurements



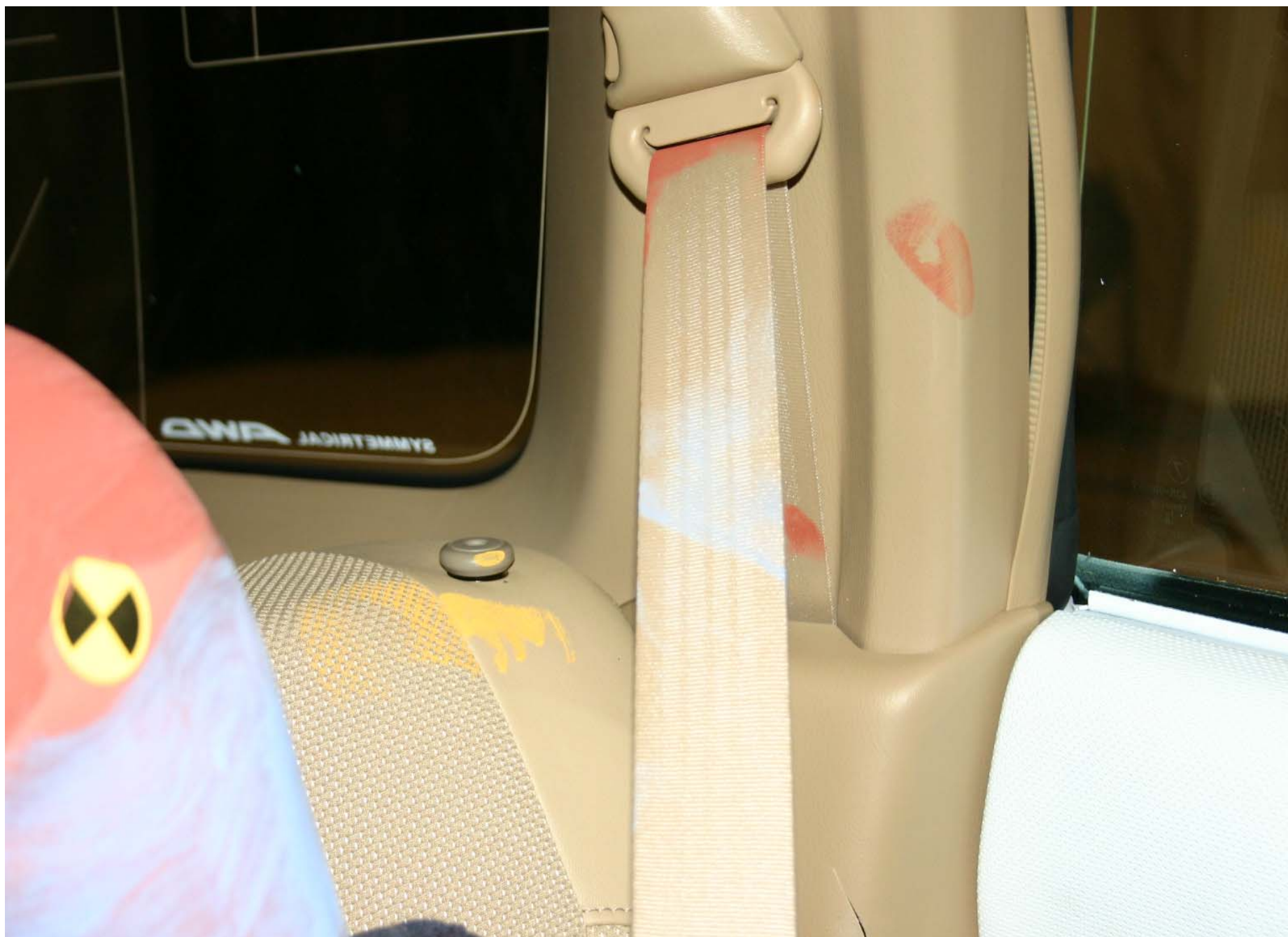
Pre-Test LRP Child Dummy Lateral Clearance Measurements



Pre-Test LRP Child Dummy Shoulder and Door Top View



Post-Test LRP Child Dummy Contact



Post-Test LRP Child Dummy Head Contact



Post-Test Impact Point on Vehicle



Post-Test Combination Airbag

**TIRE AND LOADING INFORMATION**

SEATING CAPACITY : TOTAL 5
FRONT 2 : REAR 3

The combined weight of occupants and cargo should never exceed 408kg or 900lbs.

ORIGINAL TIRE SIZE	COLD TIRE INFLATION PRESSURE	
P215/60R16	FRONT	200kPa, 29PSI
	REAR	190kPa, 28PSI
SPARE TIRE	COLD TIRE INFLATION PRESSURE	
P215/60R16	200kPa, 29PSI	

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

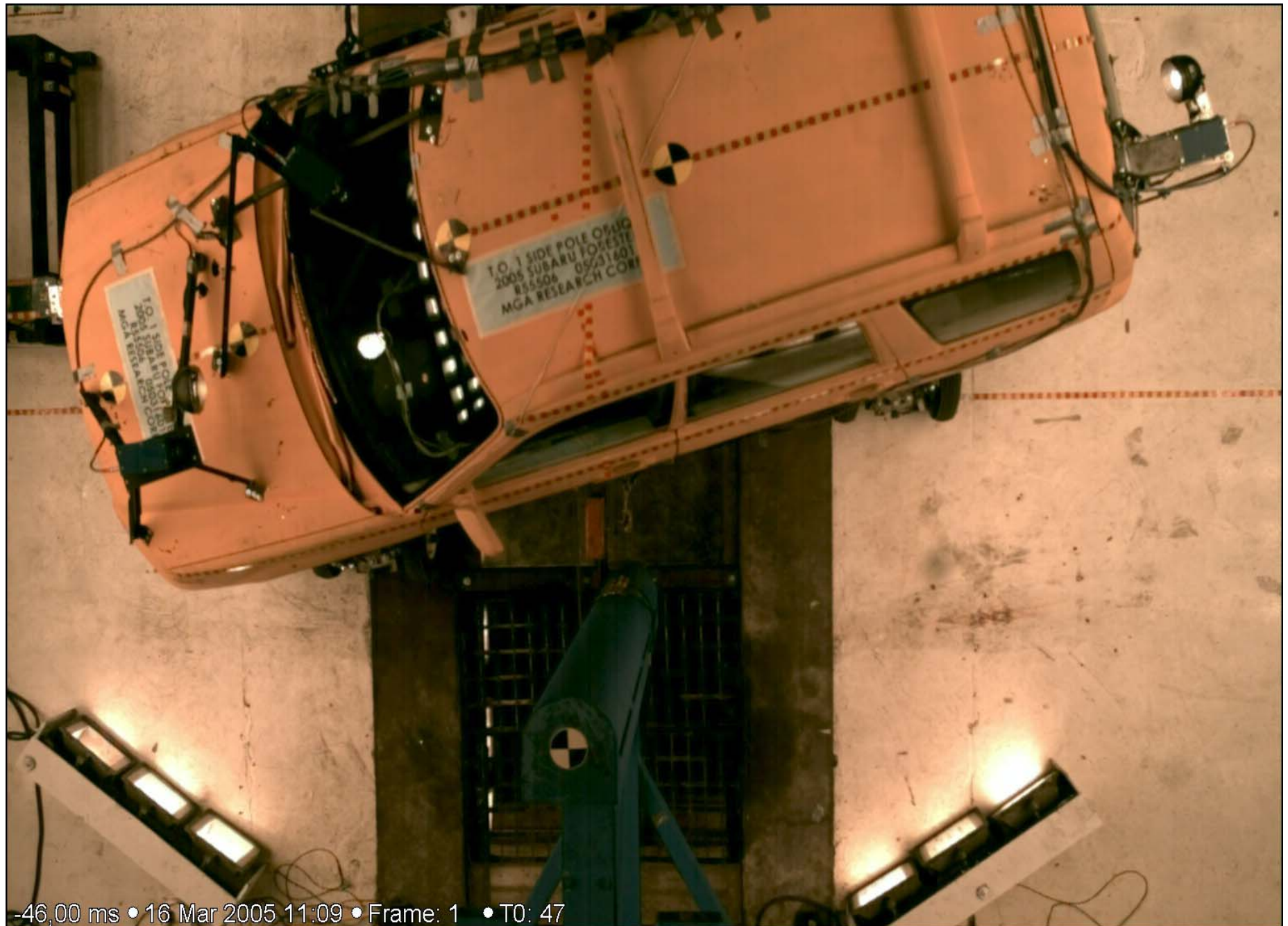
KL

Tire Placard



Pre-Test Point of Impact View

A-40.



-46,00 ms • 16 Mar 2005 11:09 • Frame: 1 • T0: 47

Post-Test Point of Impact View



24,00 ms • 16 Mar 2005 11:09 • Frame: 25 • T0: 1

Impact

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA TRACES

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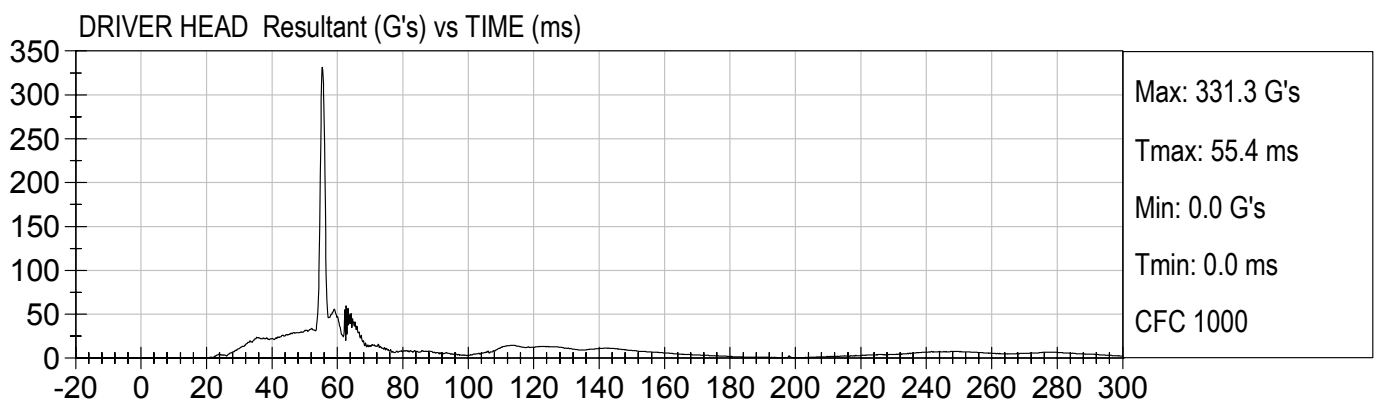
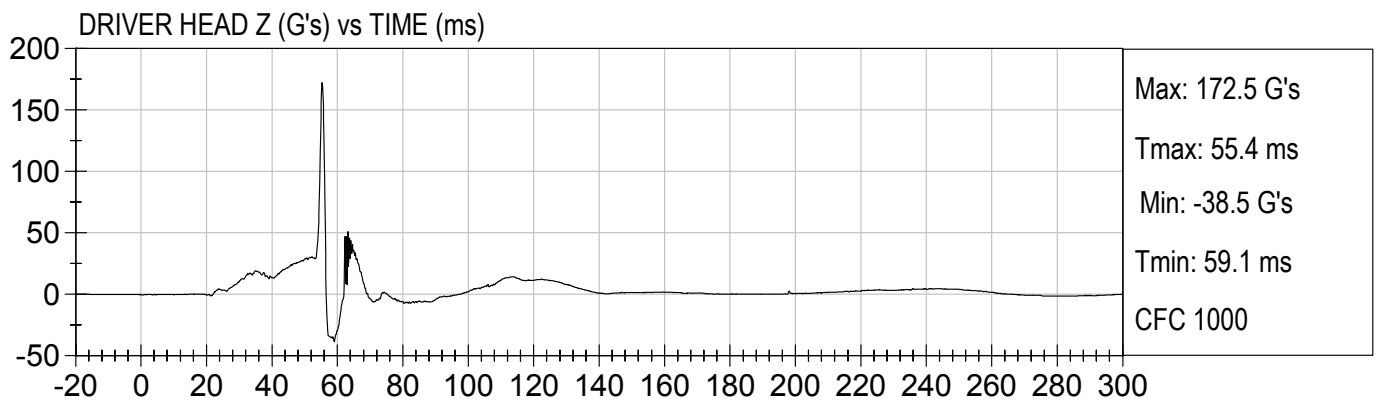
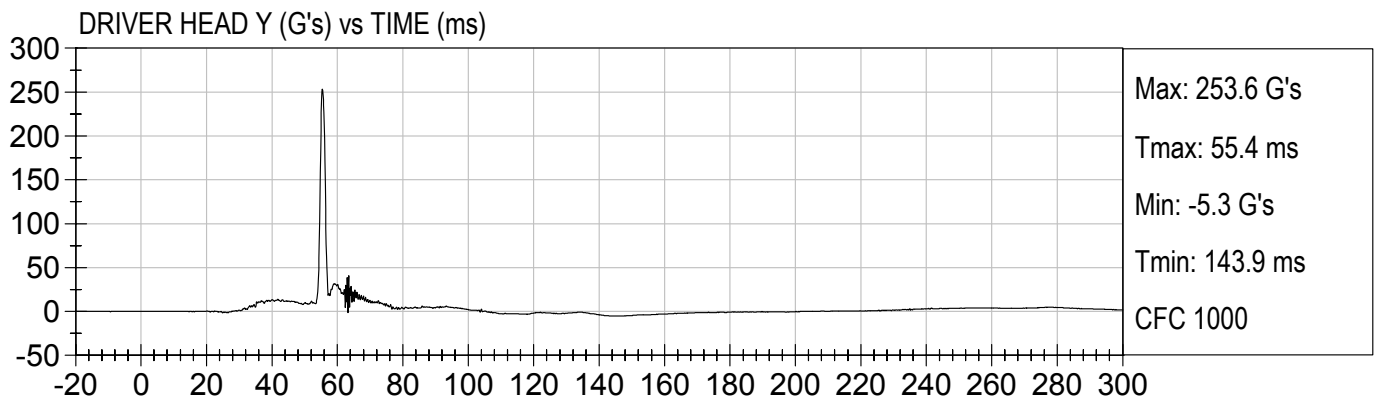
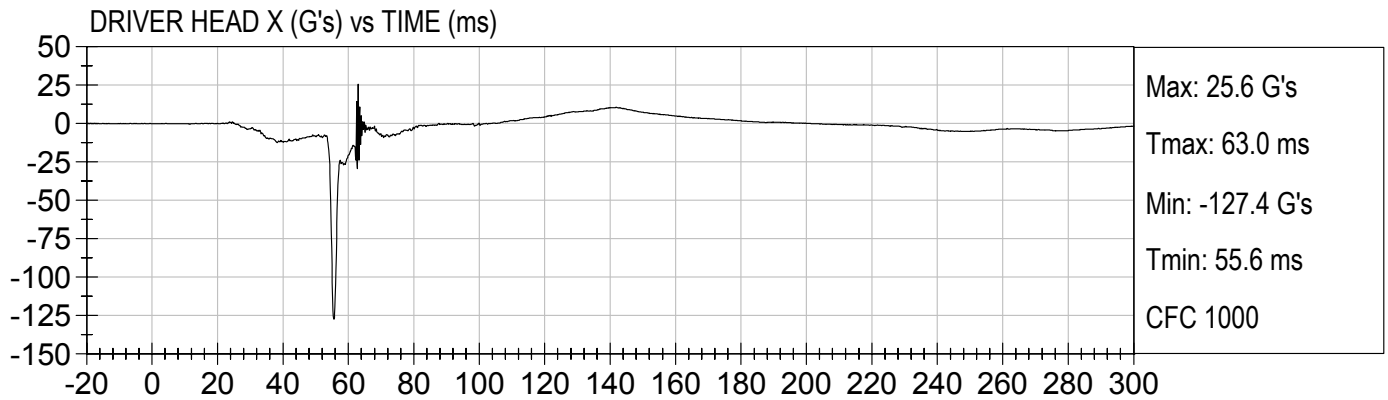
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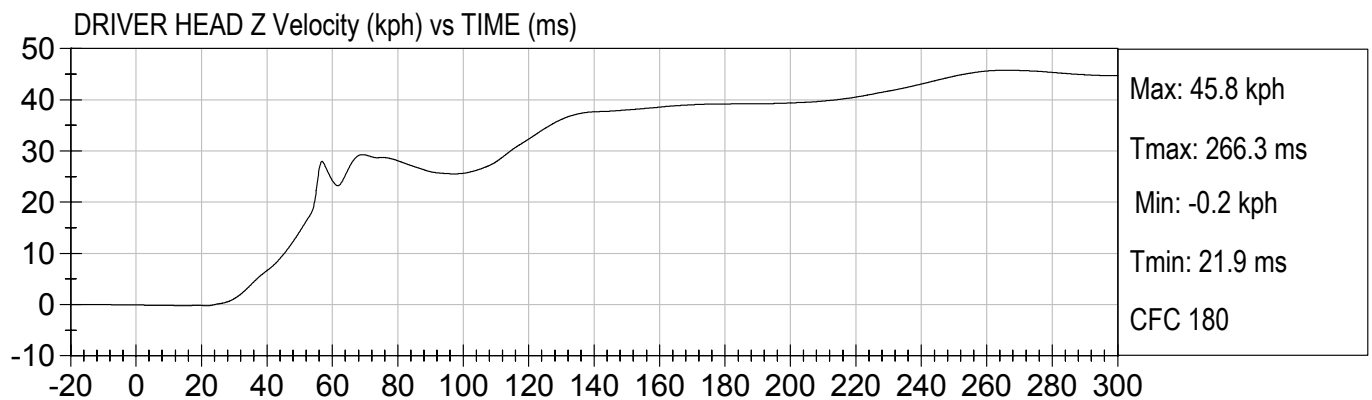
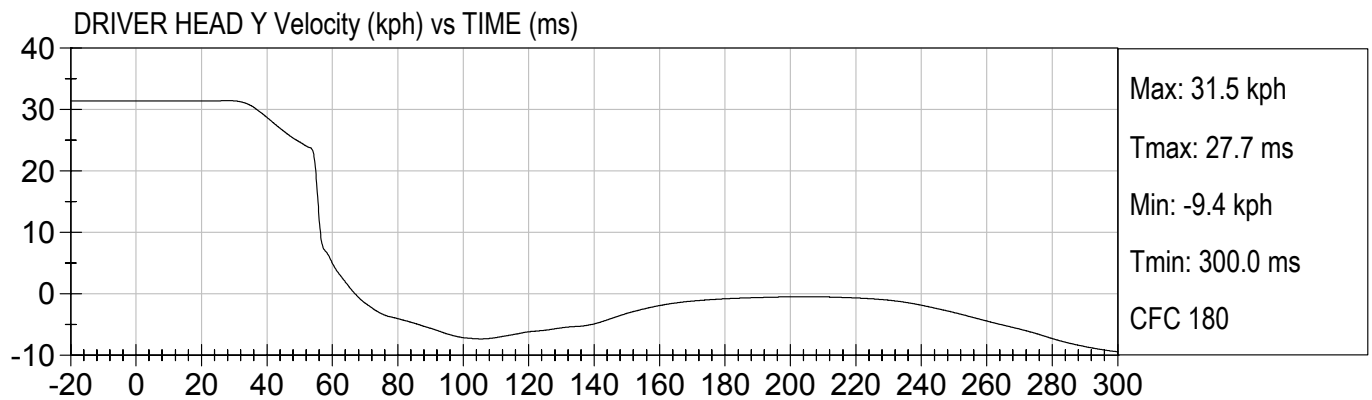
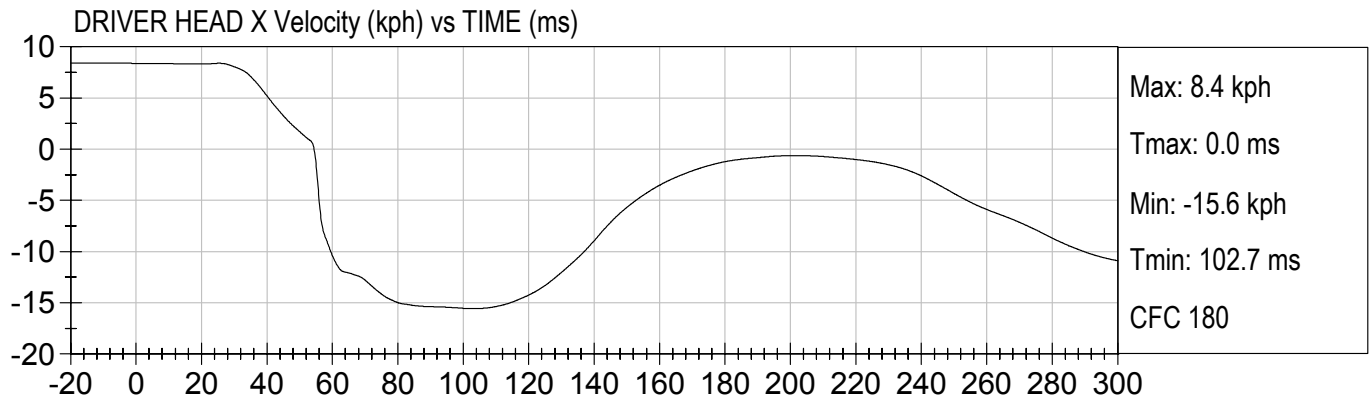
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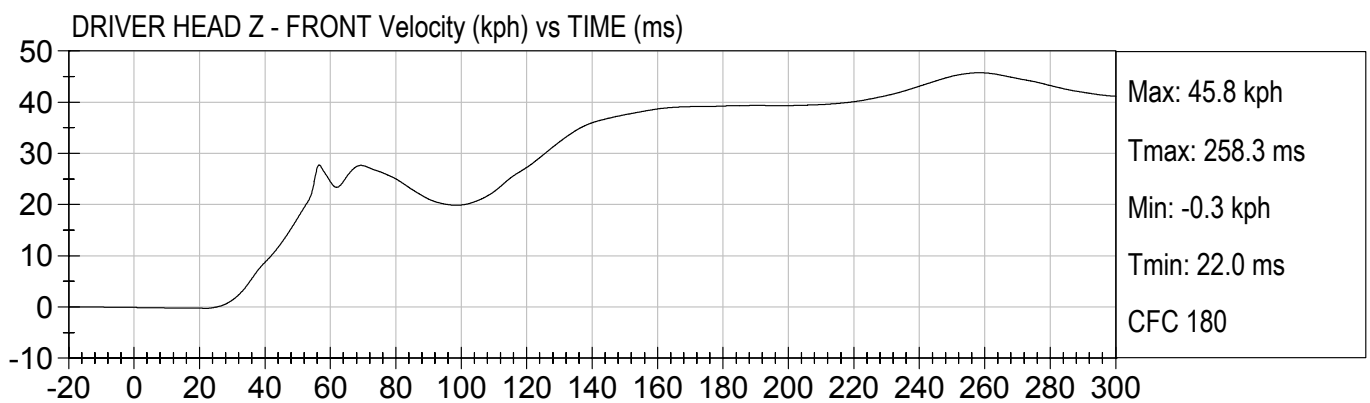
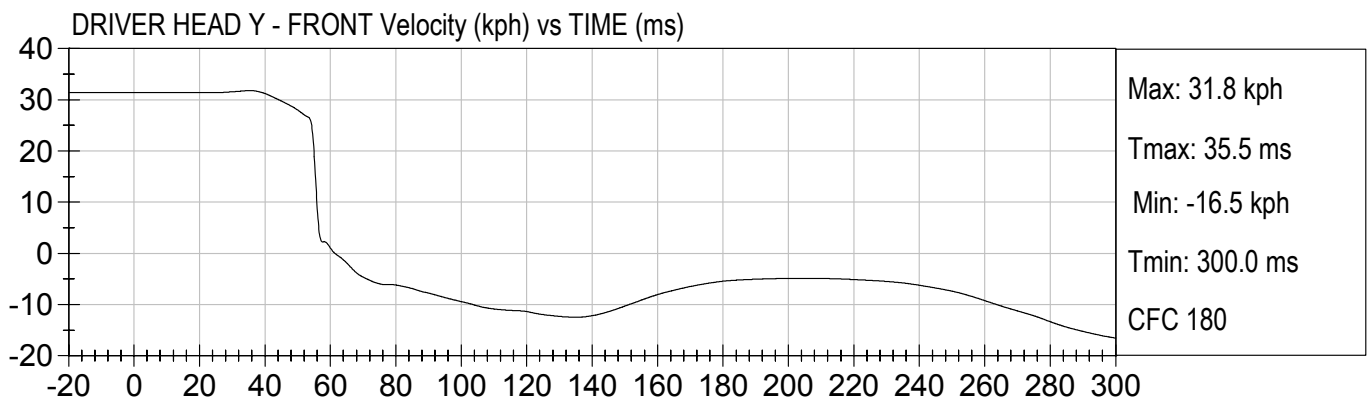
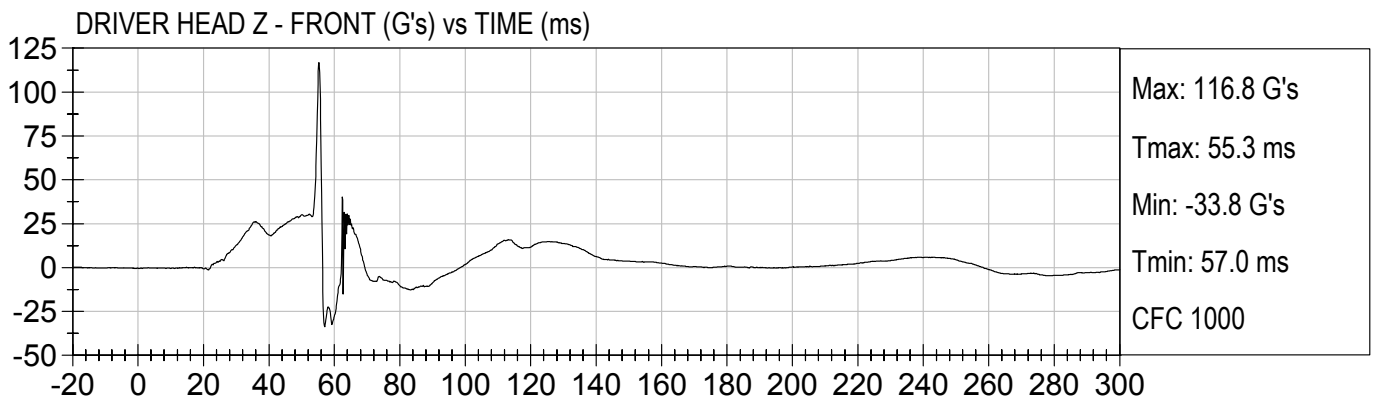
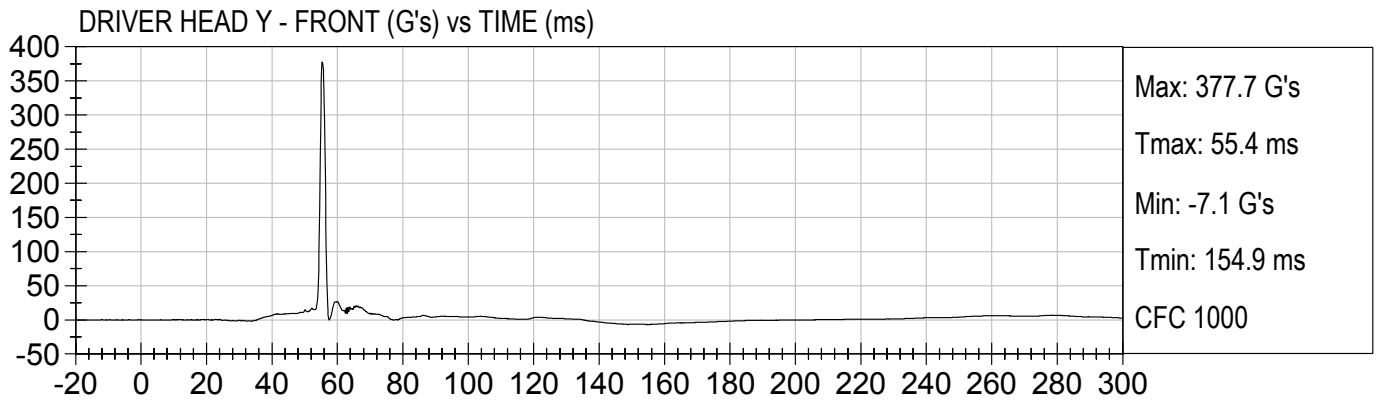
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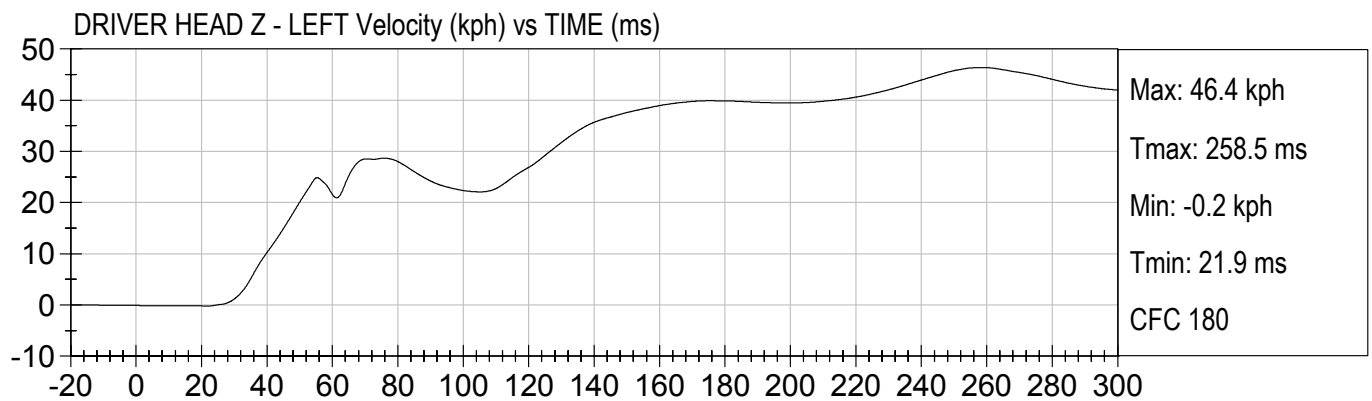
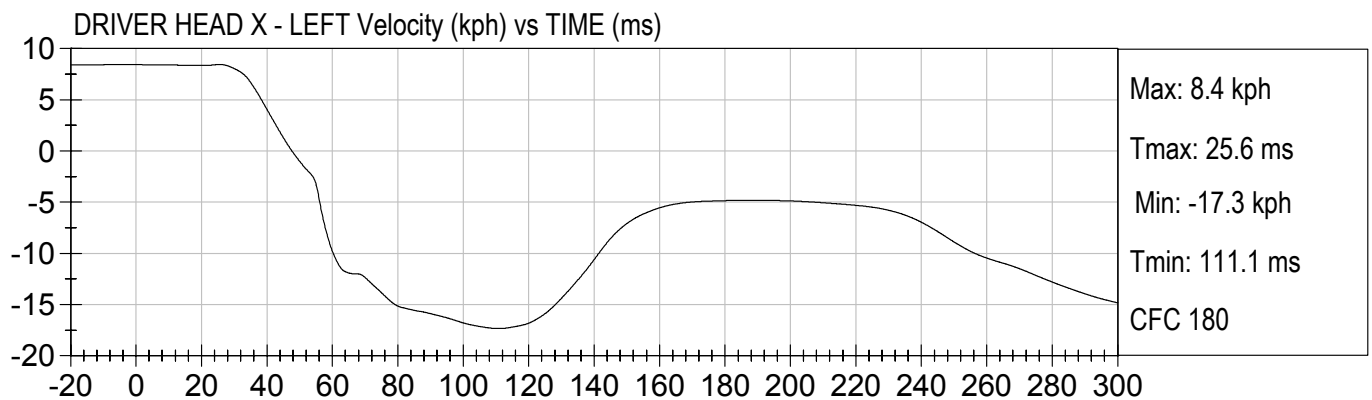
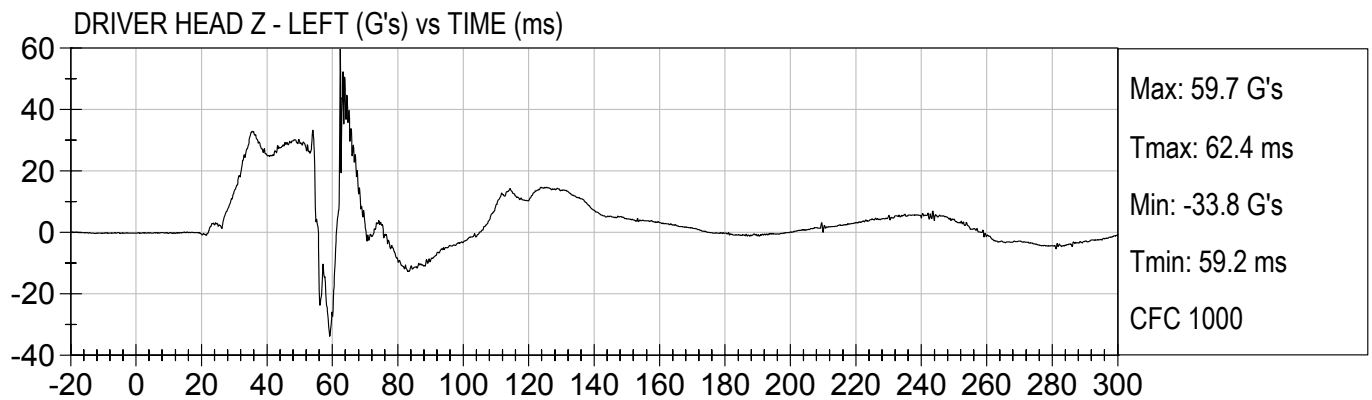
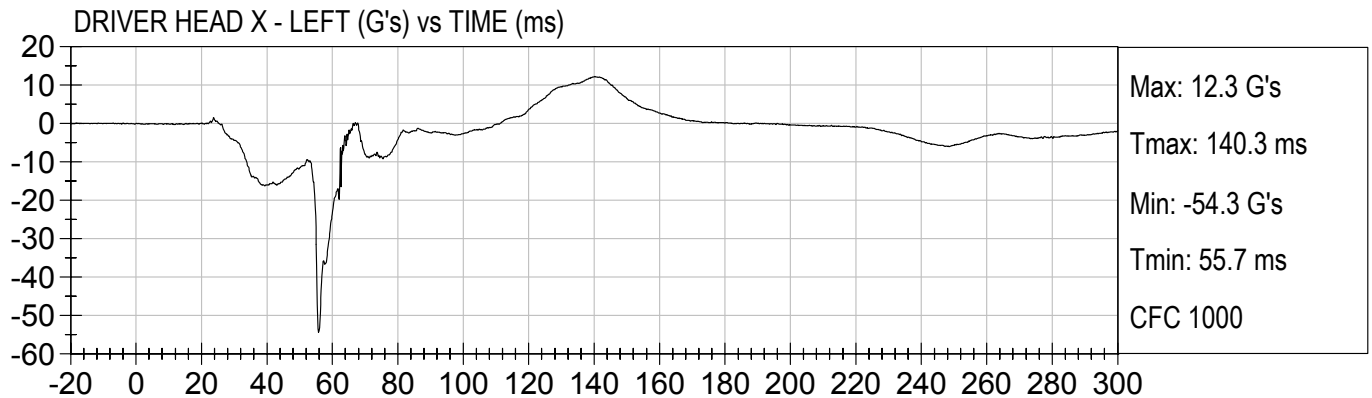
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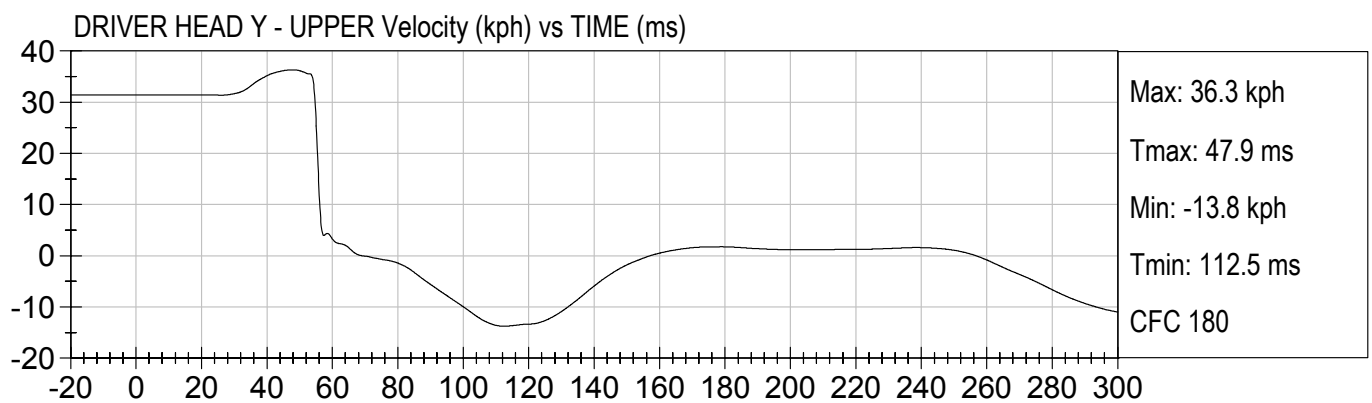
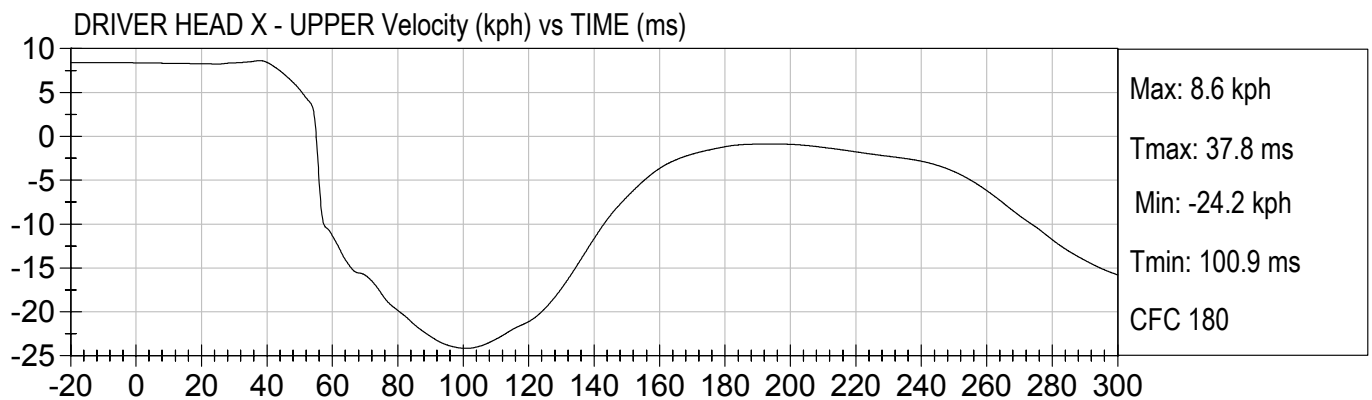
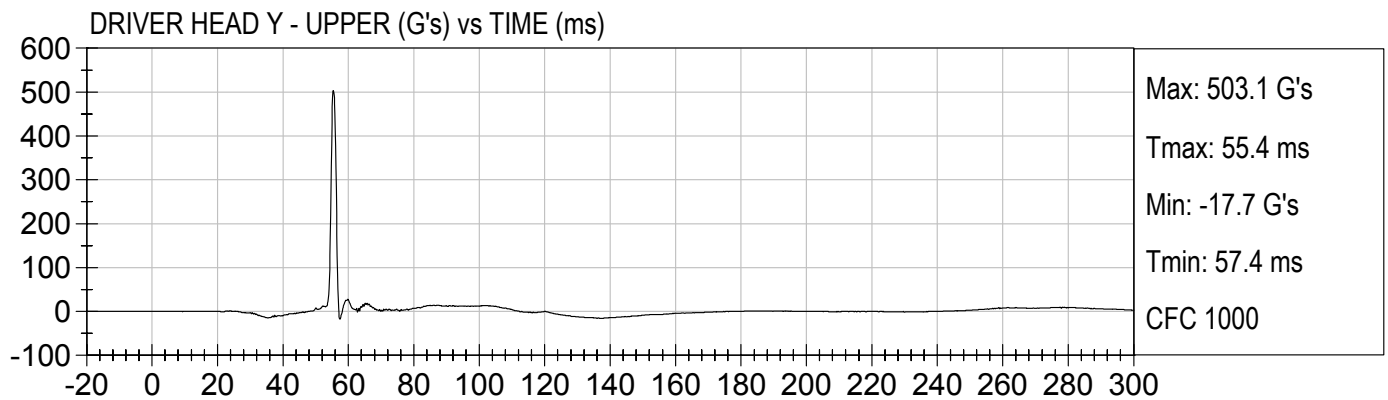
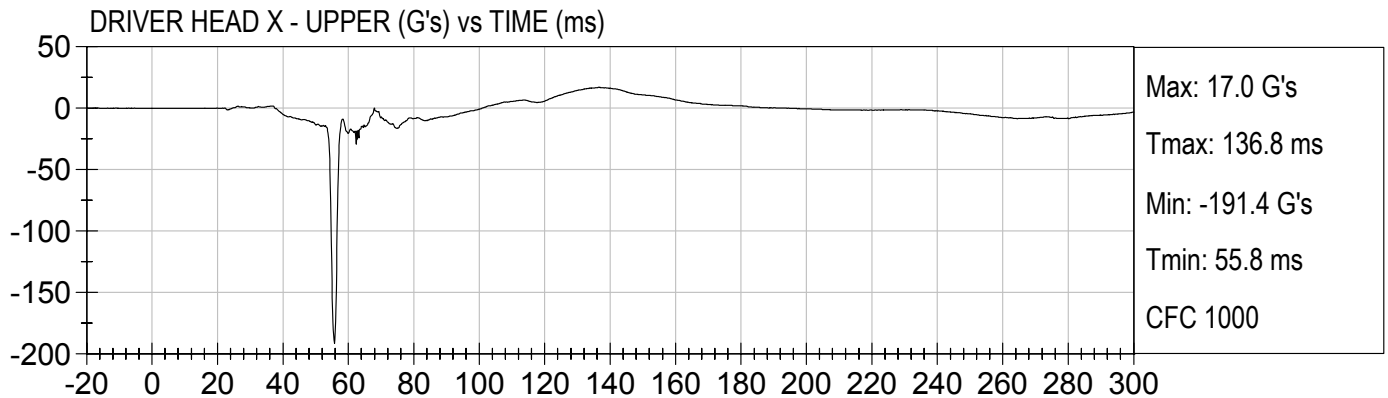
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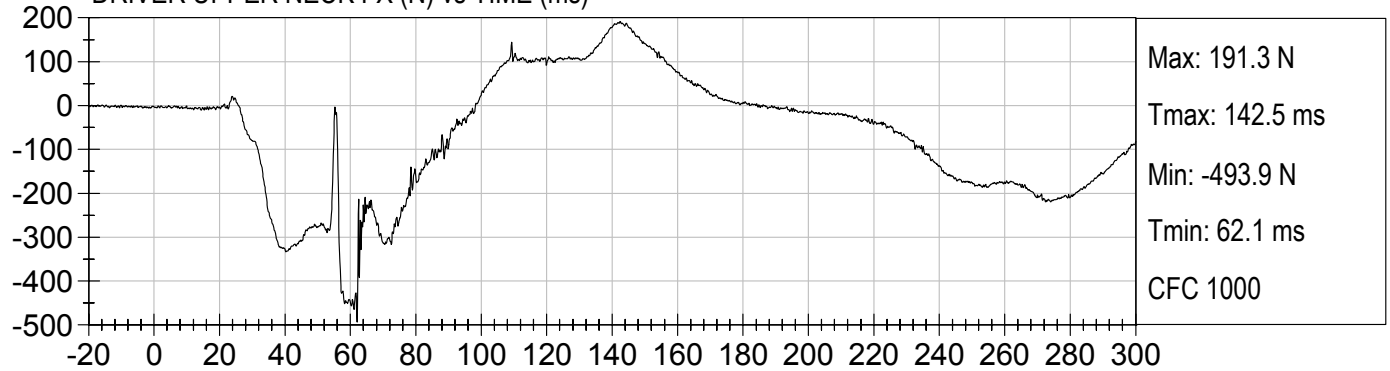




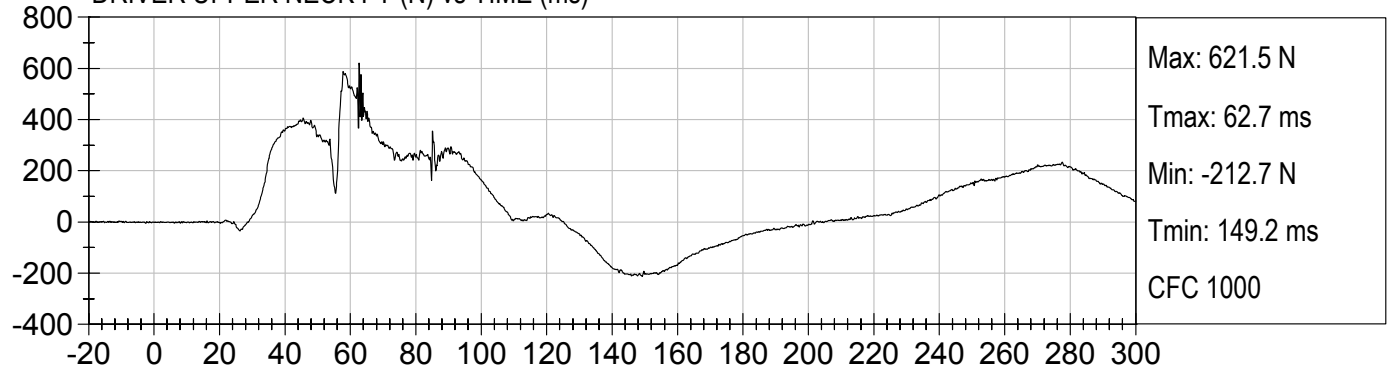




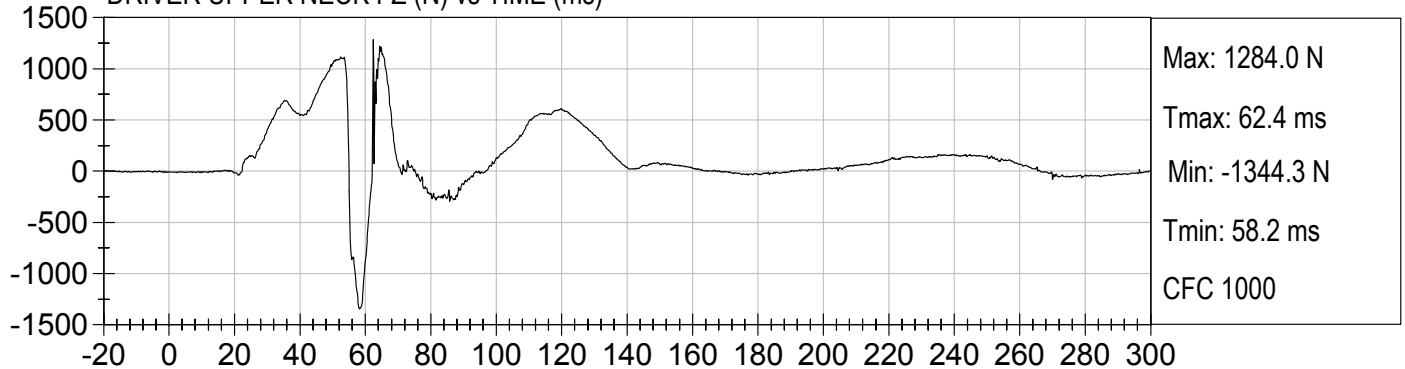
DRIVER UPPER NECK FX (N) vs TIME (ms)



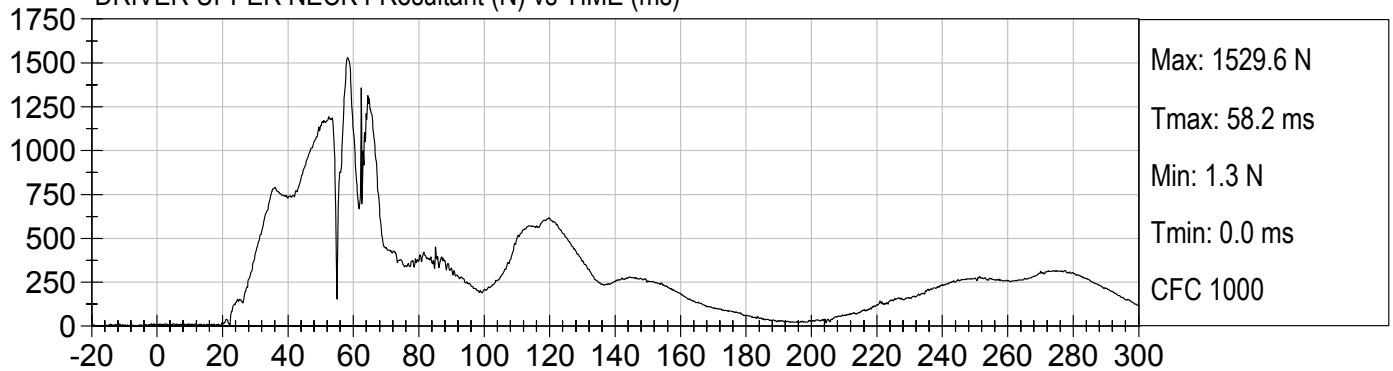
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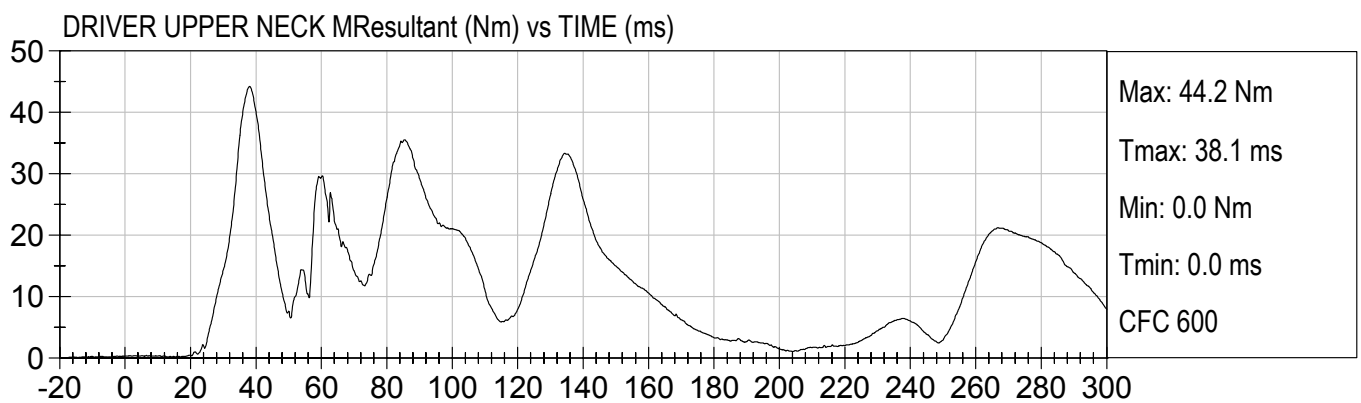
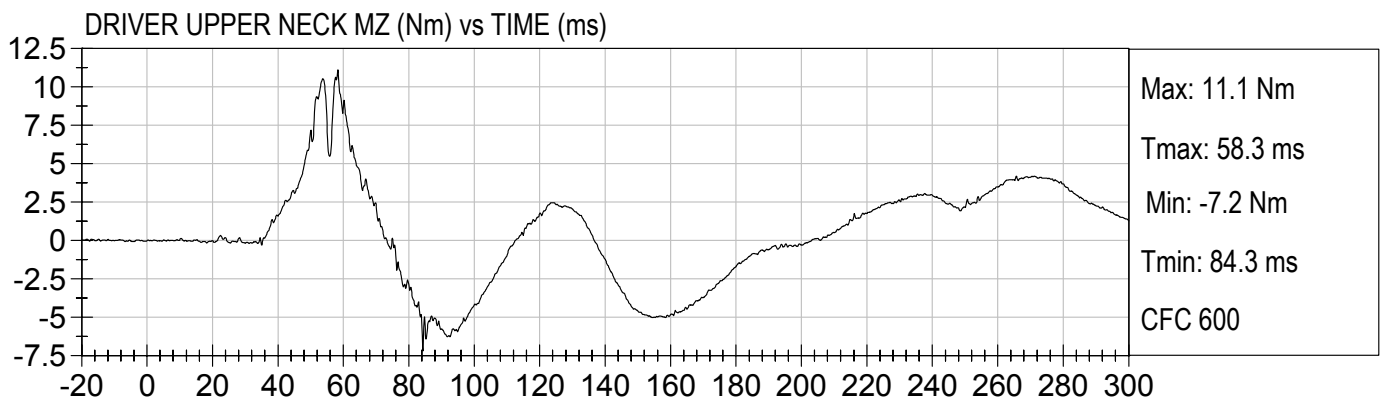
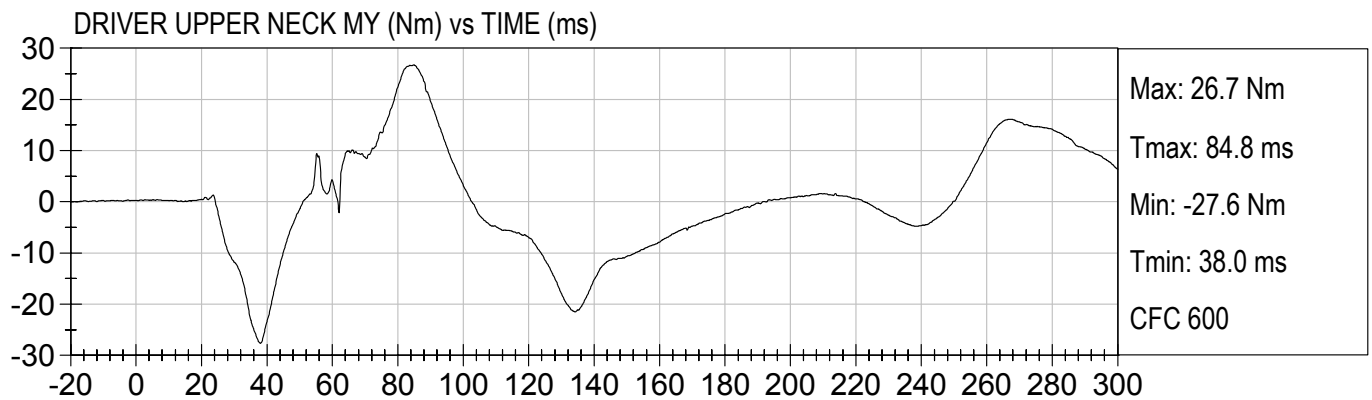
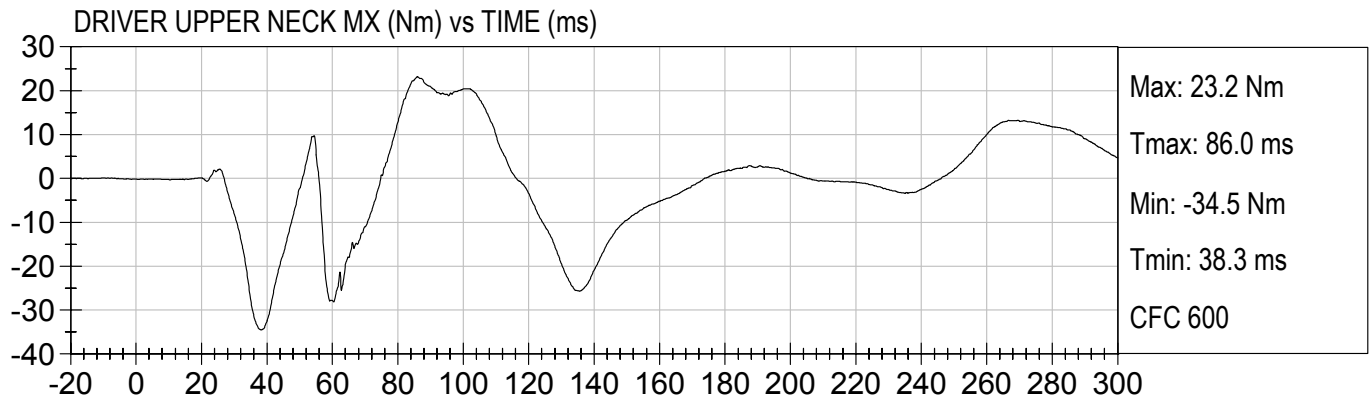


DRIVER UPPER NECK FZ (N) vs TIME (ms)



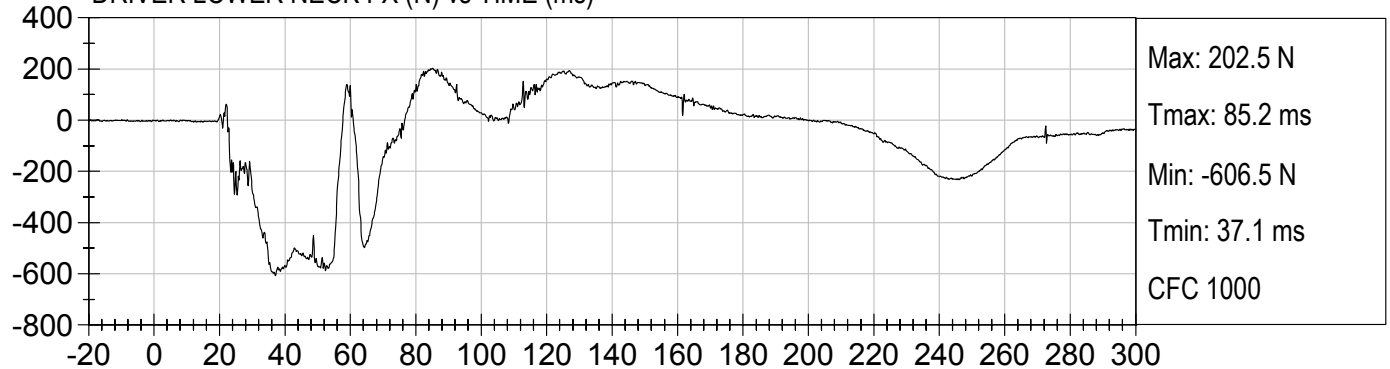
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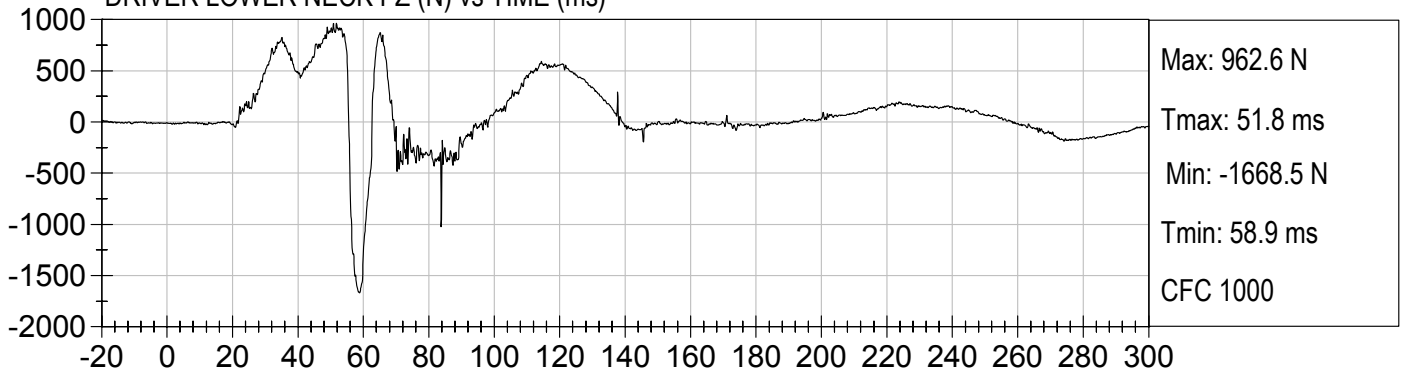
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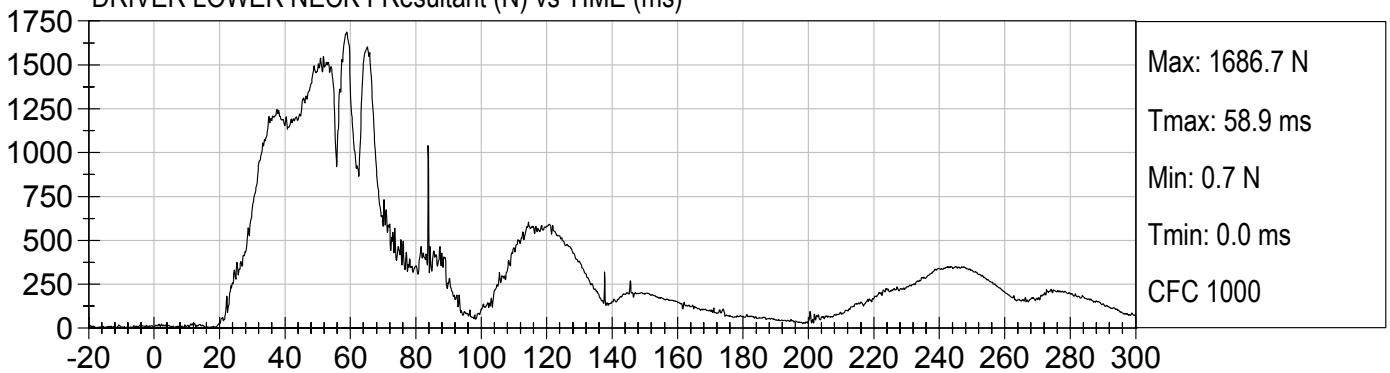
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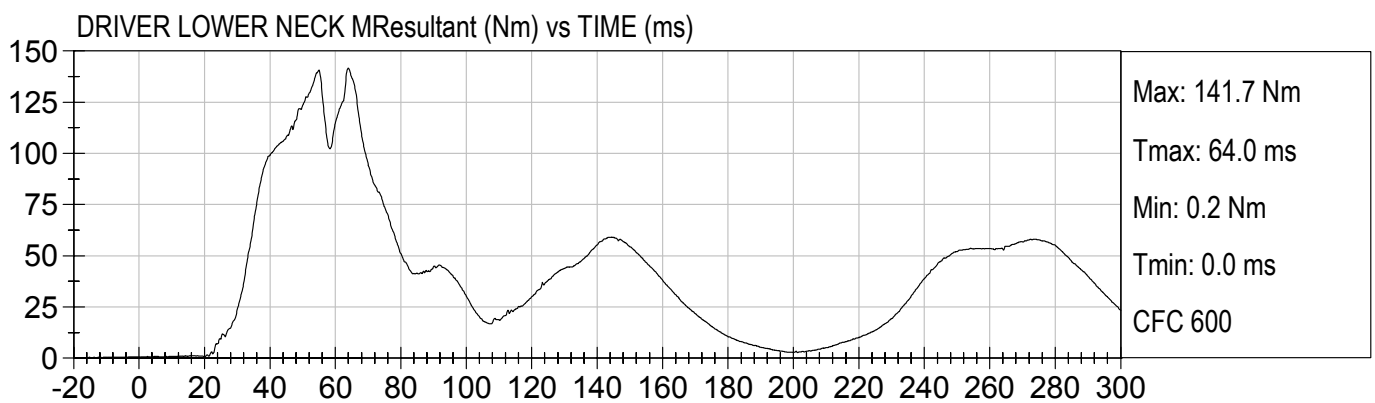
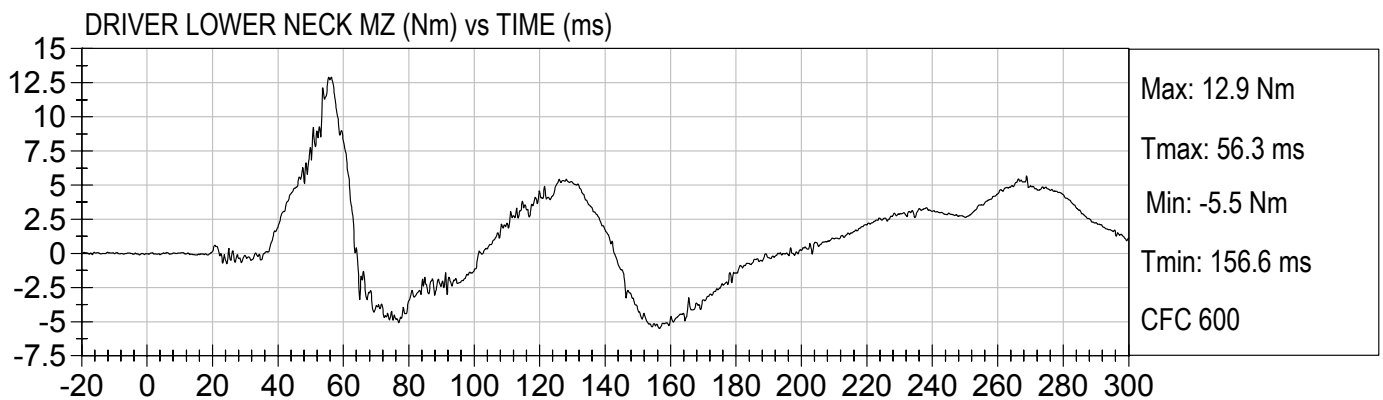
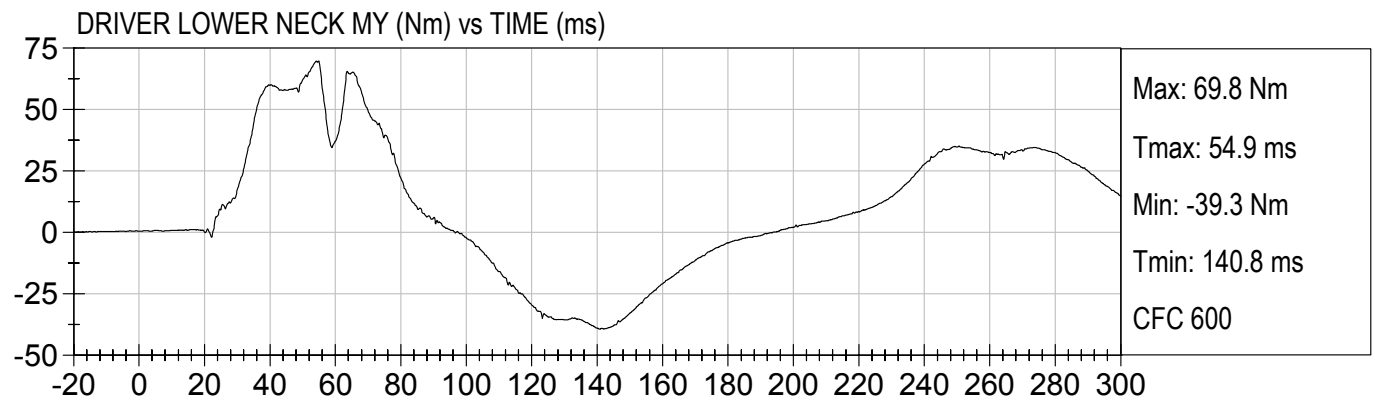
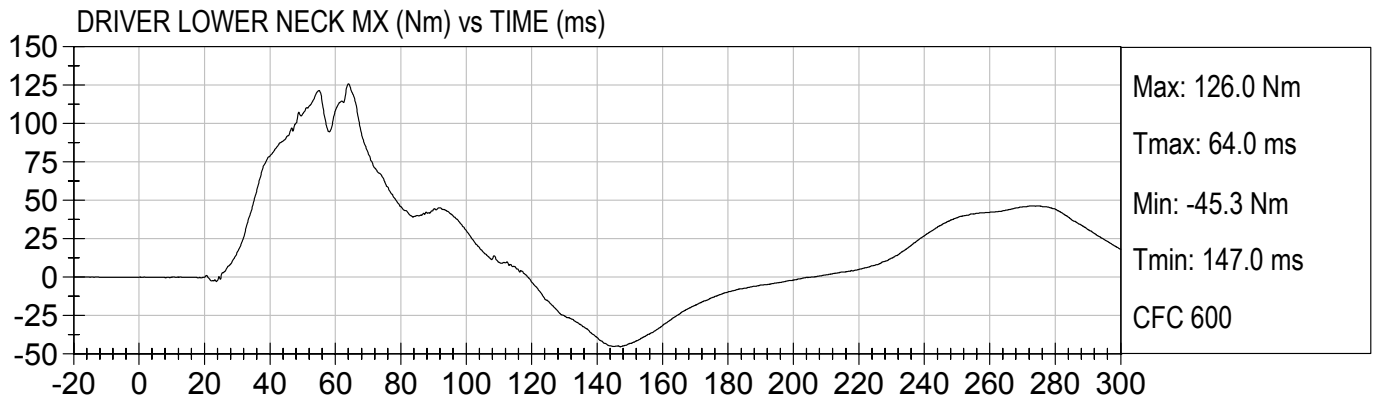


DRIVER LOWER NECK FZ (N) vs TIME (ms)



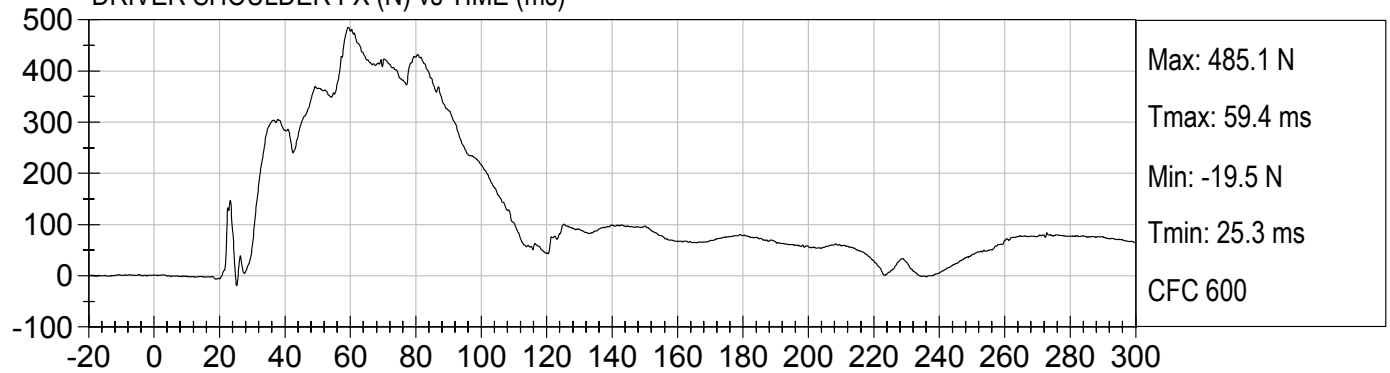
DRIVER LOWER NECK FResultant (N) vs TIME (ms)



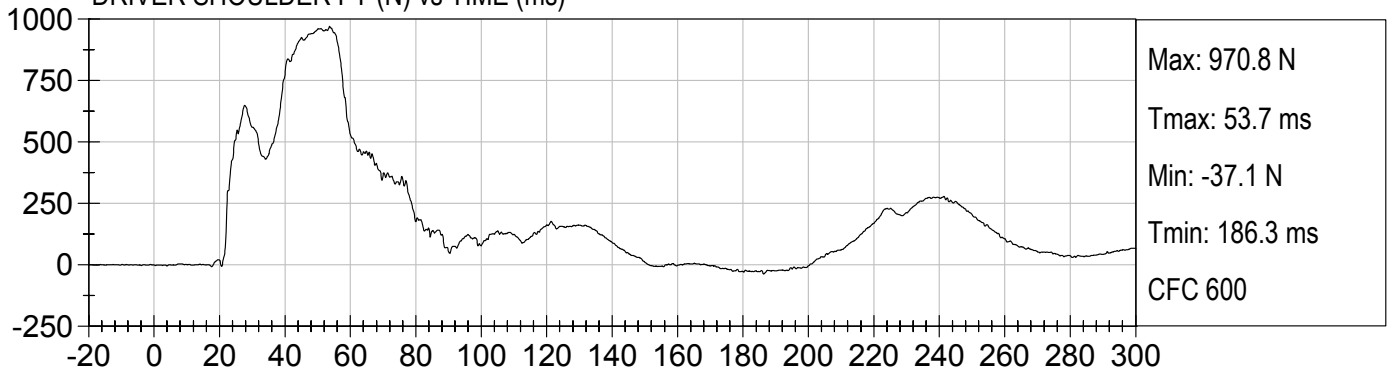




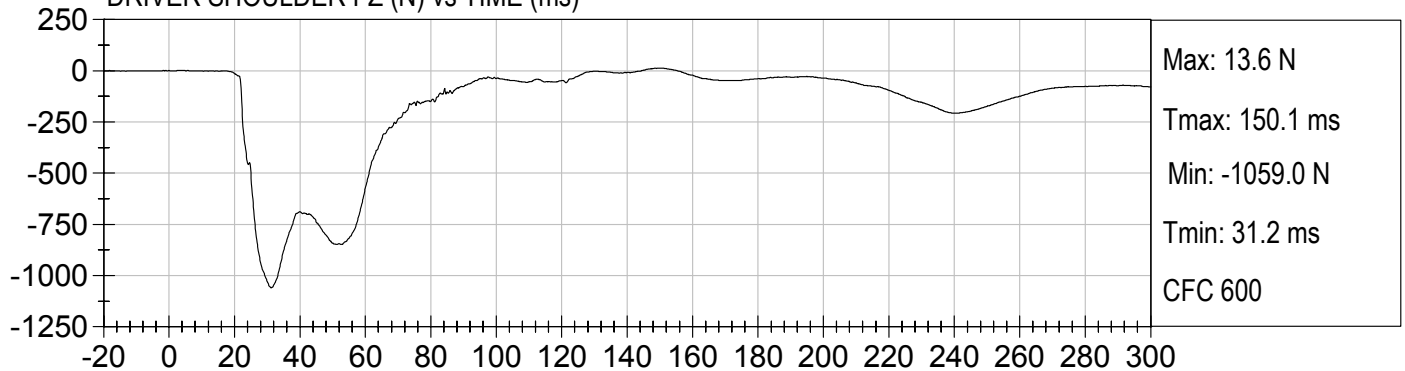
DRIVER SHOULDER FX (N) vs TIME (ms)



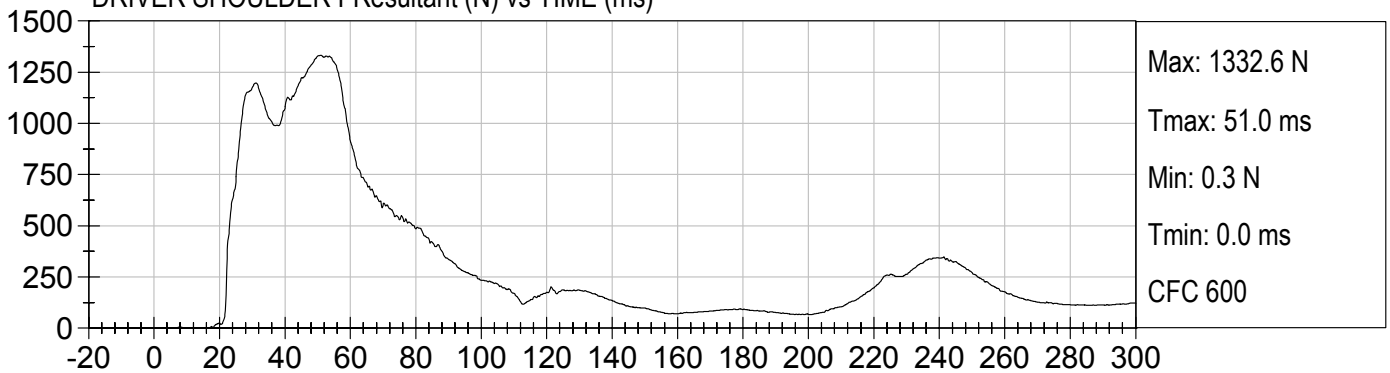
DRIVER SHOULDER FY (N) vs TIME (ms)

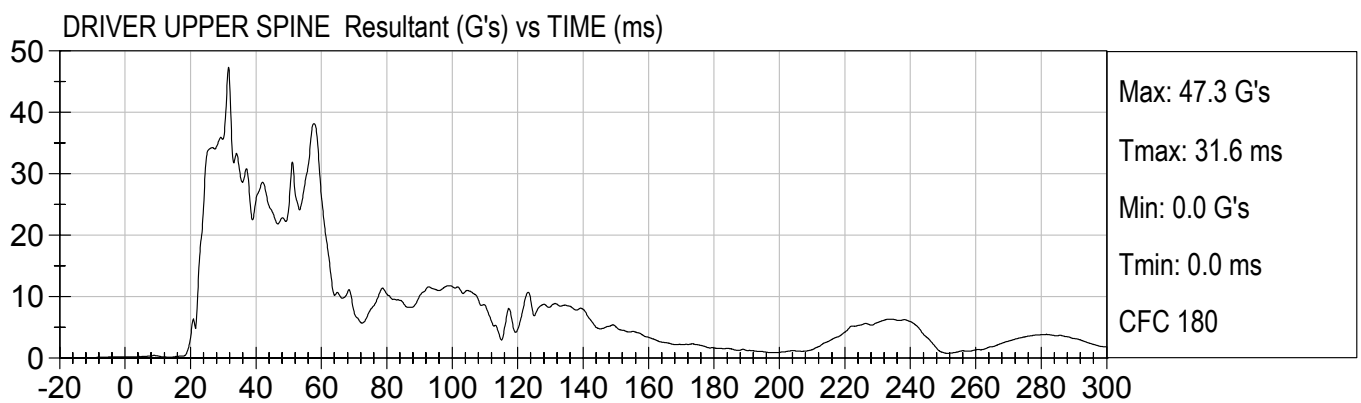
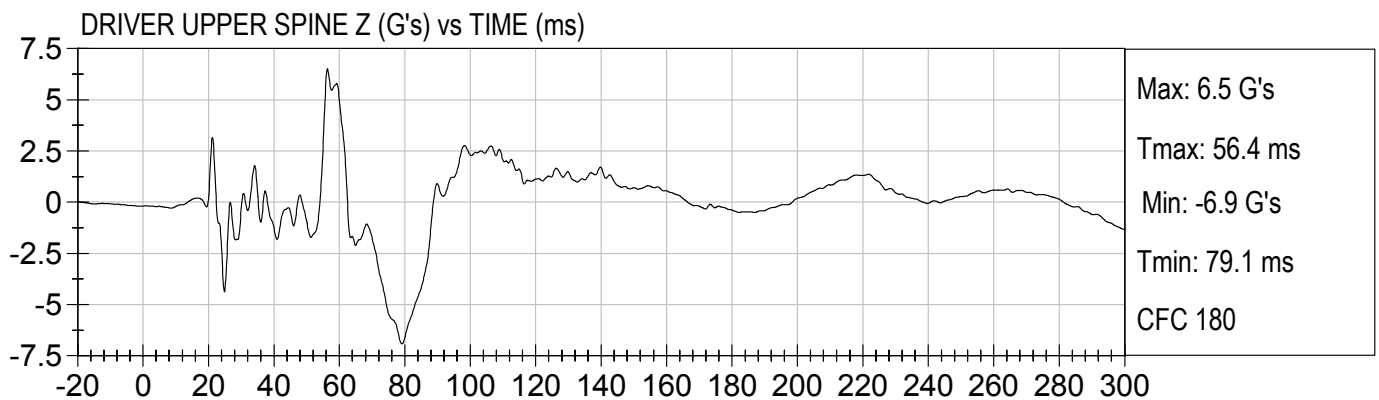
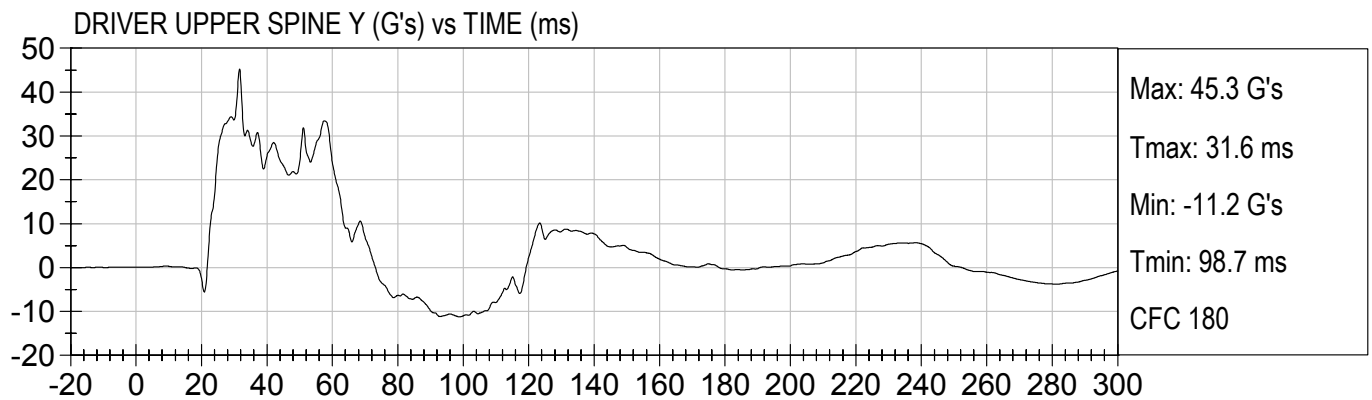
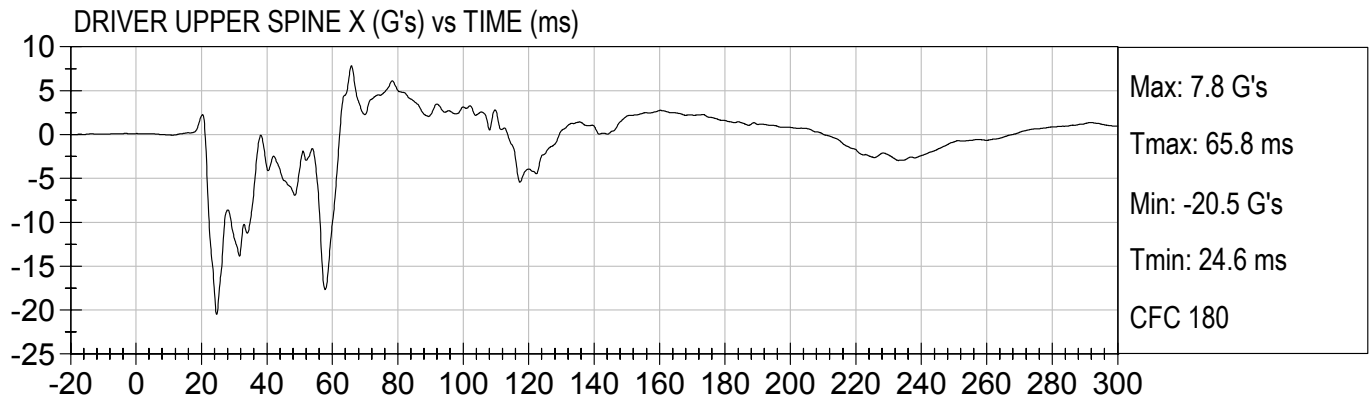


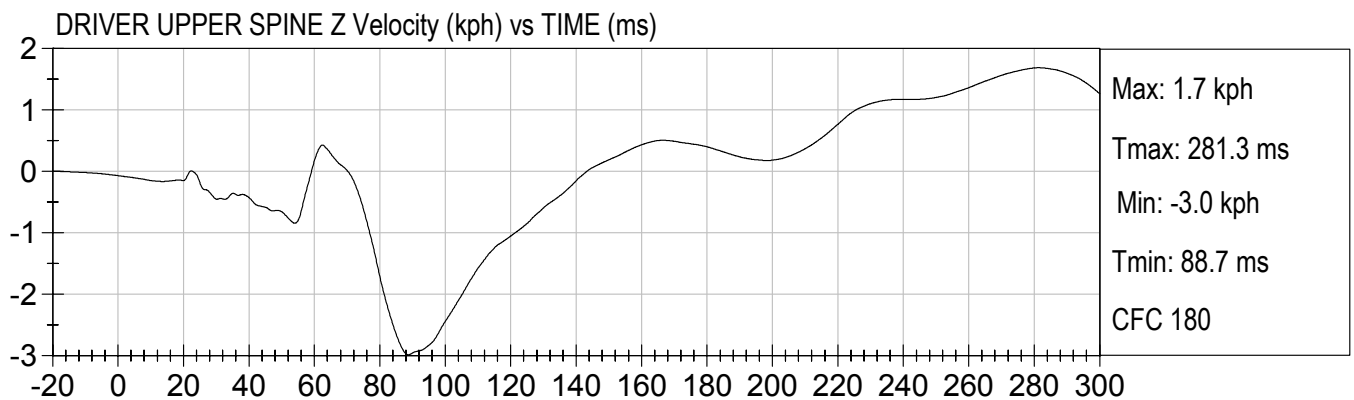
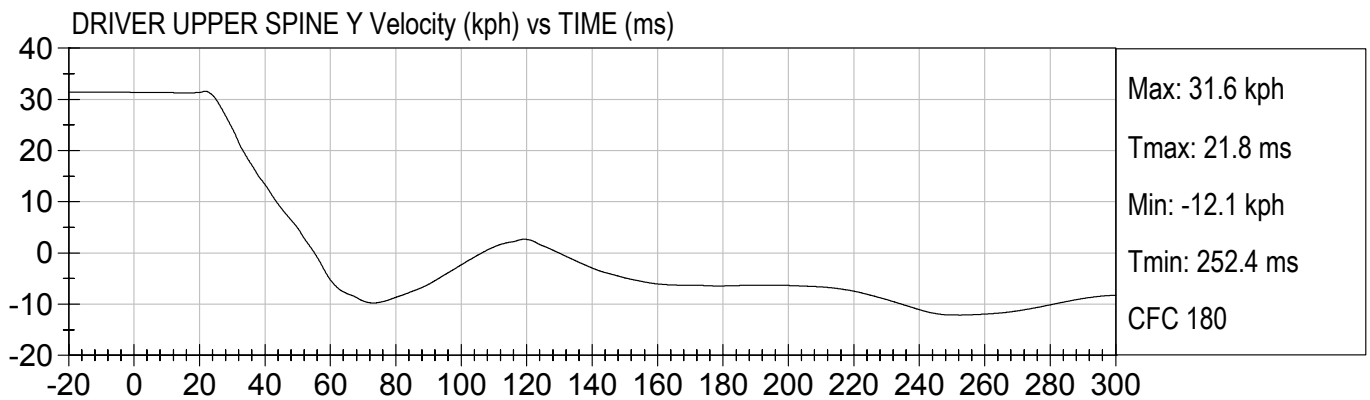
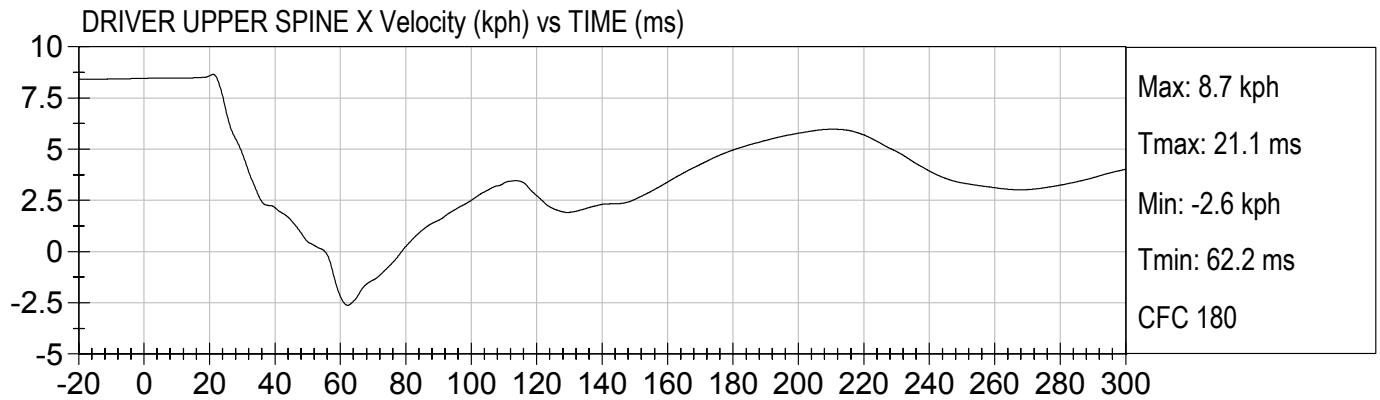
DRIVER SHOULDER FZ (N) vs TIME (ms)

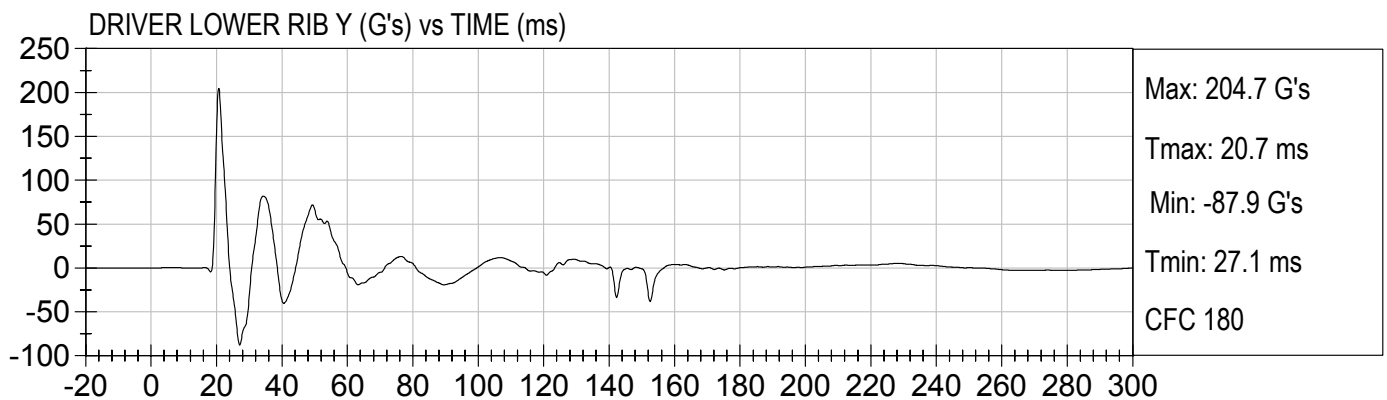
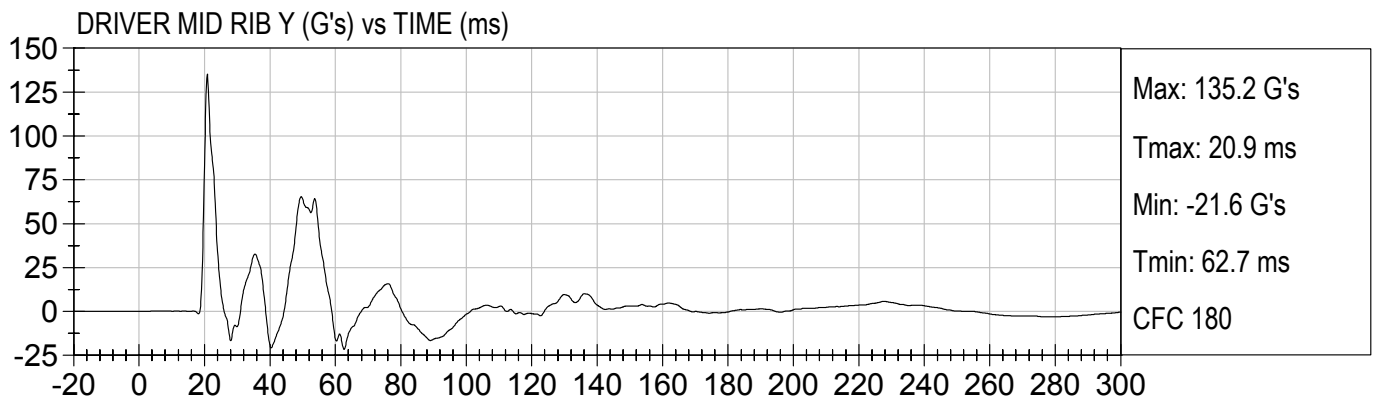
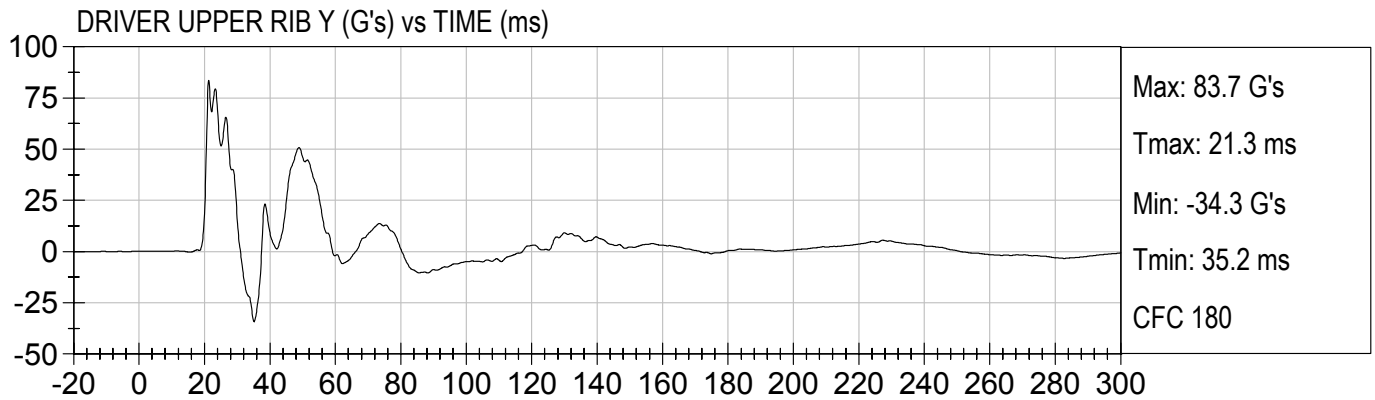


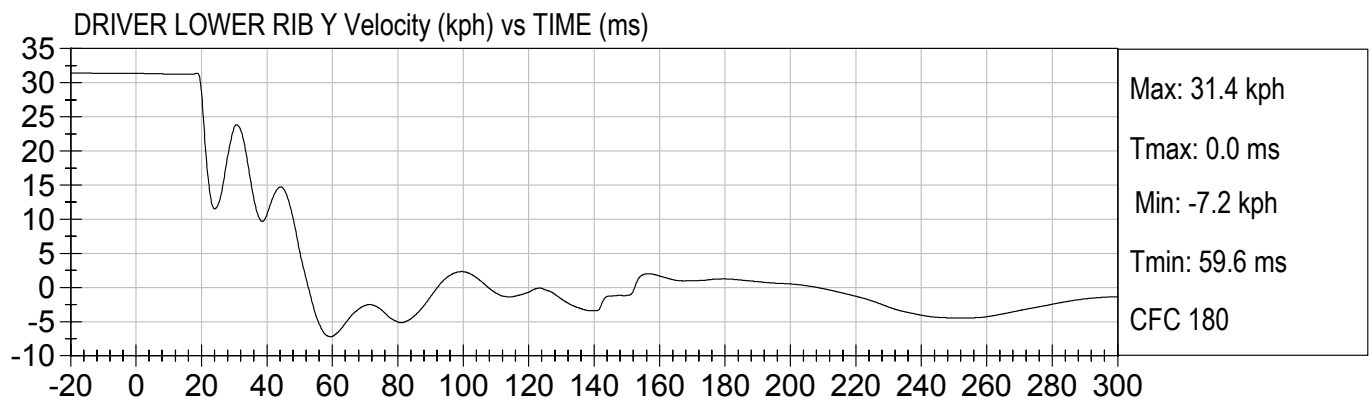
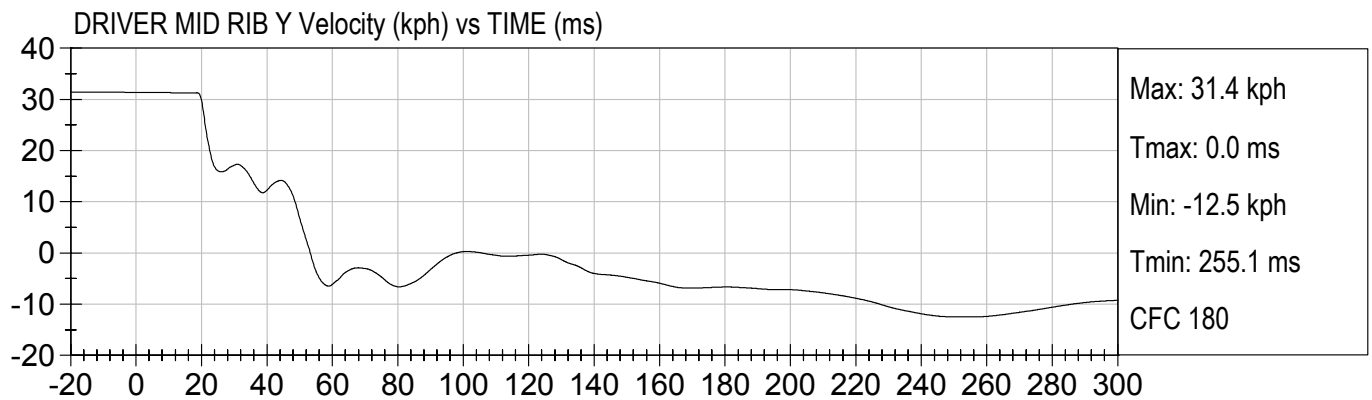
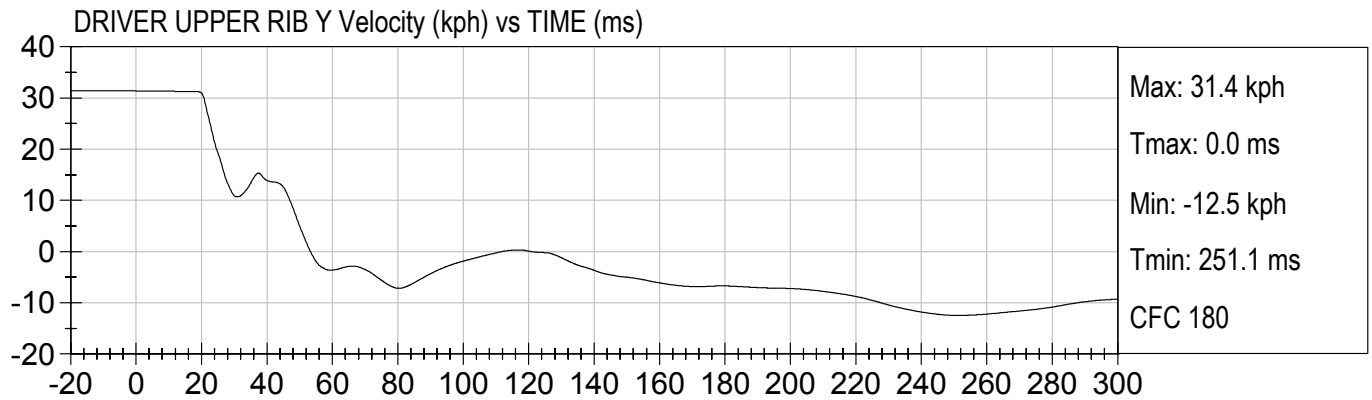
DRIVER SHOULDER FResultant (N) vs TIME (ms)

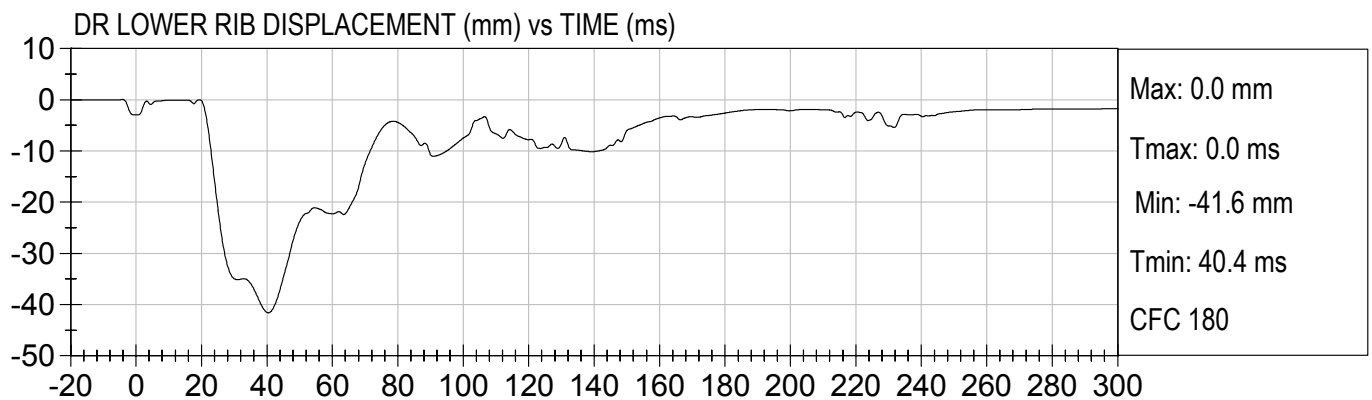
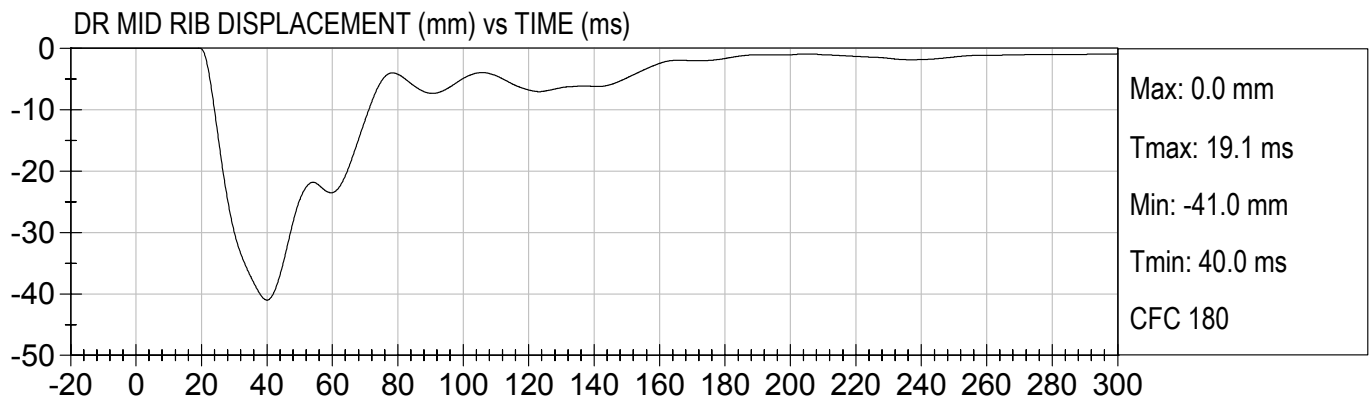
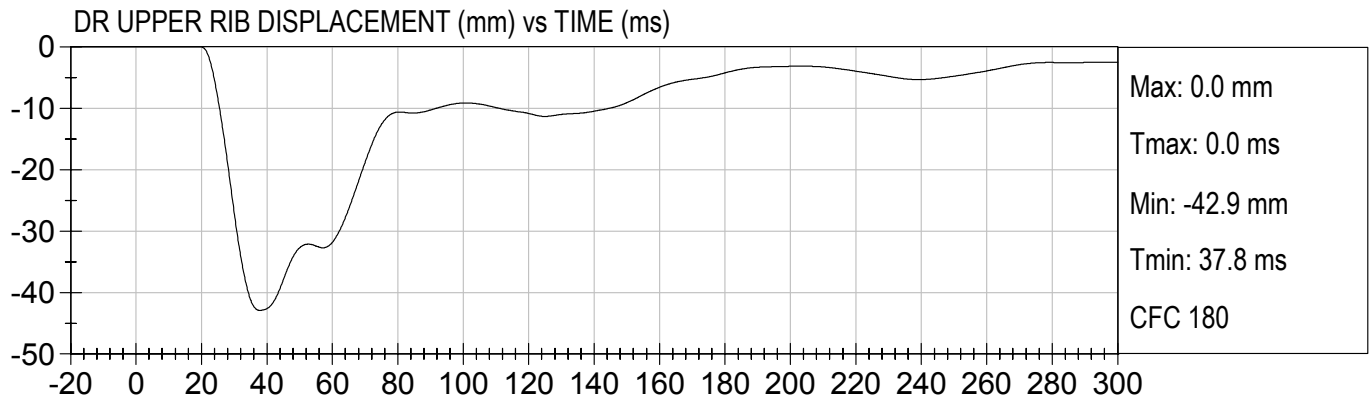


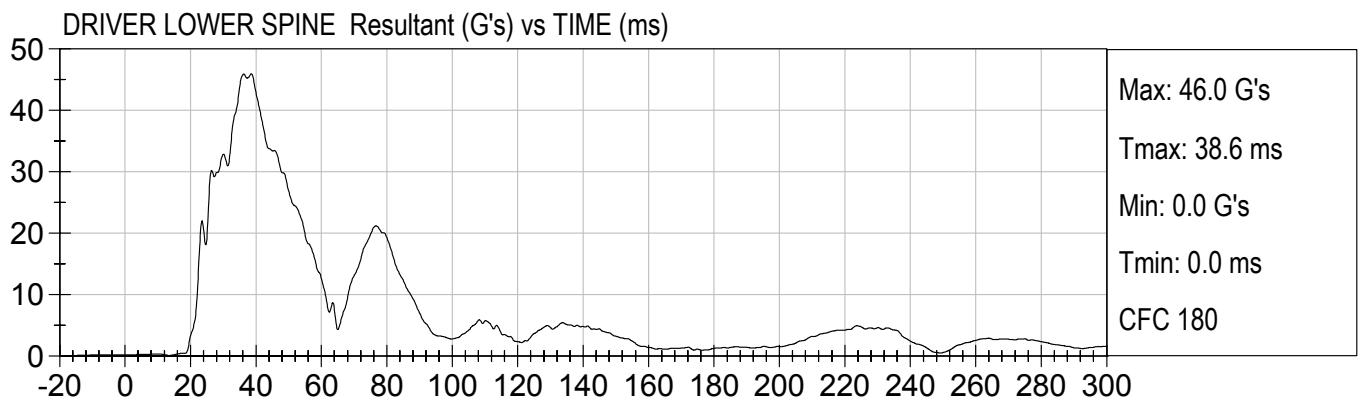
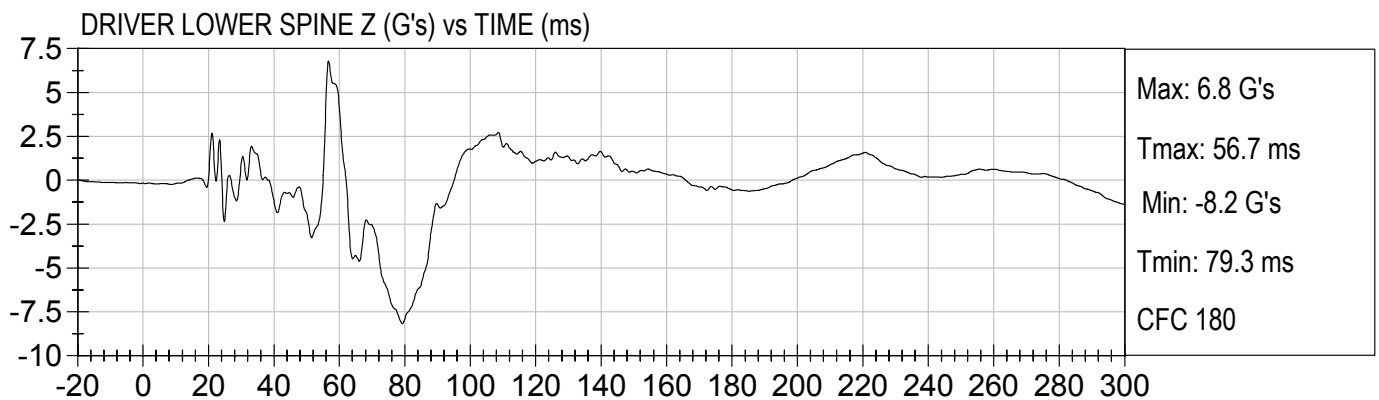
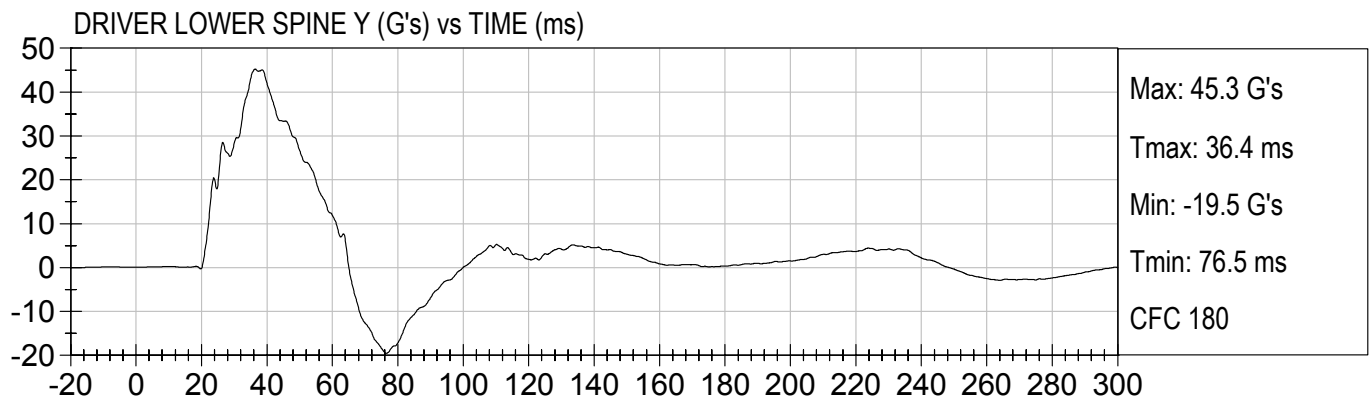
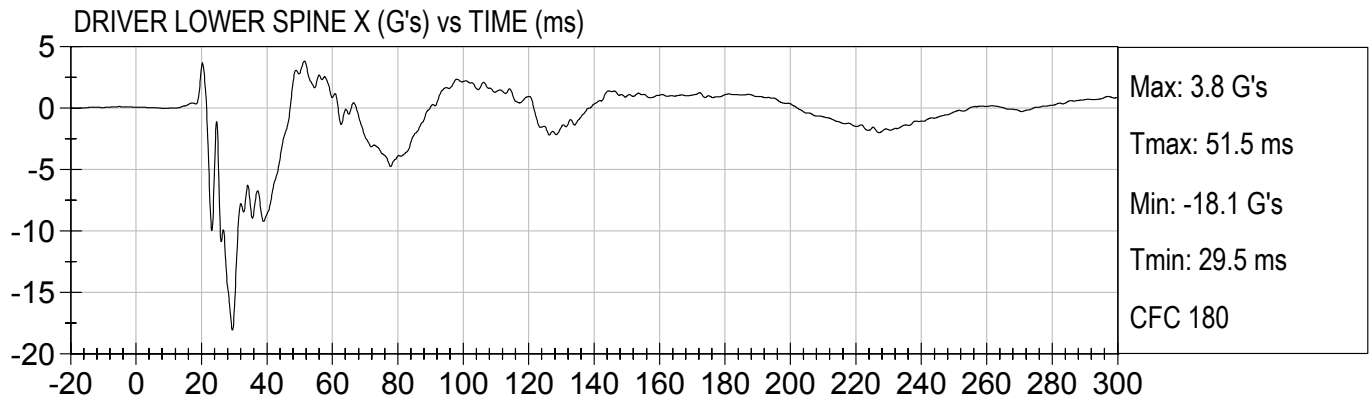






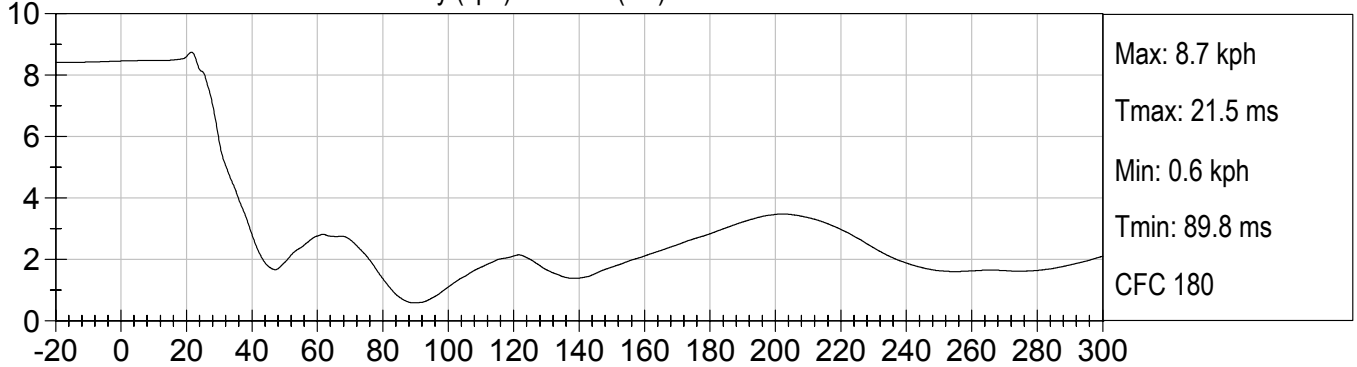




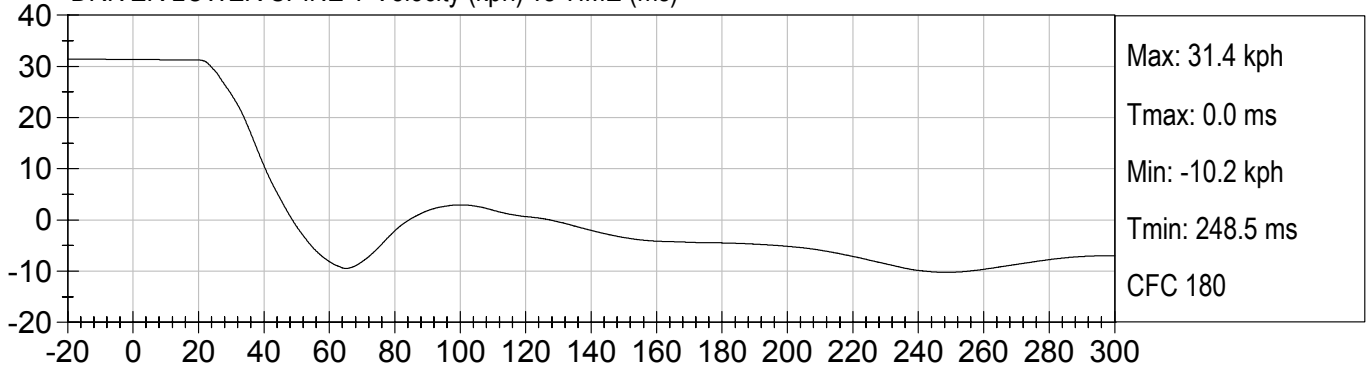




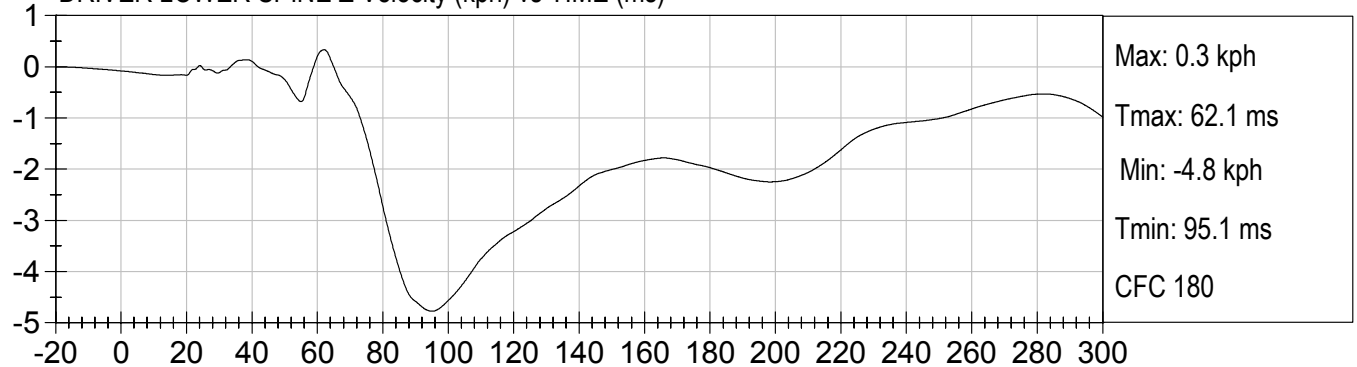
DRIVER LOWER SPINE X Velocity (kph) vs TIME (ms)

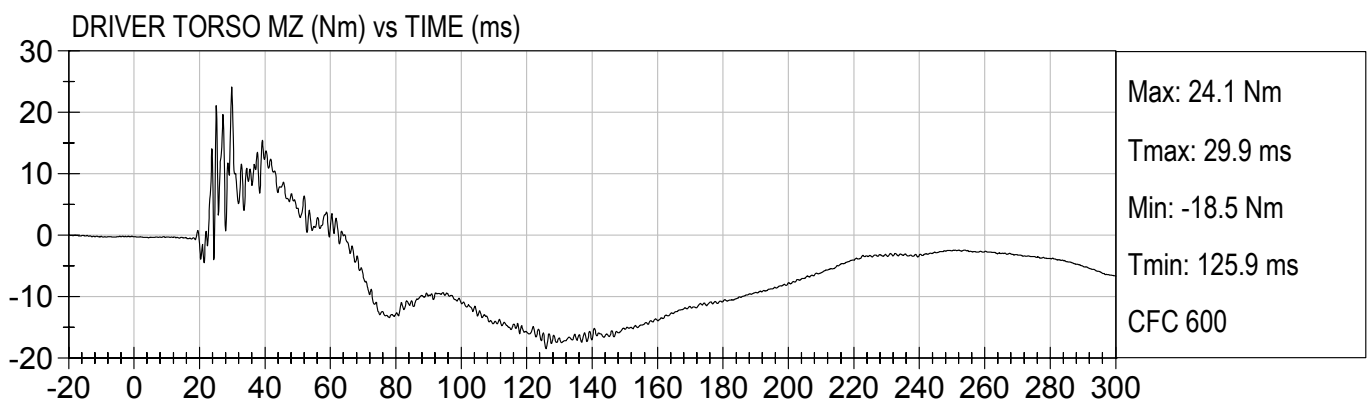
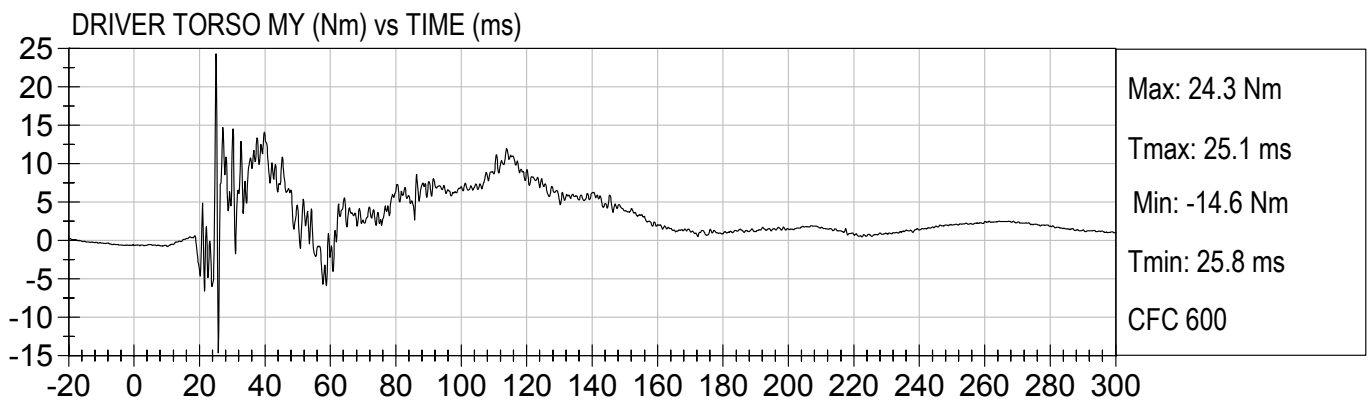
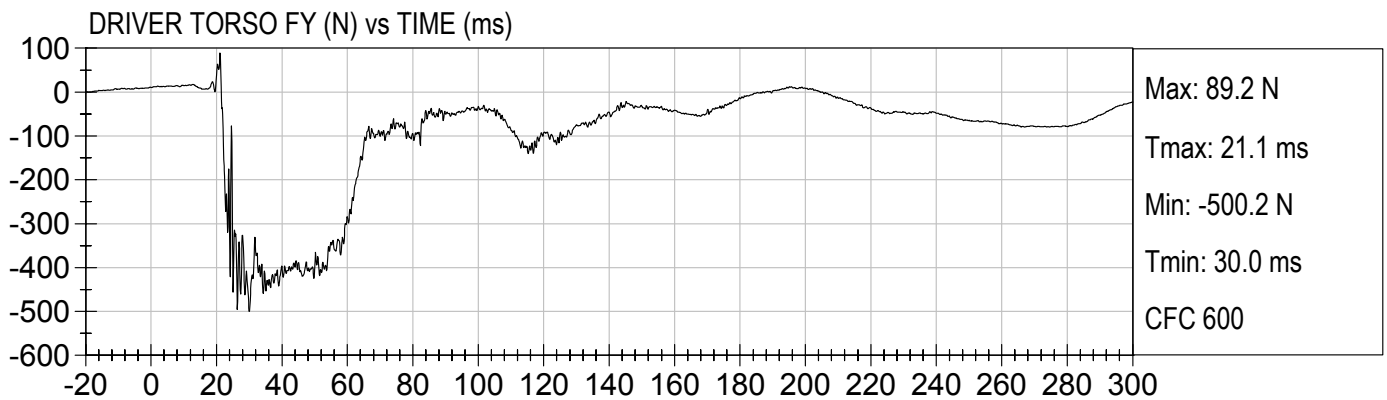
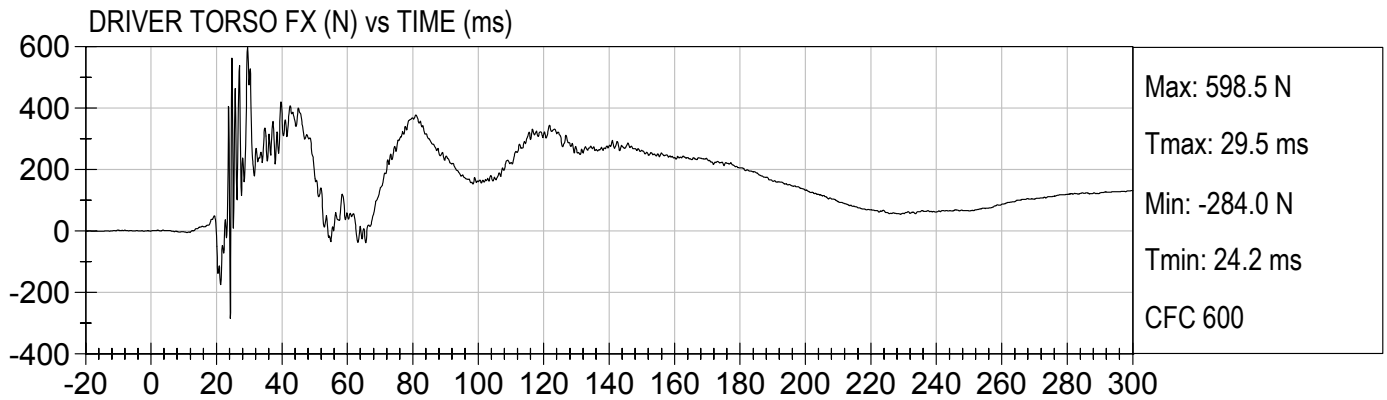


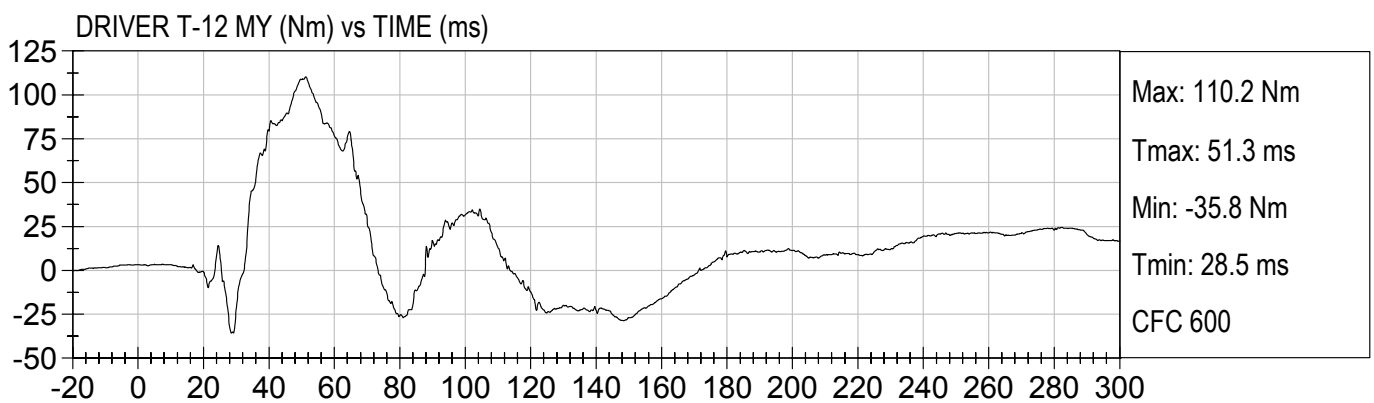
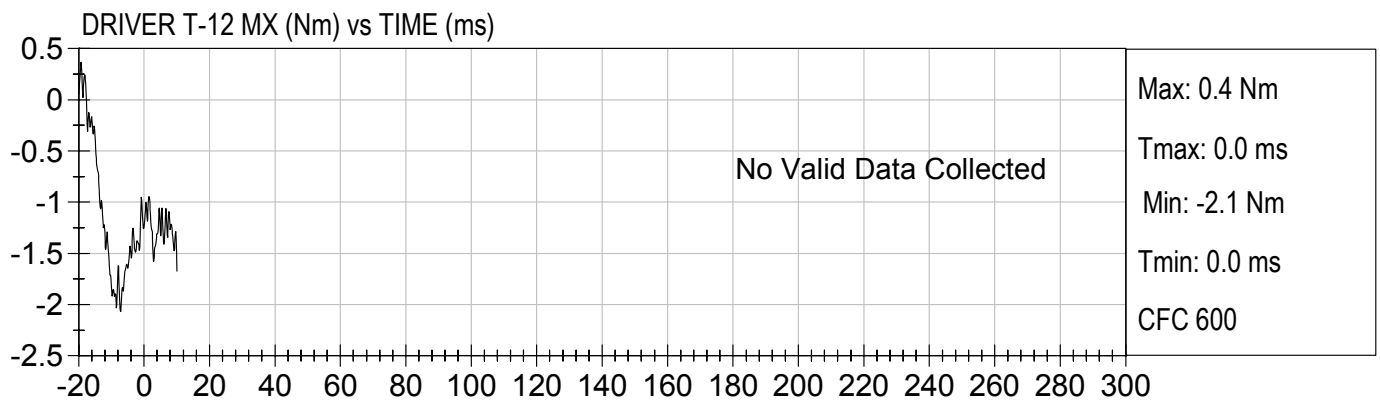
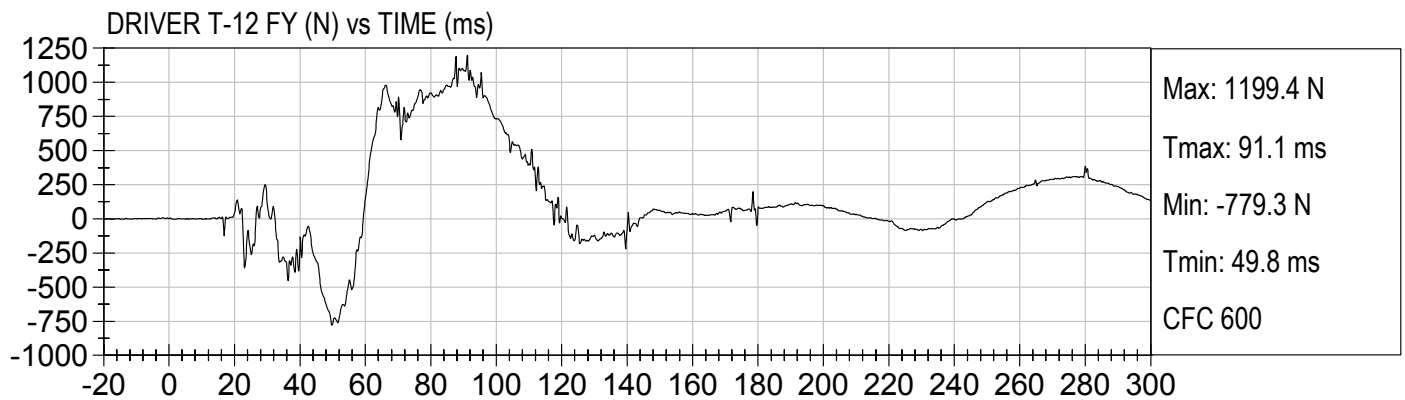
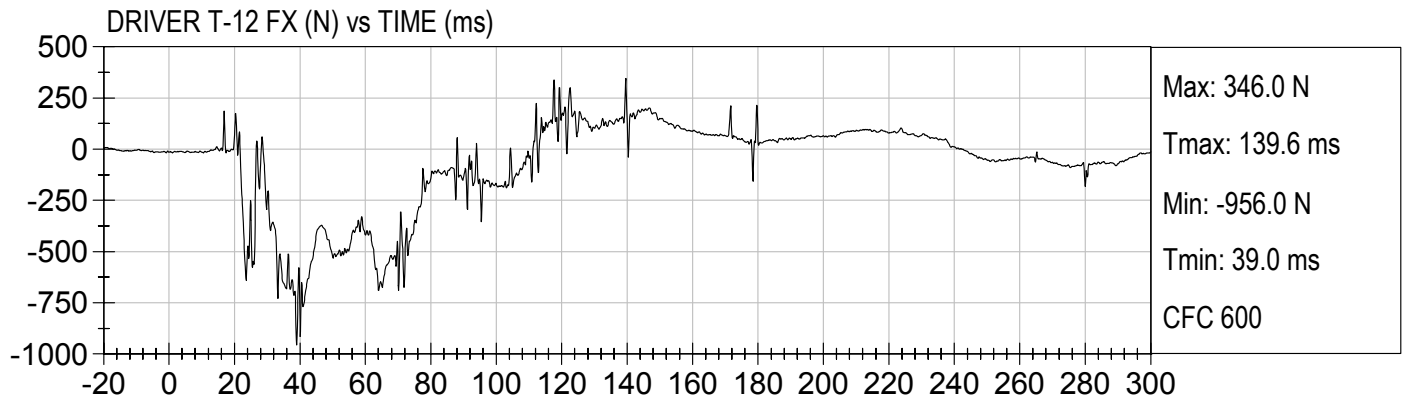
DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)



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





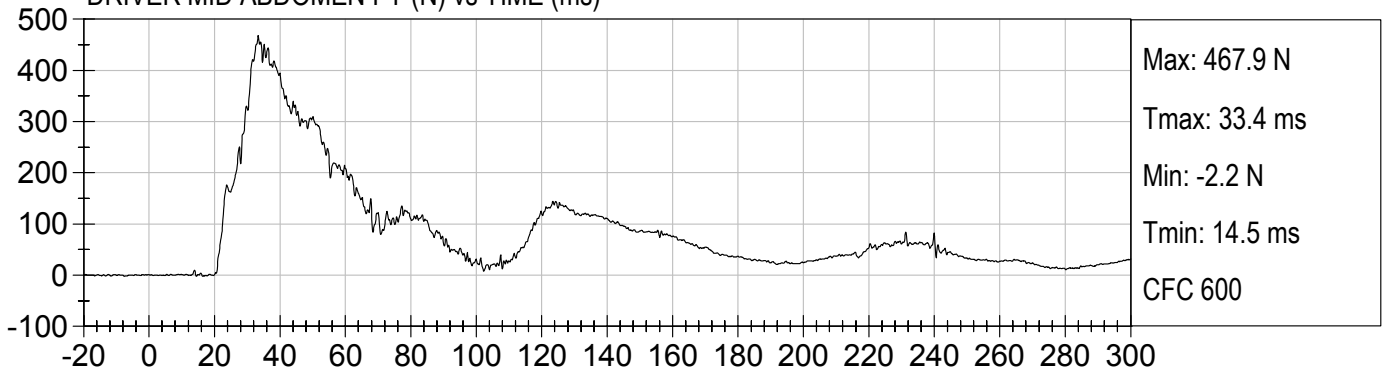




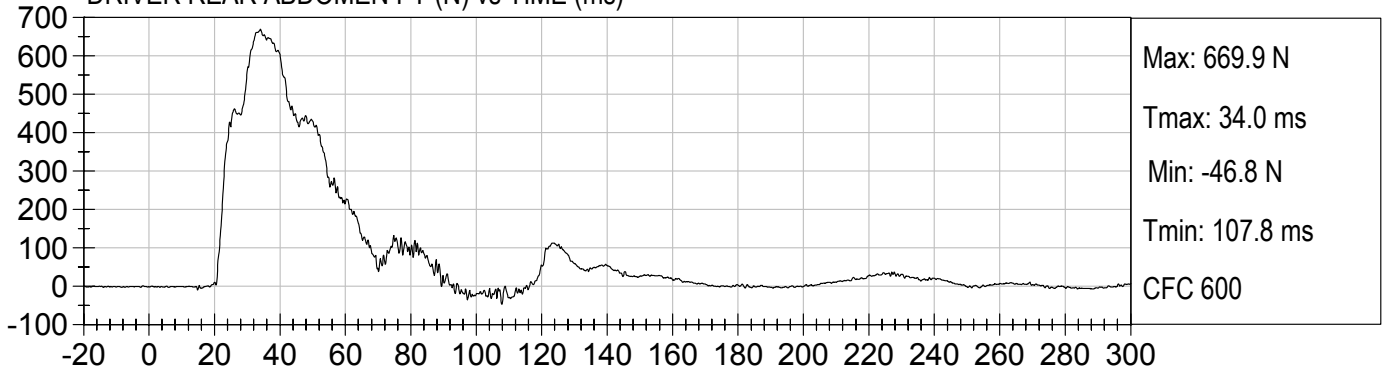
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



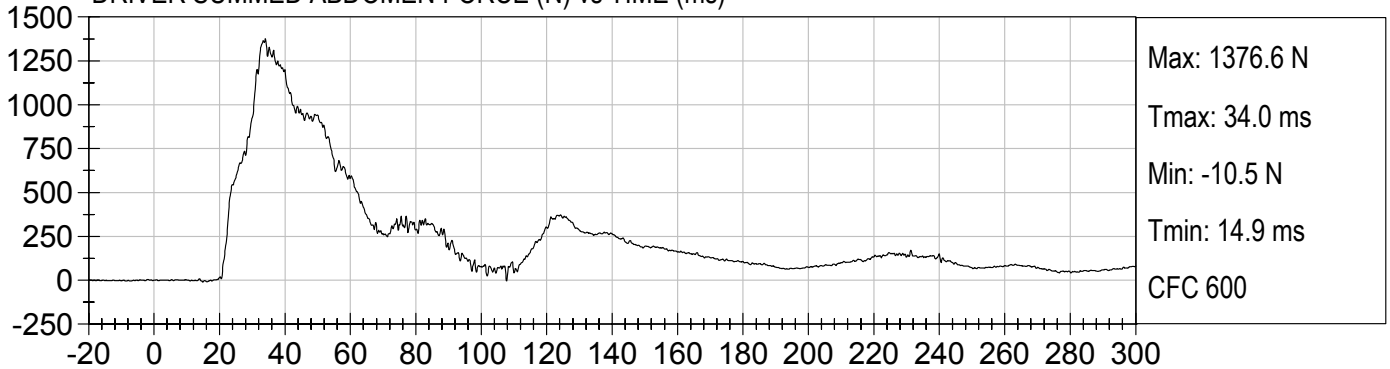
DRIVER MID ABDOMEN FY (N) vs TIME (ms)

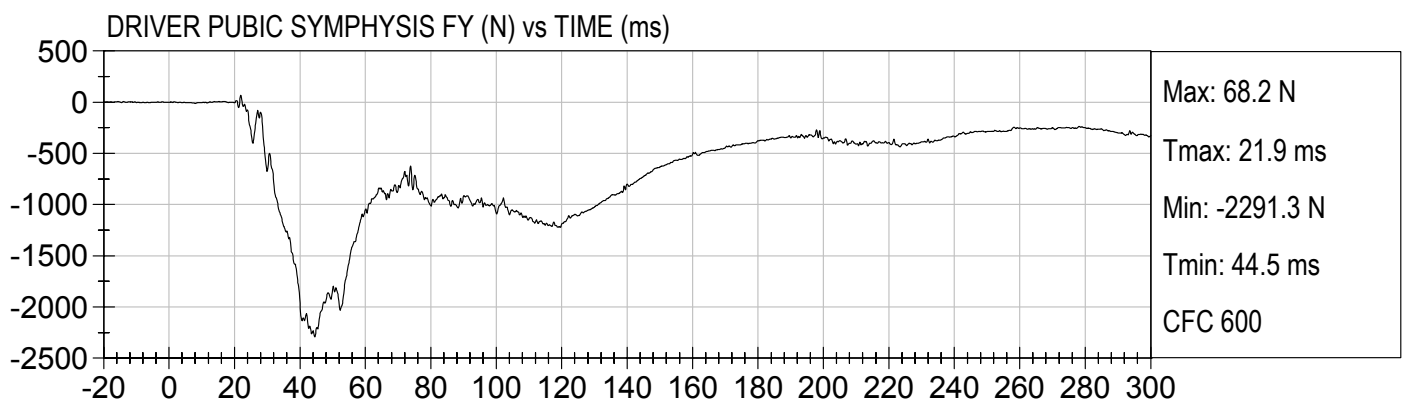
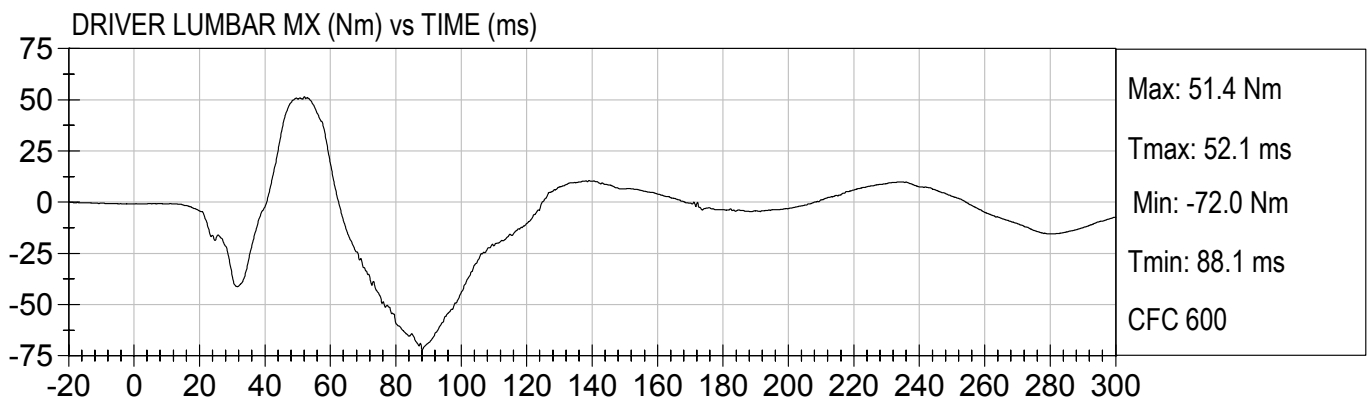
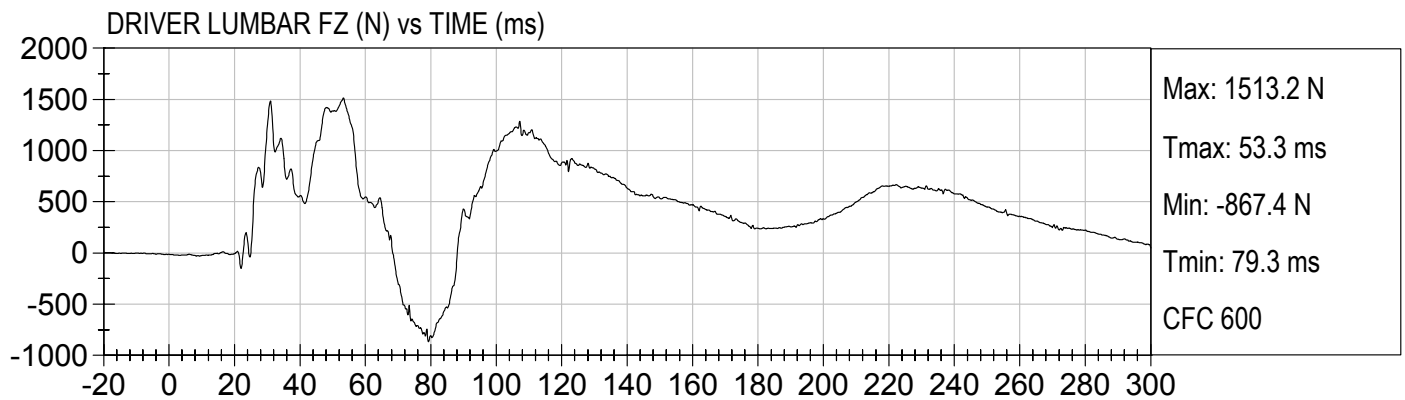
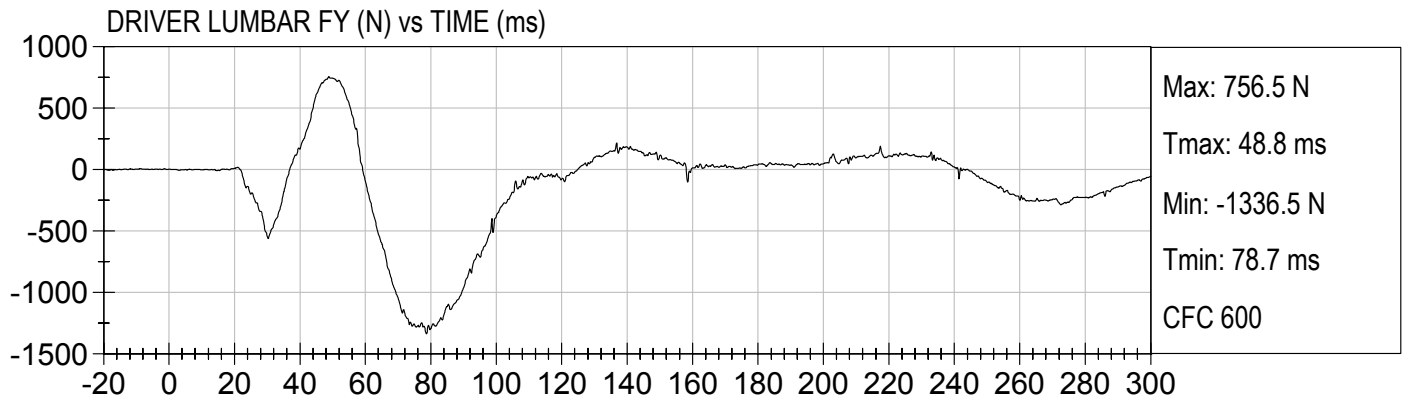


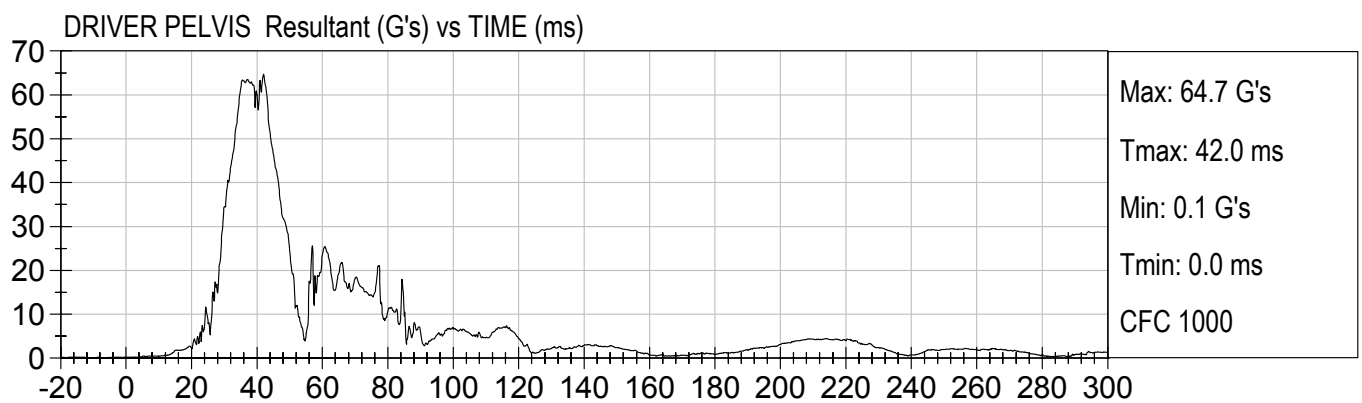
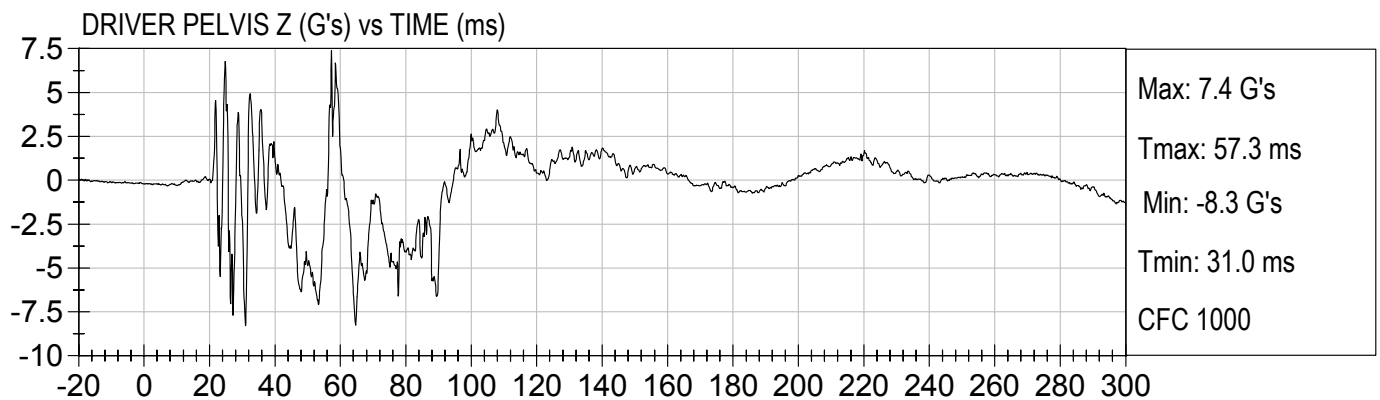
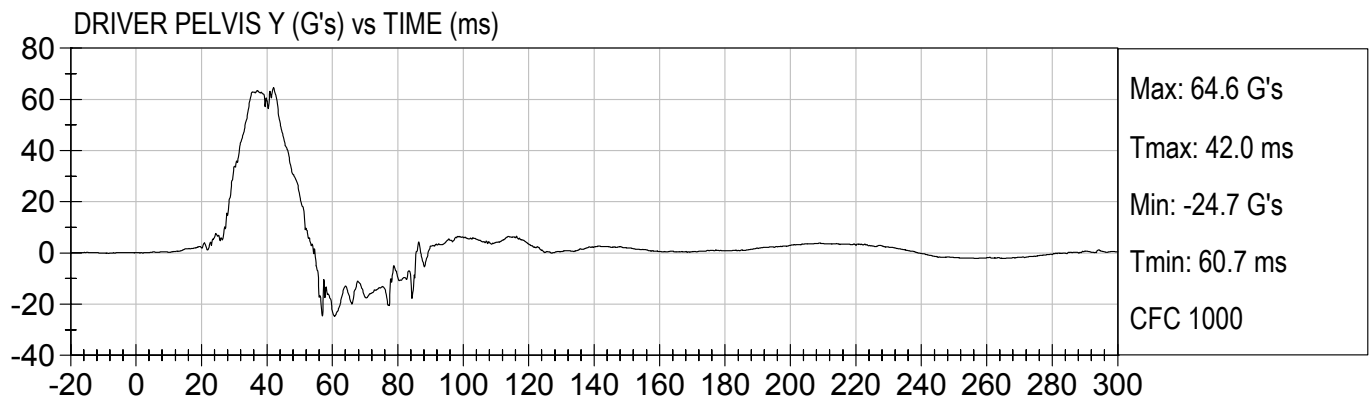
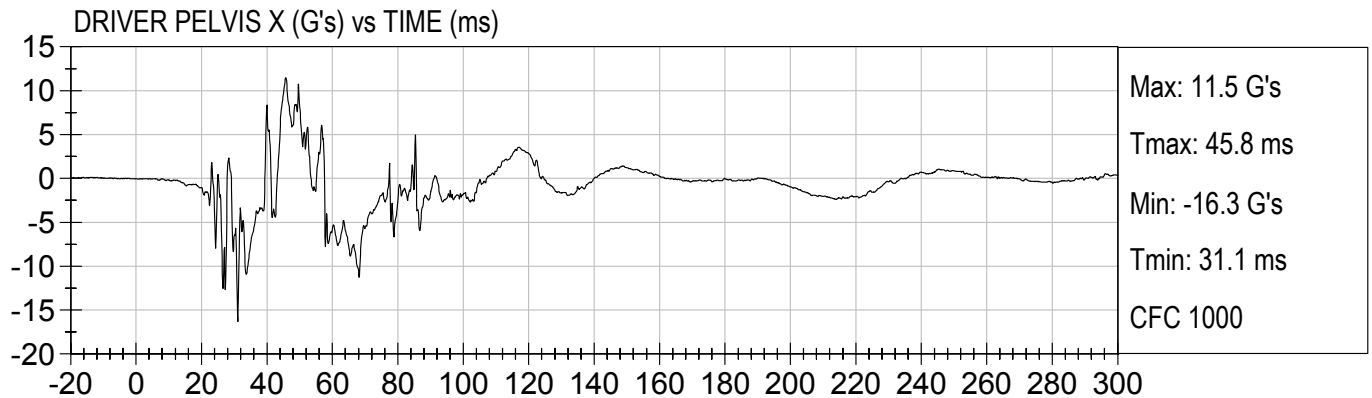
DRIVER REAR ABDOMEN FY (N) vs TIME (ms)



DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)

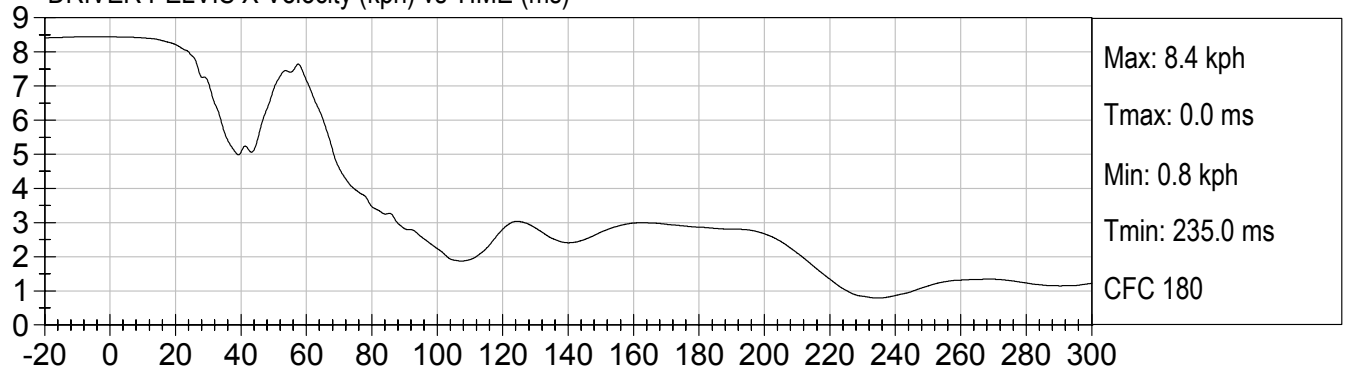




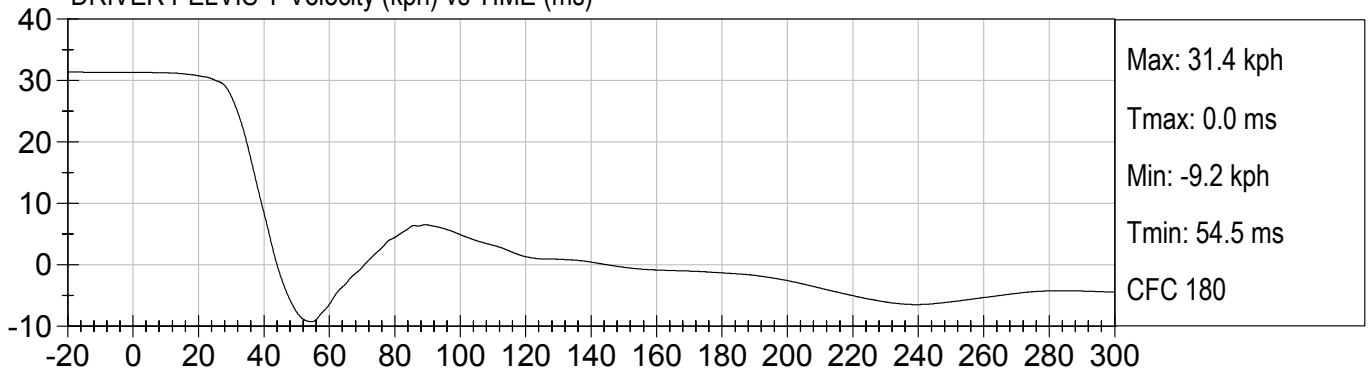




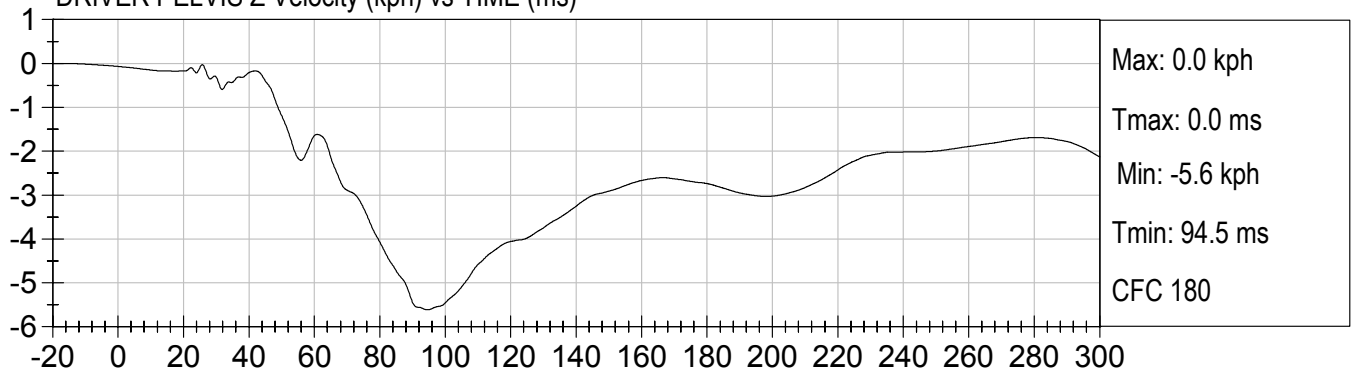
DRIVER PELVIS X Velocity (kph) vs TIME (ms)



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

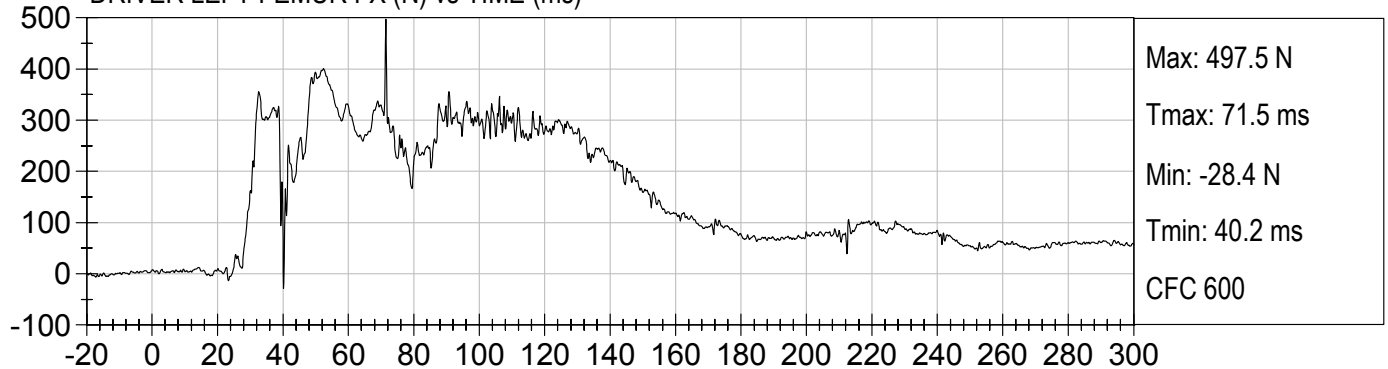


DRIVER PELVIS Z Velocity (kph) vs TIME (ms)

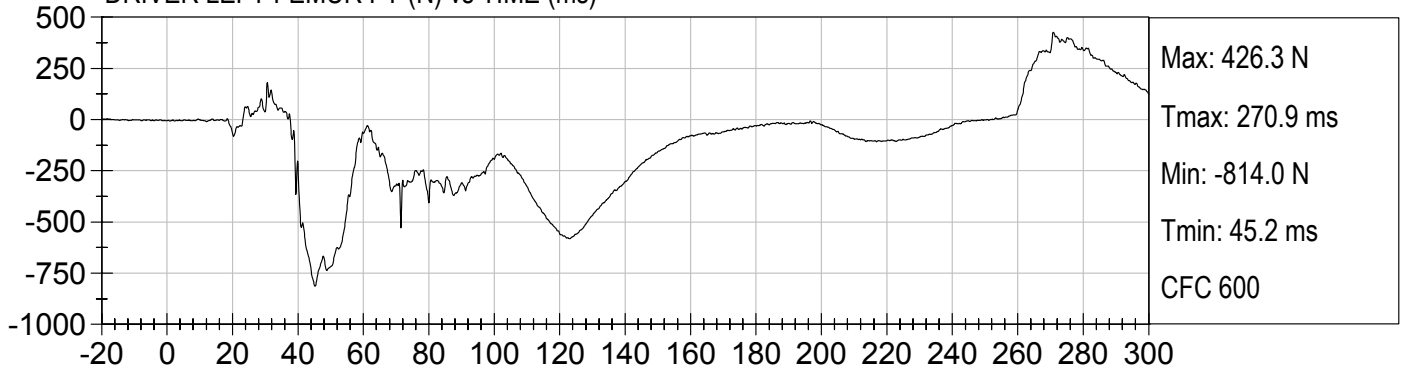




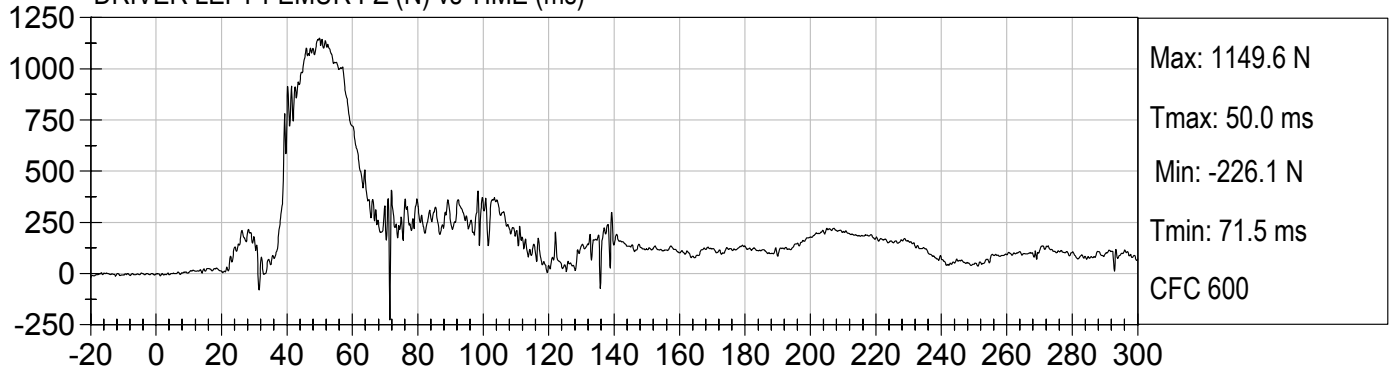
DRIVER LEFT FEMUR FX (N) vs TIME (ms)



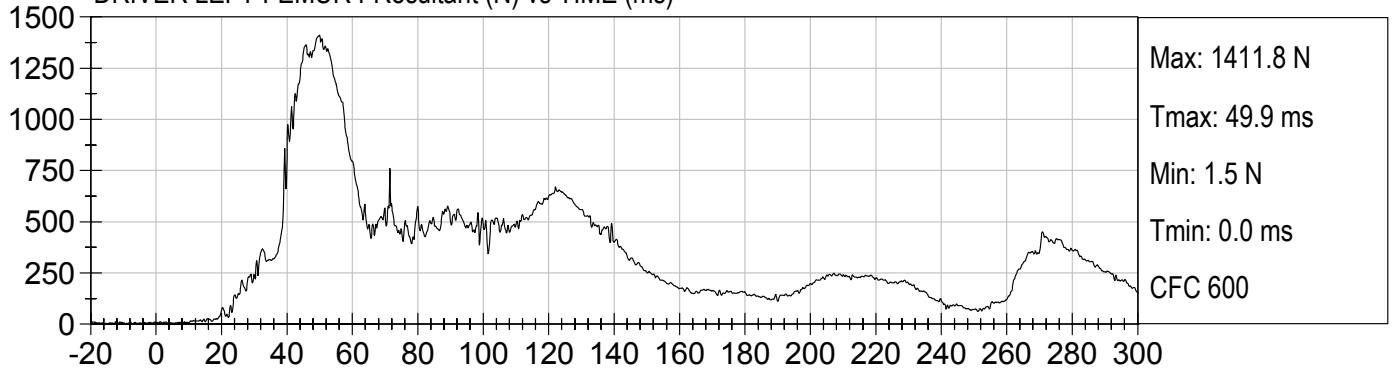
DRIVER LEFT FEMUR FY (N) vs TIME (ms)

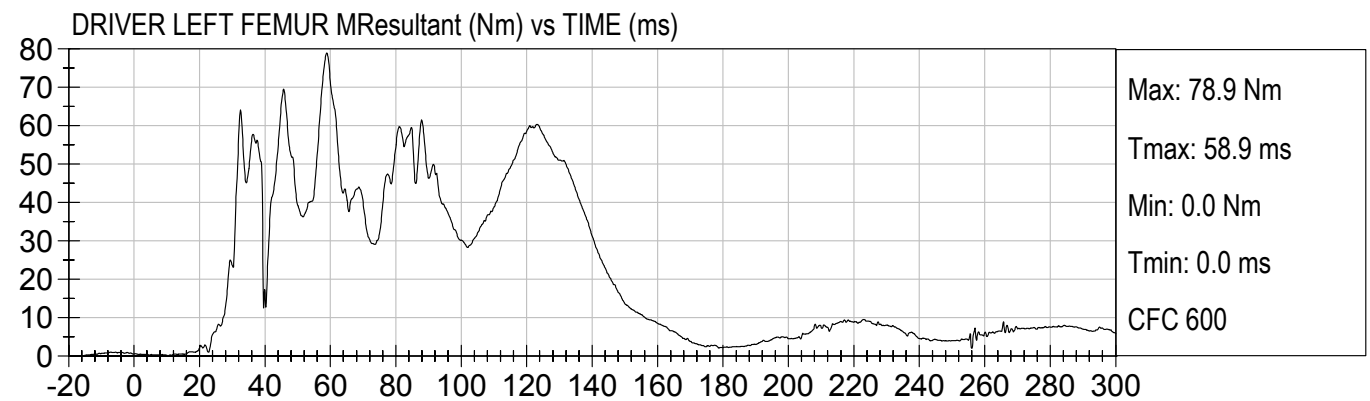
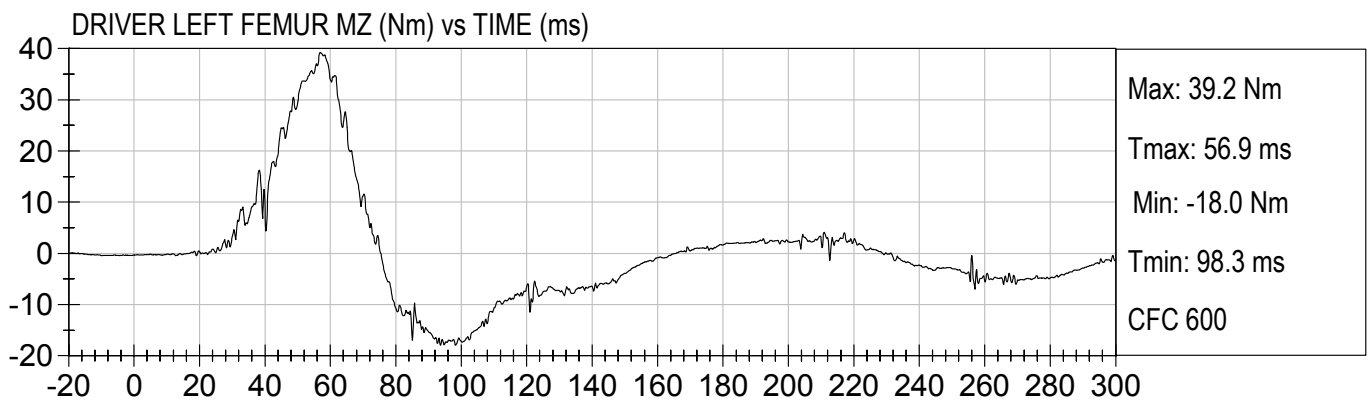
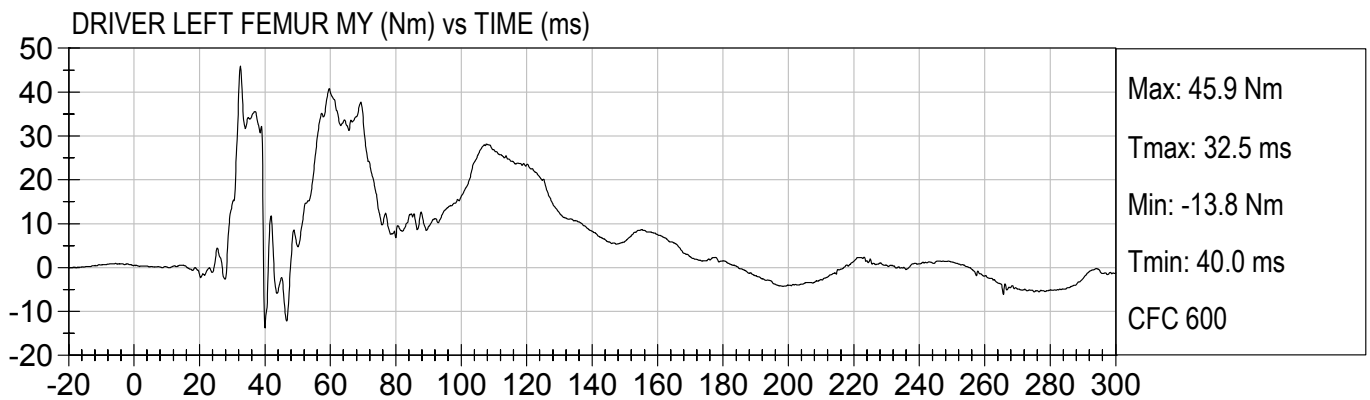
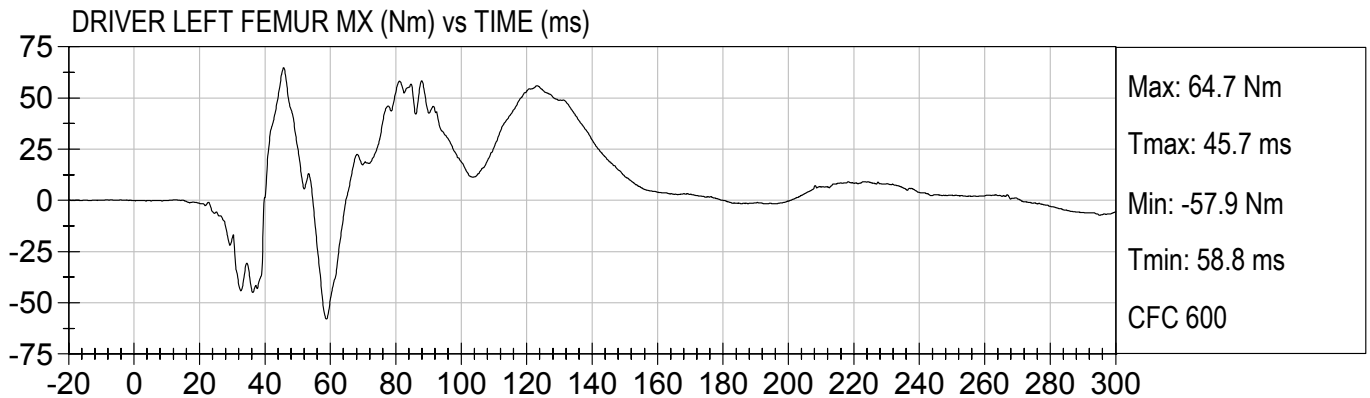


DRIVER LEFT FEMUR FZ (N) vs TIME (ms)



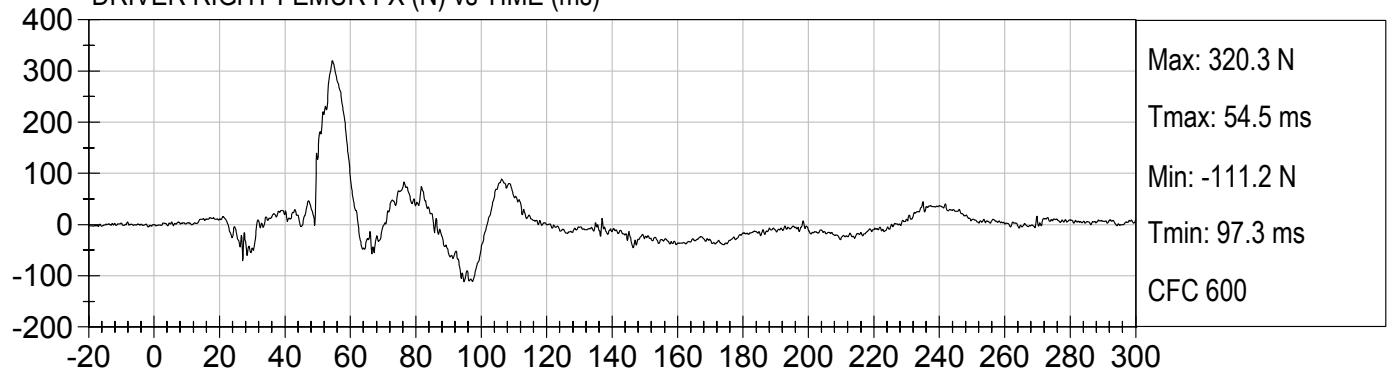
DRIVER LEFT FEMUR FResultant (N) vs TIME (ms)



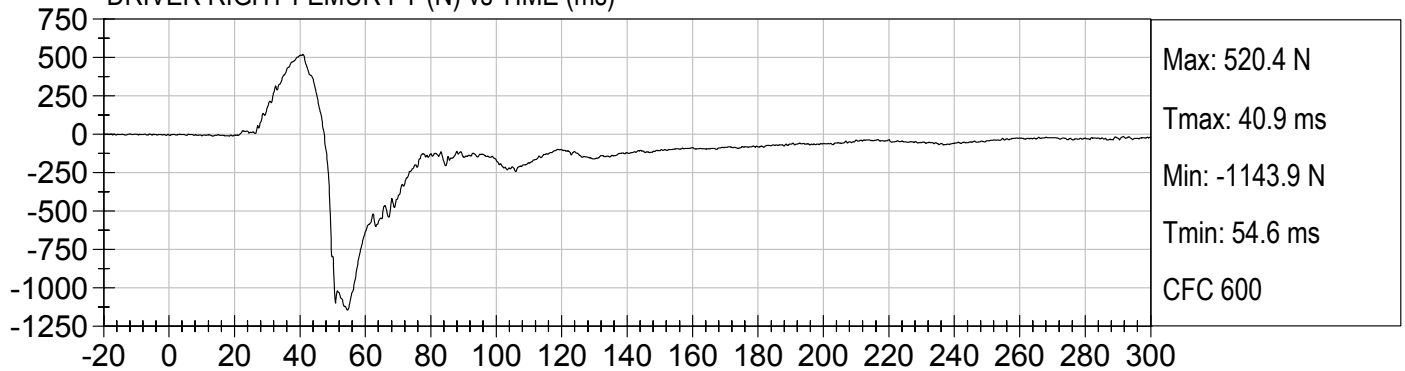




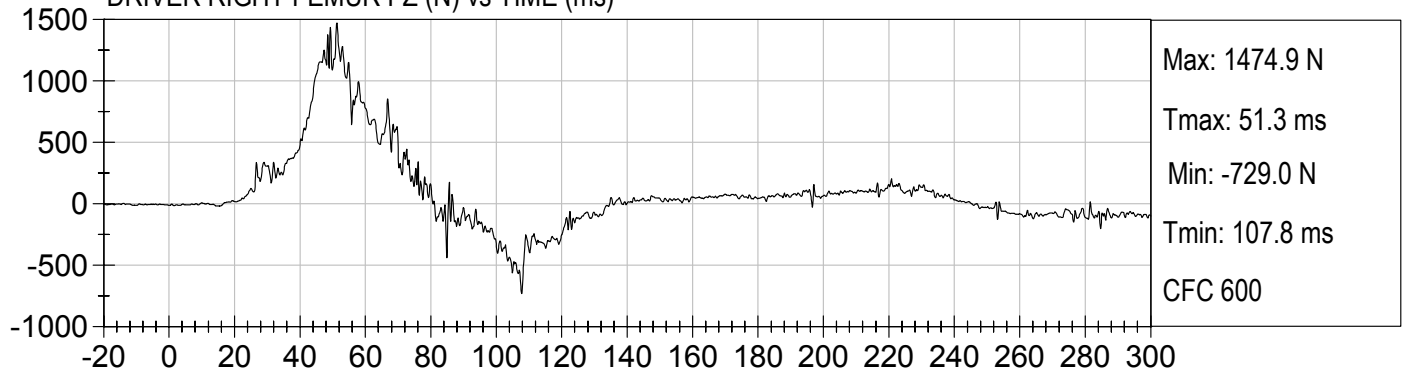
DRIVER RIGHT FEMUR FX (N) vs TIME (ms)



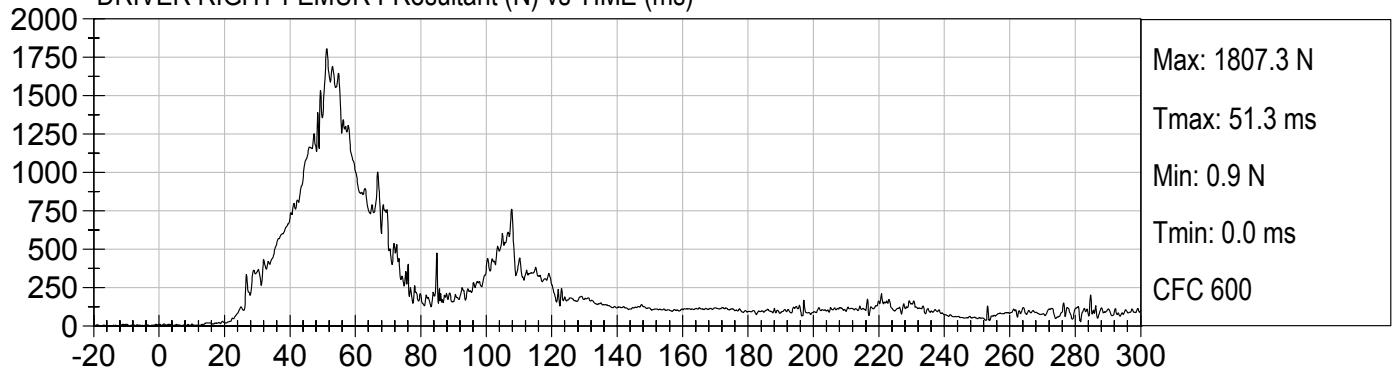
DRIVER RIGHT FEMUR FY (N) vs TIME (ms)

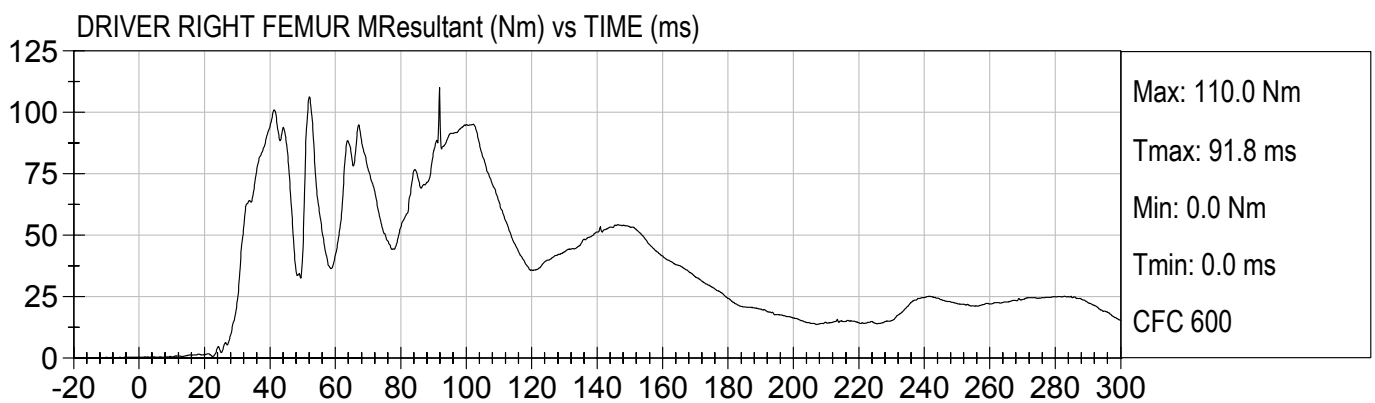
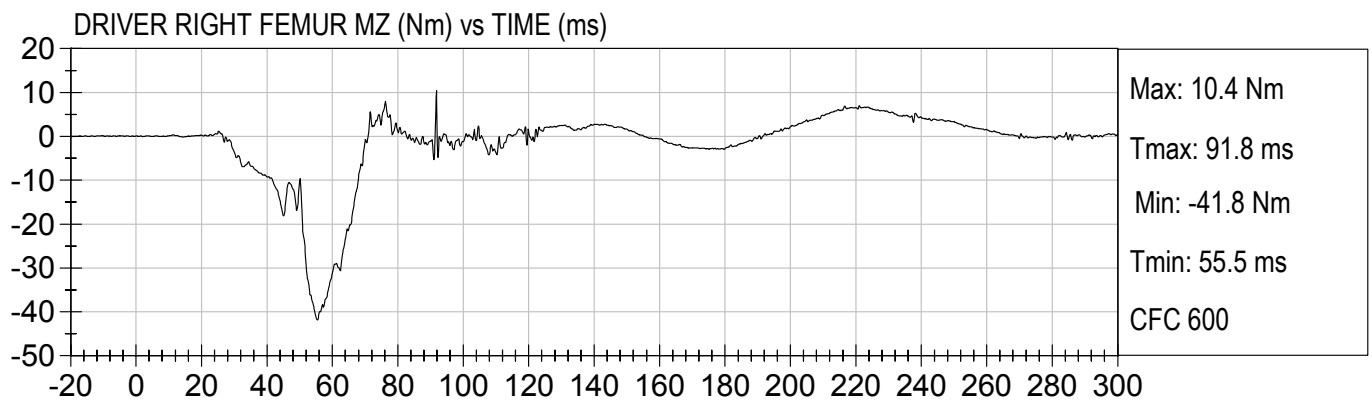
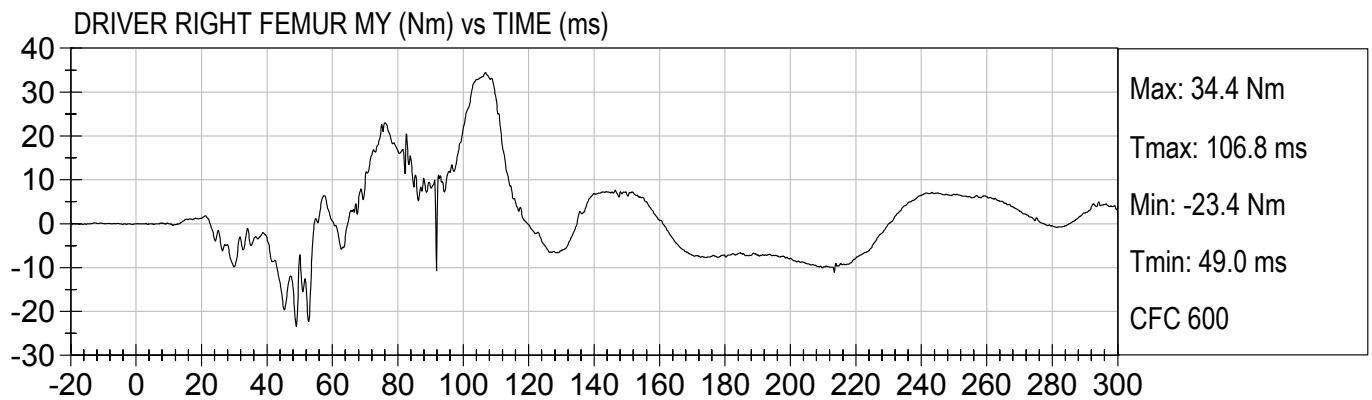
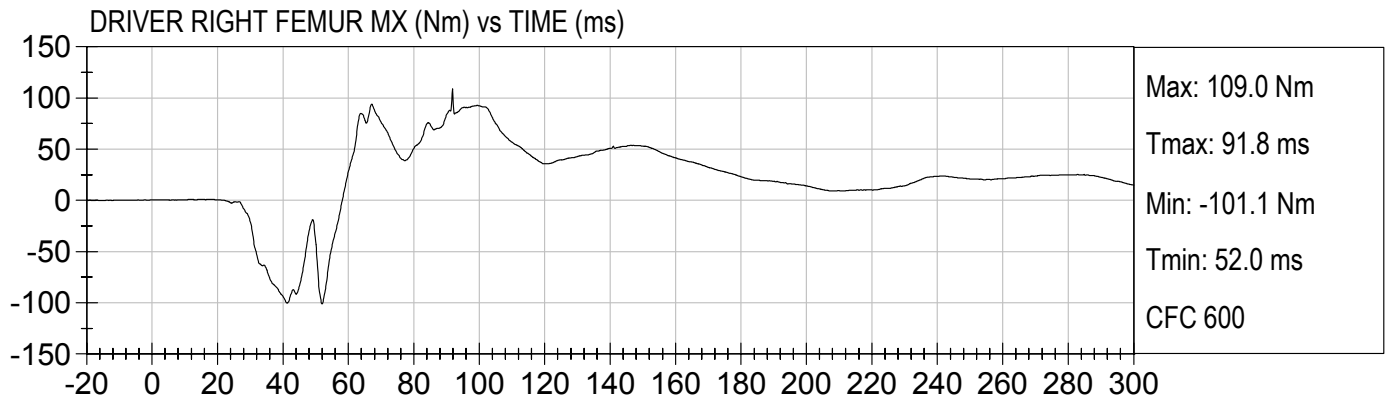


DRIVER RIGHT FEMUR FZ (N) vs TIME (ms)



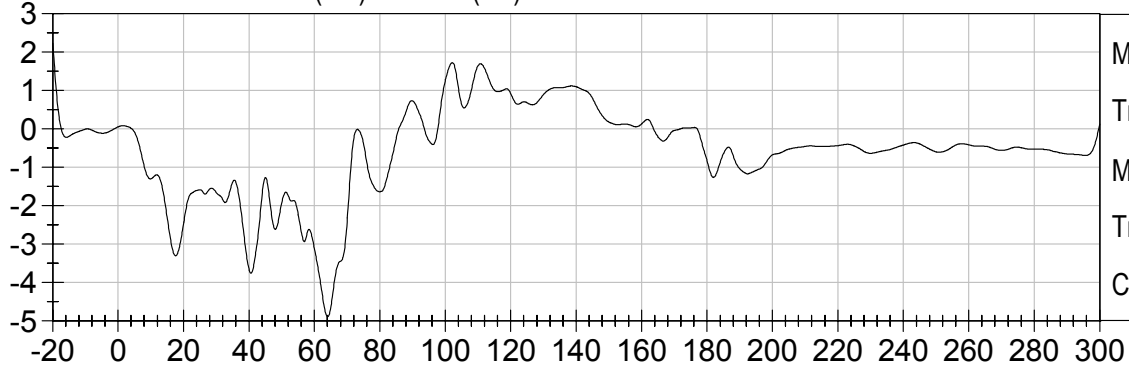
DRIVER RIGHT FEMUR FResultant (N) vs TIME (ms)



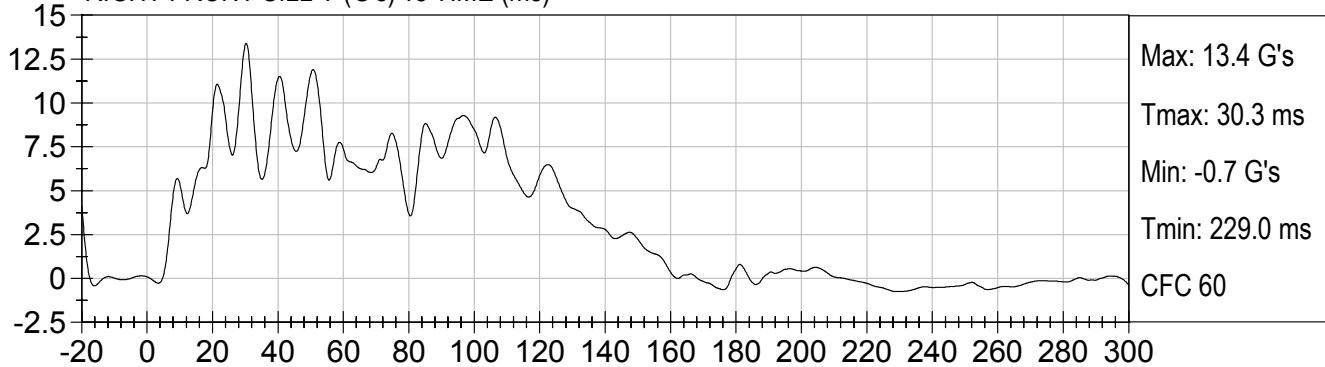




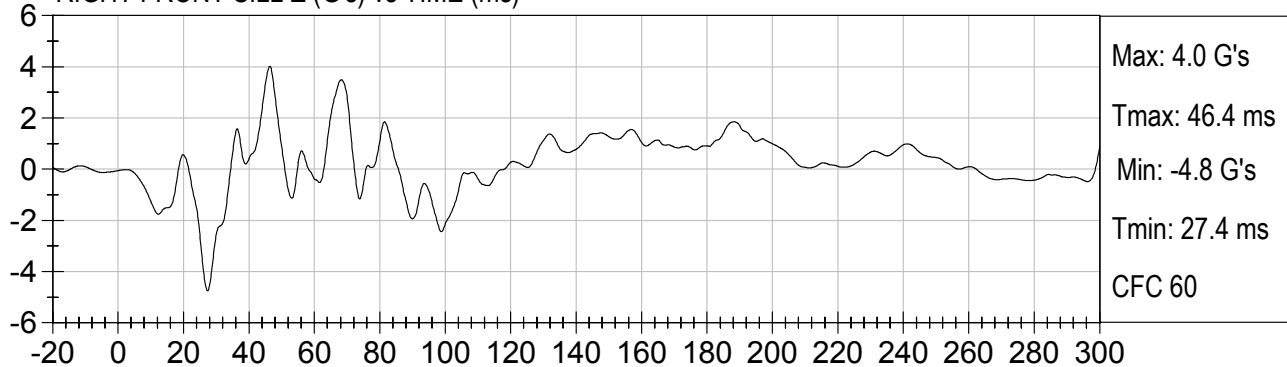
RIGHT FRONT SILL X (G's) vs TIME (ms)



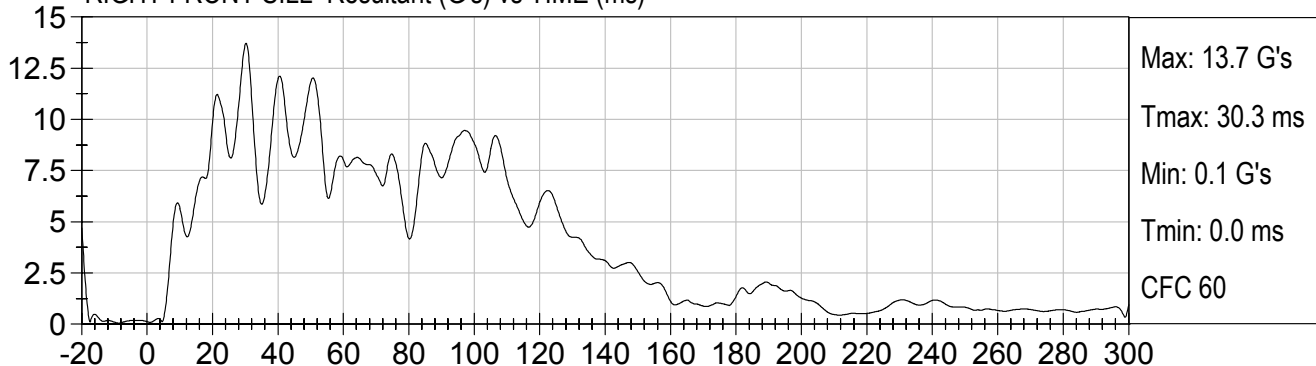
RIGHT FRONT SILL Y (G's) vs TIME (ms)

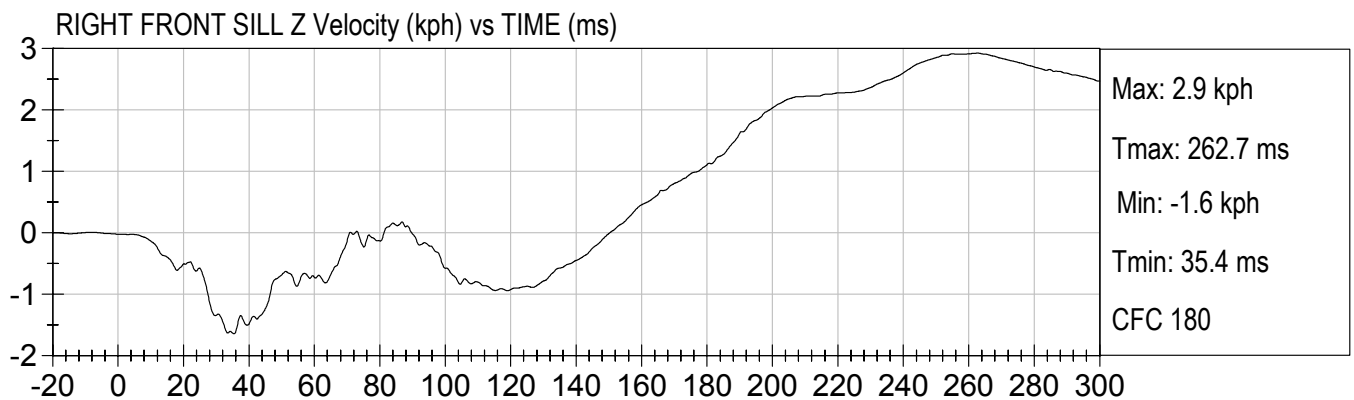
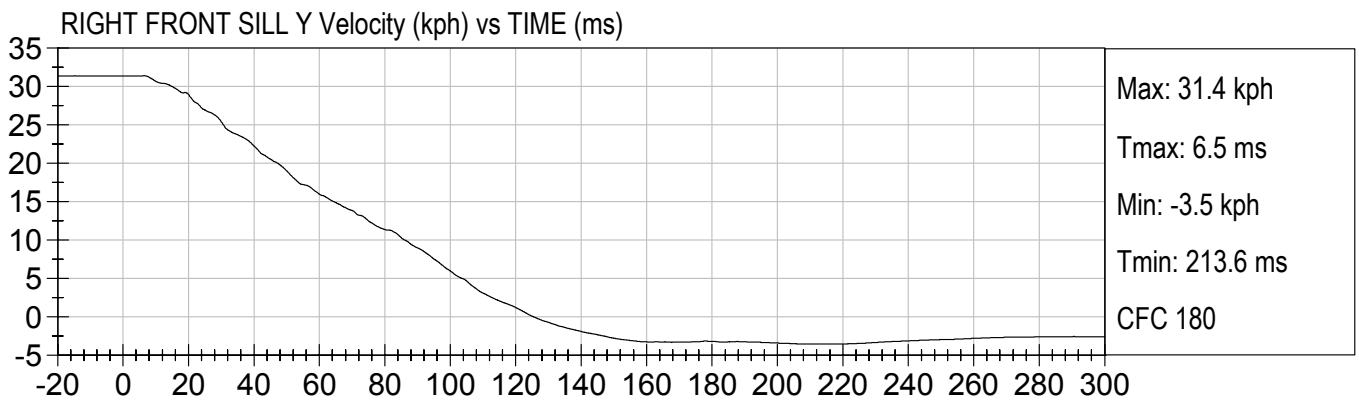
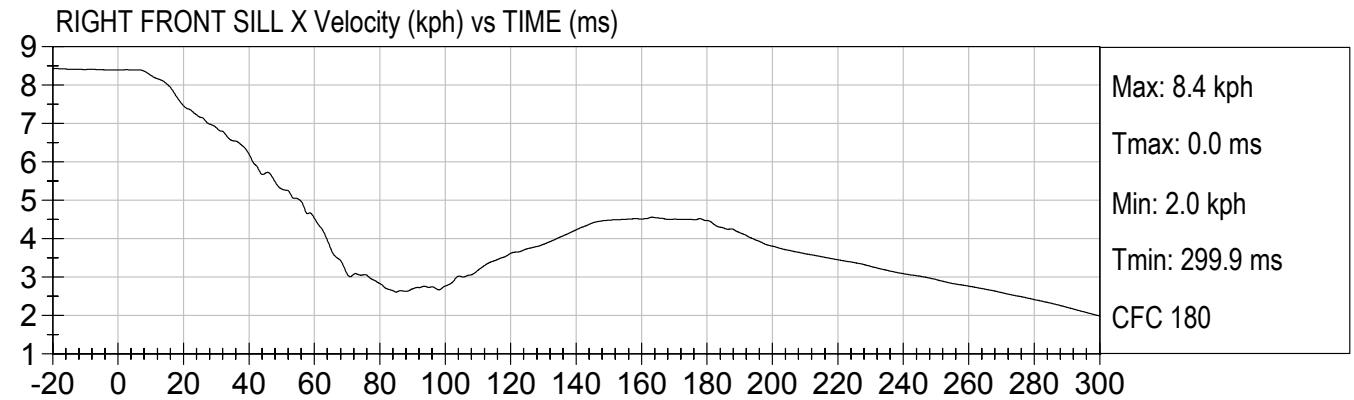


RIGHT FRONT SILL Z (G's) vs TIME (ms)



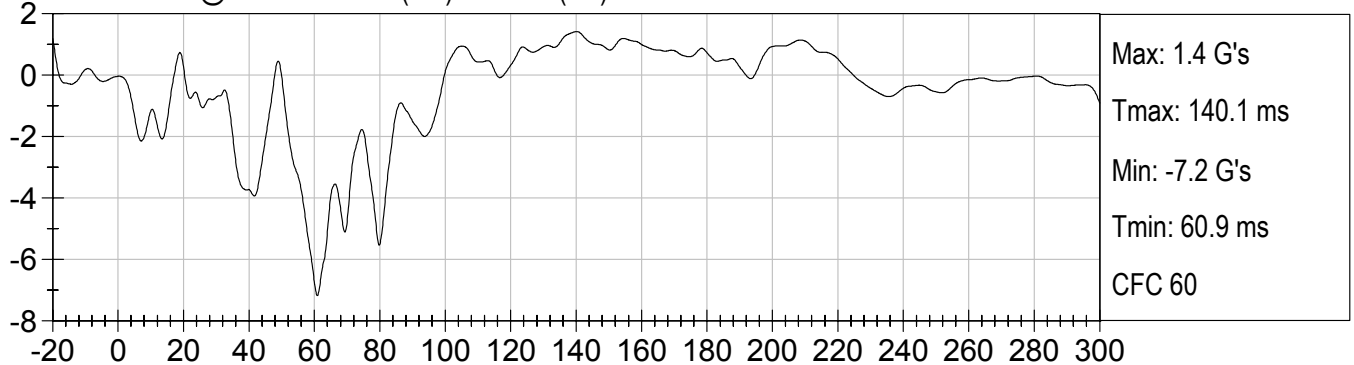
RIGHT FRONT SILL Resultant (G's) vs TIME (ms)



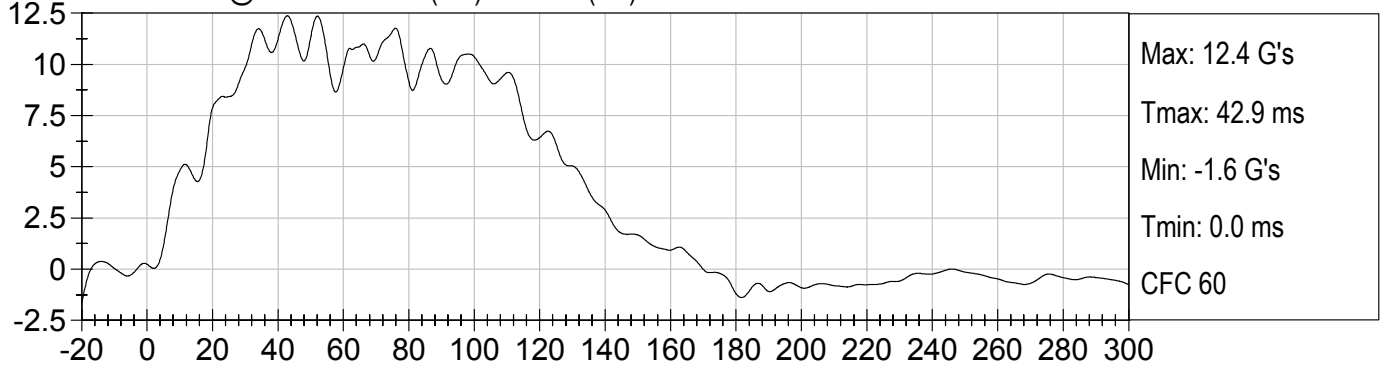




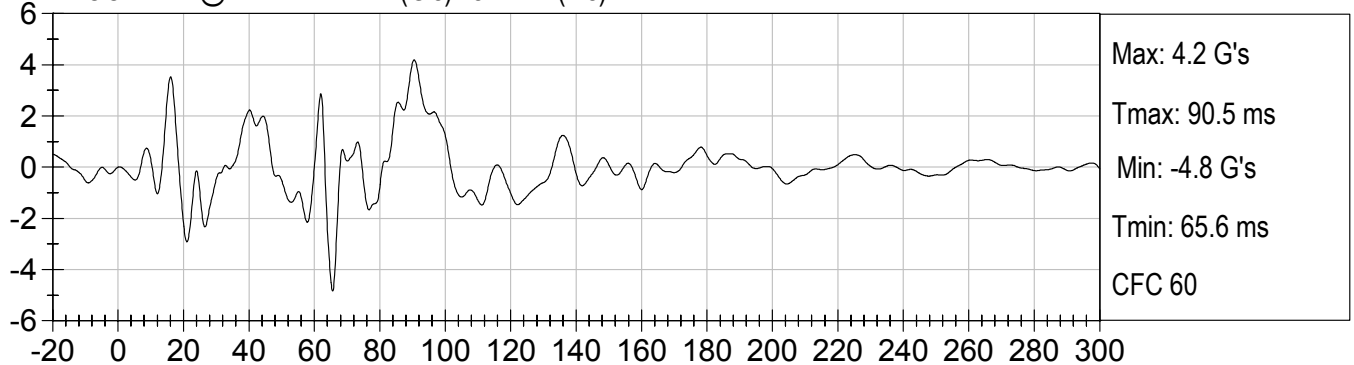
FLOORPAN @ REAR AXLE X (G's) vs TIME (ms)



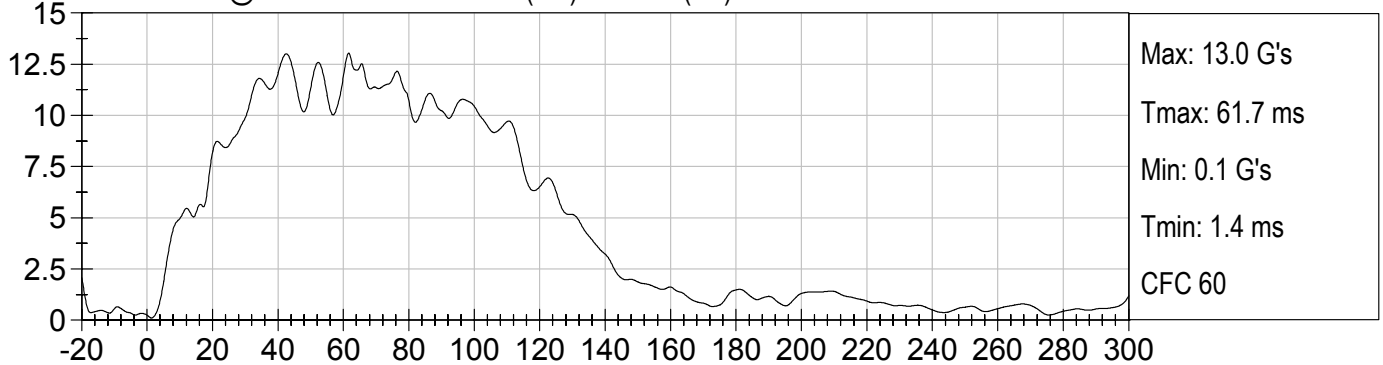
FLOORPAN @ REAR AXLE Y (G's) vs TIME (ms)



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

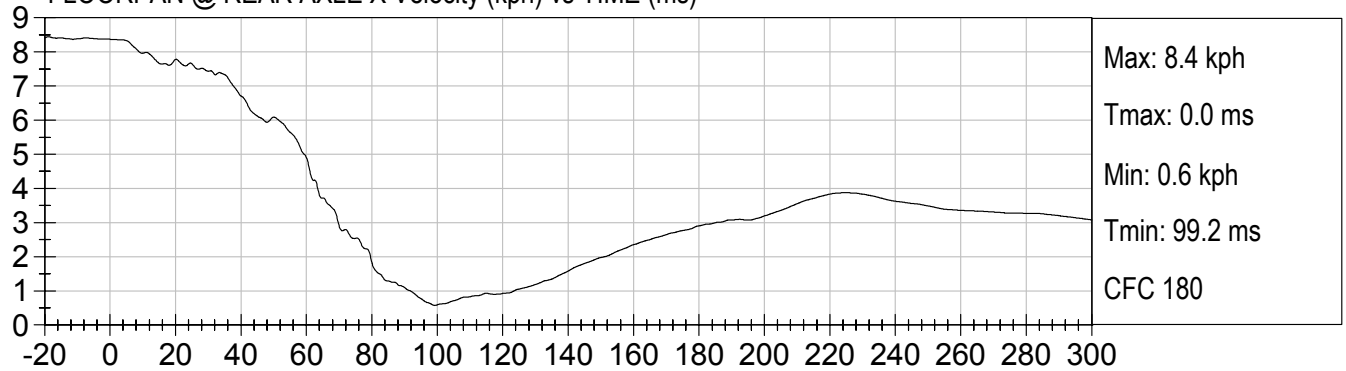


FLOORPAN @ REAR A ResultantLE X (G's) vs TIME (ms)

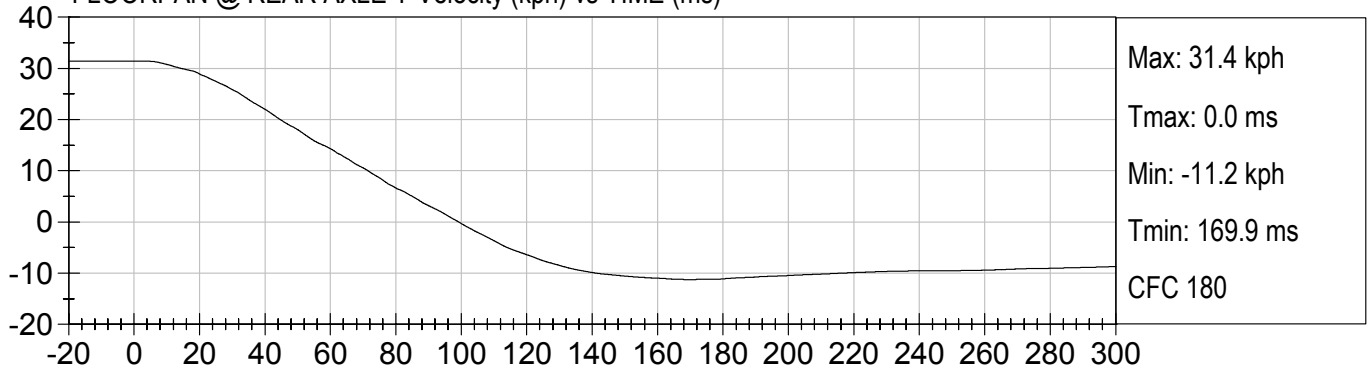




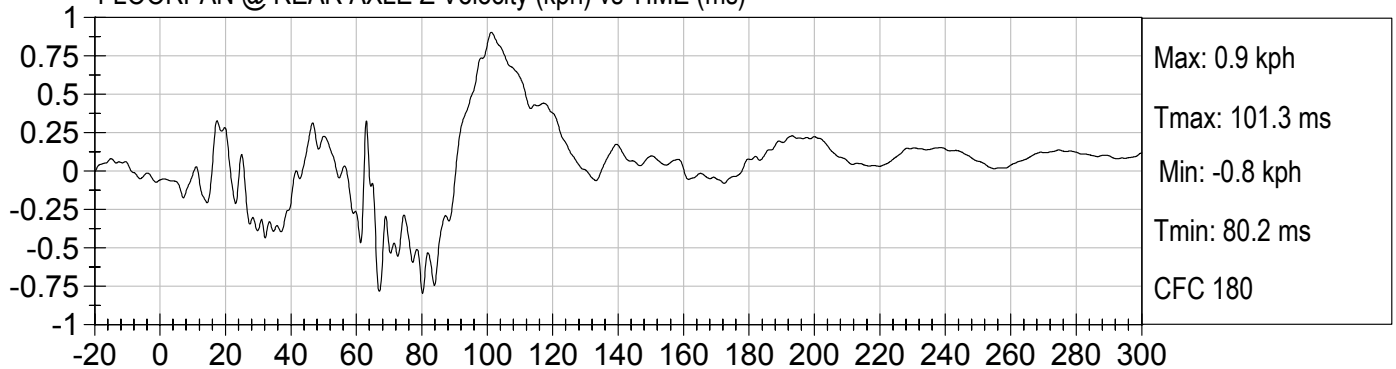
FLOORPAN @ REAR AXLE X Velocity (kph) vs TIME (ms)

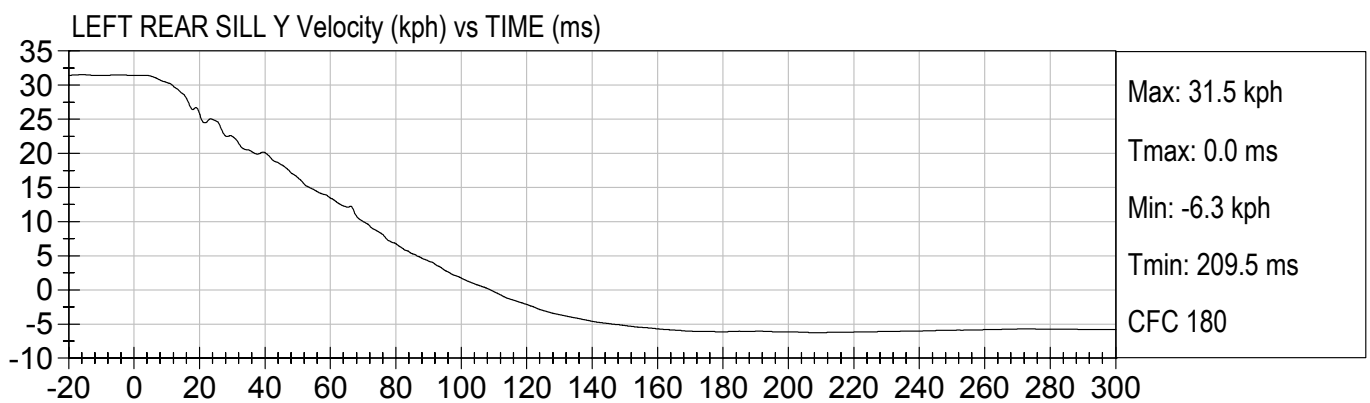
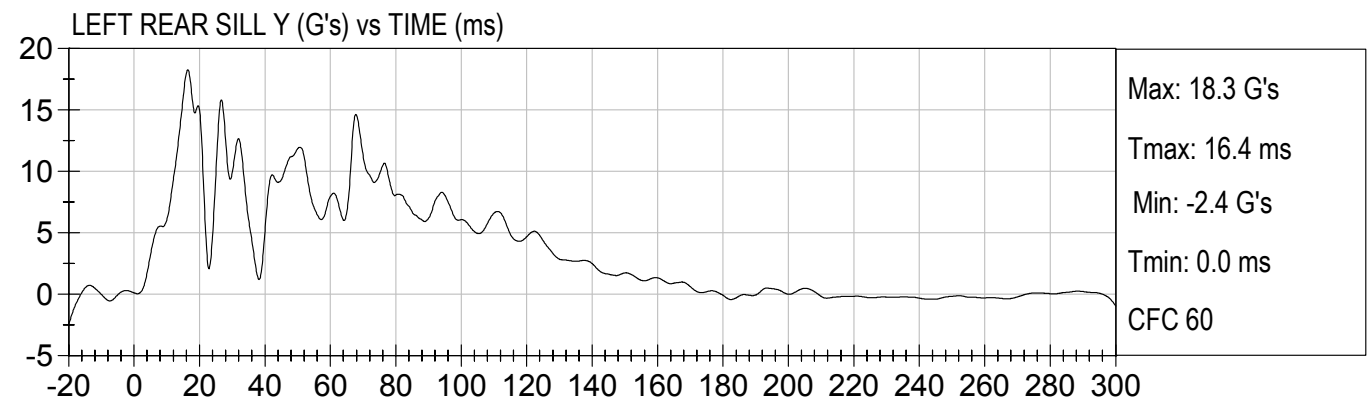
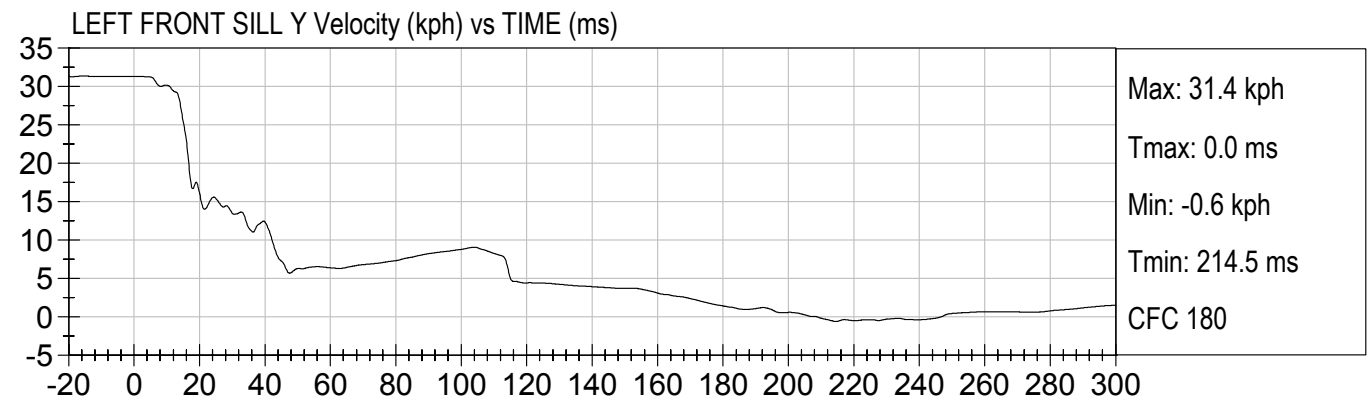
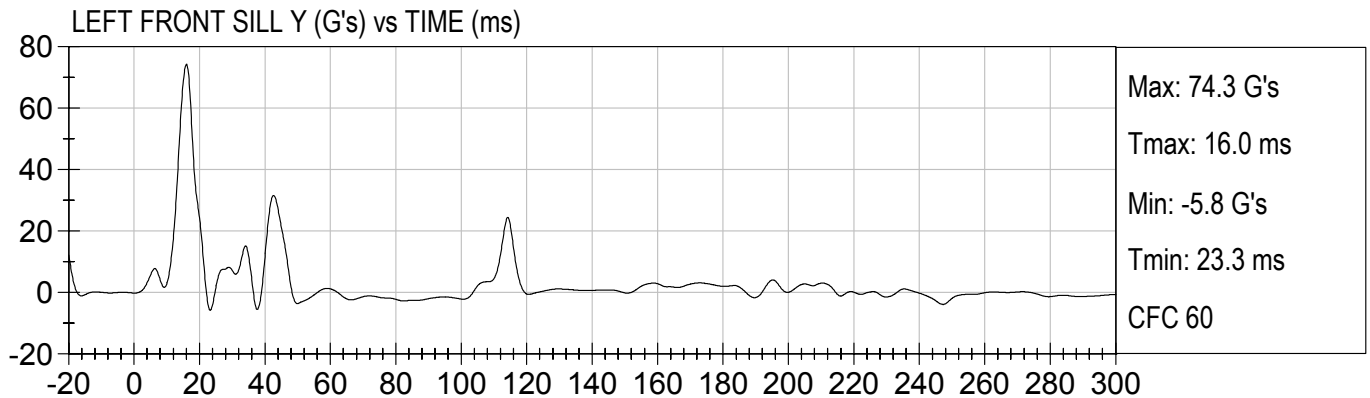


FLOORPAN @ REAR AXLE Y Velocity (kph) vs TIME (ms)



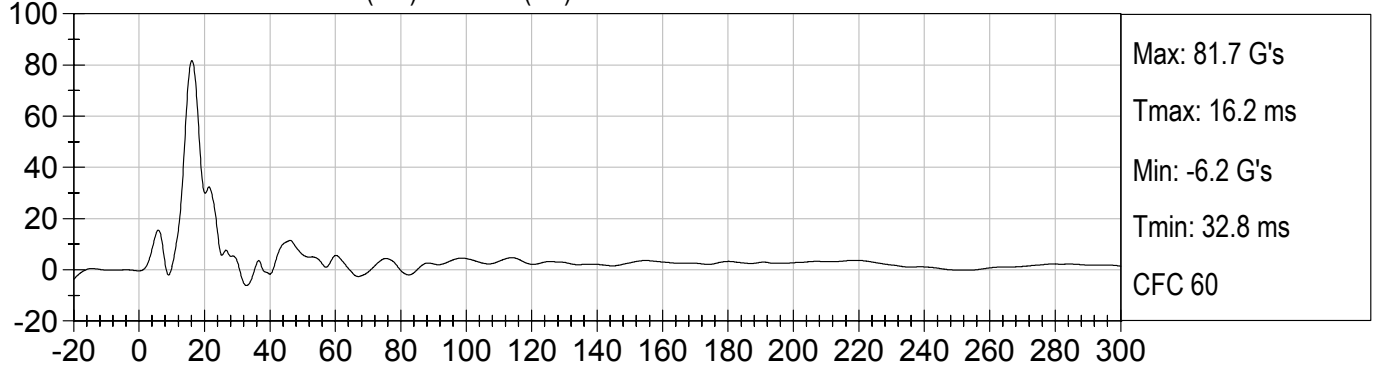
FLOORPAN @ REAR AXLE Z Velocity (kph) vs TIME (ms)



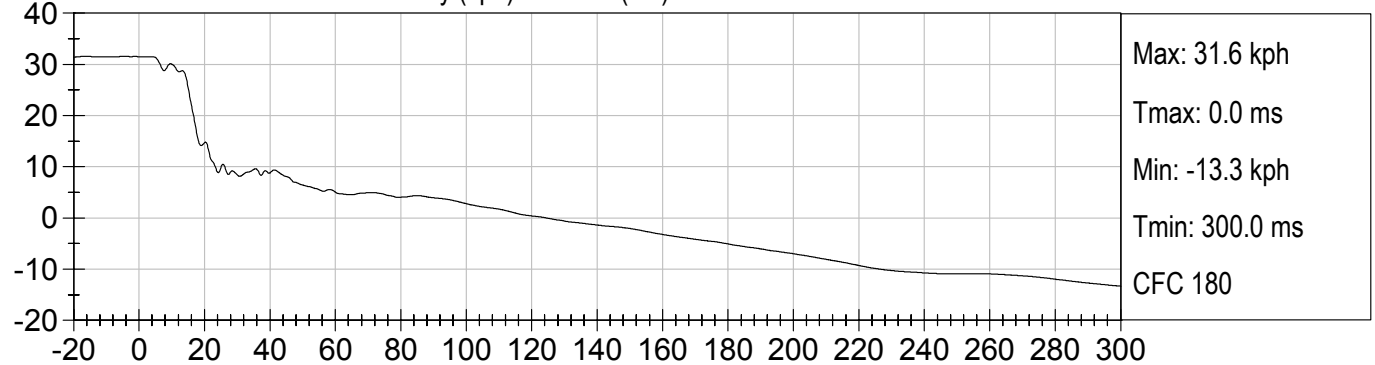




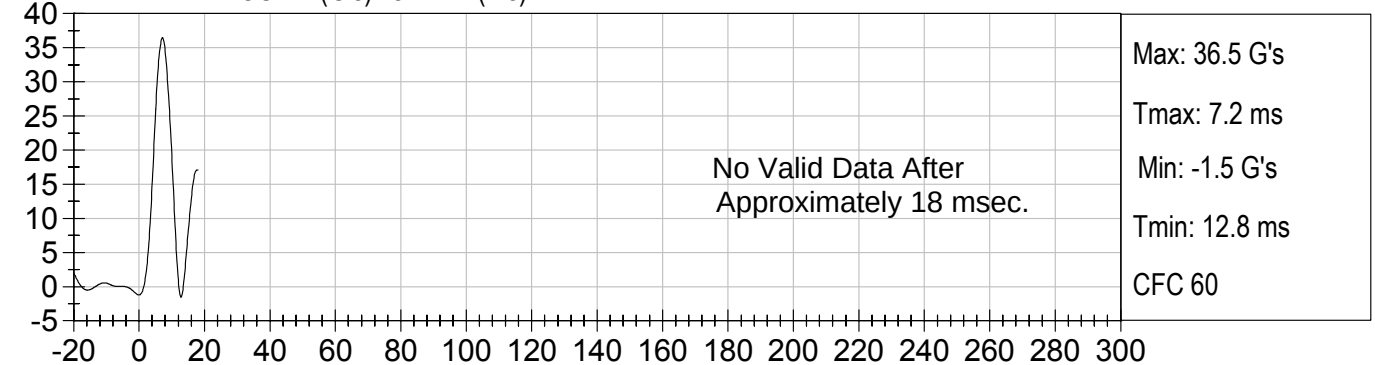
LEFT LOWER B-POST Y (G's) vs TIME (ms)



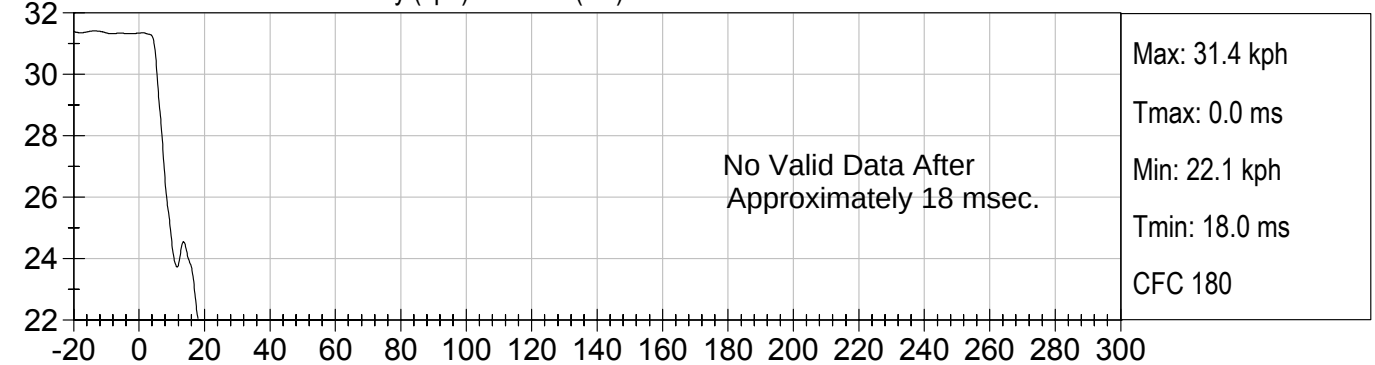
LEFT LOWER B-POST Y Velocity (kph) vs TIME (ms)

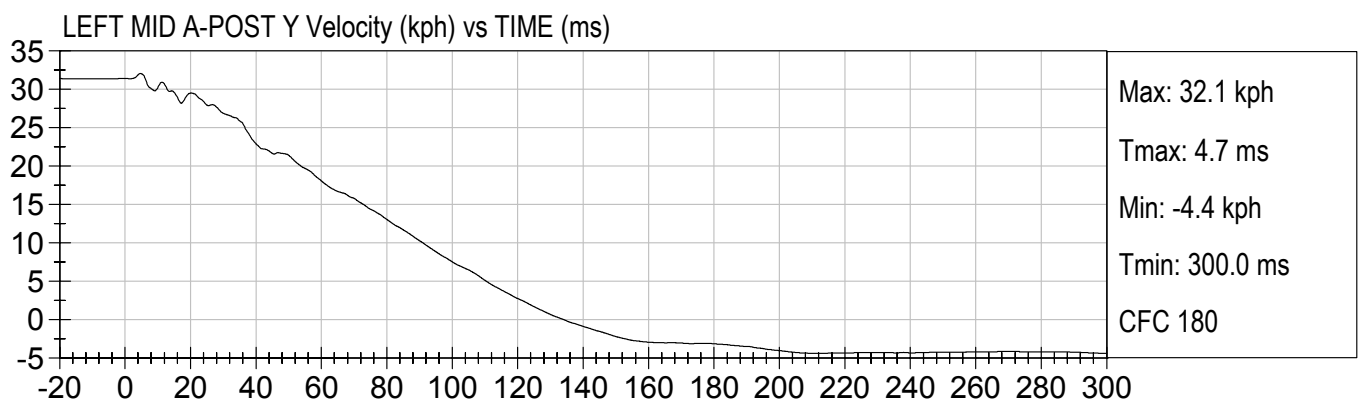
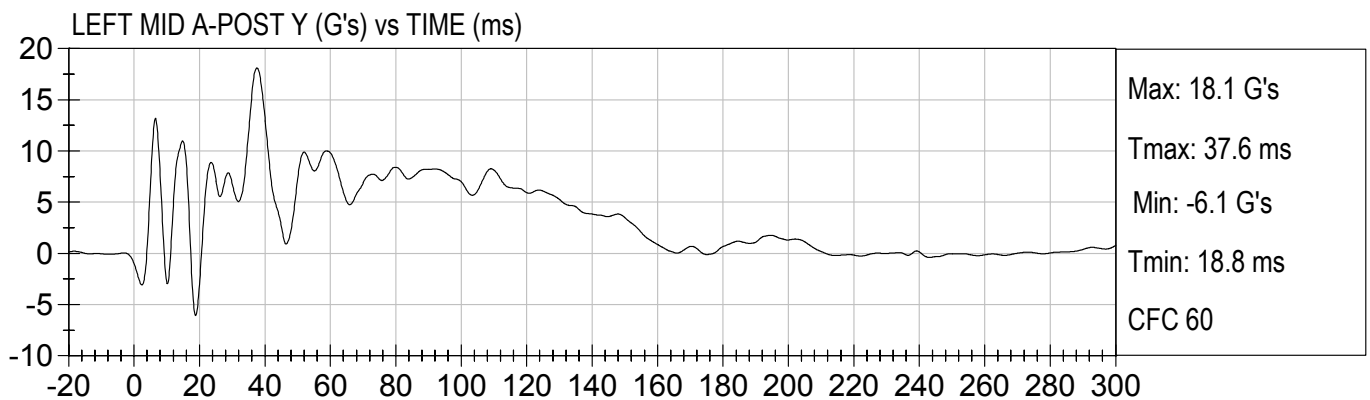
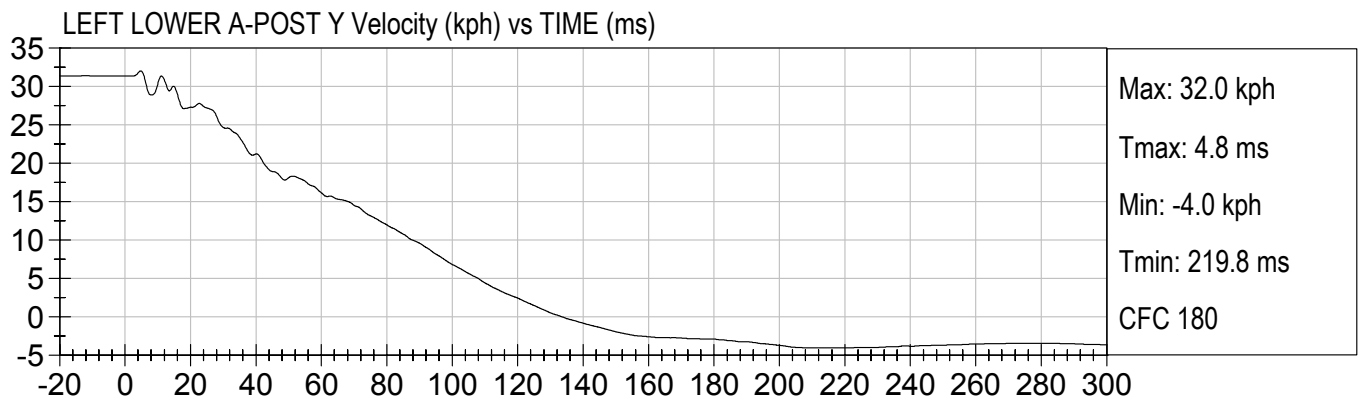
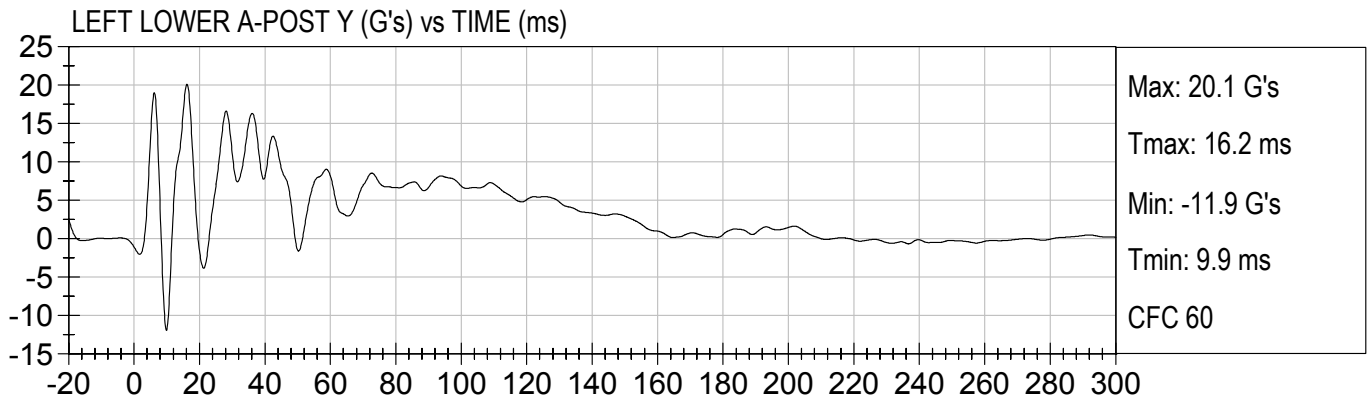


LEFT MID B-POST Y (G's) vs TIME (ms)



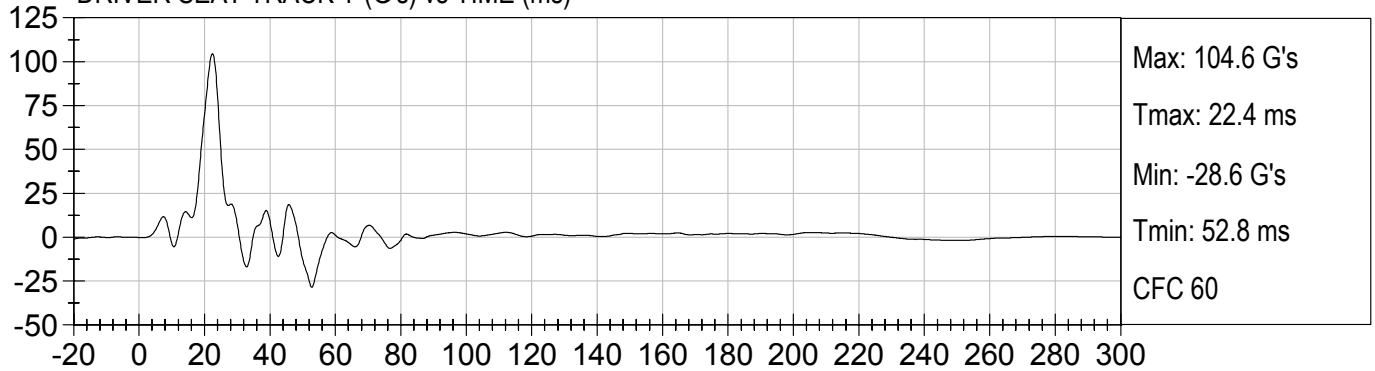
LEFT MID B-POST Y Velocity (kph) vs TIME (ms)



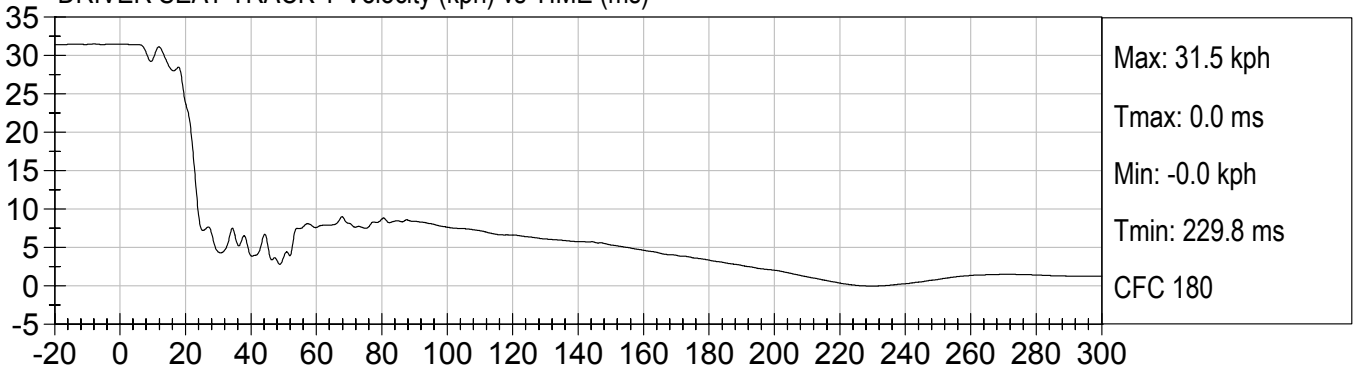




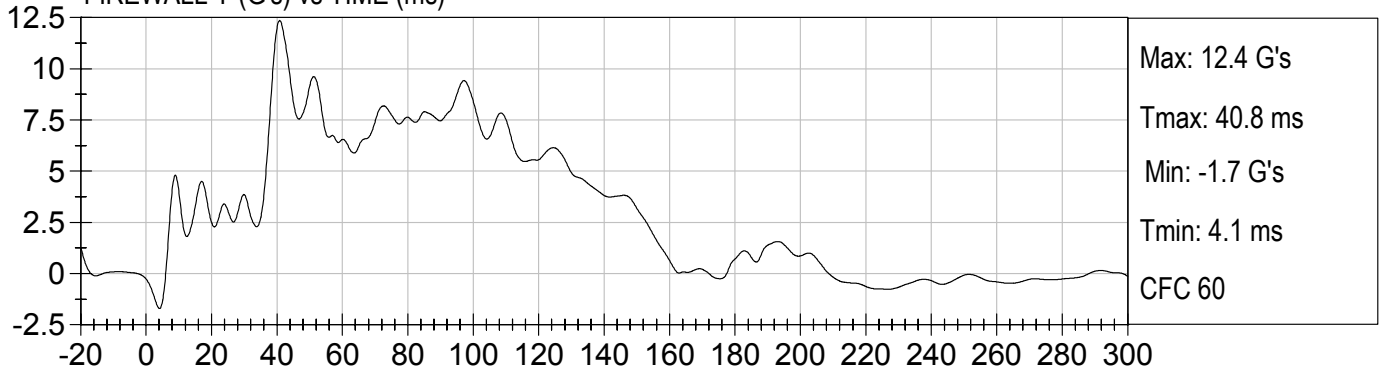
DRIVER SEAT TRACK Y (G's) vs TIME (ms)



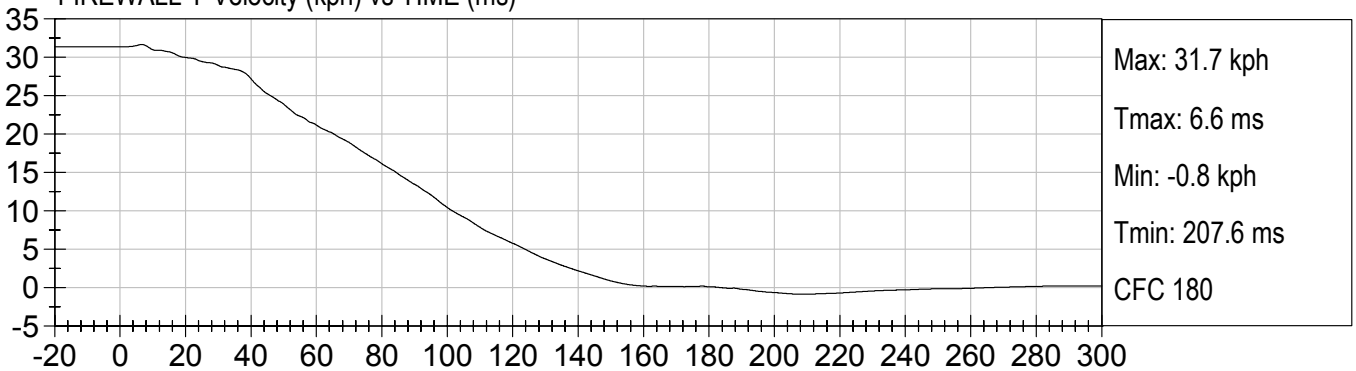
DRIVER SEAT TRACK Y Velocity (kph) vs TIME (ms)



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

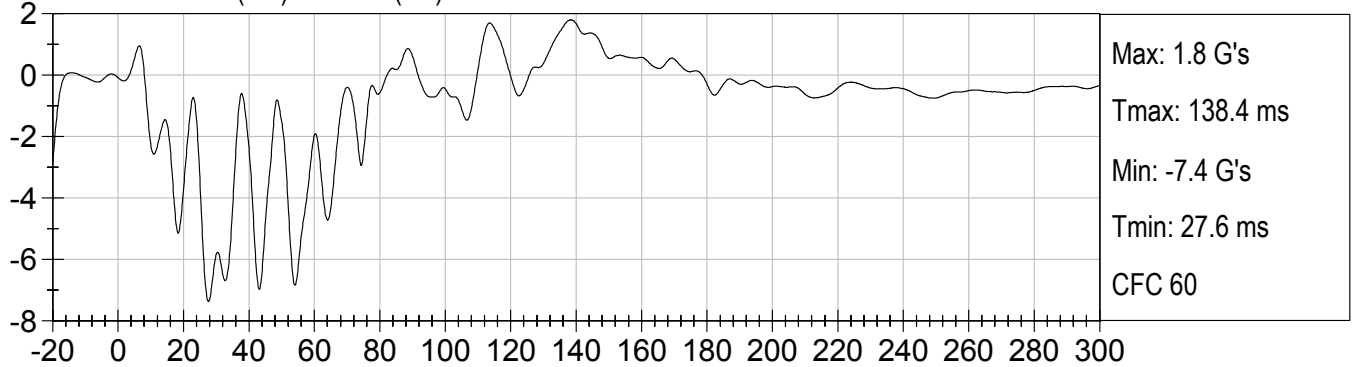


FIREWALL Y Velocity (kph) vs TIME (ms)

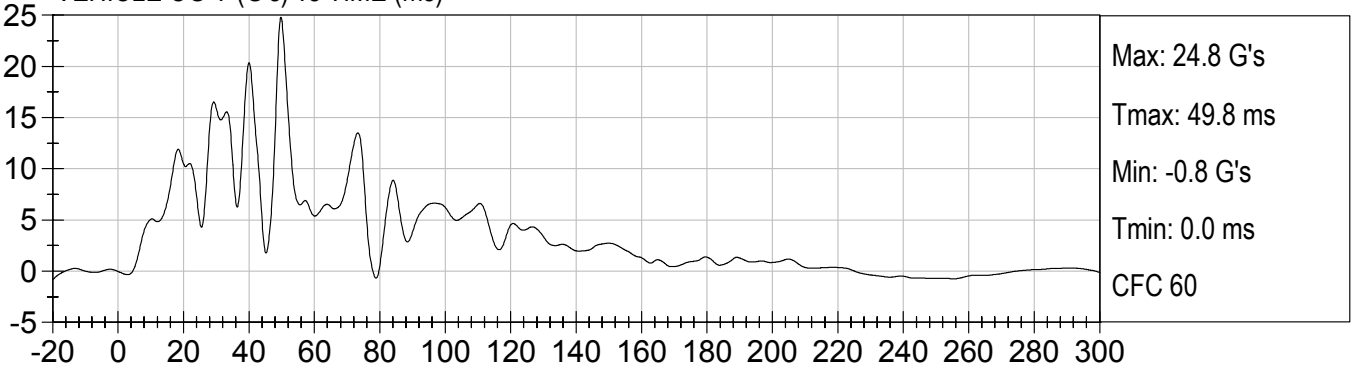




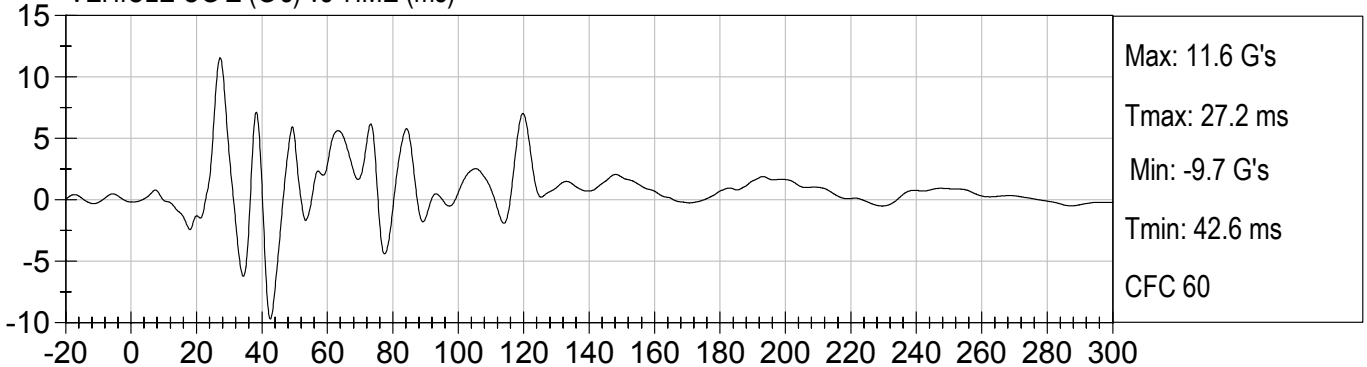
VEHICLE CG X (G's) vs TIME (ms)



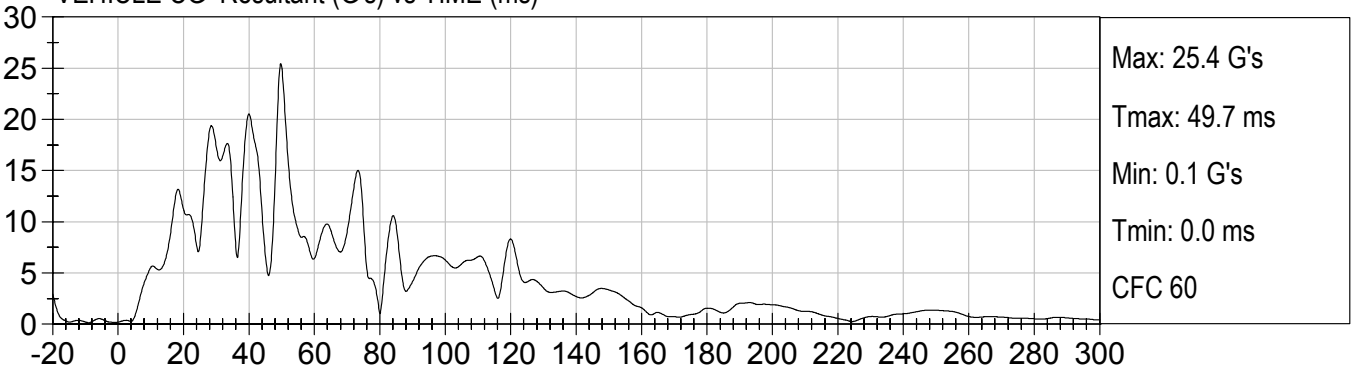
VEHICLE CG Y (G's) vs TIME (ms)



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

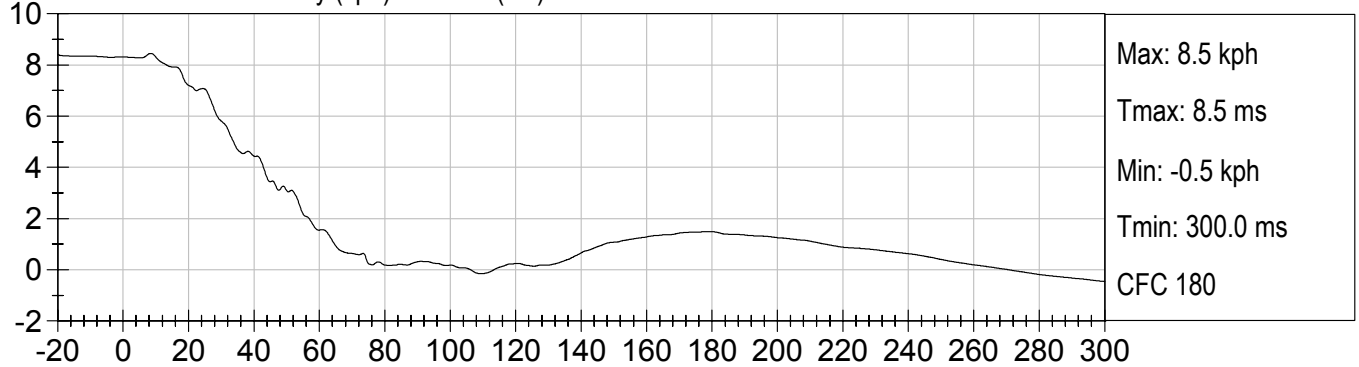


VEHICLE CG Resultant (G's) vs TIME (ms)

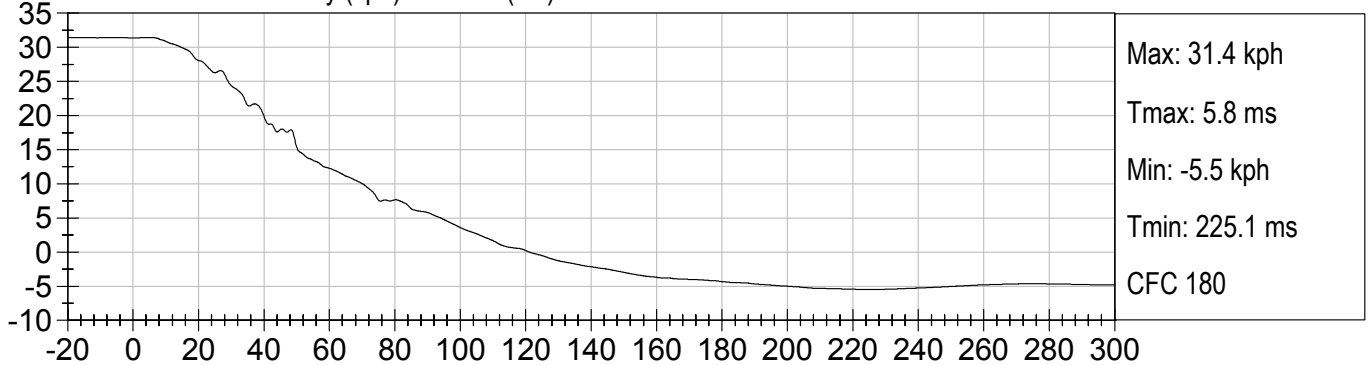




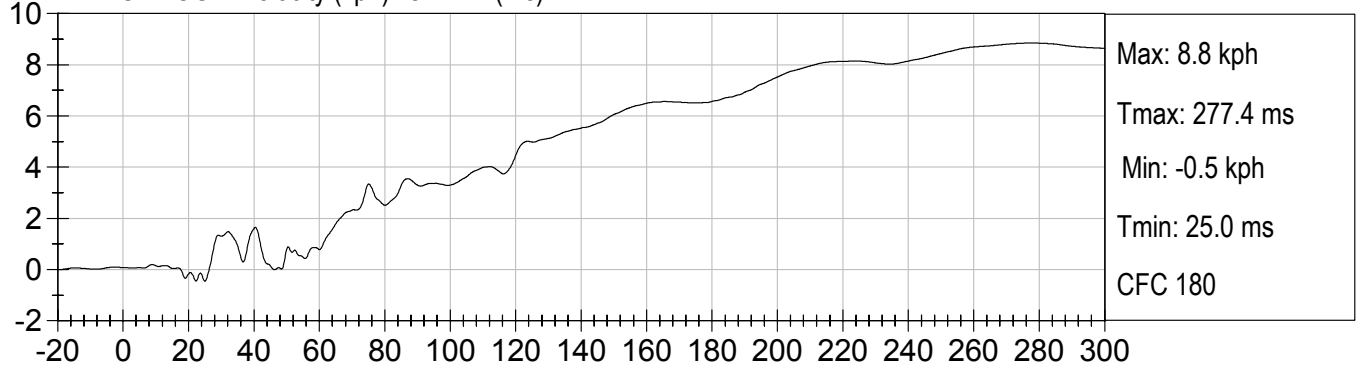
VEHICLE CG X Velocity (kph) vs TIME (ms)



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

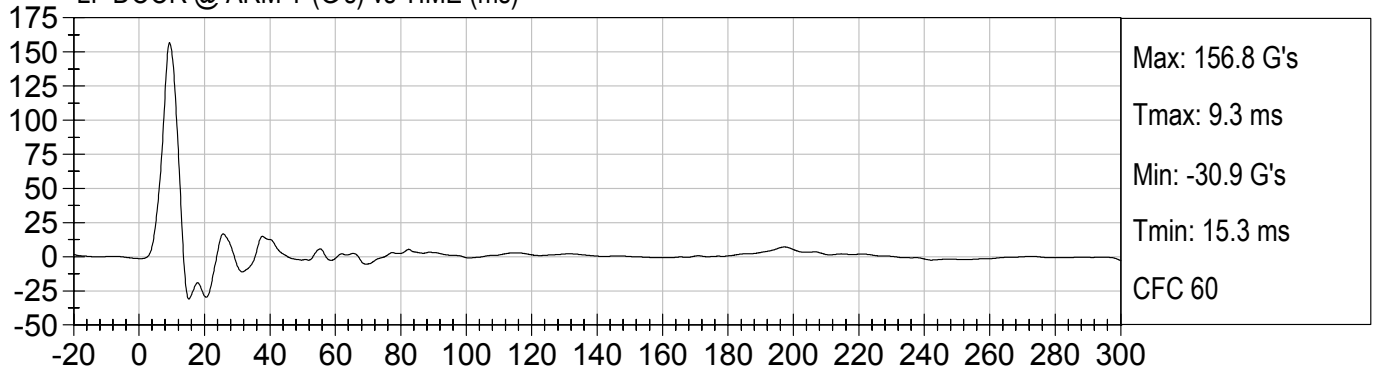


VEHICLE CG Z Velocity (kph) vs TIME (ms)

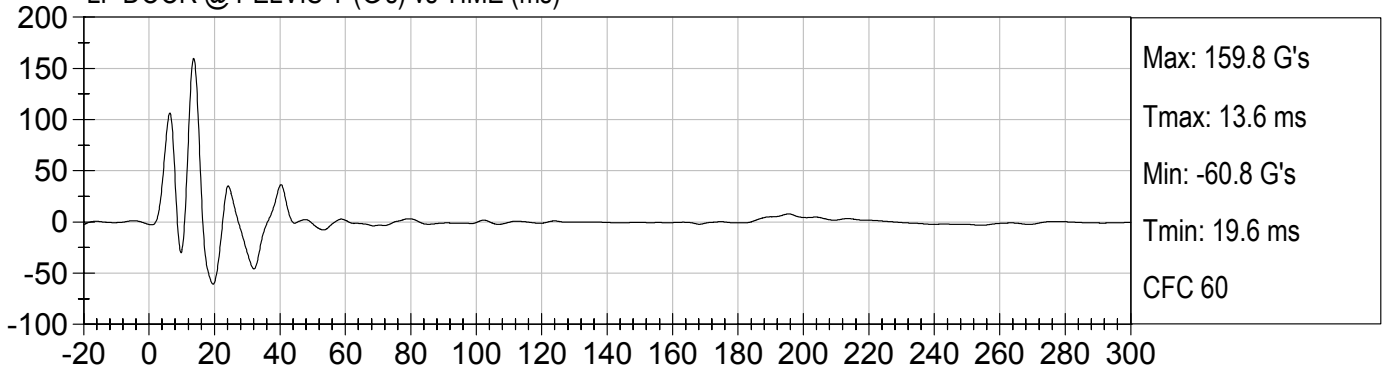




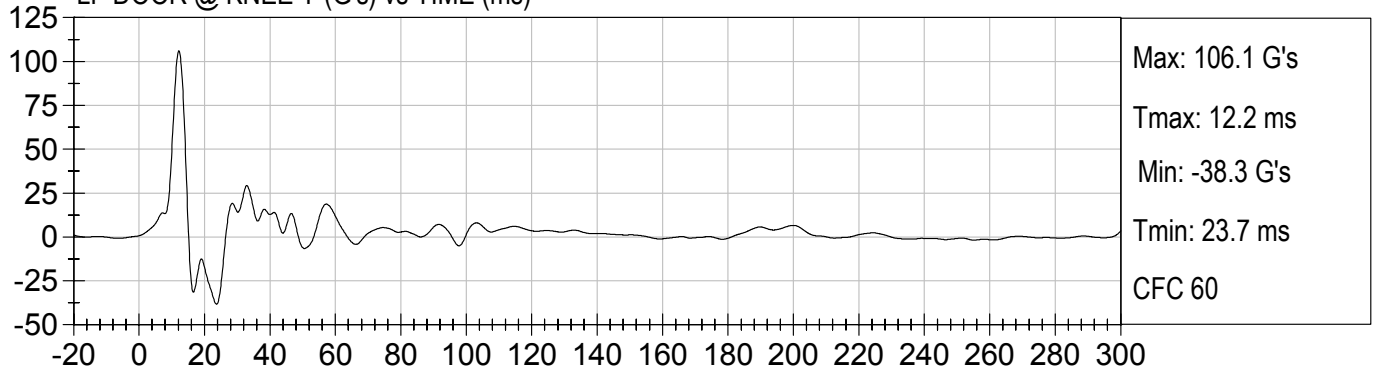
LF DOOR @ ARM Y (G's) vs TIME (ms)



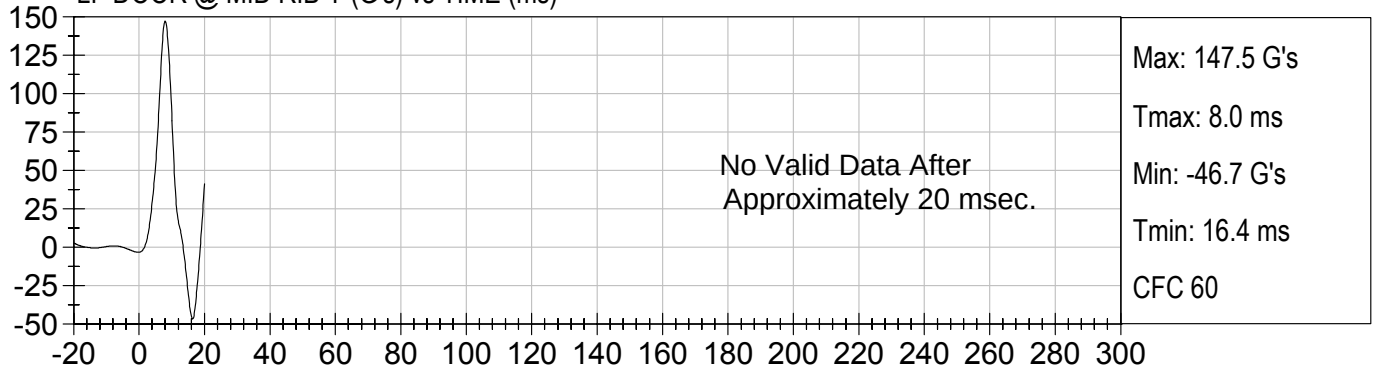
LF DOOR @ PELVIS Y (G's) vs TIME (ms)



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

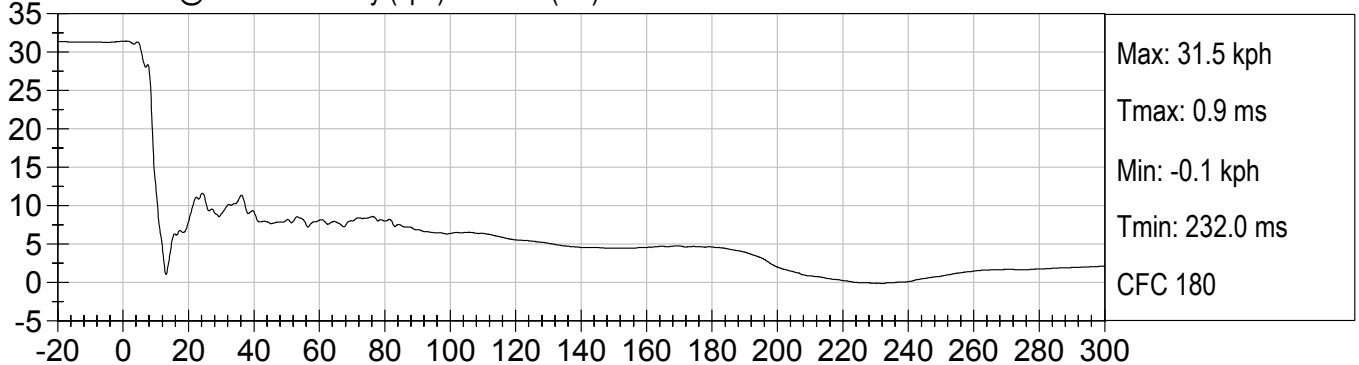


LF DOOR @ MID RIB Y (G's) vs TIME (ms)

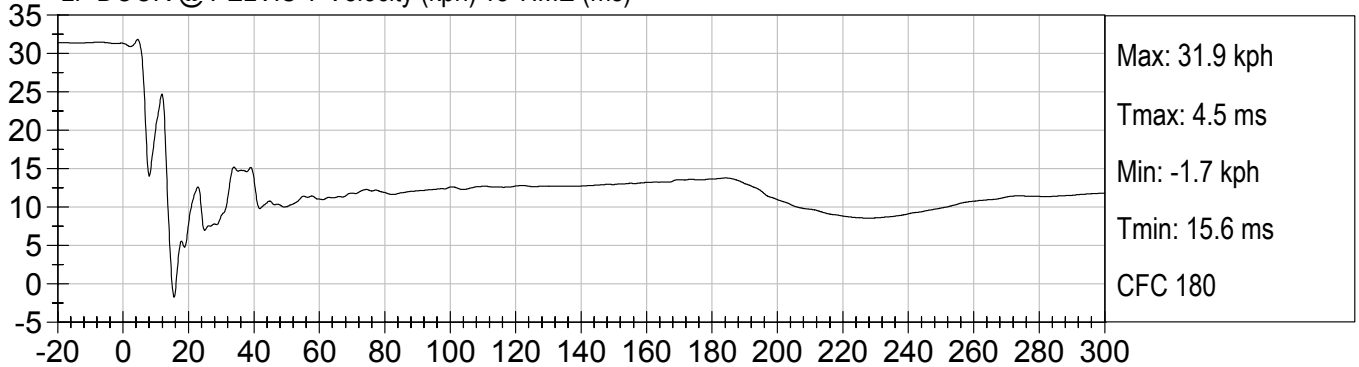




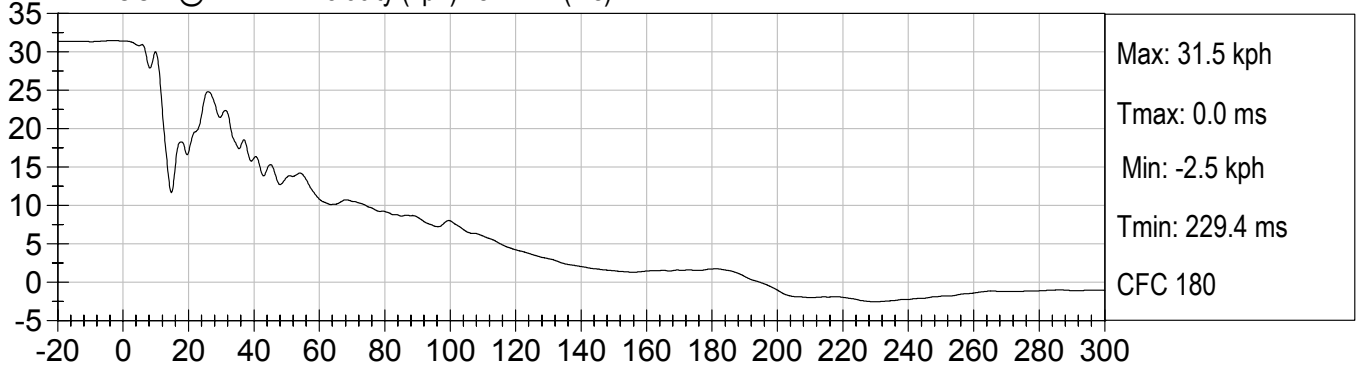
LF DOOR @ ARM Y Velocity (kph) vs TIME (ms)



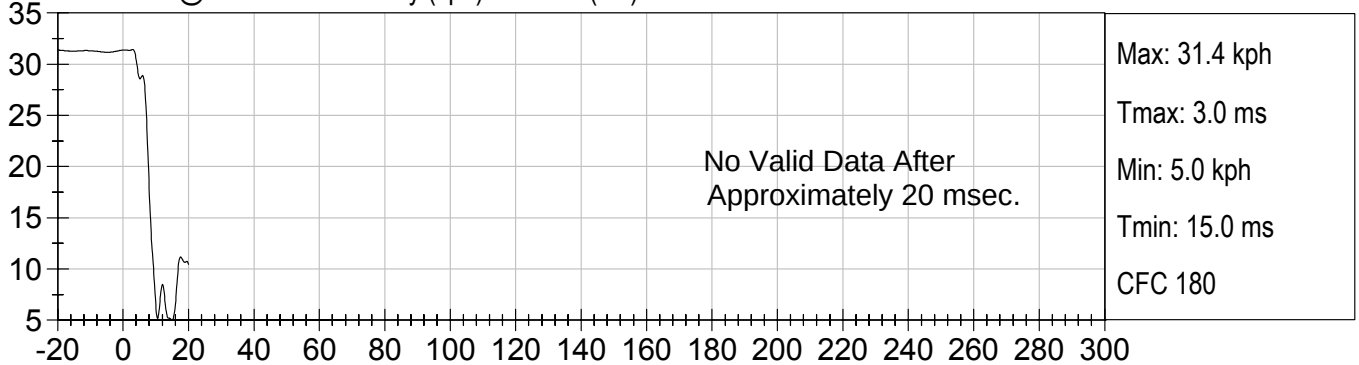
LF DOOR @ PELVIS Y Velocity (kph) vs TIME (ms)

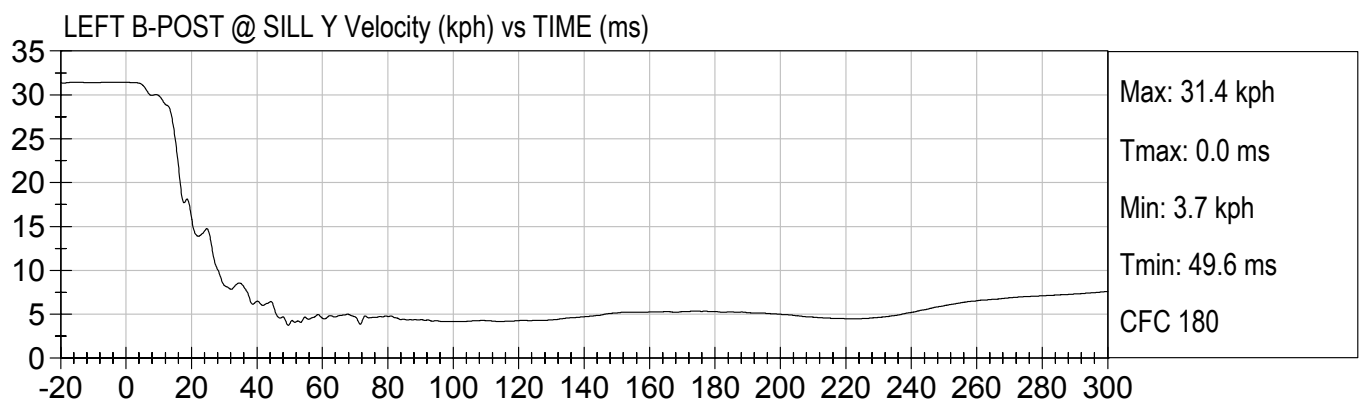
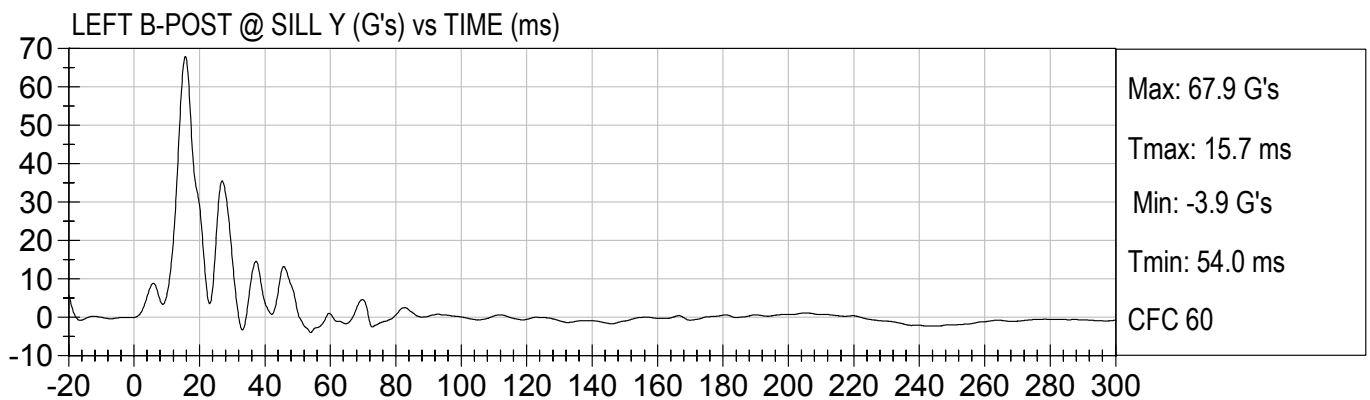
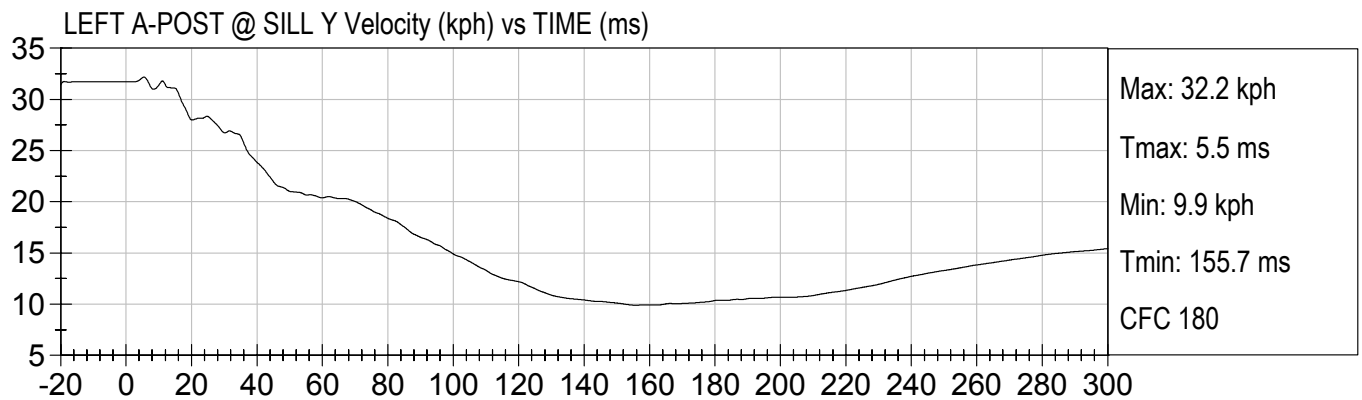
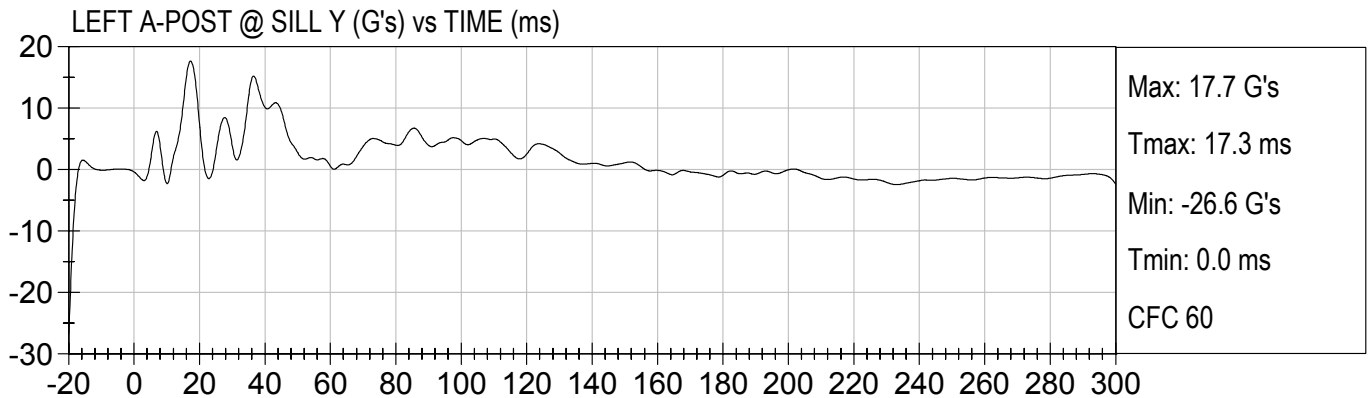


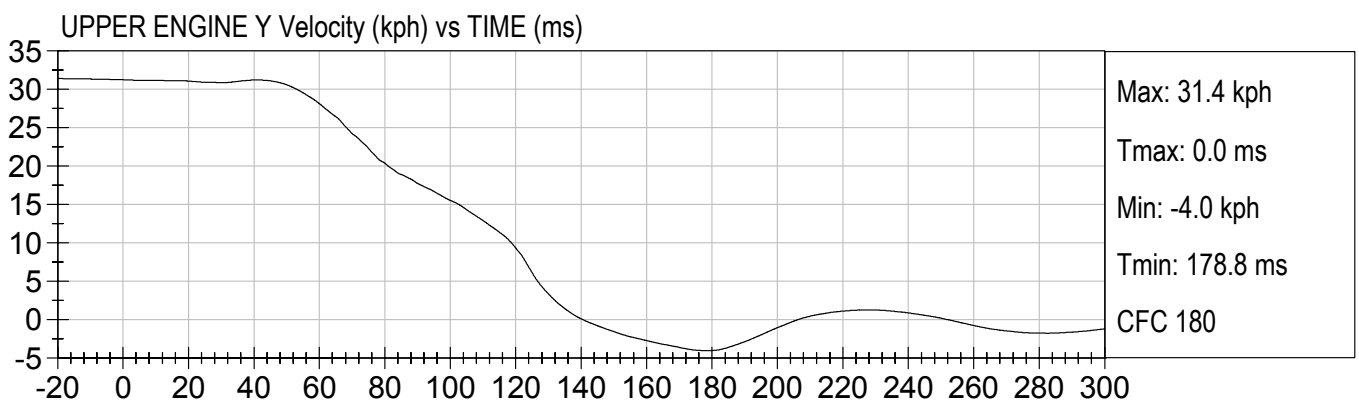
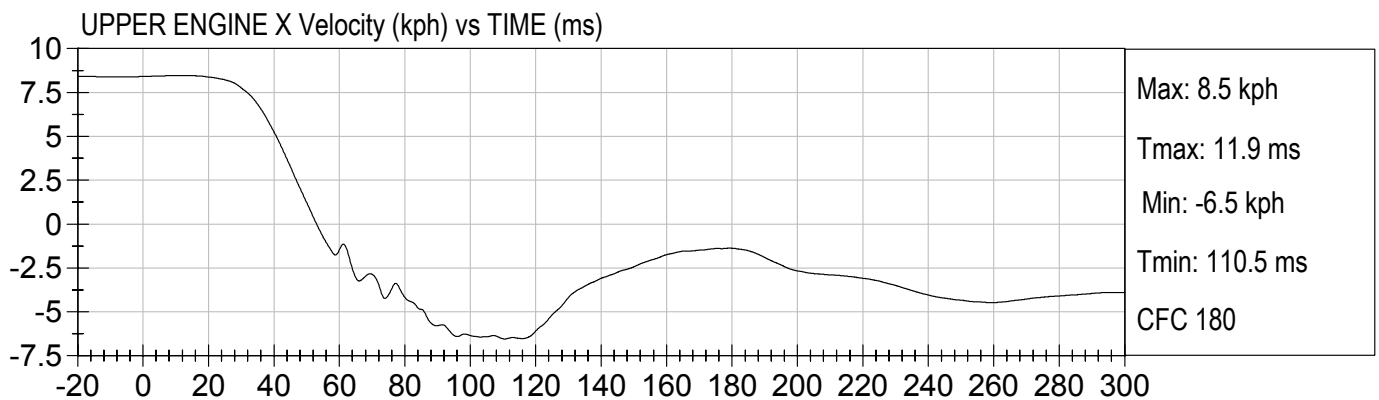
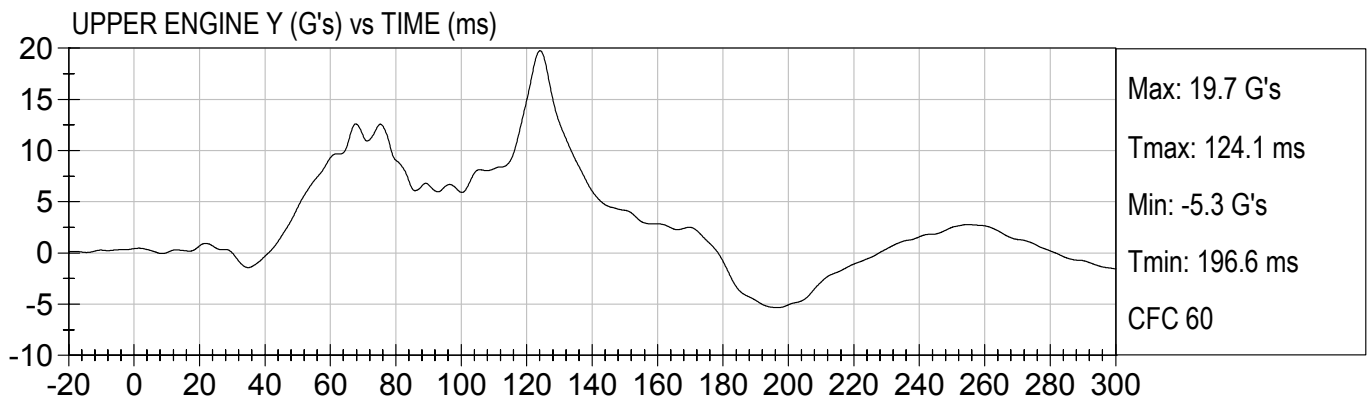
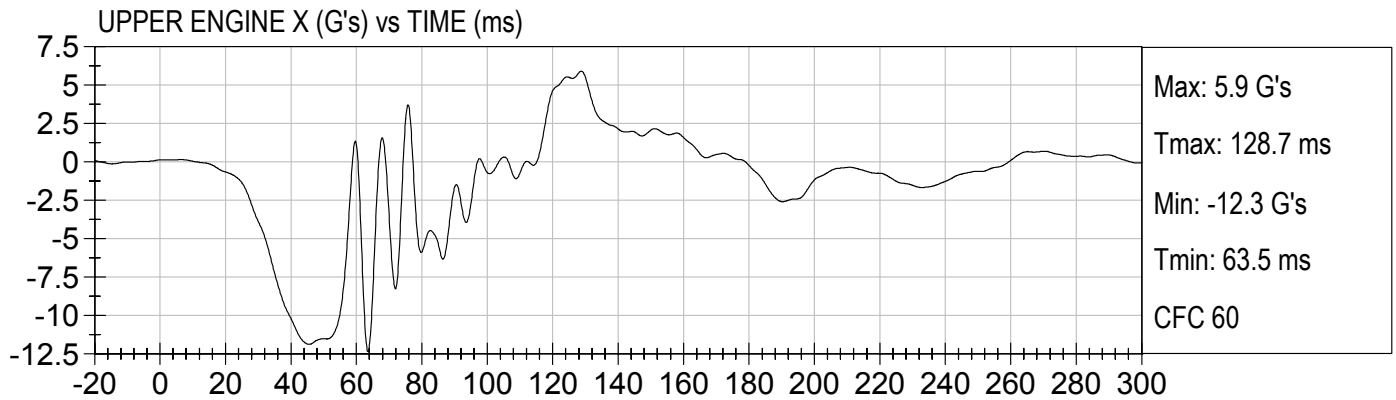
LF DOOR @ KNEE Y Velocity (kph) vs TIME (ms)

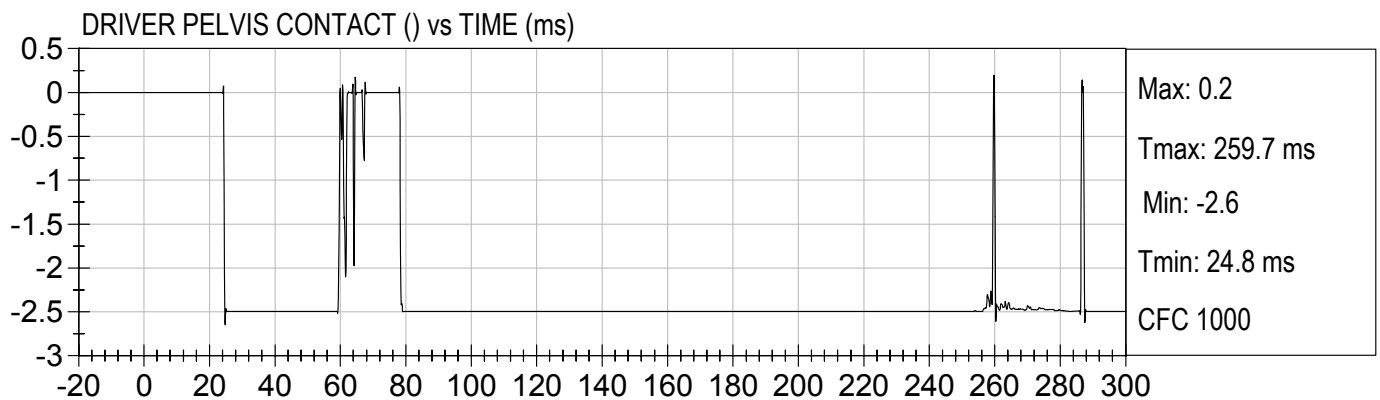
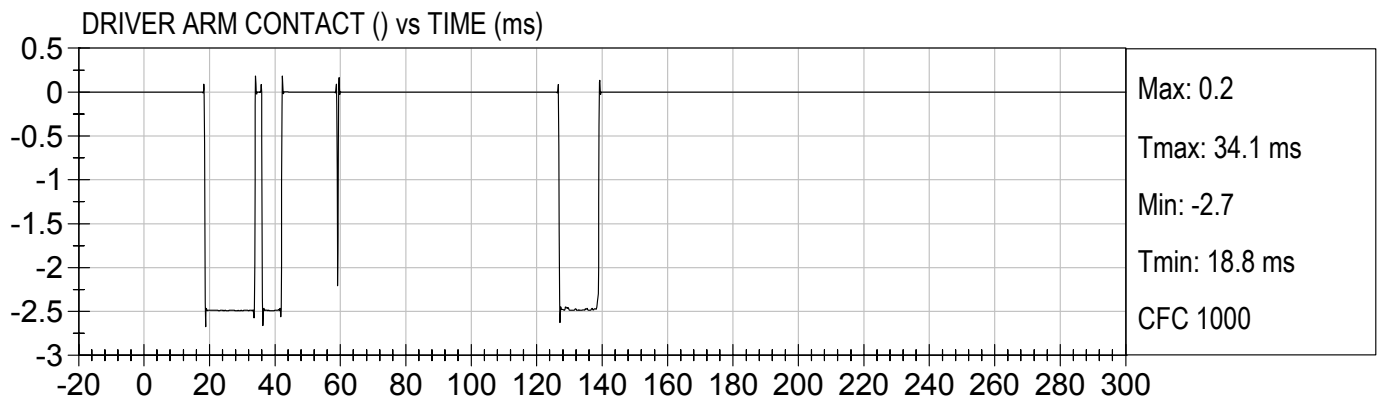
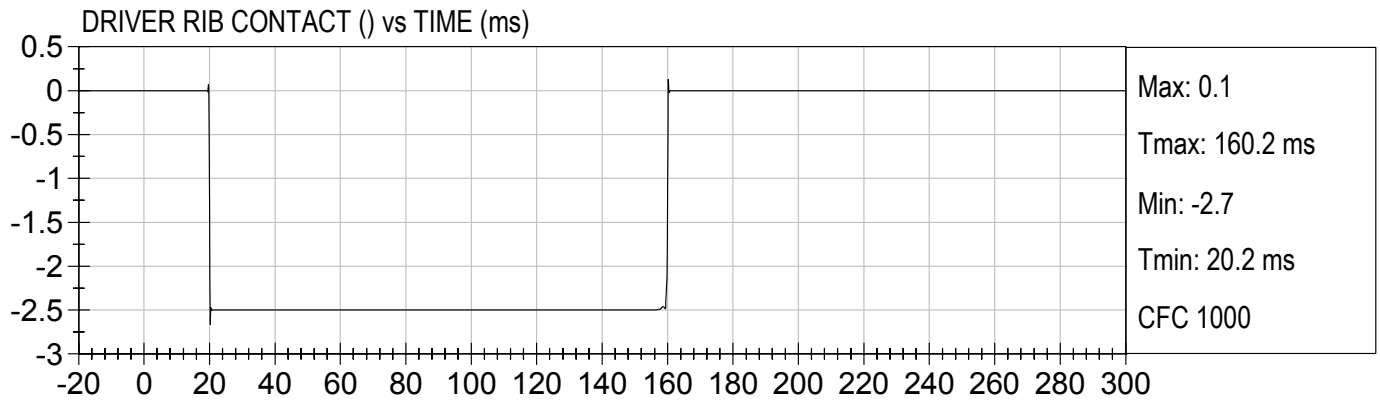


LF DOOR @ MID RIB Y Velocity (kph) vs TIME (ms)









APPENDIX C

DUMMY 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: 2/10/05

Dummy Serial Number: 009

Test Number: D05331

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.2
Relative Humidity (%)	10 – 70	15
Peak Resultant Acceleration	100 – 150 g's	129
Time of Max. Res. Acceleration	msec	26.2

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

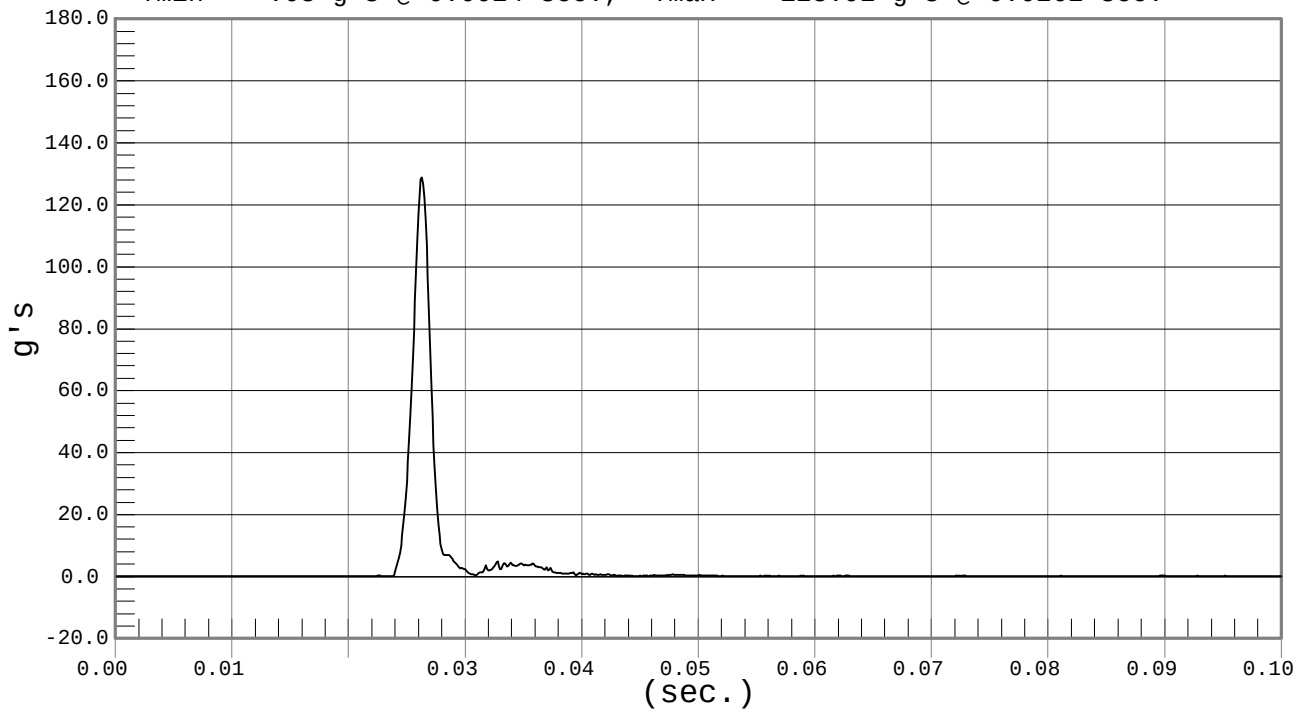


PEAK RESULTANT ACCELERATION

Test Desc.: Head Drop
Component: Dummy #009

Test Date: 02-10-05
Speed: 0.0 fps, 0.00 M/s

Ymin = .08 g's @ 0.0024 sec., Ymax = 128.92 g's @ 0.0262 sec.



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date: 2/11/05

Dummy Serial Number: 009

Test Number: D05332

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.2
Relative Humidity (%)		10 – 70	17
Pendulum Speed		3.3 - 3.5	3.5
Pendulum Deceleration	3 msec	~.25 - ~.53 m/sec	-.35
	8 msec	~1.59 - ~2.04 m/sec	-1.73
	14 msec	~3.20 - ~3.85 m/sec	-3.46
Maximum Flexion Angle		49.0 – 59.0 deg	55.4
Time of Max. Flexion Angle		54.0 – 66.0 ms	59.9
Maximum Angle Theta (A)		32.0 – 37.0 deg	34.5
Time of Max. Theta (A)		53.0 – 63.0 ms	60.0
Maximum Angle Theta (B)		29.67 – 32.17 deg	30.3
Time of Max. Theta (B)		54.0 – 64.0 ms	55.3

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

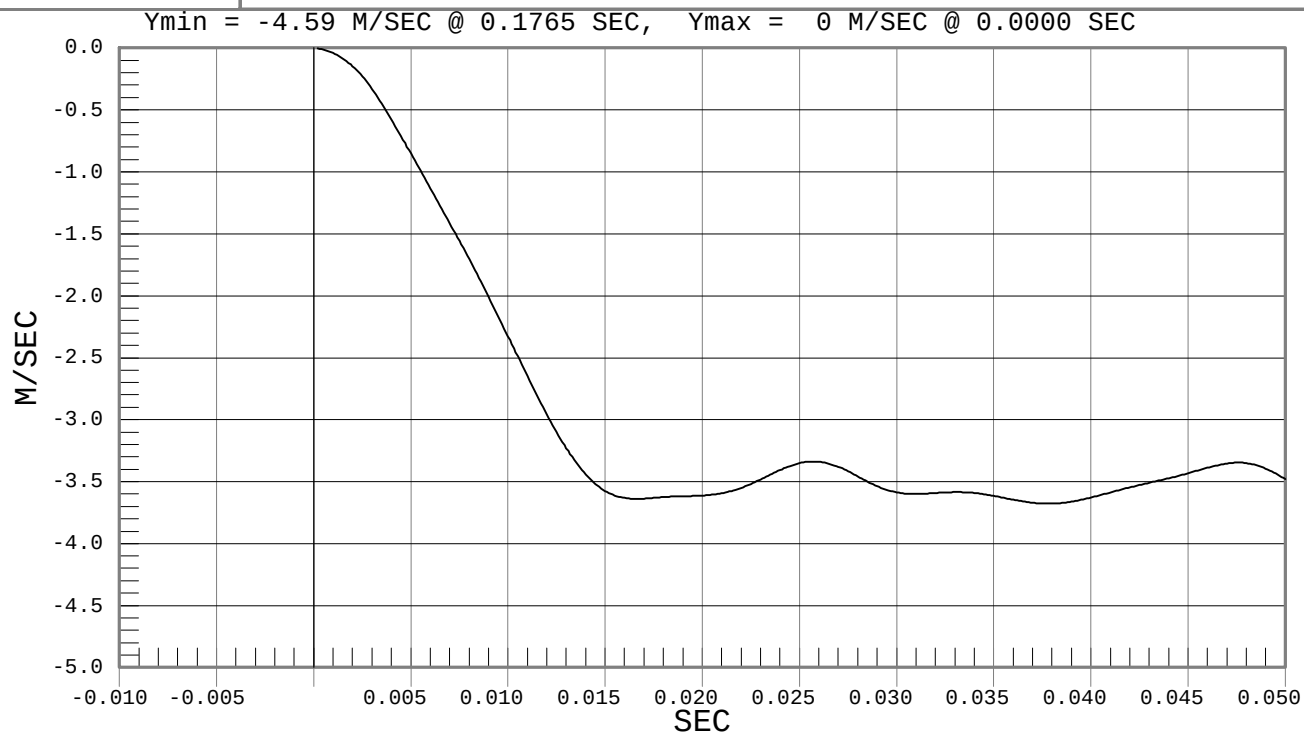
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Neck Bending
Component: Dummy #009

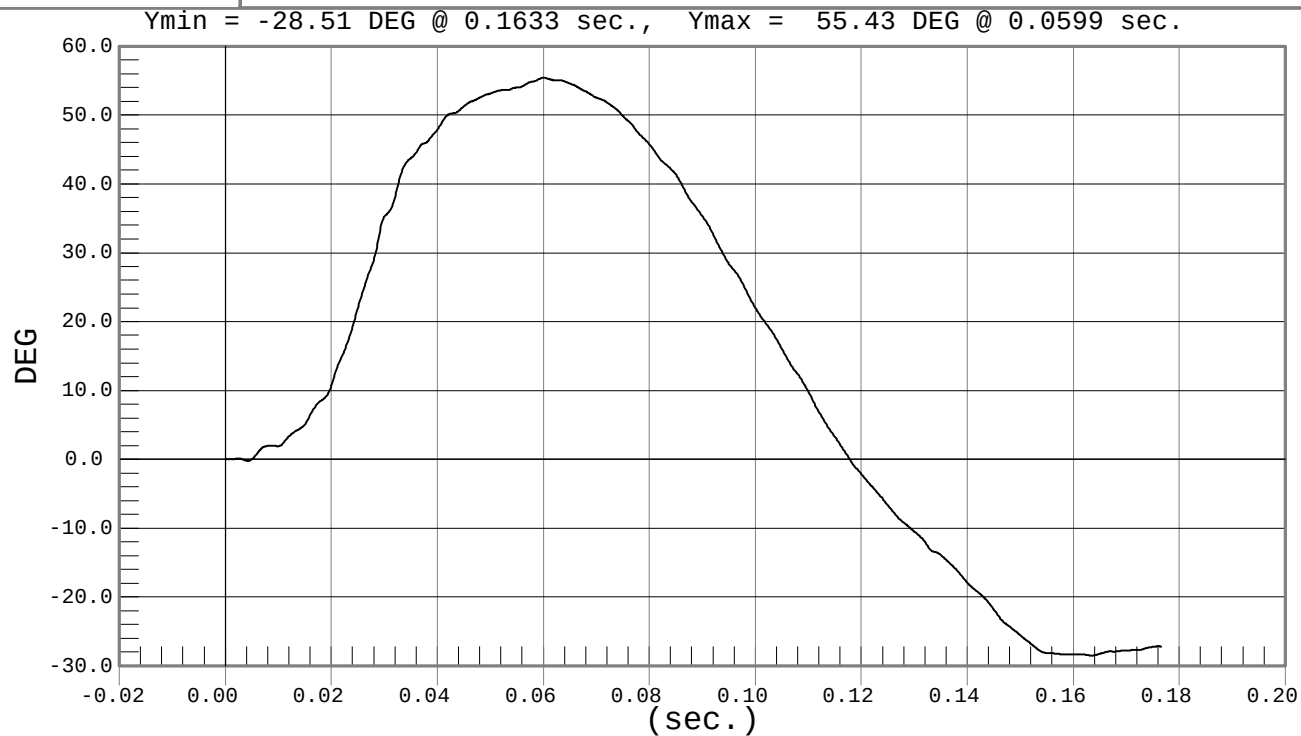
Test Date: 02-11-05
Speed: 11.3 fps, 3.45 M/s



FLEXION ANGLE

Test Desc.: Neck Bending
Component: Dummy #009

Test Date: 02-11-05
Speed: 11.3 fps, 3.45 M/s



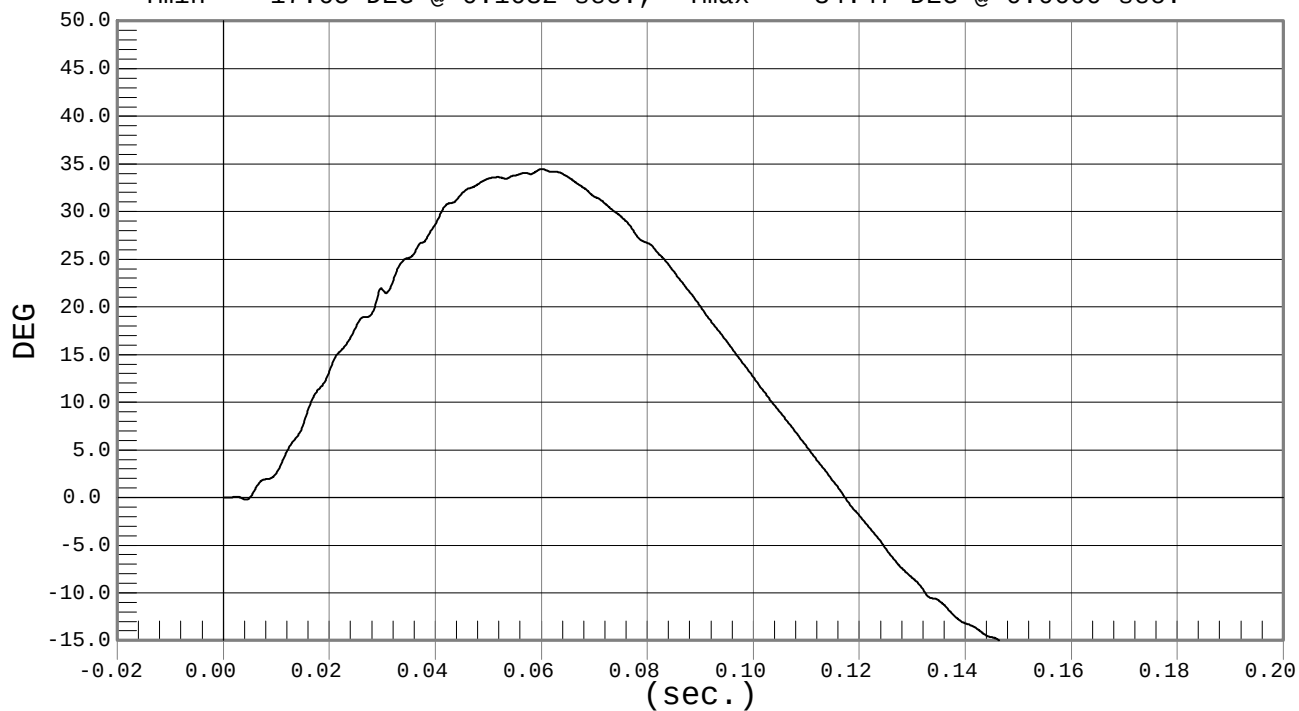


Test Desc.: Neck Bending
Component: Dummy #009

THETA A

Test Date: 02-11-05
Speed: 11.3 fps, 3.45 M/s

Ymin = -17.65 DEG @ 0.1632 sec., Ymax = 34.47 DEG @ 0.0600 sec.

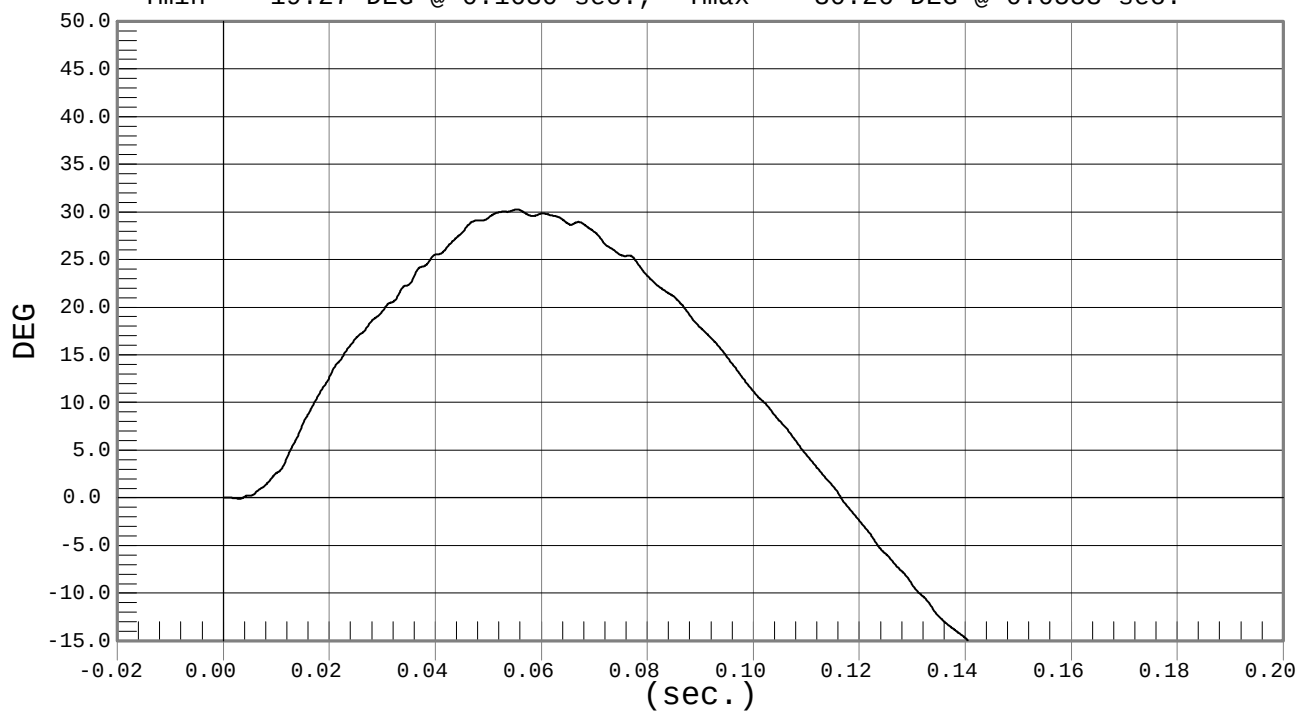


Test Desc.: Neck Bending
Component: Dummy #009

THETA B

Test Date: 02-11-05
Speed: 11.3 fps, 3.45 M/s

Ymin = -19.27 DEG @ 0.1630 sec., Ymax = 30.26 DEG @ 0.0553 sec.



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date: 2/10/05

Dummy Serial Number: 009

Test Number: D05333

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.5
Relative Humidity (%)	10 – 70	16
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	46.8

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

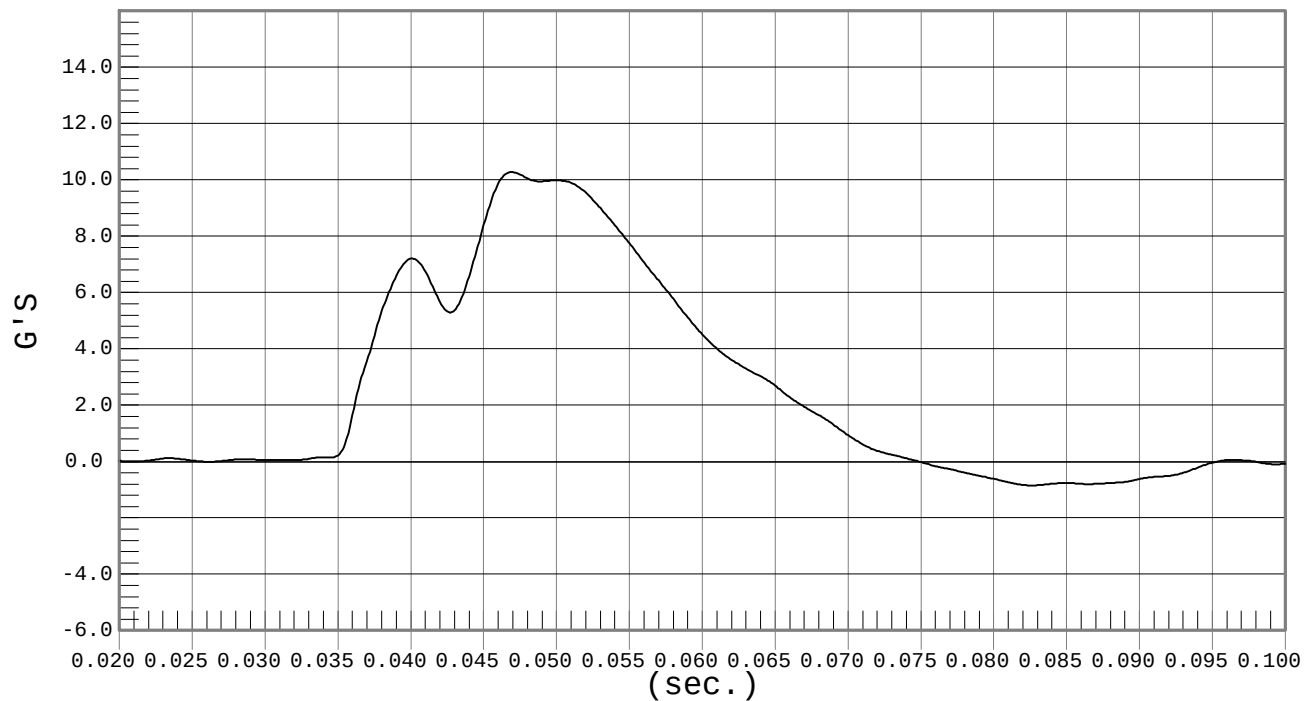


SHOULDER ACCELERATION

Test Desc.: Shoulder Impact
Component: Dummy #009

Test Date: 02-10-05
Speed: 14.2 fps, 4.33 M/s

Ymin = -1.03 G'S @ 0.1325 sec., Ymax = 10.28 G'S @ 0.0468 sec.



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

Date: 2/10/05
Dummy Serial Number: 009
Test Number: D05334, D05335, D05336

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.9
Relative Humidity (%)	10 – 70	15
Displacement at 2 m/s	23.5 – 27.5 mm	26.6
Displacement at 3 m/s	36.0 – 40.0 mm	38.5
Displacement at 4 m/s	46.0 – 51.0 mm	49.7

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.9
Relative Humidity (%)	10 – 70	15
Displacement at 2 m/s	23.5 – 27.5 mm	26.0
Displacement at 3 m/s	36.0 – 40.0 mm	37.9
Displacement at 4 m/s	46.0 – 51.0 mm	48.4

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	20.9
Relative Humidity (%)	10 – 70	15
Displacement at 2 m/s	23.5 – 27.5 mm	26.7
Displacement at 3 m/s	36.0 – 40.0 mm	38.5
Displacement at 4 m/s	46.0 – 51.0 mm	49.6

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

Approved By: David Winkelbauer

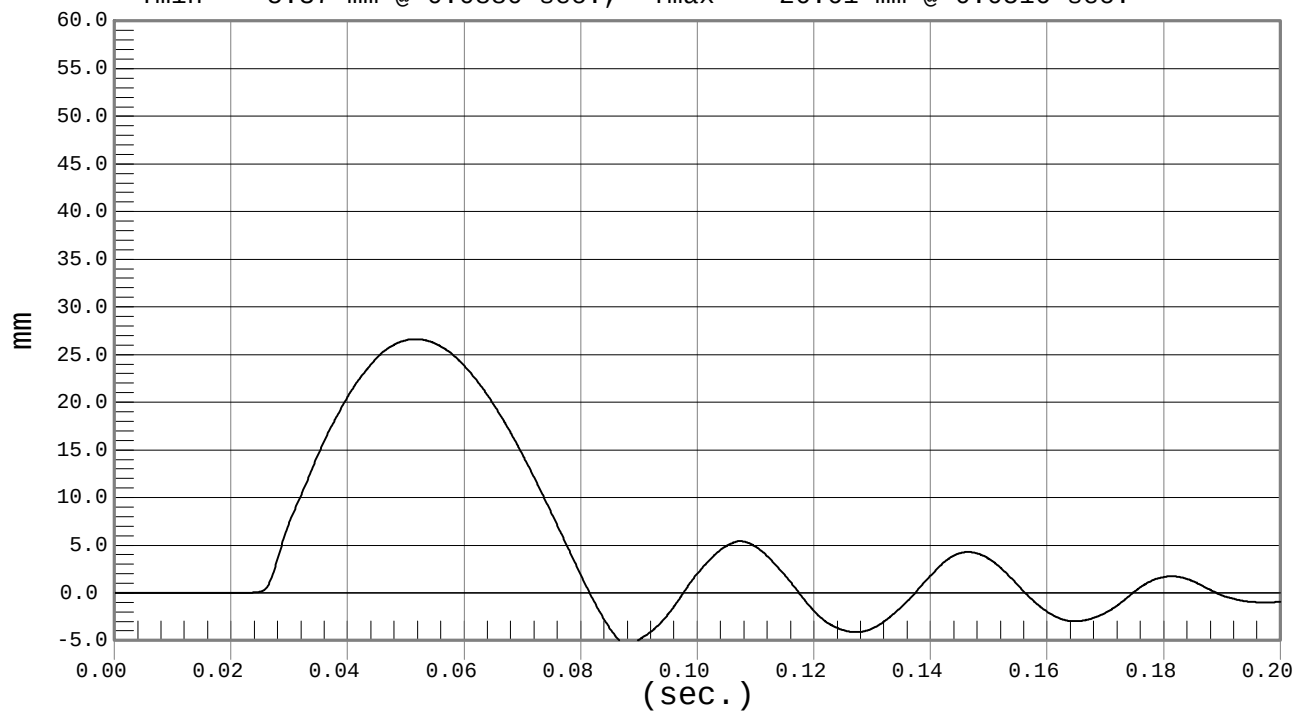


UPPER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.37 mm @ 0.0880 sec., Ymax = 26.61 mm @ 0.0516 sec.

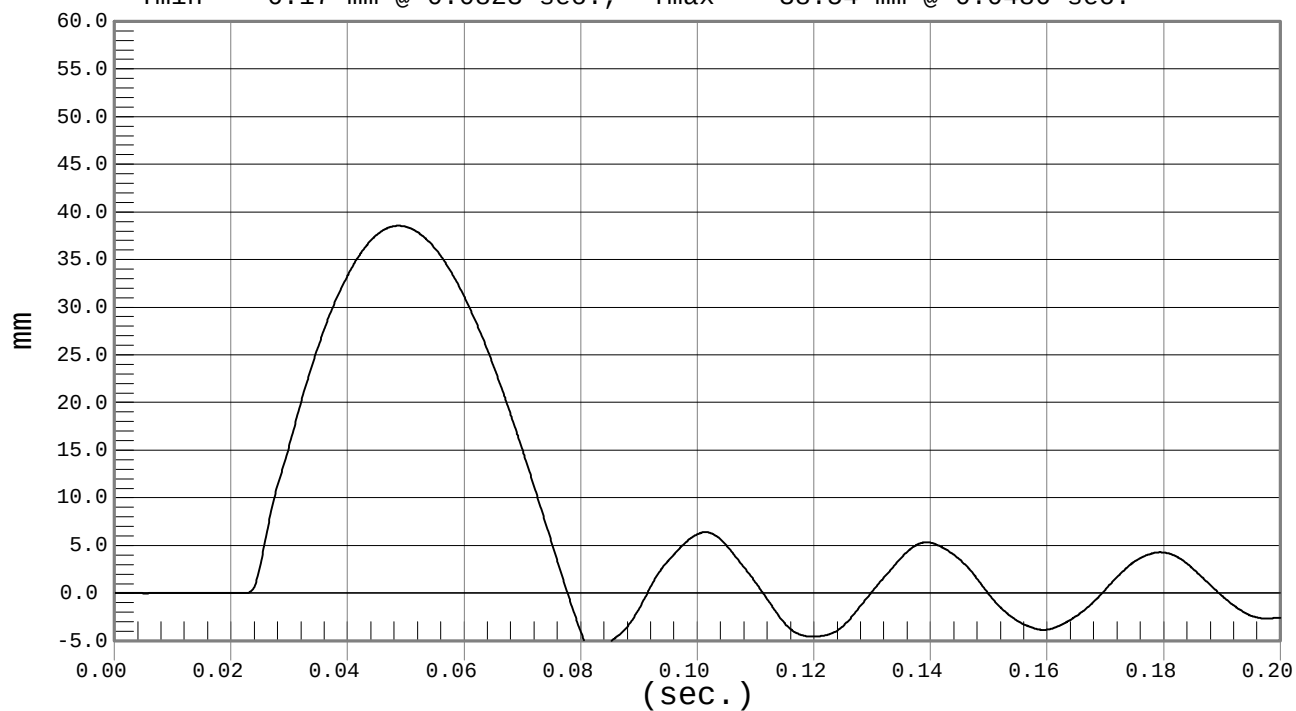


UPPER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.17 mm @ 0.0823 sec., Ymax = 38.54 mm @ 0.0486 sec.



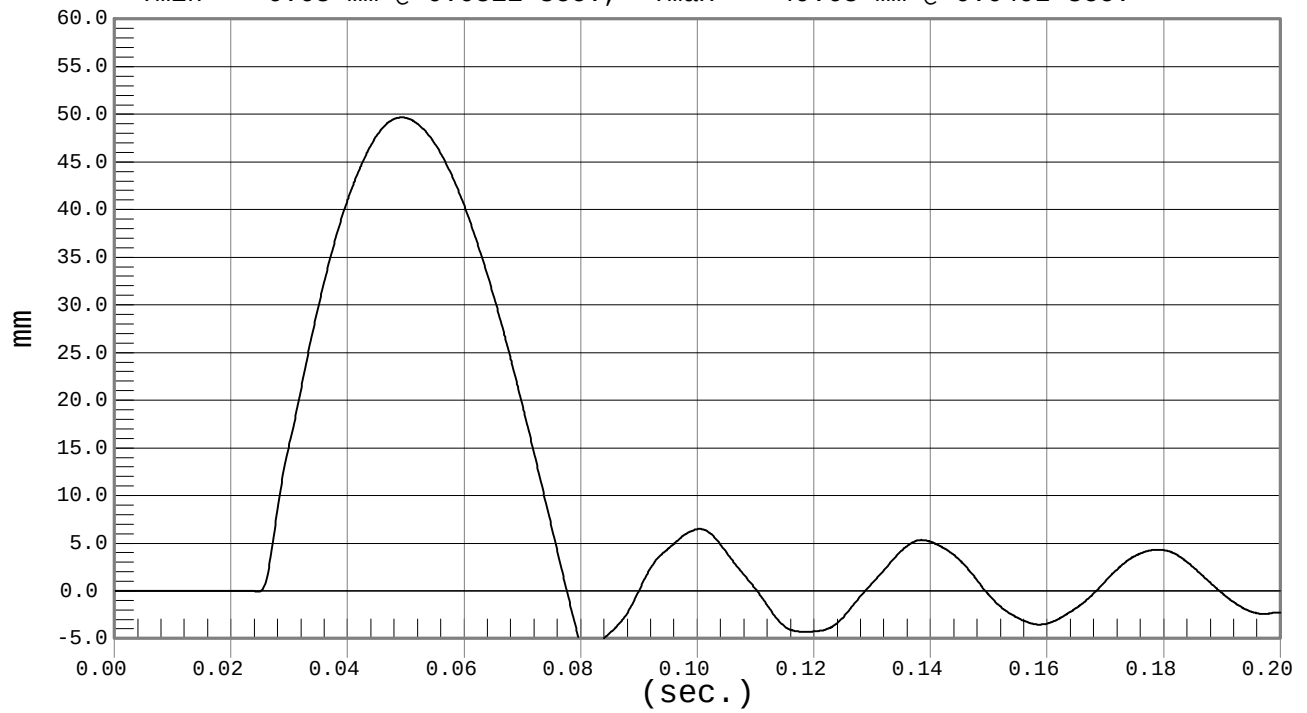


UPPER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -6.63 mm @ 0.0811 sec., Ymax = 49.68 mm @ 0.0492 sec.



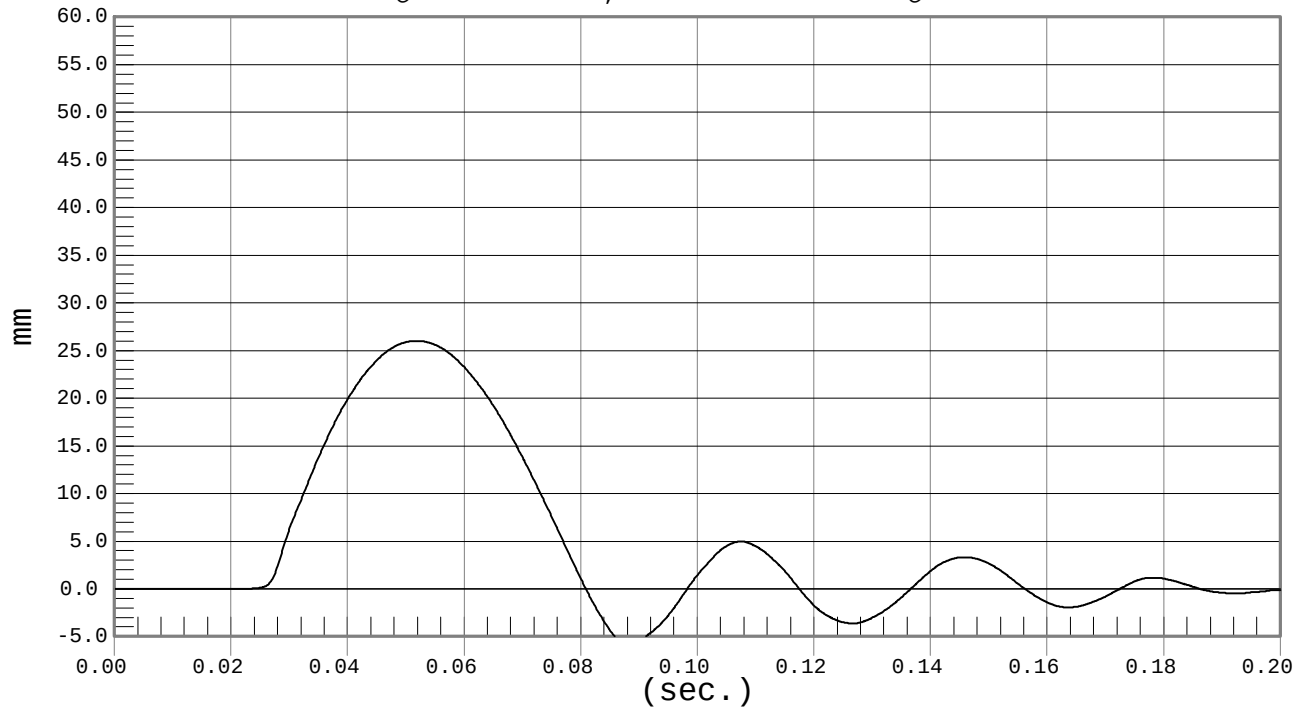


MIDDLE RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.89 mm @ 0.0880 sec., Ymax = 26.0 mm @ 0.0518 sec.

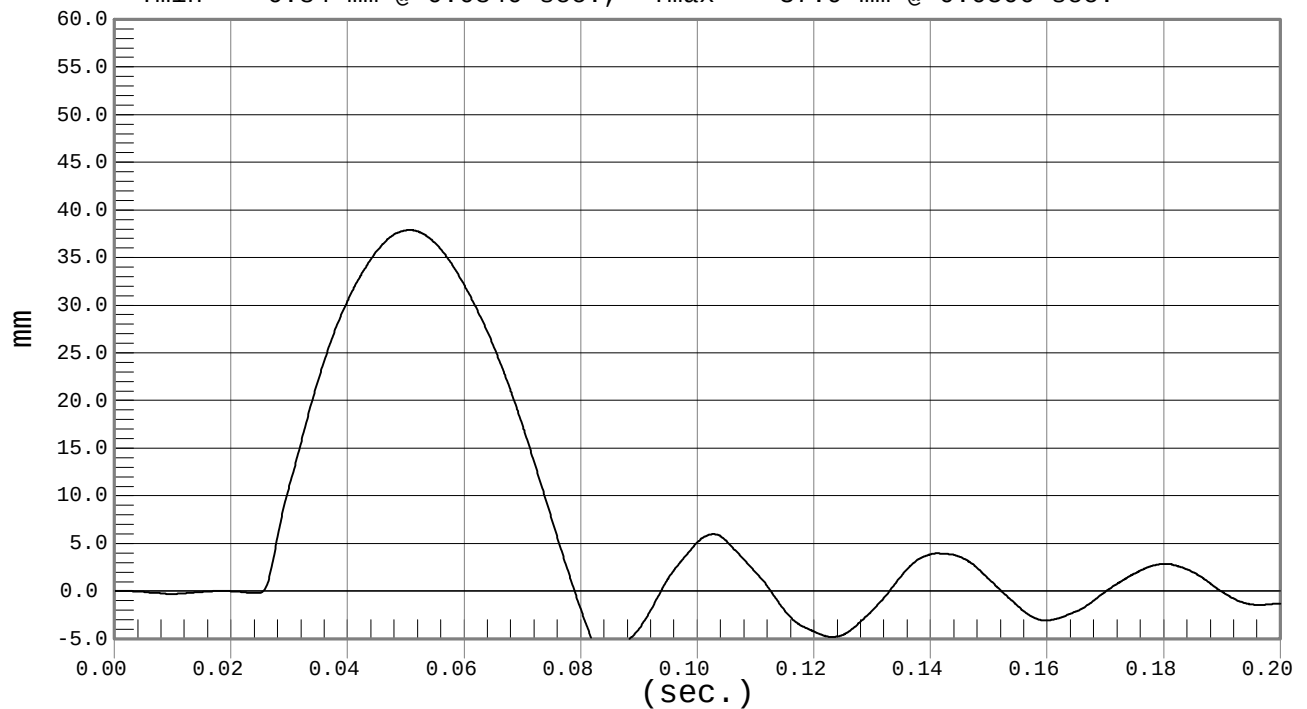


MIDDLE RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.84 mm @ 0.0840 sec., Ymax = 37.9 mm @ 0.0506 sec.



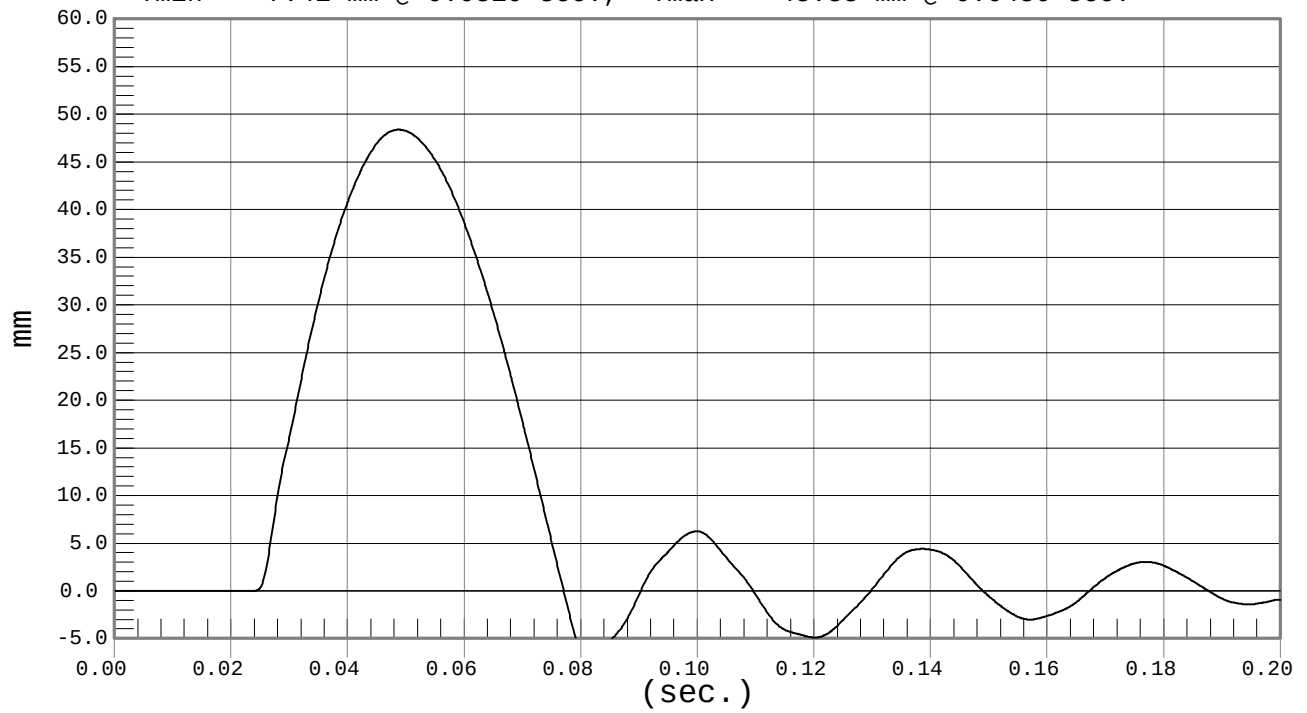


MIDDLE RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.41 mm @ 0.0810 sec., Ymax = 48.38 mm @ 0.0486 sec.



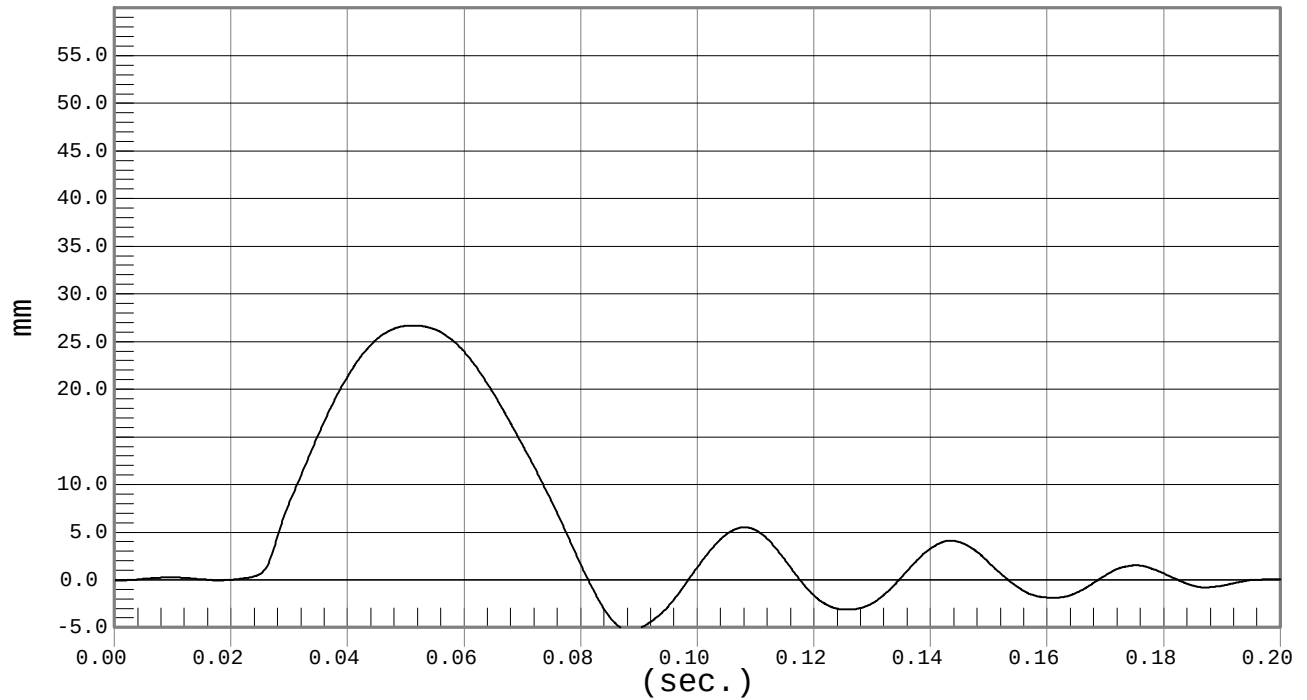


LOWER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-11-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.33 mm @ 0.0883 sec., Ymax = 26.67 mm @ 0.0516 sec.

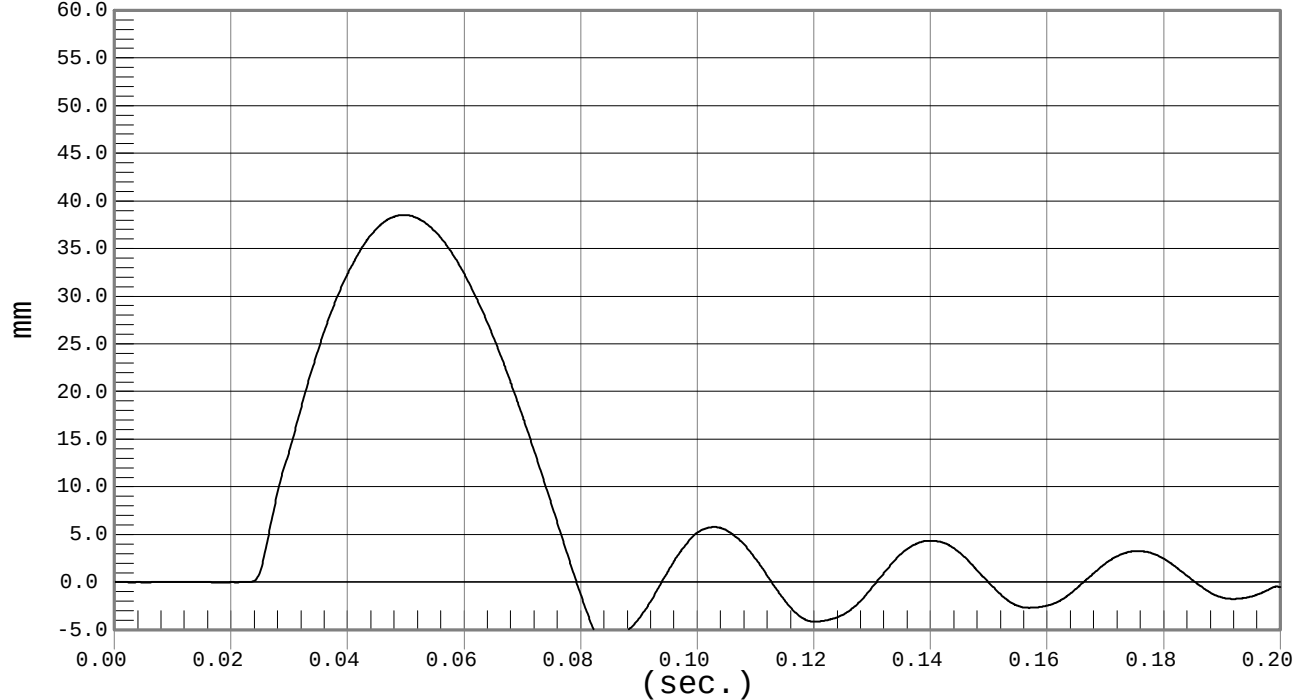


LOWER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-11-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.8 mm @ 0.0844 sec., Ymax = 38.53 mm @ 0.0496 sec.



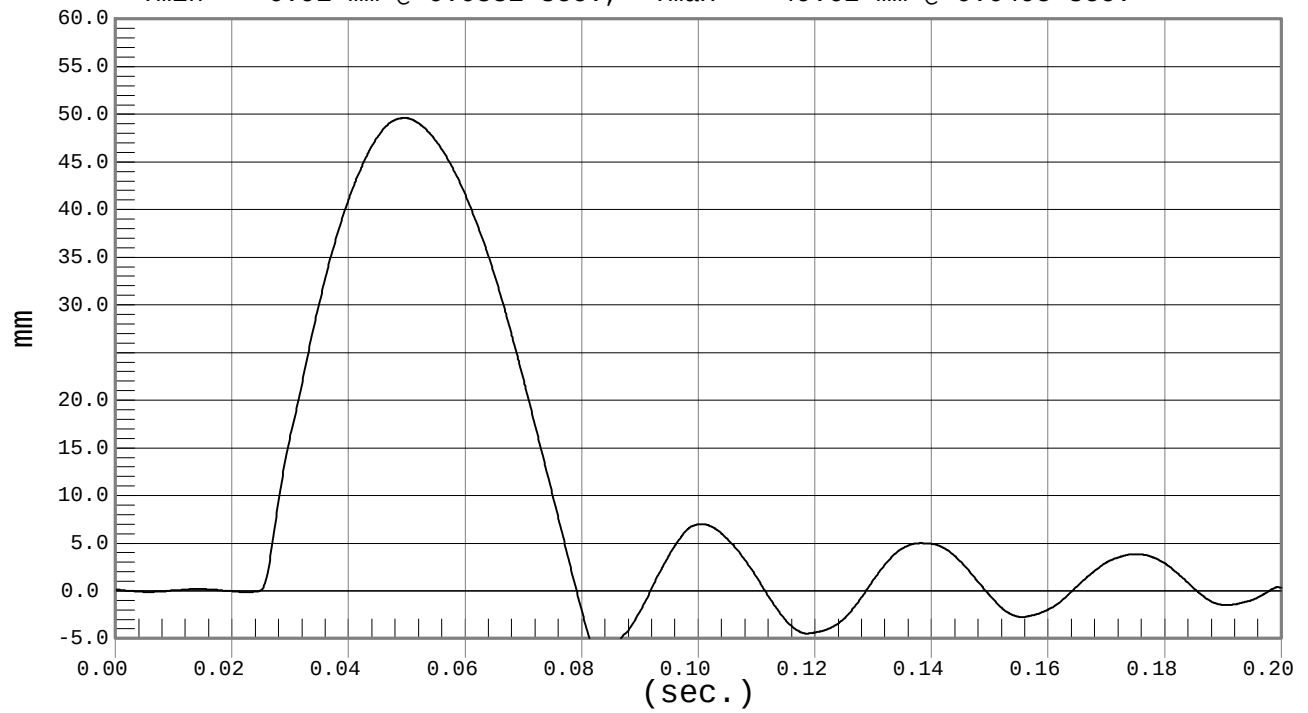


LOWER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 02-10-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -6.91 mm @ 0.0831 sec., Ymax = 49.62 mm @ 0.0495 sec.



MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

Date: 2/10/05

Dummy Serial Number: 009

Test Number: D05337

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.5
Relative Humidity (%)	10 – 70	17
Probe Speed (m/s)	3.90 – 4.10	4.02
Maximum Impact Force	4.00 – 4.80 kN	4.69
Time of Maximum Force	10.60 – 13.00 ms	10.60
Maximum Total Abdomen Force	2.20 – 2.70 kN	2.23
Time of Max. Total Force	10.00 – 12.30 ms	11.20

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

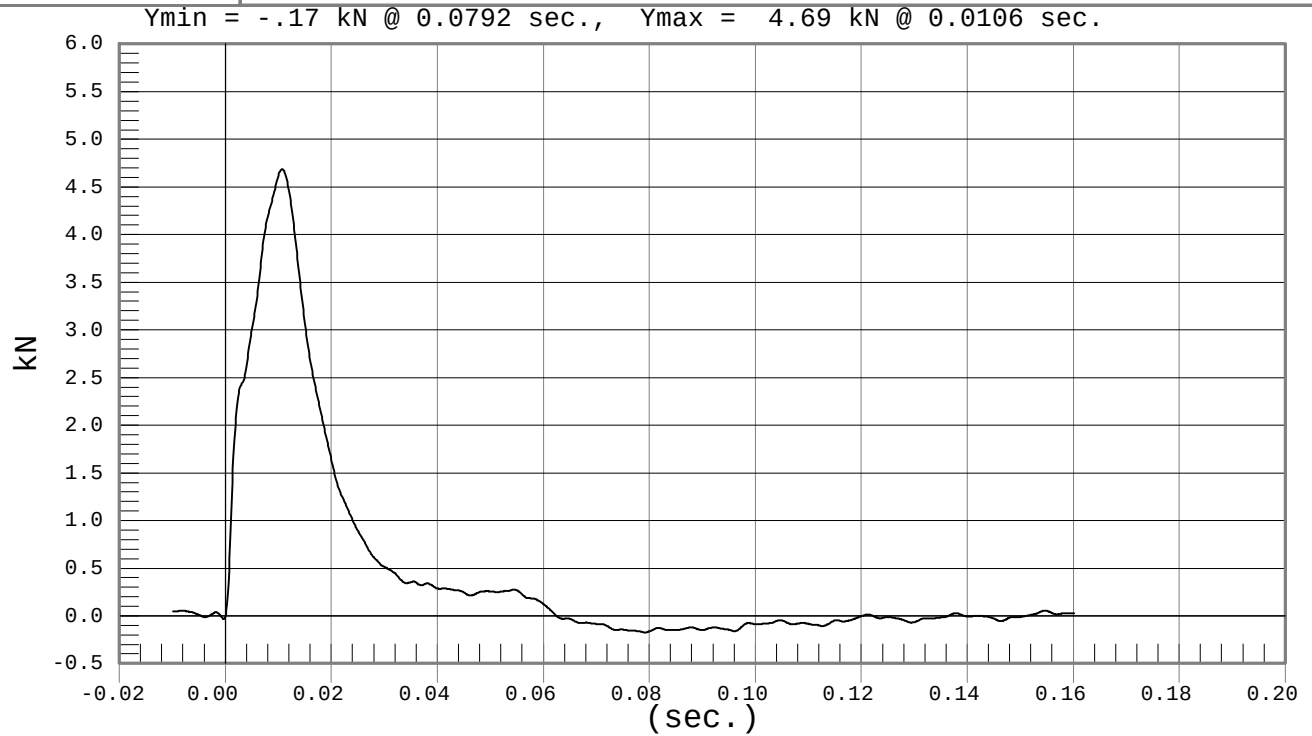
David Winkelbauer



IMPACTOR FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

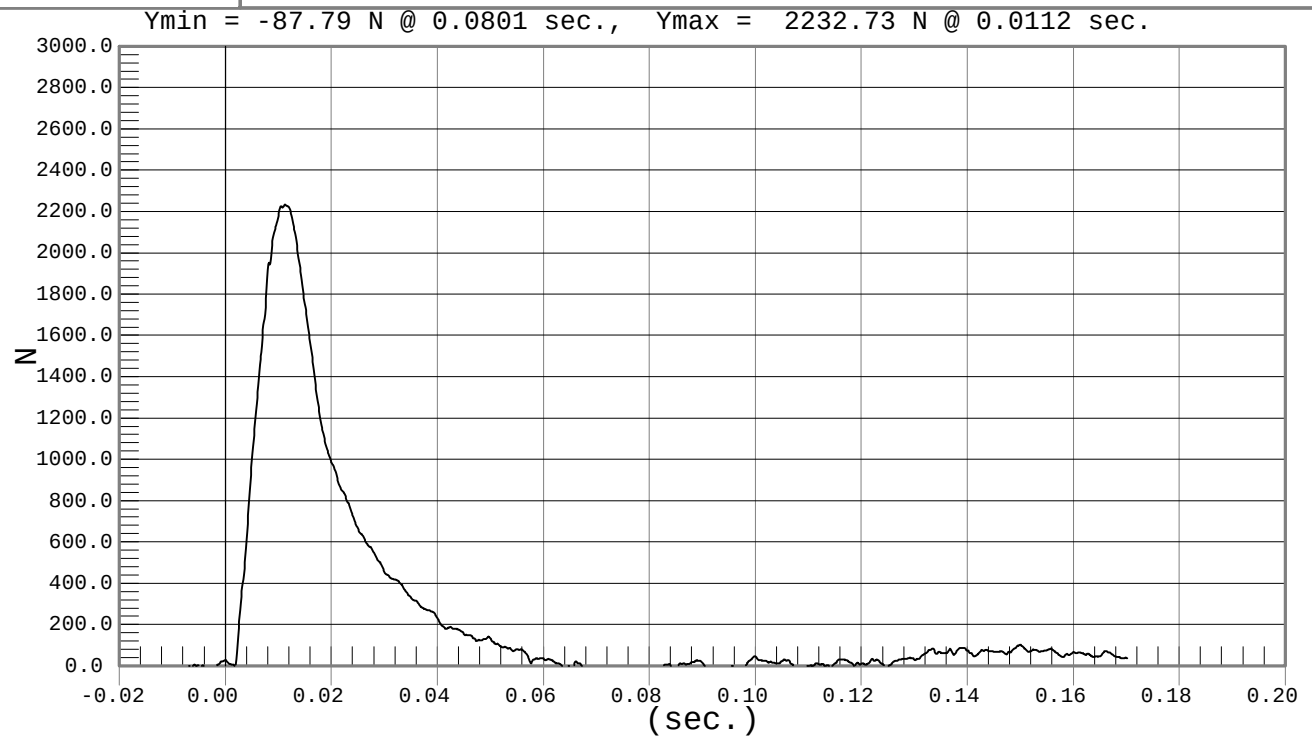
Test Date: 02-10-05
Speed: 13.2 fps, 4.02 M/s



ABDOMEN FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

Test Date: 02-10-05
Speed: 13.2 fps, 4.02 M/s



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date: 2/11/05

Dummy Serial Number: 009

Test Number: D05338

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.1
Relative Humidity (%)		10 – 70	19
Pendulum Speed		5.95 – 6.15	6.13
Pendulum Deceleration	10 msec	-2.46 - -1.59 m/sec	-2.17
	20 msec	-5.25 - -4.07 m/sec	-4.97
	25 msec	-6.64 - -5.30 m/sec	-6.14
	30 msec	≥ -6.5 m/sec	-6.36
Maximum Flexion Angle		45.0 – 55.0 deg	47.6
Time of Max. Flexion Angle		39.0 – 53.0 ms	45.4
Maximum Angle Theta (A)		31.0 – 35.0 deg	31.4
Time of Max. Theta (A)		44.0 – 52.0 ms	45.4
Maximum Angle Theta (B)		27.08– 29.58 deg	28.6
Time of Max. Theta (B)		44.0 – 52.0 ms	44.3

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

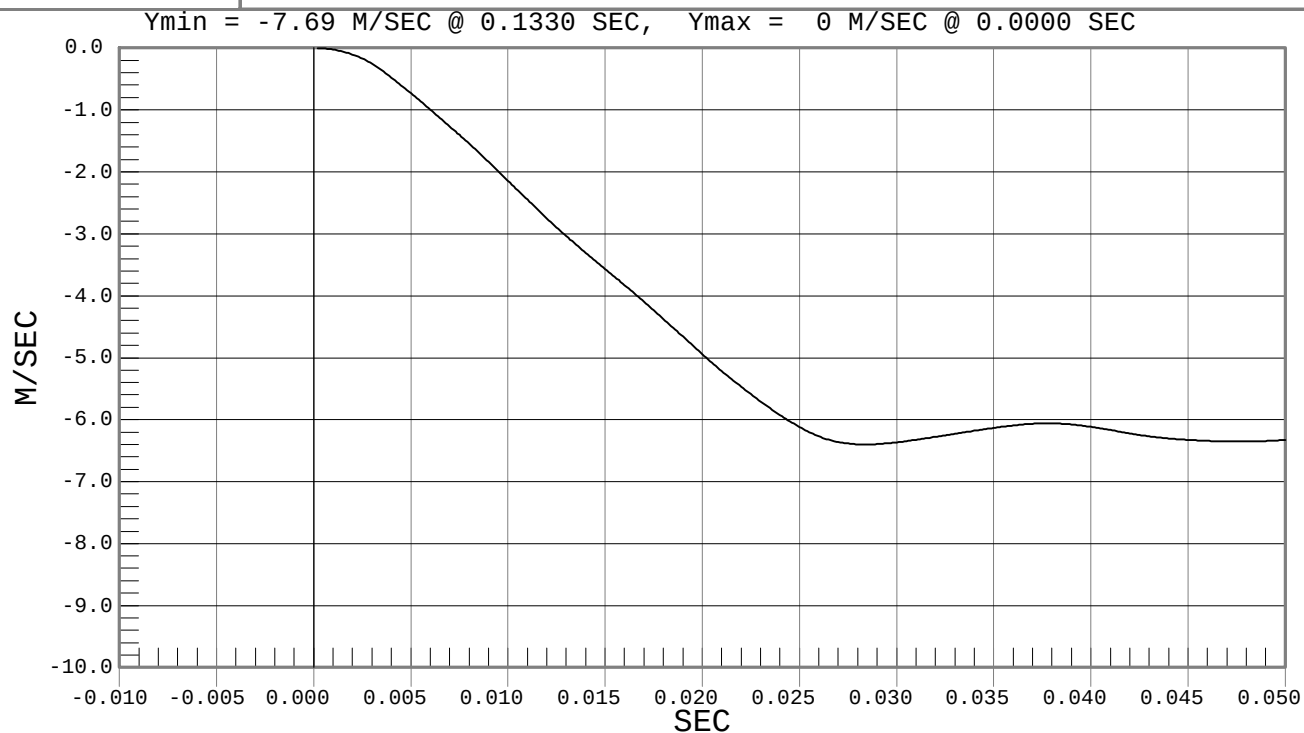
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Lumbar Bending
Component: Dummy #009

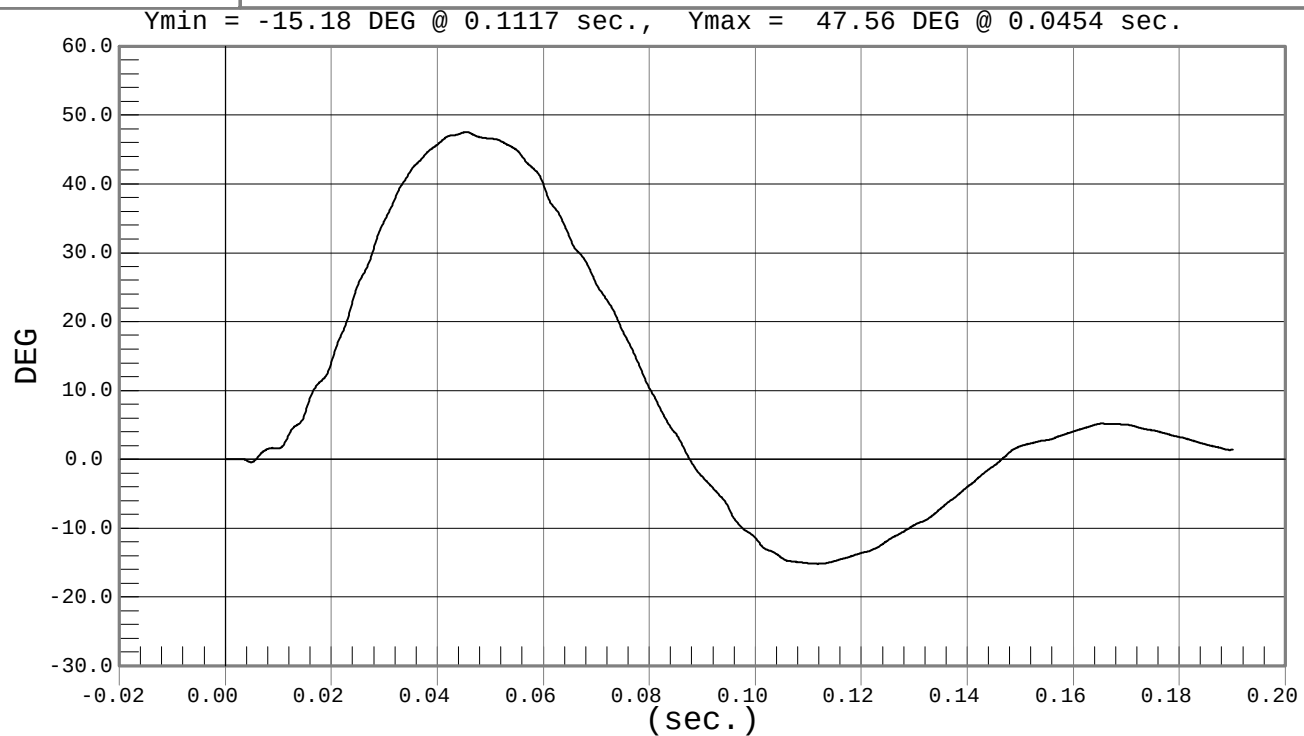
Test Date: 02-11-05
Speed: 20.1 fps, 6.13 M/s



FLEXION ANGLE

Test Desc.: Lumbar Bending
Component: Dummy #009

Test Date: 02-11-05
Speed: 20.1 fps, 6.13 M/s



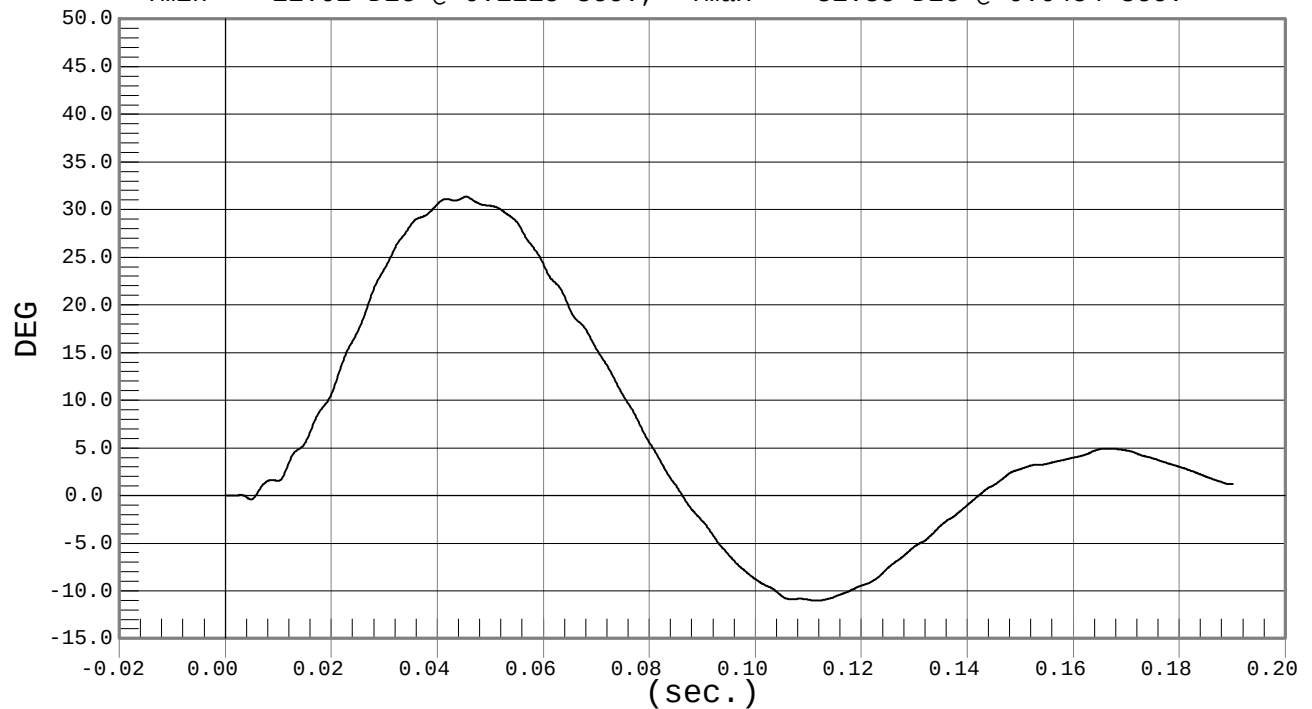


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA A

Test Date: 02-11-05
Speed: 20.1 fps, 6.13 M/s

Ymin = -11.02 DEG @ 0.1115 sec., Ymax = 31.35 DEG @ 0.0454 sec.

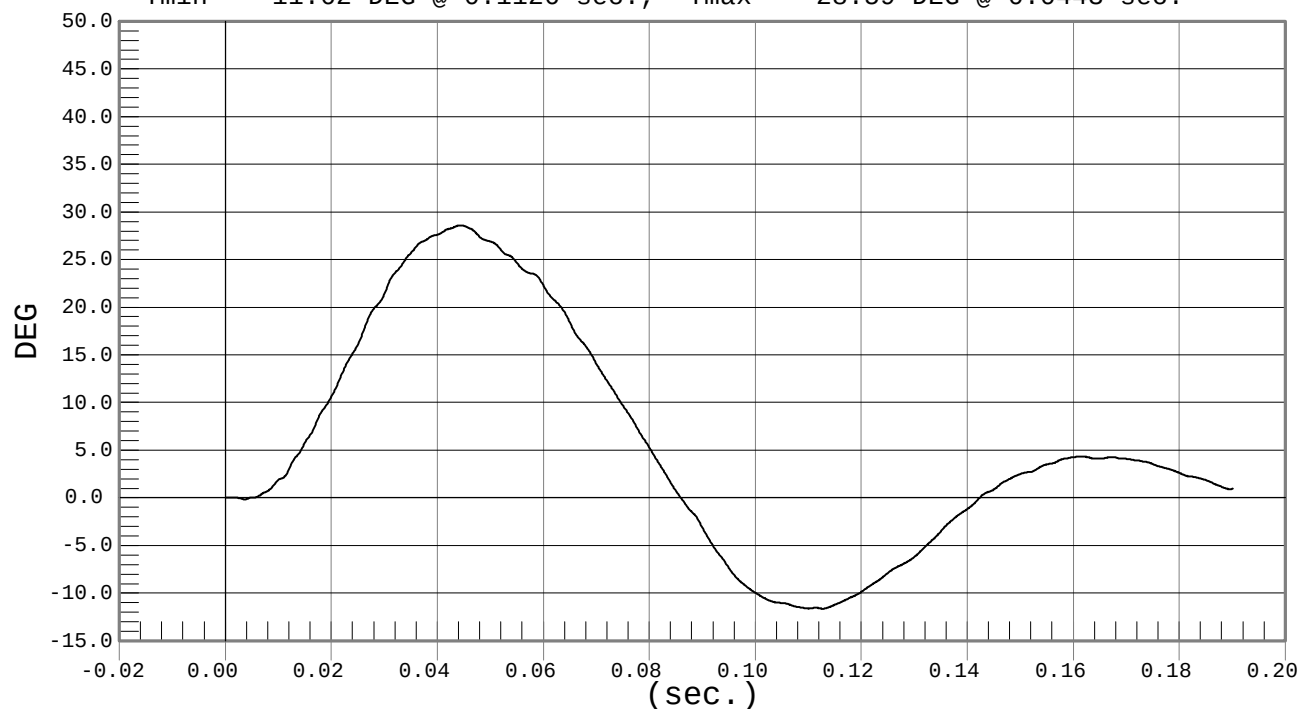


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA B

Test Date: 02-11-05
Speed: 20.1 fps, 6.13 M/s

Ymin = -11.62 DEG @ 0.1126 sec., Ymax = 28.59 DEG @ 0.0443 sec.



MGA RESEARCH CORPORATION
PELVIS TEST
EUROSID 2 DUMMY

Date: 2/10/05

Dummy Serial Number: 009

Test Number: D05339

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.5
Relative Humidity (%)	10 – 70	16
Pendulum Speed	4.20 – 4.40 m/s	4.31
Maximum Impactor Force	4.40 – 5.40 kN	5.23
Time of Max. Impactor Force	10.30 – 15.50 ms	13.70
Maximum Pubic Force	1.04 – 1.64 kN	1.40
Time of Max. Pubic Force	9.90 – 15.90 ms	15.50

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

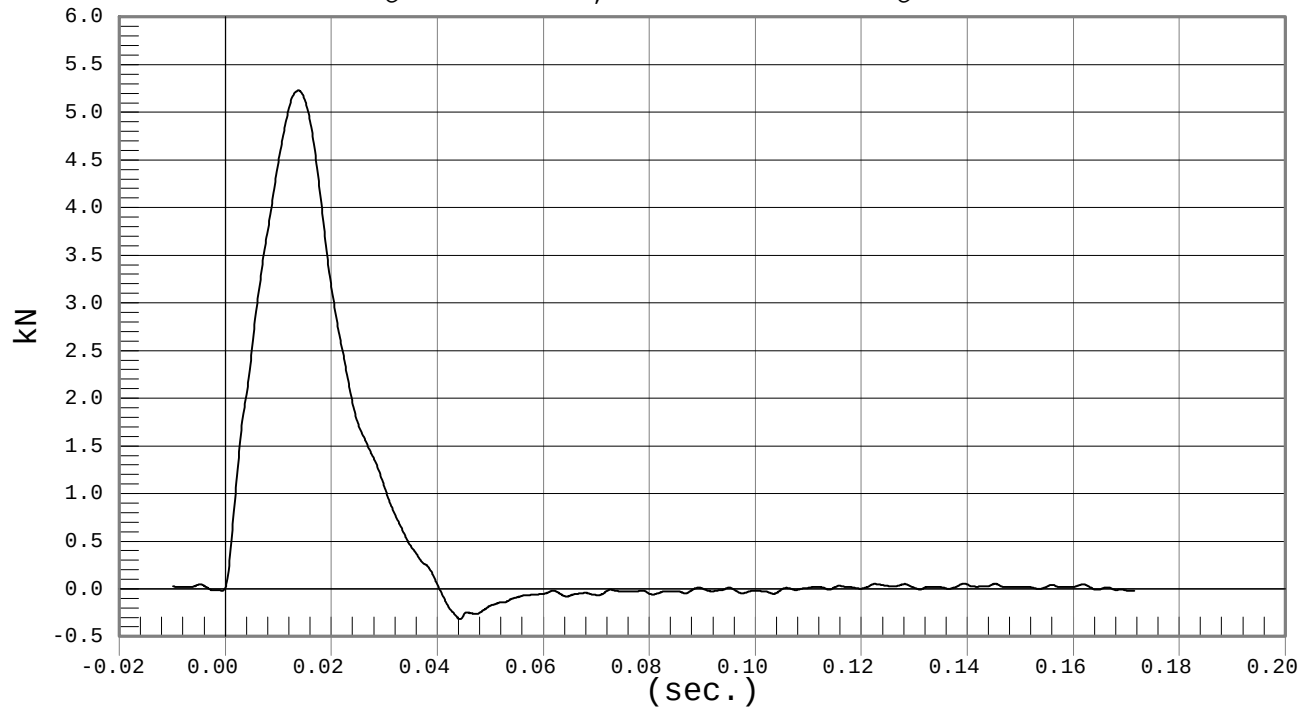


IMPACTOR FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 02-10-05
Speed: 14.1 fps, 4.31 M/s

Ymin = -.32 kN @ 0.0441 sec., Ymax = 5.23 kN @ 0.0137 sec.

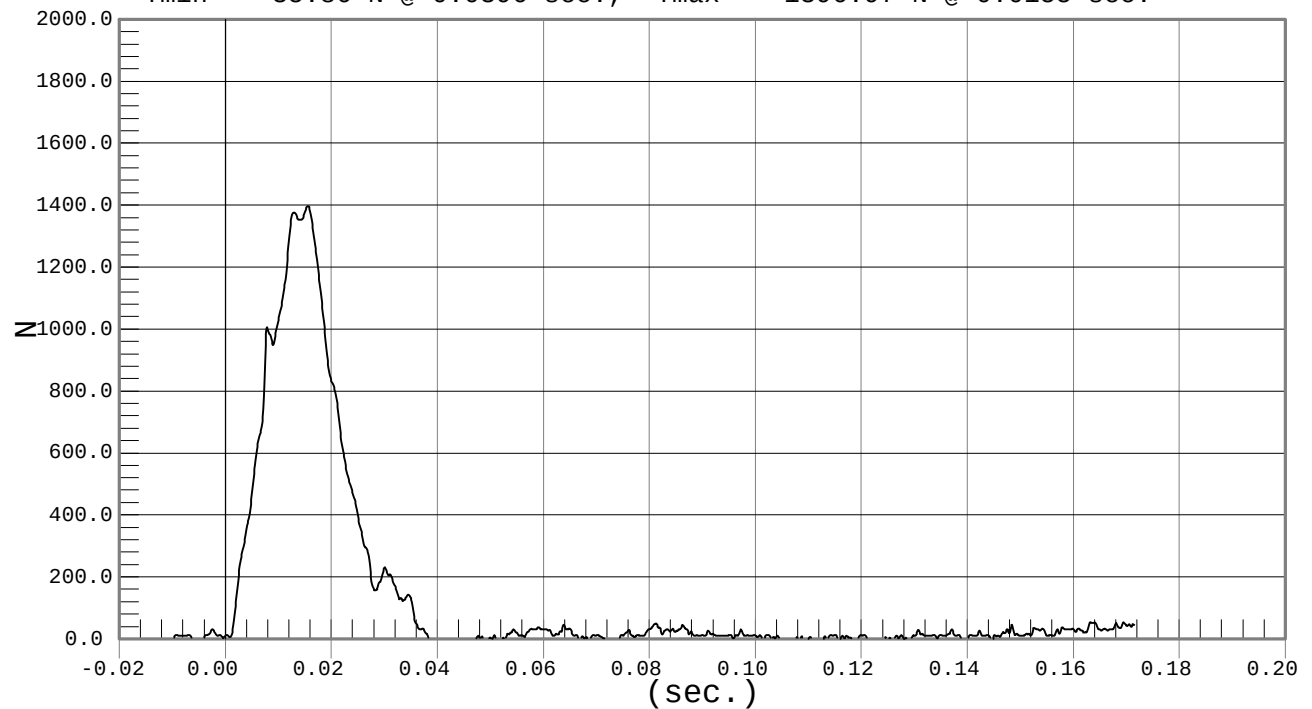


PUBIC FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 02-10-05
Speed: 14.1 fps, 4.31 M/s

Ymin = -35.86 N @ 0.0396 sec., Ymax = 1396.97 N @ 0.0155 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: 3/16/05

Dummy Serial Number: 009

Test Number: D05791

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	15
Peak Resultant Acceleration	100 – 150 g's	141
Time of Max. Res. Acceleration	msec	49.9

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

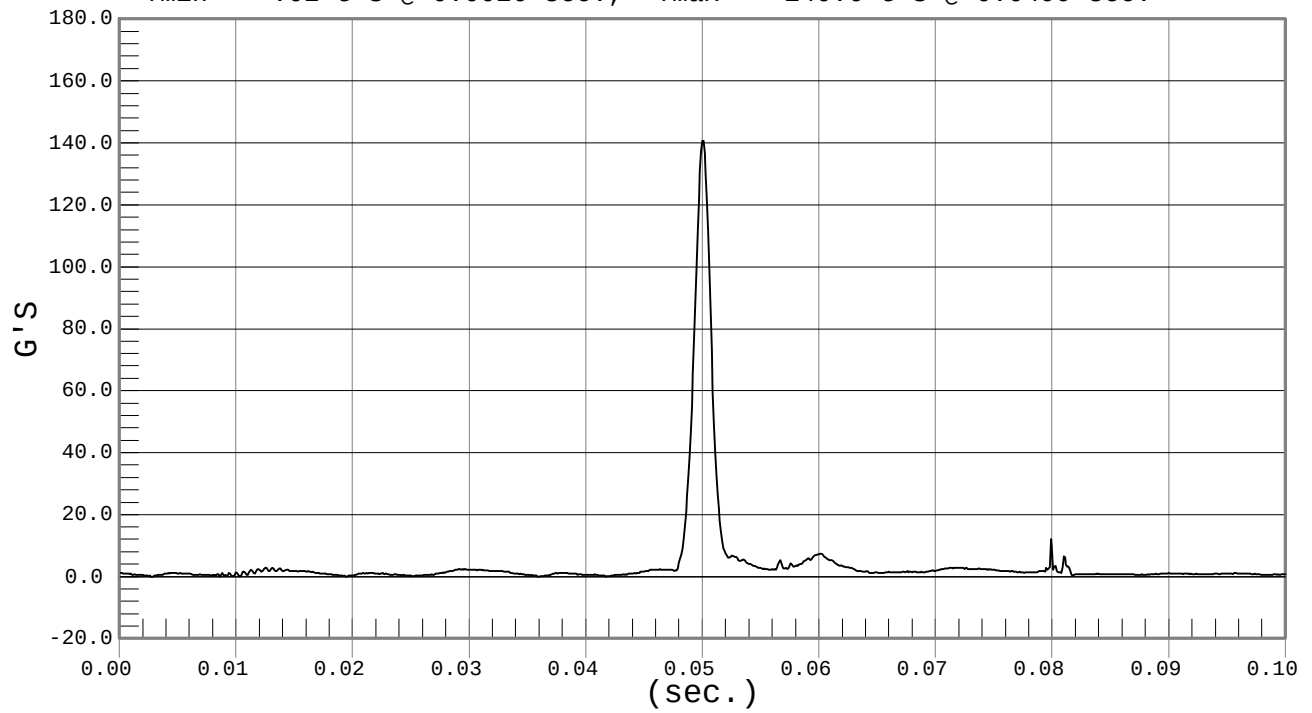


PEAK RESULTANT ACCELERATION

Test Desc.: Head Drop
Component: Dummy #009

Test Date: 03-16-05
Speed: 0.0 fps, 0.00 M/s

Ymin = .02 G'S @ 0.0026 sec., Ymax = 140.6 G'S @ 0.0499 sec.



MGA RESEARCH CORPORATION
NECK PENDULUM TEST
EUROSID 2 DUMMY

Date: 3/17/05

Dummy Serial Number: 009

Test Number: D05792

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.4
Relative Humidity (%)		10 – 70	16
Pendulum Speed		3.3 - 3.5	3.45
Pendulum Deceleration	3 msec	~.25 - ~.53 m/sec	-.32
	8 msec	~1.59 - ~2.04 m/sec	-1.80
	14 msec	~3.20 - ~3.85 m/sec	-3.48
Maximum Flexion Angle		49.0 – 59.0 deg	51.5
Time of Max. Flexion Angle		54.0 – 66.0 ms	61.6
Maximum Angle Theta (A)		32.0 – 37.0 deg	32.7
Time of Max. Theta (A)		53.0 – 63.0 ms	61.6
Maximum Angle Theta (B)		28.22 – 30.73 deg	29.09
Time of Max. Theta (B)		54.0 – 64.0 ms	57.0

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

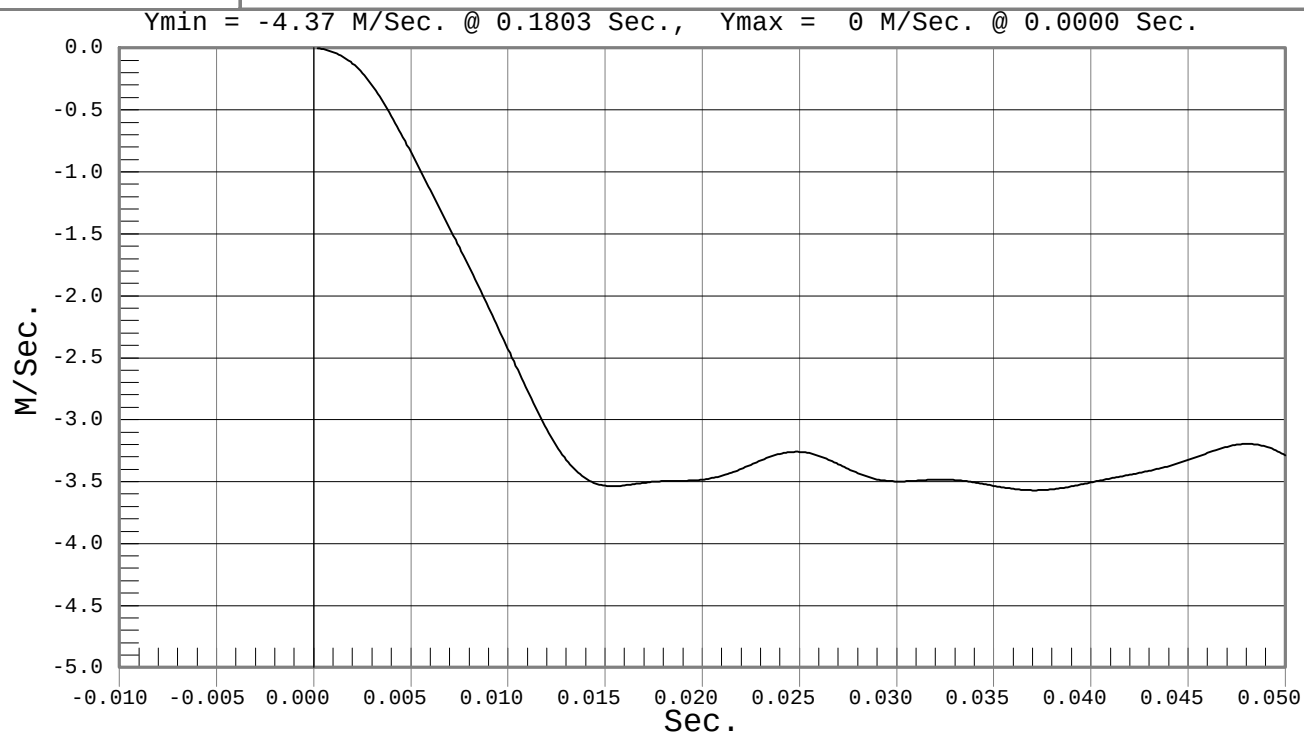
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Neck Bending
Component: Dummy #009

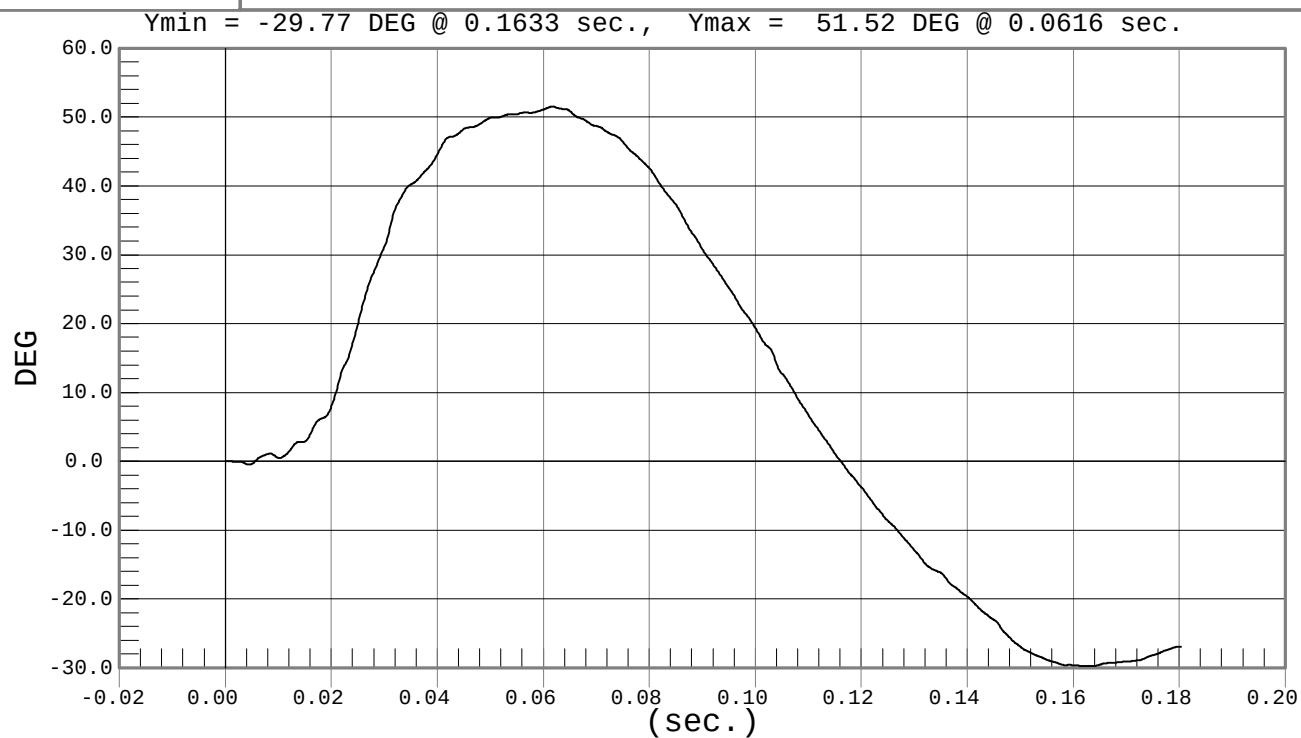
Test Date: 03-17-05
Speed: 11.3 fps, 3.45 M/s



FLEXION ANGLE

Test Desc.: Neck Bending
Component: Dummy #009

Test Date: 03-17-05
Speed: 11.3 fps, 3.45 M/s



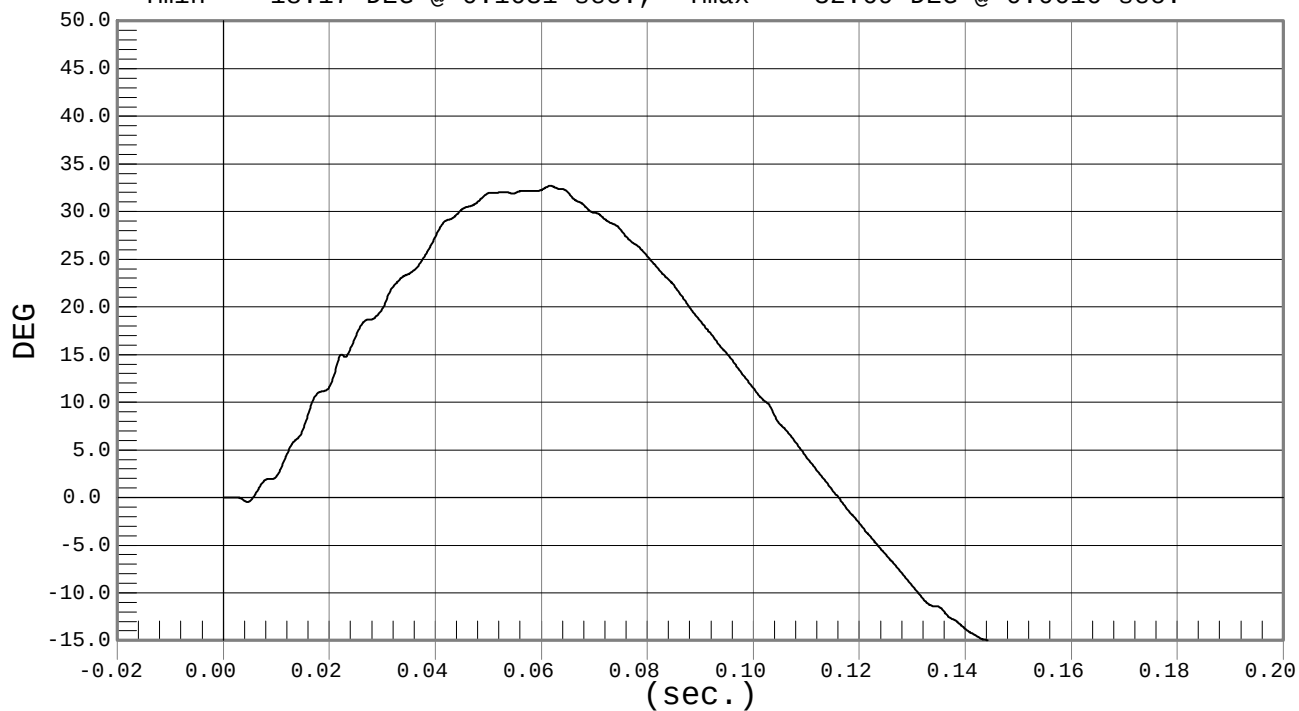


Test Desc.: Neck Bending
Component: Dummy #009

THETA A

Test Date: 03-17-05
Speed: 11.3 fps, 3.45 M/s

Ymin = -18.17 DEG @ 0.1631 sec., Ymax = 32.69 DEG @ 0.0616 sec.

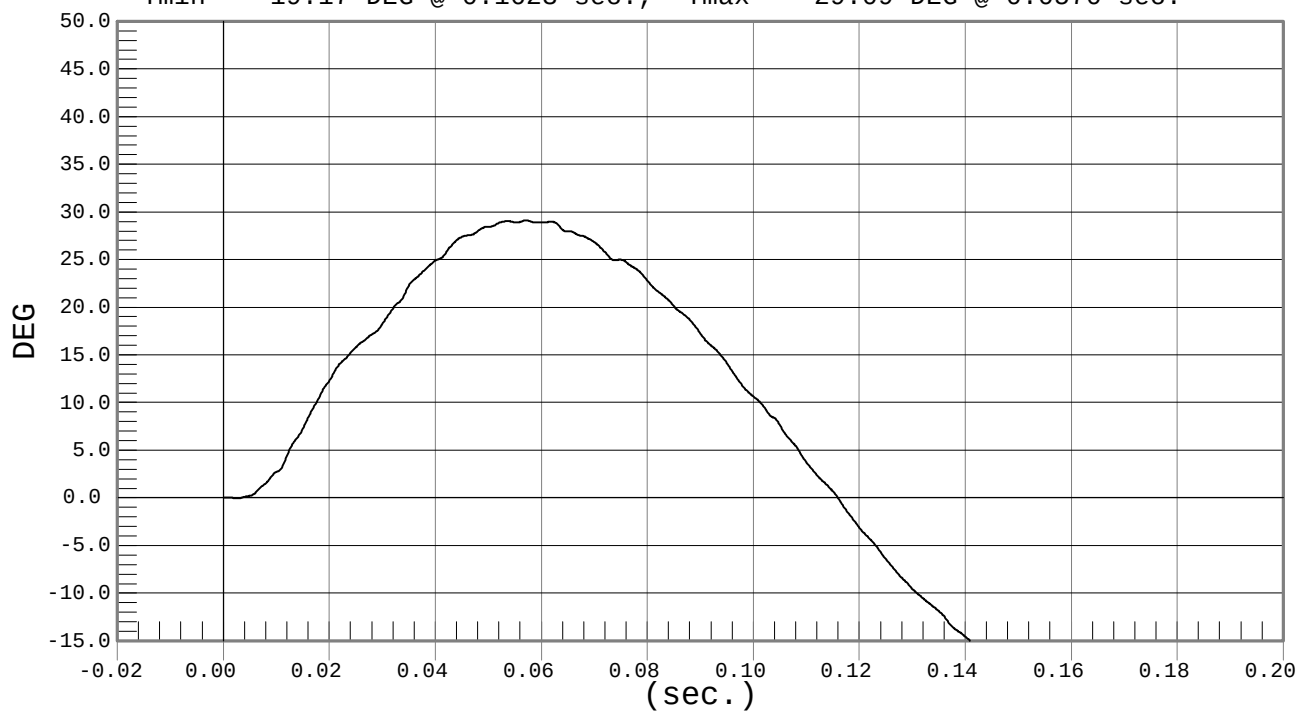


Test Desc.: Neck Bending
Component: Dummy #009

THETA B

Test Date: 03-17-05
Speed: 11.3 fps, 3.45 M/s

Ymin = -19.17 DEG @ 0.1623 sec., Ymax = 29.09 DEG @ 0.0570 sec.



MGA RESEARCH CORPORATION
SHOULDER IMPACT TEST
EUROSID 2 DUMMY

Date: 3/17/05

Dummy Serial Number: 009

Test Number: D05793

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.9
Relative Humidity (%)	10 – 70	21
Pendulum Speed	4.2 – 4.4 m/s	4.3
Max. Resultant Acceleration	7.5 – 10.5 g's	10.0
Time of Max. Pendulum Acceleration	msec	11.5

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

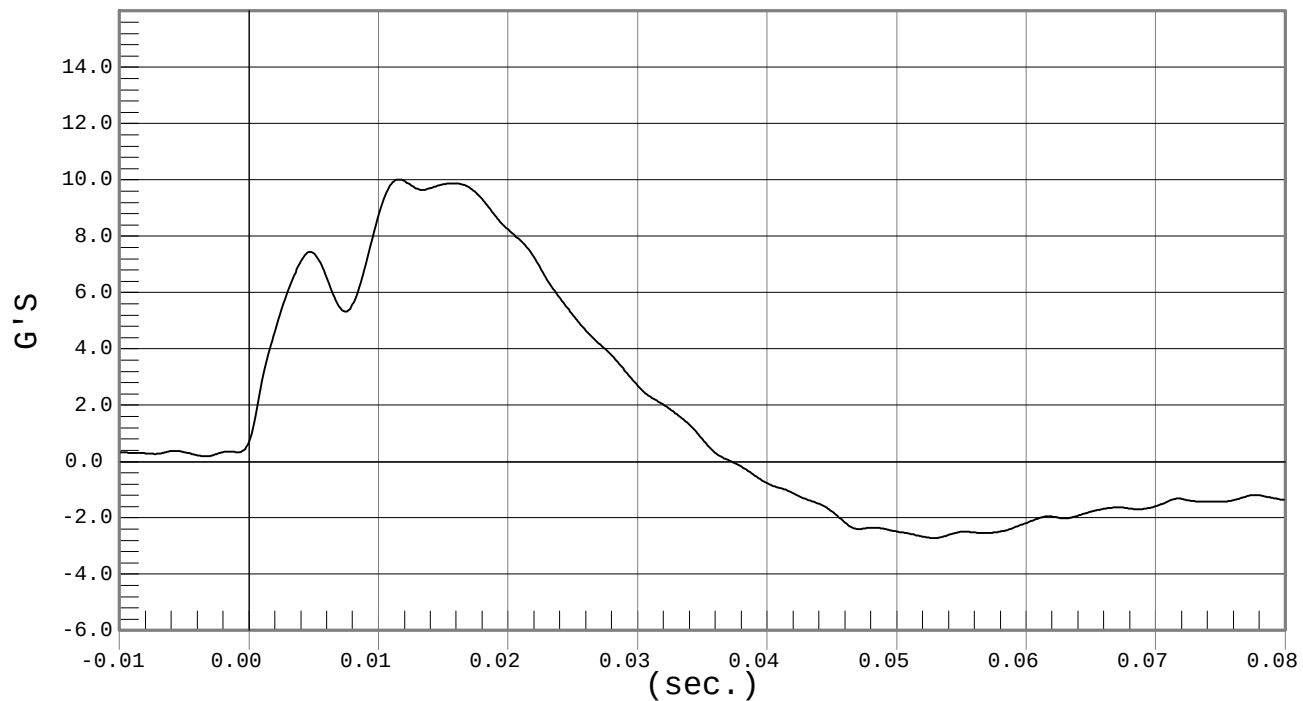


SHOULDER ACCELERATION

Test Desc.: Shoulder Impact
Component: Dummy #009

Test Date: 03-17-05
Speed: 14.0 fps, 4.28 M/s

Ymin = -2.72 G'S @ 0.0528 sec., Ymax = 10.02 G'S @ 0.0115 sec.



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

Date: 3/16/05
Dummy Serial Number: 009
Test Number: D05794, D05795, D05796

UPPER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	15
Displacement at 2 m/s	23.5 – 27.5 mm	26.6
Displacement at 3 m/s	36.0 – 40.0 mm	38.5
Displacement at 4 m/s	46.0 – 51.0 mm	49.1

MIDDLE RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	15
Displacement at 2 m/s	23.5 – 27.5 mm	26.0
Displacement at 3 m/s	36.0 – 40.0 mm	37.2
Displacement at 4 m/s	46.0 – 51.0 mm	48.5

LOWER RIB - TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.7
Relative Humidity (%)	10 – 70	15
Displacement at 2 m/s	23.5 – 27.5 mm	26.5
Displacement at 3 m/s	36.0 – 40.0 mm	38.5
Displacement at 4 m/s	46.0 – 51.0 mm	49.7

TEST MEETS SPECIFICATIONS

Technician: Jessica Hall

Approved By: David Winkelbauer

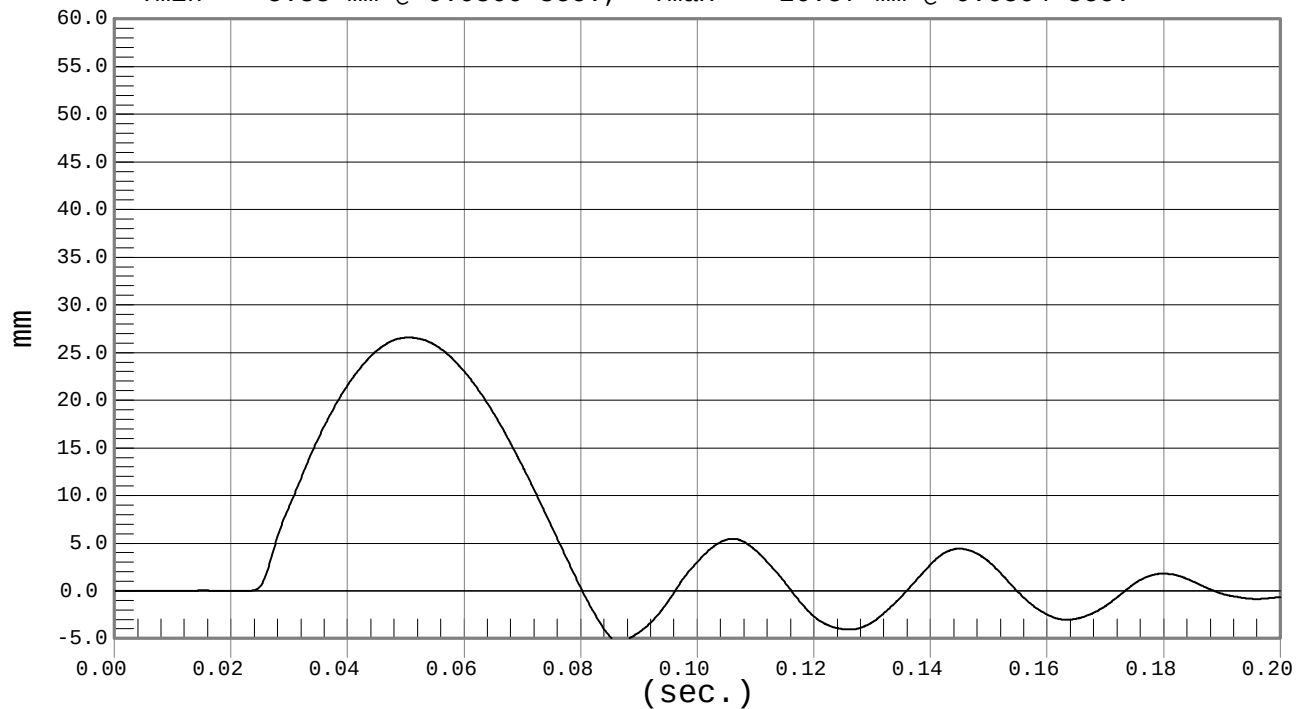


UPPER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-16-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.33 mm @ 0.0866 sec., Ymax = 26.57 mm @ 0.0504 sec.

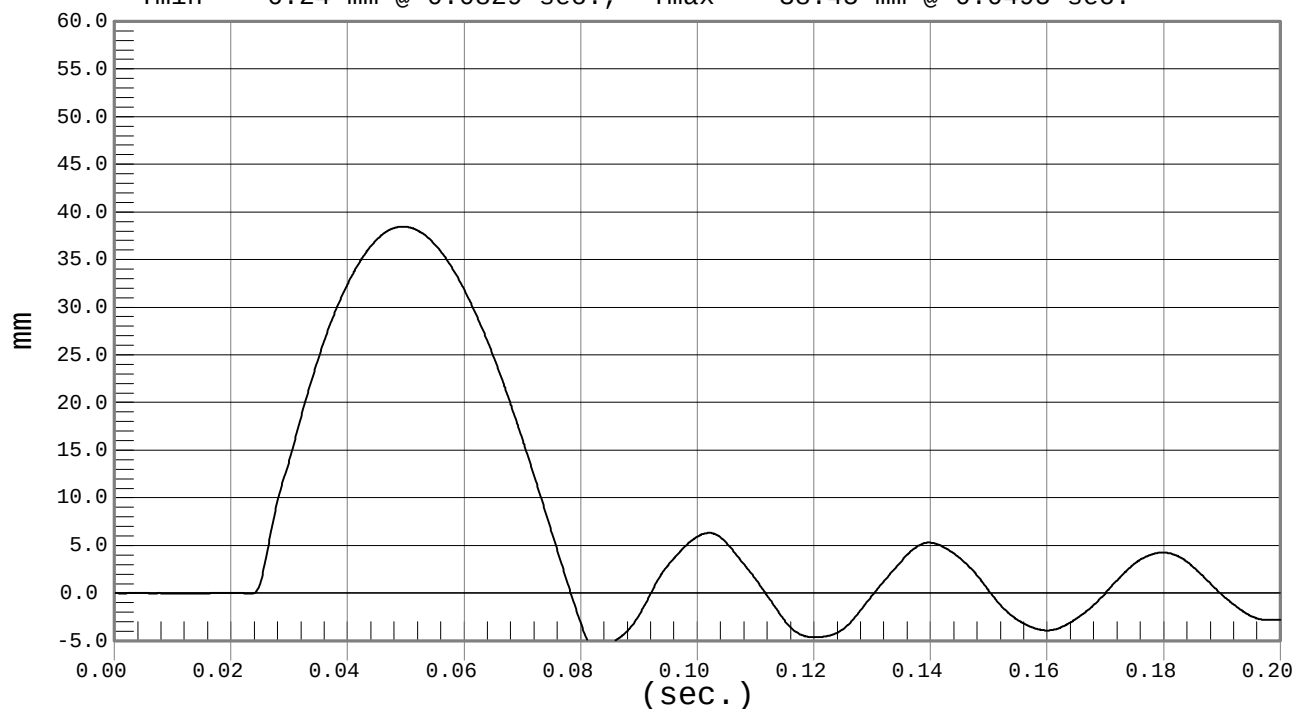


UPPER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-16-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.24 mm @ 0.0829 sec., Ymax = 38.45 mm @ 0.0495 sec.



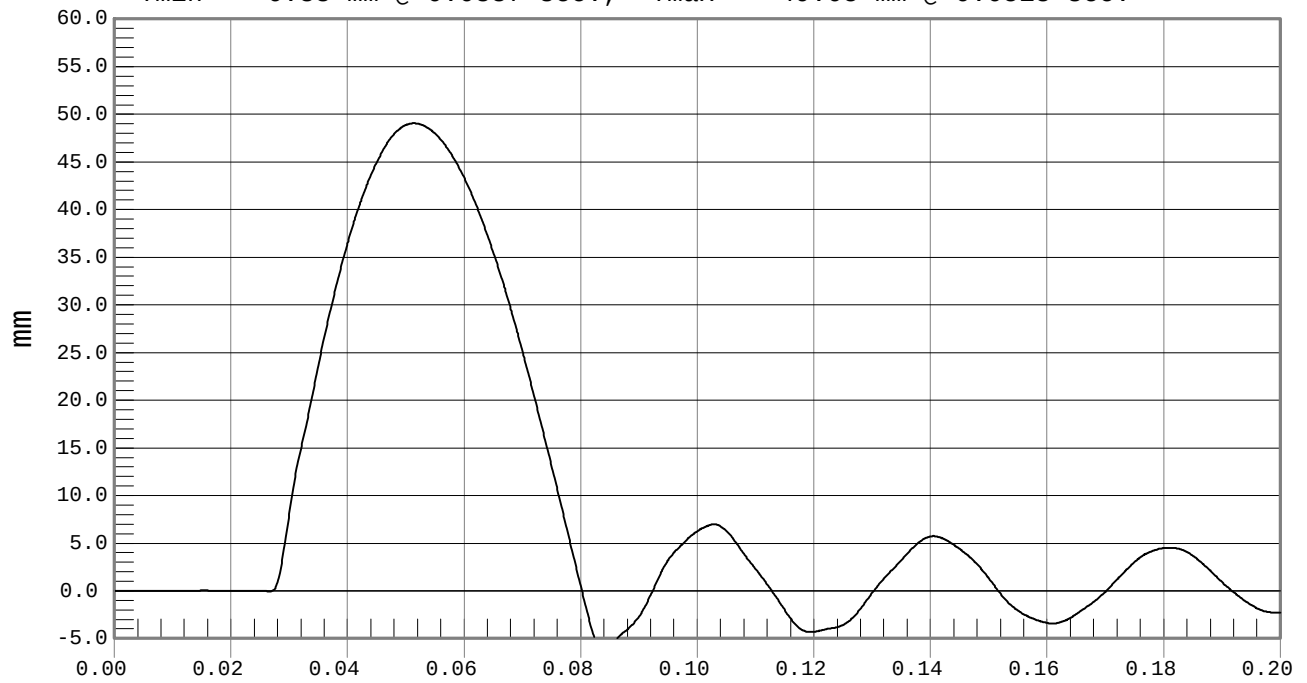


UPPER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-16-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -6.33 mm @ 0.0837 sec., Ymax = 49.05 mm @ 0.0513 sec.



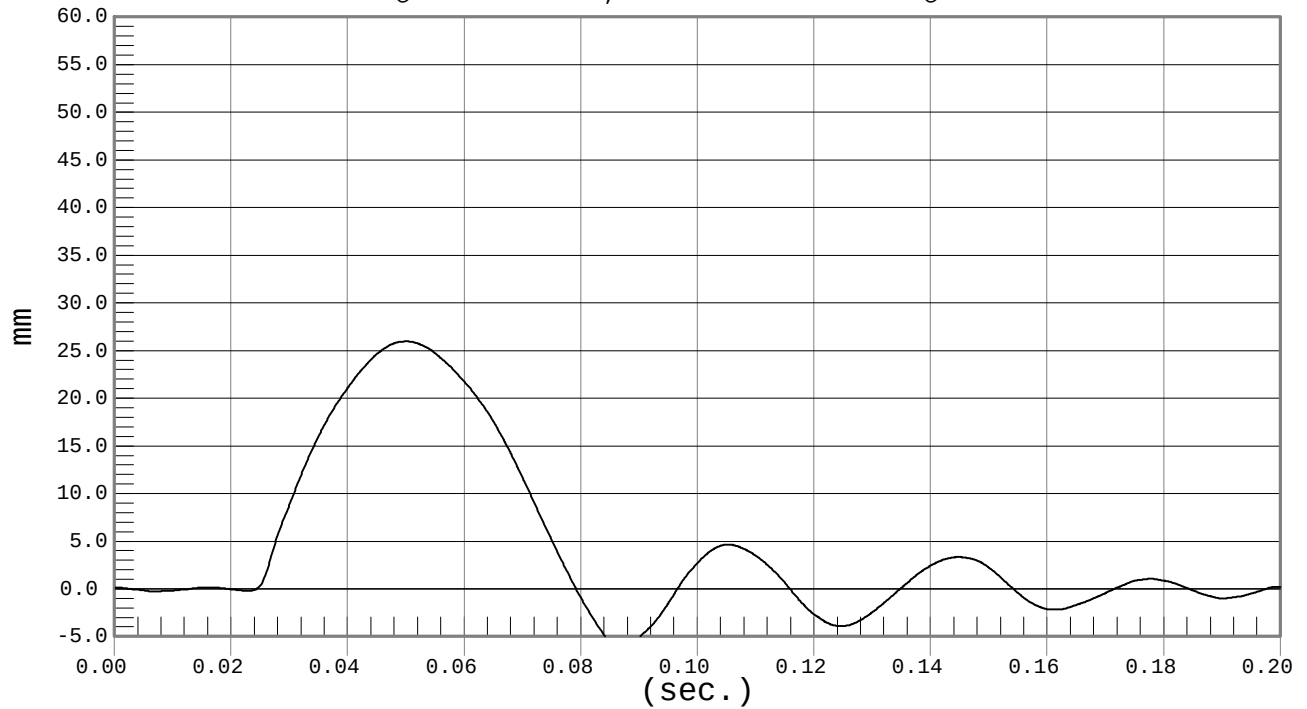


MIDDLE RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-16-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.97 mm @ 0.0865 sec., Ymax = 25.95 mm @ 0.0500 sec.

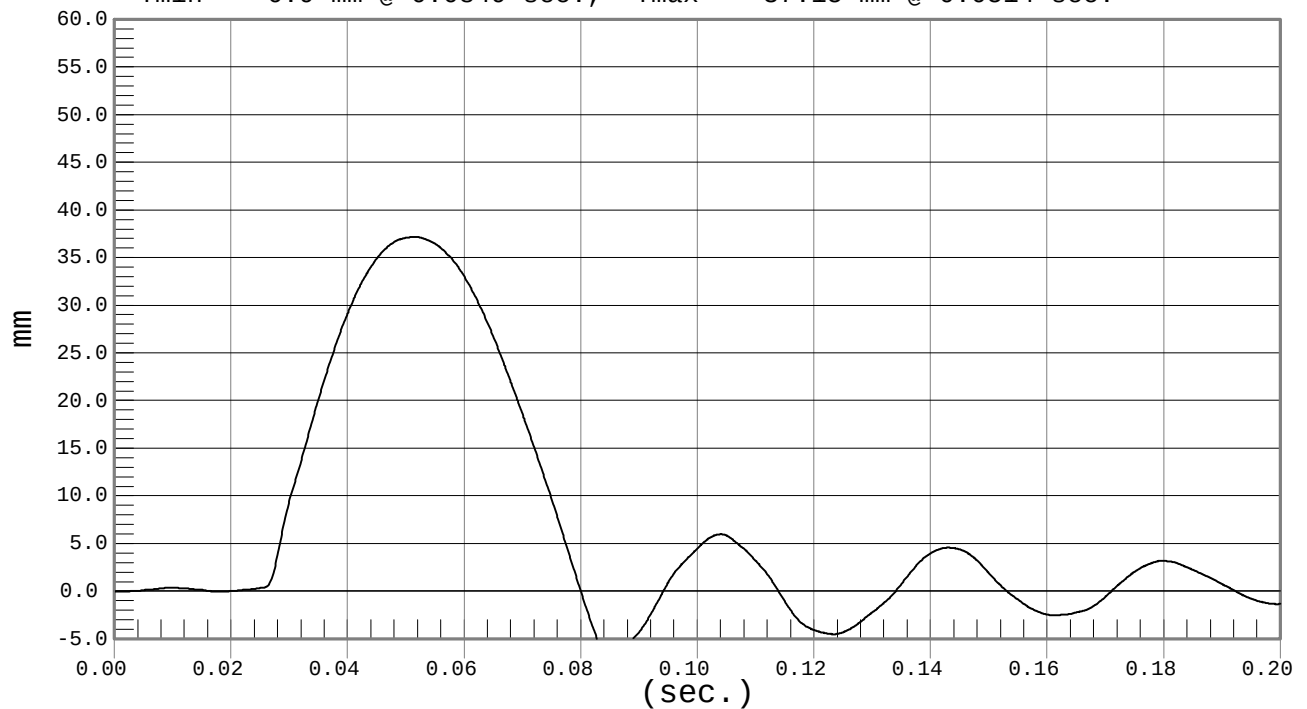


MIDDLE RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-17-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.9 mm @ 0.0849 sec., Ymax = 37.15 mm @ 0.0514 sec.



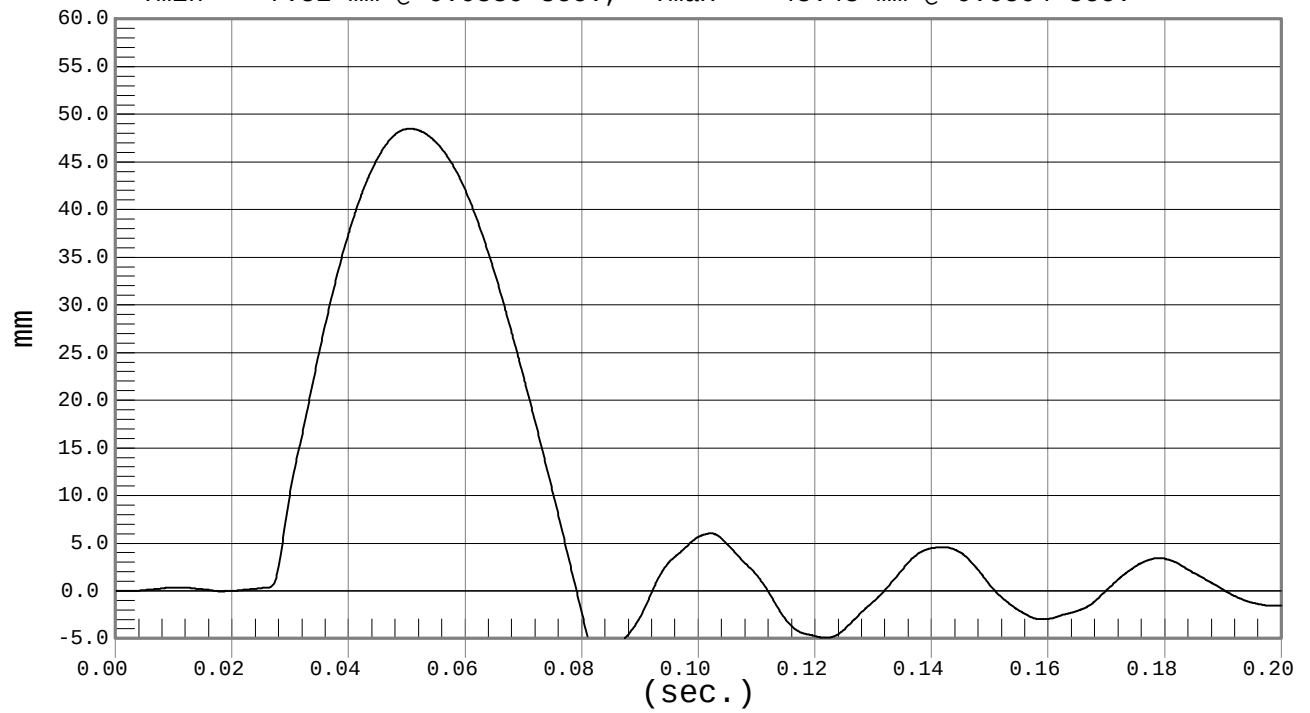


MIDDLE RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-16-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.52 mm @ 0.0830 sec., Ymax = 48.48 mm @ 0.0504 sec.



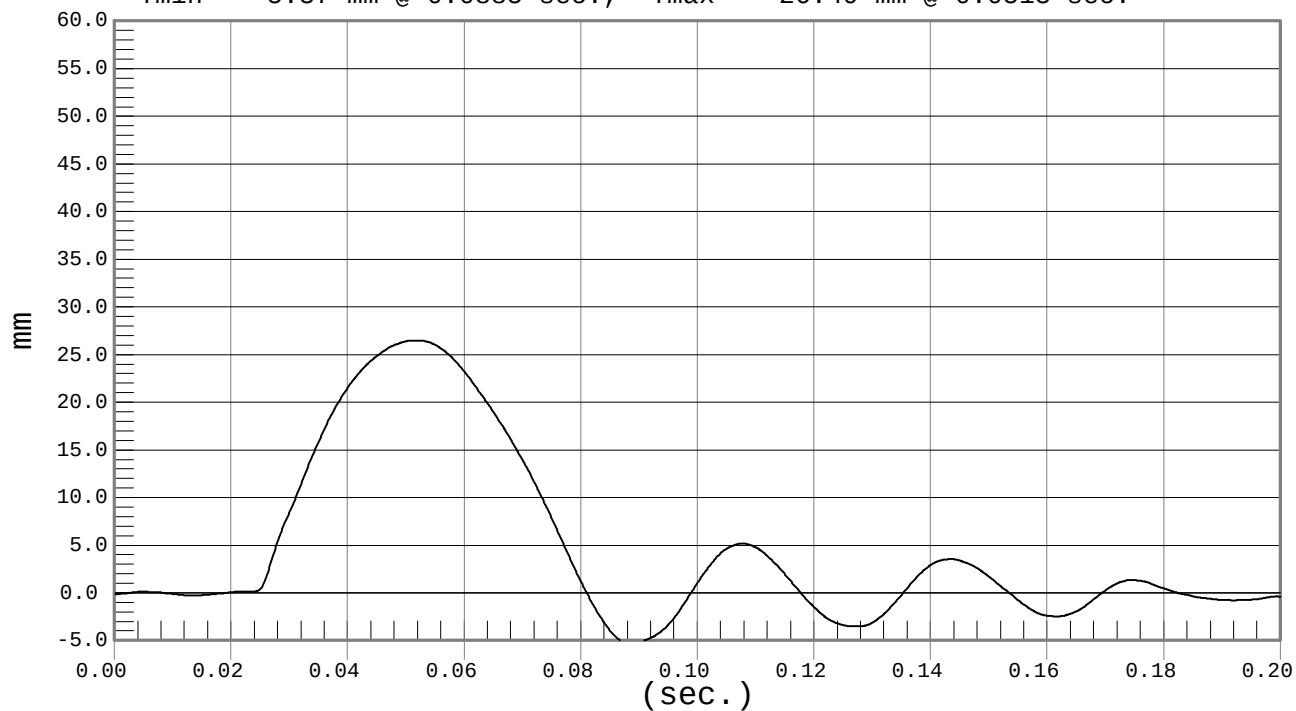


LOWER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-17-05
Speed: 6.6 fps, 2.00 M/s

Ymin = -5.37 mm @ 0.0885 sec., Ymax = 26.49 mm @ 0.0513 sec.

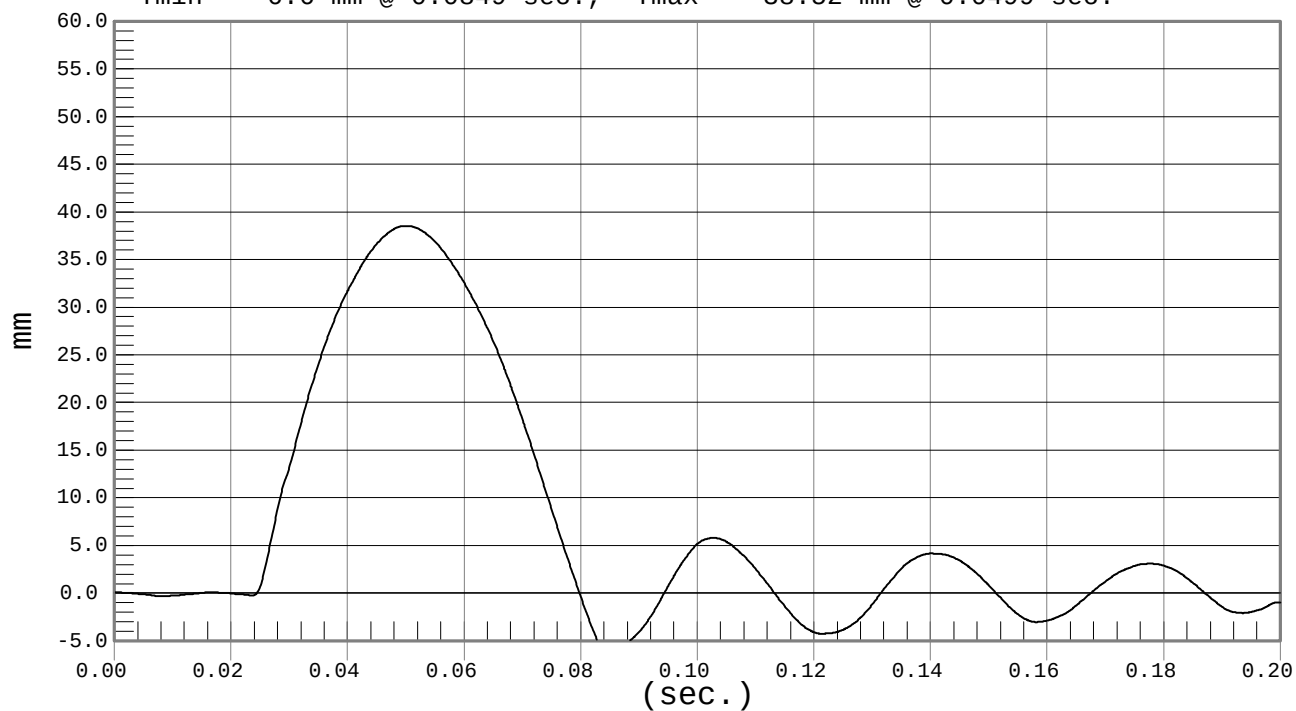


LOWER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-17-05
Speed: 9.8 fps, 3.00 M/s

Ymin = -6.6 mm @ 0.0849 sec., Ymax = 38.52 mm @ 0.0499 sec.



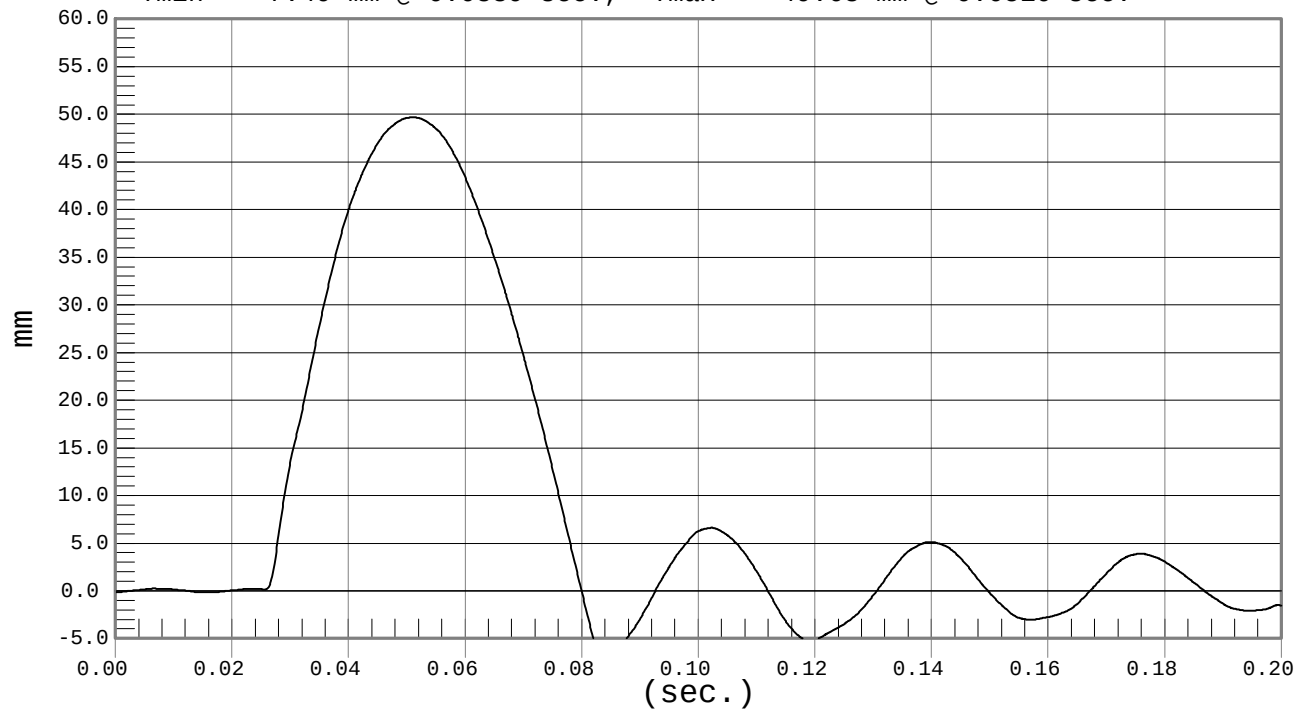


LOWER RIB DISPLACEMENT

Test Desc.: RIB IMPACT
Component: Dummy #009

Test Date: 03-17-05
Speed: 13.1 fps, 4.00 M/s

Ymin = -7.49 mm @ 0.0839 sec., Ymax = 49.68 mm @ 0.0510 sec.



MGA RESEARCH CORPORATION
ABDOMEN TEST
EUROSID 2 DUMMY

Date: 3/17/05

Dummy Serial Number: 009

Test Number: D05797

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	21.1
Relative Humidity (%)	10 – 70	21
Probe Speed (m/s)	3.90 – 4.10	4.04
Maximum Impact Force	4.00 – 4.80 kN	4.75
Time of Maximum Force	10.60 – 13.00 ms	10.60
Maximum Total Abdomen Force	2.20 – 2.70 kN	2.31
Time of Max. Total Force	10.00 – 12.30 ms	10.90

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

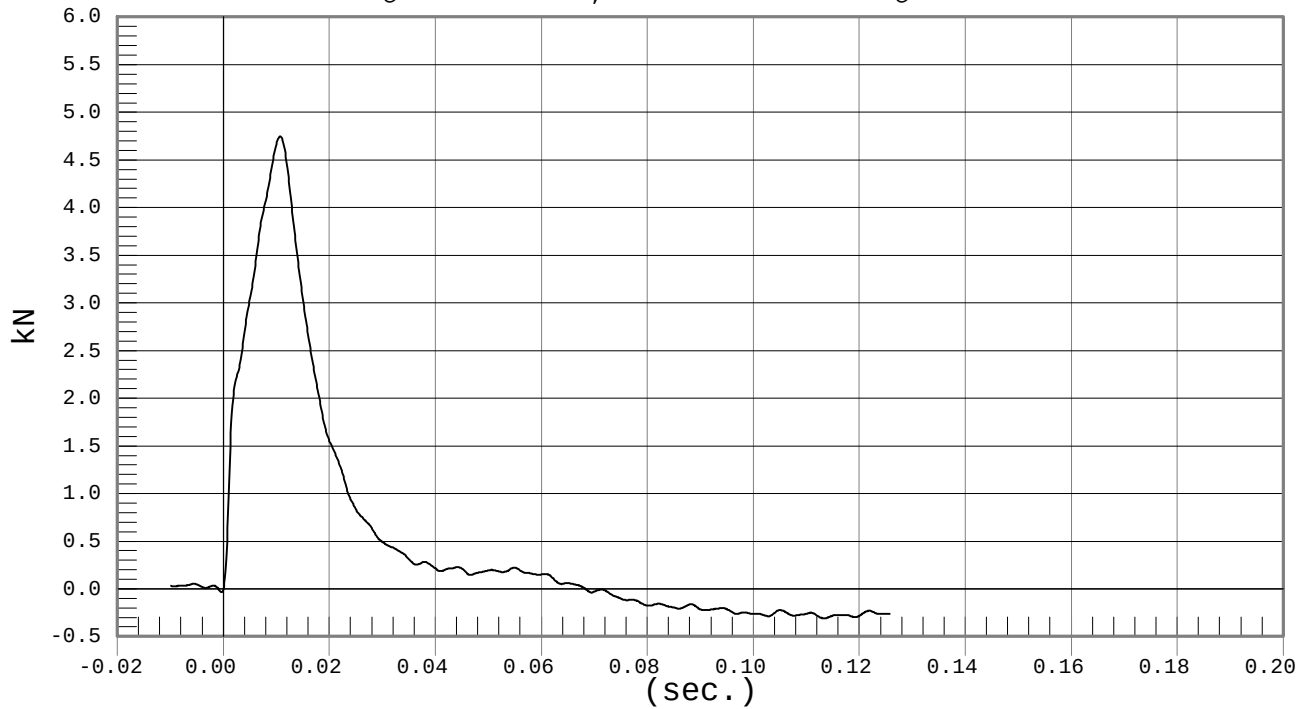


IMPACTOR FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

Test Date: 03-17-05
Speed: 13.3 fps, 4.04 M/s

Ymin = -.31 kN @ 0.1133 sec., Ymax = 4.75 kN @ 0.0106 sec.

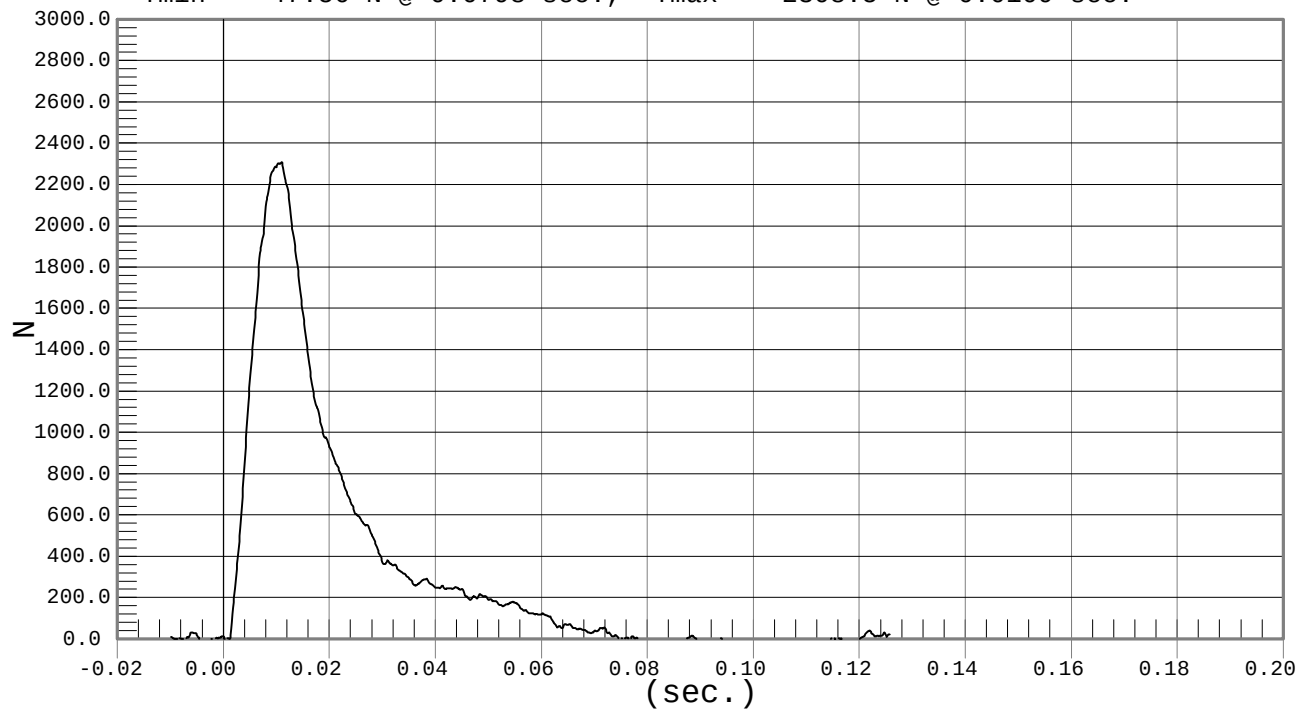


ABDOMEN FORCE

Test Desc.: Abdomen Impact
Component: Dummy #009

Test Date: 03-17-05
Speed: 13.3 fps, 4.04 M/s

Ymin = -47.56 N @ 0.0798 sec., Ymax = 2308.5 N @ 0.0109 sec.



MGA RESEARCH CORPORATION
LUMBAR SPINE TEST
EUROSID 2 DUMMY

Date: 3/17/05

Dummy Serial Number: 009

Test Number: D05798

TEST PARAMETER		SPECIFICATION	TEST RESULTS
Temperature (°C)		18.0 – 22.0	21.9
Relative Humidity (%)		10 – 70	18
Pendulum Speed		5.95 – 6.15	6.11
Pendulum Deceleration	10 msec	$\dot{2}.46 - \dot{1}.59$ m/sec	-2.25
	20 msec	$\dot{5}.25 - \dot{4}.07$ m/sec	-5.24
	25 msec	$\dot{6}.64 - \dot{5}.30$ m/sec	-6.18
	30 msec	≥ -6.5 m/sec	-6.2
Maximum Flexion Angle		45.0 – 55.0 deg	47.4
Time of Max. Flexion Angle		39.0 – 53.0 ms	44.4
Maximum Angle Theta (A)		31.0 – 35.0 deg	31.1
Time of Max. Theta (A)		44.0 – 52.0 ms	44.4
Maximum Angle Theta (B)		26.85 - 29.35 deg	28.09
Time of Max. Theta (B)		44.0 – 52.0 ms	45.3

TEST MEETS SPECIFICATIONS

Technician: Jessica Gall

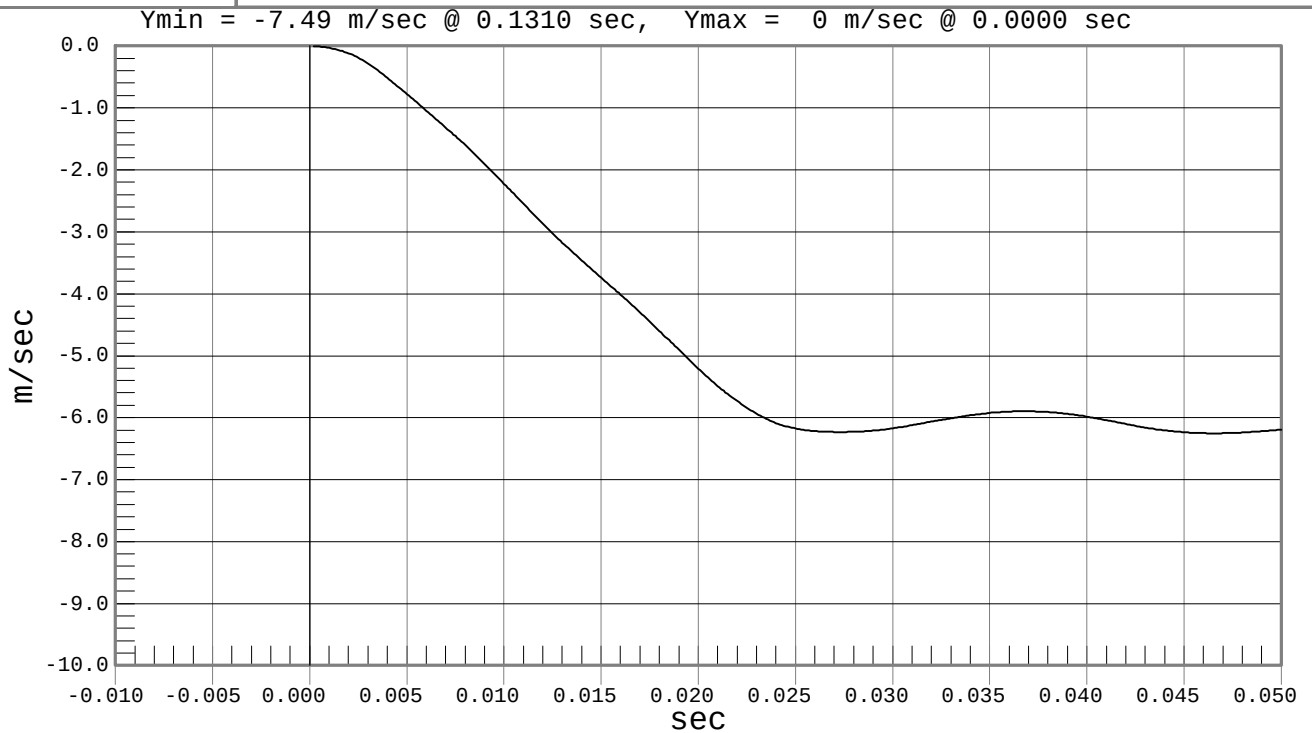
Approved By: David Winkelbauer



PENDULUM DECELERATION

Test Desc.: Lumbar Bending
Component: Dummy #009

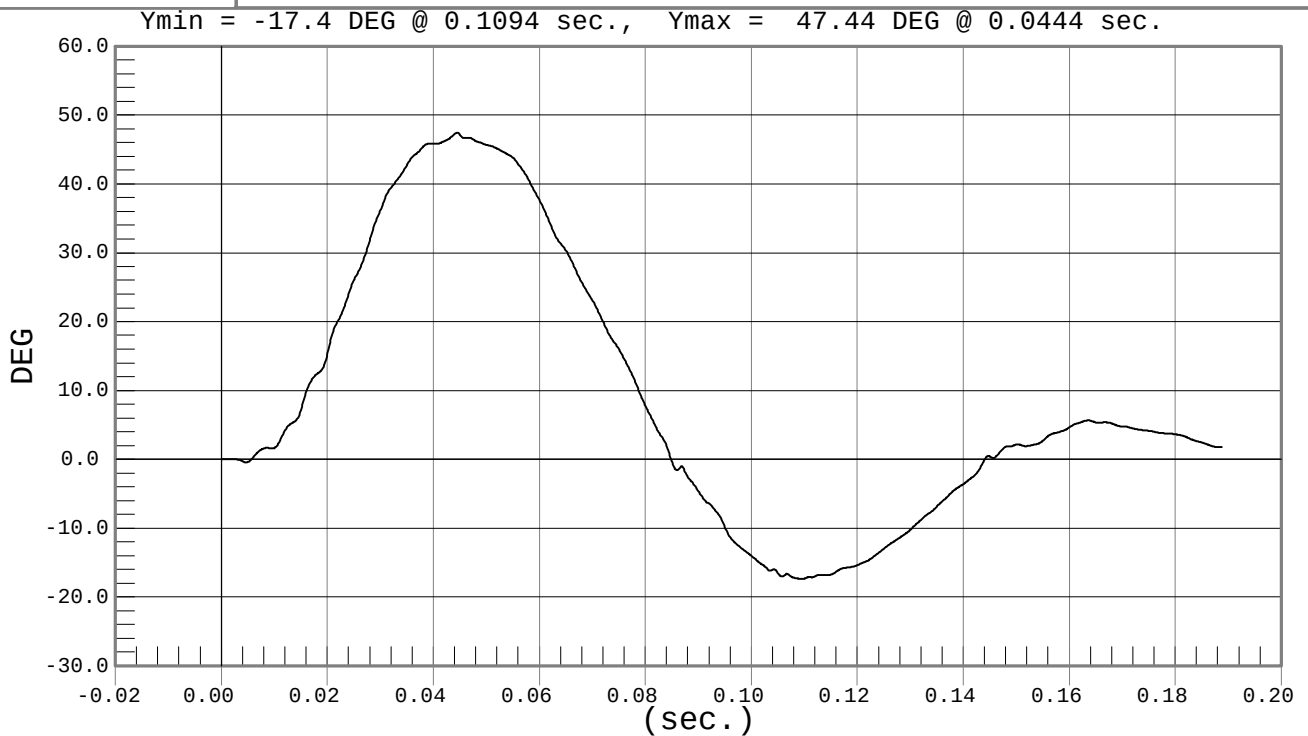
Test Date: 03-17-05
Speed: 20.0 fps, 6.11 M/s



FLEXION ANGLE

Test Desc.: Lumbar Bending
Component: Dummy #009

Test Date: 03-17-05
Speed: 20.0 fps, 6.11 M/s



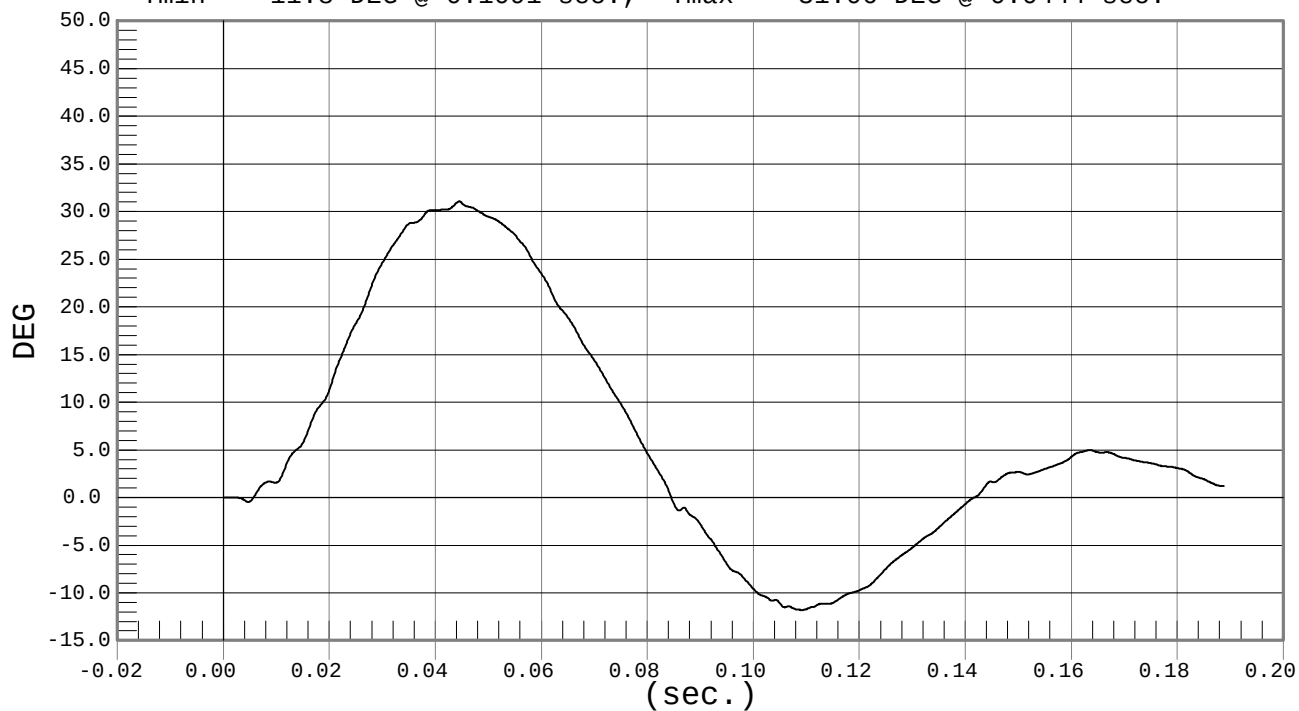


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA A

Test Date: 03-17-05
Speed: 20.0 fps, 6.11 M/s

Ymin = -11.8 DEG @ 0.1091 sec., Ymax = 31.06 DEG @ 0.0444 sec.

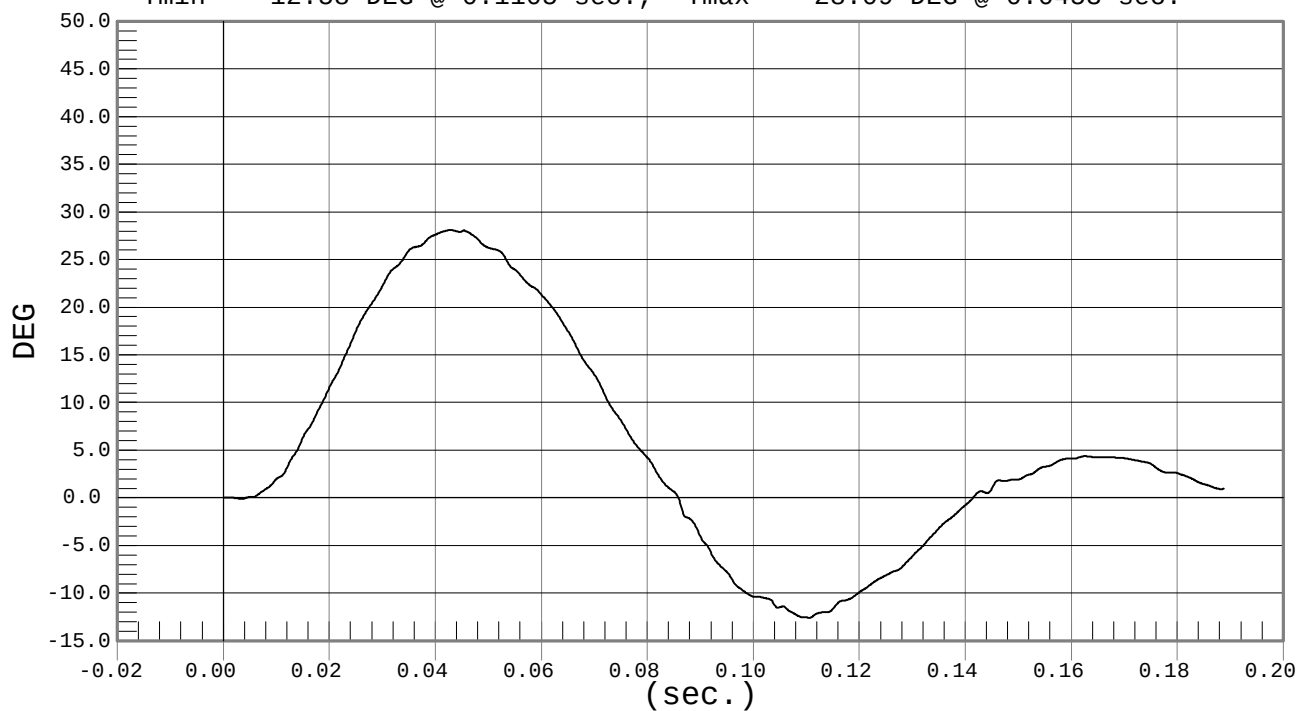


Test Desc.: Lumbar Bending
Component: Dummy #009

THETA B

Test Date: 03-17-05
Speed: 20.0 fps, 6.11 M/s

Ymin = -12.58 DEG @ 0.1105 sec., Ymax = 28.09 DEG @ 0.0453 sec.



MGA RESEARCH CORPORATION
PELVIS TEST
EUROSID 2 DUMMY

Date: 3/17/05

Dummy Serial Number: 009

Test Number: D05799

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature (°C)	18.0 – 22.0	22.0
Relative Humidity (%)	10 – 70	19
Pendulum Speed	4.20 – 4.40 m/s	4.29
Maximum Impactor Force	4.40 – 5.40 kN	4.96
Time of Max. Impactor Force	10.30 – 15.50 ms	12.50
Maximum Pubic Force	1.04 – 1.64 kN	1.54
Time of Max. Pubic Force	9.90 – 15.90 ms	13.6

TEST MEETS SPECIFICATIONS

Technician: _____

Jessica Hall

Approved By: _____

David Winkelbauer

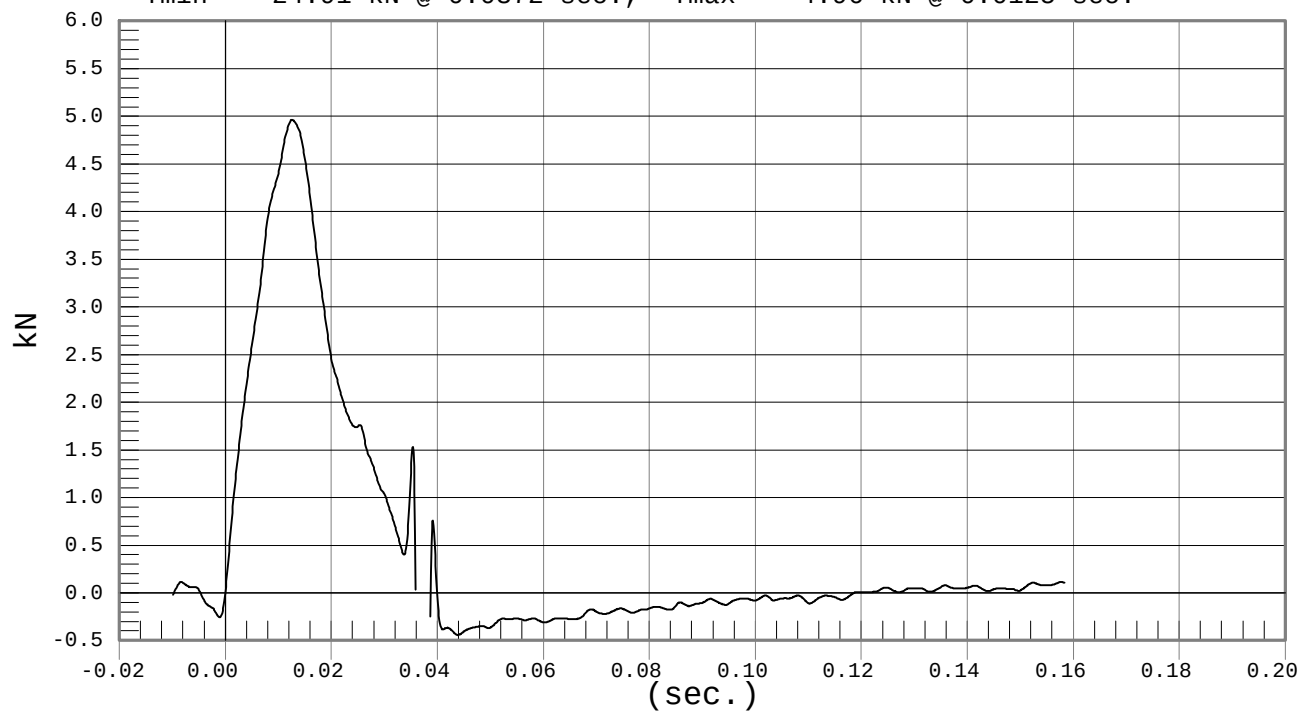


IMPACTOR FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 03-17-05
Speed: 14.1 fps, 4.29 M/s

Ymin = -24.91 kN @ 0.0372 sec., Ymax = 4.96 kN @ 0.0125 sec.

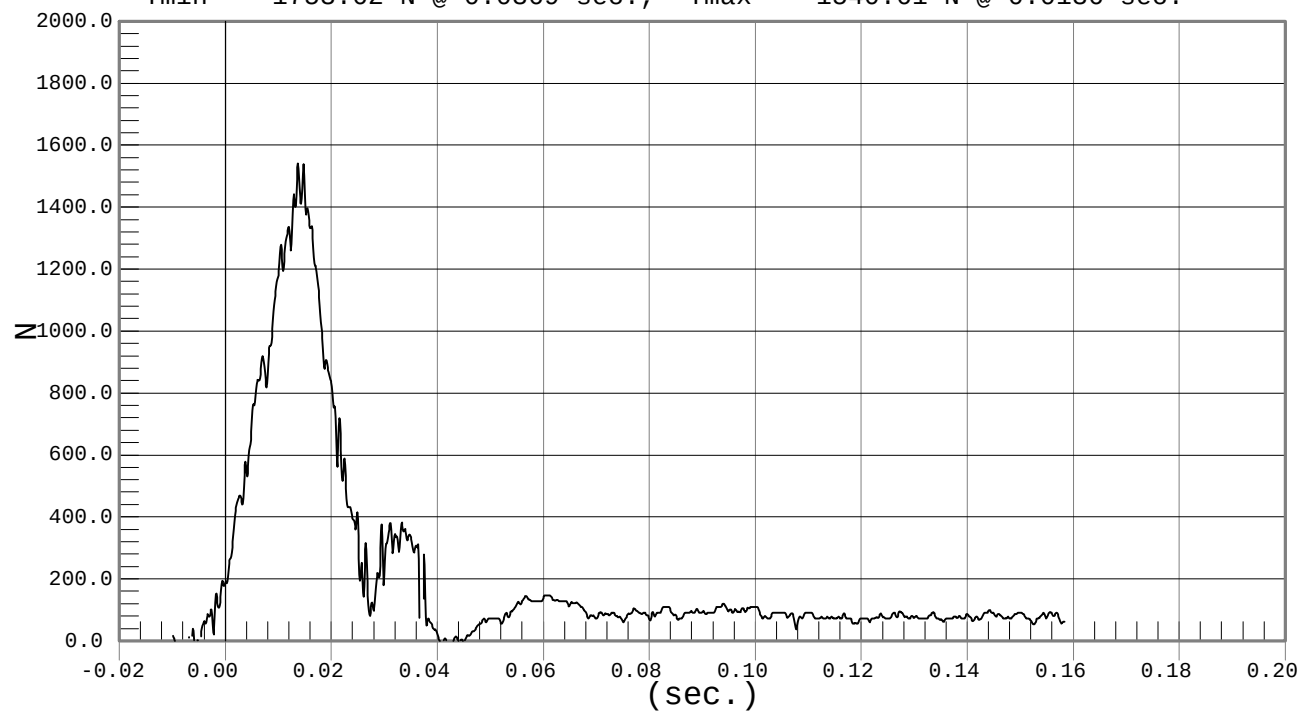


PUBIC FORCE

Test Desc.: Pelvis Impact
Component: Dummy #009

Test Date: 03-17-05
Speed: 14.1 fps, 4.29 M/s

Ymin = -1753.62 N @ 0.0369 sec., Ymax = 1540.61 N @ 0.0136 sec.



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	Entran	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	Endevco	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 Lower A-Post Y	F04-R23	Entran	9/27/04
Left Mid A-Post Y	L17-D29	Entran	12/02/04
Left Lower B-Post Y	K18-D18	Entran	12/02/04
Left Mid B-Post Y	I16-B11	Entran	10/28/04
Floorpan @ Rear Axle X	L18-N15	Entran	3/09/05
Floorpan @ Rear Axle Y	K20-J09	Entran	3/09/05
Floorpan @ Rear Axle Z	L18-N10	Entran	3/09/05
Driver Seat Track Y	J07-M06	Entran	10/29/04
Right Front Sill X	C24-B02	Entran	3/09/05
Right Front Sill Y	H21-J08	Entran	3/09/05
Right Front Sill Z	E04-R21	Entran	3/09/05
Left Rear Sill Y	F04-R22	Entran	9/27/04
Left Front Sill Y	A29-B06	Entran	9/13/04
Vehicle CG X	H20-R08	Entran	3/09/05
Vehicle CG Y	I16-B06	Entran	3/09/05
Vehicle CG Z	G10-F04	Entran	3/09/05
Left Front Door @ Pelvis	L18-J07	Entran	8/24/04
Left Front Door @ Arm	K03-J13	Entran	1/21/05
Left Front Door @ Knee	L17-D08	Entran	9/13/04
Left Front Door @ Mid Rib	L13-R25	Entran	8/24/04
Left A-Post @ Sill Y	K03-J11	Entran	1/21/05
Left B-Post @ Sill Y	K03-J14	Entran	1/21/05
Upper Engine X	I25-F09	Entran	3/09/05
Upper Engine Y	K07-R11	Entran	3/09/05
Firewall Y	B19-Z02	Entran	3/09/05

APPENDIX E
DUMMY PEAK RESPONSES

DRIVER (ES-2) PEAK RESPONSE TABLE

Location	Peak Response				
				2005 Subaru Forester 3/16/2005	
	Class	Axis	Units	Peak	Time
Head	1000	X	G	-127.4	56
	1000	Y	G	253.6	55
	1000	Z	G	172.5	55
	1000	RES	G	331.3	55
Head Injury Criteria (HIC)				2053.6	
t1					54.7
t2					56.3
Upper Neck Force	1000	X	N	-494	62
	1000	Y	N	622	63
	1000	Z	N	-1344	58
	1000	RES	N	1530	58
Upper Neck Moment	600	X	Nm	-34.5	38
	600	Y	Nm	-27.6	38
	600	Z	Nm	11.1	58
	600	RES	Nm	44.2	38
Lower Neck Force	1000	X	N	-607	37
	1000	Y	N	1260	65
	1000	Z	N	-1669	59
	1000	RES	N	1687	59

Location	Peak Response				
				2005 Subaru Forester 3/16/2005	
	Class	Axis	Units	Peak	Time
Lower Neck Moment	600	X	Nm	126.0	64
	600	Y	Nm	69.8	55
	600	Z	Nm	12.9	56
	600	RES	Nm	141.7	64
Shoulder Force	600	X	N	485	59
	600	Y	N	971	54
	600	Z	N	-1059	31
Upper Spine	180	X	G	-20.5	25
	180	Y	G	45.3	32
	180	Z	G	-6.9	79
	180	Res	G	47.3	32
Lower Spine	180	X	G	-18.1	30
	180	Y	G	45.3	36
	180	Z	G	-8.2	79
	180	Res	G	46.0	39
Upper Rib	180	Y	G	83.7	21
Mid Rib	180	Y	G	135.2	21
Lower Rib	180	Y	G	204.7	21
Upper Rib Deflection	180	Y	mm	-42.9	38

Location	Peak Response				
				2005 Subaru Forester 3/16/2005	
	Class	Axis	Units	Peak	Time
Mid Rib Deflection	180	Y	mm	-41.0	40
Lower Rib Deflection	180	Y	mm	-41.6	40
Torso Force	600	X	N	599	30
	600	Y	N	-500	30
Torso Moment	600	Y	Nm	24.3	25
	600	Z	Nm	24.1	30
T12 Force	600	X	N	-956.0	39
	600	Y	N	1199	91
T12 Moment	600	X	Nm	*	*
	600	Y	Nm	110.2	51
Abdomen Front Force	600	Y	N	252	34
Abdomen Mid Force	600	Y	N	468	33
Abdomen Rear Force	600	Y	N	670	34
Abdomen Summed Force	600	Y	N	1377	34
Pubic Symphysis Force	600	Y	N	-2291	45

* No valid Data collected

Location	Peak Response				
				2005 Subaru Forester 3/16/2005	
	Class	Axis	Units	Peak	Time
Right Femur Force	600	X	N	320	55
	600	Y	N	-1144	55
	600	Z	N	1475	51
	600	RES	N	1807	51
Right Femur Moment	600	X	Nm	109	92
	600	Y	Nm	34.4	107
	600	Z	Nm	-41.8	56
	600	RES	Nm	110.0	92
Left Femur Force	600	X	N	498	72
	600	Y	N	-814	45
	600	Z	N	1150	50
	600	RES	N	1412	50
Left Femur Moment	600	X	Nm	64.7	46
	600	Y	Nm	45.9	33
	600	Z	Nm	39.2	57
	600	RES	Nm	78.9	59
Pelvis	1000	X	G	-16.3	31
	1000	Y	G	64.6	42
	1000	Z	G	-8.3	31.0

Location	Peak Response				
				2005 Subaru Forester 3/16/2005	
	Class	Axis	Units	Peak	Time
AR (Arm to Door)			mm	72	
HP (H-Point to Door)			mm	129	
HR (Head to Roof)			mm	205	
HS (Head to Side)			mm	302	
Vehicle Weight			kg	1560.4	
Impact Speed			kph	32.5	
Impact Point Rearward			mm	13	