REPORT NUMBER: TO1-MGA-2004-024

OBLIQUE RIGID SIDE POLE IMPACT
ES-2RE DRIVER POSITION
TEST DATE: August 3, 2005
Task Order #T0001 / RFP #0004

2005 VOLKSWAGEN BEETLE CONVERTIBLE GL
NHTSA NUMBER: R55803

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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. (ES-2RE is an ES-2 with rib extensions including a modified back plate with linear bearings)

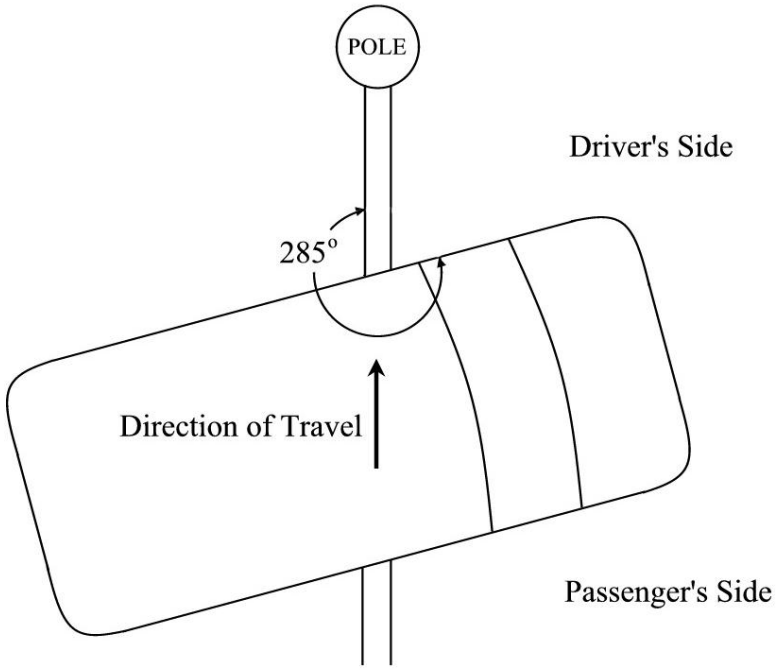
MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
SUMMARY OF SIDE IMPACT TEST

An oblique rigid side pole impact test at 75 degrees was performed on a 2005 Volkswagen Beetle. The subject vehicle was towed into an oblique rigid pole at a velocity of 32.2 km/h. The weight of the vehicle as tested was 1573.0 kg. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on August 3, 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 eleven 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.



SECTION 2…continued

SUMMARY OF SIDE IMPACT TEST

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

		Left Front
HIC 15 (CFC 1000)	T1 (msec)	47.8
	T2 (msec	62.8
	HIC 15	260.9
HIC 36 (CFC 1000)	T1 (msec)	40.7
	T2 (msec)	75.2
	HIC 36	314.9
Thorax (CFC 180)		
Chest Deflection	Upper Rib Deflection	-36.8
	Mid Rib Deflection	-29.0
	Lower Rib Deflection	-15.7
Lower Spine (CFC 180)		
	Lower Spine Resultant	69.3
Abdomen (CFC 600)		
	Front Abdominal Force	350
	Mid Abdominal Force	327
	Rear Abdominal Force	405
	Sum of Abdominal Force	1018
Pelvis (CFC 600)		
	Pubic Symphysis Force	-3815

Contact Times	Left Front
Head (msec)	**
Arm (msec)	25
Rib (msec)	32
Pelvis (msec)	34

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

TEST NOTES

Left Front Door @ Pelvis Y – No valid data collected after 36 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 Volkswagen Beetle Test Date: August 3, 2005

TEST VEHICLE INFORMATION

Make	Volkswagen
Model	Beetle Convertible GL
Body Style	Passenger Car
VIN	3VWBM31Y45M367584
Color	Black
Odometer Reading (mile)	141
Transmission	Automatic
Final Drive	Front
Number of Cylinders	4
Engine Displacement (L)	2.0
Engine Placement	Lateral

TEST VEHICLE OPTIONS

Front Airbag	Yes
Side Airbags	Head & Thorax
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	Volkswagen De Mexico
Date of Manufacture	05/05

GVWR (kg)	1790
GAWR Front (kg)	1024
GAWR Rear (kg)	800

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Cold Pressure (kPa)	230	268
Recommended Tire Size	P205/55R16	P205/55R16
Tire Size on Vehicle	P205/55R16	P205/55R16
Tire Manufacturer	Michelin	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number Of Occupants	2	2		5
Capacity Wt. (VCW) (kg)				348
Cargo Wt. (RCLW) (kg)				75.8

DATA SHEET NO. 1... (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	444.0	272.5		490.5	318.5	
Right	kg	419.0	289.0		447.5	316.5	
Ratio	%	60.6	39.4		59.6	40.4	
Totals	kg	863.0	561.5	1424.5	938.0	635.0	1573.0

TARGET TEST WEIGHT

Measured Parameter	Units	Value
As Delivered Vehicle Weight	kg	1424.5
Weight of 1 ES-2	kg	80.7
Rated Cargo Weight	kg	75.8
Vehicle Target Weight (TVTW)	kg	1581.0

TEST VEHICLE ATTITUDES

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

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

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2520
Total Vehicle Length at Centerline	mm	4091
Total Vehicle Width	mm	1724
Weight of Ballast in Cargo Area	kg	0.0
Amount of Water in Fuel Tank	liters	60.6

TEST VEHICLE VERTICAL IMPACT LINE DATA

Measurement Description	Units	Value
Impact Reference Line from Front Axle	mm	1226
Impact Point	mm	7mm forward
Impact Angle Difference	deg	1°

DATA SHEET NO. 1… (continued)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

NORMAL DESIGN RIDING POSITION

Driver seat back angle: 3.6°, on headrest post

SEAT FORE/AFT POSITIONS

The driver's seat was manually operated.

Driver seat fore/aft total travel: 13 detents

Driver seat fore/aft position: 7th detent of 13

SEAT BELT UPPER ANCHORAGE

The test vehicle "D" ring anchorage for the driver's seat position was not adjustable.

STEERING COLUMN ADJUSTMENT

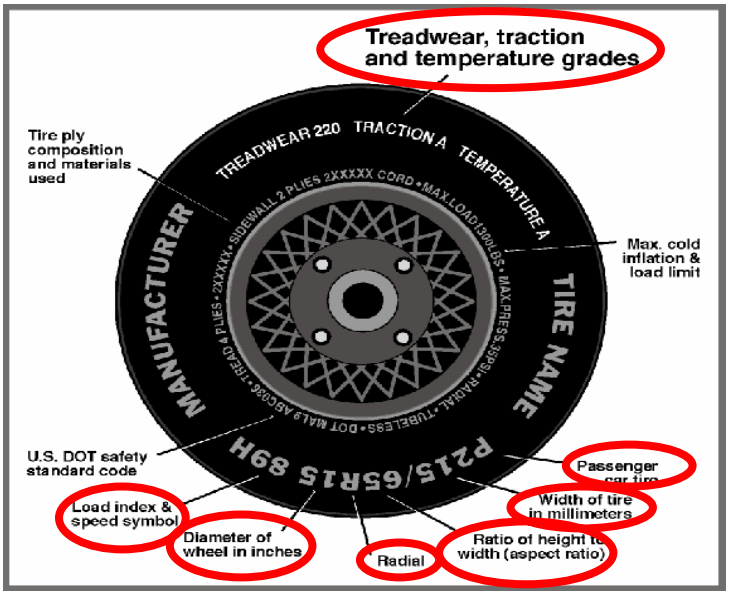
The column was placed in the mid position of travel.

DATA SHEET NO. 2

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

Vehicle Year	2005	Vehicle Make	Volkswagen
VIN	3VWBM31Y45M367584	Vehicle Model	Beetle



	Front	Rear
Tire Manufacturer	Michelin	Michelin
Tire Name	Energy MXV4 plus	Energy MXV4 plus
Tire Type	All Season	All Season
Tire Width (mm)	205	205
Ratio of Height to Width (aspect ratio)	55	55
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	91H	91H
Treadwear	400	400
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 3

POST TEST OBSERVATIONS

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Left Front
Dummy Type	ES-2RE
Head Contact	Side Airbag, Headrest, Pole
Upper Torso Contact	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	Roll cage deployed

AIRBAG DEPLOYMENT

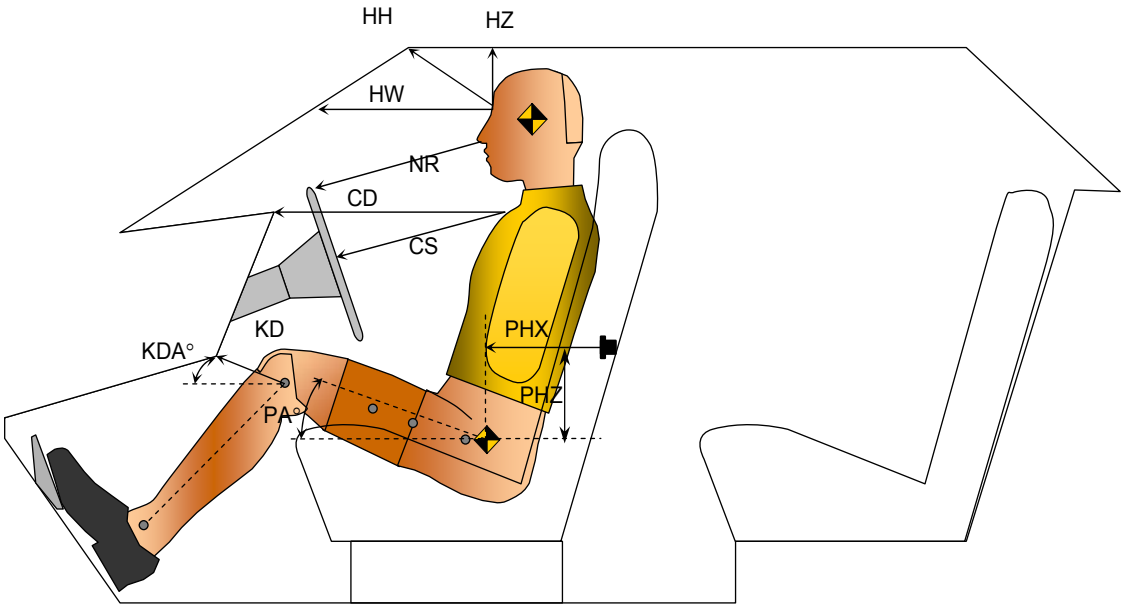
	Driver
Front	No
Side	Yes
Curtain	NA

SECTION 4
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 4

ES-2RE LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

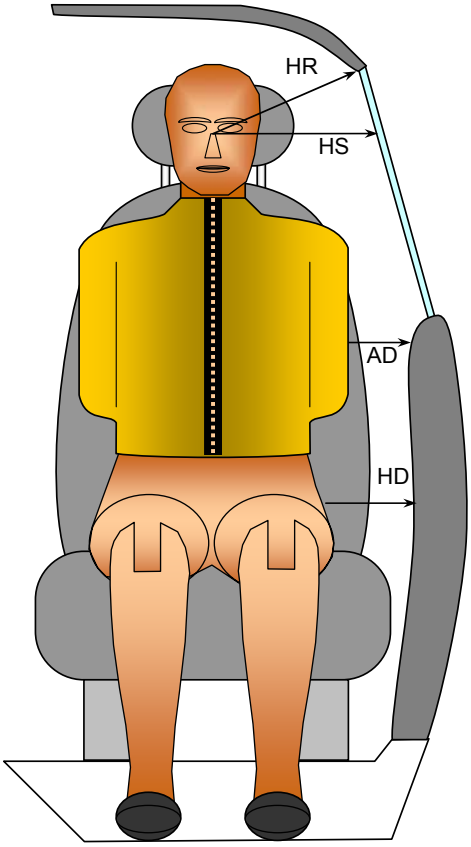


Driver Code	Measurement Description	Left Front	
		Length(mm)	Angle(°)
HH	Head to Header	574	
HW	Head to Windshield	834	
HZ	Head to Roof	254	
NR	Nose to Rim	424	
CD	Chest to Dash (Top of Rib)	544	
CS	Chest to Steering Wheel (Top of Rib)	307	
KDL	Left Knee to Dash	173	28.1
KDR	Right Knee to Dash	172	29.5
PA	Pelvic Angle (Longitudinal)		25.0
PA	Pelvic Angle (Lateral)		0.9
SA	Spine Angle (Longitudinal)		19.9
SA	Spine Angle (Lateral)		1.0
PHX	H-Point to Striker (X-Axis)	324	
PHZ	H-Point to Striker (Z-Axis)	223	

DATA SHEET NO. 5

ES-2RE LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005



FRONT VIEW OF DUMMY

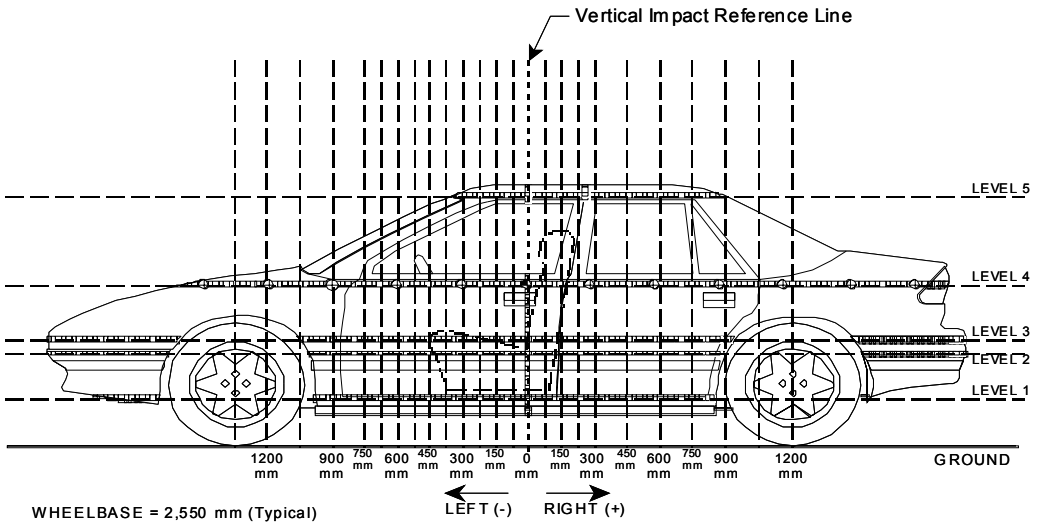
Code	Measurement Description	Units	Left Front
HR	Head to Side Header	mm	258
HS	Head to Side Window	mm	350
AD	Arm to Door	mm	86
HD	H-Point to Door	mm	216

DATA SHEET NO. 6

VEHICLE SIDE MEASUREMENTS

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

PRETEST AND POST TEST EXTERIOR PROFILE MEASUREMENTS



LEFT SIDE VIEW

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

Level	Measurement Description	Height Above Ground
5	Window	1430
4	Window Sill	953
3	Mid Door	652
2	Occupant H-Point	560
1	Sill Top	290

DATA SHEET NO. 7

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

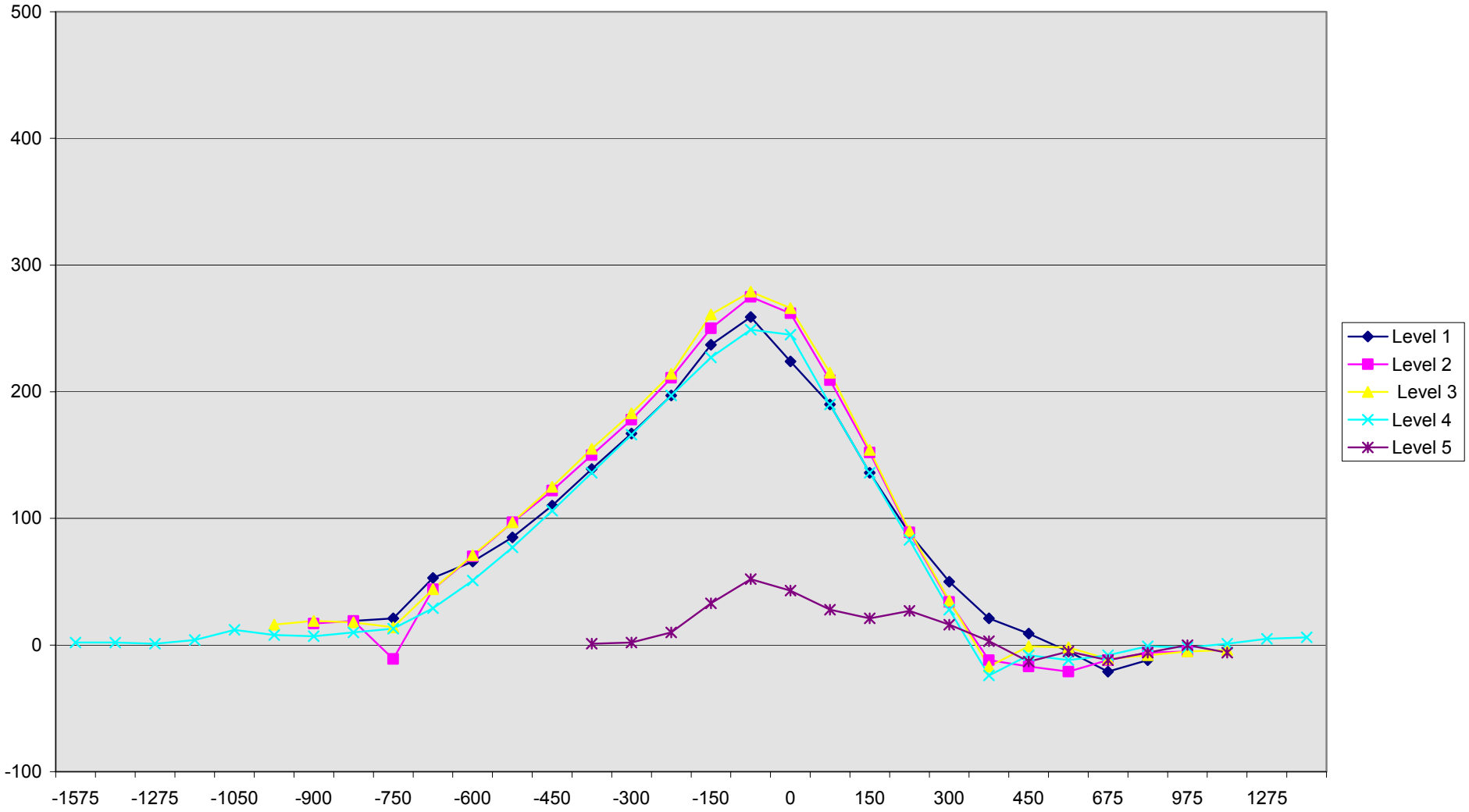
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1575				448					450					2	
-1425				424					426					2	
-1275				413					414					1	
-1125				400					404					4	
-1050				388					400					12	
-975			240	380				256	388				16	8	
-900		242	239	370			259	258	377			17	19	7	
-825	253	243	255	360		272	262	273	370		19	19	18	10	
-750	261	297	297	351		282	286	311	364		21	-11	14	13	
-675	305	298	299	346		358	342	343	375		53	44	44	29	
-600	303	293	294	340		369	363	365	391		66	70	71	51	
-525	302	289	290	334		387	386	387	411		85	97	97	77	
-450	299	285	285	329		409	407	410	435		110	122	125	106	
-375	297	283	283	325	543	436	433	438	461	544	139	150	155	136	1
-300	295	280	280	321	535	462	458	463	487	537	167	178	183	166	2
-225	293	278	278	318	534	490	489	492	515	544	197	211	214	197	10
-150	292	276	277	318	535	529	526	538	545	568	237	250	261	227	33
-75	291	275	275	315	537	550	550	554	564	589	259	275	279	249	52
0	289	275	275	314	540	513	537	541	559	583	224	262	266	245	43
75	286	274	274	315	541	476	483	489	505	569	190	209	215	190	28
150	290	274	276	315	538	426	426	430	451	559	136	152	154	136	21
225	290	275	277	317	539	378	364	367	400	566	88	89	90	83	27
300	290	275	278	320	551	340	309	313	348	567	50	34	35	28	16
375	291	277	280	323	564	312	265	263	299	567	21	-12	-17	-24	3
450	290	279	282	325	570	299	262	281	317	557	9	-17	-1	-8	-13
525	292	281	285	330	574	287	260	283	318	569	-5	-21	-2	-12	-5
675	295	287	291	340	585	274	275	280	332	573	-21	-12	-11	-8	-12
825	245	245	275	353	598	233	239	267	352	592	-12	-6	-8	-1	-6
975		241	240	372	625		236	235	370	625		-5	-5	-2	0
1125			248	397	672			244	398	666			-4	1	-6
1275				435					440					5	
1425				499					505					6	

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 Volkswagen Beetle Test Date: August 3, 2005

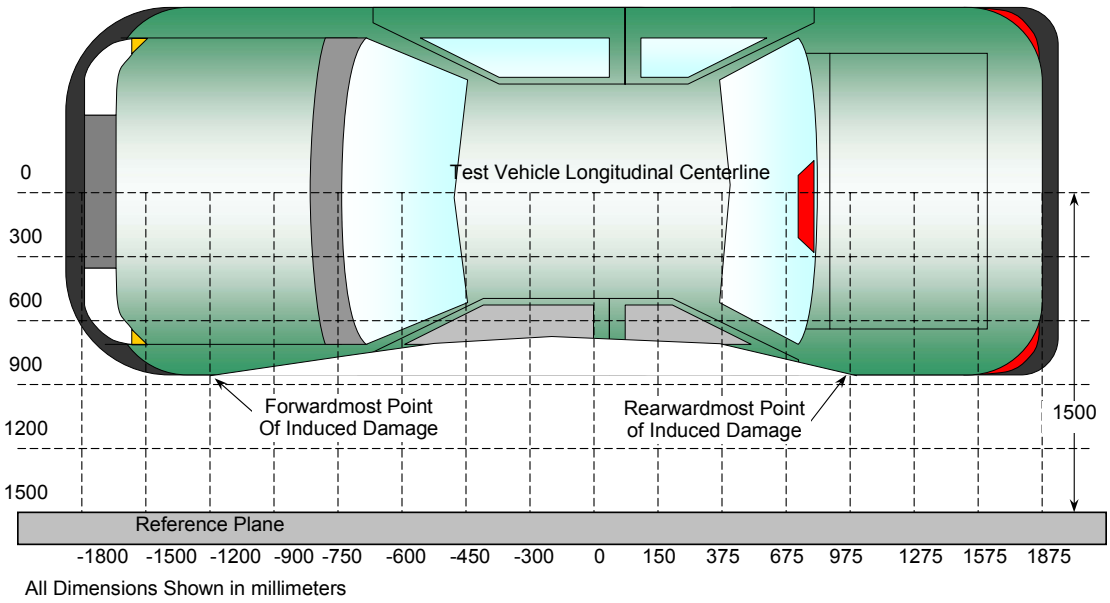


Measurement in mm.

DATA SHEET NO. 8

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 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	1425 mm	4	499	505	6
2	835 mm	3	275	260	-15
3	210 mm	1	290	388	98
4	-435 mm	4	327	448	121
5	-1001 mm	4	384	391	7
6	-1575 mm	4	448	450	2

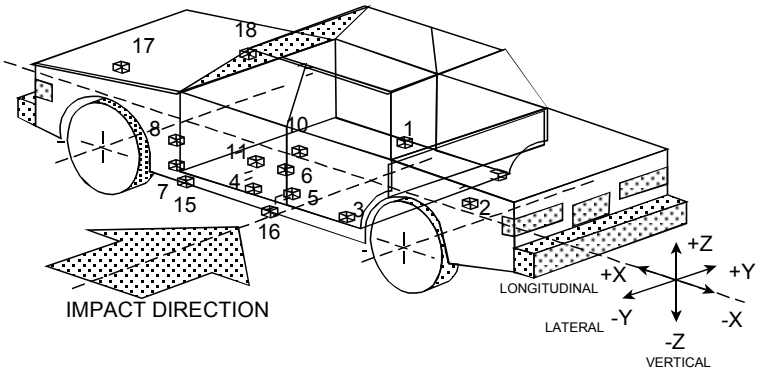
Reference plane is parallel to test vehicle longitudinal centerline.

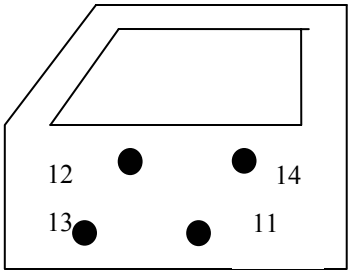
Given dimensions = Reference plane to car body.

DATA SHEET NO. 9

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 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 Volkswagen Beetle Test Date: August 3, 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	1.9	-3.1	16.6	-0.9	3.4	-6.8	17.3
2	Rear Floorpan Above Axle	2.9	-4.7	14.0	-2.4	3.6	-1.9	14.3
3	Left Side Sill at Rear Door			17.9	-2.0			
4	Left Side Sill at Front Door			46.3	-3.9			
5	Left Lower B-Post			24.7	-28.1			
6	Left Mid B-Post			29.8	-7.9			
7	Left Lower A-Post			20.5	-0.7			
8	Left Mid A-Post			31.3	-0.9			
9	Driver Left Seat Track			81.3	-17.0			
10	Vehicle CG	2.9	-8.5	31.0	-1.6	13.6	-5.1	32.7
11	Left Front Door at Pelvis			*	*			
12	Left Front Door at Arm			147.7	-29.2			
13	Left Front Door at Knee			87.9	-48.1			
14	Left Front Door at Rib			121.6	-32.0			
15	Left A-Post @ Sill			17.9	-0.7			
16	Left B-Post @ Sill			19.6	-16.6			
17	Upper Engine	5.9	-15.8	12.1	-3.1			
18	Firewall			11.6	-1.1			

*No valid data collected after 36 msec

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

DATA SHEET NO. 9... (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005

VEHICLE ACCELEROMETER COORDINATES

Loc. No.	Description	Coordinates (mm)		
		X	Y	Z
1	Right Side Sill at Front Seat	2149	715	200
2	Rear Floorpan Above Axle	862	55	515
3	Left Side Sill at Rear Door	1176	-720	202
4	Left Side Sill at Front Door	2331	-719	200
5	Left Lower B-Post	1620	-685	534
6	Left Mid B-Post	1621	-680	839
7	Left Lower A-Post	2685	-755	410
8	Left Mid A-Post	2762	-750	820
9	Driver Left Seat Track	1779	-558	427
10	Vehicle CG	2243	0	420
11	Left Door @ Pelvis	1840	-740	633
12	Left Door @ Arm	2040	-702	935
13	Left Door @ Knee	2384	-705	692
14	Left Door @ Rib	1834	-704	950
15	Left A Pillar Sill	2784	-719	203
16	Left B Pillar Sill	1467	-719	202
17	Engine	3538	30	817
18	Firewall	3405	0	910

Sign Convention X – Rear Bumper (+ forward)

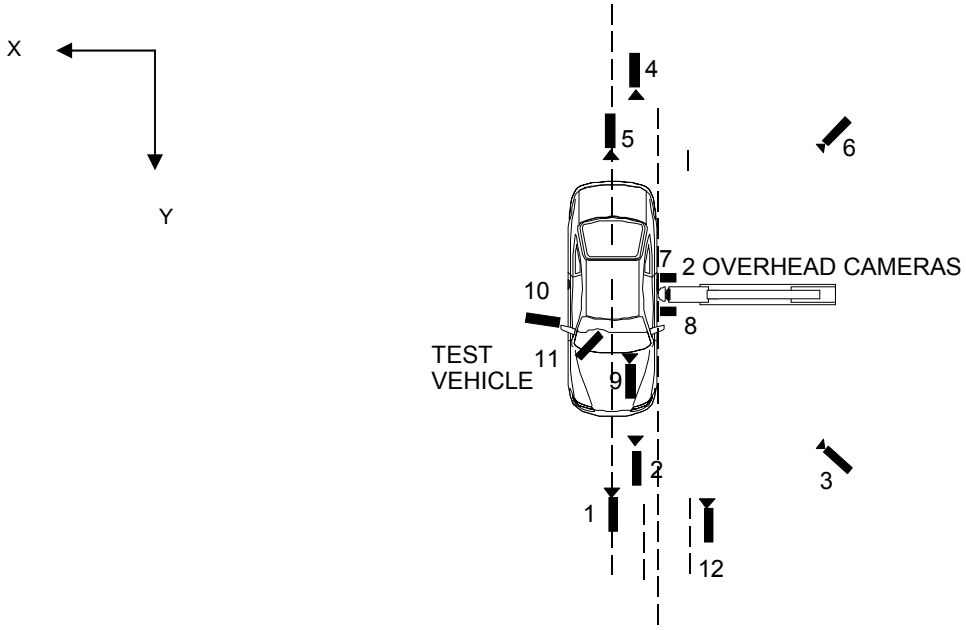
Y – Vehicle Centerline (+ to right)

Z – Ground Plane (+ up)

DATA SHEET NO. 10

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2005 Volkswagen Beetle Test Date: August 3, 2005



TOP VIEW

No.	Camera View	Location (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Front Overall	790	6215	1115	24	1000
2	Front Close Up	1545	6235	1455	35	1000
3	Front Angle	-2315	2585	1275	24	1000
4	Rear Overall	2295	-5760	1210	24	1000
5	Rear Close Up	1920	-6520	1350	35	1000
6	Rear Angle	-2095	-2475	1185	24	1000
7	Overhead View	-515	835	5725	14	1000
8	Overhead Close Up	-25	0	5050	19	1000
9	Onboard Driver Front				8	500
10	Onboard Curtain				8	1000
11	Onboard Hip to Door				10	500
12	Real Time				13	24

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

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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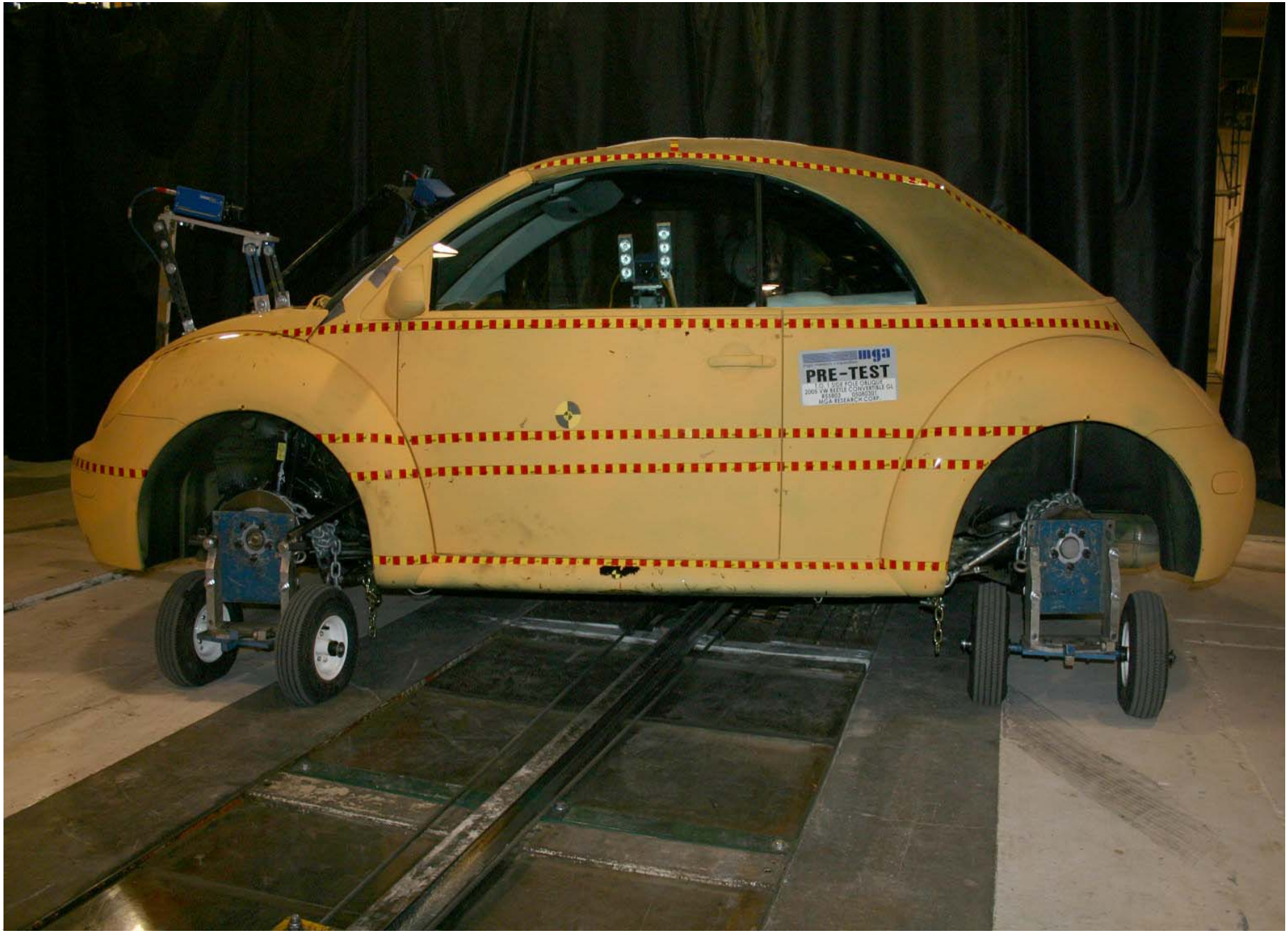
Pre-Test Front View of Test Vehicle

Post-Test Front View of Test Vehicle

Pre-Test Rear View of Test Vehicle

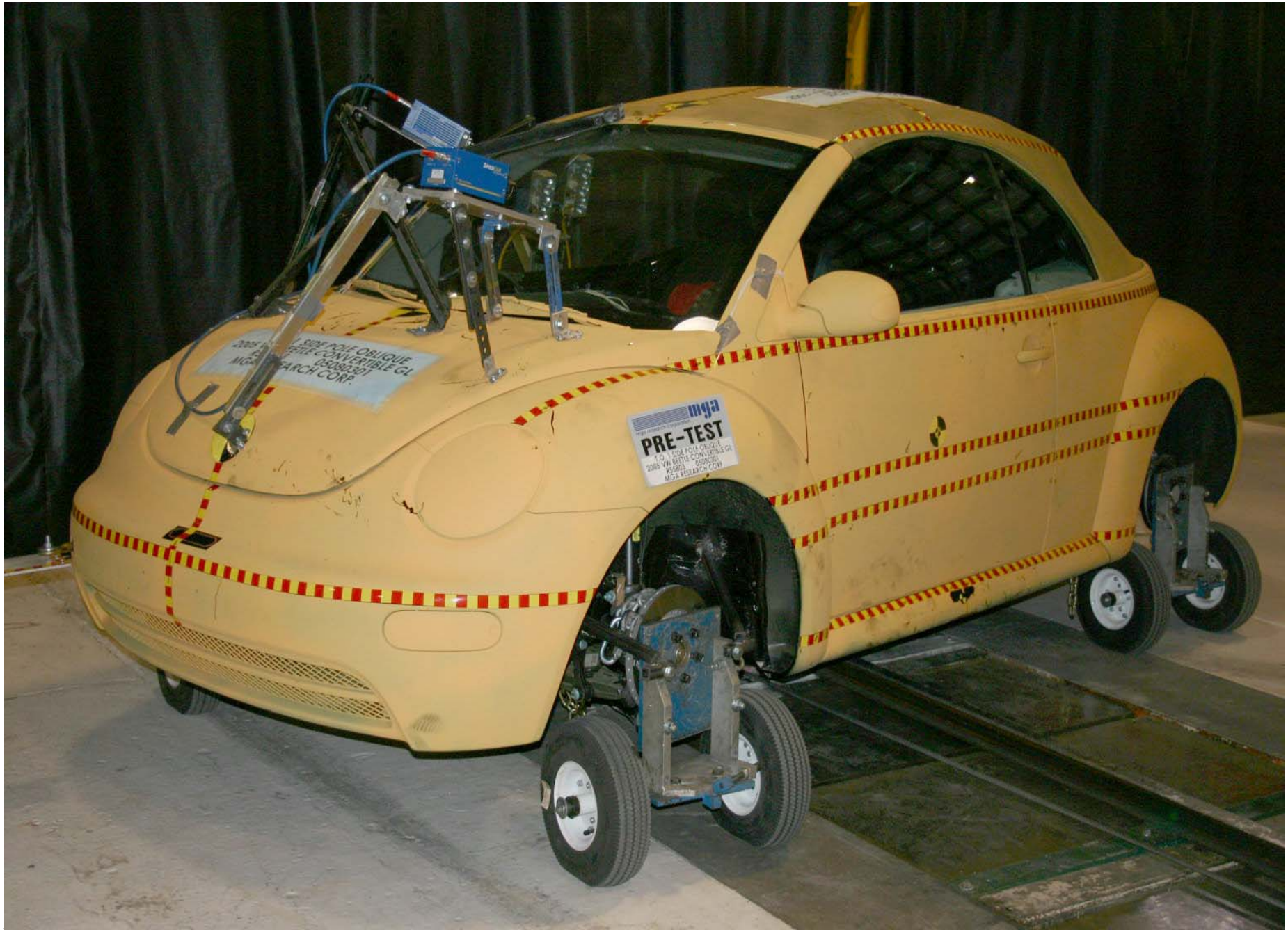
Post-Test Rear View of Test Vehicle



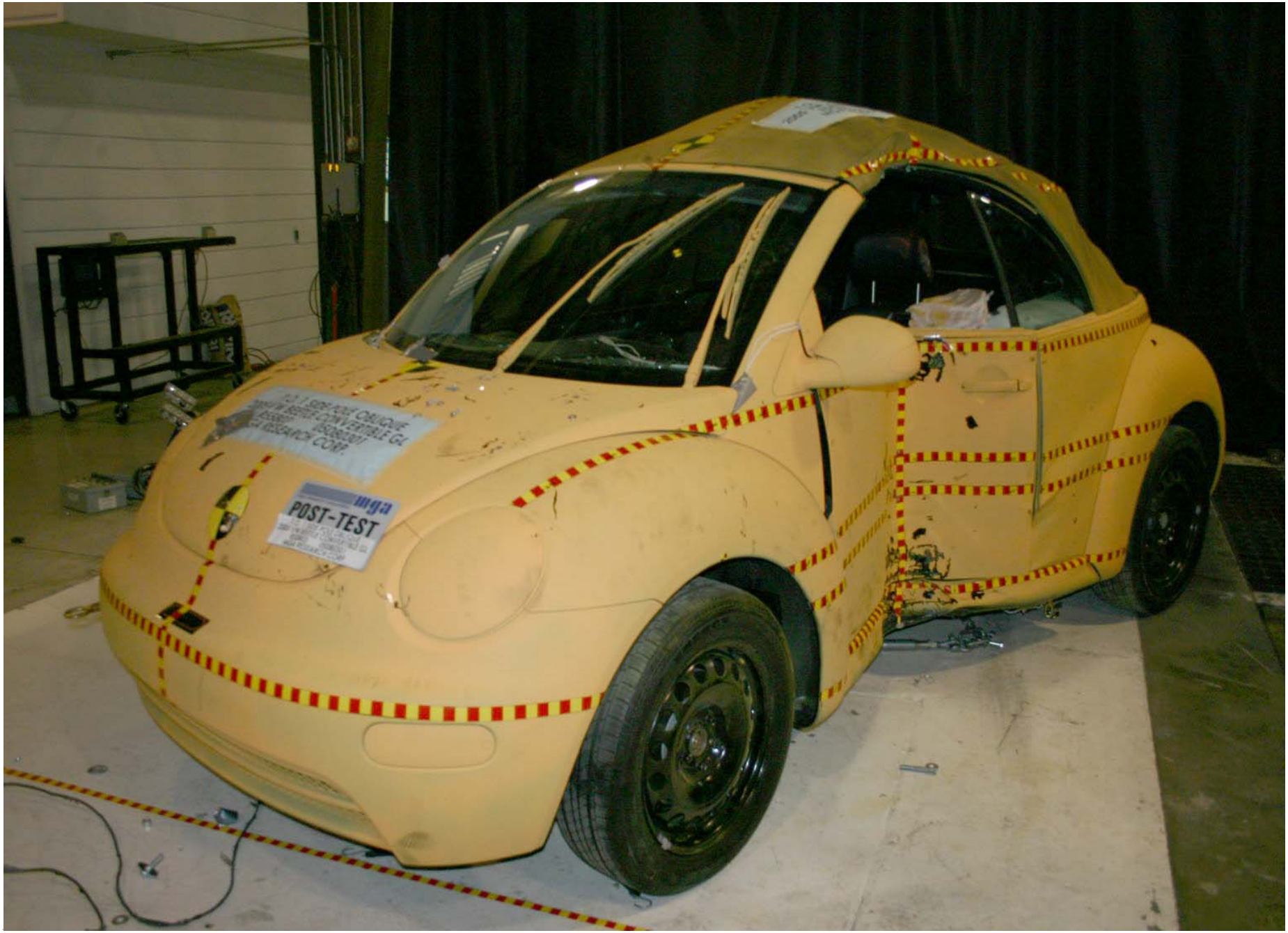
Pre-Test Left Side View of Test Vehicle

Post-Test Left Side View of Test Vehicle

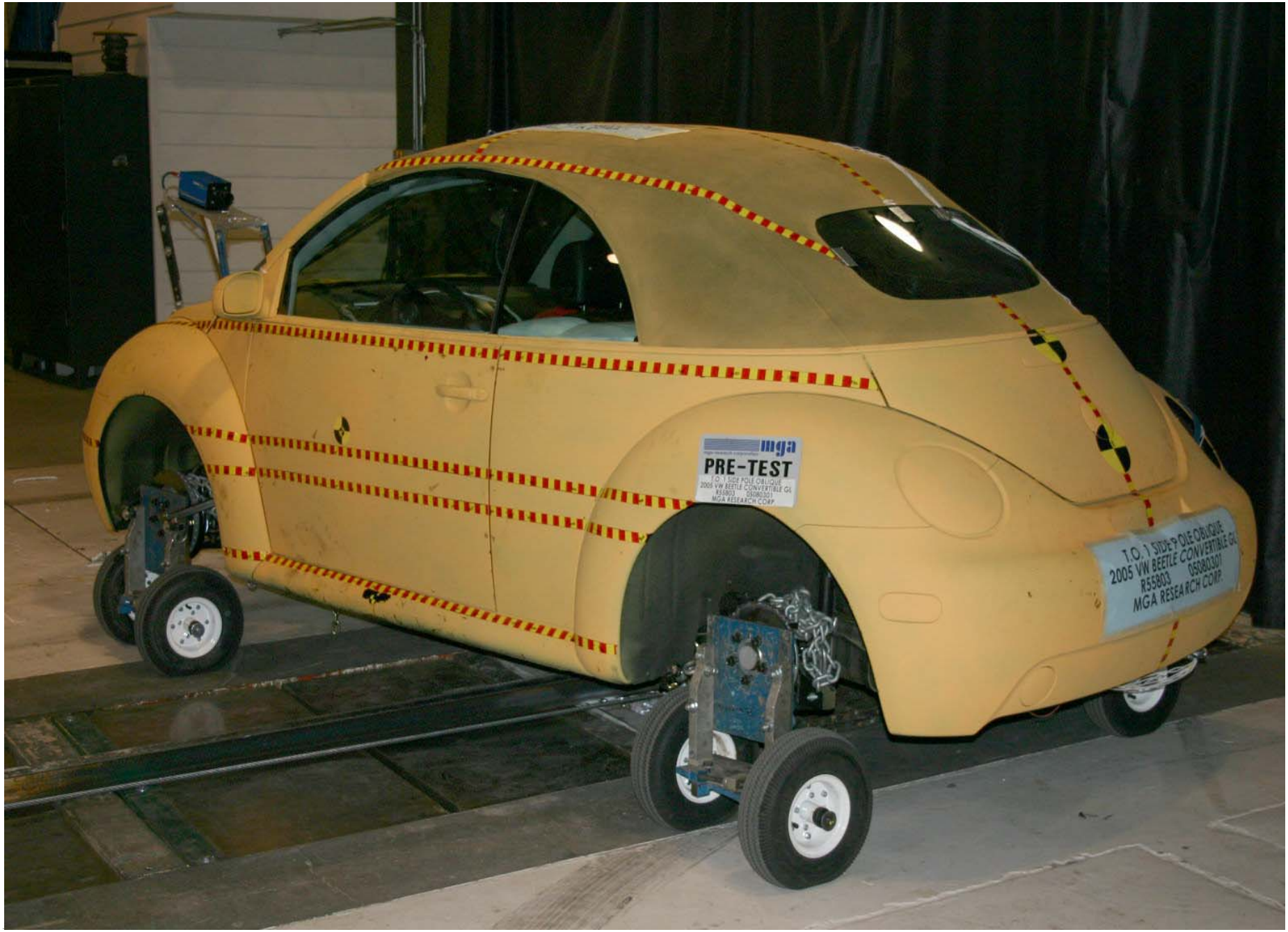
Post-Test Left Side View of Test Vehicle (Close-Up)



Pre-Test Left ¾ Front View of Test Vehicle



Post-Test Left ¾ Front View of Test Vehicle



Pre-Test Left ¾ Rear View of Test Vehicle

Pre-Test Vehicle Overhead View

Post-Test Pole and Vehicle Overhead View

Pre-Test Vehicle Overhead View (Close-Up)

Post-Test Vehicle Overhead View (Close-Up)

Pre-Test Driver Seat Position 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

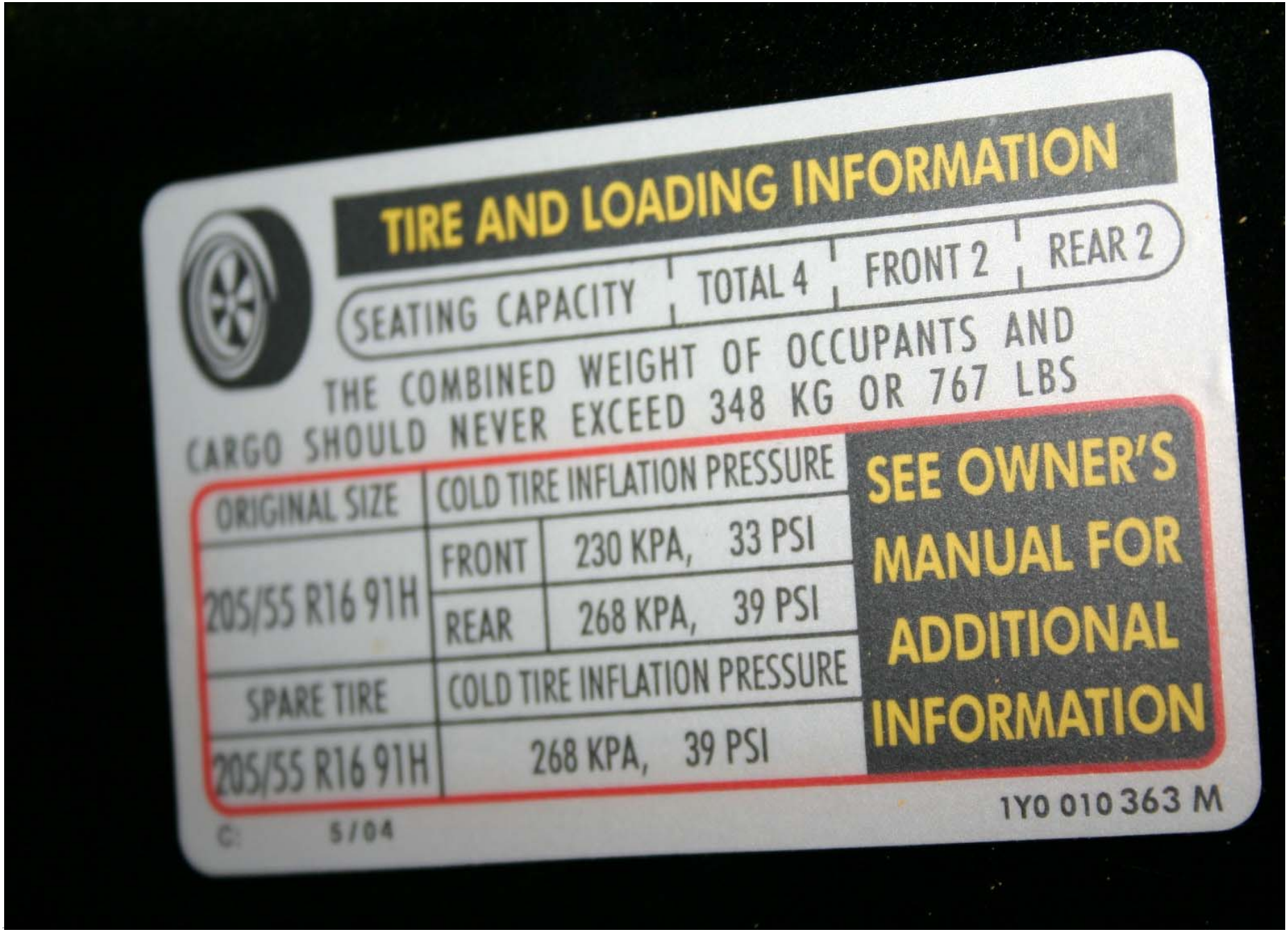
Pre-Test Driver Shoulder and Door Top View

Post-Test Driver Dummy Contact

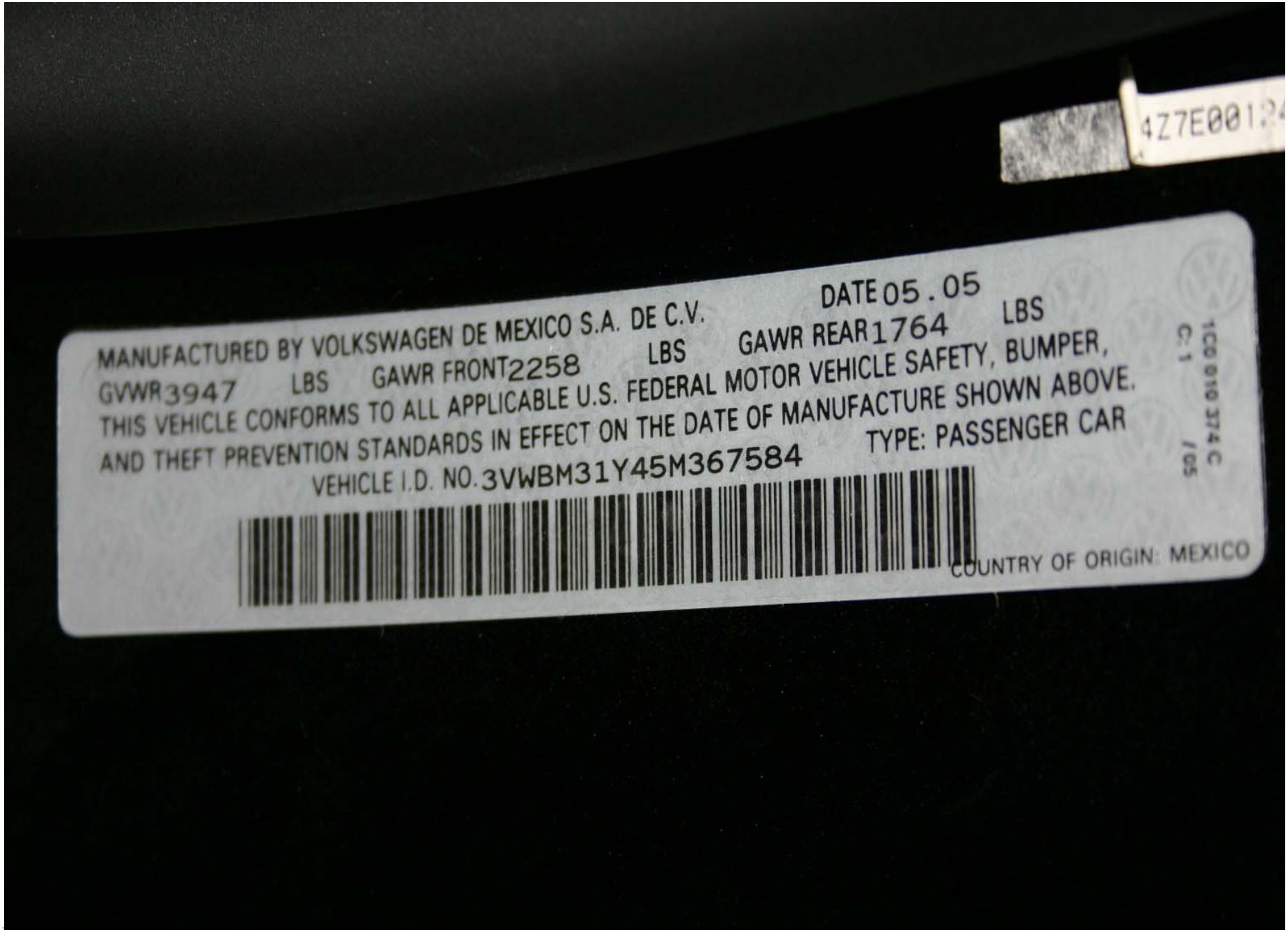
Post-Test Driver Dummy Lower Body Contact

Post-Test Driver Dummy Head Contact

Post-Test Impact Point on Vehicle



Tire Placard



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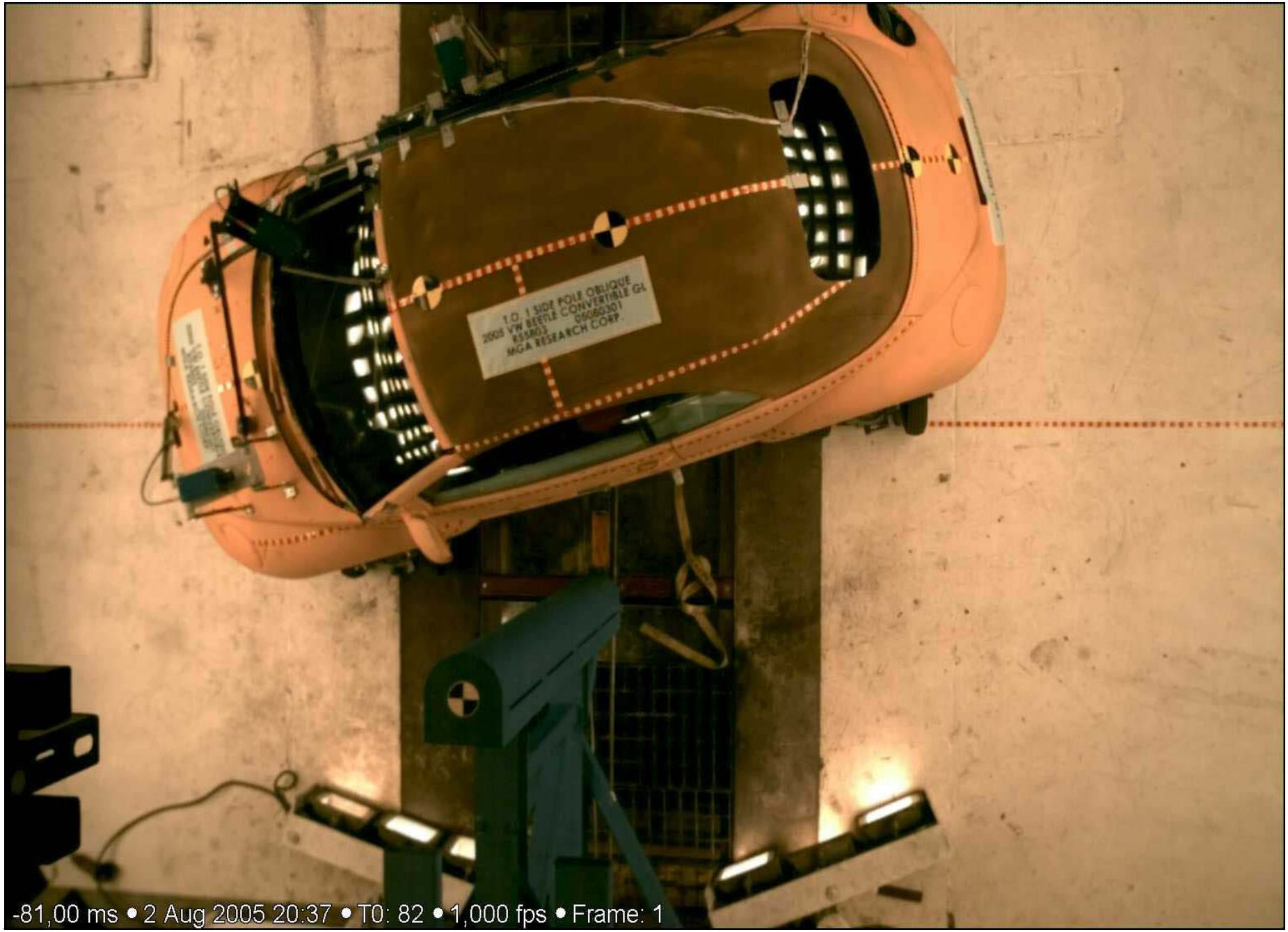
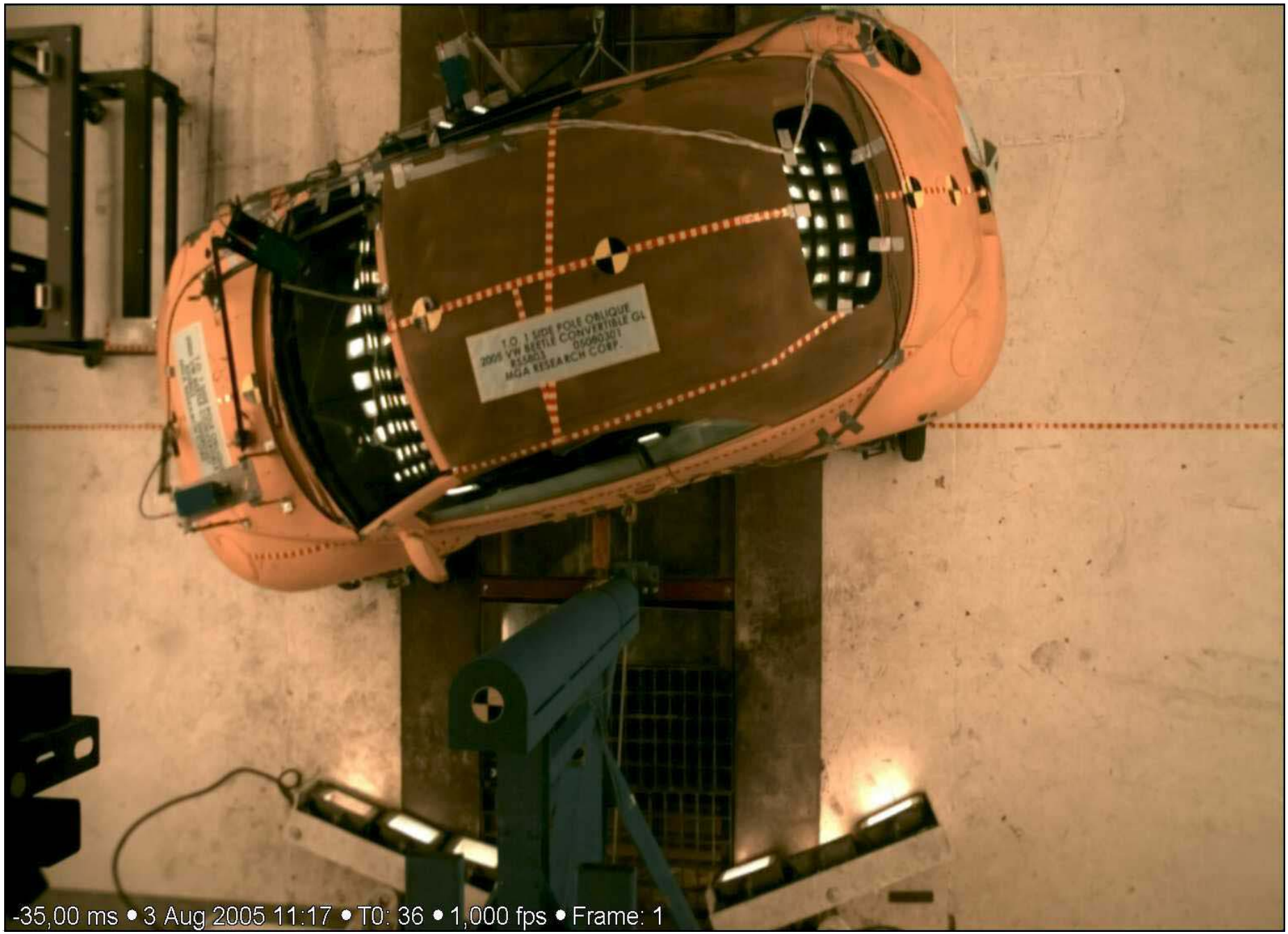


Pre-Test Point of Impact View



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Vehicle Impact

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

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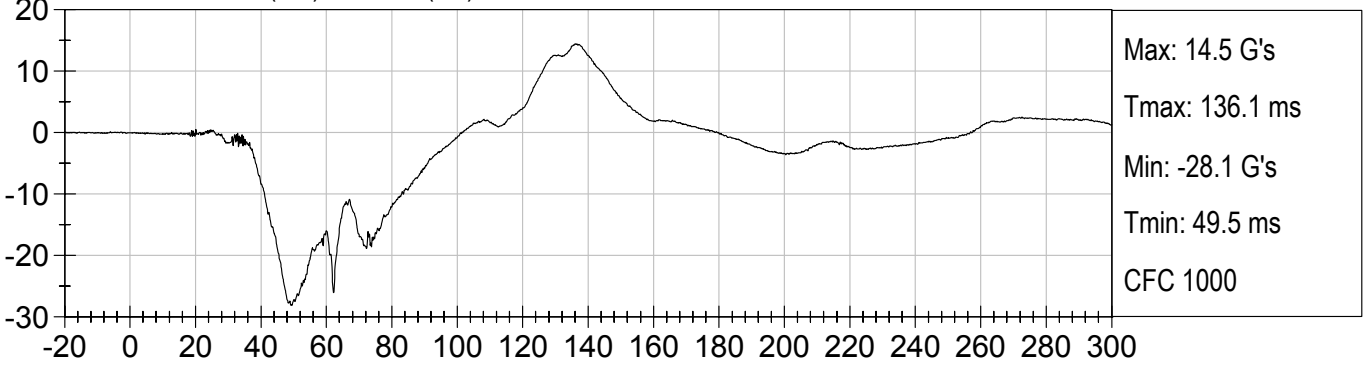
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

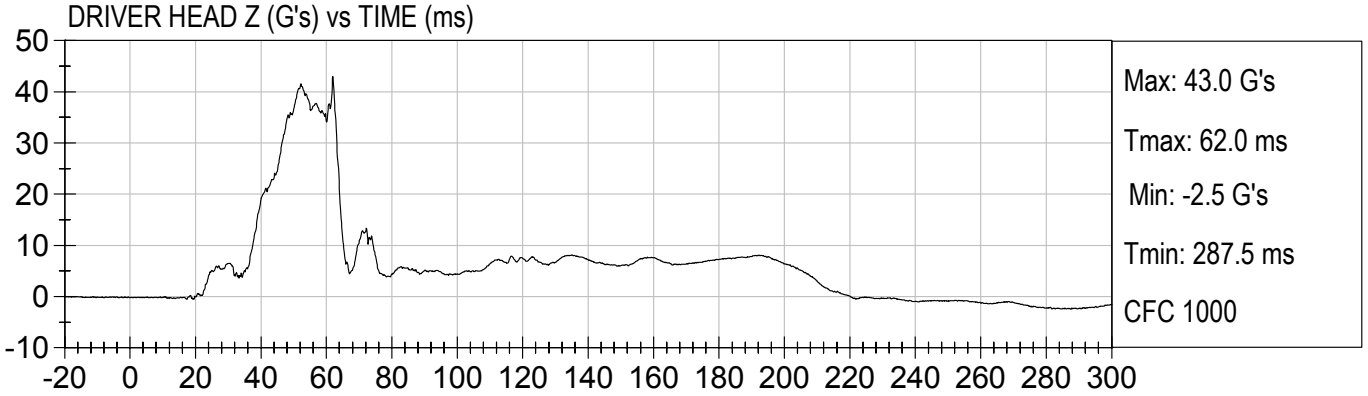
Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

DRIVER HEAD X (G's) vs TIME (ms)

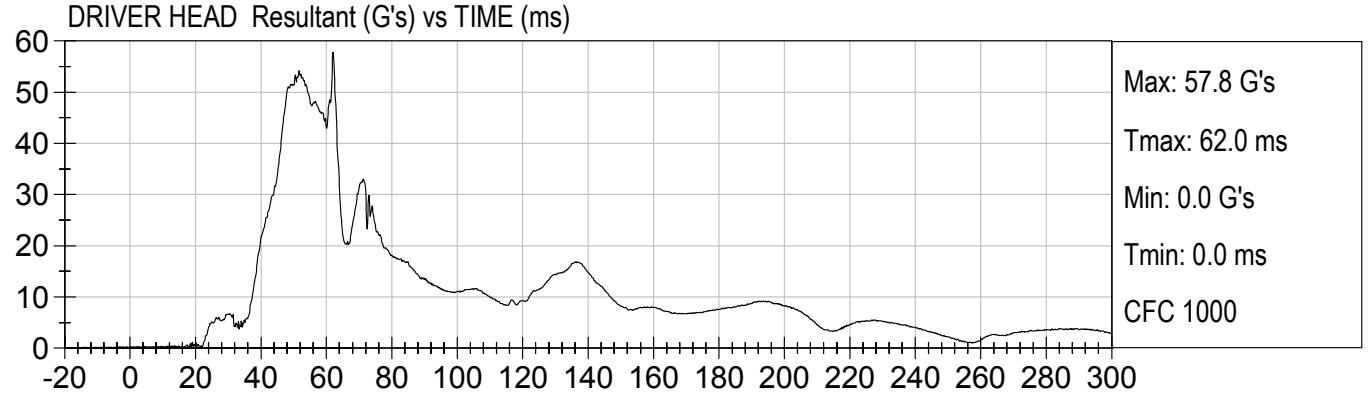


DRIVER HEAD Y (G's) vs TIME (ms)

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



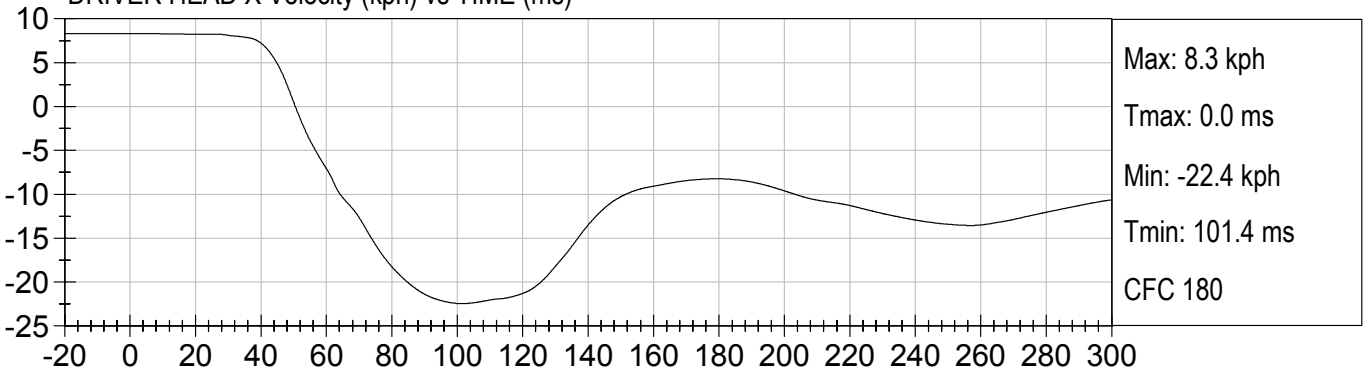
DRIVER HEAD Resultant (G's) vs TIME (ms)



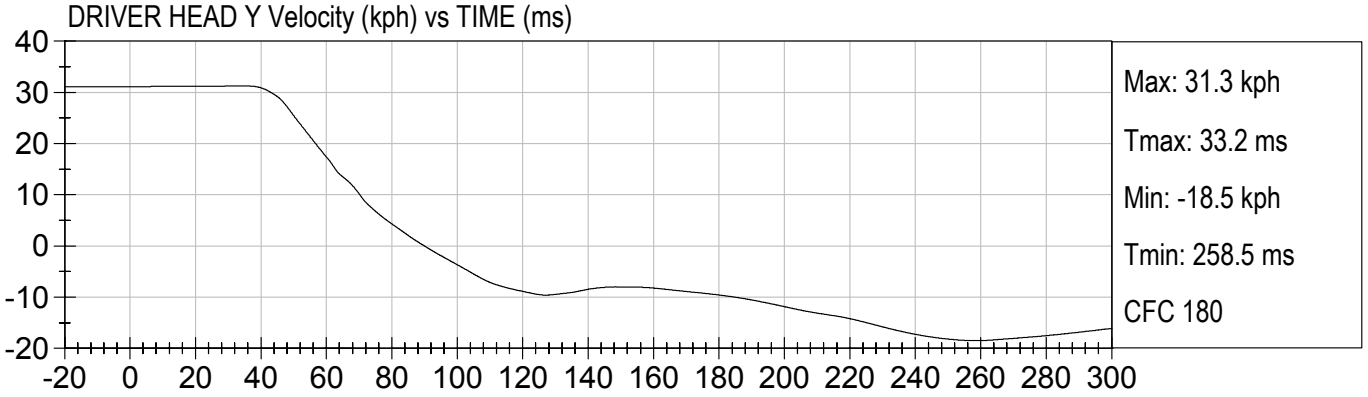
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

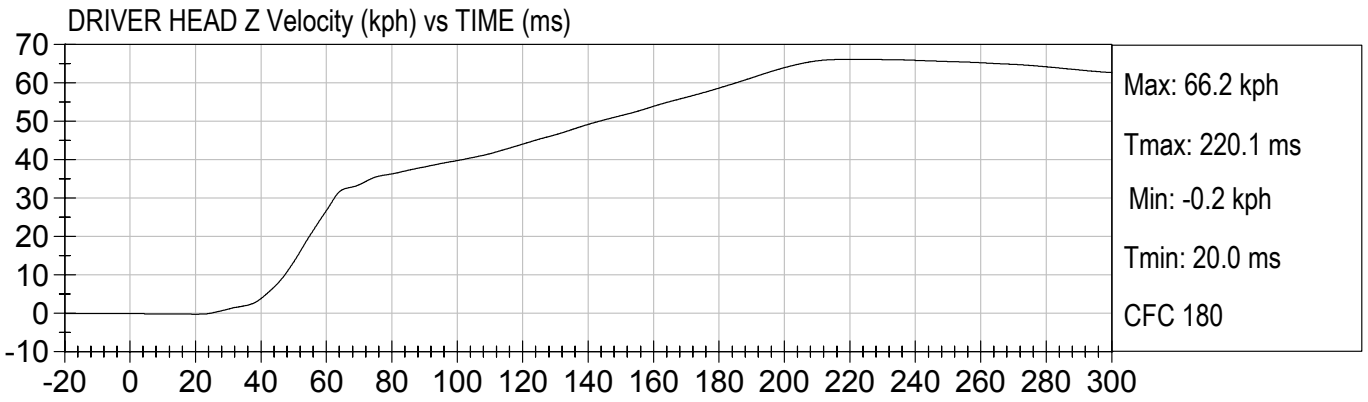
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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



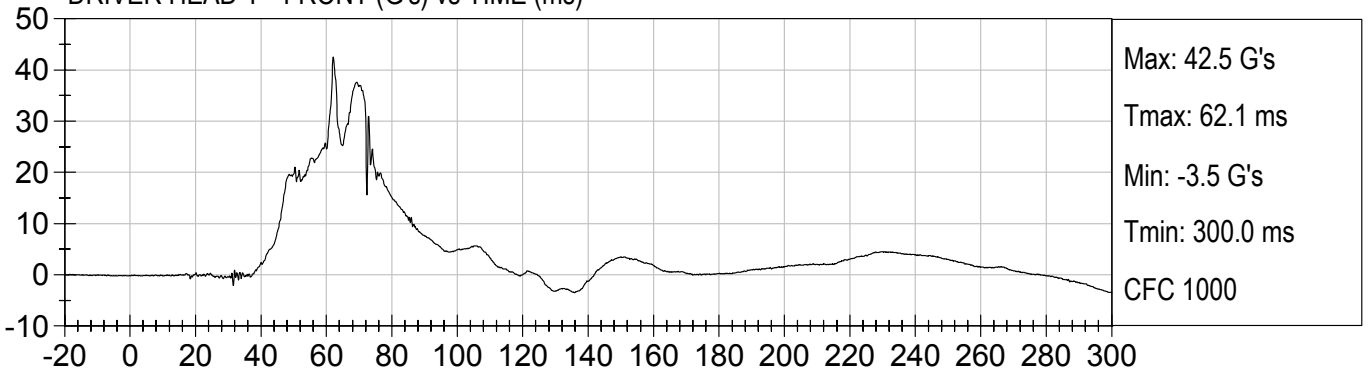
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



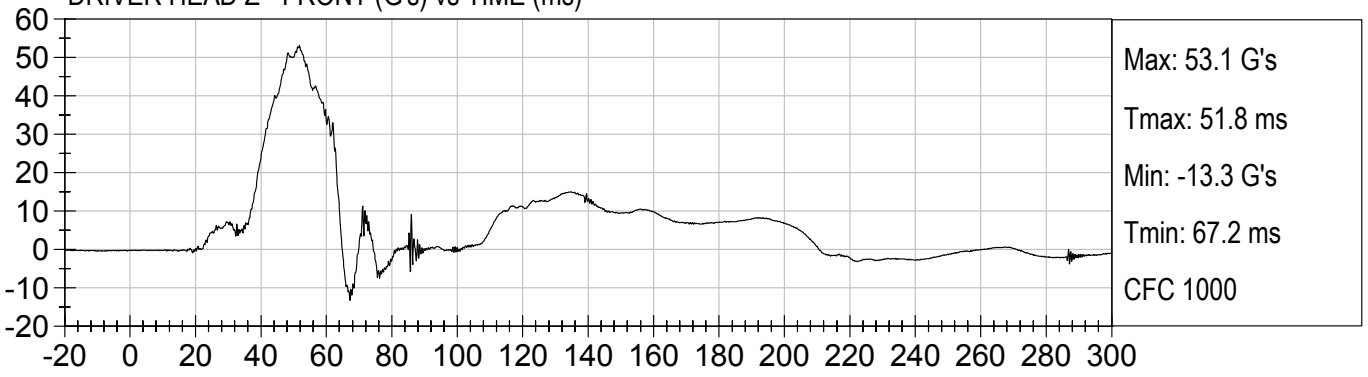
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

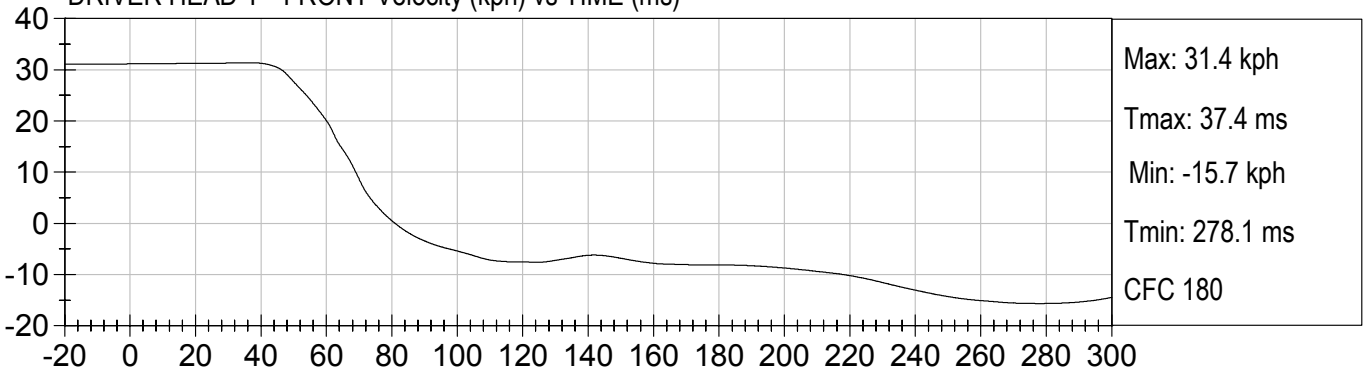
DRIVER HEAD Y - FRONT (G's) vs TIME (ms)



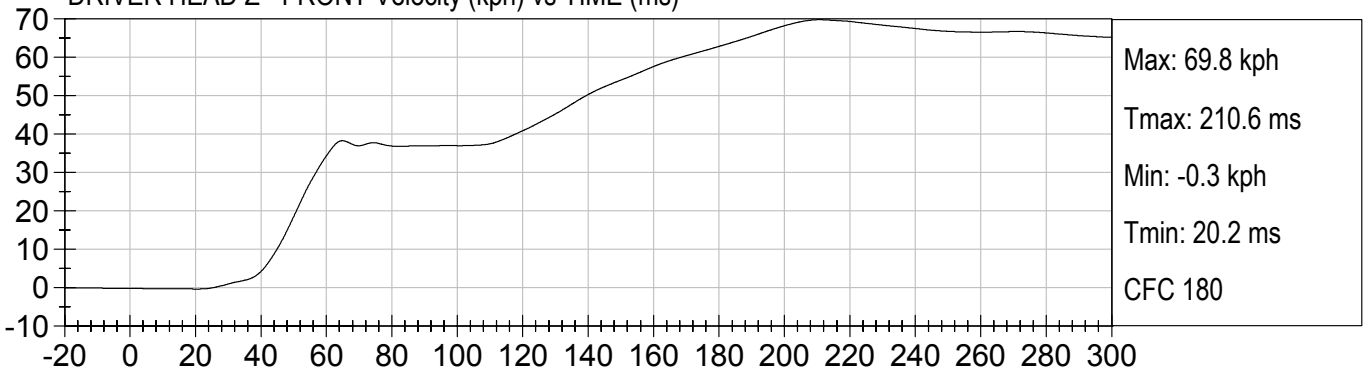
DRIVER HEAD Z - FRONT (G's) vs TIME (ms)



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



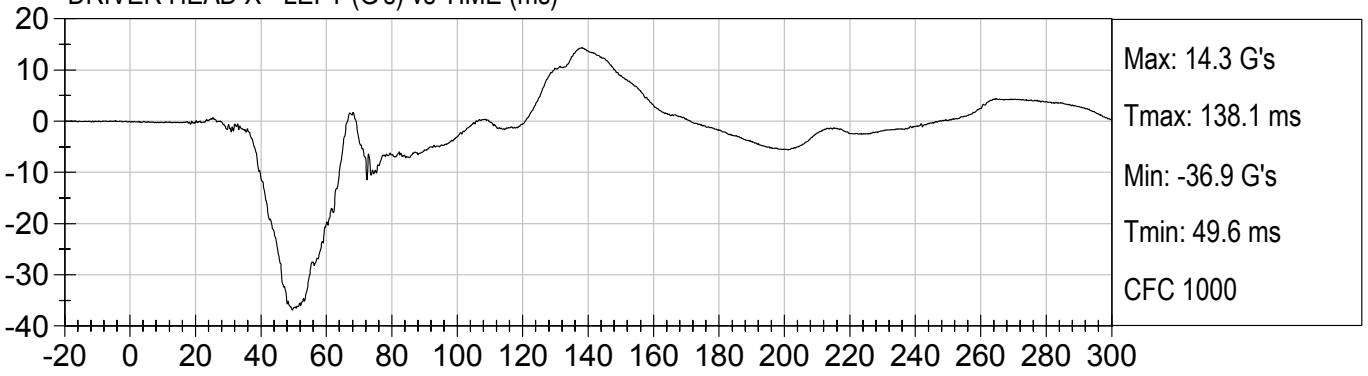
DRIVER HEAD Z - FRONT Velocity (kph) vs TIME (ms)



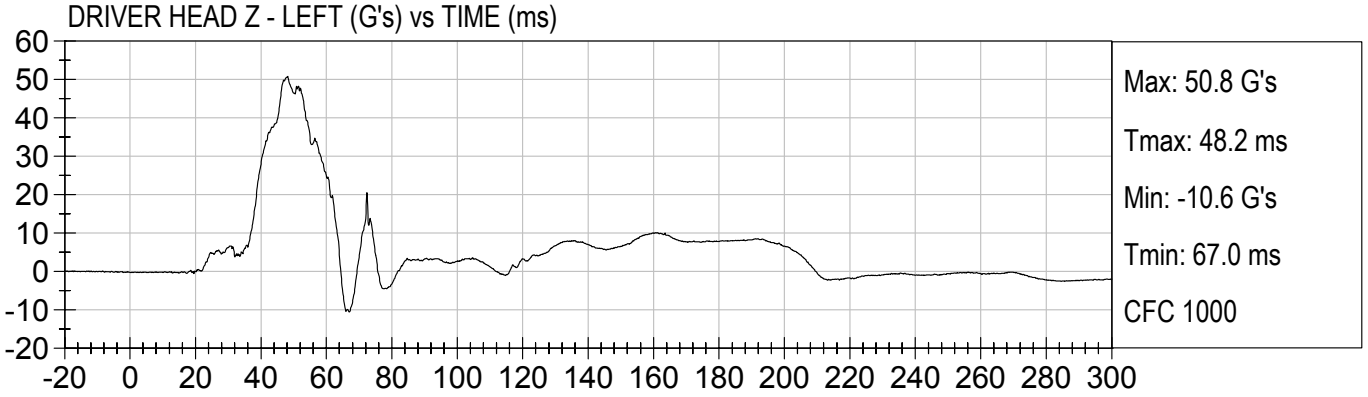
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

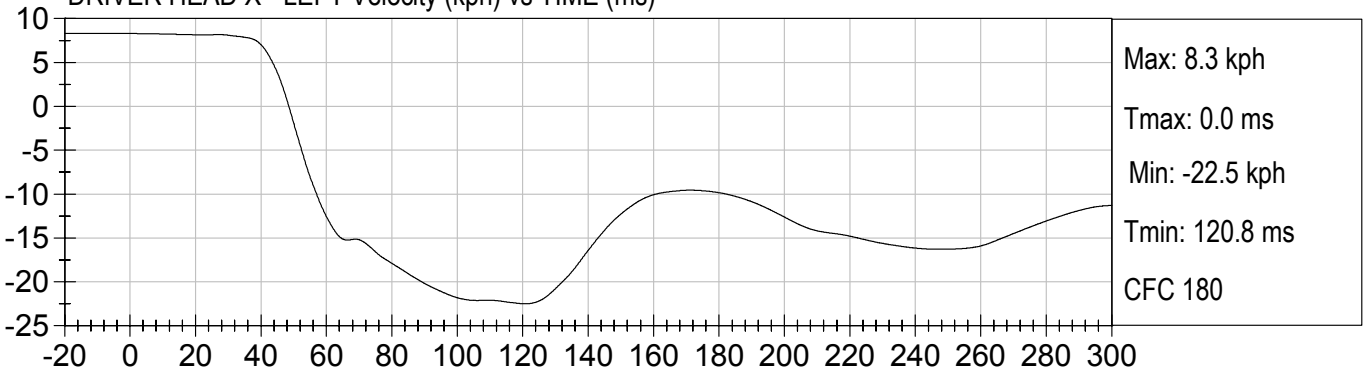
DRIVER HEAD X - LEFT (G's) vs TIME (ms)



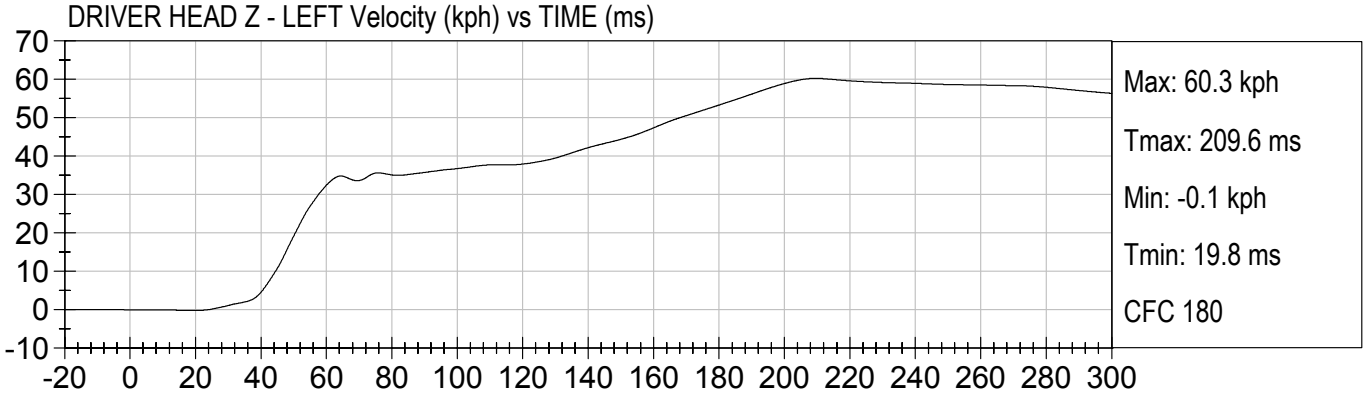
DRIVER HEAD Z - LEFT (G's) vs TIME (ms)



DRIVER HEAD X - LEFT Velocity (kph) vs TIME (ms)



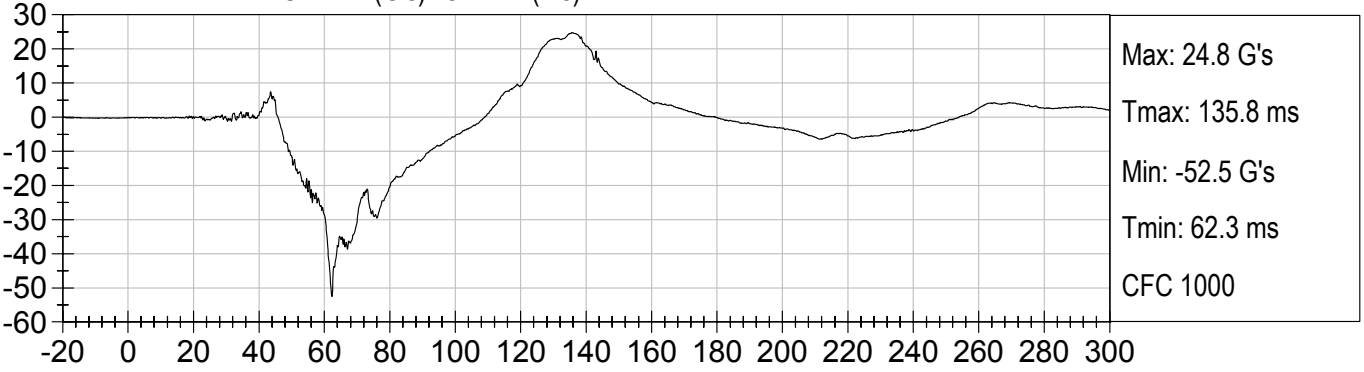
DRIVER HEAD Z - LEFT Velocity (kph) vs TIME (ms)



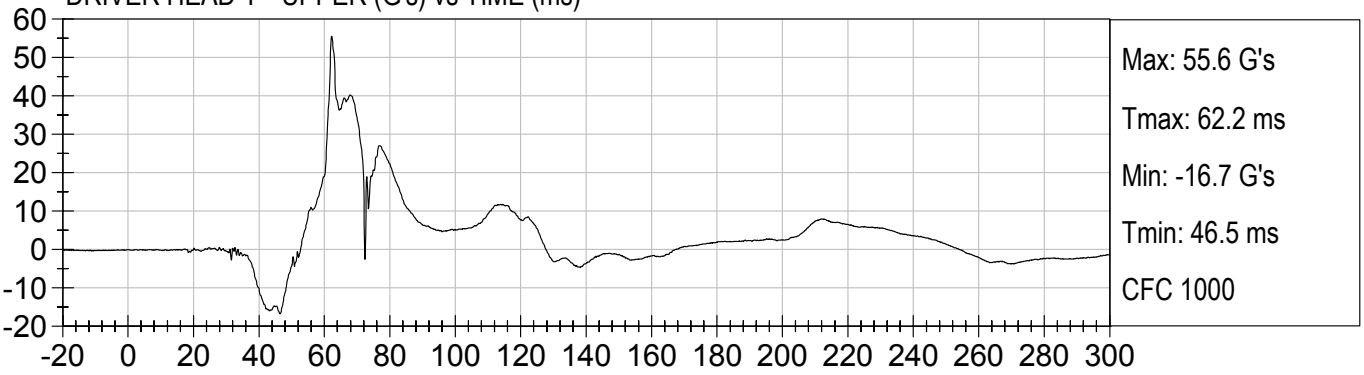
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

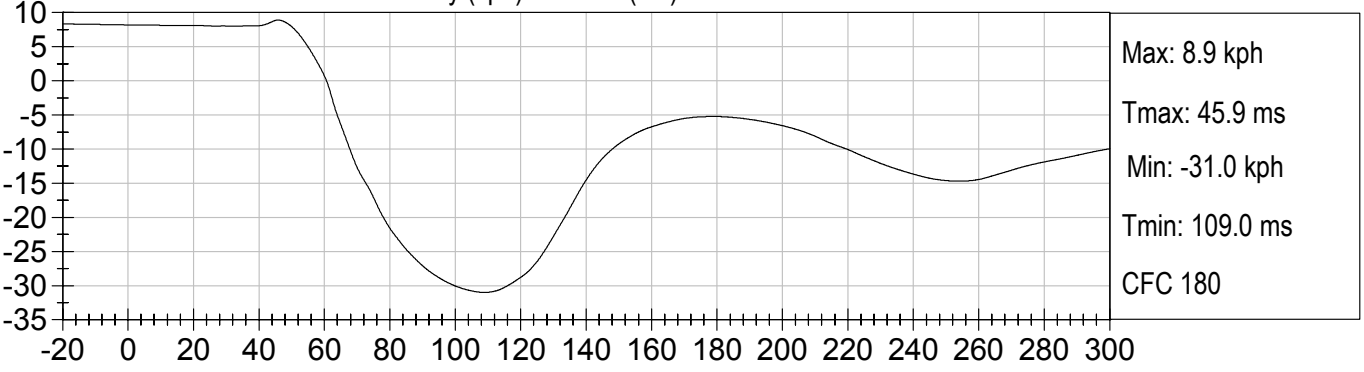
DRIVER HEAD X - UPPER (G's) vs TIME (ms)



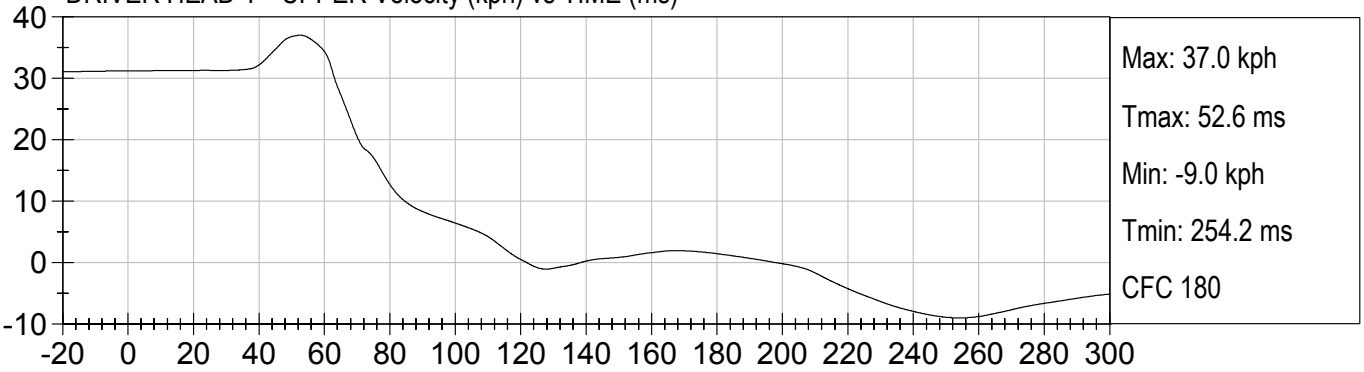
DRIVER HEAD Y - UPPER (G's) vs TIME (ms)



DRIVER HEAD X - UPPER Velocity (kph) vs TIME (ms)



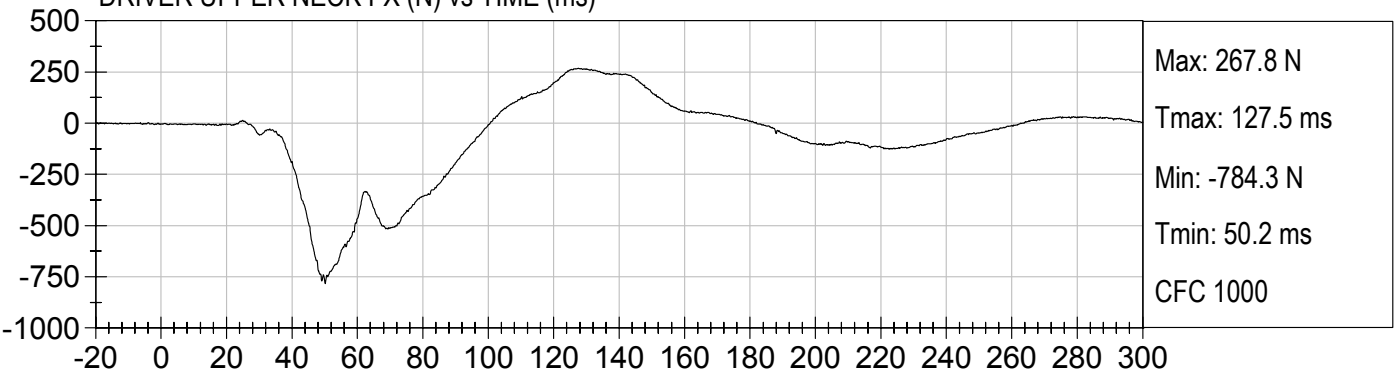
DRIVER HEAD Y - UPPER Velocity (kph) vs TIME (ms)



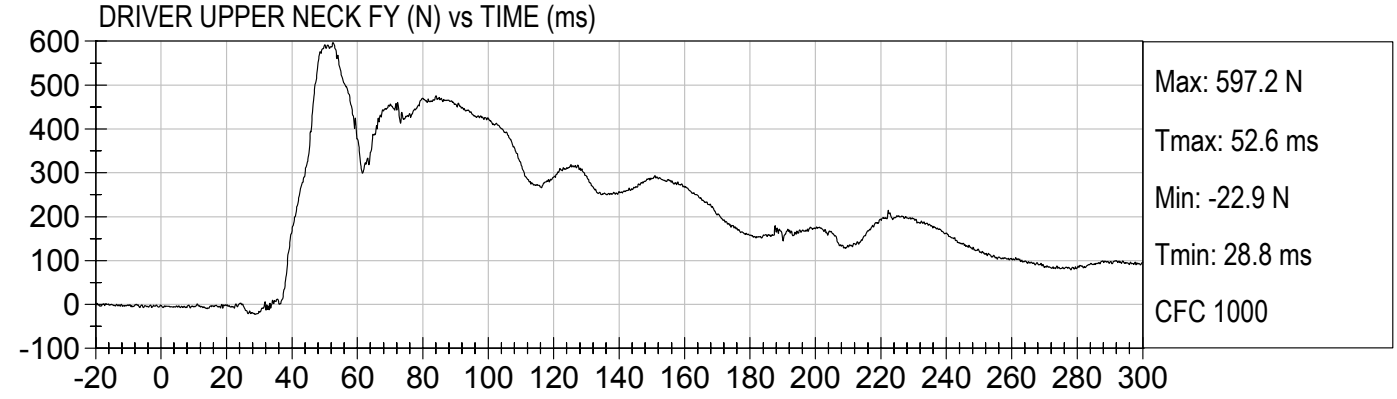
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

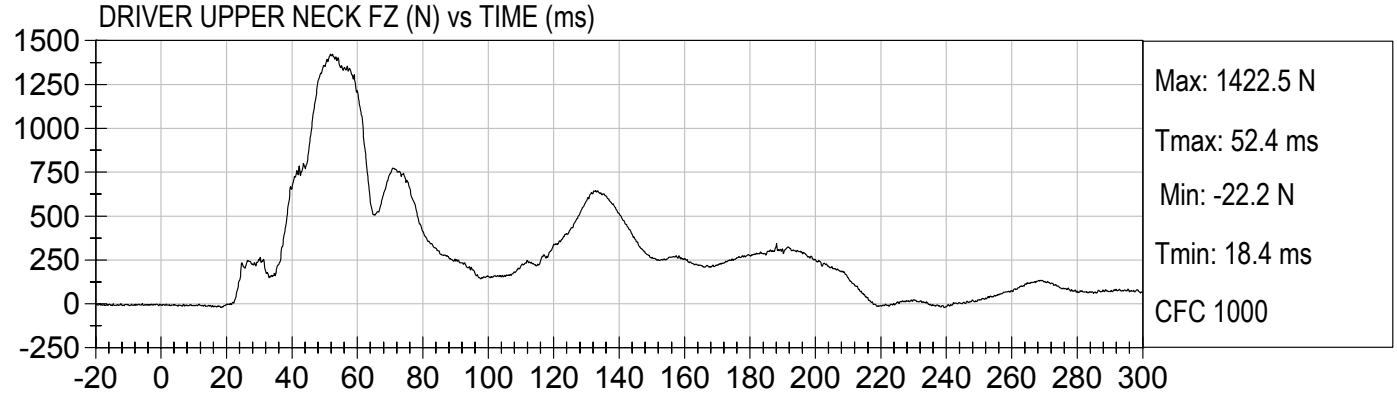
DRIVER UPPER NECK FX (N) vs TIME (ms)



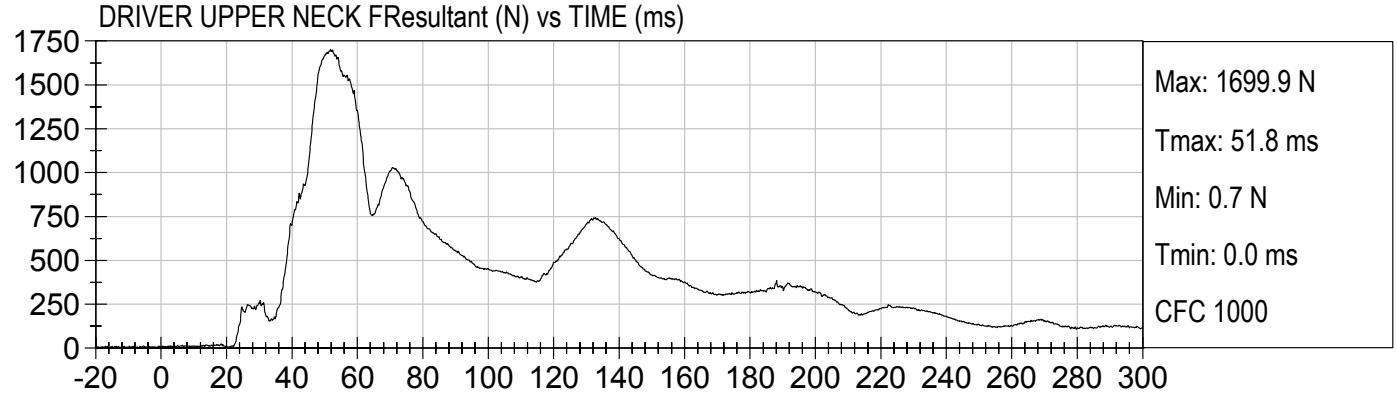
DRIVER UPPER NECK FY (N) vs TIME (ms)



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



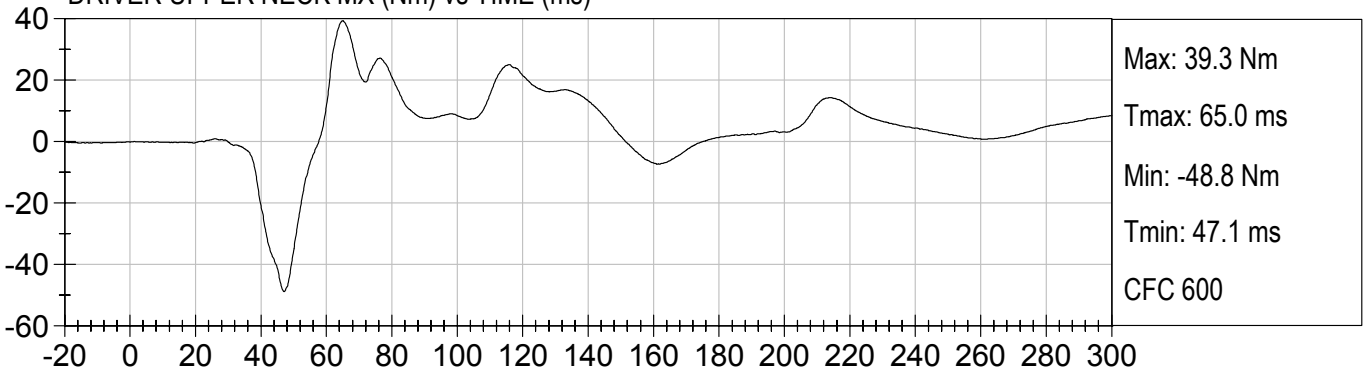
DRIVER UPPER NECK FResultant (N) vs TIME (ms)



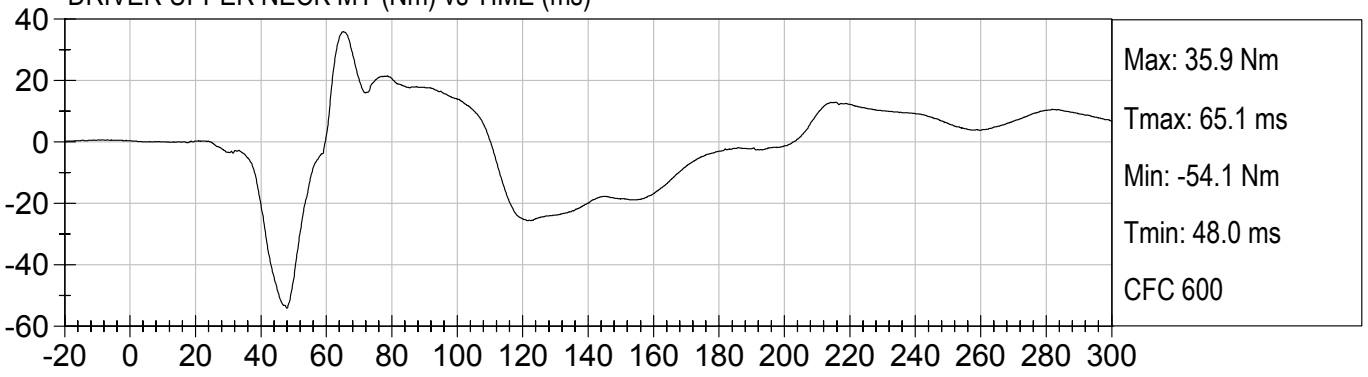
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

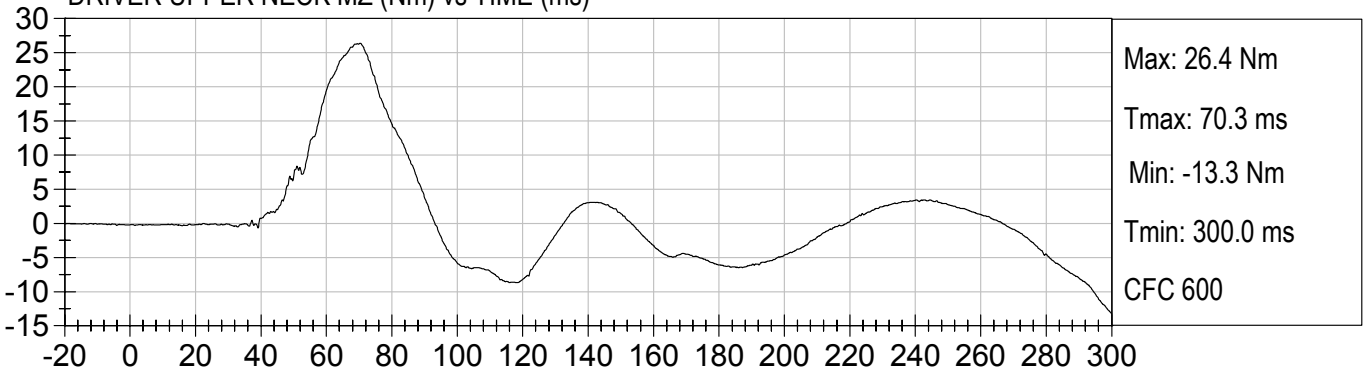
DRIVER UPPER NECK MX (Nm) vs TIME (ms)



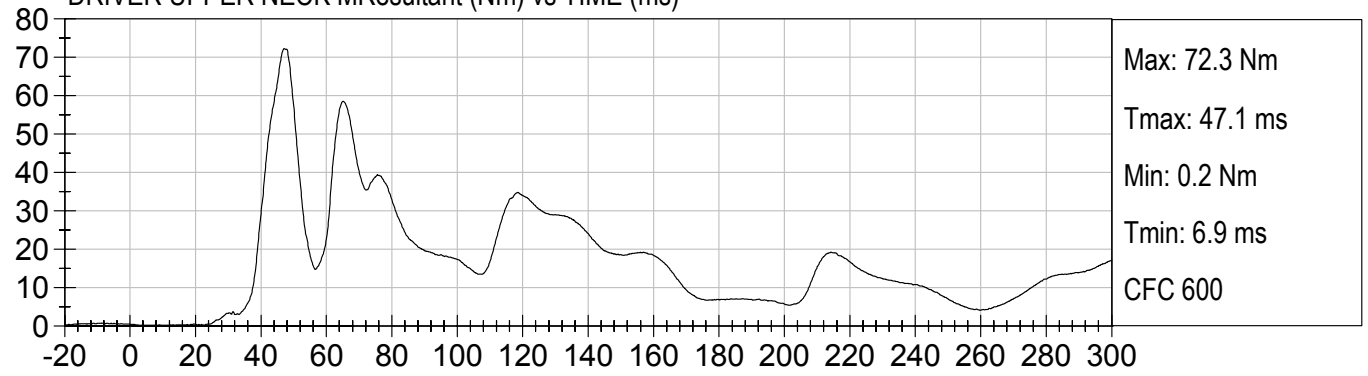
DRIVER UPPER NECK MY (Nm) vs TIME (ms)



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



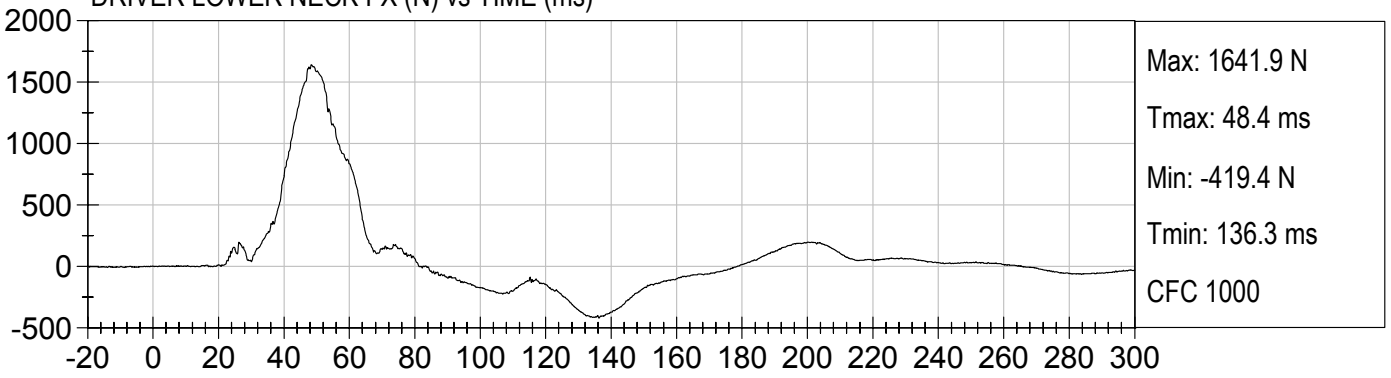
DRIVER UPPER NECK MResultant (Nm) vs TIME (ms)



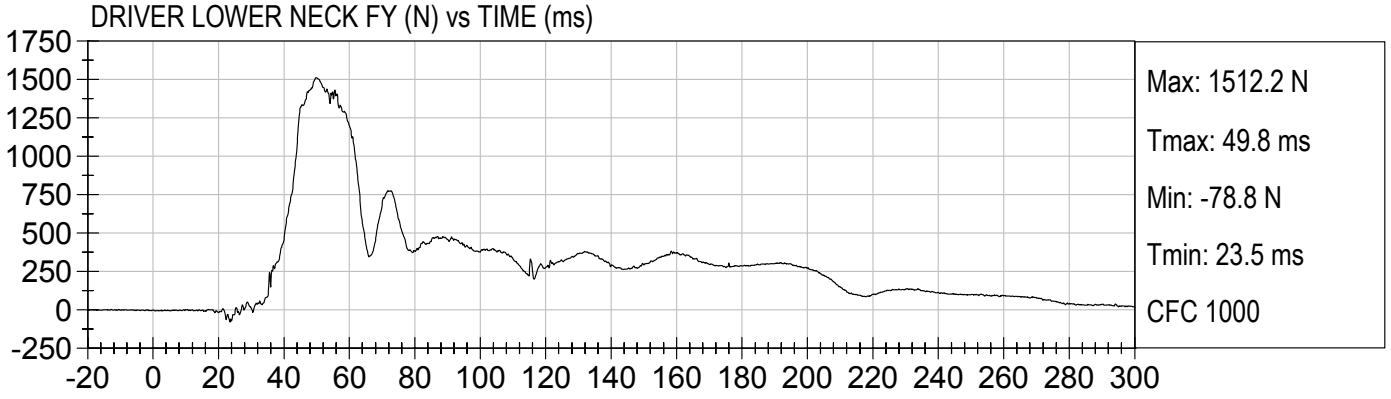
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

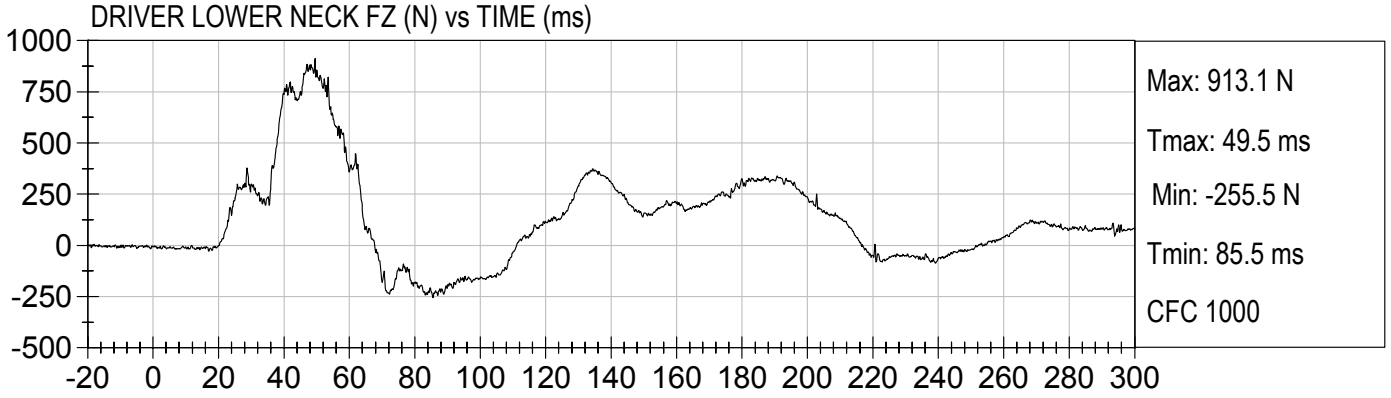
DRIVER LOWER NECK FX (N) vs TIME (ms)



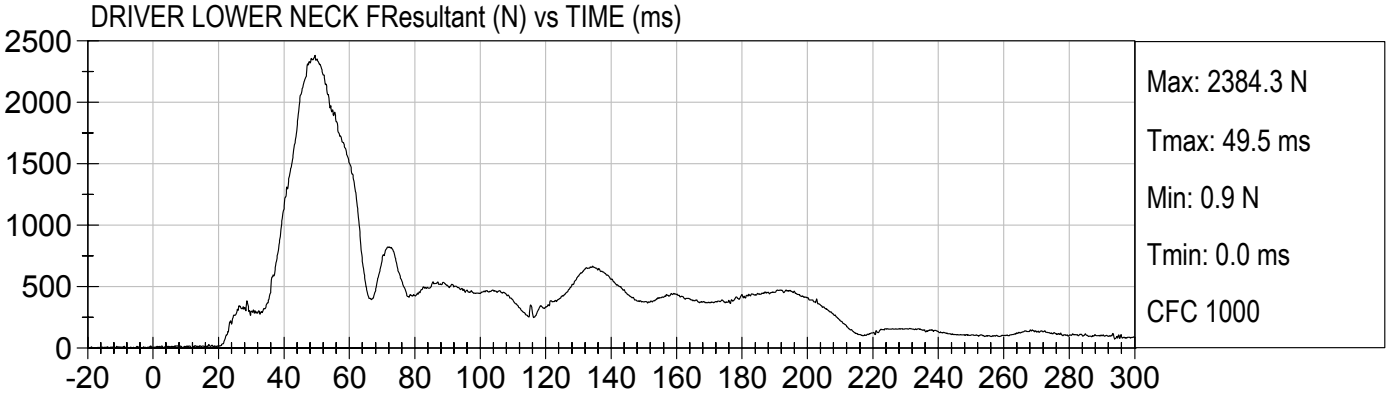
DRIVER LOWER NECK FY (N) vs TIME (ms)



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



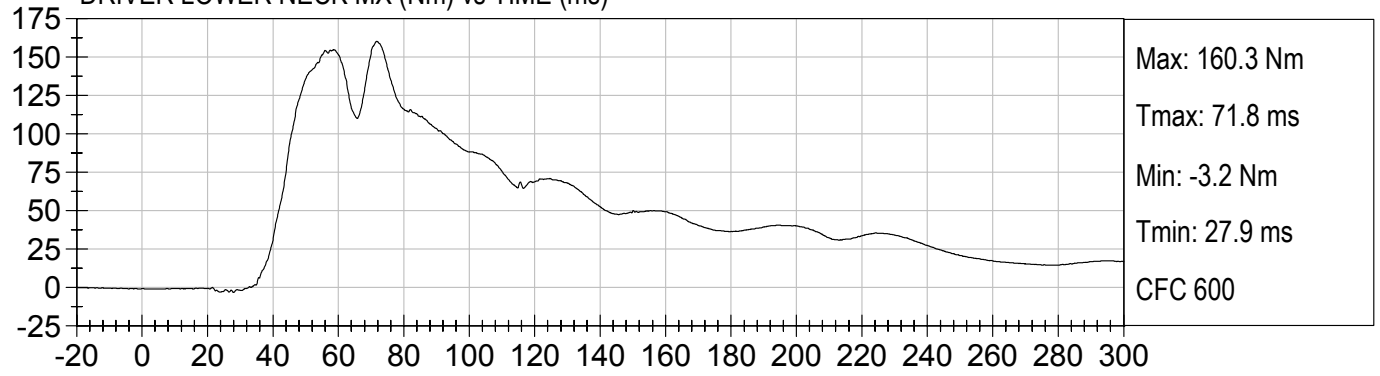
DRIVER LOWER NECK FResultant (N) vs TIME (ms)



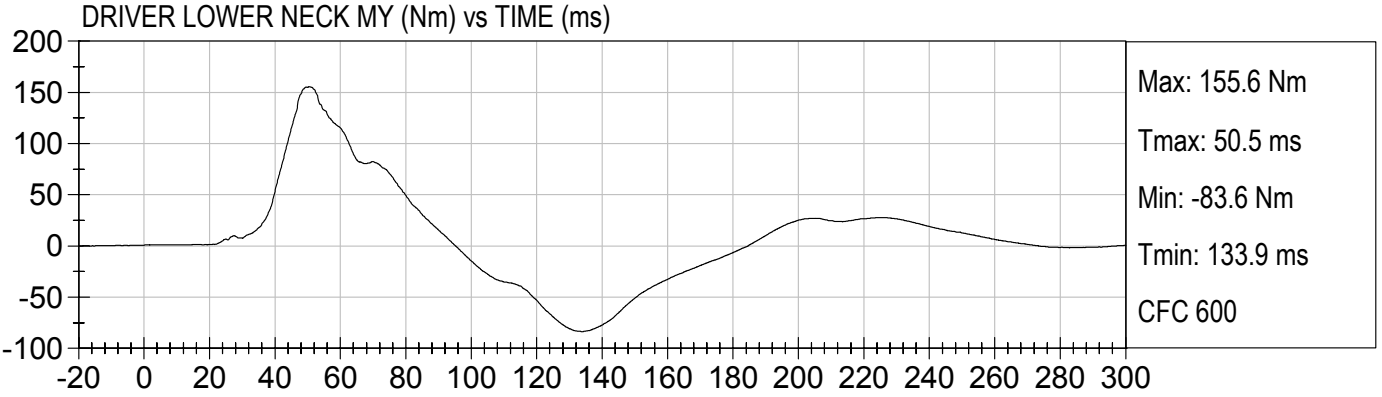
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

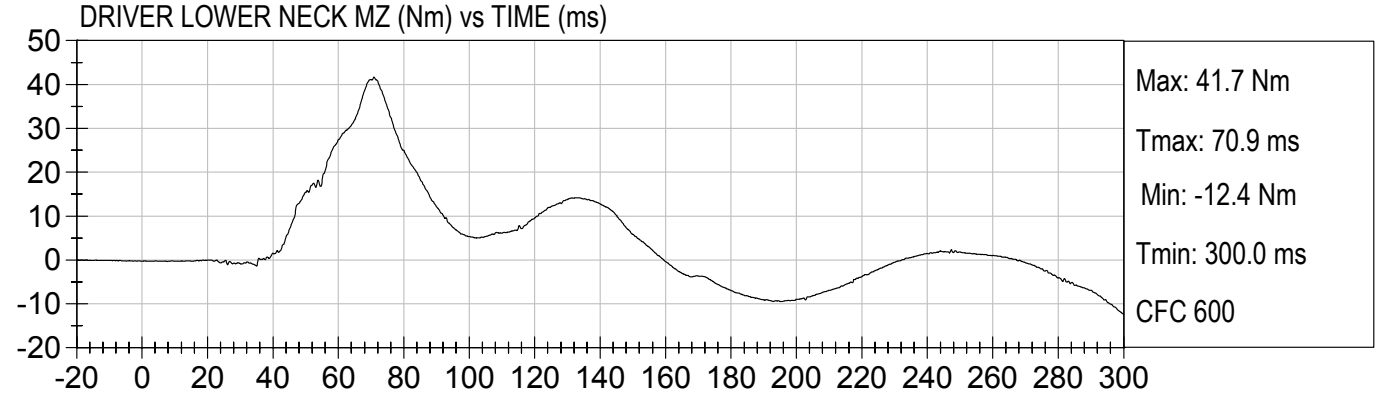
DRIVER LOWER NECK MX (Nm) vs TIME (ms)



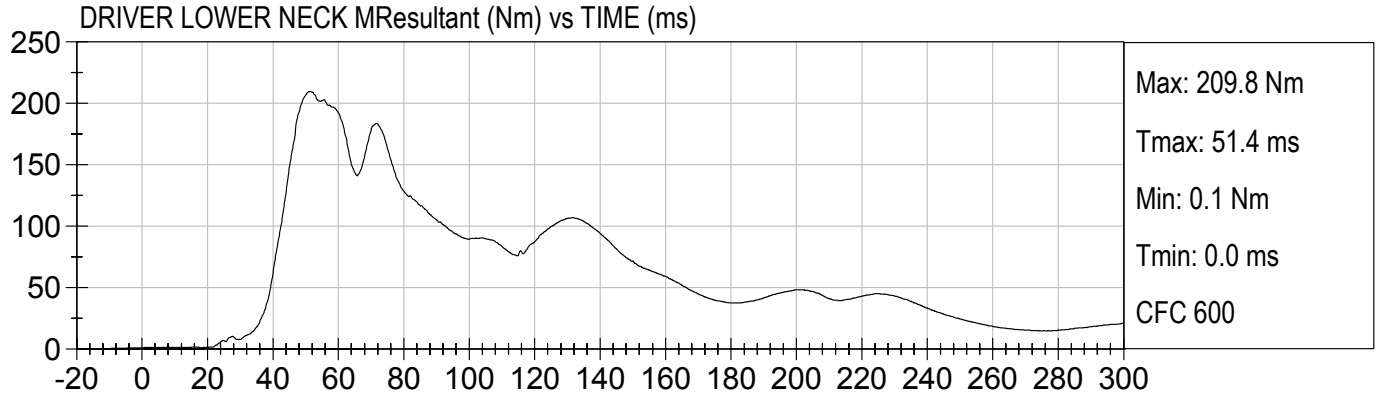
DRIVER LOWER NECK MY (Nm) vs TIME (ms)



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



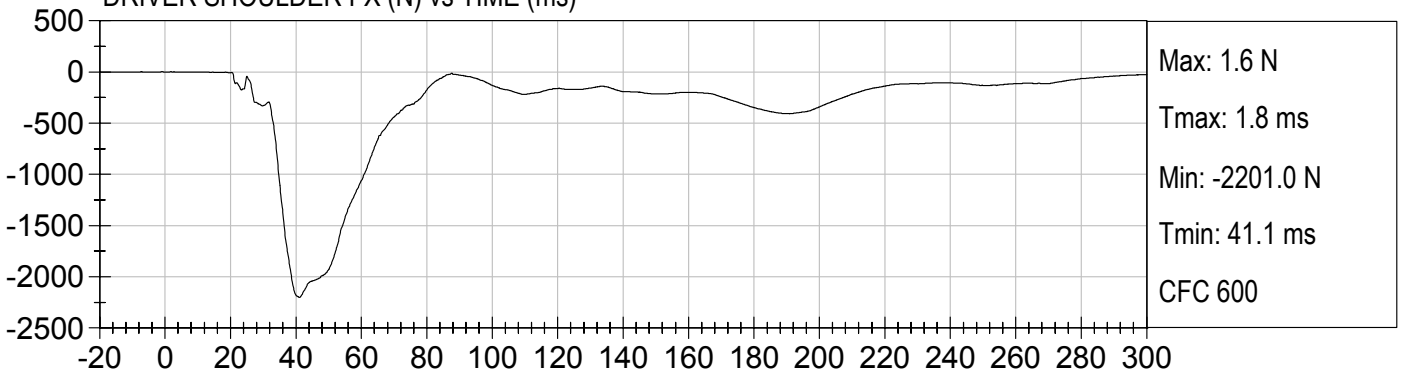
DRIVER LOWER NECK MResultant (Nm) vs TIME (ms)



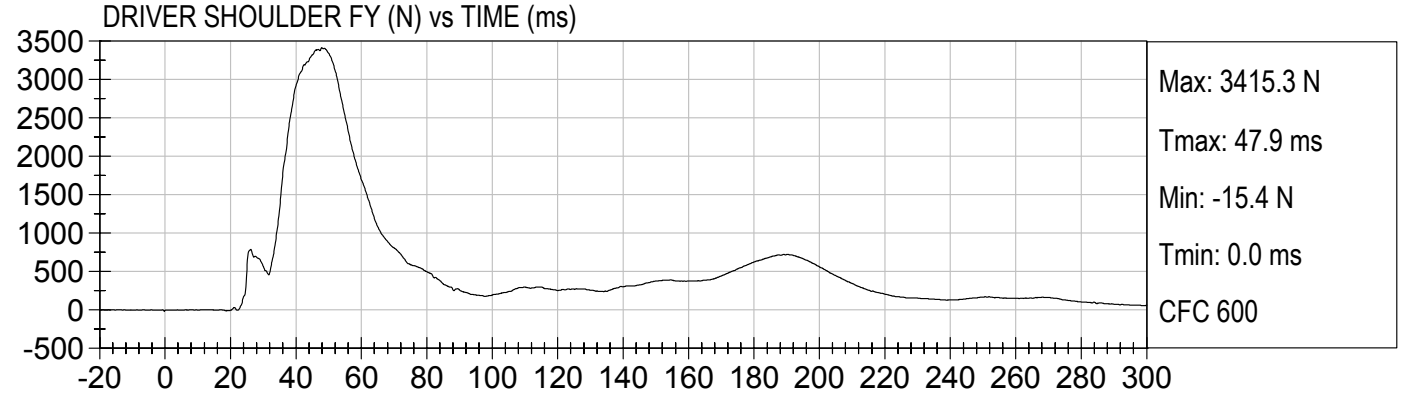
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

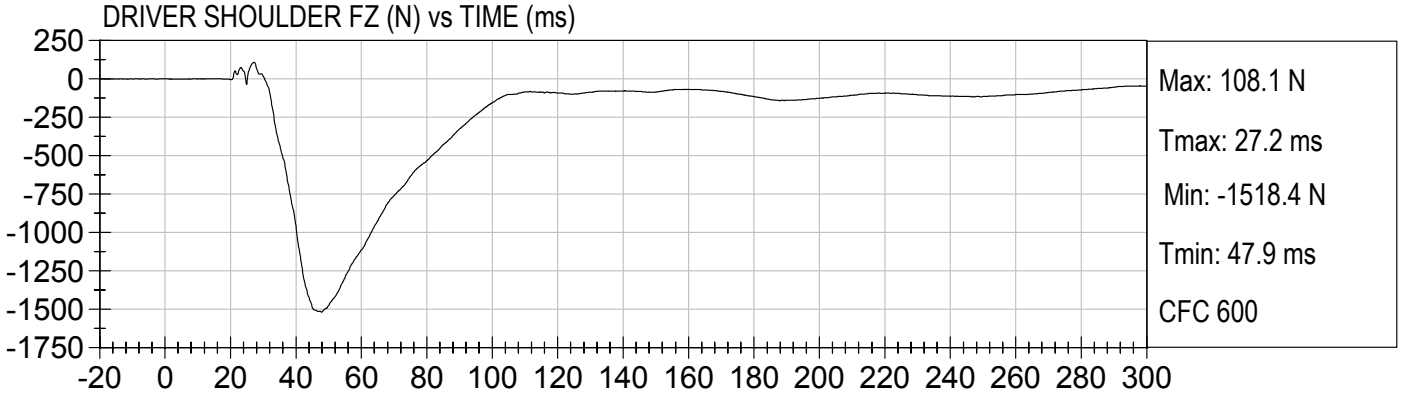
DRIVER SHOULDER FX (N) vs TIME (ms)



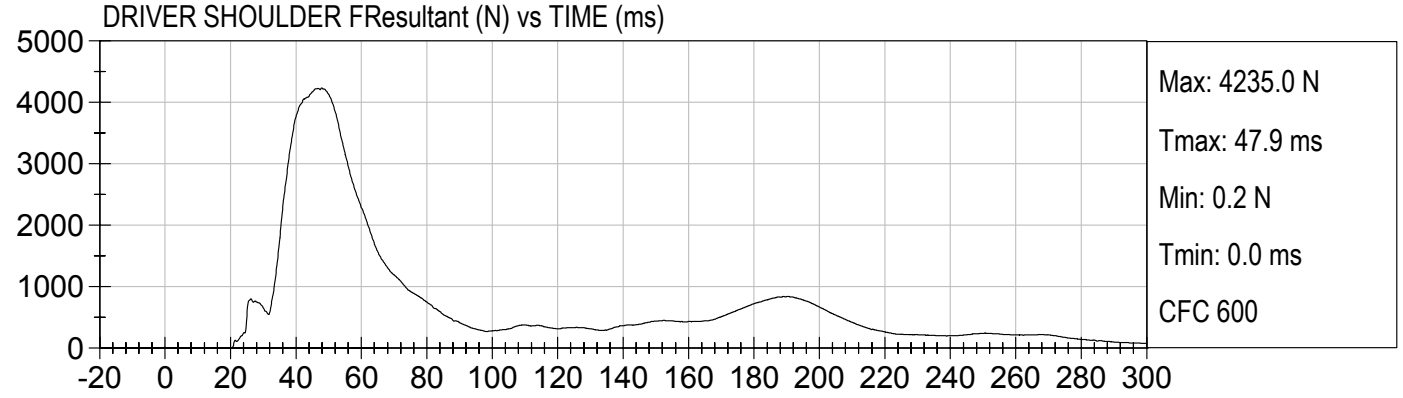
DRIVER SHOULDER FY (N) vs TIME (ms)



DRIVER SHOULDER FZ (N) vs TIME (ms)



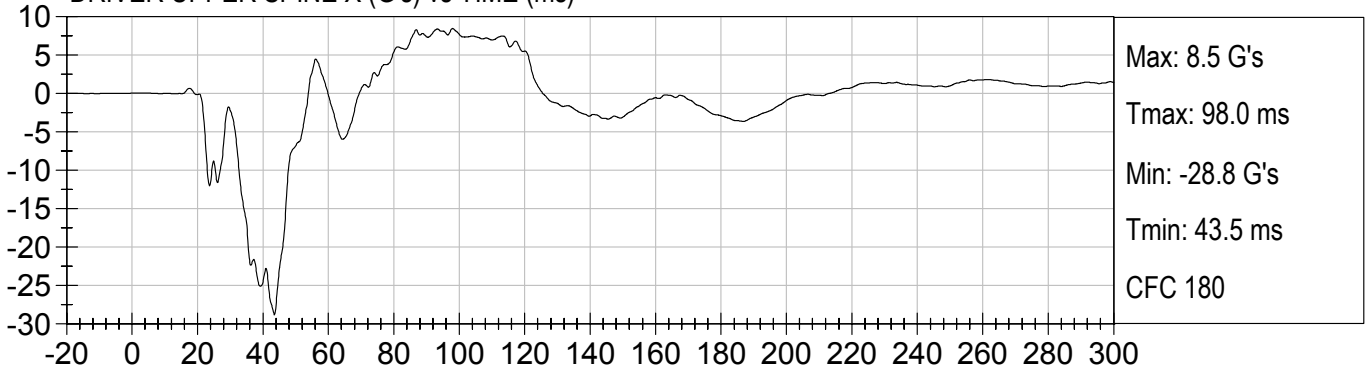
DRIVER SHOULDER FResultant (N) vs TIME (ms)



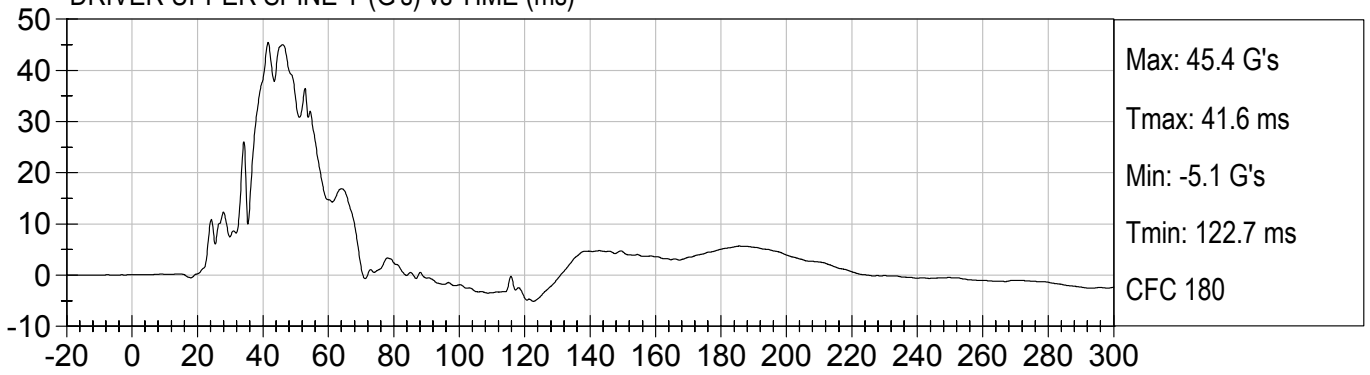
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

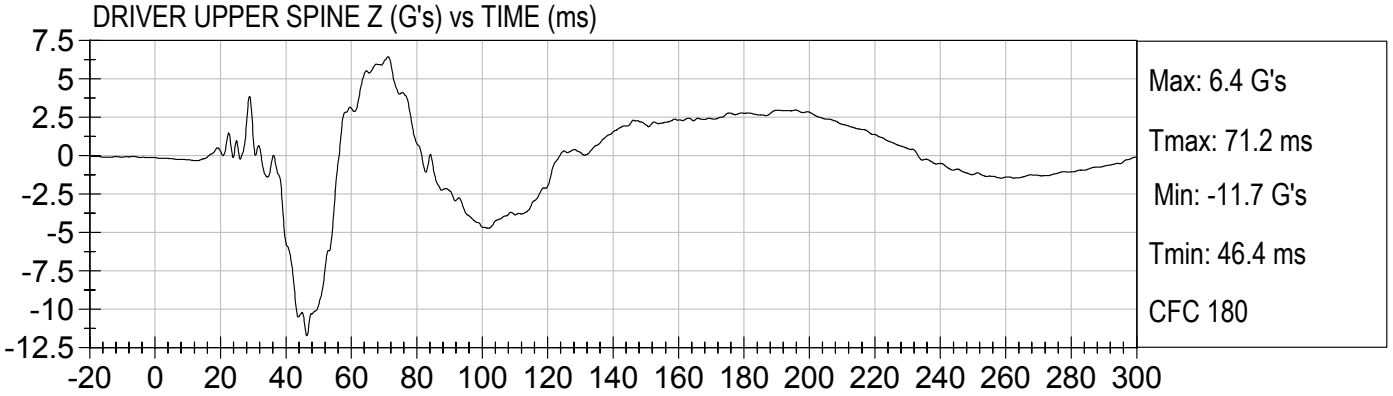
DRIVER UPPER SPINE X (G's) vs TIME (ms)



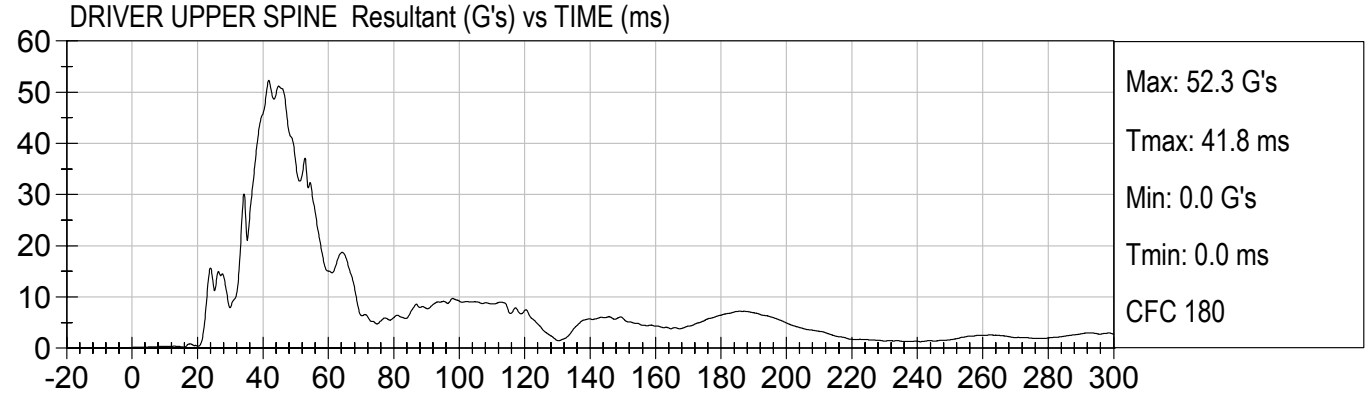
DRIVER UPPER SPINE Y (G's) vs TIME (ms)

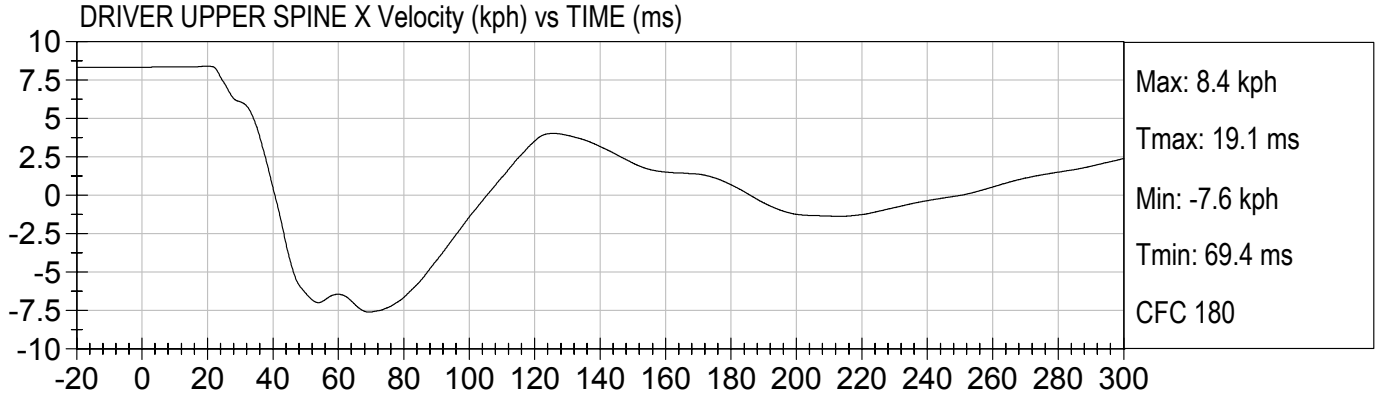


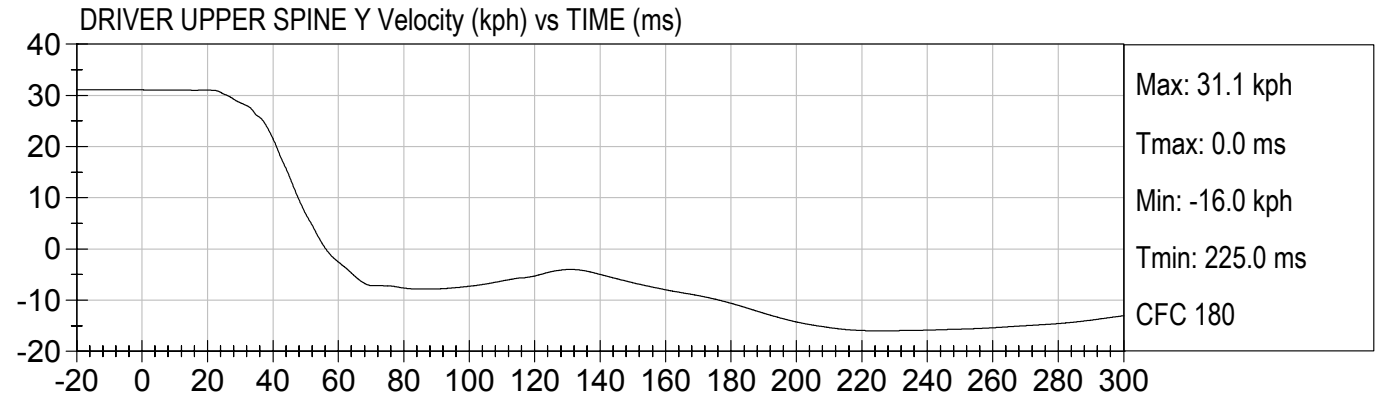
DRIVER UPPER SPINE Z (G's) vs TIME (ms)

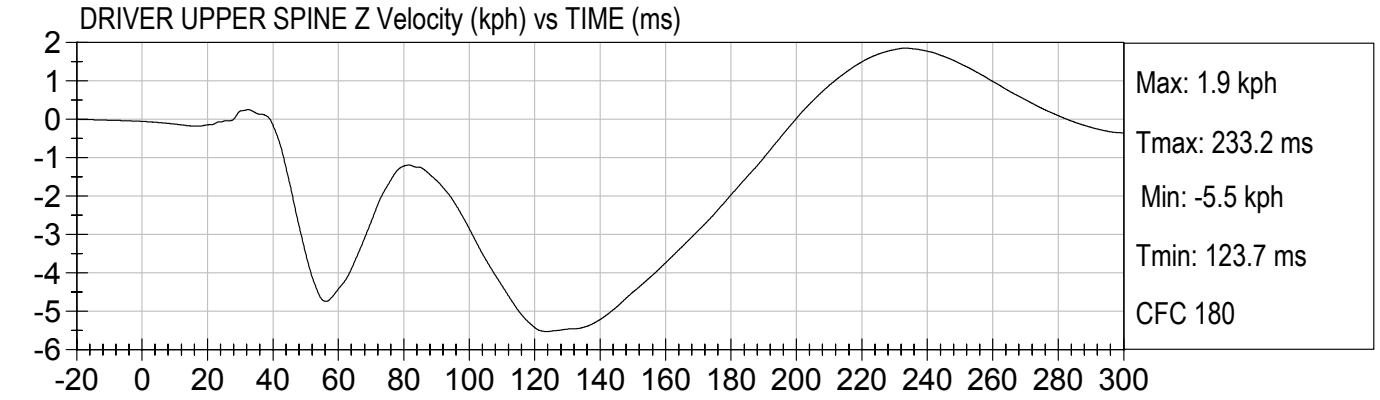


DRIVER UPPER SPINE Resultant (G's) vs TIME (ms)




DRIVER UPPER SPINE X Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-5
-7.5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 19.1 ms
Min: -7.6 kph
Tmin: 69.4 ms
CFC 180

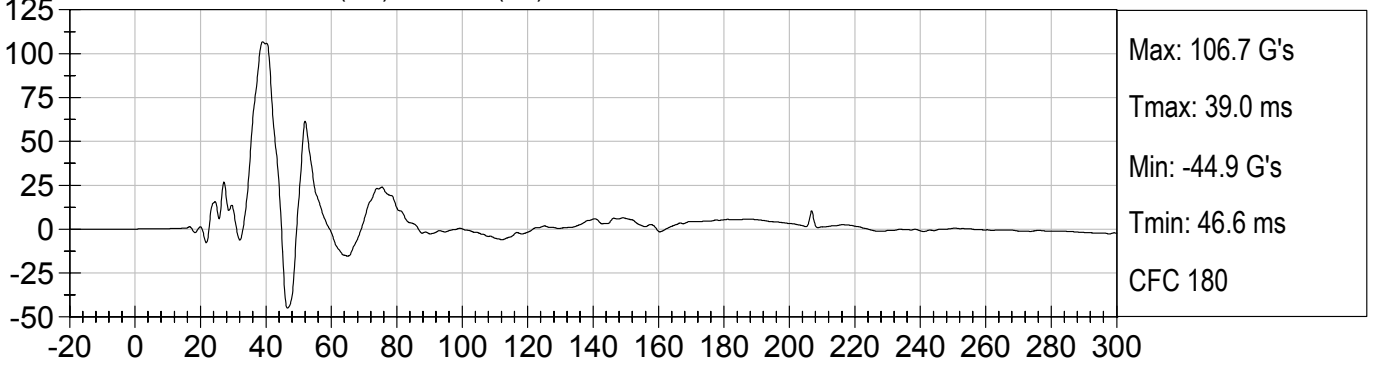

DRIVER UPPER SPINE Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 0.0 ms
Min: -16.0 kph
Tmin: 225.0 ms
CFC 180


DRIVER UPPER SPINE Z Velocity (kph) vs TIME (ms)
2
1
0
-1
-2
-3
-4
-5
-6
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 1.9 kph
Tmax: 233.2 ms
Min: -5.5 kph
Tmin: 123.7 ms
CFC 180

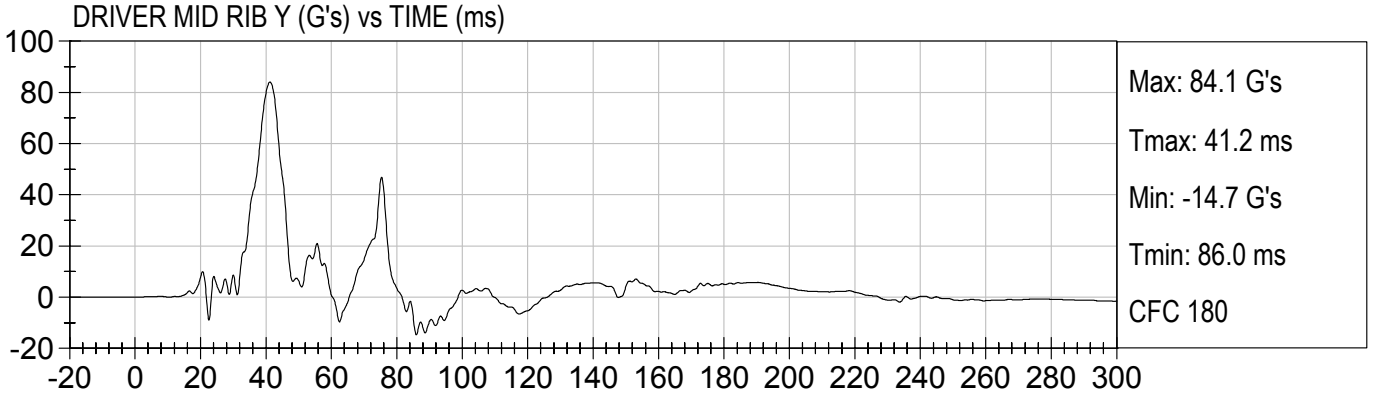
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

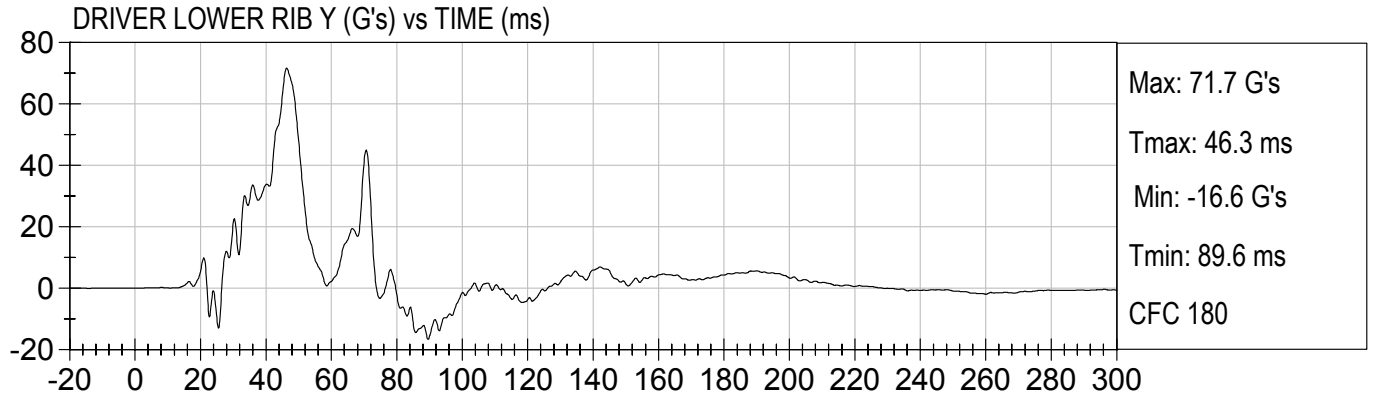
DRIVER UPPER RIB Y (G's) vs TIME (ms)

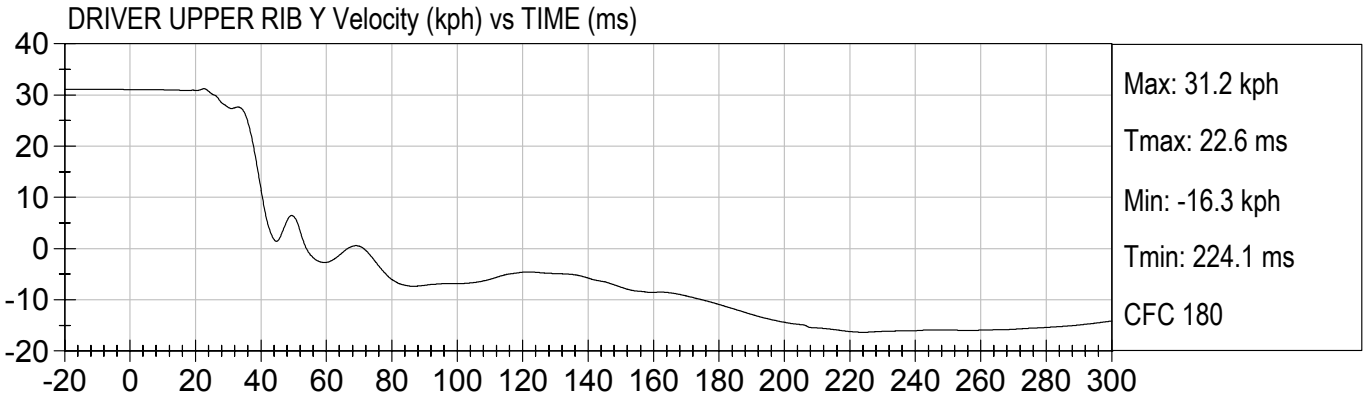


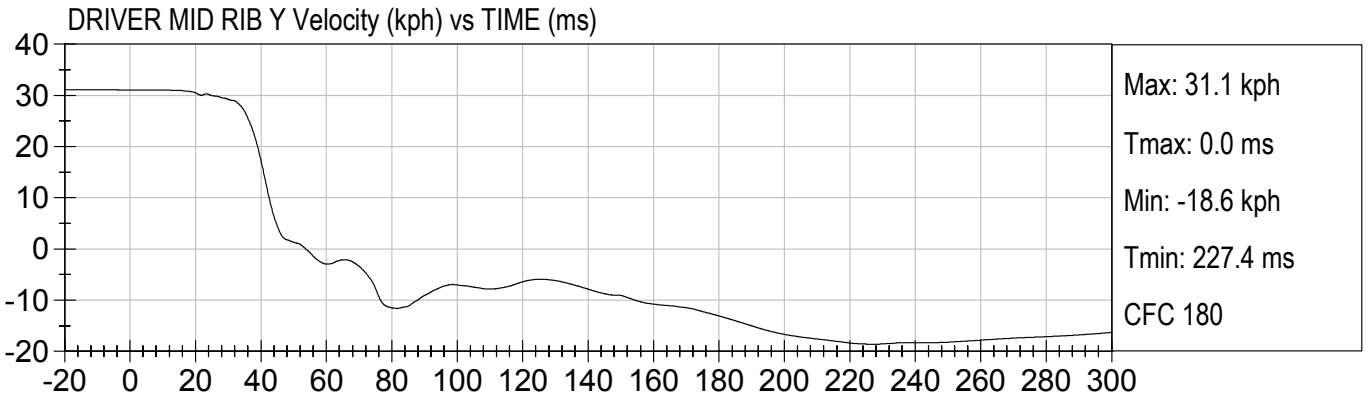
DRIVER MID RIB Y (G's) vs TIME (ms)

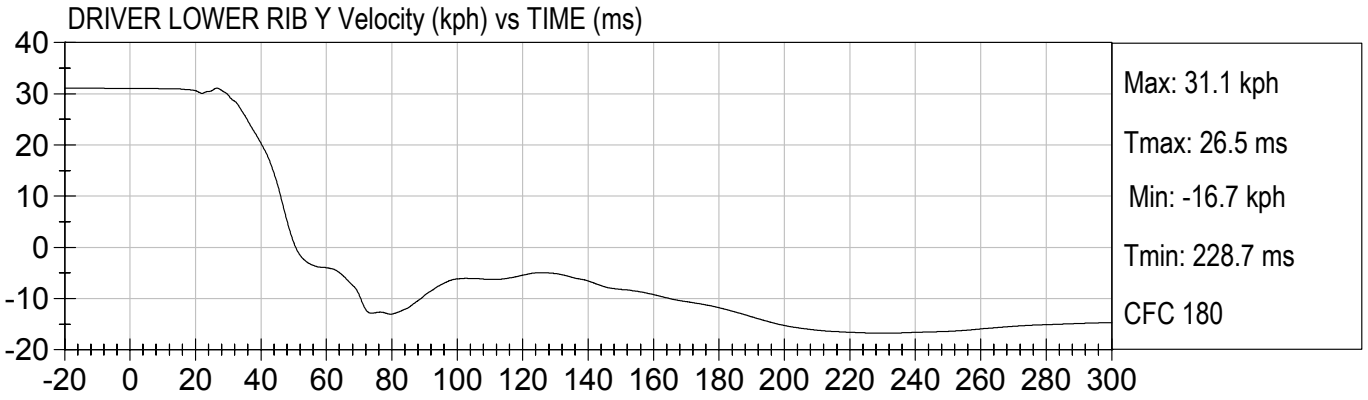


DRIVER LOWER RIB Y (G's) vs TIME (ms)




DRIVER UPPER RIB Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.2 kph
Tmax: 22.6 ms
Min: -16.3 kph
Tmin: 224.1 ms
CFC 180

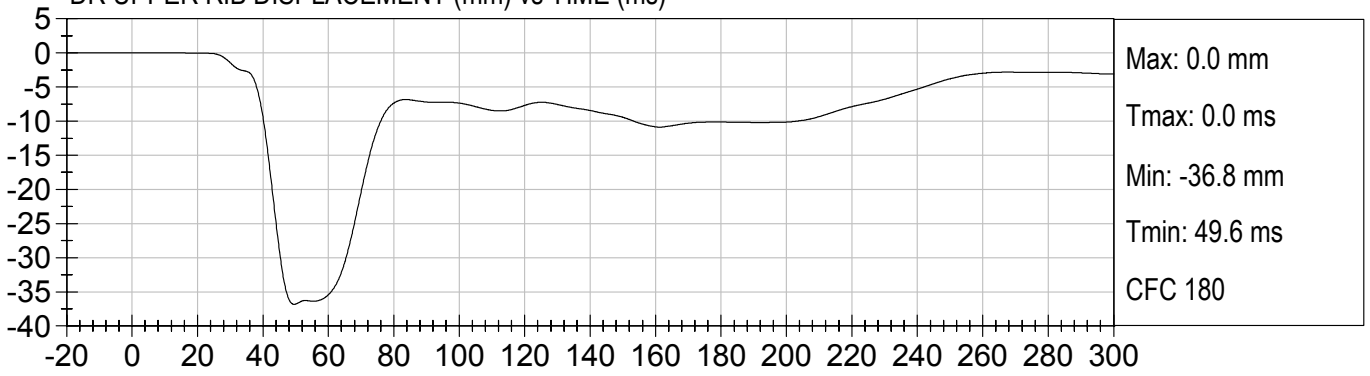

DRIVER MID RIB Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 0.0 ms
Min: -18.6 kph
Tmin: 227.4 ms
CFC 180


DRIVER LOWER RIB Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 26.5 ms
Min: -16.7 kph
Tmin: 228.7 ms
CFC 180

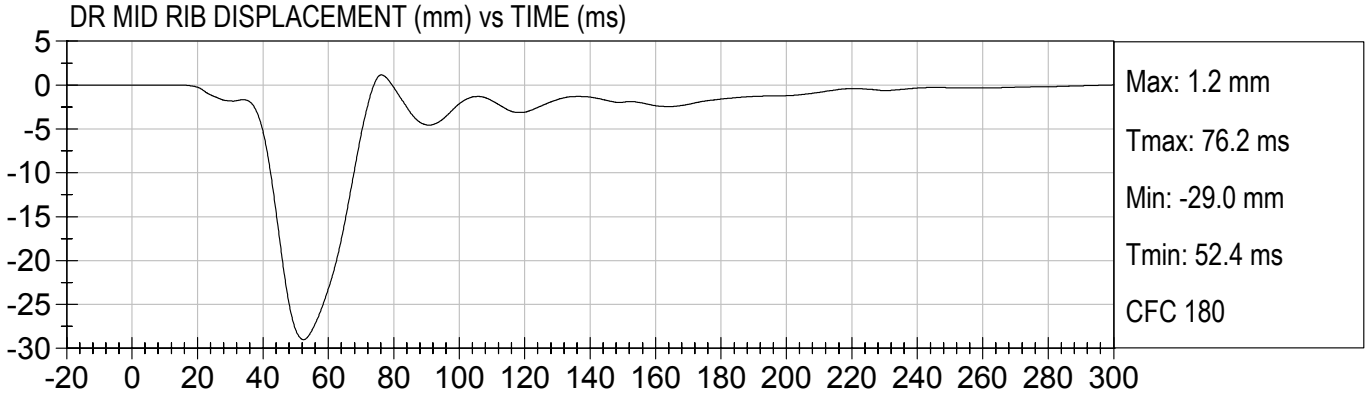
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

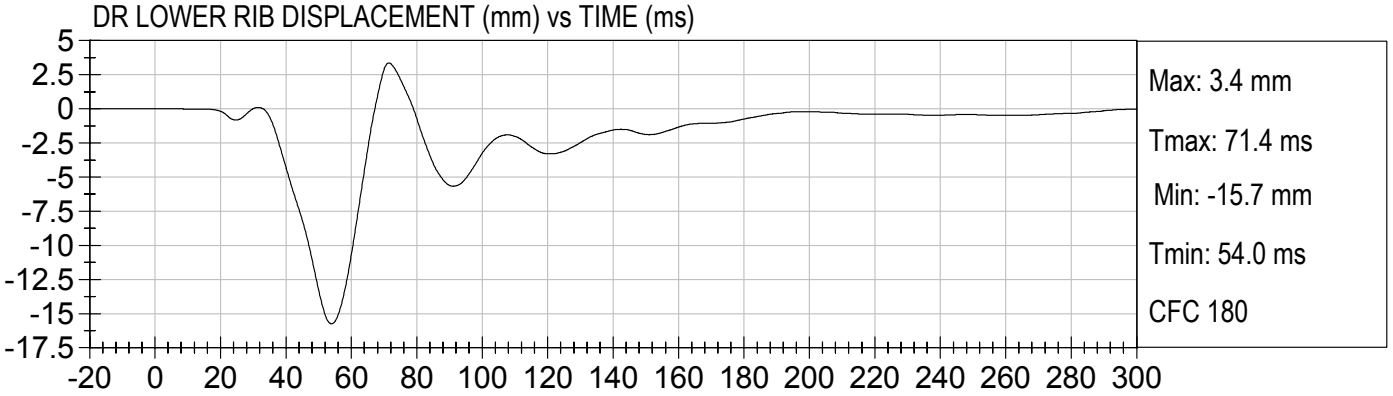
DR UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



DR MID RIB DISPLACEMENT (mm) vs TIME (ms)



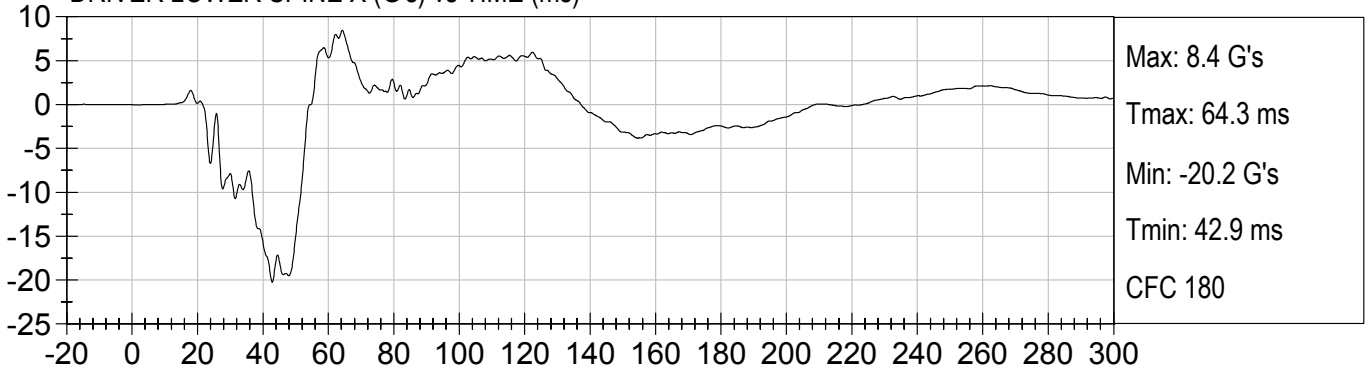
DR LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



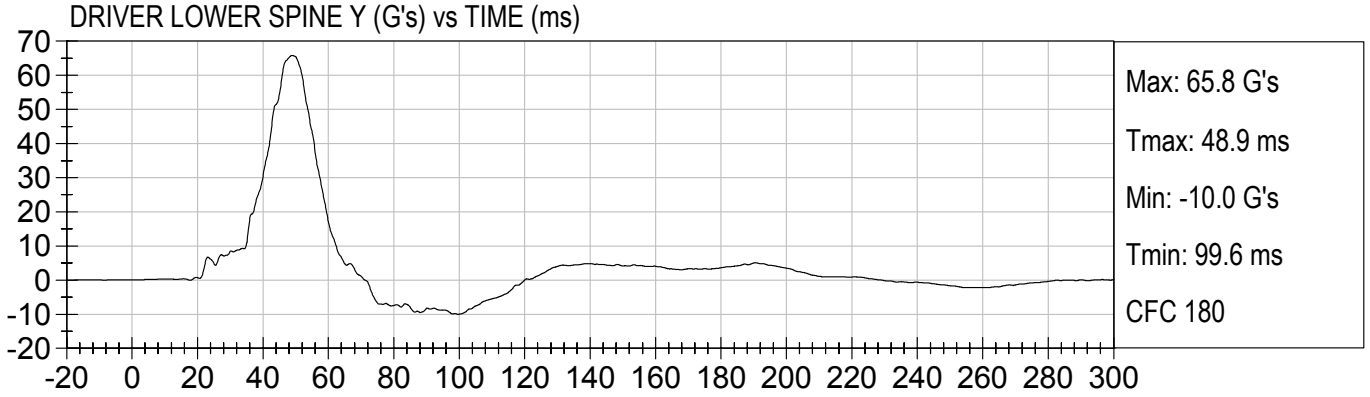
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

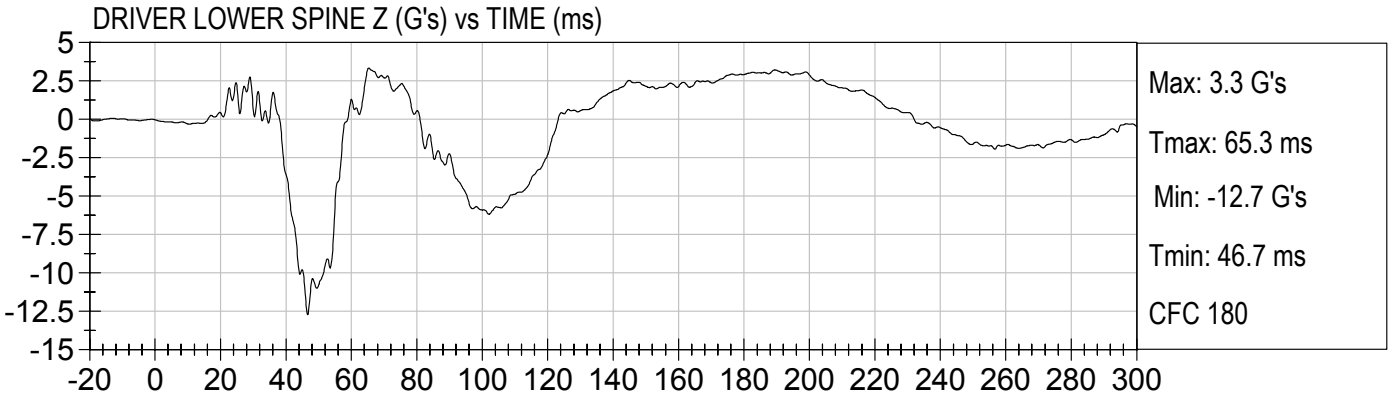
DRIVER LOWER SPINE X (G's) vs TIME (ms)



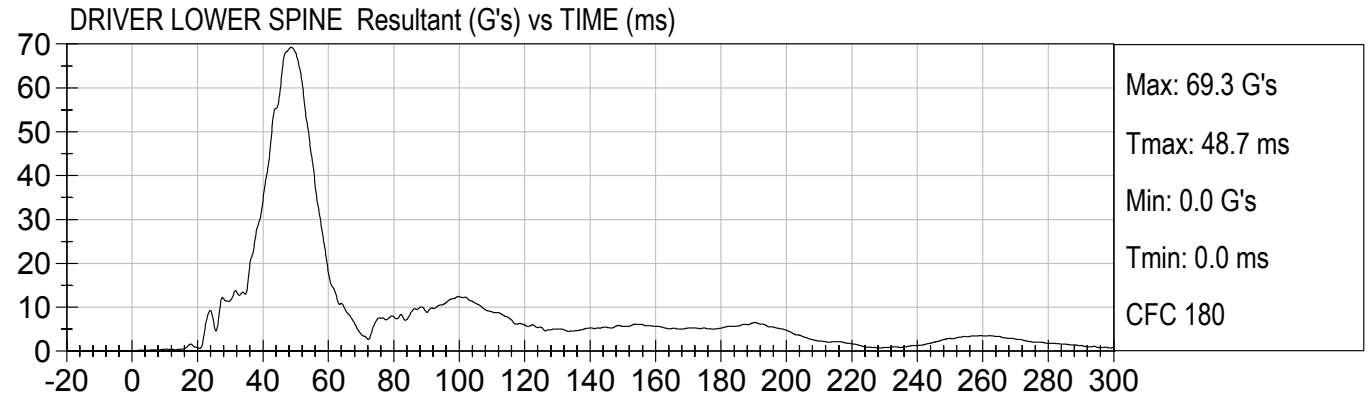
DRIVER LOWER SPINE Y (G's) vs TIME (ms)

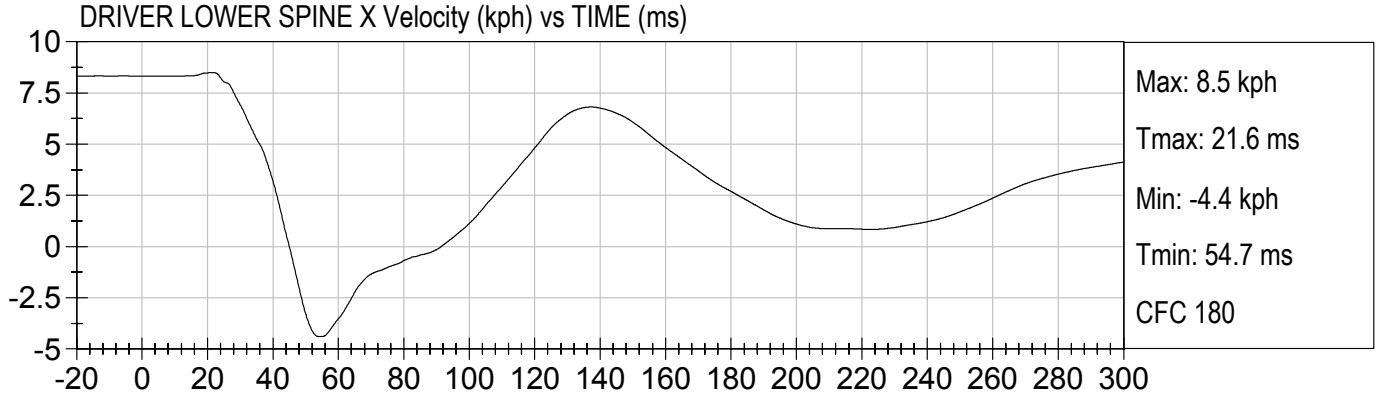


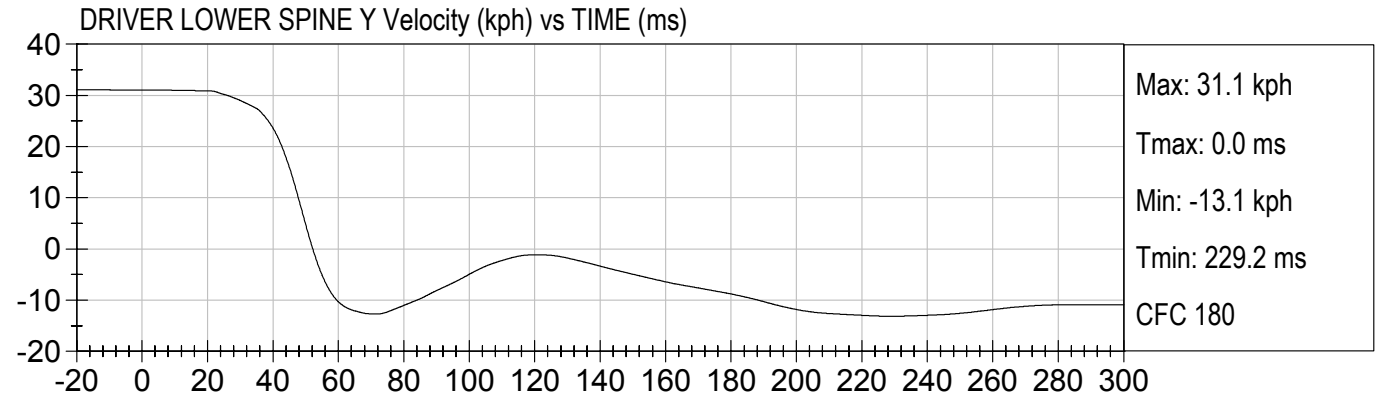
DRIVER LOWER SPINE Z (G's) vs TIME (ms)

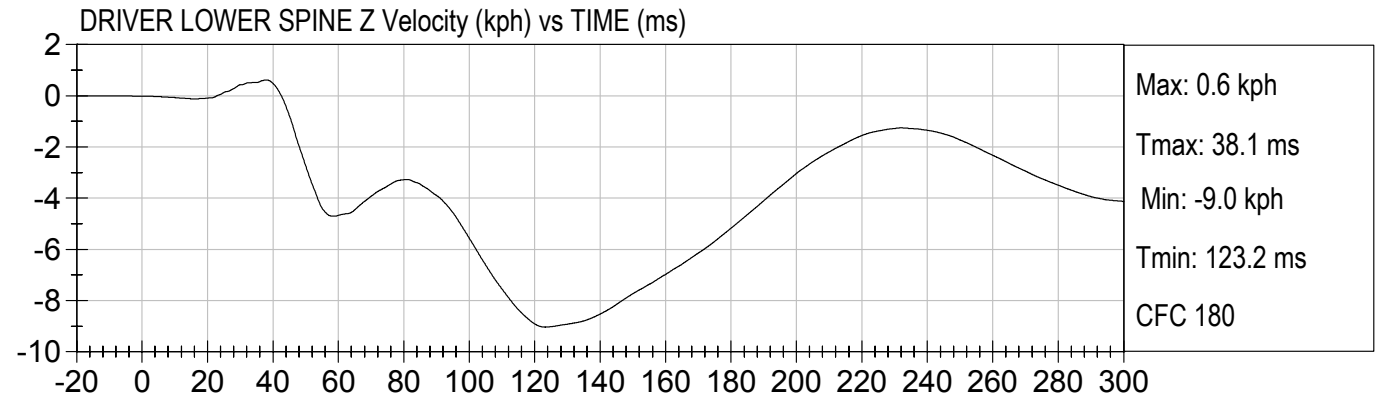


DRIVER LOWER SPINE Resultant (G's) vs TIME (ms)




DRIVER LOWER SPINE X Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.5 kph
Tmax: 21.6 ms
Min: -4.4 kph
Tmin: 54.7 ms
CFC 180

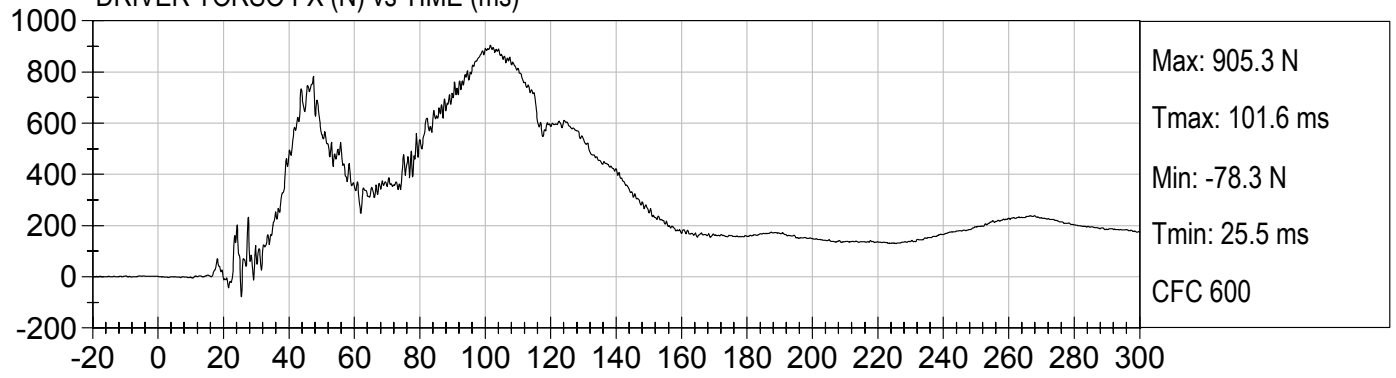

DRIVER LOWER SPINE Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 0.0 ms
Min: -13.1 kph
Tmin: 229.2 ms
CFC 180


DRIVER LOWER SPINE Z Velocity (kph) vs TIME (ms)
2
0
-2
-4
-6
-8
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.6 kph
Tmax: 38.1 ms
Min: -9.0 kph
Tmin: 123.2 ms
CFC 180

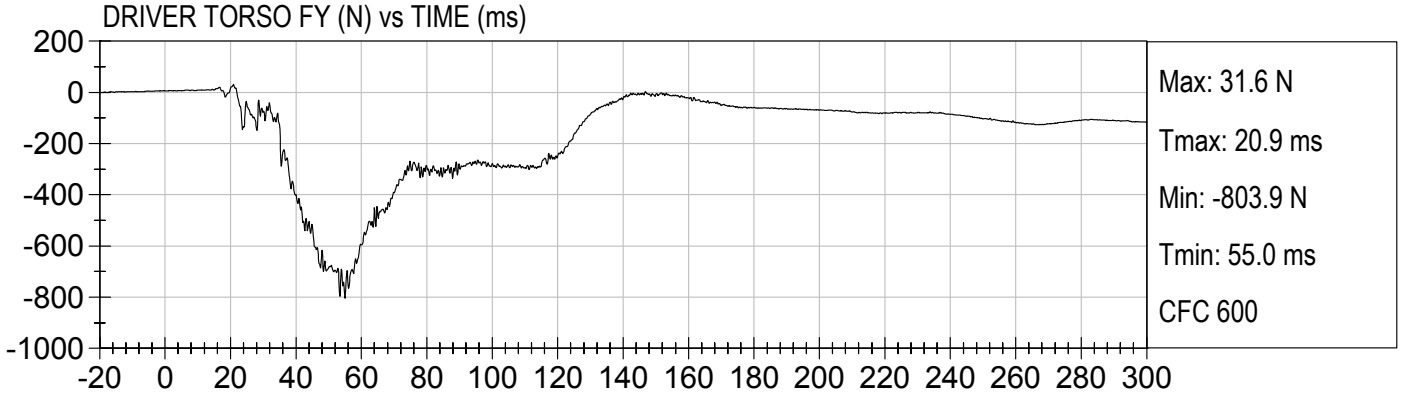
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

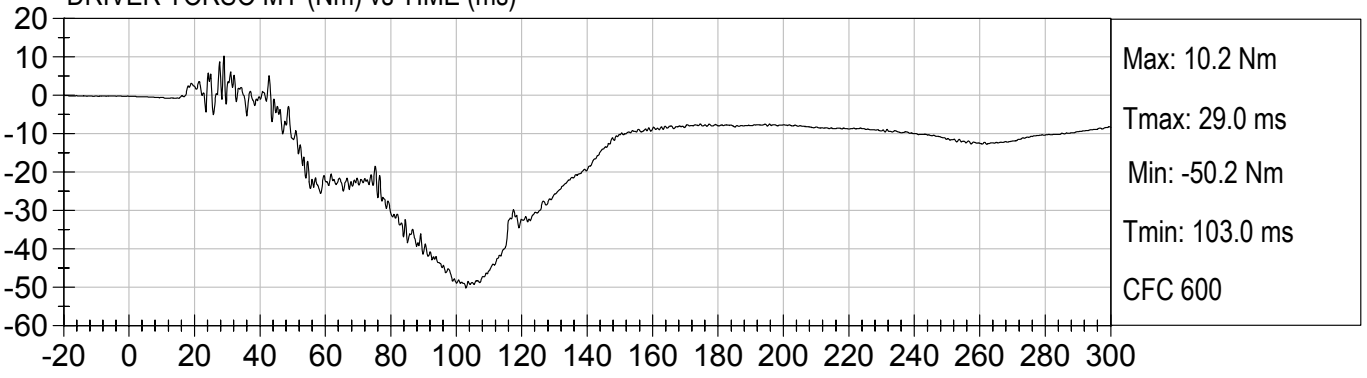
DRIVER TORSO FX (N) vs TIME (ms)



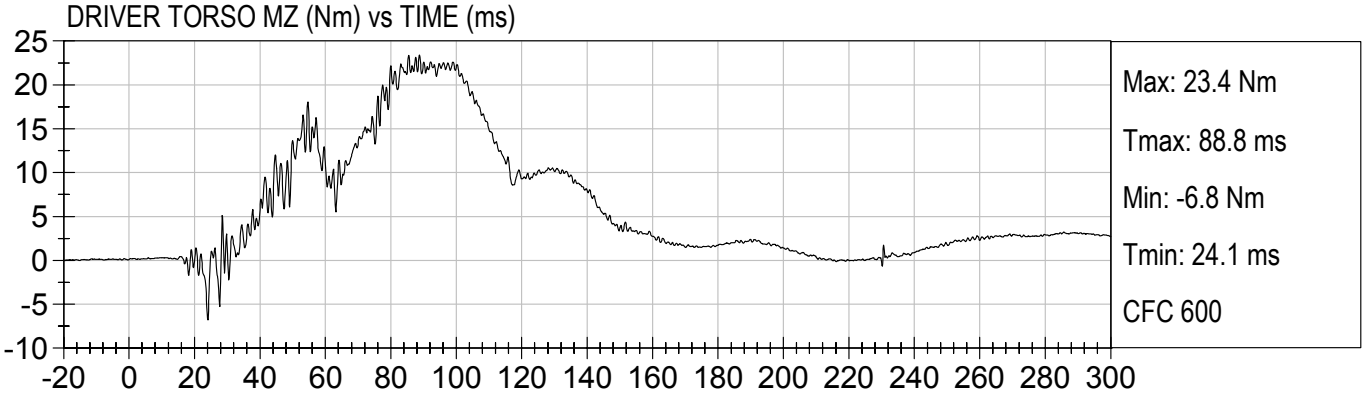
DRIVER TORSO FY (N) vs TIME (ms)



DRIVER TORSO MY (Nm) vs TIME (ms)

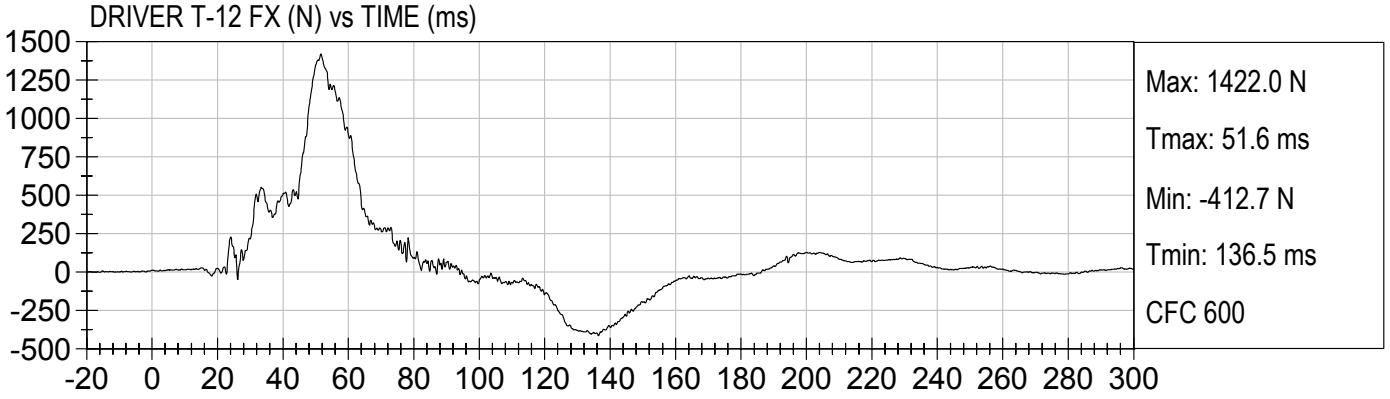


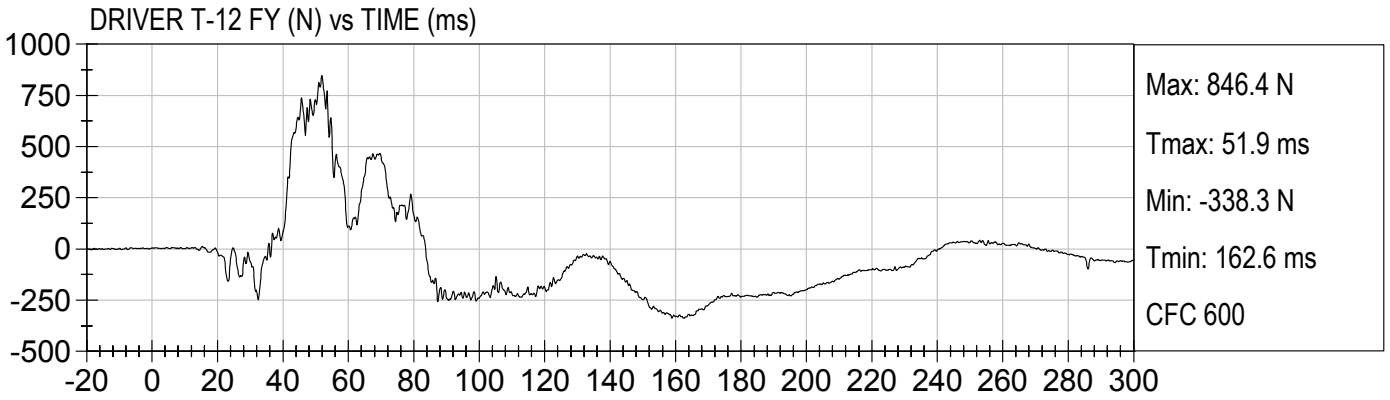
DRIVER TORSO MZ (Nm) vs TIME (ms)

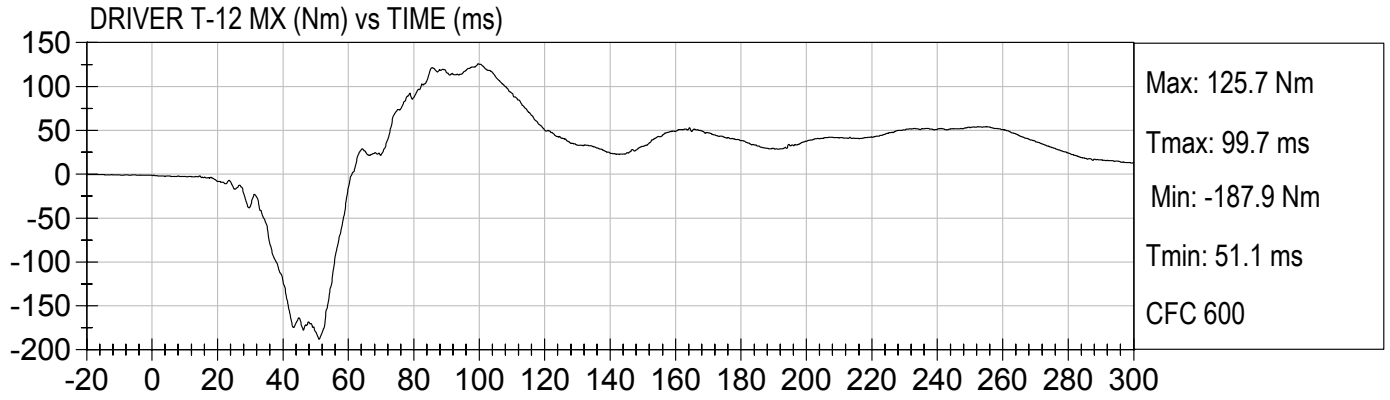


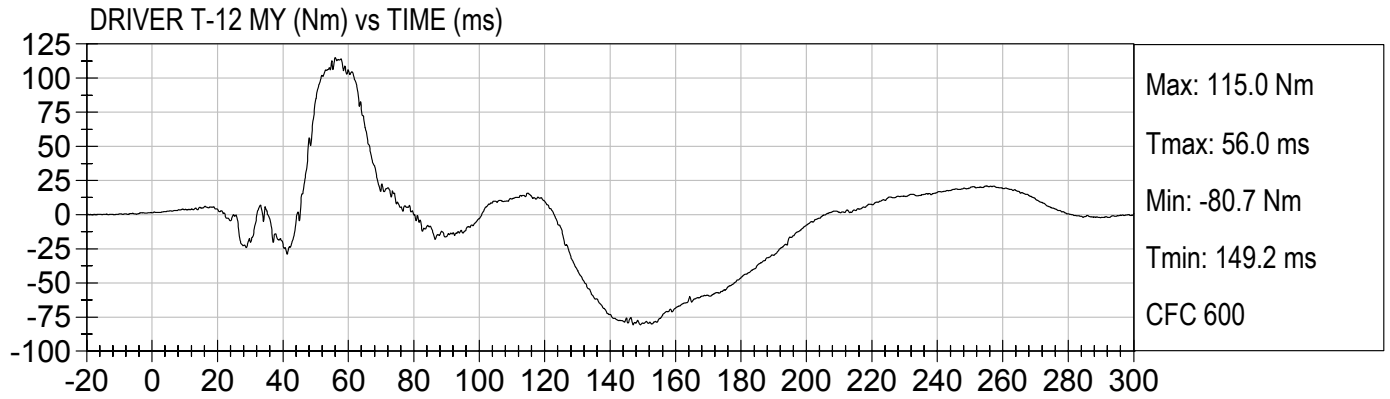
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)





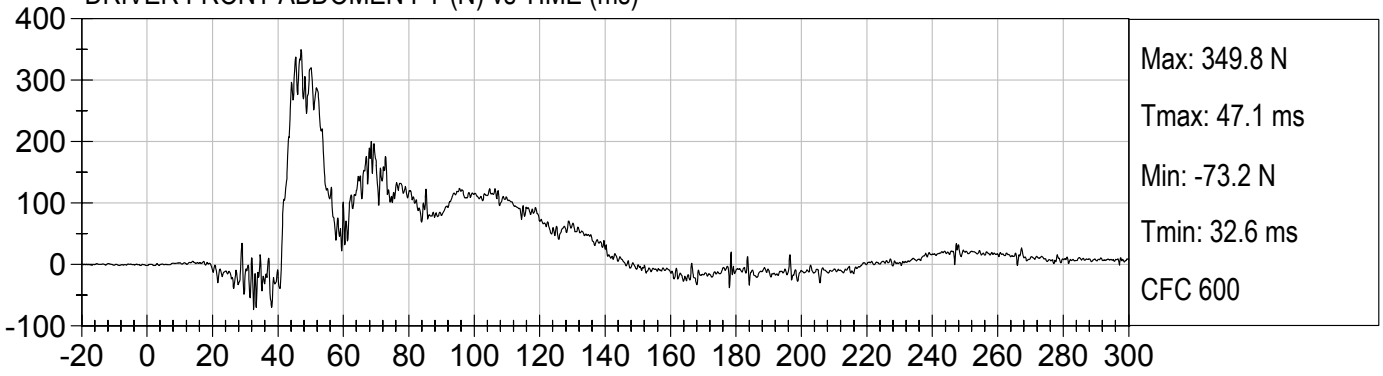




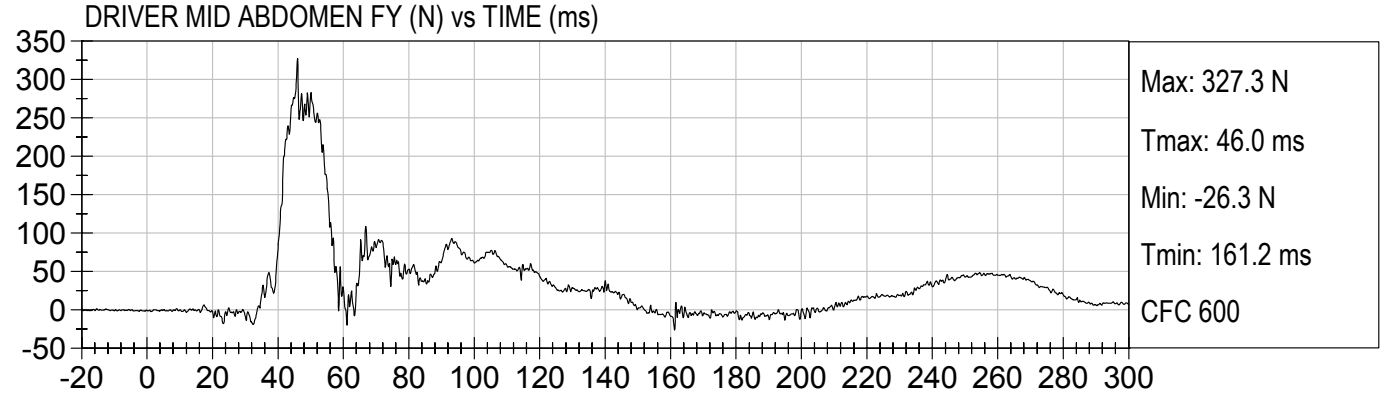
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

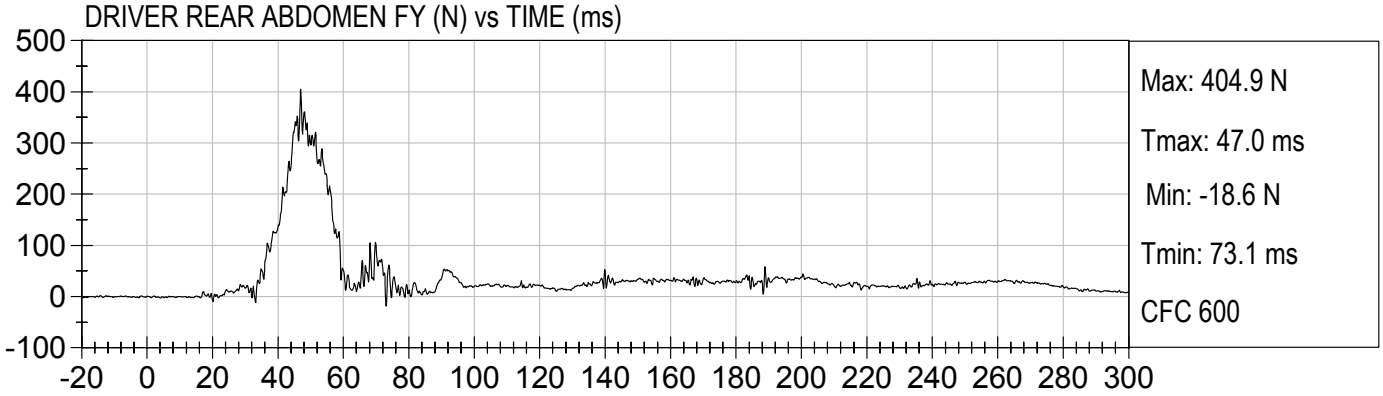
DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)



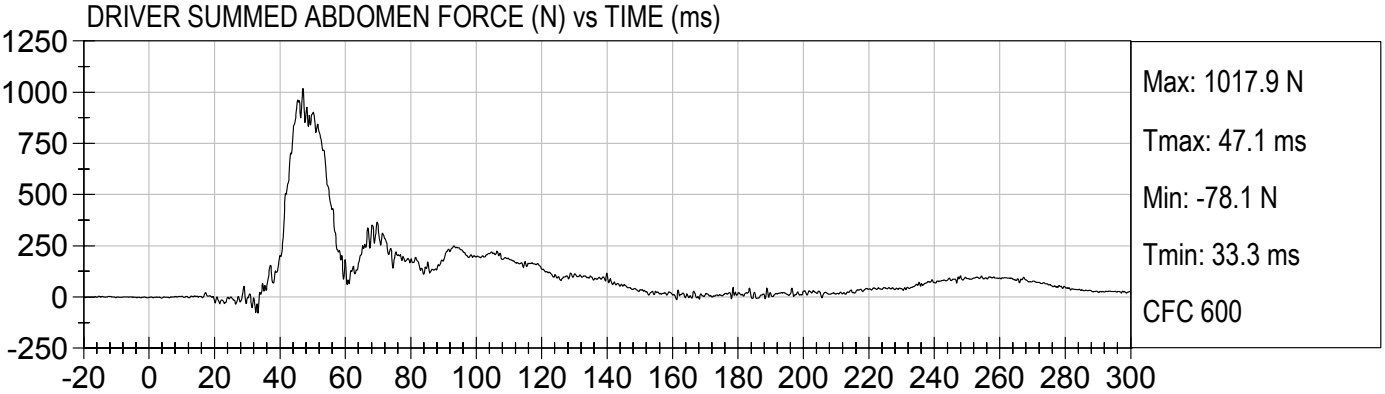
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



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



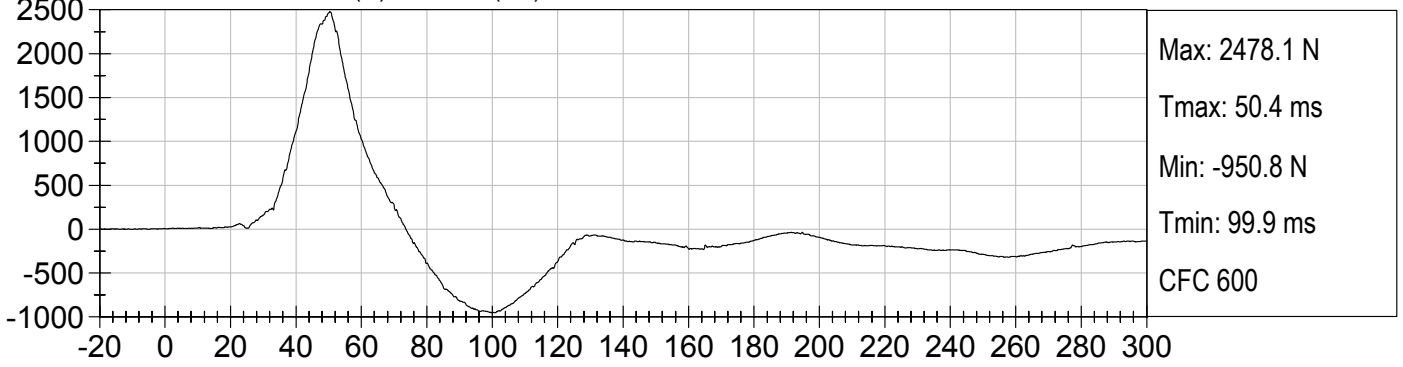
DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



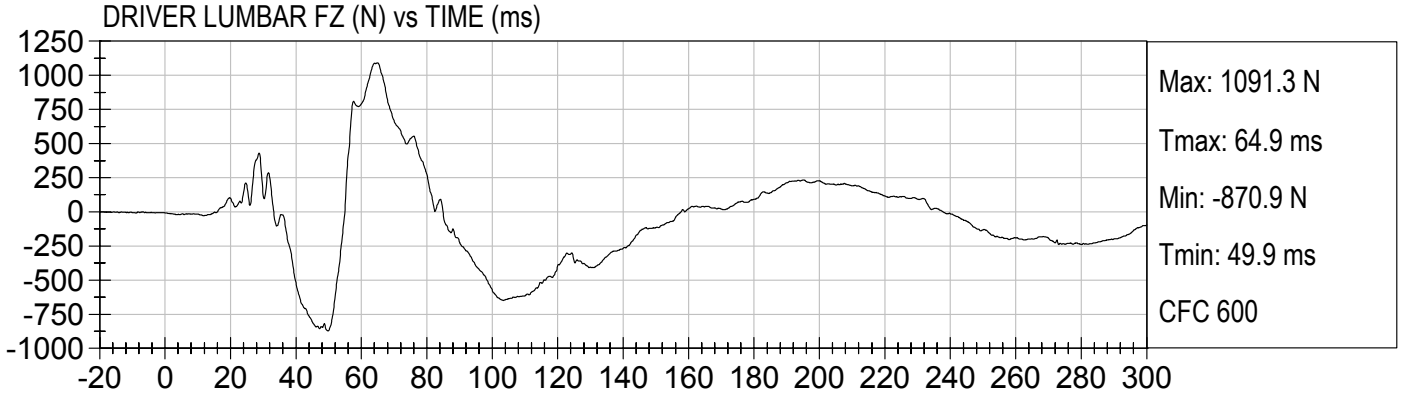
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

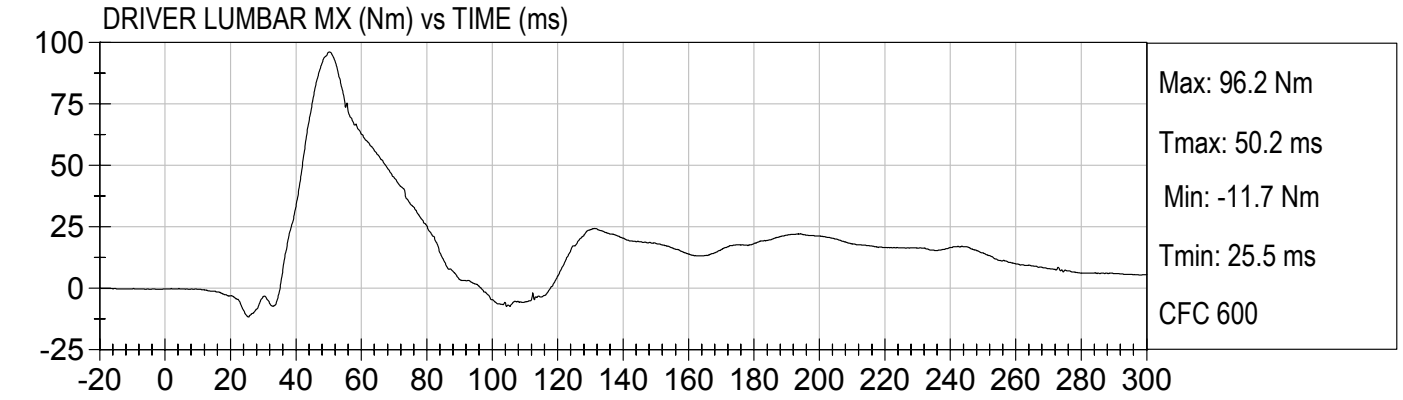
DRIVER LUMBAR FY (N) vs TIME (ms)



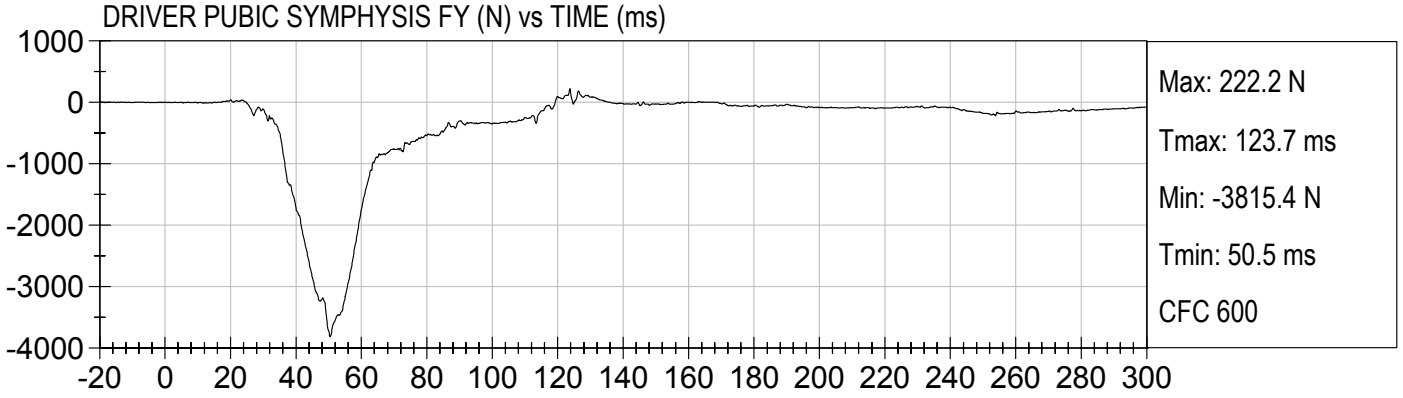
DRIVER LUMBAR FZ (N) vs TIME (ms)



DRIVER LUMBAR MX (Nm) vs TIME (ms)



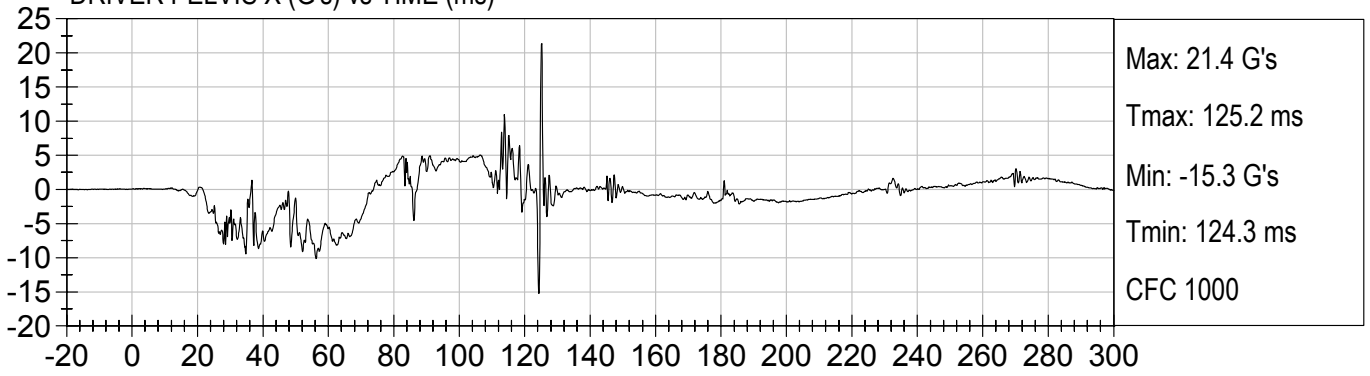
DRIVER PUBIC SYMPHYSIS FY (N) vs TIME (ms)



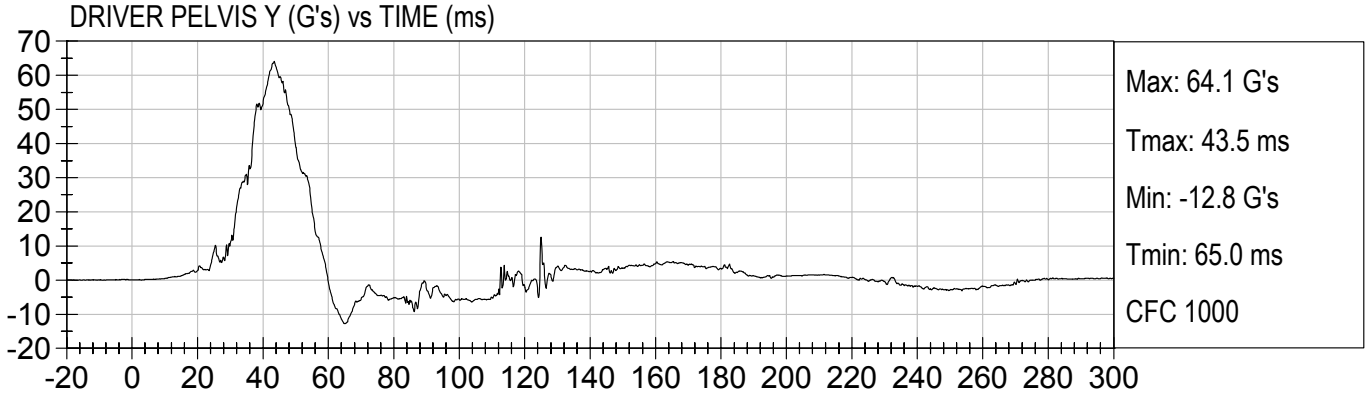
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

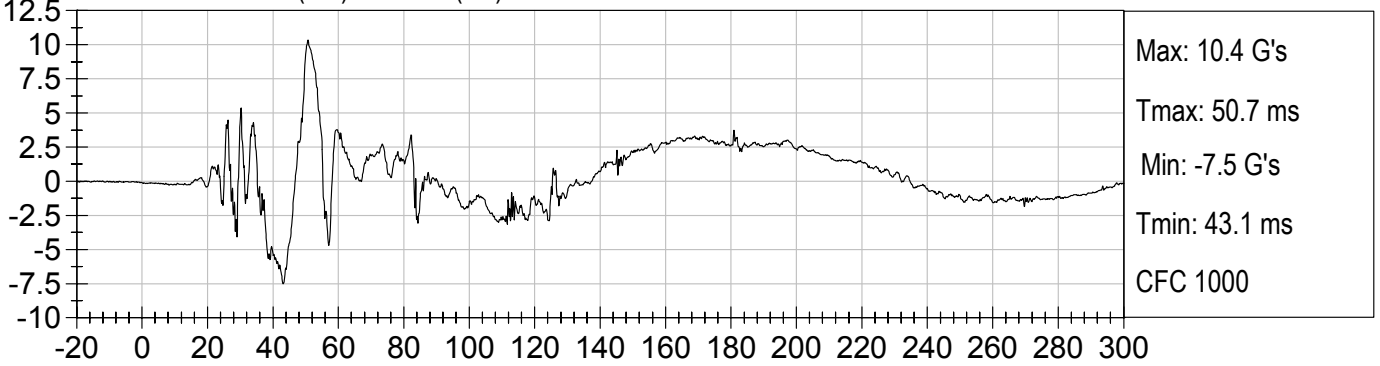
DRIVER PELVIS X (G's) vs TIME (ms)



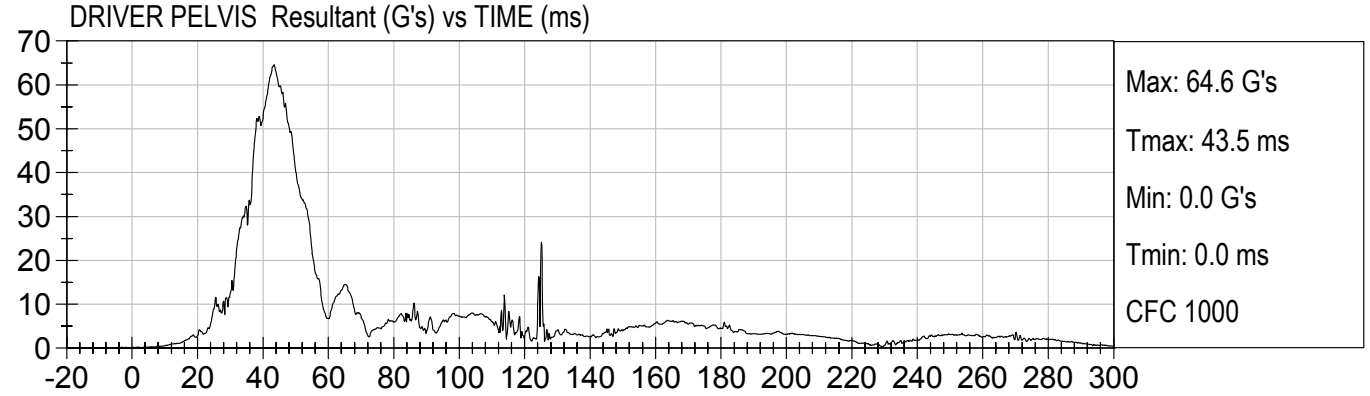
DRIVER PELVIS Y (G's) vs TIME (ms)

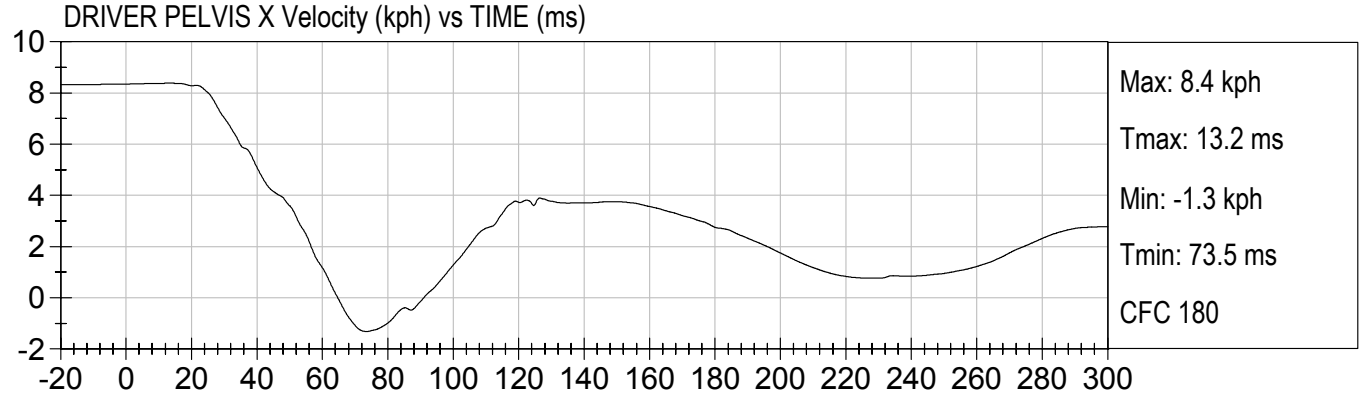


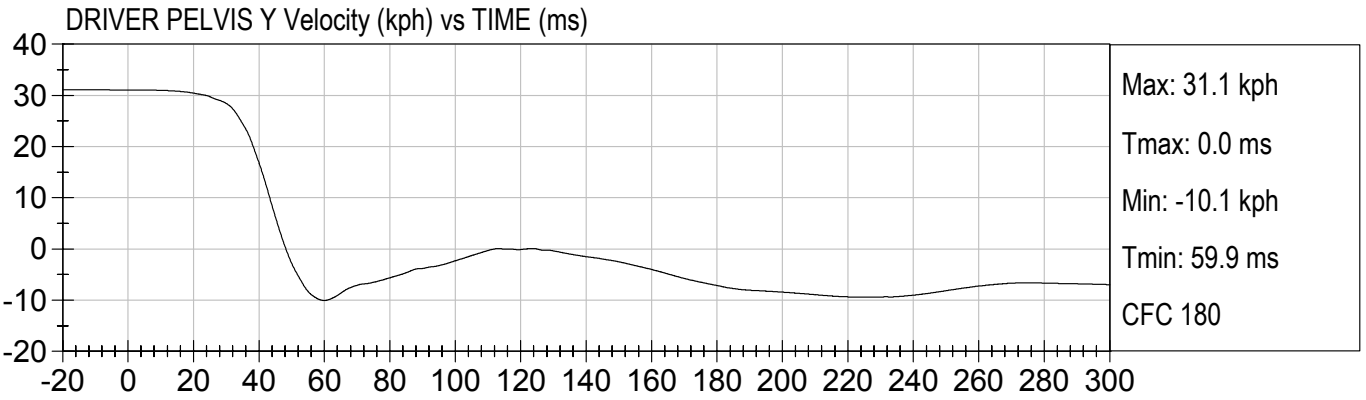
DRIVER PELVIS Z (G's) vs TIME (ms)

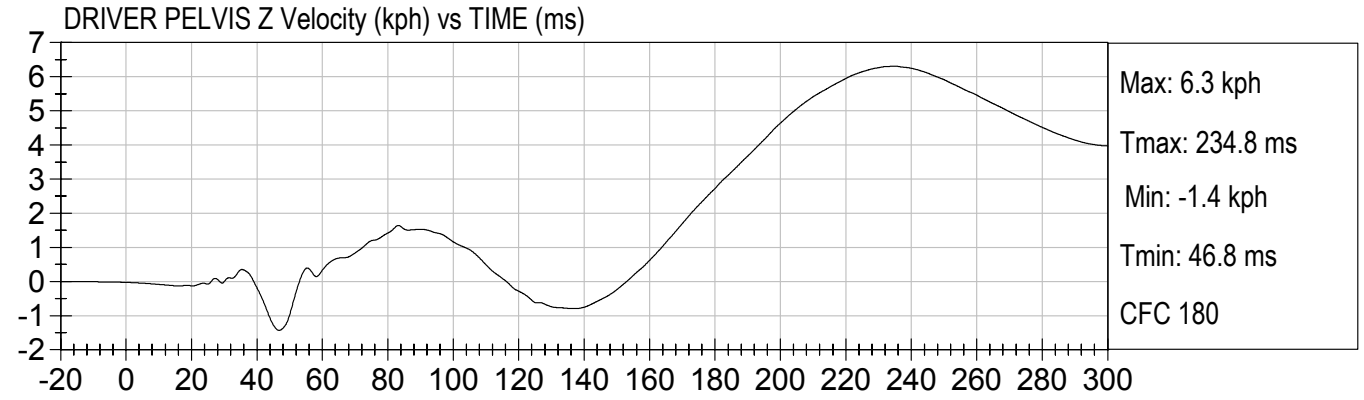


DRIVER PELVIS Resultant (G's) vs TIME (ms)

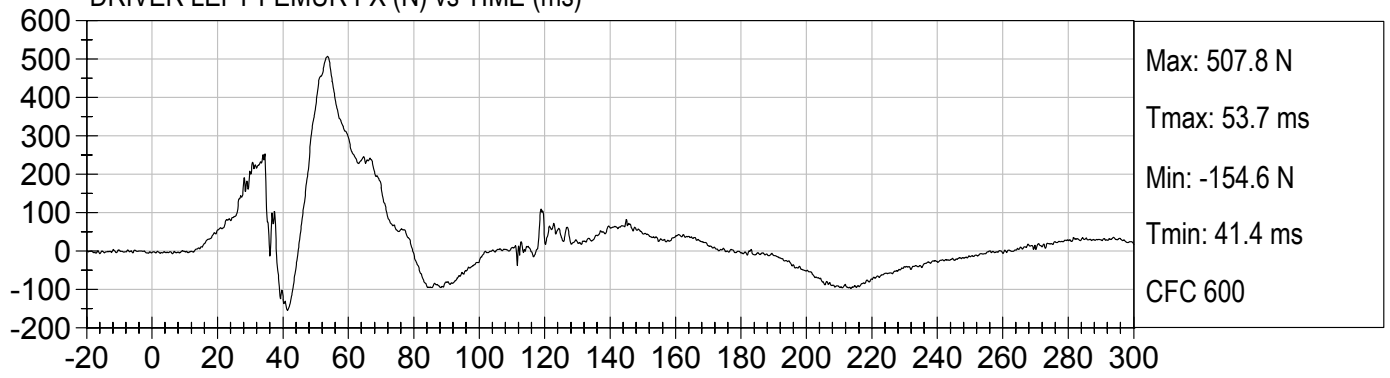



DRIVER PELVIS X Velocity (kph) vs TIME (ms)
Max: 8.4 kph
Tmax: 13.2 ms
Min: -1.3 kph
Tmin: 73.5 ms
CFC 180

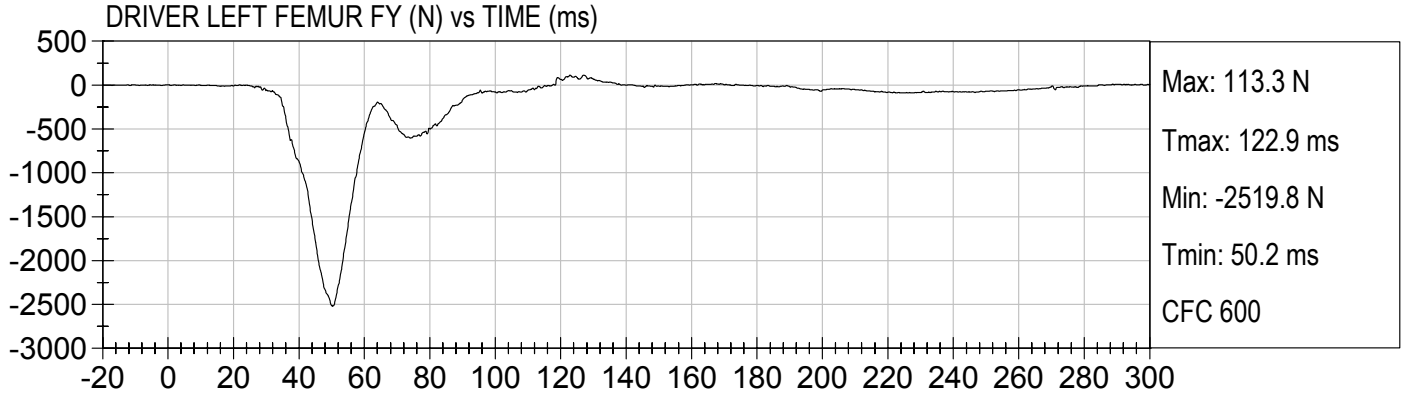

DRIVER PELVIS Y Velocity (kph) vs TIME (ms)
Max: 31.1 kph
Tmax: 0.0 ms
Min: -10.1 kph
Tmin: 59.9 ms
CFC 180


DRIVER PELVIS Z Velocity (kph) vs TIME (ms)
Max: 6.3 kph
Tmax: 234.8 ms
Min: -1.4 kph
Tmin: 46.8 ms
CFC 180

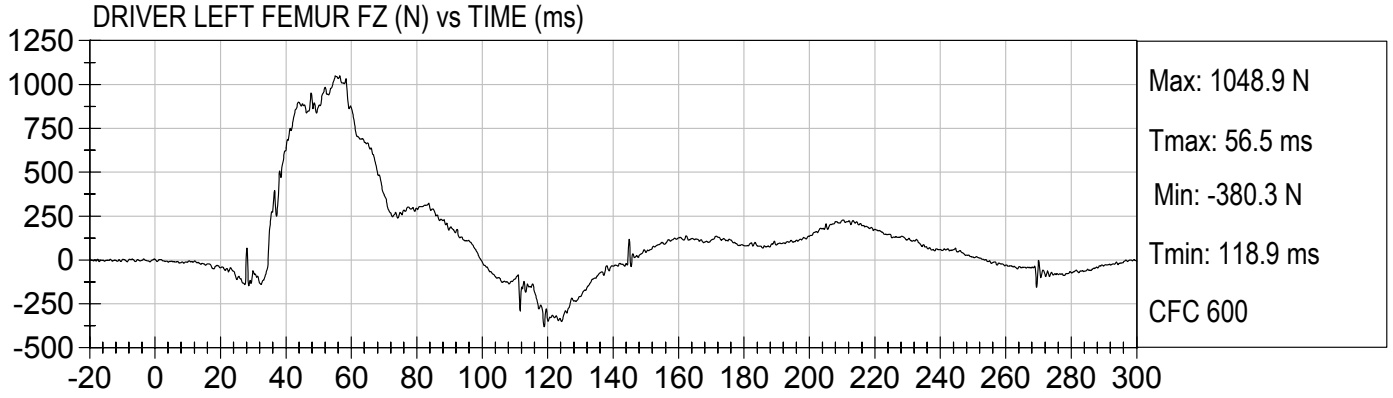
DRIVER LEFT FEMUR FX (N) vs TIME (ms)



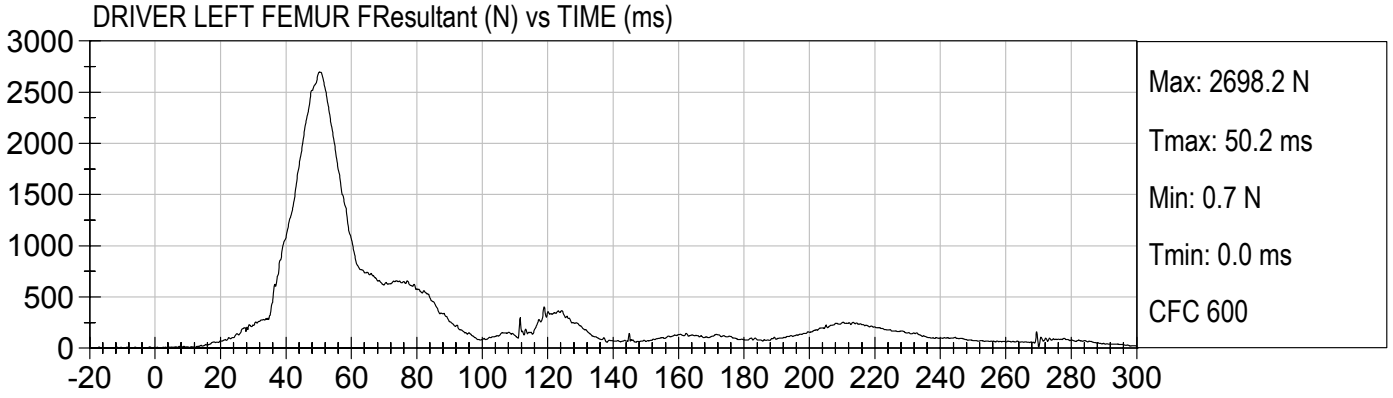
DRIVER LEFT FEMUR FY (N) vs TIME (ms)



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



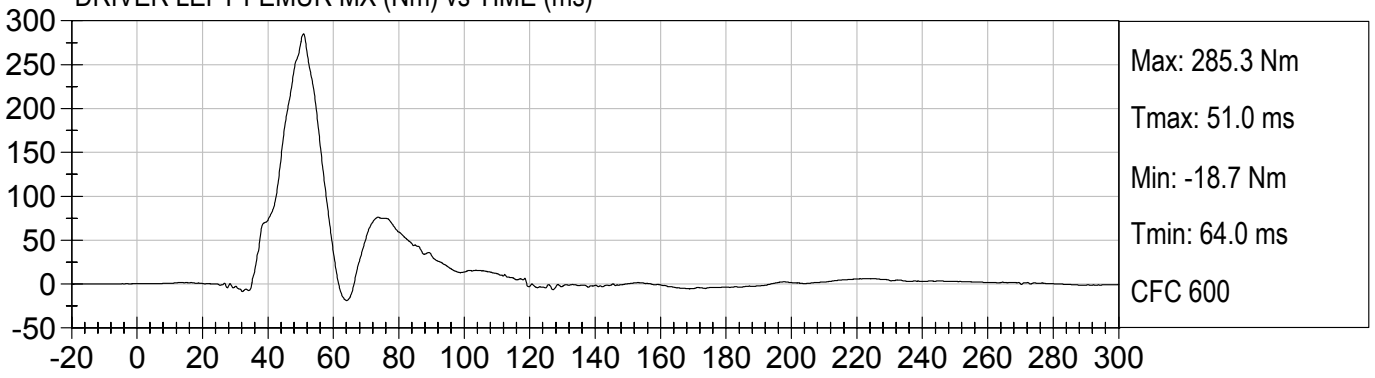
DRIVER LEFT FEMUR FResultant (N) vs TIME (ms)



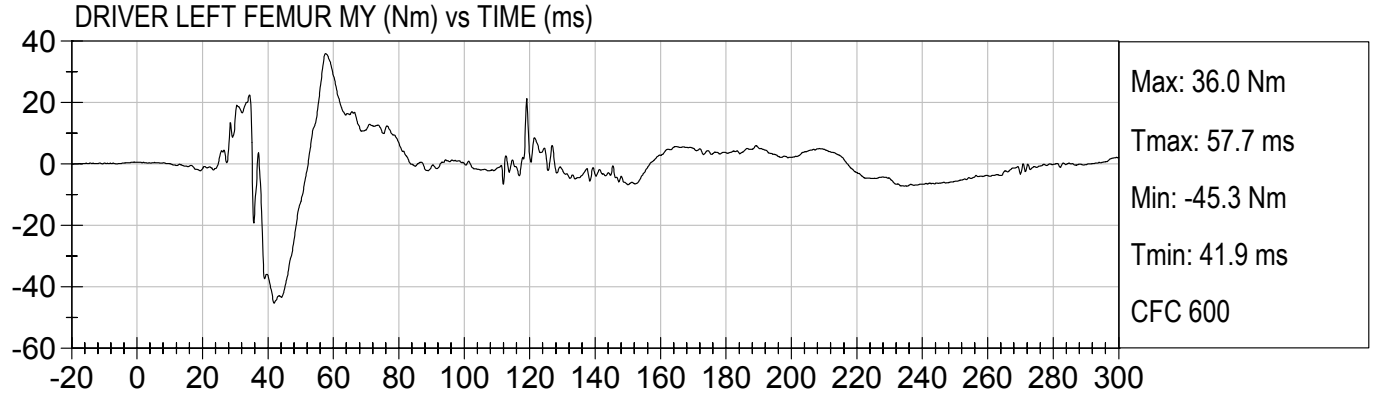
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

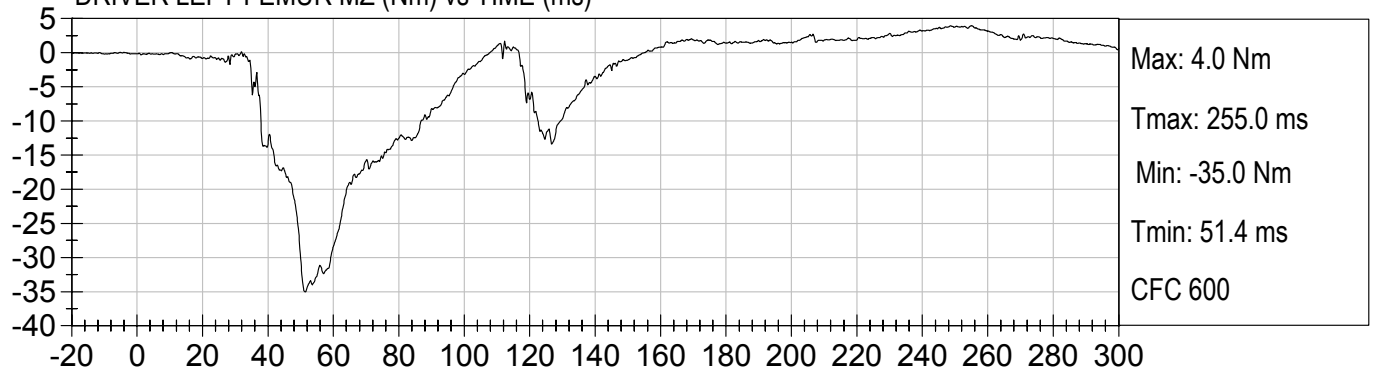
DRIVER LEFT FEMUR MX (Nm) vs TIME (ms)



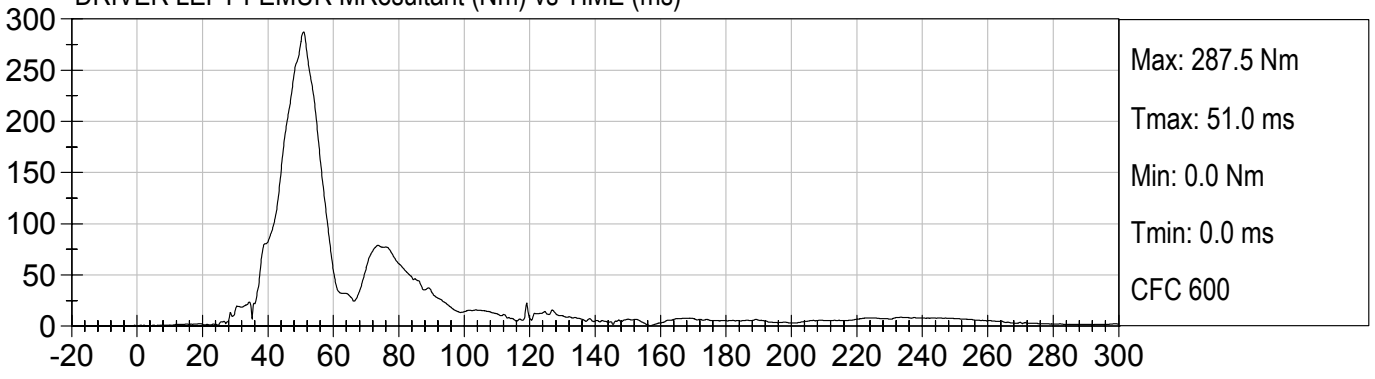
DRIVER LEFT FEMUR MY (Nm) vs TIME (ms)



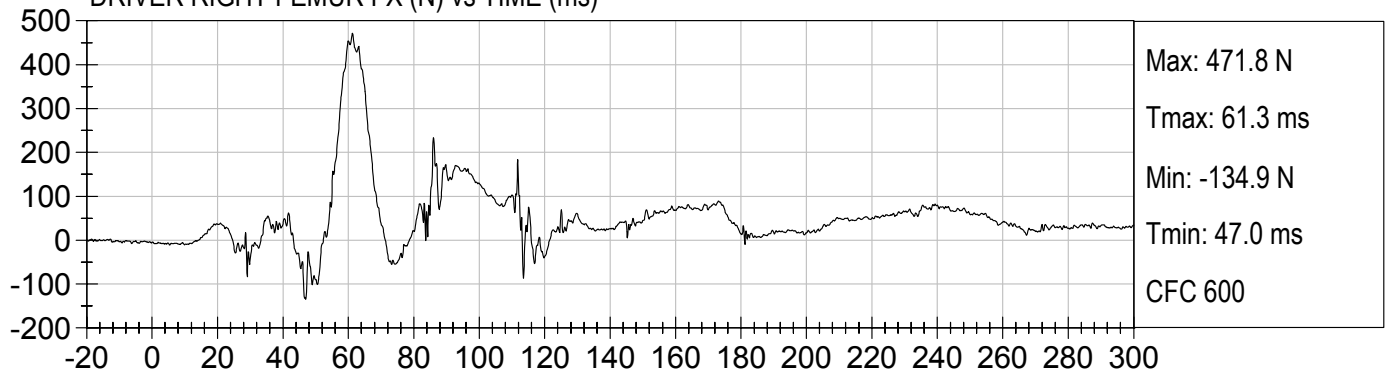
DRIVER LEFT FEMUR MZ (Nm) vs TIME (ms)



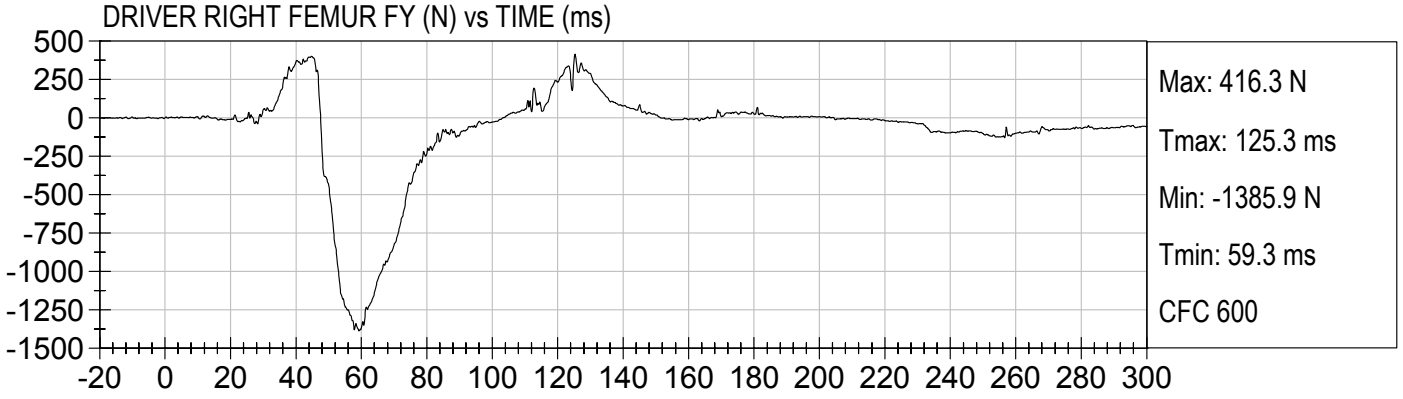
DRIVER LEFT FEMUR MResultant (Nm) vs TIME (ms)



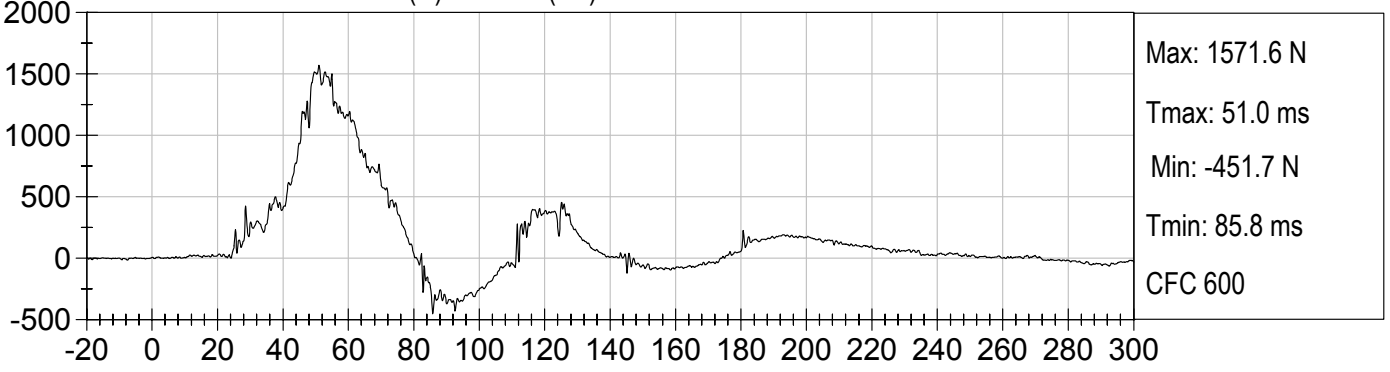
DRIVER RIGHT FEMUR FX (N) vs TIME (ms)



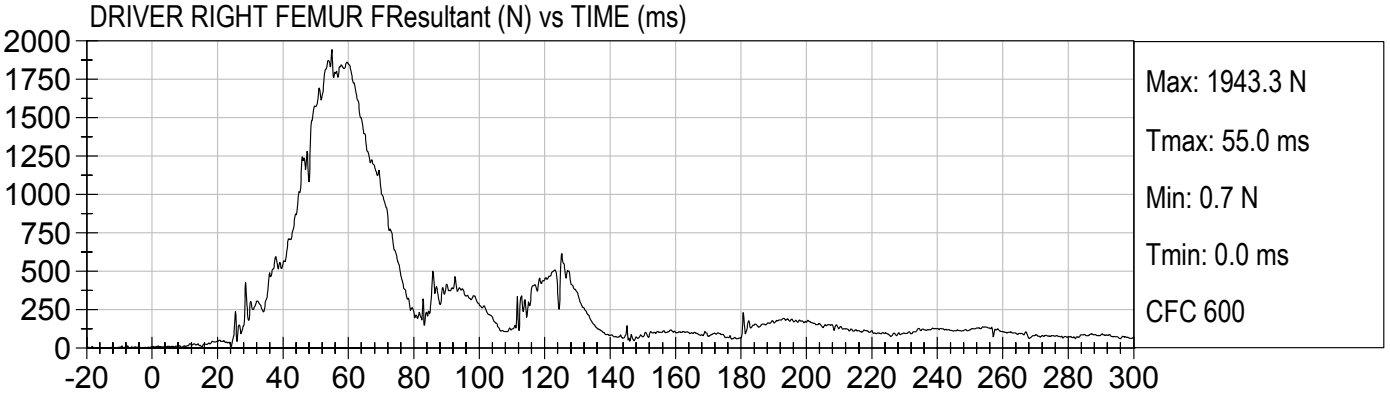
DRIVER RIGHT FEMUR FY (N) vs TIME (ms)

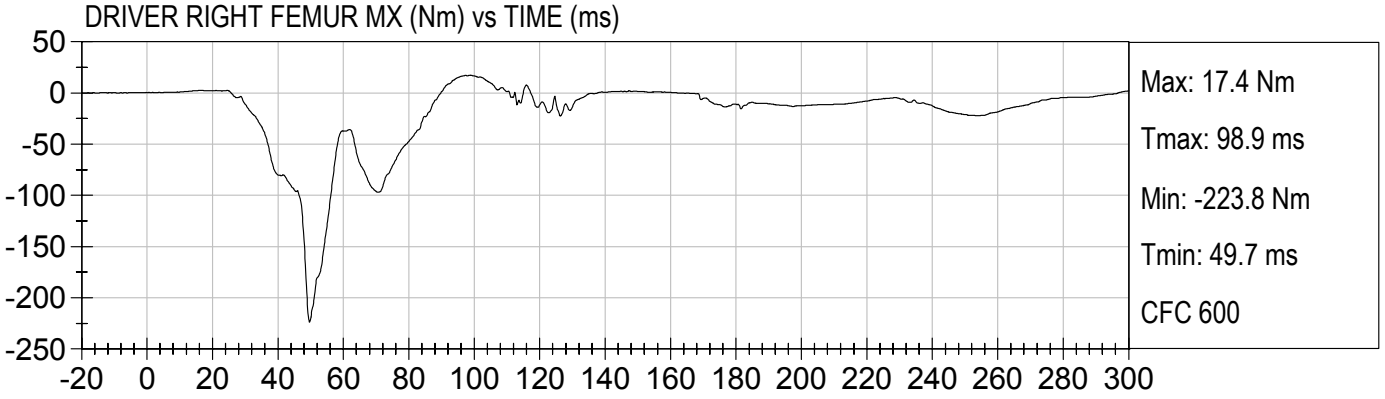


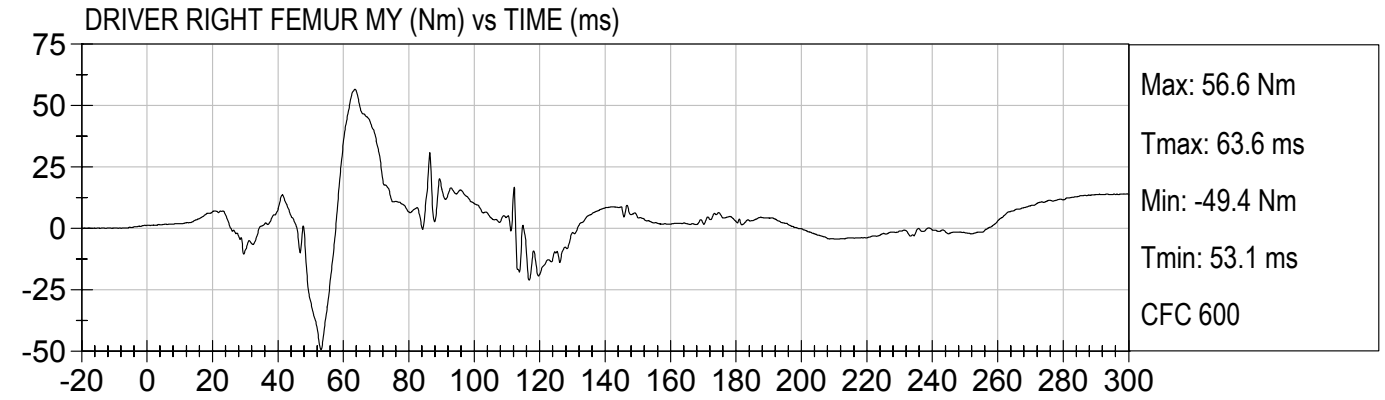
DRIVER RIGHT FEMUR FZ (N) vs TIME (ms)

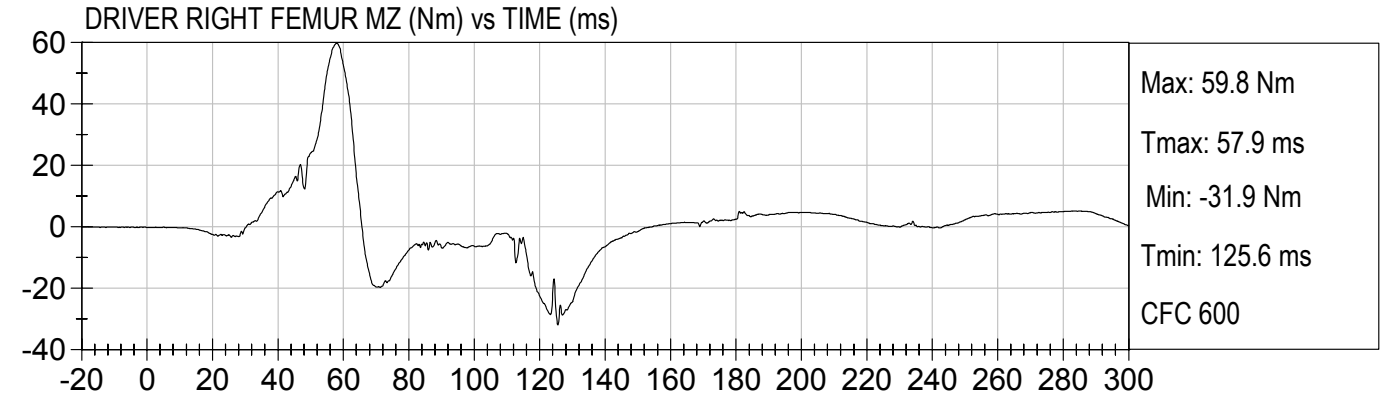


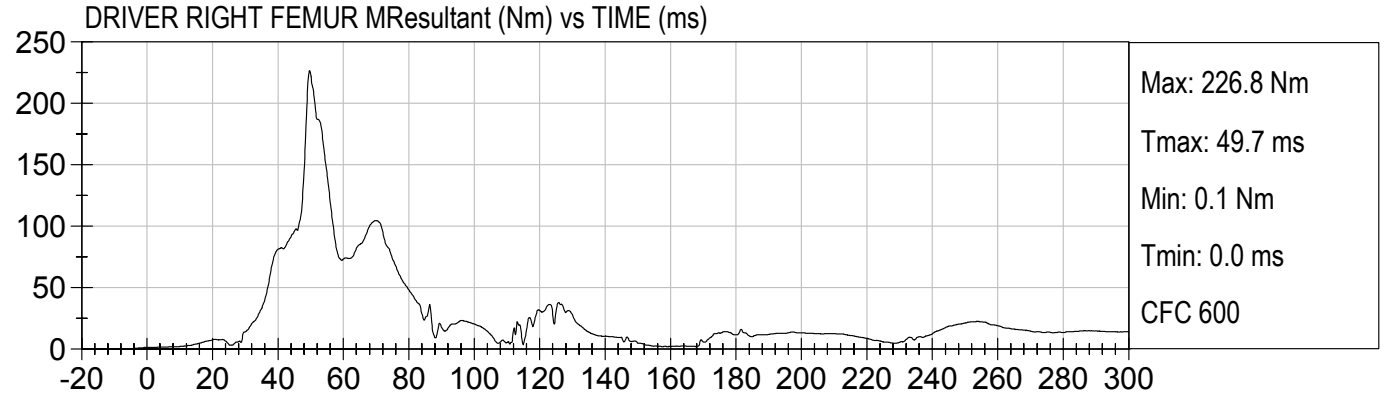
DRIVER RIGHT FEMUR FResultant (N) vs TIME (ms)




DRIVER RIGHT FEMUR MX (Nm) vs TIME (ms)
50
0
-50
-100
-150
-200
-250
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 17.4 Nm
Tmax: 98.9 ms
Min: -223.8 Nm
Tmin: 49.7 ms
CFC 600


DRIVER RIGHT FEMUR MY (Nm) vs TIME (ms)
75
50
25
0
-25
-50
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.6 Nm
Tmax: 63.6 ms
Min: -49.4 Nm
Tmin: 53.1 ms
CFC 600

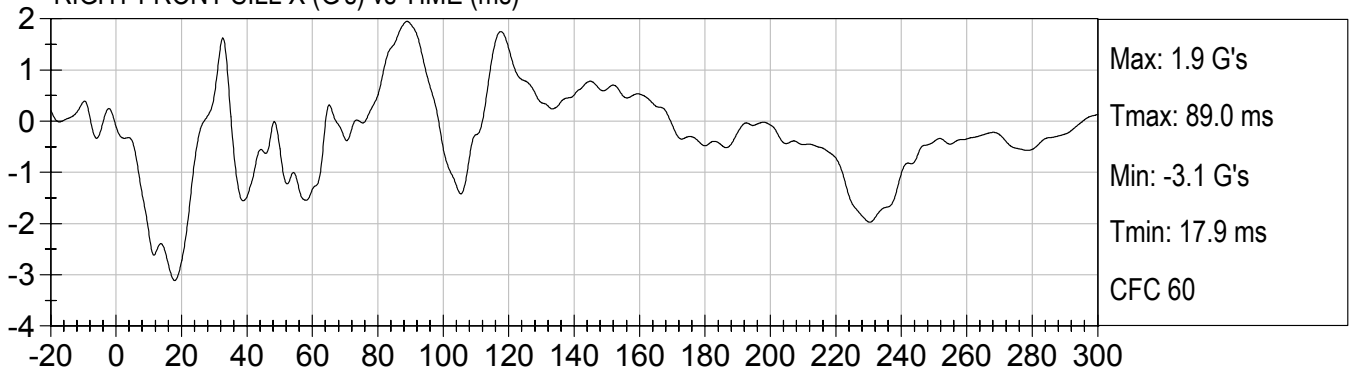

DRIVER RIGHT FEMUR MZ (Nm) vs TIME (ms)
60
40
20
0
-20
-40
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 59.8 Nm
Tmax: 57.9 ms
Min: -31.9 Nm
Tmin: 125.6 ms
CFC 600


DRIVER RIGHT FEMUR MResultant (Nm) vs TIME (ms)
250
200
150
100
50
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 226.8 Nm
Tmax: 49.7 ms
Min: 0.1 Nm
Tmin: 0.0 ms
CFC 600

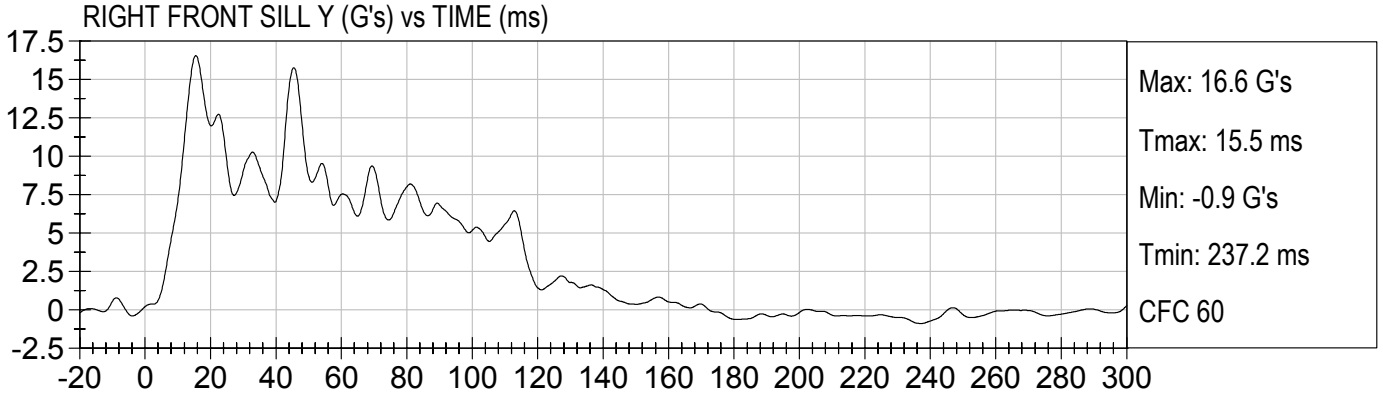
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

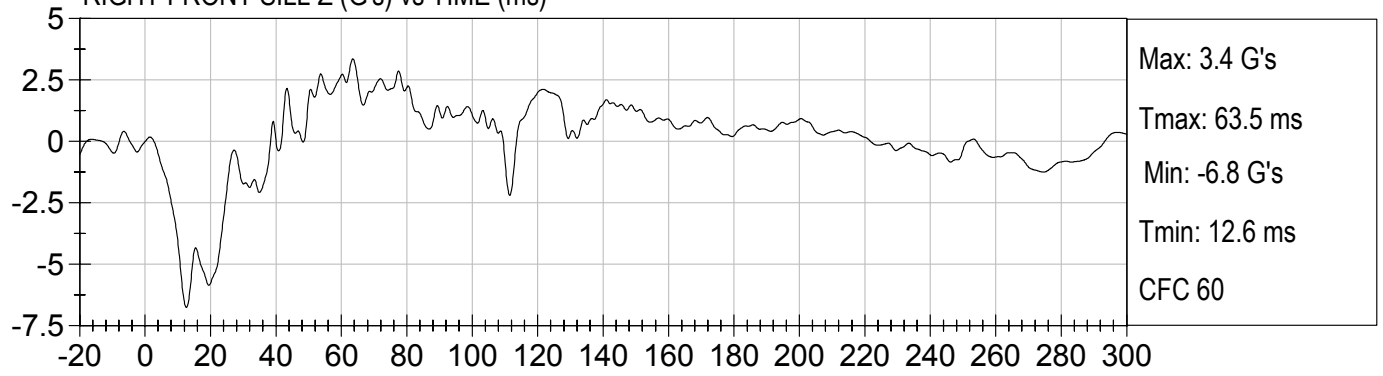
RIGHT FRONT SILL X (G's) vs TIME (ms)



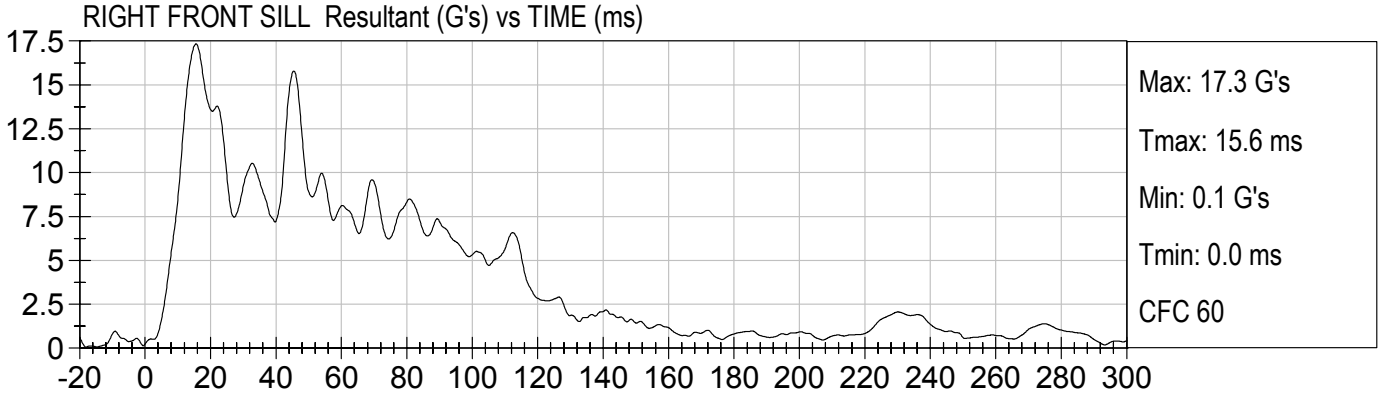
RIGHT FRONT SILL Y (G's) vs TIME (ms)

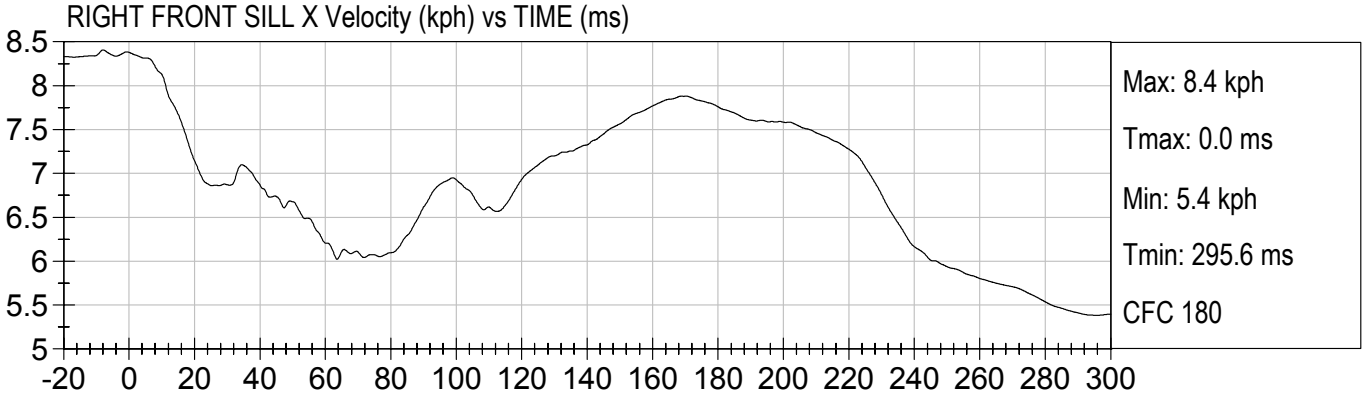


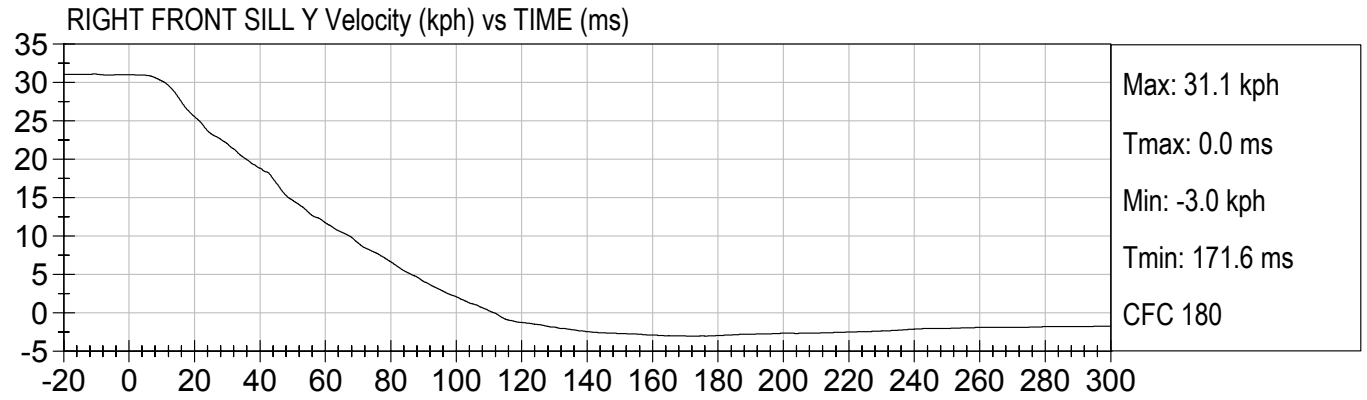
RIGHT FRONT SILL Z (G's) vs TIME (ms)

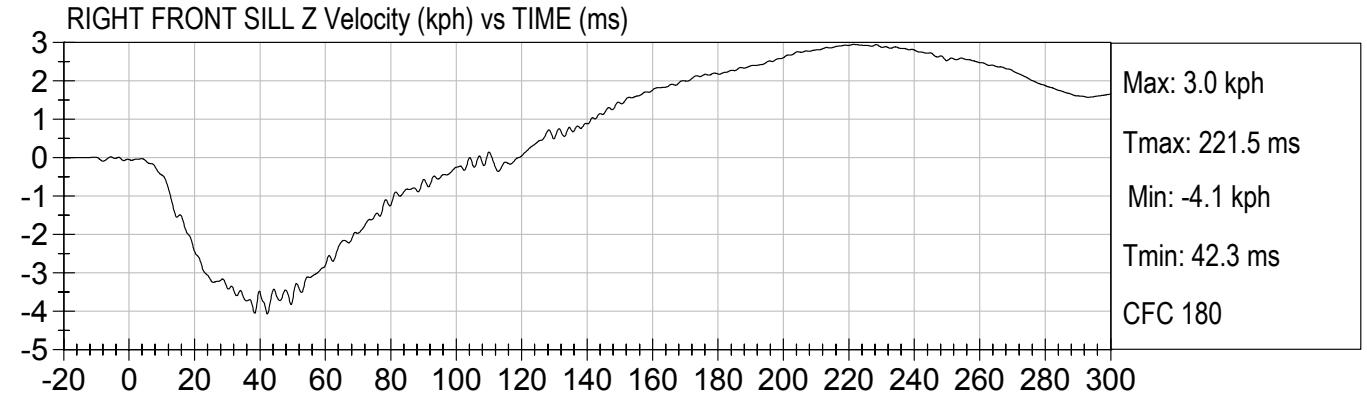


RIGHT FRONT SILL Resultant (G's) vs TIME (ms)




RIGHT FRONT SILL X Velocity (kph) vs TIME (ms)
8.5
8
7.5
7
6.5
6
5.5
5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 0.0 ms
Min: 5.4 kph
Tmin: 295.6 ms
CFC 180

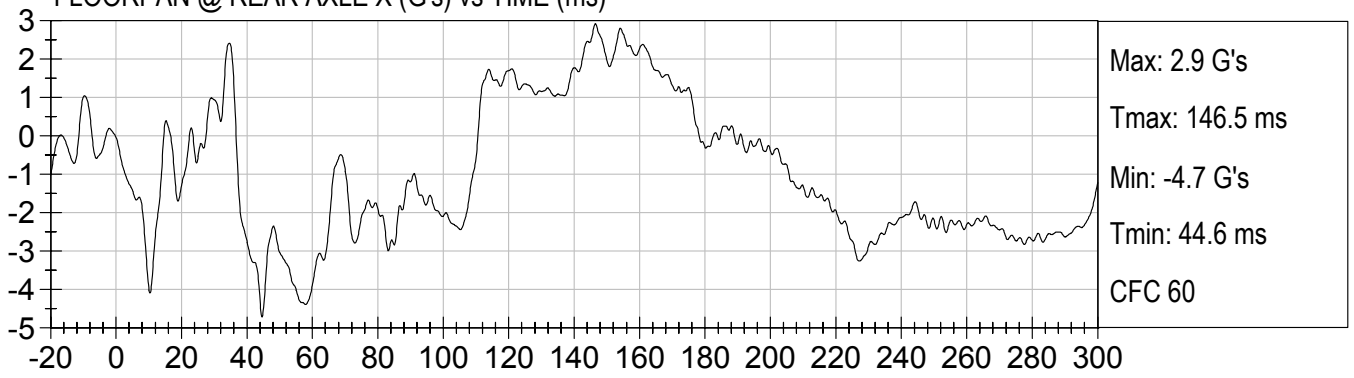

RIGHT FRONT SILL Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 0.0 ms
Min: -3.0 kph
Tmin: 171.6 ms
CFC 180


RIGHT FRONT SILL Z Velocity (kph) vs TIME (ms)
3
2
1
0
-1
-2
-3
-4
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 3.0 kph
Tmax: 221.5 ms
Min: -4.1 kph
Tmin: 42.3 ms
CFC 180

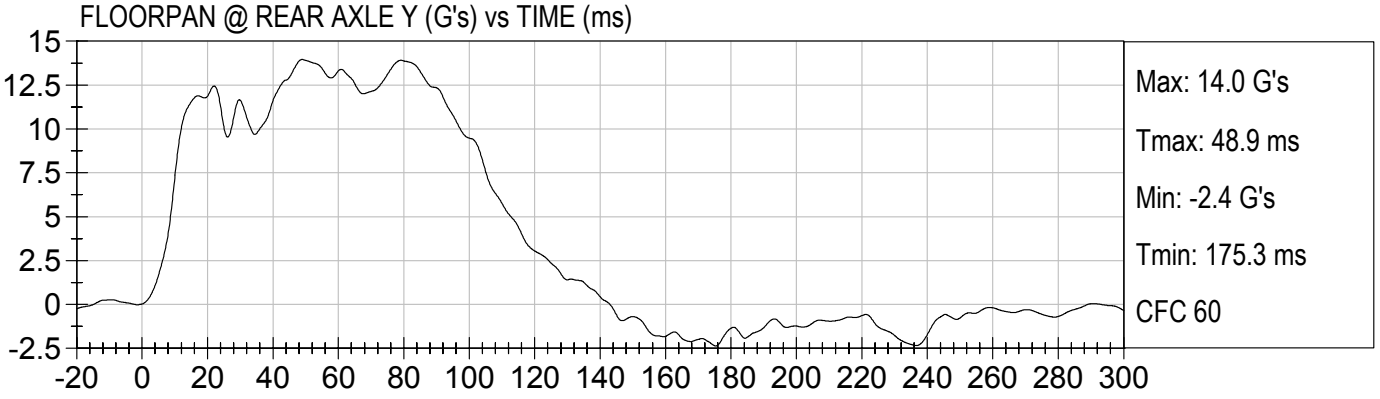
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

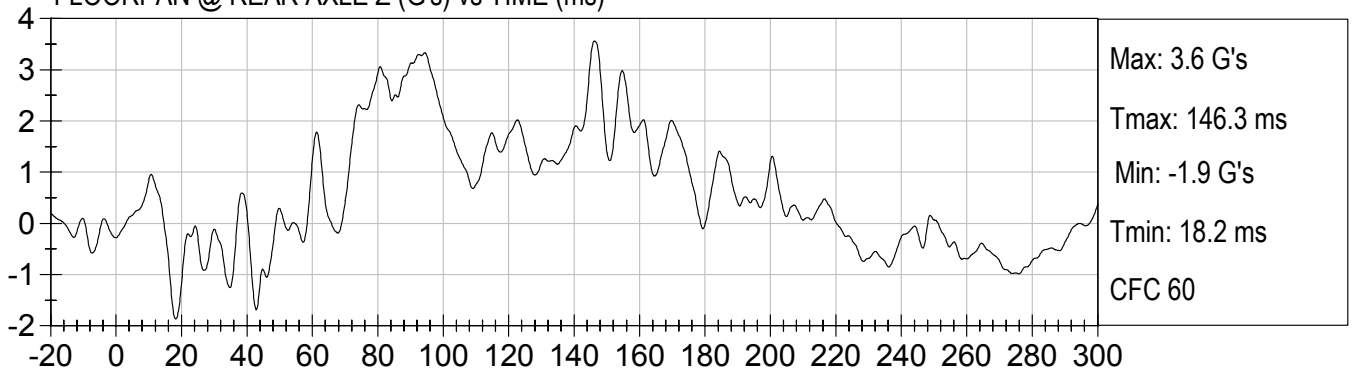
FLOORPAN @ REAR AXLE X (G's) vs TIME (ms)



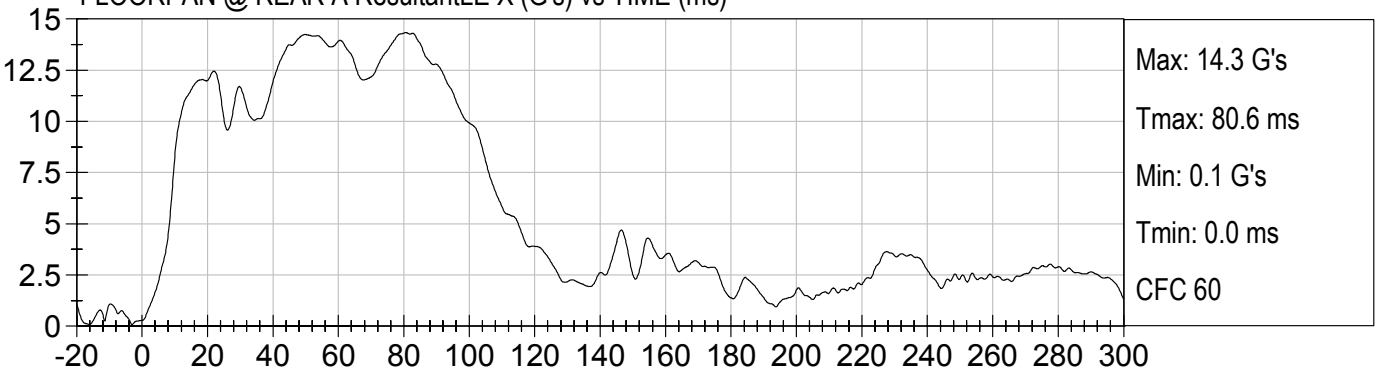
FLOORPAN @ REAR AXLE Y (G's) vs TIME (ms)

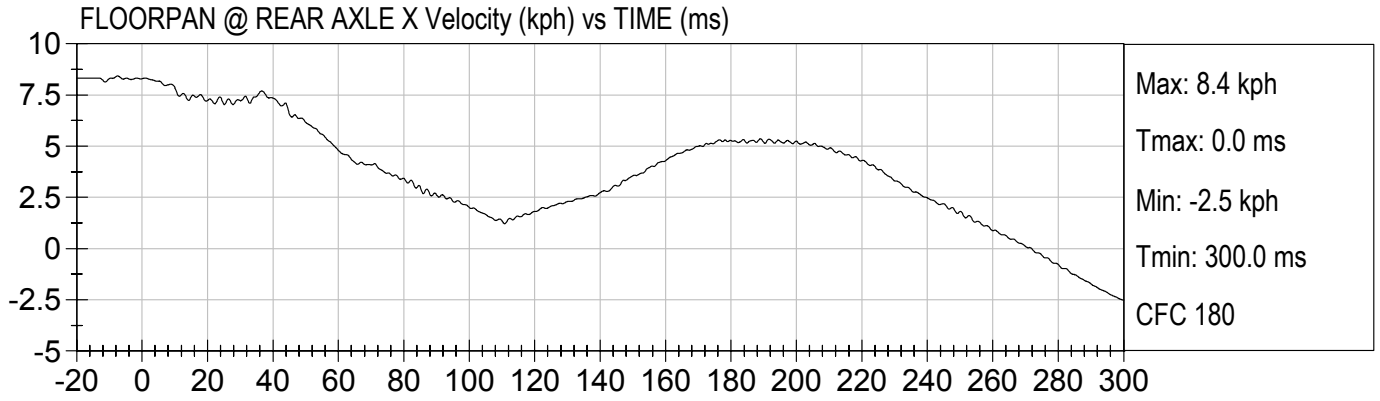


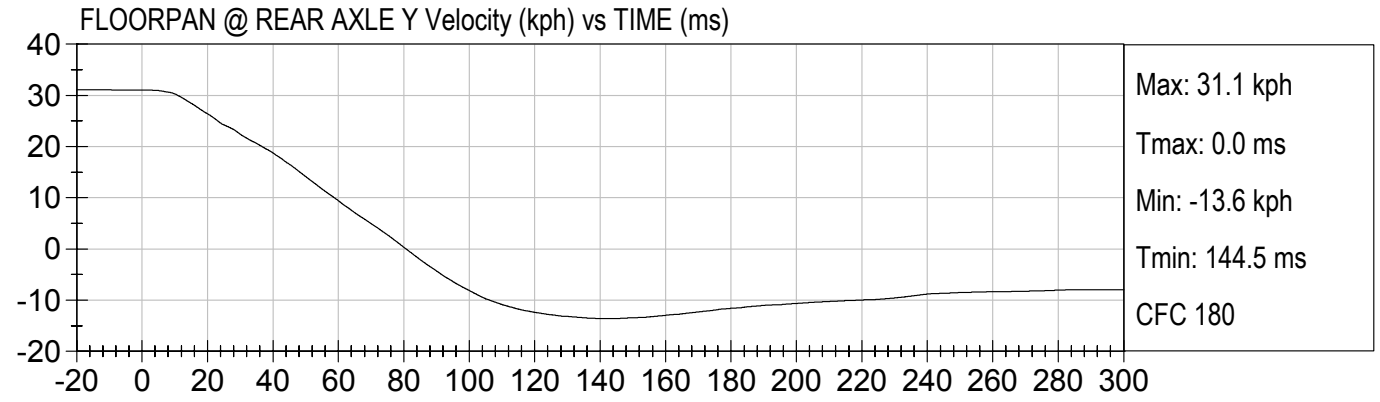
FLOORPAN @ REAR AXLE Z (G's) vs TIME (ms)

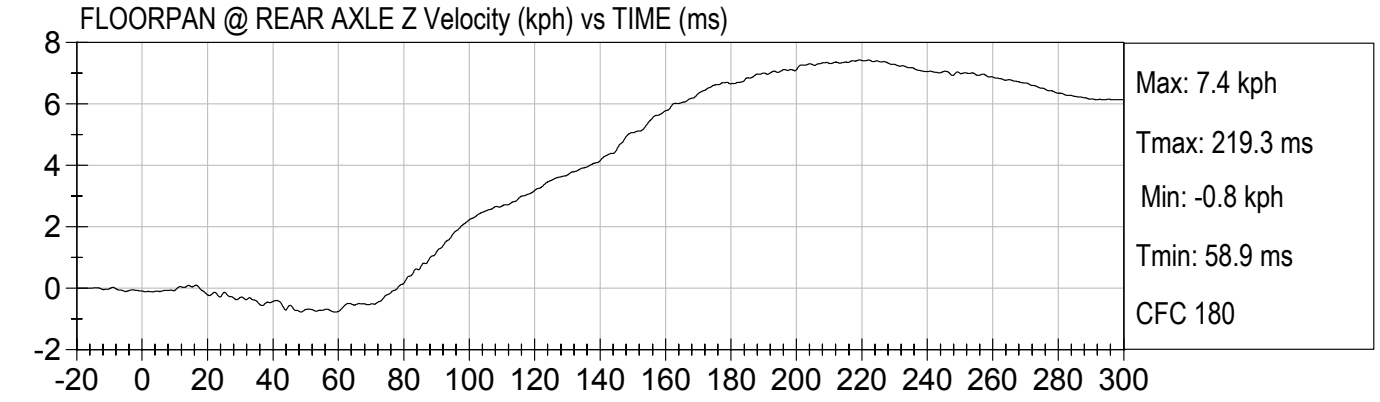


FLOORPAN @ REAR A ResultantLE X (G's) vs TIME (ms)



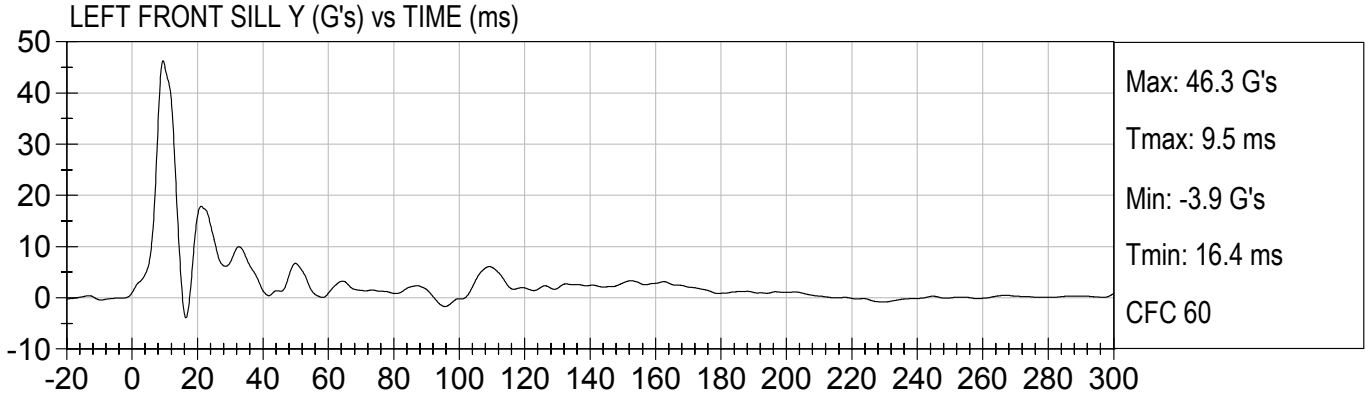

FLOORPAN @ REAR AXLE X Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 0.0 ms
Min: -2.5 kph
Tmin: 300.0 ms
CFC 180

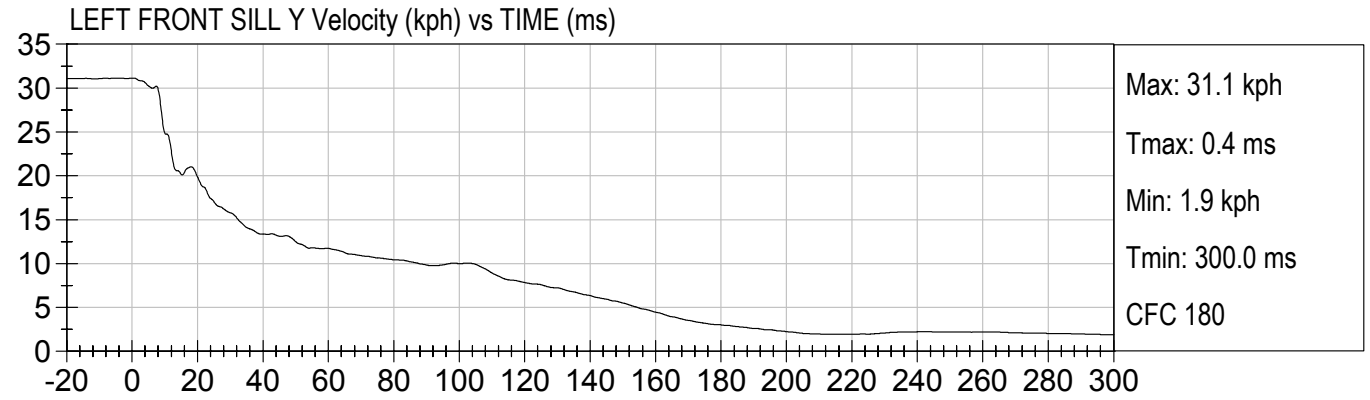

FLOORPAN @ REAR AXLE Y Velocity (kph) vs TIME (ms)
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 0.0 ms
Min: -13.6 kph
Tmin: 144.5 ms
CFC 180

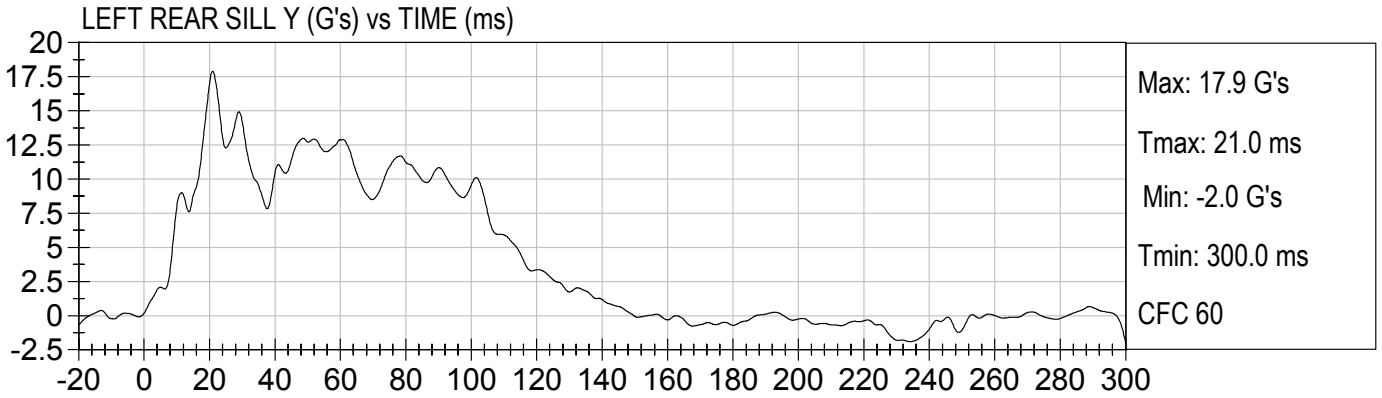

FLOORPAN @ REAR AXLE Z Velocity (kph) vs TIME (ms)
8
6
4
2
0
-2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 7.4 kph
Tmax: 219.3 ms
Min: -0.8 kph
Tmin: 58.9 ms
CFC 180

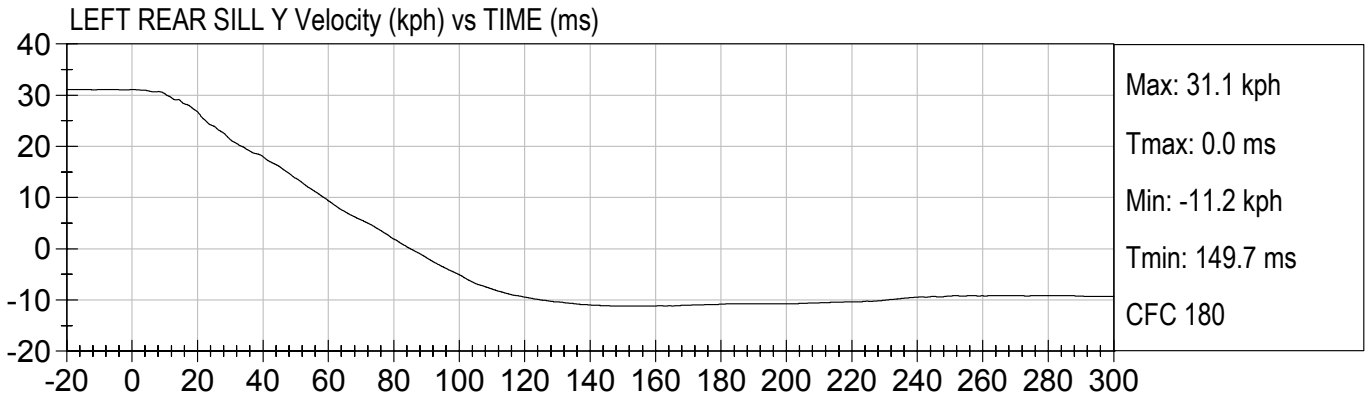
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)





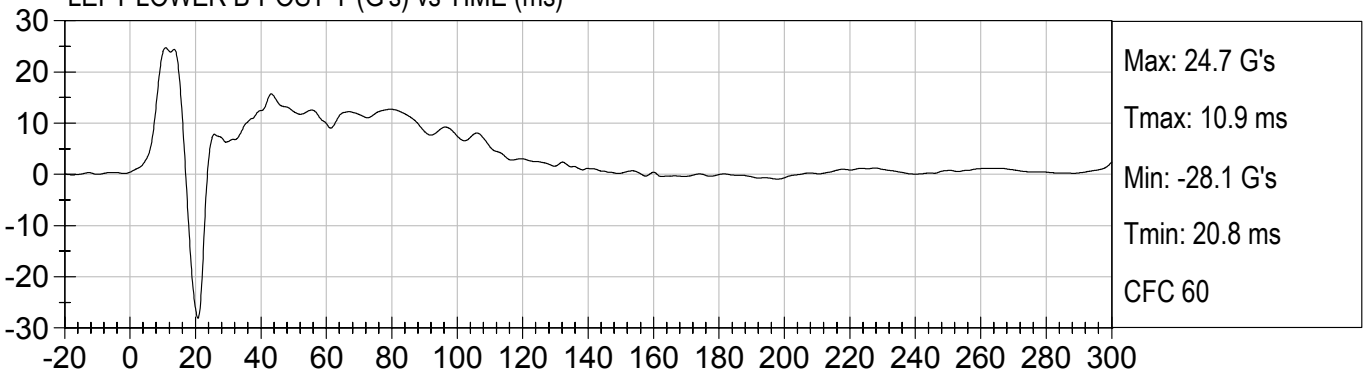




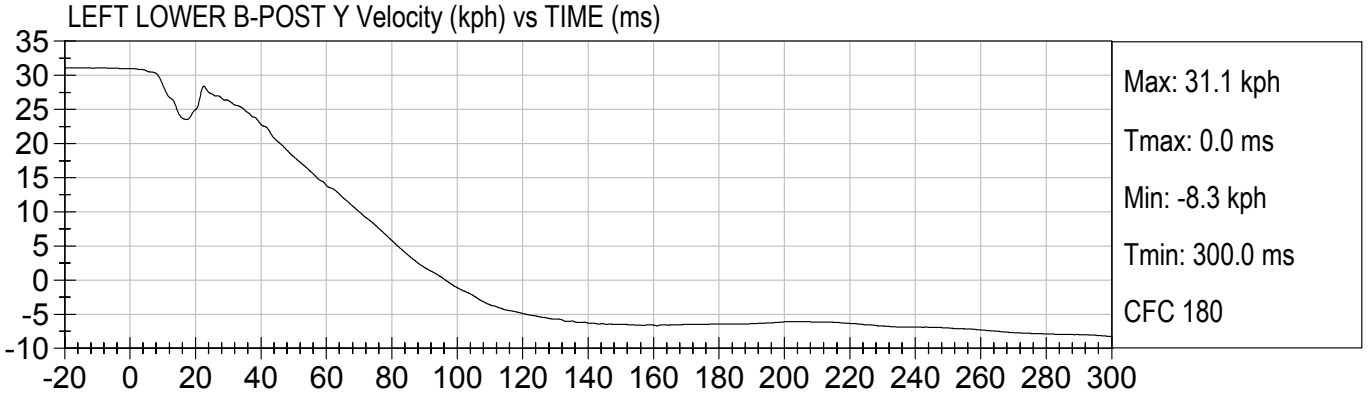
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

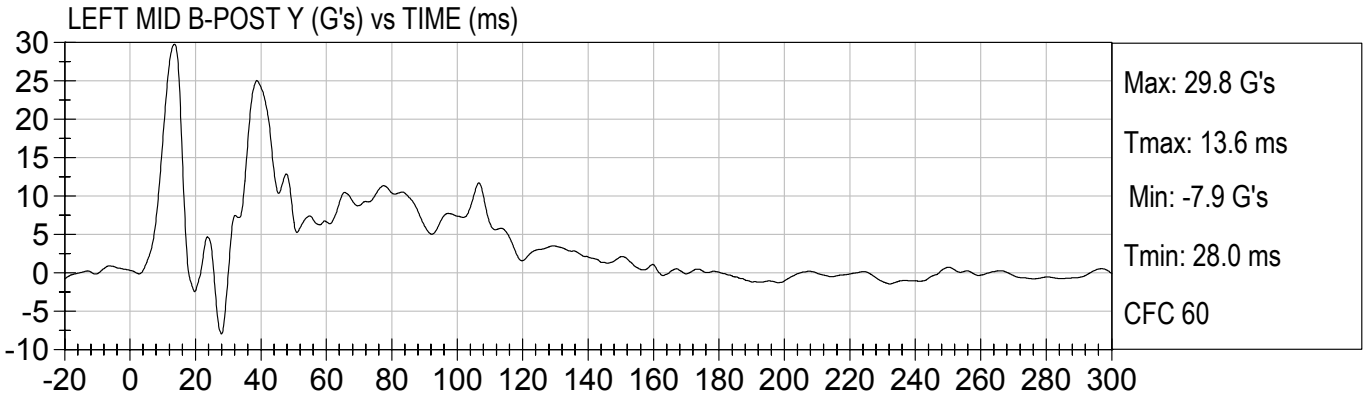
LEFT LOWER B-POST Y (G's) vs TIME (ms)



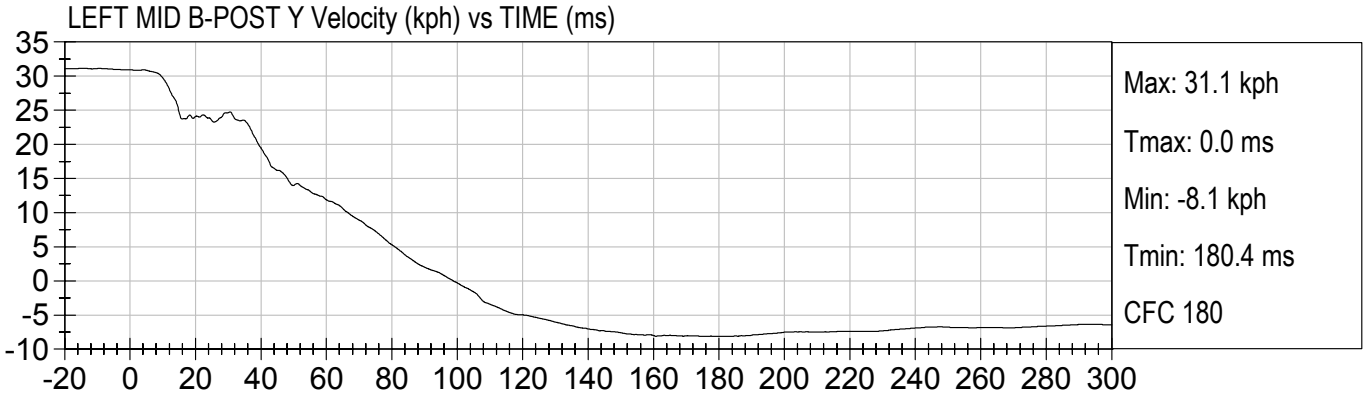
LEFT LOWER B-POST Y Velocity (kph) vs TIME (ms)

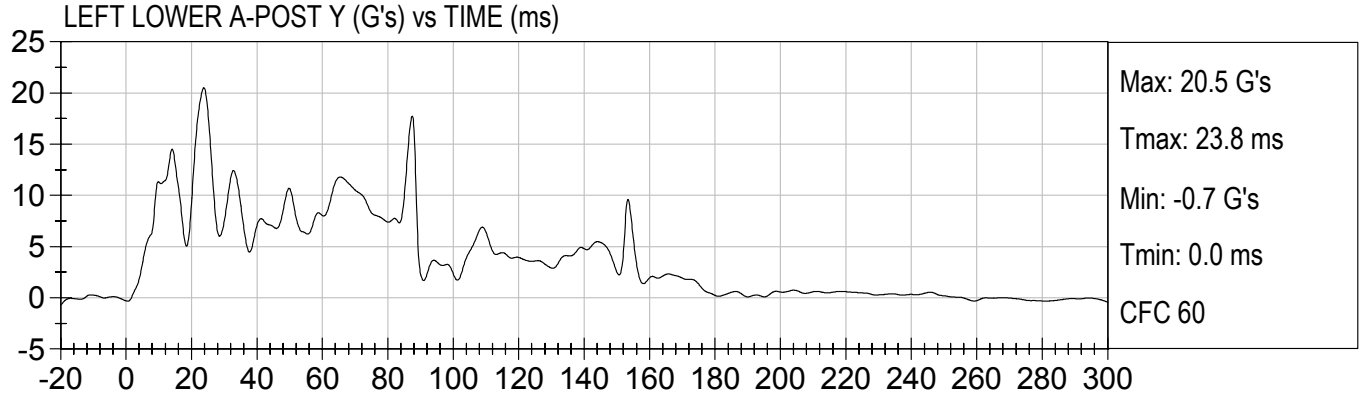


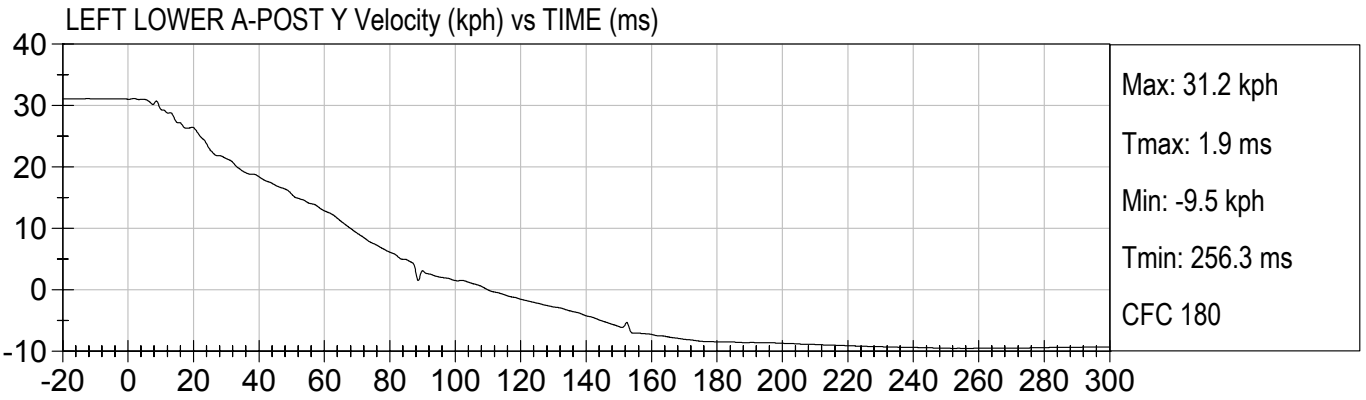
LEFT MID B-POST Y (G's) vs TIME (ms)

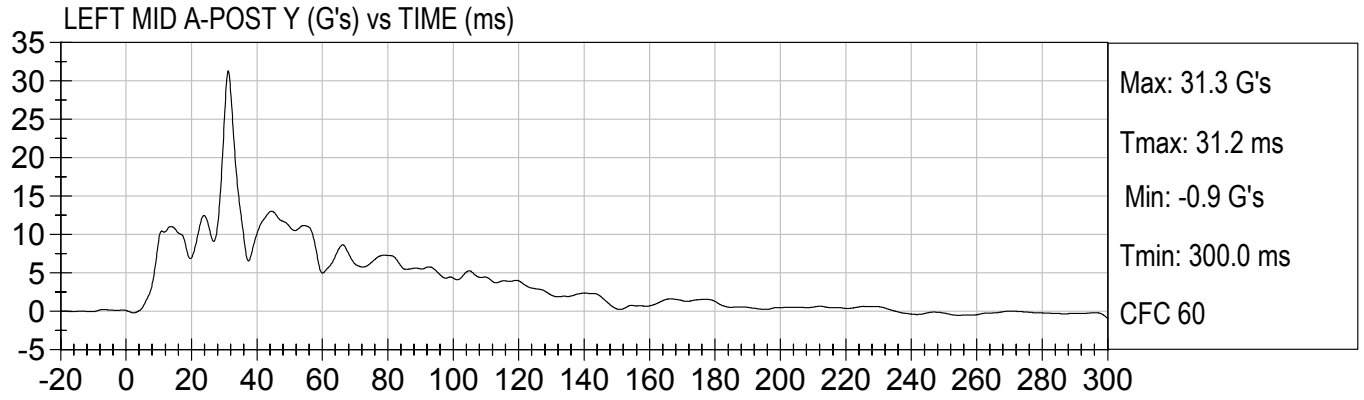


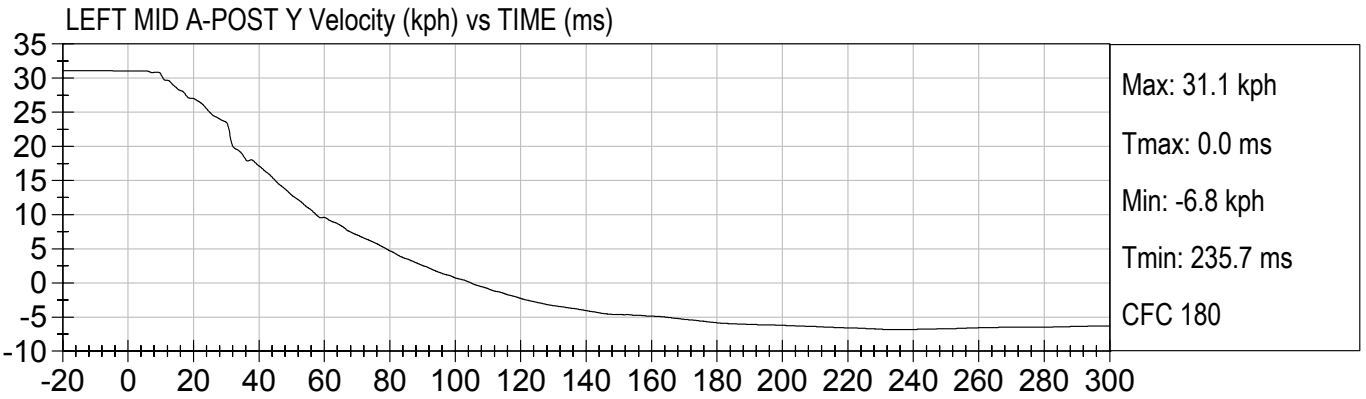
LEFT MID B-POST Y Velocity (kph) vs TIME (ms)




LEFT LOWER A-POST Y (G's) vs TIME (ms)
Max: 20.5 G's
Tmax: 23.8 ms
Min: -0.7 G's
Tmin: 0.0 ms
CFC 60


LEFT LOWER A-POST Y Velocity (kph) vs TIME (ms)
Max: 31.2 kph
Tmax: 1.9 ms
Min: -9.5 kph
Tmin: 256.3 ms
CFC 180

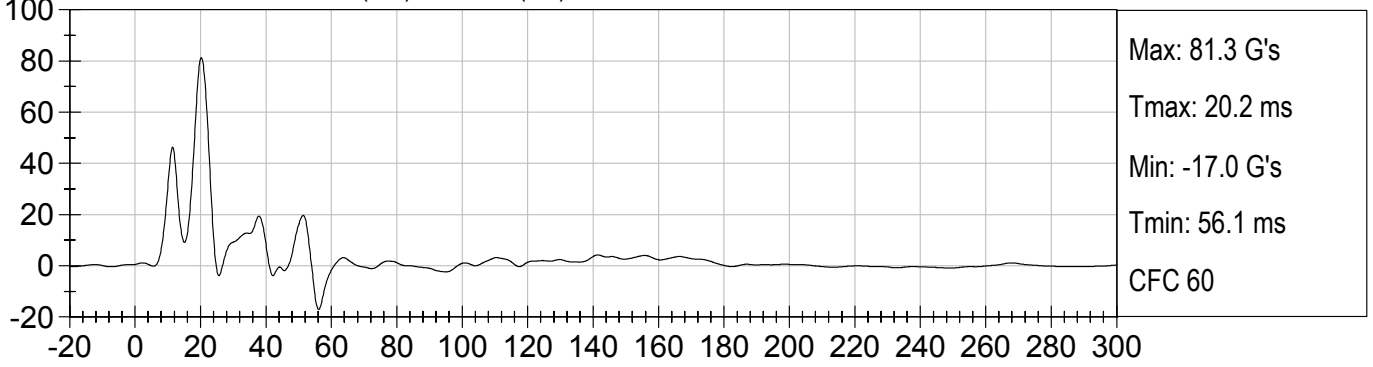

LEFT MID A-POST Y (G's) vs TIME (ms)
Max: 31.3 G's
Tmax: 31.2 ms
Min: -0.9 G's
Tmin: 300.0 ms
CFC 60


LEFT MID A-POST Y Velocity (kph) vs TIME (ms)
Max: 31.1 kph
Tmax: 0.0 ms
Min: -6.8 kph
Tmin: 235.7 ms
CFC 180

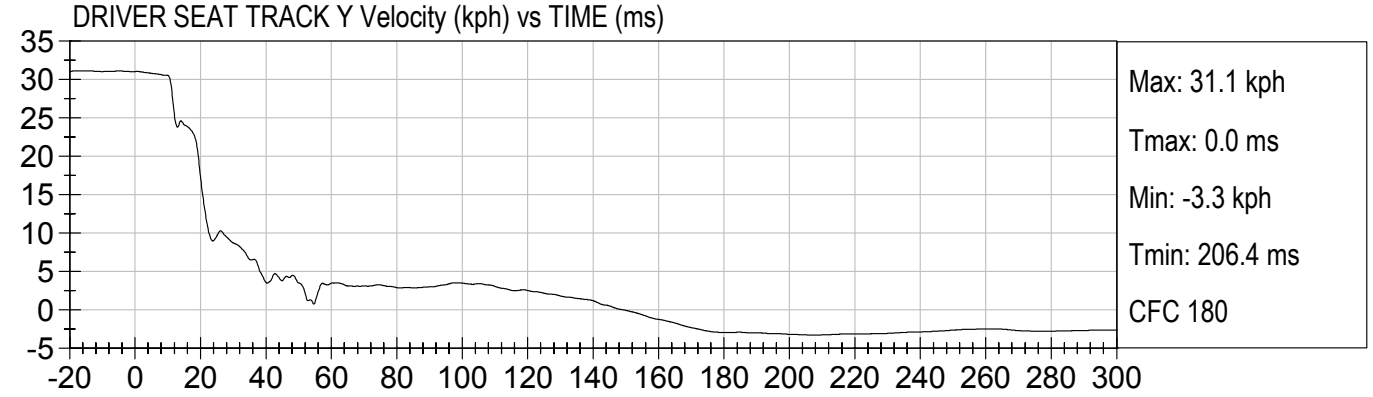
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

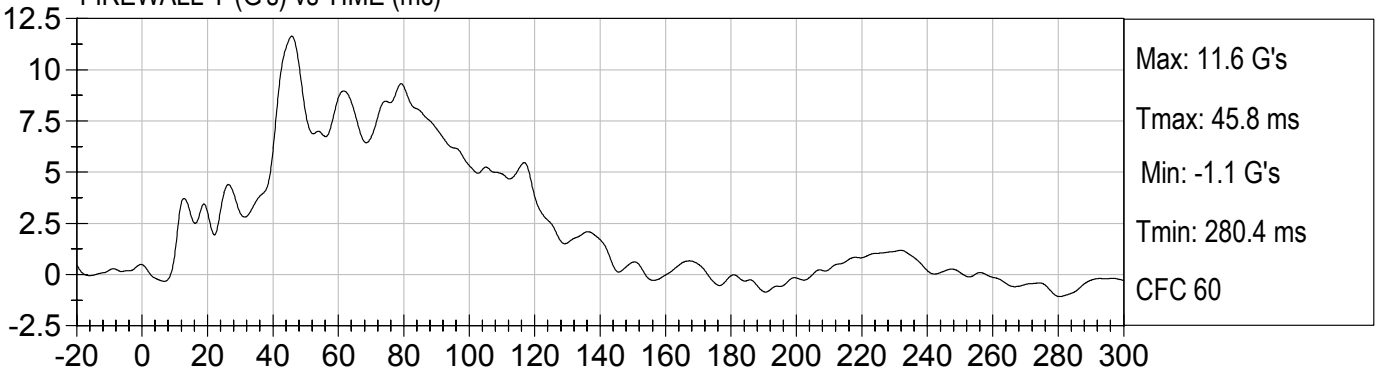
DRIVER SEAT TRACK Y (G's) vs TIME (ms)



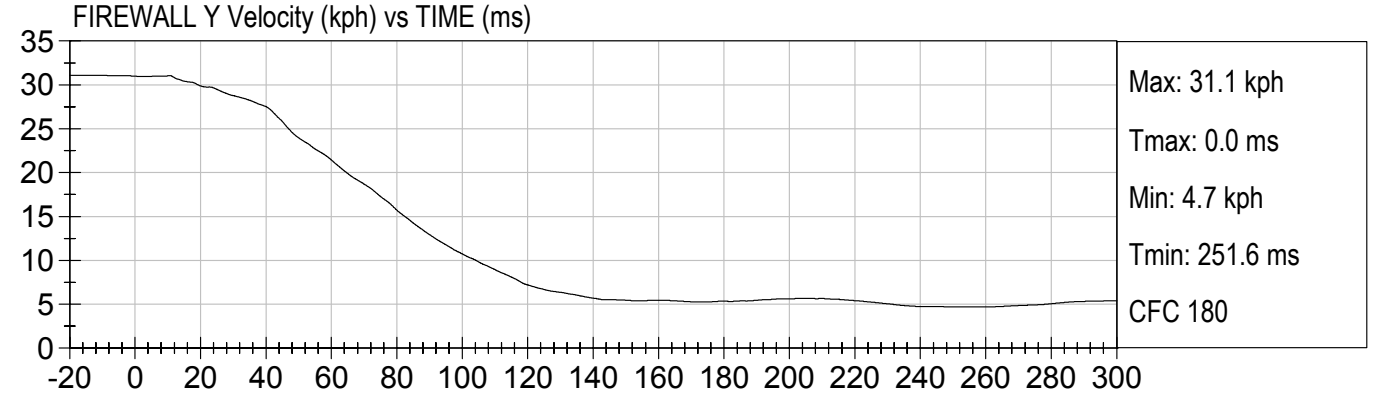
DRIVER SEAT TRACK Y Velocity (kph) vs TIME (ms)



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



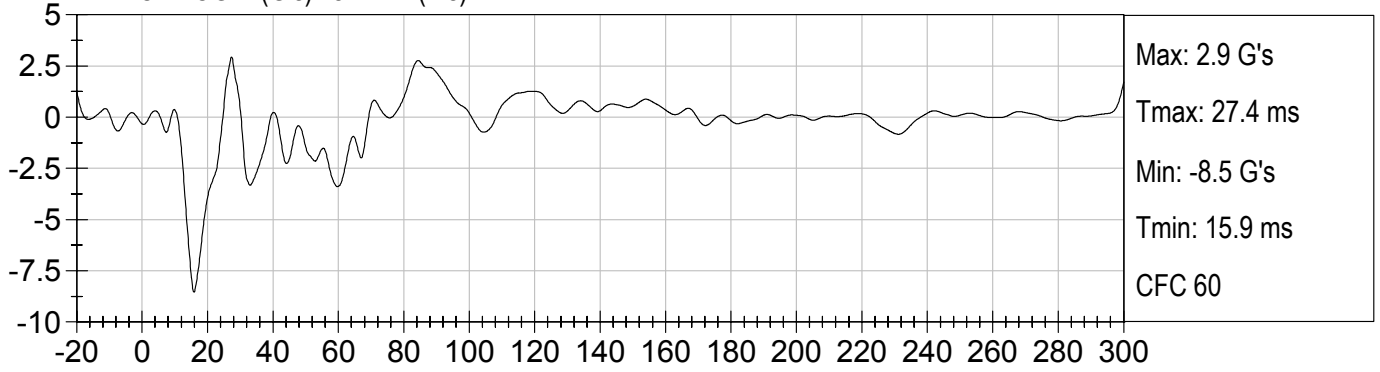
FIREWALL Y Velocity (kph) vs TIME (ms)



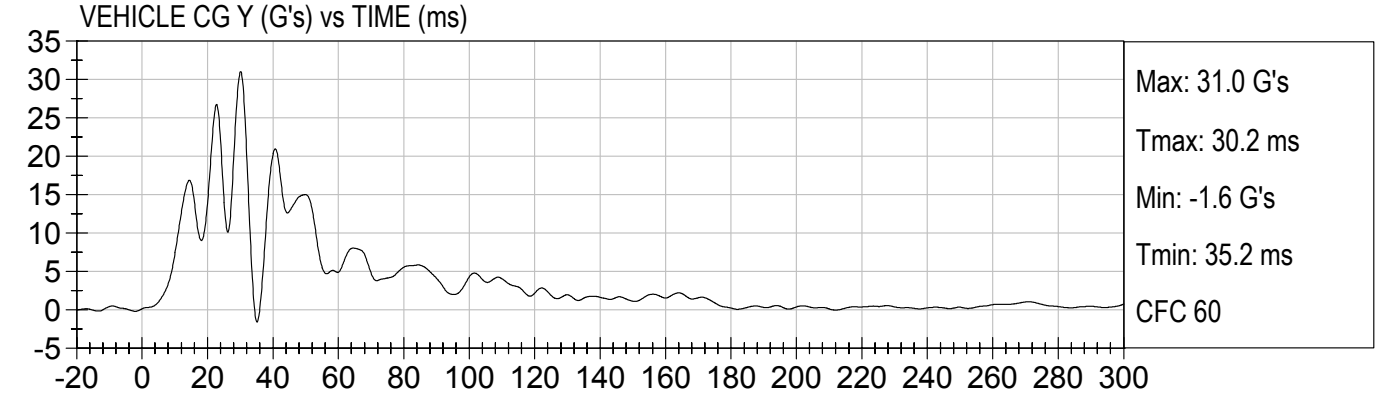
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

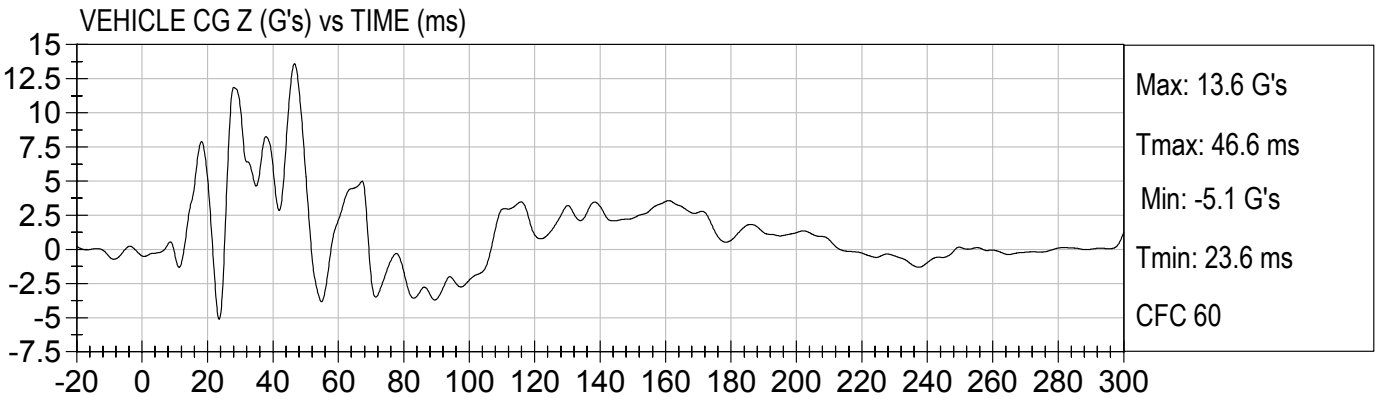
VEHICLE CG X (G's) vs TIME (ms)



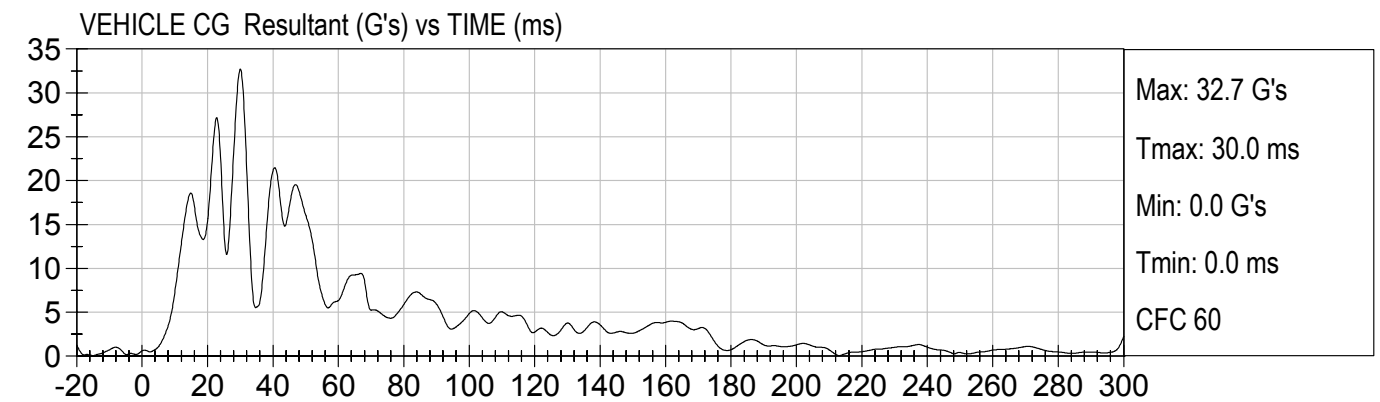
VEHICLE CG Y (G's) vs TIME (ms)

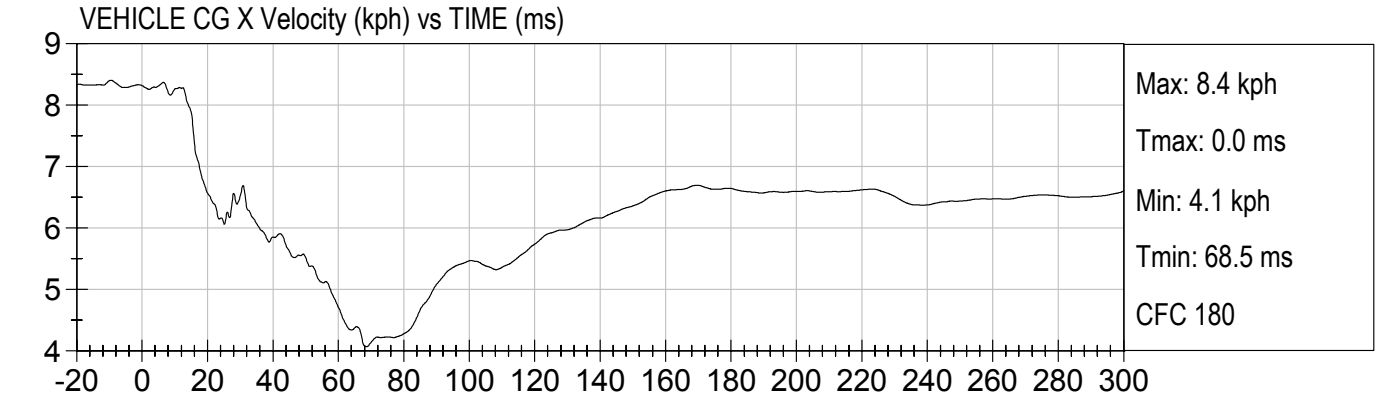


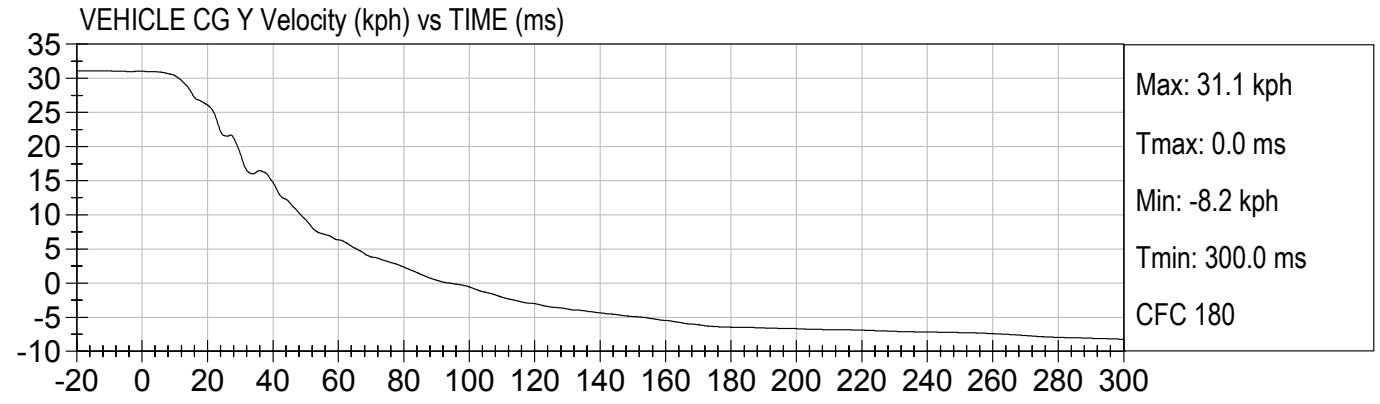
VEHICLE CG Z (G's) vs TIME (ms)

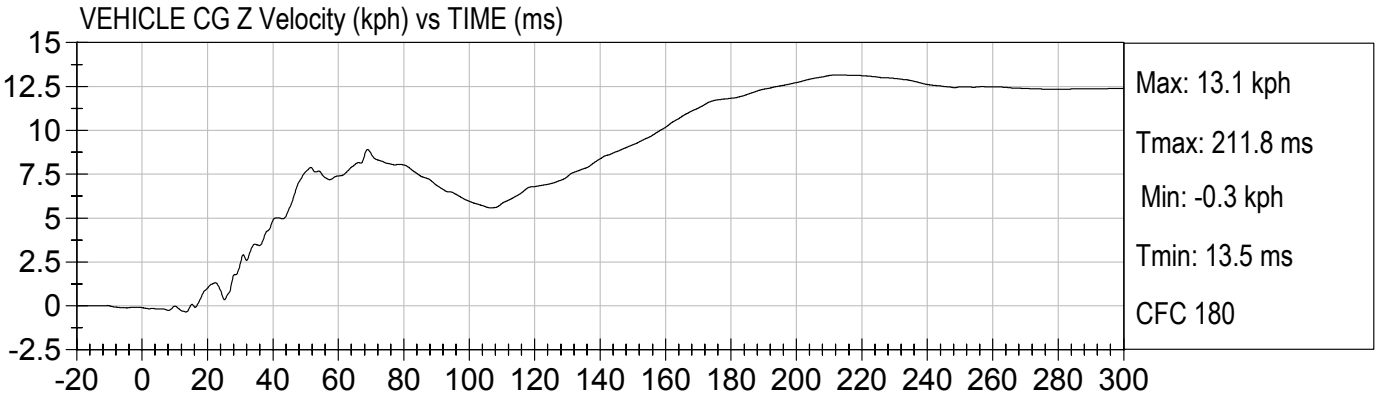


VEHICLE CG Resultant (G's) vs TIME (ms)




VEHICLE CG X Velocity (kph) vs TIME (ms)
9
8
7
6
5
4
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 0.0 ms
Min: 4.1 kph
Tmin: 68.5 ms
CFC 180

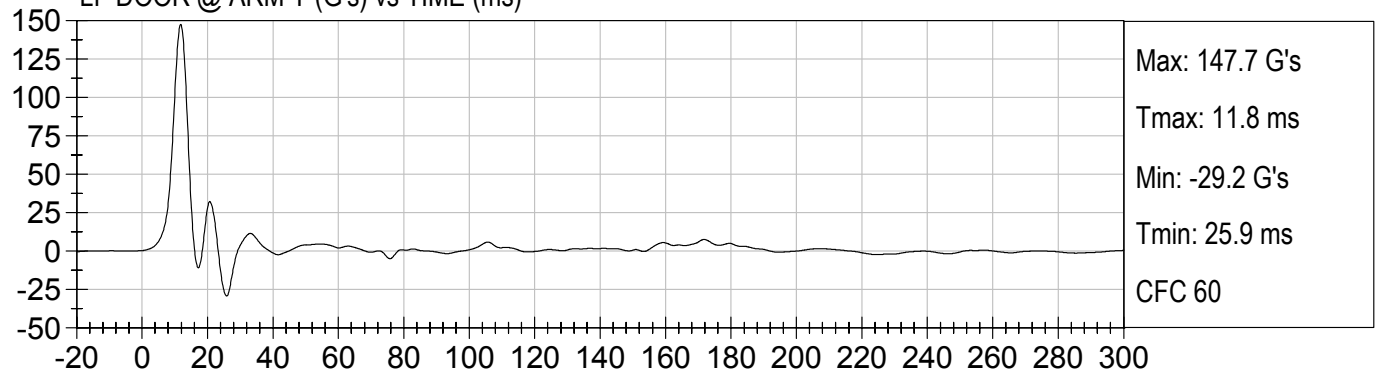

VEHICLE CG Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 31.1 kph
Tmax: 0.0 ms
Min: -8.2 kph
Tmin: 300.0 ms
CFC 180


VEHICLE CG Z Velocity (kph) vs TIME (ms)
15
12.5
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 13.1 kph
Tmax: 211.8 ms
Min: -0.3 kph
Tmin: 13.5 ms
CFC 180

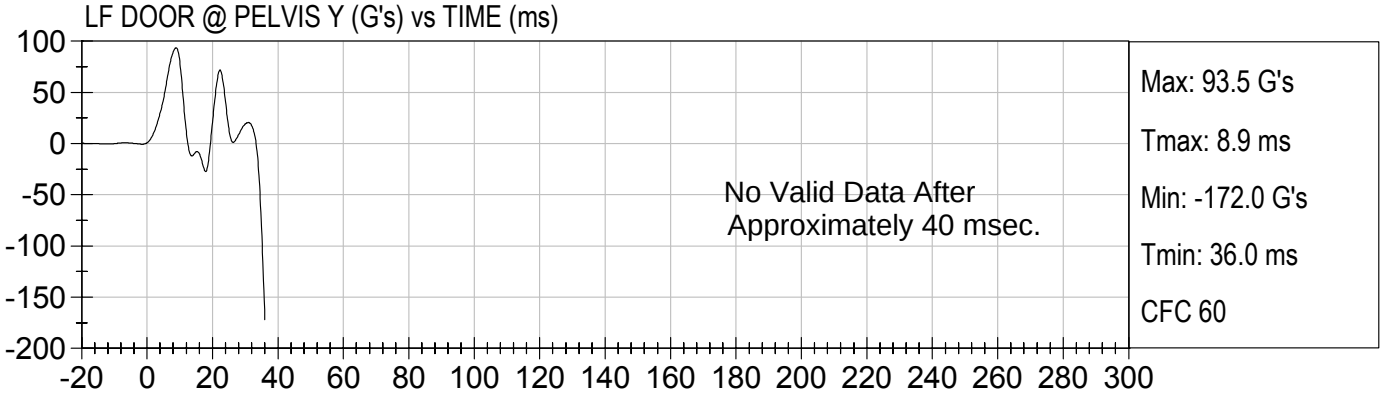
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

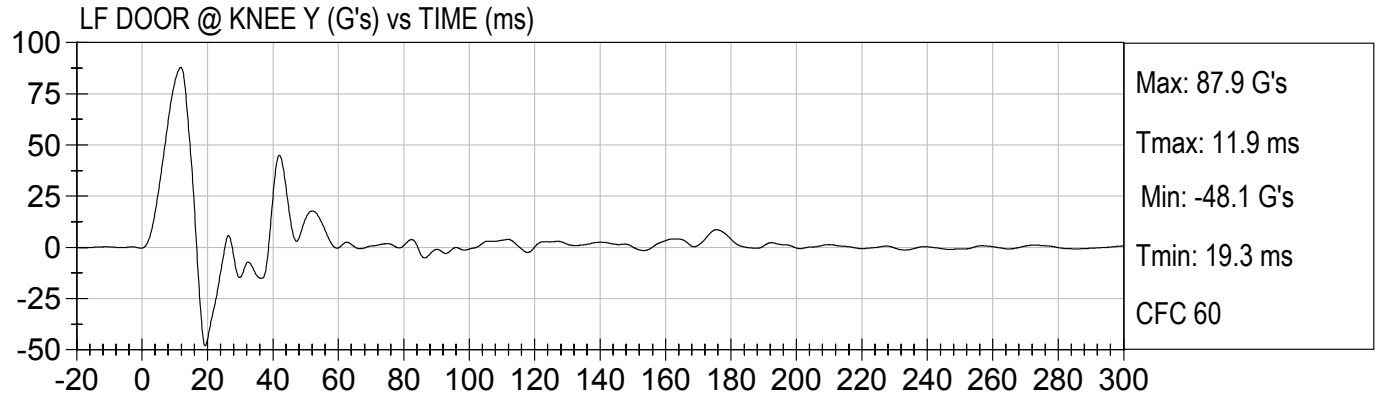
LF DOOR @ ARM Y (G's) vs TIME (ms)



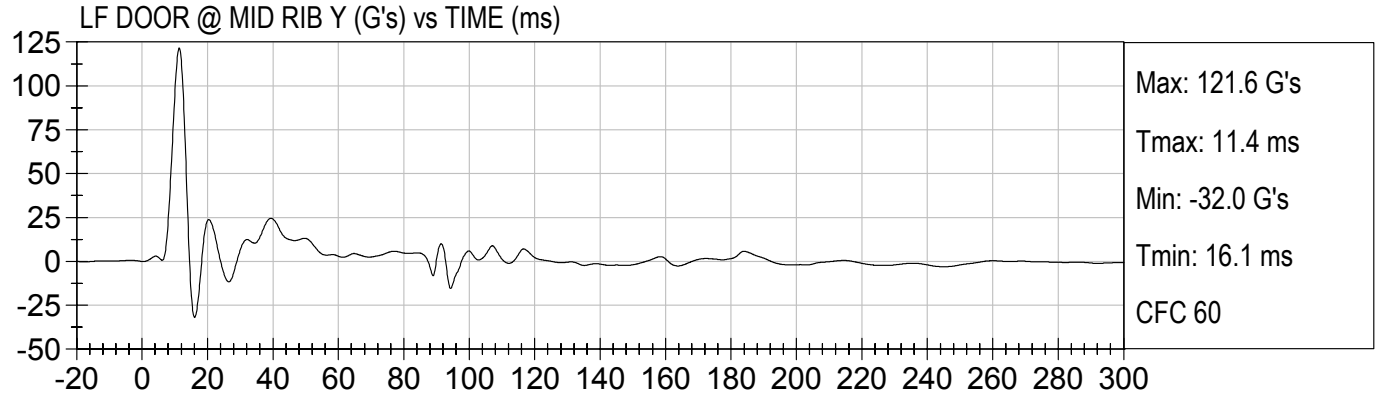
LF DOOR @ PELVIS Y (G's) vs TIME (ms)



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



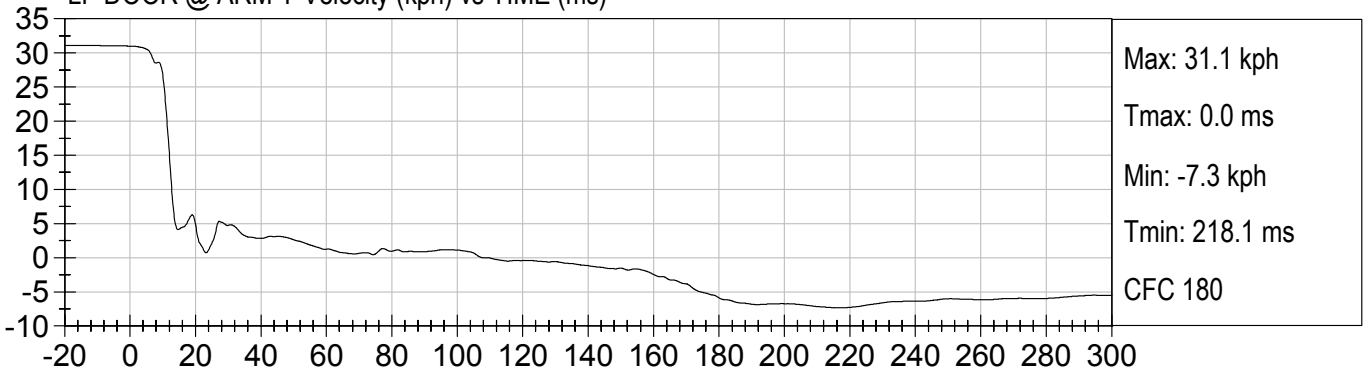
LF DOOR @ MID RIB Y (G's) vs TIME (ms)



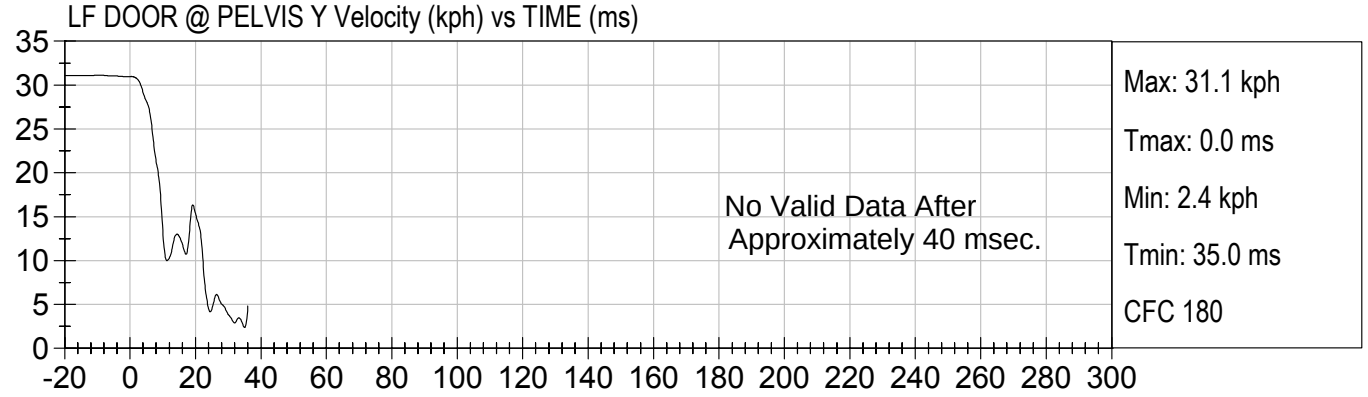
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

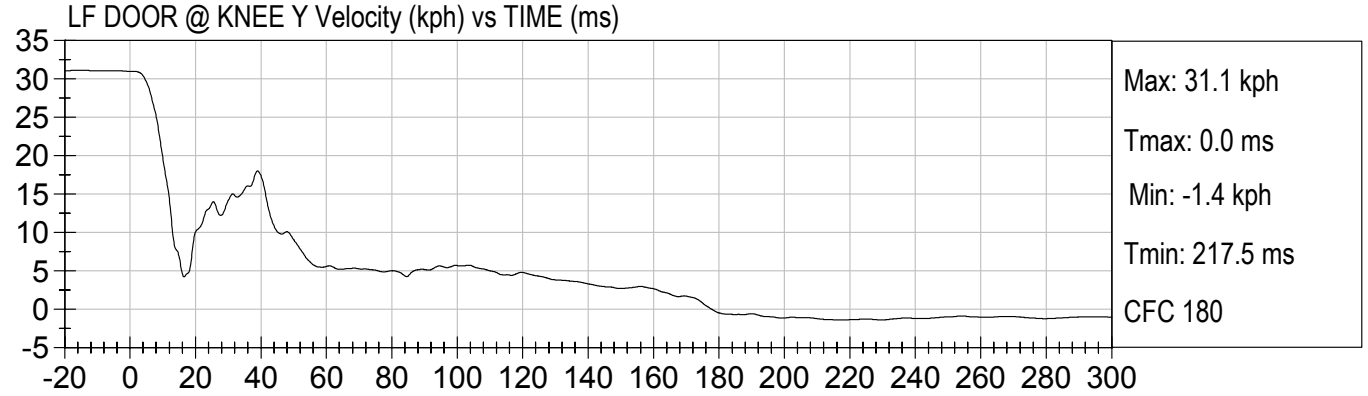
LF DOOR @ ARM Y Velocity (kph) vs TIME (ms)



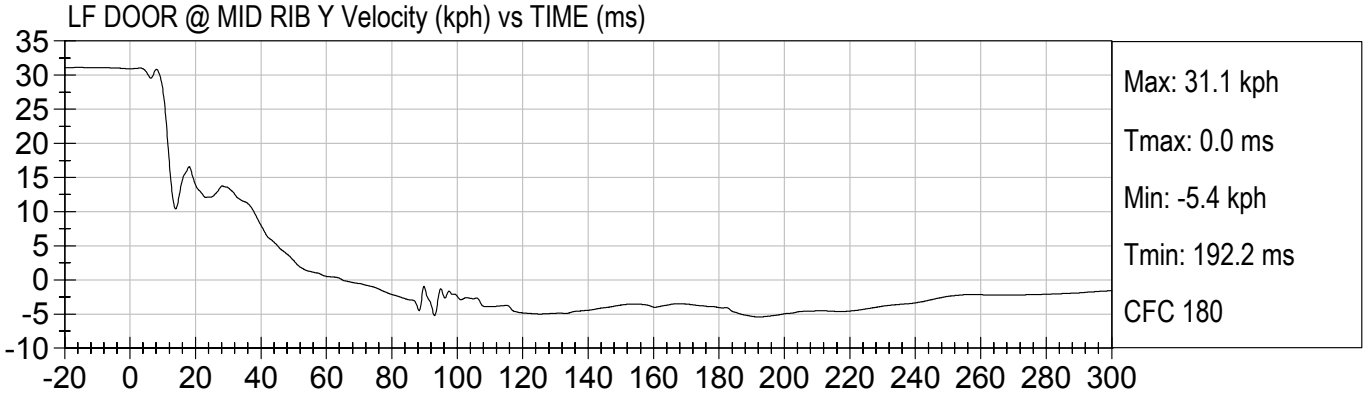
LF DOOR @ PELVIS Y Velocity (kph) vs TIME (ms)



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



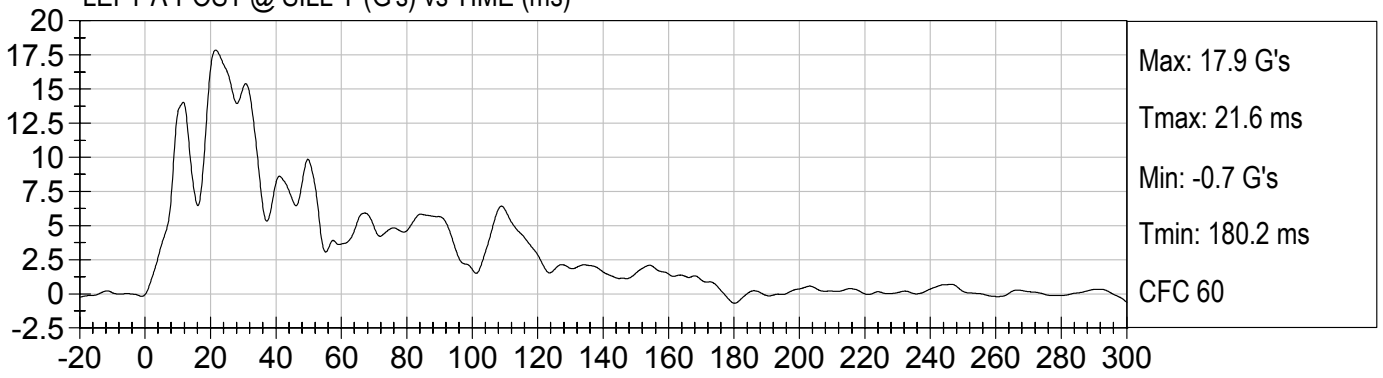
LF DOOR @ MID RIB Y Velocity (kph) vs TIME (ms)



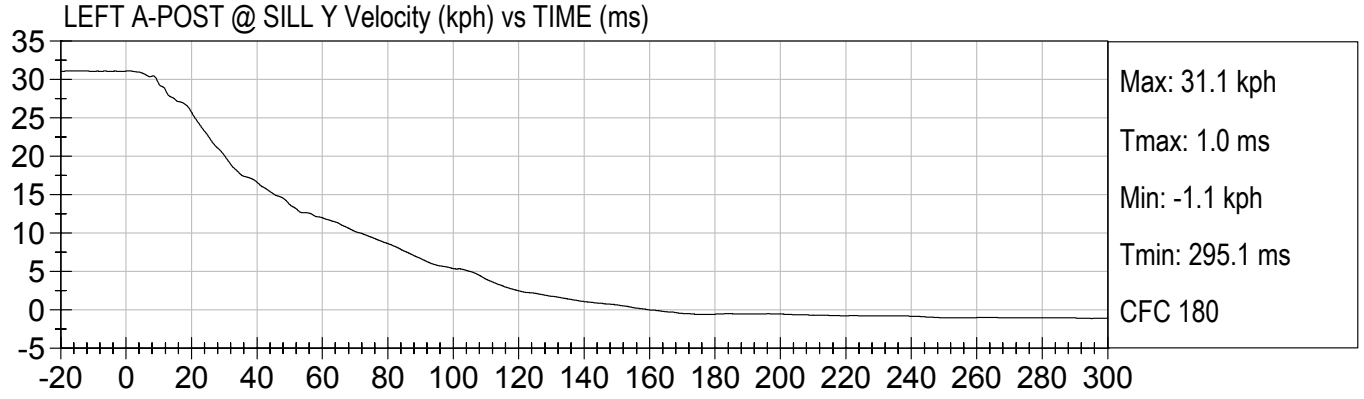
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

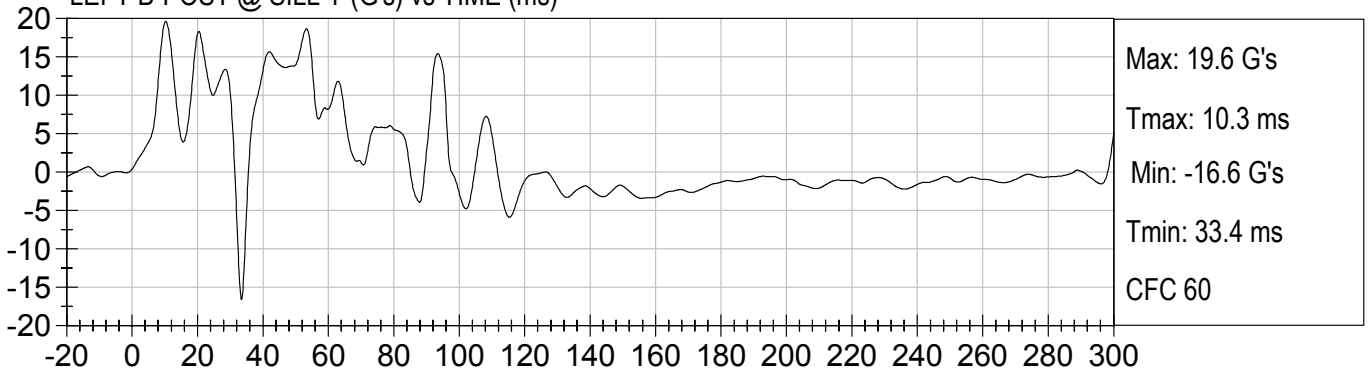
LEFT A-POST @ SILL Y (G's) vs TIME (ms)



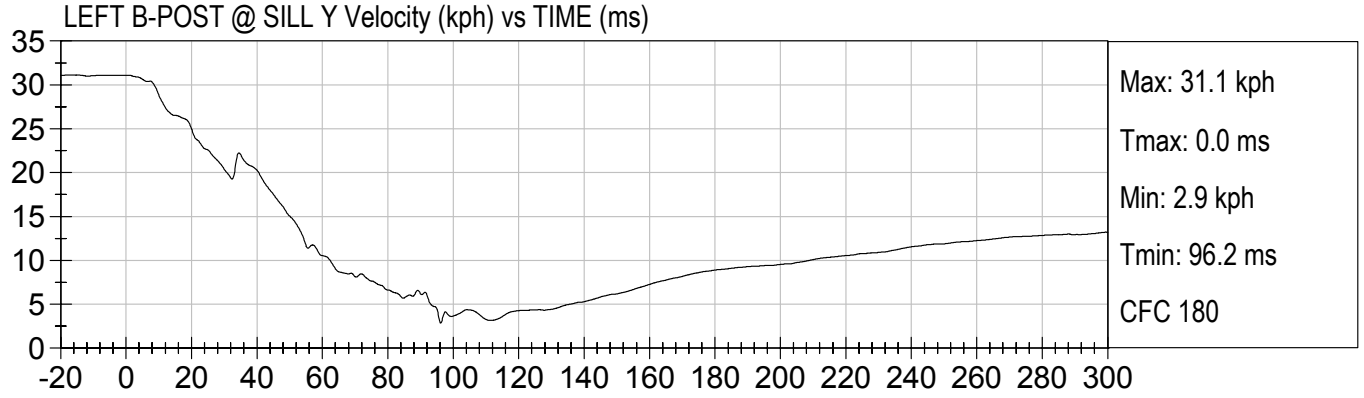
LEFT A-POST @ SILL Y Velocity (kph) vs TIME (ms)



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

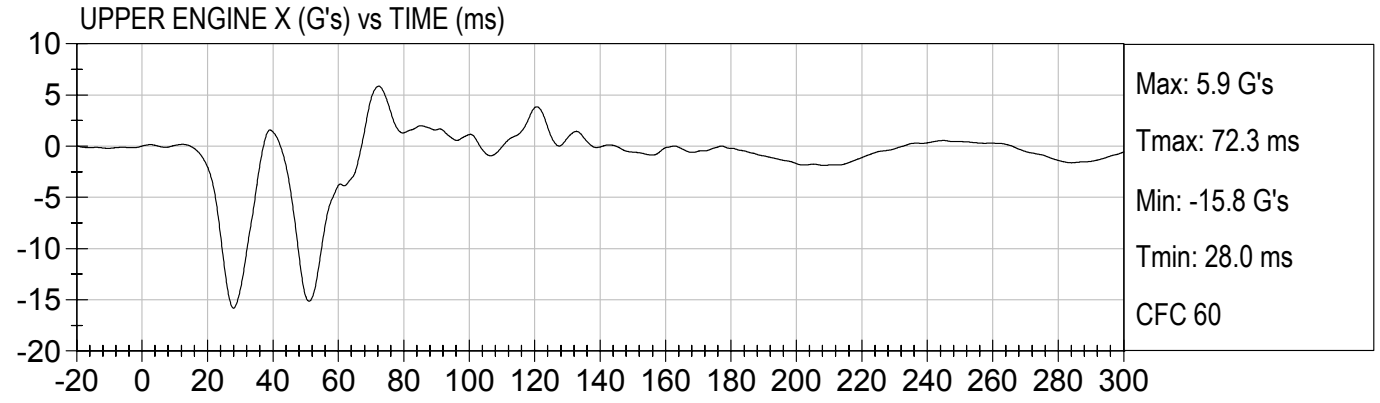


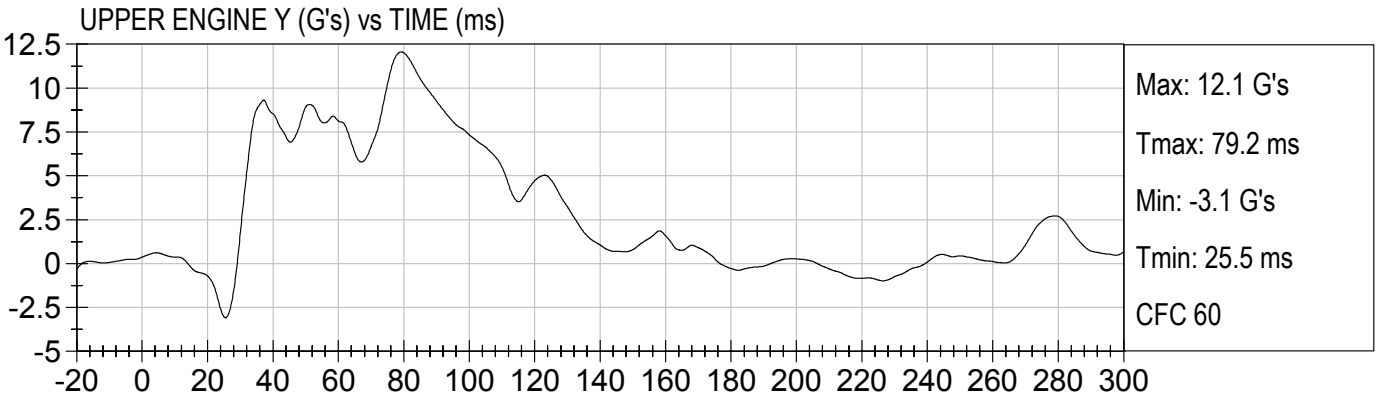
LEFT B-POST @ SILL Y Velocity (kph) vs TIME (ms)

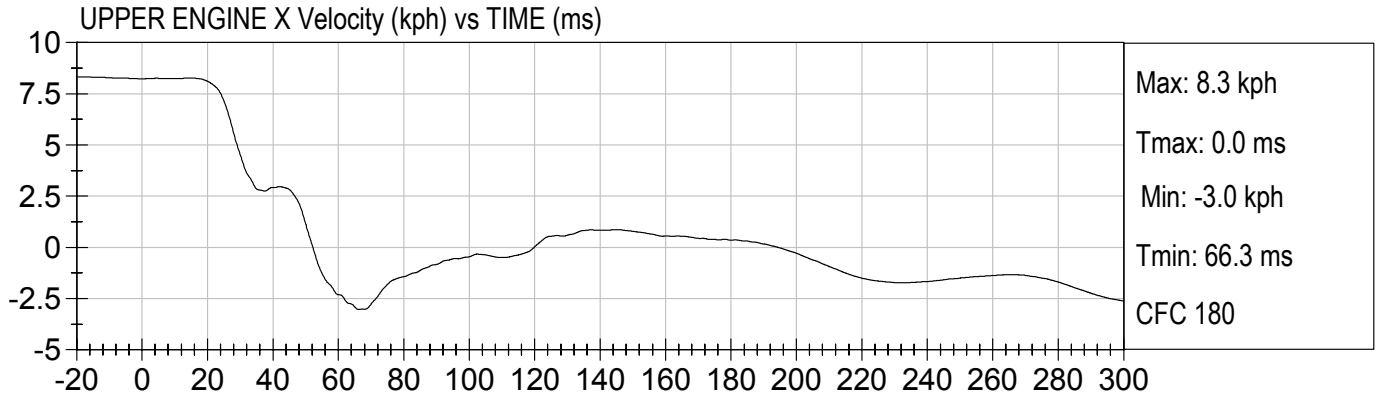


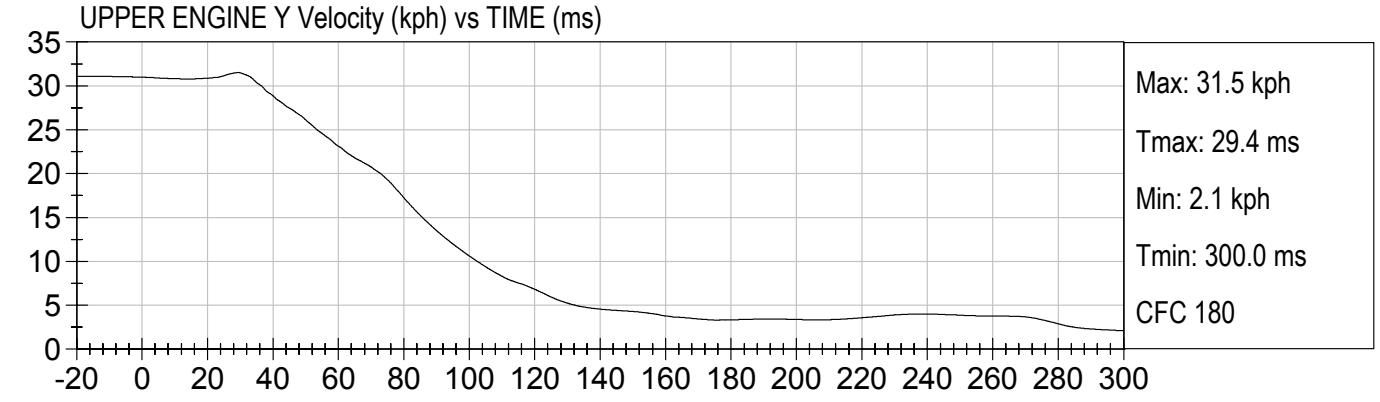
TO1 SIDE POLE OBLIQUE
2005 VW BEETLE CONVERTIBLE GL (R55803)

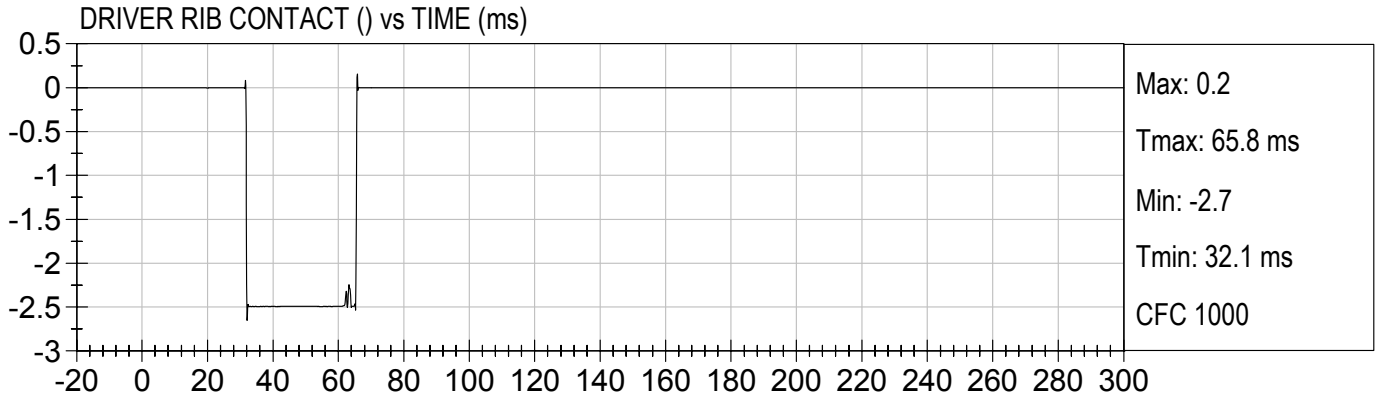
Test Date: 8/03/2005
Speed: 20.0 mph (32.2 km/h)

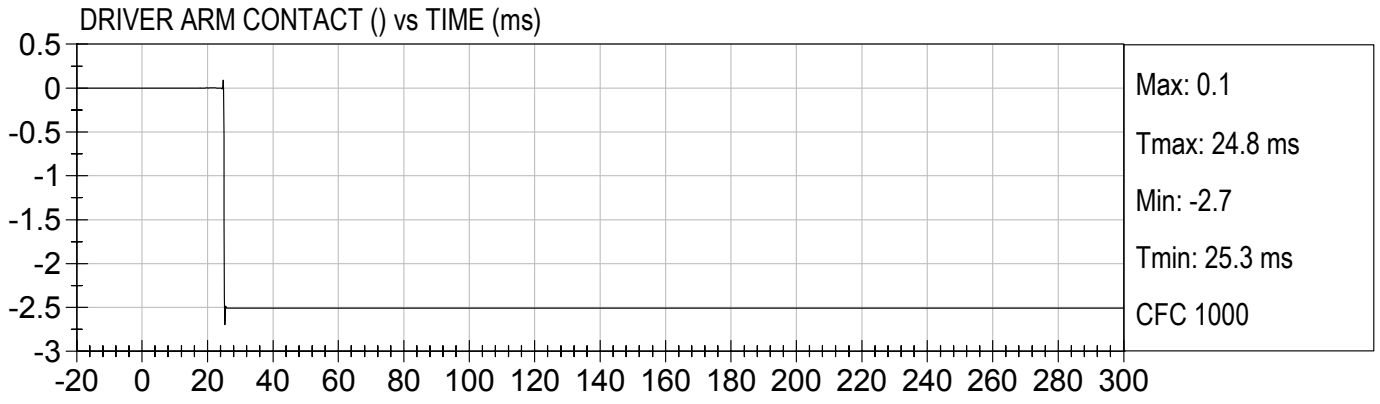


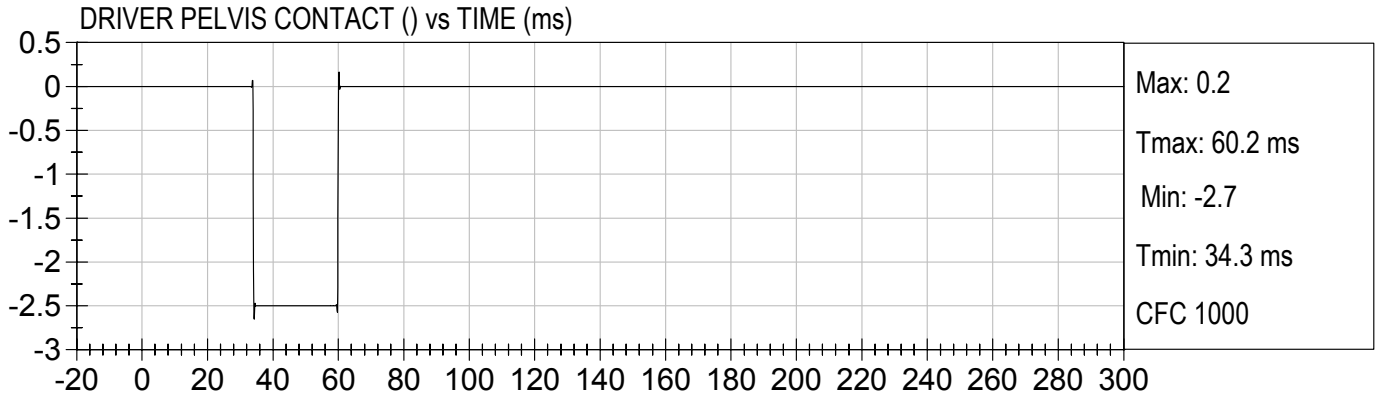







DRIVER RIB CONTACT () vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.2
Tmax: 65.8 ms
Min: -2.7
Tmin: 32.1 ms
CFC 1000


DRIVER ARM CONTACT () vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.1
Tmax: 24.8 ms
Min: -2.7
Tmin: 25.3 ms
CFC 1000


DRIVER PELVIS CONTACT () vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.2
Tmax: 60.2 ms
Min: -2.7
Tmin: 34.3 ms
CFC 1000

APPENDIX C

ES-2RE CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CERTIFICATION DATA

Dummy Serial Number: 010

PRE-TEST CALIBRATION

MGA RESEARCH CORPORATION

HEAD DROP TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test ID:** D052081

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 - 22.0	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	100 - 150	149	Pass
Time of Maximum Resultant Acceleration	msec	NA	19.8	Pass
		Overall Test Results		Pass

Joe Fleck

Laboratory Technician

07/27/2005

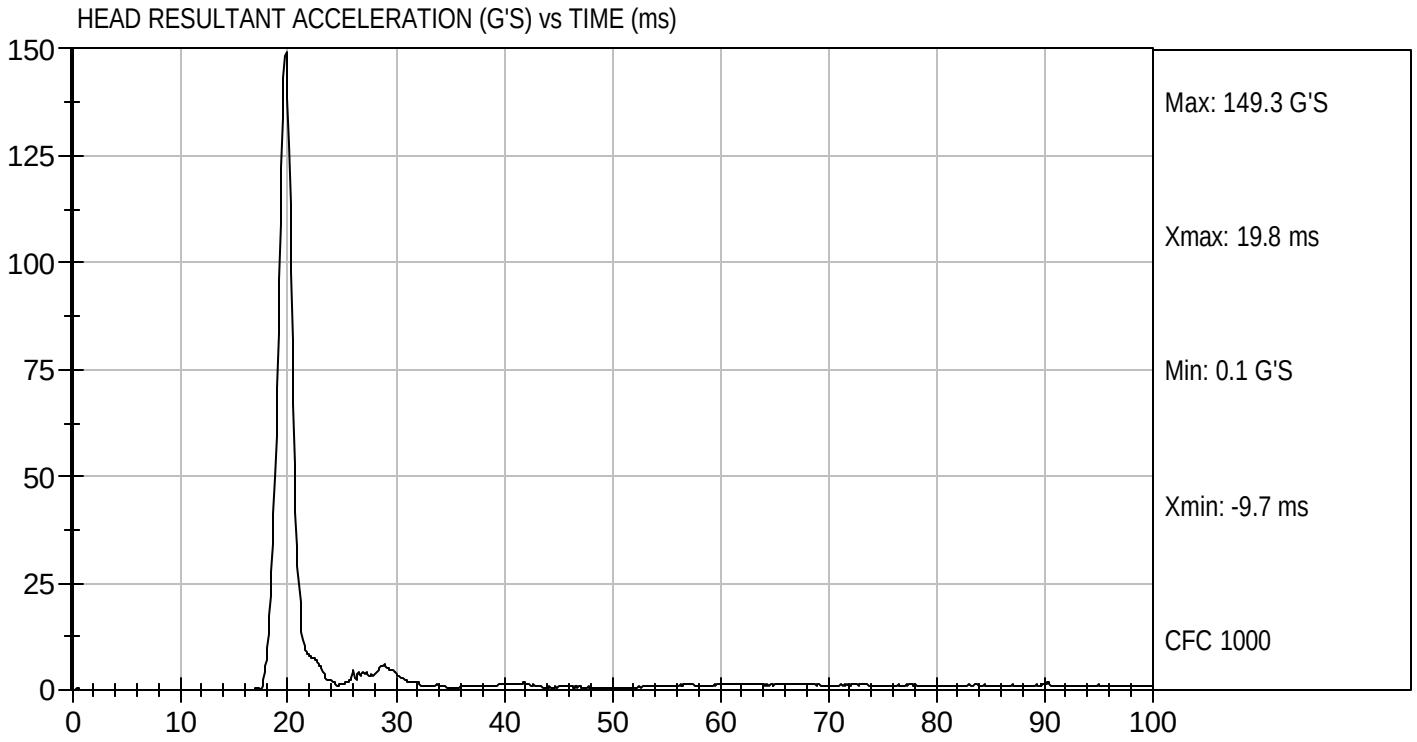
Test Date

David Winkelbauer

Approved By

Test Desc: Head Drop
Componet ID: D052081

Test Date: 07/27/2005
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052082

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.4	Pass
Pendulum Deceleration	3 msec	G's	-0.25 to -0.53	-0.47	Pass
	8 msec	G's	-1.59 to -2.04	-2.02	Pass
	14 msec	G's	-3.20 to -3.85	-3.54	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	55.7	Pass
Time of Maximum Flexion Angle		msec	54.0 to 66.0	58.0	Pass
Maximum Angle Theta (A)		deg	32.7 to 37.0	36.9	Pass
Time of Maximum Theta (A)		msec	53.0 to 63.0	58.0	Pass
Maximum Angle Theta (B)		deg	31.66 to 34.16	33.67	Pass
Time of Maximum Theta (B)		msec	54.0 to 64.0	63.3	Pass
			Overall Test Results		Pass

Ian Fleck

Laboratory Technician

07/27/2005

Test Date

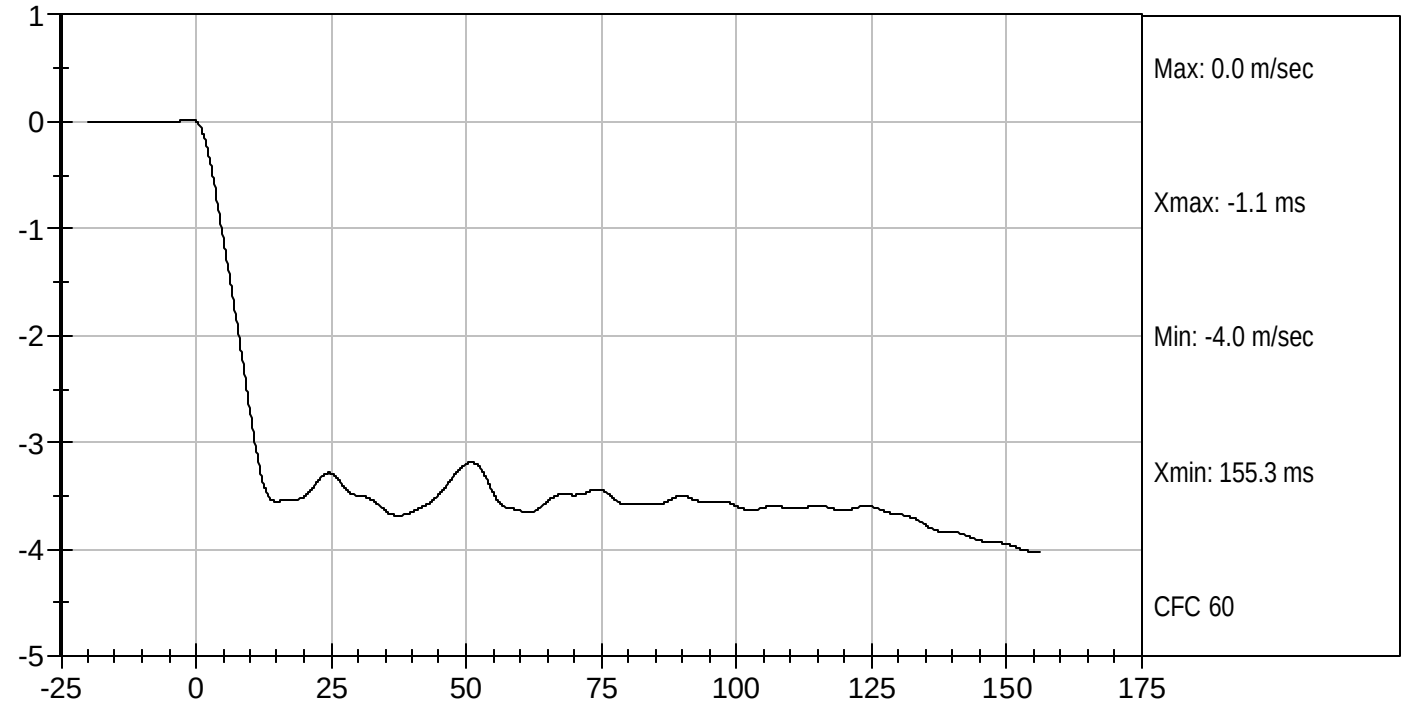
David Winkelbauer

Approved By

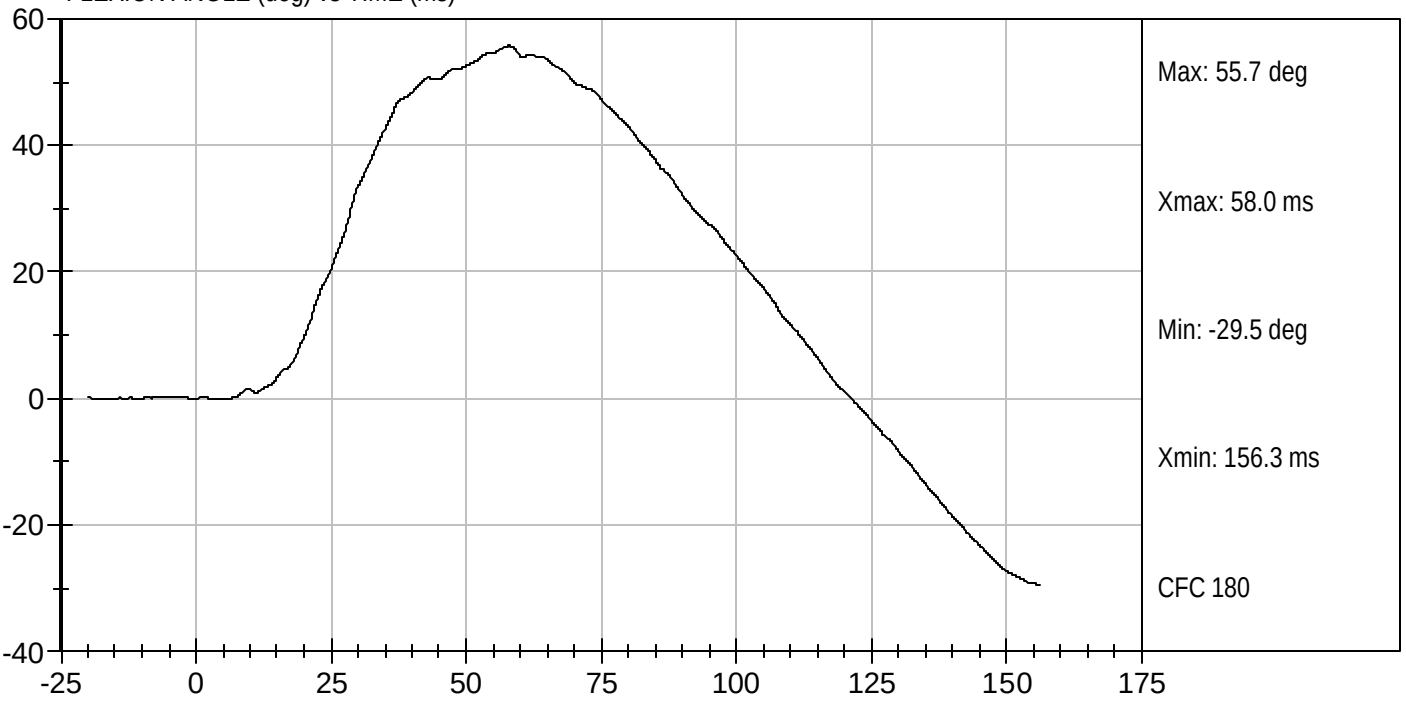
Test Desc: Neck Bending
Componet ID: D052082

Test Date: 07/27/2005
Velocity: 11.29 ft/s, 3.4 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)



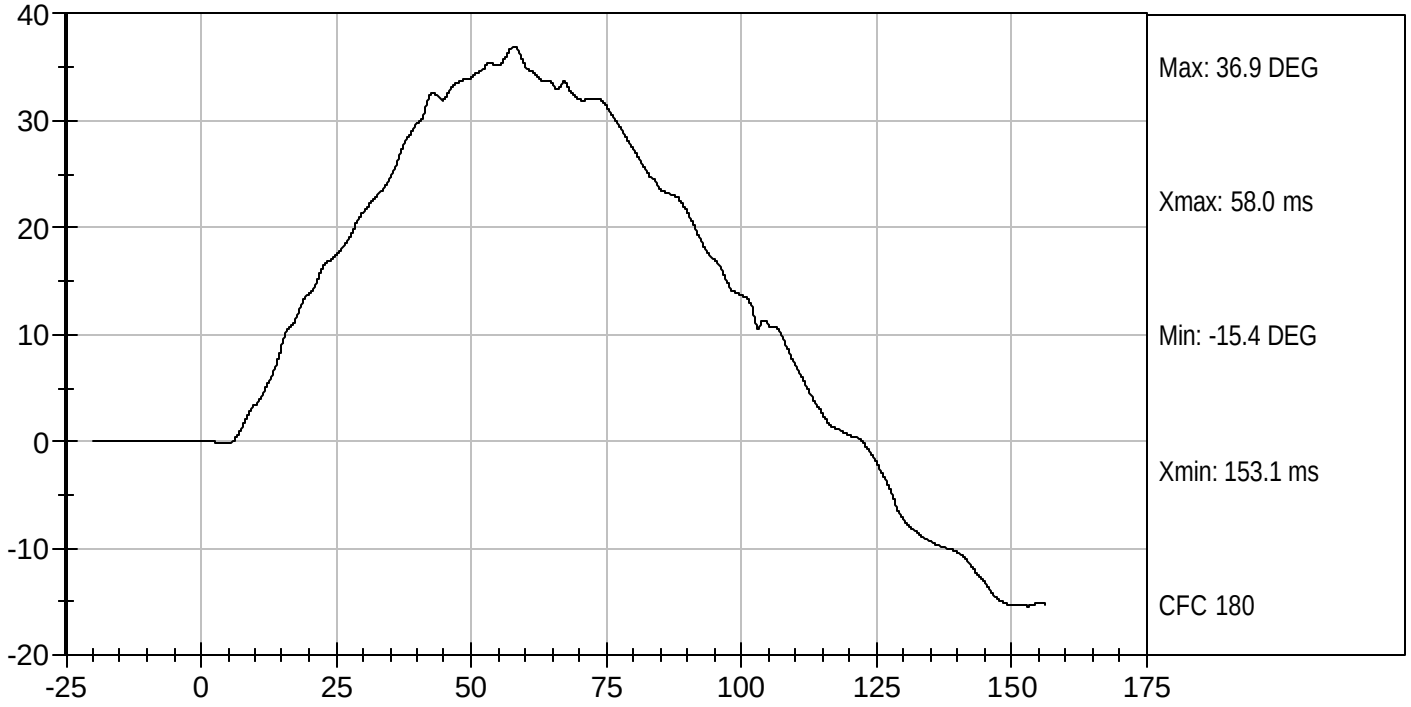
FLEXION ANGLE (deg) vs TIME (ms)



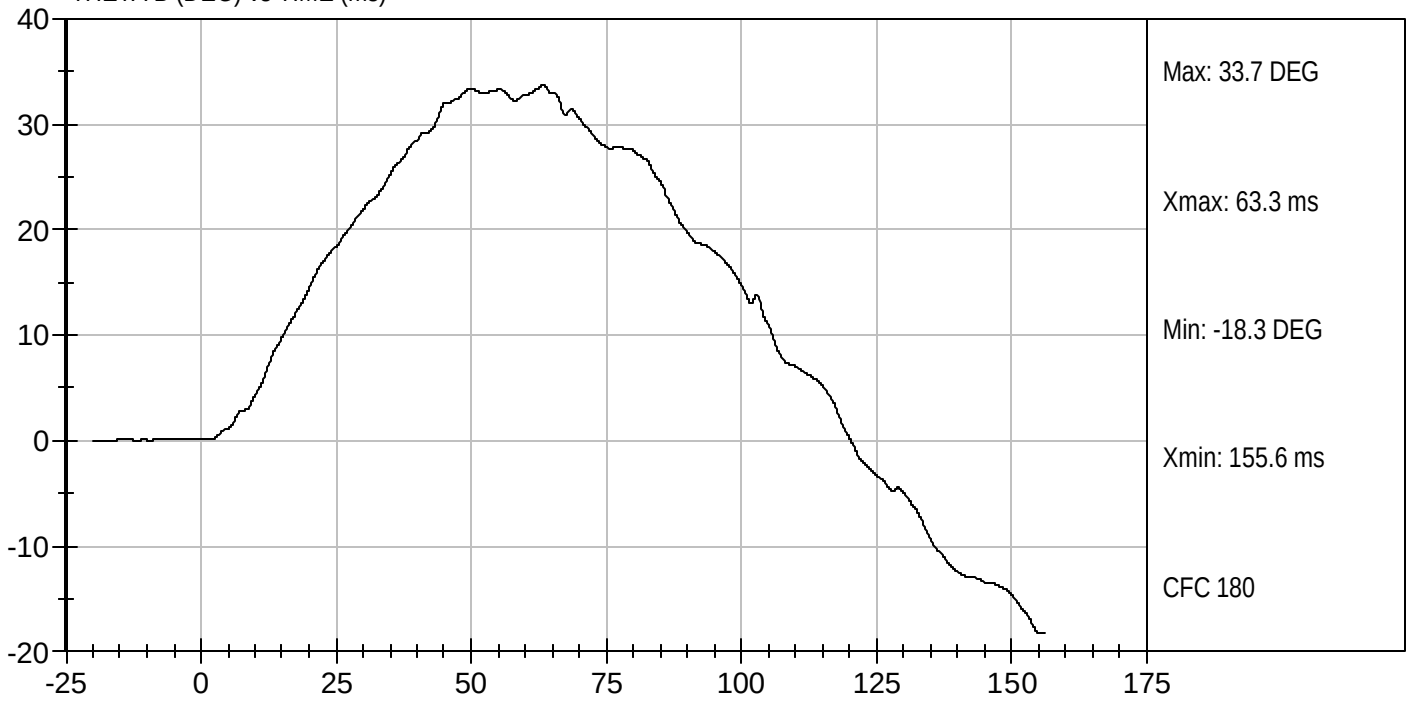
Test Desc: Neck Bending
Componet ID: D052082

Test Date: 07/27/2005
Velocity: 11.29 ft/s, 3.4 m/s

THETA A (DEG) vs TIME (ms)



THETA B (DEG) vs TIME (ms)



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052083

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.3	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	8.6	Pass
Time of Peak Shoulder Acceleration	msec	NA	15.0	Pass
		Overall Test Results		Pass

Laboratory Technician

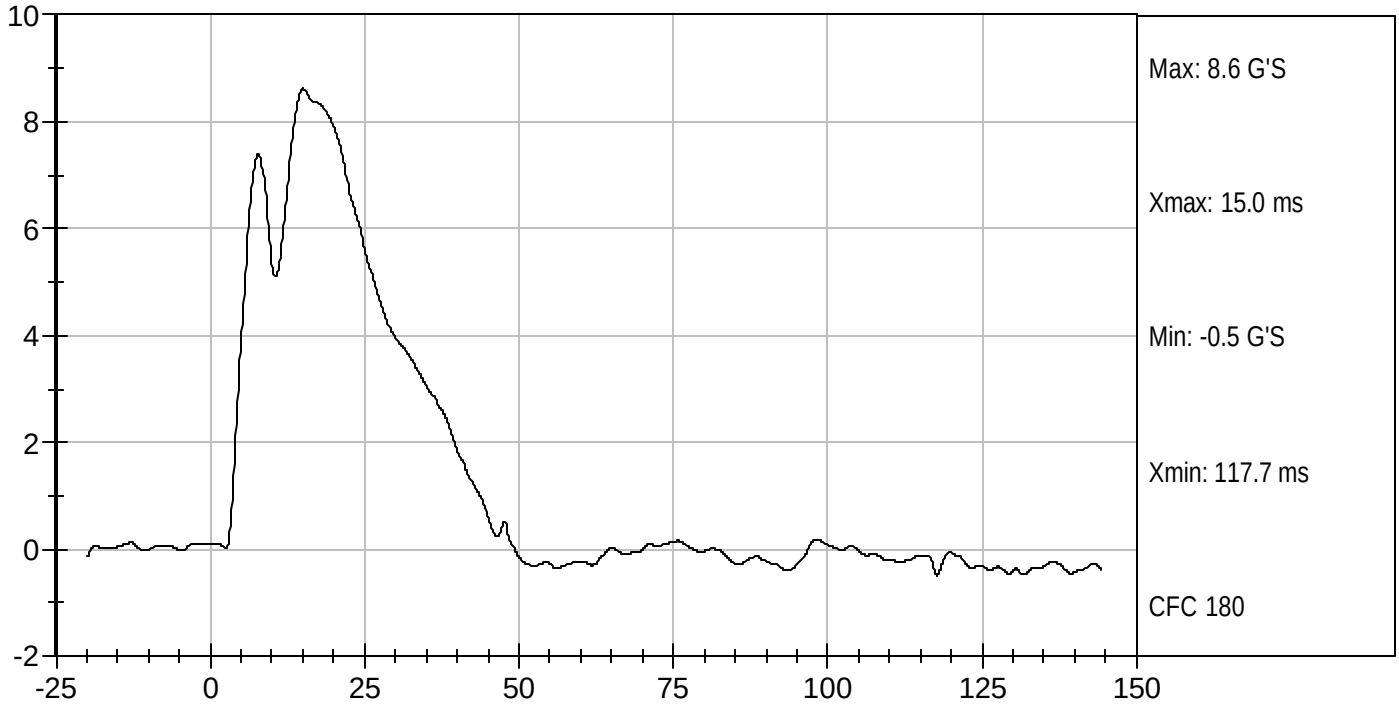
07/28/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Componet ID: D052083

Test Date: 07/28/2005
Velocity: 14.09 ft/s, 4.3 m/s

SHOULDER ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052084

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Displacement at 2 m/s	m/s	23.5 to 27.5	26.7	Pass
Displacement at 3 m/s	G's	36.0 to 40.0	36.9	Pass
Displacement at 4 m/s	msec	46.0 to 51.0	47.2	Pass
		Overall Test Results		Pass

Laboratory Technician

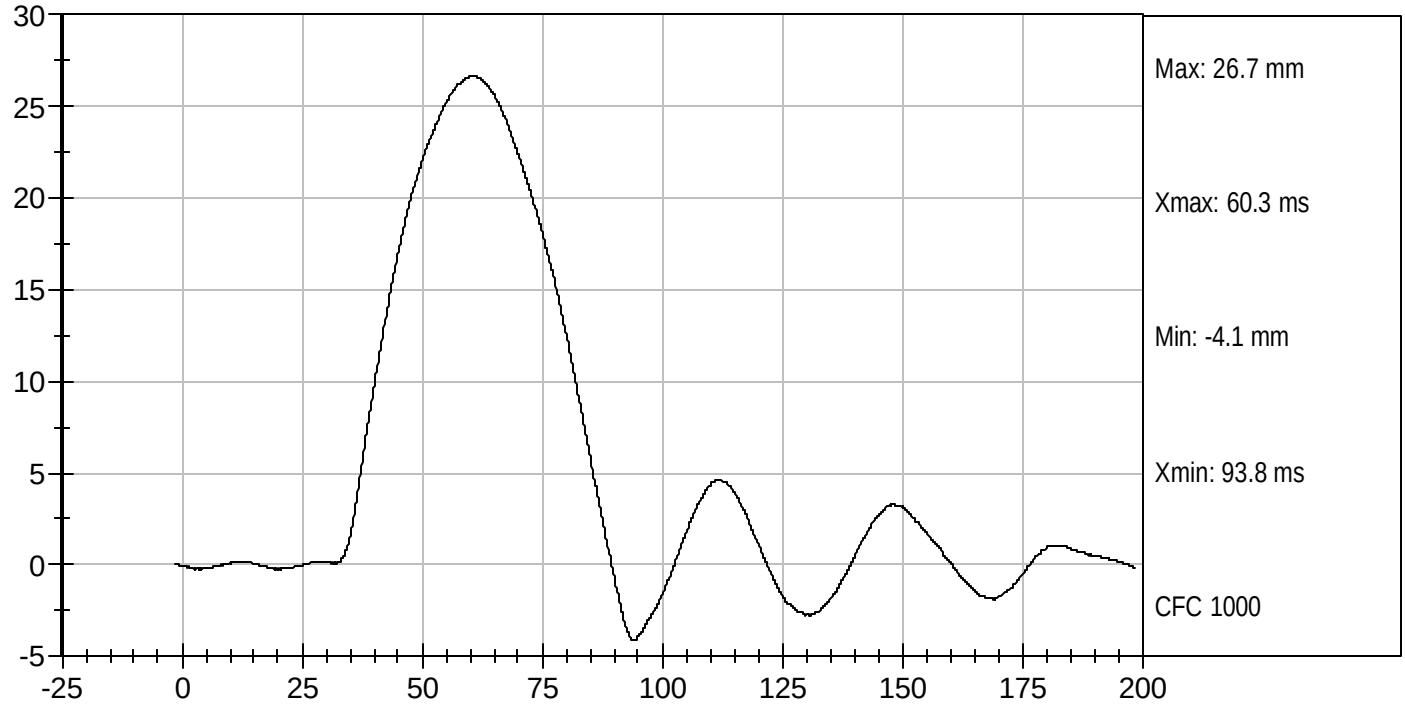
07/27/2005
Test Date

David Winkelbauer
Approved By

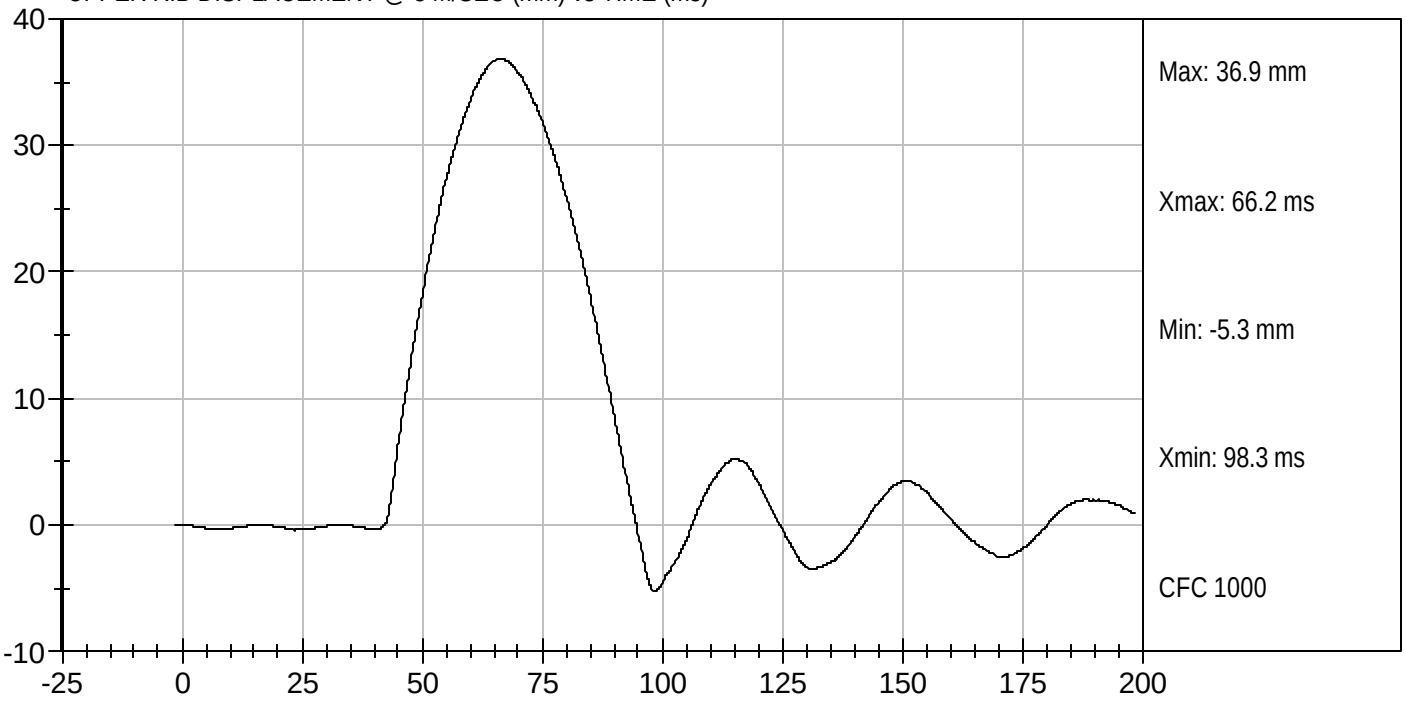
Test Desc: Rib Impact - Upper
Componet ID: D052084

Test Date: 07/27/2005
Velocity: 2, 3, 4 m/s

UPPER RIB DISPLACEMENT @ 2 M/SEC (mm) vs TIME (ms)



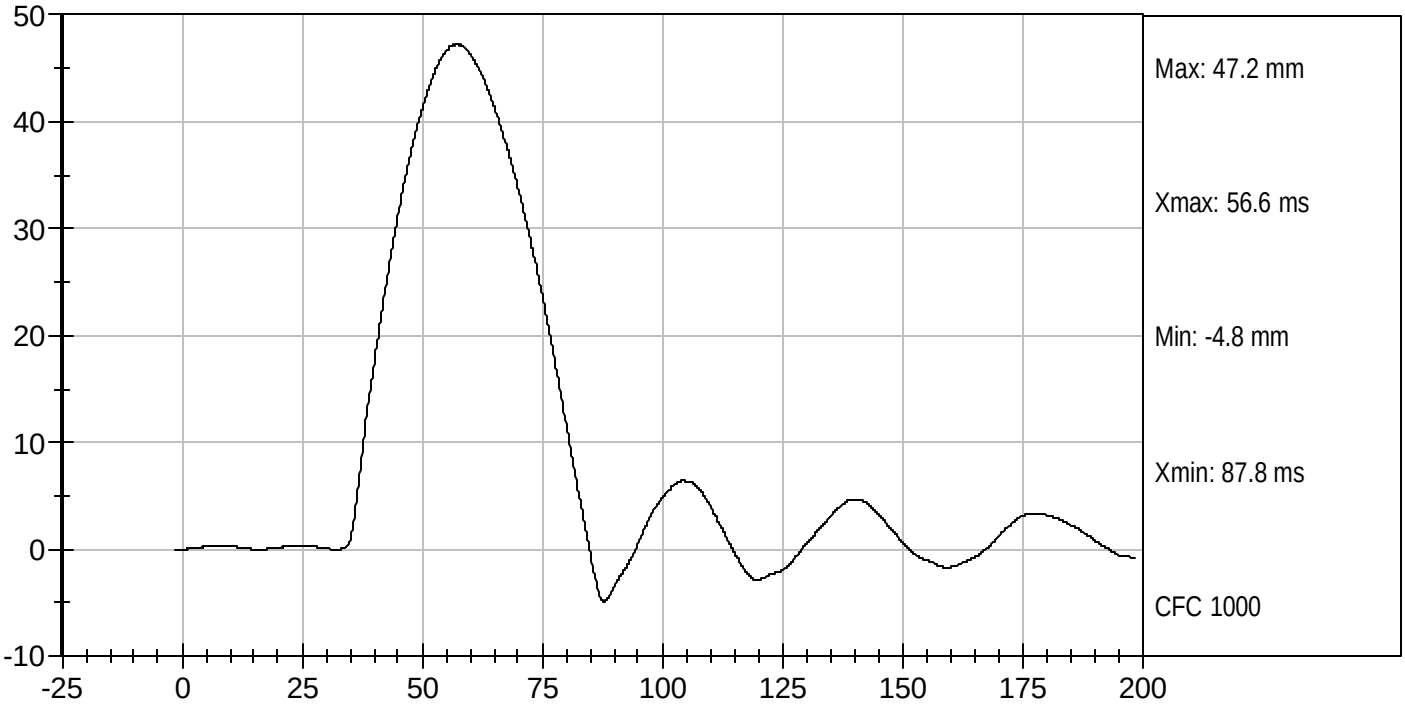
UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



Test Desc: Rib Impact - Upper
Componet ID: D052084

Test Date: 07/27/2005
Velocity: 2, 3, 4 m/s

UPPER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052085

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Displacement at 2 m/s	m/s	23.5 to 27.5	27.0	Pass
Displacement at 3 m/s	G's	36.0 to 40.0	38.9	Pass
Displacement at 4 m/s	msec	46.0 to 51.0	49.3	Pass
		Overall Test Results		Pass

Laboratory Technician

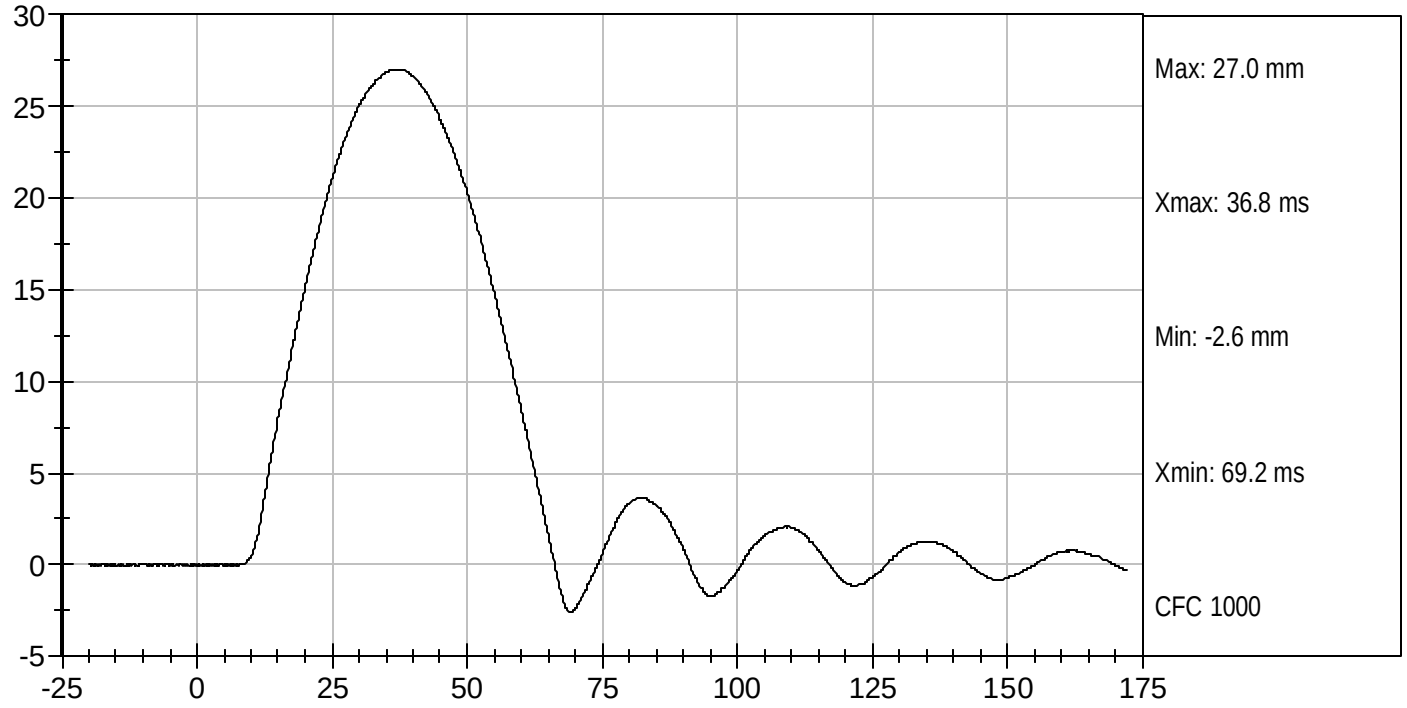
07/27/2005
Test Date

David Winkelbauer
Approved By

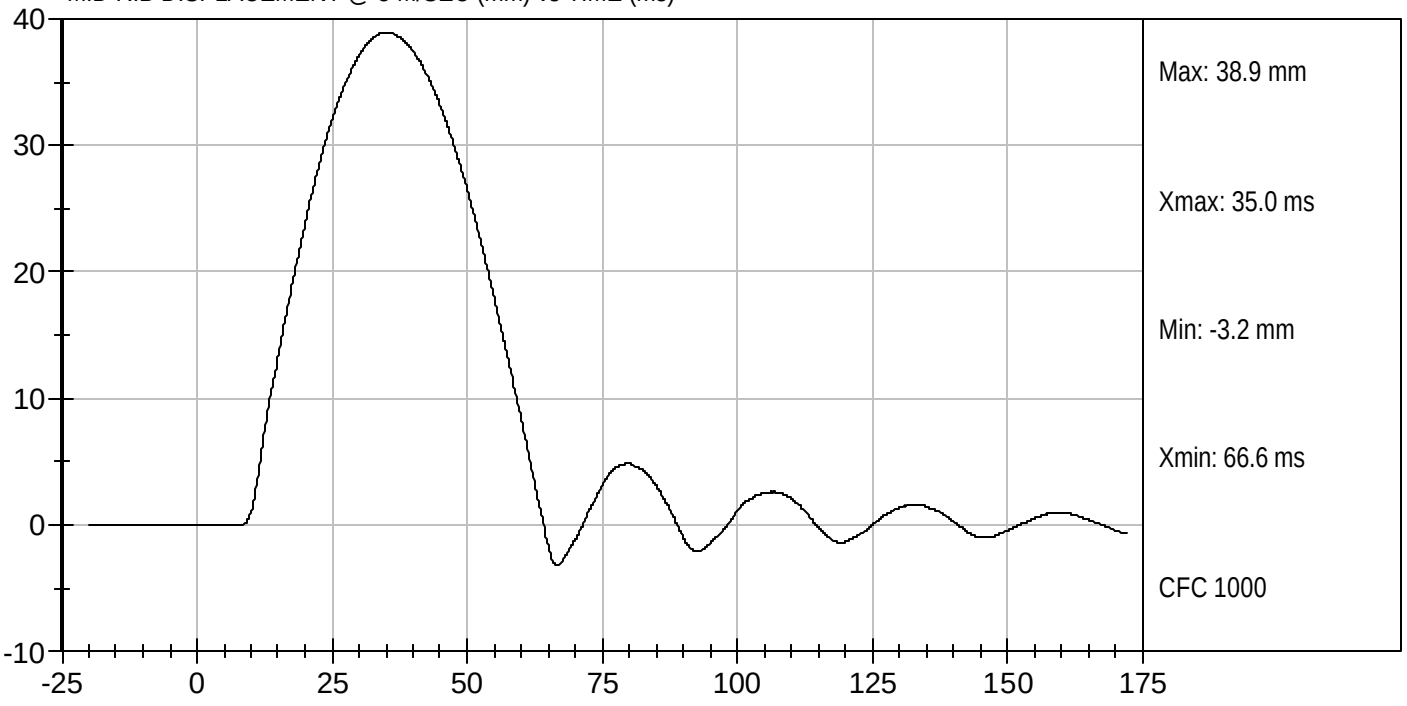
Test Desc: Rib Impact - Mid
Componet ID: D052085

Test Date: 07/27/2005
Velocity: 2, 3, 4 m/s

MID RIB DISPLACEMENT @ 2 M/SEC (mm) vs TIME (ms)



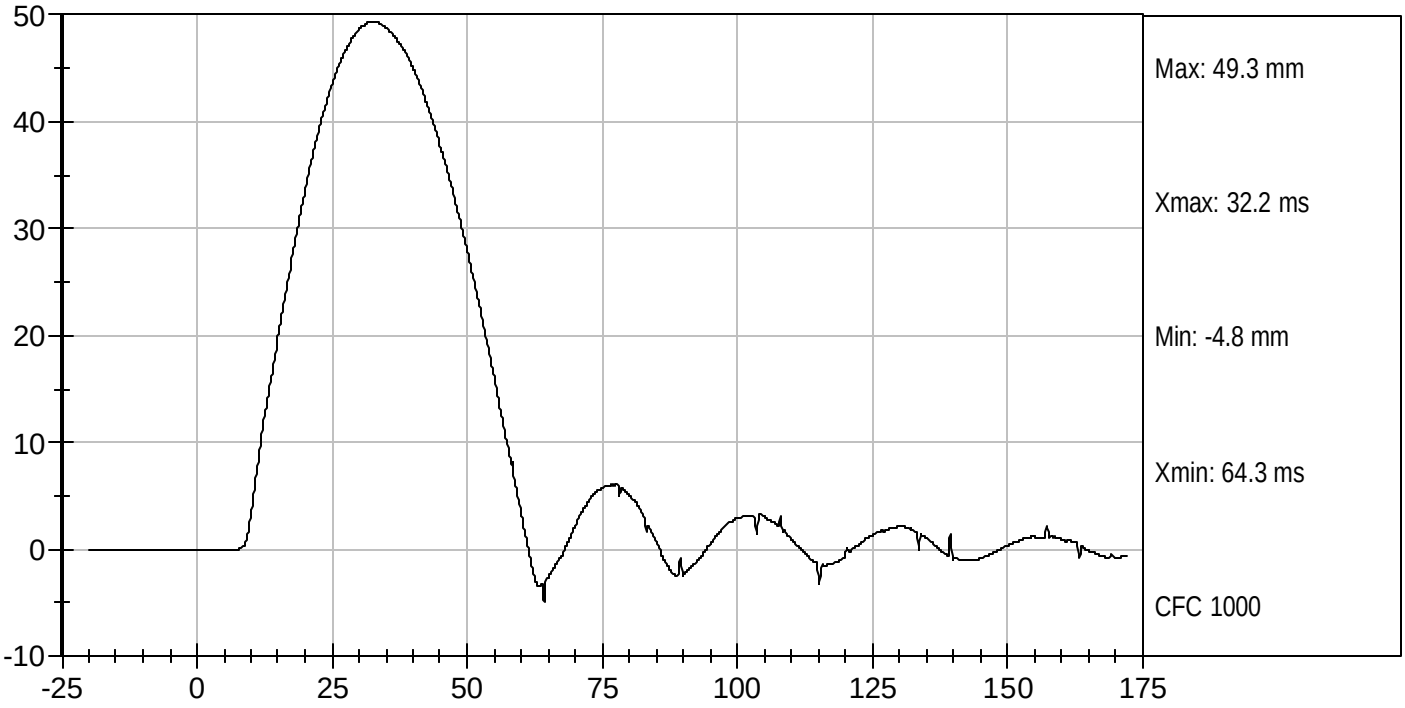
MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



Test Desc: Rib Impact - Mid
Componet ID: D052085

Test Date: 07/27/2005
Velocity: 2, 3, 4 m/s

MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052086

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Displacement at 2 m/s	m/s	23.5 to 27.5	27.2	Pass
Displacement at 3 m/s	G's	36.0 to 40.0	38.1	Pass
Displacement at 4 m/s	msec	46.0 to 51.0	46.8	Pass
		Overall Test Results		Pass

Laboratory Technician

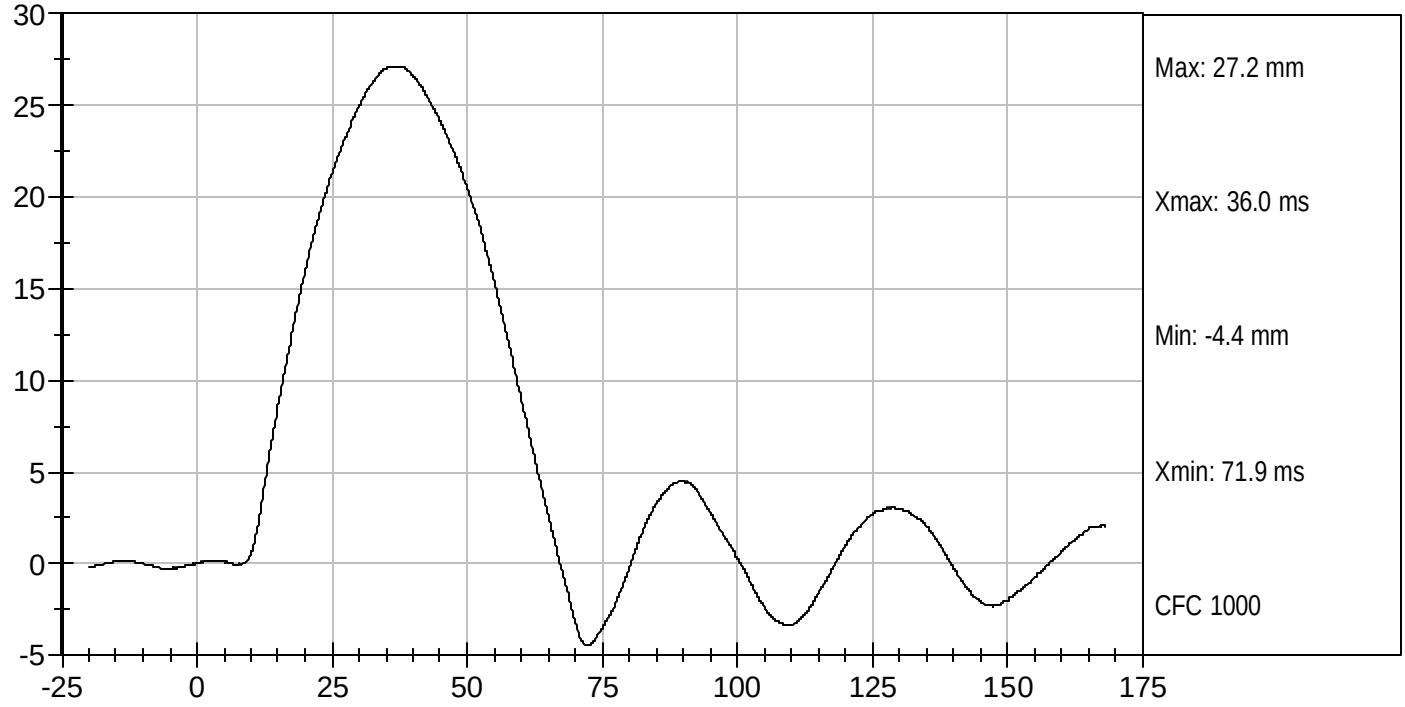
07/27/2005
Test Date

David Winkelbauer
Approved By

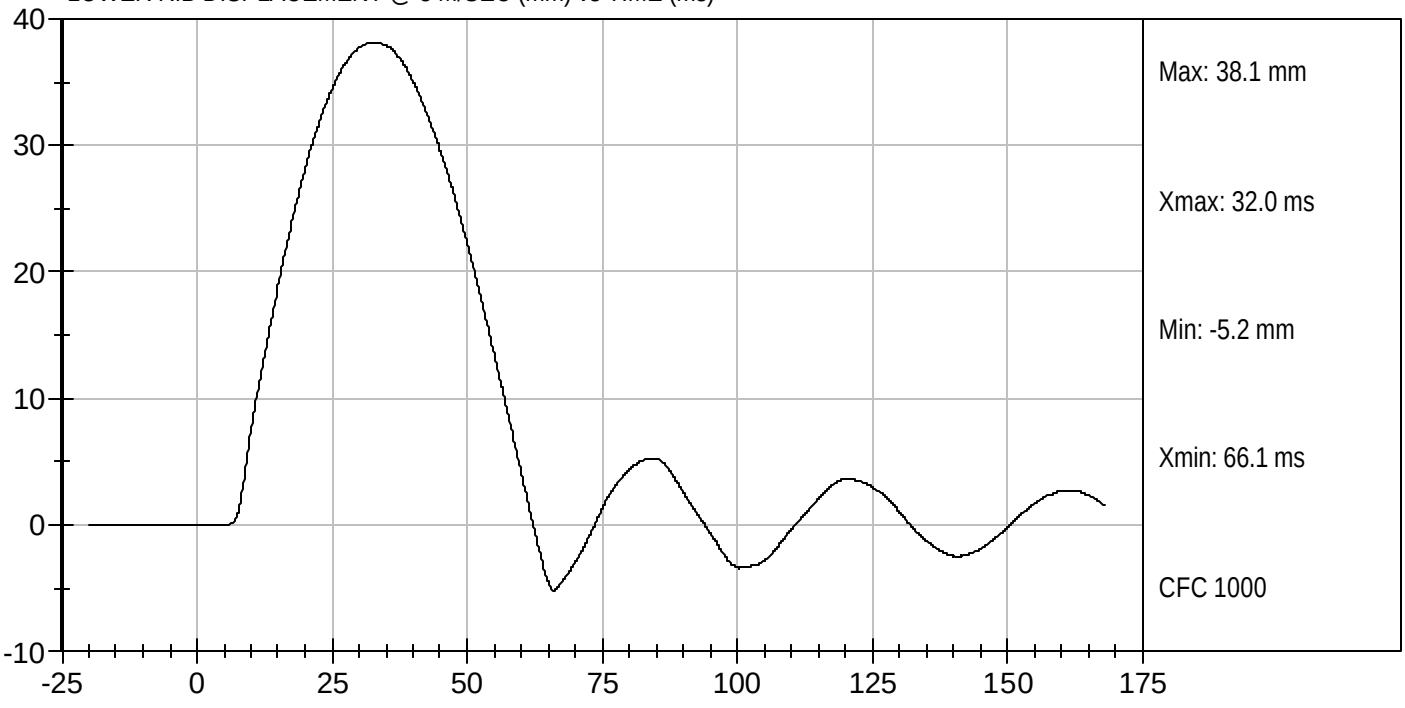
Test Desc: Rib Impact - Lower
Componet ID: D052086

Test Date: 07/27/2005
Velocity: 2, 3, 4 m/s

LOWER RIB DISPLACEMENT @ 2 M/SEC (mm) vs TIME (ms)



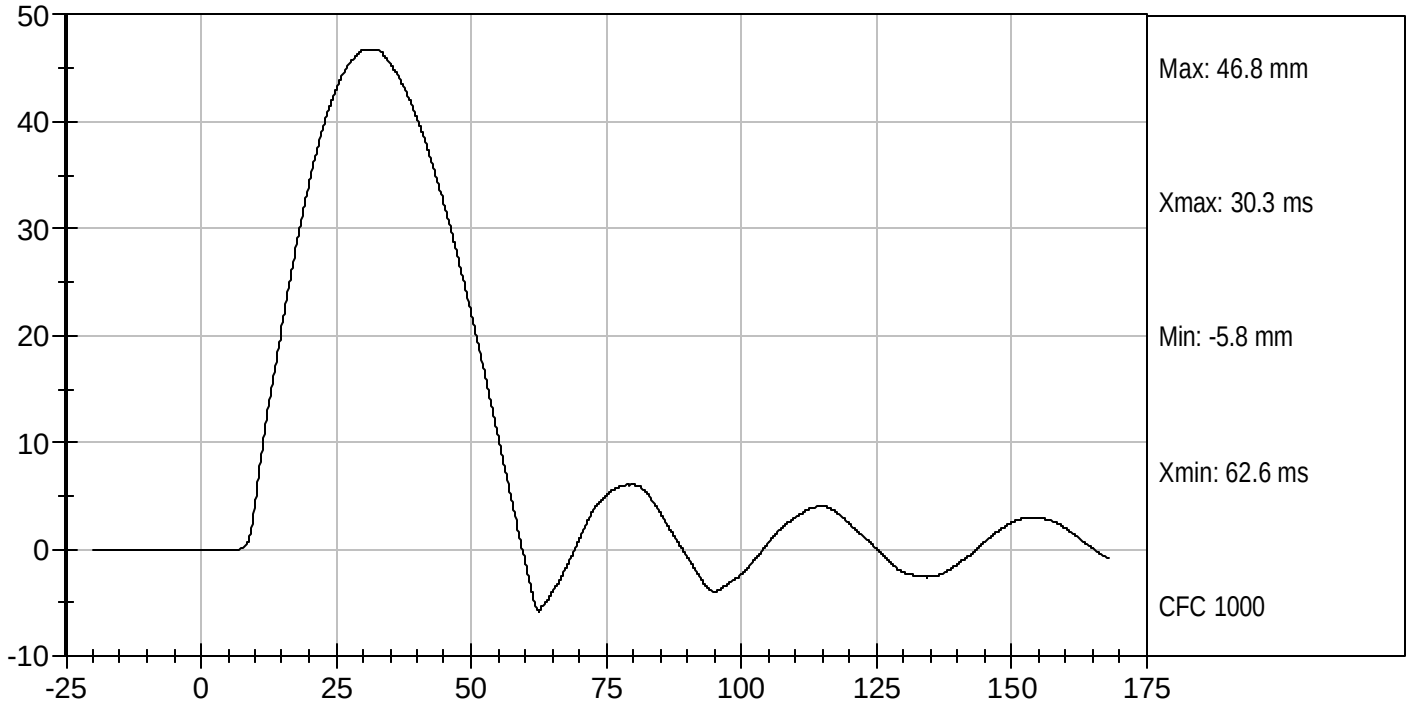
LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



Test Desc: Rib Impact - Lower
Componet ID: D052086

Test Date: 07/27/2005
Velocity: 2, 3, 4 m/s

LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052087

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/s	3.90 to 4.10	4.10	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.67	Pass
Time of Maximum Impactor Force	msec	10.60 to 13.00	12.50	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.57	Pass
Time of Maximum Abdomen Force	msec	10.00 to 12.30	12.10	Pass
		Overall Test Results		Pass

Joe Fleck
Laboratory Technician

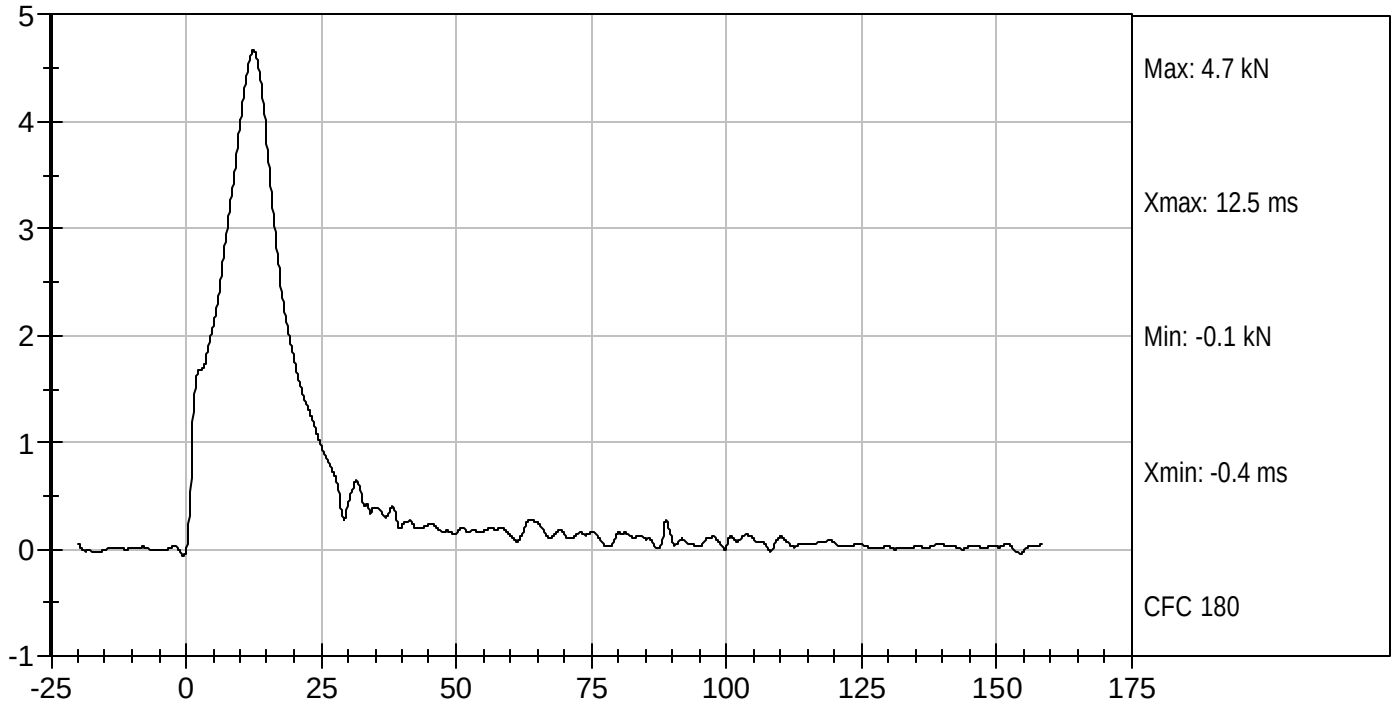
07/28/2005
Test Date

David Winkelbauer
Approved By

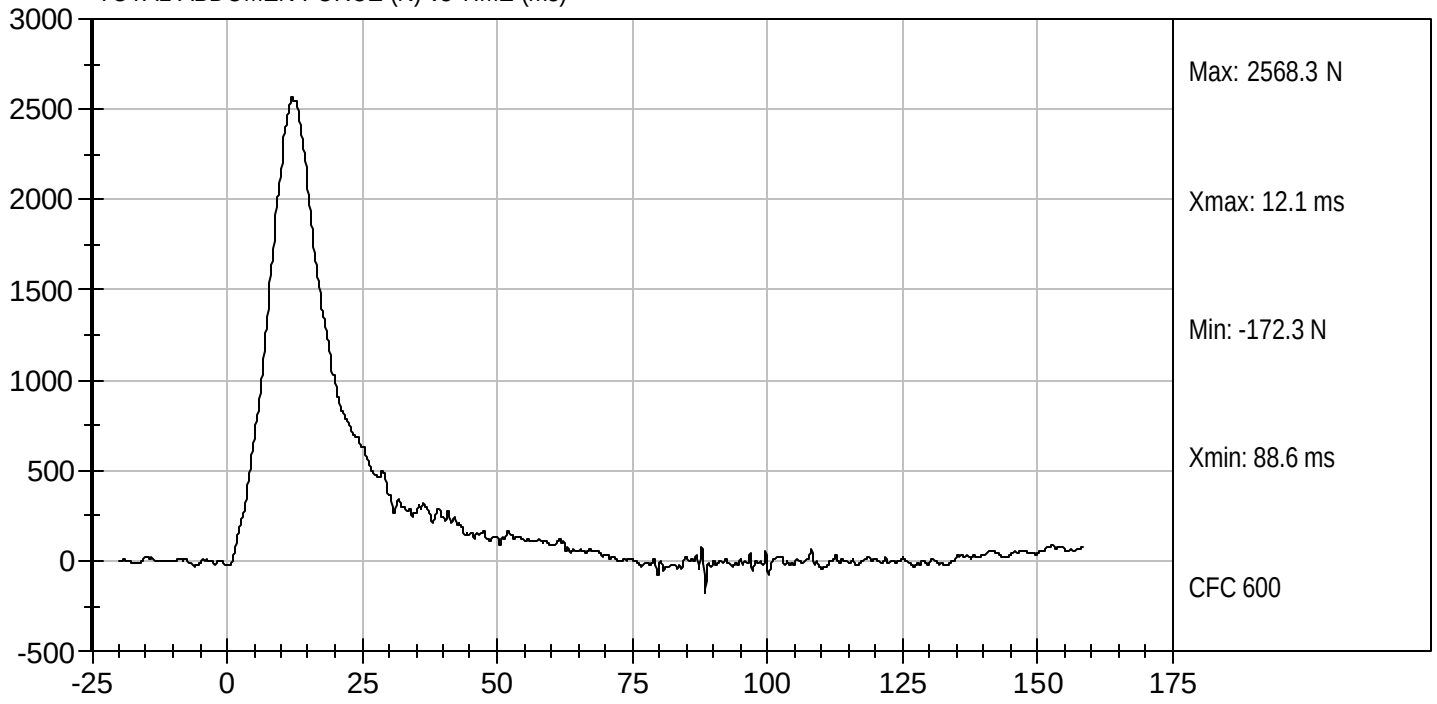
Test Desc: Abdomen Impact
Componet ID: D052087

Test Date: 07/28/2005
Velocity: 13.34 ft/s, 4.1 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052088

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Speed		m/sec	5.95 to 6.15	6.02	Pass
Pendulum Deceleration	10 msec	m/sec	-2.46 to -1.59	-2.06	Pass
	20 msec	m/sec	-5.25 to -4.07	-4.75	Pass
	25 msec	m/sec	-6.64 to -5.30	-5.95	Pass
	30 msec	m/sec	>= -6.5	-6.2	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	48.1	Pass
Time of Maximum Flexion Angle		msec	39.0 to 53.0	47.7	Pass
Maximum Theta (A)		deg	31.0 to 35.0	33.4	Pass
Time of Maximum Theta (A)		msec	44.0 to 52.0	45.4	Pass
Maximum Theta (B)		deg	28.75 to 31.25	31.17	Pass
Time of Maximum Theta (B)		msec	44.0 to 52.0	44.2	Pass
			Overall Results		Pass

Laboratory Technician

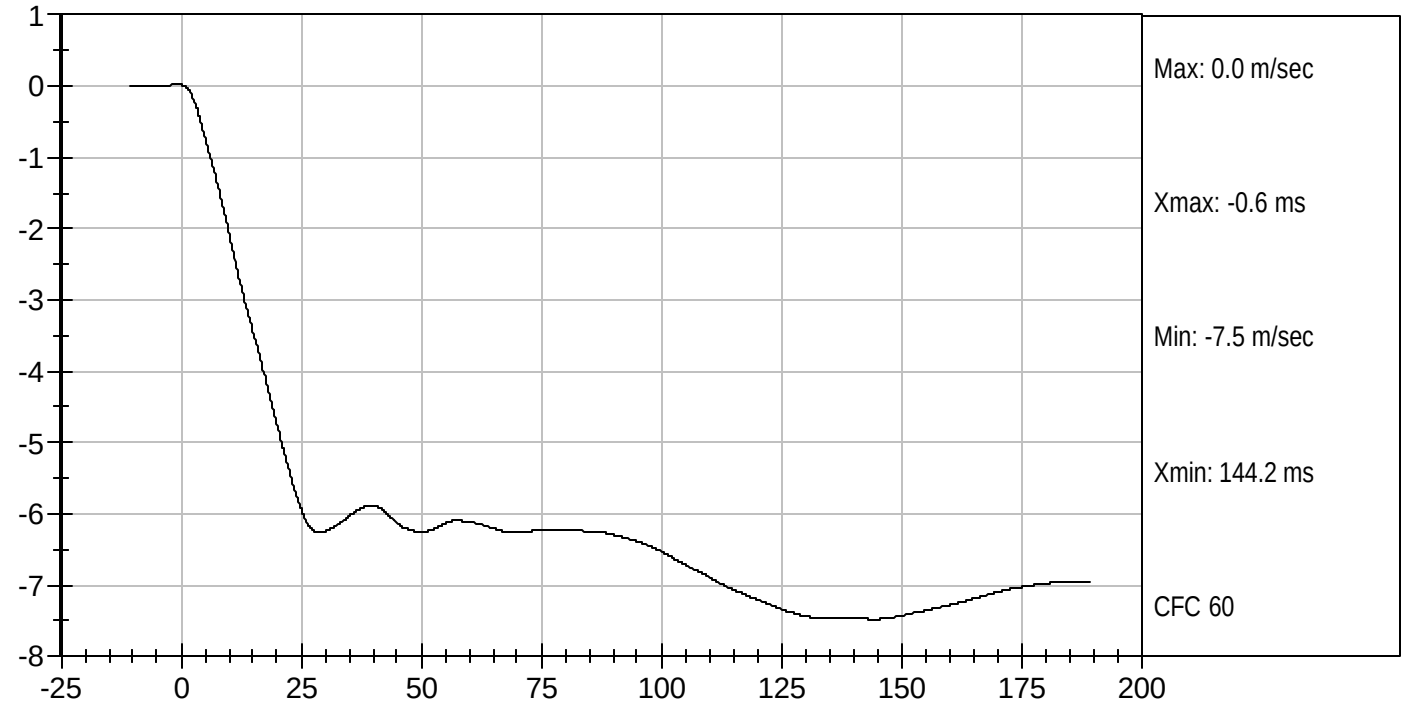
07/27/2005
Test Date

David Winkelbauer
Approved By

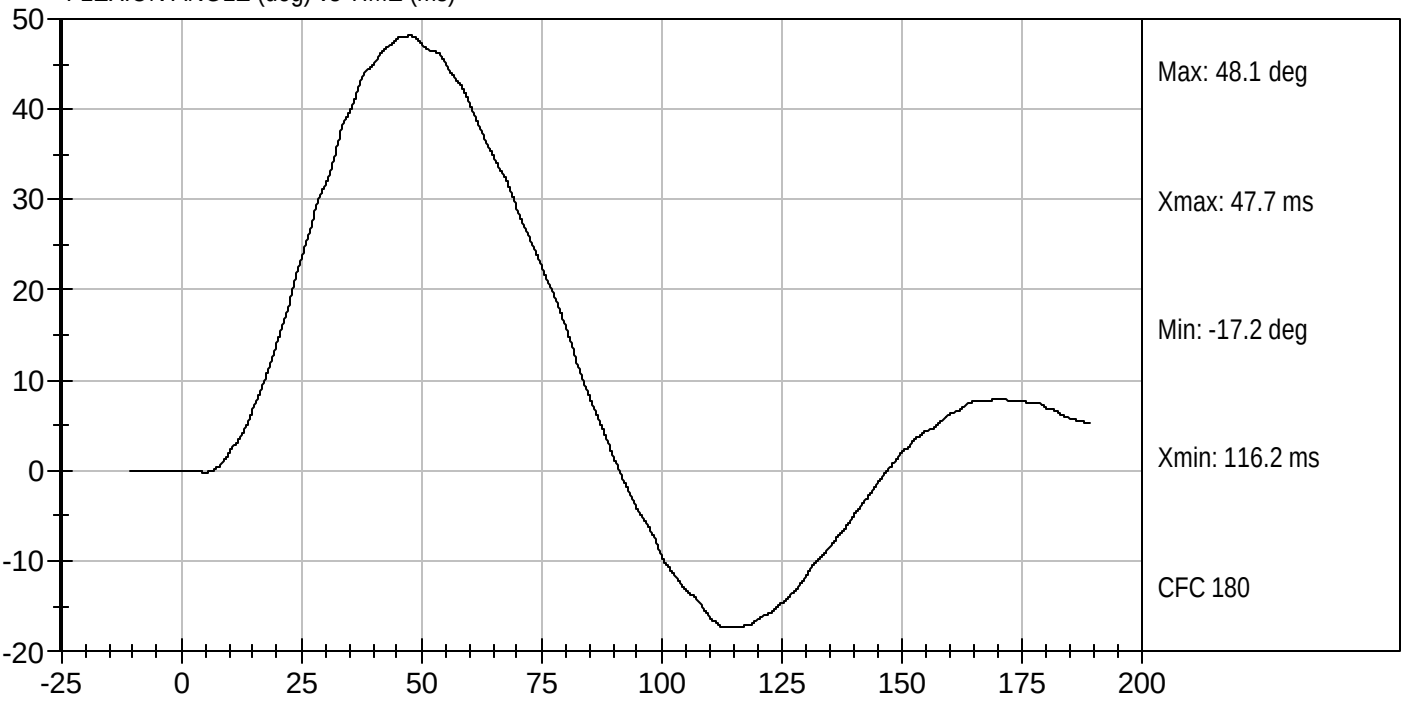
Test Desc: Neck Bending
Componet ID: D052088

Test Date: 07/27/2005
Velocity: 19.74 ft/s, 6.02 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

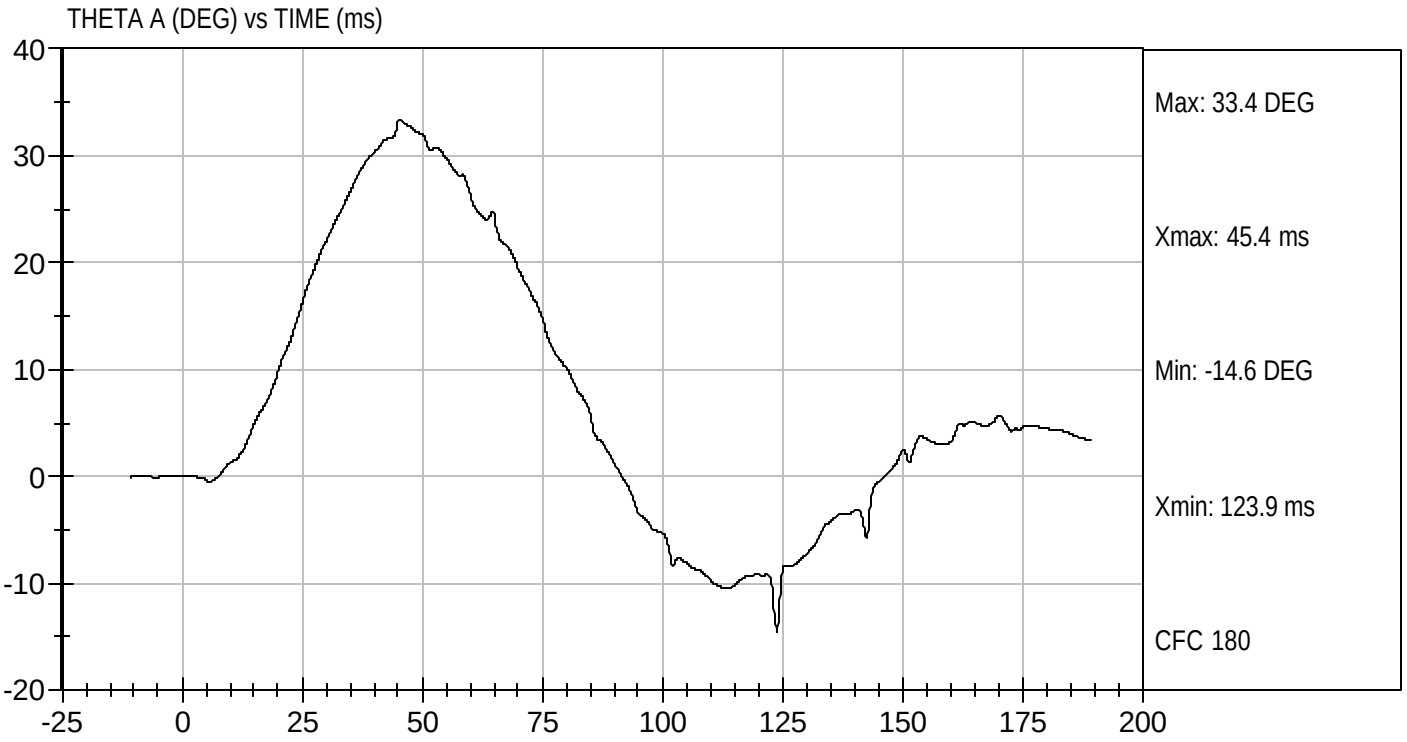


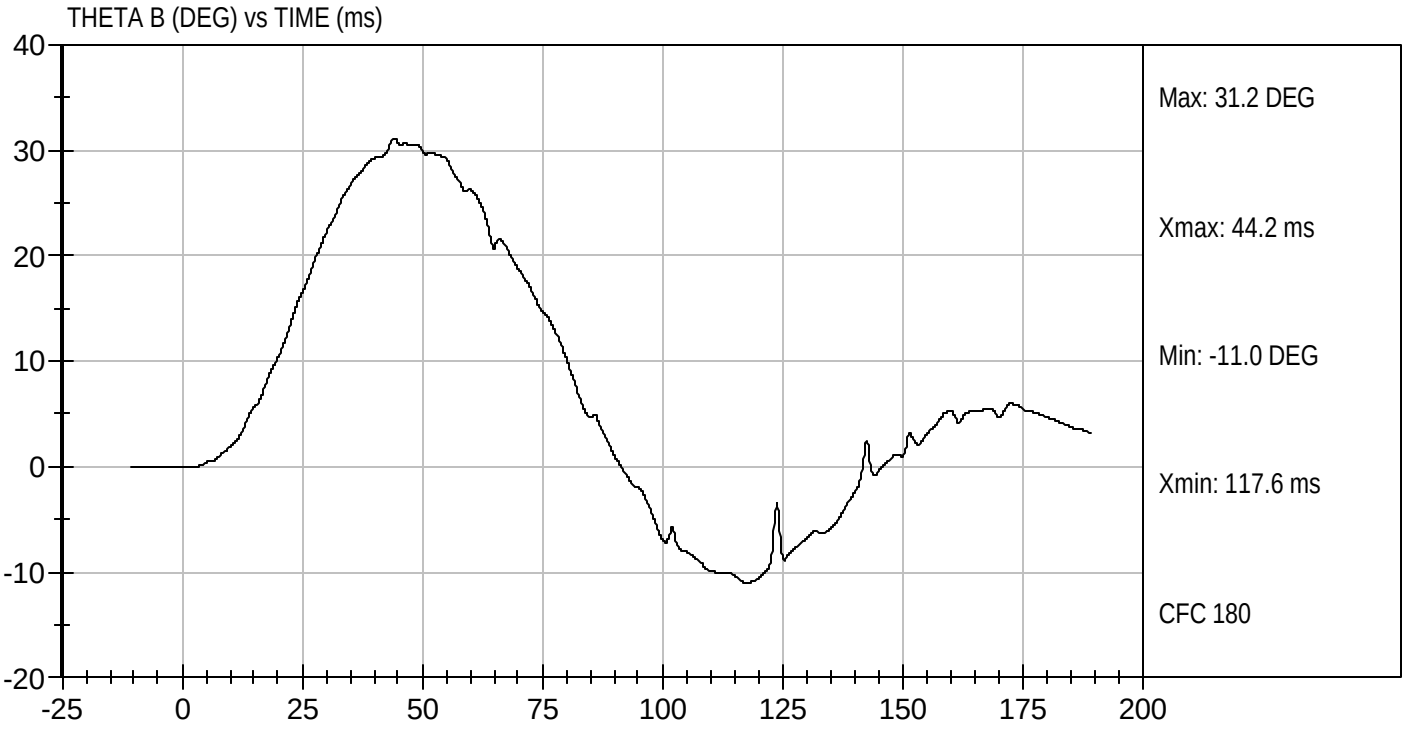
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Componet ID: D052088

Test Date: 07/27/2005
Velocity: 19.74 ft/s, 6.02 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052089

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/s	4.20 to 4.40	4.31	Pass
Maximum Impactor Force	kN	4.40 to 5.40	4.66	Pass
Time of Maximum Impactor Force	msec	10.30 to 15.50	14.90	Pass
Maximum Pubic Force	kN	1.04 to 1.64	1.34	Pass
Time of Maximum Pubic Force	msec	9.90 to 15.90	15.40	Pass
		Overall Test Results		Pass

Joe Fleck
Laboratory Technician

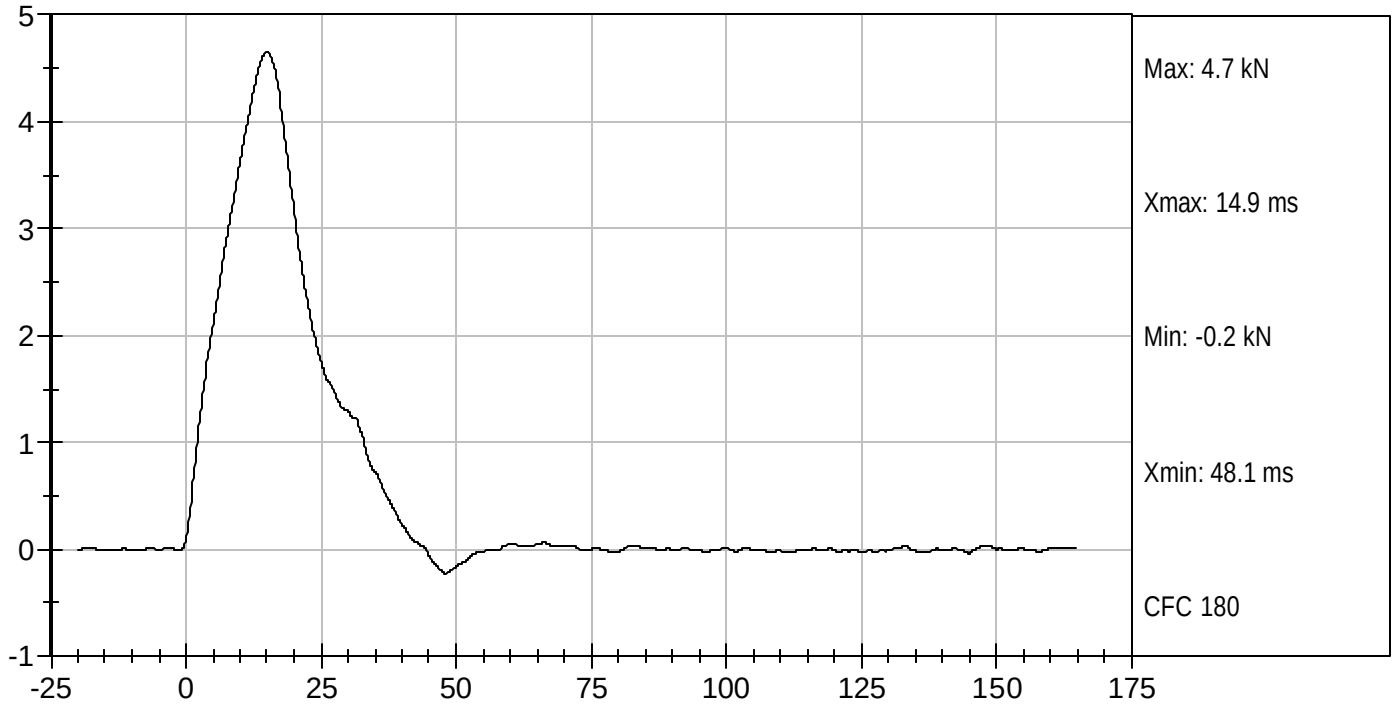
07/28/2005
Test Date

David Winkelbauer
Approved By

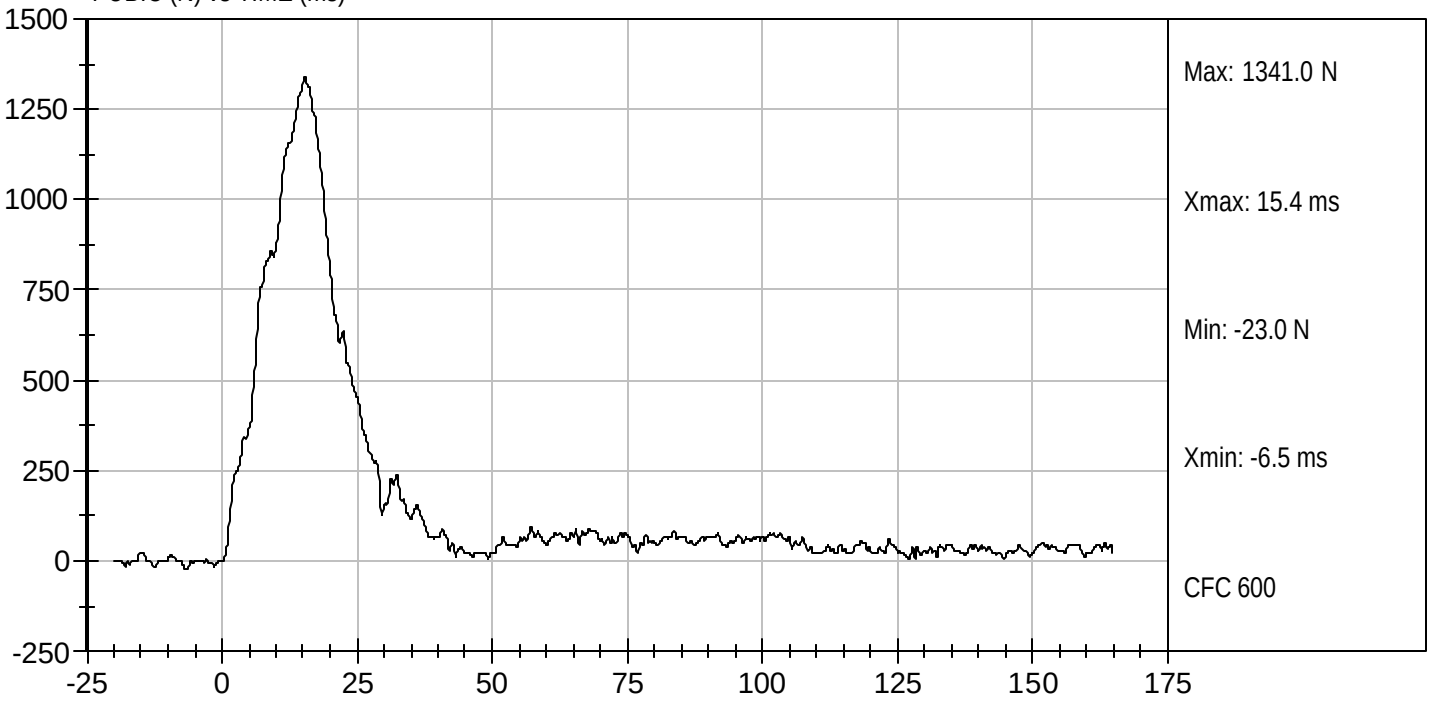
Test Desc: Pelvis Impact
Componet ID: D052089

Test Date: 07/28/2005
Velocity: 14.13 ft/s, 4.3 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



PUBIC (N) vs TIME (ms)



CERTIFICATION DATA

Dummy Serial Number: 010

POST-TEST CALIBRATION

MGA RESEARCH CORPORATION

HEAD DROP TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test ID:** D052201

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 - 22.0	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	100 - 150	127	Pass
Time of Maximum Resultant Acceleration	msec	NA	31.3	Pass
		Overall Test Results		Pass

Joe Fleck

Laboratory Technician

08/05/2005

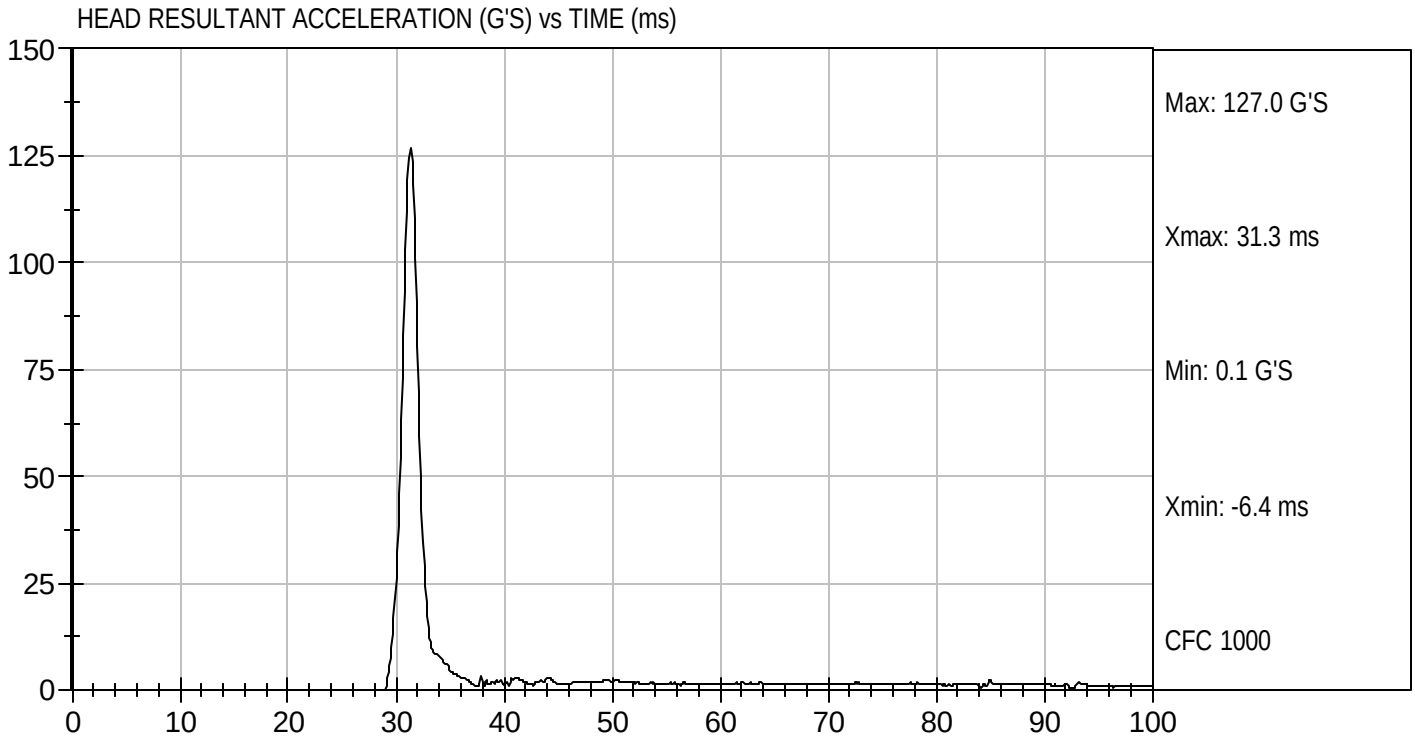
Test Date

David Winkelbauer

Approved By

Test Desc: Head Drop
Componet ID: D052201

Test Date: 08/05/2005
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052202

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.3	Pass
Pendulum Deceleration	3 msec	G's	-0.25 to -0.53	-0.40	Pass
	8 msec	G's	-1.59 to -2.04	-1.91	Pass
	14 msec	G's	-3.20 to -3.85	-3.46	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	55.5	Pass
Time of Maximum Flexion Angle		msec	54.0 to 66.0	62.5	Pass
Maximum Angle Theta (A)		deg	32.7 to 37.0	36.0	Pass
Time of Maximum Theta (A)		msec	53.0 to 63.0	56.2	Pass
Maximum Angle Theta (B)		deg	30.91 to 33.41	33.20	Pass
Time of Maximum Theta (B)		msec	54.0 to 64.0	62.8	Pass
			Overall Test Results		Pass

Joe Fleck

Laboratory Technician

08/08/2005

Test Date

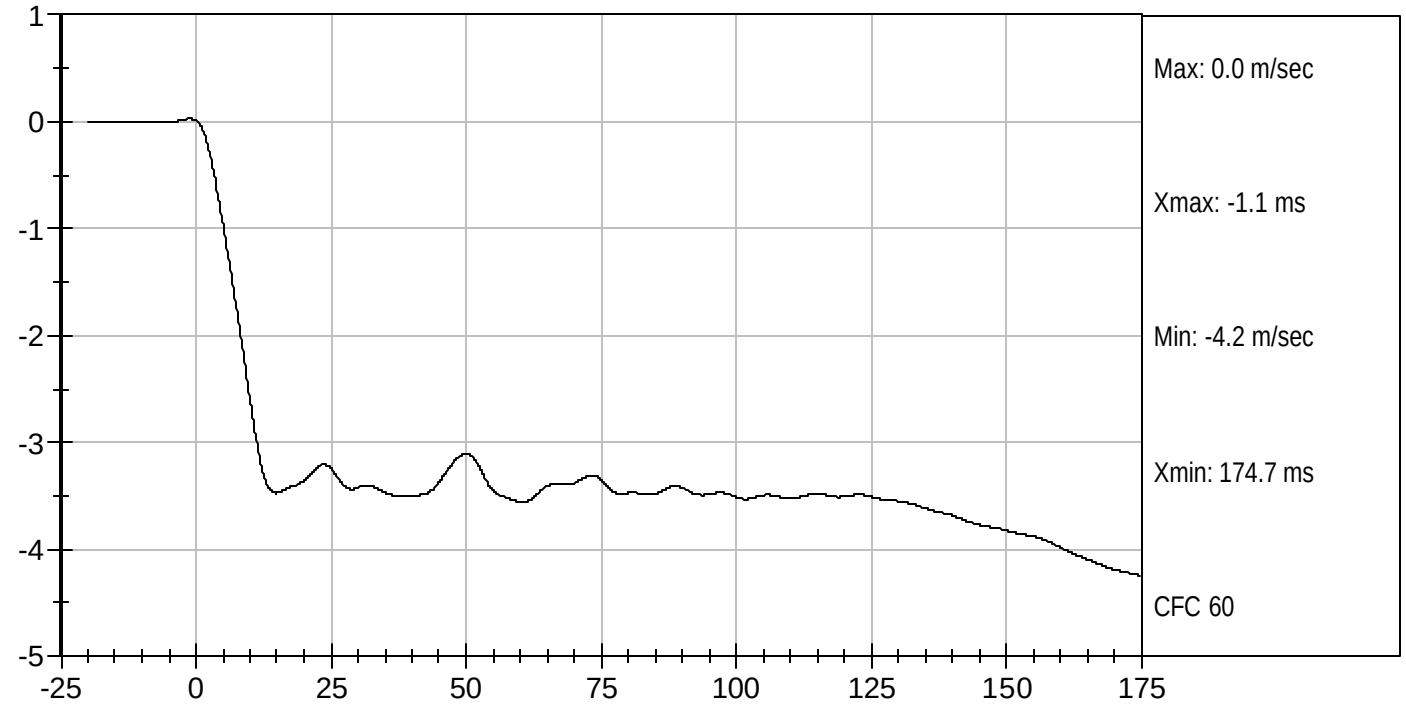
David Winkelbauer

Approved By

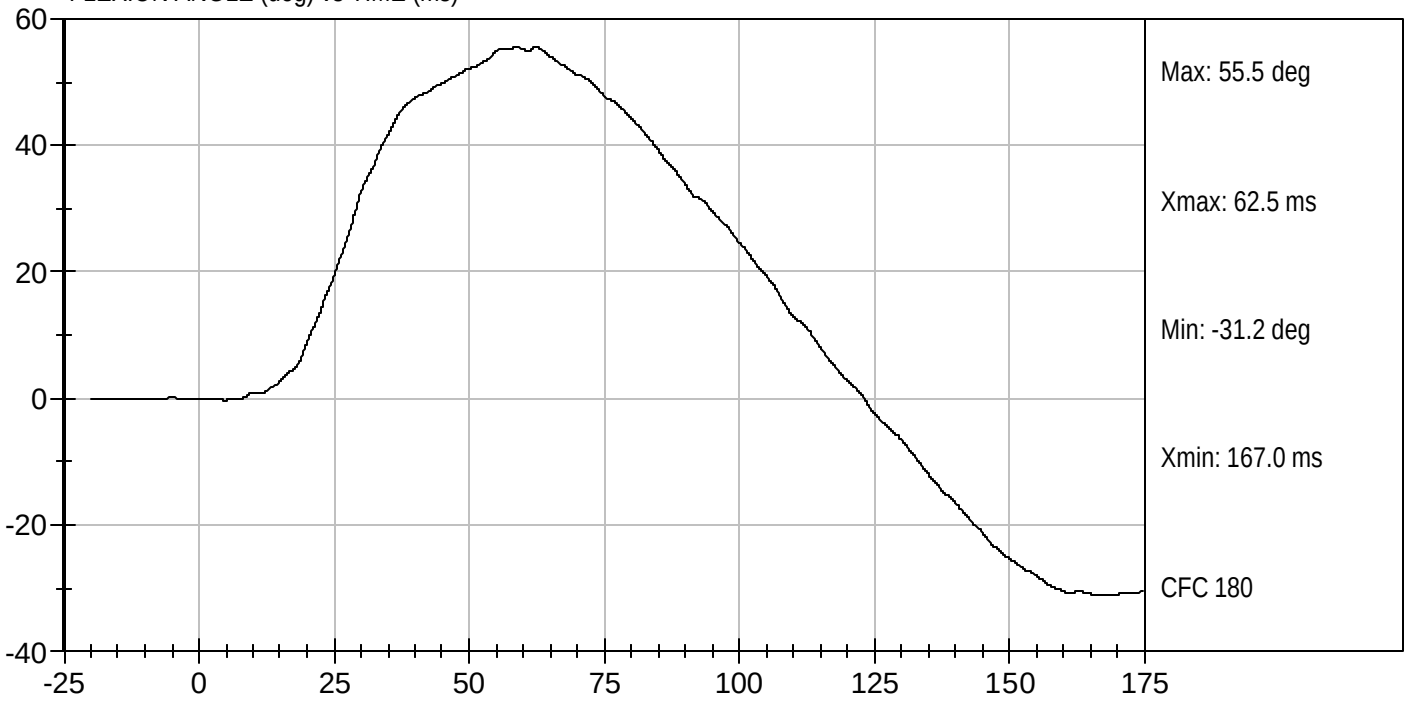
Test Desc: Neck Bending
Componet ID: D052202

Test Date: 08/08/2005
Velocity: 10.89 ft/s, 3.3 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)



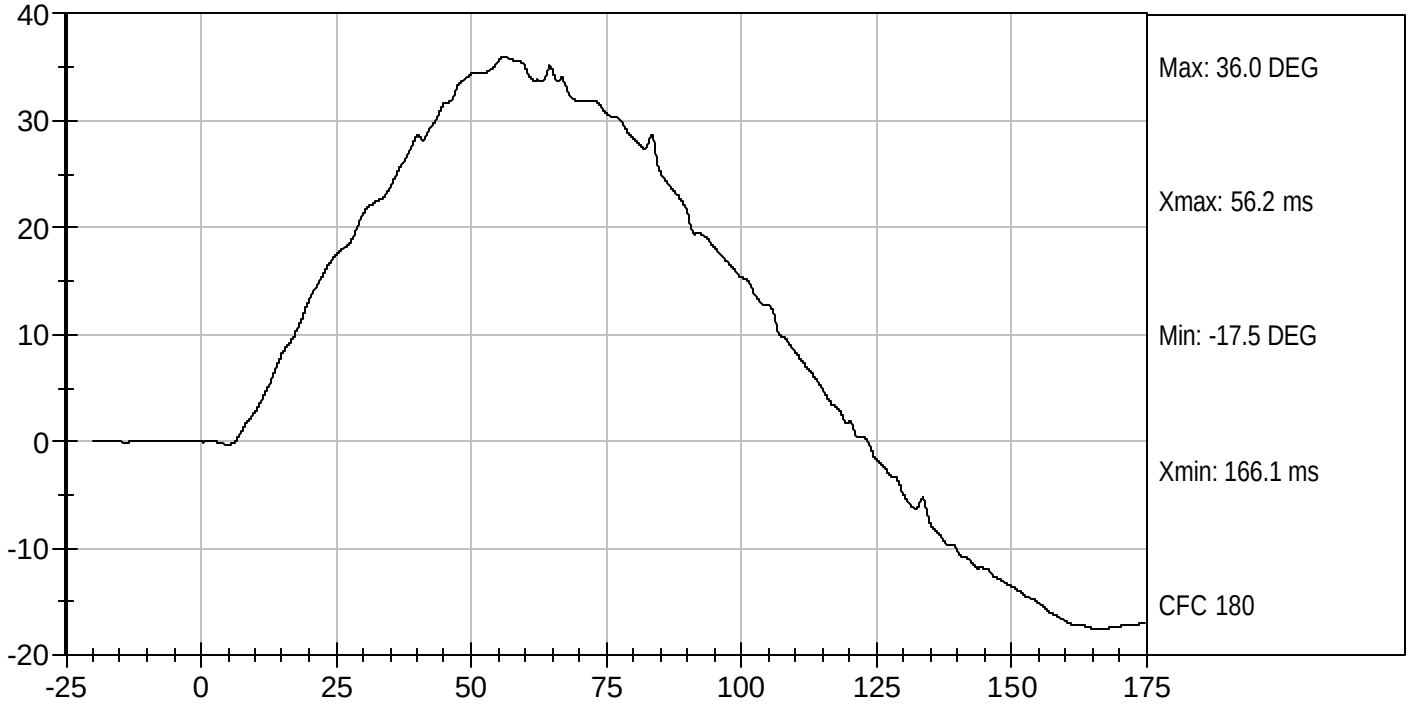
FLEXION ANGLE (deg) vs TIME (ms)



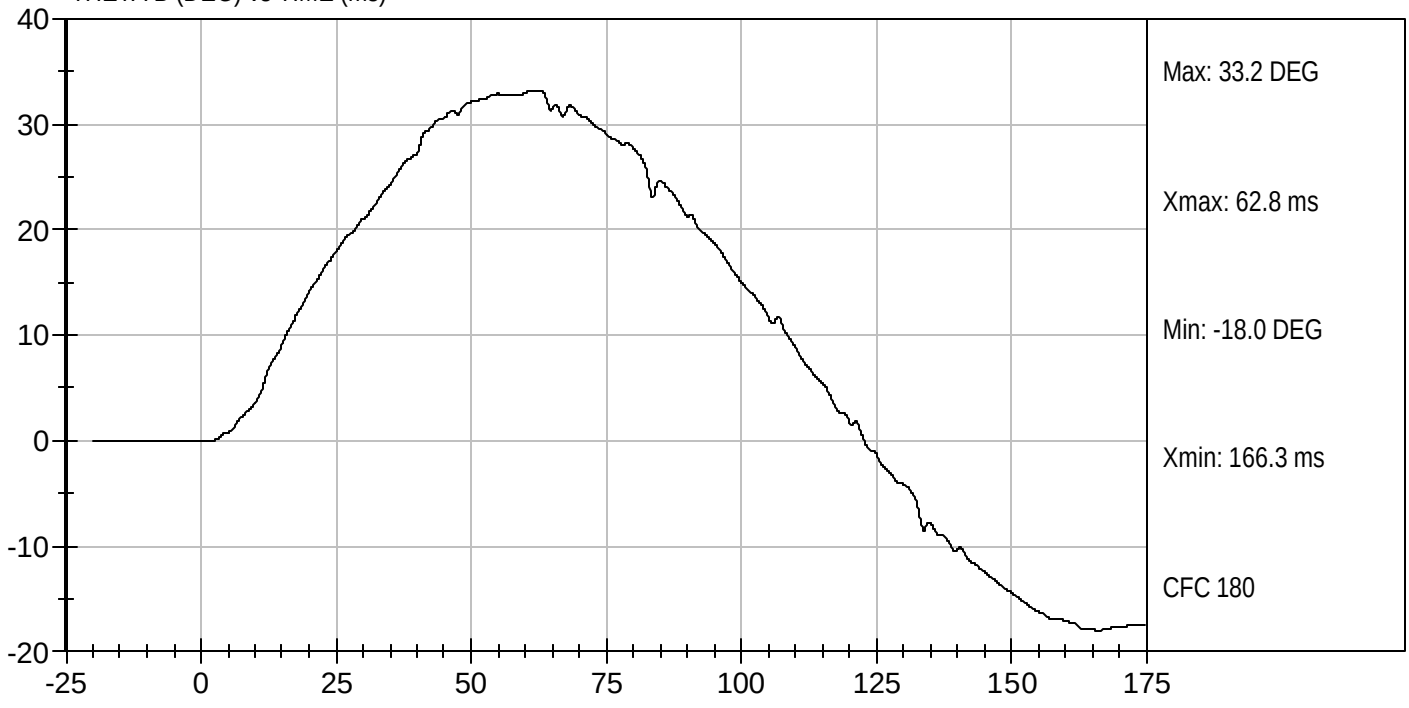
Test Desc: Neck Bending
Componet ID: D052202

Test Date: 08/08/2005
Velocity: 10.89 ft/s, 3.3 m/s

THETA A (DEG) vs TIME (ms)



THETA B (DEG) vs TIME (ms)



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052203

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.2	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	9.3	Pass
Time of Peak Shoulder Acceleration	msec	NA	13.0	Pass
		Overall Test Results		Pass

Laboratory Technician

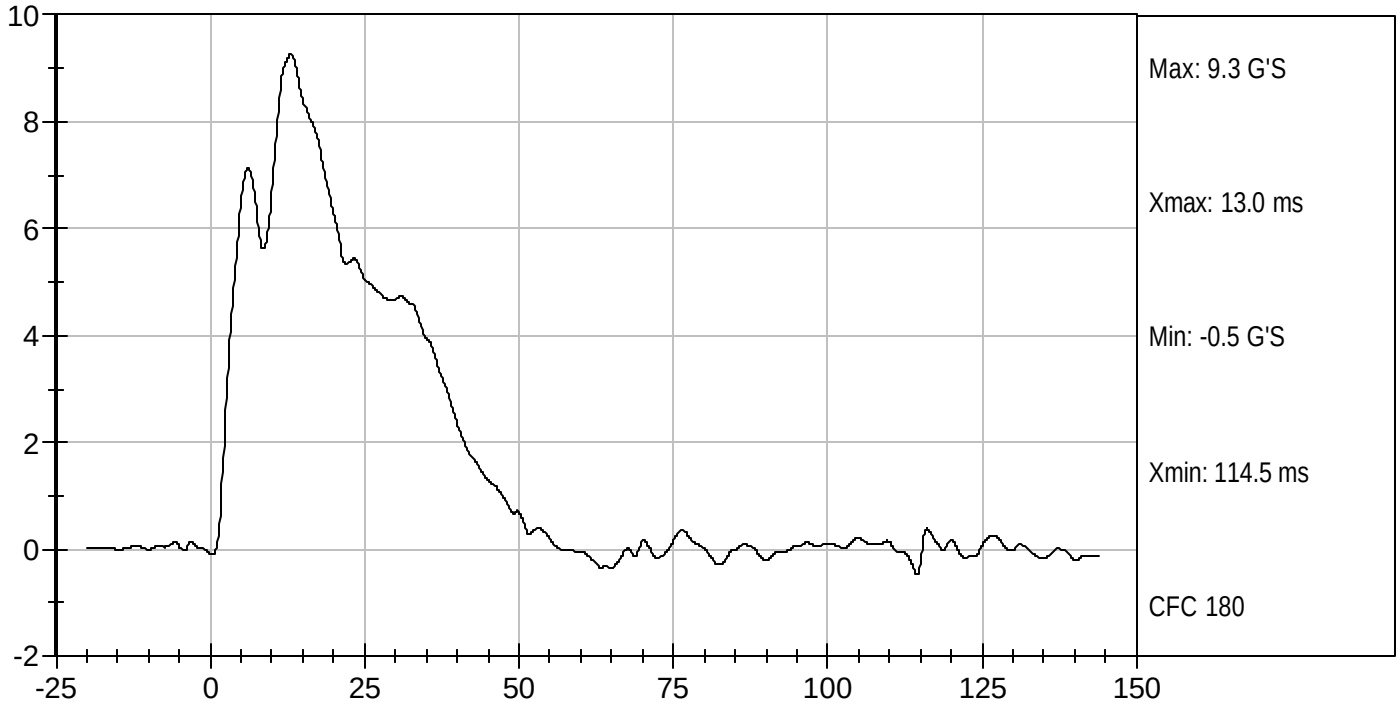
08/08/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Componet ID: D052203

Test Date: 08/08/2005
Velocity: 13.88 ft/s, 4.2 m/s

SHOULDER ACCELERATION (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052204

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Displacement at 2 m/s	m/s	23.5 to 27.5	25.7	Pass
Displacement at 3 m/s	G's	36.0 to 40.0	36.5	Pass
Displacement at 4 m/s	msec	46.0 to 51.0	47.4	Pass
		Overall Test Results		Pass

Joe Fleck
Laboratory Technician

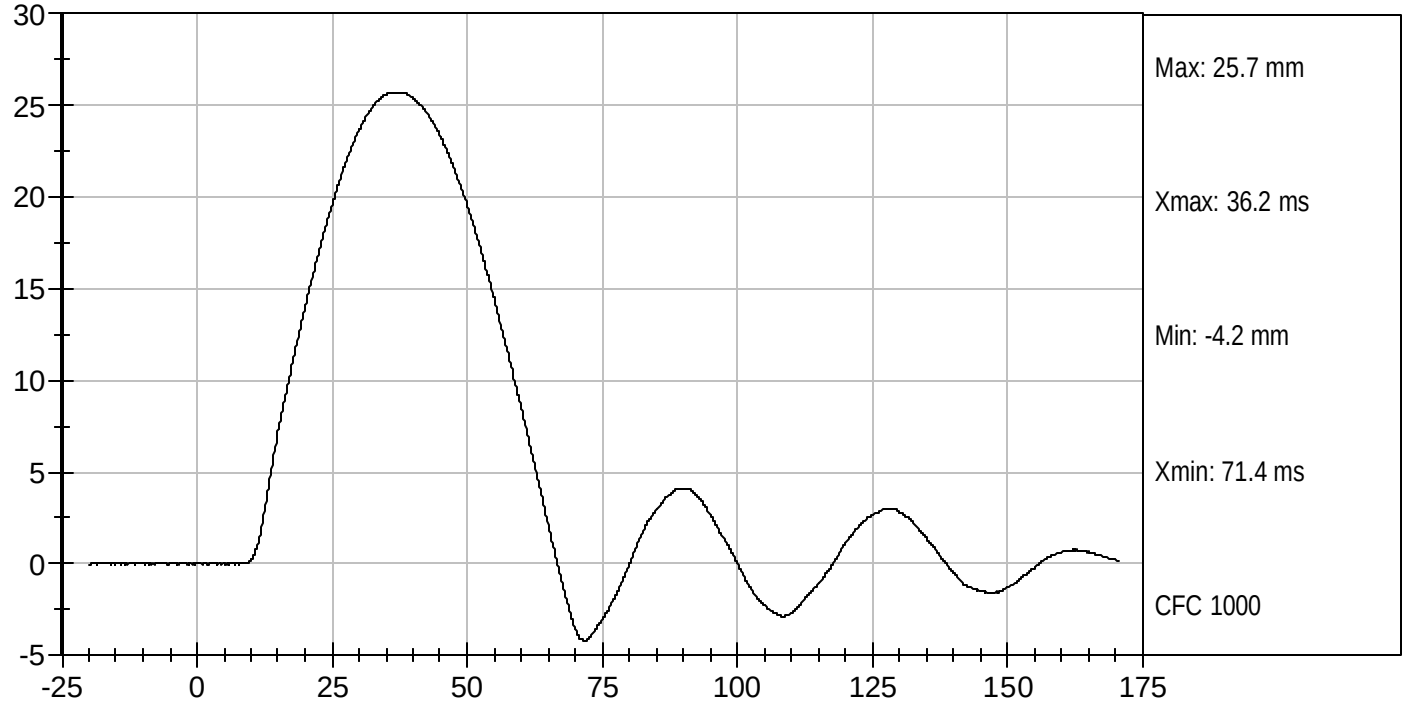
08/05/2005
Test Date

David Winkelbauer
Approved By

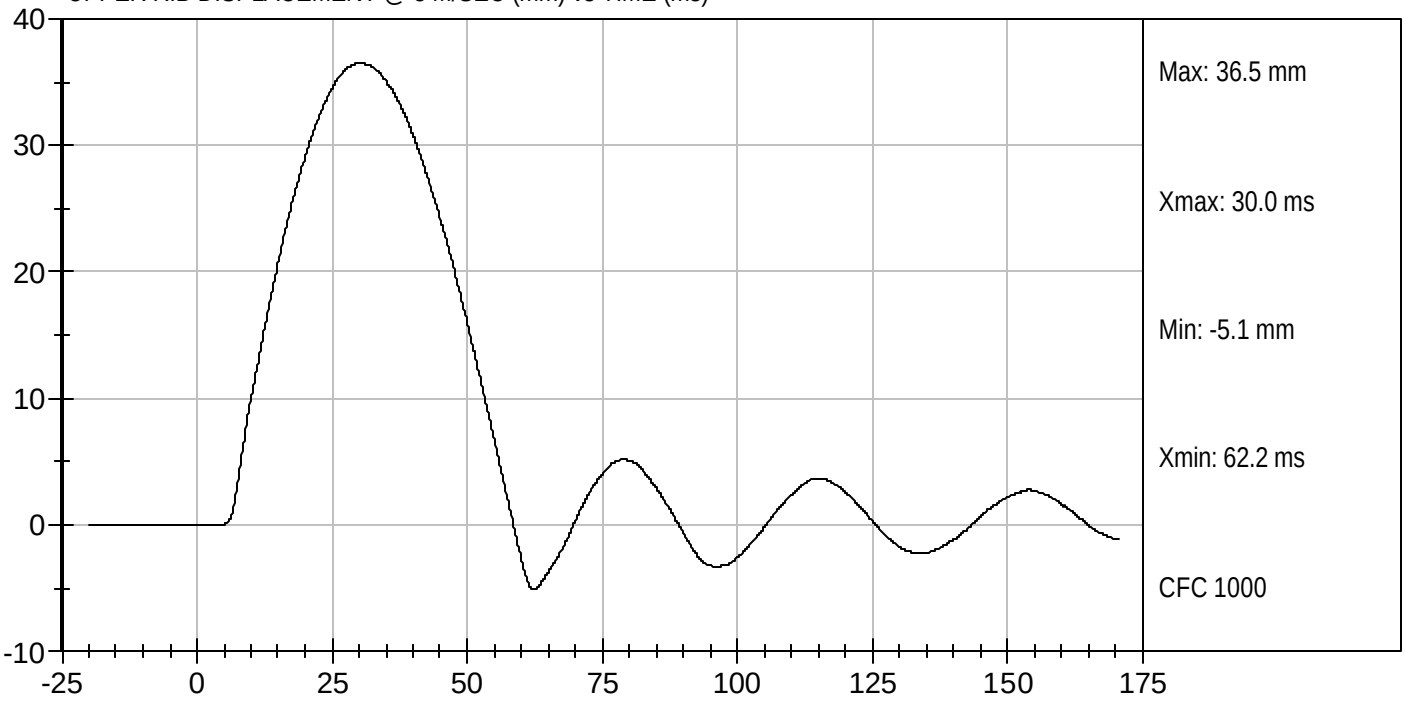
Test Desc: Rib Impact - Upper
Componet ID: D052204

Test Date: 08/05/2005
Velocity: 6.56 ft/s, 2 m/s

UPPER RIB DISPLACEMENT @ 2 M/SEC (mm) vs TIME (ms)

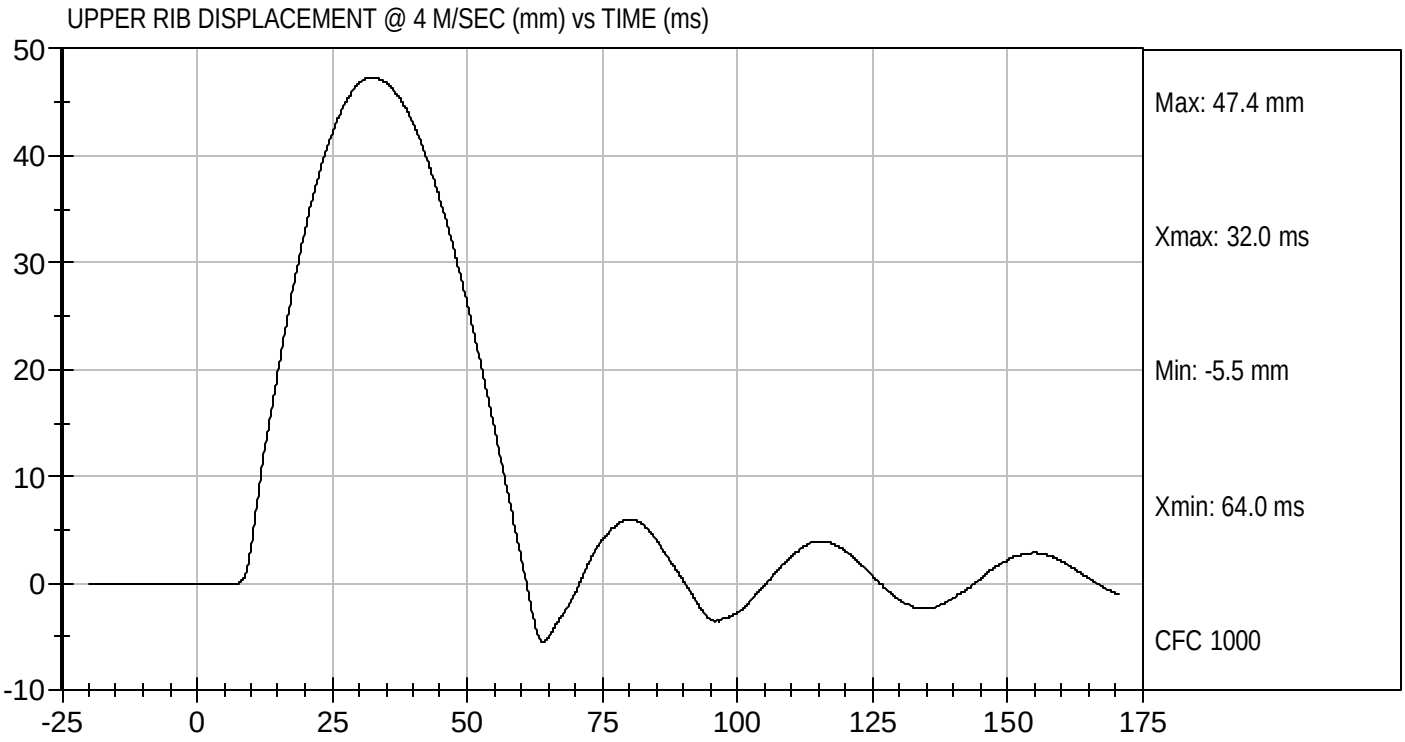


UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



Test Desc: Rib Impact - Upper
Componet ID: D052204

Test Date: 08/05/2005
Velocity: 13.12 ft/s, 4 m/s



MGA RESEARCH CORPORATION

MID RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052205

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Displacement at 2 m/s	m/s	23.5 to 27.5	26.7	Pass
Displacement at 3 m/s	G's	36.0 to 40.0	38.3	Pass
Displacement at 4 m/s	msec	46.0 to 51.0	49.0	Pass
		Overall Test Results		Pass

Laboratory Technician

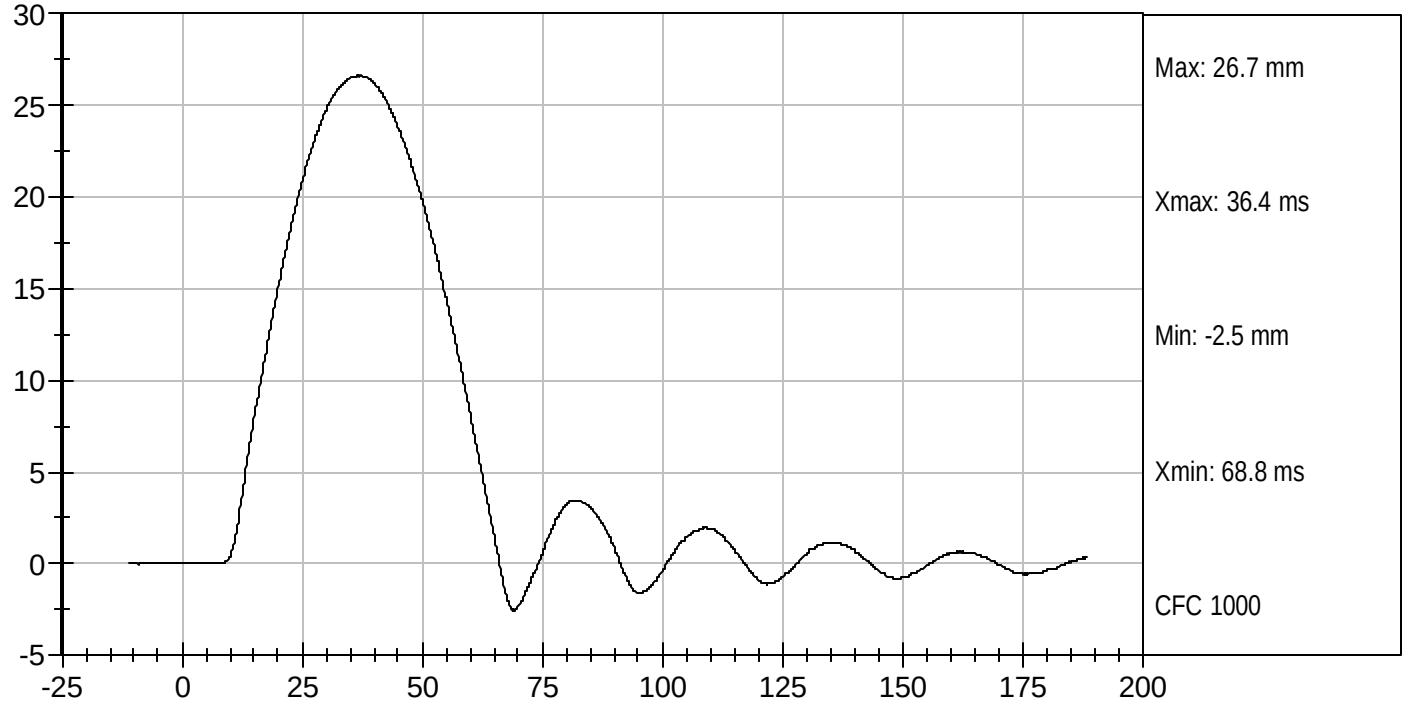
08/05/2005
Test Date

David Winkelbauer
Approved By

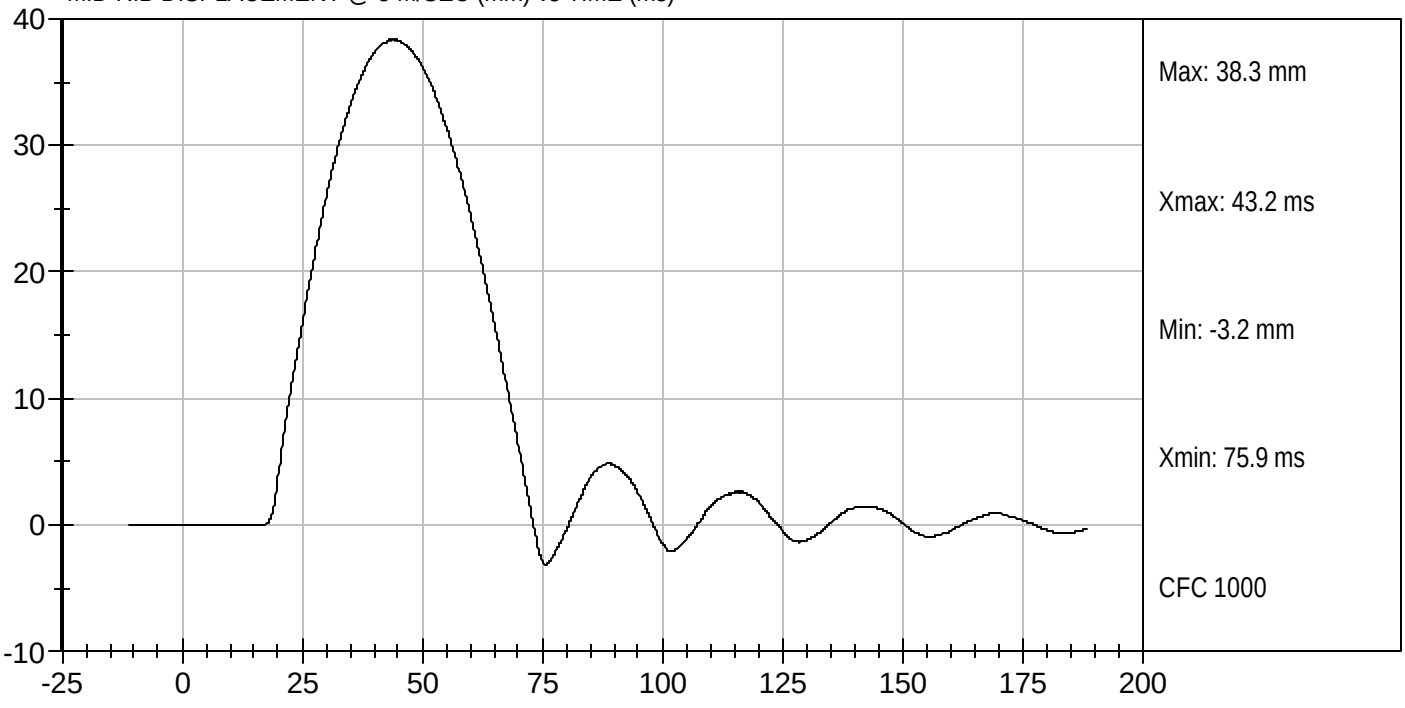
Test Desc: Rib Impact - Mid
Componet ID: D052205

Test Date: 08/05/2005
Velocity: 6.56 ft/s, 2 m/s

MID RIB DISPLACEMENT @ 2 M/SEC (mm) vs TIME (ms)

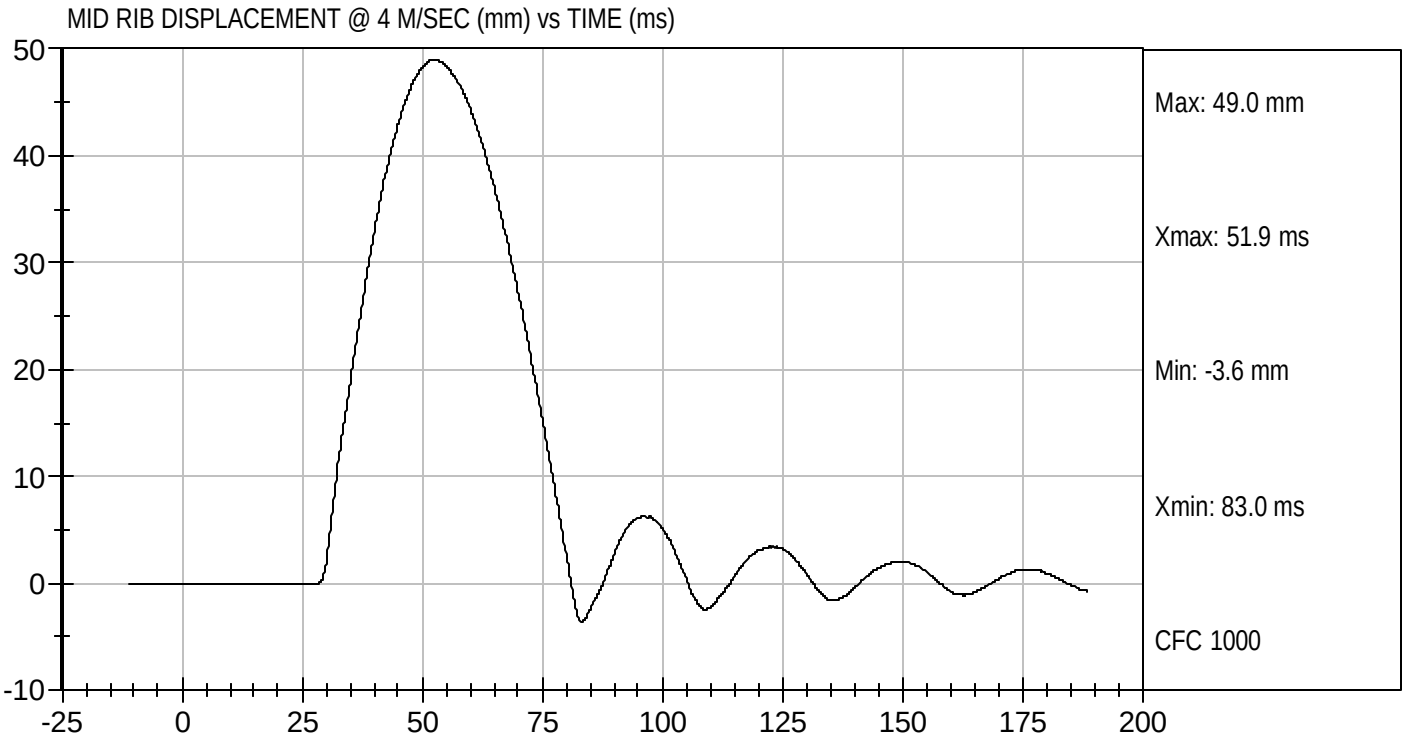


MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



Test Desc: Rib Impact - Mid
Componet ID: D052205

Test Date: 08/05/2005
Velocity: 13.12 ft/s, 4 m/s



MGA RESEARCH CORPORATION

LOWER RIB TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052206

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Displacement at 2 m/s	m/s	23.5 to 27.5	26.3	Pass
Displacement at 3 m/s	G's	36.0 to 40.0	37.5	Pass
Displacement at 4 m/s	msec	46.0 to 51.0	47.0	Pass
		Overall Test Results		Pass

Laboratory Technician

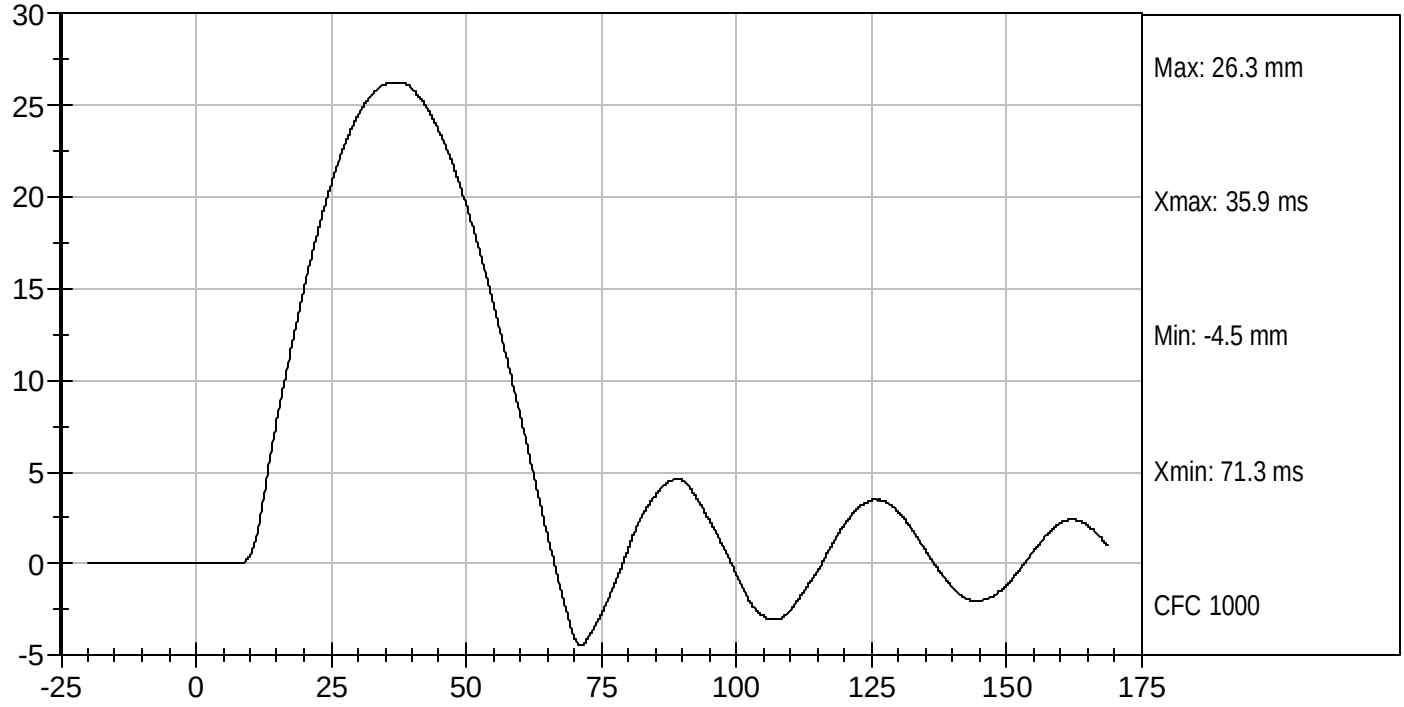
08/08/2005
Test Date

David Winkelbauer
Approved By

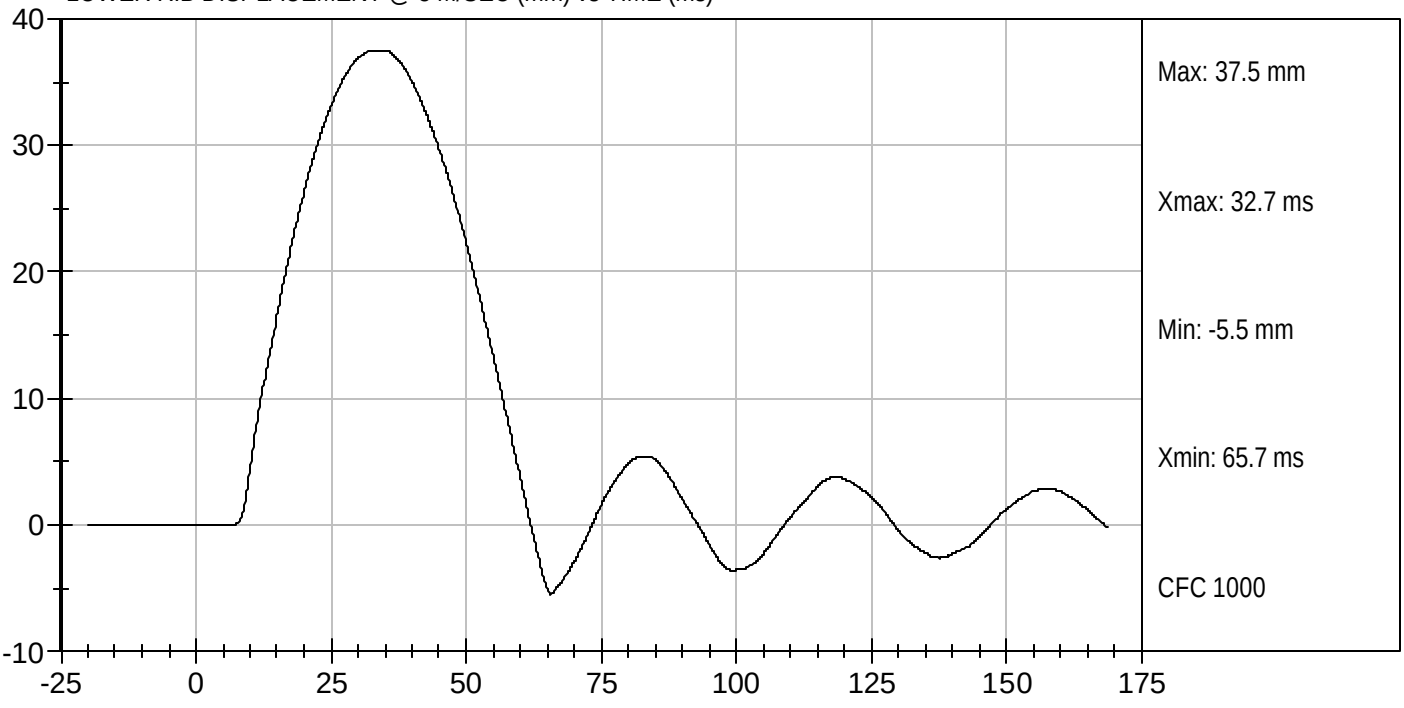
Test Desc: Rib Impact - Lower
Componet ID: D052206

Test Date: 08/08/2005
Velocity: 6.56 ft/s, 2 m/s

LOWER RIB DISPLACEMENT @ 2 M/SEC (mm) vs TIME (ms)



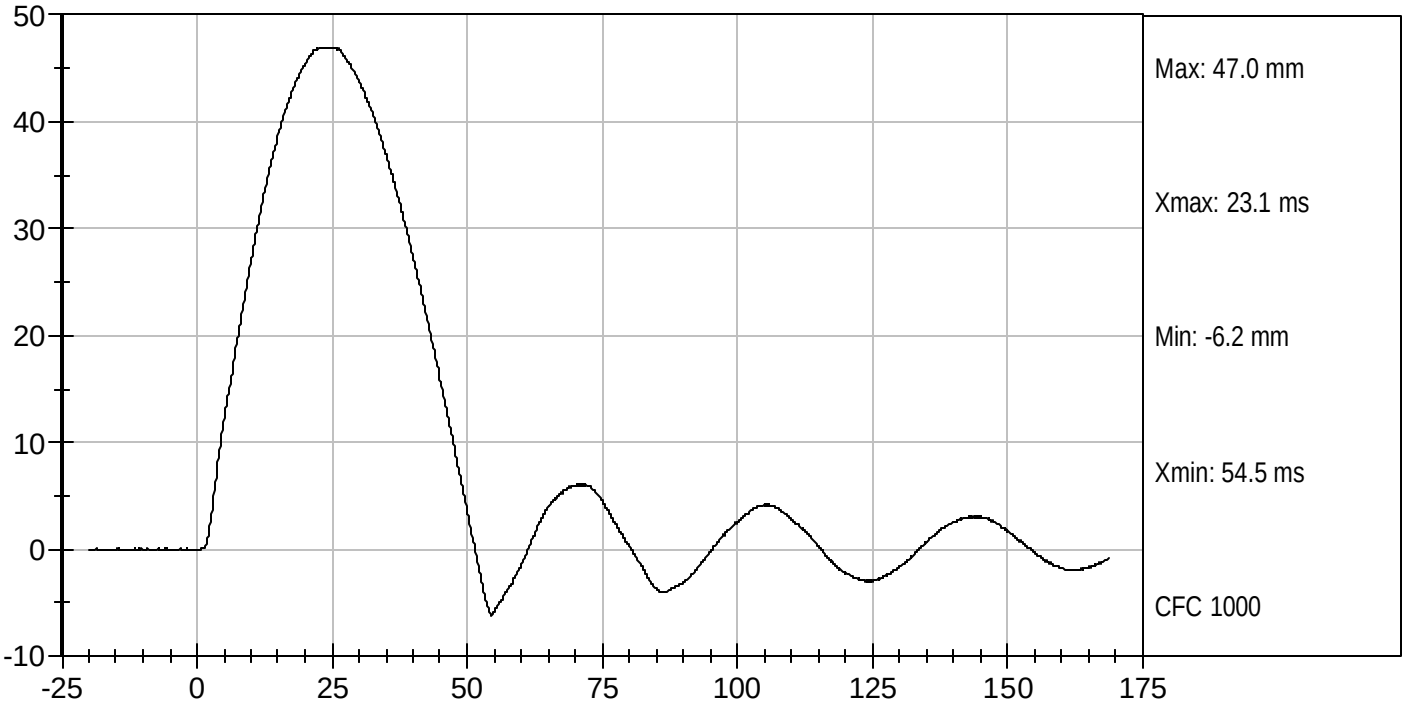
LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



Test Desc: Rib Impact - Lower
Componet ID: D052206

Test Date: 08/08/2005
Velocity: 13.12 ft/s, 4 m/s

LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052207

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	3.90 to 4.10	3.93	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.24	Pass
Time of Maximum Impactor Force	msec	10.60 to 13.00	12.60	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.51	Pass
Time of Maximum Abdomen Force	msec	10.00 to 12.30	10.20	Pass
		Overall Test Results		Pass

Joe Fleck
Laboratory Technician

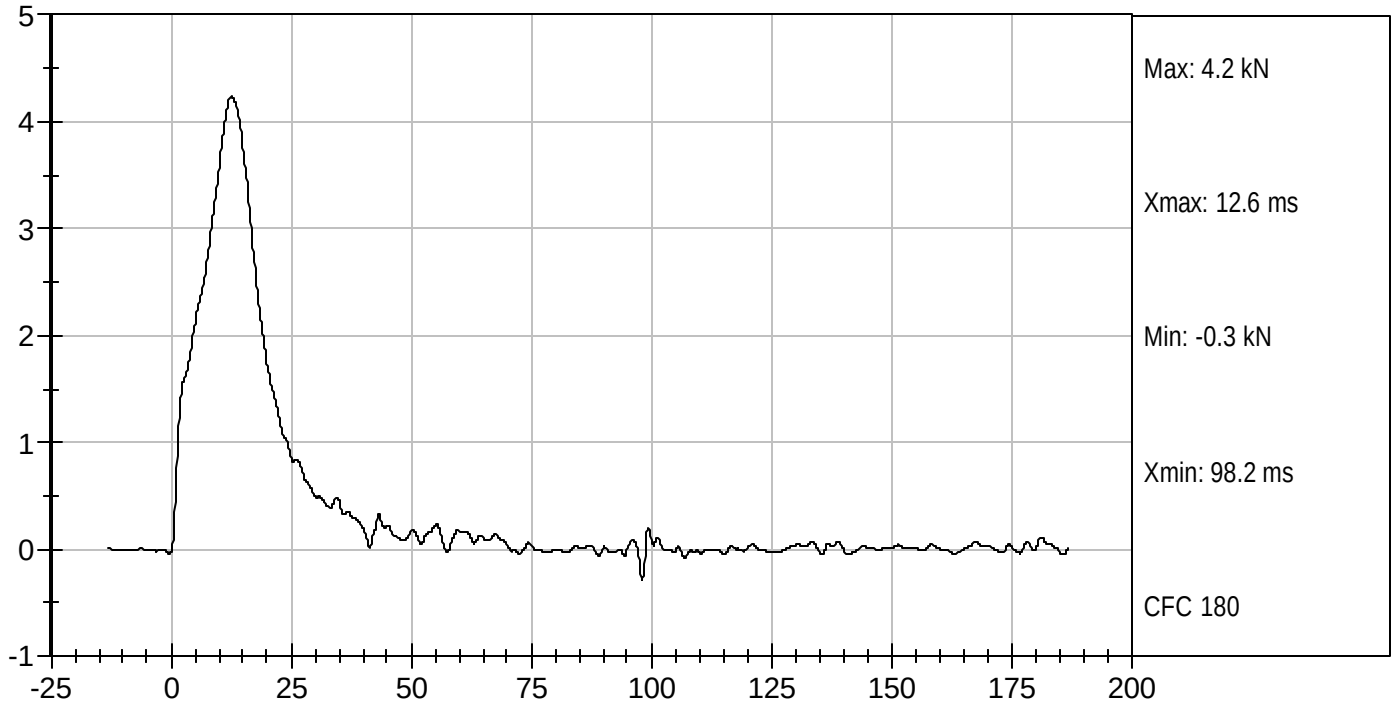
08/08/2005
Test Date

David Winkelbauer
Approved By

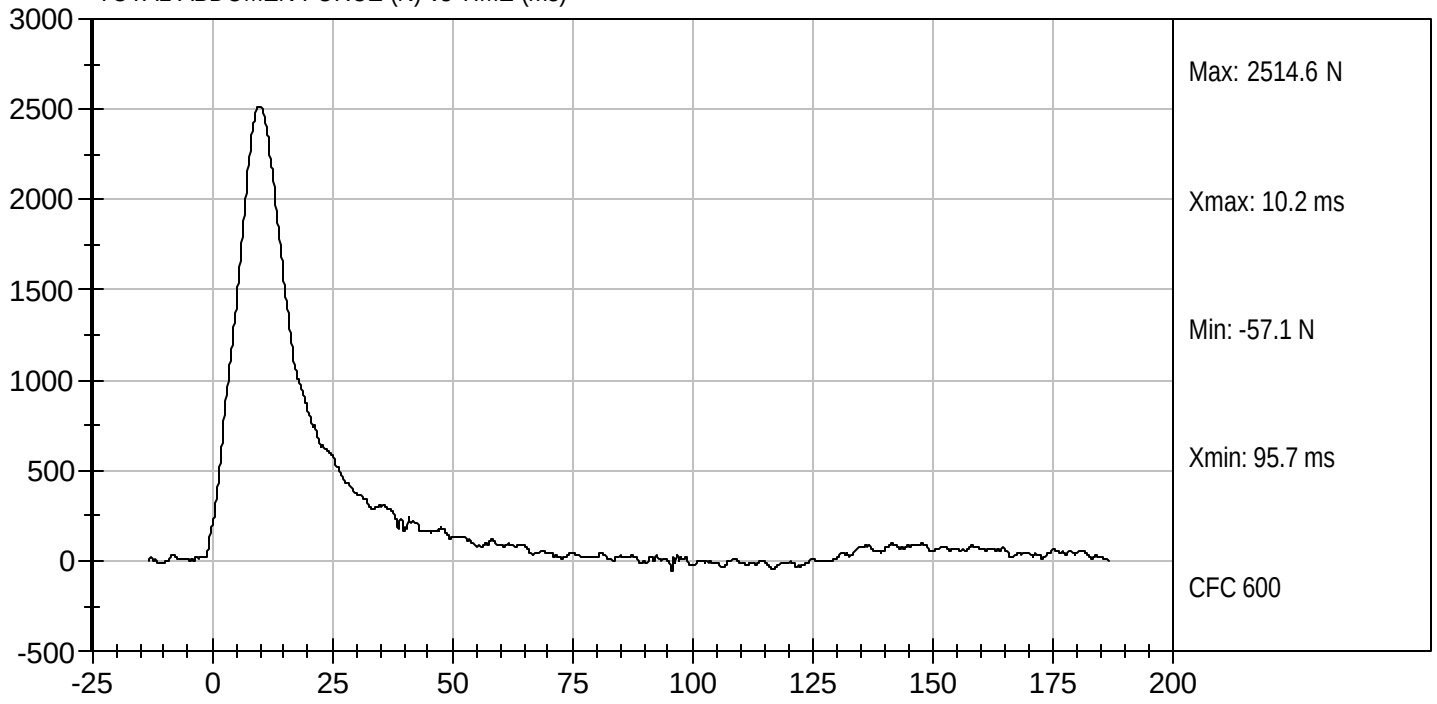
Test Desc: Abdomen Impact
Componet ID: D052207

Test Date: 08/08/2005
Velocity: 12.9 ft/s, 3.93 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052208

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	5.95 to 6.15	6.07	Pass
Pendulum Deceleration	10 msec	m/sec	-2.46 to -1.59	-2.19	Pass
	20 msec	m/sec	-5.25 to -4.07	-5.16	Pass
	25 msec	m/sec	-6.64 to -5.30	-6.22	Pass
	30 msec	m/sec	>= -6.5	-6.2	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	46.4	Pass
Time of Maximum Flexion Angle		msec	39.0 to 53.0	45.0	Pass
Maximum Theta (A)		deg	31.0 to 35.0	31.2	Pass
Time of Maximum Theta (A)		msec	44.0 to 52.0	44.5	Pass
Maximum Theta (B)		deg	26.94 to 29.44	29.23	Pass
Time of Maximum Theta (B)		msec	44.0 to 52.0	45.3	Pass
			Overall Results		Pass

Ian Fleck

Laboratory Technician

08/08/2005

Test Date

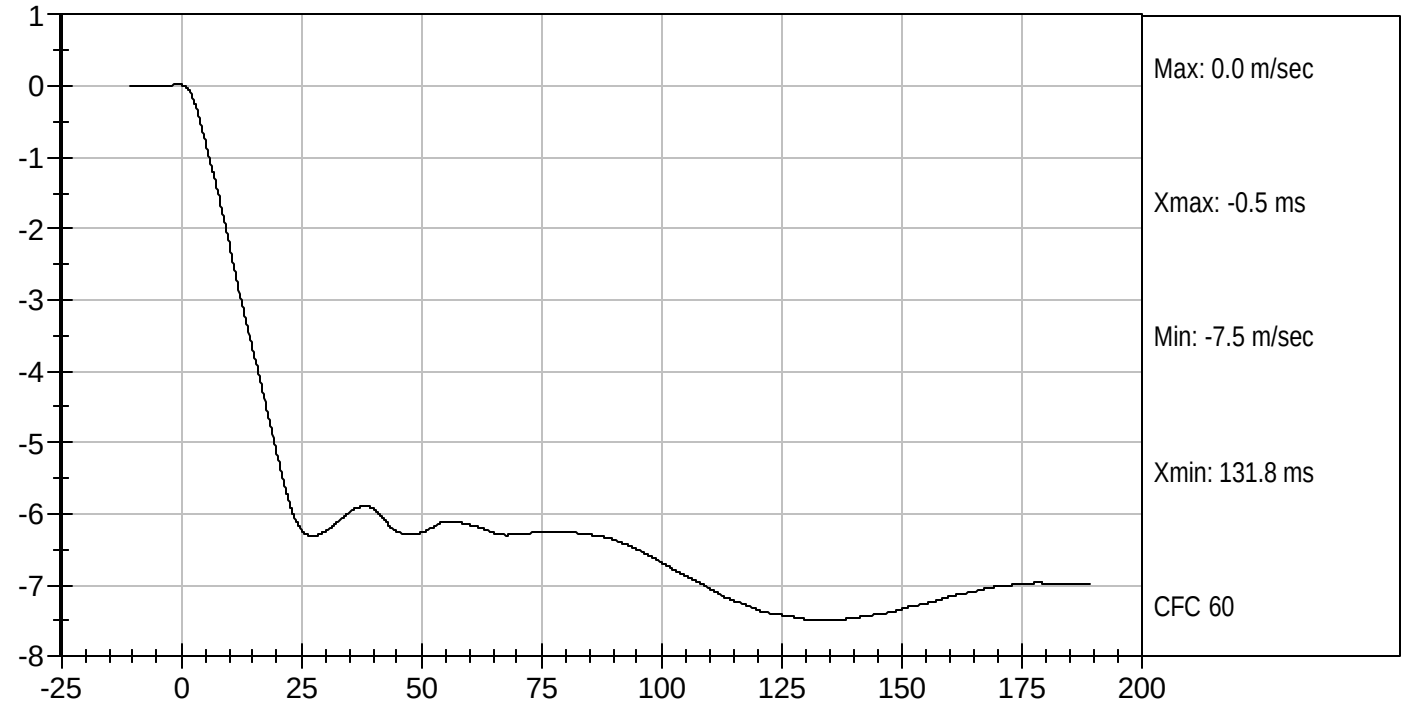
David Winkelbauer

Approved By

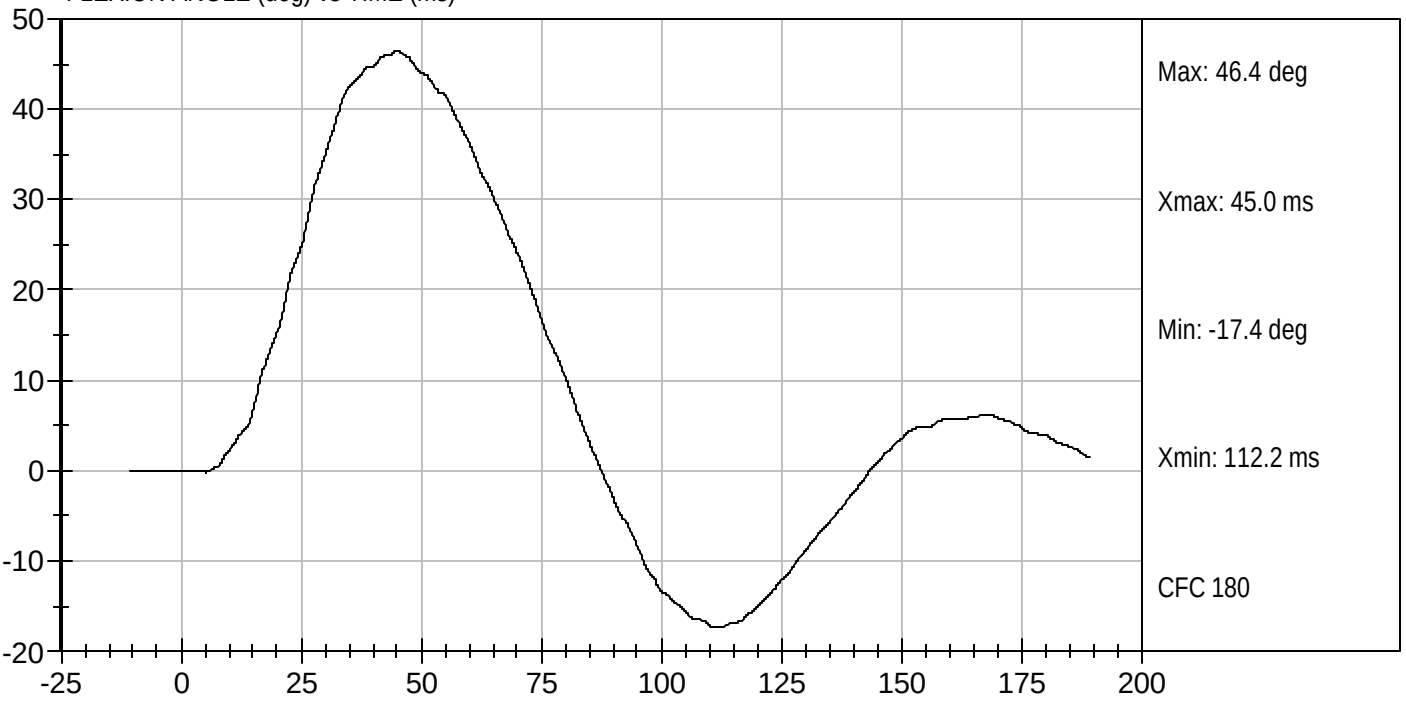
Test Desc: Lumbar Bending
Componet ID: D052208

Test Date: 08/08/2005
Velocity: 19.92 ft/s, 6.07 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

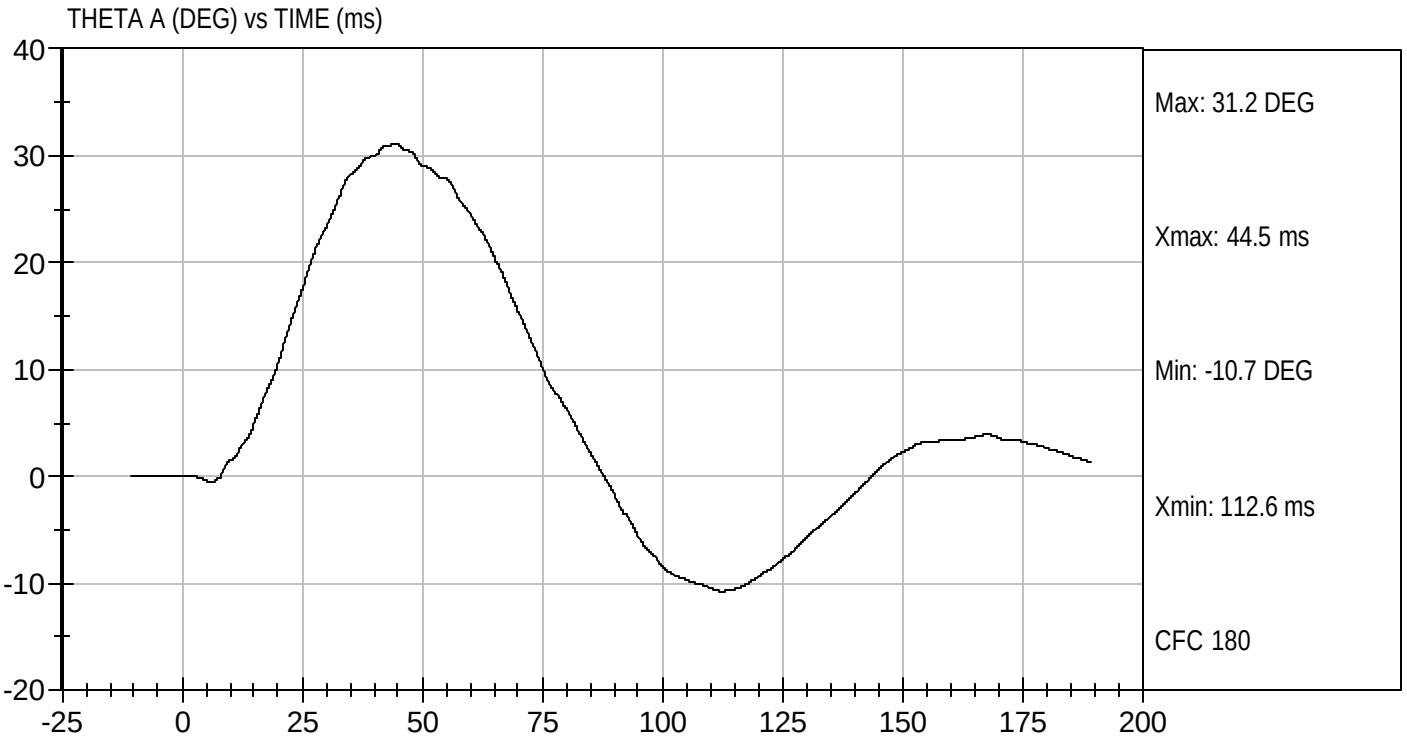


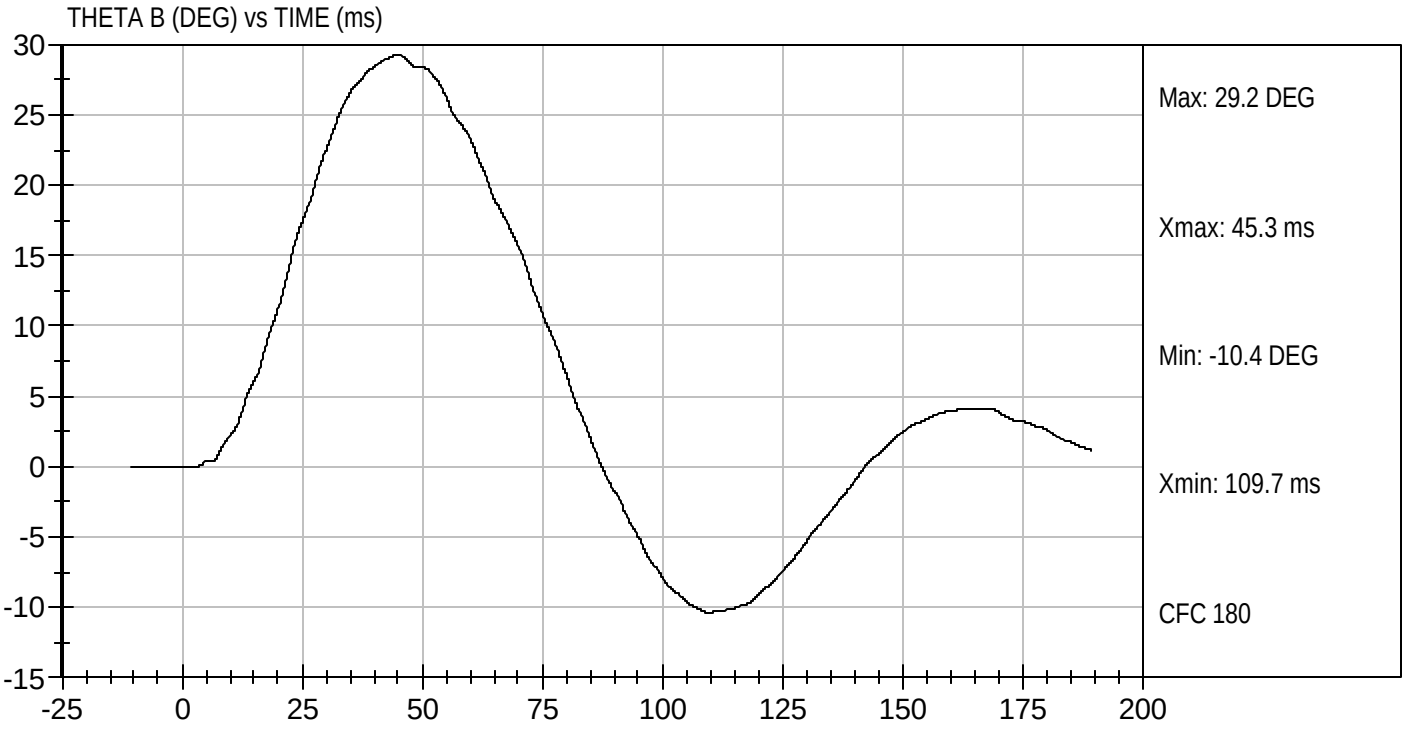
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Componet ID: D052208

Test Date: 08/08/2005
Velocity: 19.92 ft/s, 6.07 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

EUROSID 2 DUMMY

ATD Serial No: 010 **Test I.D:** D052209

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.0 to 22.0	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	4.20 to 4.40	4.26	Pass
Maximum Impactor Force	kN	4.40 to 5.40	4.59	Pass
Time of Maximum Impactor Force	msec	10.30 to 15.50	14.50	Pass
Maximum Pubic Force	kN	1.04 to 1.64	1.29	Pass
Time of Maximum Pubic Force	msec	9.90 to 15.90	15.90	Pass
		Overall Test Results		Pass

Laboratory Technician

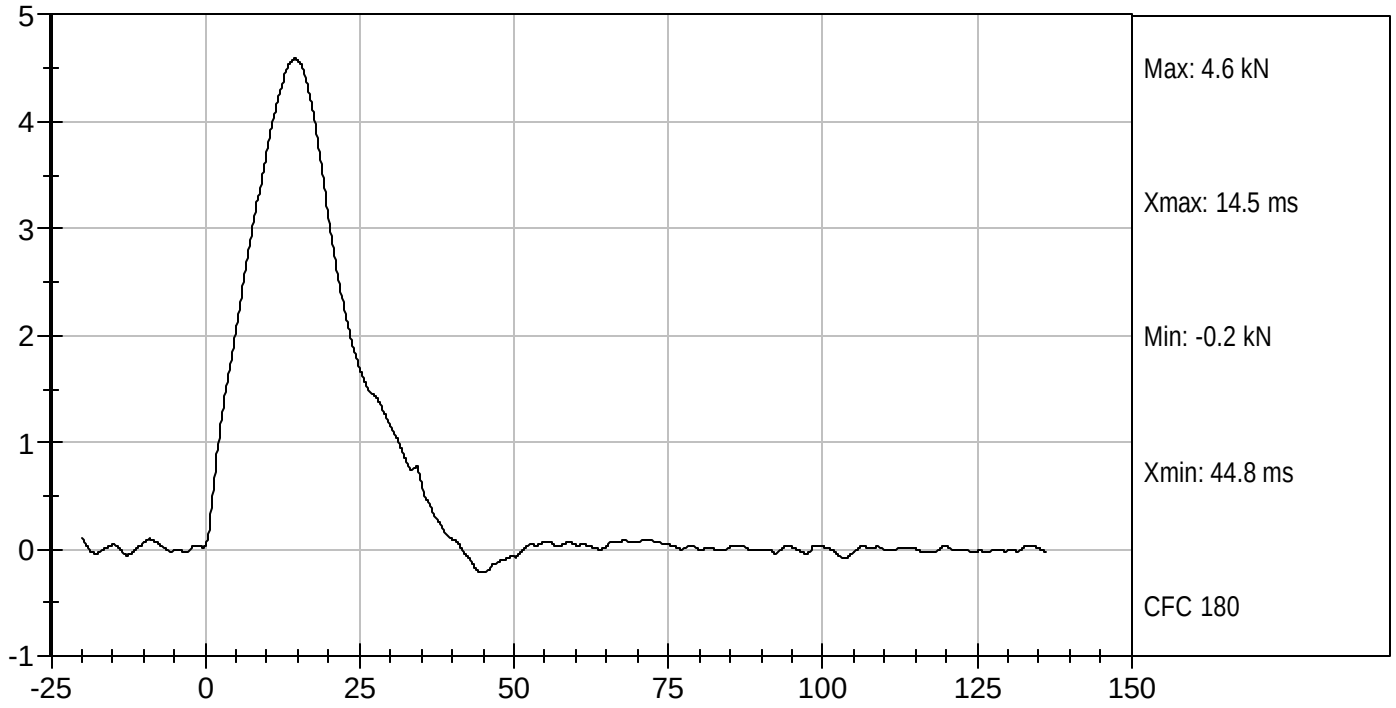
08/08/2005
Test Date

David Winkelbauer
Approved By

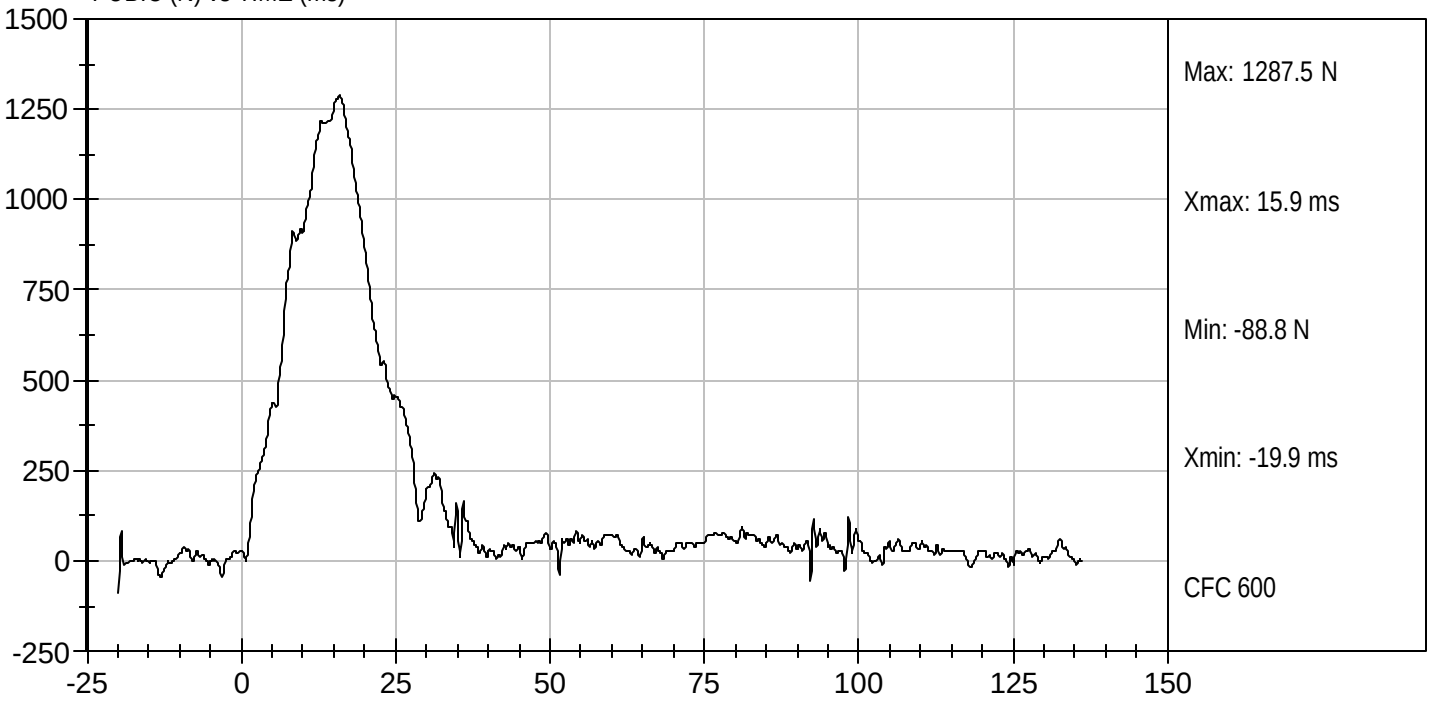
Test Desc: Pelvis Impact
Componet ID: D052209

Test Date: 08/08/2005
Velocity: 14.0 ft/s, 4.26 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



PUBIC (N) vs TIME (ms)



APPENDIX D
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY CALIBRATION DATA

	INSTRUMENTS FOR LEFT FRONT DUMMY ES-2RE: 010		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X Accelerometer	J12425	Endevco	7/28/05
Head Y Accelerometer	J12462	Endevco	7/28/05
Head Z Accelerometer	J14006	Endevco	7/28/05
Head Y - Front	04J14-J10	Entran	5/24/05
Head Z - Front	04J14-J16	Entran	5/24/05
Head X – Left	AP0G2	Endevco	4/12/05
Head Z – Left	P22454	Endevco	7/07/05
Head X – Upper	ALB87	Endevco	7/06/05
Head Y – Upper	A28-H04	Entran	4/12/05
Upper Neck Load Cell	106	FTSS	9/23/04
Lower Neck Load Cell	111	FTSS	9/23/04
Shoulder Load Cell	120	FTSS	9/29/04
T12 Load Cell	102	FTSS	9/24/04
Upper Spine X	P22652	Endevco	7/28/05
Upper Spine Y	P22150	Endevco	7/28/05
Upper Spine Z	AJ417	Endevco	7/28/05
Lower Spine X	AMR94	Endevco	4/27/05
Lower Spine Y	AN8P9	Endevco	4/27/05
Lower Spine Z	AMP95	Endevco	4/27/05
Torso Load Cell	104	FTSS	9/29/04
Upper Rib Y	AHTT2	Endevco	7/07/05
Mid Rib Y	J26-H13	Entran	7/06/05
Lower Rib Y	AC9B7	Endevco	4/27/05
Rib Displacement	010	Honeywell	7/26/05
Front Abdomen FY	ABG119FY	FTSS	9/30/04
Mid Abdomen FY	ABG120FY	FTSS	9/30/04
Rear Abdomen FY	ABG121FY	FTSS	9/30/04
Pubic Symphysis FY	PG113FY	FTSS	9/24/04
Pelvis X	P22180	Endevco	7/07/05
Pelvis Y	P22805	Endevco	7/07/05
Pelvis Z	P22190	Endevco	7/07/05
Right Femur Load Cell	137	FTSS	9/28/04
Left Femur Load Cell	109	FTSS	9/20/04
Lumbar Load Cell	105	FTSS	9/27/04

VEHICLE INSTRUMENTS CALIBRATION

	VEHICLE ACCELEROMETERS		
	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Mid A-Post Y	I16-B06	Entran	3/09/05
Left Lower A-Post Y	C29-L19	Entran	4/25/05
Left Mid B-Post Y	B16-Z09	Entran	3/03/05
Left Lower B-Post Y	B16-Z21	Entran	3/03/05
Left A-Post @ Sill Y	C04-L08	Entran	3/24/05
Left B-Post @ Sill Y	E05-Z25	Entran	6/28/05
Driver Seat Track Y	D03-Z20	Entran	4/22/05
Right Front Sill X	D03-Z17	Entran	4/22/05
Right Front Sill Y	C21-G24	Entran	4/22/05
Right Front Sill Z	D03-Z31	Entran	4/22/05
Left Rear Sill Y	B25-Z01	Entran	3/03/05
Left Front Sill Y	C04-L06	Entran	3/24/05
Floorpan @ Rear Axle X	D01-Z10	Entran	4/28/05
Floorpan @ Rear Axle Y	D01-Z12	Entran	4/28/05
Floorpan @ Rear Axle Z	D01-Z20	Entran	4/28/05
Vehicle CG X	E05-Z60	Entran	6/28/05
Vehicle CG Y	E05-Z69	Entran	6/28/05
Vehicle CG Z	E05-Z68	Entran	6/28/05
Left Front Door @ Pelvis	C09-Y04	Entran	4/22/05
Left Front Door @ Arm	J07-M09	Entran	4/28/05
Left Front Door @ Knee	C21-G03	Entran	4/28/05
Left Front Door @ Mid Rib	B21-Z02	Entran	3/03/05
Upper Engine X	F04-R23	Entran	3/17/05
Upper Engine Y	C06-L11	Entran	3/24/05
Firewall Y	B26-Z10	Entran	3/17/05