

**REPORT NUMBER: T8001-MGA-2008-009**

**VEHICLE TO DEFORMABLE BARRIER CRASH TESTS  
IN SUPPORT OF NHTSA OFFSET FRONTAL PROGRAM**

**LEFT 50% OFFSET DEFORMABLE BARRIER IMPACT  
PDB BARRIER**

**TEST DATE: APRIL 4, 2008**

**ORDER NUMBER: DTRTV-T8001**

**2007 FORD FIVE HUNDRED SEL 4-DOOR (R70206)**

**PREPARED BY:  
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**FINAL REPORT SUBMITTED:  
AUGUST 22, 2008**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION / RITA  
VOLPE NATIONAL TRANSPORTATION SYSTEM CENTER  
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CAMBRIDGE, MA 02142-1001**

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**Technical Report Documentation Page**

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16. <i>Abstract</i> A 50% frontal offset barrier impact was conducted on a 2007 Ford Five Hundred SEL 4-Door, NHTSA No. R70206, at MGA Research Corporation on April 4, 2008. This test was conducted in accordance with Volpe Order No. DTRTV-T8001 for the evaluation of vehicle and occupant responses. The impact velocity was 60.2 km/h. The ambient temperature at the barrier face at the time of impact was 21 degrees Celsius. The vehicle's maximum static crush was 494 mm located to the left of the vehicle's centerline. The driver's 15 millisecond Head Injury Criteria (HIC) was 474. The driver's chest maximum resultant acceleration with three milliseconds minimum duration was 40.2 g. The driver's maximum chest deflection was -25 millimeters. The driver's left and right femur maximum axial compressive forces were -3388 N and -1662 N, respectively. The left rear passenger's 15 millisecond Head Injury Criteria (HIC) was 310. The left rear passenger's chest maximum resultant acceleration with three milliseconds minimum duration was 43.0 g.					
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## **SECTION 1**

### **PURPOSE AND TEST PROCEDURE**

#### **PURPOSE**

This 60.0 km/h (target speed) Left 50% Offset Deformable Barrier test was conducted for the Volpe National Transportation Systems Center (VNTSC) / RITA by MGA Research Corporation.

The purpose of this testing was to evaluate and compare vehicle and occupant responses during 50% frontal offset vehicle to deformable barrier crash tests. For this test, the subject vehicle was a 2007 Ford Five Hundred SEL 4-Door with one (1) 50th percentile dummy in the front seating position and one 10-year-old dummy in the left rear seating position. The deformable barrier used for this test was the PDB barrier.

#### **TEST PROCEDURE**

This test was conducted in accordance with VNTSC's instructions for a 50% offset vehicle to deformable barrier crash test. Data was obtained relative to FMVSS 208, "Occupant Crash Protection" performance, FMVSS 212, "Windshield Retention"; FMVSS 219, "Windshield Zone Intrusion"; and FMVSS 301, "Fuel System Integrity," performance.

The test vehicle, a 2007 Ford Five Hundred SEL 4-Door, was instrumented with twelve (12) accelerometers to measure longitudinal axis accelerations, four (4) accelerometers to measure lateral axis accelerations, and six (6) accelerometers to measure vertical axis accelerations. The driver and passenger's primary and secondary airbag signals were monitored with inductive pickups. The vehicle impacted a 50% left offset deformable barrier. The vehicle's specified impact velocity range was 59.2 to 60.8 km/h.

The test vehicle contained one (1) Part 572E 50th percentile adult male Hybrid III anthropomorphic test device (dummy) with Thor-Lx legs in the driver position. A Hybrid III 10-Year-Old dummy was placed in the left rear seating position. The 50th percentile dummy was positioned in the left front outboard designated seating positions according to a procedure provided by the COTR. The seating procedure is included as Appendix D. The driver dummy was restrained with a 3-point seat belt and a front airbag. The left rear passenger dummy was in the Graco Highback Turbo booster child seat and restrained with the Type II seat belt.

The Hybrid III 50<sup>th</sup> dummy was instrumented with an array of twelve (12) accelerometers in the head, and six (6) accelerometers in the chest, oriented to measure longitudinal, lateral, and vertical accelerations. The dummy was also instrumented with 6-channel upper and lower neck moment and force load cells, left and right femur load cells to measure axial forces, a chest deflection potentiometer, and knee displacement potentiometers. The dummy was equipped with Thor-Lx legs, which included upper and lower tibia load cells to measure forces and moments, longitudinal and lateral tibia accelerometers, three (3) foot accelerometers on each foot to measure accelerations in three (3) axes and three (3) rotary potentiometers at each ankle to measure foot rotations about three (3) axes.

**SECTION 1 (CONTINUED)**  
**PURPOSE AND TEST PROCEDURE**

**TEST PROCEDURE (CONTINUED)**

The Hybrid III 10-Year-Old child dummy was instrumented with tri-axial accelerometers in the head, chest, and pelvis oriented to measure longitudinal, lateral, and vertical accelerations. The dummy was also instrumented with 6-channel upper and lower neck moment and force load cells, left and right shoulder load cells, upper and lower sternum X accelerometers, upper and lower spine X accelerometers, 6-channel lumbar moment and force load cells, right/left upper and right/left lower axis load cells.

The vehicle impacted a deformable barrier instrumented with 90 load cells to measure longitudinal forces.

The 235 data channels were digitally sampled and recorded at 10,000 samples per second and processed per SAE J211 March 1995.

The crash event was recorded by one (1) real-time panning motion picture camera and fifteen (15) high-speed digital motion picture cameras. The pre-test and post-test conditions were recorded by one (1) real-time motion picture camera.

The left 50% offset deformable barrier crash test summary data and all occupant, camera, vehicle, and deformable barrier face measurements are presented in Section 2.0. Appendix A contains the still photographs. Appendix B contains the dummy, vehicle, and barrier data plots. Appendix C contains the dummy verification data. Appendix D contains customer provided seating procedure. Appendix E contains the barrier certification. Appendix F contains an INSIA report that was the basis for the Structural Measurements presented in Data Sheet 10 (page 30) of this report.

## SECTION 2

### LEFT 50% OFFSET DEFORMABLE BARRIER IMPACT SUMMARY

This 60.0 km/h (target speed) left 50% offset deformable barrier crash test was conducted by MGA Research Corporation on April 4, 2008.

The test vehicle, a 2007 Ford Five Hundred SEL 4-Door, NHTSA Number R70206, was equipped with a 3.0 L, 6-cylinder lateral engine, automatic transmission, power steering, power brakes, and front airbags. The vehicle's test weight was 1915.6 kg. The vehicle's impact speed was 60.2 km/h. The vehicle sustained 494 mm of static crush during the impact.

The occupant injury assessment values are summarized on the following page.

### TEST NOTES

The driver airbag did not deploy.

There was no valid data collected for:

- Left Rear Passenger Lumbar FX after 205 msec.
- Driver Shoulder Belt after 100 msec.
- ODB Barrier 10

CMM Reference:      Rear Bumper Top @ Center  
                          +X Forward  
                          +Y Left  
                          +Z Up

**SECTION 2 (CONTINUED)**  
**LEFT 50% OFFSET DEFORMABLE BARRIER IMPACT SUMMARY**

**OCCUPANT INJURY ASSESSMENT VALUES**

Injury Criteria		Limit	Driver
<b>HIC 36</b>		1000	857
	T1 (msec)		95.7
	T2 (msec)		131.7
<b>HIC 15</b>		700	474
	T1 (msec)		110.1
	T2 (msec)		125.1
Upper Neck Tension (N)		4170	2727
Upper Neck Compression (N)		4000	-31
Neck Injury (NIJ) $N_{te}$		1.0	0.40
Neck Injury (NIJ) $N_{tf}$		1.0	0.50
Neck Injury (NIJ) $N_{ce}$		1.0	0.00
Neck Injury (NIJ) $N_{cf}$		1.0	0.01
Clip (g)		60	40
Chest Displacement (mm)		63	-25
Left Femur (N)		9,040	-3388
Right Femur (N)		9,040	-1662
Left Upper Tibia Index		0.91	0.55
Right Upper Tibia Index		0.91	0.44
Left Lower Tibia Index		0.91	0.51
Right Lower Tibia Index		0.91	0.50
Left Upper Tibia Force (N)		-5600	-1220
Right Upper Tibia Force (N)		-5600	-1410
Left Lower Tibia Force (N)		-5200	-1508
Right Lower Tibia Force (N)		-5200	-2454
Left Inversion (degrees)		-35	-4.8
Left Eversion (degrees)		35	25.3
Left Plantarflexion (degrees)			-17.2
Left Dorsiflexion (degrees)		35	12.0
Left External Rotation (degrees)			-7.7
Left Internal Rotation (degrees)			6.6
Right Inversion (degrees)		35	N/A
Right Eversion (degrees)		-35	-32.2
Right Plantarflexion (degrees)			-15.0
Right Dorsiflexion (degrees)		35	17.3
Right External Rotation (degrees)			10.6
Right Internal Rotation (degrees)			-0.5
Left Knee Shear (mm)		-15	-0.4
Right Knee Shear (mm)		-15	-0.3

**SECTION 2 (CONTINUED)**  
**LEFT 50% OFFSET DEFORMABLE BARRIER IMPACT SUMMARY**

**OCCUPANT INJURY ASSESSMENT VALUES (CONTINUED)**

Injury Criteria		Left Rear Passenger
<b>HIC 36</b>		641
	T1 (msec)	94.1
	T2 (msec)	130.1
<b>HIC 15</b>		310
	T1 (msec)	101.6
	T2 (msec)	116.6
Upper Neck Tension (N)		2677
Upper Neck Compression (N)		-2177
Clip (g)		43

**DATA SHEET 1**  
**CRASH VEHICLE SUMMARY**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

Description	Value
Test Time	9:20 a.m.
Temperature	21°C
Vehicle Year/ Make / Model / Body Style	2007 Ford Five Hundred SEL 4-Door
Vehicle Test Weight	1915.6 kg
Vehicle / Barrier Impact Angle	0°
Vehicle / Barrier Impact Accuracy	3 mm up / 13 mm left
Impact Velocity	60.2 km/h
Maximum Static Crush	494 mm to the left of the vehicle's C/L
Deformable Barrier	PDB
Number of Data Channels	235
Number of Real-Time Cameras	1
Number of High-Speed Cameras	15

Dummies	Driver	Left Rear Passenger
Type/Serial No.	HIII / 202	HIII 10YO / D001
Type Lower Legs	Thor-Lx	
Serial Numbers of Legs	37R / 36L	
Restraint System	3-Point Seatbelt Front Airbag	Type II Belts Graco Highback Turbo booster

**DATA SHEET 2**

**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

**TEST VEHICLE INFORMATION**

Manufacturer	Ford
Model	Five Hundred
Body Style	Sedan
NHTSA No.	R70206
VIN	1FAFP24107G100868
Color	Red
Delivery Date	2/11/2008
Odometer Reading (mile)	20,690
Dealer	Gordie Boucher
Transmission	Automatic
Final Drive	Front
Number of Cylinders	6
Engine Displacement (L)	3.0
Engine Placement	Lateral
Automatic Door Lock (ADL)	Yes
Owners Manual Details Instructions on Disabling ADLs	Yes
Bucket Seats	Yes

**TEST VEHICLE OPTIONS**

Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	No
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	No
All Wheel Drive	No
Power Seats	Yes

**DATA FROM CERTIFICATION LABEL**

Manufactured By	Ford Motor Company
Date of Manufacture	05/06

GVWR (kg)	2186
GAWR Front (kg)	1150
GAWR Rear (kg)	1066

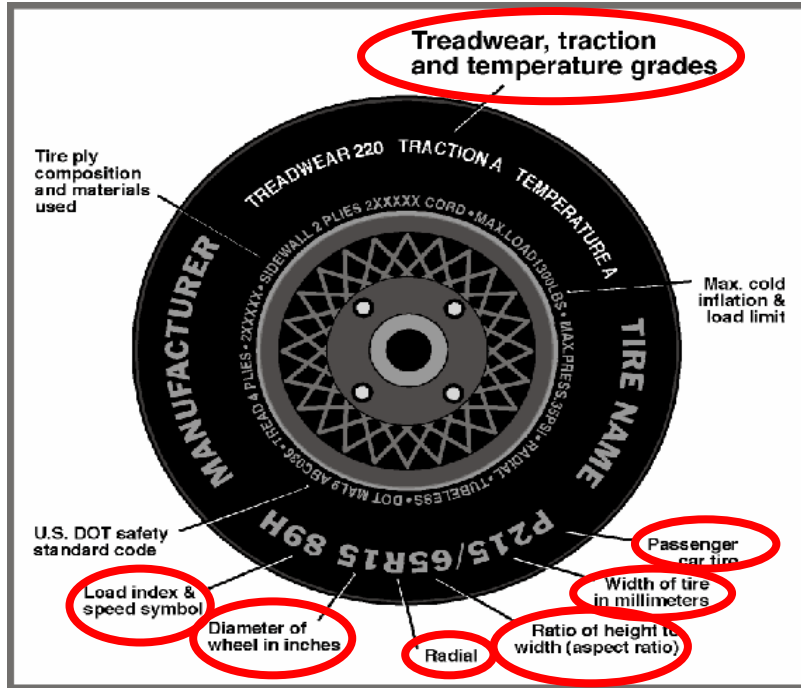
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				430
Cargo Wt. (RCLW) (kg)				90

DATA SHEET 2 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	220
Recommended Tire Size	P215/60R17	P215/60R17
Tire Size on Vehicle	P215/60R17	P215/60R17
Tire Manufacturer	Continental	Continental
Tire Name	Conti Touring Contact	Conti Touring Contact
Tire Type	Passenger	Passenger
Tire Width (mm)	215	215
Ratio of Height to Width (aspect ratio)	60	60
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	95T	95T
Treadwear	360	360
Traction Grade	A	A
Temperature Grade	A	A

**DATA SHEET 2 (CONTINUED)**

**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door      NHTSA No.: R70206  
 Test Program: Left 50% Offset Deformable Barrier      Test Date: 4/04/2008

**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	497.6	338.8		523.5	445.0	
Right	kg	504.4	333.8		513.5	433.6	
Ratio	%	59.8	40.2		54.1	45.9	
Totals	kg	1002.0	672.6	1674.6	1037.0	878.6	1915.6

Note: Test weight set to match a previous test.

**TARGET TEST WEIGHT CALCULATION**

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1674.6
Weight of 2 P572E ATDs & 1 10-Year-Old	kg	191.4
Rated Cargo/Luggage Weight (RCLW)	kg	90
Calculated Vehicle Target Weight (TVTW)	kg	1956.0

**TEST VEHICLE ATTITUDES AND CG**

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	733	735	745	744	1150
As Tested	mm	722	735	710	720	1314
Post Test	mm	782	725	696	732	

Vehicle Wheelbase (mm): 2864

Weight of Ballast secured in cargo area (kg): 0

Vehicle Components Removed: Spare tire, jack, exhaust, interiors of right doors, and right rear tail light.

Ballast weight does not include instrumentation and data acquisition system.

## DATA SHEET 2 (CONTINUED)

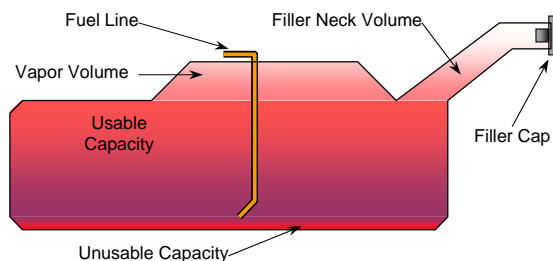
### GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door      NHTSA No.: R70206  
 Test Program: Left 50% Offset Deformable Barrier      Test Date: 4/04/2008

#### FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	75.7
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	69.6 – 71.2
Actual Amount of Solvent used	70.4
1/3 of Usable Capacity	25.2

The test vehicle is equipped with an electric fuel pump. The fuel tank is located in front of rear axle under rear seat. The fuel filler neck enters the tank of right rear corner. The fuel filler cap is located on right rear quarter panel. The fuel lines run along the right side of center tunnel.



VEHICLE FUEL TANK ASSEMBLY

#### BELT LENGTH DATA

Measurement Description	Units	Driver	Left Rear Passenger
Shoulder belt length as measured on ATD	mm	835	975
Lap belt length as measured on ATD	mm	580	705
Remainder of belt on reel	mm	905	720
Total belt length for continuous webbing systems	mm	2320	2400

#### SEAT TRACK INFORMATION

Description	Driver	Left Rear Passenger
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

**DATA SHEET 3**  
**POST IMPACT DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

**DOOR OPENING AND GLAZING DAMAGE**

Description	Left Side	Right Side
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Glazing Damage	The windshield cracked.	

**DUMMY CONTACT POINTS**

Description	Driver	Left Rear Passenger
Head Contact	Steering wheel, dash, visor, headrest	Child seat, C-pillar
Chest Contact	Steering Wheel	None
Abdomen Contact	None	None
Left Knee Contact	Knee bolster	Feet to driver seatback
Right Knee Contact	Knee bolster	Feet to driver seatback

**LEFT REAR (P4) CRS POST-TEST INSPECTION**

Location	Damage	Remarks
Cracks on CRS	None	
Fabric Tears on CRS	None	
Vehicle Seat Structure	None	
Vehicle Seat Fabric Tears	None	
Child Dummy	None	10-Year-Old

**DATA SHEET 4**

**TEST VEHICLE INFORMATION**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door NHTSA No.: R70206  
Test Program: Left 50% Offset Deformable Barrier Test Date: 4/04/2008

**NORMAL DESIGN RIDING POSITION**

Driver seat back angle: 8.5° at headrest post  
Left Rear Passenger seat back angle: Fixed

**SEAT FORE/AFT POSITIONING**

	Total Fore/Aft Travel	Placed in Position #
Left Front Seat	245 mm	52 mm rear of mid
Left Rear Seat	Fixed	Fixed

**ADJUSTABLE D-RING POSITION**

The driver D-ring was set at the upper-most detent.

**STEERING COLUMN POSITION**

	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		62.2
Geometric center position No. 2		64.8
Uppermost position No. 3		67.5

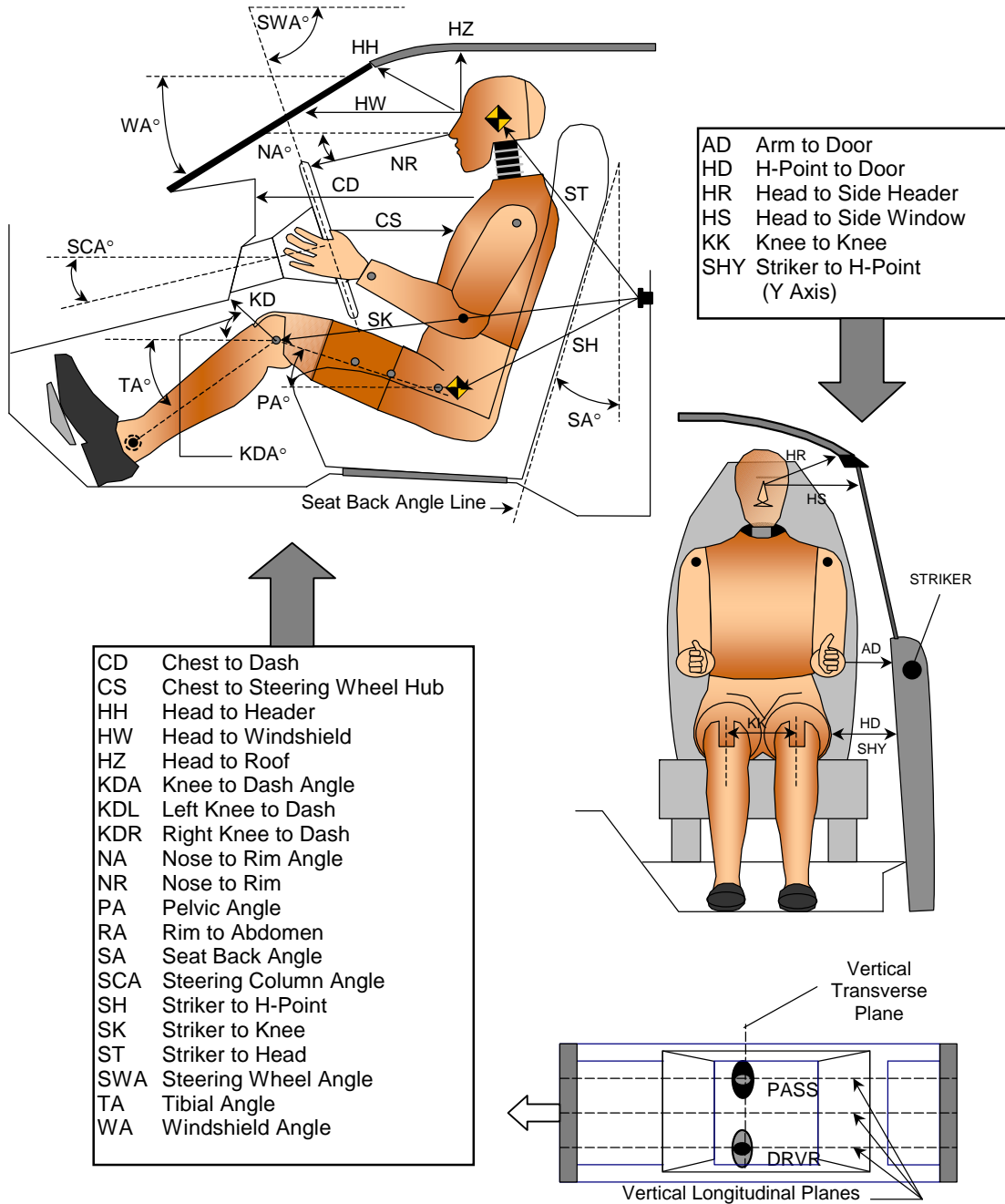
# DATA SHEET 5

## DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

### DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



**DATA SHEET 5 (CONTINUED)**  
**DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

**TEST DUMMY POSITION MEASUREMENTS**

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
WA	Windshield Angle		26.4
SWA	Steering Wheel Angle		64.8
SCA	Steering Column Angle		25.1
SA	Seat Back Angle (headrest post)		8.5
HZ	Head to Roof (Z)	233	90
HH	Head to Header	391	21.6
HW	Head to Windshield	704	0
HR	Head to Side Header (Y)	237	
NR	Nose to Rim	471	8.4
CD	Chest to Dash	646	
CS	Chest to Steering Hub	379	0.2
RA	Rim to Abdomen	262	0
KDL	Left Knee to Dash	203	26.4
KDR	Right Knee to Dash	205	
PA	Pelvic Angle		24.8
TA	Tibia Angle		48.0
KK	Knee to Knee (Y)	321	
SAN	Striker to Ankle	872	
SK	Striker to Knee	554	
ST	Striker to Head	480	
SH	Striker to H-Point	230	
SHY	Striker to H-Point (Y)	284	
HS	Head to Side Window	359	
HD	H-Point to Door (Y)	170	
AD	Arm to Door (Y)	146	
AA	Ankle to Ankle	273	

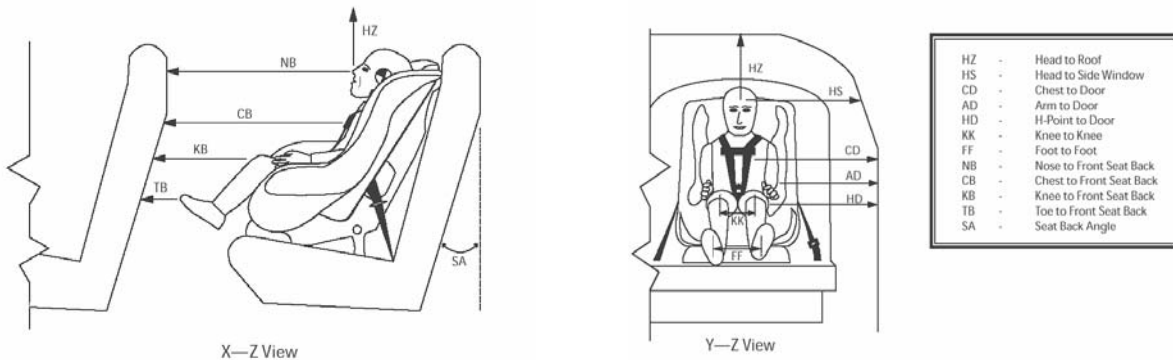
**DATA SHEET 5 (CONTINUED)**  
**DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

Child Restraint System (Position 4)	Graco Highback Turbo booster (Forward Facing)
Dummy Type / Serial Number	Hybrid III 10-Year-Old / D001

Dummy Measurements for CRS Passengers



Measurement	Pre-Test (mm)		Post-Test (mm)	
	P4 CRS		P4 CRS	
SA (deg)				
HS	354		354	
CD	355		362	
AD	171		129	
HD	169		140	
HZ	279		278	
NB	592		604	
CB	509		597	
KK	152		130	
FF	171		85	
KB - LEFT	330		291	
KB - RIGHT	327		345	
TB - LEFT	107		140	
TB - RIGHT	105		119	

All dimensions in mm (unless noted)  
 P4 – 2<sup>nd</sup> Row Left Rear Passenger (Forward Facing)

**DATA SHEET 5 (CONTINUED)**

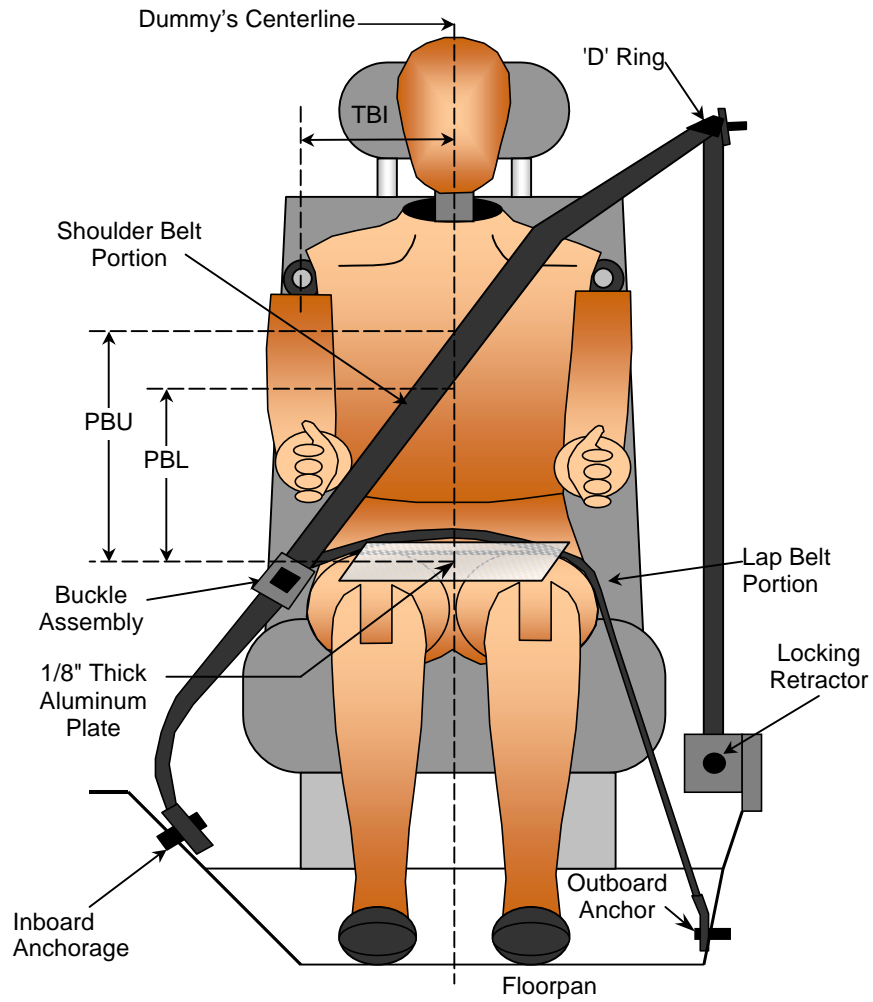
**DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door

NHTSA No.: R70206

Test Program: Left 50% Offset Deformable Barrier

Test Date: 4/04/2008



**SEAT BELT POSITIONING MEASUREMENTS**

Measurement Description	Units	Driver	Left Rear Passenger
PBU - Top surface of reference to belt upper edge	mm	350	245
PBL - Top surface of reference to belt lower edge	mm	270	165

**DATA SHEET 5 (CONTINUED)**  
**DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

	Driver			Left Rear Passenger		
	X	Y	Z	X	Y	Z
Head CG	2554	-447	-736	1593	-472	-699
Striker	2546	-823	-256	1522	-822	-377
Left Knee	3094	-534	-176	2034	-490	-279
Right Knee	3105	-290	-165			
Tip of Nose	2669	-374	-697	1715	-389	-670
H-Point	2696	-539	-81	1768	-514	-204
Left Ankle	3406	-529	111			
Right Ankle	3439	-267	94			
Left Heel	3394	-509	240			
Right Heel	3452	-234	231			
Right Toe	3650	-205	-31	2357	-291	-44
Left Toe	3643	-492	15	2352	-474	-29
Right Child Seat				1734	-174	-125
Left Child Seat				1731	-586	-116
Left Shoulder				1582	-483	-508
Right Shoulder				1584	-306	-510
Seat Anchor				1606	-604	-64
Seat Final Placement	2998	-651	88			

**DATA SHEET 6**

**VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

**VEHICLE ACCELEROMETER PRE-TEST LOCATIONS**

Accelerometer Location	Measurements (mm)		
	X	Y	Z
Left Rear Seat Crossmember X	2120	-430	383
Left Rear Seat Crossmember Y			
Right Rear Seat Crossmember X	2120	430	383
Right Rear Seat Crossmember Y			
Vehicle Center of Gravity X	2831	0	460
Vehicle Center of Gravity Y			
Vehicle Center of Gravity Z			
Top of Engine Block X	4396	0	785
Bottom of Engine Block X	4308	0	228
Left Disc Brake Caliper X	4222	-732	255
Right Disc Brake Caliper X	4222	732	255
Instrument Panel X	3272	0	932
Left Side Driver Mid Seat Track X	2548	-576	322
Accelerator Pedal X (at midfoot)	3612	-238	446
Accelerator Pedal Y (at midfoot)			
Accelerator Pedal Z (at midfoot)			
Brake Pedal X (at midfoot)	3732	-366	400
Brake Pedal Y (at midfoot)			
Brake Pedal Z (at midfoot)			
Footrest X	3592	-574	394
Footrest Y			
Footrest Z			

Reference is on the following page.

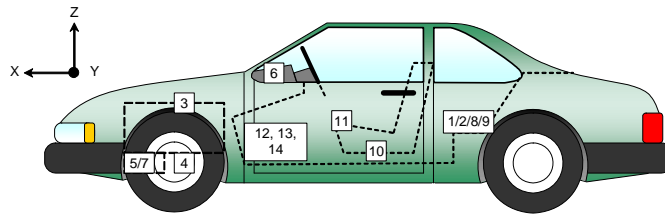
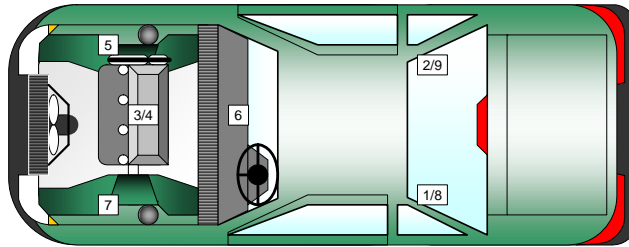
## DATA SHEET 6 (CONTINUED)

### VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

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



**DATA SHEET 6 (CONTINUED)**

**VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

Location Number	Description	Maximum Values (g's)			
		Positive	Time, ms	Negative	Time, ms
1	Left Rear Seat Cross Member X	2.1	207.6	-24.9	74.4
2	Right Rear Seat Cross Member X	1.1	194.1	-27.7	82.3
3	Top of Engine Block X	3.2	134.1	-45.3	60.2
4	Bottom of Engine Block X	1.1	248.1	-33.1	71.0
5	Disc Brake Caliper @ Right Side X	8.2	71.6	-38.8	87.3
6	Instrument Panel X	9.8	37.2	-40.7	78.2
7	Disc Brake Caliper @ Left Side X	53.9	81.5	-78.1	71.0
8	Left Rear Seat Cross Member Y	8.4	76.4	-2.9	293.9
9	Right Rear Seat Cross Member Y	9.0	76.5	-2.8	293.6
10	Left Side Driver Mid Seat Track X	5.2	165.7	-28.8	80.2
11	Vehicle Center of Gravity X	13.5	68.6	-37.4	79.7
	Vehicle Center of Gravity Y	21.4	72.0	-7.4	105.5
	Vehicle Center of Gravity Z	29.1	70.3	-18.7	83.3
	Vehicle Center of Gravity Resultant	39.6	72.0		
12	Accel Pedal Heel Location X	24.9	73.4	-42.4	55.7
	Accel Pedal Heel Location Y	20.4	243.0	-25.5	111.7
	Accel Pedal Heel Location Z	44.3	71.5	-42.7	80.5
	Accel Pedal Heel Location Resultant	49.2	80.8		
13	Brake Pedal Heel Location X	11.7	20.5	-28.0	42.8
	Brake Pedal Heel Location Y	18.6	74.3	-13.7	68.1
	Brake Pedal Heel Location Z	8.3	33.7	-18.0	74.0
	Brake Pedal Heel Location Resultant	36.0	73.8		
14	Outside Footrest X	9.7	20.6	-24.8	73.1
	Outside Footrest Y	26.8	74.9	-22.0	69.2
	Outside Footrest Z	6.8	118.9	-17.9	55.4
	Outside Footrest Resultant	34.8	74.2		

**DATA SHEET 7**  
**DUMMY INJURY CRITERIA VALUES**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

		Maximum Value			
		Driver			
Description	Unit	Positive	Time, ms	Negative	Time, ms
Head X	G	6.4	299.0	-68.8	115.2
Head Y	G	14.7	102.4	-5.0	129.5
Head Z	G	39.5	107.9	-0.8	22.9
Head Resultant	G	77.4	115.2		
Head (FT) Y	G	24.9	102.4	-10.5	113.1
Head (FT) Z	G	61.1	96.8	-1.0	34.7
Head (LT) X	G	6.4	298.6	-77.0	114.8
Head (LT) Z	G	43.2	100.3	-2.7	164.6
Head (TP) X	G	9.4	294.7	-80.4	123.1
Head (TP) Y	G	22.8	163.0	-19.7	127.9
Head Redundant X	G	6.6	300.0	-70.2	115.2
Head Redundant Y	G	14.4	102.4	-5.9	129.5
Head Redundant Z	G	40.3	104.4	-0.8	23.2
Head Resultant Redundant	G	78.8	114.9		
Upper Neck Fx	N	894.5	123.0	-394.6	95.1
Upper Neck Fy	N	518.4	160.3	-161.9	238.4
Upper Neck Fz	N	2726.5	114.2	-30.9	23.0
Upper Neck F Resultant	N	2734.9	114.2		
Upper Neck Mx	N-m	40.1	157.1	-20.9	118.6
Upper Neck My	N-m	98.1	123.0	-33.9	95.3
Upper Neck Mz	N-m	9.4	169.6	-5.6	249.3
Upper Neck M Resultant	N-m	99.4	123.0		
Lower Neck Fx	N	282.9	75.9	-886.6	114.5
Lower Neck Fy	N	756.5	138.3	-171.1	245.5
Lower Neck Fz	N	3122.4	114.2	-160.5	162.3
Lower Neck F Resultant	N	3291.9	114.2		
Lower Neck Mx	N-m	142.2	158.1	-44.6	241.9
Lower Neck My	N-m	37.5	155.6	-95.3	92.8
Lower Neck Mz	N-m	32.2	107.4	-6.3	75.0
Lower Neck M Resultant	N-m	147.4	156.9		
Chest X	G	1.4	300.0	-36.4	101.8
Chest Y	G	17.1	101.8	-3.1	162.3
Chest Z	G	13.4	111.2	-3.7	136.0
Chest Resultant	G	41.3	101.9		
Chest Redundant X	G	1.7	190.0	-36.1	105.9
Chest Redundant Y	G	17.3	101.7	-3.1	161.8
Chest Redundant Z	G	13.1	111.2	-3.9	136.1
Chest Resultant Redundant	G	40.8	101.8		
Chest Displacement	mm			-24.7	108.2

**DATA SHEET 7 (CONTINUED)**  
**DUMMY INJURY CRITERIA VALUES**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

Description	Unit	Maximum Value			
		Driver			
		Positive	Time, ms	Negative	Time, ms
Pelvis X	G	2.0	159.4	-55.2	73.9
Pelvis Y	G	17.0	92.6	-6.6	132.5
Pelvis Z	G	2.4	286.5	-17.7	89.1
Pelvis Resultant	G	56.6	73.9		
Right Femur	N	748.3	62.3	-1661.8	74.6
Left Femur	N	631.5	61.3	-3388.3	75.1
Right Knee Shear	mm	0.9	65.8	-0.3	99.5
Left Knee Shear	mm	1.0	83.6	-0.4	131.4
Right Upper Tibia Fx	N	131.7	168.3	-455.4	83.3
Right Upper Tibia Fy	N	92.3	127.2	-408.3	81.9
Right Upper Tibia Fz	N	286.2	296.8	-1409.7	107.2
Right Upper Tibia F Resultant	N	1413.1	107.2		
Right Upper Tibia Mx	N-m	40.9	97.6	-77.9	81.7
Right Upper Tibia My	N-m	40.5	177.0	-39.0	120.2
Right Lower Tibia Fx	N	139.0	296.0	-608.0	81.8
Right Lower Tibia Fy	N	126.7	171.1	-238.9	120.9
Right Lower Tibia Fz	N	448.3	267.2	-2454.3	96.0
Right Lower Tibia F Resultant	N	2457.0	106.3		
Right Lower Tibia Mx	N-m	4.7	122.4	-53.6	95.9
Right Lower Tibia My	N-m	13.1	102.6	-59.5	81.3
Right Tibia Mid Shaft X	G	2.9	233.7	-50.9	81.3
Right Tibia Mid Shaft Y	G	18.9	81.8	-8.0	138.6
Rt Dorsi/Plantar Flexion	Deg	17.3	92.8	-15.0	278.8
Rt Inversion/Eversion	Deg	-0.6	0.0	-32.2	103.5
Rt Internal/External	Deg	10.6	244.5	-0.5	25.4
Right Foot X – Front	G	29.5	92.5	-12.7	73.8
Right Foot Y – Front	G	14.3	69.2	-44.4	56.1
Right Foot Z – Front	G	37.5	57.1	-39.7	70.7
Right Foot - Front Resultant	G	51.9	56.2		
Left Upper Tibia Fx	N	57.2	57.8	-833.1	82.3
Left Upper Tibia Fy	N	238.7	85.3	-240.4	54.6
Left Upper Tibia Fz	N	339.0	98.8	-1220.1	43.7
Left Upper Tibia F Resultant	N	1226.7	43.7		
Left Upper Tibia Mx	N-m	48.7	132.2	-12.2	69.1
Left Upper Tibia My	N-m	99.5	67.5	-38.3	133.3
Left Lower Tibia Fx	N	91.7	162.3	-772.8	68.1
Left Lower Tibia Fy	N	290.6	85.6	-222.7	68.5
Left Lower Tibia Fz	N	273.4	204.2	-1507.7	43.6
Left Lower Tibia F Resultant	N	1523.2	43.7		

**DATA SHEET 7 (CONTINUED)**  
**DUMMY INJURY CRITERIA VALUES**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

		Maximum Values			
		Driver			
Description	Unit	Positive	Time, ms	Negative	Time, ms
Left Lower Tibia Mx	N-m	24.0	54.0	-21.8	84.9
Left Lower Tibia My	N-m	16.4	134.0	-86.3	82.0
Left Tibia Mid Shaft X	G	4.7	134.0	-78.5	82.0
Left Tibia Mid Shaft Y	G	26.8	82.7	-32.6	65.8
Lt Dorsi/Plantar Flexion	Deg	12.0	113.8	-17.2	0.0
Lt Inversion/Eversion	Deg	25.3	54.2	-4.8	215.7
Lt Internal/External	Deg	6.6	255.6	-7.7	64.6
Left Foot X – Front	G	34.1	67.6	-49.0	65.8
Left Foot Y – Front	G	24.0	73.1	-90.8	66.6
Left Foot Z – Front	G	76.3	80.6	-32.3	70.1
Left Foot – Front Resultant	G	101.1	66.4		
Lap Belt Load	N	6127.2	71.9		
Shoulder Belt Load	N	(1)	(1)		

		Maximum Value			
		Left Rear Passenger			
Description	Unit	Positive	Time, ms	Negative	Time, ms
Head X	G	52.1	214.3	-51.2	124.1
Head Y	G	6.4	217.5	-6.9	84.0
Head Z	G	48.1	106.7	-3.8	277.0
Head Resultant	G	65.4	214.4		
Upper Neck Fx	N	194.7	217.4	-1271.4	124.1
Upper Neck Fy	N	117.9	260.9	-219.7	218.2
Upper Neck Fz	N	2677.0	122.7	-2177.4	219.7
Upper Neck F Resultant	N	2953.2	122.7		
Upper Neck Mx	N-m	37.6	221.5	-6.1	93.8
Upper Neck My	N-m	10.8	217.6	-26.1	234.3
Upper Neck Mz	N-m	1.2	121.5	-7.0	236.2
Upper Neck M Resultant	N-m	38.0	221.8		
Lower Neck Fx	N	141.2	213.1	-2694.8	123.1
Lower Neck Fy	N	222.2	259.0	-445.6	123.7
Lower Neck Fz	N	1371.8	83.2	-2037.1	219.8
Lower Neck F Resultant	N	2751.3	123.3		
Lower Neck Mx	N-m	24.6	258.7	-44.7	122.0
Lower Neck My	N-m	271.4	123.3	-12.1	213.3
Lower Neck Mz	N-m	17.0	140.0	-8.1	227.9
Lower Neck M Resultant	N-m	274.9	123.3		

(1) No valid data after 100 msec.

**DATA SHEET 7 (CONTINUED)**  
**DUMMY INJURY CRITERIA VALUES**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

Description	Unit	Maximum Value			
		Left Rear Passenger			
		Positive	Time, ms	Negative	Time, ms
Right Shoulder Fx	N	155.8	98.2	-62.8	167.0
Right Shoulder Fz	N	148.5	121.4	-75.9	221.3
Left Shoulder Fx	N	68.1	229.5	-2399.0	96.2
Left Shoulder Fz	N	716.6	107.1	-47.3	220.6
Chest X	G	7.8	295.7	-43.8	81.0
Chest Y	G	5.8	71.8	-3.7	171.3
Chest Z	G	18.8	217.9	-12.0	130.3
Chest Resultant	G	44.0	81.0		
Chest Displacement	mm			-28.4	110.2
Upper Sternum X	G	12.7	230.0	-45.9	77.5
Lower Sternum X	G	8.9	230.6	-54.4	76.8
Upper Spine X	G	7.7	292.2	-40.4	80.8
Lower Spine X	G	7.3	296.7	-50.4	80.8
Lumbar Fx	N	(1)	(1)	(1)	(1)
Lumbar Fy	N	127.4	299.0	-426.9	72.7
Lumbar Fz	N	624.4	188.6	-699.8	104.1
Lumbar F Resultant	N	(1)	(1)		
Lumbar Mx	N-m	19.4	299.5	-68.5	96.4
Lumbar My	N-m	28.5	253.4	-97.1	125.6
Lumbar Mz	N-m	13.2	136.0	-9.3	229.2
Lumbar M Resultant	N-m	105.2	125.4		
Pelvis X	G	6.1	140.9	-42.5	79.2
Pelvis Y	G	13.4	97.5	-3.7	68.8
Pelvis Z	G	15.0	219.0	-20.0	117.9
Pelvis Resultant	G	44.9	79.3		
Right Upper Asis Fx	N	556.9	81.2	-194.3	125.2
Right Lower Asis Fx	N	729.6	80.1	-17.7	229.5
Left Upper Asis Fx	N	271.4	79.8	-112.3	189.8
Left Lower Asis Fx	N	546.9	78.8	-14.6	221.9
Shoulder Belt Load	N	5245.4	100.7		
Lap Belt Load	N	4047.0	79.2		

(1) No valid data after 205 msec.

## DATA SHEET 8

### SUMMARY OF FMVSS 212/ 219 (PARTIAL) DATA

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

**Windshield Mounting Details:**

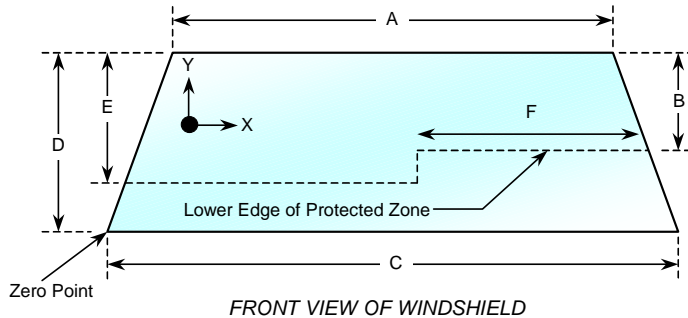
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21°C

#### WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2329	2329	100
Right Side	2329	2329	100
Total	4658	4658	100



Item	Units	Value
A	mm	1330
B	mm	490
C	mm	1658
D	mm	835
E	mm	550
F	mm	552

**AREA OF PROTECTED ZONE FAILURES - NONE**

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

X	Y

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

X	Y

**DATA SHEET 9**

**FMVSS 301 FUEL SYSTEM INTEGRITY DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

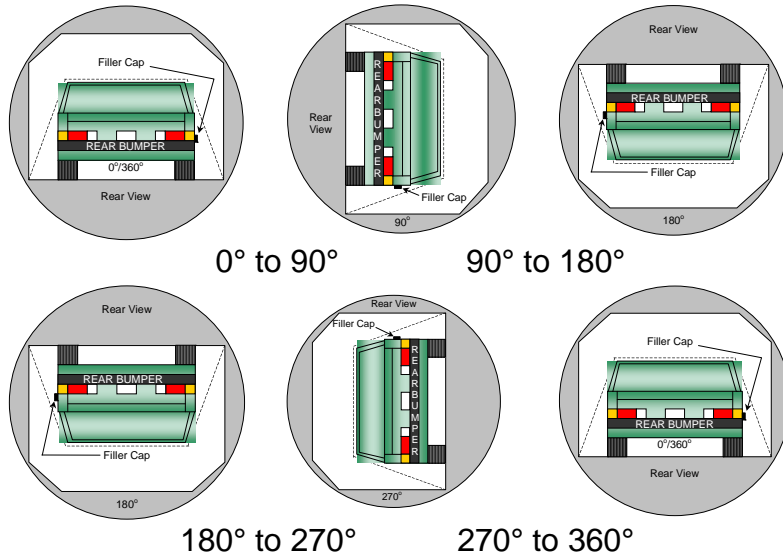
Temperature at Time of Impact: 21° C      Test Time: 9:20 am

**Stoddard Solvent Spillage Measurements**

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

**FMVSS 301 STATIC ROLLOVER DATA**

**NOT PERFORMED**



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations:

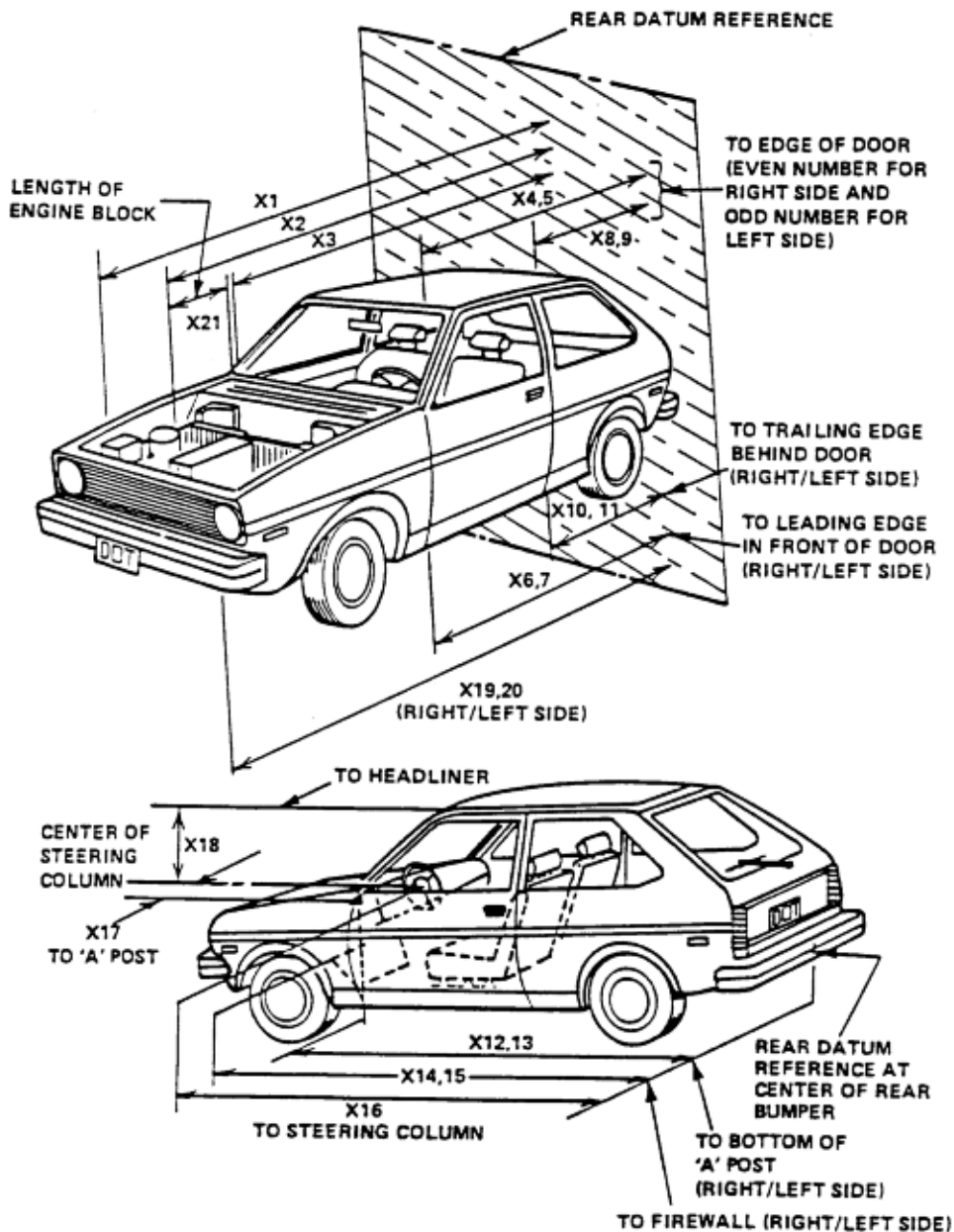
Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	N/A		
90° to 180°	N/A		
180° to 270°	N/A		
270° to 360°	N/A		

DATA SHEET 10

TEST VEHICLE MEASUREMENTS

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

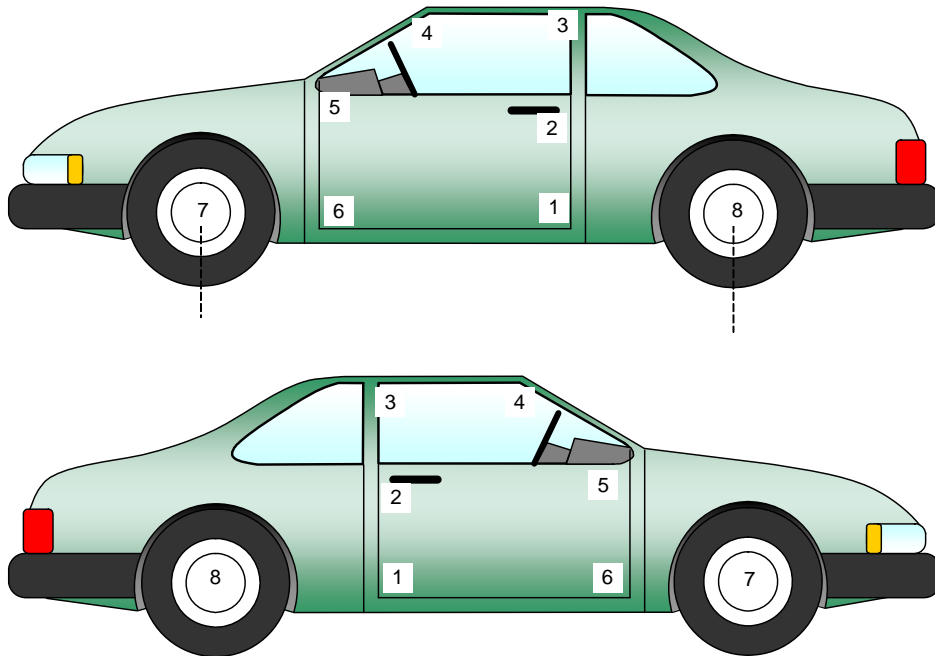
NHTSA No.: R70206  
 Test Date: 4/04/2008

No.	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
1	Total length of vehicle at centerline	4992	4520	472
2	RSOV to front of engine	4572	4417	155
3	RSOV to firewall centerline	3836	3761	75
4	RSOV to leading edge of right door	3528	3523	5
5	RSOV to leading edge of left door	3526	3514	12
6	RSOV to lower leading edge of right door	3504	3487	17
7	RSOV to lower leading edge of left door	3504	3476	28
8	RSOV to upper leading edge of right door	2421	2424	-3
9	RSOV to upper leading edge of left door	2416	2404	12
10	RSOV to lower trailing edge of right door	2450	2440	10
11	RSOV to lower trailing edge of left door	2441	2425	16
12	RSOV to bottom of right 'A' pillar	3496	3495	1
13	RSOV to bottom of left 'A' pillar	3492	3478	14
14	RSOV to firewall on right side	3924	3918	6
15	RSOV to firewall on left side	3931	3805	126
16	RSOV to steering column	3038	3051	-13
17	Center of steering column to left 'A' pillar	389	407	-18
18	Center of steering column to headlining	450	464	-14
19	RSOV to right side of front bumper	4919	4934	-15
20	RSOV to left side of front bumper	4918	4669	249
21	Length of engine block	500	500	0
RD	RSOV to right side of dash panel	3224	3214	10
CD	RSOV to center of dash panel	3229	3215	14
LD	RSOV to left side of dash panel	3227	3209	18

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



**LEFT FRONT**

Point Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
1	2609	-819	-15	2609	-826	-13	0	7	-2
2	2503	-819	-296	2501	-822	-294	-2	3	-2
3	2406	-647	-964	2402	-646	-963	-4	-1	-1
4	2927	-685	-888	2924	-687	-894	-3	2	6
5	3470	-812	-292	3452	-840	-287	-18	28	-5
6	3421	-803	112	3416	-830	119	-5	27	-7
7	4080	-882	162	3937	-901	134	-143	19	28
8	1220	-851	202	1224	-855	199	4	4	3

**RIGHT FRONT**

Point Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
1	2605	820	-31	2605	821	-31	0	-1	0
0	2501	812	-301	2501	812	-300	0	0	-1
3	2402	636	-969	2402	637	-969	0	-1	0
4	2928	679	-888	2929	677	-888	1	2	0
5	3464	813	-298	3465	816	-295	1	-3	-3
6	3402	805	108	3402	811	110	0	-6	-2
7	4077	902	157	4129	868	137	52	34	20
8	1216	850	196	1223	850	197	7	0	-1

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

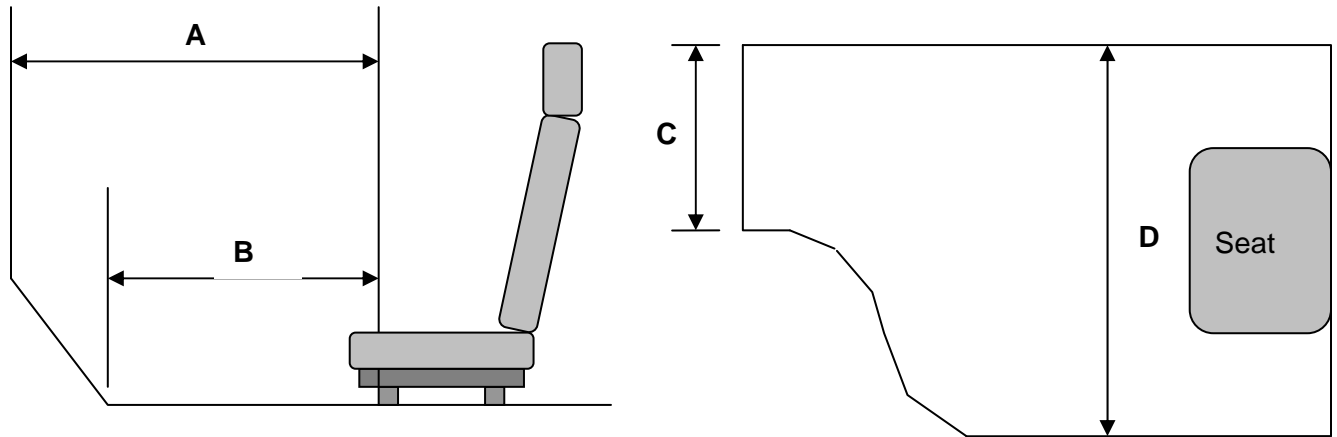
NHTSA No.: R70206  
 Test Date: 4/04/2008

	Elements	Pre-Test (mm)
1	Total Length	4992
2	Total Width	1940
3	Bumper Top Height	549
4	Bumper Bottom Height	386
5	Longitudinal Member Top Height	526
6	Distance between Longitudinal Members	1280
7	Longitudinal Member Width	120
8	Engine Top Height	918
9	Engine Bottom Height	180
10	Engine and gearbox width	850
11	Front bumper-engine distance	420
12	Front shock absorber fixing height	877
13	Bonnet leading edge height	812
14	Front shock absorber fixing width	1255
15	Front bumper – front axle distance	992
16	Front axle – a pillar distance	590
17	A-pillar – B-pillar distance	1050
18	B-Pillar – rear axle distance	1242
19	B-pillar – C-pillar distance	970
20	Roof sill bottom height	1362
21	Roof sill top height	1422
22	Floor sill bottom height	319
23	Floor sill top height	356

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



**DRIVER**

Measurements	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	505	492	13
B	419	417	2
C	367	354	13
D	473	460	13

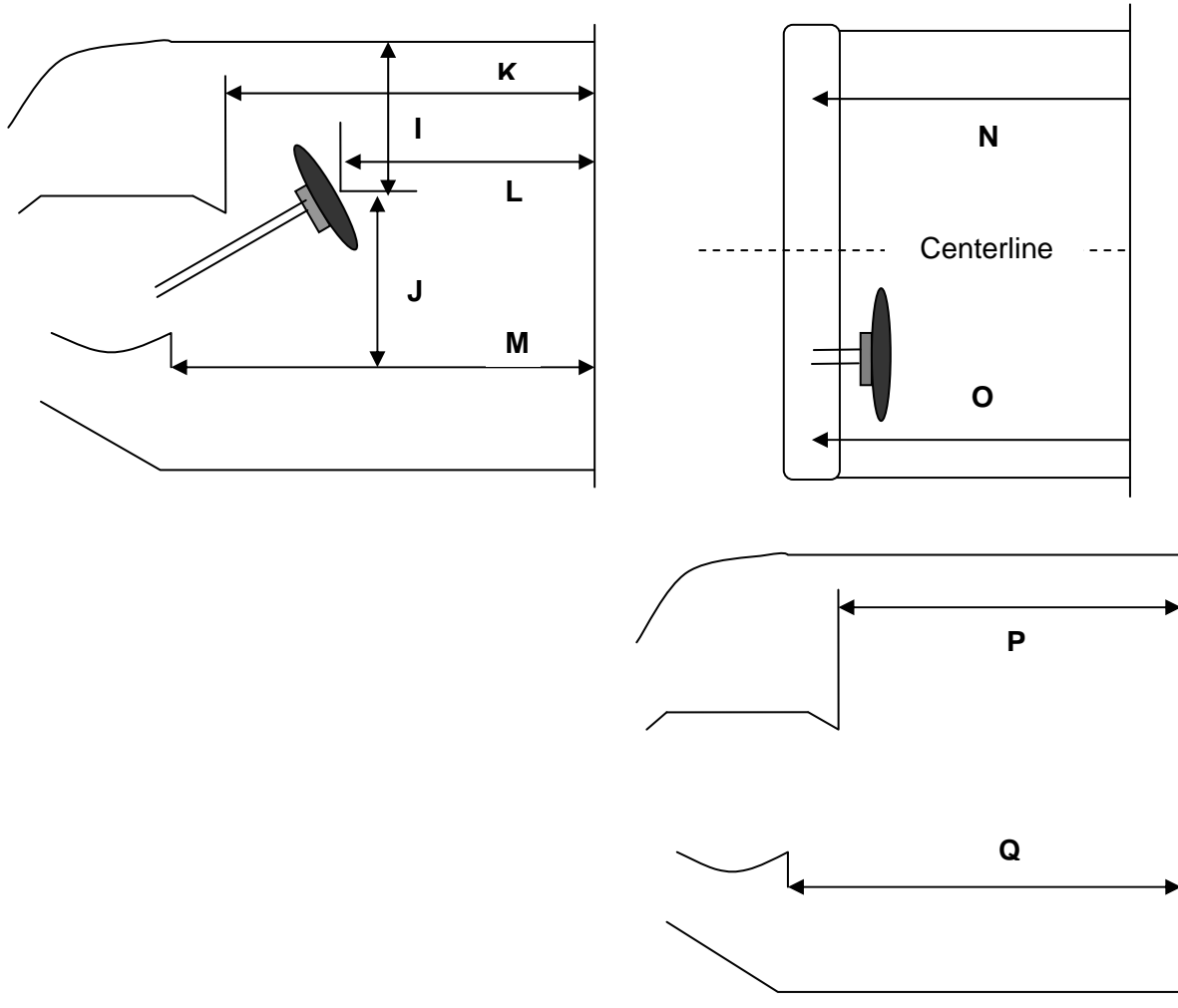
**LEFT FRONT PASSENGER**

Measurements	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	569	569	0
B	390	390	0
C	335	335	0
D	445	443	2

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



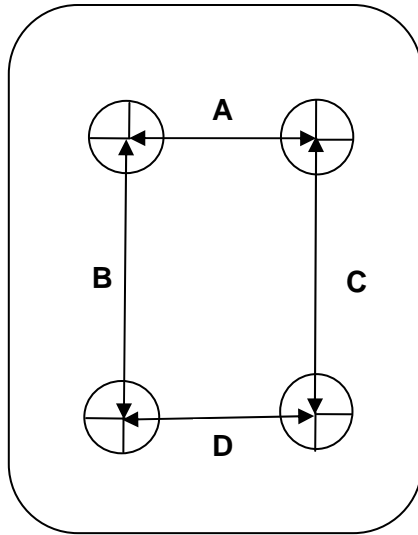
Measurements	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
I	455	466	-11
J	633	622	11
K	2060	2045	15
L	1862	1855	7
M	2226	2194	32
N	2070	2055	15
O	2094	2070	24
P= K (PASS)	2060	2051	9
Q= M (PASS)	2236	2220	16

Measurements from C-Pillar Belt Anchorage

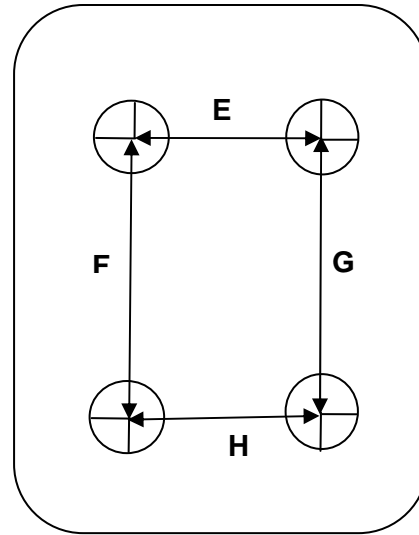
**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008



Driver



Passenger

**UNDERBODY FLOORBOARD DEFORMATION**

Measurement	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	377	374	3
B	419	418	1
C	366	366	0
D	473	471	2
E	398	398	0
F	390	390	0
G	455	455	0
H	445	444	1

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

	Points	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
		X	Y	Z	X	Y	Z	X	Y	Z
Lower Bumper Beam	1	4931	-666	30	4720	-672	-100	-211	6	130
	2	4991	-403	70	4537	-488	-69	-454	85	139
	3	5004	-131	71	4555	-218	-47	-449	87	118
	4	5004	131	68	4642	-37	-39	-362	168	107
	5	4989	400	66	4822	163	-48	-167	237	114
	6	4927	679	20	4962	415	-82	35	264	102
Upper Bumper Beam	1	4933	-667	-74	4673	-756	-134	-260	89	60
	2	4994	-401	-73	4458	-471	-183	-536	70	110
	3	5009	-135	-74	4495	-207	-176	-514	72	102
	4	5008	133	-74	4613	-14	-175	-395	147	101
	5	4993	402	-77	4787	192	-183	-206	210	106
	6	4926	681	-85	4933	439	-178	7	242	93
Upper Radiator Support	1	4582	-693	-365	4198	-718	-416	-384	25	51
	2	4782	-413	-353	4270	-385	-400	-512	28	47
	3	4782	-137	-355	4290	-125	-500	-492	12	145
	4	4780	143	-358	4461	96	-479	-319	47	121
	5	4780	413	-357	4636	299	-445	-144	114	88
	6	4581	700	-372	4564	623	-408	-17	77	36
Front of Hood	1	4644	-746	-382	4284	-754	-650	-360	8	268
	2	4888	-452	-325	4302	-501	-490	-586	49	165
	3	4940	-150	-343	4400	-230	-447	-540	80	104
	4	4941	156	-343	4582	17	-459	-359	139	116
	5	4889	455	-327	4722	284	-496	-167	171	169
	6	4642	754	-391	4609	634	-587	-33	120	196

Reference Photos on the Following Page

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008



Lower Bumper Beam / Upper Bumper Beam / Center Bumper Beam



Front of Hood



Upper Radiator Support

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

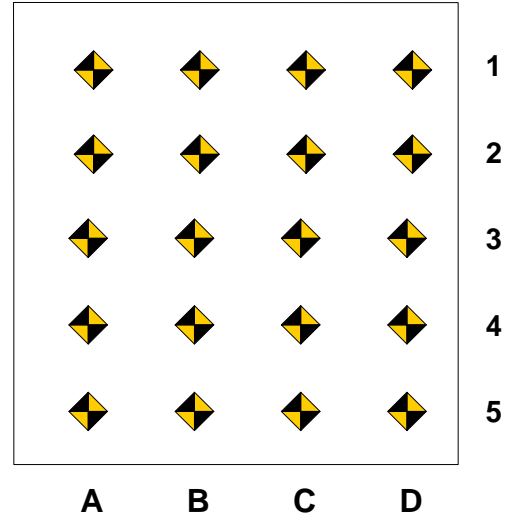
Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

Columns A through D are evenly spaced.

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

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



**DRIVER'S SIDE TOE PAN FLOOR BOARD**

Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
A1	3628	-561	84	3613	-587	79	-15	26	5
B1	3726	-432	110	3698	-444	90	-28	12	20
C1	3718	-323	111	3693	-336	97	-25	13	14
D1	3730	-192	117	3722	-205	116	-8	13	1
A2	3608	-564	163	3599	-587	161	-9	23	2
B2	3645	-456	174	3631	-471	168	-14	15	6
C2	3639	-315	166	3635	-330	175	-4	15	-9
D2	3642	-188	190	3648	-204	196	6	16	-6
A3	3553	-572	239	3554	-589	245	1	17	-6
B3	3538	-455	239	3539	-472	248	1	17	-9
C3	3535	-326	233	3538	-342	240	3	16	-7
D3	3528	-195	238	3534	-210	242	6	15	-4
A4	3321	-580	243	3324	-594	248	3	14	-5
B4	3324	-477	242	3326	-492	246	2	15	-4
C4	3323	-332	238	3327	-348	242	4	16	-4
D4	3326	-174	237	3333	-191	240	7	17	-3
A5	3130	-648	241	3132	-662	243	2	14	-2
B5	3136	-481	240	3139	-494	243	3	13	-3
C5	3145	-333	238	3150	-347	242	5	14	-4
D5	3163	-174	238	3169	-187	241	6	13	-3
Brake Pedal	3536	-358	40	3504	-377	53	-32	19	-13
IP Left	3327	-526	-235	3306	-520	-232	-21	-6	-3
IP Right	3326	-226	-235	3316	-221	-234	-10	-5	-1
Steering Column	3060	-374	-467	3065	-353	-483	5	-21	16
Front Outboard Bolt	3059	-576	155	3064	-589	158	5	13	-3

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door      NHTSA No.: R70206  
 Test Program: Left 50% Offset Deformable Barrier      Test Date: 4/04/2008

**Driver's Side Toe Pan Floor Board**  
**Additional Measurements**

Points	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
1	3668	-531	50	3643	-553	40	-25	22	10
2	3760	-412	66	3724	-422	41	-36	10	25
3	3757	-242	66	3739	-254	54	-18	12	12
4	3670	-141	167	3675	-155	171	5	14	-4
5	3584	-151	220	3590	-167	225	6	16	-5
6	3649	-537	85	3630	-559	78	-19	22	7
7	3676	-486	141	3653	-500	126	-23	14	15
8	3561	-487	236	3562	-503	245	1	16	-9
9	3613	-584	81	3600	-611	80	-13	27	1
10	3605	-515	75	3595	-528	77	-10	13	-2
11	3473	-505	226	3464	-522	229	-9	17	-3
12	3676	-373	146	3656	-387	139	-20	14	7
13	3601	-381	206	3598	-397	215	-3	16	-9
14	3601	-99	52	3608	-106	59	7	7	-7
15	3549	-631	117	3552	-663	123	3	32	-6
16	3382	-507	241	3383	-522	245	1	15	-4
17	3642	-161	4	3620	-162	13	-22	1	-9

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

**Additional Measurements (Continued)**

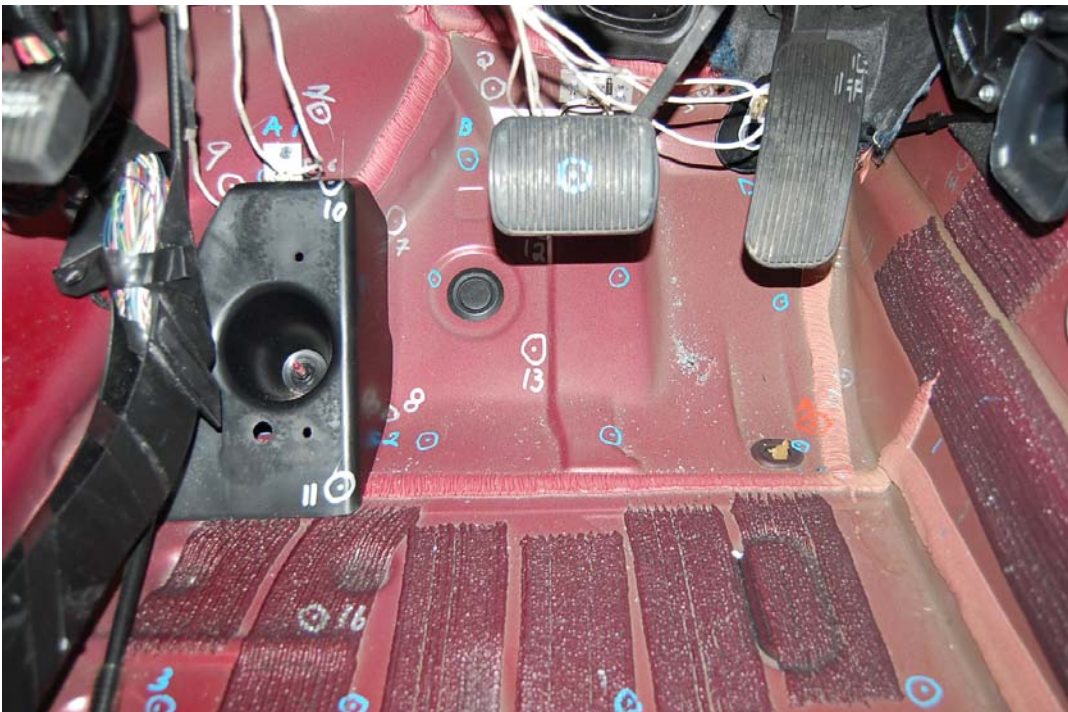
	Points	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
		X	Y	Z	X	Y	Z	X	Y	Z
Center of Grill	1	4815	-738	-247	4298	-642	-342	-517	-96	95
	2	4924	-448	-245	4383	-517	-332	-541	69	87
	3	4974	-143	-234	4487	-209	-285	-487	66	51
	4	4973	152	-236	4647	29	-331	-326	123	95
	5	4923	453	-245	4794	286	-401	-129	167	156
	6	4821	737	-245	4818	619	-263	-3	118	18
Top of Bumper Cover	1	4922	-737	-108	4412	-849	-222	-510	112	114
	2	5029	-452	-105	4499	-555	-236	-530	103	131
	3	5079	-148	-102	4608	-264	-217	-471	116	115
	4	5078	157	-103	4768	-36	-245	-310	193	142
	5	5032	453	-105	4921	218	-273	-102	235	168
	6	4932	735	-107	5033	498	-268	101	237	161
Bumper Centerline	1	4931	-666	-13	4705	-704	-124	-226	38	111
	2	4979	-552	-10	4599	-642	-131	-380	90	121
	3	4993	-414	-10	4493	-490	-134	-500	76	124
	4	5003	-273	-13	4510	-350	-131	-493	77	118
	5	5008	-140	-15	4524	-217	-125	-484	77	110
	6	5010	0	-13	4531	-103	-122	-479	103	109
	7	5008	137	-10	4629	-21	-115	-379	158	105
	8	5002	279	-11	4727	84	-119	-278	195	108
	9	4992	411	-12	4810	185	-122	-182	226	110
	10	4978	548	-11	4896	292	-123	-82	256	112
	11	4927	679	-11	4953	422	-110	26	257	99
Bottom of Bumper Cover	1	4933	-737	52	4539	-872	-130	-394	135	182
	2	5040	-449	55	4629	-599	-153	-411	150	208
	3	5084	-151	59	4709	-315	-98	-375	164	157
	4	5082	149	58	4840	-72	-106	-242	221	164
	5	5036	451	54	5015	174	-153	-21	277	207
	6	4938	733	56	5130	451	-148	192	282	204

**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

**Driver's Side Toe Pan Floor Board**



**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

**Driver's Side Toe Pan Floor Board**



**DATA SHEET 10 (CONTINUED)**  
**TEST VEHICLE MEASUREMENTS**

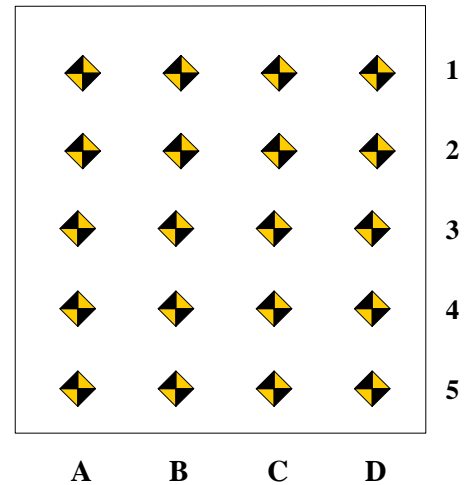
Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

Columns A through D are evenly spaced.

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

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



**PASSENGER'S SIDE TOE PAN FLOOR BOARD**

Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
A1	3738	230	96	3736	230	106	-2	0	-10
B1	3729	319	90	3726	321	95	-3	-2	-5
C1	3736	442	75	3729	443	75	-7	-1	0
D1	3650	560	45	3648	564	46	-2	-4	-1
A2	3666	217	162	3666	218	174	0	-1	-12
B2	3656	317	147	3655	320	155	-1	-3	-8
C2	3656	467	150	3653	470	153	-3	-3	-3
D2	3609	579	123	3608	582	127	-1	-3	-4
A3	3571	211	227	3572	215	240	1	-4	-13
B3	3561	310	222	3562	315	233	1	-5	-11
C3	3569	484	219	3568	488	226	-1	-4	-7
D3	3567	602	219	3566	606	222	-1	-4	-3
A4	3361	176	232	3362	180	243	1	-4	-11
B4	3354	328	228	3354	332	236	0	-4	-8
C4	3325	460	226	3326	464	235	1	-4	-9
D4	3343	620	224	3343	623	227	0	-3	-3
A5	3179	168	232	3180	171	241	1	-3	-9
B5	3157	323	229	3156	326	235	-1	-3	-6
C5	3112	468	227	3113	470	231	1	-2	-4
D5	3110	611	226	3110	614	228	0	-3	-2
Front Outboard Bolt	3329	223	-238	3318	224	-224	-11	-1	-14
IP Left	3334	526	-234	3331	528	-226	-3	-2	-8
IP Right	3056	589	143	3057	590	145	1	-1	-2

**DATA SHEET 11**  
**PHOTOGRAPHIC DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

No.	Camera View	Location (mm) *			Lens (mm)	Angle (deg)	Shutter (µs)	Speed (fps)
		X	Y	Z				
1	Left Front Half	455	-5255	1155	24	4.7	450	1000
2	Left SWC Bottom	780	-6170	875	50	3.9	500	1000
3	Left Angle 2	4530	-5240	2135	50	10.4	325	1000
4	Left Overall	1805	-7210	1340	19	6.2	550	1000
5	Right Front Half	555	-5335	155	24	3.3	600	1000
6	Onboard Driver Side				8		250	1000
7	Onboard Driver Footwell				6.5		650	1000
8	Onboard Passenger				8		250	1000
9	Windshield	-2505	0	3095	12.5	38.3	850	1000
10	Overhead Closeup	140	0	4630	50	90	300	1000
11	Overhead Overall	635	0	4630	14	90	1000	1000
12	Pit Front	5	0	-3150	24	90	1000	1000
13	Pit Rear	2165	0	-3150	24	90	1000	1000
14	Left Angle 1	3565	-5330	1655	25	4.2	400	1000
15	Left Close Up	1225	-6465	1440	35	2.6	225	1000
16	Real-Time Camera				13			24

\*COORDINATES:

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

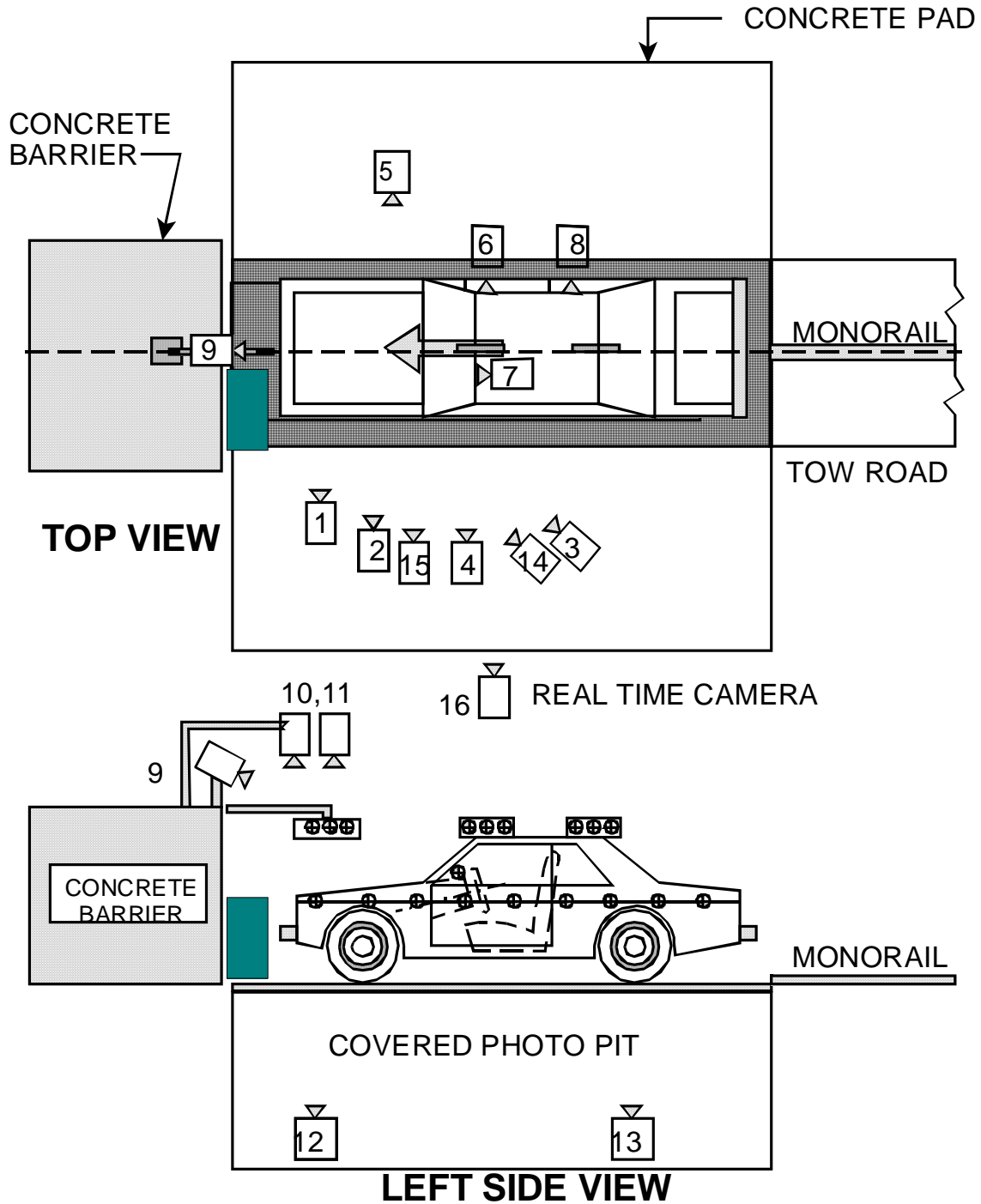
DATA SHEET 11 (CONTINUED)

PHOTOGRAPHIC DATA

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET 12

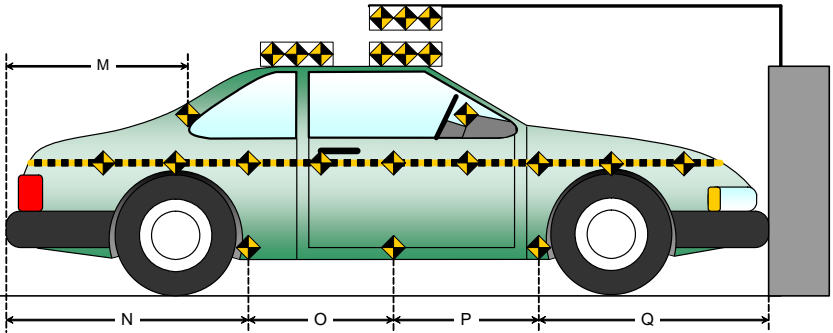
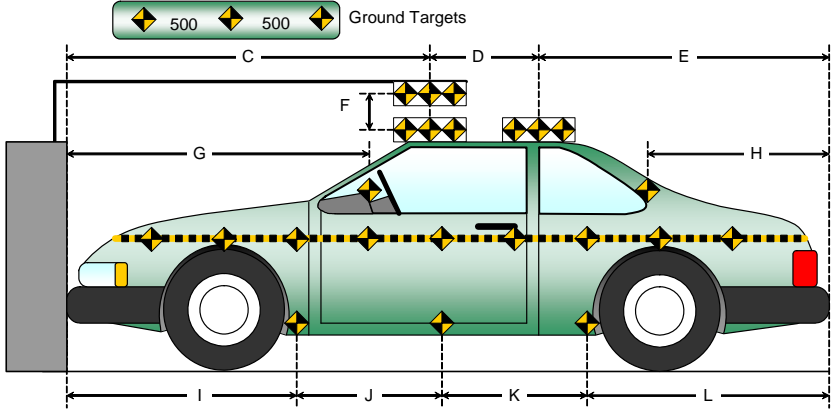
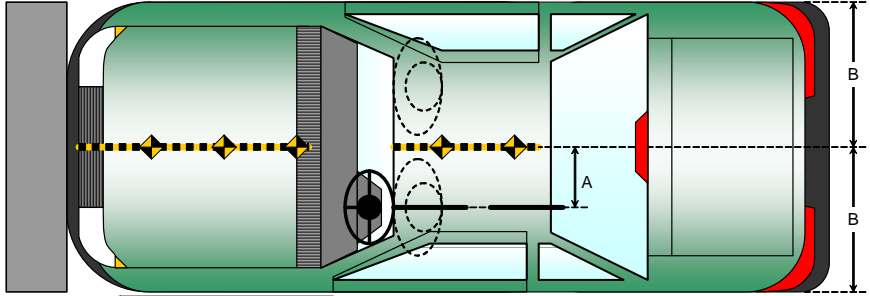
VEHICLE REFERENCE PHOTO TARGET LOCATIONS

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

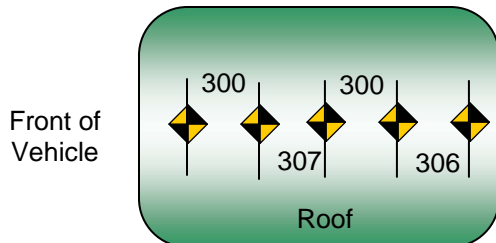
NHTSA No.: R70206  
 Test Date: 4/04/2008

Measurement from roof to overhead cameras: 3130 mm

Item	Value
A	373
B	970
C	2545
D	662
E	1785
F	280
G	
H	1032
I	1579
J	982
K	958
L	1473
M	1041
N	1545
O	961
P	970
Q	1516



Distance between left rear door targets: 200 mm  
 Overhead camera to ground: 4630 mm  
 Measurement of roof targets:



**DATA SHEET 13**  
**POST TEST AIR BAG DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

Air Bag Data	Driver
Number of Vent Holes	
Size of Vent Holes	
Shape of Vent Holes	
Total Vent Area	
Length of Deflated Airbag (if square)	
Width of Deflated Airbag (if square)	
Diameter of Deflated Airbag (if round)	
Is Airbag Tethered?	
Length of Tethers	

Note: The driver airbag did not deploy.

**DATA SHEET 14**

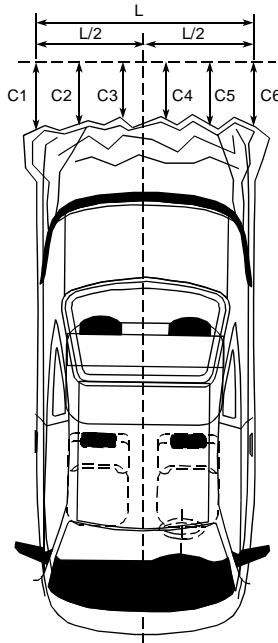
**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

**CRUSH DEPTH DIMENSIONS**

No.	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
C1	Crush zone 1 at left side	4918	4669	249
C2	Crush zone 2 at left side	4970	4476	494
C3	Crush zone 3 at left side	4988	4504	484
C4	Crush zone 4 at right side	4990	4673	317
C5	Crush zone 5 at right side	4971	4821	150
C6	Crush zone 6 at right side	4919	4934	-15
L	C1 TO C6	1322	1108	214

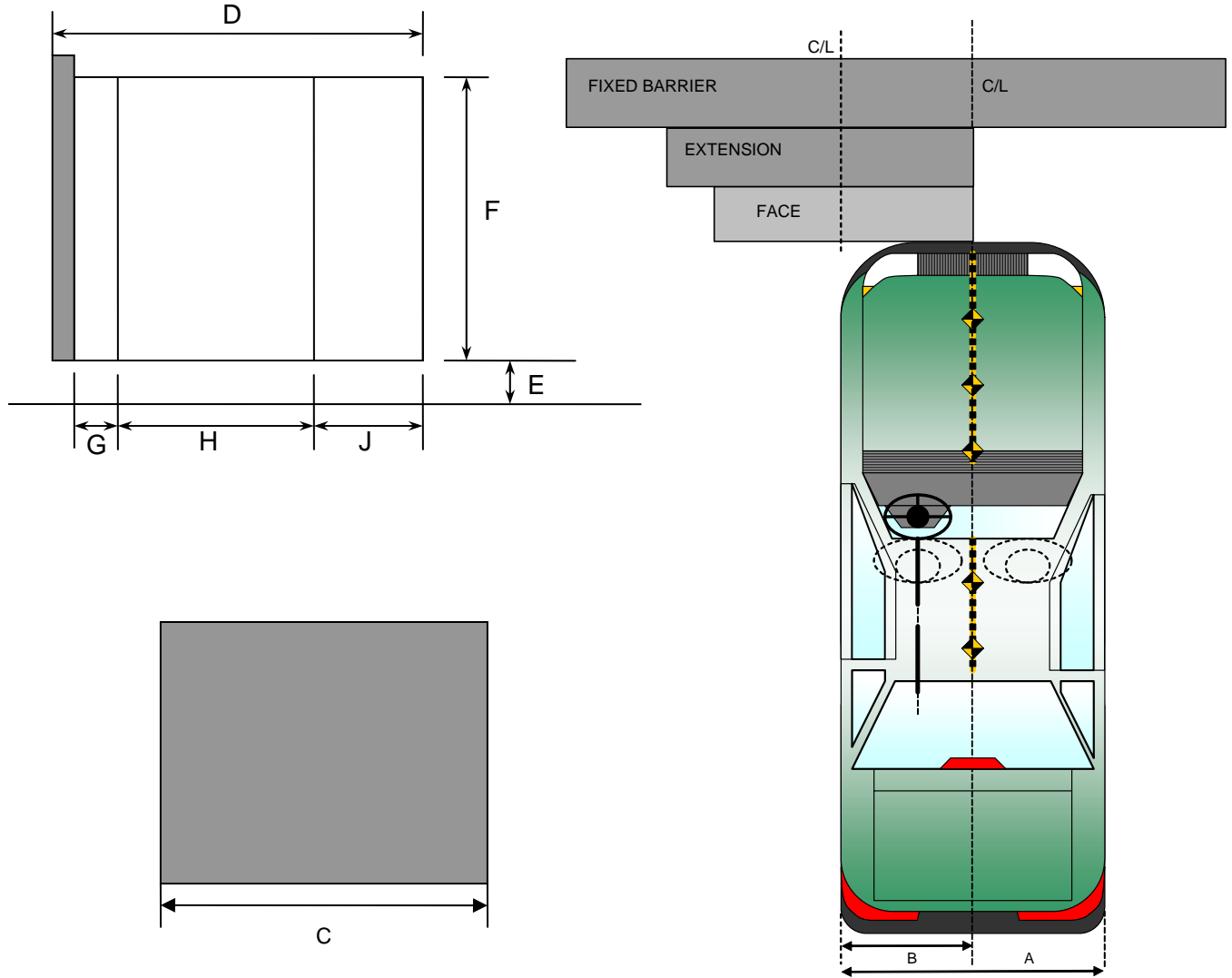


## DATA SHEET 15

### OFFSET BARRIER AND VEHICLE ORIENTATION

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



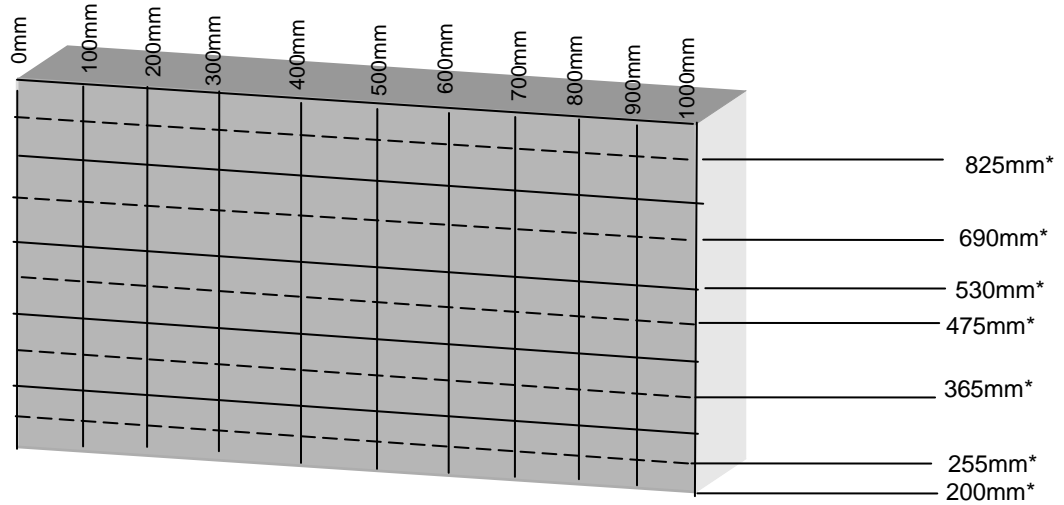
Location	Description	Measurement (mm)
A	Total Vehicle Width	1940
B	50% Overlap Distance	970
C	Deformable Face Width	1000
D	Single Stage Honeycomb Depth	800
E	Lower Edge Height From Ground	199
F	Deformable Barrier Honeycomb Height	700
G	Constant Rear Deformable Core	90
H	Progressive Rear Deformable Core	450
J	Constant Front Deformable Core	250

## DATA SHEET 16

### DEFORMABLE BARRIER HONEYCOMB CRUSH

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008



\*Measurement to Ground

	Points (mm)	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
255 mm	0	794	761	33
	100	794	741	53
	200	794	718	76
	300	794	660	134
	400	795	566	229
	500	796	395	401
	600	795	412	383
	700	795	420	375
	800	795	422	373
	900	795	423	372
	1000	795	423	372
365 mm	0	794	773	21
	100	795	759	36
	200	795	710	85
	300	795	633	162
	400	796	390	406
	500	796	382	414
	600	796	371	425
	700	796	358	438
	800	796	350	446
	900	796	345	451
	1000	795	327	468

**DATA SHEET 16 (CONTINUED)**  
**DEFORMABLE BARRIER HONEYCOMB CRUSH**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
 Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
 Test Date: 4/04/2008

	Points (mm)	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
475 mm	0	795	788	7
	100	796	766	30
	200	796	695	101
	300	796	608	188
	400	796	490	306
	500	796	471	325
	600	796	446	350
	700	796	420	376
	800	796	402	394
	900	796	387	409
	1000	795	355	440
530 mm	0	795	794	1
	100	796	764	32
	200	796	691	105
	300	796	607	189
	400	796	538	258
	500	796	520	276
	600	796	497	299
	700	797	470	327
	800	797	444	353
	900	797	418	379
	1000	795	374	421
690 mm	0	796	791	5
	100	797	740	57
	200	797	685	112
	300	797	646	151
	400	797	662	135
	500	797	637	160
	600	797	614	183
	700	797	587	210
	800	797	544	253
	900	797	496	301
	1000	796	449	347
825 mm	0	797	795	2
	100	797	743	54
	200	797	702	95
	300	797	704	93
	400	797	703	94
	500	797	685	112
	600	797	672	125
	700	797	662	135
	800	798	621	177
	900	798	553	245
	1000	798	479	319

**DATA SHEET 16 (CONTINUED)**

**DEFORMABLE BARRIER HONEYCOMB CRUSH**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

**HOLE FROM FRAME RAIL (OUTER THEN INNER)**

Point Location	X (mm)	Y (mm)	Z (mm)
1	523	284	548
2	437	292	534
3	373	329	513
4	351	380	476
5	365	436	456
6	423	422	372
7	492	377	338
8	565	290	383
9	589	250	513
10	229	295	488
11	233	337	475
12	254	330	401
13	271	318	319
14	321	229	361
15	326	228	406
16	273	243	474



**DATA SHEET 17**

**DEFORMABLE BARRIER LOAD CELL LOCATIONS**

Test Vehicle: 2007 Ford Five Hundred SEL 4-Door  
Test Program: Left 50% Offset Deformable Barrier

NHTSA No.: R70206  
Test Date: 4/04/2008

<b>Row One</b>	1	11	21	31	41	51	61	71	81
	2	12	22	32	42	52	62	72	82
	3	13	23	33	43	53	63	73	83
	4	14	24	34	44	54	64	74	84
	5	15	25	35	45	55	65	75	85
	6	16	26	36	46	56	66	76	86
	7	17	27	37	47	57	67	77	87
	8	18	28	38	48	58	68	78	88
	9	19	29	39	49	59	69	79	89
<b>Row Ten</b>	10	20	30	40	50	60	70	80	90

Track C/L

90 Load Cells  
10 Rows  
9 Columns

**Front View**

Load Cells measure 123 mm square and have a 1.5 mm gap.  
Distance from LCB to ground measures 125 mm

**APPENDIX A**  
**PHOTOGRAPHS**

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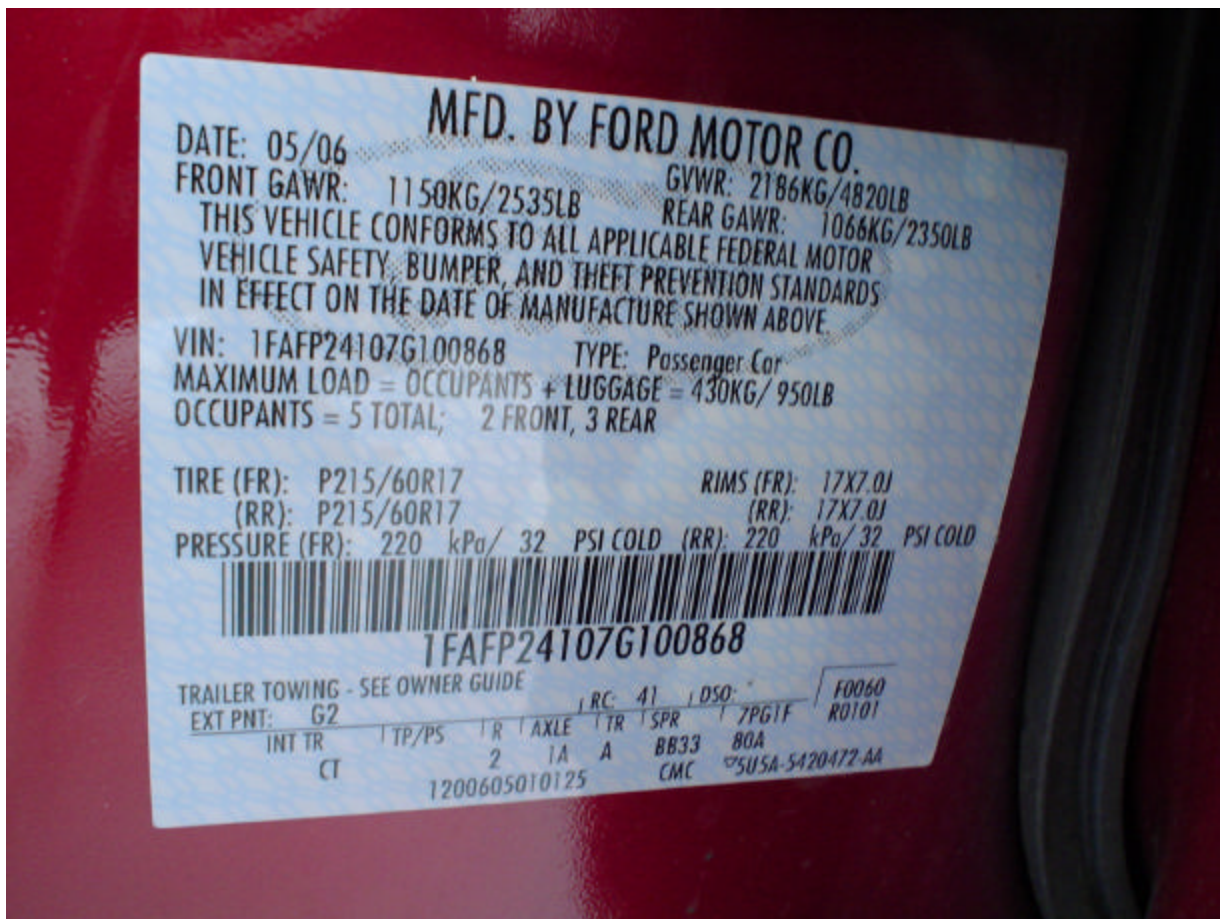
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Manufacturer's Label



Tire Placard



Left Front 3/4 View, As Received



Right Rear 3/4 View, As Received



Pre-Test Front View



Post-Test Front View



Pre-Test Left Side View



Post-Test Left Side View



Pre-Test Right Side View



Post-Test Right Side View



Pre-Test Right Front 3/4 View



Post-Test Right Front 3/4 View



Pre-Test Left Front 3/4 View



Post-Test Left Front 3/4 View



Pre-Test Left Rear 3/4 View



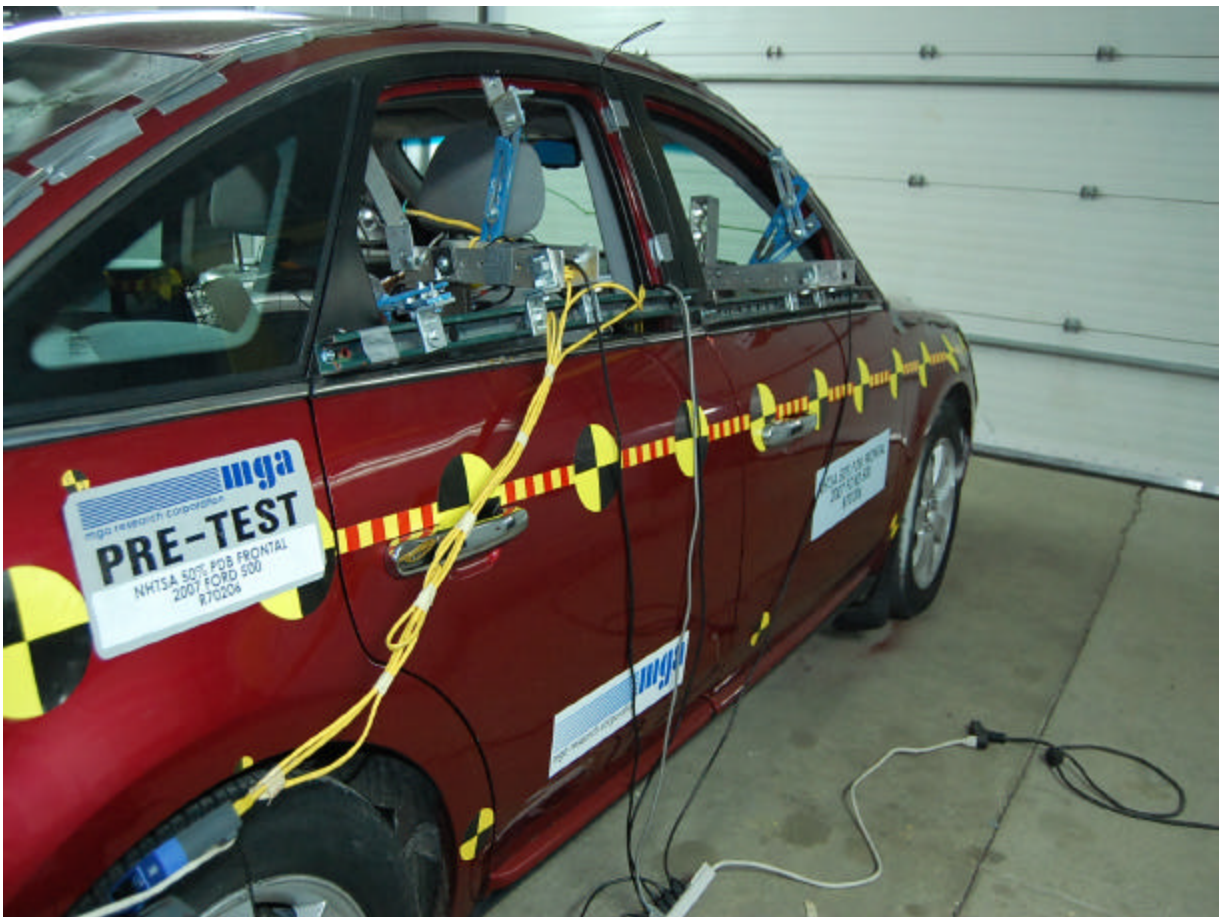
Post-Test Left Rear 3/4 View



Pre-Test Left Side  $\frac{3}{4}$  View of Doors



Post-Test Left Side  $\frac{3}{4}$  View of Doors After Impact



Pre-Test Right Side ¾ View of Doors



Post-Test Right Side ¾ View of Doors After Impact



Pre-Test Windshield View



Post-Test Windshield View



Pre-Test Engine Compartment View



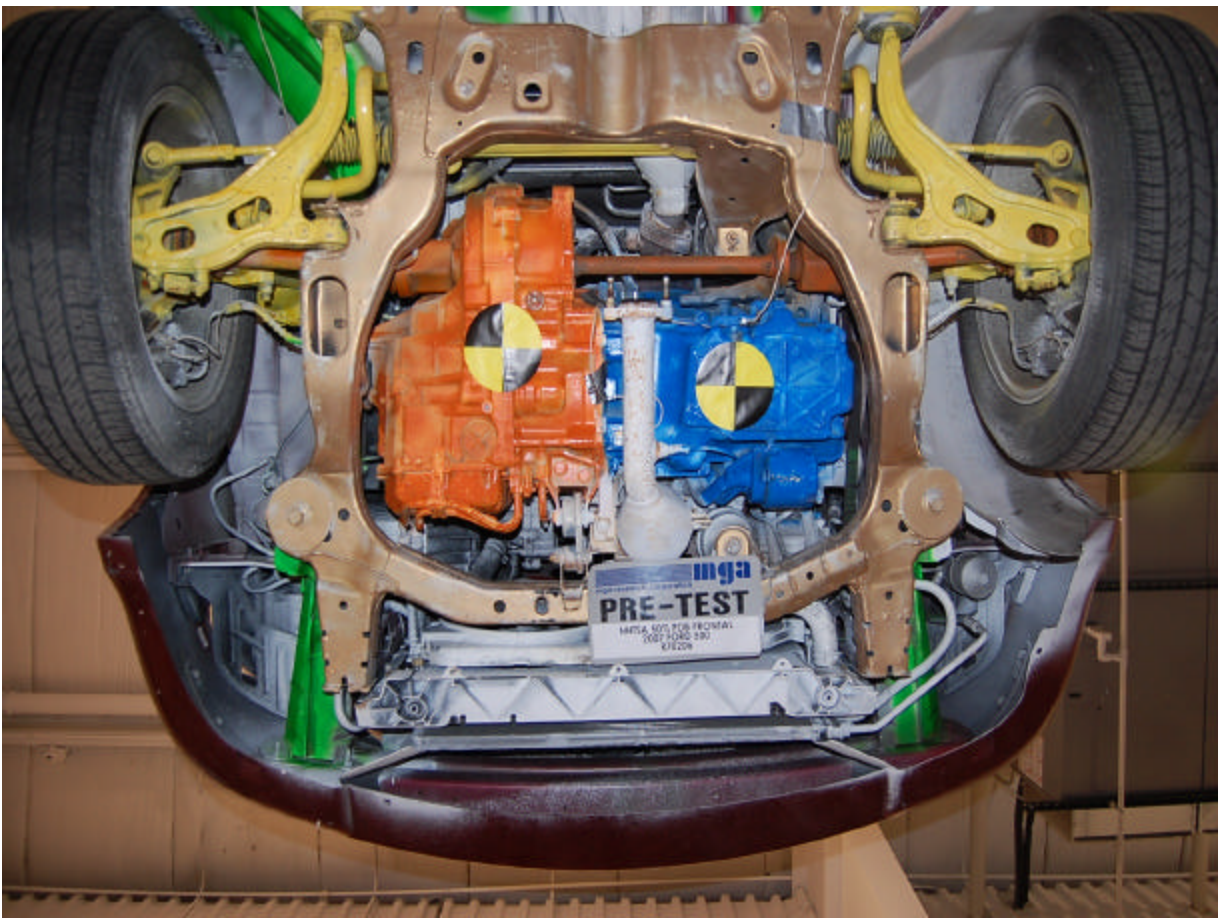
Post-Test Engine Compartment View



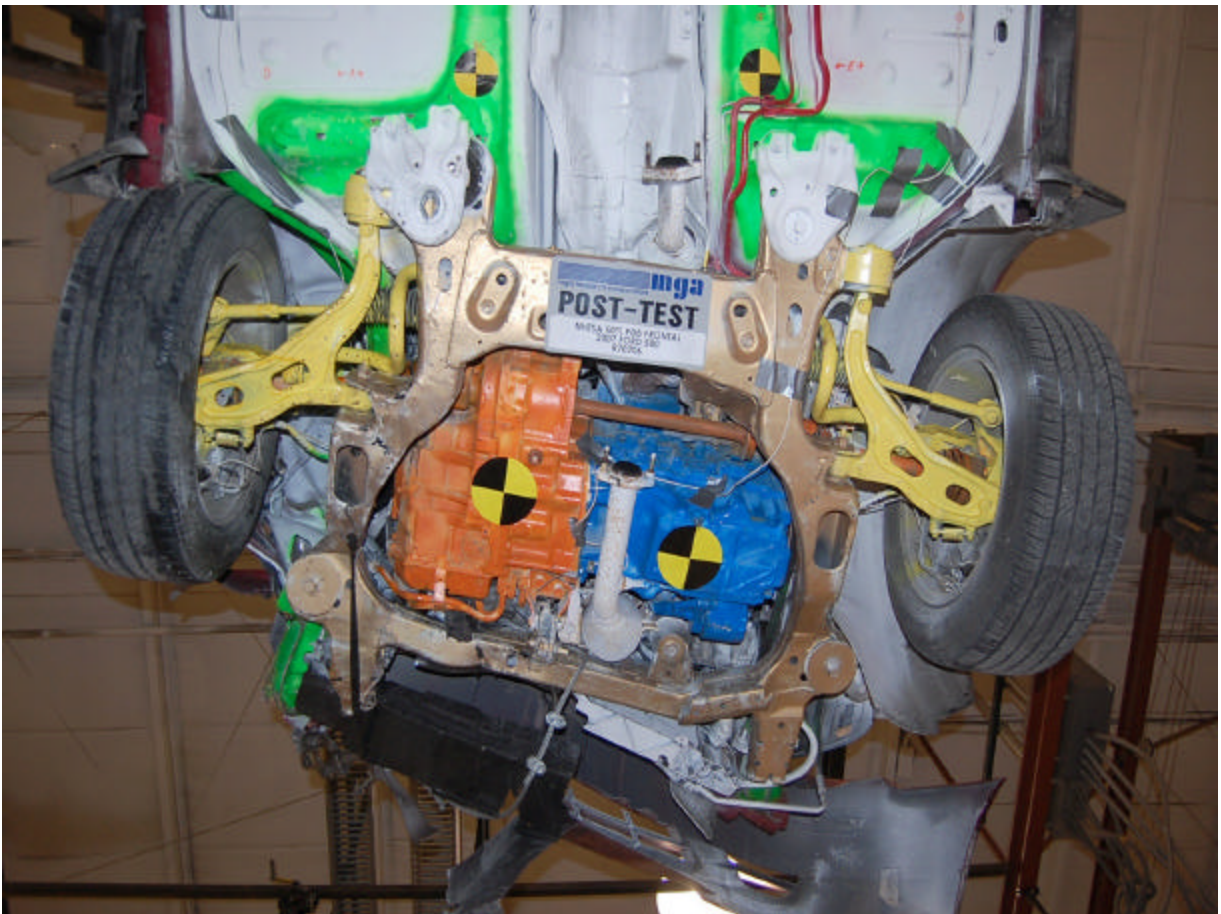
Pre-Test Fuel Cap View



Post-Test Fuel Cap View



Pre-Test Front Underbody View



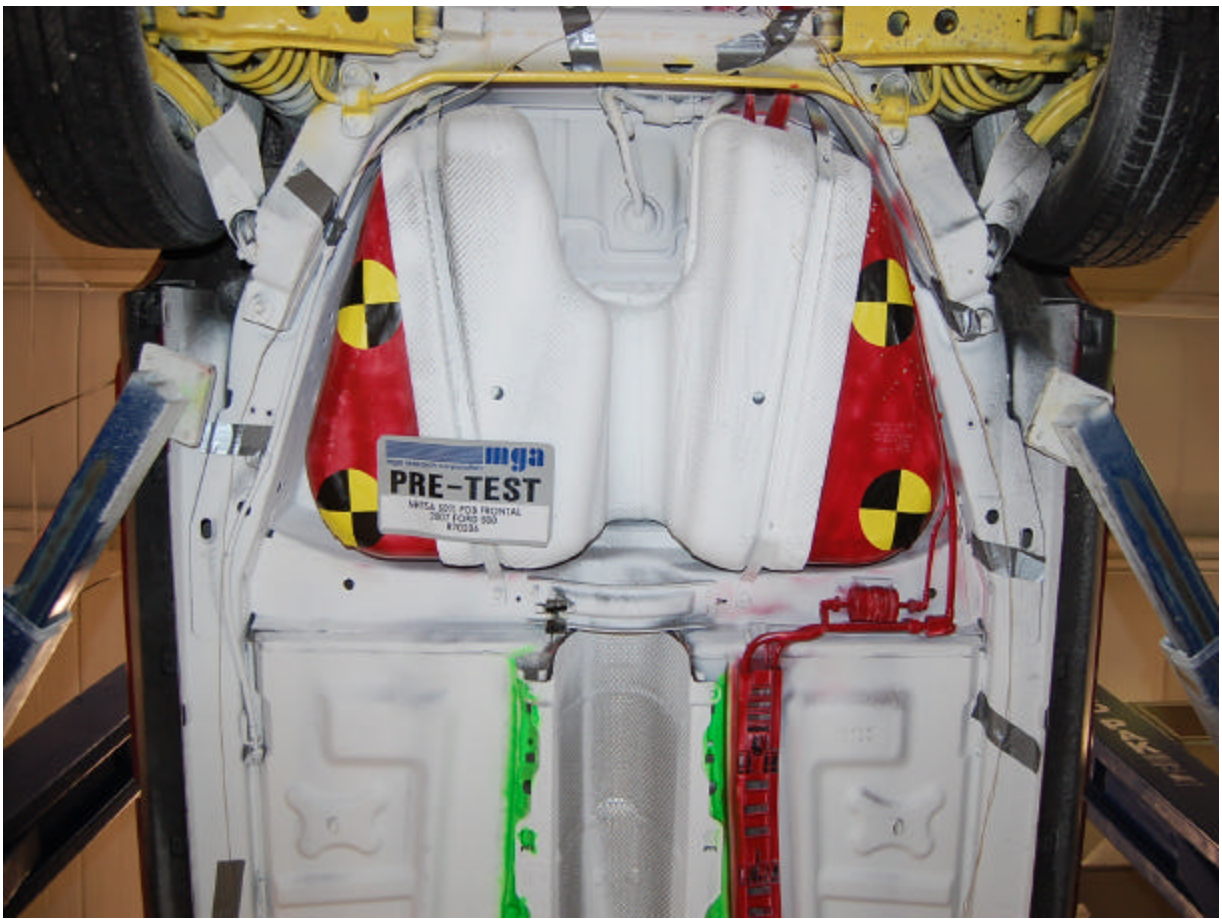
Post-Test Front Underbody View



Pre-Test Front Mid Underbody View



Post-Test Front Mid Underbody View



Pre-Test Rear Mid Underbody View



Post-Test Rear Mid Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View



Pre-Test Driver Dummy Front View (Head Position)



Post-Test Driver Dummy Front View (Head Position)



Pre-Test Driver Dummy (Through Window)



Post-Test Driver Dummy (Through Window)



Post-Test Driver Dummy (Door Open)



Pre-Test Driver Dummy Abdomen View Close-Up



Post-Test Driver Dummy Abdomen View Close-Up



Pre-Test Driver Dummy Feet



Post-Test Driver Dummy Feet



Pre-Test Driver Dummy Foot/Leg Close-Up



Post-Test Driver Dummy Foot/Leg Close-Up



Pre-Test Driver Side Knee Bolster



Post-Test Driver Side Knee Bolster



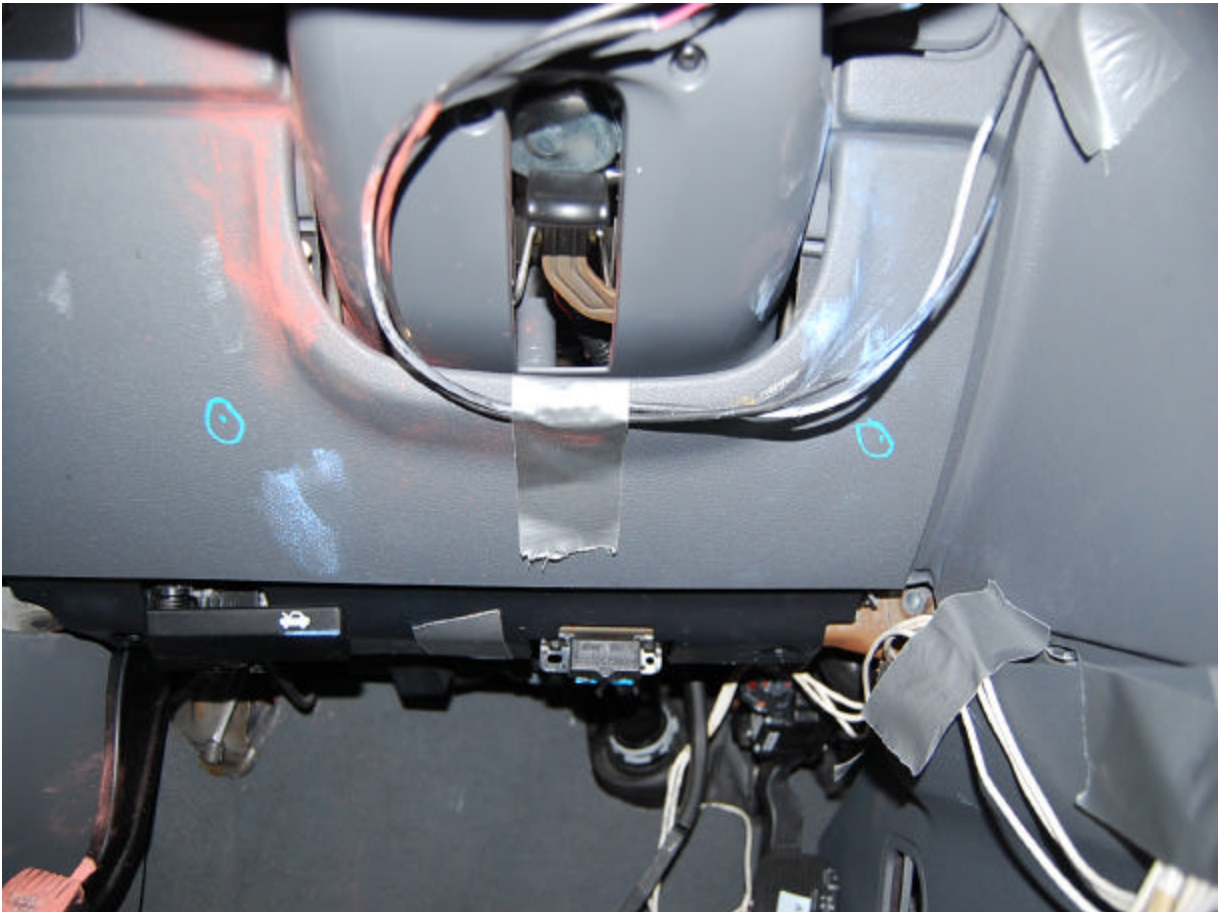
Pre-Test Driver Side Floor Pan



Post-Test Driver Side Floor Pan



Post-Test Driver Dummy Head Contact (headrest)



Post-Test Driver Dummy Knee Contact View



Pre-Test Left Rear Passenger Dummy (Through Window)



Post-Test Left Rear Passenger Dummy (Through Window)



Pre-Test Left Rear Passenger Dummy (Door Open)



Post-Test Left Rear Passenger Dummy (Door Open)



Pre-Test Left Rear Passenger Dummy Leg Position View



Post-Test Left Rear Passenger Dummy Leg Position View



Pre-Test Left Rear Passenger Dummy Feet Position View



Post-Test Left Rear Passenger Dummy Feet Position View



Post-Test Left Rear Passenger Dummy Right Side View



Post-Test Left Rear Passenger Dummy Head Contact View



Post-Test Left Rear Passenger Dummy Foot Contact View



Pre-Test Offset Deformable Barrier Front View



Post-Test Offset Deformable Barrier Front View



Pre-Test Offset Deformable Barrier Left Side View



Post-Test Offset Deformable Barrier Left Side View



Pre-Test Offset Deformable Barrier Left Side  $\frac{3}{4}$  View



Post-Test Offset Deformable Barrier Left Side  $\frac{3}{4}$  View



Pre-Test Offset Deformable Barrier Right Side View



Post-Test Offset Deformable Barrier Right Side View



Pre-Test Offset Deformable Barrier Right Side  $\frac{3}{4}$  View



Post-Test Offset Deformable Barrier Right Side  $\frac{3}{4}$  View



Pre-Test Offset Deformable Barrier Overhead View



Post-Test Offset Deformable Barrier Overhead View



Vehicle Impact



Pre-Test Left Side A Pillar (Frontal View)



Post-Test Left Side A Pillar (Frontal View)



Pre-Test Left Side A Pillar (¾ Frontal View)



Post-Test Left Side A Pillar (¾ Frontal View)



Pre-Test Left Side A Pillar (¾ Rear View)



Post-Test Left Side A Pillar (¾ Rear View)



Pre-Test Left Side B Pillar (¾ Front View)



Post-Test Left Side B Pillar (¾ Front View)



Pre-Test Left Side B Pillar (Left Side View)



Post-Test Left Side B Pillar (Left Side View)



Pre-Test Left Side B Pillar (3/4 Rear View)



Post-Test Left Side B Pillar (3/4 Rear View)



Pre-Test Left Side C Pillar (Frontal View)



Post-Test Left Side C Pillar (Frontal View)



Pre-Test Left Side C Pillar (Left Side View)



Post-Test Left Side C Pillar (Left Side View)



Pre-Test Left Side C Pillar (¾ Rear View)



Post-Test Left Side C Pillar (¾ Rear View)



Pre-Test Left Side Sill Front Half View



Post-Test Left Side Sill Front Half View



Pre-Test Left Side Sill Rear Half View



Post-Test Left Side Sill Rear Half View



Pre-Test Right Side A Pillar (Frontal View)



Post-Test Right Side A Pillar (Frontal View)



Pre-Test Right Side A Pillar (3/4 Front View)



Post-Test Right Side A Pillar (3/4 Front View)



Pre-Test Right Side A Pillar (3/4 Rear View)



Post-Test Right Side A Pillar (3/4 Rear View)



Pre-Test Right Side B Pillar (3/4 Front View)



Post-Test Right Side B Pillar (3/4 Front View)



Pre-Test Right Side B Pillar (Right Side View)



Post-Test Right Side B Pillar (Right Side View)



Pre-Test Right Side B Pillar (¾ Rear View)



Post-Test Right Side B Pillar (¾ Rear View)



Pre-Test Right Side C Pillar (Frontal View)



Post-Test Right Side C Pillar (Frontal View)



Pre-Test Right Side C Pillar (3/4 Front View)



Post-Test Right Side C Pillar (3/4 Front View)



Pre-Test Right Side Sill Front Half View



Post-Test Right Side Sill Front Half View



Pre-Test Right Side Sill Rear Half View



Post-Test Right Side Sill Rear Half View



Pre-Test Left Side Rocker View 1



Post-Test Left Side Rocker View 1



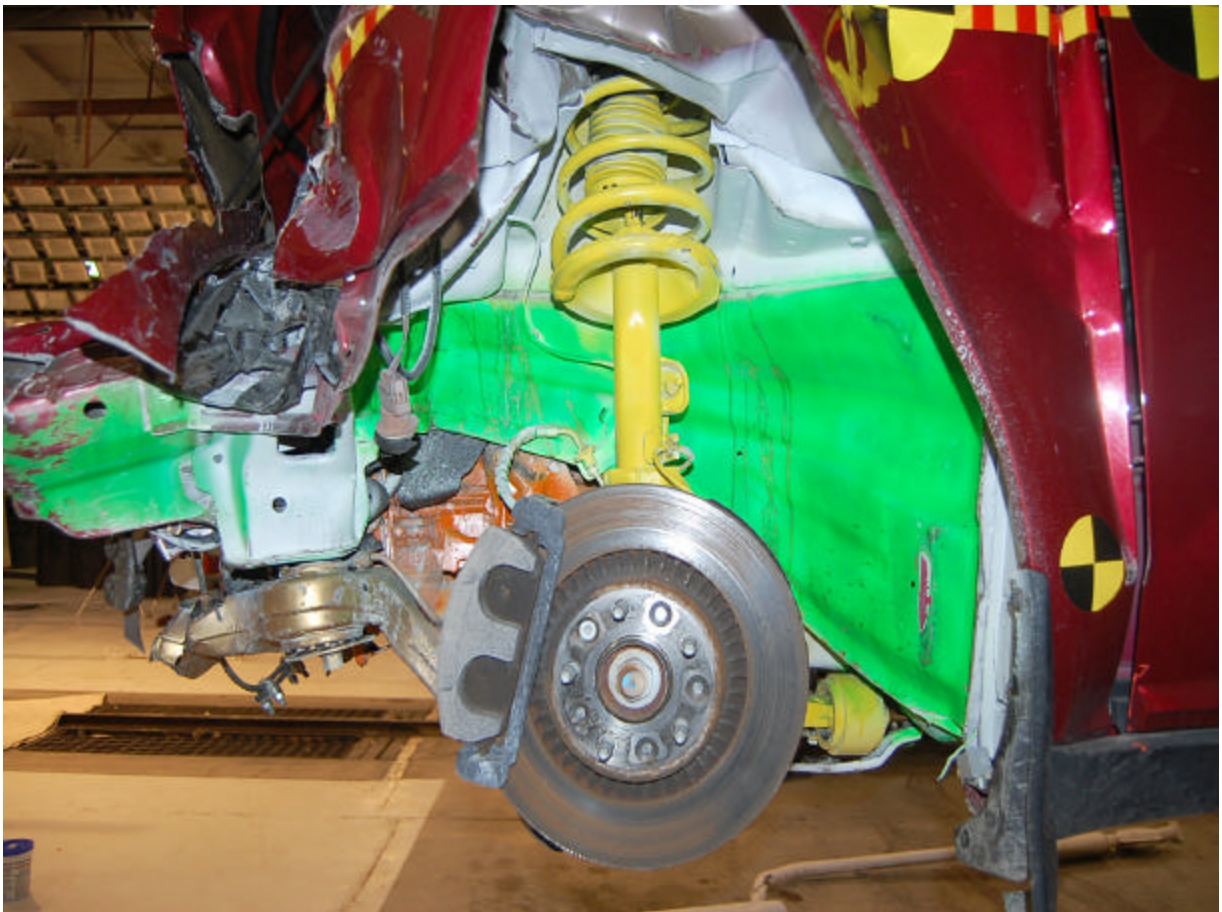
Pre-Test Left Side Rocker View 2



Post-Test Left Side Rocker View 2



Pre-Test Left Front Wheel Well



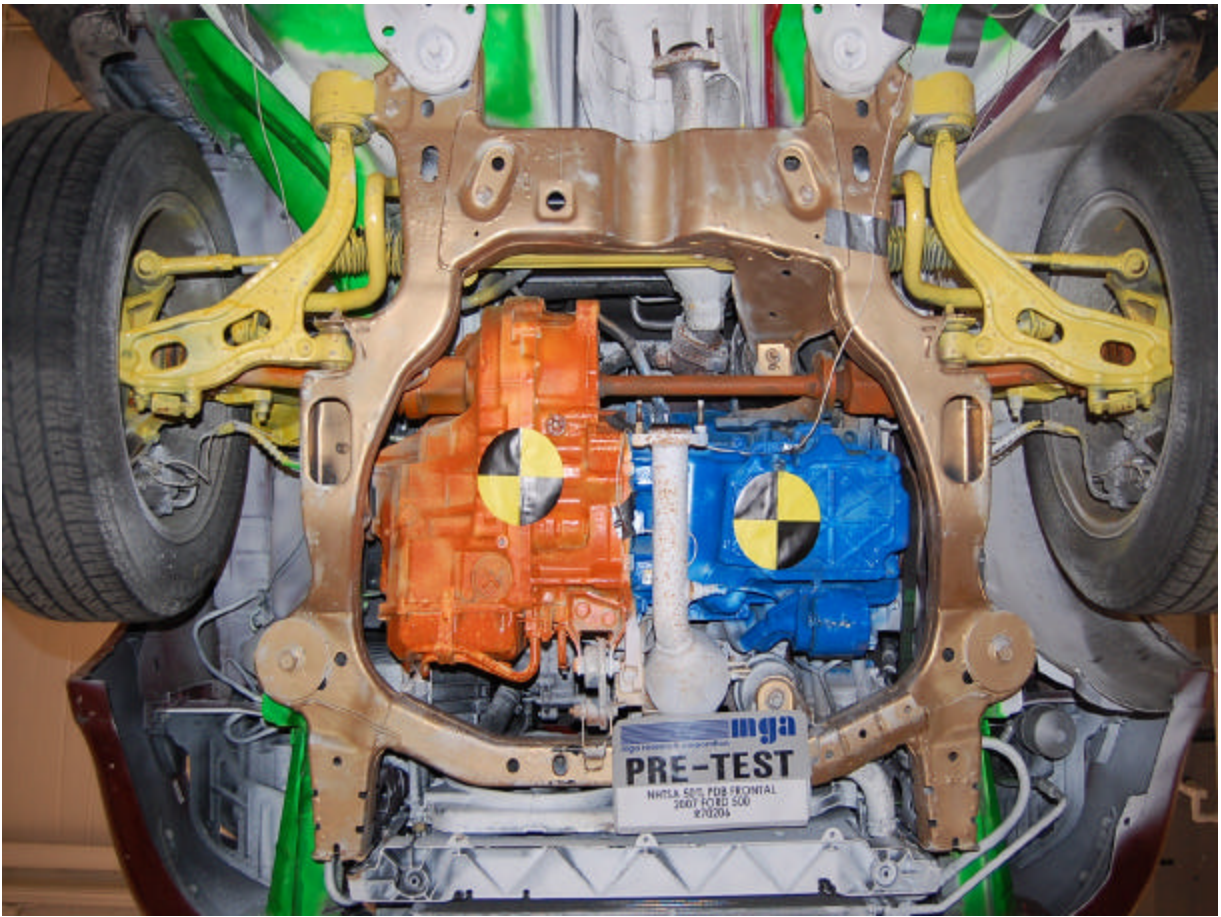
Post-Test Left Front Wheel Well



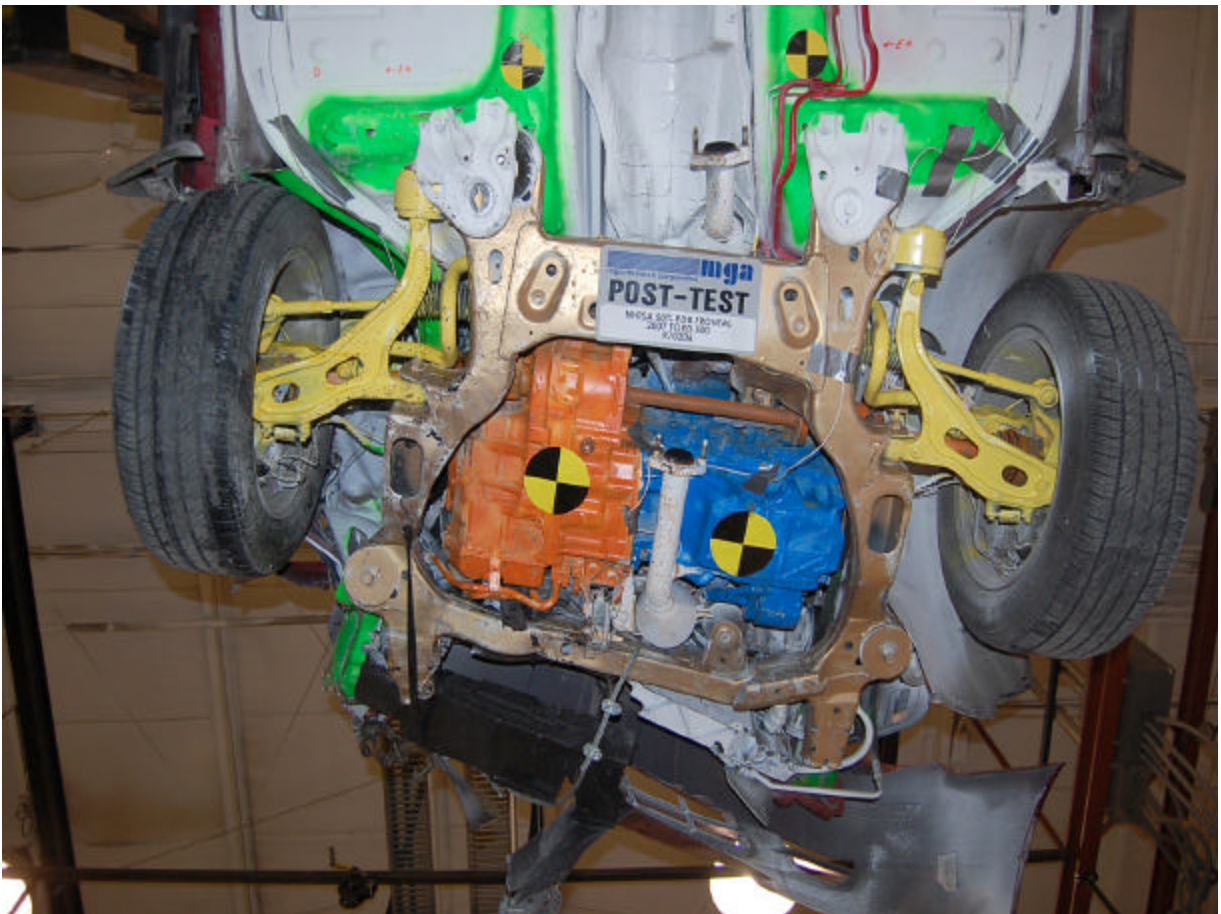
Pre-Test Left Front Shotgun



Post-Test Left Front Shotgun



Pre-Test Steering Rack View



Post-Test Steering Rack View



Pre-Test Steering Rack Left Side View



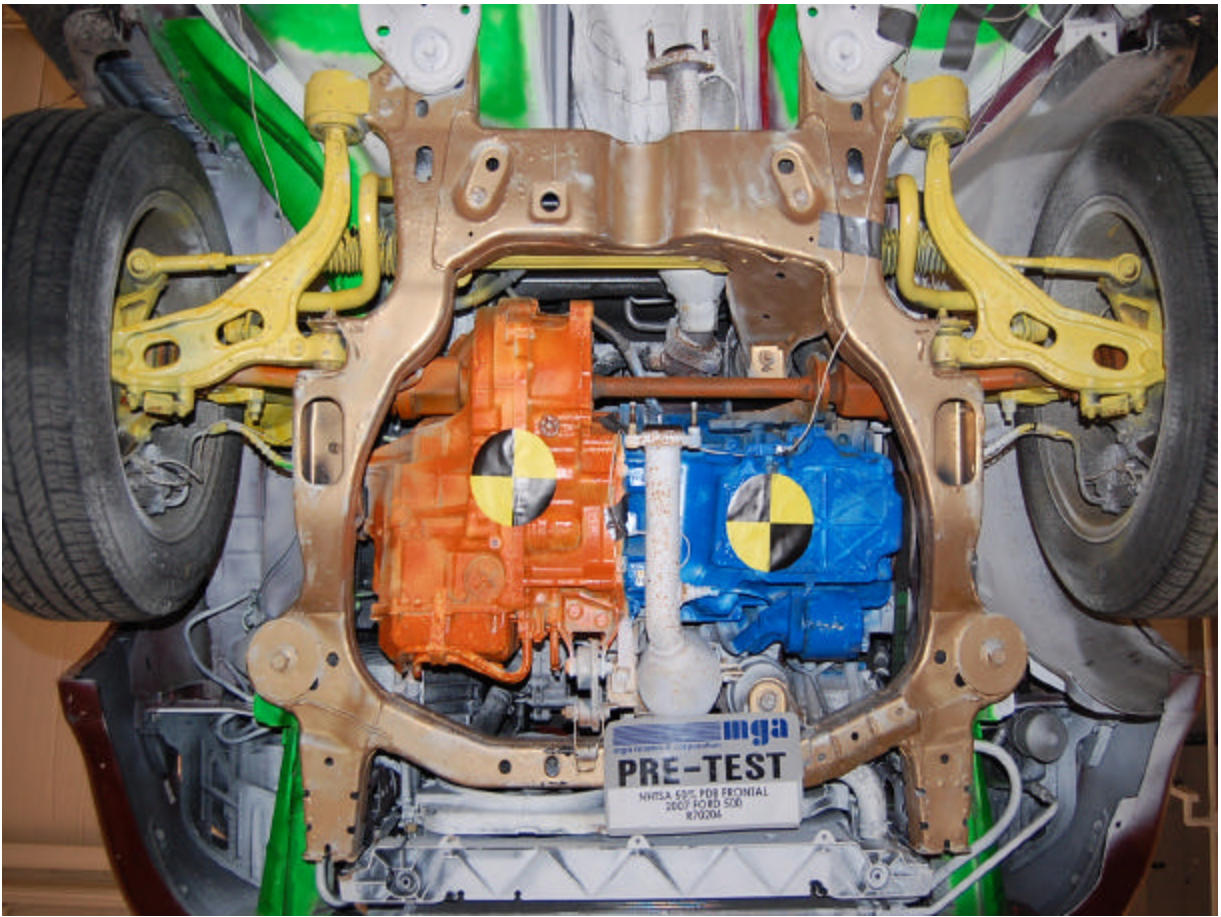
Post-Test Steering Rack Left Side View



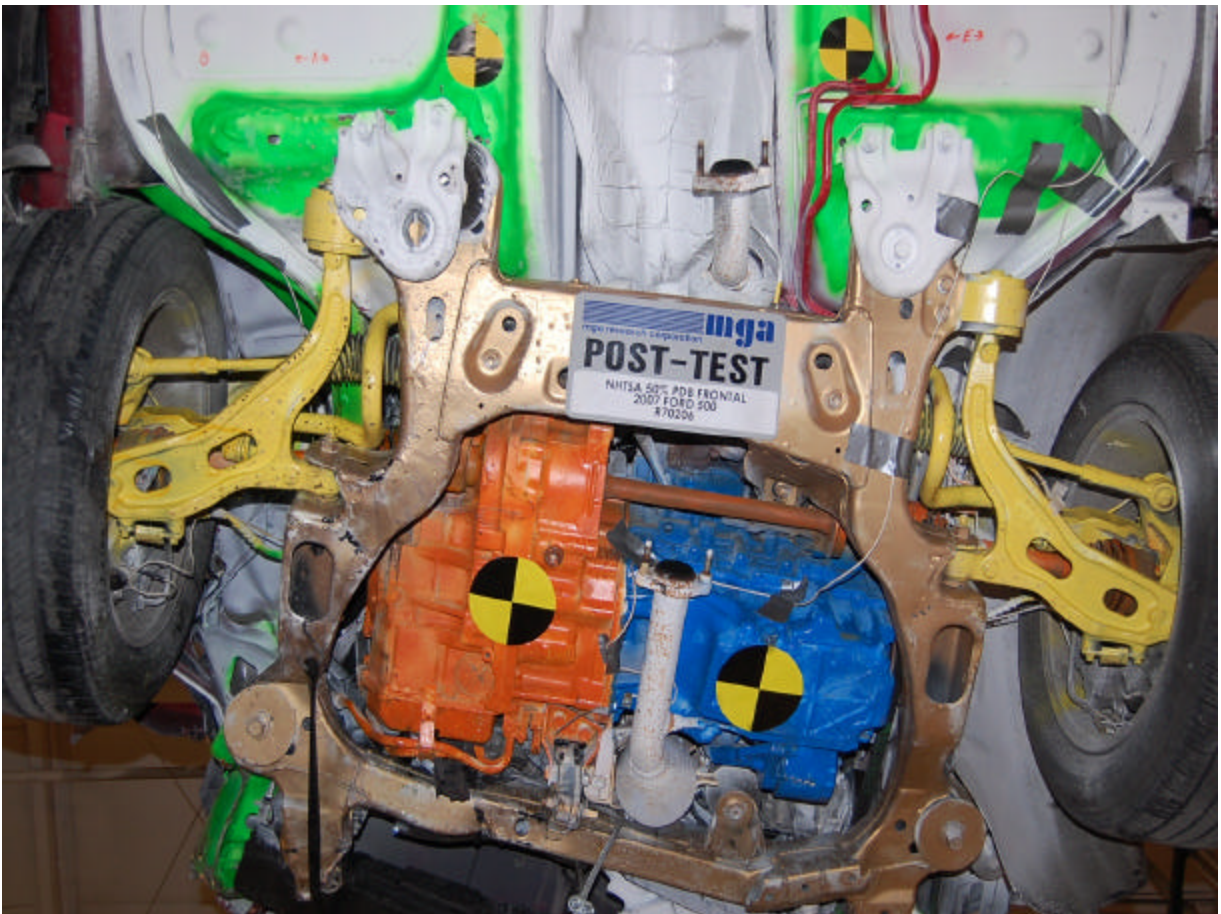
Pre-Test Steering Rack Right Side View



Post-Test Steering Rack Right Side View



Pre-Test Sway Bar View



Post-Test Sway Bar View



Pre-Test Sway Bar Left Side View



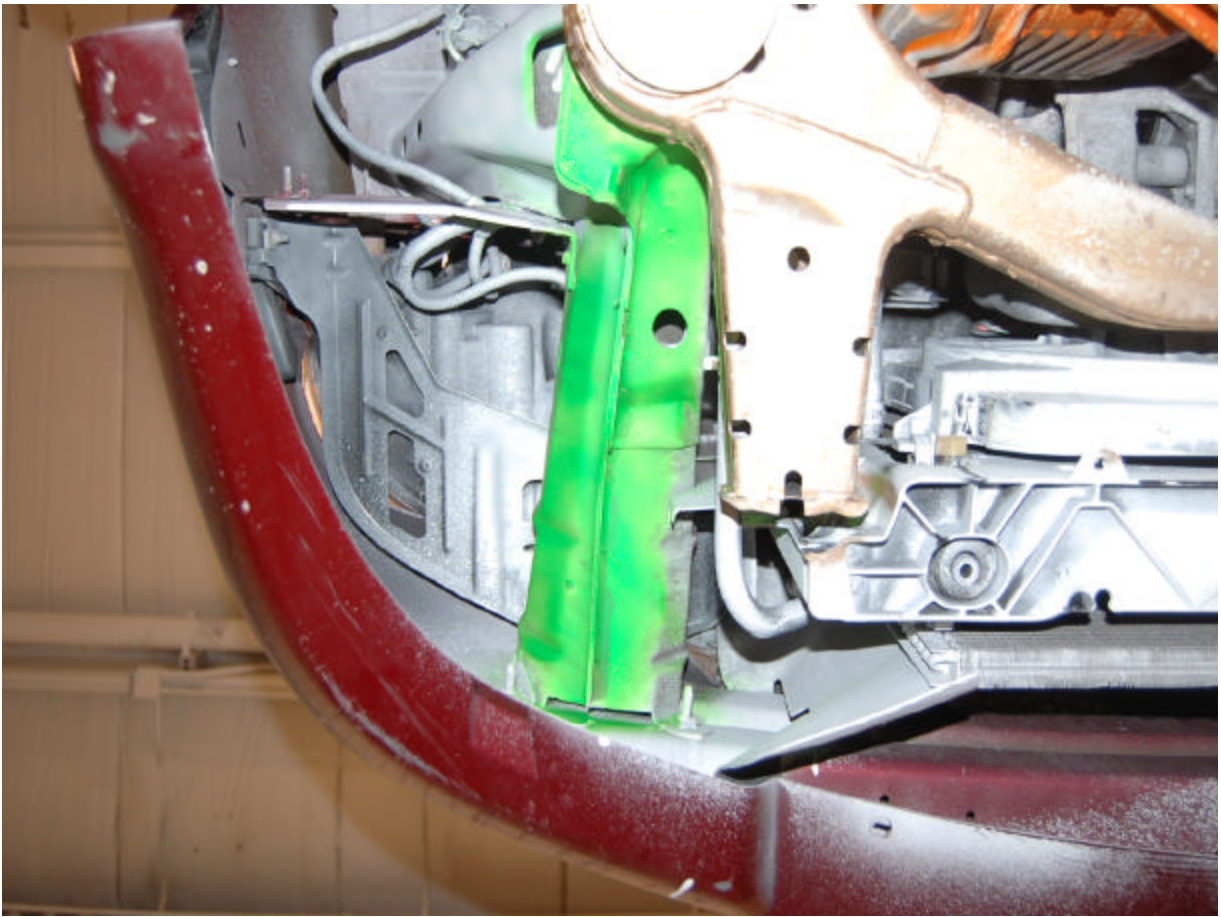
Post-Test Sway Bar Left Side View



Pre-Test Sway Bar Right Side View



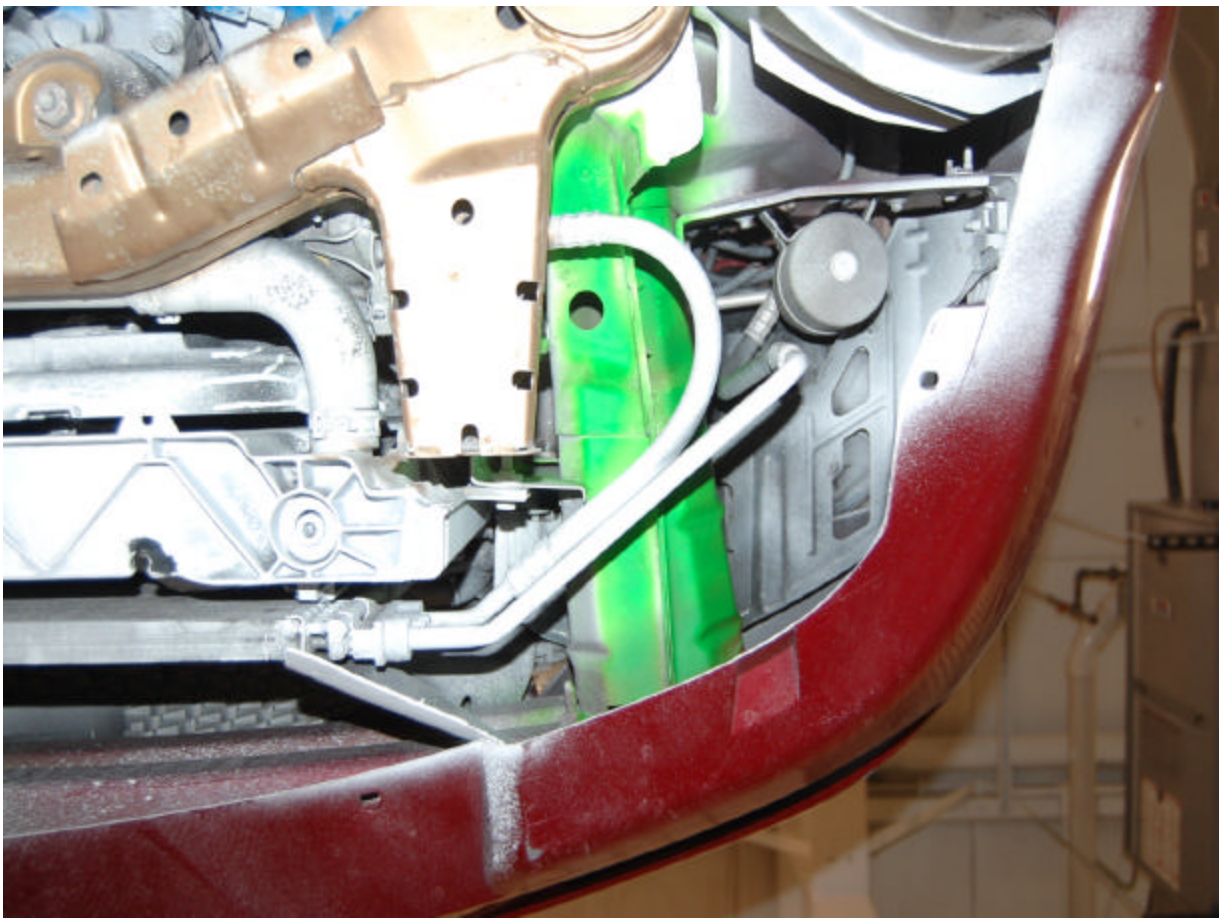
Post-Test Sway Bar Right Side View



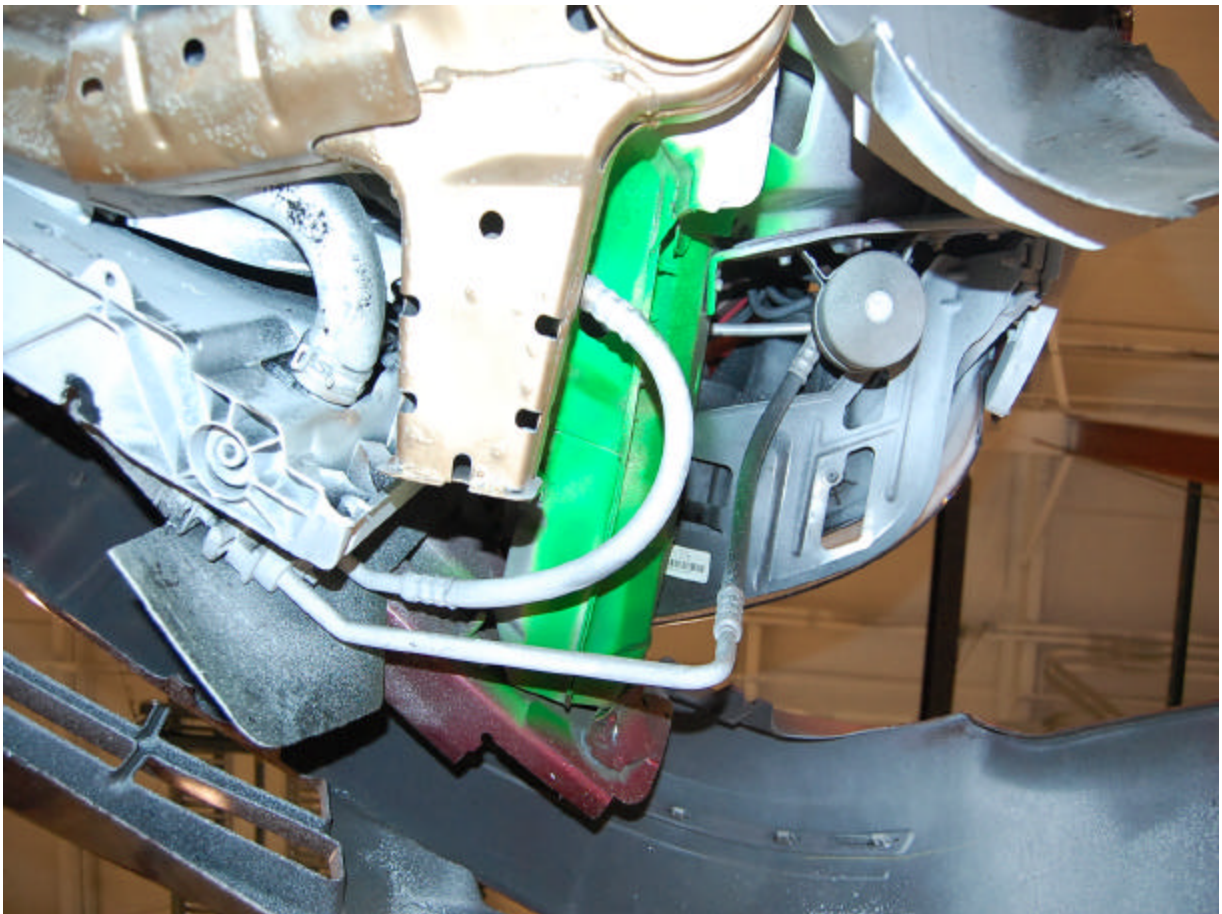
Pre-Test Left Bumper to Rail Attachment View



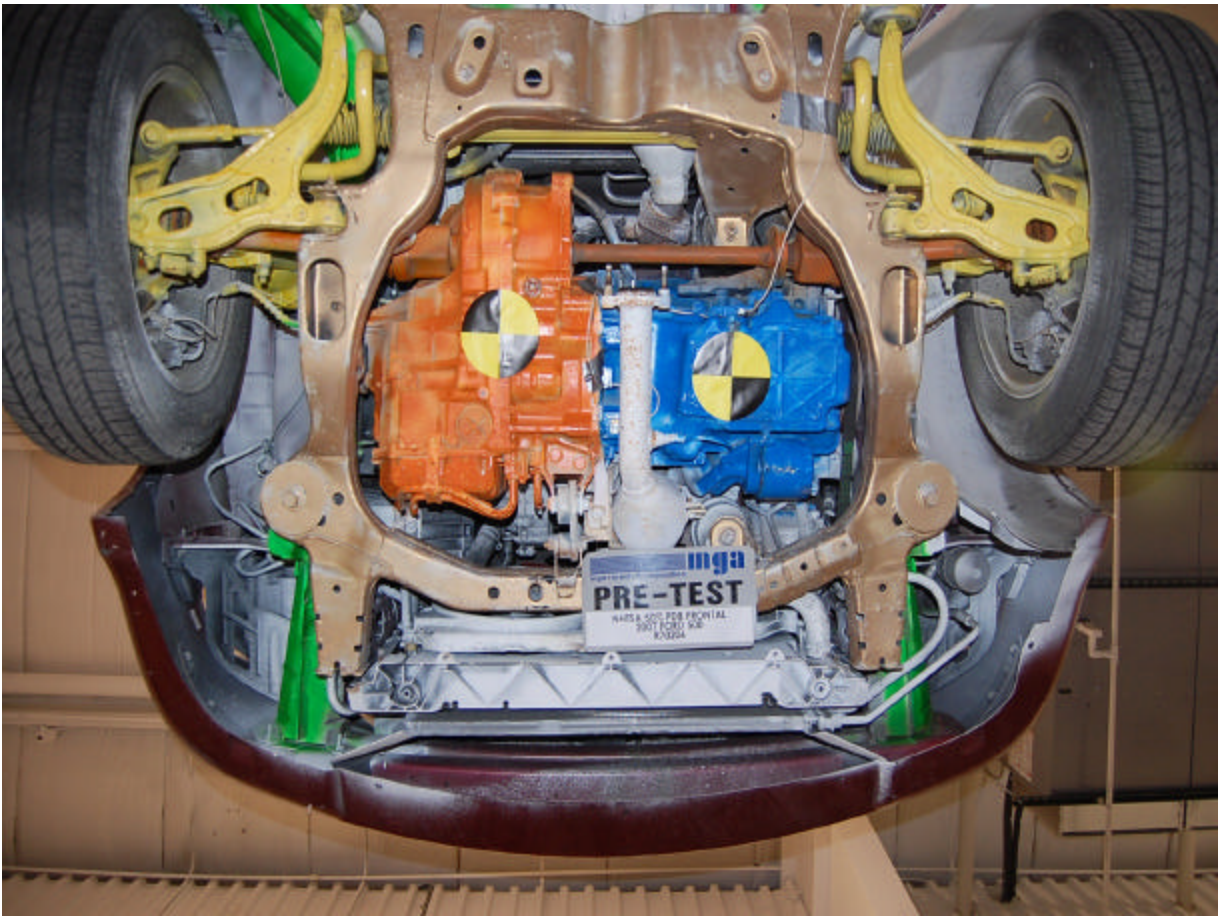
Post-Test Left Bumper to Rail Attachment View



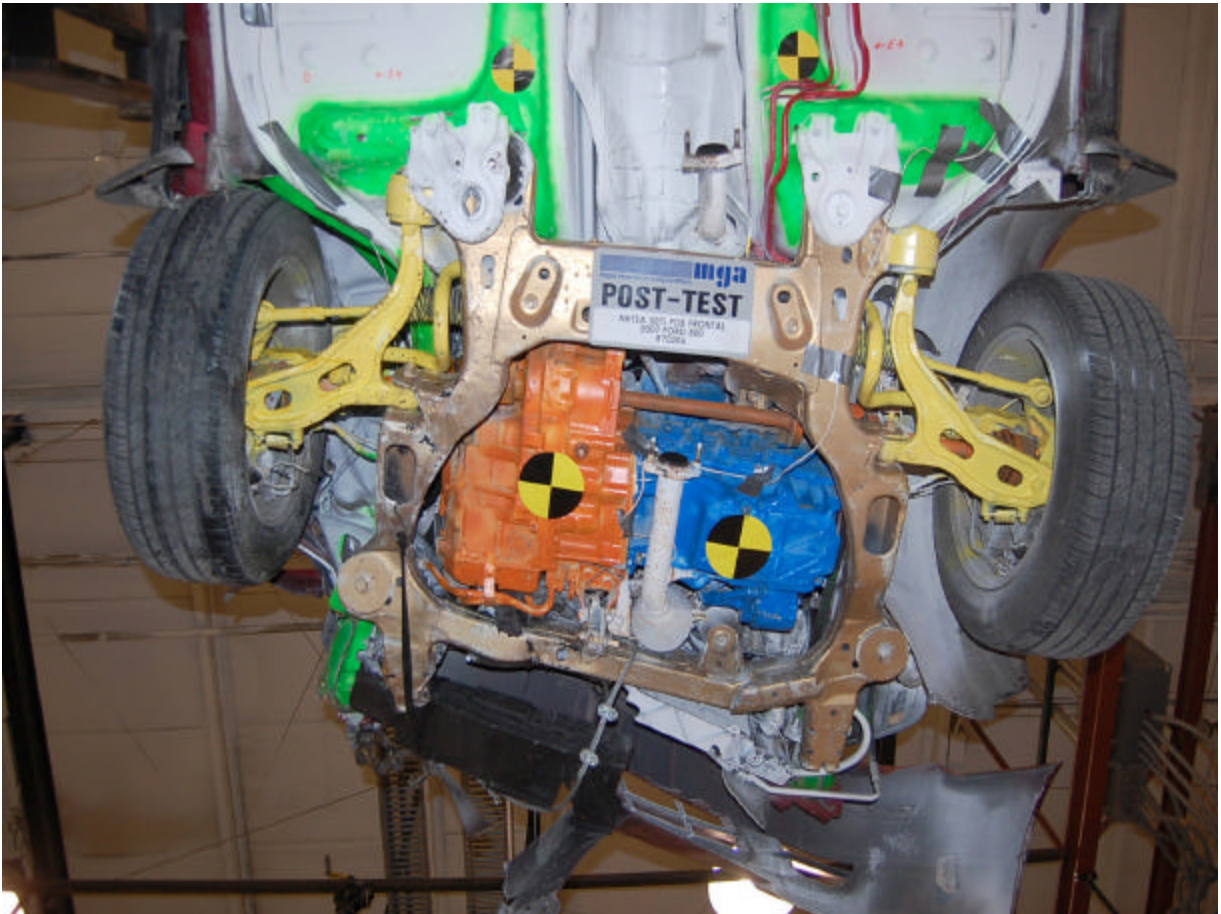
Pre-Test Right Bumper to Rail Attachment View



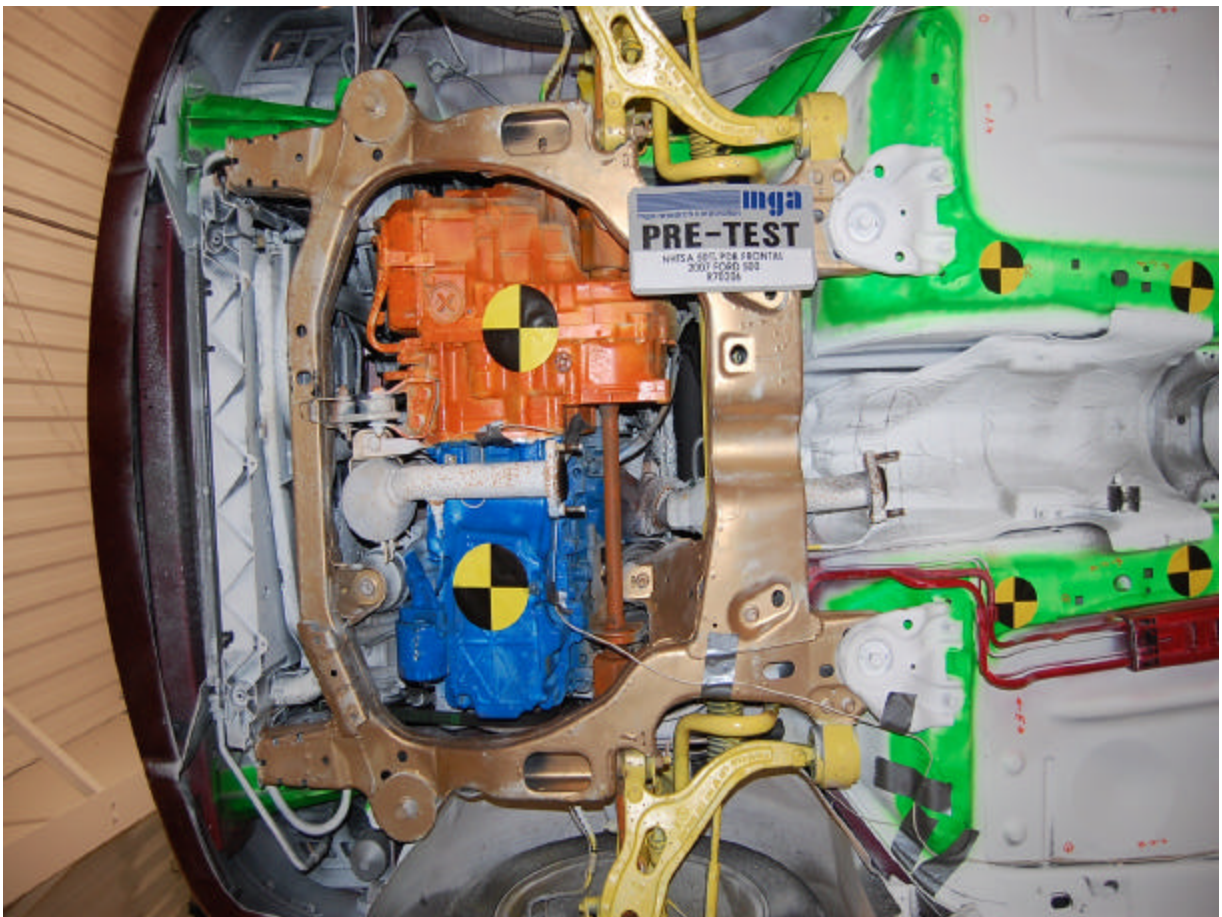
Post-Test Right Bumper to Rail Attachment View



Pre-Test Front Underbody



Post-Test Front Underbody



Pre-Test Front Underbody Perpendicular View



Post-Test Front Underbody Perpendicular View



Pre-Test Left Front Wheel Contact View



Post-Test Left Front Wheel Contact View



Pre-Test Left Front Wheel Contact Close Up View



Post-Test Left Front Wheel Contact Close Up View



Pre-Test Over Toepan/Floorpan Left of Seat, Seat Cushion Height



Post-Test Over Toepan/Floorpan Left of Seat, Seat Cushion Height



Pre-Test Over Toepan/Floorpan Left of Seat, Sill Height



Post-Test Over Toepan/Floorpan Left of Seat, Sill Height



Pre-Test Over Toepan/Floorpan Center of Seat, Seat Cushion Height



Post-Test Over Toepan/Floorpan Center of Seat, Seat Cushion Height



Pre-Test Over Toepan/Floorpan Right of Seat, Seat Cushion Height



Post-Test Over Toepan/Floorpan Right of Seat, Seat Cushion Height



Pre-Test Footrest Seat Cushion Height



Post-Test Footrest Seat Cushion Height



Pre-Test Footrest Seat Sill Height



Post-Test Footrest Seat Sill Height



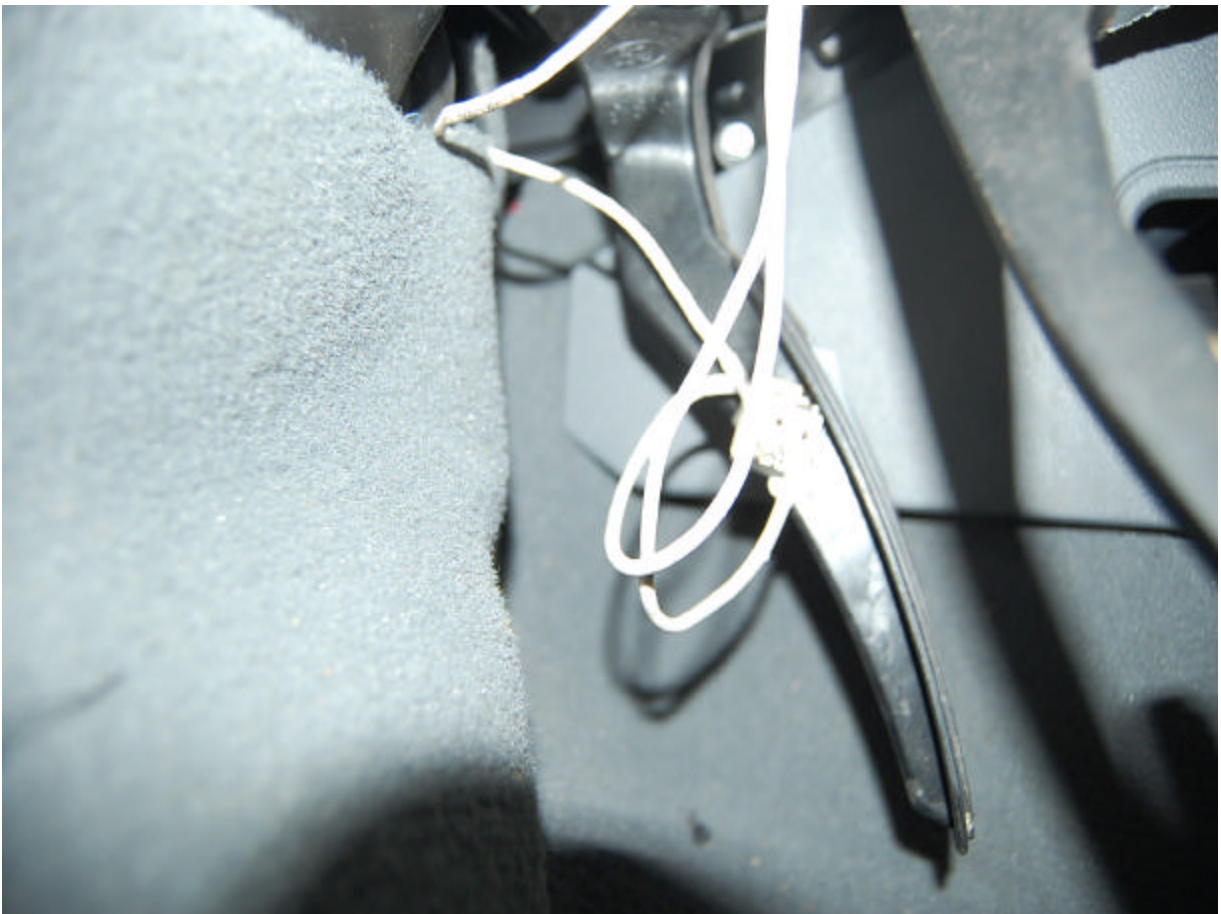
Pre-Test Accelerometer Pedal Close Up



Post-Test Accelerometer Pedal Close Up



Pre-Test Accelerometer Pedal Left Side View



Post-Test Accelerometer Pedal Left Side View



Pre-Test Right Side Floorpan, Right of Seat, Seat Cushion Height



Post-Test Right Side Floorpan, Right of Seat, Seat Cushion Height



Pre-Test Right Side Floorpan, Right of Seat, Sill Cushion Height



Post-Test Right Side Floorpan, Right of Seat, Sill Cushion Height



Pre-Test Right Side Floorpan, Center of Seat, Seat Cushion Height



Post-Test Right Side Floorpan, Center of Seat, Seat Cushion Height



Pre-Test Right Side Floorpan, Left of Seat



Post-Test Right Side Floorpan, Left of Seat



Pre-Test Front View of CRS



Post-Test Front View of CRS



Pre-Test Rear View of CRS



Post-Test Rear View of CRS



Pre-Test Left Side View of CRS



Post-Test Left Side View of CRS



Pre-Test Right Side View of CRS



Post-Test Right Side View of CRS

## **APPENDIX B**

### **DUMMY, VEHICLE AND BARRIER DATA PLOTS**

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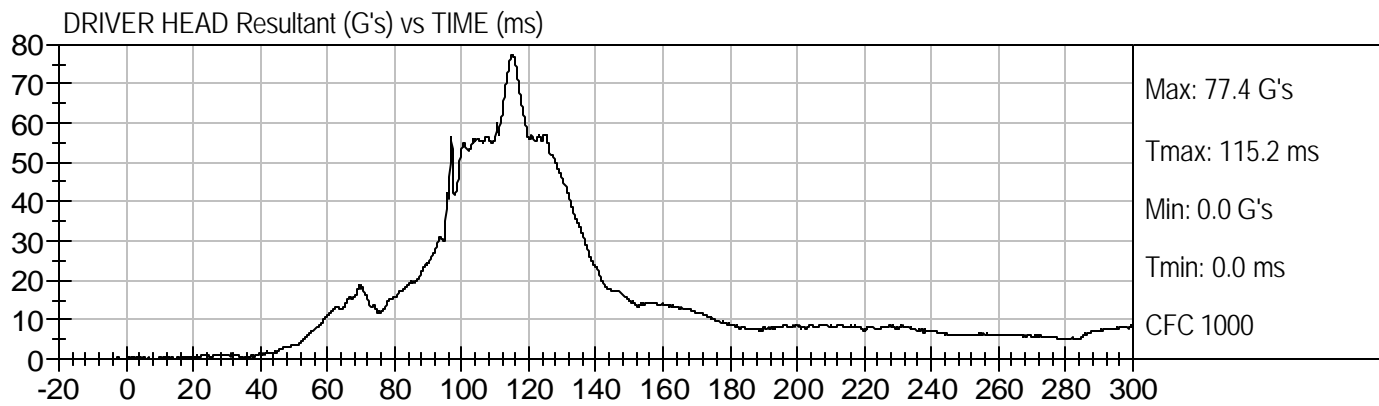
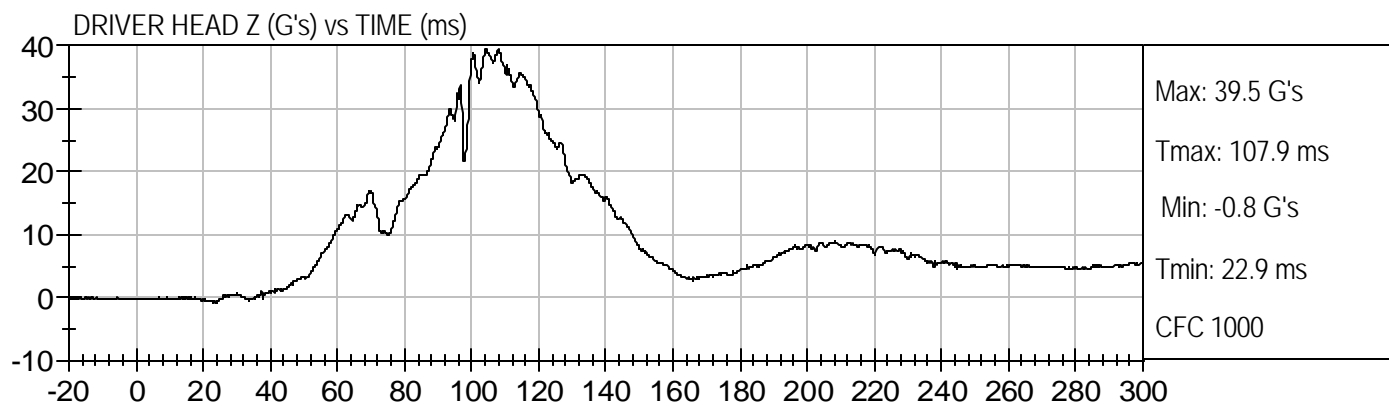
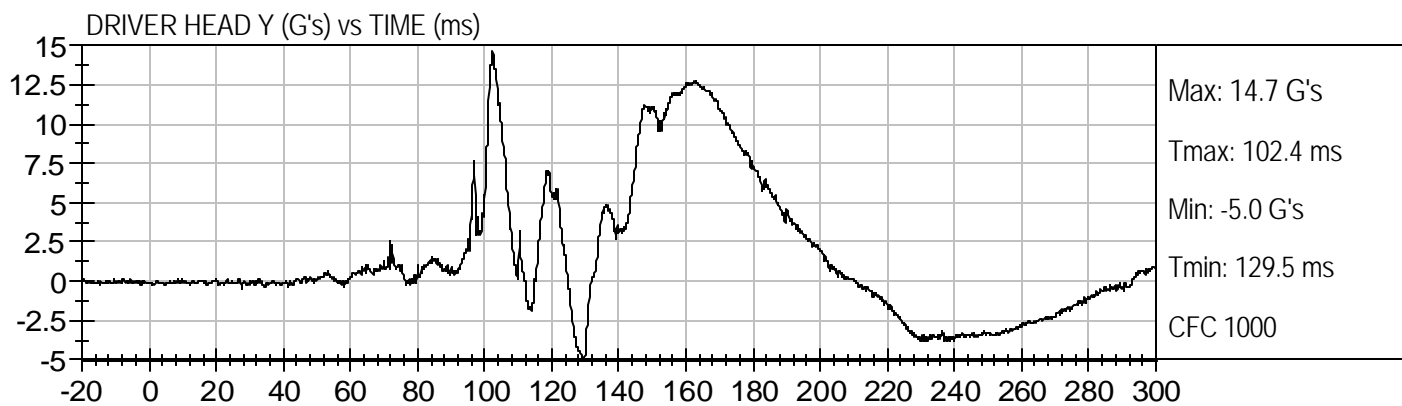
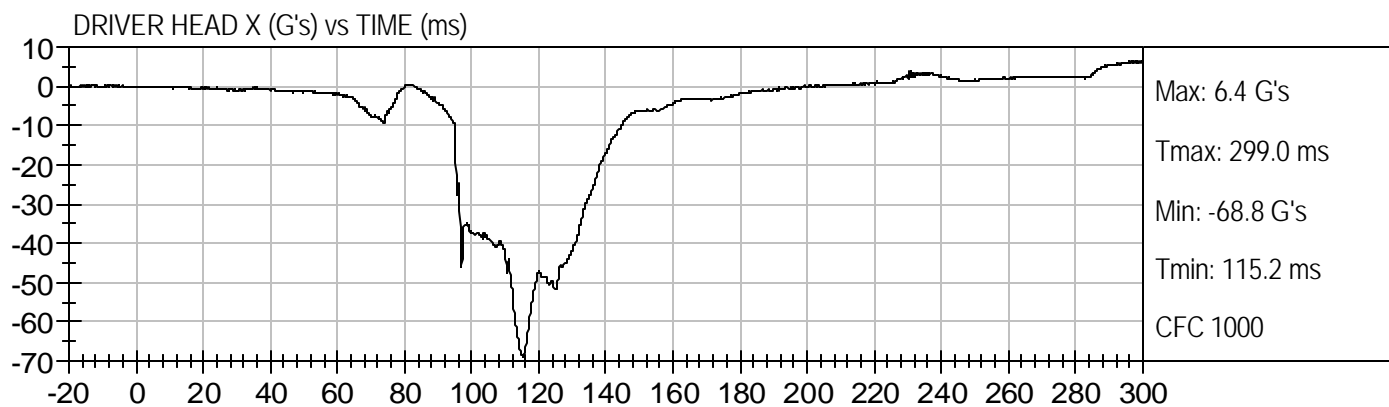
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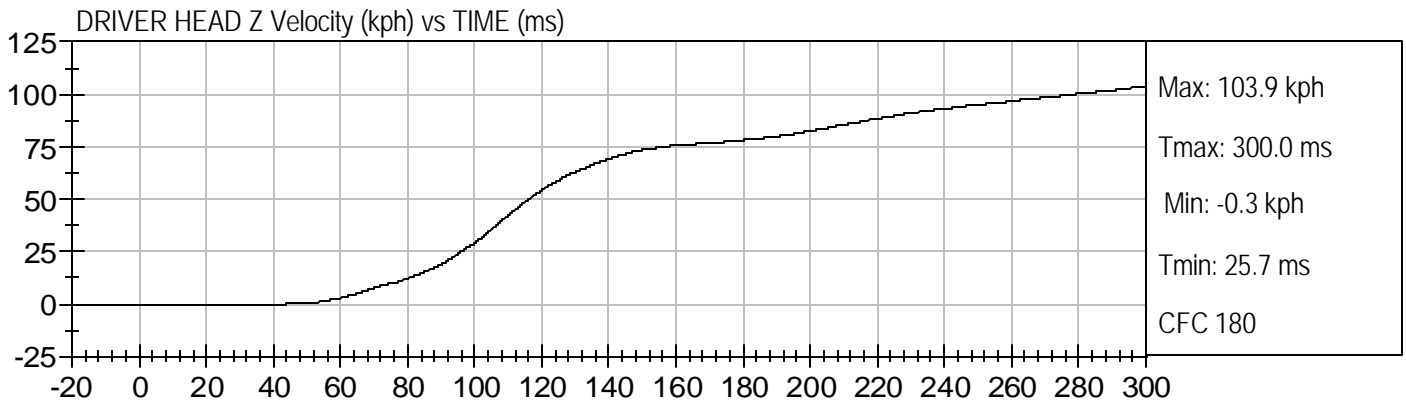
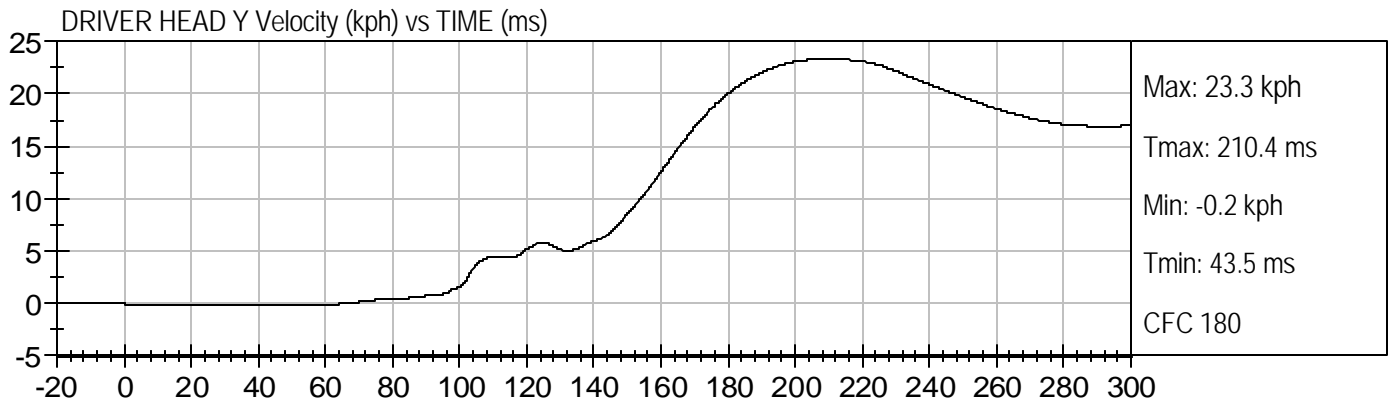
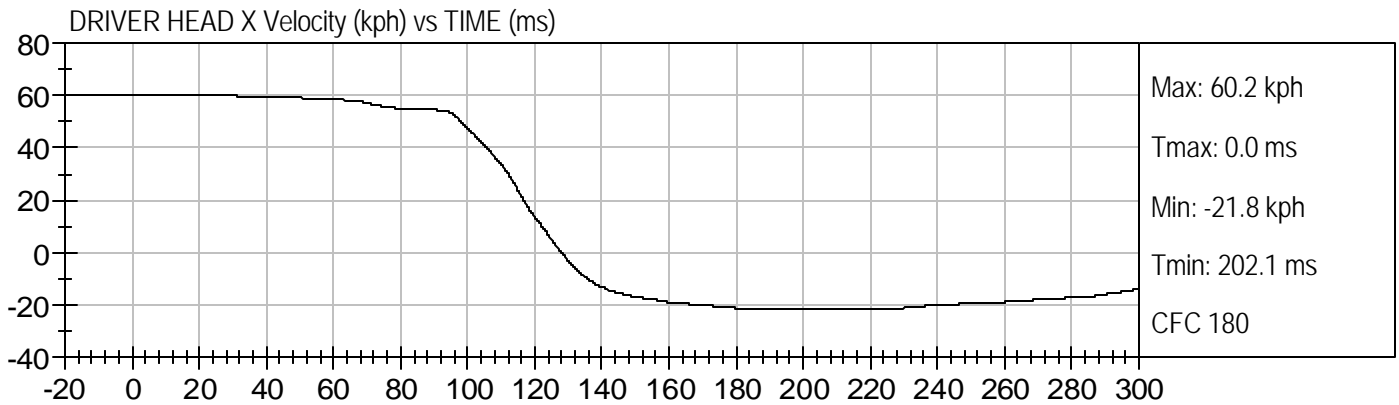
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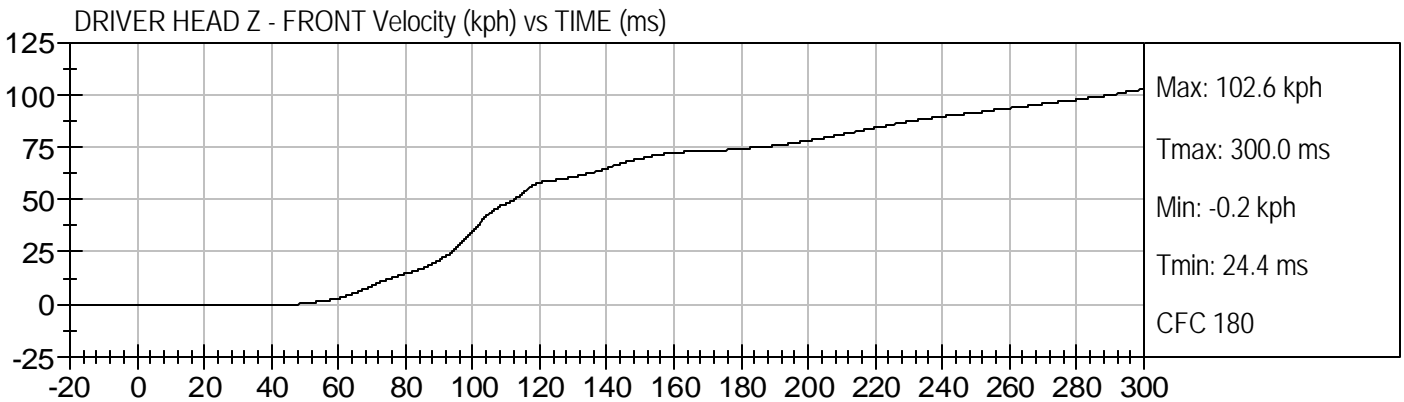
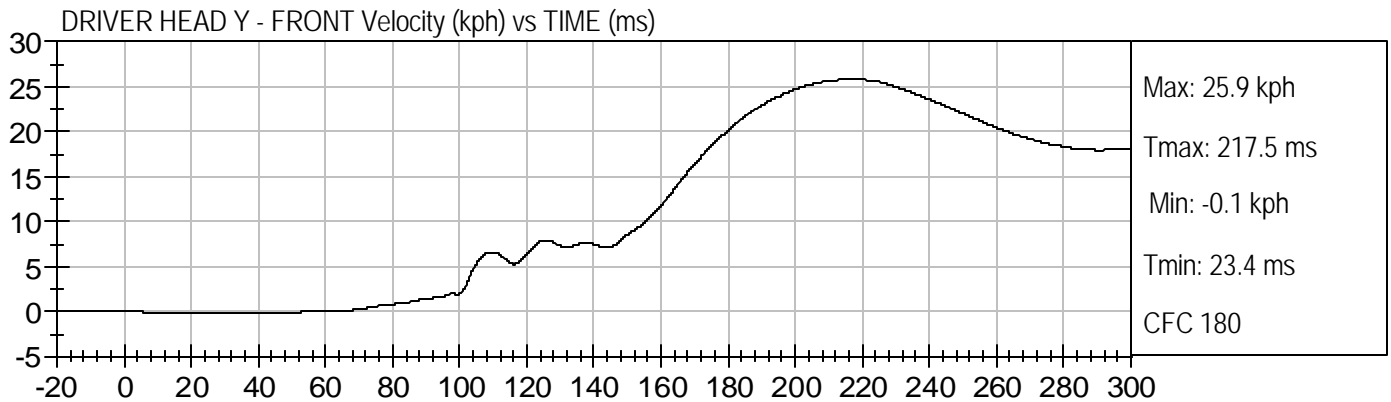
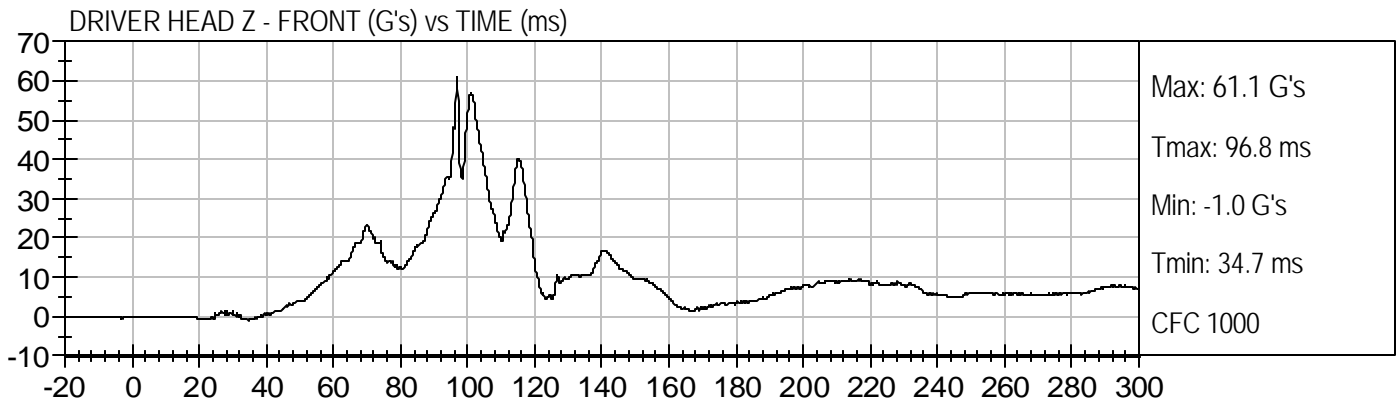
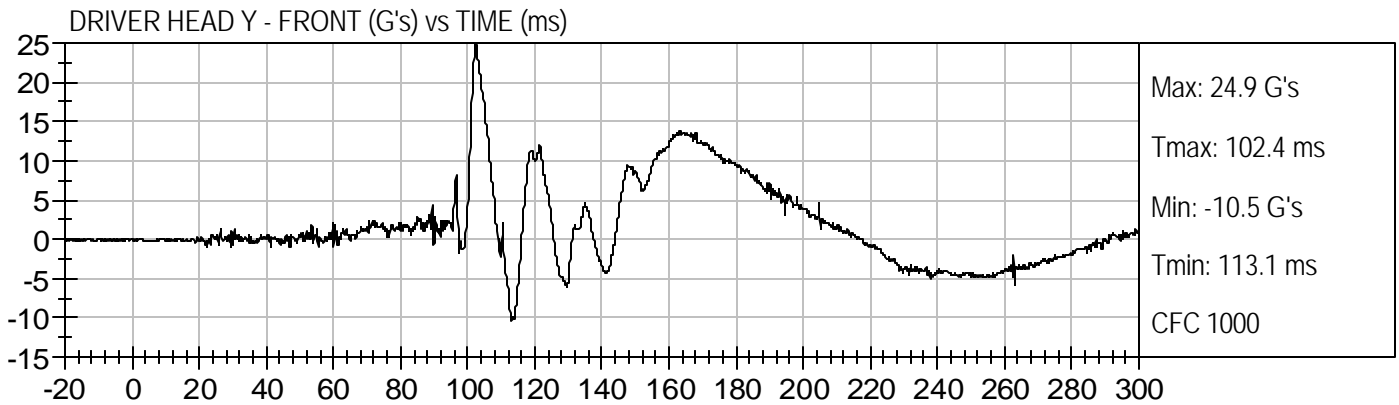
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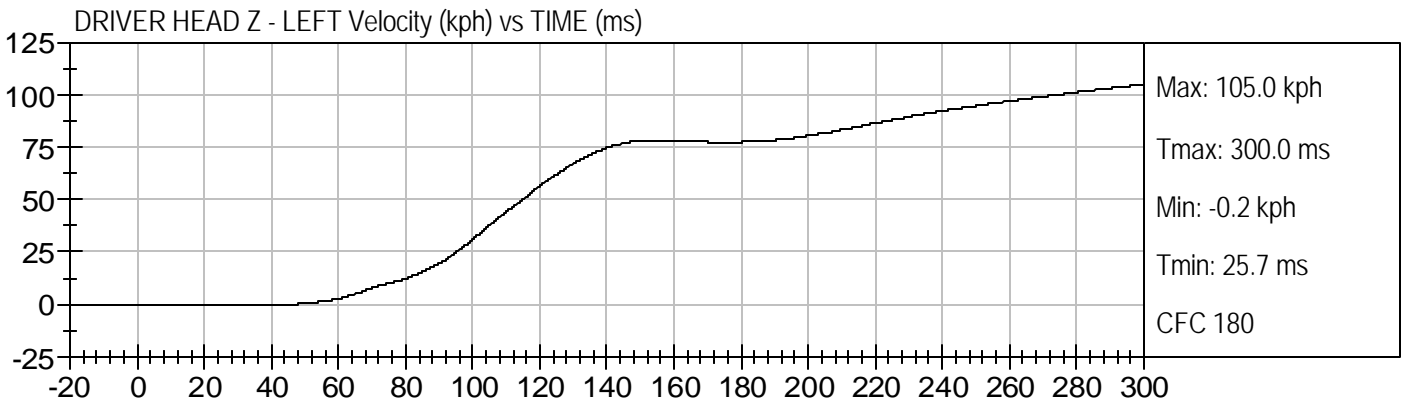
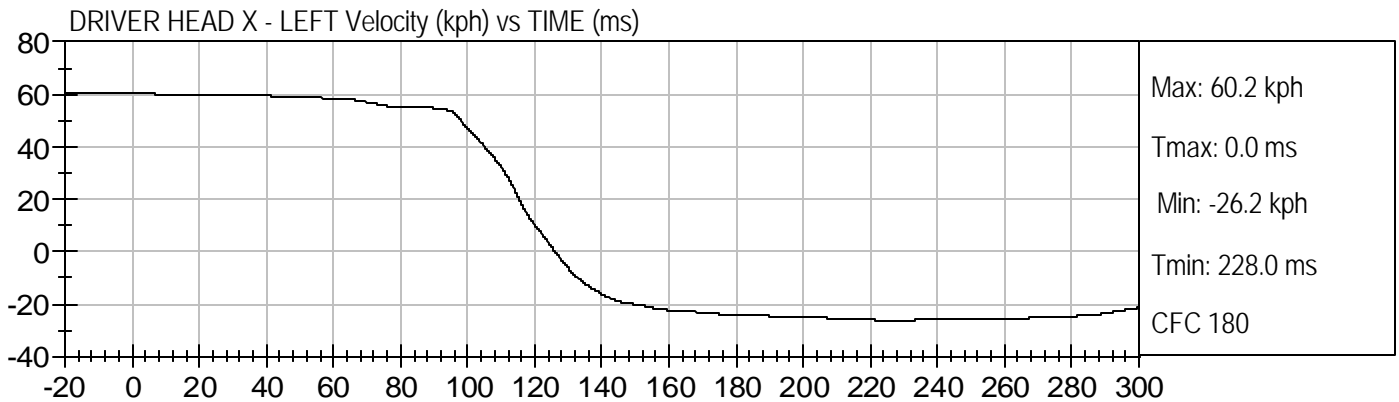
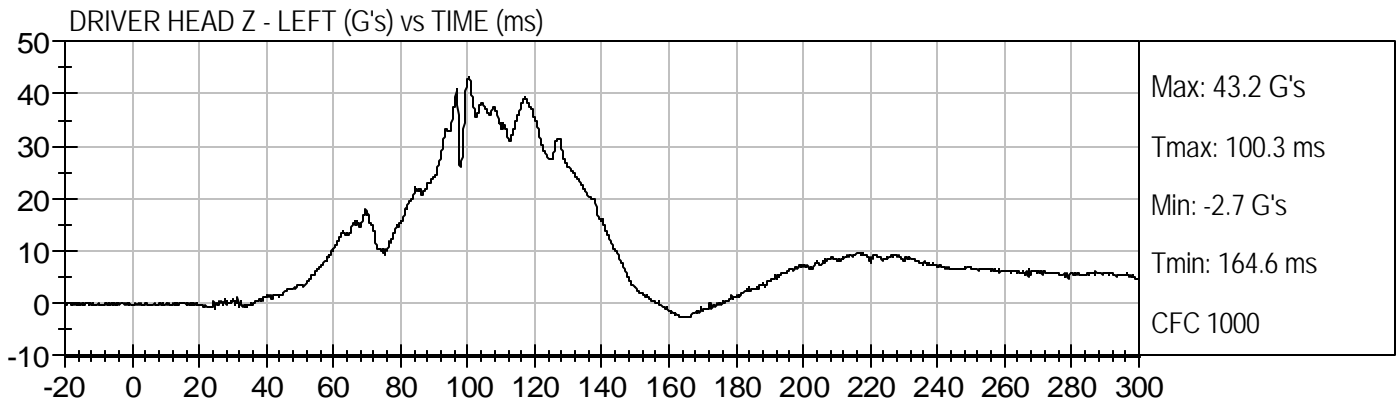
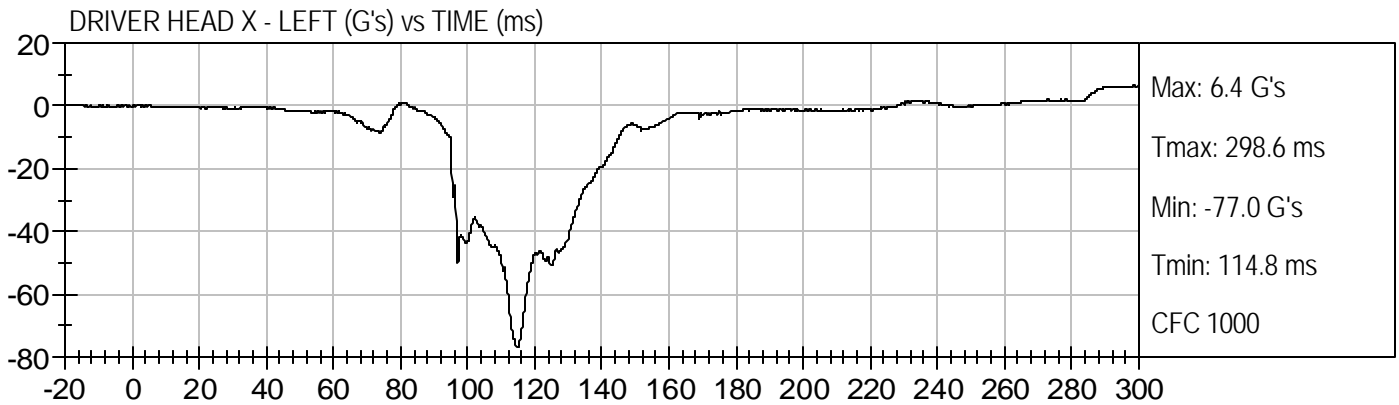
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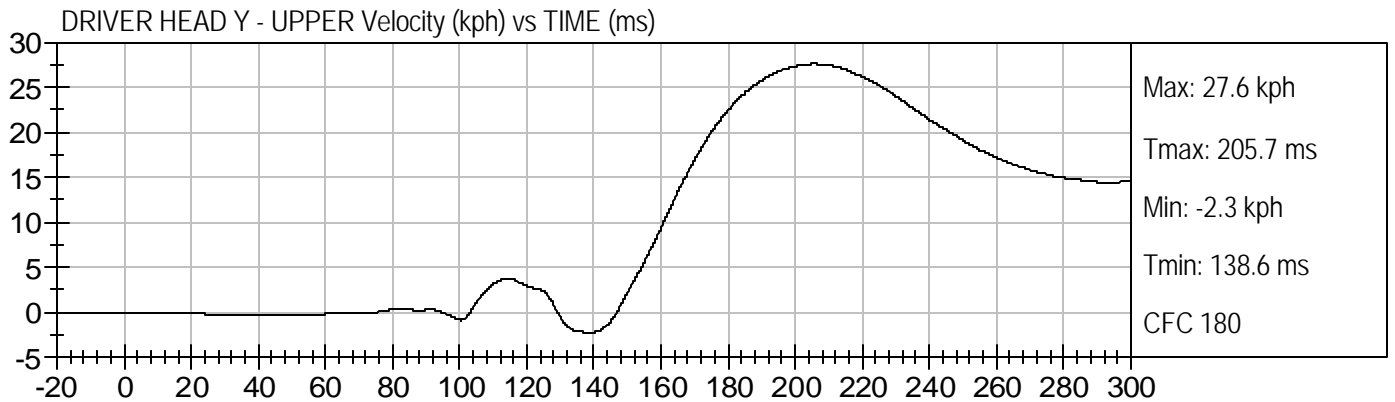
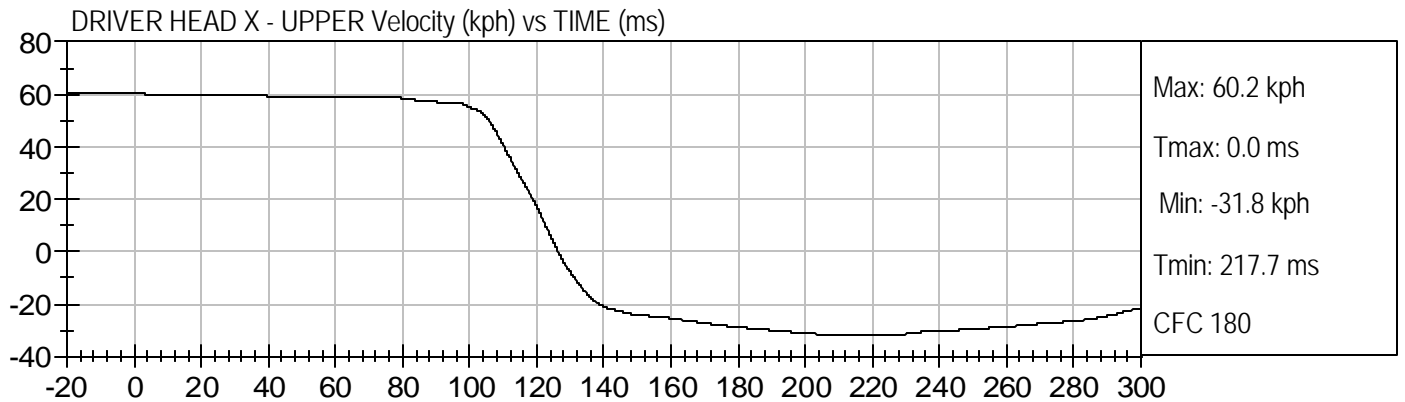
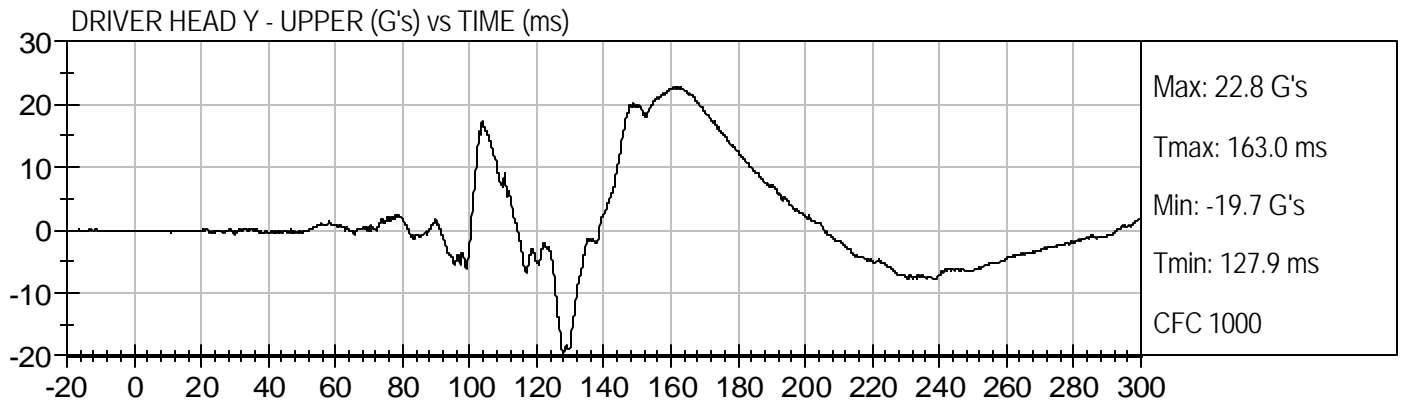
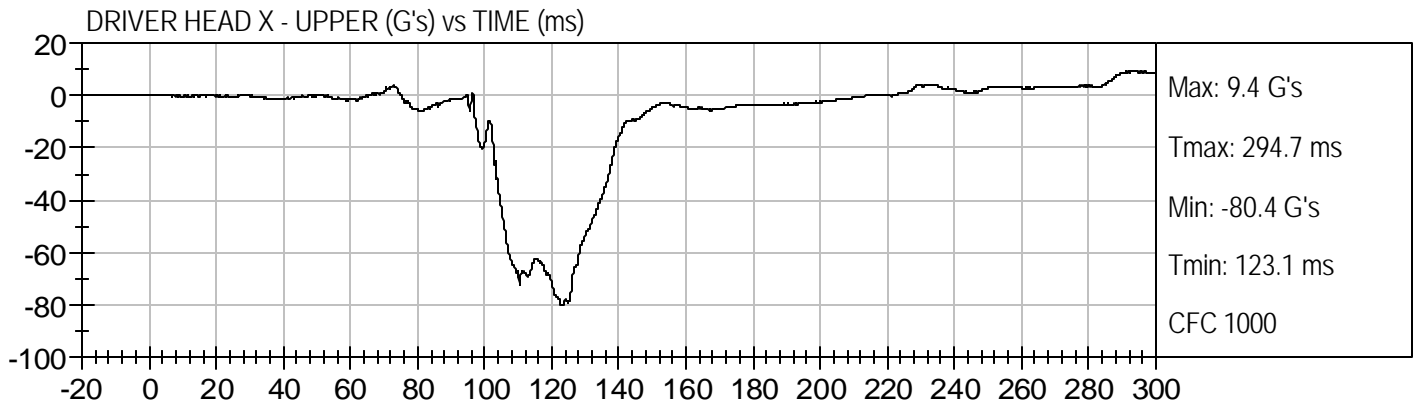
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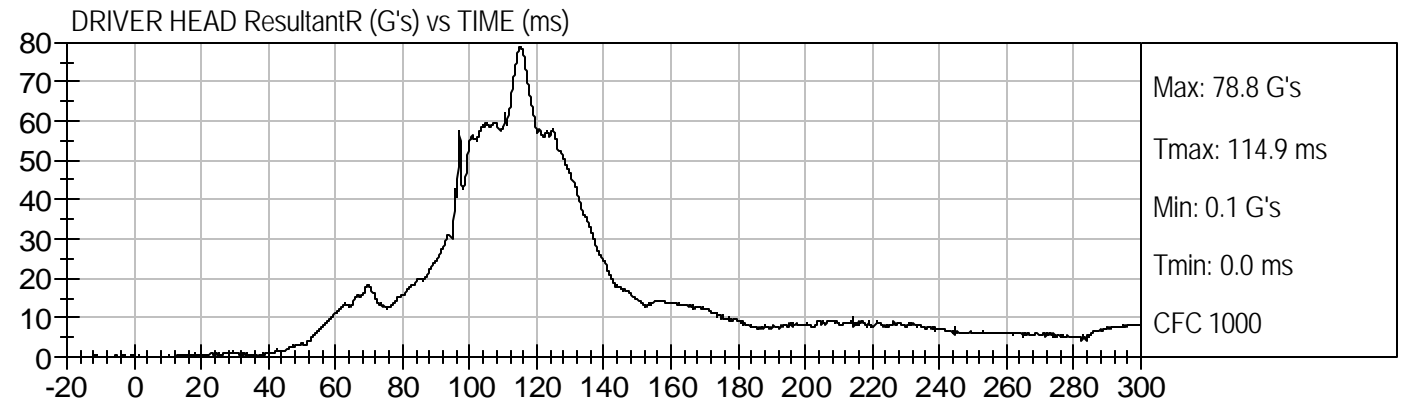
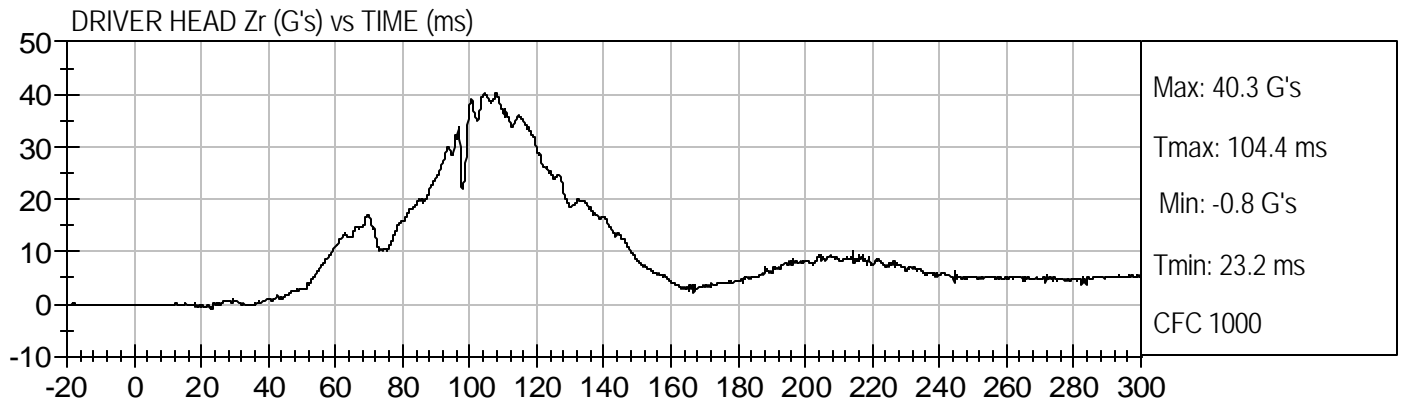
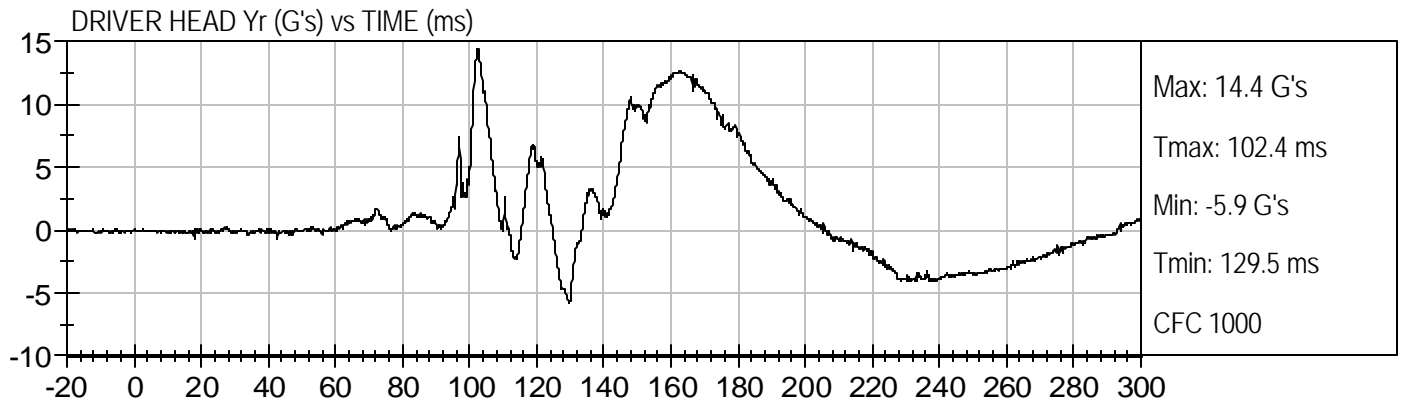
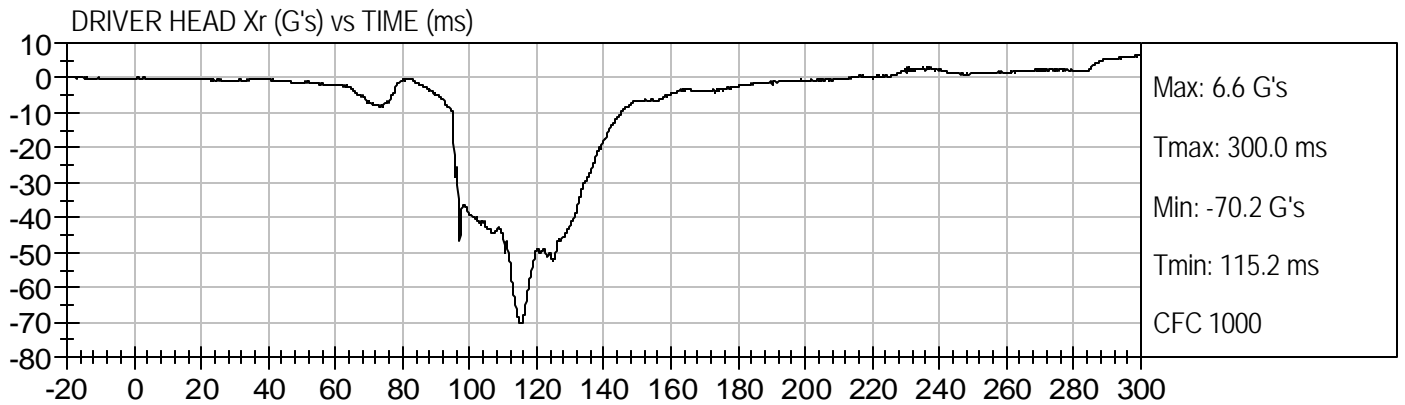


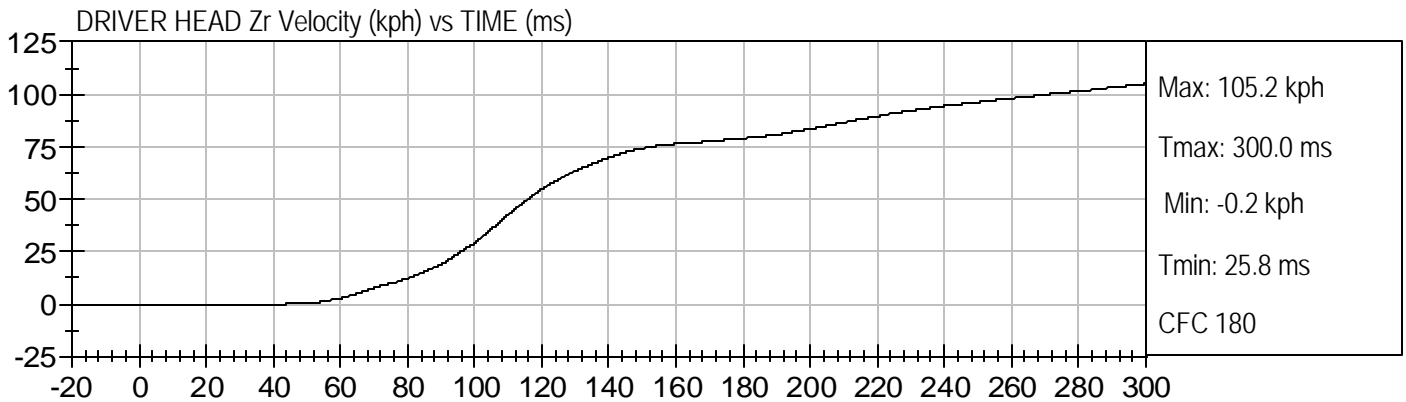
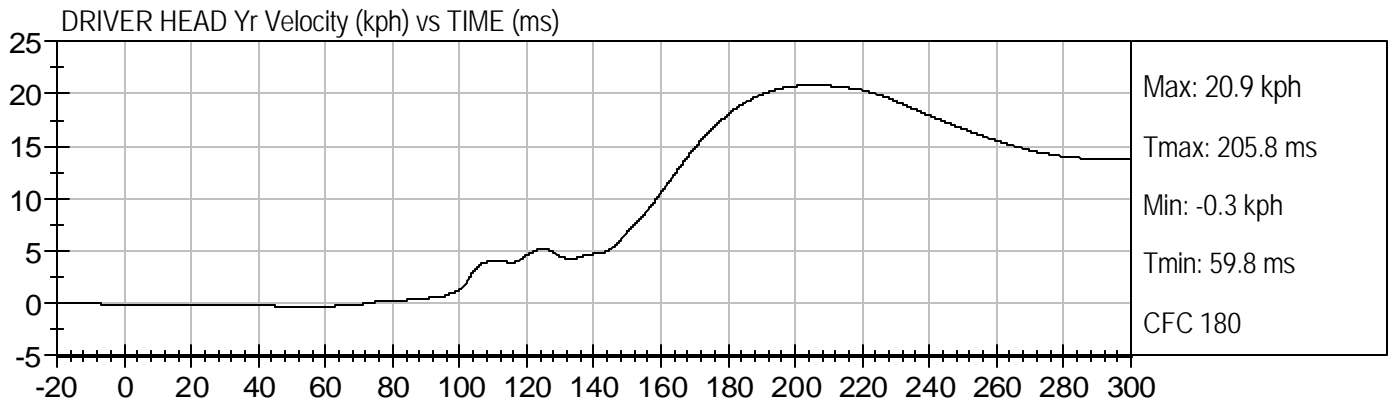
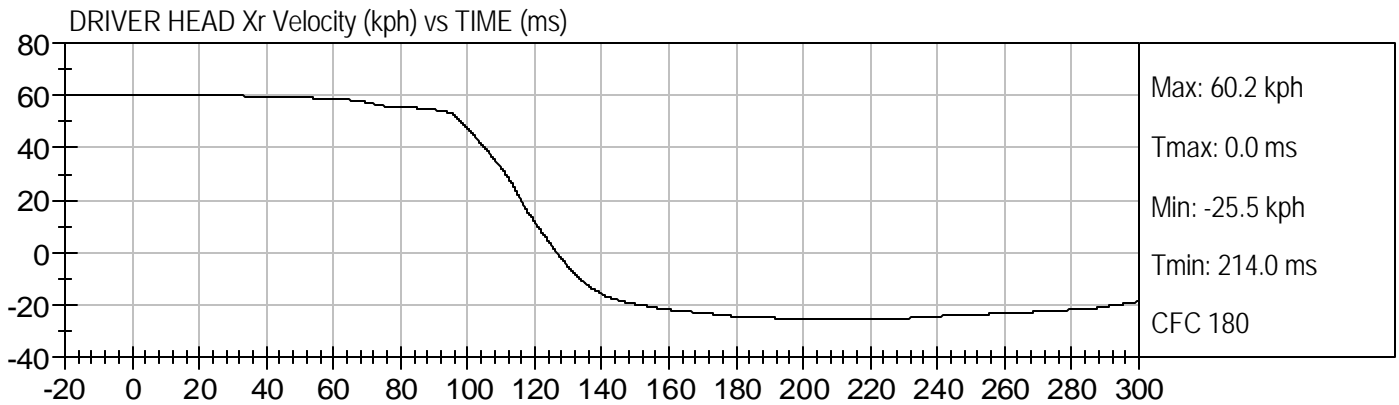


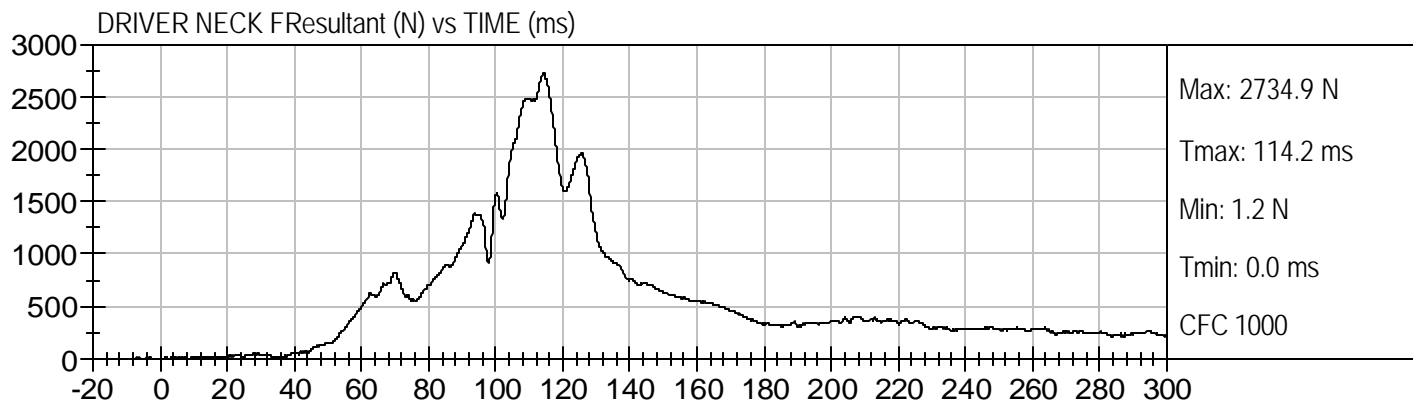
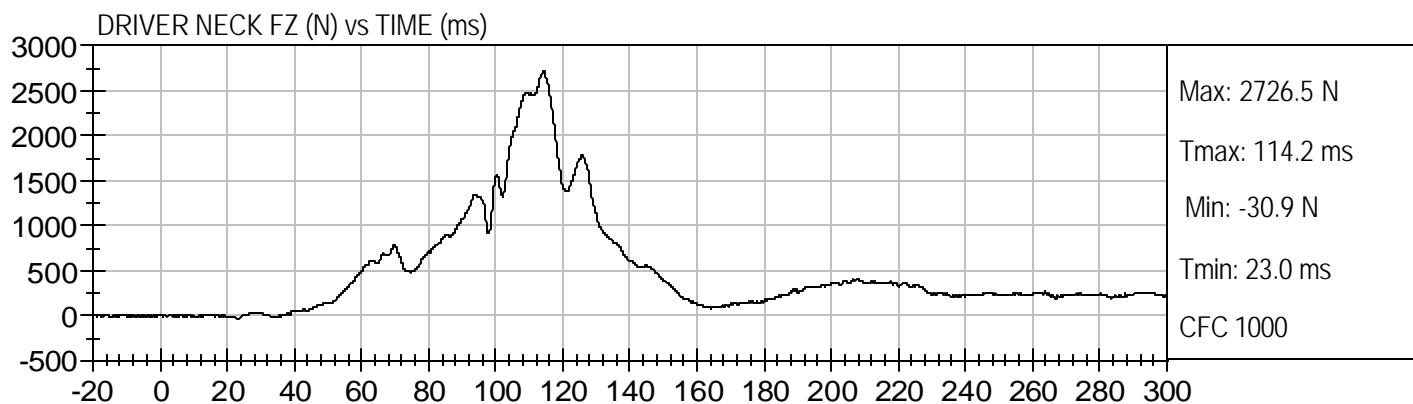
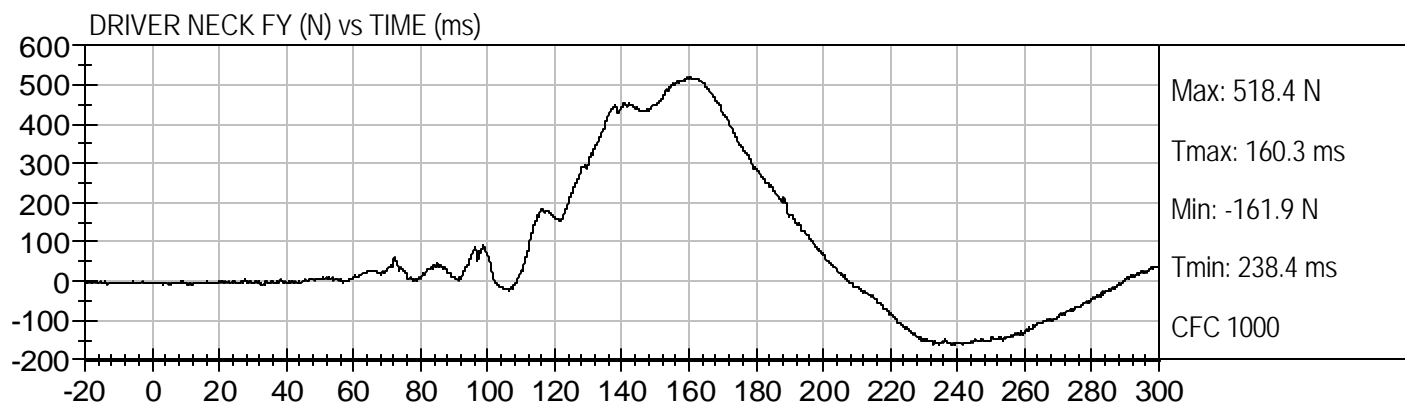
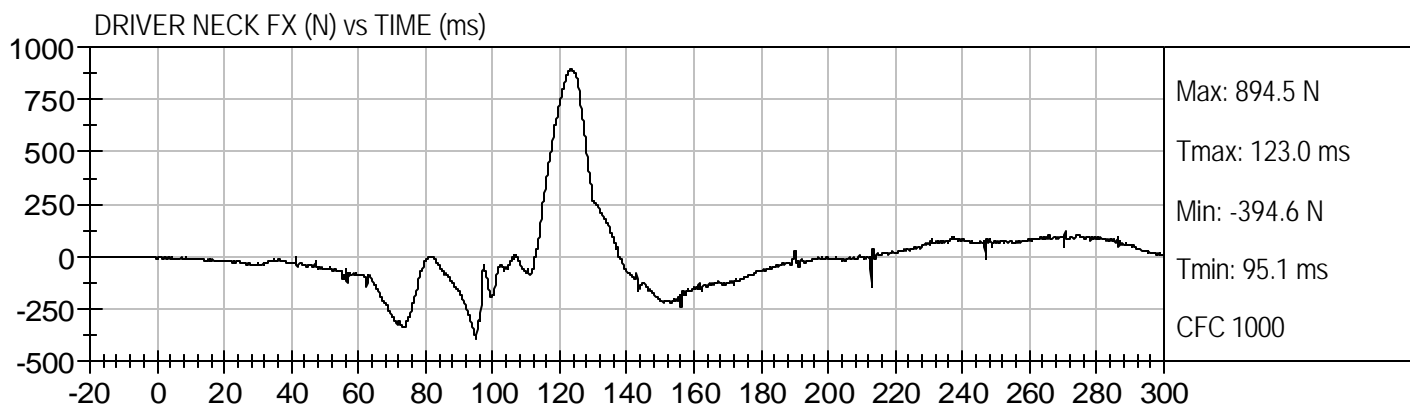


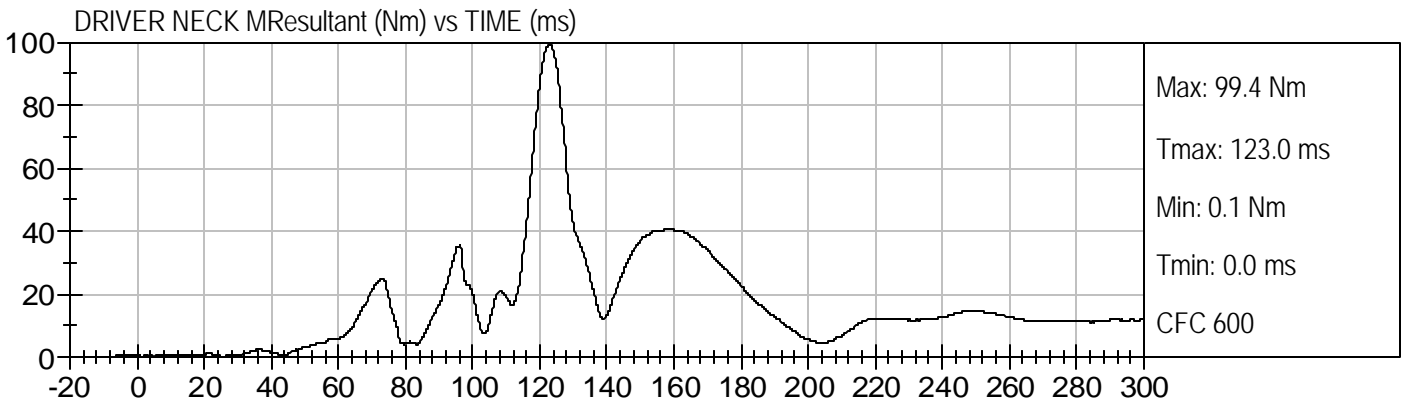
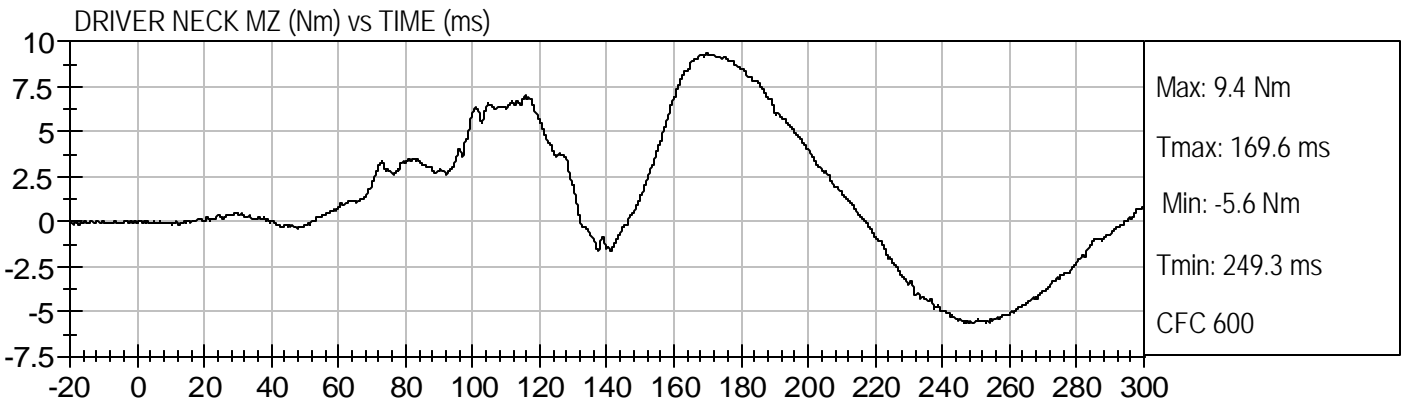
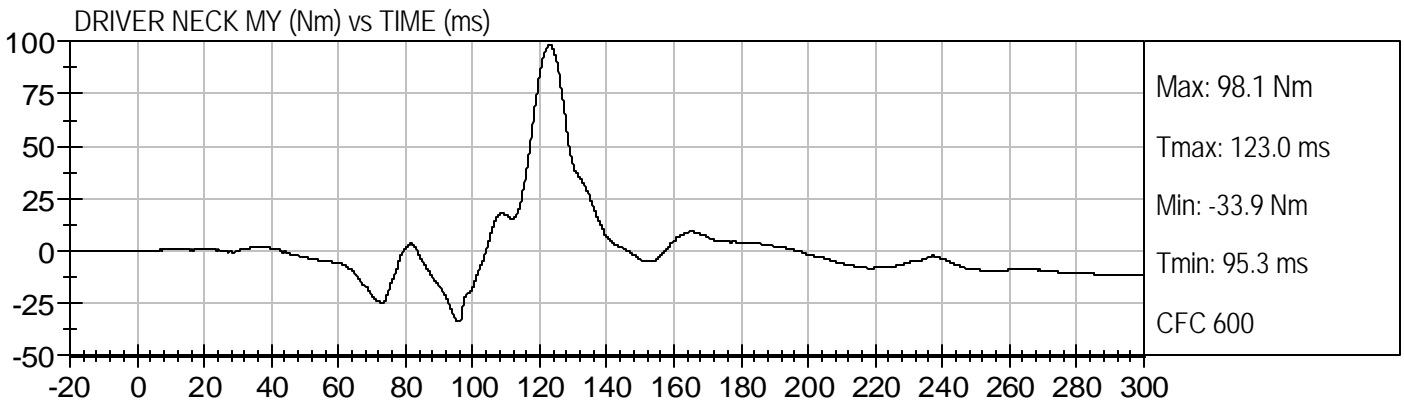
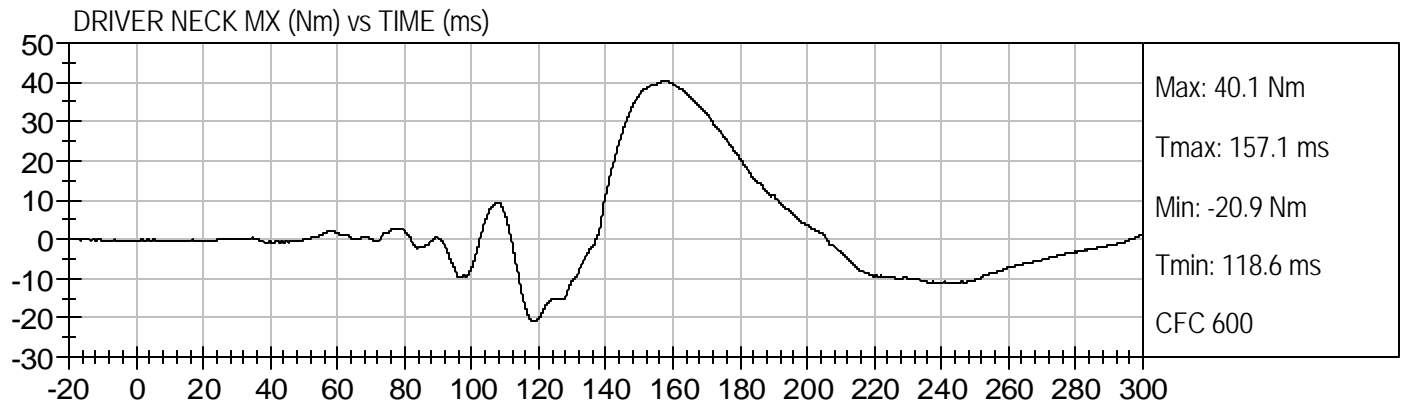


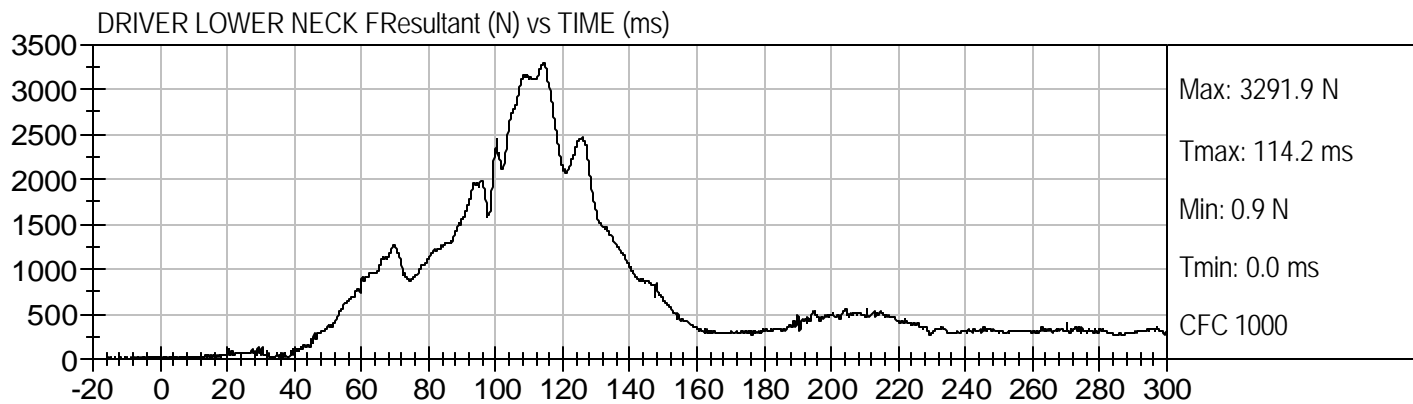
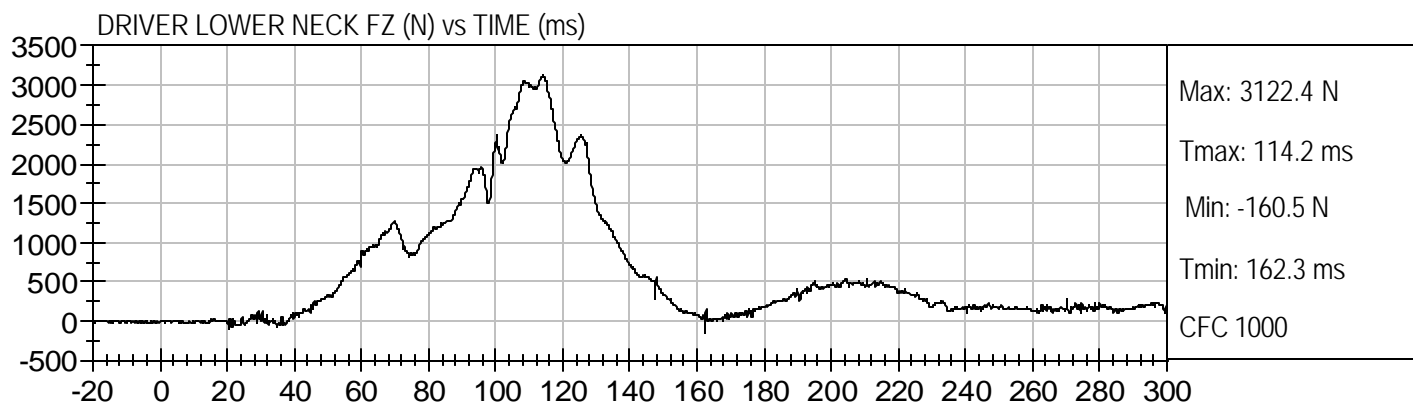
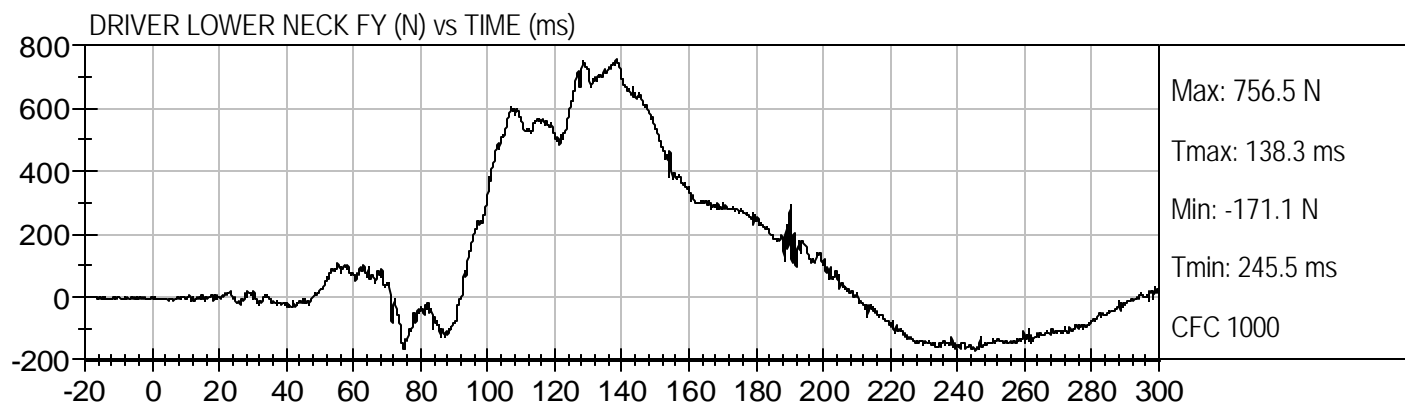
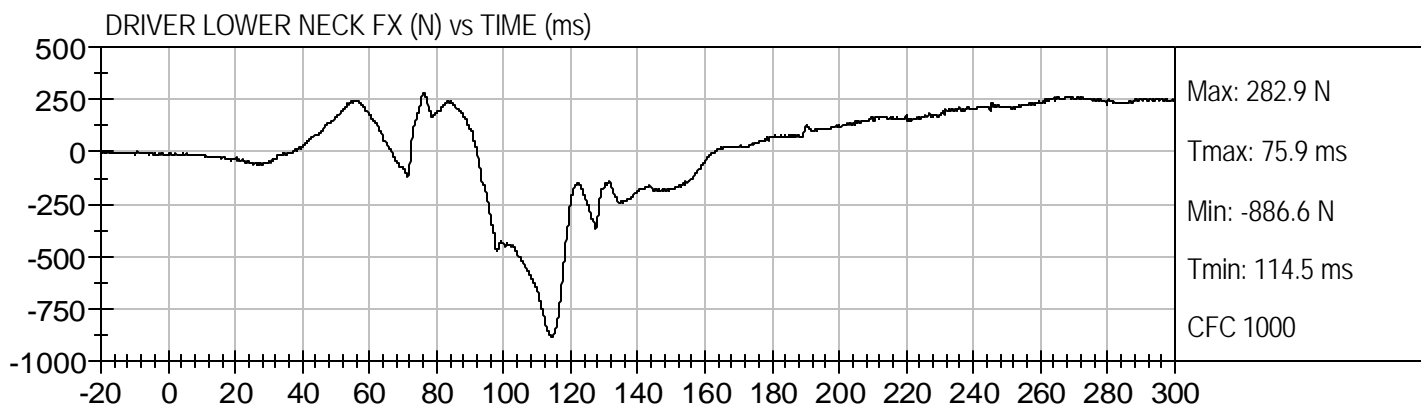


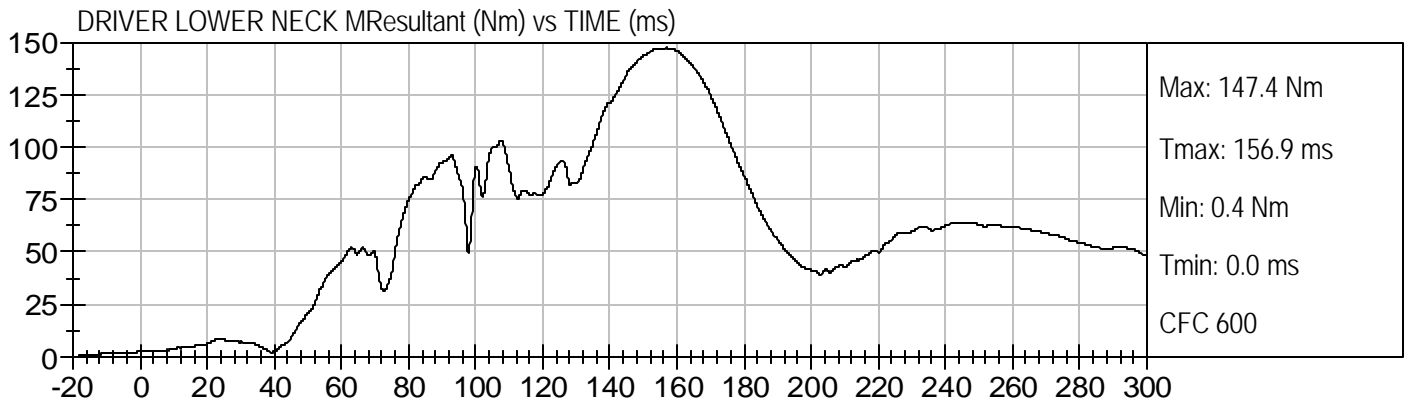
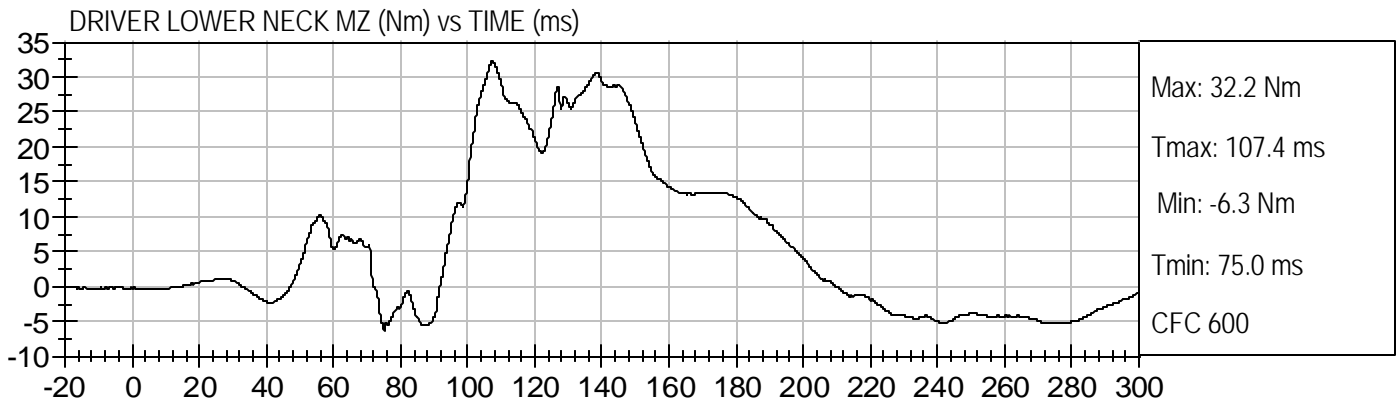
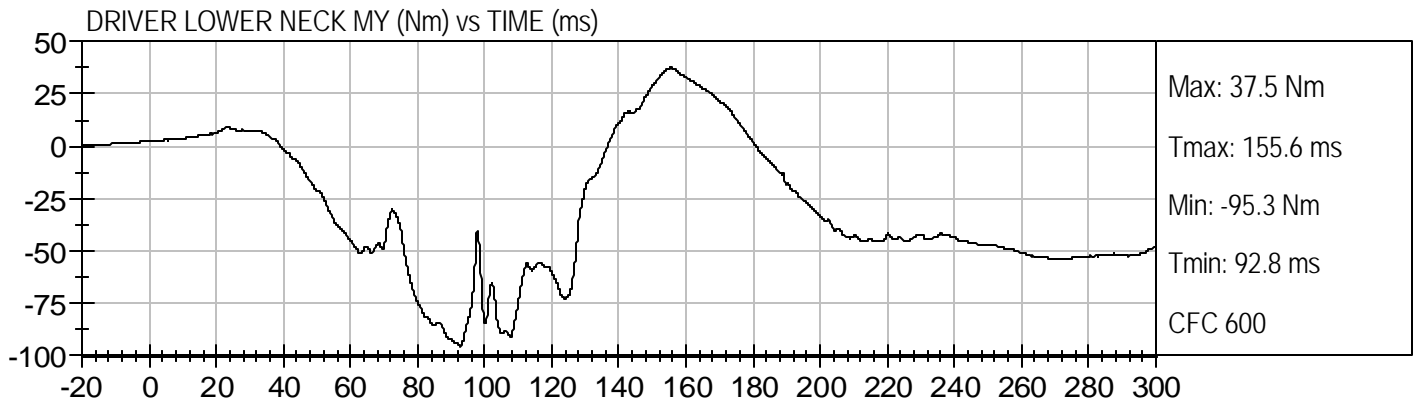
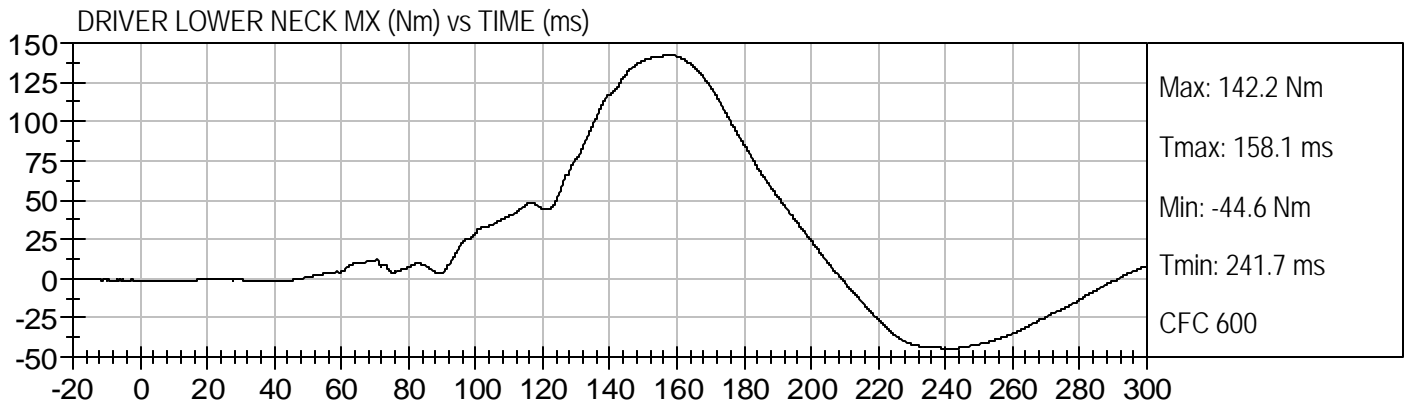


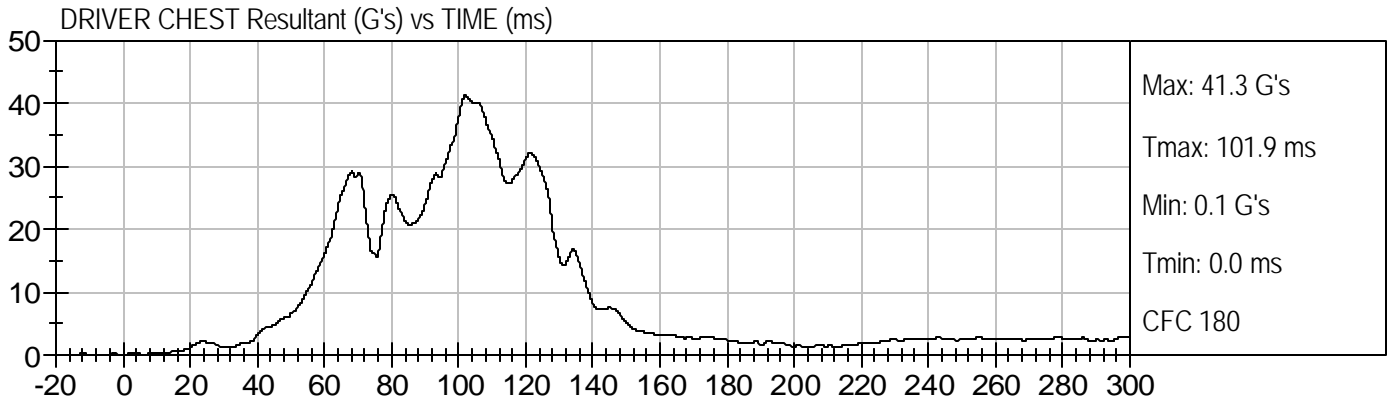
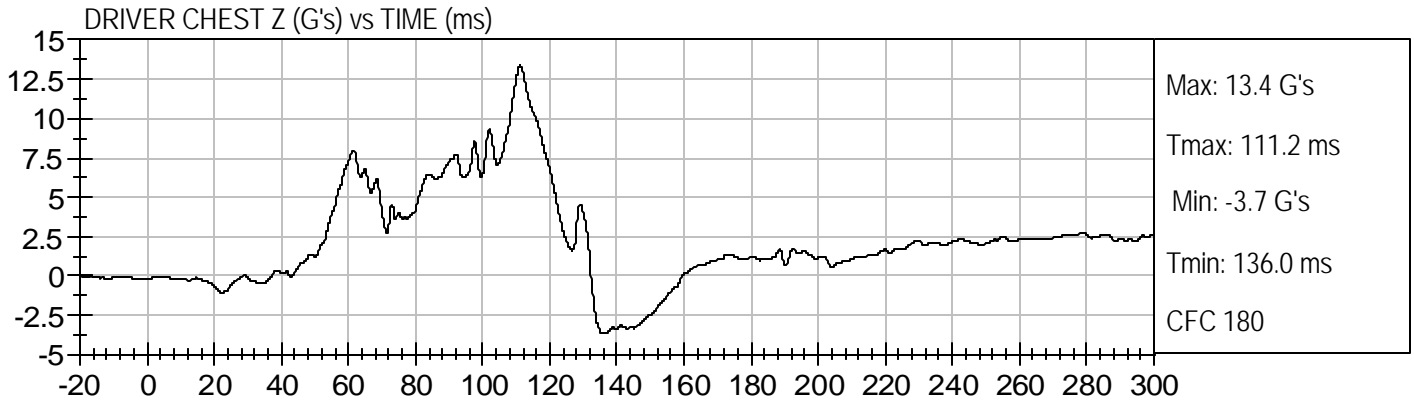
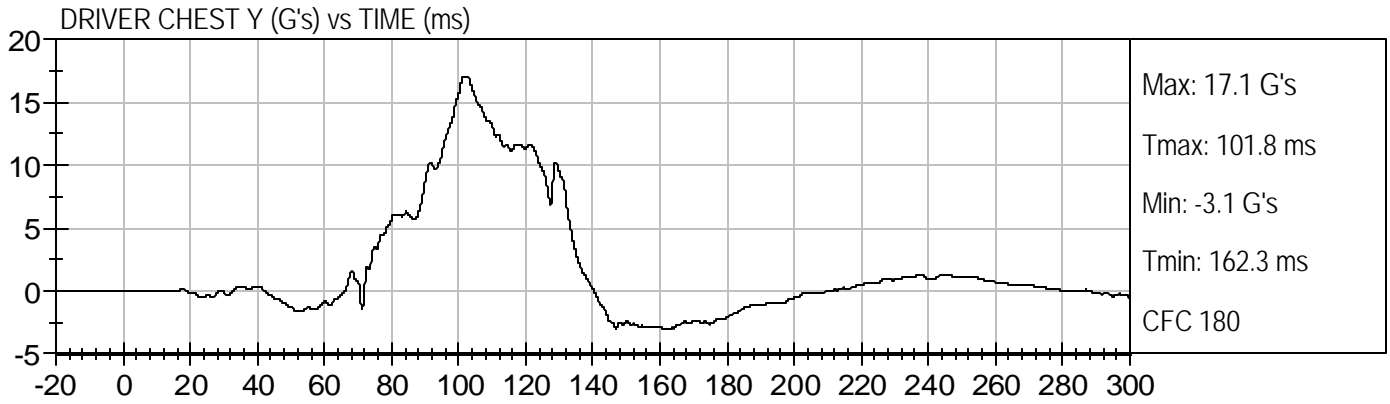
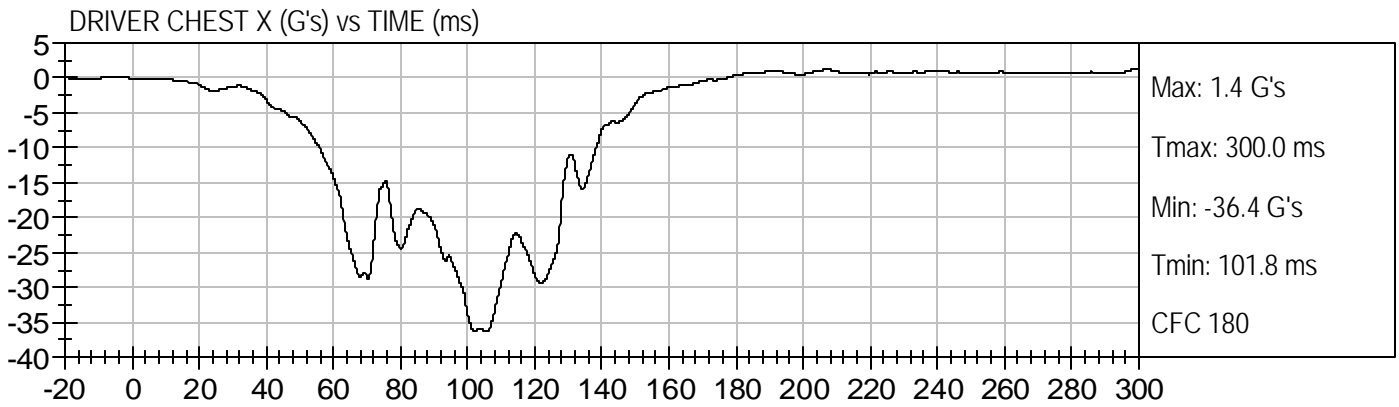


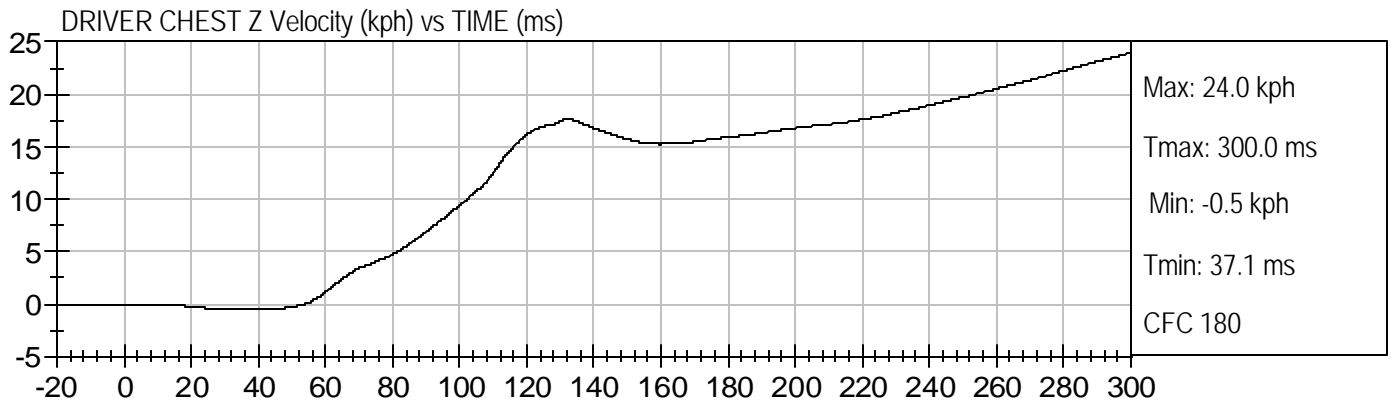
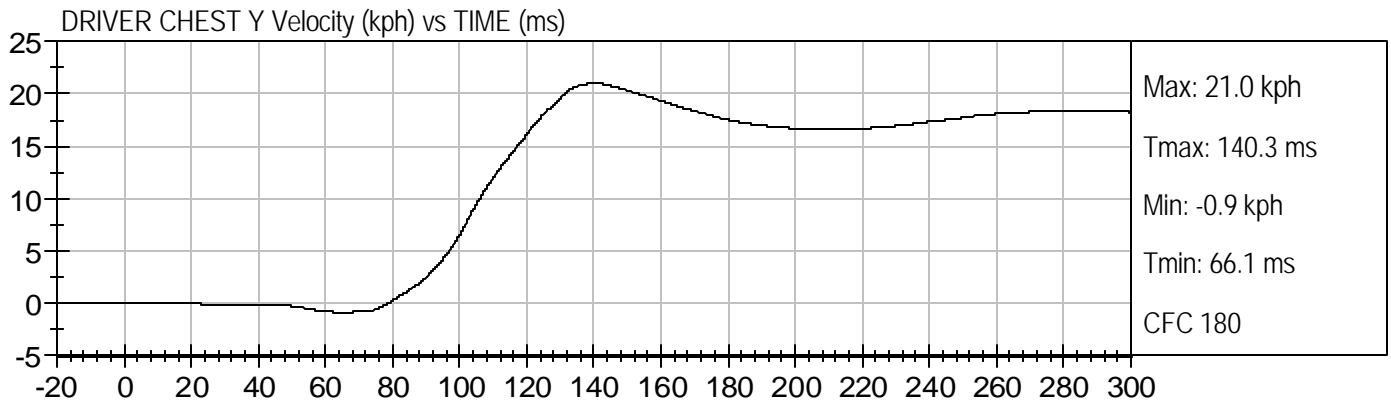
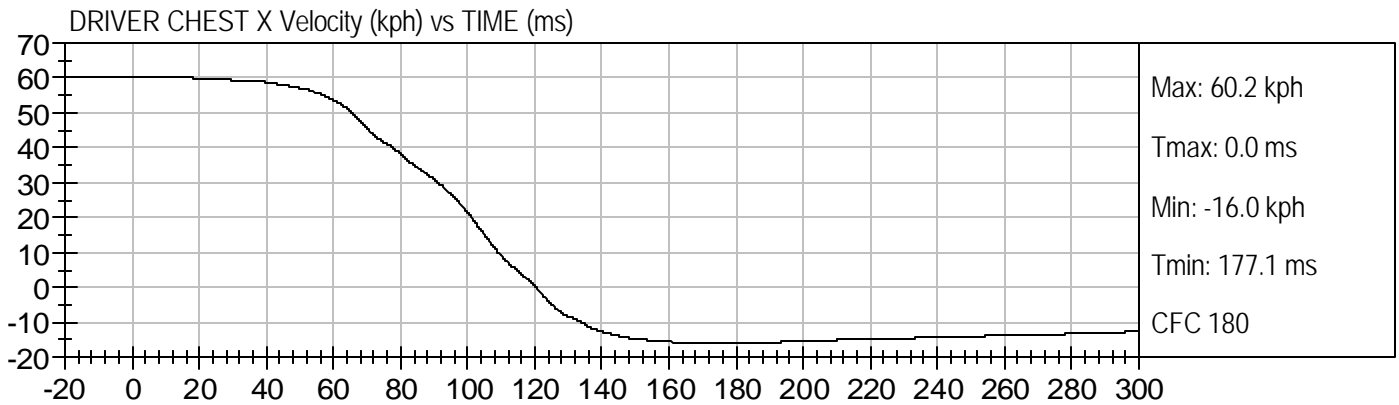


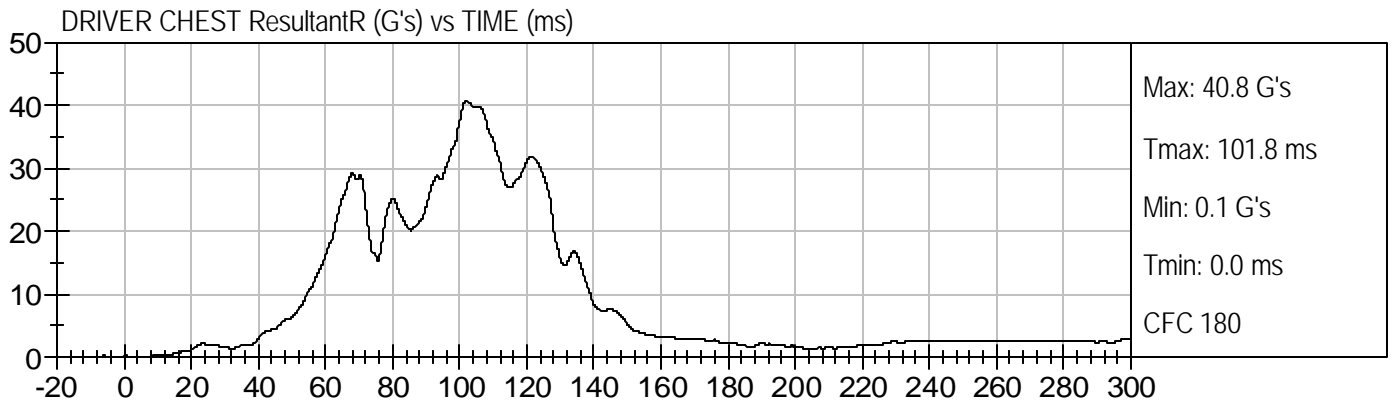
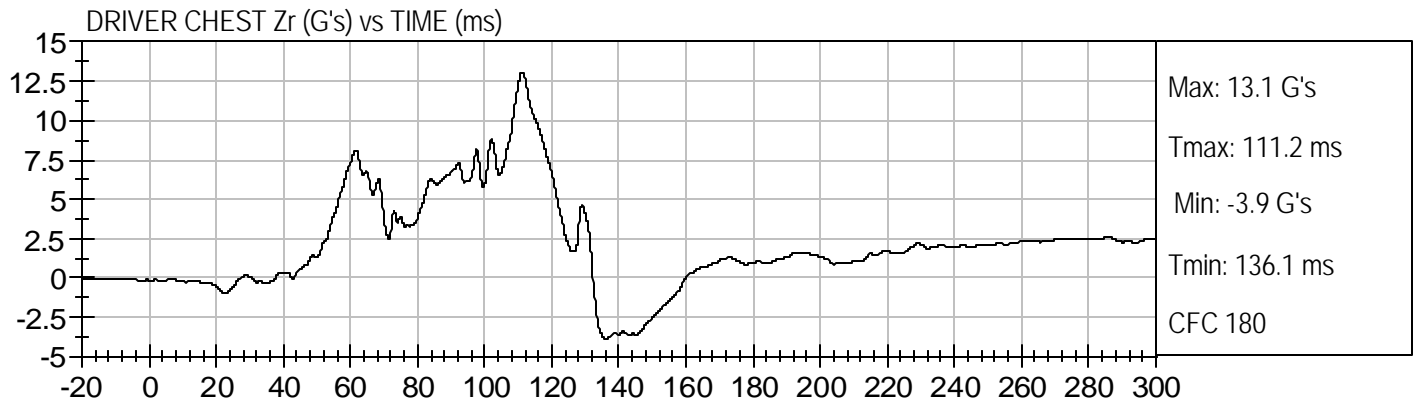
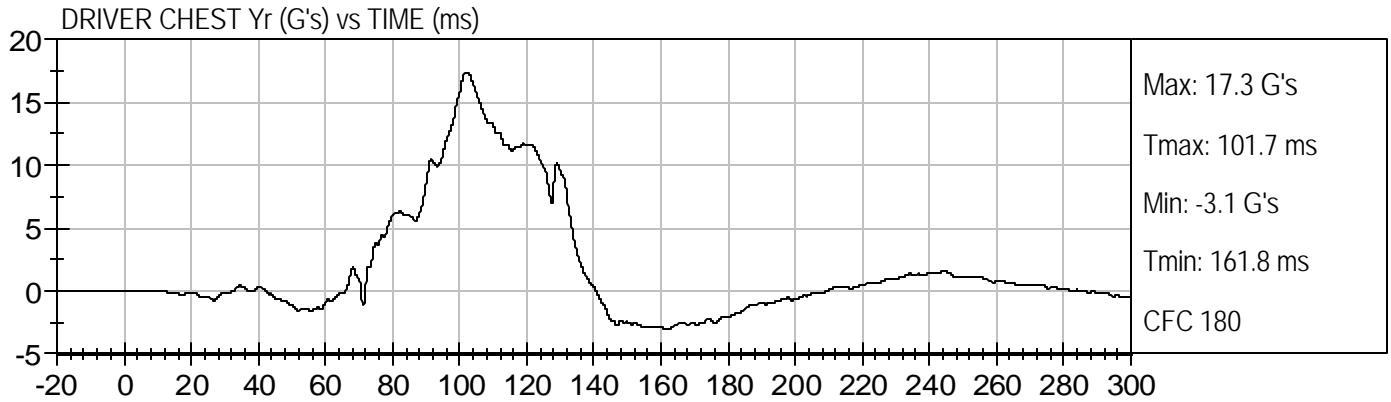
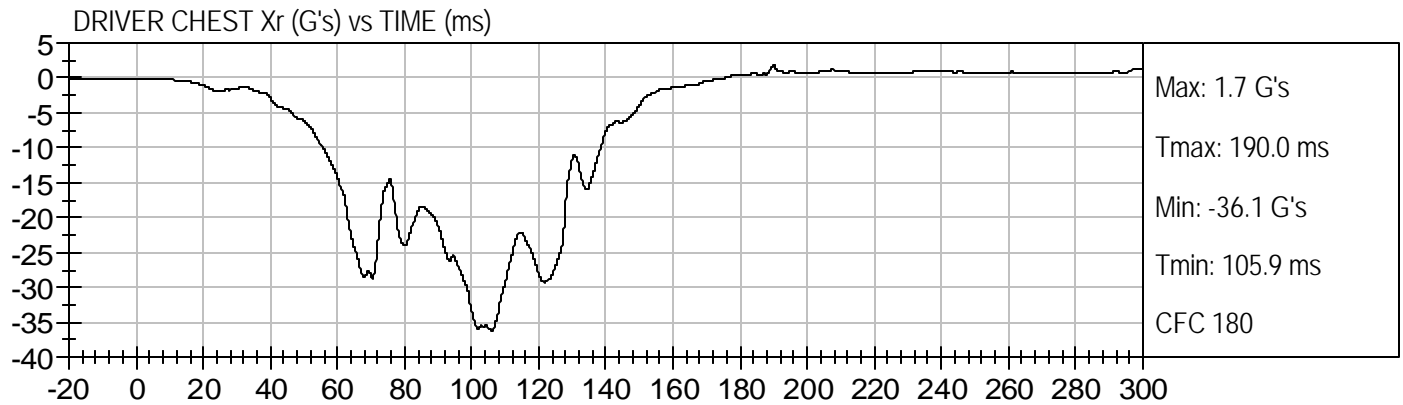


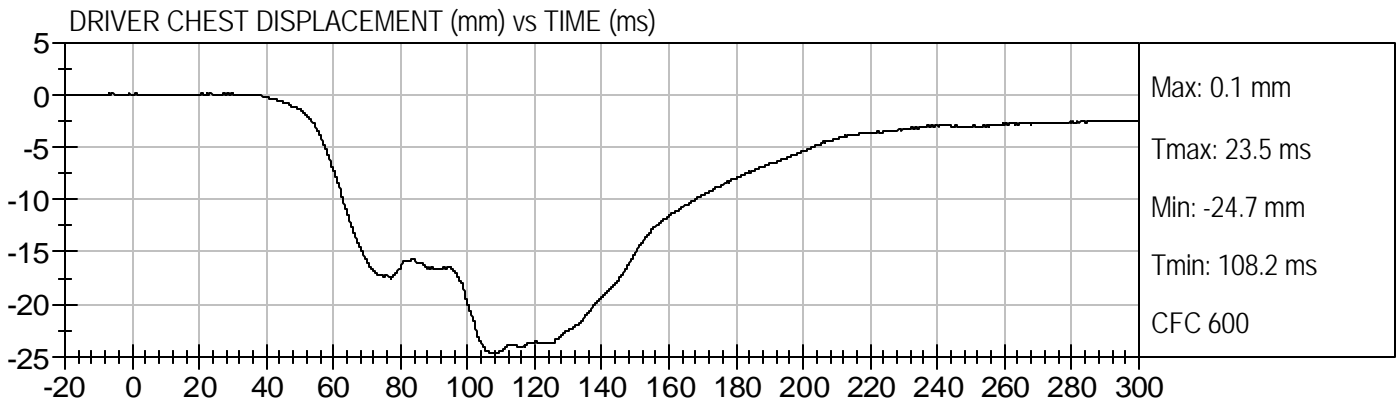
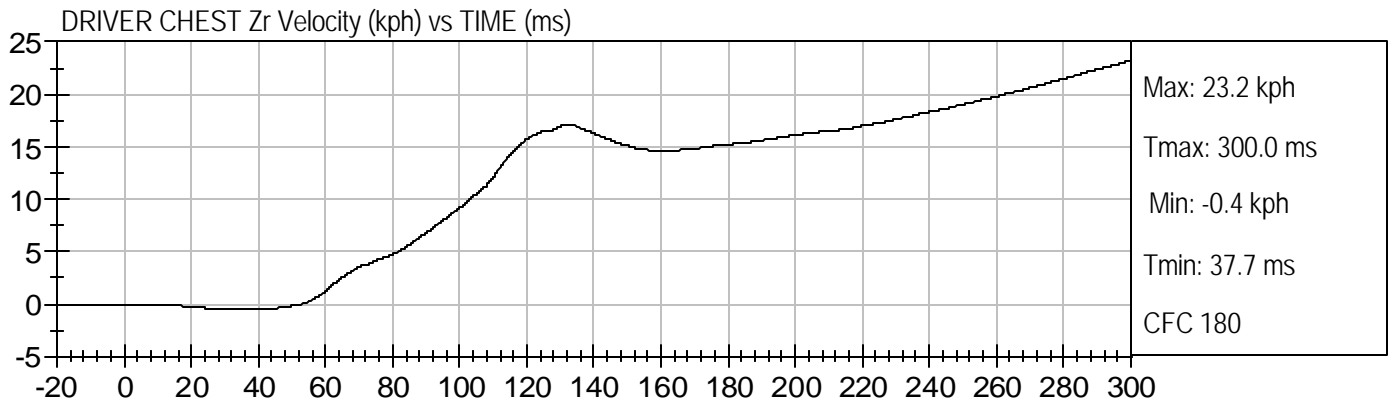
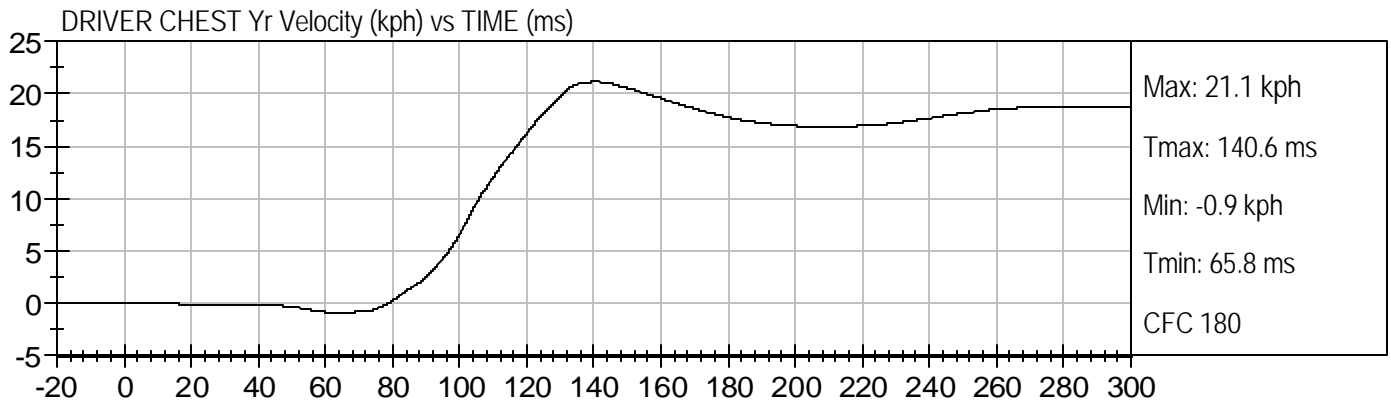
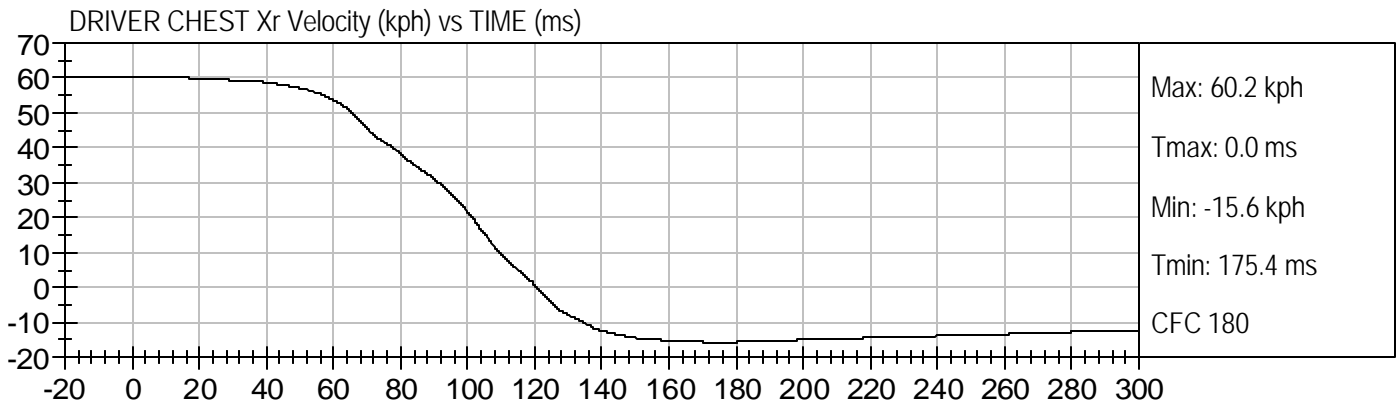


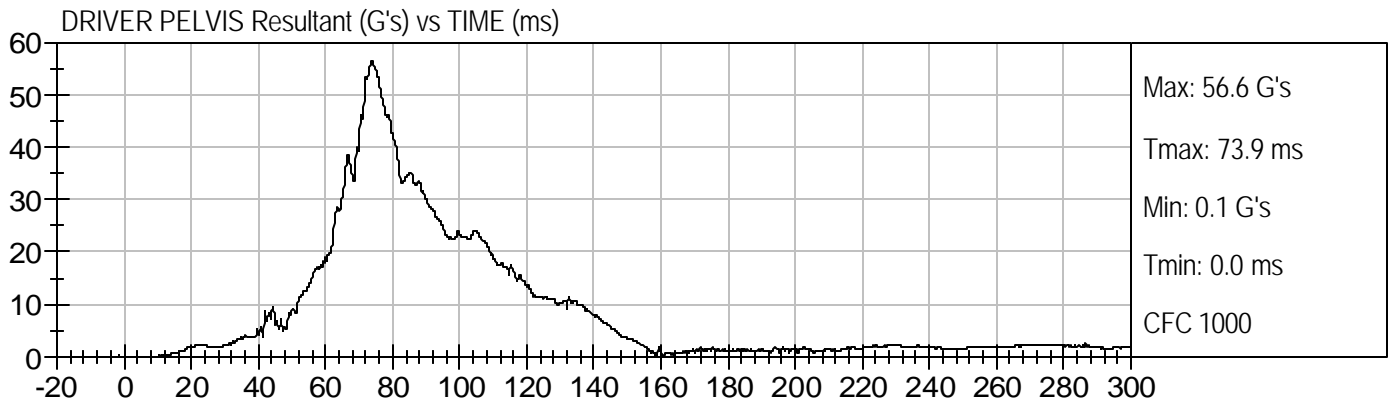
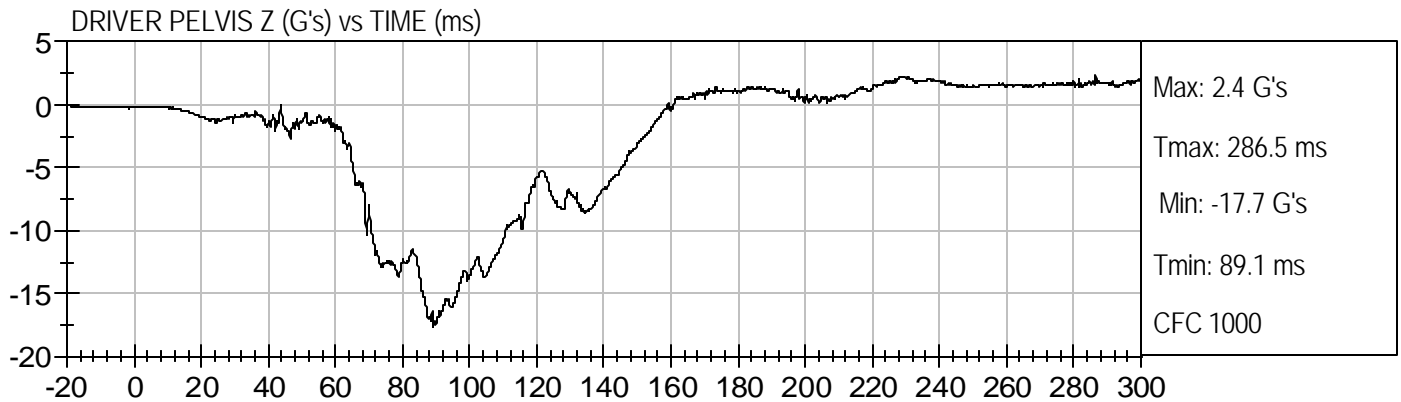
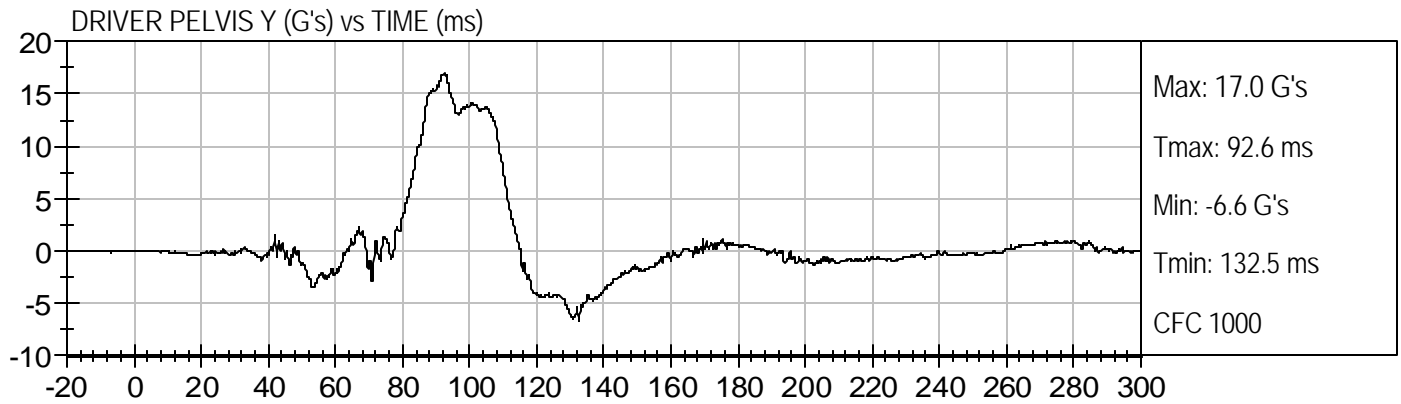
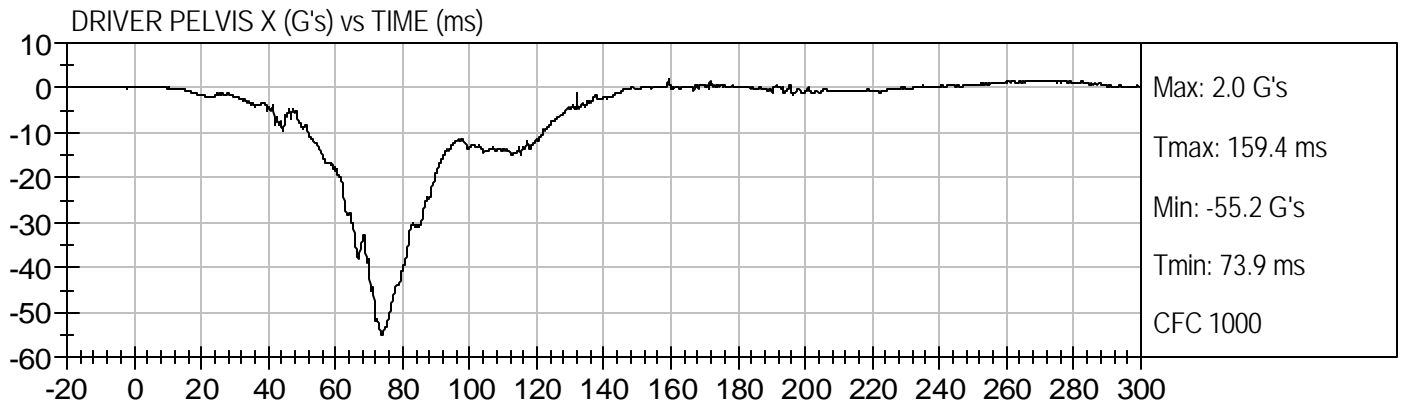


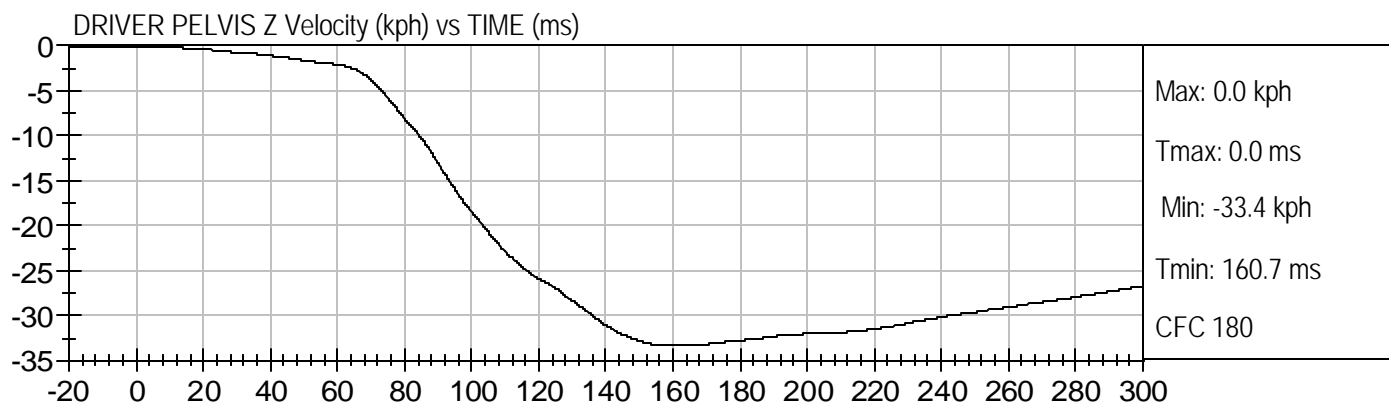
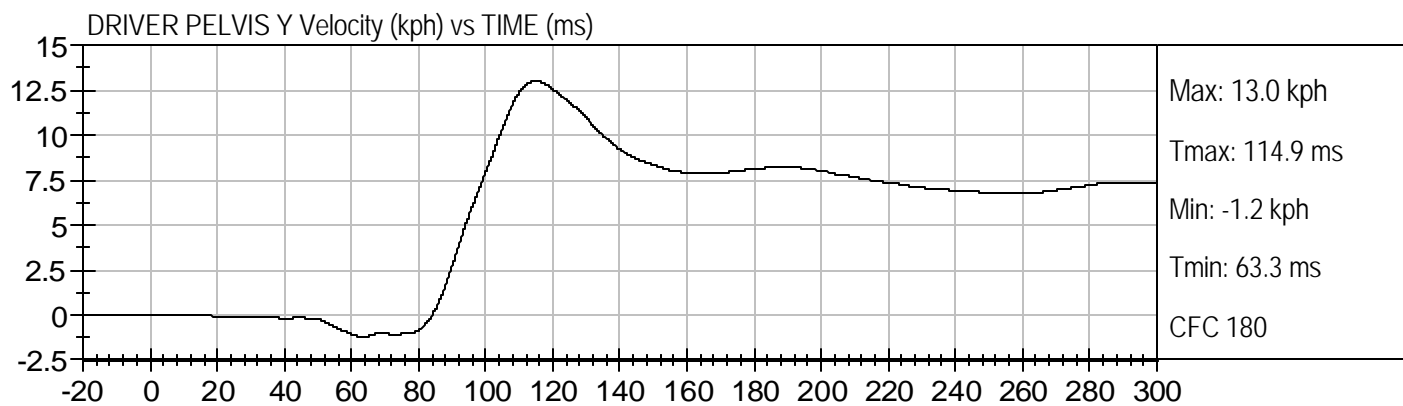
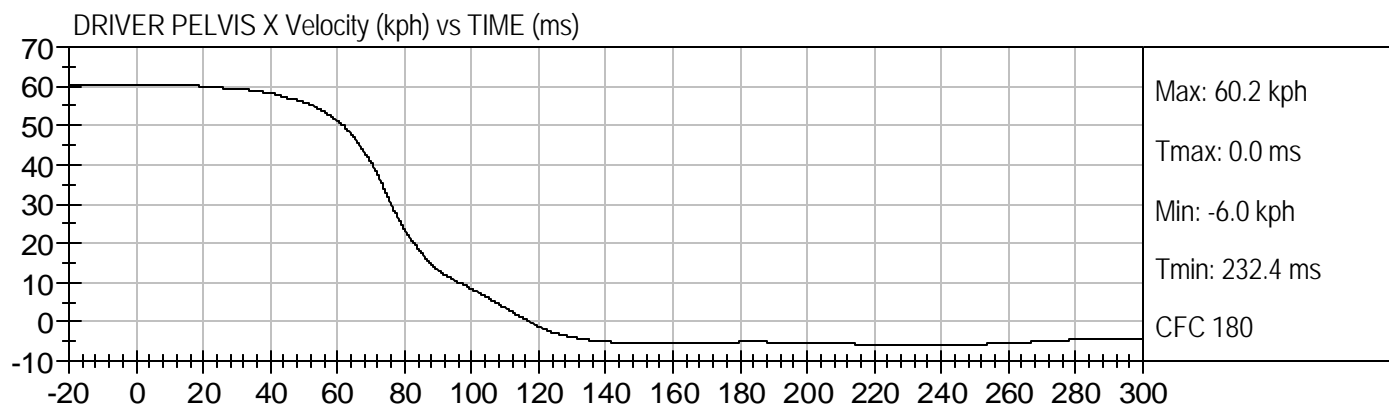


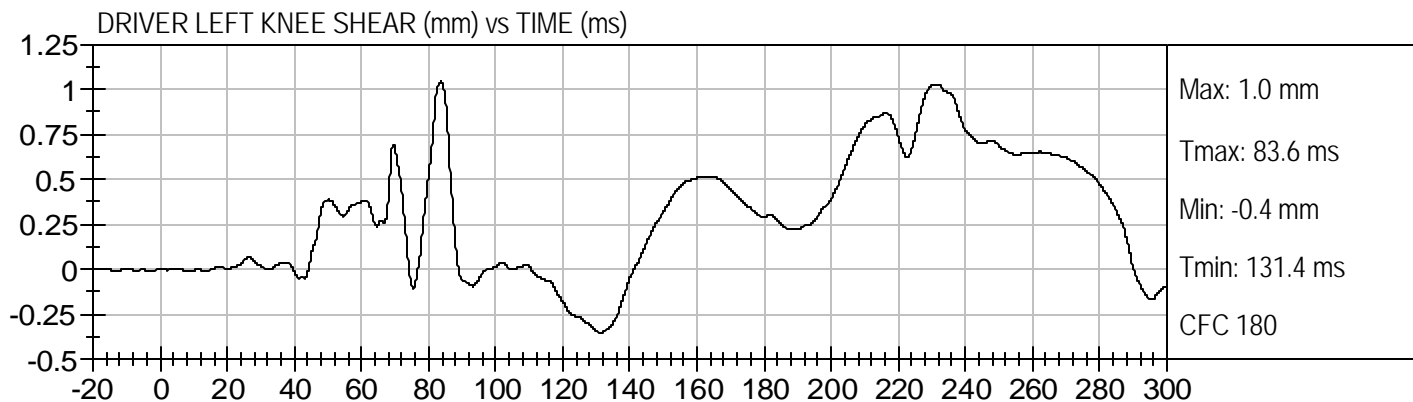
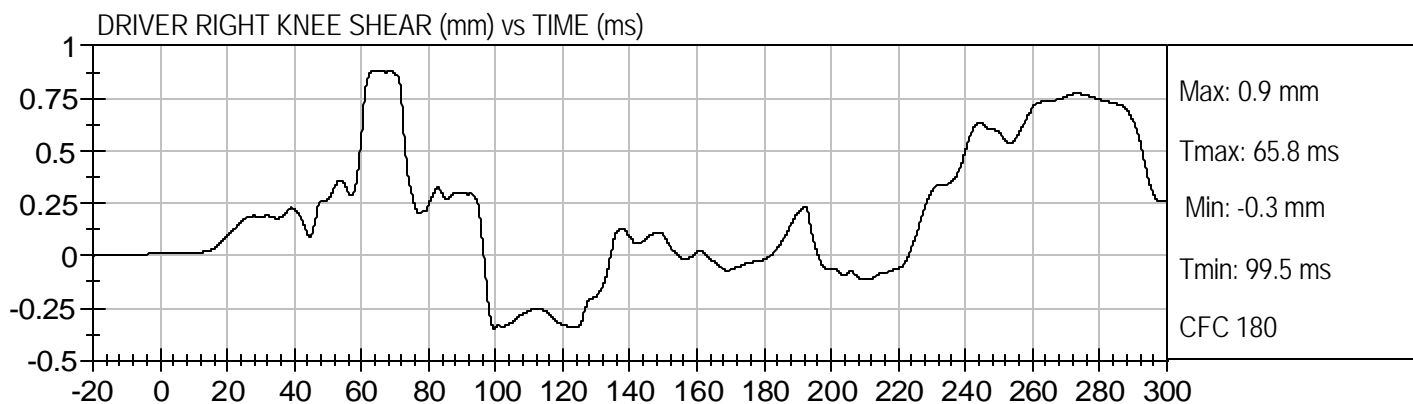
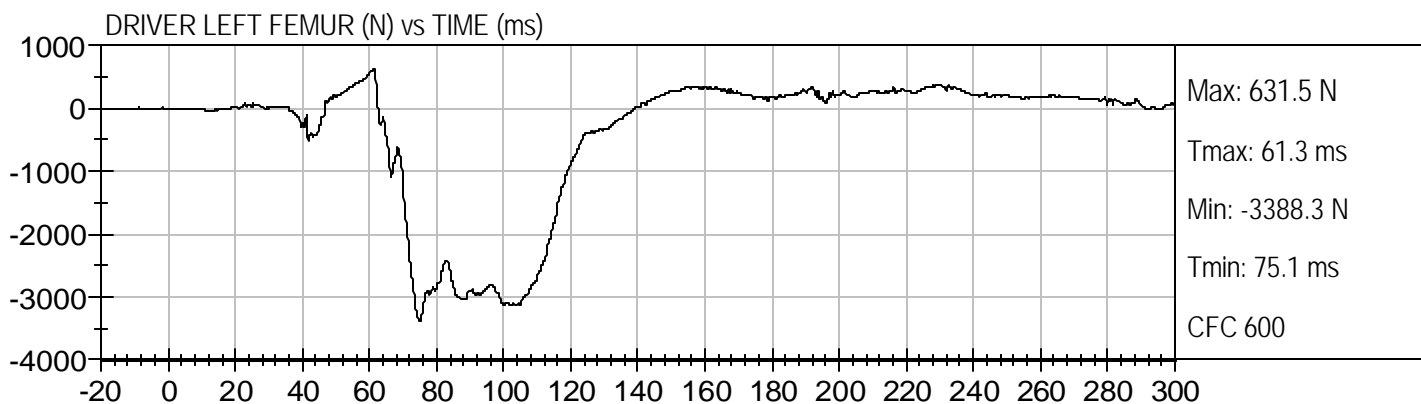
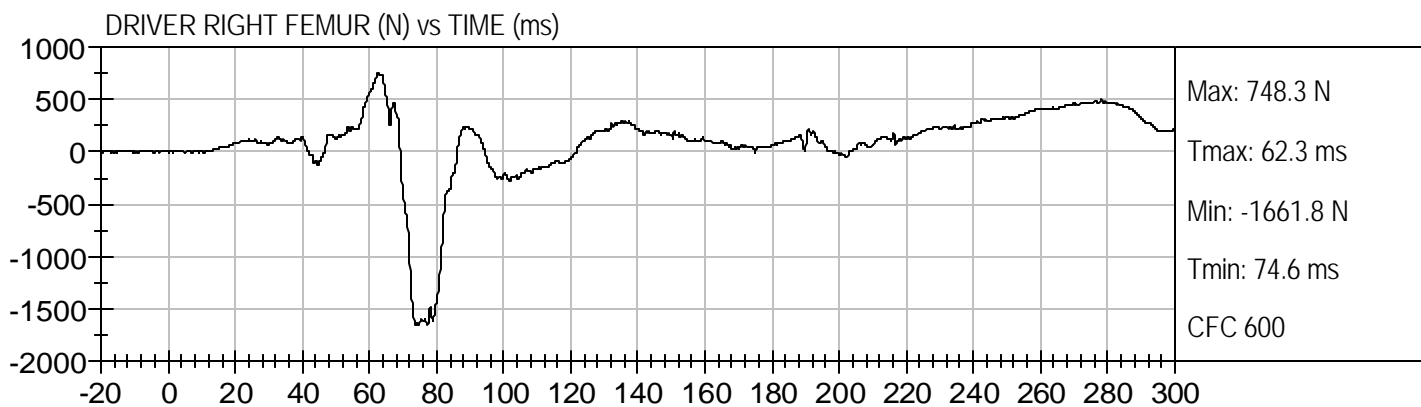


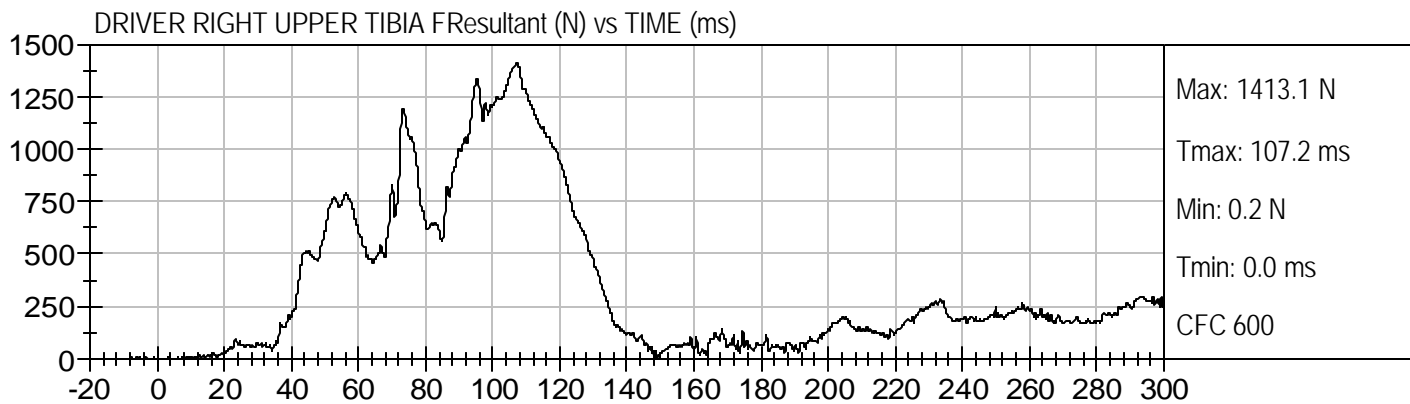
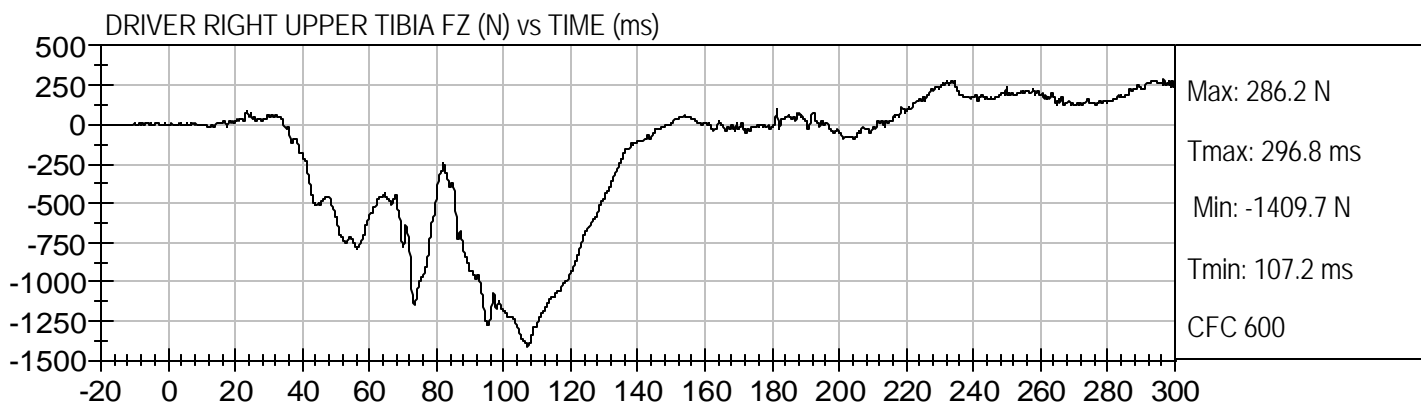
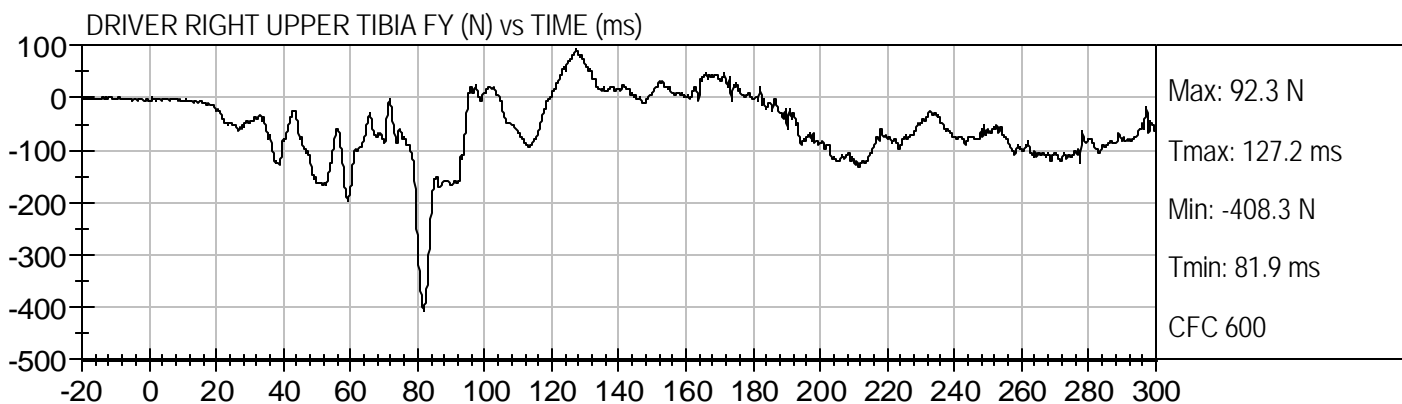
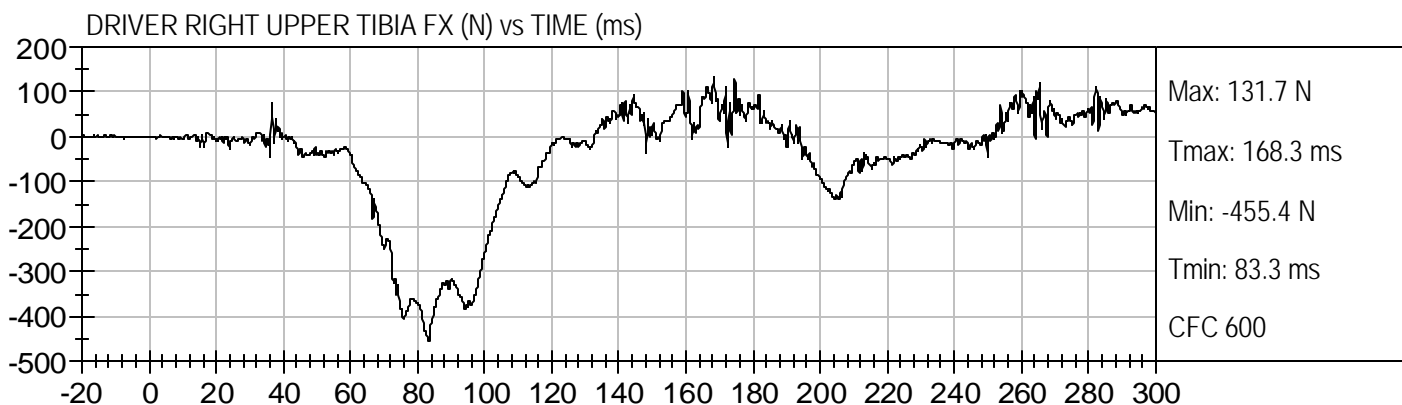


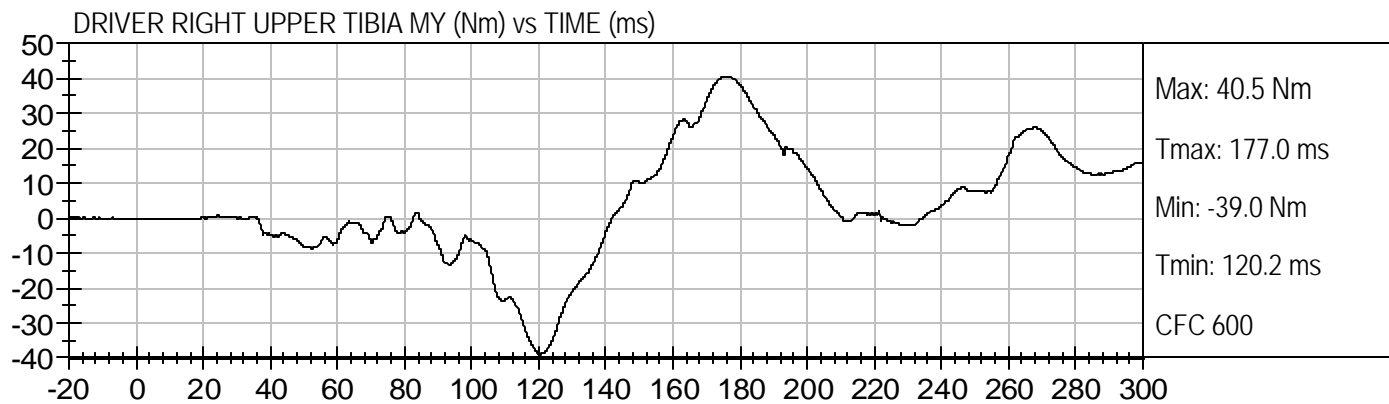
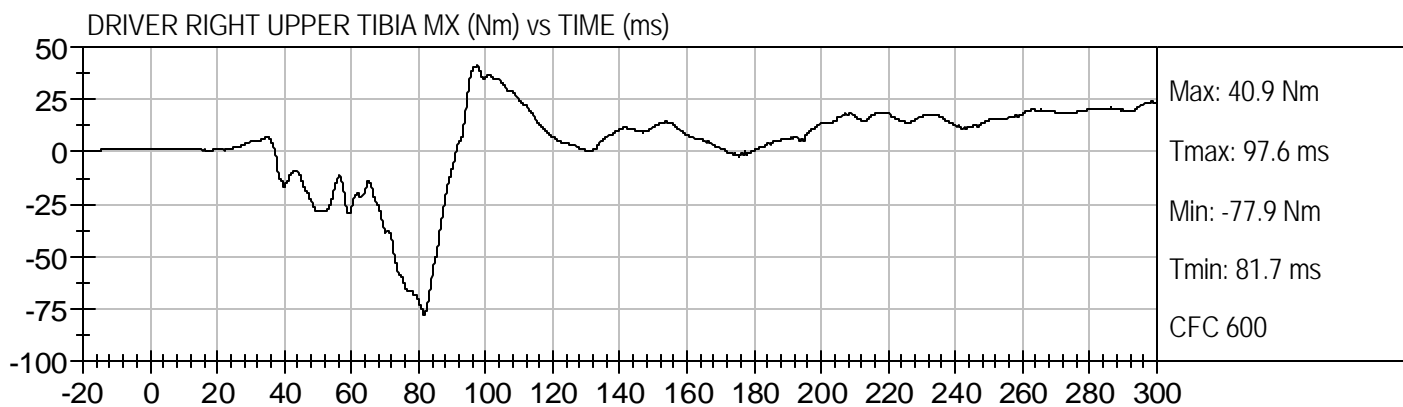


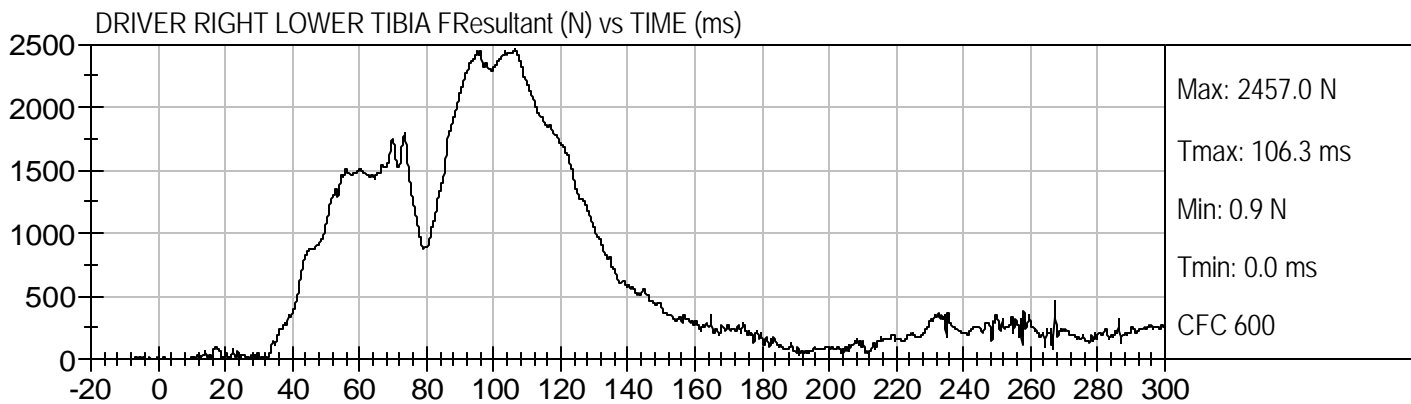
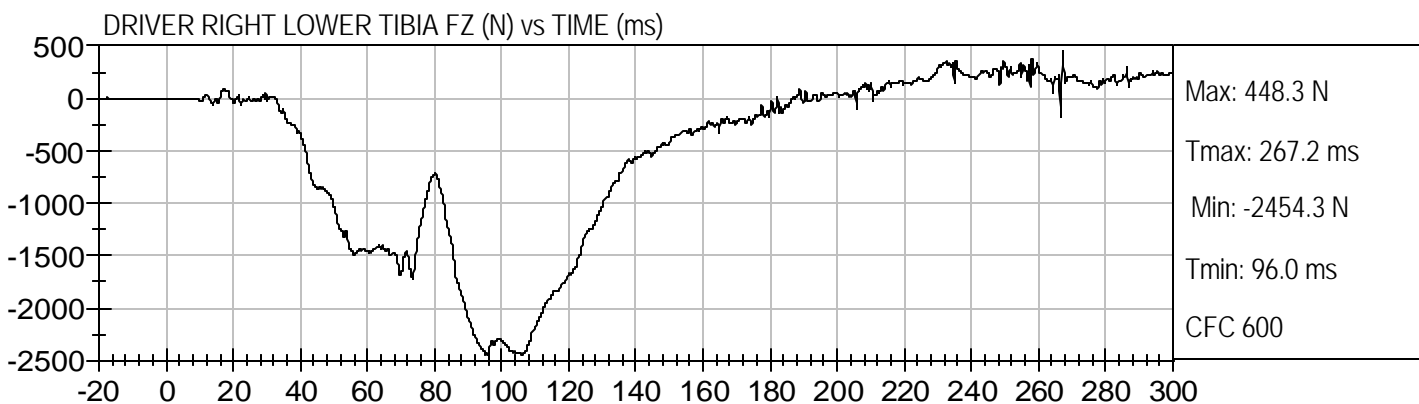
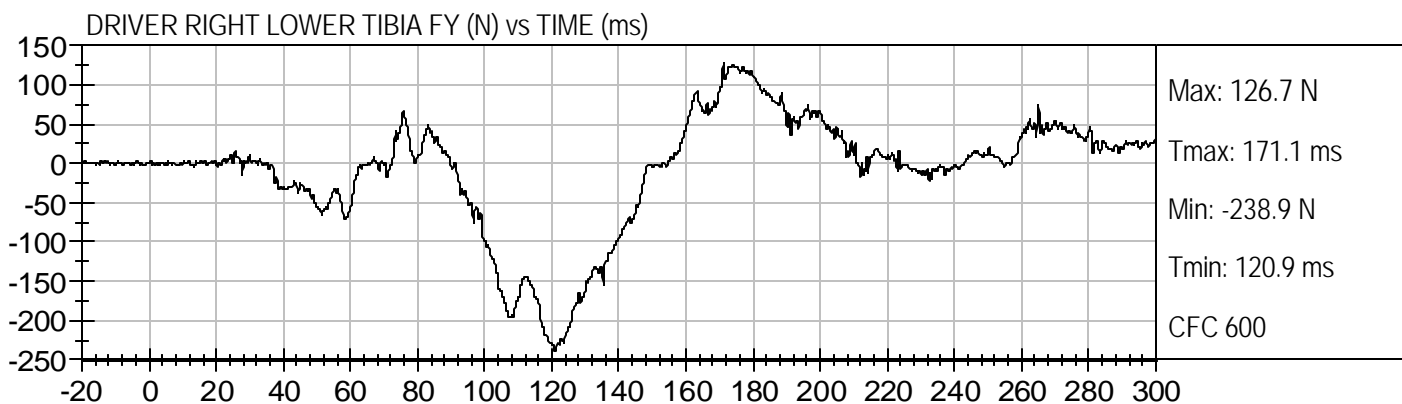
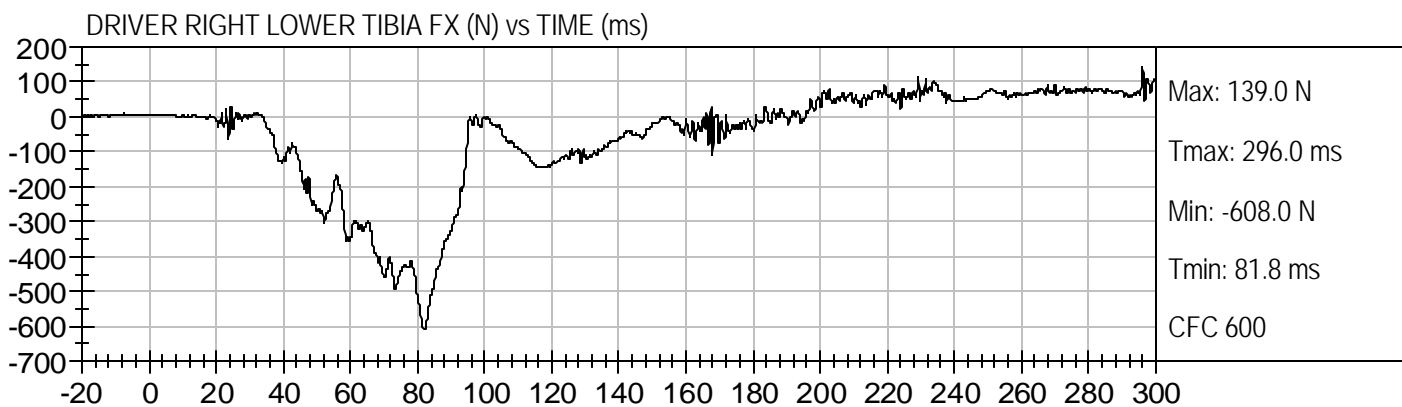


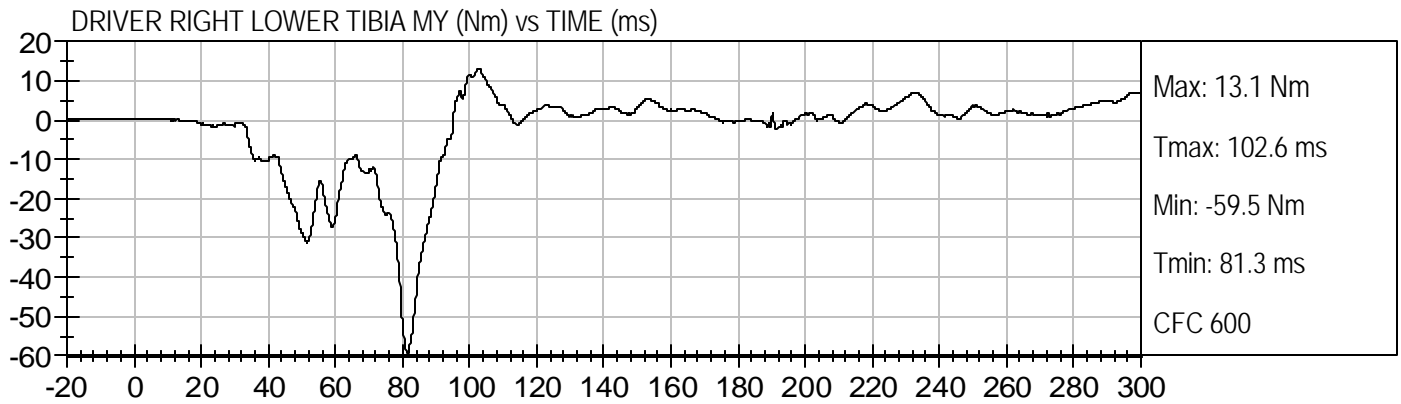
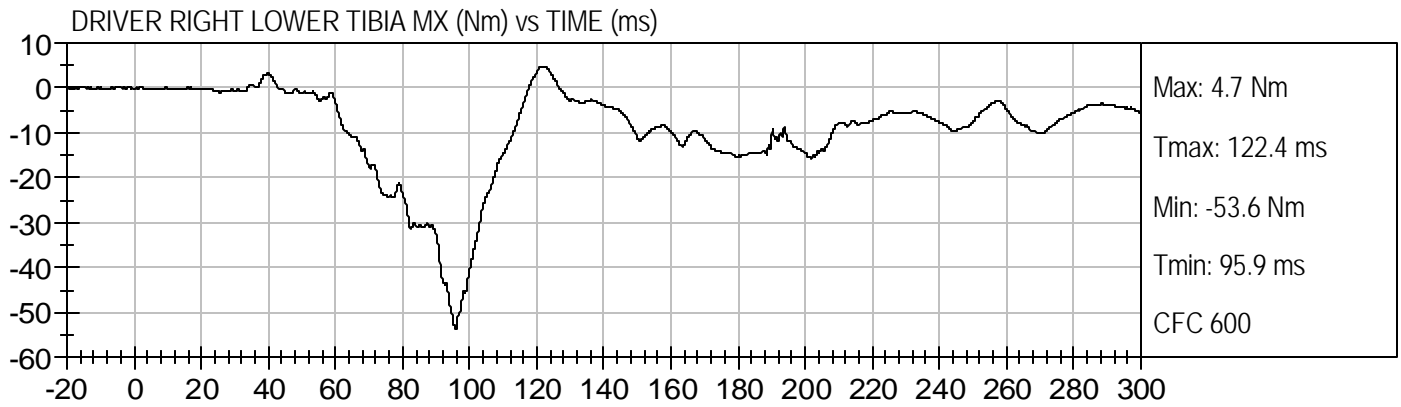


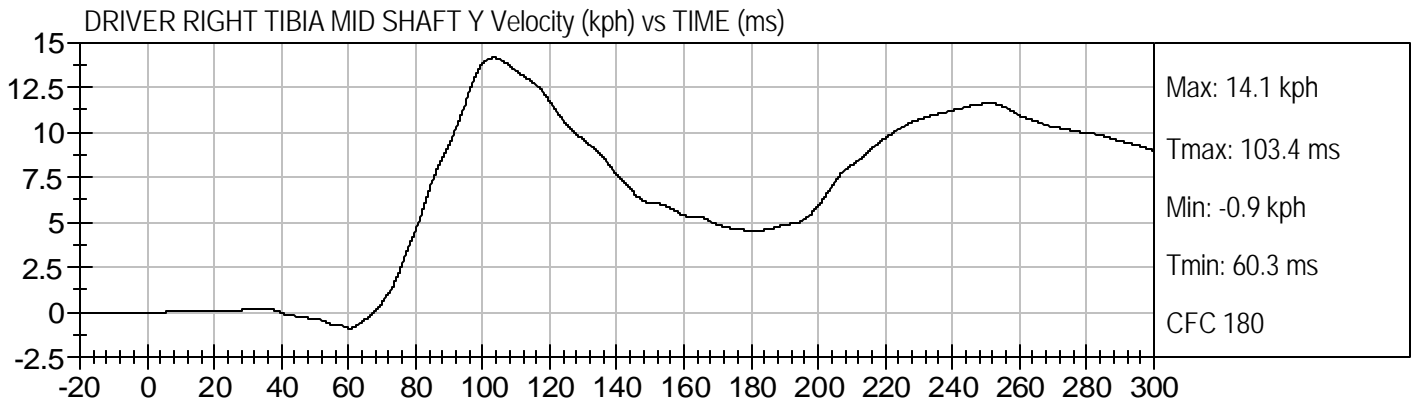
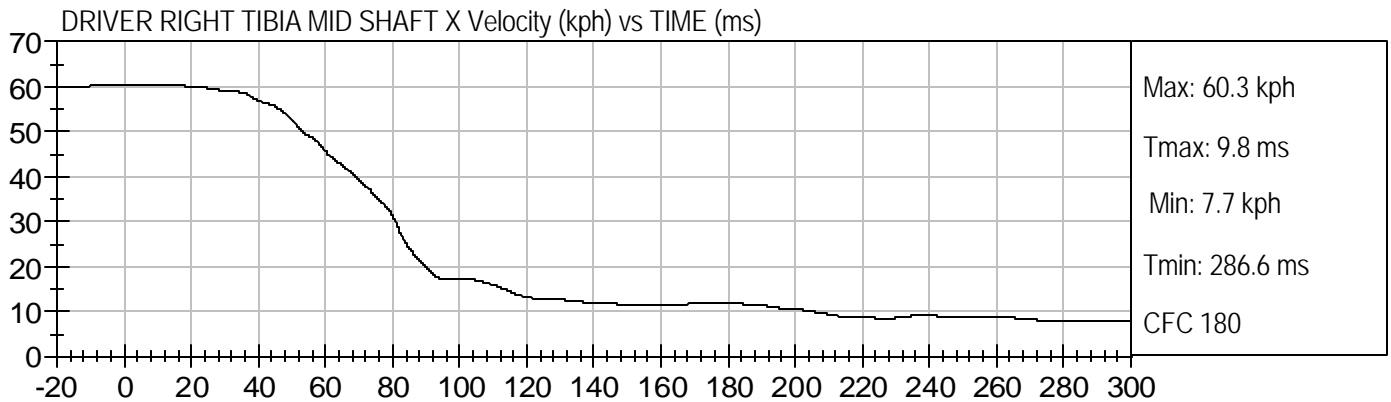
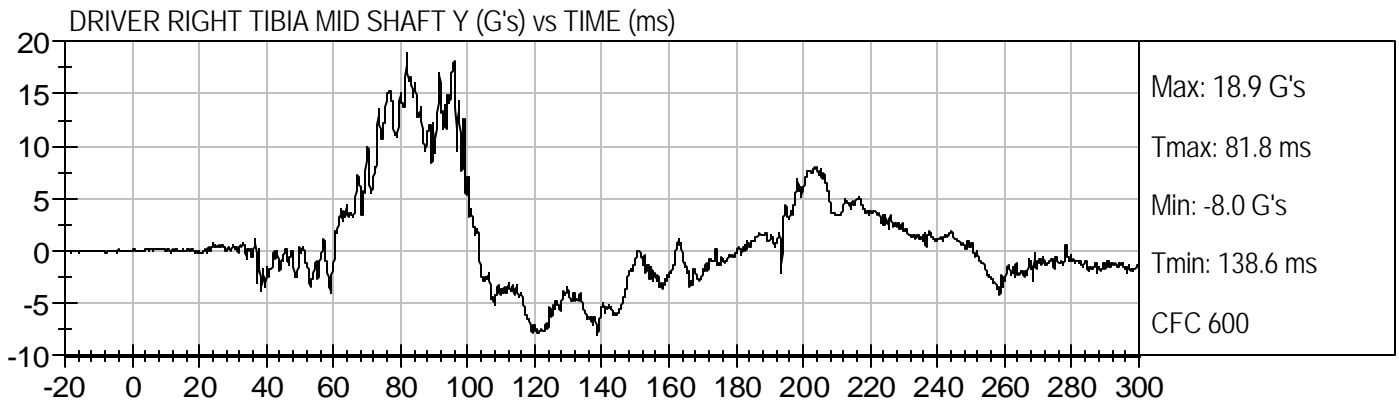
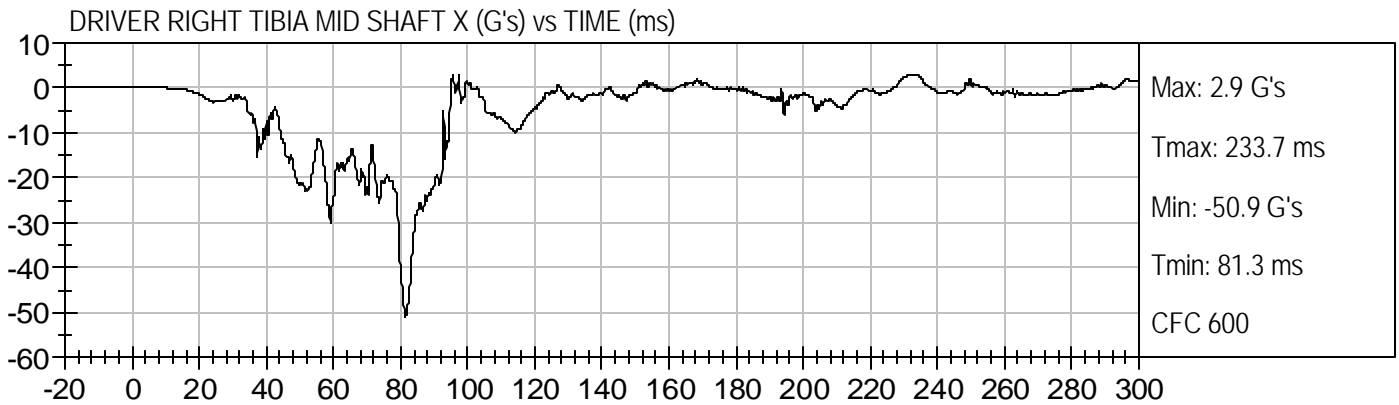


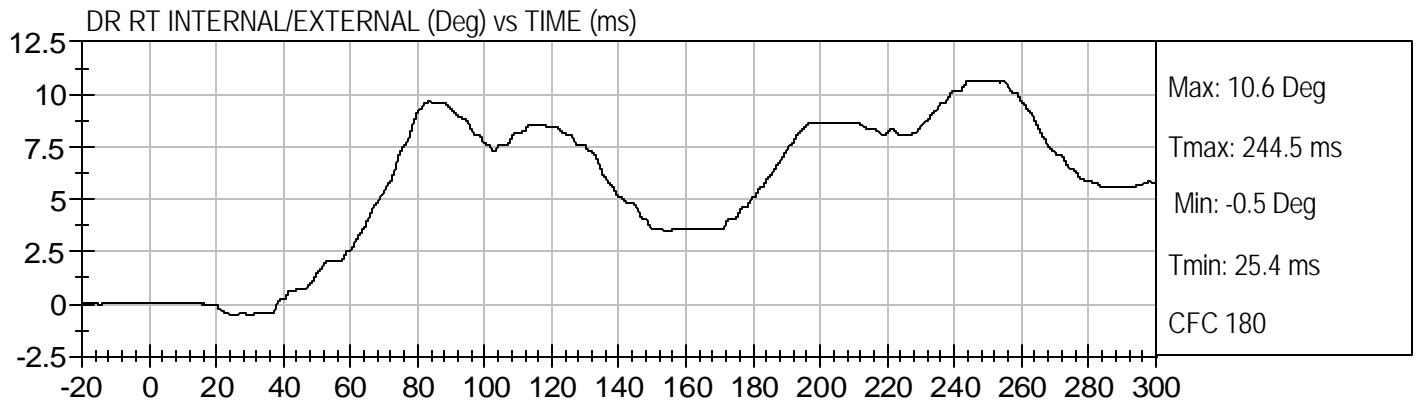
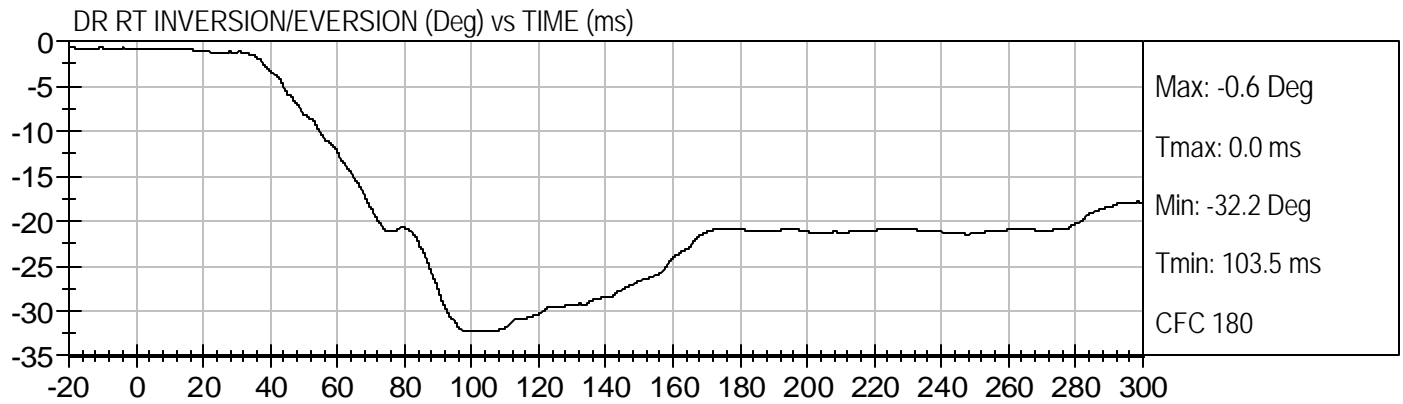
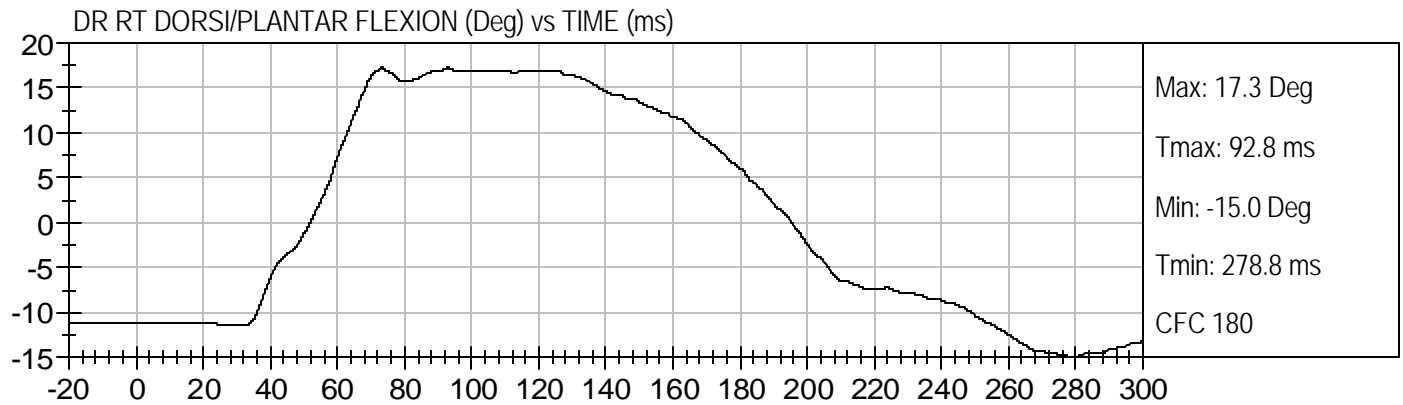


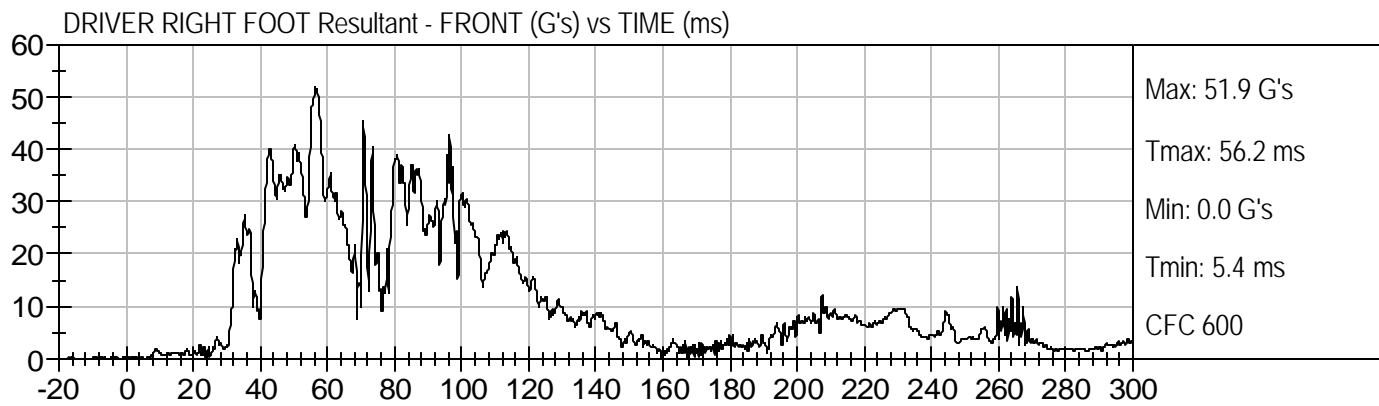
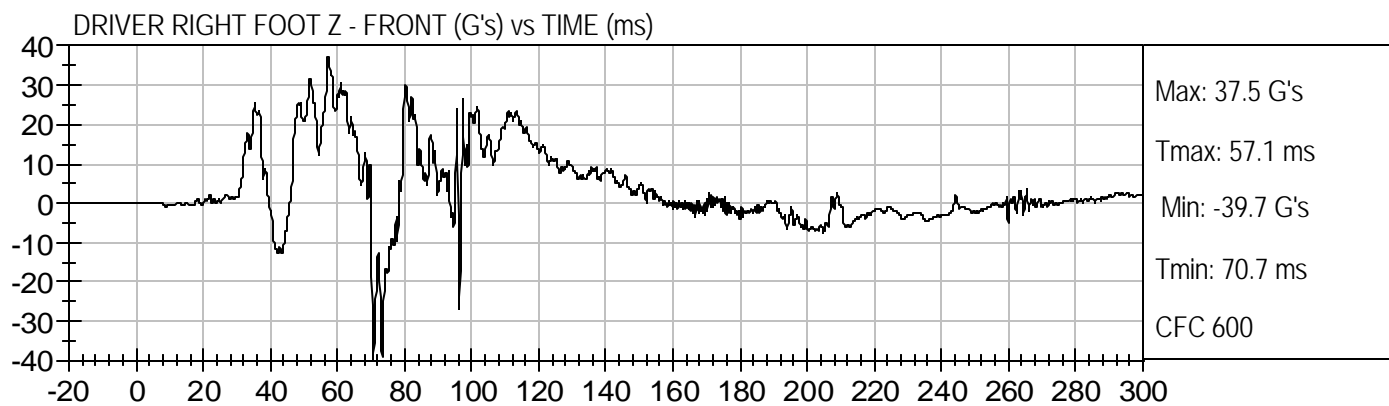
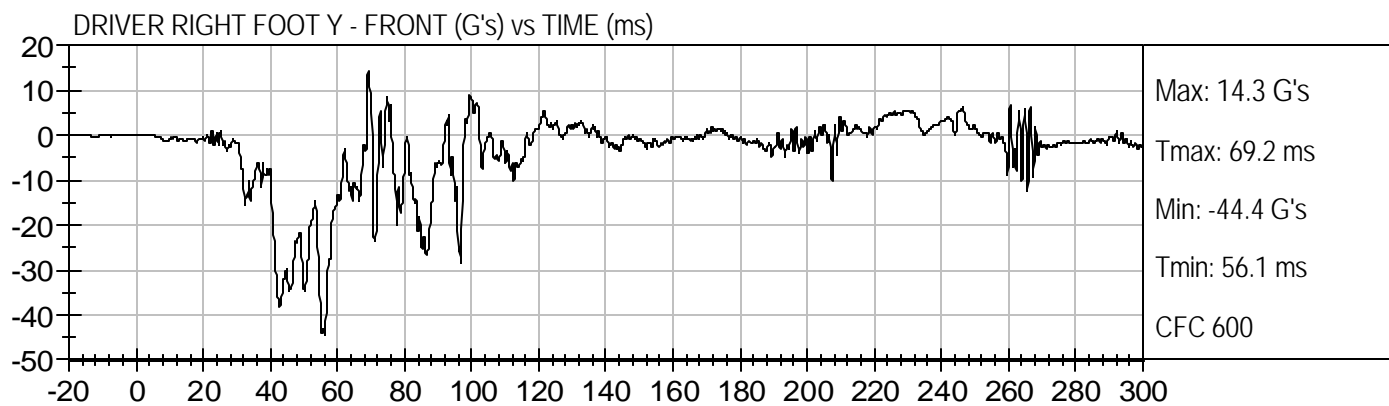
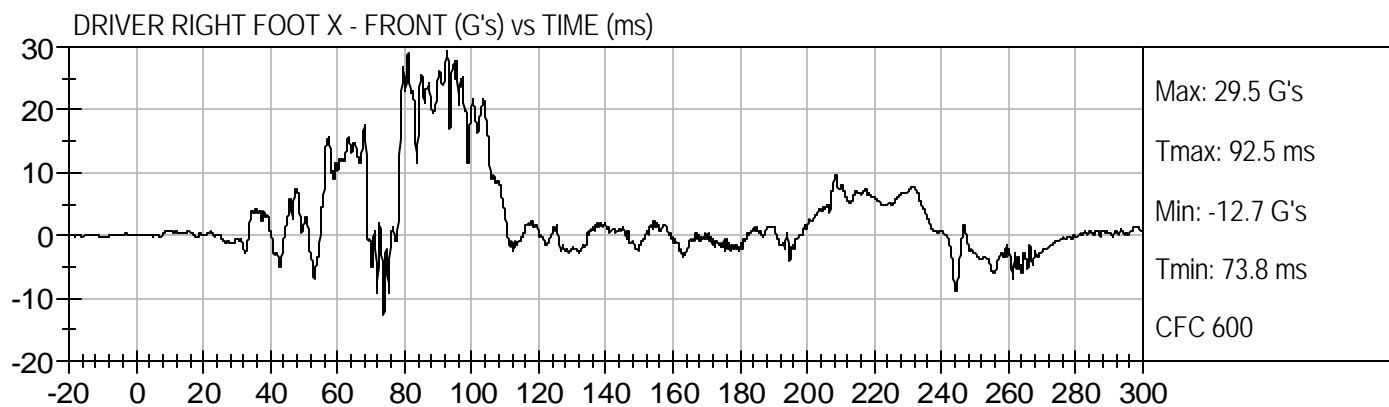


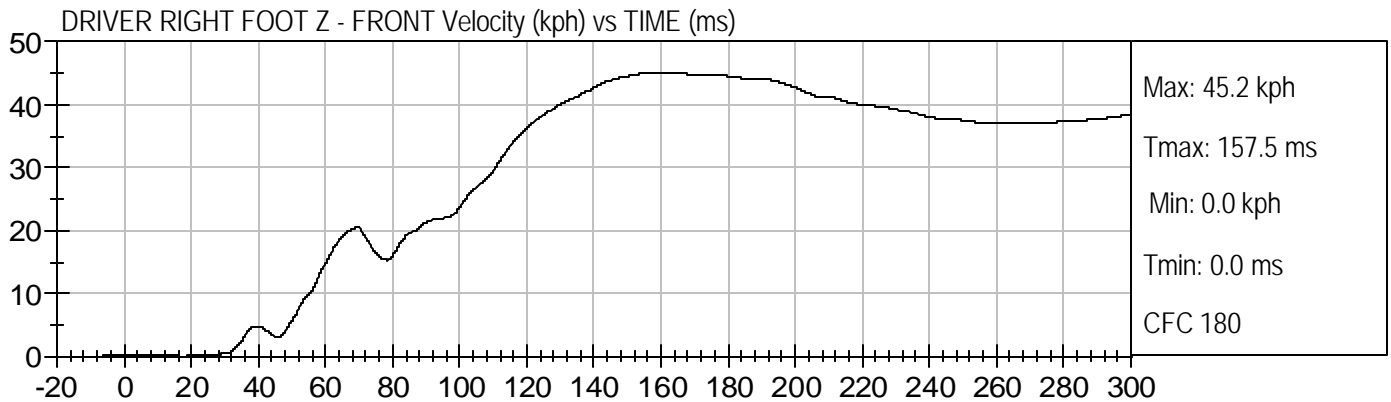
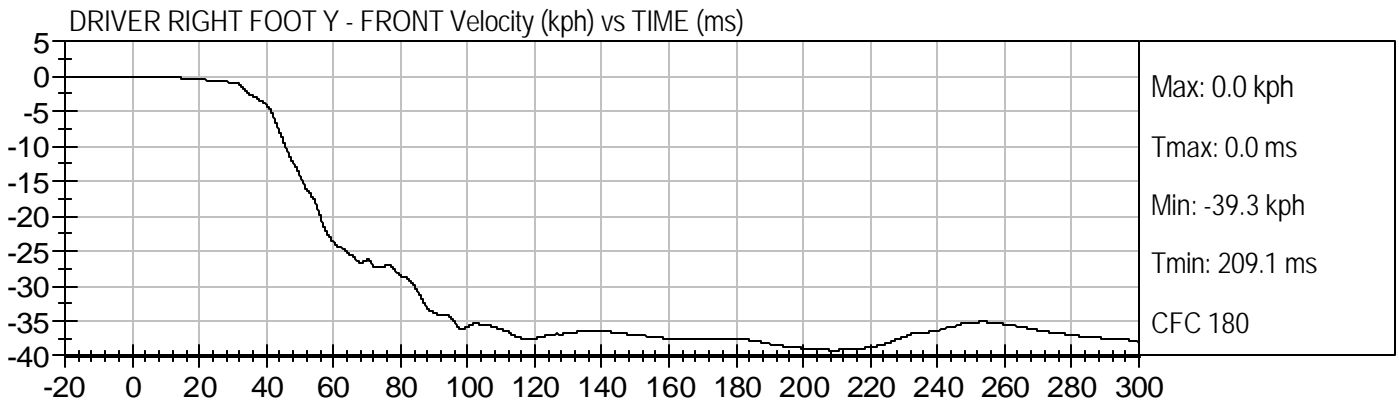
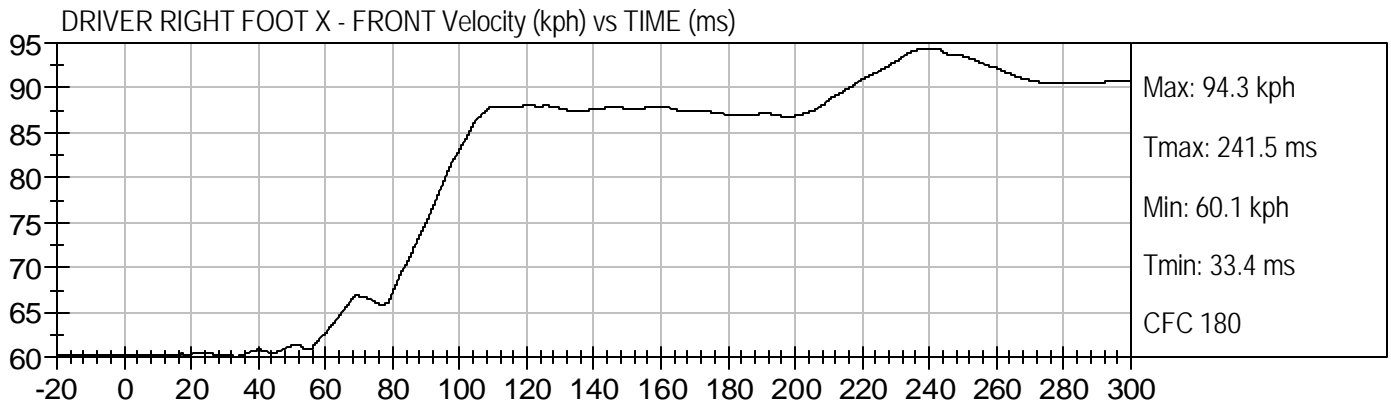


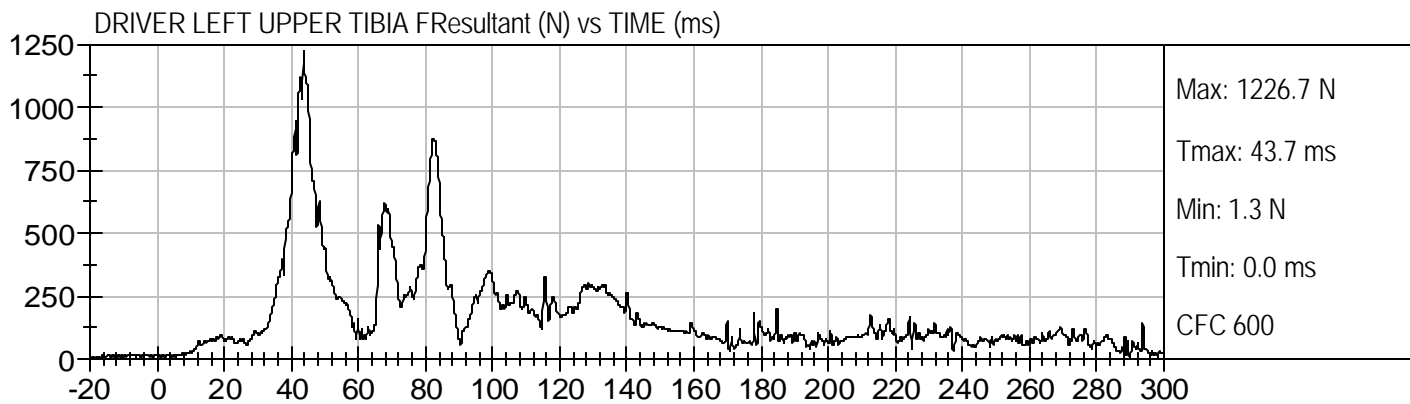
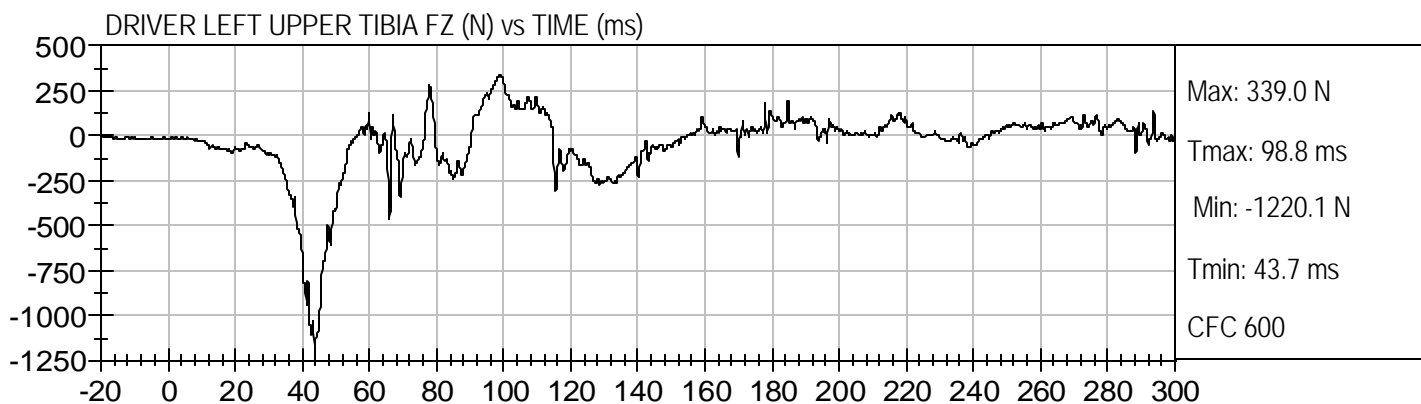
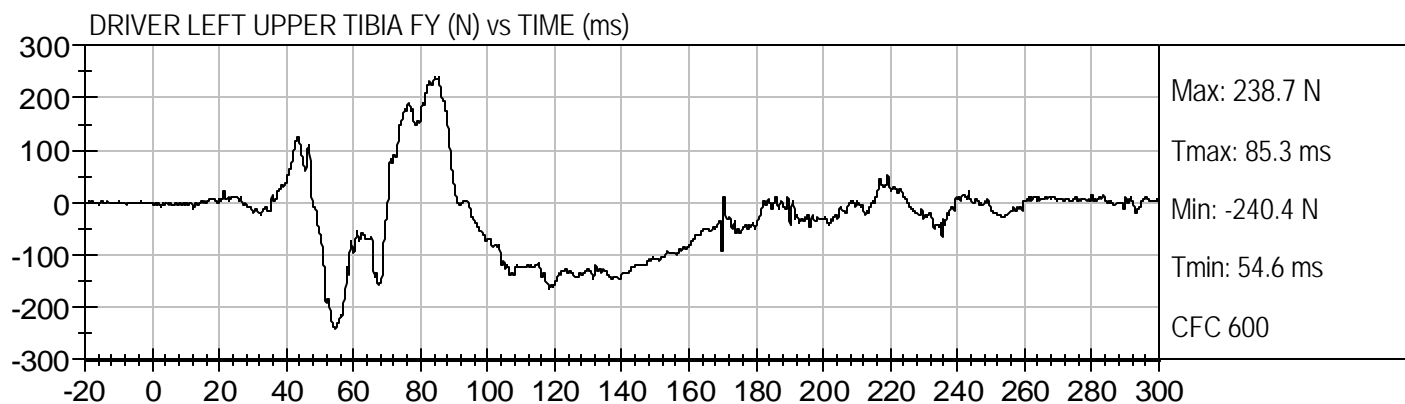
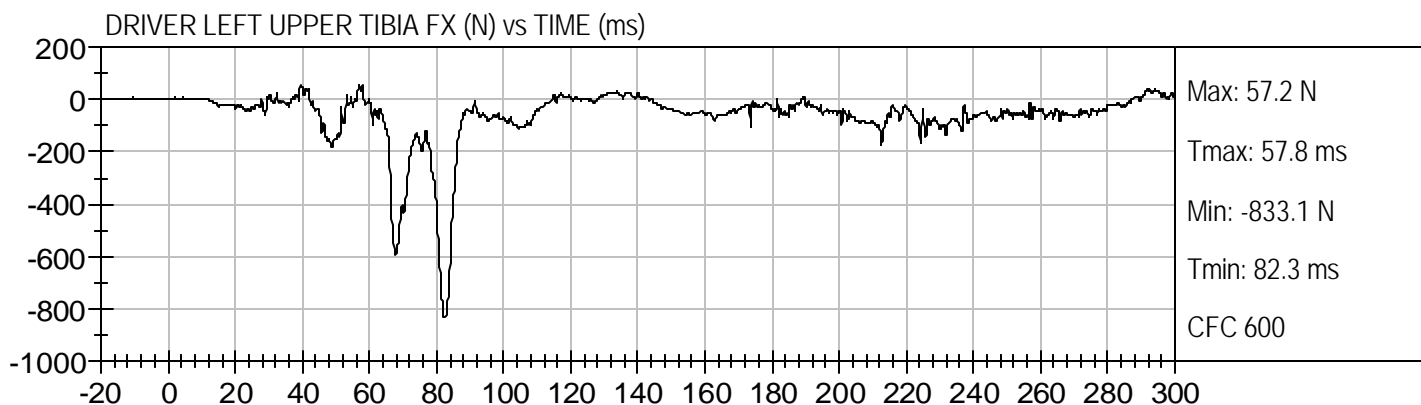


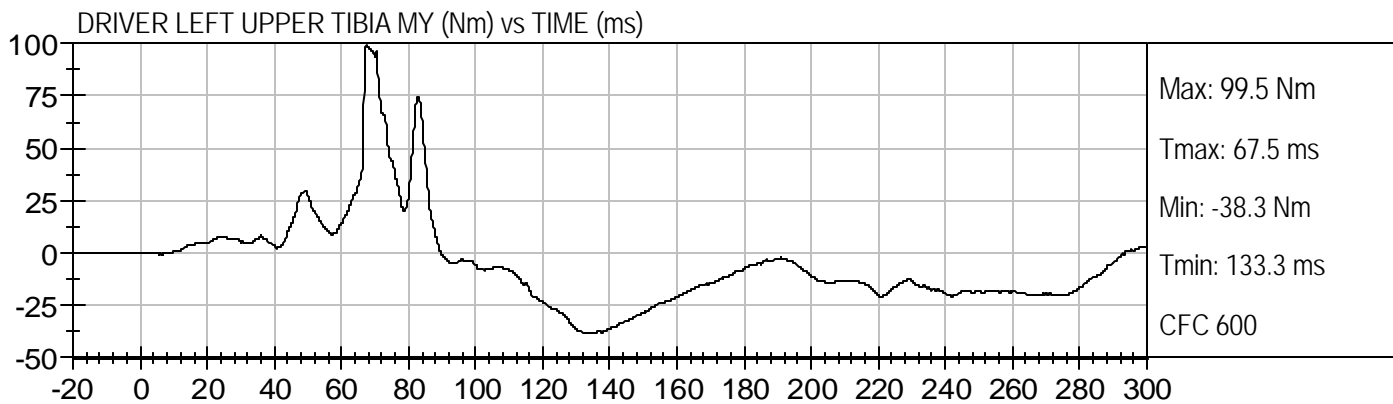
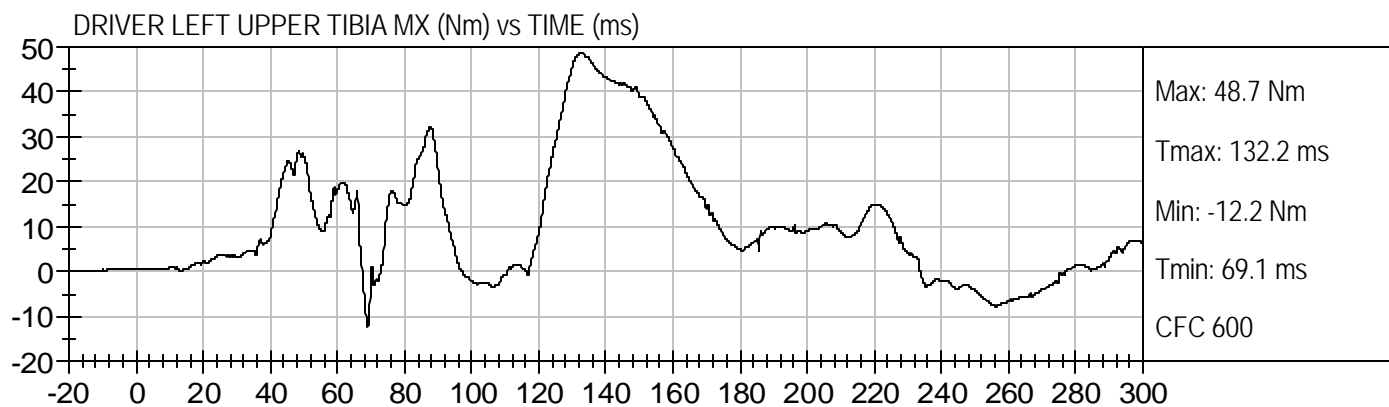


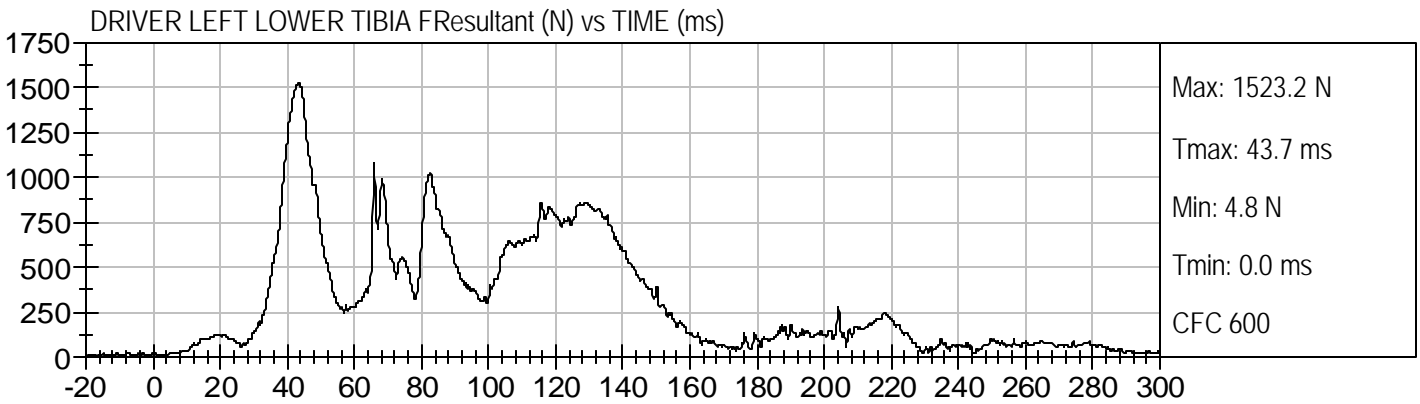
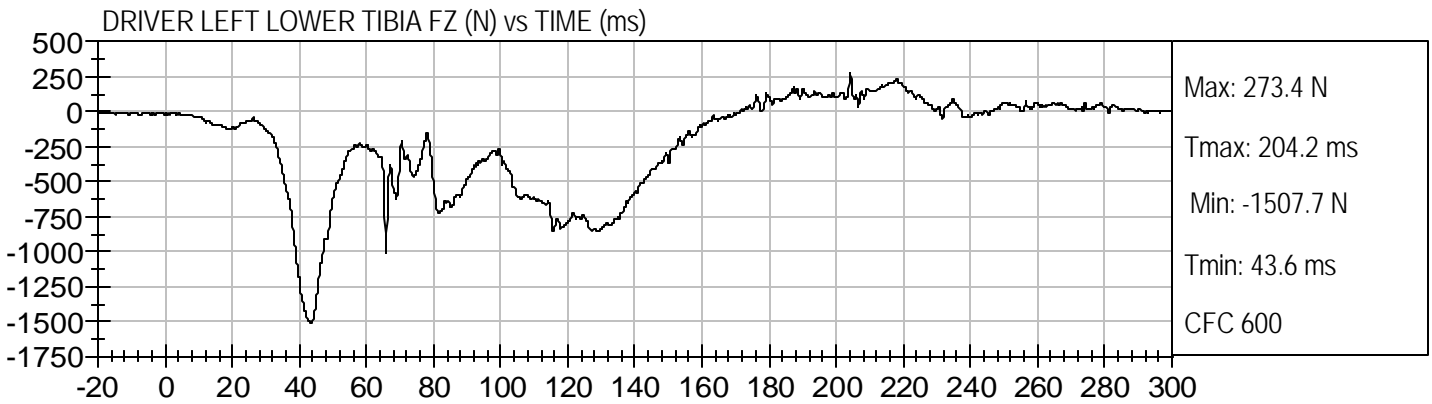
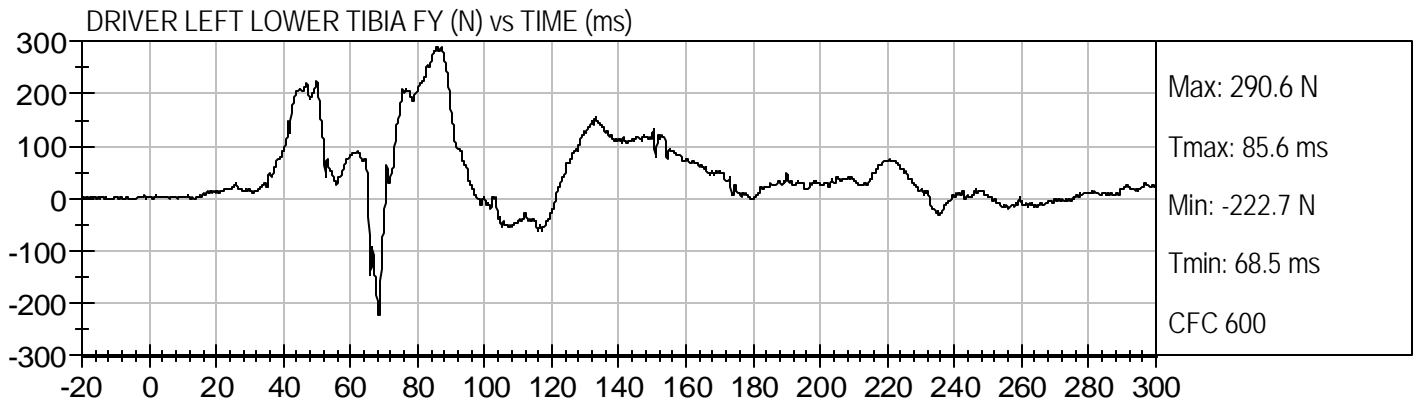
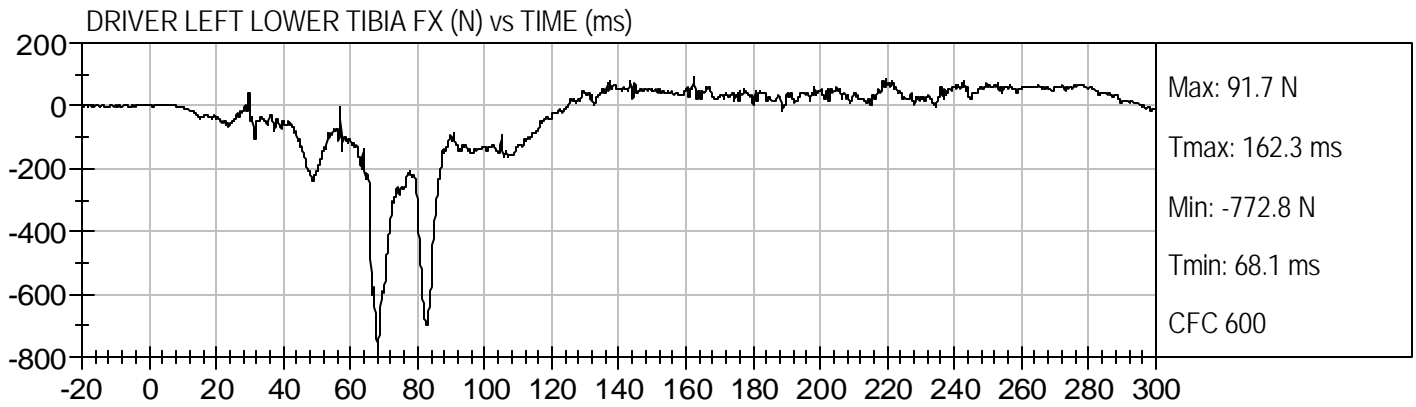


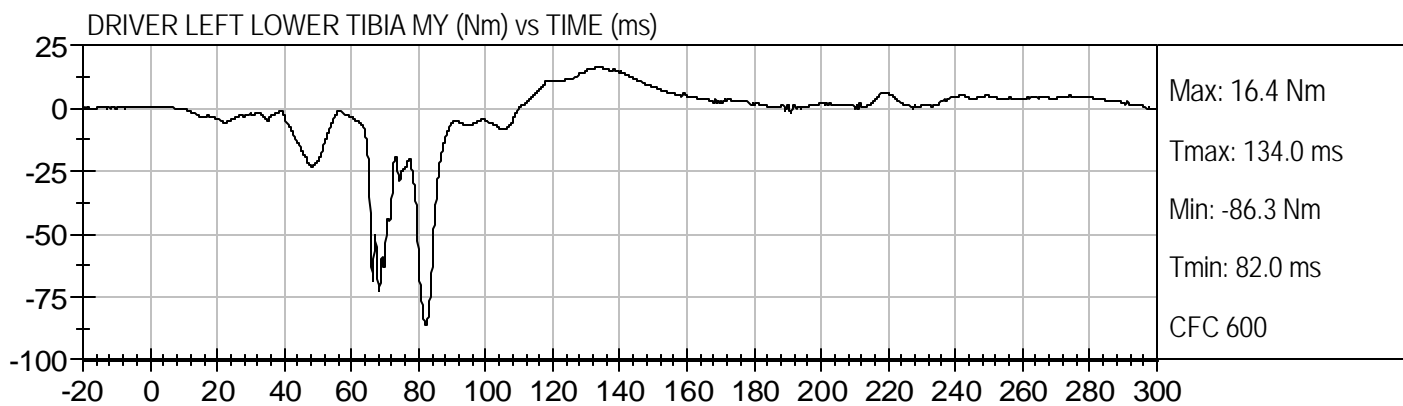
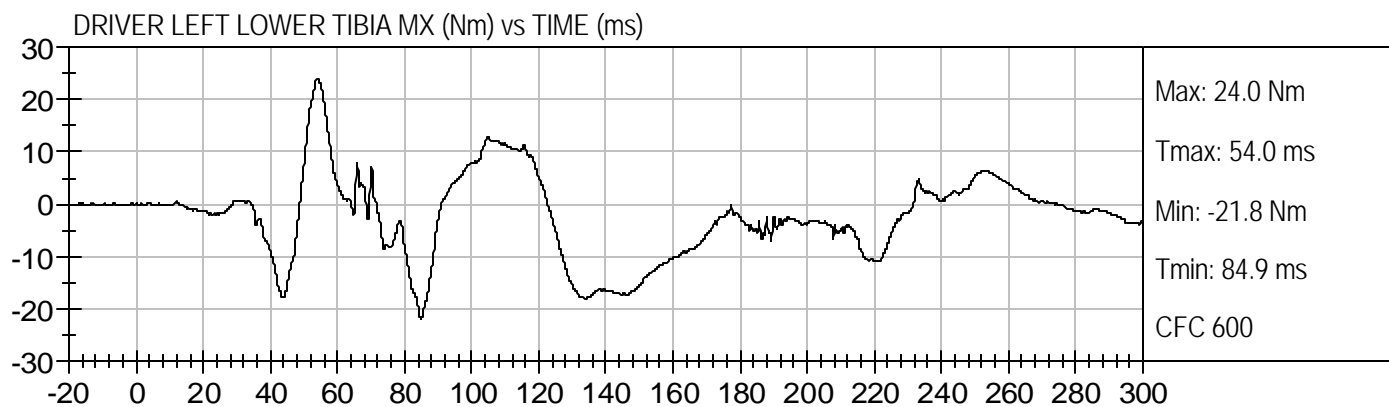


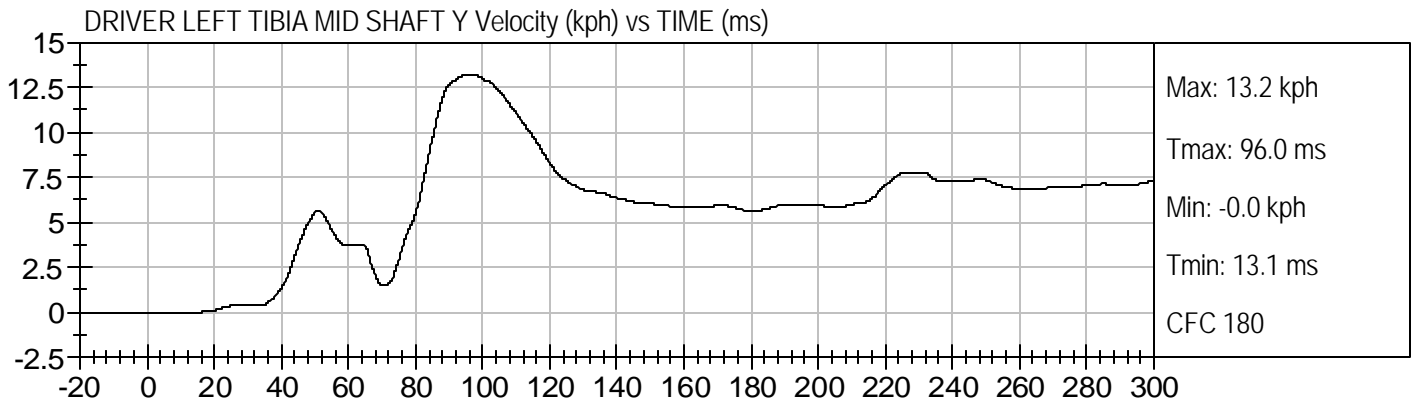
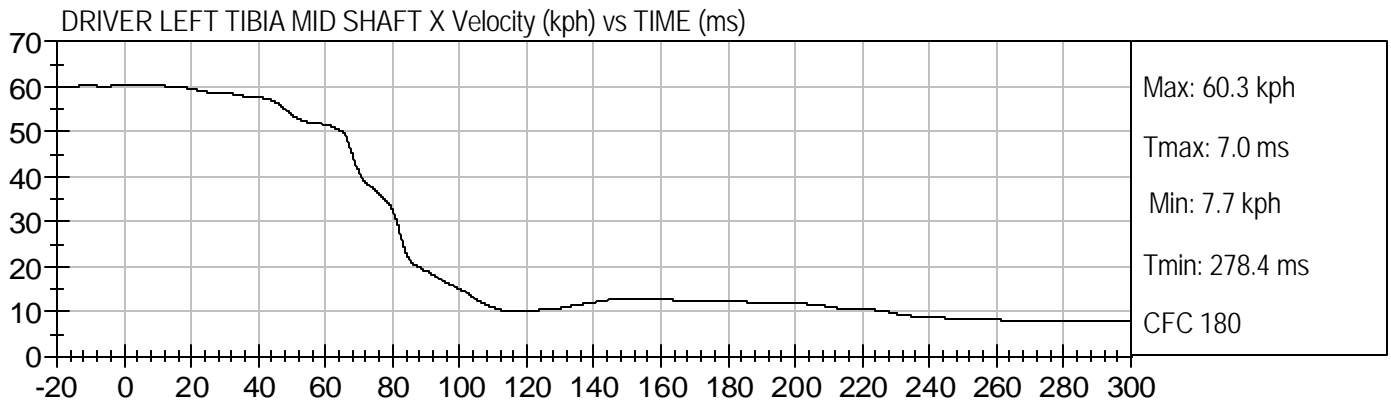
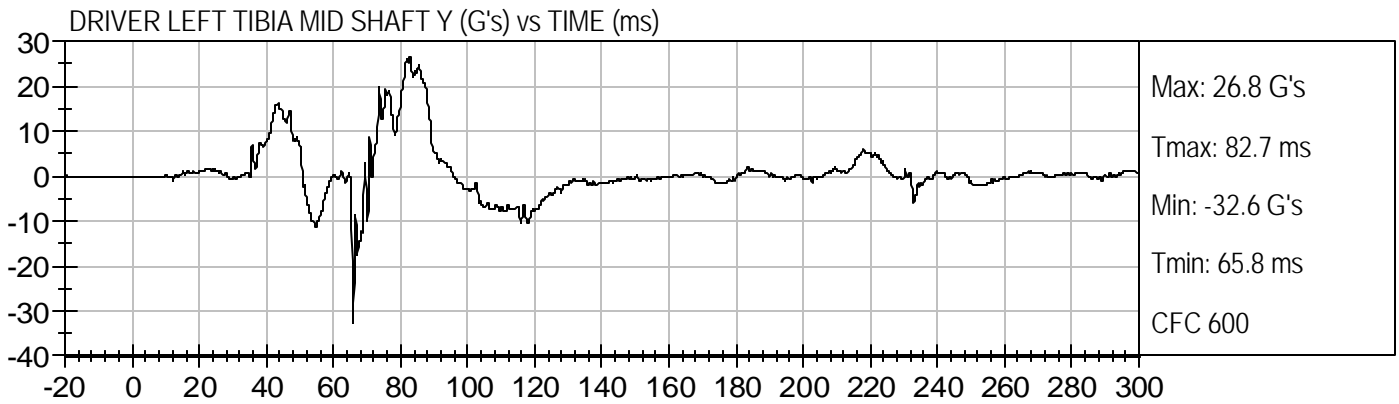
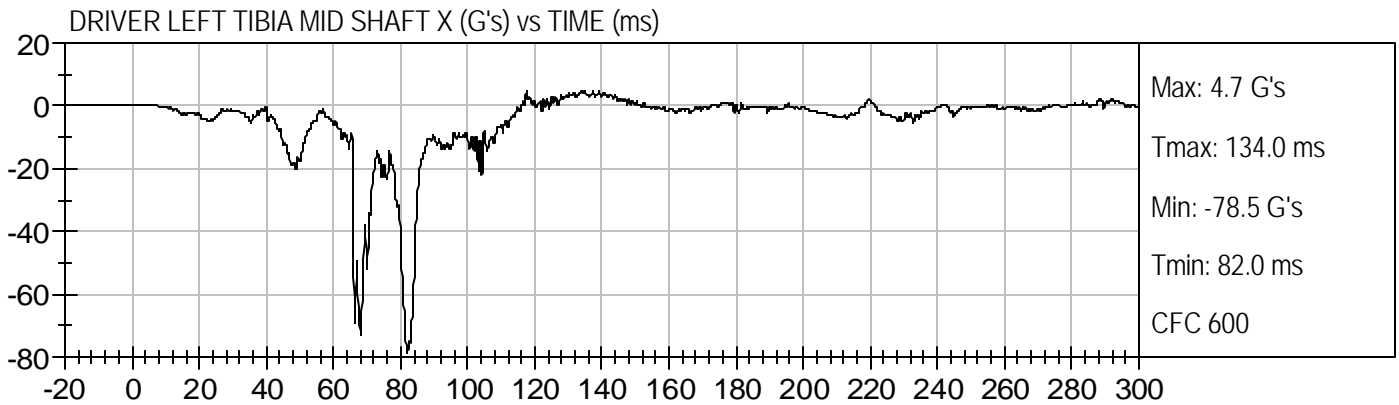


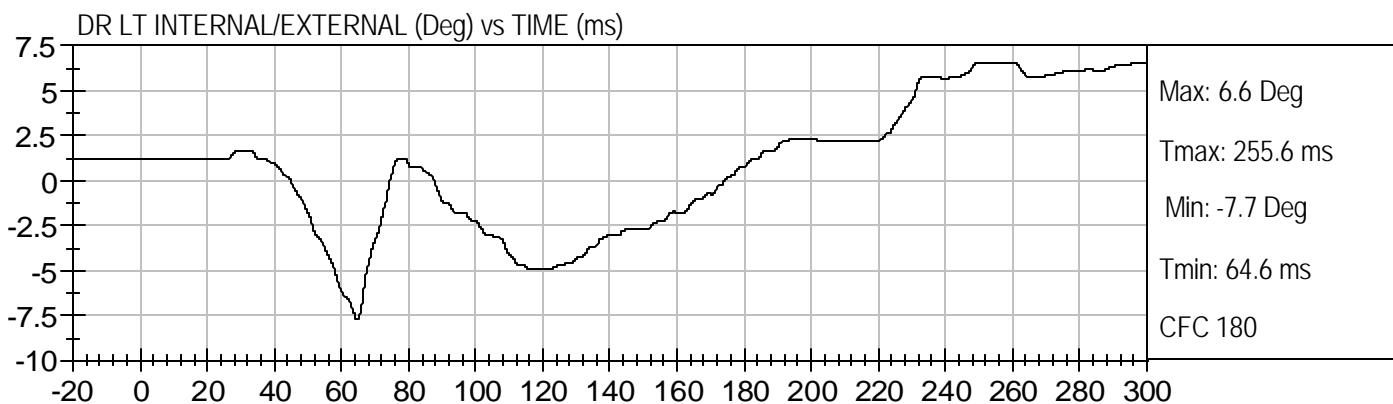
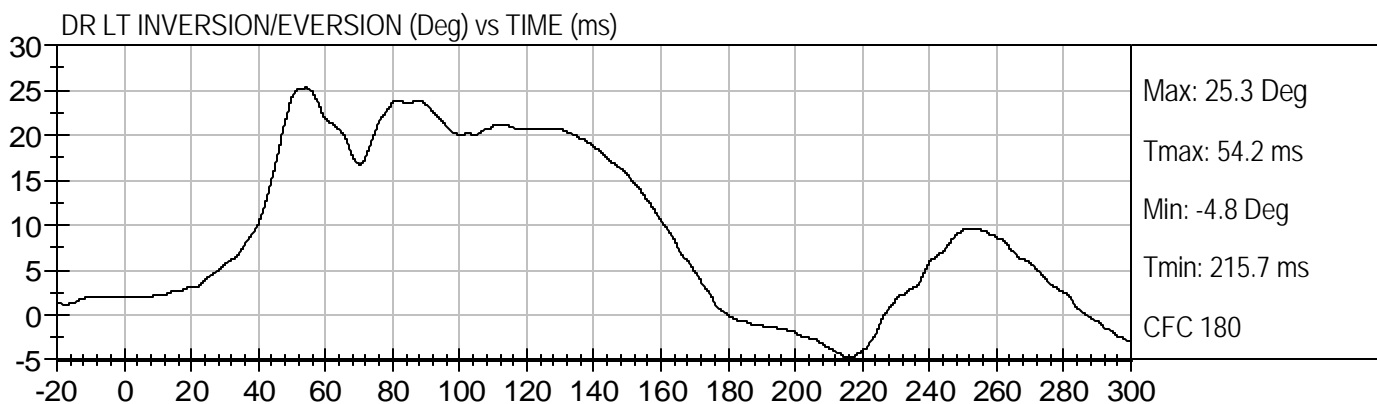
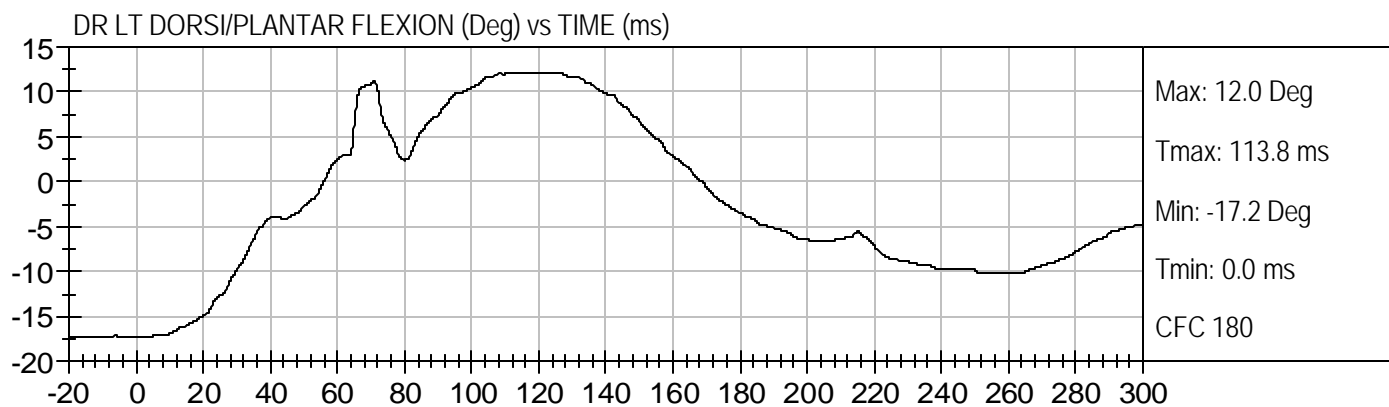


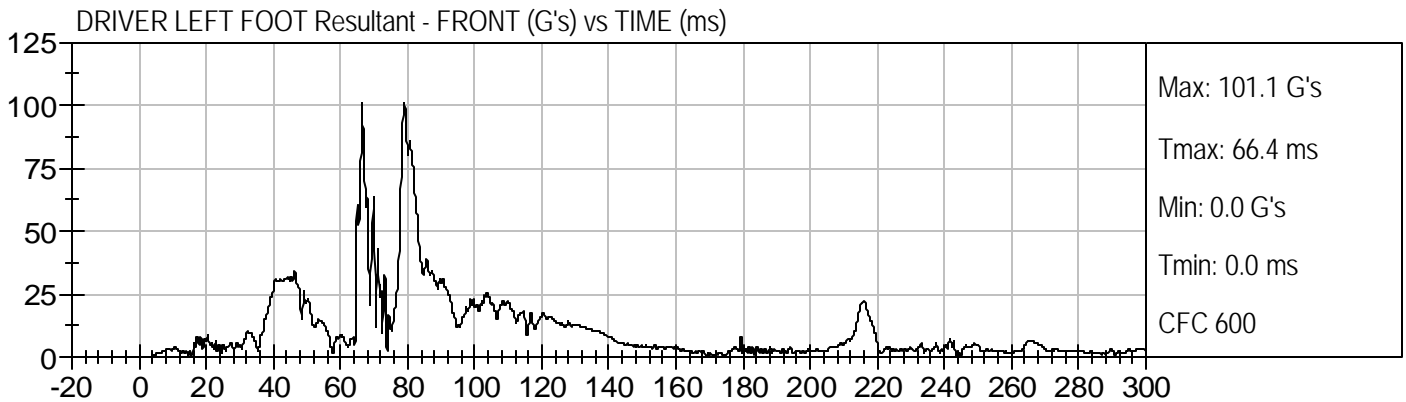
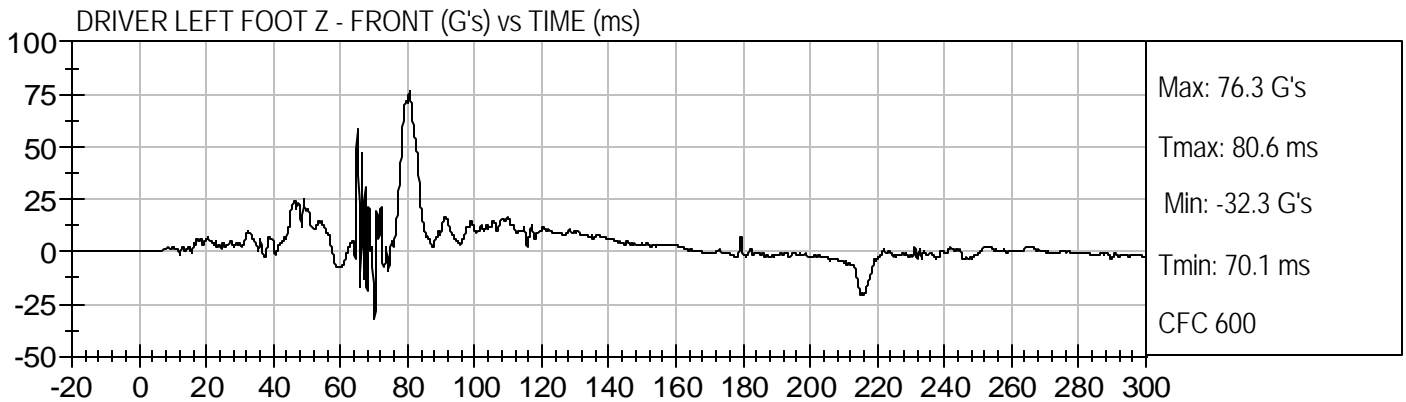
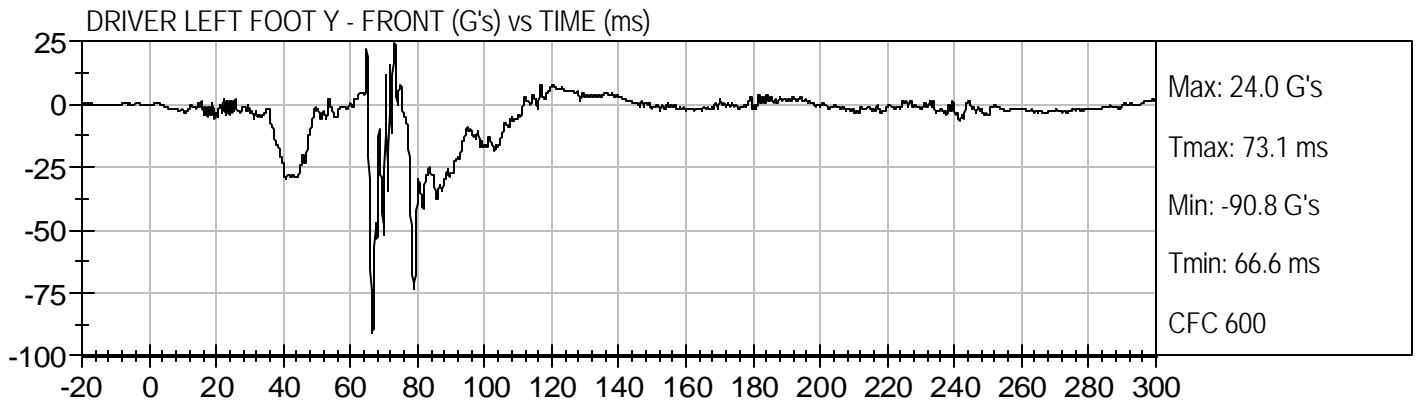
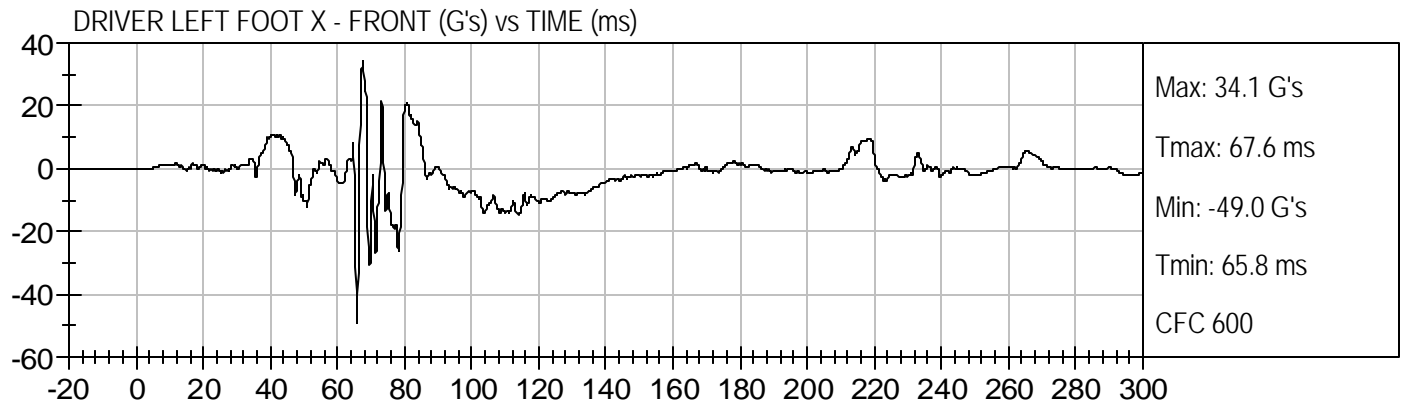


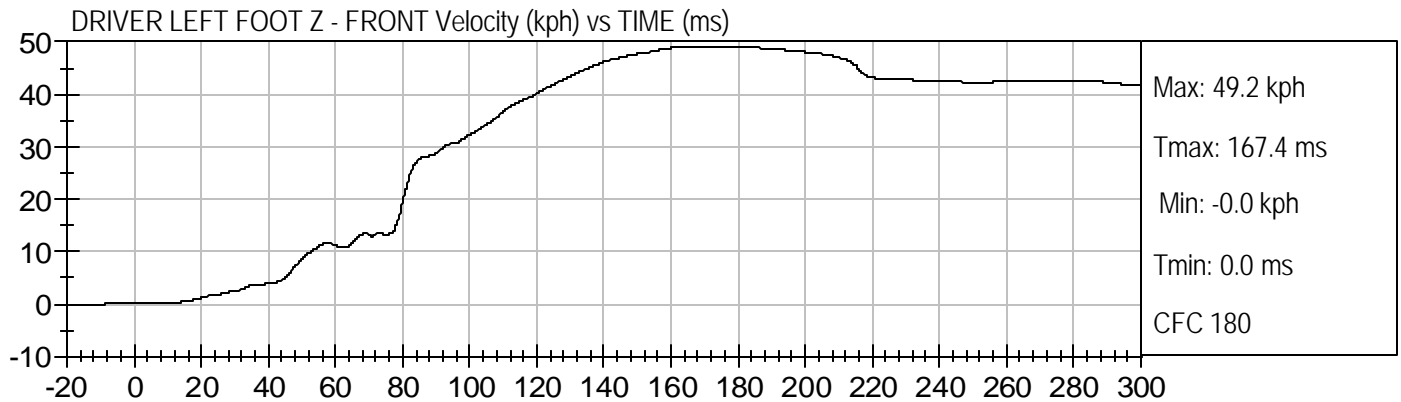
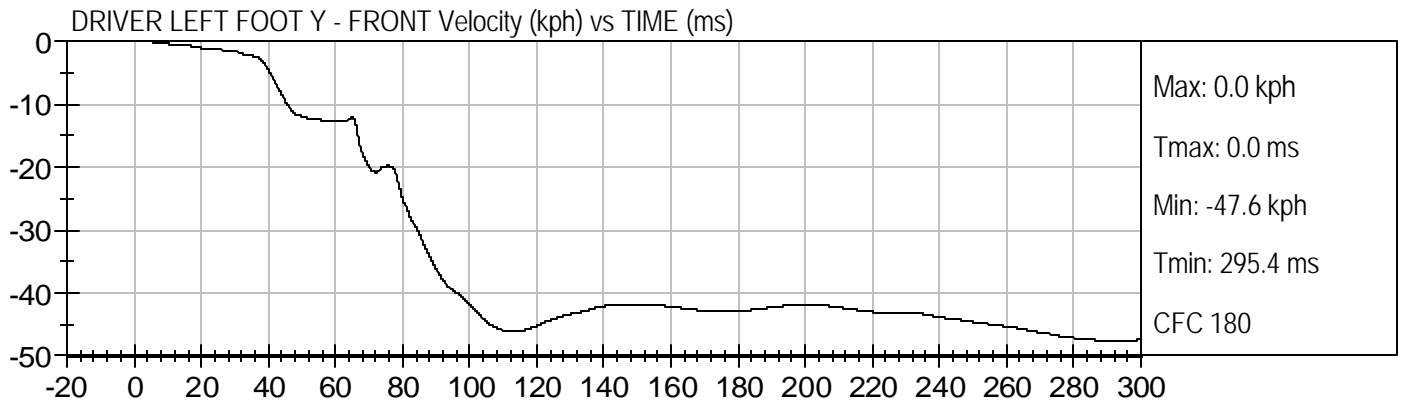
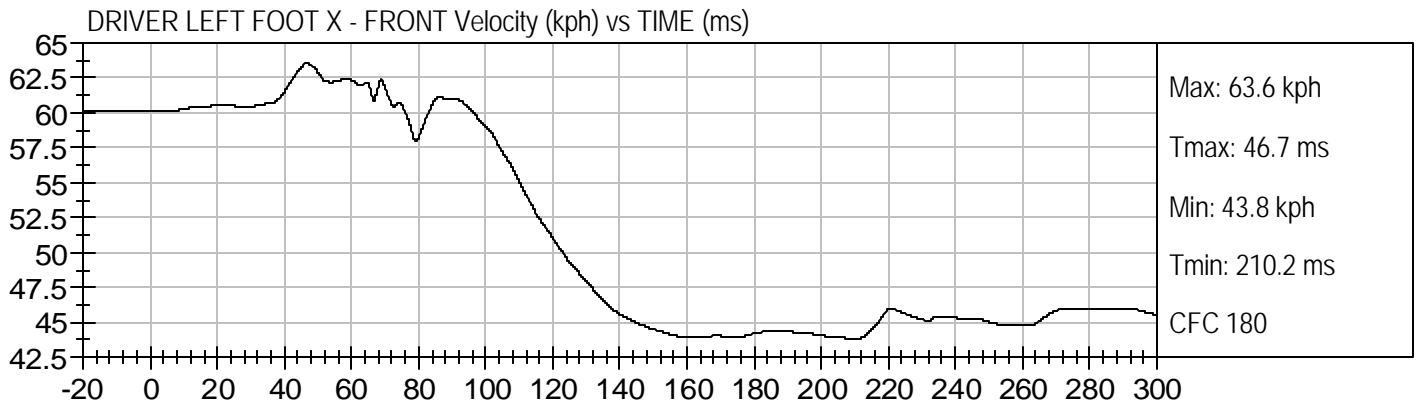


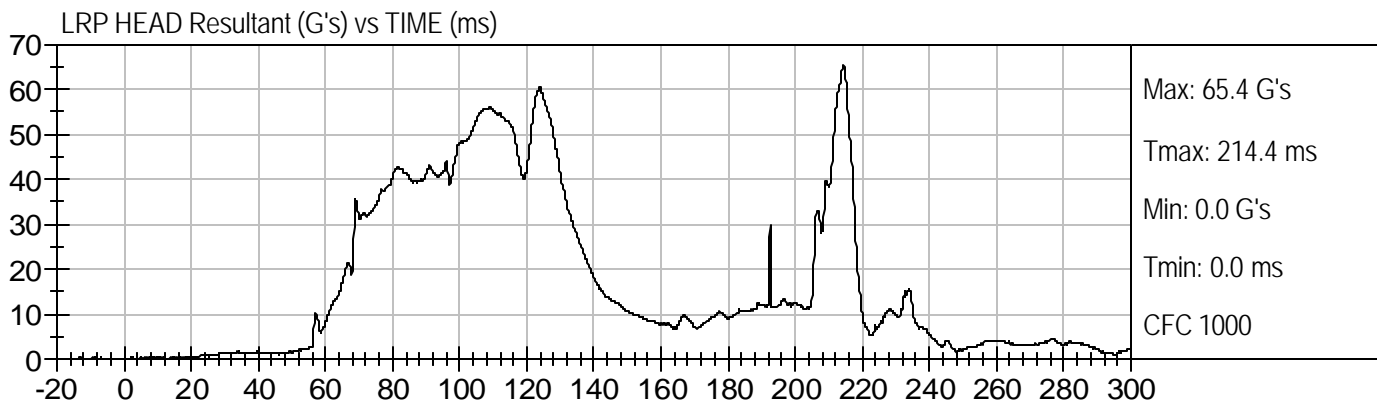
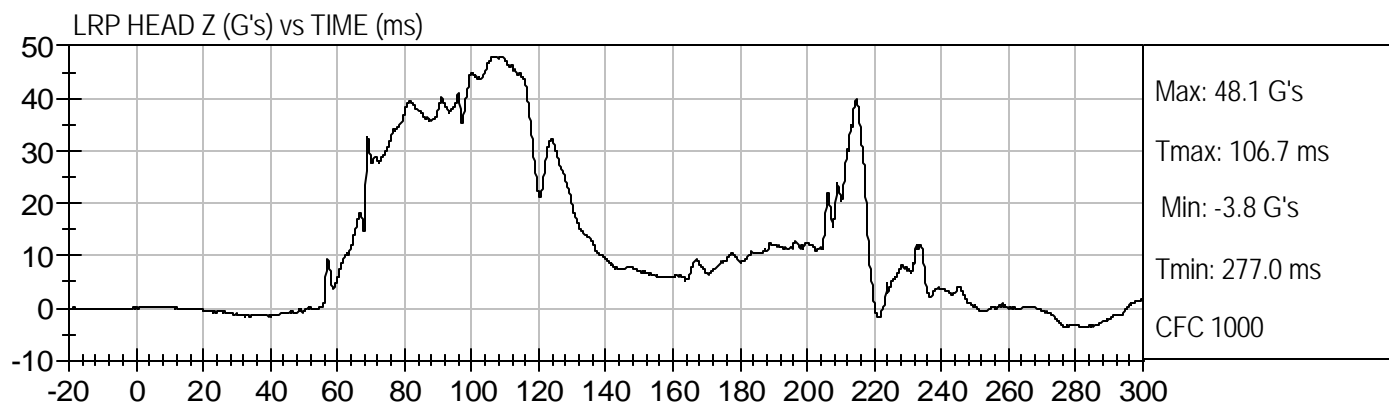
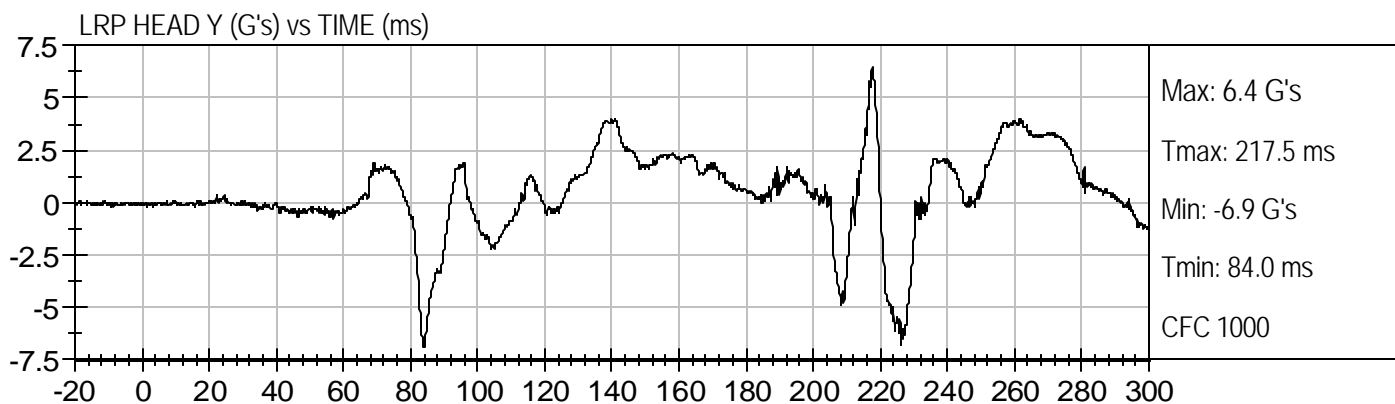
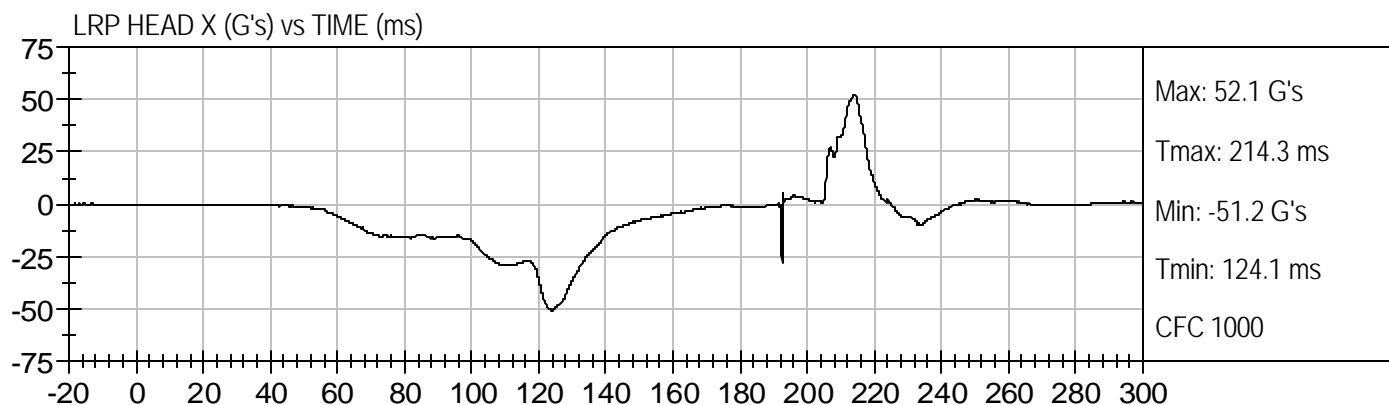


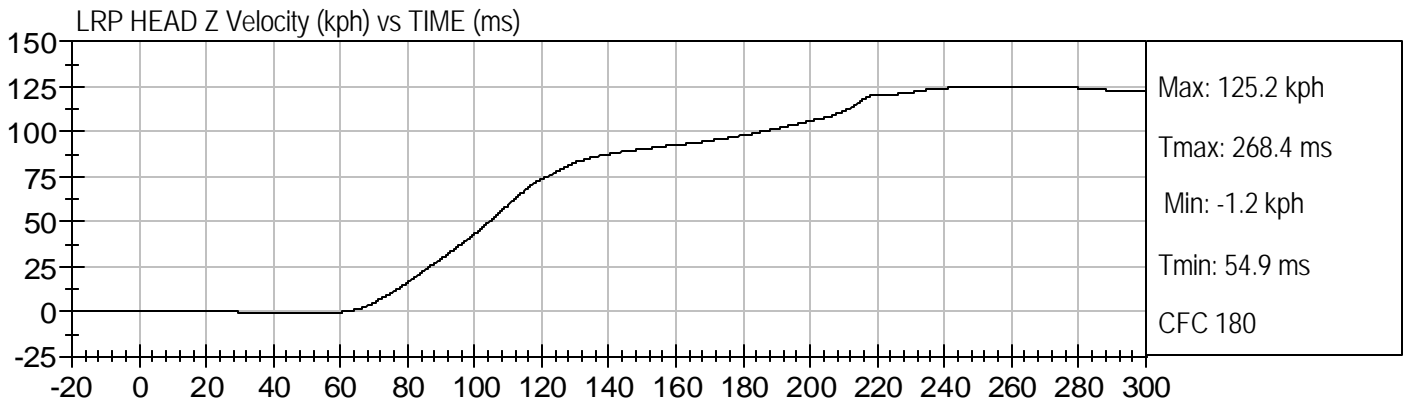
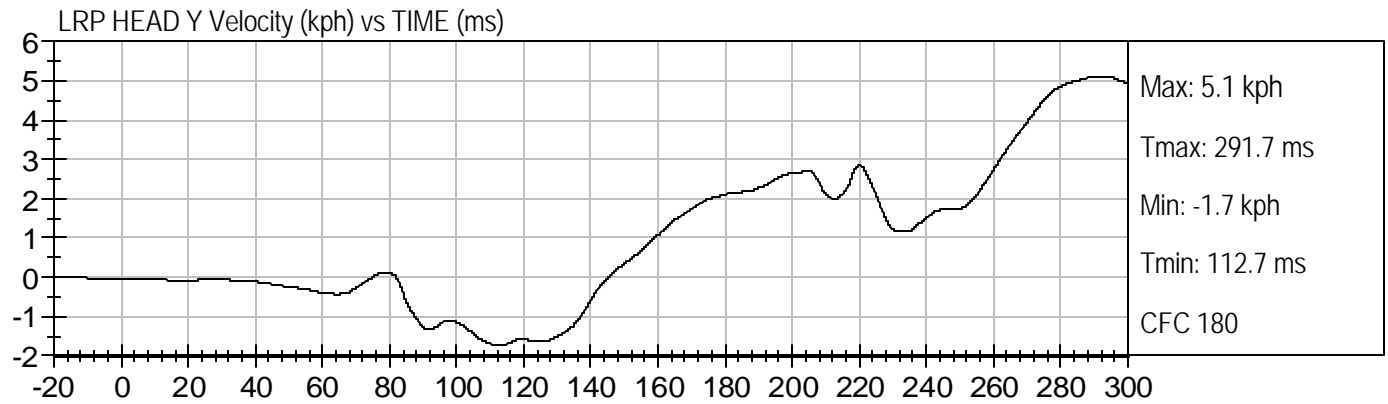
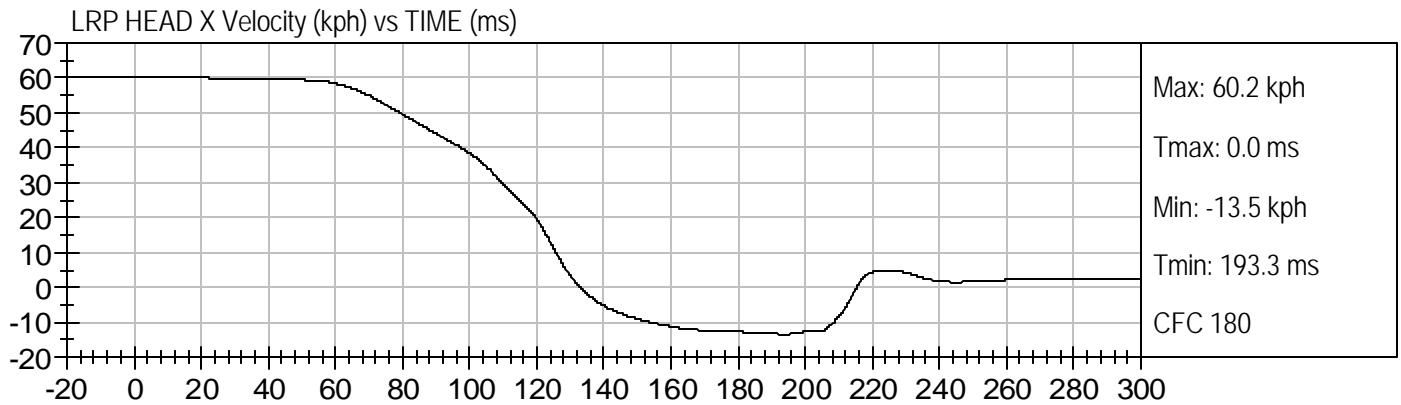


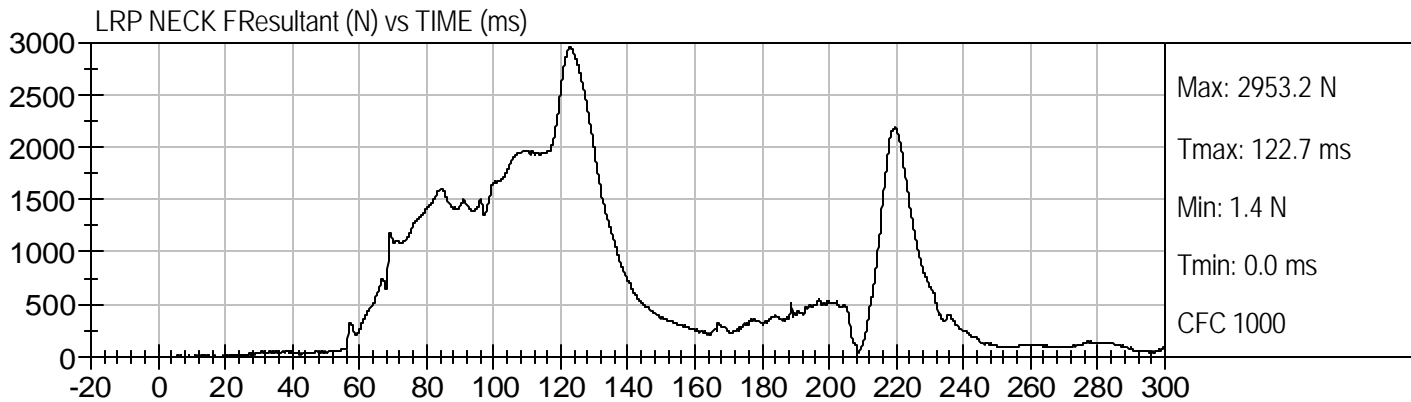
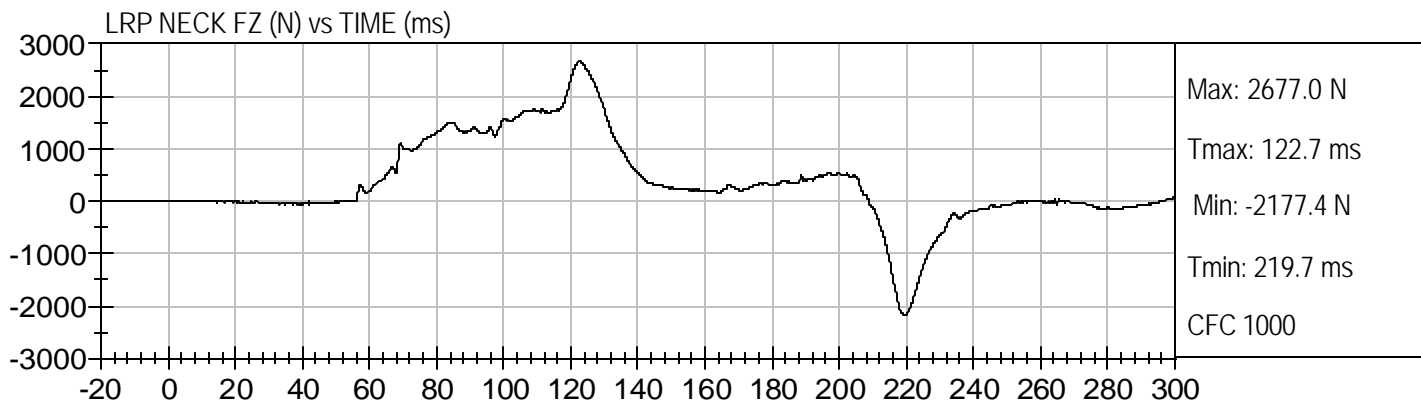
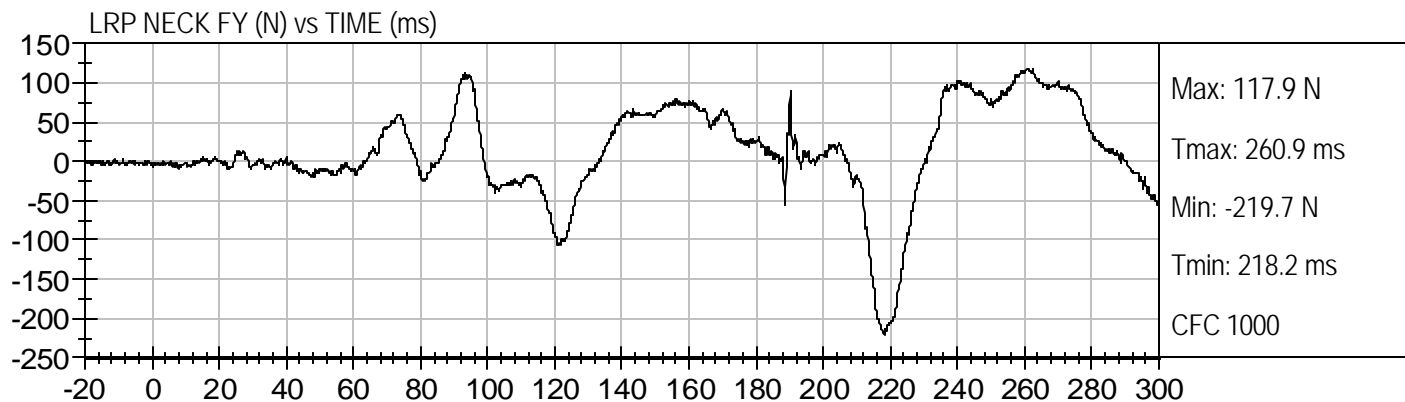
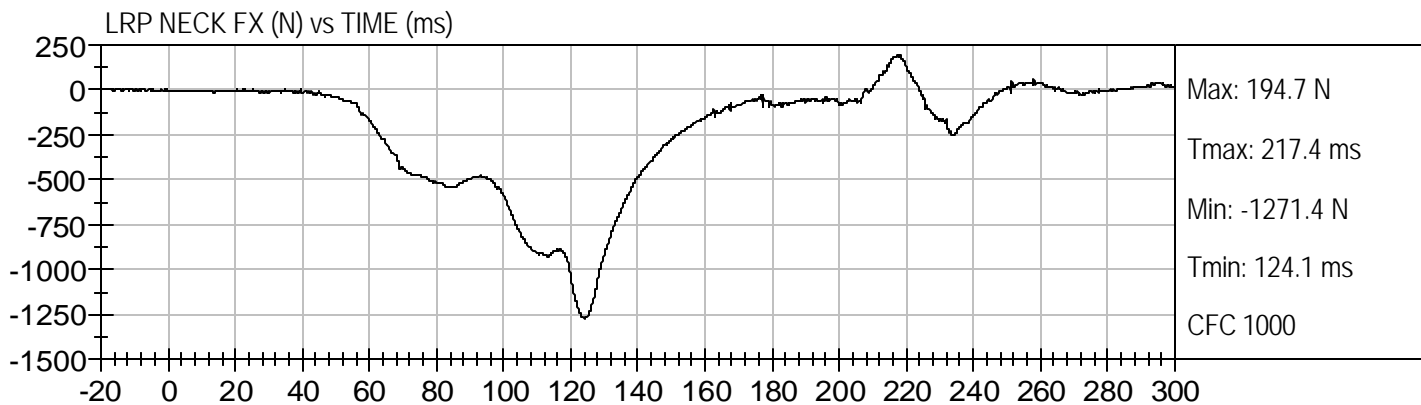


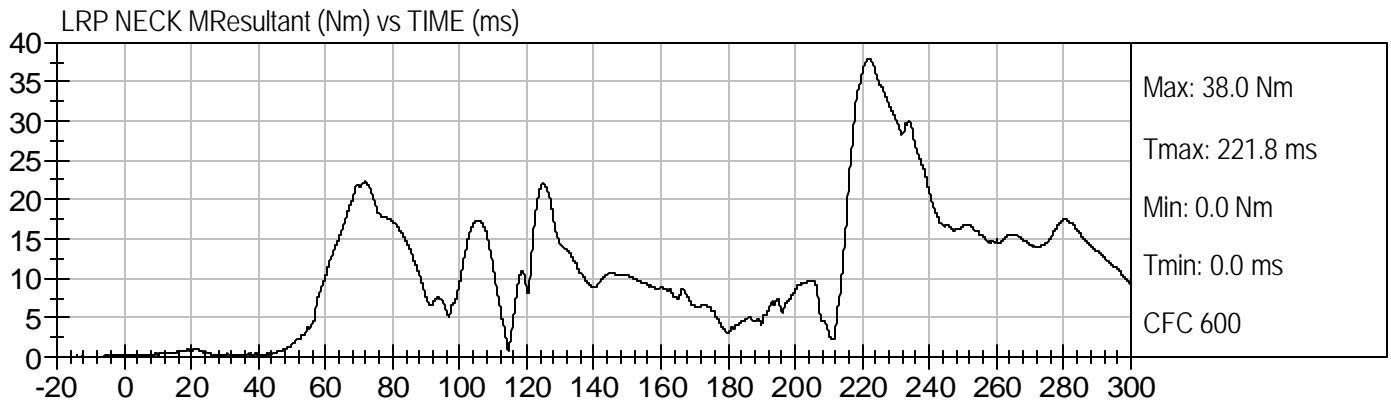
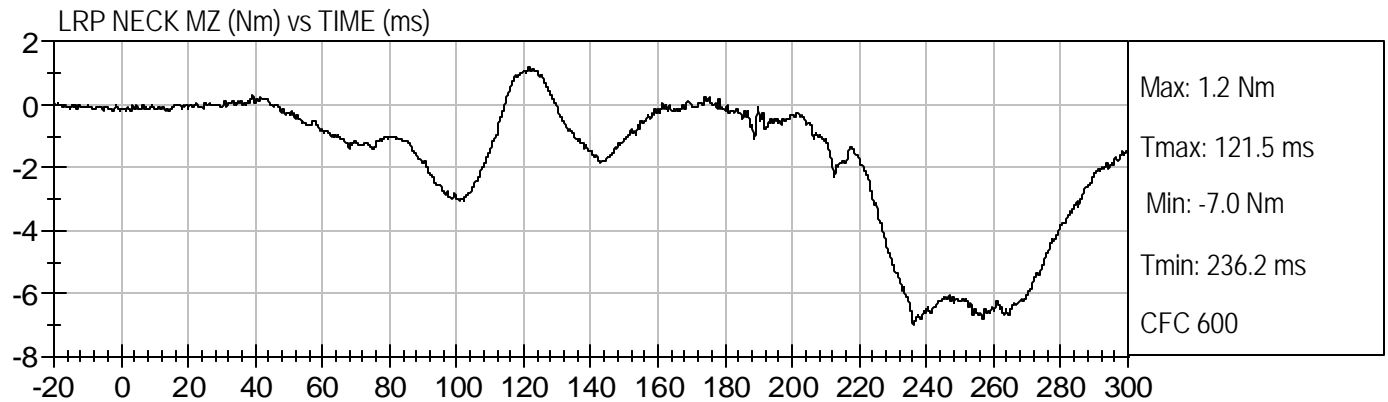
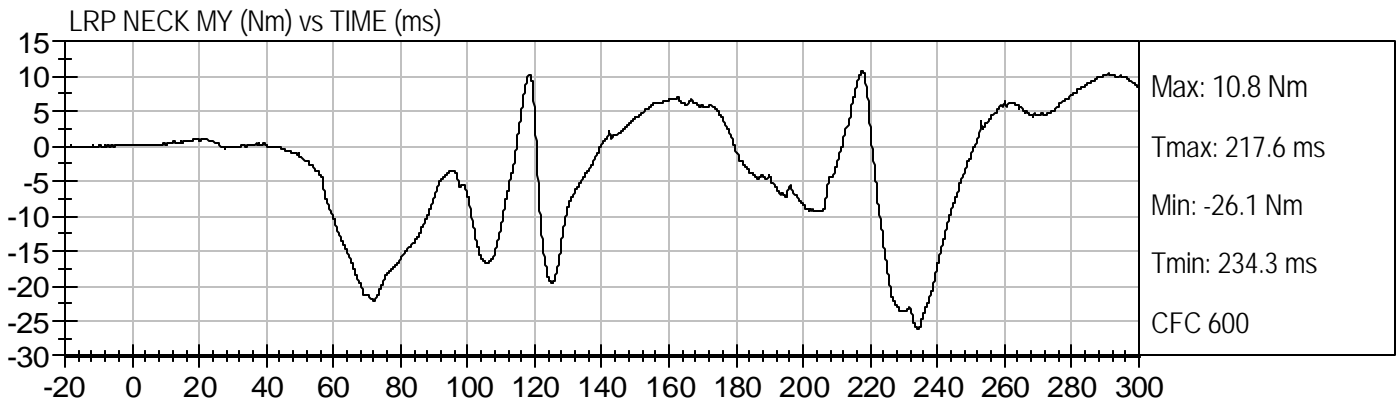
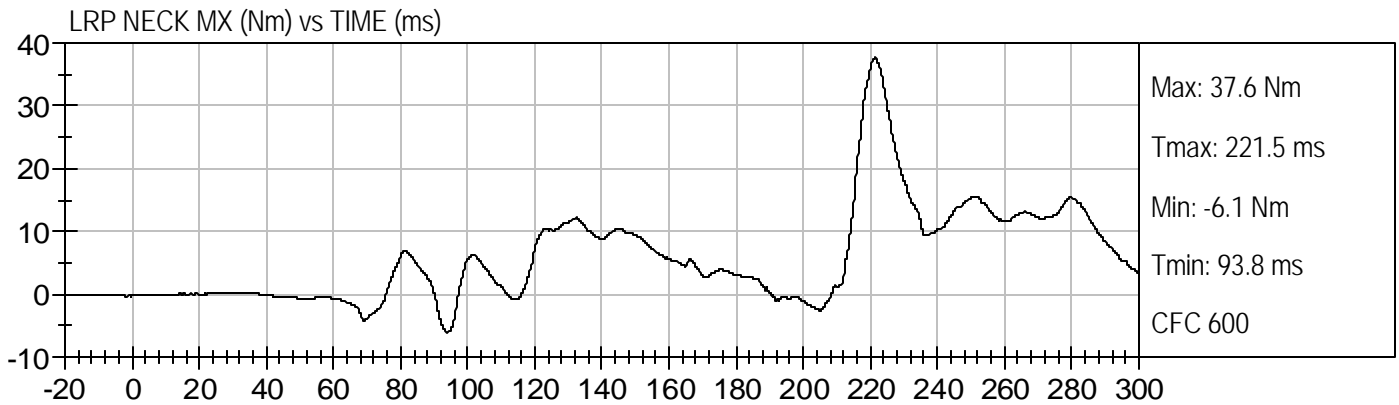


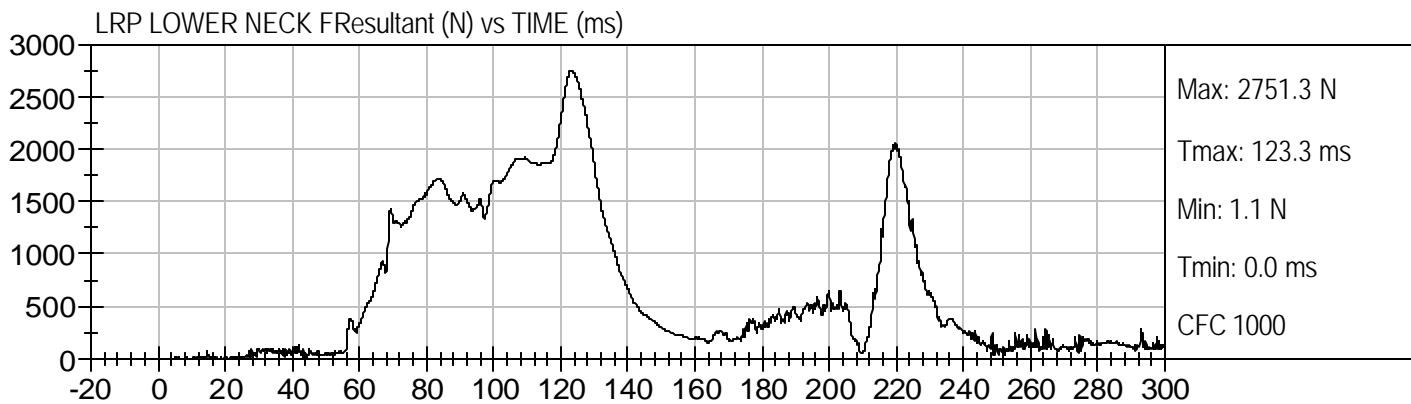
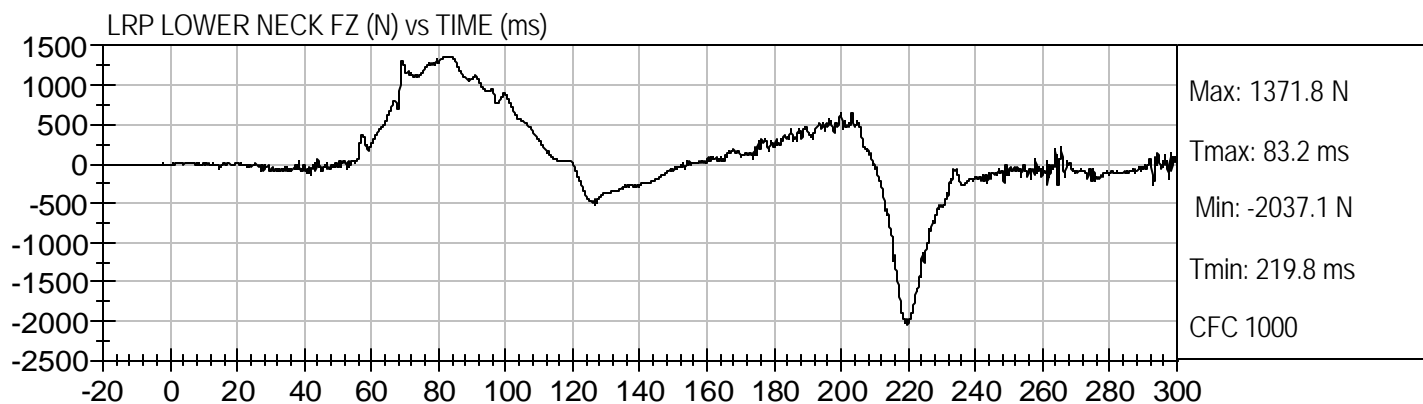
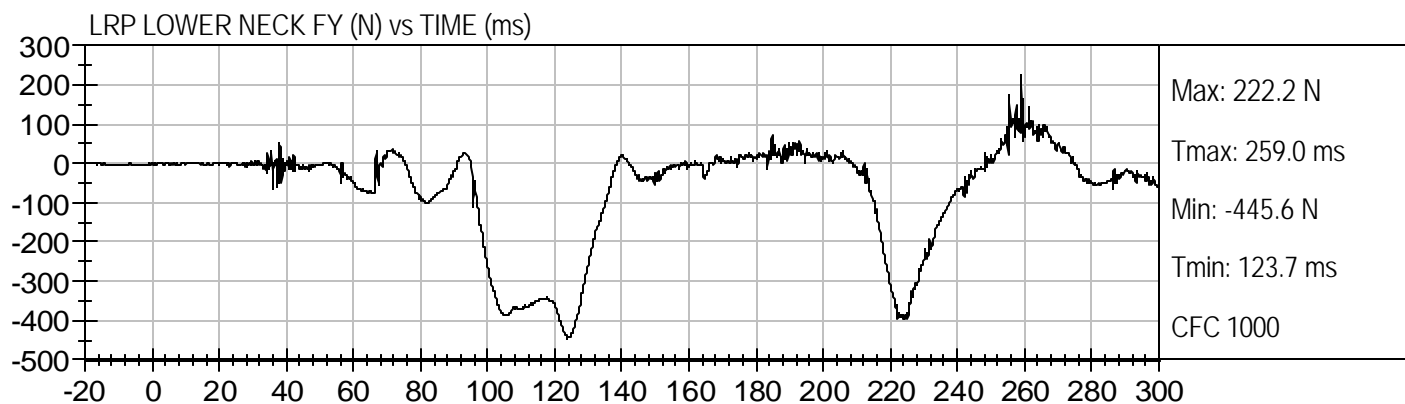
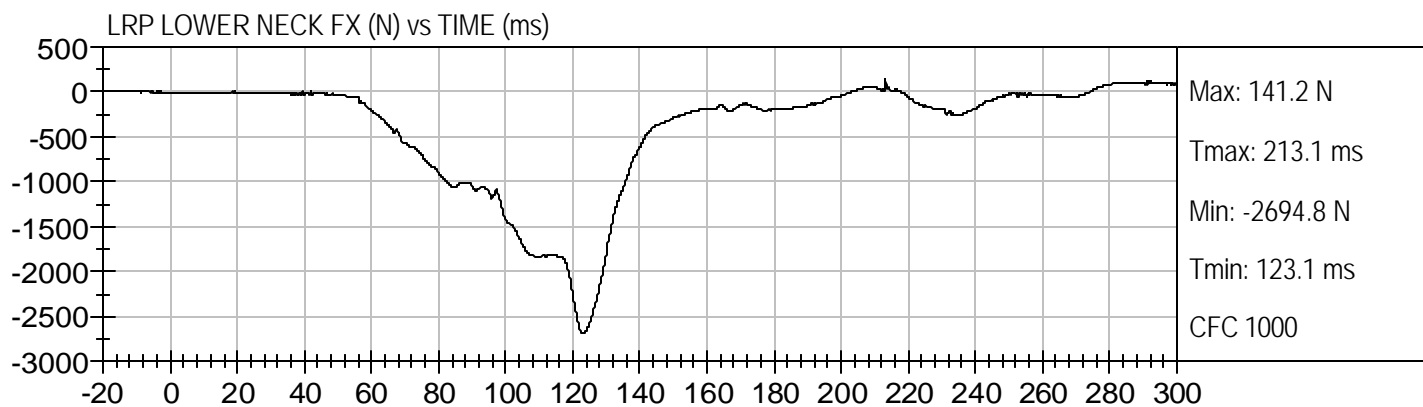


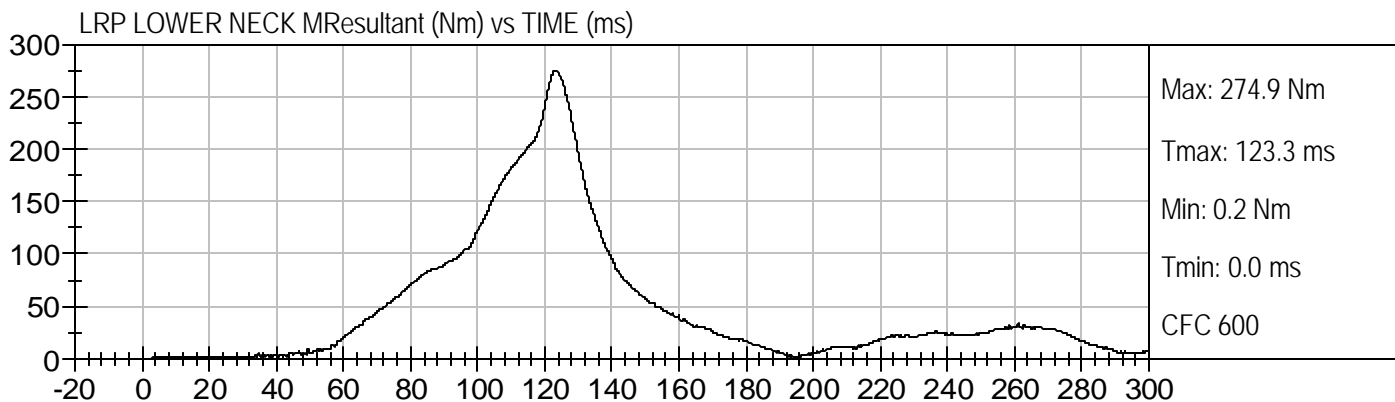
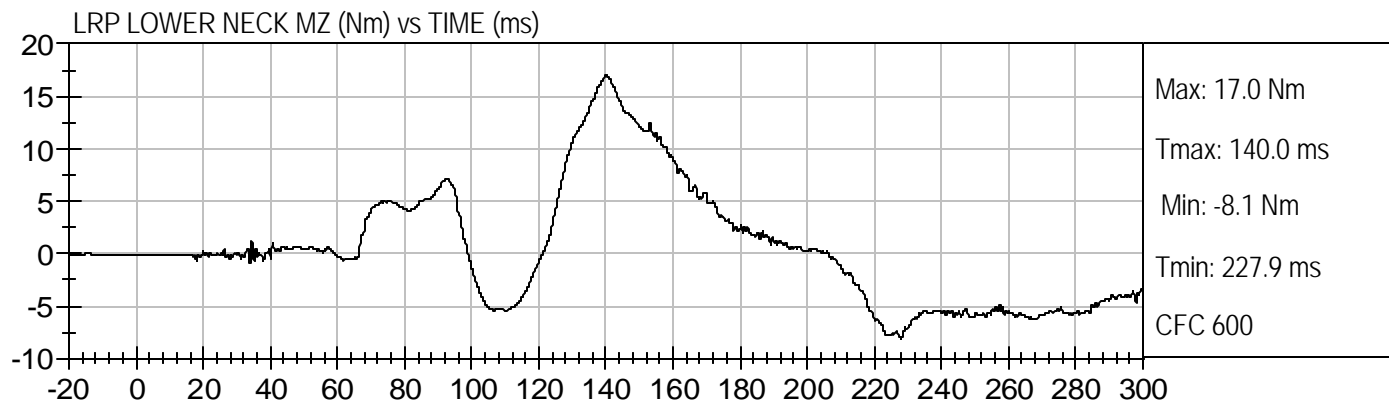
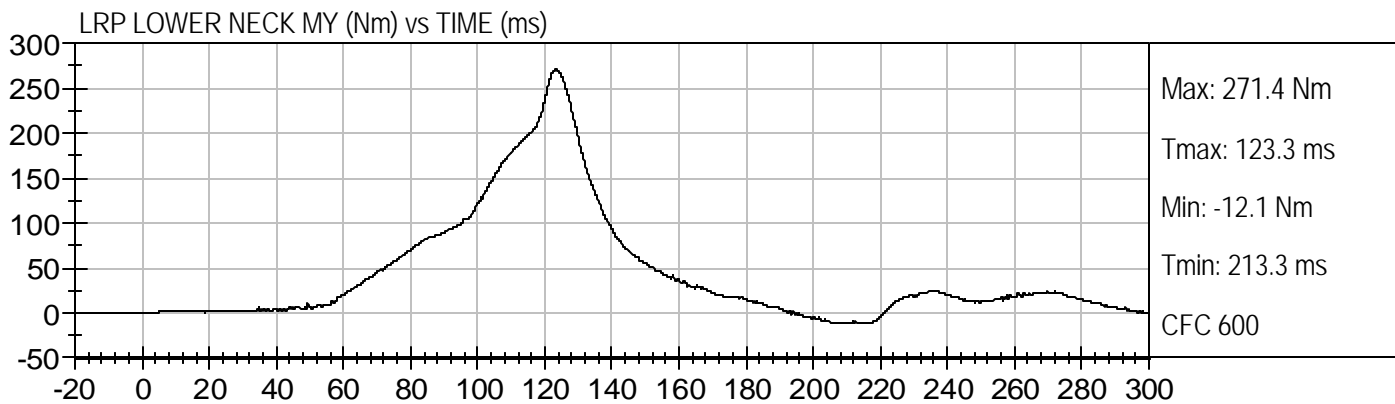
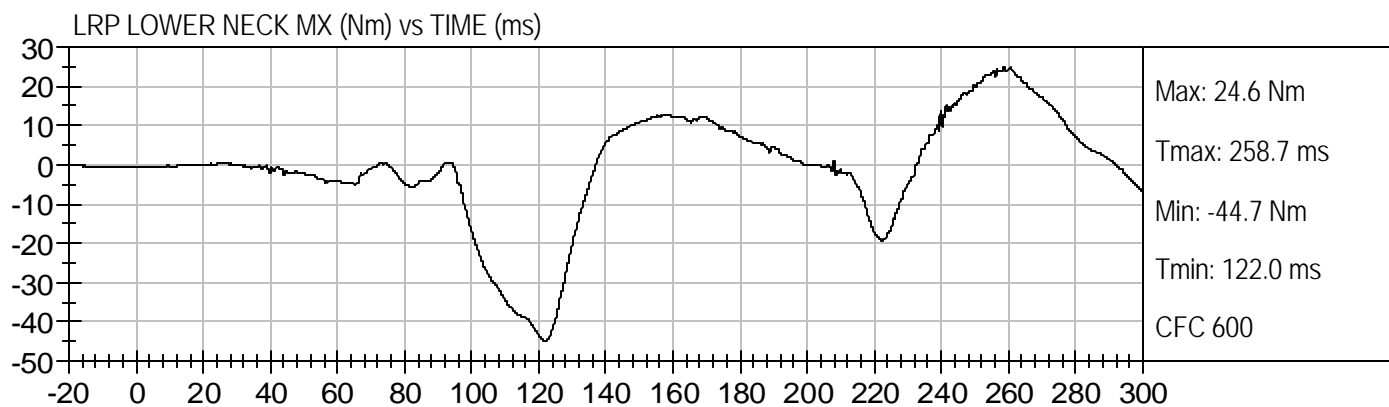


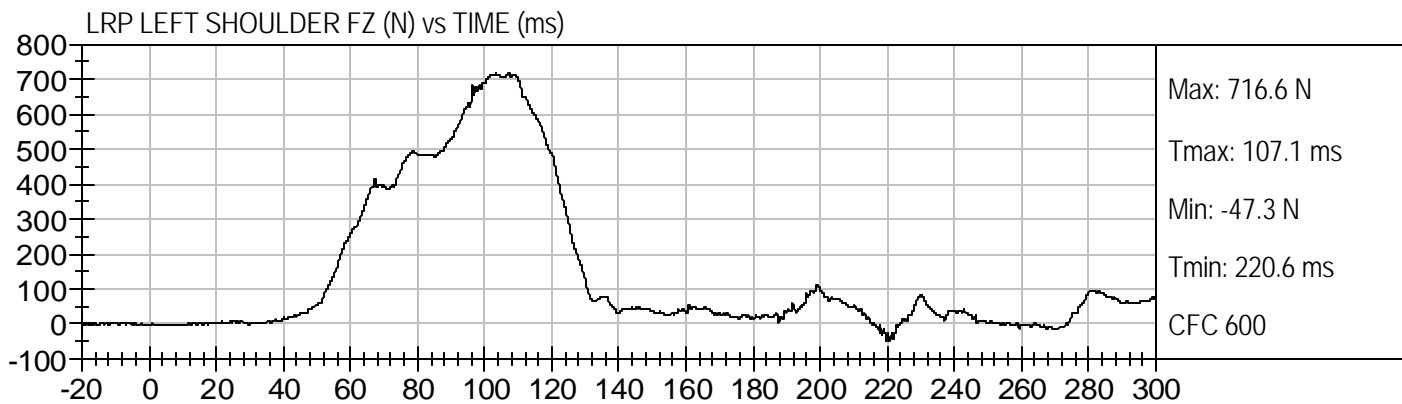
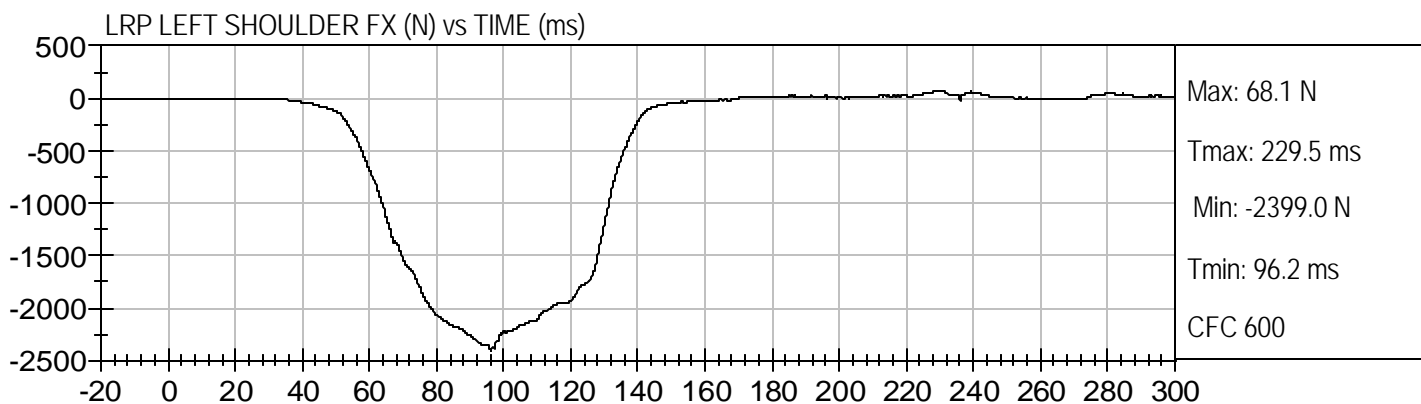
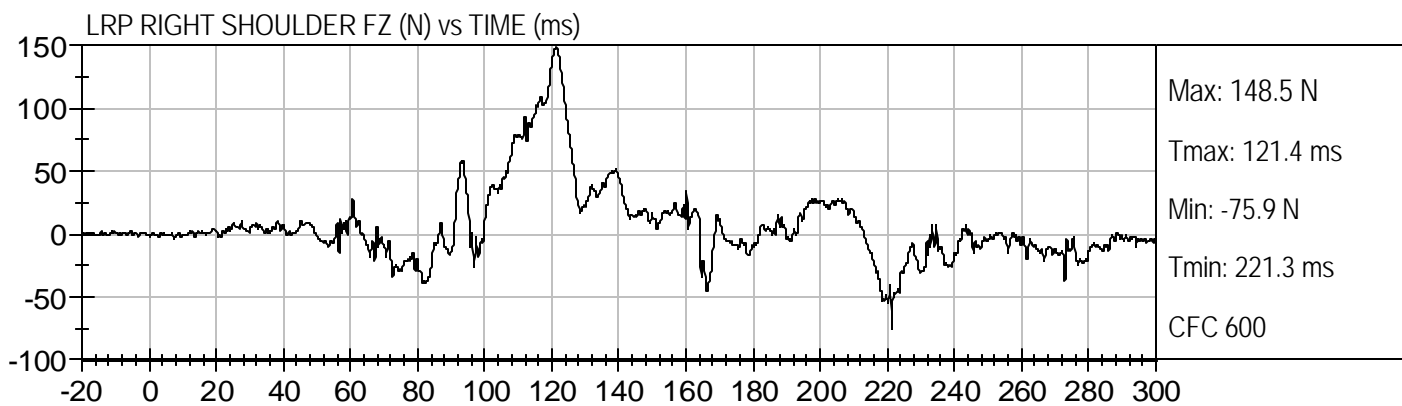
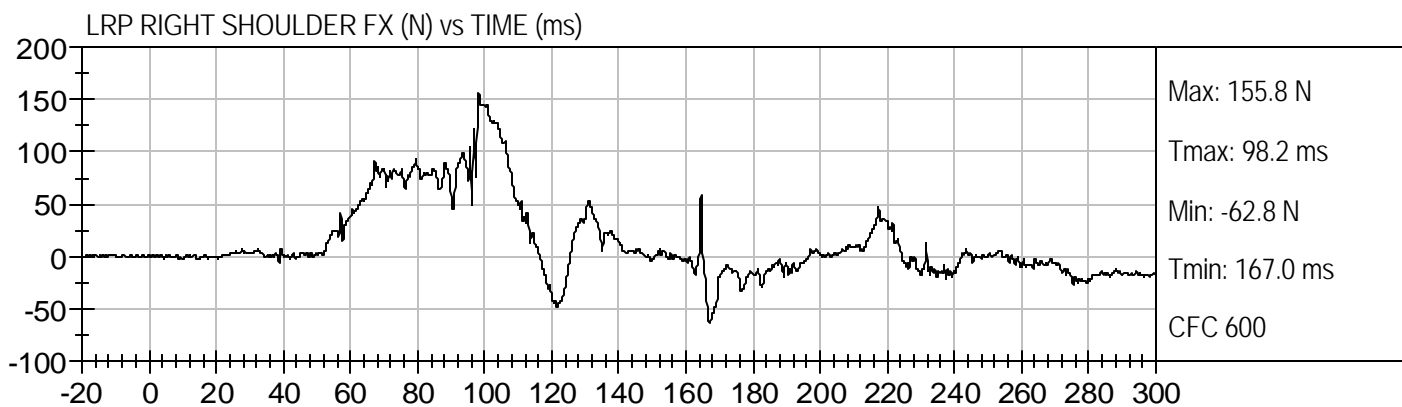


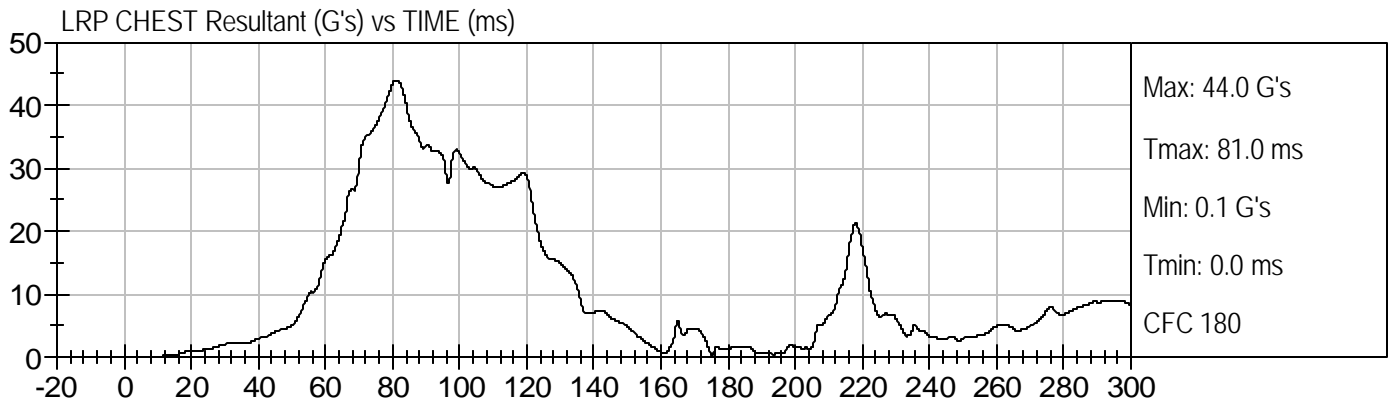
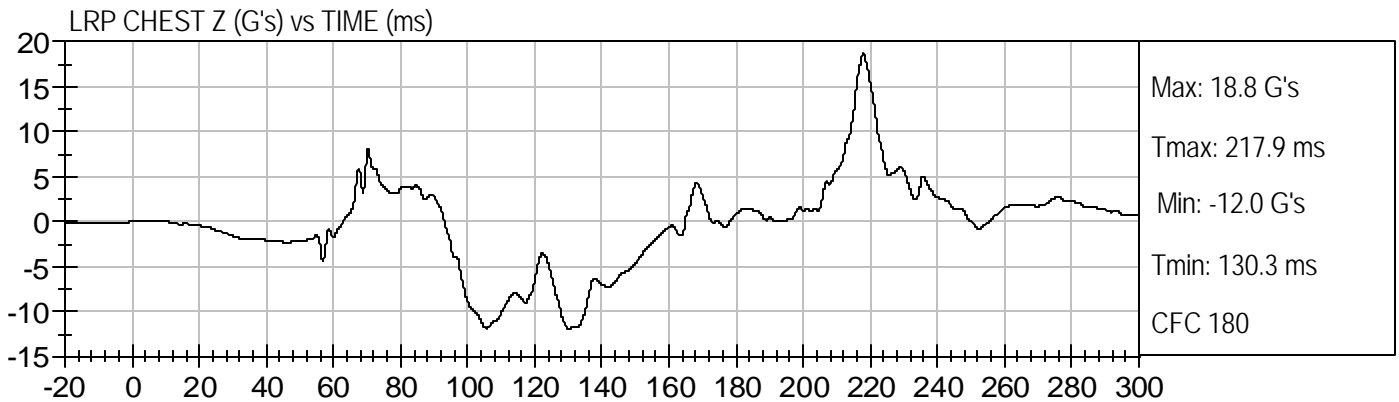
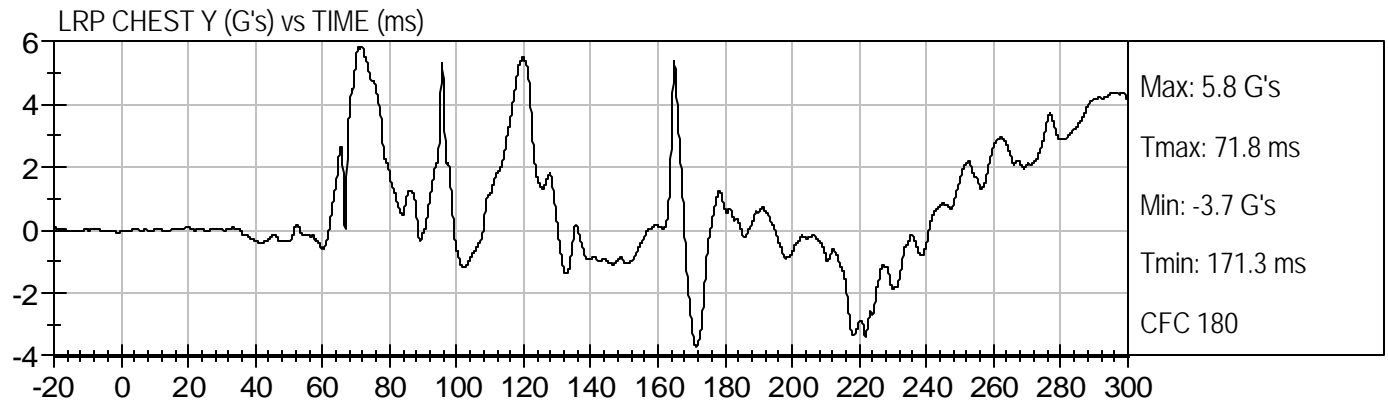
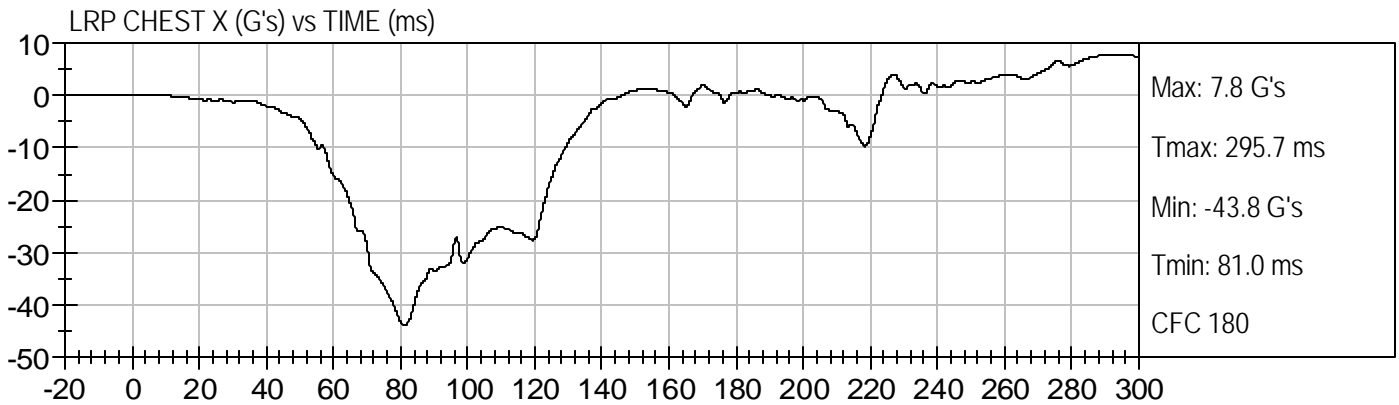


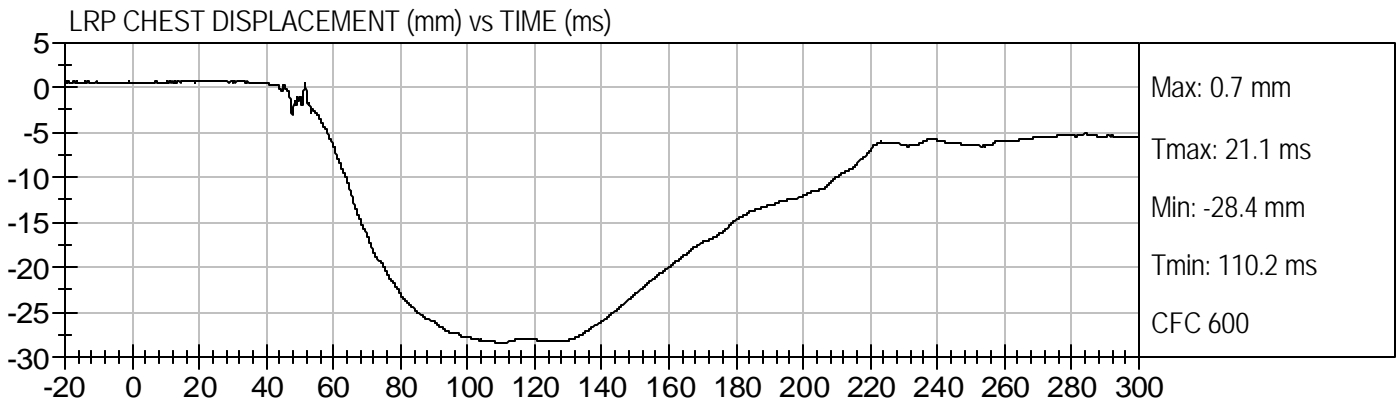
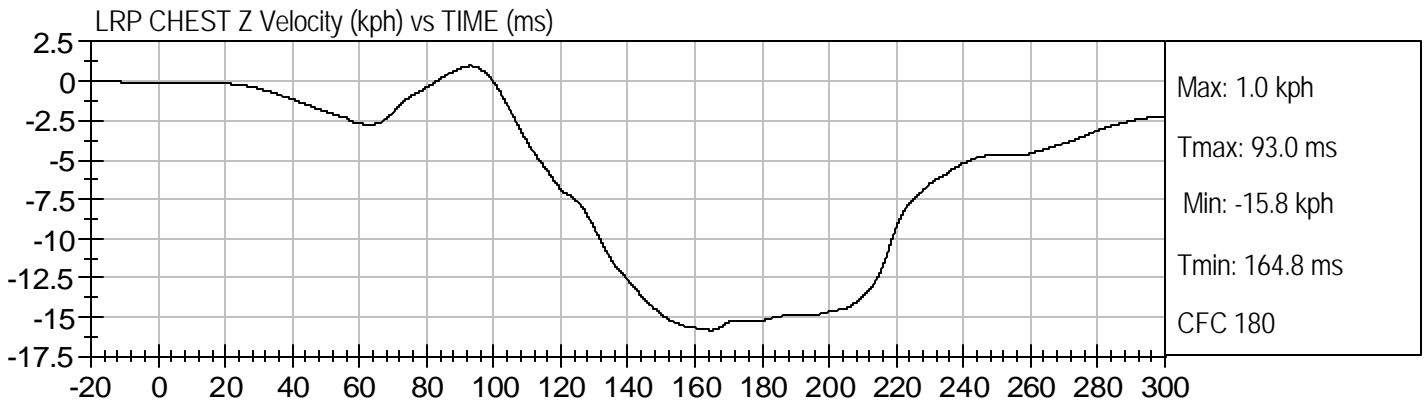
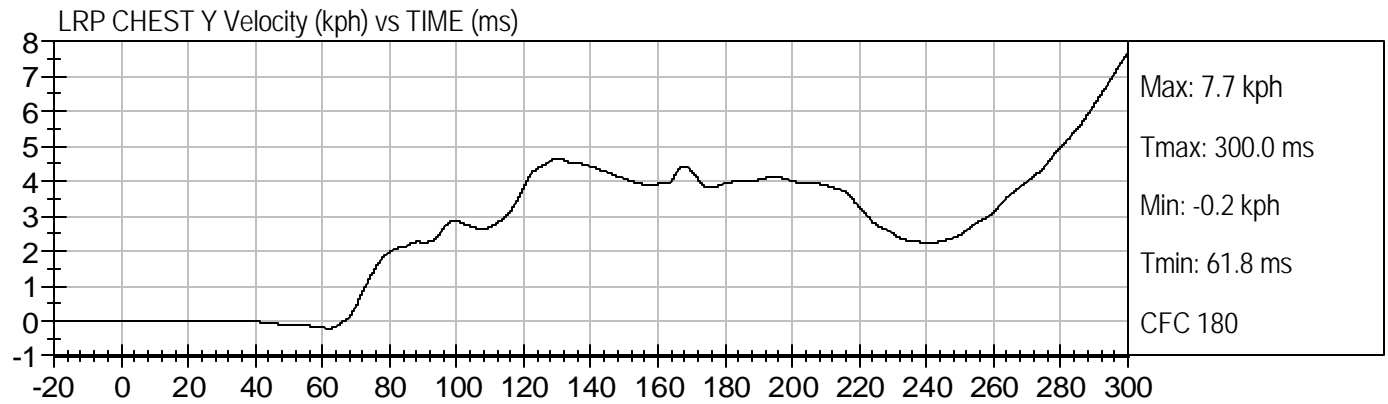
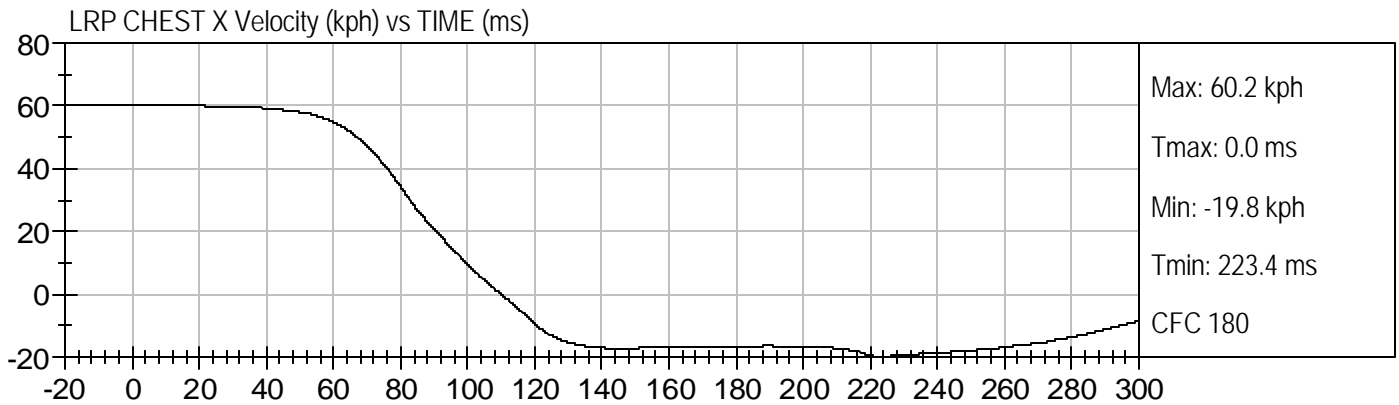


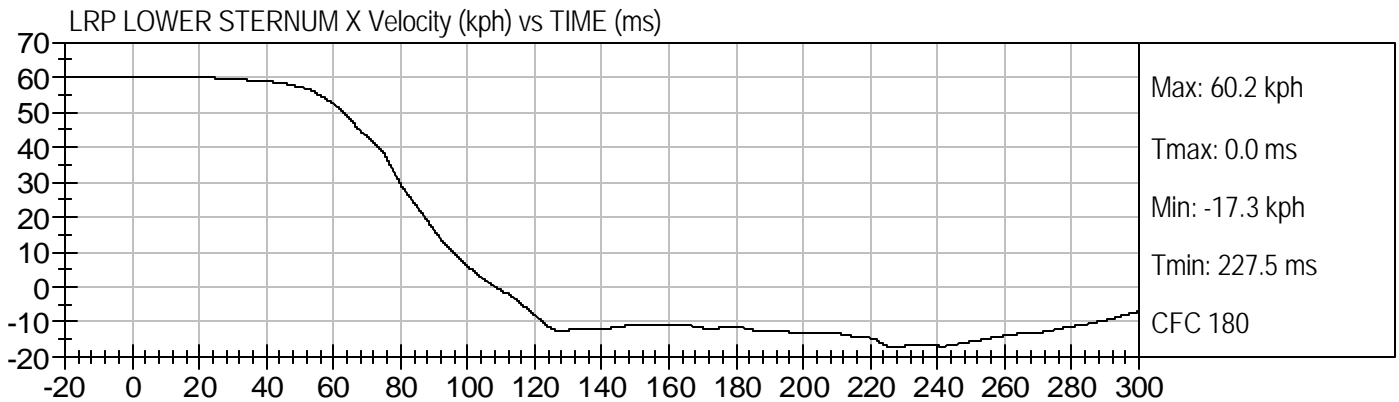
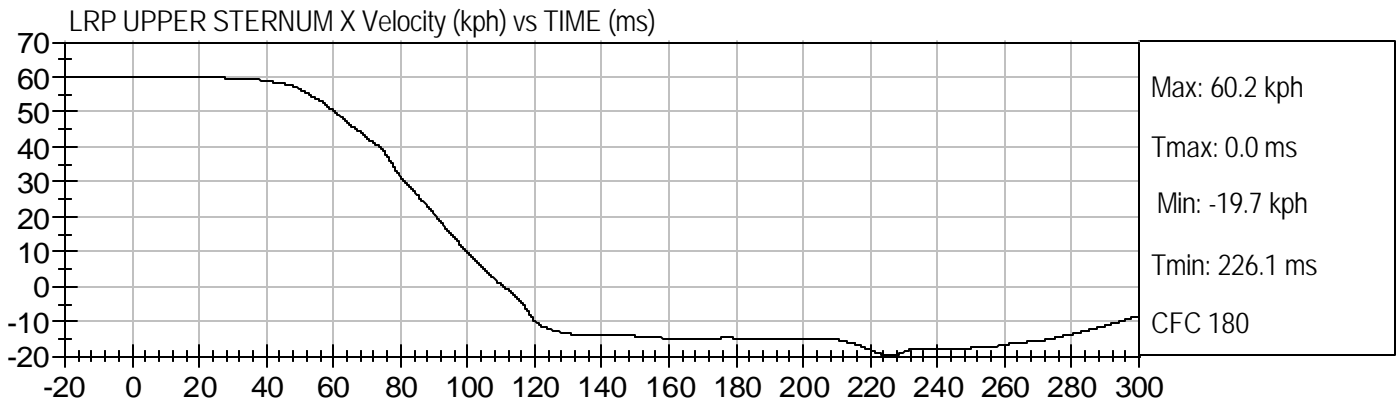
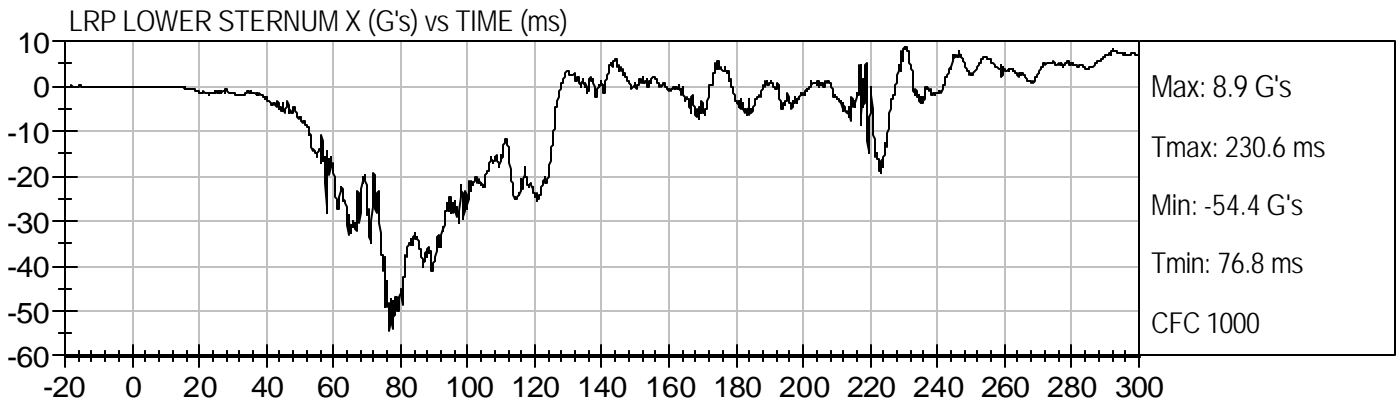
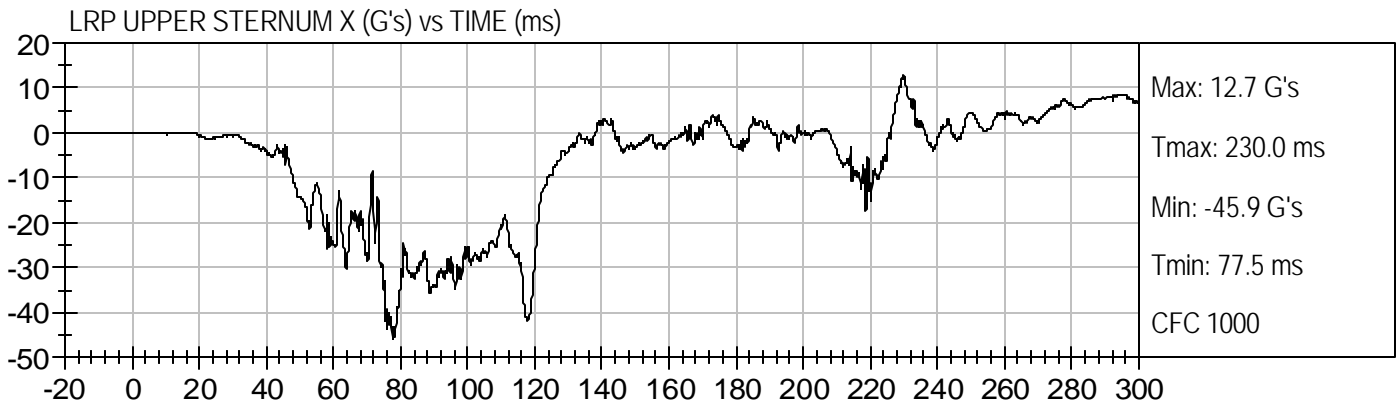


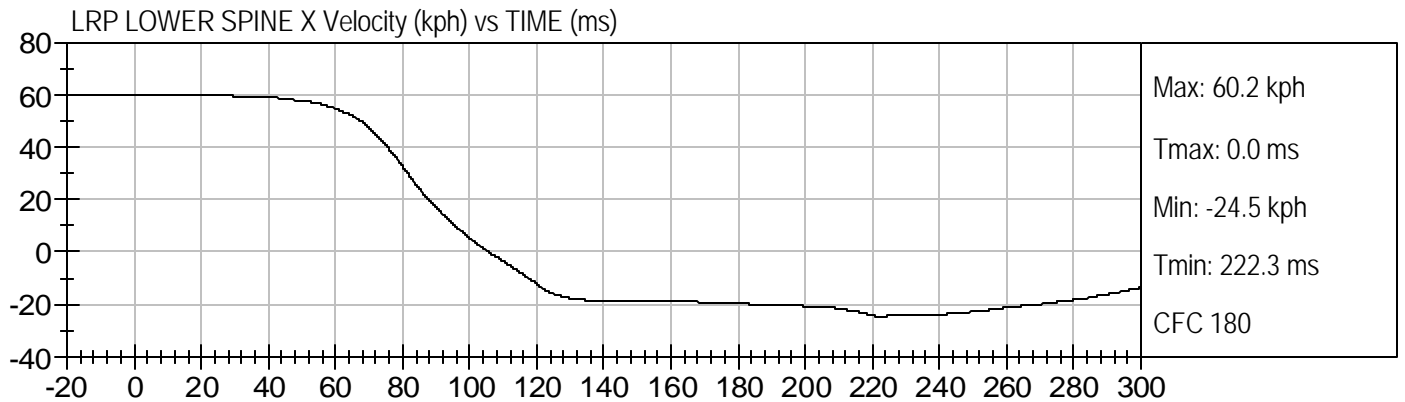
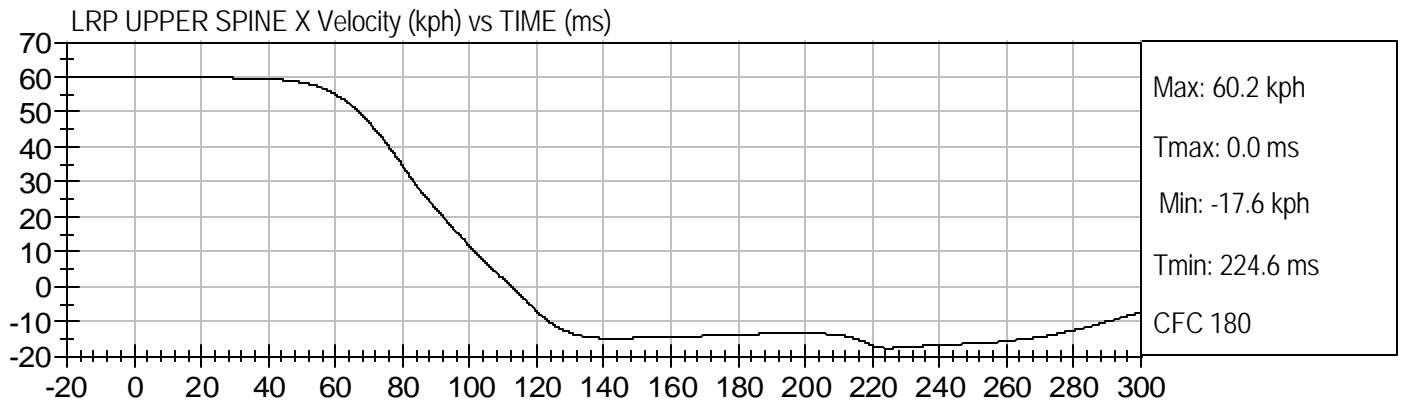
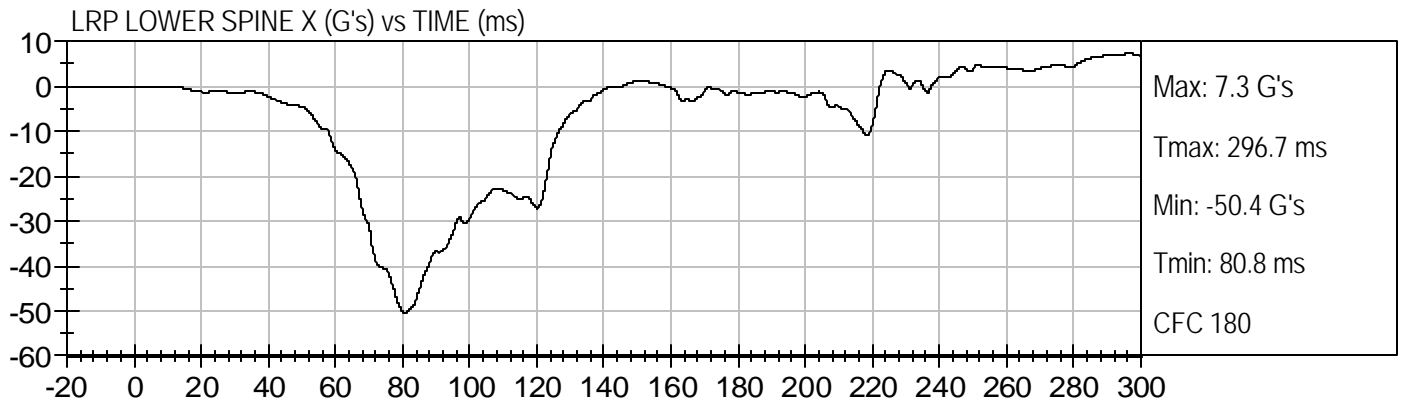
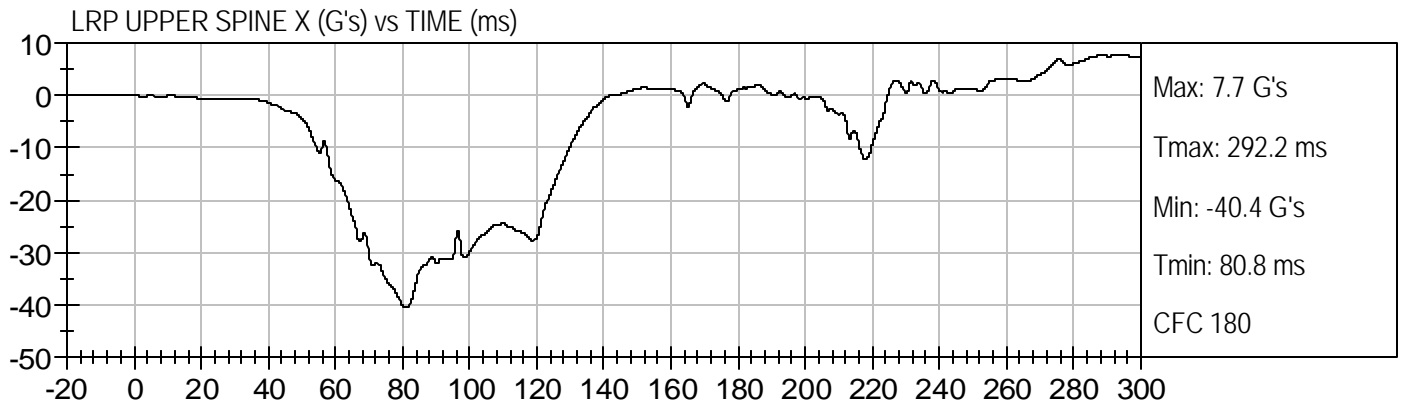


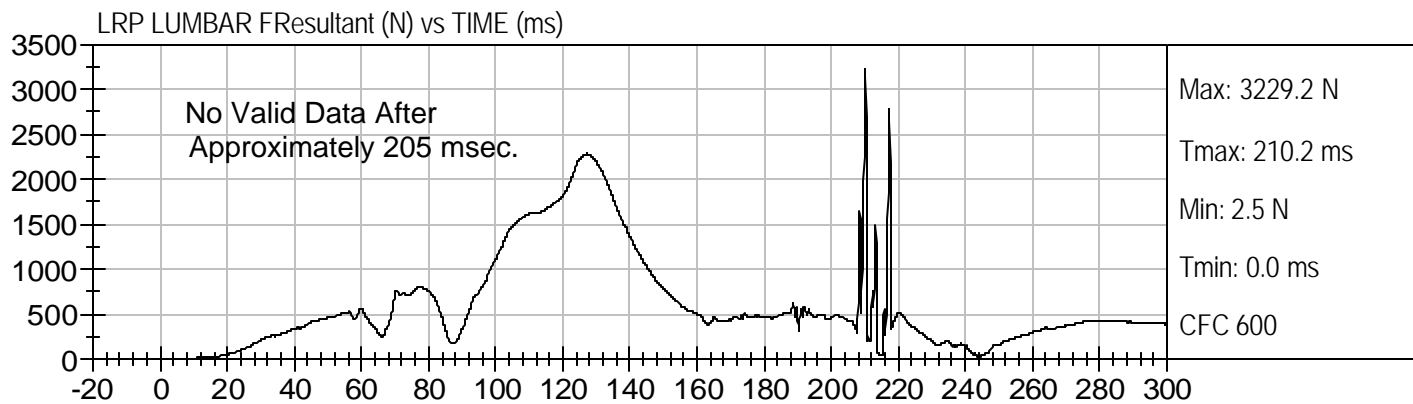
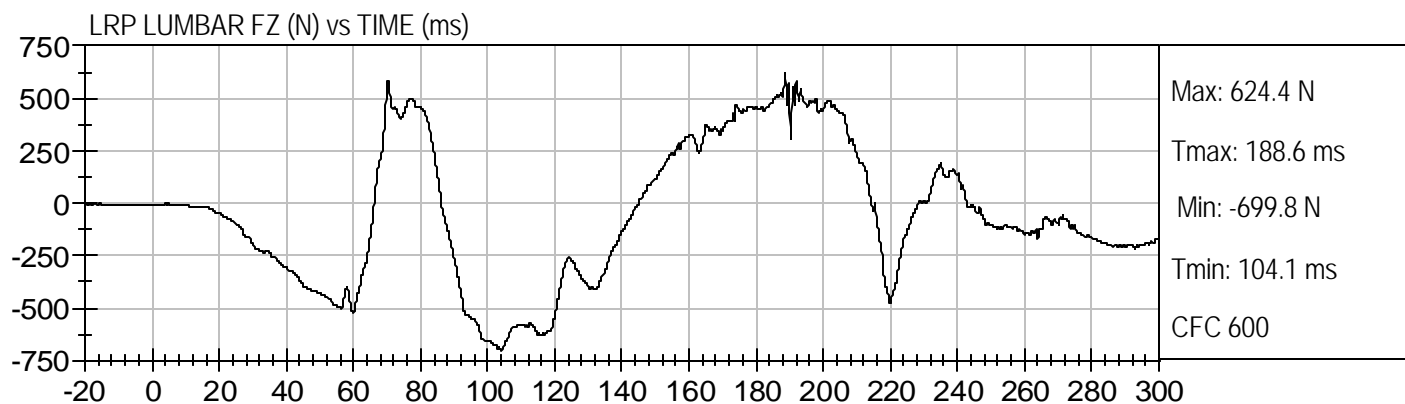
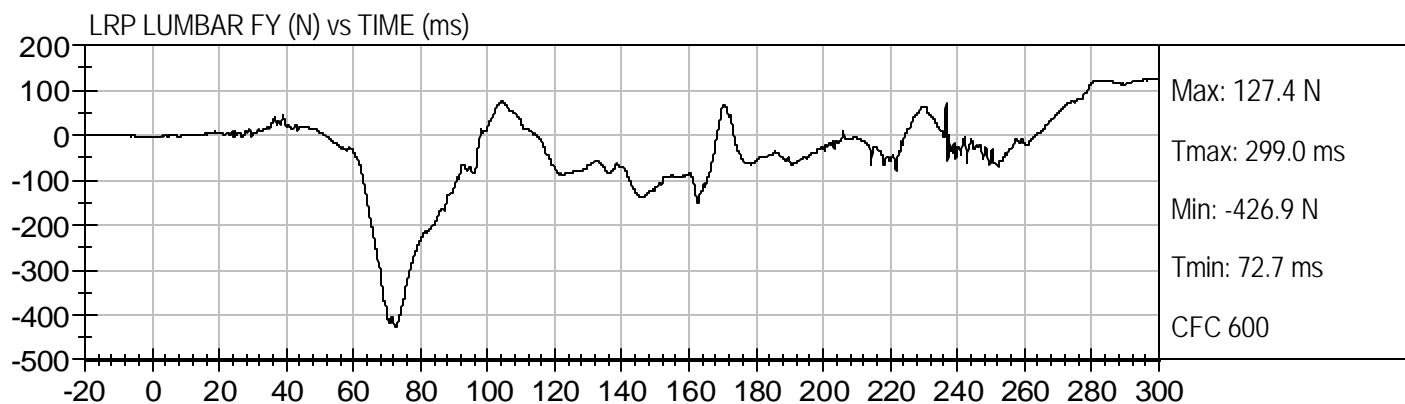
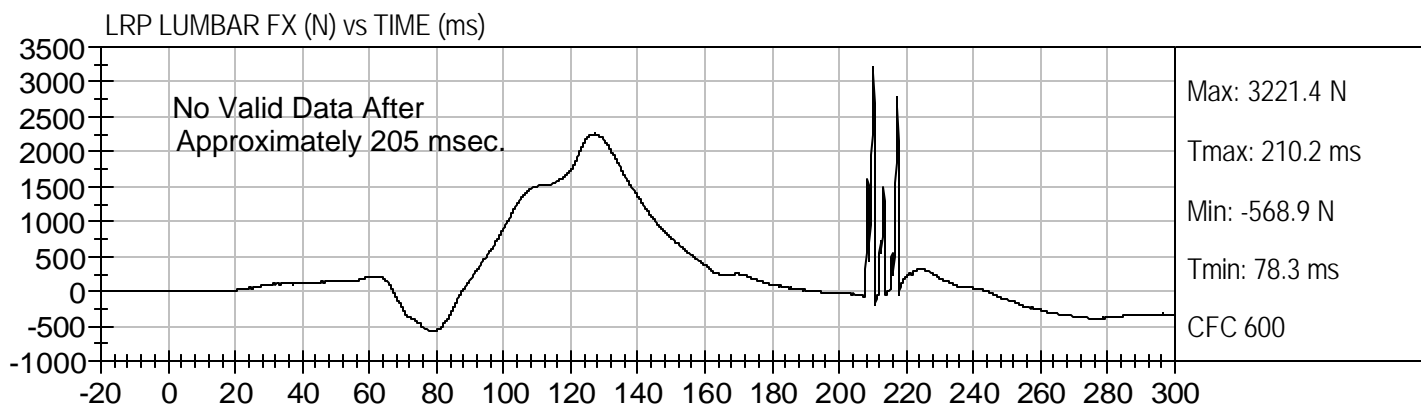


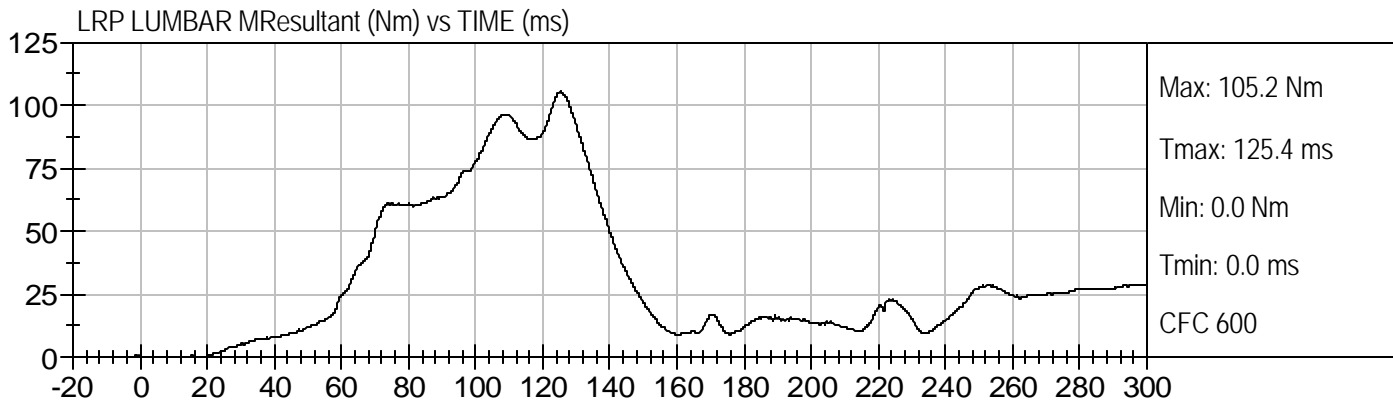
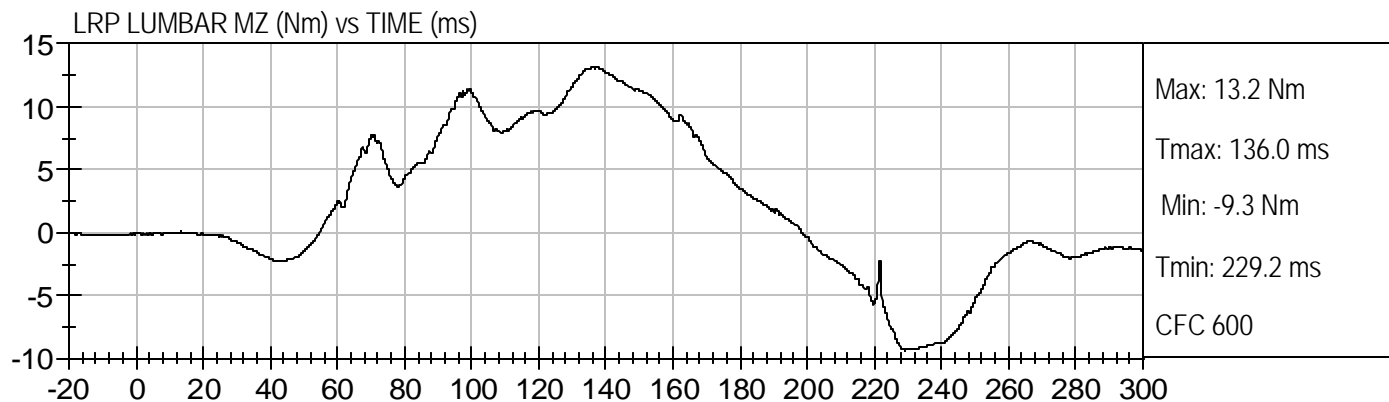
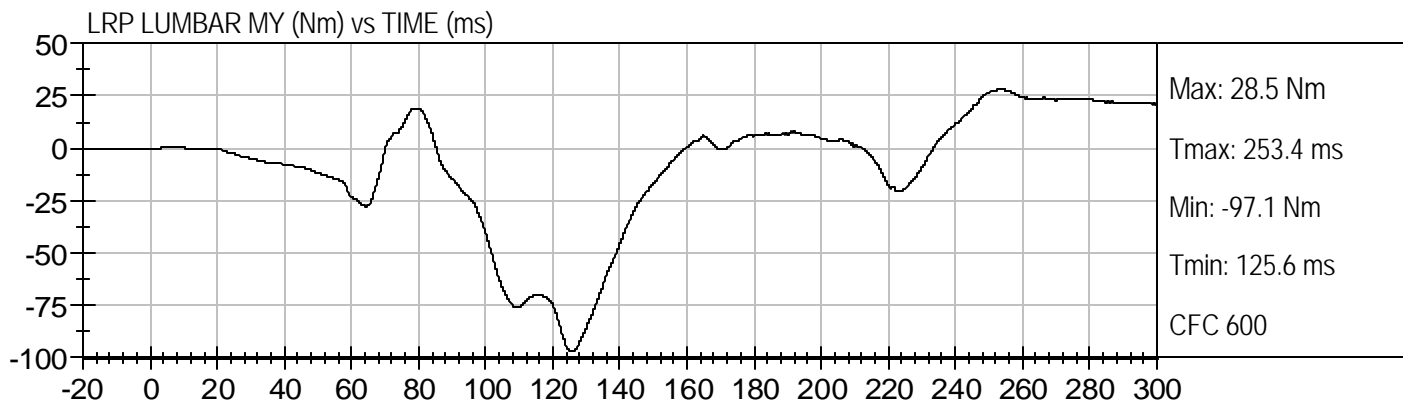
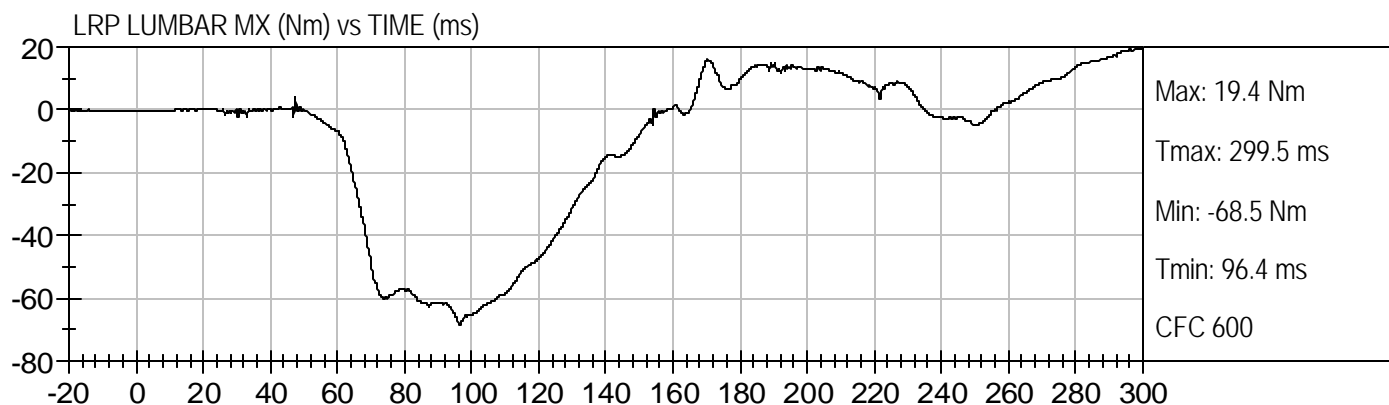


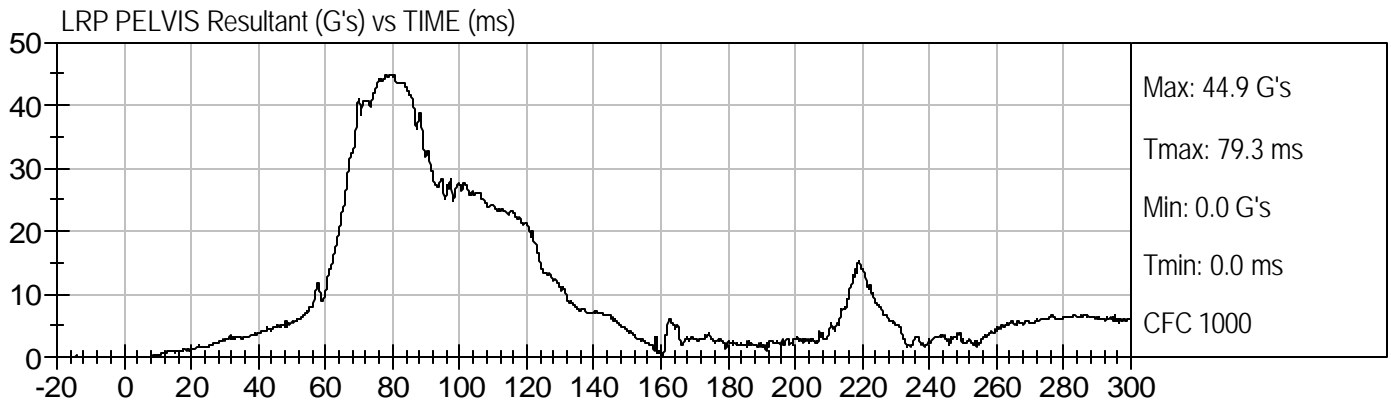
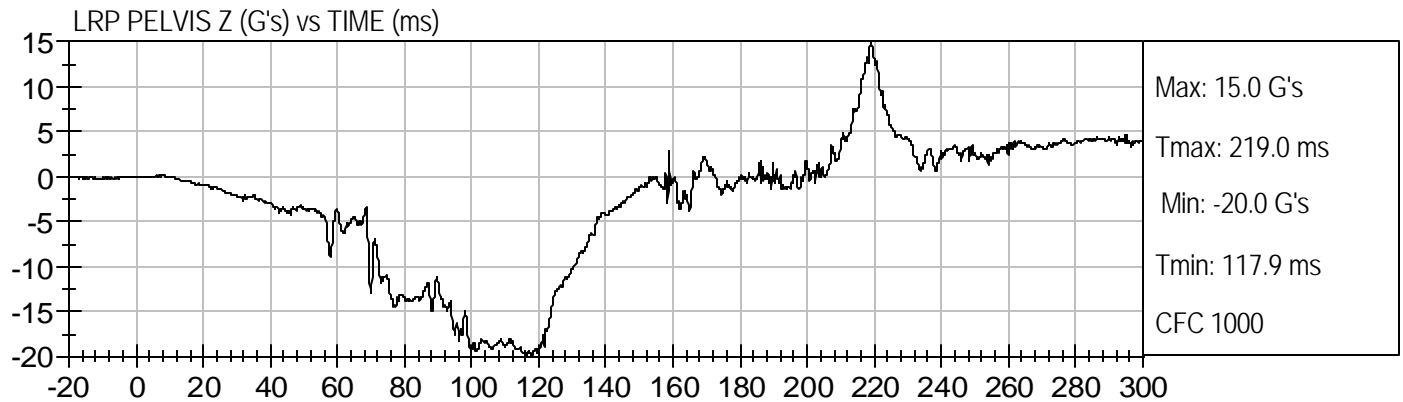
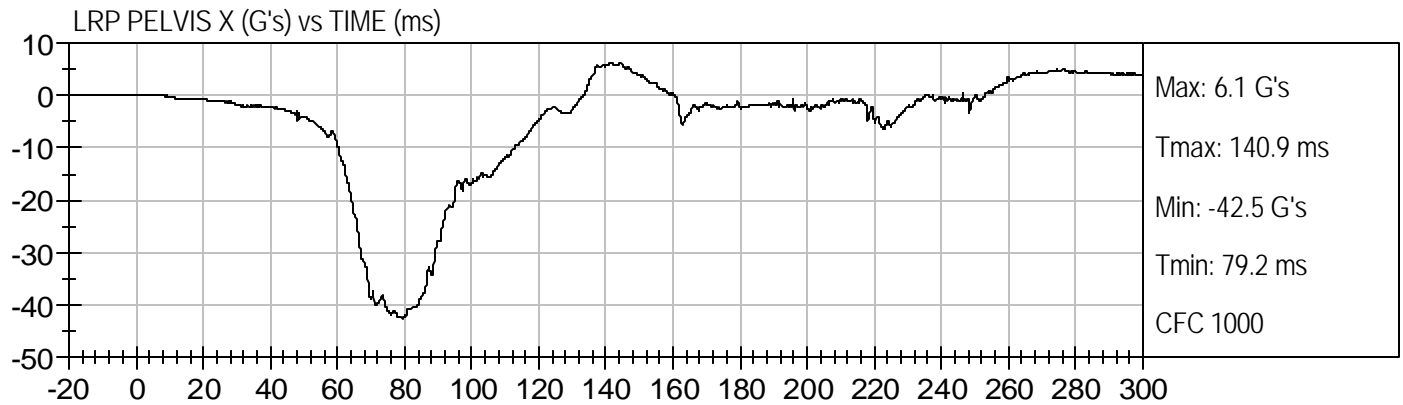


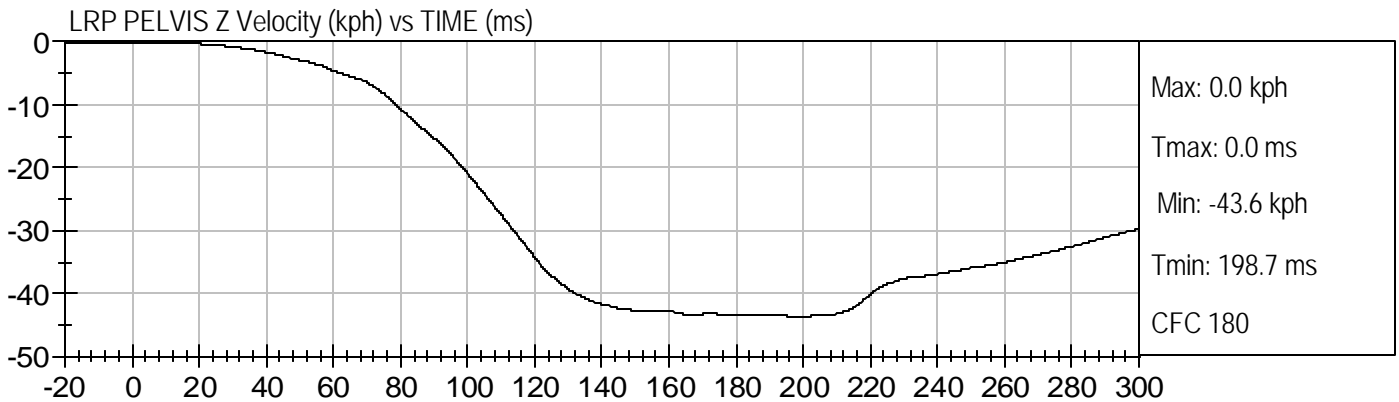
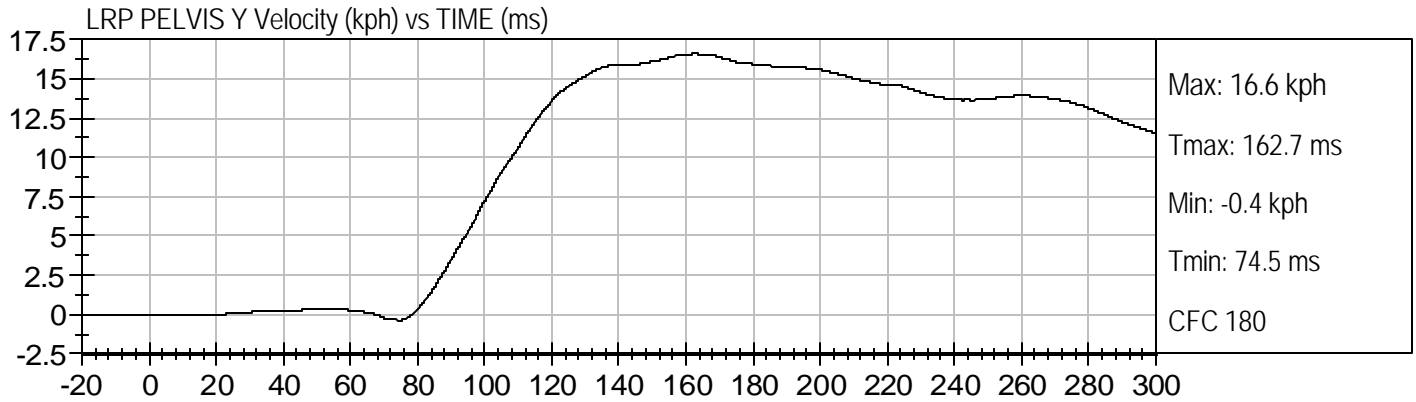
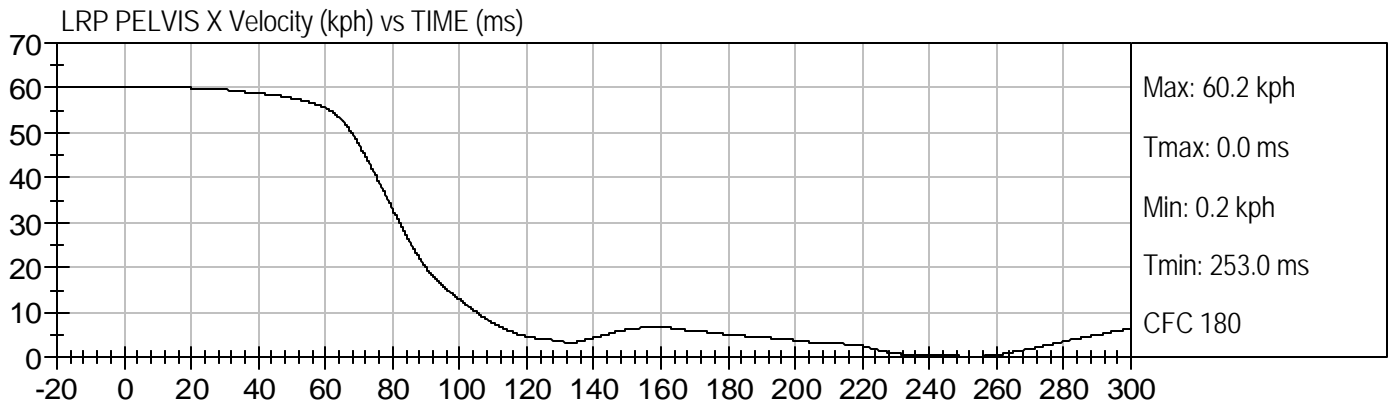


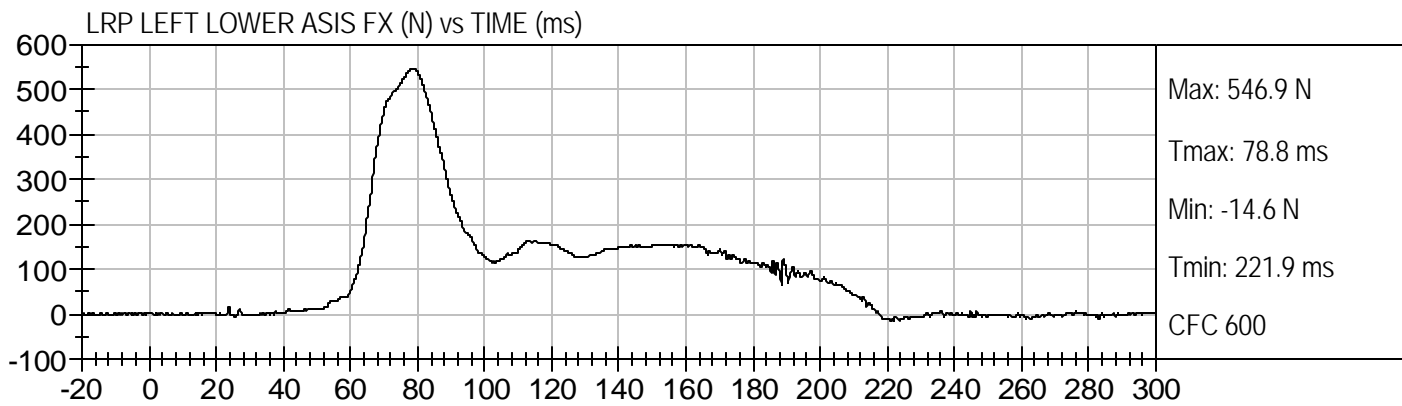
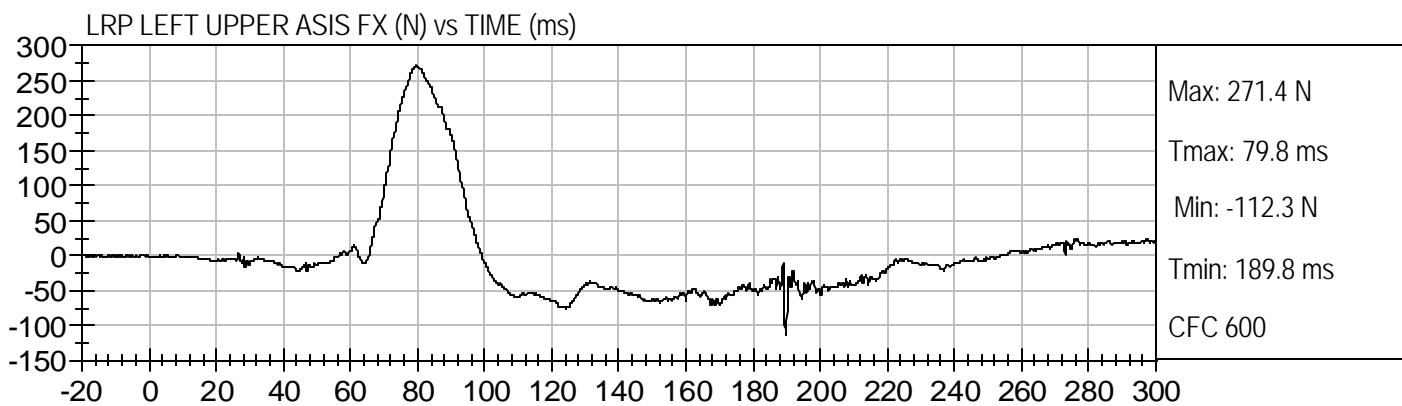
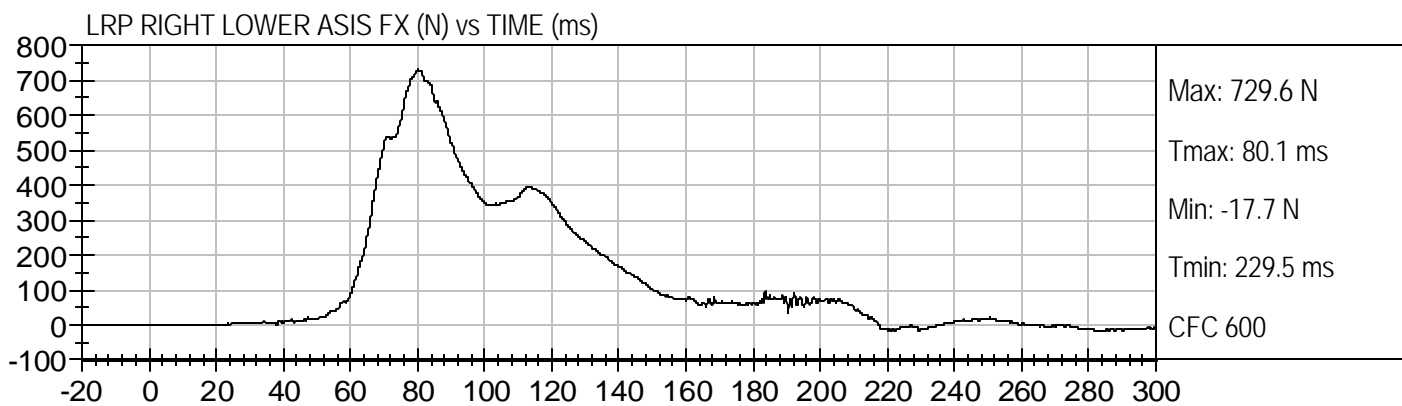
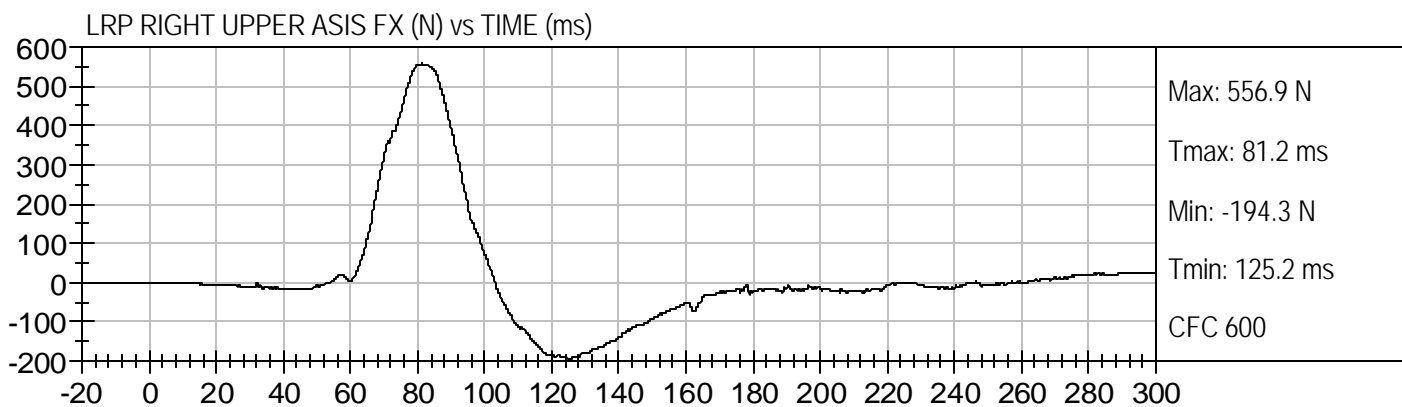


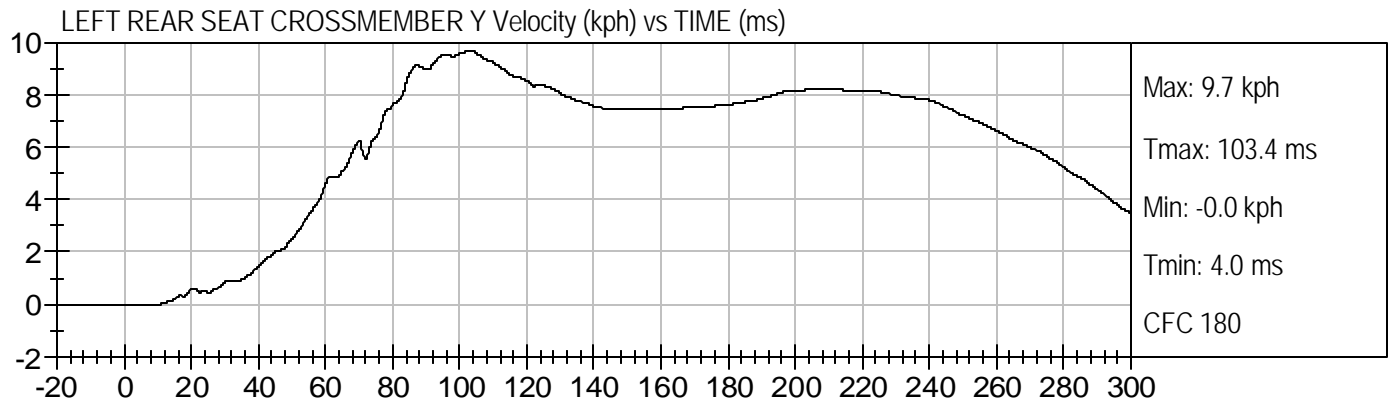
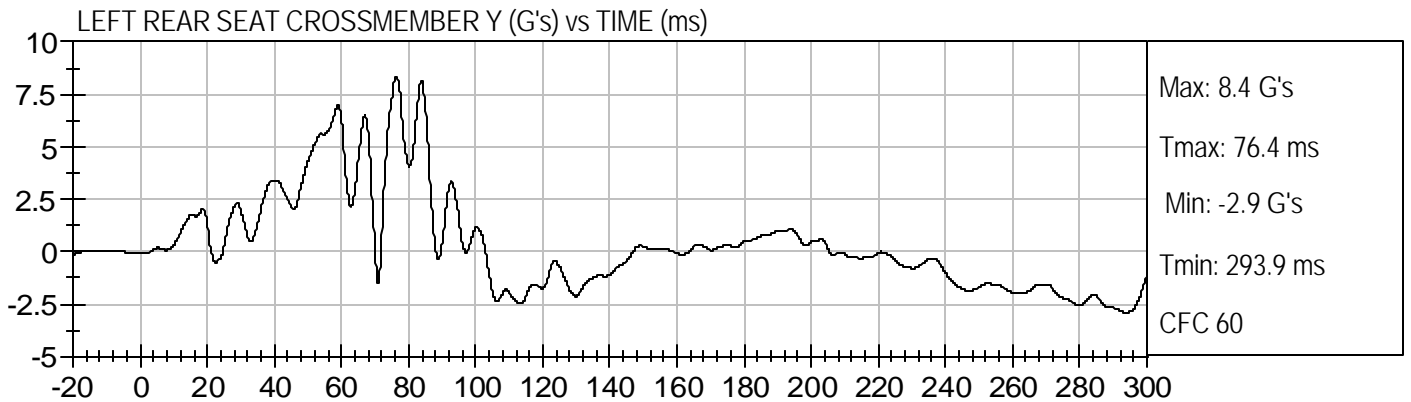
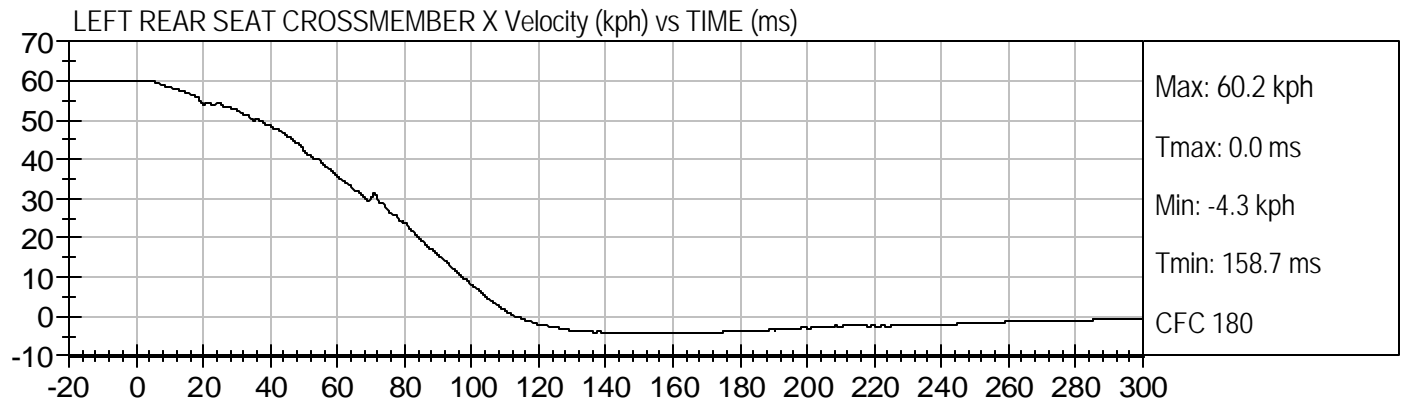
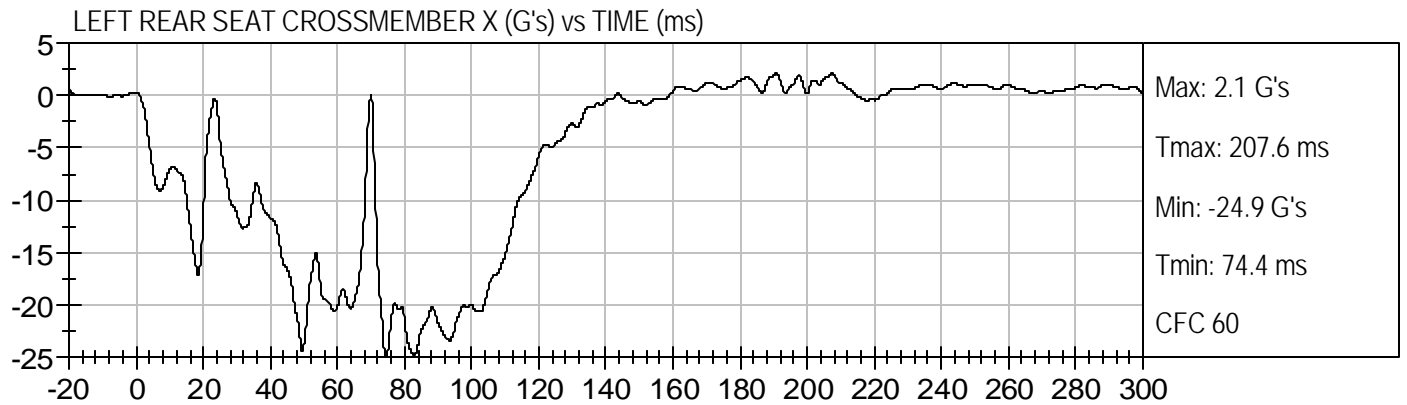


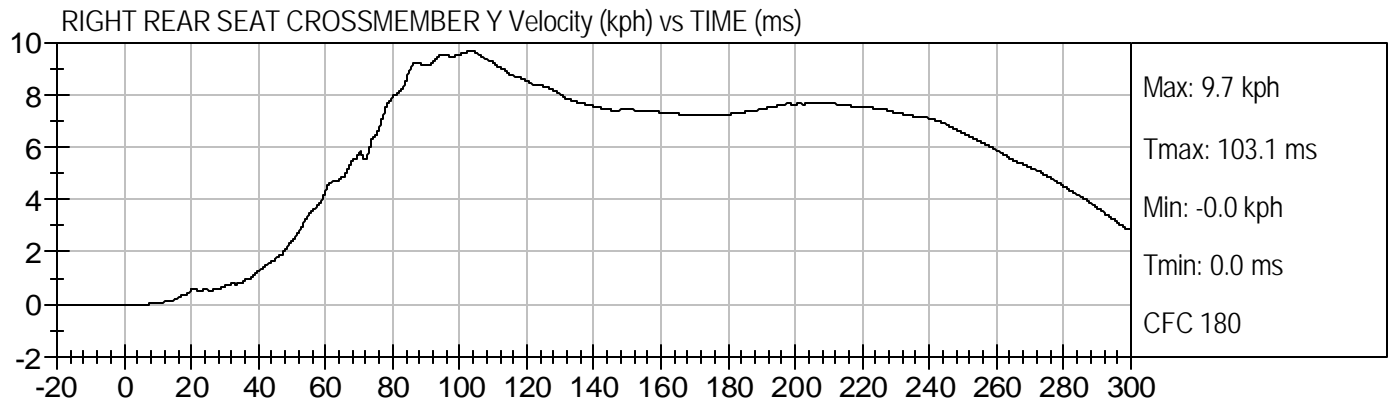
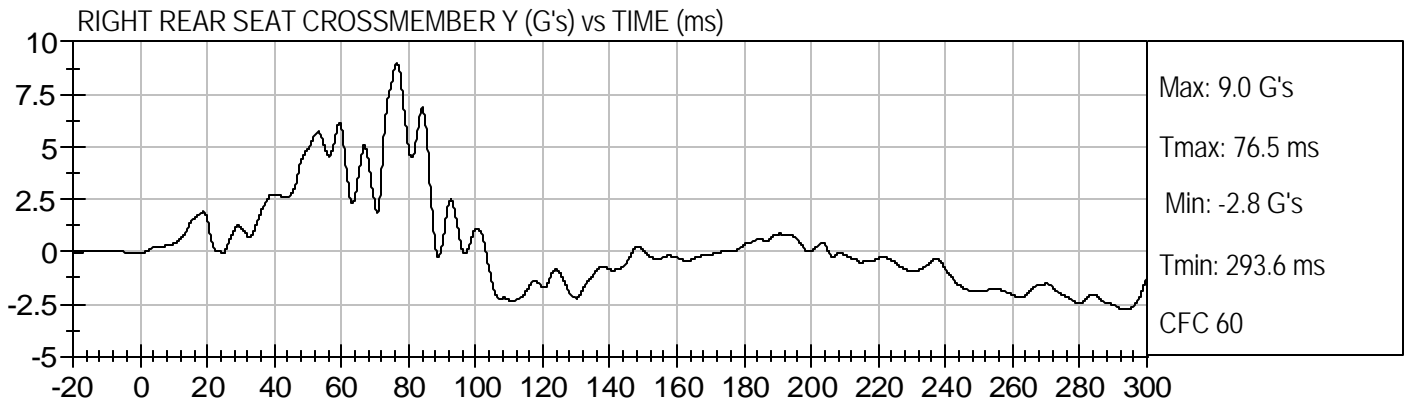
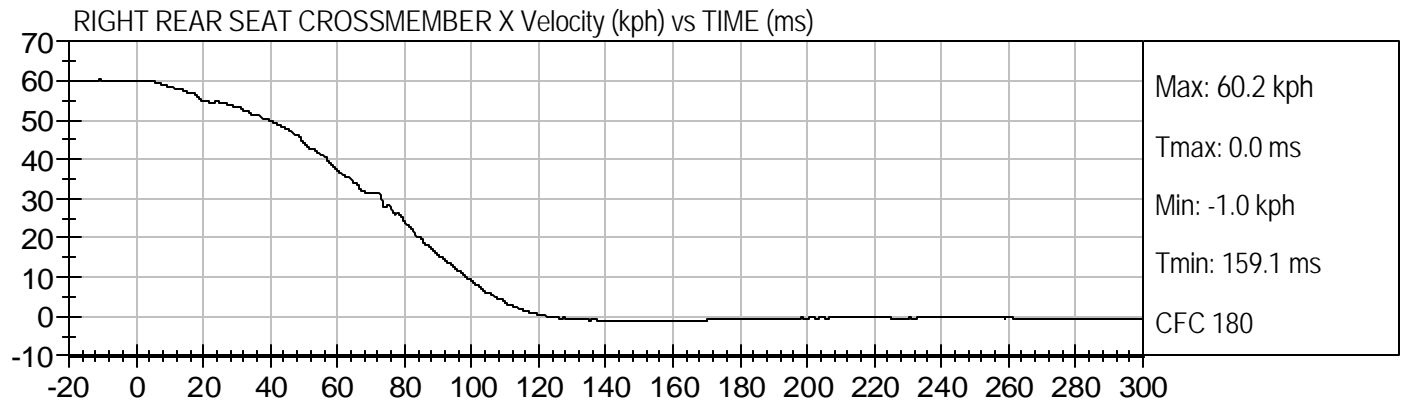
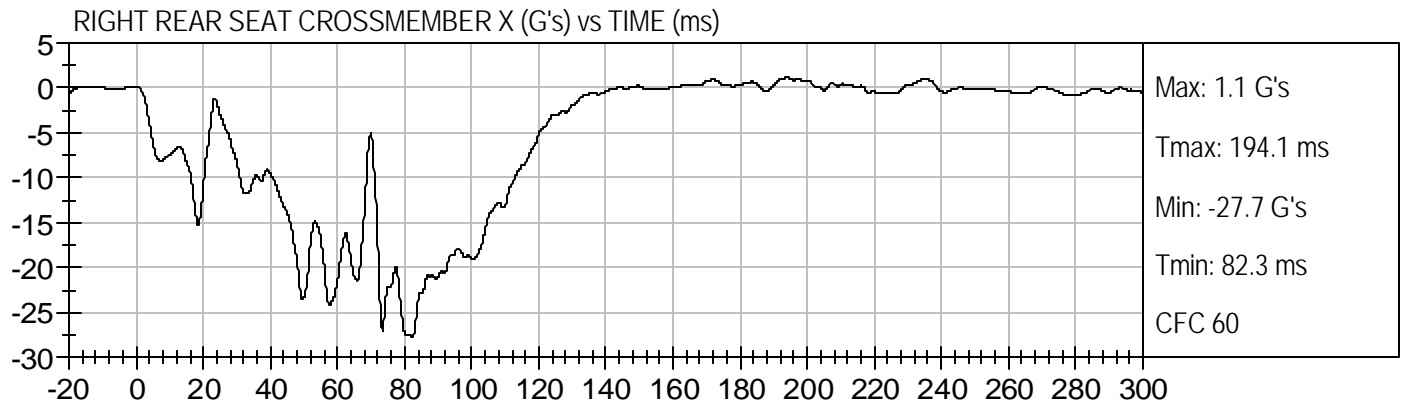


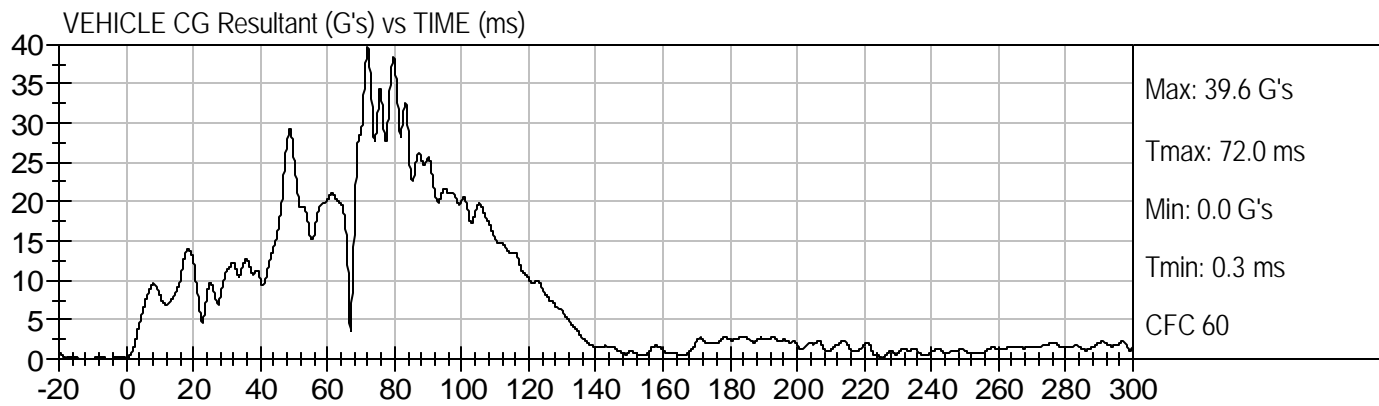
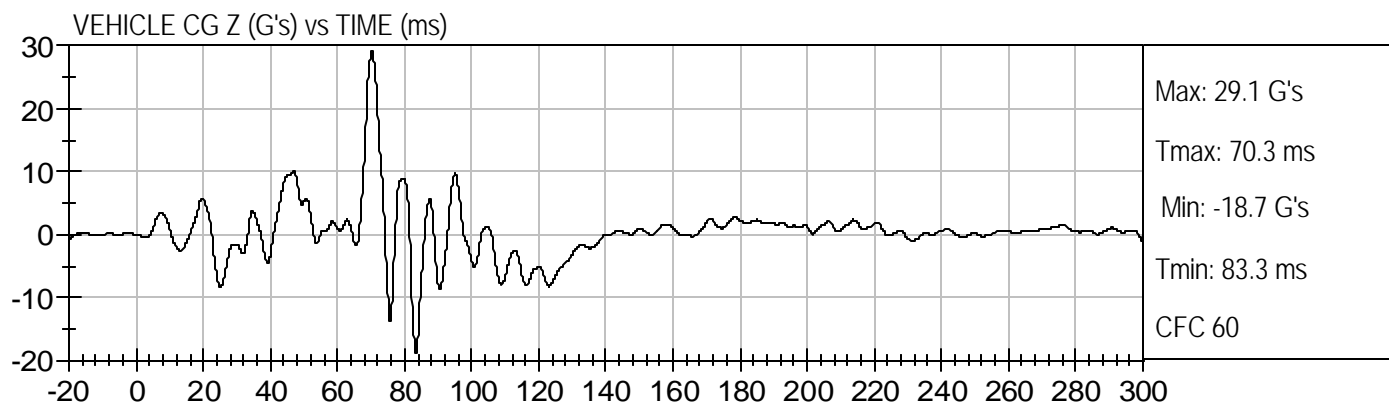
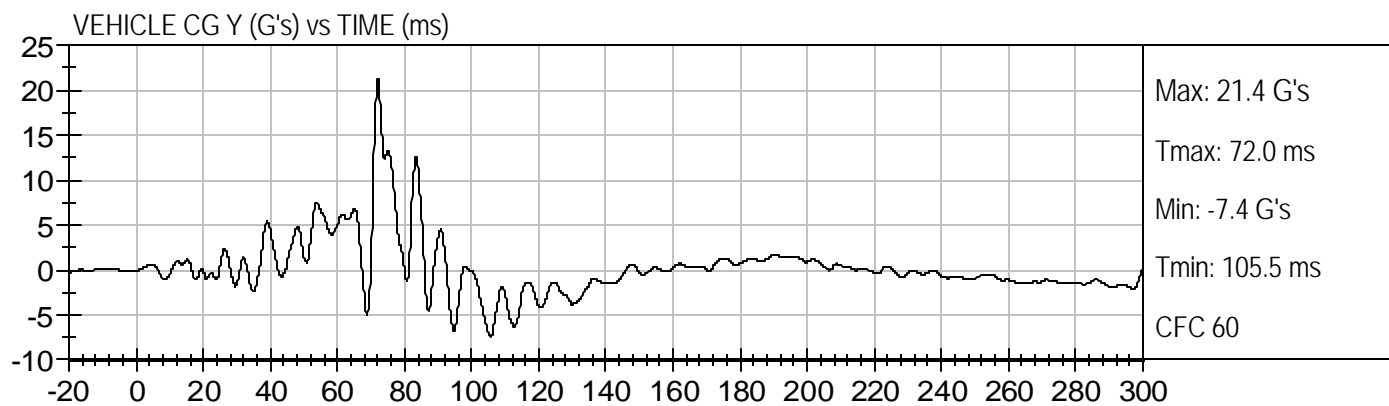
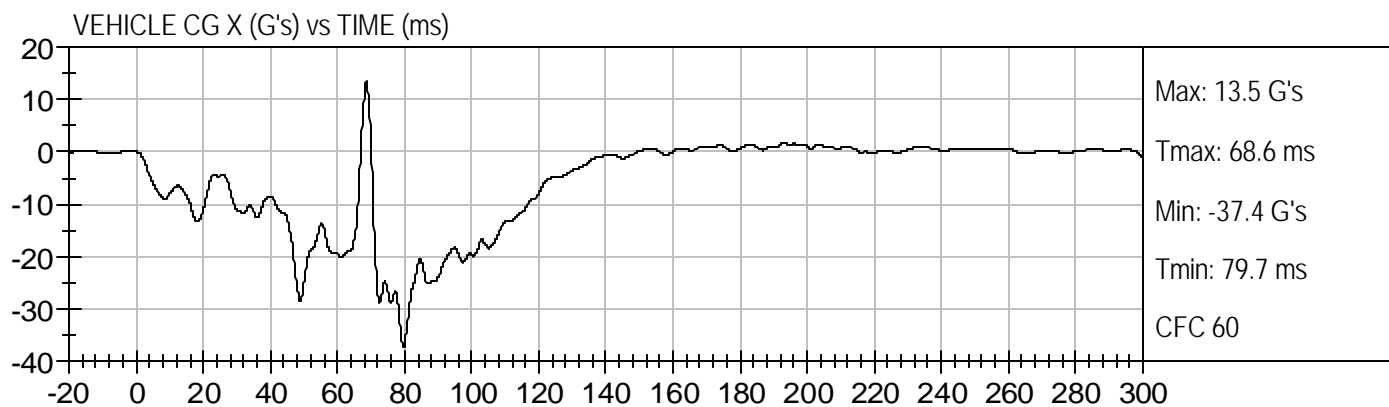


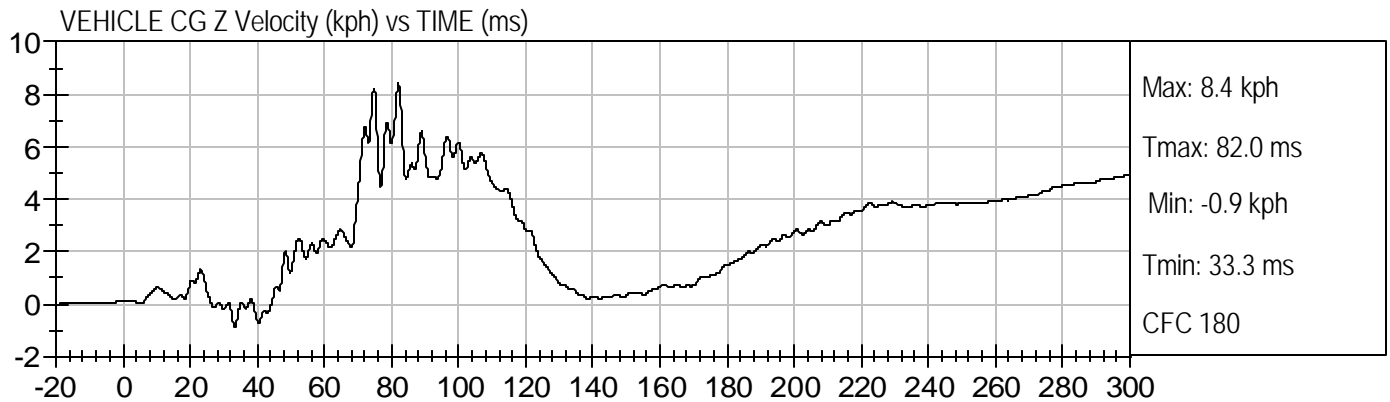
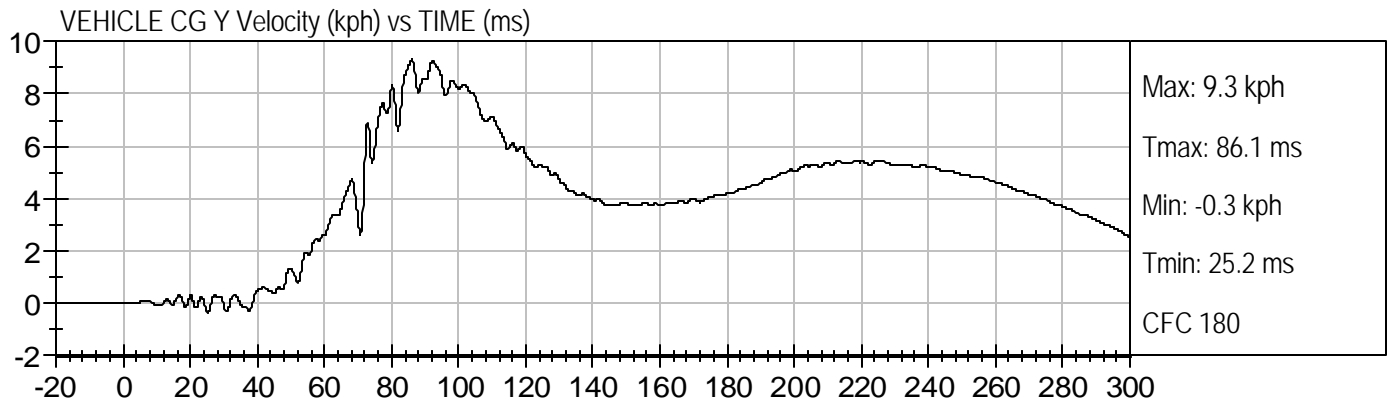
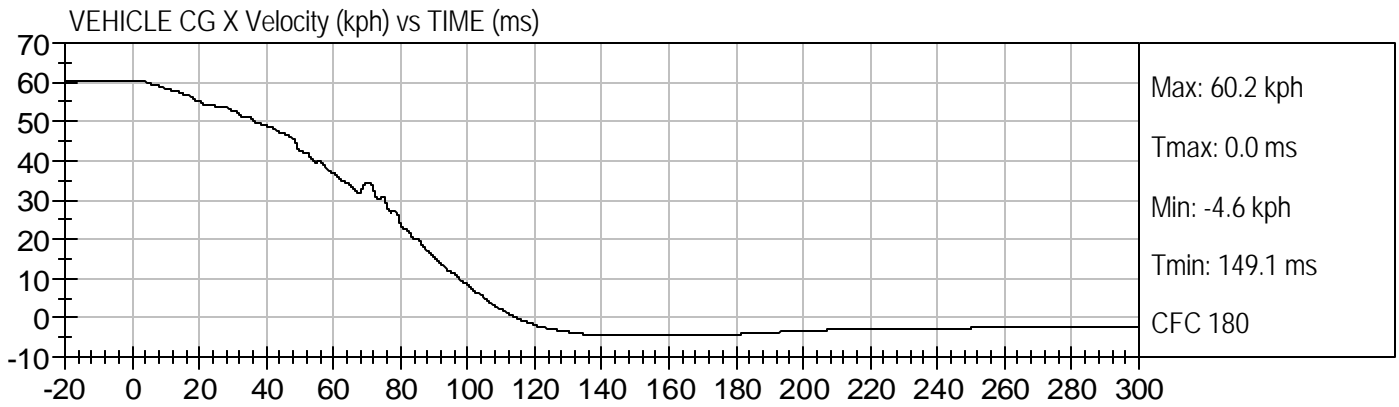


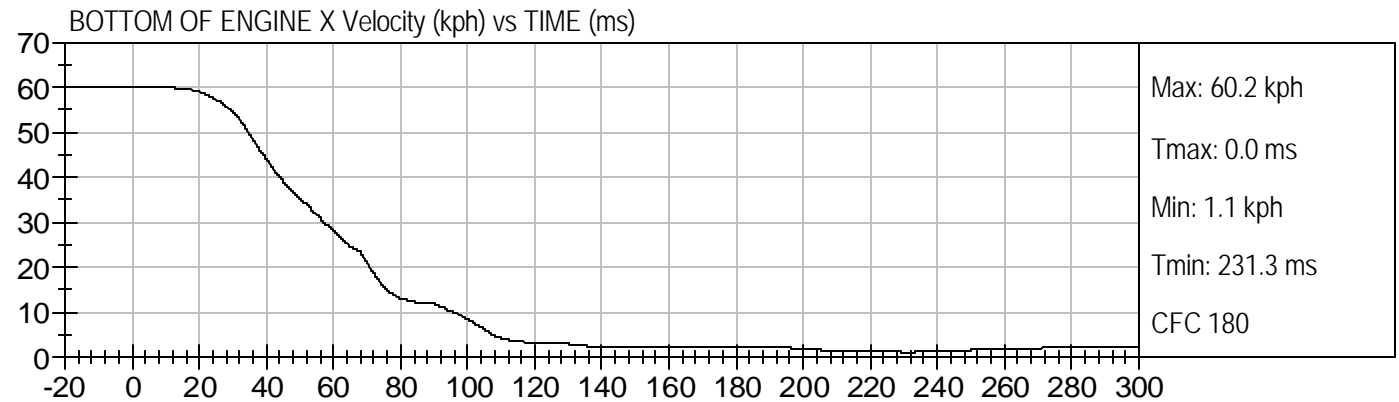
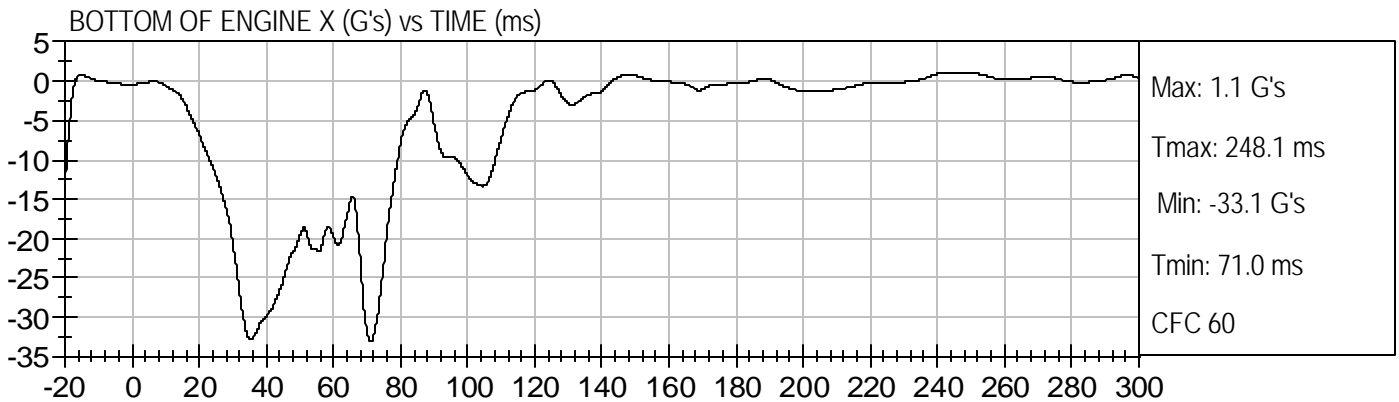
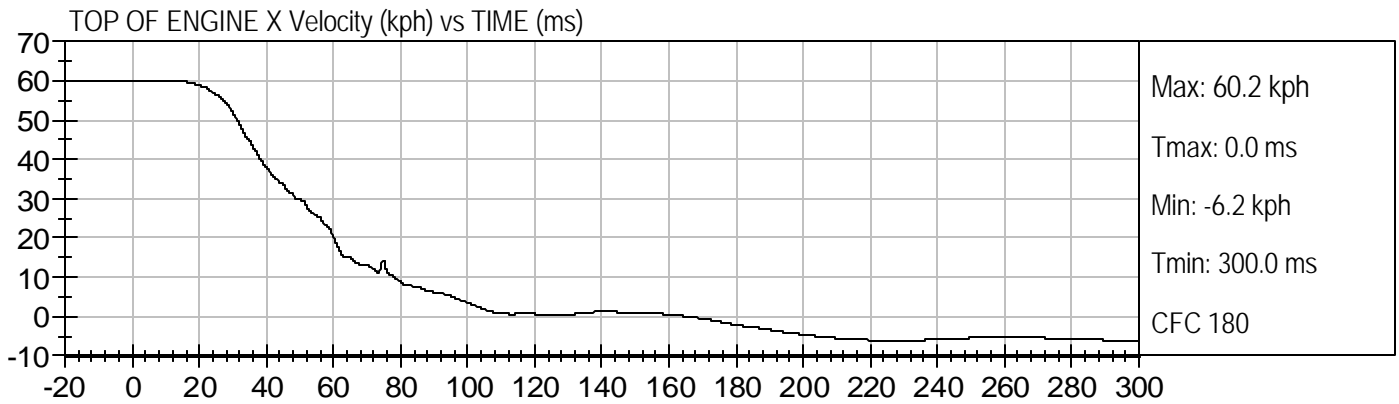
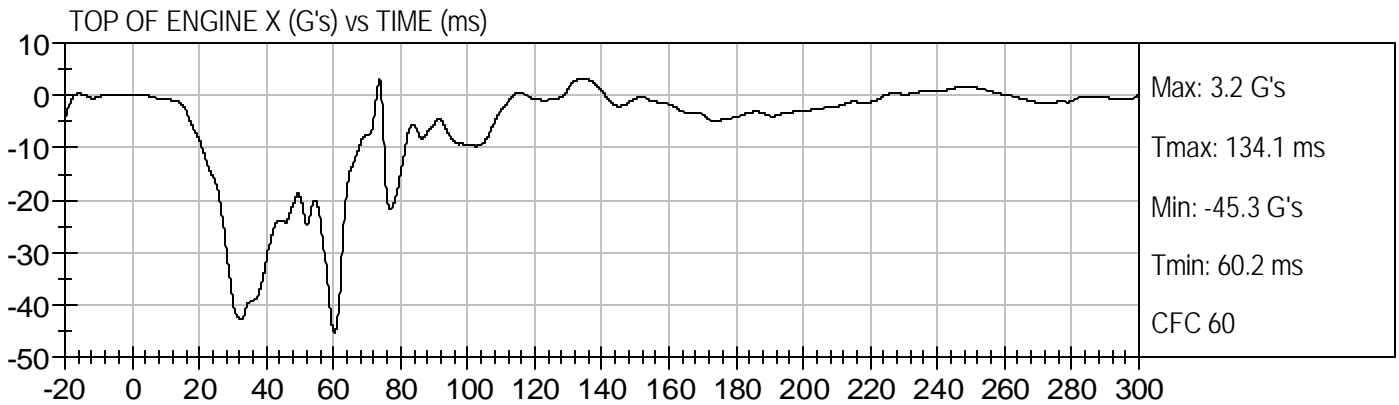


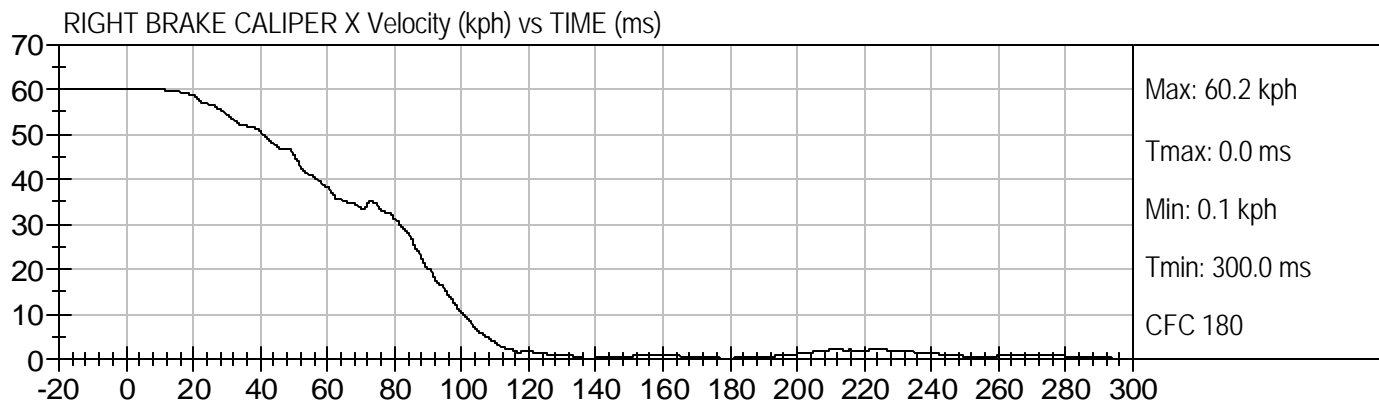
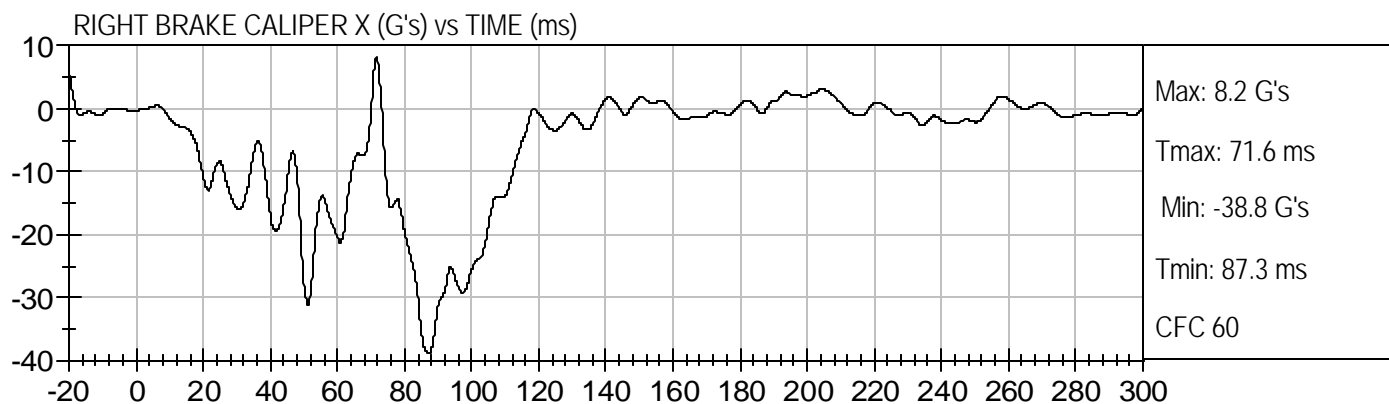
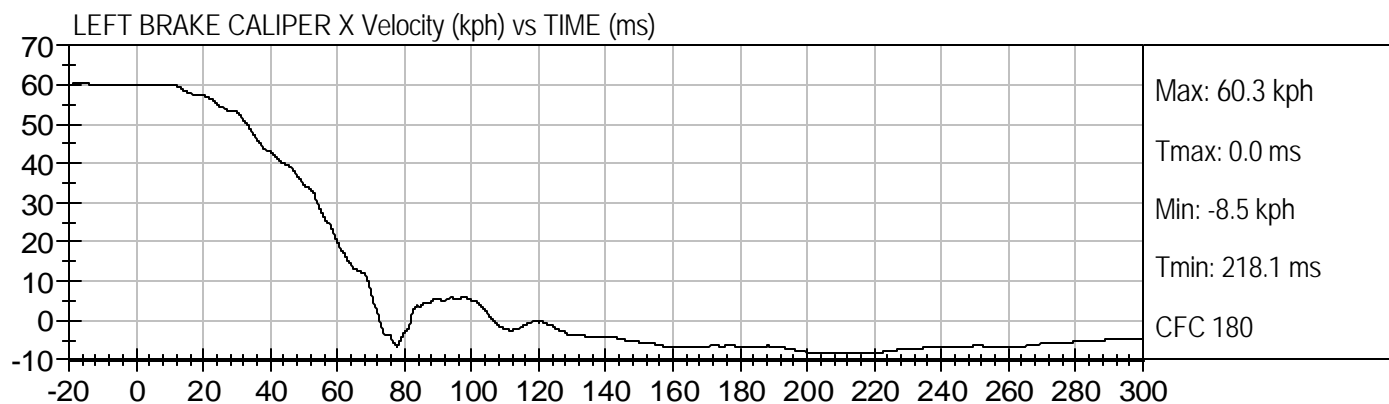
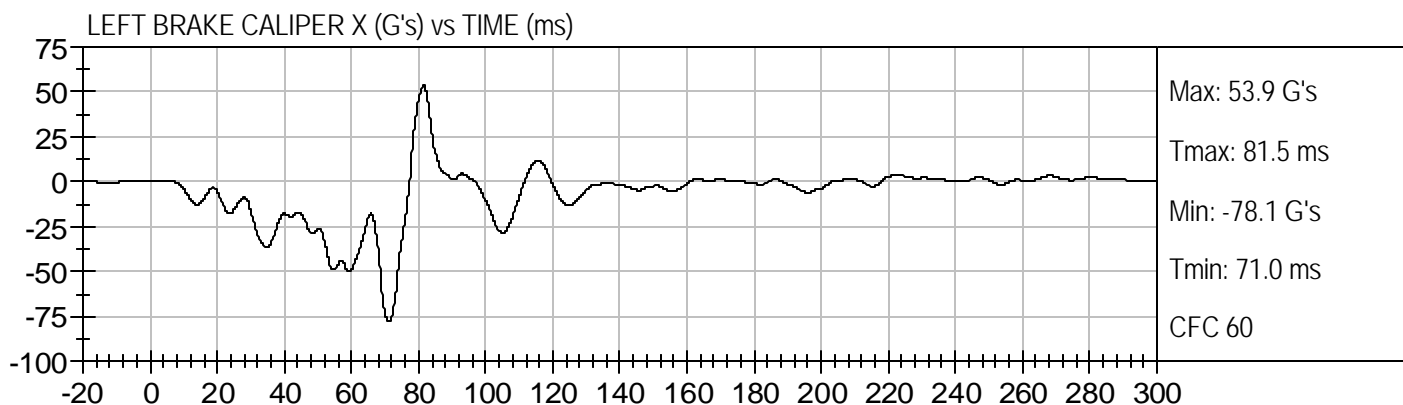


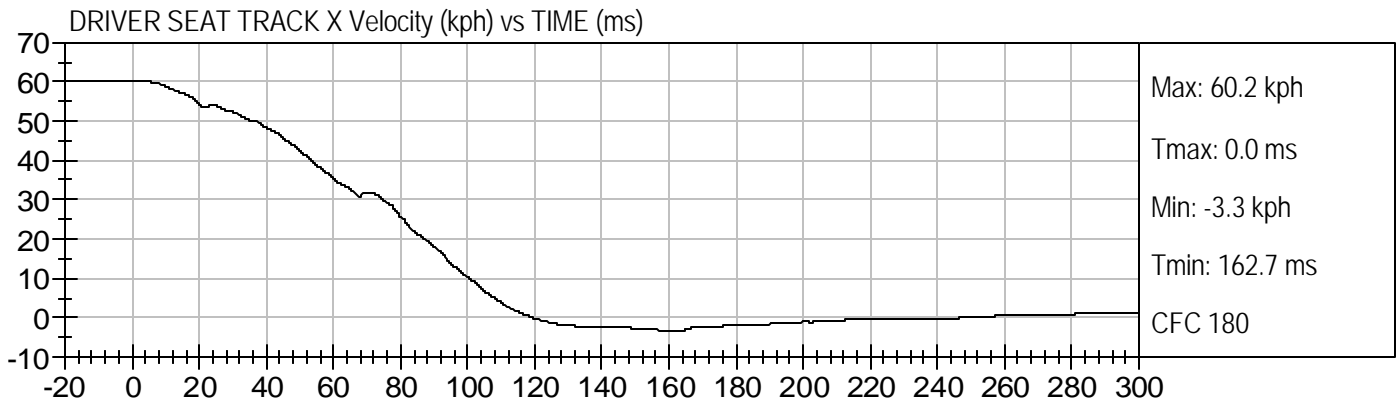
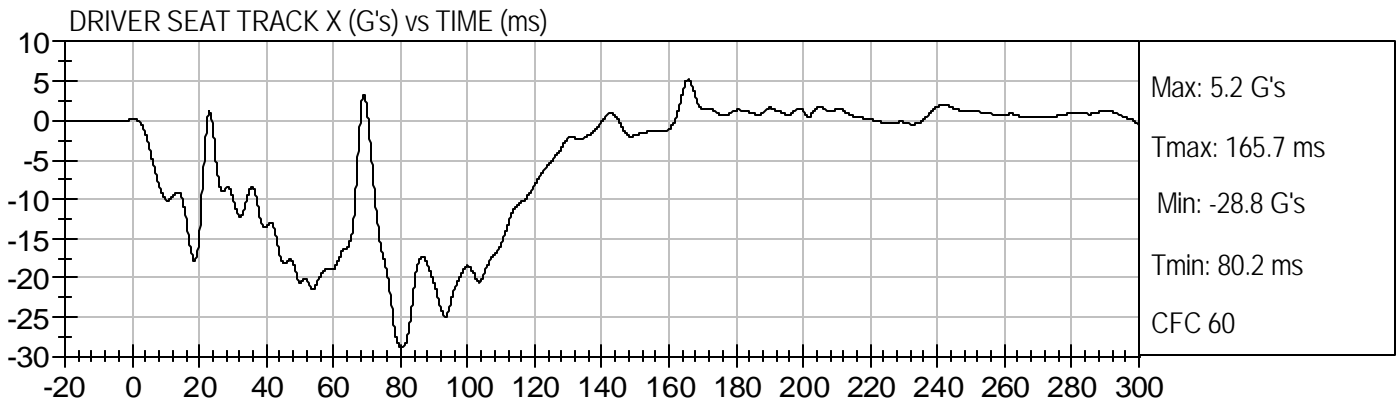
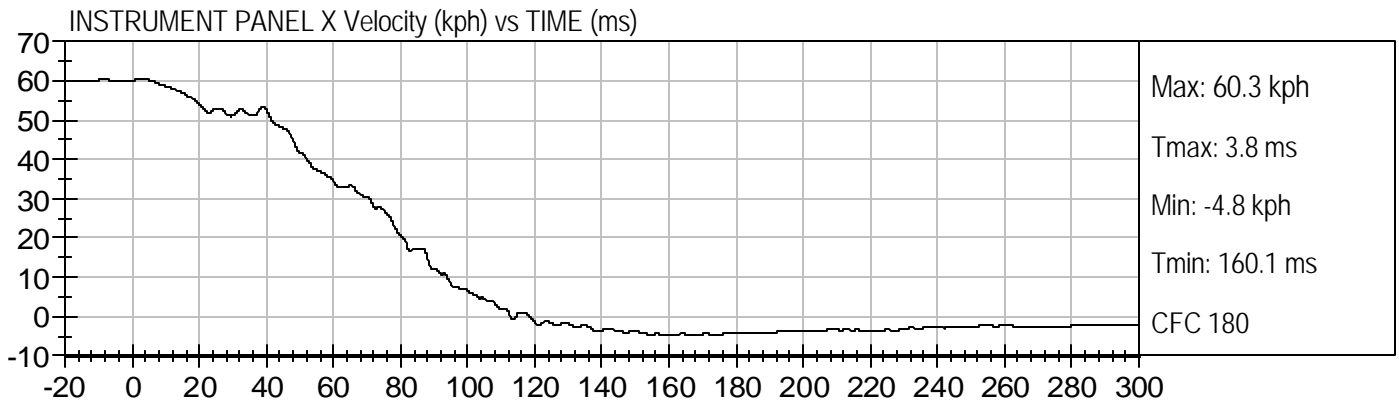
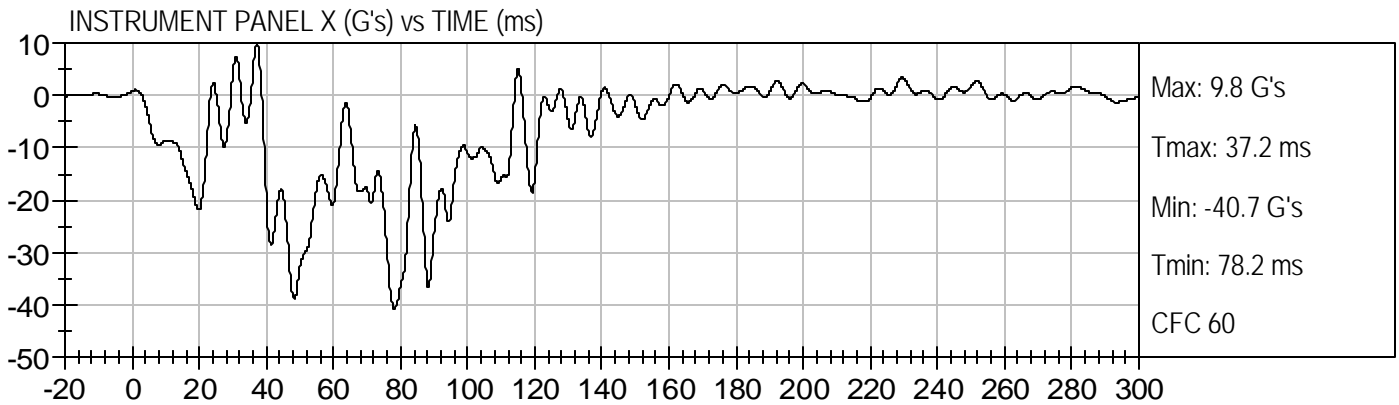


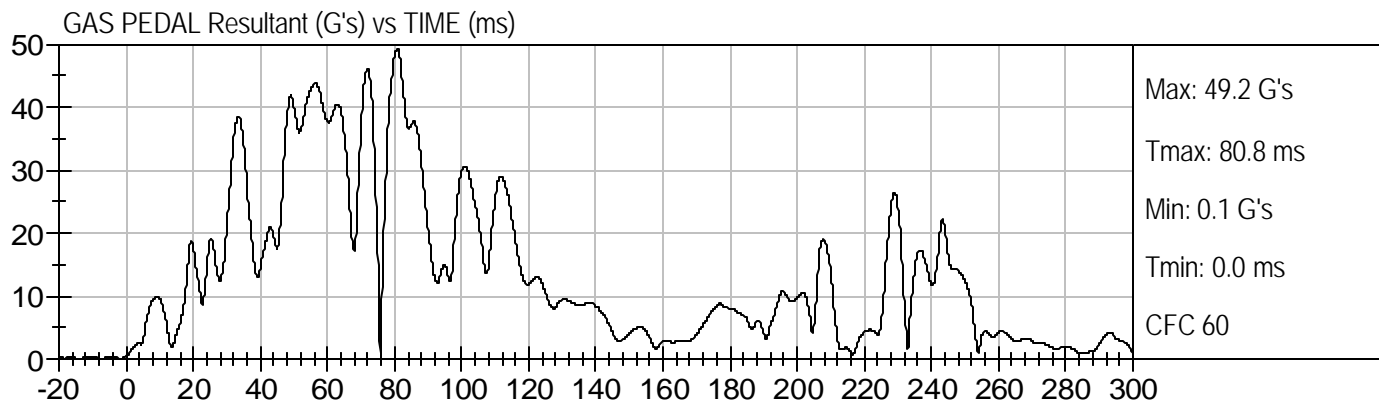
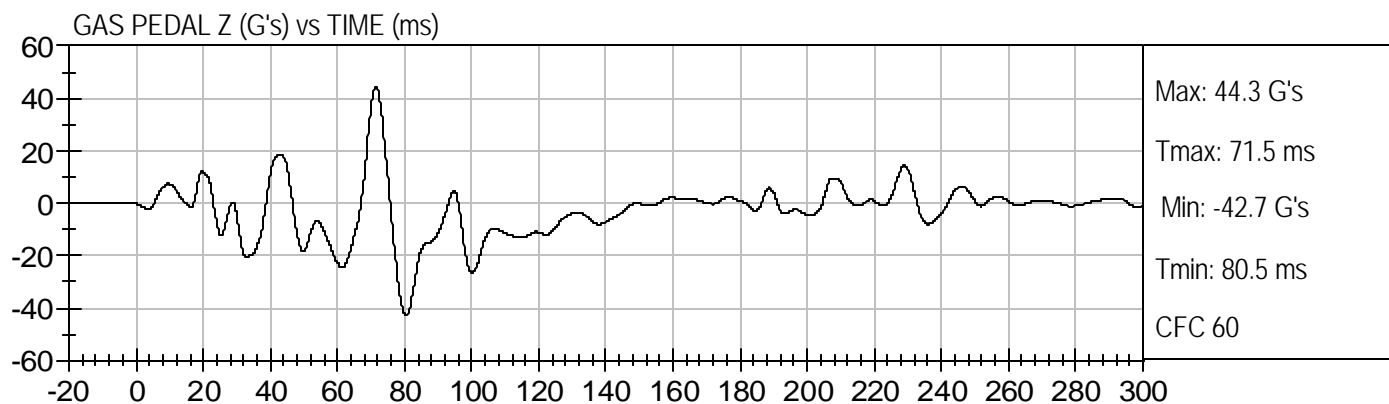
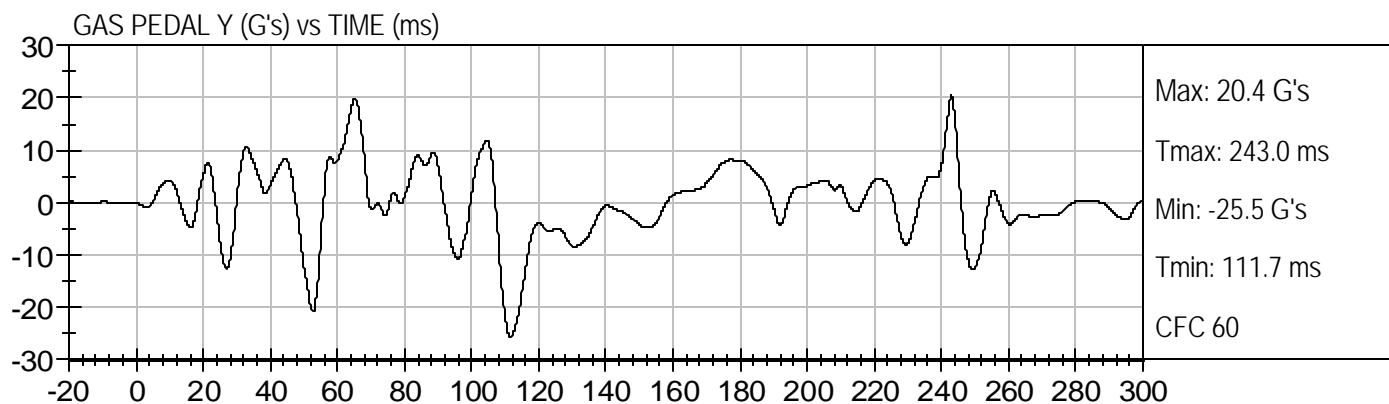
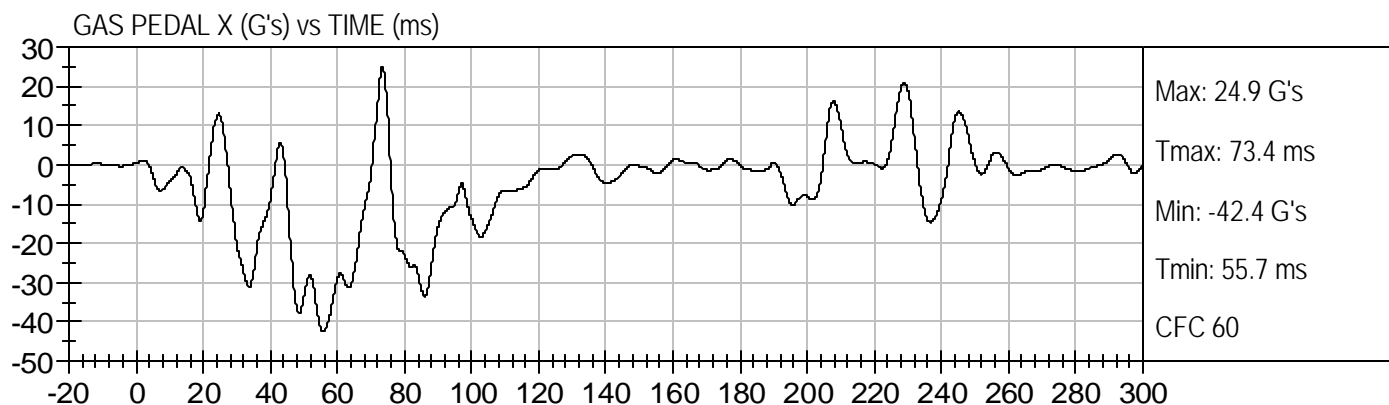


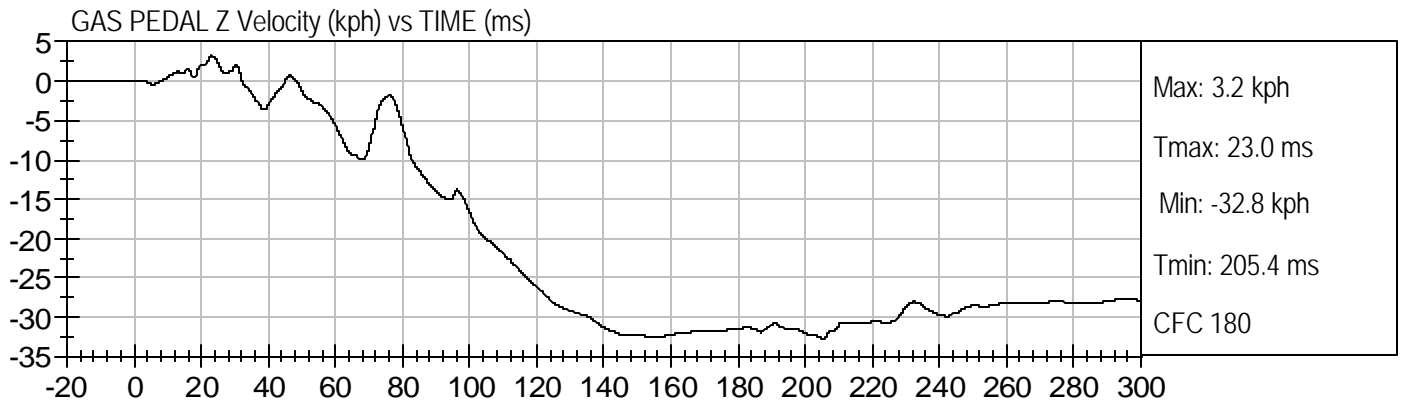
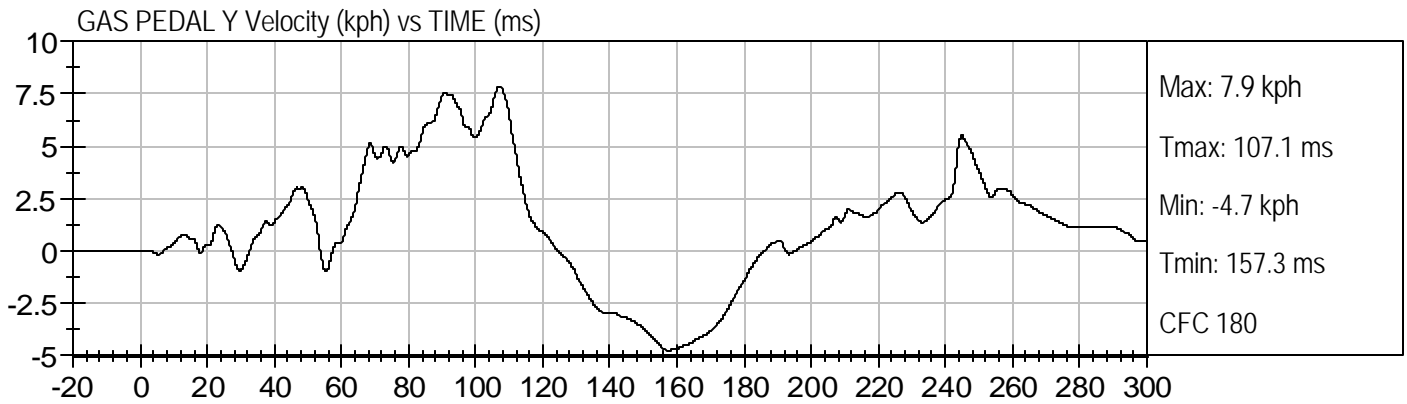
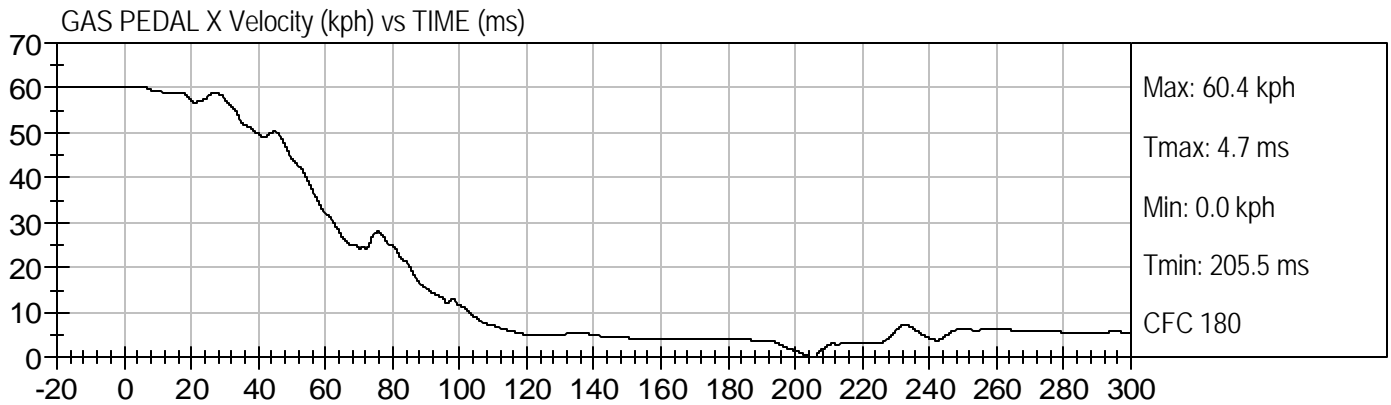


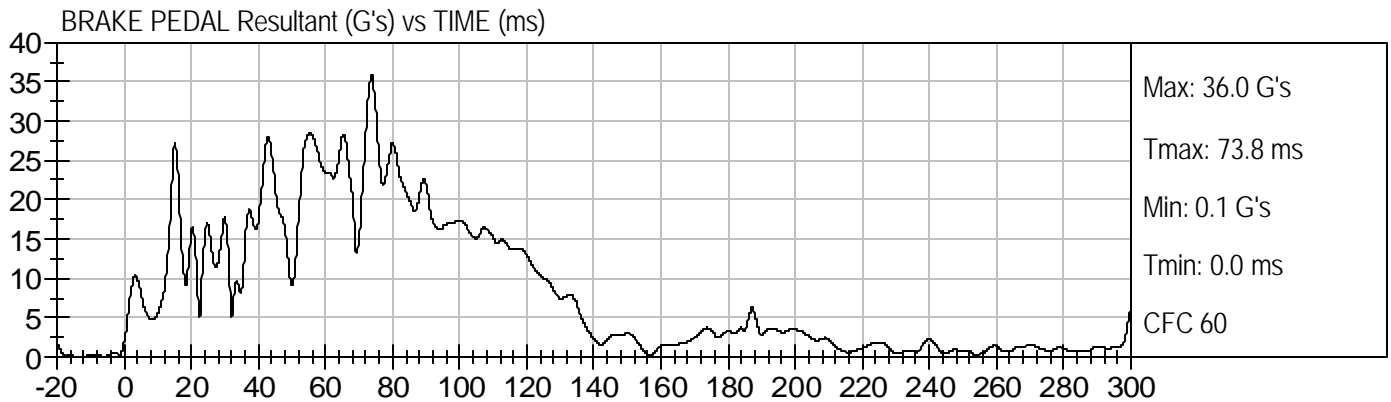
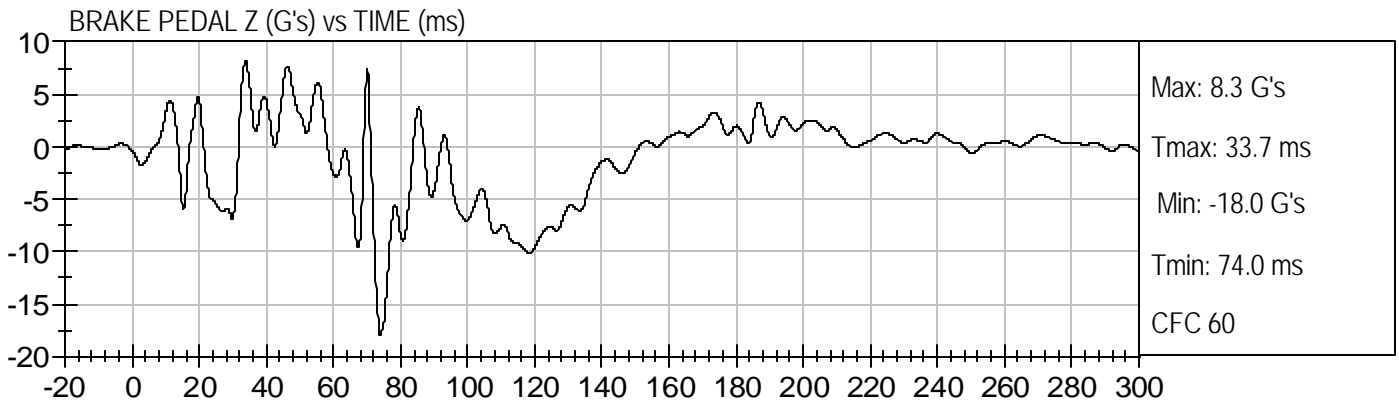
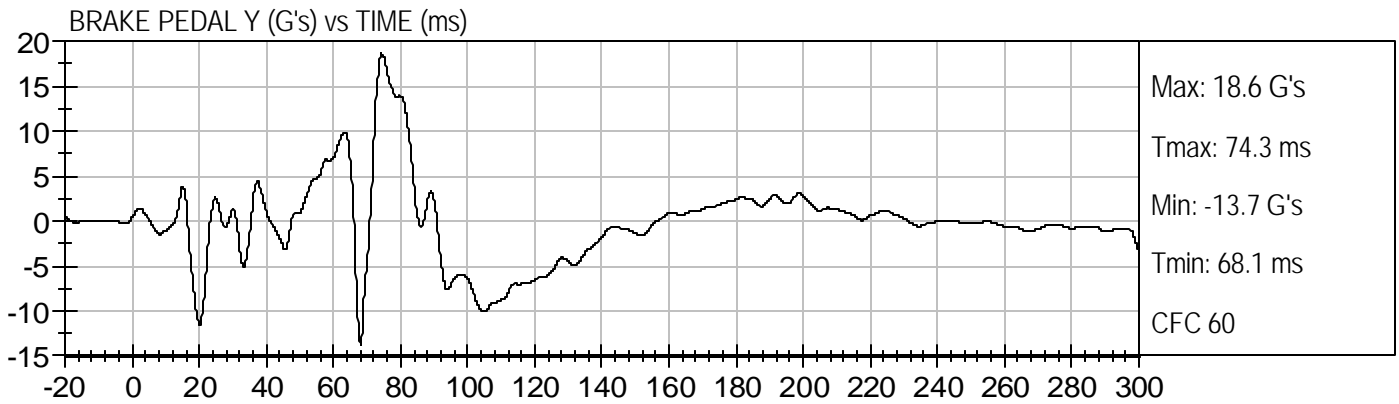
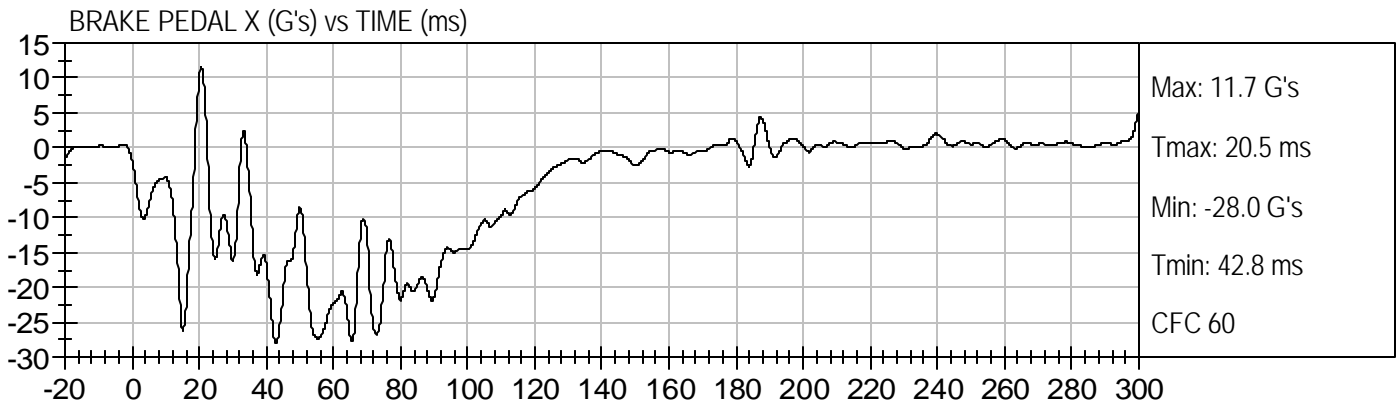


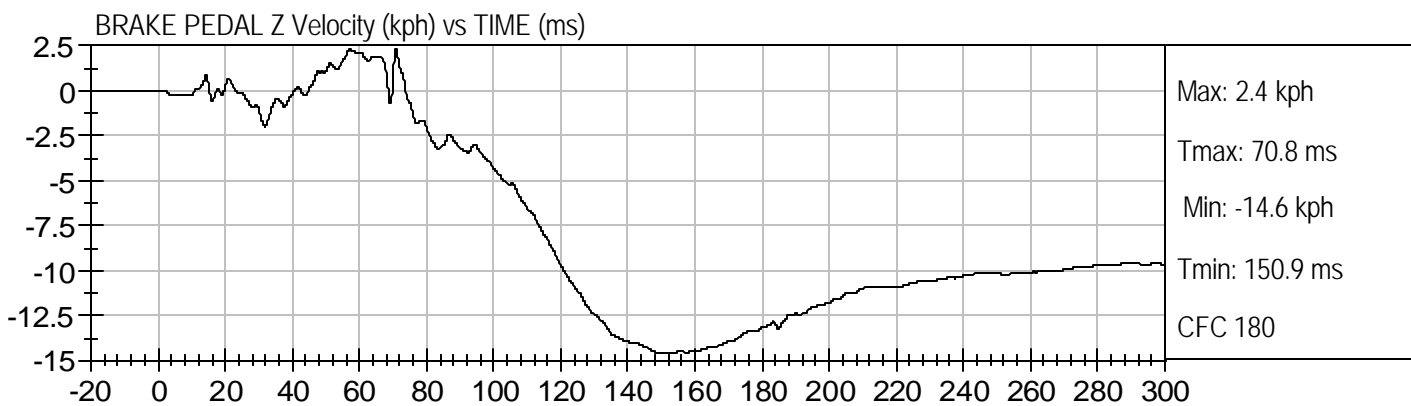
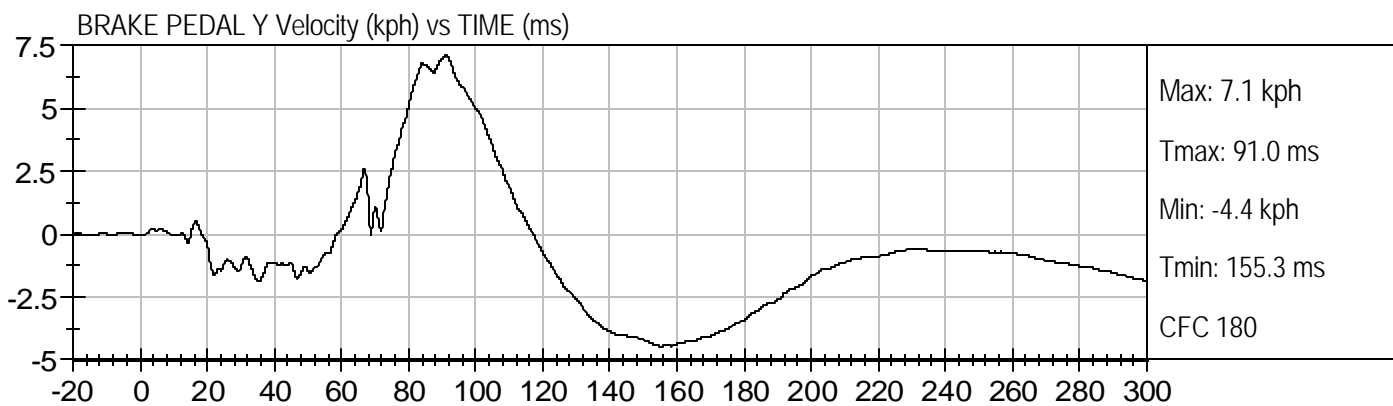
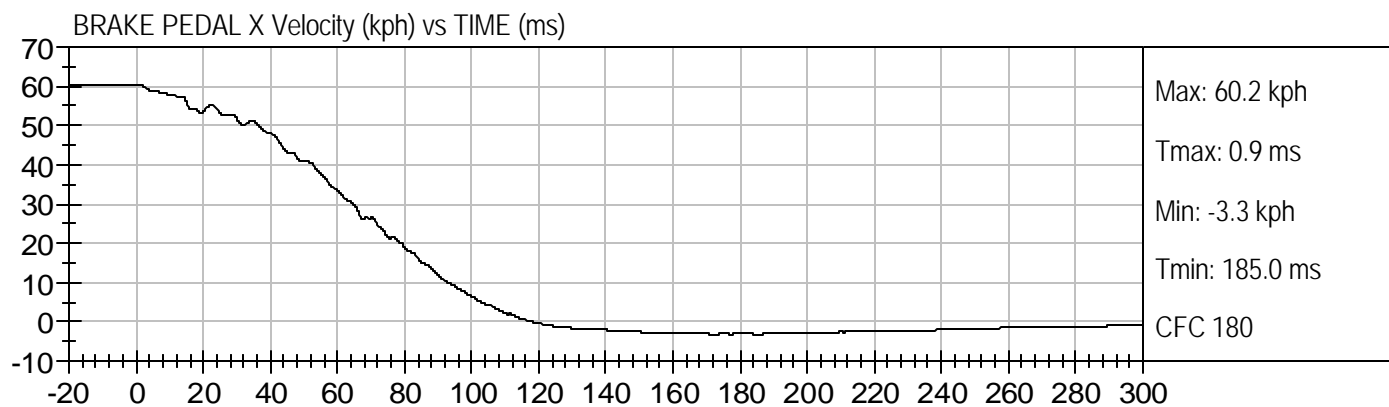


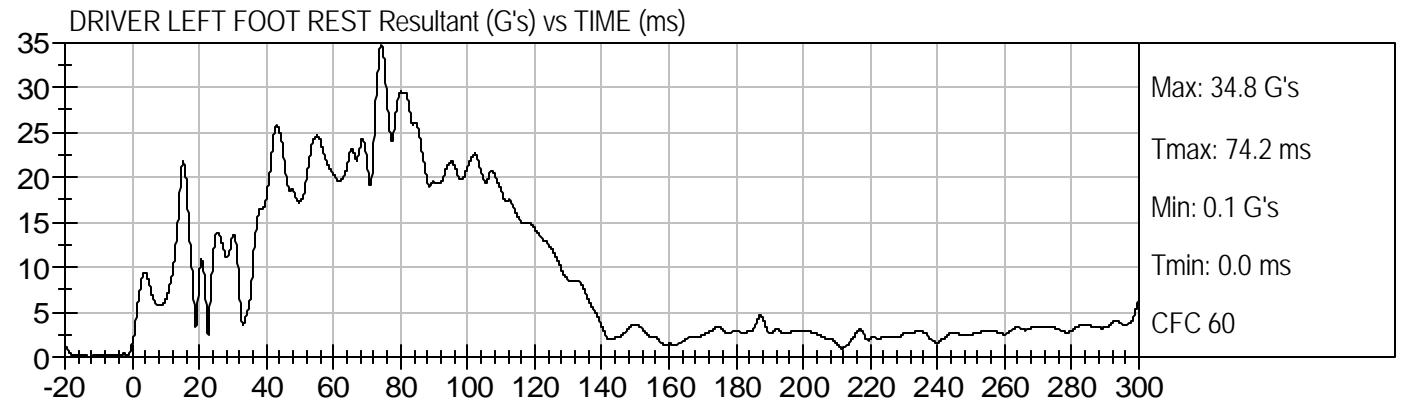
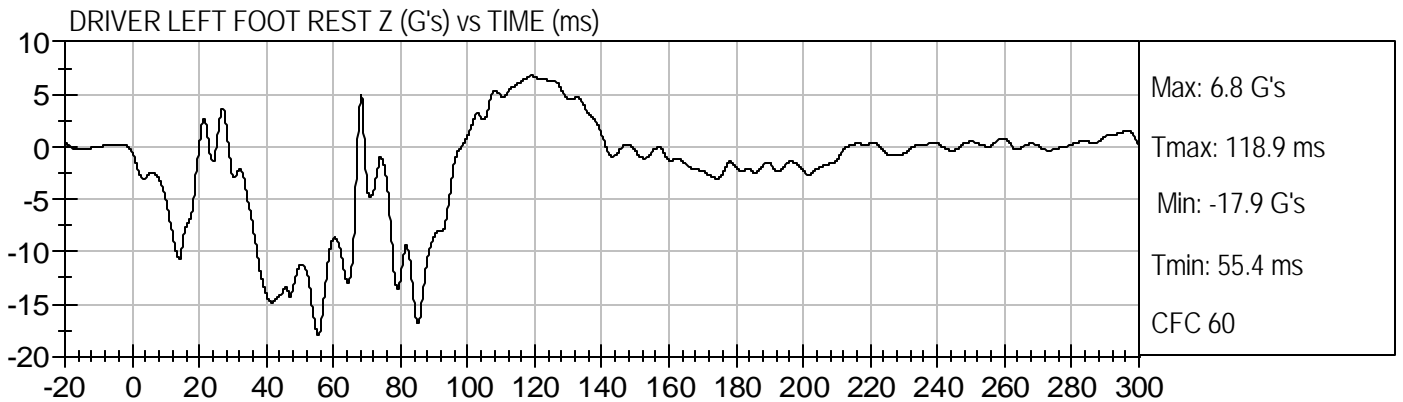
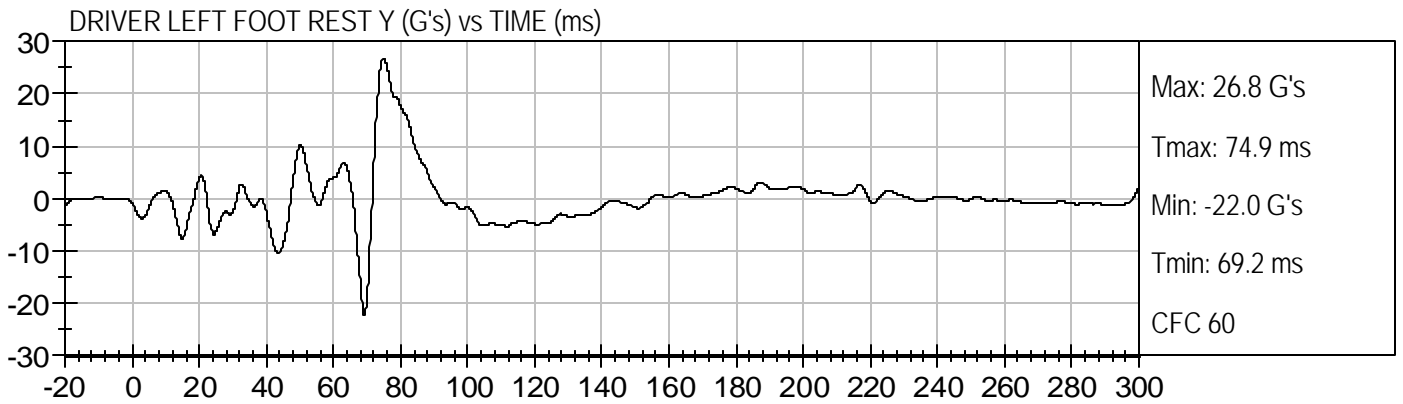
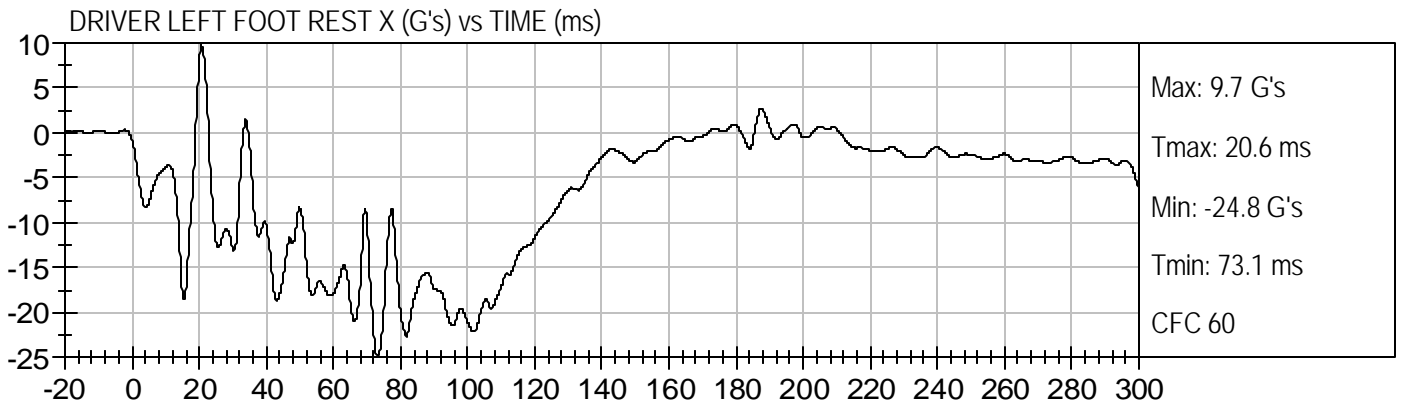


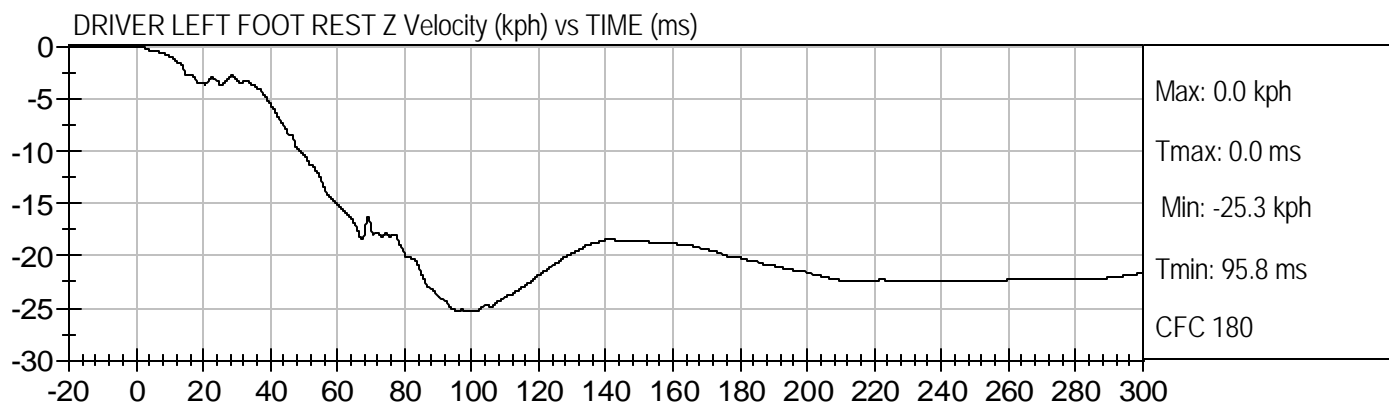
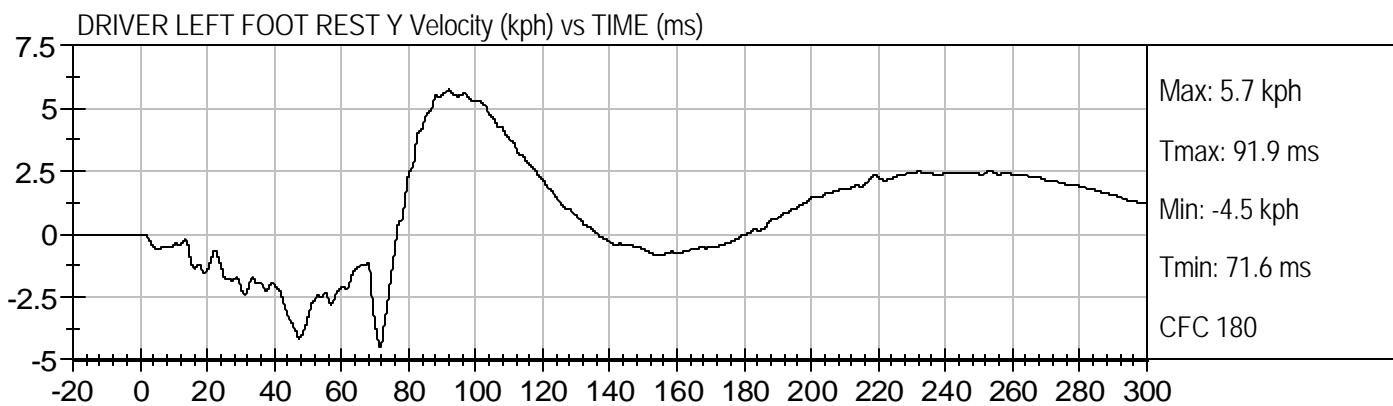
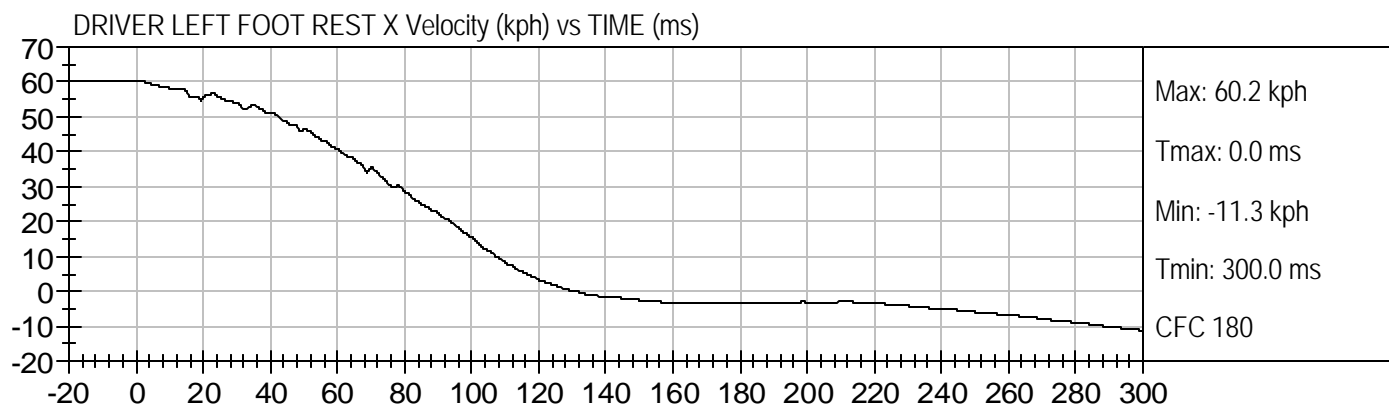


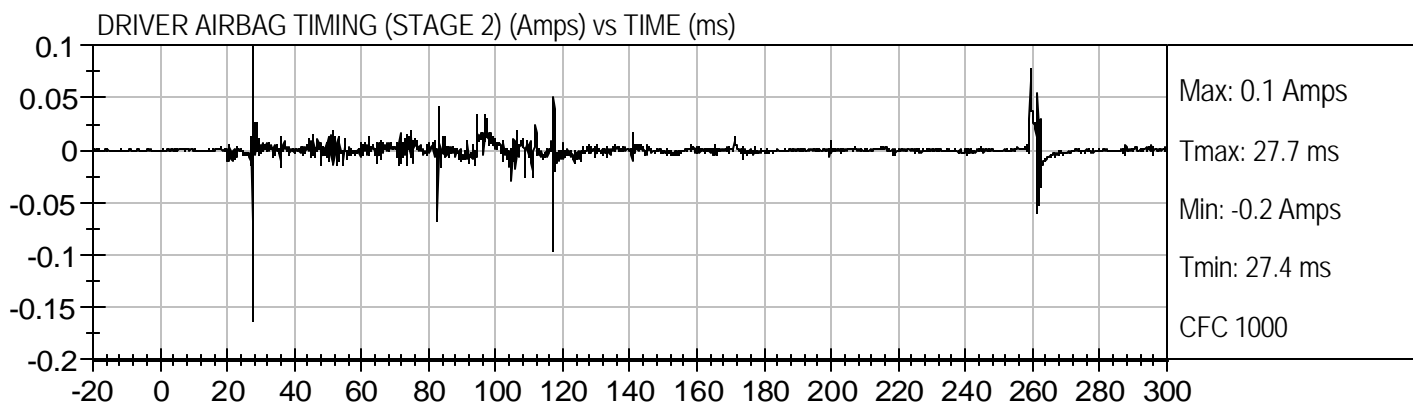
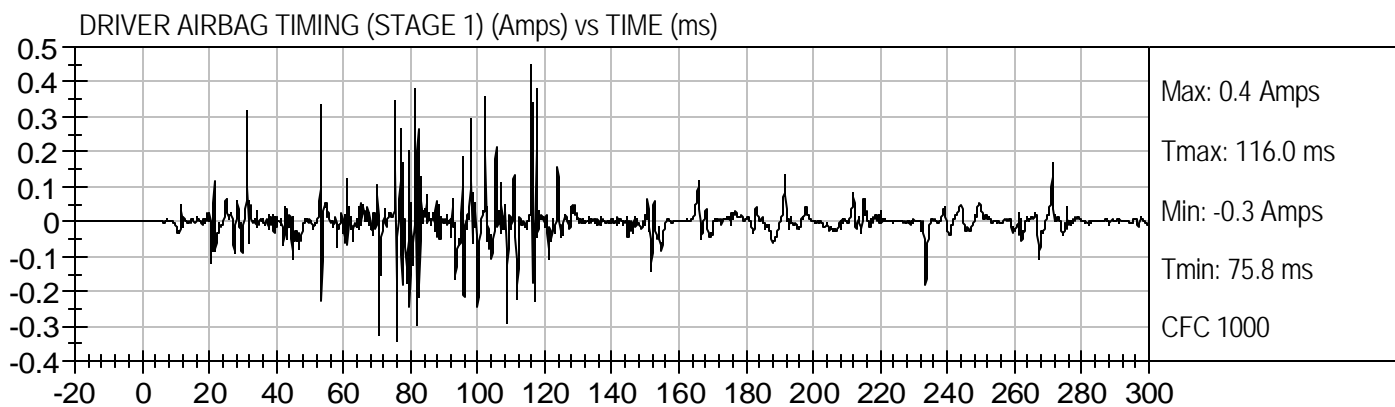


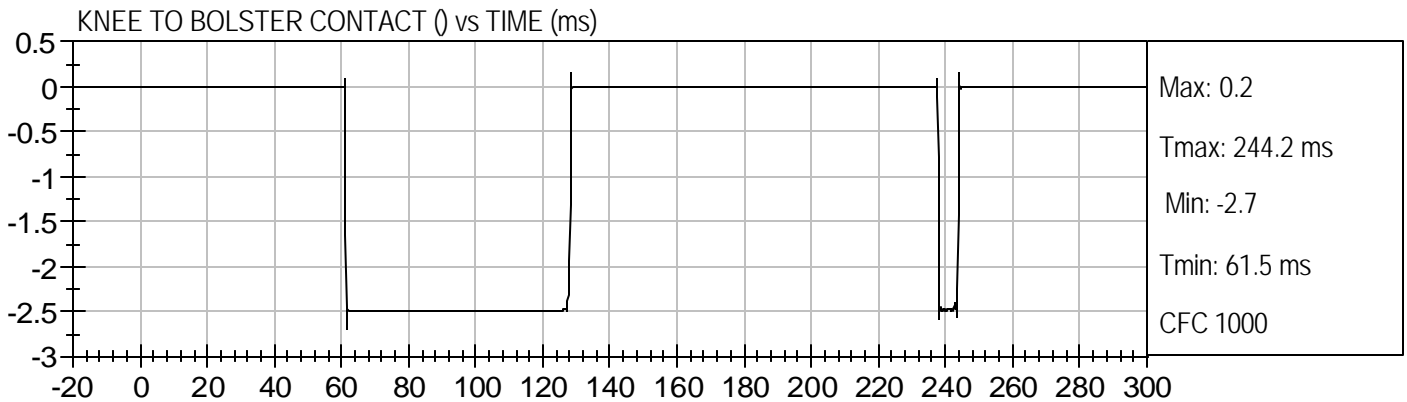
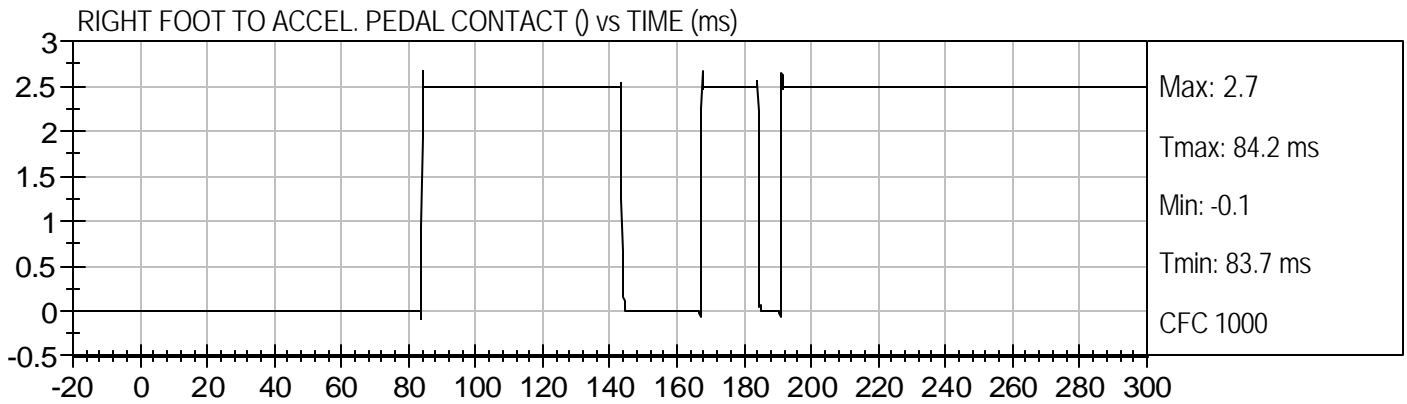
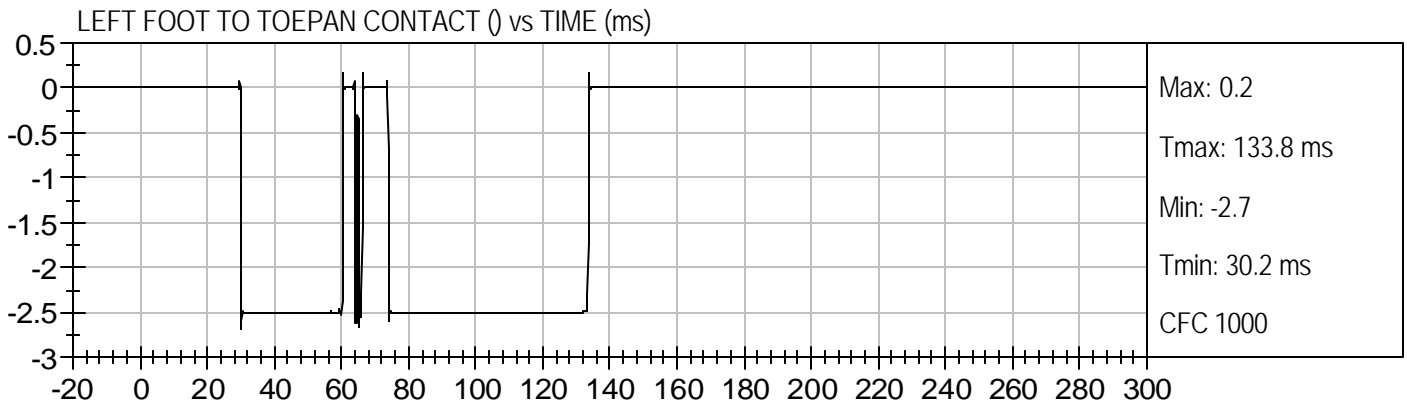


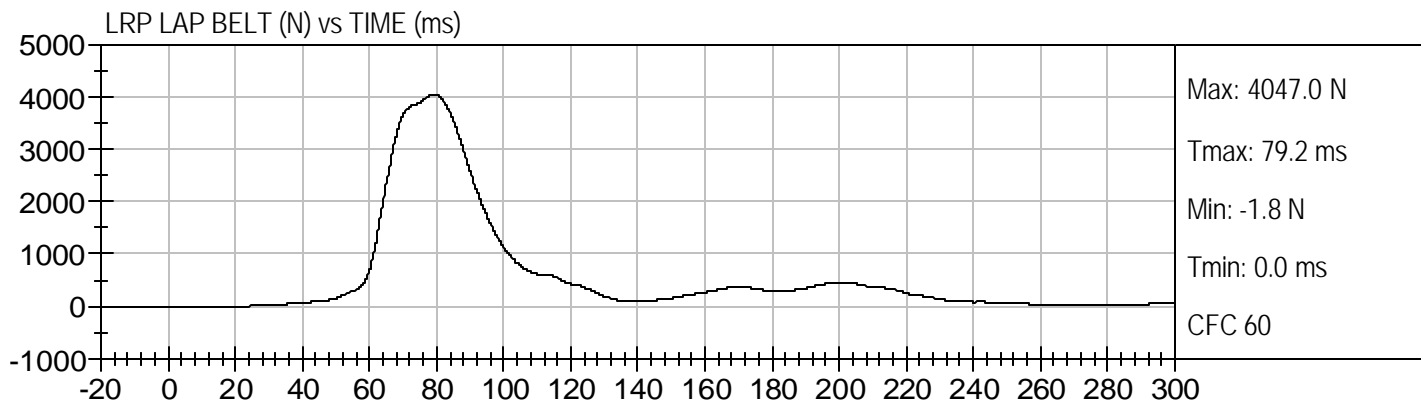
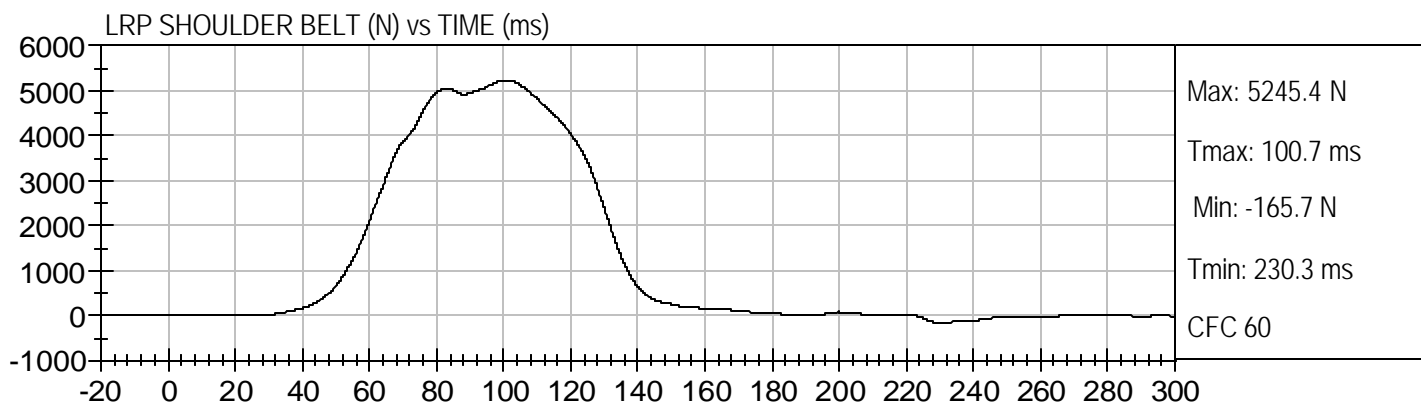
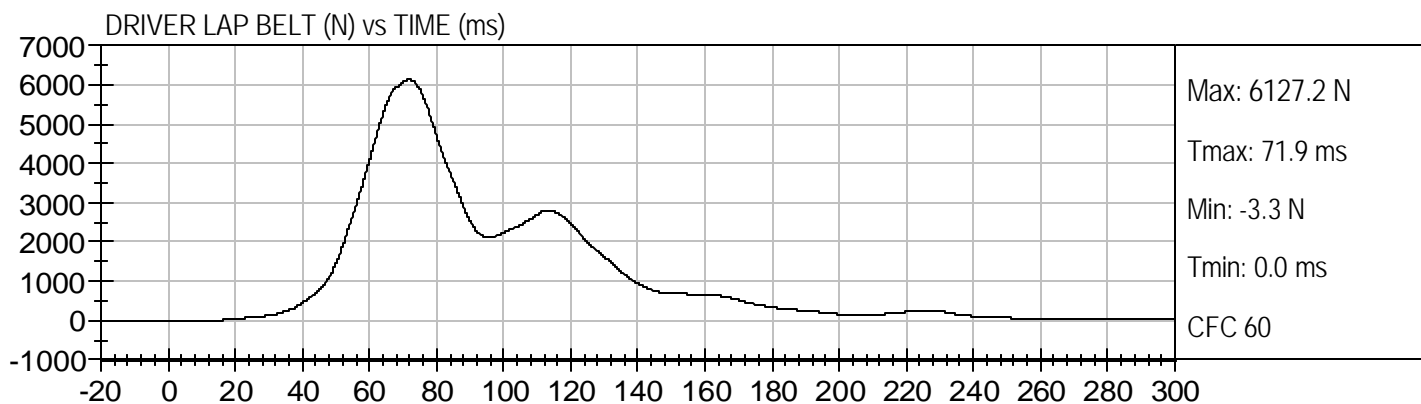
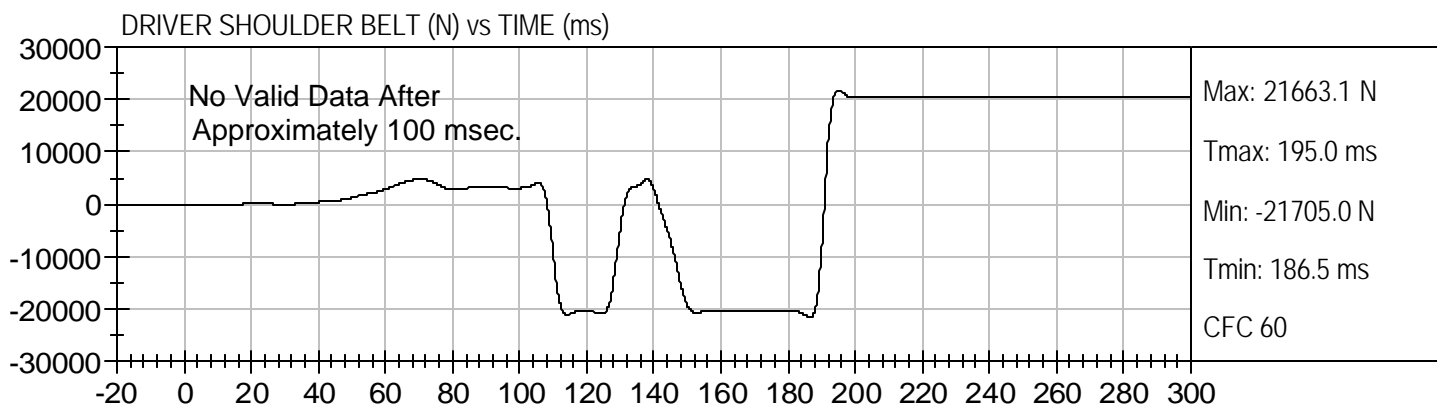


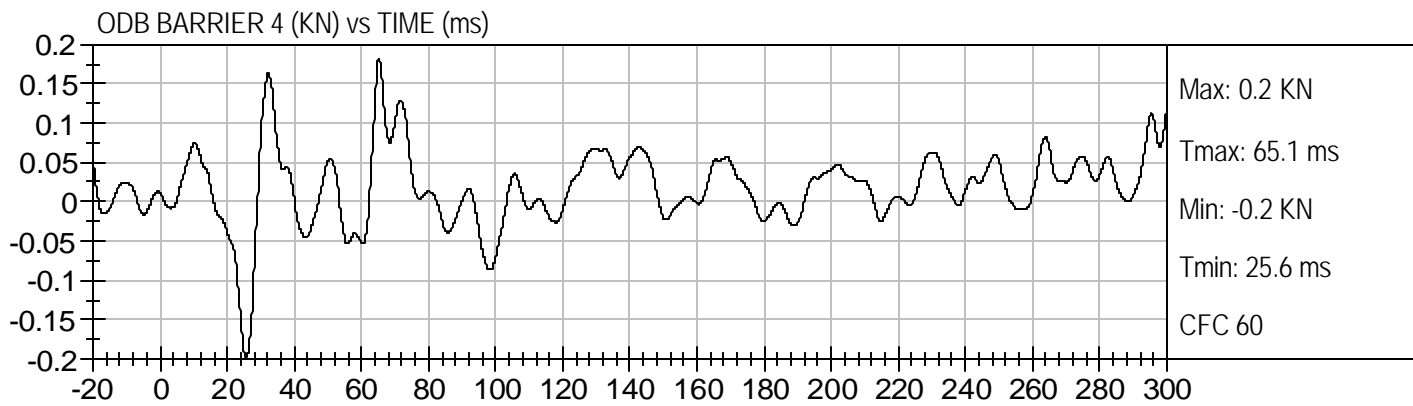
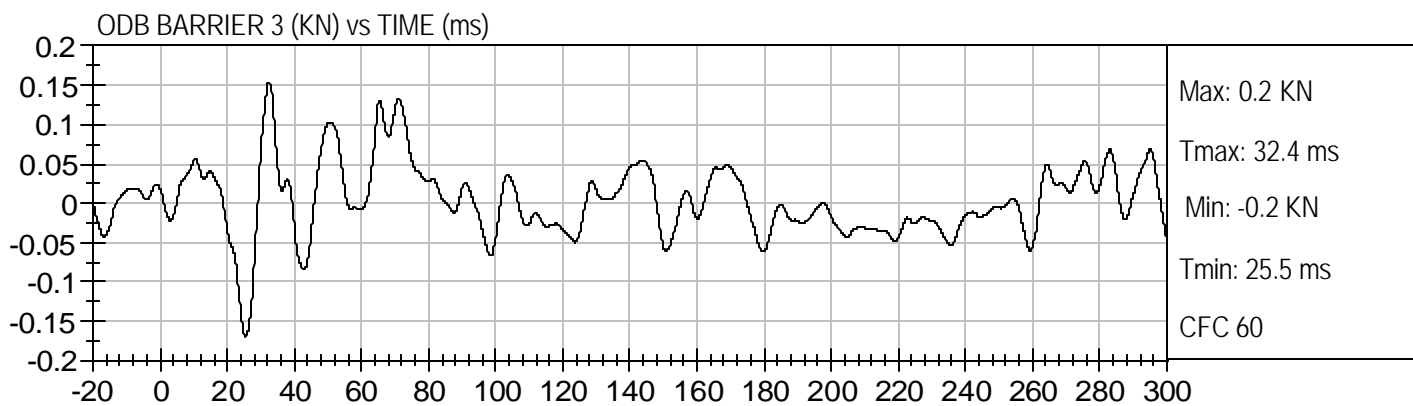
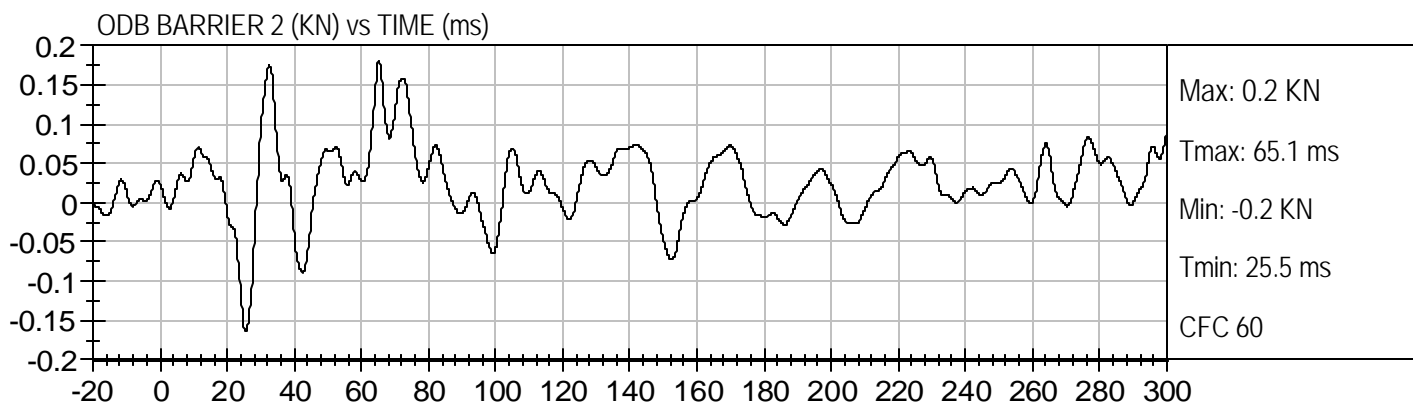
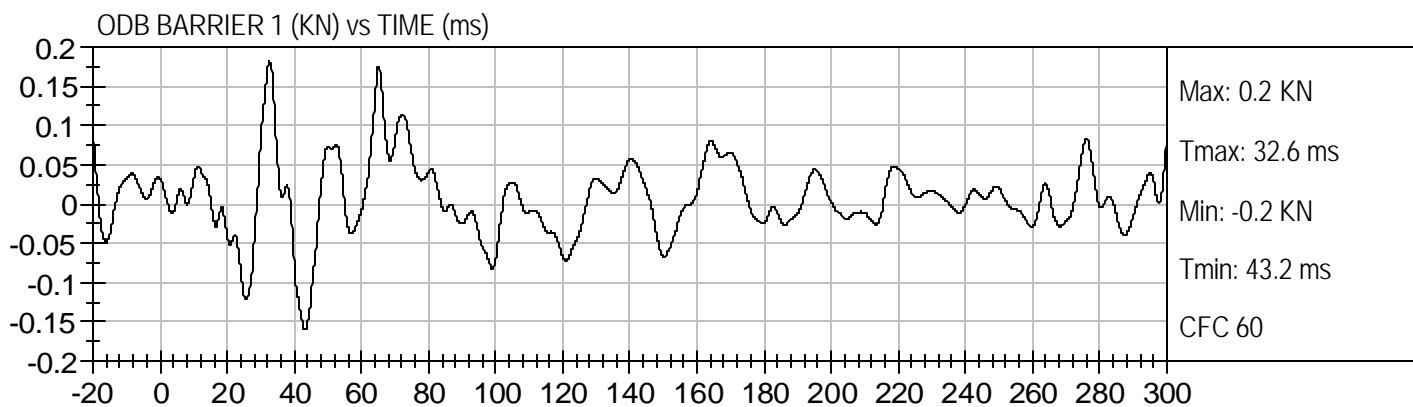


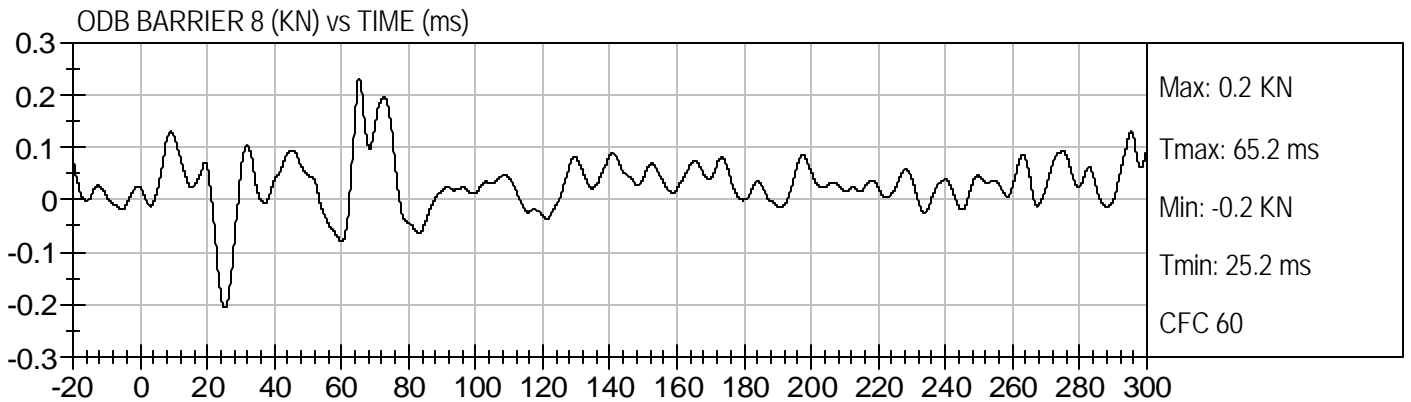
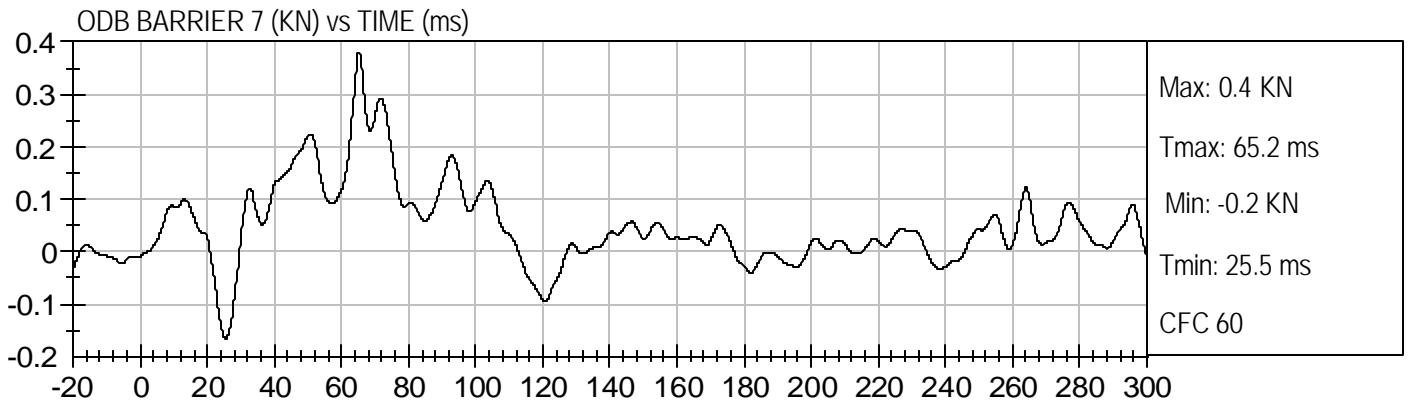
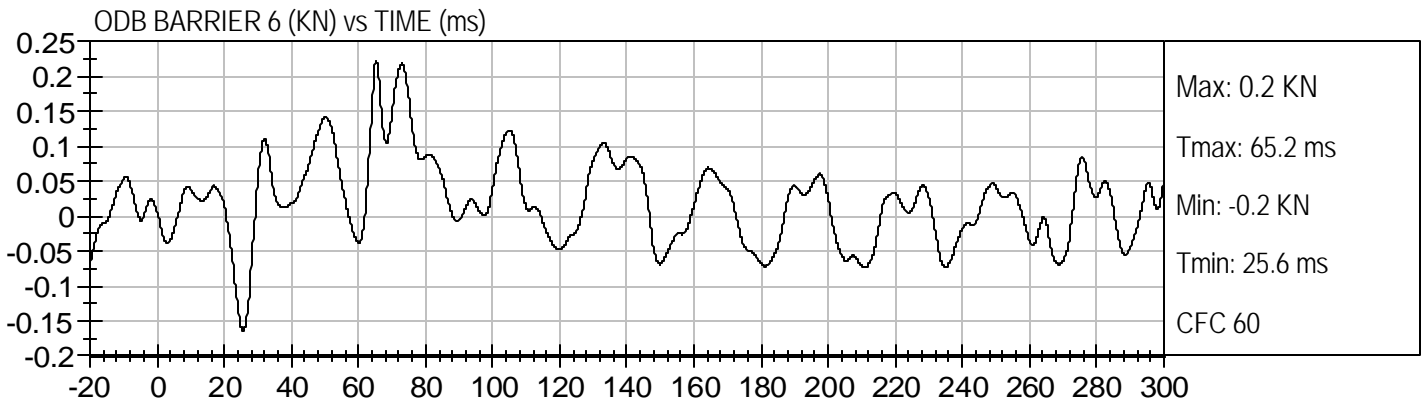
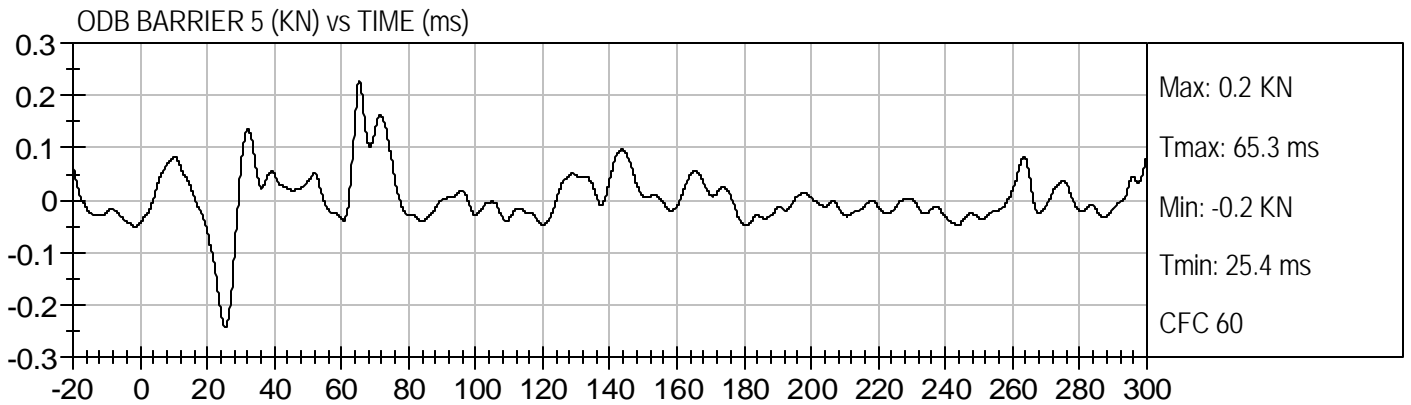






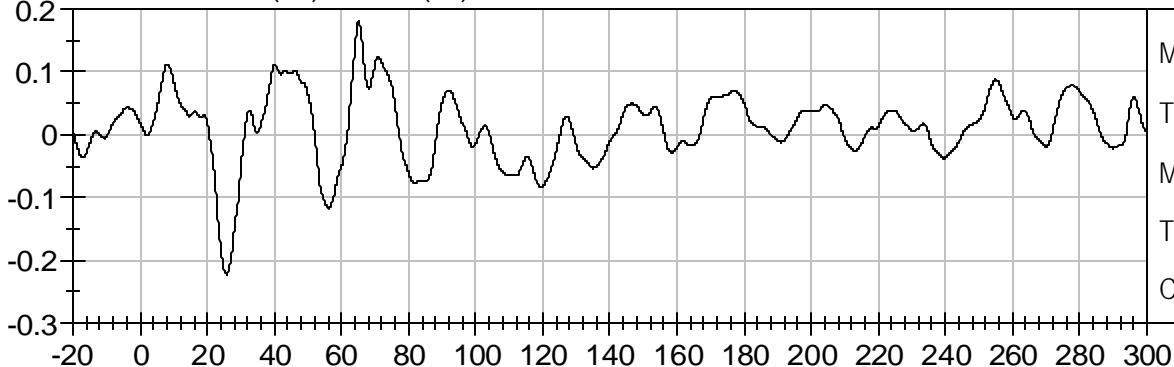






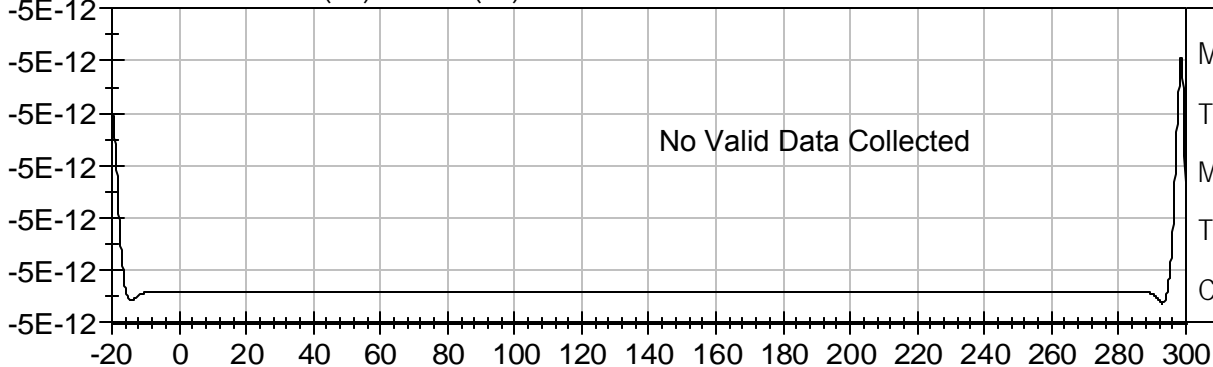


ODB BARRIER 9 (KN) vs TIME (ms)



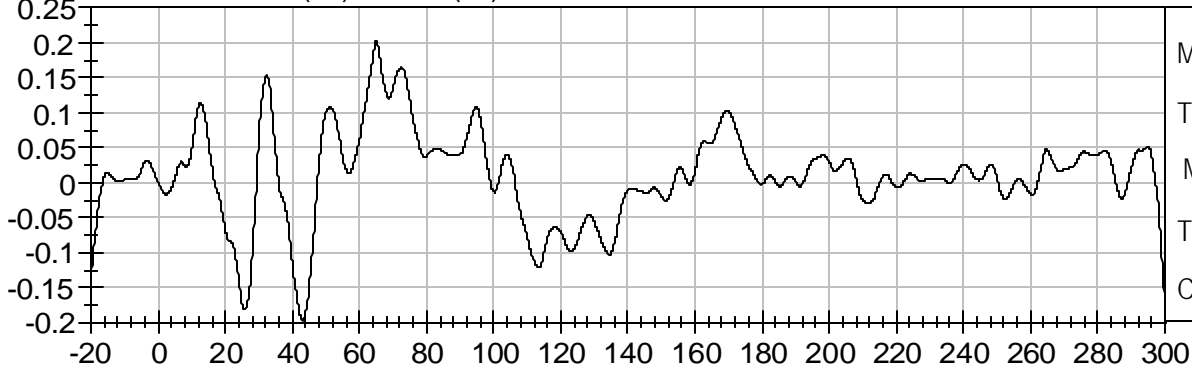
Max: 0.2 KN  
Tmax: 65.0 ms  
Min: -0.2 KN  
Tmin: 25.8 ms  
CFC 60

ODB BARRIER 10 (KN) vs TIME (ms)



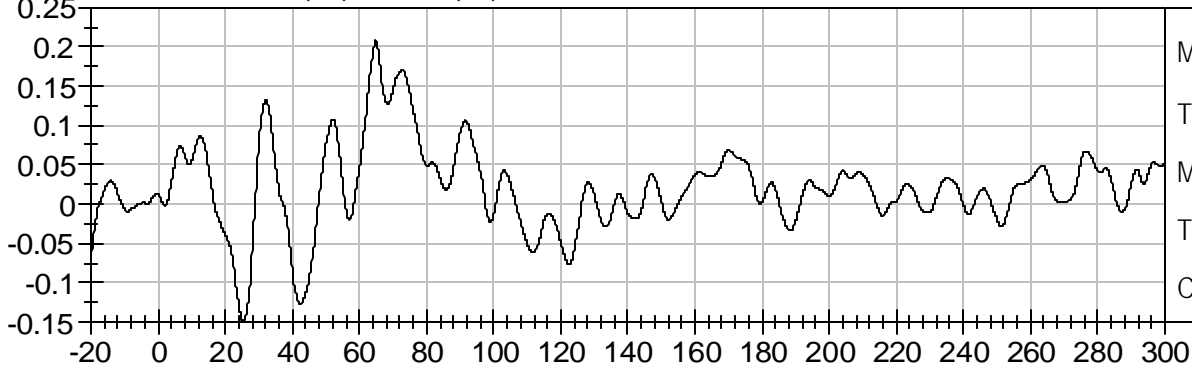
Max: -0.0 KN  
Tmax: 298.7 ms  
Min: -0.0 KN  
Tmin: 293.0 ms  
CFC 60

ODB BARRIER 11 (KN) vs TIME (ms)

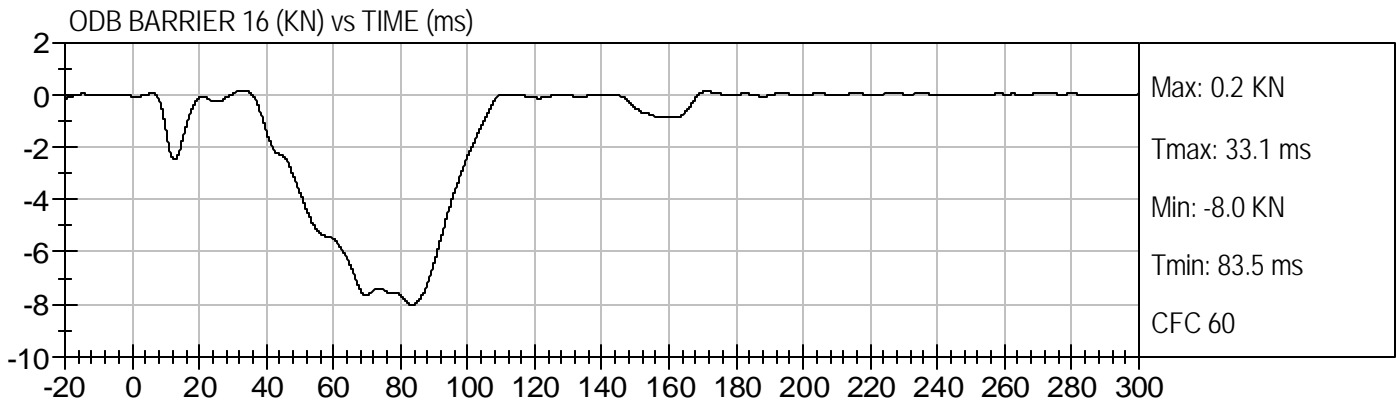
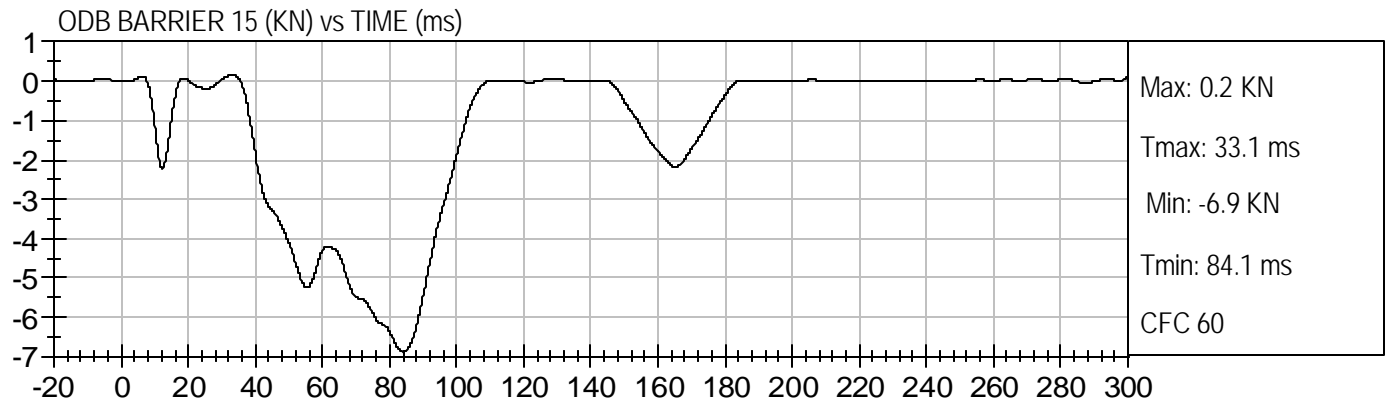
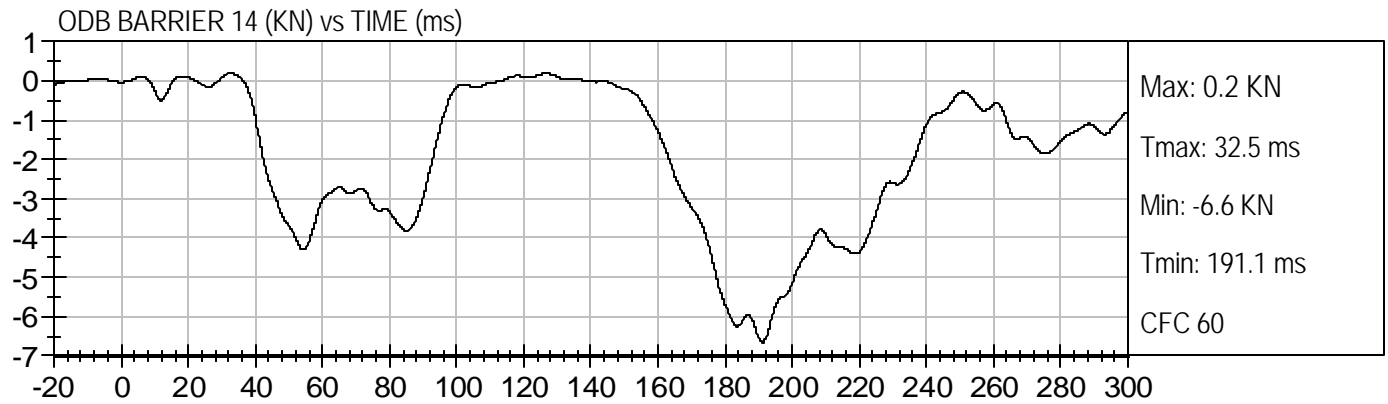
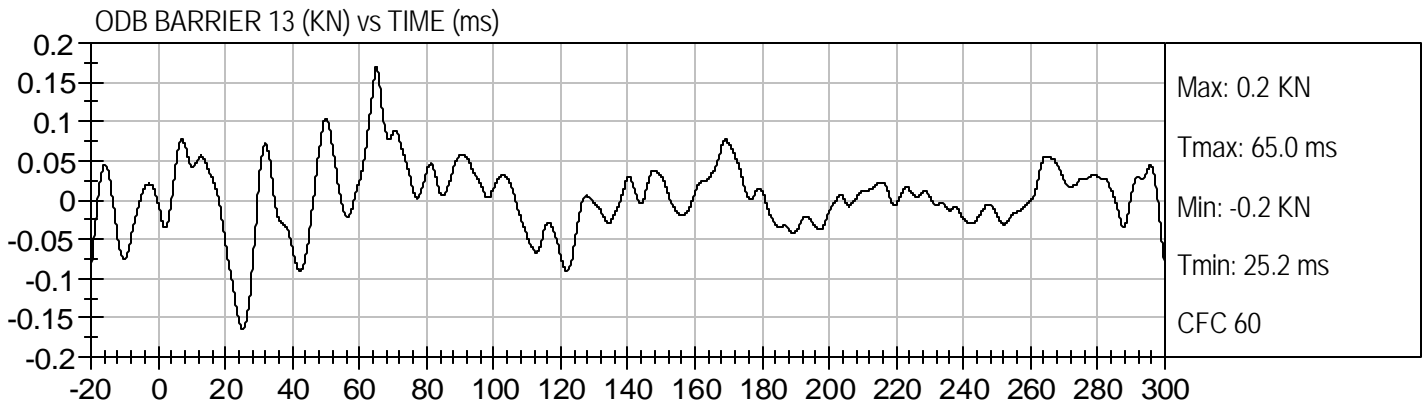


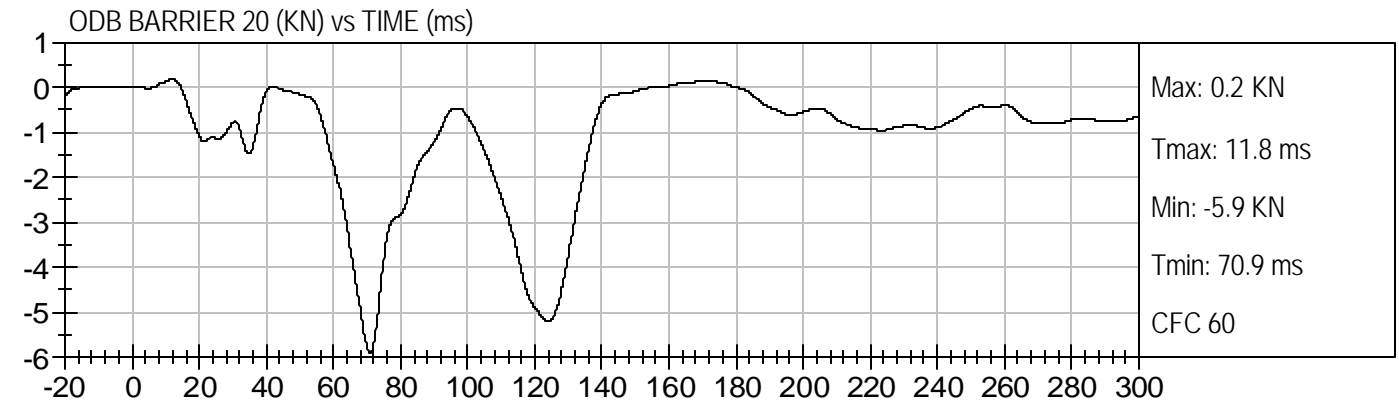
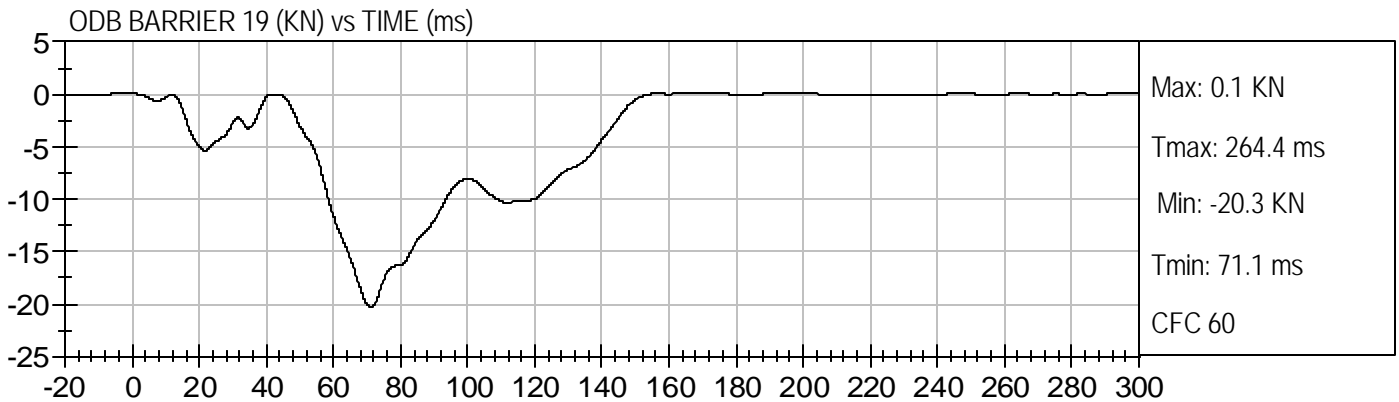
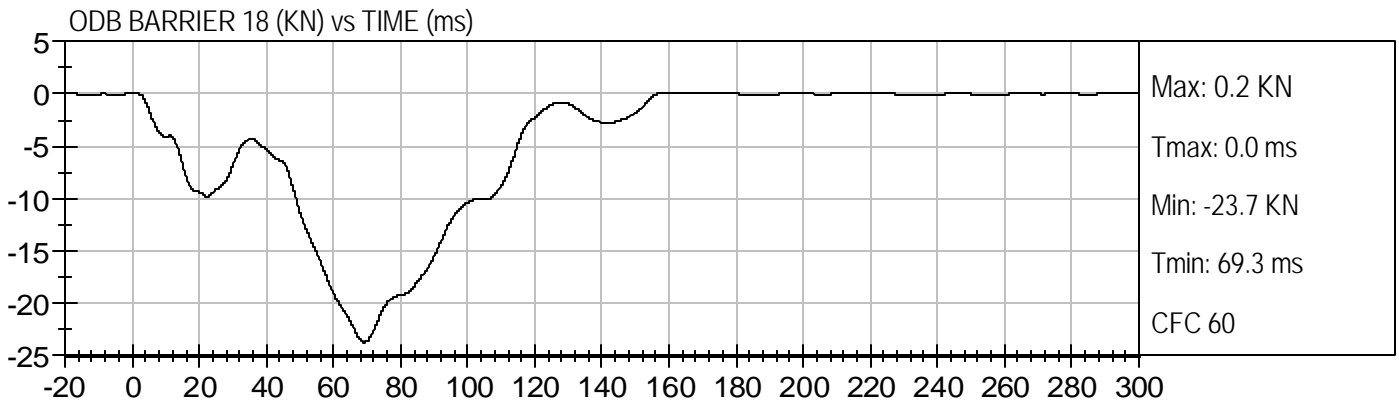
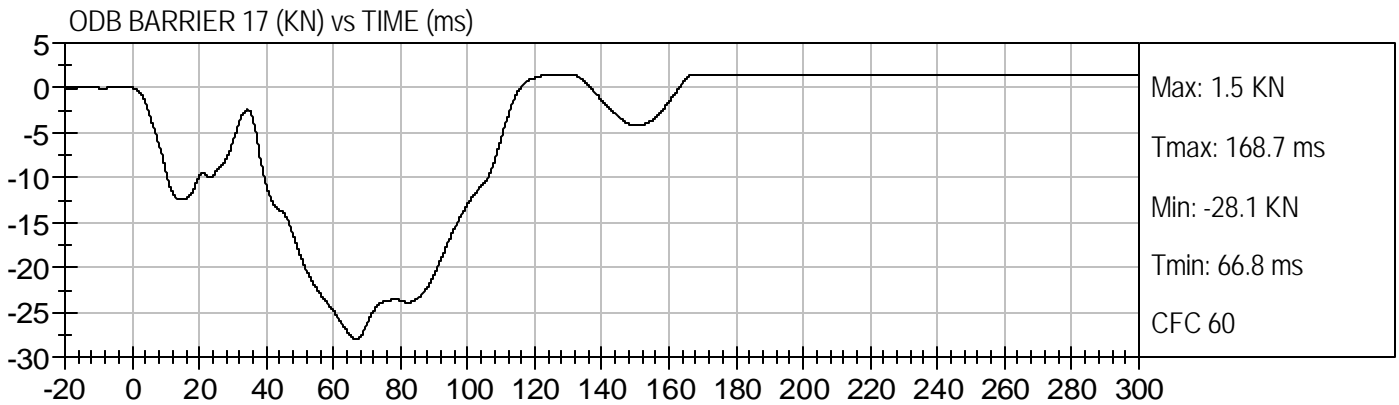
Max: 0.2 KN  
Tmax: 65.0 ms  
Min: -0.2 KN  
Tmin: 43.0 ms  
CFC 60

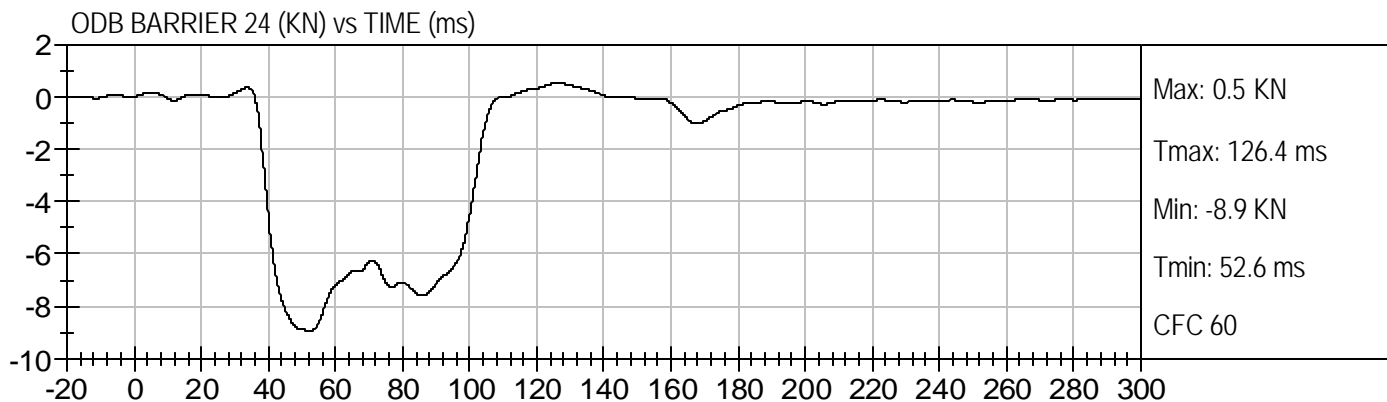
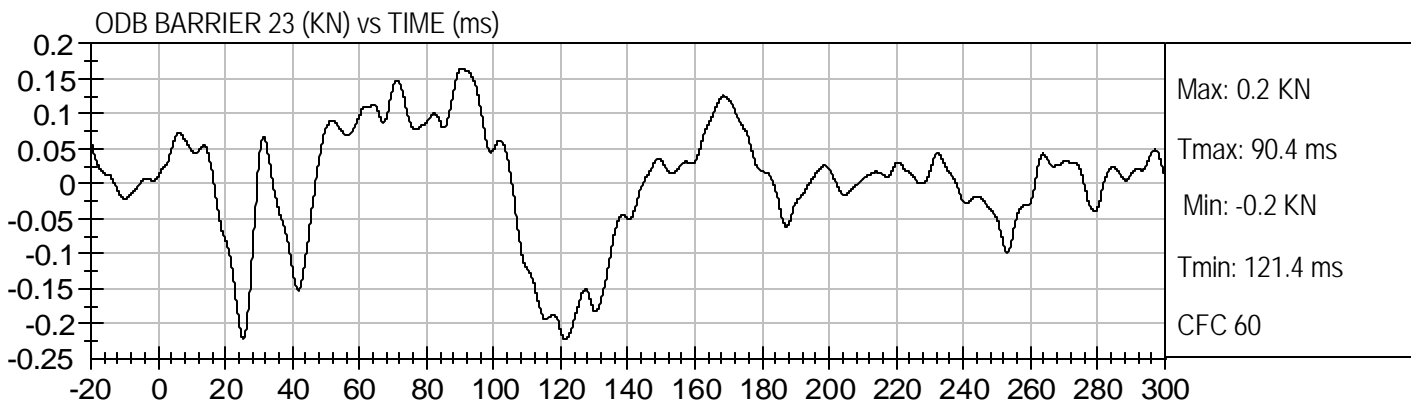
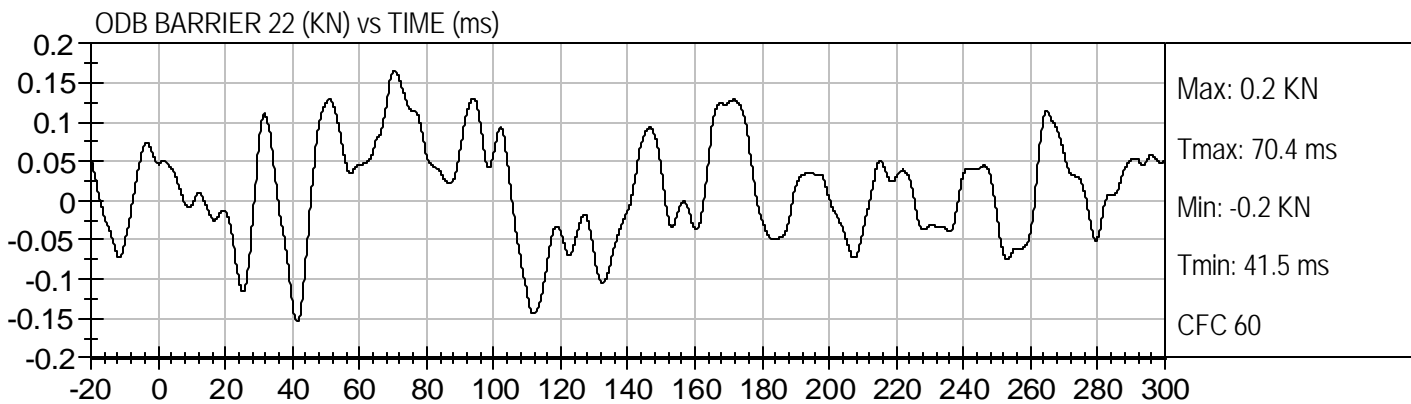
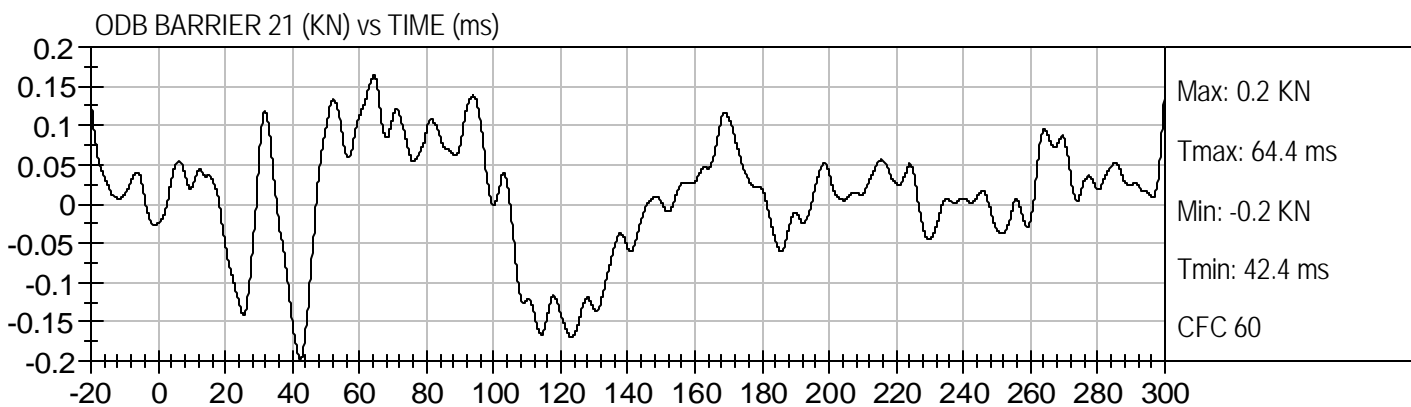
ODB BARRIER 12 (KN) vs TIME (ms)



Max: 0.2 KN  
Tmax: 64.8 ms  
Min: -0.1 KN  
Tmin: 25.4 ms  
CFC 60

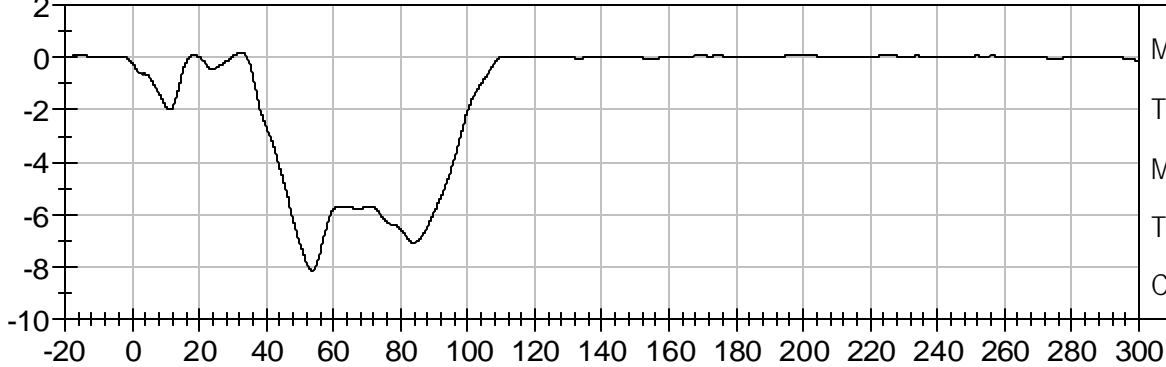






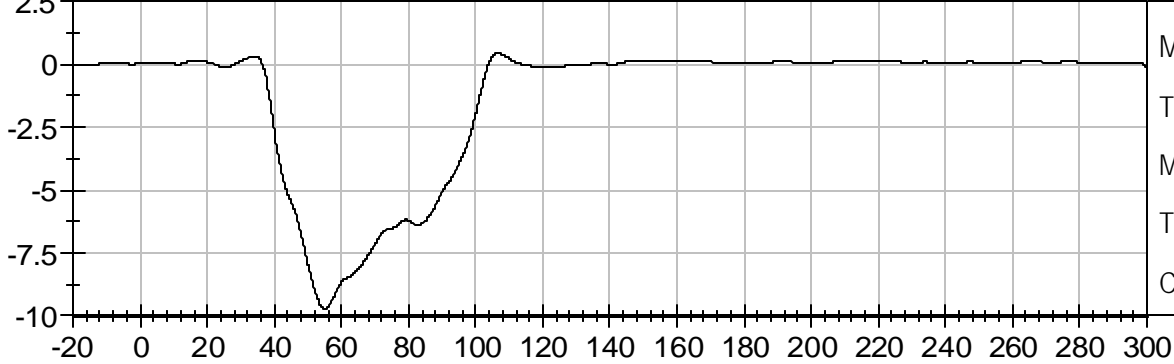


ODB BARRIER 25 (KN) vs TIME (ms)



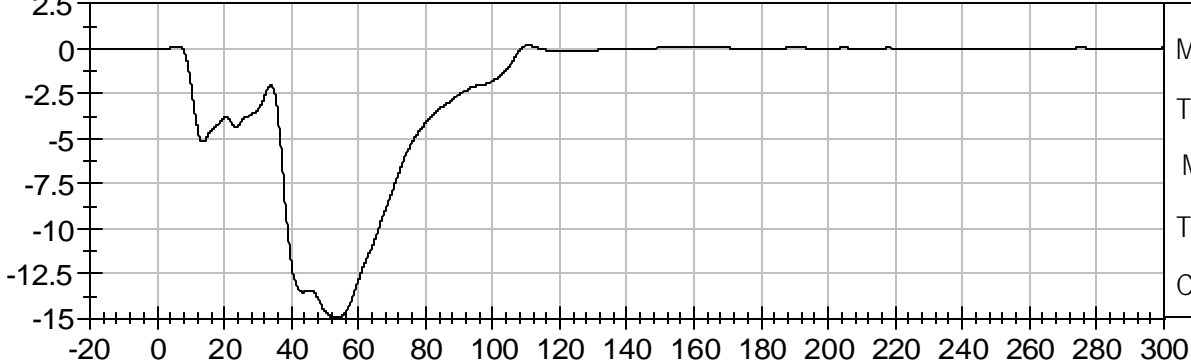
Max: 0.2 KN  
Tmax: 32.5 ms  
Min: -8.1 KN  
Tmin: 53.6 ms  
CFC 60

ODB BARRIER 26 (KN) vs TIME (ms)



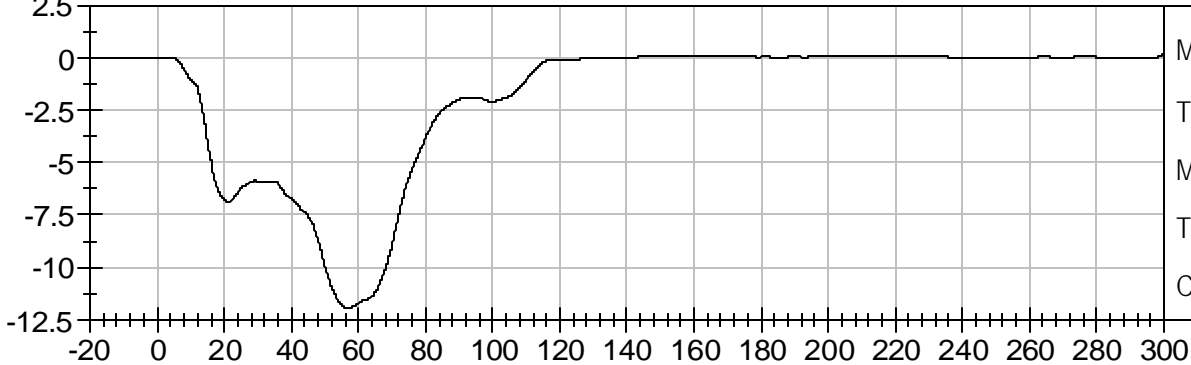
Max: 0.4 KN  
Tmax: 106.5 ms  
Min: -9.7 KN  
Tmin: 54.9 ms  
CFC 60

ODB BARRIER 27 (KN) vs TIME (ms)



Max: 0.2 KN  
Tmax: 110.5 ms  
Min: -14.9 KN  
Tmin: 53.2 ms  
CFC 60

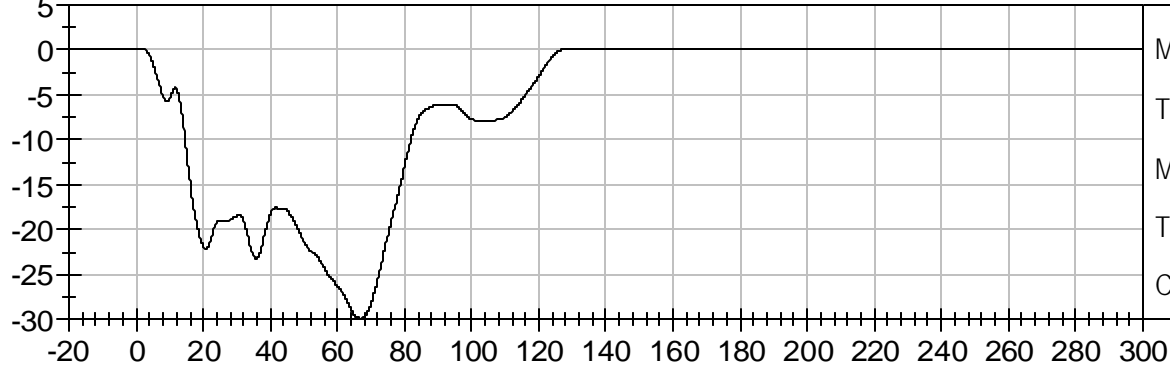
ODB BARRIER 28 (KN) vs TIME (ms)



Max: 0.2 KN  
Tmax: 300.0 ms  
Min: -11.9 KN  
Tmin: 56.8 ms  
CFC 60

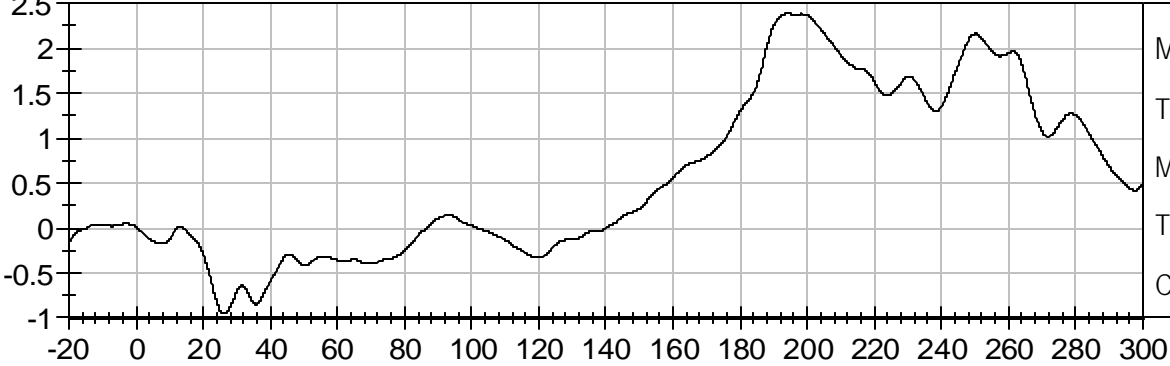


ODB BARRIER 29 (KN) vs TIME (ms)



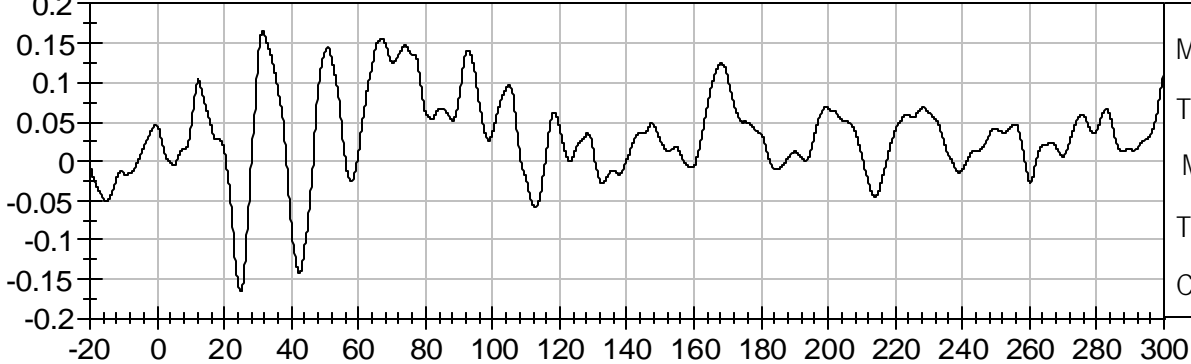
Max: 0.2 KN  
Tmax: 1.2 ms  
Min: -29.9 KN  
Tmin: 66.7 ms  
CFC 60

ODB BARRIER 30 (KN) vs TIME (ms)



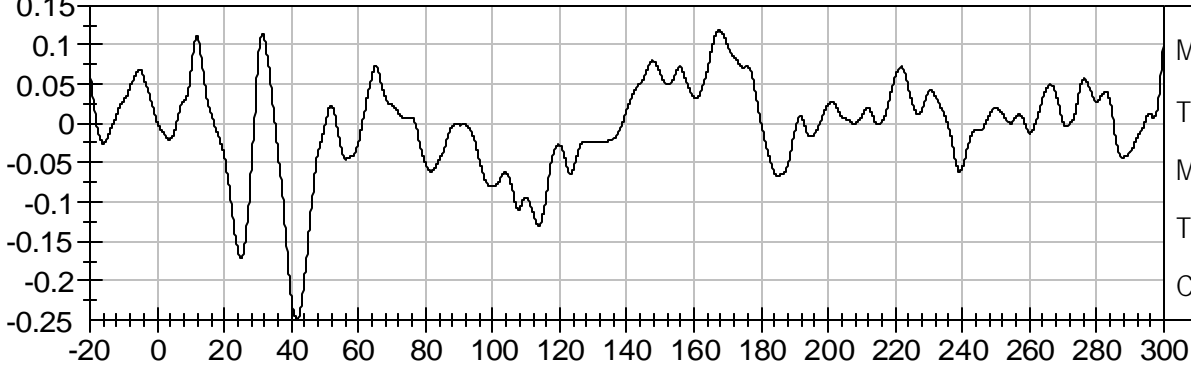
Max: 2.4 KN  
Tmax: 194.0 ms  
Min: -0.9 KN  
Tmin: 26.1 ms  
CFC 60

ODB BARRIER 31 (KN) vs TIME (ms)

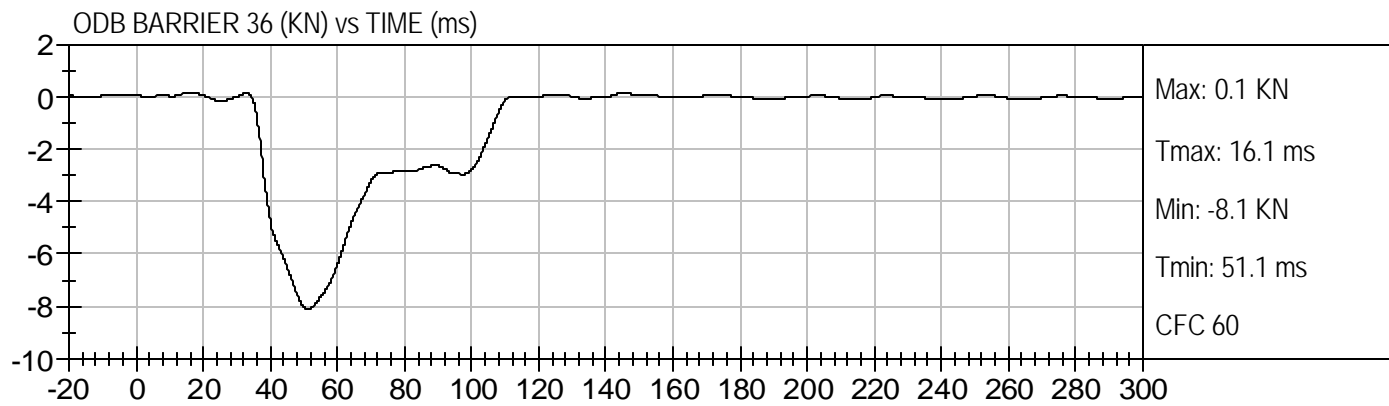
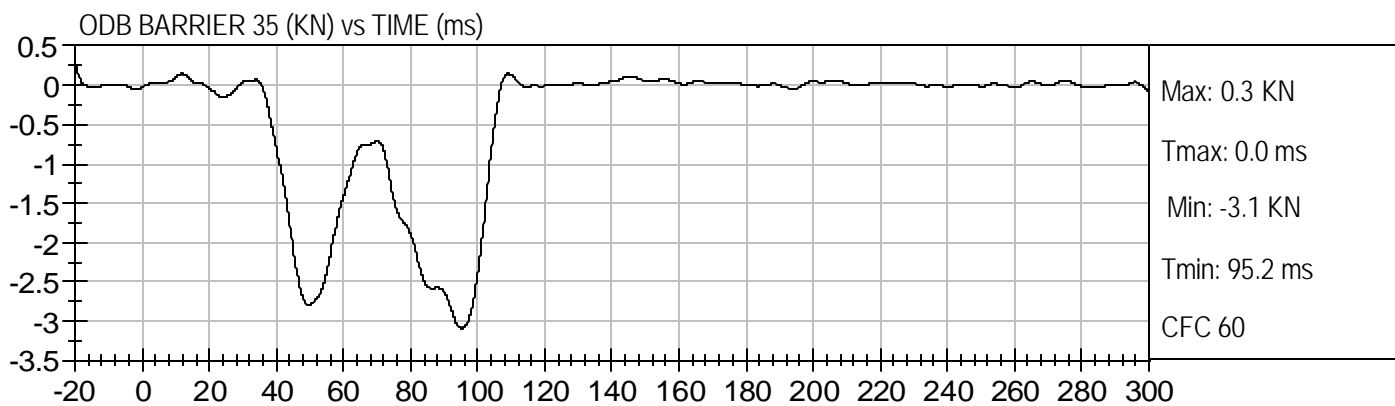
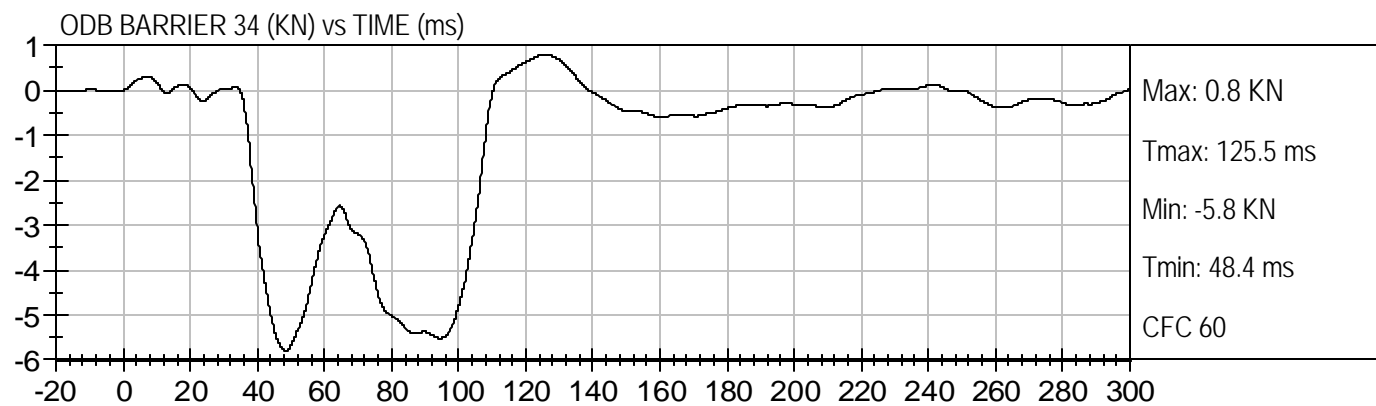
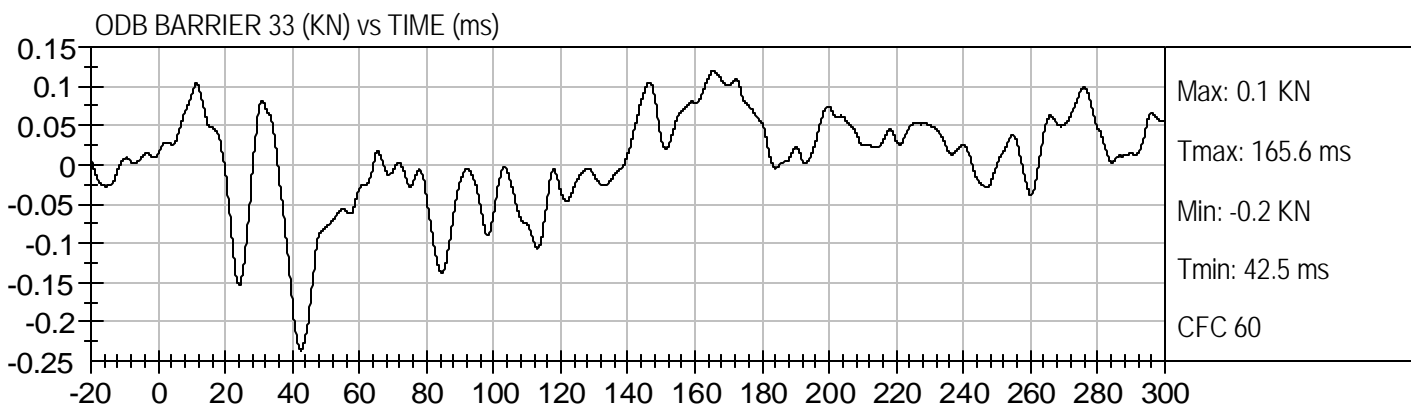


Max: 0.2 KN  
Tmax: 31.4 ms  
Min: -0.2 KN  
Tmin: 24.8 ms  
CFC 60

ODB BARRIER 32 (KN) vs TIME (ms)

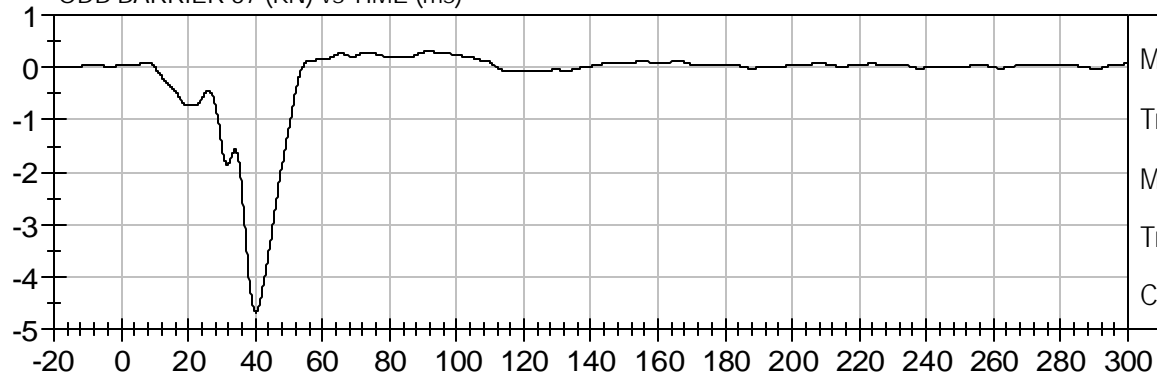


Max: 0.1 KN  
Tmax: 167.4 ms  
Min: -0.2 KN  
Tmin: 41.7 ms  
CFC 60



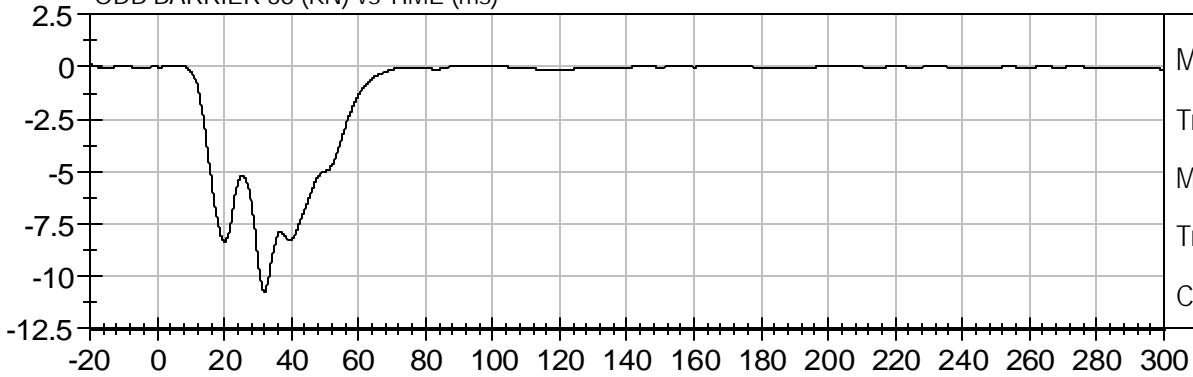


ODB BARRIER 37 (KN) vs TIME (ms)



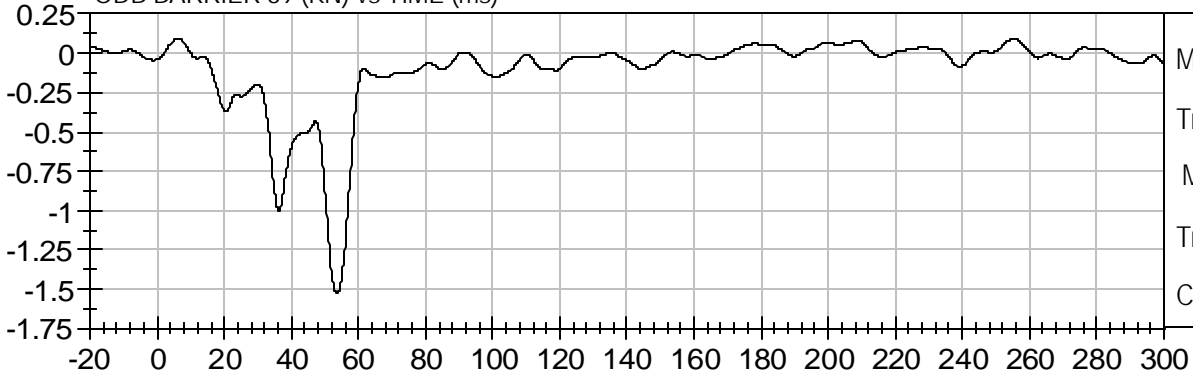
Max: 0.3 KN  
Tmax: 91.8 ms  
Min: -4.7 KN  
Tmin: 40.1 ms  
CFC 60

ODB BARRIER 38 (KN) vs TIME (ms)



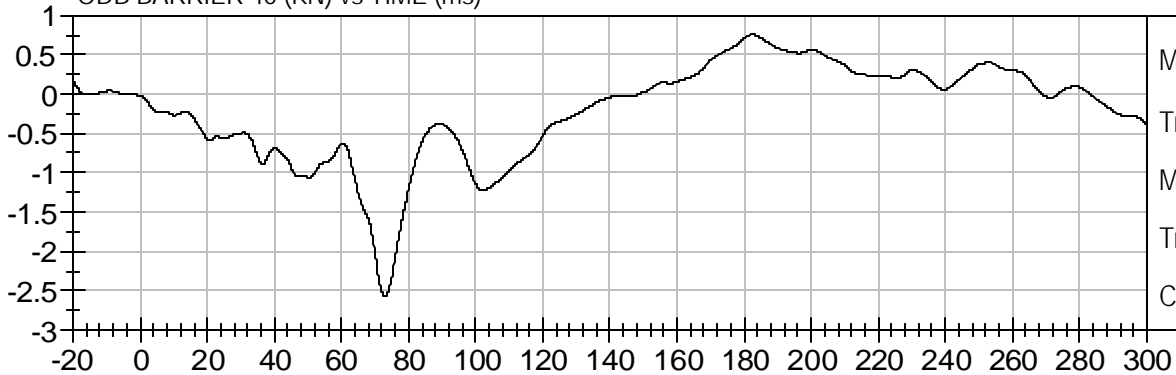
Max: 0.2 KN  
Tmax: 0.0 ms  
Min: -10.8 KN  
Tmin: 31.9 ms  
CFC 60

ODB BARRIER 39 (KN) vs TIME (ms)

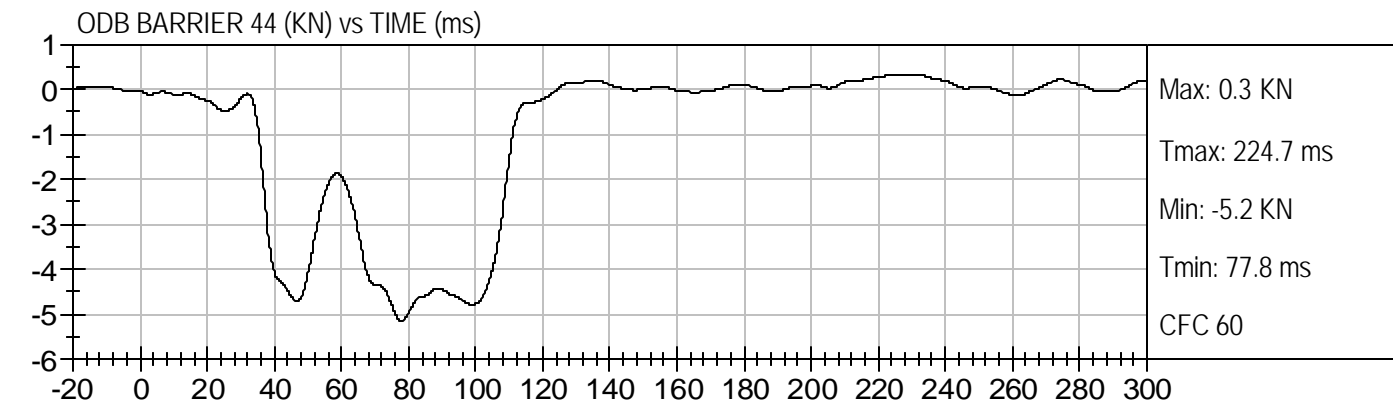
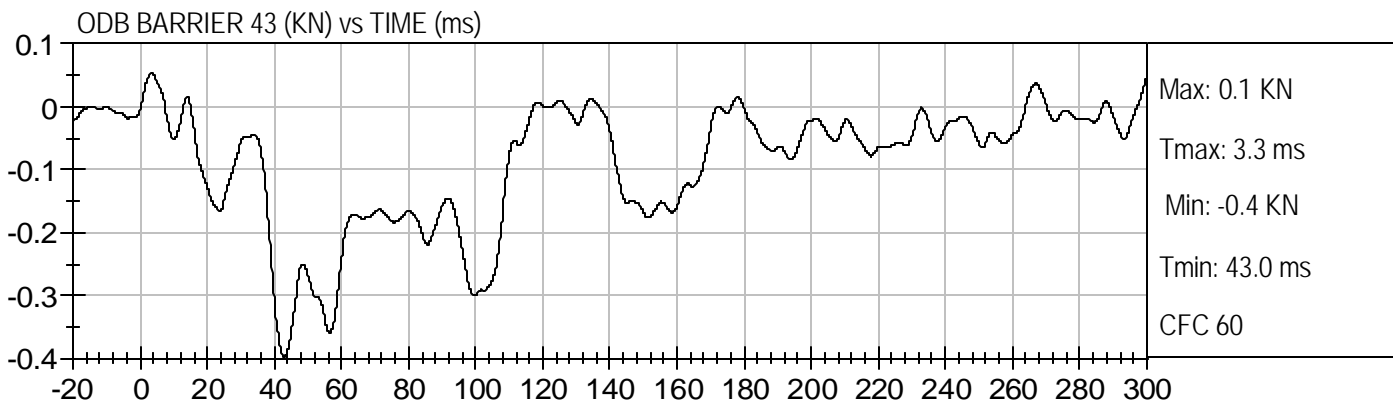
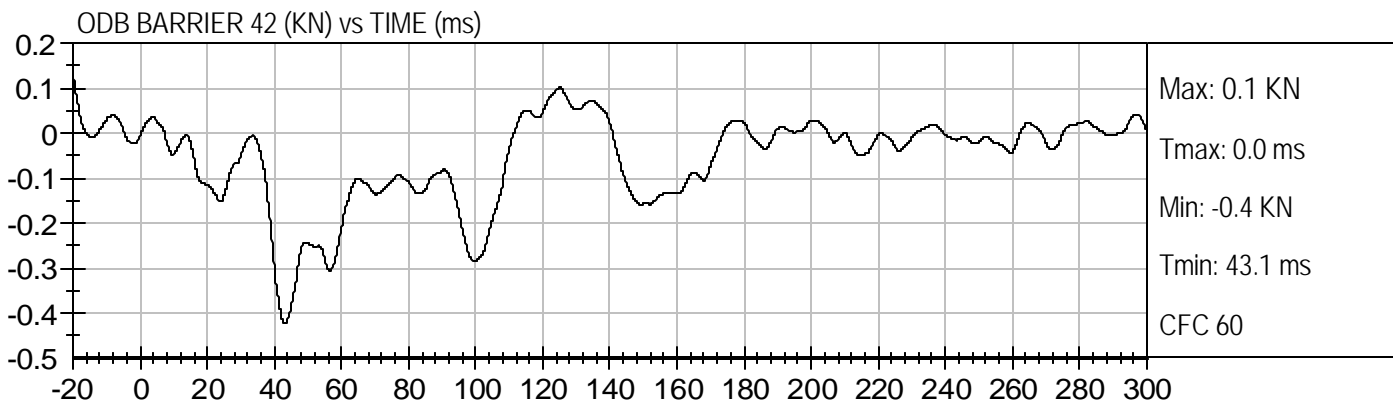
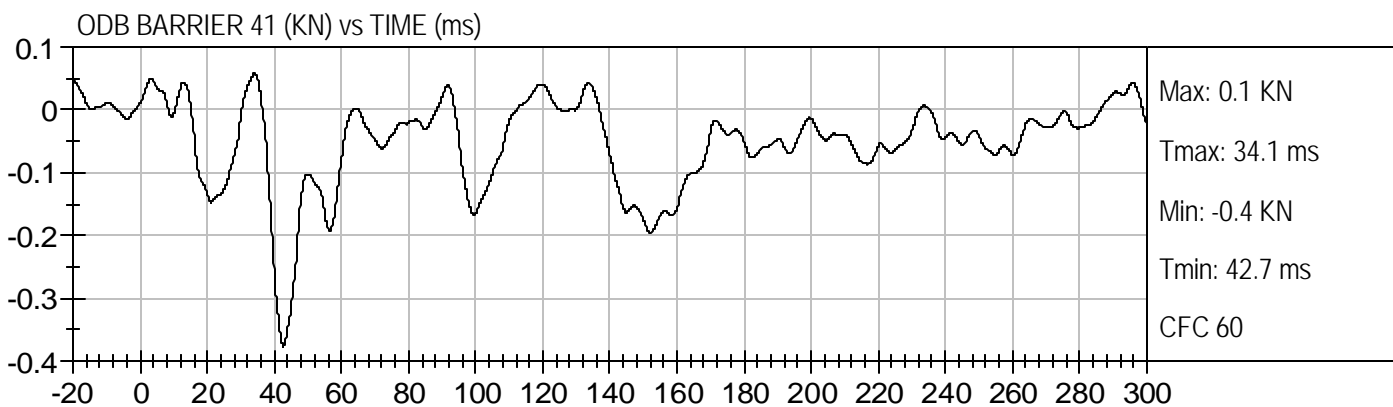


Max: 0.1 KN  
Tmax: 6.3 ms  
Min: -1.5 KN  
Tmin: 53.5 ms  
CFC 60

ODB BARRIER 40 (KN) vs TIME (ms)

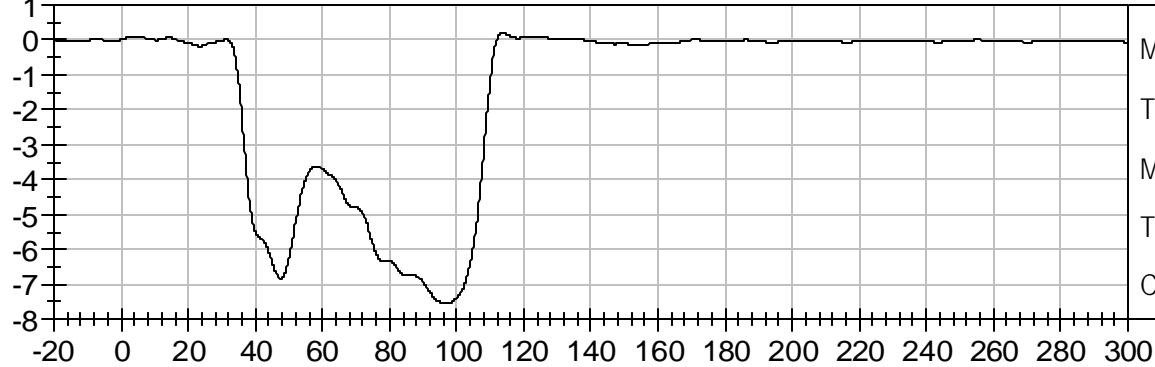


Max: 0.8 KN  
Tmax: 182.6 ms  
Min: -2.6 KN  
Tmin: 72.9 ms  
CFC 60



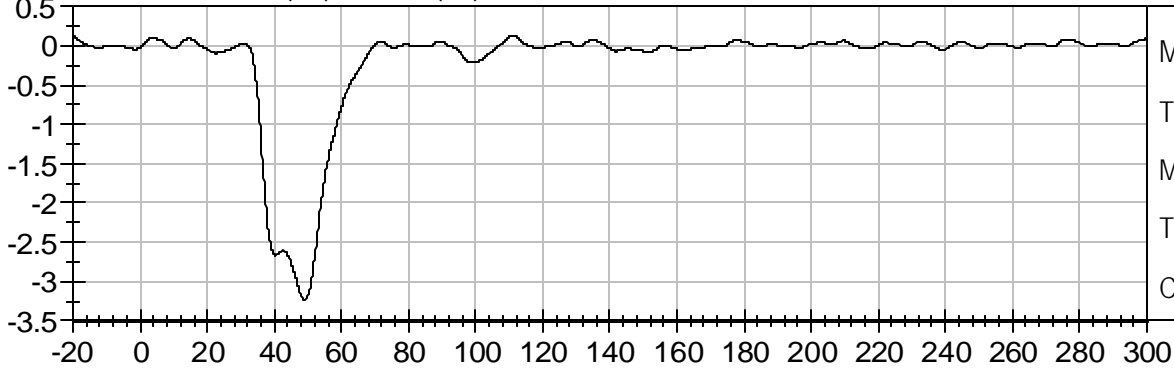


ODB BARRIER 45 (KN) vs TIME (ms)



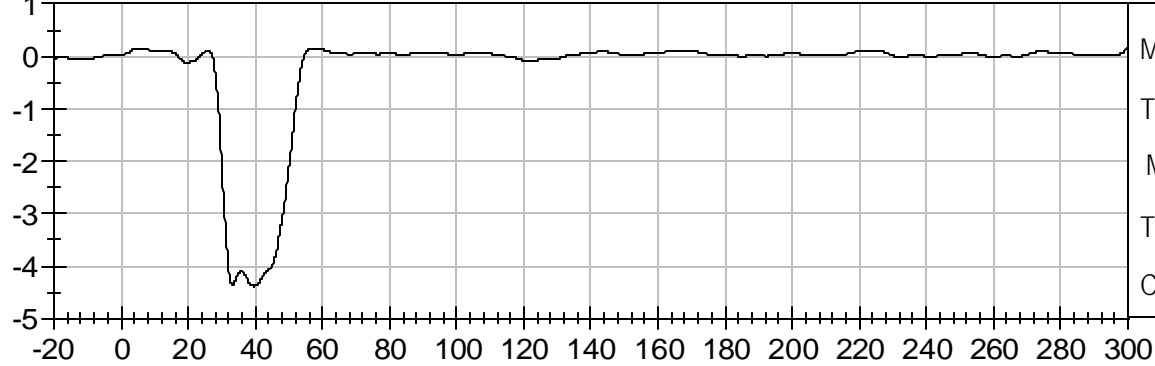
Max: 0.2 KN  
Tmax: 113.6 ms  
Min: -7.6 KN  
Tmin: 97.1 ms  
CFC 60

ODB BARRIER 46 (KN) vs TIME (ms)



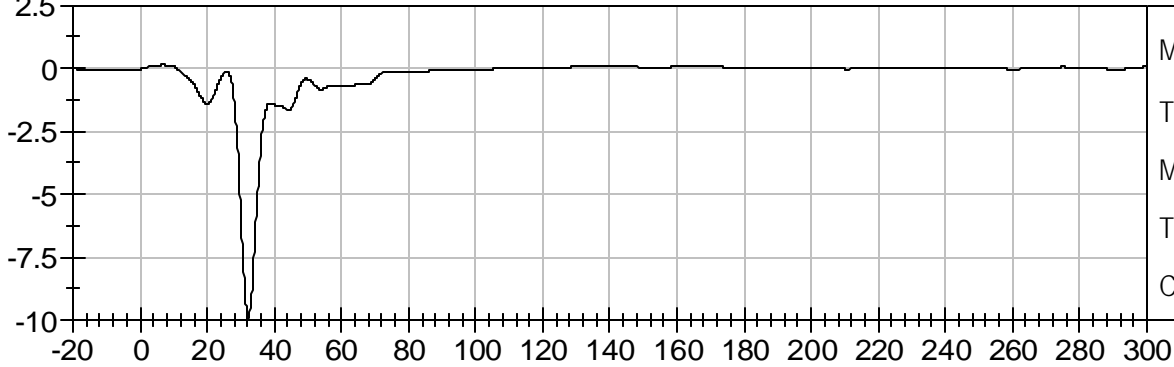
Max: 0.1 KN  
Tmax: 111.1 ms  
Min: -3.2 KN  
Tmin: 49.0 ms  
CFC 60

ODB BARRIER 47 (KN) vs TIME (ms)

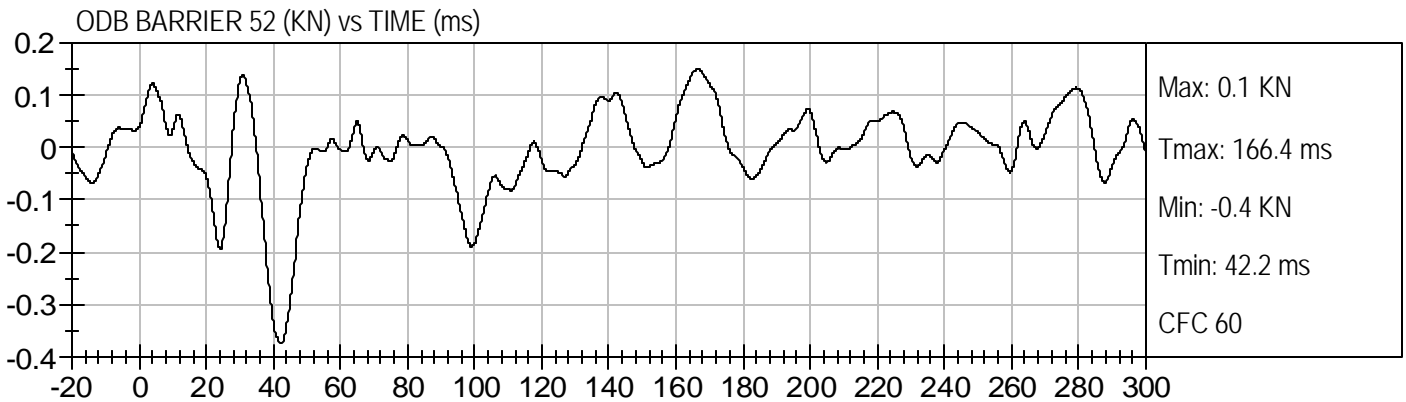
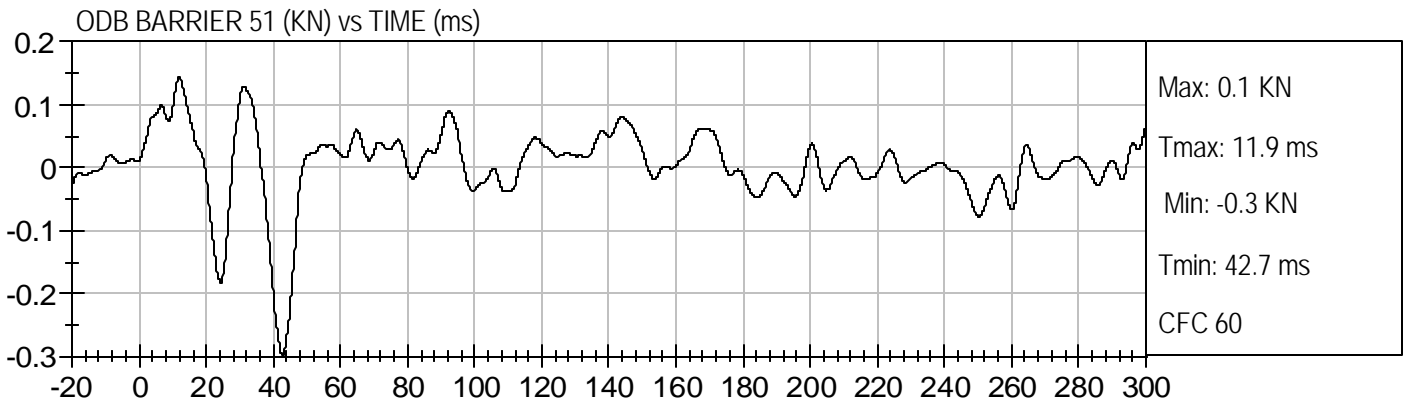
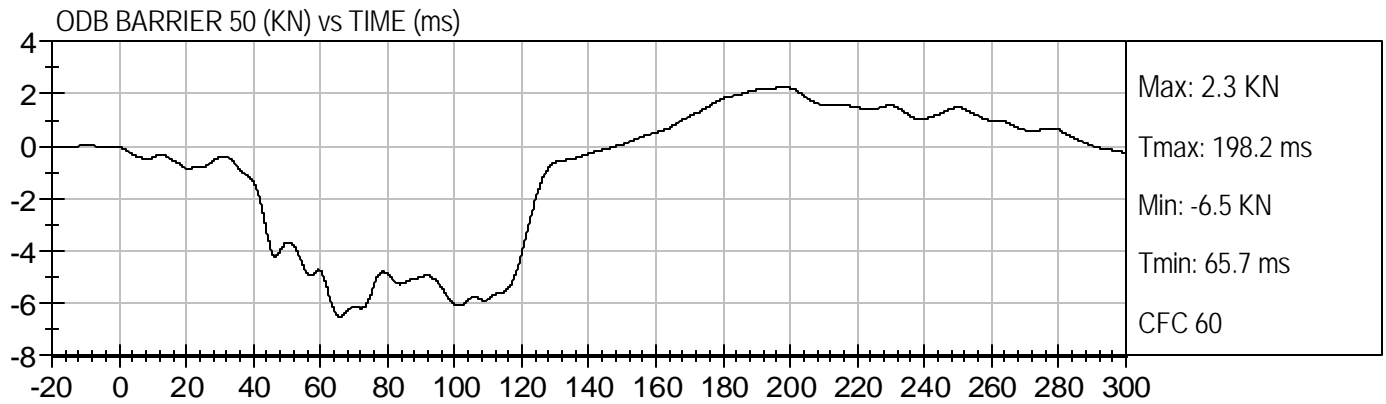
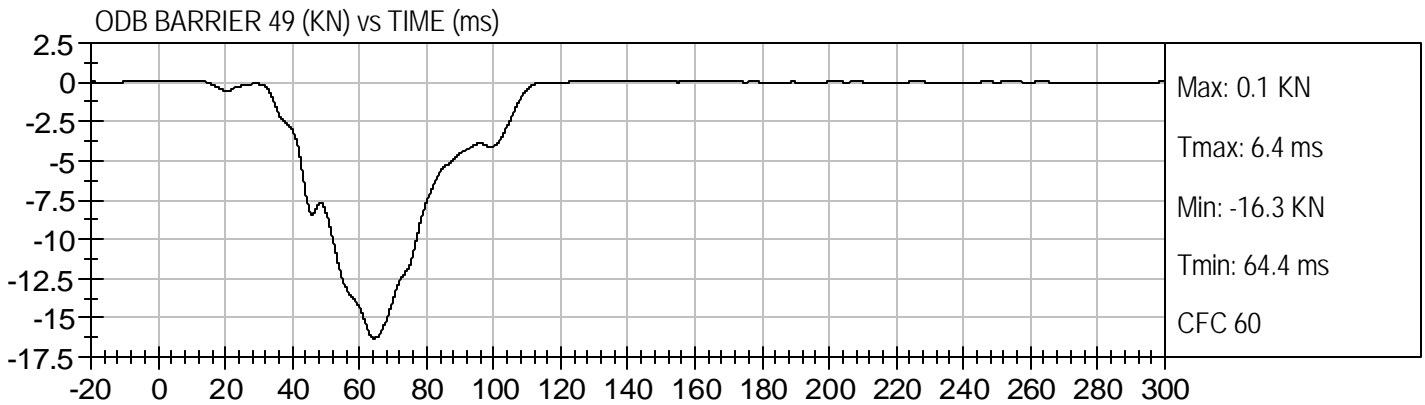


Max: 0.2 KN  
Tmax: 300.0 ms  
Min: -4.4 KN  
Tmin: 39.7 ms  
CFC 60

ODB BARRIER 48 (KN) vs TIME (ms)

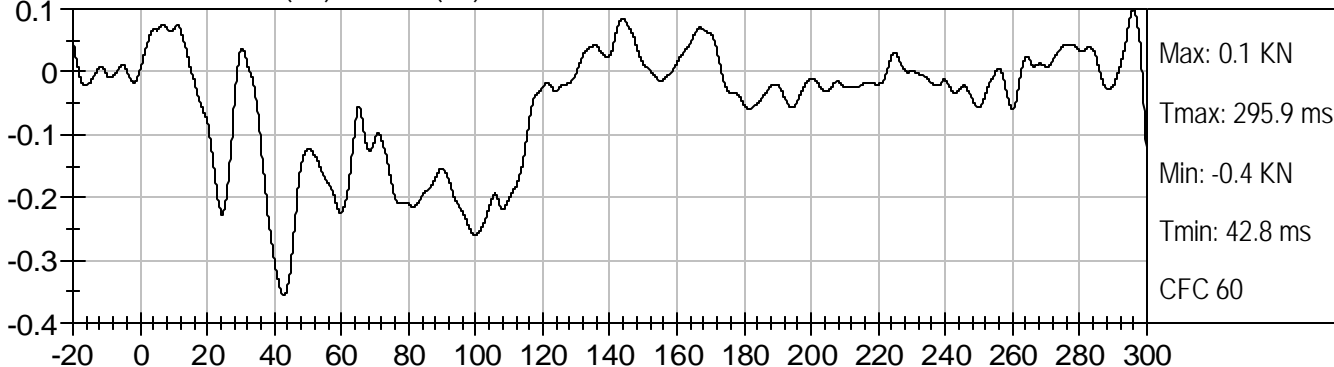


Max: 0.1 KN  
Tmax: 6.5 ms  
Min: -9.9 KN  
Tmin: 32.2 ms  
CFC 60

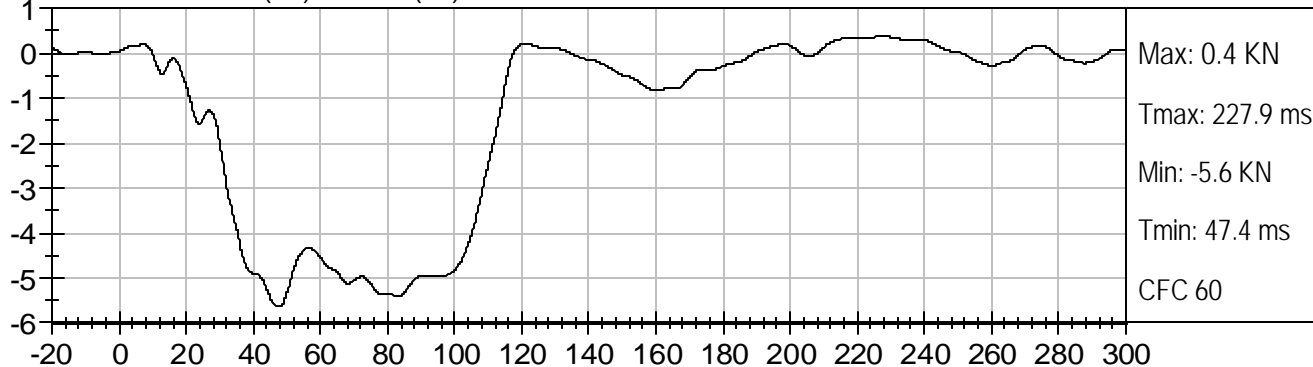




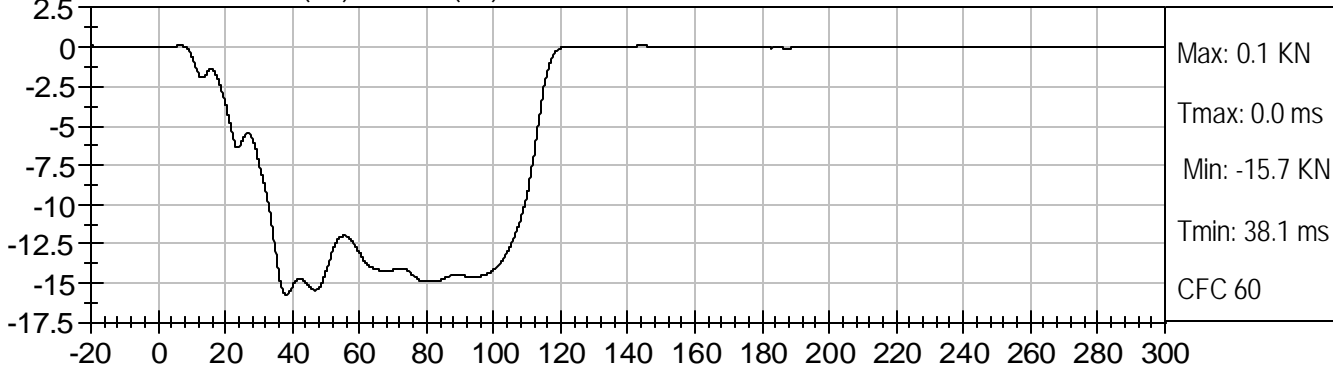
ODB BARRIER 53 (KN) vs TIME (ms)



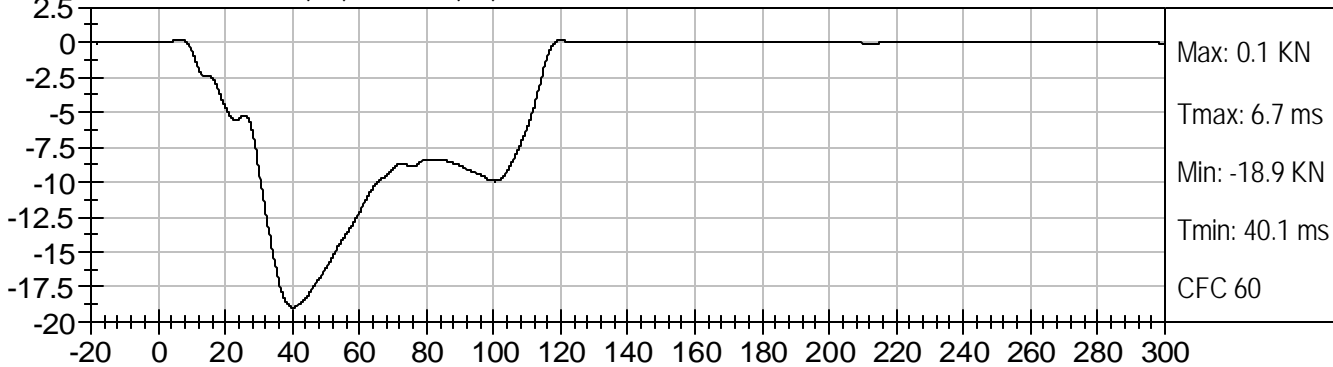
ODB BARRIER 54 (KN) vs TIME (ms)



ODB BARRIER 55 (KN) vs TIME (ms)

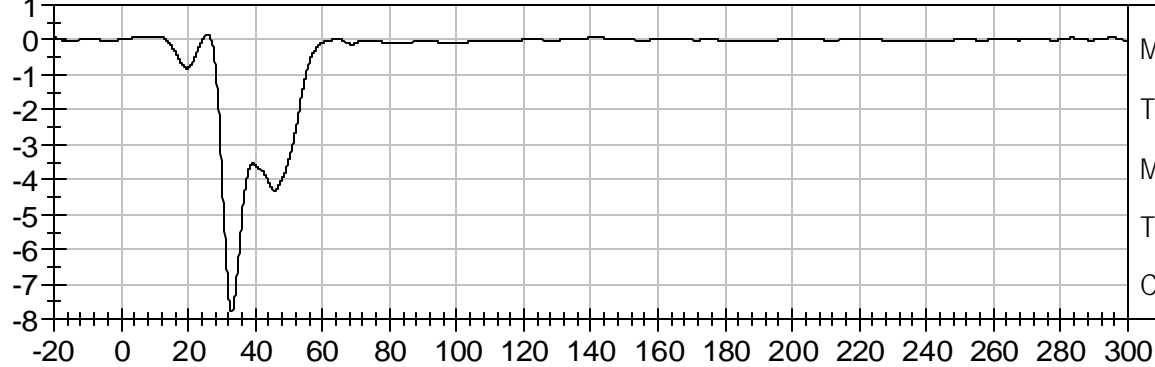


ODB BARRIER 56 (KN) vs TIME (ms)



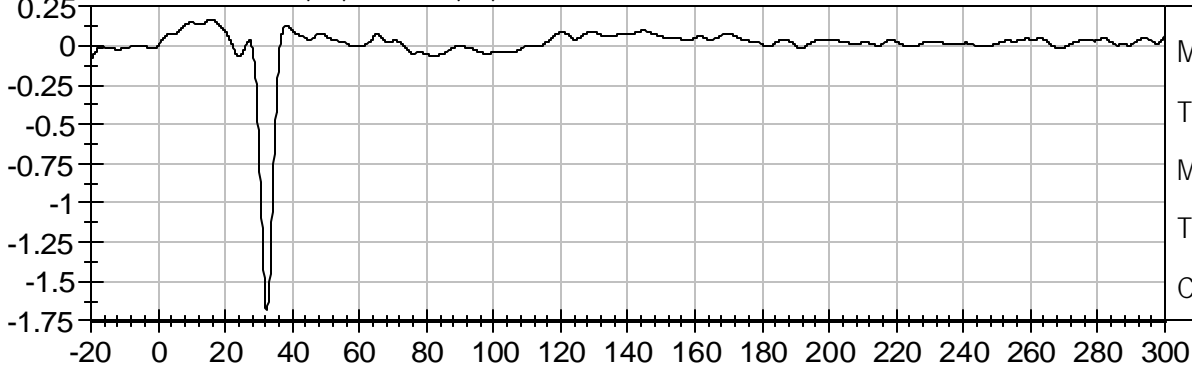


ODB BARRIER 57 (KN) vs TIME (ms)



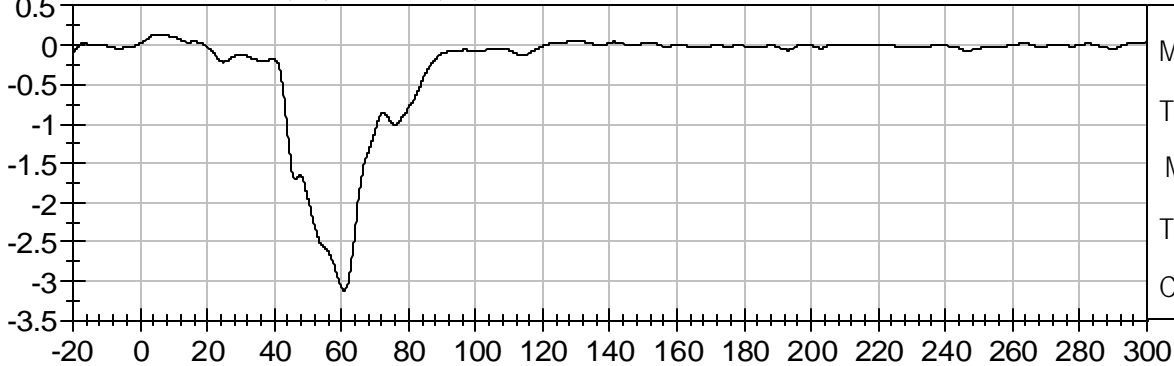
Max: 0.1 KN  
Tmax: 25.7 ms  
Min: -7.8 KN  
Tmin: 33.0 ms  
CFC 60

ODB BARRIER 58 (KN) vs TIME (ms)



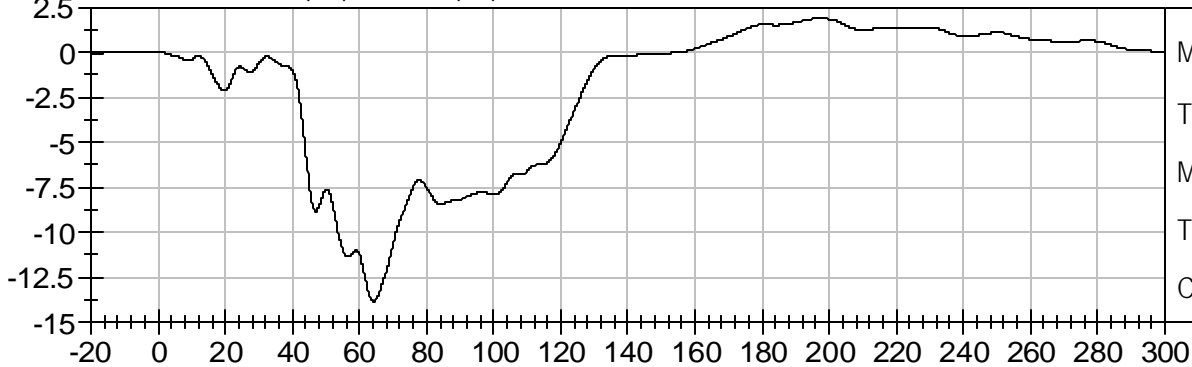
Max: 0.2 KN  
Tmax: 15.6 ms  
Min: -1.7 KN  
Tmin: 32.4 ms  
CFC 60

ODB BARRIER 59 (KN) vs TIME (ms)

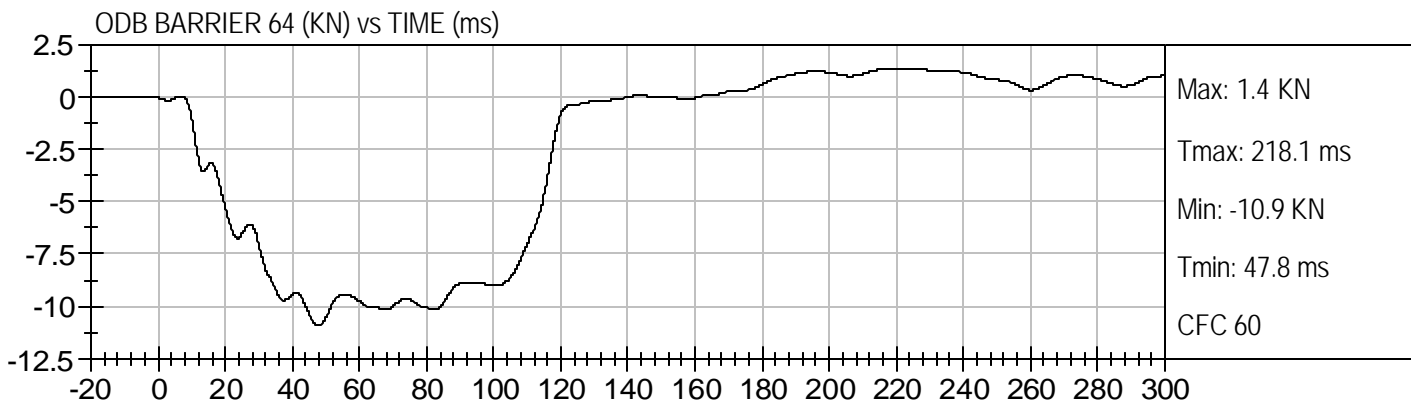
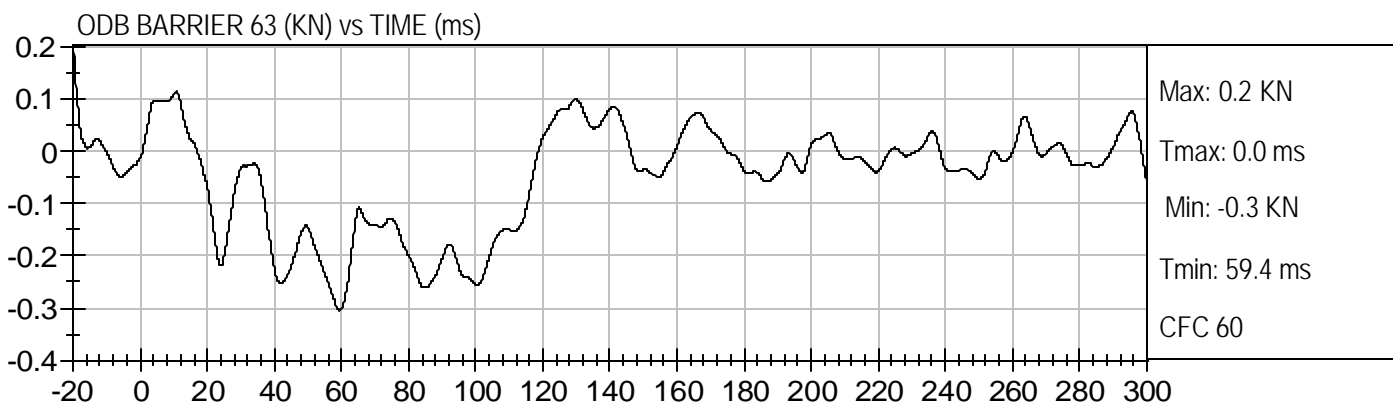
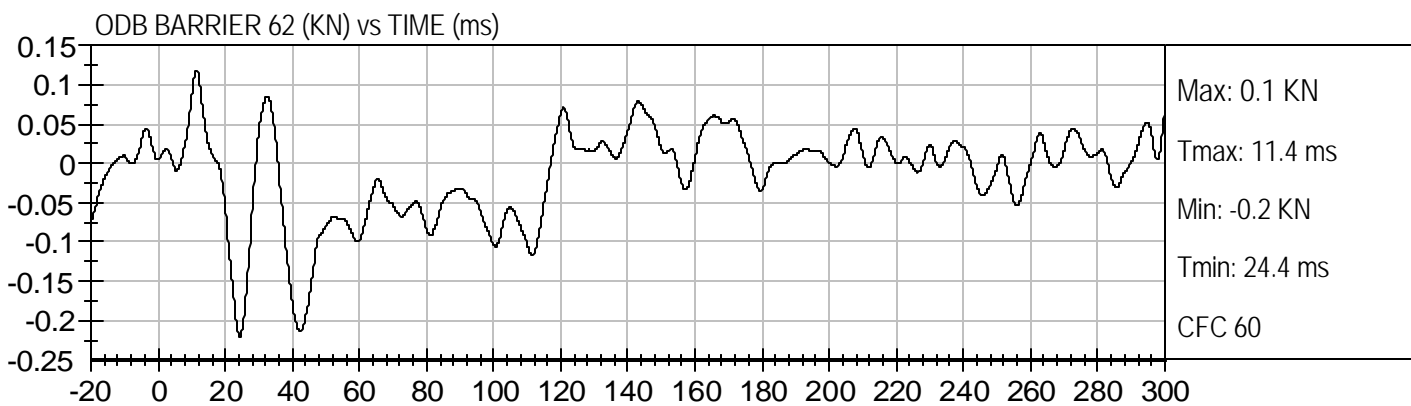
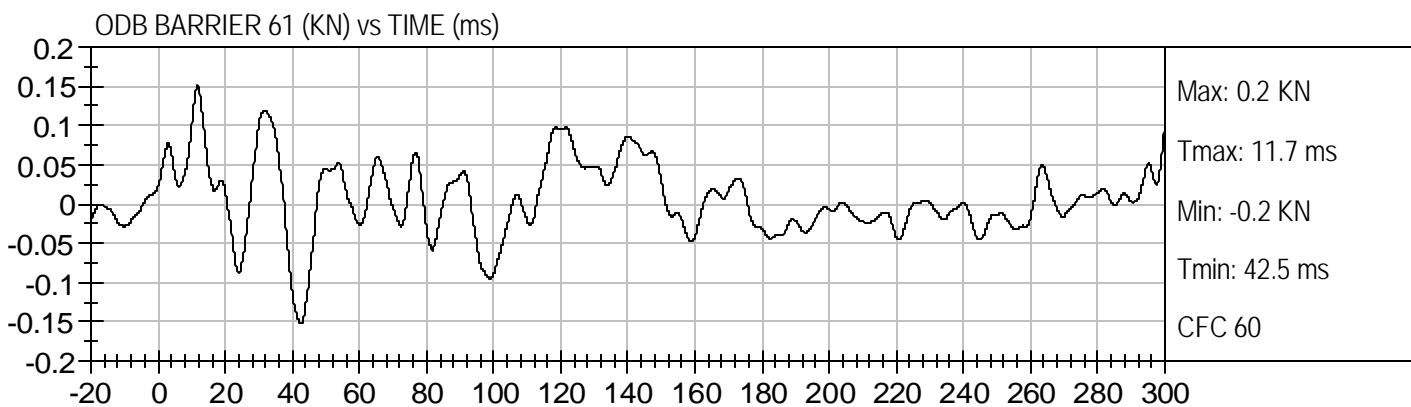


Max: 0.1 KN  
Tmax: 5.1 ms  
Min: -3.1 KN  
Tmin: 60.7 ms  
CFC 60

ODB BARRIER 60 (KN) vs TIME (ms)

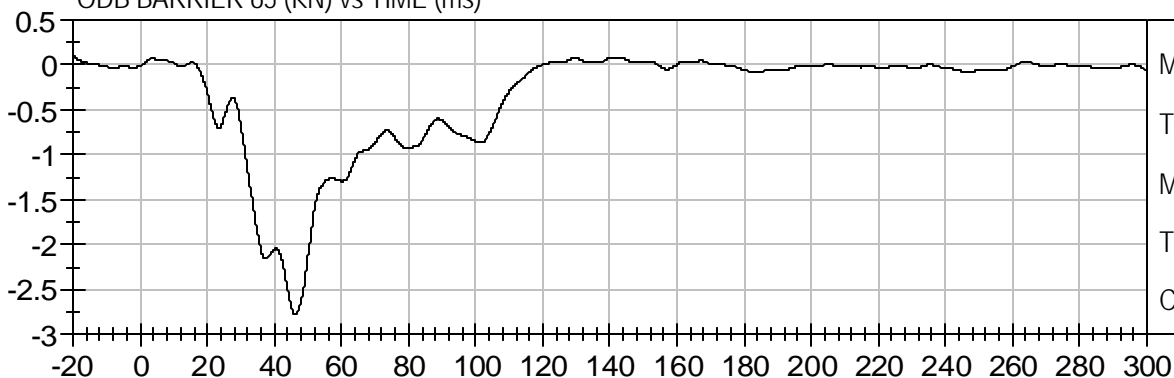


Max: 1.9 KN  
Tmax: 197.4 ms  
Min: -13.9 KN  
Tmin: 64.1 ms  
CFC 60

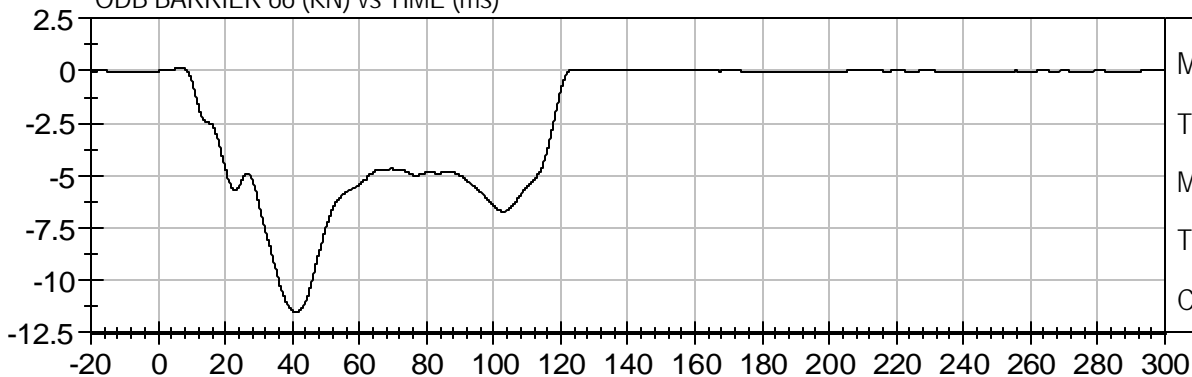




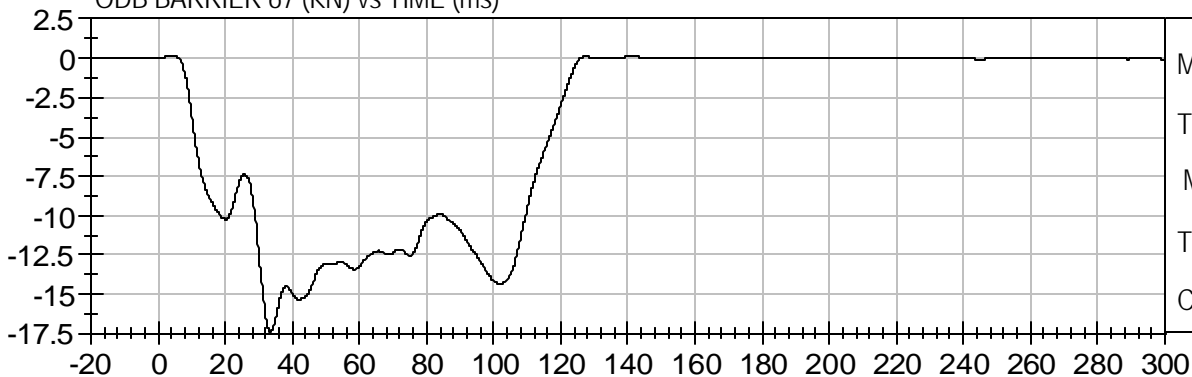
ODB BARRIER 65 (KN) vs TIME (ms)



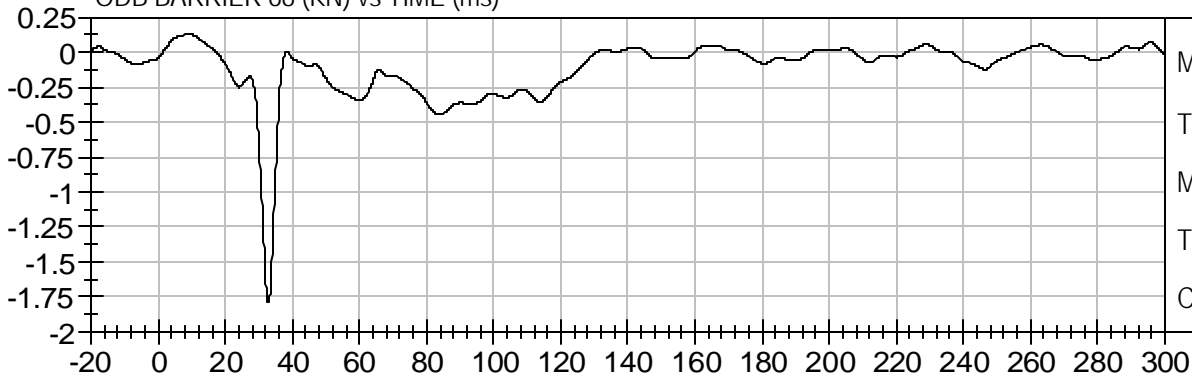
ODB BARRIER 66 (KN) vs TIME (ms)



ODB BARRIER 67 (KN) vs TIME (ms)

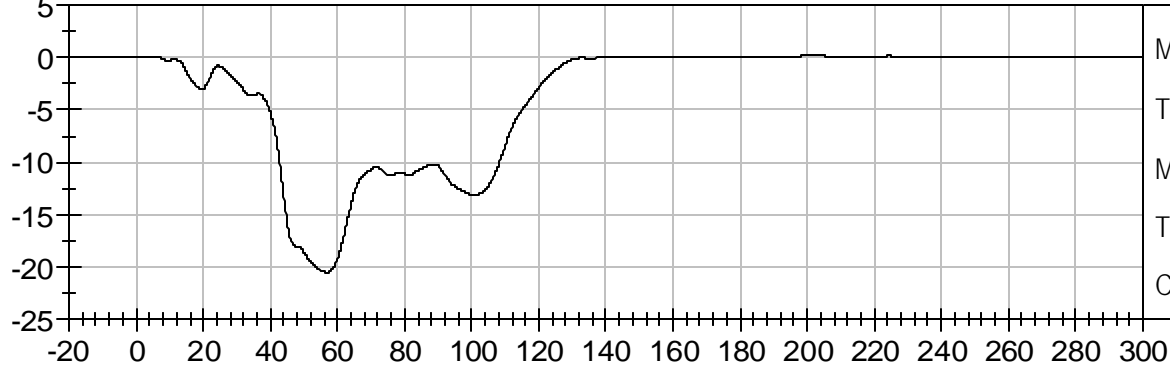


ODB BARRIER 68 (KN) vs TIME (ms)



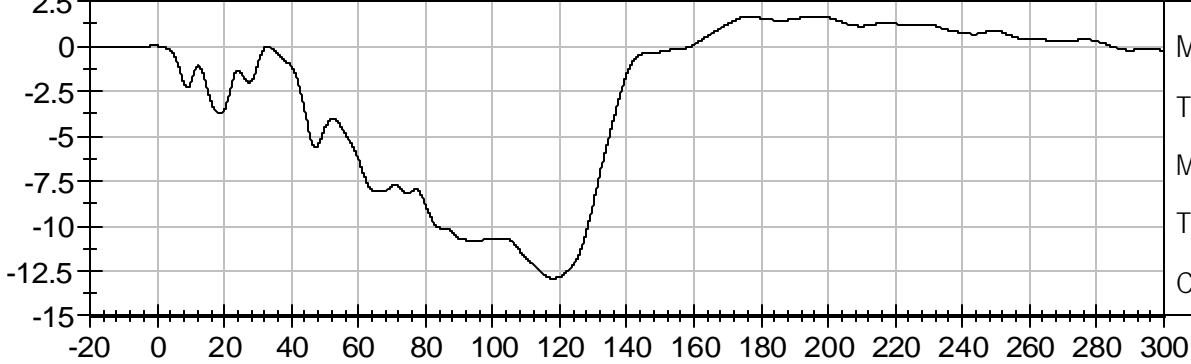


ODB BARRIER 69 (KN) vs TIME (ms)



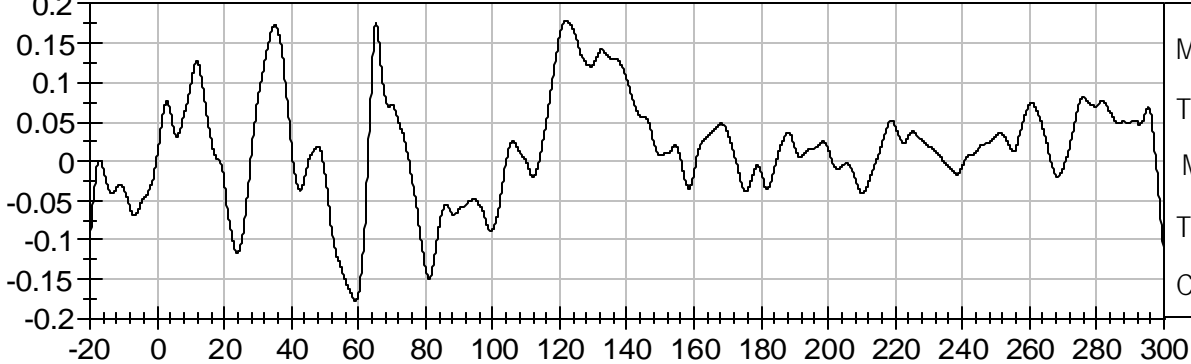
Max: 0.1 KN  
Tmax: 202.7 ms  
Min: -20.5 KN  
Tmin: 56.7 ms  
CFC 60

ODB BARRIER 70 (KN) vs TIME (ms)



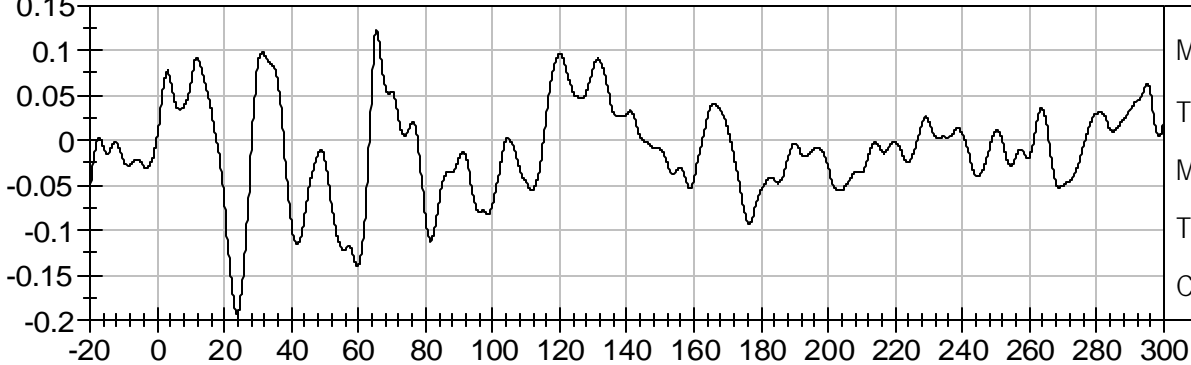
Max: 1.7 KN  
Tmax: 176.3 ms  
Min: -12.9 KN  
Tmin: 118.1 ms  
CFC 60

ODB BARRIER 71 (KN) vs TIME (ms)

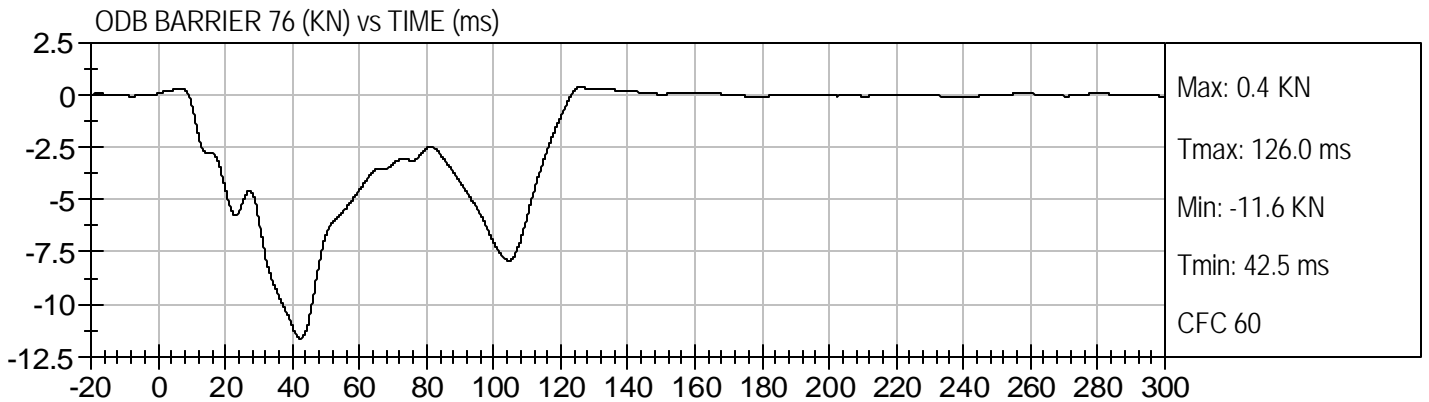
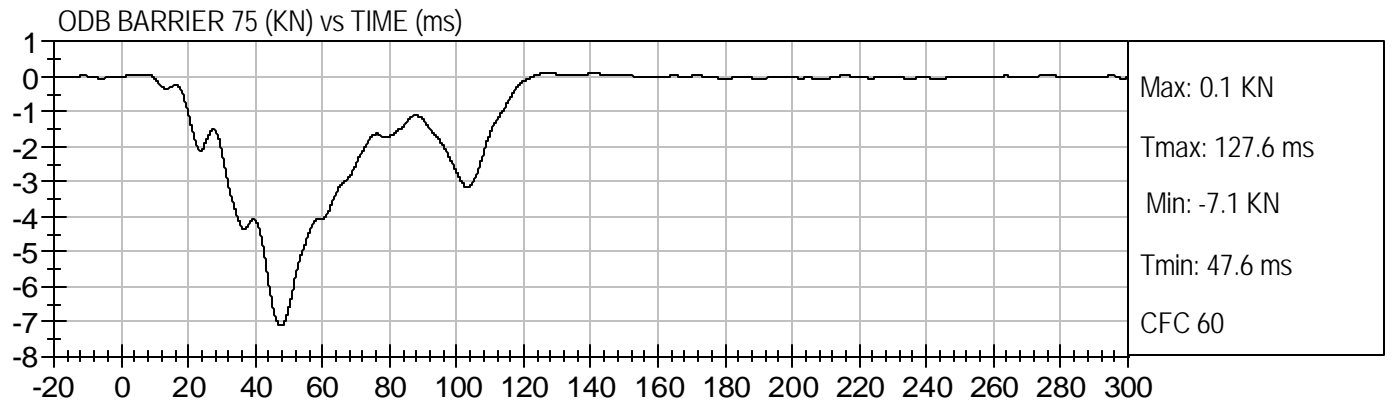
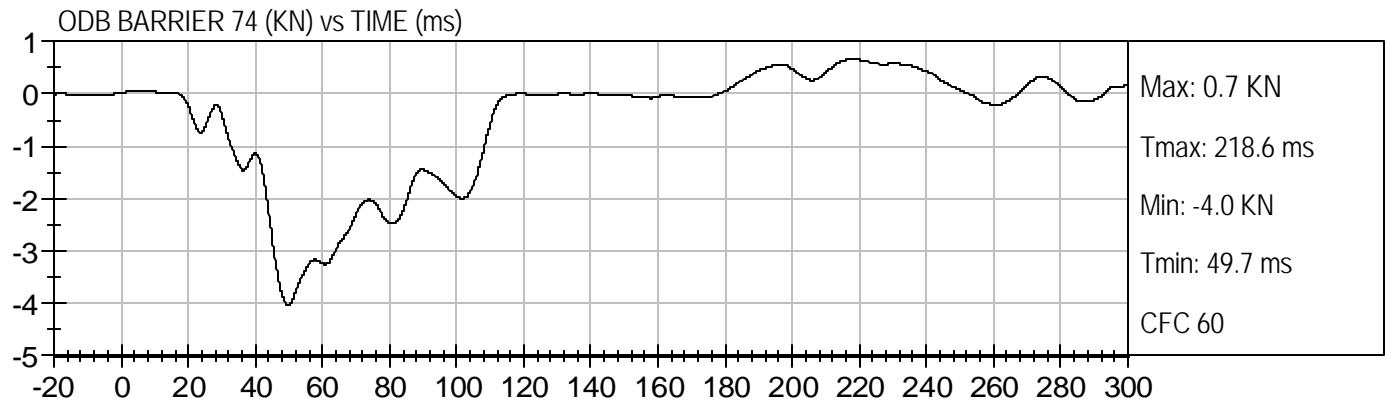
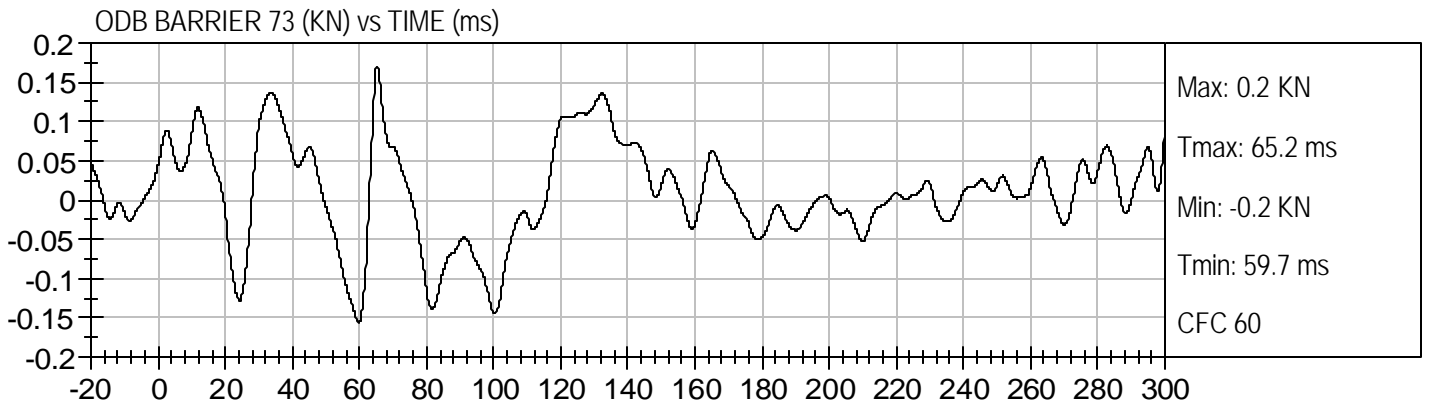


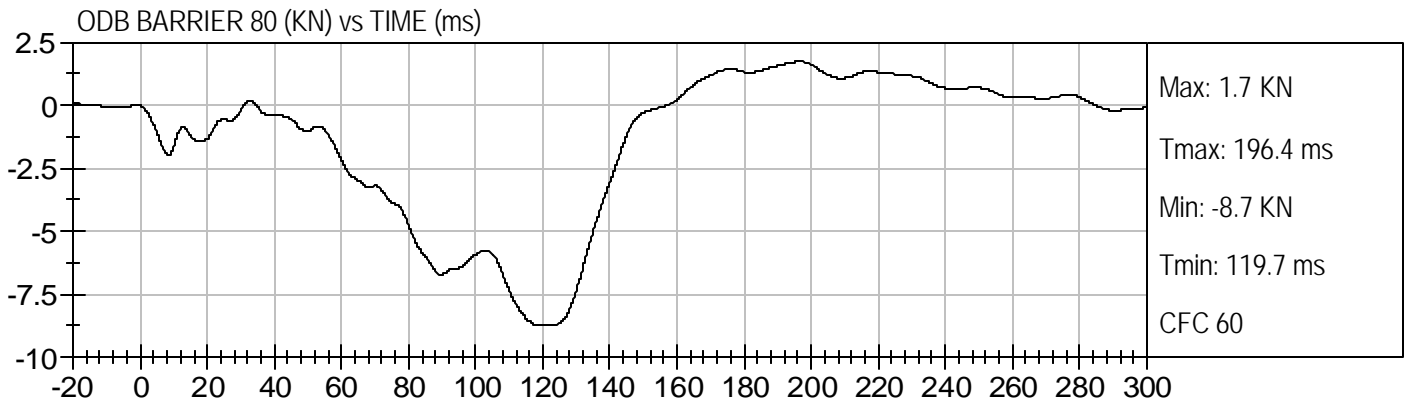
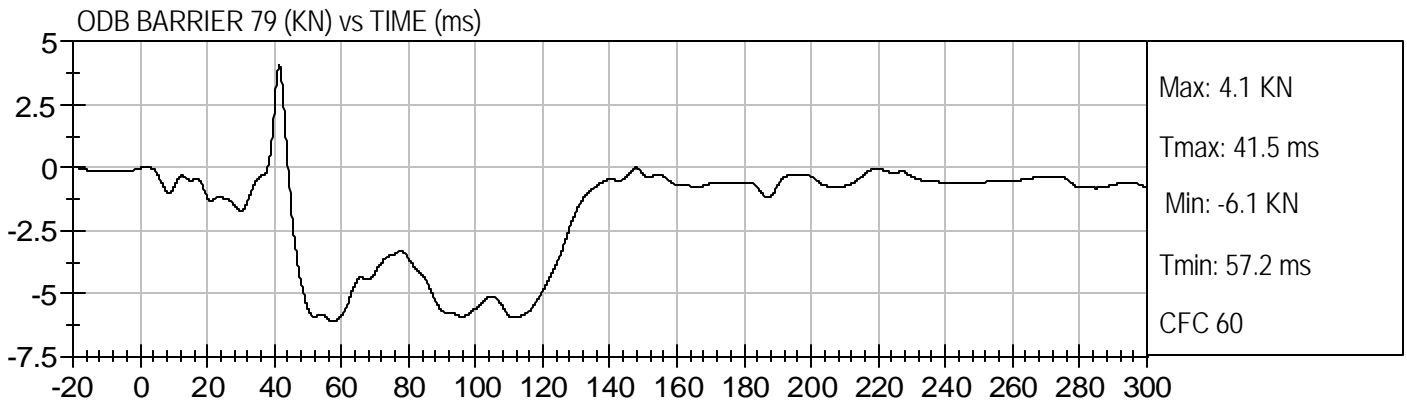
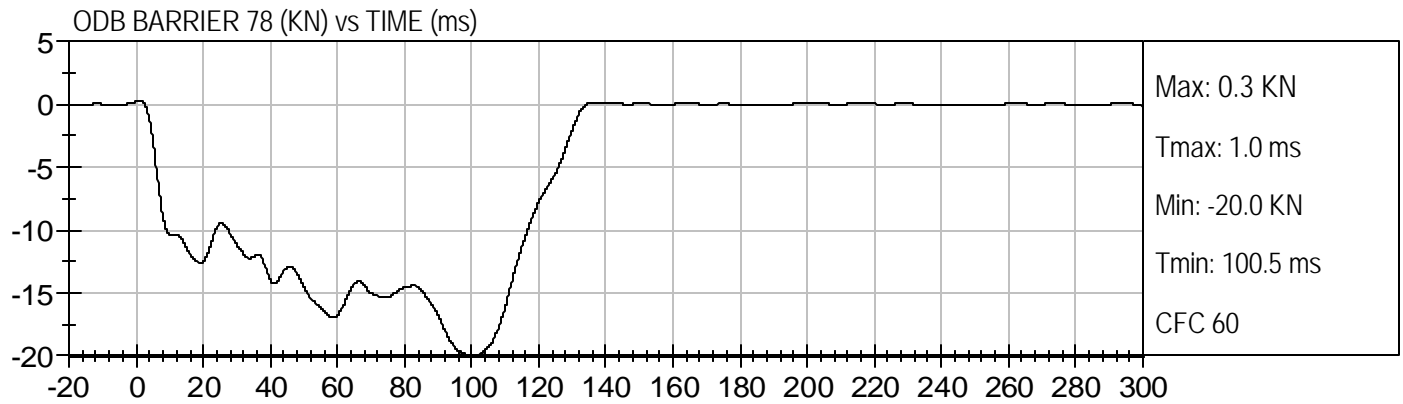
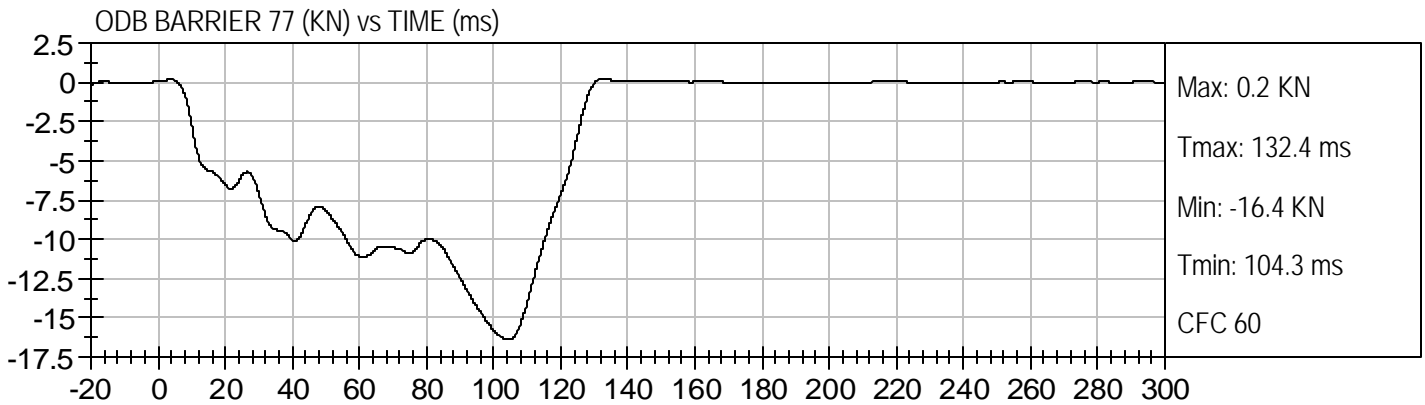
Max: 0.2 KN  
Tmax: 122.0 ms  
Min: -0.2 KN  
Tmin: 59.0 ms  
CFC 60

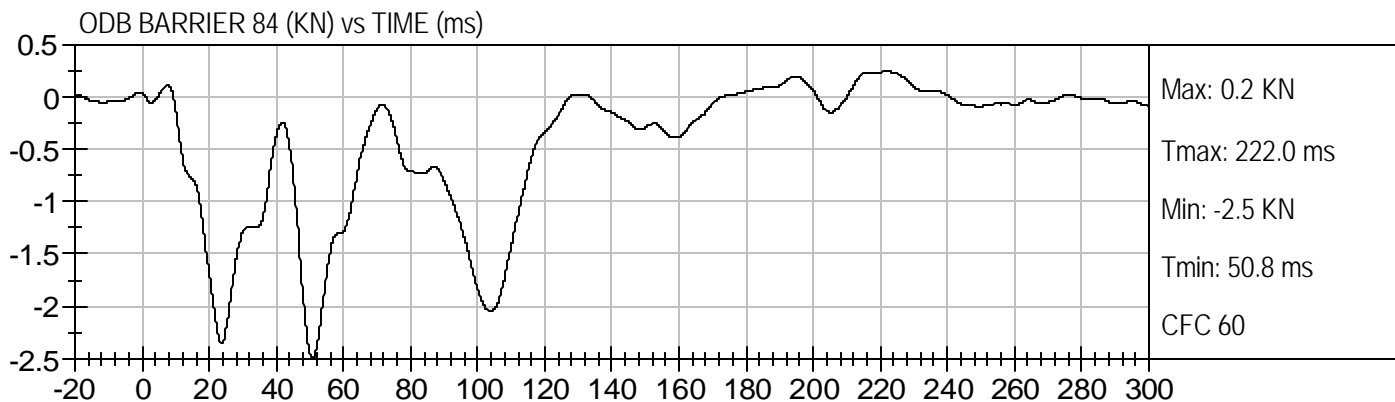
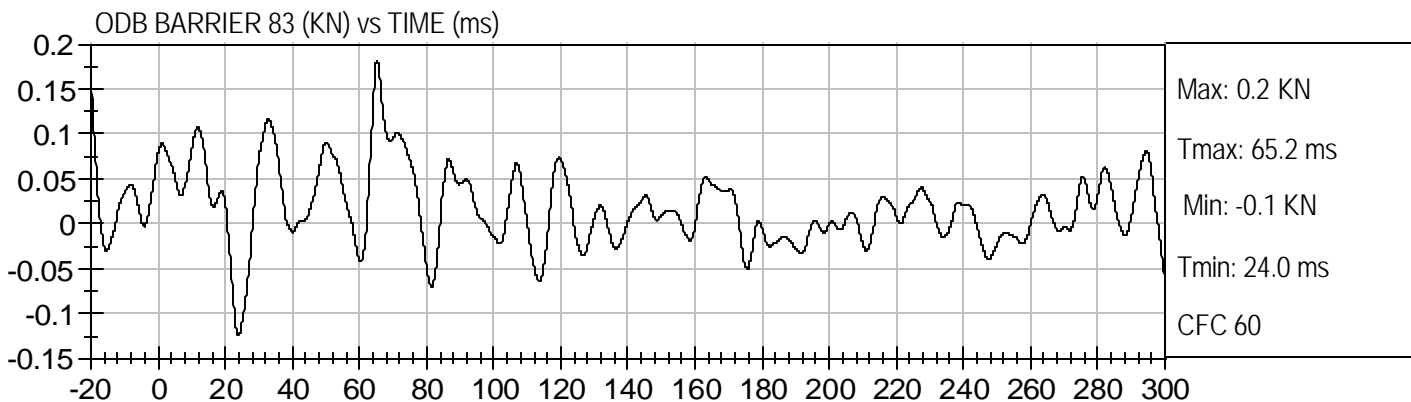
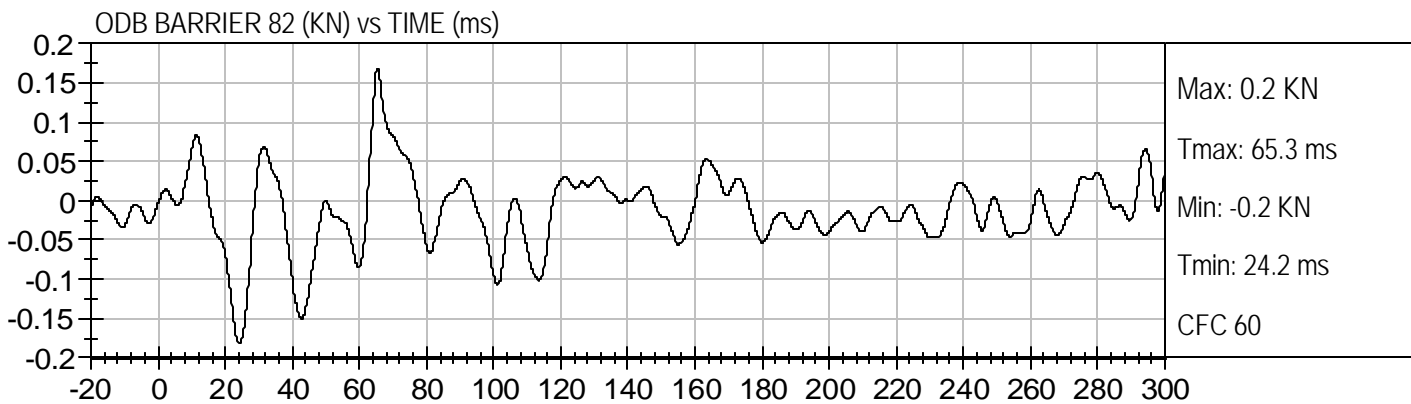
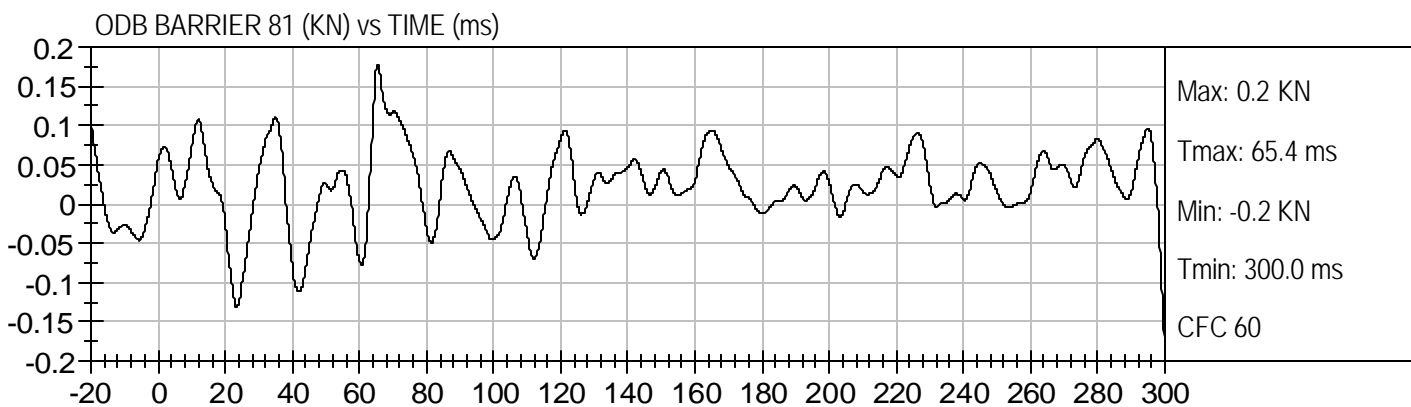
ODB BARRIER 72 (KN) vs TIME (ms)



Max: 0.1 KN  
Tmax: 65.3 ms  
Min: -0.2 KN  
Tmin: 23.9 ms  
CFC 60

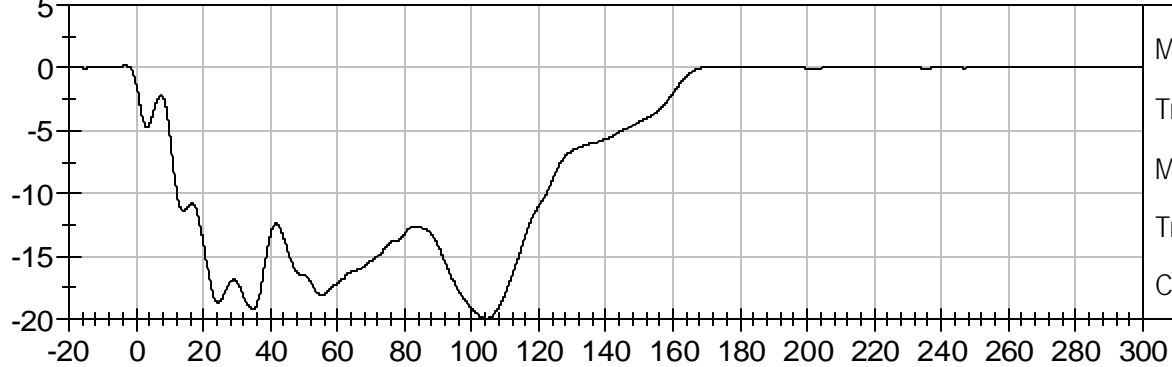






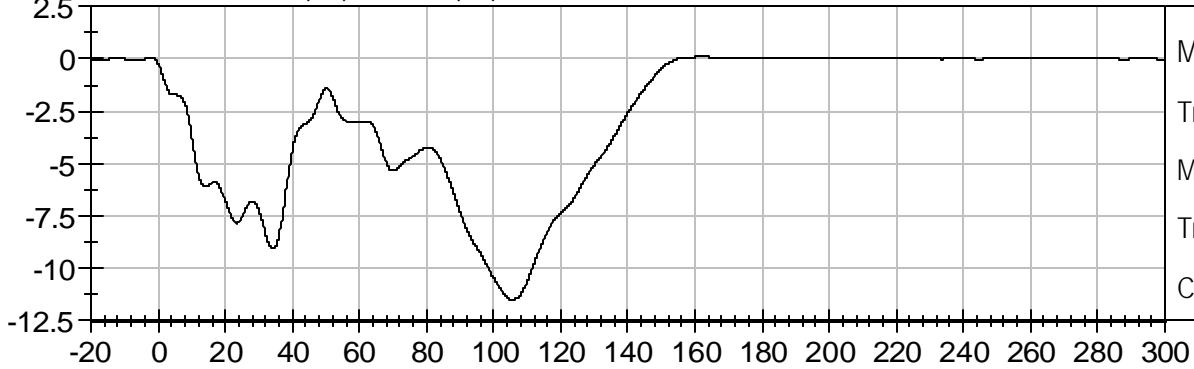


ODB BARRIER 85 (KN) vs TIME (ms)



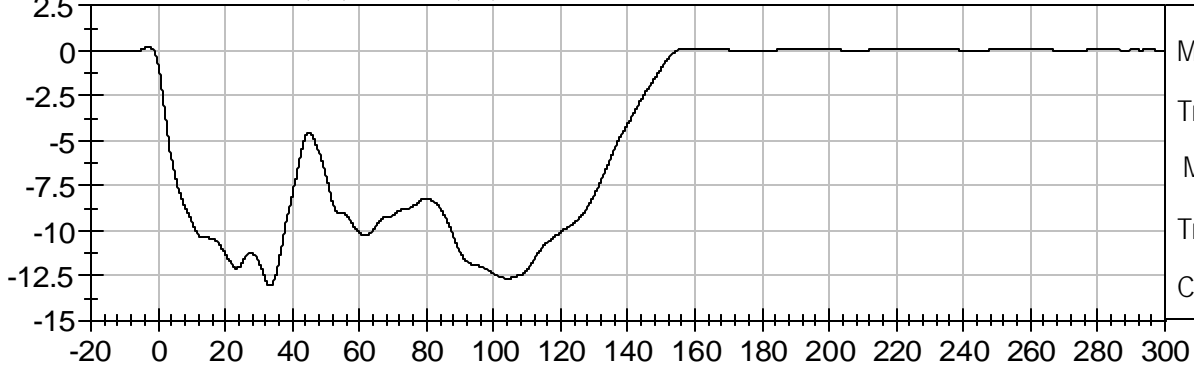
Max: 0.2 KN  
Tmax: 0.0 ms  
Min: -20.0 KN  
Tmin: 104.4 ms  
CFC 60

ODB BARRIER 86 (KN) vs TIME (ms)



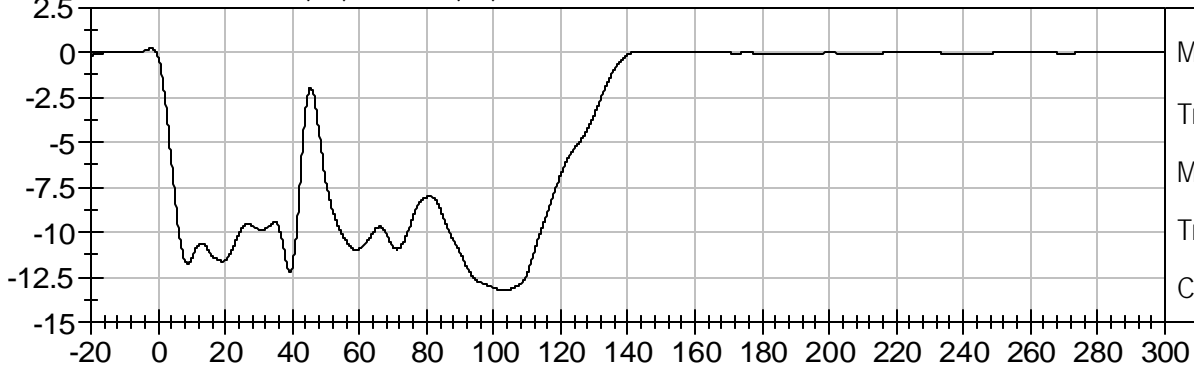
Max: 0.1 KN  
Tmax: 162.1 ms  
Min: -11.5 KN  
Tmin: 105.6 ms  
CFC 60

ODB BARRIER 87 (KN) vs TIME (ms)

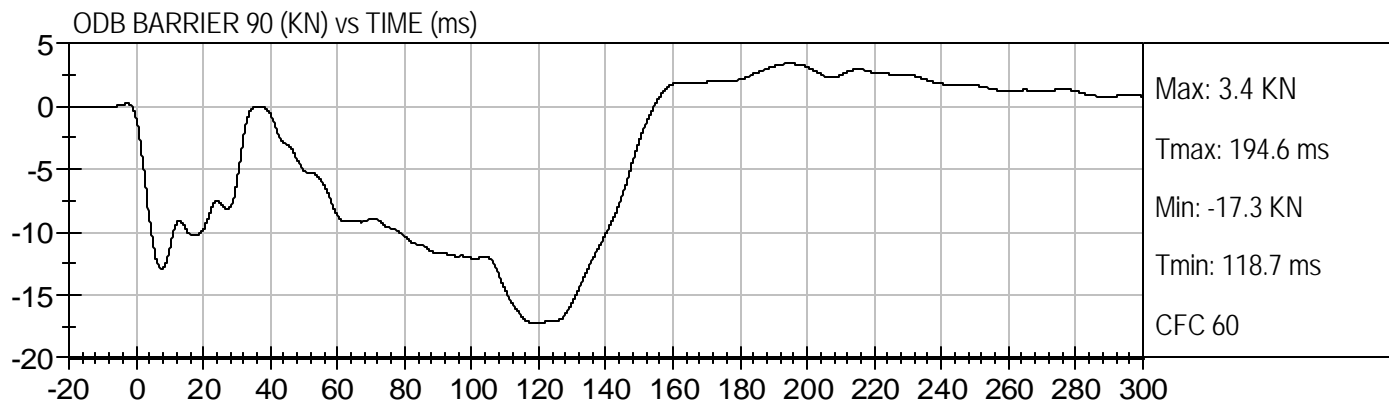
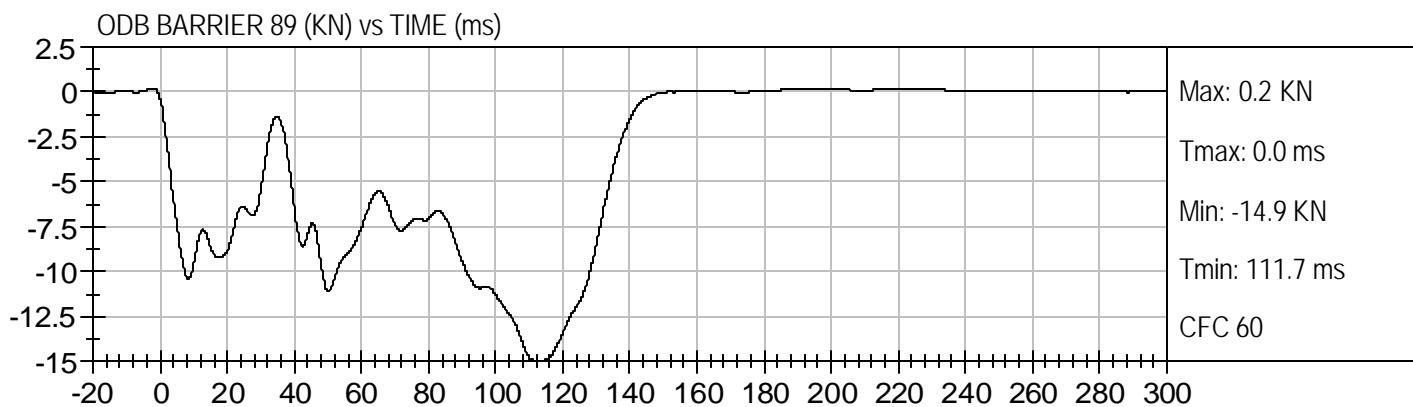


Max: 0.2 KN  
Tmax: 0.0 ms  
Min: -13.1 KN  
Tmin: 33.3 ms  
CFC 60

ODB BARRIER 88 (KN) vs TIME (ms)



Max: 0.2 KN  
Tmax: 0.0 ms  
Min: -13.2 KN  
Tmin: 102.8 ms  
CFC 60



## **APPENDIX C**

### **DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA**

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

ATD Serial No: 202

Test ID: D08481

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Peak Resultant Acceleration	G's	225 - 275	256	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Jessica Hall  
Laboratory Technician

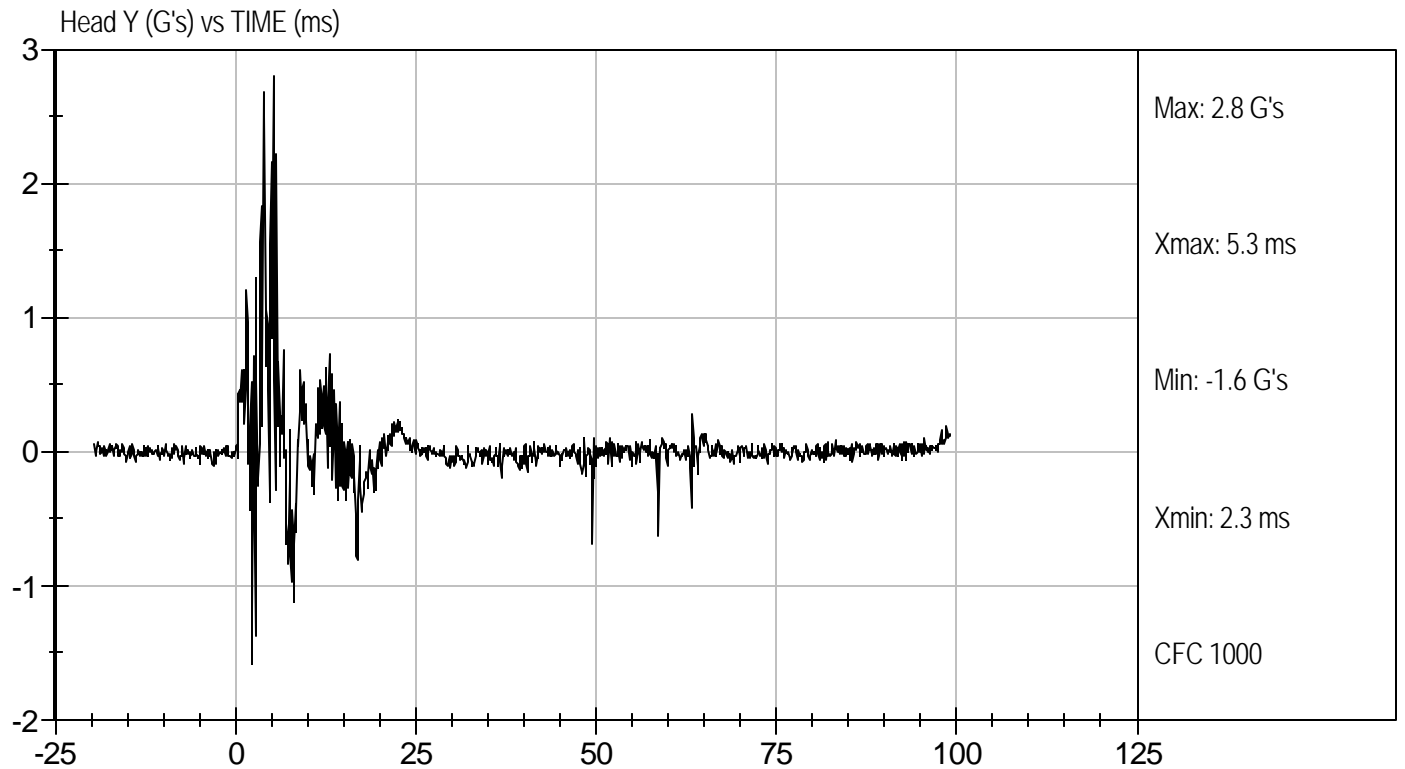
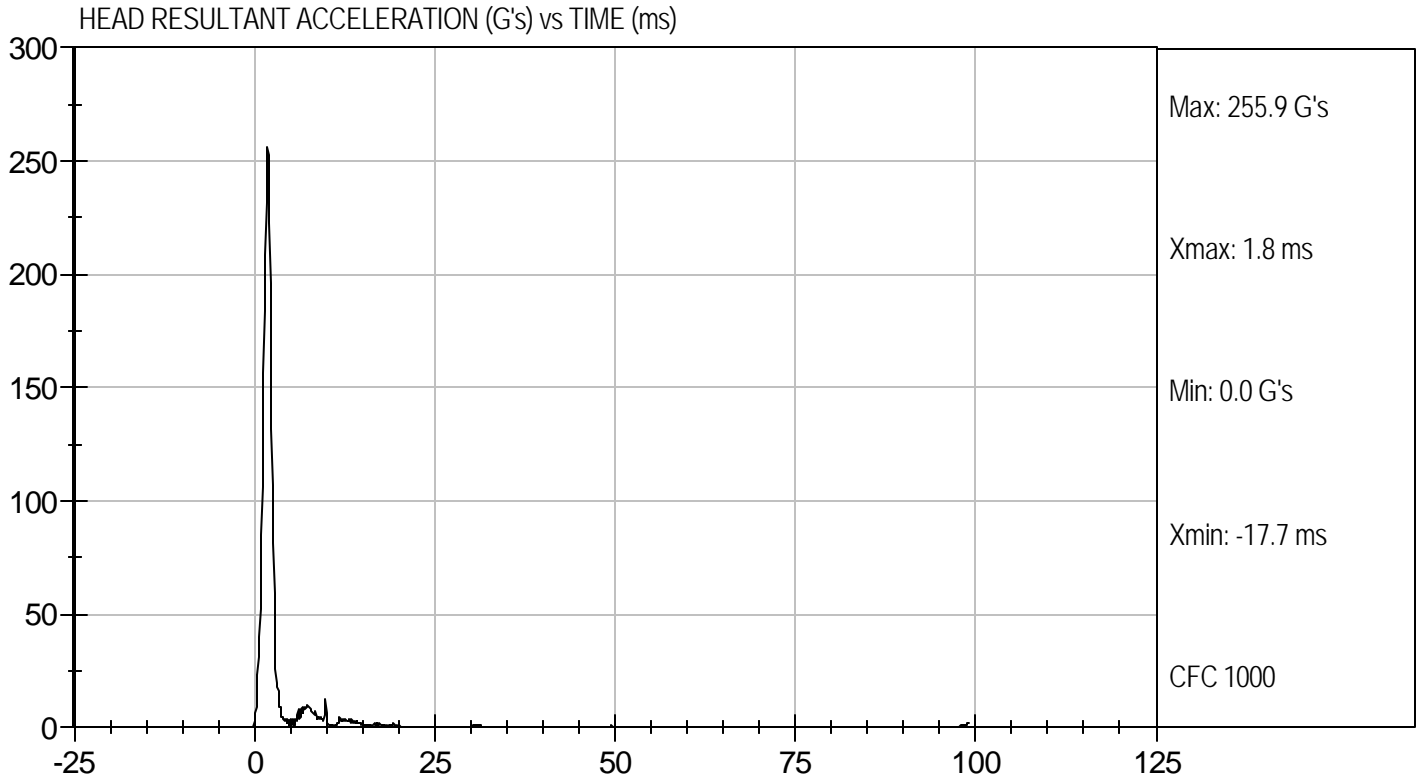
2/27/08  
Test Date

David Winkelbauer  
Approved By



Test Desc: Head Drop  
Component ID: D08481

Test Date: 2/27/08  
Velocity: 0 ft/s, 0.00 m/s



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


ATD Serial No: 202

Test I.D.: D08482

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	13	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	26.22	Pass
	20 msec	G's	17.60 to 22.60	20.16	Pass
	30 msec	G's	12.50 to 18.50	13.66	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.11	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	37.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	72.4	Pass
	Time	msec	57.0 to 64.0	57.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.8	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	96.0	Pass
	Time	msec	47.0 to 58.0	50.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	97.6	Pass
Overall Test Results					Pass

  
 Laboratory Technician

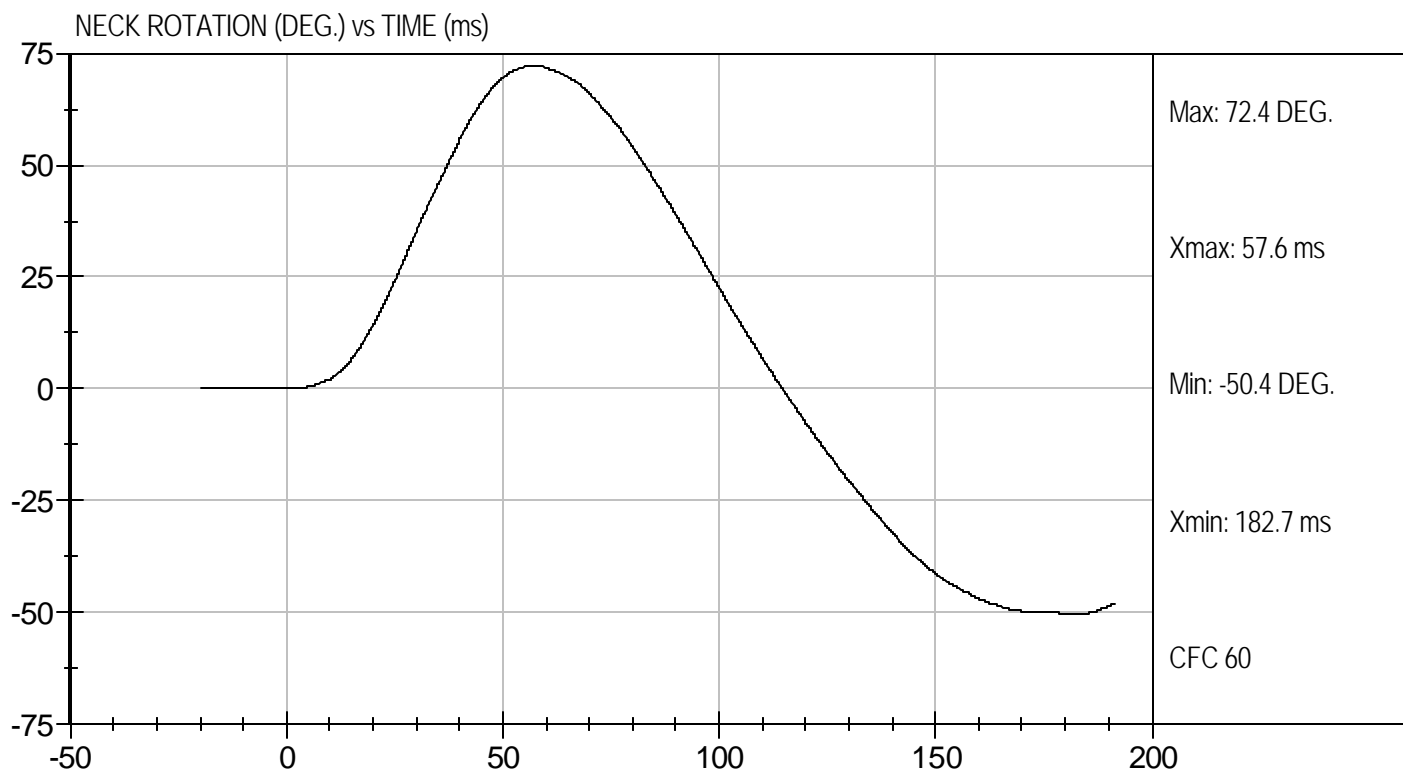
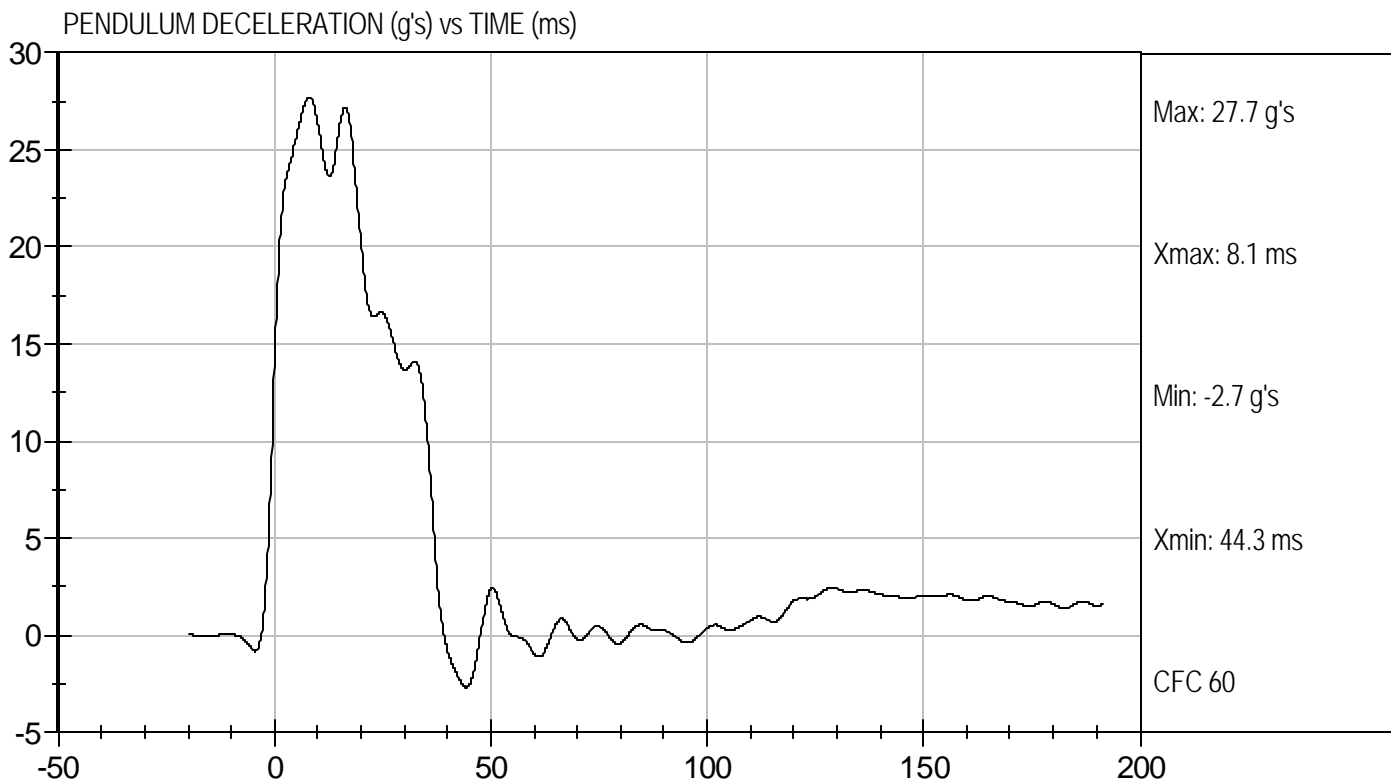
2/28/08  
 Test Date

  
 Approved By



Test Desc: Neck Flexion  
Component ID: D08482

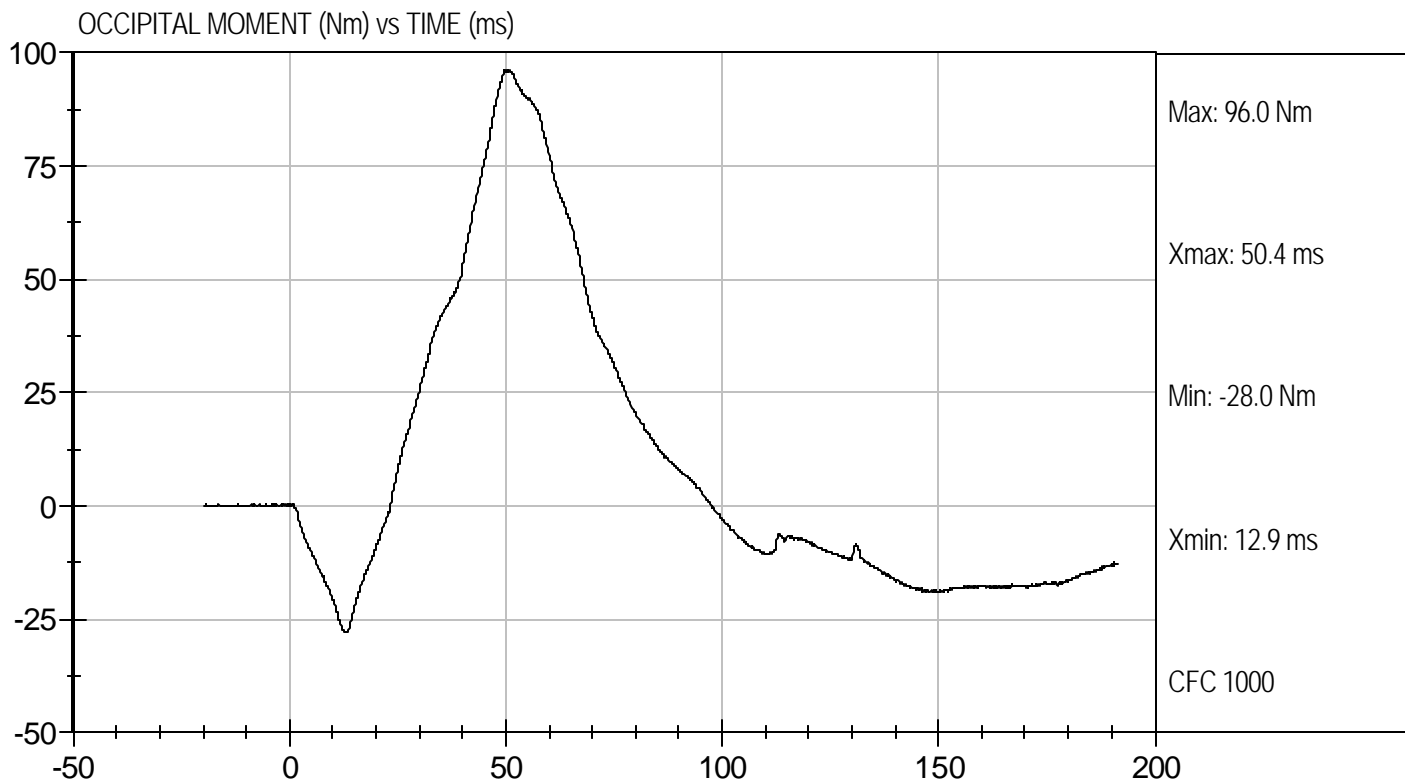
Test Date: 2/28/08  
Velocity: 23.14 ft/s, 7.05 m/s





Test Desc: Neck Flexion  
Component ID: D08482

Test Date: 2/28/08  
Velocity: 23.14 ft/s, 7.05 m/s



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


ATD Serial No: 202

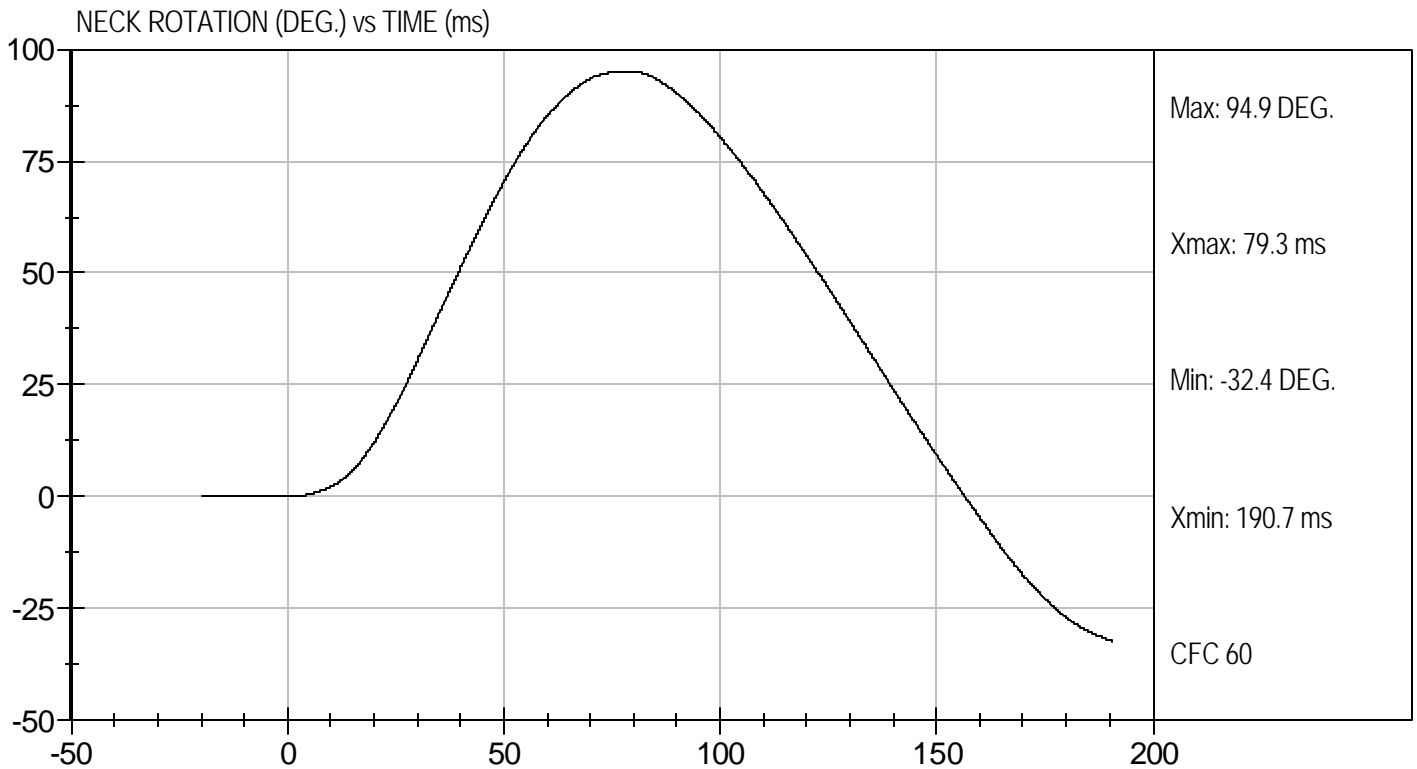
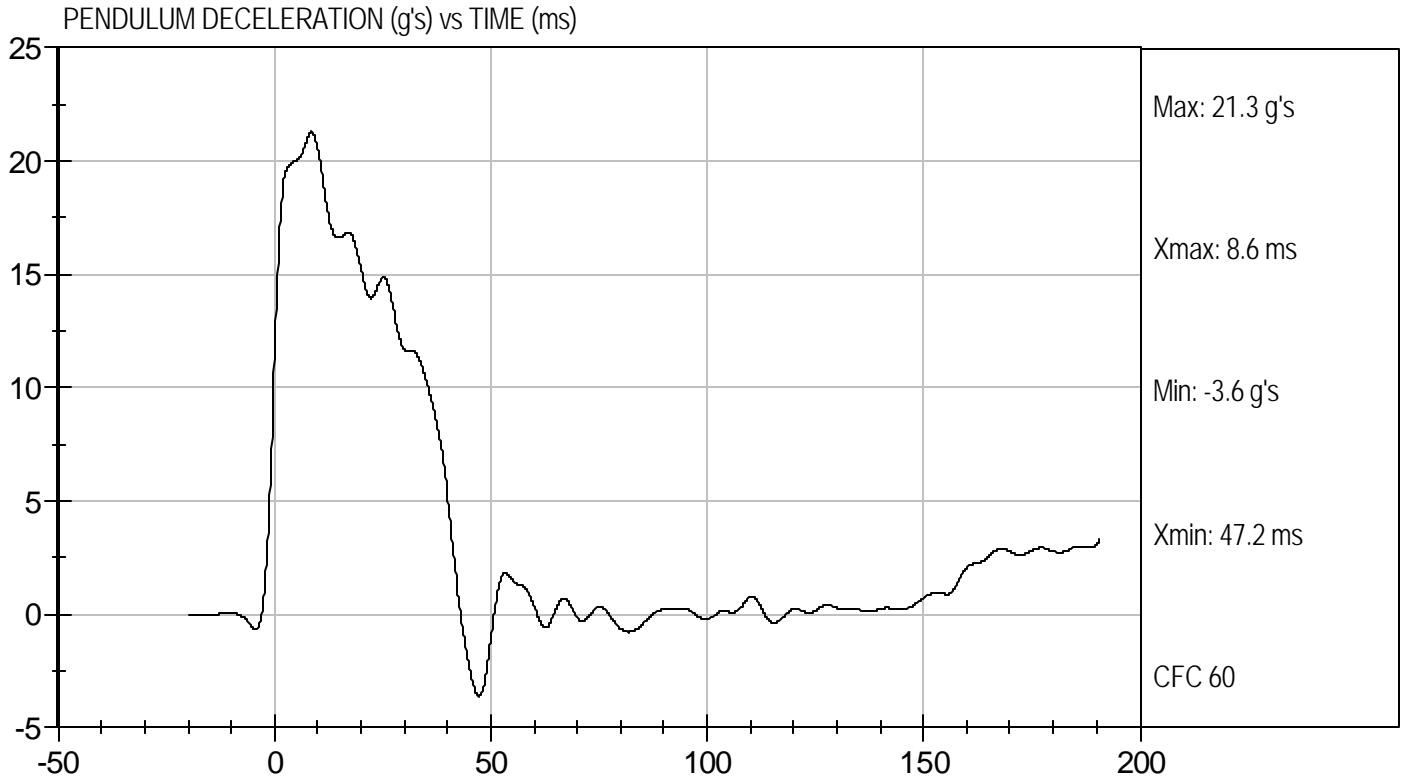
Test I.D.: D08483

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	14	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	20.43	Pass
	20 msec	G's	14.00 to 19.00	15.21	Pass
	30 msec	G's	11.00 to 16.00	11.67	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	11.65	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	40.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.9	Pass
	Time	msec	72.0 to 82.0	79.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	156.7	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-63.0	Pass
	Time	msec	65.0 to 79.0	71.2	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	140.7	Pass
Overall Test Results					Pass

  
Laboratory Technician

2/28/08  
Test Date

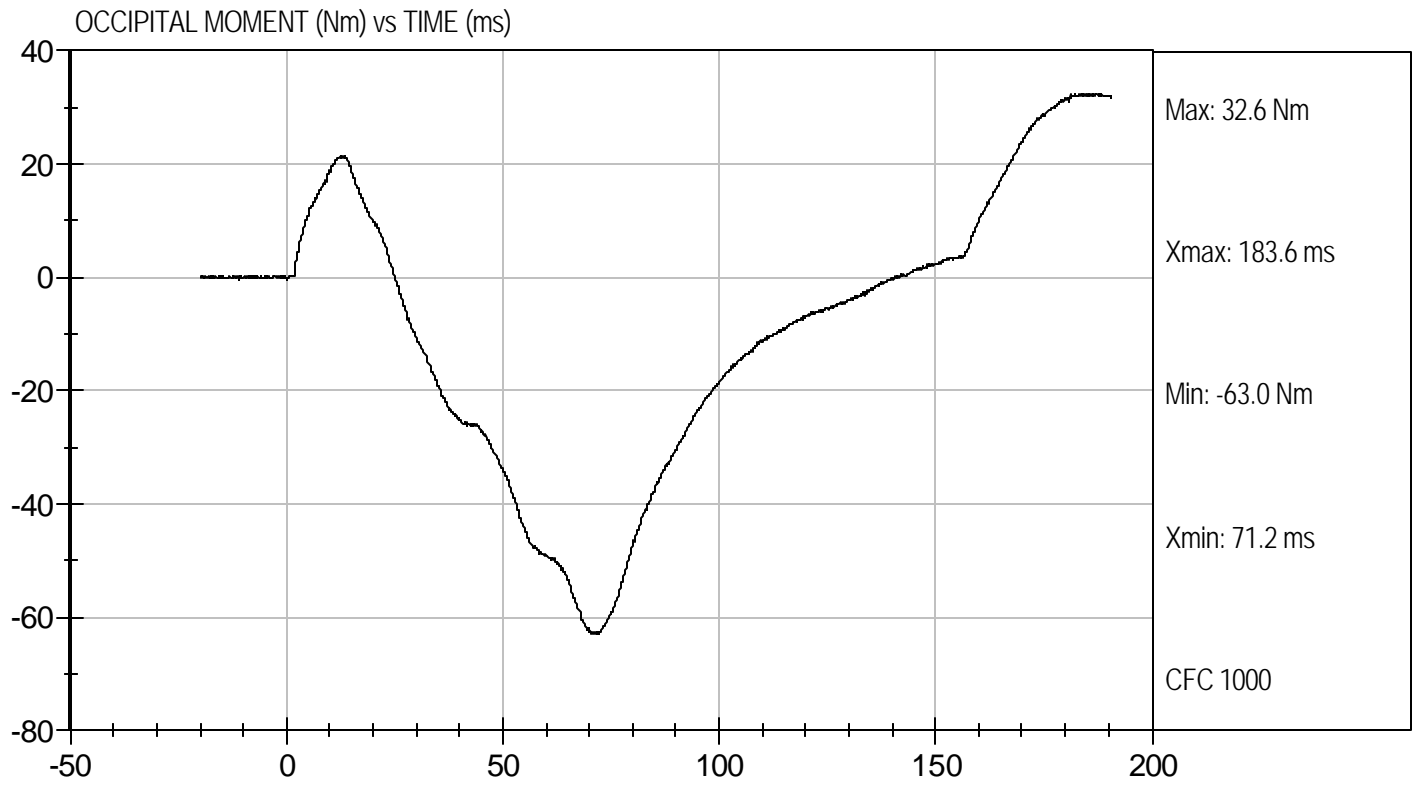
  
Approved By





Test Desc: Neck Extension  
Component ID: D08483

Test Date: 2/28/08  
Velocity: 20.08 ft/s, 6.12 m/s



**MGA RESEARCH CORPORATION  
THORAX IMPACT  
HYBRID III 50TH PERCENTILE MALE**

ATD Serial No: 202

Test I.D: D08484

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,715	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.48	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Overall Test Results				Pass

Jessica Hall  
Laboratory Technician

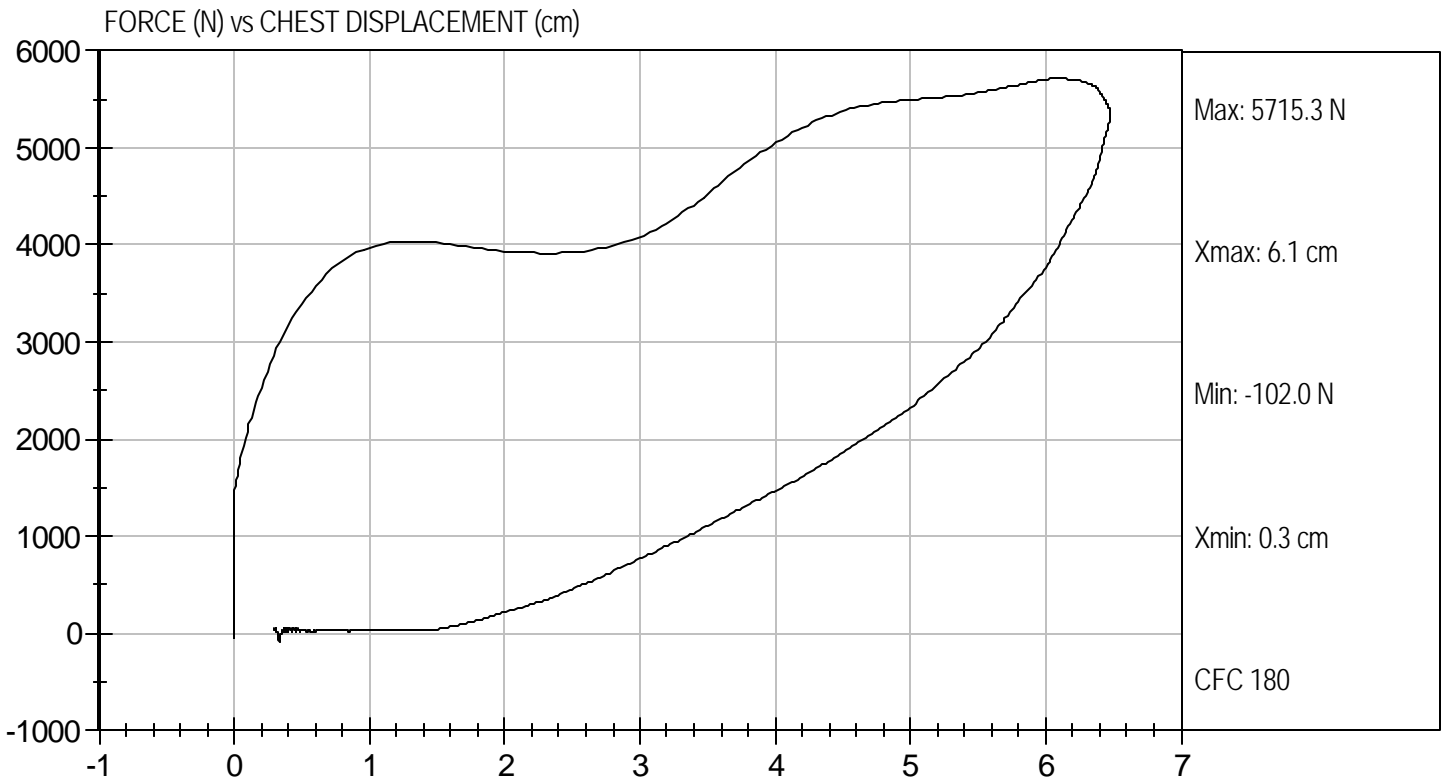
2/27/08  
Test Date

David Winkelbauer  
Approved By



Test Desc: Thorax Impact  
Component ID: D08484

Test Date: 2/27/08  
Velocity: 22.22 ft/s, 6.77 m/s



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

ATD Serial No: 202

Test I.D: D08485

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,346	Pass
Overall Test Results				Pass



Laboratory Technician

3/4/08

Test Date

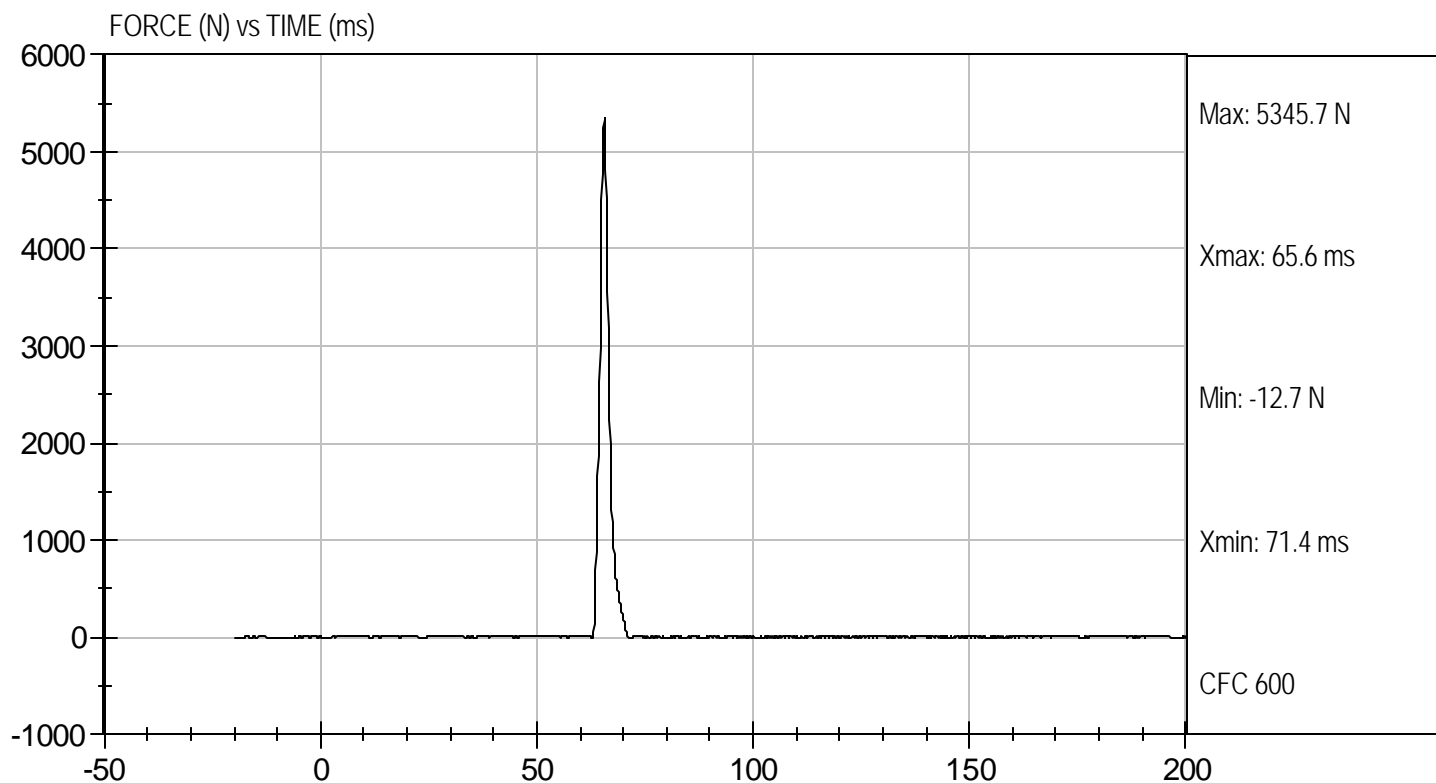


Approved By



Test Desc: Right Knee  
Component ID: D08485

Test Date: 3/4/08  
Velocity: 6.89 ft/s, 2.10 m/s



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

ATD Serial No: 202

Test I.D: D08486

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,223	Pass
Overall Test Results				Pass



Laboratory Technician

3/4/08

Test Date

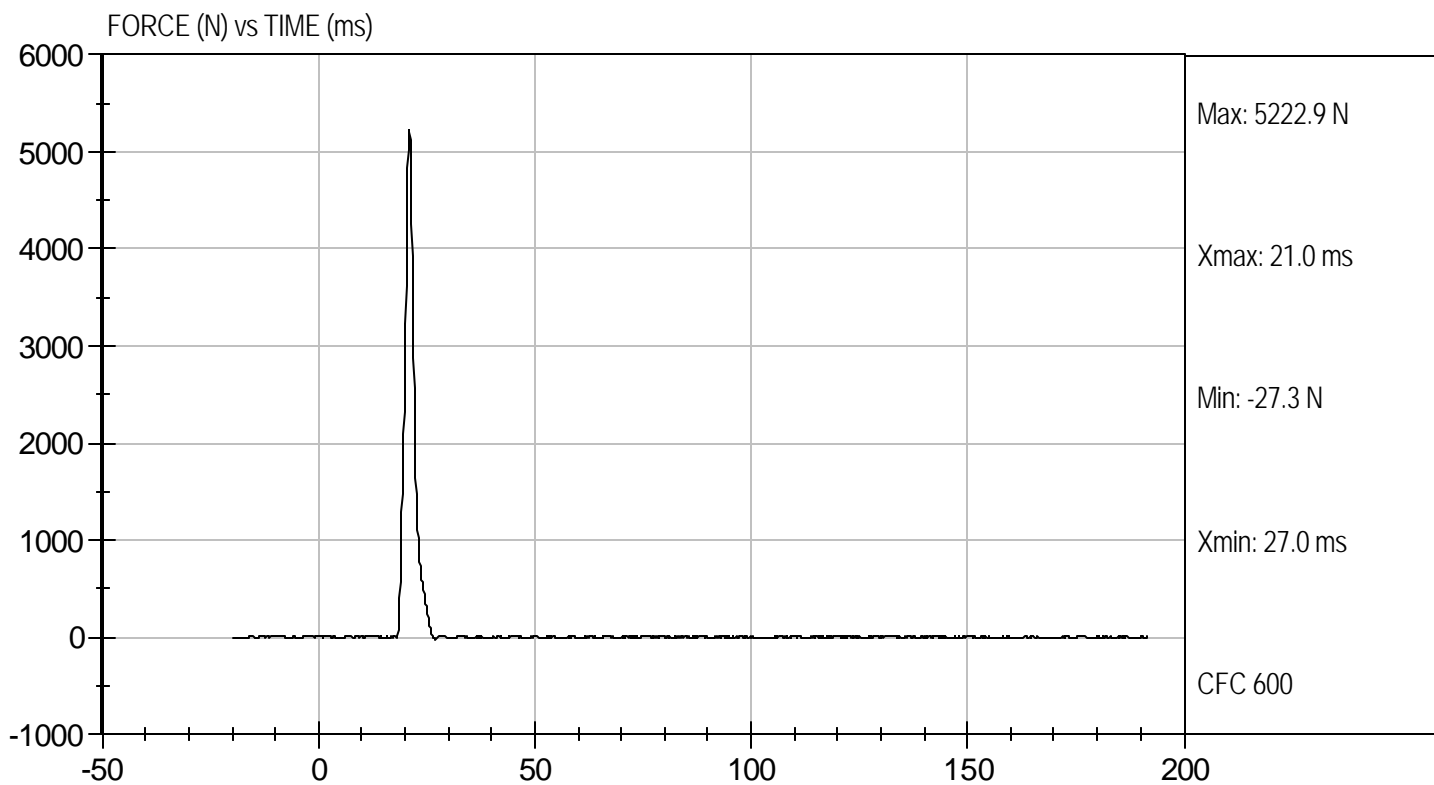


Approved By



Test Desc: Left Knee  
Component ID: D08486

Test Date: 3/4/08  
Velocity: 6.89 ft/s, 2.10 m/s



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


ATD Serial No: 202

Test I.D: D08480

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.3	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	17	17	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	86.5	83.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	41	43	Pass
Overall Test Results					Pass

  
 Laboratory Technician

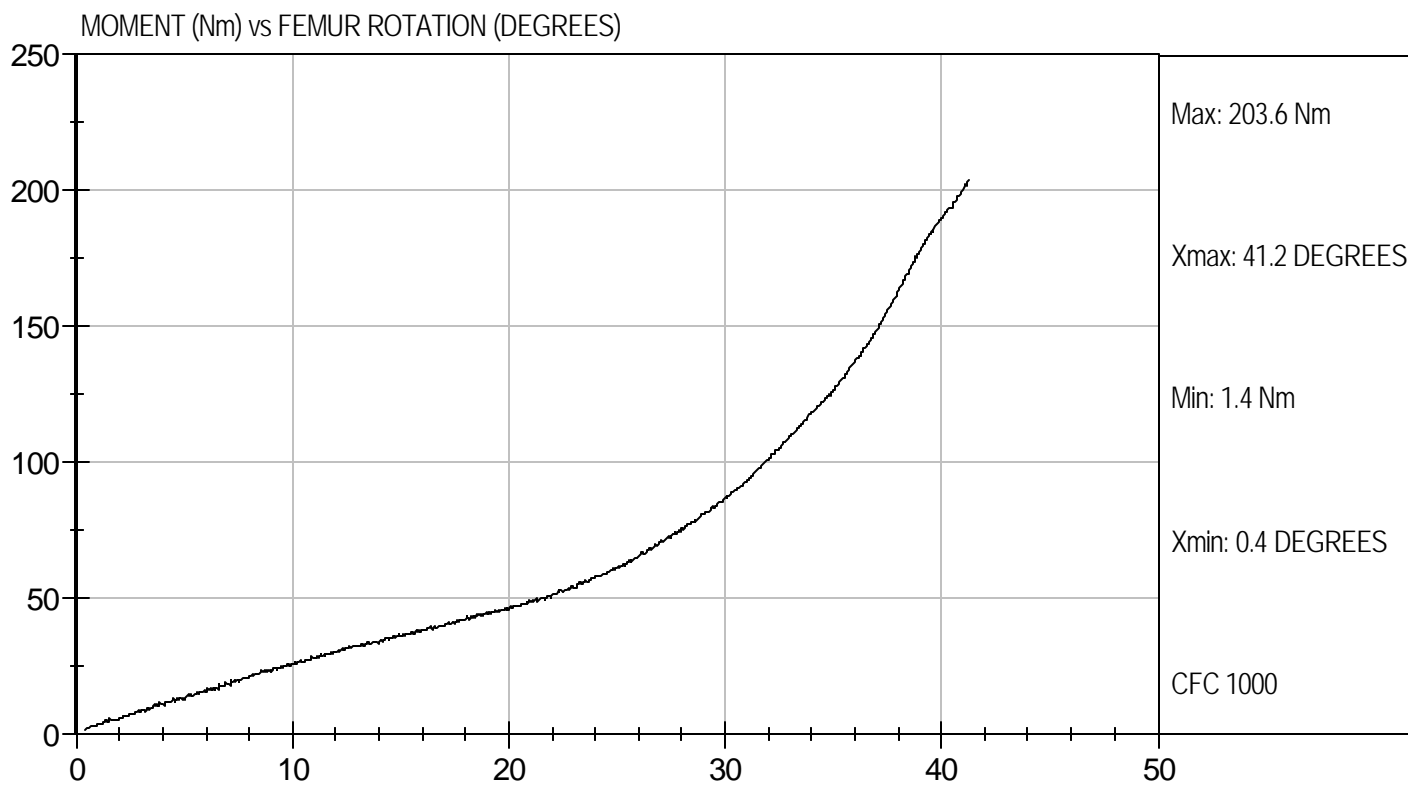
2/27/08  
 Test Date

  
 Approved By



Test Desc: Hip Femur Flexion  
Component ID: D08489

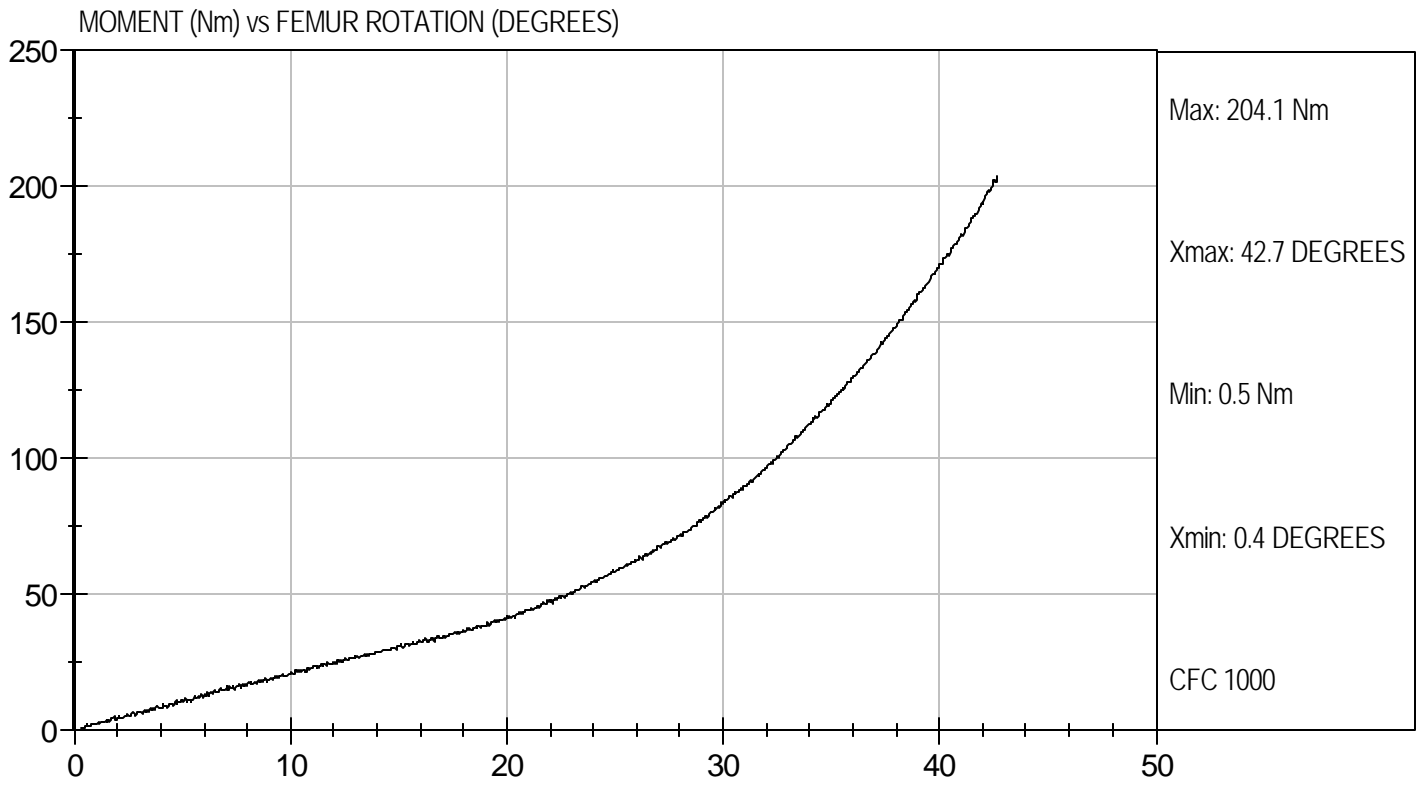
Test Date: 2/27/08  
Velocity: 0 ft/s, 0.00 m/s





Test Desc: Hip Femur Flexion  
Component ID: D08480

Test Date: 2/27/08  
Velocity: 0 ft/s, 0.00 m/s



CERTIFICATION DATA

THOR Lx Legs #036 & #037

Installed in Hybrid III 50th Percentile Male Dummy #202

# GESAC, INC

DESIGN | MANUFACTURE | TEST | SOFTWARE DEVELOPMENT | ERGONOMICS  
 125 Orchard Drive, Boonsboro, MD 21713  
 Tel (301) 432-5885 Fax (301) 432-6199

## Thor-LX Test Report

### Dynamic Ball of Foot Impact Test (page 1)

Engineer	S.Kamalakkannan	Test Date	February 27, 2008
Customer	MGA	Temp (C)/Hum.(%)	21.7/23
Description	Right Lower Extremities	Serial No.	LX037

#### Testing Summary

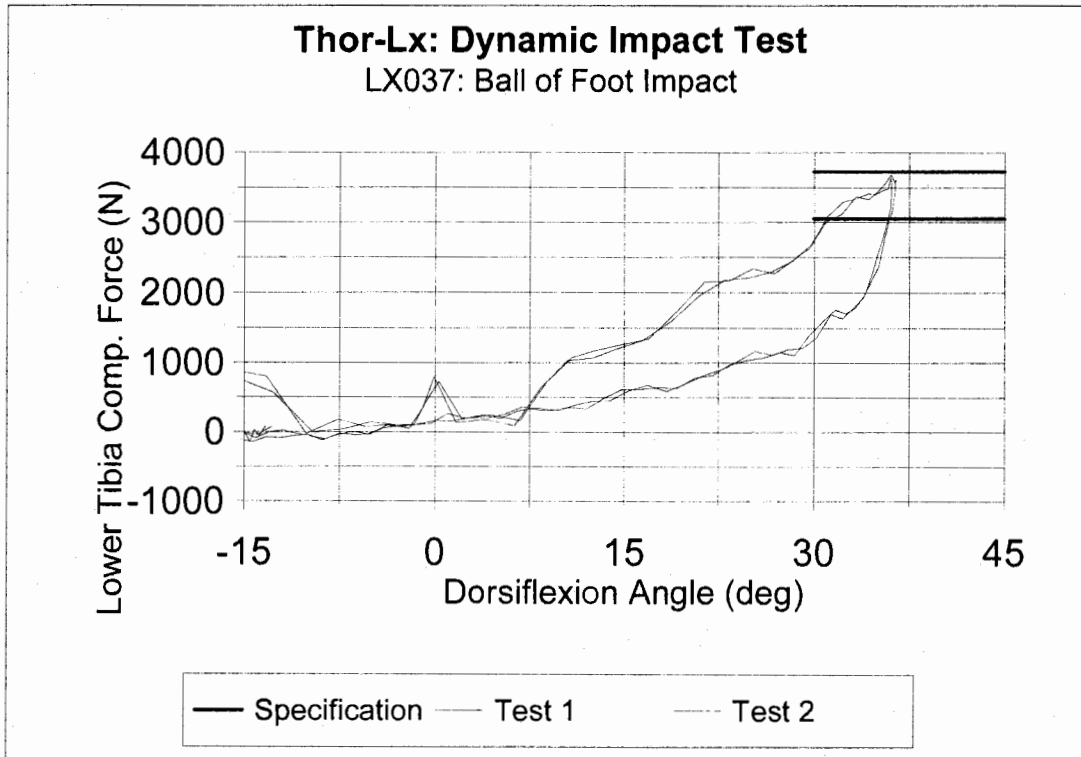
Impact Speed	5.0 m/s	Scan Rate	10000 scans/sec
Impact Effective Mass	5.0 kg	Filter	CFC 600
Impactor	NHTSA Dynamic Impactor (TLX-9000-013)		

#### Response

Peak Lower Tibia Compressive Force* (N)	Specification (N)	Within Reference
3667	3058 - 3738	Yes

\*Average Value

#### Test Plot



Tested by: <u>K. Sulh B.L.</u>	Date: <u>2/27/08</u>
Analyzed by: <u>K. Sulh B.L.</u>	Date: <u>2/27/08</u>

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## Thor-LX Test Report

### Dynamic Ball of Foot Impact Test (page 2)

Engineer S.Kamalakkannan  
 Customer MGA  
 Description Right Lower Extremities

Test Date February 27, 2008  
 Temp (C)/Hum.(%) 21.7/23  
 Serial No. LX037

#### Testing Summary

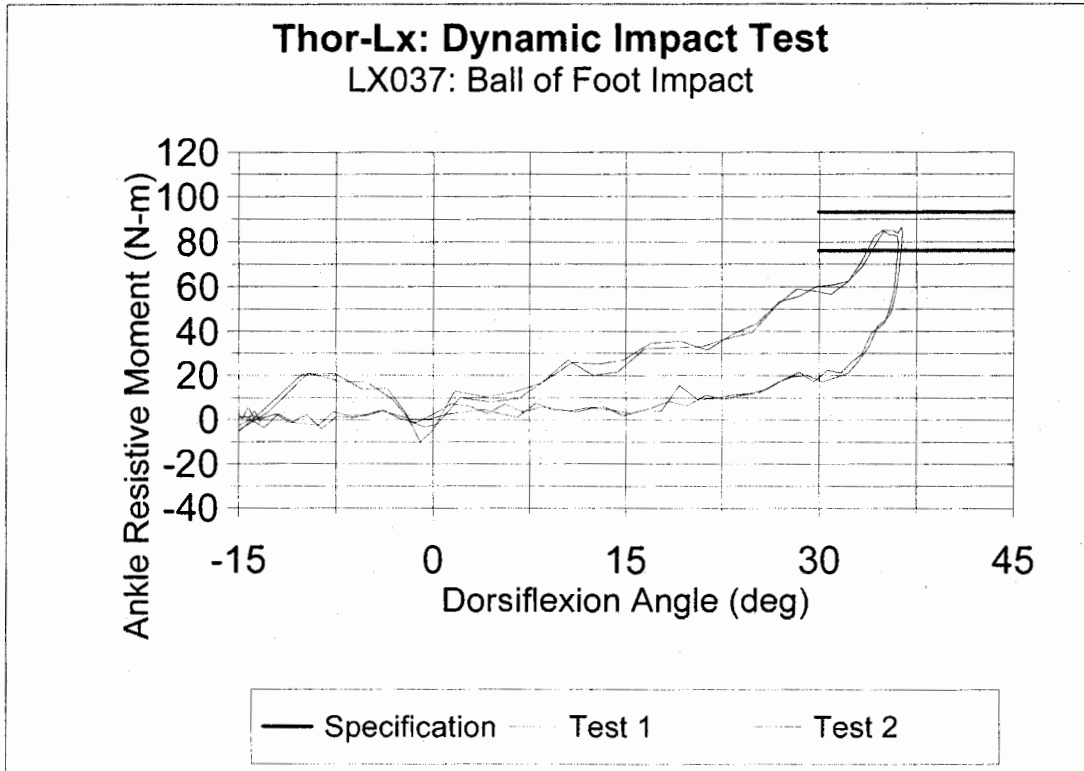
Impact Speed	5.0 m/s	Scan Rate	10000 scans/sec
Impact Effective Mass	5.0 kg	Filter	CFC 600
Impactor	NHTSA Dynamic Impactor (TLX-9000-013)		

#### Response

Peak Ankle Resistive Moment* (N-m)	Specification (N-m)	Within Reference
85.8	76.2 - 93.2	Yes

\*Average Value

#### Test Plot



Tested by: K. Sults Bil.

Date: 2/27/08

Analyzed by: K. Sults Bil.

Date: 2/27/08

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## Thor-LX Test Report

### Dynamic Heel of Foot Impact Test

<b>Engineer</b>	S.Kamalakkannan	<b>Test Date</b>	February 27, 2008
<b>Customer</b>	MGA	<b>Temp (C)/Hum.(%)</b>	20.7/23
<b>Description</b>	Right Lower Extremities	<b>Serial No.</b>	LX037

#### Testing Summary

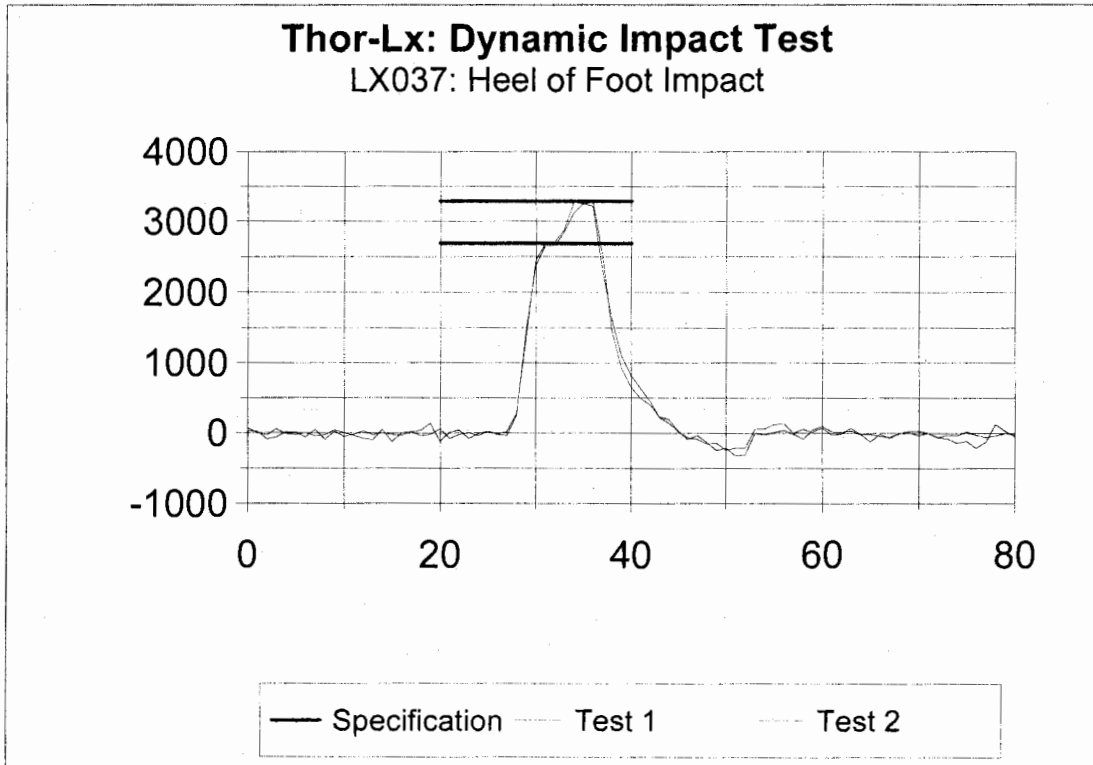
Impact Speed	4.0 m/s	Scan Rate	10000 scans/sec
Impact Effective Mass	5.0 kg	Filter	CFC 600
Impactor	NHTSA Dynamic Impactor (TLX-9000-013)		

#### Response

Peak Lower Tibia Compressive Force* (N)	Specification (N)	Within Reference
3272	2694 - 3292	Yes

\*Average Value

#### Test Plot



Tested by: <u>K. Sulh Bil</u>	Date: <u>2/27/08</u>
Analyzed by: <u>K. Sulh Bil</u>	Date: <u>2/27/08</u>

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**Thor-Lx Test Report**

Inversion Quasi-Static Test

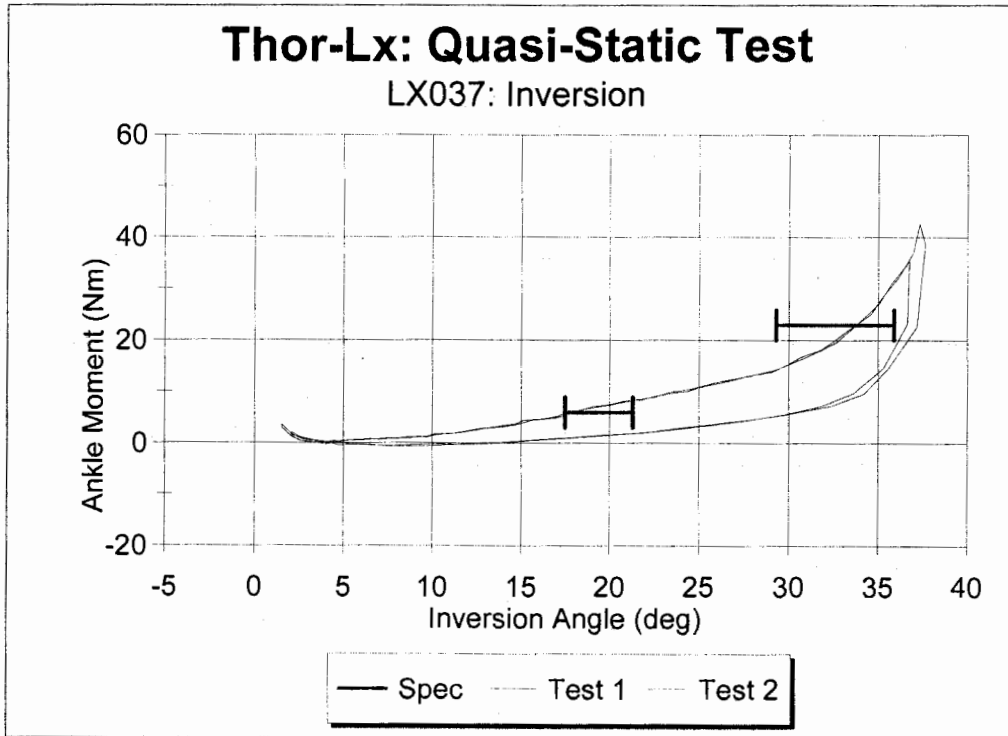
<b>Engineer</b>	S.Kamalakkannan	<b>Test Date</b>	February 28, 2008
<b>Customer</b>	MGA	<b>Temp. (C)/Hum.(%)</b>	20.7/20
<b>Description</b>	Right Lower Extremity	<b>Serial No.</b>	LX037

**Testing Summary (Design Reference)**

Ankle Moment (Nm)	Inversion Angle (Degree)	Reference Specification (Degree)	Within Reference?
6	17.8	17.5 - 21.3	Yes
23	33.8	29.3 - 35.9	Yes

\*Average Value

**Result Plot**



Tested by: K. Sulh Bel  
 Analyzed by: K. Sulh Bel

Date: 2/28/08  
 Date: 2/28/08

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## Thor-Lx Test Report

### Eversion Quasi-Static Test

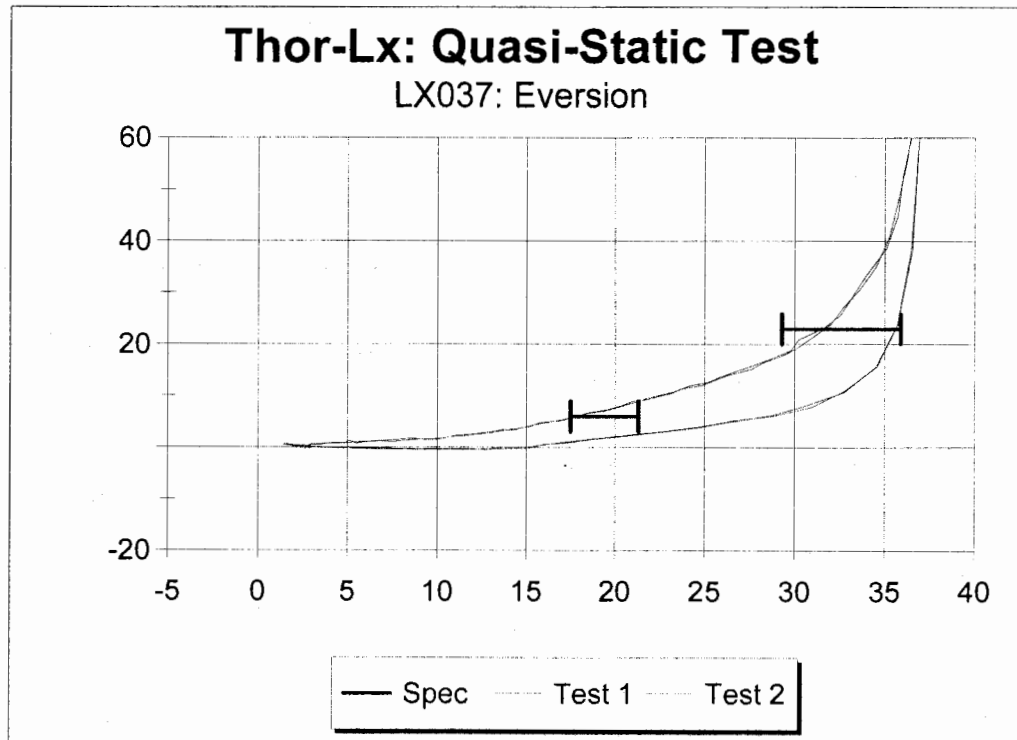
<b>Engineer</b>	S.Kamalakkannan	<b>Test Date</b>	February 28, 2008
<b>Customer</b>	MGA	<b>Temp. (C)/Hum.(%)</b>	20.7/23
<b>Description</b>	Right Lower Extremity	<b>Serial No.</b>	LX037

#### Testing Summary (Design Reference)

Ankle Moment (Nm)	Eversion Angle (Degree)	Reference Specification (Degree)	Within Reference?
6	17.8	17.5 - 21.3	Yes
23	31.6	29.3 - 35.9	Yes

\*Average Value

#### Result Plot



Tested by: K. Sath RL

Date: 2/28/08

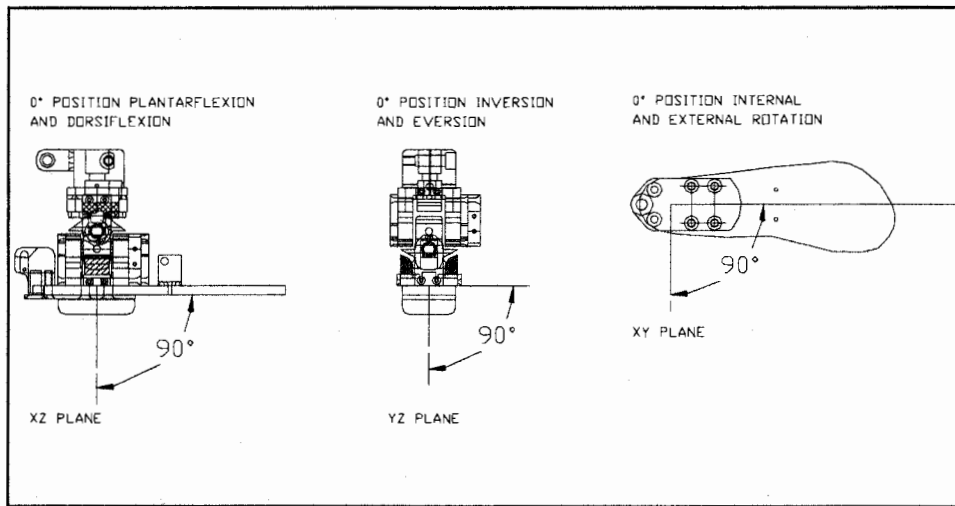
Analyzed by: K. Sath RL

Date: 2/28/08

**THOR - LX Rotary Potentiometer Calibration**

The figure below shows the three primary calibration positions for the THOR-LX Rotary Potentiometer Units.

The following table provides the expected potentiometer outputs at 10V excitation for each of the positions shown in the Figure below. The X potentiometer measures inversion / eversion rotation; the Y potentiometer measures dorsiflexion / plantarflexion rotation, and the Z potentiometer measures internal and external rotation. The voltage for each potentiometer should be verified at the zero position prior to testing.



**Rotary Potentiometer Calibrations for Right Leg - Serial # LX-037**

Pot	Rotary Pot Serial #	Sensitivity at 10 V Excitation	Units	Volts @ 0 Position	Units
X	PD210-4B 7921-0368	31.71	Volts/Degree	5.01	Volts
Y	PD210-4B 7921-0369	32.10	Volts/Degree	4.92	Volts
Z	PD210-4B 7921-0370	31.88	Volts/Degree	4.90	Volts

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## Thor-LX Test Report

### Dynamic Ball of Foot Impact Test (page 1)

<b>Engineer</b>	S.Kamalakkannan	<b>Test Date</b>	February 26, 2008
<b>Customer</b>	MGA	<b>Temp (C)/Hum.(%)</b>	21.7/21
<b>Description</b>	Left Lower Extremities	<b>Serial No.</b>	LX036

#### Testing Summary

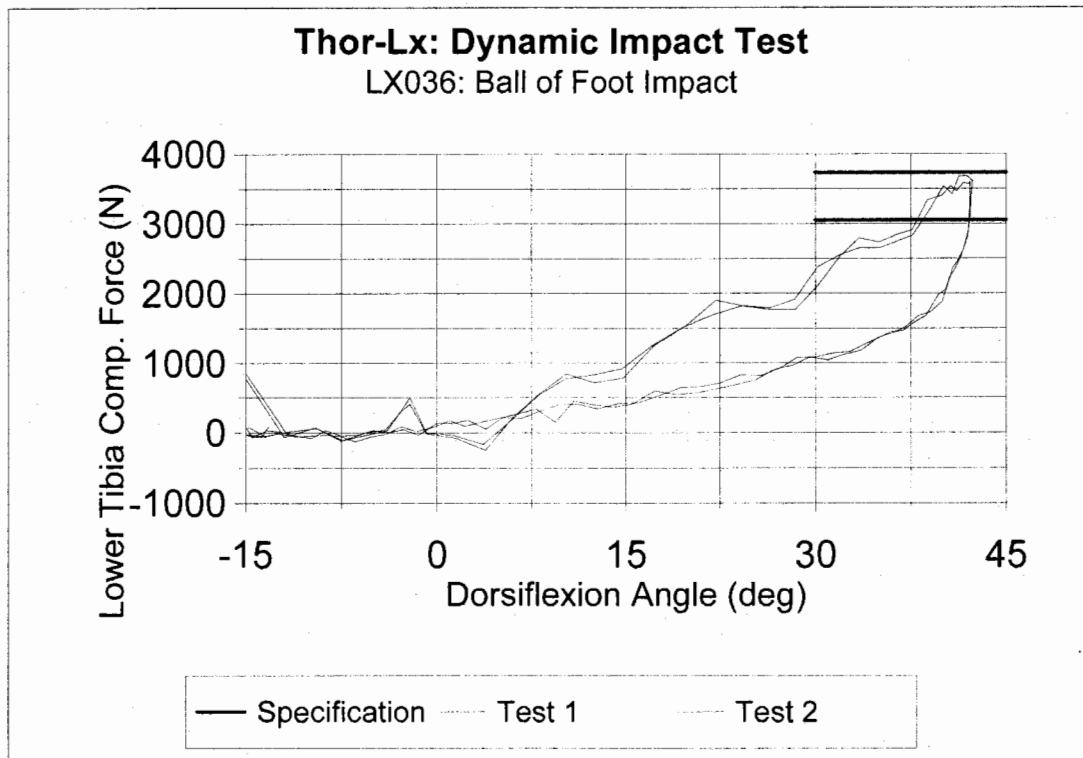
Impact Speed	5.0 m/s	Scan Rate	10000 scans/sec
Impact Effective Mass	5.0 kg	Filter	CFC 600
Impactor	NHTSA Dynamic Impactor (TLX-9000-013)		

#### Response

Peak Lower Tibia Compressive Force* (N)	Specification (N)	Within Reference
3645	3058 - 3738	Yes

\*Average Value

#### Test Plot



Tested by: K. Subh B.L.

Date: 2/26/08

Analyzed by: K. Subh B.L.

Date: 2/26/08

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Fax (301) 432-6199

## Thor-LX Test Report

### Dynamic Ball of Foot Impact Test (page 2)

**Engineer** S.Kamalakkannan  
**Customer** MGA  
**Description** Left Lower Extremities

**Test Date** February 26, 2008  
**Temp (C)/Hum.(%)** 21.7/21  
**Serial No.** LX036

**Testing Summary**

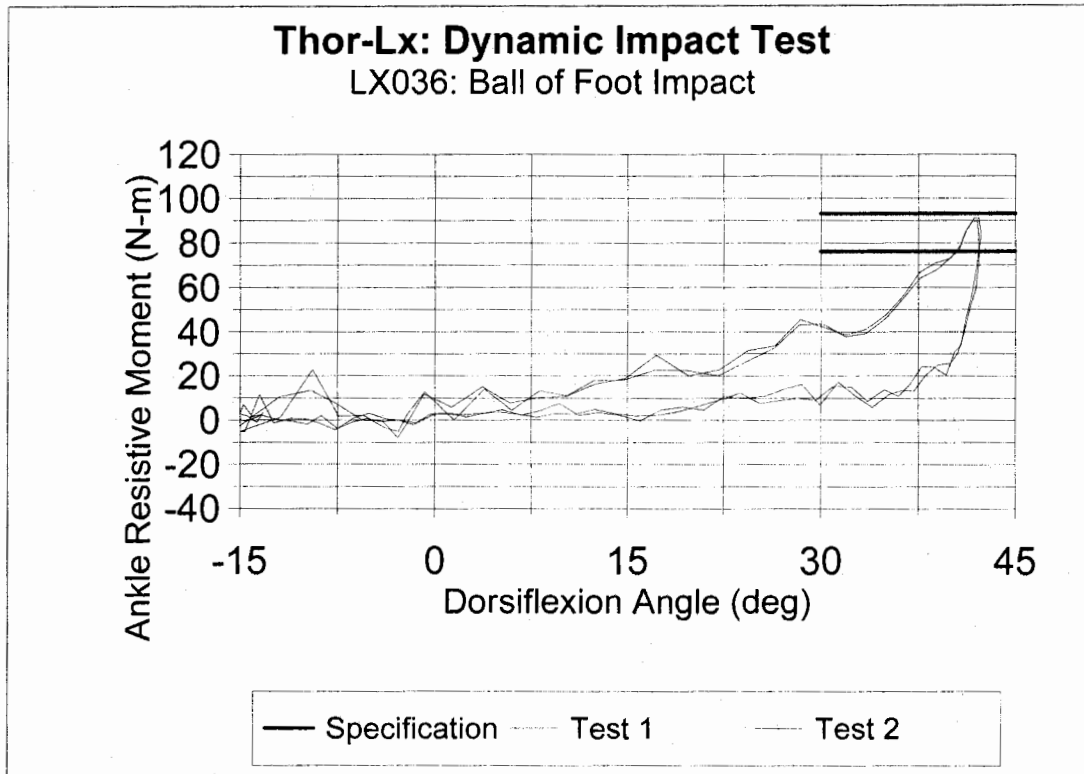
Impact Speed	5.0 m/s	Scan Rate	10000 scans/sec
Impact Effective Mass	5.0 kg	Filter	CFC 600
Impactor	NHTSA Dynamic Impactor (TLX-9000-013)		

**Response**

Peak Ankle Resistive Moment* (N-m)	Specification (N-m)	Within Reference
90.8	76.2 - 93.2	Yes

\*Average Value

**Test Plot**



Tested by: H. Sulh B.L.  
 Analyzed by: H. Sulh B.L.

Date: 2/26/08  
 Date: 2/26/08

# GESAC, INC

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## Thor-LX Test Report

### Dynamic Heel of Foot Impact Test

<b>Engineer</b>	S.Kamalakkannan	<b>Test Date</b>	February 22, 2008
<b>Customer</b>	MGA	<b>Temp (C)/Hum.(%)</b>	20.7/20
<b>Description</b>	Left Lower Extremities	<b>Serial No.</b>	LX036

**Testing Summary**

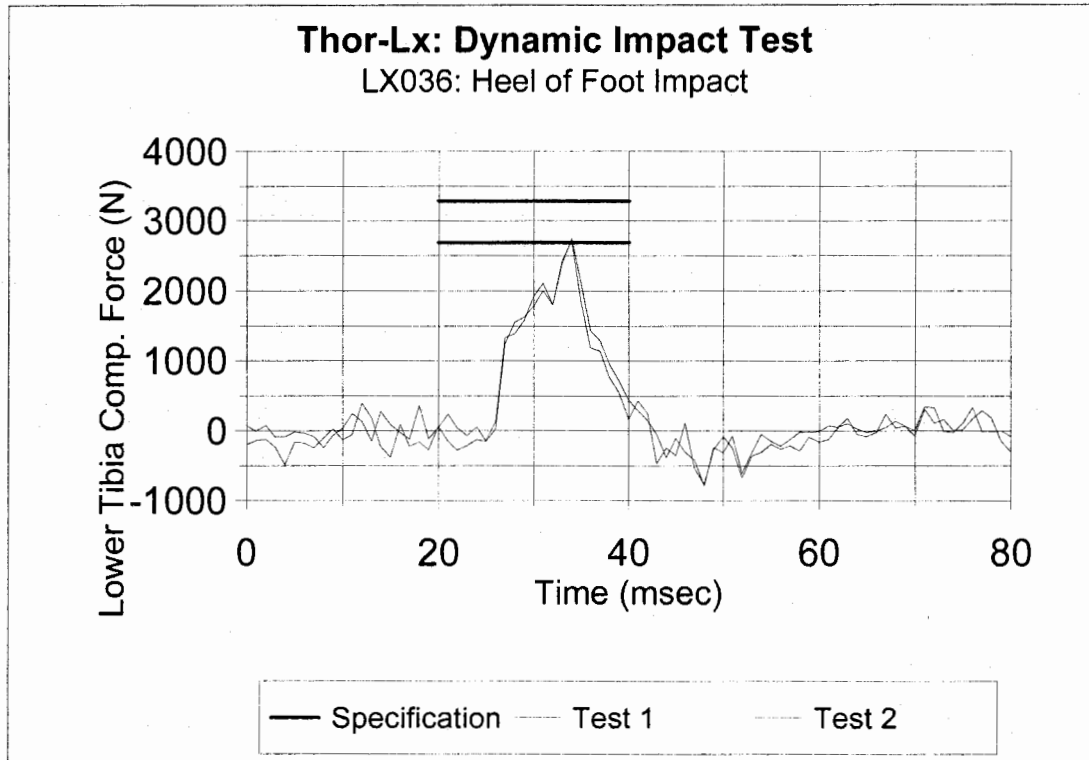
Impact Speed	4.0 m/s	Scan Rate	10000 scans/sec
Impact Effective Mass	5.0 kg	Filter	CFC 600
Impactor	NHTSA Dynamic Impactor (TLX-9000-013)		

**Response**

Peak Lower Tibia Compressive Force* (N)	Specification (N)	Within Reference
2740	2694 - 3292	Yes

\*Average Value

**Test Plot**



Tested by: K. Sulh B.l

Date: 2/22/08

Analyzed by: K. Sulh B.l

Date: 2/22/08

# GESAC, INC

DESIGN | MANUFACTURE | TEST | SOFTWARE DEVELOPMENT | ERGONOMICS

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## Thor-Lx Test Report

### Inversion Quasi-Static Test

Engineer S.Kamalakkannan

Test Date

February 26, 2008

Customer MGA  
Description Left Lower Extremity

Temp. (C)/Hum.(%)

20.7/20

Serial No.

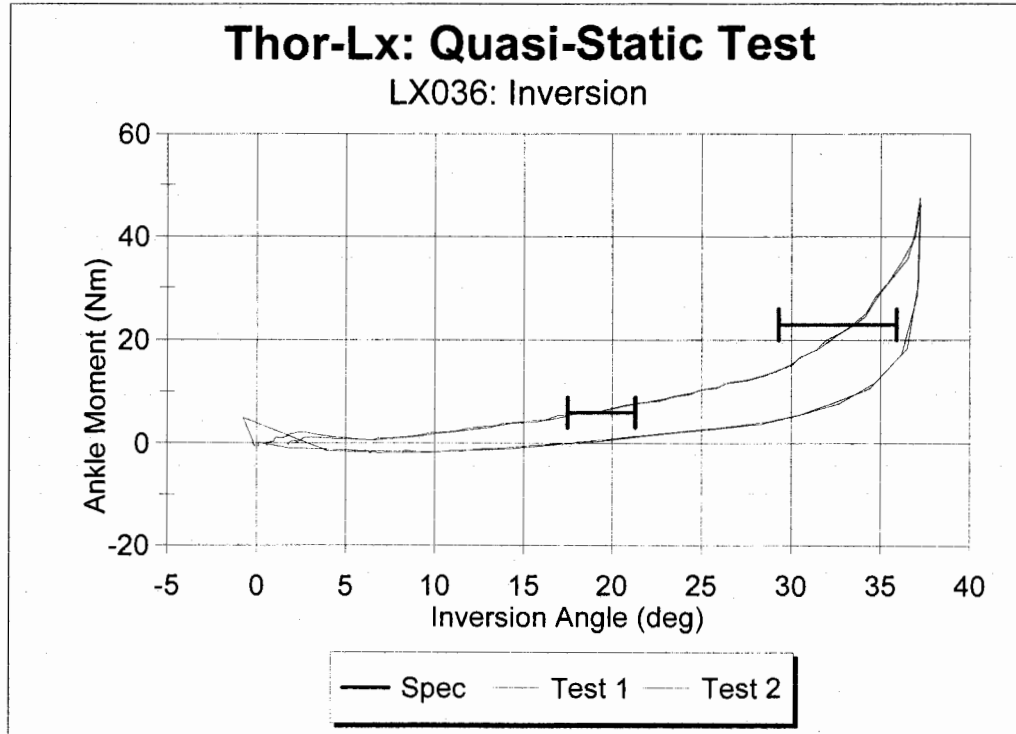
LX036

### Testing Summary (Design Reference)

Ankle Moment (Nm)	Inversion Angle (Degree)	Reference Specification (Degree)		Within Reference?
		Min	Max	
6	18.5	17.5	21.3	Yes
23	33.5	29.3	35.9	Yes

\*Average Value

### Result Plot



Tested by: K. Sulli B.J.

Date: 2/26/08

Analyzed by: K. Sulli B.J.

Date: 2/26/08

**GESAC, INC**

DESIGN | MANUFACTURE | TEST | SOFTWARE DEVELOPMENT | ERGONOMICS

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**Thor-Lx Test Report**

Eversion Quasi-Static Test

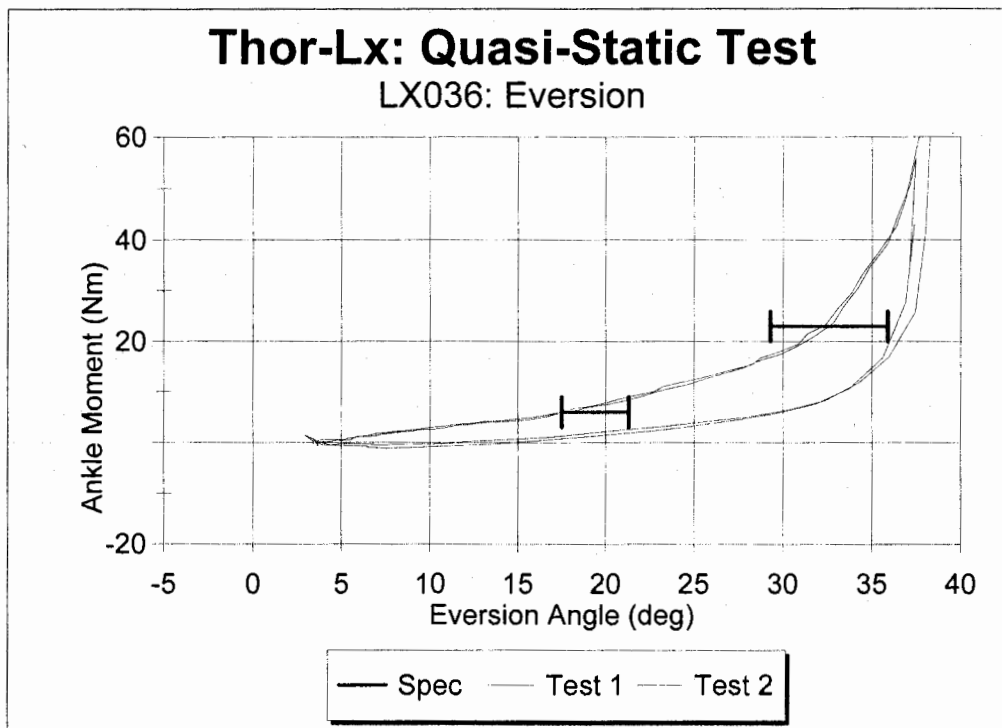
<b>Engineer</b>	S.Kamalakkannan	<b>Test Date</b>	February 27, 2008
<b>Customer</b>	MGA	<b>Temp. (C)/Hum.(%)</b>	20.7/23
<b>Description</b>	Left Lower Extremity	<b>Serial No.</b>	LX036

**Testing Summary (Design Reference)**

Ankle Moment (Nm)	Eversion Angle (Degree)	Reference Specification (Degree)	Within Reference?
6	17.6	17.5 - 21.3	Yes
23	32.4	29.3 - 35.9	Yes

\*Average Value

**Result Plot**



Tested by: K. Selh Bl.

Date: 2/27/08

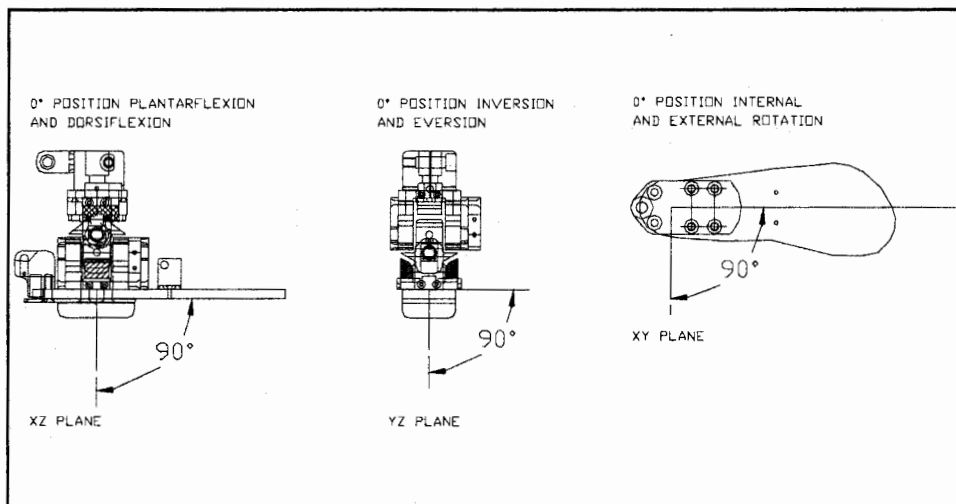
Analyzed by: K. Selh Bl.

Date: 2/27/08

**THOR - LX Rotary Potentiometer Calibration**

The figure below shows the three primary calibration positions for the THOR-LX Rotary Potentiometer Units.

The following table provides the expected potentiometer outputs at 10V excitation for each of the positions shown in the Figure below. The X potentiometer measures inversion / eversion rotation; the Y potentiometer measures dorsiflexion / plantarflexion rotation, and the Z potentiometer measures internal and external rotation. The voltage for each potentiometer should be verified at the zero position prior to testing.



**Rotary Potentiometer Calibrations for Left Leg - Serial # LX -036**

Pot	Rotary Pot Serial #	Sensitivity at 10 V Excitation	Units	Volts @ 0 Position	Units
X	PD210-4B 7921-0371	32.06	Volts/Degree	4.97	Volts
Y	PD210-4B 7921-0367	31.74	Volts/Degree	5.43	Volts
Z	PD210-4B 7921-0365	31.78	Volts/Degree	3.50	Volts

# Transportation Research Center Inc.

Front Head Drop

HIII 10YO Serial No. D001 Certification No. 14-1

Test Date: 6/12/2007

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	18.9 - 25.6 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	53 %	Yes
Peak Head Resultant Acceleration	250 - 300 g	270.3 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	9.1 g	Yes
Is Acceleration Curve Unimodal	Yes	Yes	Yes

**Test meets specifications.**

**Comments:**

Technician

Approved

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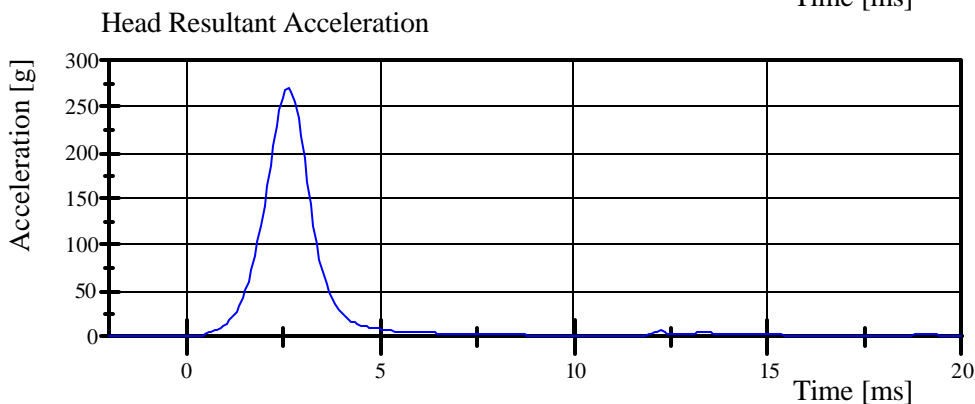
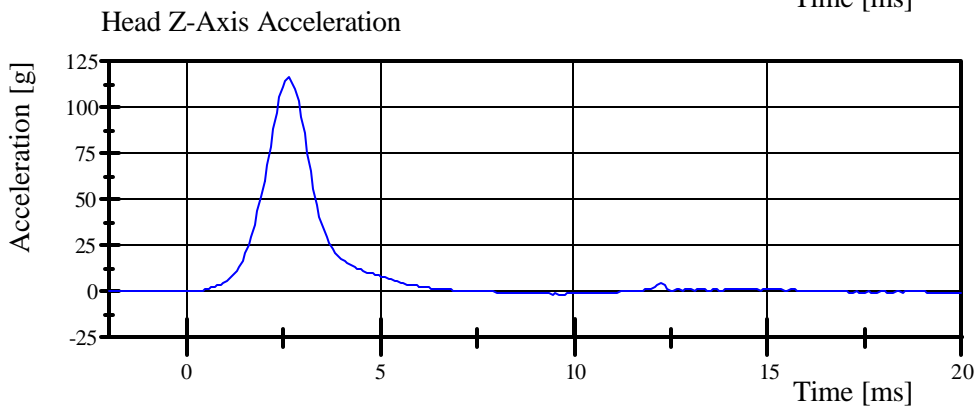
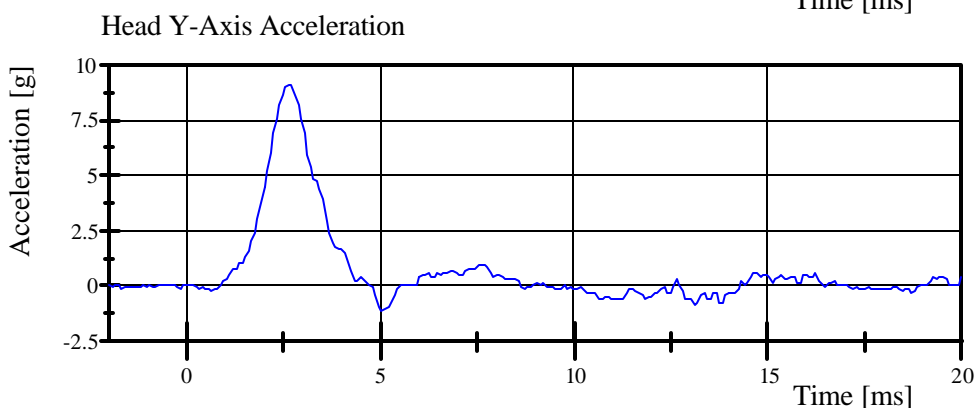
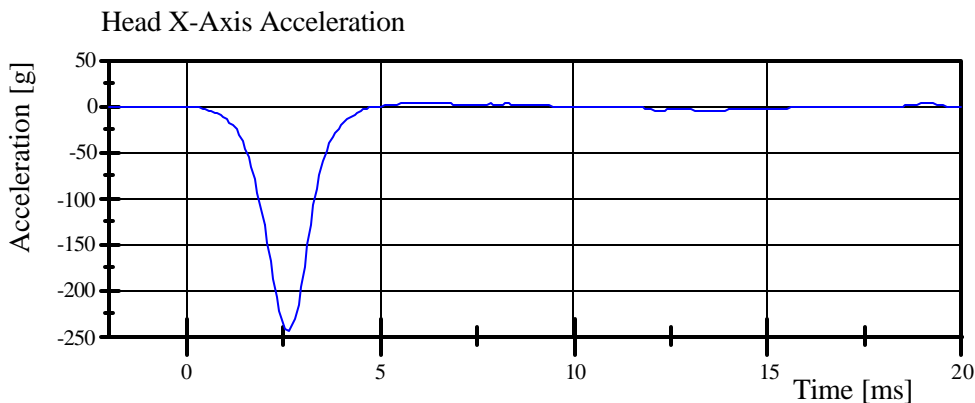


# Transportation Research Center Inc.

Front Head Drop

HIII 10YO Serial No. D001 Certification No. 14-1

Test Date: 6/12/2007



# Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. D001 Certification No. 14-2

Test Date: 6/13/2007

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	52 %	Yes
Pendulum Impact Velocity	5.98 - 6.22 m/s	6.073 m/s	Yes
Pendulum Integrated Velocity at 10ms	(-1.64) - (-2.04) m/s	-1.648 m/s	Yes
Pendulum Integrated Velocity at 20ms	(-3.04) - (-4.04) m/s	-3.189 m/s	Yes
Pendulum Integrated Velocity at 30ms	(-4.45) - (-5.65) m/s	-4.692 m/s	Yes
Total Head D-Plane Rotation	(-76.0) - (-90.0) °	-82.31 °	Yes
Total Neck Occipital Condyles Moment Between -74° and -88° Rotation	50.0 - 62.0 Nm	52.09 Nm	Yes
Neck Occipital Condyles Moment Decay to 10 Nm	86.0 - 105.0 ms	100.64 ms	Yes

**Test meets specifications.**

**Comments:**

Technician

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Approved

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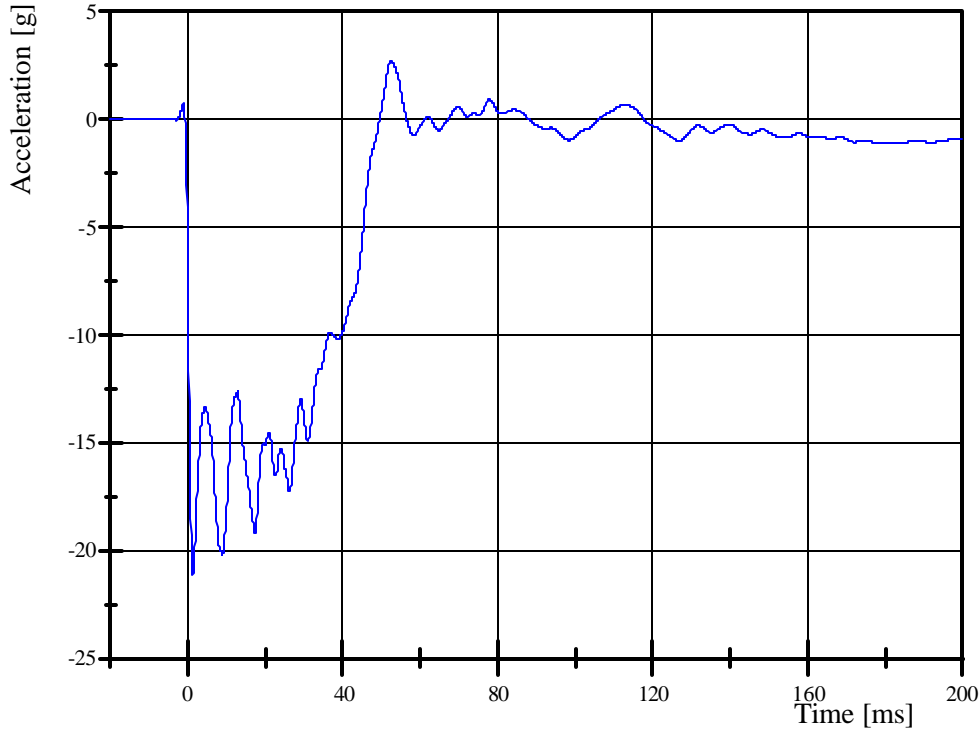
# Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. D001 Certification No. 14-2

Test Date: 6/13/2007

Pendulum Acceleration

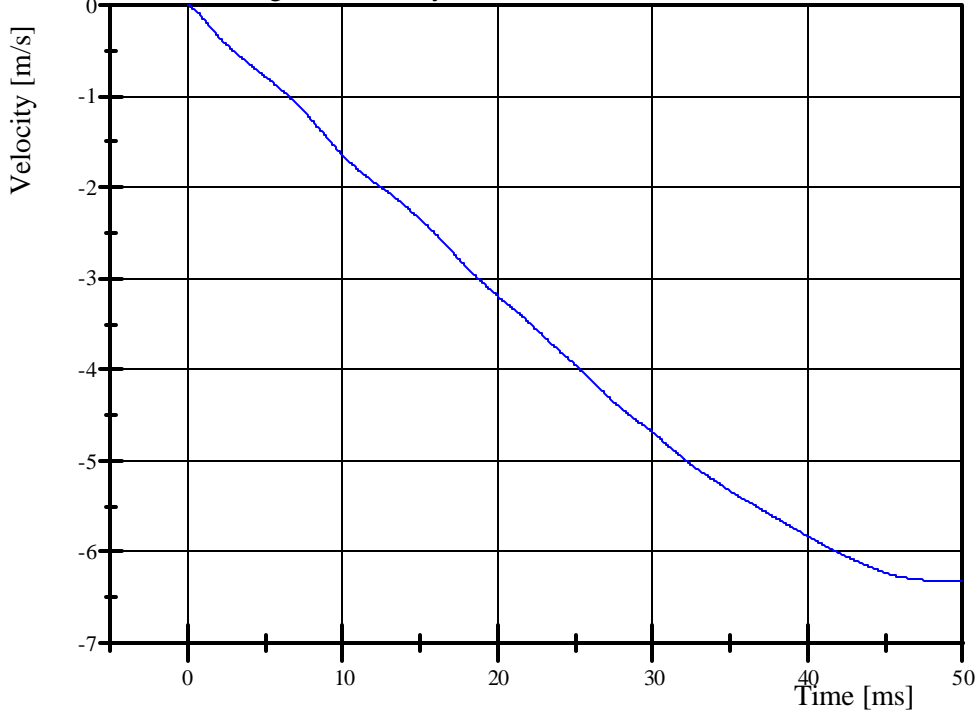


Filter Class: CFC\_180

Max: 2.7 g at 52.6 ms

Min: -21.2 g at 1.3 ms

Pendulum Integrated Velocity



Filter Class: CFC\_180

Max: 0.0 m/s at 0.0 ms

Min: -6.3 m/s at 49.5 ms

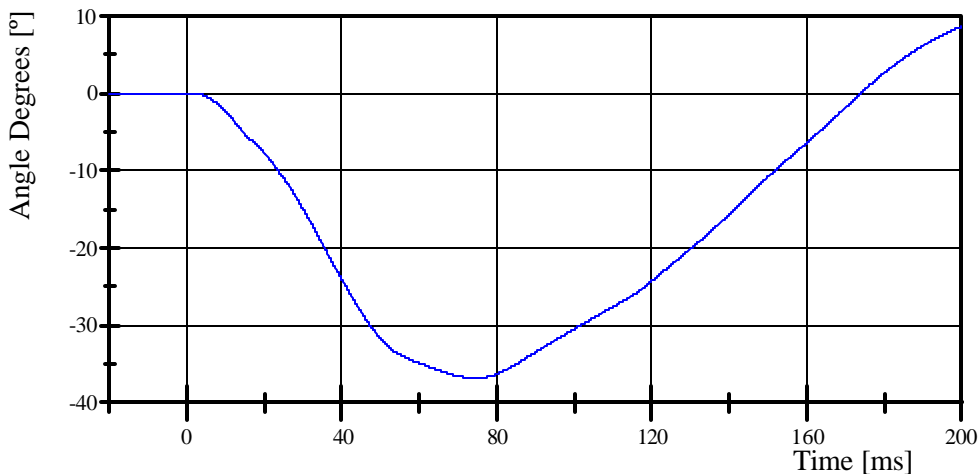
# Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. D001 Certification No. 14-2

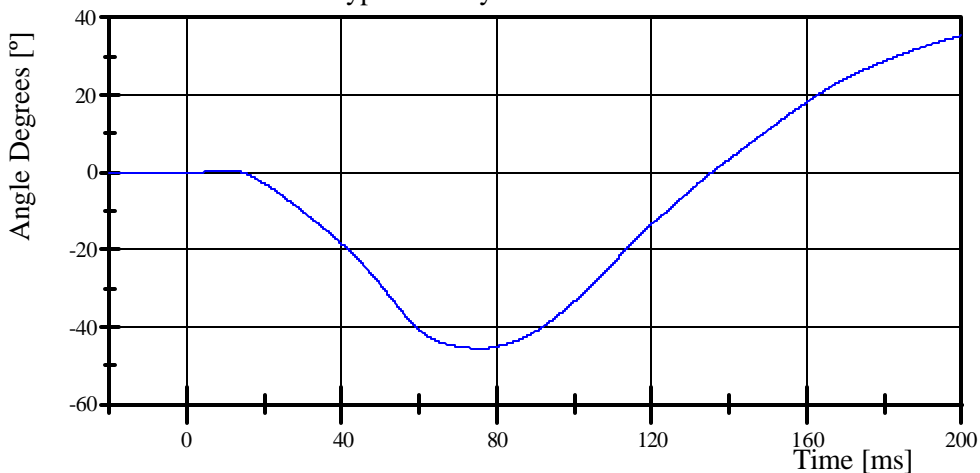
Test Date: 6/13/2007

Pot Rotation at the Base of Neck



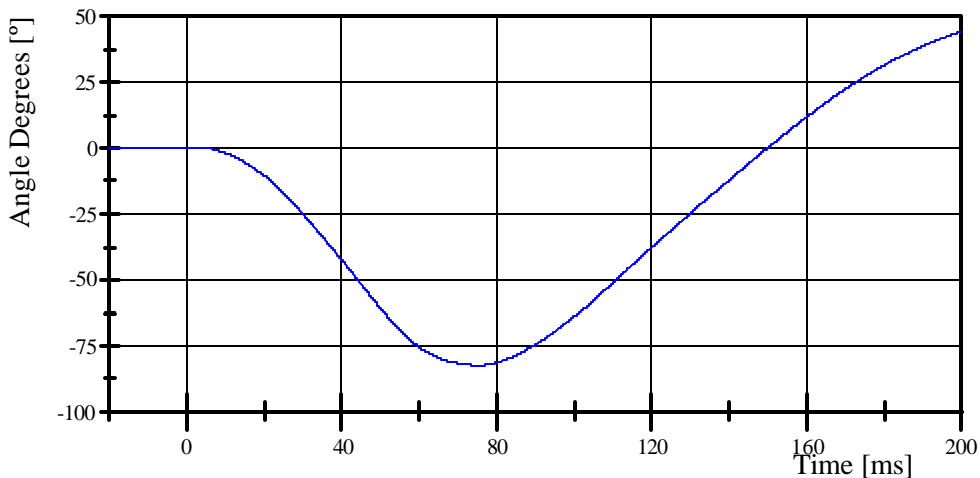
Filter Class: CFC\_60  
Max: 8.7 ° at 200.0 ms  
Min: -36.8 ° at 74.3 ms

Head Rotation at Occypital Condyles



Filter Class: CFC\_60  
Max: 35.4 ° at 200.0 ms  
Min: -45.6 ° at 75.7 ms

Total Head D-Plane Rotation



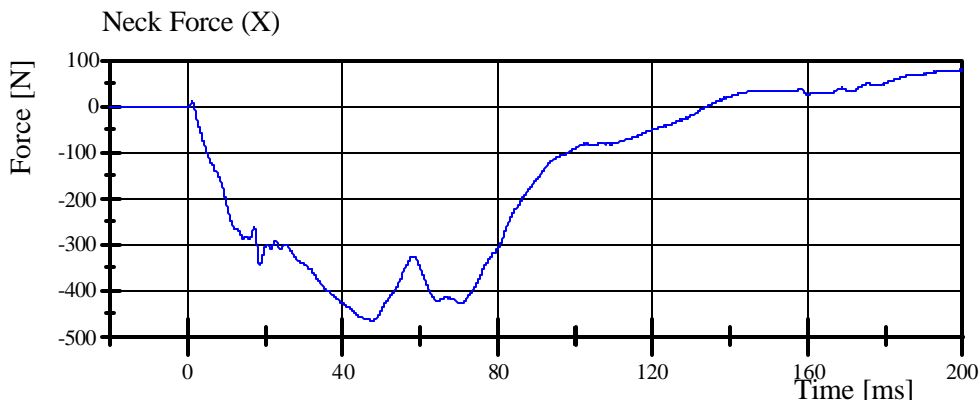
Filter Class: CFC\_60  
Max: 44.1 ° at 200.0 ms  
Min: -82.3 ° at 75.3 ms

# Transportation Research Center Inc.

Neck Flexion

HIII 10YO Serial No. D001 Certification No. 14-2

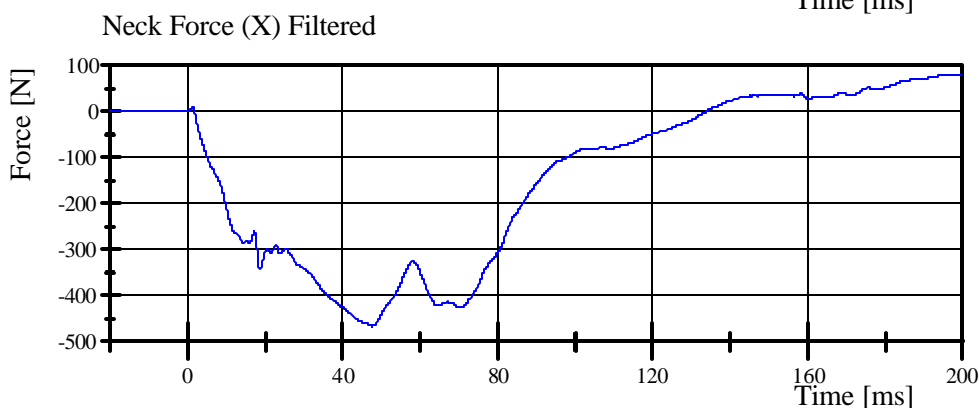
Test Date: 6/13/2007



Filter Class: CFC\_1000

Max: 80.1 N at 199.8 ms

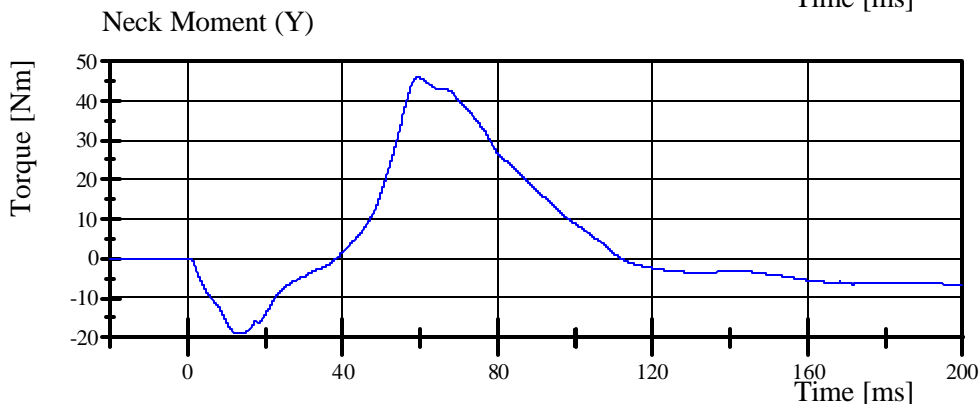
Min: -467.0 N at 47.6 ms



Filter Class: CFC\_600

Max: 79.9 N at 200.0 ms

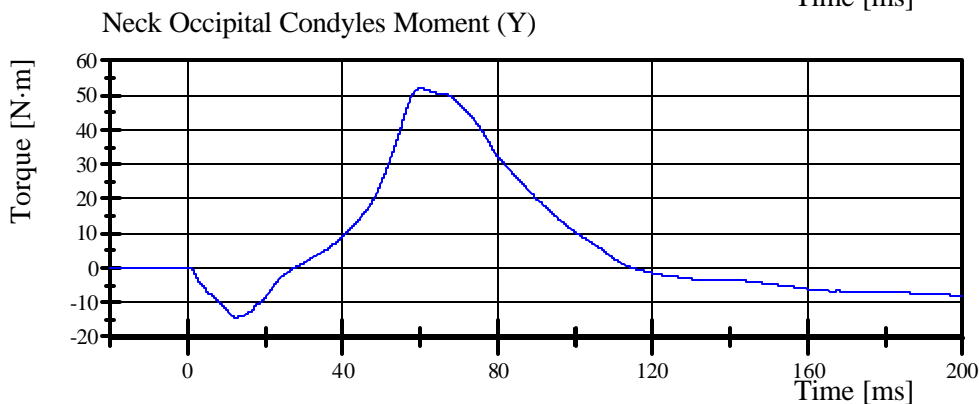
Min: -466.7 N at 47.5 ms



Filter Class: CFC\_600

Max: 45.9 Nm at 59.6 ms

Min: -19.1 Nm at 14.1 ms



Filter Class: CFC\_600

Max: 52.1 N·m at 60.2 ms

Min: -14.3 N·m at 12.8 ms

# Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. D001 Certification No. 14-1

Test Date: 6/13/2007

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	20.6 - 22.2 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	53 %	Yes
Pendulum Impact Velocity	4.91 - 5.15 m/s	5.018 m/s	Yes
Pendulum Integrated Velocity at 10ms	1.49 - 1.89 m/s	1.789 m/s	Yes
Pendulum Integrated Velocity at 20ms	2.88 - 3.68 m/s	3.403 m/s	Yes
Pendulum Integrated Velocity at 30ms	4.20 - 5.20 m/s	4.899 m/s	Yes
Total Head D-Plane Rotation	96.0 - 115.0 °	103.19 °	Yes
Total Neck Occipital Condyles Moment Between 99° and 114° Rotation	(-37.0) - (-46.0) Nm	-43.33 Nm	Yes
Neck Occipital Condyles Moment Decay to -10 Nm	100.0 - 116.0 ms	107.36 ms	Yes

**Test meets specifications.**

**Comments:**

Technician

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Approved

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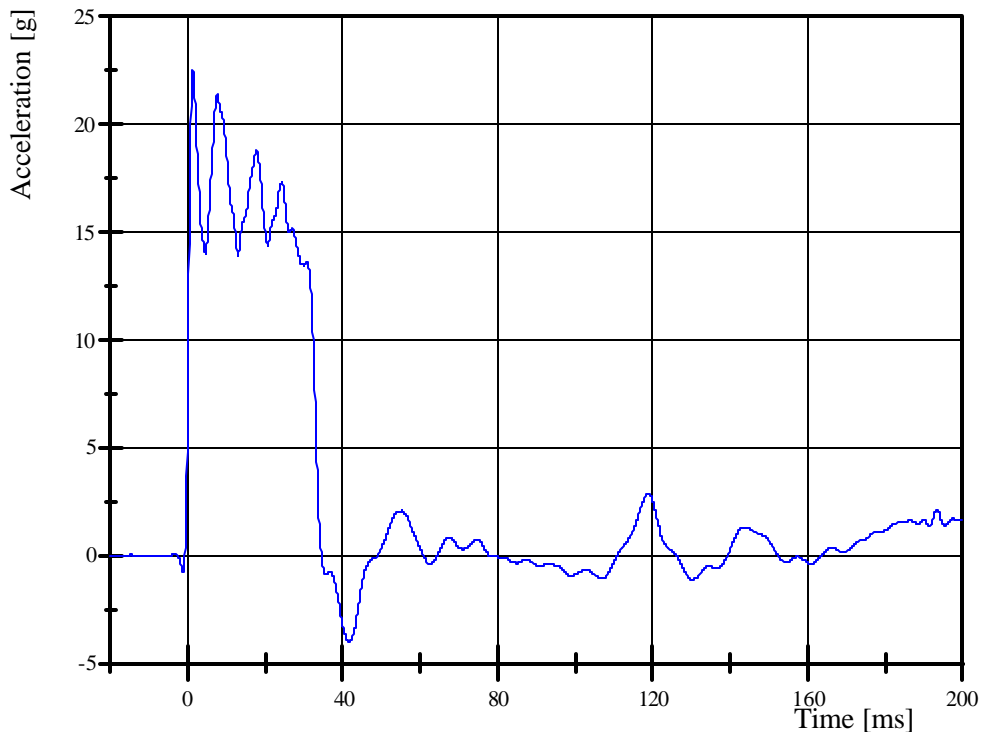
# Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. D001 Certification No. 14-1

Test Date: 6/13/2007

Pendulum Acceleration

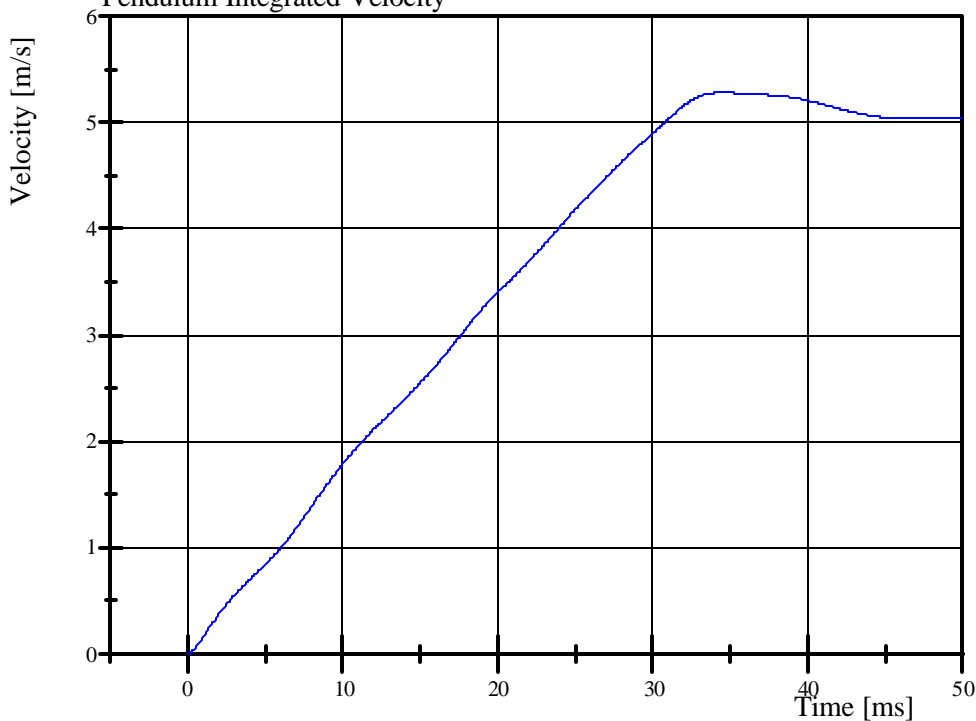


Filter Class: CFC\_180

Max: 22.5 g at 1.2 ms

Min: -4.0 g at 41.5 ms

Pendulum Integrated Velocity



Filter Class: CFC\_180

Max: 5.3 m/s at 34.5 ms

Min: 0.0 m/s at 0.0 ms

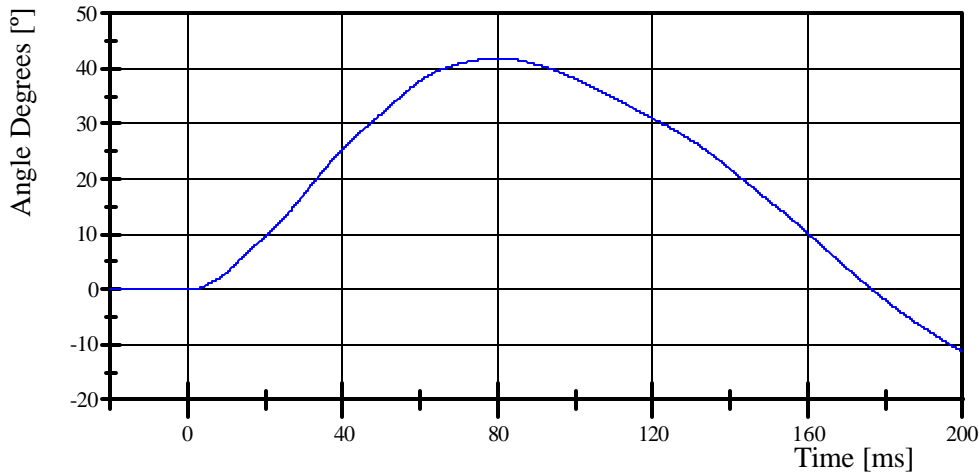
# Transportation Research Center Inc.

Neck Extension

HIII 10YO Serial No. D001 Certification No. 14-1

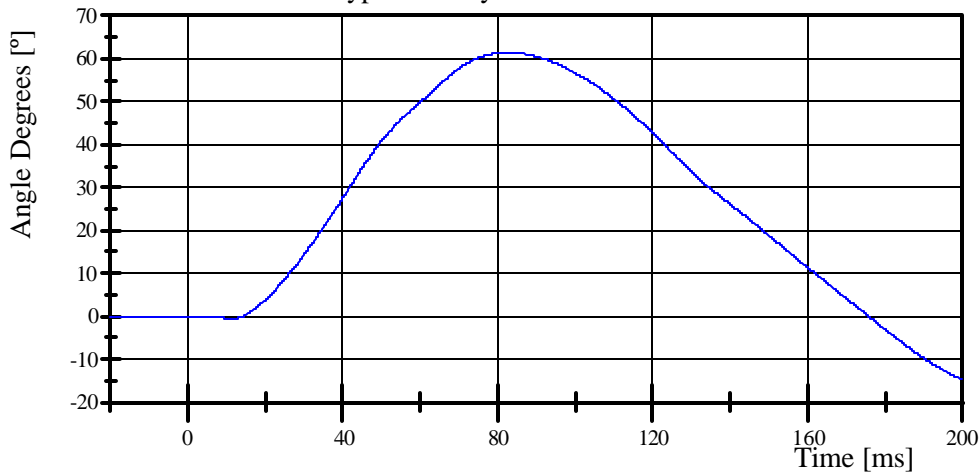
Test Date: 6/13/2007

### Pot Rotation at the Base of Neck



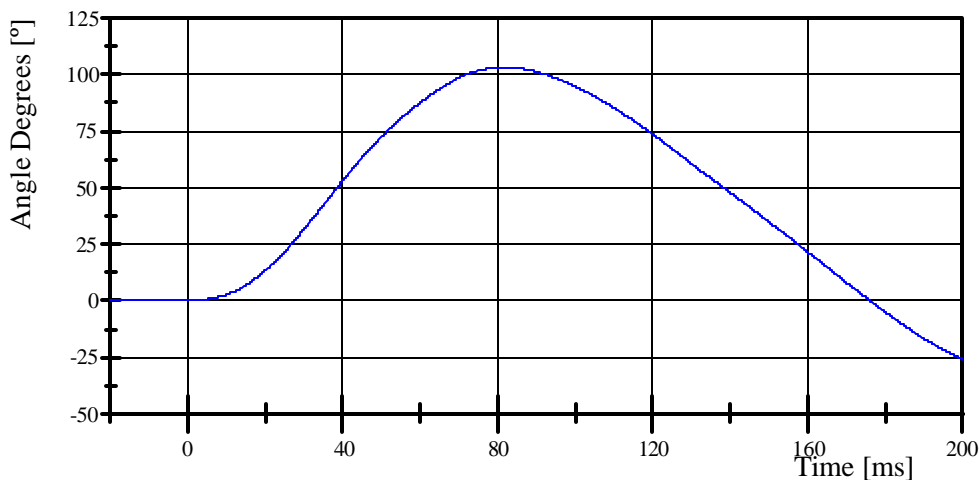
Filter Class: CFC\_60  
Max: 41.8 ° at 80.1 ms  
Min: -11.2 ° at 200.0 ms

### Head Rotation at Occypital Condyles



Filter Class: CFC\_60  
Max: 61.4 ° at 83.0 ms  
Min: -14.7 ° at 200.0 ms

### Total Head D-Plane Rotation



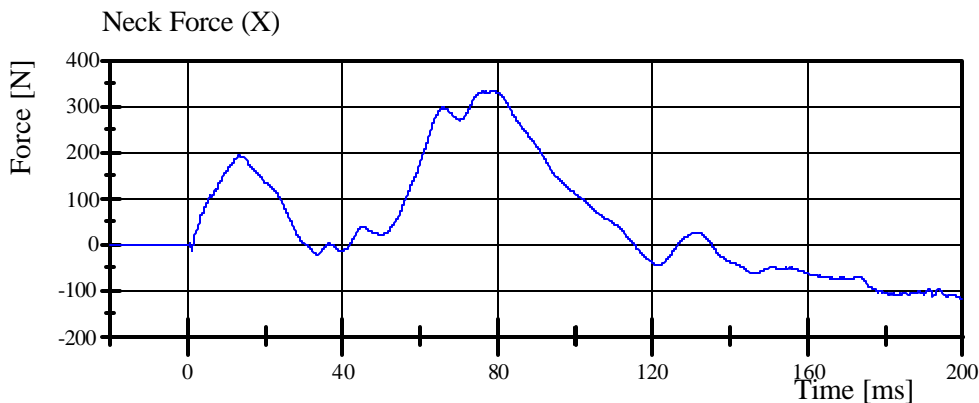
Filter Class: CFC\_60  
Max: 103.2 ° at 81.8 ms  
Min: -25.9 ° at 200.0 ms

# Transportation Research Center Inc.

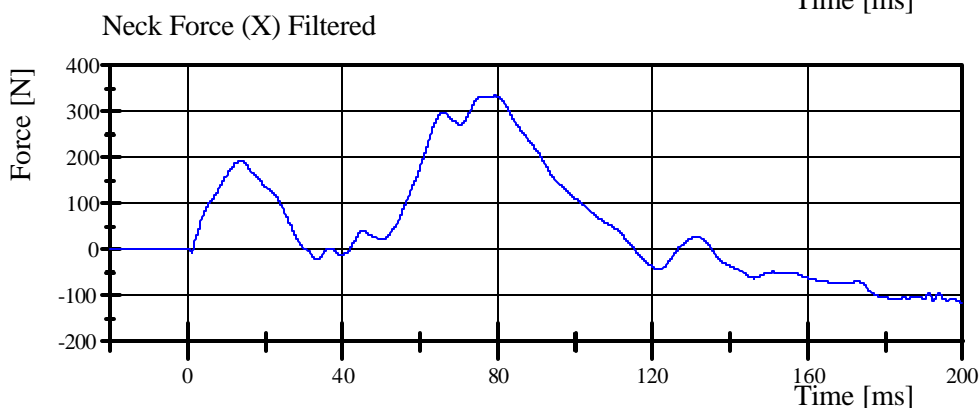
Neck Extension

HIII 10YO Serial No. D001 Certification No. 14-1

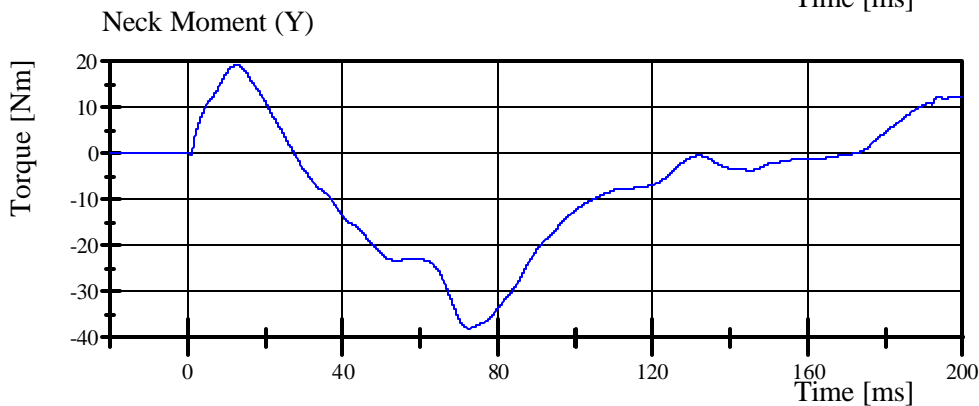
Test Date: 6/13/2007



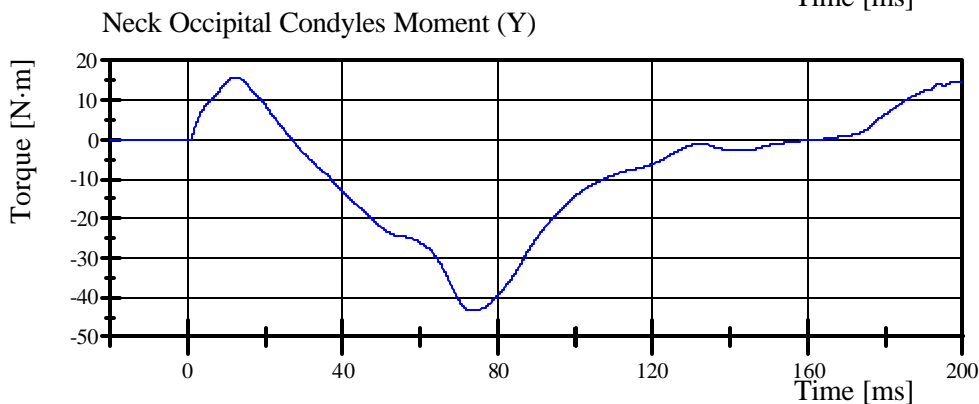
Filter Class: CFC\_1000  
Max: 333.9 N at 79.3 ms  
Min: -118.3 N at 200.0 ms



Filter Class: CFC\_600  
Max: 333.5 N at 79.3 ms  
Min: -118.2 N at 200.0 ms



Filter Class: CFC\_600  
Max: 19.3 Nm at 13.0 ms  
Min: -38.0 Nm at 72.6 ms



Filter Class: CFC\_600  
Max: 15.9 N·m at 12.3 ms  
Min: -43.3 N·m at 73.4 ms

# Transportation Research Center Inc.

Front Thorax

HIII 10YO Serial No. D001 Certification No. 14-2

Test Date: 6/13/2007

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.0 °C	Yes
Relative Humidity	10 - 70 %	55 %	Yes
Probe Velocity	5.88 - 6.12 m/s	5.946 m/s	Yes
Probe Force Peak Between 37.0 mm and 46.0 mm Chest Deflection	(-2,000) - (-2,450) N	-2,255.5 N	Yes
Probe Force Peak Between 20.0 mm and 40.5 mm Chest Deflection	$\geq$ (-2,450) N	-2,218.4 N	Yes
Maximum Chest Compression	(-37) - (-46) mm	-45.6 mm	Yes
Internal Hysteresis	69 - 85 %	79.2 %	Yes

**Test meets specifications.**

**Comments:**

Technician

Approved

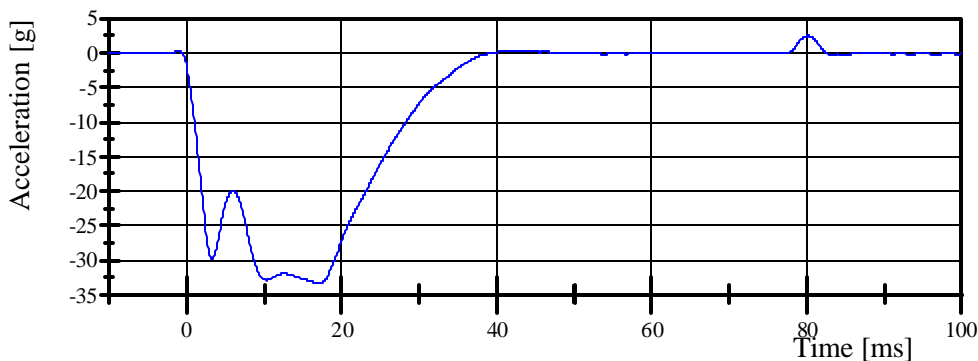
# Transportation Research Center Inc.

Front Thorax

HIII 10YO Serial No. D001 Certification No. 14-2

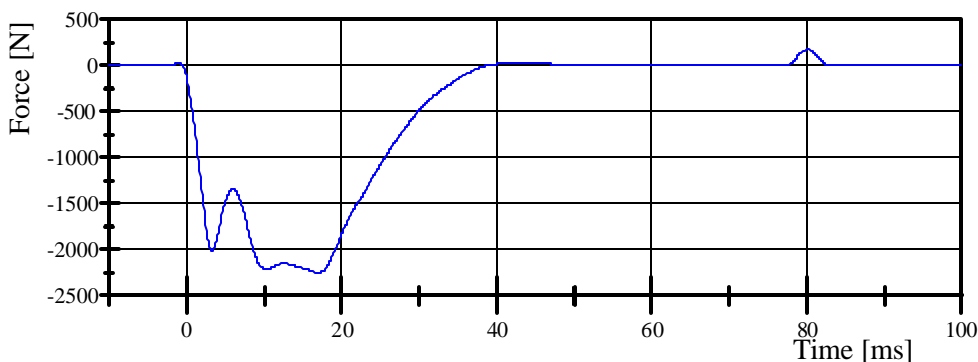
Test Date: 6/13/2007

### Pendulum Acceleration



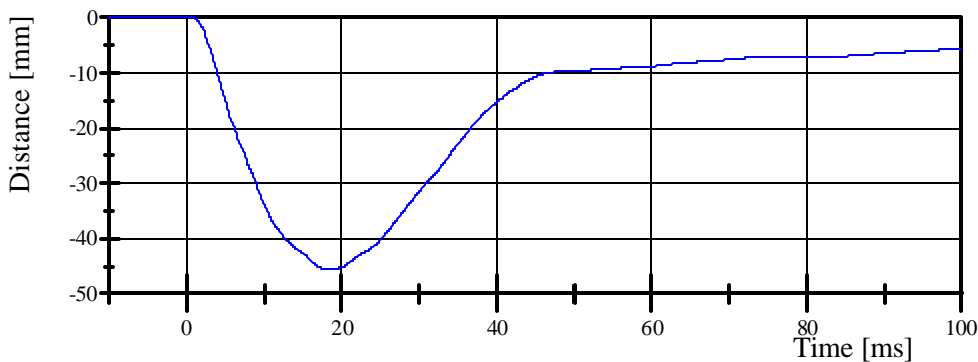
Filter Class: CFC\_180  
Max: 2.5 g at 80.2 ms  
Min: -33.4 g at 17.0 ms

### Pendulum Force



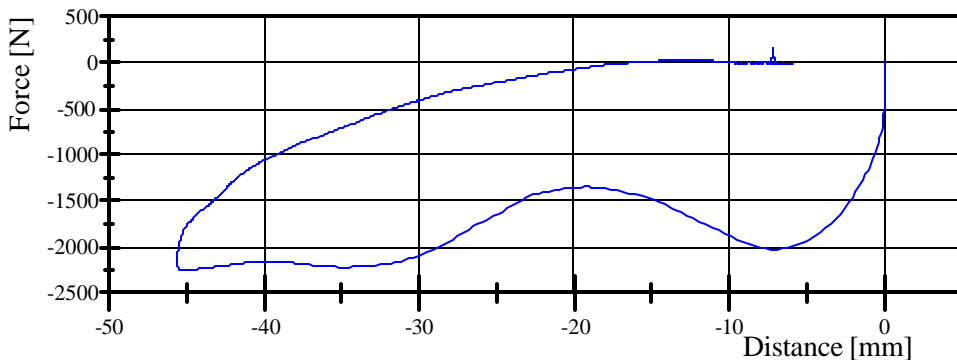
Filter Class: CFC\_180  
Max: 169.5 N at 80.2 ms  
Min: -2,255.5 N at 17.0 ms

### Thorax Displacement X-Axis



Filter Class: CFC\_600  
Max: 0.0 mm at -5.9 ms  
Min: -45.6 mm at 18.5 ms

### Pendulum Force vs. Thorax Displacement X-Axis



Filter Class: CFC\_180  
Max: 169.5 N at -7.2 mm  
Min: -2,255.5 N at -45.1 mm

### POST-TEST DUMMY INSPECTION

Position:	Driver
Dummy:	Hybrid III 50 <sup>th</sup> Percentile Male with Thor-Lx Legs
Serial Number:	#202 (Right Leg #037; Left Leg #036)
Inspected By:	Jessica Gall
Date:	April 4, 2008
Comments:	No Damage.

Position:	Left Rear Passenger
Dummy:	Hybrid III 10 year old
Serial Number:	#D001
Inspected By:	Jessica Gall
Date:	April 4, 2008
Comments:	No Damage.

**APPENDIX D**

**CUSTOMER PROVIDED SEATING PROCEDURE**

## CONTROL LOG

### *50th Percentile Male Dummy - Driver side*

Rev. No.	Date	Description
00	1/16/2008	Original release by VRTC
01	1/22/2008	Modified left foot placement to avoid pedals (modified step 30 and 35)

## A.2 50<sup>th</sup> Percentile Male Dummy - Driver side

1. Position the seat's adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment positions.  
 N/A – No lumbar adjustment
2. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position.  
 N/A – No additional support adjustment
3. Position an adjustable leg support system in its rearmost position  
 N/A – No adjustable leg support system
4. Mark a point (seat cushion reference point) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion.
5. Draw a line (seat cushion reference line) through the seat cushion reference point.
6. Use only the controls that primarily move the seat in the fore-aft direction to move the seat cushion reference point to the rearmost position.
7. If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the seat cushion reference point to the rearmost position.  
 N/A – No independent fore-aft seat cushion adjustment
8. Use any part of any control, other than the parts just used for fore-aft positioning, to determine the range of angles of the seat cushion reference line and to set the seat cushion reference line at the mid-angle.  
Maximum angle \_\_\_\_\_  
Minimum angle \_\_\_\_\_  
Mid-angle \_\_\_\_\_
9. If the seat and/or seat cushion height is adjustable, use any part of any control other than the parts which primarily move the seat or seat cushion fore-aft, to put the seat cushion reference point in its lowest position with the seat cushion reference line angle at the mid-angle found in 8.  
 N/A – No seat height adjustment
10. Use only the controls that primarily move the seat in the fore-aft direction to verify the seat is in the rearmost position.
11. Place seat back at angle specified by the manufacturer. If angle is not provided, place seat back at 25 degrees from vertical.  
 N/A – No seat back angle adjustment  
Manufacturer's design seat back angle \_\_\_\_\_
12. Is the seat a bucket seat?  
 Yes, go to 13 and skip 14  
 No, go to 14 and skip 13
13. Bucket seats:  
Locate and mark for future reference the longitudinal centerline of the seat cushion. The intersection of the vertical longitudinal plane that passes through the SgRP and the seat cushion upper surface determines the longitudinal centerline of a bucket seat cushion.
14. Bench seats  
Locate and mark for future reference the longitudinal line on the seat cushion that marks the intersection of the vertical longitudinal plane through the centerline of the steering wheel and the seat cushion upper surface.
15. Head Restraint Position  
 N/A Vehicle contains automatic head restraints.  
 N/A, there is no head restraint adjustment  
 Adjust the head restraint to its highest position.
16. Place any adjustable seat belt anchorages at the vehicle manufacturer's nominal design position for a 50th percentile adult male occupant  
 N/A – No adjustable upper seat belt anchorage  
Manufacturer's specified anchorage position. \_\_\_\_\_  
Tested anchorage position \_\_\_\_\_

- \_\_\_17. Place adjustable pedals in the full forward position (towards the front of the vehicle.)  
\_\_\_N/A – the pedals are not adjustable.
- \_\_\_18. Locate and mark the right heel point (RHP) on the carpet.  
Flat accelerator pedals: Extend a line through the axis of symmetry (that is closest to the vertical plane) of the accelerator pedal. The RHP is the intersection of that line with the floorpan.  
Curved accelerator pedals: Construct a line in the side view tangent to the accelerator pedal such that the distance from the contact point on the pedal to the floorpan, along the tangent line, is 200 mm. The RHP is at the intersection of this tangent line and the floorpan
- \_\_\_19. Locate a longitudinal line L1 and a transverse line T1 on the floorpan through the RHP. Locate a Left Heel Point (LHP) point on the line T1 that is to the left of the seat centerline at the same distance from the seat centerline as the RHP. Locate a longitudinal line L2 through the LHP.
- \_\_\_20. Set the steering wheel hub at the geometric center of the full range of driving positions including any telescoping positions as determined in data sheet 14.3.
- \_\_\_21. Verify that the seat is in the rearmost seat track position and full down height adjustment with the seat cushion at the mid-angle with the seat back at the manufacturer's nominal seat back angle or as determined in step 11
- \_\_\_22. With the seat in the rearmost, full down, mid-angle position, determine the H-point using SAE J826 and the FMVSS 208 leg and thigh dimensions. Record the measurements.
- \_\_\_23. Place the dummy in the seat such that the midsagittal plane is coincident with the longitudinal seat cushion markings and the upper torso resting against the seat back.
- \_\_\_24. Rest the thighs on the seat cushion.
- \_\_\_25. Set the distance between the outboard knee clevis flange surfaces at 10.6 inches.  
\_\_\_measured distance (10.6 inches)
- \_\_\_26. Set the heels of the feet on the floor pan.
- \_\_\_27. Position the H-point of the dummy within 0.5 inch of the vertical dimension and 0.5 inch of the horizontal dimension of a point 0.25 inch below the H-point determined in step 22  
Measure the pelvic angle with respect to the horizontal using the pelvic angle gage.  
Adjust the dummy position until these three measurements are within the specifications.  
\_\_\_horizontal inches from the point 0.25 below the determined H-point (0.5 inch max.)  
\_\_\_vertical inches from the point 0.25 below the determined H-point (0.5 inch max.)  
\_\_\_pelvic angle (20° to 25°)  
**The H-point and pelvic angle are not adjusted after this step.**
- \_\_\_28. Set the left and right feet in the neutral position (longitudinal centerline of foot in the same plane as the lower leg/thigh, foot Y angle at -15 degrees +/- 2 degrees to lower leg), as determined by the output of the potentiometers at the ankle.
- \_\_\_29. Without moving the seat, and while keeping the right thigh and leg in the same vertical plane, set the right foot heel on Line L1. If the vehicle interior prevents the heel from reaching L1, place the heel as close to L1 as possible, while maintaining a clearance of 0.25" from the vehicle interior.
- \_\_\_30. Without moving the seat, and while keeping the left thigh and leg in the same vertical plane, move the left foot laterally to the left **until any of the following occurs first:**  
- The right edge of the foot is clear of the brake or clutch pedal by 0.25" laterally or  
- The left edge of the shoe contacts the vehicle interior
- \_\_\_31. Place a 100 N +0, -5N weight (e.g. 100 N shot bag), no larger than 4" x 4", on each knee-thigh area. The weight should be centered on the assembly-hole on the top of the knee.
- \_\_\_32. Raise the heels off the floor pan so that the seat can be moved forward.
- \_\_\_33. Using only the control that primarily moves the seat in the fore-aft direction, move the seat forward and rest the rearmost point of the right foot heel on the floor pan such that:  
- the heel is on the line L1  
- the foot is in the same plane as the lower leg/thigh, foot at -15 degrees +/- 2 degrees (about the Y- axis) to lower leg,

- foot is contacting the accelerator pedal
  - the thighs are resting on the seat cushion
  - the thigh, leg and foot are in the same vertical plane
- \_\_\_33.1 If the heel is unable to reach line L1 because the foot contacts the vehicle interior, place the foot as close to the line L1 as possible while maintaining a gap of no more than 5 mm between the shoe and the vehicle interior.
- \_\_\_33.2 If the left foot contacts the brake or clutch pedals or the vehicle interior, then stop the forward movement of the left foot, raising the left knee off the seat cushion if needed. The pedals should not be depressed.
- \_\_\_34. If the right foot does not reach the accelerator pedal, move the adjustable pedal until it contacts the foot. Locate a new heel point. Repeat steps 18 – 33 to re-position the seat. If the pedals are not adjustable, place the heel at the point closest to the pedal, in the same longitudinal vertical plane as the line L1.  
\_\_\_N/A – the accelerator pedal is not adjustable  
\_\_\_N/A – the accelerator pedal did not need to be moved.
- \_\_\_35. Verify that the left thigh and leg are in a vertical longitudinal plane, the foot in the neutral position (longitudinal centerline of foot in the same plane as the lower leg/thigh, foot at - 15 degrees +/- 2 degrees (Y-axis) to lower leg), the heel on the floor pan. Place the heel on the line L2, unless the left edge of the shoe contacts the vehicle, preventing the heel from reaching Line L2. If there is overlap with the pedal, move the leg to the left until a lateral clearance of 0.25" from the pedal is attained, unless the left edge of the shoe contacts the vehicle. If the left edge of the shoe contacts the vehicle interior, maintain a clearance of 0.25" from the vehicle interior.
- \_\_\_36. Remove the leg weights.
- \_\_\_37. Verify that the right foot is in the neutral position, at the lateral location determined in step 30, and is contacting the accelerator pedal. If the foot is not contacting the accelerator pedal, move the seat forward to rest the right foot on the accelerator pedal, keeping the foot in the neutral position
- \_\_\_38. While holding the thighs in place, push with a 50 lb force on a 3 inch diameter area of the chest that is centered 5" (127mm) vertically below the chin on the midsagittal plane of the dummy.
- \_\_\_39.1 Fasten the seat belt around the dummy.
- \_\_\_39.2 Remove all slack from the lap belt portion.
- \_\_\_39.3 Pull the upper torso webbing out of the retractor and allow it to retract; repeat this four times.
- \_\_\_39.4 Apply a 2 to 4 pound tension load to the lap belt.  
\_\_\_pound load applied
- \_\_\_39.5 Is the belt system equipped with a tension-relieving device?  
\_\_\_Yes, continue  
\_\_\_No, go to 40
- \_\_\_39.6 Introduce the maximum amount of slack into the upper torso belt that is recommended by the vehicle manufacturer in the vehicle owner's manual..
- \_\_\_40. Place the upper arms adjacent to the torso with the centerline as close to a vertical plane as possible.
- \_\_\_41. Adjust the head level within  $\pm 0.5$  degrees using the seat back adjustment. Check the head angle after pushing on the chest with a 50 lb force on a 3 inch diameter area of the chest that is centered 5" (127mm) vertically below the chin on the midsagittal plane of the dummy, while holding the thighs in place, and releasing.
- \_\_\_42. No seat back adjustment. Adjust the neck bracket to achieve head level within  $\pm 0.5$  degrees Record neck bracket setting. \_\_\_\_\_
- \_\_\_43. Maintaining the head alignment as determined above, place the right hand with the palm in contact with the steering wheel at the rim's horizontal centerline and with the thumb over the steering wheel.
- \_\_\_44. Maintaining the head alignment as determined above place the left hand with the palm in contact with the steering wheel at the rim's horizontal centerline and with the thumb over the steering wheel.

- \_\_\_45. If the hands don't reach the steering wheel at the horizontal centerline, maintaining the head alignment place them at symmetric location on the wheel, below the horizontal centerline.
- \_\_\_46. Tape the thumb of each hand to the steering wheel by using masking tape with a width of 0.25 inch. The length of the tape shall only be enough to go around the thumb and steering wheel one time.
- \_\_\_47. Verify that the feet are in the neutral position ( $\pm 2$  deg), and at lateral locations determined in step 30 (right foot) and step 35 (left foot), and the head is level ( $\pm 0.5$  deg). Adjust and repeat until the feet position and angles and head angles are within their ranges.



U.S. Department  
of Transportation

National Highway  
Traffic Safety  
Administration

# Memorandum

Vehicle Research and Test Center P.O. Box B37  
East Liberty, Ohio 43319  
(937) 666-4511

Subject: VRTC Seating Procedure for FMVSS 213-Type Booster Seat  
Testing with the Hybrid III 6 Year Old & 10 Year Old Child  
Dummies

OCT 24 2007

From: *Joseph M. Kaniyantra*  
Joseph M. Kaniyantra, Ph.D.  
Associate Administrator for  
Vehicle Safety Research

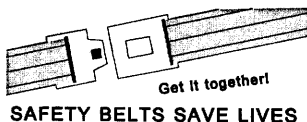
To: Docket NHTSA-2005-21245

Thru: *Anthony M. Cooke*  
Anthony M. Cooke  
Chief Counsel

VRTC Seating Procedure for Hybrid III 6 Year Old Child Dummy for Testing Belt Positioning  
Booster Seats

*VRTC*  
Use the following procedure to position the dummy in the belt positioning booster seat:

- a) Place the booster seat on the FMVSS 213 bench seat such that it is centered between the lap belt anchor positions and the booster is pushed rearward until the intersection of the booster's back and bottom contacts the intersection of the FMVSS 213 bench seat's back and base cushions.
- b) Place the dummy in the booster seat so that the mid-sagittal line of the dummy is coincident with the centerline of the booster.
- c) Measure the X and Z locations of the left and right shoulder pivots. Position the dummy so that the difference between the X and Z values for these two points is less than or equal to 1 cm (see Figure 1).
- d) As illustrated in Figure 2 of this section, calculate the H-point location of the dummy relative to the FMVSS 213 seat Z point (see Figure 1B in FMVSS 213) by
  - a. Measuring the X and Z coordinates of the knee pivot ( $X_{KP}$  and  $Z_{KP}$ ) and head center of gravity ( $X_{CG}$  and  $Z_{CG}$ ).
  - b. Mathematically locating the intersection point of two circles using the knee pivot and head center of gravity as the centers and the known dummy anthropometric lengths as radii. The equations for calculating the H-point are as follows:



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$$X_{HP} = X_{CG} + \frac{A(X_{KP} - X_{CG})}{B} + \frac{\sqrt{473^2 - A^2}(Z_{KP} - Z_{CG})}{B}$$

$$Z_{HP} = Z_{CG} + \frac{A(Z_{KP} - Z_{CG})}{B} - \frac{\sqrt{473^2 - A^2}(X_{KP} - X_{CG})}{B}$$

Where:

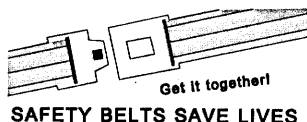
$$A = \frac{(473^2 - 238^2 + B^2)}{2B}$$

$$B = \sqrt{(X_{KP} - X_{CG})^2 + (Z_{KP} - Z_{CG})^2}$$

- e) Use the H-point location and head center of gravity location to determine the torso angle relative to vertical. This angle is calculated using

$$\text{Torso Angle} = \arctan\left(\frac{X_{HP} - X_{CG}}{Z_{CG} - Z_{HP}}\right)\left(\frac{180}{\pi}\right)$$

- f) Adjust the dummy until the torso angle is  $14 \pm 0.5$  degrees from vertical.
- g) Secure the dummy and booster with belt restraint, following booster manufacturer's instructions for routing the shoulder and lap belts. Apply standard FMVSS 213 belt tensions.
- h) Locate the shoulder belt such that its outboard edge is inside of the outer edge of the chest jacket (see Figure 3). If it is not feasible to get the outboard edge of the belt inside the outer edge of the chest jacket, document the closest distance from the belt to the chest jacket that is obtainable.
- i) The straight line distance from the bottom of the dummy's chin to the center of the shoulder belt/middle of the sternum along the dummy's mid-sagittal line should be  $15.5 \pm 0.5$  cm (see Figure 4). Measure and document the intersection of the dummy's mid-sagittal line and vertical center of shoulder belt's width.
- j) Measure and document the angle of the shoulder belt relative to horizontal. The shoulder belt angle should be  $50^\circ \pm 10^\circ$ . If it is not feasible to achieve the specified shoulder belt angle while following the manufacturer's instructions for belt routing, document angle that is obtainable.
- k) Locate the lap belt such that the top of the belt is 2.54 cm or more below the top rim of the pelvis molded skin at the dummy's mid-sagittal line (Figure 4). If it is not feasible to locate the lap belt at least 2.54 cm below the top of the pelvis while following the manufacturer's instructions for belt routing, position belt as low as possible on pelvis.
- l) Measure and document the intersection of the dummy's mid-sagittal line and center of lap belt width.
- m) Put upper arms as close as possible to, and in alignment with, the upper torso on sides and bend at elbows such that the hands are resting on the booster seat cushion if possible; otherwise bend lower arm perpendicular to upper arm and have hands pointed forward.



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- n) Level the top of the dummy's head  $\pm 1^\circ$  off of horizontal.
- o) Document final H-point, Head CG, and Knee Pivot coordinates in addition to the torso angle.

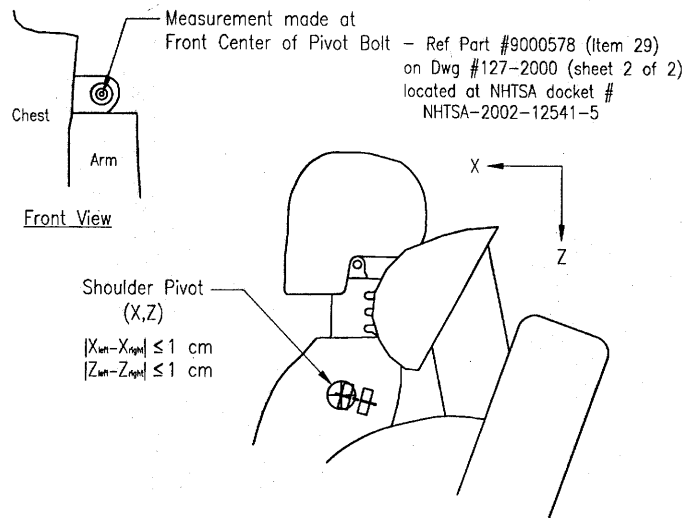


Figure 1. Shoulder Pivot Bolt Alignment

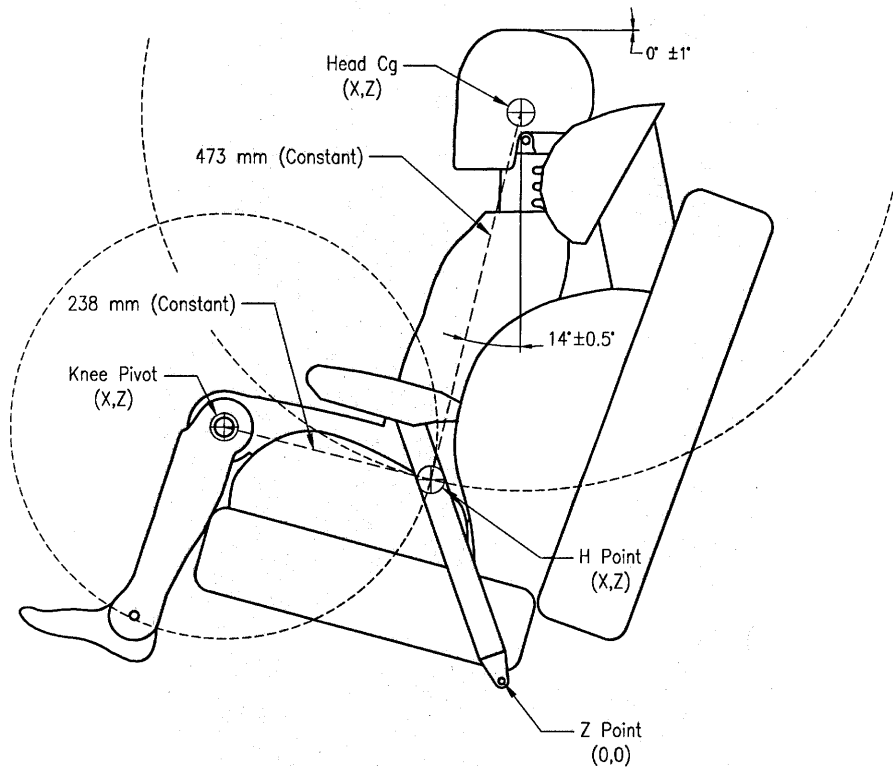
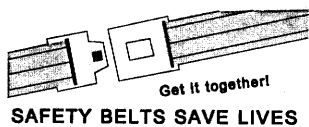


Figure 2. Locating the H-Point so that HIII-6C Torso Angle is  $14 \pm 0.5$  Degrees from Vertical



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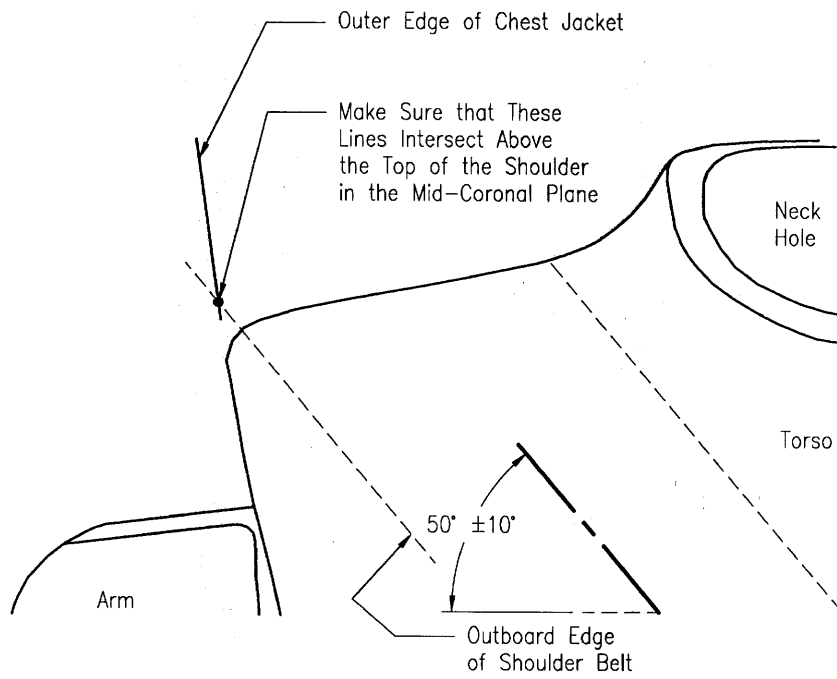
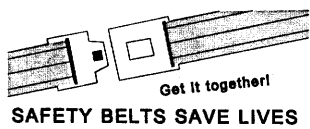


Figure 3. Shoulder Belt Placement



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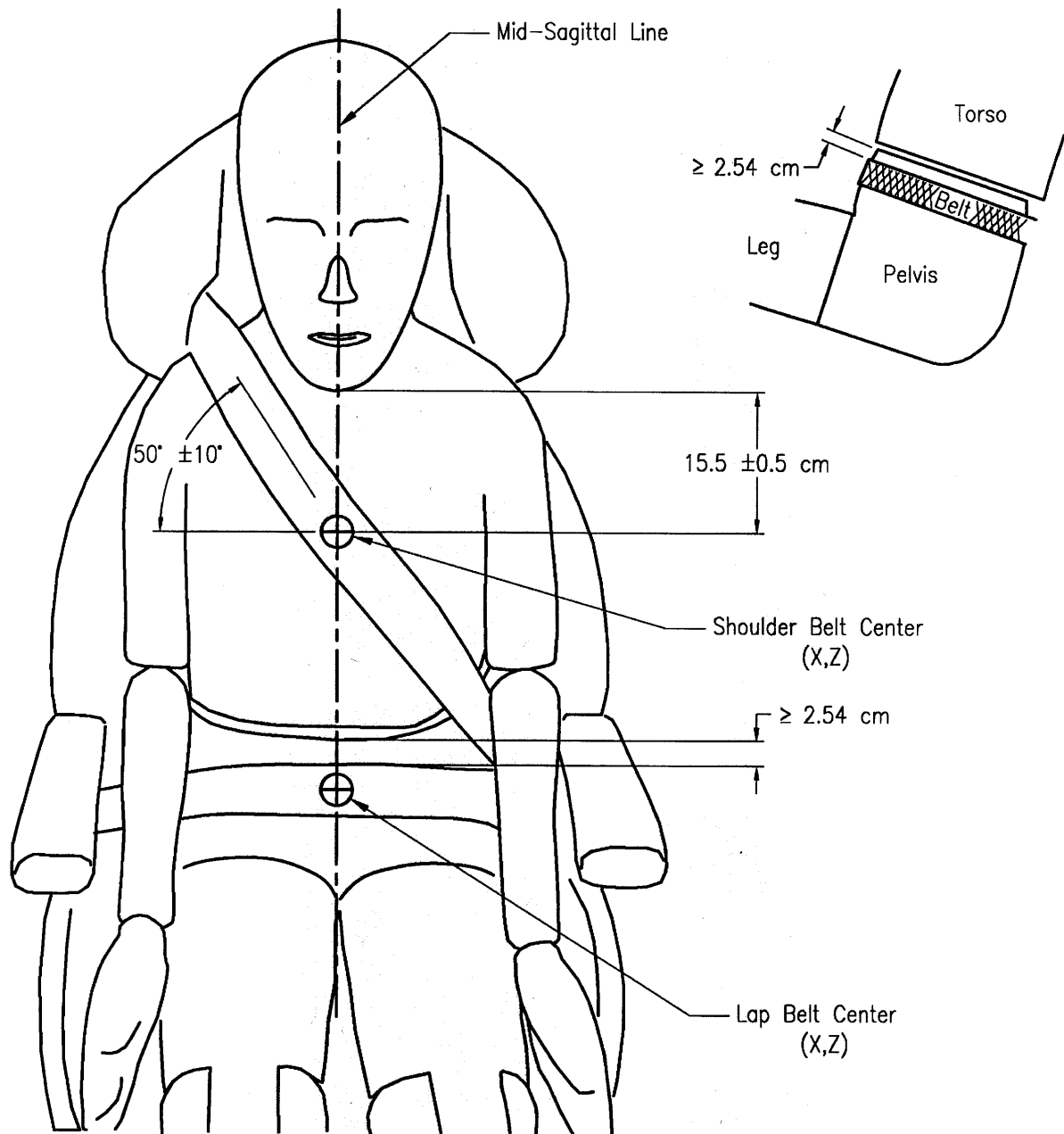
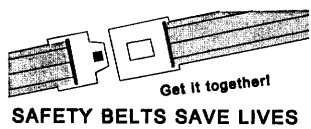


Figure 4. Overall Belt Placement for HIII-6C Dummy



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VRTC Seating Procedure for Hybrid III 10 Year Old Child Dummy for Testing Belt Positioning Booster Seats

Use the following procedure to position the dummy in the belt positioning booster seat:

- a) Set the dummy's neck angle at the SP-16 setting (Figure 5a). See also Figure 20 of PADI (NHTSA-2005-21247-8) for more detail.
- b) Set the dummy's lumbar angle at the SP-12 setting ("SP" means standard posture), see Figure 5b. This is done by aligning the notch on the lumbar adjustment bracket with the SP-12 notch on the lumbar attachment. See also Figure 45 of PADI for more detail.
- c) Place the booster seat on the FMVSS 213 bench seat such that it is centered between the lap belt anchor positions and the booster is pushed rearward until the intersection of the booster's back and bottom contacts the intersection of the FMVSS 213 bench seat's back and base cushions.
- d) Place the dummy in the booster seat so that the mid-sagittal line of the dummy is coincident with the centerline of the booster.
- e) Measure the X and Z locations of the left and right shoulder pivots. Position the dummy so that the difference between the X and Z values for these two points is less than or equal to 1 cm (see Figure 6).
- f) As illustrated in Figure 7 of this section, calculate the H-point location of the dummy relative to the FMVSS 213 seat Z point (see Figure 1B in FMVSS 213) by
  1. Measuring the X and Z coordinates of the knee pivot ( $X_{KP}$  and  $Z_{KP}$ ) and head center of gravity ( $X_{CG}$  and  $Z_{CG}$ ).
  2. Mathematically locating the intersection point of two circles using the knee pivot and head center of gravity as the centers and the known dummy anthropometric lengths as radii. The equations for calculating the H-point are as follows:

$$X_{HP} = X_{CG} + \frac{A(X_{KP} - X_{CG})}{B} + \frac{\sqrt{527^2 - A^2}(Z_{KP} - Z_{CG})}{B}$$

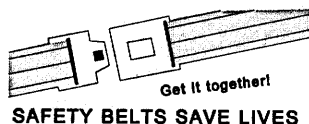
$$Z_{HP} = Z_{CG} + \frac{A(Z_{KP} - Z_{CG})}{B} - \frac{\sqrt{527^2 - A^2}(X_{KP} - X_{CG})}{B}$$

Where:

$$A = \frac{(527^2 - 288^2 + B^2)}{2B}$$

$$B = \sqrt{(X_{KP} - X_{CG})^2 + (Z_{KP} - Z_{CG})^2}$$

- g) Use the H-point location and head center of gravity location to determine the torso angle relative to vertical. This angle is calculated using



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$$\text{Torso Angle} = \arctan\left(\frac{X_{HP} - X_{CG}}{Z_{CG} - Z_{HP}}\right)\left(\frac{180}{\pi}\right)$$

- h) Adjust the dummy until the torso angle is  $14 \pm 0.5$  degrees from vertical.
- i) Secure the dummy and booster with belt restraint, following booster manufacturer's instructions for routing the shoulder and lap belts. Apply standard FMVSS 213 belt tensions.
- j) Locate the shoulder belt such that its outboard edge is inside of the outer edge of the chest jacket (see Figure 8). If it is not feasible to get the outboard edge of the belt inside the outer edge of the chest jacket, document the closest distance from the belt to the chest jacket that is obtainable.
- k) The straight line distance from the bottom of the dummy's chin to the center of the shoulder belt/middle of the sternum along the dummy's mid-sagittal line should be  $16 \pm 0.5$  cm (see Figure 9). Measure and document the intersection of the dummy's mid-sagittal line and vertical center of shoulder belt's width.
- l) Measure and document the angle of the shoulder belt relative to horizontal. The shoulder belt angle should be  $50^\circ \pm 10^\circ$ . If it is not feasible to achieve the specified shoulder belt angle while following the manufacturer's instructions for belt routing, document angle that is obtainable.
- m) Locate the lap belt such that the top of the belt is 2.54 cm or more below the top rim of the pelvis molded skin at the dummy's mid-sagittal line (Figure 9). If it is not feasible to locate the lap belt at least 2.54 cm below the top of the pelvis while following the manufacturer's instructions for belt routing, position belt as low as possible on pelvis.
- n) Measure and document the intersection of the dummy's mid-sagittal line and center of lap belt width.
- o) Put upper arms as close as possible to, and in alignment with, the upper torso on sides and bend at elbows such that the hands are resting on the booster seat cushion if possible; otherwise bend lower arm perpendicular to upper arm and have hands pointed forward.
- p) Level dummy's head  $\pm 1^\circ$  off of horizontal.
- q) Document final H-point, Head CG, and Knee Pivot coordinates in addition to the torso angle.

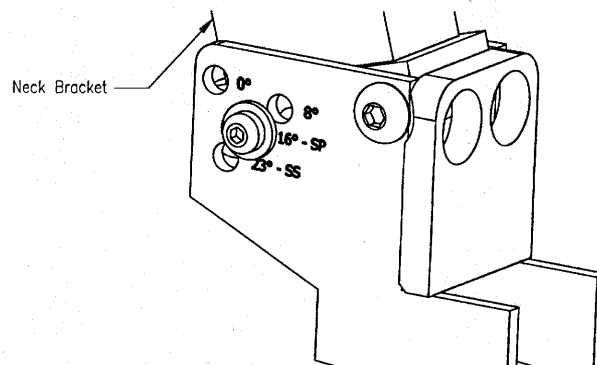
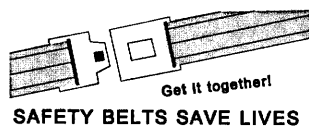


Figure 5a. Neck Angle Setting is SP-16 Degrees



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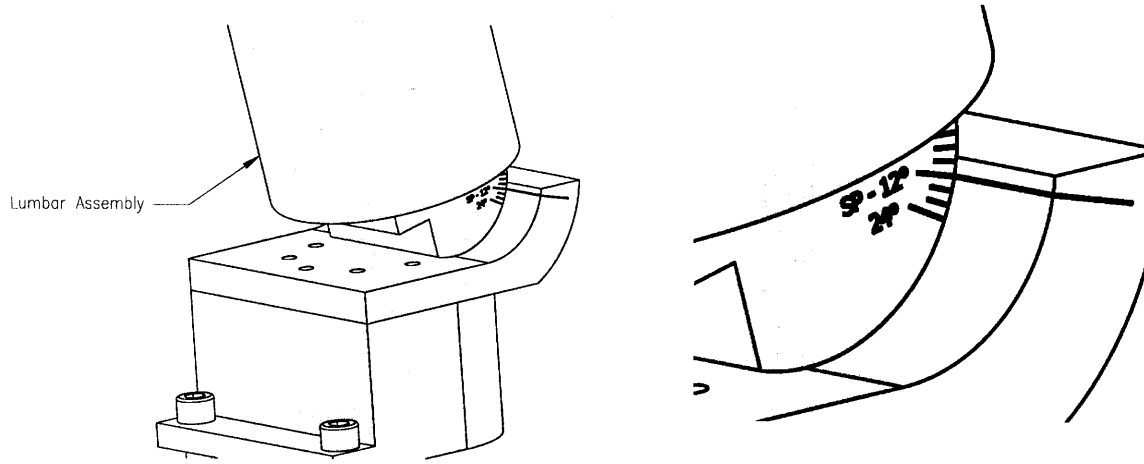


Figure 5b. Lumbar Angle Setting is SP-12 Degrees

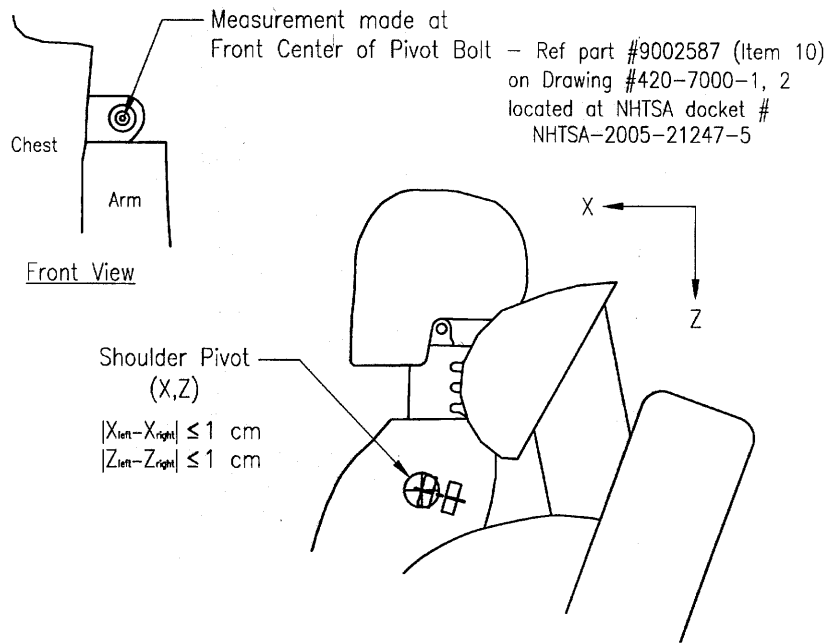
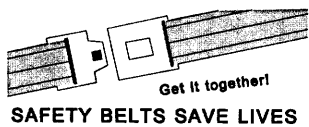


Figure 6. Shoulder Pivot Bolt Alignment



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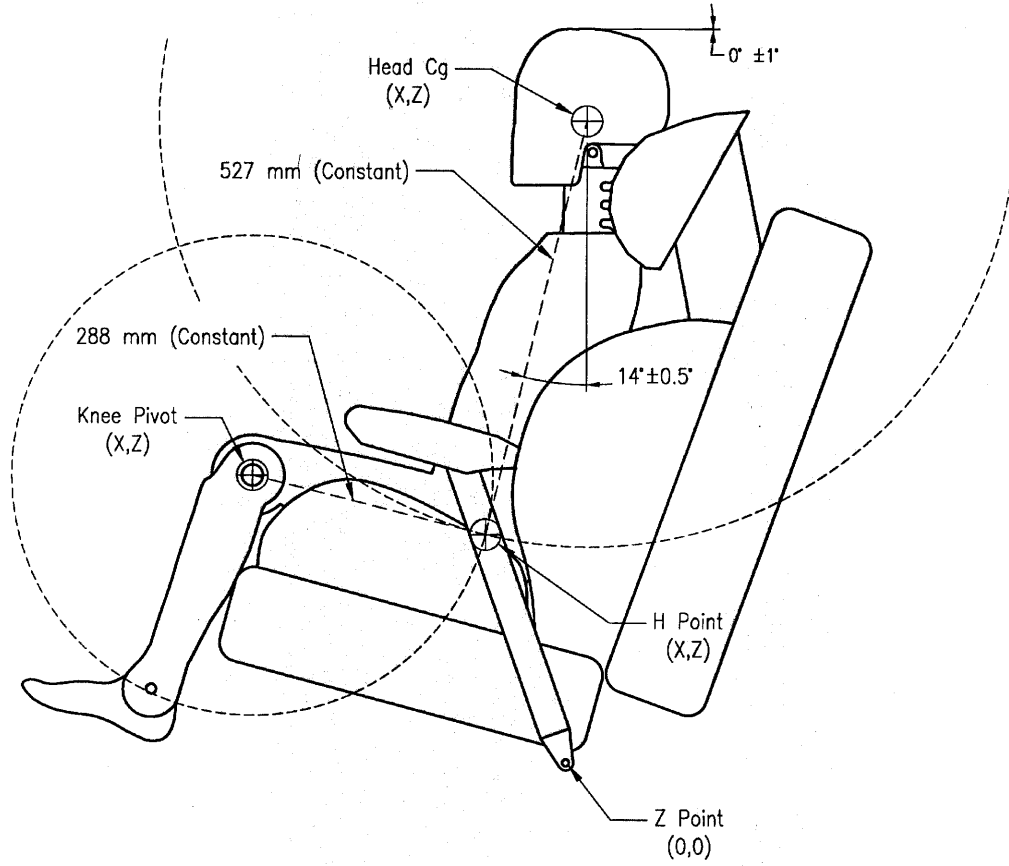


Figure 7. Locating the H-Point so that HIII-10C Torso Angle is  $14 \pm 0.5$  Degrees from Vertical

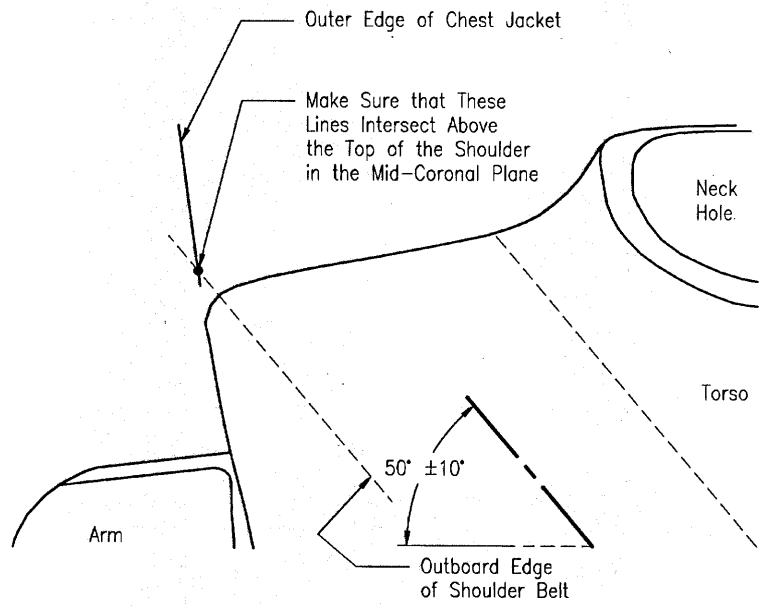
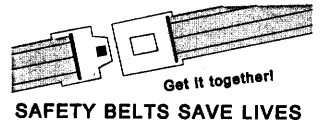


Figure 8. Shoulder Belt Placement



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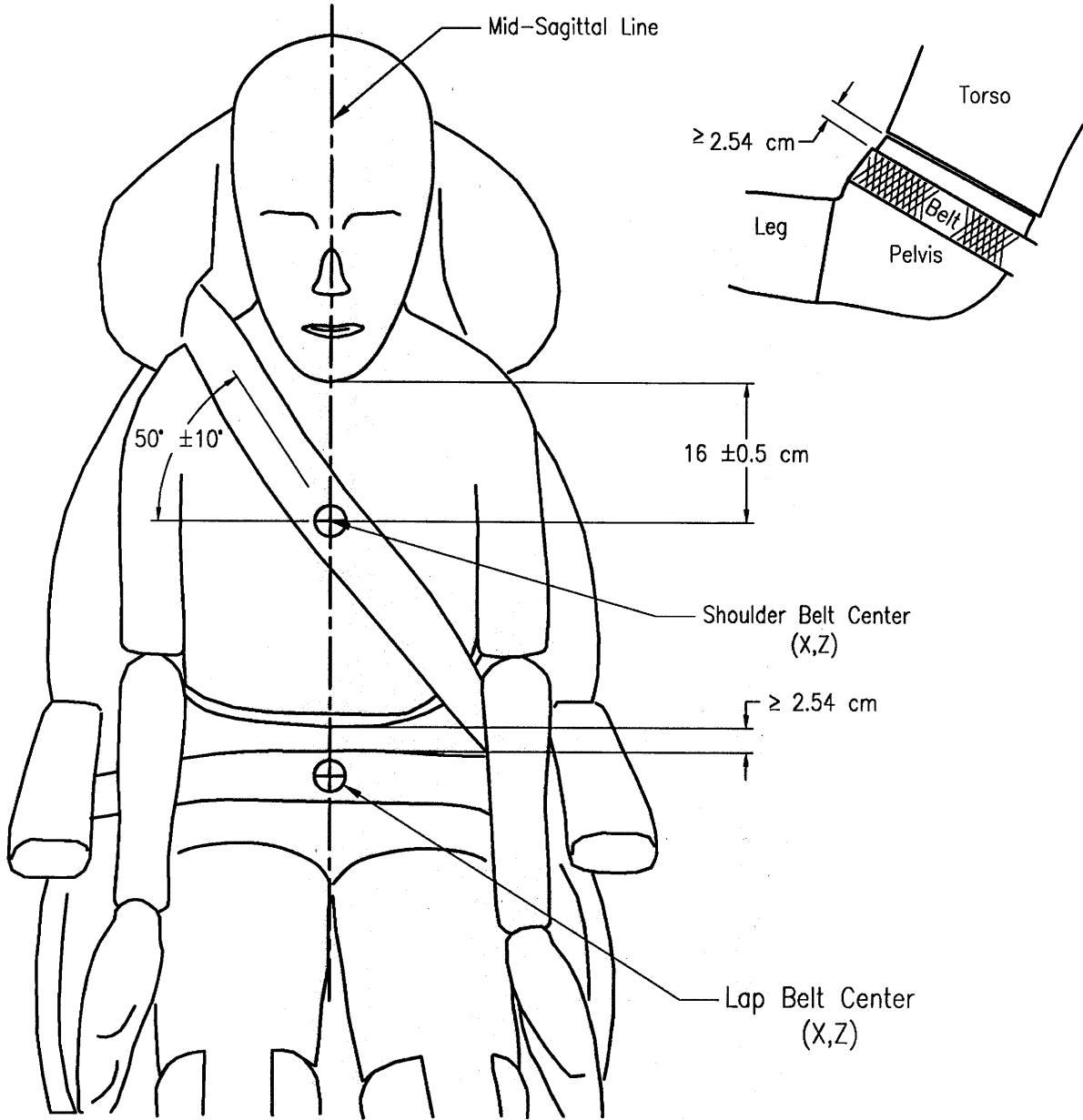
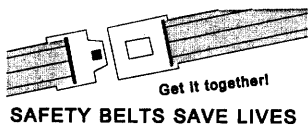


Figure 9. Overall Belt Placement for HIII-10C Dummy



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**VRTC DUMMY SETUP SHEET**

Dummy S/N \_\_\_\_\_ Test Date \_\_\_\_\_ Test No. \_\_\_\_\_

**DUMMY CONFIGURATION**

Lumbar Angle Setting (10YO only) \_\_\_\_\_ Neck Angle Setting (10YO only) \_\_\_\_\_

**DUMMY ALIGNMENT**

Dummy/Booster Centerline Coincident (check when confirmed)

Left Shoulder Pivot Bolt: X \_\_\_\_\_ Z \_\_\_\_\_  
 Right Shoulder Pivot Bolt: X \_\_\_\_\_ Z \_\_\_\_\_

**BELT PLACEMENT**

Belt routed per manufacturer instructions (check when confirmed)

Shoulder Belt Tension \_\_\_\_\_ lbs  
 Lap Belt Tension \_\_\_\_\_ lbs

Outside edge of shoulder belt inside outer edge of chest jacket (circle one)? Yes / No  
 If "No", what is distance from outside edge of belt to outer edge of chest jacket (along top of shoulder)? \_\_\_\_\_ mm

Intersection of mid-sagittal plane and center of shoulder belt: X \_\_\_\_\_ Y \_\_\_\_\_ Z \_\_\_\_\_  
 Shoulder belt angle relative to horizontal ( $50 \pm 10$  degrees): \_\_\_\_\_ deg

Top edge of lap belt  $\geq 2.54$  cm from pelvis rim (circle one)? Yes / No  
 If "No", is belt positioned as low as possible (check when confirmed)

Intersection of mid-sagittal plane and center of lap belt: X \_\_\_\_\_ Y \_\_\_\_\_ Z \_\_\_\_\_

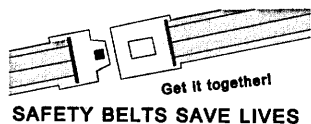
**DUMMY POSTURE**

Arms positioned correctly (check when confirmed)

Head is level ( $0 \pm 1$  degree): \_\_\_\_\_ deg

Head Center of Gravity (outboard side): X \_\_\_\_\_ Y \_\_\_\_\_ Z \_\_\_\_\_  
 H-Point (outboard side): X \_\_\_\_\_ Y \_\_\_\_\_ Z \_\_\_\_\_  
 Knee Pivot (outboard side): X \_\_\_\_\_ Y \_\_\_\_\_ Z \_\_\_\_\_

Torso Angle ( $14 \pm 0.5$  degrees): \_\_\_\_\_ deg



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**APPENDIX E**  
**BARRIER CERTIFICATION**



## DECLARATION DE CONFORMITE / STATEMENT OF CONFORMITY (NF L 00-015C)



N° Déclaration **DC 2007-11-199**  
Statement N°

N° Contrat : Your Purchase order N°: 03-08-0119  
Order N°

Client / Customer :

MGA RESEARCH Corp  
5000, Warren road  
WI  
53105 BURLINGTON  
USA

Contact : M. David WINKELBAUER

N°	Code	Désignation	Qté
1	PROD101XT	Progressive Deformable Barrier for frontal offset test PDB-XT	7.000
2		<b>Informations Tracabilité / Qualité</b>	
	QUAL1	N° de lot / Batch Number: CP0801003	
	QUAL1	N° de lot / Batch Number: CP0801004	
	QUAL1	N° de lot / Batch Number: CP0801006	
	QUAL1	N° de lot / Batch Number: CP0801007	
	QUAL1	N° de lot / Batch Number: CP0801009	
	QUAL1	N° de lot / Batch Number: CP0801012	
	QUAL1	N° de lot / Batch Number: CP0801011	
3		<b>Informations d'expédition</b>	
	BL	Bon de livraison N° / Delivery Note N° : BL 2007-11-199	

**Nous déclarons que la fourniture citée est conforme aux exigences du contrat et que, après vérifications et essais, elle répond en tout point, aux exigences et règlements applicables, sauf exceptions, réserves ou dérogations énumérées dans la présente déclaration de conformité.**

We hereby declare, barring exceptions, reservations, or exemptions listed in this statement of conformity, that the listed supplies comply with the contract requirements and that, after completion of testing and verification, they completely satisfy all specified requirements, and applicable standards and regulations.

Responsable Qualité Fournisseur / Supplier Quality Manager

Date : 17 janvier 2008

Nom et fonction / Name and title : Karine LAIGNEL

Signature :

1419, Route de Viroy  
BP 60120 - 45201 MONTARGIS - FRANCE  
Tél : 02 38 89 14 00  
Fax : 02 38 89 12 30  
Email : [contact@afl-honeycomb.com](mailto:contact@afl-honeycomb.com)

E-1

[www.afl-honeycomb.com](http://www.afl-honeycomb.com)

Barrier: Progressive Deformable Barrier for Frontal Offset Test PDB-XT  
Batch Number: CP0801006



**APPENDIX F**

**INSIA REPORT ON STRUCTURAL MEASUREMENTS**

# **STRUCTURAL SURVEY OF CARS. MEASUREMENT METHODOLOGY OF THE MAIN RESISTANT ELEMENTS IN THE CAR BODY**

**APARICIO IZQUIERDO, FRANCISCO  
PÁEZ AYUSO, FRANCISCO JAVIER**

**INSIA  
Carretera de Valencia, km. 7  
Campus Sur de la Universidad Politécnica de Madrid  
28031 – MADRID – (SPAIN)**

March, 1999

**REPORT DOCUMENTATION PAGE**
**Title:**

*STRUCTURAL SURVEY OF CARS. MEASUREMENT METHODOLOGY OF THE MAIN RESISTANT ELEMENTS IN THE CAR BODY*

**Author(s):**

Aparicio Izquierdo, Francisco  
 Páez Ayuso, Francisco Javier

**Performing Organisation name and address:**

INSIA – University Institute for Automobile Research  
 Carretera de Valencia, Km. 7 – Campus Sur de la Universidad Politécnica de Madrid  
 28031 – Madrid – Spain

**Supplementary notes:**

Under contract to:

THE EUROPEAN COMMUNITY

Project: “Improvement of Crash Compatibility between Cars”  
 Contract N°: RO – 97 – SC.1064

**Abstract:**

The main aim of this working package -*Structural Survey of Cars*- is the reduction of incompatibilities, both structural and geometric, between passenger vehicles and their potential collision partners. The understanding of these incompatibilities needs a previous step for the knowledge of the existing car fleet.

Firstly, it is necessary to select the main resistant elements in the car body. These elements have to be chosen from the point of view of the sort of collision that we want to study, that is to say, frontal and side impacts.

Detailed measurements have been taken from exterior and interior elements, spread to a total number of 74 models selected from the main vehicle manufacturers at Spain. All of them are being sold this year. Using the information available from the previous measurements in vehicles, the geometric characteristics of the main resistant elements involved in the geometric compatibility between cars will be defined.

This report shows the methodology followed to get these measurements.

**Subject terms:**

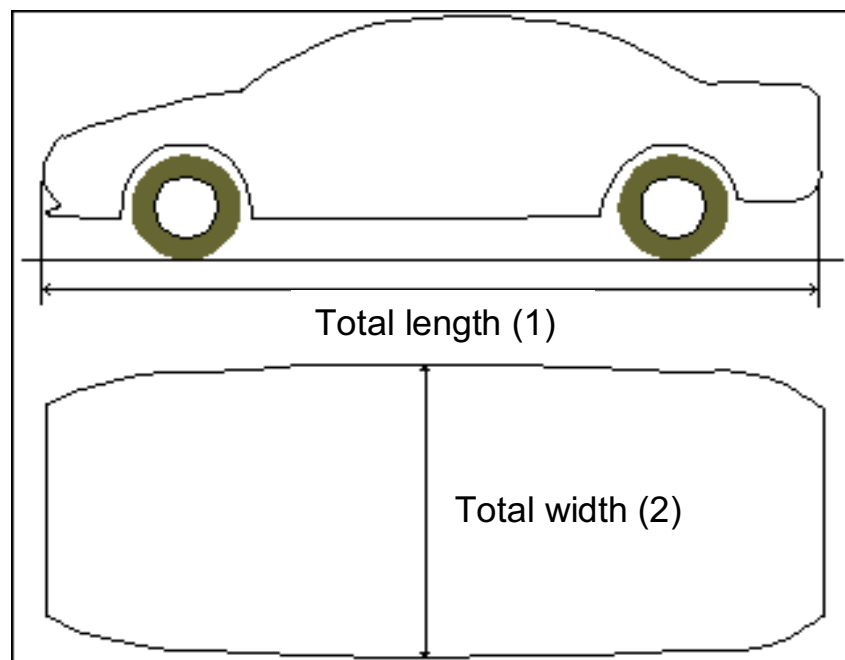
Crash compatibility, geometric compatibility, resistant elements, measure methodology

**Date:**

March, 1999

## 1.- METHODOLOGY.

Detailed measurements have been taken from exterior and interior elements. Using the information available from the previous measurements in vehicles, the geometric characteristics of the main resistant elements involved in the geometric compatibility between cars have been defined. These elements are presented in the following figures, and have been divided in two main groups according to the vehicle zones studied in this project.



*Figure 1.- Definition of the main resistant elements. General dimensions.*

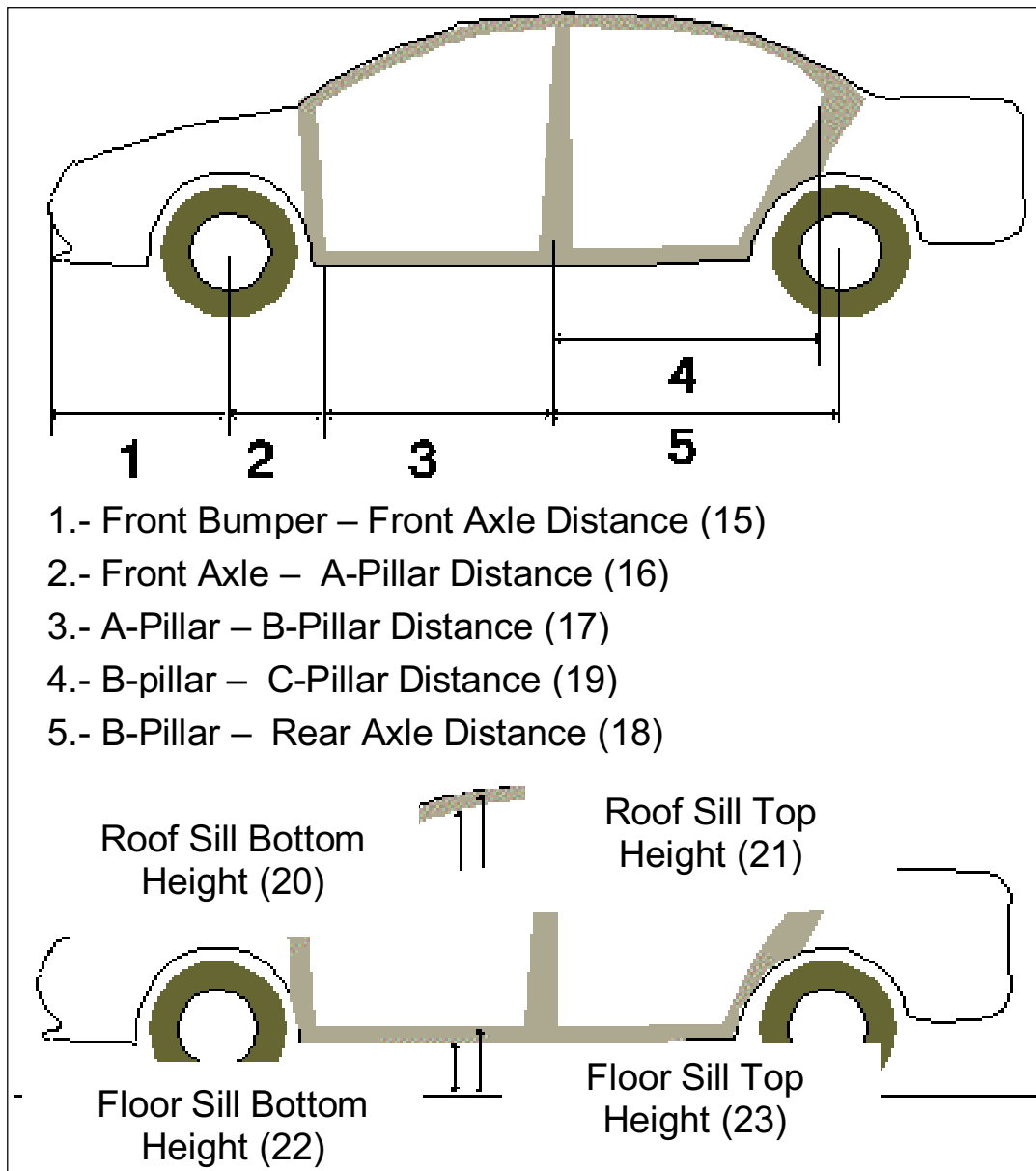


Figure 2.- Definition of the main resistant elements. Side elements.

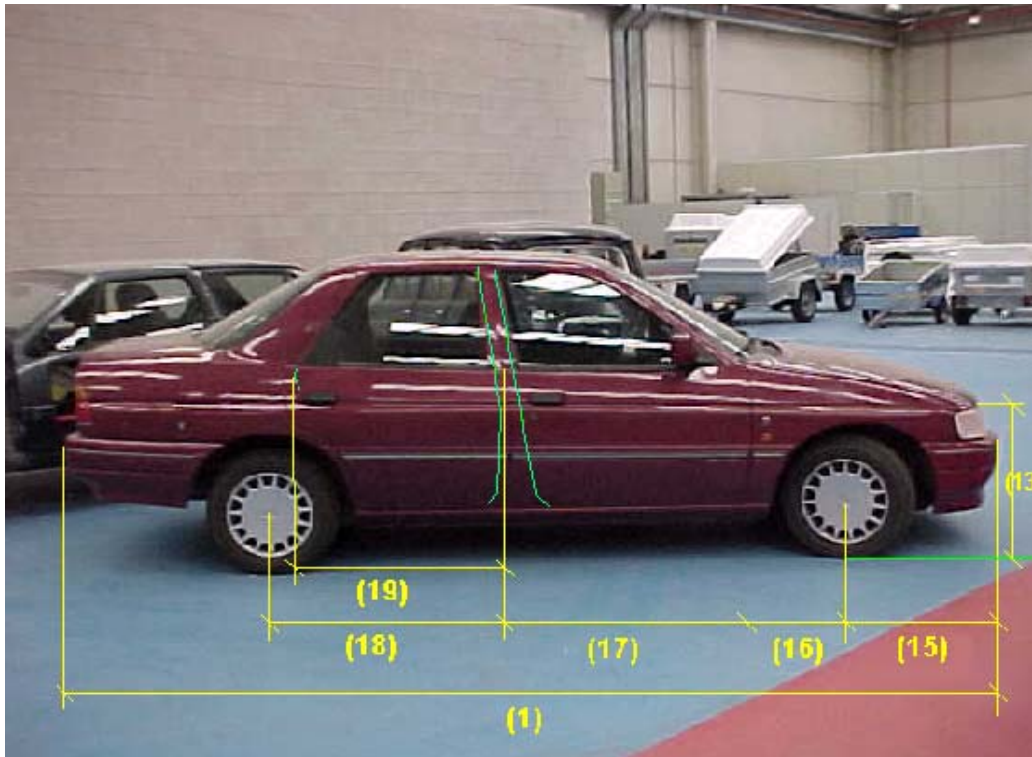
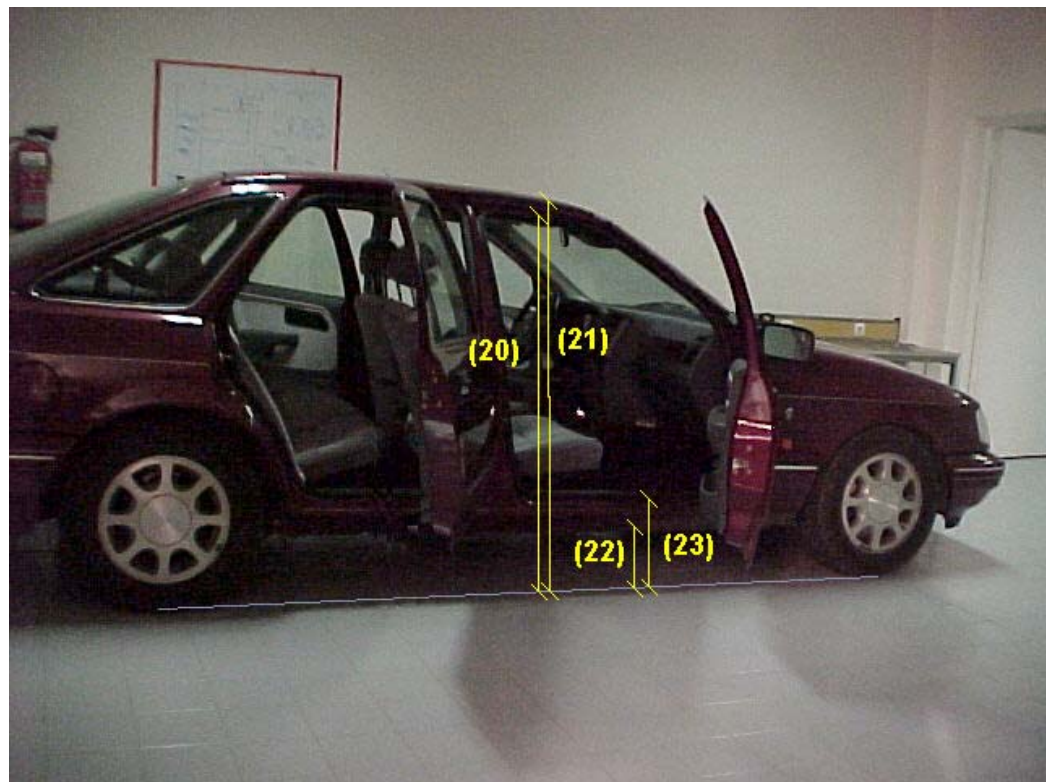


Figure 3.-  
Measurements of  
the side resistant  
elements (outer).

Figure 4.- Measurements  
of the side resistant  
elements (inner).



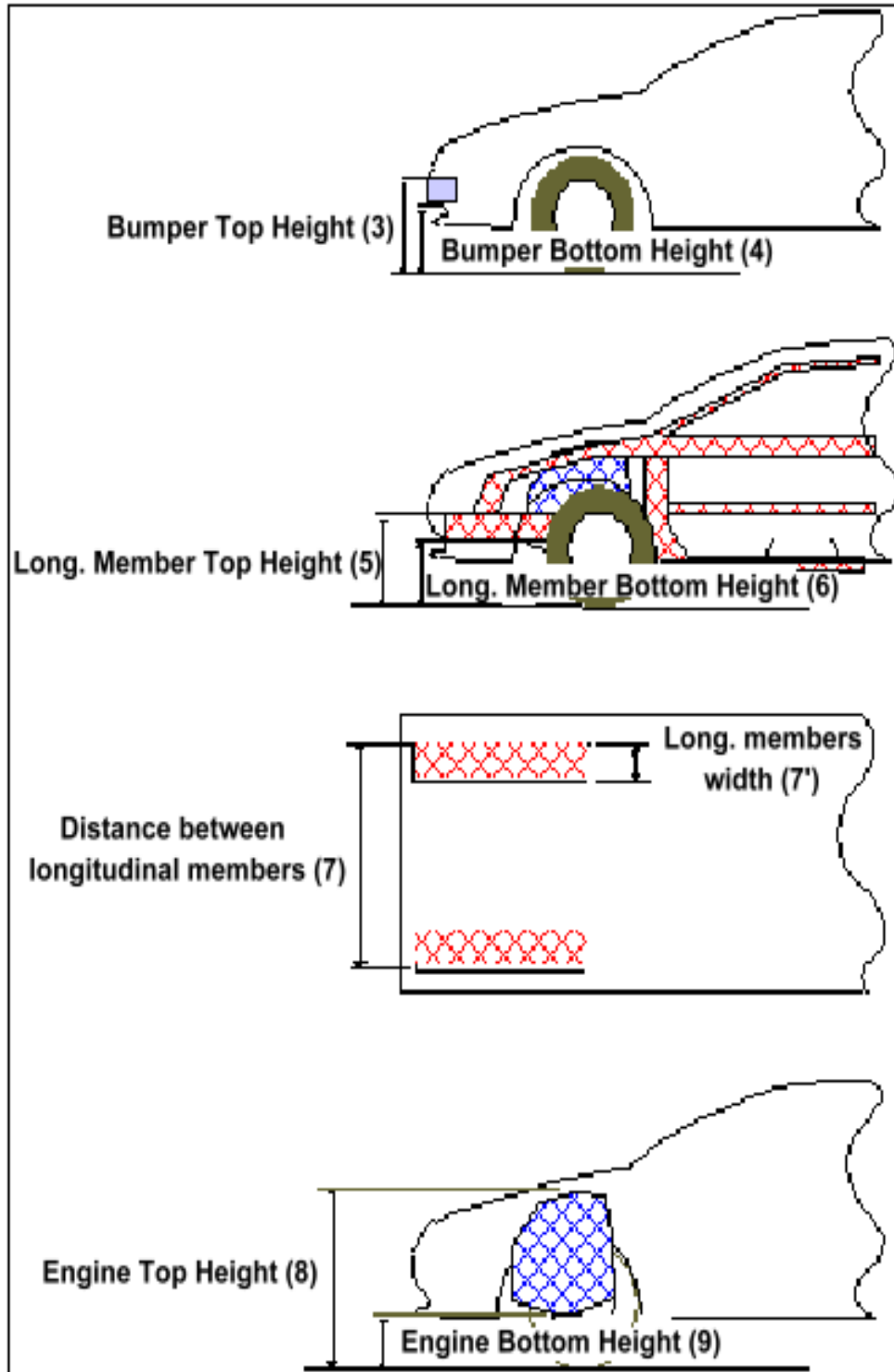
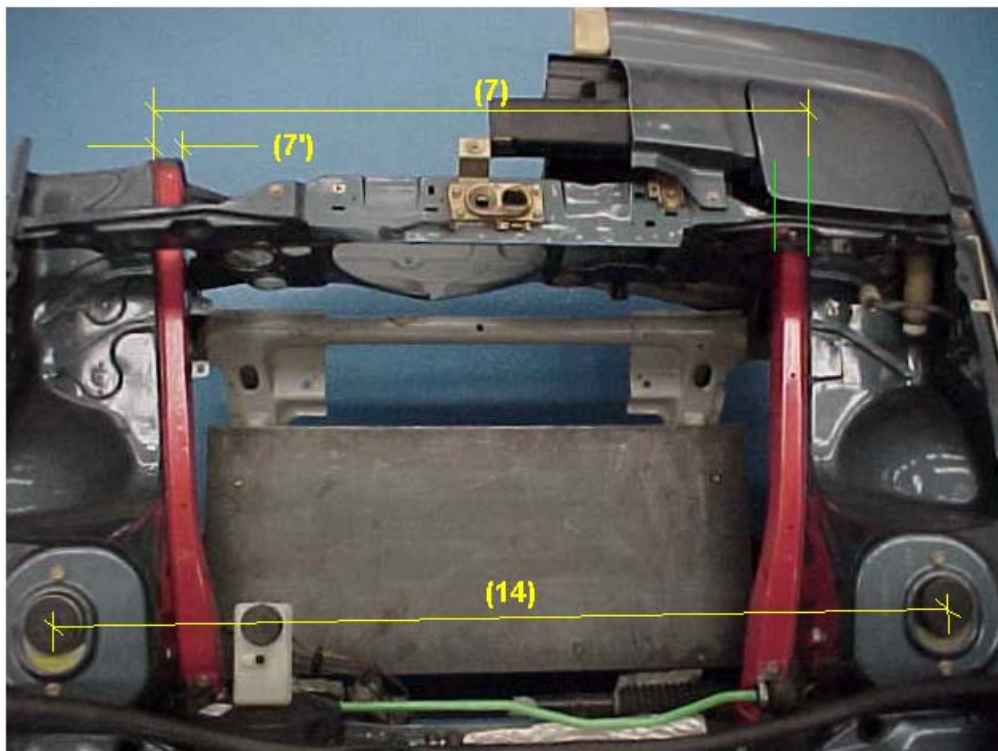
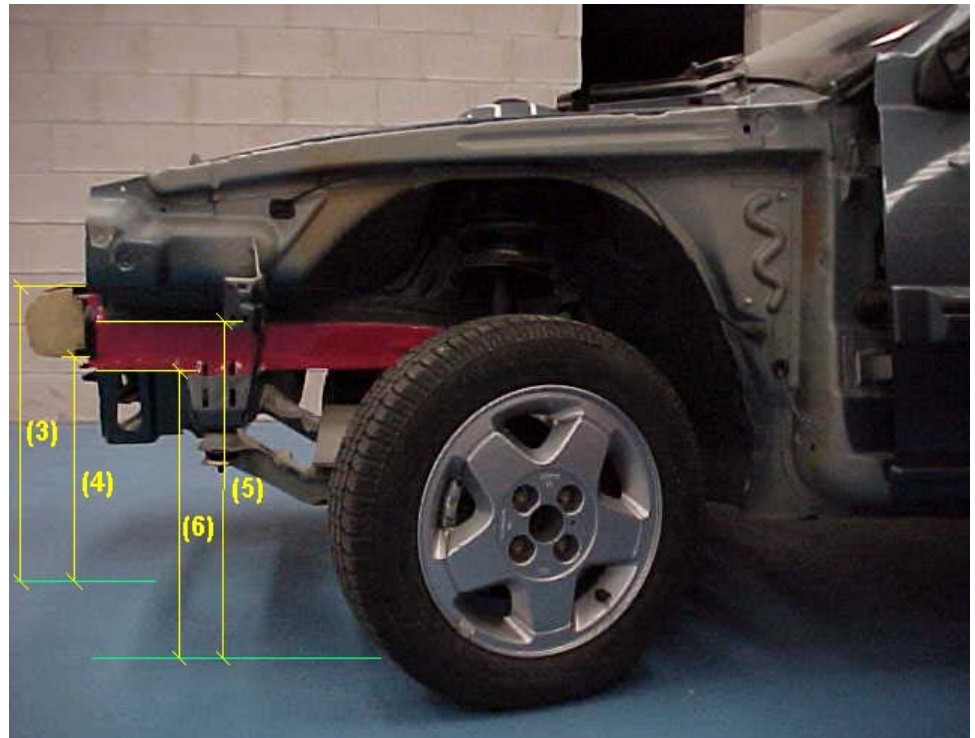


Figure 5.- Definition of the main resistant elements. Front elements.

*Figure 6.-  
Measurements of the  
main resistant elements.  
Front elements 1.*



*Figure 7.-  
Measurements  
of the main  
resistant  
elements. Front  
elements 2.*

Figure 8.-  
Measurements of  
the main resistant  
elements. Front  
elements 3.

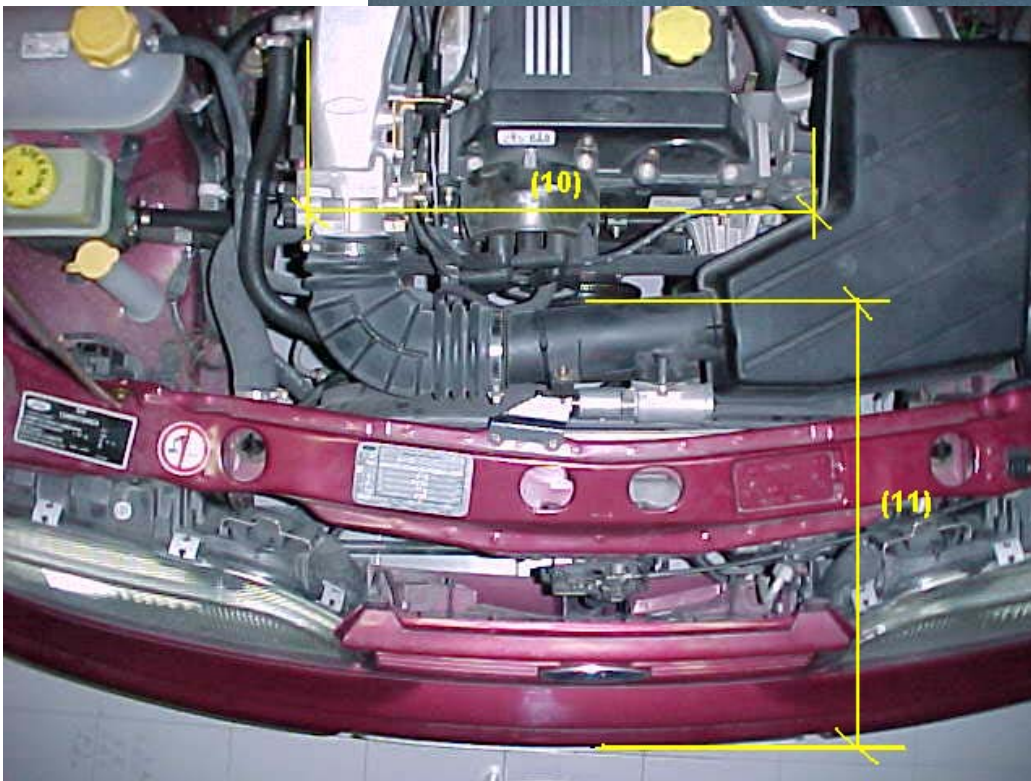
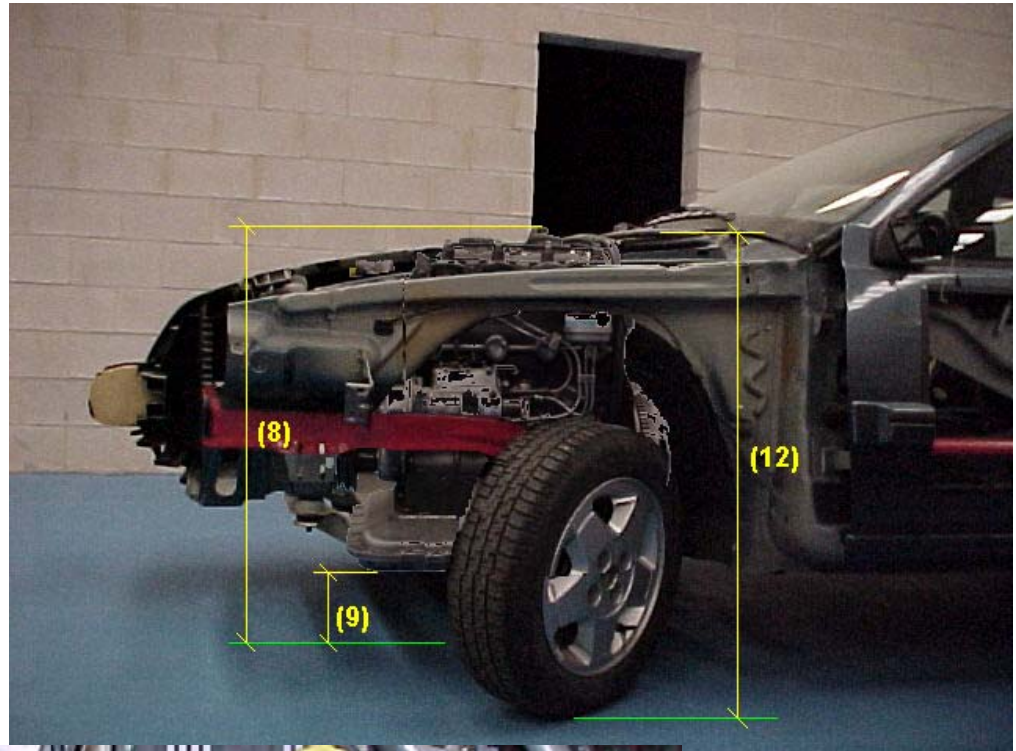


Figure 9.-  
Definition of  
the main  
resistant  
elements. Front  
elements  
(Longitudinal  
engine).

The procedure considered to measure these elements is described as follows, where it is indicated the location of these ones in the Excel Sheet (SURVEY.XLS) into brackets:

### **FRONT ELEMENTS**

- **Total Length –(1)- (Side & Front Sheets - C column):** distance between the point in the front bumper further on and the point in the rear bumper further back.
- **Weight (Side & Front Sheets - D column):** mass, including an average driver weight (70 kg), and the fuel tank mass (at half-capacity).
- **Total Width –(2)- (Side & Front Sheets - E column):** distance between the outer side points in a transverse plane of the vehicle (middle plane between the front and rear axles).
- **Bumper bottom height –(4)- (Front Sheet G column):** distance between the ground and the lowest point on the front bumper, being a resistant member (aerodynamic elements under the front bumper are not considered).
- **Bumper top height –(3)- (Front Sheet H column):** distance between the ground and the highest point on the front bumper, being a resistant member (aerodynamic elements are not considered).
- **Longitudinal member top height –(5)- (Front Sheet I column):** distance between the ground and the highest point on the longitudinal members, measured approximately in the front bumper-longitudinal member joint (when accessible).
- **Longitudinal member bottom height –(6)- (Front Sheet J column):** distance between the ground and the lowest point on the longitudinal members, measured approximately in the front bumper-longitudinal member joint.
- **Distance between longitudinal members (Front Sheet K column):** transverse distance between extreme points in longitudinal members, measured approximately in the front bumper-longitudinal member joint.

Depending on the accessibility of these members, the extreme points are the inner points (I) or the outer points (O).

- **Longitudinal member width -7'- (Front Sheet L column):** width of one of the longitudinal members, measured approximately in the front bumper-longitudinal member joint.

- 
- **Engine top height (8) (Front Sheet N column):** distance between the ground and the highest point on the engine that can be a resistant member in case of accident (usually, the highest point on the head, or the highest point of the inlet or exhaust manifolds).
  - **Engine bottom height (9) (Front Sheet M column):** distance between the ground and the lowest point on the engine (usually, the lowest point on the crankcase).
  - **Engine and Gearbox width (10) (Front Sheet O & P columns):**
    - *Transverse configuration engine:* distance between extreme points in the gearbox-cylinder block unit or others resistant members attached to the cylinder block unit, i.e. fan belts (from a front point of view).
    - *Longitudinal configuration engine:* distance between extreme points in the cylinder block unit (from a front point of view).
  - **Front bumper - Engine distance (11) (Front Sheet Q column):** distance between the point in the front bumper further on and the point in the engine further on that is a resistant element, i.e. the further on point of the exhaust manifold placed in the front of the engine.
  - **Front shock absorber fixing width (14) (Front Sheet R column):** transverse distance between the front shock absorber - body car joints.
  - **Front shock absorber fixing height (12) (Front Sheet S column):** distance between the ground and the front shock absorber-body car joint.
  - **Bonnet leading edge height (Front Sheet T column):** distance between the ground and the bonnet edge further on.

## SIDE ELEMENTS

- **Front bumper - Front axle distance (15) (Side Sheet G column):** distance between the point in the front bumper further on and the middle point in the front tyre-road contact patch.
- **Front axle - A Pillar distance (16) (Side Sheet H column):** distance between the middle point in the front tyre-road contact patch and the point in the A-pillar further back.
- **A Pillar - B Pillar distance (17) (Side Sheet I column):** distance between the point in the A-pillar further back and the middle point in the B-pillar.
- **B Pillar - C Pillar distance (19) (Side Sheet J column):** distance between the middle point in the B-pillar and the point in the C-pillar further back (only 4/5-door vehicles).
- **B Pillar - Rear axle distance (18) (Side Sheet K column):** distance between the middle point in the B-pillar and the middle point in the rear tyre-road contact patch.
- **Roof sill bottom height (20) (Side Sheet L column):** distance between the ground and the lowest point on the roof sill, measured in the front door middle point.
- **Roof sill top height (21) (Side Sheet M column):** distance between the ground and the highest point on the roof sill (usually located in the sill-roof joint), measured in the front door middle point.
- **Floor sill bottom height (22) (Side Sheet N column):** distance between the ground and the lowest point on the floor sill, measured in the front door middle point.
- **Floor sill top height (23) (Side Sheet O column):** distance between the ground and the highest point on the floor sill, measured in the front door middle point.

## NOTE

- N/A: dimension not available.