REPORT NUMBER: NCAP-MGA-2011-058

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

KIA MOTORS CORPORATION
2011 Kia Forte LX 4-Dr Sedan
NHTSA No.: MB0511

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: January 3, 2011

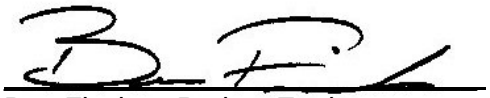
Final Report Date: February 11, 2011

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
1200 New Jersey Ave, SE
Mail Code: NVS 111, Room W43-410
Washington, DC 20590

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-06-D-00028.

Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Ben Fischer, Project Engineer

Approval Date: February 11, 2011

FINAL REPORT ACCEPTANCE BY OCWS:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

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15. Supplementary Notes		

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on the 2011 Kia Forte LX 4-Dr Sedan in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure for the generation of consumer information on vehicle frontal crash protection. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin, on January 3, 2011.

The impact velocity was 56.3 km/h and the ambient temperature at the barrier face at the time of impact was 21°C. The target vehicle post-test maximum crush was 494 mm located at the vehicle's centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Threshold		Driver ATD	Passenger ATD
		50th	5th		
Head Injury Criteria (HIC_{15})	N/A	700	700	249	371
Maximum Chest Compression	mm	63	52	20	9
Nij	N/A	1	1	0.27	0.68
Neck Tension	N	4170	2620	1223	1069
Neck Compression	N	4000	2520	188	460
Left Femur Force	N	10008	6805	1304	2858
Right Femur Force	N	10008	6805	2534	251

17. Key Words 35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP)		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Adm. Technical Reference Division 1200 New Jersey Ave, SE Washington, D.C. 20590	
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-D-00028. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standard's NCAP Frontal Laboratory Test Procedure dated January 2010.

SUMMARY

A load cell barrier was impacted by a 2011 Kia Forte LX 4-Dr Sedan at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on January 3, 2011. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two real-time cameras and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E, 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were on the driver's lap and shoulder belts and the passenger's lap belt to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 036) and the right-front passenger (position 2) ATD (Serial No. 634) were calibrated previous to this test. Certification details, along with verification data, are found in Appendix C of this report.

The 227 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest displacement, neck, and femur response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 494 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glovebox.

The occupant data is summarized below:

ATD position	HIC_{15}	T^1	T^2	Chest Disp. (mm)	Nij	Neck Tension (N)	Neck Comp. (N)	Left Femur (N)	Right Femur (N)
Driver (50^{th})	249	64.4	79.4	20	0.27	1223	188	1304	2534
Passenger (5^{th})	371	66.1	81.1	9	0.68	1069	460	2858	251

The test data can be found on the NHTSA website at www.nhtsa.dot.gov.

TEST NOTES

There was no valid data collected for:
Passenger Right Ankle X after 125 msec.
Left Rear Seat Crossmember Z between 42-49 msec.

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

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0511
Test Date: 1/03/2011

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	MB0511
Model Year	2011
Make	Kia
Model	Forte
Body Style	Sedan
VIN	KNAFT4A21B5888933
Body Color	Bright Silver
Delivery Date	12/15/2010
Odometer (mi)	56
Odometer (km)	90
Dealer	Rosen Kia
Transmission	Automatic
Final Drive	Front
Type/No. Cylinders	4
Engine Displacement (L)	2.0
Engine Placement	Lateral
Roof Rack	No
Sunroof/T-Top	No
Tinted Glass	No
Traction Control	Yes
Power Brakes	Yes
Front Disc	Yes
Rear Disc	Yes
Does owner's manual provide instructions to turn off automatic door locks?	N/A

Anti-Lock Brakes	Yes
All Wheel Drive	No
Power Steering	Yes
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Pass. Front Airbag	Yes
Pass. Curtain Airbag	Yes
Pass. Head/Torso Airbag	No
Pass. Torso Airbag	No
Pass. Torso/Pelvis Airbag	Yes
Pass. Pelvis Airbag	No
Pass. Knee Airbag	No
Pretensioners	Yes
Load Limiters	Yes
Automatic Door Locks	No
Bucket Seats	Yes
Tilt Steering	Yes
Other	

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Corporation
Date of Manufacture	09/10

GVWR (kg)	1730
GAWR Front (kg)	980
GAWR Rear (kg)	820

VEHICLE SEATING AND WEIGHT CAPACITY DATA

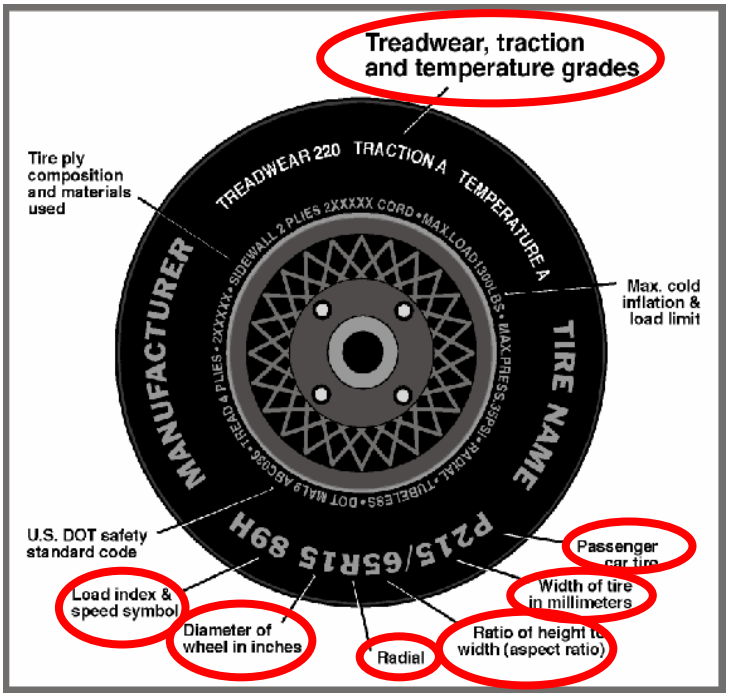
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Designated Seating Capacity (DSC)	2	3		5
Capacity Weight (VCW) (kg)				385
Cargo Weight (RCLW) (kg)				45

DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0511
Test Date: 1/03/2011



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	220
Recommended Tire Size	P195/65R15	P195/65R15
Tire Size on Vehicle	P195/65R15	P195/65R15
Tire Manufacturer	Hankook	Hankook
Tire Model	Optimo H426	Optimo H426
Treadwear	440	440
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1	1
Tire Plies Body	4	4
Load Index & Speed Symbol	89T	89T
Tire Material	Rubber	Rubber
DOT Safety Code Right	T7DY DLH	T7DY DLH
DOT Safety Code Left	T7DY DLH	T7DY DLH

DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	411.4	247.2		435.9	315.7	
Right	kg	404.6	238.6		435.4	293.0	
Ratio	%	62.7	37.3		58.9	41.1	
Totals	kg	816.0	485.8	1301.8	871.3	608.7	1480.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1301.8
Weight of 1 P572E ATD & 1 P572O ATD	kg	140.6
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Target Vehicle Target Weight (TVTW)	kg	1487.4

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	665	665	663	670	990
As Tested	mm	655	658	637	643	1091
Post Test	mm	661	663	650	630	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2653
Total Vehicle Length at Left Side	mm	4260
Total Vehicle Length at Centerline	mm	4535
Total Vehicle Length at Right Side	mm	4260
Weight of Ballast in Cargo Area	kg	24.9
Weight of Vehicle Components Removed	kg	18.1
Amount of Stoddard Solvent in Fuel Tank	L	48.4

List of components removed to meet test weight: Spare tire, right tail light, jack & tools, rear floor mats, trunk carpet.

DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4535
2	Total Width	1755
3	Bumper Top Height	555
4	Bumper Bottom Height	410
5	Longitudinal Member Top Height	530
6	Distance between Longitudinal Members	941
7	Longitudinal Member Width	74
8	Engine Top Height	814
9	Engine Bottom Height	289
10	Engine and Gearbox Width	878
11	Front Bumper-Engine Distance	453
12	Front Shock Absorber Fixing Height	1155
13	Bonnet Leading Edge Height	720
14	Front Shock Absorber Fixing Width	864
15	Front Bumper – Front Axle Distance	890
16	Front Axle – A-Pillar Distance	417
17	A-Pillar – B-Pillar Distance	1335
18	B-Pillar – Rear Axle Distance	1107
19	B-Pillar – C-Pillar Distance	690
20	Roof Sill Bottom Height	1316
21	Roof Sill Top Height	1426
22	Floor Sill bottom Height	199
23	Floor Sill Top Height	331

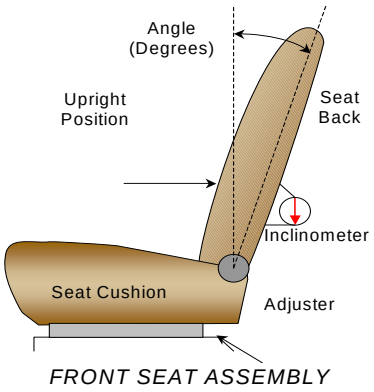
DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.



SEAT BACK ANGLE	Degrees
Driver Seat Back Angle	8.0° on headrest post
Passenger Seat Back Angle	8.2° on headrest post

SEAT FORE/AFT POSITIONS

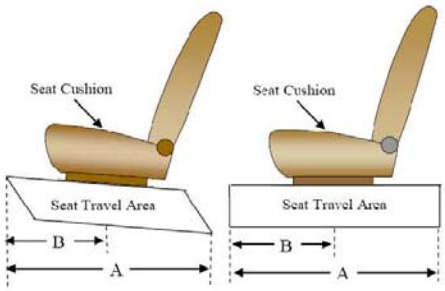
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Seating & Positioning Procedures" in the NCAP Test Procedure dated January 2010.

SEAT FORE/AFT POSITIONS	Total Fore/Aft Travel	Placed in Position #
Driver Seat	20 detents (1st as 0)	9th detent (forward-most as 0)
Passenger Seat	20 detents (1st as 0)	0 detent (forward-most as 0)

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are positioning following the manufacturer's specified position as listed in Form 1.

SEAT BELT UPPER ANCHORAGES	Total # of Positions	Placed in Position #
Driver Seat	4	0 (uppermost as 0)
Passenger Seat	4	0 (uppermost as 0)



DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

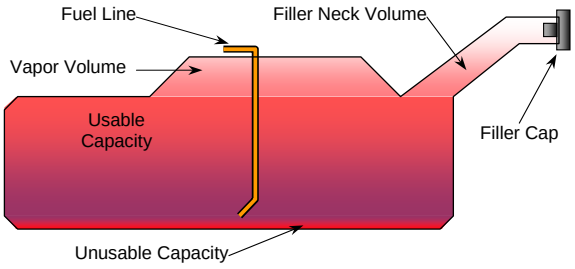
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	52.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	47.8 to 48.9
Actual Amount of Solvent used	48.4
1/3 of Usable Capacity	17.3

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

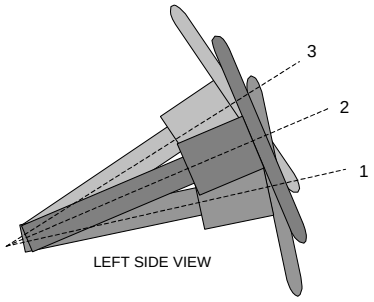
The vehicle is equipped with an electric fuel pump. Fuel pump will operate when engine system is normally operating. The fuel pipe is on the left side.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

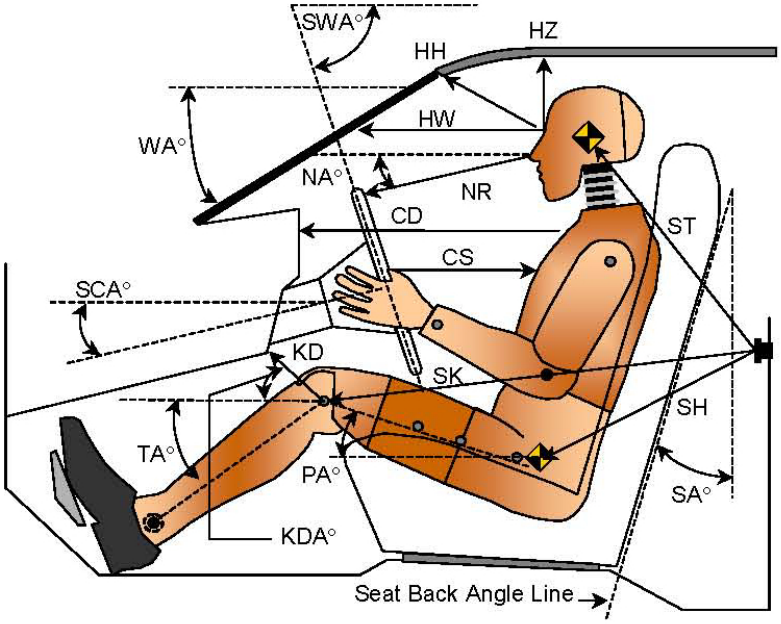
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	68.4	
Geometric Center – Position 2	66.3	
Uppermost – Position 3	64.2	
Telescoping Steering Wheel Travel		
Test Position	66.3	

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

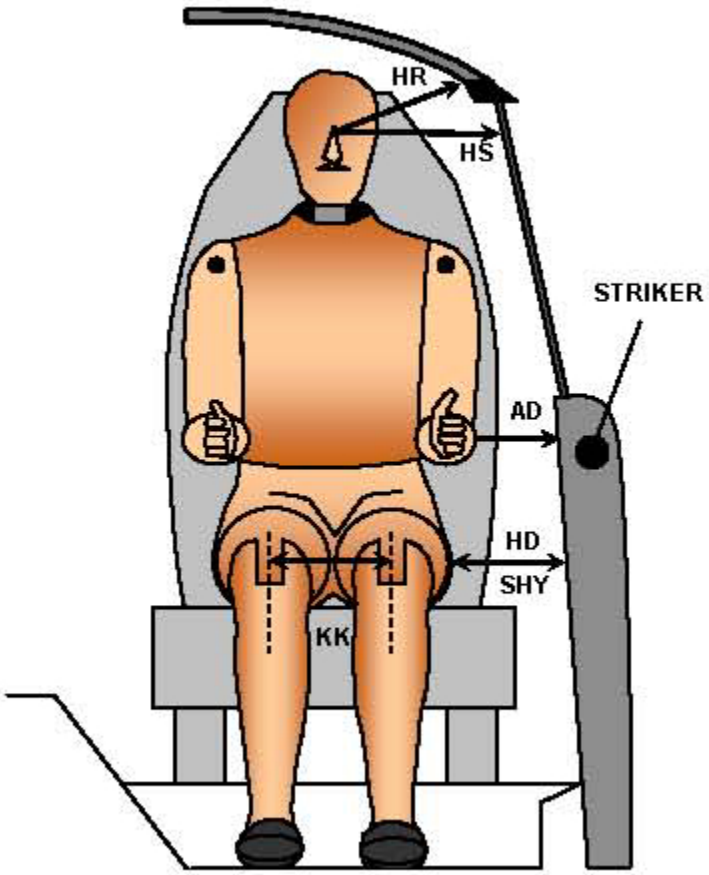


Code	Measurement Description	Driver S/N 036		Passenger S/N 634	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		26.7		
SWA	Steering Wheel Angle		66.3		
SCA	Steering Column Angle		23.7		
SA	Seat Back Angle		8.0		8.2
HZ	Head to Roof (Z)	185	90	225	90
HH	Head to Header	358	23.7	325	40.7
HW	Head to Windshield	622	0	681	0
NR	Nose to Rim	402	14.7		
CD	Chest to Dash	533		470	
CS	Chest to Steering Hub	306	5.0		
RA	Rim to Abdomen	195	0		
KDL	Left Knee to Dash	177	23.8	135	34.7
KDR	Right Knee to Dash	130	31.6	147	34.2
PA	Pelvic Angle		24.2		22.0
TA	Tibia Angle		48.7		46.5
SK	Striker to Knee	584	100.7	672	101.9
ST	Striker to Head	449	11.6	387	25.7
SH	Striker to H-Point	303	138.0	376	119.4

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011



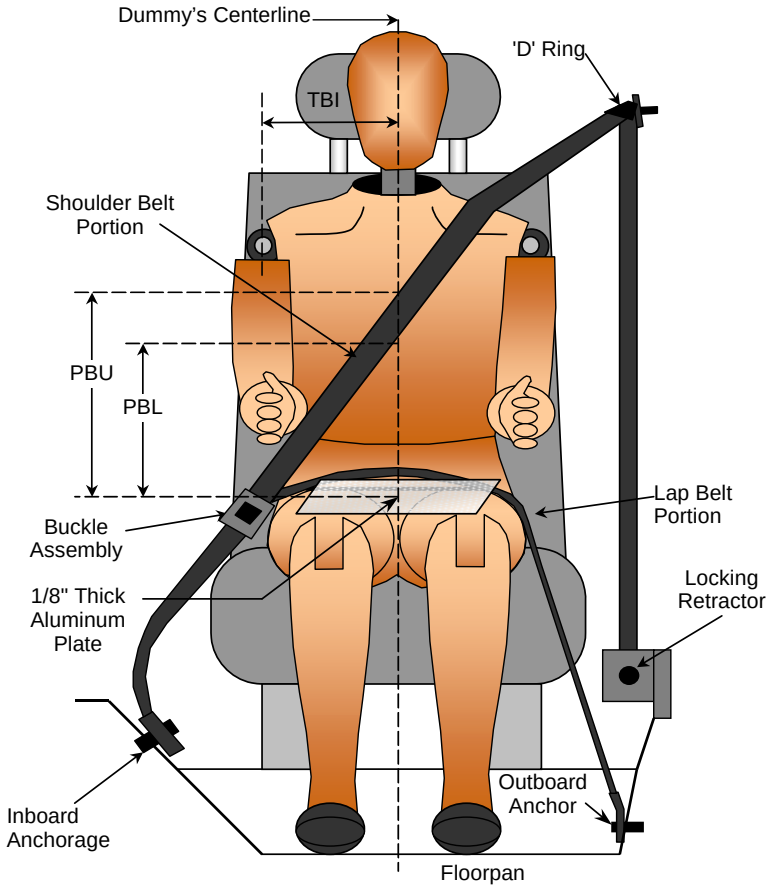
FRONT VIEW OF DUMMY

Code	Measurement Description	Driver S/N 036	Passenger S/N 634
		Length (mm)	
AD	Arm to Door	143	93
HD	H-Point to Door	182	187
HR	Head to Side Header	224	252
HS	Head to Side Window	340	357
KK	Knee to Knee	345	210
SHY	Striker to H-Point (Y Direction)	275	290
AA	Ankle to Ankle	375	176

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	380	355
PBL - To surface of reference to belt lower edge	mm	310	275

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	890	940
Lap Belt Length as measured on ATD	mm	600	610
Remainder of belt of reel	mm	1540	1500
Total Belt Length for Continuous Webbing Systems	mm	3030	3050

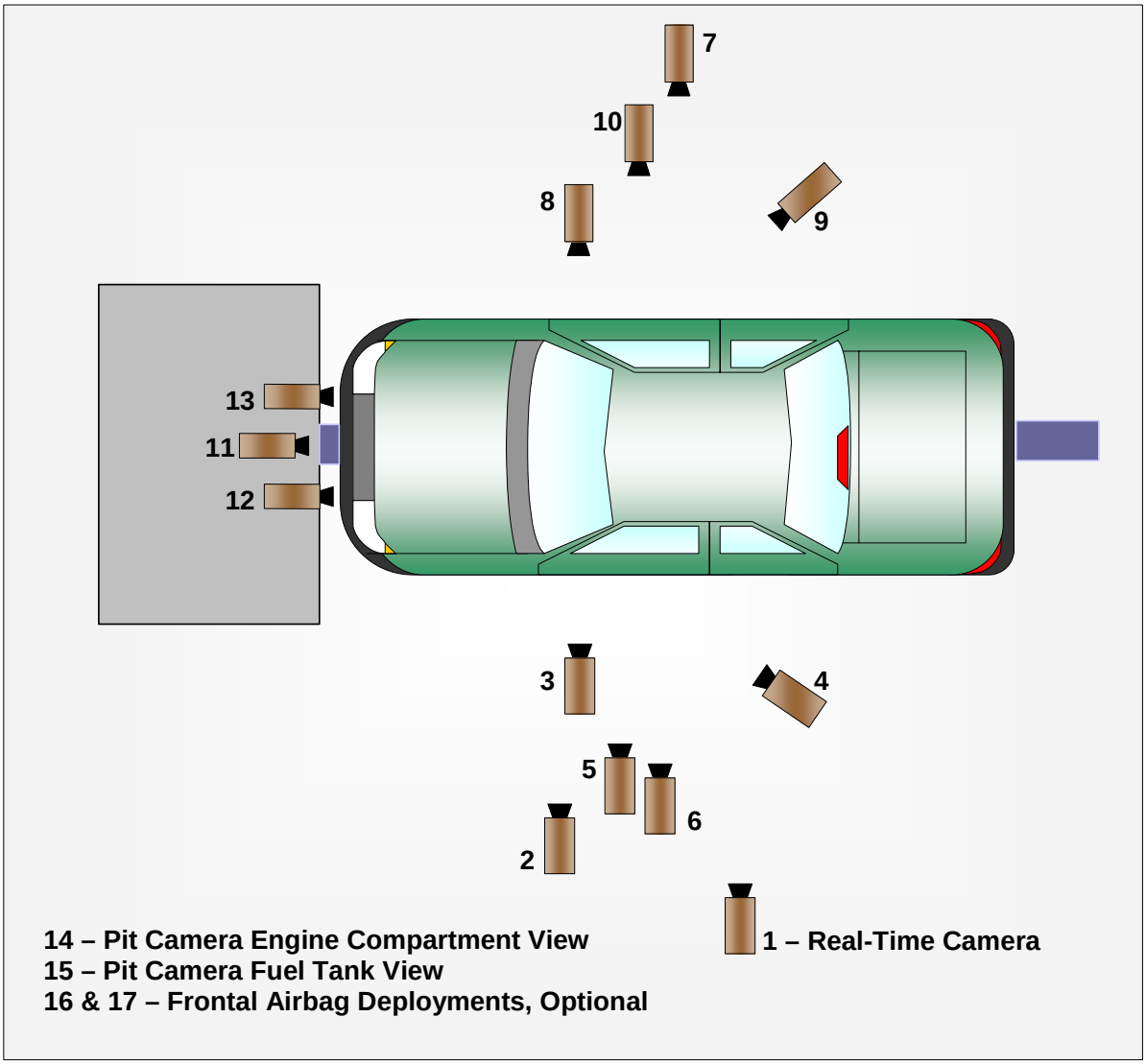
DATA SHEET NO. 6

HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0511
Test Date: 1/03/2011

CAMERA POSITIONS FOR FRONTAL IMPACTS



14 – Pit Camera Engine Compartment View
15 – Pit Camera Fuel Tank View
16 & 17 – Frontal Airbag Deployments, Optional

1 – Real-Time Camera

DATA SHEET NO. 6 (CONTINUED)

CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Side View					30
2	Left Front Half	1350	-5170	-1260	24	1000
3	Driver Close-Up	1510	-6160	-1570	35	1000
4	Driver Angle	5420	-5090	-1890	50	1000
5	Steering Column Top	840	-5170	-1220	24	1000
6	Steering Column Bottom	800	-5130	-860	24	1000
7	Right Overall	2130	6600	-1280	20	1000
8	Passenger Close-Up	1580	6270	-1590	35	1000
9	Passenger Angle	5460	4930	-1870	50	1000
10	Right Front Half	1320	5140	-1230	24	1000
11	Windshield	-260	0	-2860	24	1000
12	Top Driver	-20	-310	-2070	12.5	1000
13	Top Passenger	-20	310	-2070	12.5	1000
14	Pit Front	1390	0	3150	24	1000
15	Pit Rear	3160	0	3150	24	1000
16	Onboard Driver Side (optional)					
17	Onboard Passenger Side (optional)					
18	Real-Time Pan View					30

*COORDINATES:

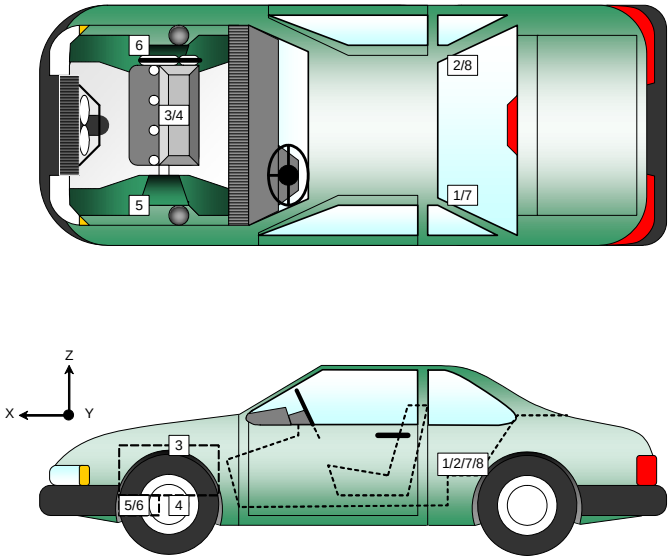
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

Cameras 16 & 17 were not used for this test.

DATA SHEET NO. 7

VEHICLE ACCELEROMETER DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1803	-370	-162
2	Right Rear X-Member X	1803	370	-162
3	Engine Top X	3811	0	-814
4	Engine Bottom X	3830	0	-289
5	Left Brake Caliper X	3451	-695	-271
6	Right Brake Caliper X	3451	695	-271
7	Left Rear X-Member Z	1803	-370	-162
8	Right Rear X-Member Z	1803	370	-162

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

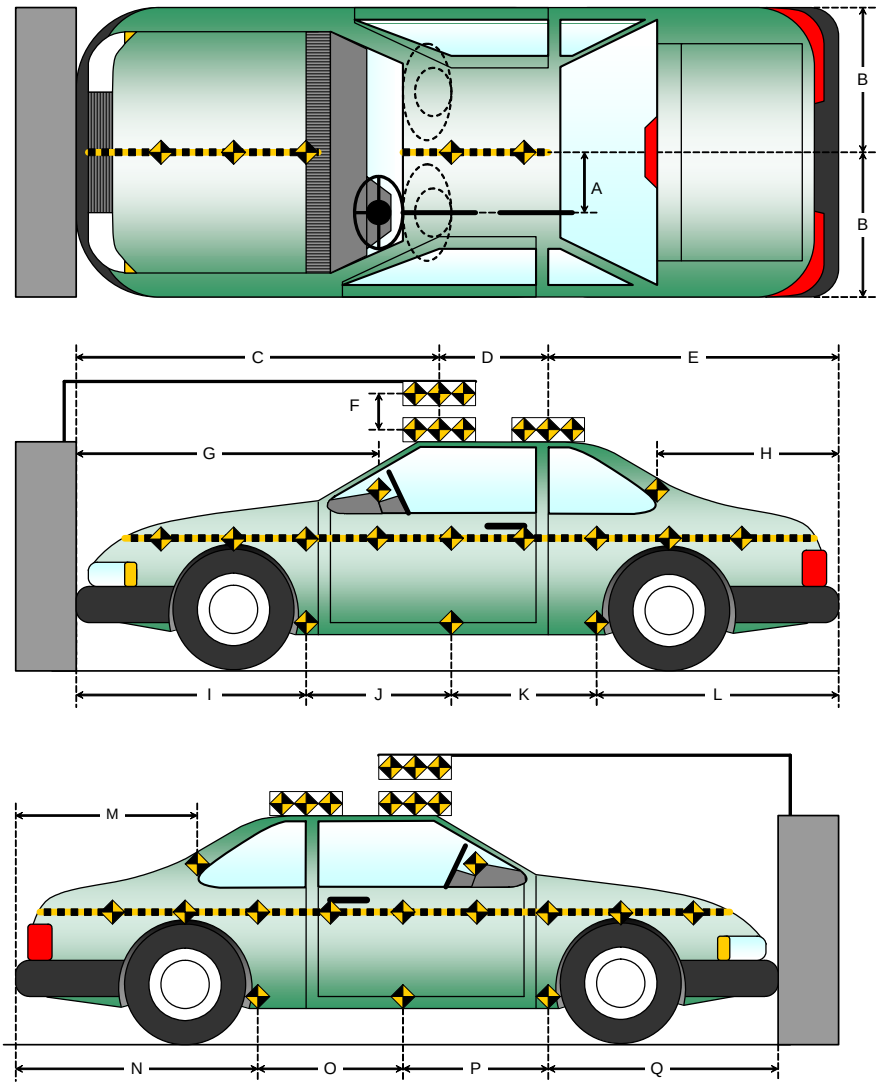
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: MB0511
Test Date: 1/03/2011

Item	Value (mm)
A	329
B	877
C	2270
D	662
E	1603
F	125
G	
H	958
I	1305
J	917
K	917
L	1396
M	958
N	1396
O	917
P	917
Q	1305

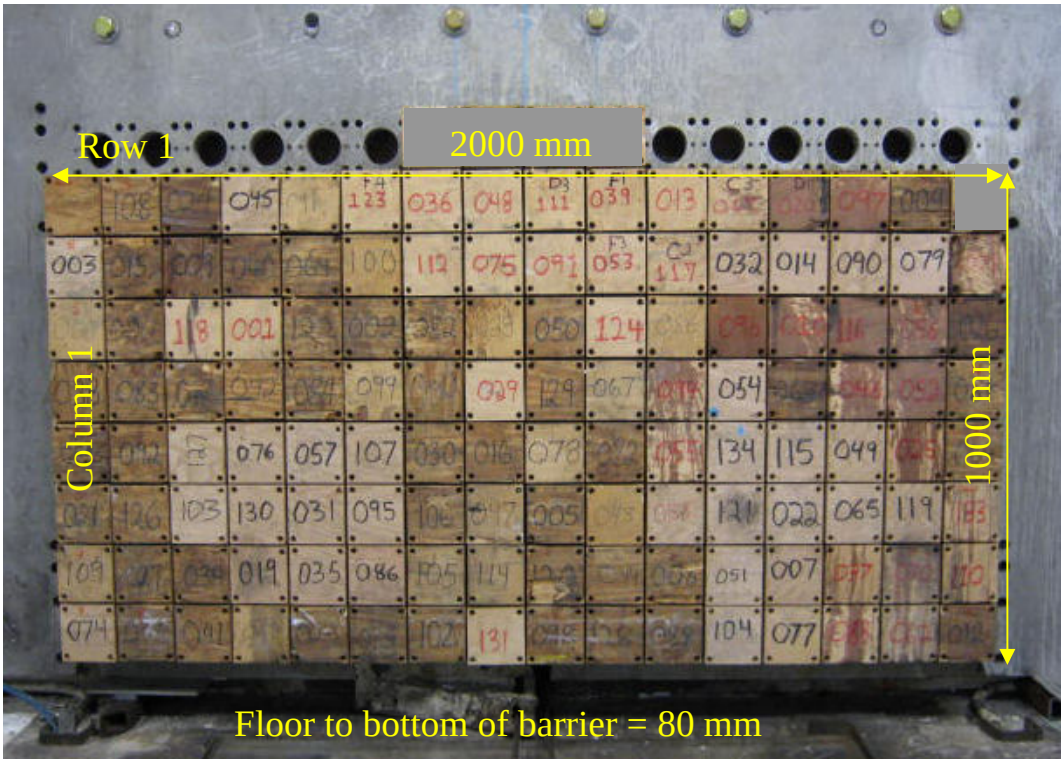


DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

Advanced Research Load Cell Barrier



1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	1-12	1-13	1-14	1-15	1-16
2-1	2-2	2-3	2-4	2-5	2-6	2-7	2-8	2-9	2-10	2-11	2-12	2-13	2-14	2-15	2-16
3-1	3-2	3-3	3-4	3-5	3-6	3-7	3-8	3-9	3-10	3-11	3-12	3-13	3-14	3-15	3-16
4-1	4-2	4-3	4-4	4-5	4-6	4-7	4-8	4-9	4-10	4-11	4-12	4-13	4-14	4-15	4-16
5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12	5-13	5-14	5-15	5-16
6-1	6-2	6-3	6-4	6-5	6-6	6-7	6-8	6-9	6-10	6-11	6-12	6-13	6-14	6-15	6-16
7-1	7-2	7-3	7-4	7-5	7-6	7-7	7-8	7-9	7-10	7-11	7-12	7-13	7-14	7-15	7-16
8-1	8-2	8-3	8-4	8-5	8-6	8-7	8-8	8-9	8-10	8-11	8-12	8-13	8-14	8-15	8-16
9-1	9-2	9-3	9-4	9-5	9-6	9-7	9-8	9-9	9-10	9-11	9-12	9-13	9-14	9-15	9-16

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

INSTRUMENTATION

Driver Dummy Data Channels	46
Passenger Dummy Data Channels	46
Vehicle Structure Accelerometers	8
Barrier Channels	127
Total	227

CAMERA COVERAGE

High-Speed Vehicle Onboard	0
High-Speed Offboard	14
Real-Time	2
Total	16

DATA SHEET NO. 11

POST-TEST OBSERVATIONS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 036	HIII 5% / 634
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	Airbag	Airbag
Left Knee Contact	Knee Bolster	Glovebox
Right Knee Contact	Knee Bolster	Glovebox

DOOR OPENING AND SEAT TRACK INFORMATION

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

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	Cracked
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1009
Center	mm	981
Right Side	mm	963
Average	mm	984

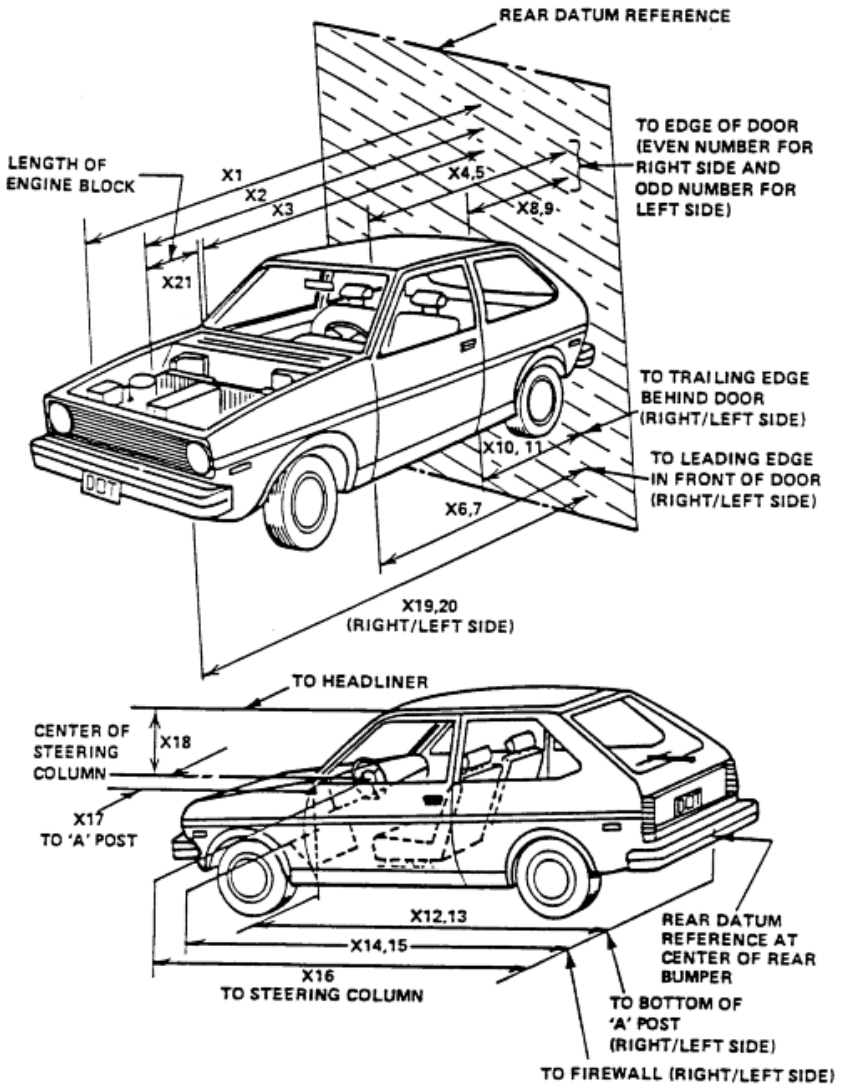
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Left Front (Driver) P1		Left Front (Passenger) P2	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Knee Airbag	No		No	
Curtain Side Airbag	Yes	No	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011



DATA SHEET NO. 12 (CONTINUED)

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4535	4041	494
2	RSOV to Front of Engine	mm	4043	3901	142
3	RSOV to Firewall	mm	3522	3506	16
4	RSOV to Upper Leading Edge of Right Door	mm	3092	3094	-2
5	RSOV to Upper Leading Edge of Left Door	mm	3092	3109	-17
6	RSOV to Lower Leading Edge of Right Door	mm	3102	3102	0
7	RSOV to Lower Leading Edge of Left Door	mm	3102	3102	0
8	RSOV to Upper Trailing Edge of Right Door	mm	2035	2043	-8
9	RSOV to Upper Trailing Edge of Left Door	mm	2035	2044	-9
10	RSOV to Lower Trailing Edge of Right Door	mm	2054	2046	8
11	RSOV to Lower Trailing Edge of Left Door	mm	2054	2049	5
12	RSOV to Bottom of “A” Post of Right Side	mm	3109	3106	3
13	RSOV to Bottom of “A” Post of Left Side	mm	3107	3102	5
14	RSOV to Firewall, Right Side	mm	3490	3406	84
15	RSOV to Firewall, Left Side	mm	3490	3436	54
16	RSOV to Steering Column	mm	2670	2665	5
17	Center of Steering Column to “A” Post	mm	377	361	16
18	Center of Steering Column to Headliner	mm	421	403	18
19	RSOV to Right Side of Front Bumper	mm	4260	3986	274
20	RSOV to Left Side of Front Bumper	mm	4260	3993	267
21	Length of Engine Block	mm	479	479	0
RD	RSOV to Right Side of Dash Panel	mm	2870	2884	-14
CD	RSOV to Center of Dash Panel	mm	2912	2910	2
LD	RSOV to Left Side of Dash Panel	mm	2870	2868	2

DATA SHEET NO. 13

ACCIDENT INVESTIGATION DIVISION DATA

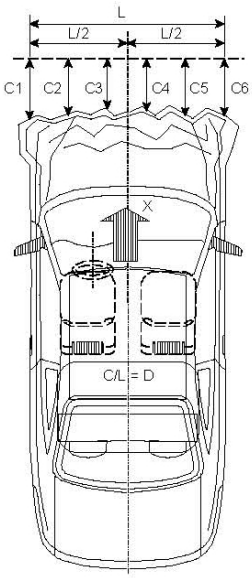
Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

VEHICLE INFORMATION

VIN: KNAFT4A21B5888933 Wheelbase (mm): 2653
Vehicle Size Category: Sedan Test Weight (kg): 1480.0

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal Linearity: > 99%
Impact Velocity (km/h): 56.3
Velocity Change (km/h): 63.5
Time of Separation (msec): 85.1



CRUSH PROFILE

Collision Deformation Classification: Frontal
Midpoint of Damage: Centerline
Damage Region Length (mm): 1514
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4260	3993	267
C2	Crush zone 2 at left side	mm	4397	3995	402
C3	Crush zone 3 at left side	mm	4465	4021	444
C4	Crush zone 4 at right side	mm	4465	4023	442
C5	Crush zone 5 at right side	mm	4397	3998	399
C6	Crush zone 6 at right side	mm	4260	3986	274
L	C1 TO C6	mm	1514	1486	28

DATA SHEET NO. 14

VEHICLE INTRUSION MEASUREMENTS

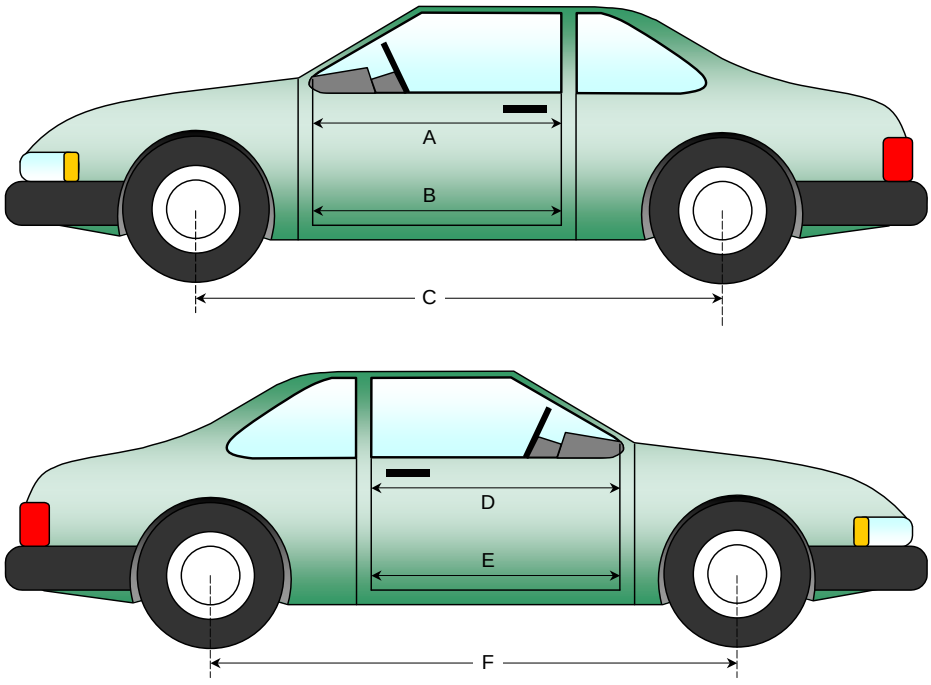
Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0511
Test Date: 1/03/2011

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	985	983	2
B	Left Side Lower	mm	920	920	0
D	Right Side Upper	mm	985	985	0
E	Right Side Lower	mm	920	922	-2

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2653	2576	77
F	Right Side Wheelbase	mm	2653	2586	67



DATA SHEET NO. 14 (CONTINUED)

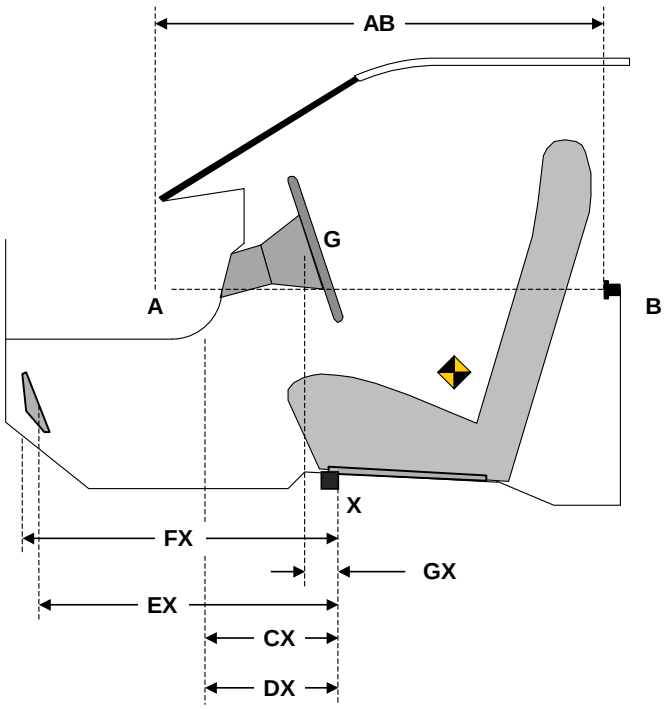
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: MB0511
Test Date: 1/03/2011

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	815	815	0
CX	Left Knee Bolster to X	mm	304	305	-1
DX	Right Knee Bolster to X	mm	272	273	-1
EX	Brake Pedal to X	mm	580	508	72
FX	Foot Rest to X	mm	572	556	16
GX	Center of Steering Column Wheel Hub to X	mm	82	76	6

X = Front of Seat Track (stationary)

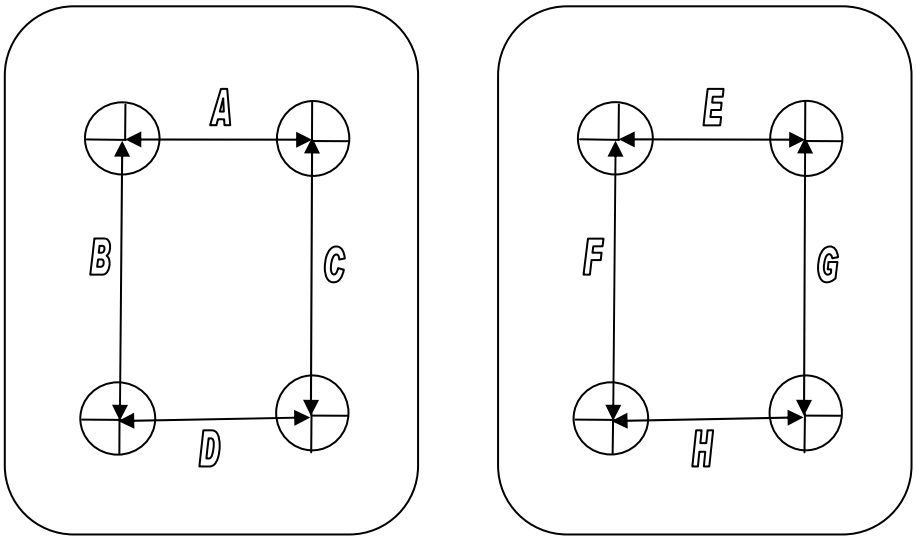


DRIVER COMPARTMENT

DATA SHEET NO. 14 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011



Driver Passenger

TOP VIEW THROUGH FLOOR PAN

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Units	Pre-Test	Post-Test	Difference
A	mm	429	391	38
B	mm	429	414	15
C	mm	429	392	37
D	mm	429	412	17
E	mm	429	408	21
F	mm	429	388	41
G	mm	429	410	19
H	mm	429	412	17

DATA SHEET NO. 15

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

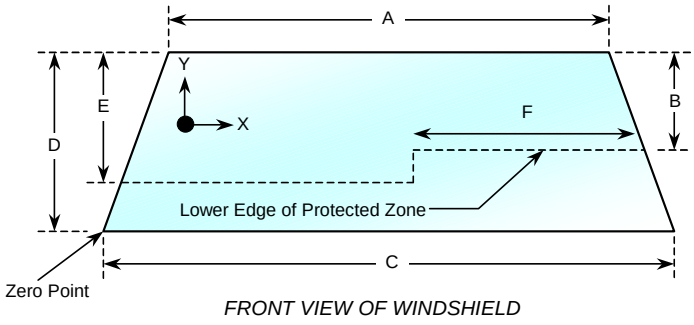
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2137	2137	100
Right Side	2137	2137	100
Total	4274	4274	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1156
B	mm	570
C	mm	1444
D	mm	837
E	mm	568
F	mm	510

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 NO. 15 (CONTINUED)

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle:	2011 Kia Forte LX 4-Dr Sedan	NHTSA No.:	MB0511
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	1/03/2011

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Test Time: 11:21 pm Temperature: 21° C

A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

B. For the 5 minute period after motion ceases: None
(Maximum allowable = 5 ounces)

C. For the following 25 minutes: None
(Maximum allowable = 1 oz./minute)

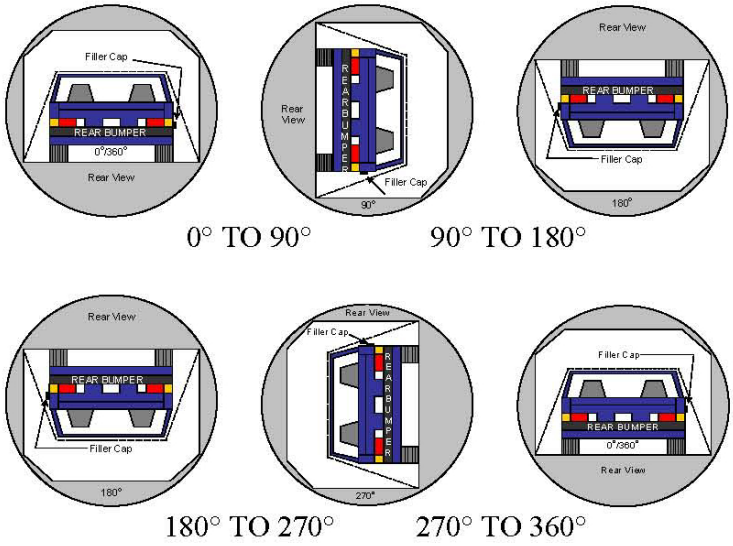
D. Spillage Details: None

DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011

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: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	117	300	417
90° to 180°	110	300	410
180° to 270°	104	300	404
270° to 360°	115	300	415

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

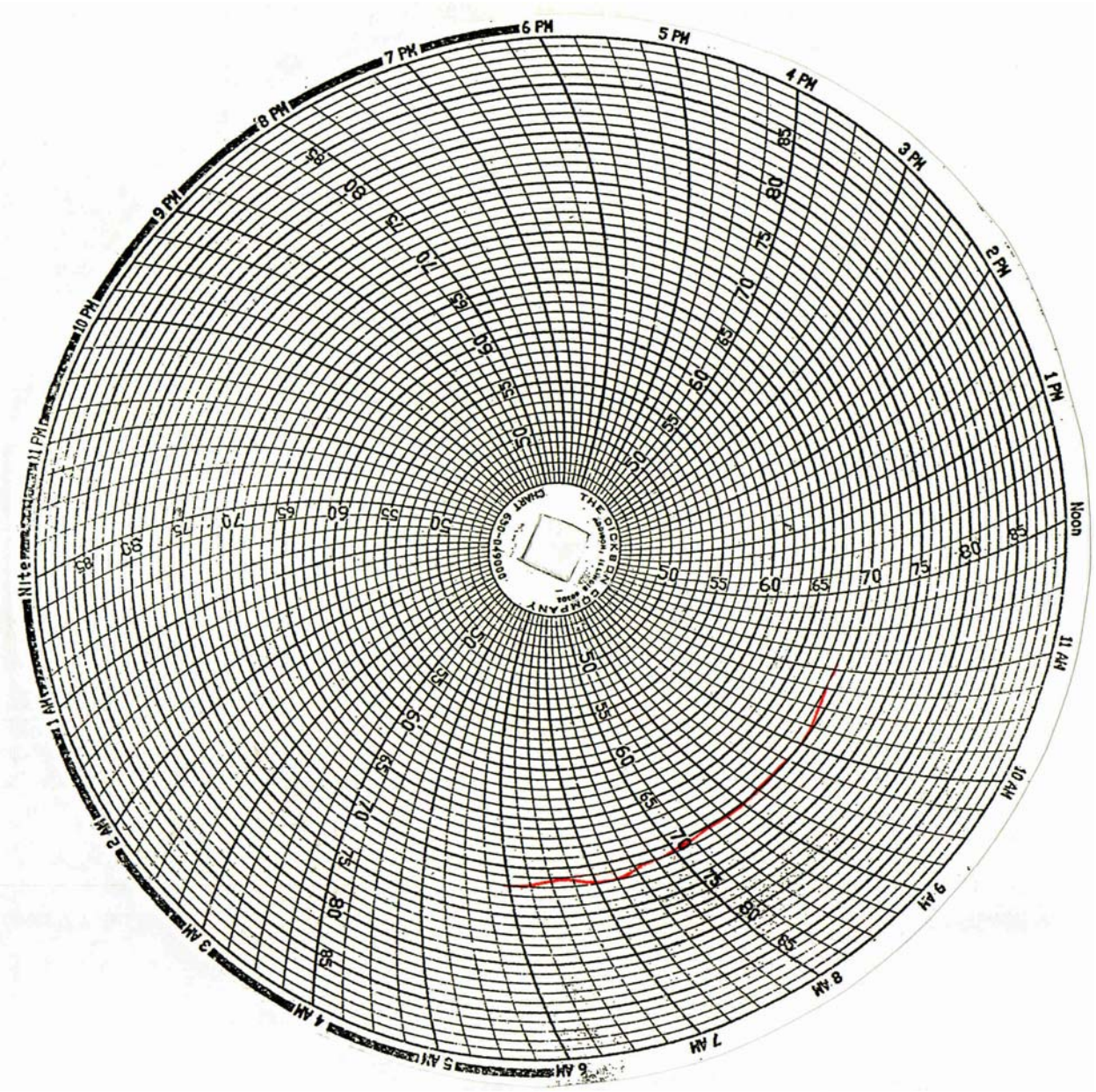
ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

DATA SHEET NO. 17

DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

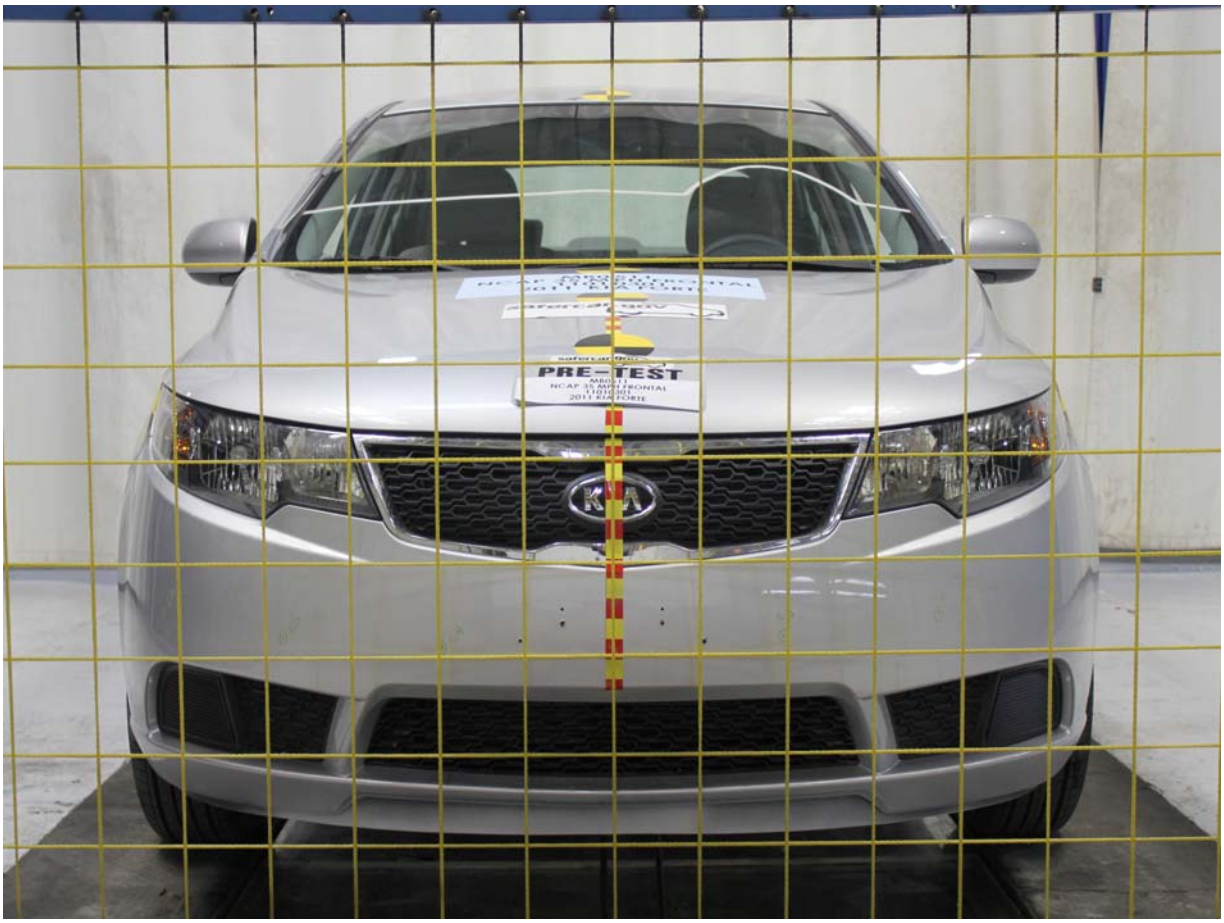
Test Vehicle: 2011 Kia Forte LX 4-Dr Sedan NHTSA No.: MB0511
Test Program: NCAP Frontal Barrier Impact Test Test Date: 1/03/2011



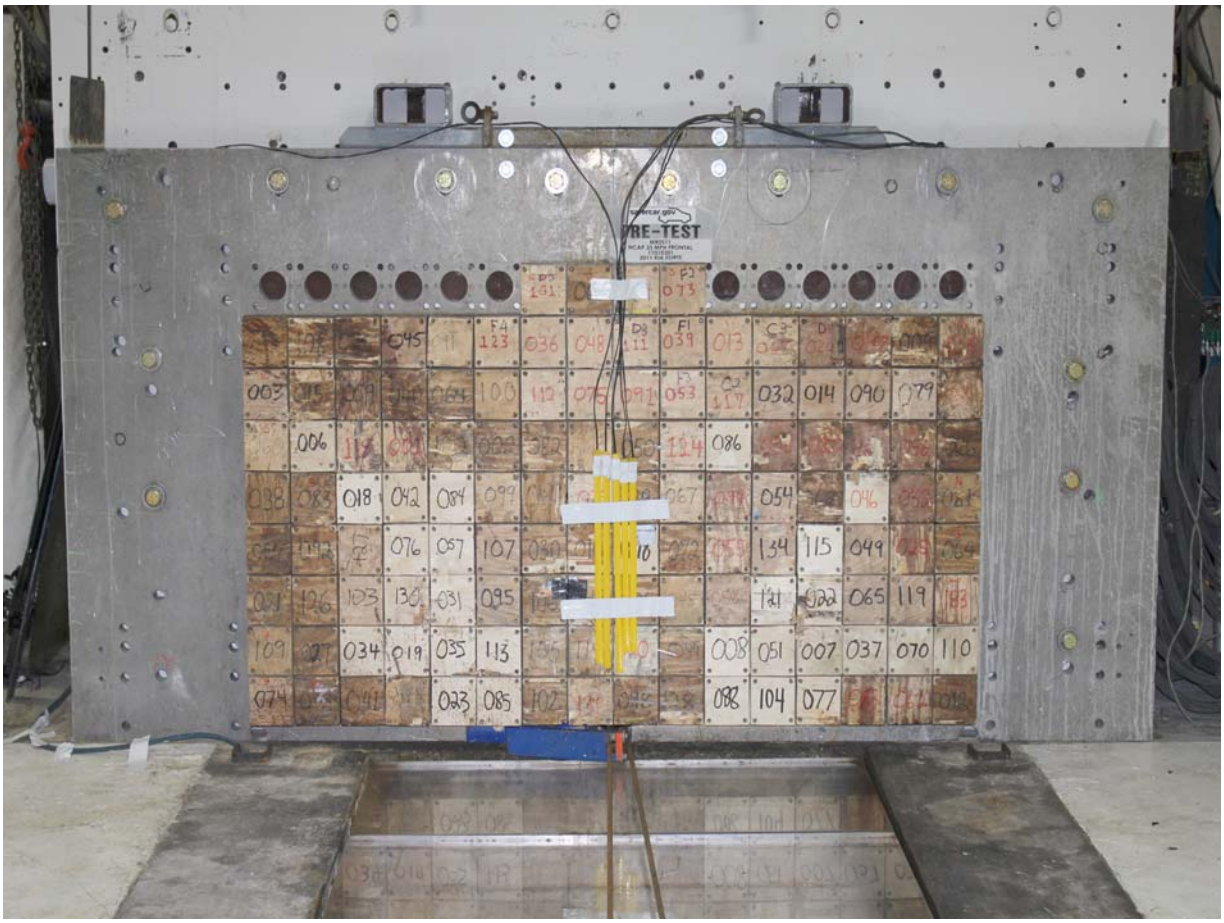
APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS



Load Cell Location



Load Cell Wall

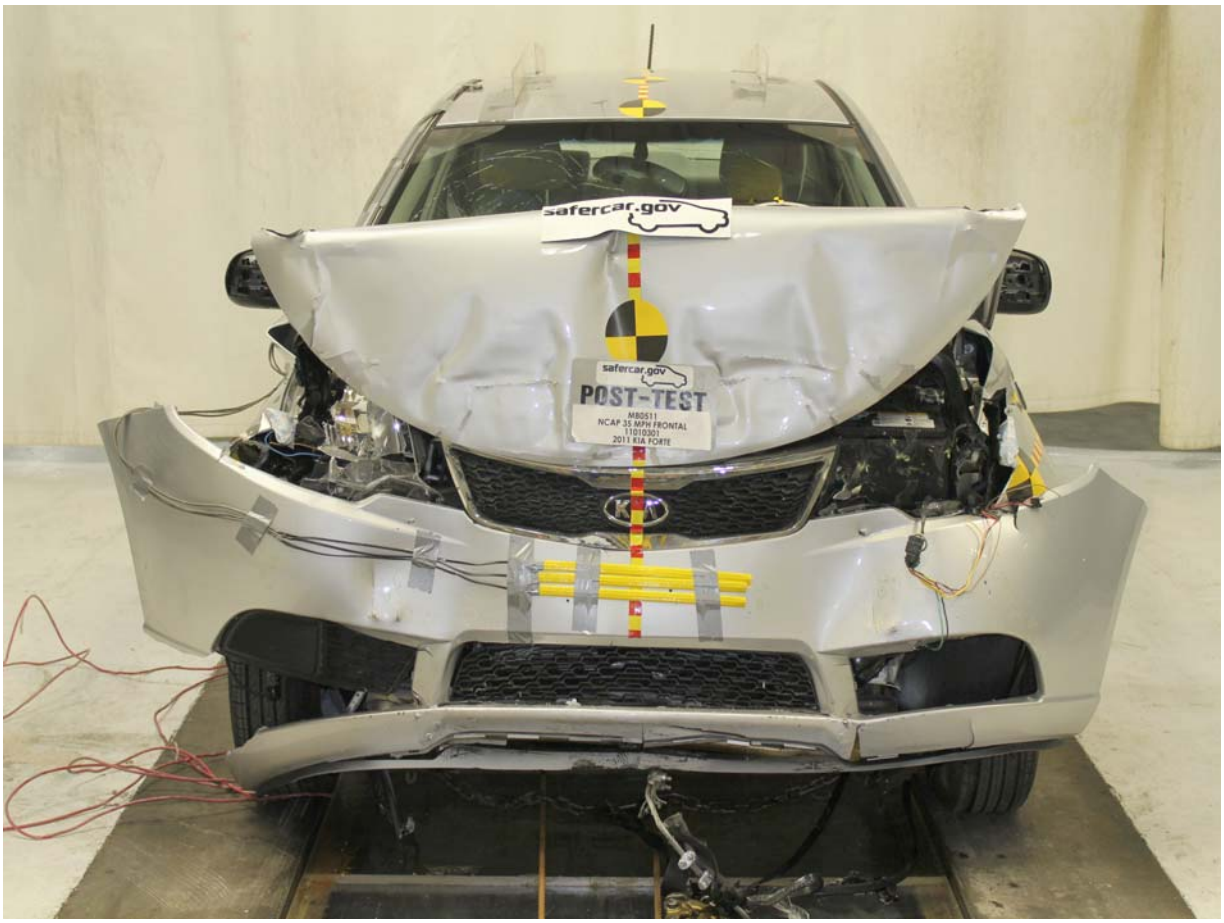
Manufacturer's Label

Tire Placard

Right Front Three-Quarter View, As Received

Left Rear Three-Quarter View, As Received

Pre-Test Front View



Post-Test Front View

Pre-Test Left Side View (with vehicle at barrier)

Post-Test Left Side View

Pre-Test Right Side View (with vehicle at barrier)

Post-Test Right Side View

Pre-Test Right Front Three-Quarter View

Post-Test Right Front Three-Quarter View

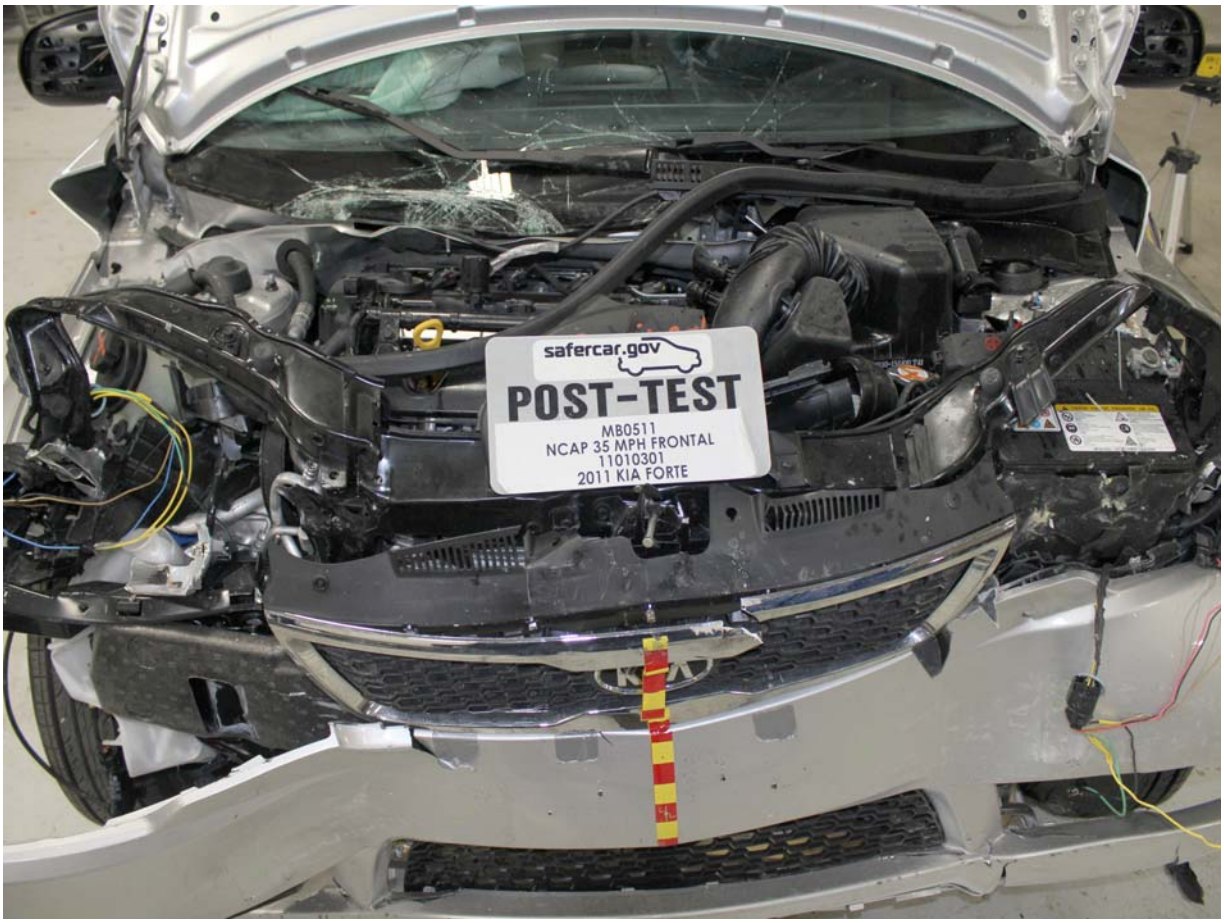
Pre-Test Left Rear Three-Quarter View (with vehicle at barrier)

Post-Test Left Rear Three-Quarter View

Pre-Test Windshield View

Post-Test Windshield View

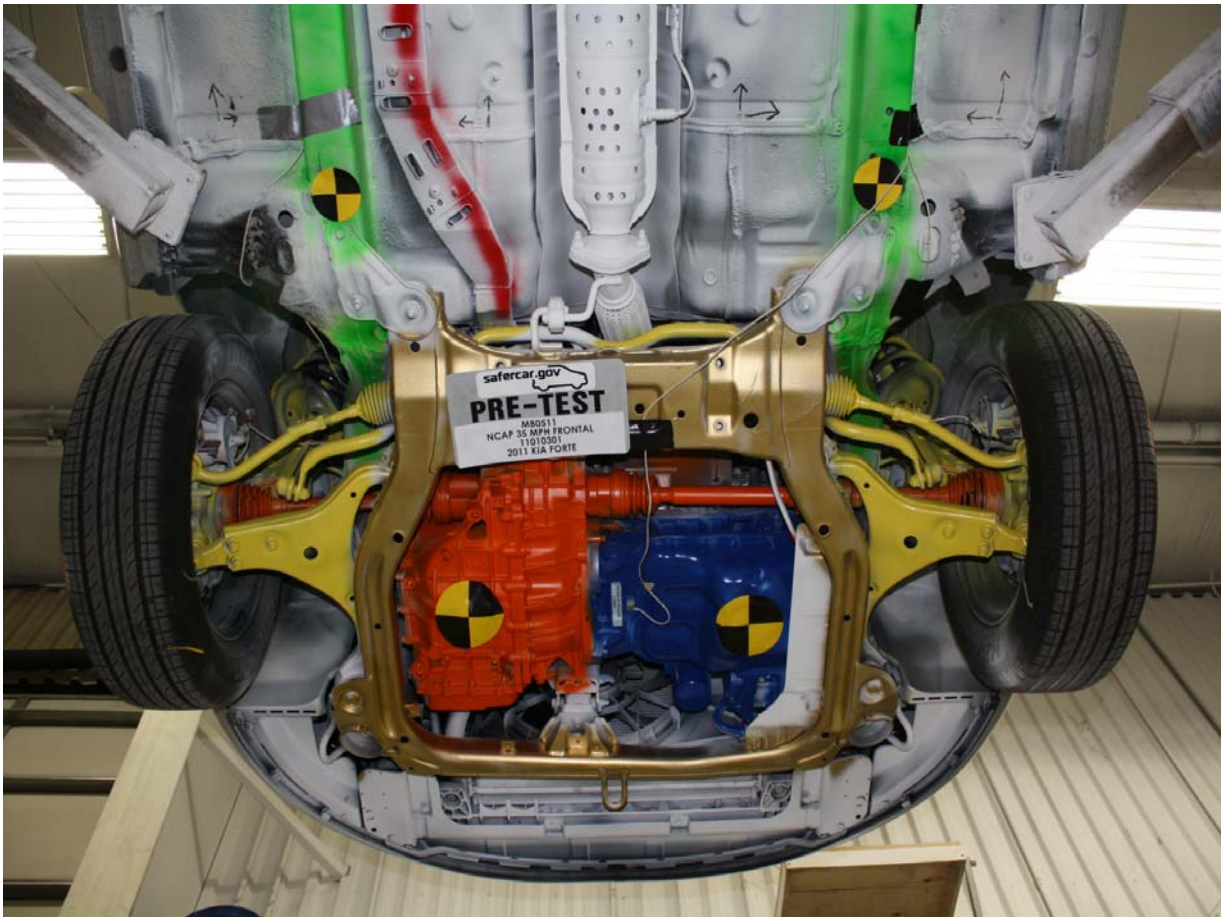
Pre-Test Engine Compartment View



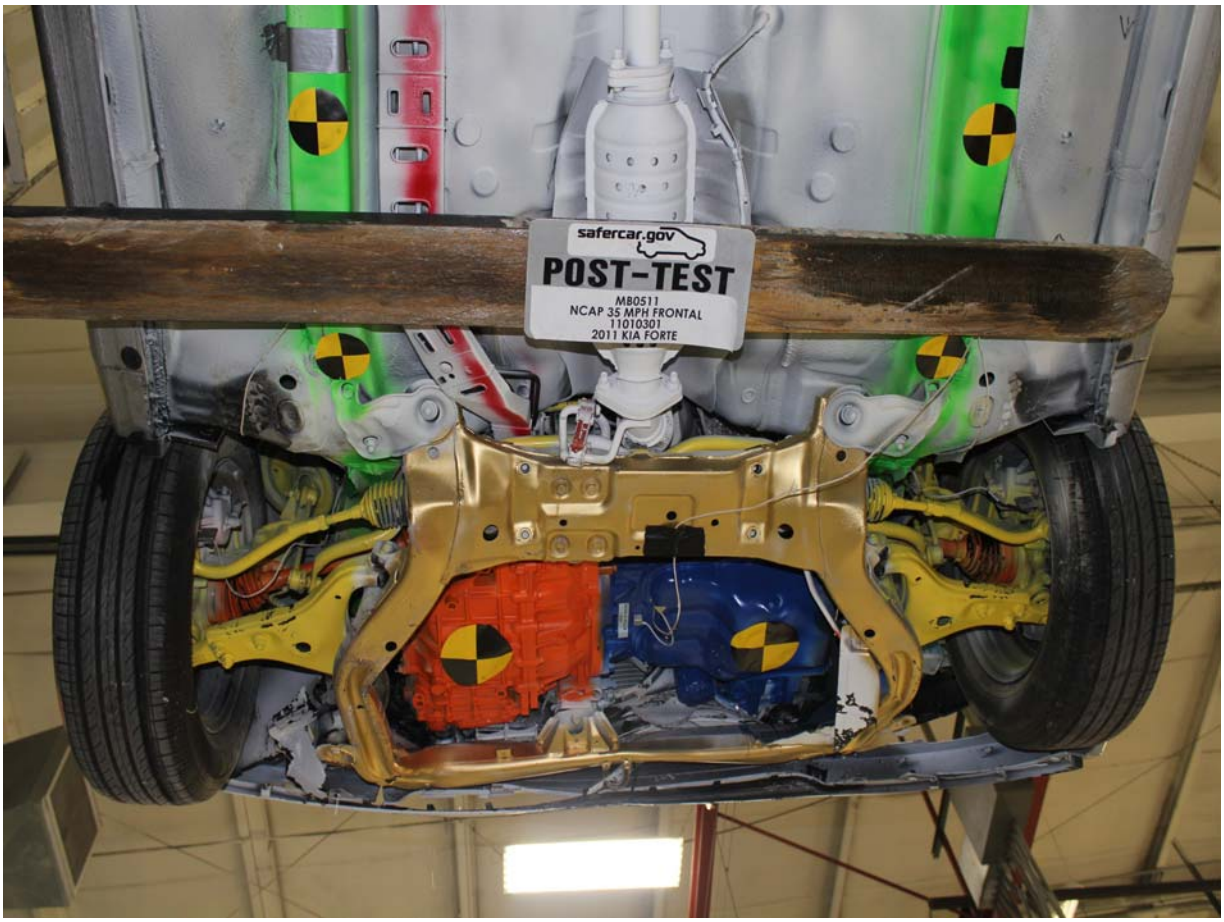
Post-Test Engine Compartment View

Pre-Test Fuel Cap View

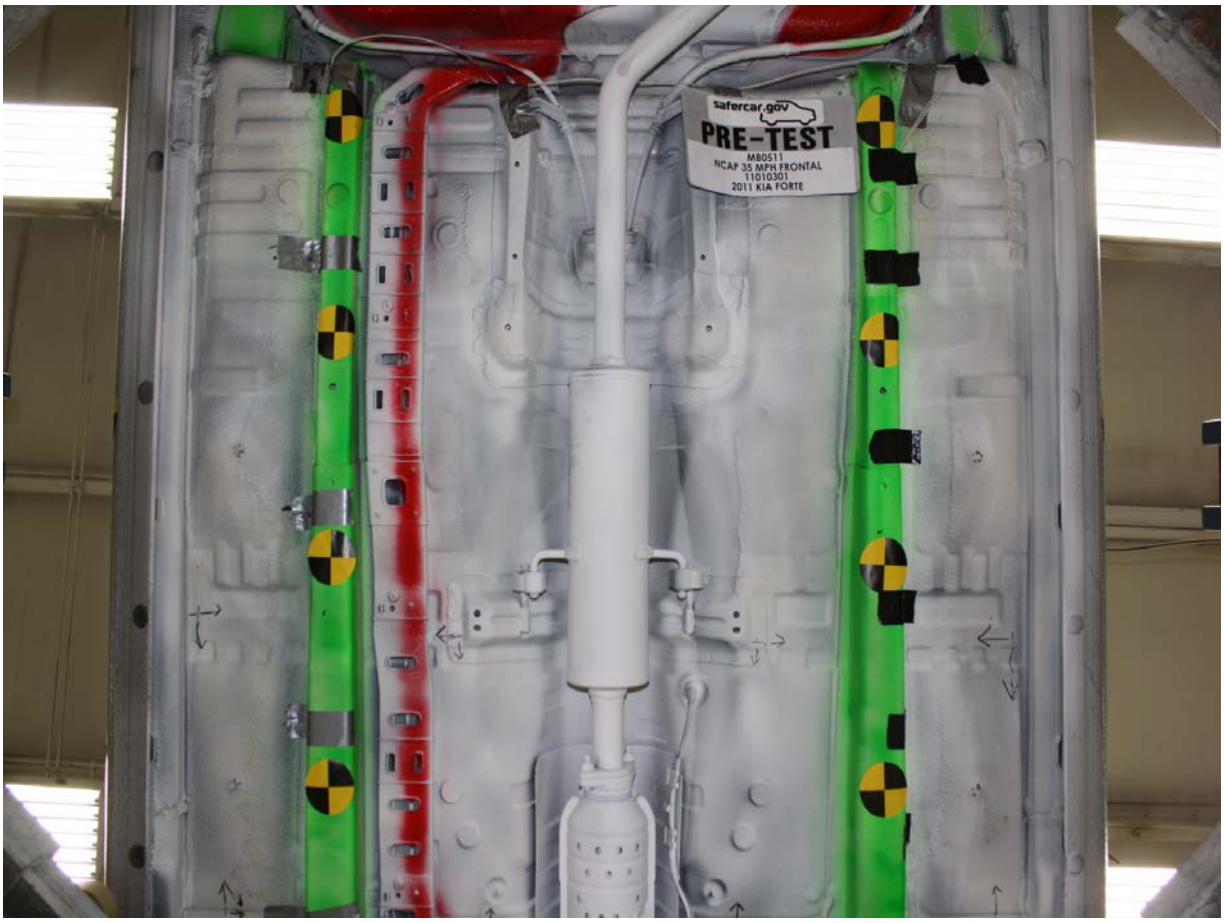
Post-Test Fuel Cap View



Pre-Test Front Underbody View

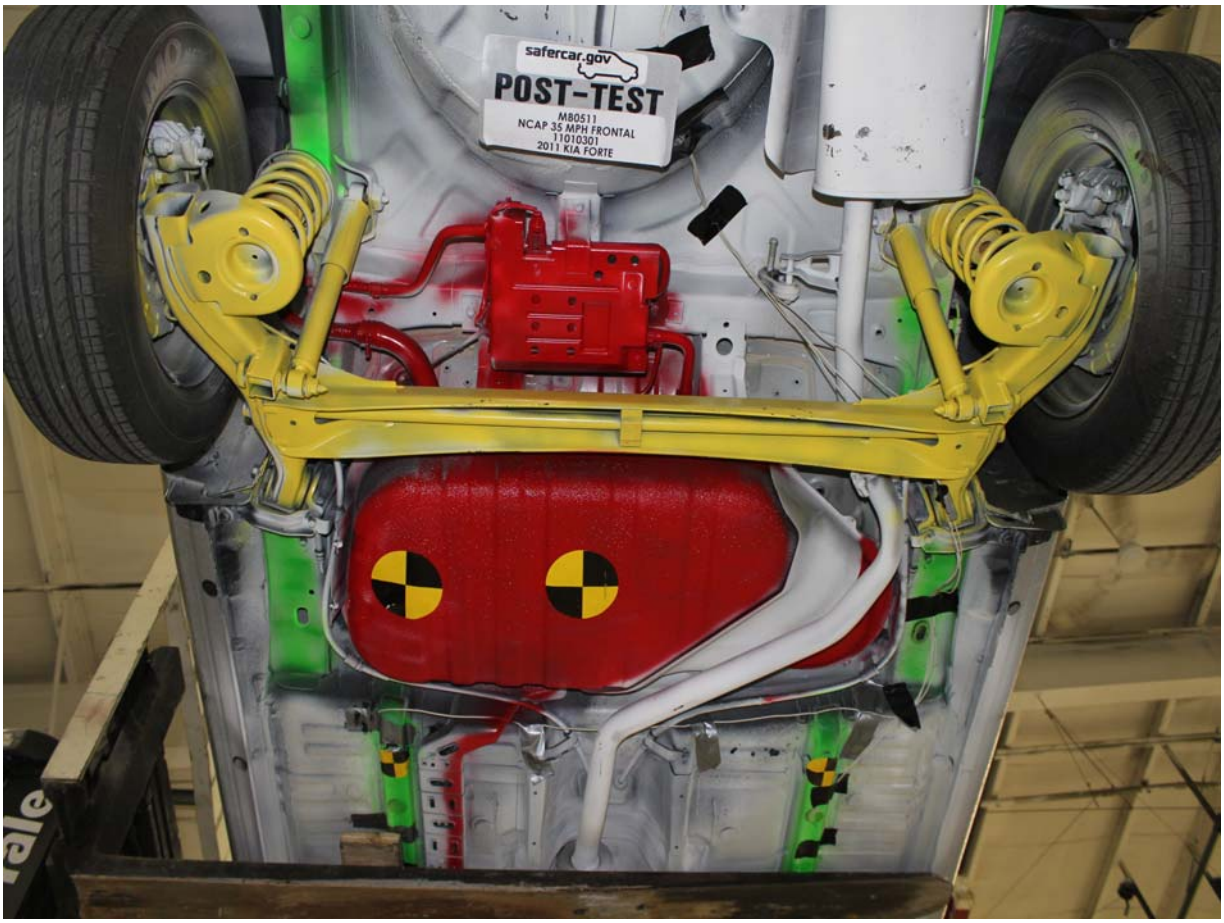


Post-Test Front Underbody View



Pre-Test Mid Underbody View

Post-Test Mid Front Underbody View



Post-Test Mid Rear Underbody View

Pre-Test Rear Underbody View

Post-Test Rear Underbody View

Pre-Test Dummy Cable Routing

Post-Test Dummy Cable Routing

Pre-Test Driver Dummy Front View

Post-Test Driver Dummy Front View

Pre-Test Driver Dummy Window View

Post-Test Driver Dummy Window View

Pre-Test Driver Dummy and Vehicle Interior (Door Open)

Post-Test Driver Dummy and Vehicle Interior (Door Open)

Pre-Test Driver's Seat Fore-Aft Markings

Post-Test Driver's Seat Fore-Aft Markings

Pre-Test Driver Dummy Feet

Post-Test Driver Dummy Feet

Pre-Test Driver's Side Knee Bolster (without dummy)

Post-Test Driver's Side Knee Bolster (without dummy)

PHOTOGRAPH NOT AVAILABLE

Pre-Test Driver's Side Floorpan

Post-Test Driver's Side Floorpan

Post-Test Driver Dummy Contact with Airbag

Post-Test Driver Dummy Contact with Headrest

Post-Test Driver Dummy Contact with Knee Bolster

Pre-Test View of Steering Column Shear Capsule

Post-Test View of Steering Column Shear Capsule

Pre-Test Passenger Dummy Front View

Post-Test Passenger Dummy Front View

Pre-Test Passenger Dummy Window View

Post-Test Passenger Dummy Window View

Pre-Test Passenger Dummy and Vehicle Interior (Door Open)

Post-Test Passenger Dummy and Vehicle Interior (Door Open)

Pre-Test Passenger's Seat Fore-Aft Markings

Post-Test Passenger's Seat Fore-Aft Markings

Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

Pre-Test Passenger's Side Knee Bolster (without dummy)

Post-Test Passenger's Side Knee Bolster (without dummy)

PHOTOGRAPH NOT AVAILABLE

Pre-Test Passenger's Side Floorpan

Post-Test Passenger's Side Floorpan

Post-Test Passenger Dummy Contact with Airbag

Post-Test Passenger Dummy Contact with Headrest

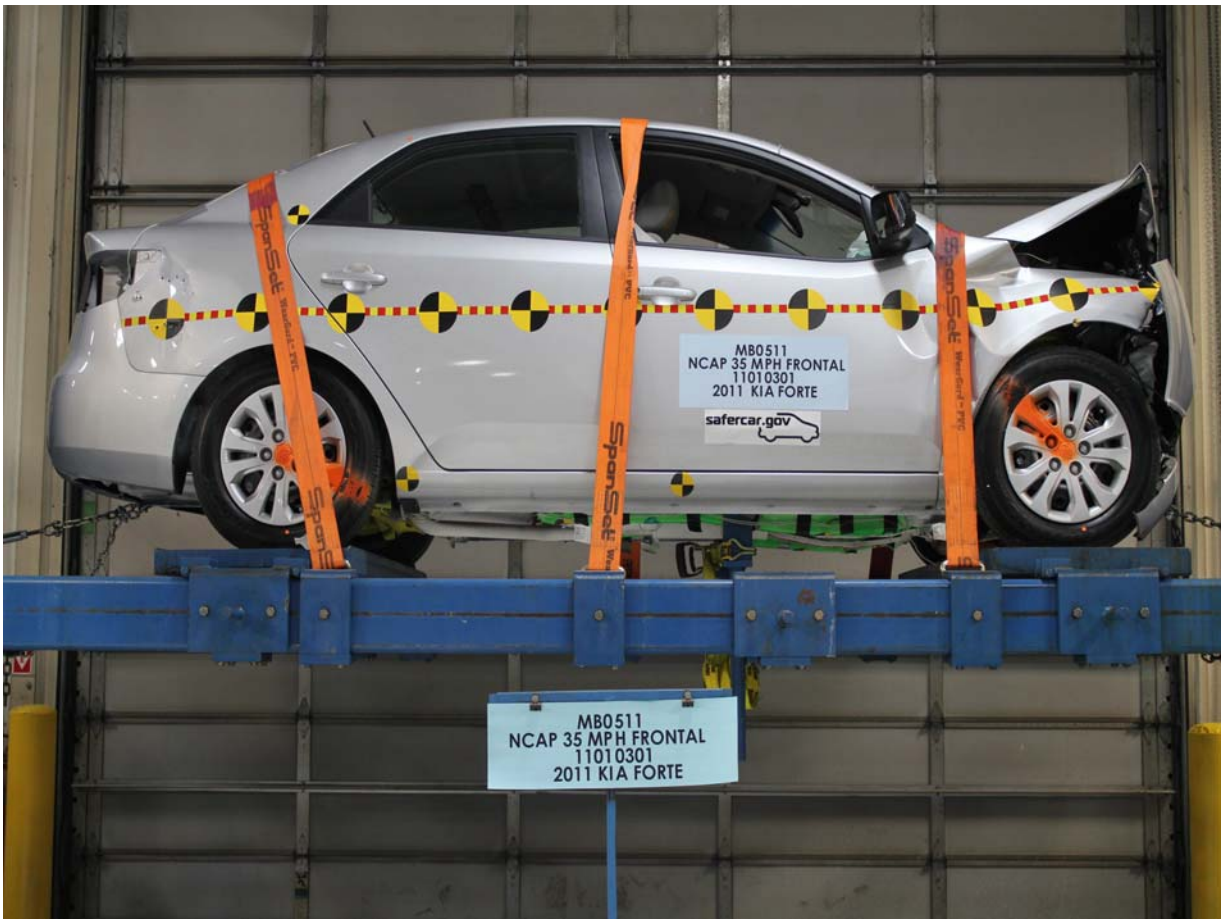
Post-Test Passenger Dummy Contact with Knee Bolster

Ballast Installed in Vehicle

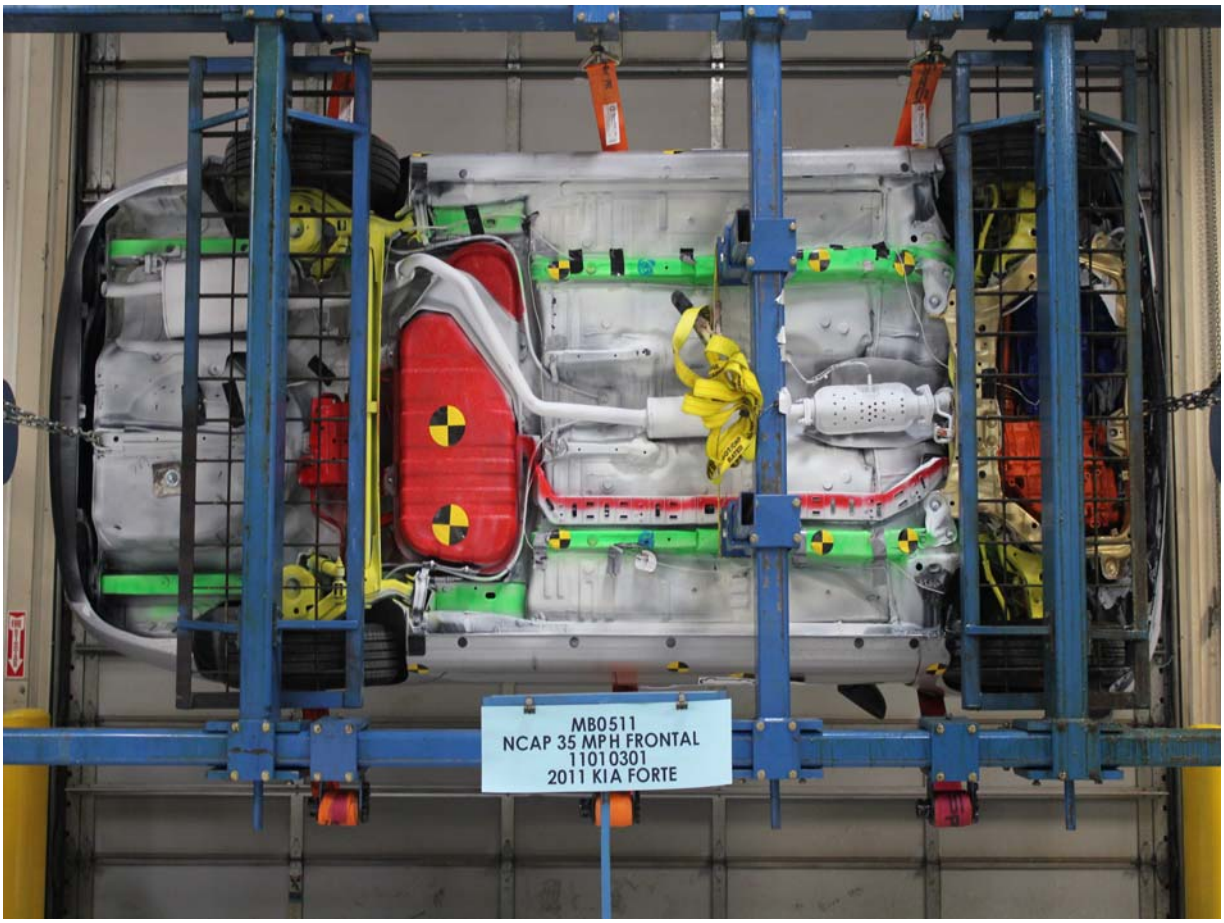
PHOTOGRAPH NOT APPLICABLE

Post-Test Stoddard Solvent Spillage Location View

Post-Test Speed Trap Read-Out



Vehicle at 0 Degrees on Static Rollover Device



Vehicle at 90 Degrees on Static Rollover Device

Vehicle at 180 Degrees on Static Rollover Device

Vehicle at 270 Degrees on Static Rollover Device

Vehicle at 360 Degrees on Static Rollover Device

Vehicle Impact

Monroney Label

A-40

2011	C 422	KIA FORTE LX
MODEL YEAR	MODEL	MODEL DESCRIPTION

BRIGHT SILVER/STONE
EXTERIOR / INTERIOR COLOR

KNAFT4A21B5888933	G4KDAH62
VEHICLE NUMBER	ENGINE NUMBER

TACOMA	TRUCK
PORT OF ENTRY	MODE OF TRANSPORTATION

SOLD TO:
WI001
ROSEN KIA
5575 SOUTH 27TH STREET
5505 SOUTH 27TH STREET
MILWAUKEE WI 53221

SHIP TO:
WI001

STANDARD FEATURES

MECHANICAL
2.0L 16-Valve DOHC CVVT 4-Cylinder Engine
6-Speed Automatic Transmission
Front Stabilizer Bar and Monotube Shock Absorbers
15" Steel Wheels with Wheel Covers
Front and Rear Disc Brakes
SAFETY
Anti-Lock Brake System (ABS) w/Brake Assist (BAS)
Electronic Brake-force Distribution (EBD)
Electronic Stability Control (ESC)
Traction Control System (TCS)
Dual Front Advanced Airbags
Front Seat-Mounted Side Airbags
Full-Length Side Curtain Airbags
Front Active Headrests
Tire Pressure Monitoring System (TPMS)
Lower Anchors and Tethers for Children (LATCH)
INTERIOR
Air Conditioning, Tinted Solar Glass
AM/FM/CD/MP3 Audio w/4 Speakers
SIRIUS Satellite Radio w/a 3-month complimentary subscription included**
BLUETOOTH Wireless Technology
USB & Auxiliary Input Jacks
60/40 Split Folding Rear Seats w/Center Armrest
Center Console w/ Armrest and Storage Bin
Dual Remote Mirrors, Visor Vanity Mirrors
Dual 12v Power Outlets
Remote Fuel Door, Trunk and Hood Releases
Tilt Steering Column
ECOMINDER™ Indicator
EXTERIOR
Variable Intermittent Windshield Wipers
Body Color Outside Mirrors
Body Color Door Handles
WARRANTY
10 YEARS/100,000 MILES
LIMITED POWERTRAIN WARRANTY
5 YEARS/60,000 MILES
24-HOUR ROADSIDE ASSISTANCE
**Ask dealer for details

MANUFACTURER'S SUGGESTED RETAIL PRICE ➤	$15,995.00
ADDITIONAL INSTALLED EQUIPMENT:	
(In addition to or in place of standard features)	
Carpeted Floor Mats	$85.00
Cargo Net	$40.00
EC Mirror w/ Compass	$180.00
K8616	
Need Books	
MSRP INCLUDING OPTIONS	$16,310.00
INLAND FREIGHT AND HANDLING	$695.00
TOTAL MANUFACTURER'S SUGGESTED RETAIL PRICE ➤	$17,005.00

Manufacturer's suggested retail price includes manufacturer's recommended dealer delivery service. License and title fees, state and local taxes and other dealer installed options and accessories are not included in the manufacturer's suggested retail price.

EPA Fuel Economy Estimates

These estimates reflect new EPA methods beginning with 2008 models.

CITY MPG
26
Expected range for most drivers
21 to **31** MPG

Estimated Annual Fuel Cost
$1553.00
based on 15,000 miles at $3.00 per gallon

HIGHWAY MPG
36
Expected range for most drivers
29 to **43** MPG

Combined Fuel Economy
This Vehicle
10 — **29** — 39
ALL MIDSIZE CARS

Your actual mileage will vary depending on how you drive and maintain your vehicle.

See the FREE Fuel Economy Guide at dealers or www.fueleconomy.gov

GOVERNMENT SAFETY RATINGS

Frontal Crash — Driver ★★★★★ Passenger ★★★★★
Star ratings based on the risk of injury in a frontal impact.
Frontal ratings should ONLY be compared to other vehicles of similar size and weight

Side Crash — Front seat ★★★★★ Rear seat ★★★★
Star ratings based on the risk of injury in a side impact.

Rollover ★★★★
Star ratings based on the risk of rollover in a single vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.

Source: National Highway Traffic Safety Administration (NHTSA).

www.safercar.gov or 1-888-327-4236

Environmental Performance

Protect the environment, choose vehicles with **higher scores:**

Global Warming Score
8
1 — Average new vehicle — 10 Cleanest

Smog Score
5
1 — Average new vehicle — 10 Cleanest

Using alternative fuels may improve scores. See www.DriveClean.ca.gov

Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle's measured emissions. Please visit www.DriveClean.ca.gov for more information. California Environmental Protection Agency AIR RESOURCES BOARD

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CAR LINE U.S./CANADIAN PARTS CONTENT: 3%

MAJOR SOURCES OF FOREIGN PARTS:
KOREA: 91%

NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE FINAL ASSEMBLY POINT:
KOREA

COUNTRY OF ORIGIN
ENGINE : KOREA
TRANSMISSION : KOREA

APPENDIX B

DUMMY RESPONSE DATA

TABLE OF DATA PLOTS

The following dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Left Femur Redundant

Driver Right Femur Redundant

Driver Shoulder Belt Force

Driver Lap Belt Force

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Upper Neck Force Y

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Lap Belt Force

Passenger Shoulder Belt Force – not installed

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Left Rear Seat Crossmember X

Left Rear Seat Crossmember Z

Right Rear Seat Crossmember X

Right Rear Seat Crossmember Z

Vehicle Engine Top X

Vehicle Engine Bottom X

Vehicle Left Brake Caliper X

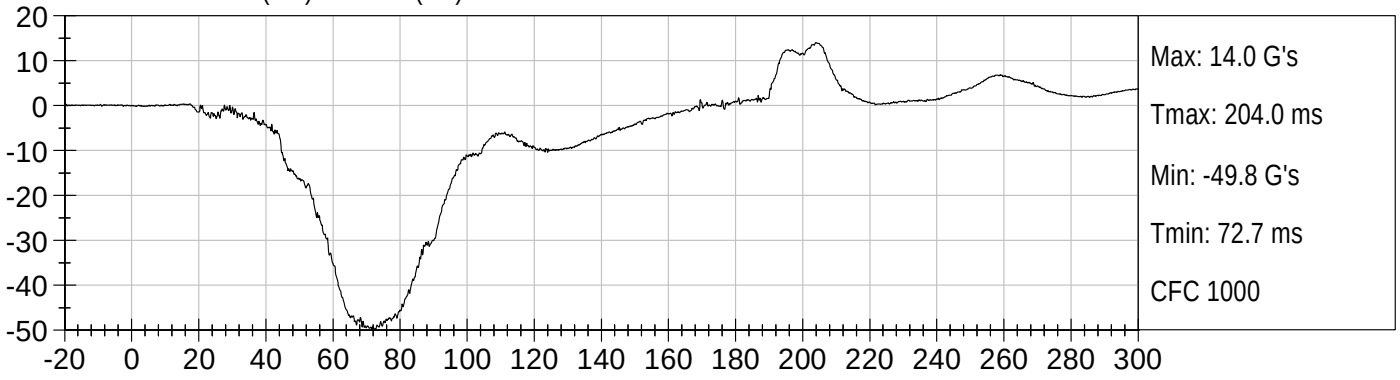
Vehicle Right Brake Caliper X

Advanced Research Load Cell Barrier – 127 channels

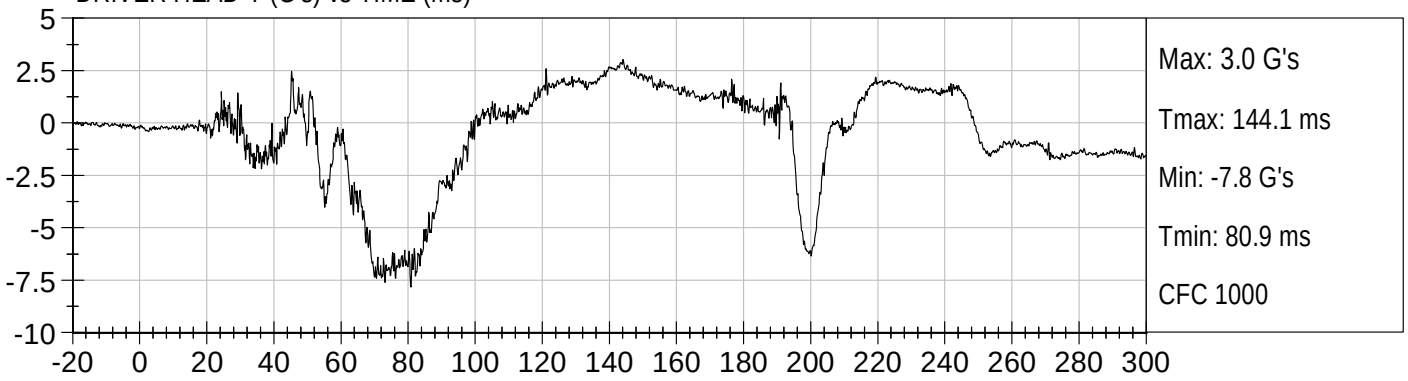
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

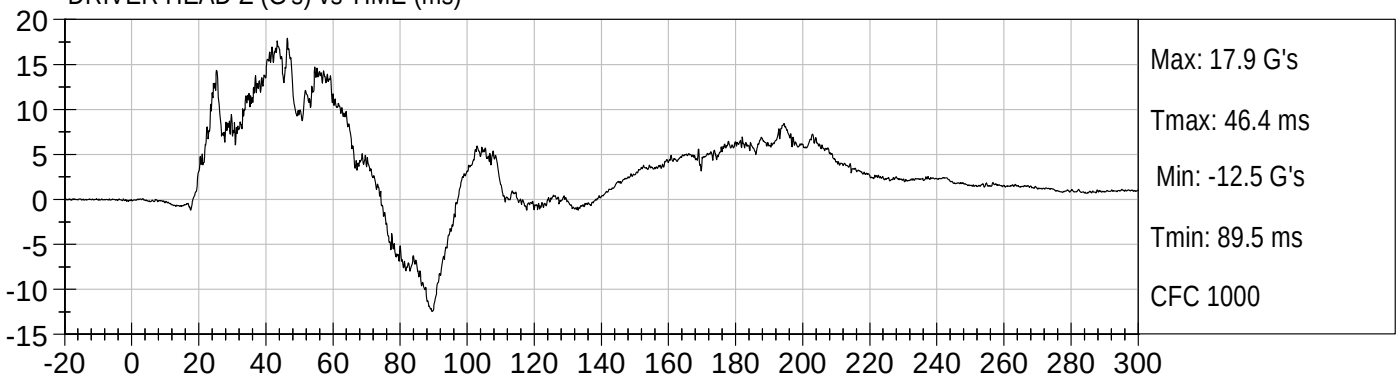
DRIVER HEAD X (G's) vs TIME (ms)



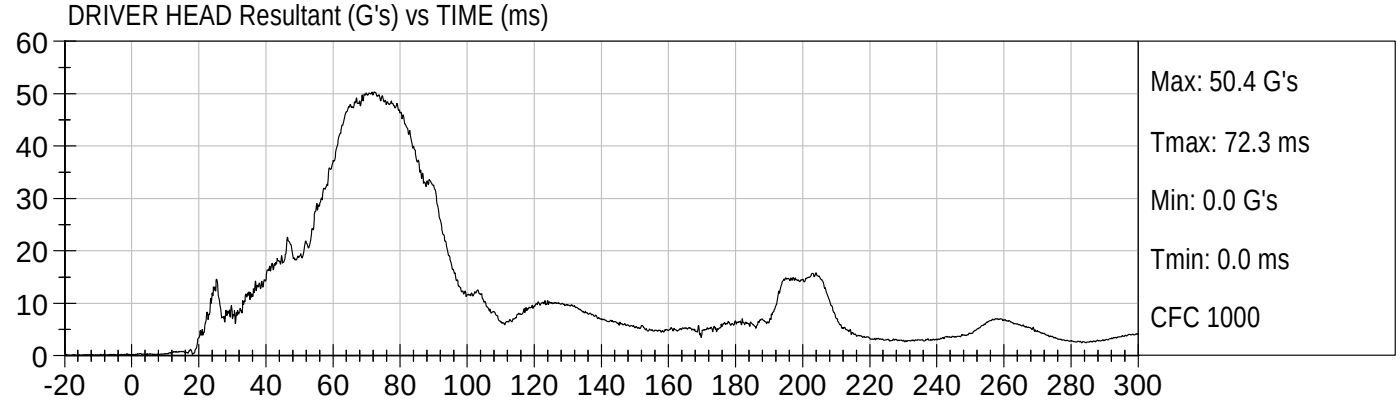
DRIVER HEAD Y (G's) vs TIME (ms)



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



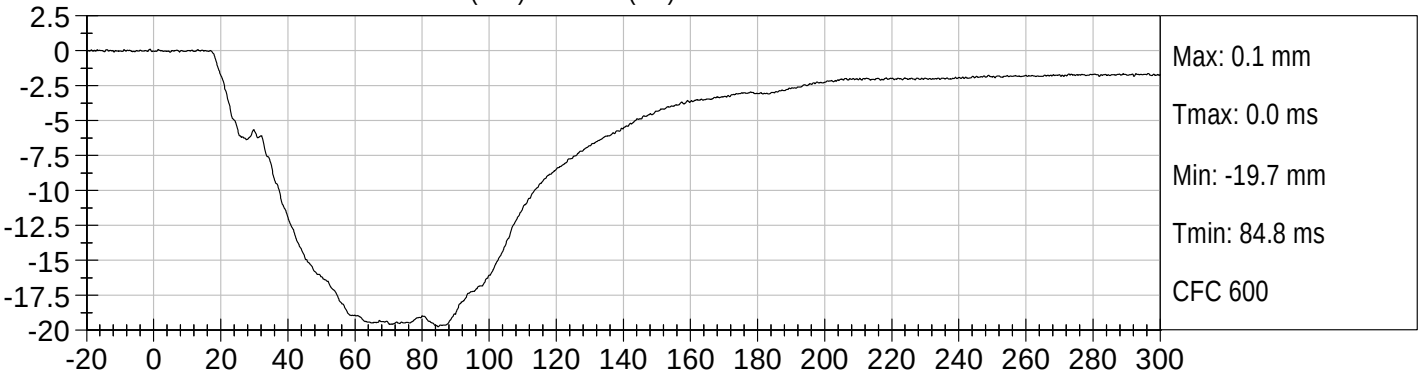
DRIVER HEAD Resultant (G's) vs TIME (ms)



NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

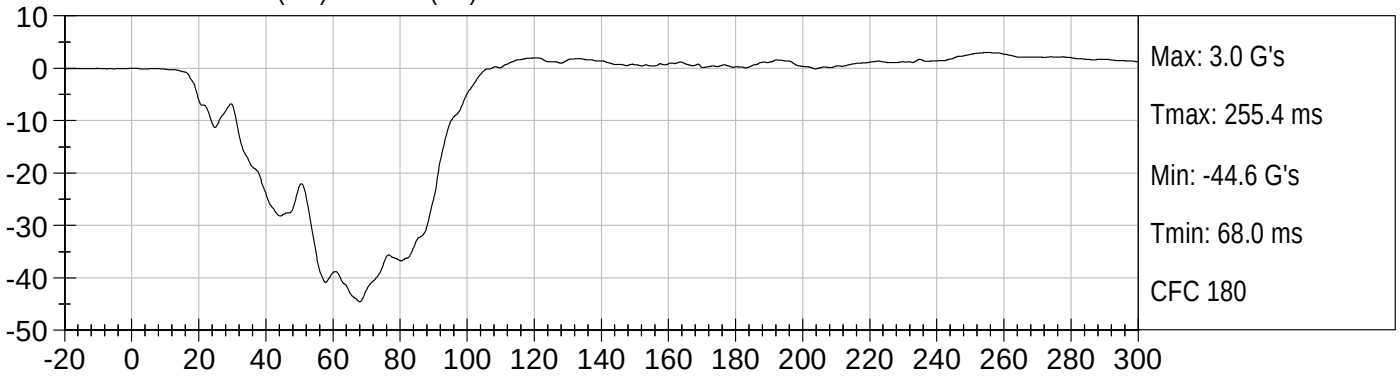
DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)



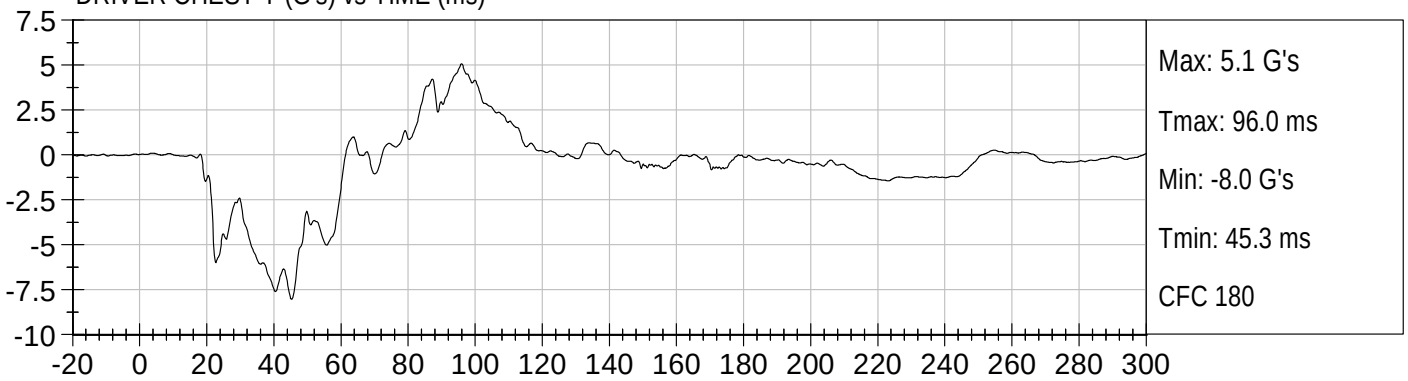
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

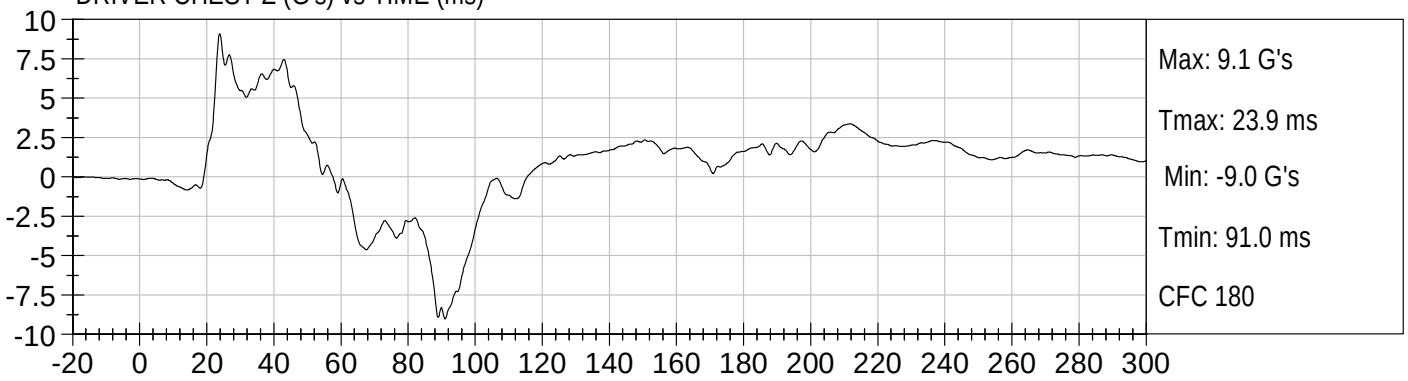
DRIVER CHEST X (G's) vs TIME (ms)



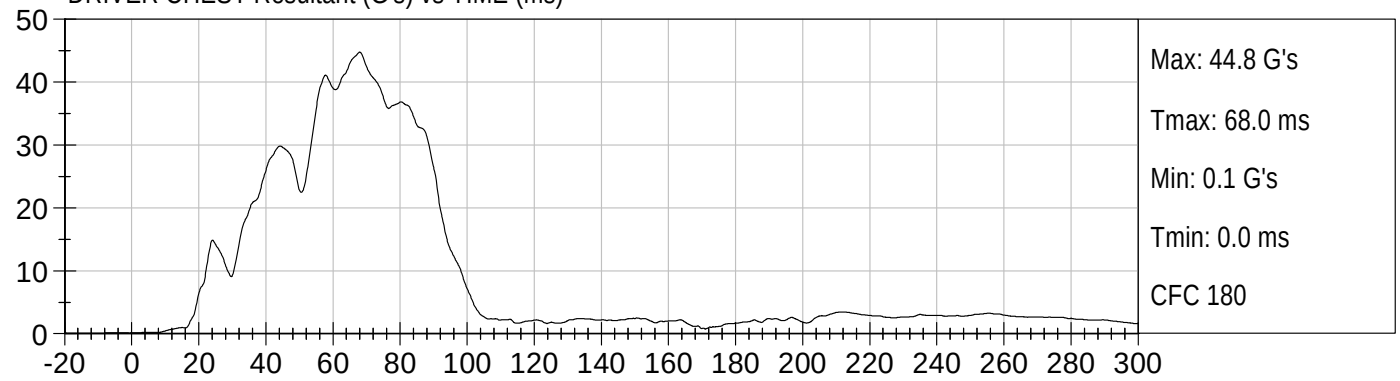
DRIVER CHEST Y (G's) vs TIME (ms)



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



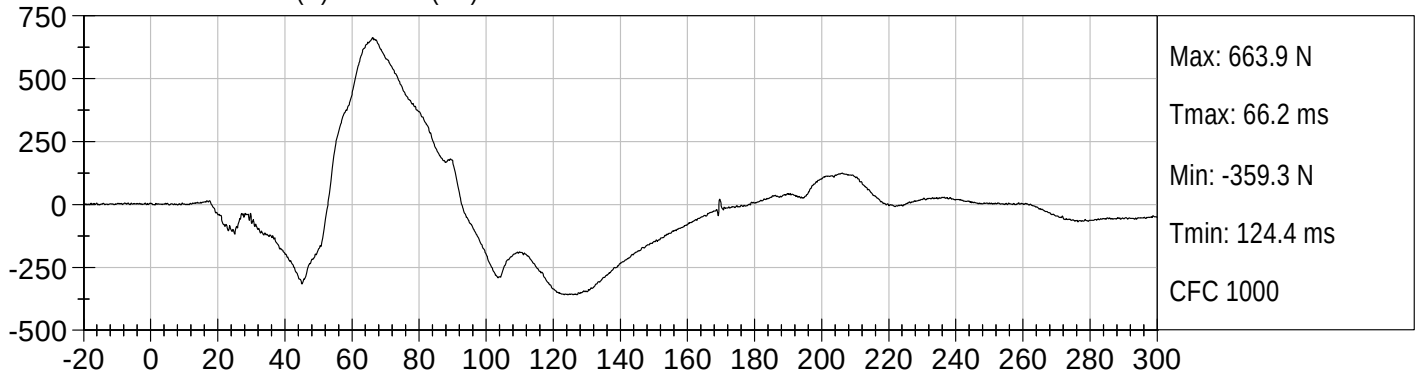
DRIVER CHEST Resultant (G's) vs TIME (ms)



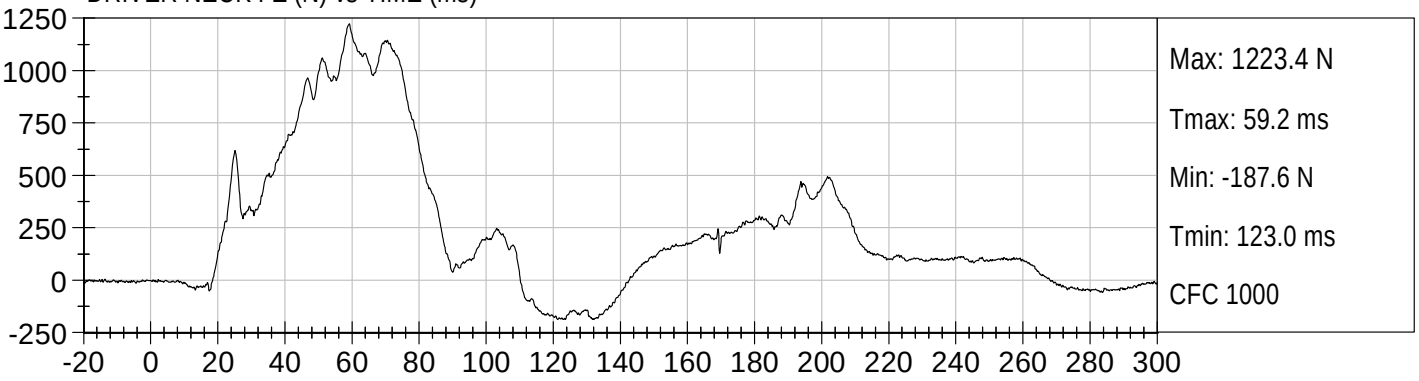
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

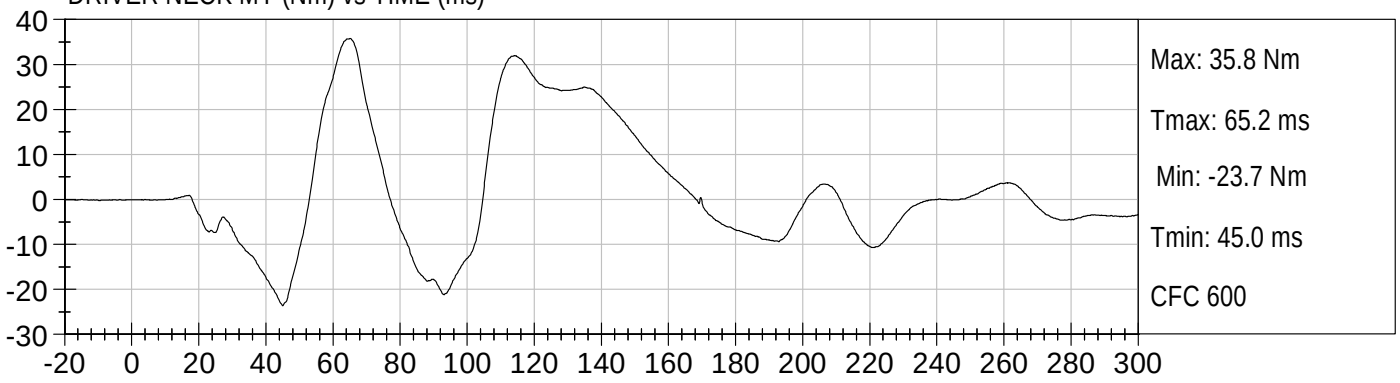
DRIVER NECK FX (N) vs TIME (ms)

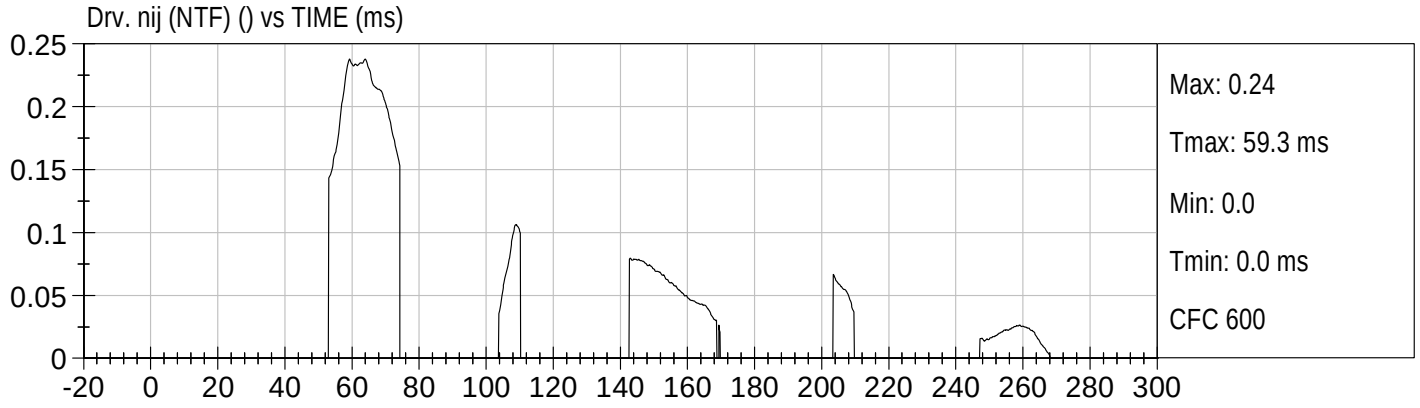


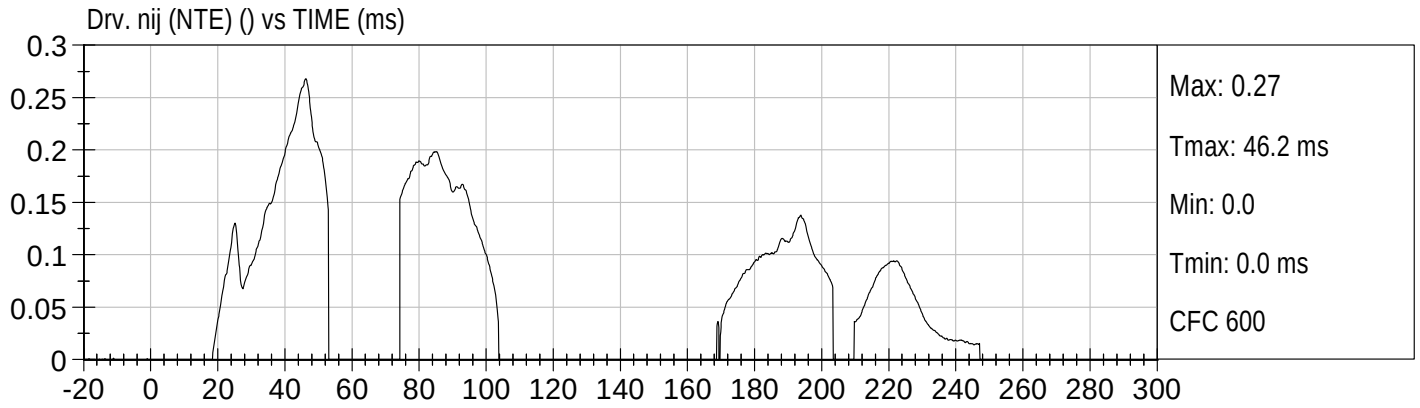
DRIVER NECK FZ (N) vs TIME (ms)

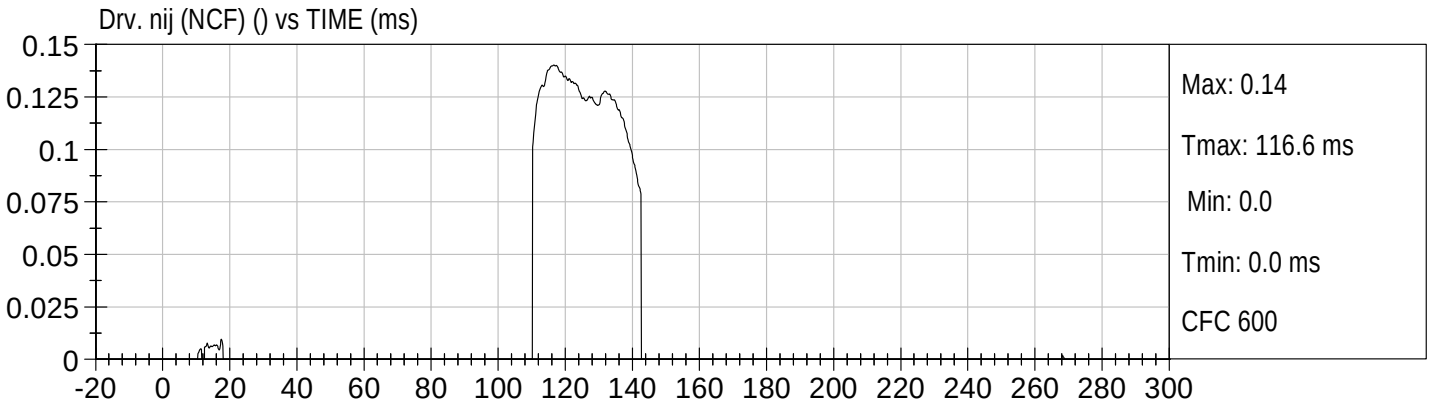


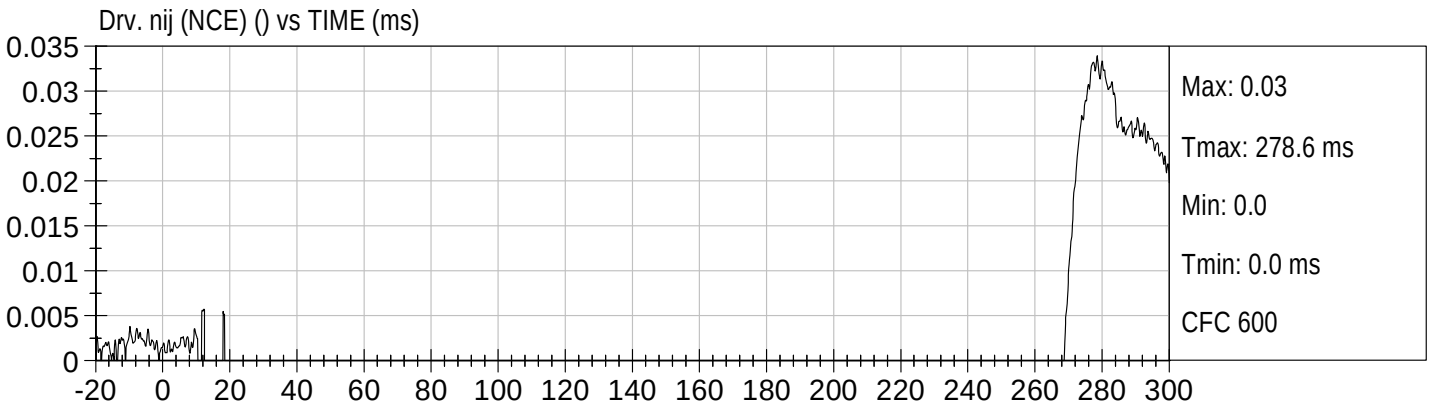
DRIVER NECK MY (Nm) vs TIME (ms)




Drv. nij (NTF) () vs TIME (ms)
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.24
Tmax: 59.3 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600


Drv. nij (NTE) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.27
Tmax: 46.2 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

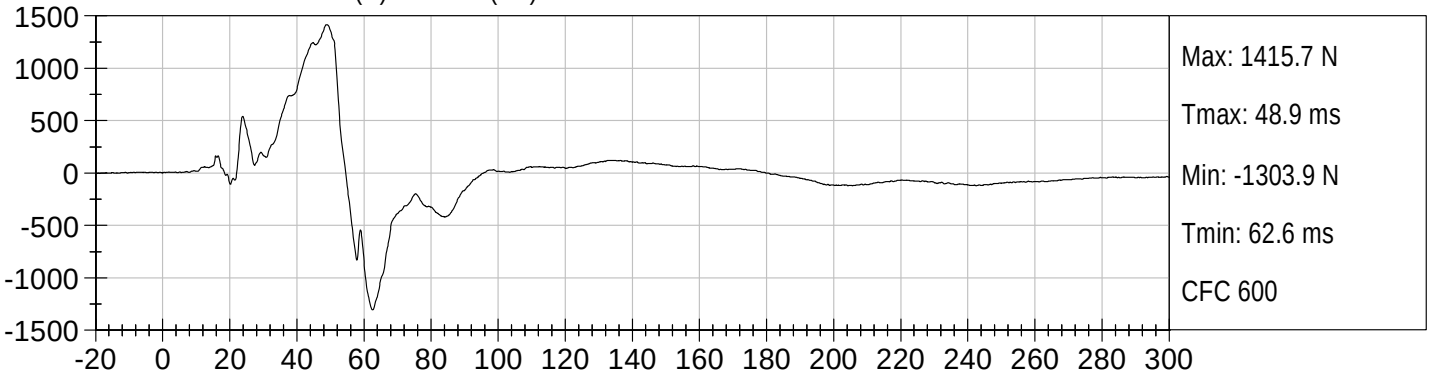

Drv. nij (NCF) () vs TIME (ms)
0.15
0.125
0.1
0.075
0.05
0.025
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.14
Tmax: 116.6 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600


Drv. nij (NCE) () vs TIME (ms)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.03
Tmax: 278.6 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

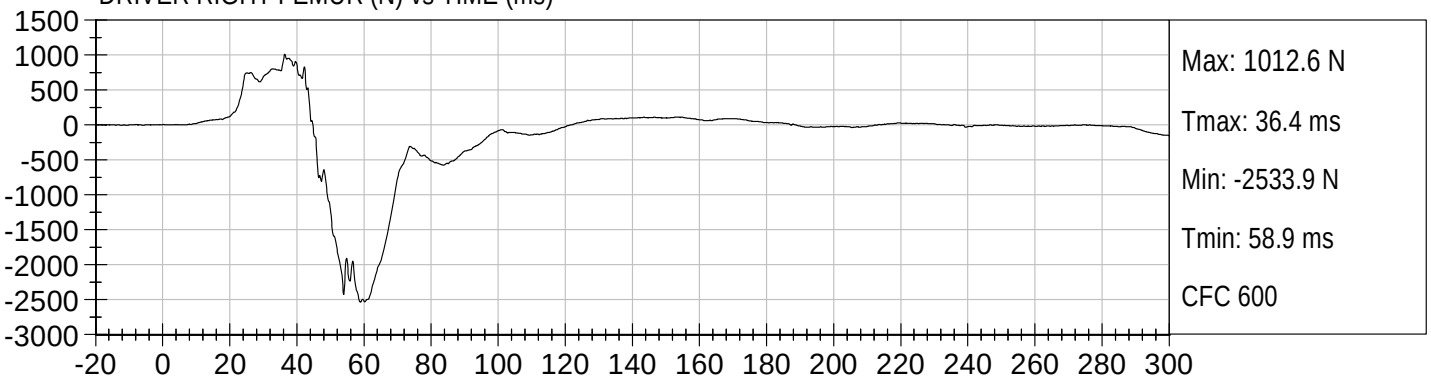
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

DRIVER LEFT FEMUR (N) vs TIME (ms)



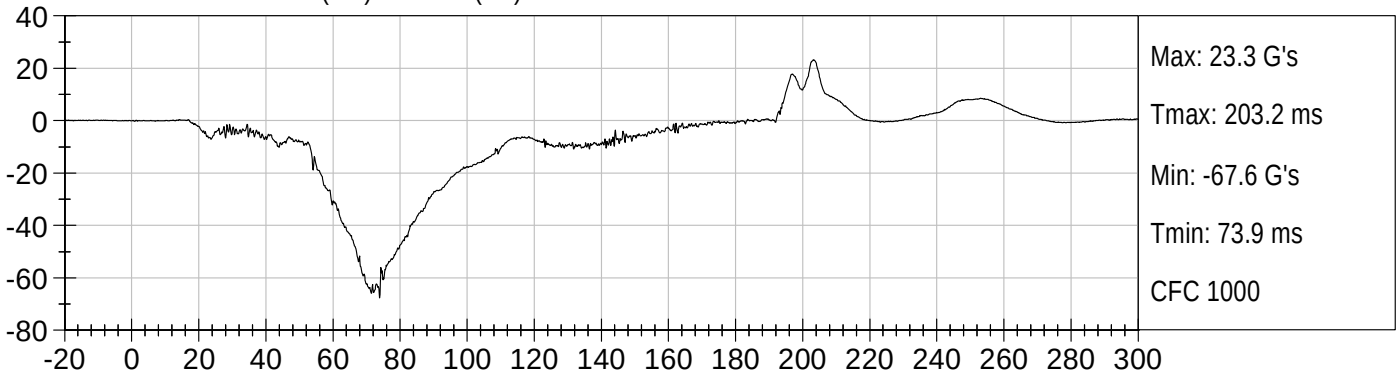
DRIVER RIGHT FEMUR (N) vs TIME (ms)



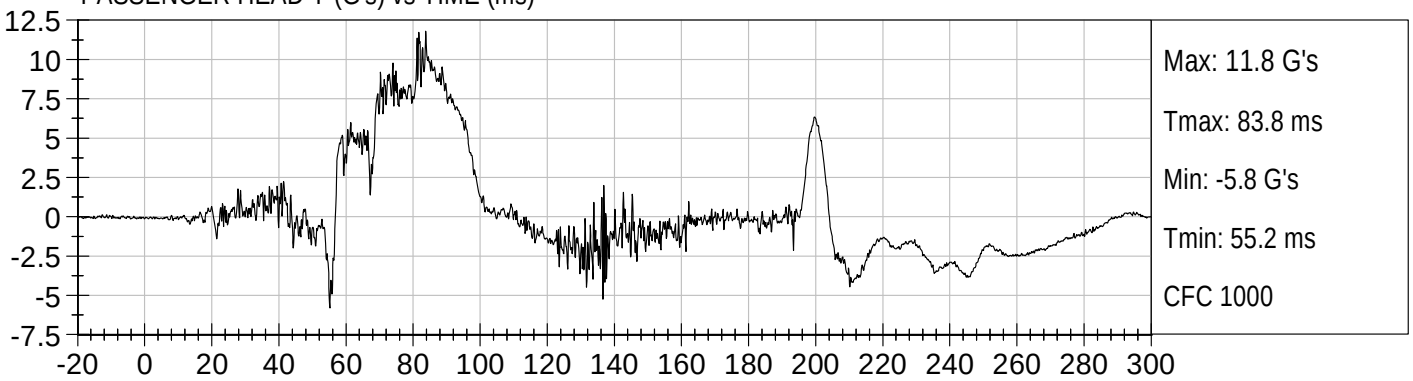
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

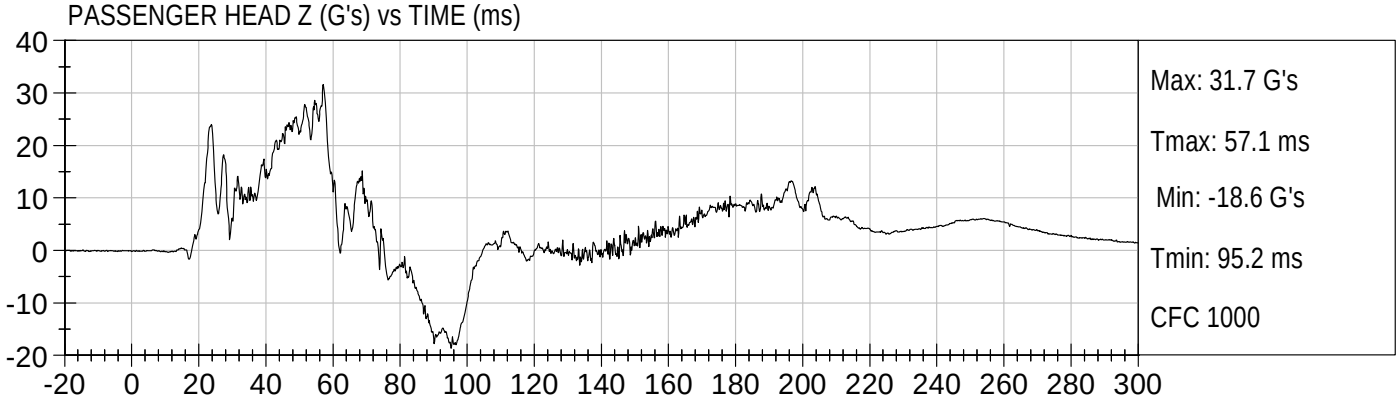
PASSENGER HEAD X (G's) vs TIME (ms)



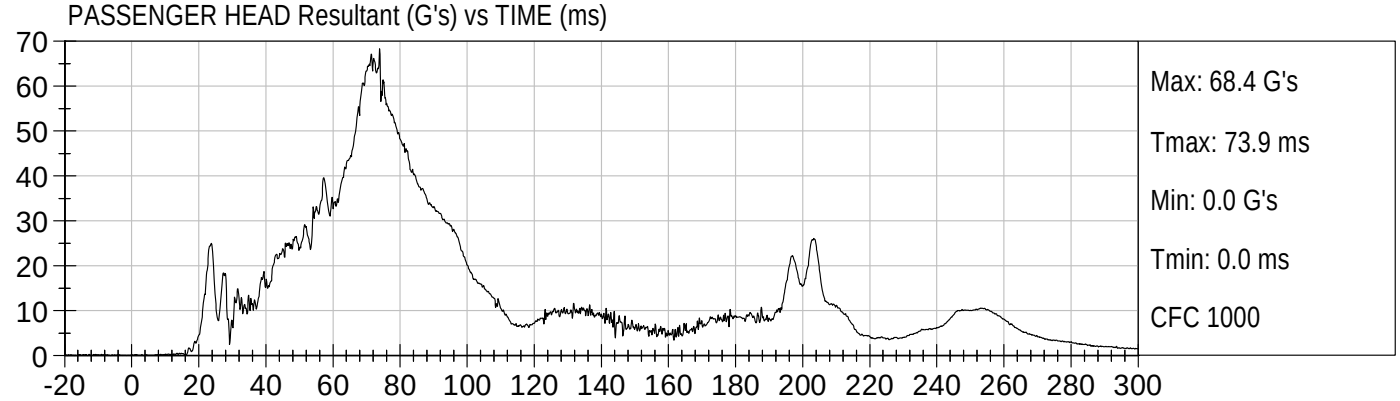
PASSENGER HEAD Y (G's) vs TIME (ms)



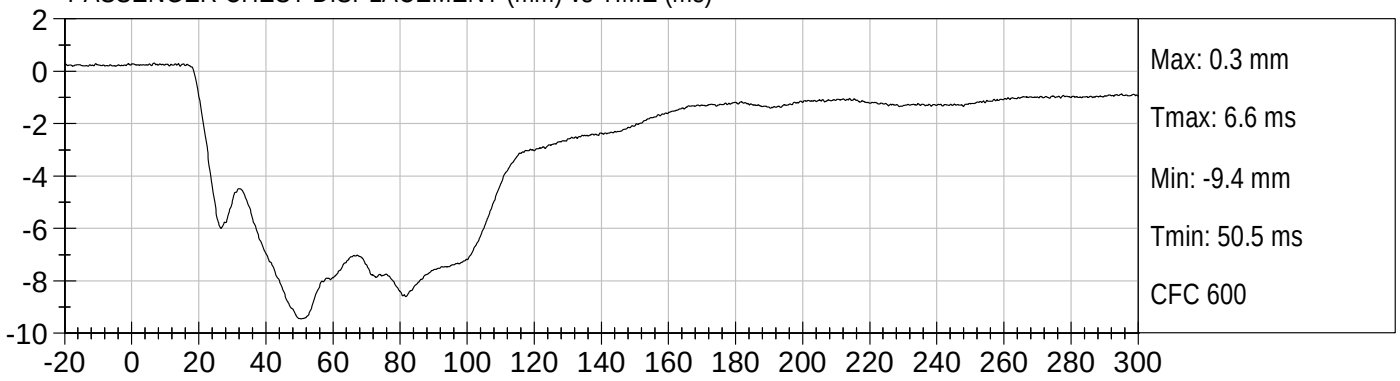
PASSENGER HEAD Z (G's) vs TIME (ms)



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



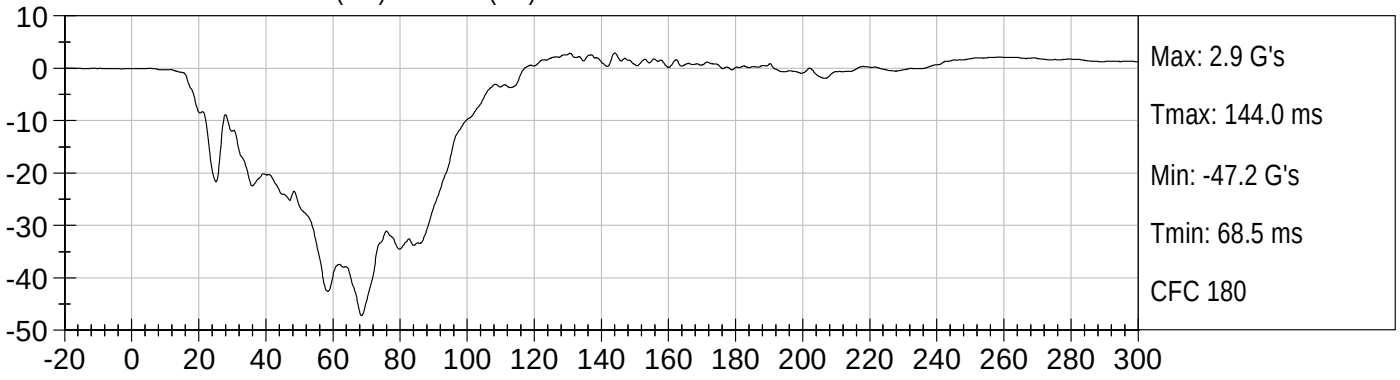
PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)



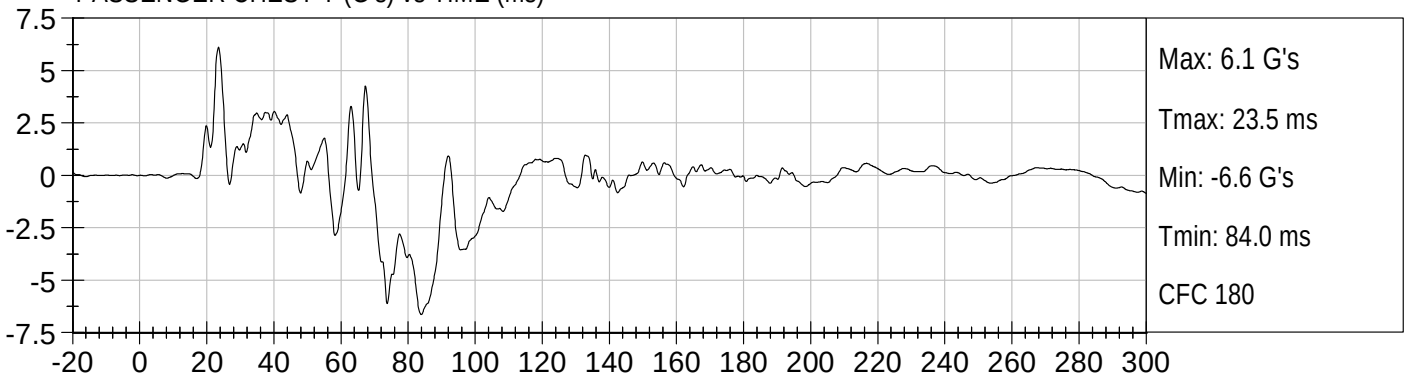
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

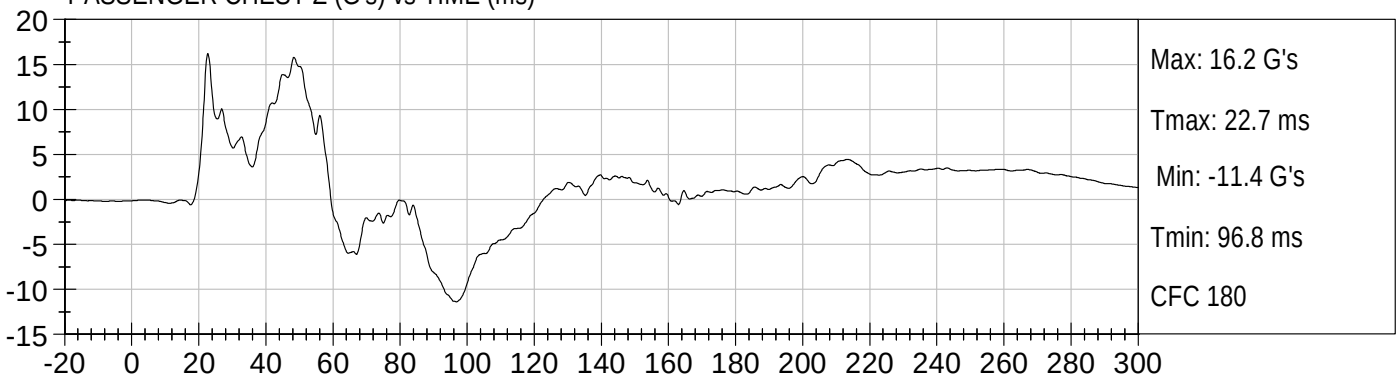
PASSENGER CHEST X (G's) vs TIME (ms)



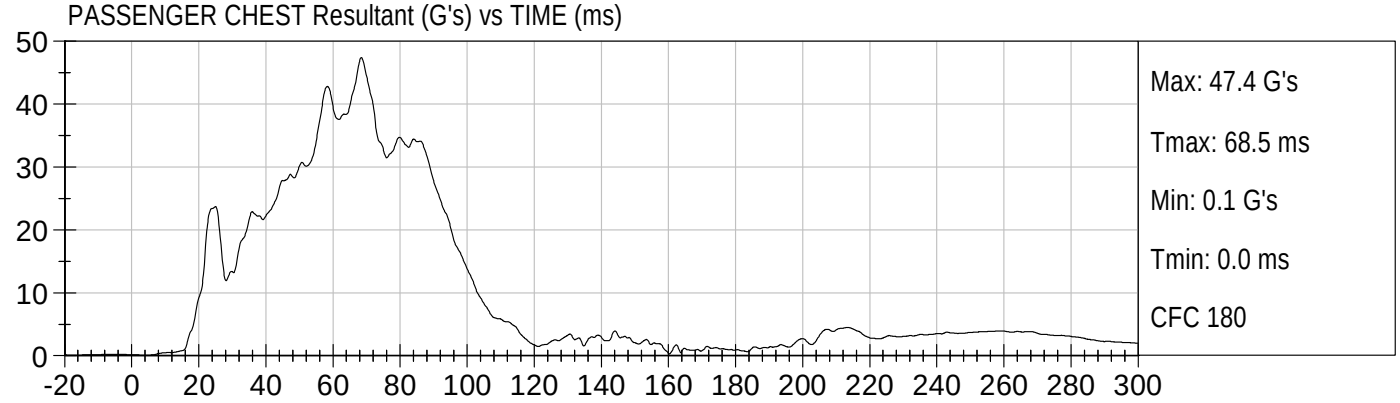
PASSENGER CHEST Y (G's) vs TIME (ms)



PASSENGER CHEST Z (G's) vs TIME (ms)



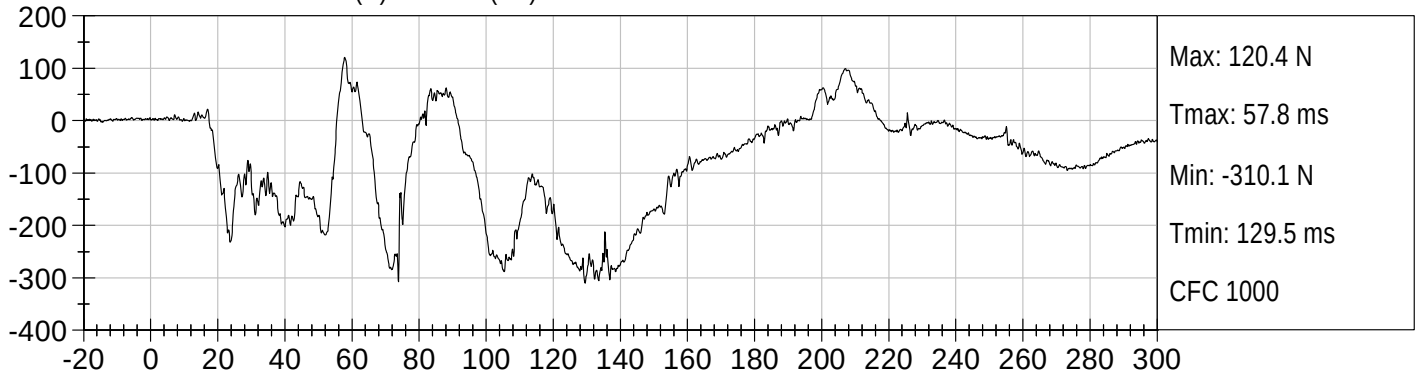
PASSENGER CHEST Resultant (G's) vs TIME (ms)



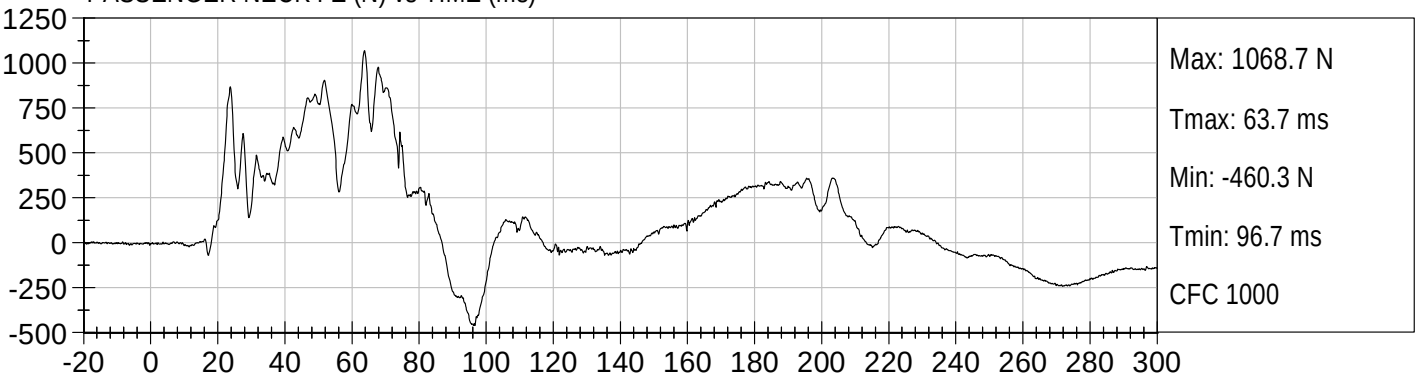
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

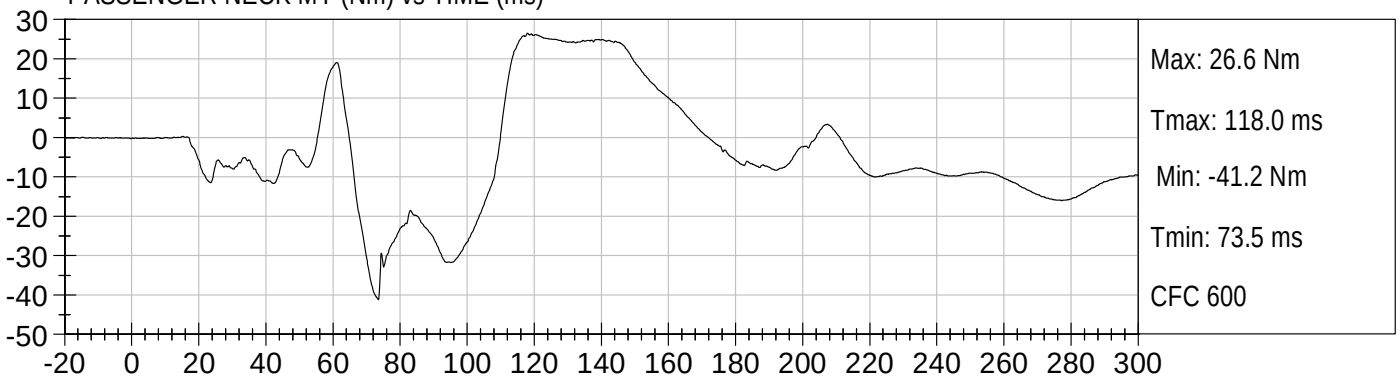
PASSENGER NECK FX (N) vs TIME (ms)

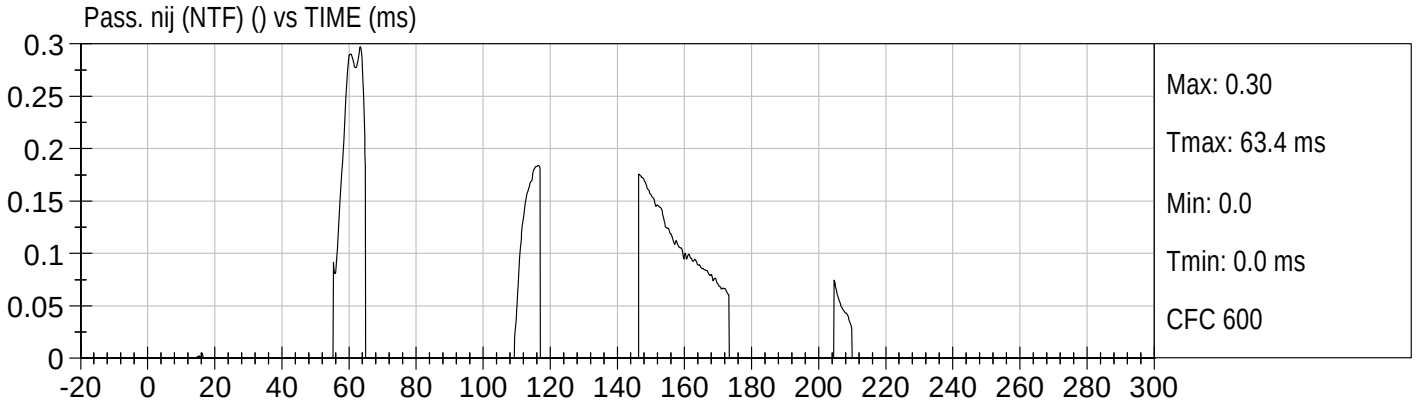


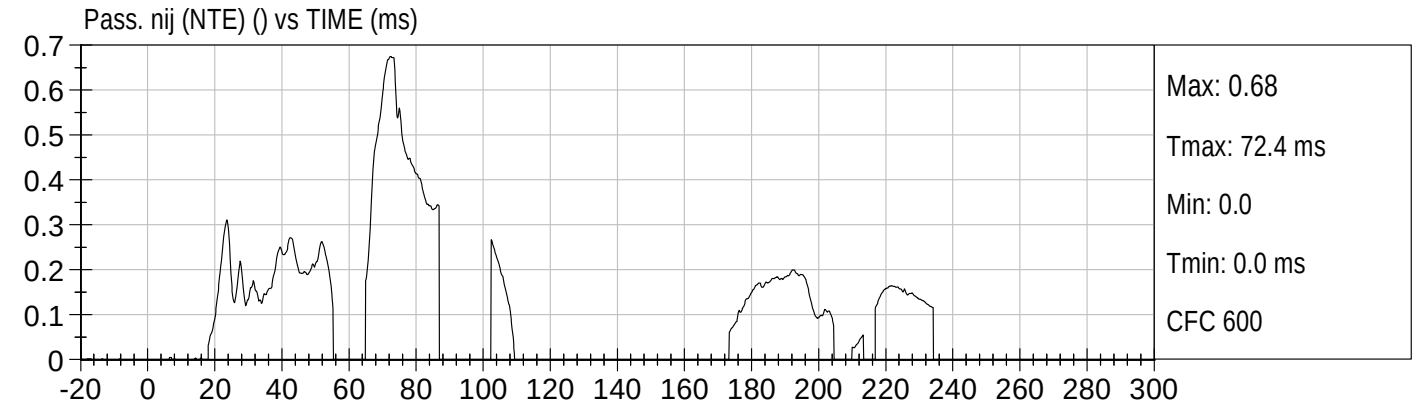
PASSENGER NECK FZ (N) vs TIME (ms)

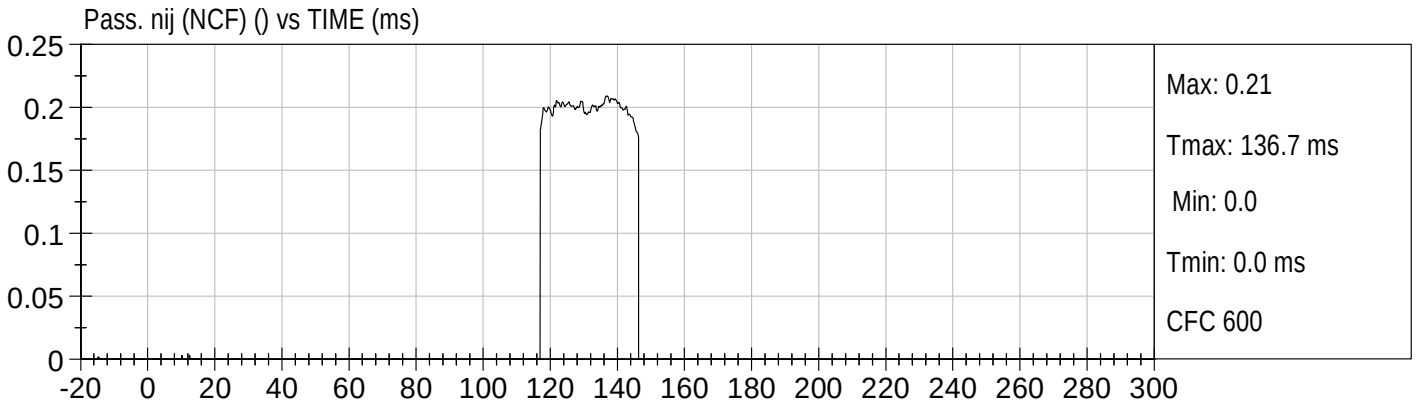


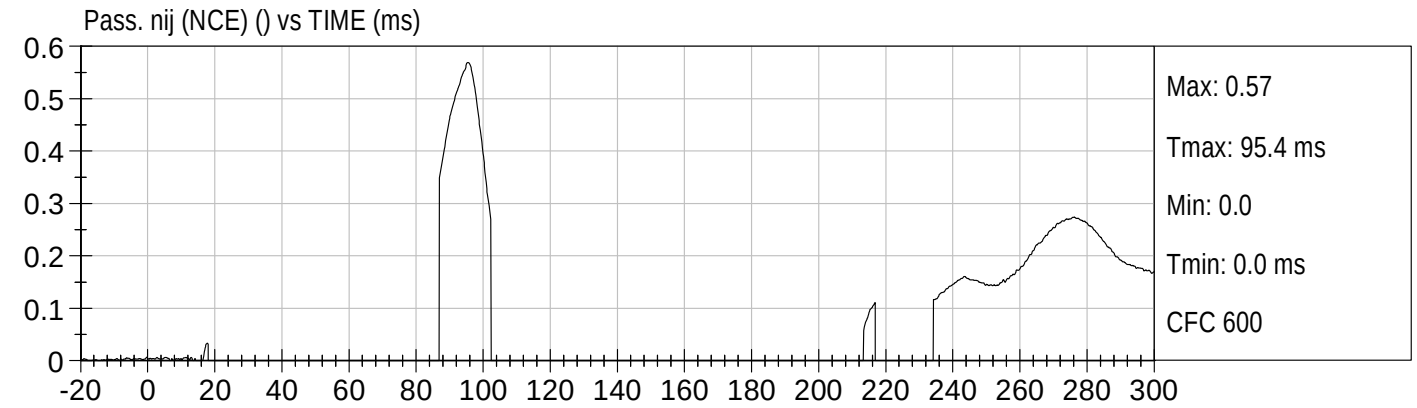
PASSENGER NECK MY (Nm) vs TIME (ms)




Pass. nij (NTF) () vs TIME (ms)
0.3
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.30
Tmax: 63.4 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600


Pass. nij (NTE) () vs TIME (ms)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.68
Tmax: 72.4 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

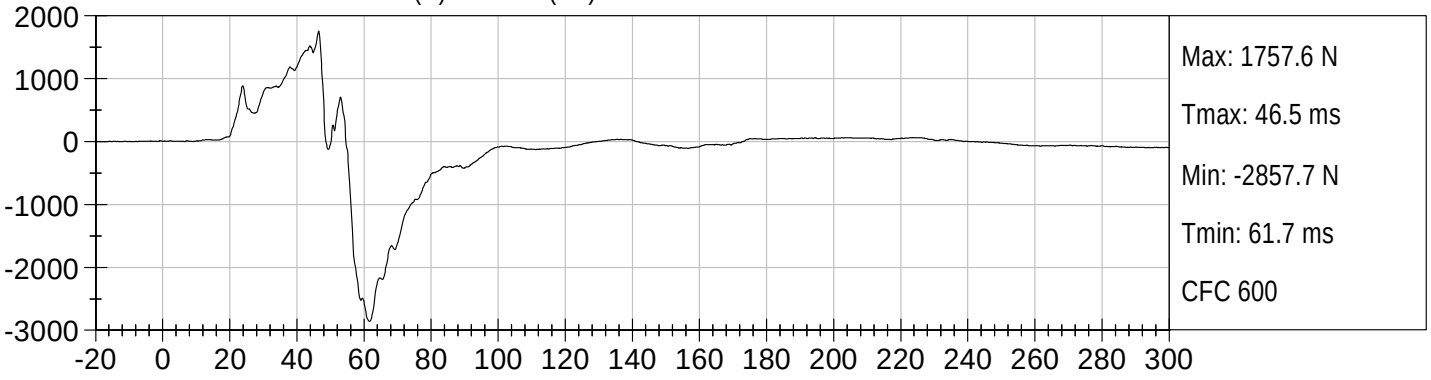

Pass. nij (NCF) () vs TIME (ms)
0.25
0.2
0.15
0.1
0.05
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.21
Tmax: 136.7 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600


Pass. nij (NCE) () vs TIME (ms)
0.6
0.5
0.4
0.3
0.2
0.1
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.57
Tmax: 95.4 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

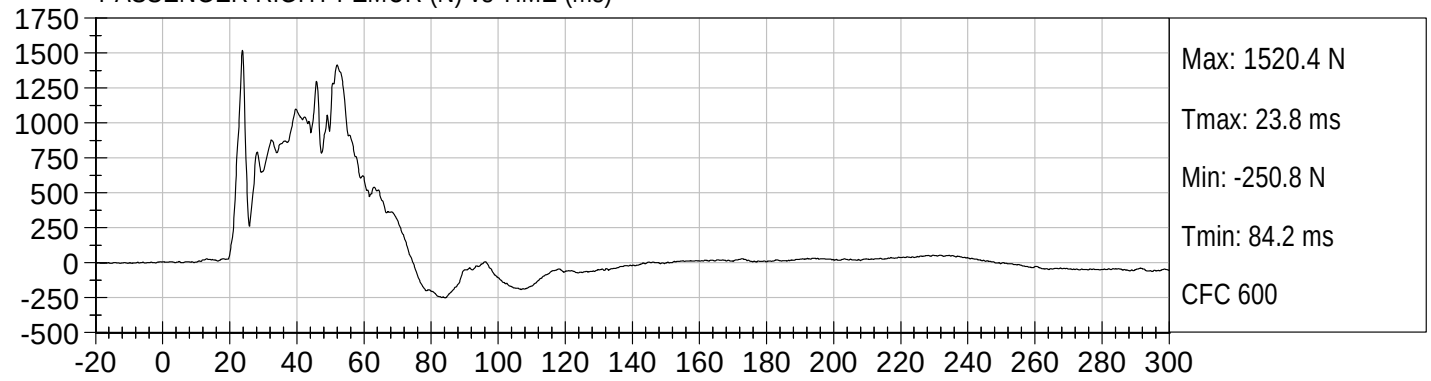
NCAP 35mph Frontal
2011 Kia Forte - MB0511

Test Date: 01/03/2011
Speed: 35.0 mph (56.3 km/h)

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test ID:** D104291

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Peak Resultant Acceleration	G's	225 - 275	240	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-3.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

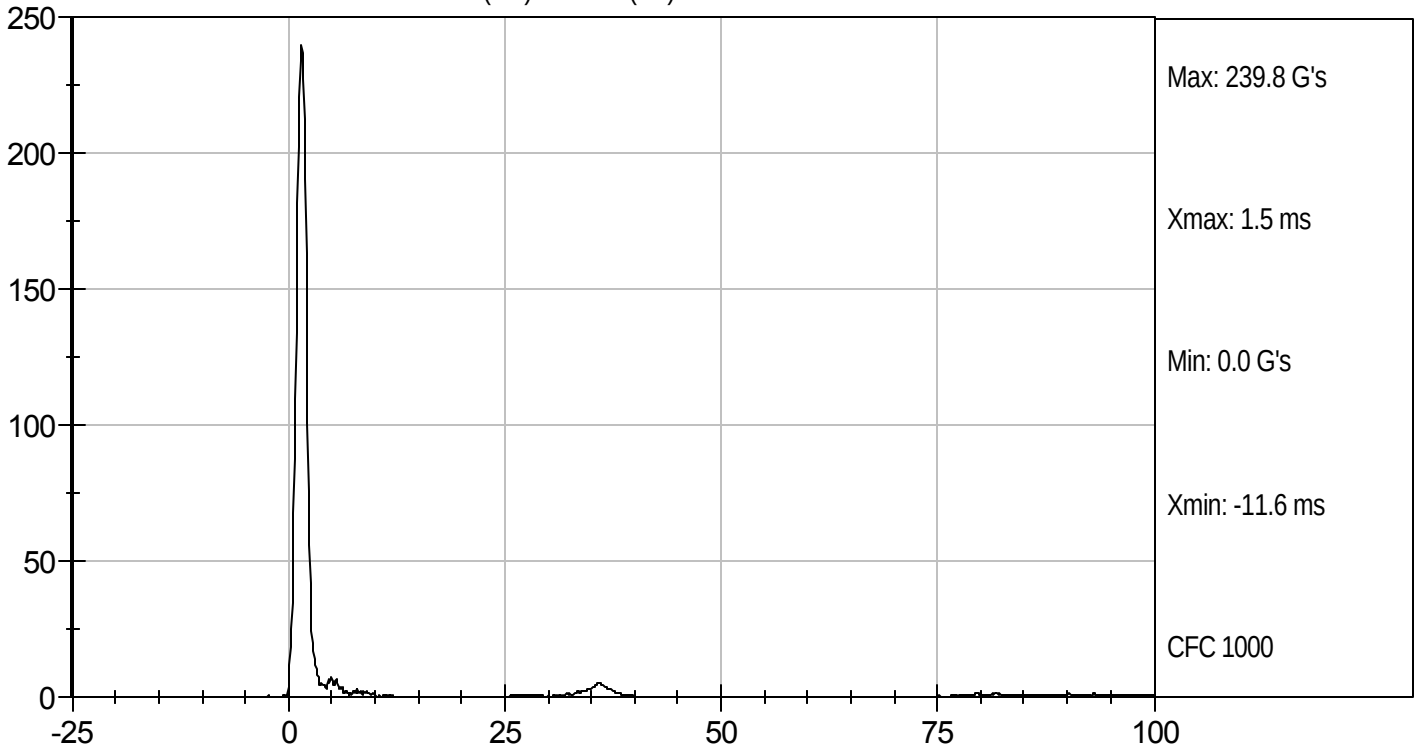
12/6/10
Test Date

David Winkelbauer
Approved By

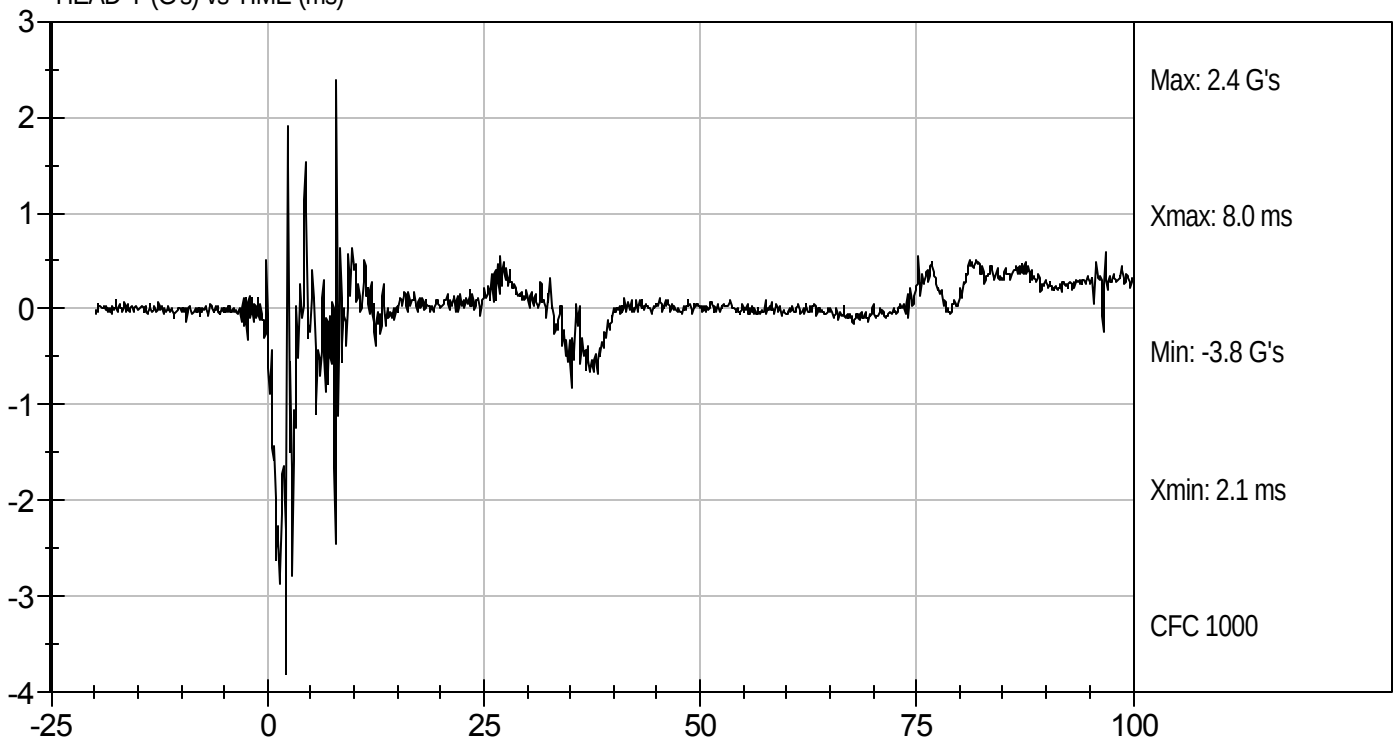
Test Desc: Head Drop
Component ID: D104291

Test Date: 12/6/10
Velocity: 0 ft/s, 0.00 m/s

RESULTANT HEAD ACCELERATION (G's) vs TIME (ms)



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D104292

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	12	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.95	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.50	Pass
	20 ms	G's	17.60 to 22.60	21.26	Pass
	30 ms	G's	12.50 to 18.50	15.57	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.3	Pass
	Time	ms	57.0 to 64.0	58.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	115.7	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	97.2	Pass
	Time	ms	47.0 to 58.0	47.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.5	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

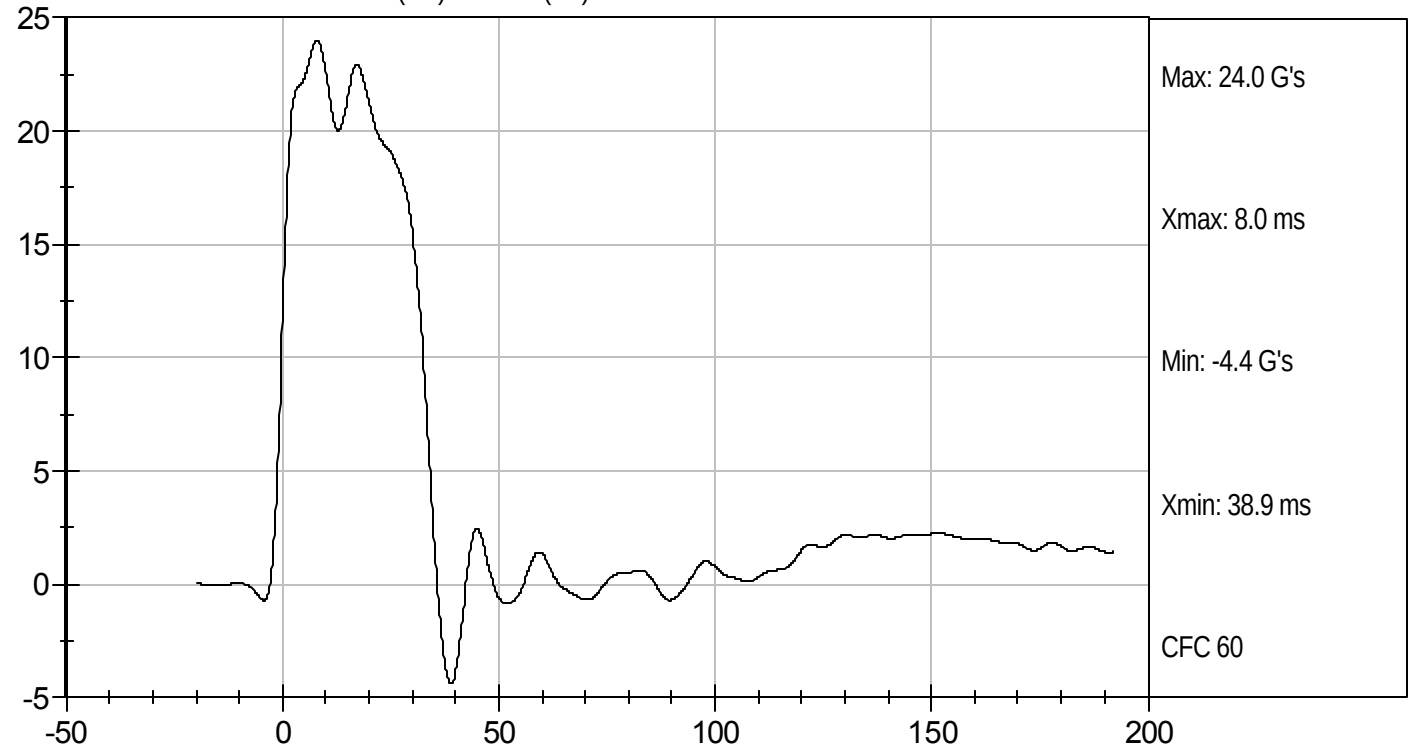
12/7/10
Test Date

David Winkelbauer
Approved By

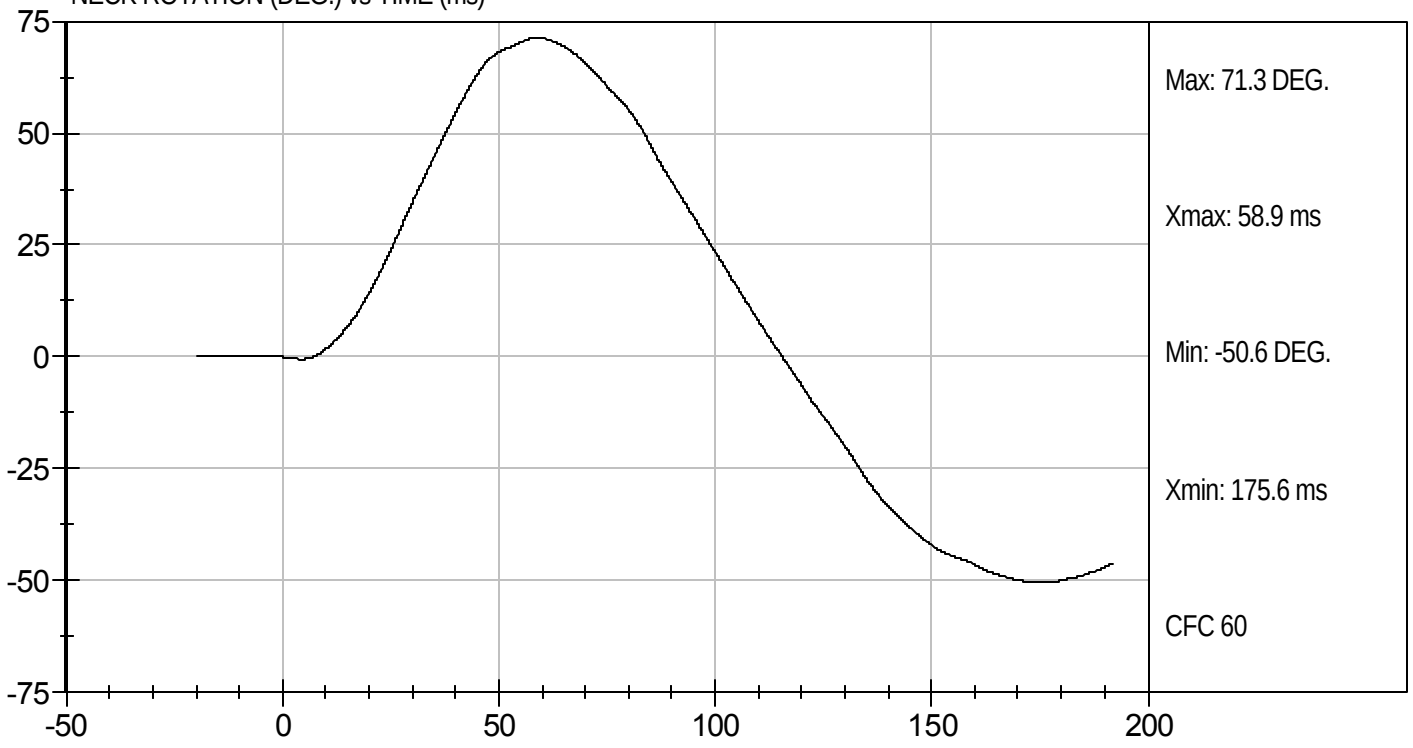
Test Desc: Neck Flexion
Component ID: D104292

Test Date: 12/7/10
Velocity: 22.8 ft/s, 6.95 m/s

PENDULUM DECELERATION (G's) vs TIME (ms)

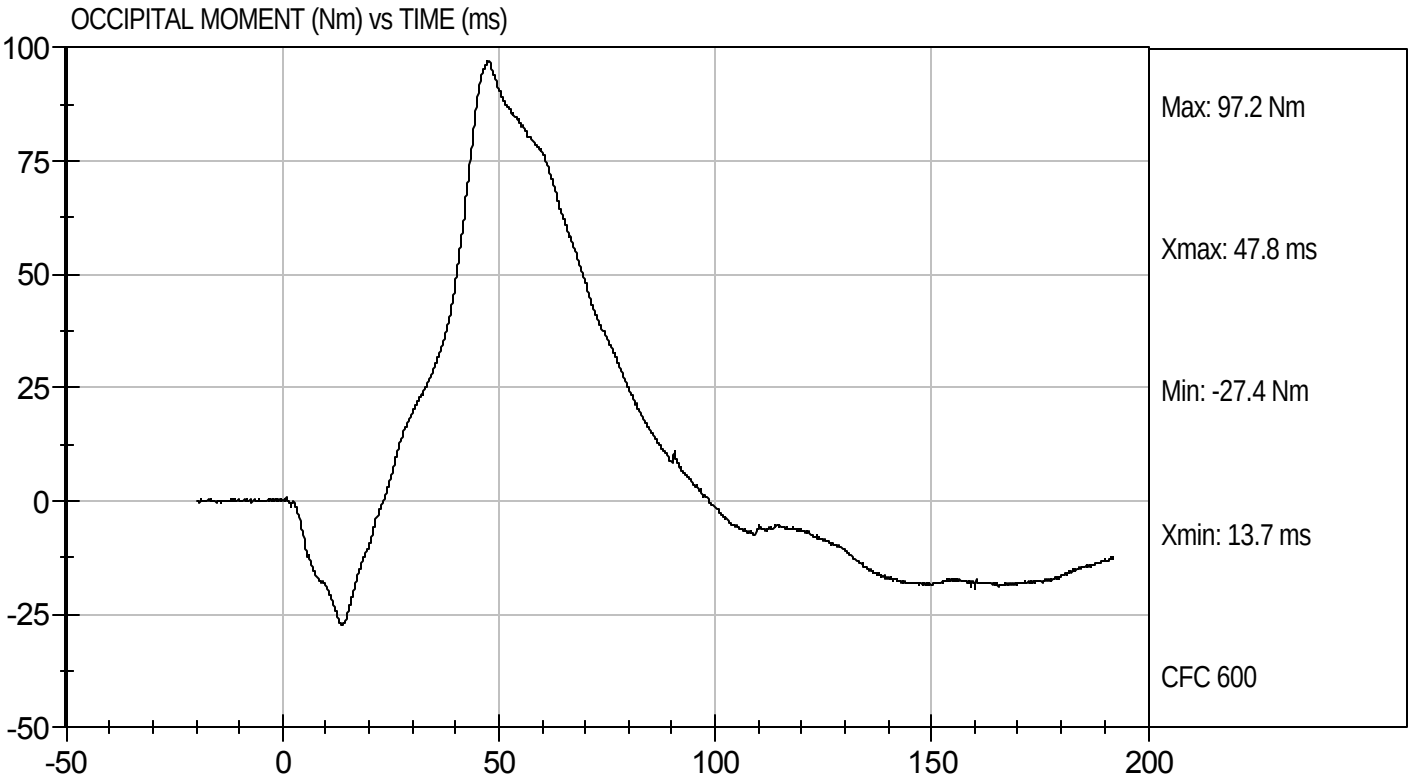


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D104292

Test Date: 12/7/10
Velocity: 22.8 ft/s, 6.95 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D104293

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	12	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.10	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.84	Pass
	20 ms	G's	14.00 to 19.00	16.64	Pass
	30 ms	G's	11.00 to 16.00	12.95	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.9	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.5	Pass
	Time	ms	72.0 to 82.0	75.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	156.1	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-68.2	Pass
	Time	ms	65.0 to 79.0	70.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	142.2	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

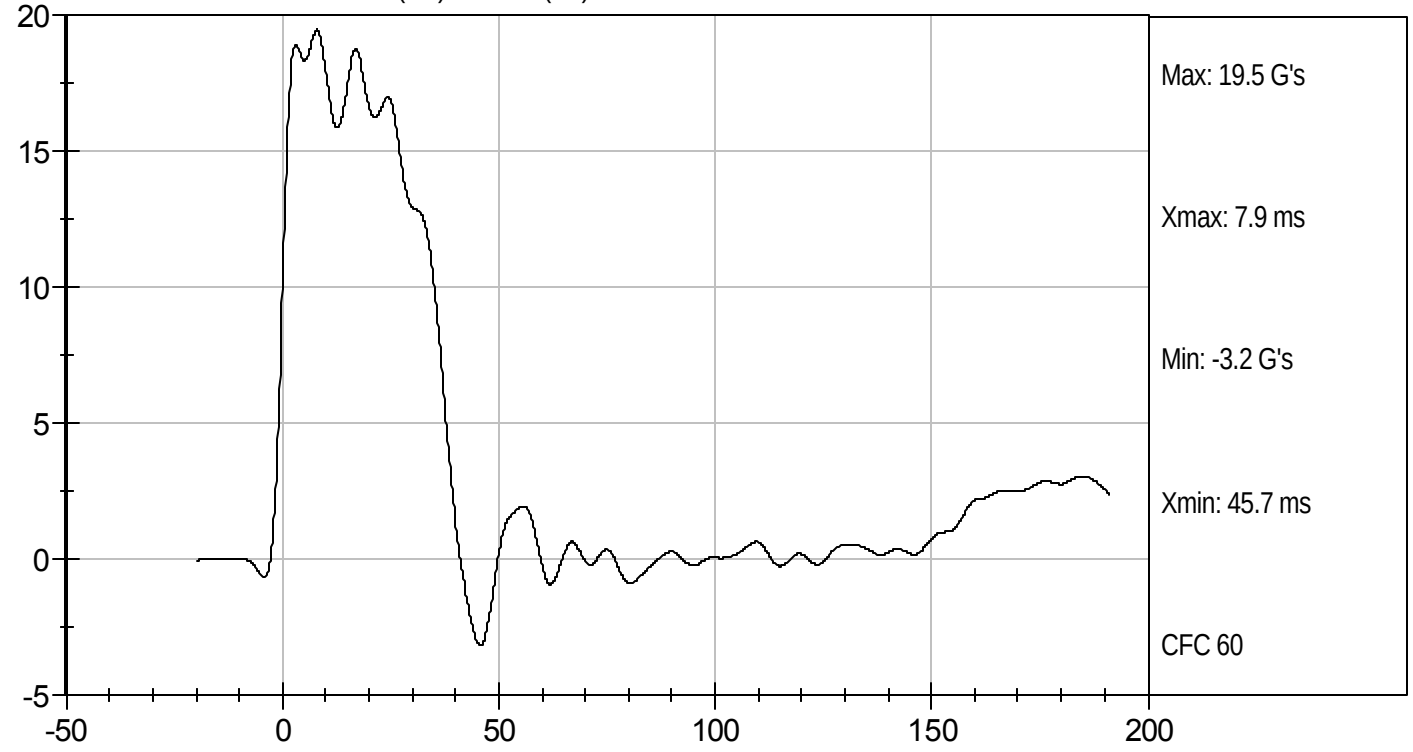
12/7/10
Test Date

David Winkelbauer
Approved By

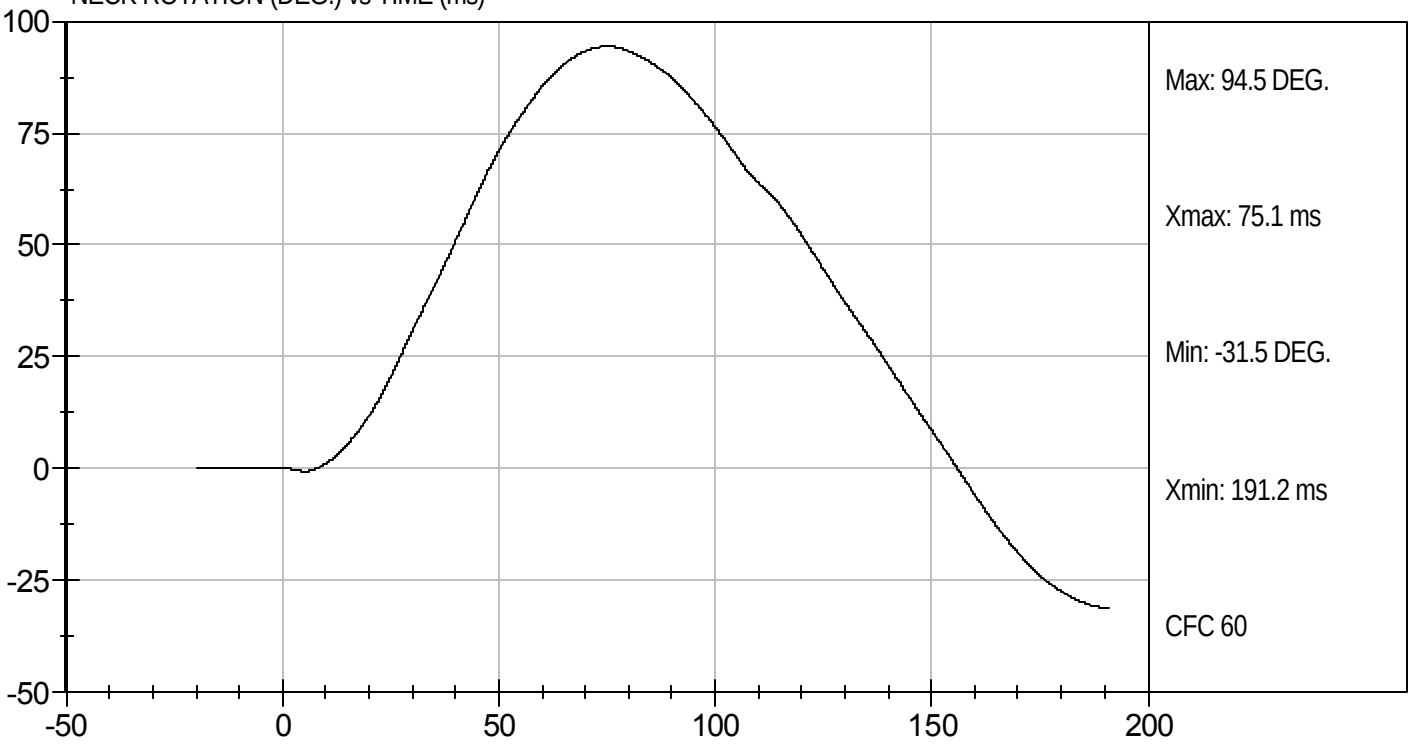
Test Desc: Neck Extension
Component ID: D104293

Test Date: 12/7/10
Velocity: 20.0 ft/s, 6.10 m/s

PENDULUM DECELERATION (G's) vs TIME (ms)

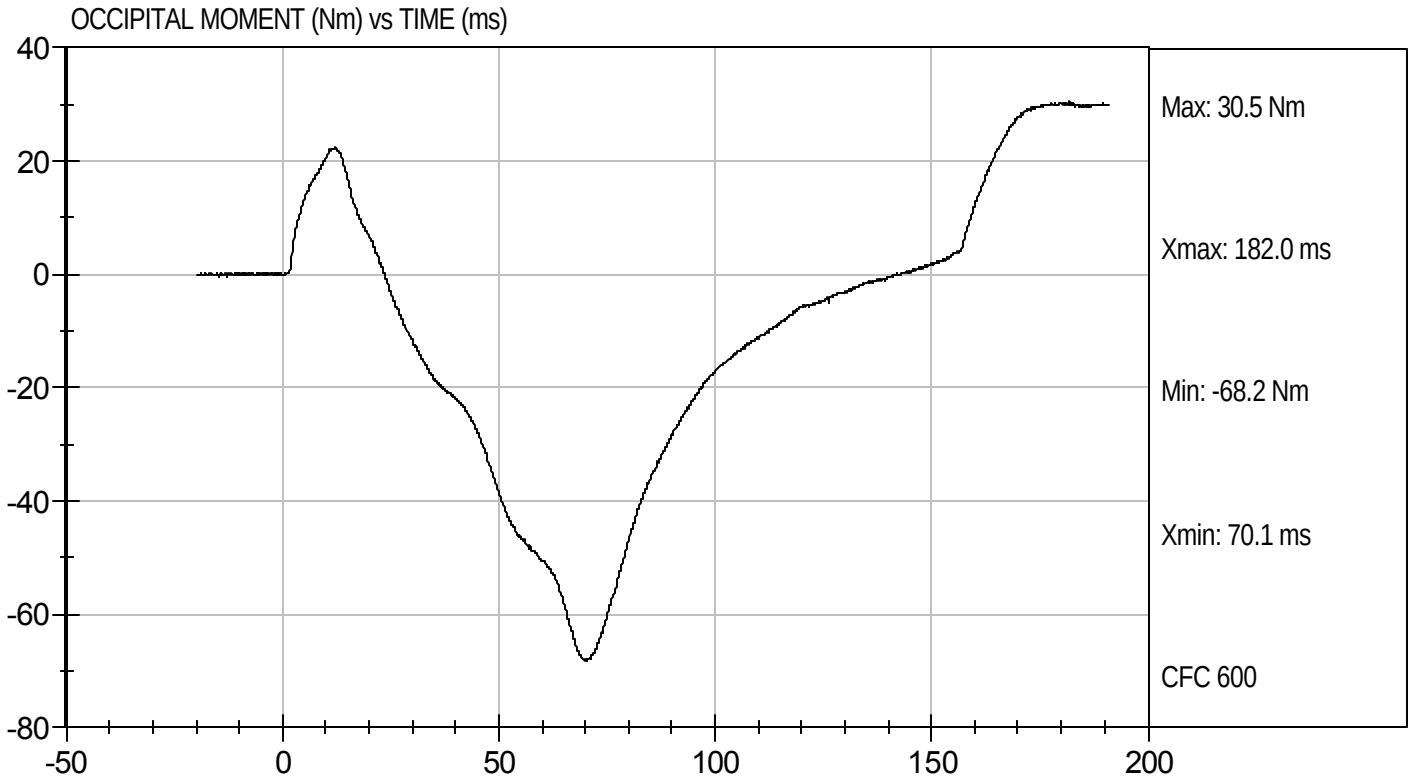


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D104293

Test Date: 12/7/10
Velocity: 20.0 ft/s, 6.10 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D104294

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,423	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.62	Pass
Internal Hysteresis	%	69 to 85	72	Pass
		Overall Test Results		Pass

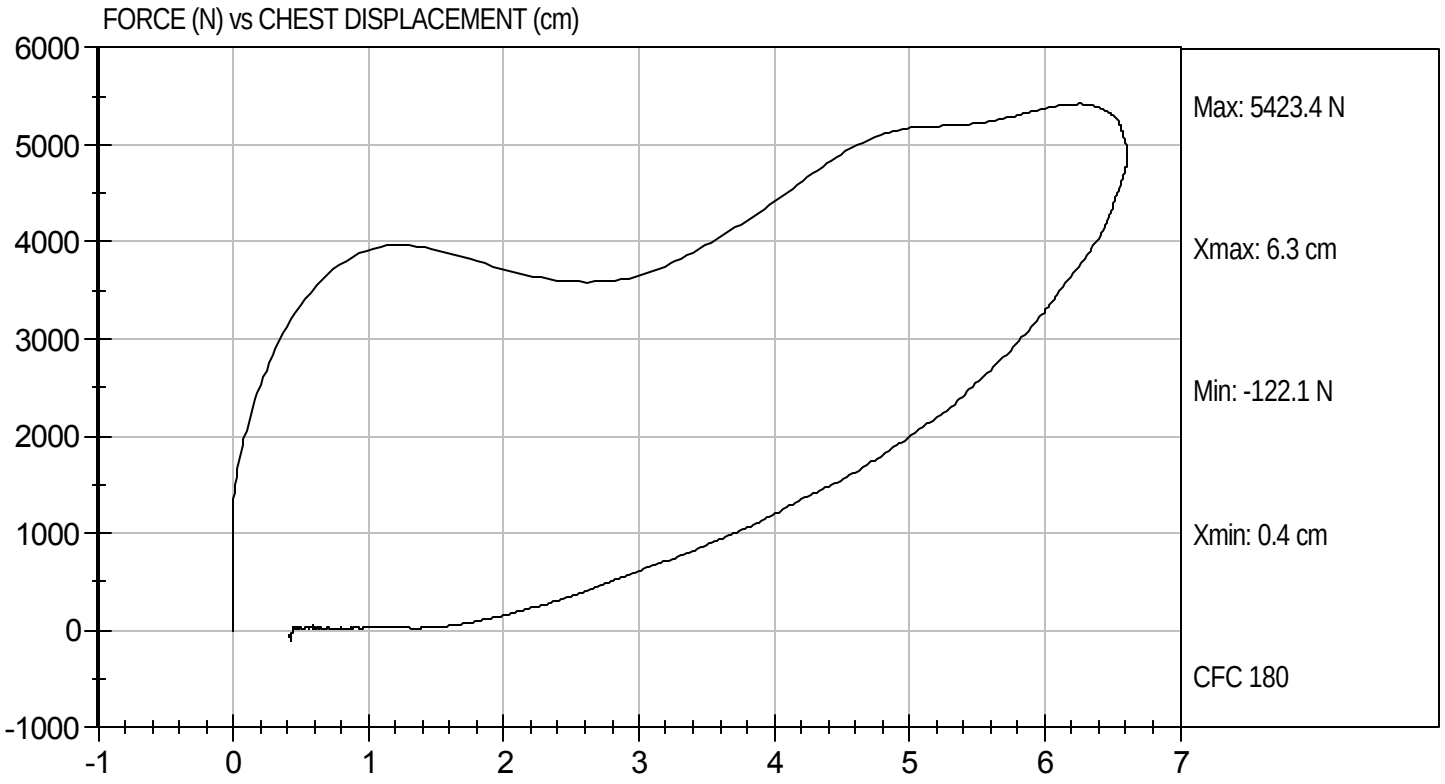
Jessica Hall
Laboratory Technician

12/7/10
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D104294

Test Date: 12/7/10
Velocity: 21.93 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D104295

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	4,933	Pass
		Overall Test Results		Pass

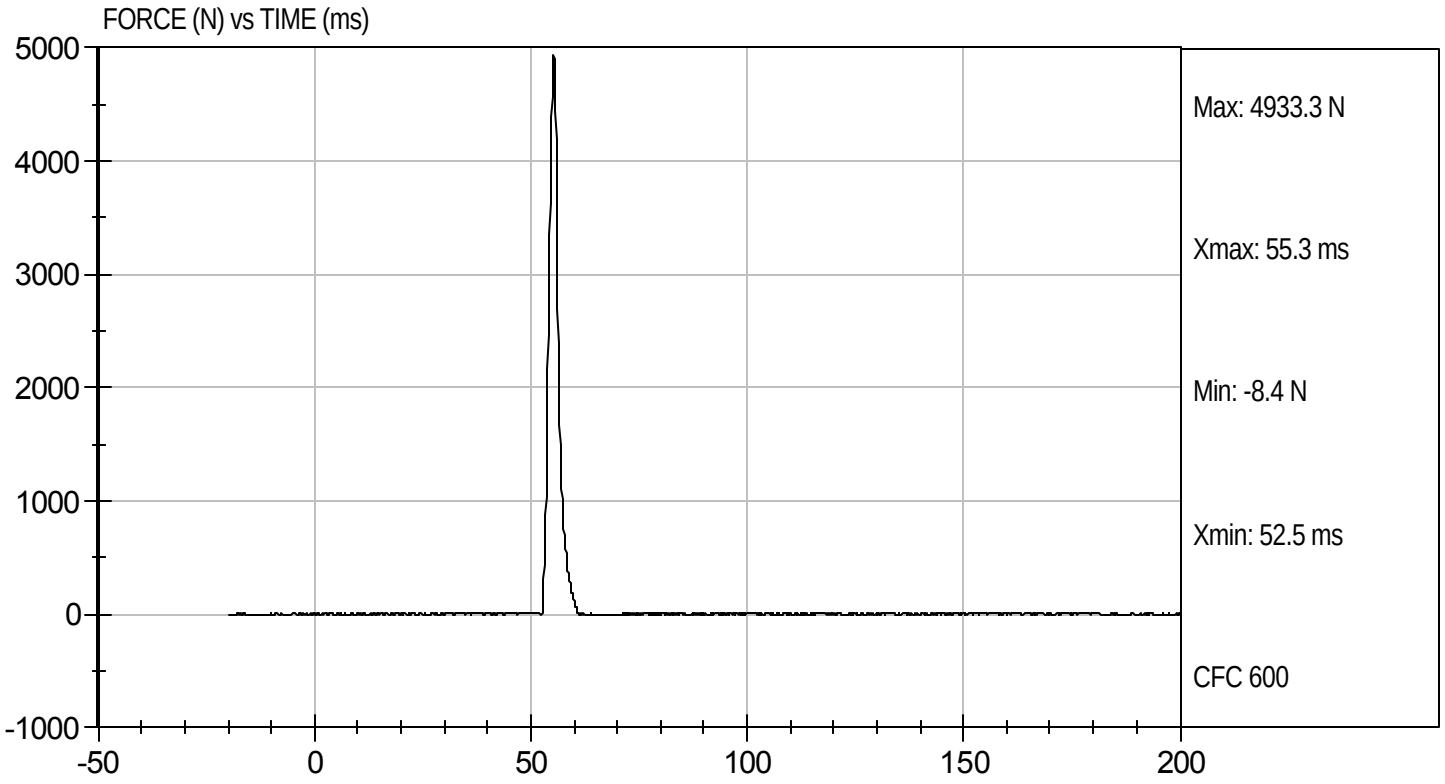
Jessica Gall
Laboratory Technician

12/7/10
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D104295

Test Date: 12/7/10
Velocity: 6.94 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D104296

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,180	Pass
		Overall Test Results		Pass

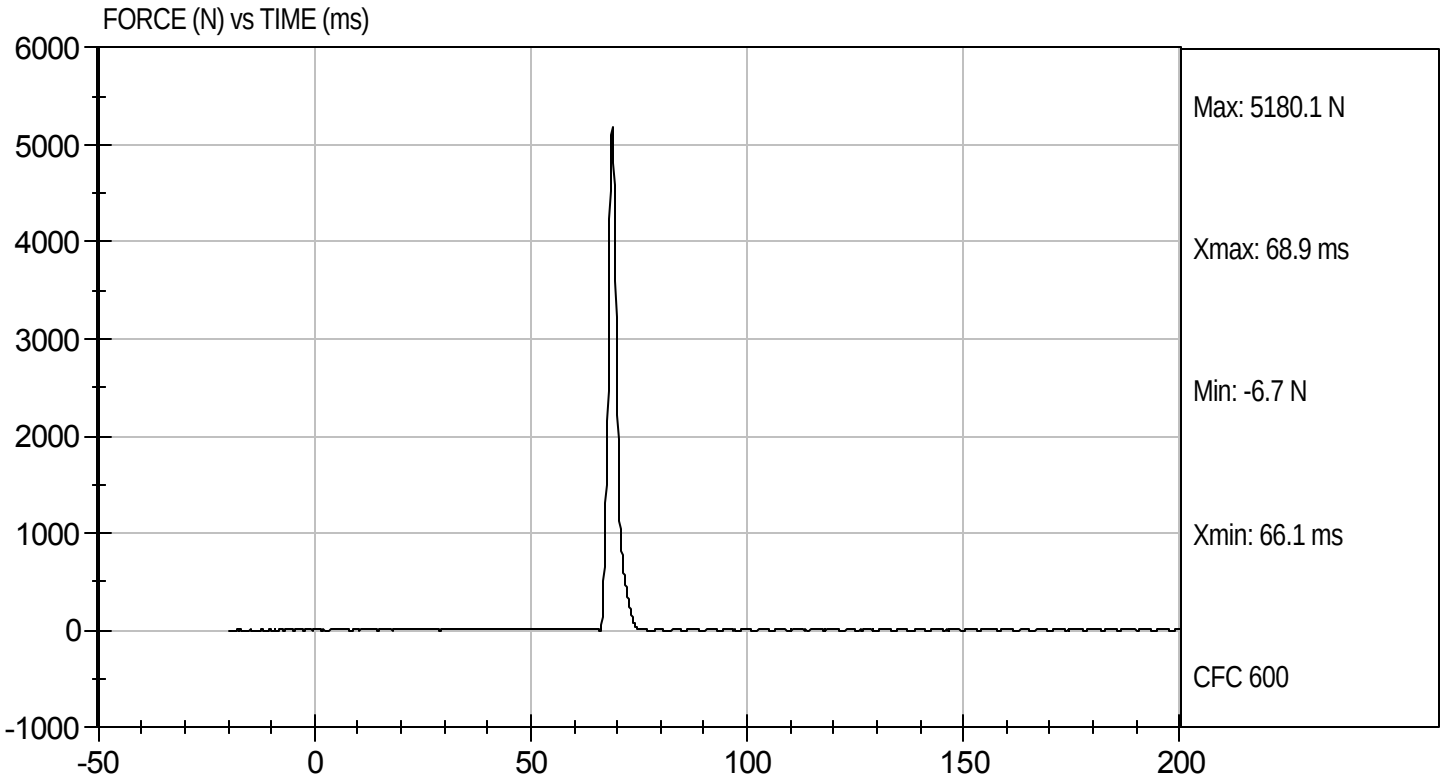
Jessica Hall
Laboratory Technician

12/7/10
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D104296

Test Date: 12/7/10
Velocity: 6.92 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D104290

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.0	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	13	13	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	57.8	54.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	49	48	Pass
		Overall Test Results			Pass

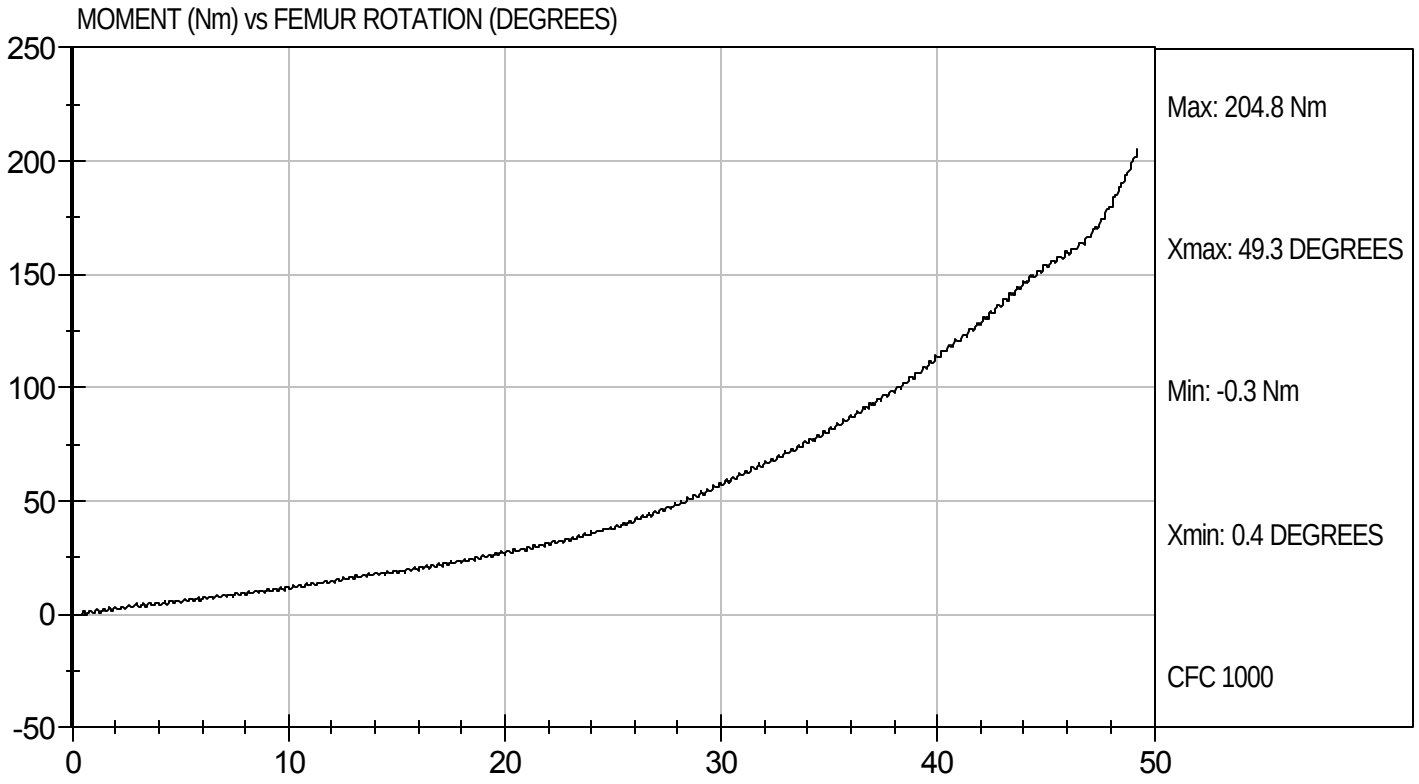
Jessica Gall
Laboratory Technician

12/7/10
Test Date

David Winkelbauer
Approved By

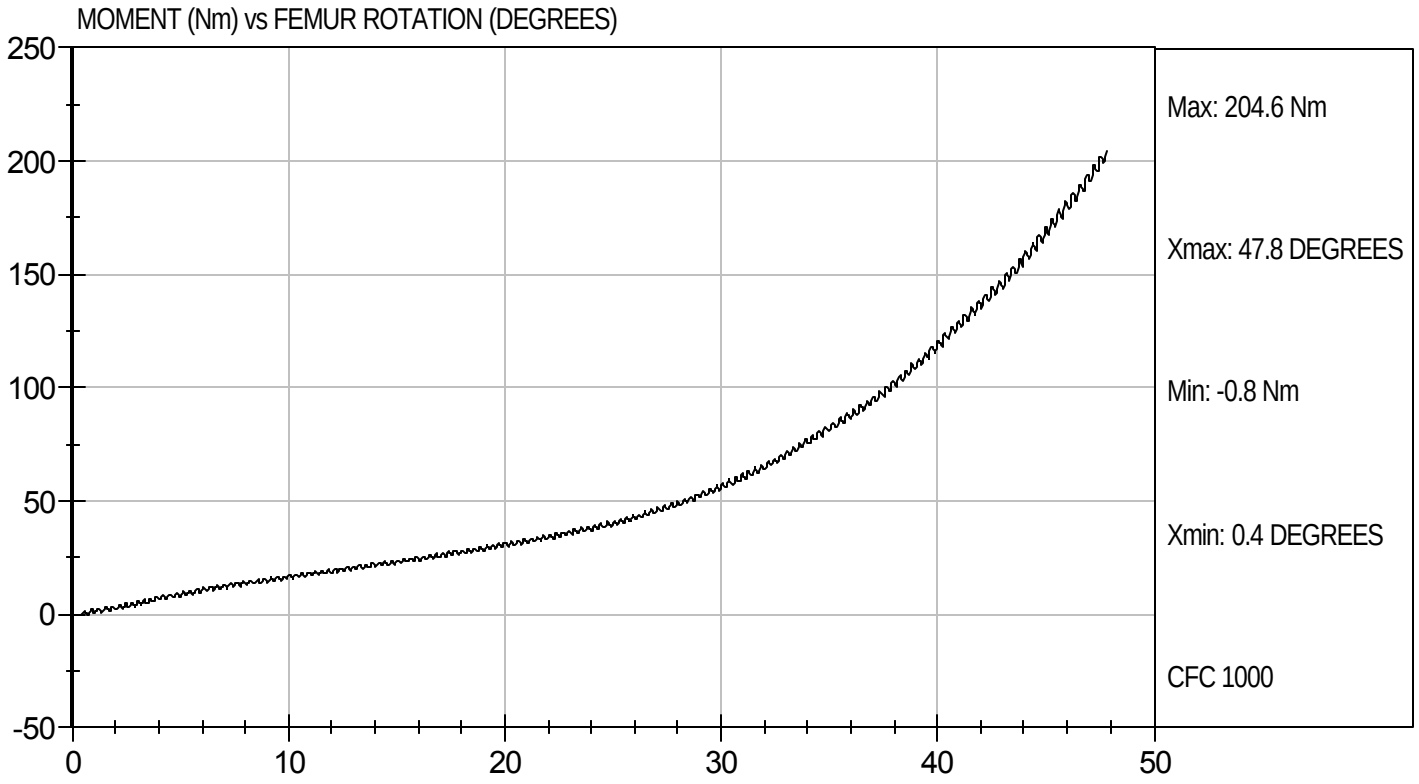
Test Desc: Hip Femur Flexion
Component ID: D104299

Test Date: 12/7/10
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D104290

Test Date: 12/7/10
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test ID:** D11021

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	225 - 275	253	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-11.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

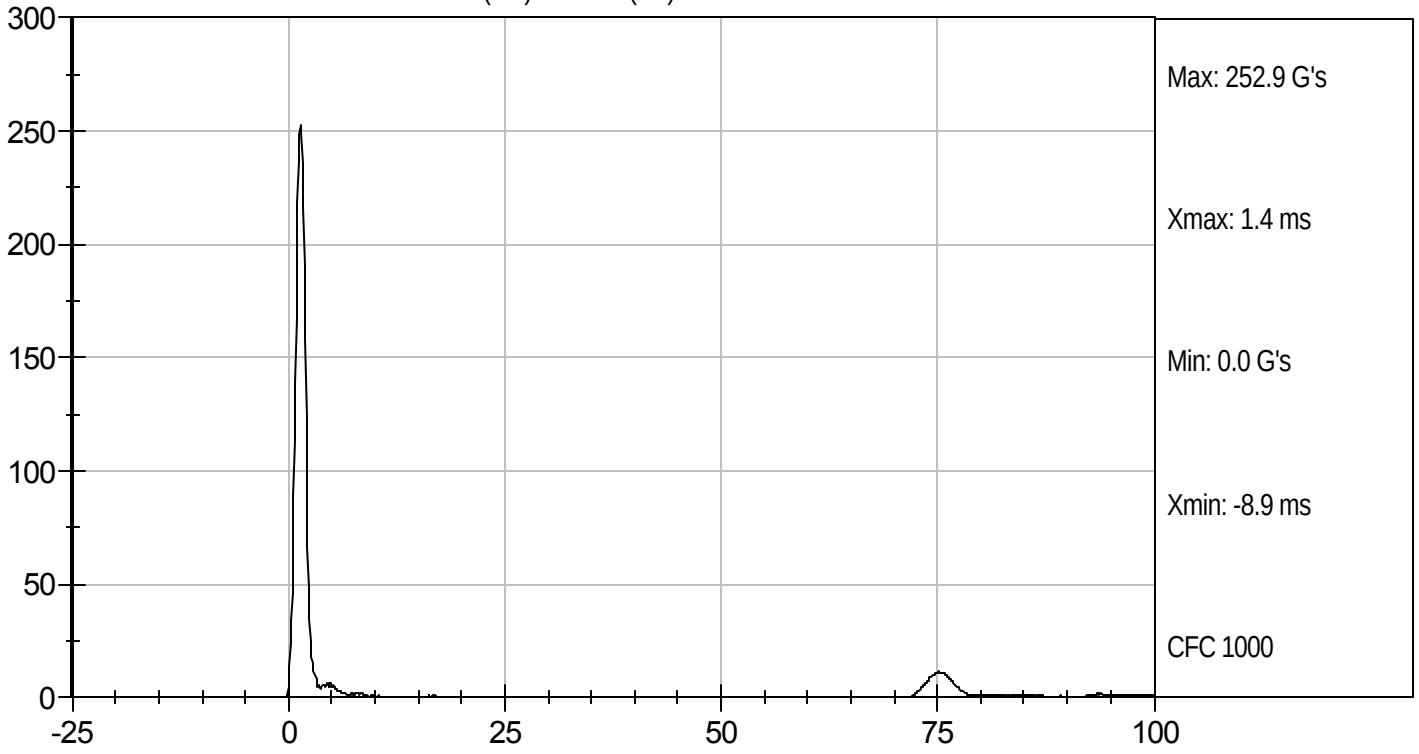
1/4/11
Test Date

David Winkelbauer
Approved By

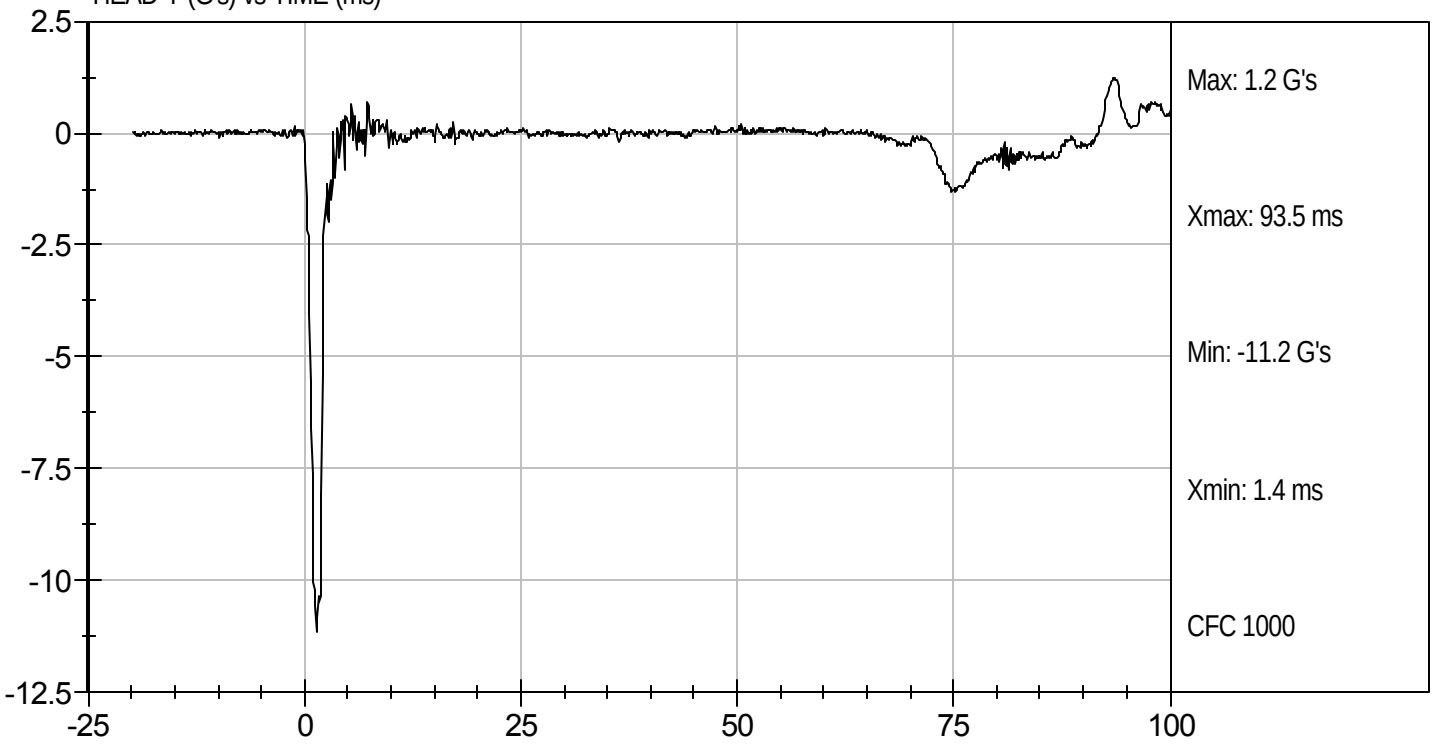
Test Desc: Head Drop
Component ID: D11021

Test Date: 1/4/11
Velocity: 0 ft/s, 0.00 m/s

RESULTANT HEAD ACCELERATION (G's) vs TIME (ms)



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D11022

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.05	Pass
	20 ms	G's	17.60 to 22.60	18.98	Pass
	30 ms	G's	12.50 to 18.50	16.09	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	73.6	Pass
	Time	ms	57.0 to 64.0	58.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	121.1	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	97.2	Pass
	Time	ms	47.0 to 58.0	48.7	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

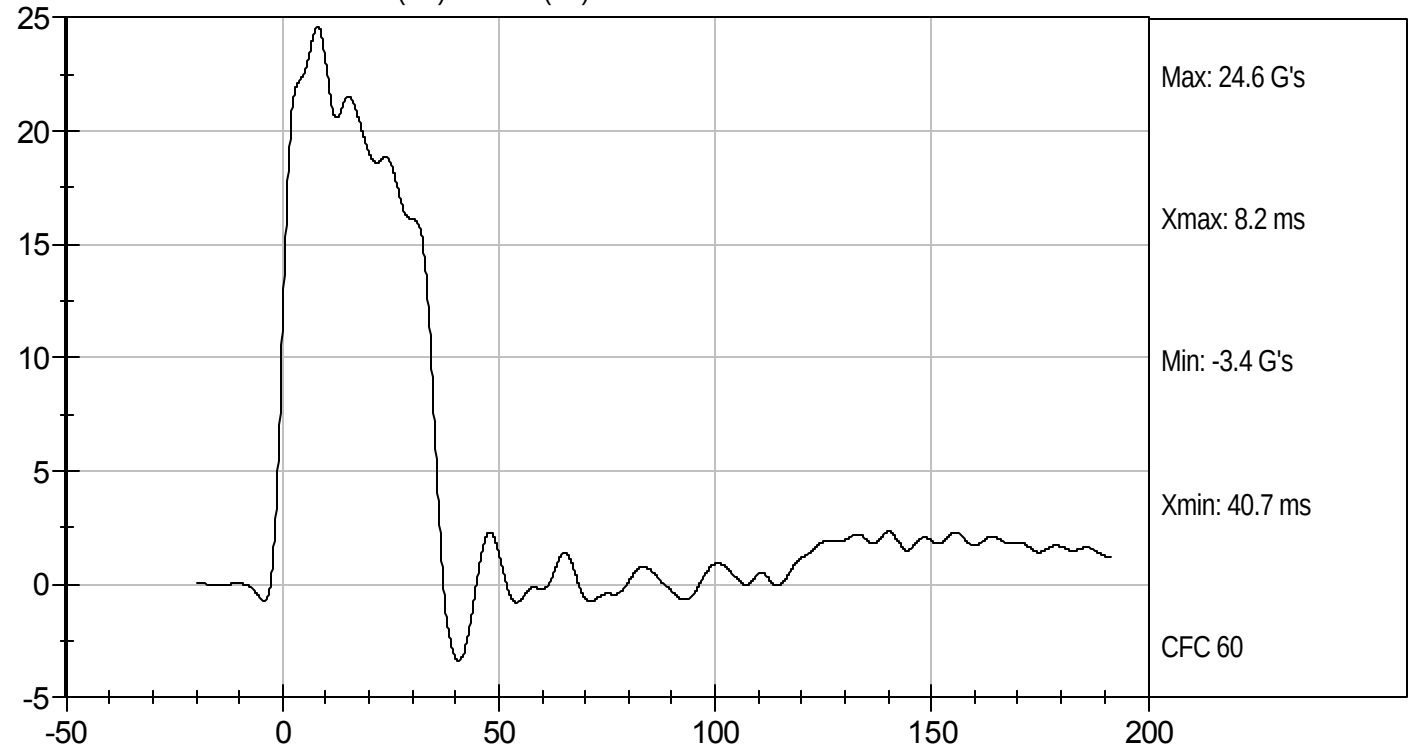
1/4/11
Test Date

David Winkelbauer
Approved By

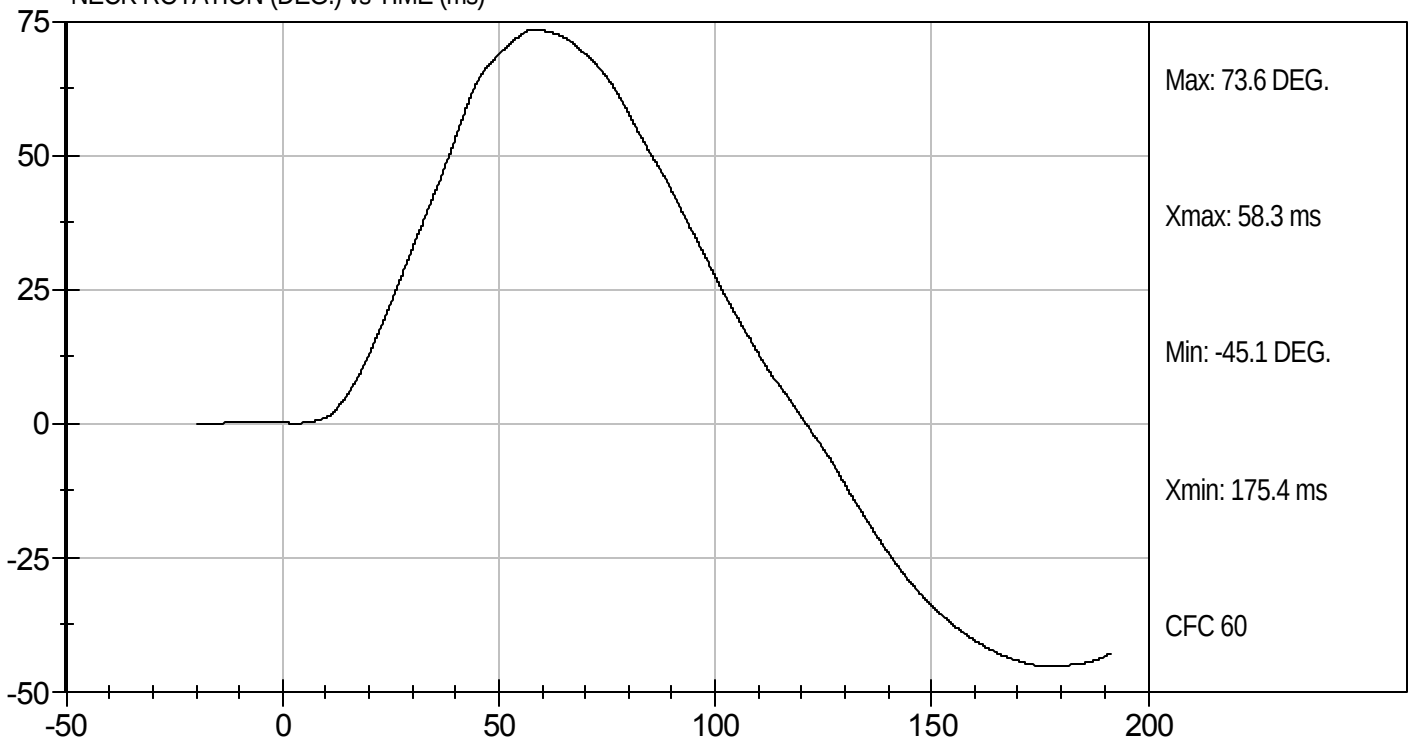
Test Desc: Neck Flexion
Component ID: D11022

Test Date: 1/4/11
Velocity: 22.83 ft/s, 6.96 m/s

PENDULUM DECELERATION (G's) vs TIME (ms)

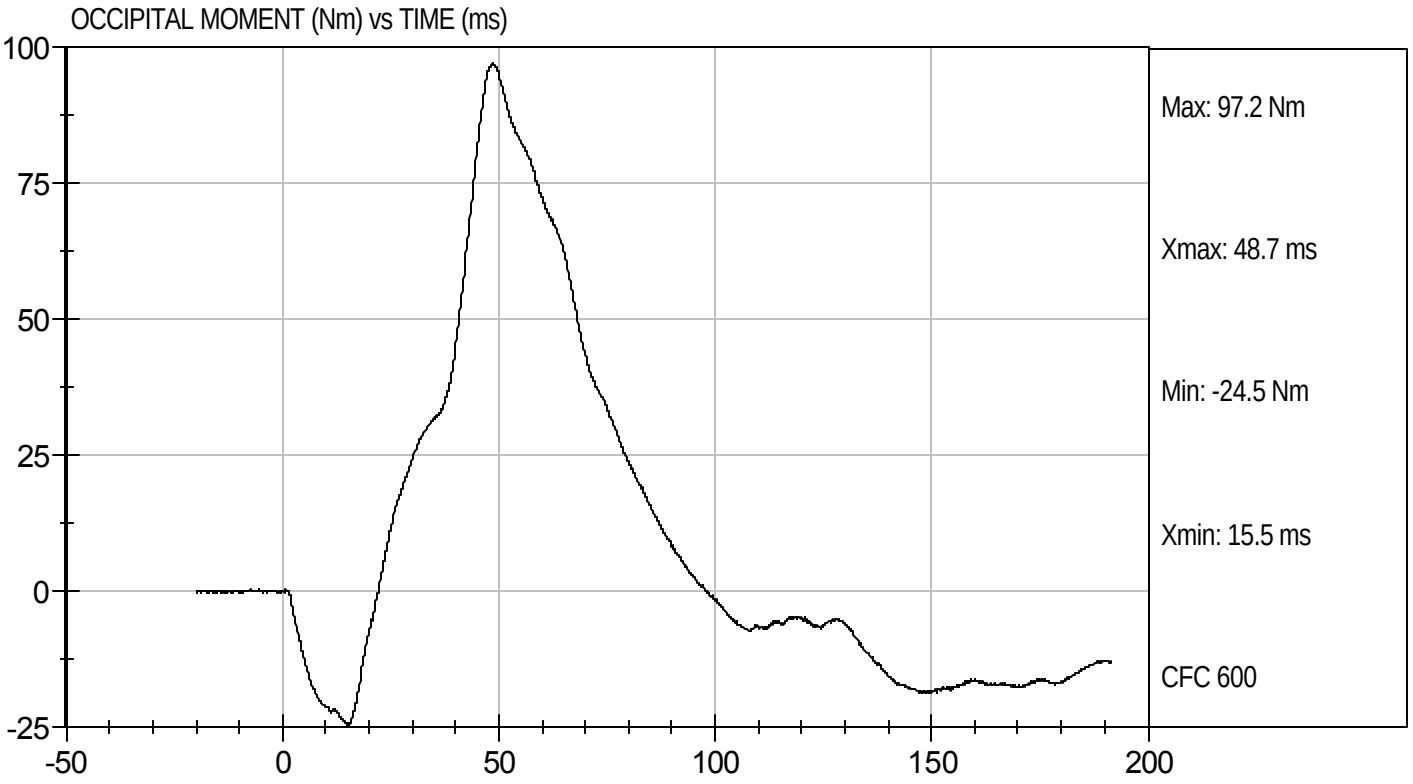


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D11022

Test Date: 1/4/11
Velocity: 22.83 ft/s, 6.96 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D11023

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.48	Pass
	20 ms	G's	14.00 to 19.00	17.66	Pass
	30 ms	G's	11.00 to 16.00	14.39	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.6	Pass
	Time	ms	72.0 to 82.0	74.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	153.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-68.9	Pass
	Time	ms	65.0 to 79.0	68.4	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	139.8	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

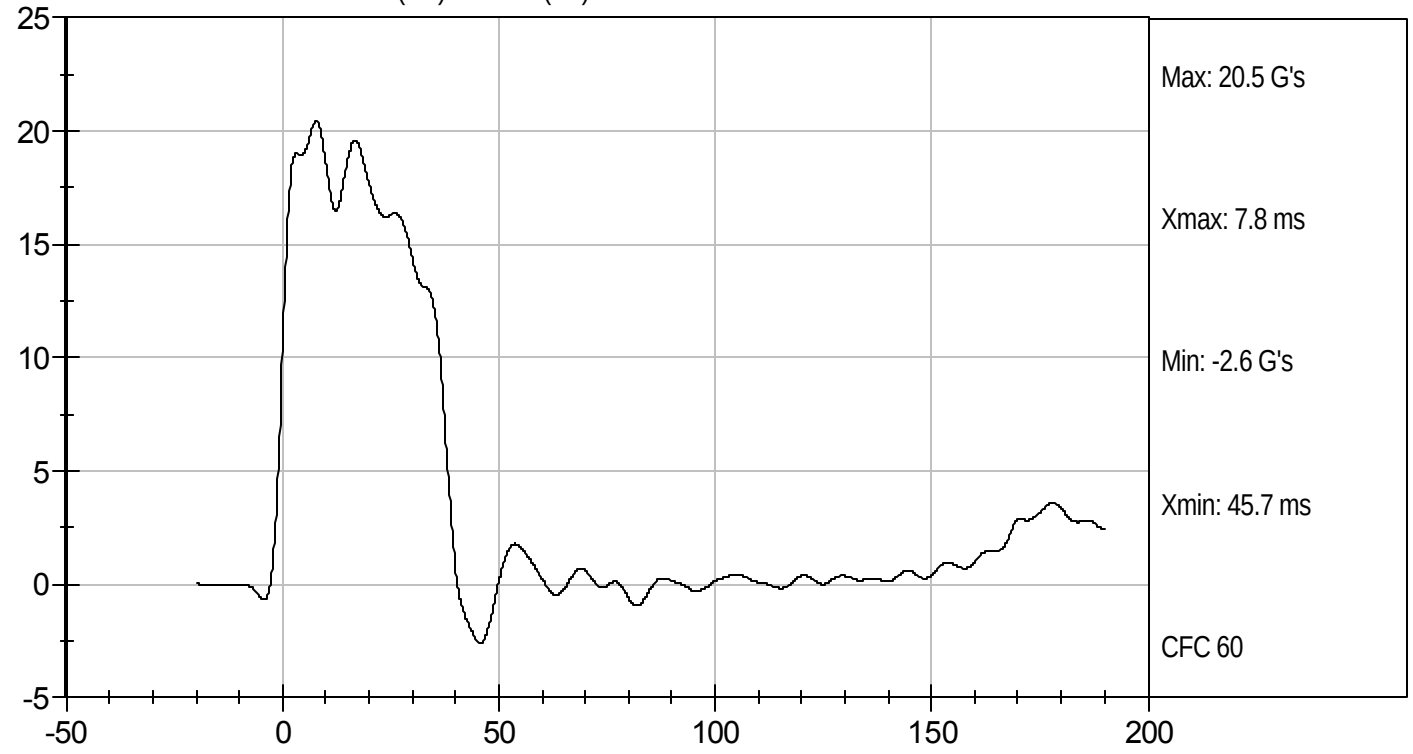
1/4/11
Test Date

David Winkelbauer
Approved By

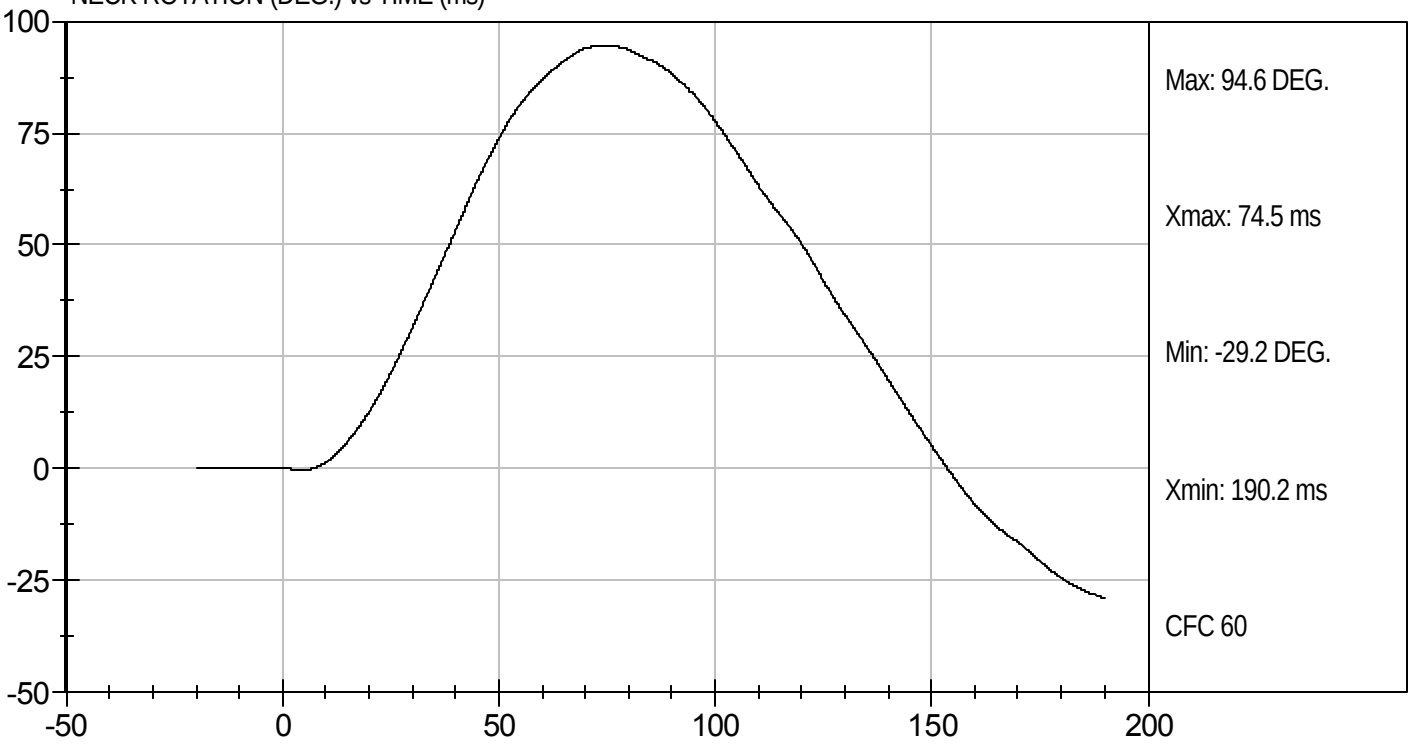
Test Desc: Neck Extension
Component ID: D11023

Test Date: 1/4/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (G's) vs TIME (ms)

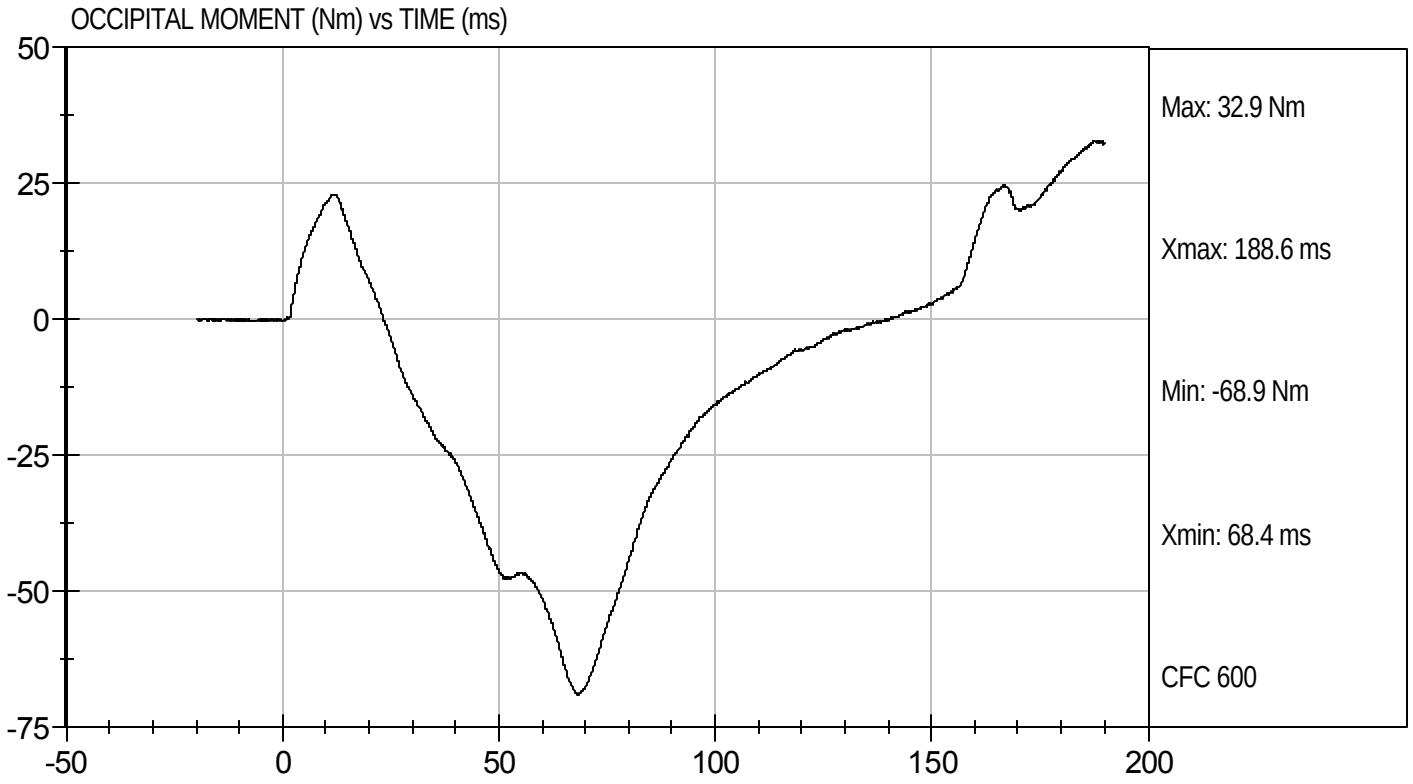


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D11023

Test Date: 1/4/11
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D11024

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,576	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.36	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

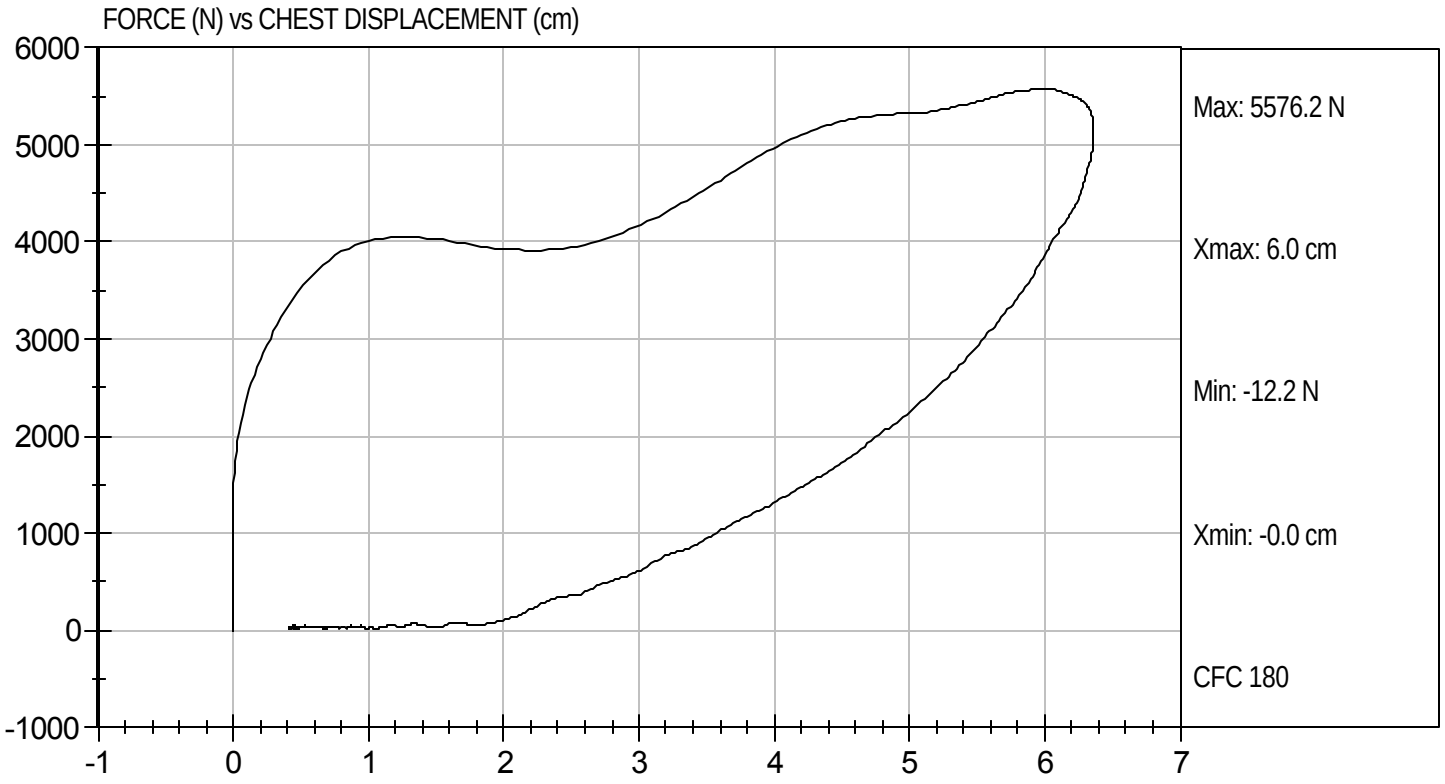
Jessica Hall
Laboratory Technician

1/3/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D11024

Test Date: 1/3/11
Velocity: 22.22 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D11025

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,052	Pass
		Overall Test Results		Pass

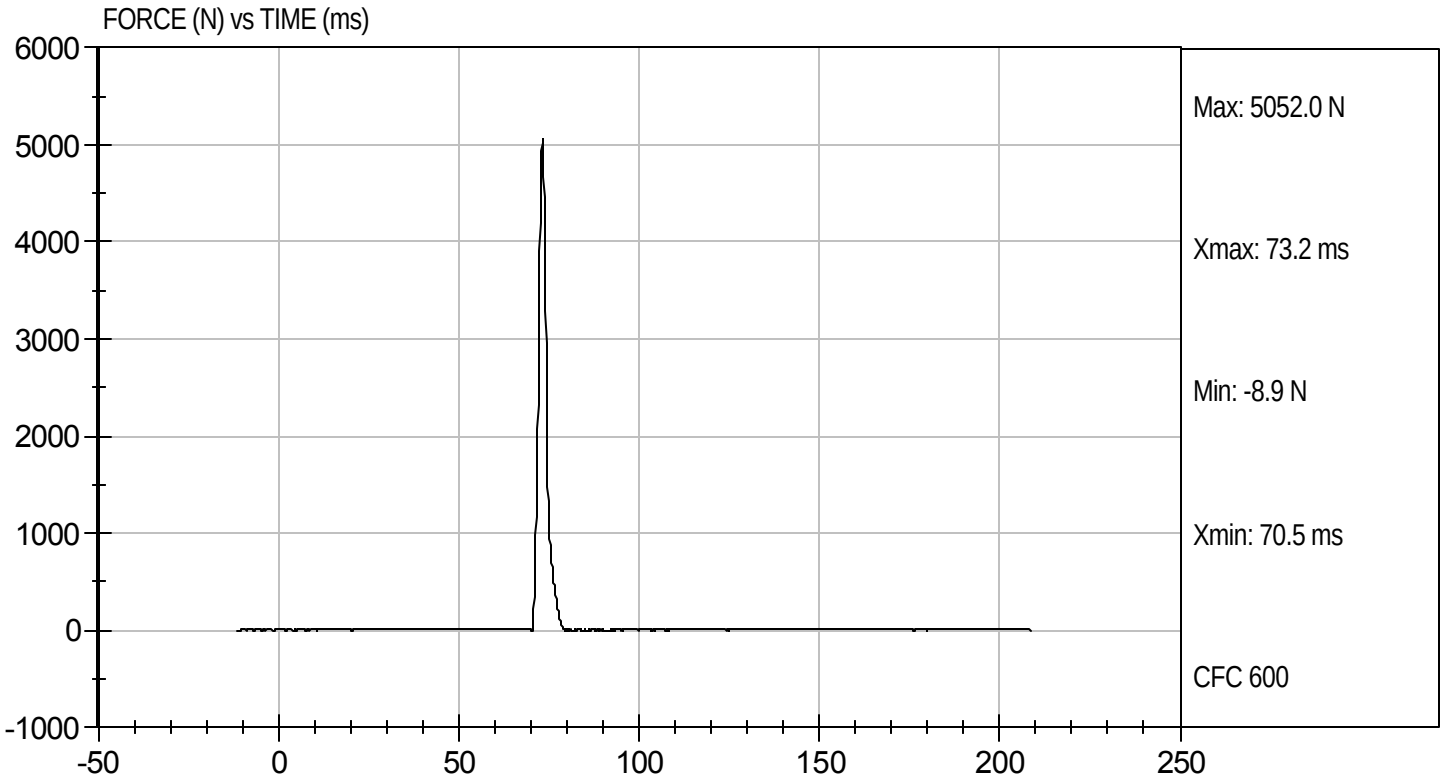
Jessica Gall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D11025

Test Date: 1/4/11
Velocity: 6.88 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D11026

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,422	Pass
		Overall Test Results		Pass

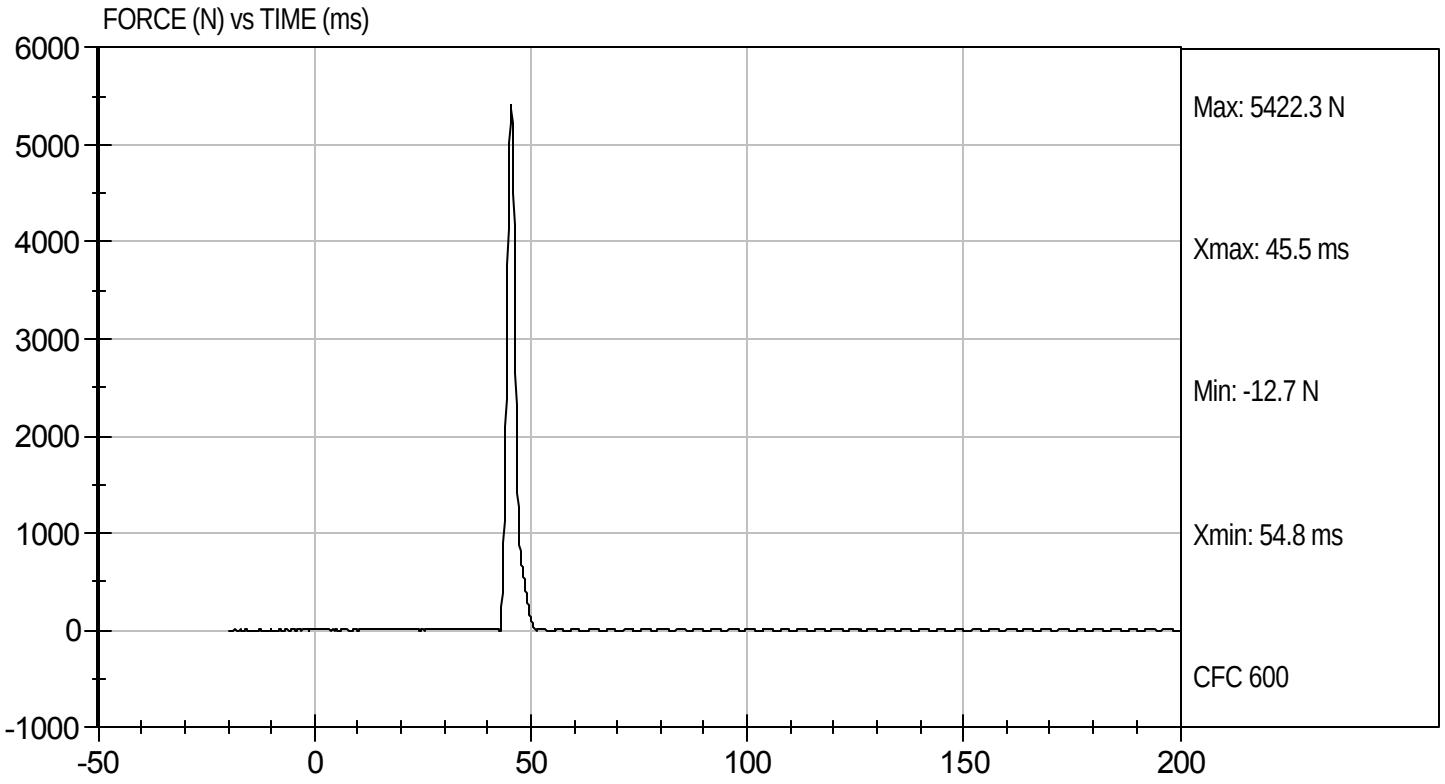
Jessica Hall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D11026

Test Date: 1/4/11
Velocity: 6.91 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 036 **Test I.D:** D11020

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.8	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	21	21	Pass
Rotation Rate	deg/s	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	58.5	48.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	49	48	Pass
		Overall Test Results			Pass

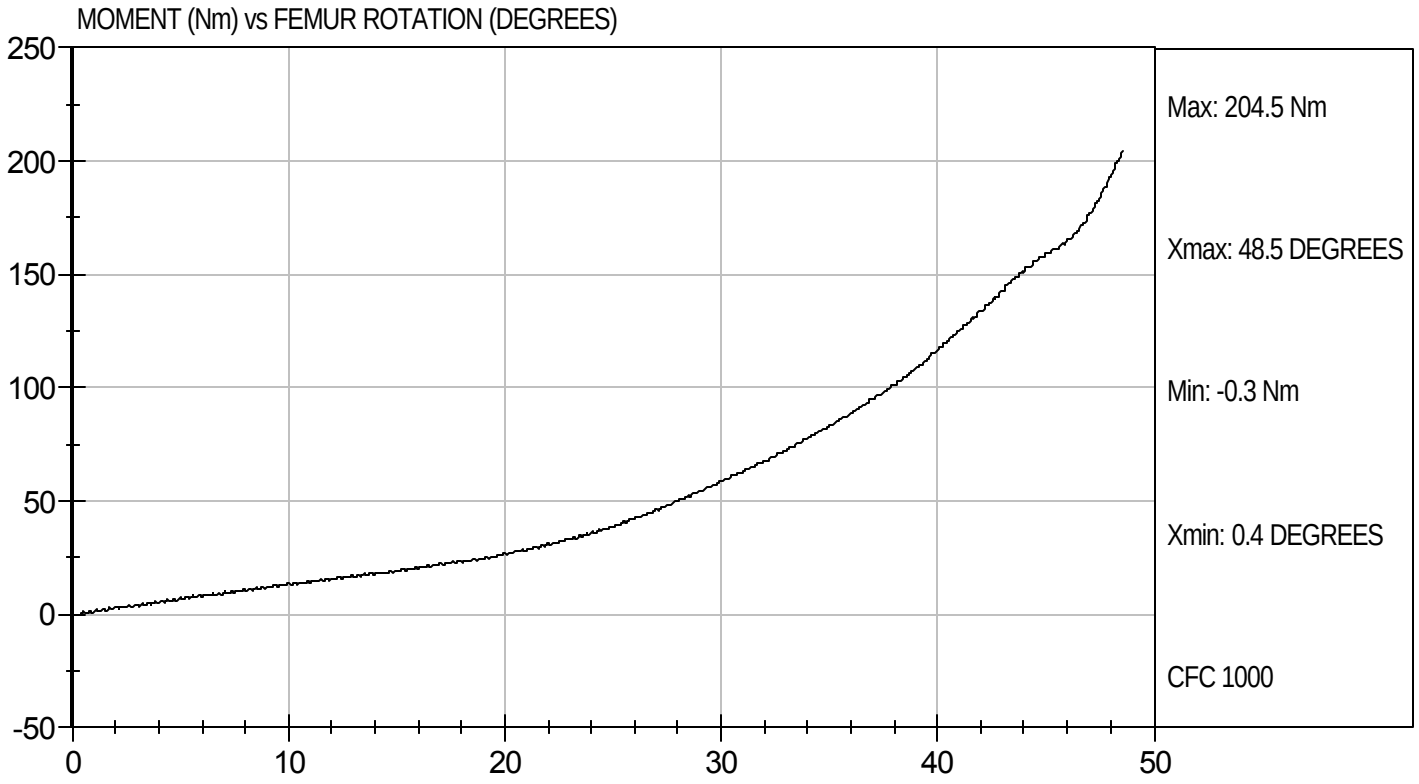
Jessica Gall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By

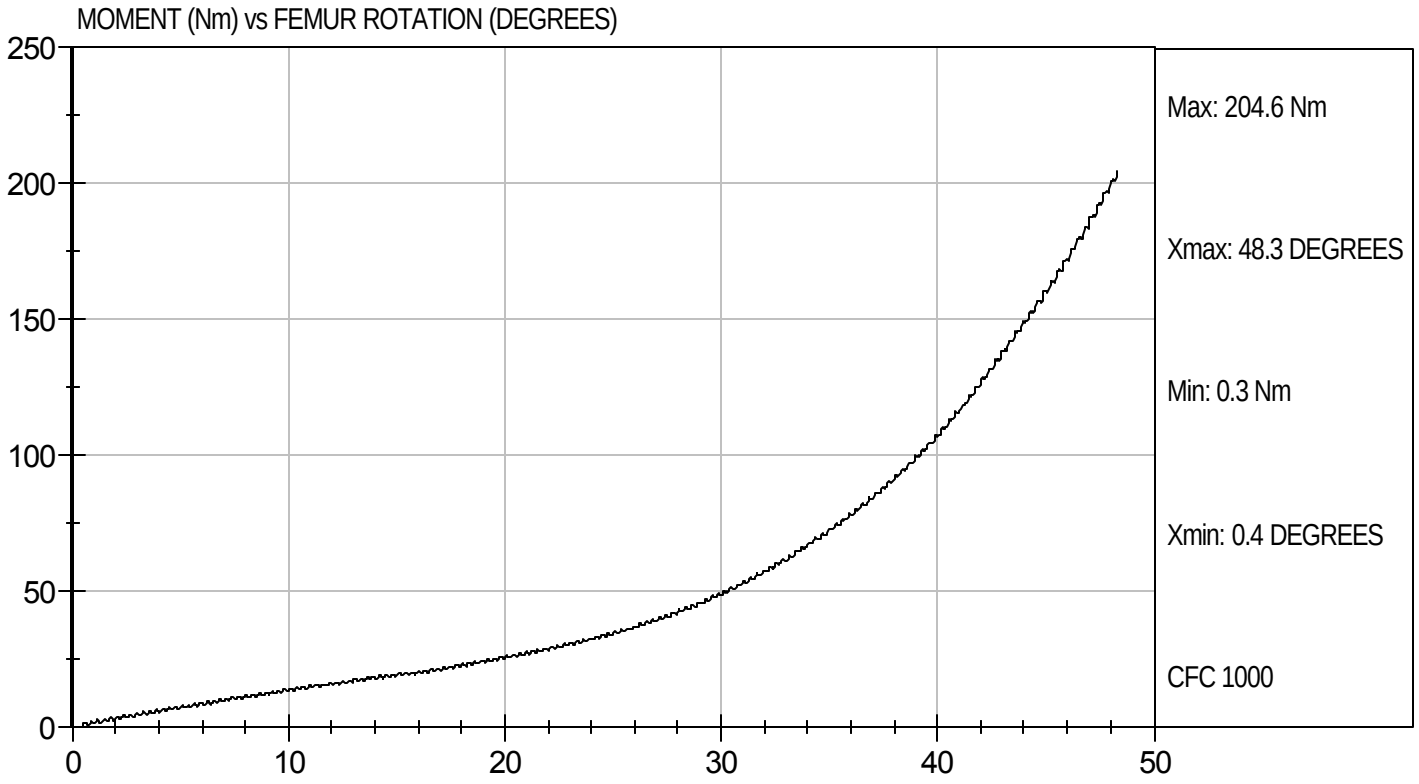
Test Desc: Hip Femur Flexion
Component ID: D11029

Test Date: 1/4/11
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D11020

Test Date: 1/4/11
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D104391

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	12	Pass
Peak Resultant Acceleration	G's	250 to 300	294	Pass
Peak Lateral Acceleration	G's	+/- 15	-9.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

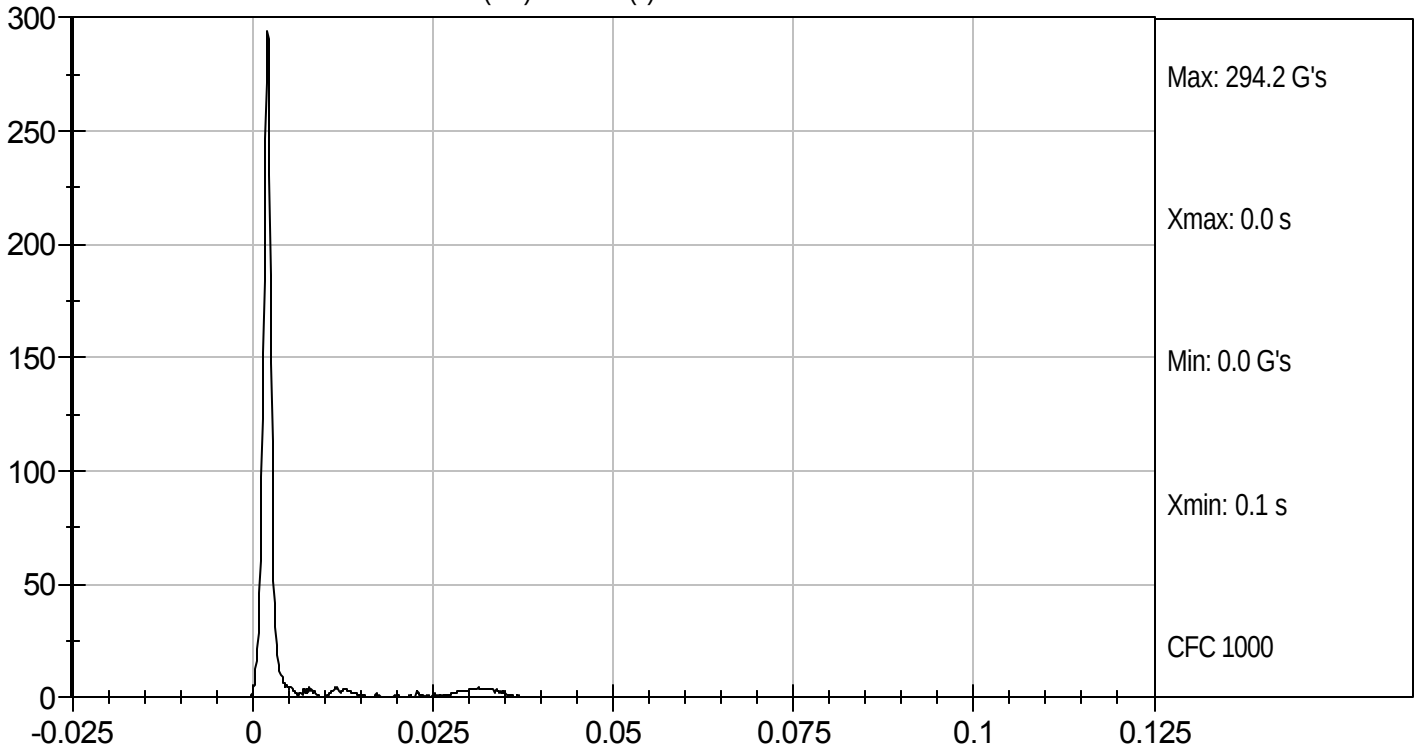
12/13/10
Test Date

David Winkelbauer
Approved By

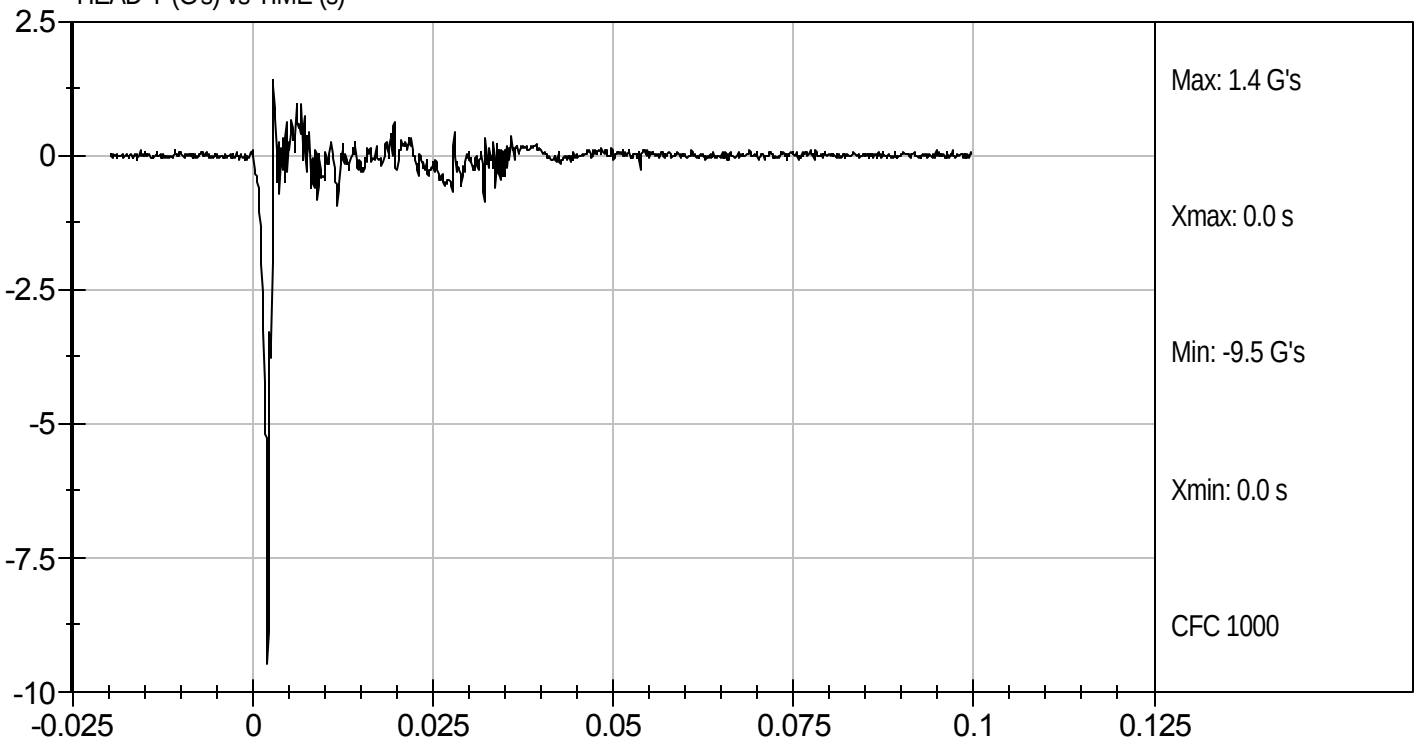
Test Desc: Head Drop
Component ID: D104391

Test Date: 12/13/10
Velocity: 0 ft/s, 0 m/s

RESULTANT HEAD ACCELERATION (G's) vs TIME (s)



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D104392

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	11	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.4	Pass
	30 ms	m/s	5.8 to 7.0	6.1	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	69	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

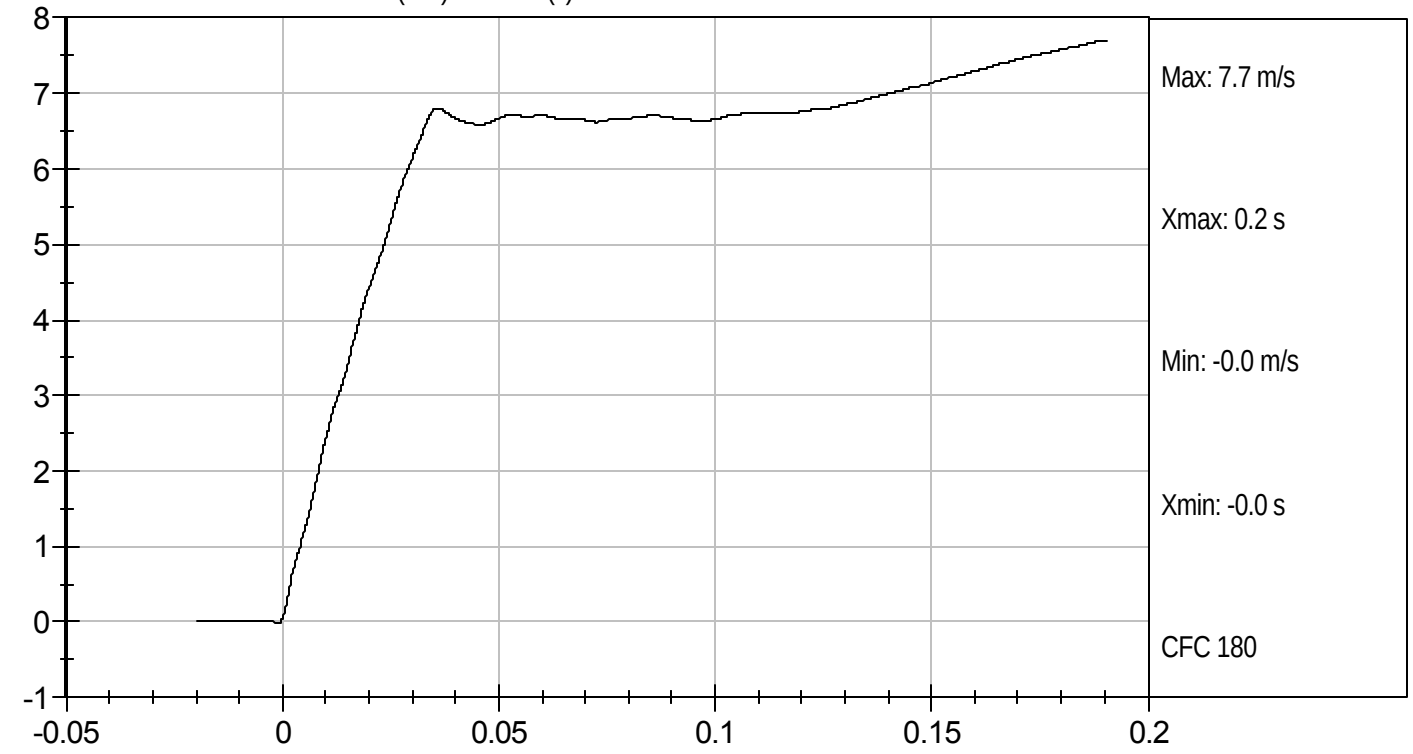
12/13/10
Test Date

David Winkelbauer
Approved By

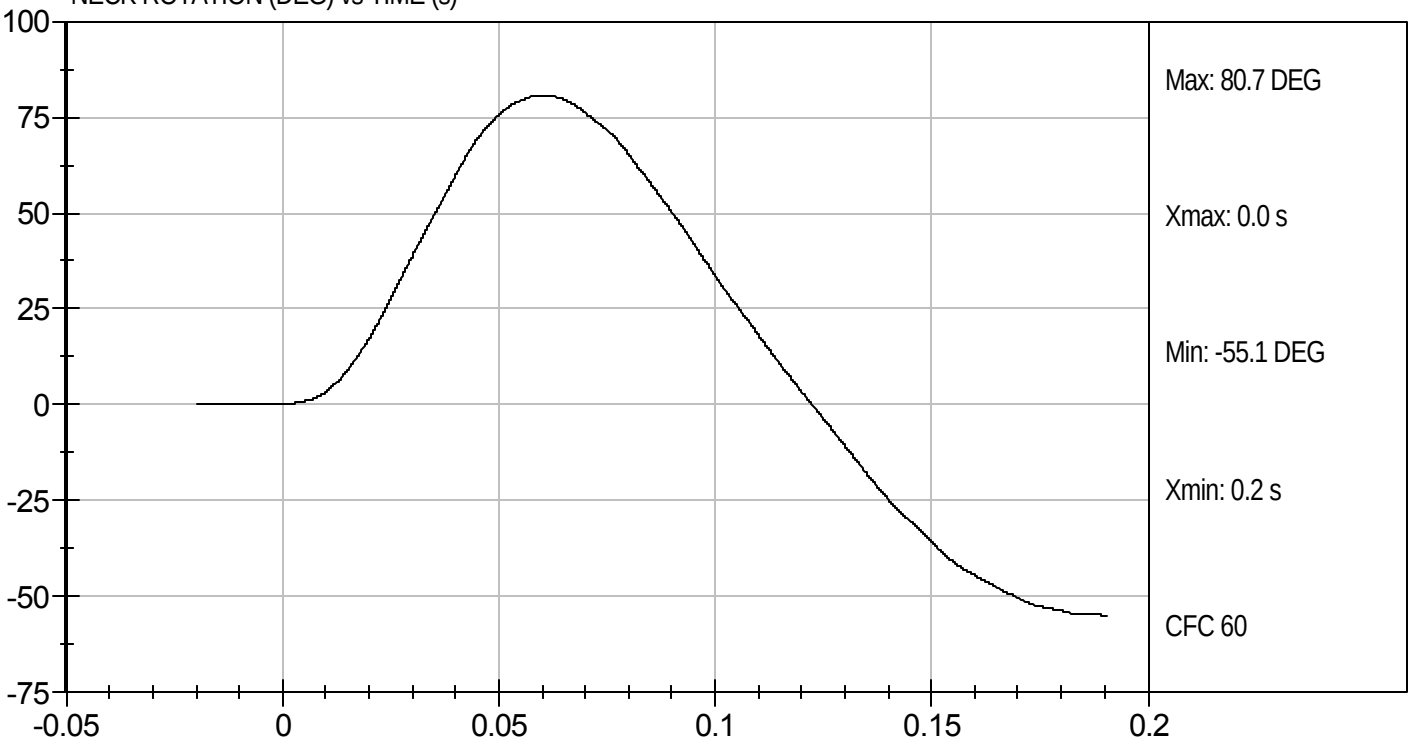
Test Desc: Neck Flexion
Component ID: D104392

Test Date: 12/13/10
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)

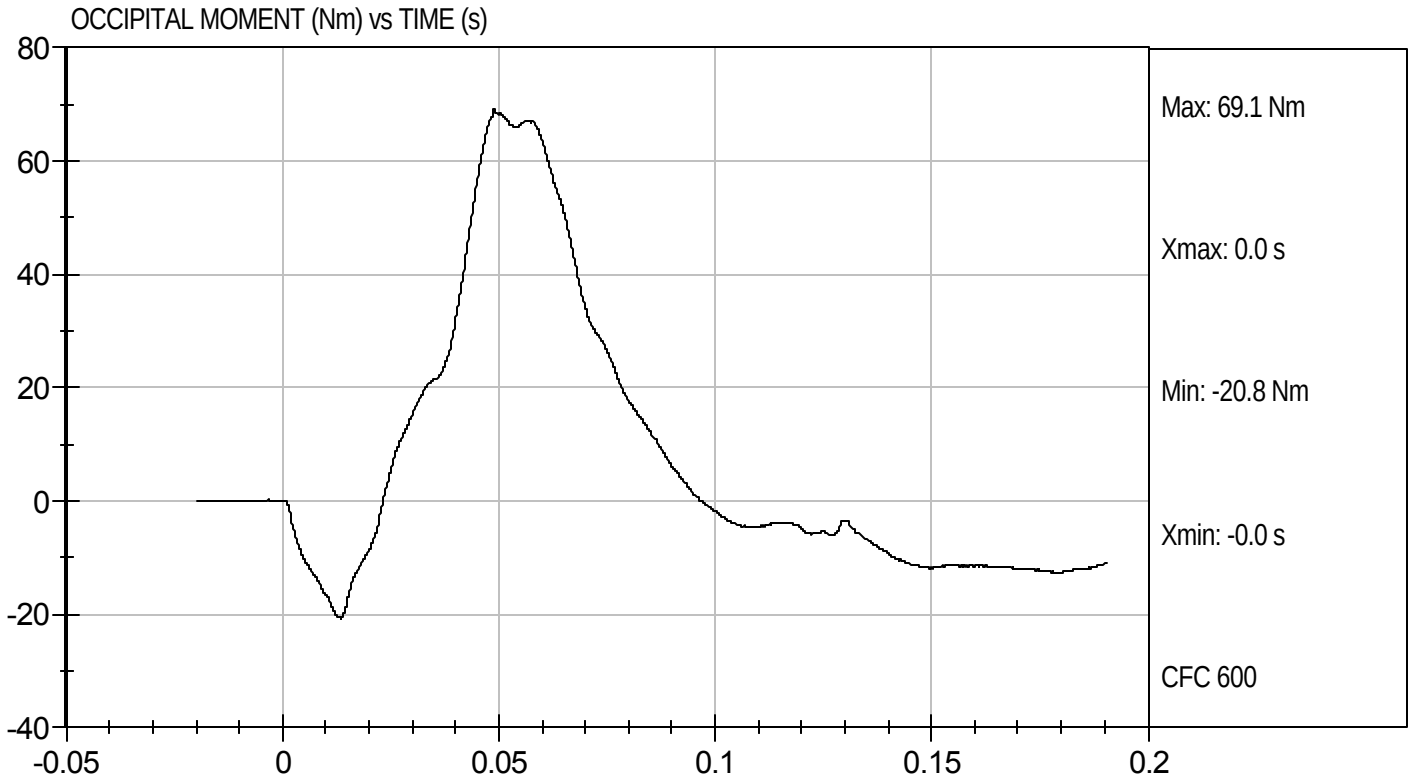


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D104392

Test Date: 12/13/10
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D104393

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	11	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	104	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

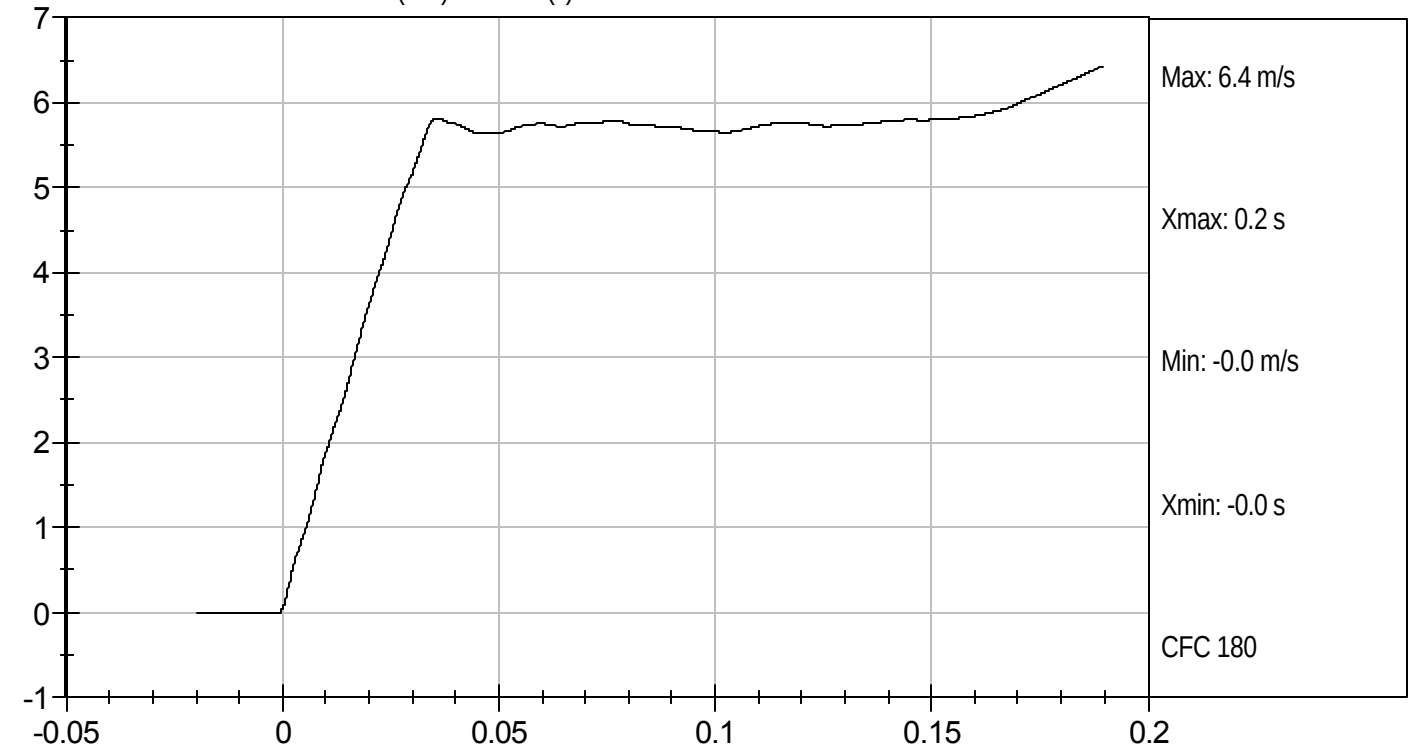
12/13/10
Test Date

David Winkelbauer
Approved By

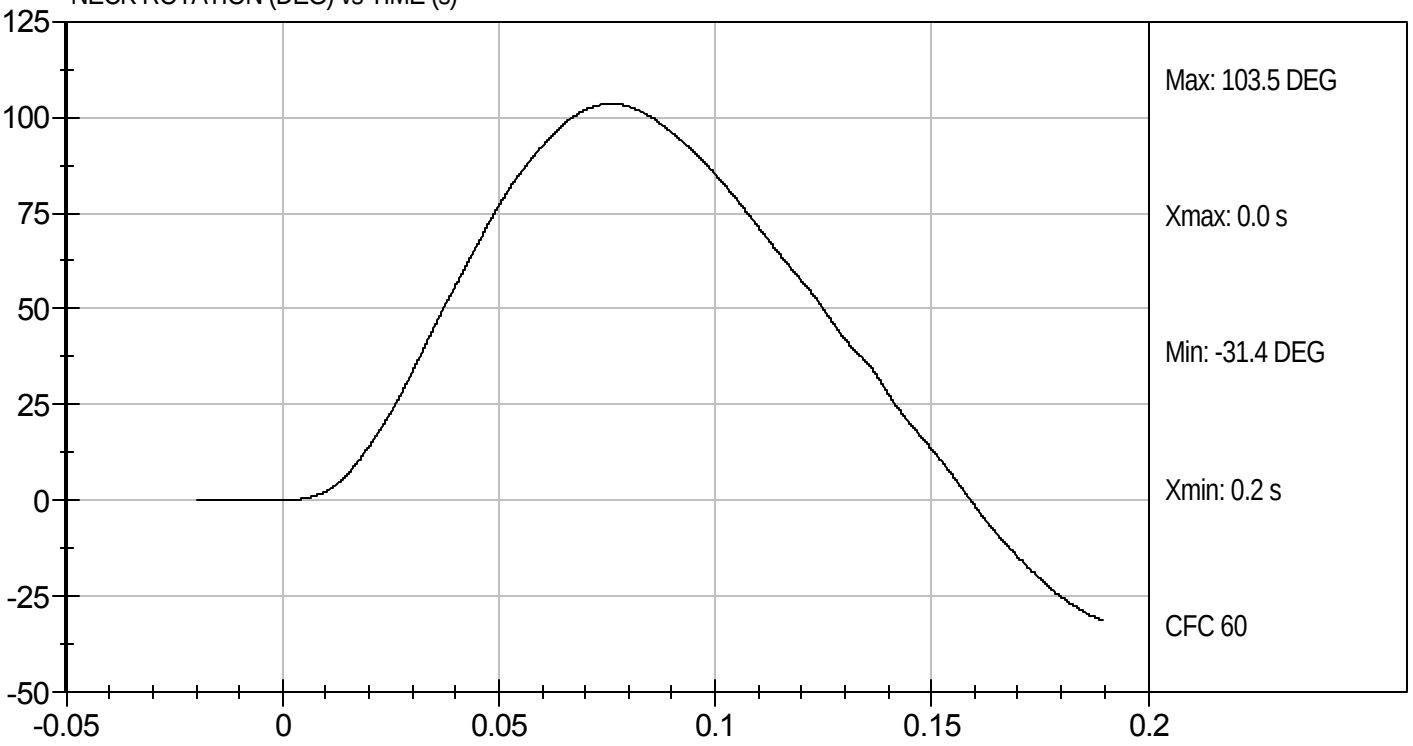
Test Desc: Neck Extension
Component ID: D104393

Test Date: 12/13/10
Velocity: 20.10 ft/s, 6.13 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)

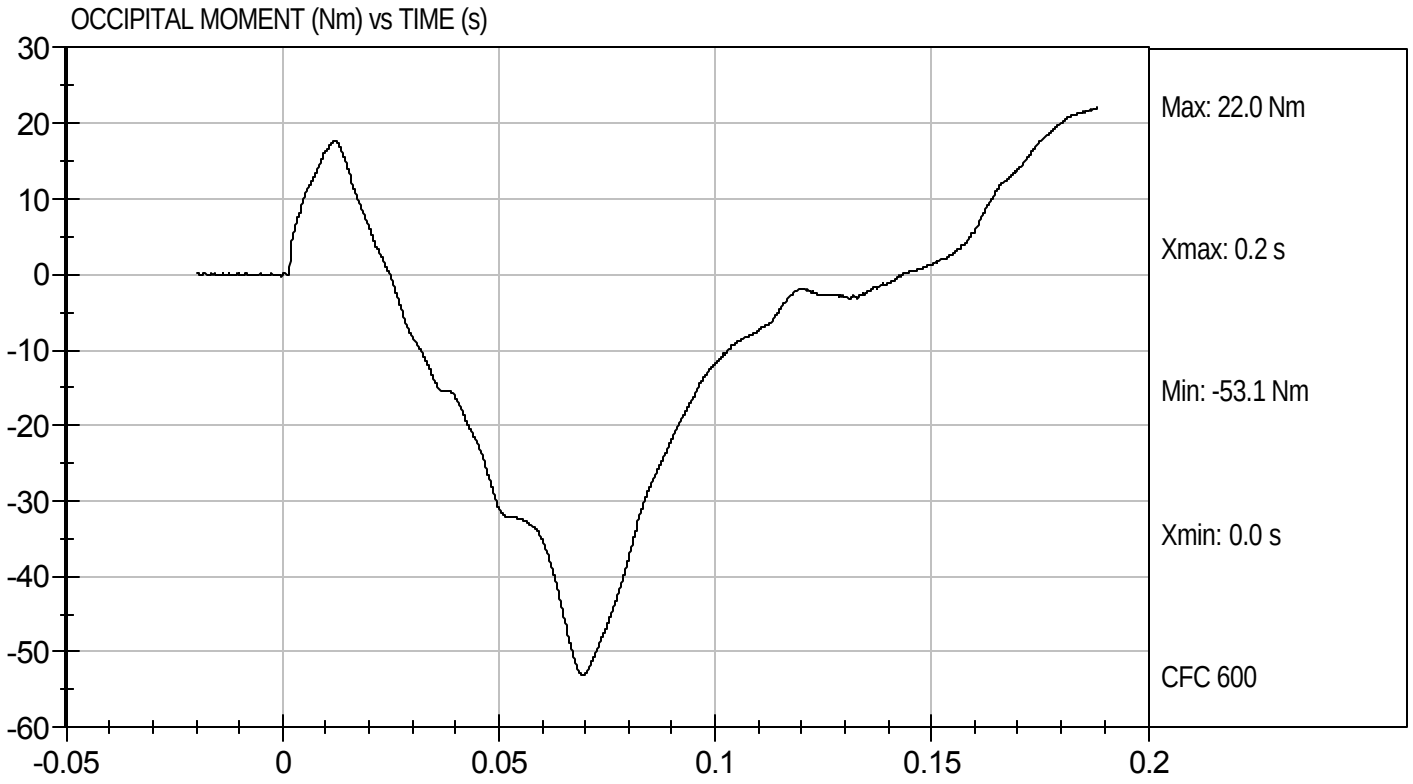


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Extension
Component ID: D104393

Test Date: 12/13/10
Velocity: 20.10 ft/s, 6.13 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D104394

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Relative Humidity	%	10 to 70	14	Pass
Probe Speed	m/s	6.59 to 6.83	6.60	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4263	Pass
		Overall Test Results		Pass

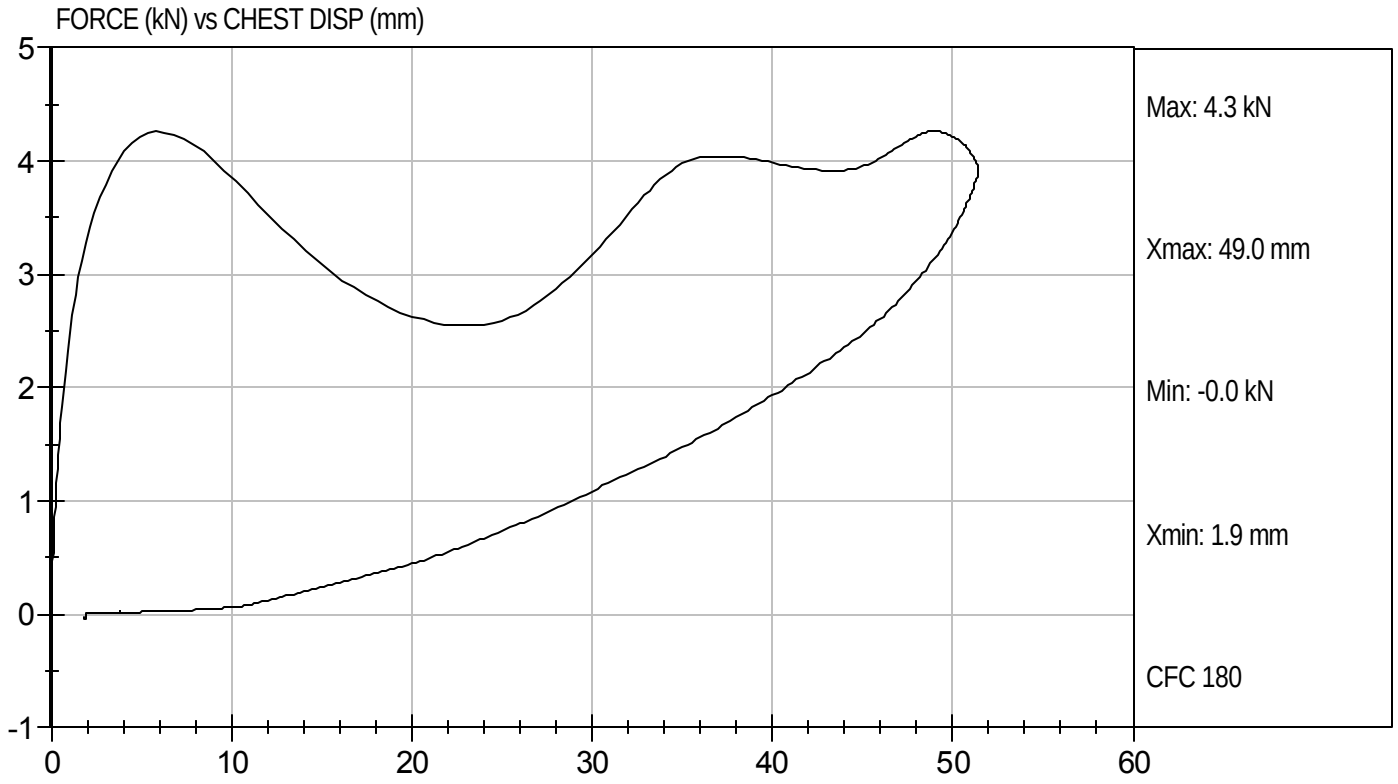
Jessica Gall
Laboratory Technician

12/13/10
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D104394

Test Date: 12/13/10
Velocity: 21.64 ft/s, 6.60 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D104395

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.76	Pass
		Overall Test Results		Pass

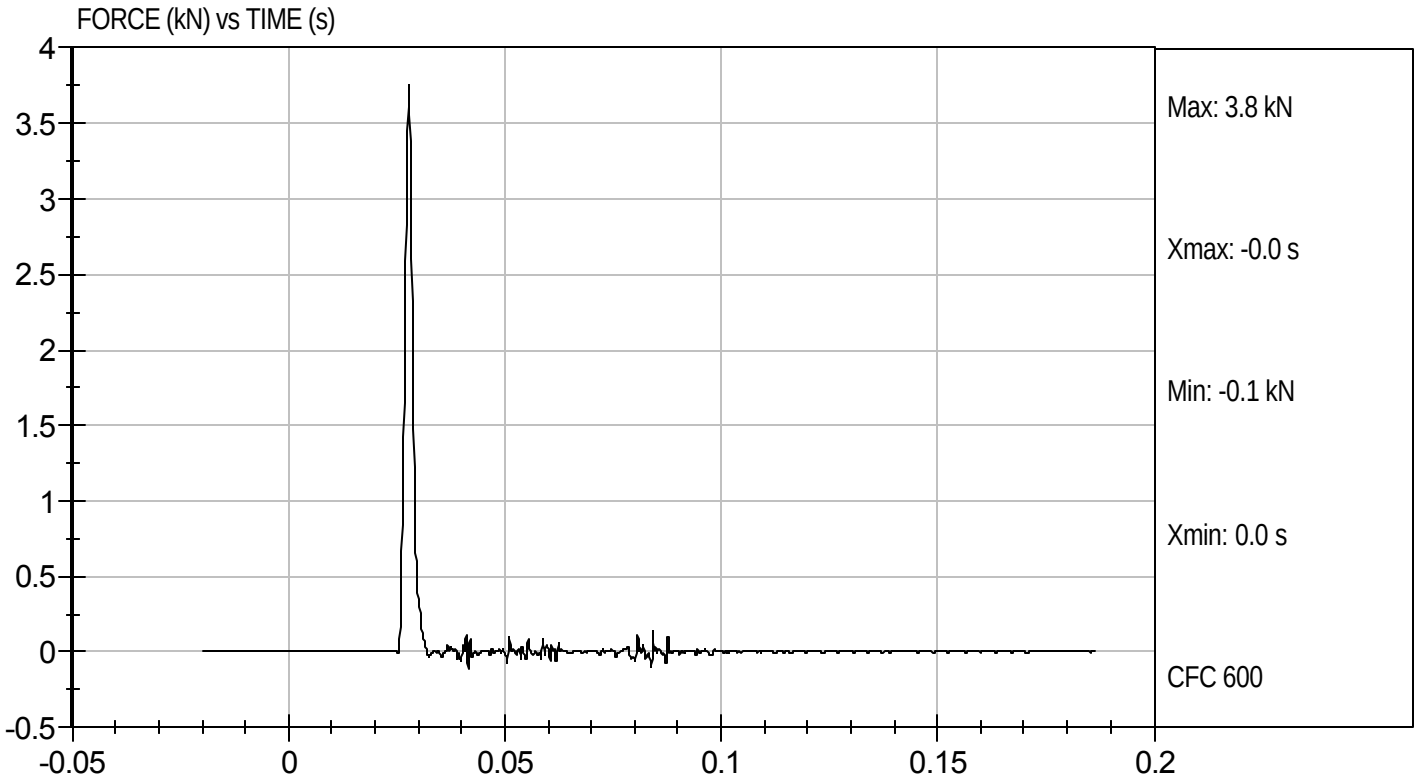
Jessica Hall
Laboratory Technician

12/13/10
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D104395

Test Date: 12/13/10
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D104396

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.84	Pass
		Overall Test Results		Pass

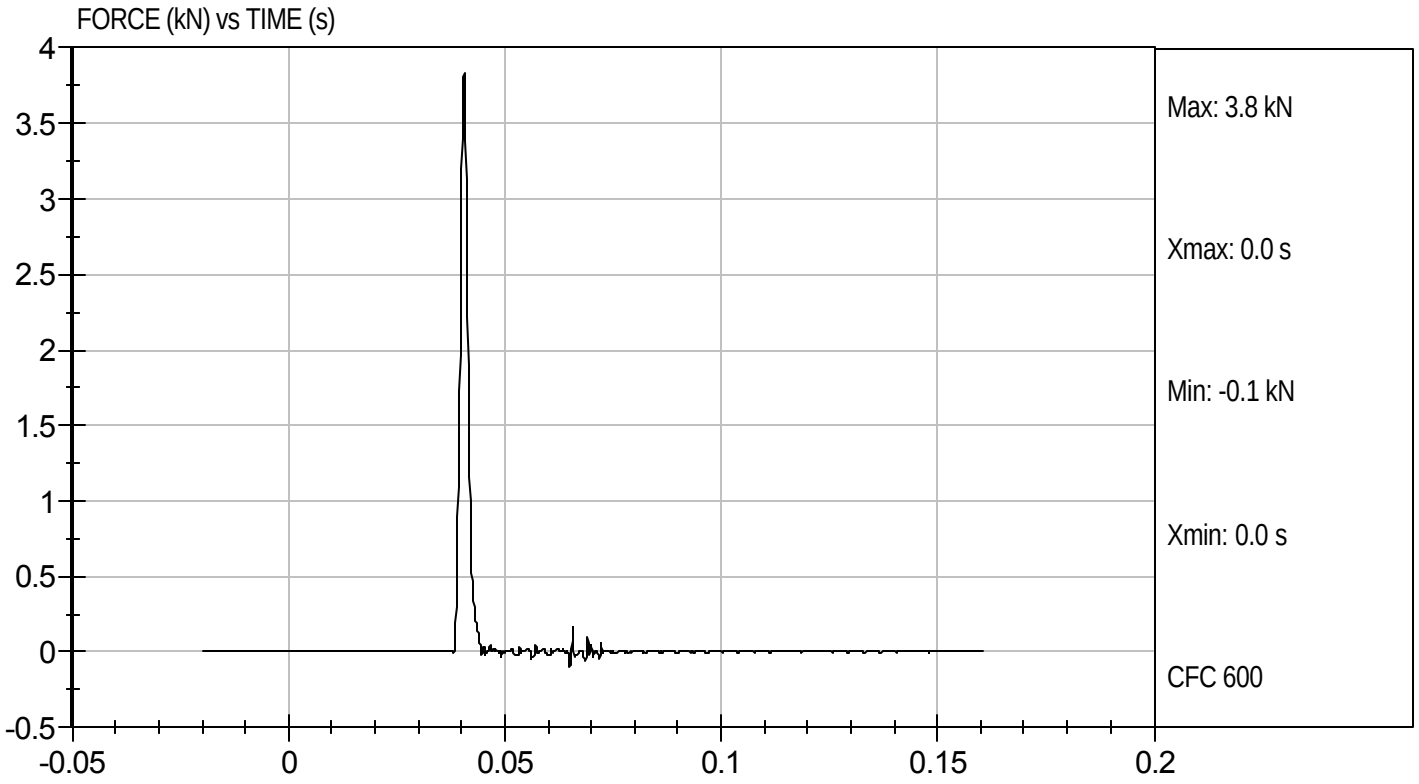
Jessica Hall
Laboratory Technician

12/13/10
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D104396

Test Date: 12/13/10
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D104397

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	14	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	5	Pass
Force at 45 deg	N	320 to 390	363	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jessica Hall
Laboratory Technician

12/13/10
Test Date

David Winkelbauer
Approved By

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test ID:** D11031

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	G's	250 to 300	252	Pass
Peak Lateral Acceleration	G's	+/- 15	4.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

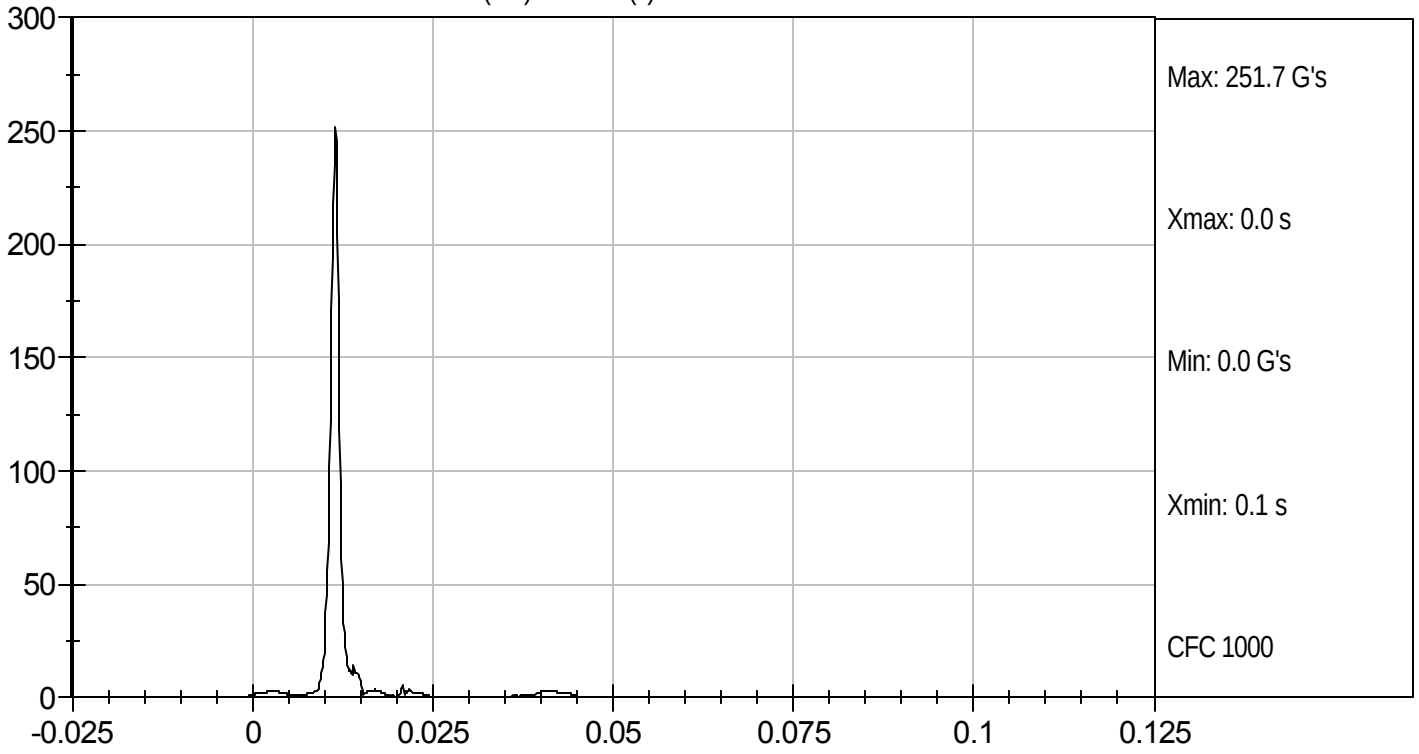
1/4/11
Test Date

David Winkelbauer
Approved By

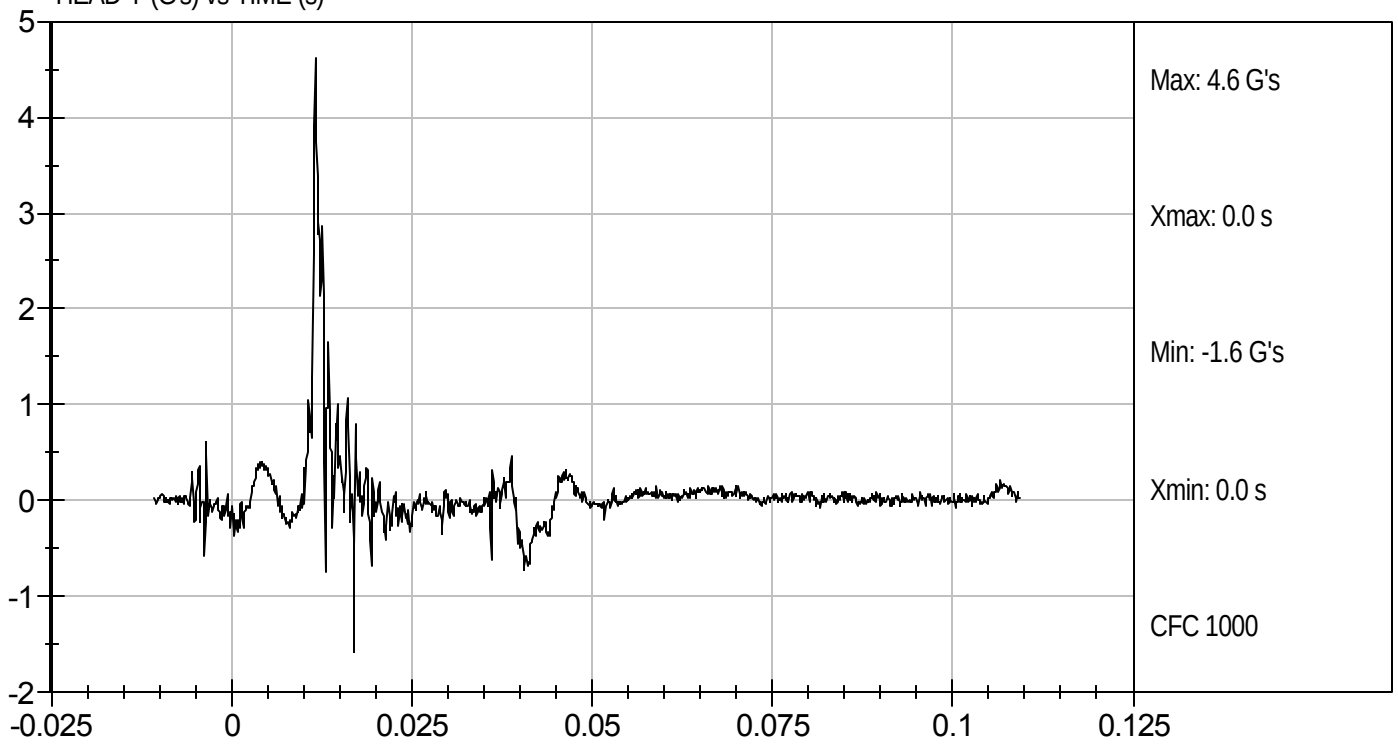
Test Desc: Head Drop
Component ID: D11031

Test Date: 1/4/11
Velocity: 0 ft/s, 0.00 m/s

RESULTANT HEAD ACCELERATION (G's) vs TIME (s)



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



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11032

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	17	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	72	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	84	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

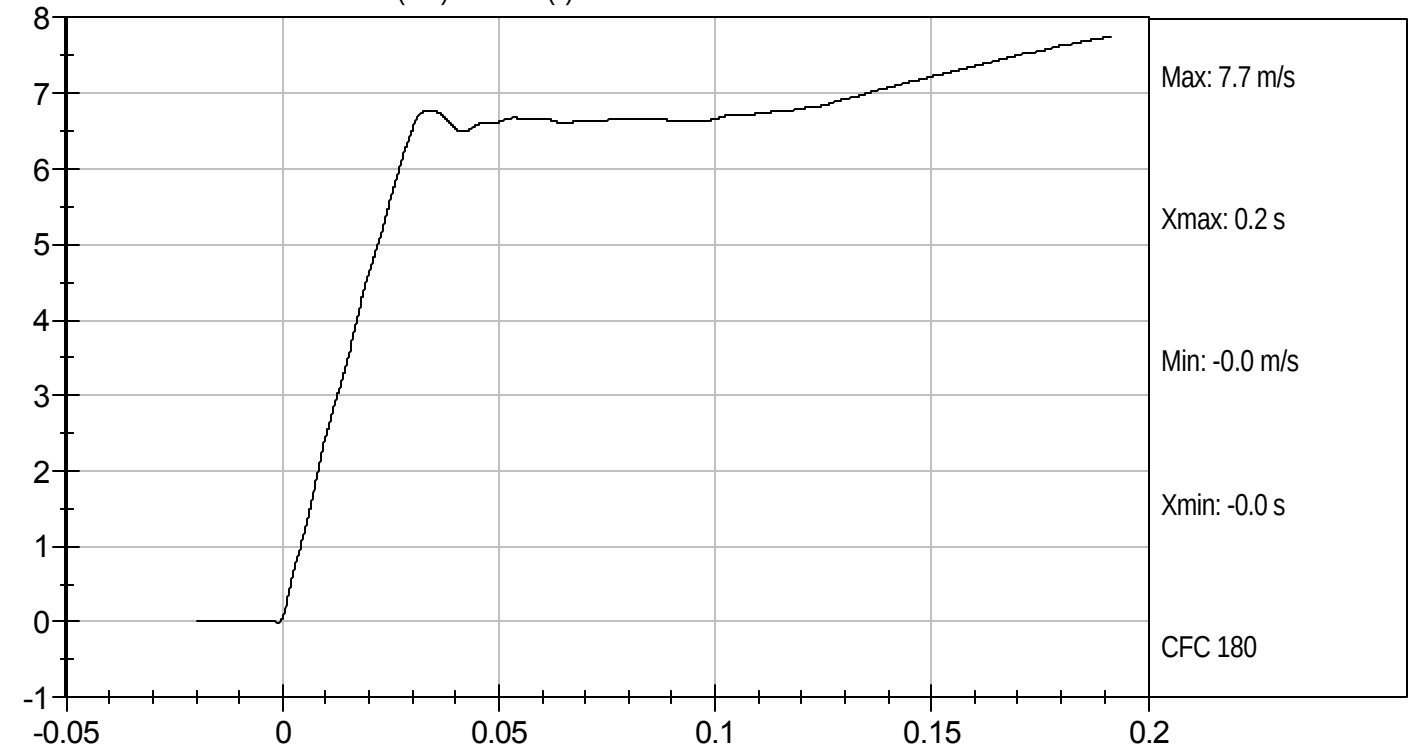
1/3/11
Test Date

David Winkelbauer
Approved By

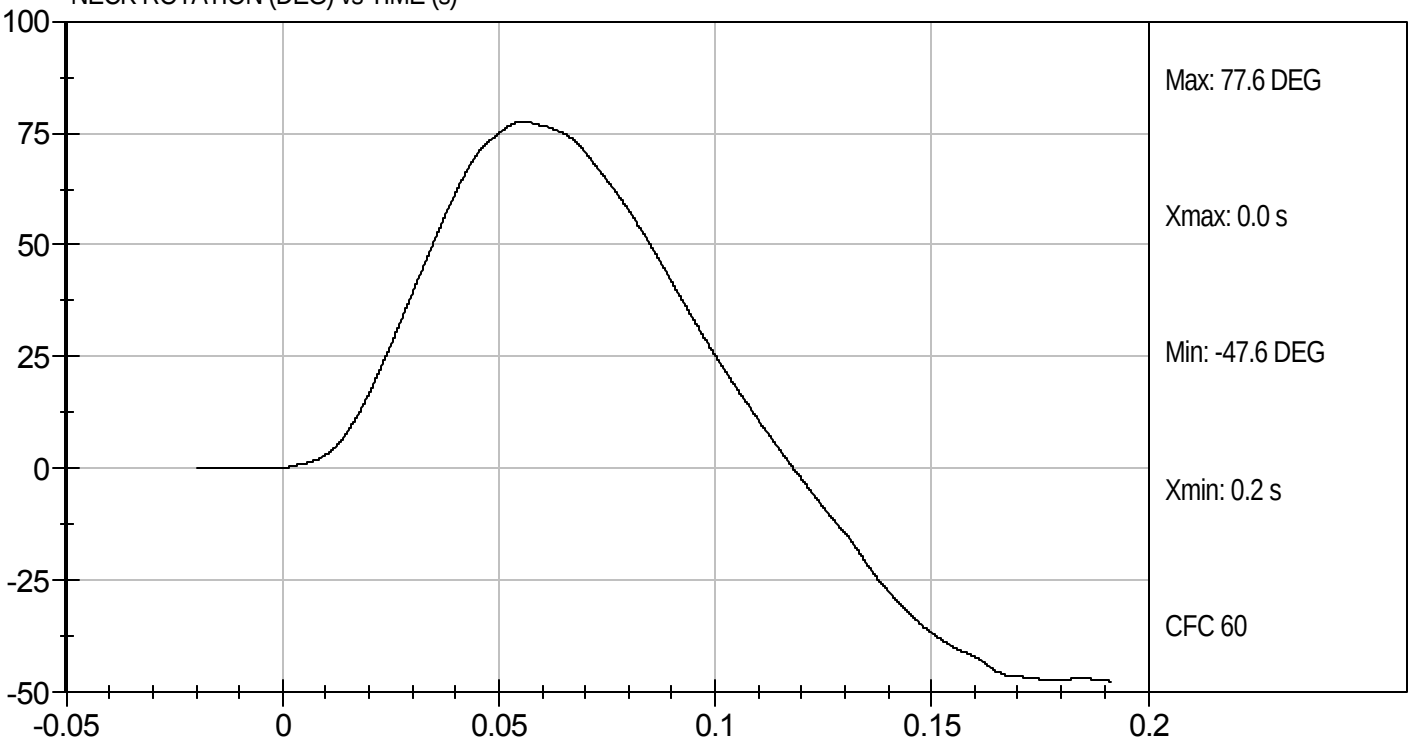
Test Desc: Neck Flexion
Component ID: D11032

Test Date: 1/3/11
Velocity: 23.15 ft/s, 7.06 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)

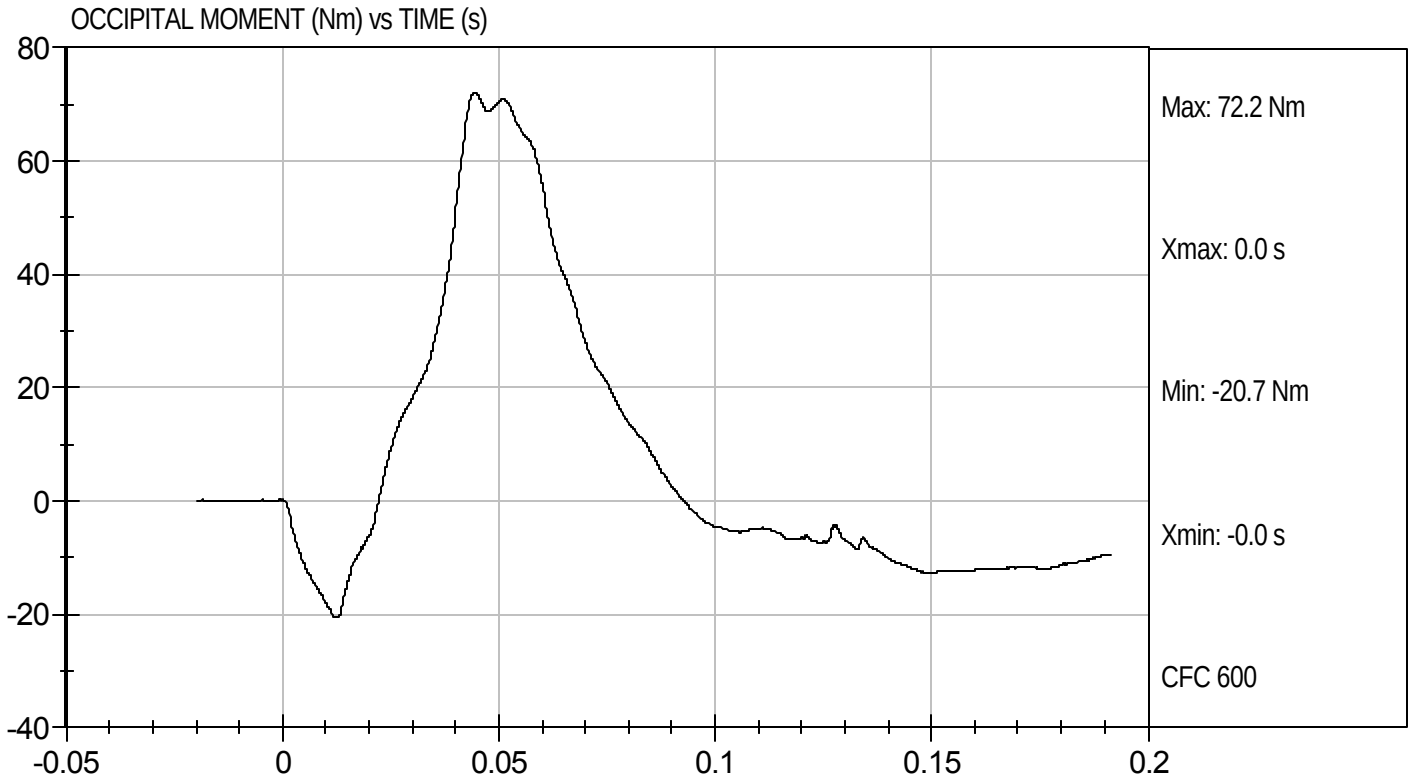


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D11032

Test Date: 1/3/11
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11033

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	17	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.0	Pass
D Plane Rotation	Max	deg	99 to 114	100	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

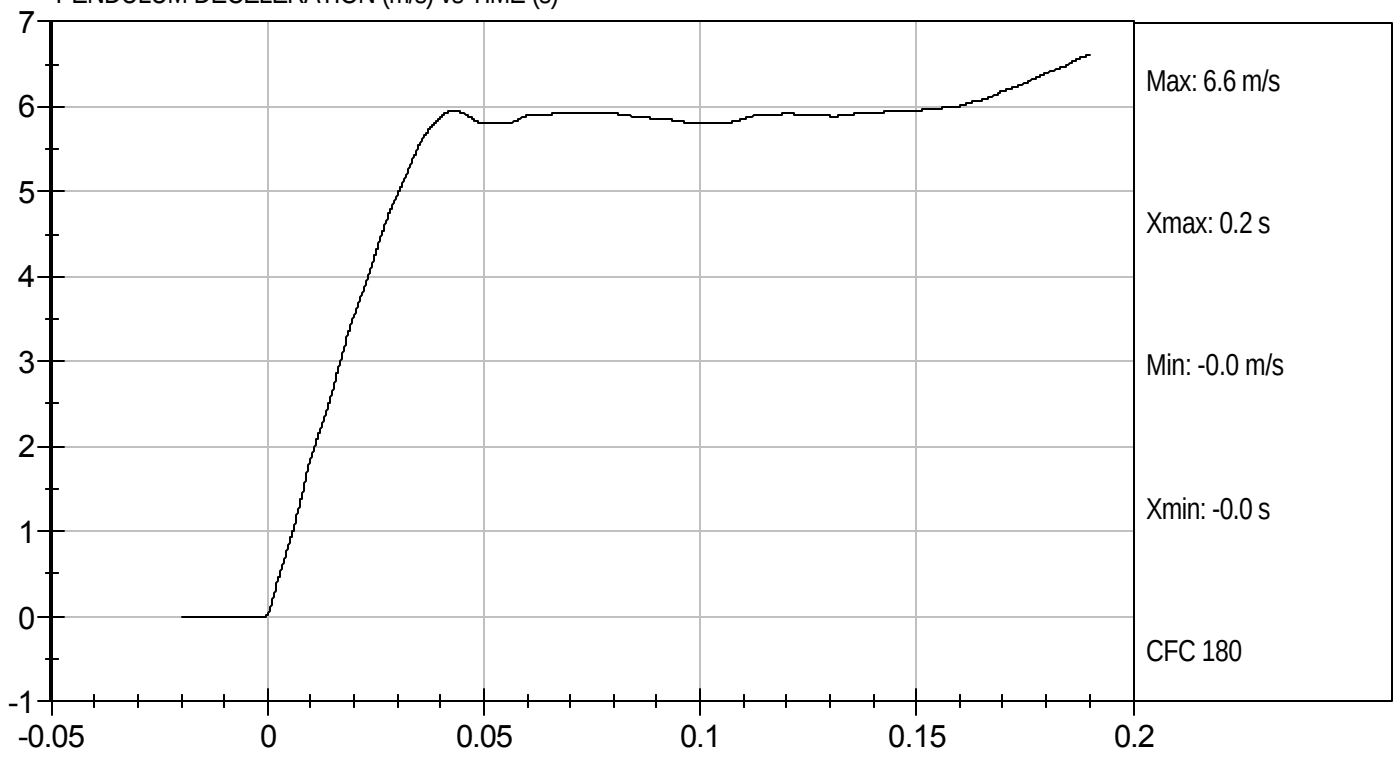
1/3/11
Test Date

David Winkelbauer
Approved By

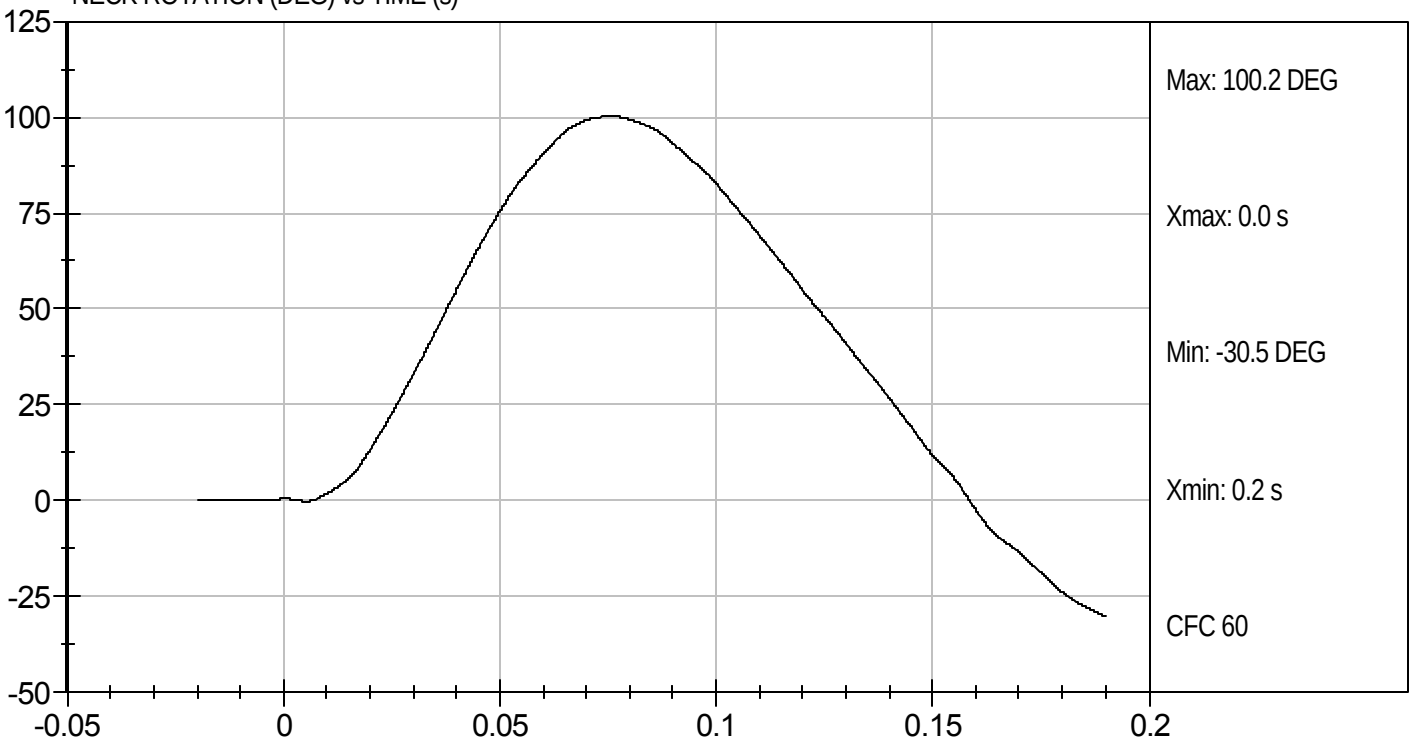
Test Desc: Neck Extension
Component ID: D11033

Test Date: 1/3/11
Velocity: 20.20 ft/s, 6.16 m/s

PENDULUM DECELERATION (m/s) vs TIME (s)

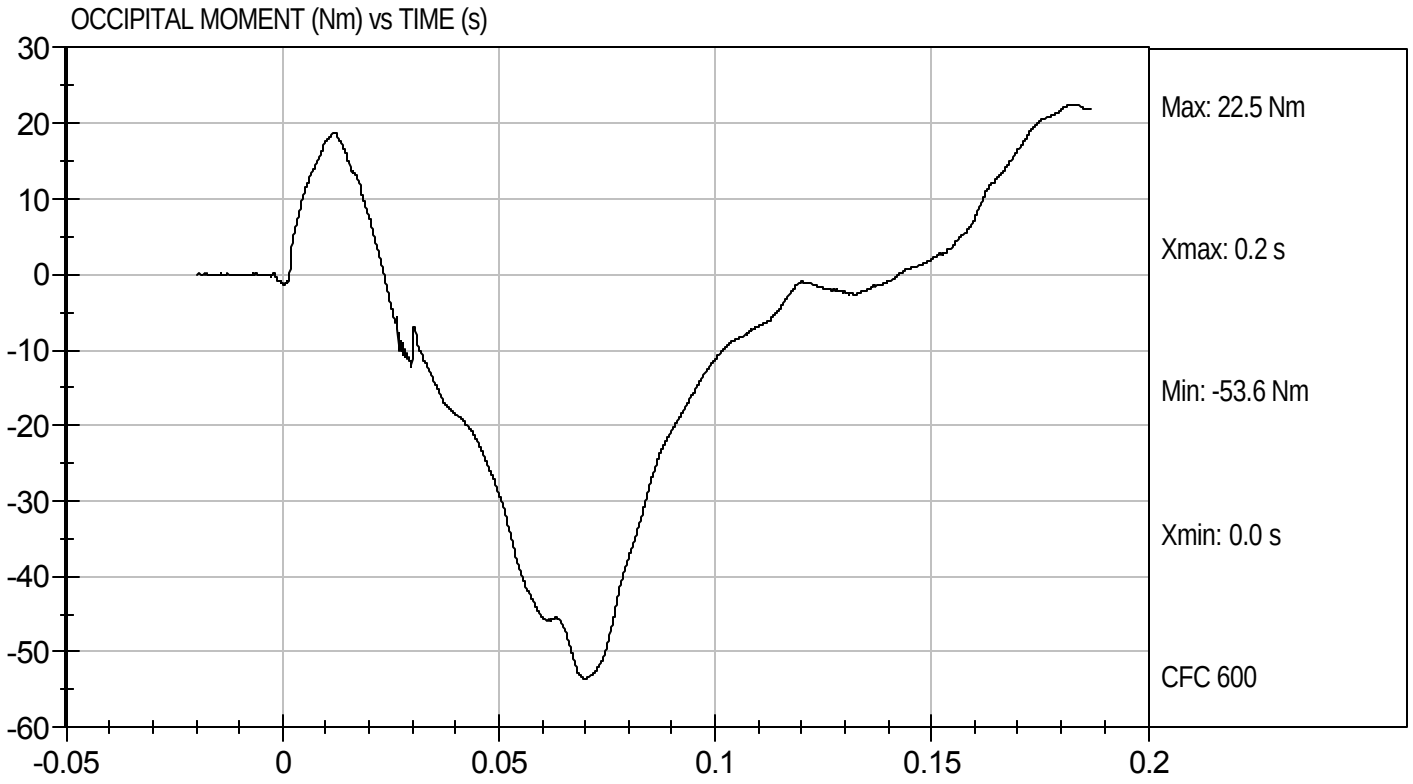


NECK ROTATION (DEG) vs TIME (s)



Test Desc: Neck Extension
Component ID: D11033

Test Date: 1/3/11
Velocity: 20.20 ft/s, 6.16 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11034

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4,600 N	4251	Pass
		Overall Test Results		Pass

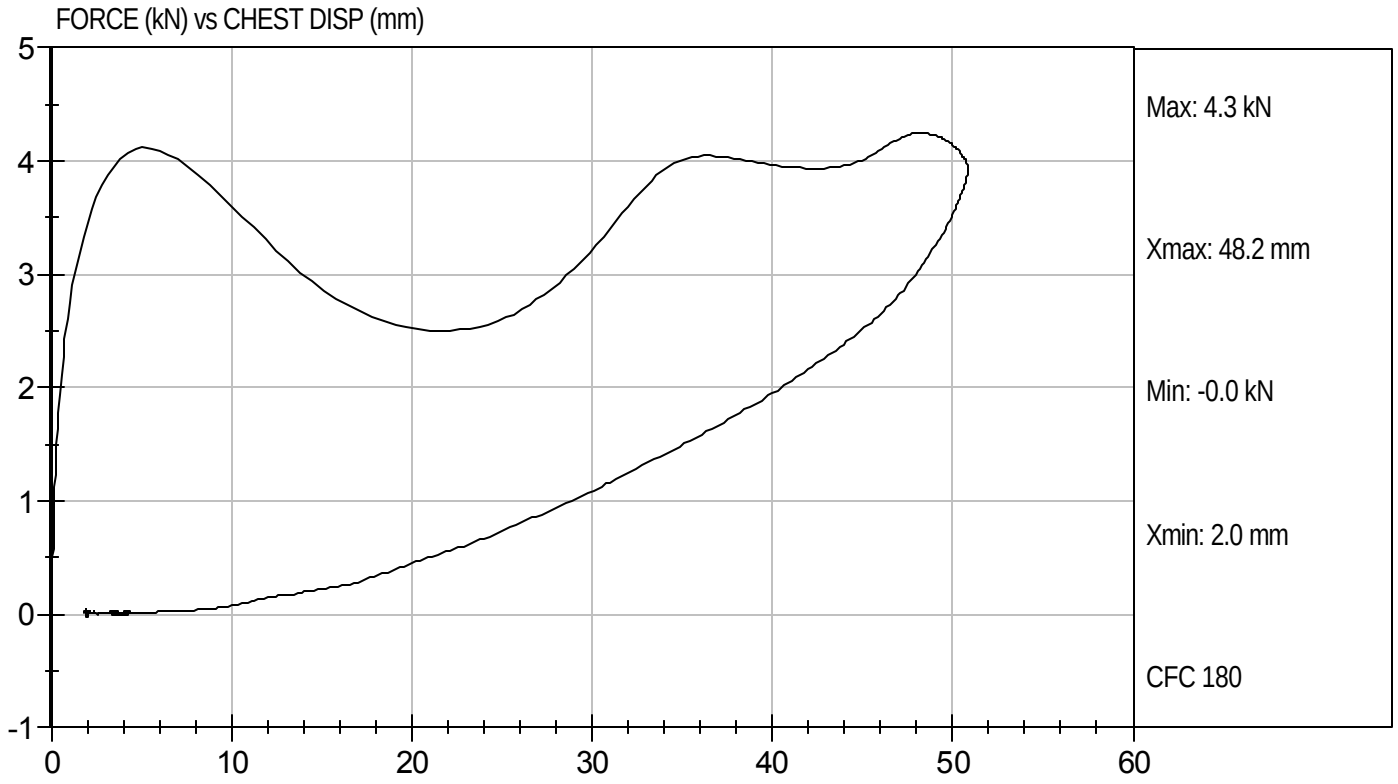
Jessica Hall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D11034

Test Date: 1/4/11
Velocity: 22.22 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11035

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.51	Pass
		Overall Test Results		Pass

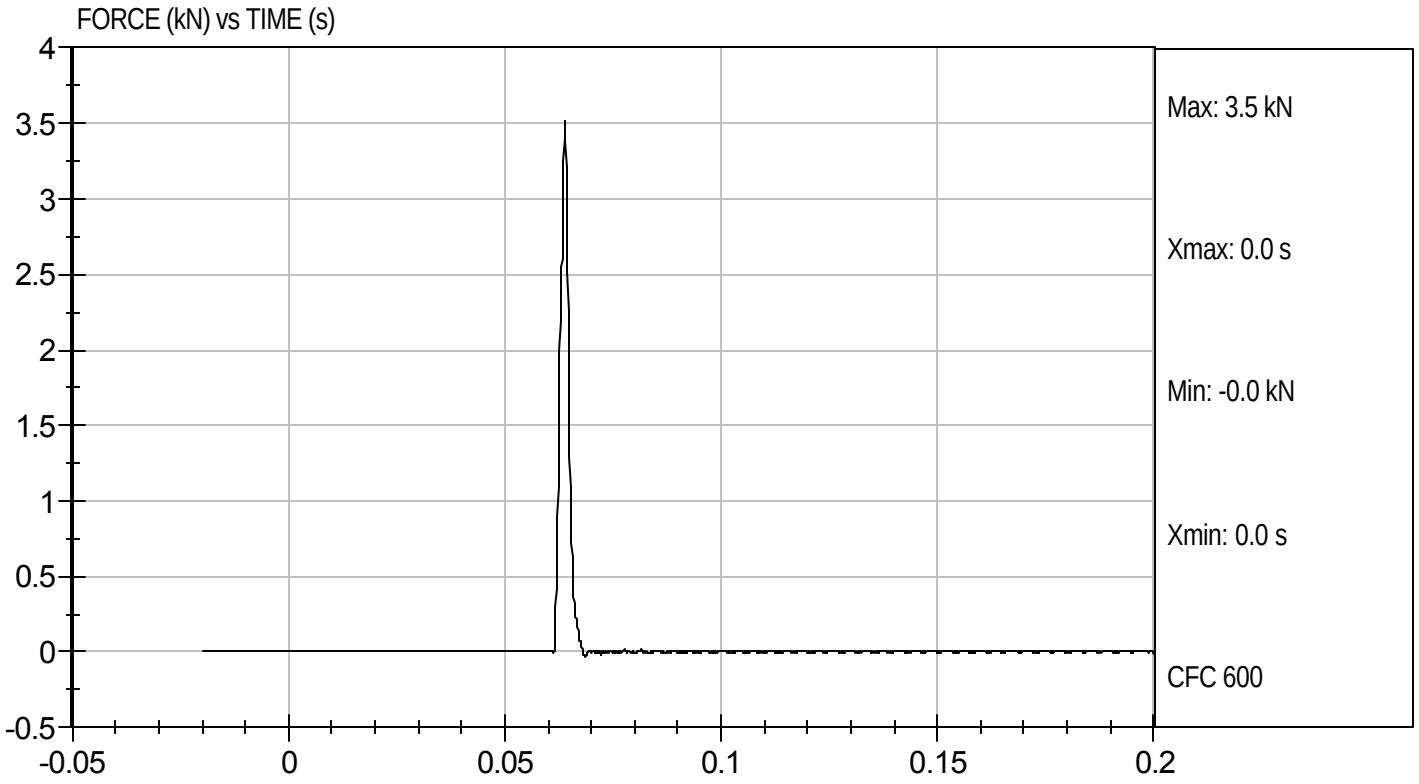
Jessica Gall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D11035

Test Date: 1/4/11
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11036

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.88	Pass
		Overall Test Results		Pass

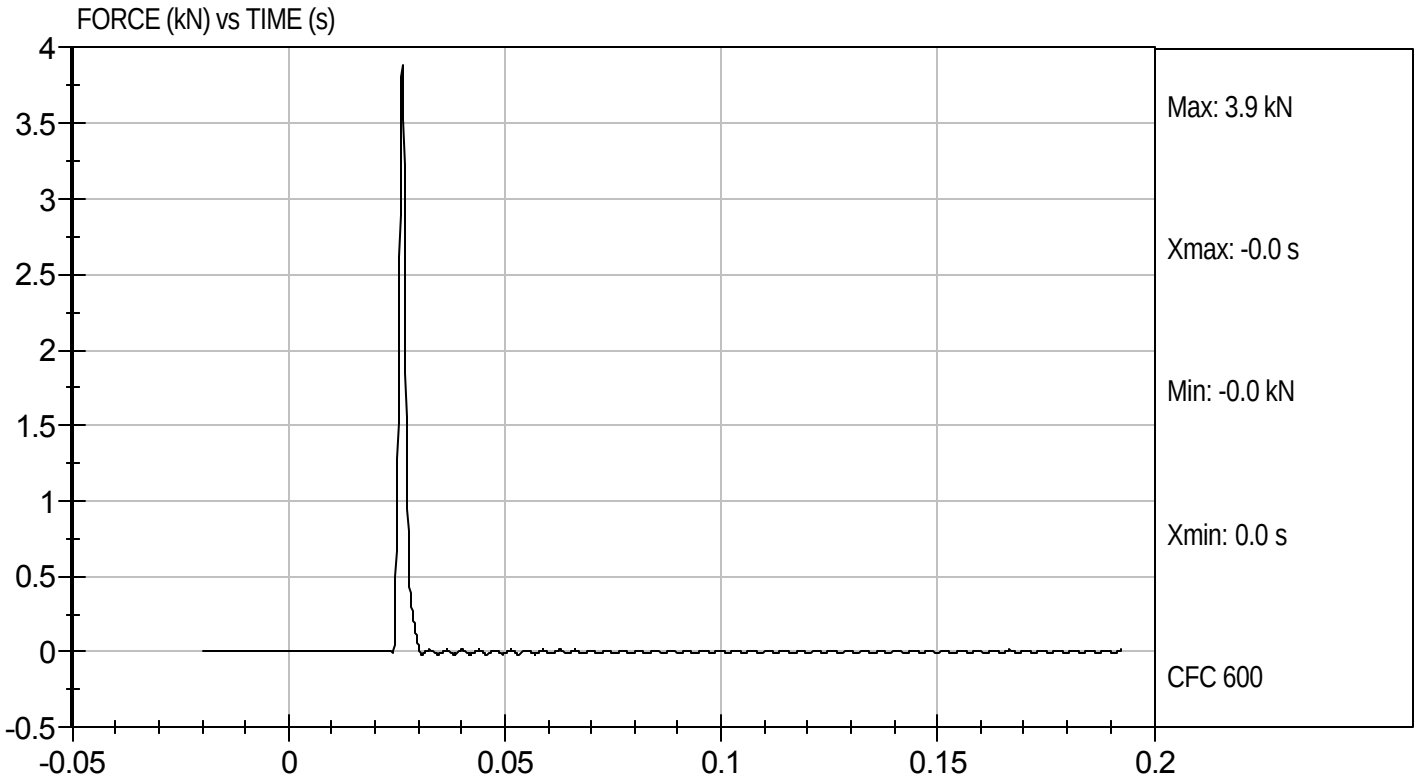
Jessica Gall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D11036

Test Date: 1/4/11
Velocity: 6.97 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 634 **Test I.D:** D11037

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	5	Pass
Force at 45 deg	N	320 to 390	375	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jessica Gall
Laboratory Technician

1/4/11
Test Date

David Winkelbauer
Approved By