REPORT NUMBER: NCAP-MGA-2007-010

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

KIA MOTORS CORPORATION
2007 KIA SORENTO LX 4X2
NHTSA NUMBER: M70506

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

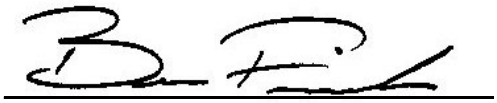
Test Date: December 6, 2006

Final Report Date: January 3, 2007

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
400 SEVENTH STREET, SW, ROOM 5311
WASHINGTON, D.C. 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:  Date: 1/03/07

Ben Fischer, Project Engineer

Reviewed by:  Date: 1/03/07

David Winkelbauer, Facility Director

Technical Report Documentation Page

1. Report No. NCAP-MGA-2007-010	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Final Report of New Car Assessment Program Testing of a 2007 Kia Sorento LX 4x2 NHTSA No.: M70506		*5. Report Date* January 3, 2007 *6. Performing Organization Code* MGA	
7. Author(s) Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP-MGA-2007-010	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-06-D-00028	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Rulemaking, Office of Crashworthiness Standards 400 Seventh Street, SW, Room 5311 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Report 12/06/2006 to 1/03/2007 *14. Sponsoring Agency Code* NVS-111	
15. Supplementary Notes			

16. Abstract

A frontal barrier impact was conducted on a 2007 Kia Sorento LX 4x2 at MGA Research Corporation on December 6, 2006. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The impact velocity was 56.2 km/h. The ambient temperature at the barrier face at the time of impact was 21 degrees Celsius. The vehicle's maximum post test static crush is 448 mm located to the left of the vehicle's centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:

Measurement Description	Units	Threshold	Driver ATD	Pass. ATD
Head Injury Criteria (HIC)	N/A	1000	450	527
Max. Thorax Accel. (3ms Clip)	G's	60	38	39
Left Femur Force	Newton	10009	-2250	-2910
Right Femur Force	Newton	10009	-2467	-889

17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2007 Kia Sorento LX 4x2 NHTSA No: M70506		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Admin., Technical Ref. Division, Room 5108 (NPO-230) 400 Seventh Street, S.W. Washington, D.C. 20590	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 119	22. Price

Form DOT F1700.7 (8-72)

TABLE OF CONTENTS

SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This 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 an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier was impacted by a 2007 Kia Sorento at a velocity of 56.2 kph. The test was performed at MGA Research Corporation on December 6, 2006. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and fourteen 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.

Two Part 572E, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometer, upper neck transducers, right/left femur load cells, and lower leg instrumentation. The driver (position 1) ATD (Serial No. 066) and right-front passenger (position 2) ATD (Serial No. 065) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest, 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 448 mm and both the driver and passenger side doors remained closed and latched 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 bag and bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC	T^1	T^2	Clip (g)	T^1	T^2	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver	450	51.4	87.4	38	56.3	59.3	-29	-2250	-2467
Passenger	527	54.9	90.9	39	66.2	69.2	-30	-2910	-889

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

TEST NOTES

There was no valid data collected for:
Driver Head Z Redundant after 70 msec.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

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)	11 mm rearward	0
Seat Back Failure	None	None
Glazing Damage	The windshield cracked.	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	593
Center	mm	546
Right Side	mm	602
Average	mm	580

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	820	815
Lap belt length as measured on ATD	mm	780	760
Remainder of belt on reel	mm	1742	1744
Total belt length for continuous webbing systems	mm	3342	3319

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

TEST VEHICLE INFORMATION

Manufacturer	Kia
Model	Sorento
Body Style	MPV
NHTSA No.	M70506
VIN	KNDJD736075671523
Color	Ice Blue
Delivery Date	11/21/06
Odometer Reading (mile)	35
Dealer	Boucher Kia
Transmission	Automatic
Final Drive	4x2
Number of Cylinders	6
Engine Displacement (L)	3.8
Engine Placement	Longitudinal
Automatic Door Lock (ADL)	No
Owners Manual Details Instructions on Disabling ADLs	N/A
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	Yes
All Wheel Drive	No
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Kia Motors Corporation
Date of Manufacture	06/06

GVWR (kg)	2480
GAWR Front (kg)	1280
GAWR Rear (kg)	1500

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				400
Cargo Wt. (RCLW) (kg)				60

DATA SHEET NO. 2... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	508.5	432.7		546.1	506.2	
Right	kg	518.5	429.6		547.1	499.9	
Ratio	%	54.4	45.6		52.1	47.9	
Totals	kg	1027.0	862.3	1889.3	1093.2	1006.1	2099.3

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1889.3
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	60
Calculated Vehicle Target Weight (TVTW)	kg	2105.3

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	815	815	832	832	1238
As Tested	mm	796	794	802	801	1300
Post Test	mm	749	767	823	793	

Vehicle Wheelbase (mm): 2713

Weight of Ballast secured in cargo area (kg): 20.4

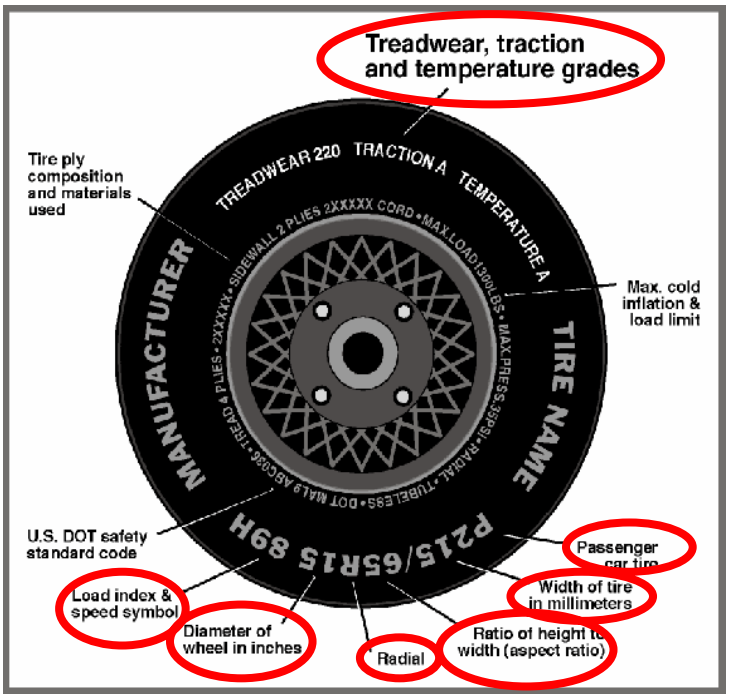
Vehicle Components Removed: cargo area carpet and storage area, right taillight

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	210	210
Recommended Tire Size	P245/70R16	P245/70R16
Tire Size on Vehicle	P245/70R16	P245/70R16
Tire Manufacturer	Michelin	Michelin
Tire Name	Latitude	Latitude
Tire Type	Passenger	Passenger
Tire Width (mm)	245	245
Ratio of Height to Width (aspect ratio)	70	70
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	106T	106T
Treadwear	620	620
Traction Grade	A	A
Temperature Grade	B	B

DATA SHEET NO. 4

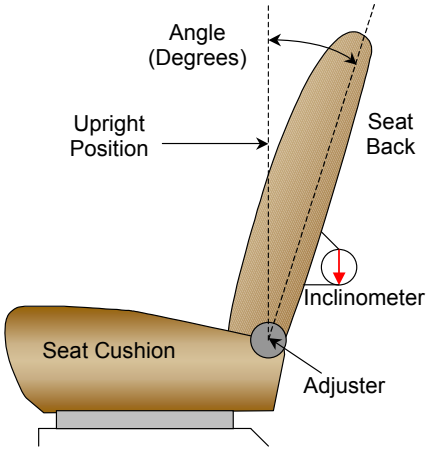
TEST VEHICLE INFORMATION

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Set at 7th notch with the forward-most detent as 0.

Driver seat back angle: 7th notch, 1st as 0
Passenger seat back angle: 7th notch, 1st as 0



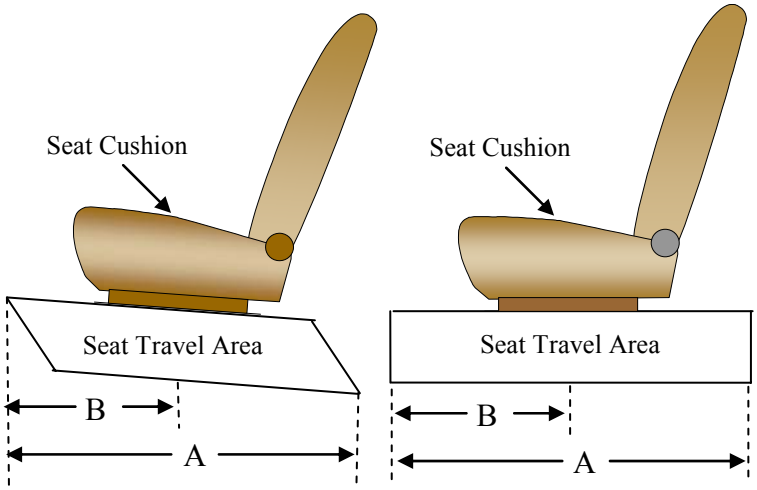
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	18 detents	9th detent, 1st as 0
Passenger Seat	18 detents	9th detent, 1st as 0

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were placed in the 1st notch down from uppermost position (top notch as 0).



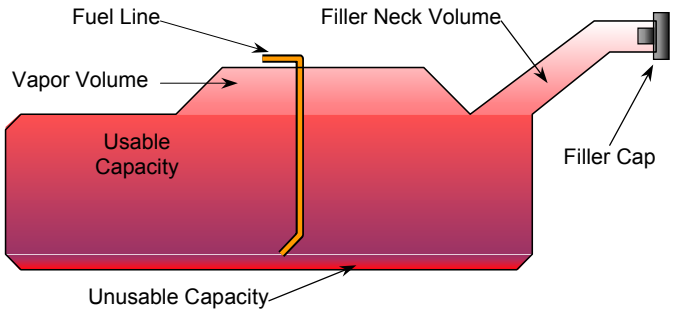
DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	79.9
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	73.5 – 75.1
Actual Amount of Solvent used	74.6
1/3 of Usable Capacity	26.6

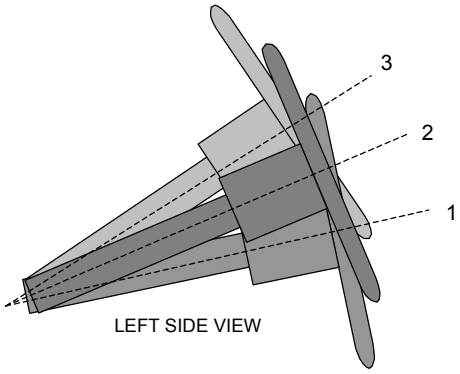
The test vehicle is equipped with an electric fuel pump. Fuel pump operates on ignition "START".



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 POSITIONS

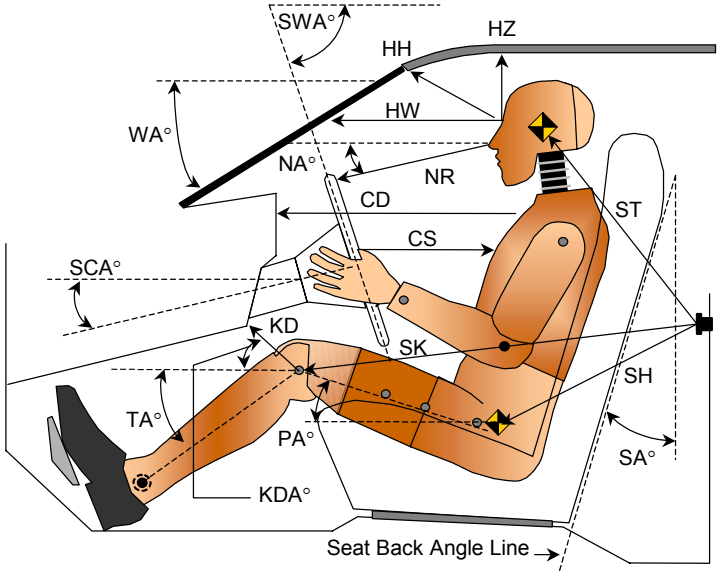
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		18.5
Geometric center position No. 2		23.2
Uppermost position No. 3		27.9

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

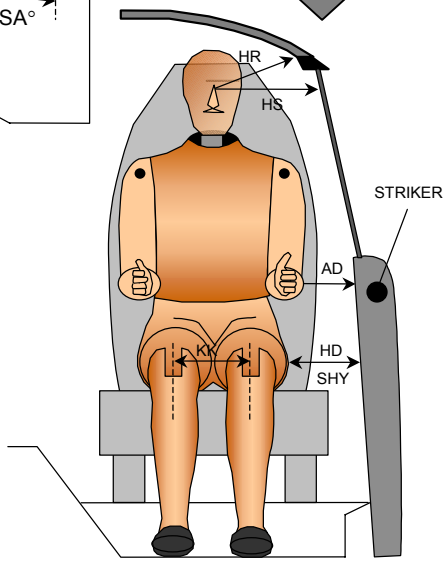
Test Vehicle:	2007 Kia Sorento LX 4x2	NHTSA No.:	M70506
Test Program:	35mph Frontal Impact	Test Date:	12/06/2006

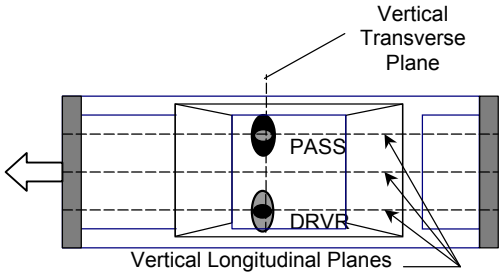
DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



CD	Chest to Dash
CS	Chest to Steering Wheel Hub
HH	Head to Header
HW	Head to Windshield
HZ	Head to Roof
KDA	Knee to Dash Angle
KDL	Left Knee to Dash
KDR	Right Knee to Dash
NA	Nose to Rim Angle
NR	Nose to Rim
PA	Pelvic Angle
RA	Rim to Abdomen
SA	Seat Back Angle
SCA	Steering Column Angle
SH	Striker to H-Point
SK	Striker to Knee
ST	Striker to Head
SWA	Steering Wheel Angle
TA	Tibial Angle
WA	Windshield Angle

AD	Arm to Door
HD	H-Point to Door
HR	Head to Side Header
HS	Head to Side Window
KK	Knee to Knee
SHY	Striker to H-Point (Y Axis)





DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

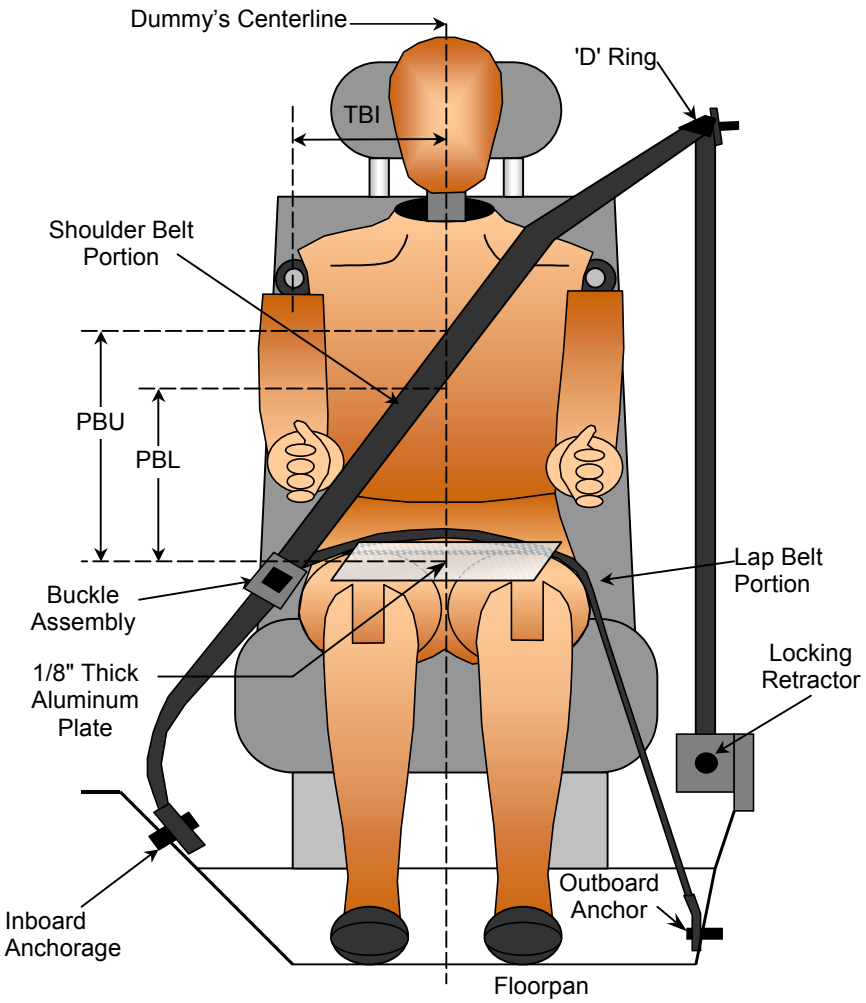
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		29.4		
SWA	Steering Wheel Angle		66.9		
SCA	Steering Column Angle		23.2		
SA	Seat Back Angle (seat frame)		18.7		18.7
HZ	Head to Roof (Z)	191	90	175	90
HH	Head to Header	390	21.4	361	20.1
HW	Head to Windshield	626	0	563	0
HR	Head to Side Header (Y)	216		191	
NR	Nose to Rim	400	11.8		
CD	Chest to Dash	523		538	
CS	Chest to Steering Hub	317	6.2		
RA	Rim to Abdomen	195	0		
KDL	Left Knee to Dash	168	27.9	153	
KDR	Right Knee to Dash	140		166	29.8
PA	Pelvic Angle		23.5		21.7
TA	Tibia Angle		45.8		43.8
KK	Knee to Knee (Y)	305		275	
SK	Striker to Knee	584	85.1	582	90.1
ST	Striker to Head	585	4.2	624	8.7
SH	Striker to H-Point	181	99.8	197	102.9
SHY	Striker to H-Point (Y)	249		231	
HS	Head to Side Window	323		304	
HD	H-Point to Door (Y)	193		181	
AD	Arm to Door (Y)	141		131	
AA	Ankle to Ankle	330		242	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006



SEAT BELT POSITIONING MEASUREMENTS

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

DATA SHEET NO. 7

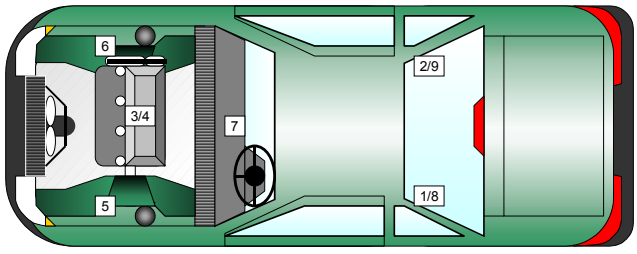
VEHICLE ACCELEROMETER LOCATIONS

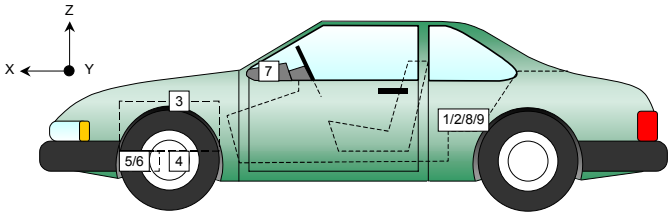
Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1751	-345	549
2	Right Rear X-Member X	1751	371	548
3	Engine Top X	3676	0	1047
4	Engine Bottom X	3911	-29	376
5	Left Brake Caliper X	3864	-695	298
6	Right Brake Caliper X	3863	695	299
7	Instrument Panel X			
8	Left Rear X-Member Z	1751	-345	549
9	Right Rear X-Member Z	1751	371	548

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





DATA SHEET NO. 8

SUMMARY OF FMVSS 212 AND FMVSS 219 (Partial) DATA

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

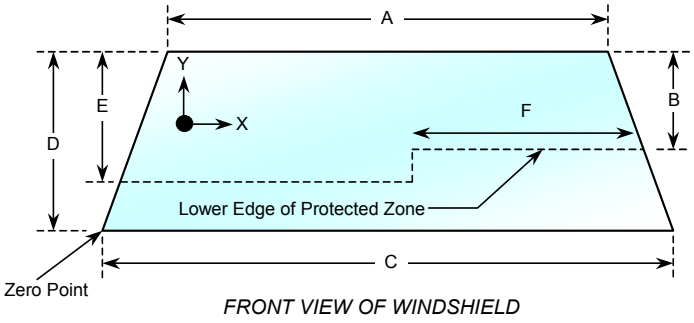
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2101	2101	100
Right Side	2101	2101	100
Total	4202	4202	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1164
B	mm	480
C	mm	1478
D	mm	780
E	mm	471
F	mm	483

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. 9

SUMMARY OF FMVSS 301 DATA

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 7:18 pm

Stoddard Solvent Spillage Measurements

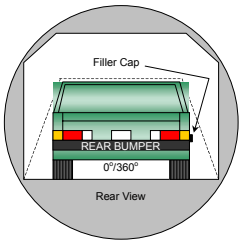
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

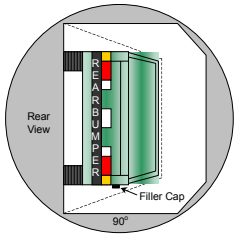
B. For the 5 minute period after motion ceases: 0 oz.
(Maximum Allowable = 5 ounces)

C. For the following 25 minutes: 0 oz.
(Maximum Allowable = 1 oz. /minute)

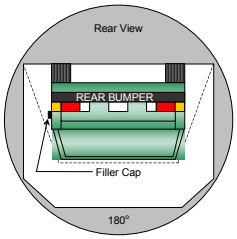
D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA

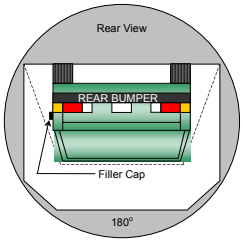




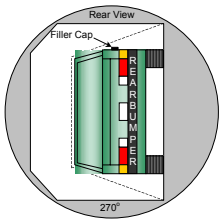
0° to 90°



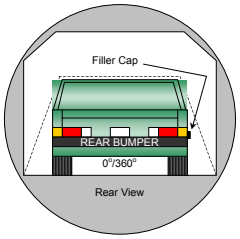
90° to 180°



180° to 270°



270° to 360°



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:

None

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	113	300	0
90° to 180°	104	300	0
180° to 270°	105	300	0
270° to 360°	110	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

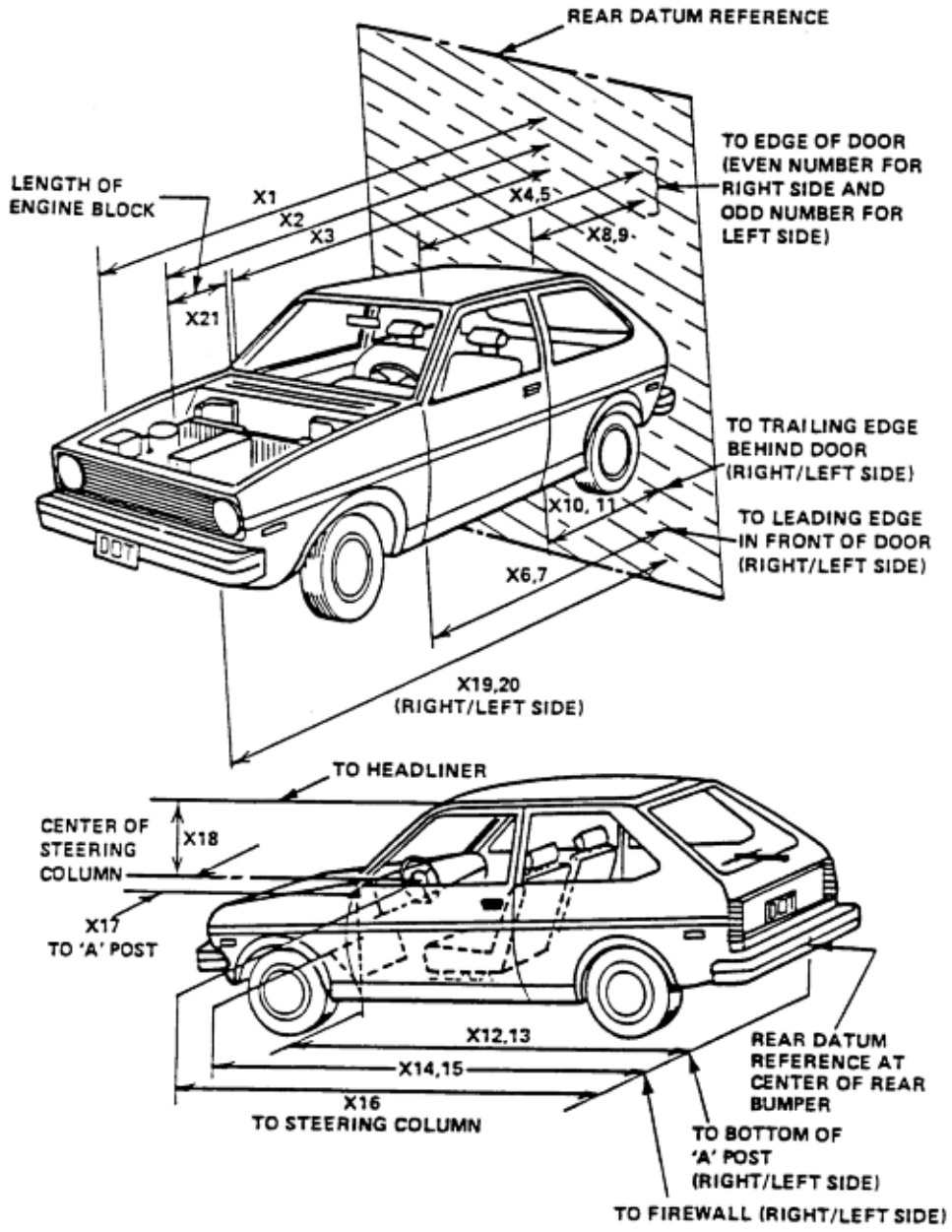
Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4565	4162	403
2	RSOV to front of engine	mm	4188	3776	412
3	RSOV to firewall centerline	mm	3520	3511	9
4	RSOV to leading edge of right door	mm	3186	3219	-33
5	RSOV to leading edge of left door	mm	3186	3210	-24
6	RSOV to lower leading edge of right door	mm	3155	3164	-9
7	RSOV to lower leading edge of left door	mm	3158	3160	-2
8	RSOV to upper leading edge of right door	mm	2104	2132	-28
9	RSOV to upper leading edge of left door	mm	2099	2128	-29
10	RSOV to lower trailing edge of right door	mm	2094	2100	-6
11	RSOV to lower trailing edge of left door	mm	2094	2098	-4
12	RSOV to bottom of right 'A' pillar	mm	3154	3159	-5
13	RSOV to bottom of left 'A' pillar	mm	3159	3160	-1
14	RSOV to firewall on right side	mm	3445	3467	-22
15	RSOV to firewall on left side	mm	3442	3441	1
16	RSOV to steering column	mm	2660	2720	-60
17	Center of steering column to left 'A' pillar	mm	412	410	2
18	Center of steering column to headlining	mm	443	440	3
19	RSOV to right side of front bumper	mm	4344	4109	235
20	RSOV to left side of front bumper	mm	4345	4099	246
21	Length of engine block	mm	588	588	0
RD	RSOV to right side of dash panel	mm	2914	2944	-30
CD	RSOV to center of dash panel	mm	2838	2842	-4
LD	RSOV to left side of dash panel	mm	2911	2935	-24

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle:	2007 Kia Sorento LX 4x2	NHTSA No.:	M70506
Test Program:	35mph Frontal Impact	Test Date:	12/06/2006



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4565
2	Total Width	1819
3	Bumper Top Height	545
4	Bumper Bottom Height	443
5	Longitudinal Member Top Height	534
6	Distance between Longitudinal Members	849
7	Longitudinal Member Width	60
8	Engine Top Height	1078
9	Engine Bottom Height	385
10	Engine and gearbox width	660
11	Front bumper-engine distance	541
12	Front shock absorber fixing height	773
13	Bonnet leading edge height	725
14	Front shock absorber fixing width	793
15	Front bumper – front axle distance	856
16	Front axle – a pillar distance	541
17	A-pillar – B-pillar distance	1092
18	B-Pillar – rear axle distance	1077
19	B-pillar – C-pillar distance	1043
20	Roof sill bottom height	1671
21	Roof sill top height	1687
22	Floor sill bottom height	356
23	Floor sill top height	423

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	925	-5000	1190	25	1000
3	Steering Column Top	1305	-4995	1300	25	1000
4	Steering Column Bottom	1290	-4990	900	25	1000
5	Driver Close-up	1295	-6255	1500	35	1000
6	Driver Angle	7075	-4895	2050	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	1770	6210	1270	19	1000
10	Right Passenger Half	1035	5050	1185	24	1000
11	Right Close-up	1245	6285	1495	35	1000
12	Right Angle	6705	4970	2050	50	1000
13	Windshield	-285	0	2830	24	1000
14	Top Driver	-135	-395	2225	24	1000
15	Top Passenger	-110	515	2245	24	1000
16	Pit Front	1205	0	-3150	24	1000
17	Pit Rear	3325	0	-3150	24	1000

*COORDINATES:

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

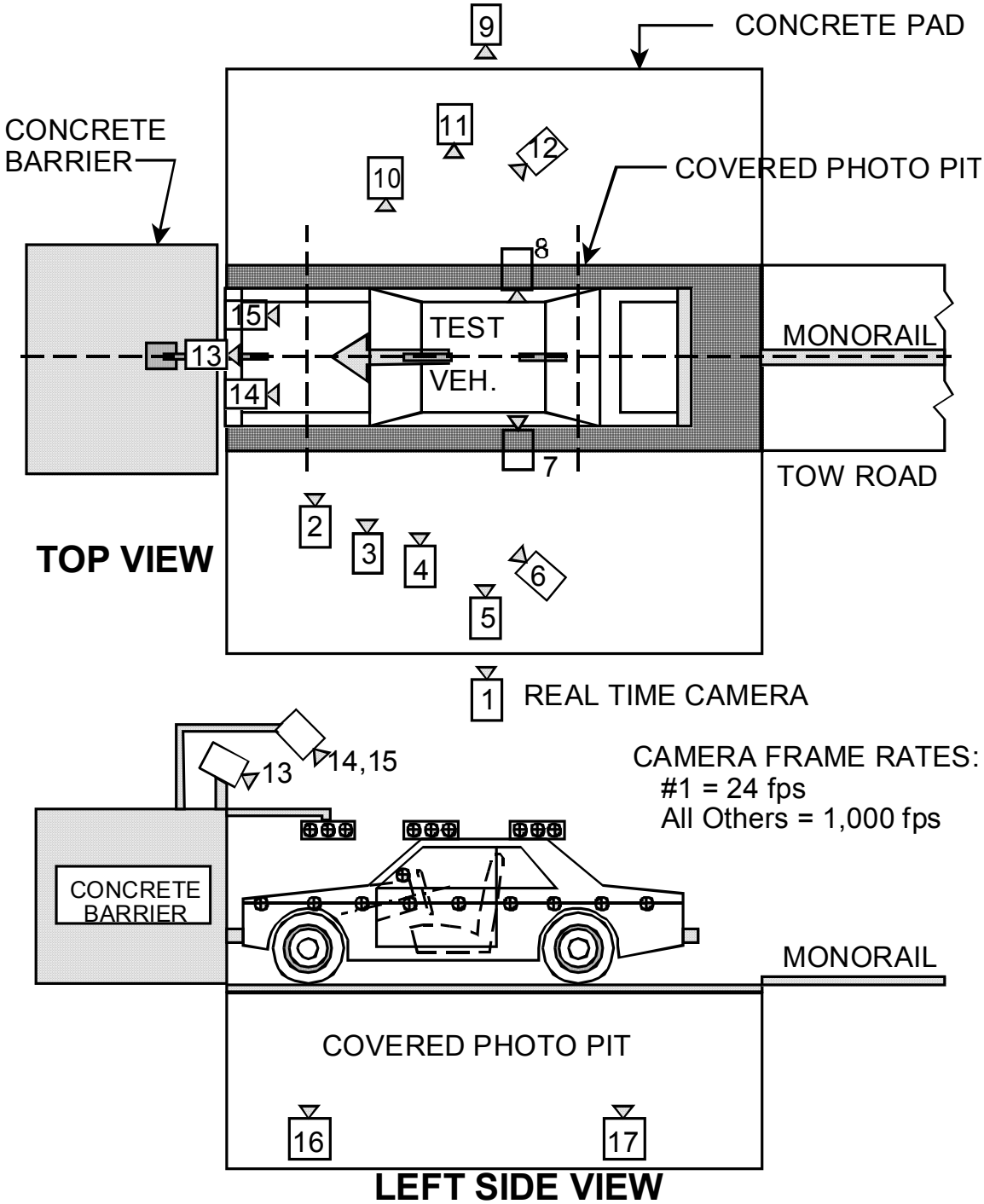
Note: Cameras 7 and 8 were not used for this test.

DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle:	2007 Kia Sorento LX 4x2	NHTSA No.:	M70506
Test Program:	35mph Frontal Impact	Test Date:	12/06/2006

CAMERA POSITIONS FOR FRONTAL IMPACTS

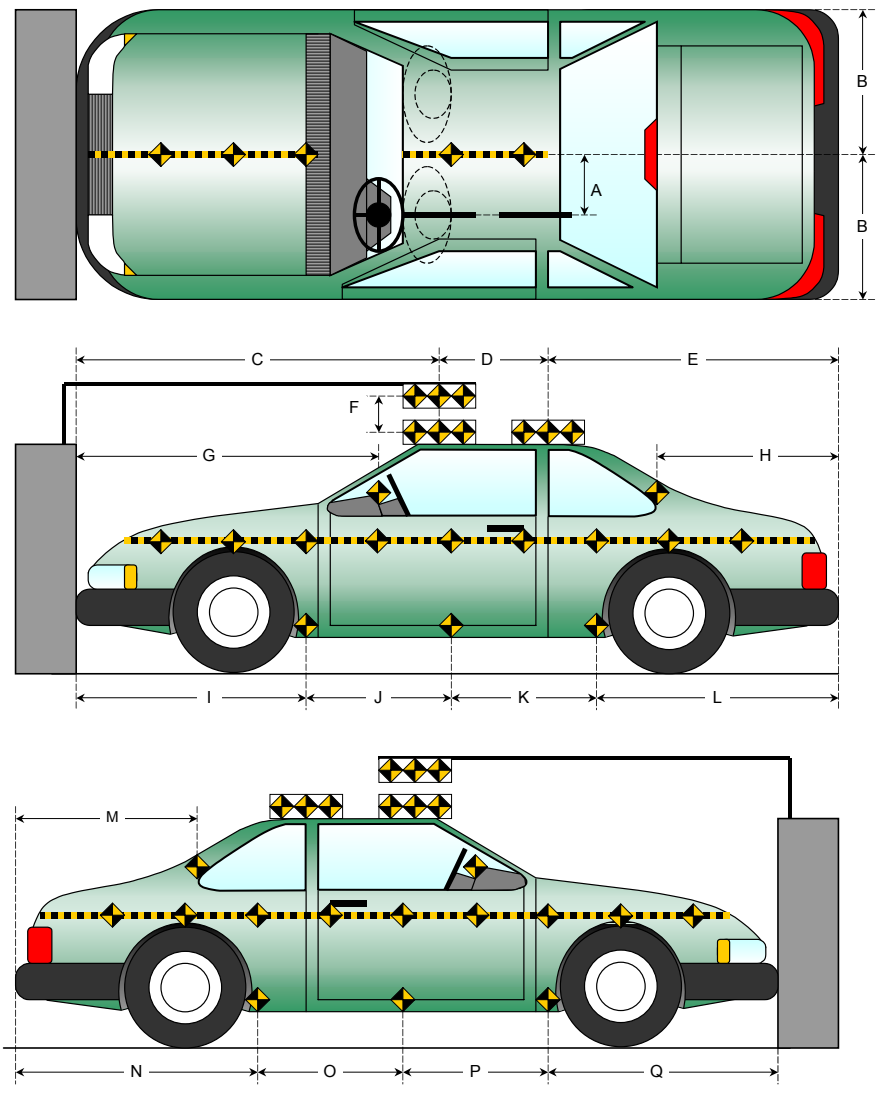


DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

Item	Value
A	356
B	909
C	2325
D	611
E	1629
F	1715
G	
H	926
I	1320
J	871
K	872
L	1502
M	901
N	1501
O	868
P	877
Q	1319



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

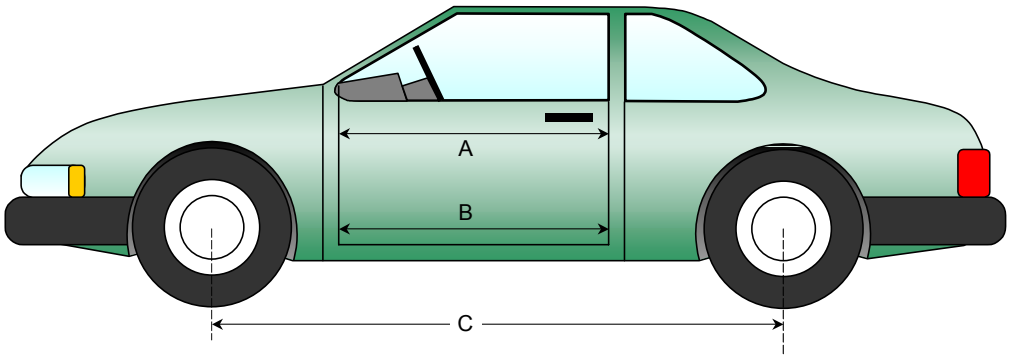
Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

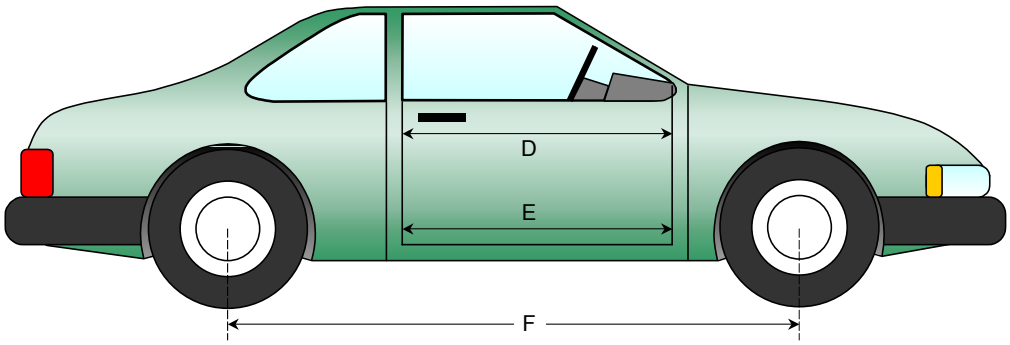
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	991	985	6
B	Left Side Lower	mm	848	846	2
D	Right Side Upper	mm	995	990	5
E	Right Side Lower	mm	845	843	2

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2713	2636	77
F	Right Side Wheelbase	mm	2713	2652	61





DATA SHEET NO. 13... (continued)

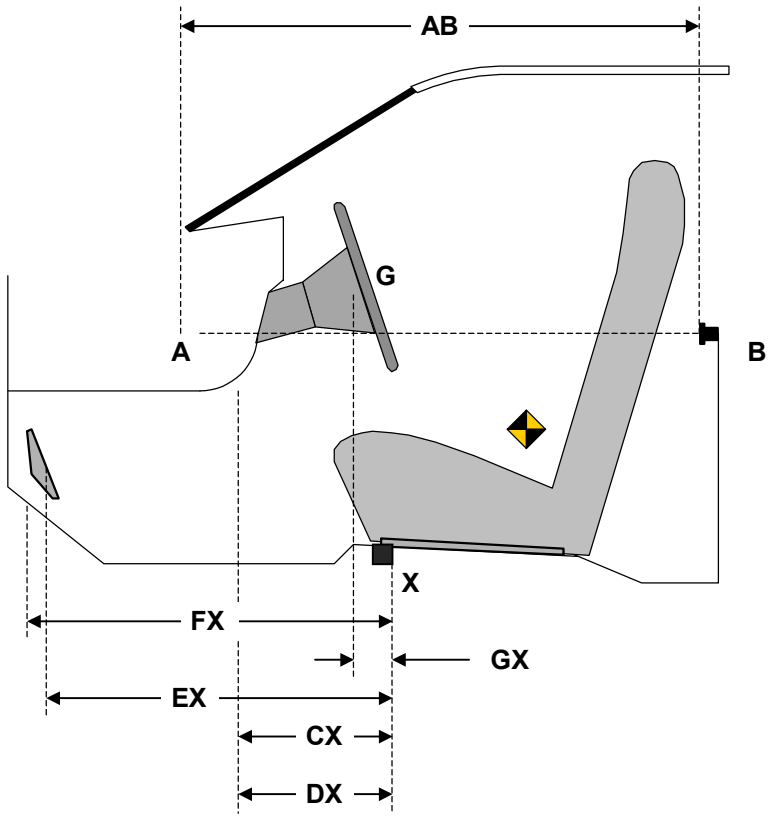
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	739	737	2
CX	Left Knee Bolster to X	mm	358	372	-14
DX	Right Knee Bolster to X	mm	350	363	-13
EX	Brake Pedal to X	mm	547	534	13
FX	Foot Rest to X	mm	610	610	0
GX	Center of Steering Column Wheel Hub to X	mm	84	150	-66

X = Front of Seat Track (stationary)

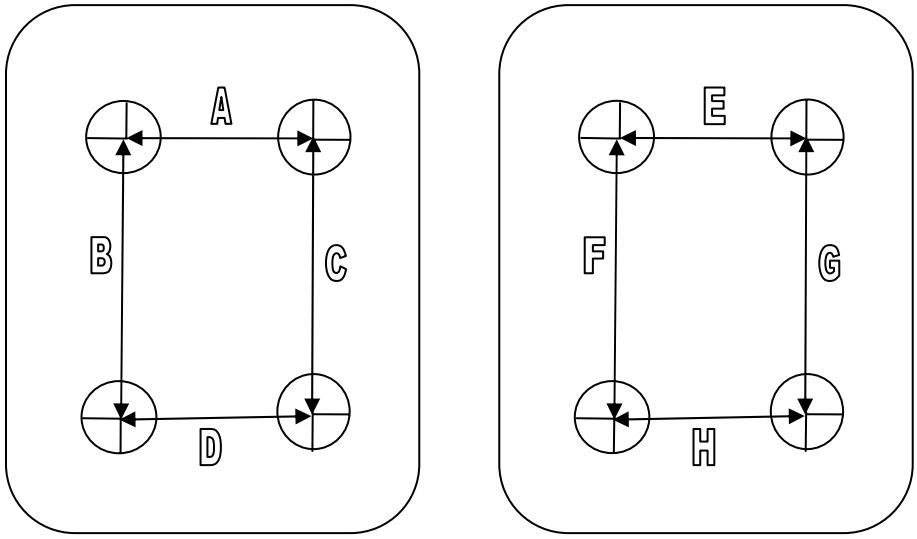


DRIVER COMPARTMENT

DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006



Driver Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	320	320	0
B	230	232	-2
C	250	251	-1
D	322	322	0
E	295	305	-10
F	293	293	0
G	277	275	2
H	274	274	0

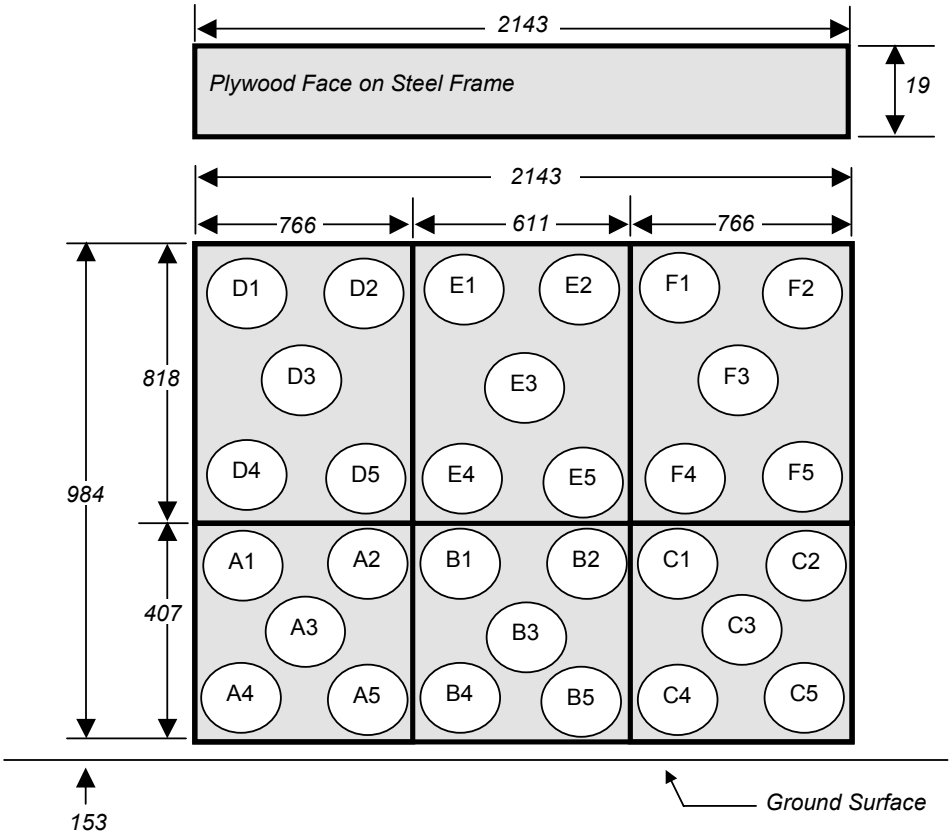
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

30 Load Cell Rigid Barrier

Load Cell Locations on Fixed Barrier



Group 4 D1-D5	Group 5 E1-E5	Group 6 F1-F5
Group 1 A1-A5	Group 2 B1-B5	Group 3 C1-C5

6 Groups of 5 Load Cells Each

DATA SHEET NO. 15

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2007 Kia Sorento LX 4x2 NHTSA No.: M70506
Test Program: 35mph Frontal Impact Test Date: 12/06/2006

VEHICLE INFORMATION

VIN: KNDJD736075671523 Wheelbase (mm) : 2713
Vehicle Size Category: MPV Test Weight (kg) : 2099.3

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 12
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal Linearity: > 99%
Impact Velocity (km/h): 56.2
Velocity Change (km/h): 64.2 Time of Separation (msec): 95

CRUSH PROFILE

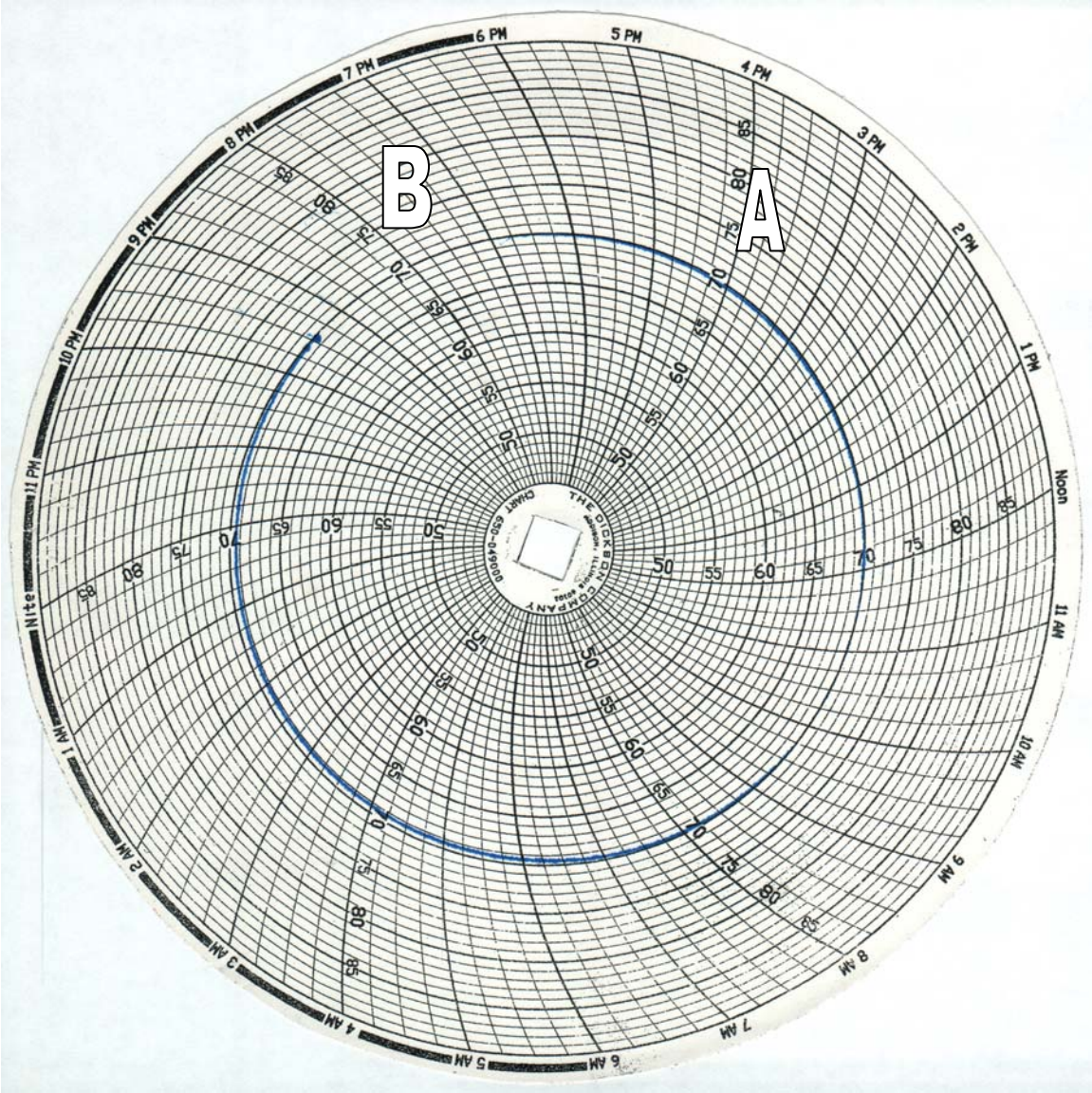
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1668 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4345	4099	246
C2	Crush zone 2 at left side	mm	4479	4160	319
C3	Crush zone 3 at left side	mm	4556	4108	448
C4	Crush zone 4 at right side	mm	4556	4113	443
C5	Crush zone 5 at right side	mm	4476	4105	371
C6	Crush zone 6 at right side	mm	4344	4109	235
L	C1 TO C6	mm	1668	1649	19

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle:	2007 Kia Sorento LX 4x2	NHTSA No.:	M70506
Test Program:	35mph Frontal Impact	Test Date:	12/06/2006



A = Dummies installed in vehicle at 4:30 pm

B = Test conducted at 7:18 pm

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Load Cell Location

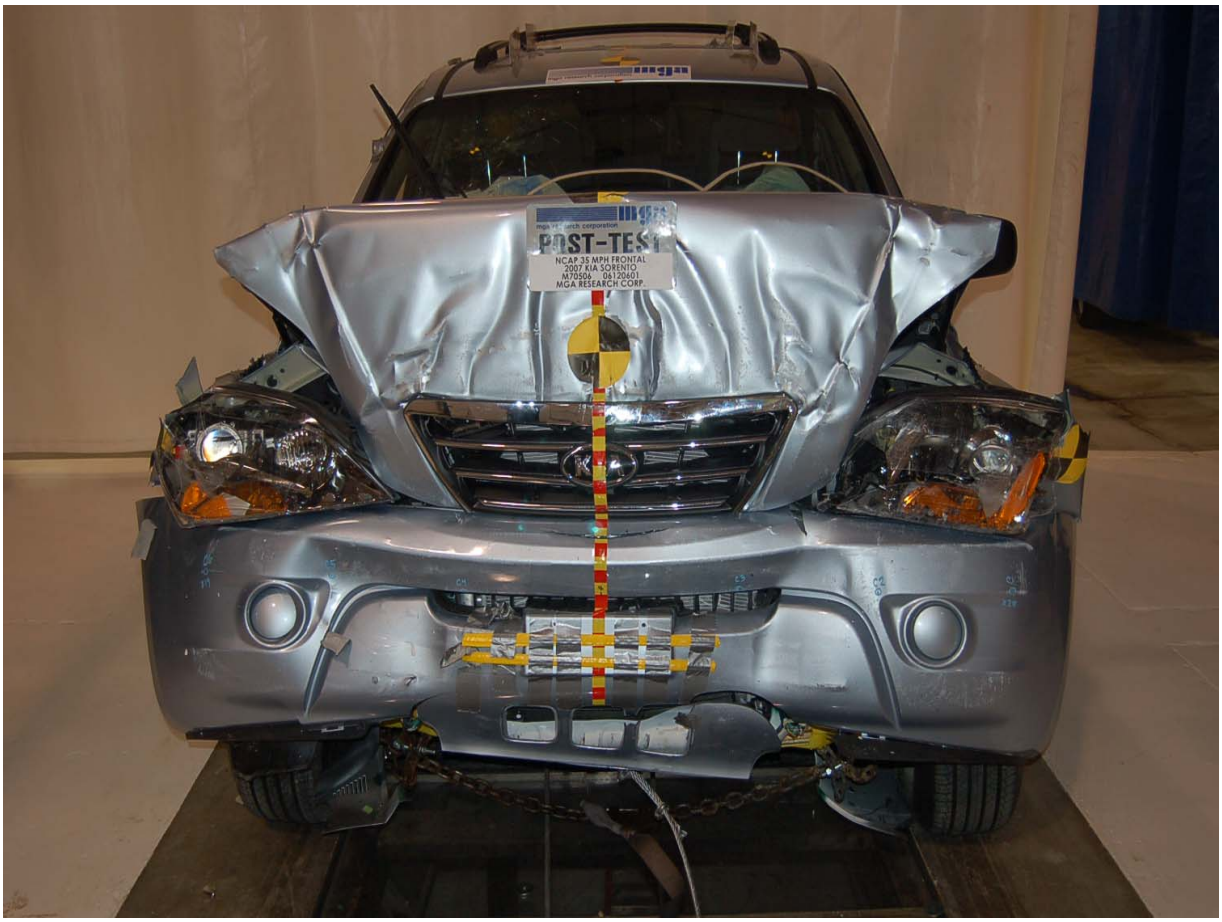
Manufacturer's Label

Tire Placard

Left Front ¾ View, As Received

Right Rear ¾ 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 ¾ View

Post-Test Right Front ¾ View

Pre-Test Left Rear ¾ View

Post-Test Left Rear ¾ View

Pre-Test Left Side ¾ View of Doors

Post-Test Left Side ¾ View of Doors After Impact

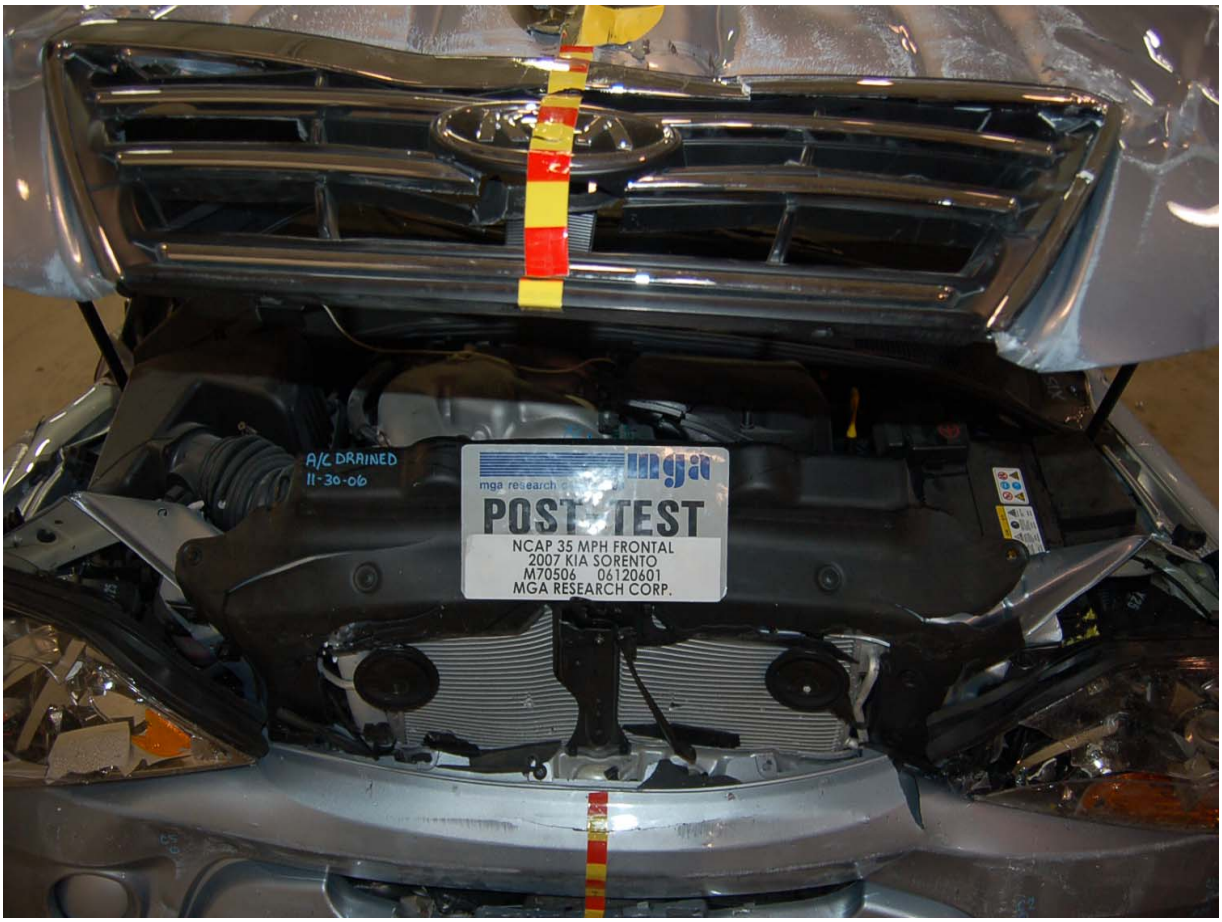
Pre-Test Right Side ¾ View of Doors

Post-Test Right Side ¾ View of Doors After Impact

Pre-Test Windshield View

Post-Test Windshield View

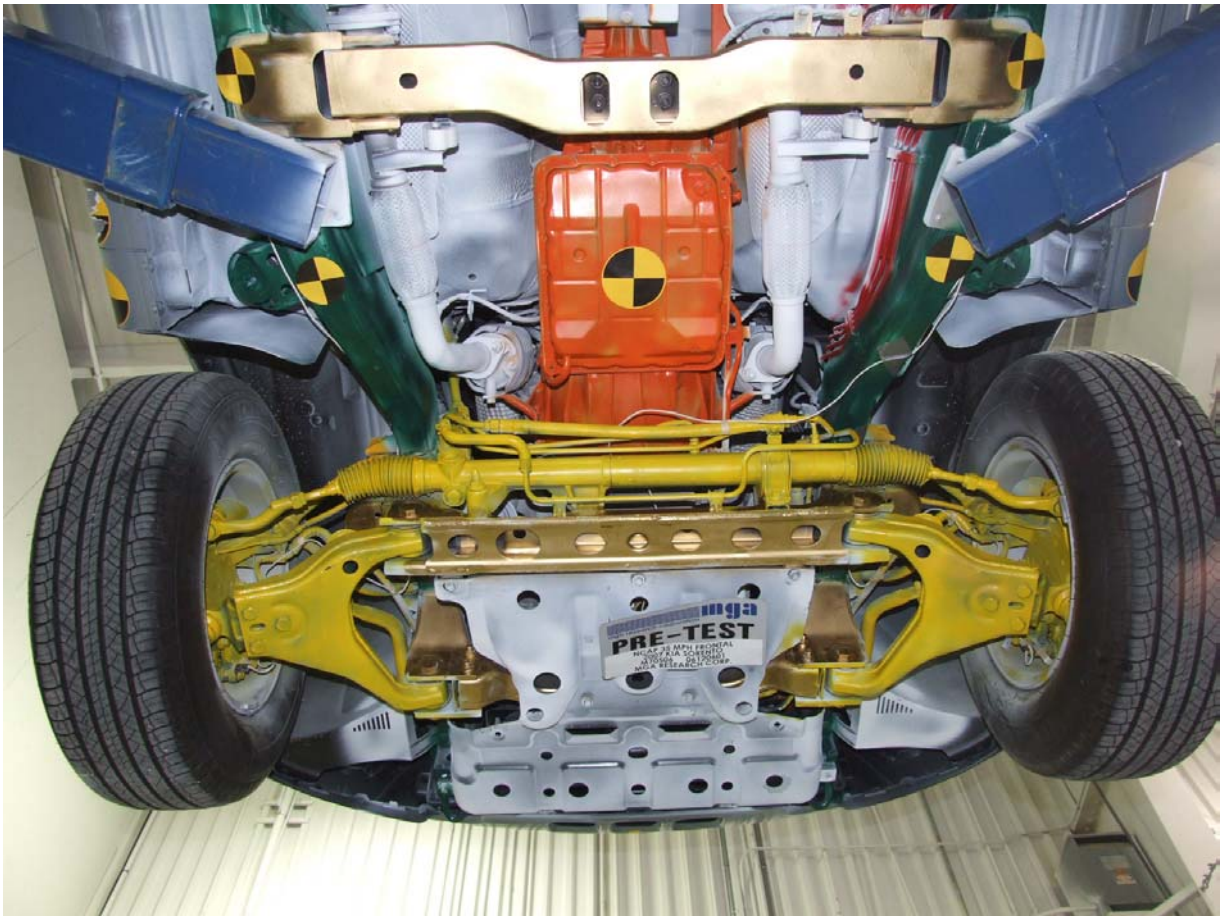
Pre-Test Engine Compartment View



Post-Test Engine Compartment View

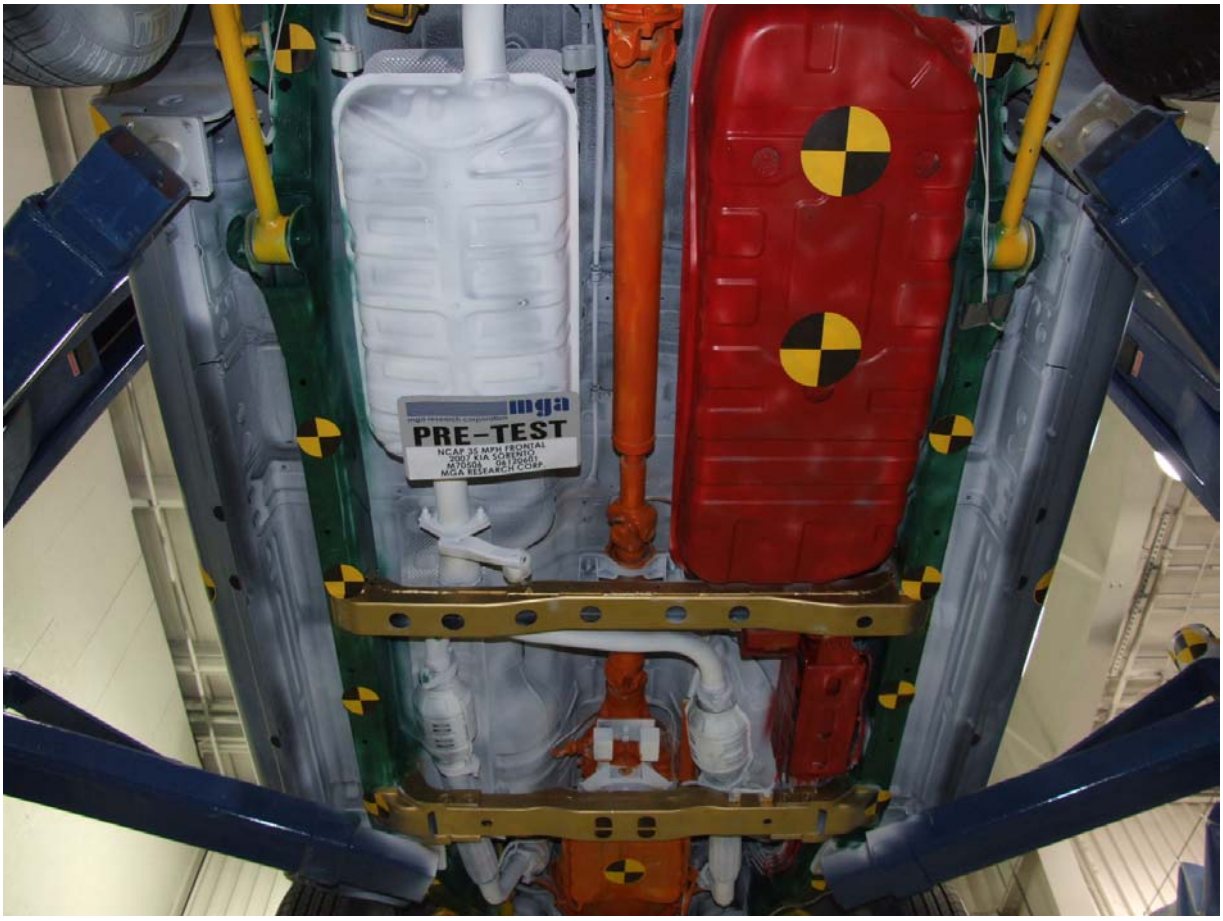
Pre-Test Fuel Cap View

Post-Test Fuel Cap View



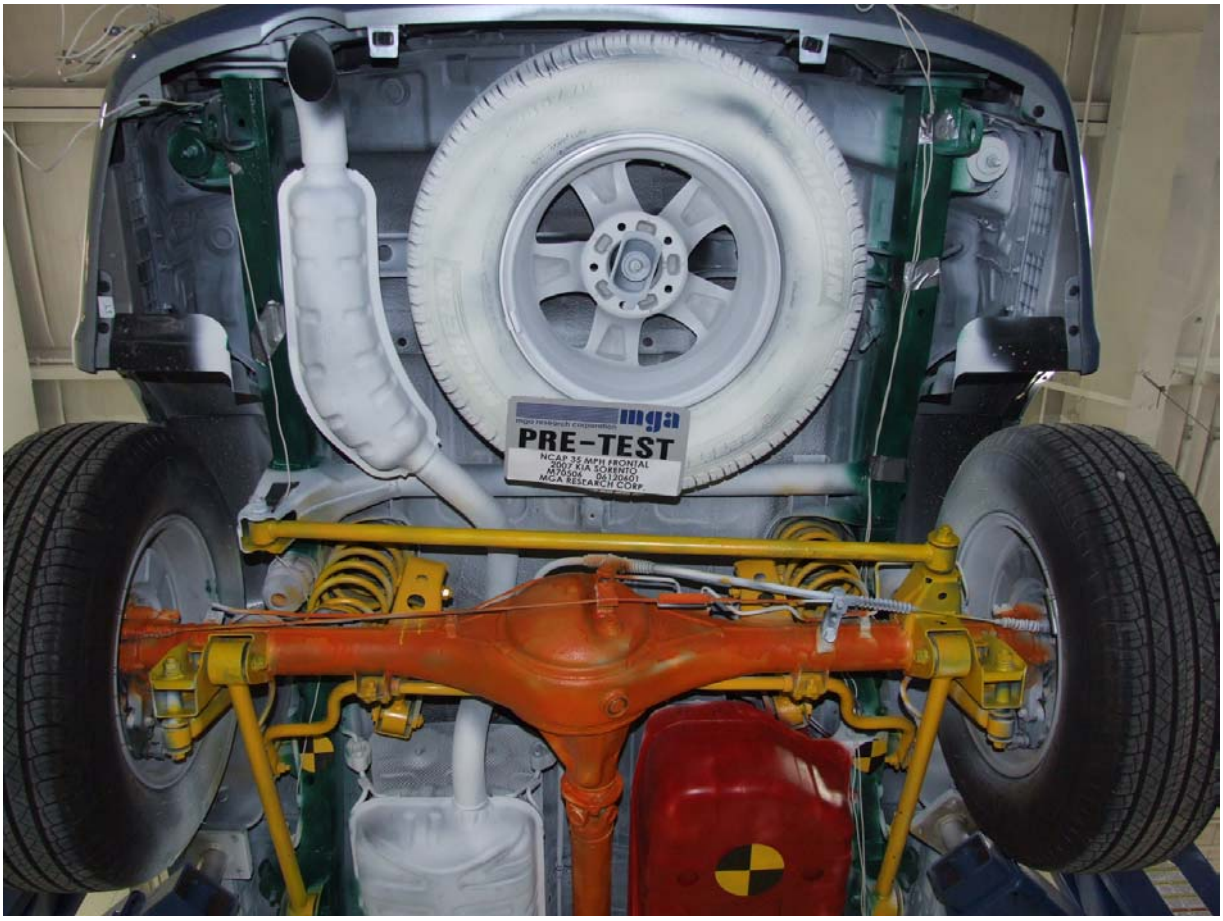
Pre-Test Front Underbody View

Post-Test Front Underbody View



Pre-Test Mid Underbody View

Post-Test 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)

Pre-Test Driver Dummy (Door Open)

Post-Test Driver Dummy (Door Open)

Pre-Test Driver Dummy Feet

Post-Test Driver Dummy Feet

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

Post-Test Driver Dummy Airbag Contact

Pre-Test Passenger Dummy Front View (Head Position)

Post-Test Passenger Dummy Front View (Head Position)

Pre-Test Passenger Dummy (Through Window)

Post-Test Passenger Dummy (Through Window)

Pre-Test Passenger Dummy (Door Open)

Post-Test Passenger Dummy (Door Open)

Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

Pre-Test Passenger Side Glove Box

Post-Test Passenger Side Glove Box

Pre-Test Passenger Side Floor Pan

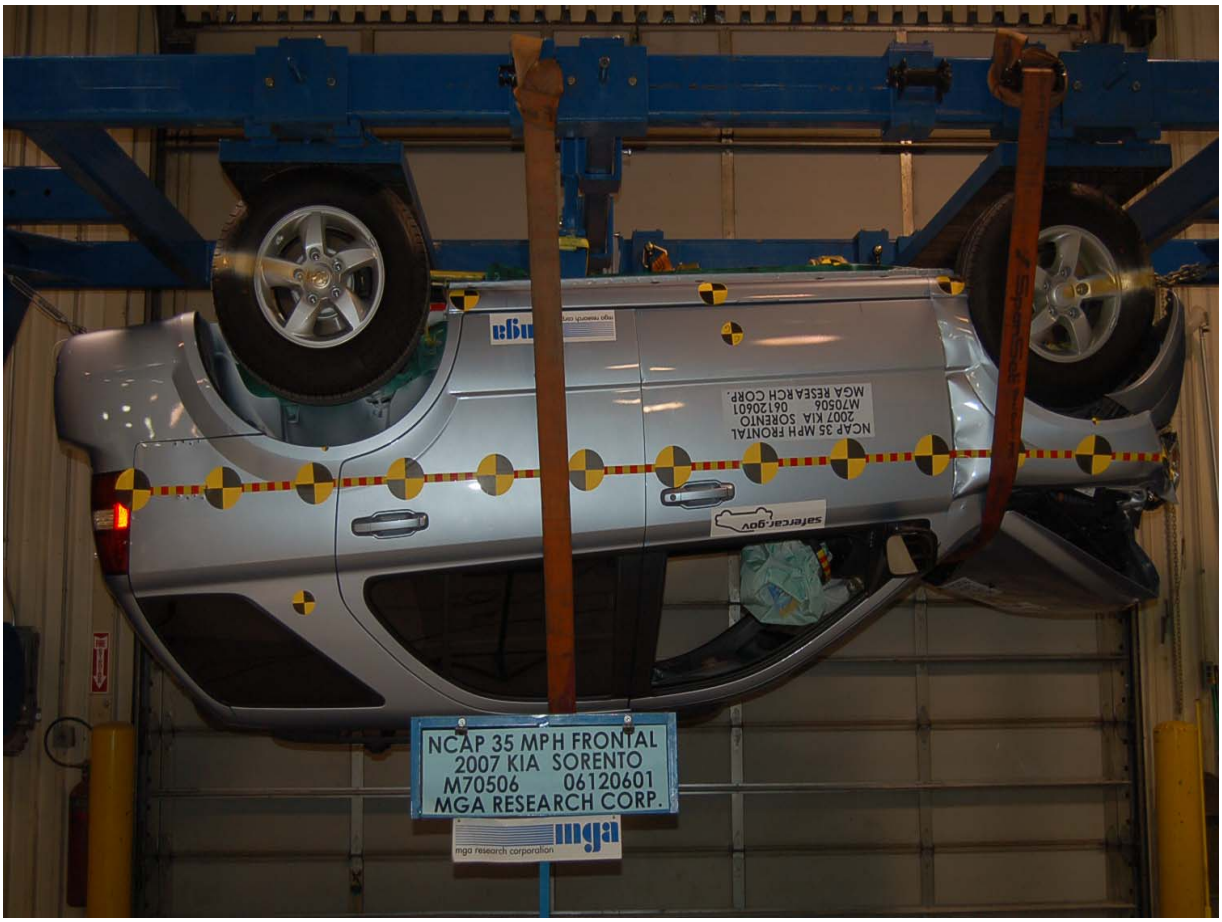
Post-Test Passenger Side Floor Pan

Post-Test Passenger Dummy Head Contact (headrest)

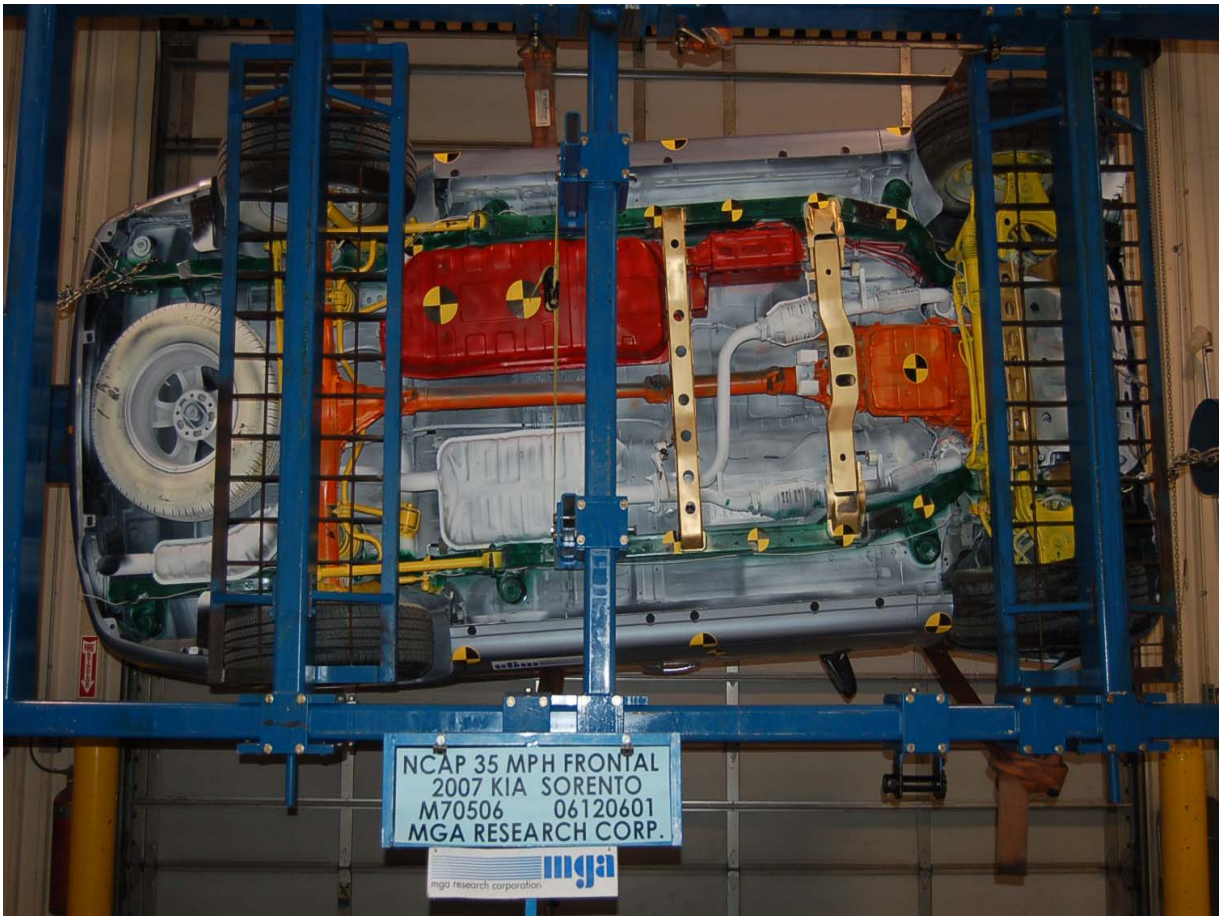
Post-Test Passenger Dummy Knee Contact

Post-Test Passenger Dummy Airbag Contact

Rollover 90 Degrees



Rollover 180 Degrees



Rollover 270 Degrees

Rollover 360 Degrees

Vehicle Impact

APPENDIX B

DUMMY RESPONSE DATA TRACES

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 X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

Driver Upper Neck Moment X

Driver Upper Neck Moment Y

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Chest Displacement

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

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 X

Passenger Upper Neck Force Y

Passenger Upper Neck Force Z

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Y

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Chest Displacement

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Shoulder Belt Force

Passenger Lap Belt Force

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

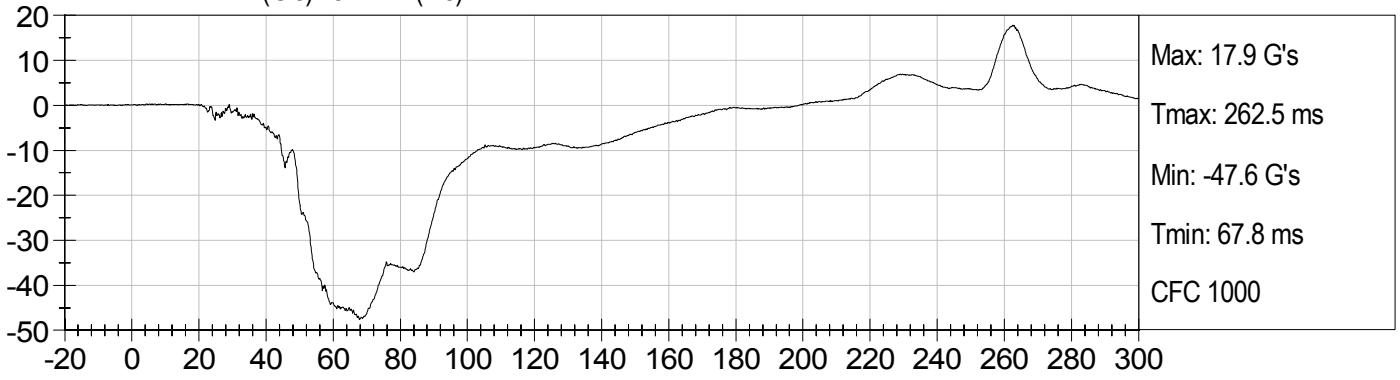
Vehicle Left Brake Caliper X

Vehicle Right Brake Caliper X

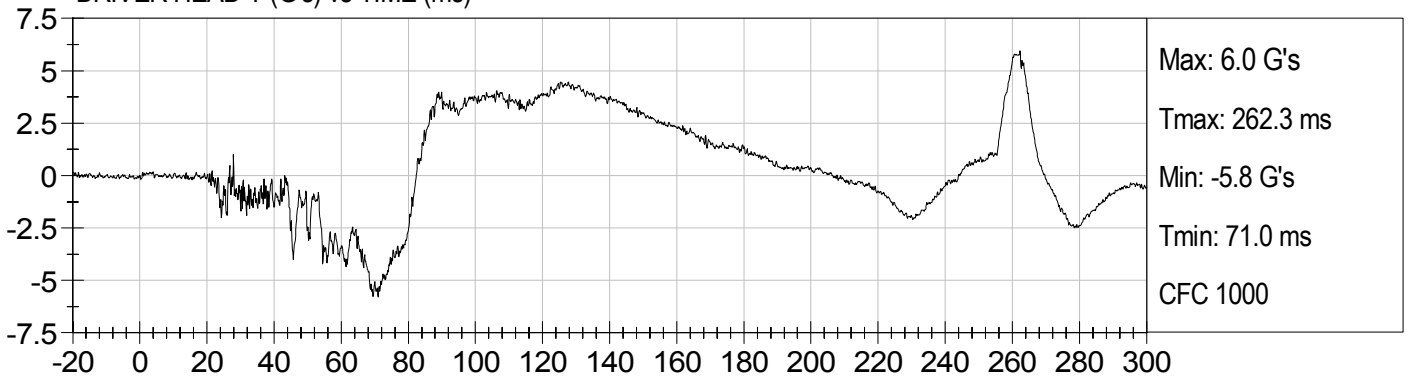
NCAP 35 MPH FRONTAL
2007 KIA SORENTO M70506

Test Date: 12/06/2006
Speed: 34.9 mph (56.2 km/h)

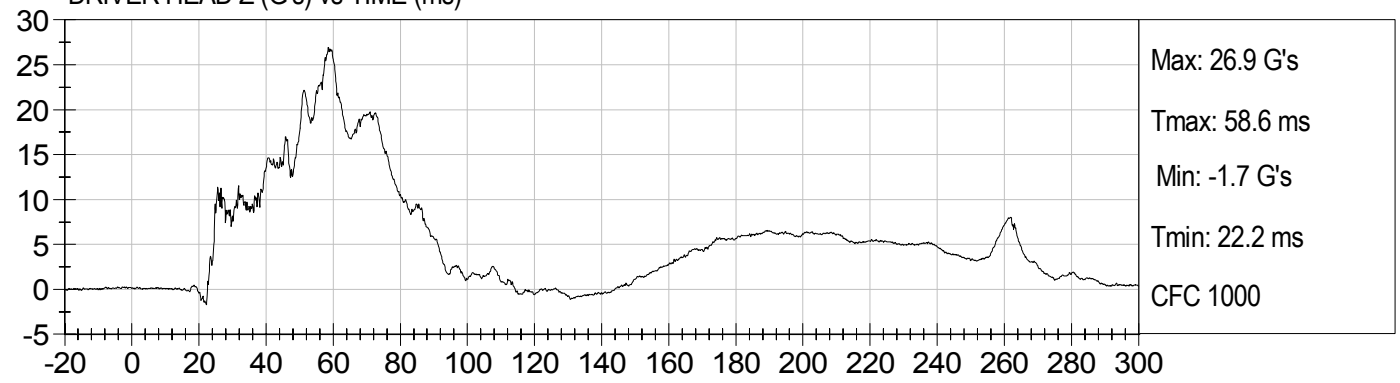
DRIVER HEAD X (G's) vs TIME (ms)



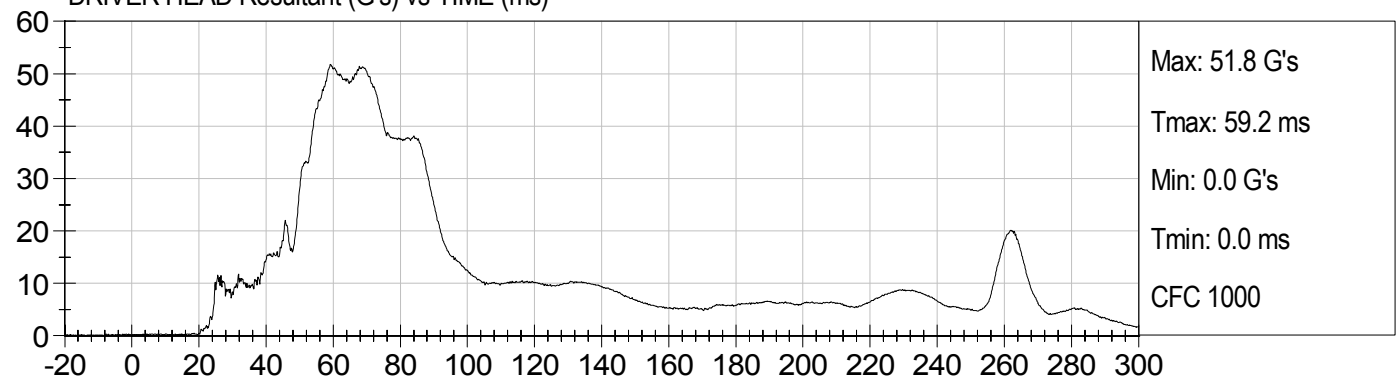
DRIVER HEAD Y (G's) vs TIME (ms)



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



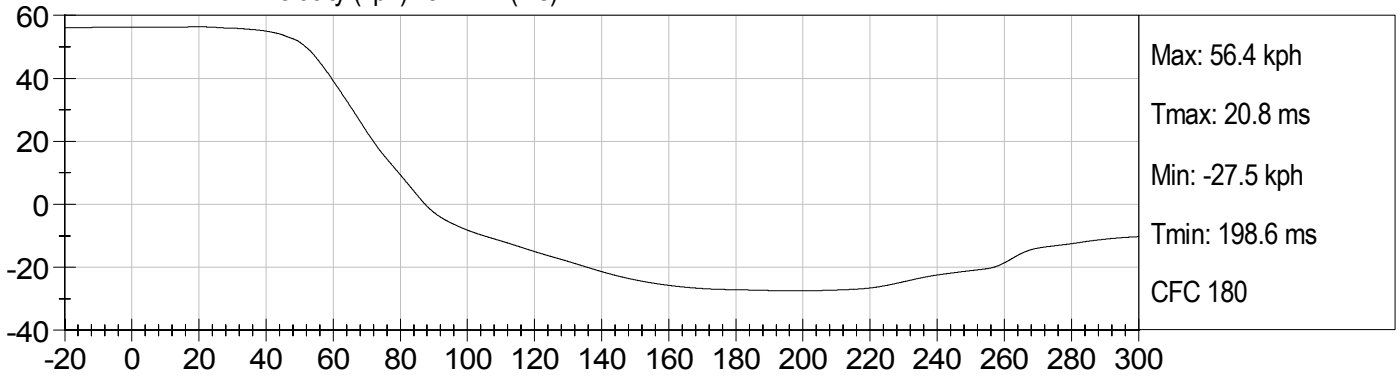
DRIVER HEAD Resultant (G's) vs TIME (ms)



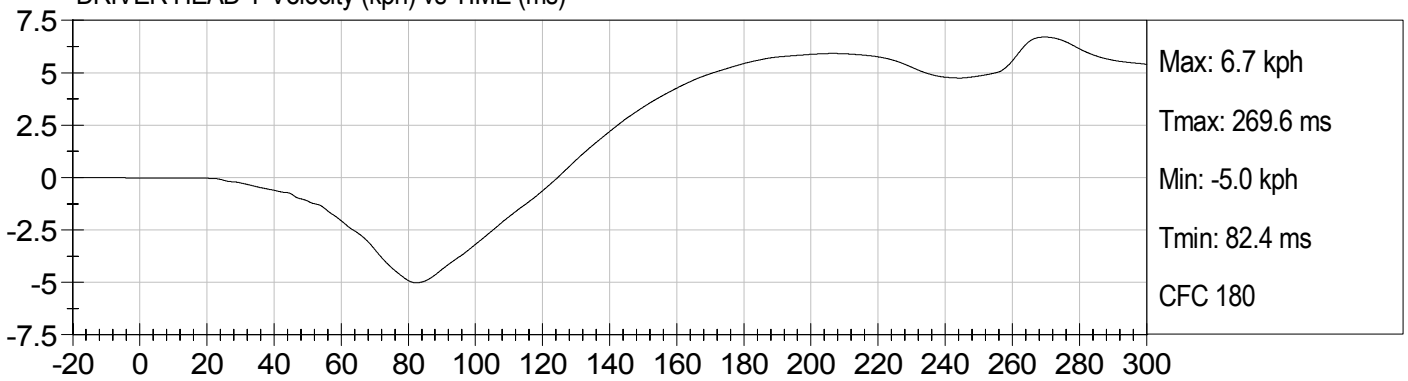
NCAP 35 MPH FRONTAL
2007 KIA SORENTO M70506

Test Date: 12/06/2006
Speed: 34.9 mph (56.2 km/h)

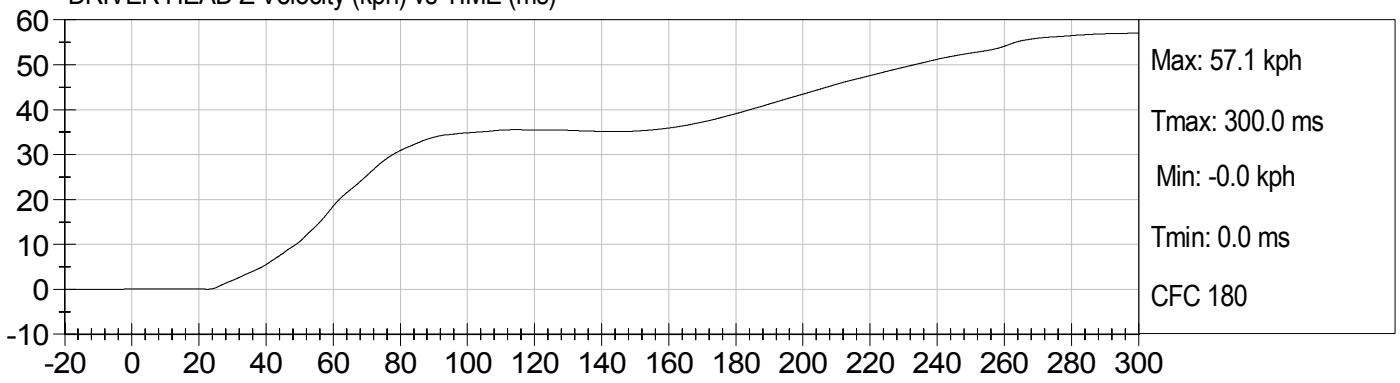
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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



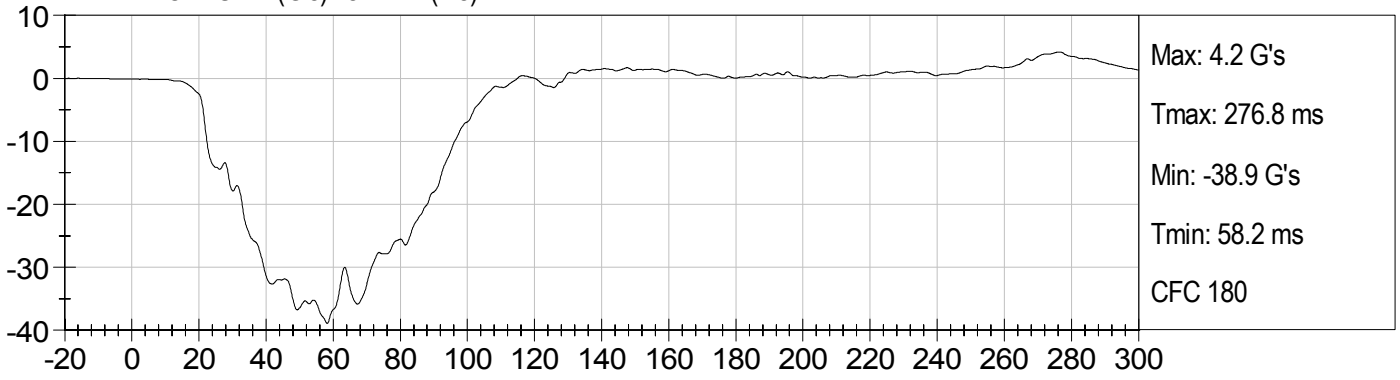
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



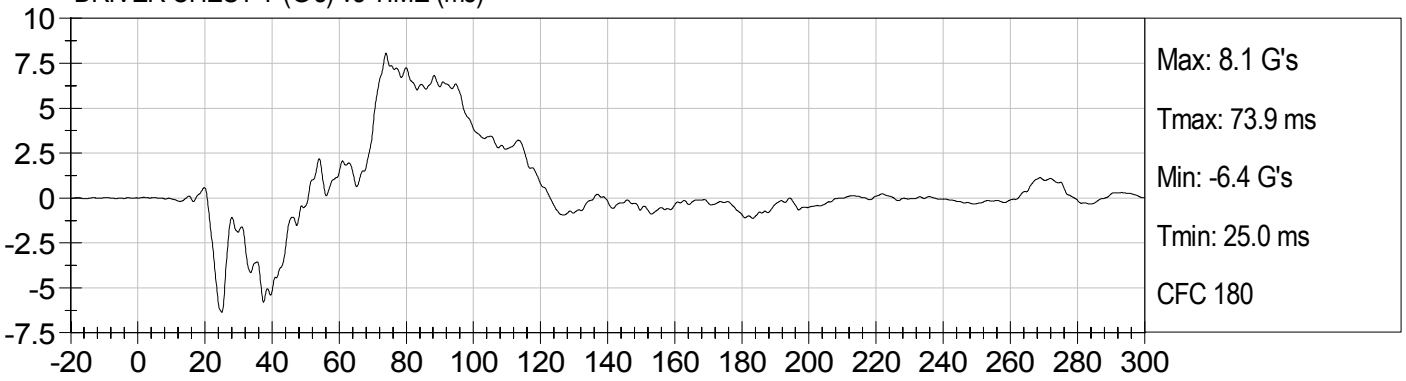
NCAP 35 MPH FRONTAL
2007 KIA SORENTO M70506

Test Date: 12/06/2006
Speed: 34.9 mph (56.2 km/h)

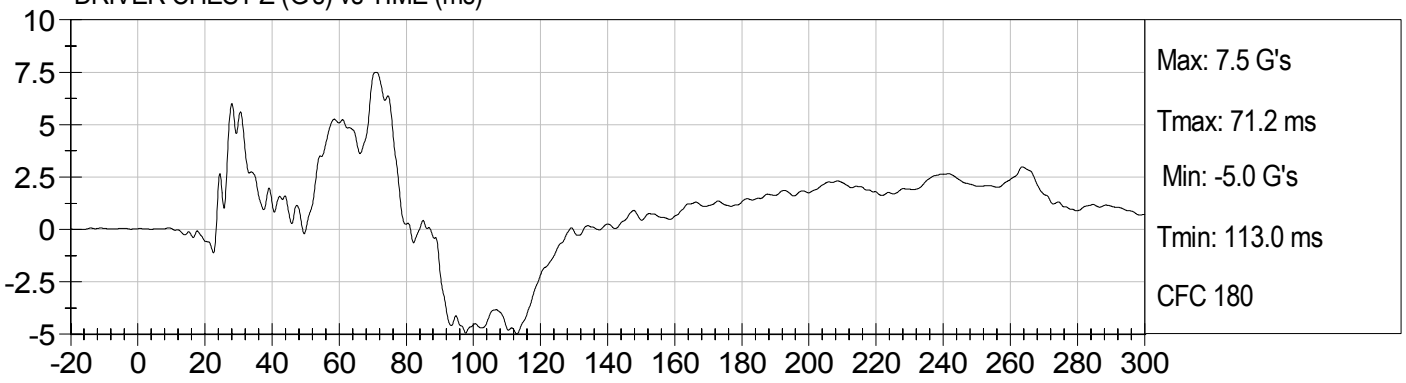
DRIVER CHEST X (G's) vs TIME (ms)



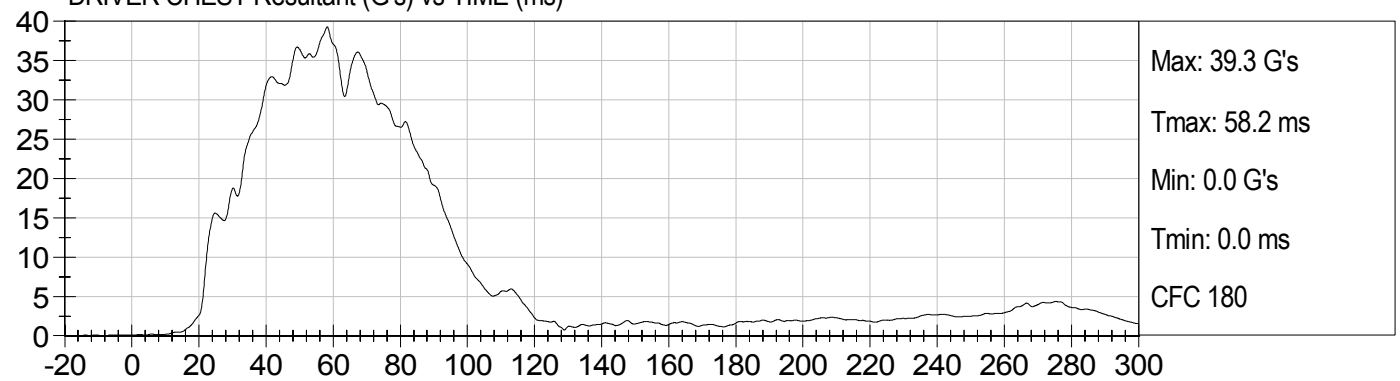
DRIVER CHEST Y (G's) vs TIME (ms)



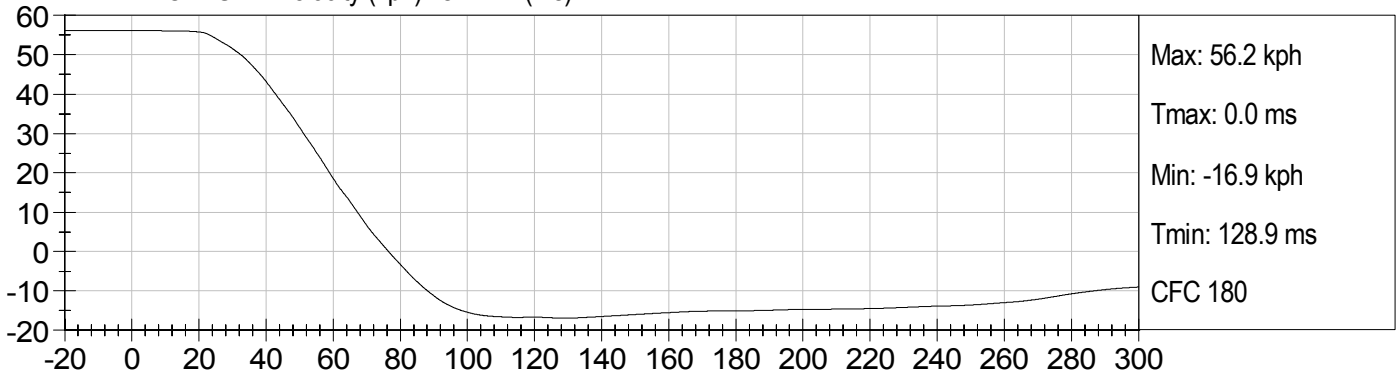
DRIVER CHEST Z (G's) vs TIME (ms)



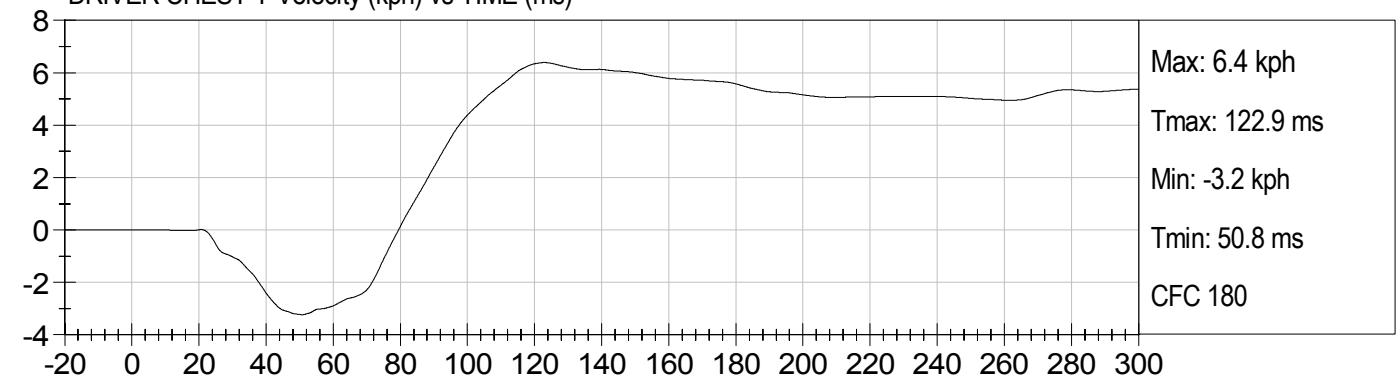
DRIVER CHEST Resultant (G's) vs TIME (ms)



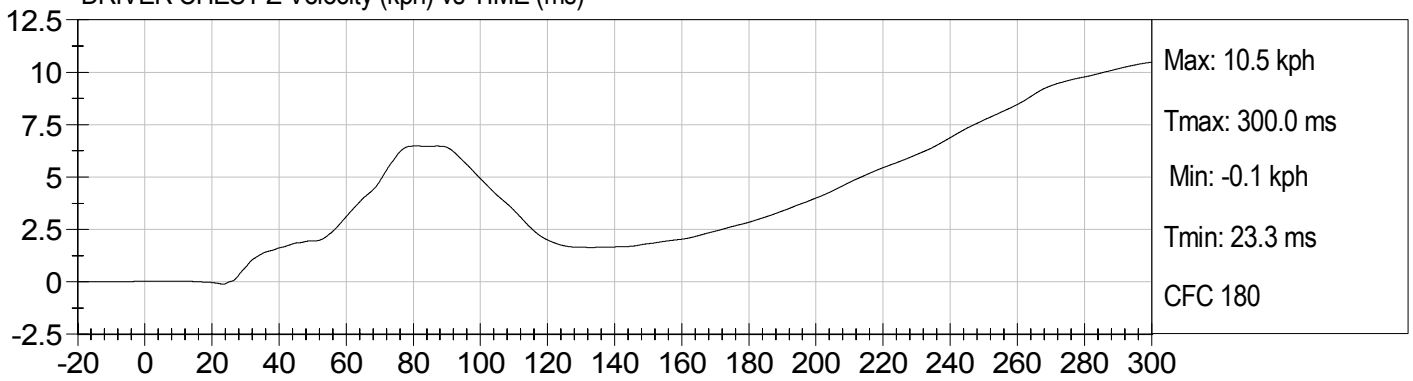
DRIVER CHEST X Velocity (kph) vs TIME (ms)

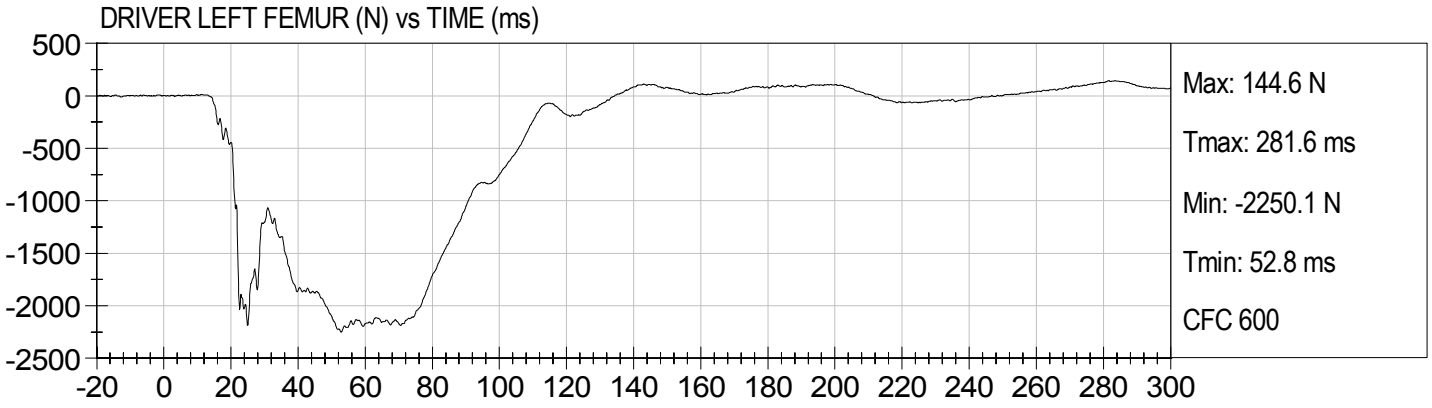


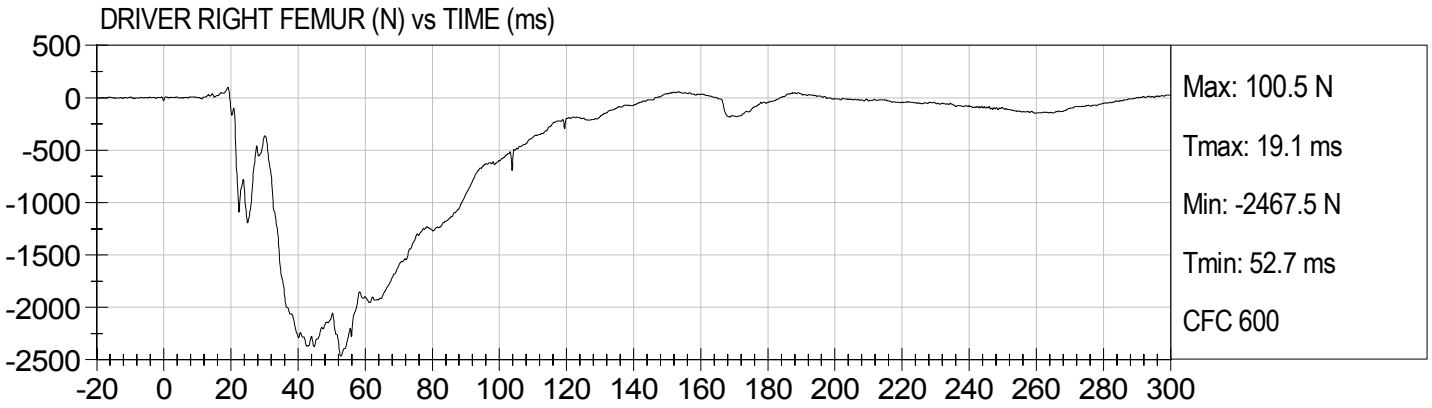
DRIVER CHEST Y Velocity (kph) vs TIME (ms)



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



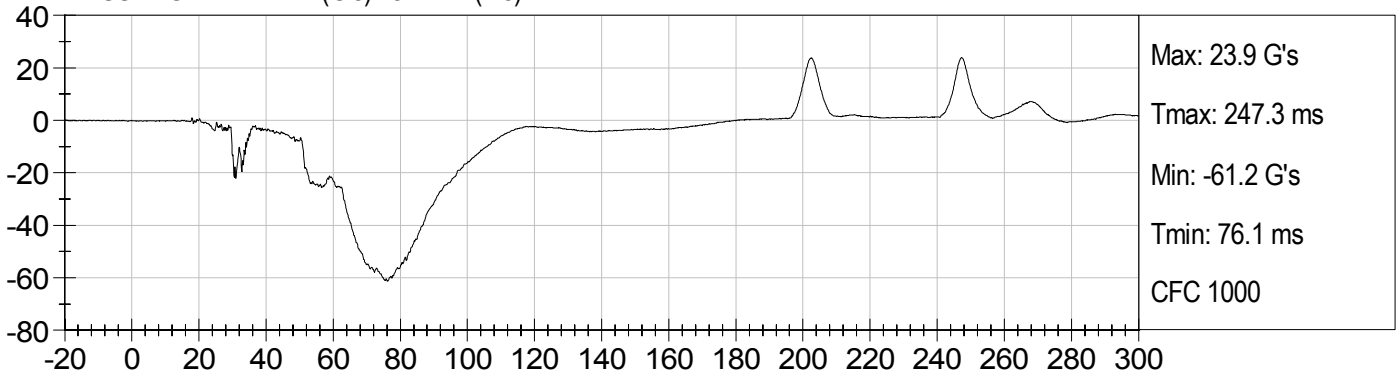

DRIVER LEFT FEMUR (N) vs TIME (ms)
500
0
-500
-1000
-1500
-2000
-2500
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 144.6 N
Tmax: 281.6 ms
Min: -2250.1 N
Tmin: 52.8 ms
CFC 600


DRIVER RIGHT FEMUR (N) vs TIME (ms)
500
0
-500
-1000
-1500
-2000
-2500
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 100.5 N
Tmax: 19.1 ms
Min: -2467.5 N
Tmin: 52.7 ms
CFC 600

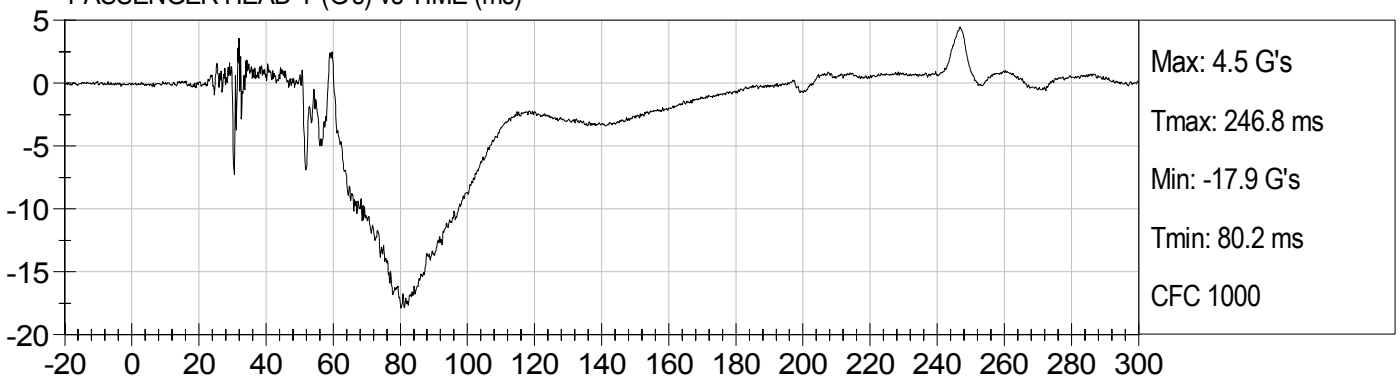
NCAP 35 MPH FRONTAL
2007 KIA SORENTO M70506

Test Date: 12/06/2006
Speed: 34.9 mph (56.2 km/h)

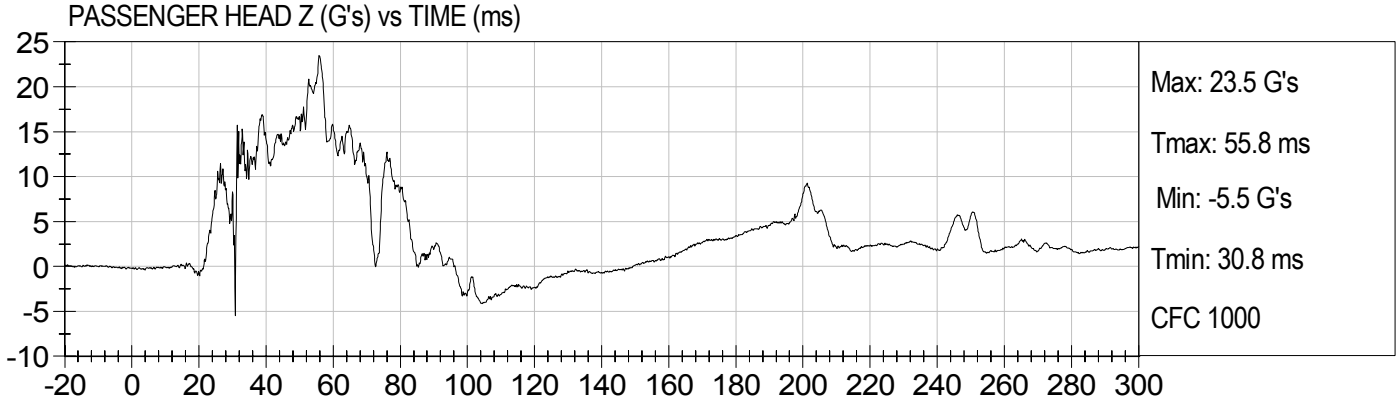
PASSENGER HEAD X (G's) vs TIME (ms)



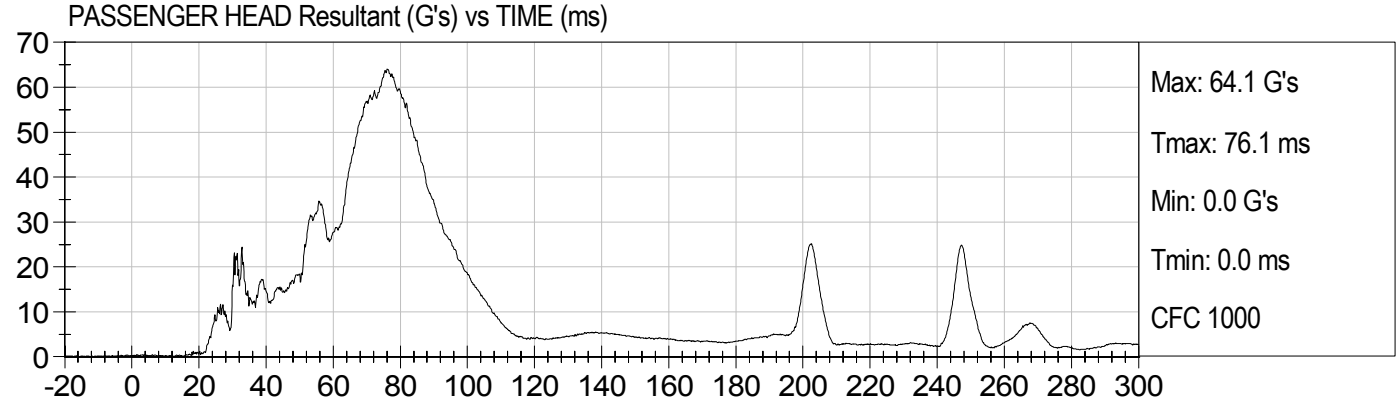
PASSENGER HEAD Y (G's) vs TIME (ms)



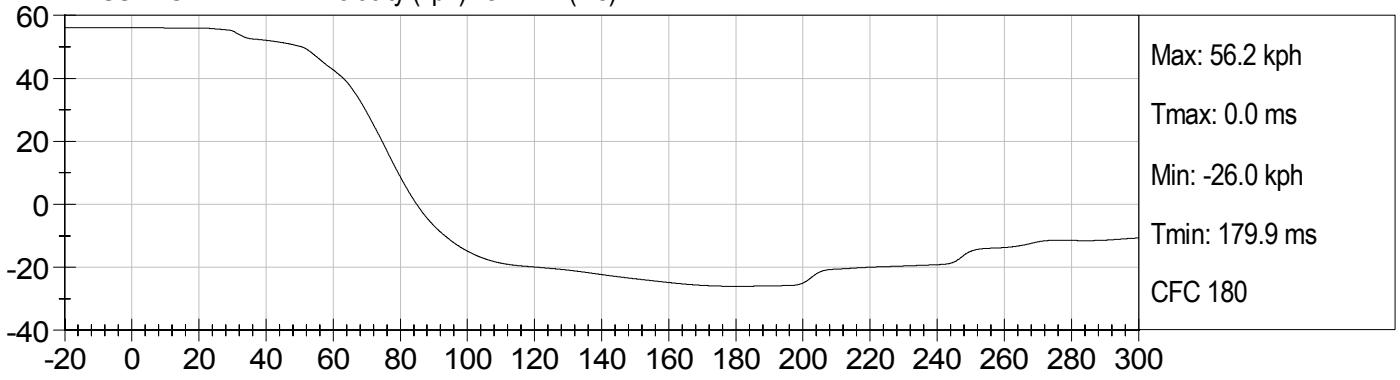
PASSENGER HEAD Z (G's) vs TIME (ms)



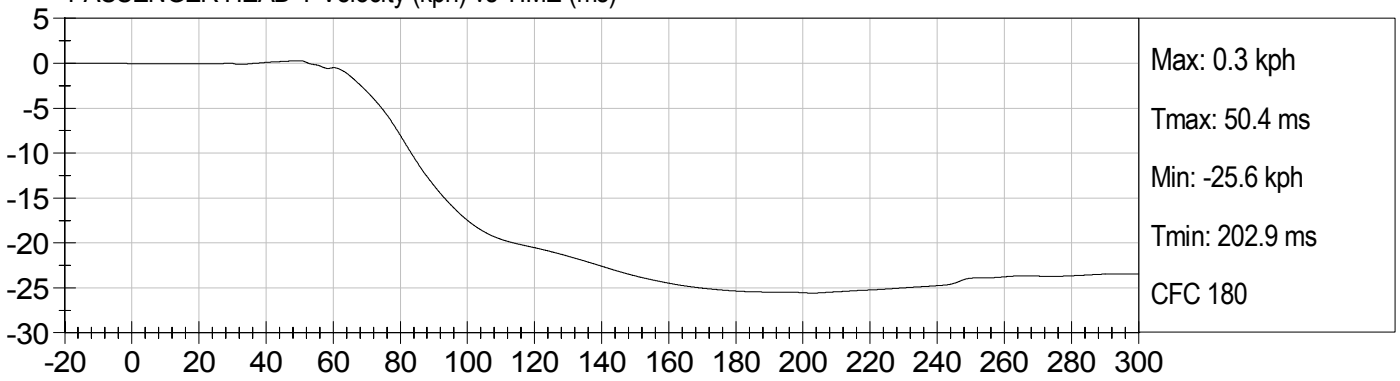
PASSENGER HEAD Resultant (G's) vs TIME (ms)



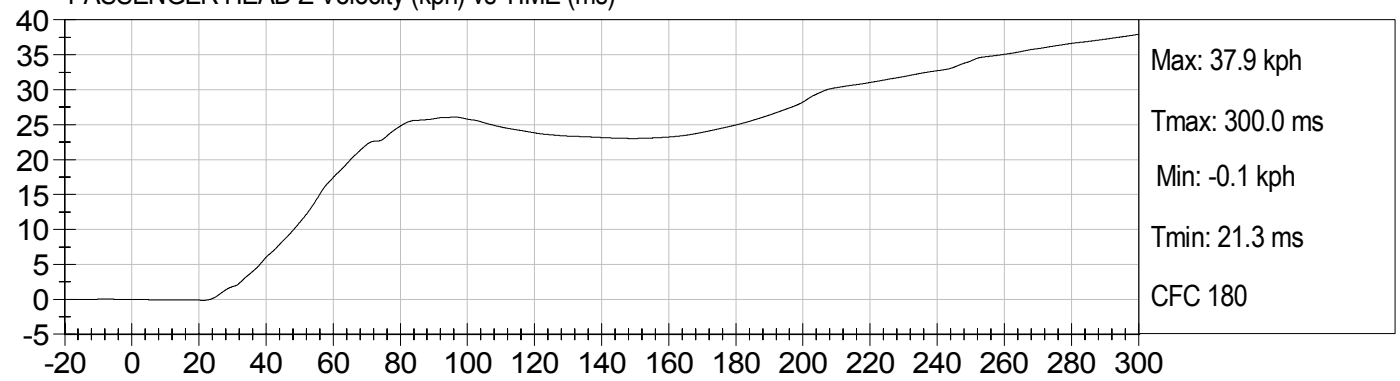
PASSENGER HEAD X Velocity (kph) vs TIME (ms)



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



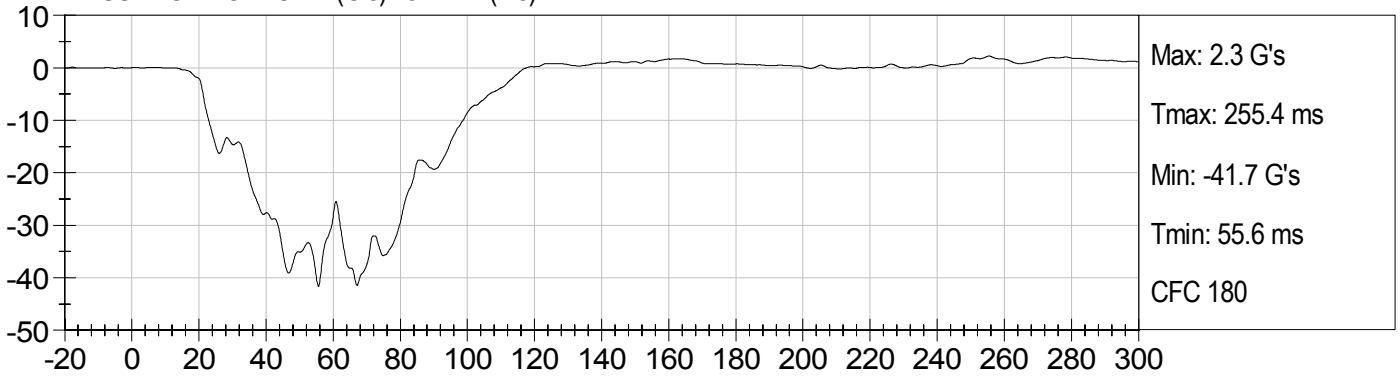
PASSENGER HEAD Z Velocity (kph) vs TIME (ms)



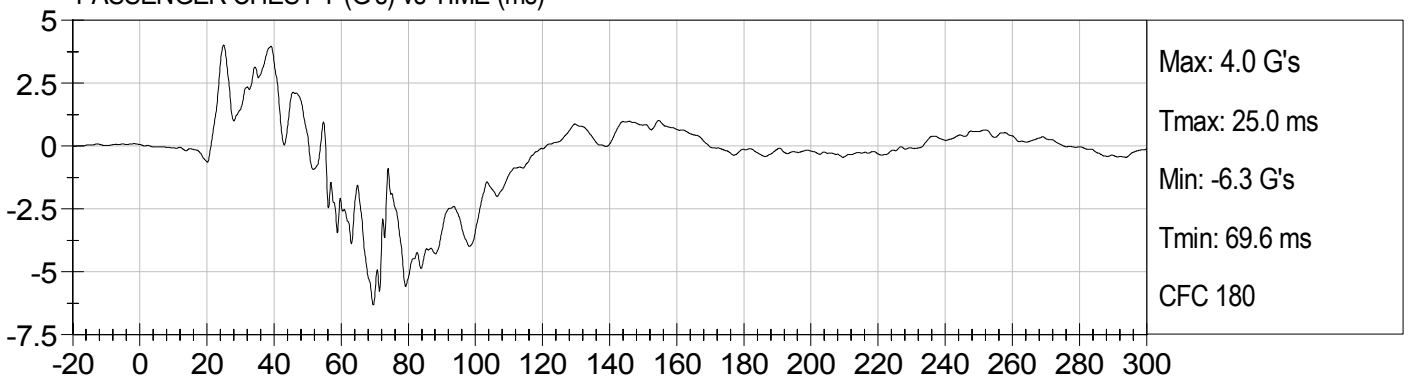
NCAP 35 MPH FRONTAL
2007 KIA SORENTO M70506

Test Date: 12/06/2006
Speed: 34.9 mph (56.2 km/h)

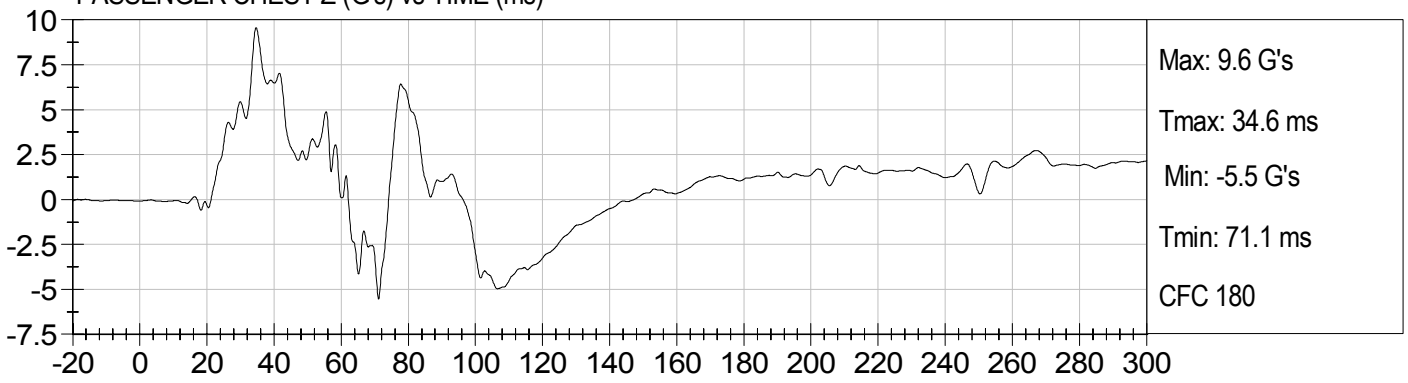
PASSENGER CHEST X (G's) vs TIME (ms)



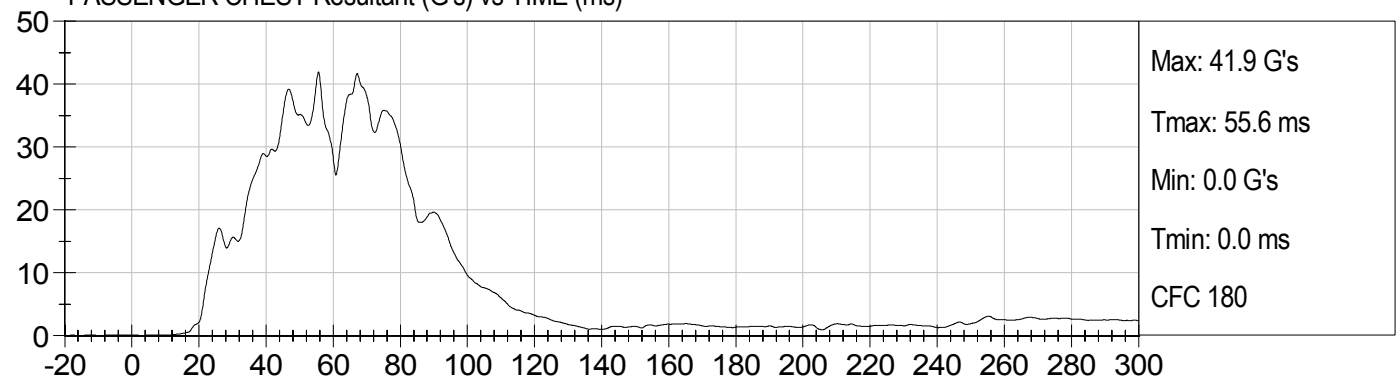
PASSENGER CHEST Y (G's) vs TIME (ms)



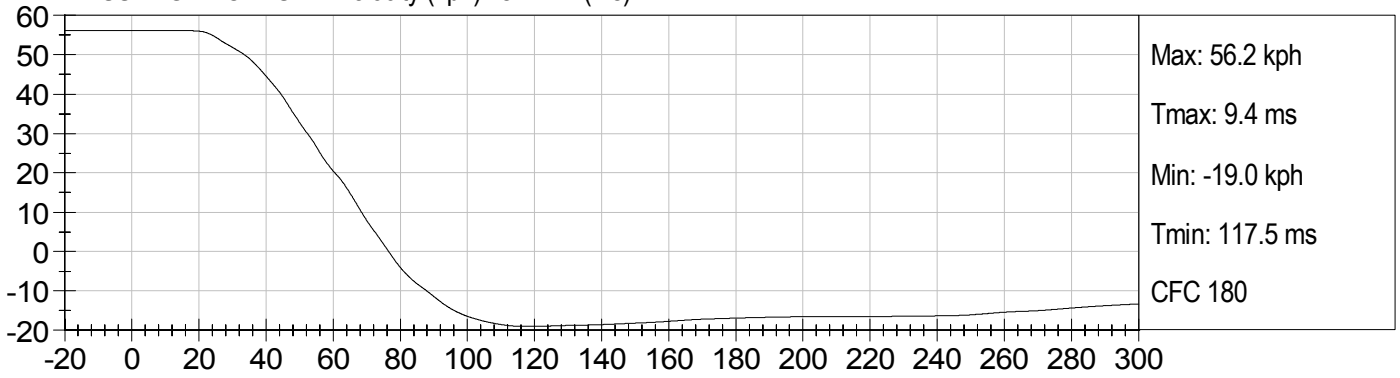
PASSENGER CHEST Z (G's) vs TIME (ms)



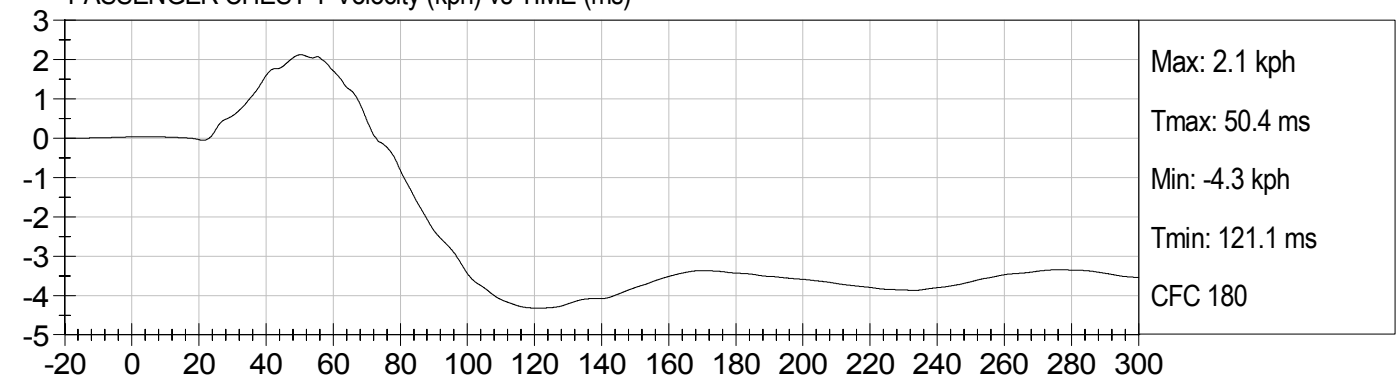
PASSENGER CHEST Resultant (G's) vs TIME (ms)



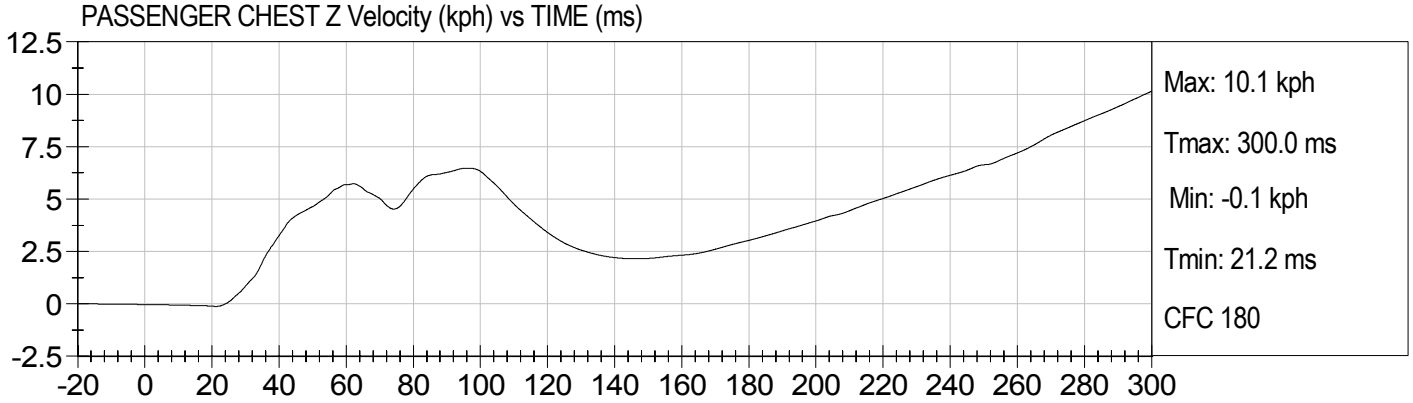
PASSENGER CHEST X Velocity (kph) vs TIME (ms)



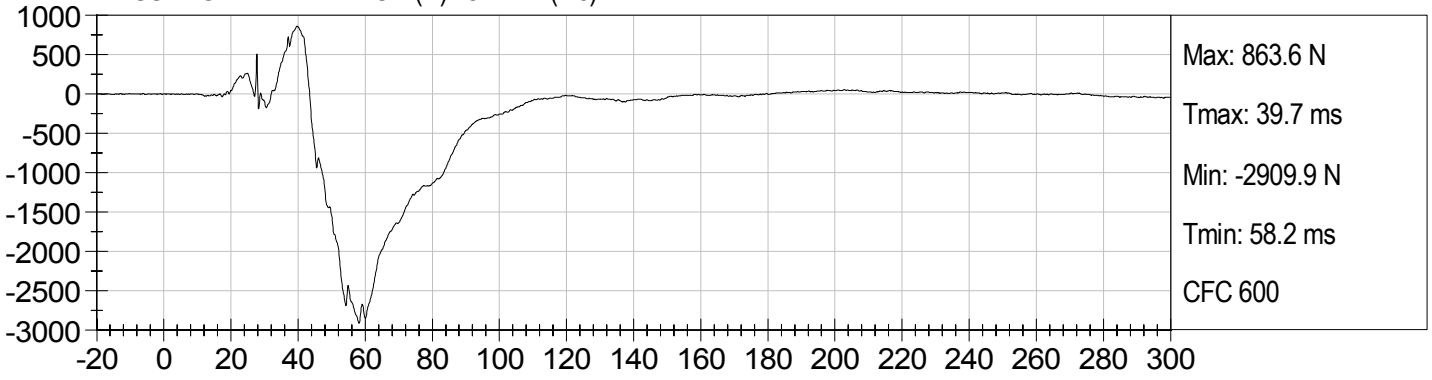
PASSENGER CHEST Y Velocity (kph) vs TIME (ms)



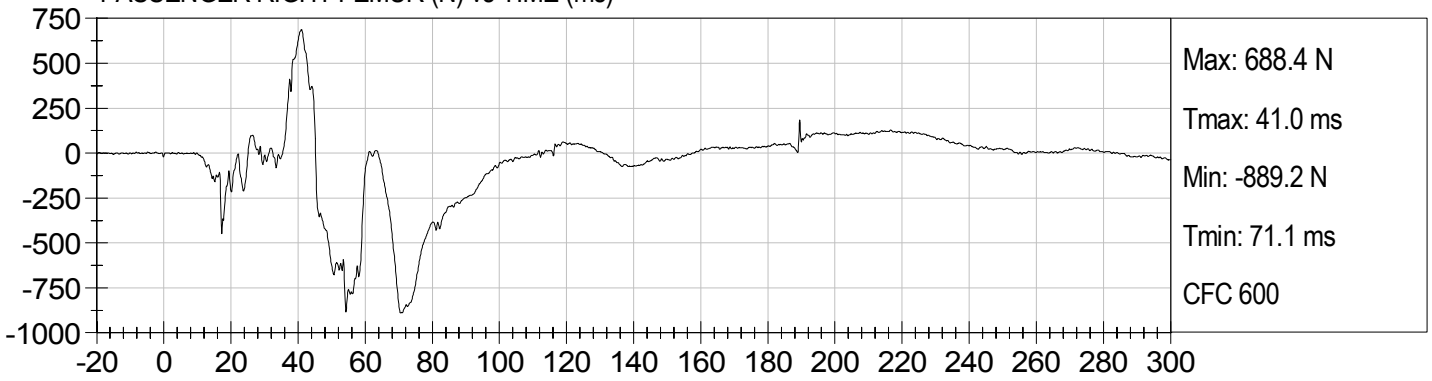
PASSENGER CHEST Z Velocity (kph) vs TIME (ms)



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: 066 **Test ID:** D063321

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Peak Resultant Acceleration	G's	225 - 275	265	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

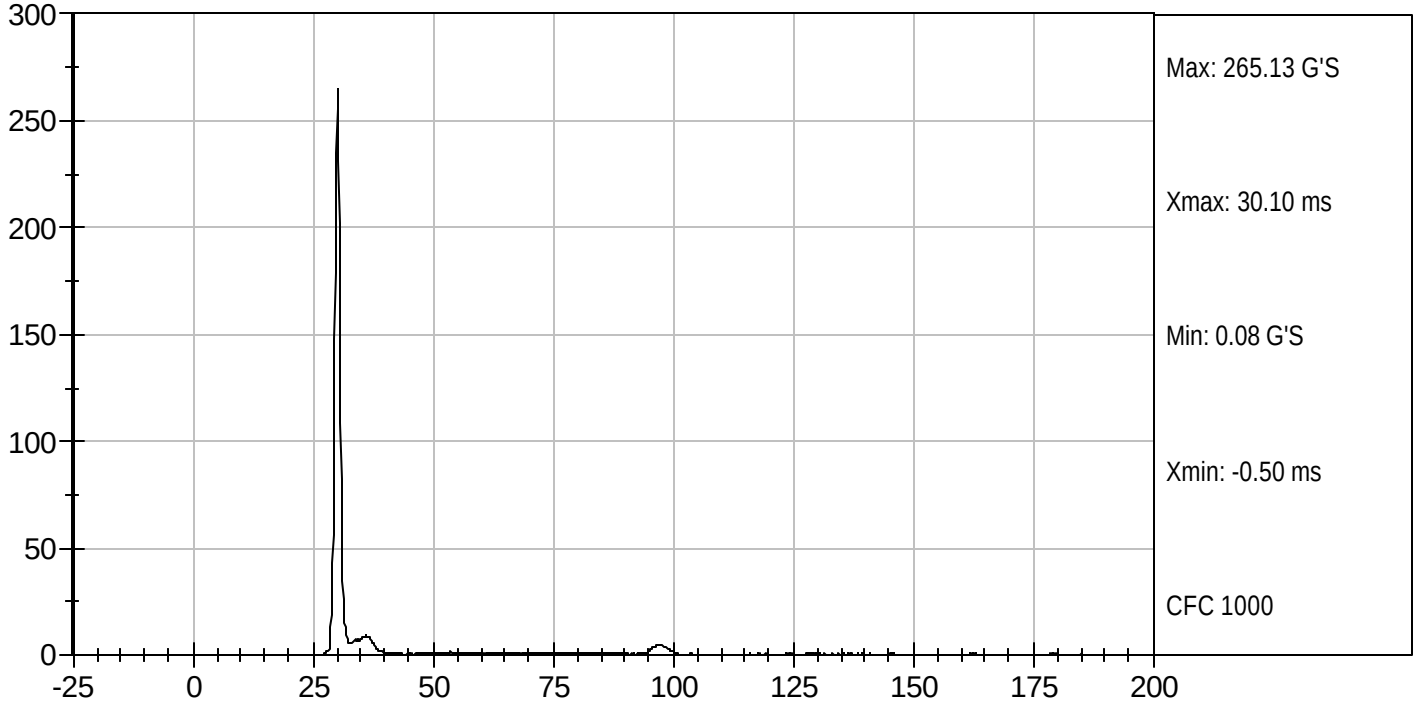
11/17/2006
Test Date

David Winkelbauer
Approved By

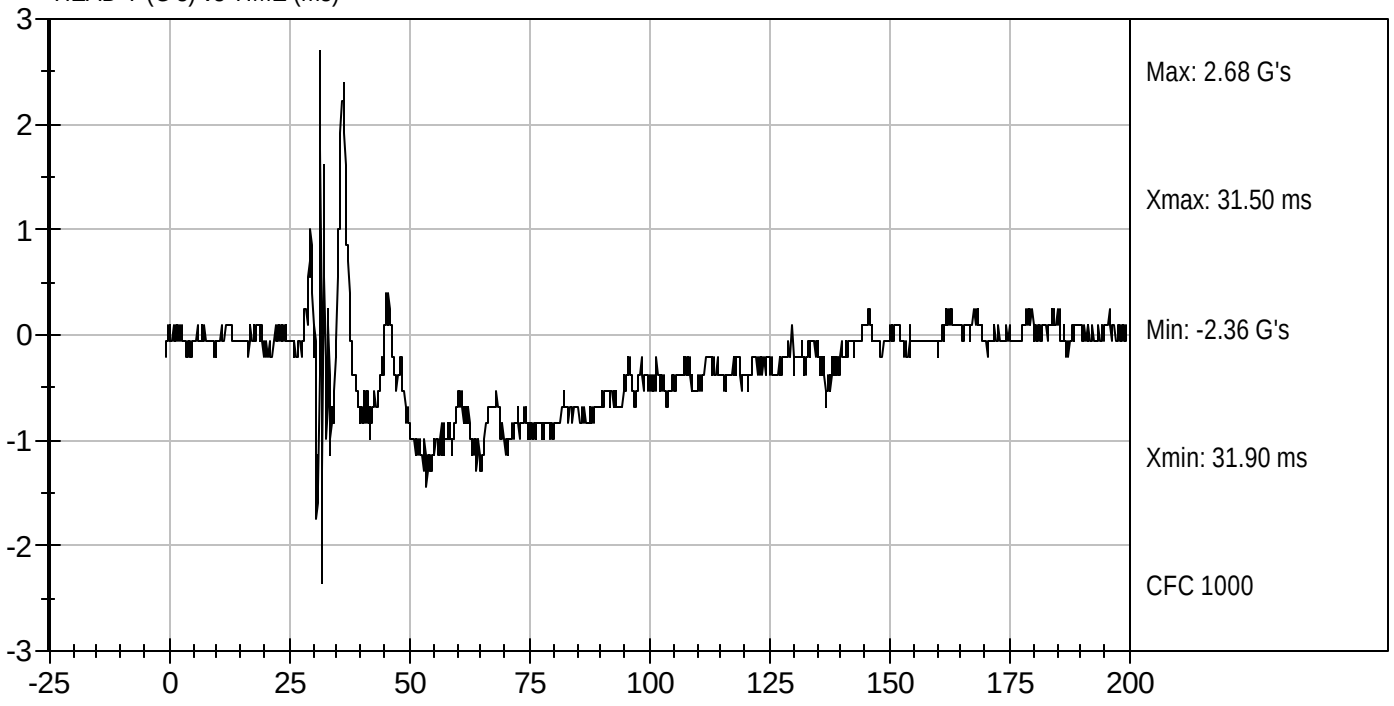
Test Desc: Head Drop
Componet ID: D063321

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s

HEAD RESULTANT 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: 066 **Test I.D:** D063322

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.01	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.82	Pass
	20 msec	G's	17.60 to 22.60	18.11	Pass
	30 msec	G's	12.50 to 18.50	14.69	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.64	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	40.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.9	Pass
	Time	msec	57.0 to 64.0	60.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.5	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	92.1	Pass
	Time	msec	47.0 to 58.0	54.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.2	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

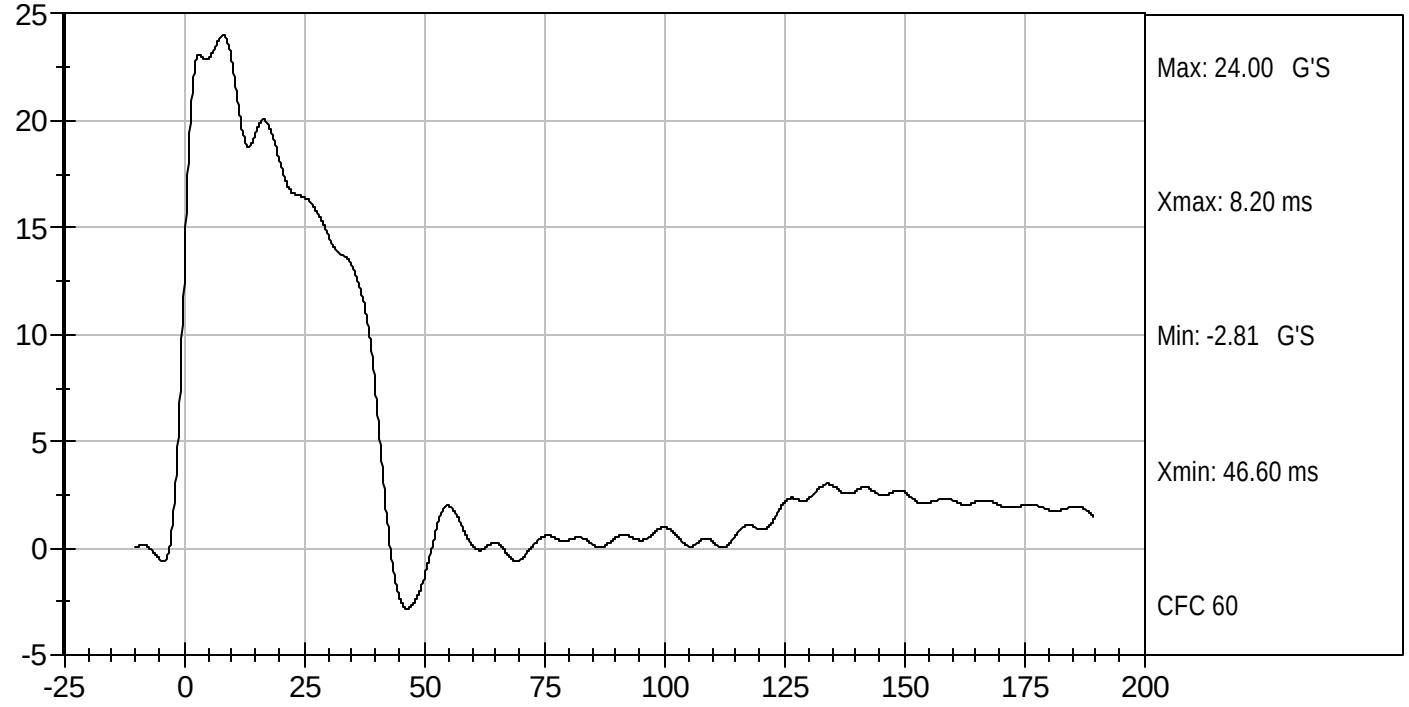
11/20/2006
Test Date

David Winkelbauer
Approved By

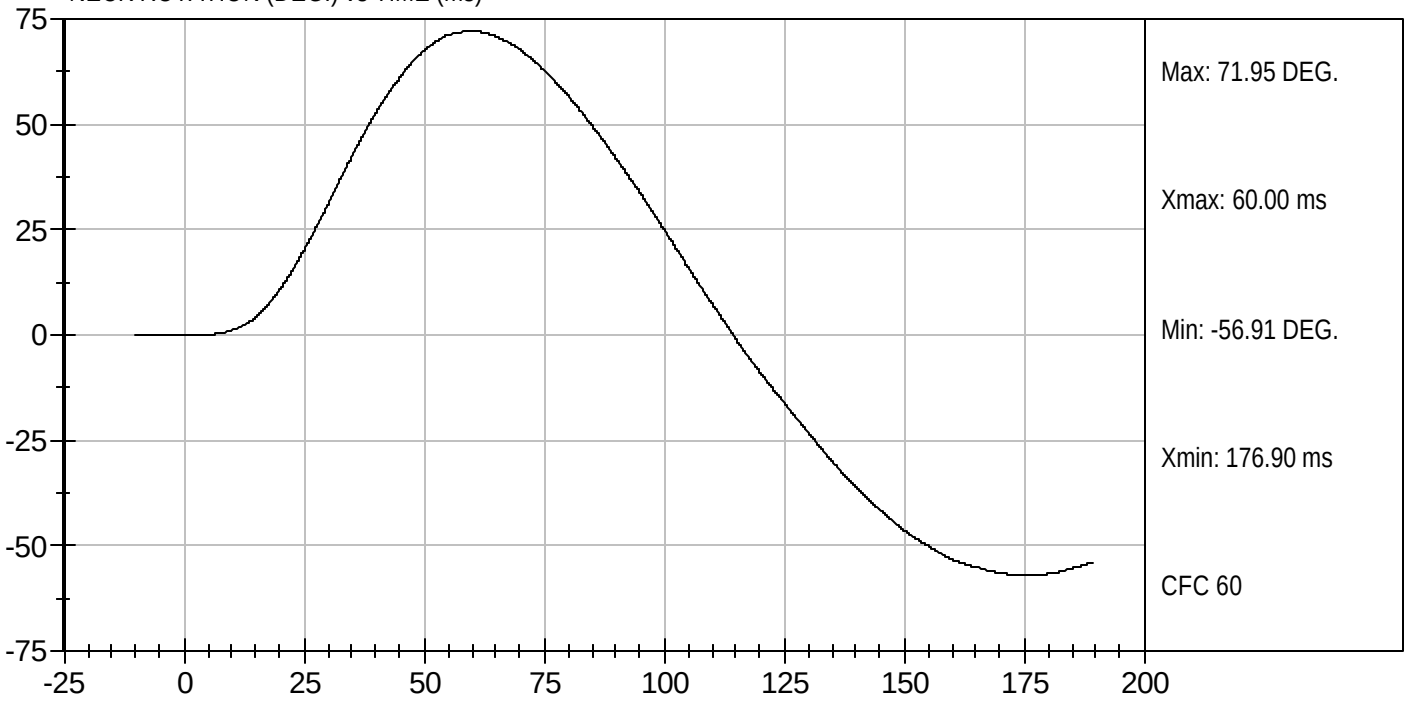
Test Desc: Neck Flexion
Componet ID: D063322

Test Date: 11/20/2006
Velocity: 22.99 ft/s, 7.01 m/s

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

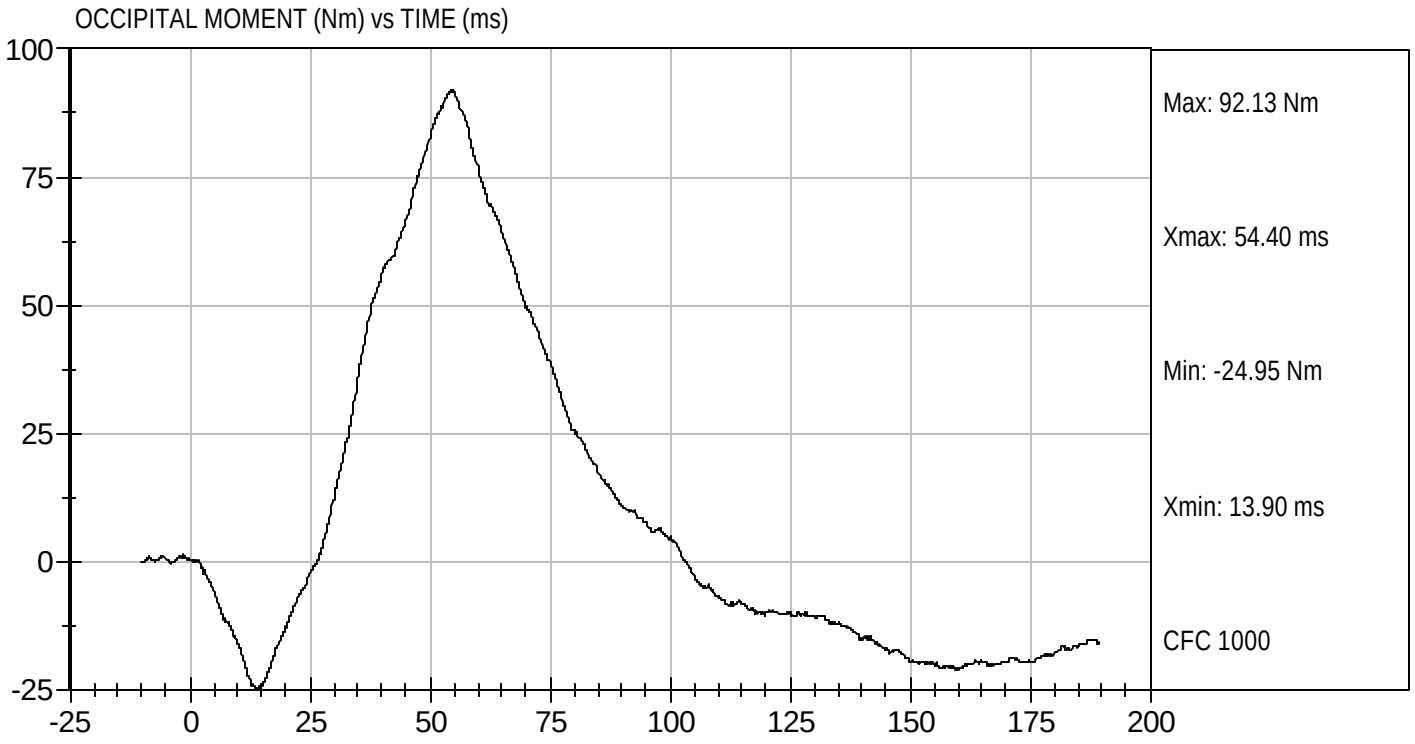


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D063322

Test Date: 11/20/2006
Velocity: 22.99 ft/s, 7.01 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063323

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.07	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	17.33	Pass
	20 msec	G's	14.00 to 19.00	15.96	Pass
	30 msec	G's	11.00 to 16.00	13.17	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.16	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	42.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.3	Pass
	Time	msec	72.0 to 82.0	78.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	157.6	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-65.8	Pass
	Time	msec	65.0 to 79.0	74.9	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.2	Pass
			Overall Test Results		Pass

Laboratory Technician

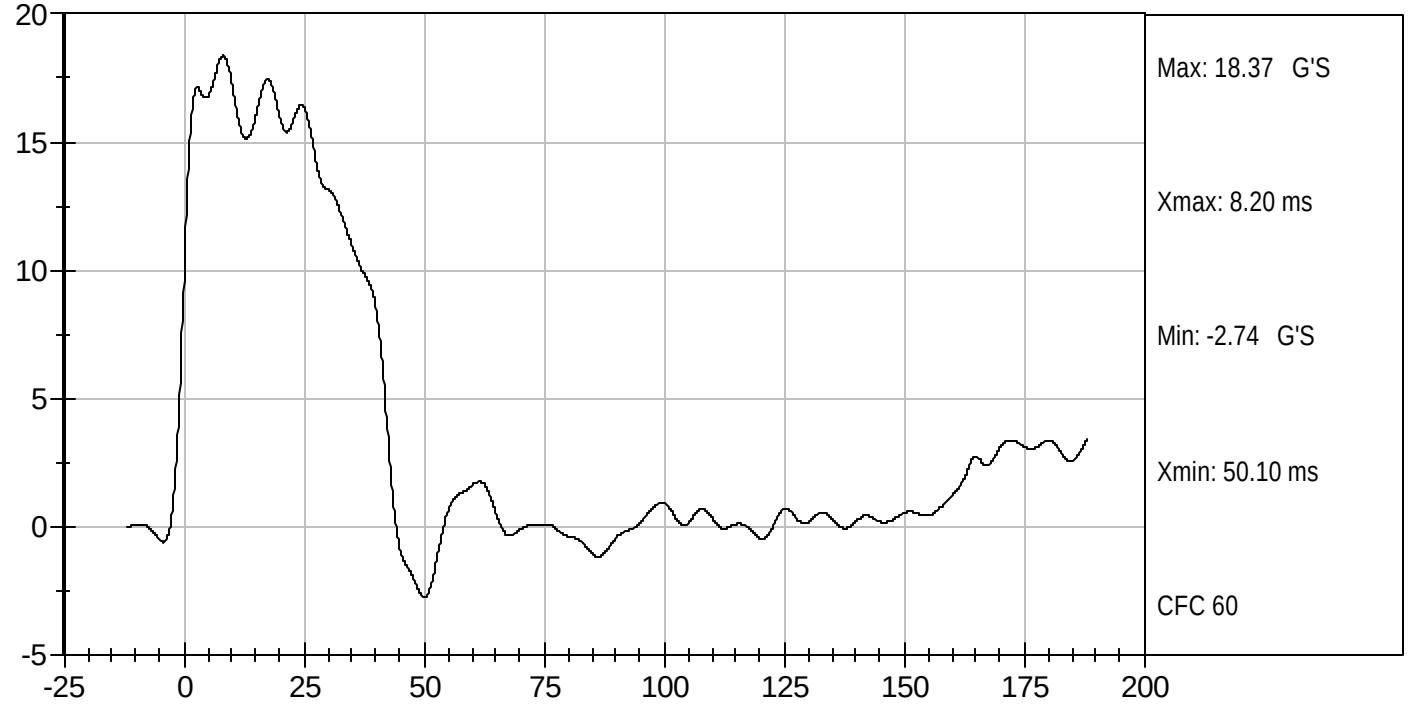
11/20/2006
Test Date

Approved By

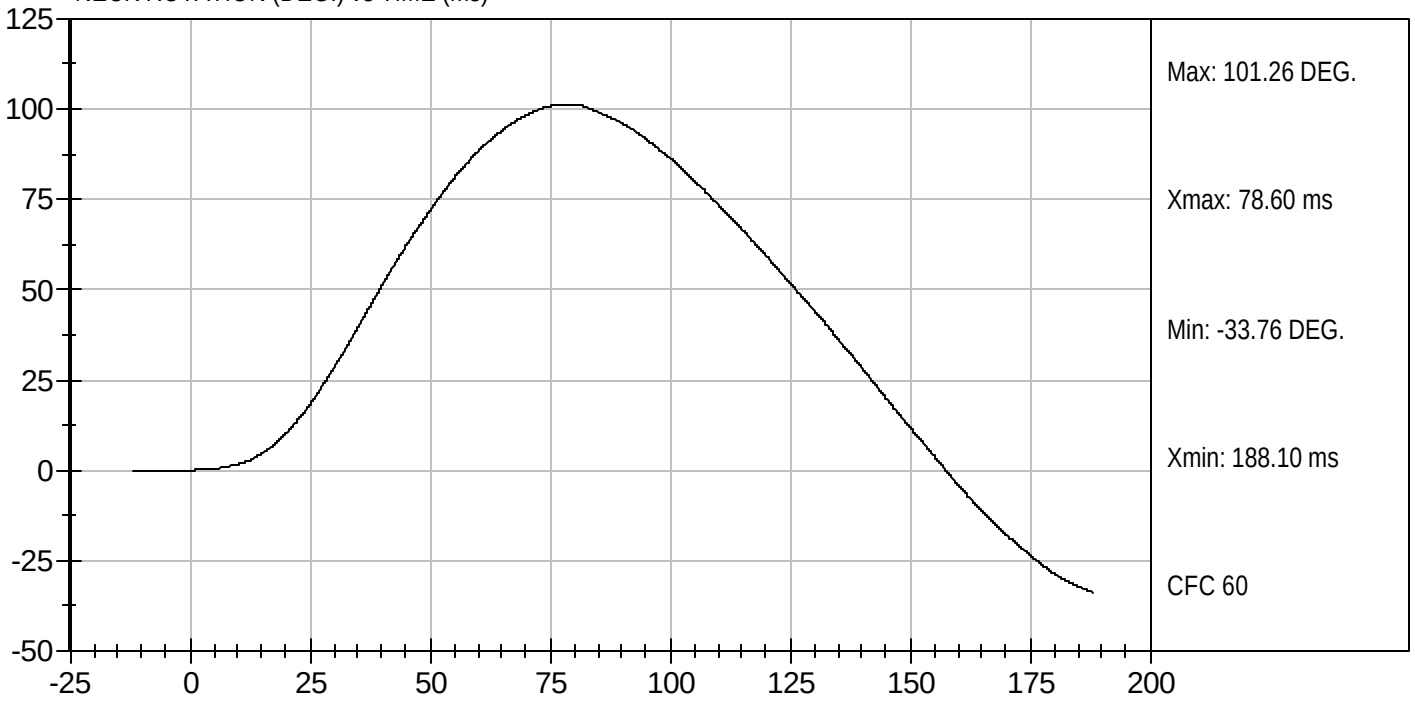
Test Desc: Neck Extension
Componet ID: D063323

Test Date: 11/20/2006
Velocity: 19.91 ft/s, 6.07 m/s

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



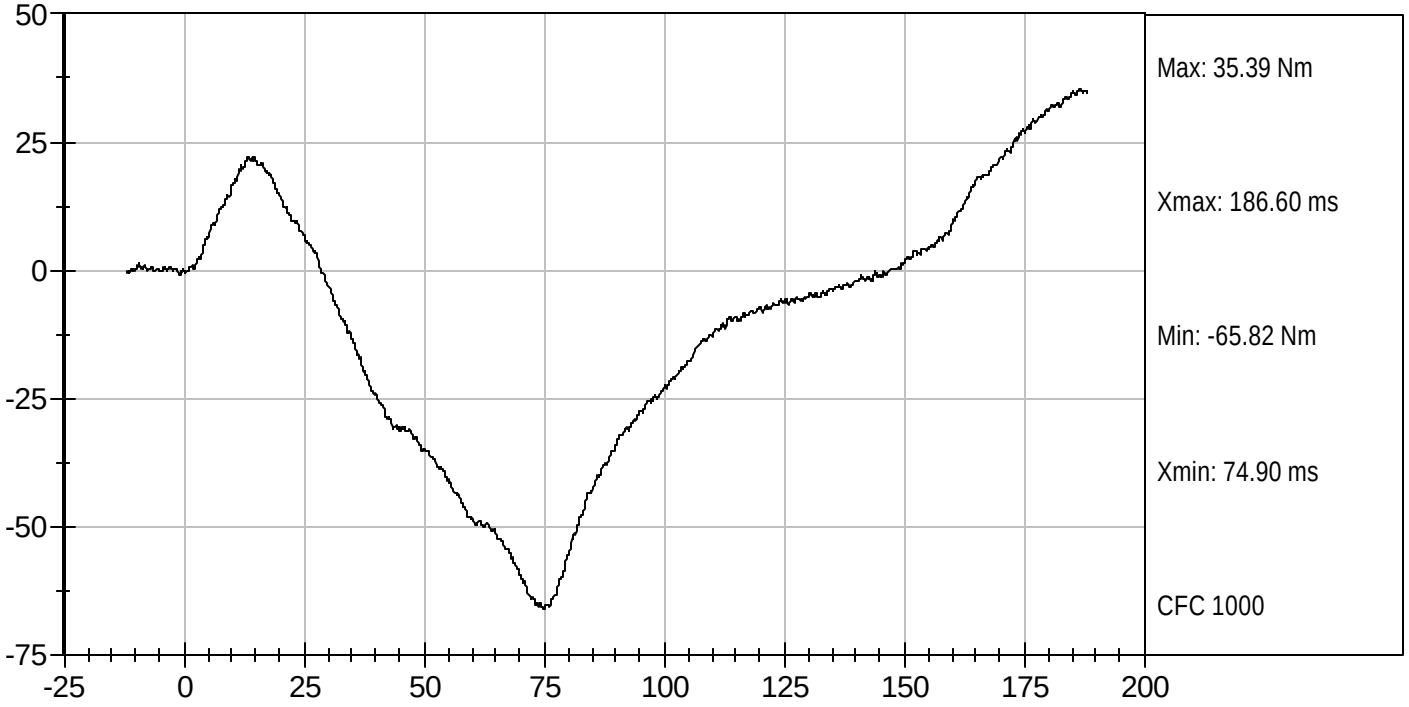
NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D063323

Test Date: 11/20/2006
Velocity: 19.91 ft/s, 6.07 m/s

OCCIPITAL MOMENT (Nm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063324

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	24	Pass
Probe Velocity	m/s	6.58 to 6.82	6.66	Pass
Peak Probe Force	N	5159 to 5893	5,692	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.99	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

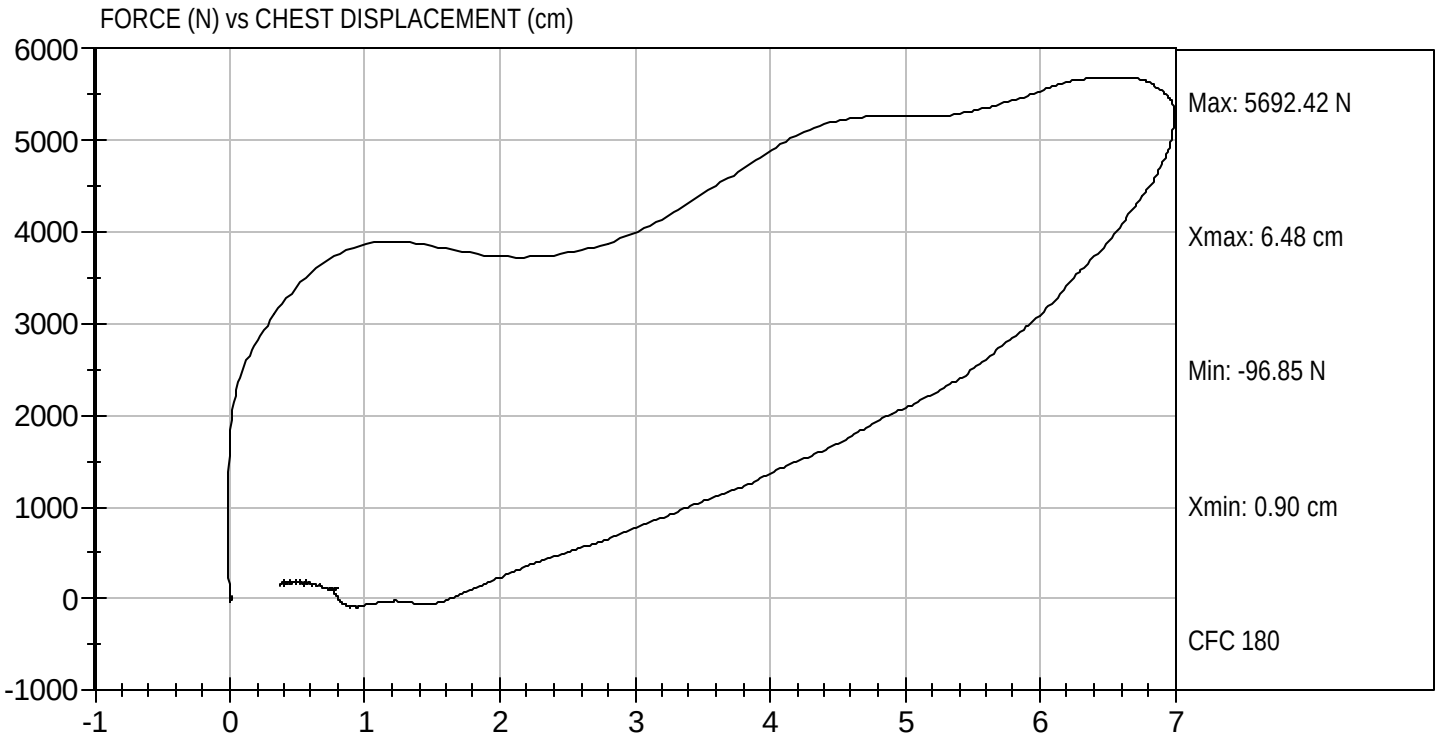
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Componet ID: D063324

Test Date: 11/17/2006
Velocity: 21.86 ft/s, 6.66 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063325

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	5,463	Pass
		Overall Test Results		Pass

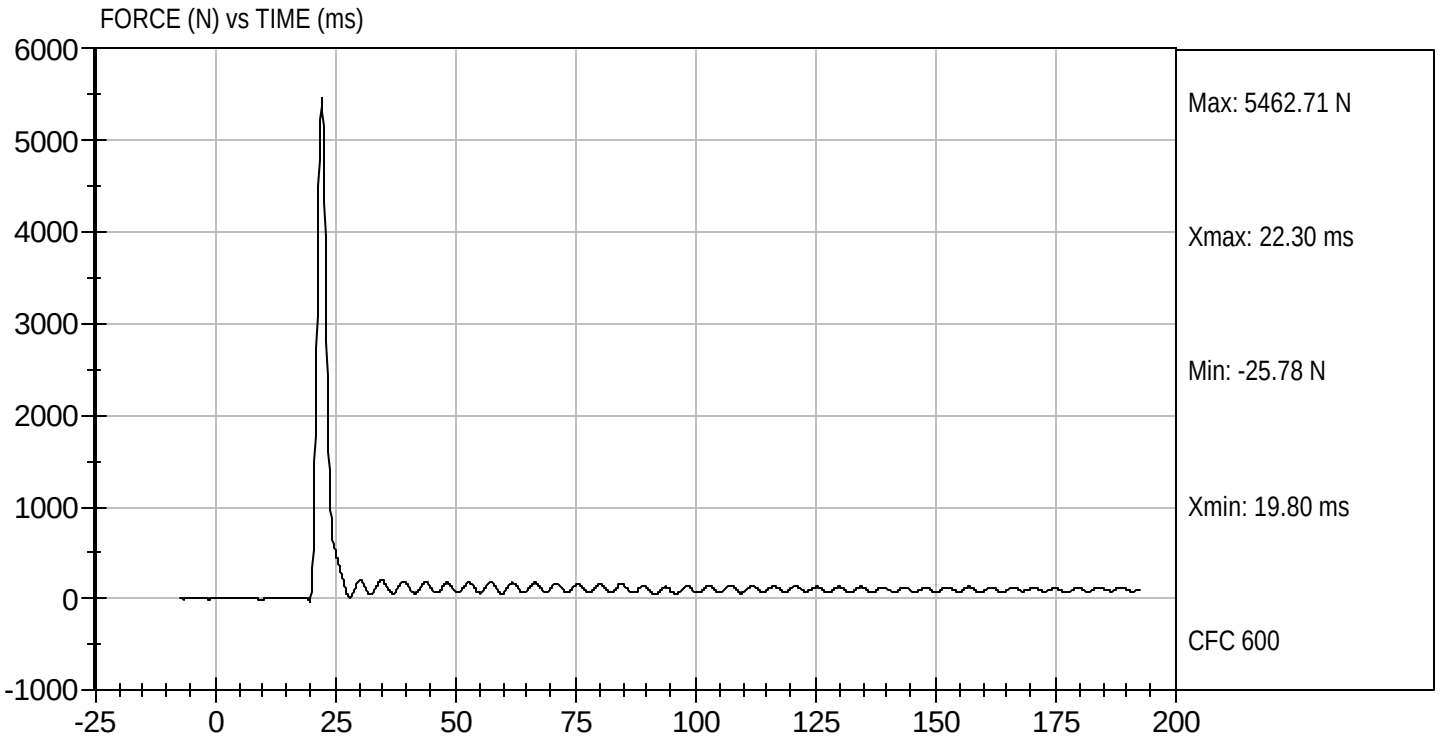
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D063325

Test Date: 11/20/2006
Velocity: 6.85 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063326

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	5,160	Pass
		Overall Test Results		Pass

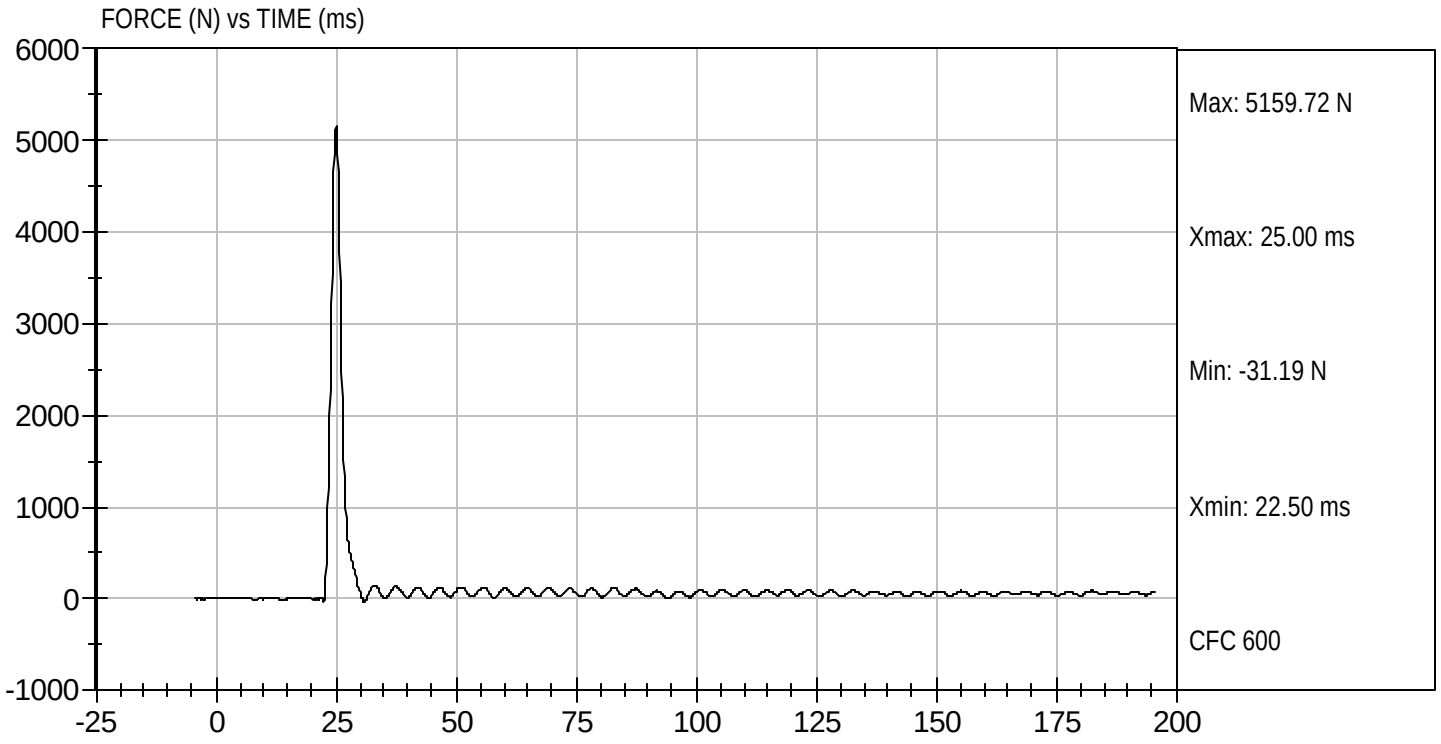
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D063326

Test Date: 11/20/2006
Velocity: 6.87 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D063320

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	88.0	84.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	40	Pass
		Overall Test Results			Pass

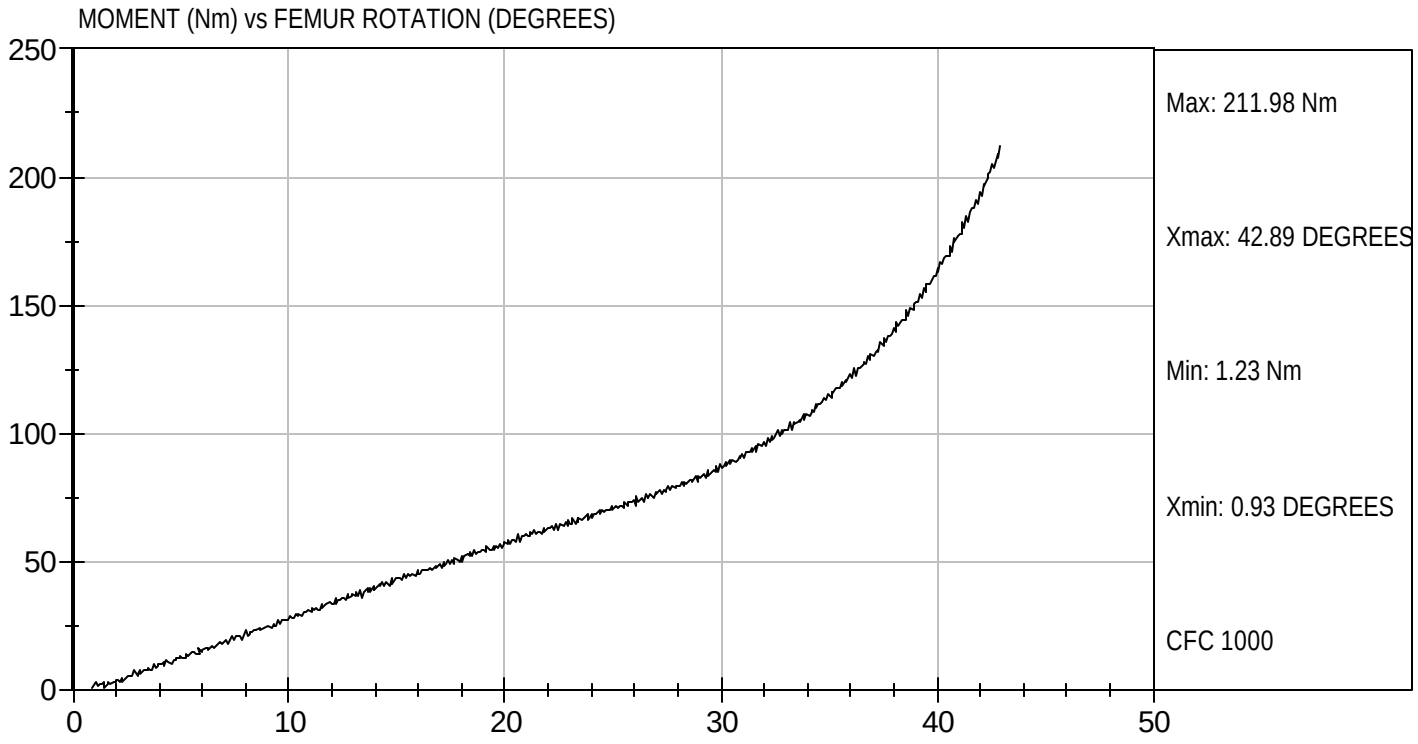
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

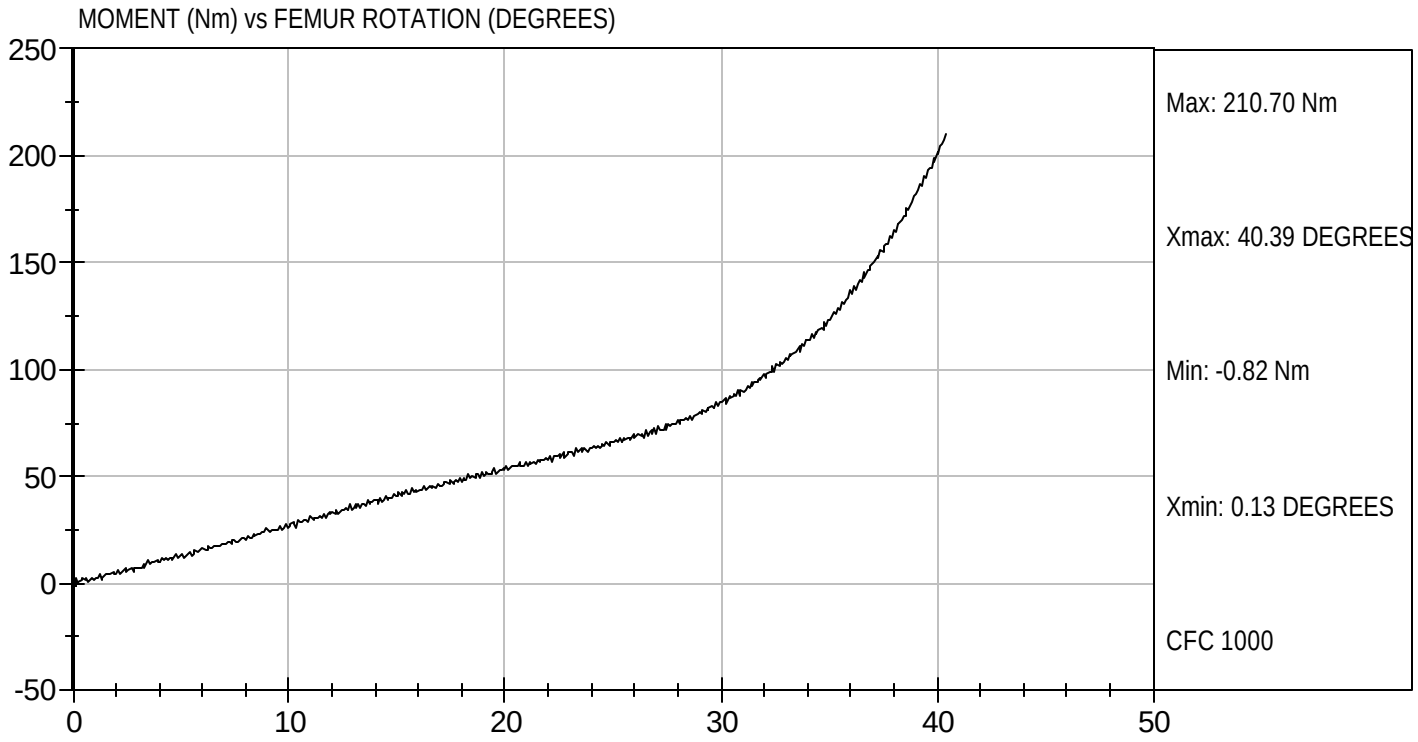
Test Desc: Hip Femur Flexion
Componet ID: D063329

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D063320

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test ID:** D063311

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	225 - 275	235	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

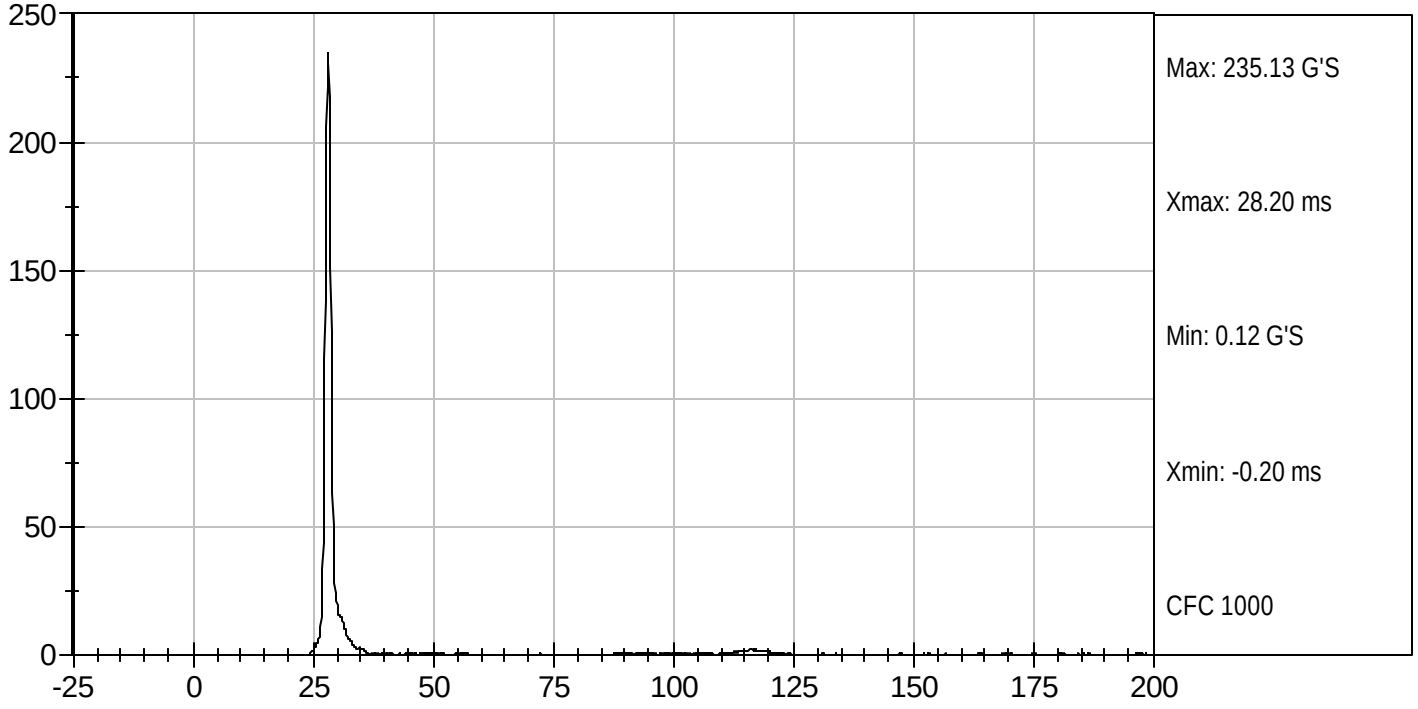
11/17/2006
Test Date

David Winkelbauer
Approved By

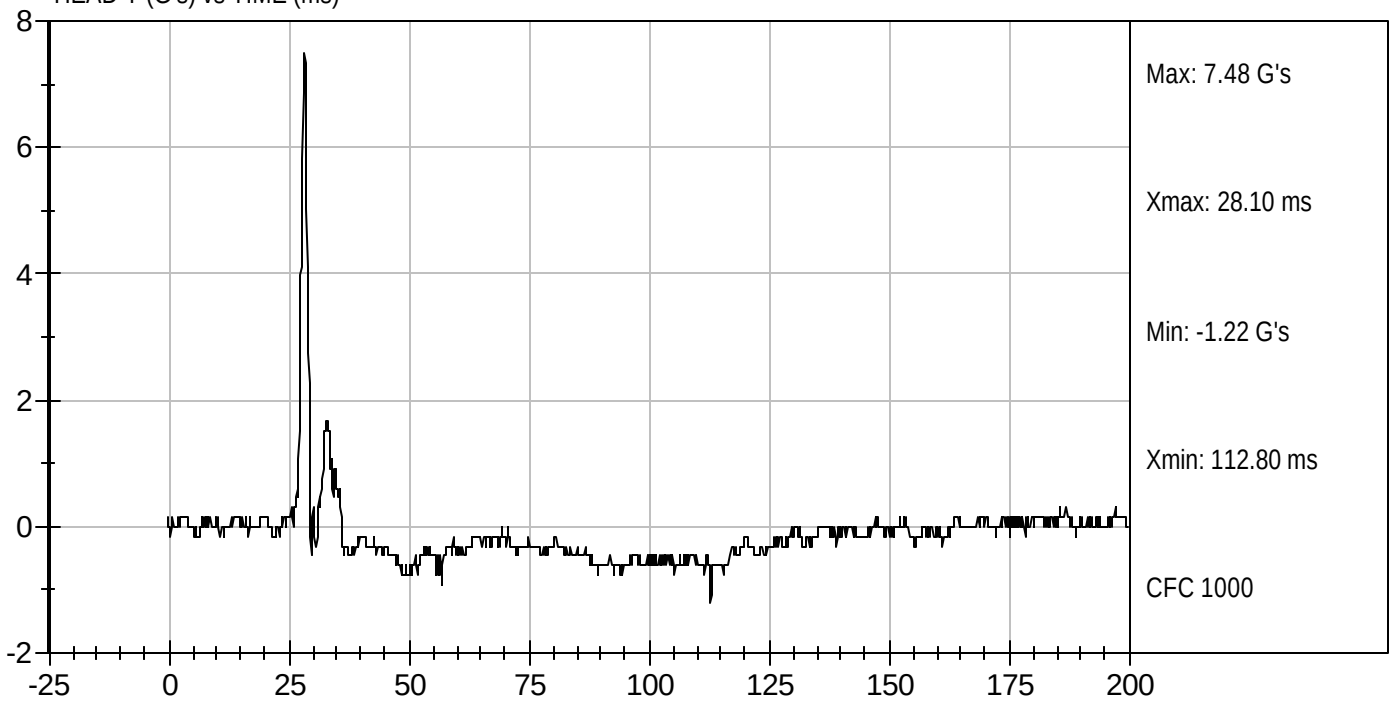
Test Desc: Head Drop
Componet ID: D063311

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s

HEAD RESULTANT 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: 065 **Test I.D:** D063312

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.00	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	26.27	Pass
	20 msec	G's	17.60 to 22.60	21.01	Pass
	30 msec	G's	12.50 to 18.50	15.14	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.06	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	34.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	76.5	Pass
	Time	msec	57.0 to 64.0	60.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.7	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	99.5	Pass
	Time	msec	47.0 to 58.0	47.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.8	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

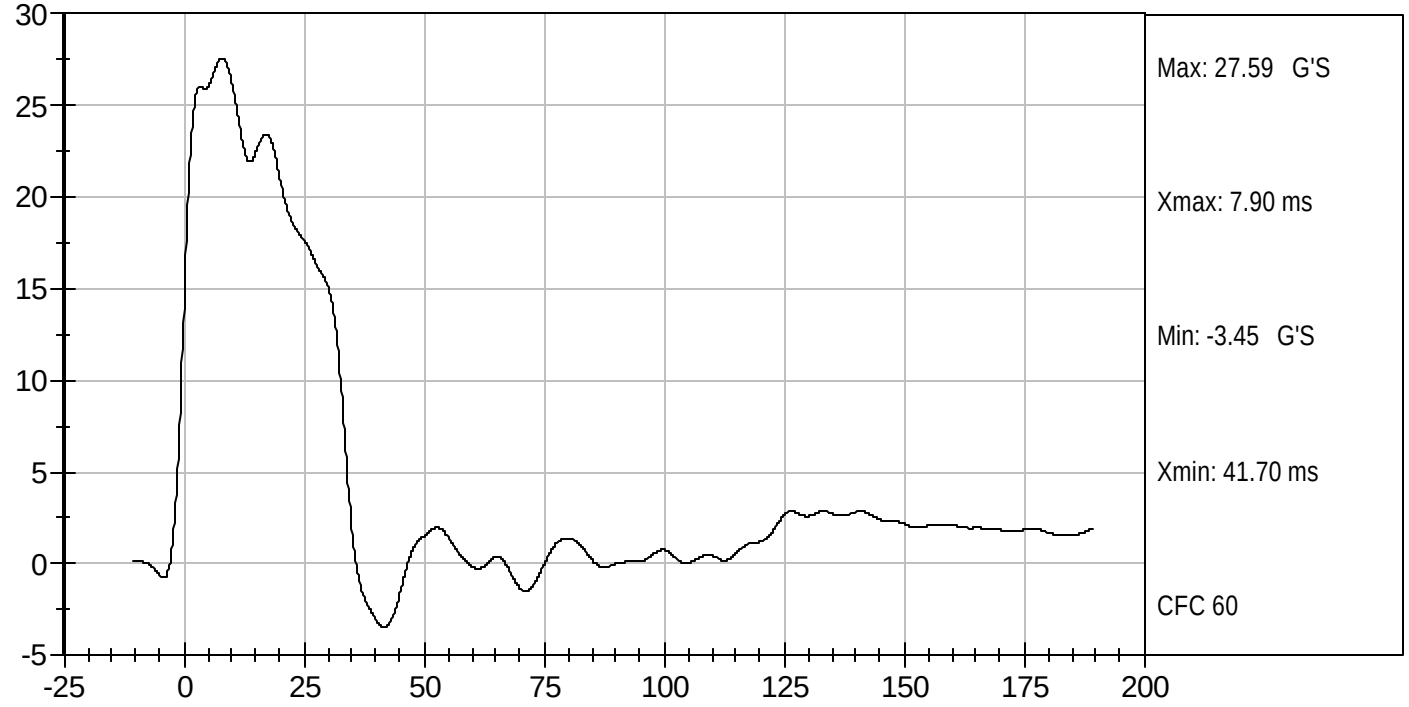
11/20/2006
Test Date

David Winkelbauer
Approved By

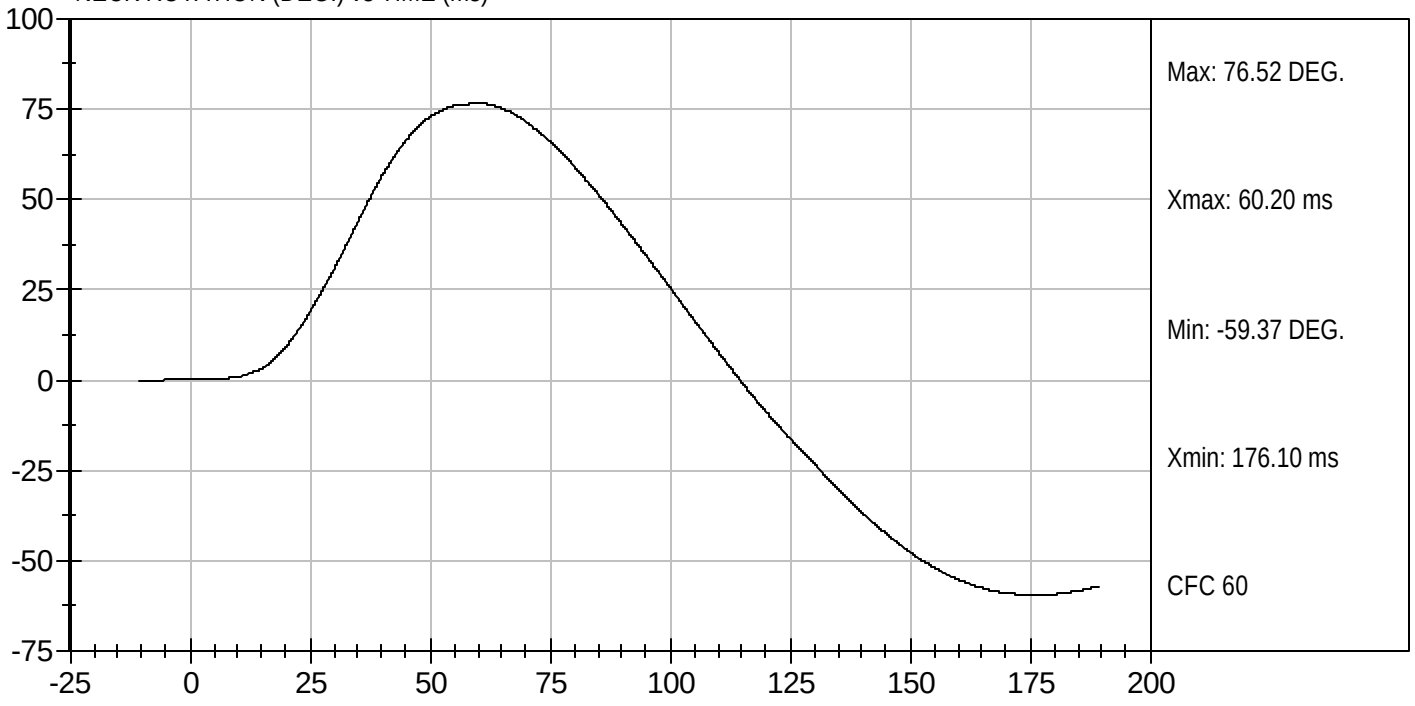
Test Desc: Neck Flexion
Componet ID: D063312

Test Date: 11/20/2006
Velocity: 22.96 ft/s, 7.00 m/s

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

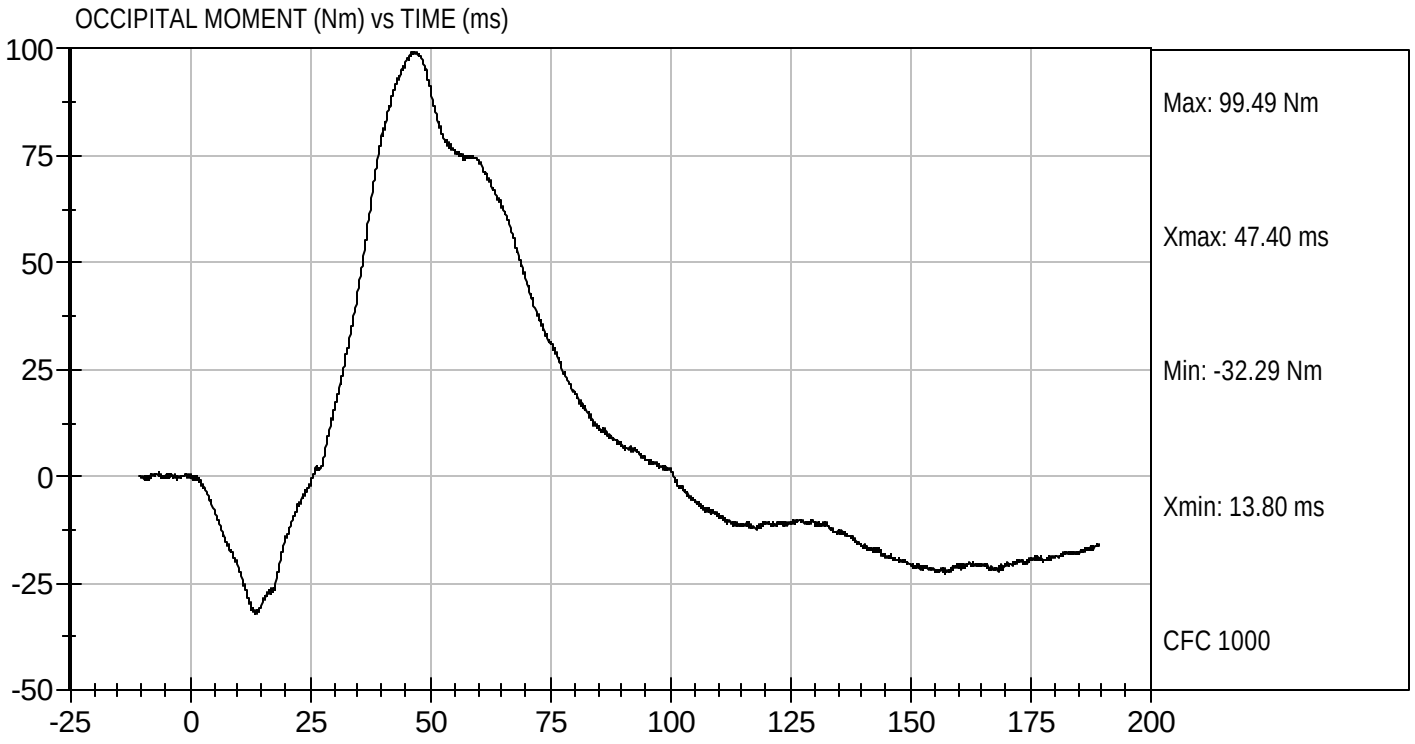


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D063312

Test Date: 11/20/2006
Velocity: 22.96 ft/s, 7.00 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063313

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.08	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	18.52	Pass
	20 msec	G's	14.00 to 19.00	16.43	Pass
	30 msec	G's	11.00 to 16.00	14.66	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	14.89	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	103.1	Pass
	Time	msec	72.0 to 82.0	78.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	158.1	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-72.0	Pass
	Time	msec	65.0 to 79.0	73.6	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.1	Pass
			Overall Test Results		Pass

Laboratory Technician

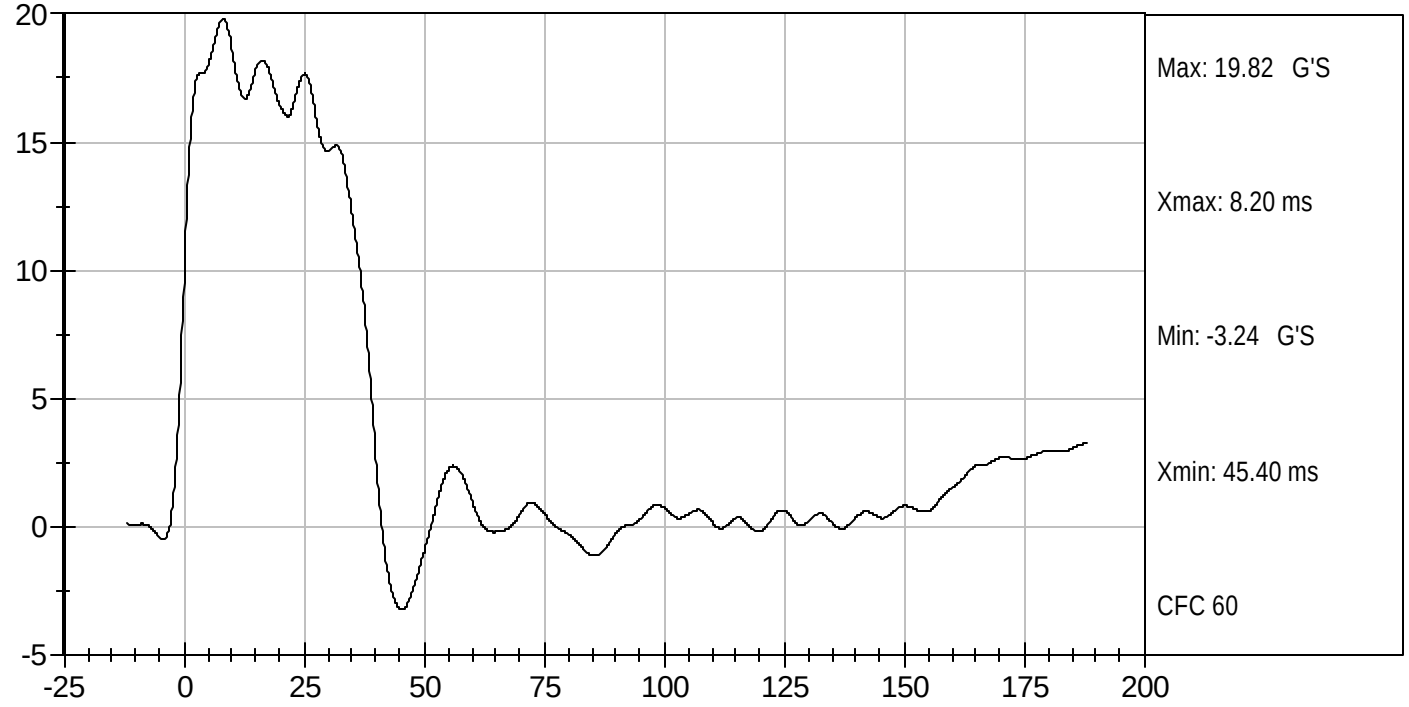
11/20/2006
Test Date

Approved By

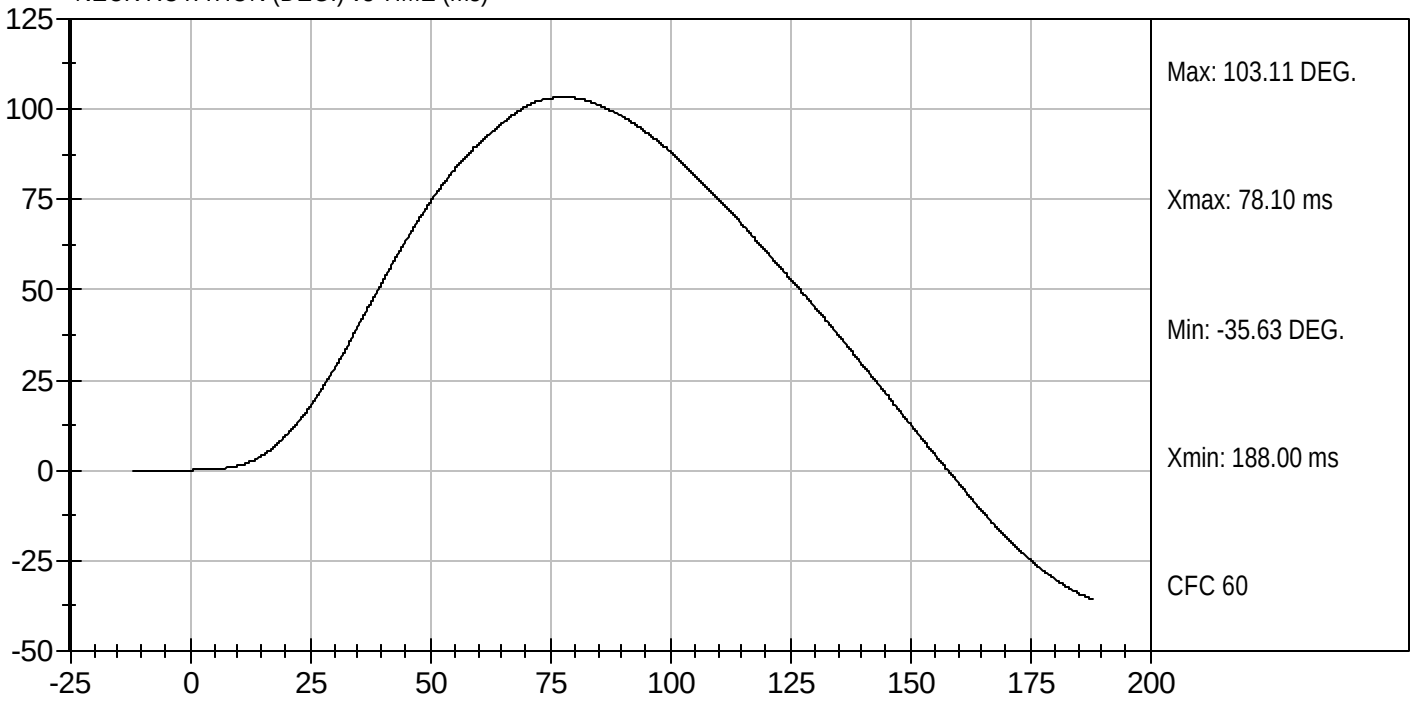
Test Desc: Neck Extension
Componet ID: D063313

Test Date: 11/20/2006
Velocity: 19.94 ft/s, 6.08 m/s

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

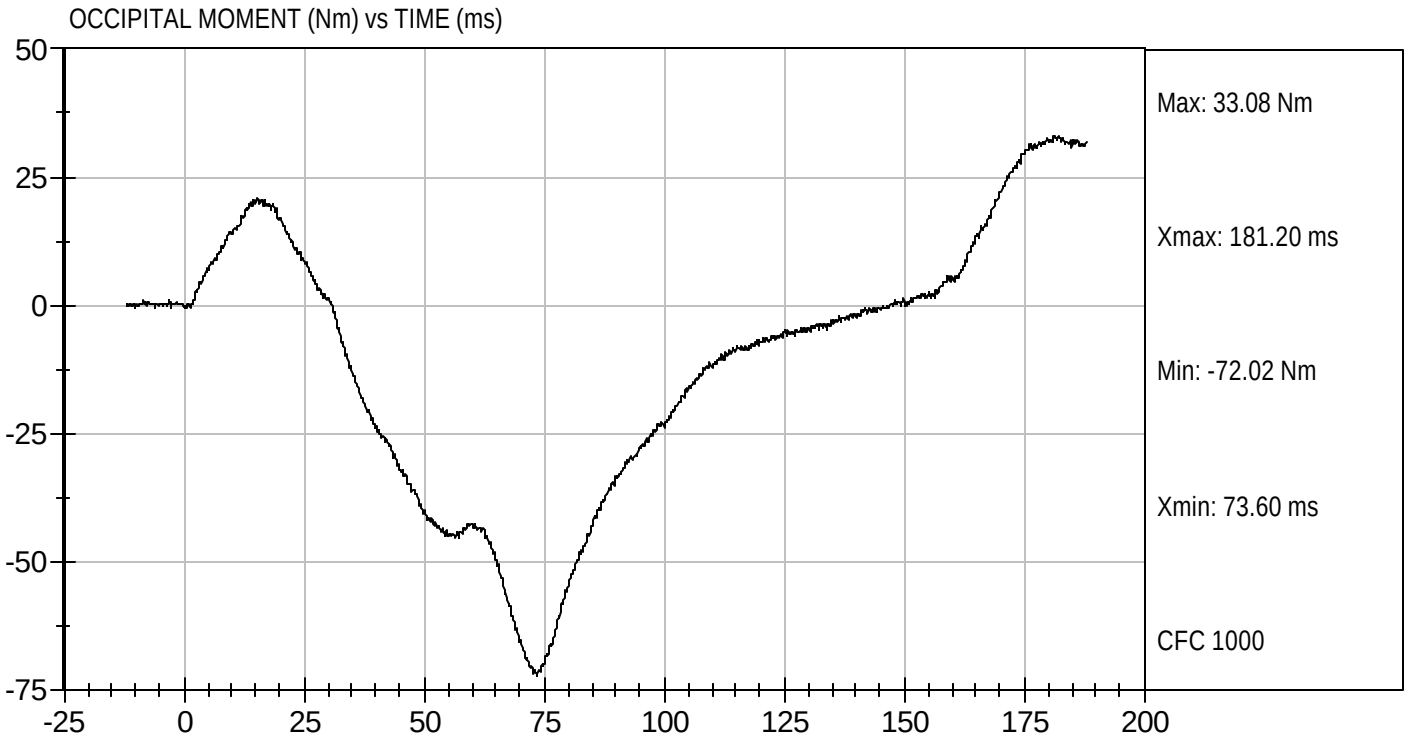


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D063313

Test Date: 11/20/2006
Velocity: 19.94 ft/s, 6.08 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063314

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Velocity	m/s	6.58 to 6.82	6.65	Pass
Peak Probe Force	N	5159 to 5893	5,826	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.73	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

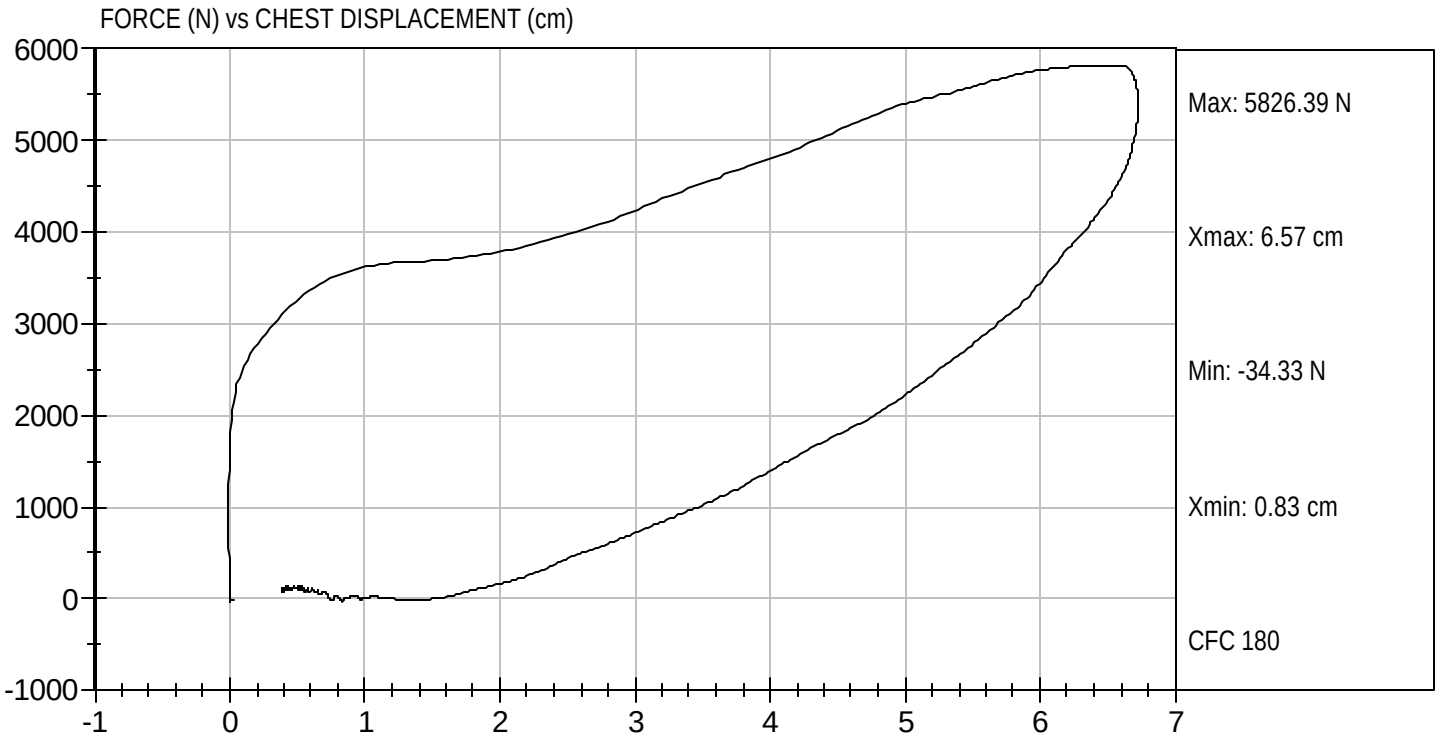
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Componet ID: D063314

Test Date: 11/17/2006
Velocity: 21.82 ft/s, 6.65 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063315

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	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,238	Pass
		Overall Test Results		Pass

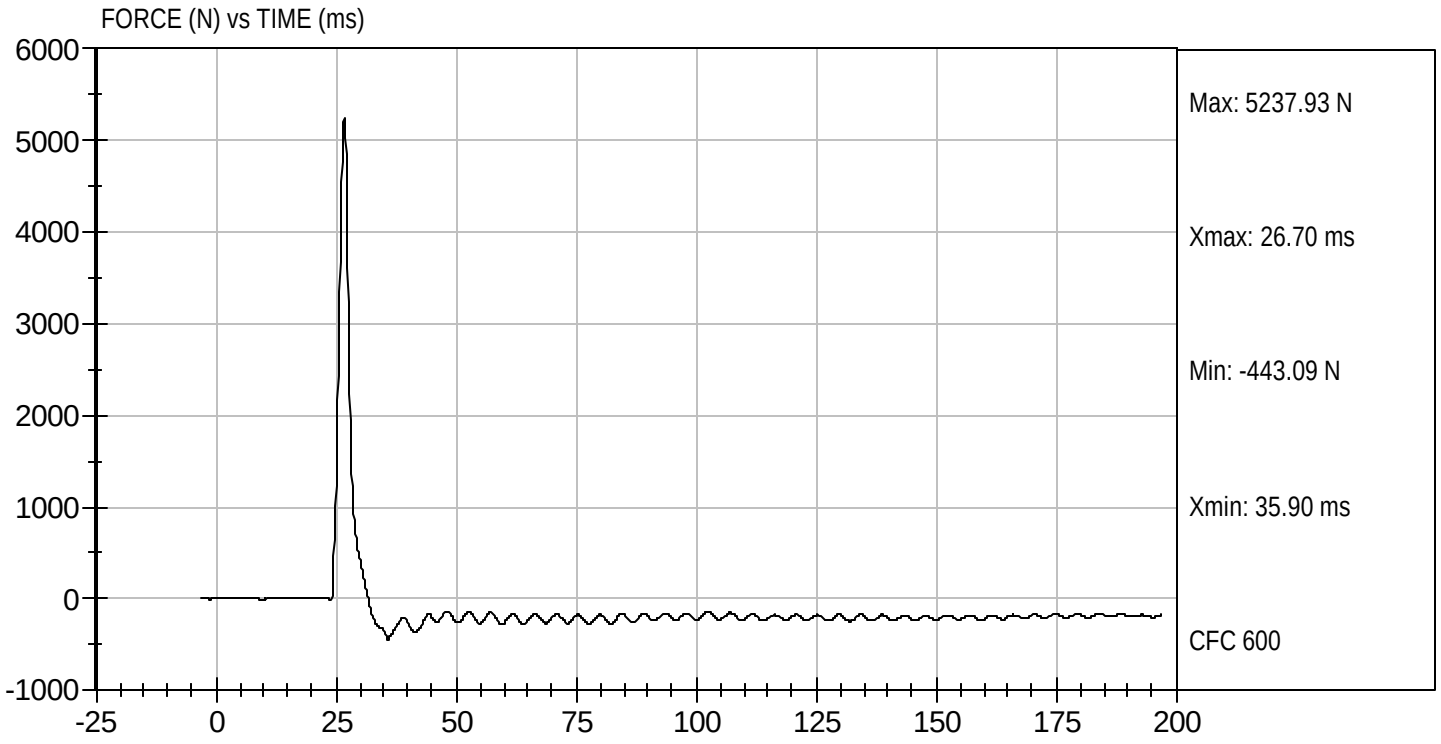
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D063315

Test Date: 11/20/2006
Velocity: 6.92 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063316

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	20	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,558	Pass
		Overall Test Results		Pass

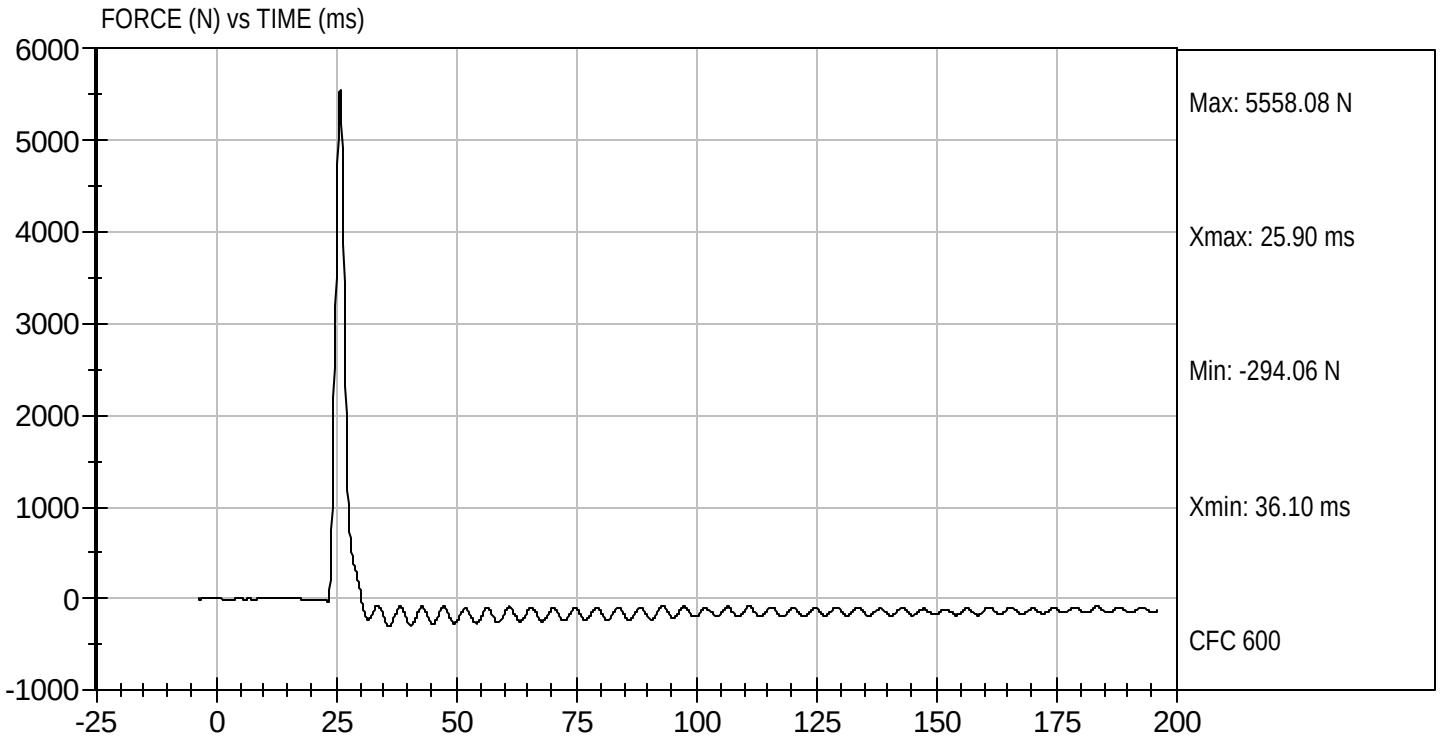
Laboratory Technician

11/20/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D063316

Test Date: 11/20/2006
Velocity: 6.88 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D063310

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.8	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	92.1	83.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	41	Pass
		Overall Test Results			Pass

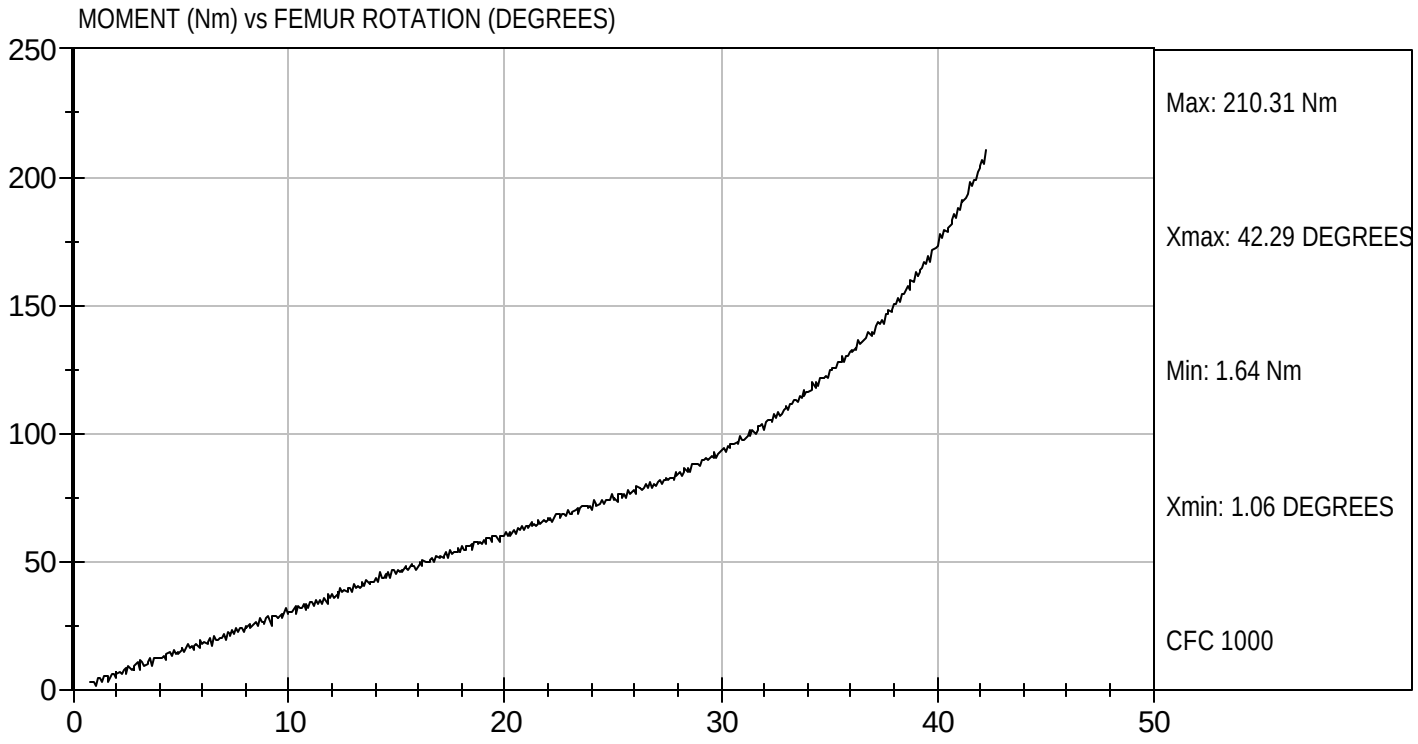
Laboratory Technician

11/17/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Hip Femur Flexion
Componet ID: D063319

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D063310

Test Date: 11/17/2006
Velocity: 0 ft/s, 0.00 m/s