REPORT NUMBER: NCAP-MGA-2006-012

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

GENERAL MOTORS DE MEXICO
2007 CHEVROLET SUBURBAN
NHTSA NUMBER: M70100

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

Test Date: May 17, 2006

Final Report Date: June 21, 2006

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
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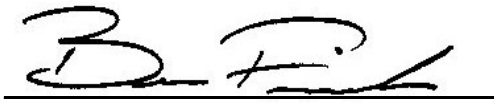
This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-01-D-12005.

Prepared by:  Date: 6/21/06

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Reviewed by:  Date: 6/21/06

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Technical Report Documentation Page

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16. Abstract

A frontal barrier impact was conducted on a 2007 Chevrolet Suburban at MGA Research Corporation on May 17, 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 56.3 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 730 mm located at the centerline of the vehicle. 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	321	282
Max. Thorax Accel. (3ms Clip)	G's	60	28	36
Left Femur Force	Newton	10009	-2956	-2658
Right Femur Force	Newton	10009	-3383	-4255

17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2007 Chevrolet Suburban NHTSA No: M70100		*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	
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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 DTNH22-01-D-12005. 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 Chevrolet Suburban at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on May 17, 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. 065) and right-front passenger (position 2) ATD (Serial No. 066) 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 730 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 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	321	66.2	102.2	28	75.5	79.2	-28	-2956	-3383
Passenger	282	68.7	104.7	36	76.8	79.8	-26	-2658	-4255

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

TEST NOTES

There was no valid data collected for:
Top of Engine X – After 70 msec.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

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)	5 forward	0
Seat Back Failure	None	None
Glazing Damage	The windshield was cracked.	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1000
Center	mm	985
Right Side	mm	998
Average	mm	994

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	925	864
Lap belt length as measured on ATD	mm	625	618
Remainder of belt on reel	mm	1000	1066
Total belt length for continuous webbing systems	mm	2550	2548

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Chevrolet Suburban
Test Program: 35mph Frontal Impact
NHTSA No.: M70100
Test Date: 5/17/2006

TEST VEHICLE INFORMATION

Manufacturer	General Motors de Mexico
Model	Suburban
Body Style	MPV
NHTSA No.	M70100
VIN	3GNFK163X7G104942
Color	Black
Delivery Date	5/5/06
Odometer Reading (mile)	113
Dealer	Rockenbach Chevrolet
Transmission	Automatic
Final Drive	4WD
Number of Cylinders	8
Engine Displacement (L)	5.3
Engine Placement	Lateral
Automatic Door Lock (ADL)	Yes
Owners Manual Details Instructions on Disabling ADLs	Yes
Bucket Seats	Yes

TEST VEHICLE OPTIONS

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

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors de Mexico
Date of Manufacture	04/06

GVWR (kg)	3357
GAWR Front (kg)	1633
GAWR Rear (kg)	1905

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket + Mid	Bench		
Number of Occupants	3	5		8
Capacity Wt. (VCW) (kg)				730
Cargo Wt. (RCLW) (kg)				204

DATA SHEET NO. 2... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	692.2	635.0		722.1	747.5	
Right	kg	653.6	630.1		679.0	747.5	
Ratio	%	51.5	48.5		48.4	51.6	
Totals	kg	1345.8	1265.1	2610.9	1401.1	1495.0	2896.1

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2610.9
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	136.1
Calculated Vehicle Target Weight (TVTW)	kg	2903.0

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	905	901	963	968	1604
As Tested	mm	898	896	936	935	1709
Post Test	mm	917	916	958	927	

Vehicle Wheelbase (mm): 3311

Weight of Ballast secured in cargo area (kg): 90.7

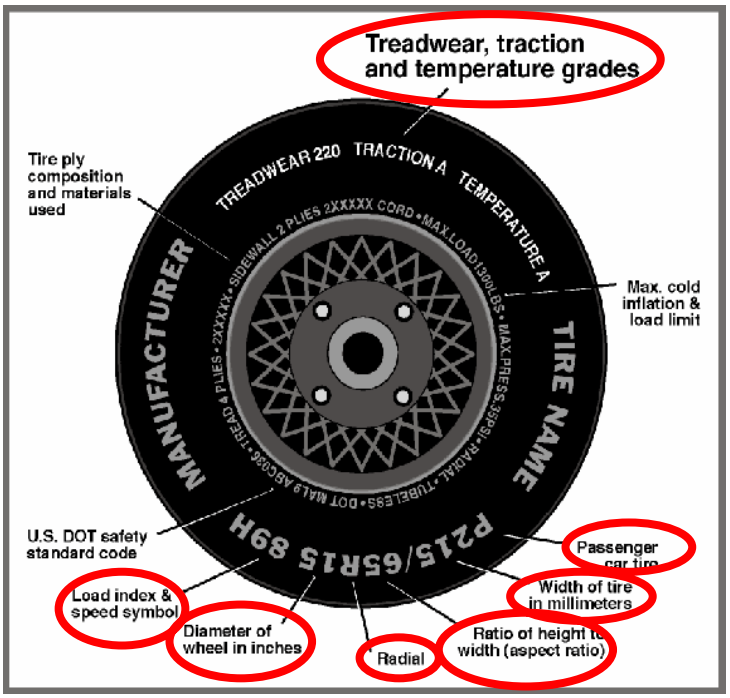
Vehicle Components Removed: Jack and tools, rear cargo carpet

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle:	2007 Chevrolet Suburban	NHTSA No.:	M70100
Test Program:	35mph Frontal Impact	Test Date:	5/17/2006



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (max)	210	210
Recommended Tire Size	P265/70R17	P265/70R17
Tire size on Vehicle	P265/70R17	P265/70R17
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Wrangler	Wrangler
Tire Type	P	P
Tire Width (mm)	265	265
Ratio of Height to Width (aspect ratio)	70	70
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	113S	113S
Treadwear	340	340
Traction Grade	A	A
Temperature Grade	B	B

DATA SHEET NO. 4

TEST VEHICLE INFORMATION

Test Vehicle:	2007 Chevrolet Suburban	NHTSA No.:	M70100
Test Program:	35mph Frontal Impact	Test Date:	5/17/2006

NORMAL DESIGN RIDING POSITION

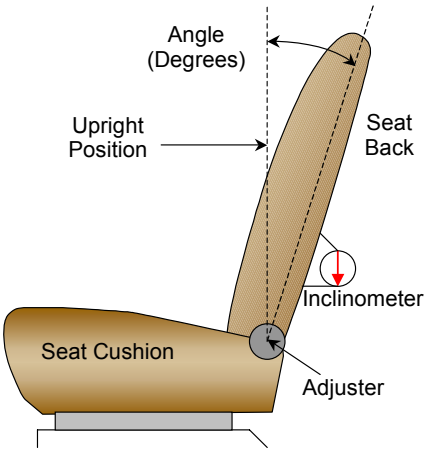
The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: The driver and passenger seatback is placed in the seventh detent, first as zero.

Driver seat back angle: 7th detent, 1st as zero

Passenger seat back angle: 7th detent, 1st as zero

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	259 mm	129 mm
Passenger Seat	25 detents	12th detent, 1st as zero

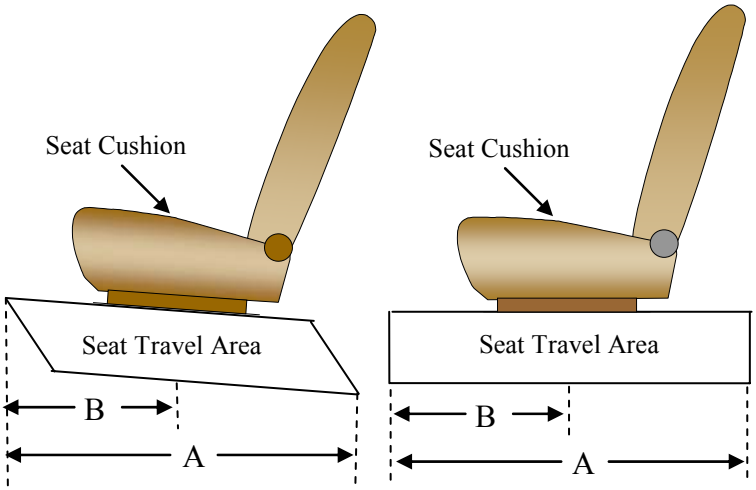


FRONT SEAT ASSEMBLY

ADJUSTABLE D-RING POSITION

The driver D-Ring was placed in the first position with the uppermost position as zero.

The passenger D-ring was placed in the uppermost position.



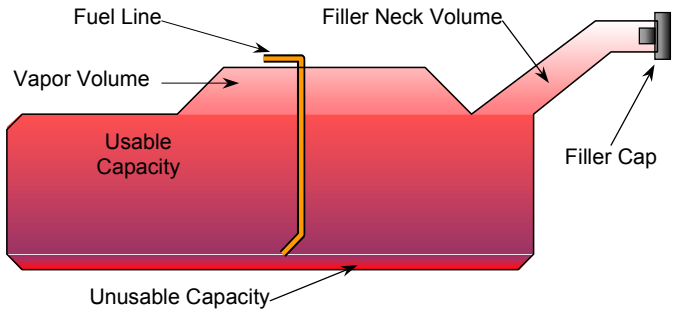
DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	114.3
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	105.2 – 107.4
Actual Amount of Solvent used	107.1
1/3 of Usable Capacity	38.1

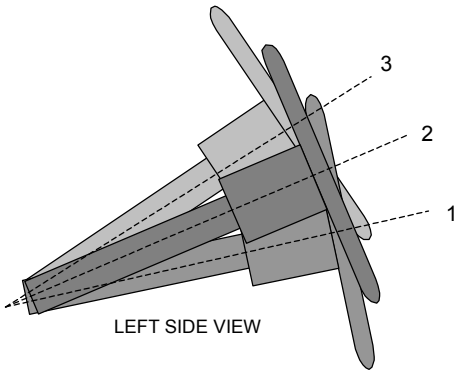
The test vehicle is equipped with an electric fuel pump. Pump will run when the engine is running. Also, it will run briefly when the ignition key is turned to the "on" position without starting the engine.



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

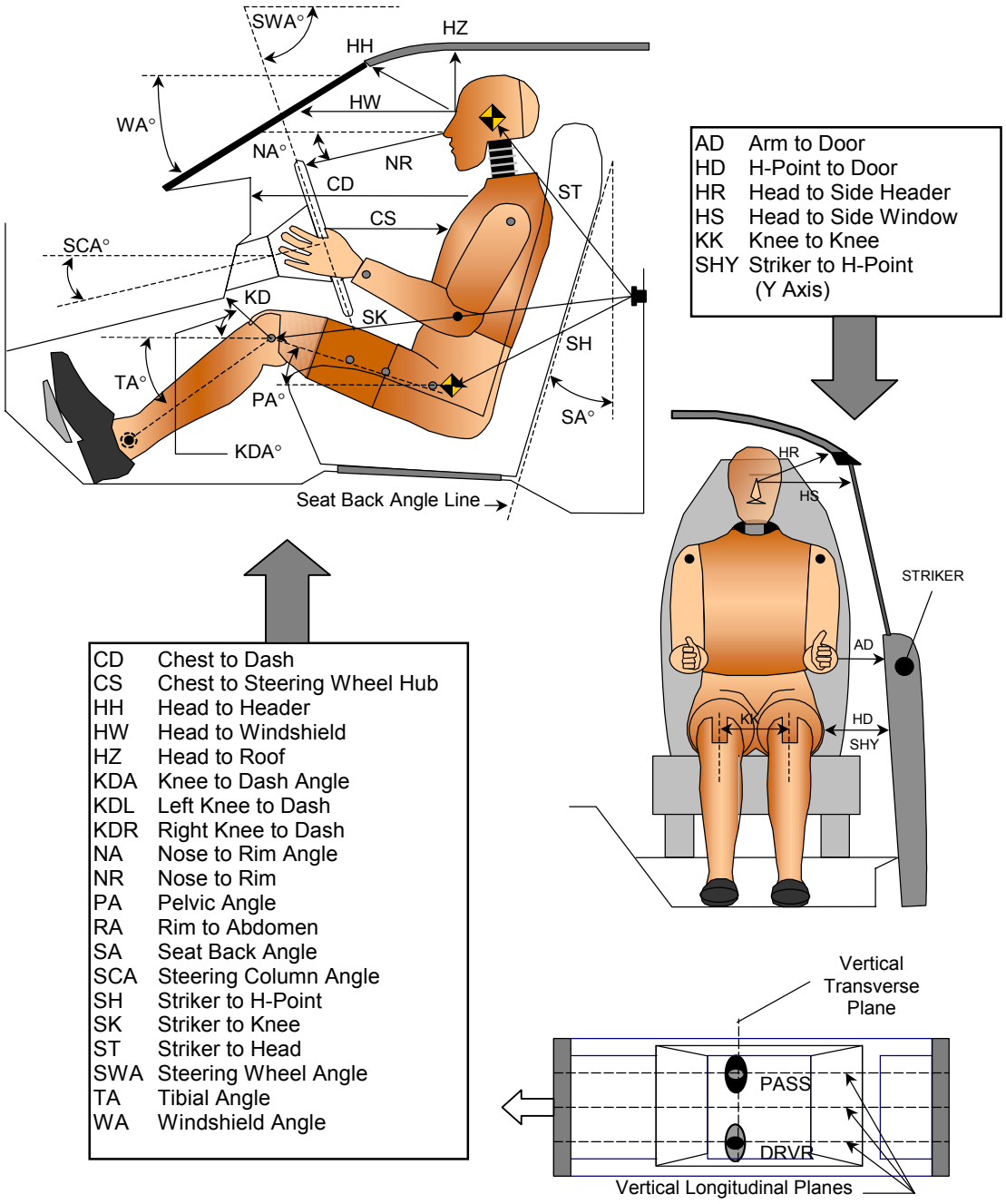
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		10.7
Geometric center position No. 2		20.7
Uppermost position No. 3		30.9

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle:	2007 Chevrolet Suburban	NHTSA No.:	M70100
Test Program:	35mph Frontal Impact	Test Date:	5/17/2006

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

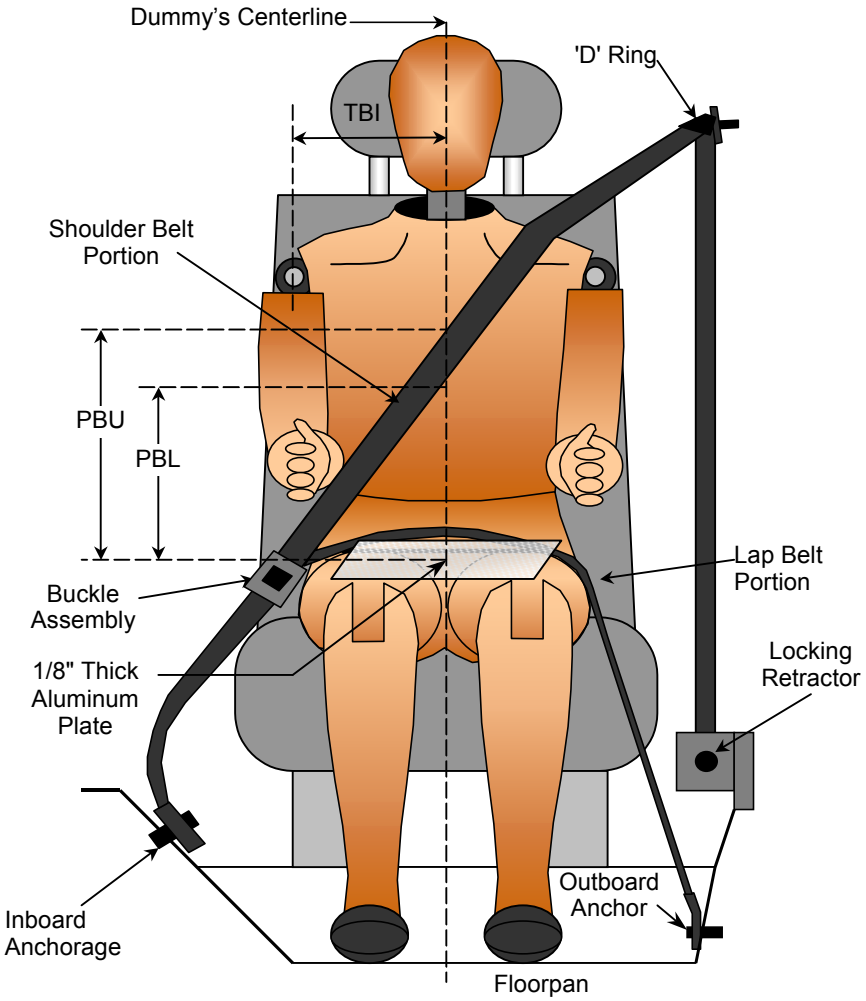
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		33.7		
SWA	Steering Wheel Angle		69.3		
SCA	Steering Column Angle		24.3		
SA	Seat Back Angle (headrest post)		6.4		6.1
HZ	Head to Roof (Z)	246	90	231	90
HH	Head to Header	455	20.0	473	15.9
HW	Head to Windshield	669	0	658	0
HR	Head to Side Header (Y)	229		206	
NR	Nose to Rim	372	13.3		
CD	Chest to Dash	507		516	
CS	Chest to Steering Hub	313	9.3		
RA	Rim to Abdomen	191	0		
KDL	Left Knee to Dash	142	28.3	137	
KDR	Right Knee to Dash	138		144	26.7
PA	Pelvic Angle		23.6		21.9
TA	Tibia Angle		41.3		56.3
KK	Knee to Knee (Y)	320		273	
SK	Striker to Knee	735	85.7	709	85.7
ST	Striker to Head	673	16.7	670	20.8
SH	Striker to H-Point	313	90.1	312	94.9
SHY	Striker to H-Point (Y)	271		280	
HS	Head to Side Window	323		327	
HD	H-Point to Door (Y)	202		207	
AD	Arm to Door (Y)	132		141	
AA	Ankle to Ankle	320		204	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	340	340
PBL - To surface of reference to belt lower edge	mm	260	260

DATA SHEET NO. 7

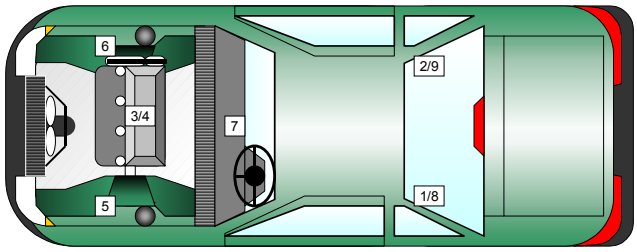
VEHICLE ACCELEROMETER LOCATIONS

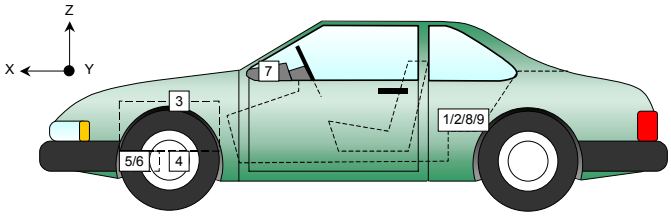
Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1164	-412	794
2	Right Rear X-Member X	1167	412	794
3	Engine Top X	4642	0	1156
4	Engine Bottom X	4322	0	362
5	Left Brake Caliper X	4780	-754	300
6	Right Brake Caliper X	4778	754	300
7	Instrument Panel X			
8	Left Rear X-Member Z	1164	-412	794
9	Right Rear X-Member Z	1167	412	794

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 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

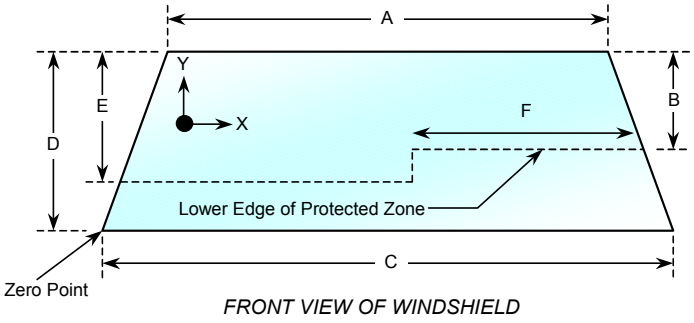
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2282	2282	100
Right Side	2282	2282	100
Total	4564	4564	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1378
B	mm	492
C	mm	1720
D	mm	733
E	mm	490
F	mm	504

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 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 11:53 am

Stoddard Solvent Spillage Measurements

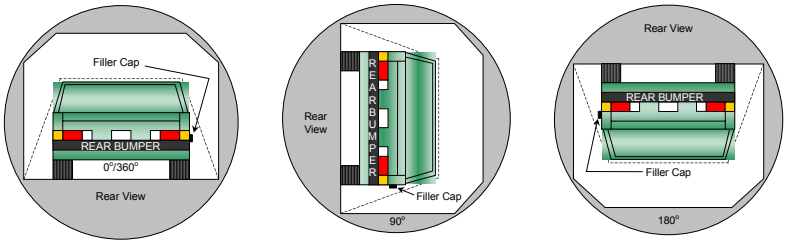
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

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

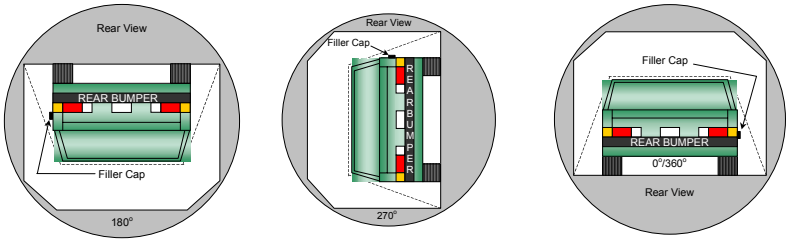
C. For the following 25 minutes: 0 oz.
(Maximum Allowable = 1 oz. /minute)

D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



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°	122	300	0
90° to 180°	121	300	0
180° to 270°	125	300	0
270° to 360°	123	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

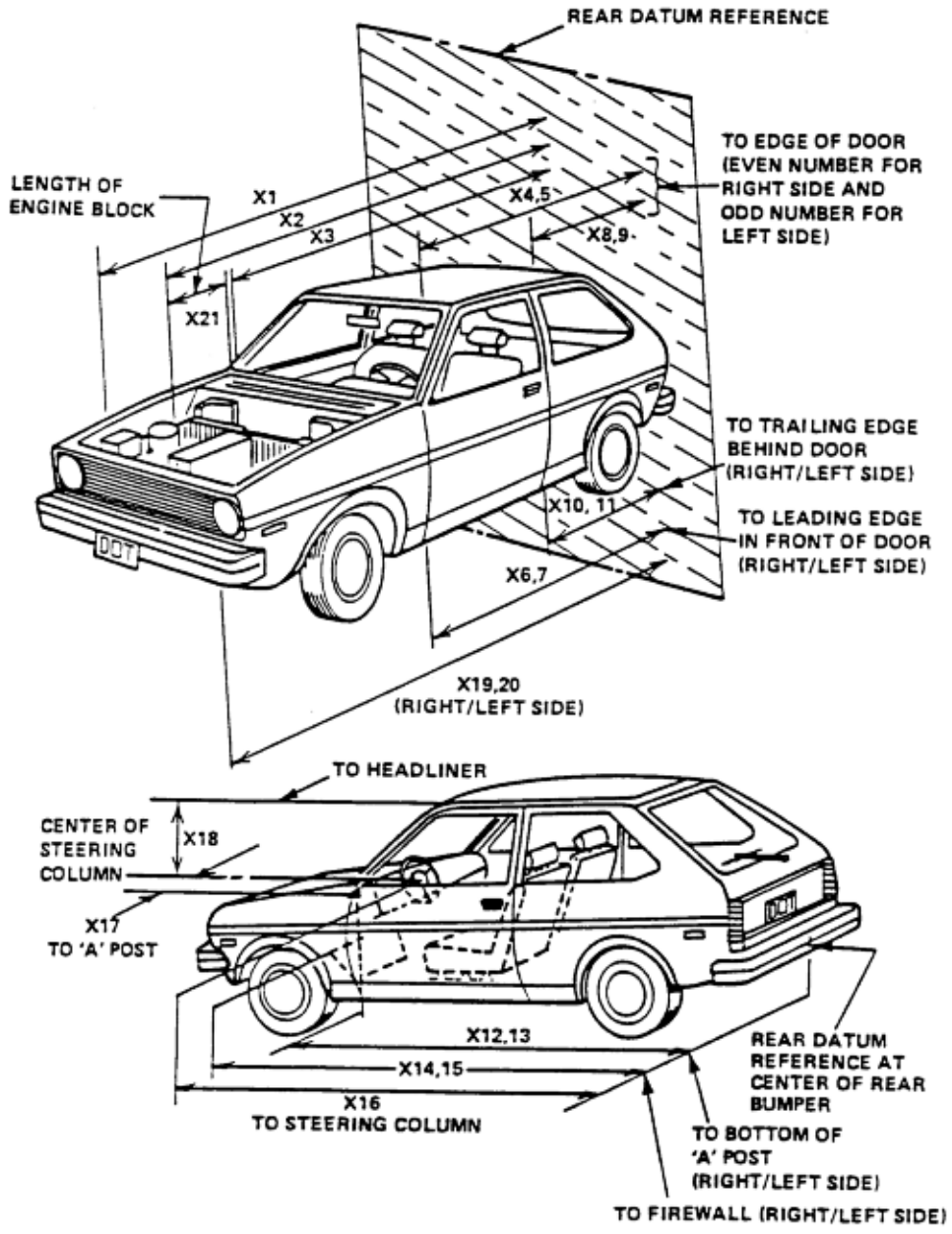
Test Vehicle: 2007 Chevrolet Suburban
Test Program: 35mph Frontal Impact
NHTSA No.: M70100
Test Date: 5/17/2006

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	5583	4853	730
2	RSOV to front of engine	mm	4774	4732	42
3	RSOV to firewall centerline	mm	4480	4638	-158
4	RSOV to leading edge of right door	mm	3984	4040	-56
5	RSOV to leading edge of left door	mm	3974	4032	-58
6	RSOV to lower leading edge of right door	mm	4051	3963	88
7	RSOV to lower leading edge of left door	mm	4033	3970	63
8	RSOV to upper leading edge of right door	mm	2854	2848	6
9	RSOV to upper leading edge of left door	mm	2846	2847	-1
10	RSOV to lower trailing edge of right door	mm	2838	2823	15
11	RSOV to lower trailing edge of left door	mm	2834	2828	6
12	RSOV to bottom of right 'A' pillar	mm	3984	3958	26
13	RSOV to bottom of left 'A' pillar	mm	3974	3954	20
14	RSOV to firewall on right side	mm	4383	4376	7
15	RSOV to firewall on left side	mm	4382	4384	-2
16	RSOV to steering column	mm	3532	3523	9
17	Center of steering column to left 'A' pillar	mm	400	400	0
18	Center of steering column to headlining	mm	452	466	-14
19	RSOV to right side of front bumper	mm	5370	4779	591
20	RSOV to left side of front bumper	mm	5372	4749	623
21	Length of engine block	mm	538	538	0
RD	RSOV to right side of dash panel	mm	3743	3757	-14
CD	RSOV to center of dash panel	mm	3676	3763	-87
LD	RSOV to left side of dash panel	mm	3735	3745	-10

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle:	2007 Chevrolet Suburban	NHTSA No.:	M70100
Test Program:	35mph Frontal Impact	Test Date:	5/17/2006



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	5583
2	Total Width	1980
3	Bumper Top Height	703
4	Bumper Bottom Height	279
5	Longitudinal Member Top Height	630
6	Distance between Longitudinal Members	746
7	Longitudinal Member Width	93
8	Engine Top Height	1195
9	Engine Bottom Height	320
10	Engine and gearbox width	642
11	Front bumper-engine distance	711
12	Front shock absorber fixing height	774
13	Bonnet leading edge height	1043
14	Front shock absorber fixing width	964
15	Front bumper – front axle distance	996
16	Front axle – a pillar distance	530
17	A-pillar – B-pillar distance	1217
18	B-Pillar – rear axle distance	1554
19	B-pillar – C-pillar distance	942
20	Roof sill bottom height	1758
21	Roof sill top height	1820
22	Floor sill bottom height	388
23	Floor sill top height	535

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1185	-5655	1320	24	1000
3	Steering Column Top	1715	-4710	1475	25	1000
4	Steering Column Bottom	1710	-4690	1020	25	1000
5	Driver Close-up	1710	-6090	1675	35	1000
6	Driver Angle	6745	-5235	2005	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	2325	6965	1505	19	1000
10	Right Passenger Half	1185	5545	1430	24	1000
11	Right Close-up	1530	5930	1580	35	1000
12	Right Angle	6300	4780	2060	50	1000
13	Windshield	-285	0	2370	19	1000
14	Top Driver	-65	-395	2235	24	1000
15	Top Passenger	-80	470	2240	24	1000
16	Pit Front	1270	0	-3150	24	1000
17	Pit Rear	3495	0	-3150	24	1000

*COORDINATES:

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

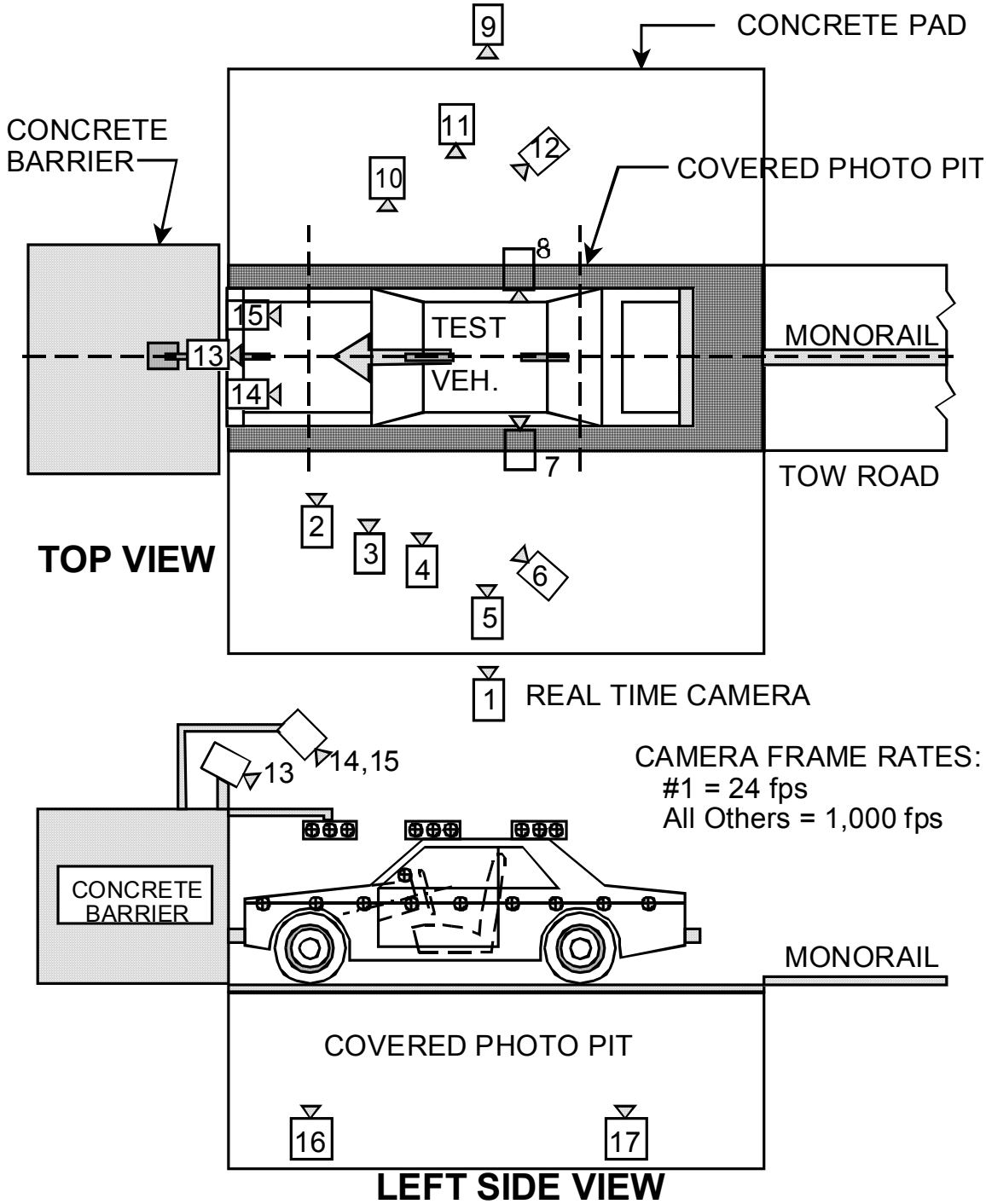
Note: Cameras 7 and 8 were not used for this test.

DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle:	2007 Chevrolet Suburban	NHTSA No.:	M70100
Test Program:	35mph Frontal Impact	Test Date:	5/17/2006

CAMERA POSITIONS FOR FRONTAL IMPACTS



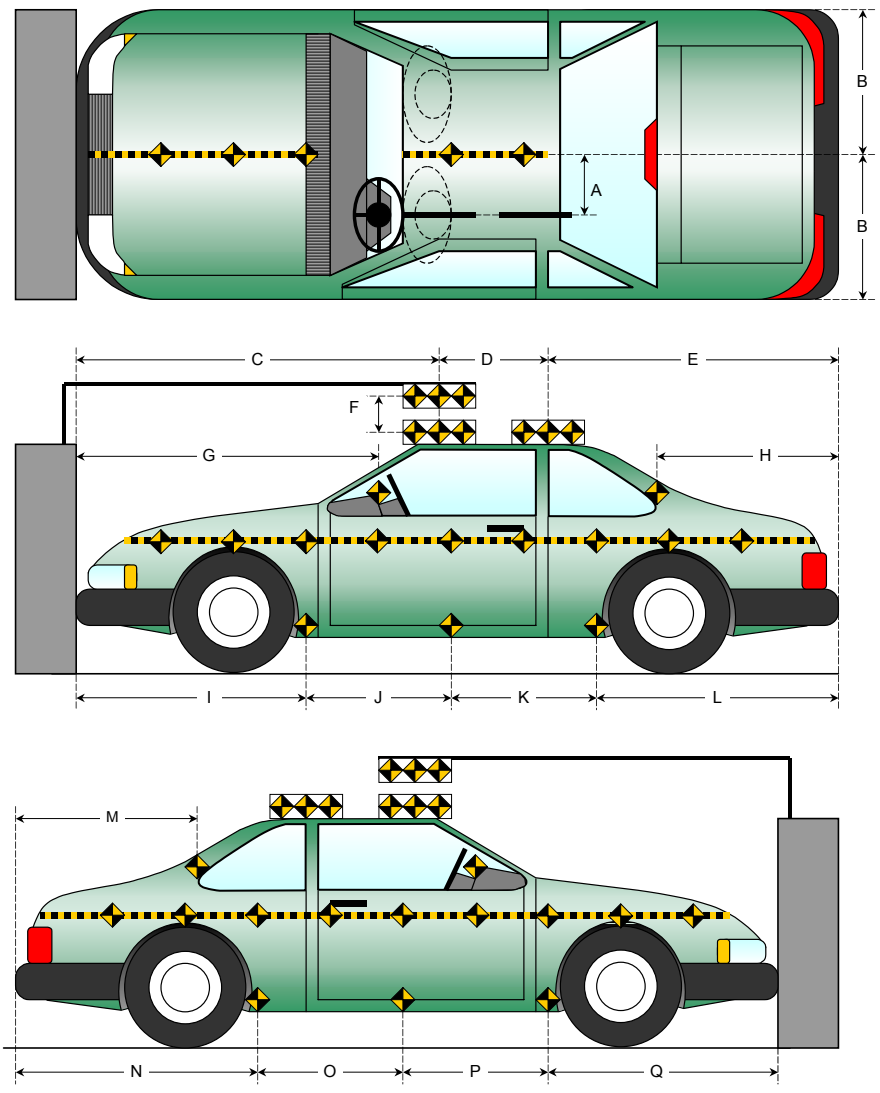
DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2007 Chevrolet Suburban
Test Program: 35mph Frontal Impact

NHTSA No.: M70100
Test Date: 5/17/2006

Item	Value
A	440
B	990
C	2465
D	610
E	2508
F	1870
G	
H	1864
I	1495
J	1145
K	1142
L	1801
M	1872
N	1803
O	1140
P	1145
Q	1495



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

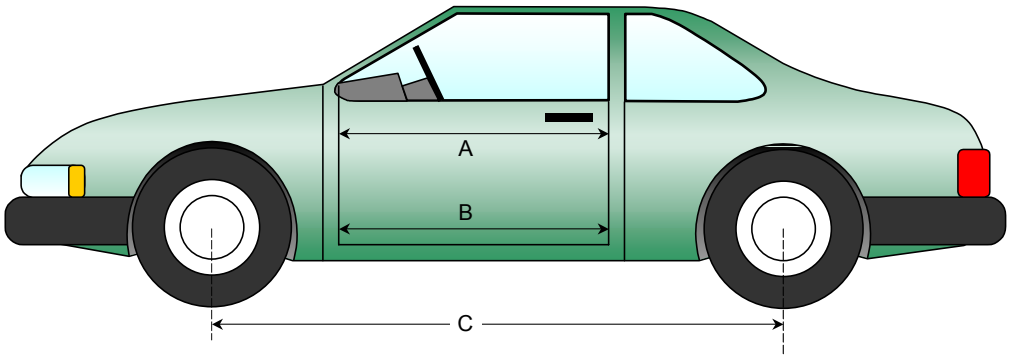
Test Vehicle: 2007 Chevrolet Suburban
Test Program: 35mph Frontal Impact
NHTSA No.: M70100
Test Date: 5/17/2006

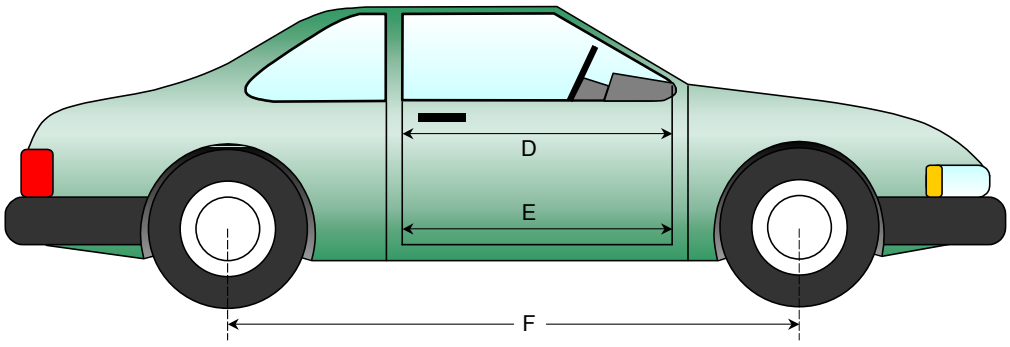
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1112	1090	22
B	Left Side Lower	mm	1103	1092	11
D	Right Side Upper	mm	1114	1095	19
E	Right Side Lower	mm	1103	1092	11

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	3311	3216	95
F	Right Side Wheelbase	mm	3311	3218	93





DATA SHEET NO. 13... (continued)

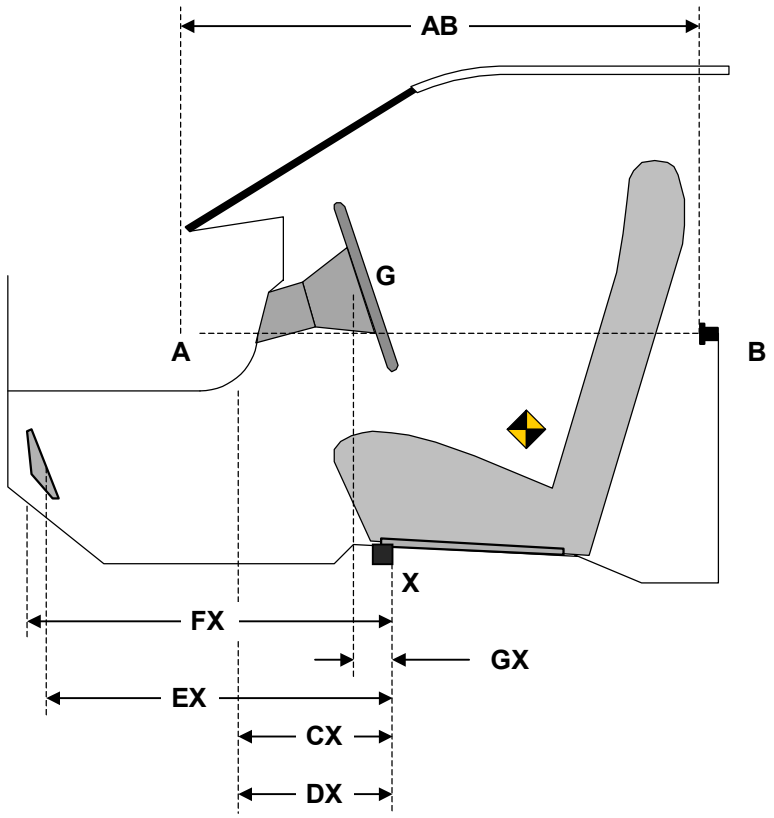
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	1112	1090	22
CX	Left Knee Bolster to X	mm	304	295	9
DX	Right Knee Bolster to X	mm	301	285	16
EX	Brake Pedal to X	mm	552	520	32
FX	Foot Rest to X	mm	718	700	18
GX	Center of Steering Column Wheel Hub to X	mm	107	109	-2

X = Front of Seat Track (stationary)

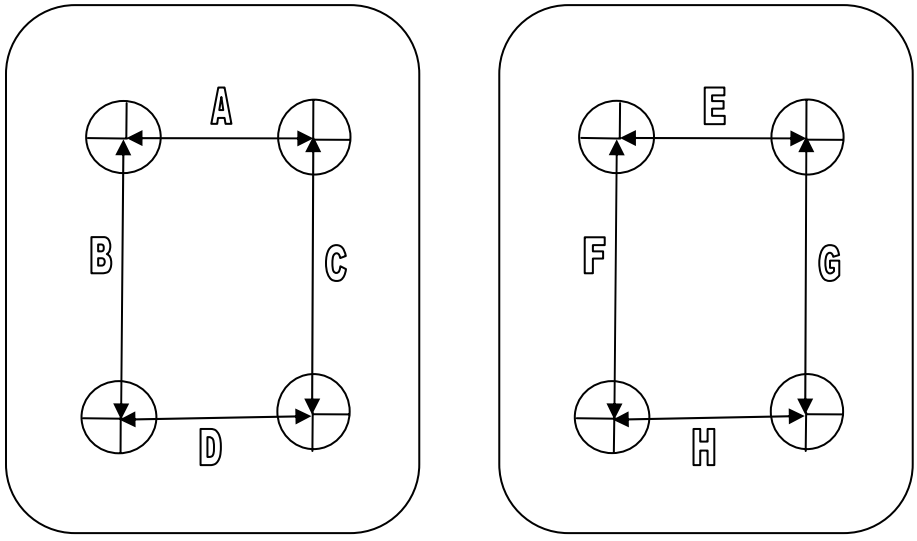


DRIVER COMPARTMENT

DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006



Driver Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	330	310	20
B	215	206	9
C	270	249	21
D	320	314	6
E	320	320	0
F	310	305	5
G	300	297	3
H	320	316	4

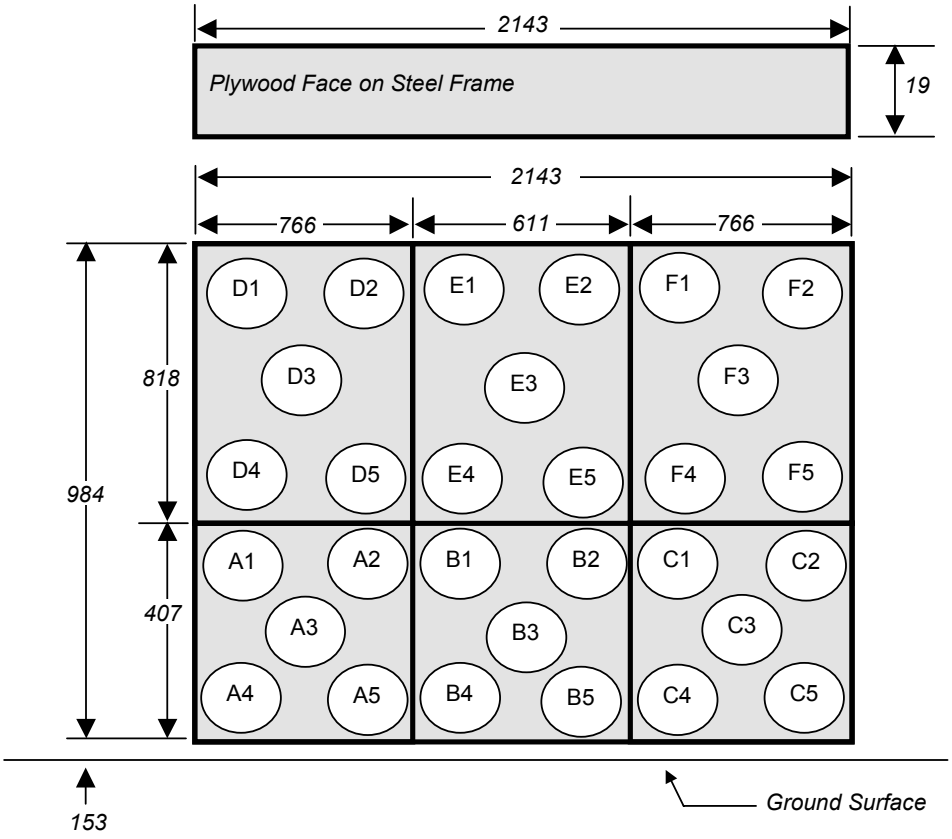
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2007 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

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 Chevrolet Suburban NHTSA No.: M70100
Test Program: 35mph Frontal Impact Test Date: 5/17/2006

VEHICLE INFORMATION

VIN: 3GNFK163X7G104942 Wheelbase (mm) : 3311
Vehicle Size Category: MPV Test Weight (kg) : 2896.1

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): 56.3
Velocity Change (km/h): 63.1 Time of Separation (msec): 156

CRUSH PROFILE

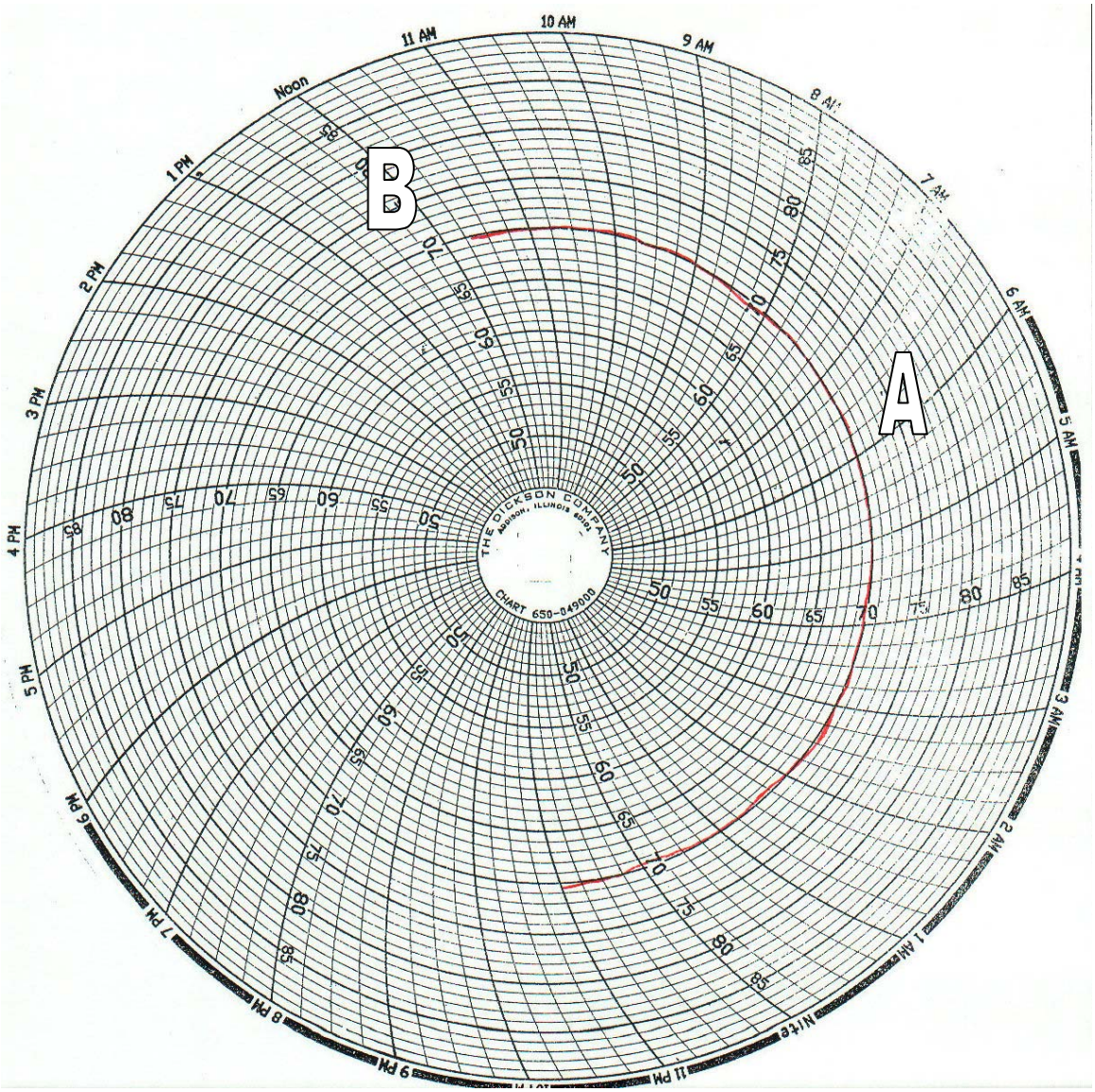
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1840 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	5372	4749	623
C2	Crush zone 2 at left side	mm	5509	4858	651
C3	Crush zone 3 at left side	mm	5568	4874	694
C4	Crush zone 4 at right side	mm	5567	4876	691
C5	Crush zone 5 at right side	mm	5508	4860	648
C6	Crush zone 6 at right side	mm	5370	4779	591
L	C1 TO C6	mm	1840	1870	-30

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle:	2007 Chevrolet Suburban	NHTSA No.:	M70100
Test Program:	35mph Frontal Impact	Test Date:	5/17/2006



A = Dummies installed in vehicle at 6:00 am

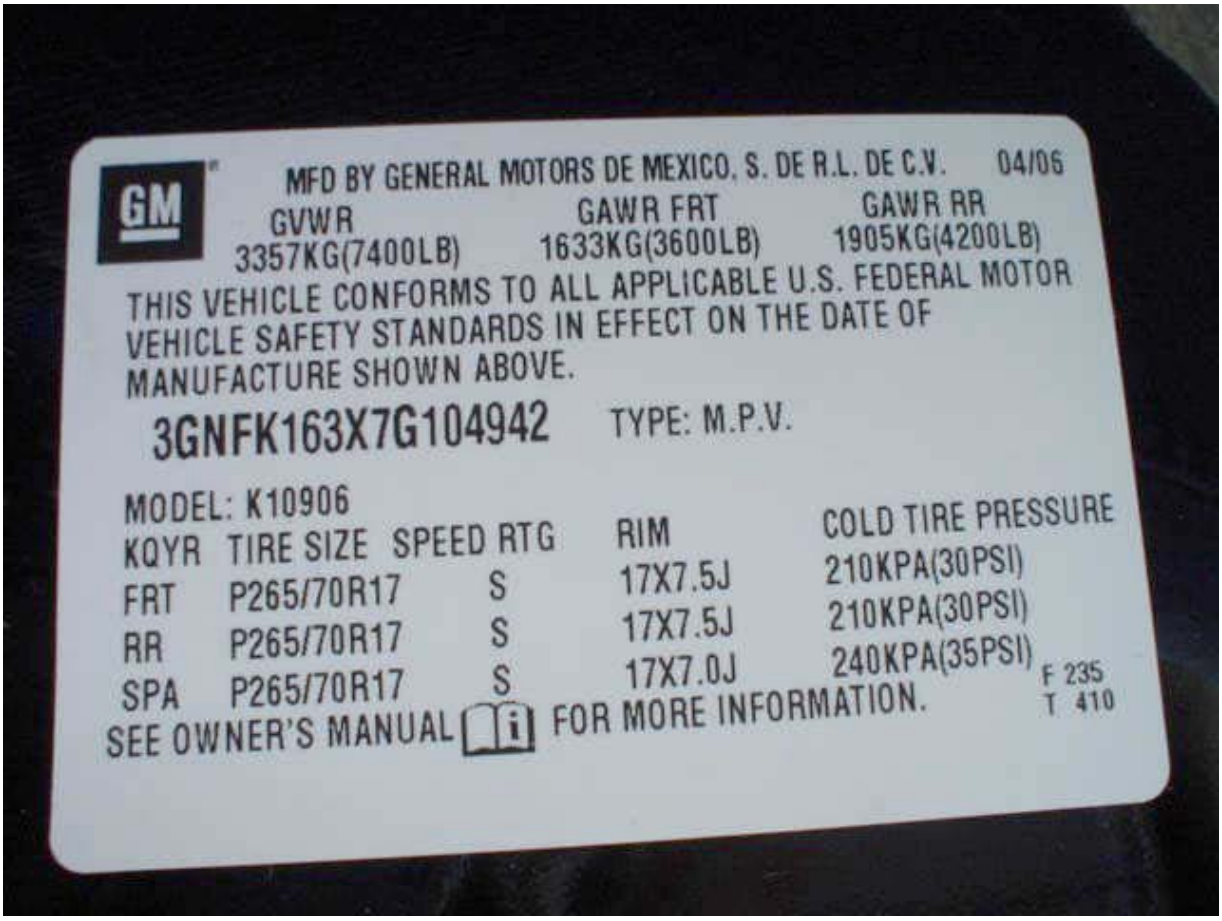
B = Test conducted at 11:53 am

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Load Cell Location

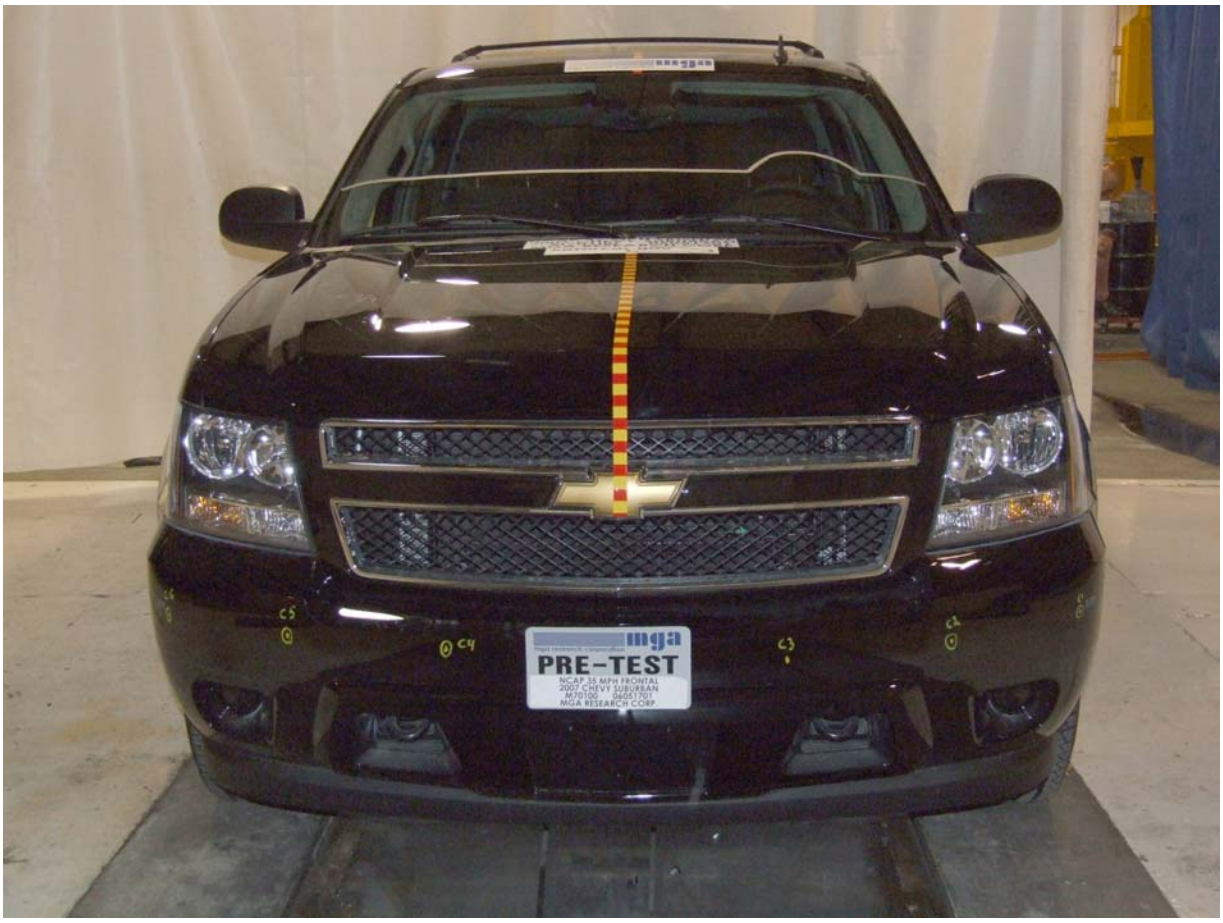


Manufacturer's Label

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

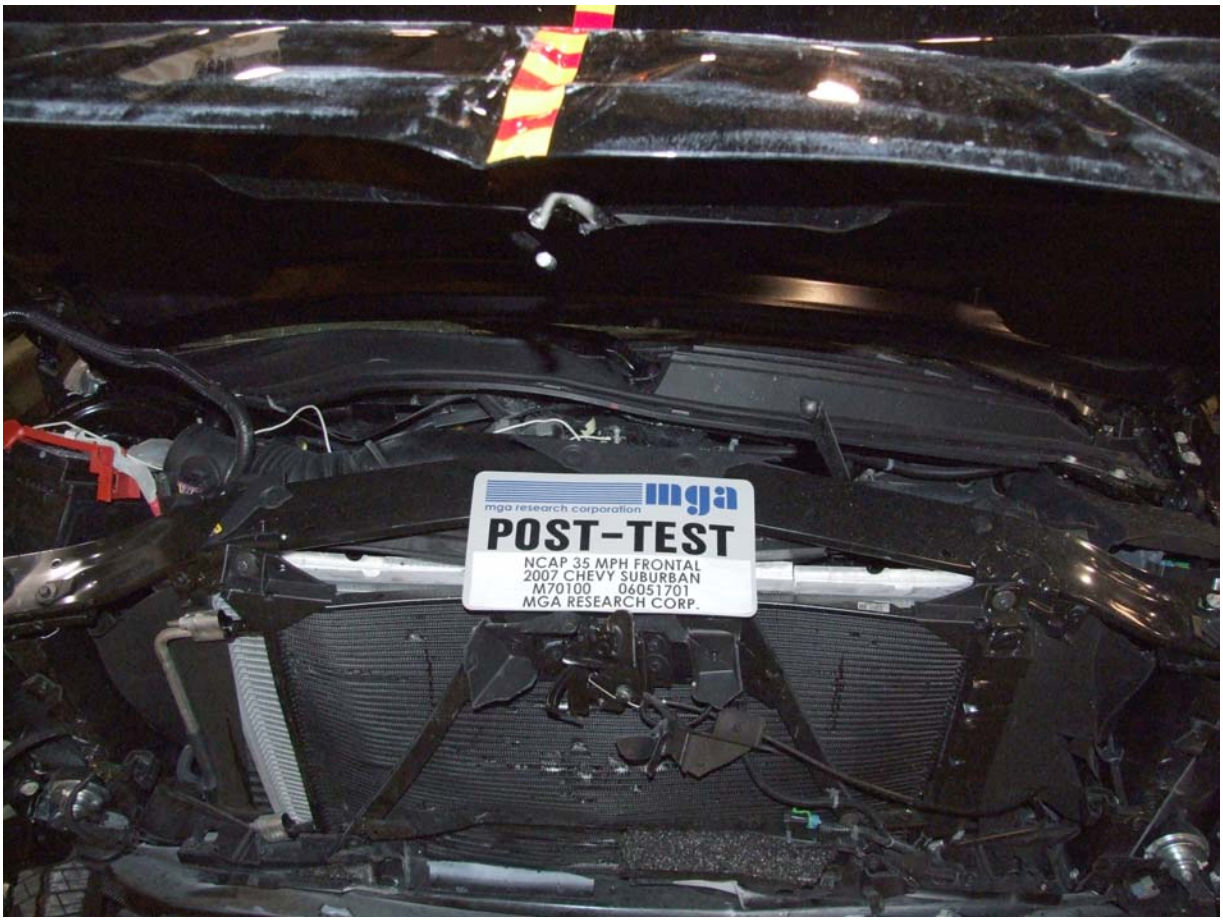
Pre-Test Right Side ¾ View of Doors

Post-Test Right Side ¾ View of Doors After Impact

Pre-Test Windshield View

Post-Test Windshield View

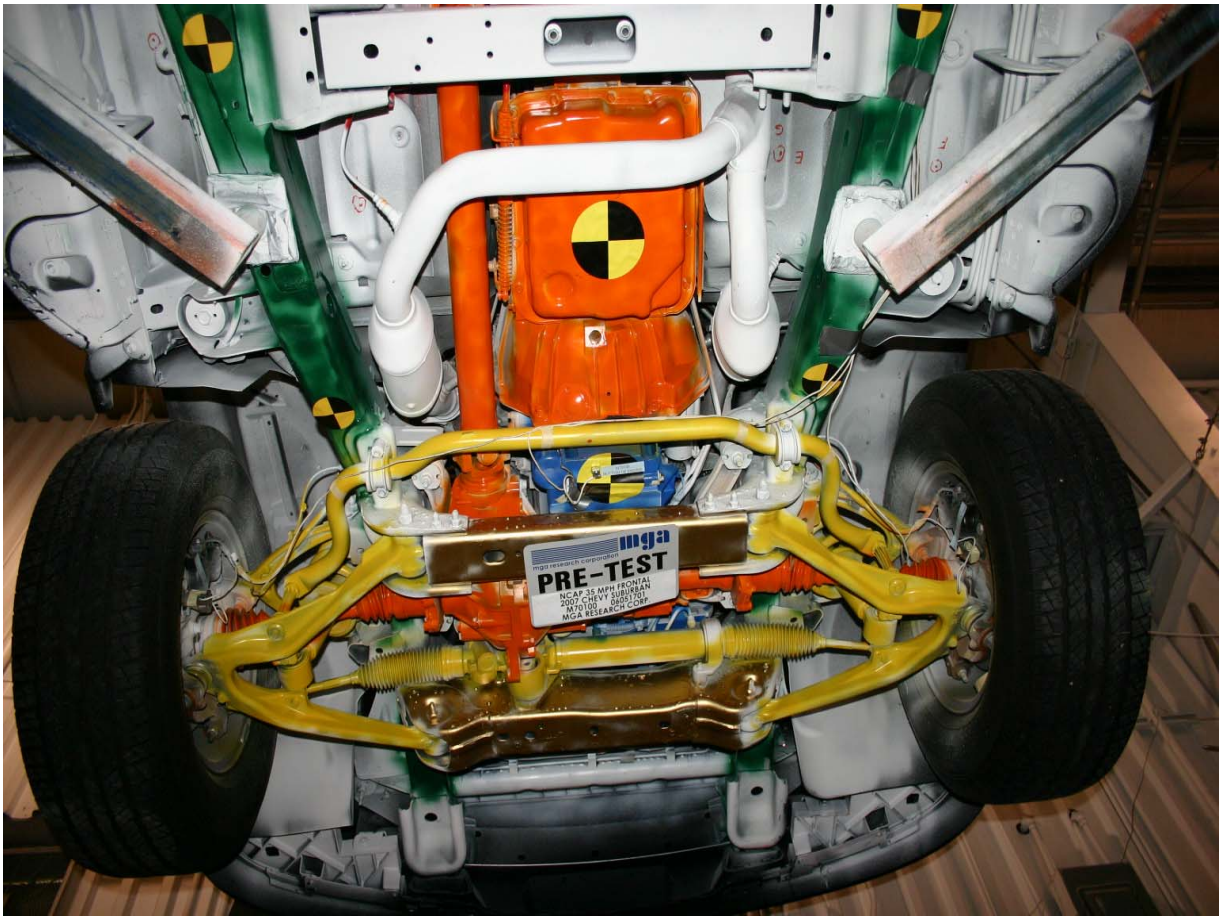
Pre-Test Engine Compartment View



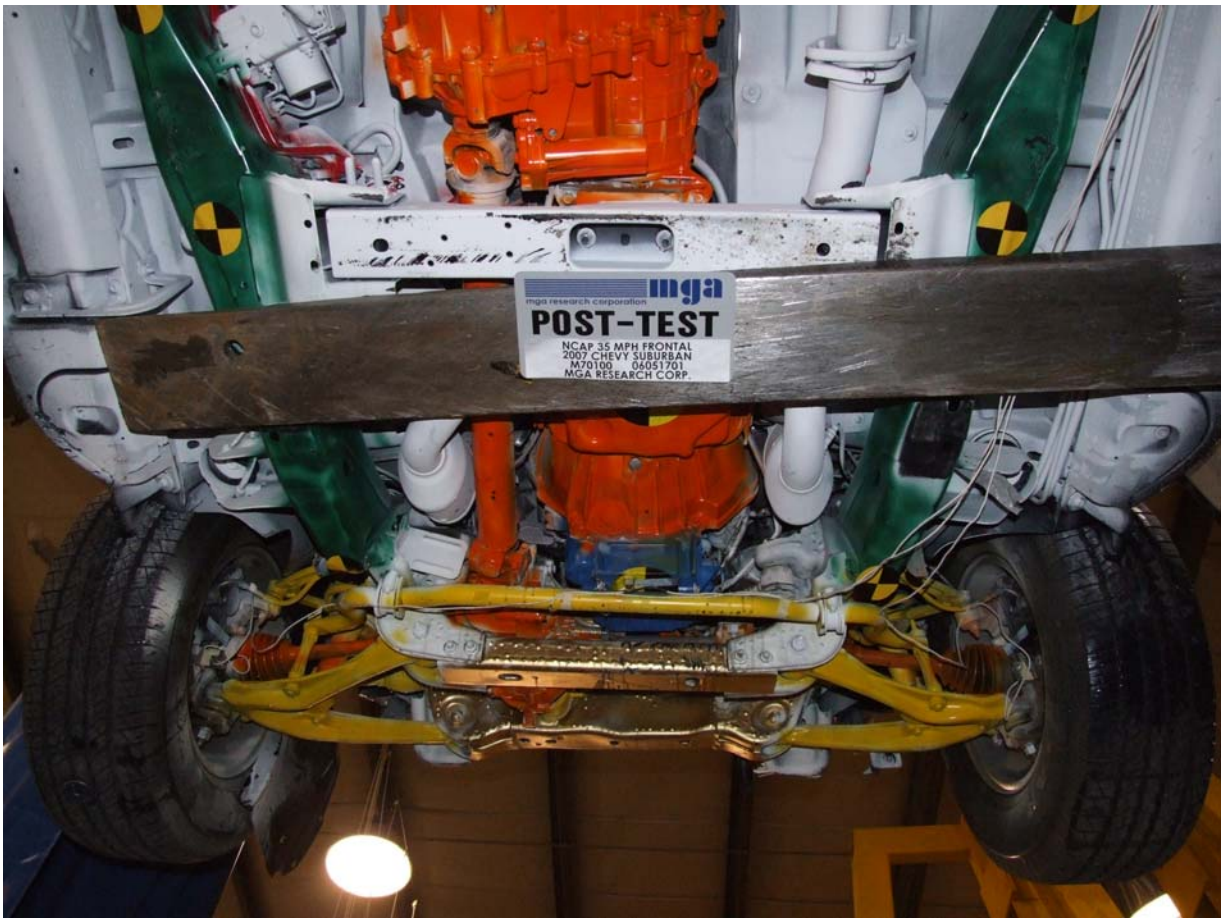
Post-Test Engine Compartment View

Pre-Test Fuel Cap View

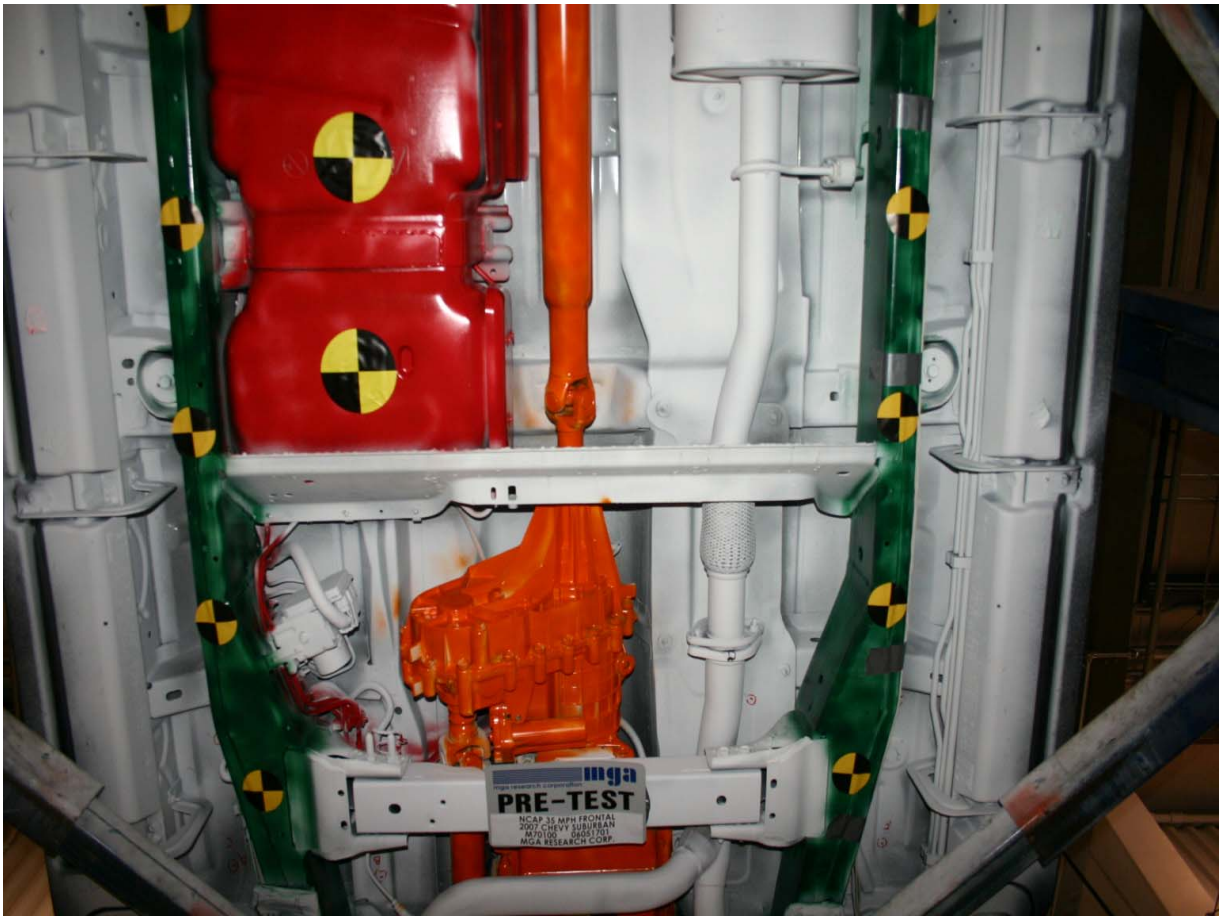
Post-Test Fuel Cap View



Pre-Test Front Underbody View

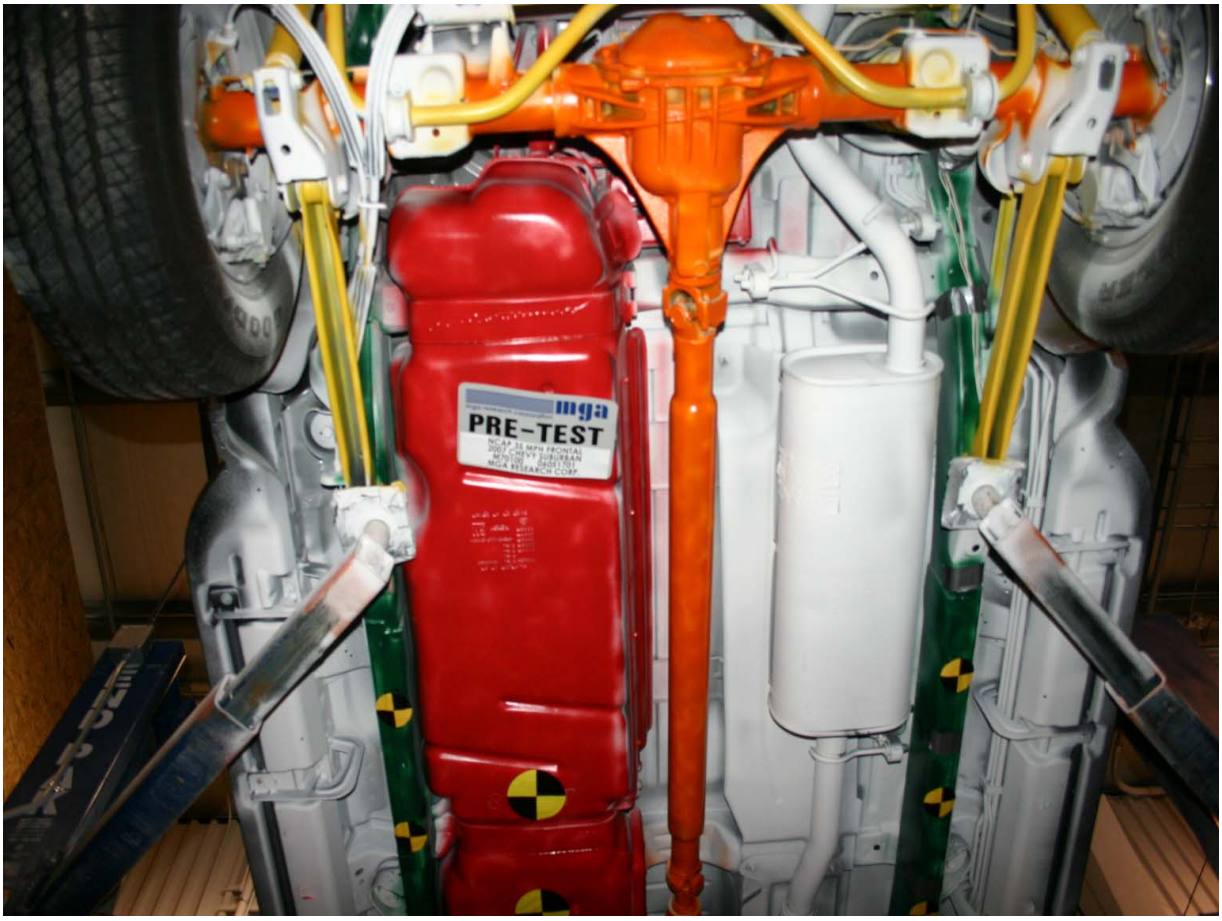


Post-Test Front Underbody View



Pre-Test Front Mid Underbody View

Post-Test Front Mid Underbody View

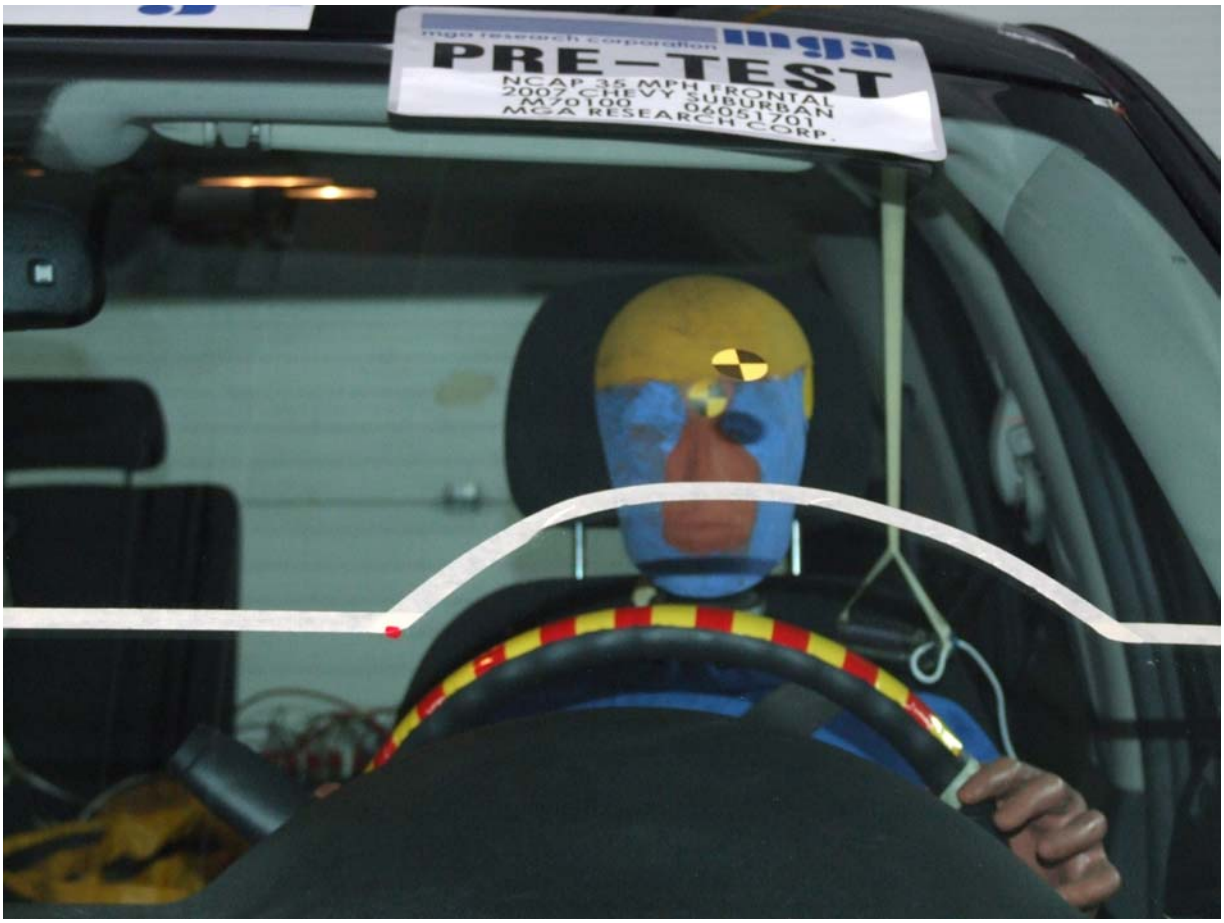


Pre-Test Rear Mid Underbody View

Post-Test Rear Mid Underbody View

Pre-Test Rear Underbody View

Post-Test Rear Underbody View



Pre-Test Driver Dummy Front View (Head Position)

Post-Test Driver Dummy Front View (Head Position)

Pre-Test Driver Dummy (Through Window)

Post-Test Driver Dummy (Through Window)

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

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

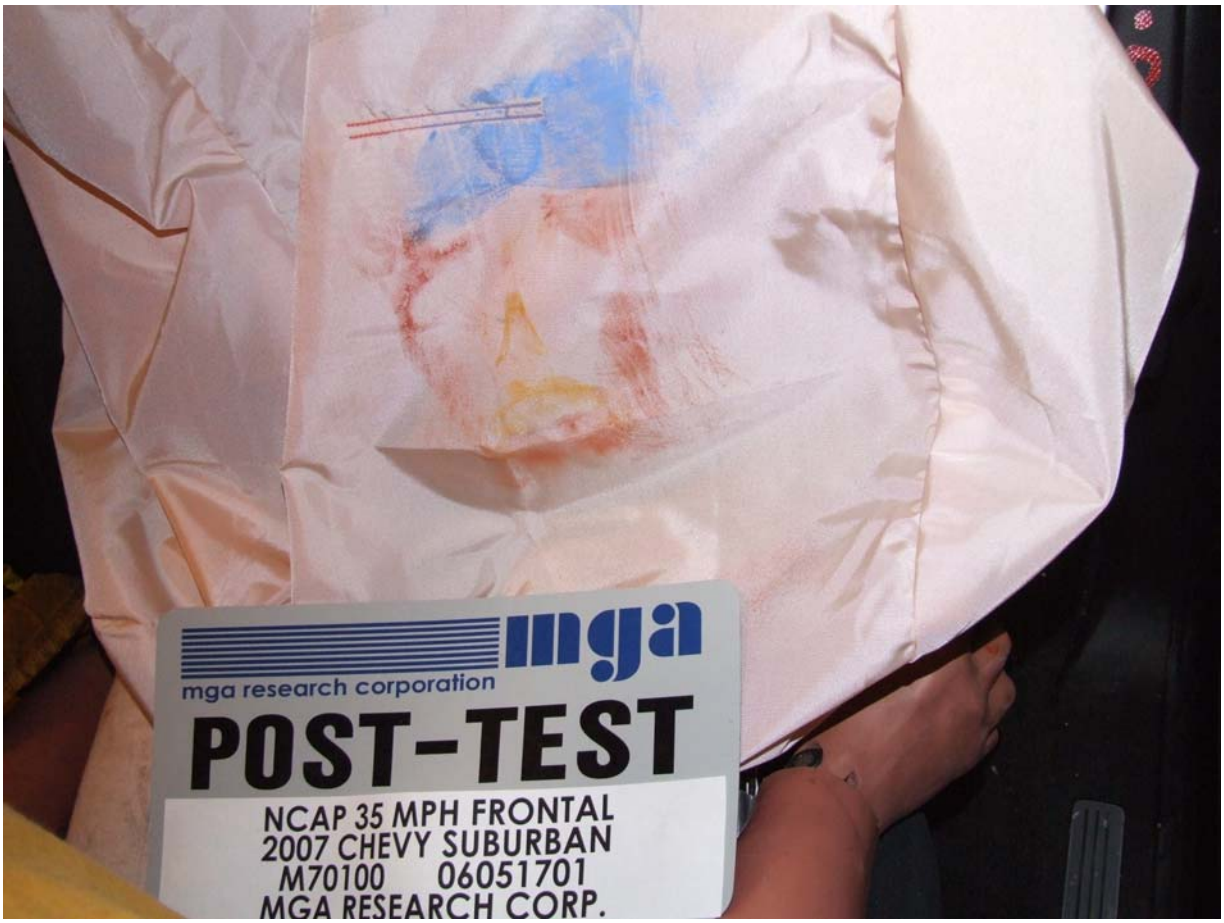
Post-Test Passenger Side Glove Box

Pre-Test Passenger Side Floor Pan

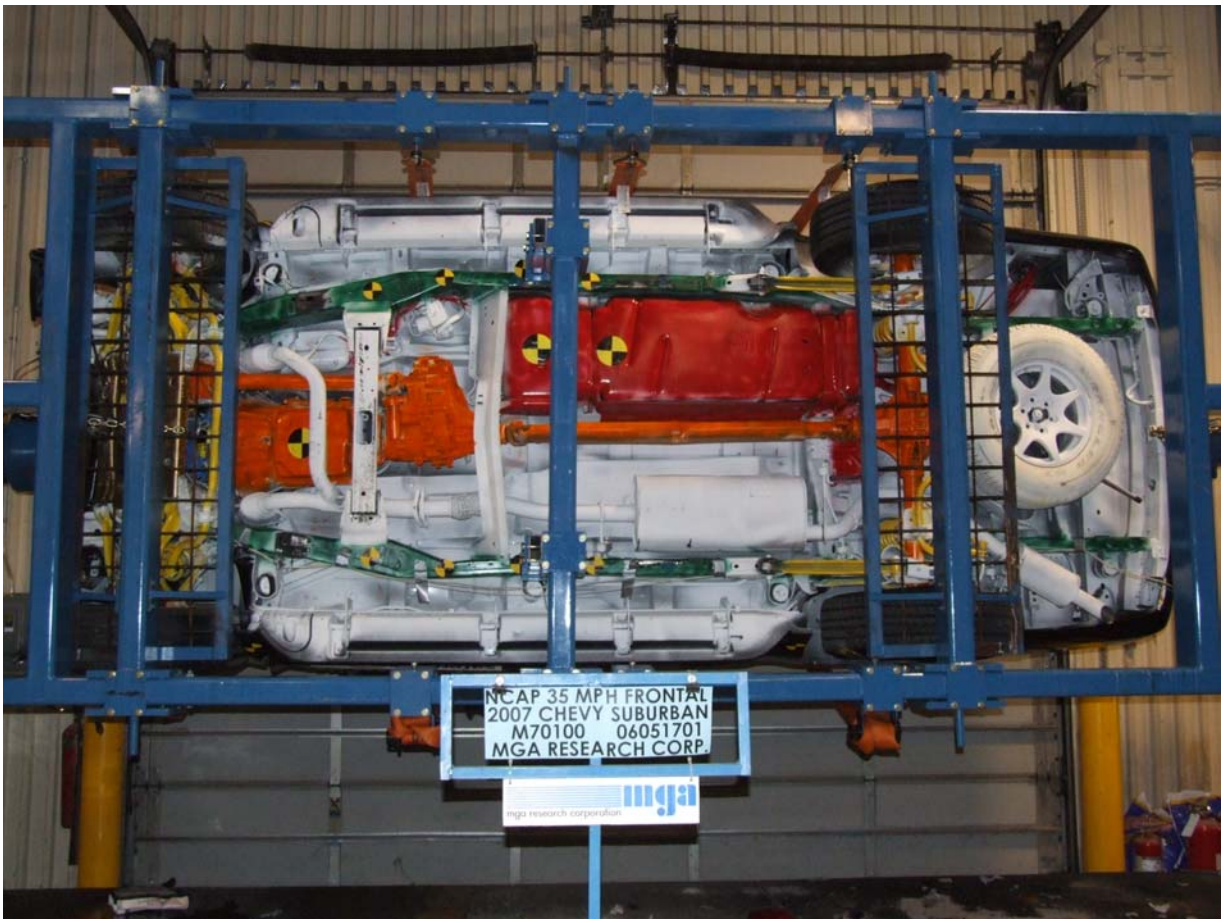
Post-Test Passenger Side Floor Pan

Post-Test Passenger Dummy Head Contact

Post-Test Passenger Dummy Knee Contact



Post-Test Passenger Dummy Airbag Contact

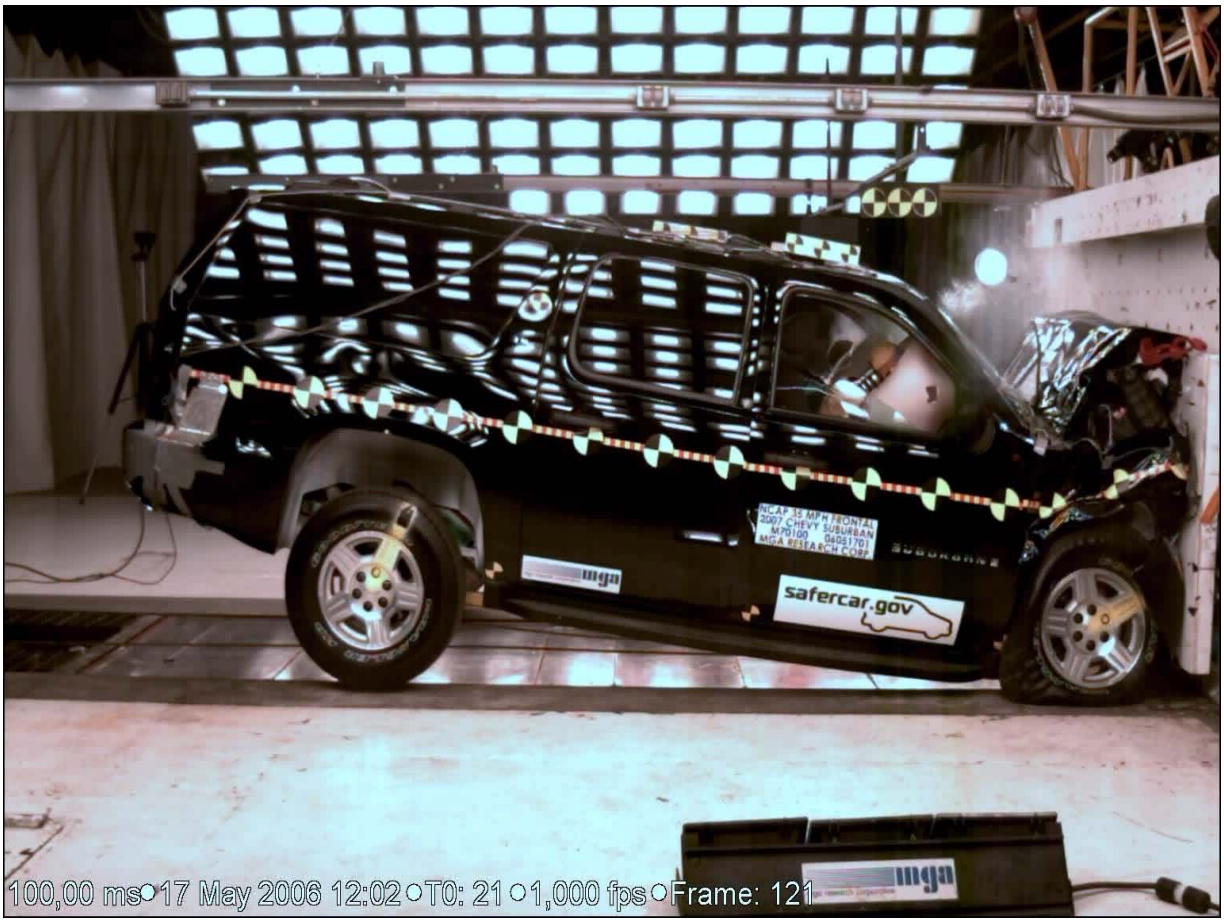


Vehicle on Rollover Device at 90 Degrees

Vehicle on Rollover Device at 180 Degrees

Vehicle on Rollover Device at 270 Degrees

Vehicle on Rollover Device at 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

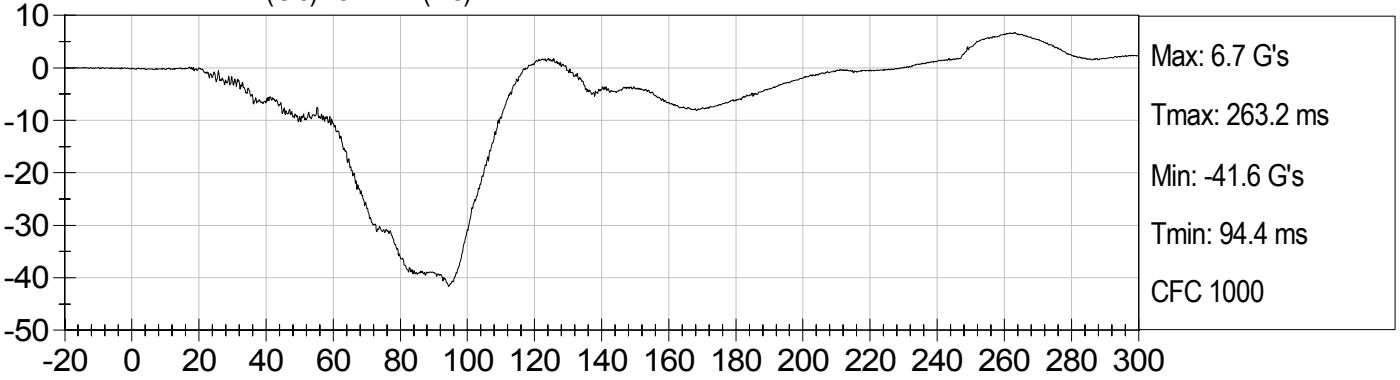
Vehicle Left Brake Caliper X

Vehicle Right Brake Caliper X

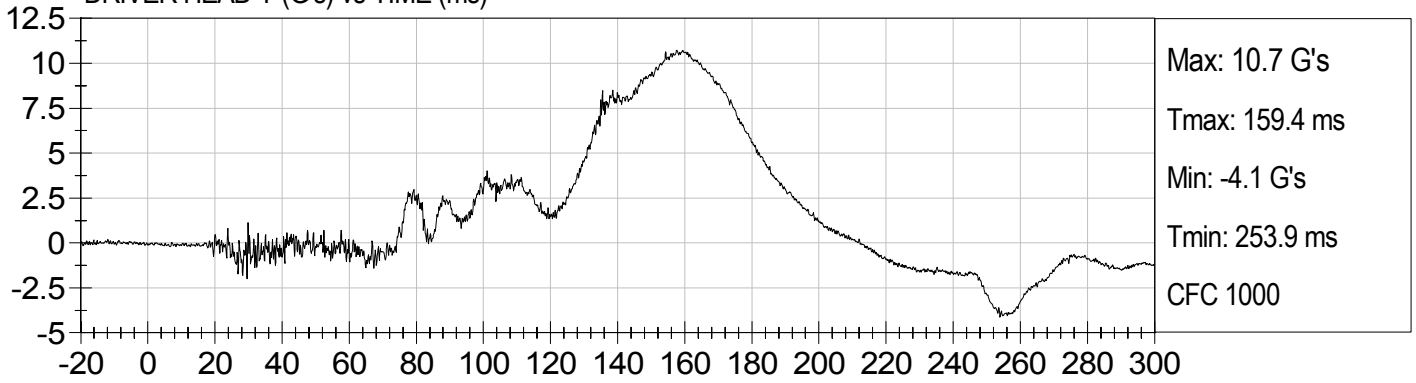
NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)

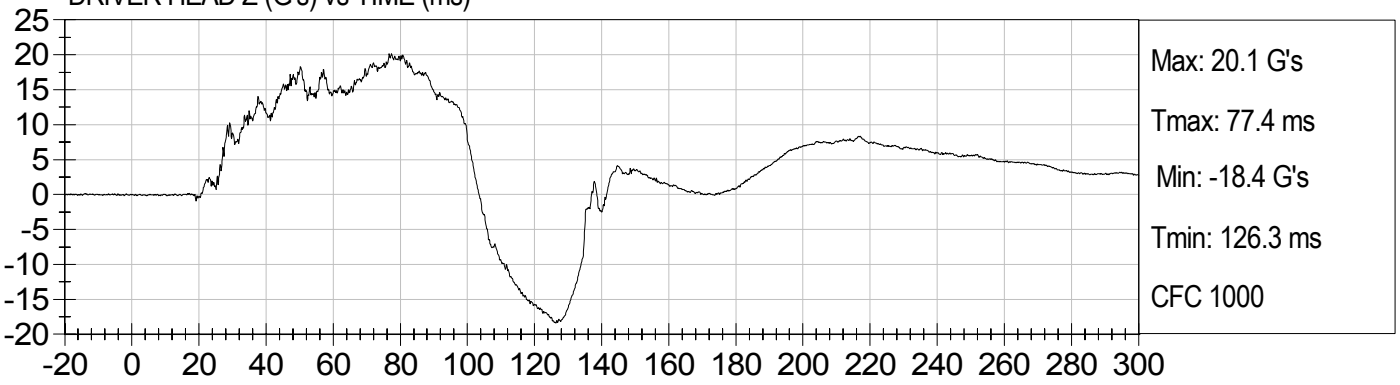
DRIVER HEAD X (G's) vs TIME (ms)



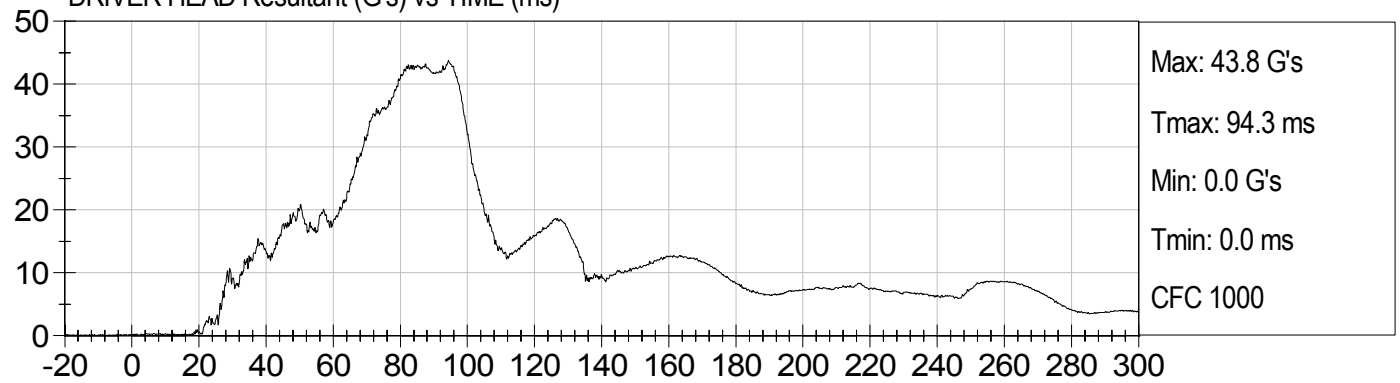
DRIVER HEAD Y (G's) vs TIME (ms)



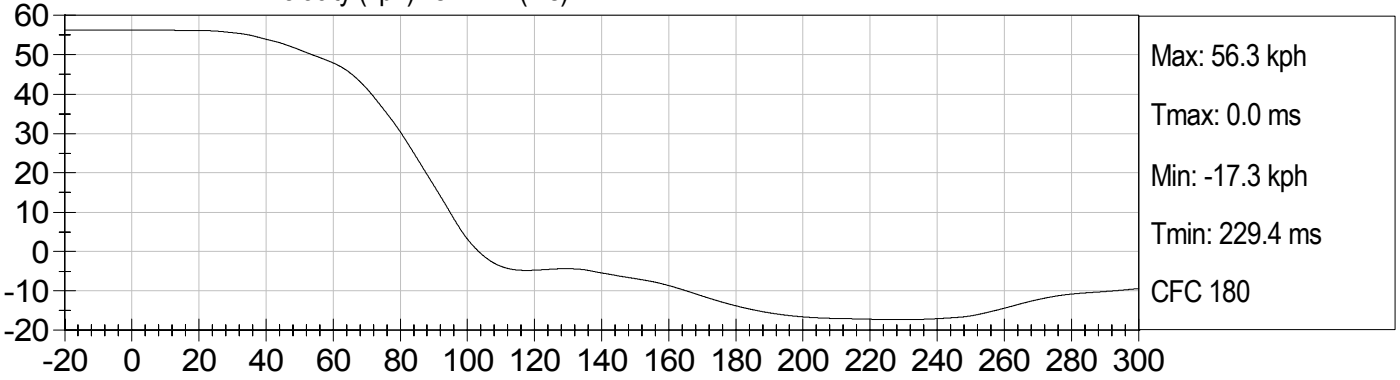
DRIVER HEAD Z (G's) vs TIME (ms)



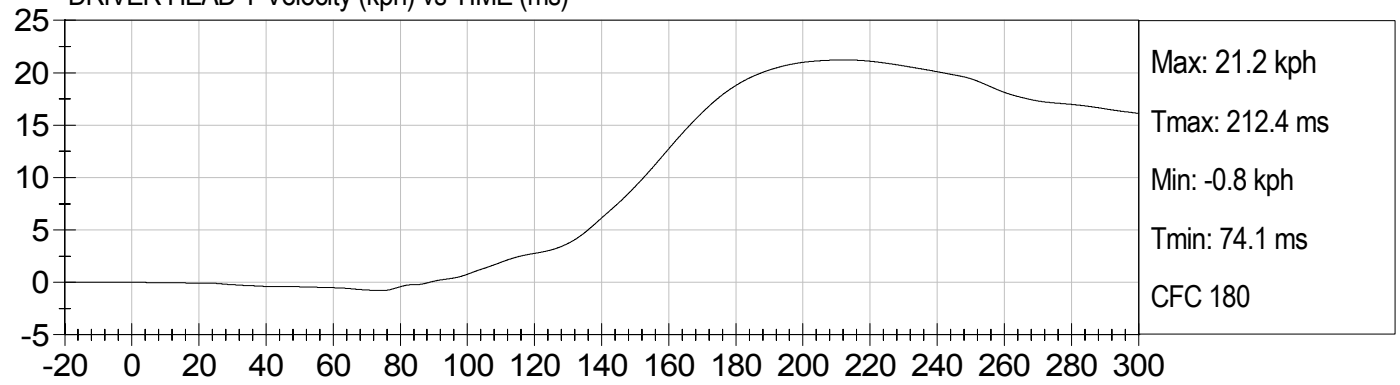
DRIVER HEAD Resultant (G's) vs TIME (ms)



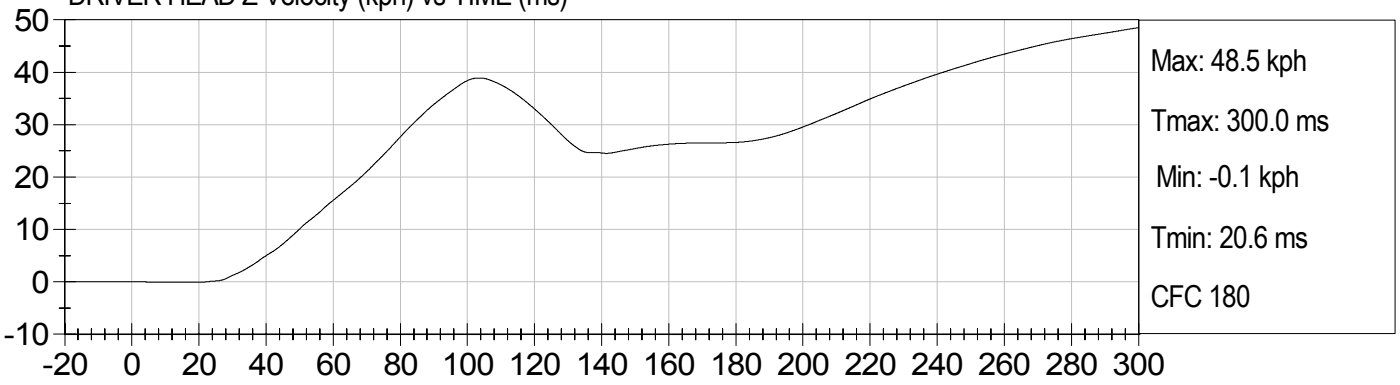
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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



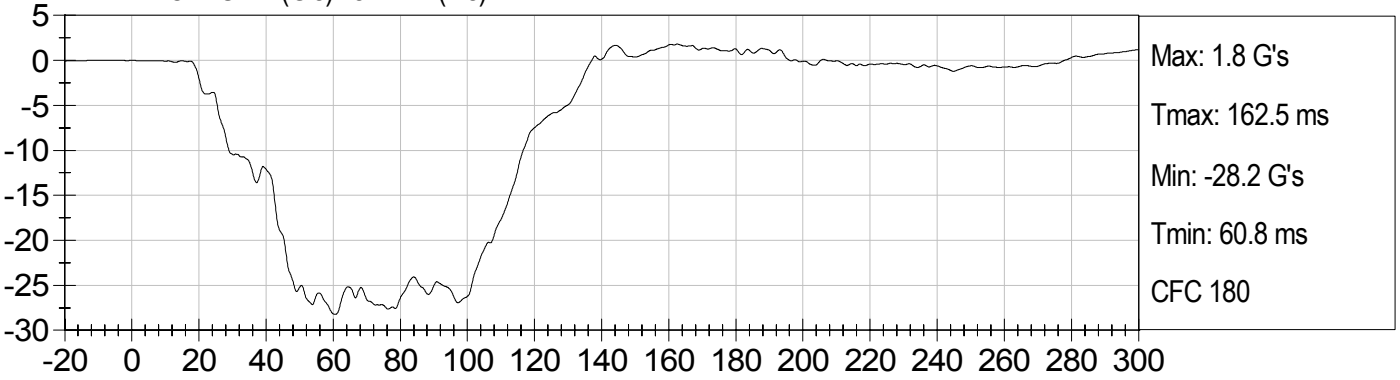
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



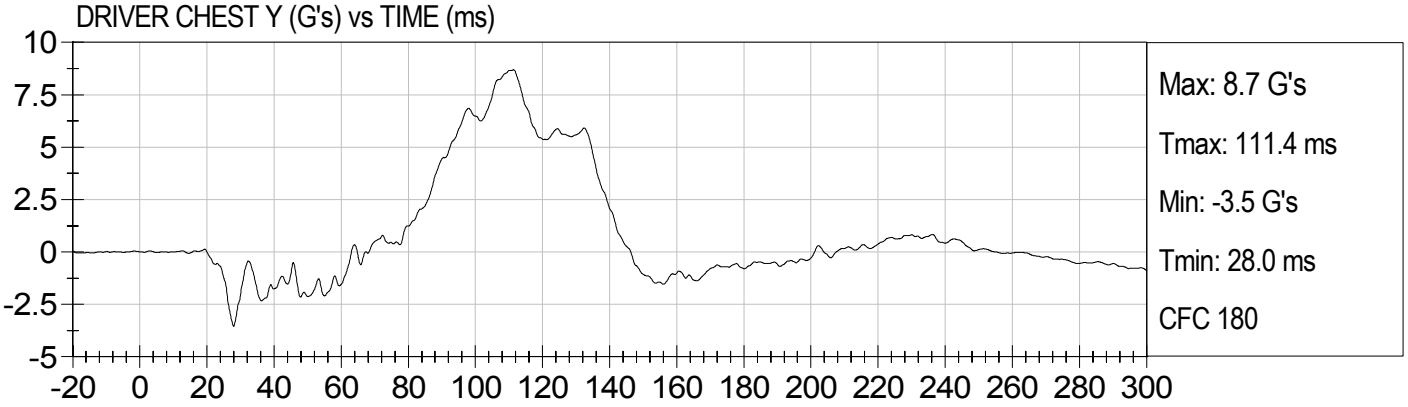
NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)

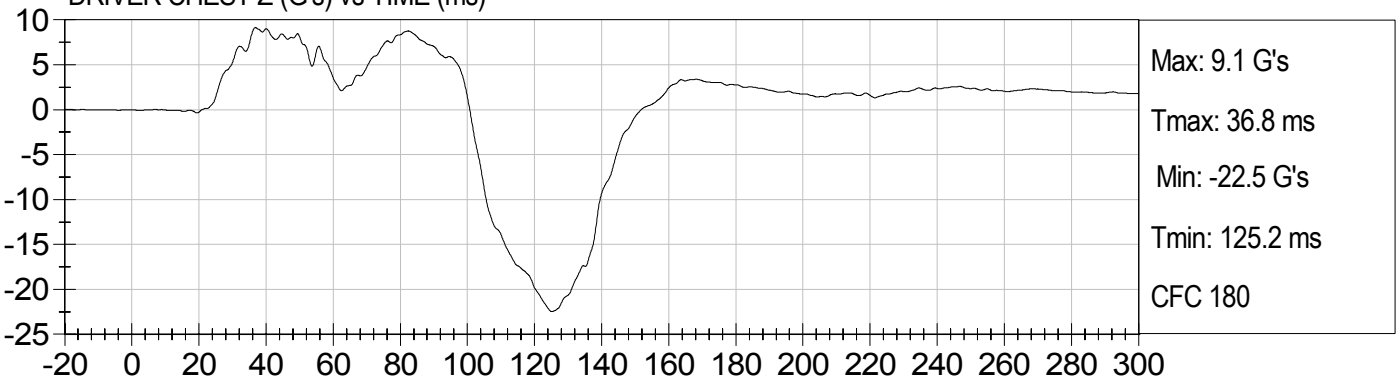
DRIVER CHEST X (G's) vs TIME (ms)



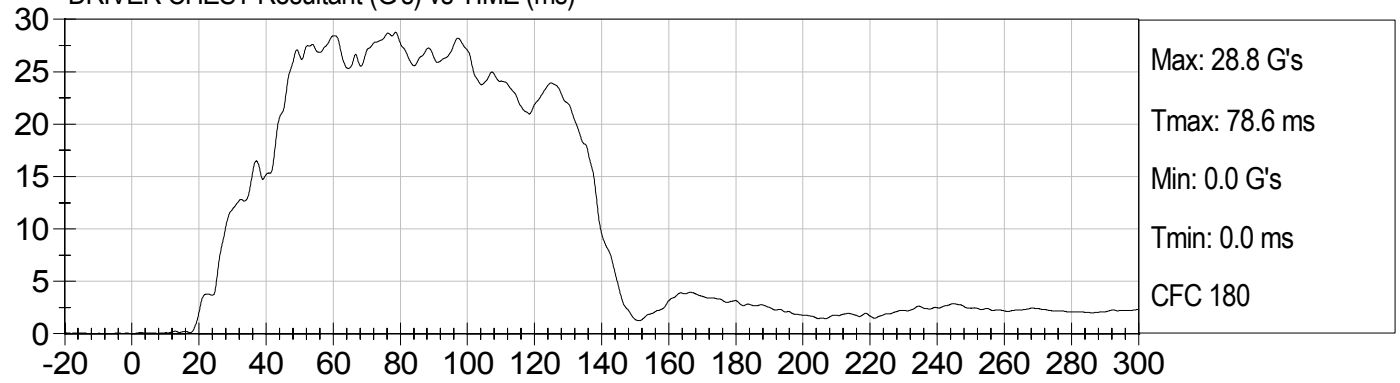
DRIVER CHEST Y (G's) vs TIME (ms)



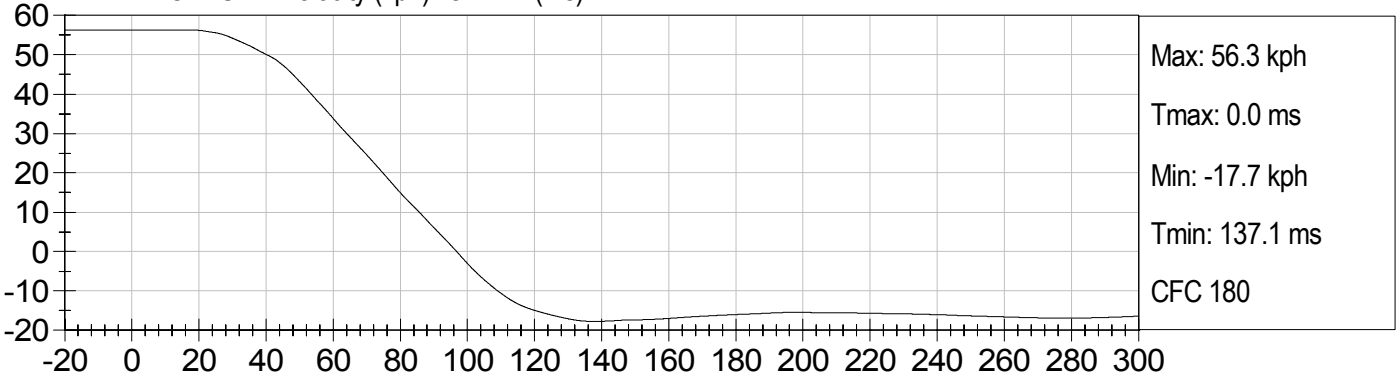
DRIVER CHEST Z (G's) vs TIME (ms)



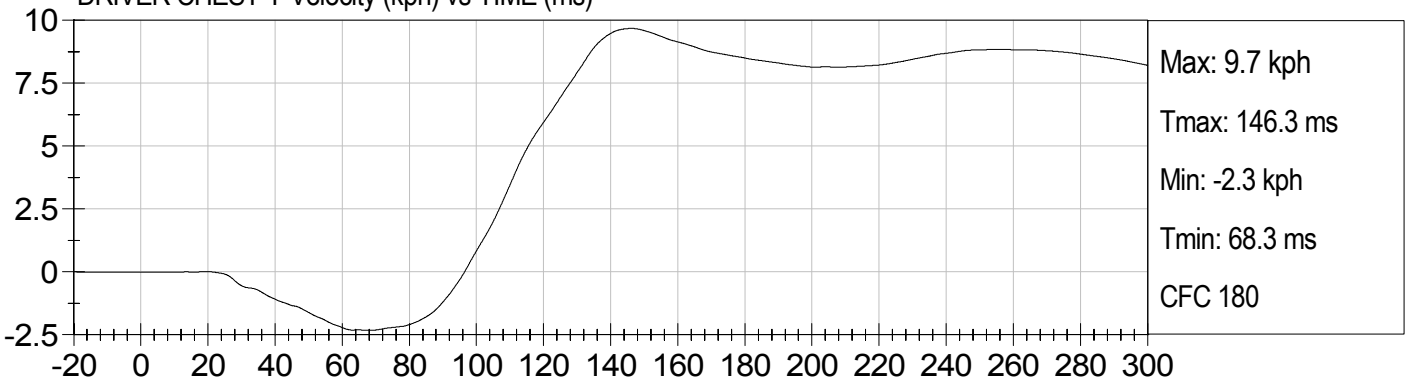
DRIVER CHEST Resultant (G's) vs TIME (ms)



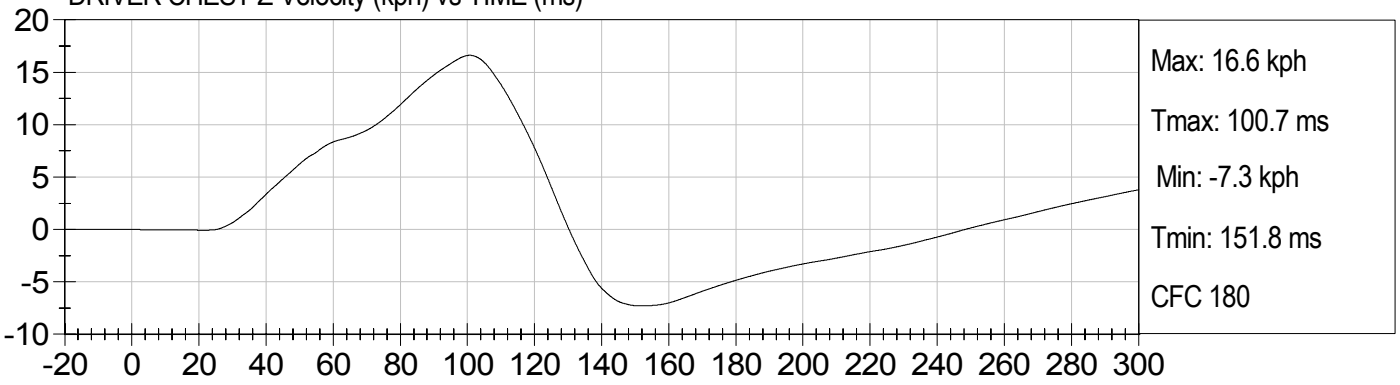
DRIVER CHEST X Velocity (kph) vs TIME (ms)



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

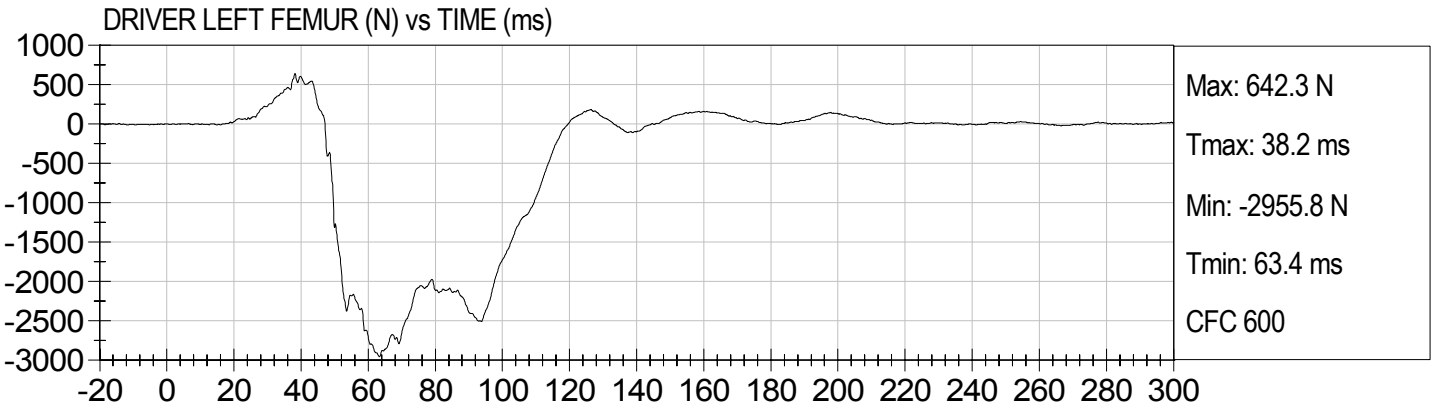


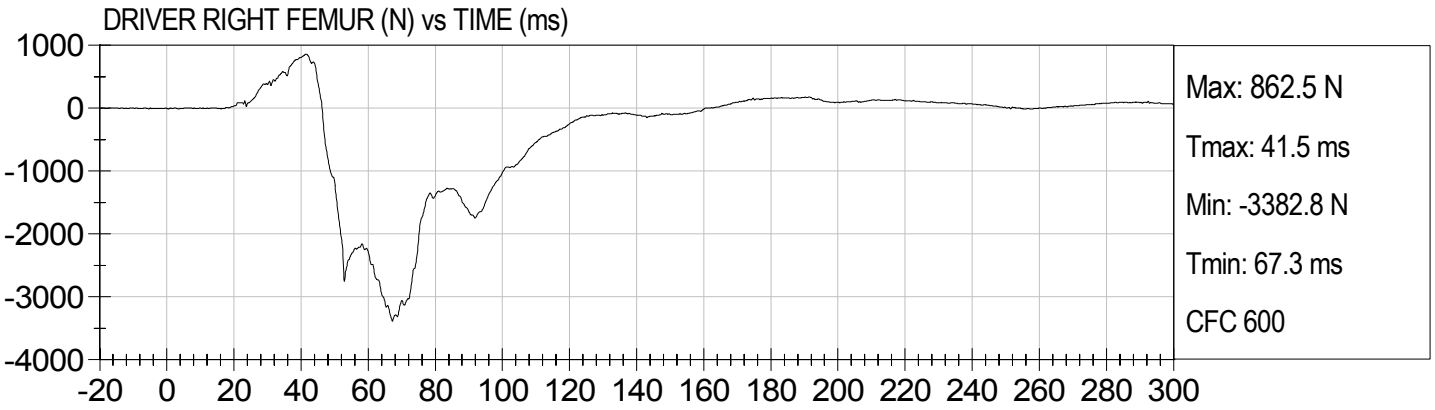
DRIVER CHEST Z Velocity (kph) vs TIME (ms)



NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)

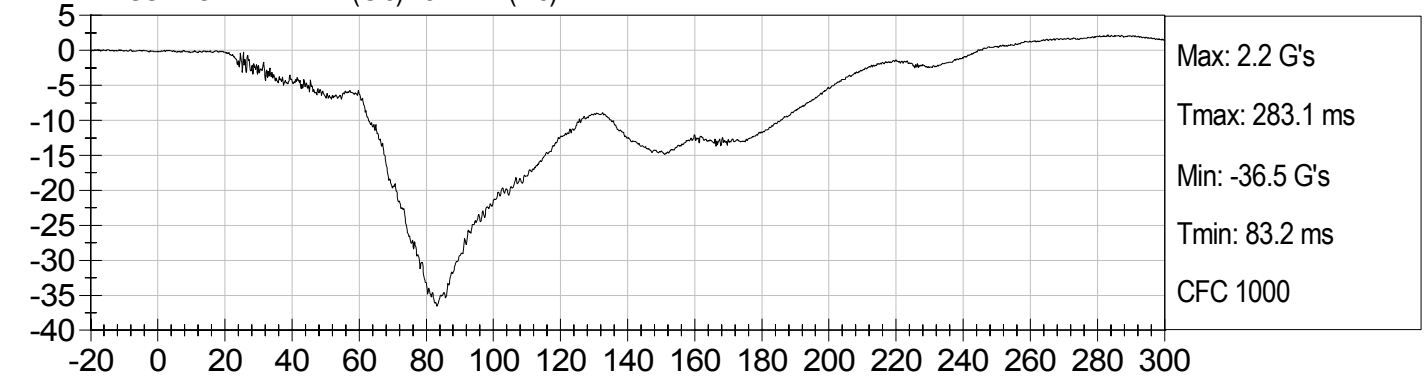




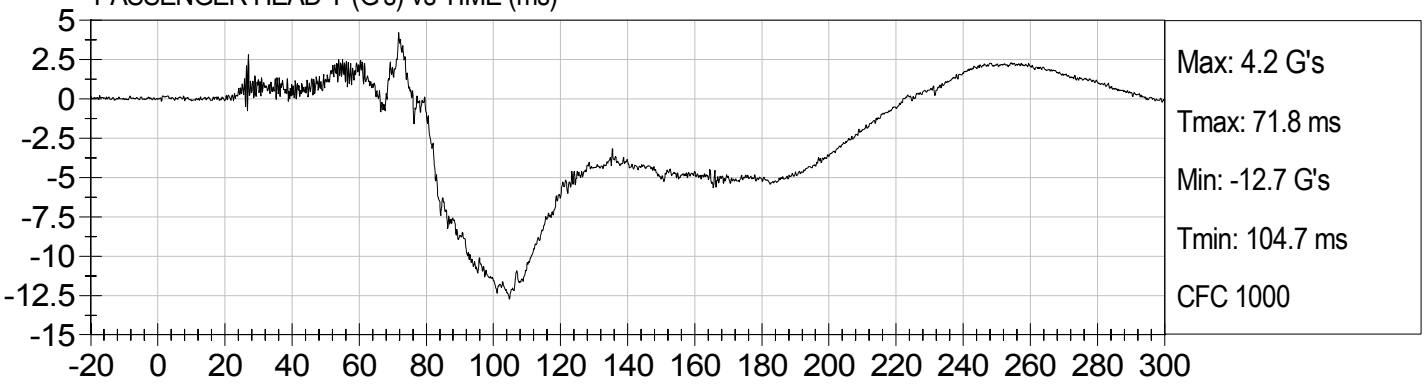
NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)

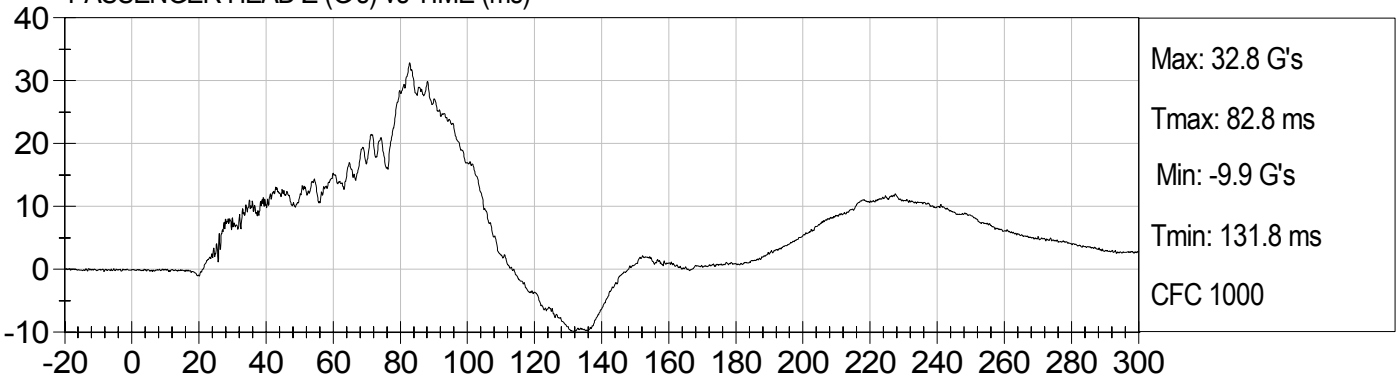
PASSENGER HEAD X (G's) vs TIME (ms)



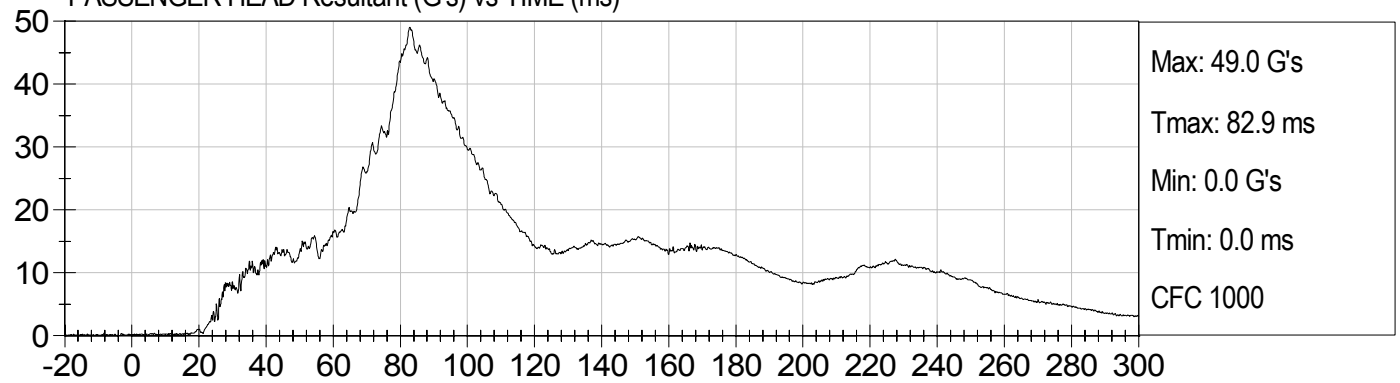
PASSENGER HEAD Y (G's) vs TIME (ms)



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

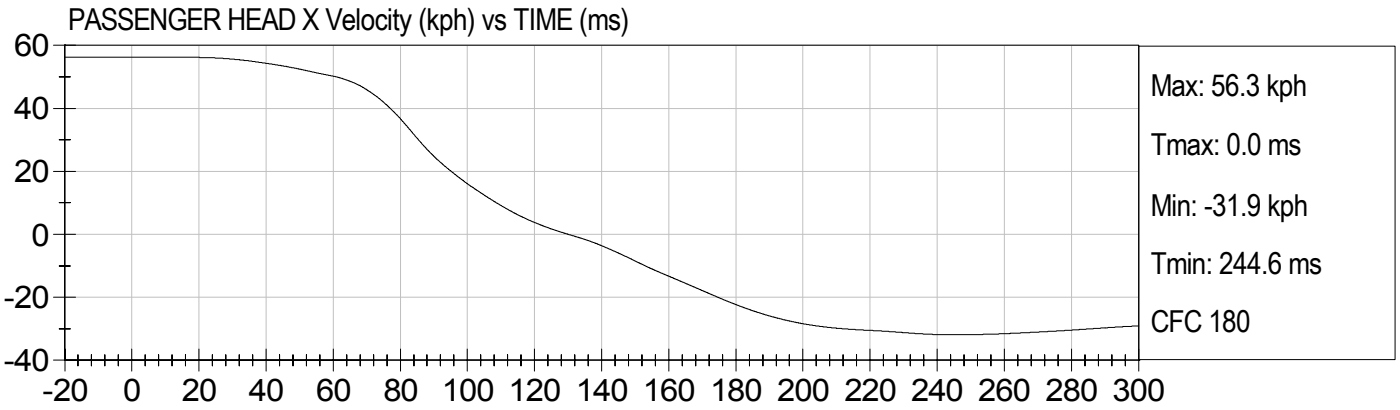


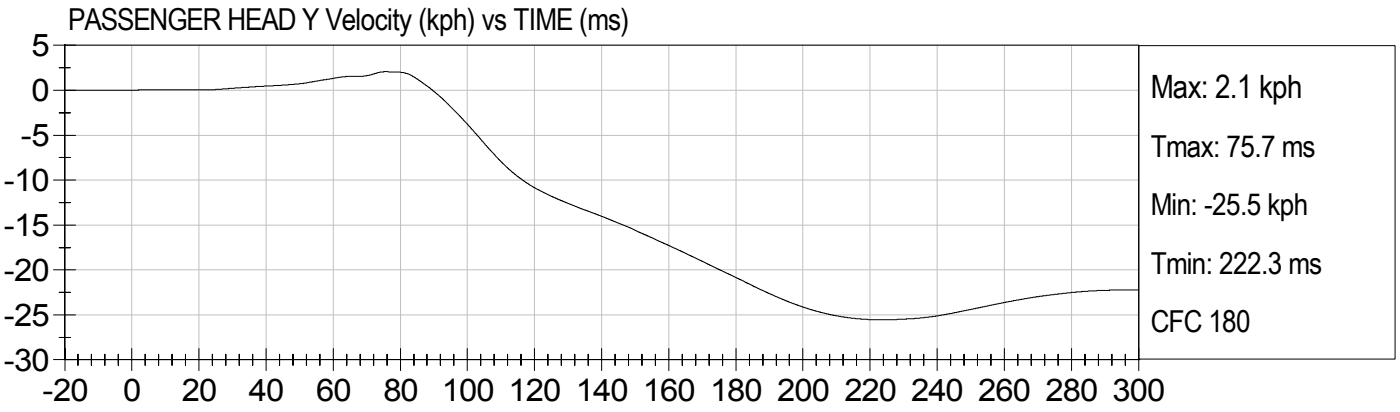
PASSENGER HEAD Resultant (G's) vs TIME (ms)

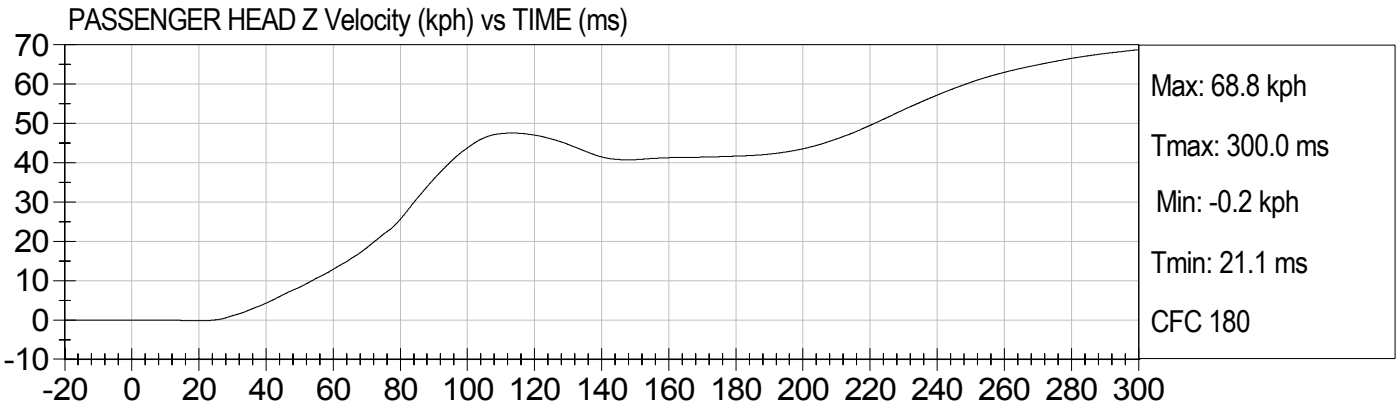


NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)



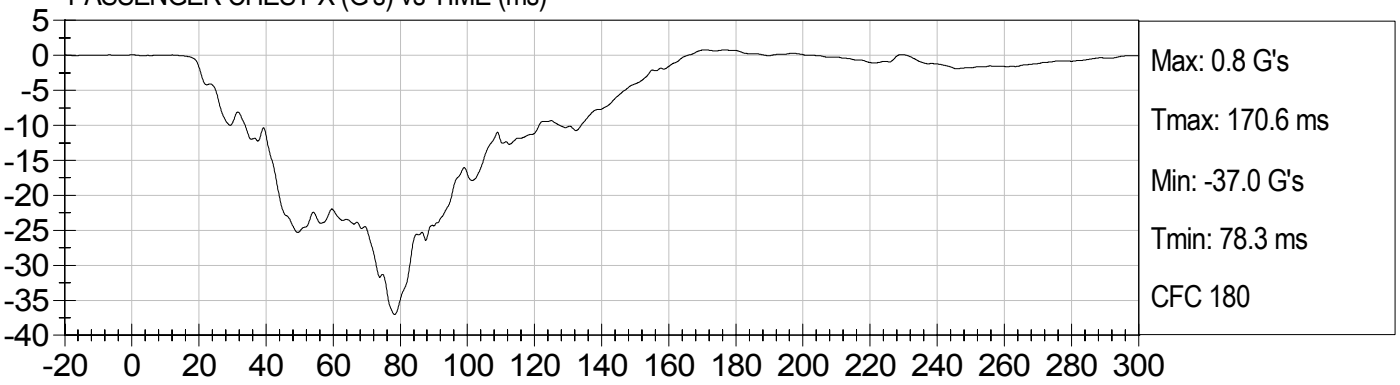




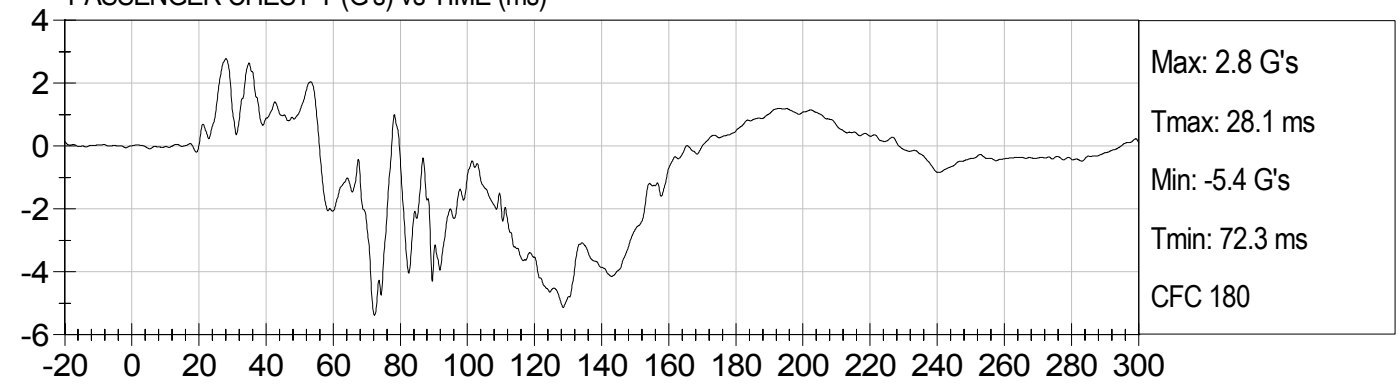
NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)

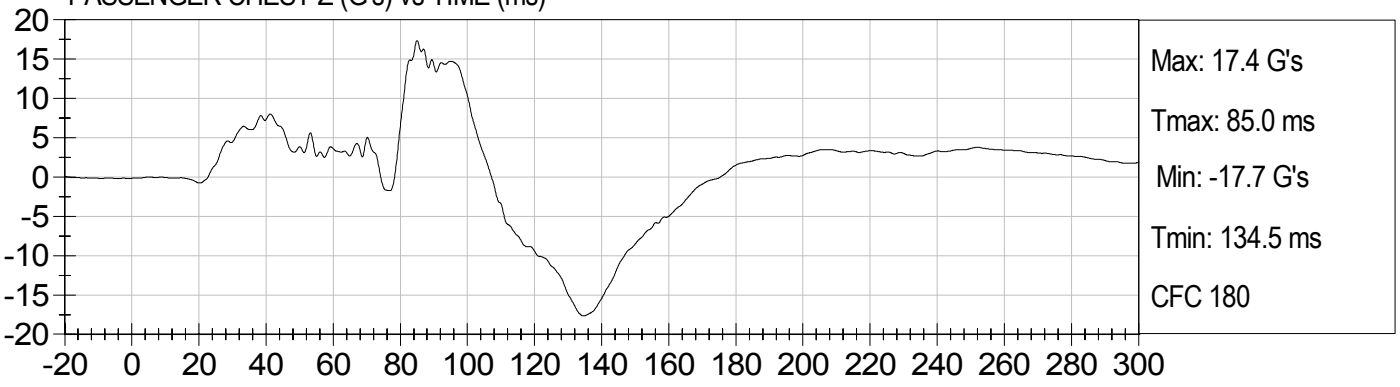
PASSENGER CHEST X (G's) vs TIME (ms)



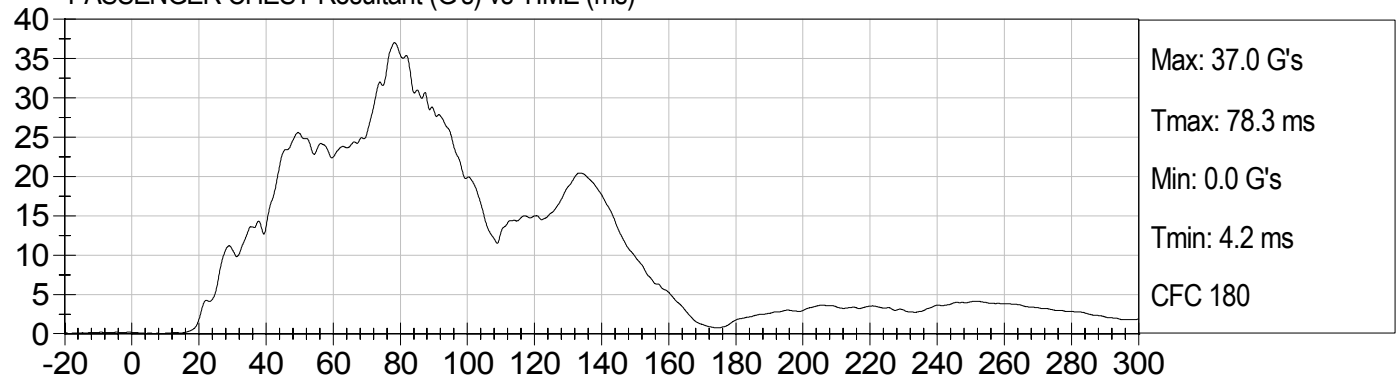
PASSENGER CHEST Y (G's) vs TIME (ms)



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



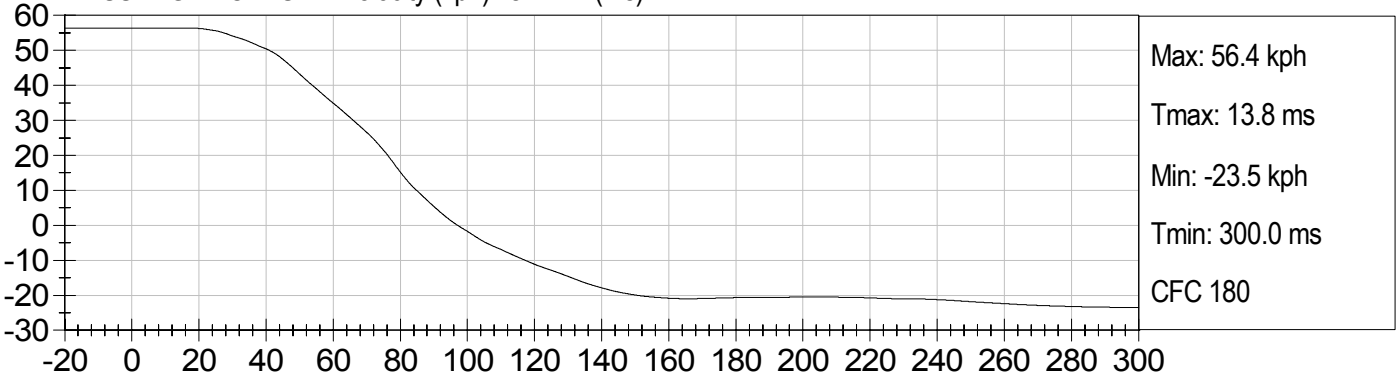
PASSENGER CHEST Resultant (G's) vs TIME (ms)



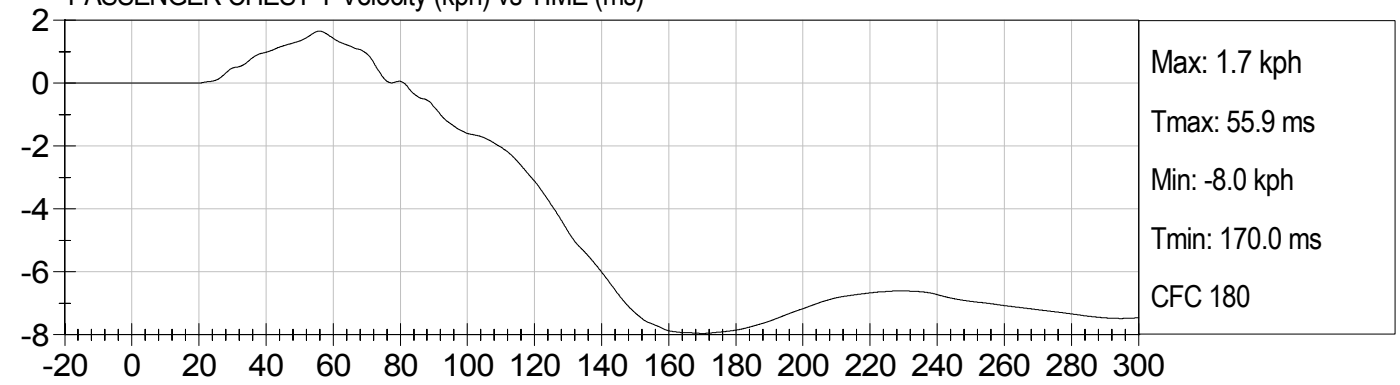
NCAP 35 MPH FRONTAL
2007 CHEVY SUBURBAN

Test Date: 05/17/2006
Speed: 35.0 mph (56.3 km/h)

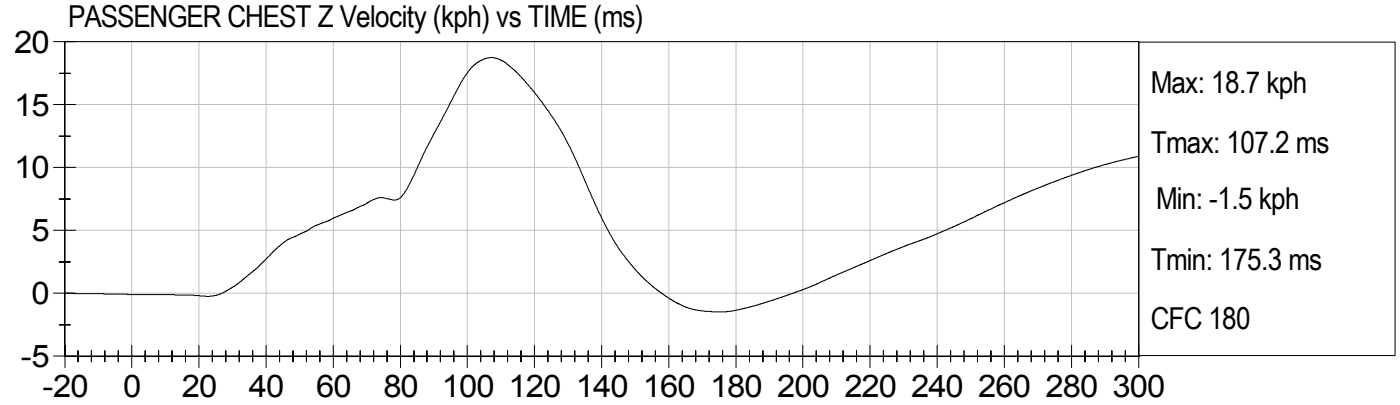
PASSENGER CHEST X Velocity (kph) vs TIME (ms)

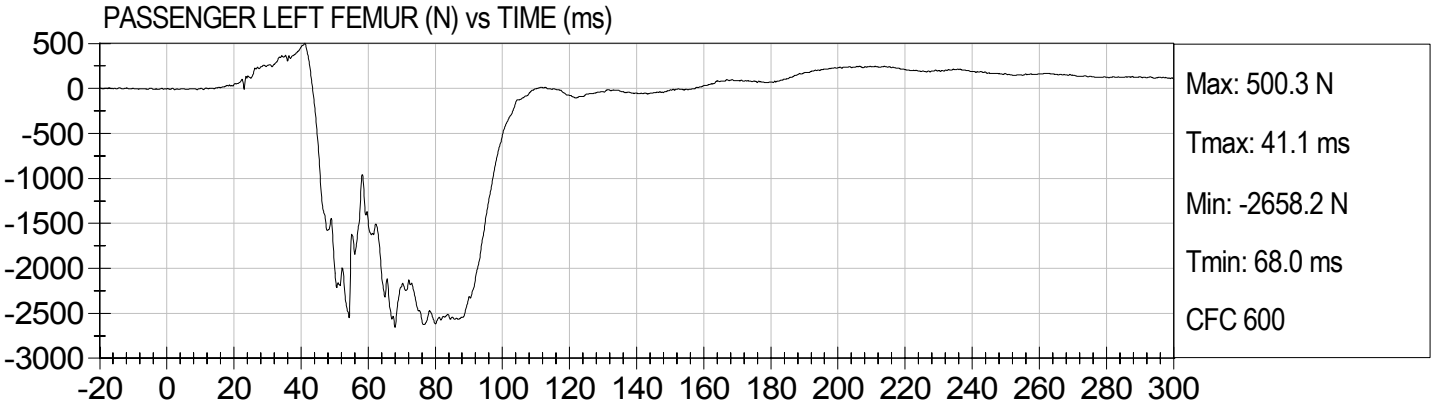


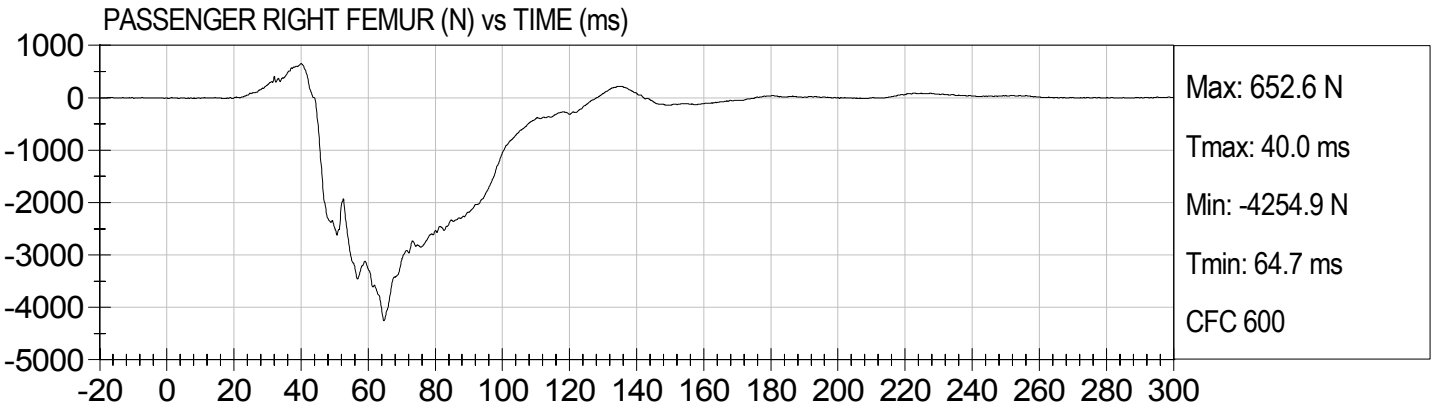
PASSENGER CHEST Y Velocity (kph) vs TIME (ms)



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




PASSENGER LEFT FEMUR (N) vs TIME (ms)
500
0
-500
-1000
-1500
-2000
-2500
-3000
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 500.3 N
Tmax: 41.1 ms
Min: -2658.2 N
Tmin: 68.0 ms
CFC 600


PASSENGER RIGHT FEMUR (N) vs TIME (ms)
1000
0
-1000
-2000
-3000
-4000
-5000
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 652.6 N
Tmax: 40.0 ms
Min: -4254.9 N
Tmin: 64.7 ms
CFC 600

APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test ID:** D061271

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	225 - 275	230	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

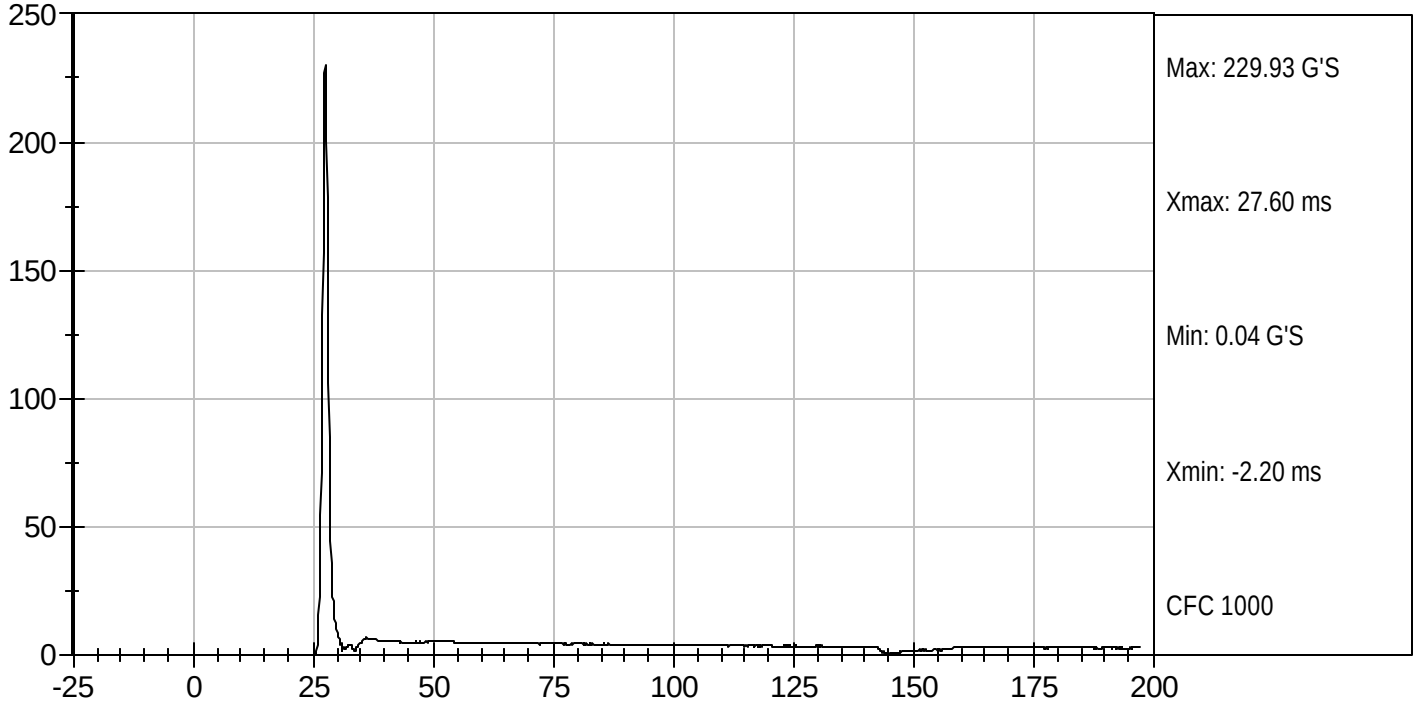
05/10/2006
Test Date

Approved By

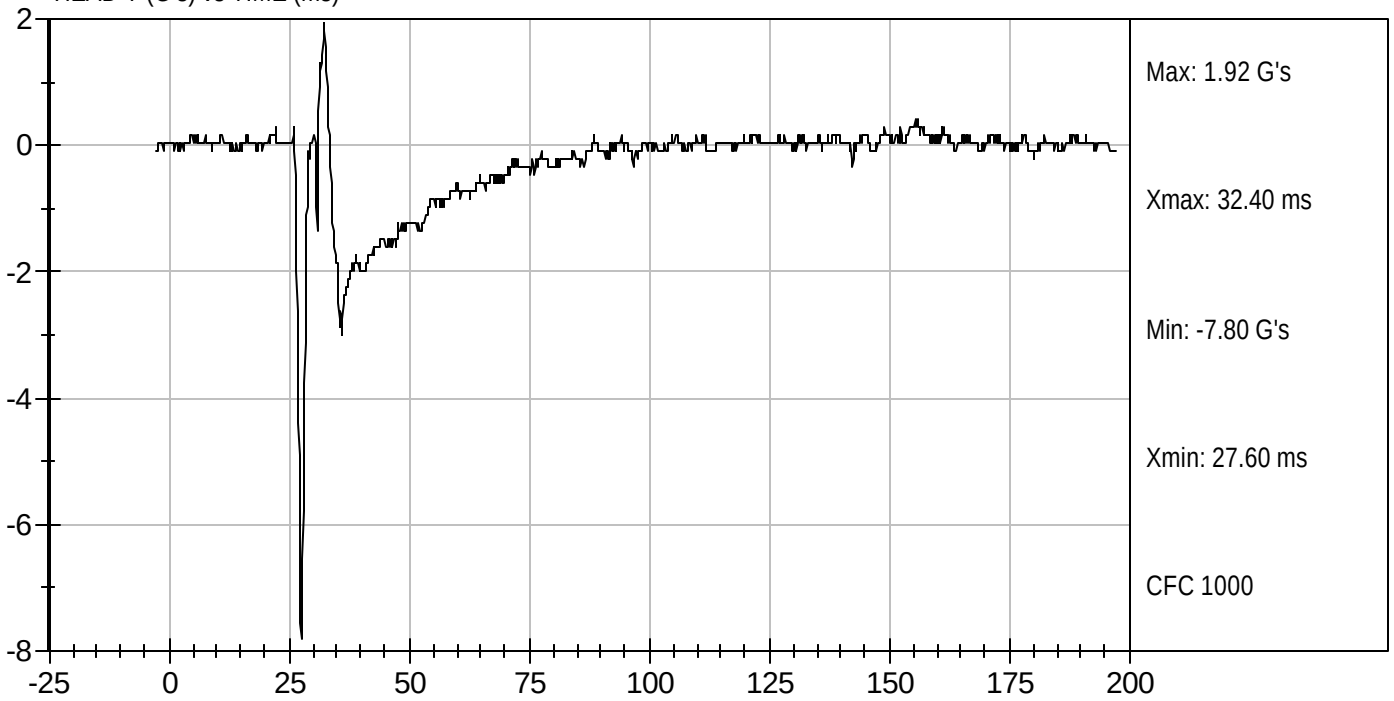
Test Desc: Head Drop
Componet ID: D061271

Test Date: 05/10/2006
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:** D061272

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	47	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.01	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.16	Pass
	20 msec	G's	17.60 to 22.60	20.87	Pass
	30 msec	G's	12.50 to 18.50	15.72	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.66	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	36.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	72.6	Pass
	Time	msec	57.0 to 64.0	58.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.3	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	90.3	Pass
	Time	msec	47.0 to 58.0	48.8	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.8	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

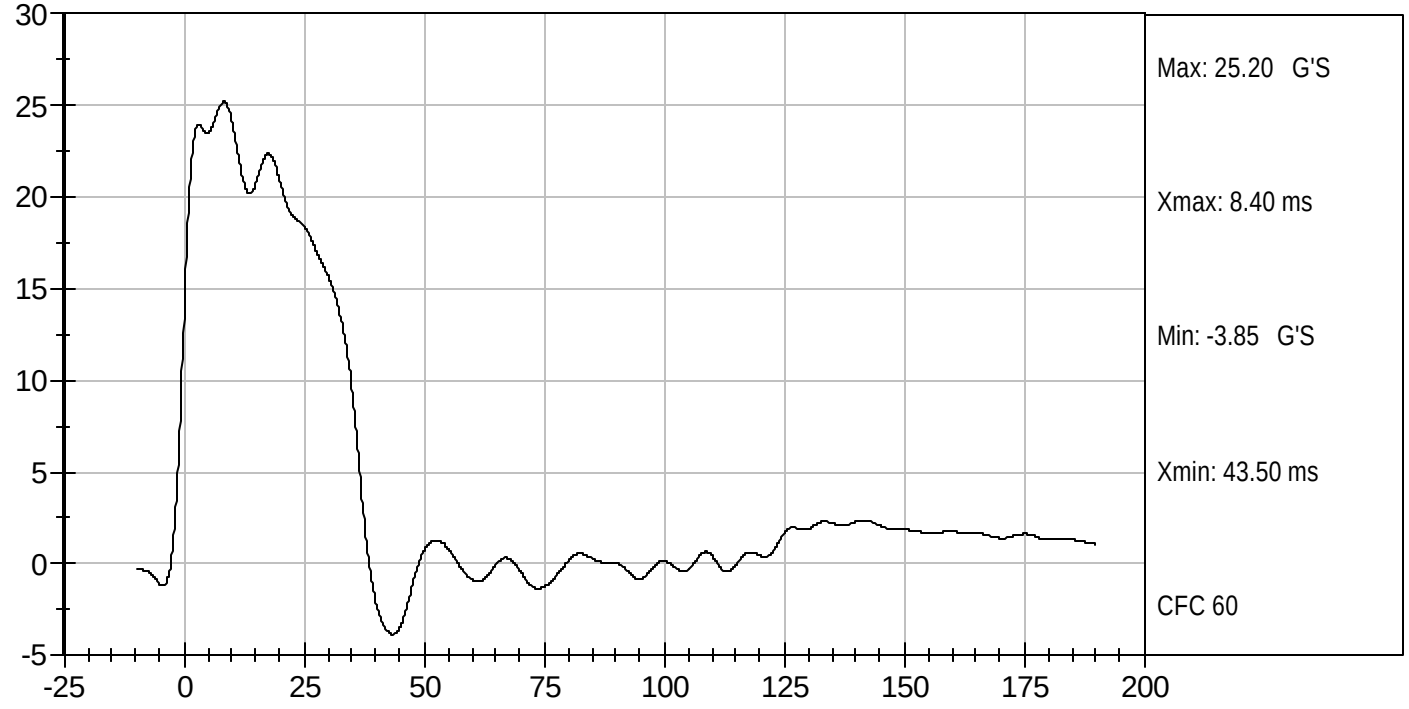
05/11/2006
Test Date

David Winkelbauer
Approved By

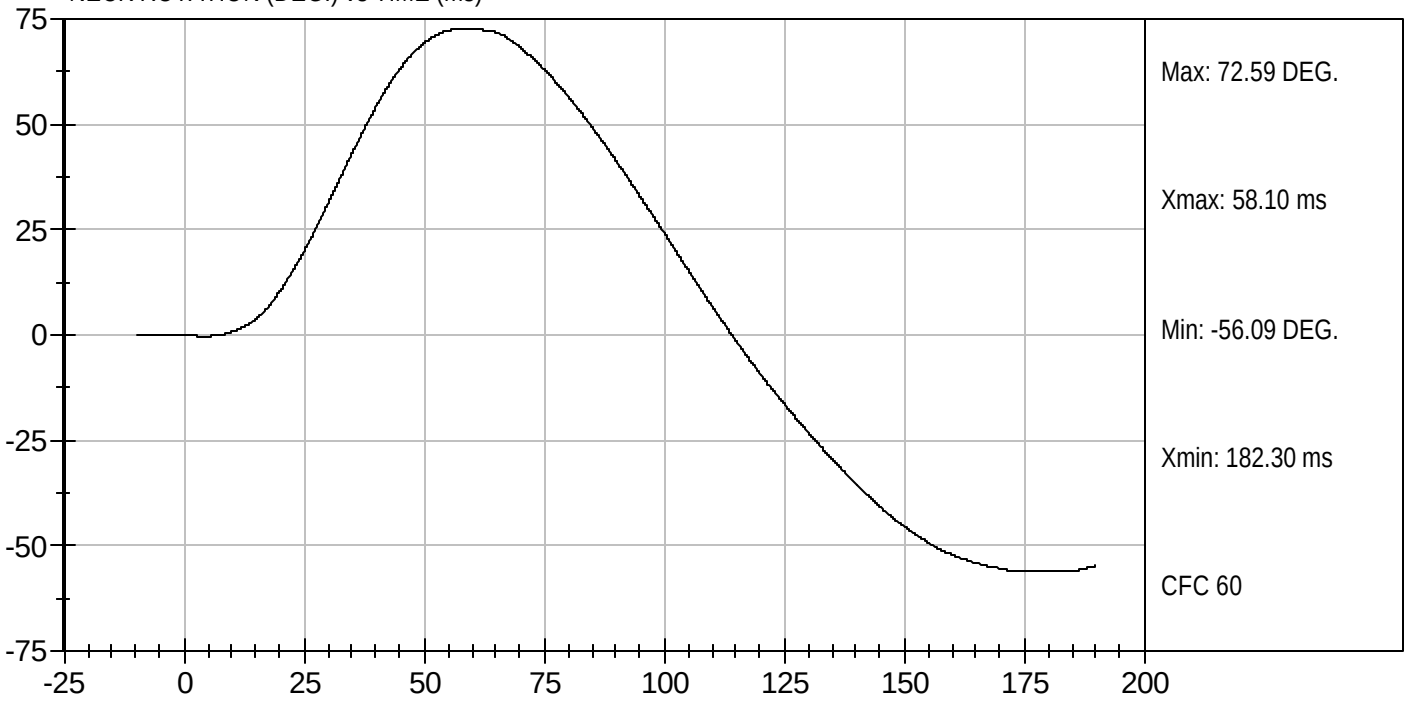
Test Desc: Neck Flexion
Componet ID: D061272

Test Date: 05/11/2006
Velocity: 22.99 ft/s, 7.01 m/s

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

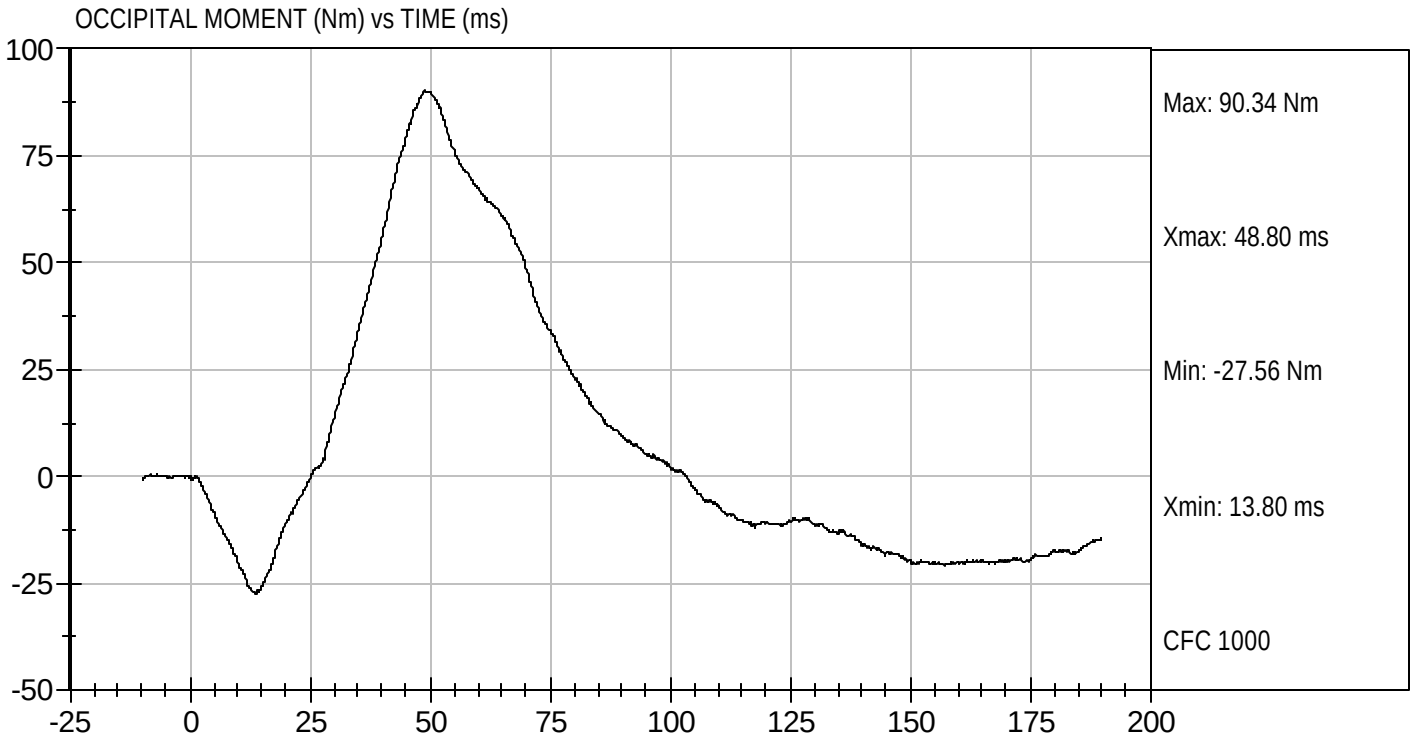


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D061272

Test Date: 05/11/2006
Velocity: 22.99 ft/s, 7.01 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D061273

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	46	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.14	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.38	Pass
	20 msec	G's	14.00 to 19.00	17.18	Pass
	30 msec	G's	11.00 to 16.00	14.17	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	14.58	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	102.6	Pass
	Time	msec	72.0 to 82.0	78.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	158.2	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-73.3	Pass
	Time	msec	65.0 to 79.0	72.4	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	145.6	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

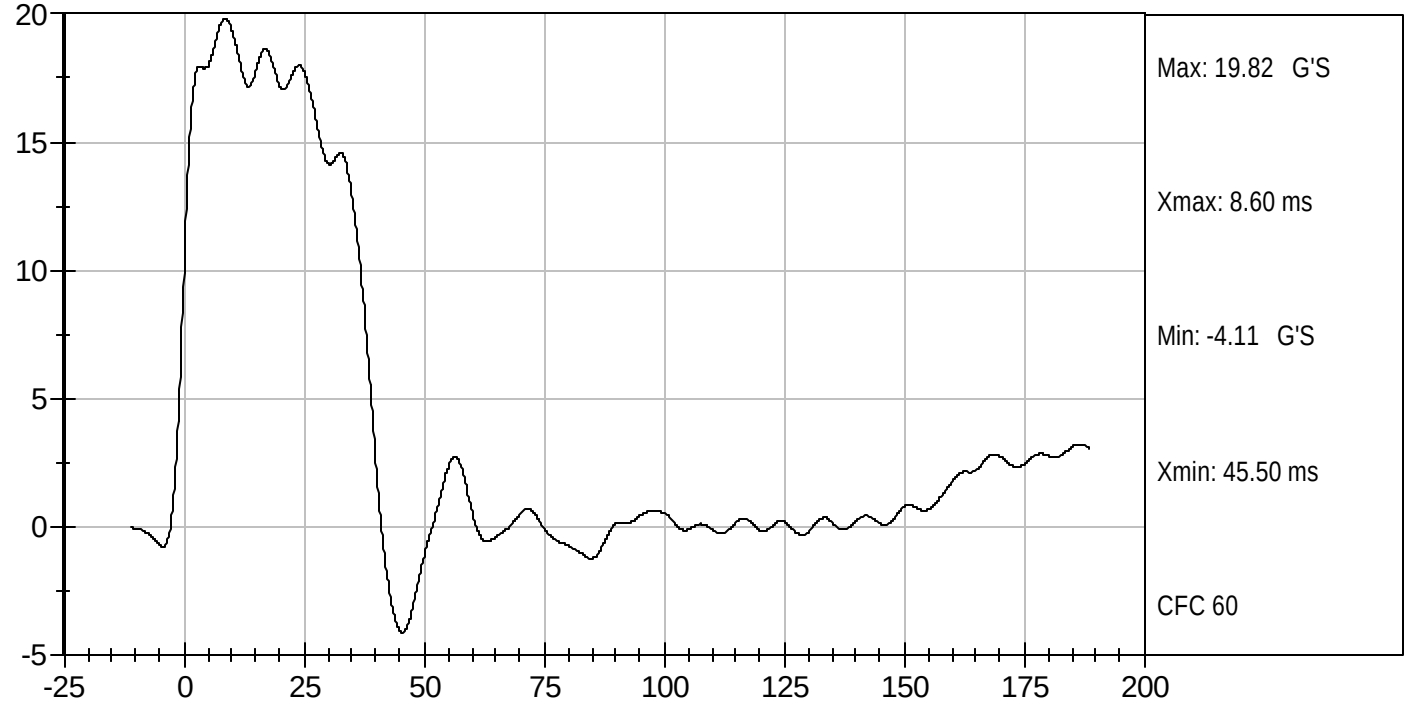
05/11/2006
Test Date

David Winkelbauer
Approved By

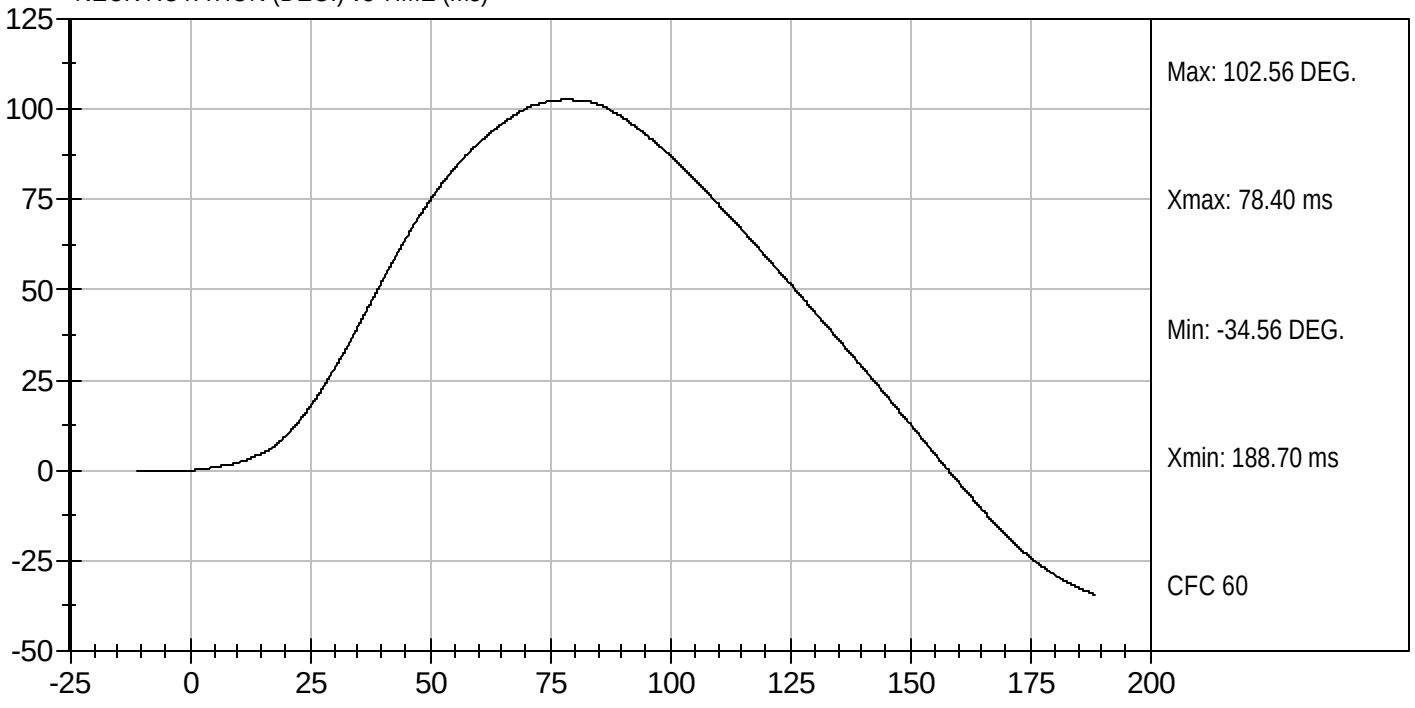
Test Desc: Neck Extension
Componet ID: D061273

Test Date: 05/11/2006
Velocity: 20.14 ft/s, 6.14 m/s

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



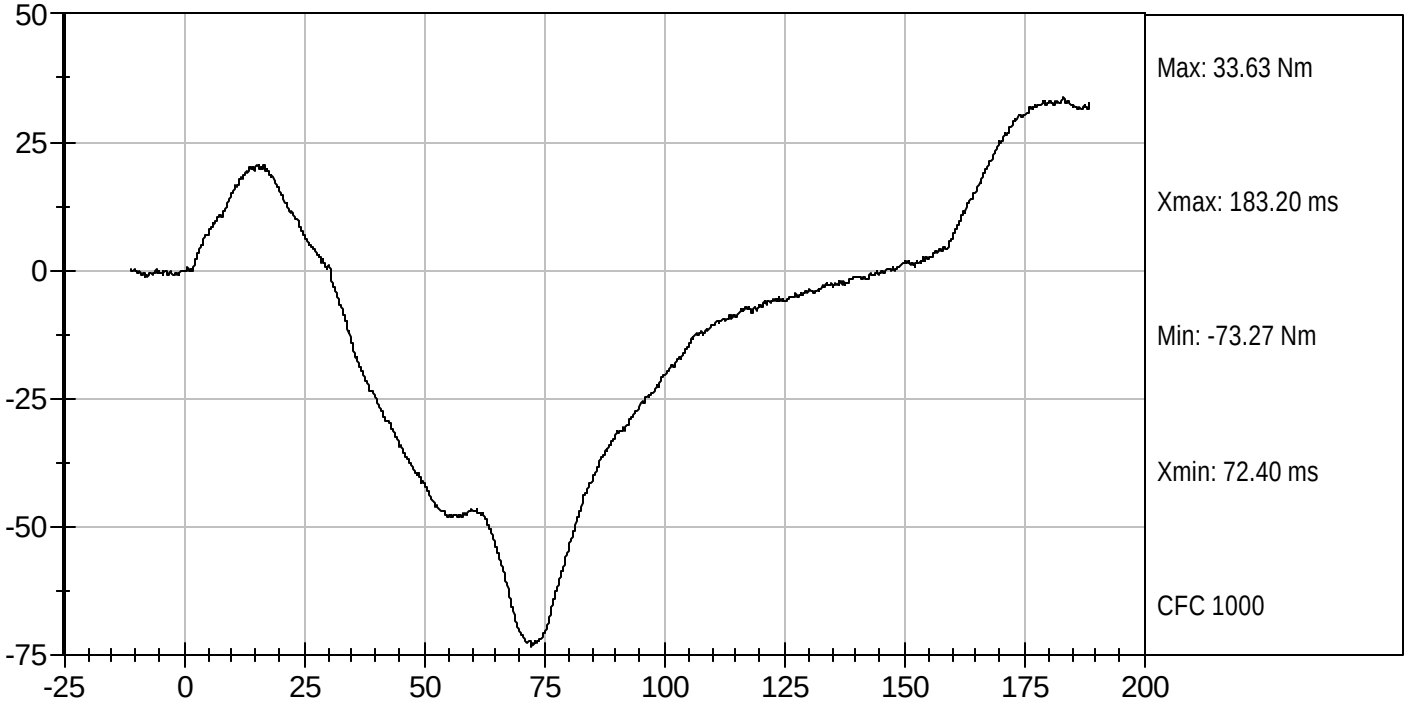
NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D061273

Test Date: 05/11/2006
Velocity: 20.14 ft/s, 6.14 m/s

OCCIPITAL MOMENT (Nm) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D061274

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	44	Pass
Probe Velocity	m/s	6.58 to 6.82	6.66	Pass
Peak Probe Force	N	5159 to 5893	5,754	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.10	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

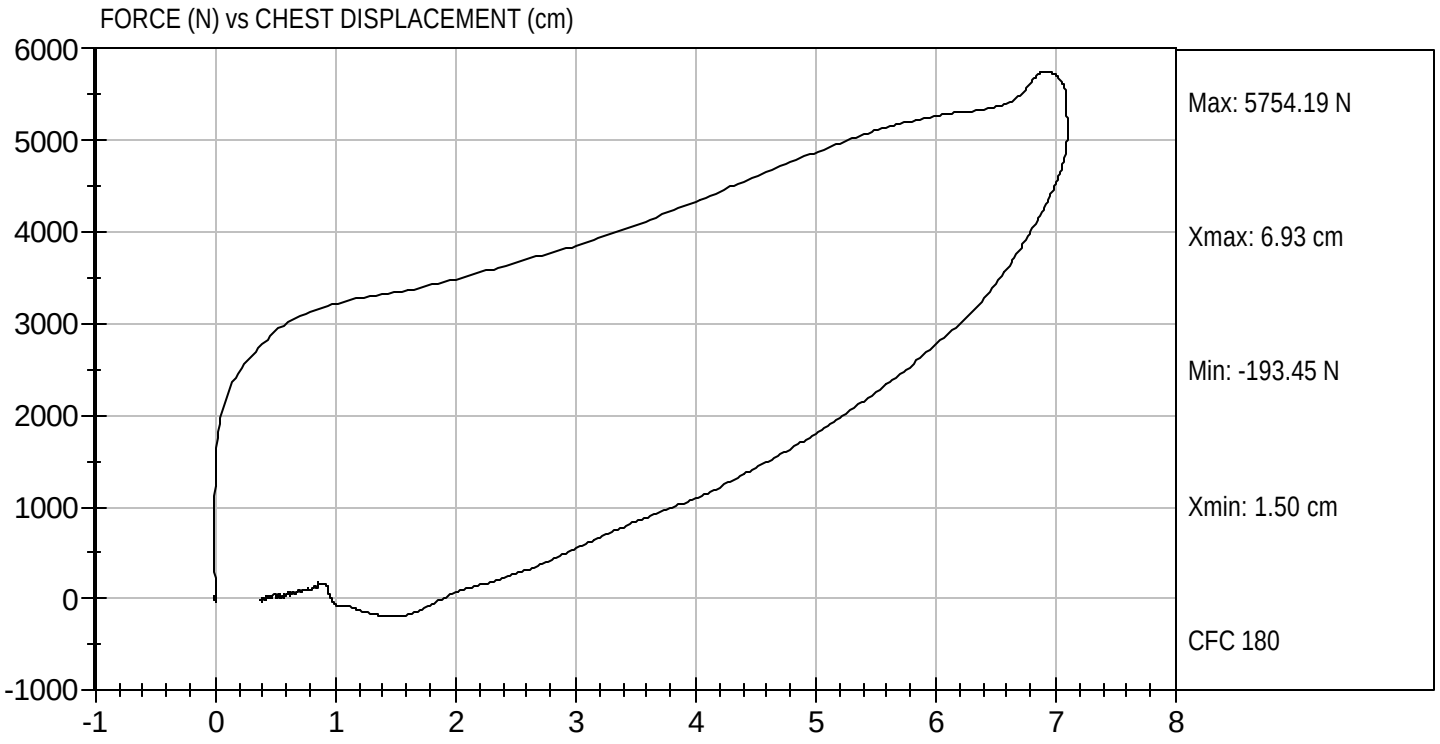
Tim Brady
Laboratory Technician

05/11/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Componet ID: D061274

Test Date: 05/11/2006
Velocity: 21.85 ft/s, 6.66 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D061275

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,317	Pass
		Overall Test Results		Pass

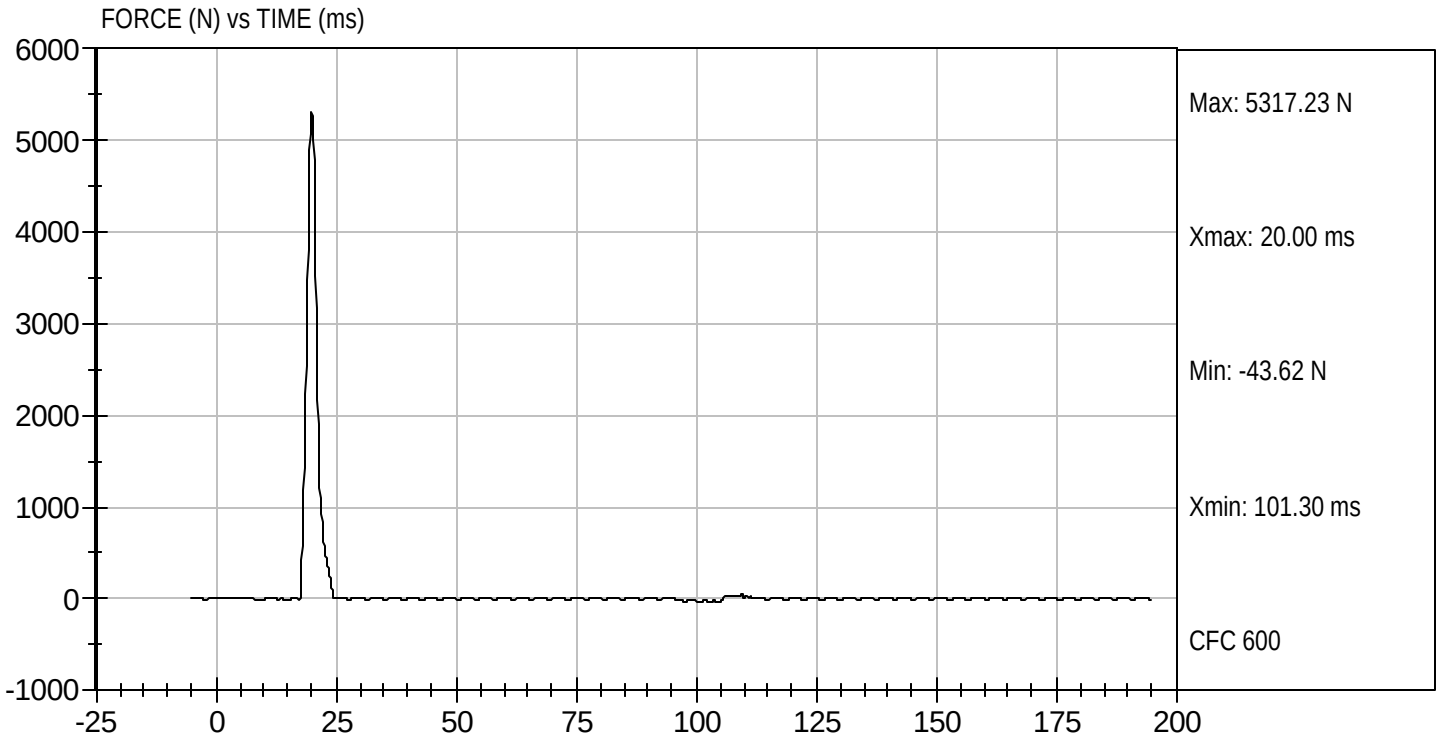
Tim Brady
Laboratory Technician

05/11/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D061275

Test Date: 05/11/2006
Velocity: 6.94 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D061276

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,699	Pass
		Overall Test Results		Pass

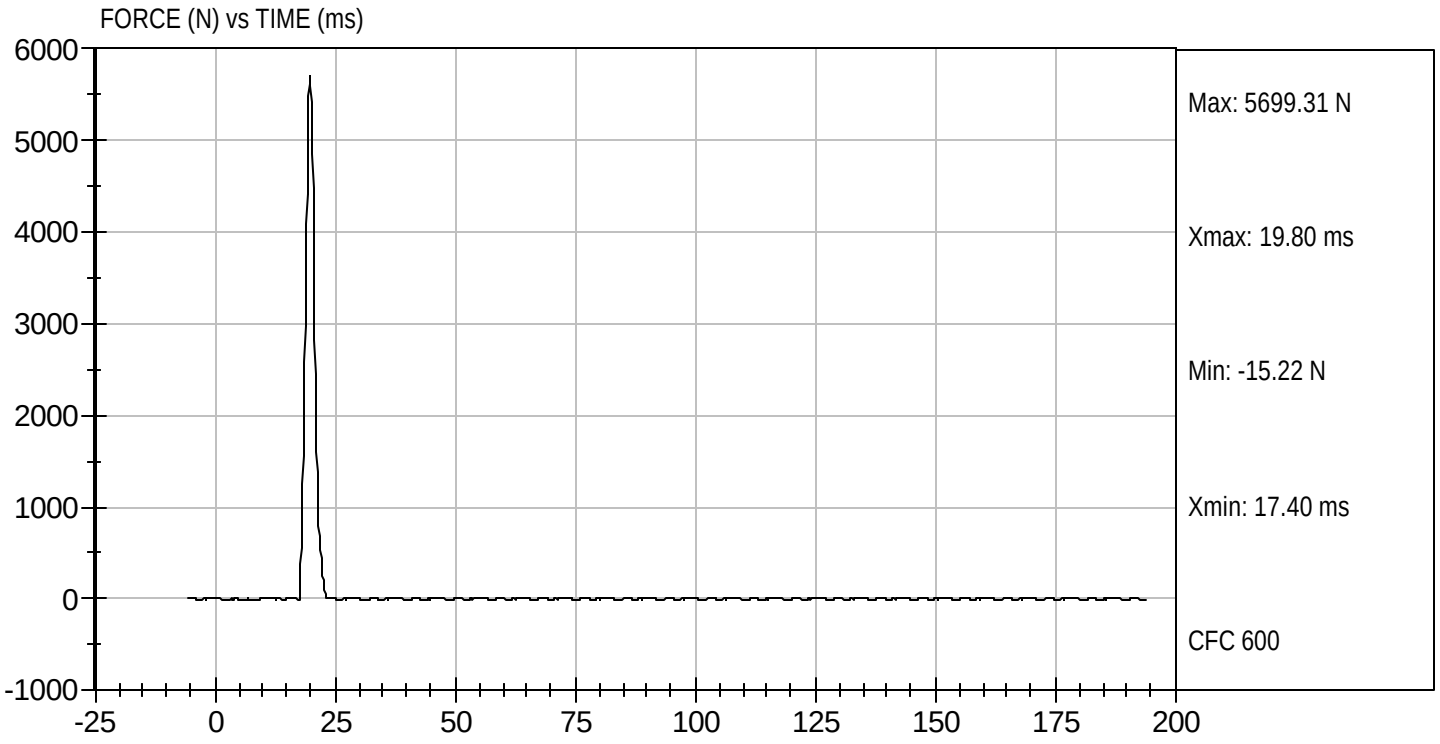
Tim Brady
Laboratory Technician

05/11/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D061276

Test Date: 05/11/2006
Velocity: 6.82 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D061270

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	48	48	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	83.6	75.4	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	43	Pass
		Overall Test Results			Pass

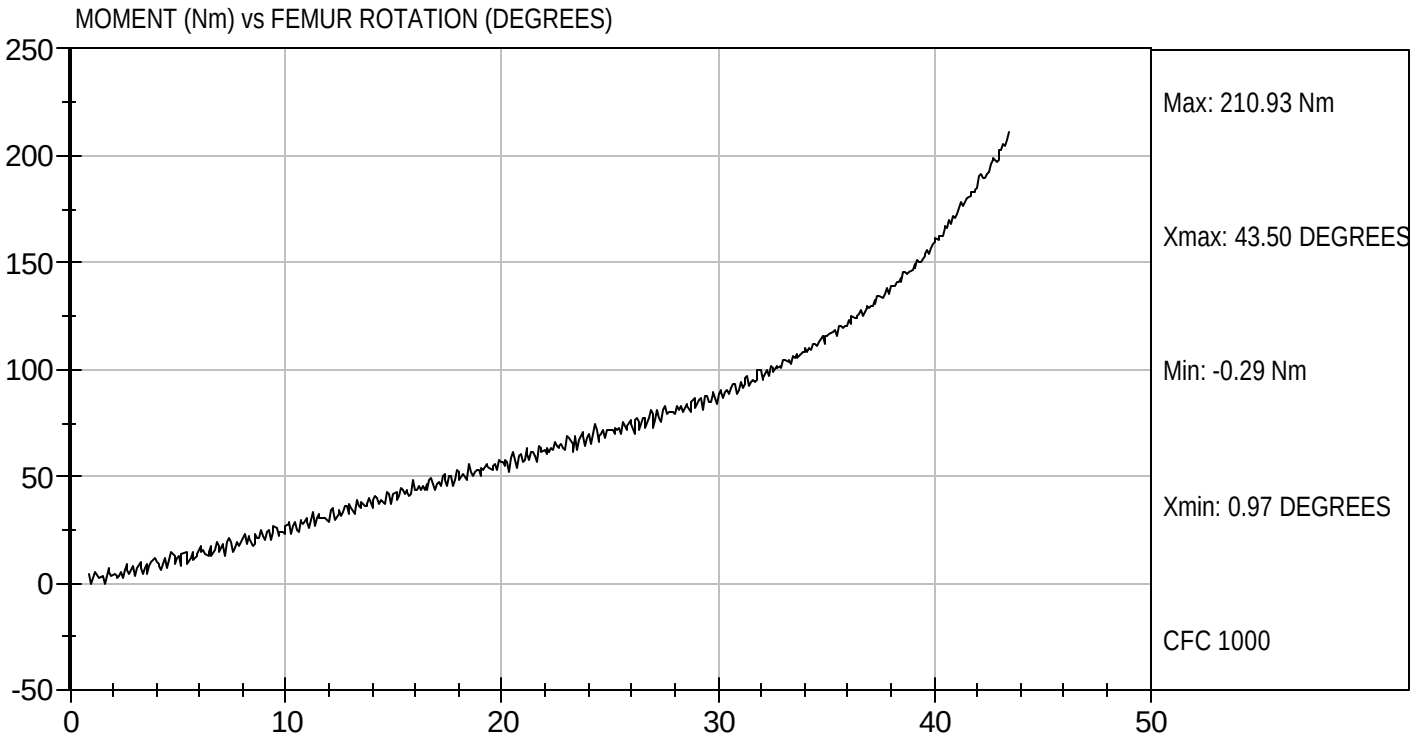
Laboratory Technician

05/11/2006
Test Date

Approved By

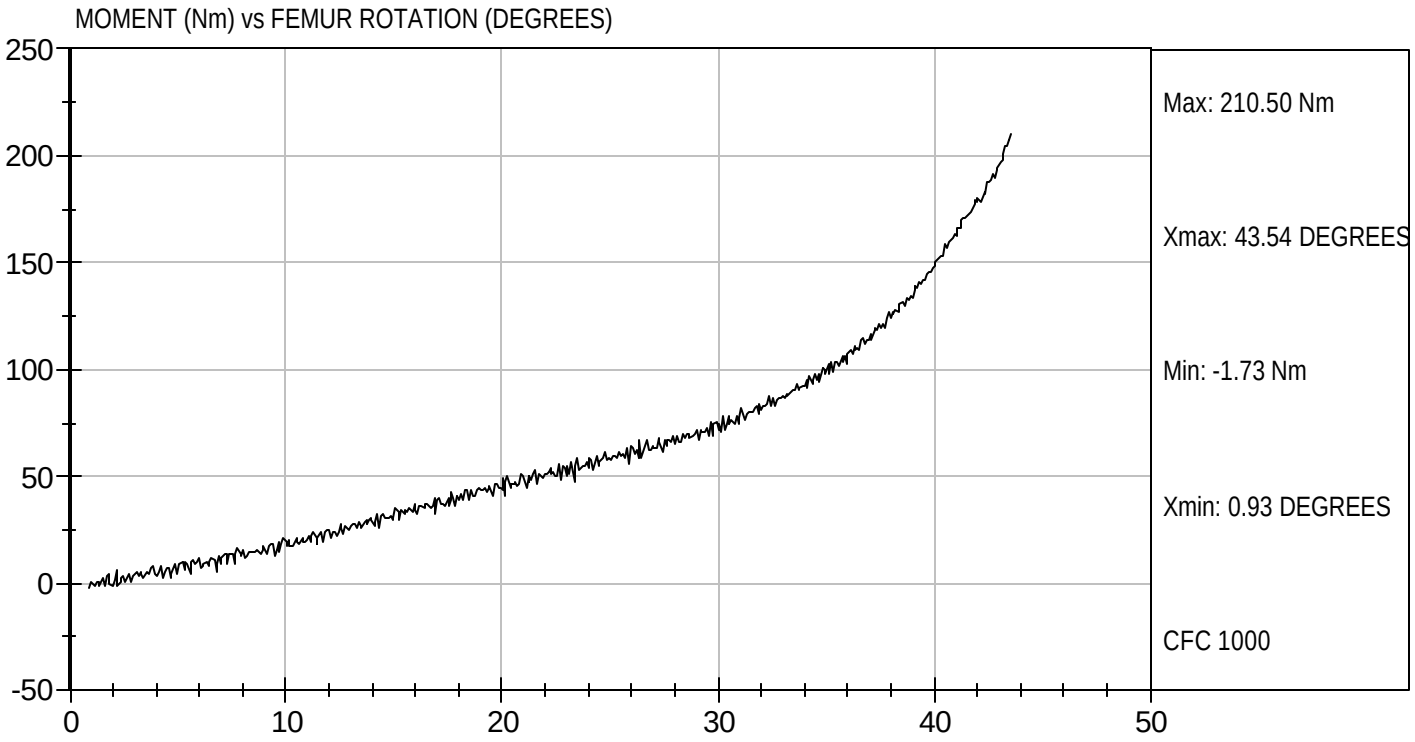
Test Desc: Hip Femur Flexion
Componet ID: D061279

Test Date: 05/11/2006
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D061270

Test Date: 05/11/2006
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test ID:** D061281

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	225 - 275	254	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

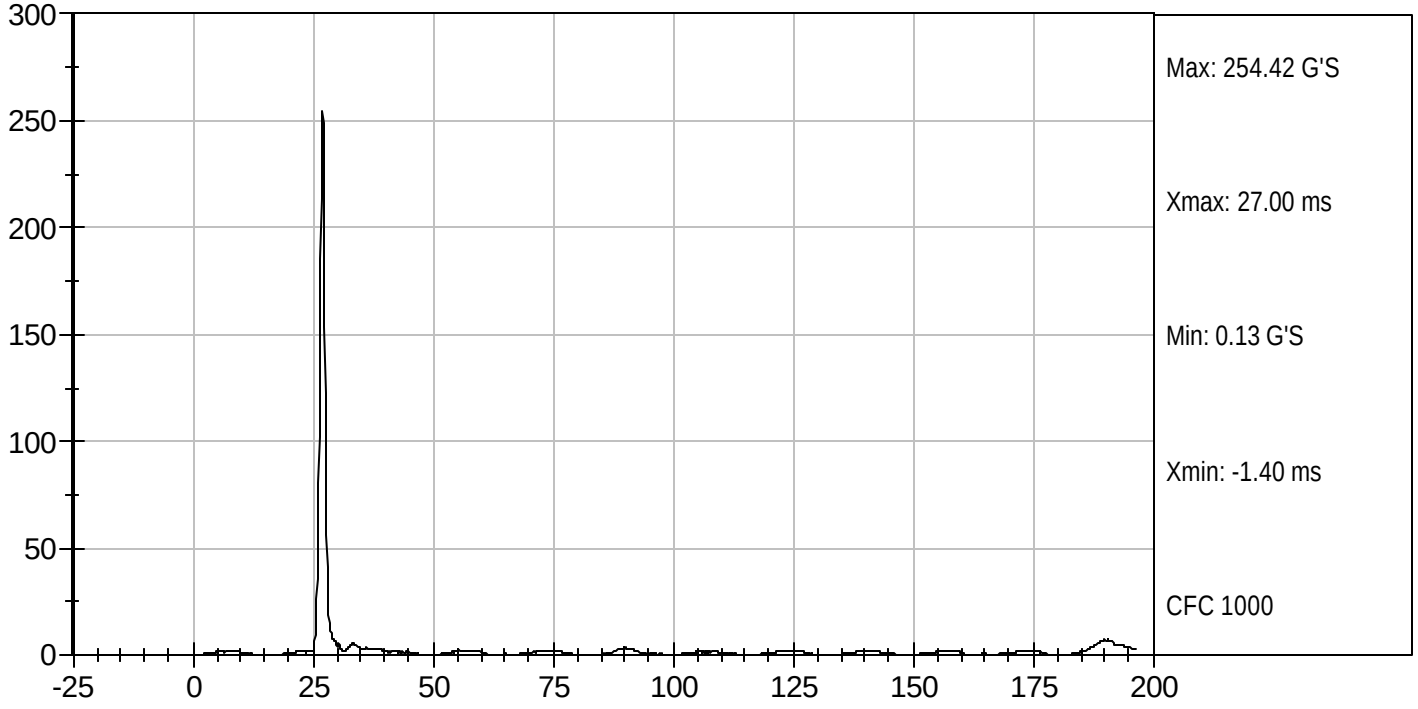
05/10/2006
Test Date

Approved By

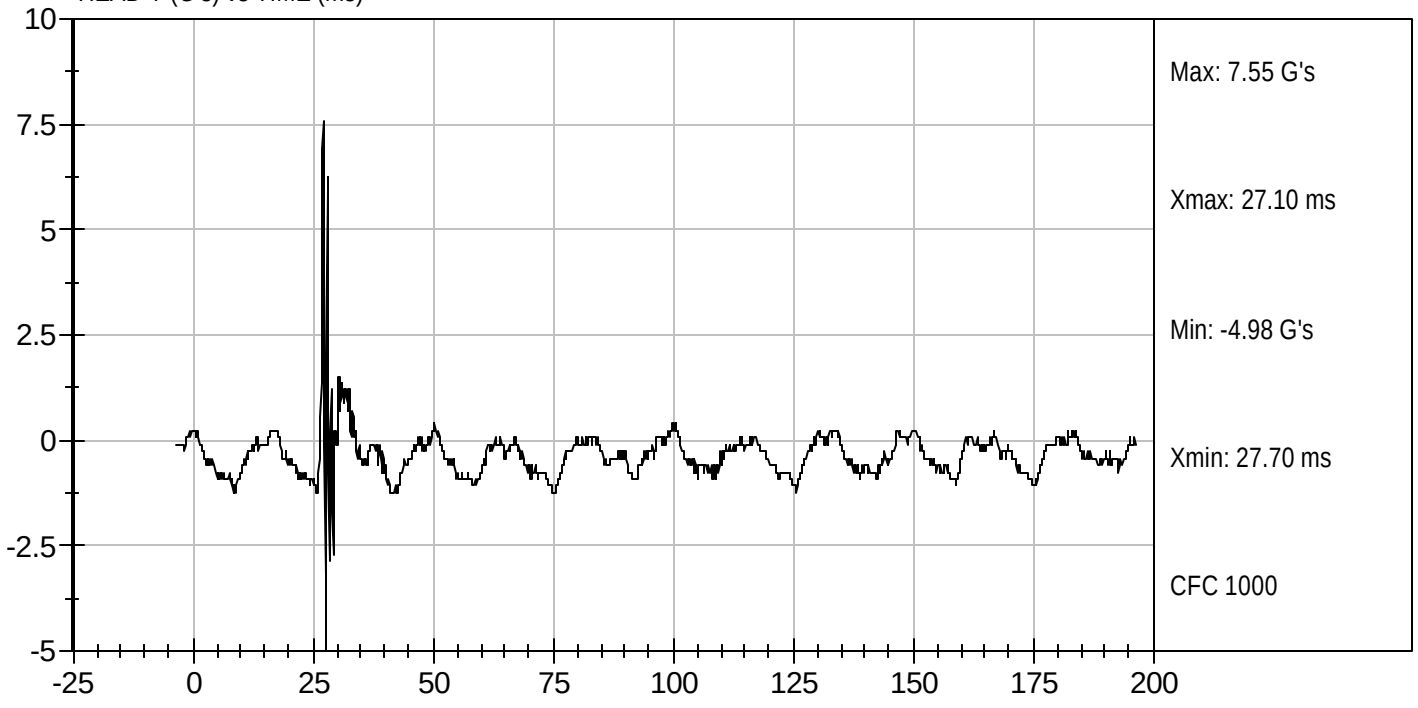
Test Desc: Head Drop
Componet ID: D061281

Test Date: 05/10/2006
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:** D061282

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	48	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.09	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	26.21	Pass
	20 msec	G's	17.60 to 22.60	20.79	Pass
	30 msec	G's	12.50 to 18.50	15.41	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.68	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	37.6	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	72.1	Pass
	Time	msec	57.0 to 64.0	59.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.2	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.8	Pass
	Time	msec	47.0 to 58.0	48.7	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.2	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

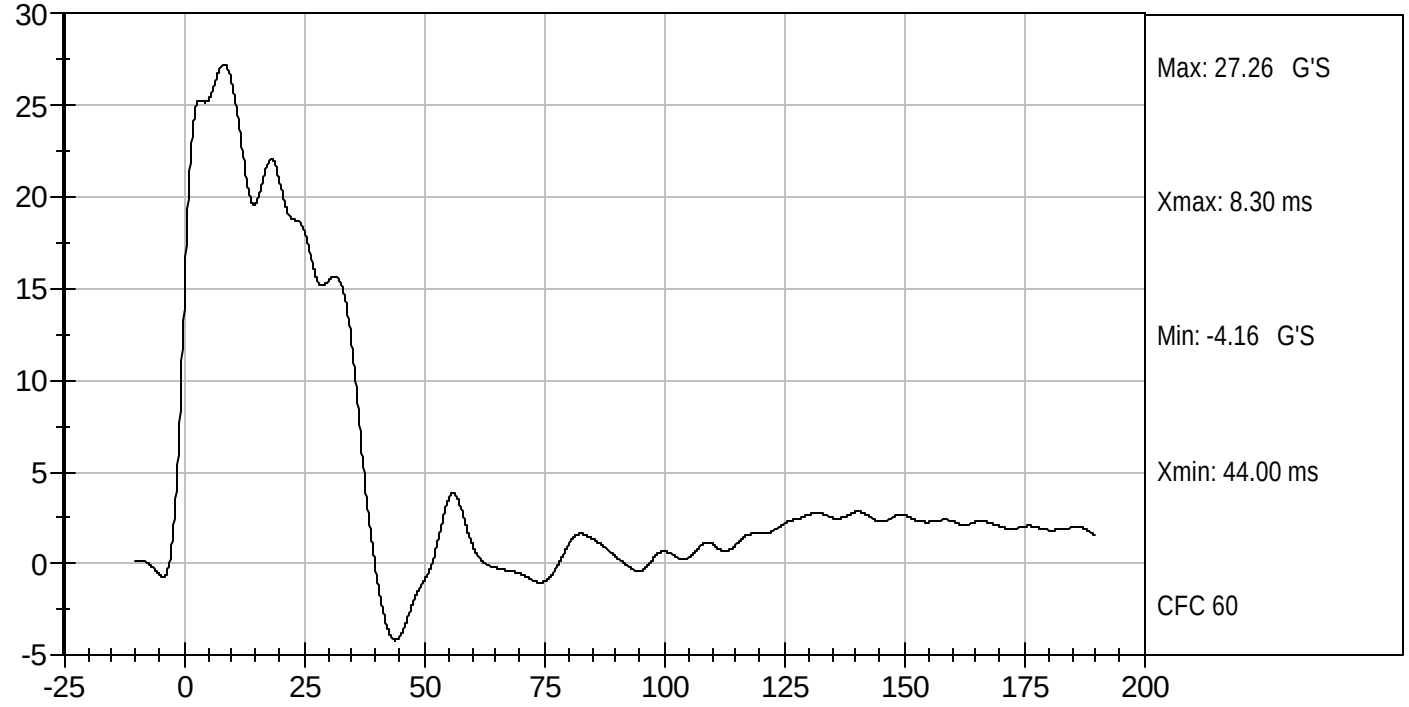
05/11/2006
Test Date

David Winkelbauer
Approved By

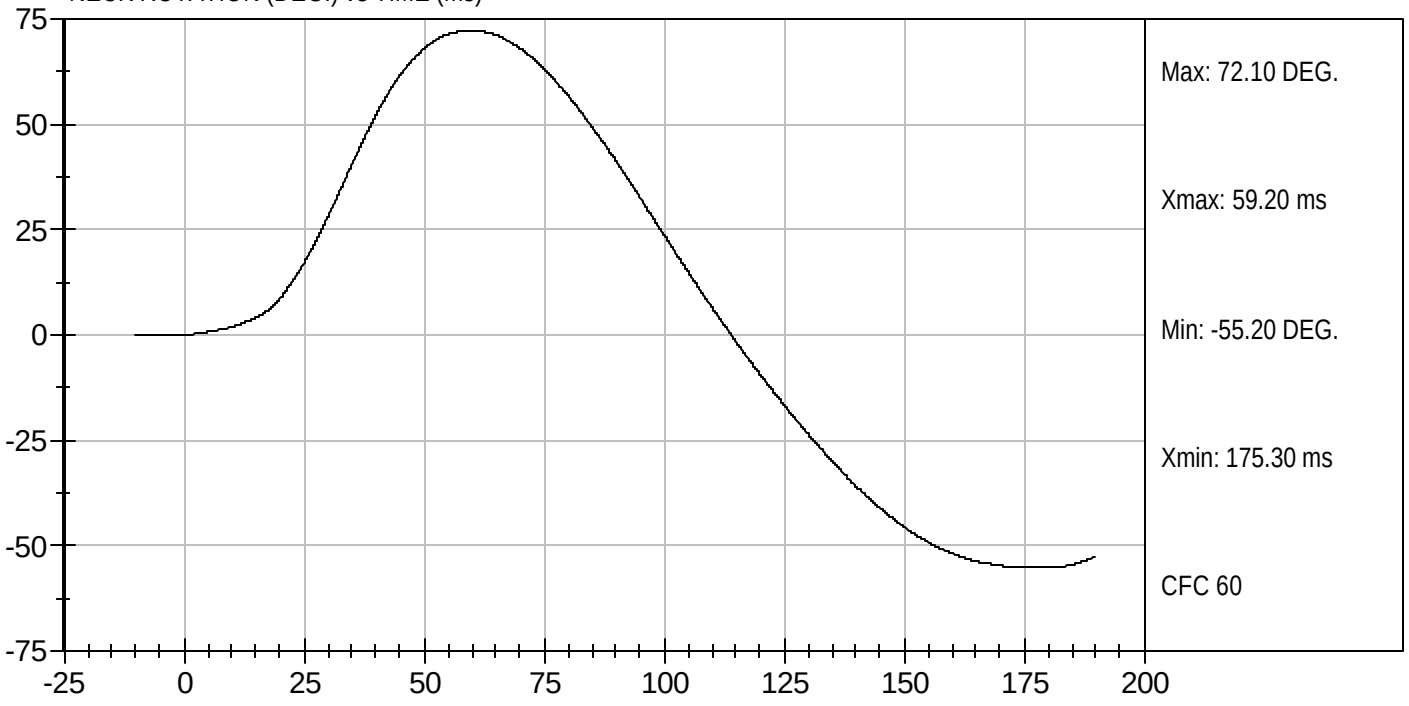
Test Desc: Neck Flexion
Componet ID: D061282

Test Date: 05/11/2006
Velocity: 23.26 ft/s, 7.09 m/s

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

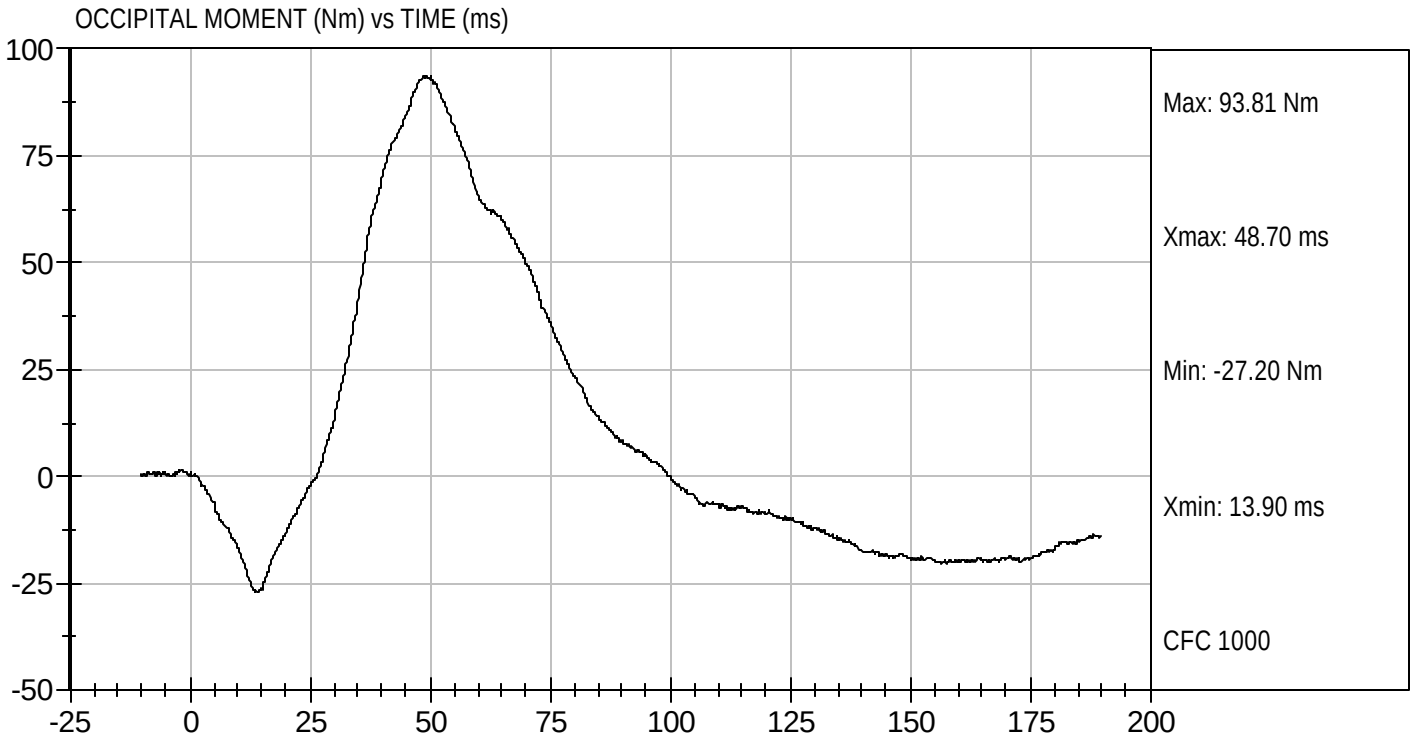


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D061282

Test Date: 05/11/2006
Velocity: 23.26 ft/s, 7.09 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D061283

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	47	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.14	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.74	Pass
	20 msec	G's	14.00 to 19.00	17.82	Pass
	30 msec	G's	11.00 to 16.00	13.57	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.56	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	40.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.1	Pass
	Time	msec	72.0 to 82.0	79.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	155.0	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-72.2	Pass
	Time	msec	65.0 to 79.0	72.0	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	140.7	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

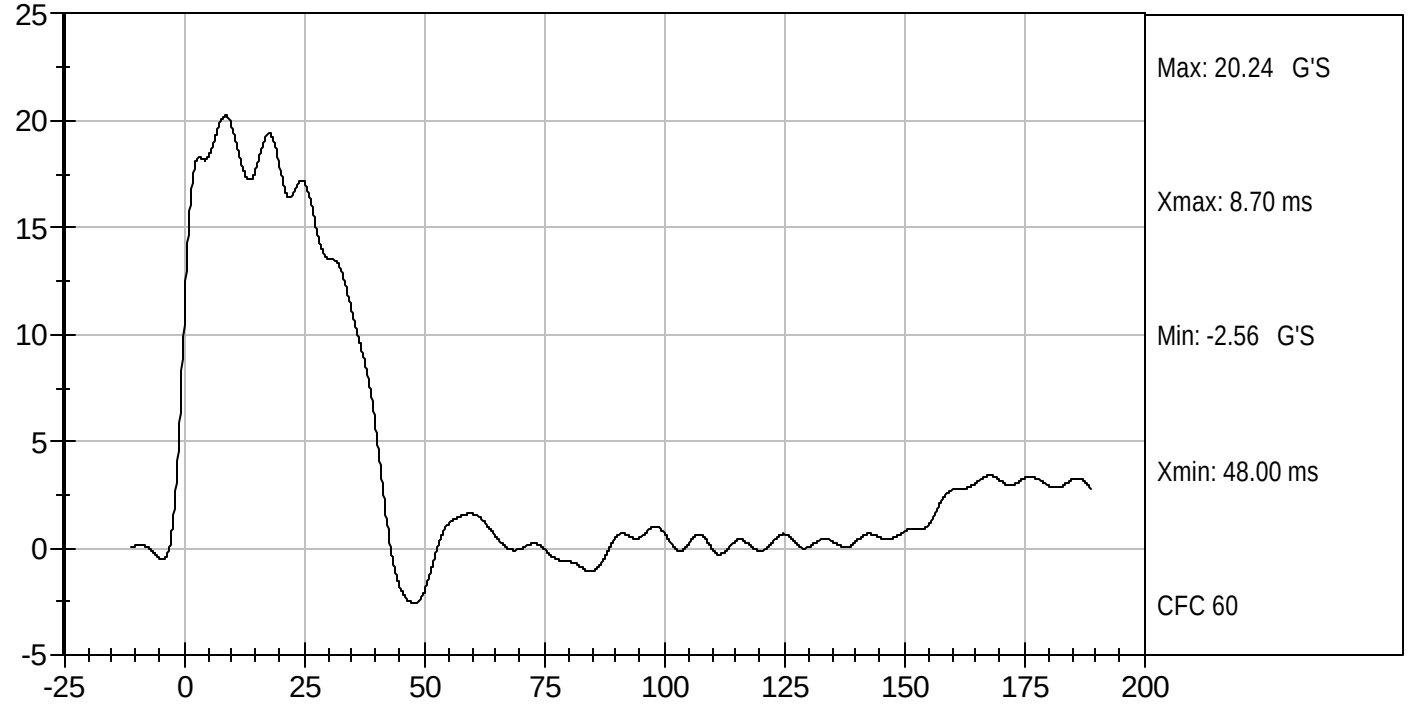
05/11/2006
Test Date

David Winkelbauer
Approved By

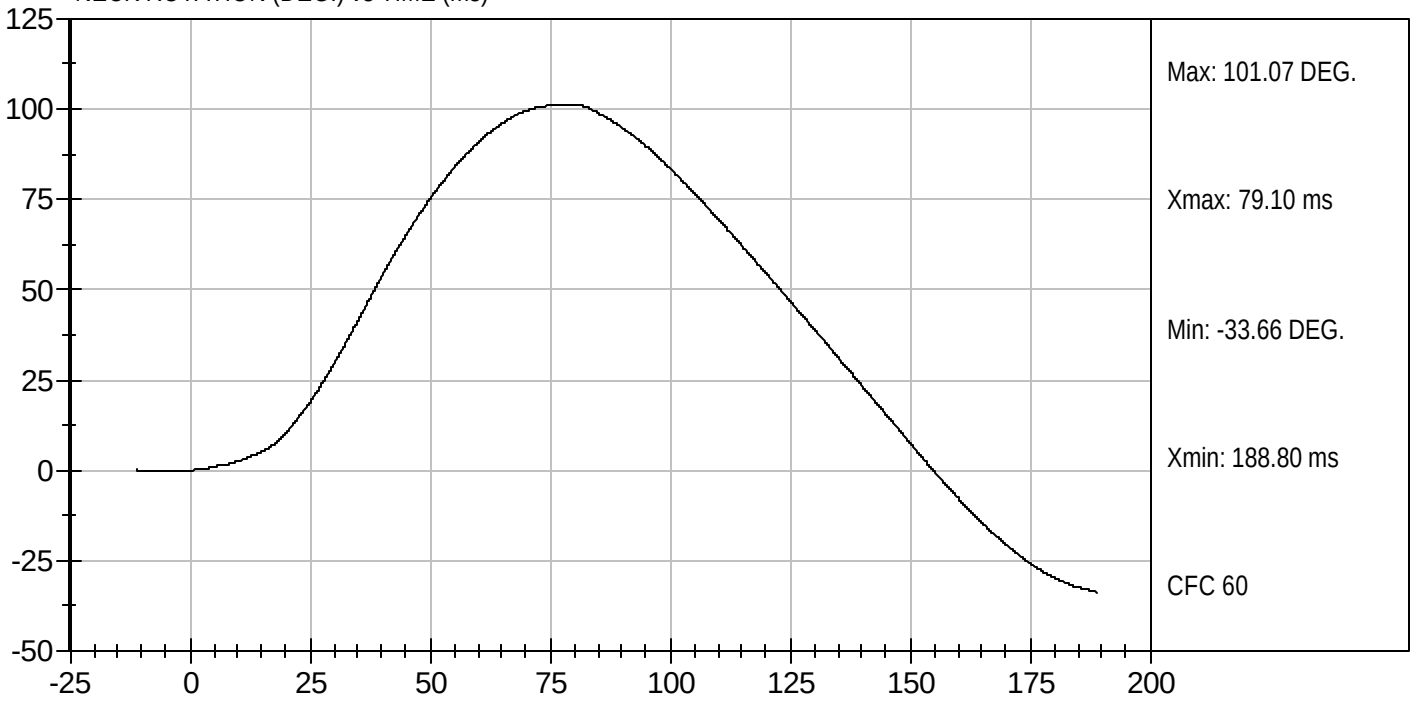
Test Desc: Neck Extension
Componet ID: D061283

Test Date: 05/11/2006
Velocity: 20.13 ft/s, 6.14 m/s

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



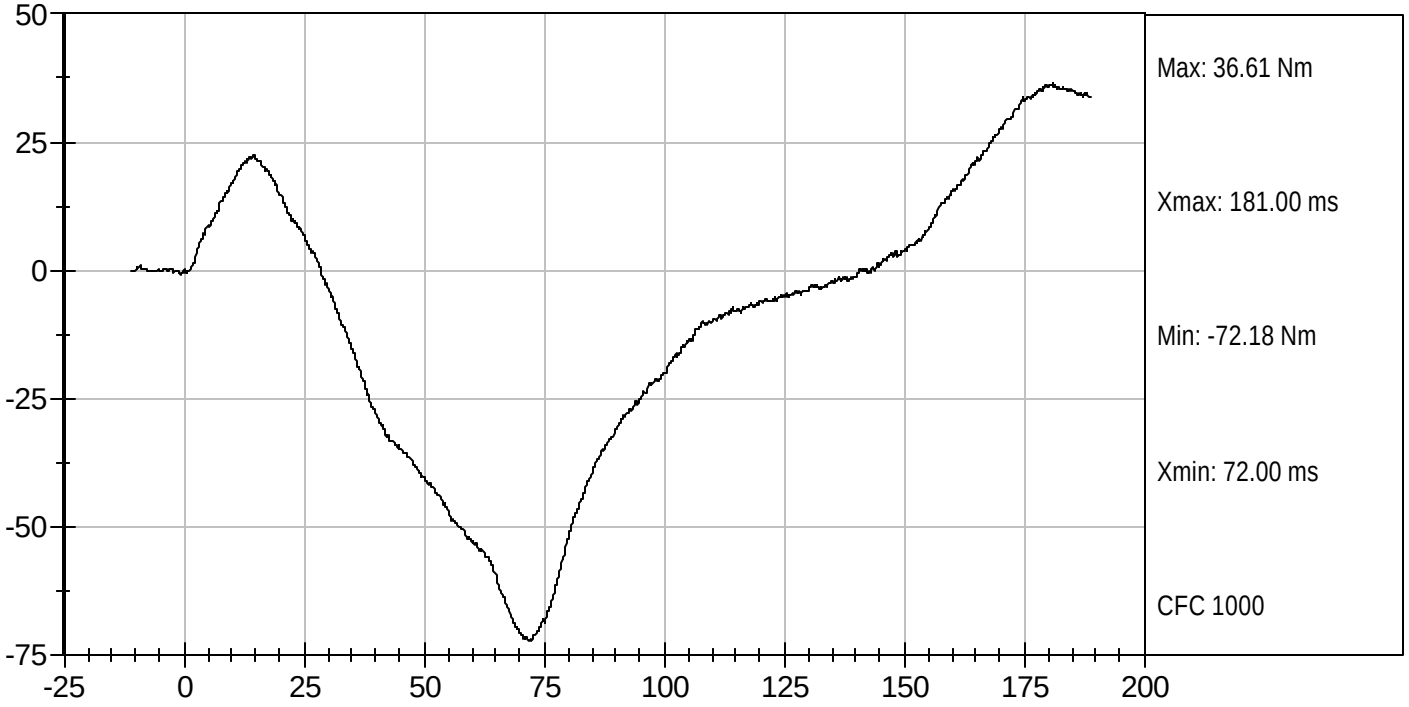
NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D061283

Test Date: 05/11/2006
Velocity: 20.13 ft/s, 6.14 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:** D061284

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	43	Pass
Probe Velocity	m/s	6.58 to 6.82	6.67	Pass
Peak Probe Force	N	5159 to 5893	5,499	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.08	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

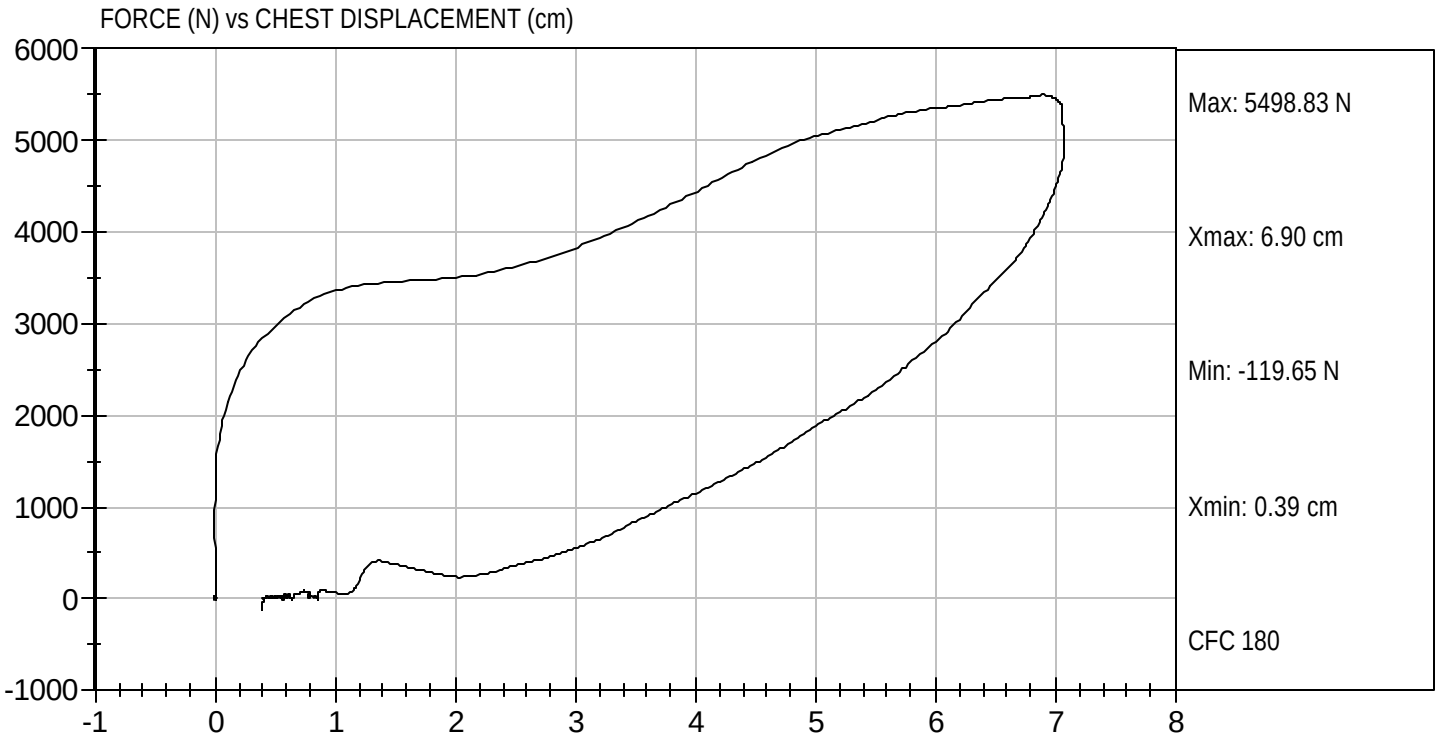
Tim Brady
Laboratory Technician

05/11/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Componet ID: D061284

Test Date: 05/11/2006
Velocity: 21.87 ft/s, 6.67 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D061285

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,561	Pass
		Overall Test Results		Pass

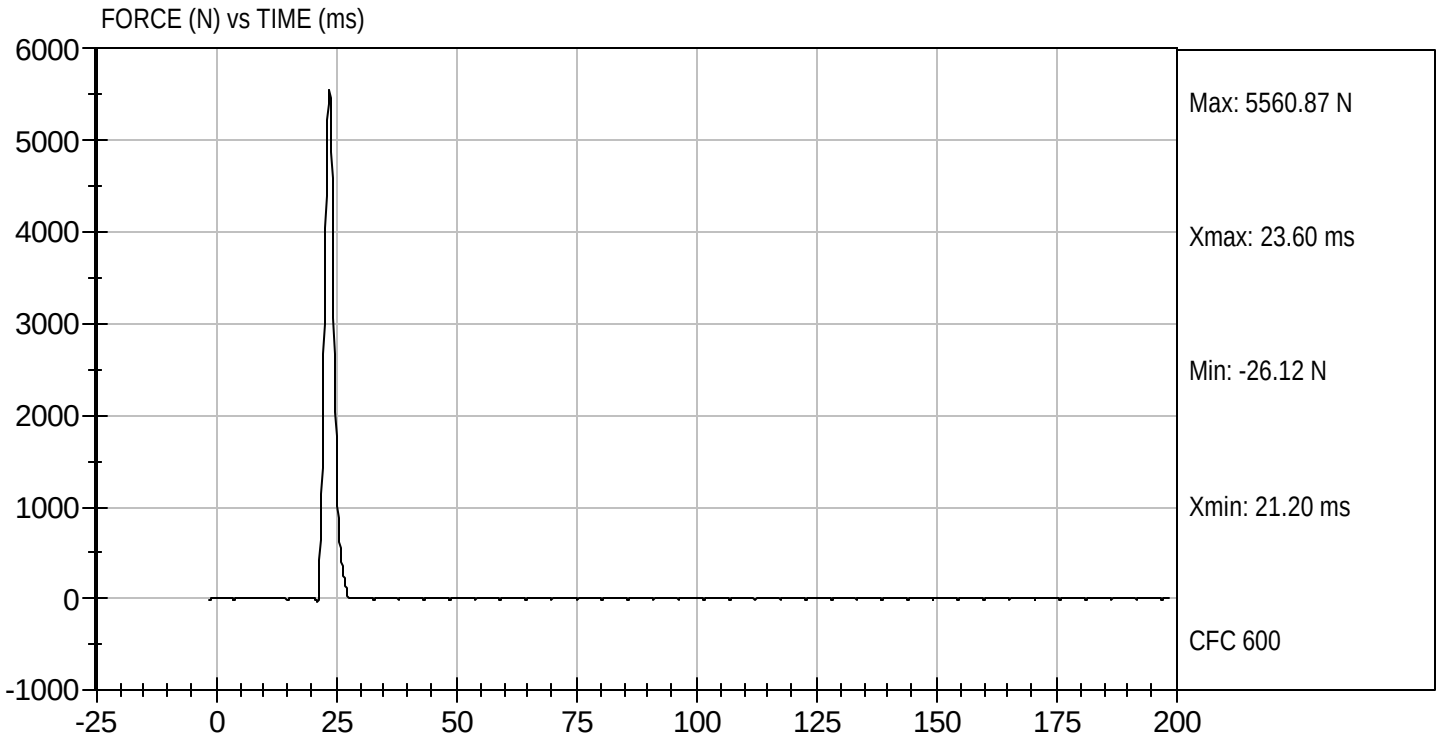
Tim Brady
Laboratory Technician

05/11/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D061285

Test Date: 05/11/2006
Velocity: 6.91 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D061286

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,054	Pass
		Overall Test Results		Pass

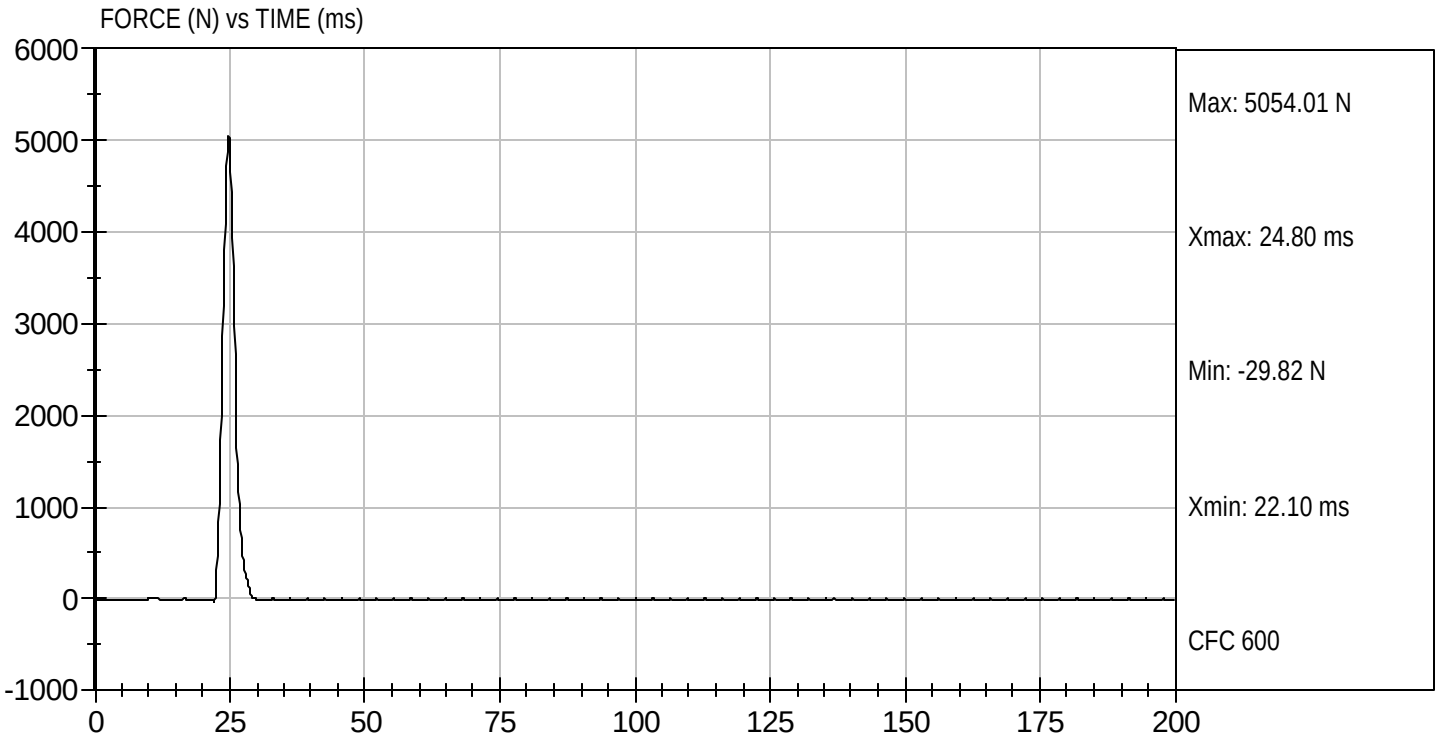
Tim Brady
Laboratory Technician

05/11/2006
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D061286

Test Date: 05/11/2006
Velocity: 6.93 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D061280

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.7	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	47	47	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	88.4	81.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	42	Pass
		Overall Test Results			Pass

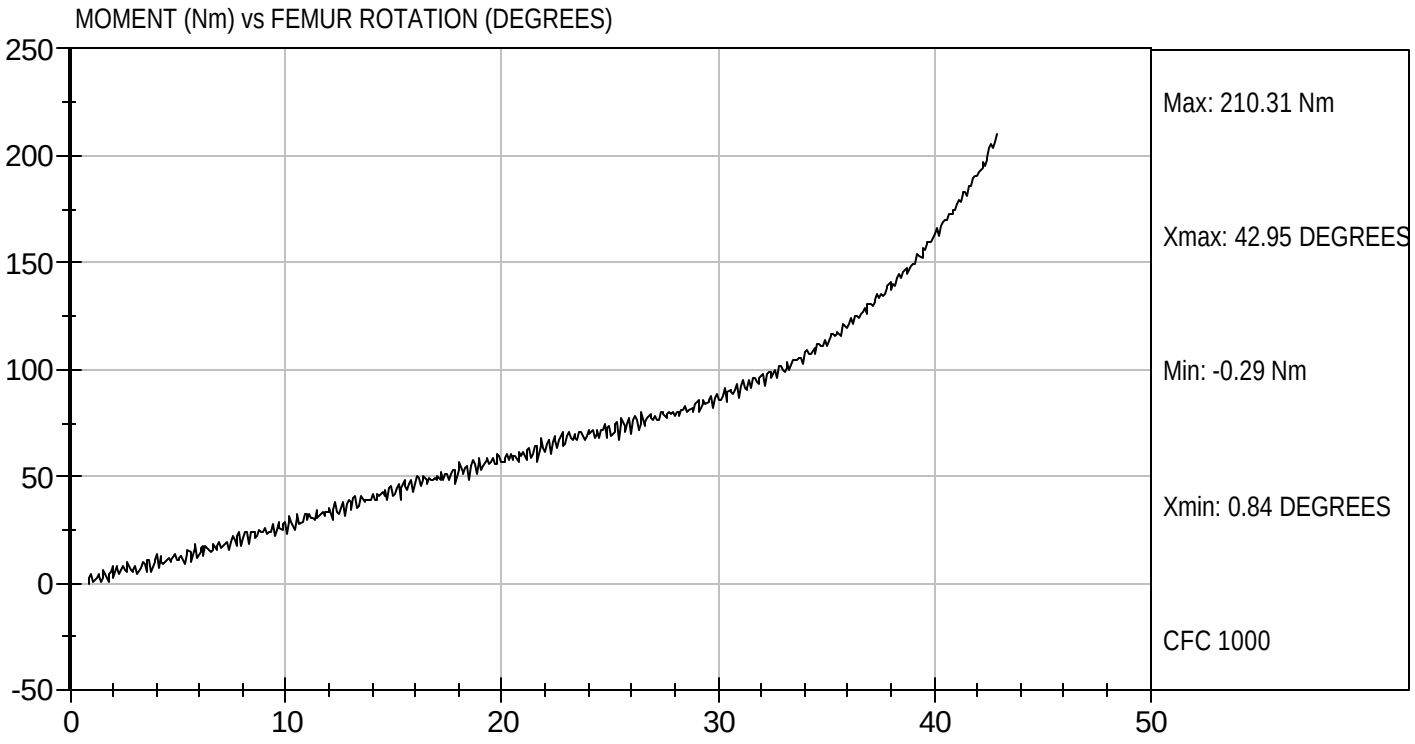
Laboratory Technician

05/11/2006
Test Date

Approved By

Test Desc: Hip Femur Flexion
Componet ID: D061289

Test Date: 05/11/2006
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D061280

Test Date: 05/11/2006
Velocity: 0 ft/s, 0.00 m/s