REPORT NUMBER: NCAP-MGA-2008-002

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

DAIMLERCHRYSLER CORPORATION
2008 DODGE GRAND CARAVAN SE
NHTSA NUMBER: M80307

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

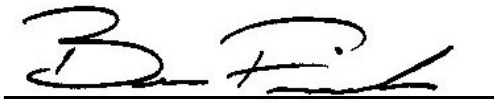
Test Date: August 30, 2007

Final Report Date: September 26, 2007

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
1200 NEW JERSEY AVENUE, SE, ROOM W43-410
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: 9/26/07
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Technical Report Documentation Page

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15. Supplementary Notes			

16. Abstract

A frontal barrier impact was conducted on a 2008 Dodge Grand Caravan SE at MGA Research Corporation on August 30, 2007. 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 615 mm located at 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	477	386
Max. Thorax Accel. (3ms Clip)	G's	60	38	38
Left Femur Force	Newton	10009	-3661	-3903
Right Femur Force	Newton	10009	-2651	-3560

17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2008 Dodge Grand Caravan SE NHTSA No: M80307		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Adm. Technical Ref. Division, 1200 New Jersey Ave, SE 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 DTNH22-06-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 2008 Dodge Grand Caravan SE at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on August 30, 2007. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and sixteen 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 615 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 bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest and headliner/visor. 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	477	58.6	94.6	38	70.2	73.2	-31	-3661	-2651
Passenger	386	71.1	107.1	38	73.4	76.4	-27	-3903	-3560

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

TEST NOTES

None

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2008 Dodge Grand Caravan SE
Test Program: 35mph Frontal Impact
NHTSA No.: M80307
Test Date: 8/30/2007

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		
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None
Glazing Damage	The windshield cracked.	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1973
Center	mm	1928
Right Side	mm	1987
Average	mm	1963

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	905	877
Lap belt length as measured on ATD	mm	641	662
Remainder of belt on reel	mm	737	845
Total belt length for continuous webbing systems	mm	2283	2384

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 Dodge Grand Caravan SE
Test Program: 35mph Frontal Impact
NHTSA No.: M80307
Test Date: 8/30/2007

TEST VEHICLE INFORMATION

Manufacturer	Dodge
Model	Grand Caravan SE
Body Style	MPV
NHTSA No.	M80307
VIN	2D8HN44H68R104829
Color	Stone White
Delivery Date	8/16/2007
Odometer Reading (mile)	88
Dealer	Frank Boucher
Transmission	Automatic
Final Drive	Front
Number of Cylinders	6
Engine Displacement (L)	3.3
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	Yes
Driver Side Torso Airbag	No
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	No
All Wheel Drive	No
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	DaimlerChrysler Corporation
Date of Manufacture	8-07

GVWR (kg)	2745
GAWR Front (kg)	1339
GAWR Rear (kg)	1407

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bucket	Split Bench	
Number of Occupants	2	3	2	7
Capacity Wt. (VCW) (kg)				521
Cargo Wt. (RCLW) (kg)				45

DATA SHEET NO. 2... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	568.8	448.2		618.7	495.3	
Right	kg	544.8	454.5		570.2	525.3	
Ratio	%	55.2	44.8		53.8	46.2	
Totals	kg	1113.6	902.7	2016.3	1188.9	1020.6	2209.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2016.3
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	2217.3

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	782	781	788	788	1376
As Tested	mm	767	767	755	756	1420
Post Test	mm	795	771	791	737	

Vehicle Wheelbase (mm): 3074

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

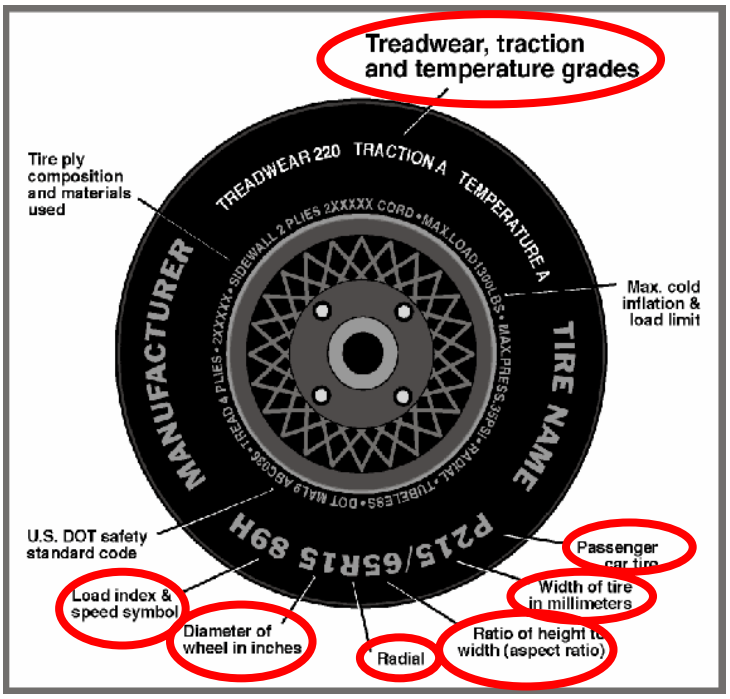
Vehicle Components Removed: Third row seats, right taillight, rear carpet, Jack, spare tire

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	250	250
Recommended Tire Size	P225/65R16	P225/65R16
Tire Size on Vehicle	P225/65R16	P225/65R16
Tire Manufacturer	Yokohama	Yokohama
Tire Name	AVID S33	AVID S33
Tire Type	Passenger	Passenger
Tire Width (mm)	225	225
Ratio of Height to Width (aspect ratio)	65	65
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	100S	100S
Treadwear	460	460
Traction Grade	B	B
Temperature Grade	B	B

DATA SHEET NO. 4

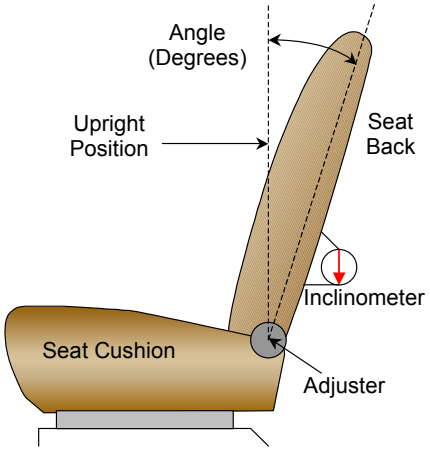
TEST VEHICLE INFORMATION

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: 15.44 degrees (measured to flat on back of frame)

Driver seat back angle: 16.0 degrees
Passenger seat back angle: 15.0 degrees



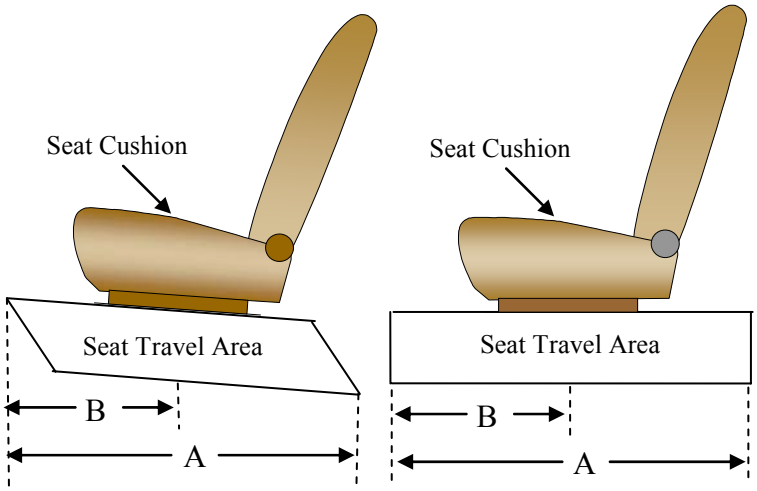
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	33 detents	16th detent (1st as 0)
Passenger Seat	33 detents	16th detent (1st as 0)

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were placed in the second position with the uppermost detent defined as 0. (mid position)



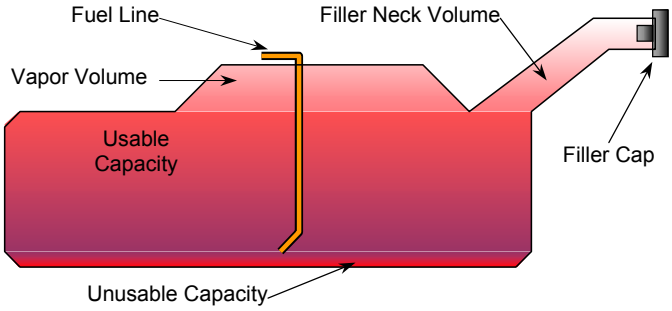
DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	75.7
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	69.6 – 71.2
Actual Amount of Solvent used	70.8
1/3 of Usable Capacity	25.2

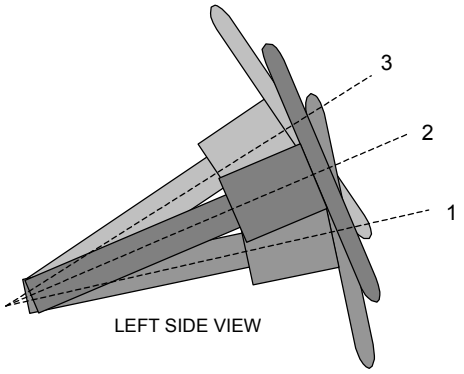
The test vehicle is equipped with an electric fuel pump. For the fuel pump to pump fuel, the engine must be running.



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

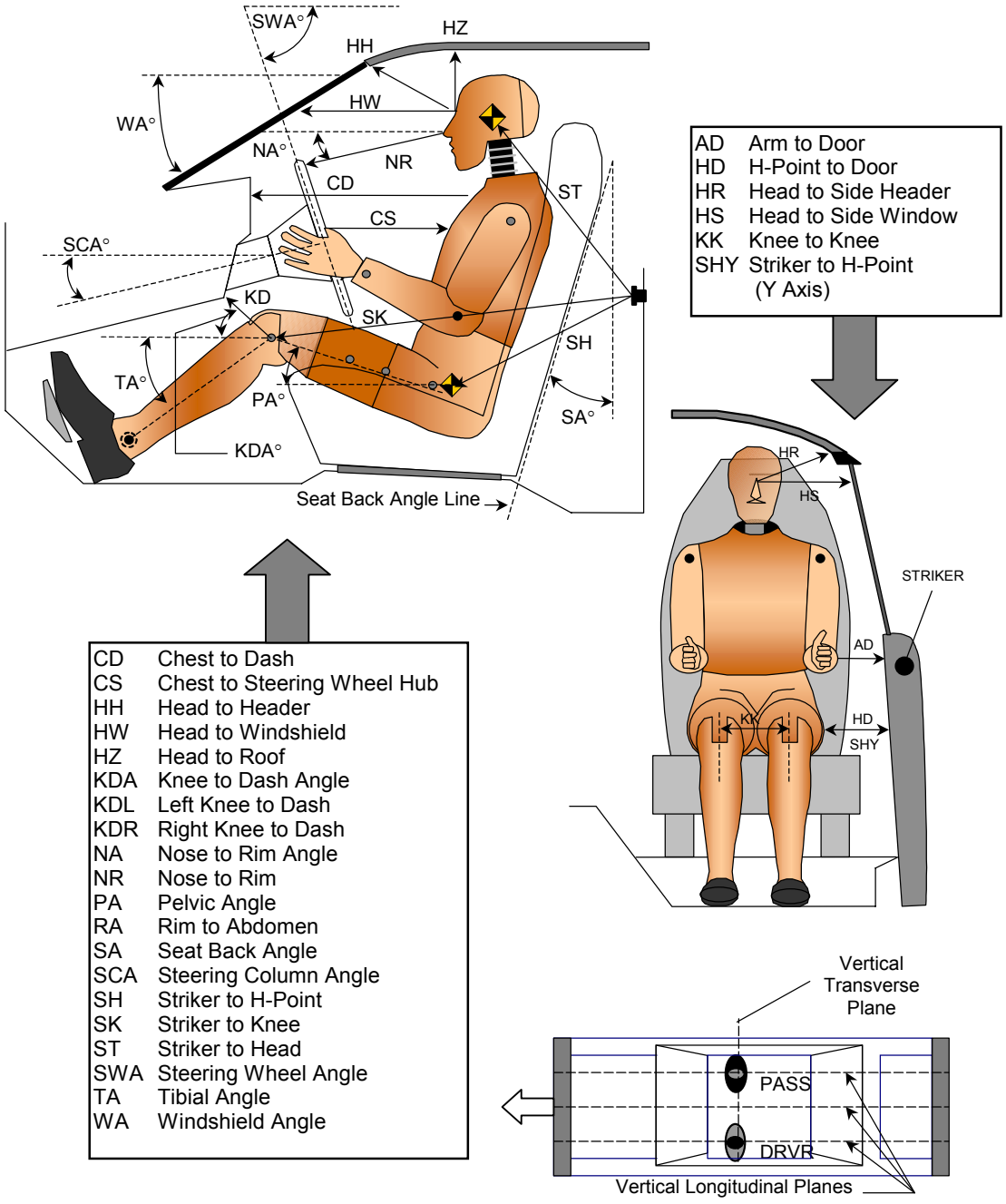
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		20.7
Geometric center position No. 2		23.8
Uppermost position No. 3		26.8

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

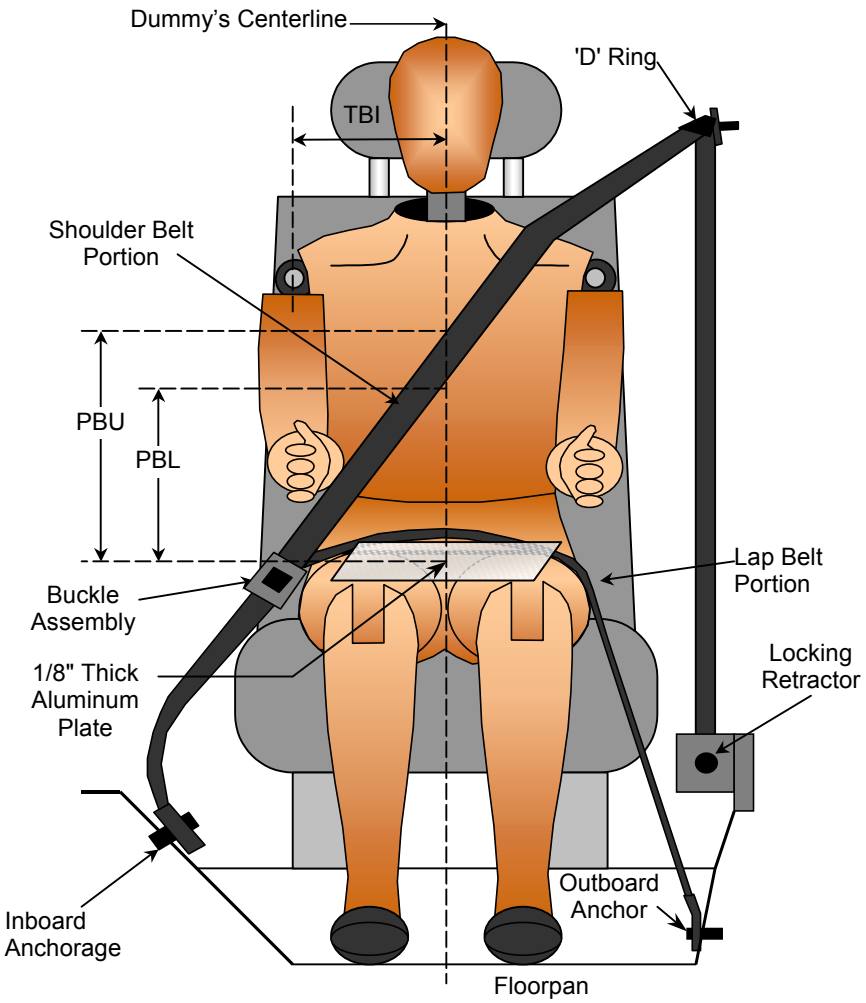
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		30.4		
SWA	Steering Wheel Angle		23.8		
SCA	Steering Column Angle		25.1		
SA	Seat Back Angle (on headrest post)		15.6		15.4
HZ	Head to Roof (Z)	192	90	178	90
HH	Head to Header	326	23.8	321	23.4
HW	Head to Windshield	673	0	652	0
HR	Head to Side Header (Y)	252		241	
NR	Nose to Rim	387	15.3		
CD	Chest to Dash	527		501	
CS	Chest to Steering Hub	318	12.0		
RA	Rim to Abdomen	182	0		
KDL	Left Knee to Dash	148	33.4	112	
KDR	Right Knee to Dash	132		118	39.8
PA	Pelvic Angle		22.4		21.6
TA	Tibia Angle		52.1		59.2
KK	Knee to Knee (Y)	345		268	
SK	Striker to Knee	610	81.2	634	83.0
ST	Striker to Head	677	10.9	674	10.8
SH	Striker to H-Point	220	87.0	220	95.6
SHY	Striker to H-Point (Y)	299		280	
HS	Head to Side Window	379		381	
HD	H-Point to Door (Y)	120		108	
AD	Arm to Door (Y)	143		133	
AA	Ankle to Ankle	355		231	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2008 Dodge Grand Caravan SE
Test Program: 35mph Frontal Impact
NHTSA No.: M80307
Test Date: 8/30/2007



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	329	329
PBL - To surface of reference to belt lower edge	mm	245	245

DATA SHEET NO. 7

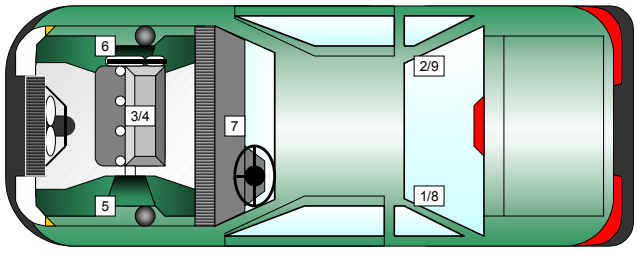
VEHICLE ACCELEROMETER LOCATIONS

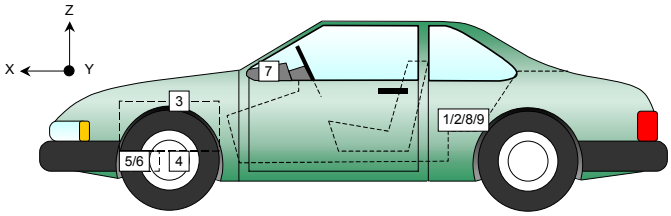
Test Vehicle: 2008 Dodge Grand Caravan SE
Test Program: 35mph Frontal Impact
NHTSA No.: M80307
Test Date: 8/30/2007

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	2192	-695	485
2	Right Rear X-Member X	2212	695	485
3	Engine Top X	4360	-80	948
4	Engine Bottom X	4392	0	257
5	Left Brake Caliper X	4292	-751	236
6	Right Brake Caliper X	4292	751	236
7	Instrument Panel X			
8	Left Rear X-Member Z	2192	-695	485
9	Right Rear X-Member Z	2212	695	485

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: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

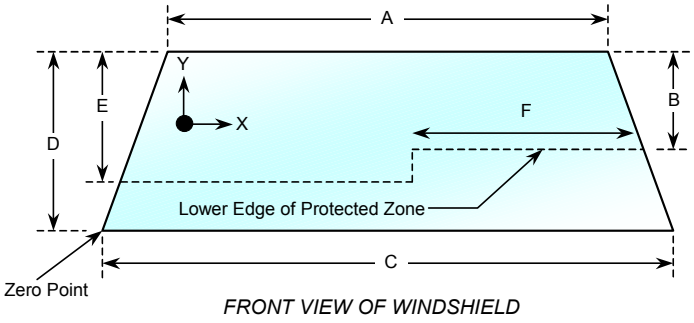
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2458	2458	100
Right Side	2458	2458	100
Total	4916	4916	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1422
B	mm	587
C	mm	1726
D	mm	884
E	mm	584
F	mm	575

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: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 5:55 pm

Stoddard Solvent Spillage Measurements

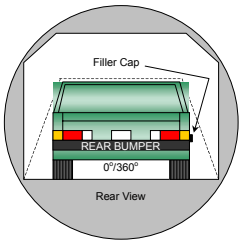
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

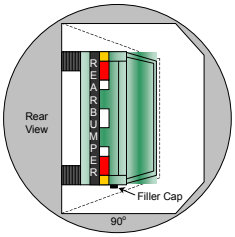
B. For the 5 minute period after motion ceases: 0 oz.
(Maximum Allowable = 5 ounces)

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

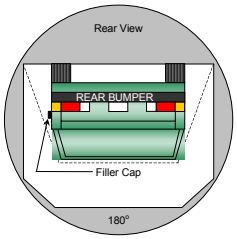
D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA

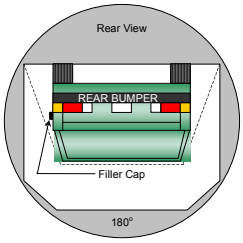




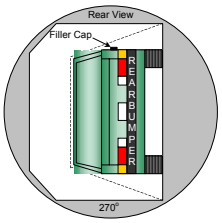
0° to 90°

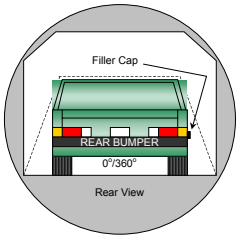


90° to 180°



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°	113	300	0
180° to 270°	109	300	0
270° to 360°	113	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

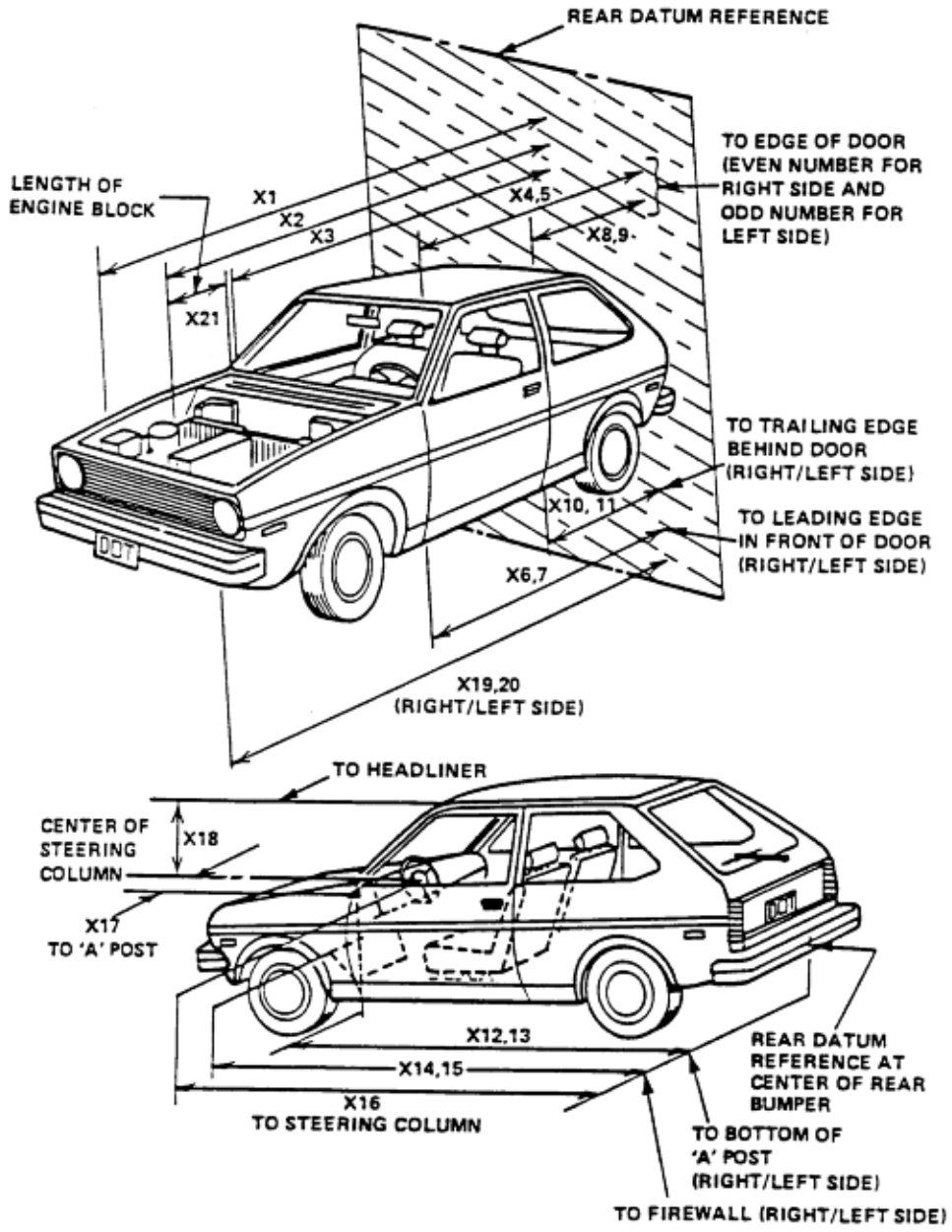
Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	5089	4474	615
2	RSOV to front of engine	mm	4573	4330	243
3	RSOV to firewall centerline	mm	4191	4168	23
4	RSOV to leading edge of right door	mm	3650	3664	-14
5	RSOV to leading edge of left door	mm	3651	3659	-8
6	RSOV to lower leading edge of right door	mm	3651	3586	65
7	RSOV to lower leading edge of left door	mm	3585	3581	4
8	RSOV to upper leading edge of right door	mm	2585	2608	-23
9	RSOV to upper leading edge of left door	mm	2587	2603	-16
10	RSOV to lower trailing edge of right door	mm	2585	2590	-5
11	RSOV to lower trailing edge of left door	mm	2582	2591	-9
12	RSOV to bottom of right 'A' pillar	mm	3654	3590	64
13	RSOV to bottom of left 'A' pillar	mm	3653	3576	77
14	RSOV to firewall on right side	mm	4228	4230	-2
15	RSOV to firewall on left side	mm	4237	4209	28
16	RSOV to steering column	mm	3158	3198	-40
17	Center of steering column to left 'A' pillar	mm	444	422	22
18	Center of steering column to headlining	mm	451	411	40
19	RSOV to right side of front bumper	mm	4986	4454	532
20	RSOV to left side of front bumper	mm	4985	4491	494
21	Length of engine block	mm	395	395	0
RD	RSOV to right side of dash panel	mm	3377	3392	-15
CD	RSOV to center of dash panel	mm	3384	3361	23
LD	RSOV to left side of dash panel	mm	3357	3387	-30

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	5089
2	Total Width	1968
3	Bumper Top Height	629
4	Bumper Bottom Height	464
5	Longitudinal Member Top Height	642
6	Distance between Longitudinal Members	1055
7	Longitudinal Member Width	77
8	Engine Top Height	948
9	Engine Bottom Height	241
10	Engine and gearbox width	885
11	Front bumper-engine distance	350
12	Front shock absorber fixing height	936
13	Bonnet leading edge height	898
14	Front shock absorber fixing width	1202
15	Front bumper – front axle distance	897
16	Front axle – a pillar distance	480
17	A-pillar – B-pillar distance	1072
18	B-Pillar – rear axle distance	1522
19	B-pillar – C-pillar distance	1080
20	Roof sill bottom height	1628
21	Roof sill top height	1668
22	Floor sill bottom height	281
23	Floor sill top height	411

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1450	-4500	1115	24	1000
3	Steering Column Top	1150	-5130	1265	25	1000
4	Steering Column Bottom	1250	-5130	885	25	1000
5	Driver Close-up	1430	-5930	1140	35	1000
6	Driver Angle	7020	-5200	2105	50	1000
7	On board Driver Side				8	1000
8	On board Passenger Side				8	1000
9	Right Overall	2050	7130	1280	24	1000
10	Right Passenger Half	1380	5245	1120	24	1000
11	Right Close-up	1600	6120	1500	35	1000
12	Right Angle	7125	5155	2200	50	1000
13	Windshield	-285	0	2900	12.5	1000
14	Top Driver	-135	-470	2602	24	1000
15	Top Passenger	-110	420	2310	24	1000
16	Pit Front	1220	0	-3150	24	1000
17	Pit Rear	3350	0	-3150	24	1000

*COORDINATES:

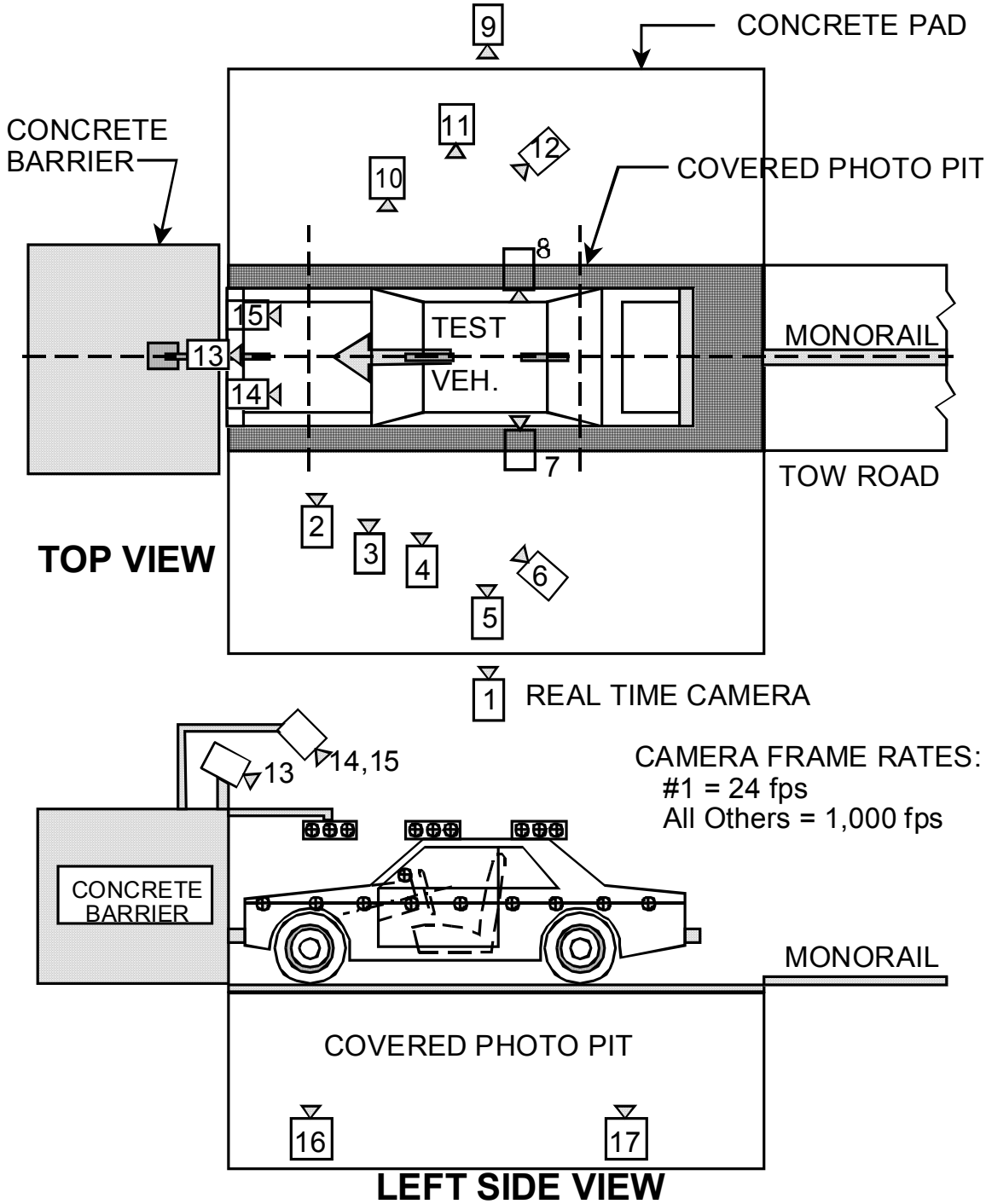
+X = forward of impact plane
+Y = right of monorail centerline
+Z = above ground level

DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle:	2008 Dodge Grand Caravan SE	NHTSA No.:	M80307
Test Program:	35mph Frontal Impact	Test Date:	8/30/2007

CAMERA POSITIONS FOR FRONTAL IMPACTS

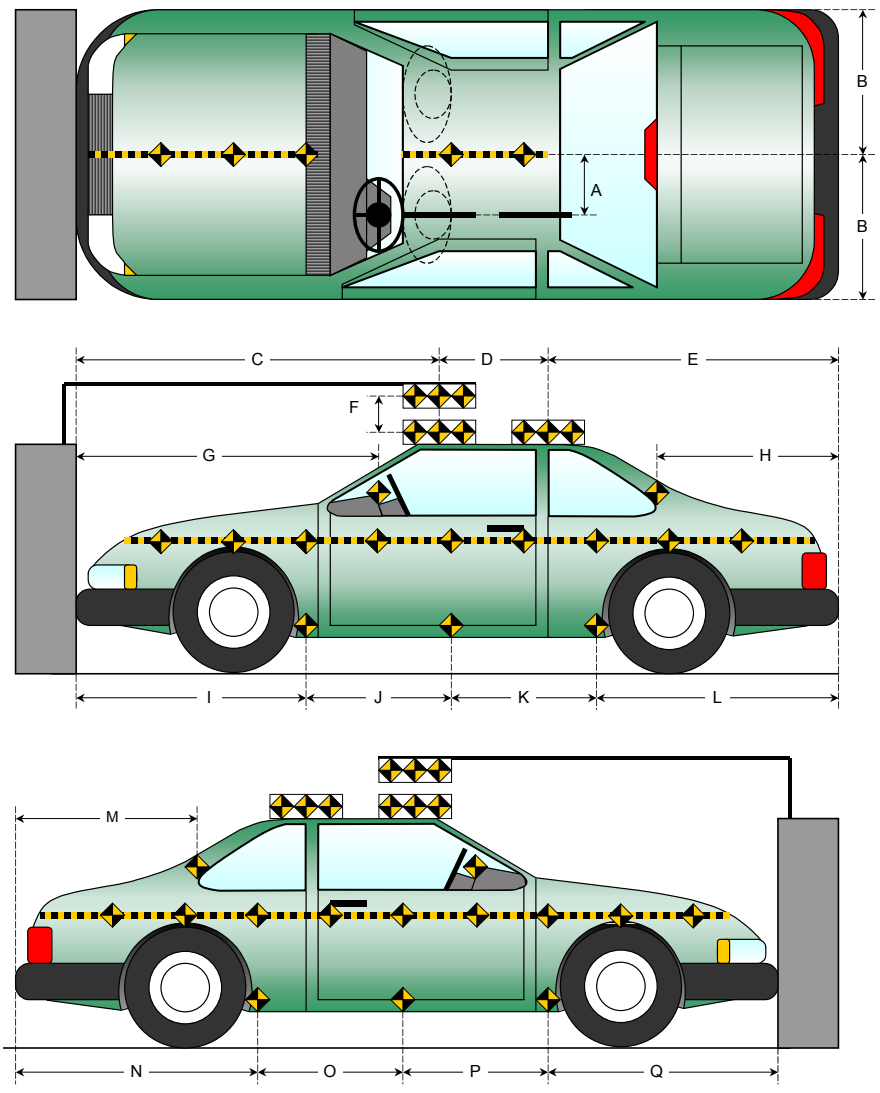


DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2008 Dodge Grand Caravan SE
Test Program: 35mph Frontal Impact
NHTSA No.: M80307
Test Date: 8/30/2007

Item	Value
A	426
B	984
C	2285
D	660
E	2144
F	
G	
H	1487
I	1417
J	1082
K	1085
L	1505
M	1487
N	1514
O	1083
P	1082
Q	1410



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

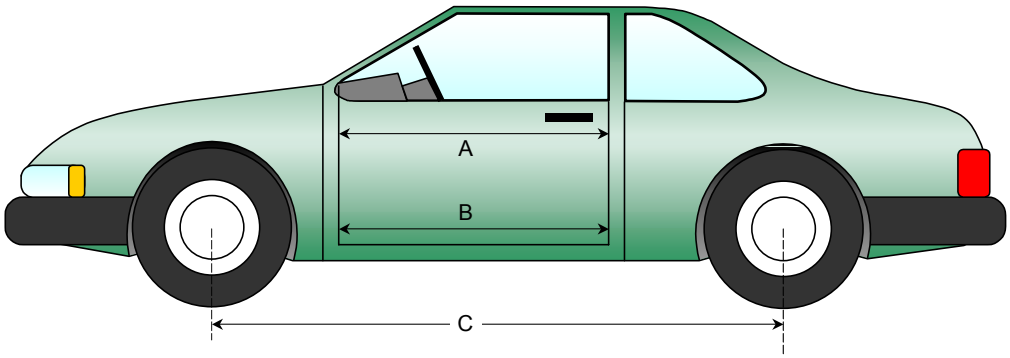
Test Vehicle: 2008 Dodge Grand Caravan SE
Test Program: 35mph Frontal Impact
NHTSA No.: M80307
Test Date: 8/30/2007

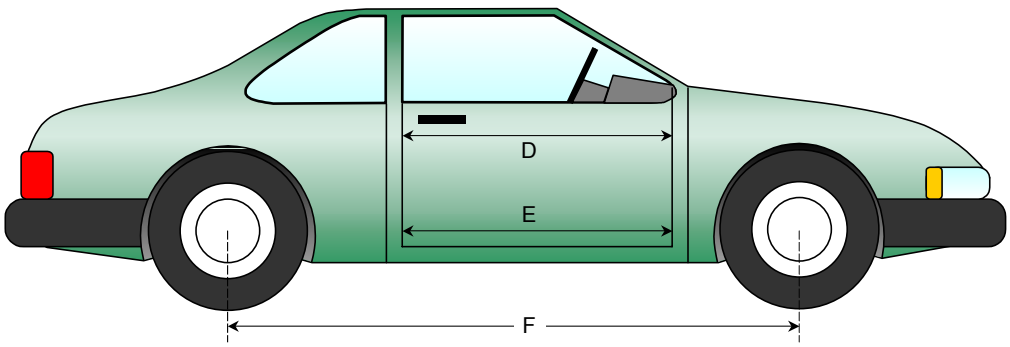
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	970	969	1
B	Left Side Lower	mm	954	952	2
D	Right Side Upper	mm	971	976	-5
E	Right Side Lower	mm	954	954	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	3078	2974	104
F	Right Side Wheelbase	mm	3078	3027	51





DATA SHEET NO. 13... (continued)

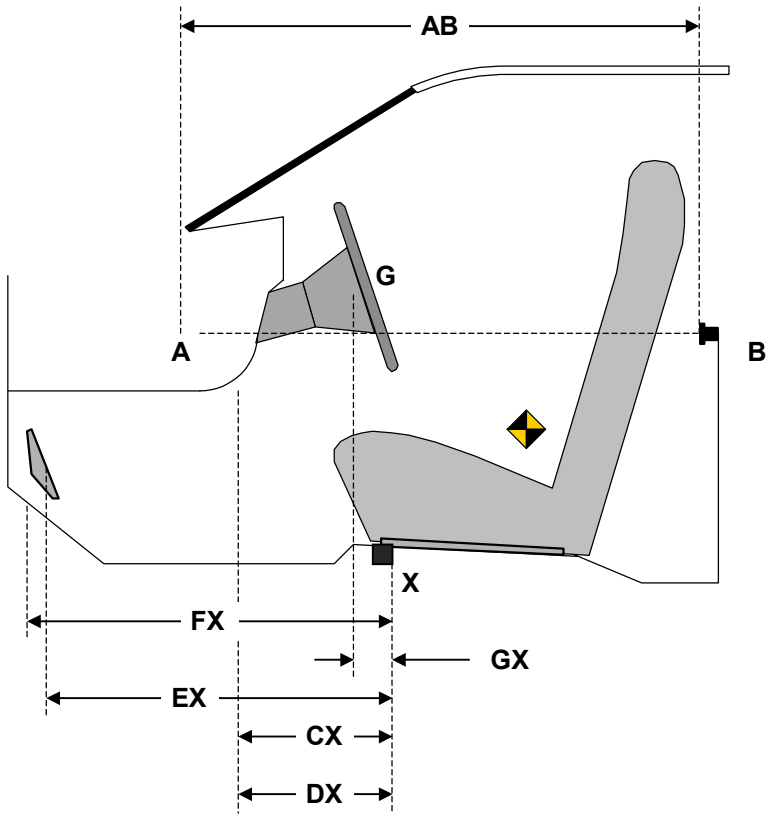
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	850	852	-2
CX	Left Knee Bolster to X	mm	341	338	3
DX	Right Knee Bolster to X	mm	333	325	8
EX	Brake Pedal to X	mm	521	470	51
FX	Foot Rest to X	mm	552	540	12
GX	Center of Steering Column Wheel Hub to X	mm	84	69	15

X = Front of Seat Track (stationary)

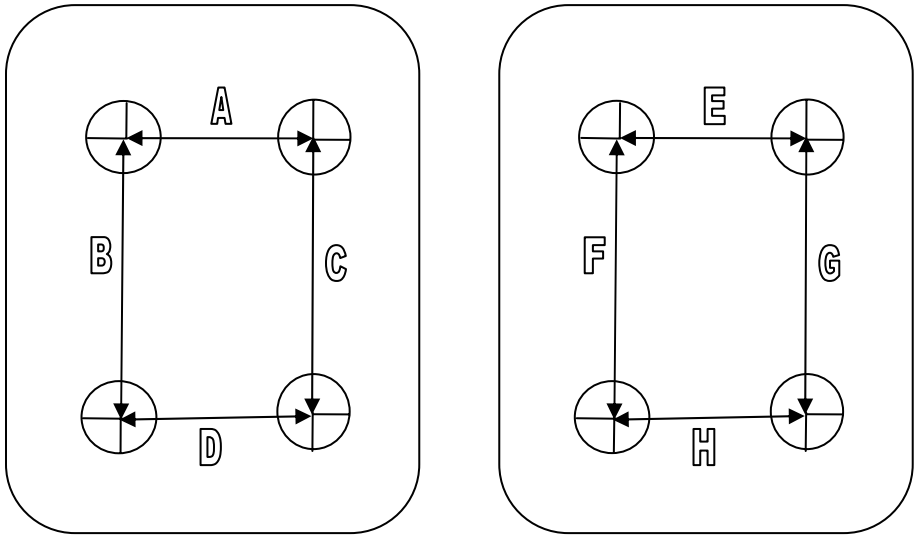


DRIVER COMPARTMENT

DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007



Driver Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	266	259	7
B	385	378	7
C	360	360	0
D	269	258	11
E	259	250	9
F	386	384	2
G	370	370	0
H	277	277	0

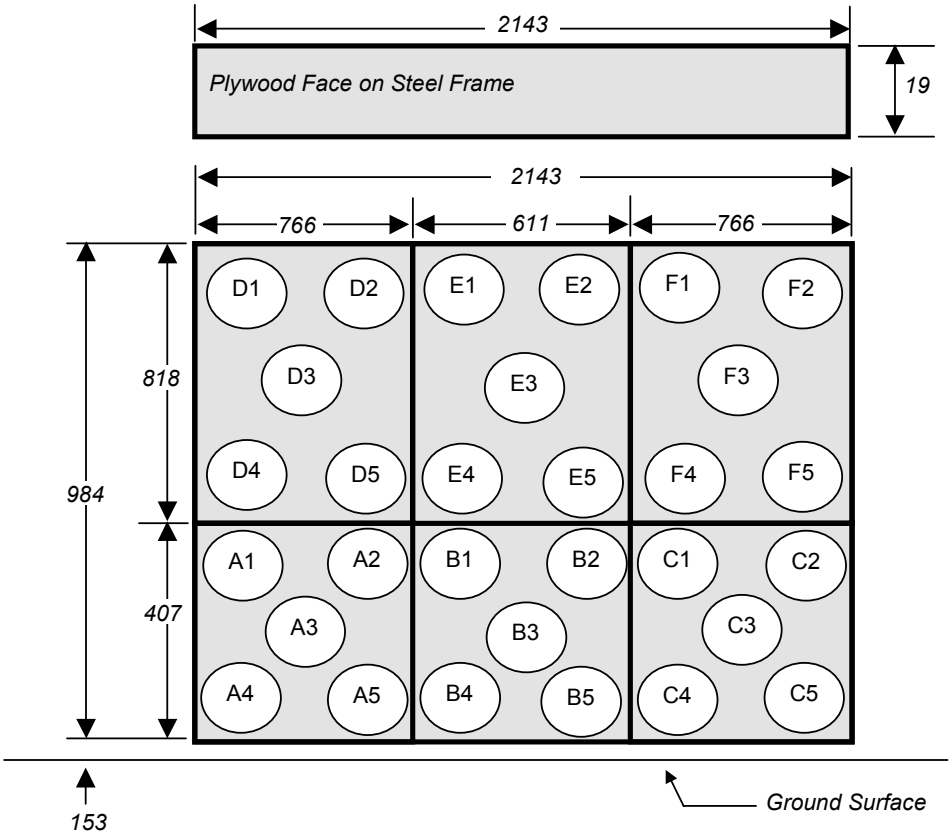
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

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: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007

VEHICLE INFORMATION

VIN: 2D8HN44H68R104829 Wheelbase (mm) : 3074
Vehicle Size Category: MPV Test Weight (kg) : 2209.5

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): 63.0 Time of Separation (msec): 194

CRUSH PROFILE

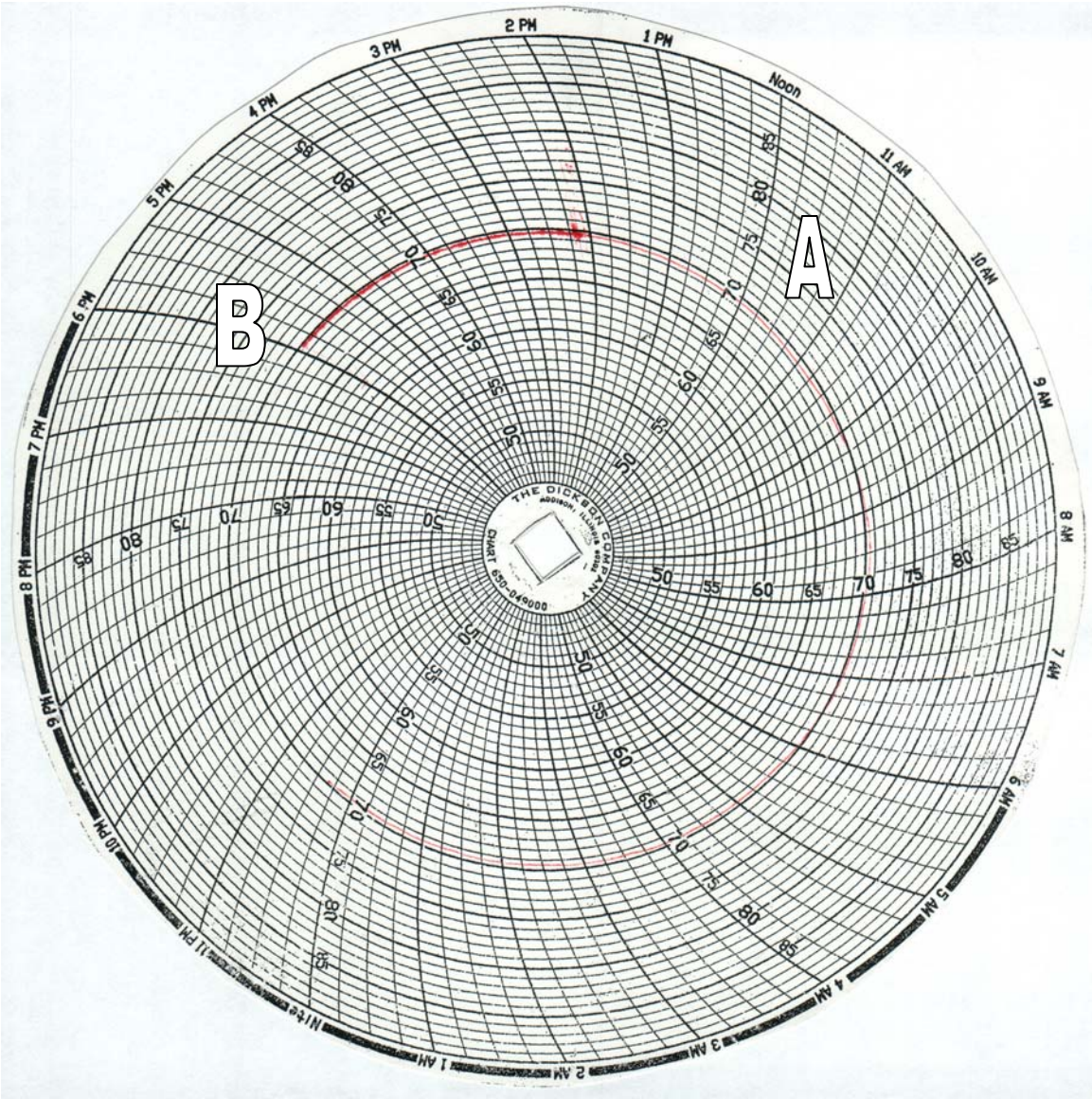
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1260 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	Mm	4985	4491	494
C2	Crush zone 2 at left side	mm	5046	4484	562
C3	Crush zone 3 at left side	mm	5078	4491	587
C4	Crush zone 4 at right side	mm	5080	4482	598
C5	Crush zone 5 at right side	mm	5047	4487	560
C6	Crush zone 6 at right side	mm	4986	4454	532
L	C1 TO C6	mm	1260	1239	21

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2008 Dodge Grand Caravan SE NHTSA No.: M80307
Test Program: 35mph Frontal Impact Test Date: 8/30/2007



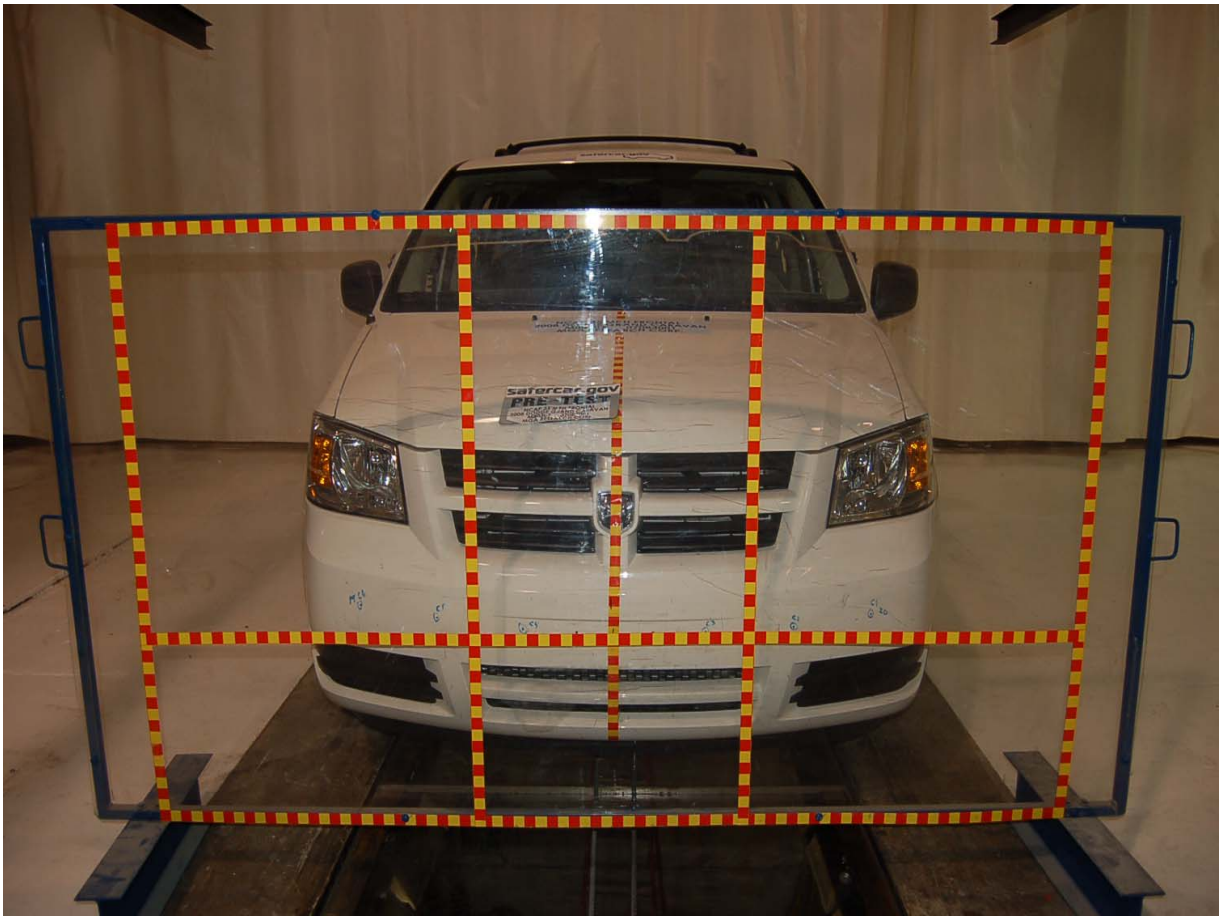
A = Dummies installed in vehicle at 11:30 am

B = Test conducted at 5:55 pm

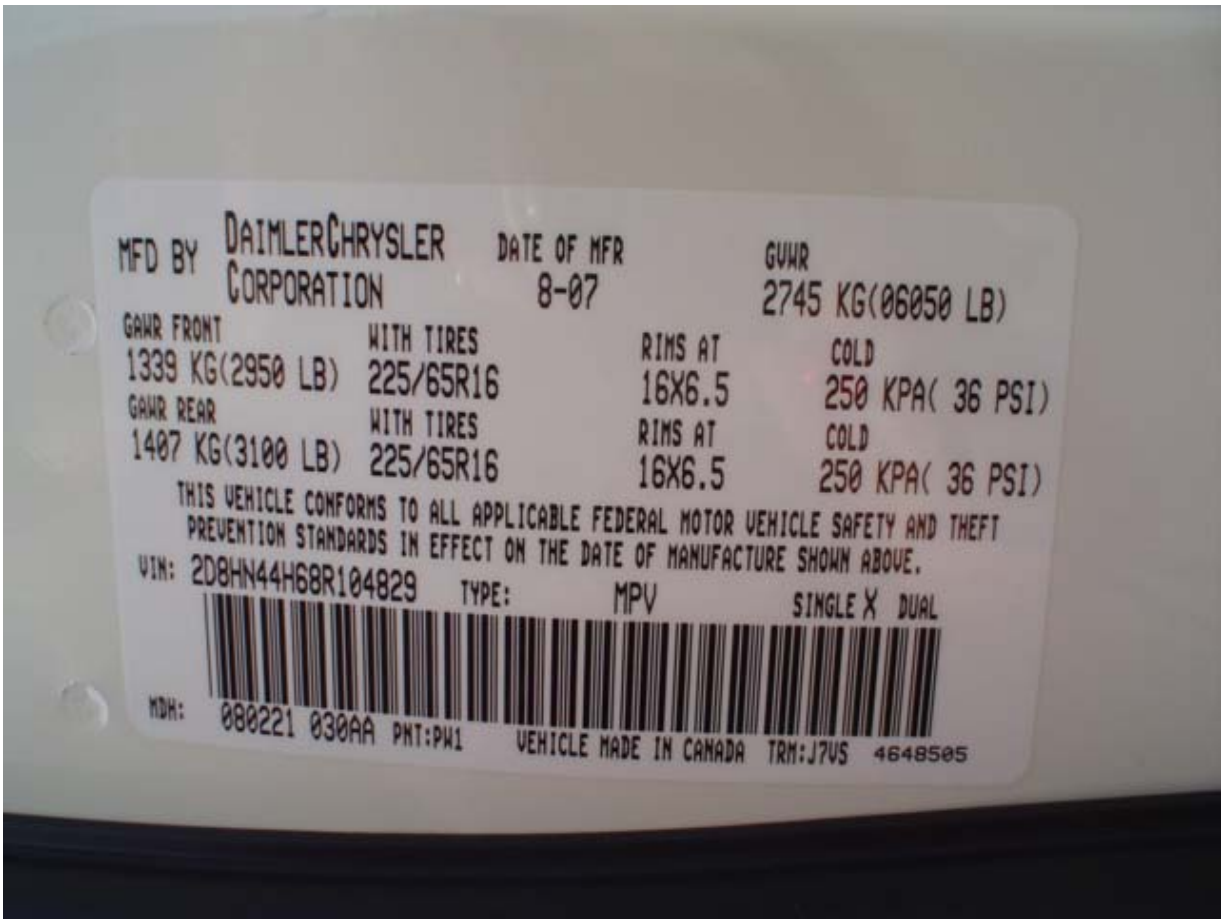
APPENDIX A

PHOTOGRAPHS

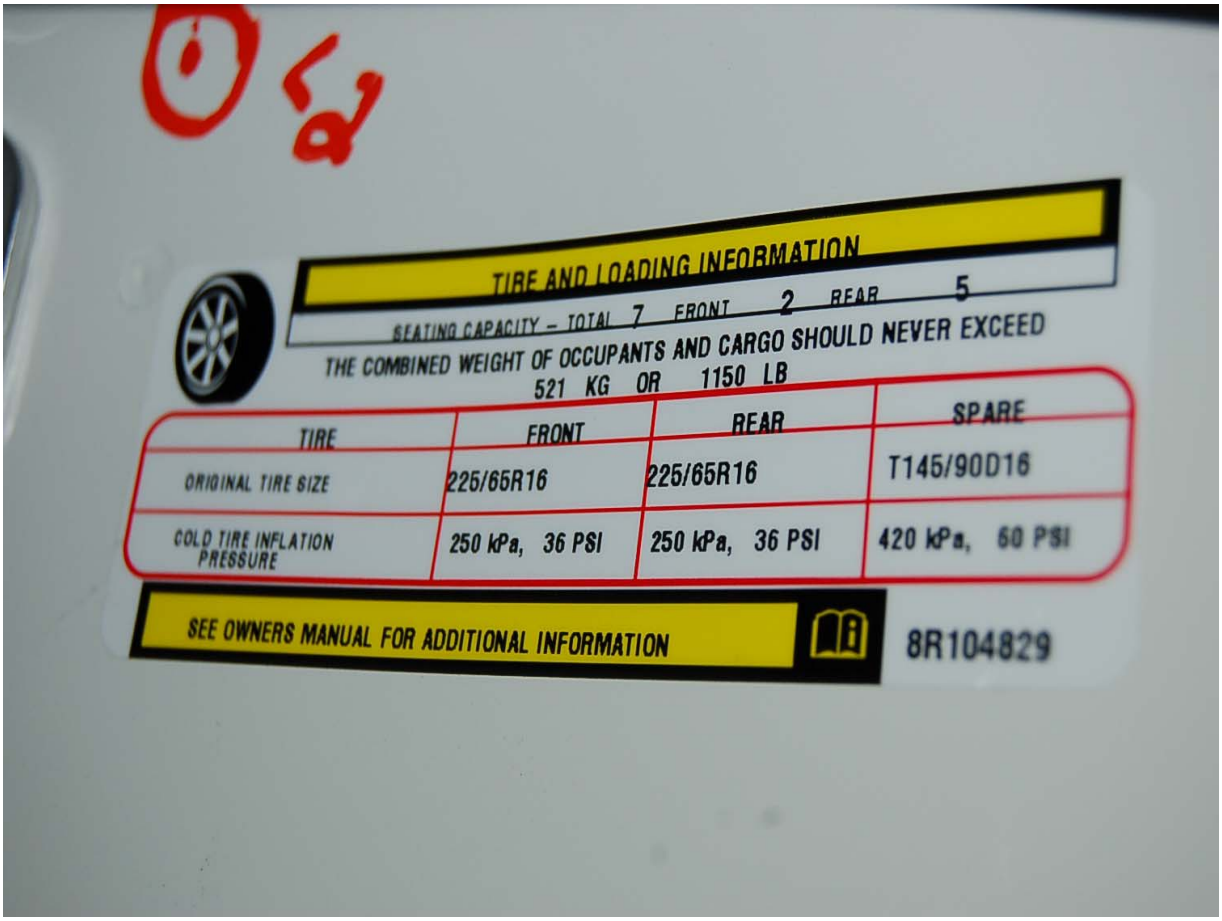
TABLE OF PHOTOGRAPHS



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

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

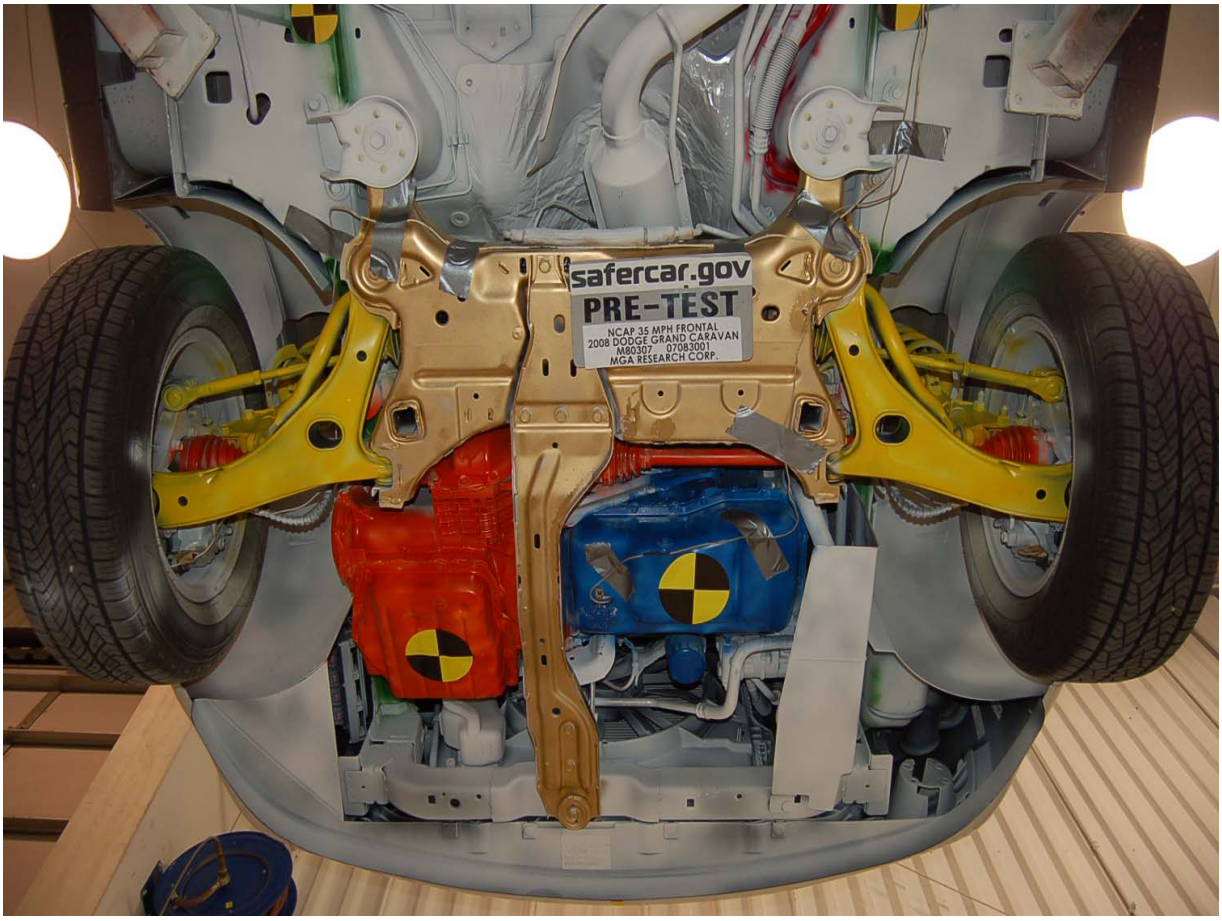
Pre-Test Windshield View

Post-Test Windshield View

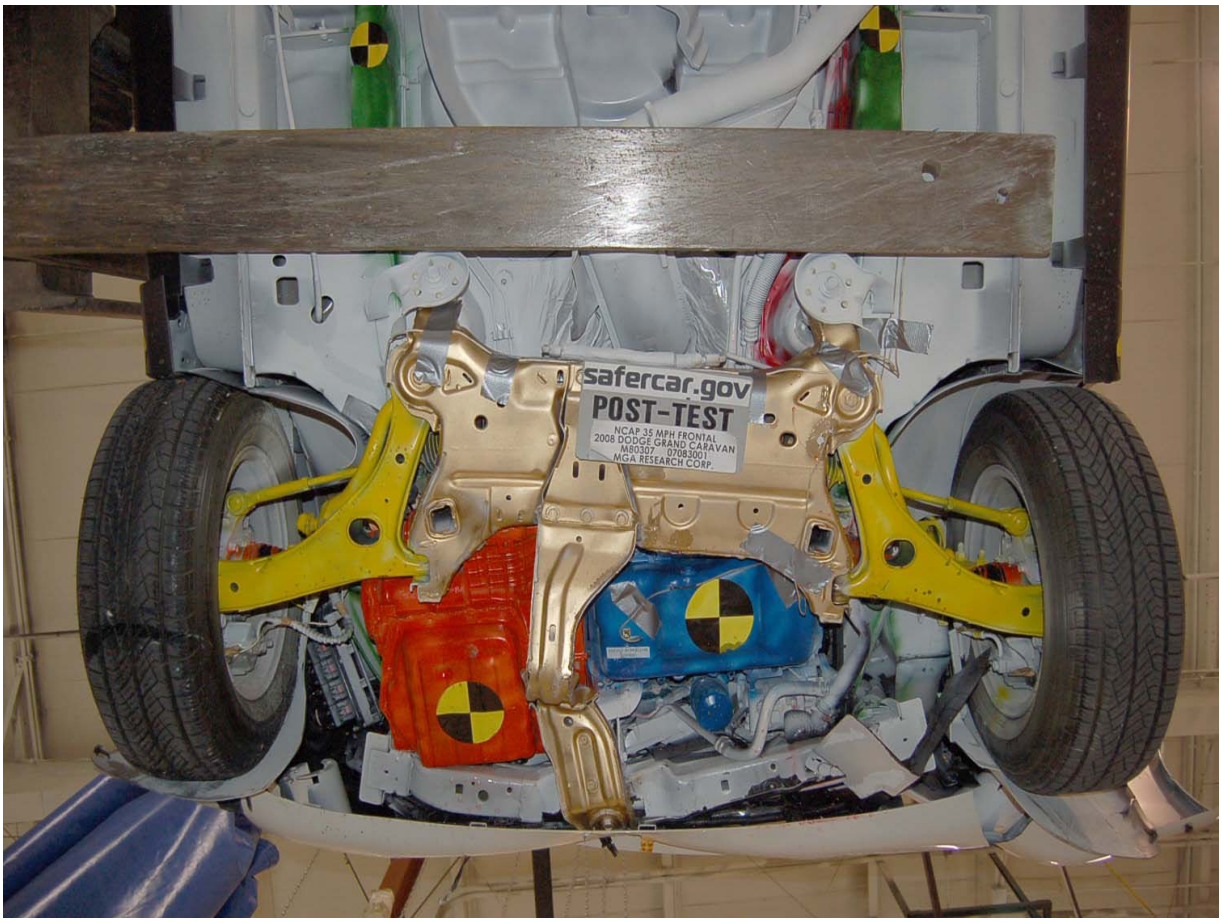
Pre-Test Engine Compartment View

Post-Test Engine Compartment View

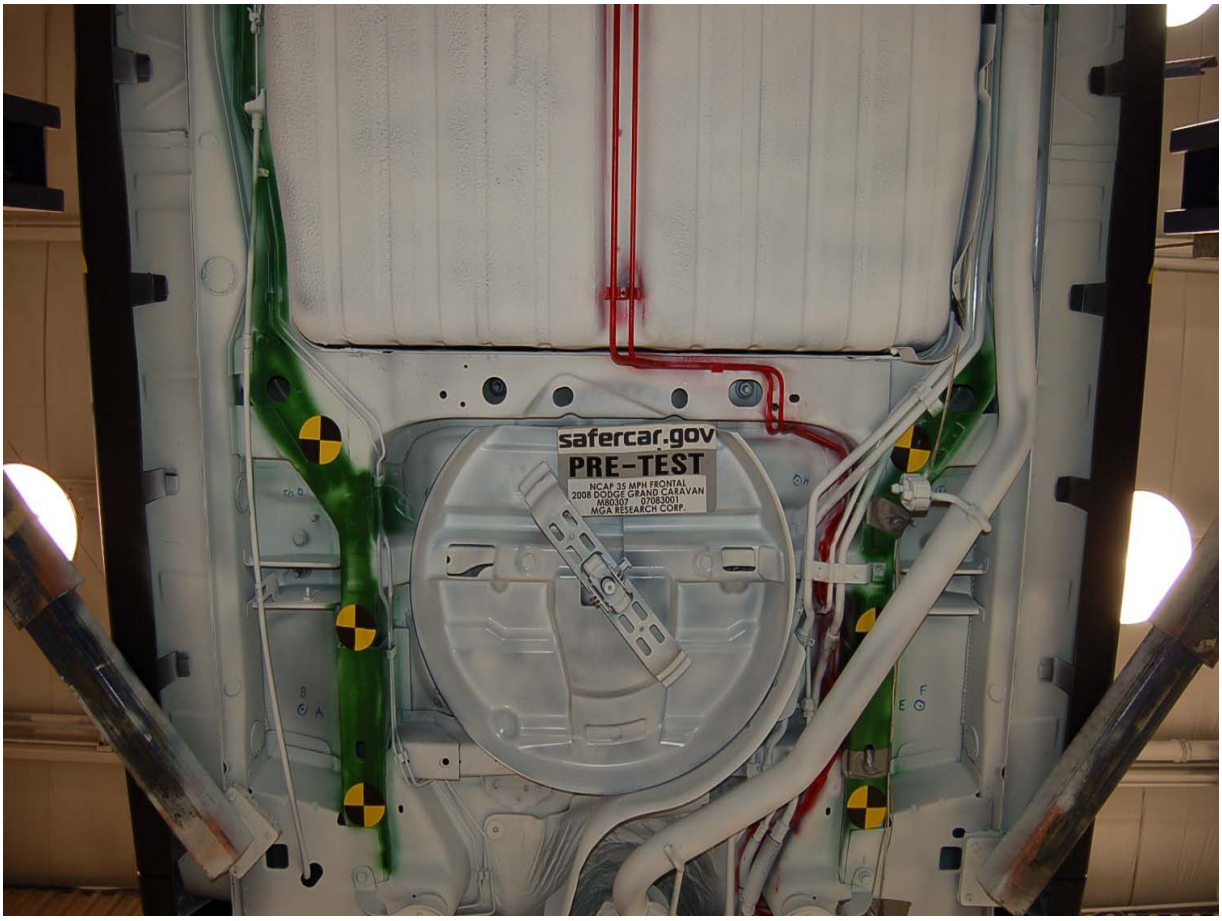
Pre-Test Fuel Cap View



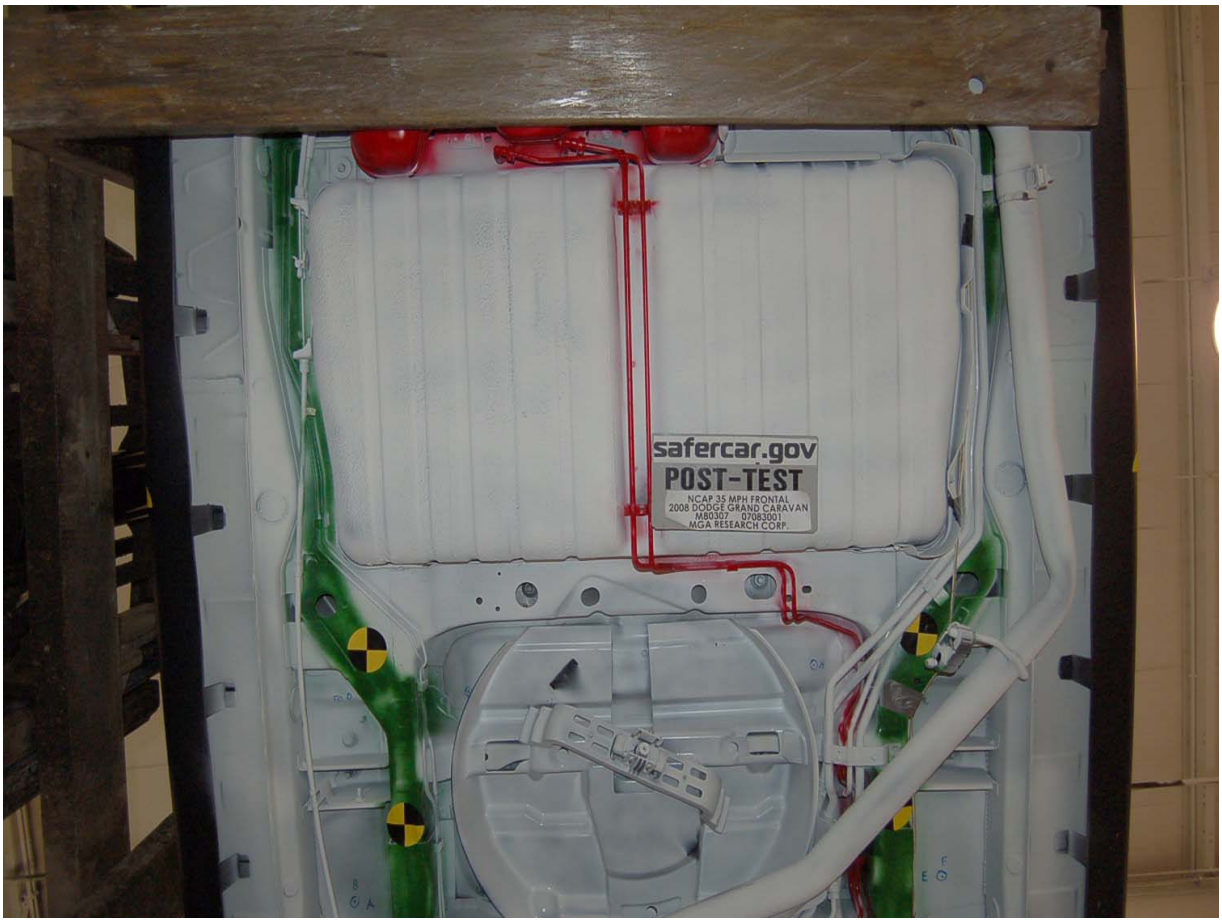
Pre-Test Front Underbody View



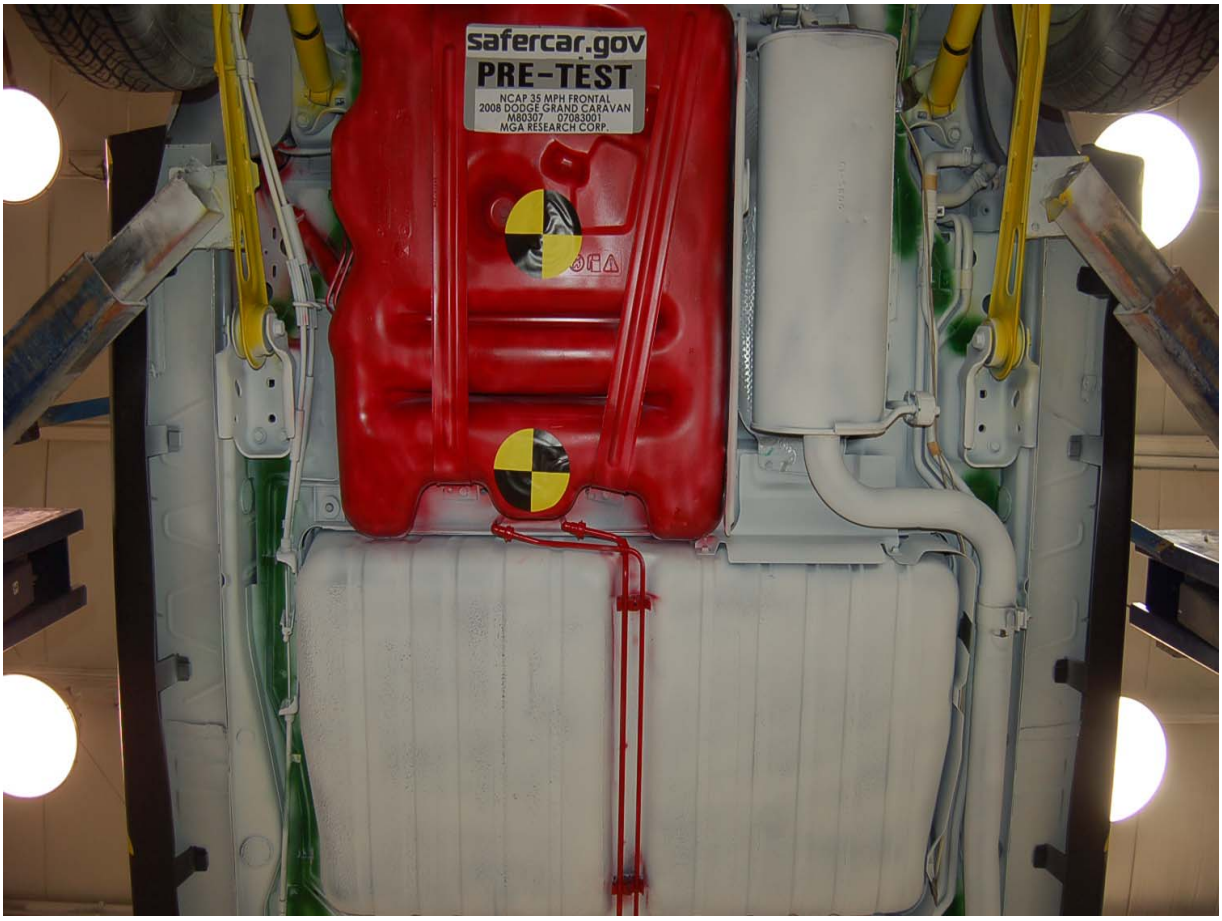
Post-Test Front Underbody View



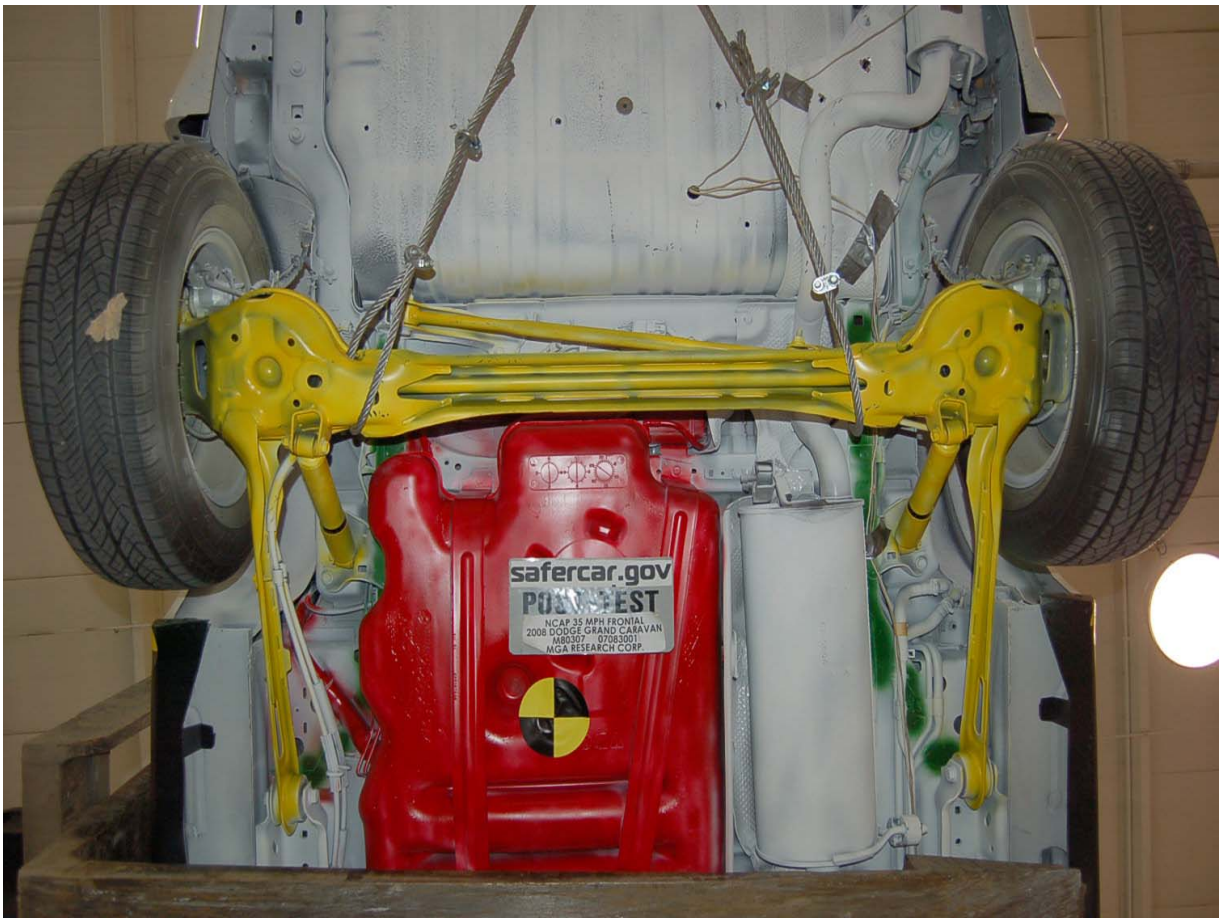
Pre-Test Mid Front Underbody View



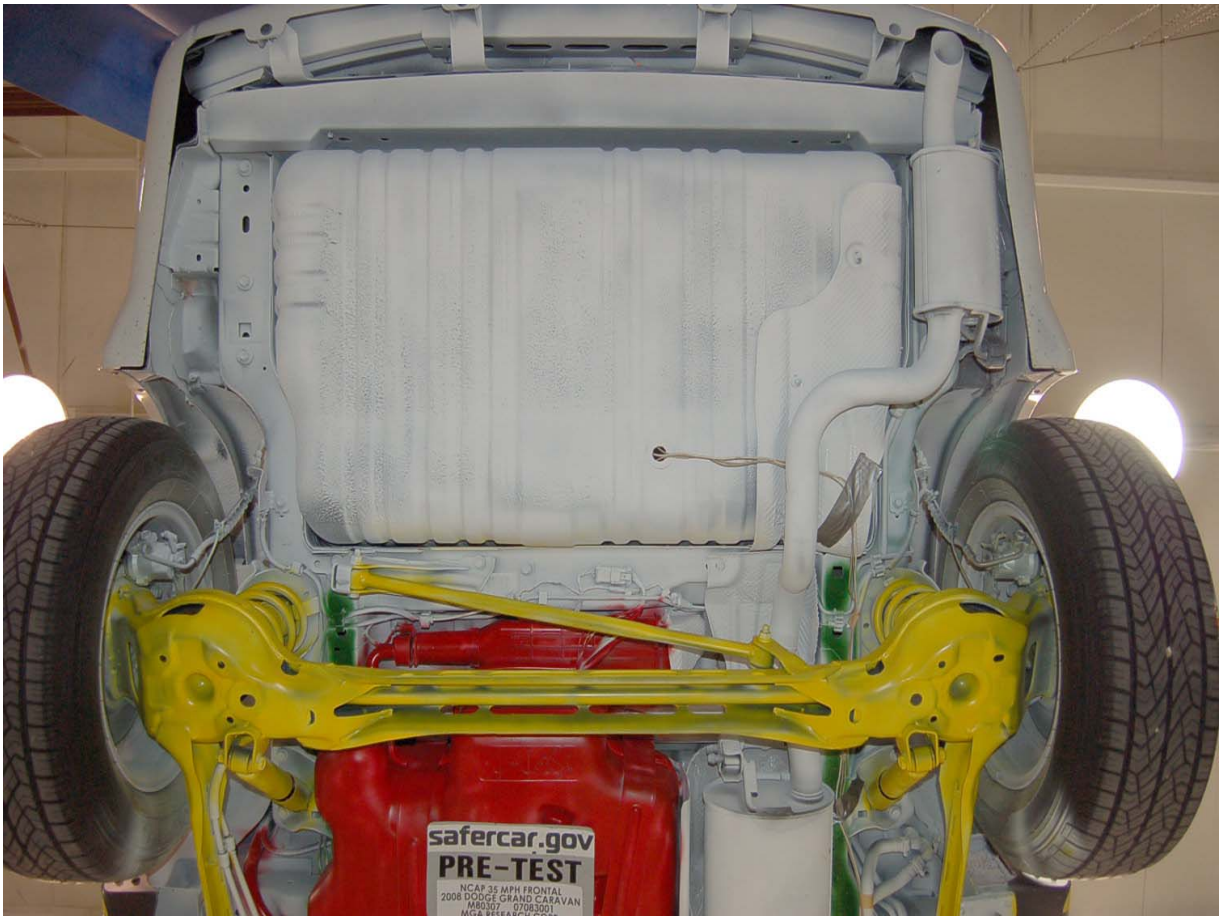
Post-Test Mid Front Underbody View



Pre-Test Mid Rear Underbody View



Post-Test Mid Rear 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)

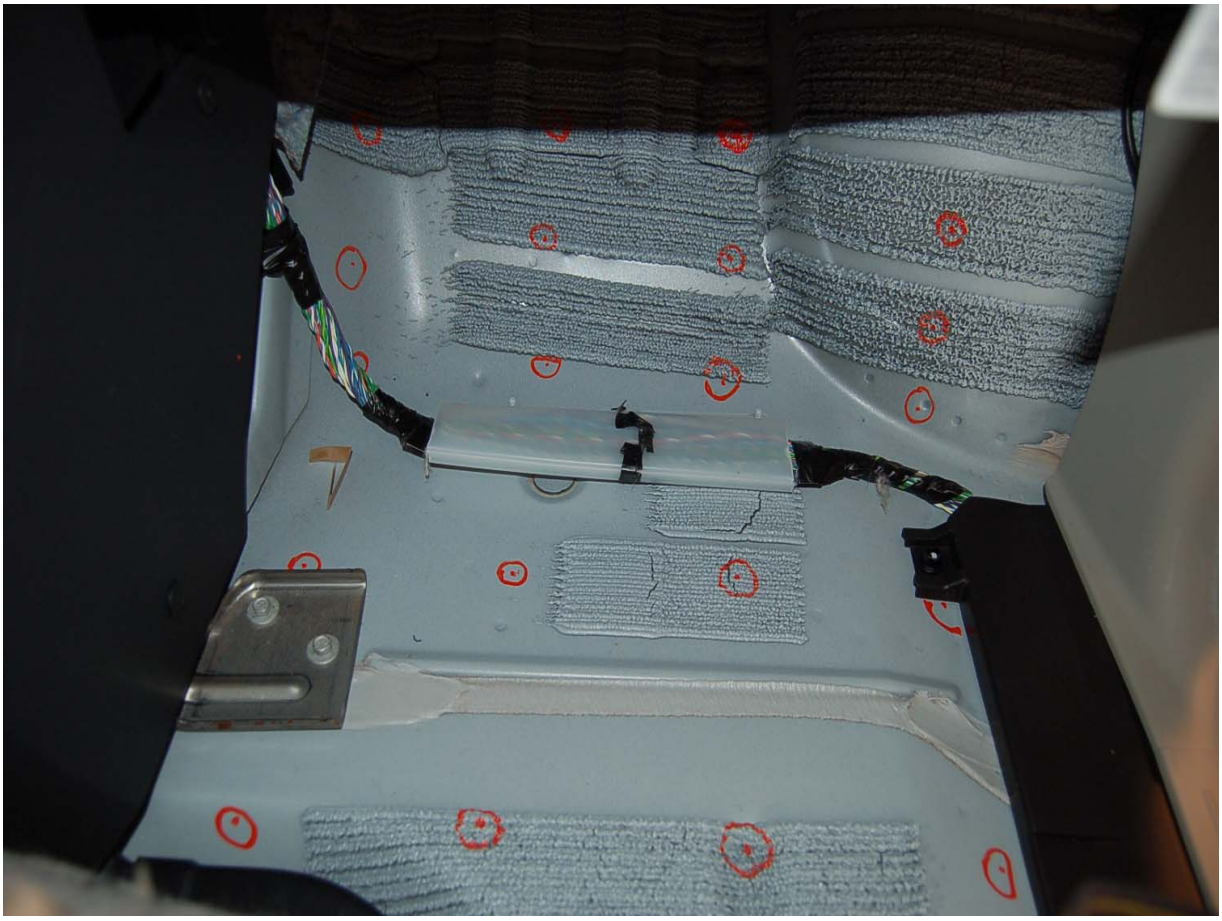
Post-Test Passenger Dummy (Door Open)

Pre-Test Passenger Dummy Feet

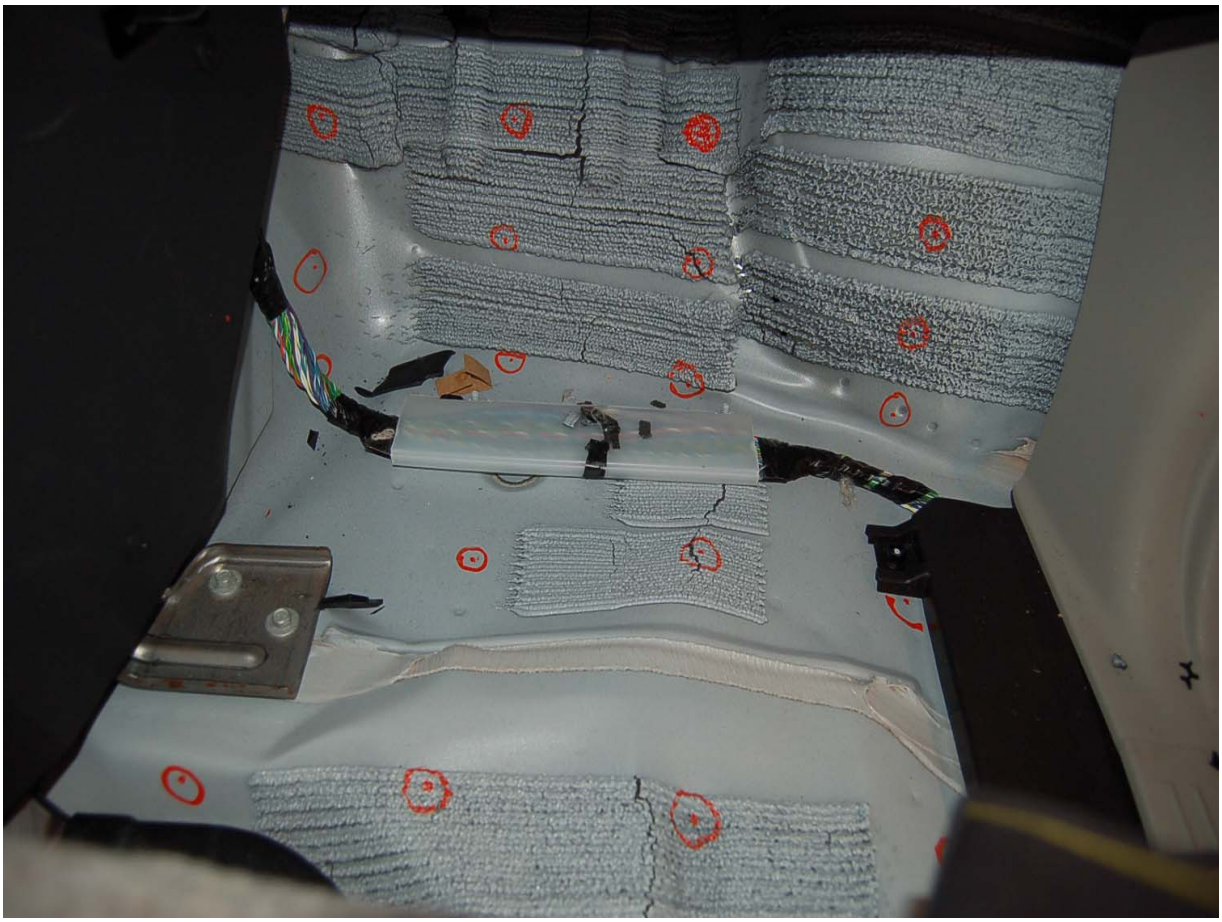
Post-Test Passenger Dummy Feet

Pre-Test Passenger Side Glove Box

Post-Test Passenger Side Glove Box



Pre-Test Passenger Side Floor Pan



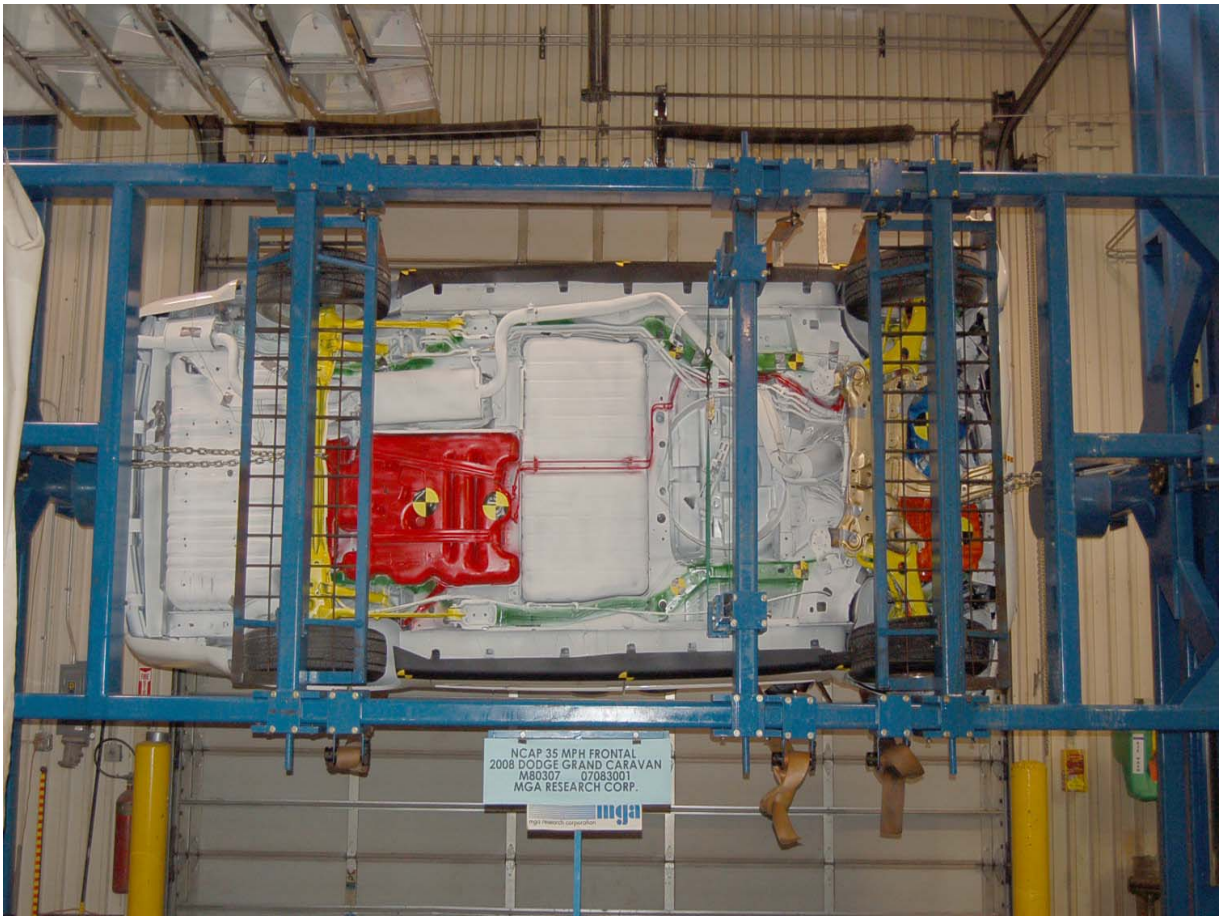
Post-Test Passenger Side Floor Pan

Post-Test Passenger Dummy Head Contact (headrest)

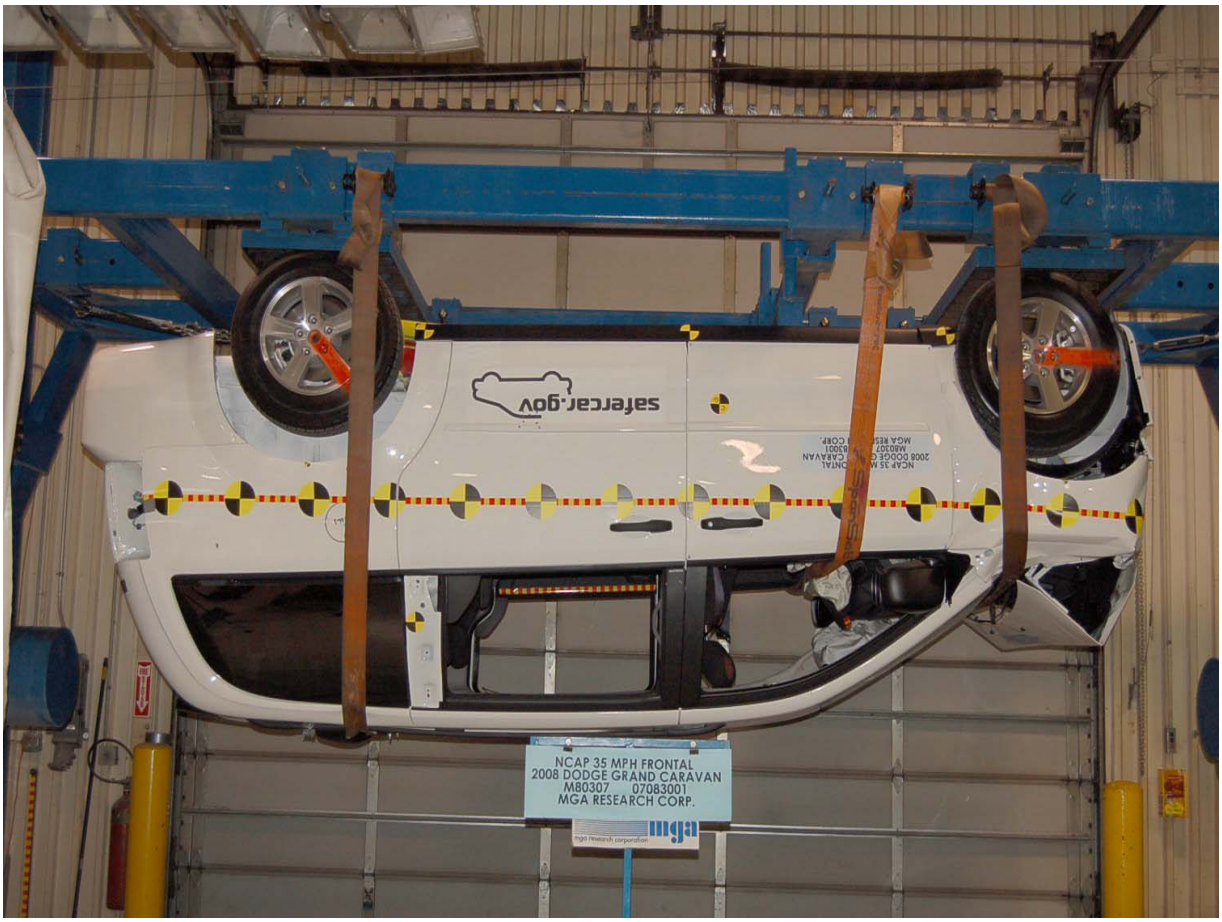
Post-Test Passenger Dummy Head Contact (visor)

Post-Test Passenger Dummy Knee Contact

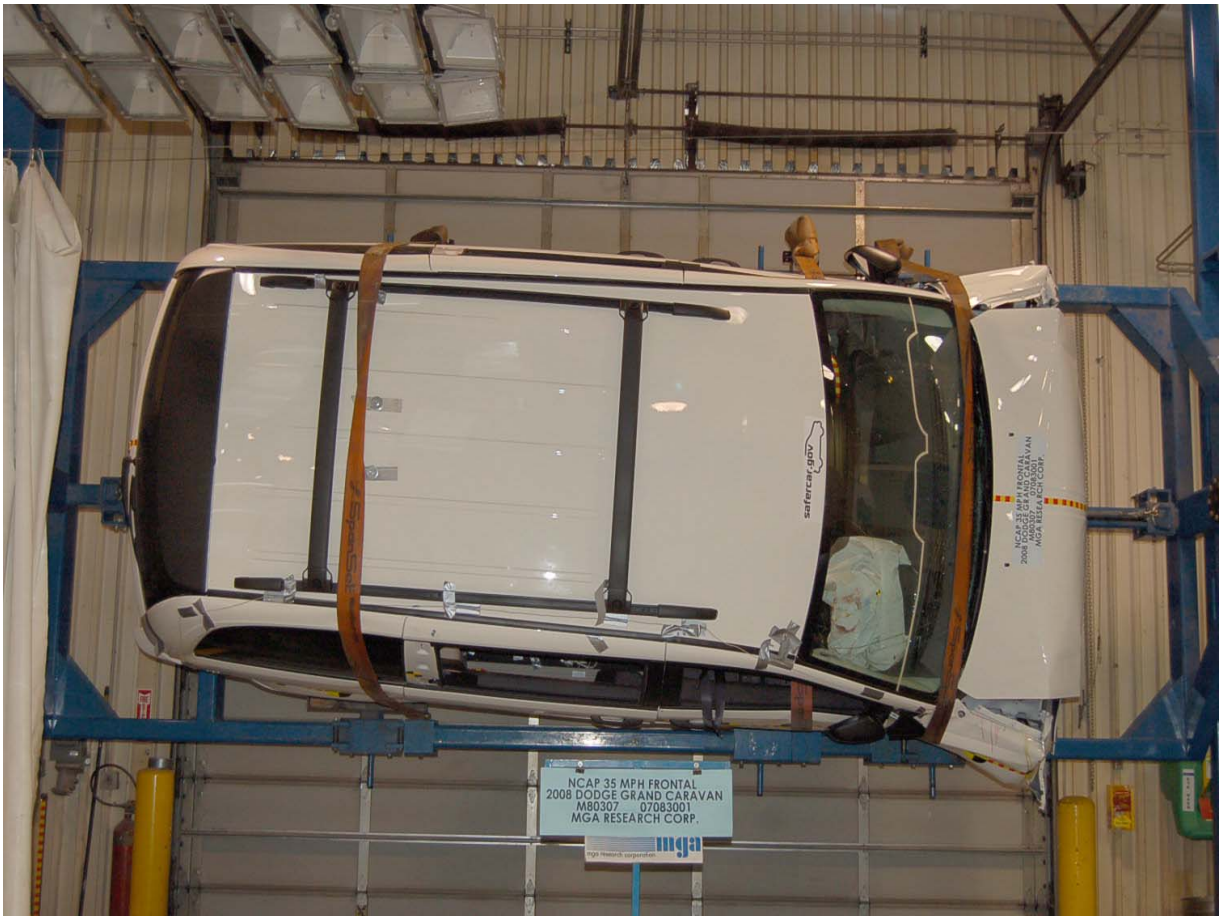
Post-Test Passenger Dummy Airbag Contact



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

Barrier Force – Upper Left

Barrier Force – Upper Center

Barrier Force – Upper Right

Barrier Force – Lower Left

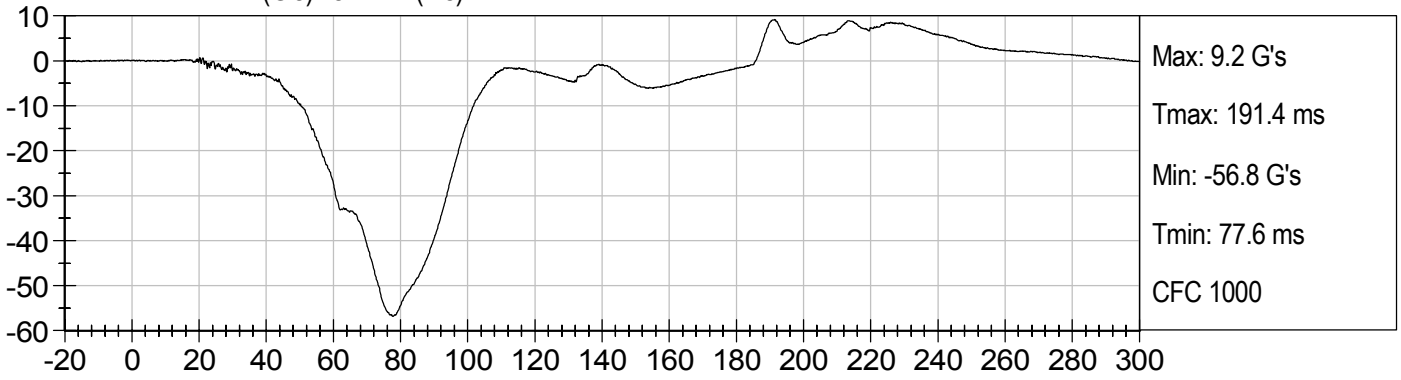
Barrier Force – Lower Center

Barrier Force – Lower Right

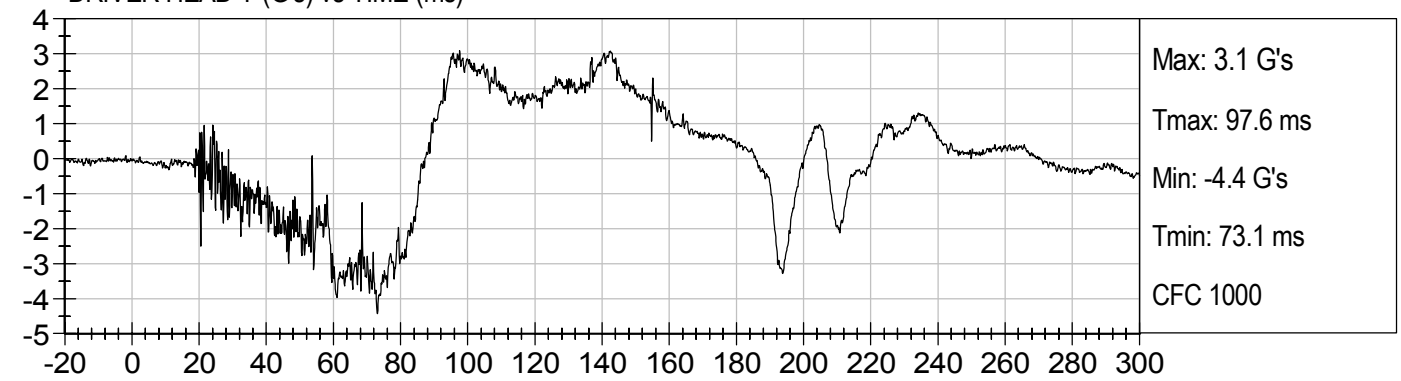
NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307

Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

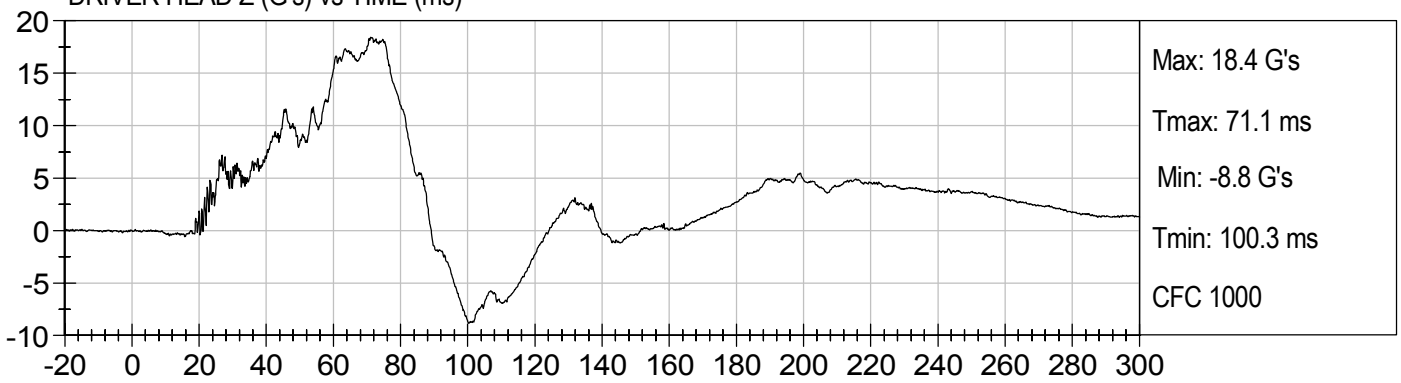
DRIVER HEAD X (G's) vs TIME (ms)



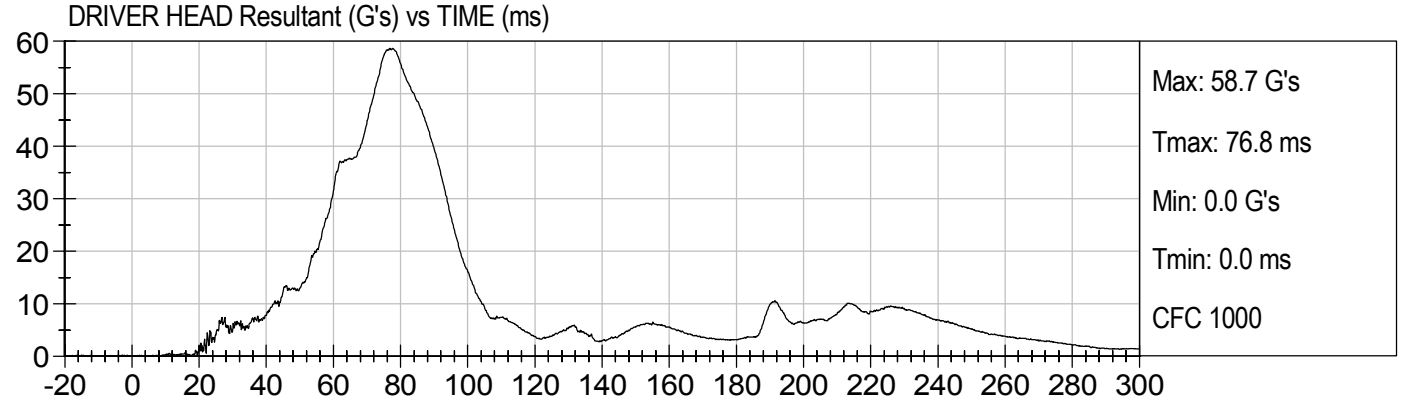
DRIVER HEAD Y (G's) vs TIME (ms)



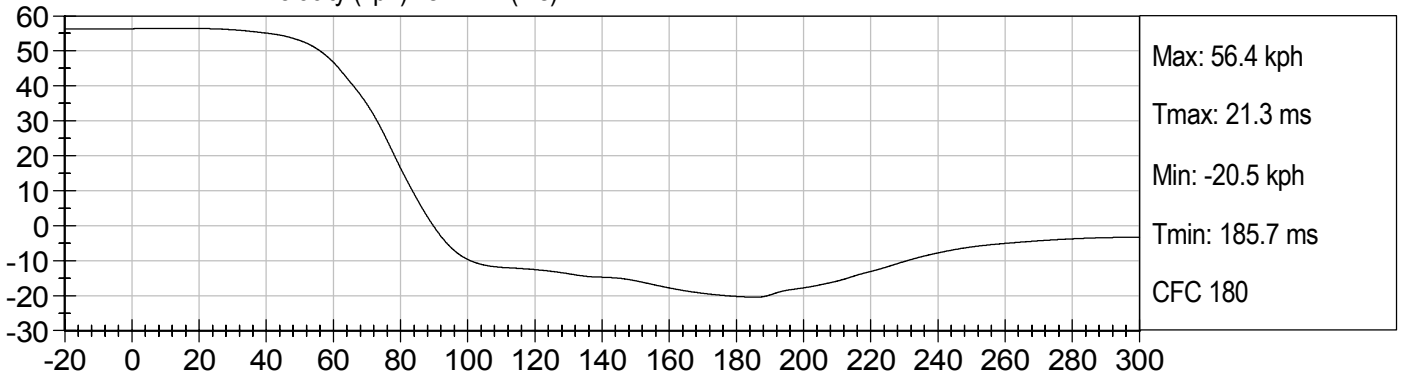
DRIVER HEAD Z (G's) vs TIME (ms)



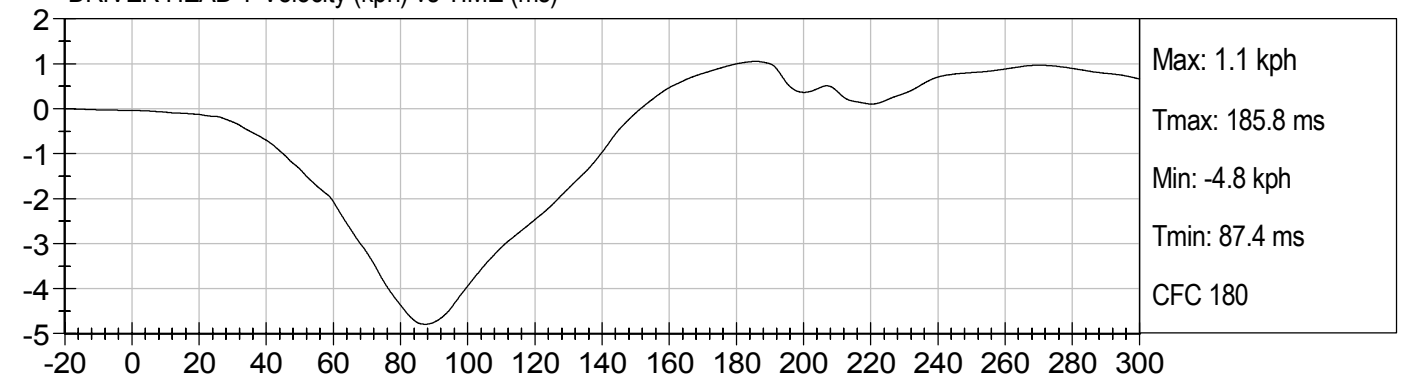
DRIVER HEAD Resultant (G's) vs TIME (ms)



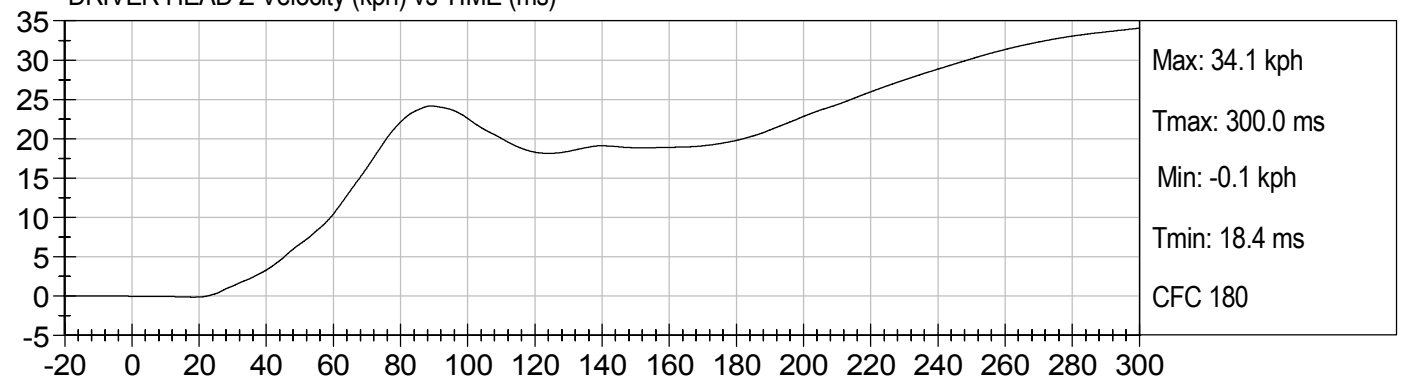
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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



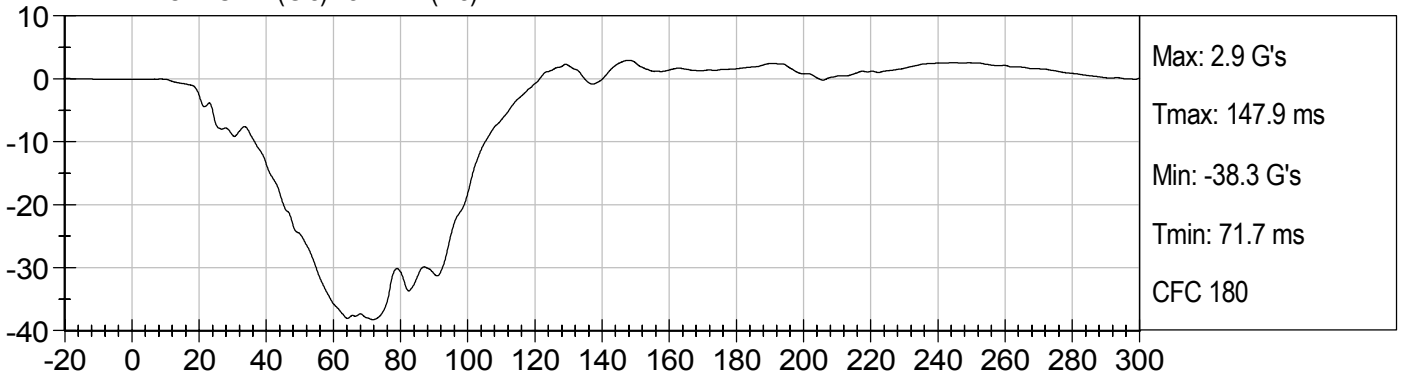
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



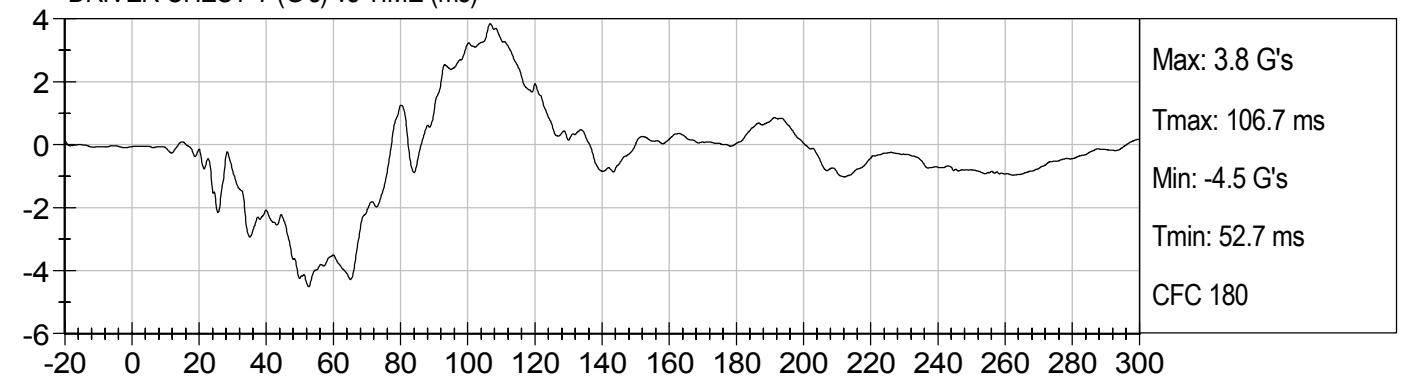
NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307

Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

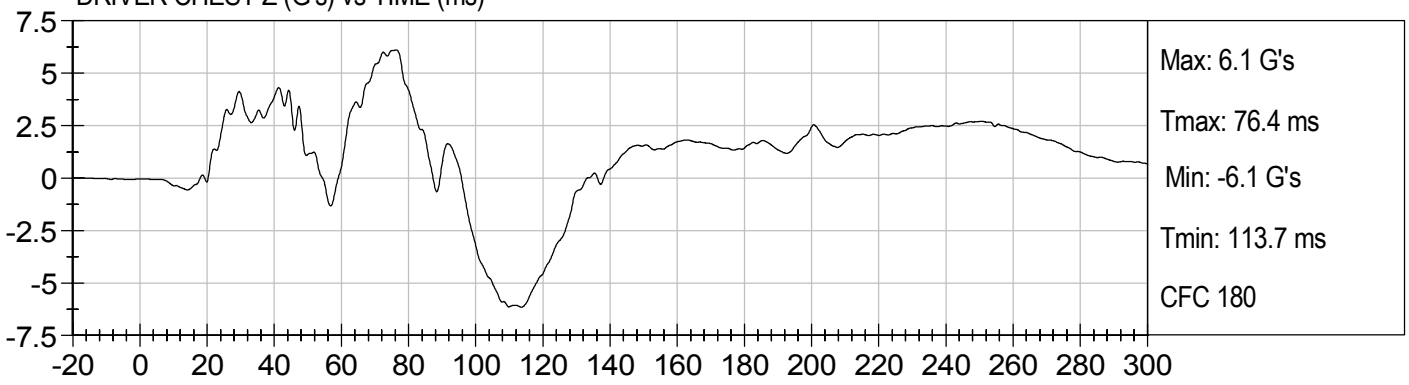
DRIVER CHEST X (G's) vs TIME (ms)



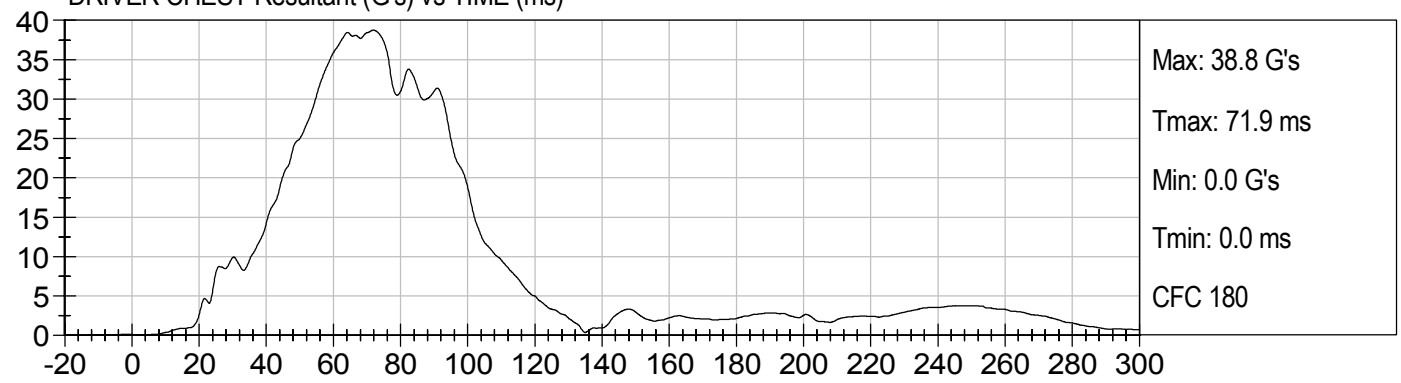
DRIVER CHEST Y (G's) vs TIME (ms)



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

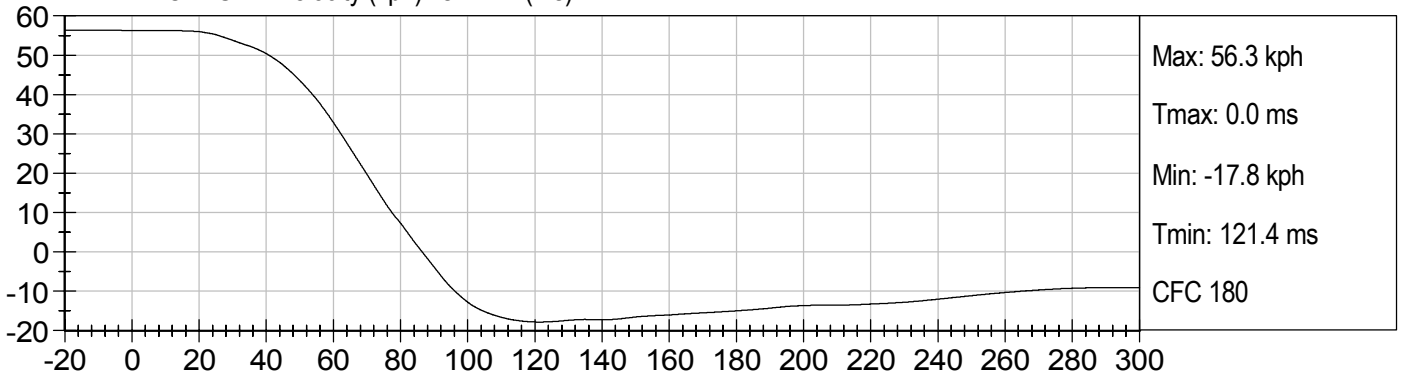


DRIVER CHEST Resultant (G's) vs TIME (ms)

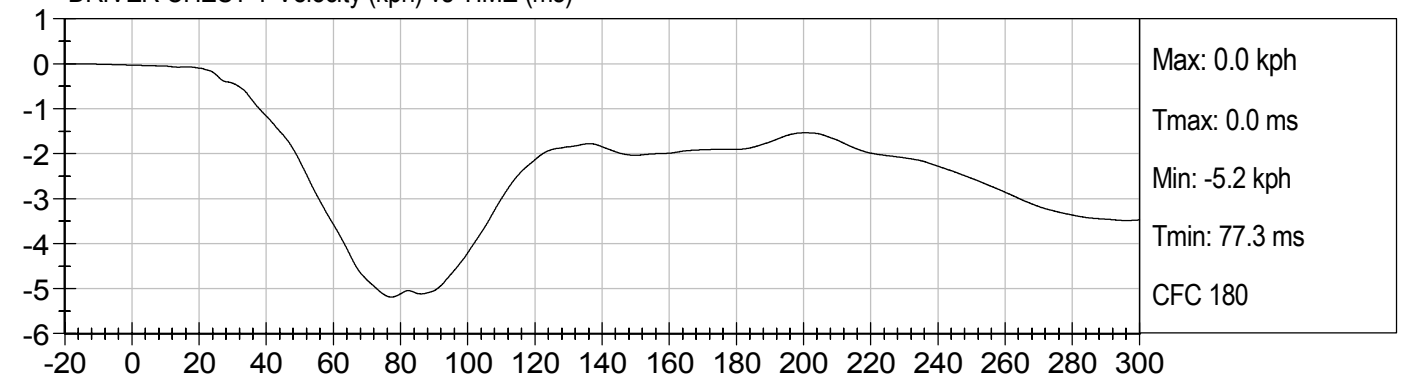


NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307
Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

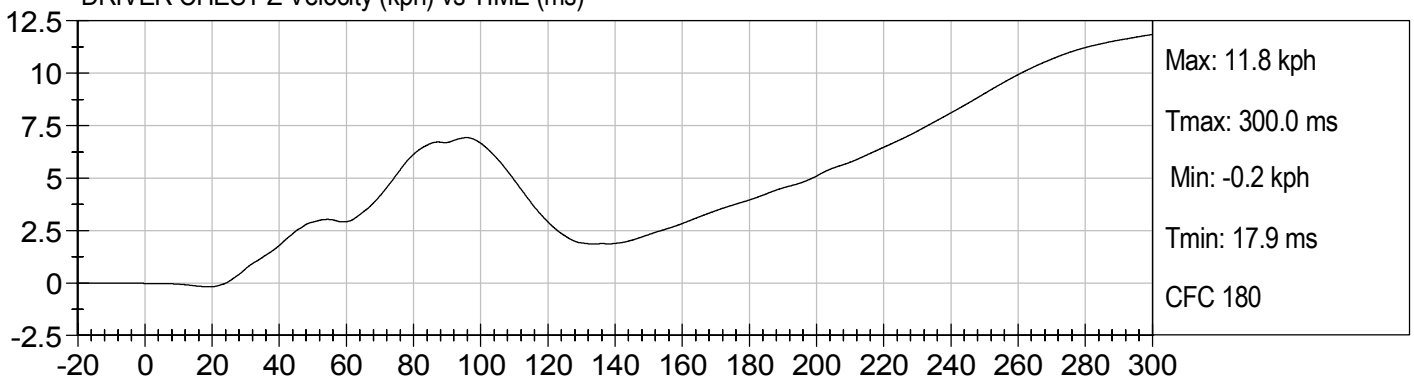
DRIVER CHEST X Velocity (kph) vs TIME (ms)



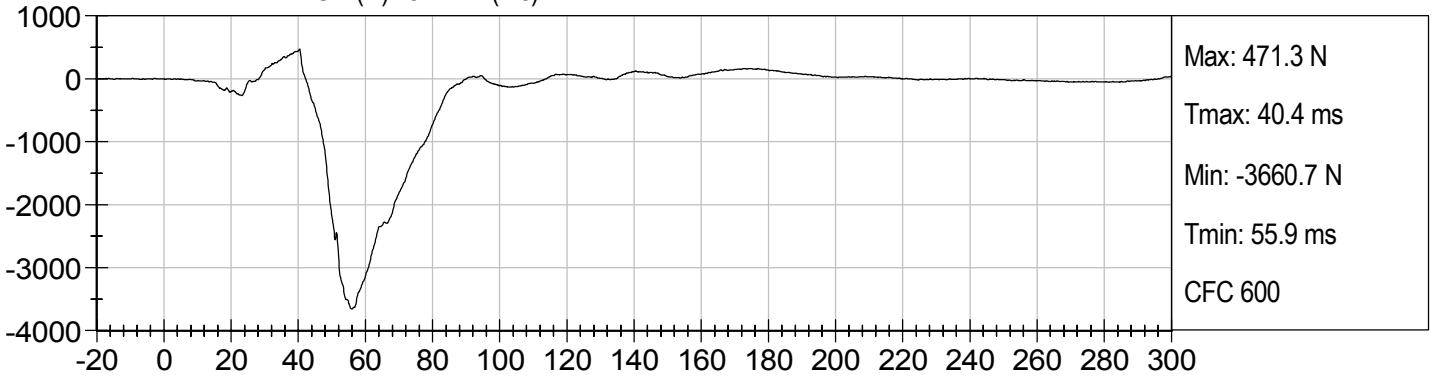
DRIVER CHEST Y Velocity (kph) vs TIME (ms)



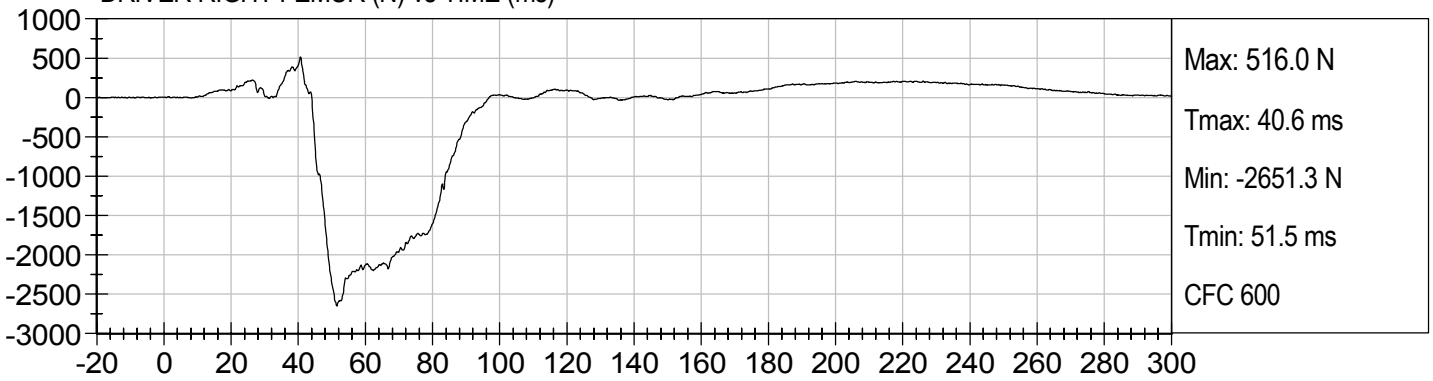
DRIVER CHEST Z Velocity (kph) vs TIME (ms)



DRIVER LEFT FEMUR (N) vs TIME (ms)



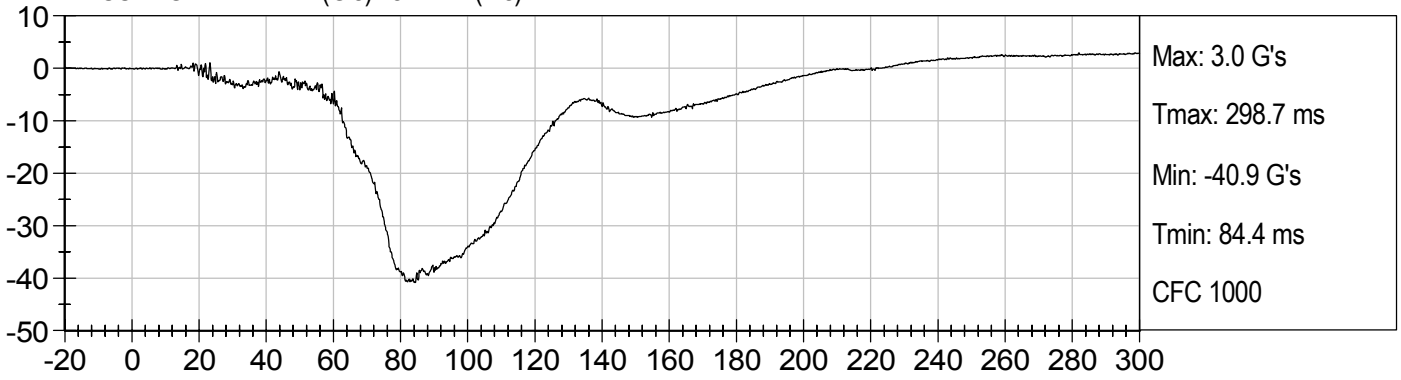
DRIVER RIGHT FEMUR (N) vs TIME (ms)



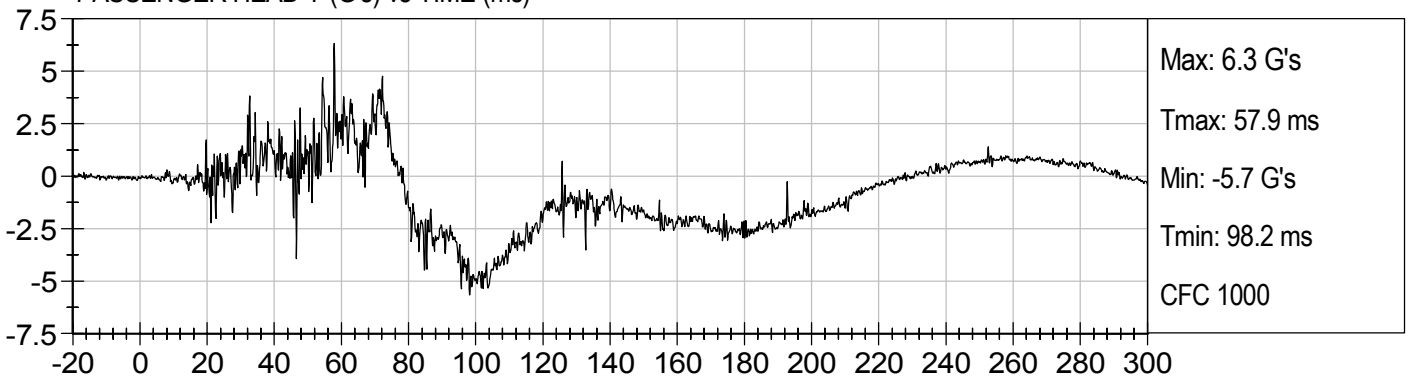
NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307

Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

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

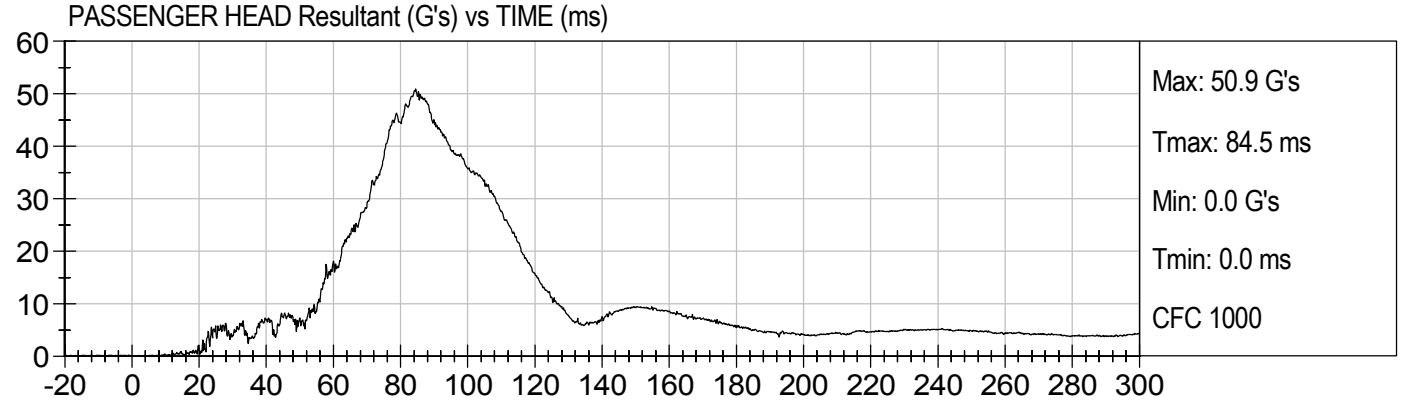


PASSENGER HEAD Y (G's) vs TIME (ms)

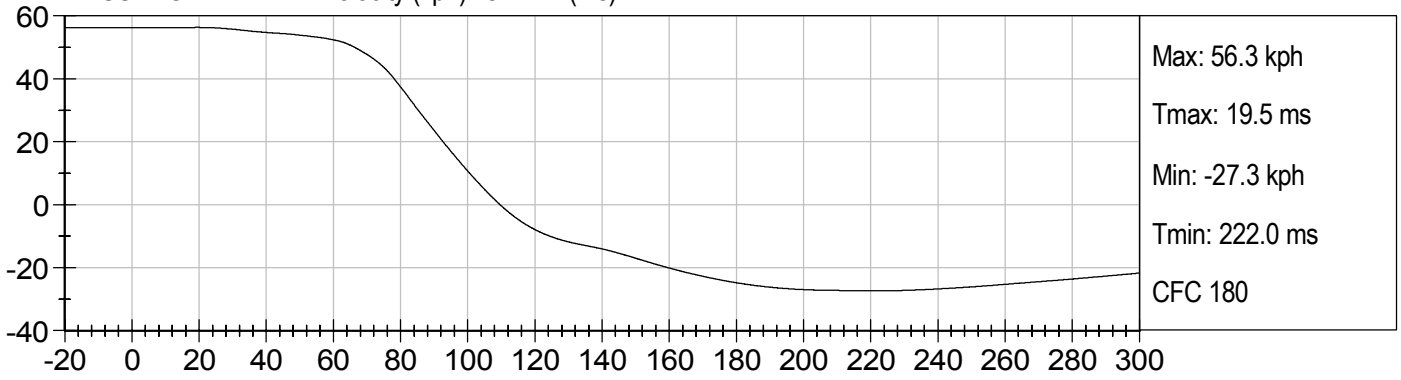


PASSENGER HEAD Z (G's) vs TIME (ms)

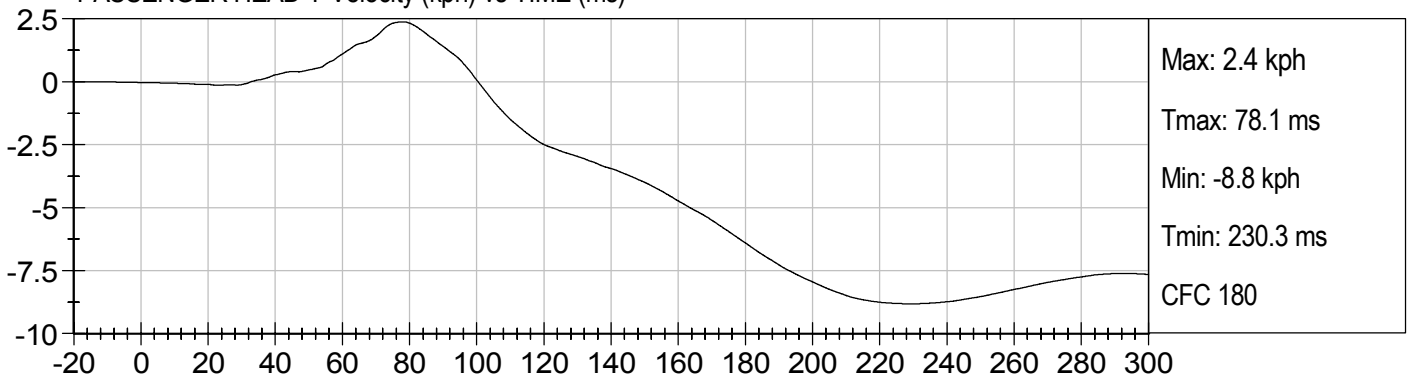
PASSENGER HEAD Resultant (G's) vs TIME (ms)



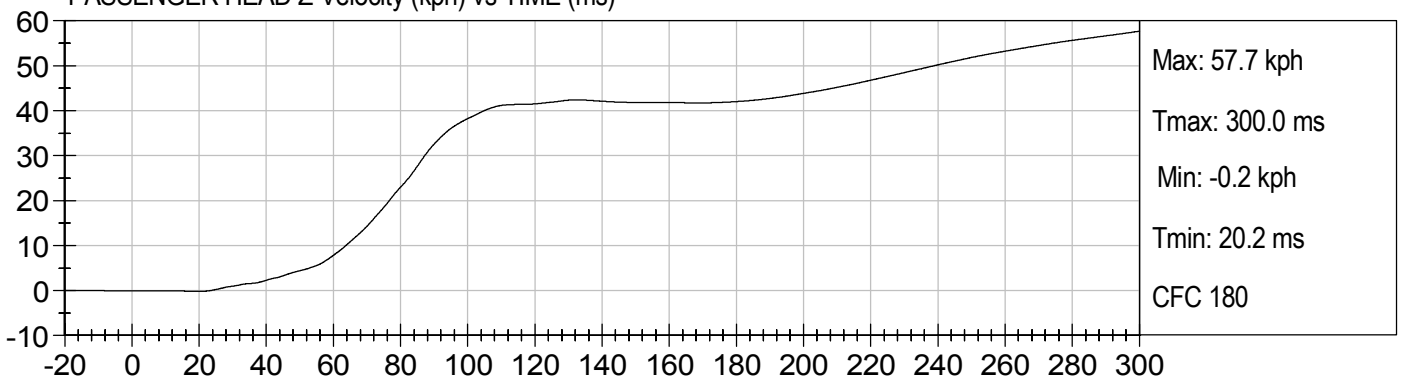
PASSENGER HEAD X Velocity (kph) vs TIME (ms)



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



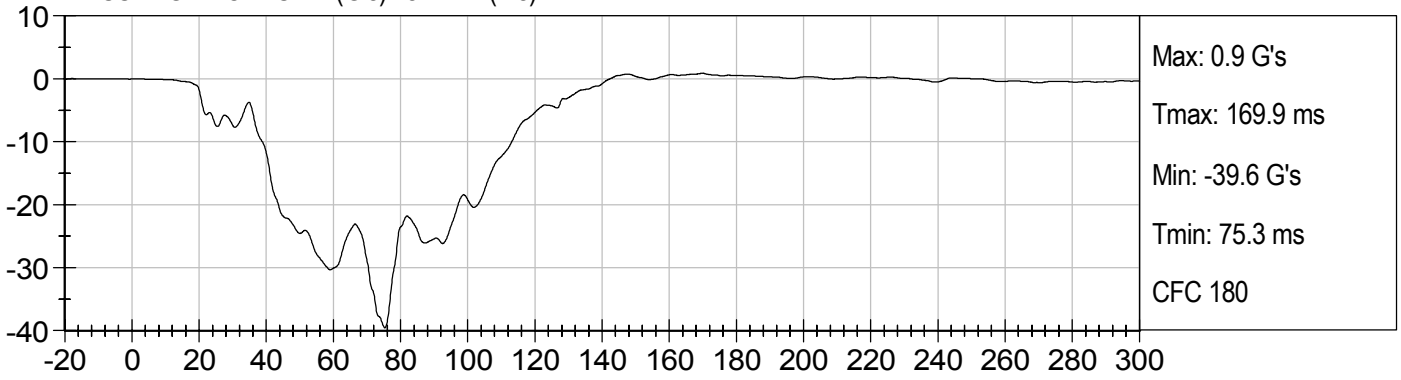
PASSENGER HEAD Z Velocity (kph) vs TIME (ms)



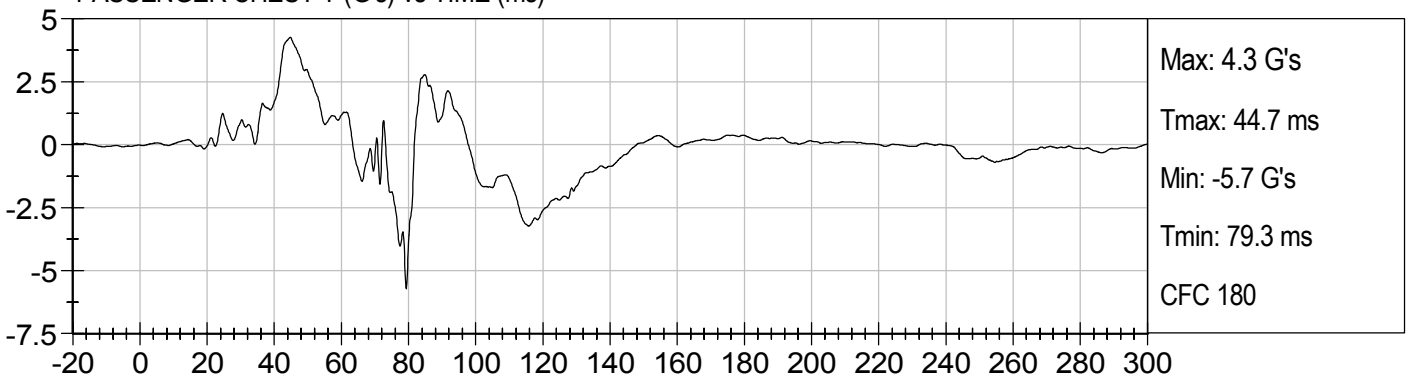
NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307

Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

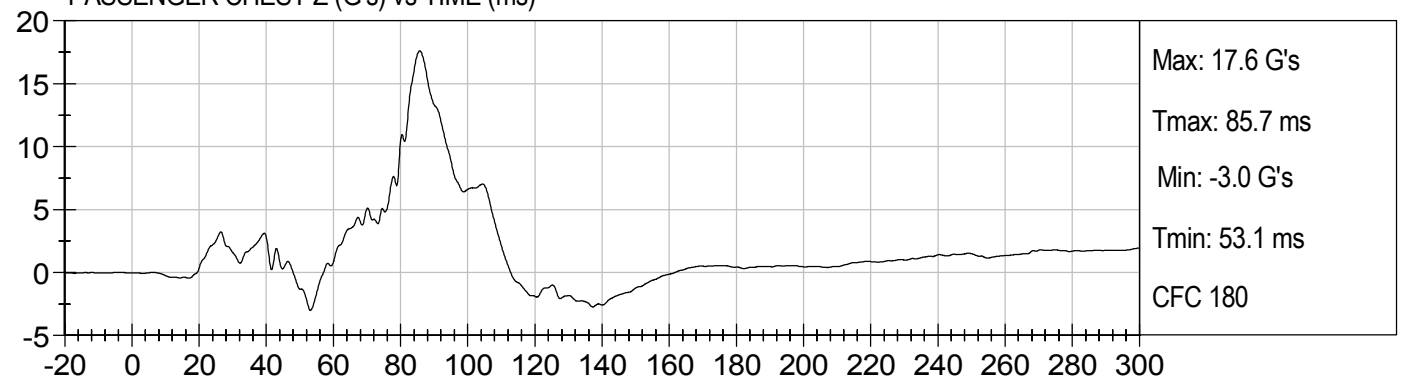
PASSENGER CHEST X (G's) vs TIME (ms)



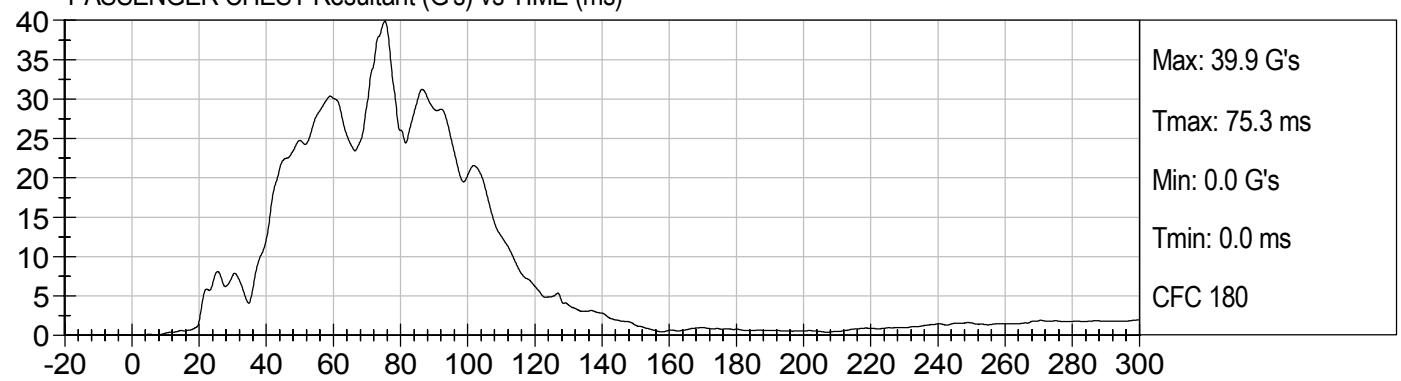
PASSENGER CHEST Y (G's) vs TIME (ms)



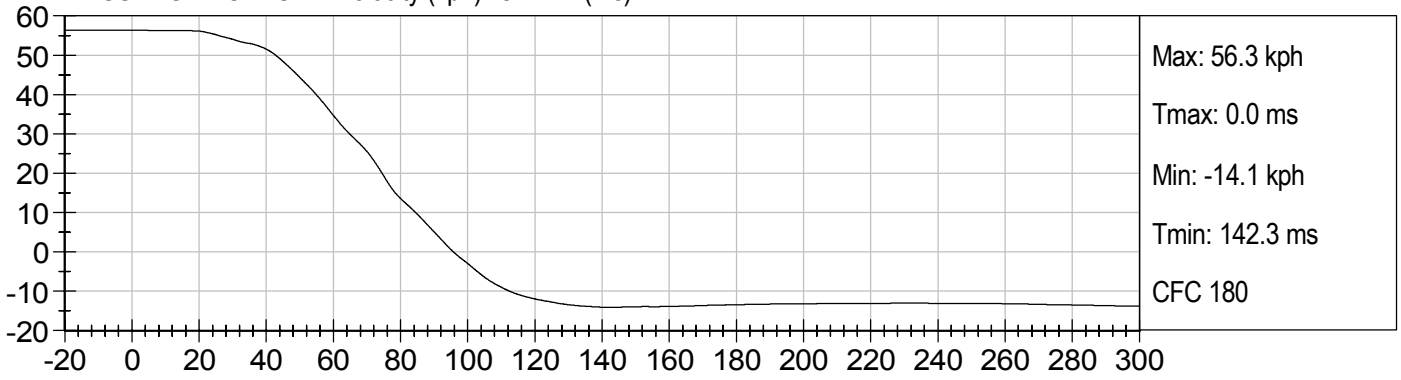
PASSENGER CHEST Z (G's) vs TIME (ms)



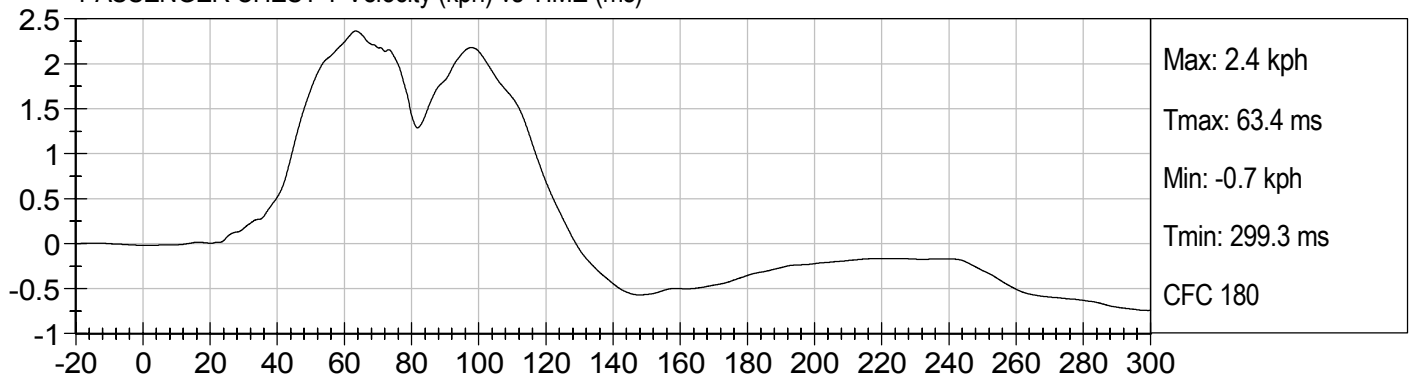
PASSENGER CHEST Resultant (G's) vs TIME (ms)



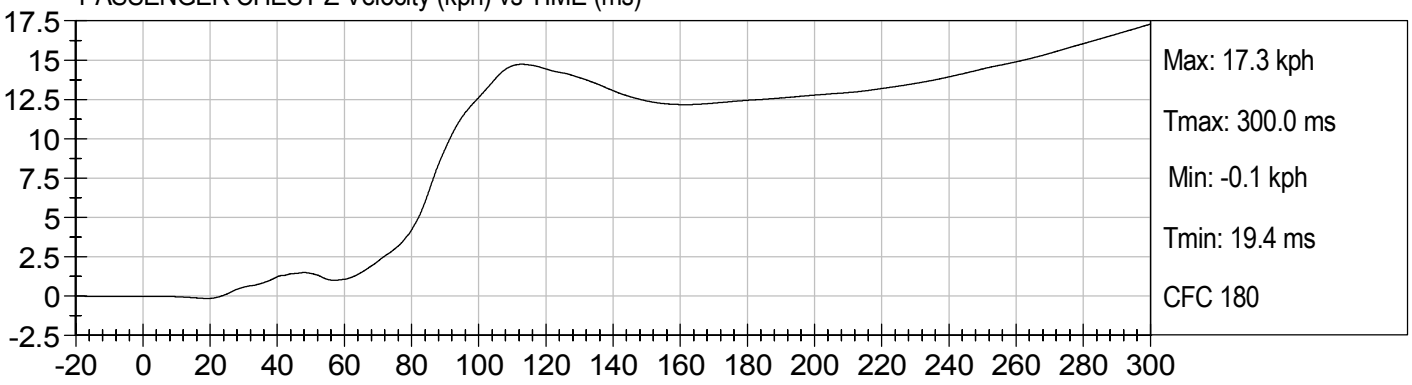
PASSENGER CHEST X Velocity (kph) vs TIME (ms)



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

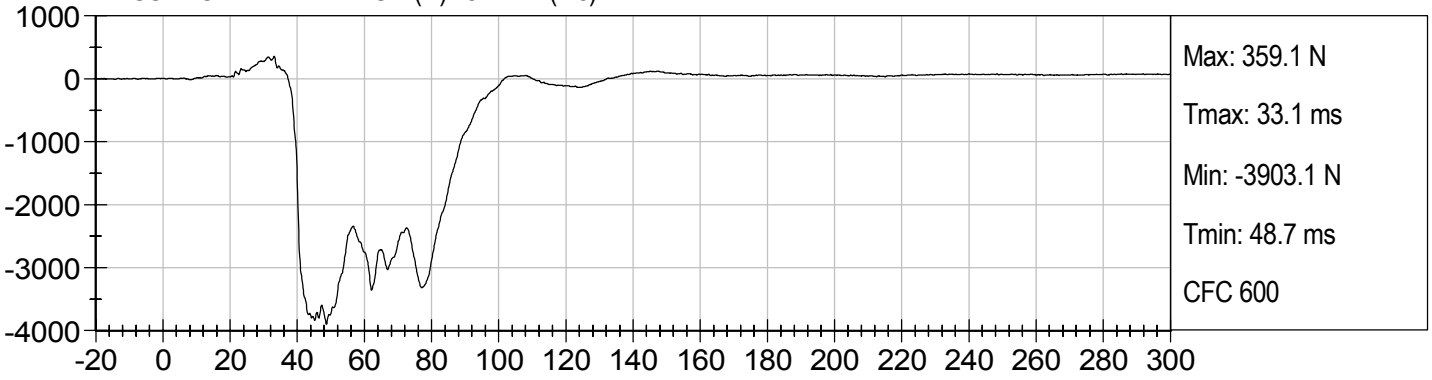


PASSENGER CHEST Z Velocity (kph) vs TIME (ms)

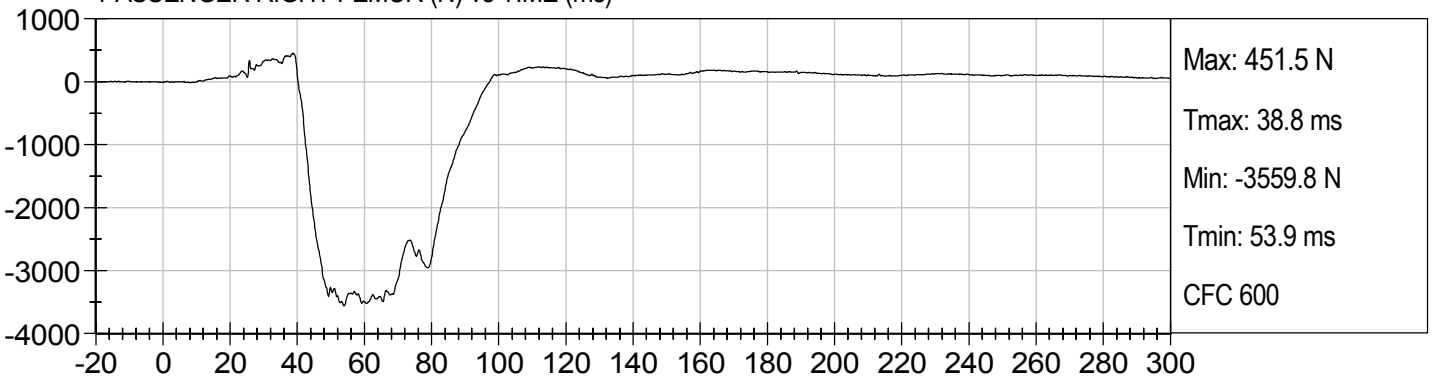


NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307
Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test ID:** D071351_

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Peak Resultant Acceleration	G's	225 - 275	261	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

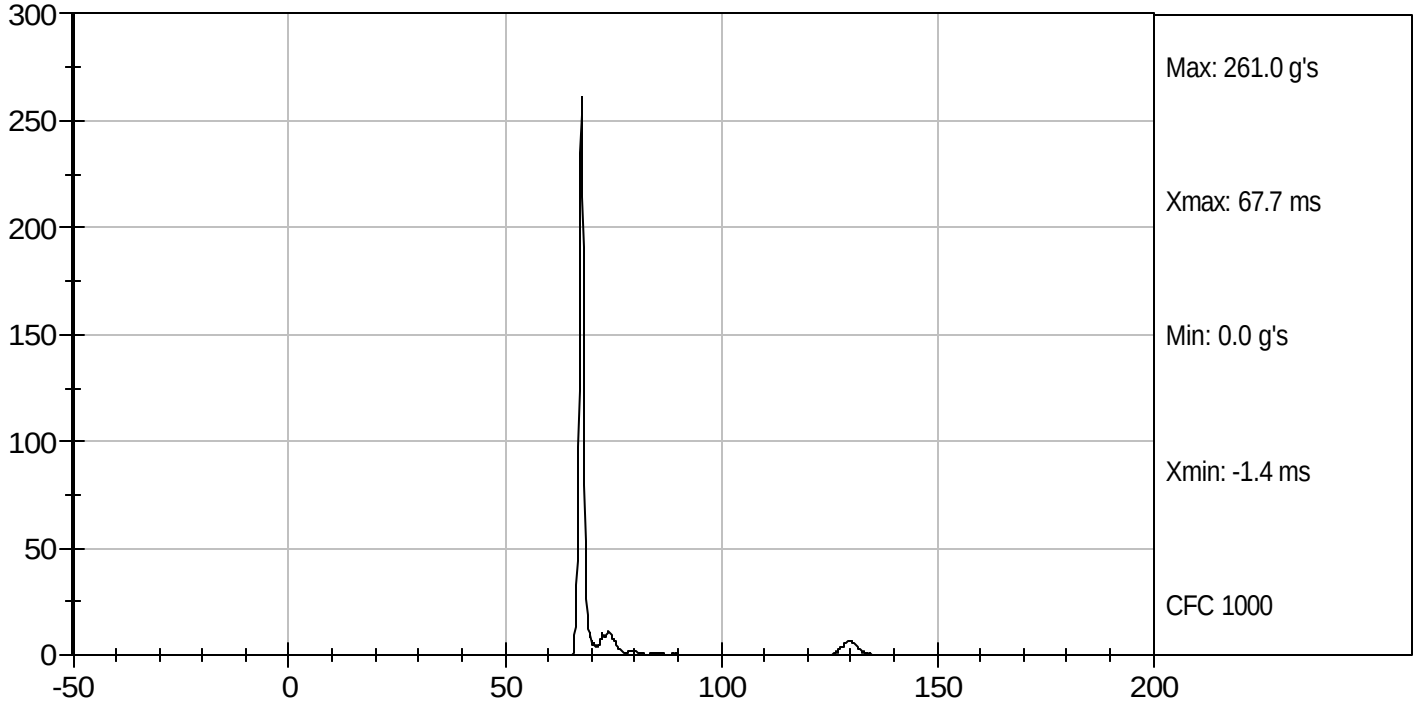
5/14/07
Test Date

David Winkelbauer
Approved By

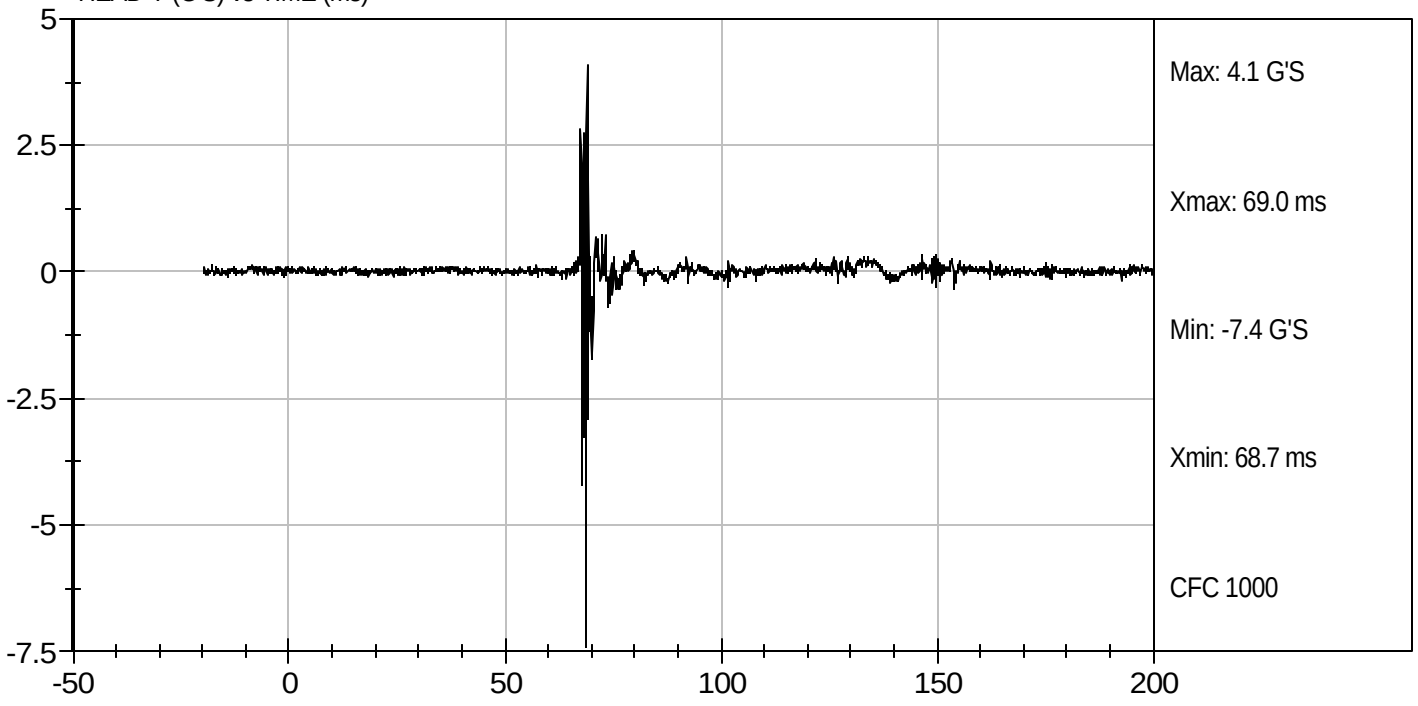
Test Desc: Head Drop
Component ID: D071351

Test Date: 5/14/07
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:** D071352

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.73	Pass
	20 msec	G's	17.60 to 22.60	18.05	Pass
	30 msec	G's	12.50 to 18.50	13.59	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	13.65	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	41.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	74.3	Pass
	Time	msec	57.0 to 64.0	59.3	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	93.9	Pass
	Time	msec	47.0 to 58.0	52.3	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.3	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

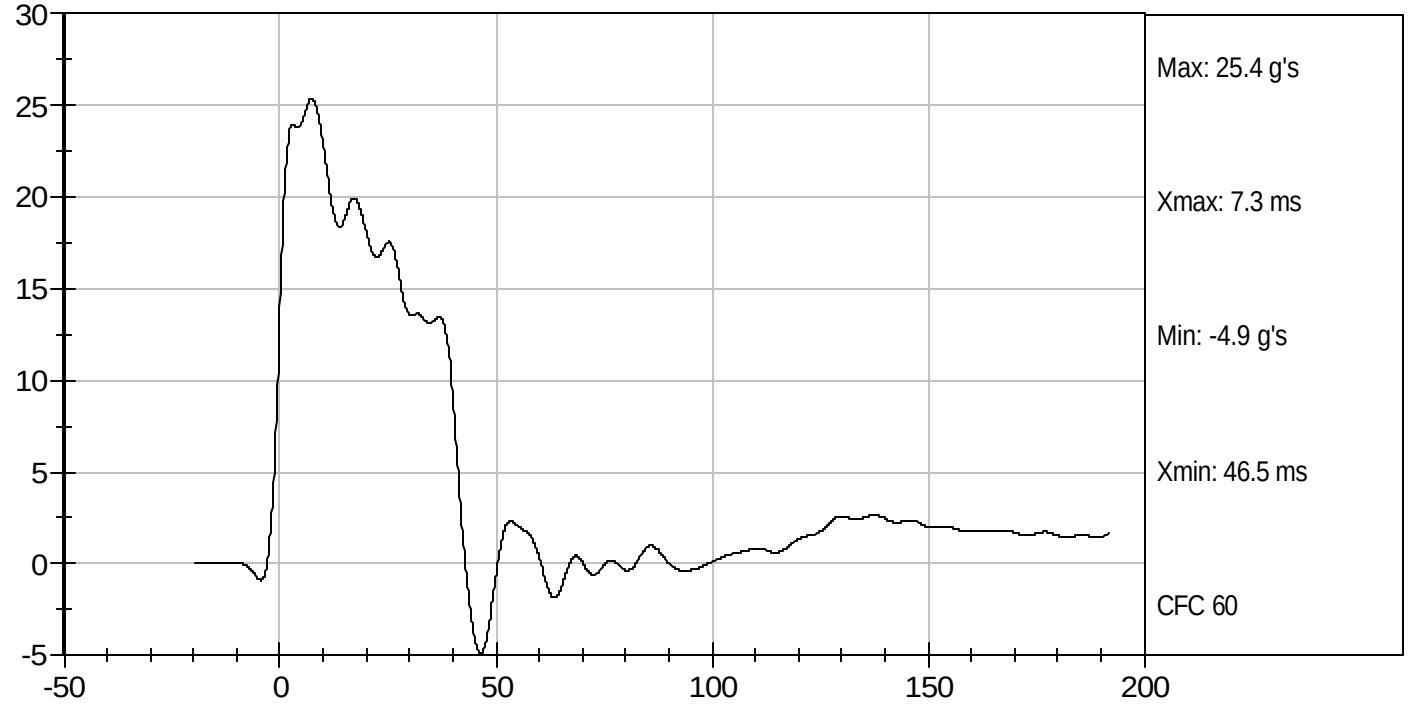
5/15/07
Test Date

David Winkelbauer
Approved By

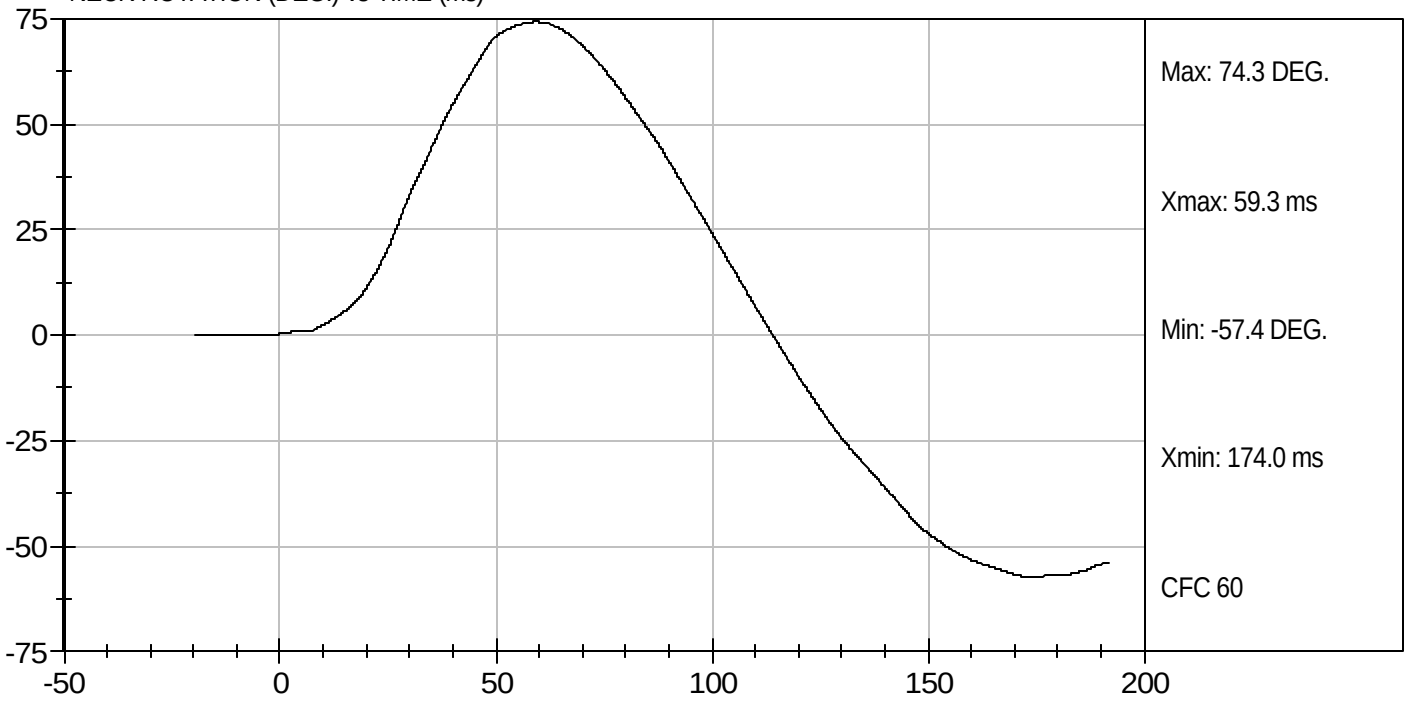
Test Desc: Neck Flexion
Component ID: D071352

Test Date: 5/15/07
Velocity: 22.83 ft/s, 6.96 m/s

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

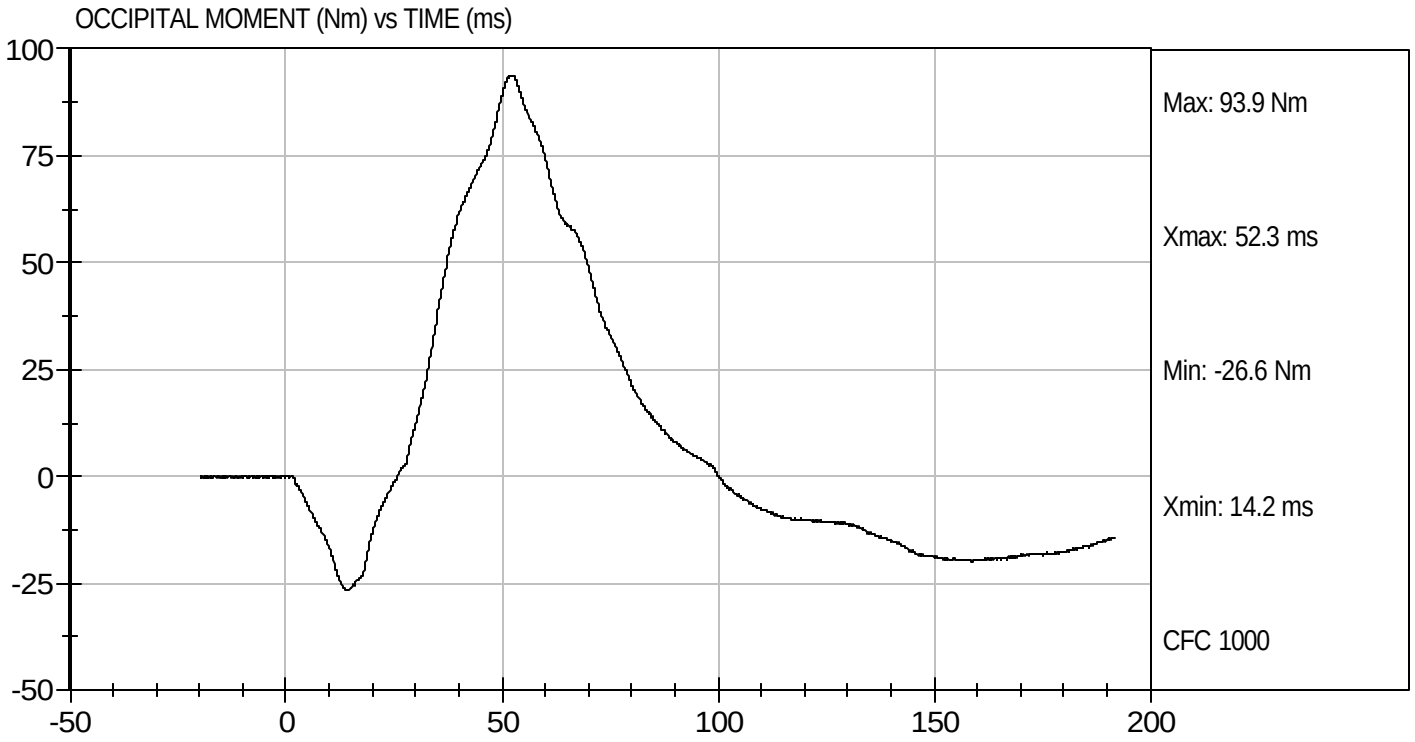


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D071352

Test Date: 5/15/07
Velocity: 22.83 ft/s, 6.96 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D071353

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.12	Pass
	20 msec	G's	14.00 to 19.00	16.06	Pass
	30 msec	G's	11.00 to 16.00	12.73	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	12.69	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	38.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	98.9	Pass
	Time	msec	72.0 to 82.0	75.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	155.4	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-61.1	Pass
	Time	msec	65.0 to 79.0	71.9	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.0	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

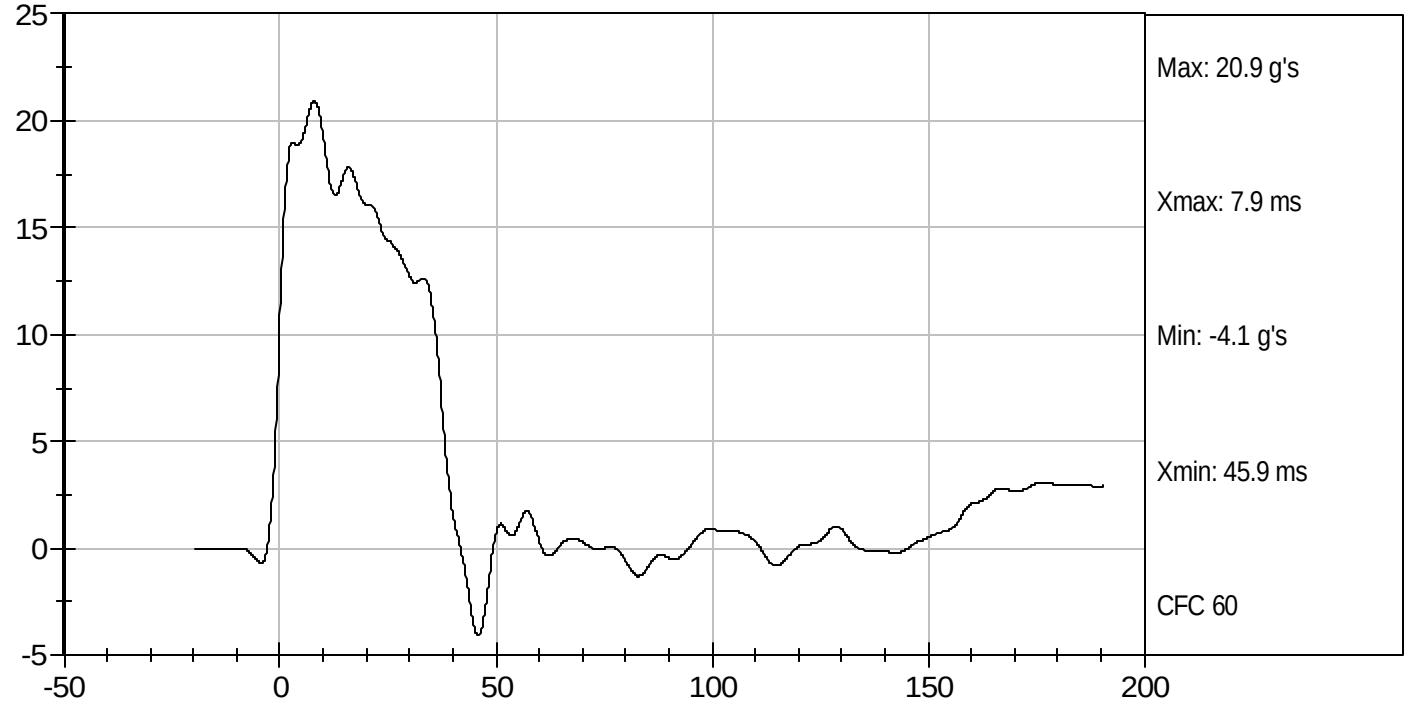
5/15/07
Test Date

David Winkelbauer
Approved By

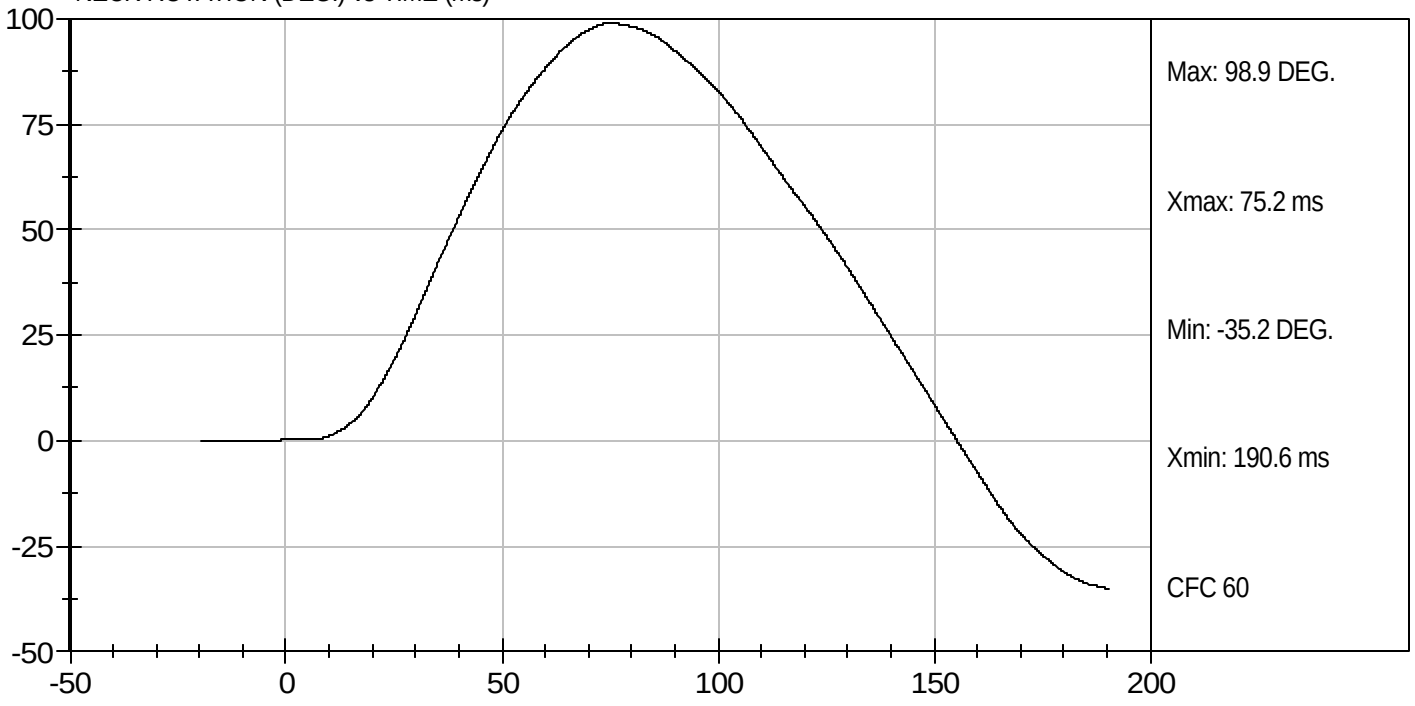
Test Desc: Neck Extension
Component ID: D071353

Test Date: 5/15/07
Velocity: 19.84 ft/s, 6.05 m/s

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

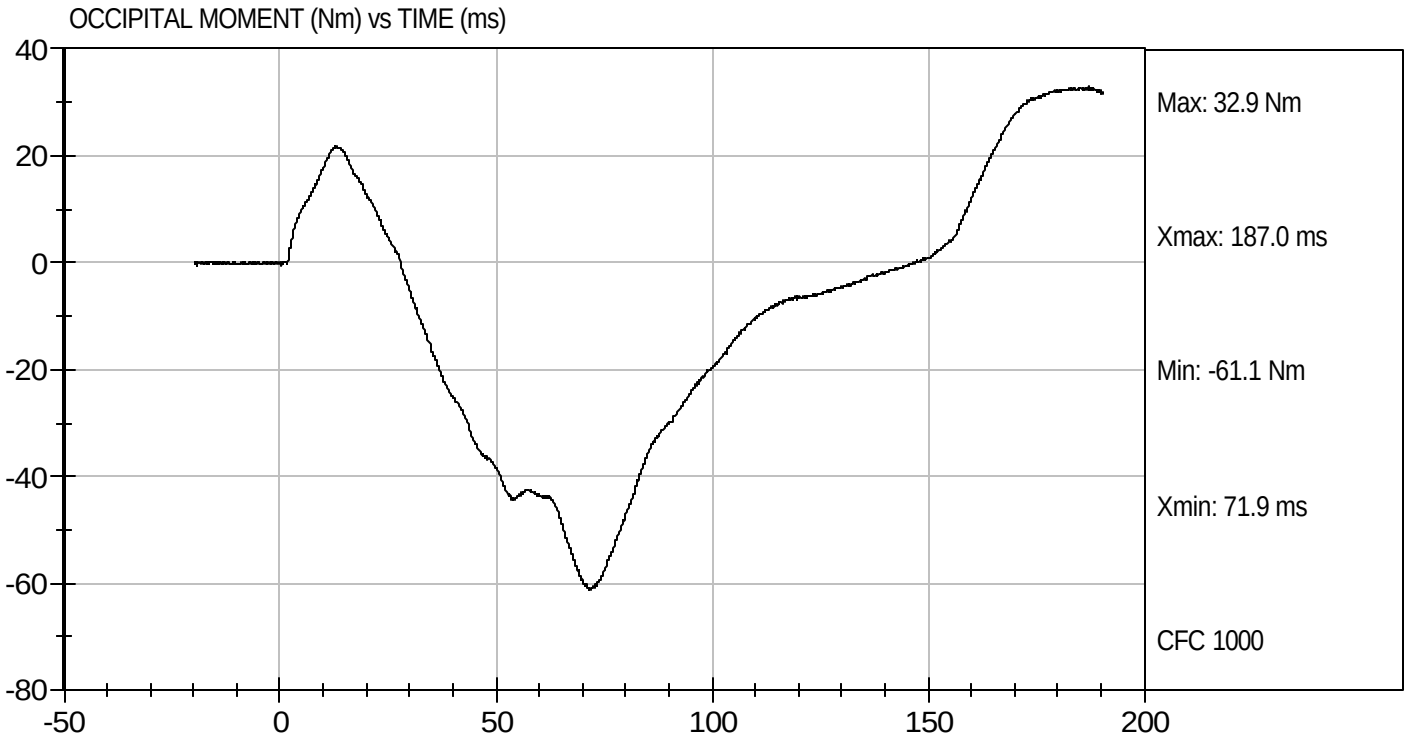


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D071353

Test Date: 5/15/07
Velocity: 19.84 ft/s, 6.05 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D071354

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,450	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.49	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

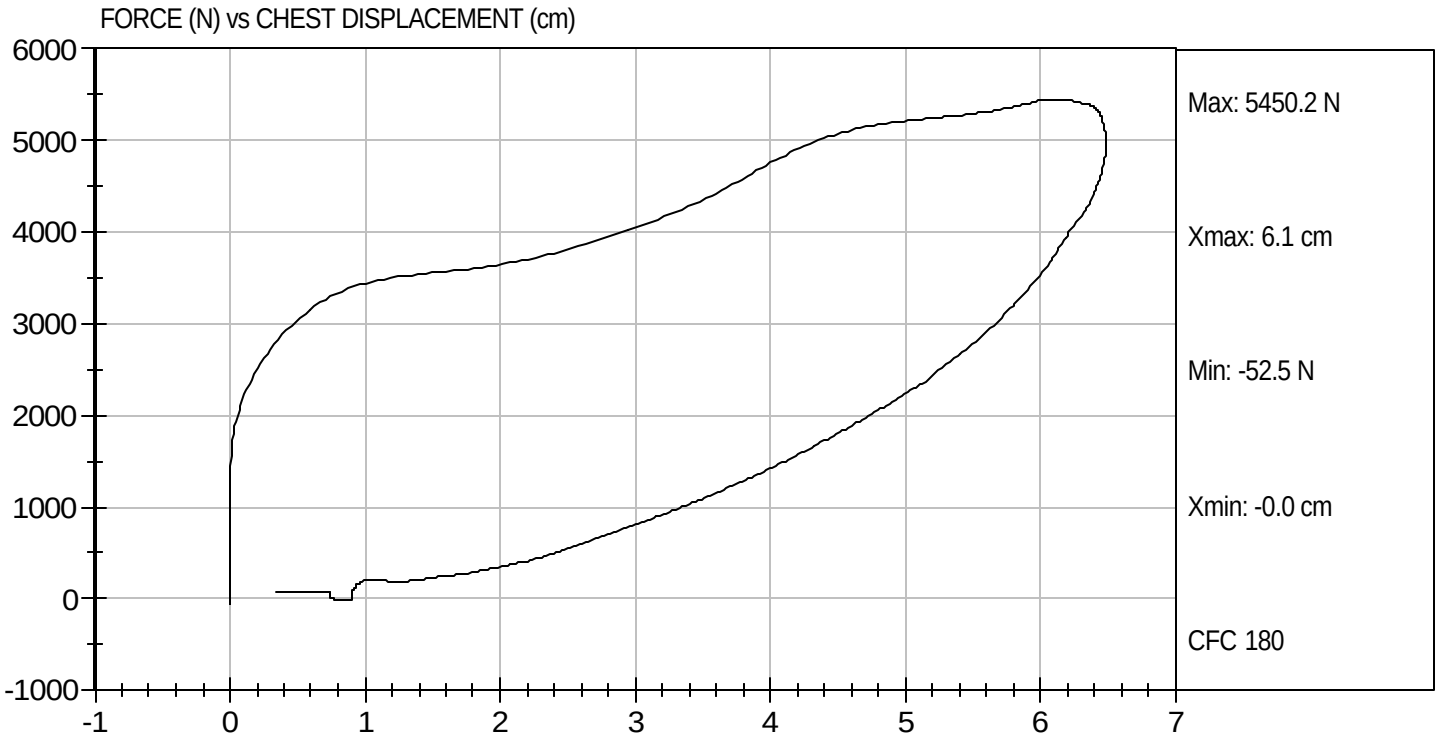
Tim Brady
Laboratory Technician

5/16/07
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D071354

Test Date: 5/16/07
Velocity: 21.92 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D071355

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	4,926	Pass
		Overall Test Results		Pass

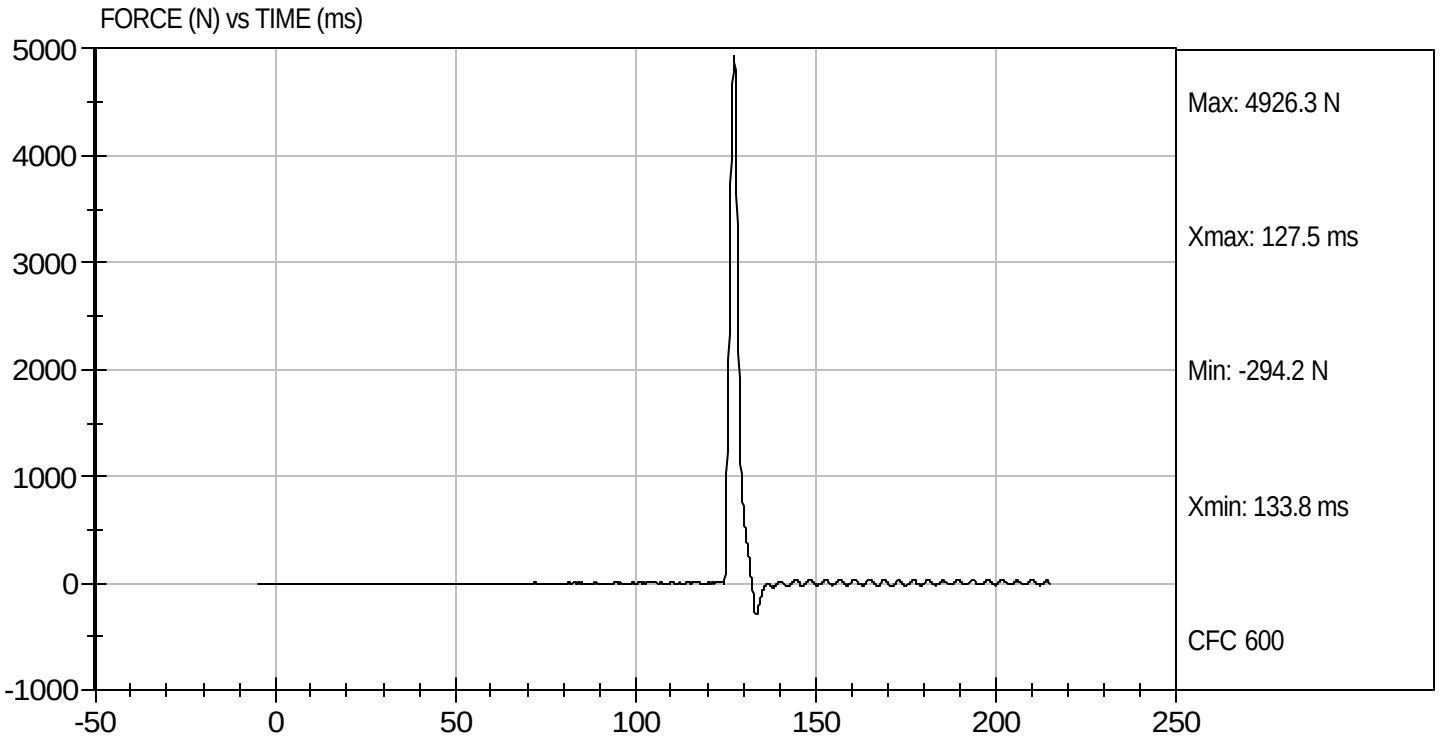
Laboratory Technician

5/15/07
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D071355

Test Date: 5/15/07
Velocity: 6.83 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D071356

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	42	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	4,838	Pass
		Overall Test Results		Pass

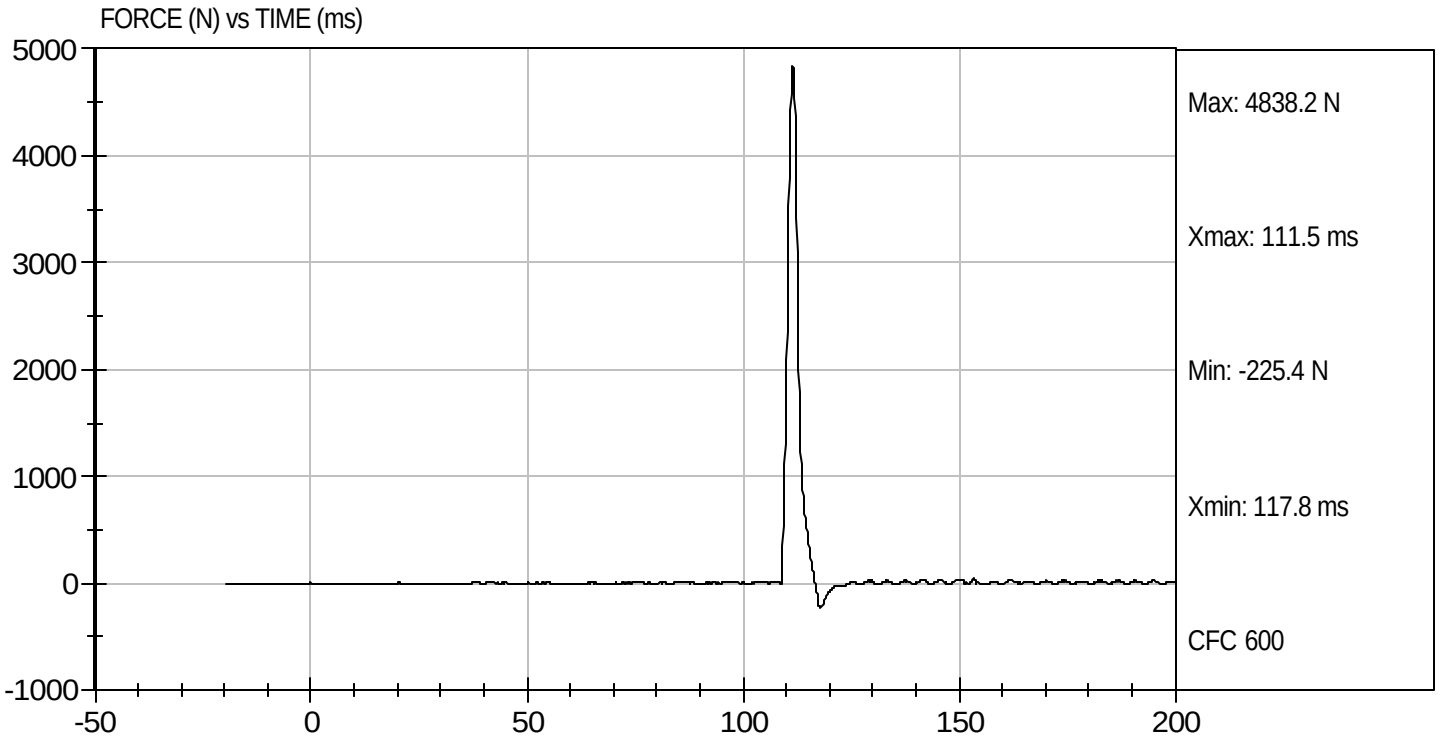
Tim Brady
Laboratory Technician

5/15/07
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D071356

Test Date: 5/15/07
Velocity: 6.83 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D071350

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	37	37	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	62.4	56.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	42	Pass
		Overall Test Results			Pass

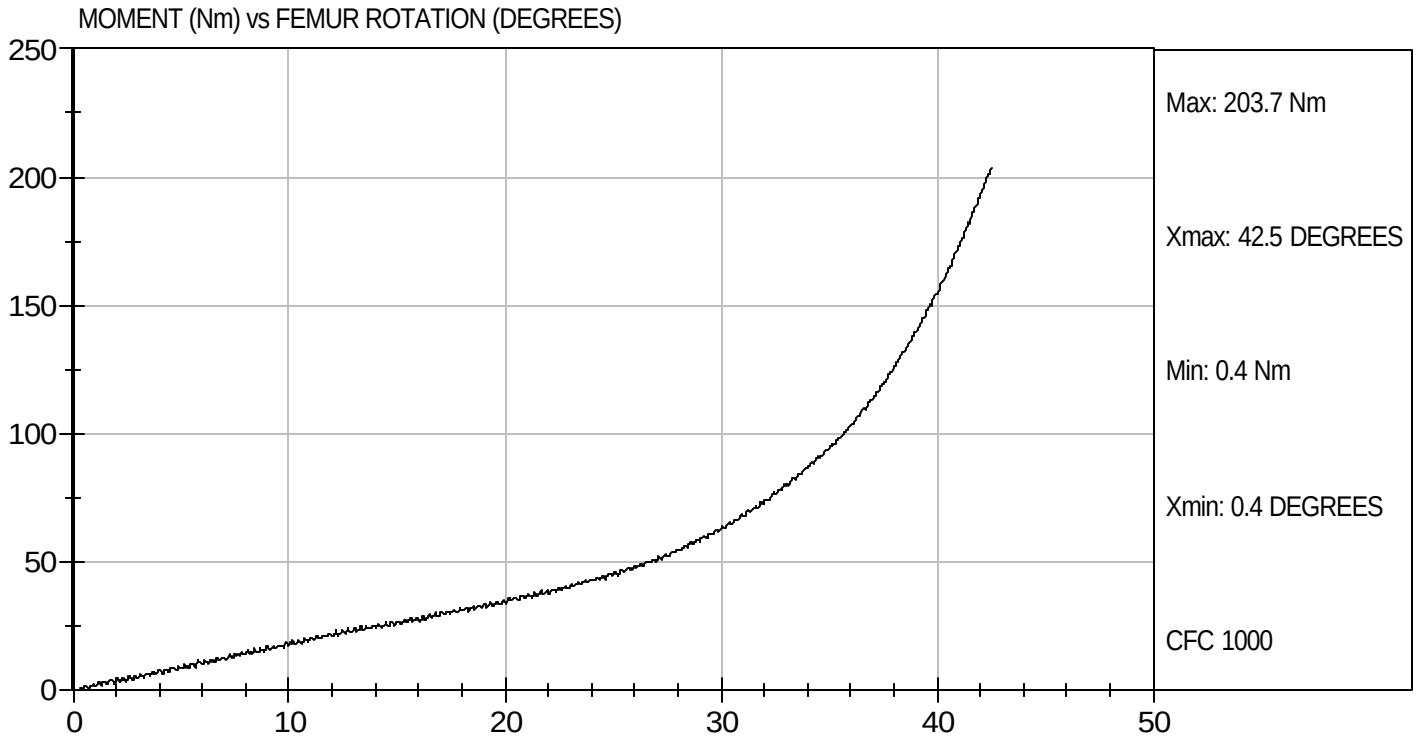
Laboratory Technician

5/14/07
Test Date

David Winkelbauer
Approved By

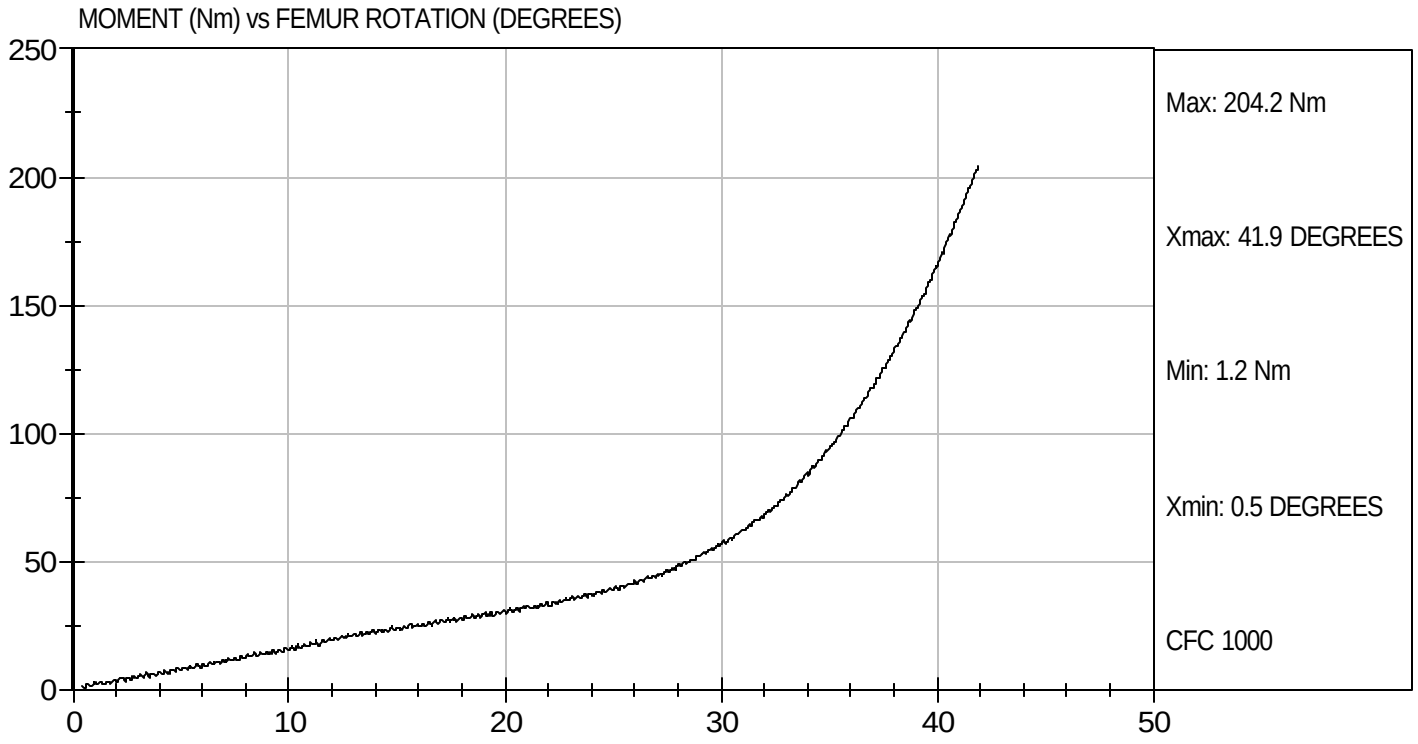
Test Desc: Hip Femur Flexion
Component ID: D071359

Test Date: 5/14/07
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D071350

Test Date: 5/14/07
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:** D071341

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Peak Resultant Acceleration	G's	225 - 275	235	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	4.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

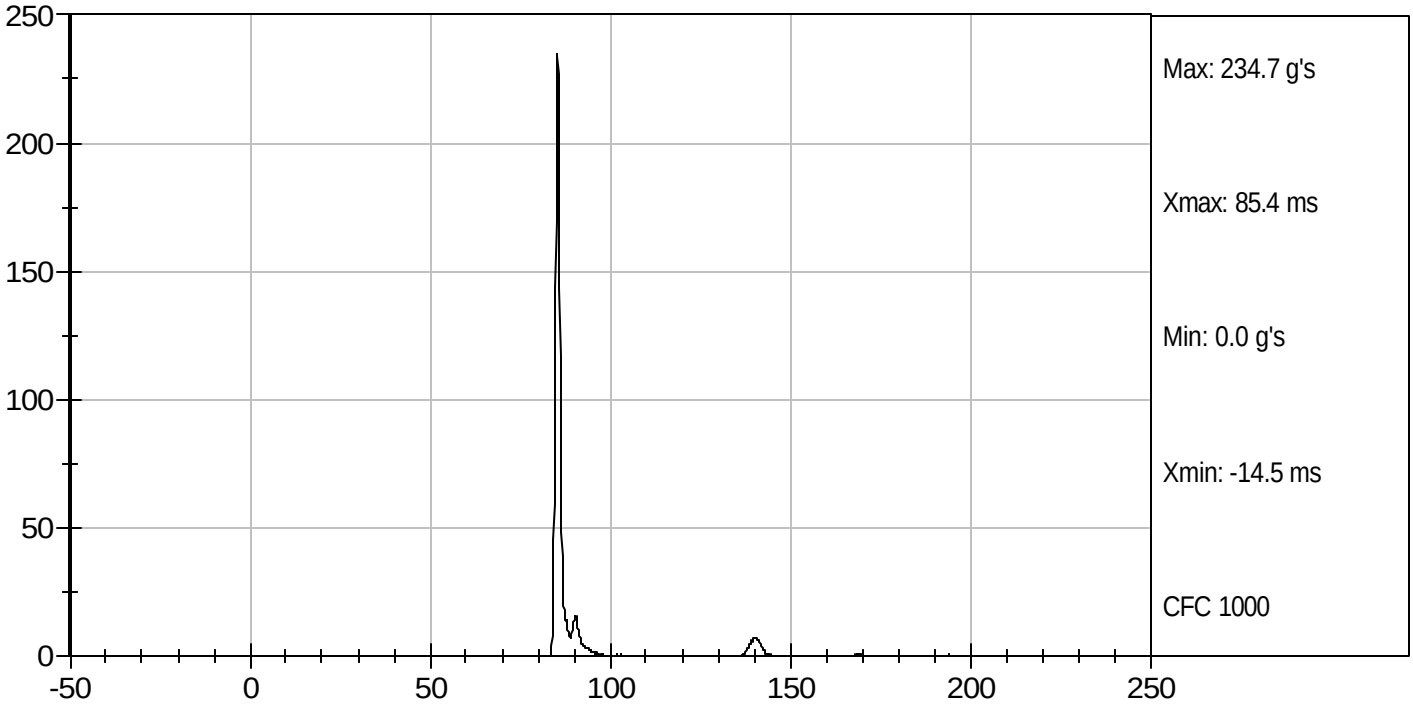
5/14/07
Test Date

David Winkelbauer
Approved By

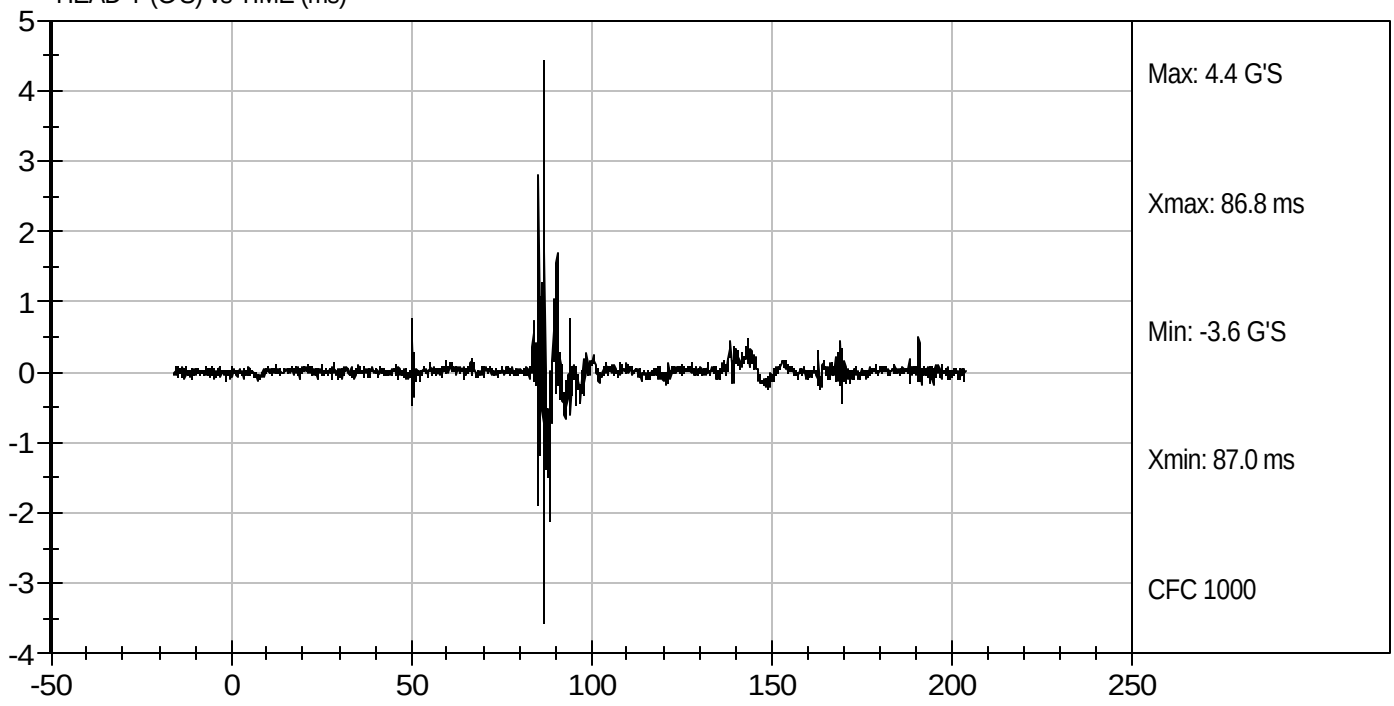
Test Desc: Head Drop
Component ID: D071341

Test Date: 5/14/07
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:** D071342

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.94	Pass
	20 msec	G's	17.60 to 22.60	17.69	Pass
	30 msec	G's	12.50 to 18.50	13.31	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	13.42	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	37.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	73.6	Pass
	Time	msec	57.0 to 64.0	59.1	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	113.5	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.1	Pass
	Time	msec	47.0 to 58.0	51.3	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.4	Pass
			Overall Test Results		Pass

Laboratory Technician

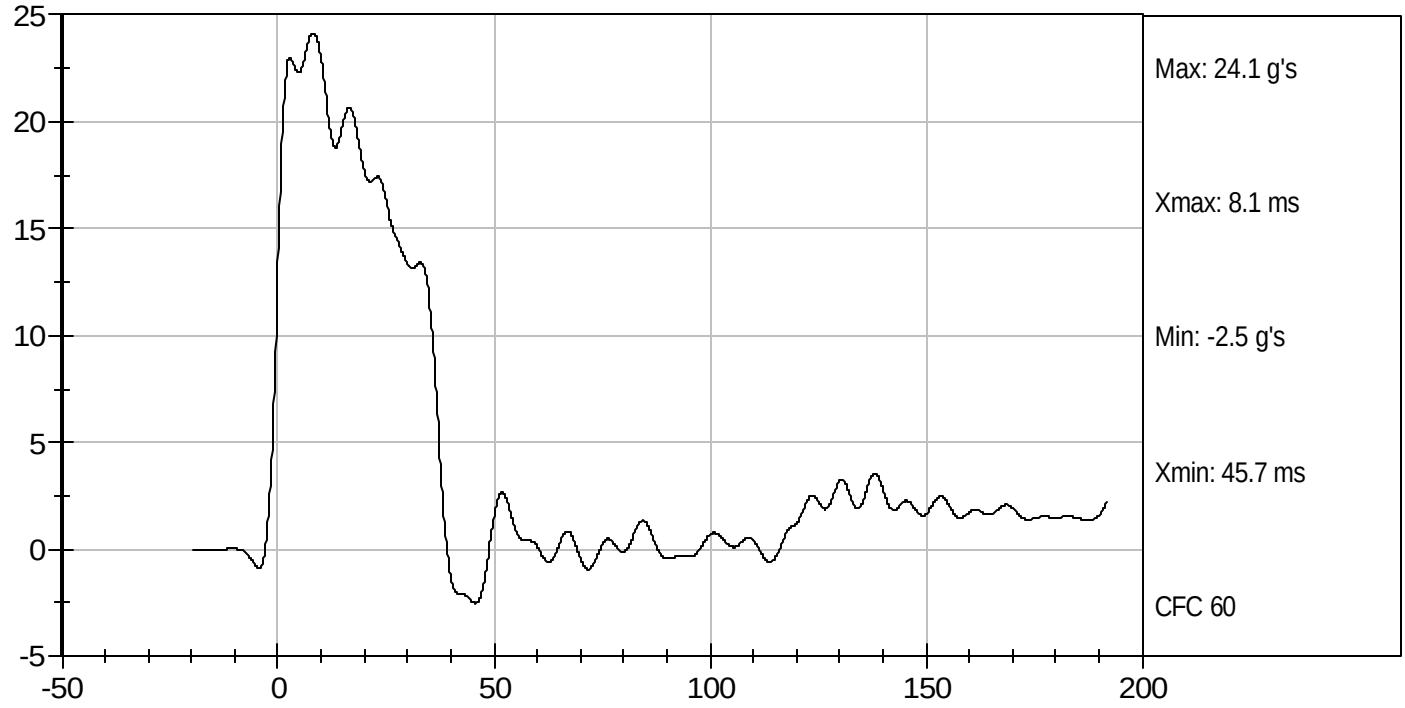
5/15/07
Test Date

David Winkelbauer
Approved By

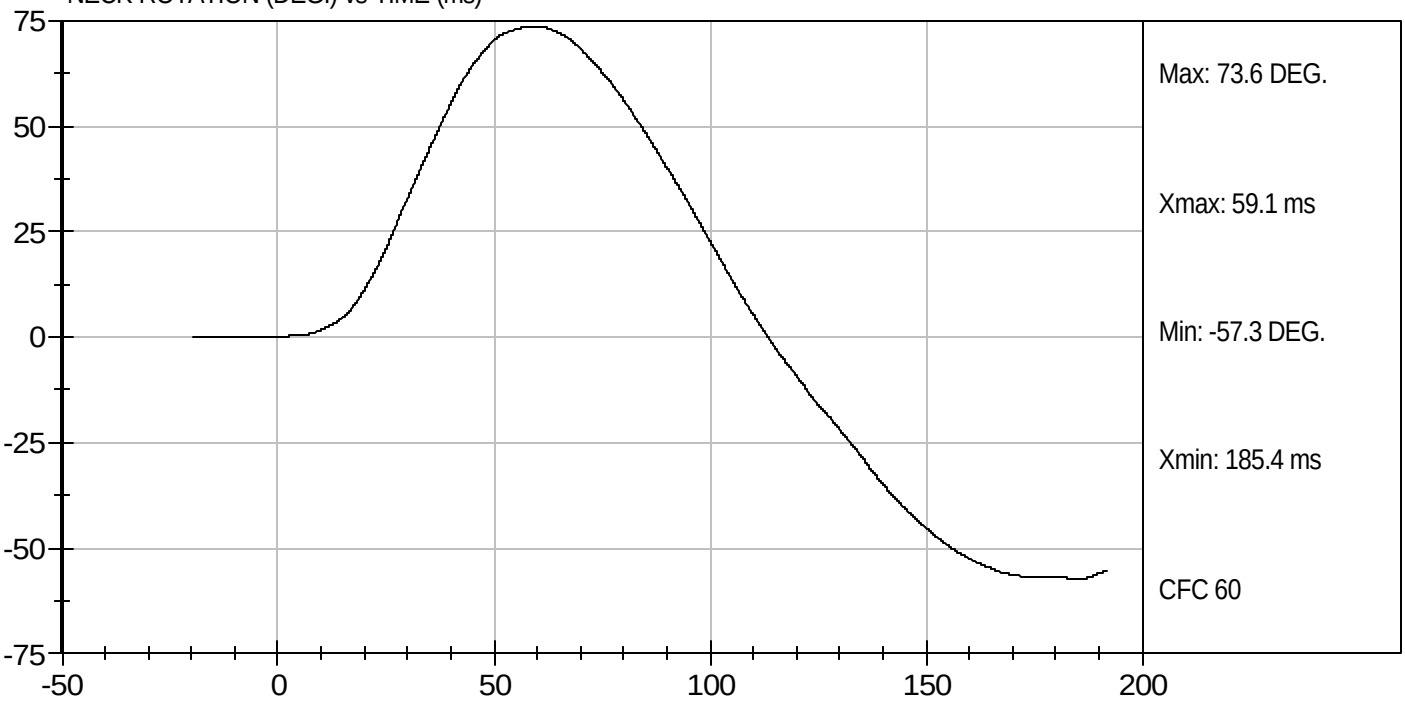
Test Desc: Neck Flexion
Component ID: D071342

Test Date: 5/15/07
Velocity: 23.14 ft/s, 7.05 m/s

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

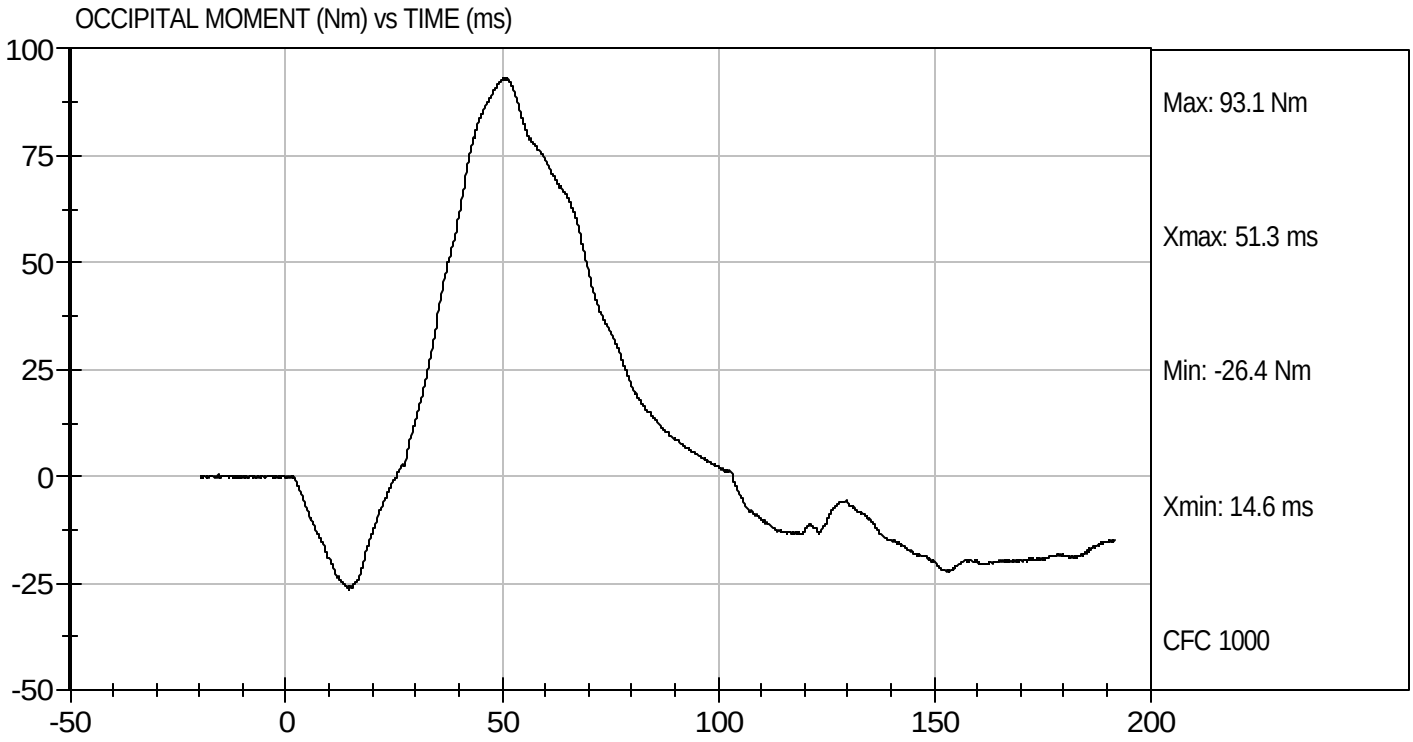


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D071342

Test Date: 5/15/07
Velocity: 23.14 ft/s, 7.05 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D071343

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	18.15	Pass
	20 msec	G's	14.00 to 19.00	14.33	Pass
	30 msec	G's	11.00 to 16.00	12.70	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.26	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	98.4	Pass
	Time	msec	72.0 to 82.0	78.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	159.3	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-60.1	Pass
	Time	msec	65.0 to 79.0	72.5	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	147.600	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

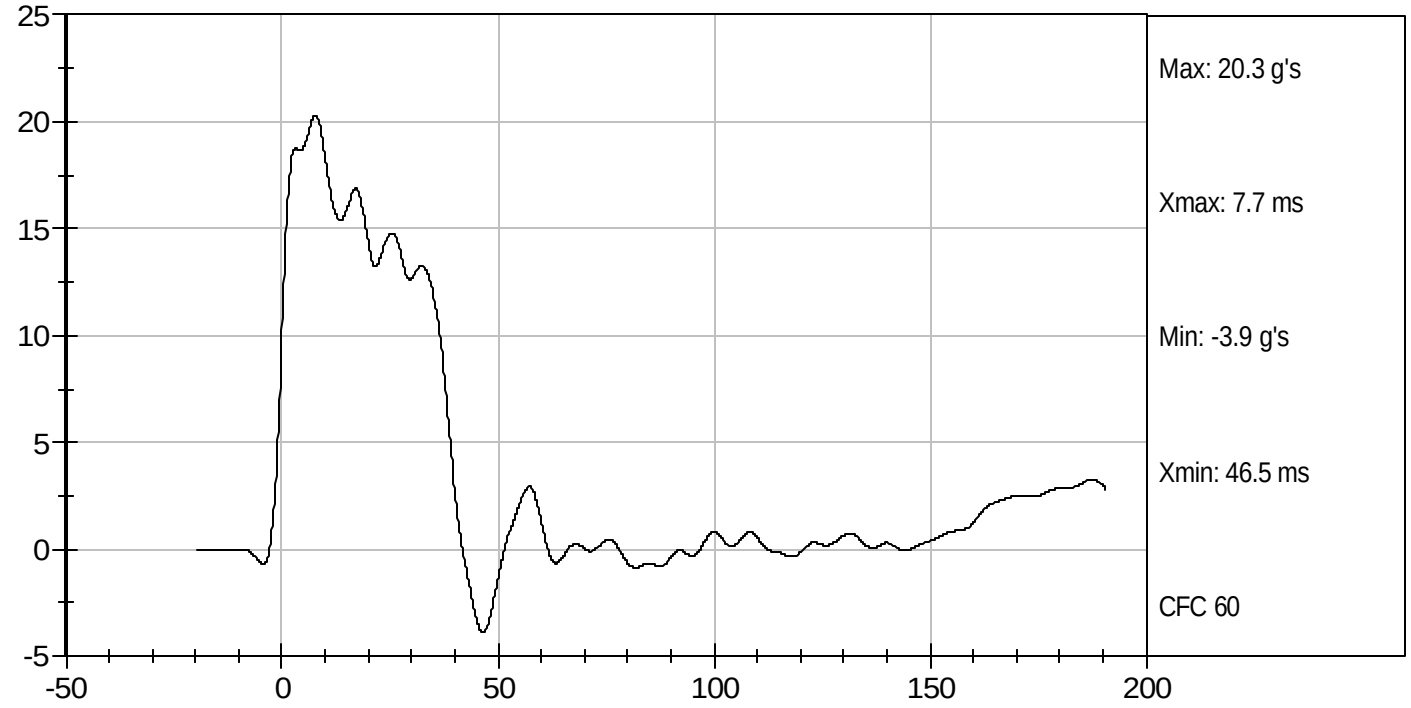
5/15/07
Test Date

David Winkelbauer
Approved By

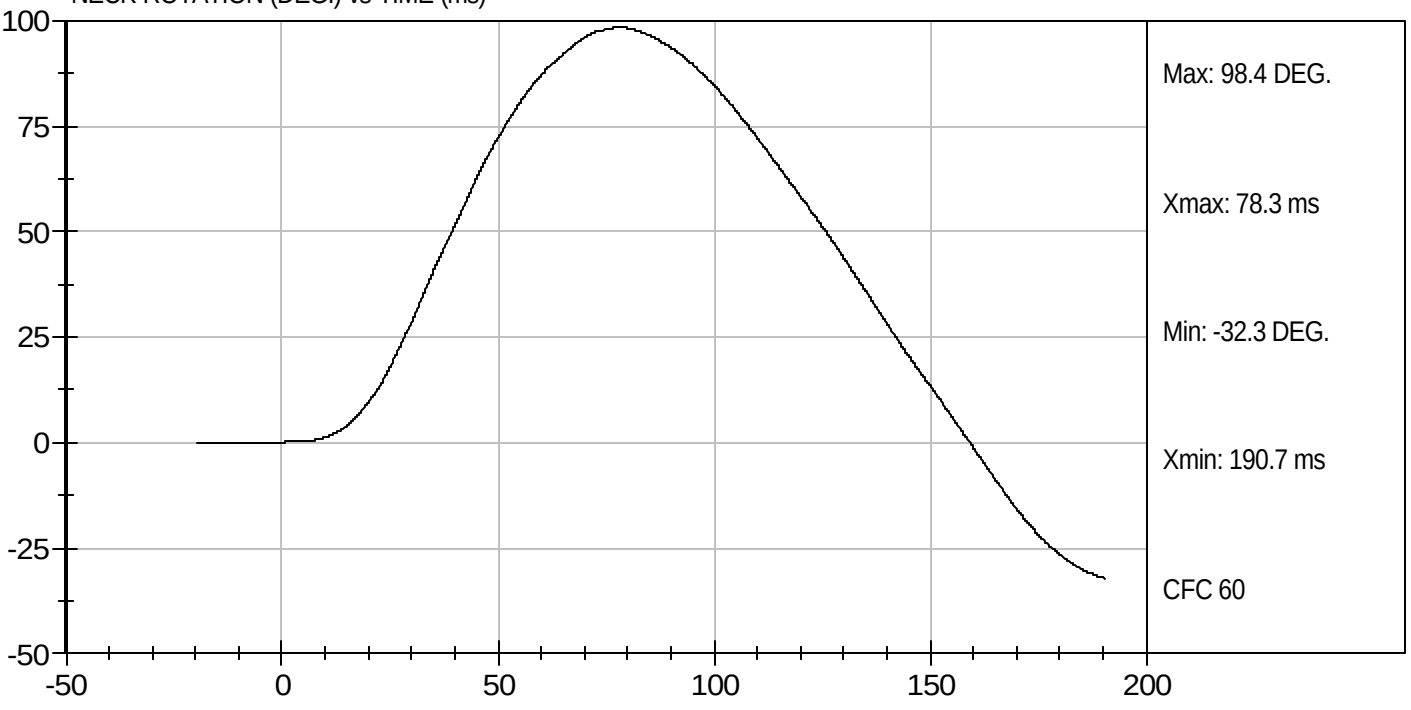
Test Desc: Neck Extension
Component ID: D071343

Test Date: 5/15/07
Velocity: 19.84 ft/s, 6.05 m/s

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

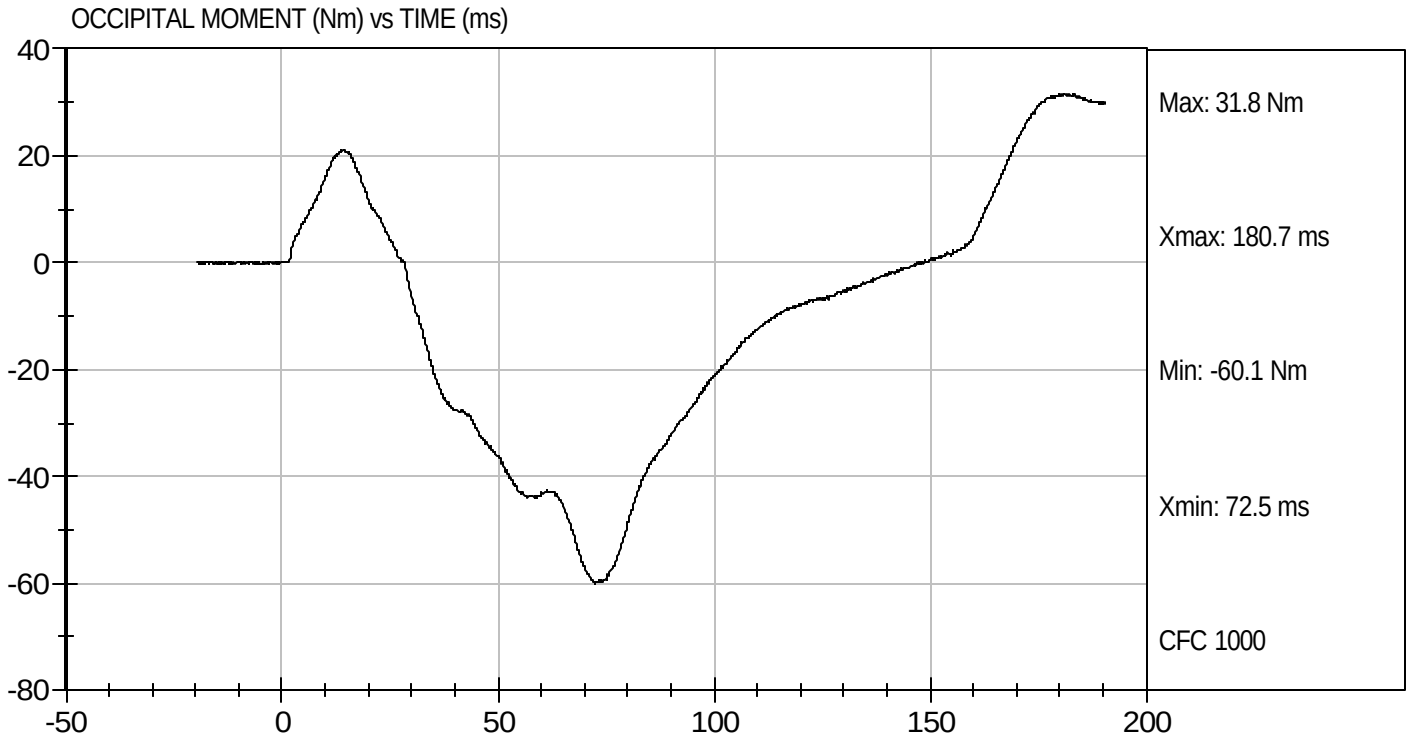


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D071343

Test Date: 5/15/07
Velocity: 19.84 ft/s, 6.05 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D071344

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,557	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.73	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

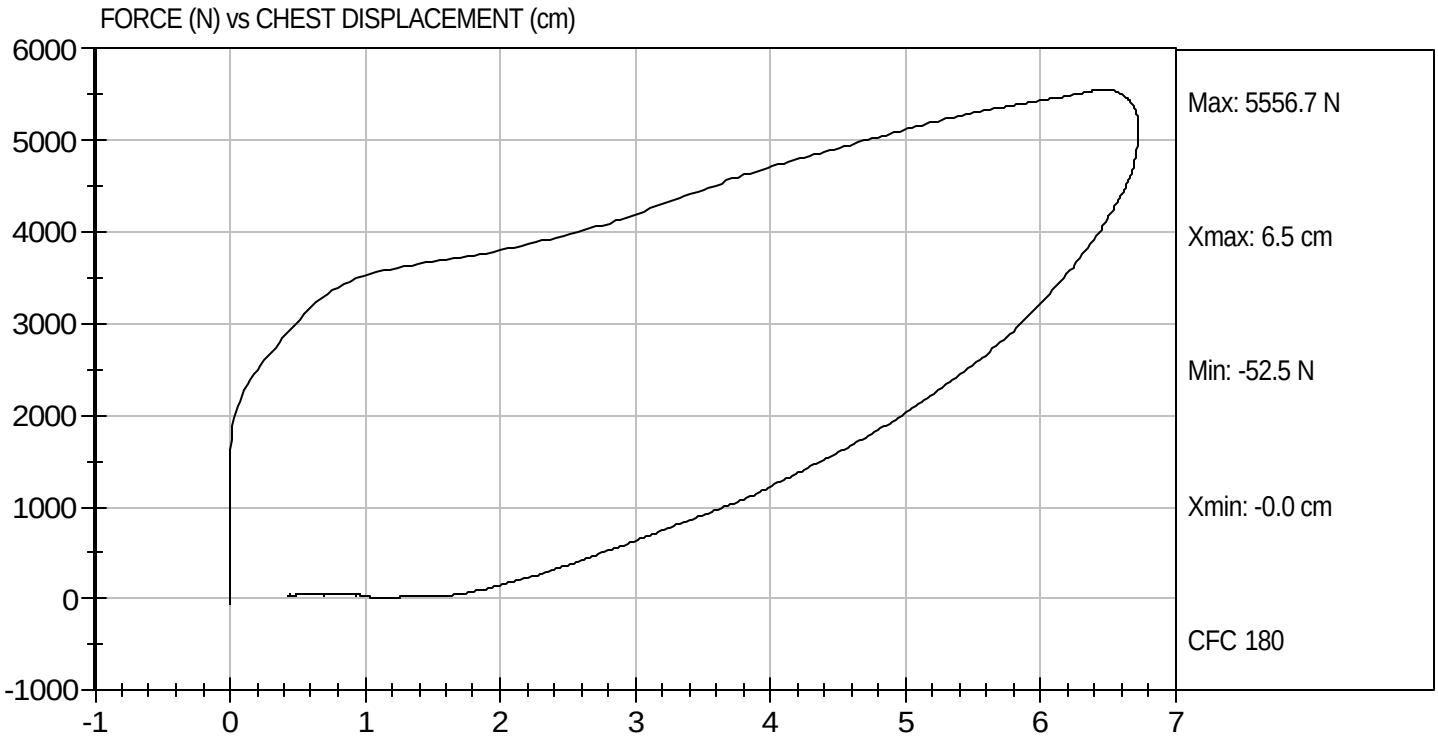
Laboratory Technician

5/15/07
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D071344

Test Date: 5/15/07
Velocity: 21.92 ft/s, 6.68 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D071345

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,444	Pass
		Overall Test Results		Pass

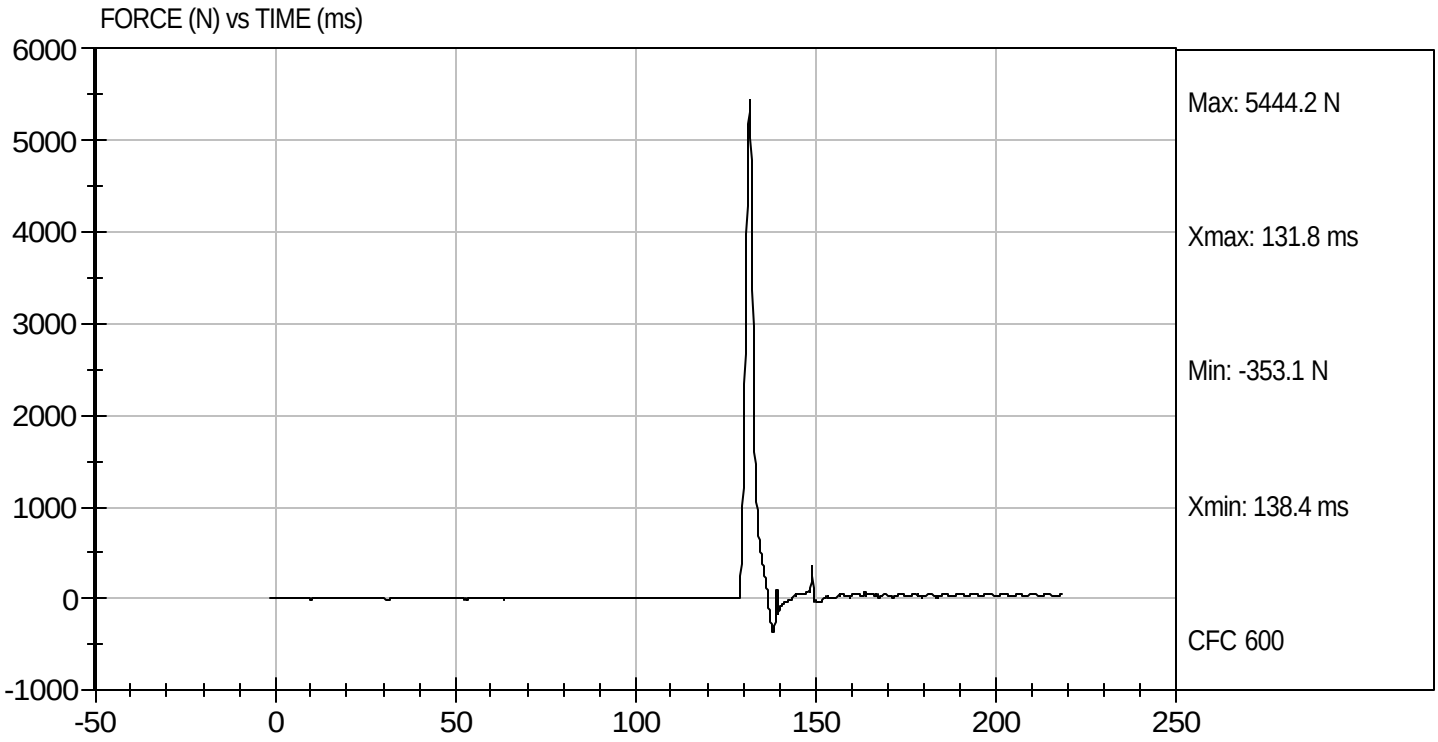
Laboratory Technician

5/15/07
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D071345

Test Date: 5/15/07
Velocity: 6.91 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:** D071346

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.07	Pass
Peak Probe Force	Newtons	4715 to 5782	5,164	Pass
		Overall Test Results		Pass

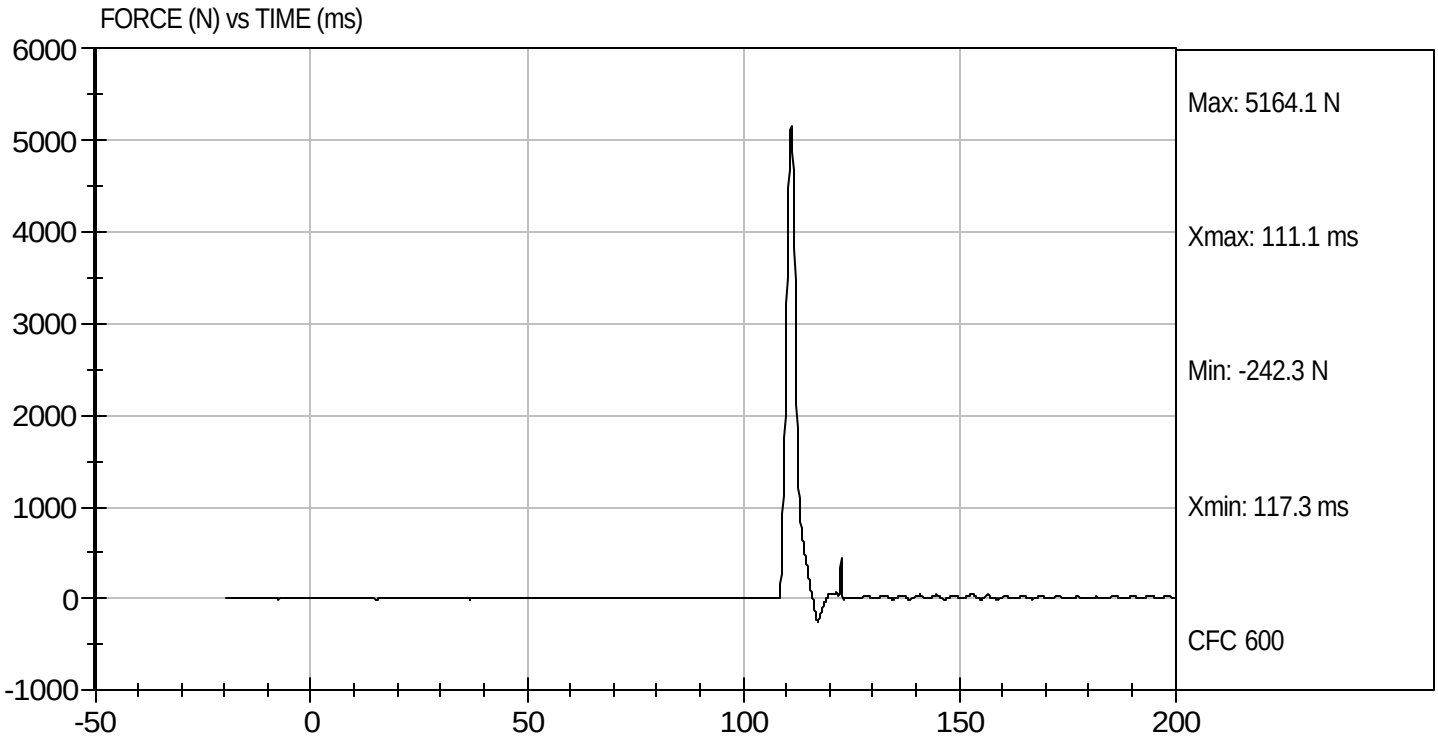
Laboratory Technician

5/15/07
Test Date

Approved By

Test Desc: Left Knee
Component ID: D071346

Test Date: 5/15/07
Velocity: 6.803 ft/s, 2.07 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D071340

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	39	39	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	62.0	63.0	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	41	Pass
		Overall Test Results			Pass

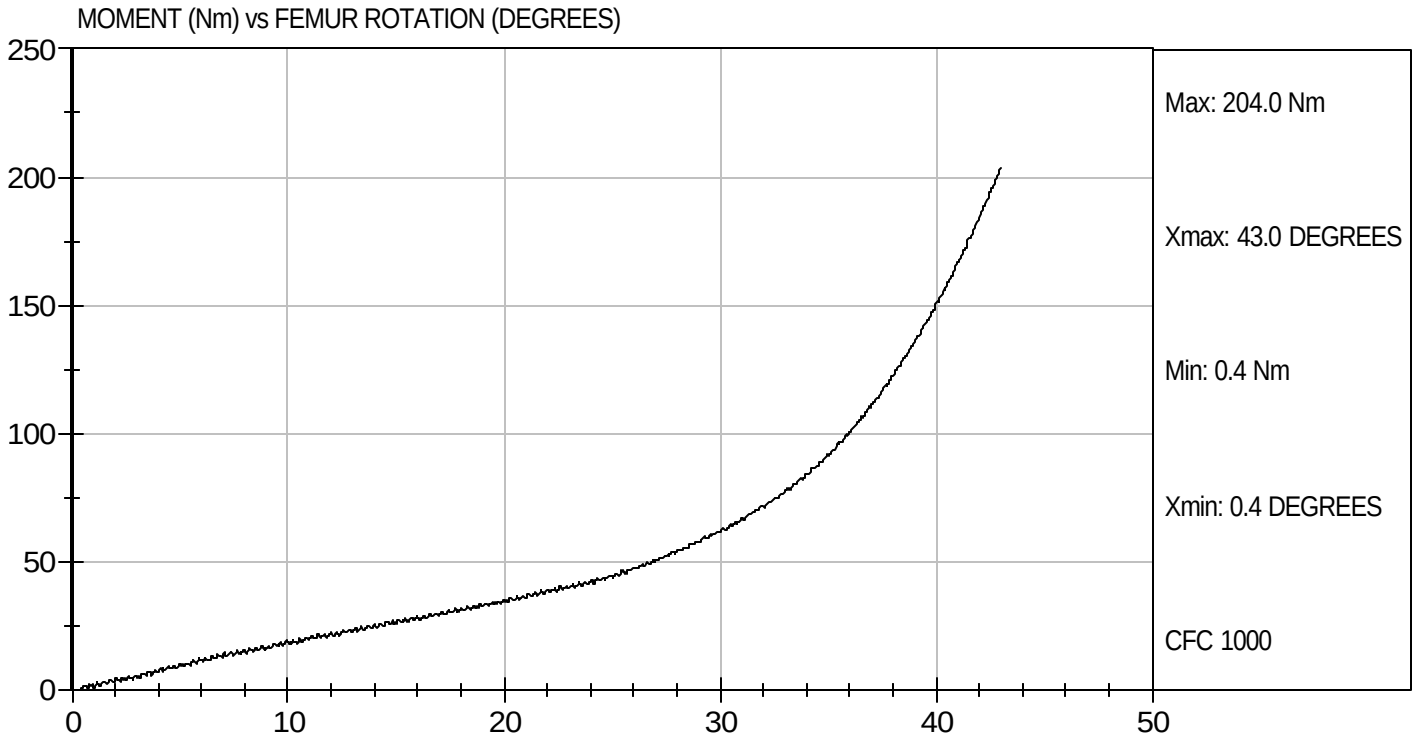
Tim Brady
Laboratory Technician

5/14/07
Test Date

David Winkelbauer
Approved By

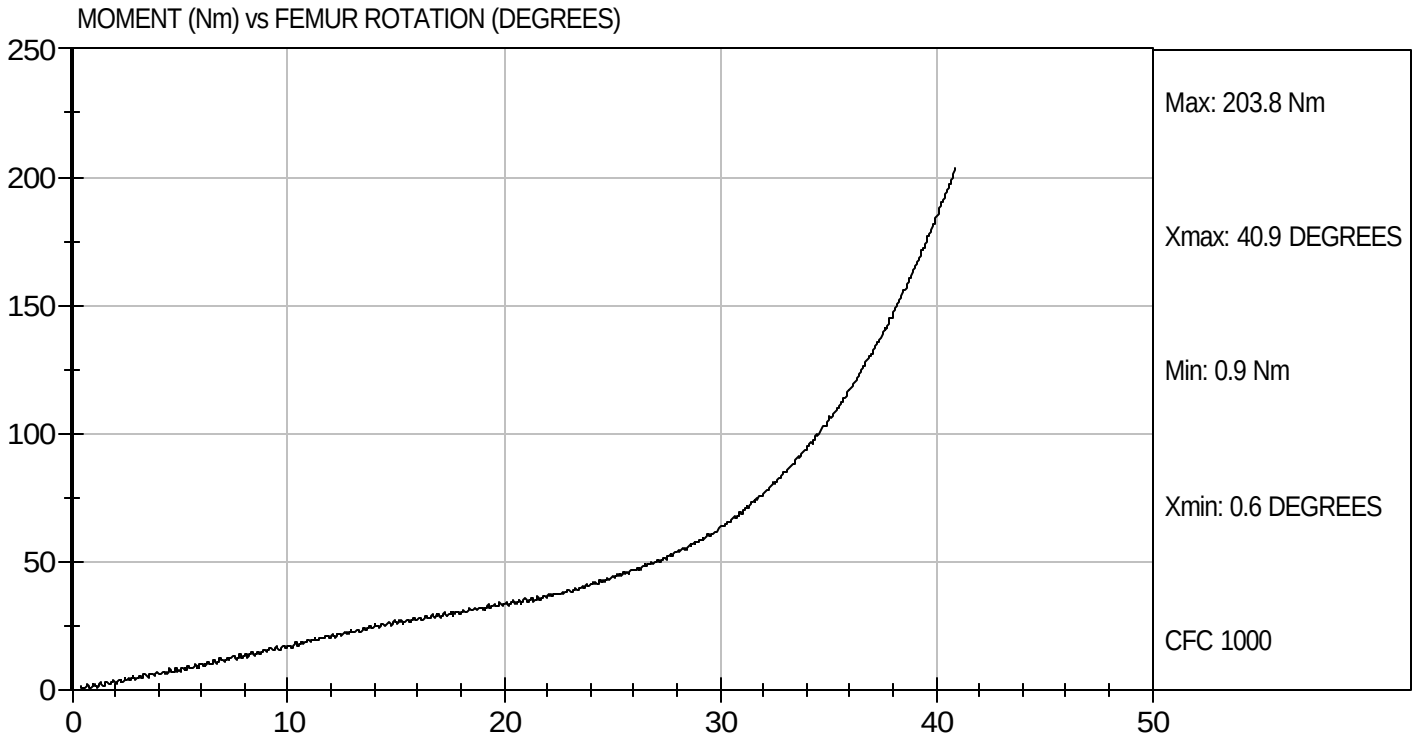
Test Desc: Hip Femur Flexion
Component ID: D071349

Test Date: 5/14/07
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D071340

Test Date: 5/14/07
Velocity: 0 ft/s, 0.00 m/s



APPENDIX D

CHILD DUMMY DATA

SUMMARY OF TEST

Measurement Description	Units	Threshold	P3 ATD	P4 ATD
Head Injury Criteria (HIC36)	N/A	N/A	1049	1412
Head Injury Criteria (HIC15)	N/A	390	562	1412
Max. Thorax Accel. (3msec Clip)	G's	50	54	70

Both child dummies were instrumented with head, chest, and upper six axial neck force and moment sensors.

The right rear (Position 3) child dummy (S/N 093) and left rear (Position 4) child dummy (S/N 090) were calibrated previous to this test. Child dummy certification information can be found in this Appendix.

Positions 3 and 4 were rear facing and used the vehicle LATCH attachment.

TEST VEHICLE WEIGHTS

	Units	As Tested (ATW) (Axle)		
		Front	Rear	Total
Left	kg	618.7	495.3	
Right	kg	570.2	525.3	
Ratio	%	53.8	46.2	
Totals	kg	1188.9	1020.6	2209.5

As tested weight of vehicle includes two ATDs, two CRABIs with CRS, cargo, equipment and instrumentation.

TEST NOTES

The child seat in Position P4 became unattached from its base during impact.

TEST DUMMY INFORMATION

Description	Position 3 CRS	Position 4 CRS
Dummy Type / Serial No.	12 month old CRABI / 093	12 month old CRABI / 090
Number of Data Channels	12	12
Restraint System	Graco Snugride (Rear Facing)	Combi Centre DX (Rear Facing)

POST TEST SEAT DATA

Location	Seat Movement (mm)	Seat Back Failure
P1 (Left Front)	0	None
P2 (Right Front)	0	None
P3 (Right Rear)	0	None
P4 (Left Rear)	0	None

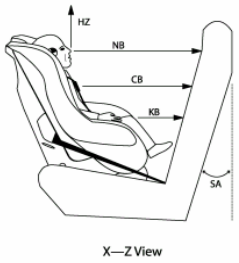
VISIBLE DUMMY CONTACT POINTS

Description	Position 3 CRS	Position 4 CRS
Head Contact	Back of head to CRS	Head to back of driver's seat
Upper Torso Contact	None	None
Lower Torso Contact	None	None
Left Foot Contact	Foot to vehicle rear seat	Foot to vehicle rear seat and back of driver's seat
Right Foot Contact	Foot to vehicle rear seat	Foot to vehicle rear seat and back of driver's seat and headrest

CHILD DUMMY POSITIONING IN VEHICLE

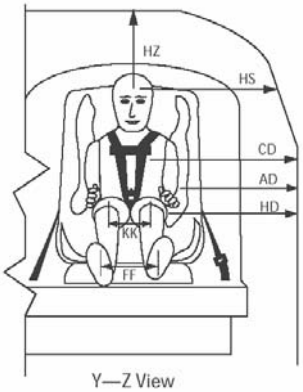
Child Restraint System (Position 3)	Graco Snugride (Rear Facing)
NHTSA No.	M80307

Dummy Measurements for Rear-facing CRS Passengers



X—Z View

HZ	-	Head to Roof
NB	-	Nose to Front of Back Seat
CB	-	Chest to Front of Back Seat
KB	-	Knee to Front of Back Seat
SA	-	Seat Back Angle



Y—Z View

X—Z View

HZ	-	Head to Roof
HS	-	Head to Side Window
CD	-	Chest to Door
AD	-	Arm to Door
HD	-	H-Point to Door
KK	-	Knee to Knee
FF	-	Foot to Foot
NB	-	Nose to Front Seat Back
CB	-	Chest to Front Seat Back
KB	-	Knee to Front Seat Back
TB	-	Toe to Front Seat Back
SA	-	Seat Back Angle

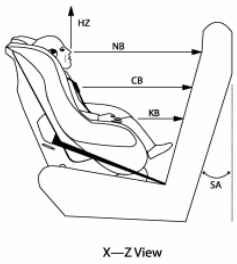
Measurement	Pre-Test (mm)	Post-Test (mm)
	P3 CRS (093)	P3 CRS (093)
SA (deg)	18.8	
HS	458	450
CD	426	430
AD	335	315
HD	369	358
HZ	440	428
NB	526	491
CB	425	390
KK	105	98
FF	106	89
KB - LEFT	195	175
KB – RIGHT	195	196
TB – LEFT	35	50
TB - RIGHT	37	88

All dimensions in mm (unless noted)
P3 – Right Rear Passenger (Rear Facing)

CHILD DUMMY POSITIONING IN VEHICLE

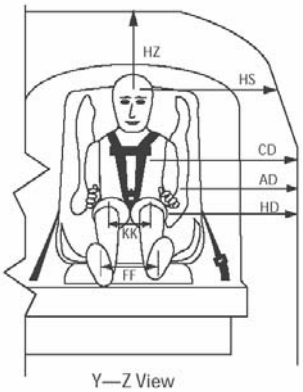
Child Restraint System (Position 4)	Combi Centre DX (Rear Facing)
NHTSA No.	M80307

Dummy Measurements for Rear-facing CRS Passengers



X—Z View

HZ	-	Head to Roof
NB	-	Nose to Front of Back Seat
CB	-	Chest to Front of Back Seat
KB	-	Knee to Front of Back Seat
SA	-	Seat Back Angle



Y—Z View

X—Z View

HZ	-	Head to Roof
HS	-	Head to Side Window
CD	-	Chest to Door
AD	-	Arm to Door
HD	-	H-Point to Door
KK	-	Knee to Knee
FF	-	Foot to Foot
NB	-	Nose to Front Seat Back
CB	-	Chest to Front Seat Back
KB	-	Knee to Front Seat Back
TB	-	Toe to Front Seat Back
SA	-	Seat Back Angle

Measurement	Pre-Test (mm)	Post-Test (mm)
	P4 CRS (090)	P4 CRS (090)
SA (deg)	18.8	
HS	455	1008
CD	430	937
AD	325	834
HD	361	779
HZ	455	775
NB	480	1203
CB	410	1024
KK	103	101
FF	105	120
KB - LEFT	188	803
KB – RIGHT	189	760
TB - LEFT	73	779
TB - RIGHT	69	732

All dimensions in mm (unless noted)
P4 – Left Rear Passenger (Rear facing)

CRS PERFORMANCE DATA

Child Restraint System (Position 3)	Graco Snugride (Rear Facing)
Child Restraint System (Position 4)	Combi Centre DX (Rear Facing)
NHTSA No.	M80307

POSITION 3 CRS POST-TEST INSPECTION

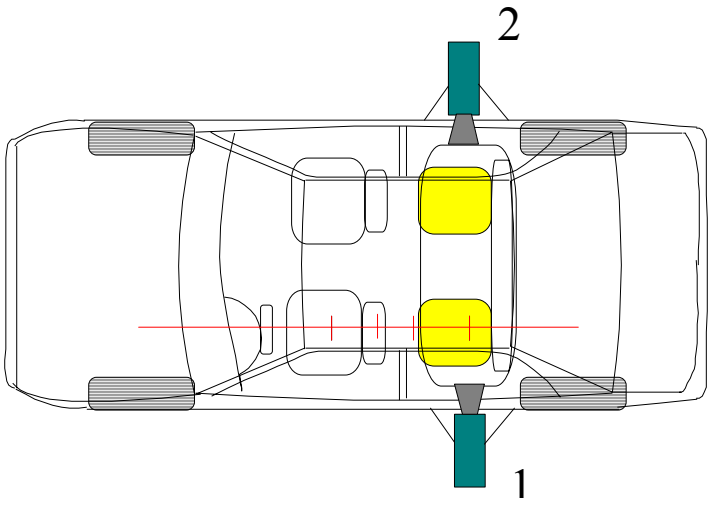
Location	Damage	Remarks
Upper Tether Strap		
Upper Tether Buckle		
Upper Tether Hook		
Vehicle Upper Tether Anchor		
Lower Anchor Strap	None	
Lower Anchor Buckle		
Lower Anchor Hooks	None	
Vehicle Lower CRS Anchors	None	
Five Point Harness Connections	None	
Cracks on CRS	None	
Fabric Tears on CRS	None	
Vehicle Seat Structure	None	
Vehicle Seat Fabric Tears	None	
Child Dummy	None	CRABI 12 Month Old

POSITION 4 CRS POST-TEST INSPECTION

Location	Damage	Remarks
Upper Tether Strap		
Upper Tether Buckle		
Upper Tether Hook		
Vehicle Upper Tether Anchor		
Lower Anchor Strap	None	
Lower Anchor Buckle		
Lower Anchor Hooks	None	
Vehicle Lower CRS Anchors	None	
Five Point Harness Connections	None	
Cracks on CRS	None	
Fabric Tears on CRS	None	
Vehicle Seat Structure	None	
Vehicle Seat Fabric Tears	None	
Child Dummy	None	CRABI 12 Month Old

CRS CAMERA DATA

Child Restraint System (Position 3)	Graco Snugride (Rear Facing)
Child Restraint System (Position 4)	Combi Centre DX (Rear Facing)
NHTSA No.	M80307



No.	Camera View	Location (mm) *			Angle (deg)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Left Side CRS Lateral View					8	1000
2	Right Side CRS Lateral View					8	1000

*COORDINATES:

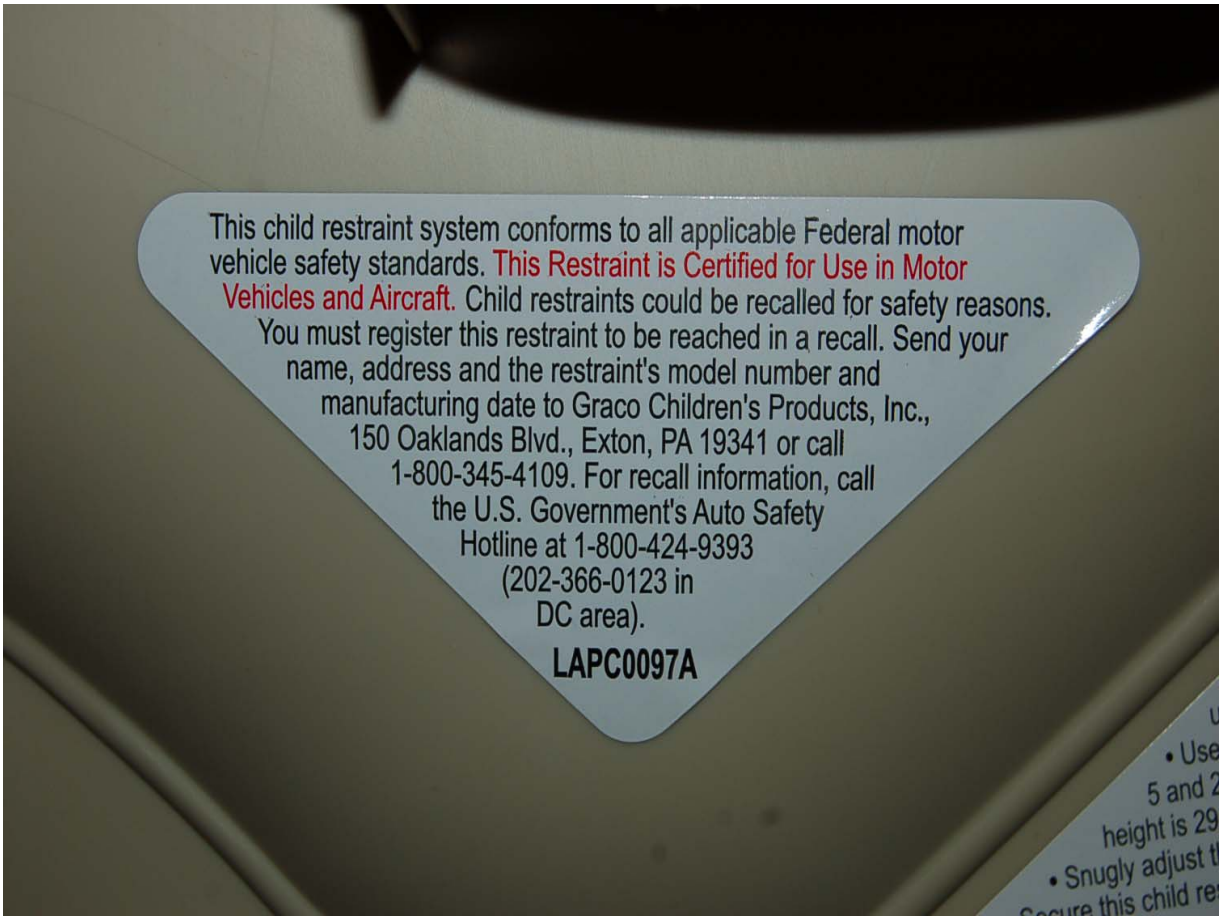
+X = film plane rearward of barrier

+Y = film plane to right of monorail centerline

+Z = film plane above ground level

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS



Close-up View of Position 3 CRS Label

Pre-Test Front View of Position 3 CRS

Post-Test Front View of Position 3 CRS

Pre-Test Rear View of Position 3 CRS

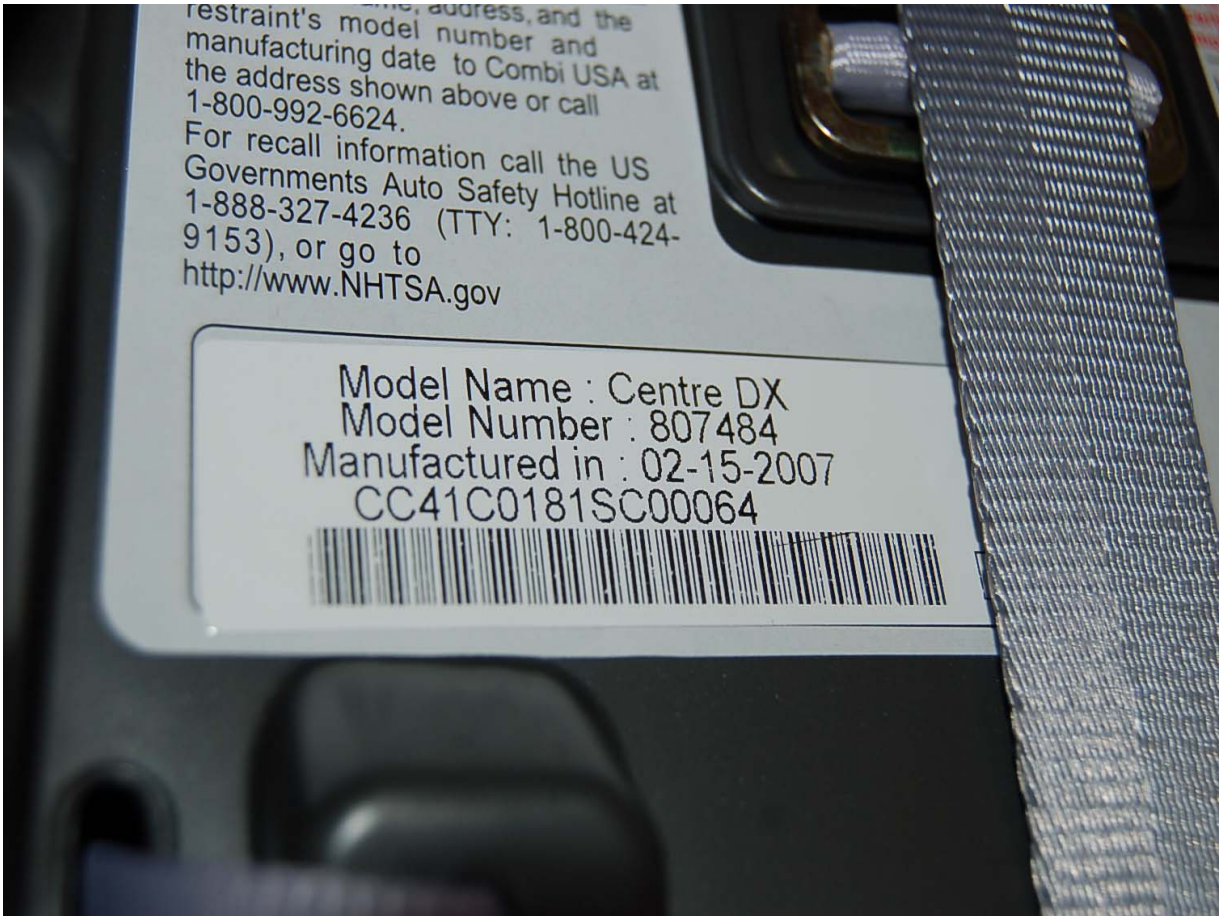
Post-Test Rear View of Position 3 CRS

Pre-Test Left Side View of Position 3 CRS

Post-Test Left Side View of Position 3 CRS

Pre-Test Right Side View of Position 3 CRS

Post-Test Right Side View of Position 3 CRS



Close-up View of Position 4 CRS Label

Pre-Test Front View of Position 4 CRS

Post-Test Front View of Position 4 CRS

Pre-Test Rear View of Position 4 CRS

Post-Test Rear View of Position 4 CRS

Pre-Test Left Side View of Position 4 CRS

Post-Test Left Side View of Position 4 CRS

Pre-Test Right Side View of Position 4 CRS

Post-Test Right Side View of Position 4 CRS

Pre-Test Position 3 Left Side View

Post-Test Position 3 Left Side View

Pre-Test Position 4 Left Side View

Post-Test Position 4 Left Side View

Pre-Test Position 3 Right Side View

Post-Test Position 3 Right Side View

Pre-Test Position 4 Right Side View


Post-Test Position 3 & 4 Feet Contact

Post-Test Position 4 Head and Feet Contact

Post-Test Position 4 Feet Contact

CHILD DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

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

LRP Child Upper Neck Force X vs. Time

LRP Child Upper Neck Force Y vs. Time

LRP Child Upper Neck Force Z vs. Time

LRP Child Upper Neck Force Resultant vs. Time

LRP Child Upper Neck Moment X vs. Time

LRP Child Upper Neck Moment Y vs. Time

LRP Child Upper Neck Moment Z vs. Time

LRP Child Upper Neck Moment Resultant vs. Time

RRP Child Upper Neck Force X vs. Time

RRP Child Upper Neck Force Y vs. Time

RRP Child Upper Neck Force Z vs. Time

RRP Child Upper Neck Force Resultant vs. Time

RRP Child Upper Neck Moment X vs. Time

RRP Child Upper Neck Moment Y vs. Time

RRP Child Upper Neck Moment Z vs. Time

RRP Child Upper Neck Moment Resultant vs. Time

LRP Child Seat X Acceleration vs. Time

LRP Child Seat Y Acceleration vs. Time

LRP Child Seat Z Acceleration vs. Time

LRP Child Seat Resultant Acceleration vs. Time

RRP Child Seat X Acceleration vs. Time

RRP Child Seat Y Acceleration vs. Time

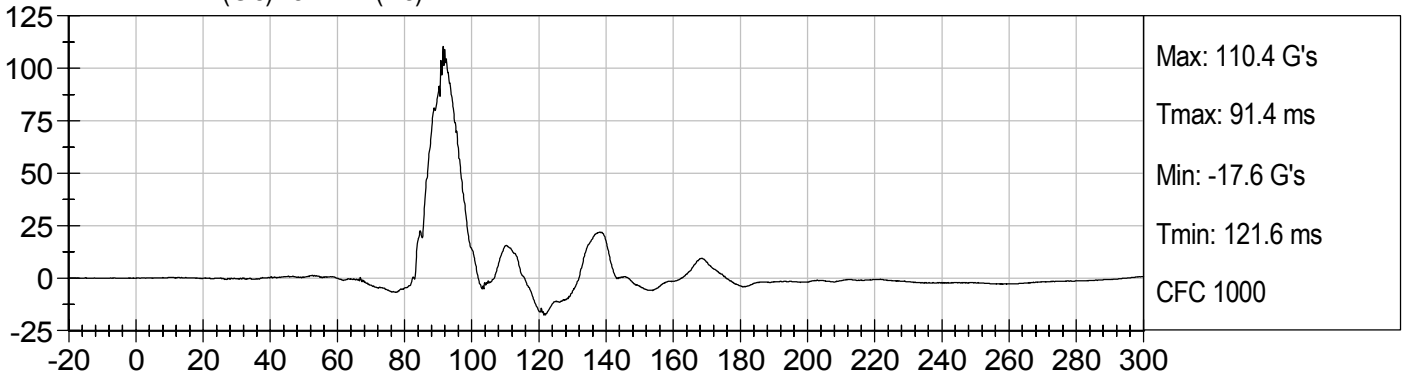
RRP Child Seat Z Acceleration vs. Time

RRP Child Seat Resultant Acceleration vs. Time

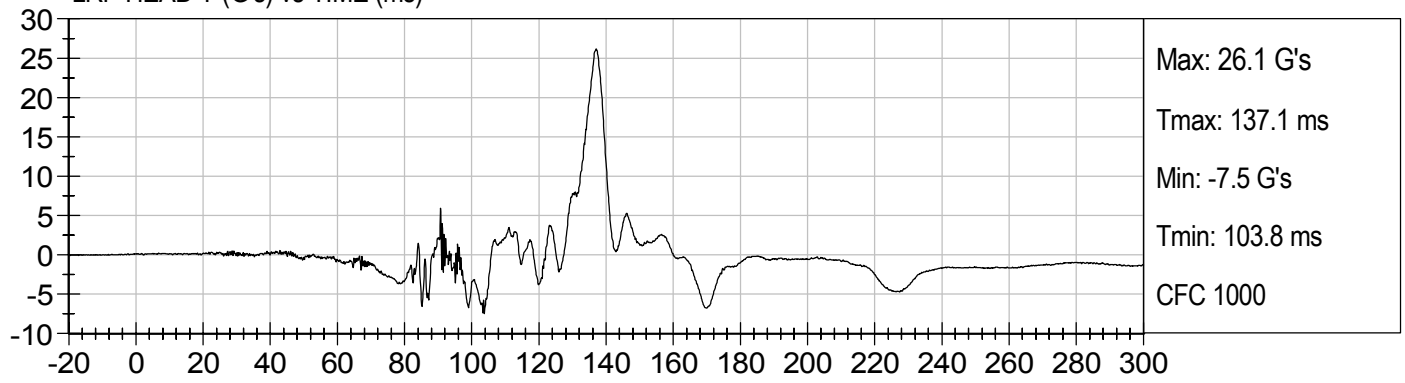
NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307

Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

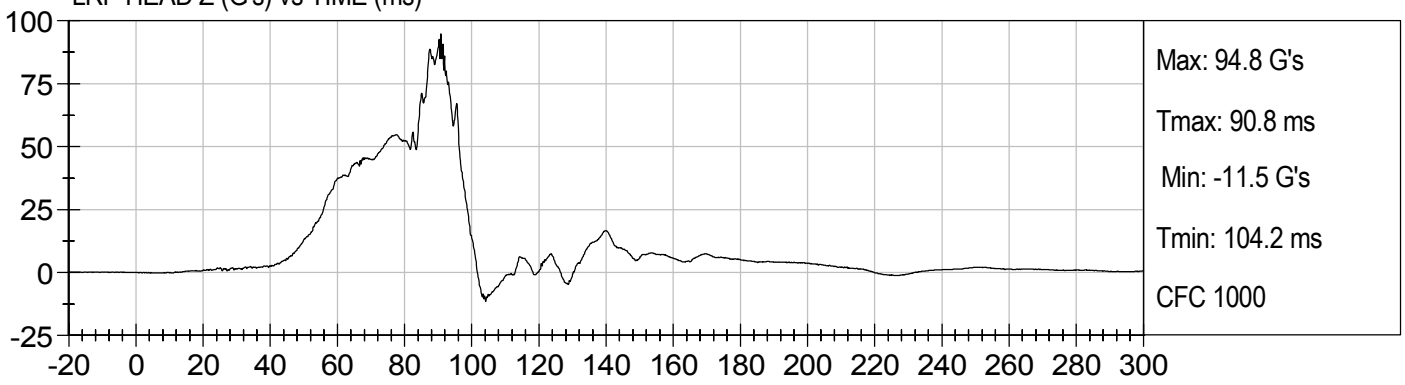
LRP HEAD X (G's) vs TIME (ms)



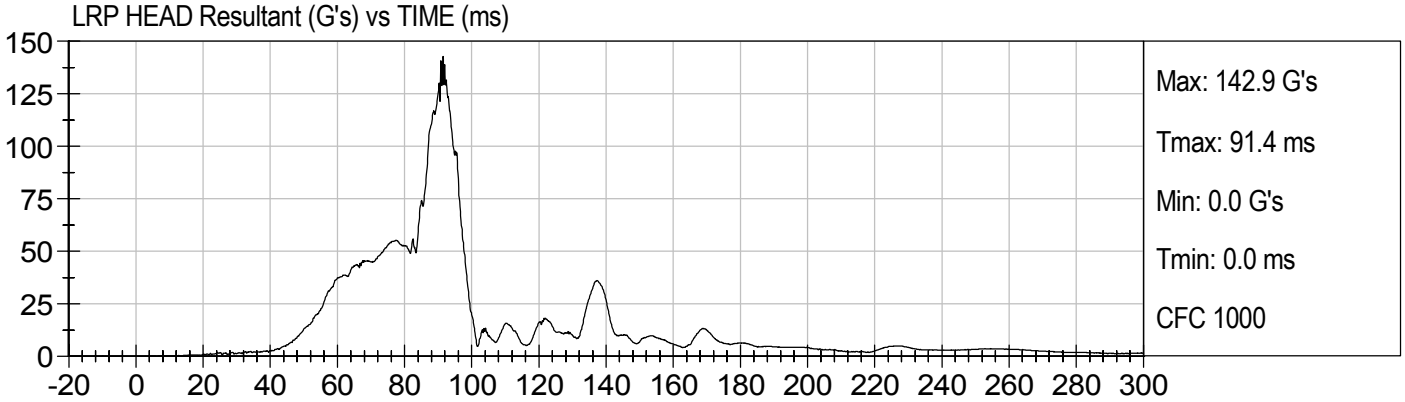
LRP HEAD Y (G's) vs TIME (ms)



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

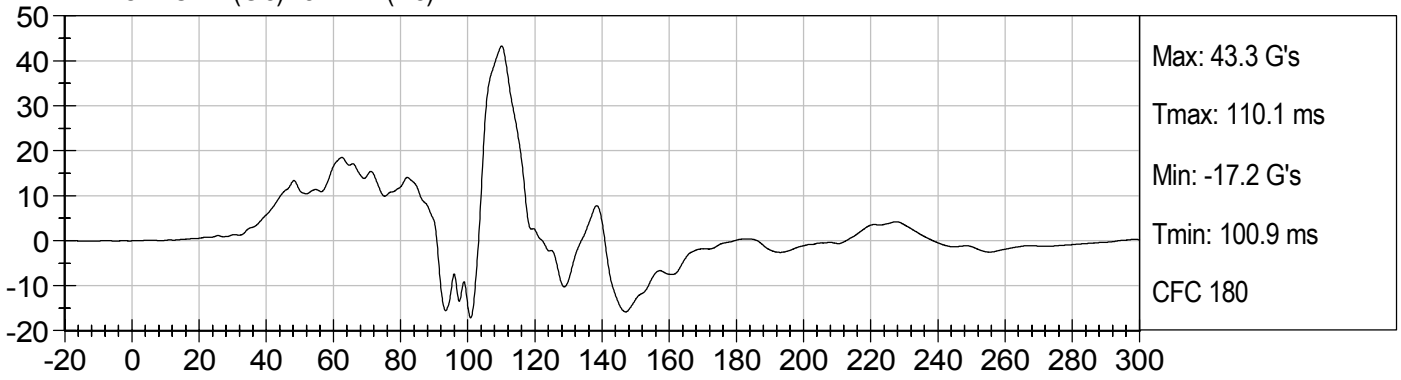


LRP HEAD Resultant (G's) vs TIME (ms)

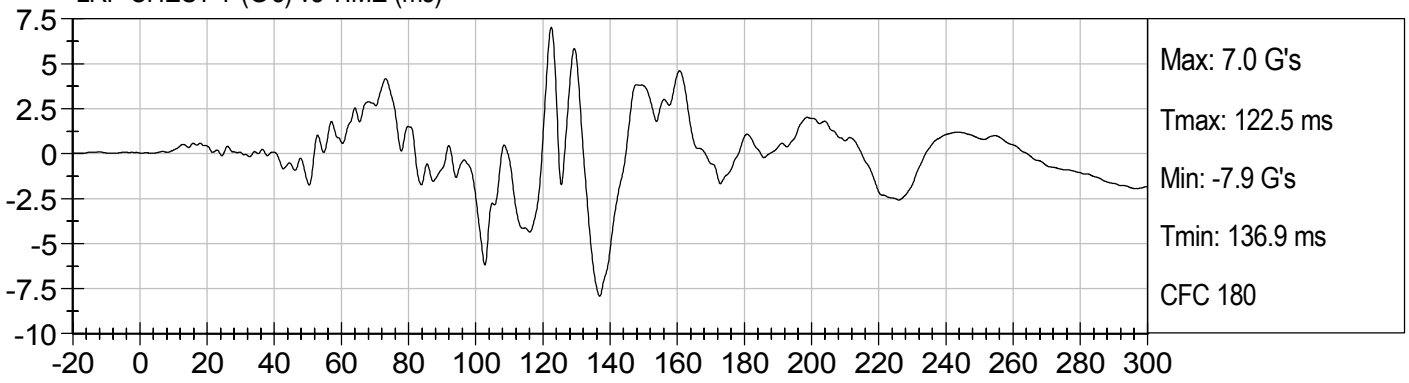


NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307
Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

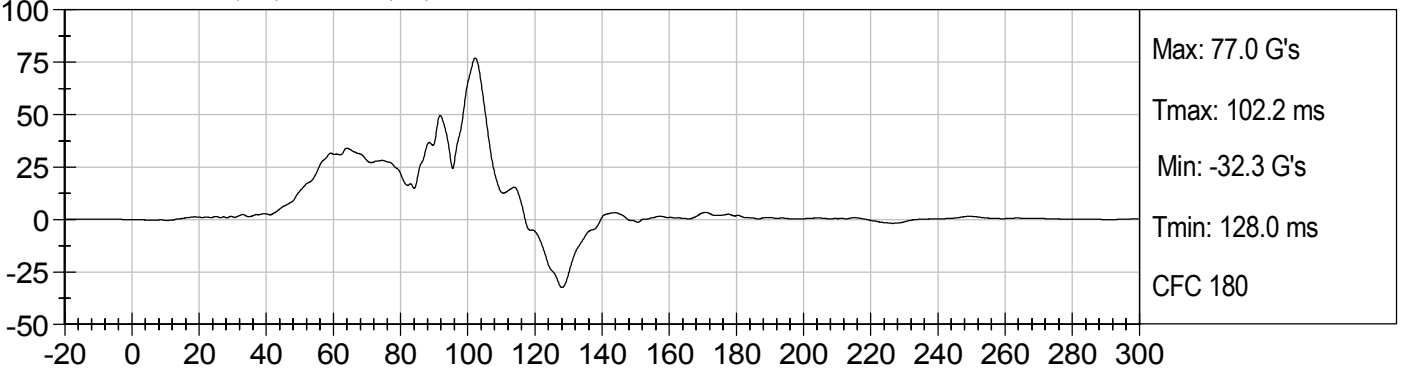
LRP CHEST X (G's) vs TIME (ms)



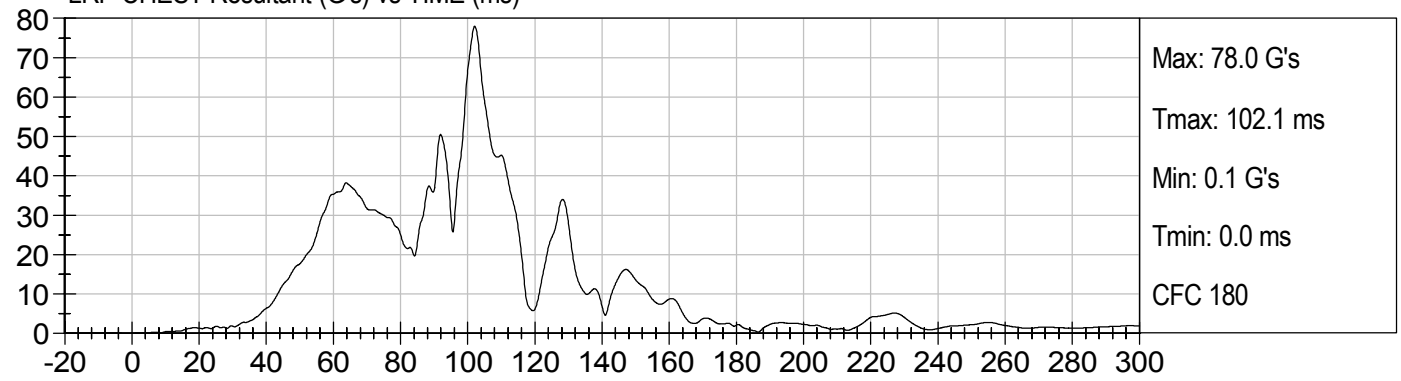
LRP CHEST Y (G's) vs TIME (ms)



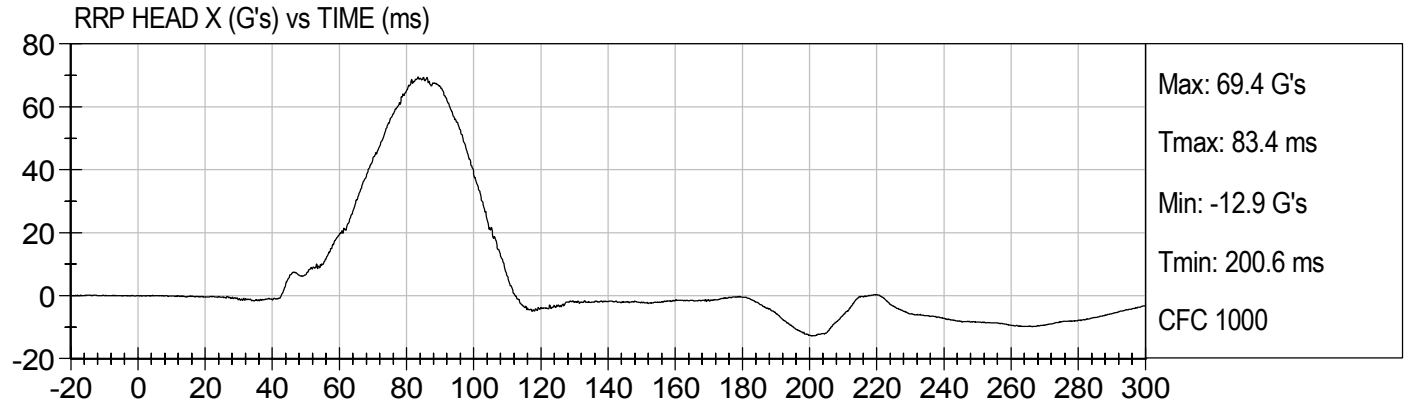
LRP CHEST Z (G's) vs TIME (ms)

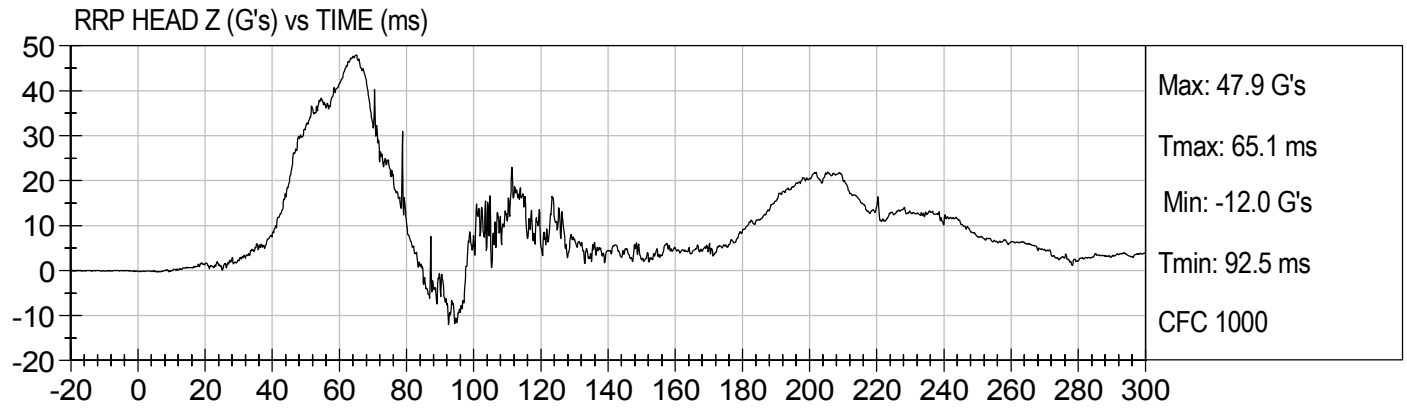


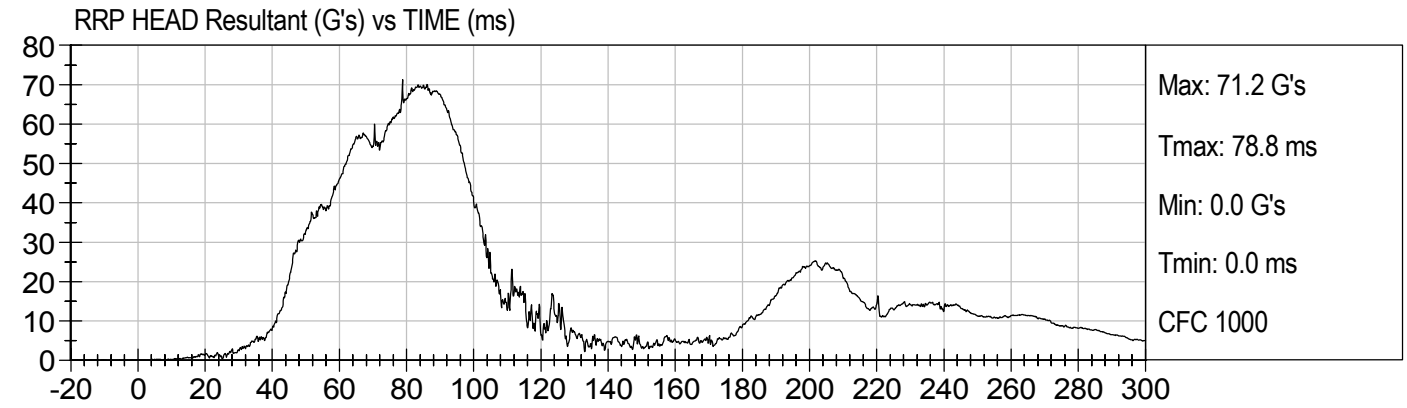
LRP CHEST Resultant (G's) vs TIME (ms)



NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307
Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)

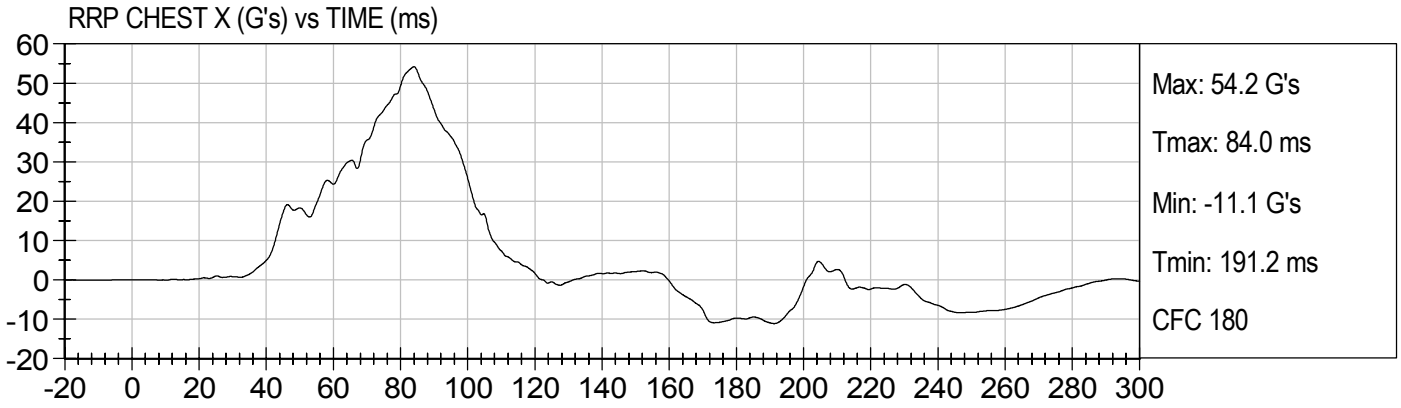


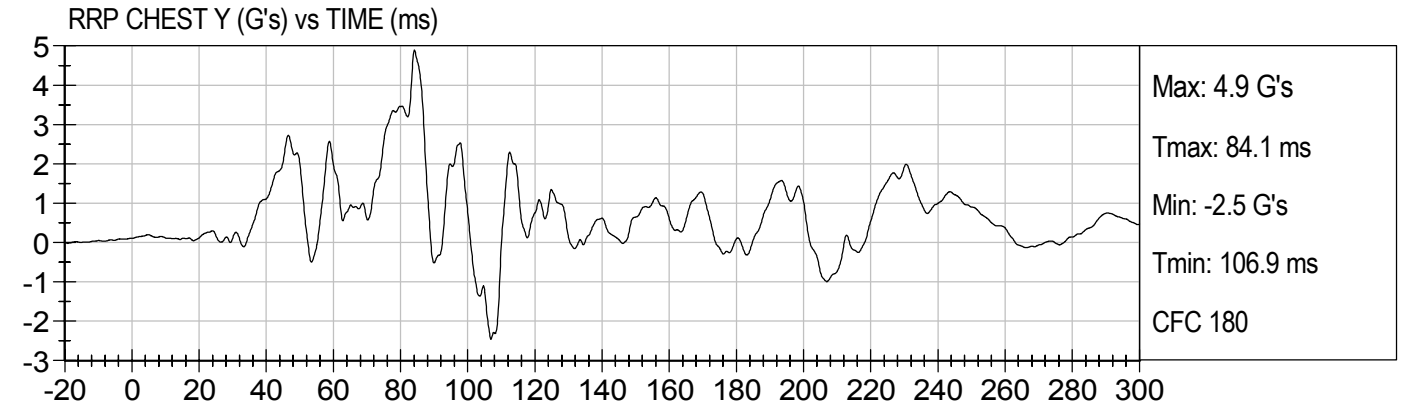


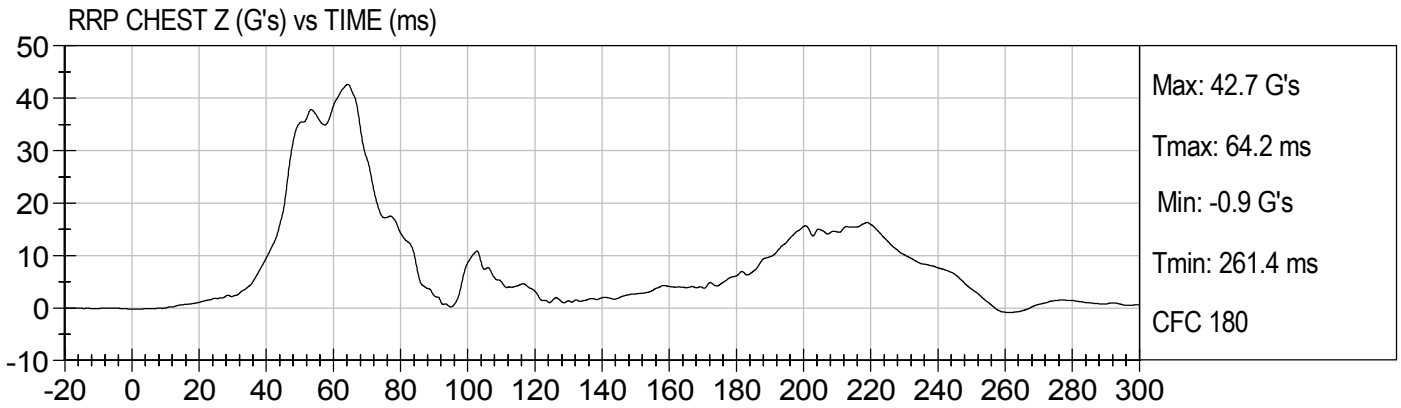


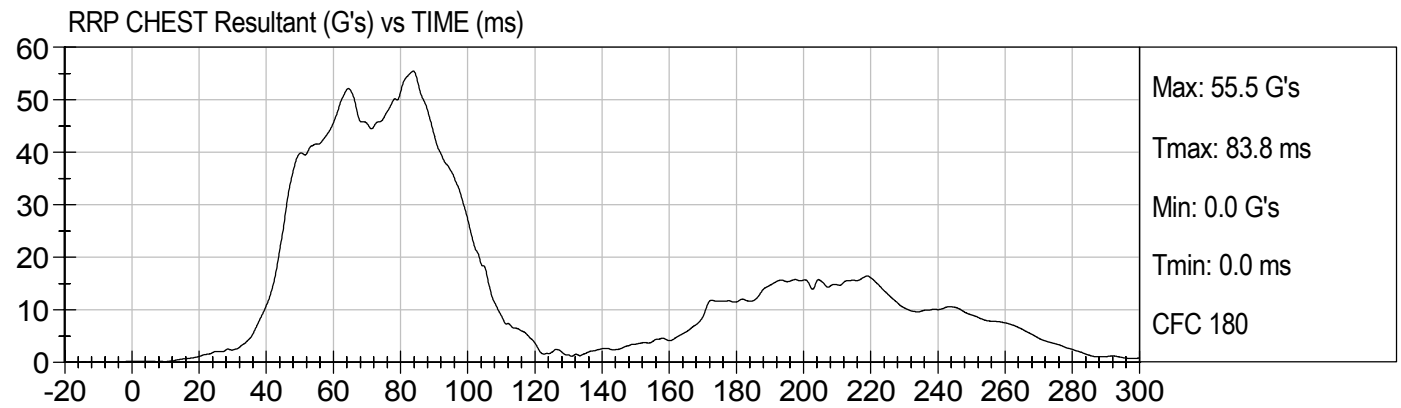
NCAP 35MPH FRONTAL
2008 DODGE GRAND CARAVAN M80307

Test Date: 08/30/2007
Speed: 35.0 mph (56.3 km/h)









CHILD DUMMY CALIBRATION INFORMATION

MGA RESEARCH CORPORATION

FRONT HEAD DROP TEST

CRABI 12 MONTH

ATD Serial No: 093 **Test ID:** D072541

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Peak Resultant Acceleration	G's	100 to 120	110	Pass
Peak Lateral Acceleration	G's	+/- 15	-3	Pass
Unimodal	N/A	within 17% of peak	Yes	Pass
		Overall Test Results		Pass

Tim Brady

Laboratory Technician

8/23/07

Test Date

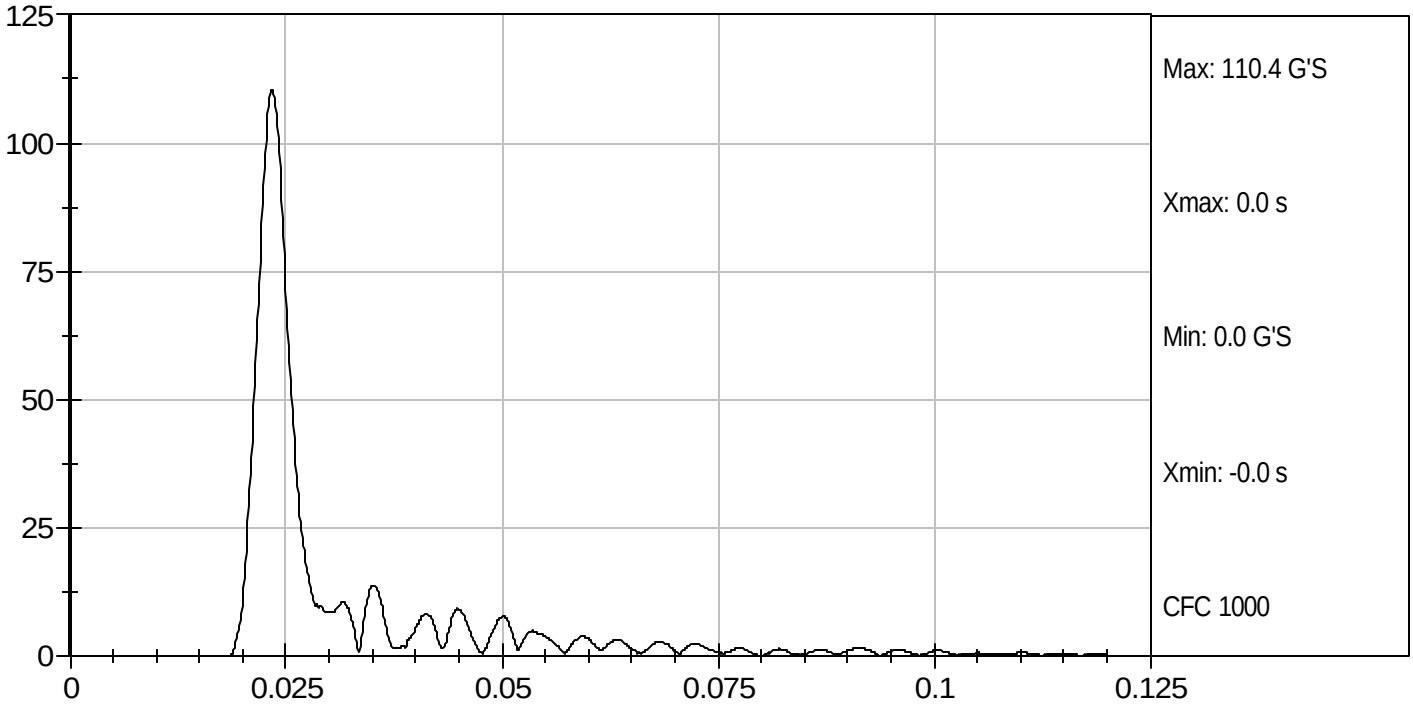
David Winkelbauer

Approved By

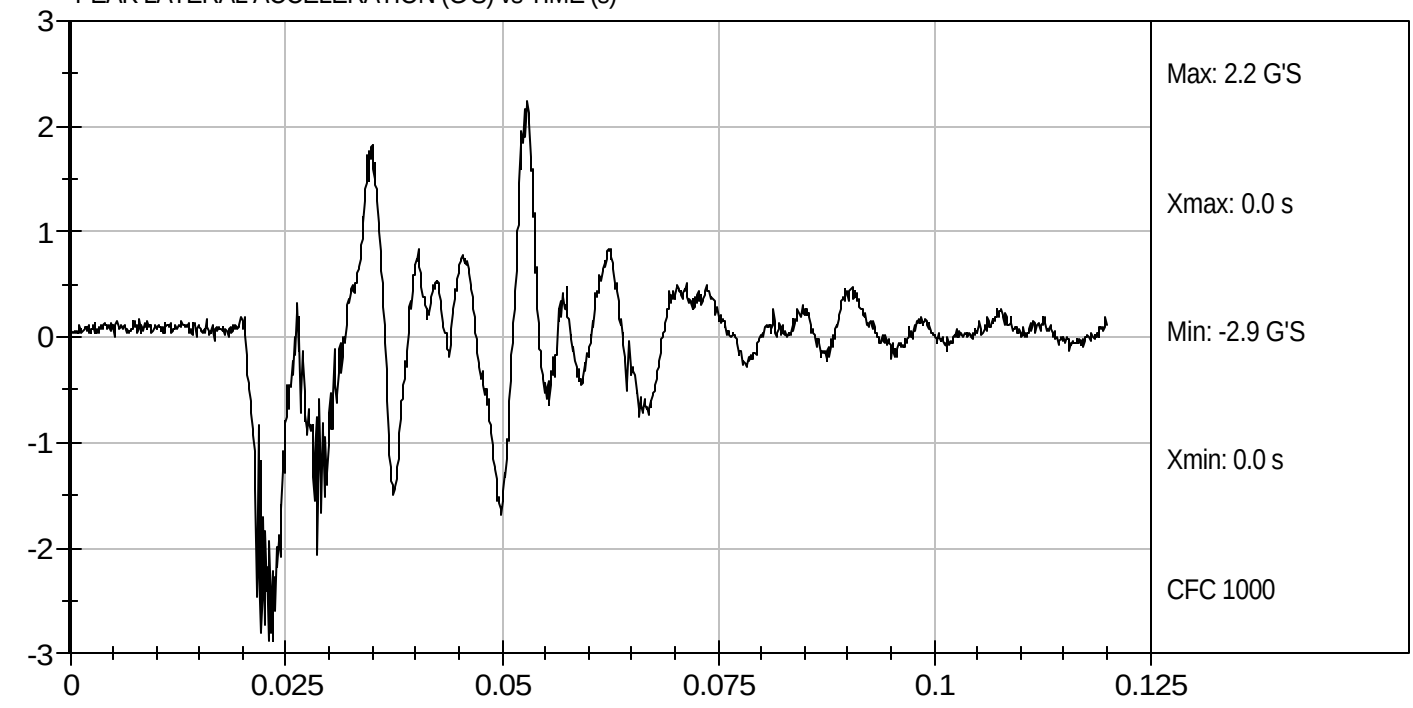
Test Desc: Head Drop
Component ID: D072541

Test Date: 8/23/07
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G'S) vs TIME (s)



PEAK LATERAL ACCELERATION (G'S) vs TIME (s)



MGA RESEARCH CORPORATION

NECK FLEXION TEST

CRABI 12 MONTH

ATD Serial No: 093 **Test I.D:** D072542

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.8	Pass
Humidity		%	10 to 70	46	Pass
Impact Velocity		m/s	5.1 to 5.3	5.2	Pass
Pendulum Deceleration	10 msec	m/s	1.6 to 2.3	1.9	Pass
	20 msec	m/s	3.4 to 4.2	3.6	Pass
	25 msec	m/s	4.3 to 5.2	4.4	Pass
D Plane Rotation		deg	75.0 to 86.0	83.1	Pass
Moment About Occipital Condyle		Nm	36.0 to 45.0	40.2	Pass
Positive Moment - Time Curve Decay to 5 Nm		msec	60 to 80	74	Pass
			Overall Test Results		Pass

Laboratory Technician

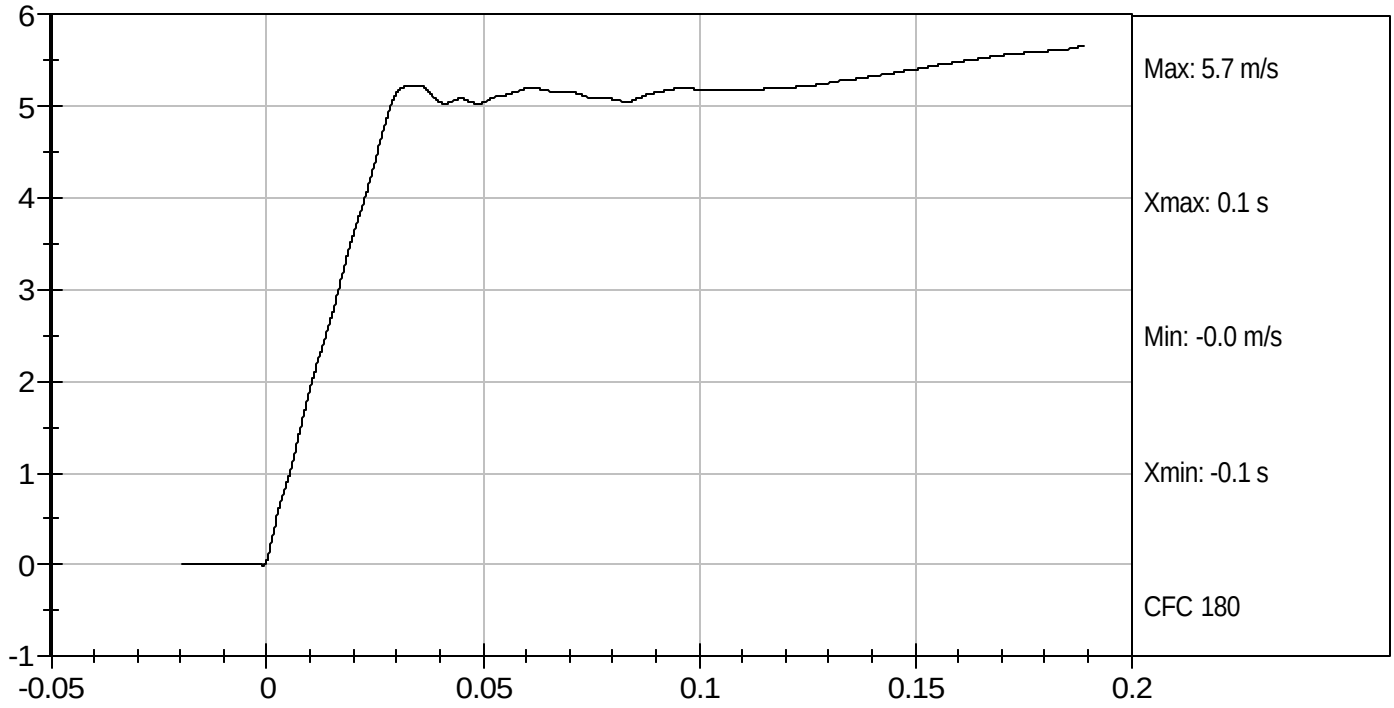
8/23/07
Test Date

David Winkelbauer
Approved By

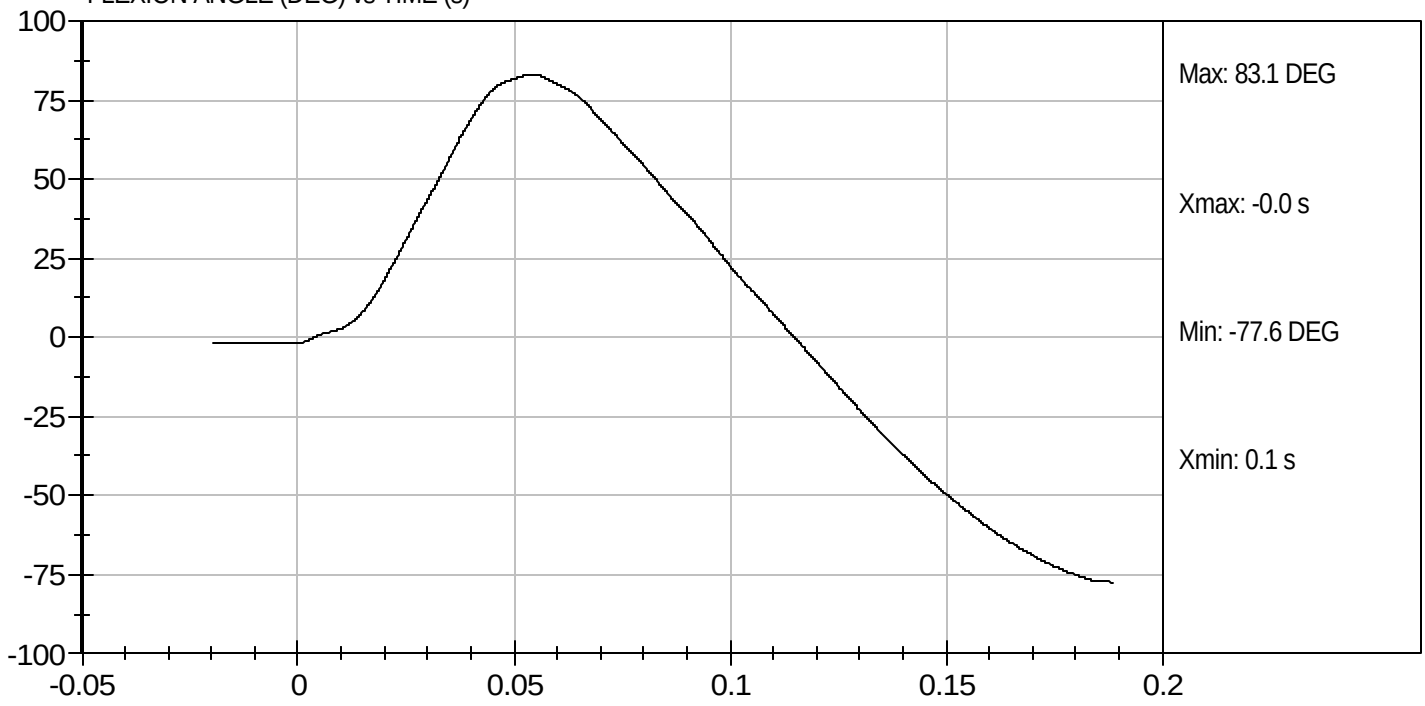
Test Desc: Neck Flexion
Component ID: D072542

Test Date: 8/23/07
Velocity: 17.006 ft/s, 5.2 m/s

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

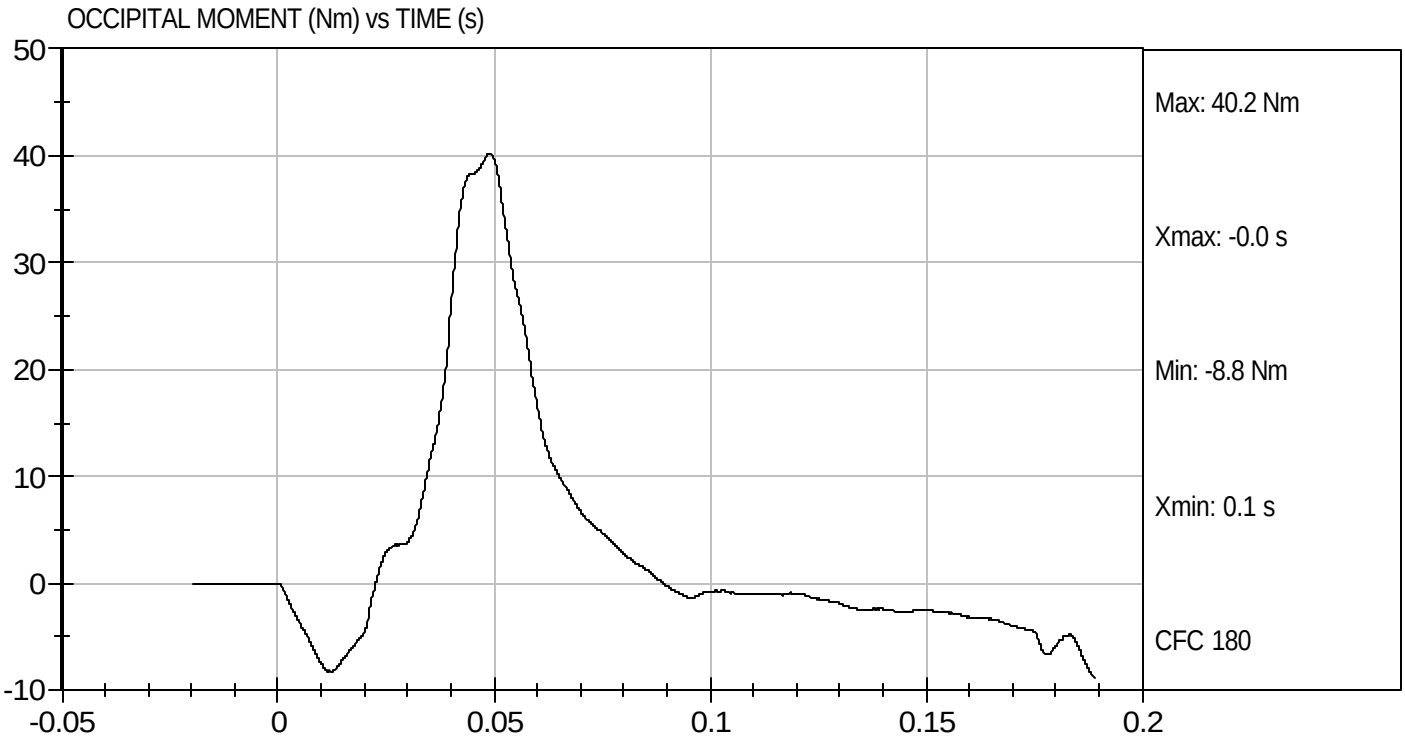


FLEXION ANGLE (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D072542

Test Date: 8/23/07
Velocity: 17.006 ft/s, 5.2 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

CRABI 12 MONTH

ATD Serial No: 093 **Test I.D:** D072543

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.8	Pass
Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/s	2.4 to 2.6	2.5	Pass
Pendulum Deceleration	6 msec	m/s	0.8 to 1.2	1.0	Pass
	10 msec	m/s	1.5 to 2.1	2.0	Pass
	14 msec	m/s	2.2 to 2.9	2.3	Pass
D Plane Rotation		deg	80.0 to 92.0	80.3	Pass
Moment About Occipital Condyle		Nm	-23.0 to -12.0	-19.1	Pass
Negative Moment - Time Curve Decay to -5 Nm		msec	76 to 90	77	Pass
			Overall Test Results		Pass

Laboratory Technician

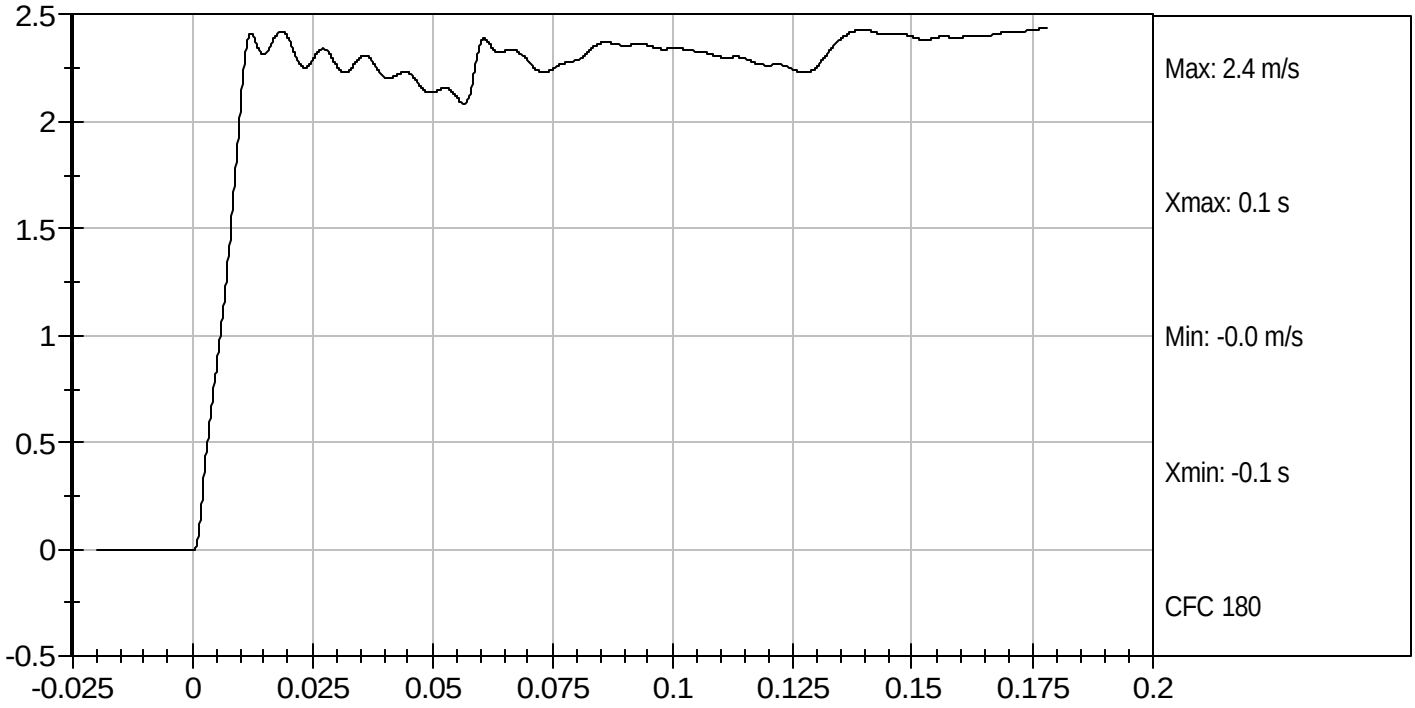
8/23/07
Test Date

David Winkelbauer
Approved By

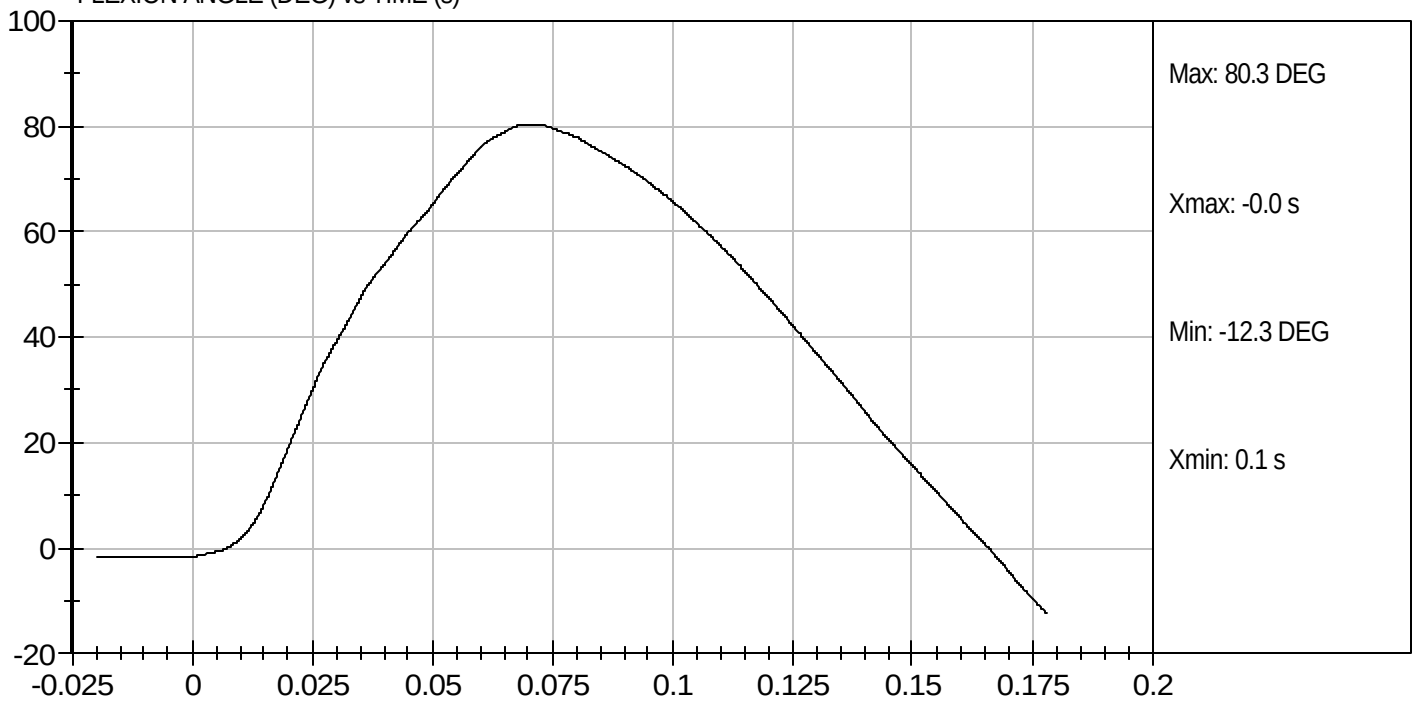
Test Desc: Neck Extension
Component ID: D072543

Test Date: 8/23/07
Velocity: 8.33 ft/s, 2.5 m/s

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

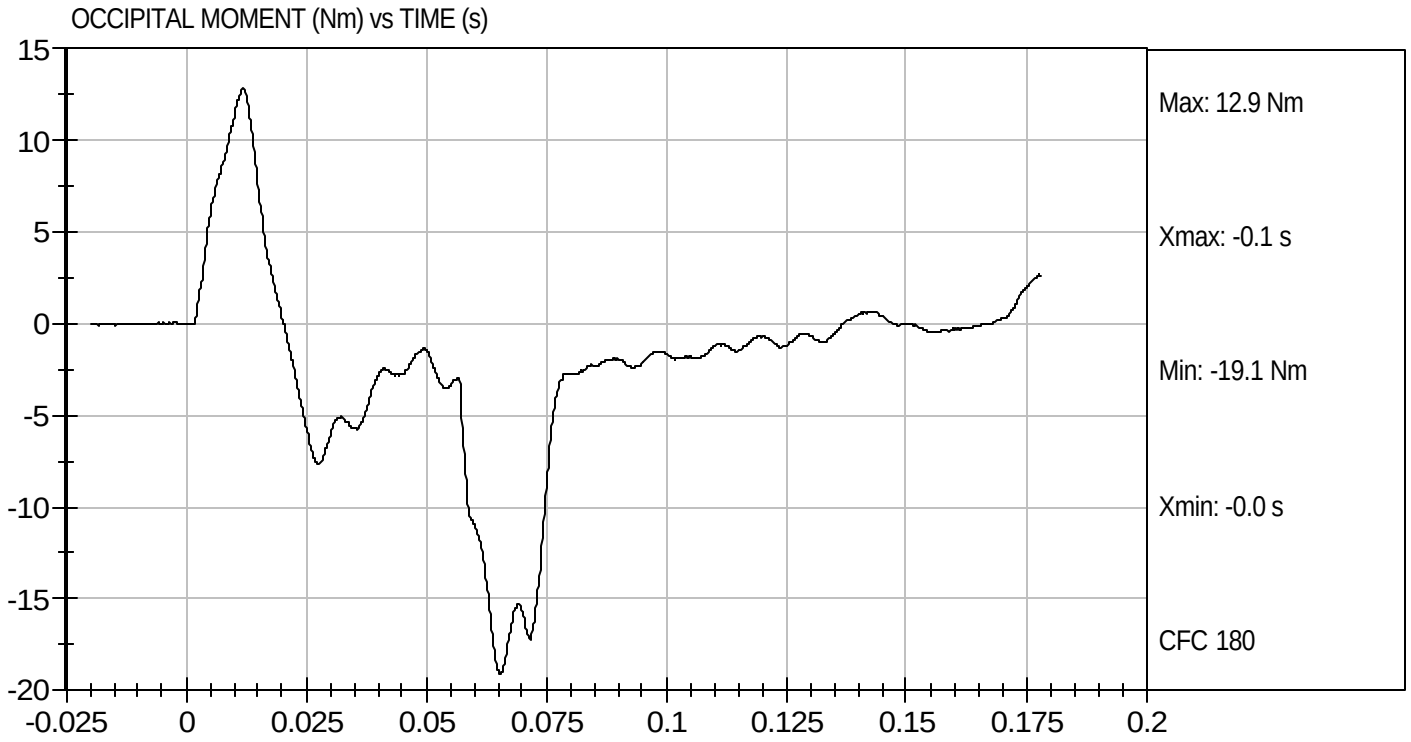


FLEXION ANGLE (DEG) vs TIME (s)



Test Desc: Neck Extension
Component ID: D072543

Test Date: 8/23/07
Velocity: 8.33 ft/s, 2.5 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

CRABI 12 MONTH

ATD Serial No: 093 **Test I.D:** D072544

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/sec	4.9 to 5.1	5.03	Pass
Probe Force	kN	1.51 to 1.80	1.55	Pass
		Overall Test Results		Pass

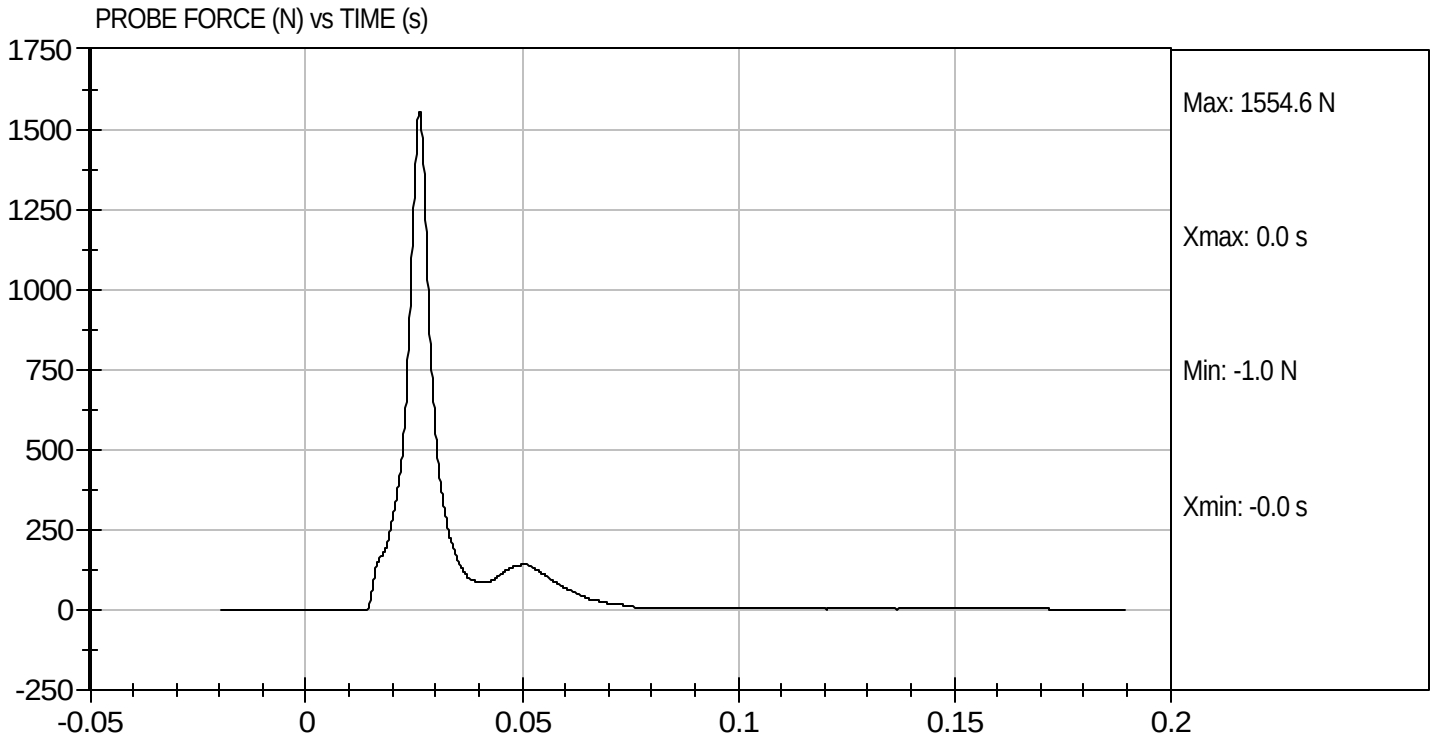
Laboratory Technician

8/23/07
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D072544

Test Date: 8/23/07
Velocity: 16.5 ft/s, 5.03 m/s



MGA RESEARCH CORPORATION

REAR HEAD DROP TEST

CRABI 12 MONTH

ATD Serial No: 093 **Test ID:** D072545

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Peak Resultant Acceleration	G's	55 to 71	69	Pass
Peak Lateral Acceleration	G's	+/- 15	3	Pass
Unimodal	N/A	within 17% of peak	Yes	Pass
		Overall Test Results		Pass

Tim Brady
Laboratory Technician

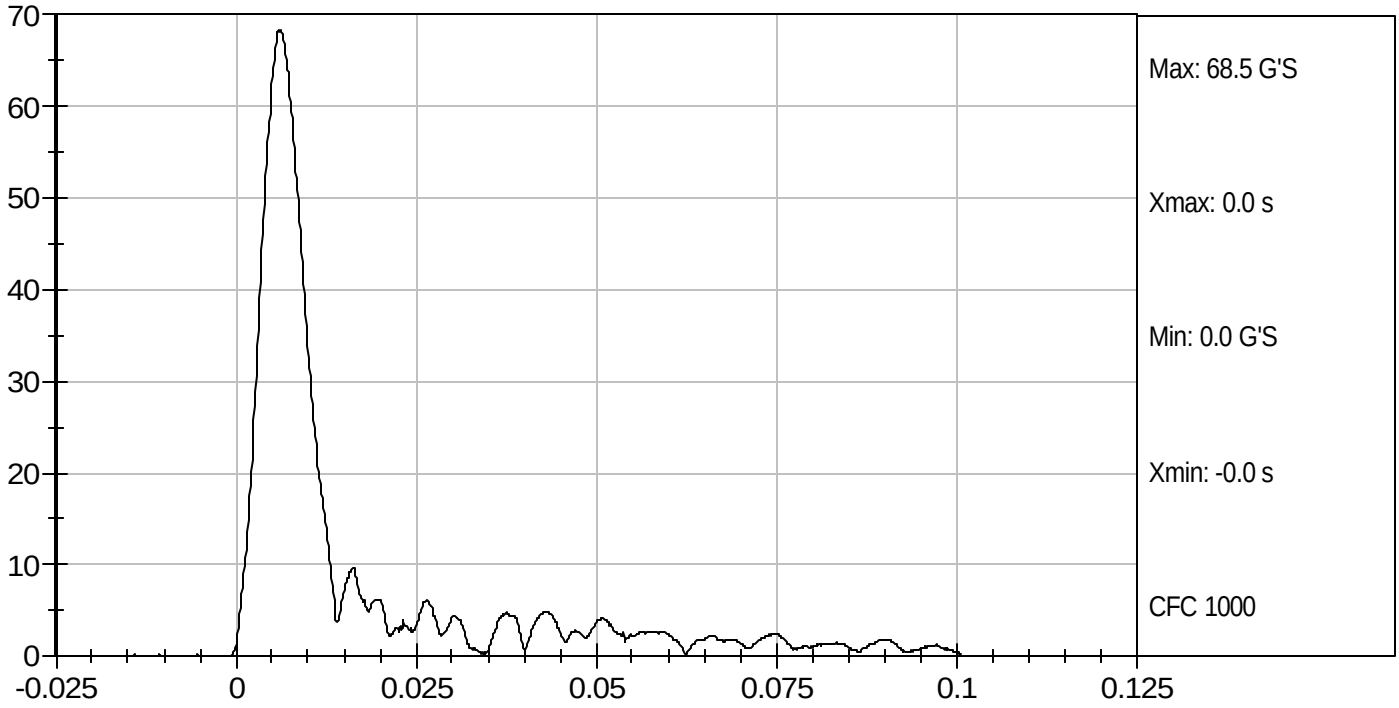
8/23/07
Test Date

David Winkelbauer
Approved By

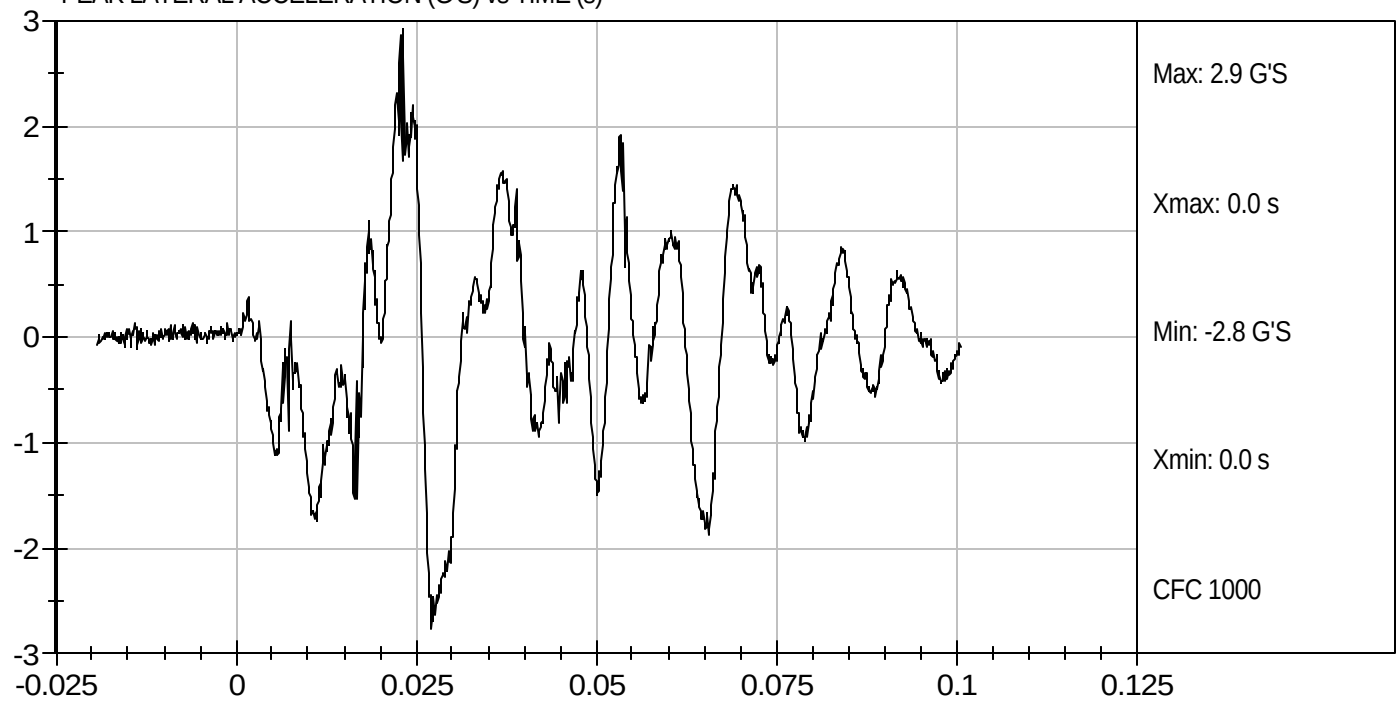
Test Desc: Head Drop
Component ID: D072545

Test Date: 8/23/07
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G'S) vs TIME (s)



PEAK LATERAL ACCELERATION (G'S) vs TIME (s)



MGA RESEARCH CORPORATION

FRONT HEAD DROP TEST

CRABI 12 MONTH

ATD Serial No: 090 **Test ID:** D072531

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	100 to 120	108	Pass
Peak Lateral Acceleration	G's	+/- 15	-4	Pass
Unimodal	N/A	within 17% of peak	Yes	Pass
		Overall Test Results		Pass

Tim Brady
Laboratory Technician

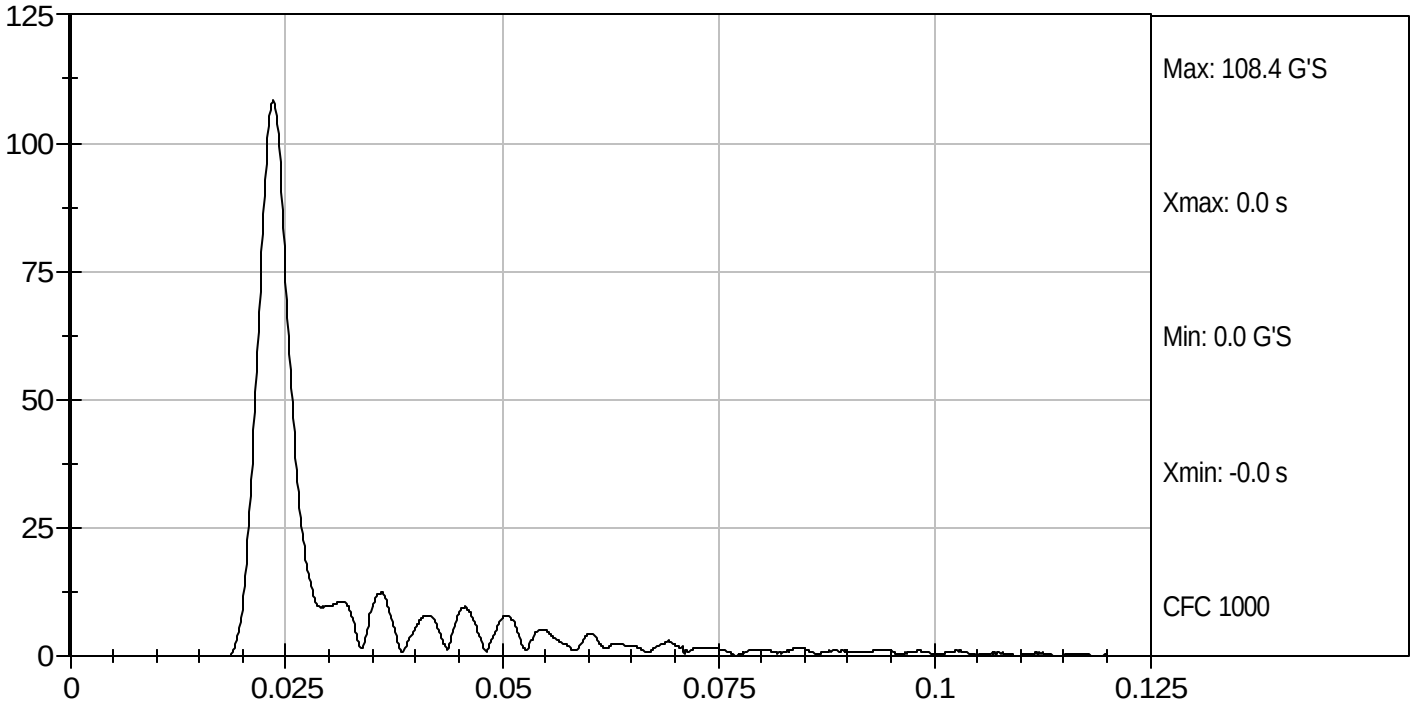
8/23/07
Test Date

David Winkelbauer
Approved By

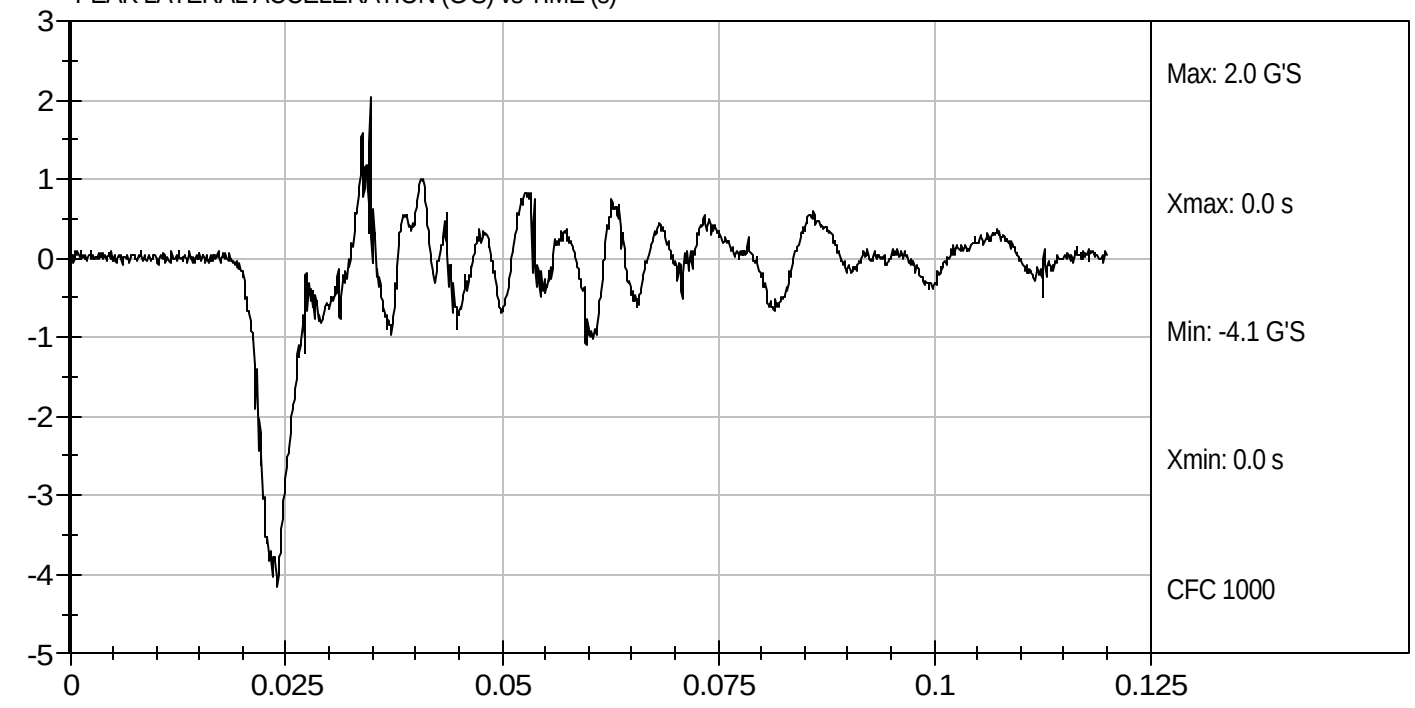
Test Desc: Head Drop
Component ID: D072531

Test Date: 8/23/07
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G'S) vs TIME (s)



PEAK LATERAL ACCELERATION (G'S) vs TIME (s)



MGA RESEARCH CORPORATION

NECK FLEXION TEST

CRABI 12 MONTH

ATD Serial No: 090 **Test I.D:** D072532

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.7	Pass
Humidity		%	10 to 70	46	Pass
Impact Velocity		m/s	5.1 to 5.3	5.2	Pass
Pendulum Deceleration	10 msec	m/s	1.6 to 2.3	2.0	Pass
	20 msec	m/s	3.4 to 4.2	3.6	Pass
	25 msec	m/s	4.3 to 5.2	4.3	Pass
D Plane Rotation		deg	75.0 to 86.0	79.7	Pass
Moment About Occipital Condyle		Nm	36.0 to 45.0	37.0	Pass
Positive Moment - Time Curve Decay to 5 Nm		msec	60 to 80	75	Pass
			Overall Test Results		Pass

Laboratory Technician

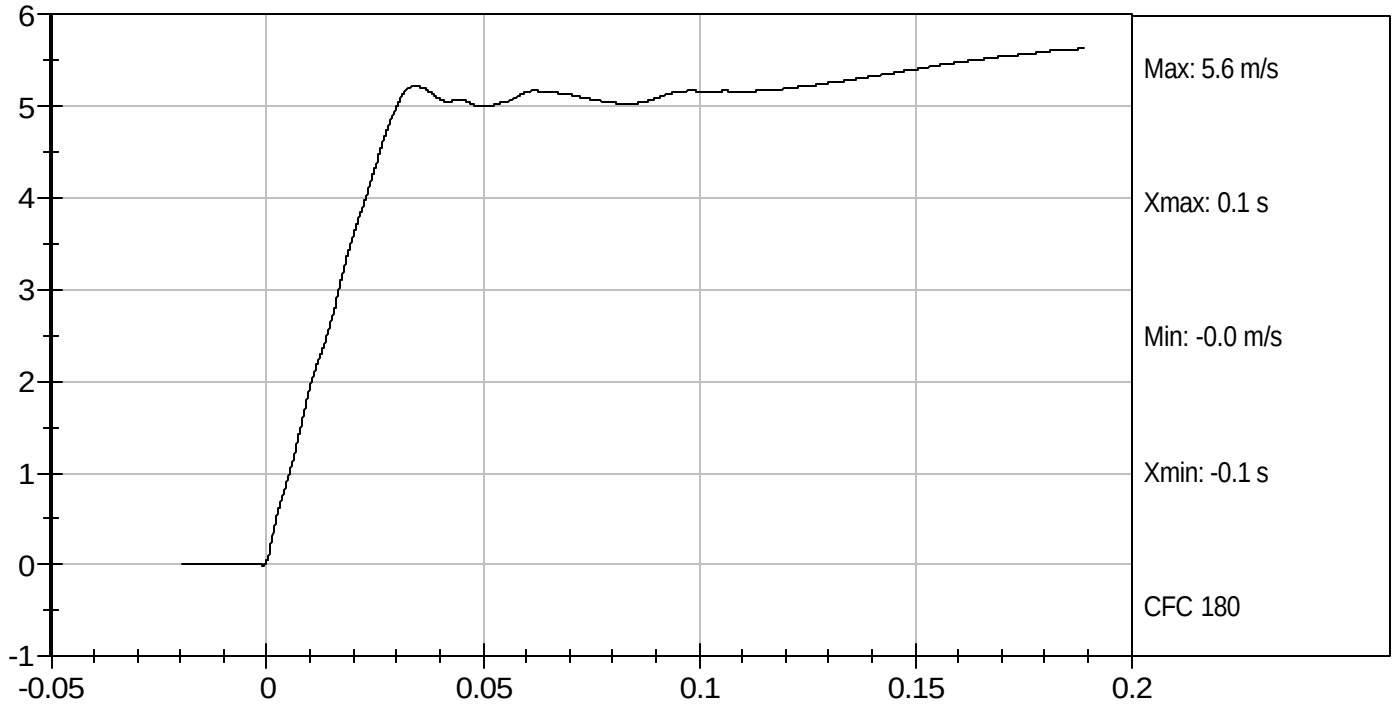
8/23/07
Test Date

David Winkelbauer
Approved By

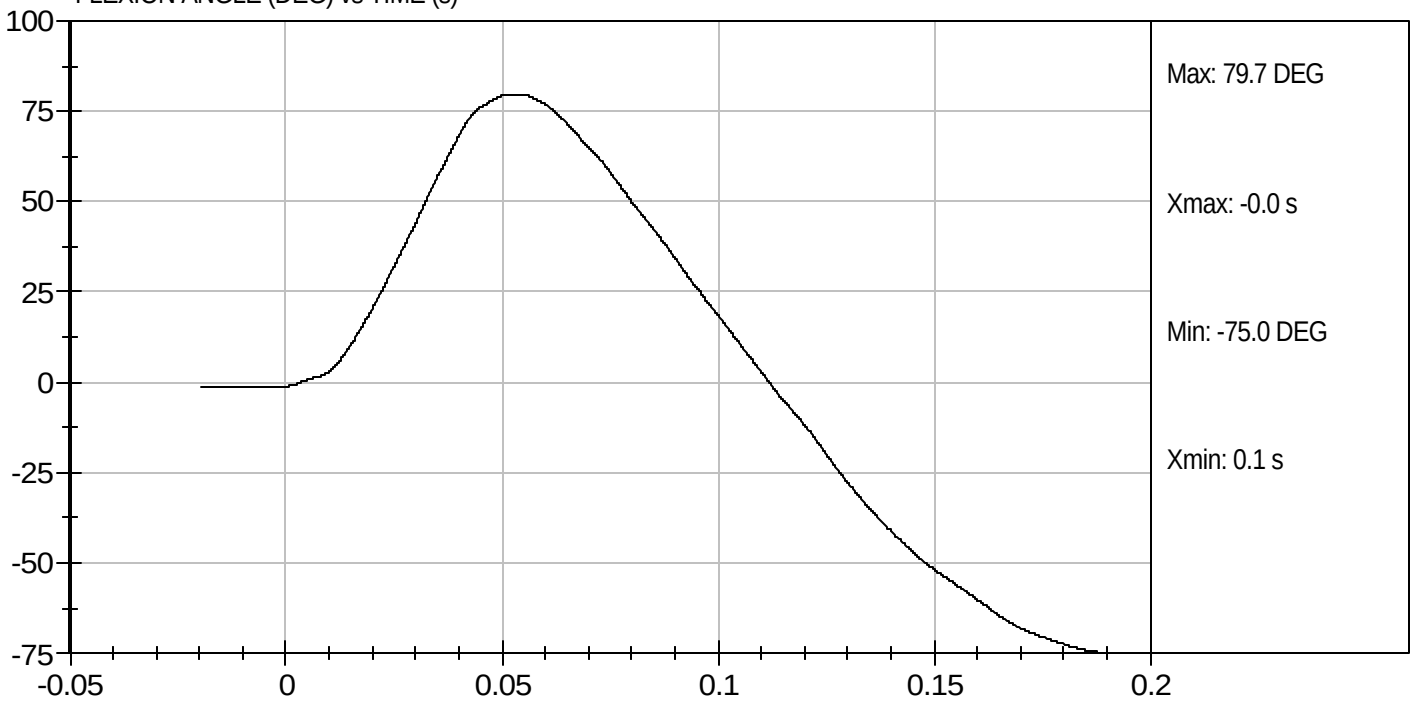
Test Desc: Neck Flexion
Component ID: D072532

Test Date: 8/23/07
Velocity: 17.182 ft/s, 5.2 m/s

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

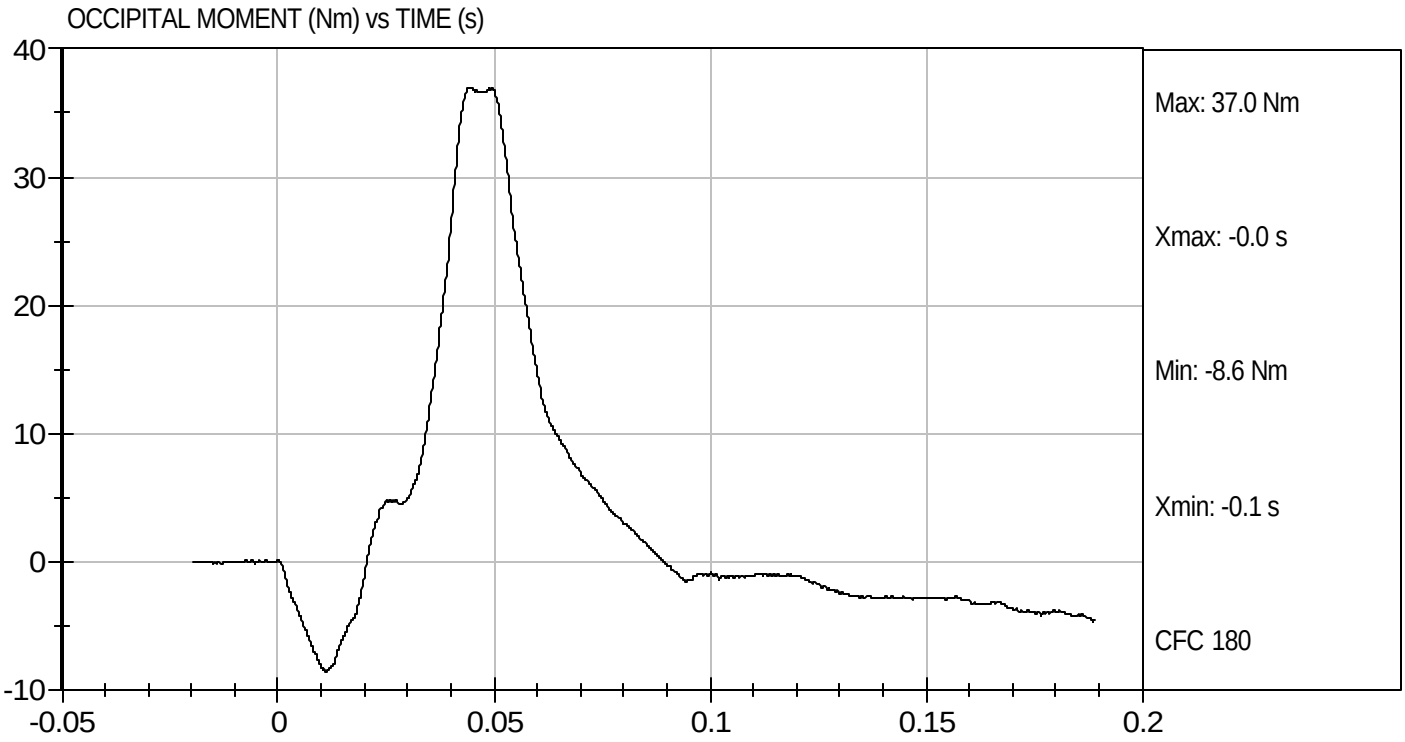


FLEXION ANGLE (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D072532

Test Date: 8/23/07
Velocity: 17.182 ft/s, 5.2 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

CRABI 12 MONTH

ATD Serial No: 090 **Test I.D:** D072533

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.7	Pass
Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/s	2.4 to 2.6	2.5	Pass
Pendulum Deceleration	6 msec	m/s	0.8 to 1.2	0.9	Pass
	10 msec	m/s	1.5 to 2.1	1.7	Pass
	14 msec	m/s	2.2 to 2.9	2.3	Pass
D Plane Rotation		deg	80.0 to 92.0	80.2	Pass
Moment About Occipital Condyle		Nm	-23.0 to -12.0	-14.8	Pass
Negative Moment - Time Curve Decay to -5 Nm		msec	76 to 90	84	Pass
			Overall Test Results		Pass

Laboratory Technician

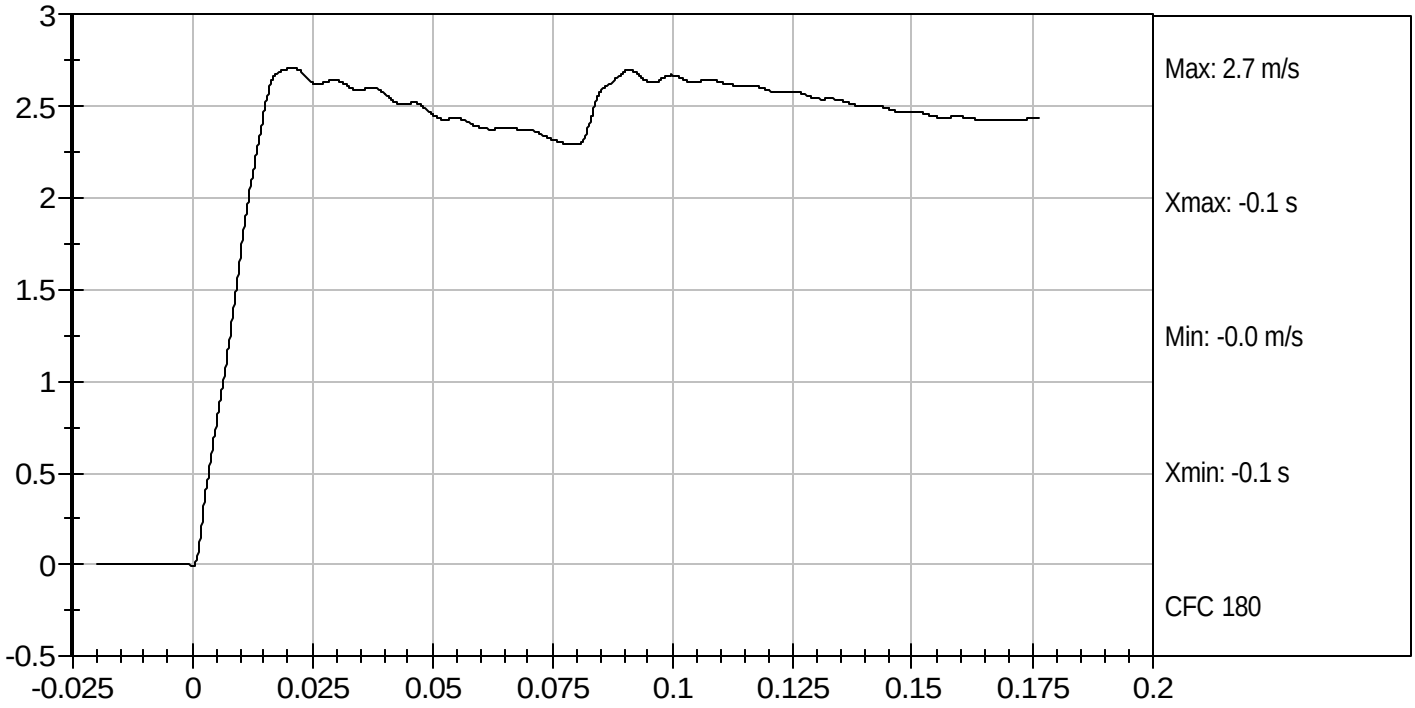
8/23/07
Test Date

David Winkelbauer
Approved By

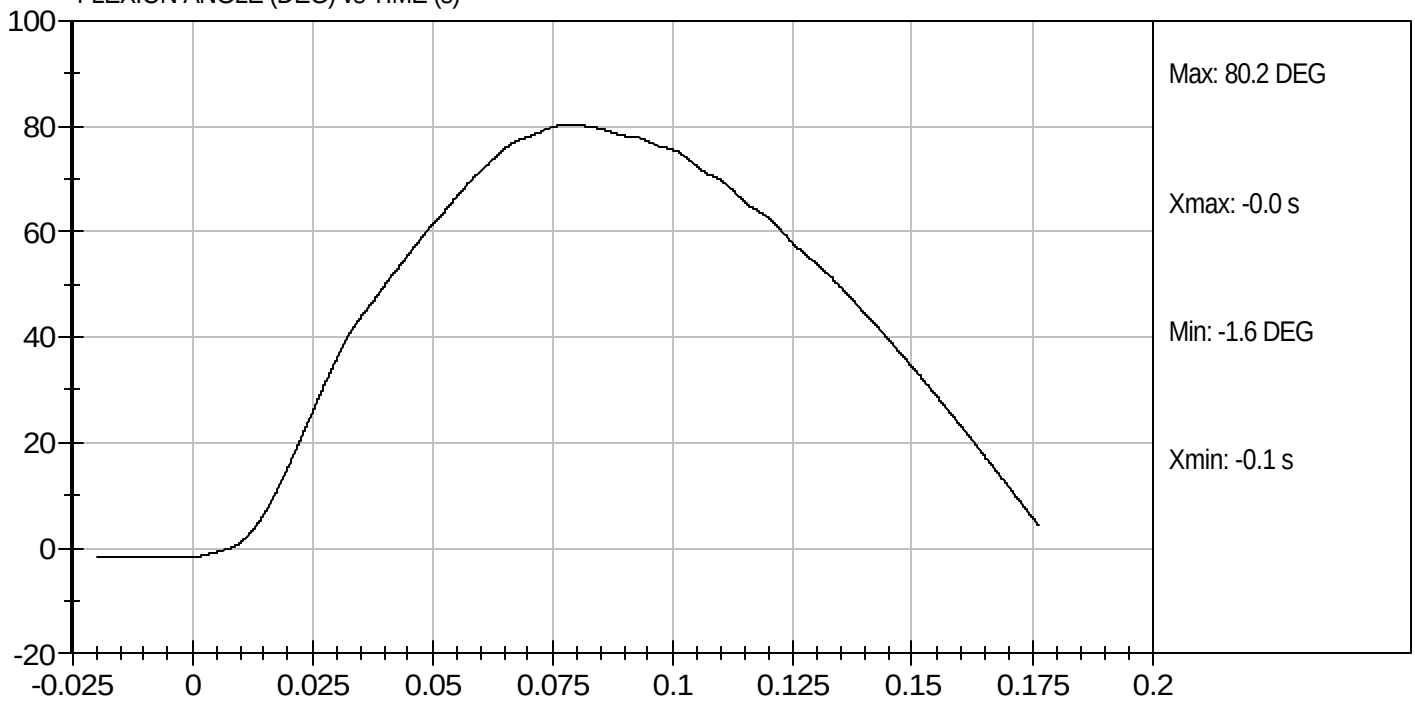
Test Desc: Neck Flexion
Component ID: D072533

Test Date: 8/23/07
Velocity: 8.33 ft/s, 2.5 m/s

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

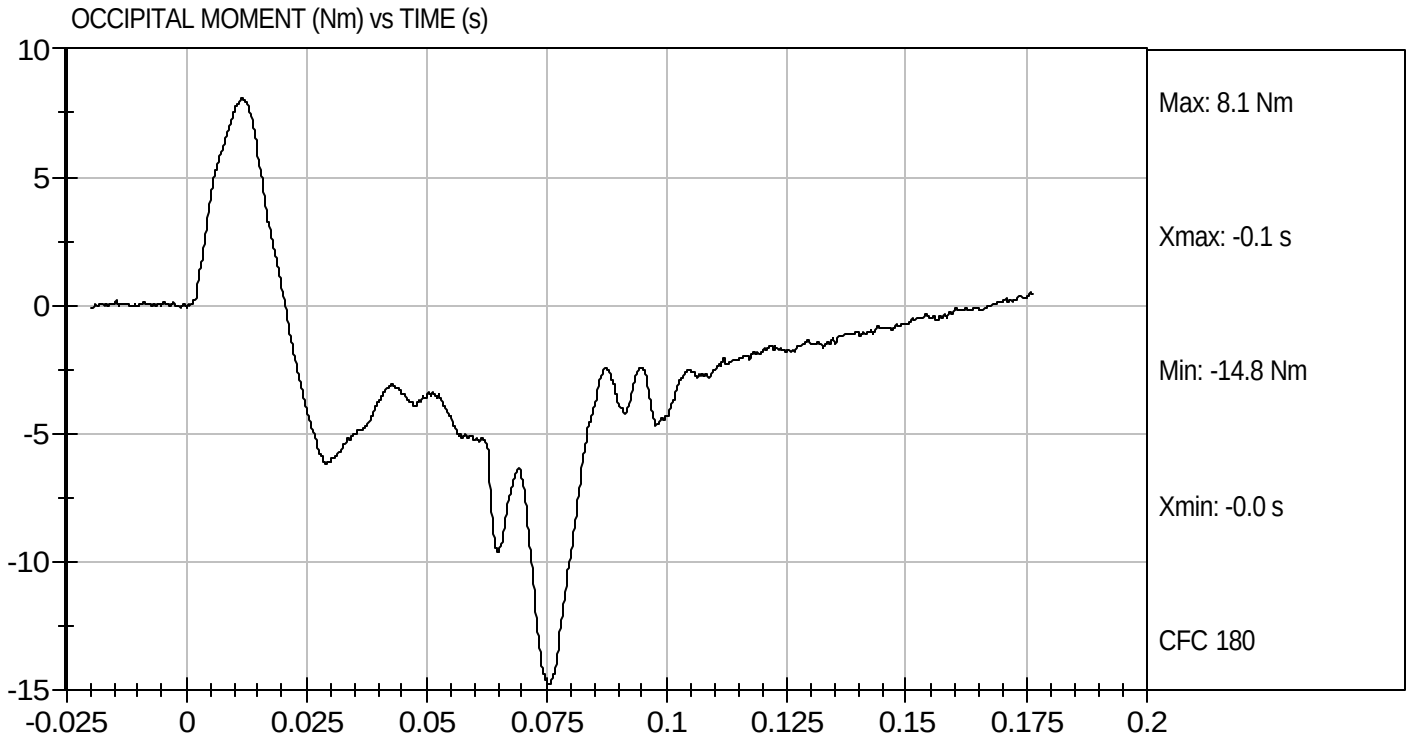


FLEXION ANGLE (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D072533

Test Date: 8/23/07
Velocity: 8.33 ft/s, 2.5 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT TEST

CRABI 12 MONTH

ATD Serial No: 090 **Test I.D:** D072534

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/sec	4.9 to 5.1	5.03	Pass
Probe Force	kN	1.51 to 1.80	1.55	Pass
		Overall Test Results		Pass

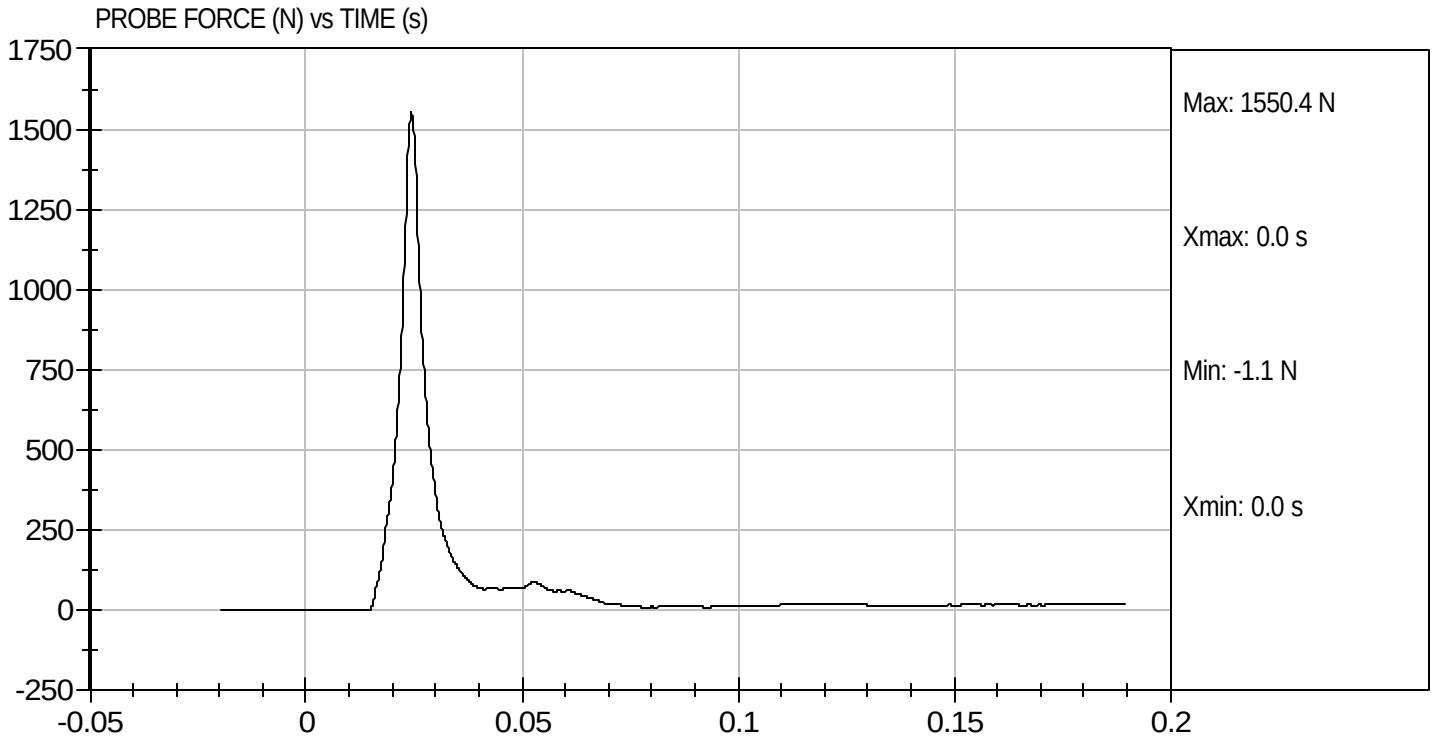
Laboratory Technician

8/23/07
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D072534

Test Date: 8/23/07
Velocity: 16.501 ft/s, 5.03 m/s



MGA RESEARCH CORPORATION

REAR HEAD DROP TEST

CRABI 12 MONTH

ATD Serial No: 090 **Test ID:** D072535

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	55 to 71	67	Pass
Peak Lateral Acceleration	G's	+/- 15	-3	Pass
Unimodal	N/A	within 17% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

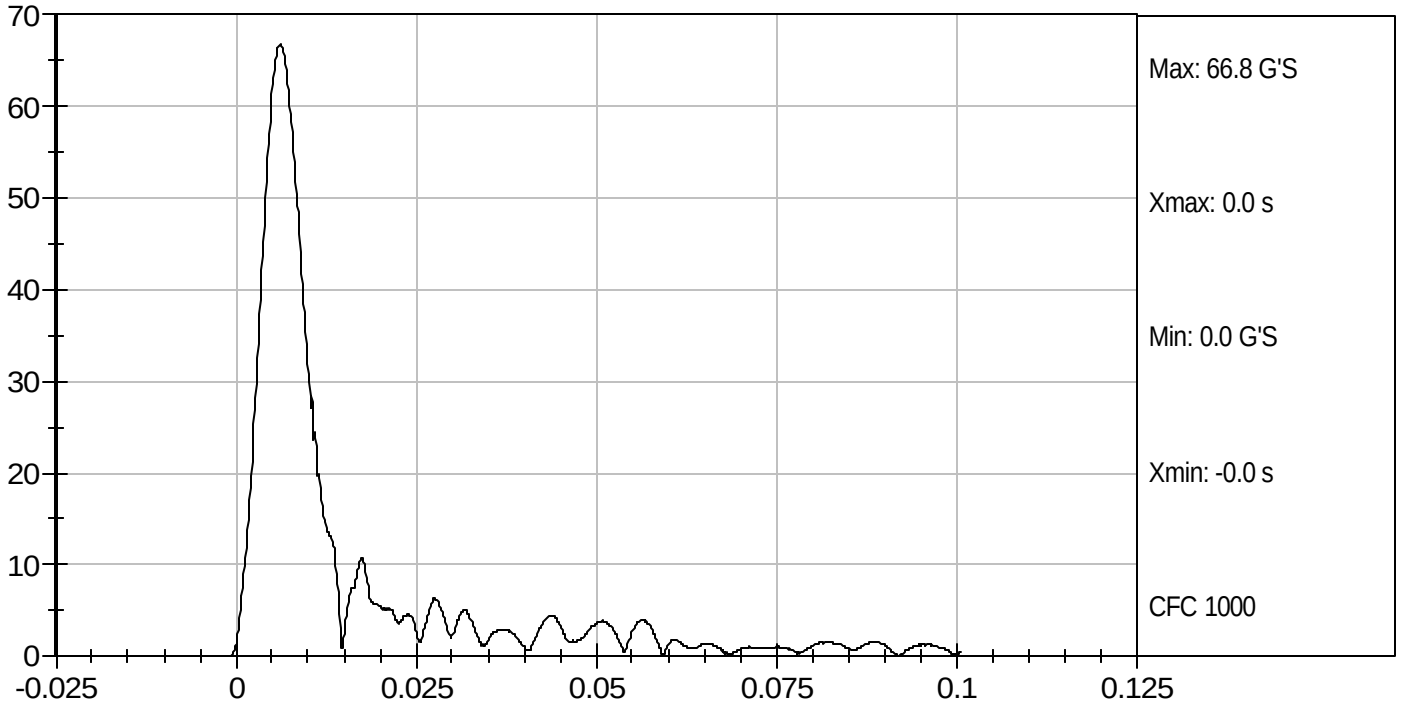
8/23/07
Test Date

Approved By

Test Desc: Head Drop
Component ID: D072535

Test Date: 8/23/07
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G'S) vs TIME (s)



PEAK LATERAL ACCELERATION (G'S) vs TIME (s)