REPORT NUMBER: NCAP-MGA-2008-005

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

FORD MOTOR COMPANY
2008 FORD FUSION SE
NHTSA NUMBER: F80202

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

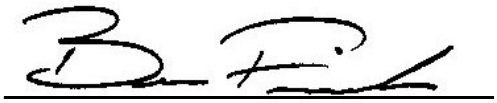
Test Date: October 2, 2007

Final Report Date: November 8, 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: 11/08/07

Ben Fischer, Project Engineer

Reviewed by:  Date: 11/08/07

David Winkelbauer, Facility Director

Technical Report Documentation Page

1. Report No. NCAP-MGA-2008-005	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Final Report of New Car Assessment Program Testing of a 2008 Ford Fusion SE NHTSA No.: F80202		*5. Report Date* November 8, 2007 *6. Performing Organization Code* MGA	
7. Author(s) Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP-MGA-2008-005	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-06-D-00028	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Rulemaking, Office of Crashworthiness Standards 1200 New Jersey Ave, SE, Room W43-410, NVS-111 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Report 10/02/2007 – 11/08/2007 *14. Sponsoring Agency Code* NVS-111	
15. Supplementary Notes			

16. Abstract

A frontal barrier impact was conducted on a 2008 Ford Fusion SE at MGA Research Corporation on October 2, 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 662 mm located to the right of the vehicle's centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:

Measurement Description	Units	Threshold	Driver ATD	Pass. ATD
Head Injury Criteria (HIC)	N/A	1000	366	367
Max. Thorax Accel. (3ms Clip)	G's	60	36	35
Left Femur Force	Newton	10009	-1773	-2942
Right Femur Force	Newton	10009	-3753	-2485

17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2008 Ford Fusion SE NHTSA No: F80202		*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	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 172	22. Price

Form DOT F1700.7 (8-72)

TABLE OF CONTENTS

SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-D-00028. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier was impacted by a 2008 Ford Fusion SE at a velocity of 56.3 kph. The test was performed at MGA Research Corporation on October 2, 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. 065) and right-front passenger (position 2) ATD (Serial No. 066) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 102 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest, and femur response data traces.

There was 90.6 percent windshield retention and no intrusion into the protected zone of the windshield during the event (see figure on page 2). 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 662 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. The passenger's knees contacted the glove box.

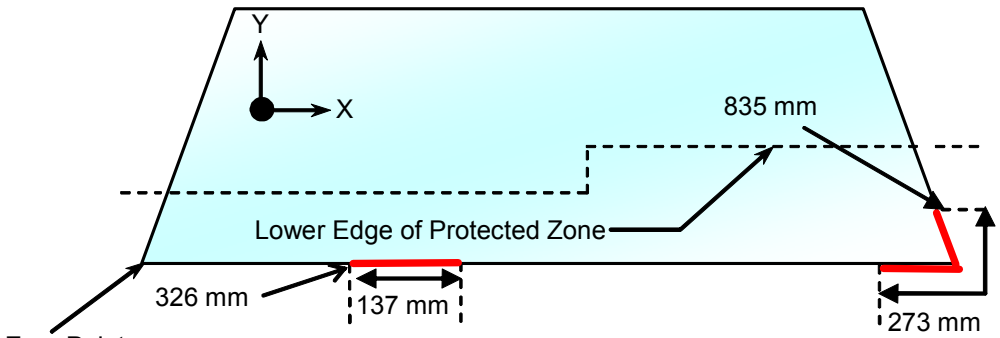
The occupant data is summarized below:

ATD position	HIC	T^1	T^2	Clip (g)	T^1	T^2	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver	366	57.8	93.8	36	87.4	90.4	-31	-1773	-3753
Passenger	367	78.4	114.4	35	57.1	60.1	-31	-2942	-2485

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

TEST NOTES

There was no valid data collected for:
Passenger Left Foot Z - Front
Top of Engine X after 60 msec.
Right Rear Seat Crossmember Z after 50 msec.



FRONT VIEW OF WINDSHIELD / RETENTION LOSS

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007

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	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	6 mm forward	12 mm forward
Seat Back Failure	None	None
Glazing Damage	The windshield cracked.	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	510
Center	mm	503
Right Side	mm	610
Average	mm	541

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	1489	1472
Lap belt length as measured on ATD	mm	760	651
Remainder of belt on reel	mm	921	847
Total belt length for continuous webbing systems	mm	3170	2970

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007

TEST VEHICLE INFORMATION

Manufacturer	Ford
Model	Fusion
Body Style	Sedan
NHTSA No.	F80202
VIN	3FAHP07Z78R123654
Color	Vapor Silver
Delivery Date	9/21/2007
Odometer Reading (mile)	29
Dealer	Gordie Boucher
Transmission	Automatic
Final Drive	Front
Number of Cylinders	4
Engine Displacement (L)	2.3
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	Yes
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 (driver only)	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company
Date of Manufacture	08/07

GVWR (kg)	1929
GAWR Front (kg)	1031
GAWR Rear (kg)	912

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				385
Cargo Wt. (RCLW) (kg)				45

DATA SHEET NO. 2... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

NHTSA No.: F80202
Test Date: 10/02/2007

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	446.3	308.0		489.9	363.3	
Right	kg	456.8	297.1		499.4	348.8	
Ratio	%	59.9	40.1		58.1	41.9	
Totals	kg	903.1	605.1	1508.2	989.3	712.1	1701.4

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1508.2
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	1709.2

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	706	708	703	709	1095
As Tested	mm	698	696	672	673	1143
Post Test	mm	677	758	672	677	

Vehicle Wheelbase (mm): 2730

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

Vehicle Components Removed: Trunk lid, rear bumper and cover, spare tire, tools, tail lights, mirrors, rear door glass, rear speakers, and exhaust front to back

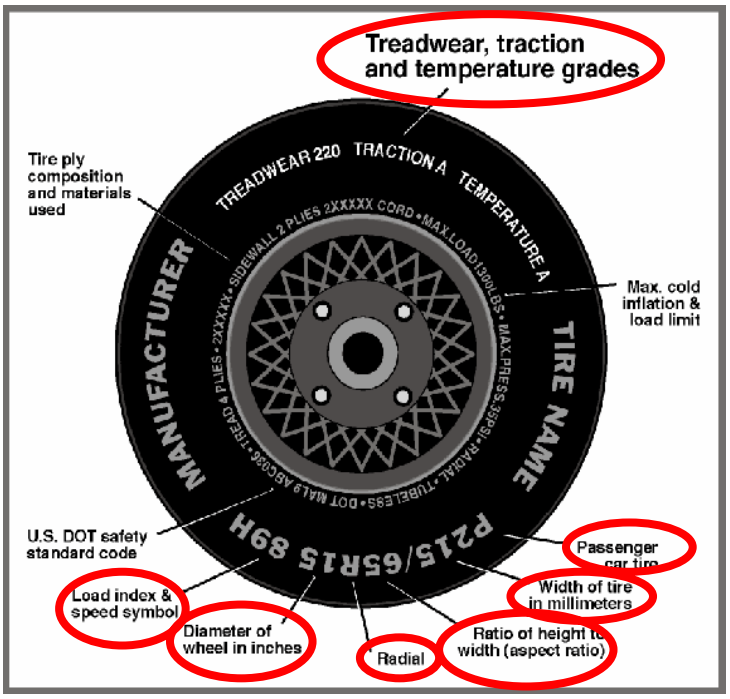
Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

NHTSA No.: F80202
Test Date: 10/02/2007



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	275	275
Cold Pressure (kPa)	235	235
Recommended Tire Size	P205/60R16	P205/60R16
Tire Size on Vehicle	P205/60R16	P205/60R16
Tire Manufacturer	Continental	Continental
Tire Name	Contact	Contact
Tire Type	Passenger	Passenger
Tire Width (mm)	205	205
Ratio of Height to Width (aspect ratio)	60	60
Radial	R	R
Wheel Diameter	16	16
Load Index & Speed Symbol	91T	91T
Treadwear	400	400
Traction Grade	AA	AA
Temperature Grade	A	A

DATA SHEET NO. 4

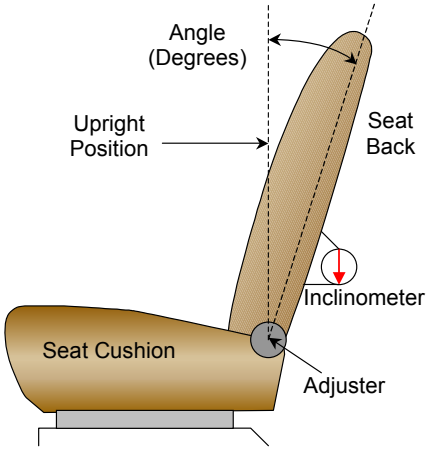
TEST VEHICLE INFORMATION

Test Vehicle: 2008 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: The seat back angle is measured relative to the rocker sill. Measure the seat back angle at headrest post only. Seat and curtain airbags will deploy in frontal crash events, so seat back fabric and foam must not be cut. Test position = 10.8 degrees.

Driver seat back angle: 10.9 degrees on headrest post
Passenger seat back angle: 11.0 degrees on headrest post



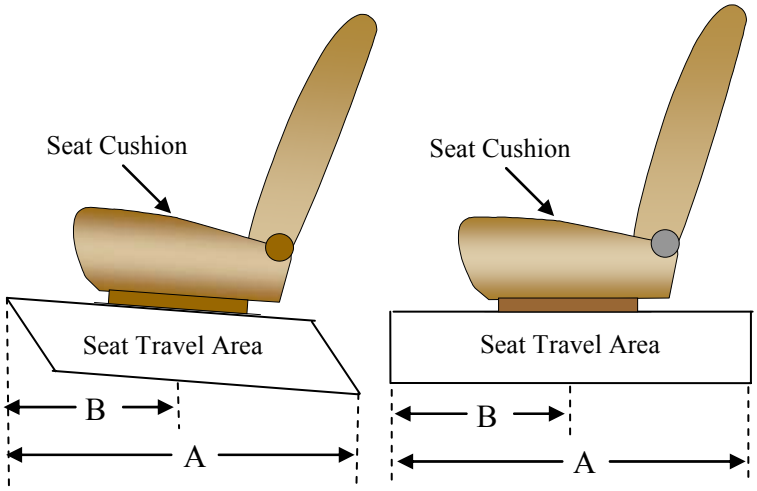
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	295 mm	147 mm
Passenger Seat	234 mm	117 mm

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were placed in the first position with the uppermost detent defined as 0.



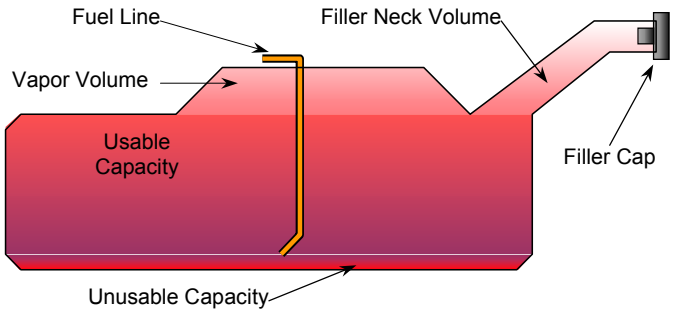
DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2008 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	66.2
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	60.9 – 62.2
Actual Amount of Solvent used	41.6 to maintain test weight
1/3 of Usable Capacity	22.1

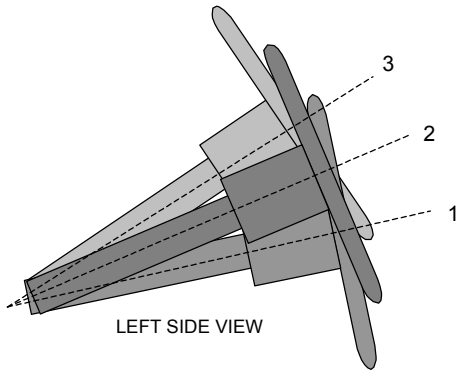
The test vehicle is equipped with an electric fuel pump. The electric fuel pump operates for 2 seconds to pressurize the fuel system following the actuation of the ignition. If no attempt has been made to start the engine within 2 seconds following ignition actuation, the fuel pump will shut off. The fuel pump operates continuously while the engine is running. If the engine stalls, the fuel pump is deactivated. Also, a fuel pump shut-off switch is provided, designed to stop fuel flow to the engine if the vehicle sustains an impact above a certain magnitude.



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	0	62.5
Geometric center position No. 2	25	65.5
Uppermost position No. 3	50	68.5

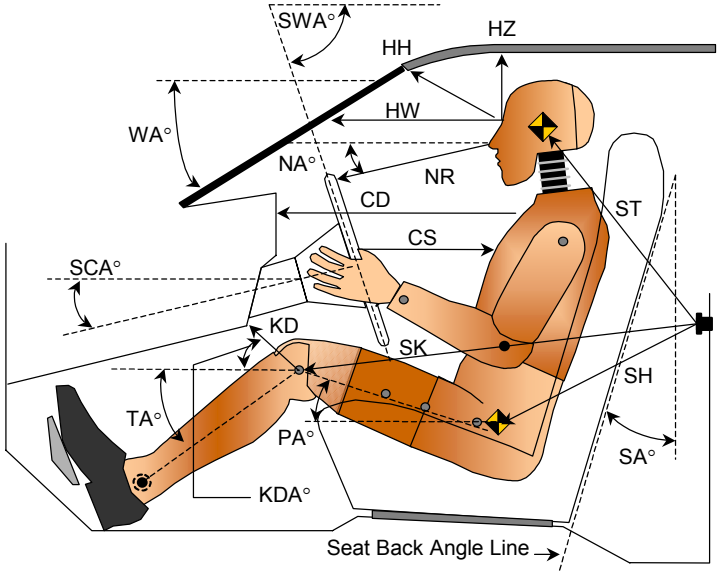
DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

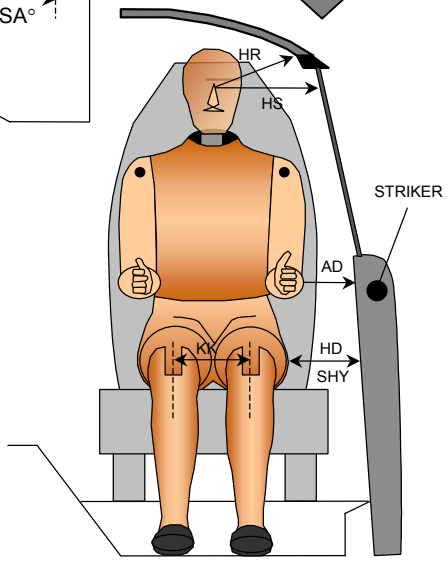
Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

NHTSA No.: F80202
Test Date: 10/02/2007

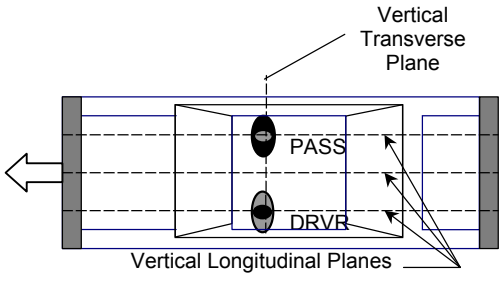
DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



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



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



DATA SHEET NO. 5... (CONTINUED)

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007

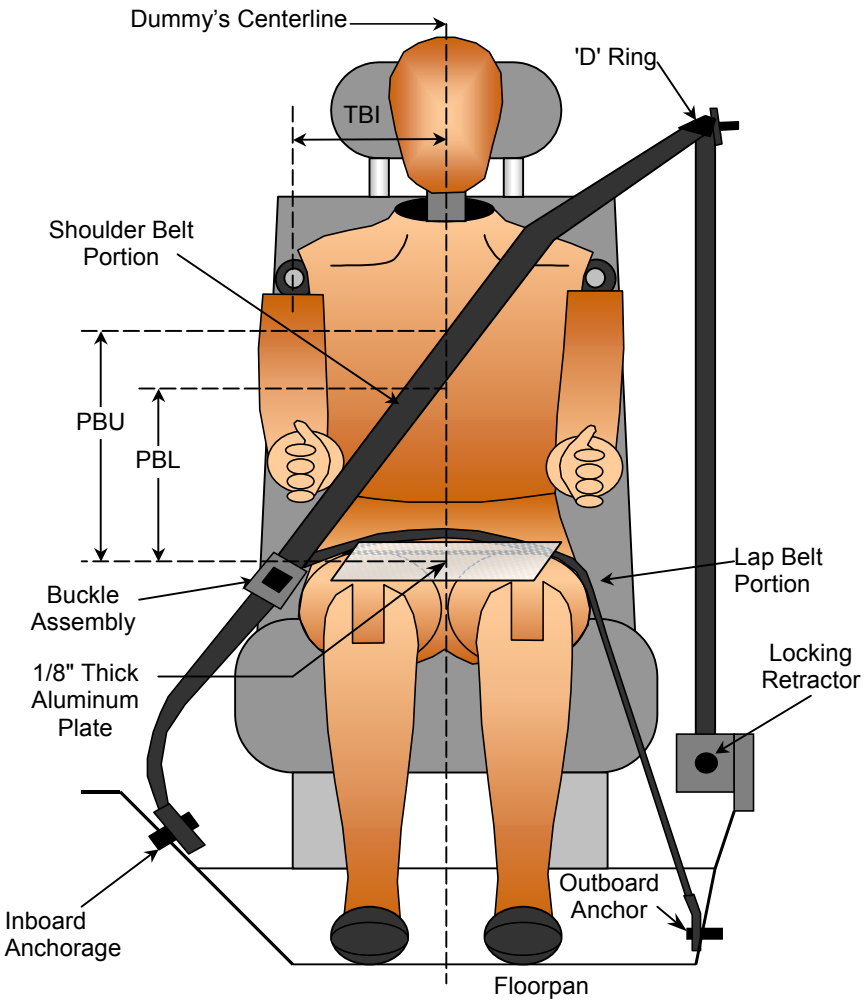
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		27.5		
SWA	Steering Wheel Angle		65.5		
SCA	Steering Column Angle		25.5		
SA	Seat Back Angle (on headrest post)		10.9		11.0
HZ	Head to Roof (Z)	159	90	148	90
HH	Head to Header	277	26.4	307	23.2
HW	Head to Windshield	596	0	616	0
HR	Head to Side Header (Y)	196		221	
NR	Nose to Rim	385	6.4		
CD	Chest to Dash	530		564	
CS	Chest to Steering Hub	309	0		
RA	Rim to Abdomen	185	0		
KDL	Left Knee to Dash	168	23.4	165	
KDR	Right Knee to Dash	154		178	27.0
PA	Pelvic Angle		21.4		24.7
TA	Tibia Angle		36.3		42.6
KK	Knee to Knee (Y)	275		270	
SK	Striker to Knee	566	88.7	562	87.0
ST	Striker to Head	520	7.6	527	6.9
SH	Striker to H-Point	234	130.3	207	129.8
SHY	Striker to H-Point (Y)	276		266	
HS	Head to Side Window	329		341	
HD	H-Point to Door (Y)	154		137	
AD	Arm to Door (Y)	141		141	
AA	Ankle to Ankle	304		220	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	345	345
PBL - To surface of reference to belt lower edge	mm	265	265

DATA SHEET NO. 7

VEHICLE ACCELEROMETER LOCATIONS

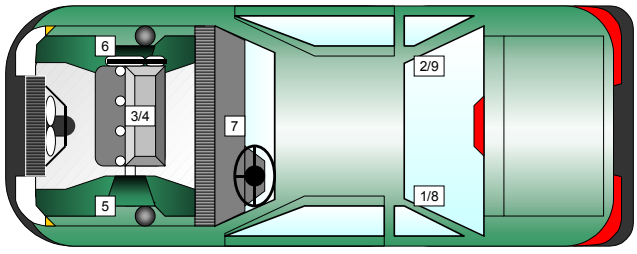
Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

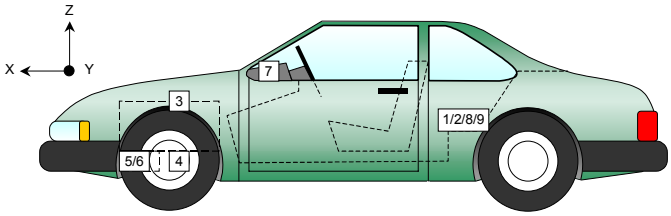
NHTSA No.: F80202
Test Date: 10/02/2007

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1892	-365	227
2	Right Rear X-Member X	1892	365	227
3	Engine Top X	3952	0	828
4	Engine Bottom X	4041	10	234
5	Left Brake Caliper X	3008	-137	272
6	Right Brake Caliper X	3011	137	272
7	Instrument Panel X			
8	Left Rear X-Member Z	1892	-365	227
9	Right Rear X-Member Z	1892	365	227

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 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

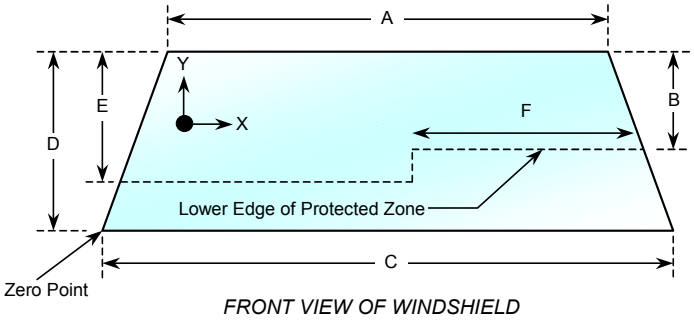
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2188	1915	87.5
Right Side	2188	2051	93.7
Total	4376	3966	90.6



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1146
B	mm	550
C	mm	1514
D	mm	858
E	mm	560
F	mm	523

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 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 11:41 am

Stoddard Solvent Spillage Measurements

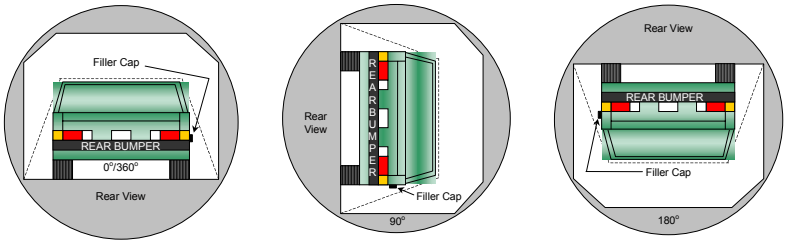
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

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

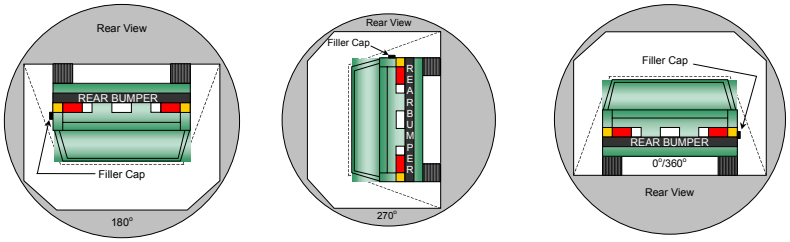
C. For the following 25 minutes: 0 oz.
(Maximum Allowable = 1 oz. /minute)

D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



0° to 90° 90° to 180°



180° to 270° 270° to 360°

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

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

3. Details of Stoddard Solvent spillage locations:

None

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	122	300	0
90° to 180°	127	300	0
180° to 270°	109	300	0
270° to 360°	119	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

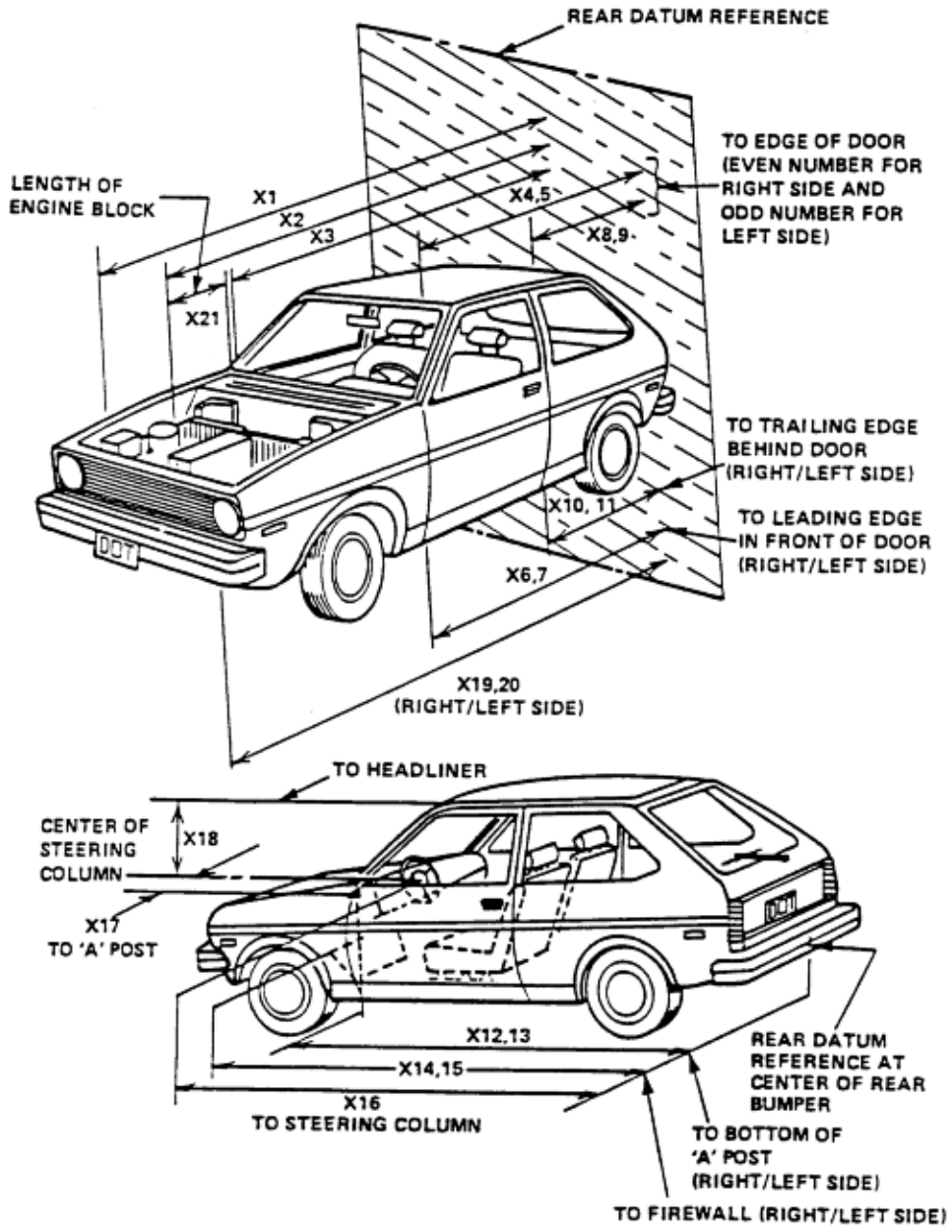
NHTSA No.: F80202
Test Date: 10/02/2007

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4801	4148	653
2	RSOV to front of engine	mm	4295	3986	309
3	RSOV to firewall centerline	mm	3672	3622	50
4	RSOV to leading edge of right door	mm	3337	3324	13
5	RSOV to leading edge of left door	mm	3332	3324	8
6	RSOV to lower leading edge of right door	mm	3323	3291	32
7	RSOV to lower leading edge of left door	mm	3311	3288	23
8	RSOV to upper leading edge of right door	mm	2217	2207	10
9	RSOV to upper leading edge of left door	mm	2224	2214	10
10	RSOV to lower trailing edge of right door	mm	2243	2217	26
11	RSOV to lower trailing edge of left door	mm	2243	2224	19
12	RSOV to bottom of right 'A' pillar	mm	3267	3239	28
13	RSOV to bottom of left 'A' pillar	mm	3260	3243	17
14	RSOV to firewall on right side	mm	3671	3568	103
15	RSOV to firewall on left side	mm	3693	3662	31
16	RSOV to steering column	mm	2808	2864	-56
17	Center of steering column to left 'A' pillar	mm	387	366	21
18	Center of steering column to headlining	mm	438	441	-3
19	RSOV to right side of front bumper	mm	4696	4086	610
20	RSOV to left side of front bumper	mm	4696	4261	435
21	Length of engine block	mm	475	475	0
RD	RSOV to right side of dash panel	mm	3097	3085	12
CD	RSOV to center of dash panel	mm	3074	3058	16
LD	RSOV to left side of dash panel	mm	3107	3099	8

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2008 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2008 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4801
2	Total Width	1820
3	Bumper Top Height	550
4	Bumper Bottom Height	425
5	Longitudinal Member Top Height	562
6	Distance between Longitudinal Members	928
7	Longitudinal Member Width	62
8	Engine Top Height	822
9	Engine Bottom Height	214
10	Engine and gearbox width	826
11	Front bumper-engine distance	480
12	Front shock absorber fixing height	884
13	Bonnet leading edge height	717
14	Front shock absorber fixing width	1004
15	Front bumper – front axle distance	1005
16	Front axle – a pillar distance	444
17	A-pillar – B-pillar distance	1125
18	B-Pillar – rear axle distance	1162
19	B-pillar – C-pillar distance	715
20	Roof sill bottom height	1230
21	Roof sill top height	1399
22	Floor sill bottom height	170
23	Floor sill top height	332

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1300	-4650	1190	24	1000
3	Steering Column Top	1100	-5210	1210	25	1000
4	Steering Column Bottom	1110	-5220	1200	25	1000
5	Driver Close-up	1380	-5200	1280	35	1000
6	Driver Angle	6850	-5120	2230	50	1000
7	On board Driver Side				8	1000
8	On board Passenger Side				8	1000
9	Right Overall	1650	6800	1280	24	1000
10	Right Passenger Half	1310	4700	1230	24	1000
11	Right Close-up	1400	5300	1320	35	1000
12	Right Angle	6800	5280	2200	50	1000
13	Windshield	-285	0	2860	12.5	1000
14	Top Driver	-135	-470	2180	24	1000
15	Top Passenger	-110	420	2180	24	1000
16	Pit Front	1210	0	-3150	24	1000
17	Pit Rear	3220	0	-3150	24	1000

*COORDINATES:

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

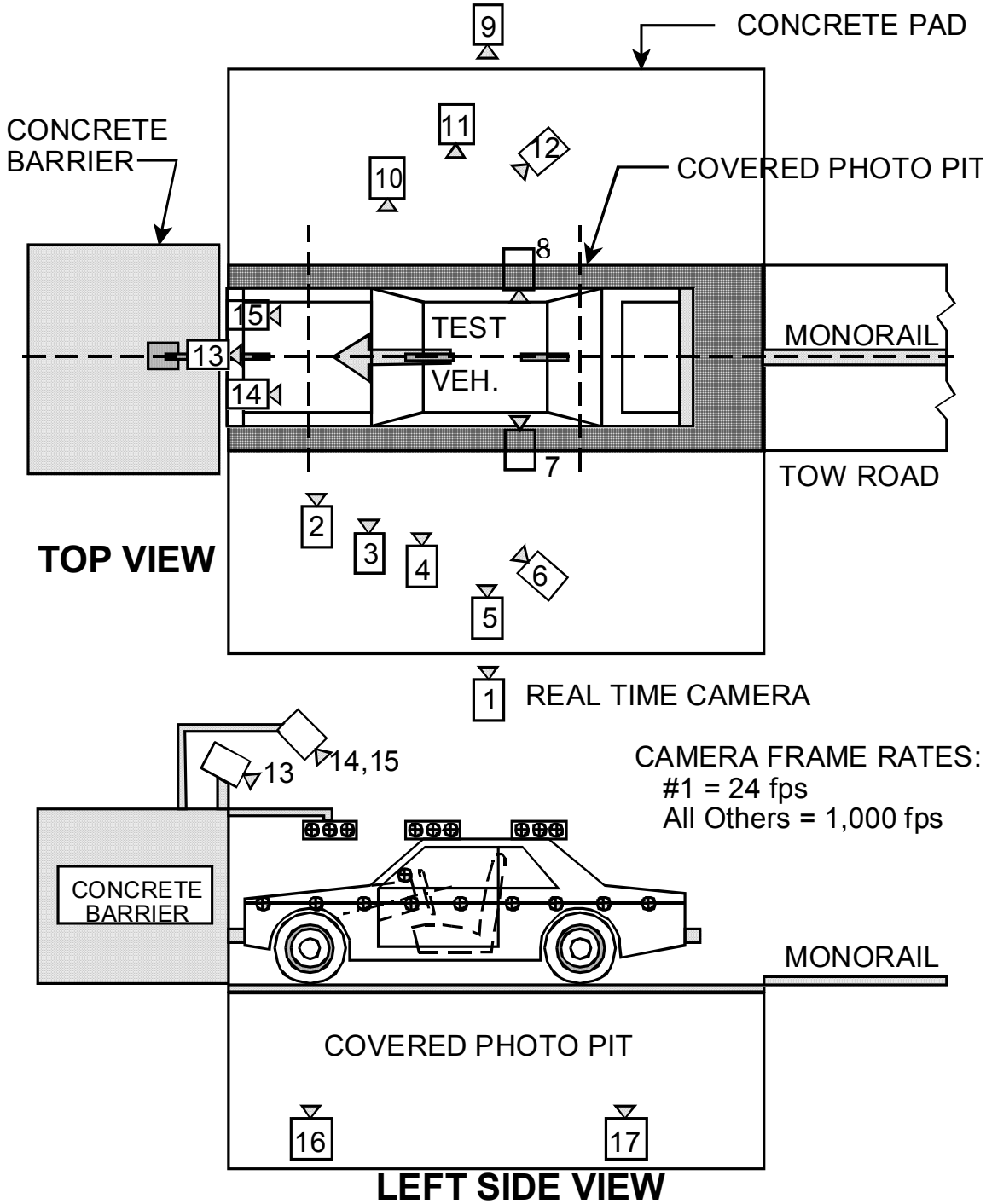
Note: Cameras 7 and 8 were not used for this test.

DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle: 2008 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

CAMERA POSITIONS FOR FRONTAL IMPACTS



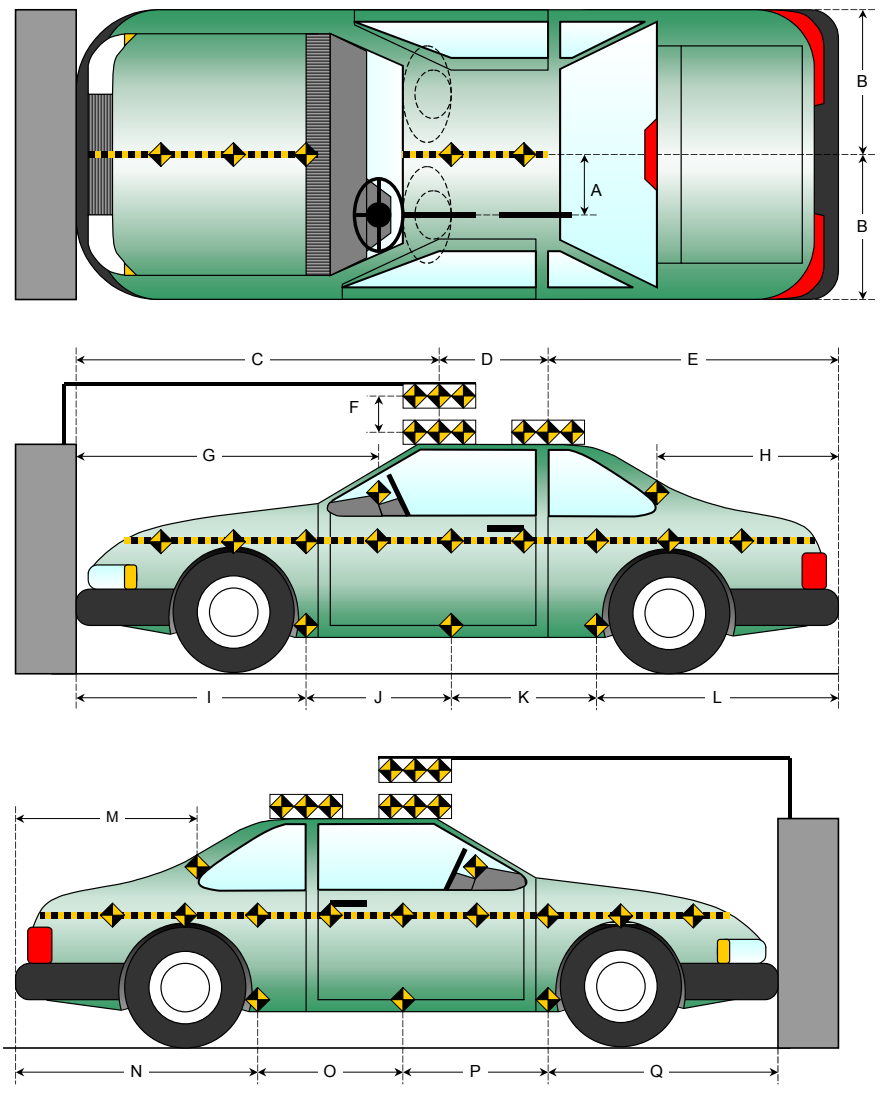
DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

NHTSA No.: F80202
Test Date: 10/02/2007

Item	Value
A	355
B	910
C	2321
D	916
E	1564
F	1442
G	
H	1210
I	1443
J	920
K	920
L	1518
M	1180
N	1520
O	920
P	920
Q	1441



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

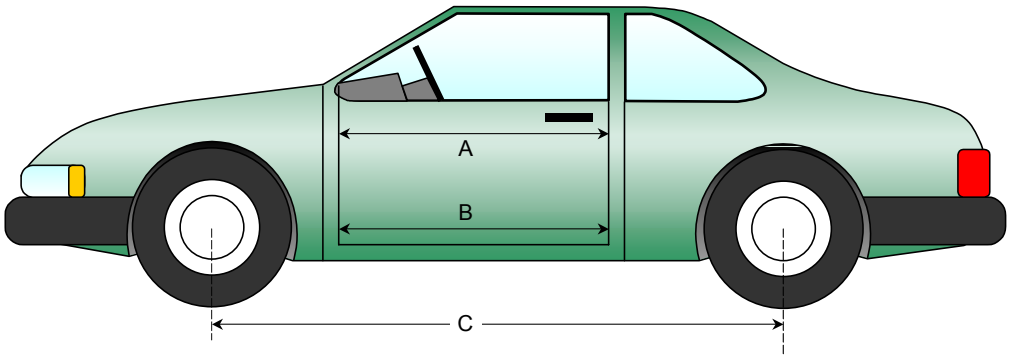
Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007

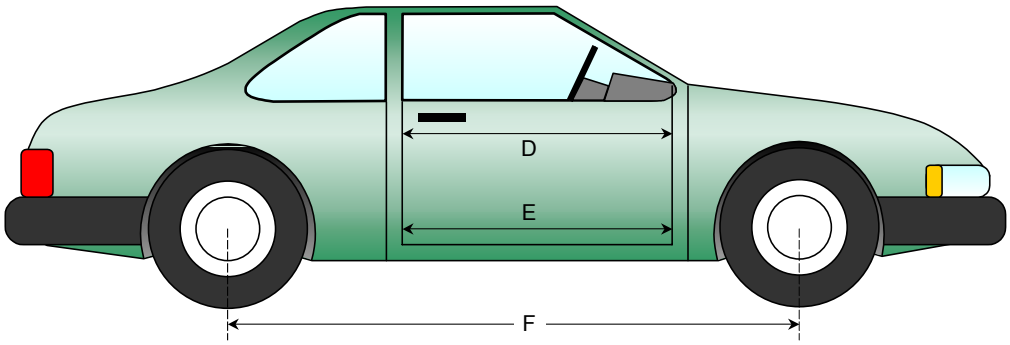
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	988	981	7
B	Left Side Lower	mm	961	956	5
D	Right Side Upper	mm	989	986	3
E	Right Side Lower	mm	929	928	1

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2730	2687	43
F	Right Side Wheelbase	mm	2730	2674	56





DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

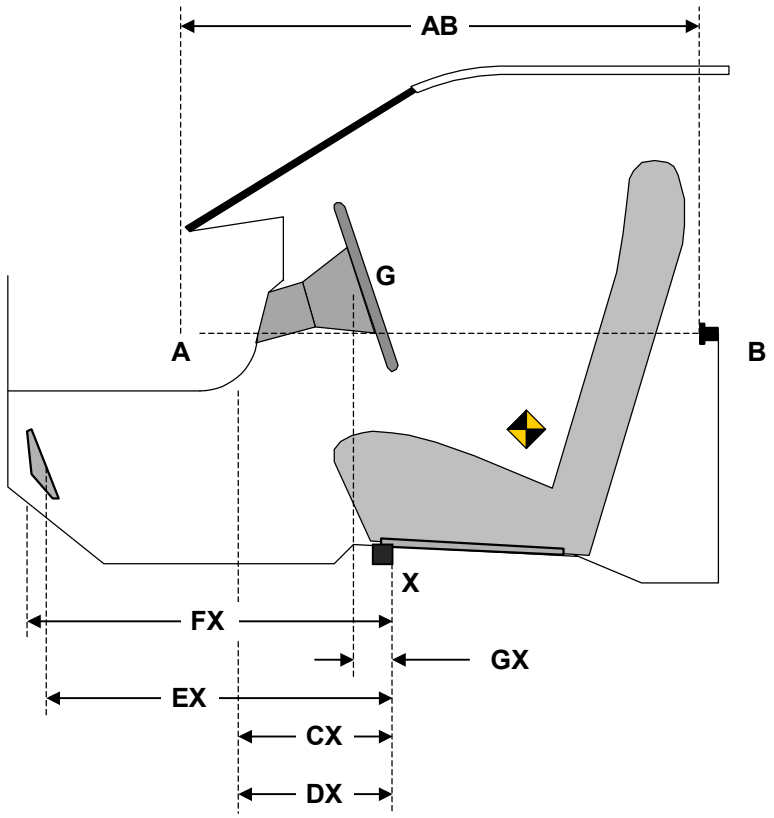
Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

NHTSA No.: F80202
Test Date: 10/02/2007

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	742	742	0
CX	Left Knee Bolster to X	mm	316	317	-1
DX	Right Knee Bolster to X	mm	304	294	10
EX	Brake Pedal to X	mm	584	505	79
FX	Foot Rest to X	mm	610	590	20
GX	Center of Steering Column Wheel Hub to X	mm	74	176	-102

X = Front of Seat Track (stationary)



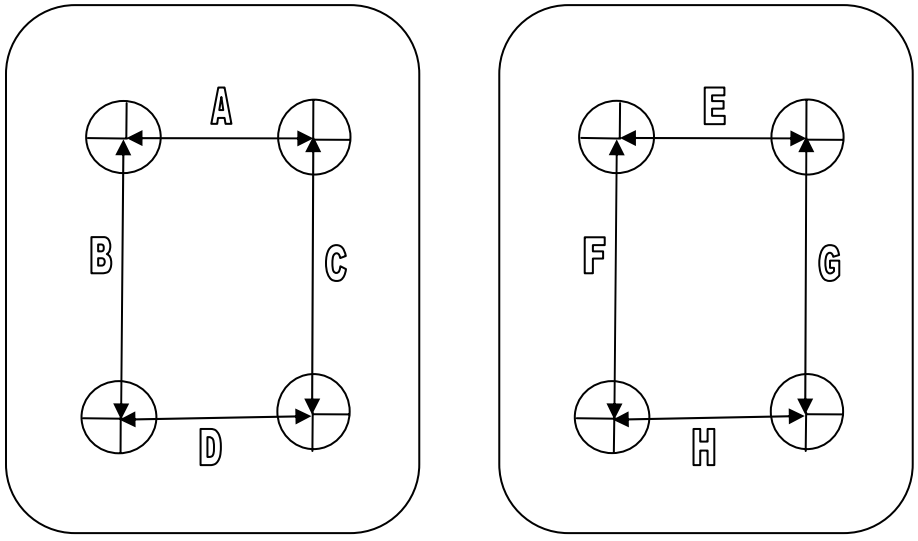
DRIVER COMPARTMENT

DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact

NHTSA No.: F80202
Test Date: 10/02/2007



Driver Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	253	242	11
B	270	259	11
C	257	260	-3
D	259	244	15
E	256	252	4
F	253	254	-1
G	214	212	2
H	278	274	4

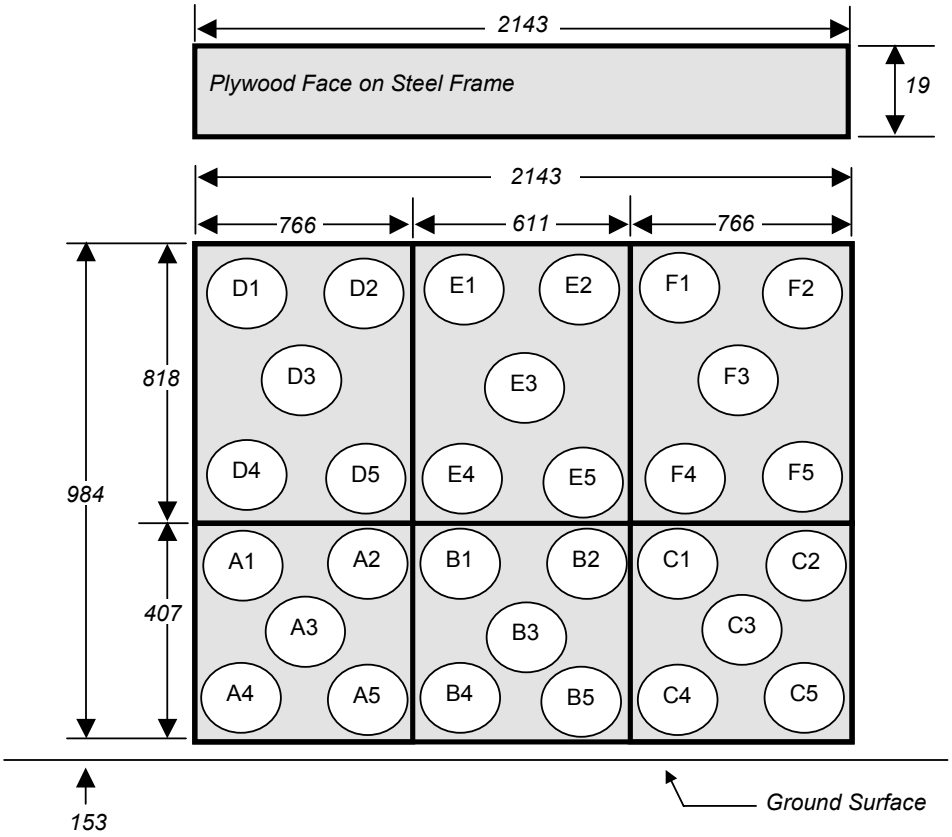
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2008 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

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 Ford Fusion SE NHTSA No.: F80202
Test Program: 35mph Frontal Impact Test Date: 10/02/2007

VEHICLE INFORMATION

VIN: 3FAHP07Z78R123654 Wheelbase (mm) : 2730
Vehicle Size Category: Sedan Test Weight (kg) : 1701.4

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): 61.2 Time of Separation (msec): 193

CRUSH PROFILE

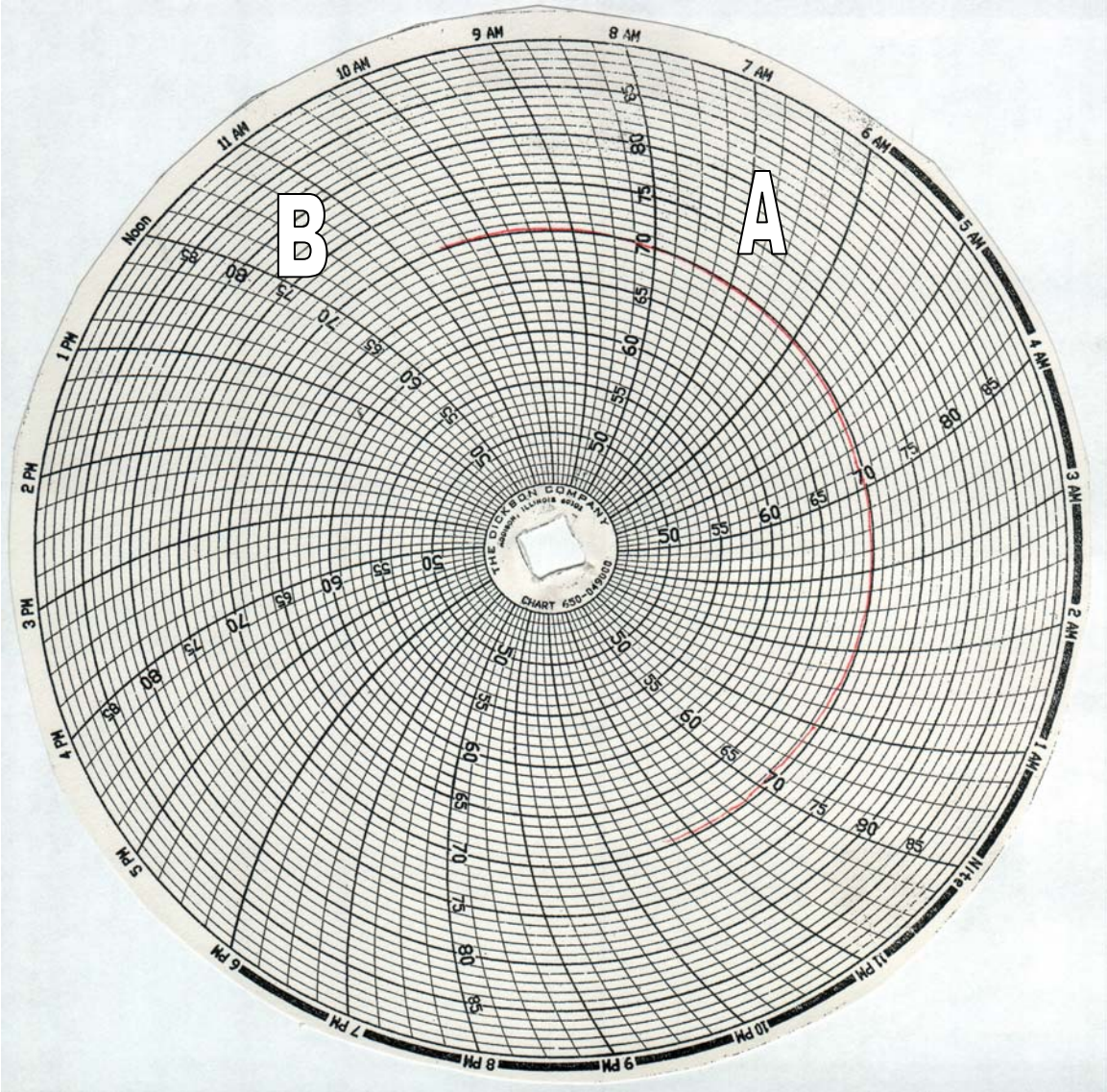
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1100 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4696	4261	435
C2	Crush zone 2 at left side	mm	4765	4226	539
C3	Crush zone 3 at left side	mm	4791	4190	601
C4	Crush zone 4 at right side	mm	4792	4130	662
C5	Crush zone 5 at right side	mm	4765	4119	646
C6	Crush zone 6 at right side	mm	4696	4086	610
L	C1 TO C6	mm	1100	1093	7

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2008 Ford Fusion SE
Test Program: 35mph Frontal Impact
NHTSA No.: F80202
Test Date: 10/02/2007



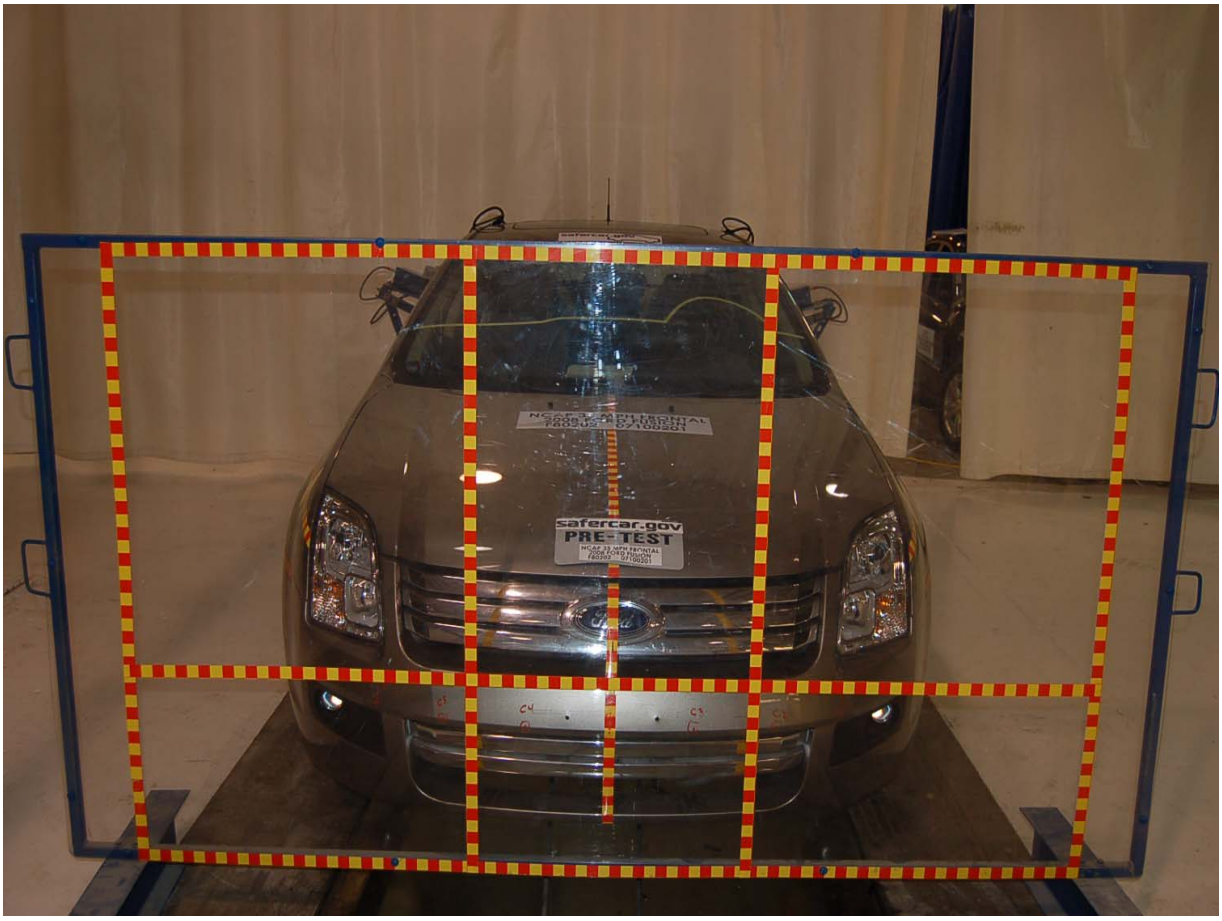
A = Dummies installed in vehicle at 6:00 am

B = Test conducted at 11:41 am

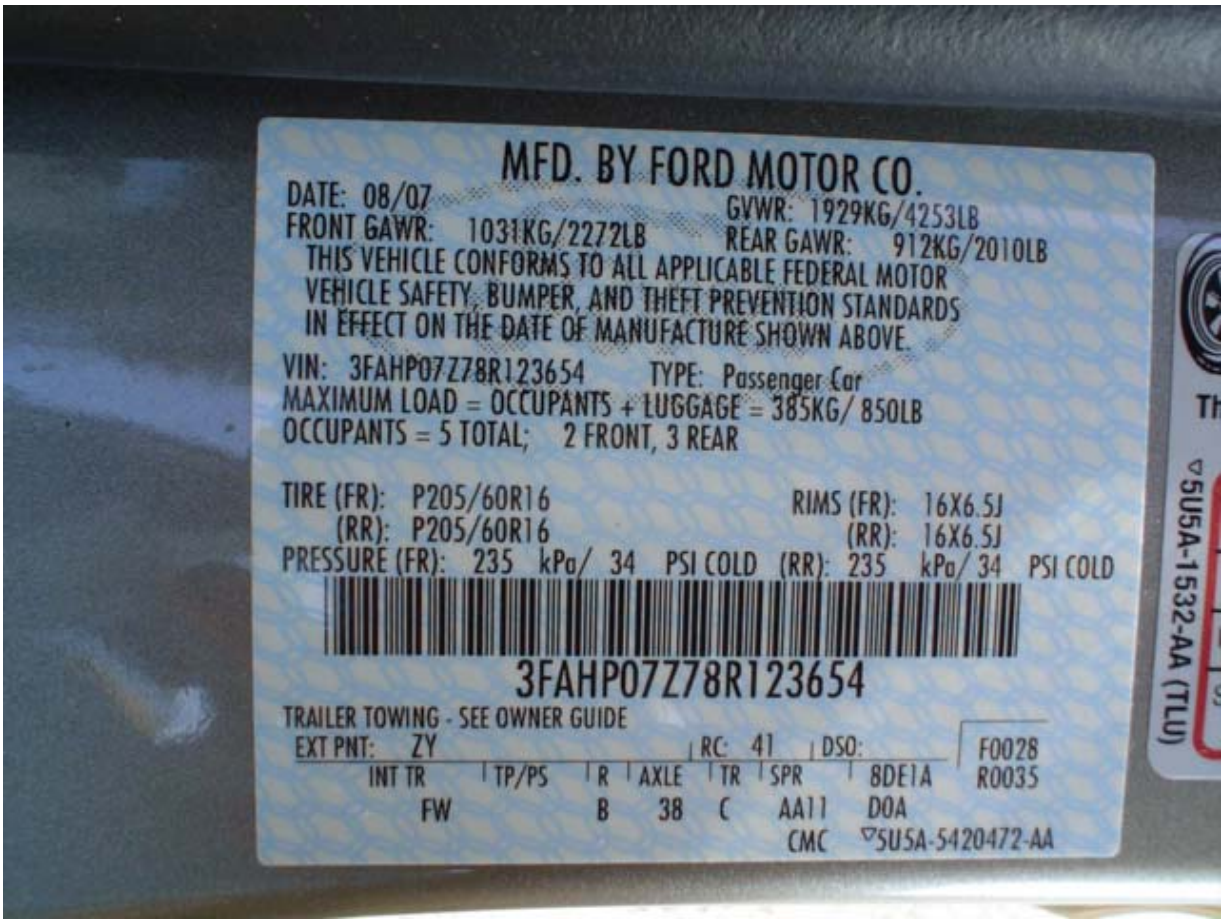
APPENDIX A

PHOTOGRAPHS

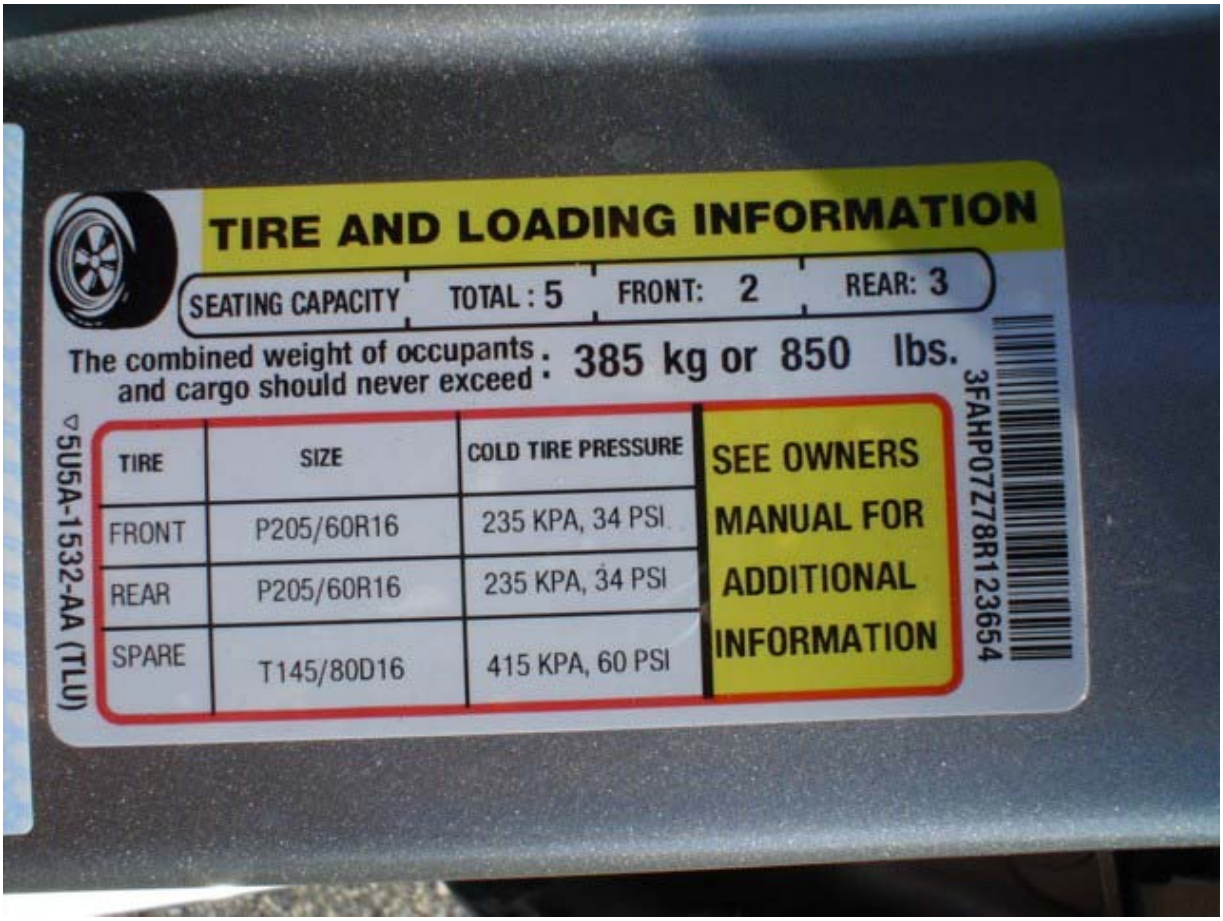
TABLE OF PHOTOGRAPHS



Load Cell Location



Manufacturer's Label



Tire Placard

Left Front ¾ View, As Received

Right Rear ¾ View, As Received

Pre-Test Front View

Post-Test Front View

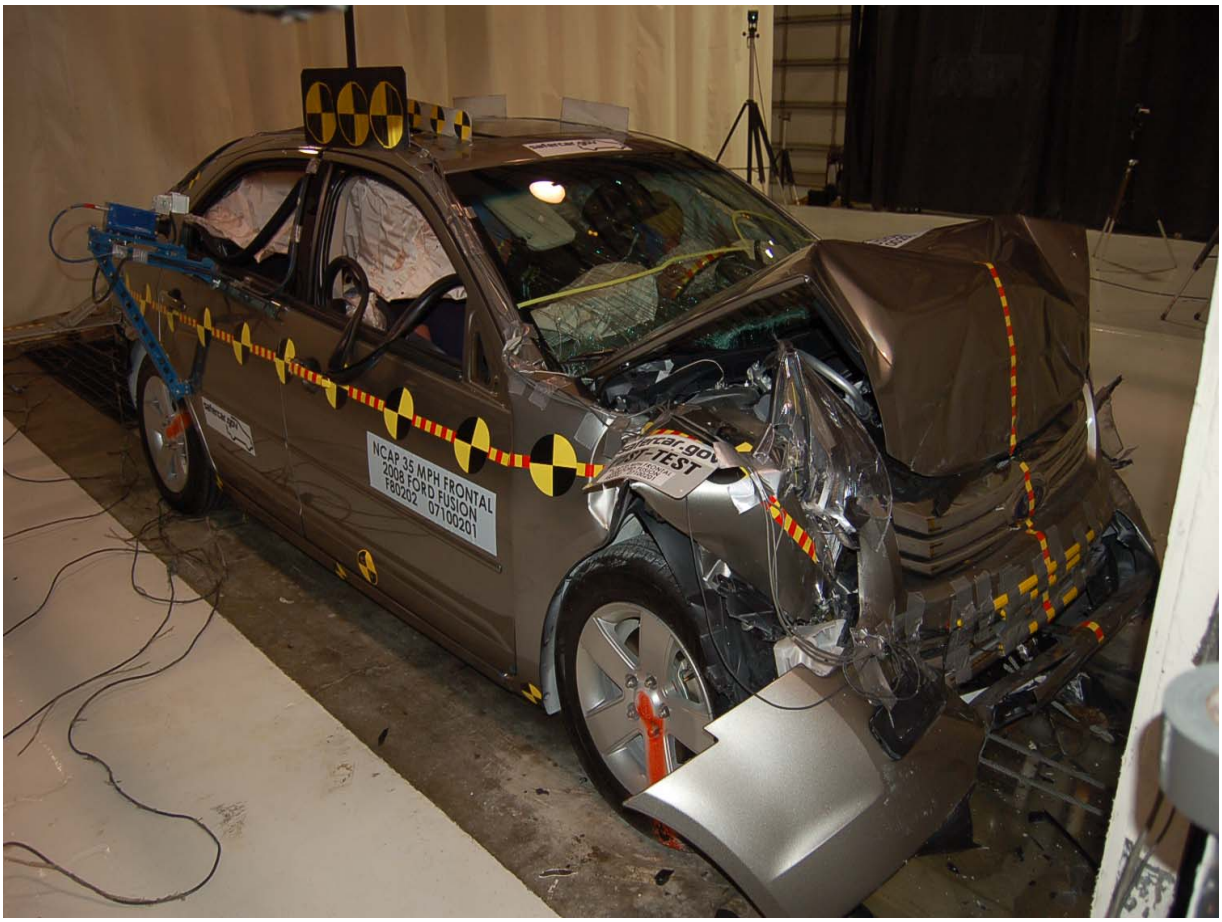
Pre-Test Left Side View

Post-Test Left Side View

Pre-Test Right Side View

Post-Test Right Side View

Pre-Test Right Front ¾ View



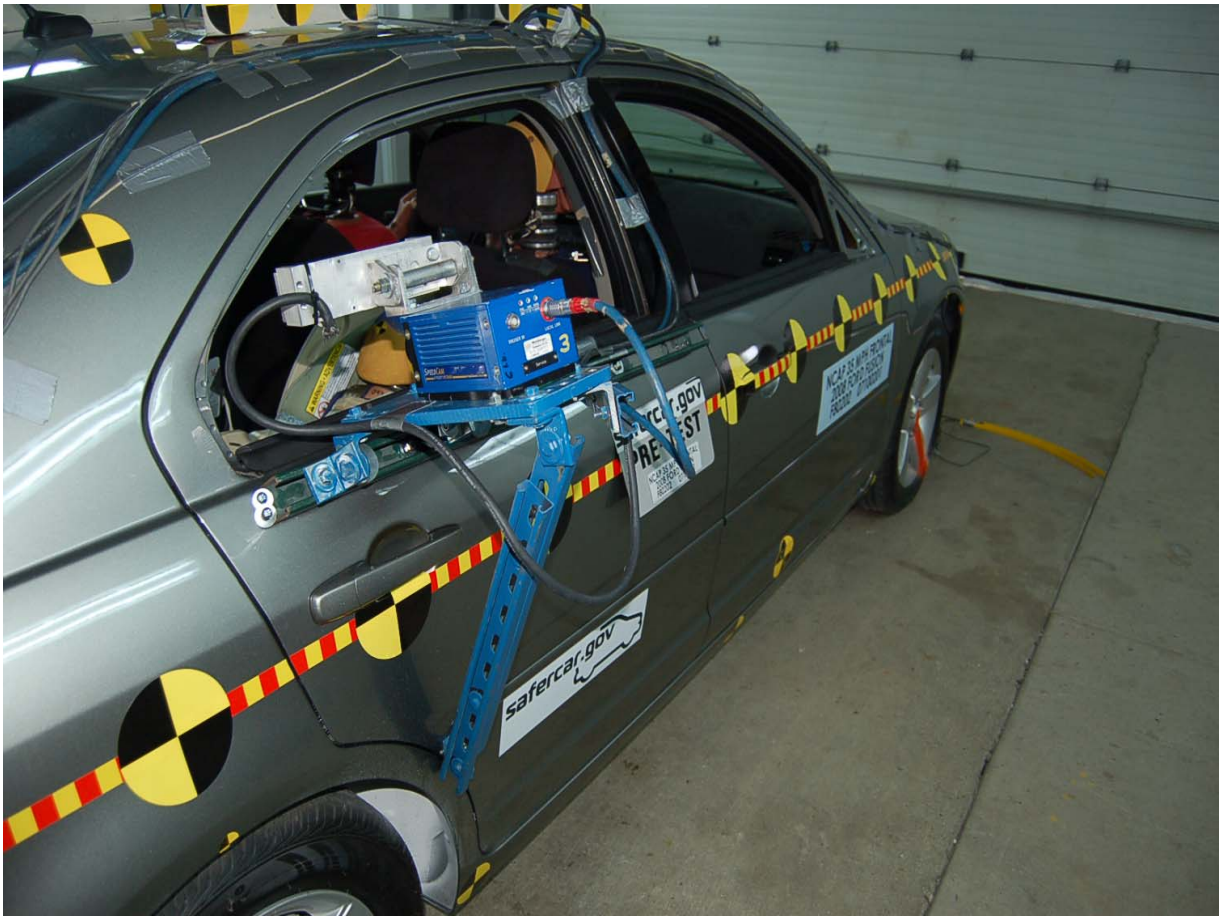
Post-Test Right Front ¾ View

Pre-Test Left Rear ¾ View

Post-Test Left Rear ¾ View

Pre-Test Left Side ¾ View of Doors

Post-Test Left Side ¾ View of Doors After Impact



Pre-Test Right Side ¾ View of Doors

Post-Test Right Side ¾ View of Doors After Impact

Pre-Test Windshield View

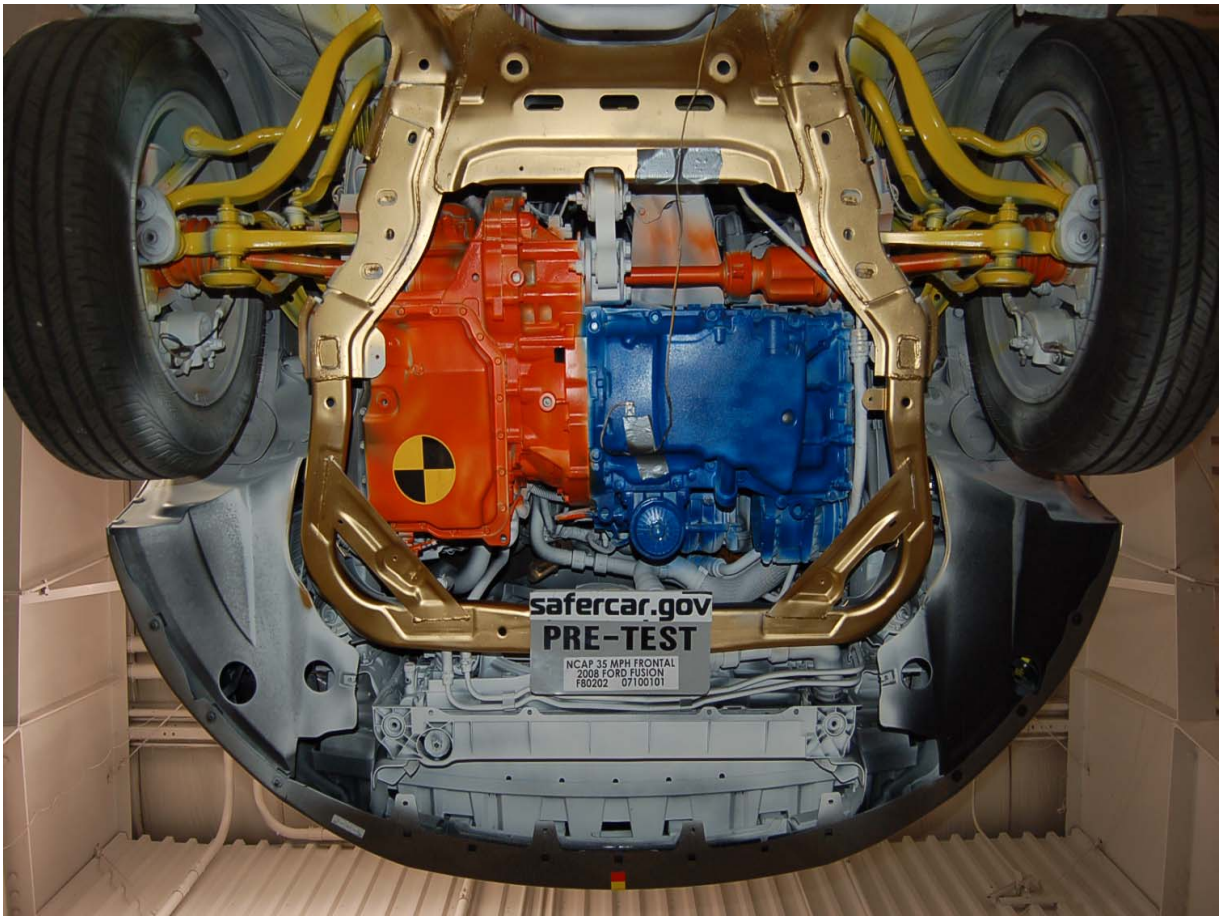
Post-Test Windshield View

Pre-Test Engine Compartment View

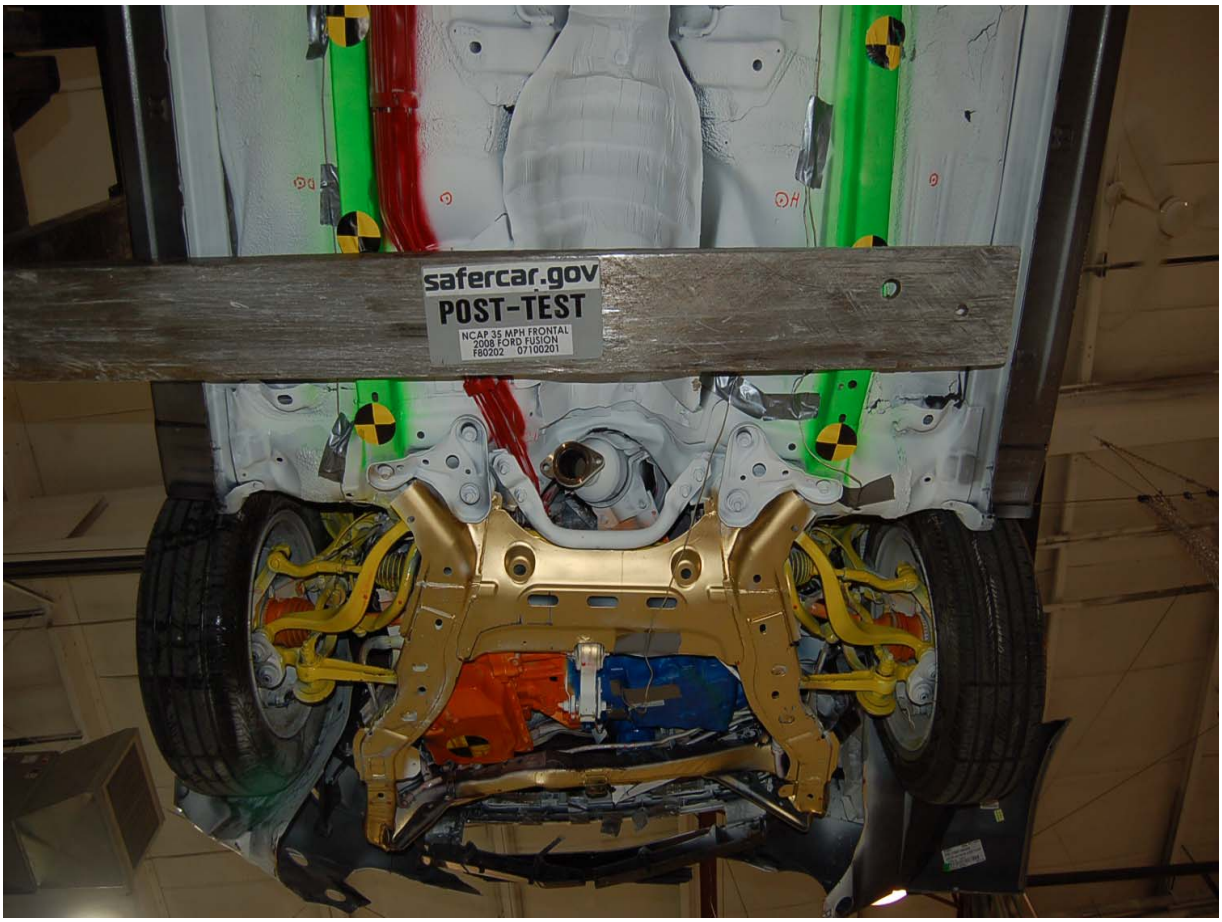
Post-Test Engine Compartment View

Pre-Test Fuel Cap View

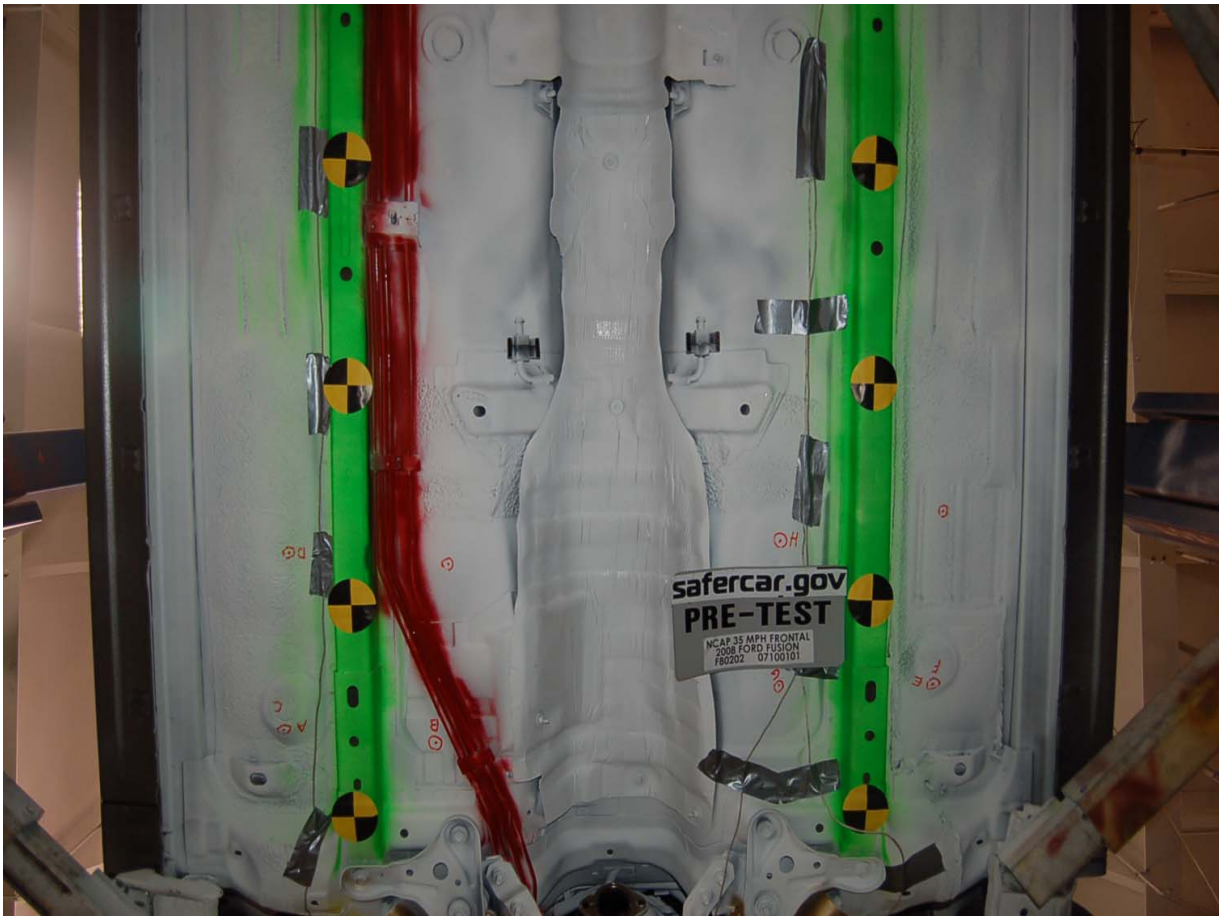
Post-Test Fuel Cap View



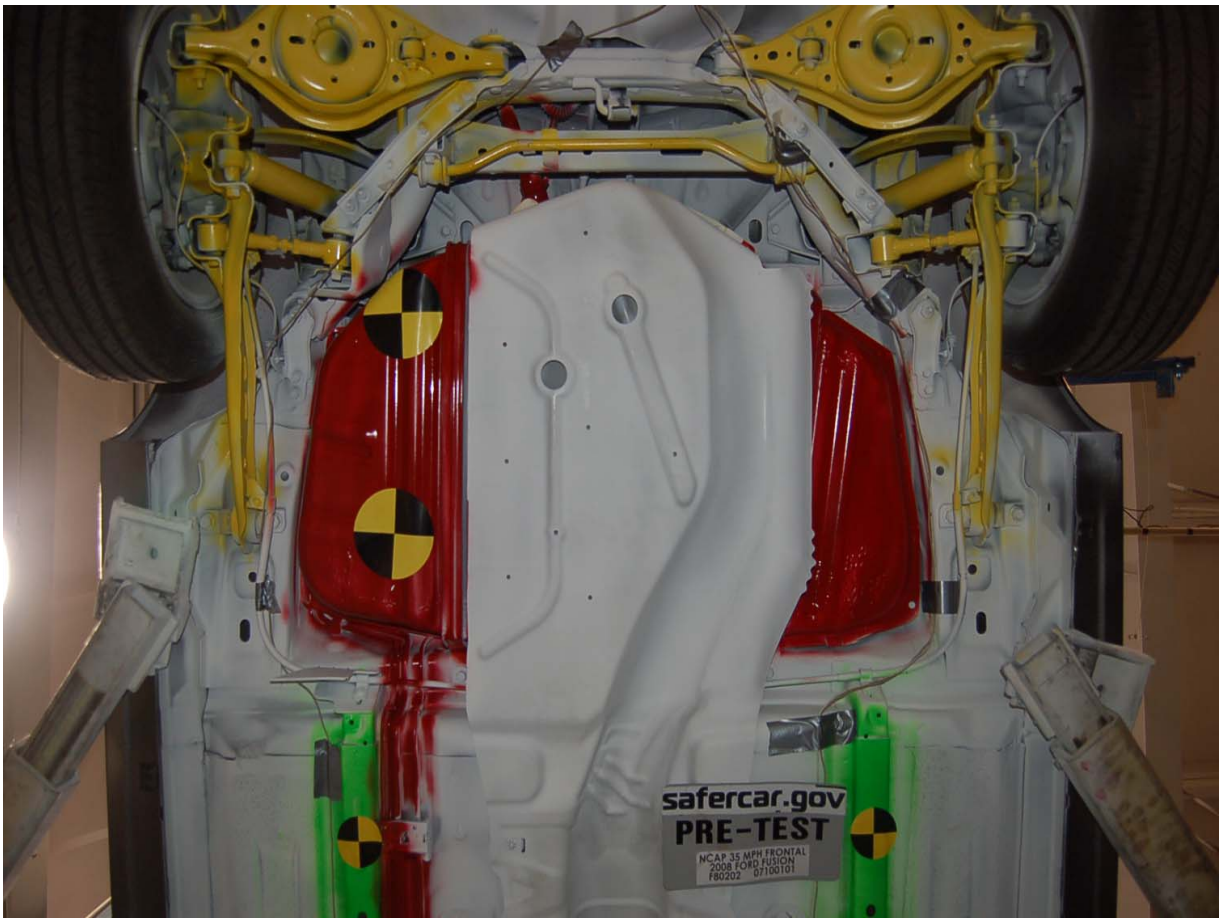
Pre-Test Front Underbody View



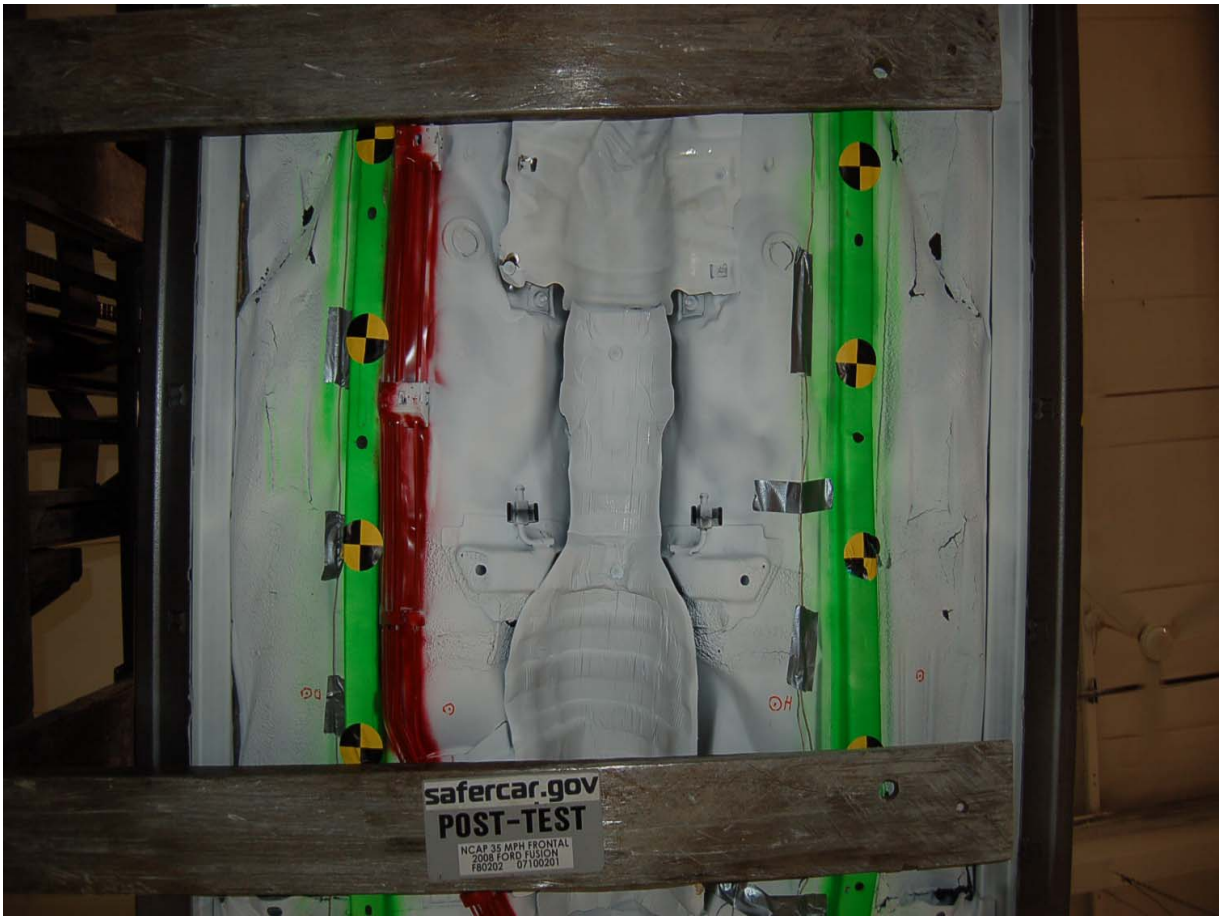
Post-Test Front Underbody View



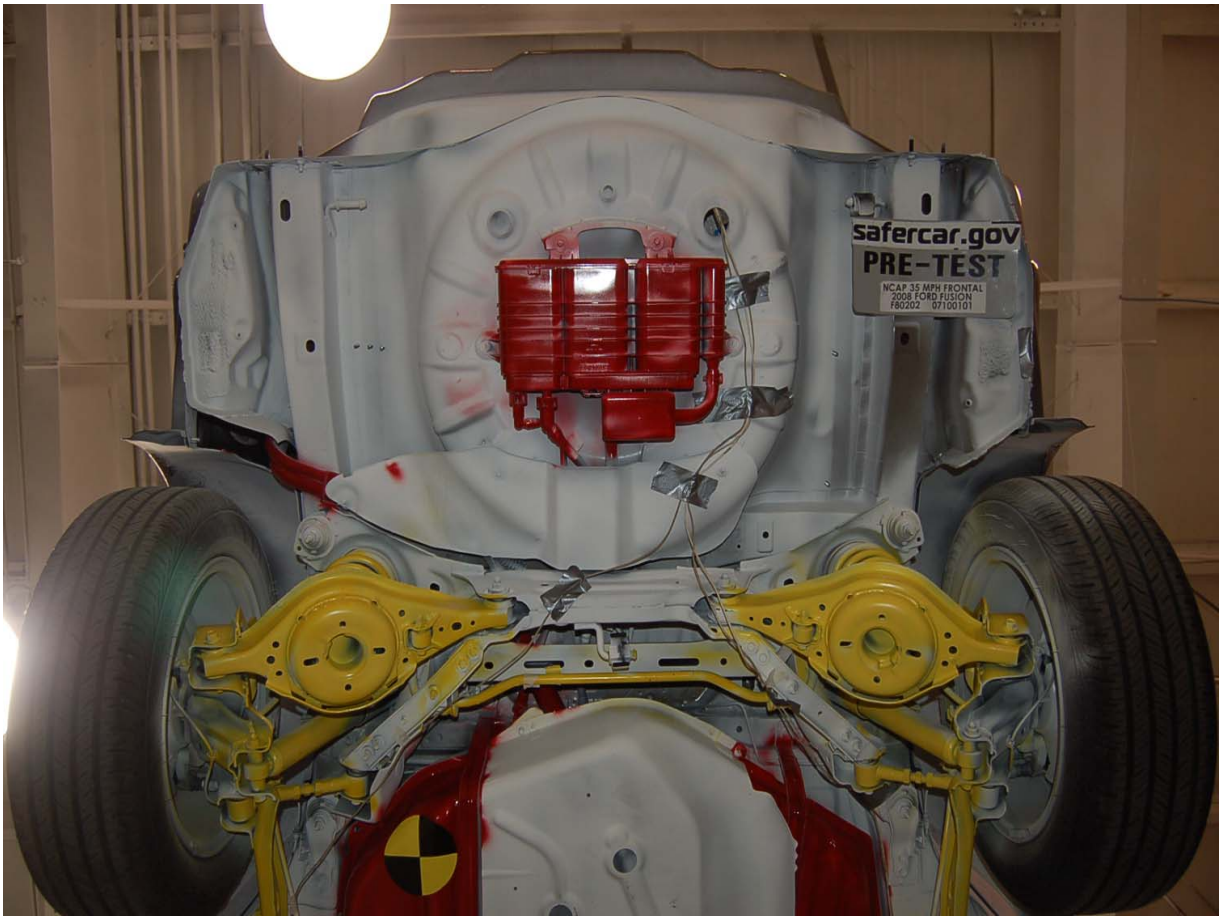
Pre-Test Mid Front Underbody View



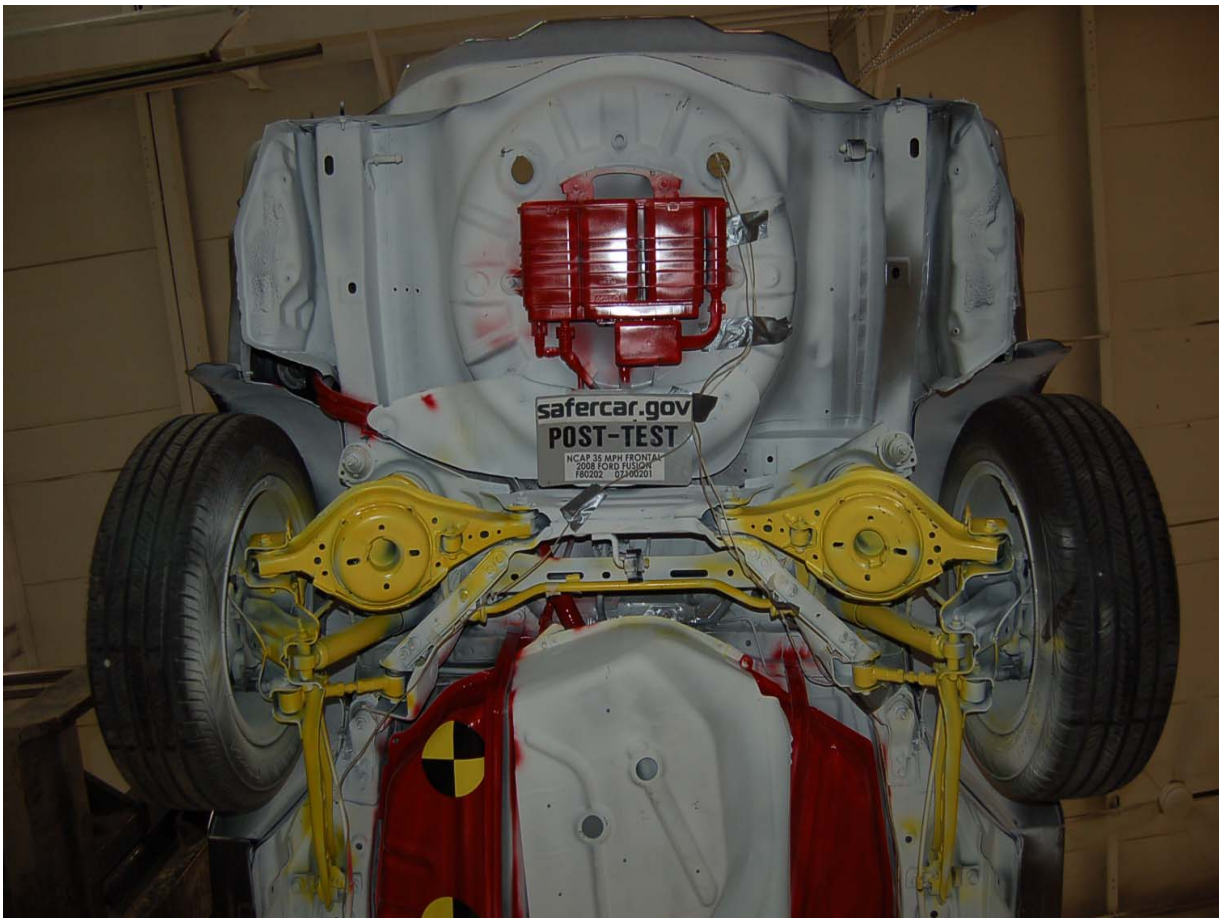
Pre-Test Mid Rear Underbody View



Post-Test Mid Underbody View



Pre-Test Rear Underbody View



Post-Test Rear Underbody View

Pre-Test Driver Dummy Front View (Head Position)

Post-Test Driver Dummy Front View (Head Position)

Pre-Test Driver Dummy (Through Window)

Post-Test Driver Dummy (Through Window)

Pre-Test Driver Dummy (Door Open)

Post-Test Driver Dummy (Door Open)

Pre-Test Driver Dummy Feet

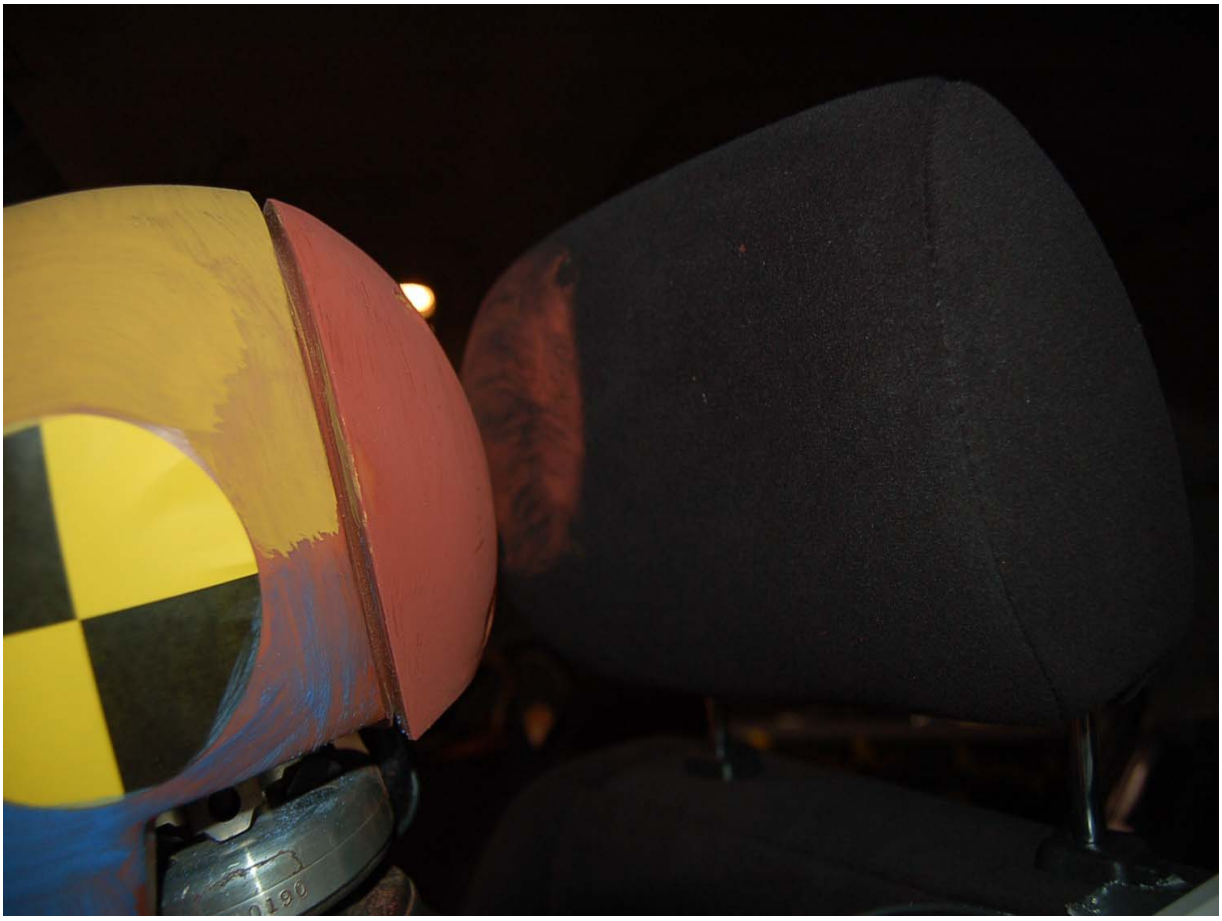
Post-Test Driver Dummy Feet

Pre-Test Driver Side Knee Bolster

Post-Test Driver Side Knee Bolster

Pre-Test Driver Side Floor Pan


Post-Test Driver Side Floor Pan



Post-Test Driver Dummy Head Contact (headrest)

Post-Test Driver Dummy Knee Contact

Post-Test Driver Dummy Airbag Contact

Pre-Test Passenger Dummy Front View (Head Position)

Post-Test Passenger Dummy Front View (Head Position)

Pre-Test Passenger Dummy (Through Window)

Post-Test Passenger Dummy (Through Window)

Pre-Test Passenger Dummy (Door Open)

Post-Test Passenger Dummy (Door Open)

Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

Pre-Test Passenger Side Glove Box

Post-Test Passenger Side Glove Box

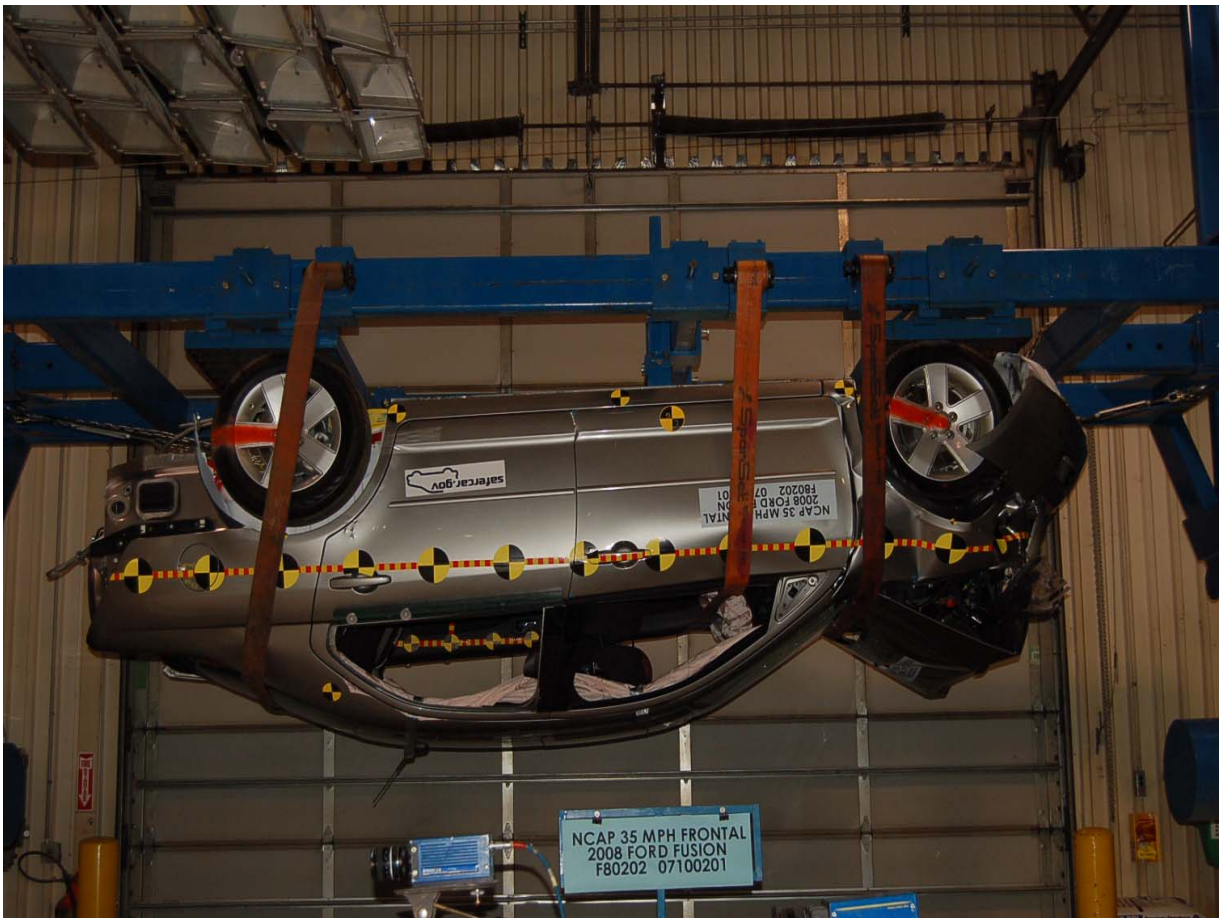
Pre-Test Passenger Side Floor Pan


Post-Test Passenger Side Floor Pan

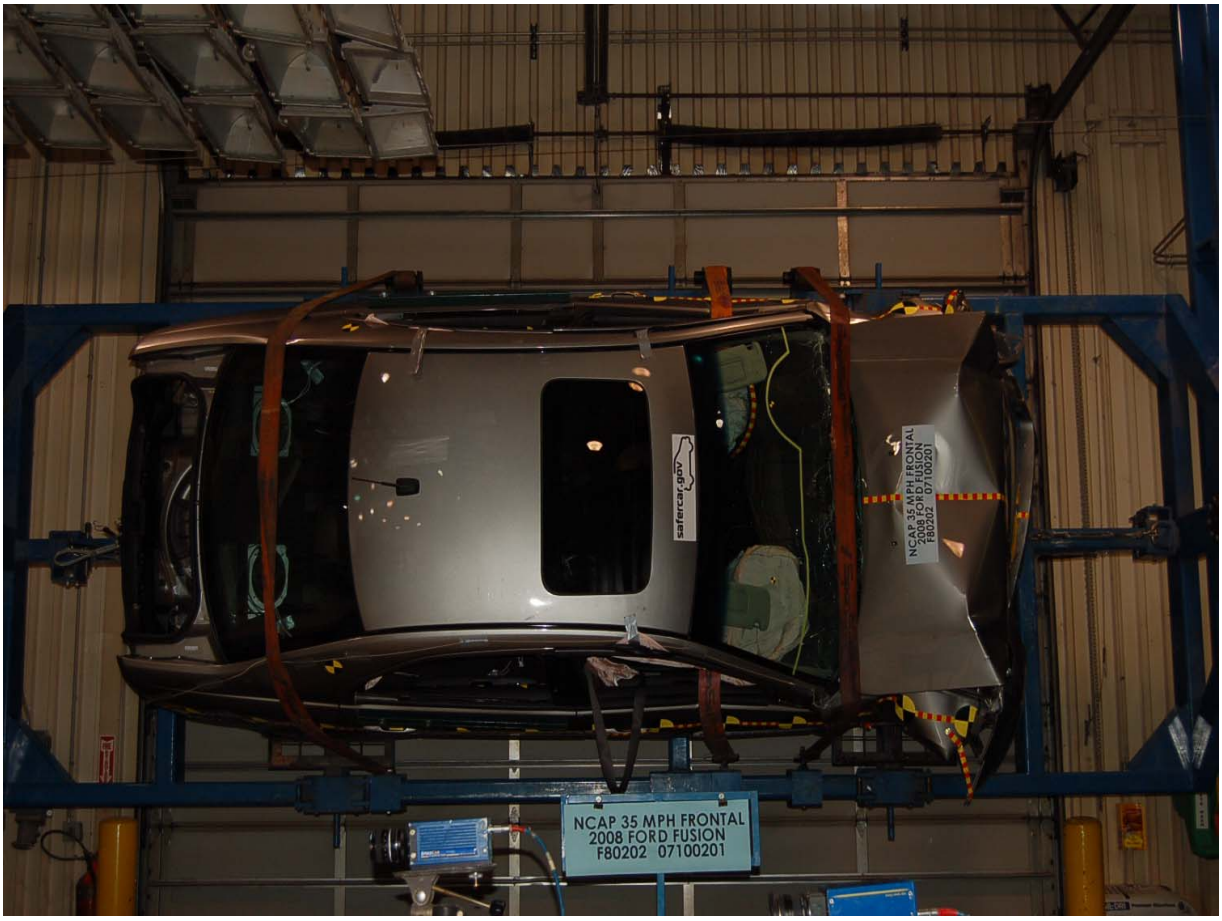
Post-Test Passenger Dummy Head Contact (headrest)

Post-Test Passenger Dummy Knee Contact

Post-Test Passenger Dummy Airbag Contact



Rollover 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

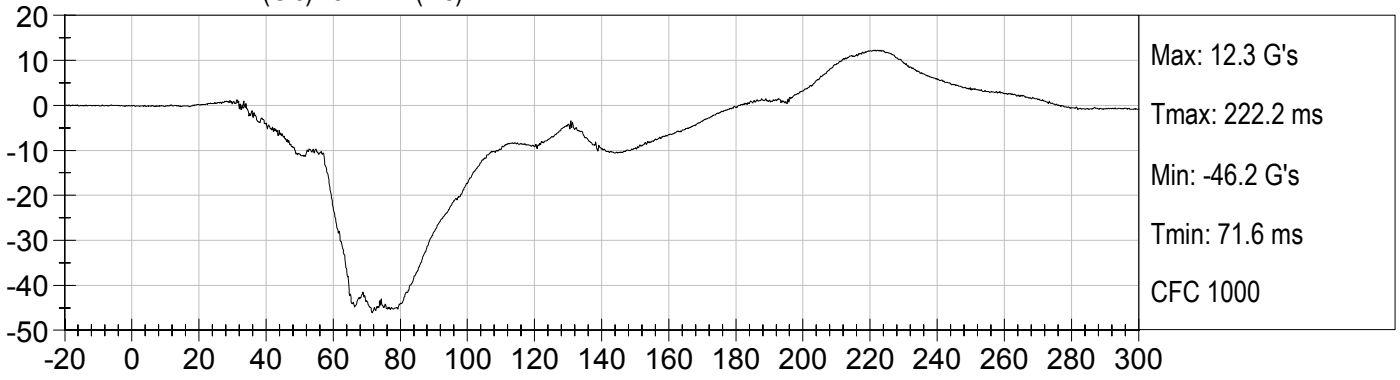
Barrier Force – Lower Center

Barrier Force – Lower Right

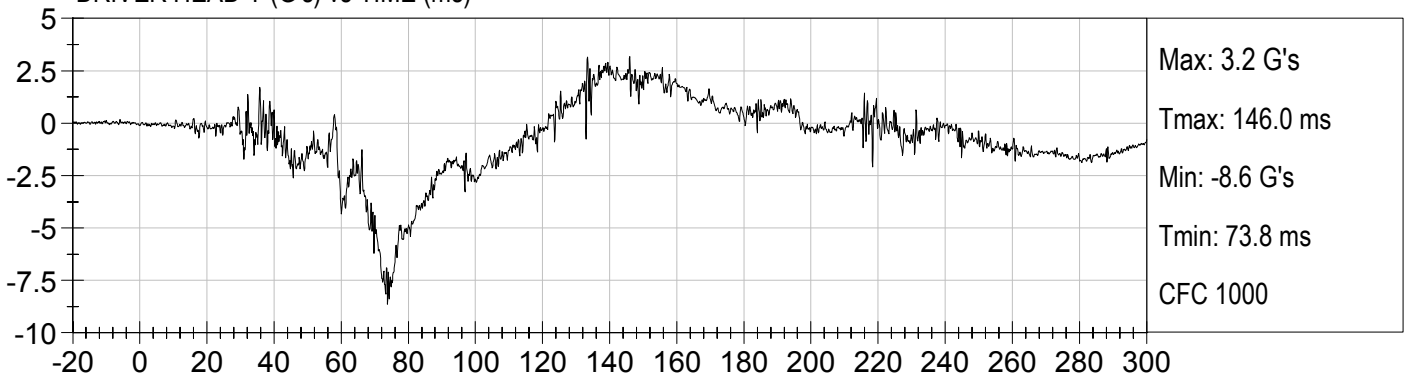
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

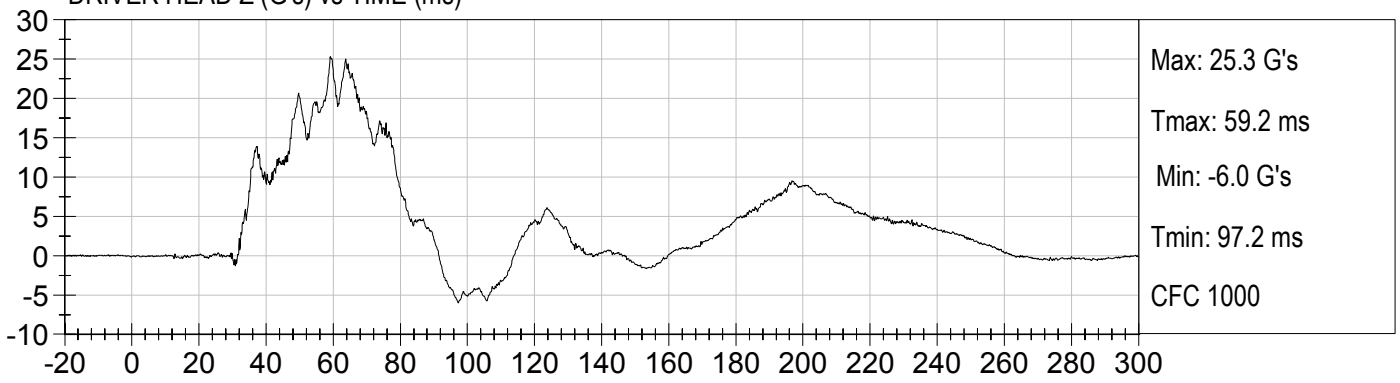
DRIVER HEAD X (G's) vs TIME (ms)



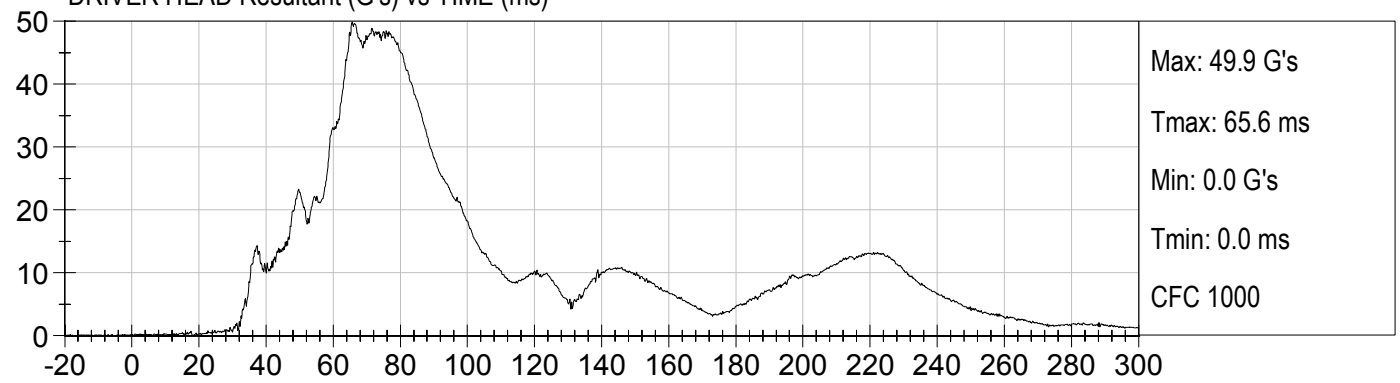
DRIVER HEAD Y (G's) vs TIME (ms)



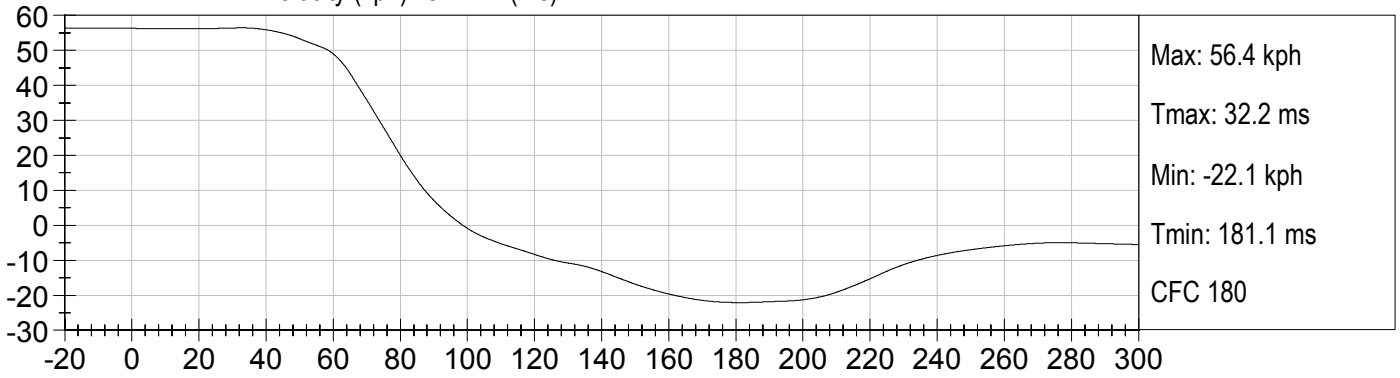
DRIVER HEAD Z (G's) vs TIME (ms)



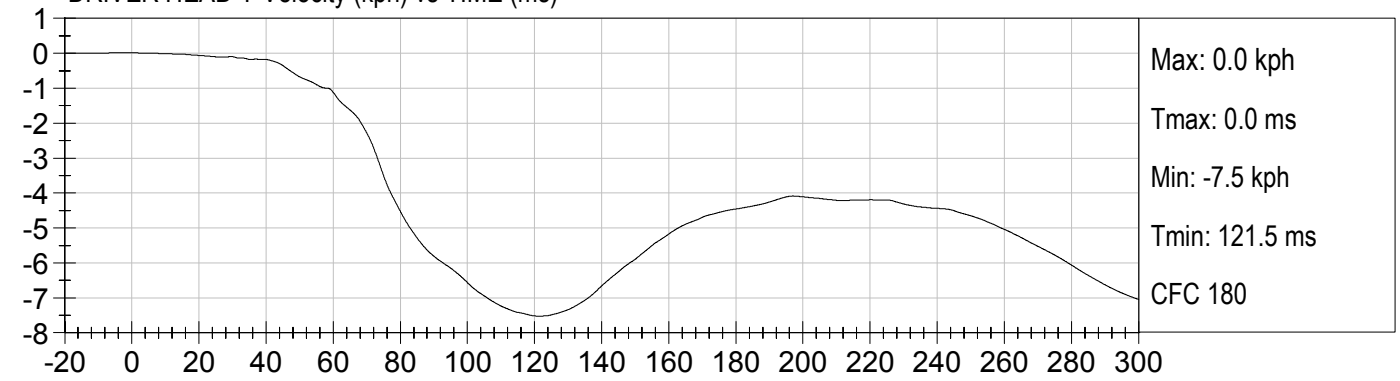
DRIVER HEAD Resultant (G's) vs TIME (ms)



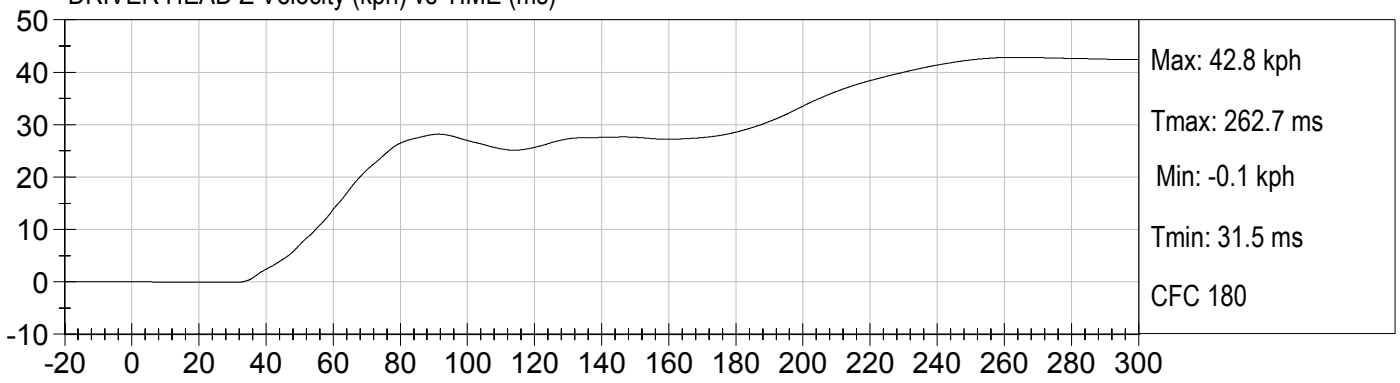
DRIVER HEAD X Velocity (kph) vs TIME (ms)



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



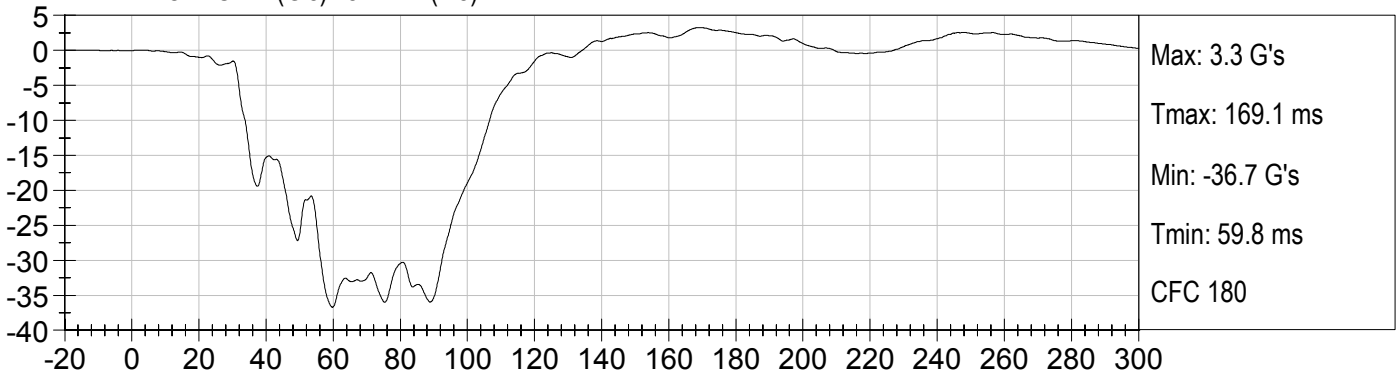
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



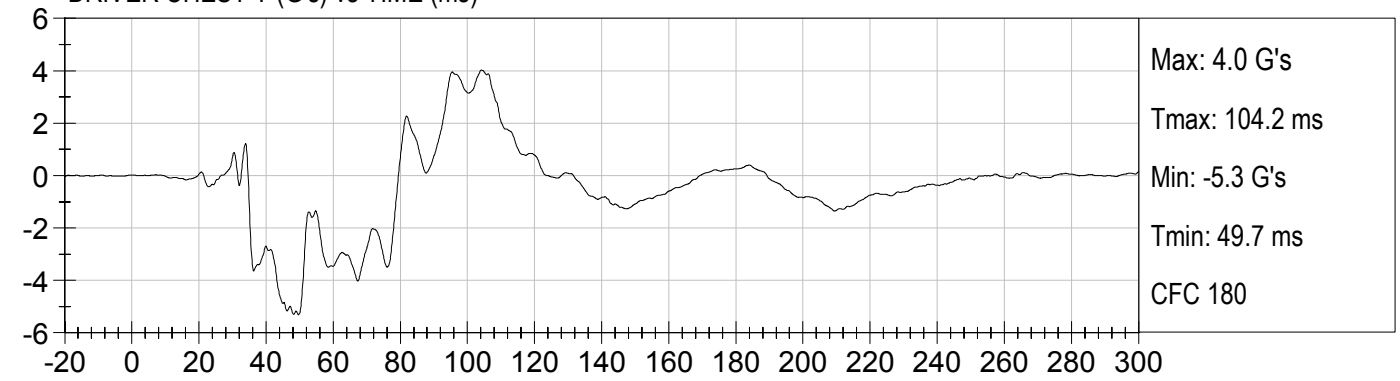
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

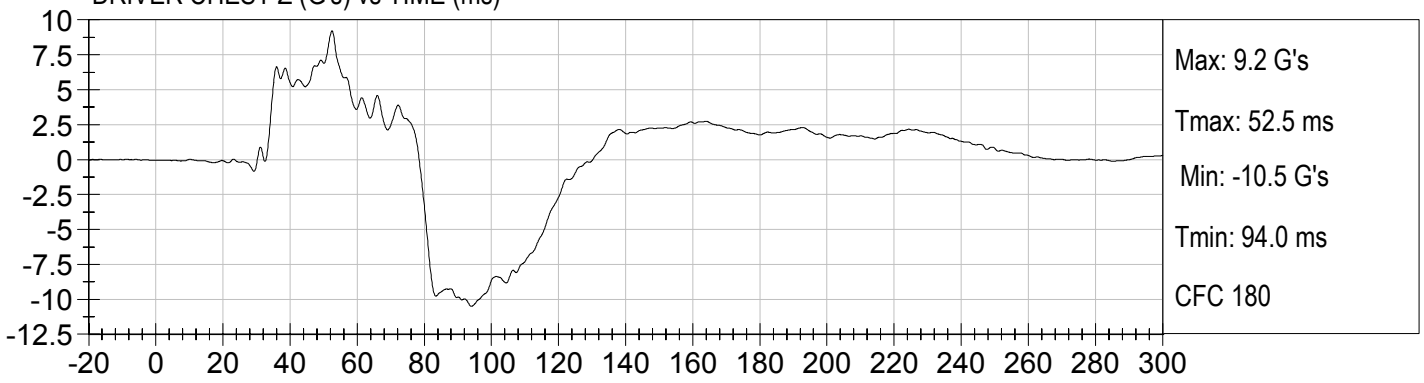
DRIVER CHEST X (G's) vs TIME (ms)



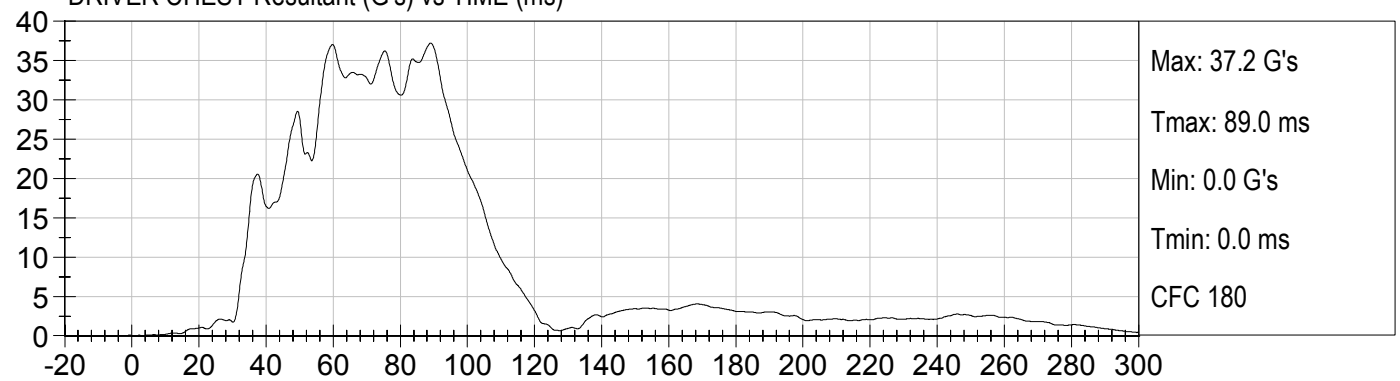
DRIVER CHEST Y (G's) vs TIME (ms)



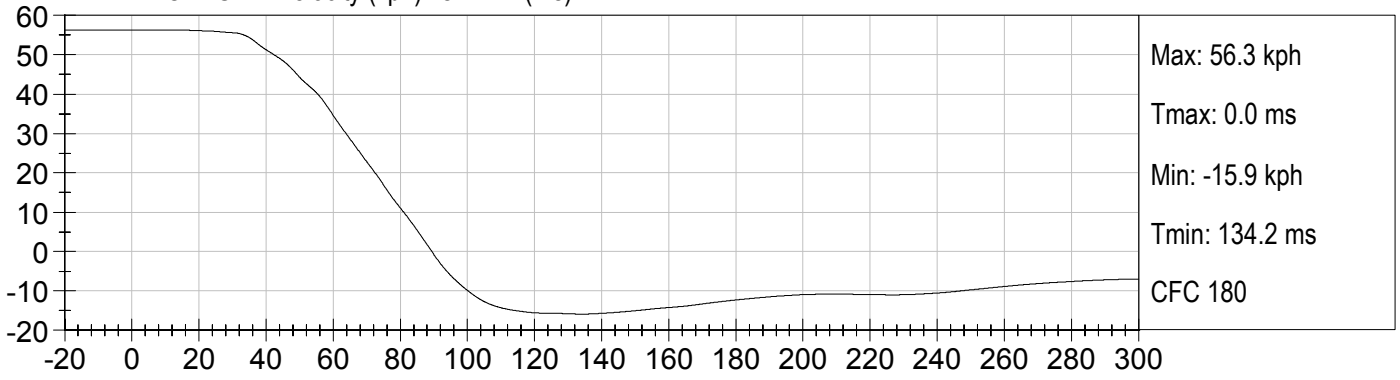
DRIVER CHEST Z (G's) vs TIME (ms)



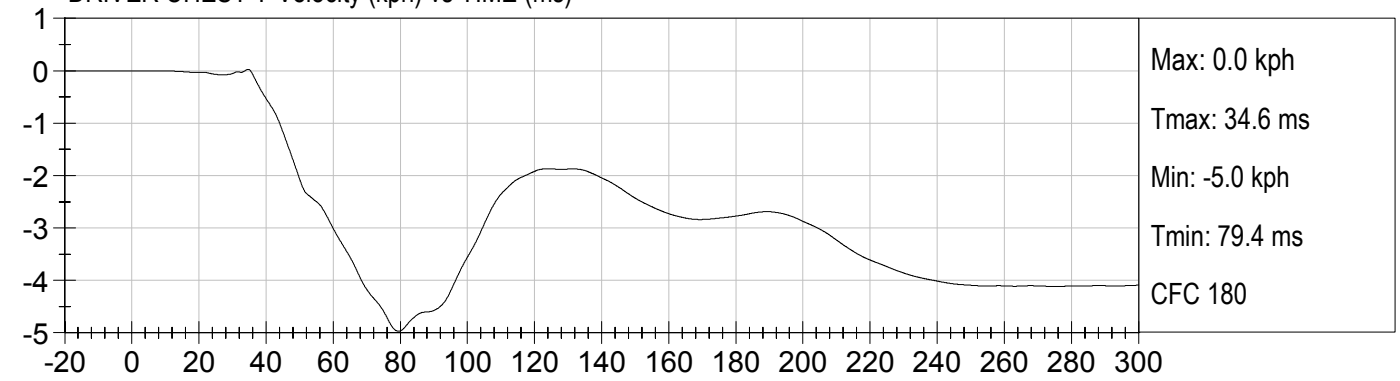
DRIVER CHEST Resultant (G's) vs TIME (ms)



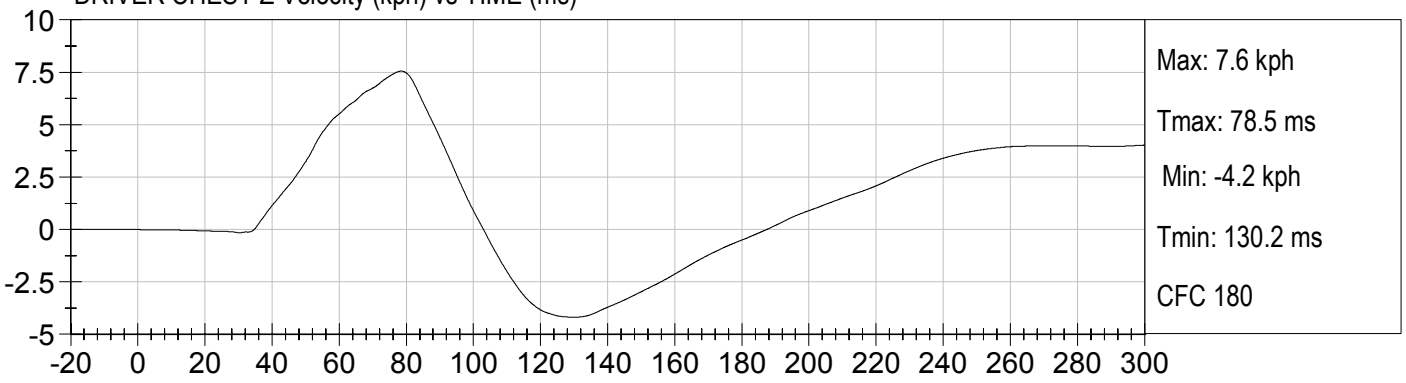
DRIVER CHEST X Velocity (kph) vs TIME (ms)



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

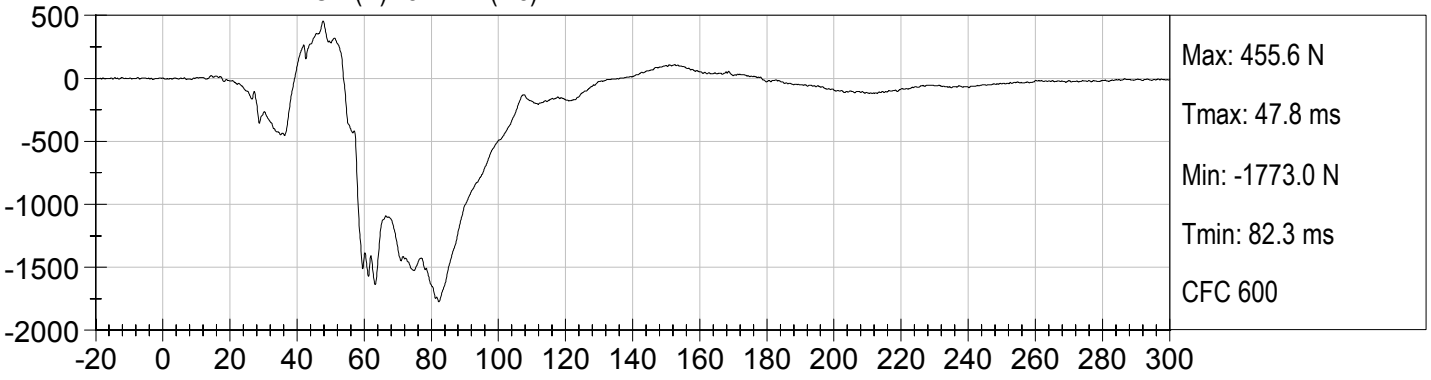


DRIVER CHEST Z Velocity (kph) vs TIME (ms)

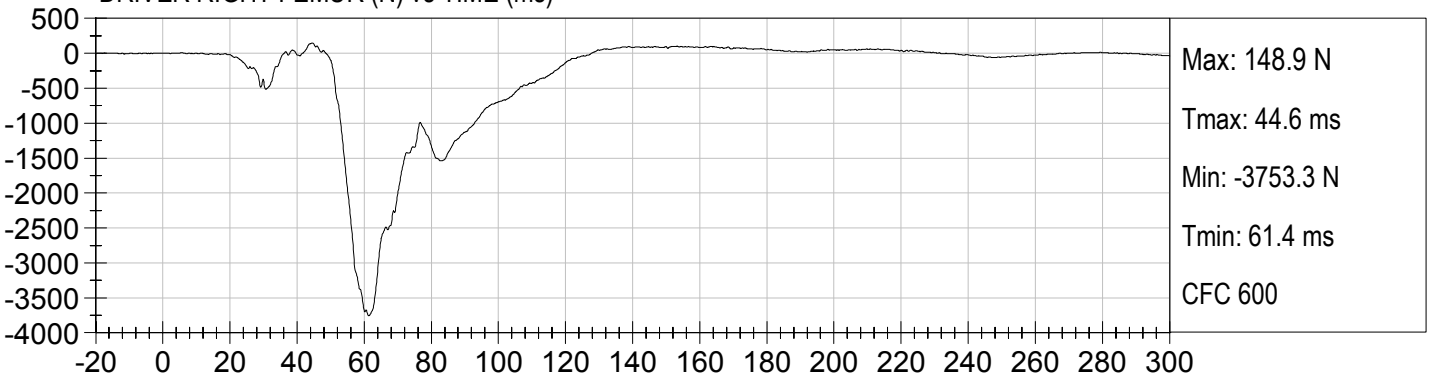


NCAP FRONTAL
2008 FORD FUSION F80202
Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

DRIVER LEFT FEMUR (N) vs TIME (ms)



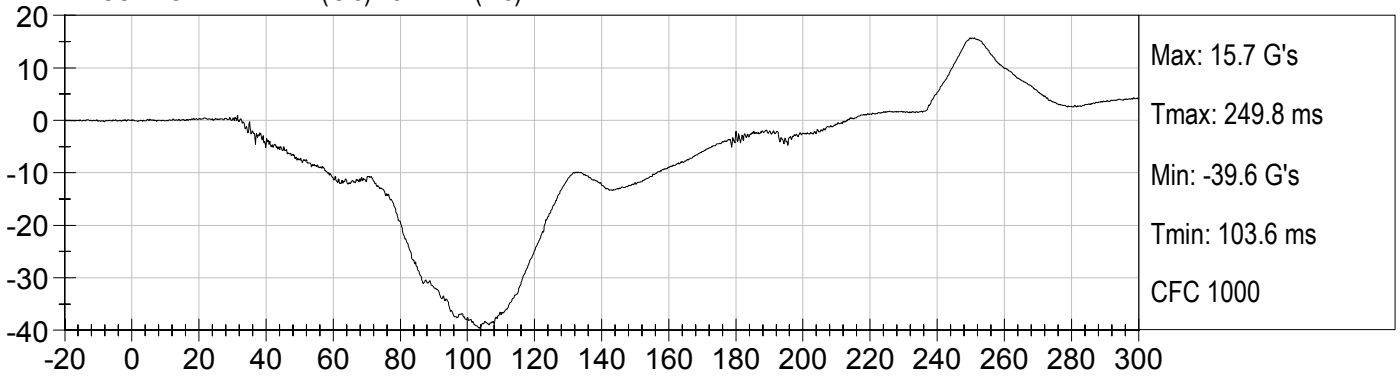
DRIVER RIGHT FEMUR (N) vs TIME (ms)



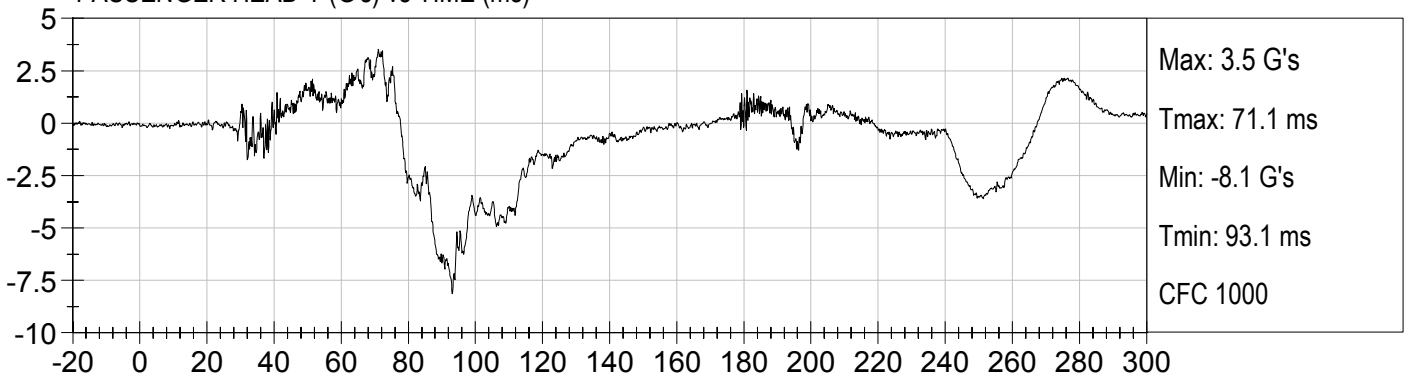
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

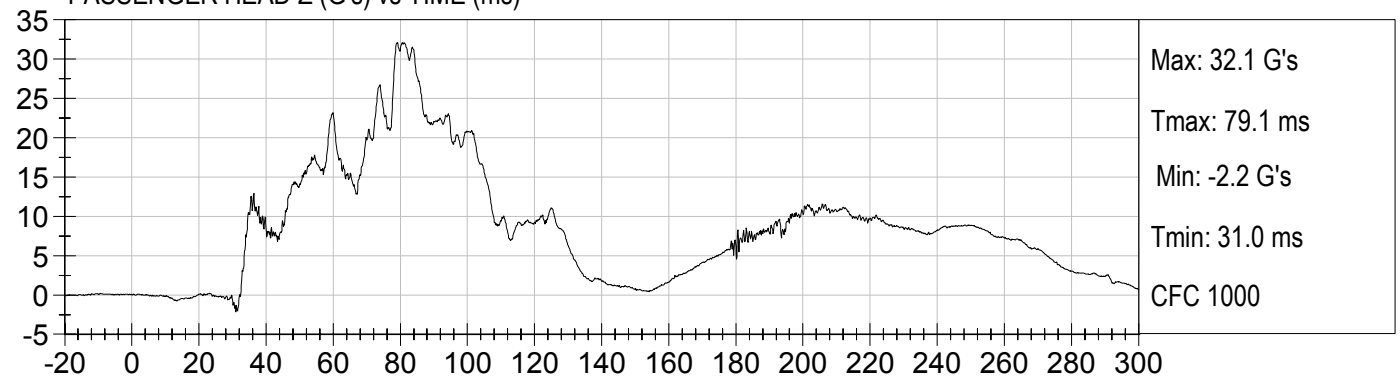
PASSENGER HEAD X (G's) vs TIME (ms)



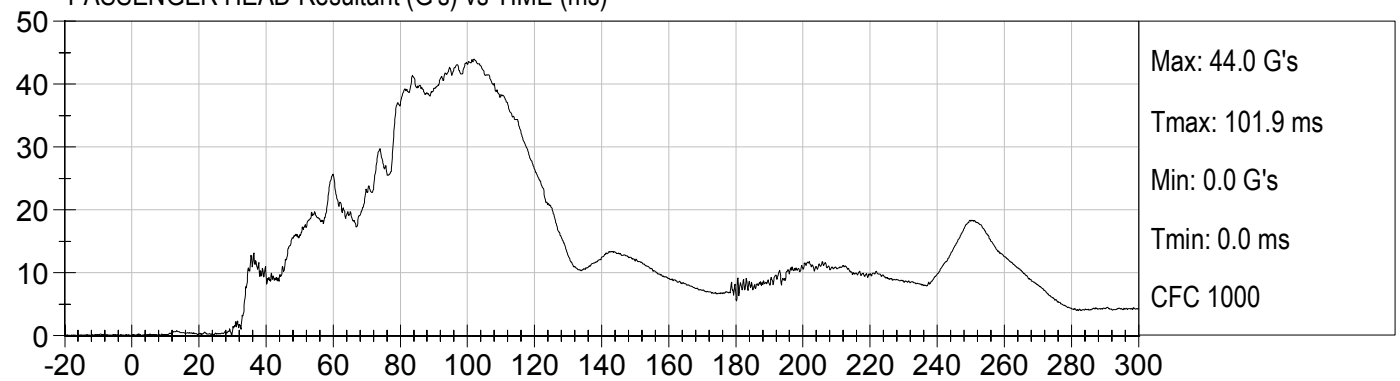
PASSENGER HEAD Y (G's) vs TIME (ms)



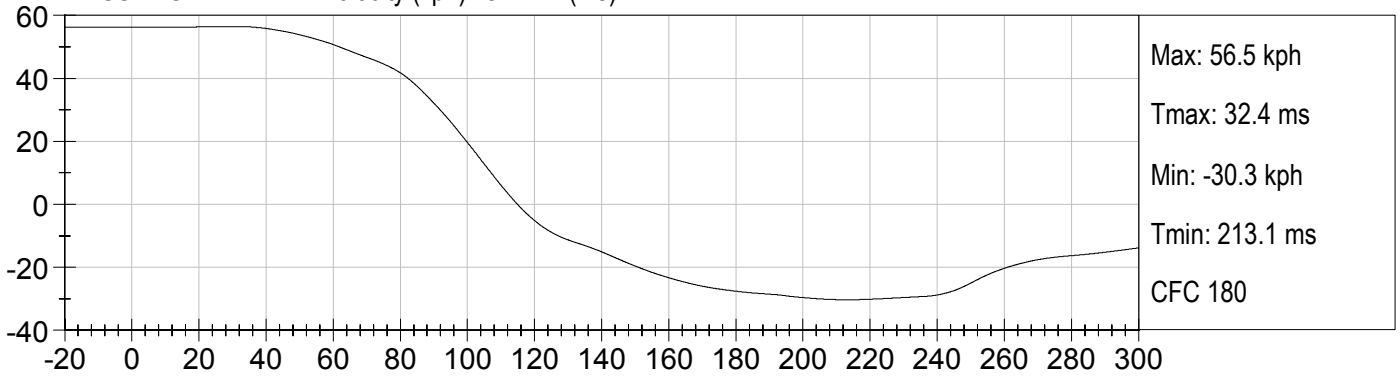
PASSENGER HEAD Z (G's) vs TIME (ms)



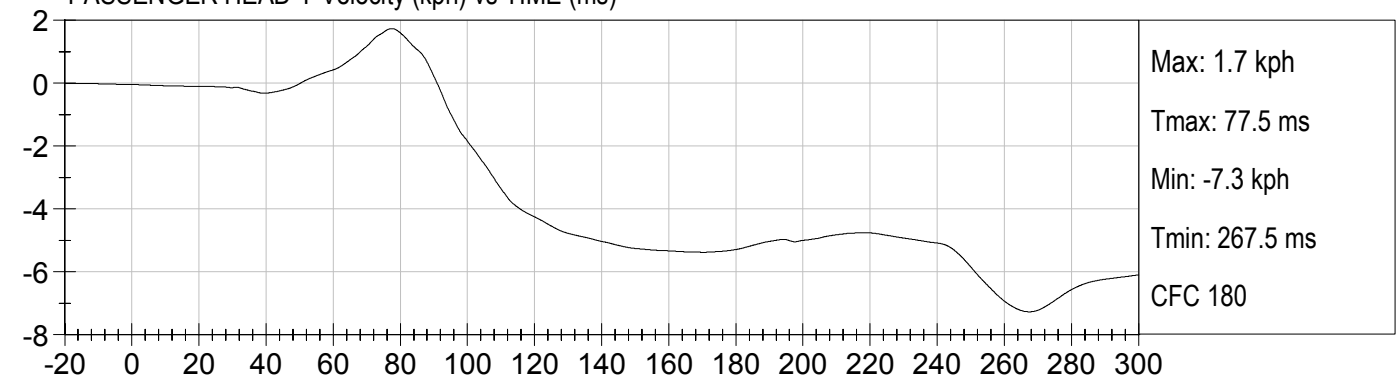
PASSENGER HEAD Resultant (G's) vs TIME (ms)



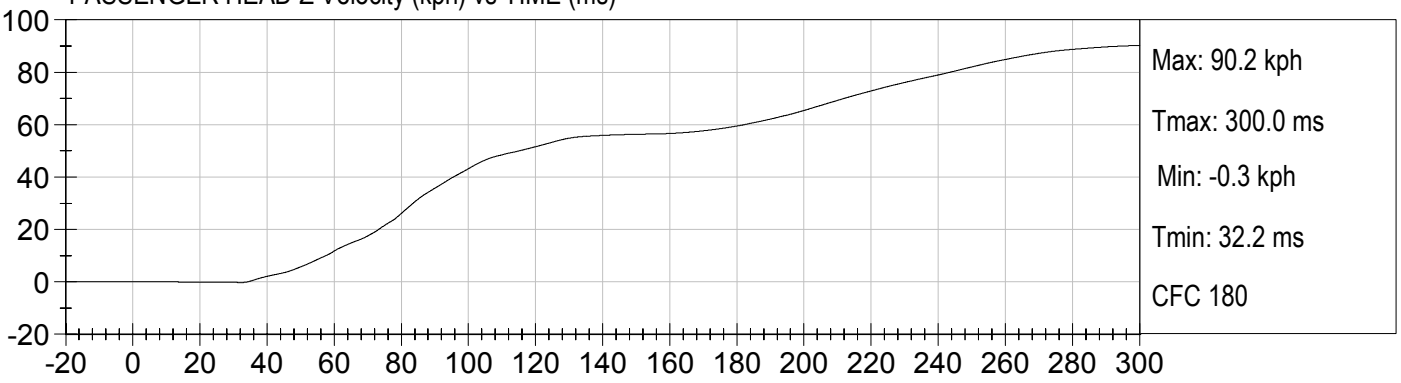
PASSENGER HEAD X Velocity (kph) vs TIME (ms)



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

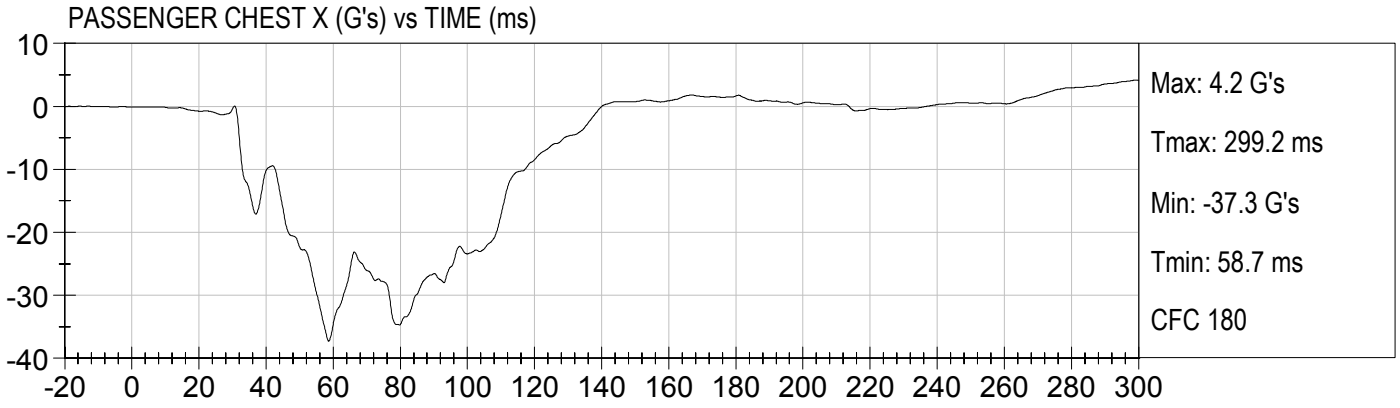


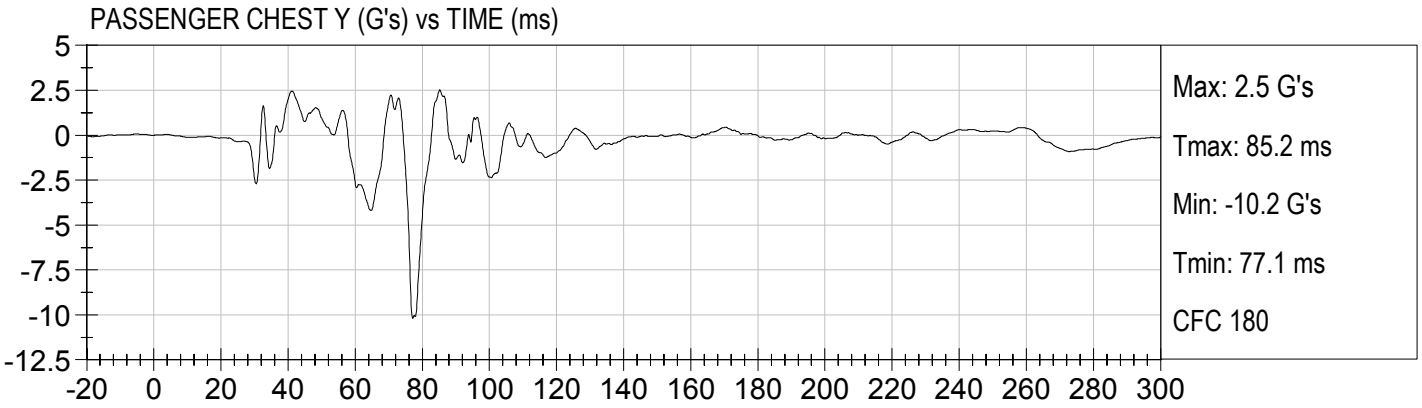
PASSENGER HEAD Z Velocity (kph) vs TIME (ms)

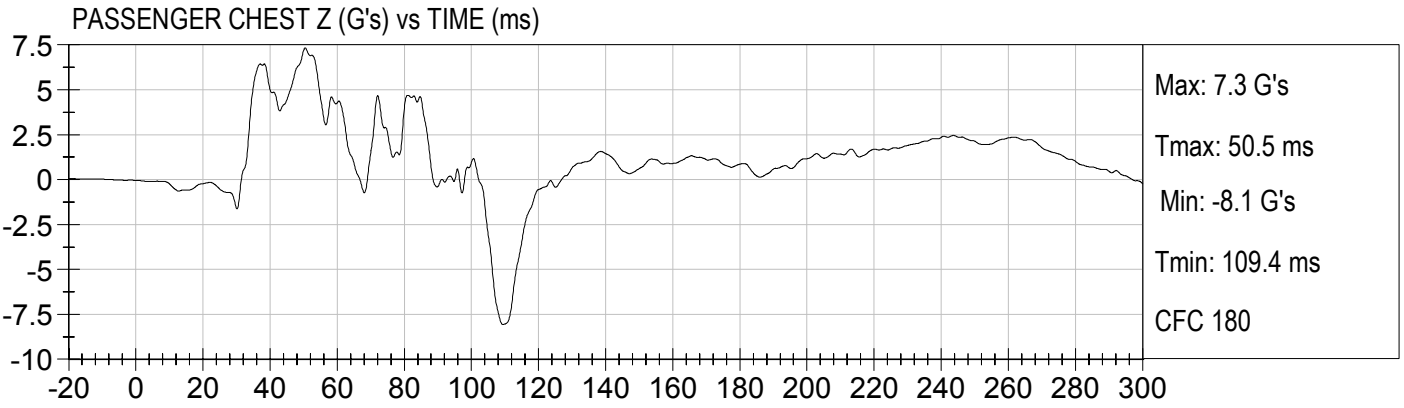


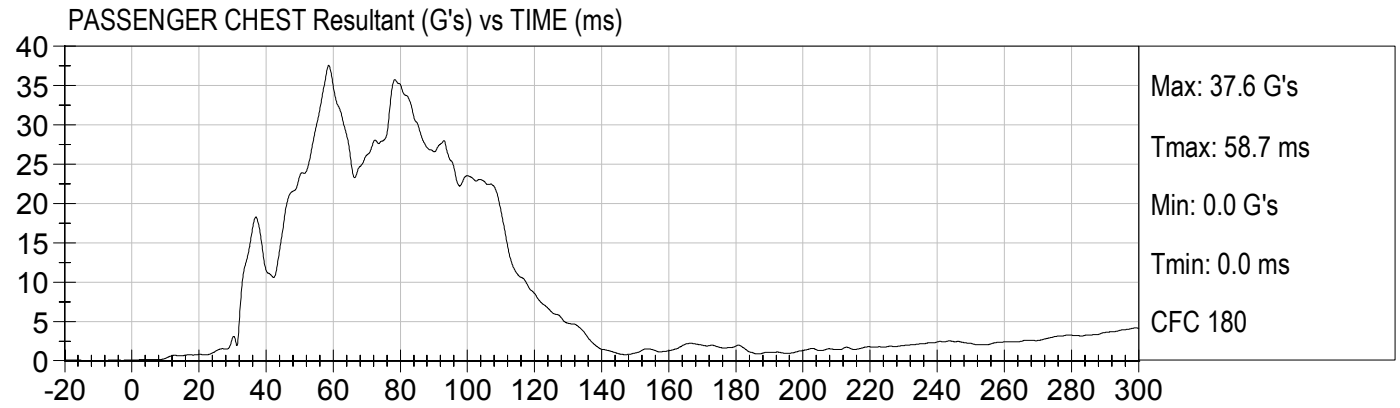
NCAP FRONTAL
2008 FORD FUSION F80202

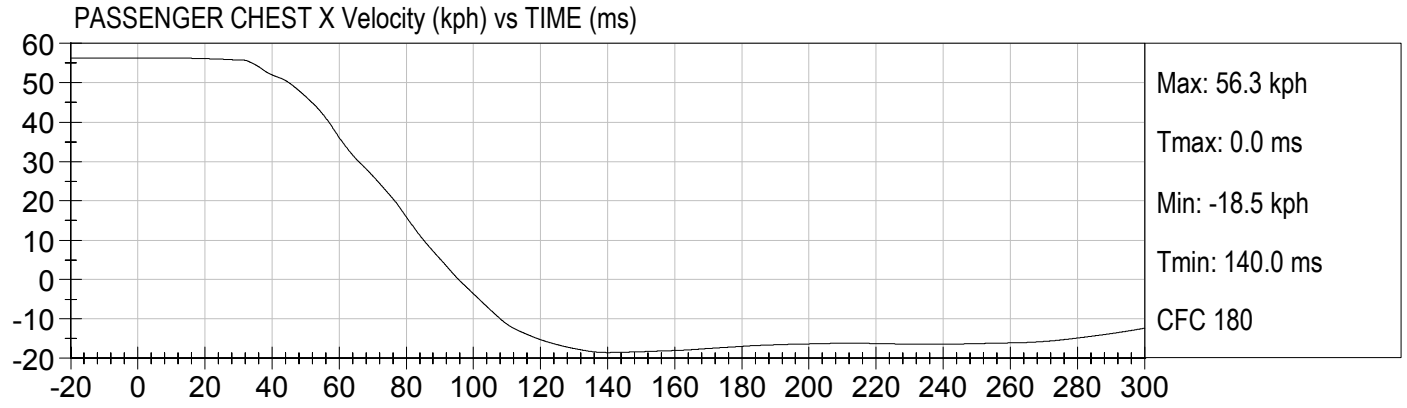
Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

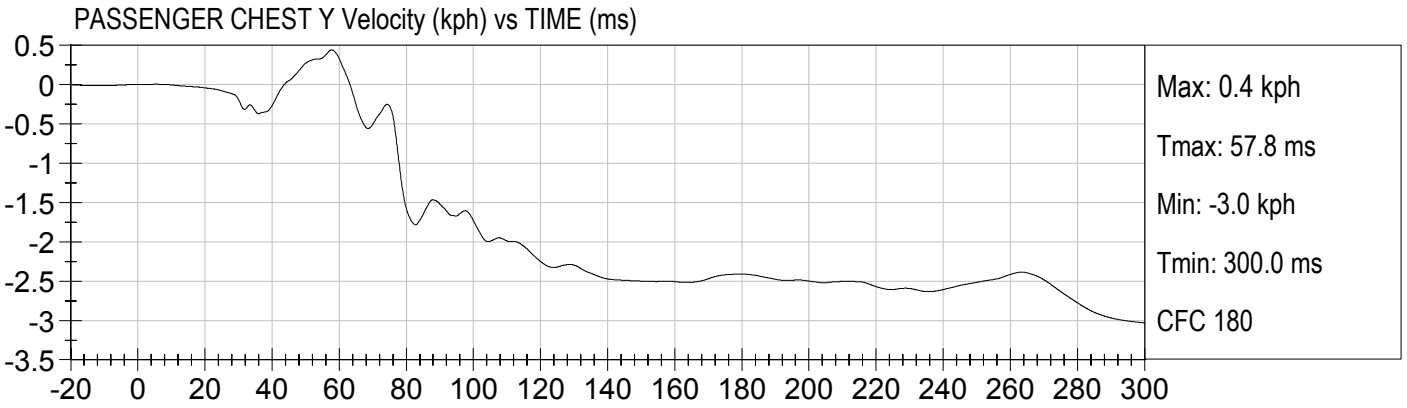


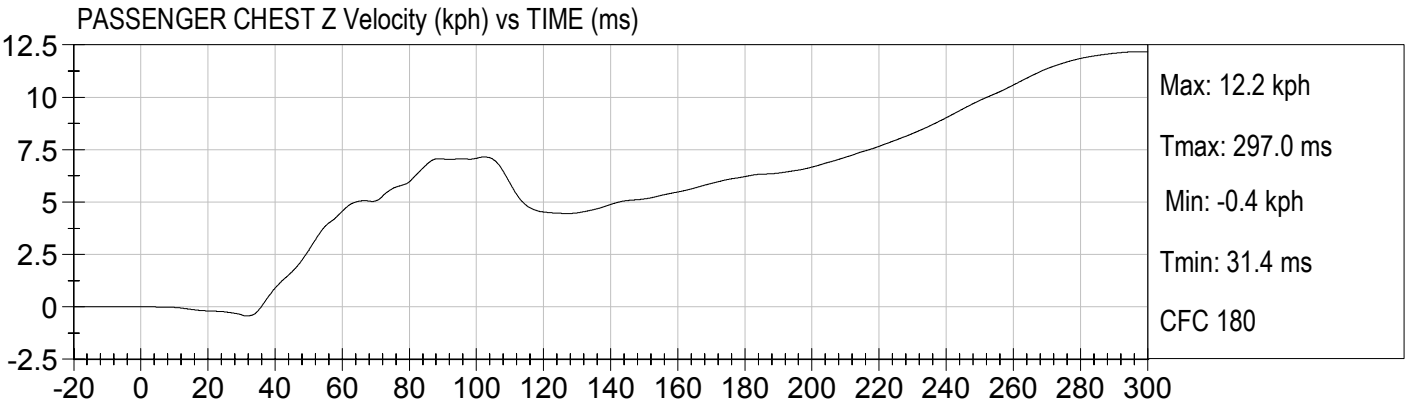




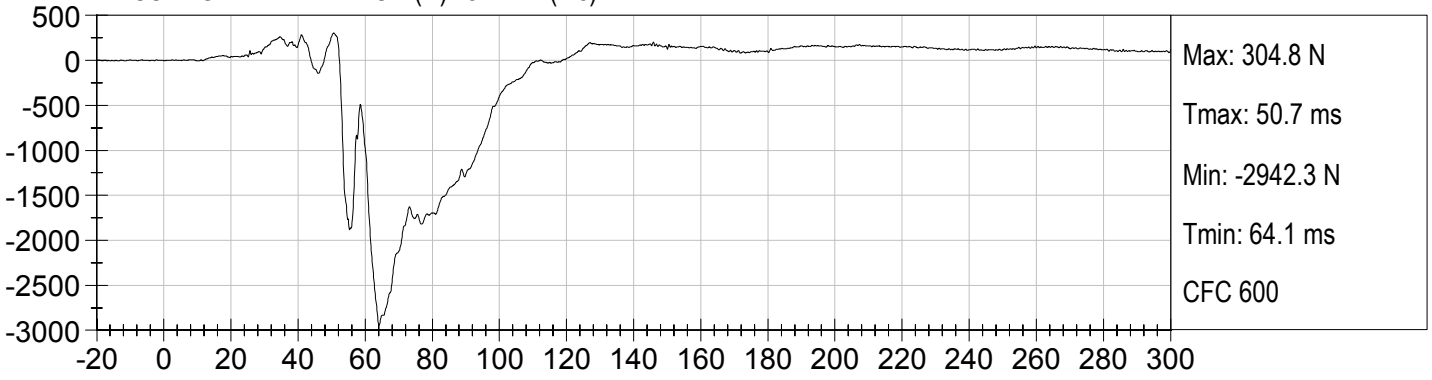



PASSENGER CHEST X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.3 kph
Tmax: 0.0 ms
Min: -18.5 kph
Tmin: 140.0 ms
CFC 180

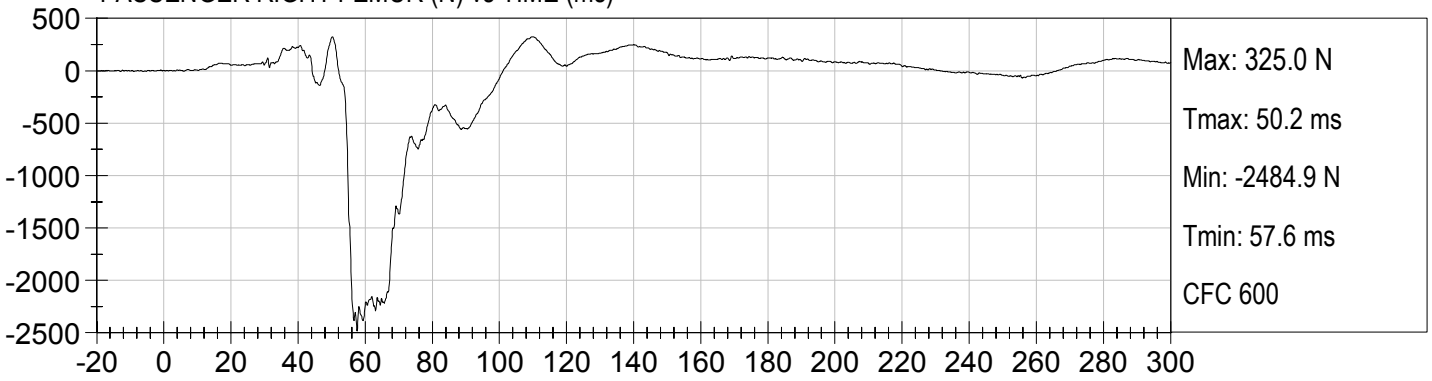

PASSENGER CHEST Y Velocity (kph) vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.4 kph
Tmax: 57.8 ms
Min: -3.0 kph
Tmin: 300.0 ms
CFC 180


PASSENGER CHEST Z Velocity (kph) vs TIME (ms)
12.5
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 12.2 kph
Tmax: 297.0 ms
Min: -0.4 kph
Tmin: 31.4 ms
CFC 180

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: 065 **Test ID:** D072841

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	225 - 275	227	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

9/11/07

Test Date

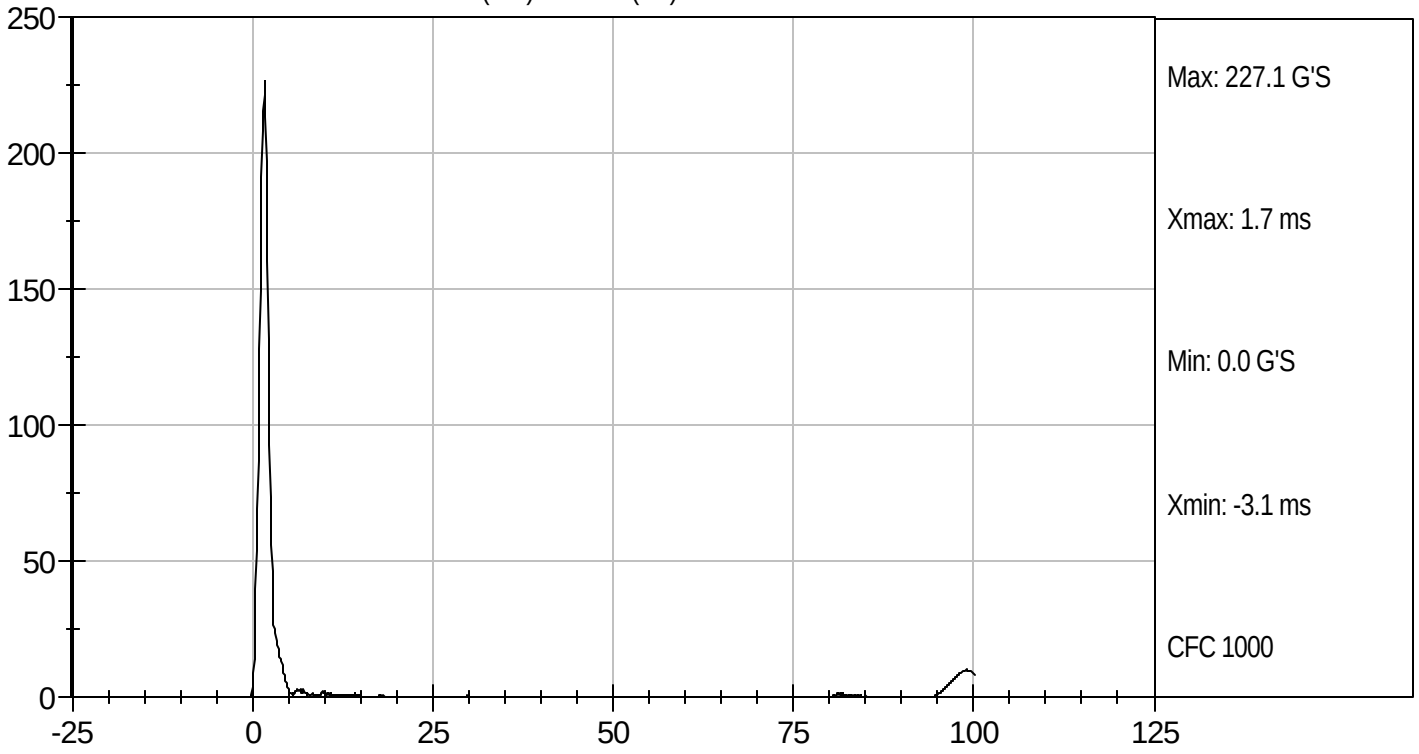
David Winkelbauer

Approved By

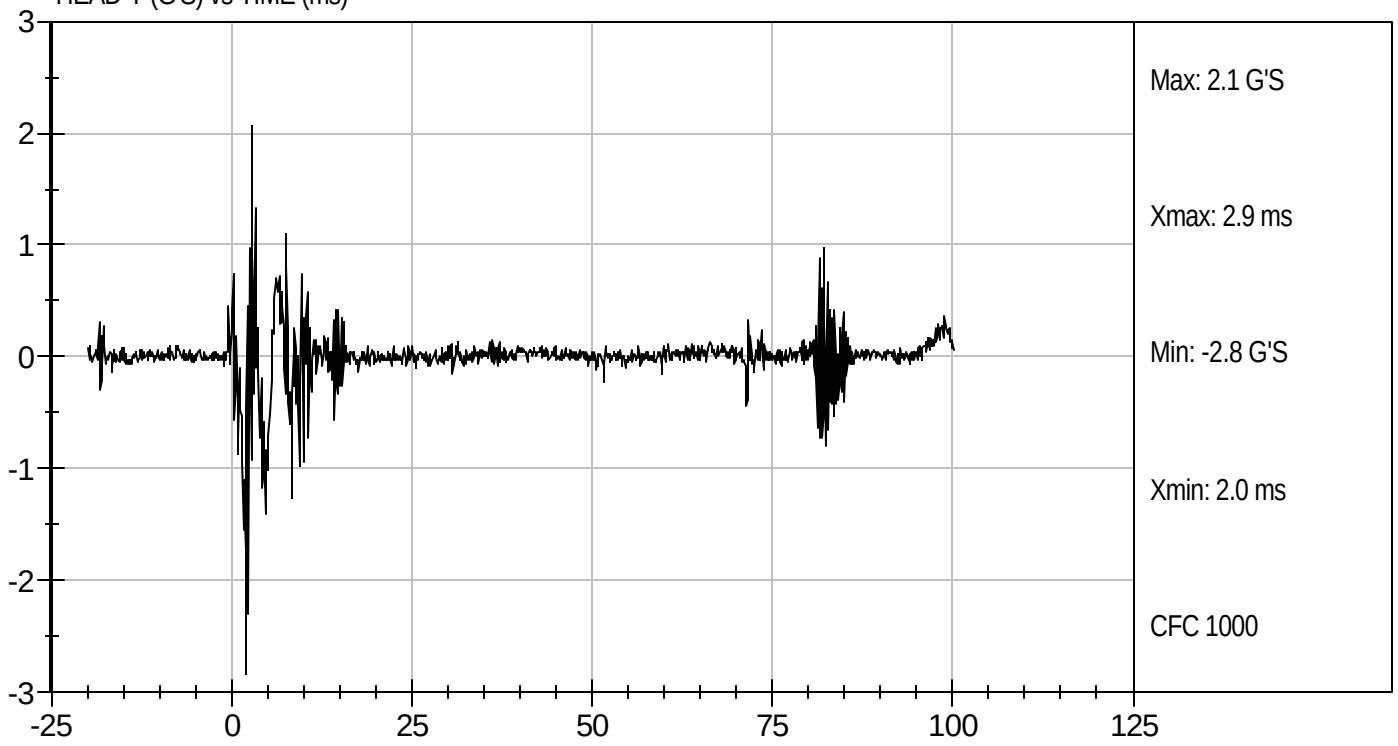
Test Desc: Head Drop
Component ID: D072841

Test Date: 9/11/07
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:** D072842

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	36	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.38	Pass
	20 msec	G's	17.60 to 22.60	18.49	Pass
	30 msec	G's	12.50 to 18.50	14.46	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.42	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	35.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	68.2	Pass
	Time	msec	57.0 to 64.0	63.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	113.1	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	92.9	Pass
	Time	msec	47.0 to 58.0	47.8	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	101.3	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

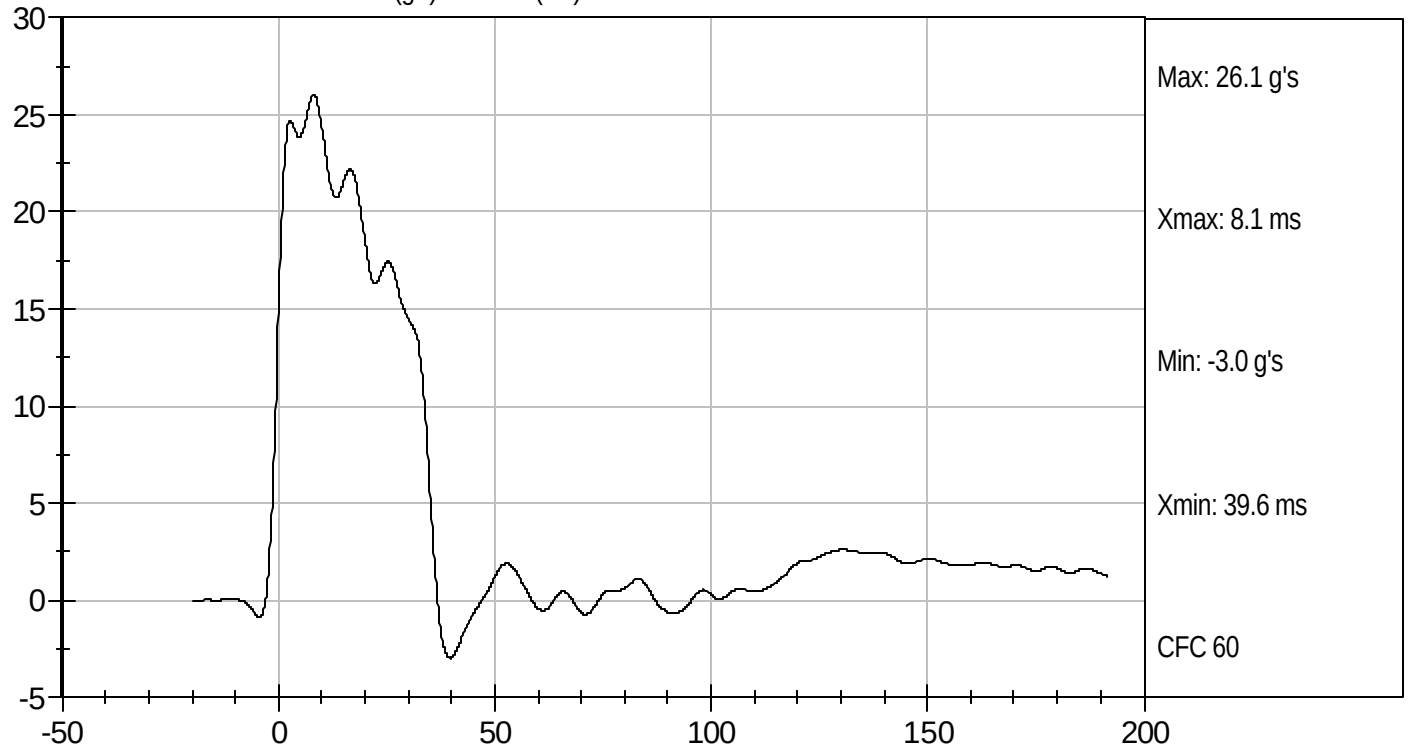
9/11/07
Test Date

David Winkelbauer
Approved By

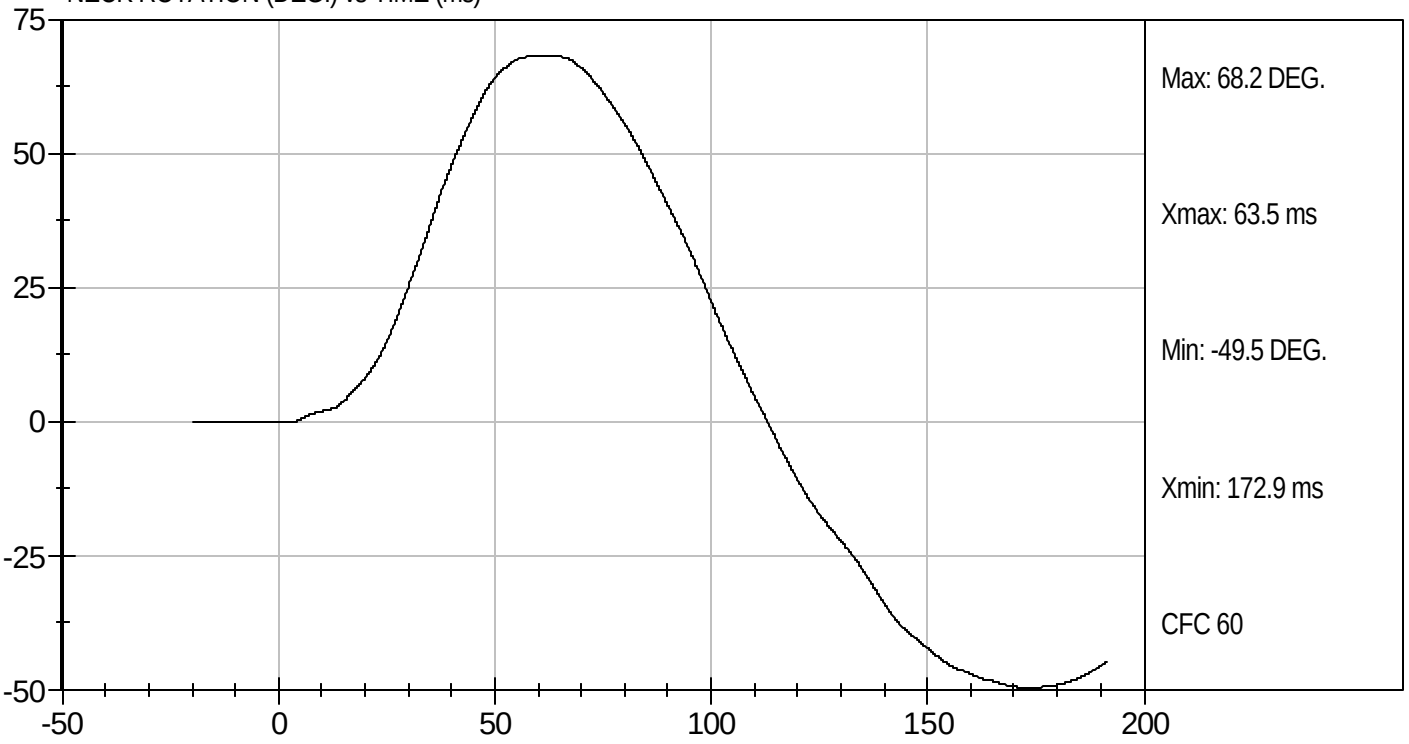
Test Desc: Neck Flexion
Component ID: D072842

Test Date: 9/11/07
Velocity: 23.15 ft/s, 7.06 m/s

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

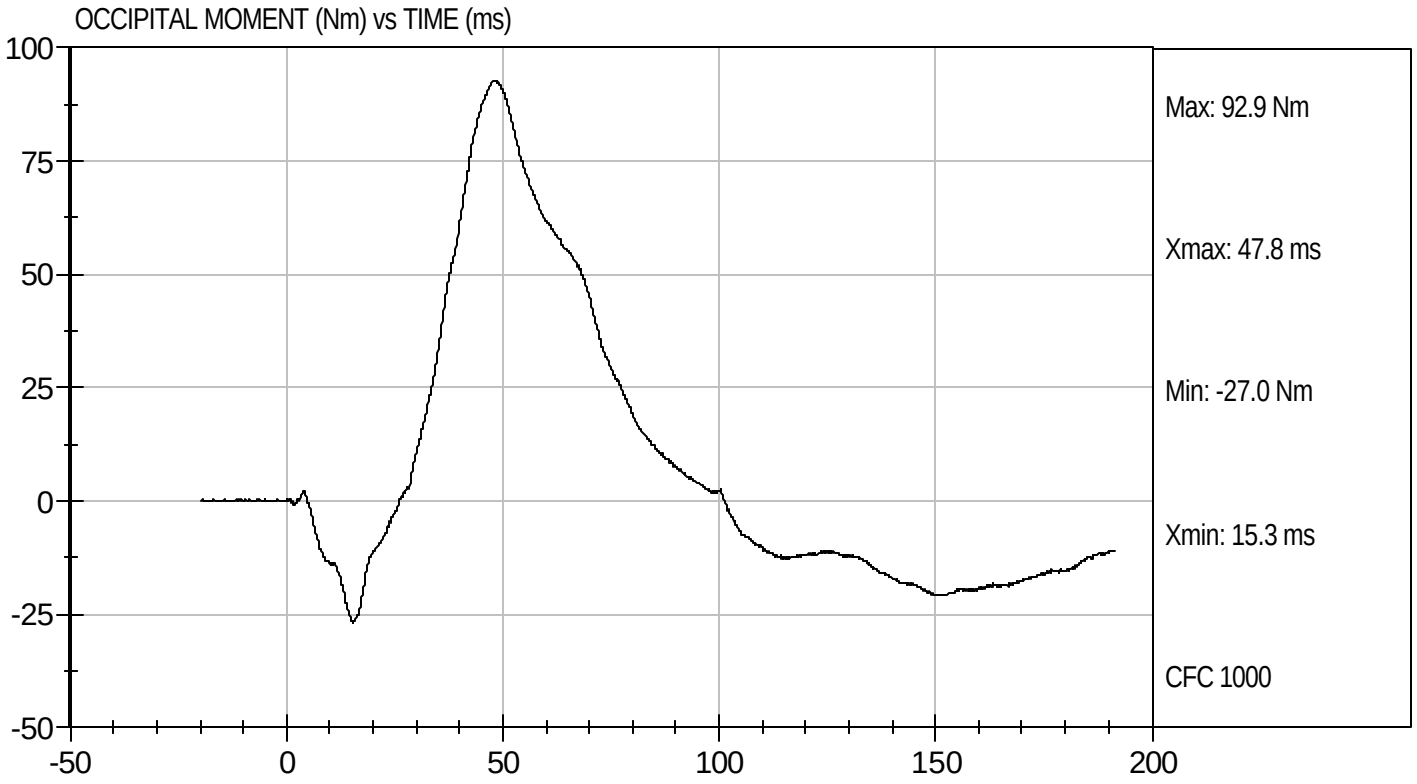


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D072842

Test Date: 9/11/07
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D072843

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	36	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.04	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	18.79	Pass
	20 msec	G's	14.00 to 19.00	16.07	Pass
	30 msec	G's	11.00 to 16.00	13.16	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.13	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	38.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.5	Pass
	Time	msec	72.0 to 82.0	73.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	152.3	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-59.9	Pass
	Time	msec	65.0 to 79.0	69.4	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	139.5	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

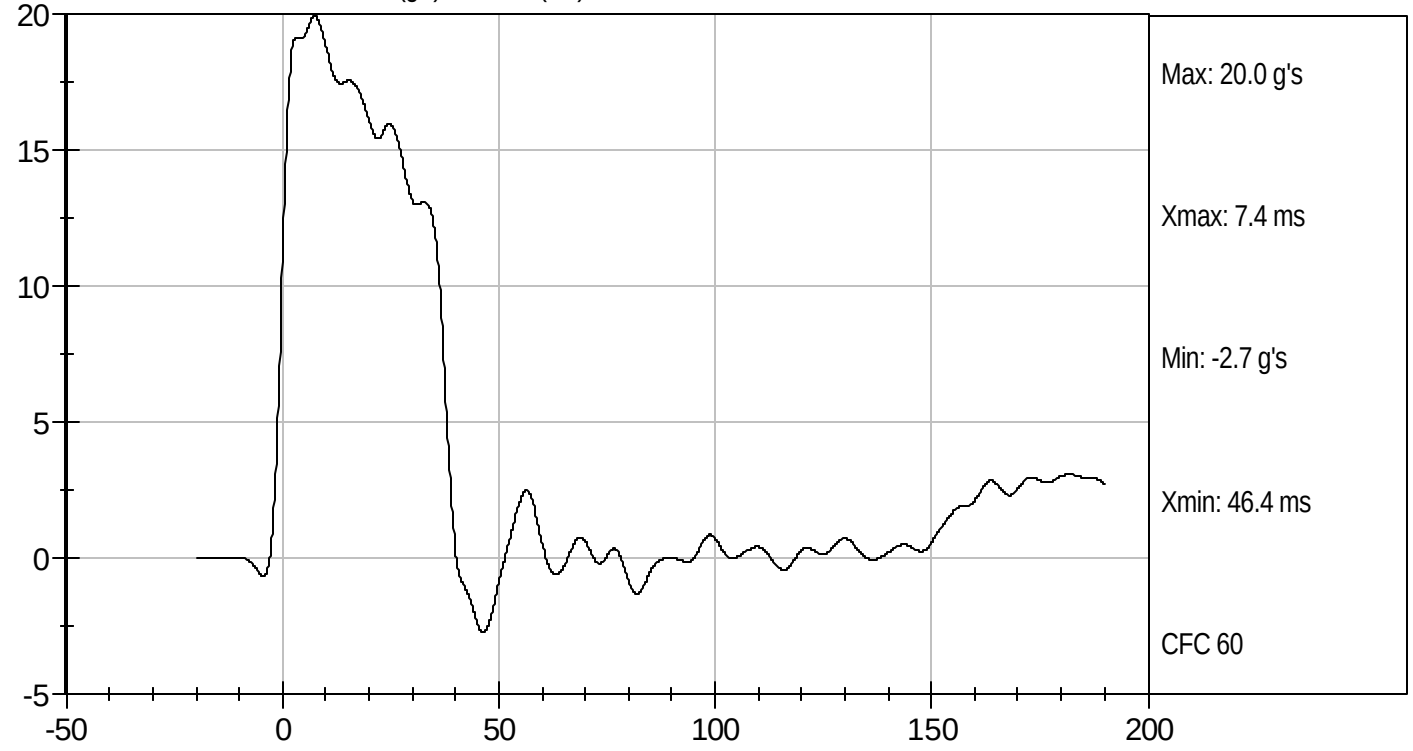
9/11/07
Test Date

David Winkelbauer
Approved By

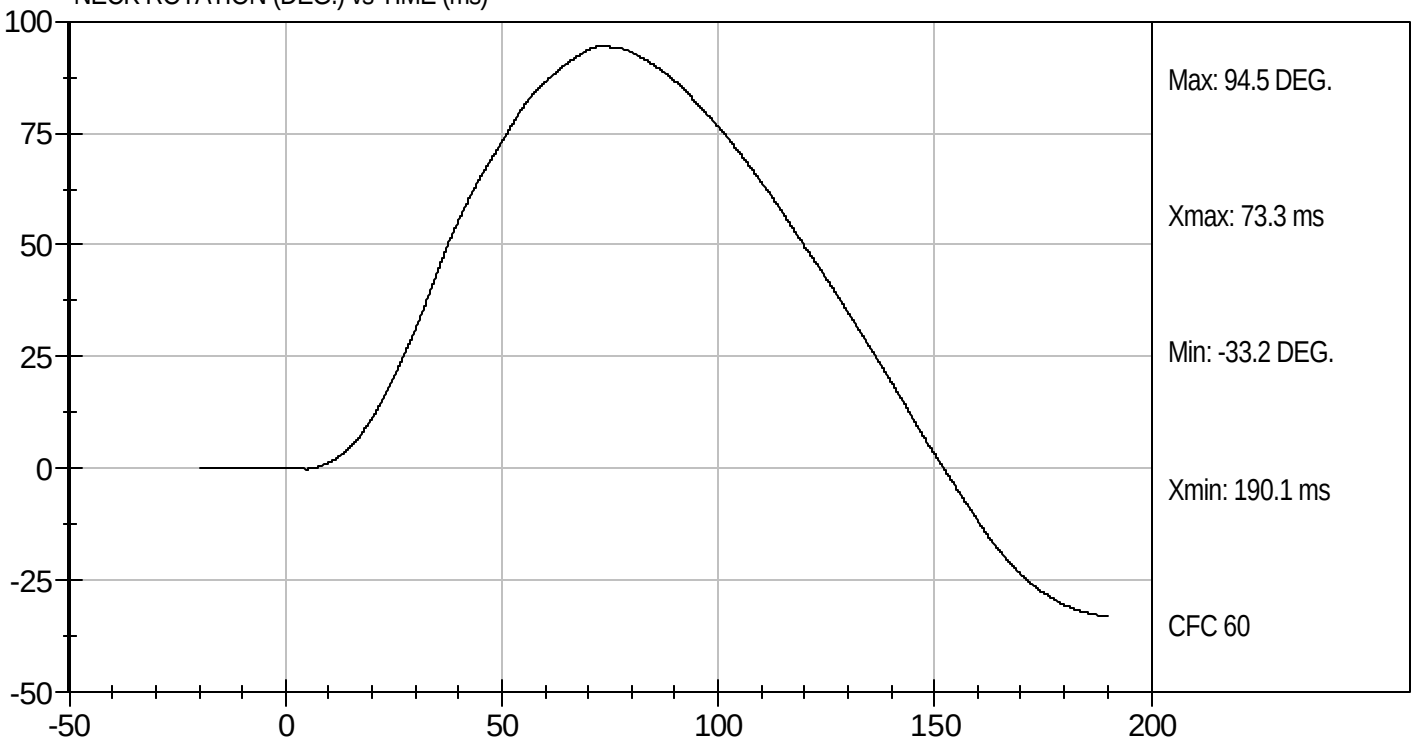
Test Desc: Neck Extension
Component ID: D072843

Test Date: 9/11/07
Velocity: 19.83 ft/s, 6.04 m/s

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

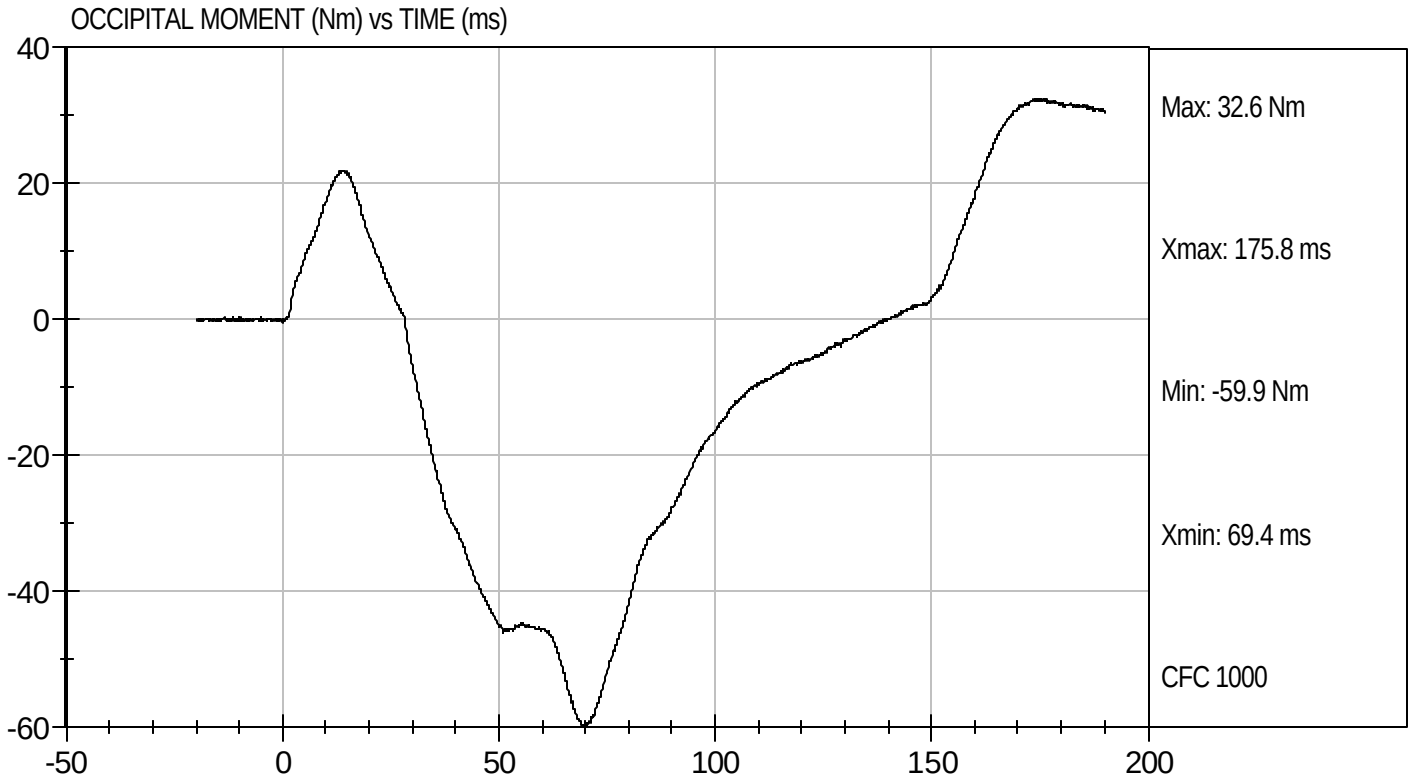


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D072843

Test Date: 9/11/07
Velocity: 19.83 ft/s, 6.04 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D072844

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,400	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.55	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

Laboratory Technician

9/11/07

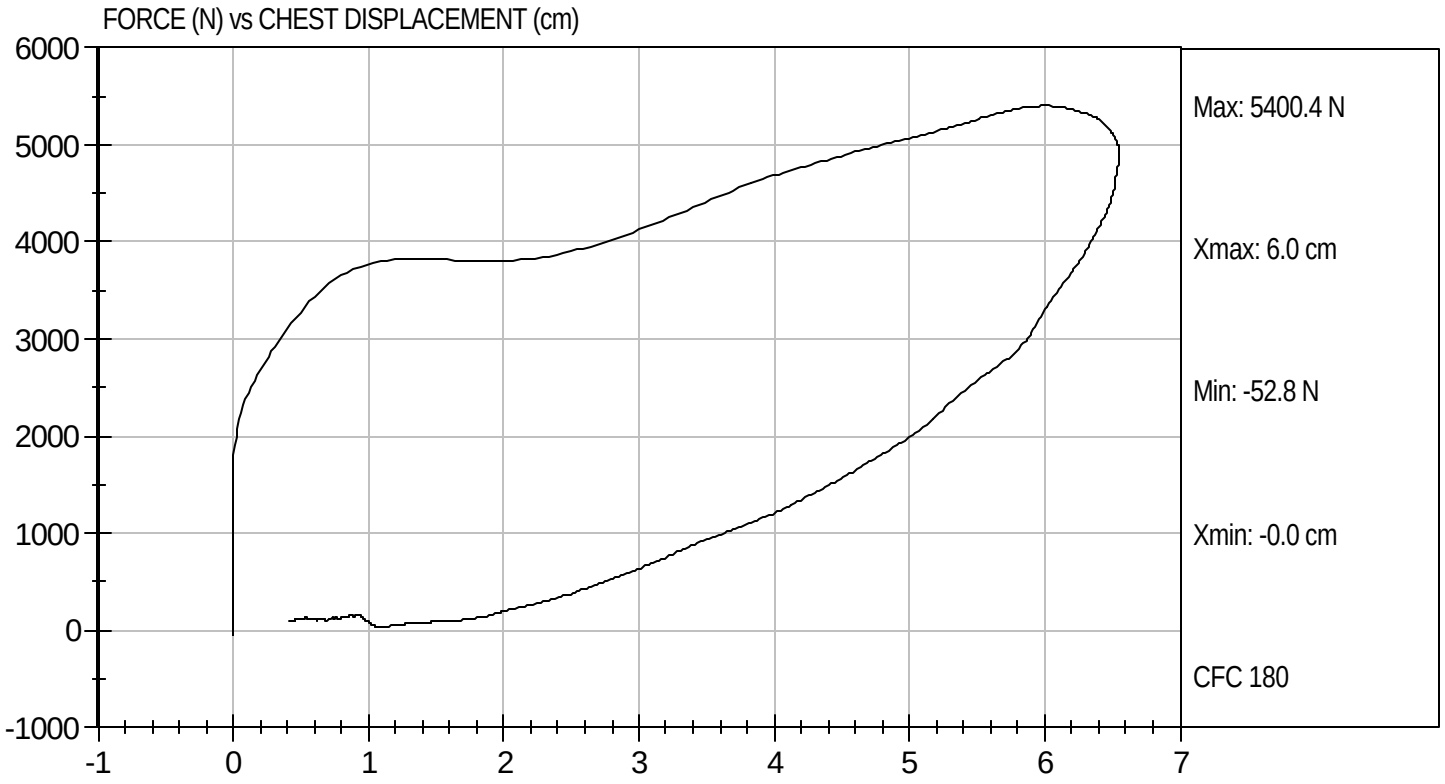
Test Date

David Winkelbauer

Approved By

Test Desc: Thorax Impact
Component ID: D072844

Test Date: 9/11/07
Velocity: 22.222 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D072845

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	37	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,686	Pass
		Overall Test Results		Pass

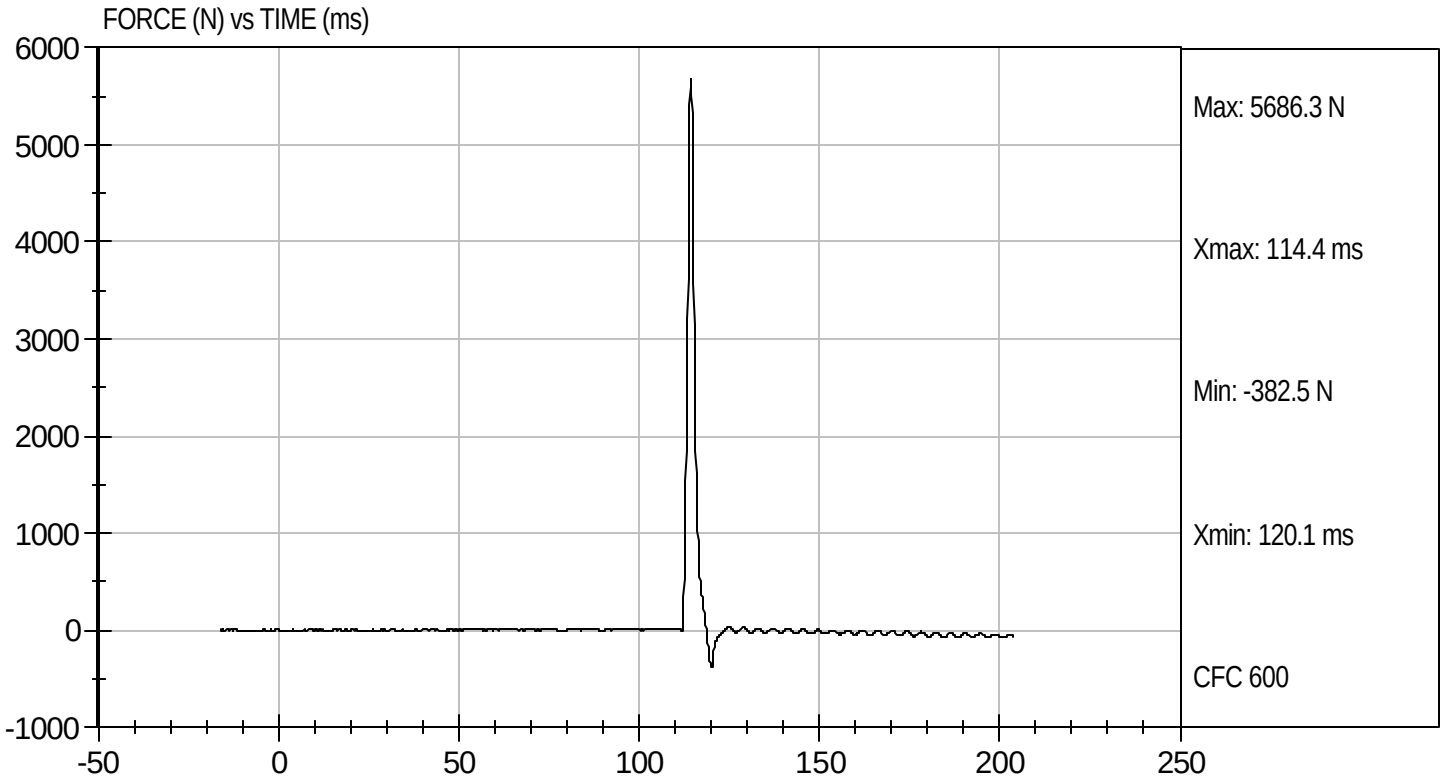
Jessica Gall
Laboratory Technician

9/11/07
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D072845

Test Date: 9/11/07
Velocity: 6.83 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D072846

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,608	Pass
		Overall Test Results		Pass

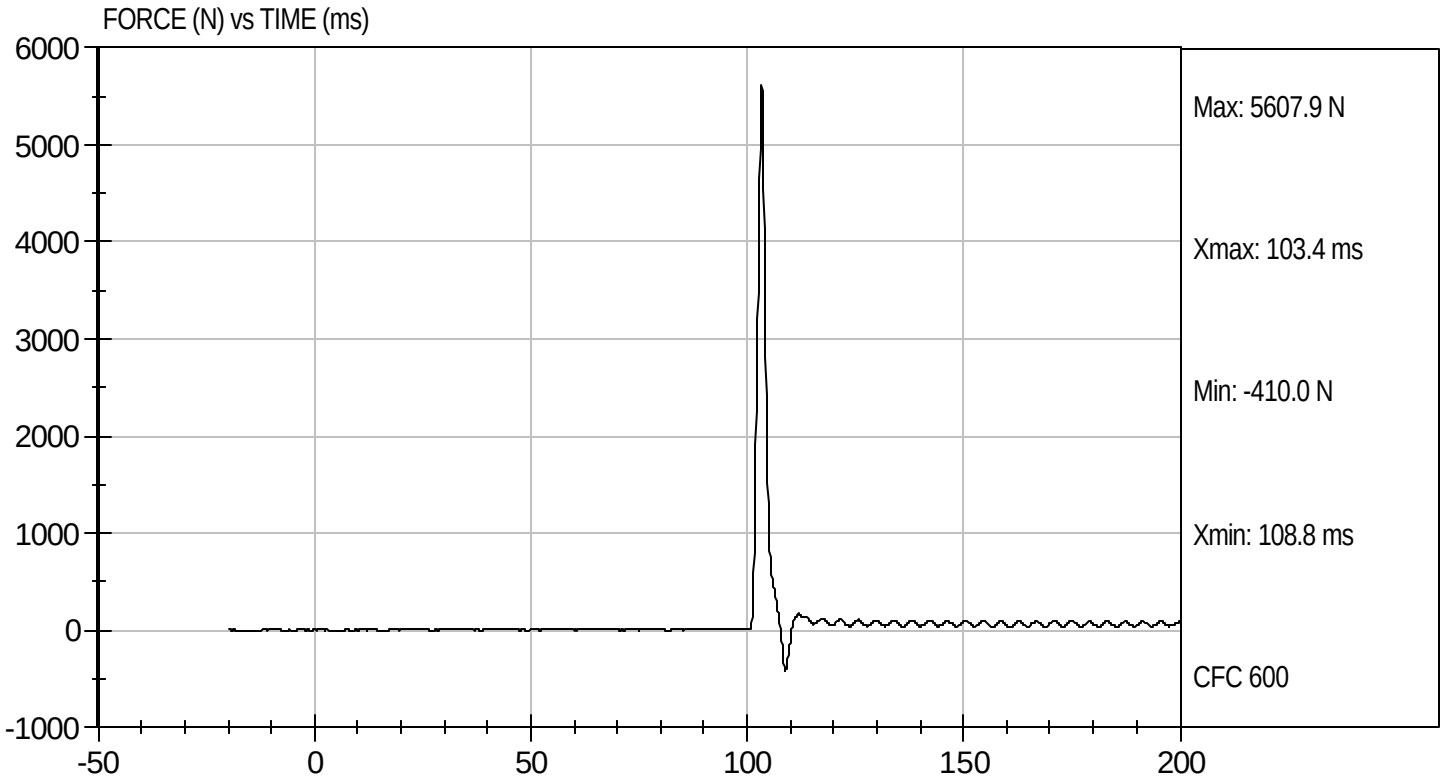
Jessica Gall
Laboratory Technician

9/11/07
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D072846

Test Date: 9/11/07
Velocity: 6.89 ft/s, 2.10 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D072840

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.8	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	43	43	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	65.5	59.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	42	Pass
		Overall Test Results			Pass

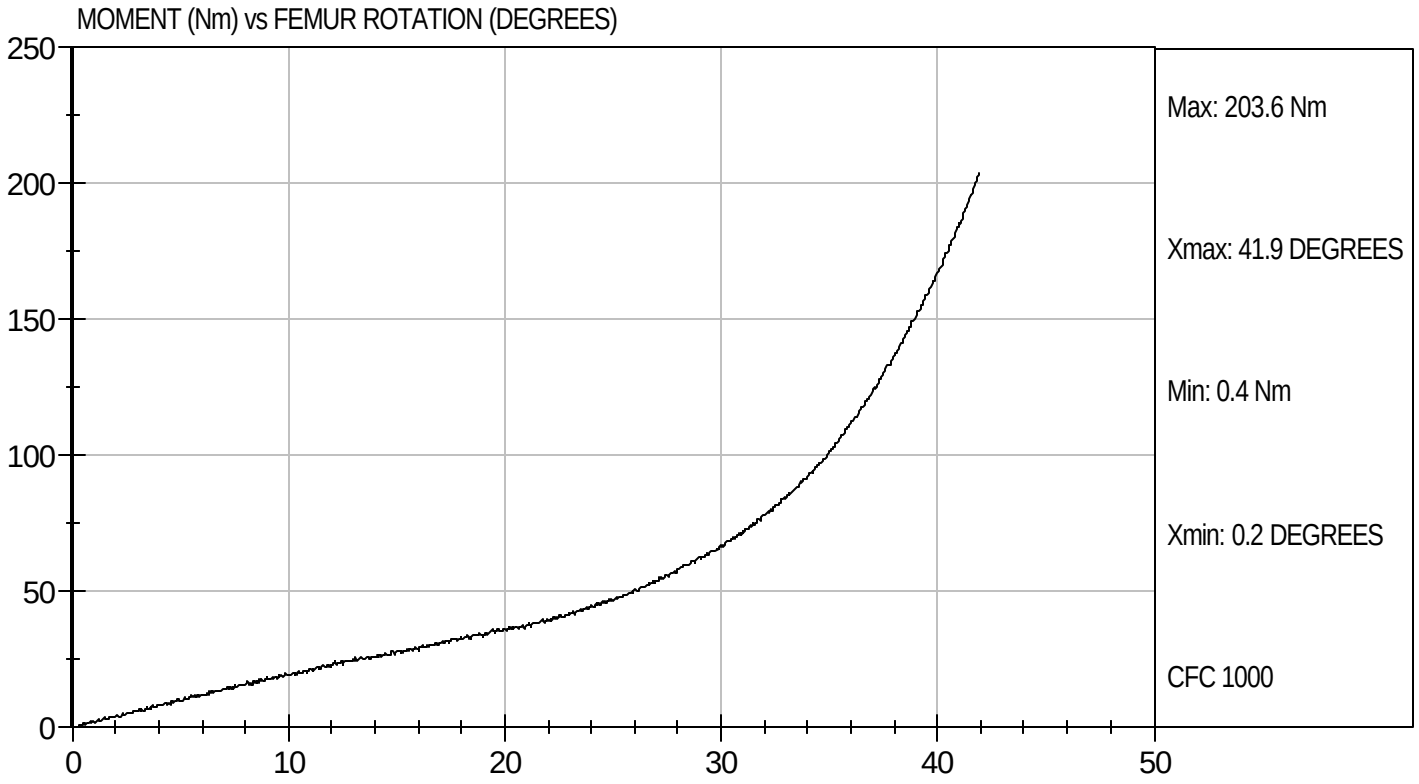
Laboratory Technician

9/11/07
Test Date

David Winkelbauer
Approved By

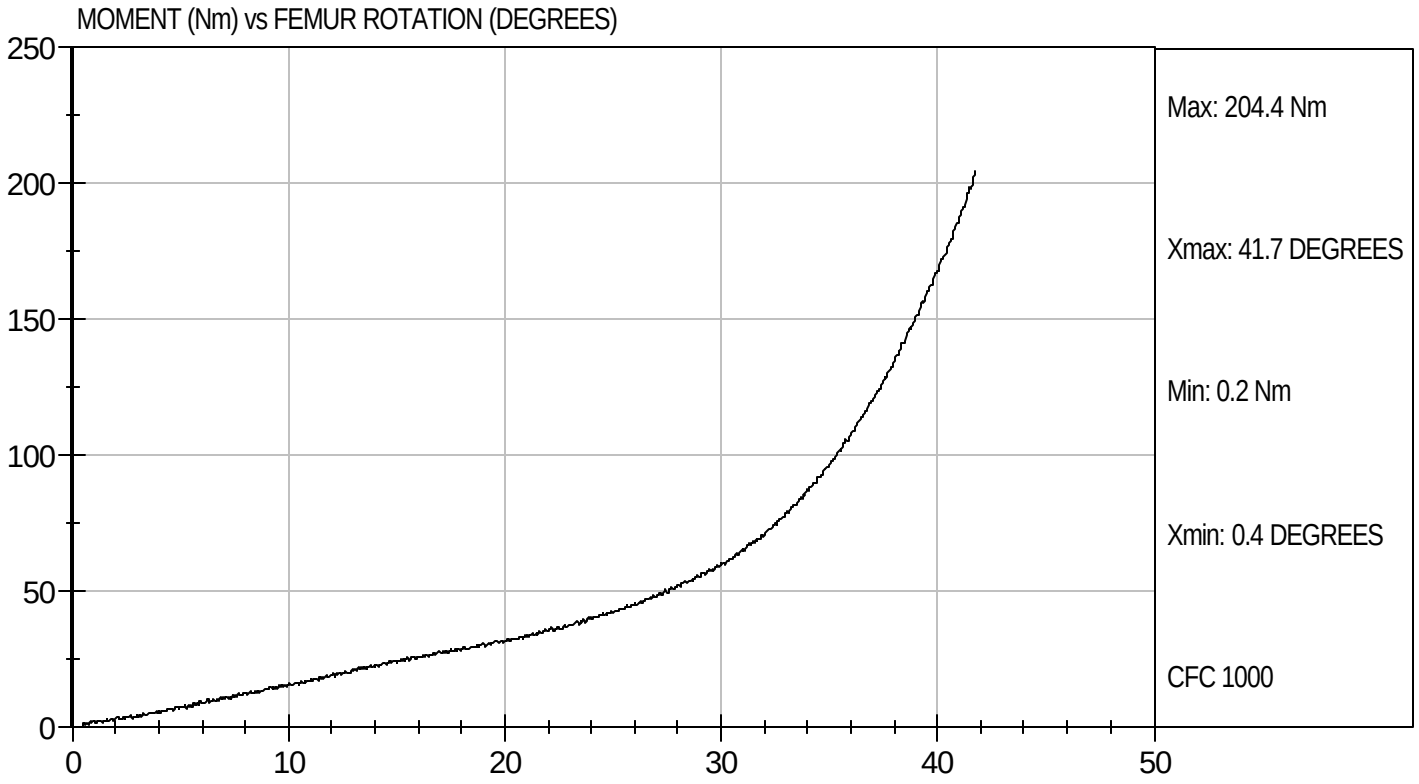
Test Desc: Hip Femur Flexion
Component ID: D072849

Test Date: 9/11/07
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D072840

Test Date: 9/11/07
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test ID:** D072851

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	225 - 275	267	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	9.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

9/11/07

Test Date

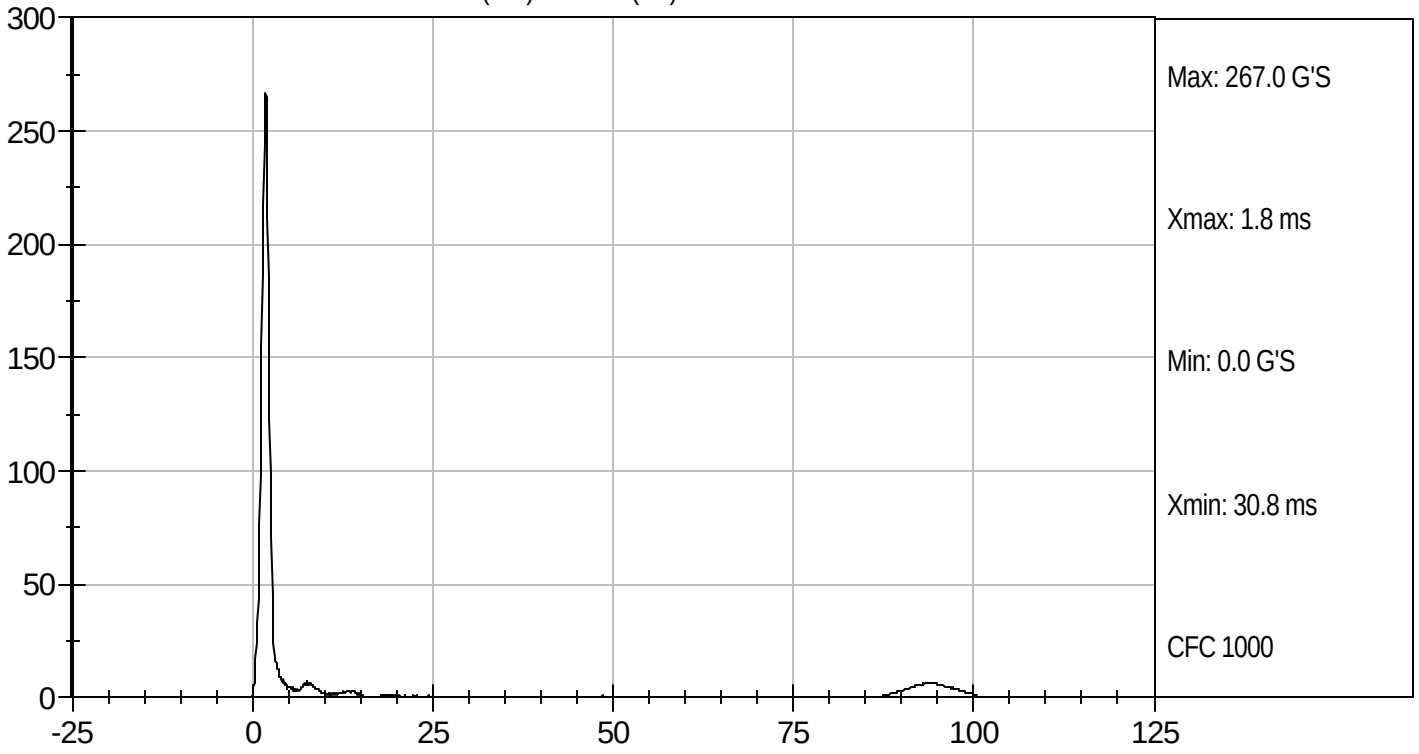
David Winkelbauer

Approved By

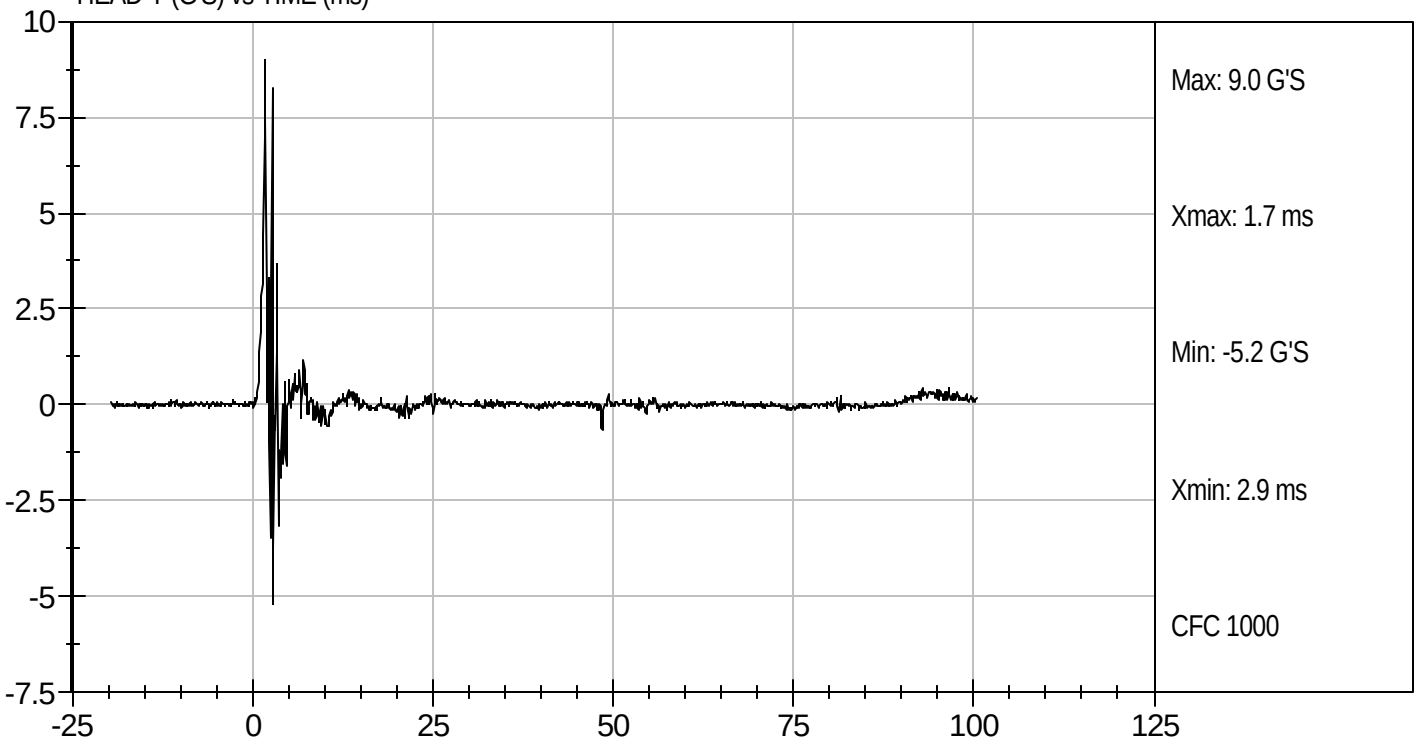
Test Desc: Head Drop
Component ID: D072851

Test Date: 9/11/07
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:** D072852

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	36	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.18	Pass
	20 msec	G's	17.60 to 22.60	19.53	Pass
	30 msec	G's	12.50 to 18.50	14.71	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.63	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	35.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	69.4	Pass
	Time	msec	57.0 to 64.0	57.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	114.8	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	93.5	Pass
	Time	msec	47.0 to 58.0	47.3	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.8	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

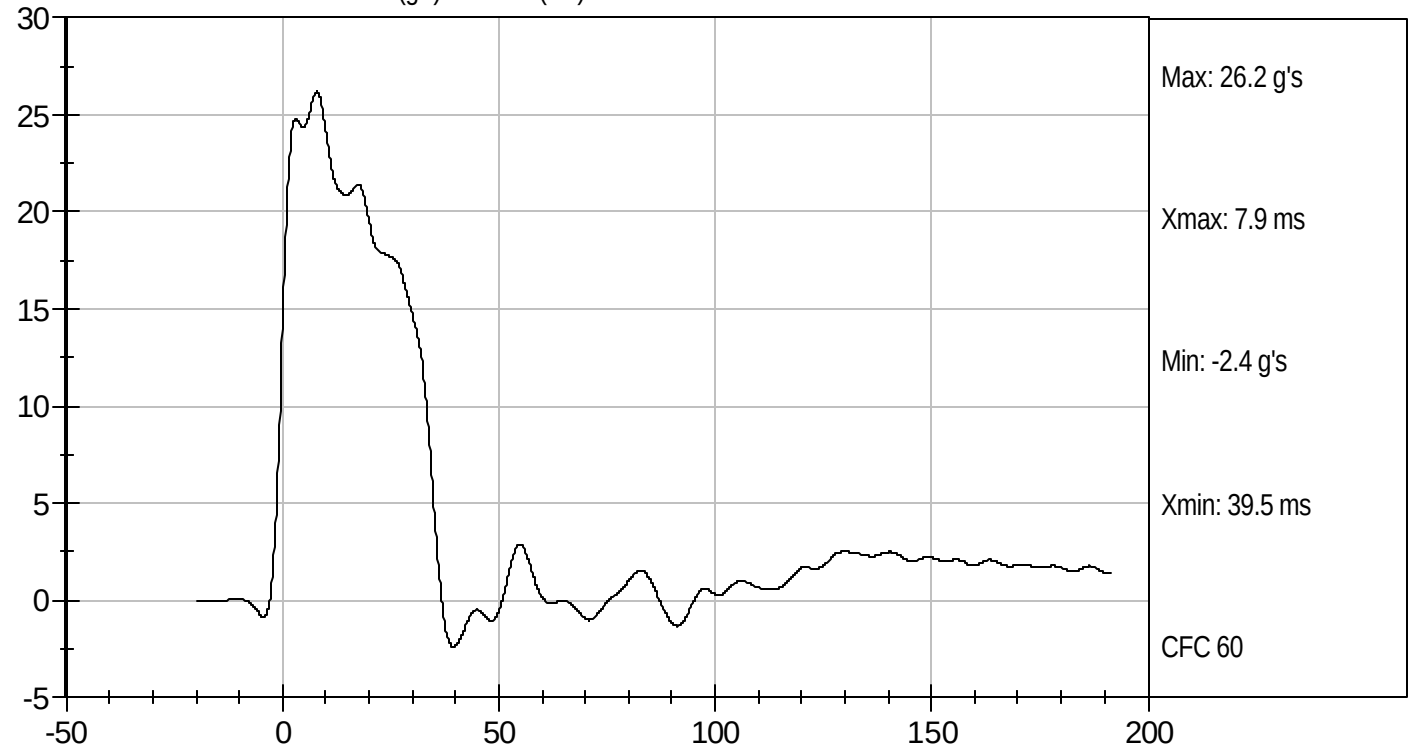
9/11/07
Test Date

David Winkelbauer
Approved By

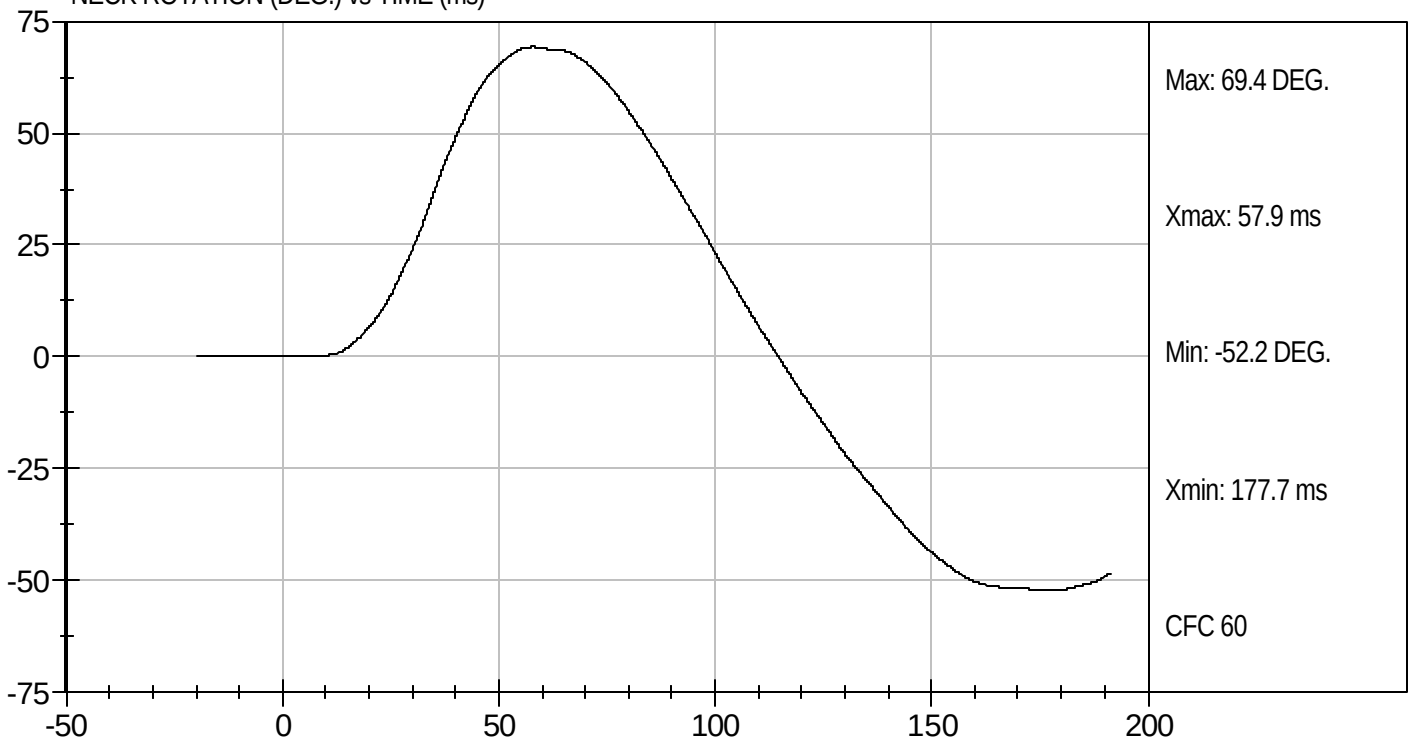
Test Desc: Neck Flexion
Component ID: D072852

Test Date: 9/11/07
Velocity: 23.15 ft/s, 7.06 m/s

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

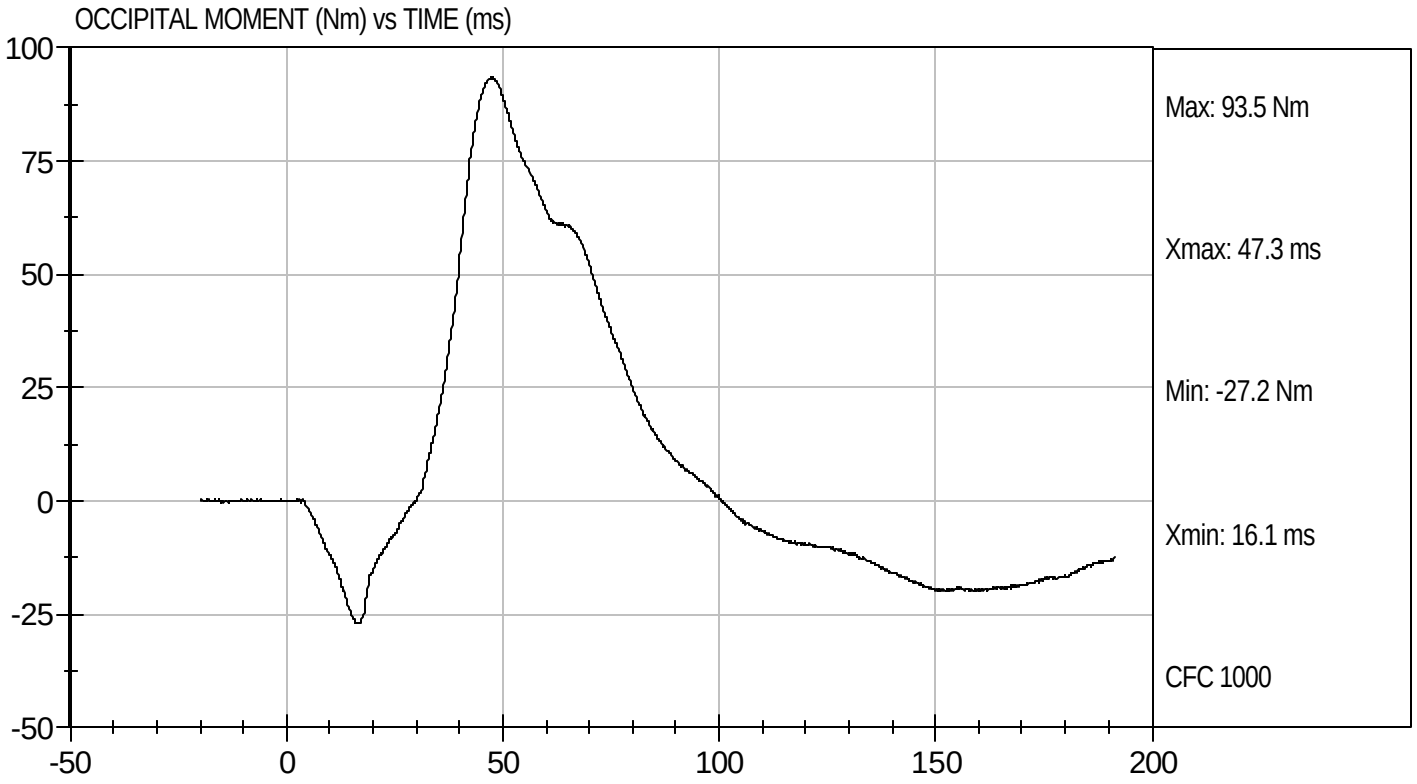


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D072852

Test Date: 9/11/07
Velocity: 23.15 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D072853

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	36	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.84	Pass
	20 msec	G's	14.00 to 19.00	17.65	Pass
	30 msec	G's	11.00 to 16.00	13.24	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.15	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	98.0	Pass
	Time	msec	72.0 to 82.0	74.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	153.0	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-62.6	Pass
	Time	msec	65.0 to 79.0	69.8	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	141.2	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

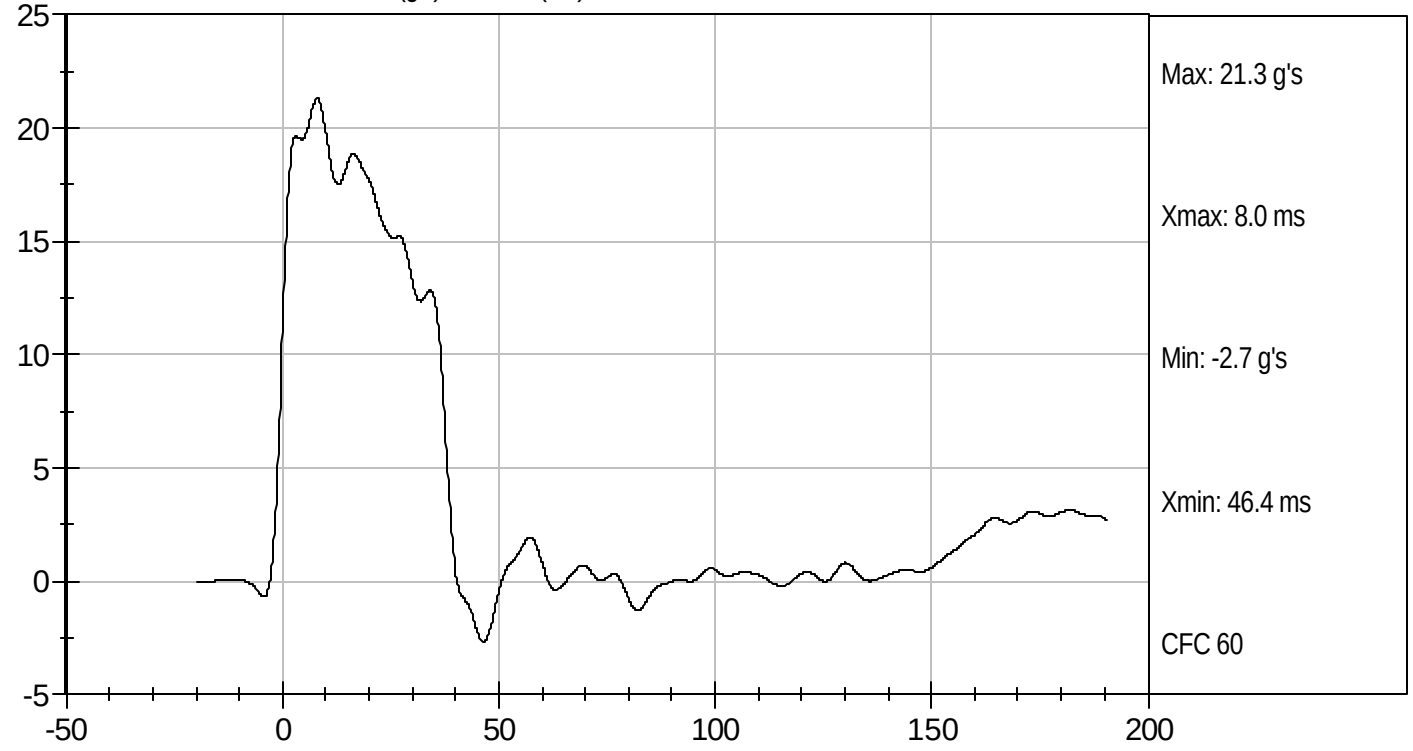
9/11/07
Test Date

David Winkelbauer
Approved By

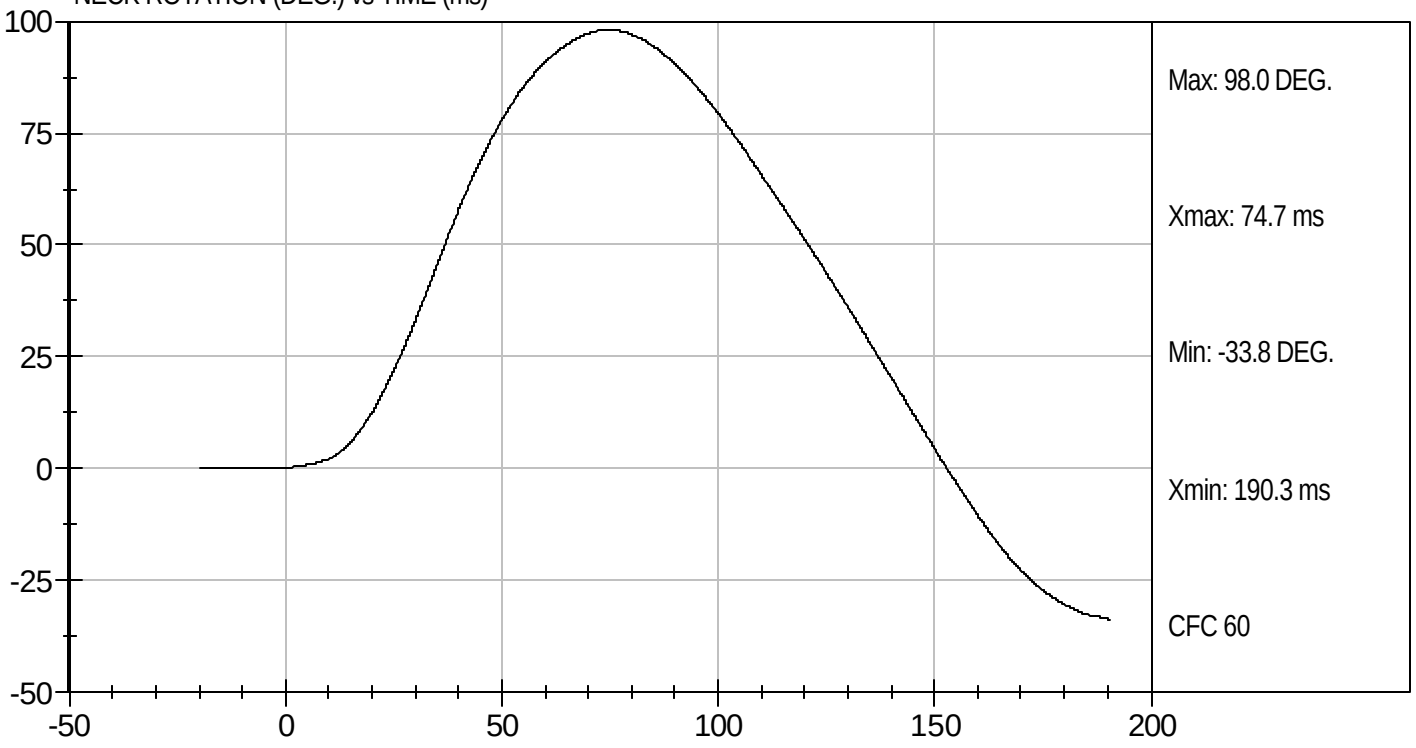
Test Desc: Neck Extension
Component ID: D072853

Test Date: 9/11/07
Velocity: 20.08 ft/s, 6.12 m/s

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

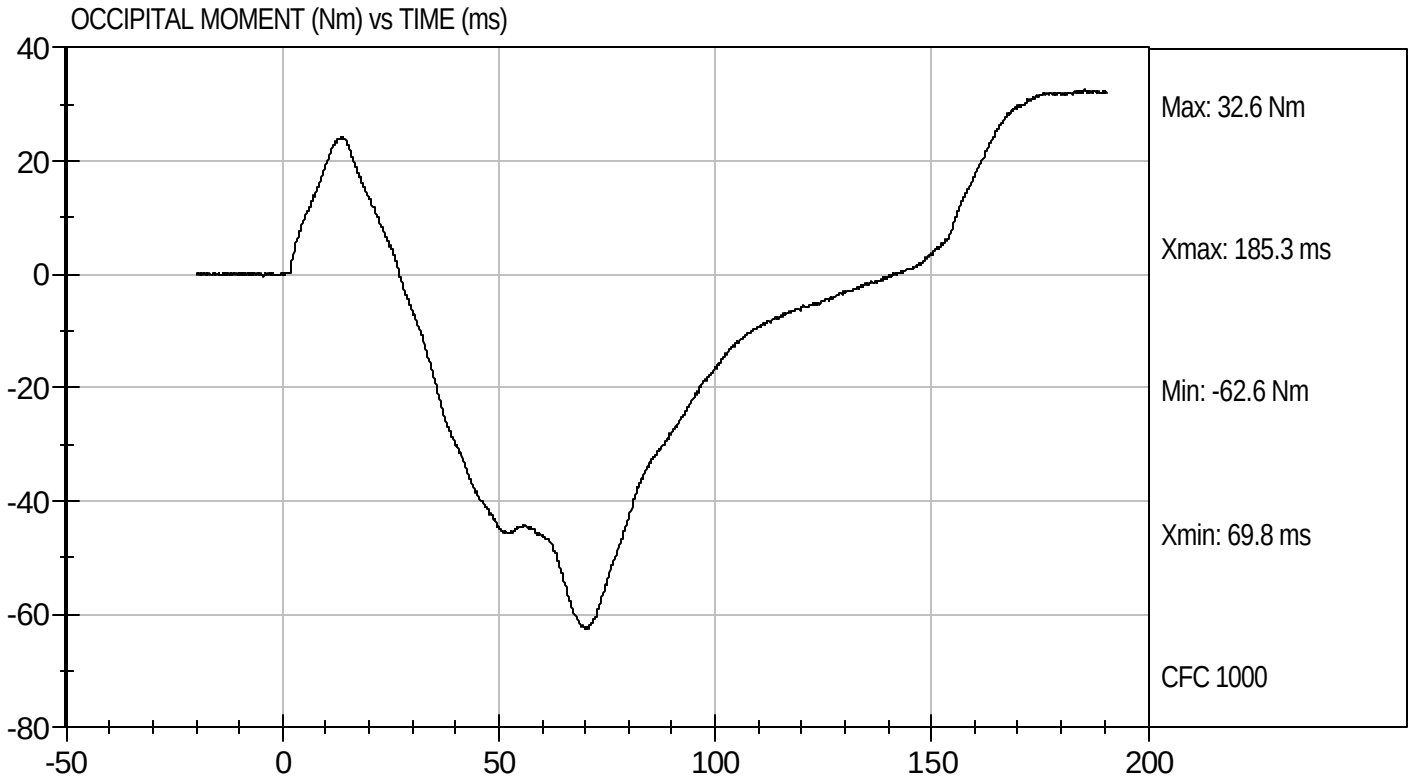


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D072853

Test Date: 9/11/07
Velocity: 20.08 ft/s, 6.12 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D072854

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,306	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.48	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

Laboratory Technician

9/11/07

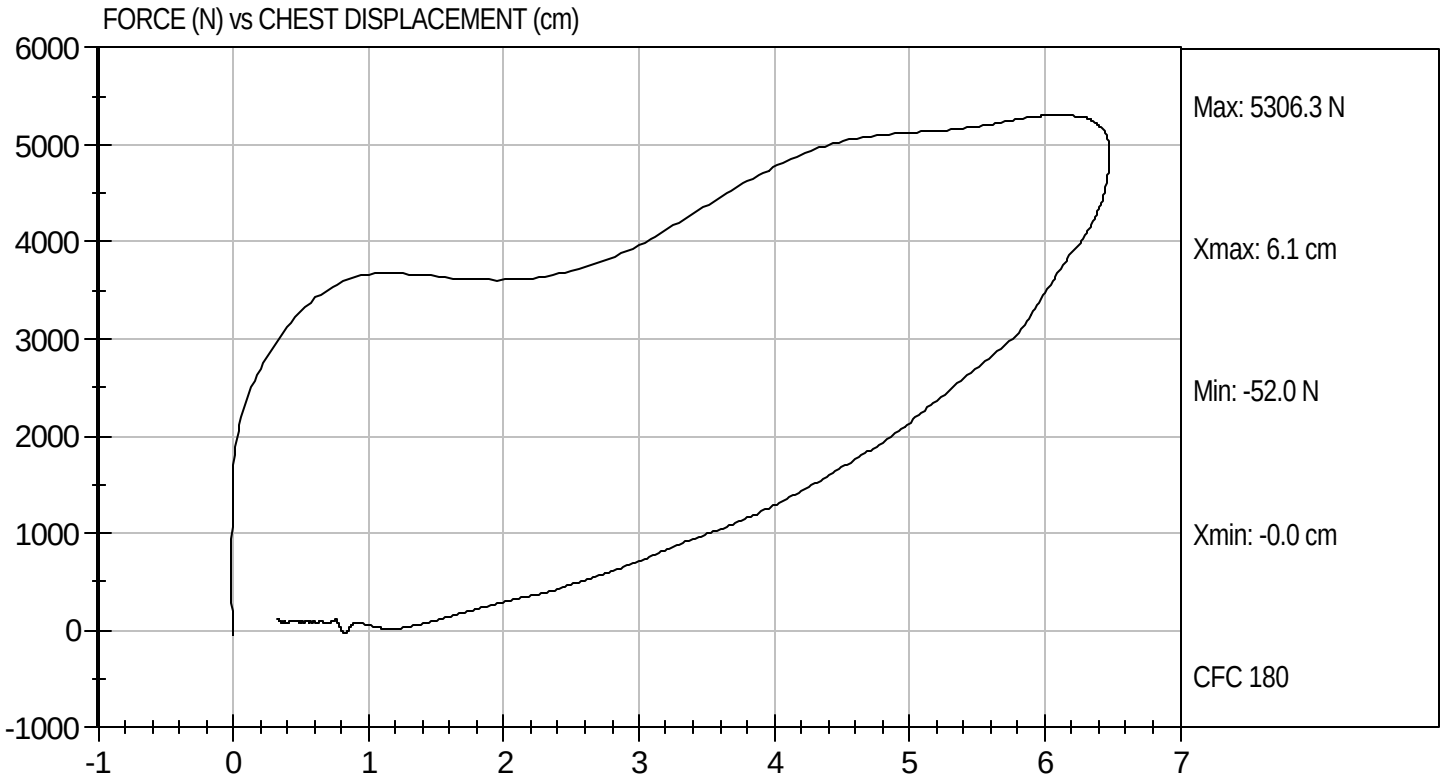
Test Date

David Winkelbauer

Approved By

Test Desc: Thorax Impact
Component ID: D072854

Test Date: 9/11/07
Velocity: 21.929 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:** D072855

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,536	Pass
		Overall Test Results		Pass

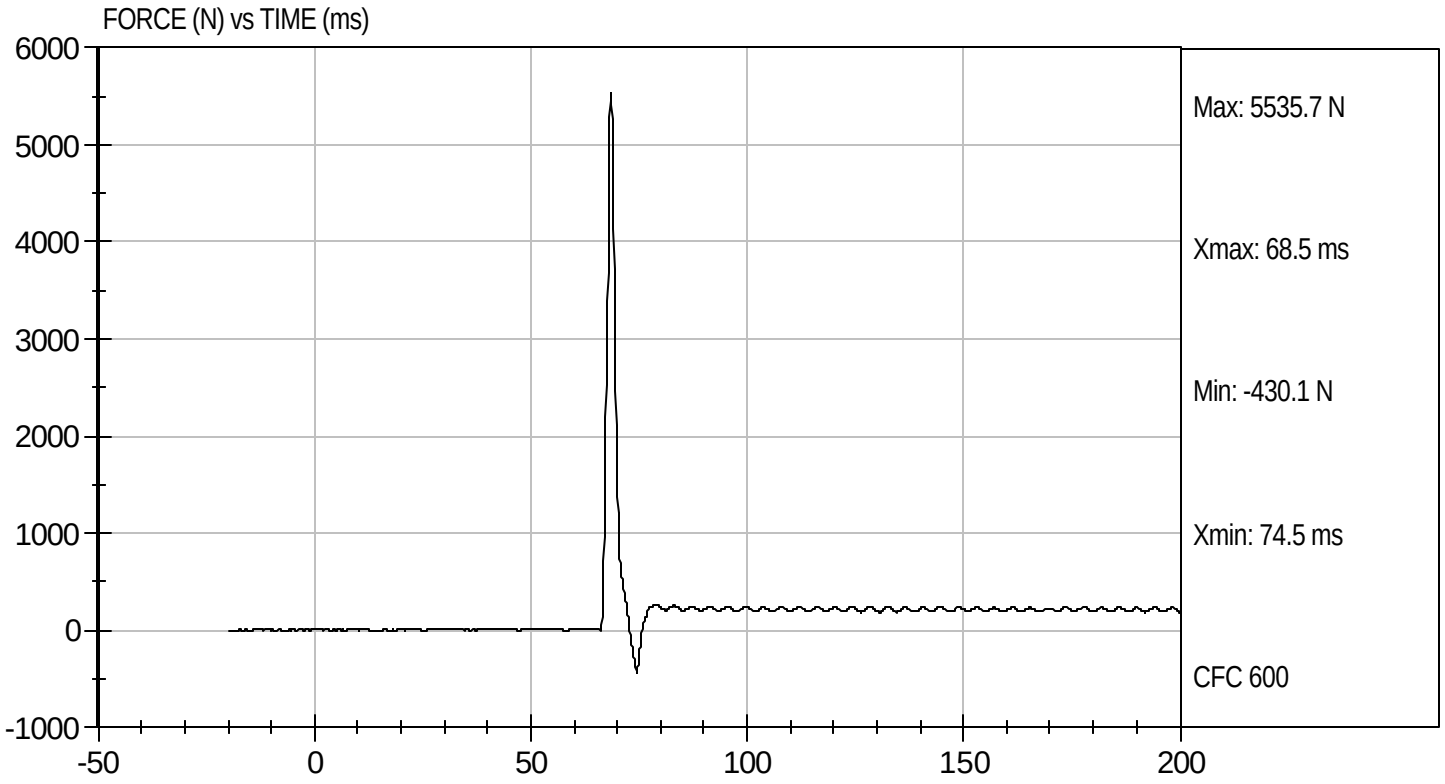
Jessica Gall
Laboratory Technician

9/11/07
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Component ID: D072855

Test Date: 9/11/07
Velocity: 6.92 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D072856

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	38	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	4,920	Pass
		Overall Test Results		Pass

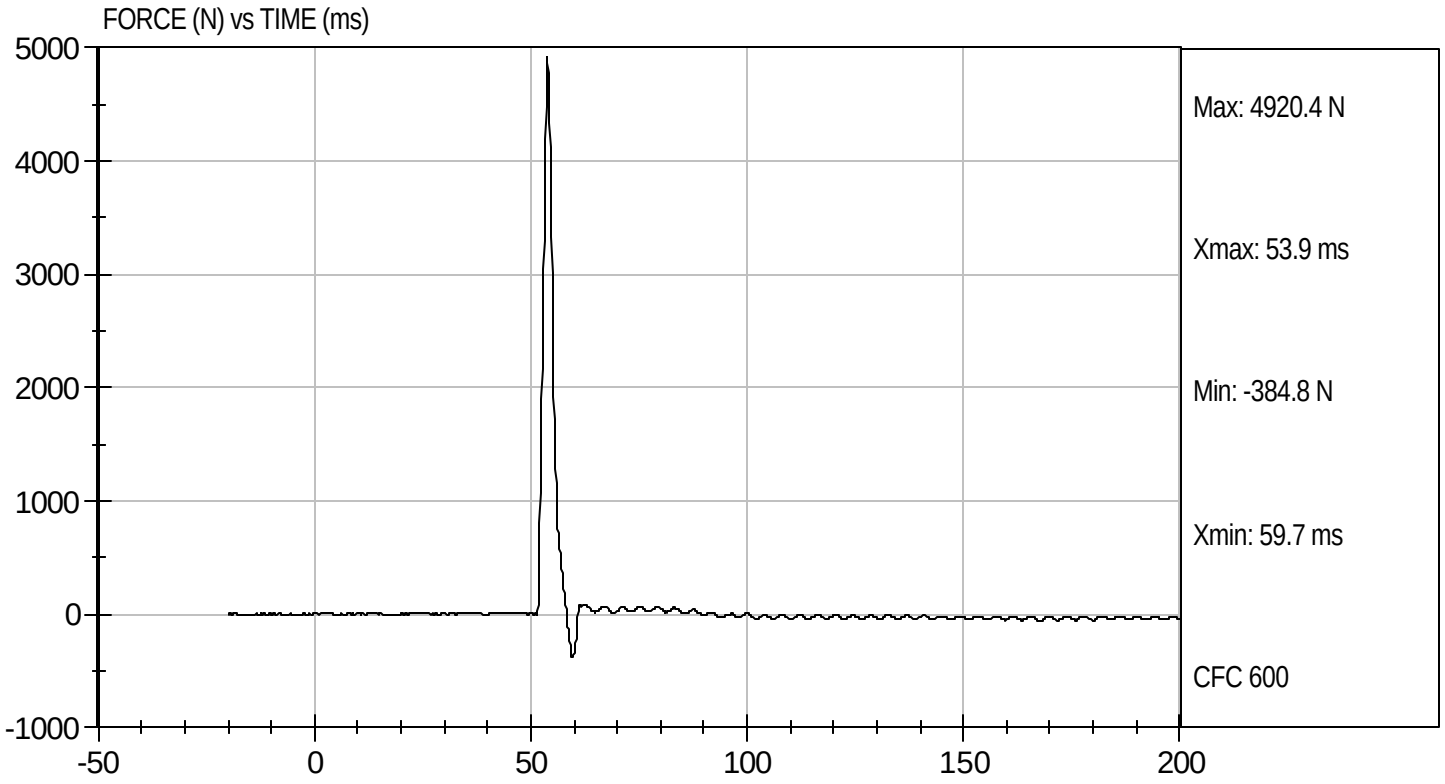
Jessica Gall
Laboratory Technician

9/11/07
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Component ID: D072856

Test Date: 9/11/07
Velocity: 6.92 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D072850

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	20.9	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	40	40	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	65.6	61.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	41	40	Pass
		Overall Test Results			Pass

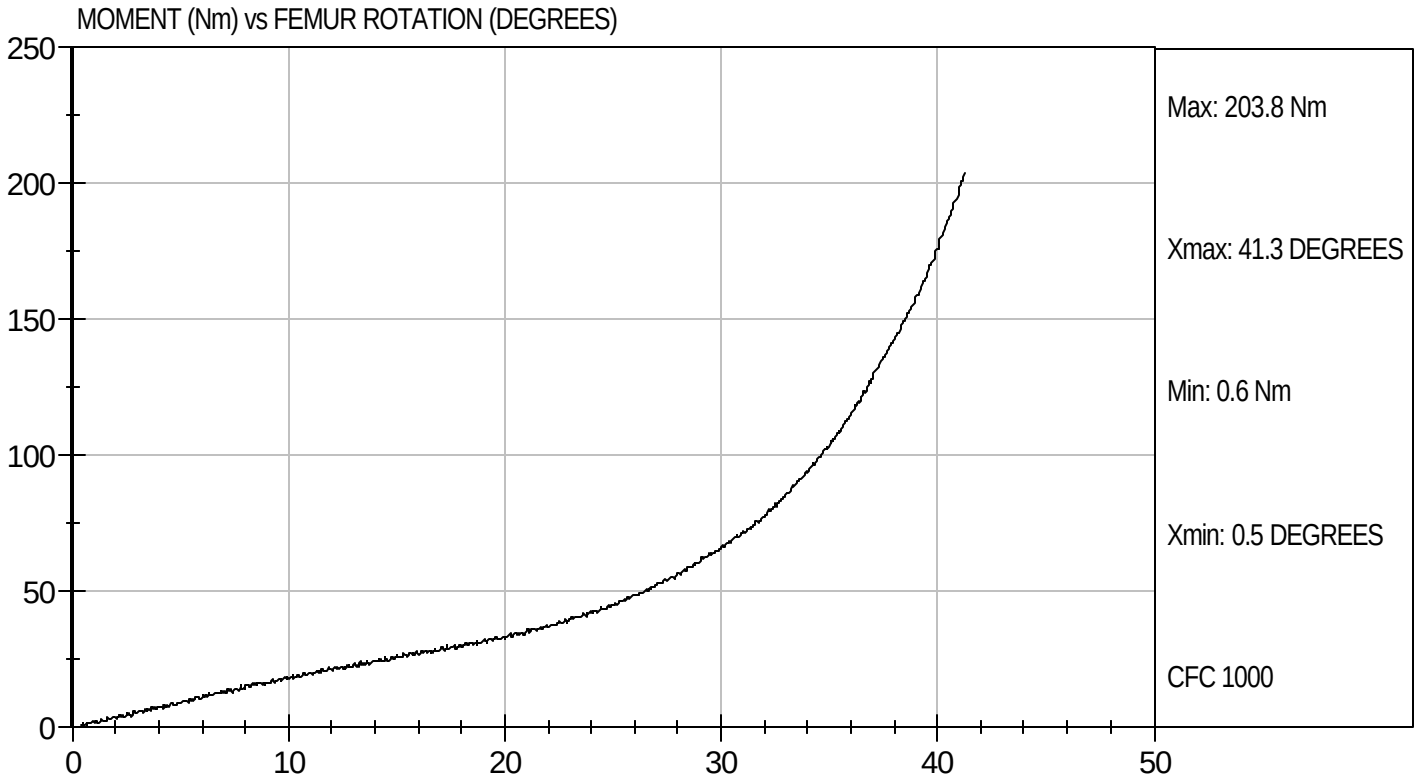
Laboratory Technician

09/11/07
Test Date

David Winkelbauer
Approved By

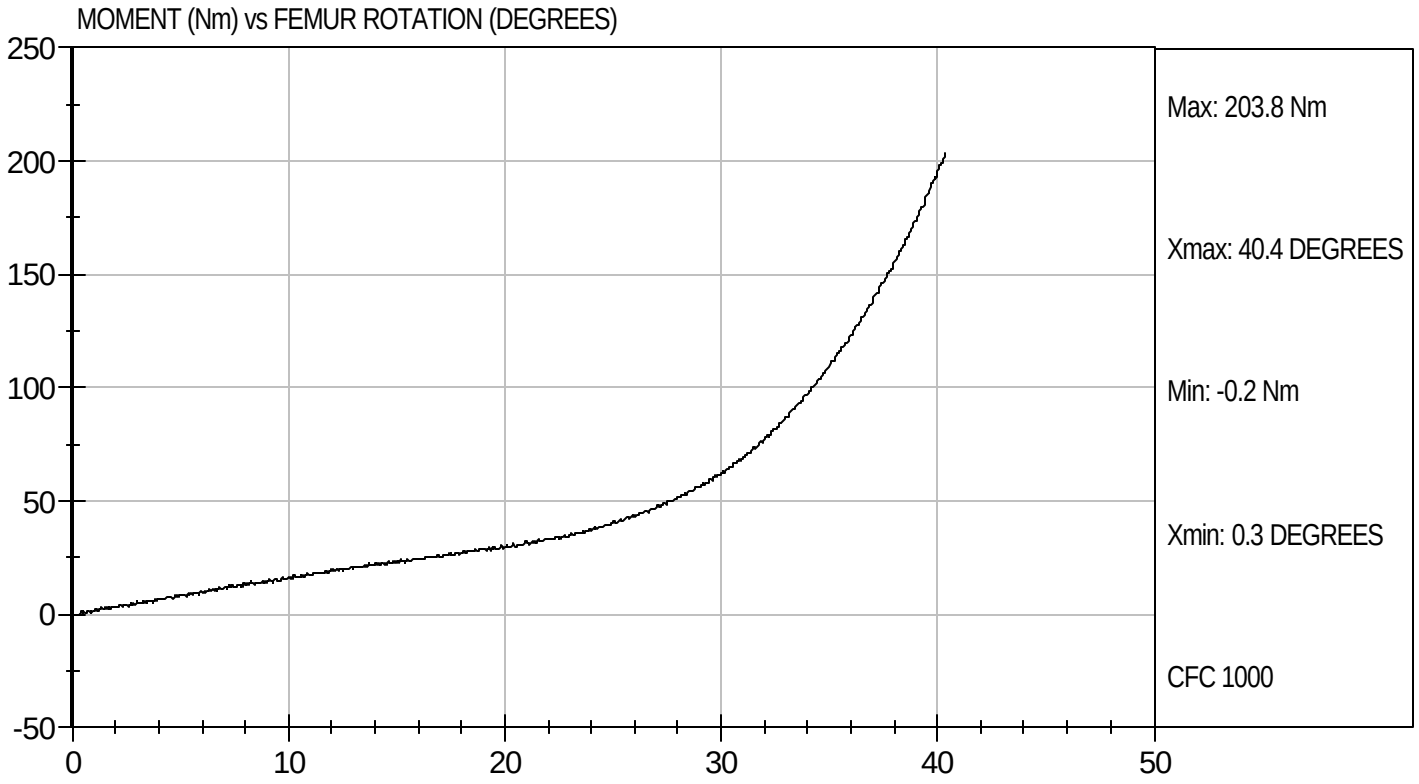
Test Desc: Hip Femur Flexion
Component ID: D072859

Test Date: 9/11/07
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D072850

Test Date: 09/11/07
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	654	815
Head Injury Criteria (HIC15)	N/A	390	340	436
Max. Thorax Accel. (3msec Clip)	G's	50	57	51

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	489.9	363.3	
Right	kg	499.4	348.8	
Ratio	%	58.1	41.9	
Totals	kg	989.3	712.1	1701.4

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

TEST NOTES

There was no valid data collected for:

Right Rear Passenger Neck Moment X after 20 msec.

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)	Peg Perego Primo Viaggio (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

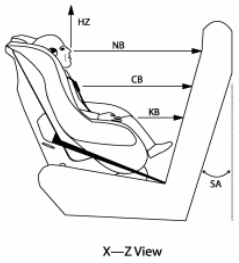
VISIBLE DUMMY CONTACT POINTS

Description	Position 3 CRS	Position 4 CRS
Head Contact	None	None
Upper Torso Contact	None	None
Lower Torso Contact	None	None
Left Foot Contact	Foot to vehicle rear seat	Foot to vehicle rear seat
Right Foot Contact	Foot to vehicle rear seat	Foot to vehicle rear seat

CHILD DUMMY POSITIONING IN VEHICLE

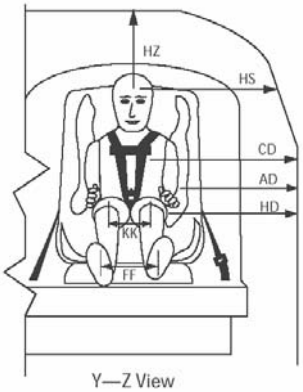
Child Restraint System (Position 3)	Graco Snugride (Rear Facing)
NHTSA No.	F80202

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

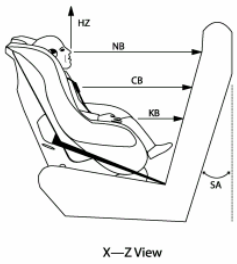
Measurement	Pre-Test (mm)	Post-Test (mm)
	P3 CRS (093)	P3 CRS (093)
SA (deg)	Fixed	
HS	437	341
CD	355	372
AD	235	242
HD	284	303
HZ	377	362
NB	572	583
CB	460	451
KK	109	110
FF	106	122
KB - LEFT	193	252
KB – RIGHT	194	273
TB – LEFT	43	125
TB - RIGHT	45	163

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

CHILD DUMMY POSITIONING IN VEHICLE

Child Restraint System (Position 4)	Peg Perego Primo Viaggio (Rear Facing)
NHTSA No.	F80202

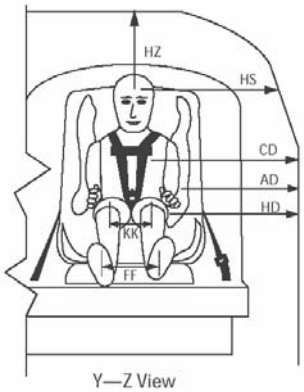
Dummy Measurements for Rear-facing CRS Passengers



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

X—Z View



Y—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)	Fixed	
HS	448	346
CD	365	353
AD	249	246
HD	295	278
HZ	336	284
NB	481	384
CB	395	357
KK	100	135
FF	103	152
KB - LEFT	183	191
KB – RIGHT	183	187
TB - LEFT	20	42
TB - RIGHT	22	52

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)	Peg Perego Primo Viaggio (Rear Facing)
NHTSA No.	F80202

POSITION 3 CRS POST-TEST INSPECTION

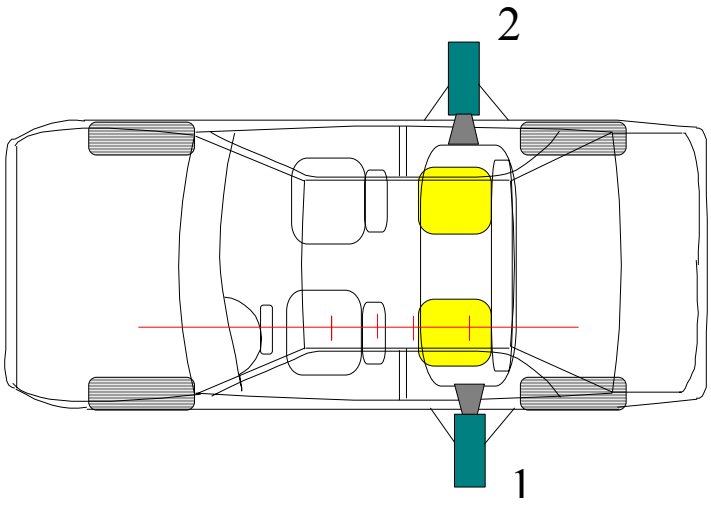
Location	Damage	Remarks
Upper Tether Strap		
Upper Tether Buckle		
Upper Tether Hook		
Vehicle Upper Tether Anchor		
Lower Anchor Strap	None	
Lower Anchor Buckle		
Lower Anchor Hooks	None	
Vehicle Lower CRS Anchors	None	
Five Point Harness Connections	None	
Cracks on CRS	None	
Fabric Tears on CRS	None	
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)	Peg Perego Primo Viaggio (Rear Facing)
NHTSA No.	F80202



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:

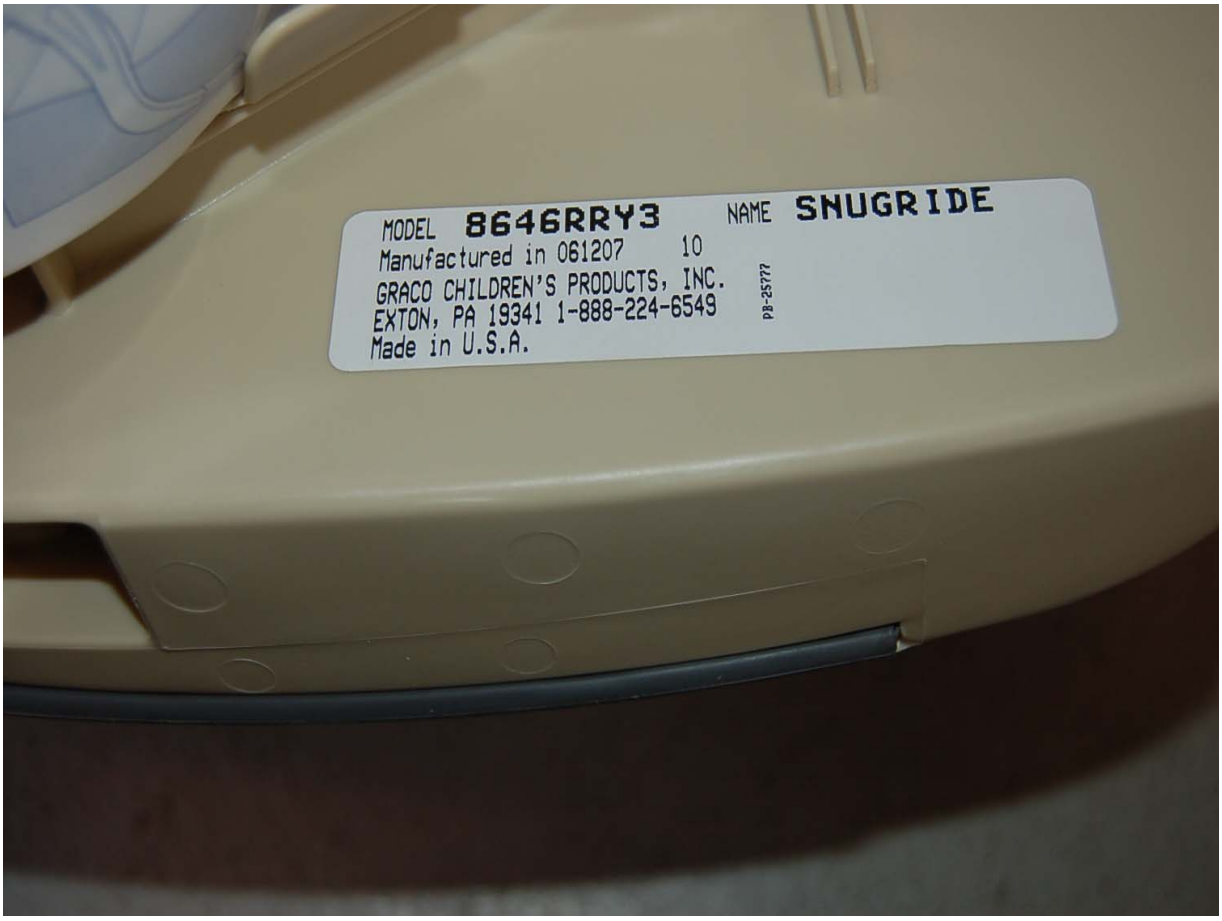
+X = film plane rearward of barrier

+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 4 Right Side View

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

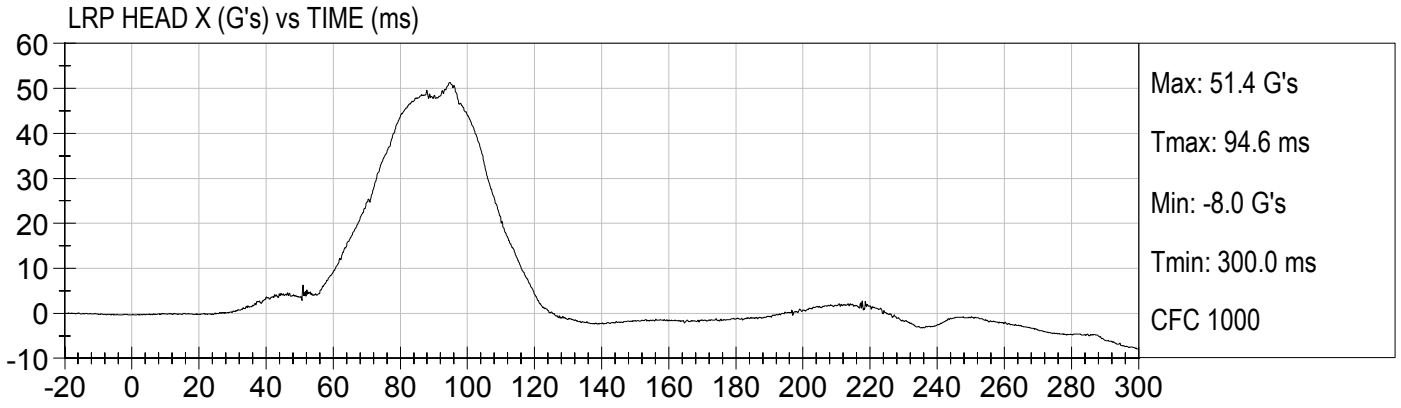
RRP Child Seat Y Acceleration vs. Time

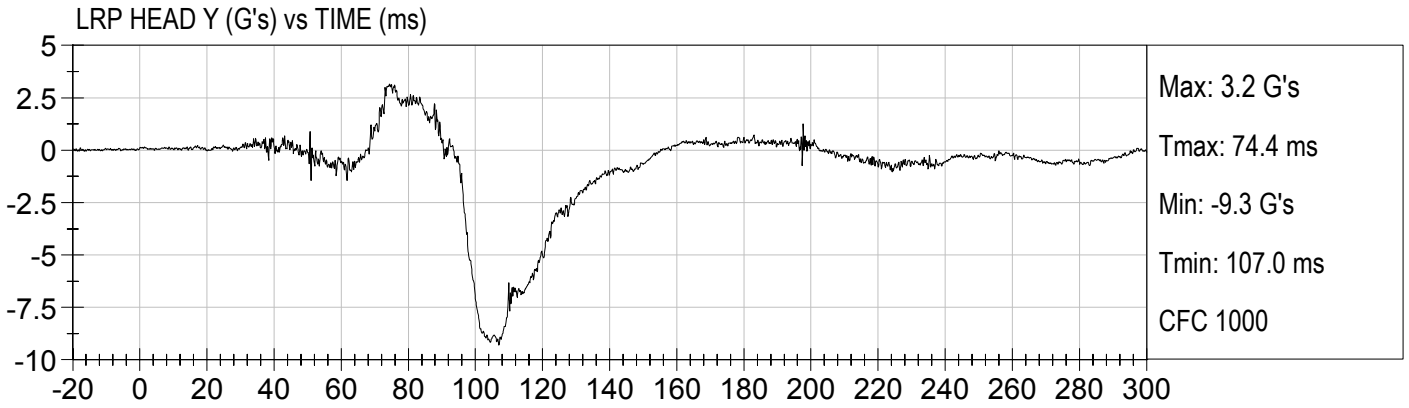
RRP Child Seat Z Acceleration vs. Time

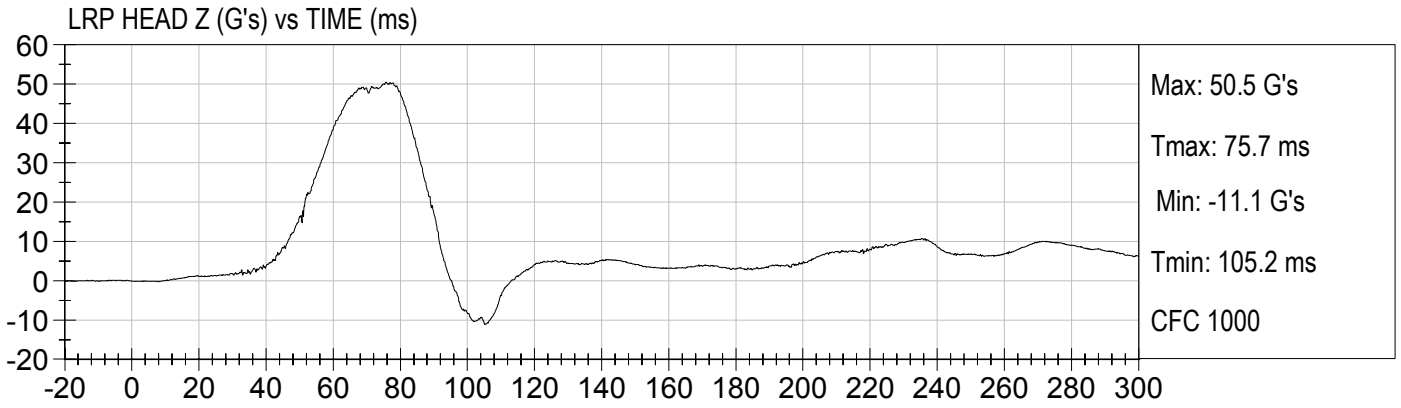
RRP Child Seat Resultant Acceleration vs. Time

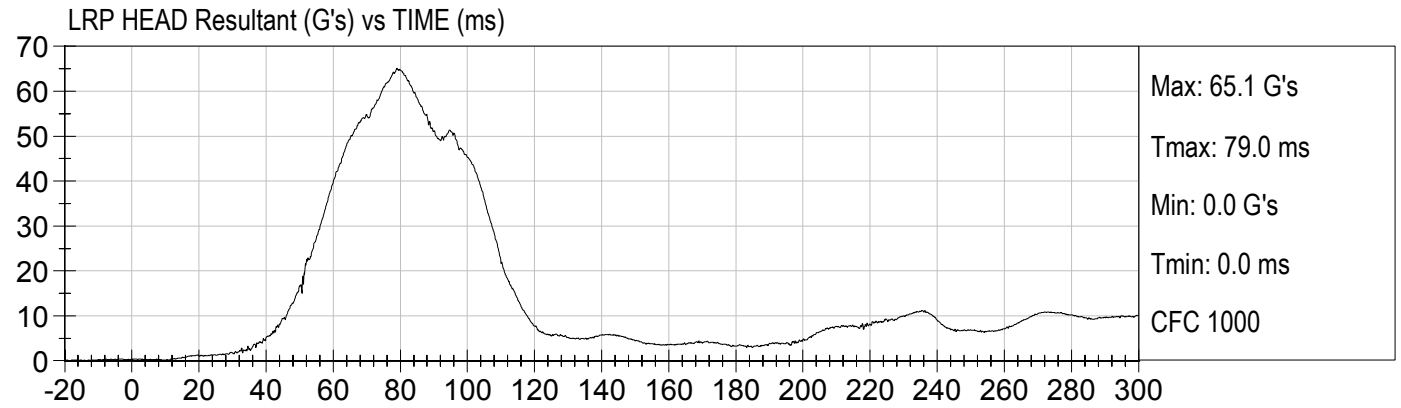
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)





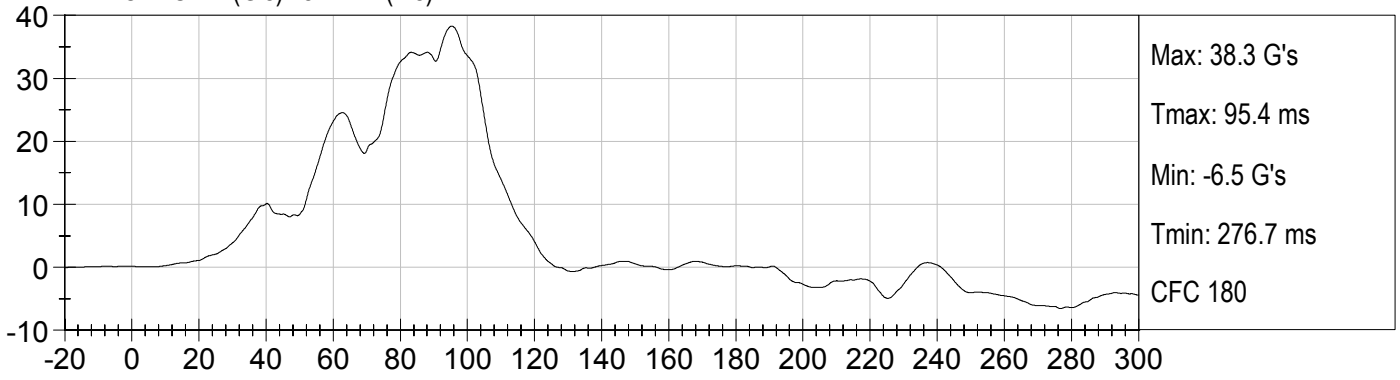




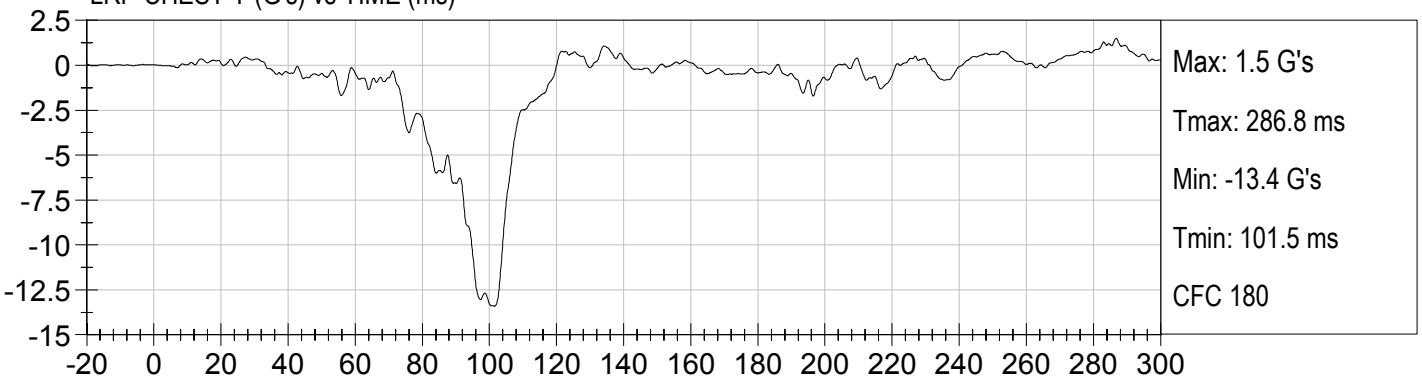
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

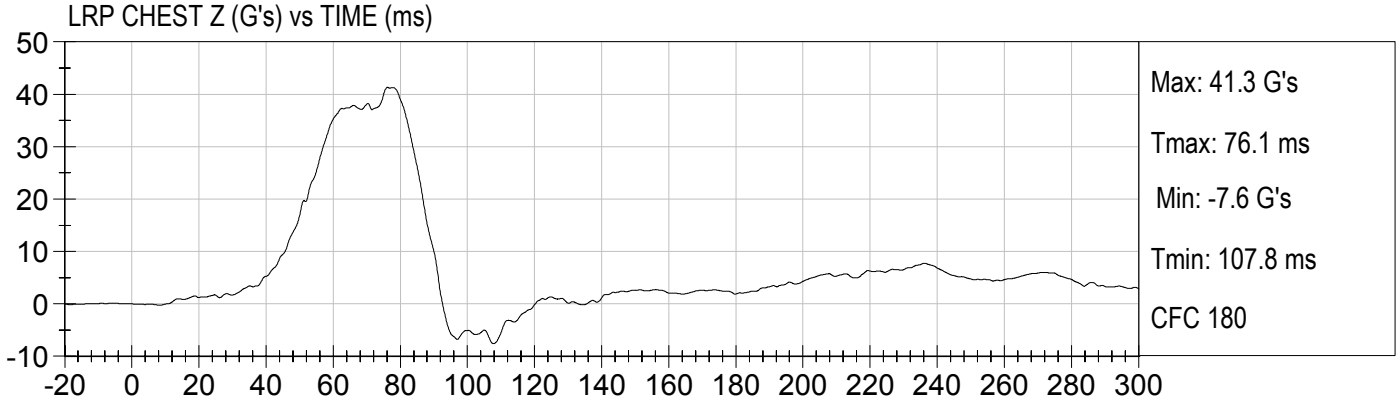
LRP CHEST X (G's) vs TIME (ms)



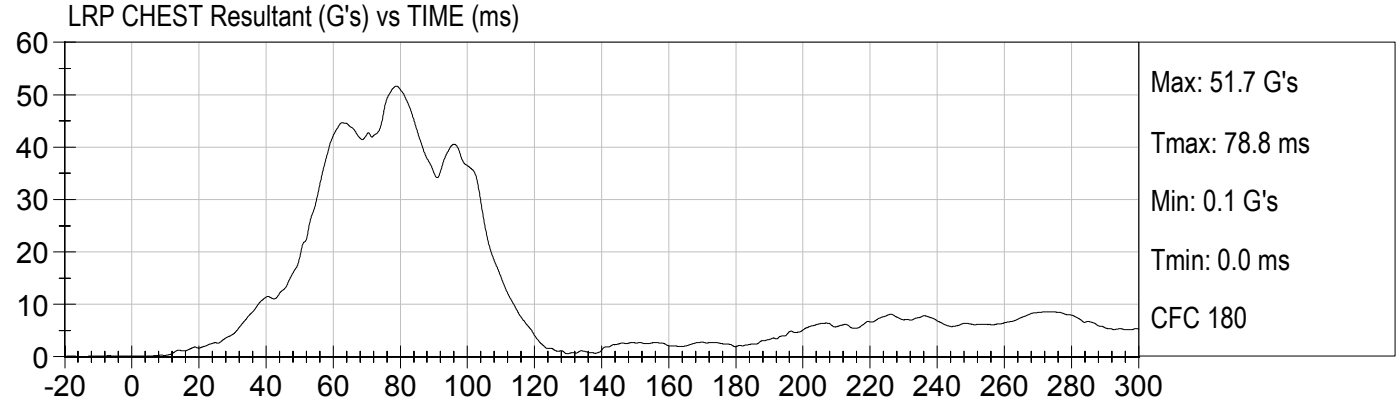
LRP CHEST Y (G's) vs TIME (ms)



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



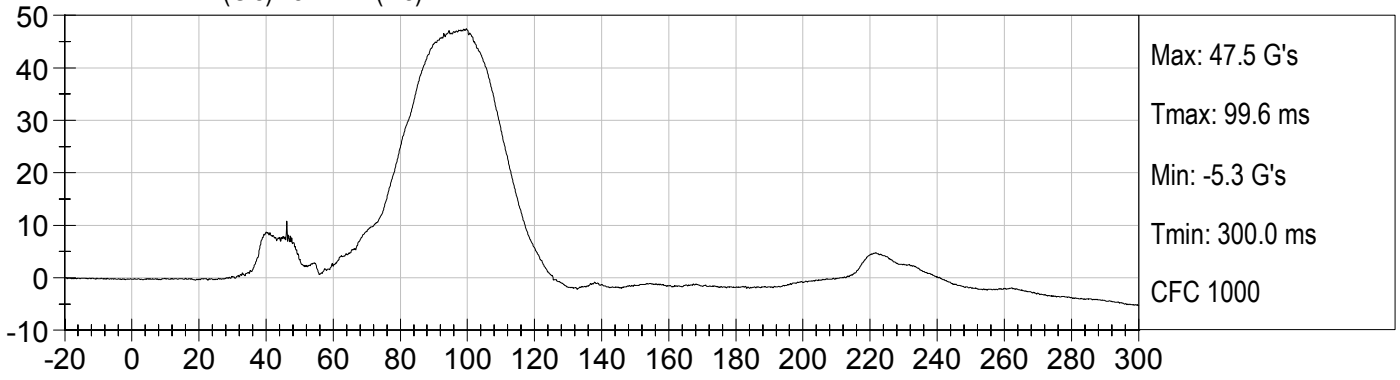
LRP CHEST Resultant (G's) vs TIME (ms)



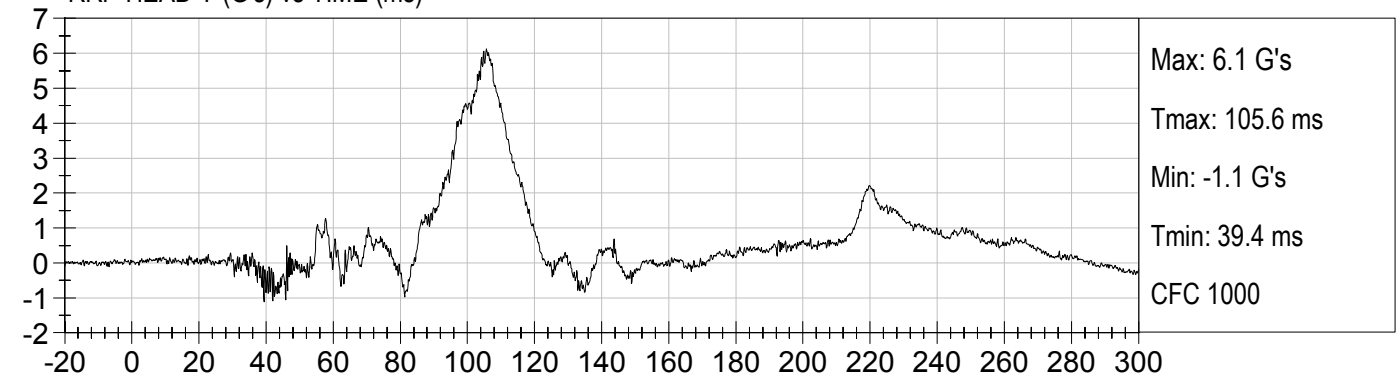
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

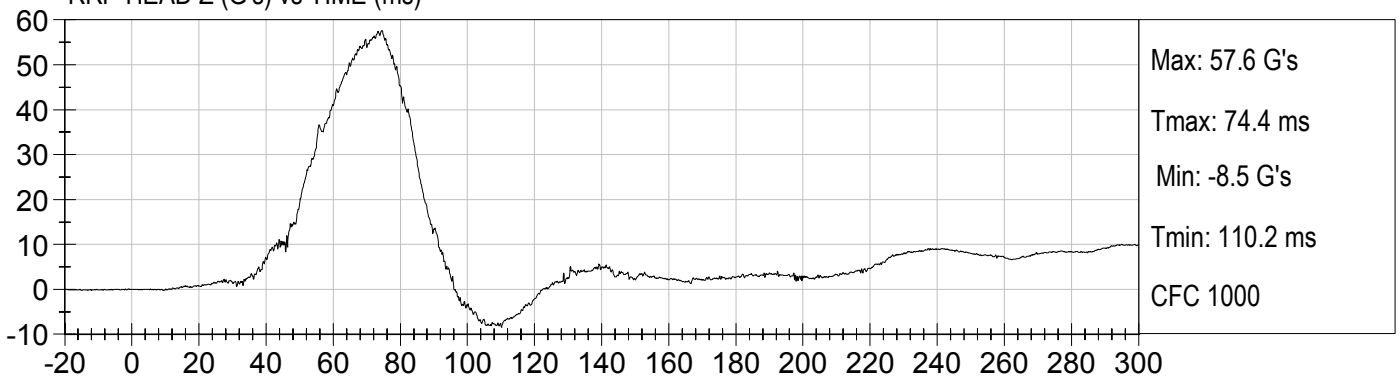
RRP HEAD X (G's) vs TIME (ms)



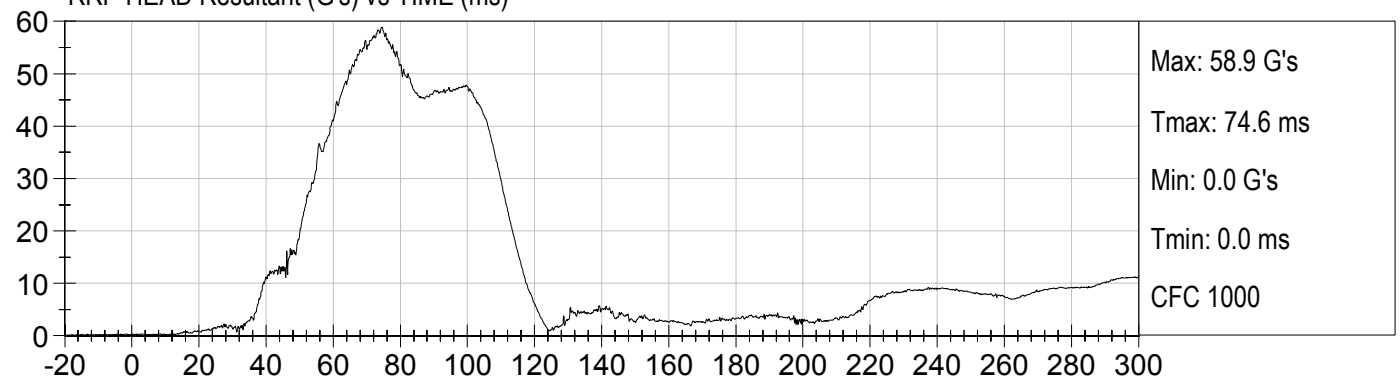
RRP HEAD Y (G's) vs TIME (ms)



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



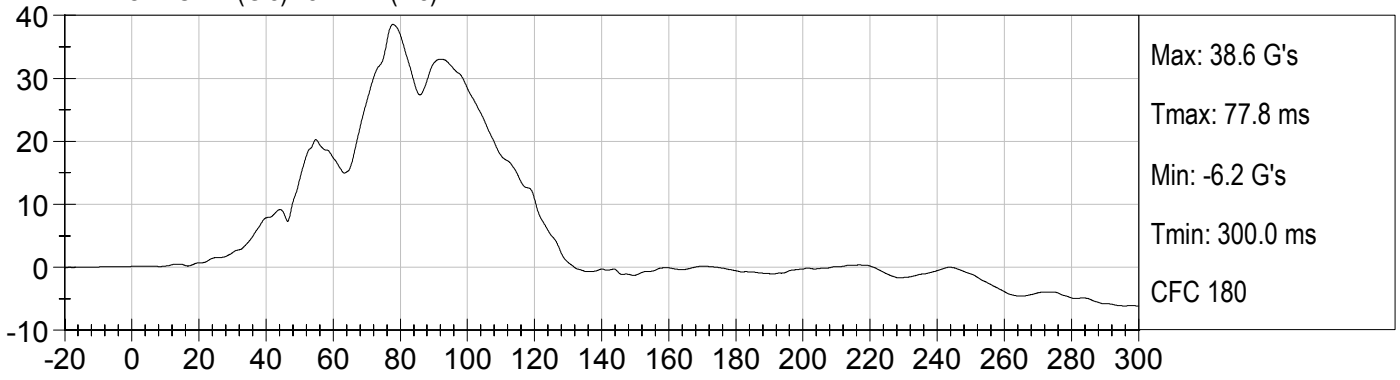
RRP HEAD Resultant (G's) vs TIME (ms)



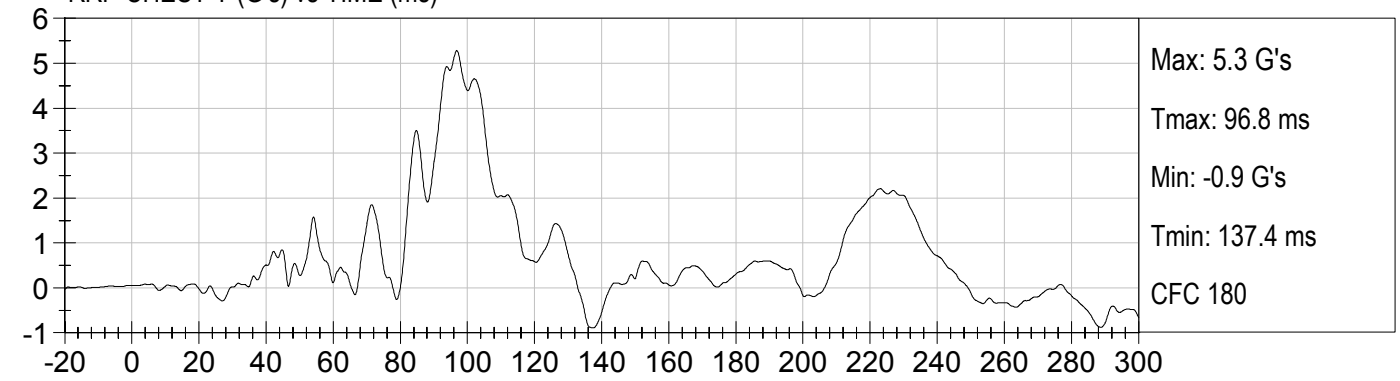
NCAP FRONTAL
2008 FORD FUSION F80202

Test Date: 10/02/2007
Speed: 35.0 mph (56.3 km/h)

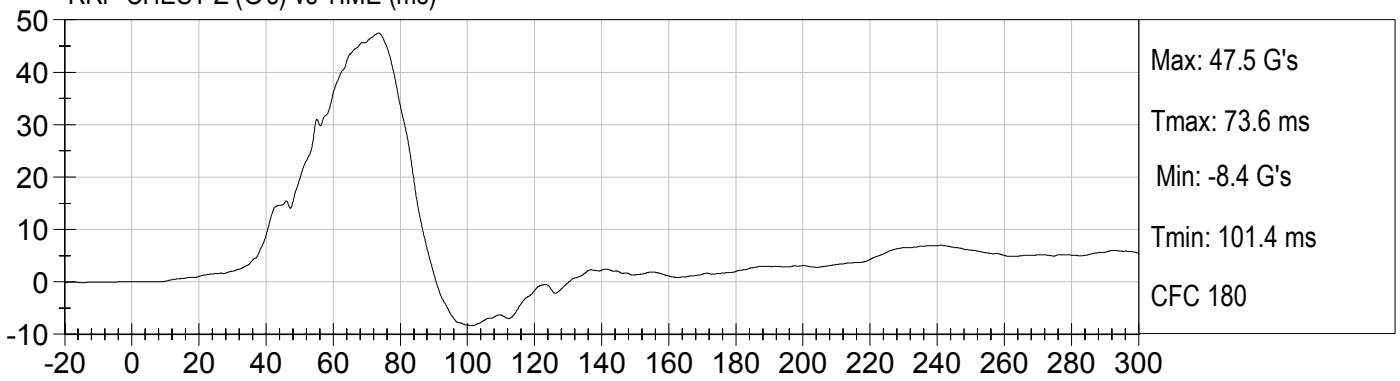
RRP CHEST X (G's) vs TIME (ms)



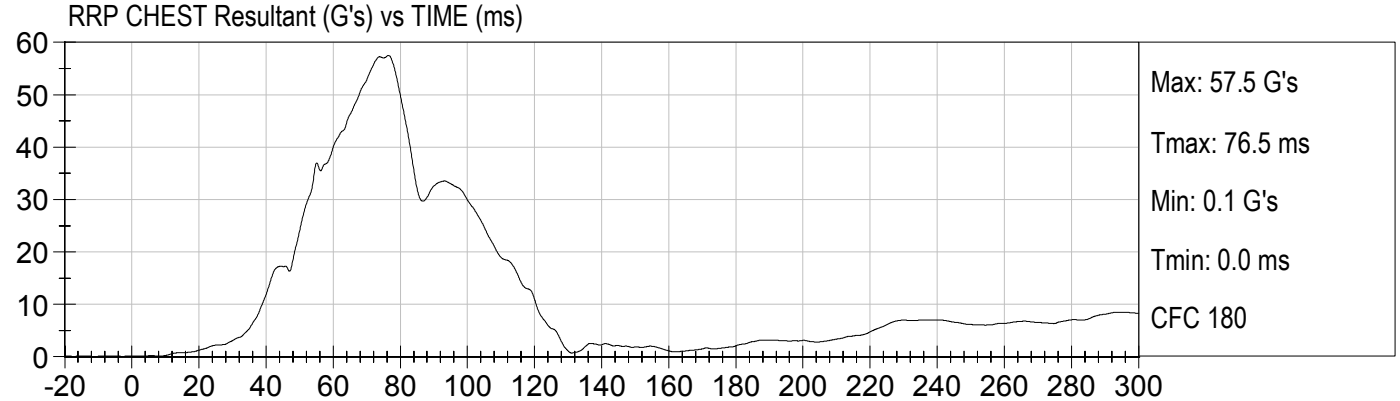
RRP CHEST Y (G's) vs TIME (ms)



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



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



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

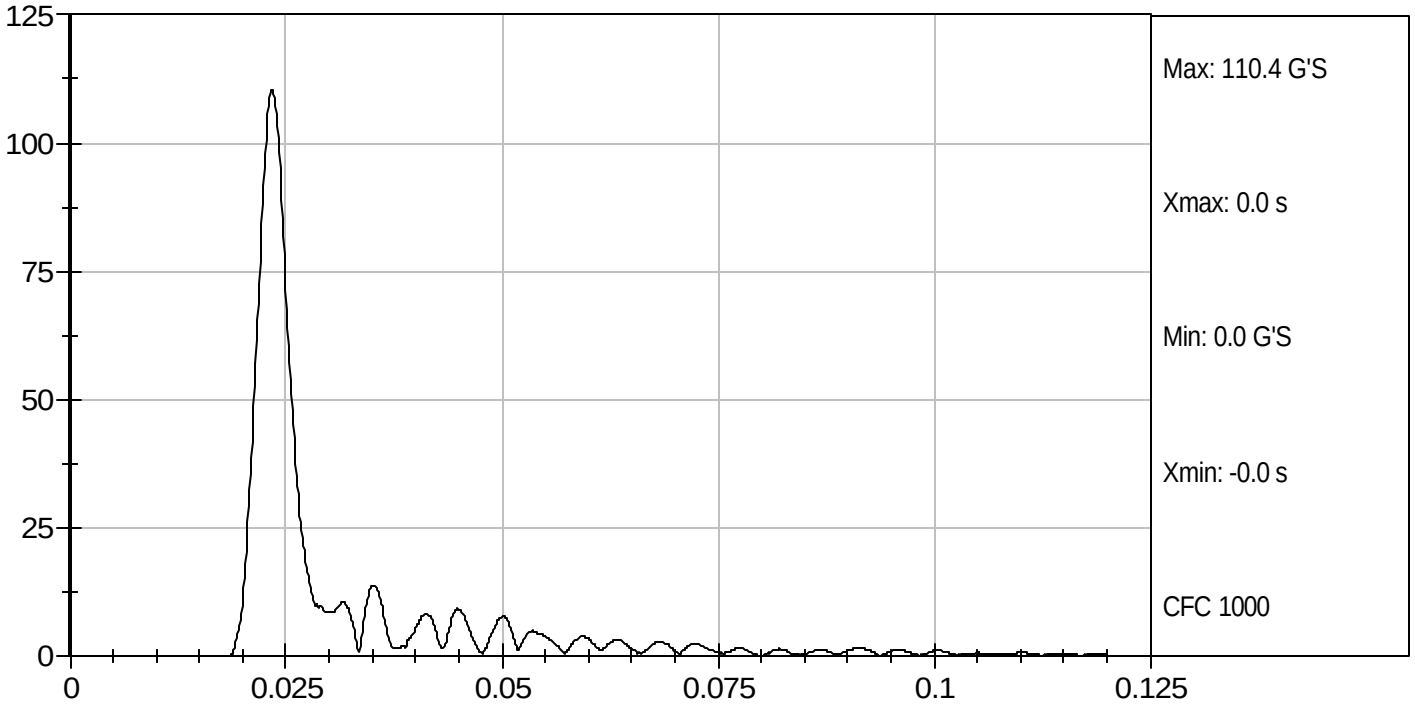
8/23/07
Test Date

David Winkelbauer
Approved By

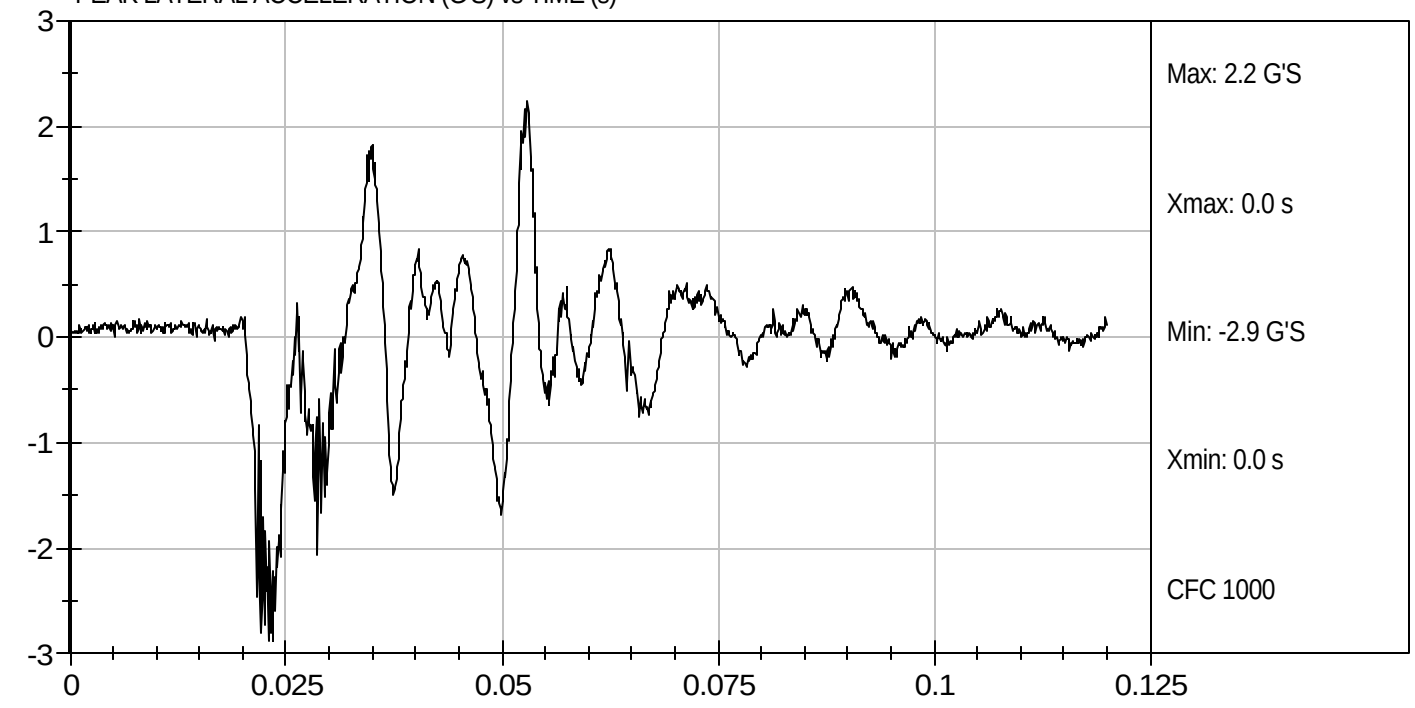
Test Desc: Head Drop
Component ID: D072541

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

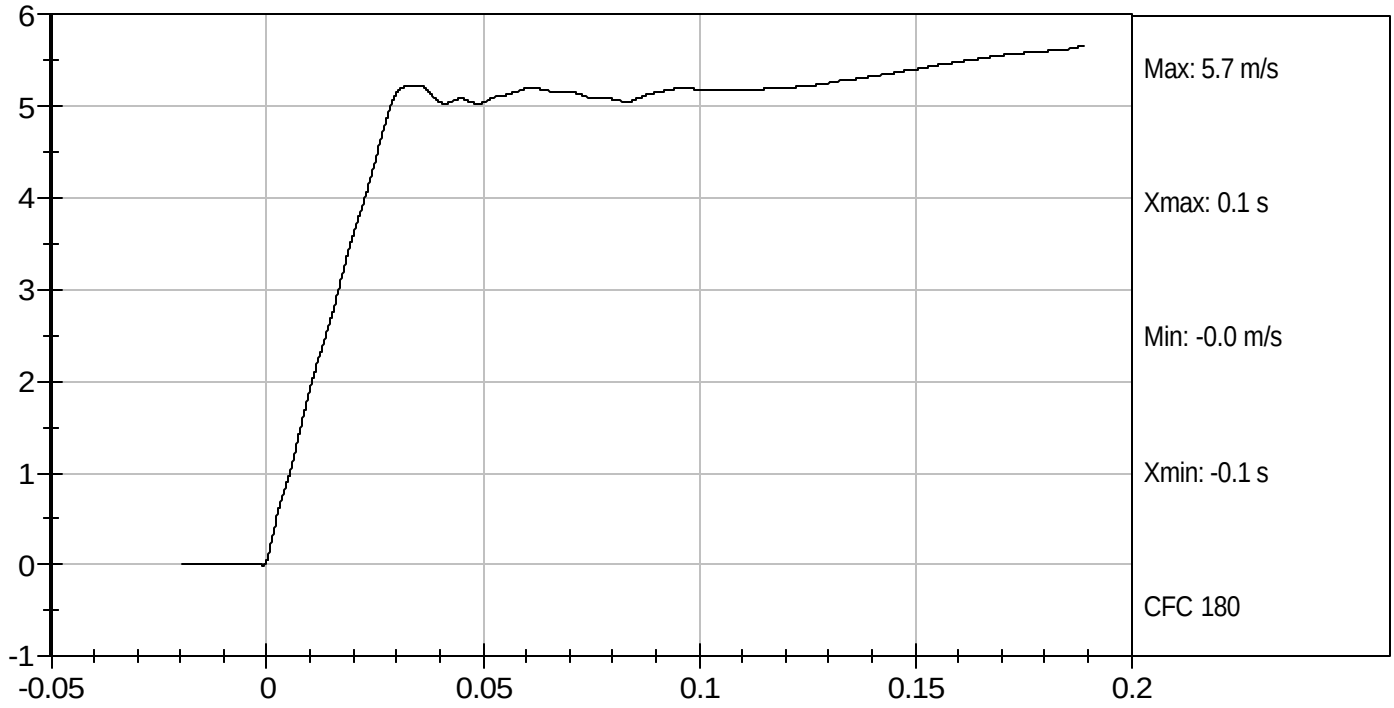
8/23/07
Test Date

David Winkelbauer
Approved By

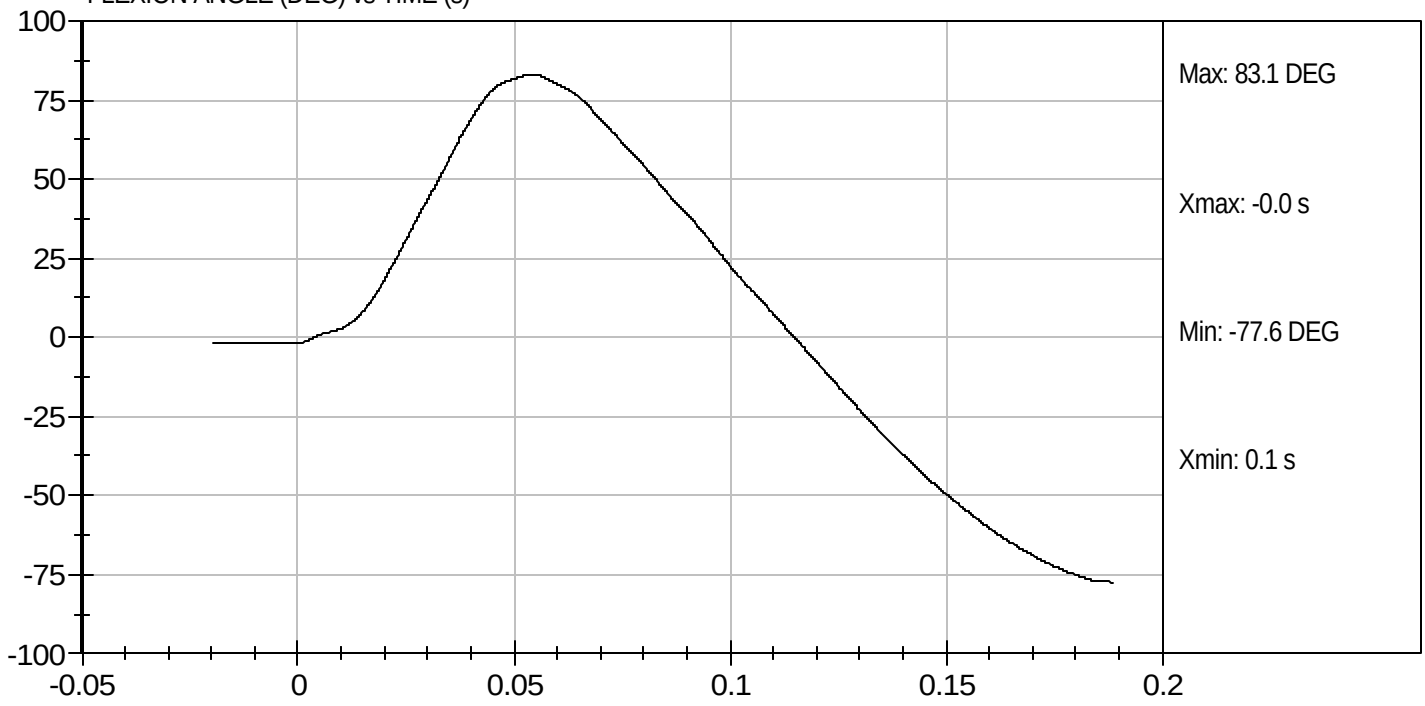
Test Desc: Neck Flexion
Component ID: D072542

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

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



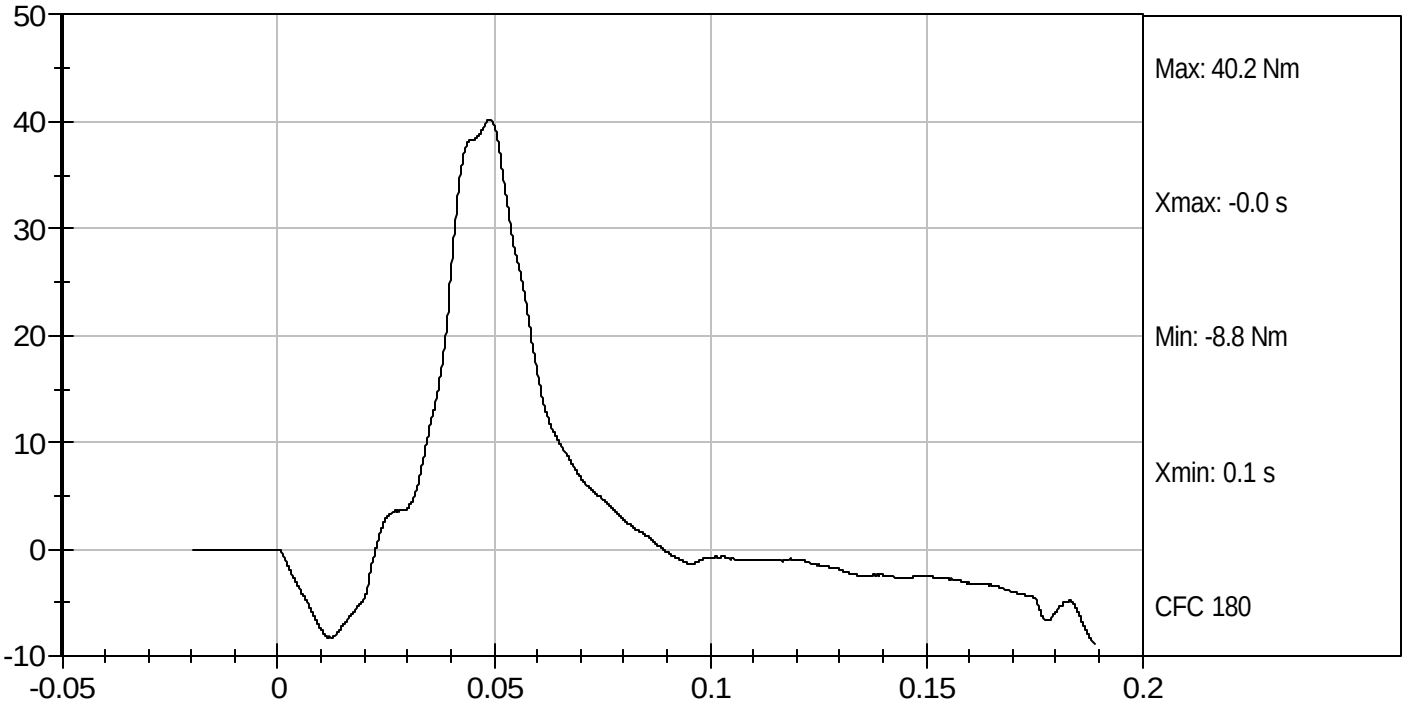
FLEXION ANGLE (DEG) vs TIME (s)



Test Desc: Neck Flexion
Component ID: D072542

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

OCCIPITAL MOMENT (Nm) vs TIME (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

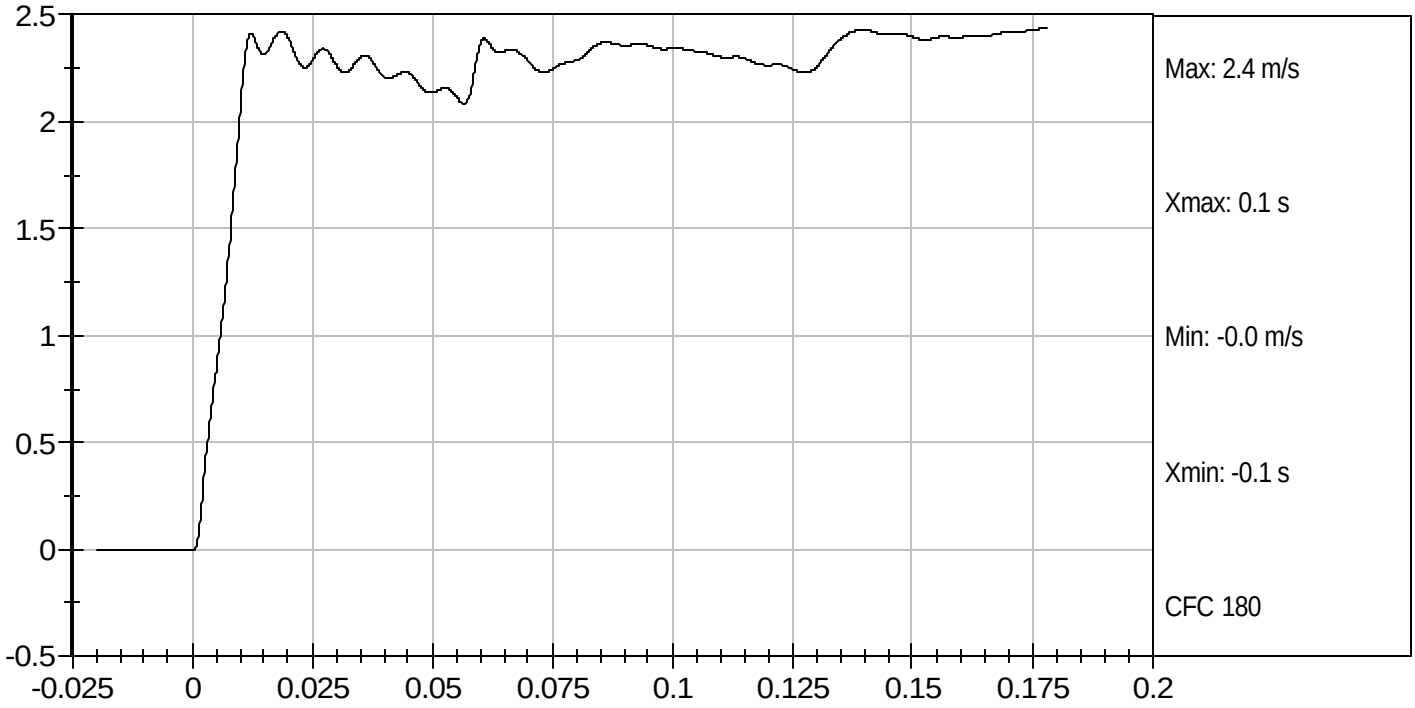
8/23/07
Test Date

David Winkelbauer
Approved By

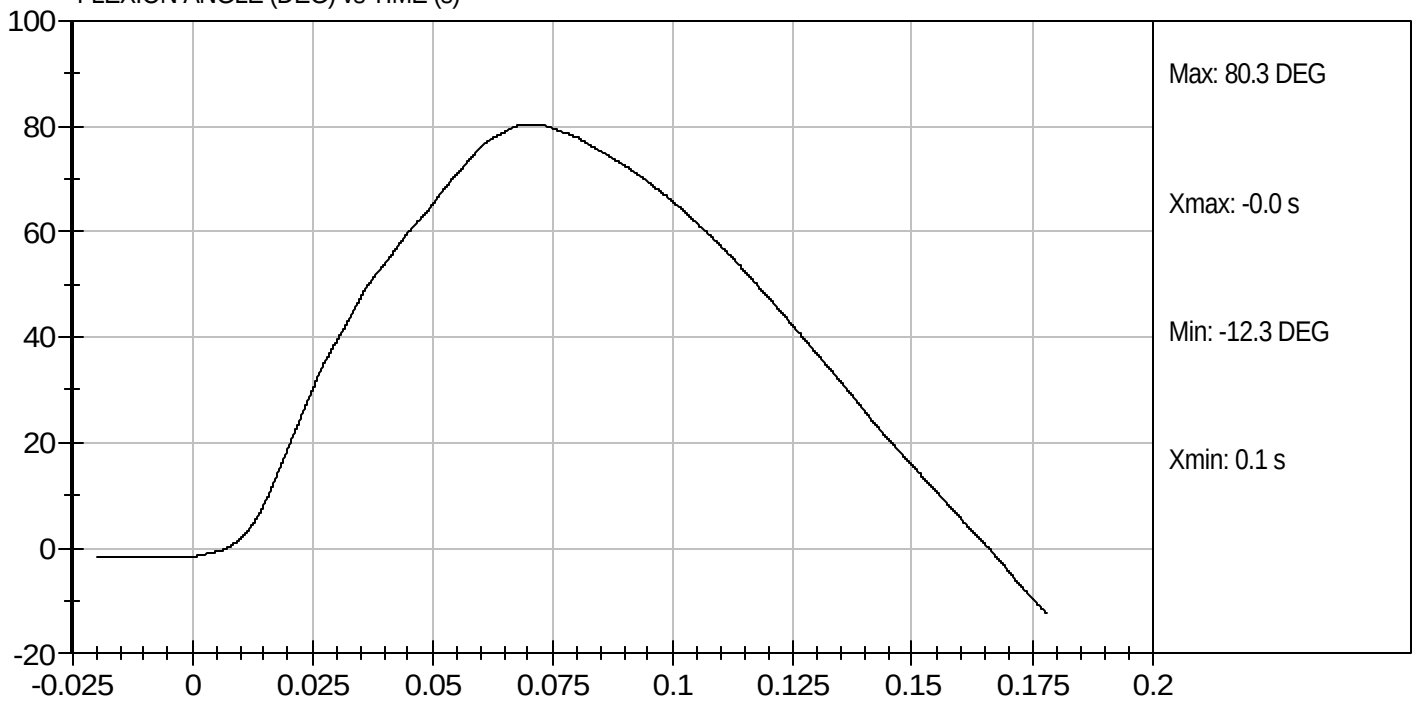
Test Desc: Neck Extension
Component ID: D072543

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

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

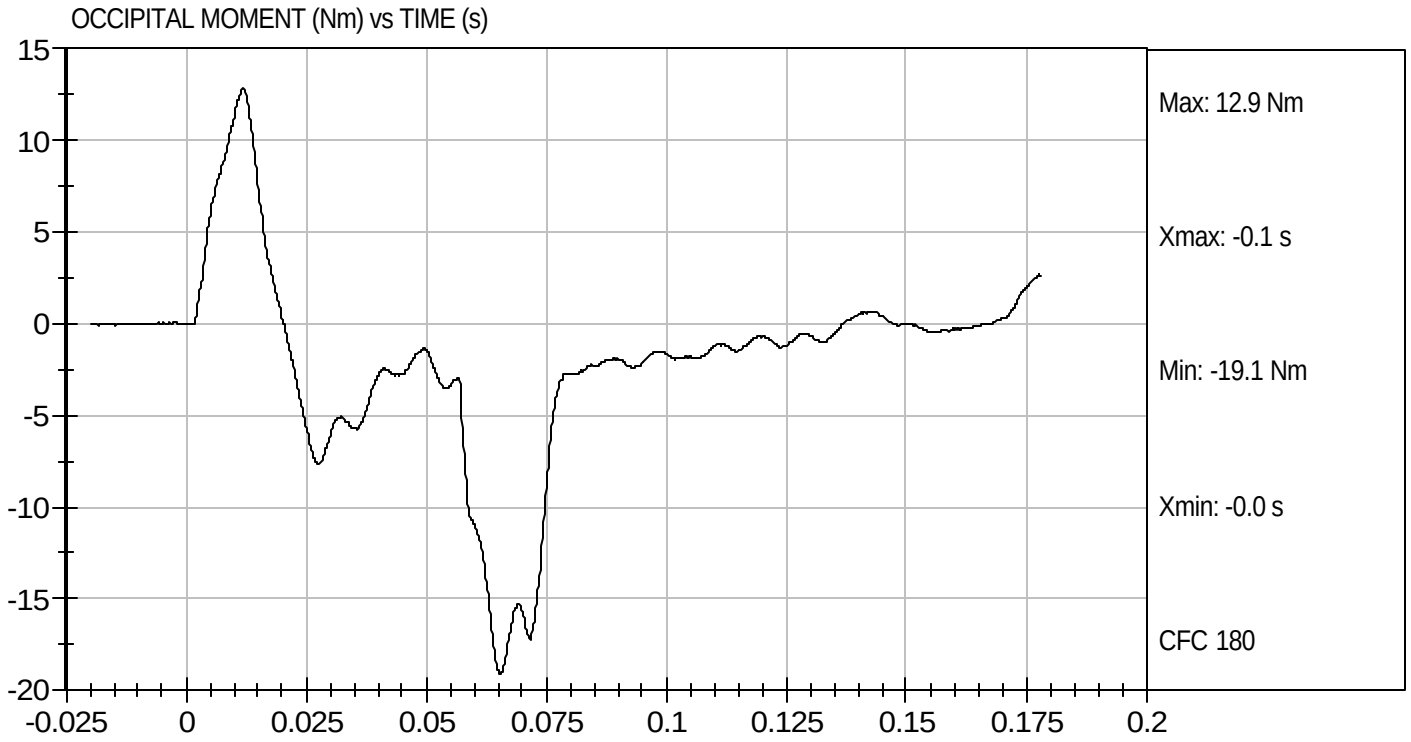


FLEXION ANGLE (DEG) vs TIME (s)



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

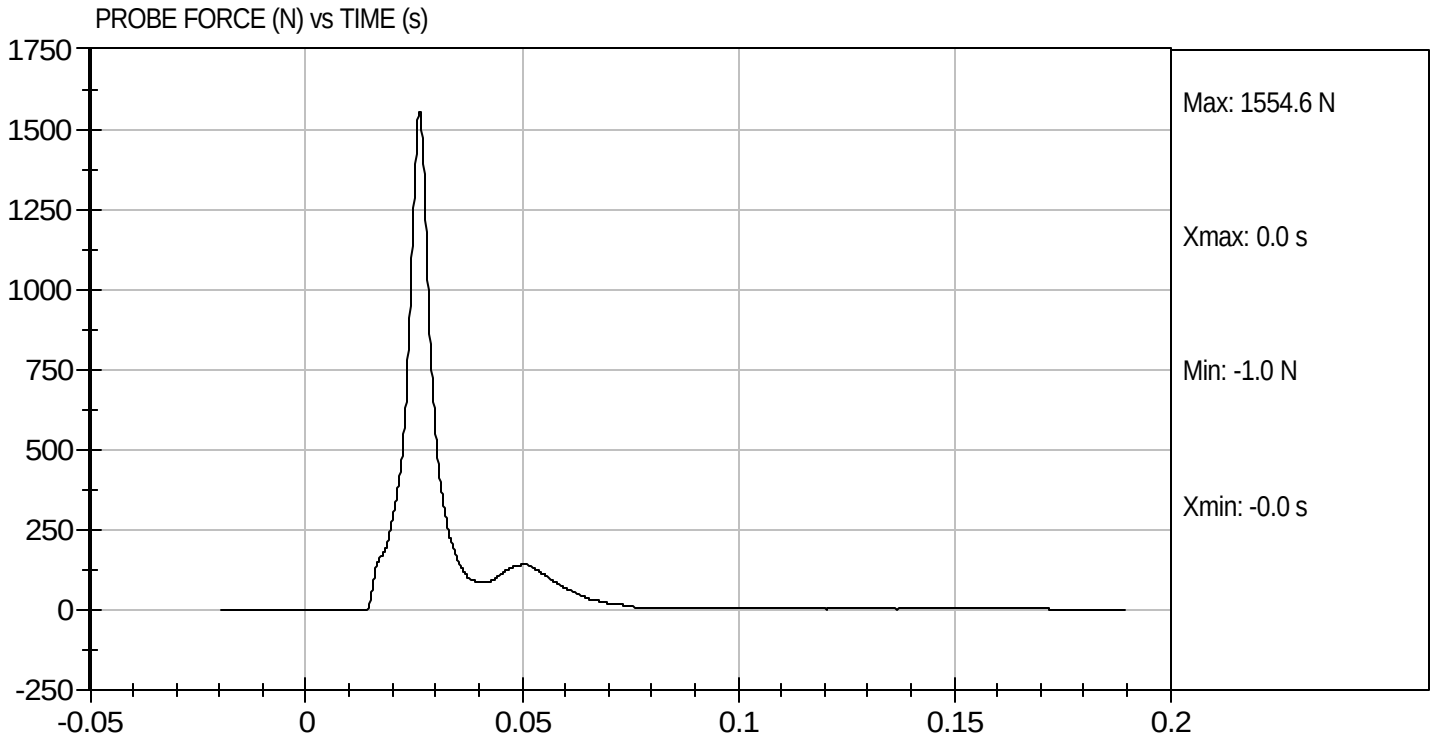
Laboratory Technician

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

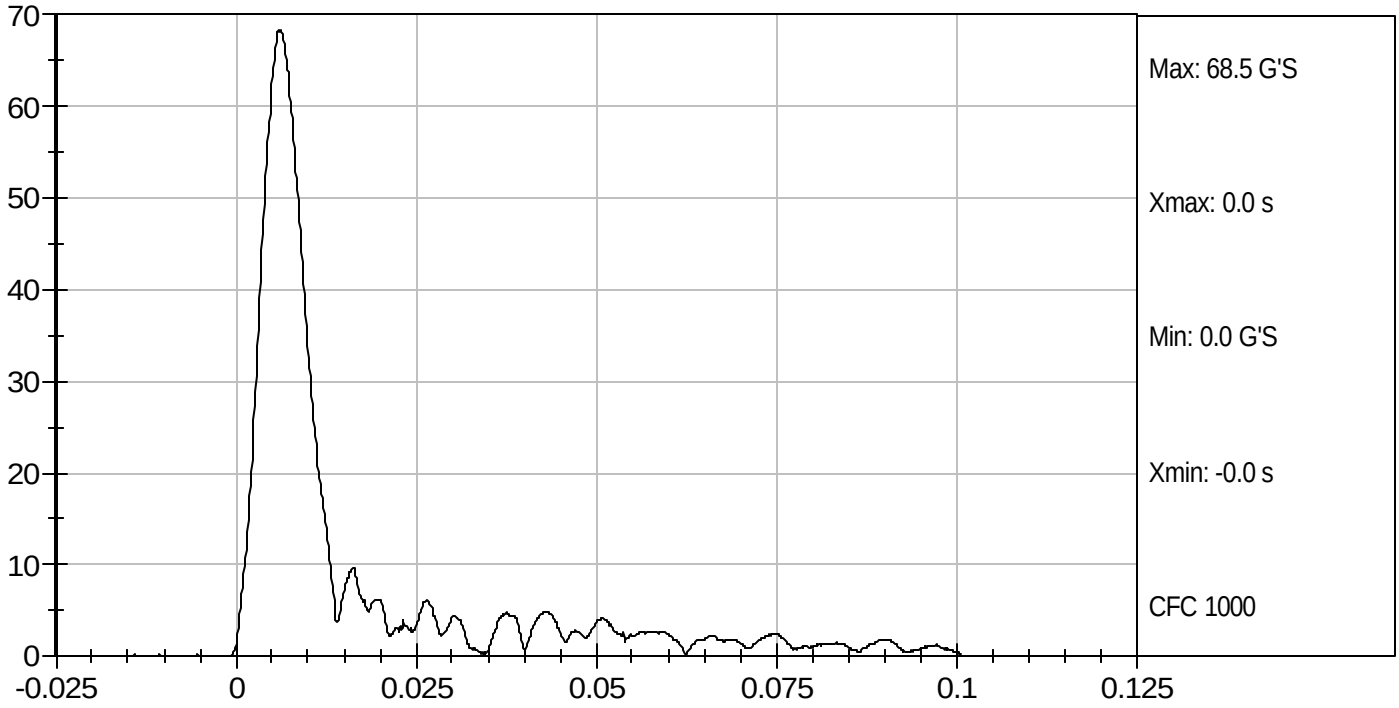
8/23/07
Test Date

David Winkelbauer
Approved By

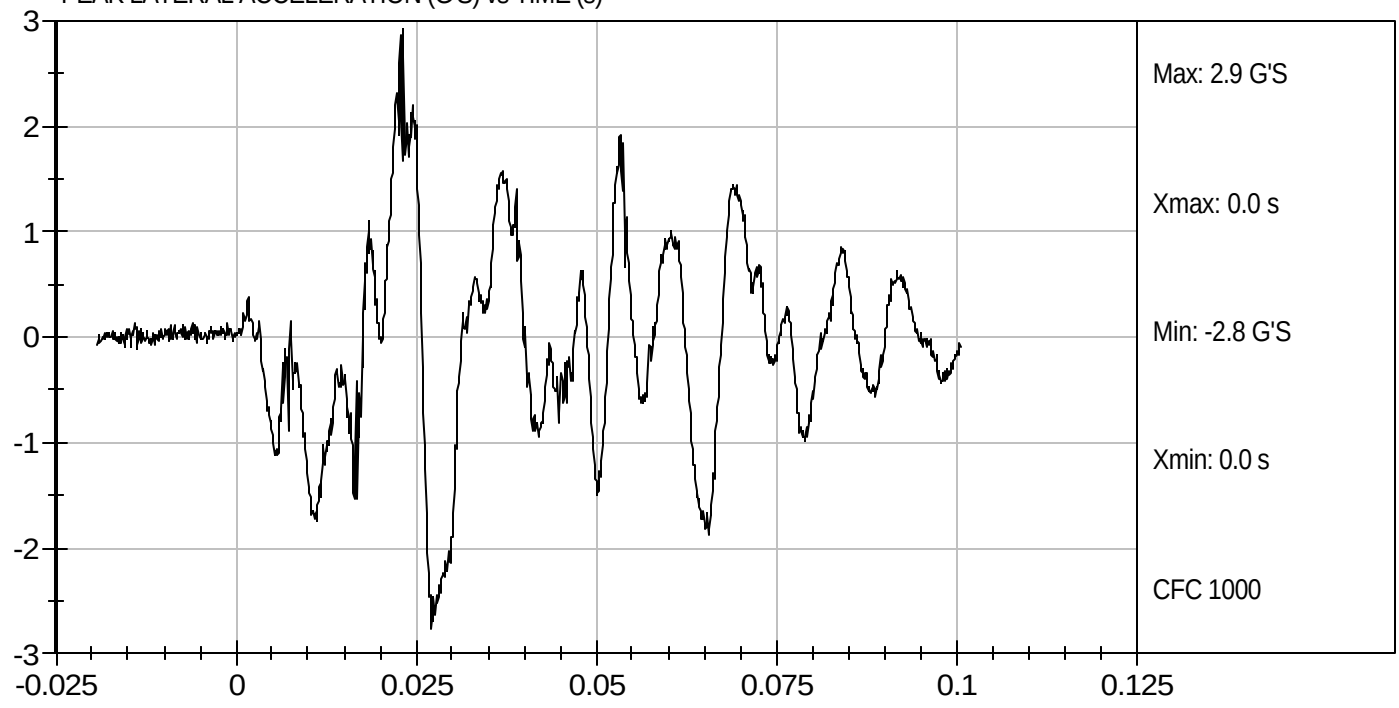
Test Desc: Head Drop
Component ID: D072545

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

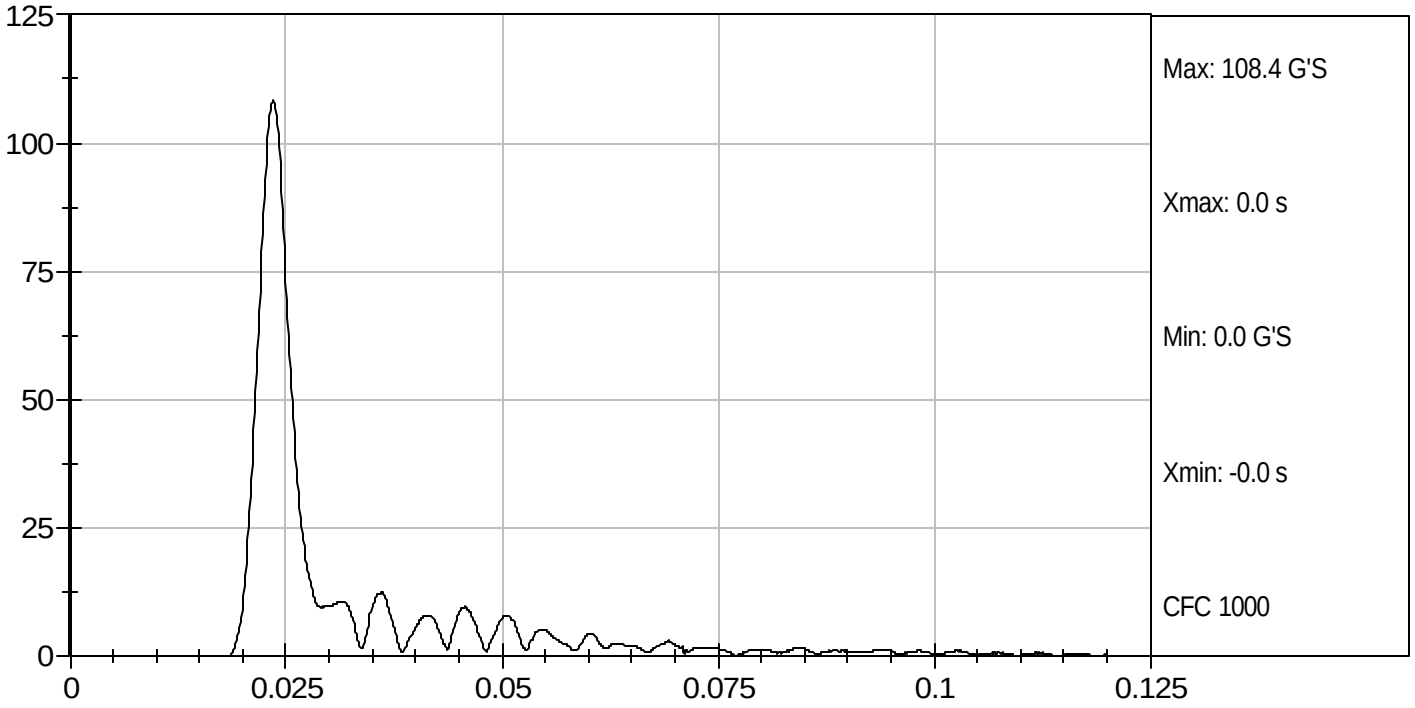
8/23/07
Test Date

David Winkelbauer
Approved By

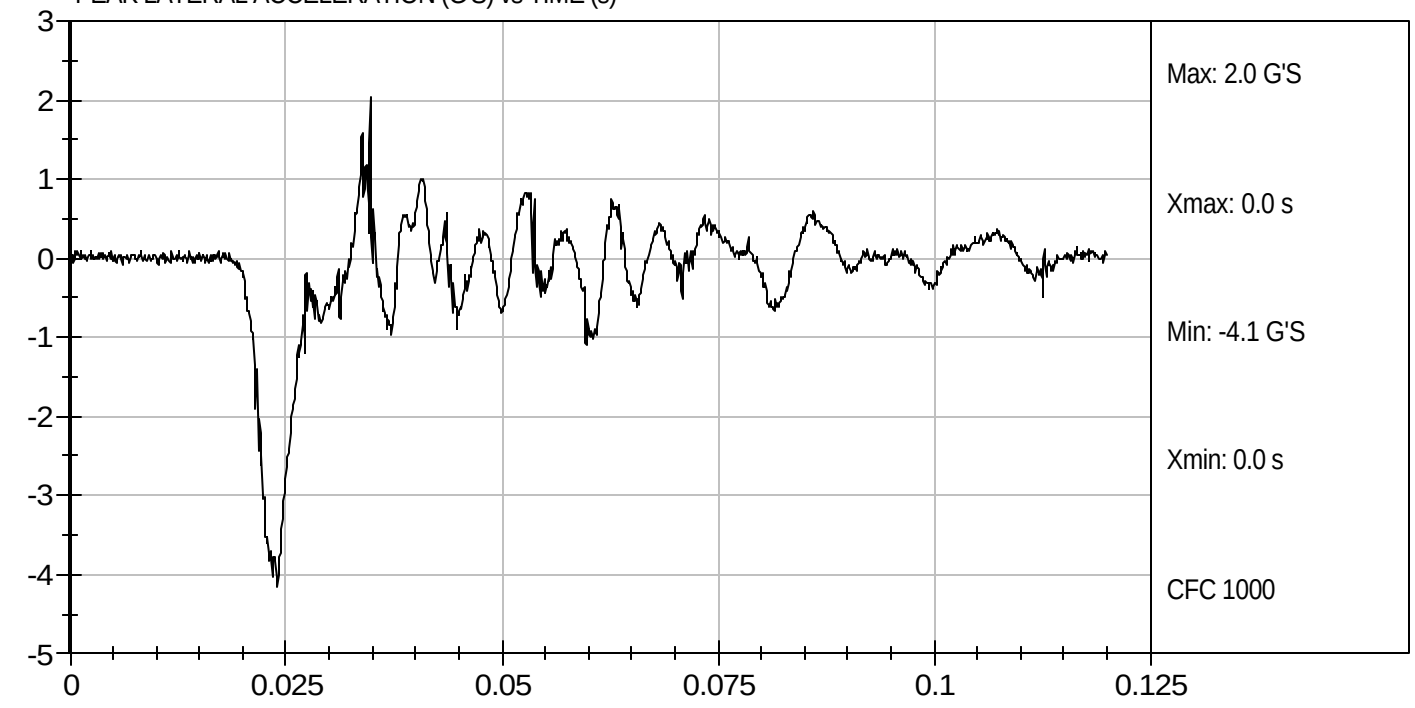
Test Desc: Head Drop
Component ID: D072531

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

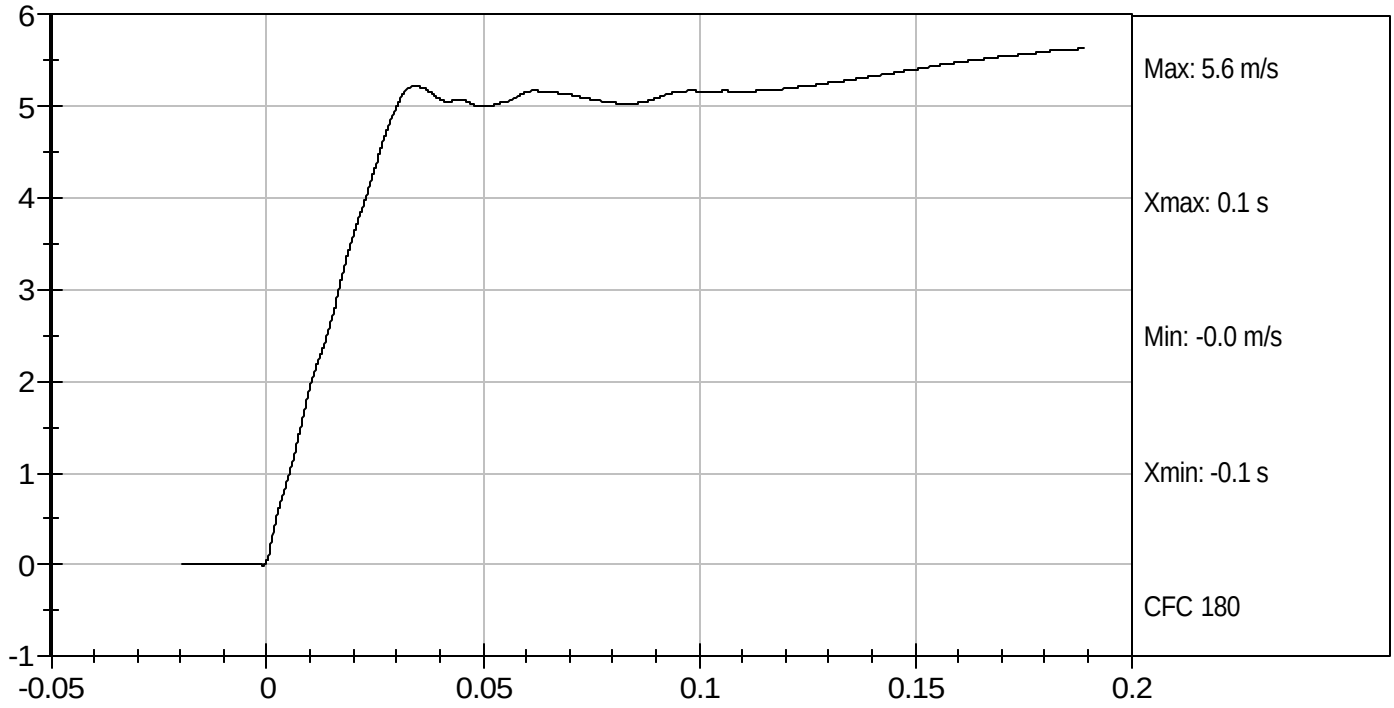
8/23/07
Test Date

David Winkelbauer
Approved By

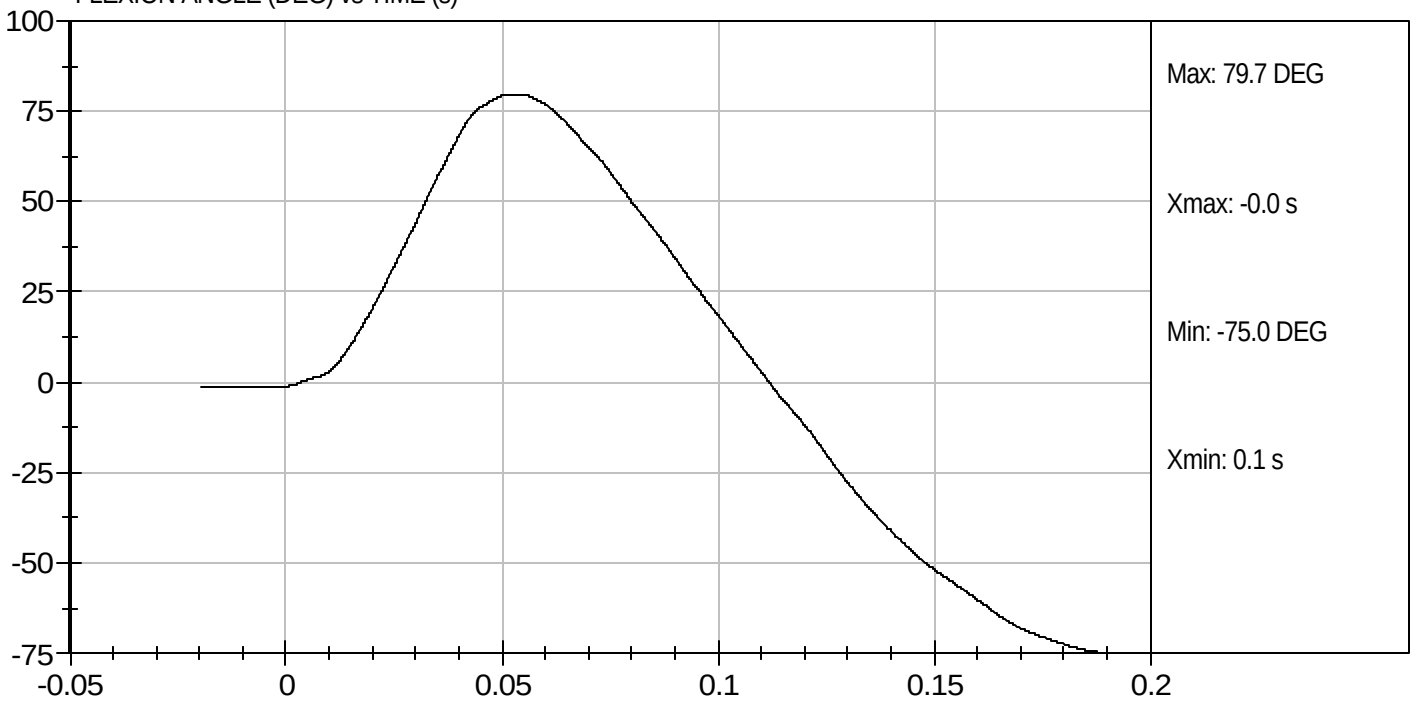
Test Desc: Neck Flexion
Component ID: D072532

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

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

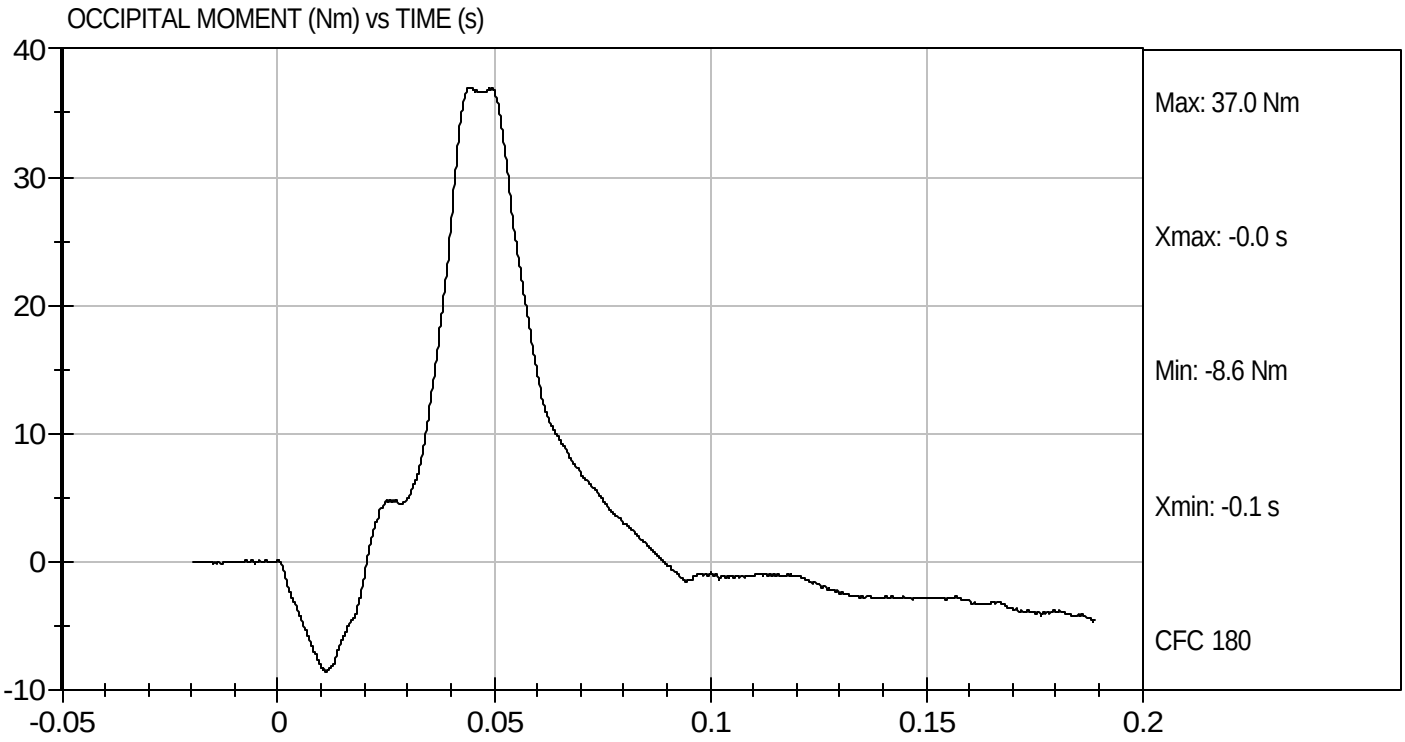


FLEXION ANGLE (DEG) vs TIME (s)



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

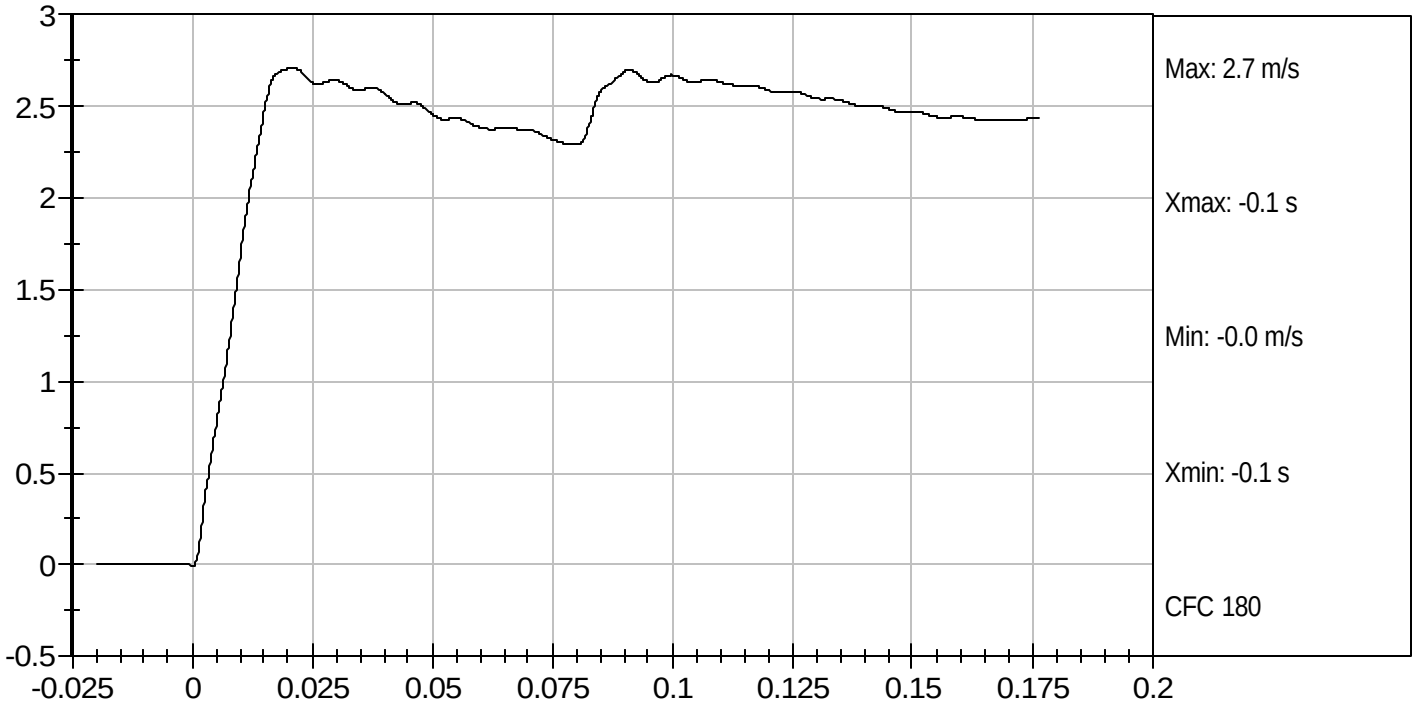
8/23/07
Test Date

David Winkelbauer
Approved By

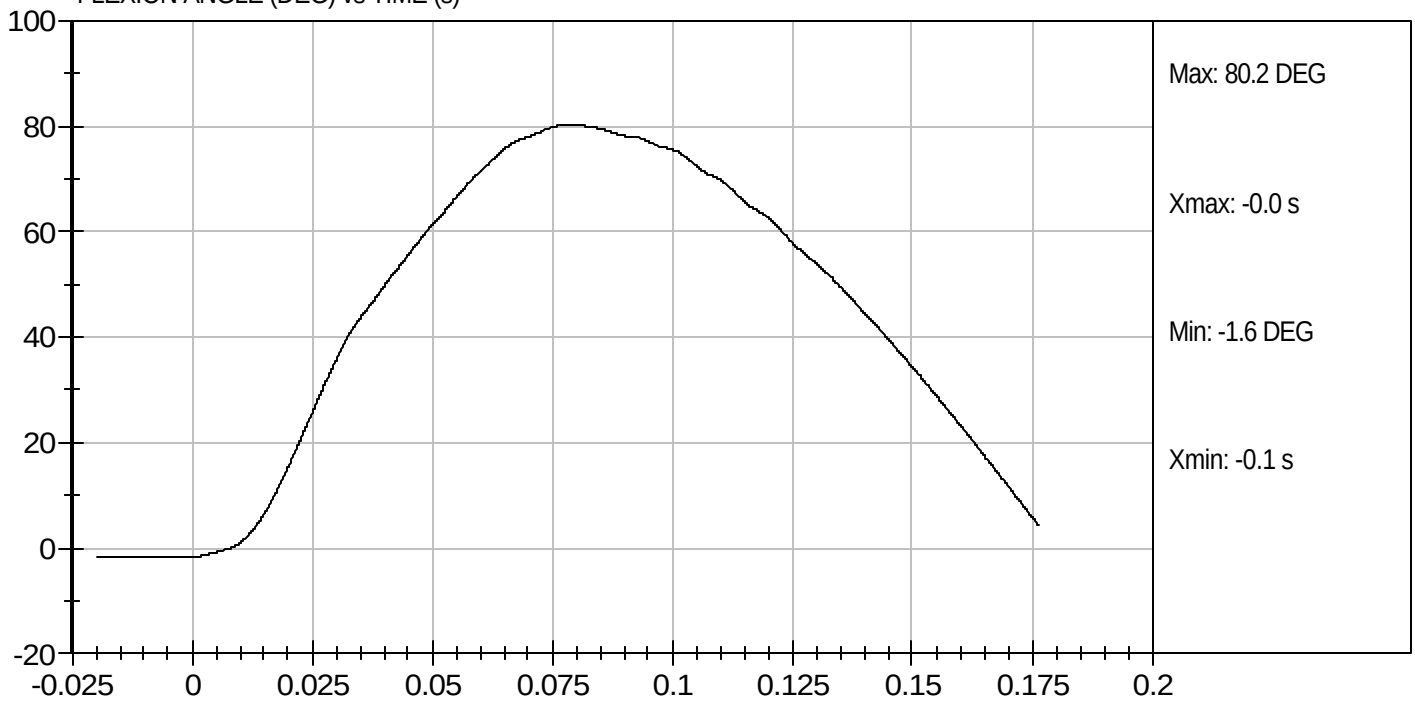
Test Desc: Neck Flexion
Component ID: D072533

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

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

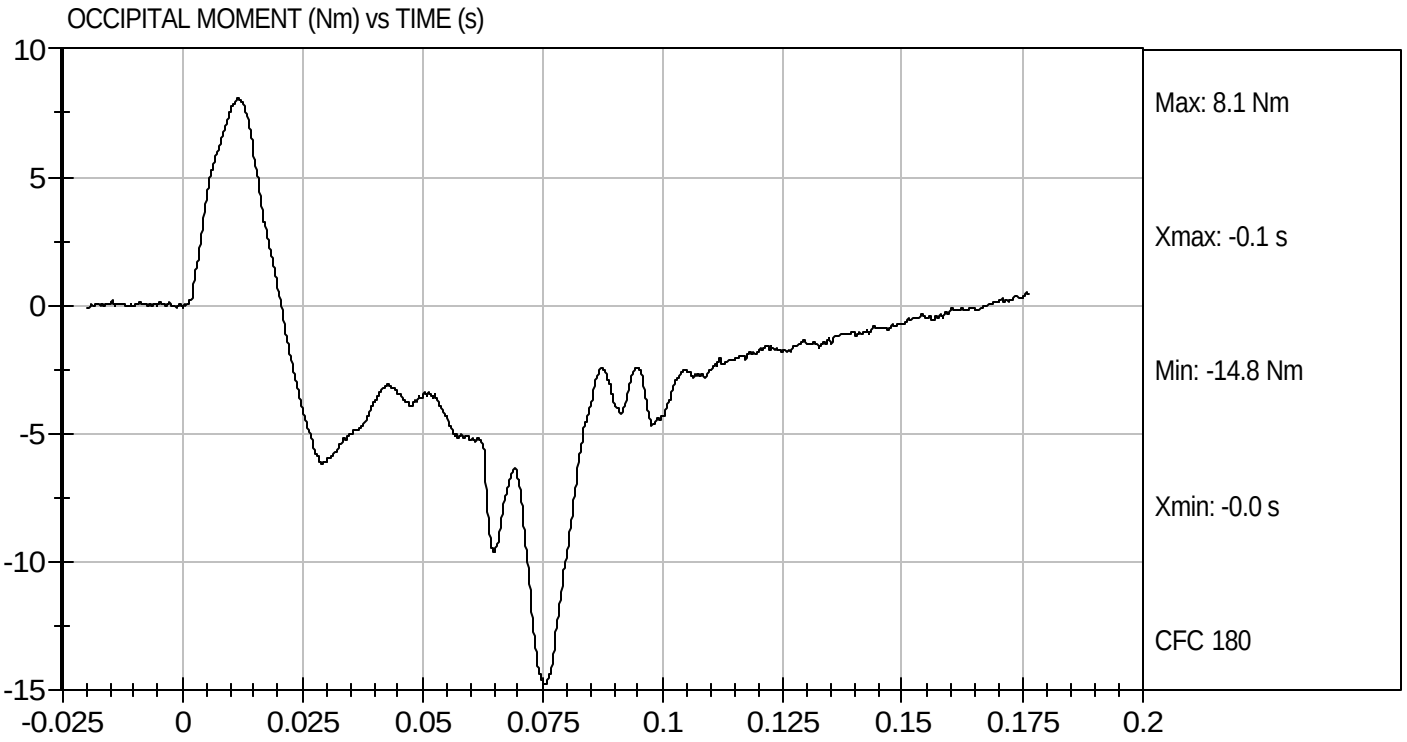


FLEXION ANGLE (DEG) vs TIME (s)



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

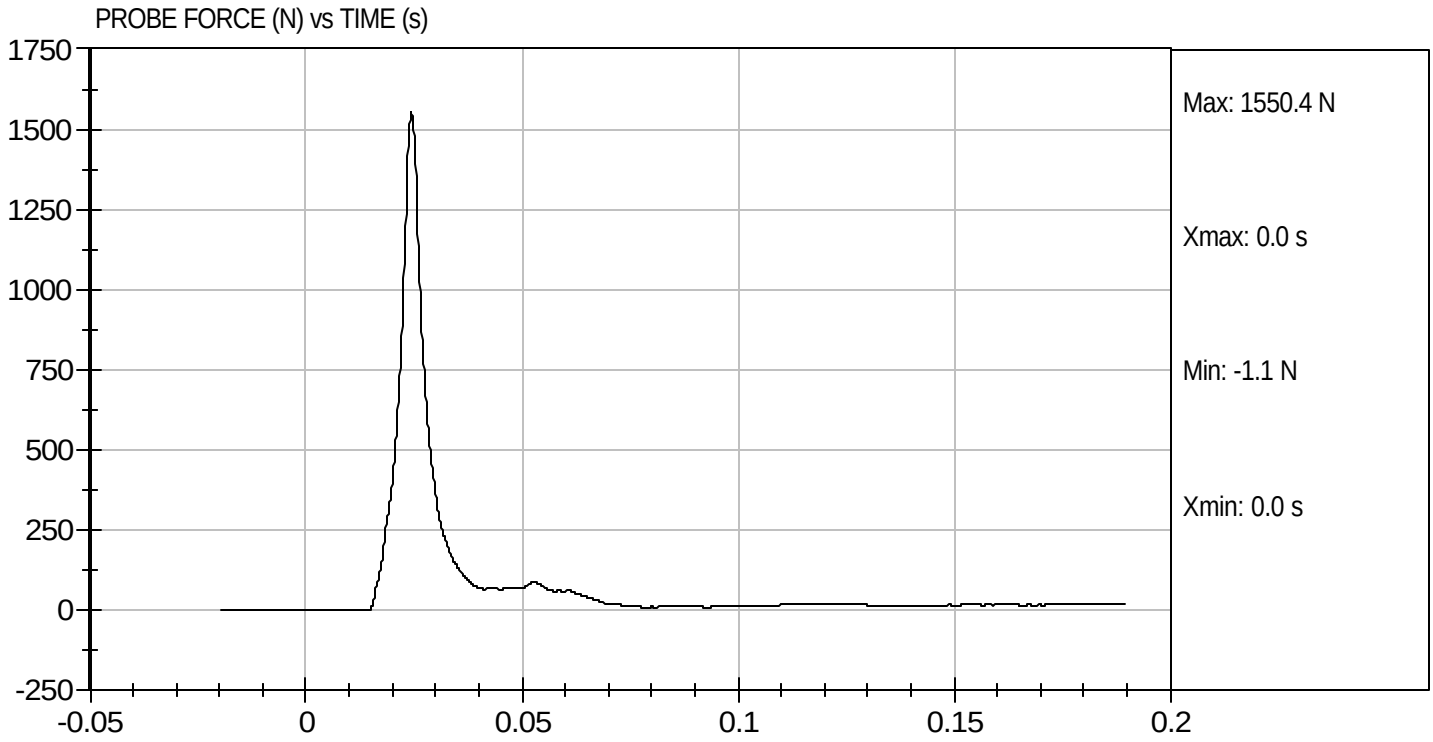
Laboratory Technician

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

Tim Brady
Laboratory Technician

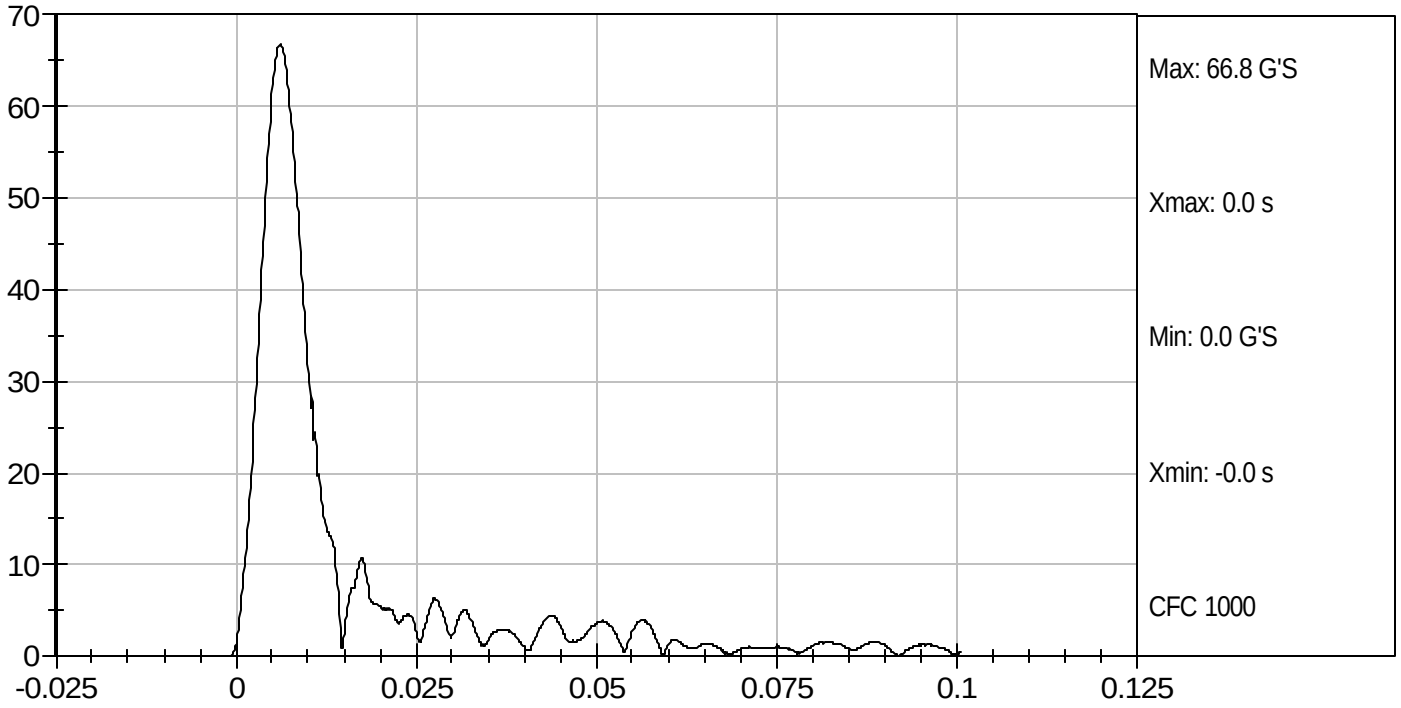
8/23/07
Test Date

David Winkelbauer
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)