REPORT NUMBER: NCAP-MGA-2006-005

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

FORD MOTOR COMPANY
2006 FORD FUSION
NHTSA NUMBER: M60203

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

Test Date: October 19, 2005

Final Report Date: November 10, 2005

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
400 SEVENTH STREET, SW, ROOM 5311
WASHINGTON, D.C. 20590

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Prepared by: Kristin L. Ebert Date: 11/10/05
Kristin Ebert, Project Engineer

Reviewed by: David Winkelbauer Date: 11/10/05
David Winkelbauer, Facility Director

Technical Report Documentation Page

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16. Abstract

A frontal barrier impact was conducted on a 2006 Ford Fusion at MGA Research Corporation on October 19, 2005. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The impact velocity was 56.5 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 610 mm located at the vehicle's centerline. The test vehicle is equipped with a 3-point continuous belt system and an airbag in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:

Measurement Description	Units	Threshold	Driver ATD	Pass. ATD
Head Injury Criteria (HIC)	N/A	1000	510	490
Max. Thorax Accel. (3ms Clip)	G's	60	43	46
Left Femur Force	Newton	10009	-2920	-4855
Right Femur Force	Newton	10009	-4550	-4246

17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2006 Ford Fusion NHTSA No: M60203		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Admin., Technical Ref. Division, Room 5108 (NPO-230) 400 Seventh Street, S.W. Washington, D.C. 20590	
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-01-D-12005. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact in excess of the current 48.3 kph requirements.

SUMMARY

A load cell barrier was impacted by a 2006 Ford Fusion at a velocity of 56.5 kph. The test was performed at MGA Research Corporation on October 19, 2005. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

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

The 104 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head, chest, and femur response data traces.

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

The maximum static crush of the vehicle was 610 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, chest, and abdomen contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted side header. 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	510	59.5	95.5	43	81.3	84.3	-29	-2920	-4550
Passenger	490	65.6	101.6	46	71.5	74.5	-32	-4855	-4246

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

TEST NOTES

No valid data was collected for the following:

Driver Left Upper Tibia MX
Driver Left Upper Tibia MY
Driver Left Upper Tibia FZ
Passenger Right Ankle X – after 64msec
Top of Engine X – after 48msec

There was separation of the unibody on the right side of the vehicle located about 140mm behind the right side of the engine crossmember. The length of separation was approximately 465mm and was 60mm at the widest point.

There was separation of the right front passenger's toepan between rows 1 and 2 and columns A to B. The length of separation was approximately 140mm and 30mm at the widest point.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None
Glazing Damage	The windshield cracked	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	440
Center	mm	395
Right Side	mm	430
Average	mm	422

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	843	892
Lap belt length as measured on ATD	mm	810	696
Remainder of belt on reel	mm	1470	1474
Total belt length for continuous webbing systems	mm	3123	3062

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005

TEST VEHICLE INFORMATION

Manufacturer	Ford
Model	Fusion
Body Style	Sedan
NHTSA No.	M60203
VIN	3FAHP08186R102253
Color	Dark Blue Pearl
Delivery Date	10/06/05
Odometer Reading (mile)	60
Dealer	Gordie Boucher Ford
Transmission	Automatic
Final Drive	Front
Number of Cylinders	6
Engine Displacement (L)	3.0
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	Yes
All Wheel Drive	No
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Ford Motor Company
Date of Manufacture	08/05

GVWR (kg)	1987
GAWR Front (kg)	1084
GAWR Rear (kg)	925

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				385
Cargo Wt. (RCLW) (kg)				45.4

DATA SHEET NO. 2... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	482.5	319.5		524.0	379.0	
Right	kg	477.5	307.5		514.5	363.0	
Ratio	%	60.5	39.5		58.3	41.7	
Totals	kg	960.0	627.0	1587.0	1038.5	742.0	1780.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1587.0
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	45.4
Calculated Vehicle Target Weight (TVTW)	kg	1788.4

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG(aft of front axle)
As Delivered	mm	728	727	736	737	1079
As Tested	mm	713	715	698	693	1138
Post Test	mm	737	764	676	657	

Vehicle Wheelbase (mm): 2730

Weight of Ballast secured in cargo area (kg): 18.1

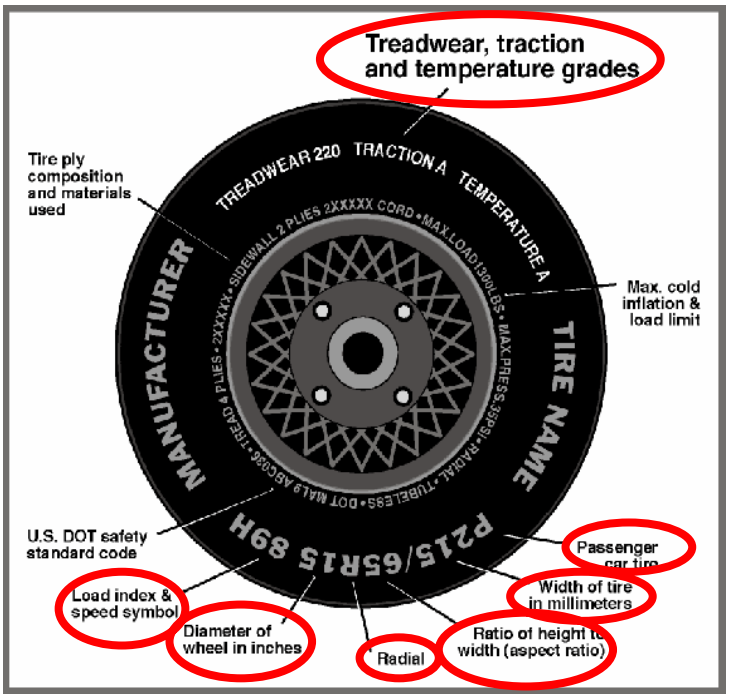
Vehicle Components Removed: Spare tire, tools, jack, trunk interior, rear seat cushion

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (max)	230	230
Recommended Tire Size	P225/50R17	P225/50R17
Tire size on Vehicle	P225/50R17	P225/50R17
Tire Manufacturer	Michelin	Michelin
Tire Name	Pilot HX MXM4	Pilot HX MXM4
Tire Type	Passenger	Passenger
Tire Width (mm)	225	225
Ratio of Height to Width (aspect ratio)	50	50
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	93V	93V
Treadwear	300	300
Traction Grade	A	A
Temperature Grade	A	A

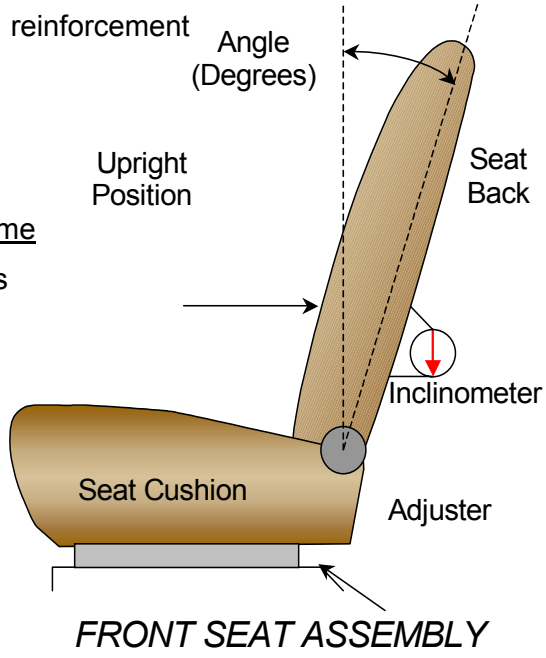
DATA SHEET NO. 4

TEST VEHICLE INFORMATION

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Measure the seatback angle relative to the rocker sill. Remove the seat back panel and position the inclinometer 13 inches above the back pivot point on the rear outboard seat frame. Avoid reinforcement plates.



FRONT SEAT ASSEMBLY

Driver seat back angle: 24.4 on the rear inboard seat frame

Passenger seat back angle: 24.5 on the rear inboard seat frame

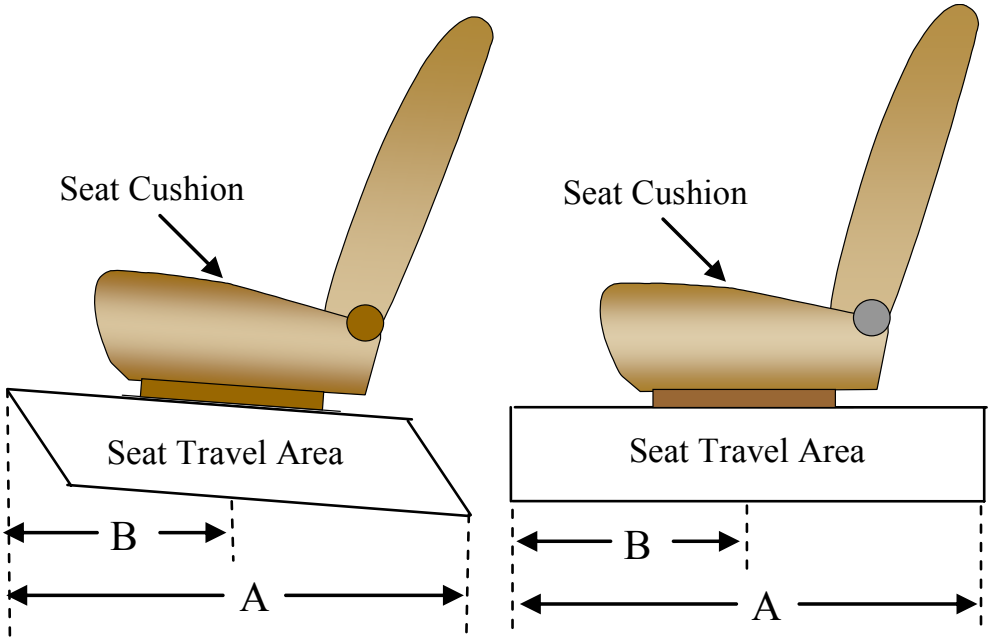
*measured off inboard seat frame as to not affect side airbags

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in position #
Driver Seat	261mm	131 from full forward
Passenger Seat	234mm	117 from full forward

ADJUSTABLE D-RING POSITION

The D-Ring was placed in the first detent down from the upper most position.

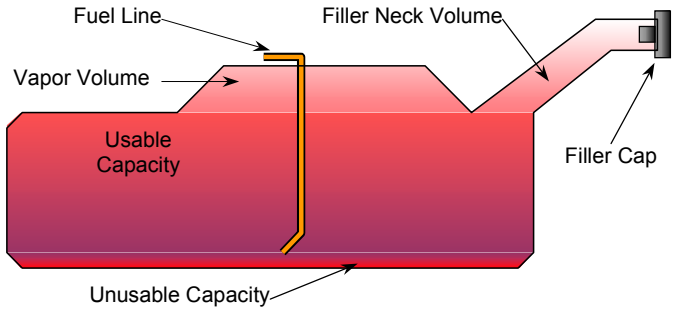


DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

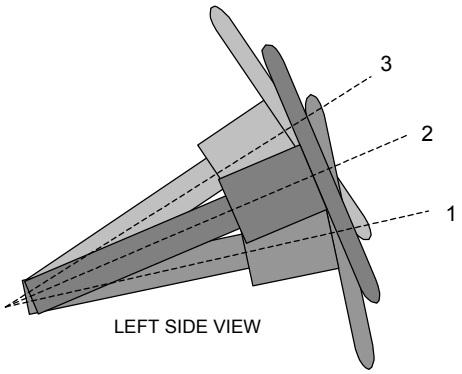
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	66.2
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	60.9 to 62.2
Actual Amount of Solvent used	61.7
1/3 of Usable Capacity	20.1



VEHICLE FUEL TANK ASSEMBLY

The test vehicle is equipped with an electric fuel pump that 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.



STEERING COLUMN 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 POSITIONS

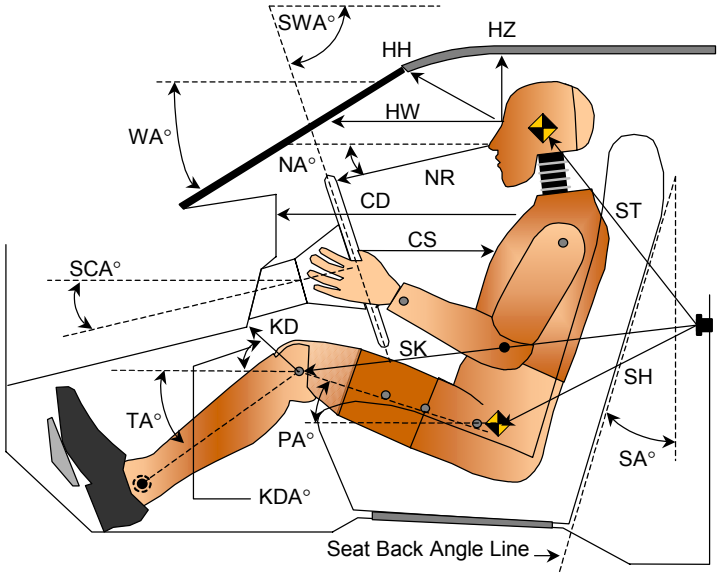
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1		20.4
Geometric center position No. 2		23.4
Uppermost position No. 3		26.4

DATA SHEET NO. 5

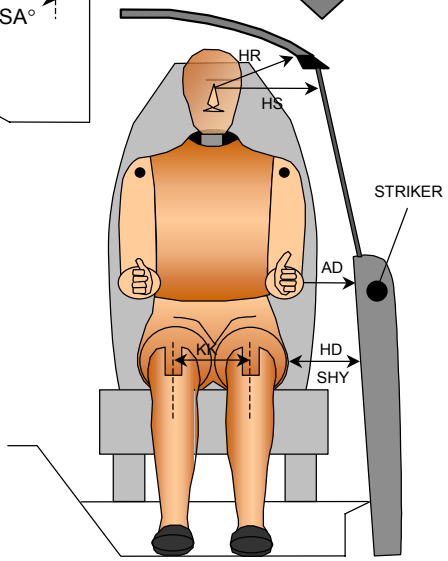
DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

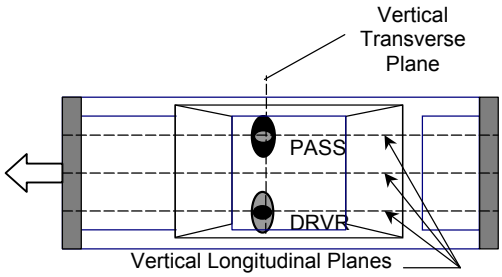
DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS



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: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

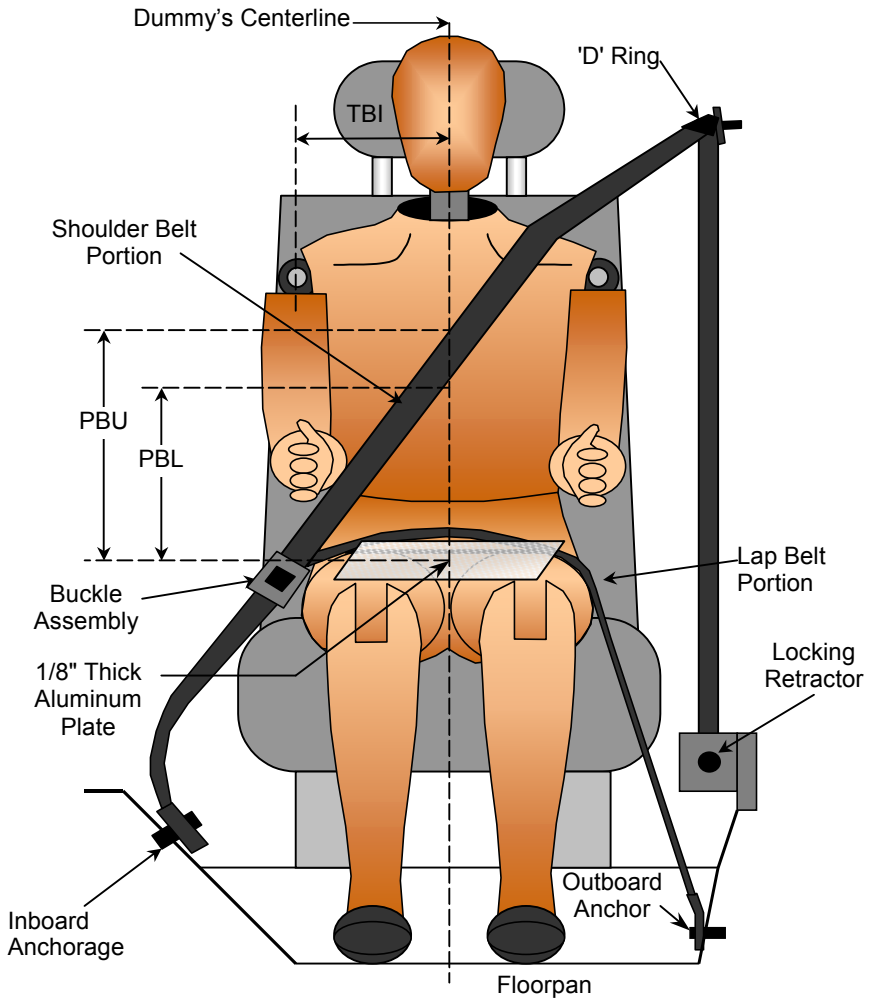
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		26.8		
SWA	Steering Wheel Angle		67.0		
SCA	Steering Column Angle		23.3		
SA	Seat Back Angle		24.4		24.5
HZ	Head to Roof (Z)	160	90.0	124	90.0
HH	Head to Header	323	27.5	331	19.2
HW	Head to Windshield	625	0.0	558	0.0
HR	Head to Side Header (Y)	216		179	
NR	Nose to Rim	401	8.9		
CD	Chest to Dash	545		557	
CS	Chest to Steering Hub	317	11.3		
RA	Rim to Abdomen	185	0.0		
KDL	Left Knee to Dash	172	10.3	148	
KDR	Right Knee to Dash	85		168	26.4
PA	Pelvic Angle		24.1		24.5
TA	Tibia Angle		45.7		41.5
KK	Knee to Knee (Y)	343		295	
SK	Striker to Knee	560	94.1	574	92.2
ST	Striker to Head	498	2.2	522	6.2
SH	Striker to H-Point	238	124.5	196	120.0
SHY	Striker to H-Point (Y)	275		283	
HS	Head to Side Window	333		313	
HD	H-Point to Door (Y)	152		146	
AD	Arm to Door (Y)	149		137	
AA	Ankle to Ankle	370		265	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
TBI - Dummy centerline to shoulder bolt	mm	225	225
PBU - Top surface of reference to belt upper edge	mm	335	336
PBL - To surface of reference to belt lower edge	mm	262	262

DATA SHEET NO. 7

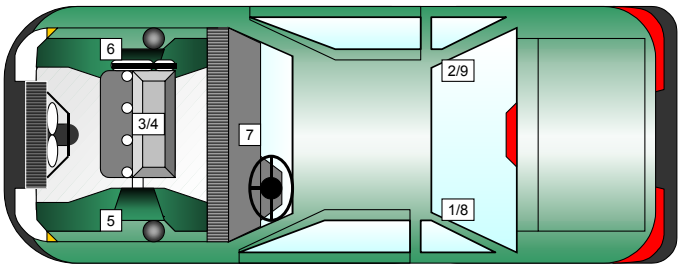
VEHICLE ACCELEROMETER LOCATIONS

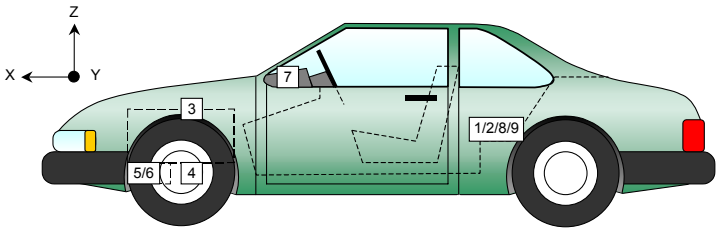
Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1855	-330	395
2	Right Rear X-Member X	1855	330	395
3	Engine Top X	3900	-60	910
4	Engine Bottom X	4130	-75	235
5	Left Brake Caliper X	3970	-690	270
6	Right Brake Caliper X	3970	690	270
7	Instrument Panel X	3075	0	990
8	Left Rear X-Member Z	1855	-330	395
9	Right Rear X-Member Z	1855	330	395

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: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005

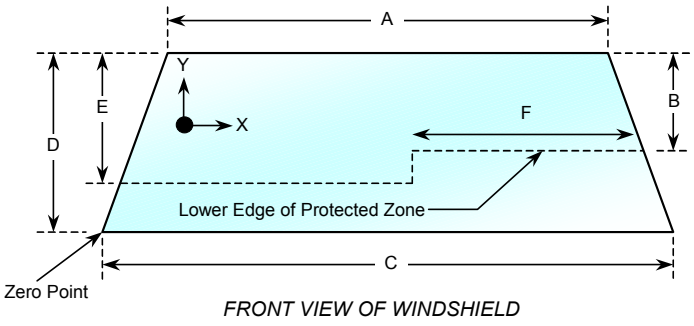
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2129	2129	100
Right Side	2129	2129	100
Total	4258	4258	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1142
B	mm	510
C	mm	1428
D	mm	844
E	mm	536
F	mm	507

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: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 11:57 am

Stoddard Solvent Spillage Measurements

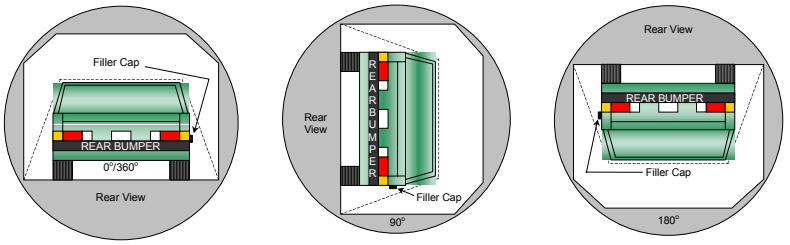
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

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

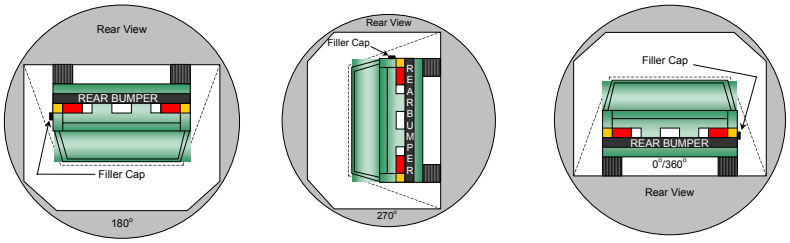
C. For the following 25 minutes: 0 oz.
(Maximum Allowable = 1 oz. /minute)

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°	159	300	0
90° to 180°	147	300	0
180° to 270°	135	300	0
270° to 360°	158	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

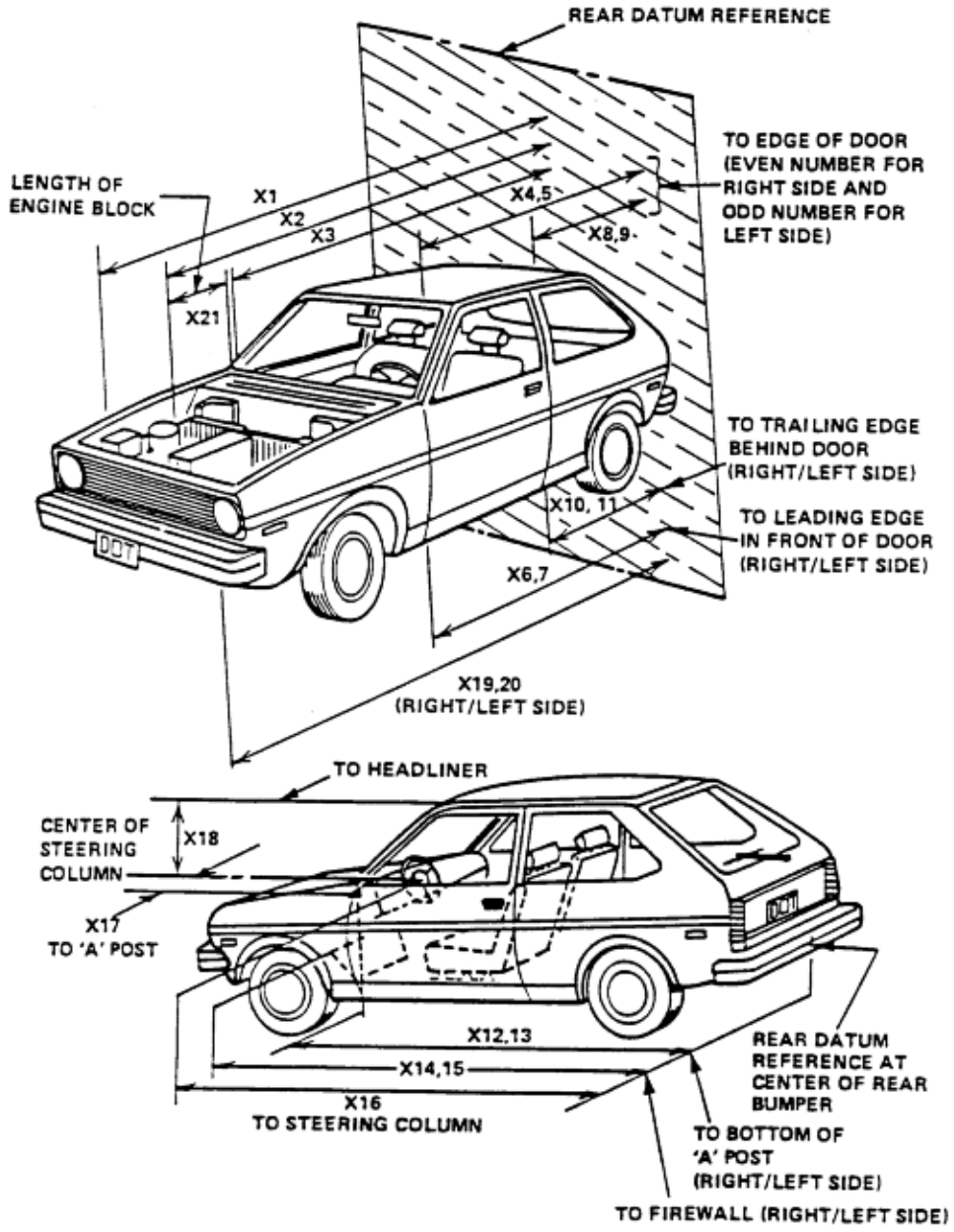
Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4842	4232	610
2	RSOV to front of engine	mm	4152	3794	358
3	RSOV to firewall centerline	mm	3672	3664	8
4	RSOV to leading edge of right door	mm	3345	3364	-19
5	RSOV to leading edge of left door	mm	3350	3351	-1
6	RSOV to lower leading edge of right door	mm	3348	3334	14
7	RSOV to lower leading edge of left door	mm	3355	3342	13
8	RSOV to upper leading edge of right door	mm	2230	2243	-13
9	RSOV to upper leading edge of left door	mm	2230	2239	-9
10	RSOV to lower trailing edge of right door	mm	2258	2246	12
11	RSOV to lower trailing edge of left door	mm	2264	2246	18
12	RSOV to bottom of right 'A' pillar	mm	3291	3271	20
13	RSOV to bottom of left 'A' pillar	mm	3293	3274	19
14	RSOV to firewall on right side	mm	3653	3569	84
15	RSOV to firewall on left side	mm	3662	3632	30
16	RSOV to steering column	mm	2853	2847	6
17	Center of steering column to left 'A' pillar	mm	405	395	10
18	Center of steering column to headlining	mm	438	426	12
19	RSOV to right side of front bumper	mm	4695	4203	492
20	RSOV to left side of front bumper	mm	4705	4217	488
21	Length of engine block	mm	510	509	1
RD	RSOV to right side of dash panel	mm	3120	3114	6
CD	RSOV to center of dash panel	mm	3063	3016	47
LD	RSOV to left side of dash panel	mm	3150	3143	7

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle:	2006 Ford Fusion	NHTSA No.:	M60203
Test Program:	35mph Frontal Impact	Test Date:	10/19/2005



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4842
2	Total Width	1820
3	Bumper Top Height	570
4	Bumper Bottom Height	435
5	Longitudinal Member Top Height	566
6	Distance between Longitudinal Members	940
7	Longitudinal Member Width	85
8	Engine Top Height	912
9	Engine Bottom Height	225
10	Engine and gearbox width	510
11	Front bumper-engine distance	510
12	Front shock absorber fixing height	910
13	Bonnet leading edge height	750
14	Front shock absorber fixing width	1008
15	Front bumper – front axle distance	992
16	Front axle – a pillar distance	405
17	A-pillar – B-pillar distance	1165
18	B-Pillar – rear axle distance	1175
19	B-pillar – C-pillar distance	775
20	Roof sill bottom height	1414
21	Roof sill top height	1250
22	Floor sill bottom height	215
23	Floor sill top height	350

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1010	-5355	1245	24	1000
3	Steering Column Top	1290	-5340	1475	25	1000
4	Steering Column Bottom	1300	-5325	1025	25	1000
5	Driver Close-up	1655	-5955	1525	35	1000
6	Driver Angle	6865	-4910	2080	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	2115	6590	1530	19	1000
10	Right Passenger Half	995	5185	1280	24	1000
11	Right Close-up	1490	5925	1495	35	1000
12	Right Angle	6655	5025	2145	50	1000
13	Windshield	-285	0	2370	19	1000
14	Top Driver	180	-405	2065	12.5	1000
15	Top Passenger	170	495	2070	12.5	1000
16	Pit Front	1050	0	-3150	24	1000
17	Pit Rear	3080	0	-3150	24	1000

*COORDINATES:

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

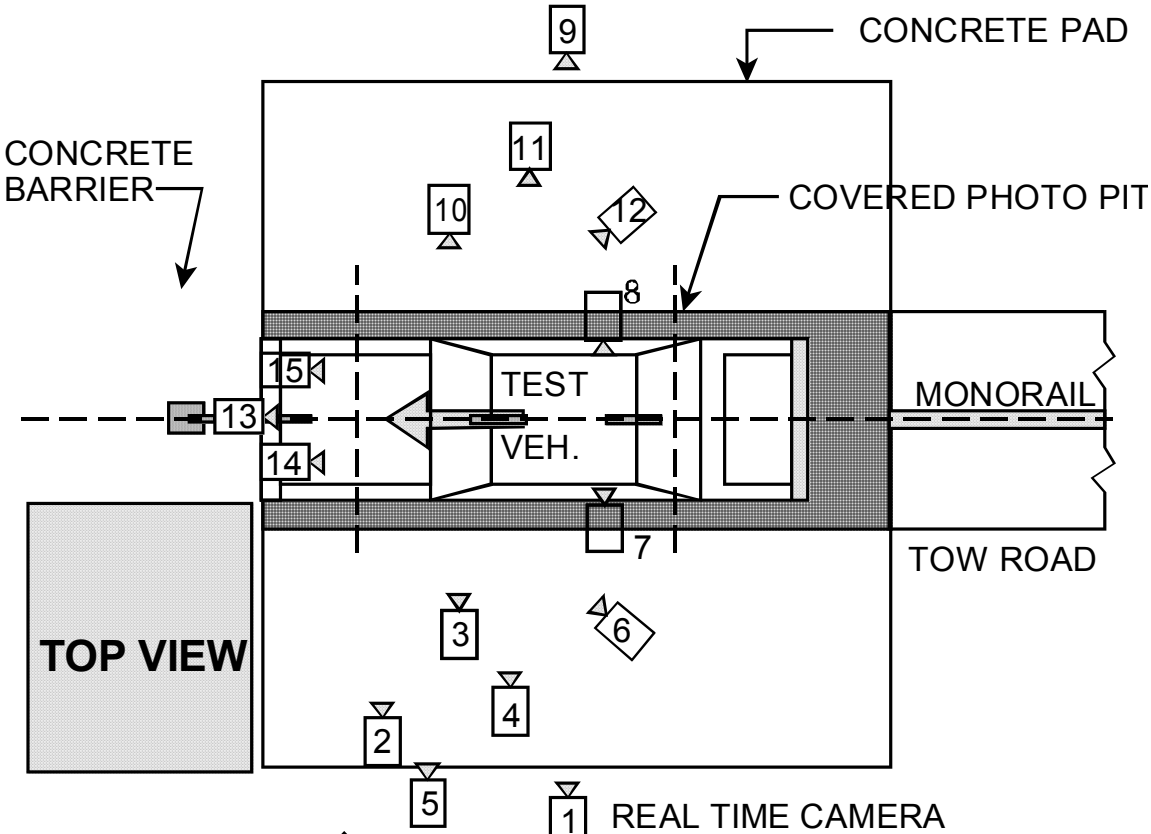
Note: Cameras 7 and 8 were not used for this test.

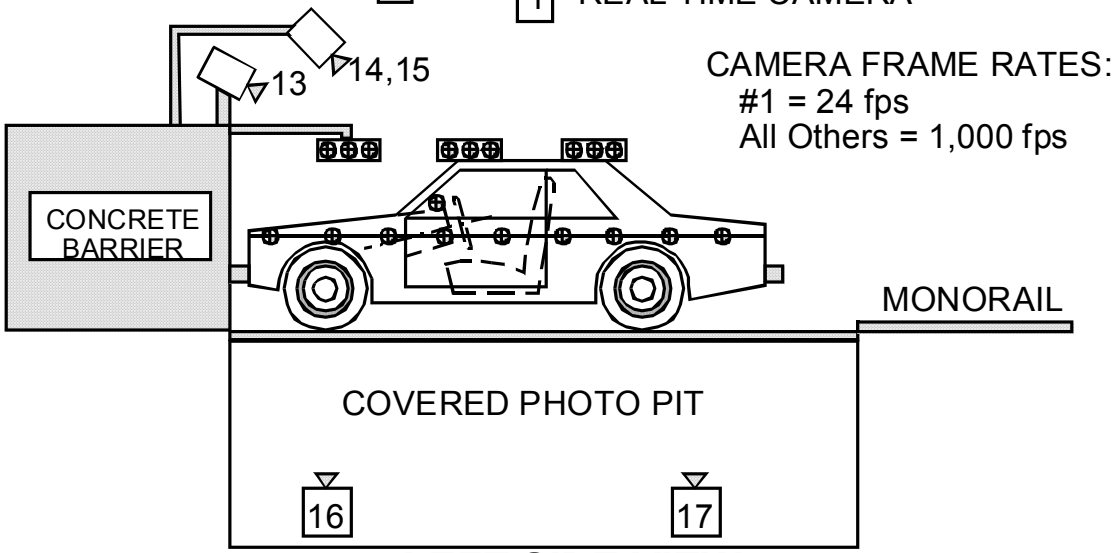
DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle:	2006 Ford Fusion	NHTSA No.:	M60203
Test Program:	35mph Frontal Impact	Test Date:	10/19/2005

CAMERA POSITIONS FOR FRONTAL IMPACTS





LEFT SIDE VIEW

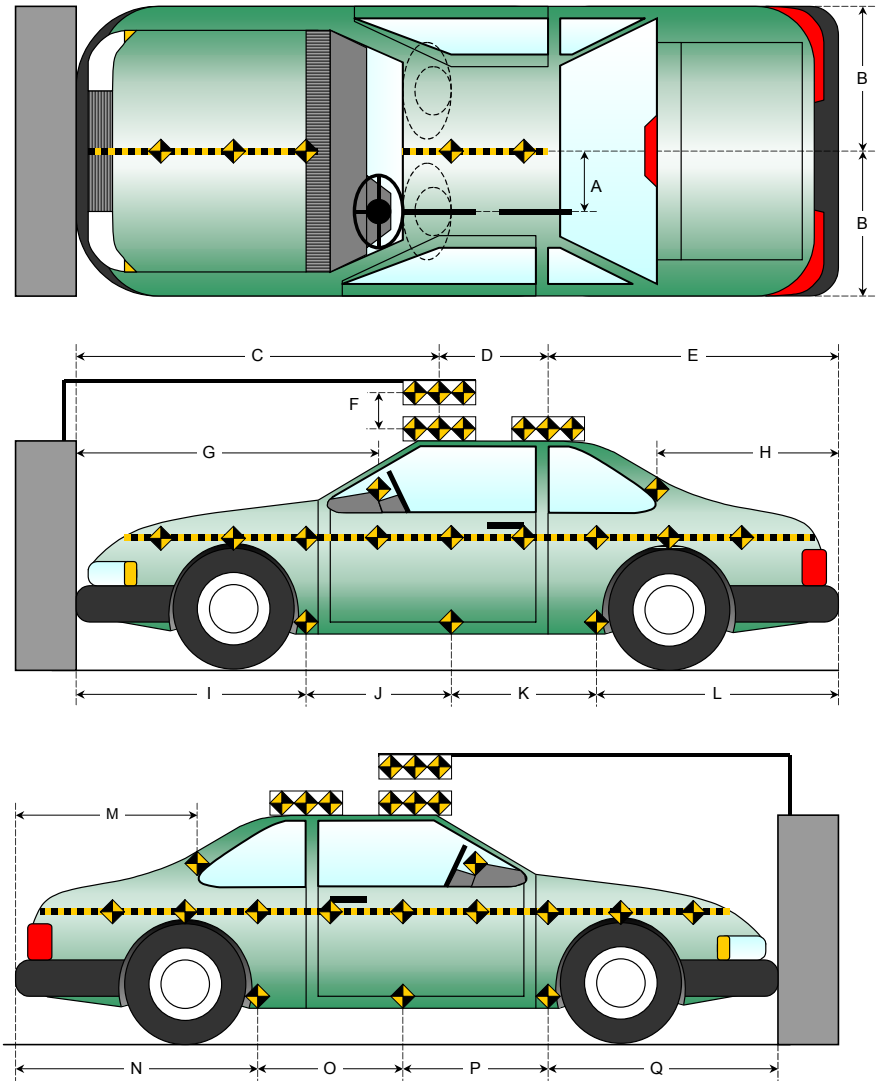
DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact

NHTSA No.: M60203
Test Date: 10/19/2005

Item	Value
A	357
B	910
C	2426
D	610
E	1806
F	127
G	
H	1174
I	1467
J	917
K	917
L	1541
M	1165
N	1536
O	919
P	919
Q	1468



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

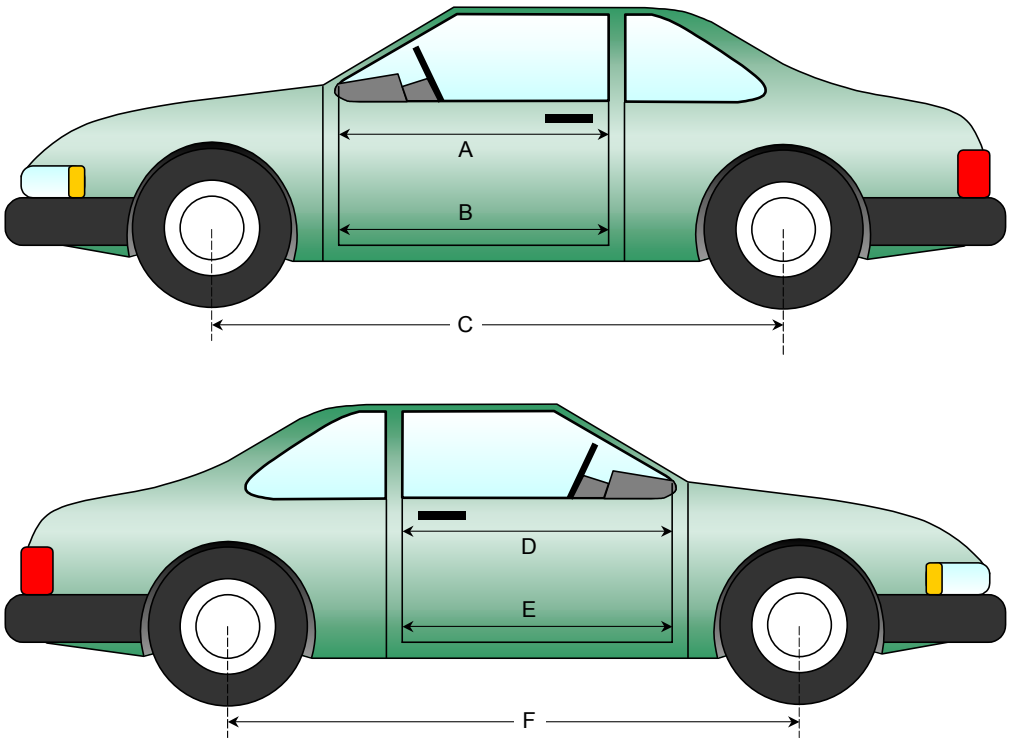
Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact
NHTSA No.: M60203
Test Date: 10/19/2005

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	988	988	0
B	Left Side Lower	mm	958	959	-1
D	Right Side Upper	mm	984	985	-1
E	Right Side Lower	mm	957	958	1

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2730	2692	38
F	Right Side Wheelbase	mm	2730	2694	36



DATA SHEET NO. 13... (continued)

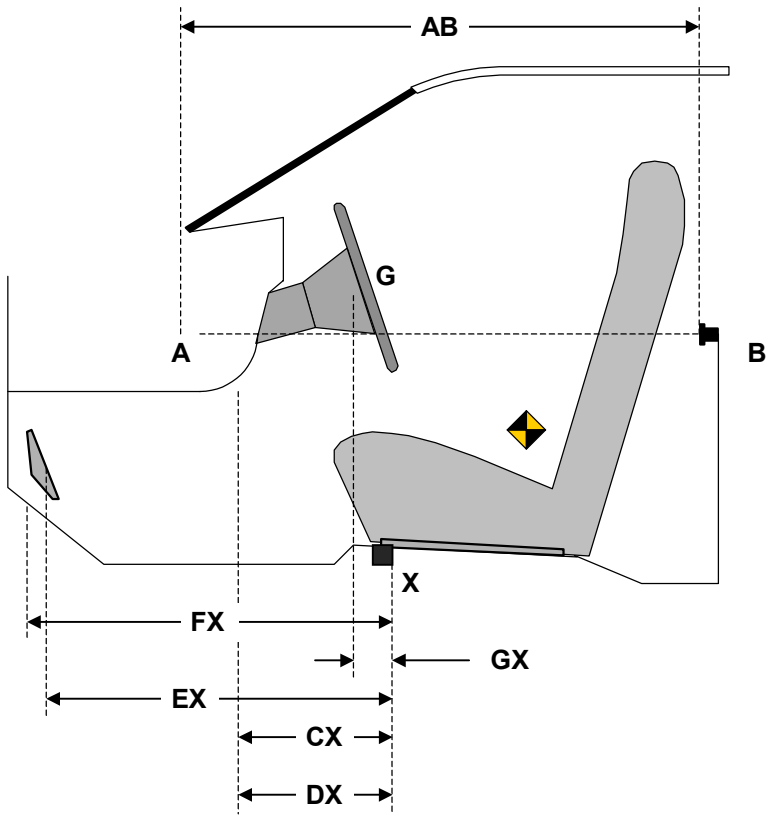
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	763	762	1
CX	Left Knee Bolster to X	mm	280	273	7
DX	Right Knee Bolster to X	mm	257	249	8
EX	Brake Pedal to X	mm	590	583	7
FX	Foot Rest to X	mm	600	592	8
GX	Center of Steering Column Wheel Hub to X	mm	92	69	23

X = Front of Seat Track (stationary)



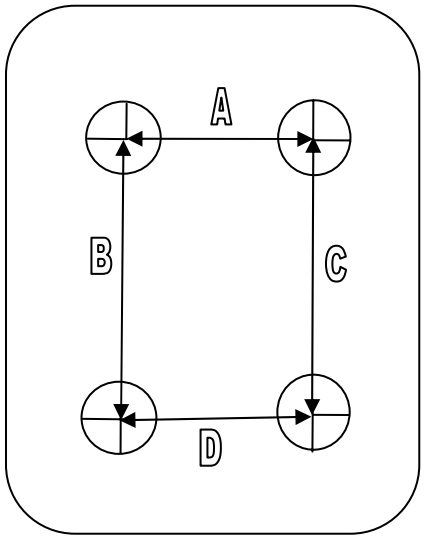
DRIVER COMPARTMENT

DATA SHEET NO. 13... (continued)

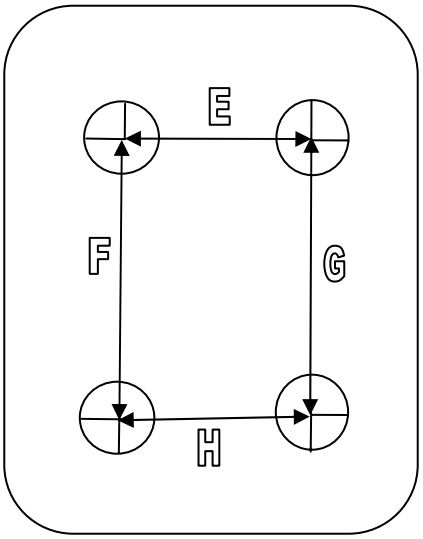
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2006 Ford Fusion
Test Program: 35mph Frontal Impact

NHTSA No.: M60203
Test Date: 10/19/2005



Driver



Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	360	325	35
B	404	394	10
C	402	363	39
D	358	329	29
E	349	337	12
F	359	309	50
G	363	362	1
H	357	341	16

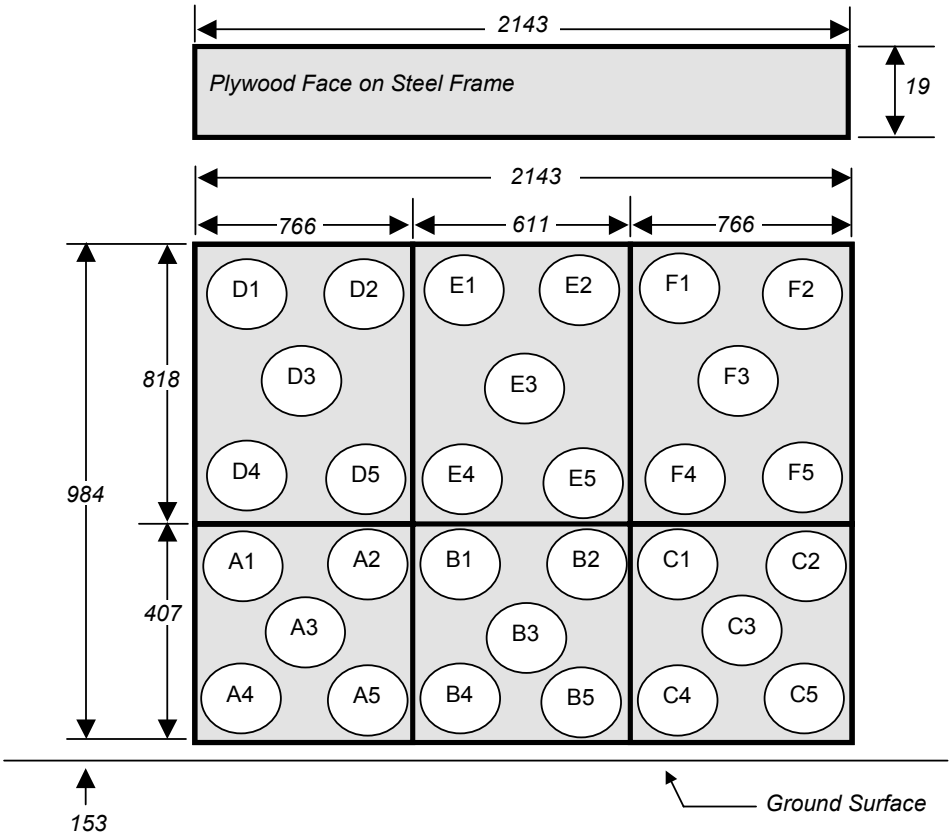
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

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: 2006 Ford Fusion NHTSA No.: M60203
Test Program: 35mph Frontal Impact Test Date: 10/19/2005

VEHICLE INFORMATION

VIN: 3FAHP08186R102253 Wheelbase (mm) : 2730
Vehicle Size Category: Sedan Test Weight (kg) : 1780.5

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 12
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal Linearity: > 99%
Impact Velocity (km/h): 56.5
Velocity Change (km/h): 63.4 Time of Separation (msec): 102

CRUSH PROFILE

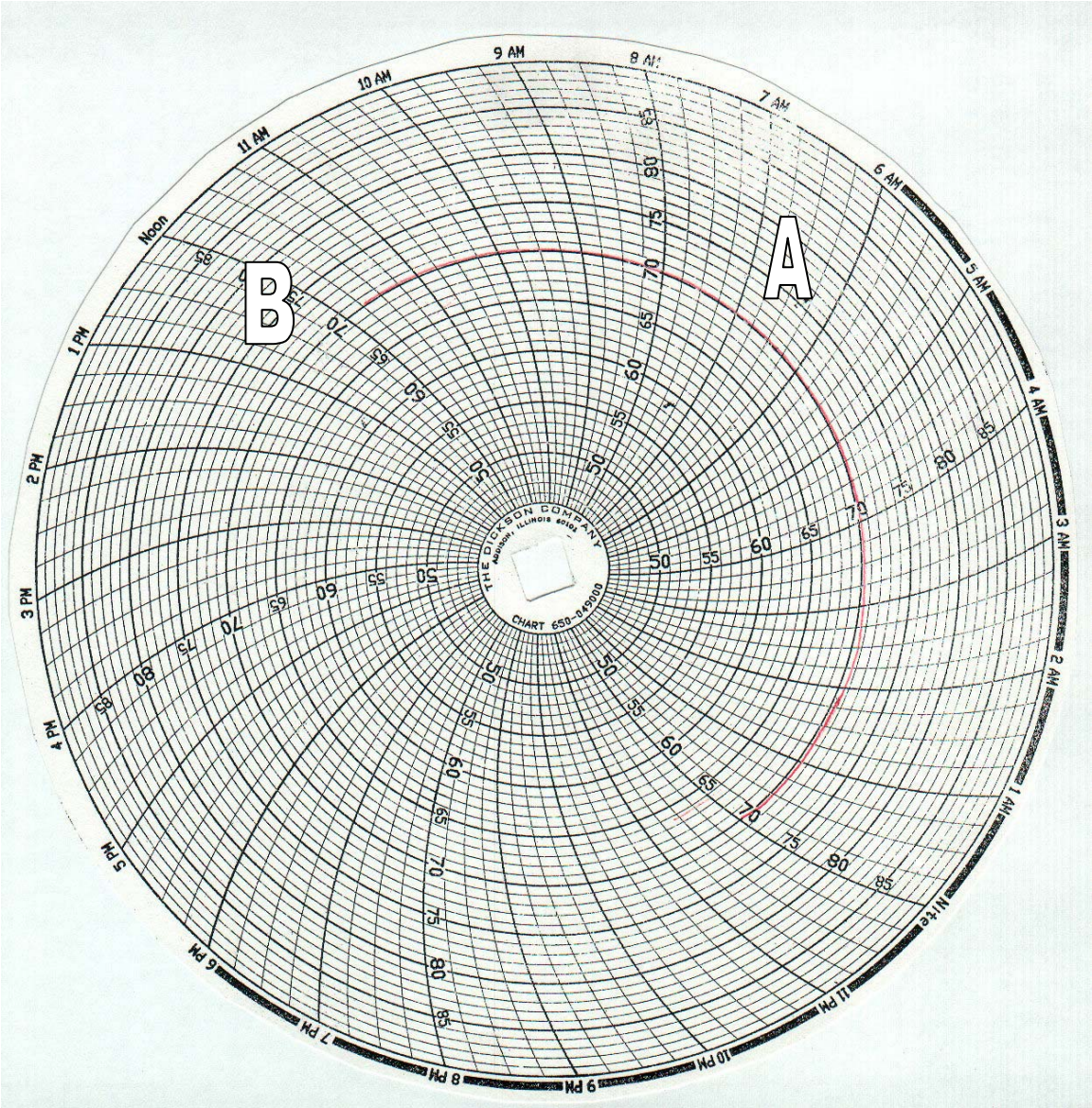
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1180 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4705	4217	488
C2	Crush zone 2 at left side	mm	4787	4221	566
C3	Crush zone 3 at left side	mm	4815	4229	586
C4	Crush zone 4 at right side	mm	4813	4223	590
C5	Crush zone 5 at right side	mm	4782	4217	565
C6	Crush zone 6 at right side	mm	4695	4203	492
L	C1 TO C6	mm	1180	1156	24

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle:	2006 Ford Fusion	NHTSA No.:	M60203
Test Program:	35mph Frontal Impact	Test Date:	10/19/2005



A = Dummies installed in vehicle at 7:00 am

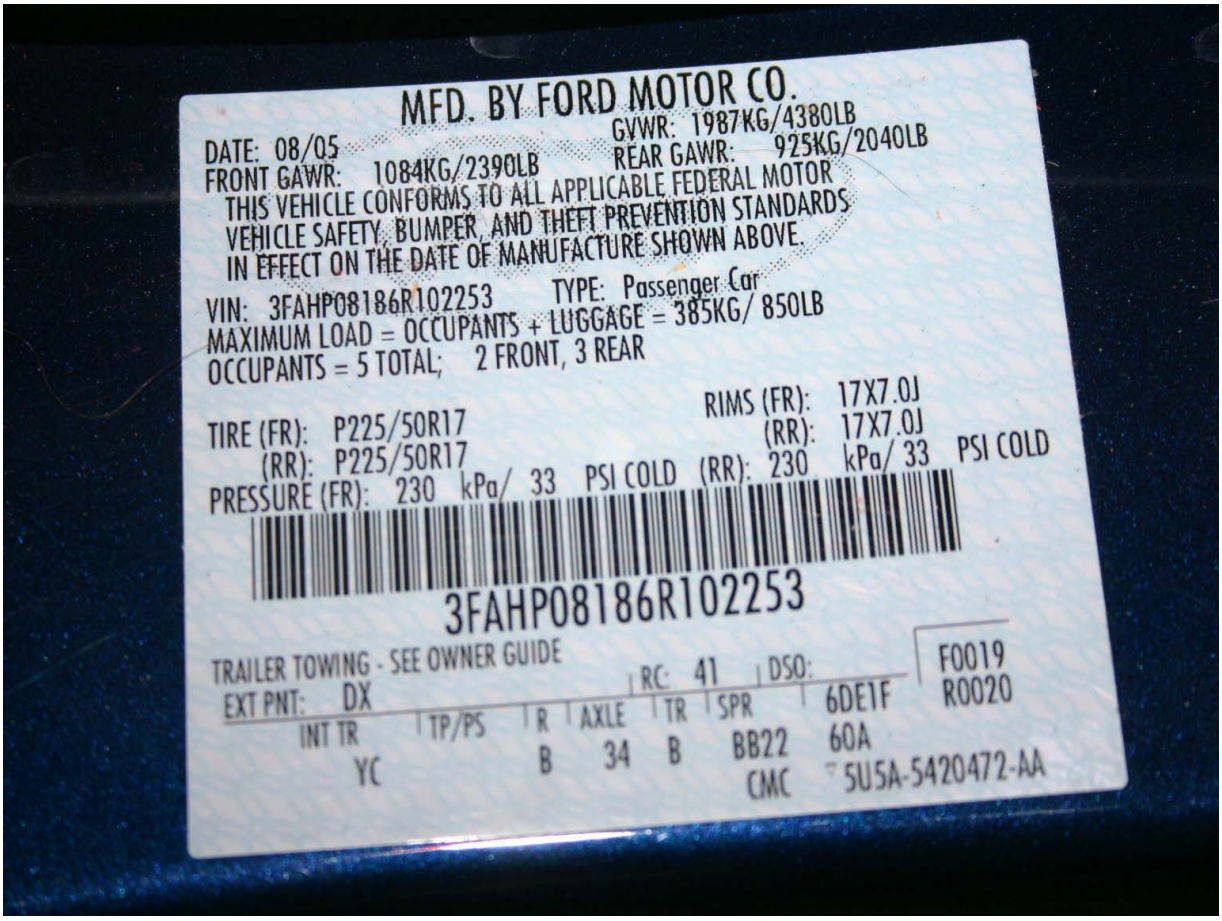
B = Test conducted at 11:57 am

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Load Cell Location



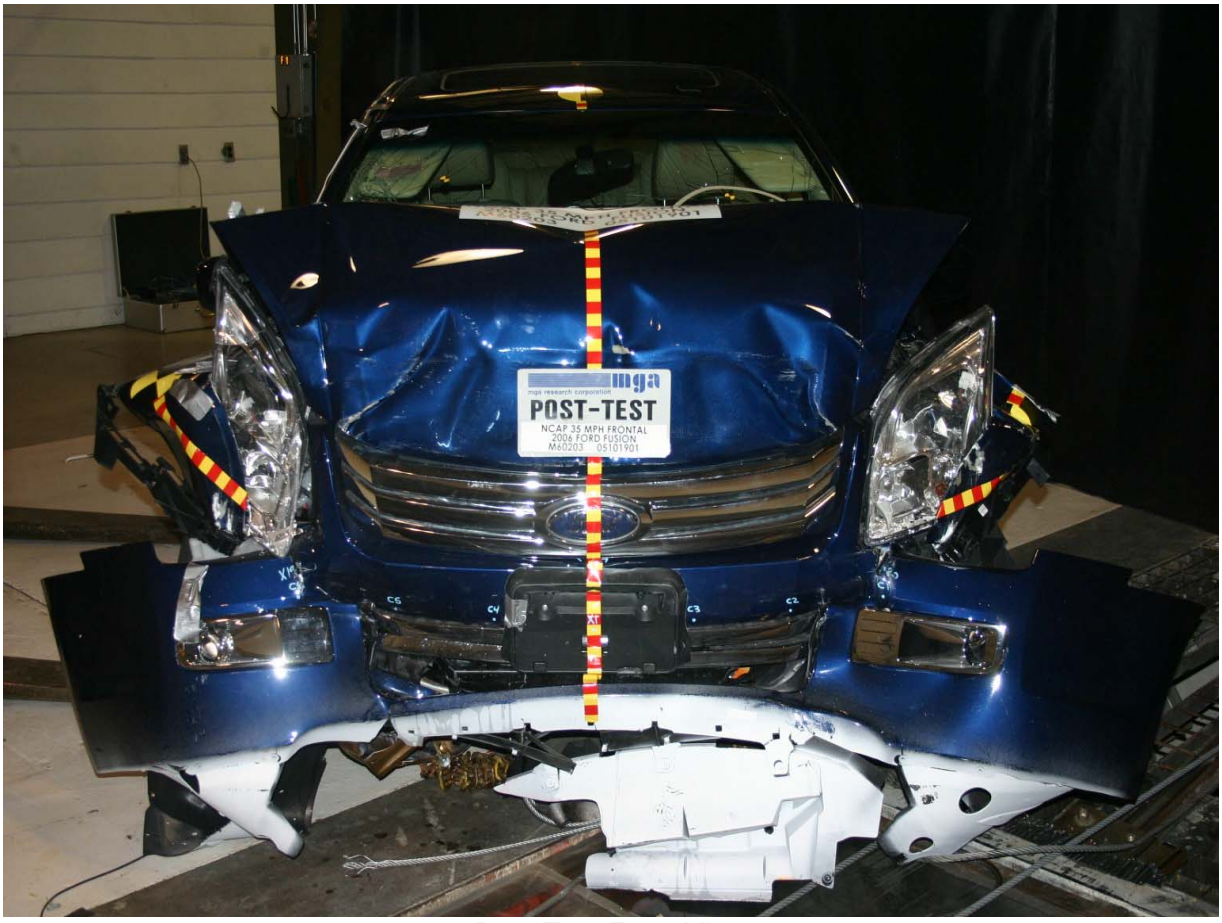
Manufacturer's Label

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

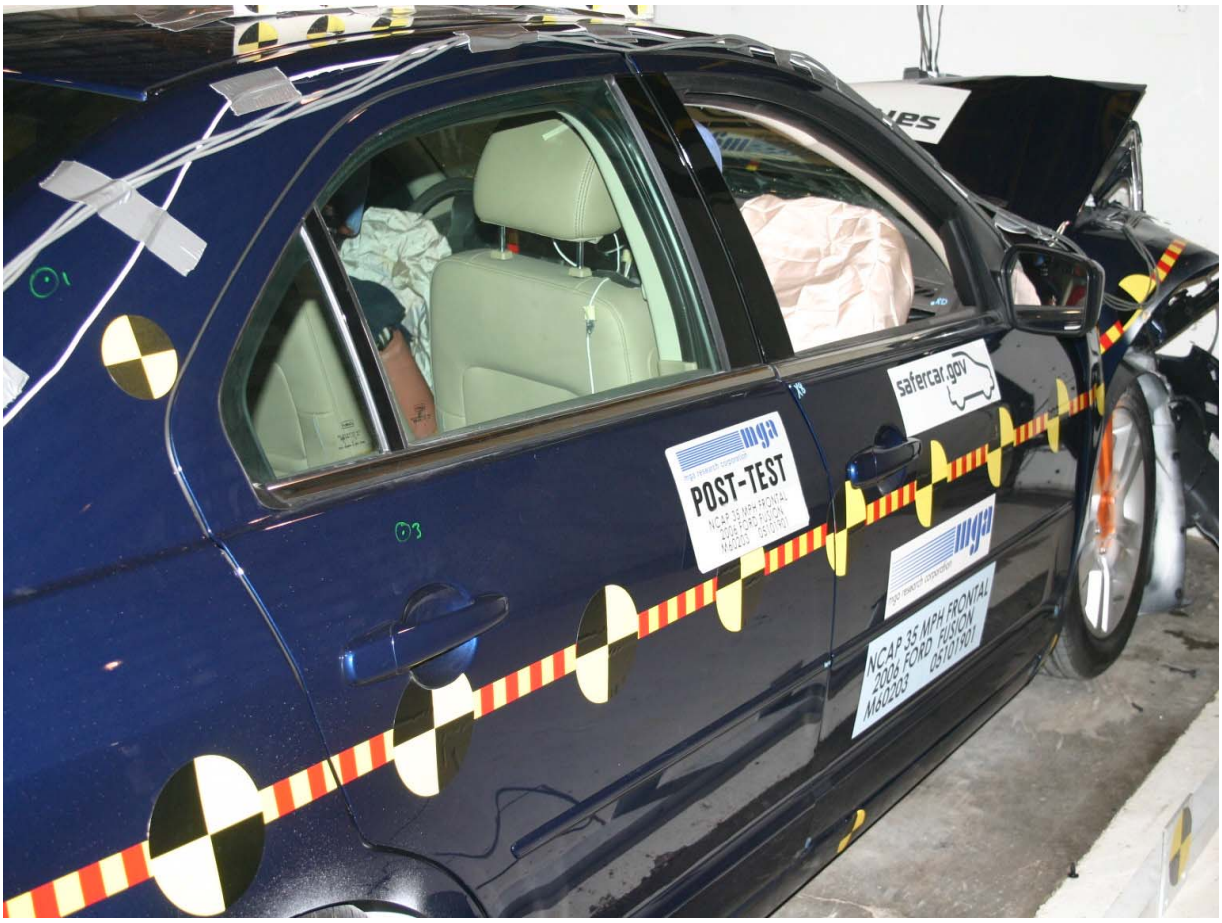
Pre-Test Left Rear ¾ View

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

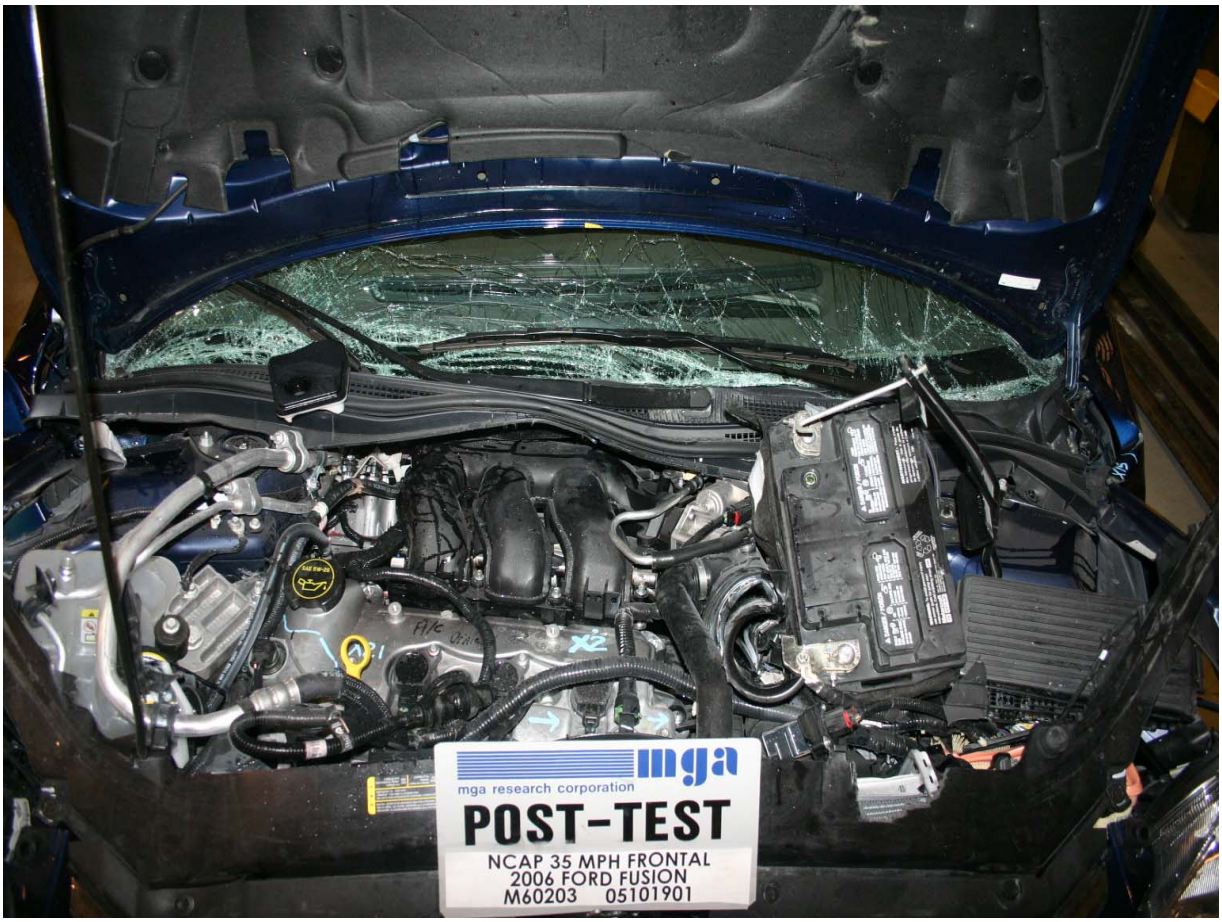


Post-Test Right Side ¾ View of Doors After Impact

Pre-Test Windshield View

Post-Test Windshield View

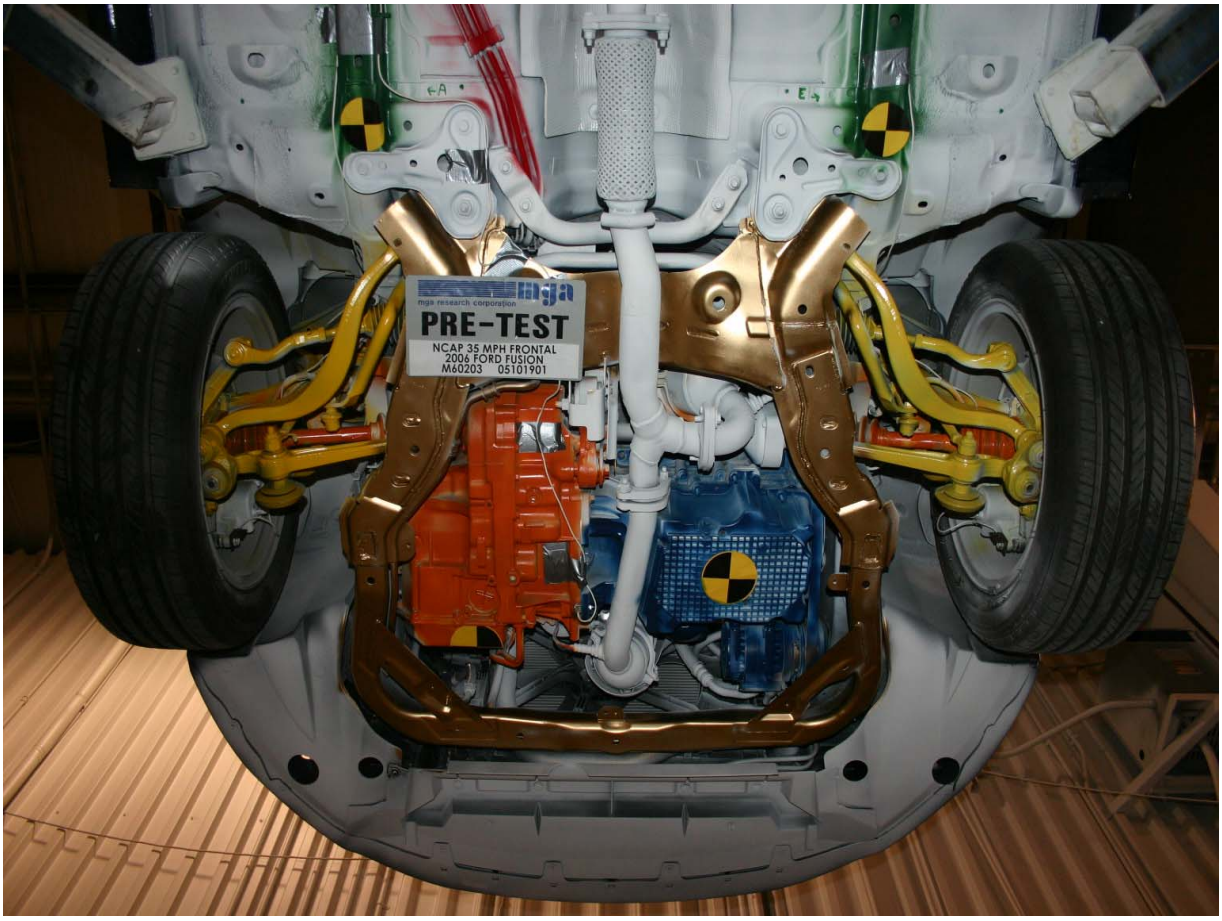
Pre-Test Engine Compartment View



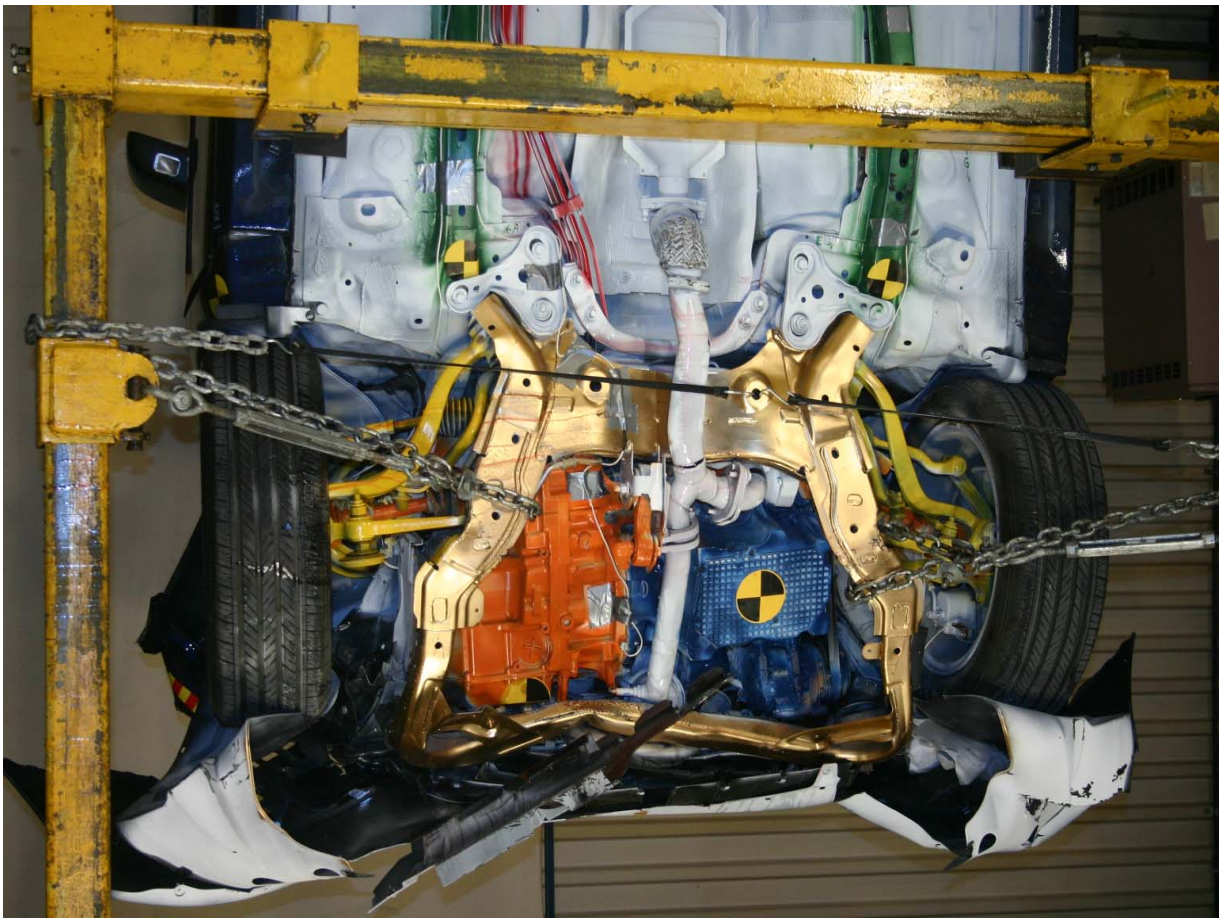
Post-Test Engine Compartment View

Pre-Test Fuel Cap View

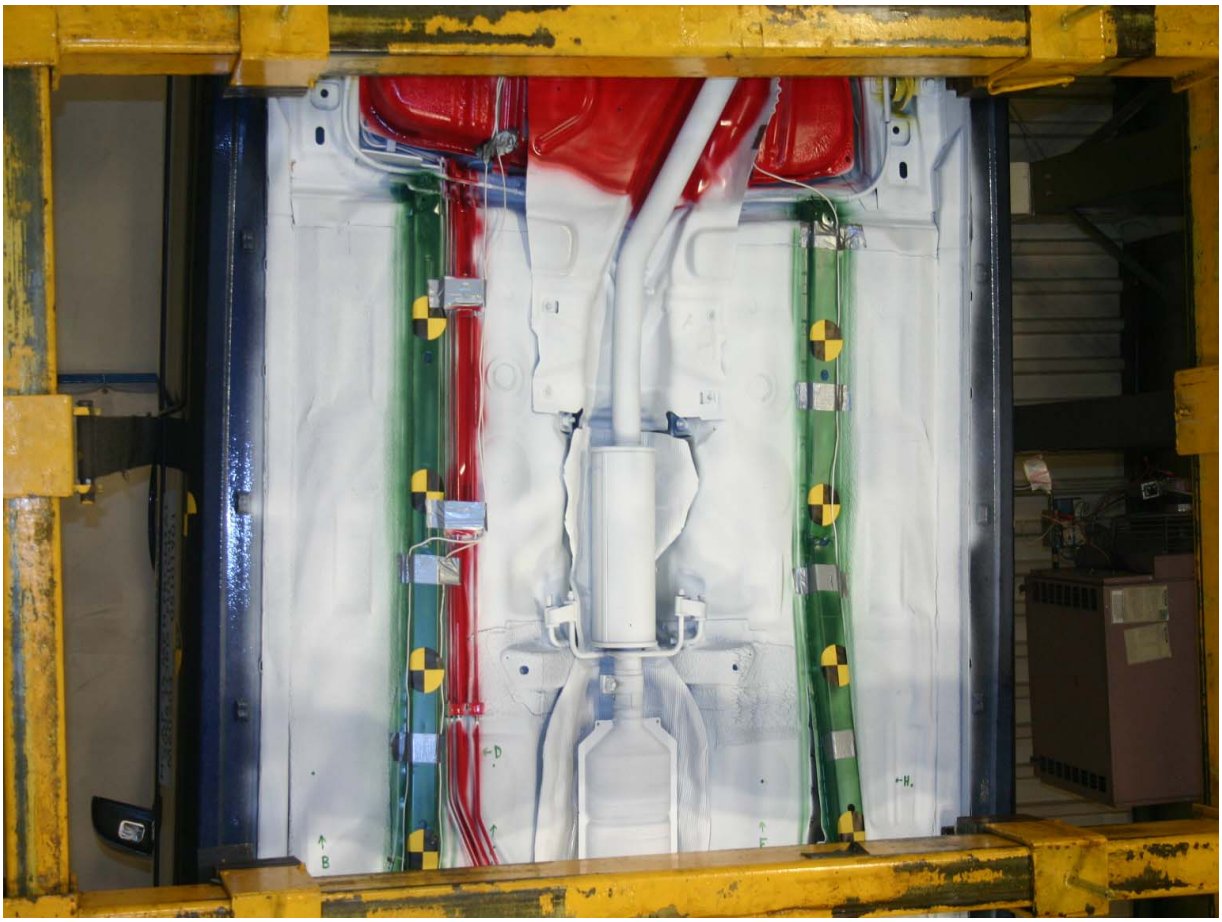
Post-Test Fuel Cap View



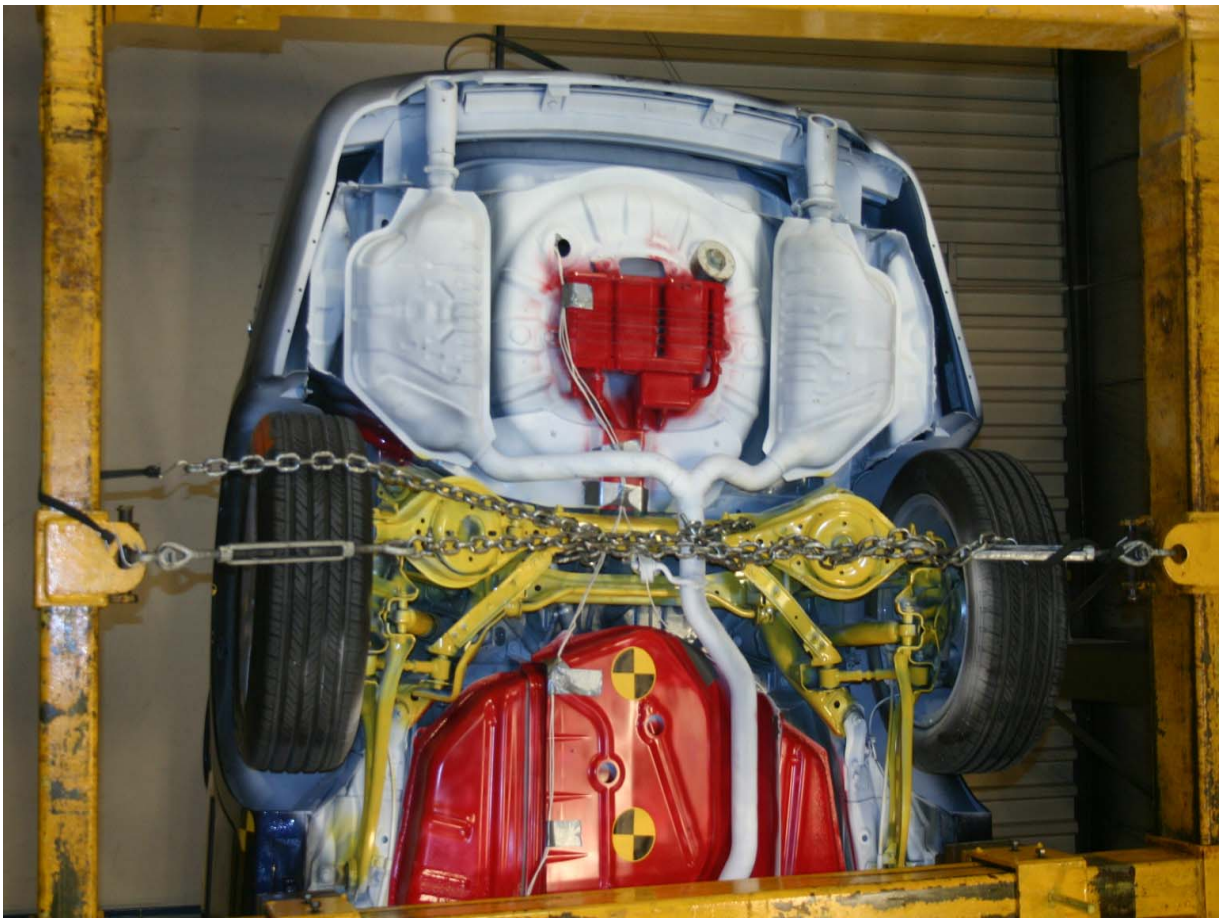
Pre-Test Front Underbody View

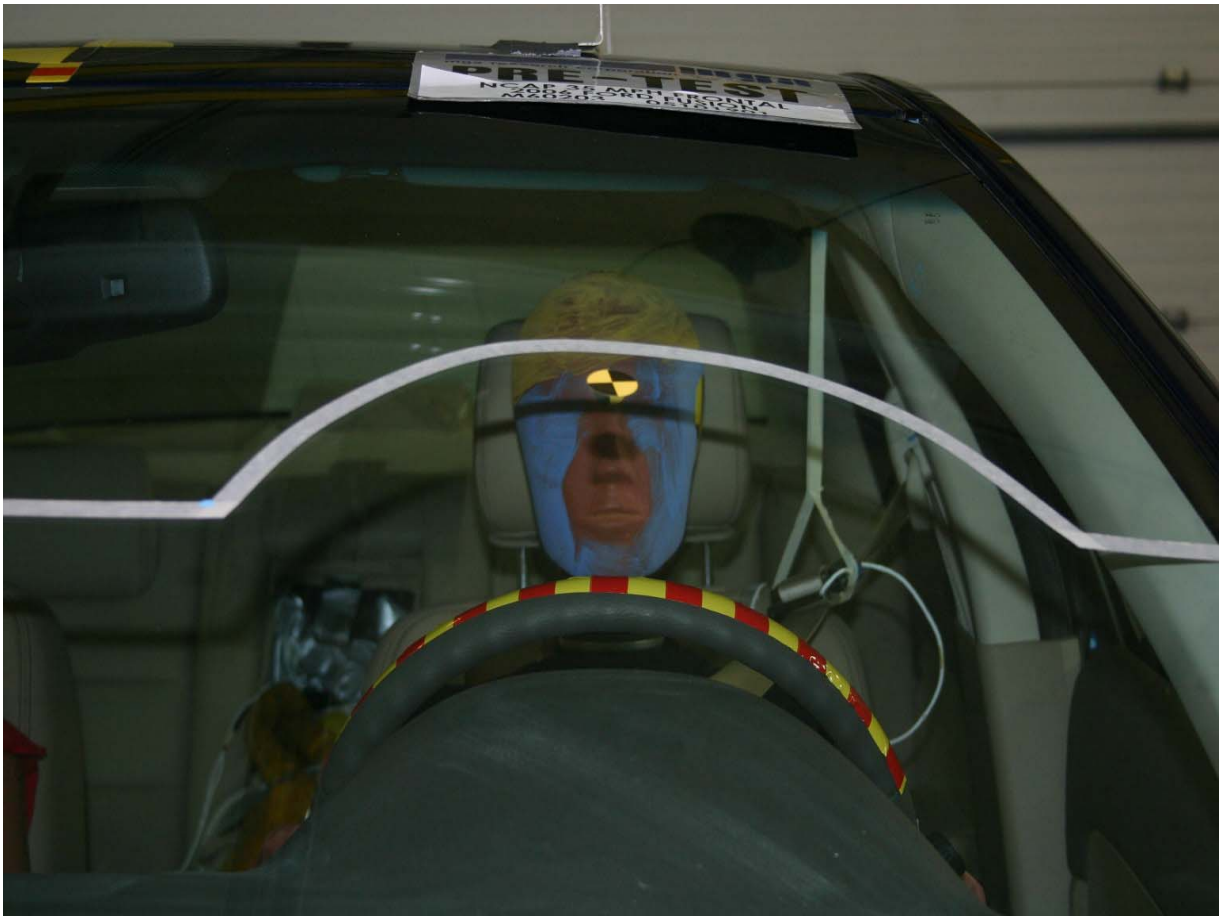

Post-Test Front Underbody View

Pre-Test Mid Underbody View


Post-Test Mid Underbody View

Pre-Test Rear Underbody View


Post-Test Rear Underbody View

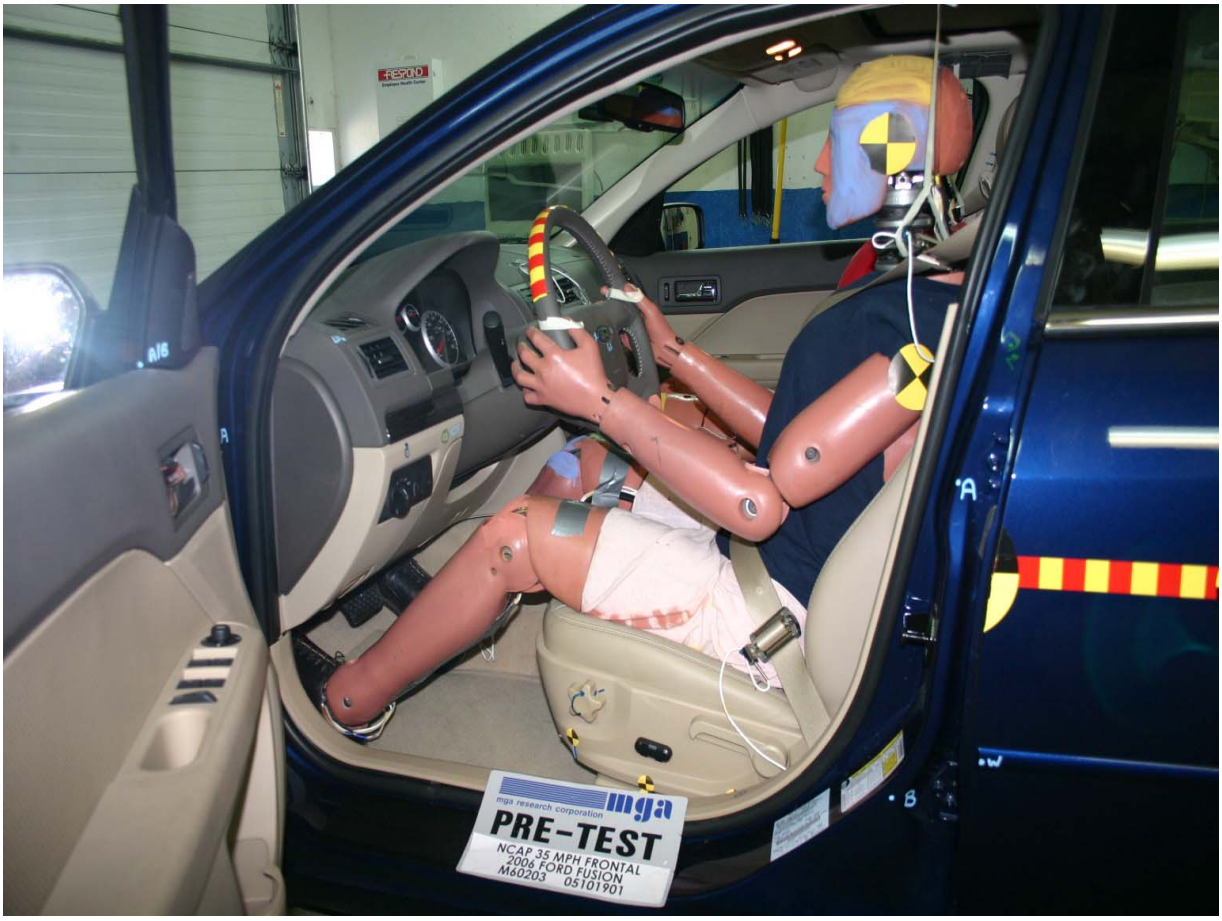


Pre-Test Driver Dummy Front View (Head Position)

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

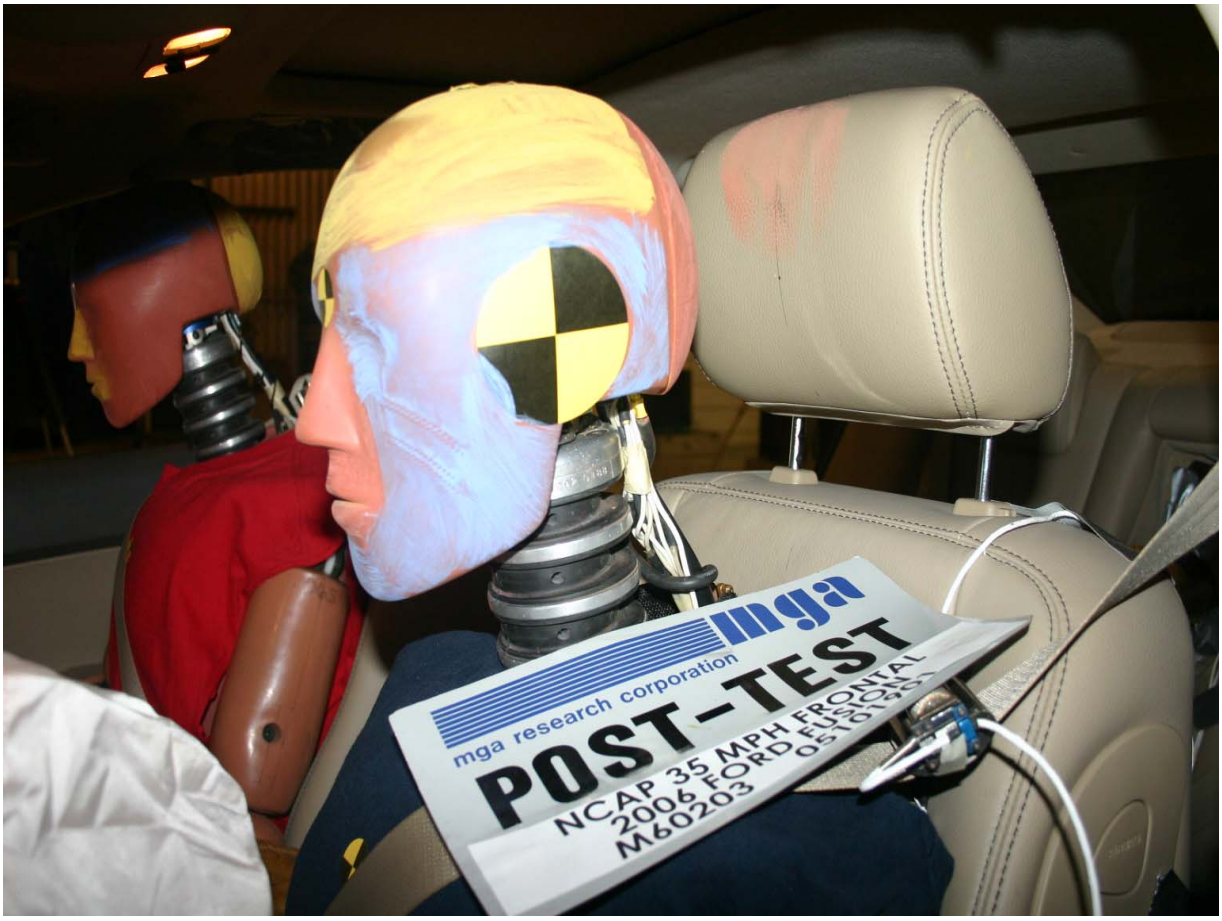
Post-Test Driver Dummy Feet

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

Post-Test Driver Dummy Knee Contact

Post-Test Driver Dummy Airbag Contact

Pre-Test Passenger Dummy Front View (Head Position)

Post-Test Passenger Dummy Front View (Head Position)

Pre-Test Passenger Dummy (Through Window)

Post-Test Passenger Dummy (Through Window)

Pre-Test Passenger Dummy (Door Open)

Post-Test Passenger Dummy (Door Open)

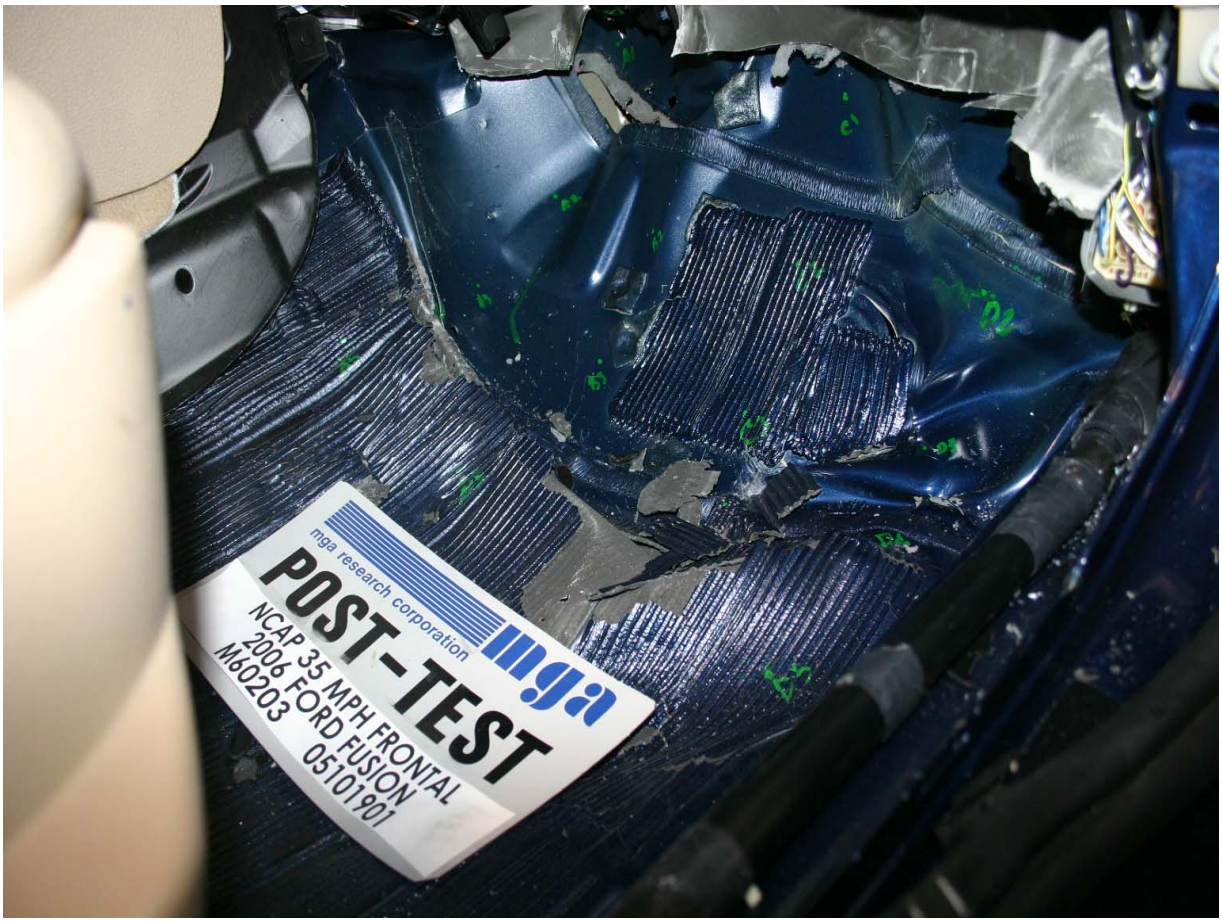
Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

Pre-Test Passenger Side Glove Box

Post-Test Passenger Side Glove Box

Pre-Test Passenger Side Floor Pan



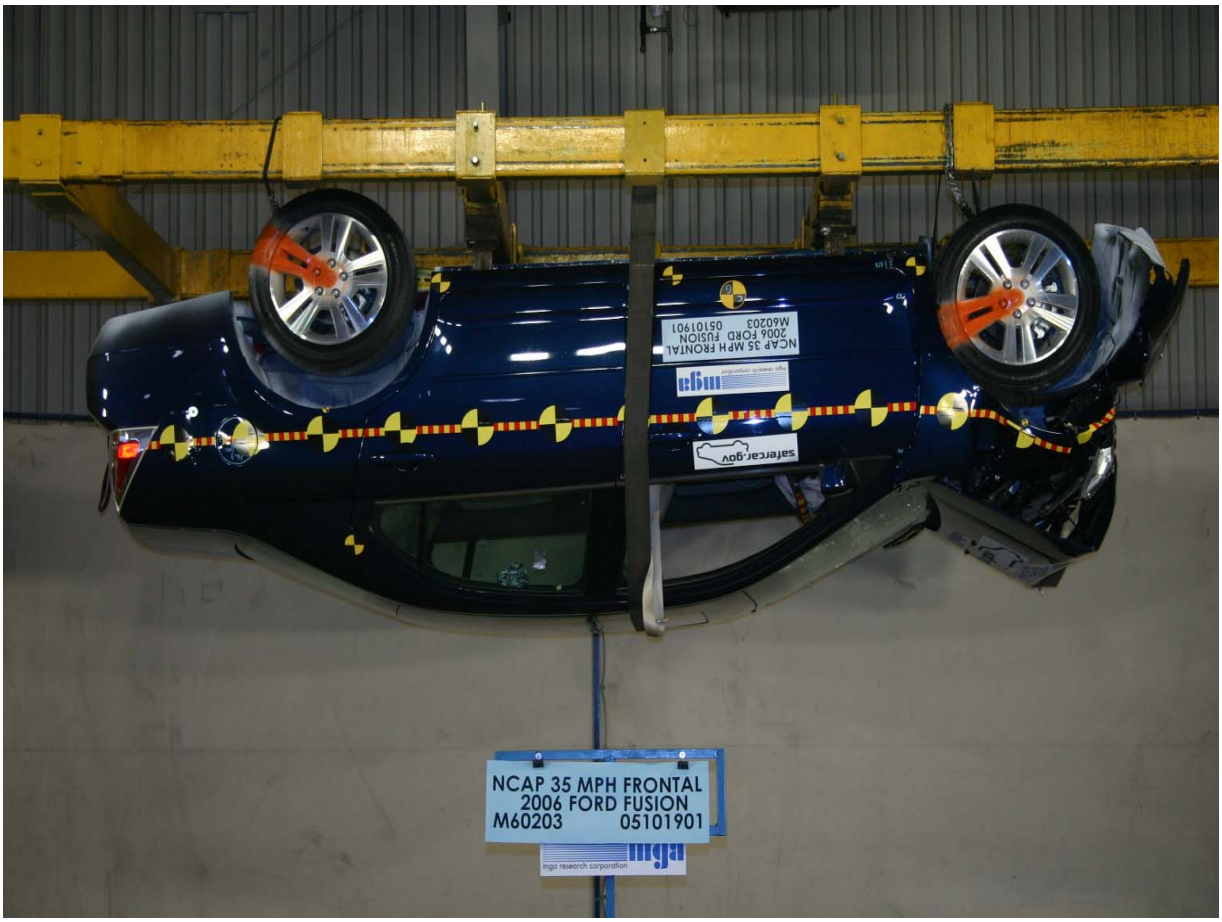
Post-Test Passenger Side Floor Pan

Post-Test Passenger Dummy Head Contact

Post-Test Passenger Dummy Knee Contact

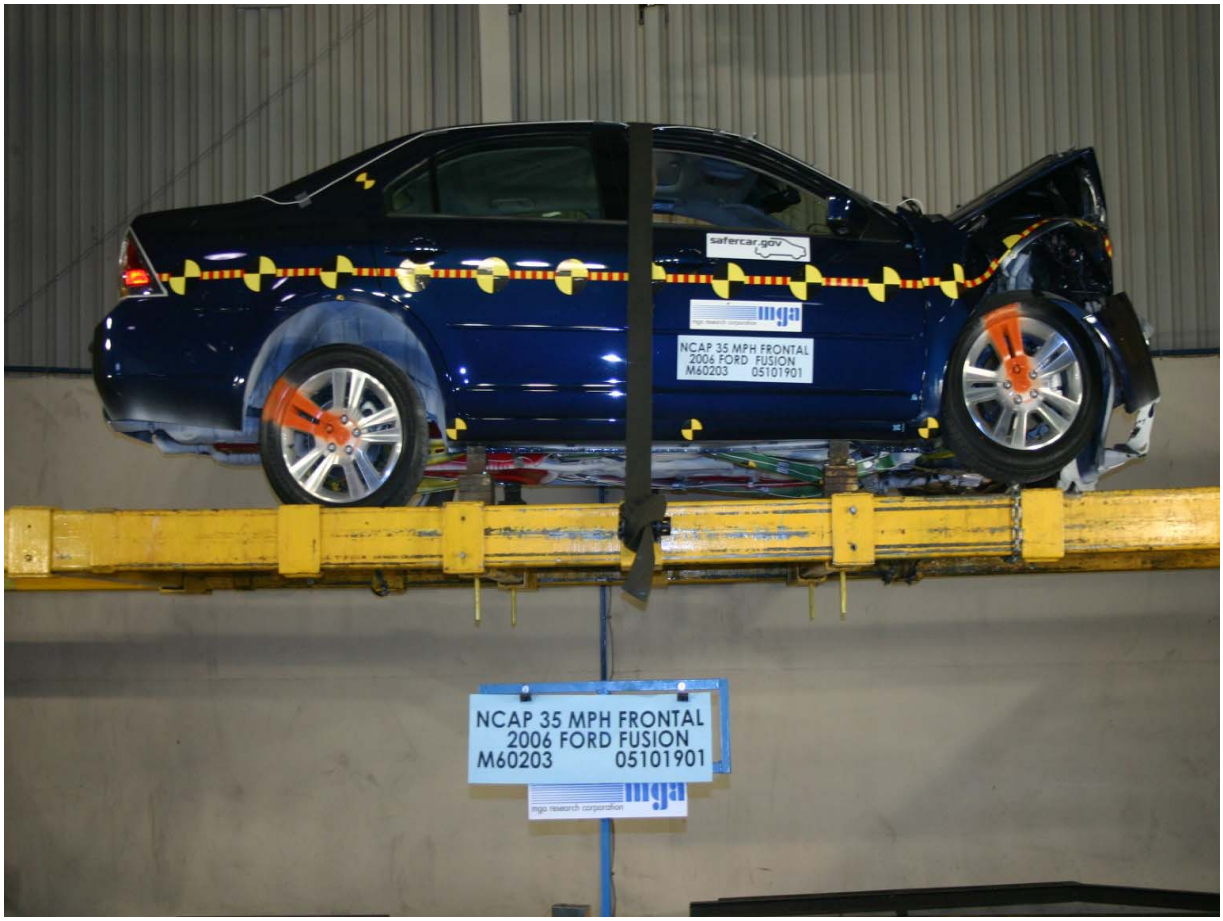
Post-Test Passenger Dummy Airbag Contact

Vehicle on Rollover Device at 90 Degrees



Vehicle on Rollover Device at 180 Degrees

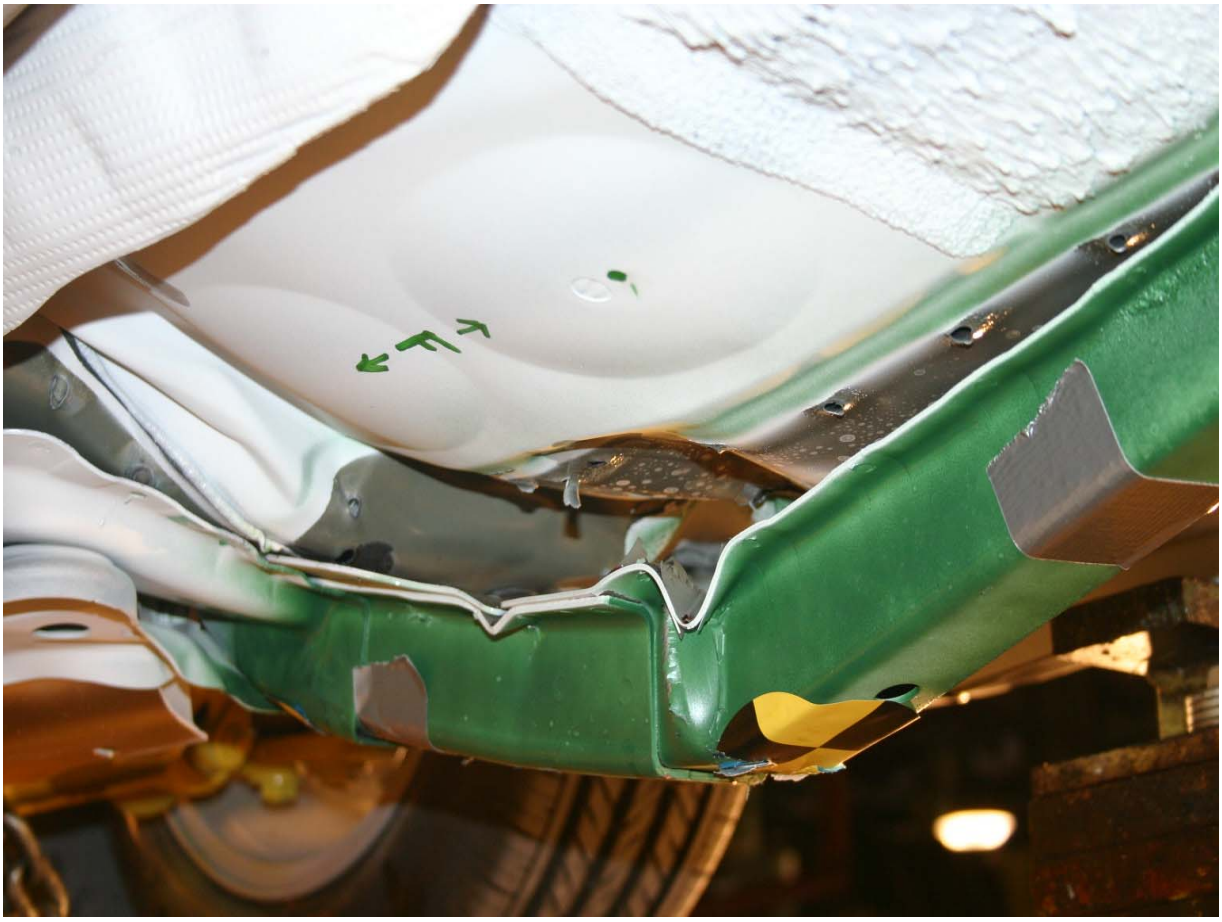
Vehicle on Rollover Device at 270 Degrees



Vehicle on Rollover Device at 360 Degrees

Vehicle Impact

Unibody Separation



Unibody Separation

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

Vehicle Instrument Panel X

Barrier Force – Upper Right

Barrier Force – Upper Center

Barrier Force – Upper Right

Barrier Force – Lower Right

Barrier Force – Lower Center

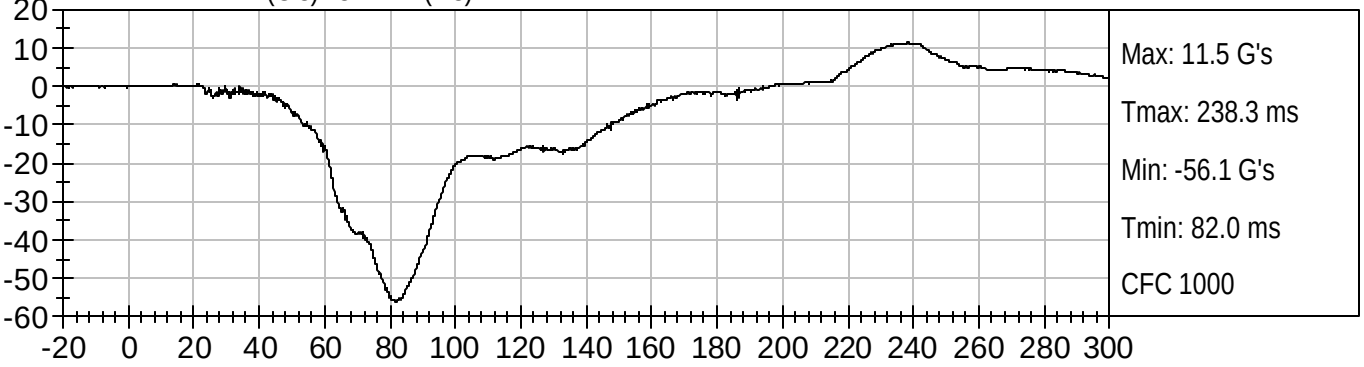
Barrier Force – Lower Right

Barrier Contact

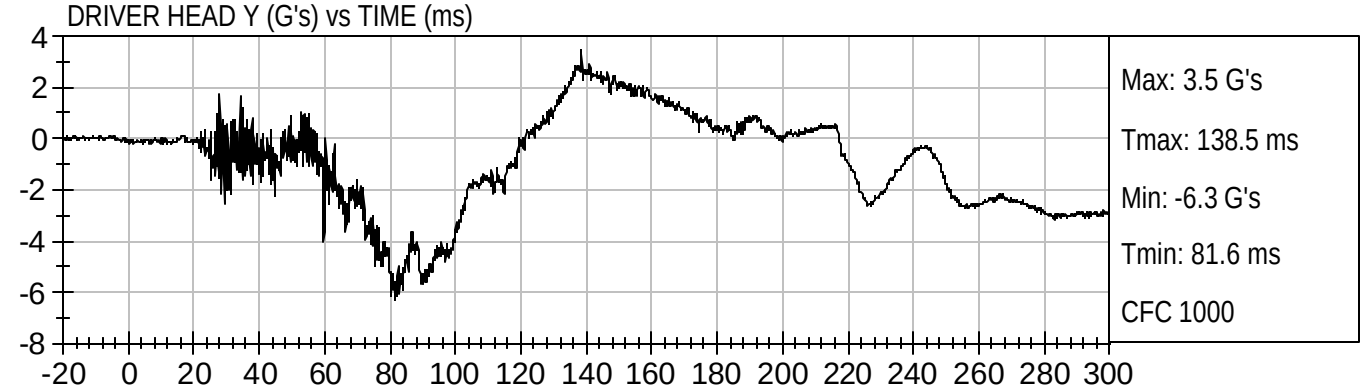
35MPH NCAP FRONTAL
2006 FORD FUSION (M60203)

Test Date: 10/19/2005
Speed: 35.1 mph (56.5 km/h)

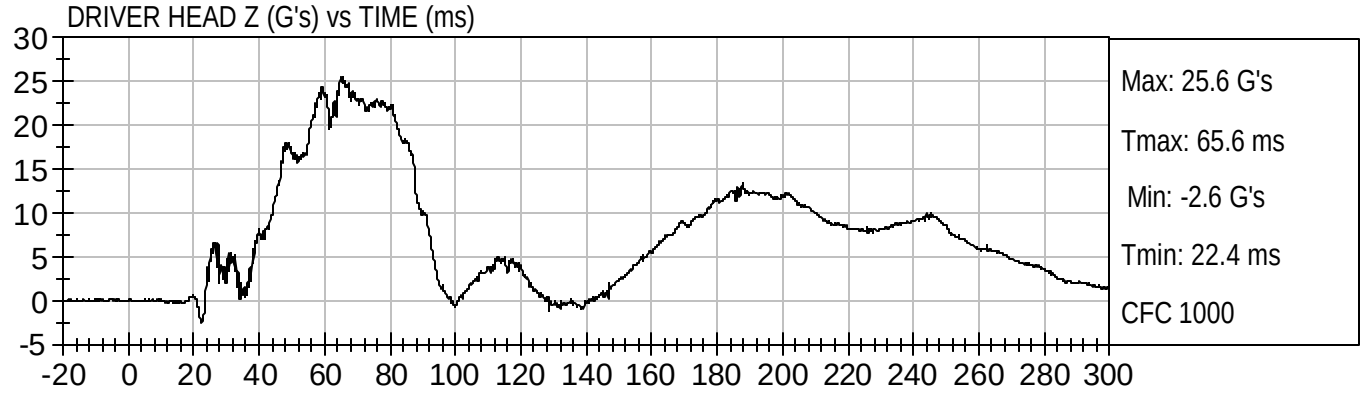
DRIVER HEAD X (G's) vs TIME (ms)



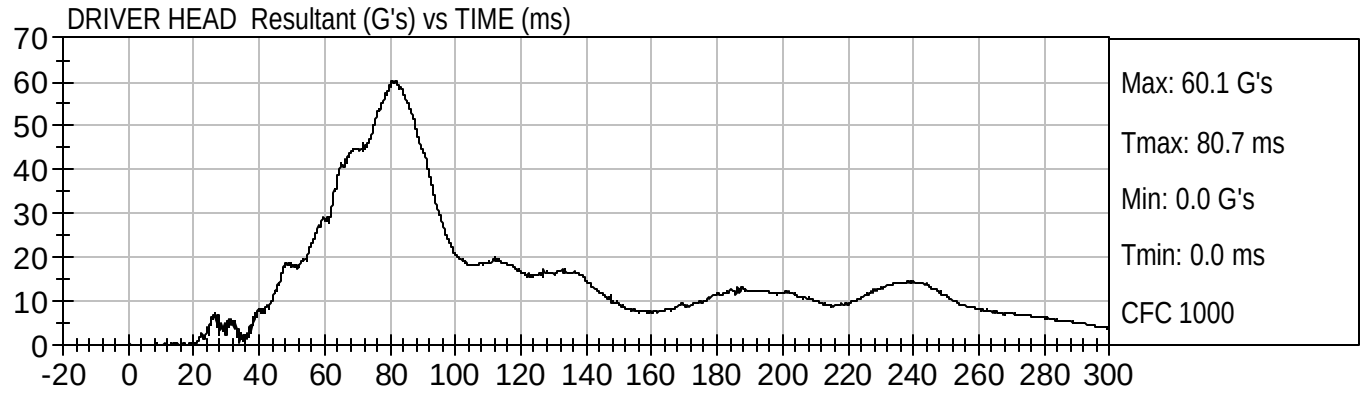
DRIVER HEAD Y (G's) vs TIME (ms)



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

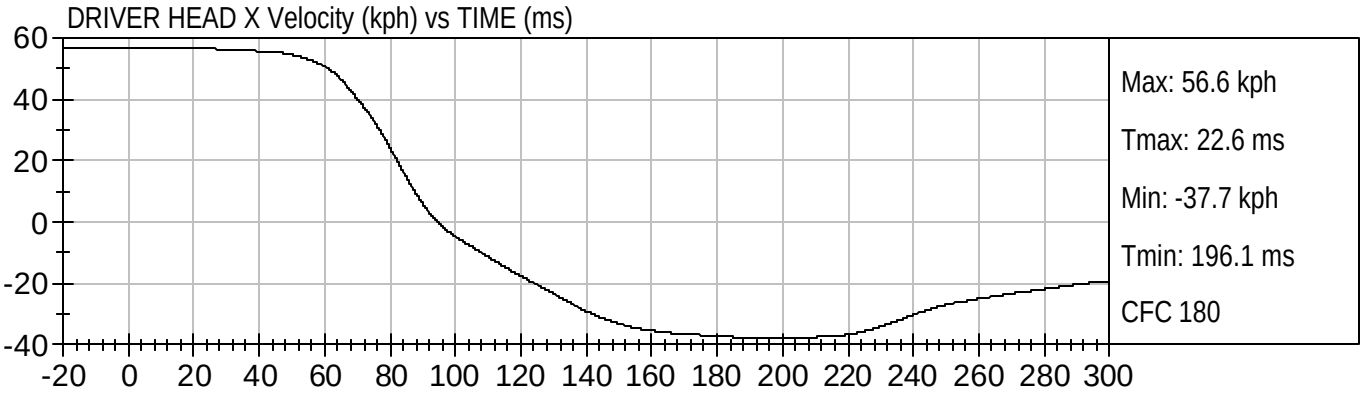


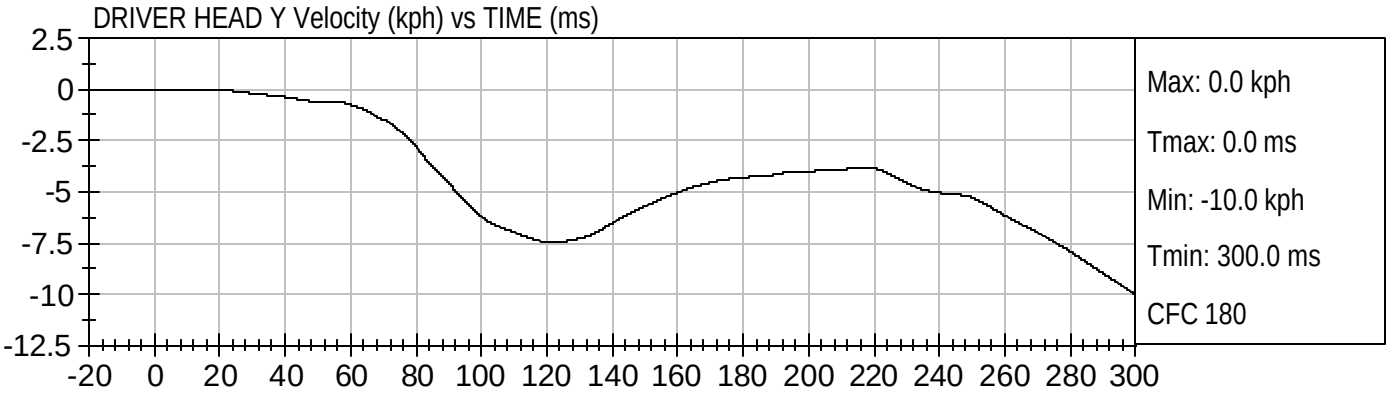
DRIVER HEAD Resultant (G's) vs TIME (ms)

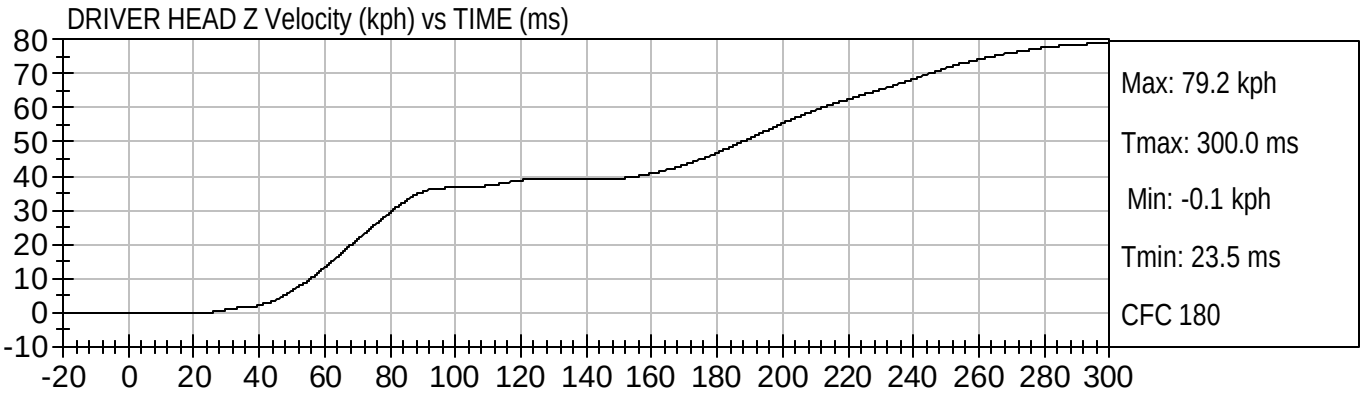


35MPH NCAP FRONTAL
2006 FORD FUSION (M60203)

Test Date: 10/19/2005
Speed: 35.1 mph (56.5 km/h)

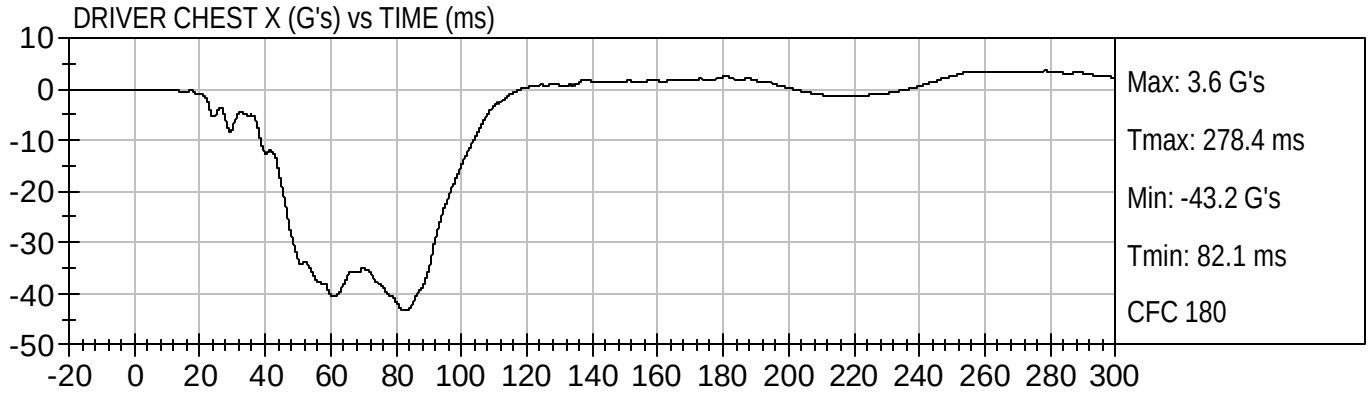


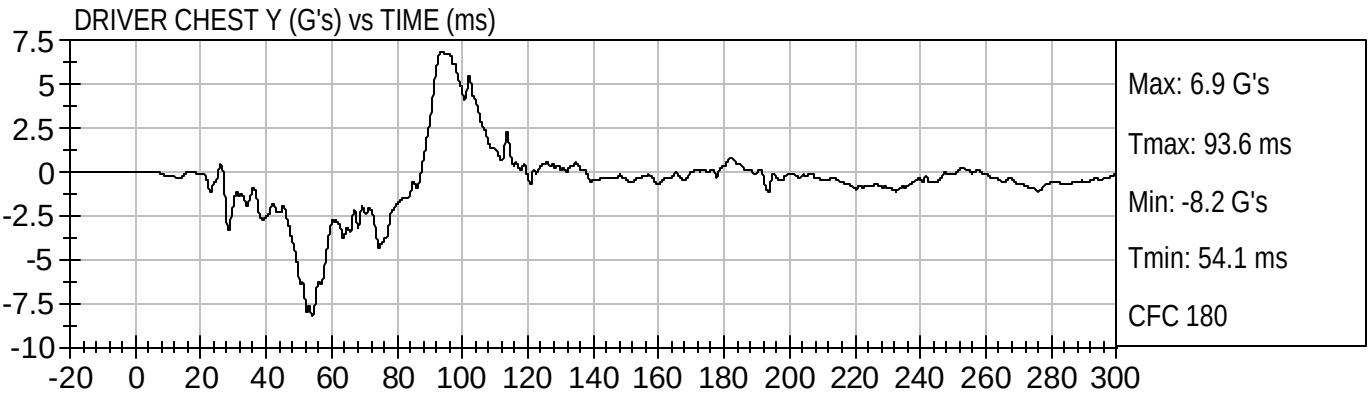


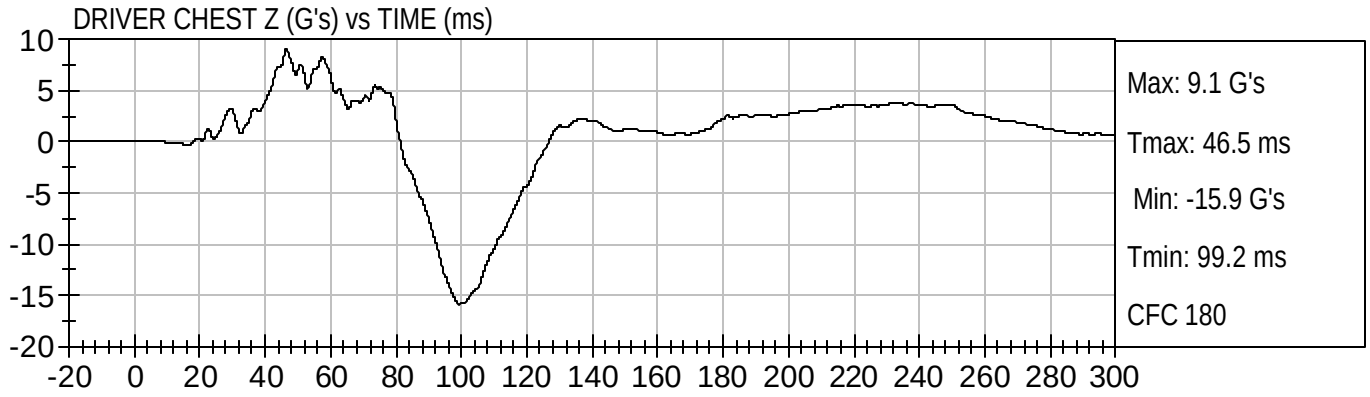


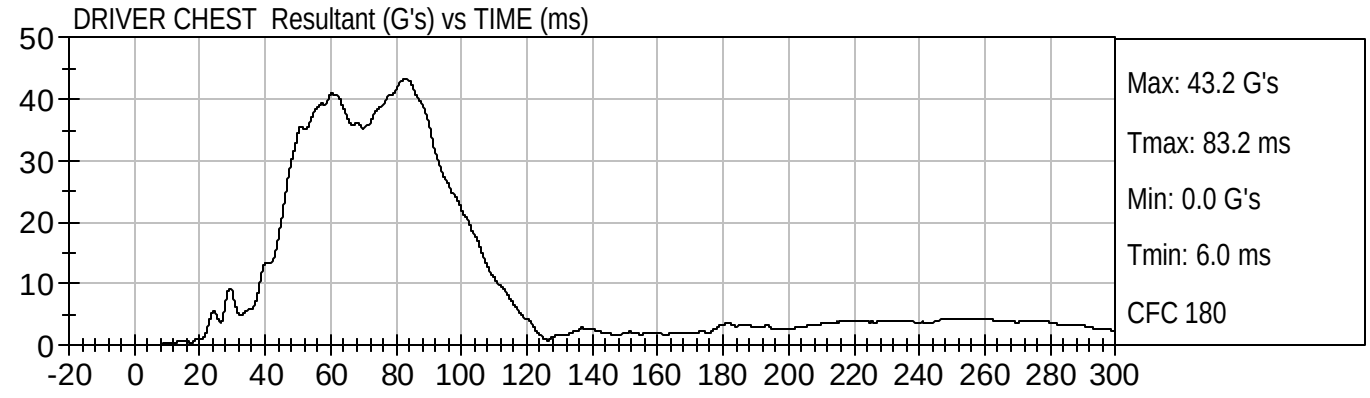
35MPH NCAP FRONTAL
2006 FORD FUSION (M60203)

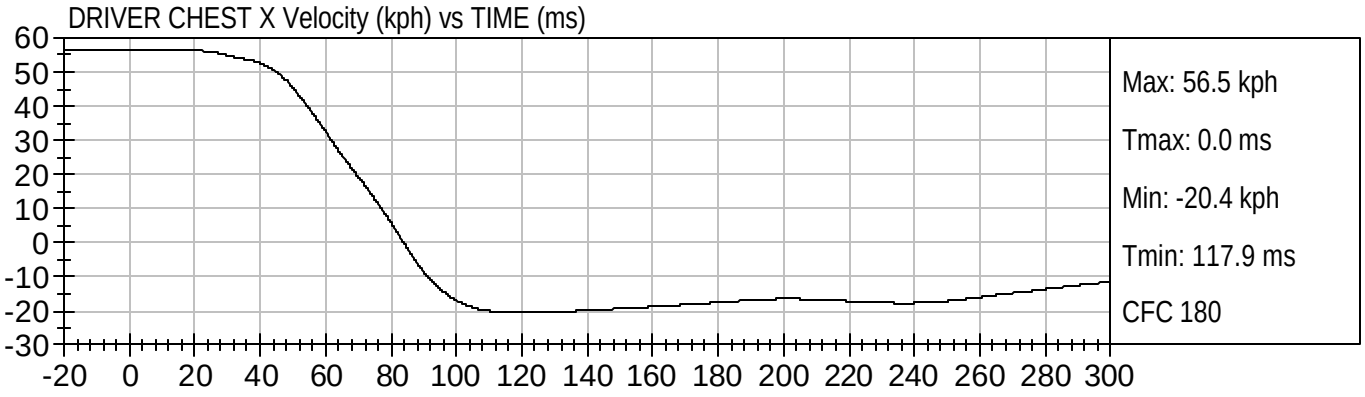
Test Date: 10/19/2005
Speed: 35.1 mph (56.5 km/h)

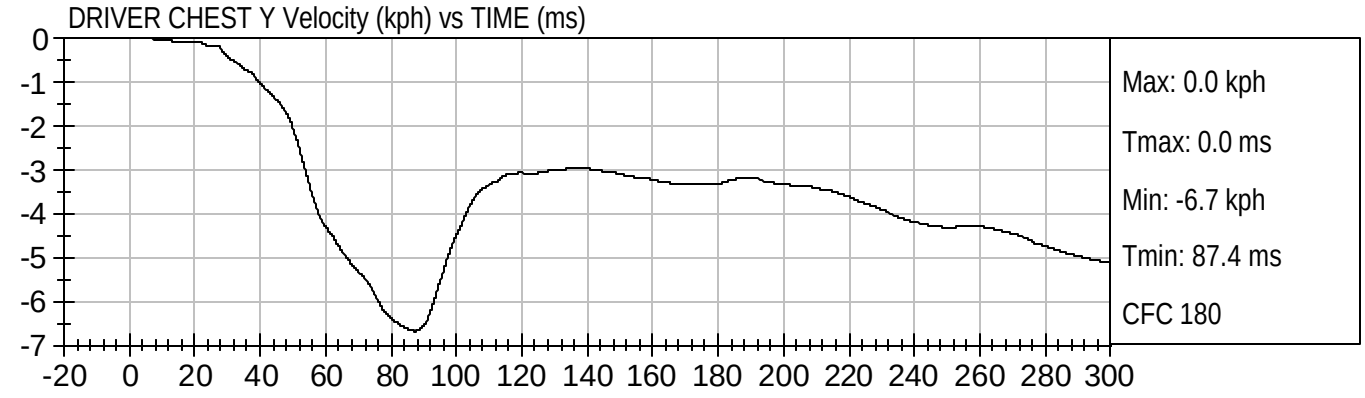


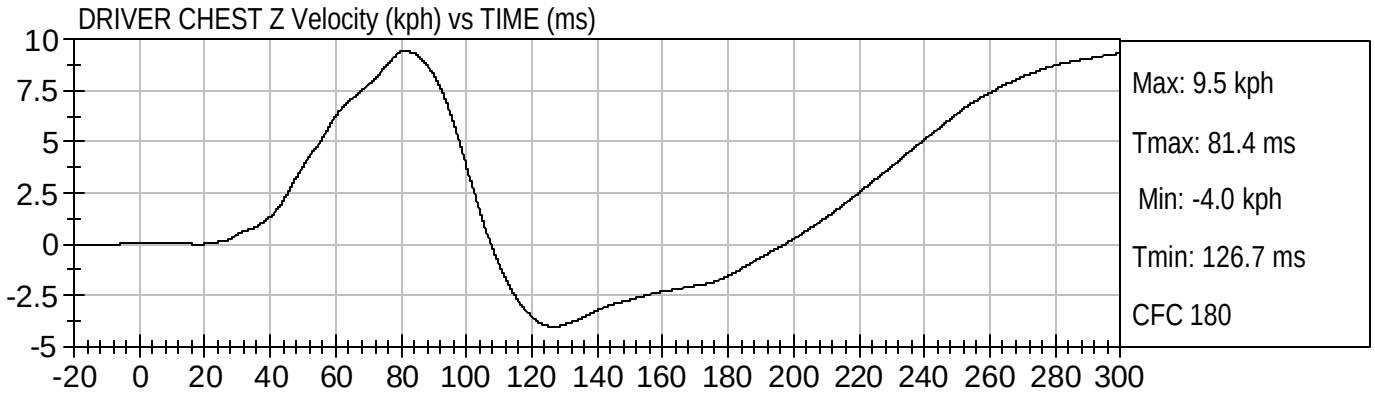






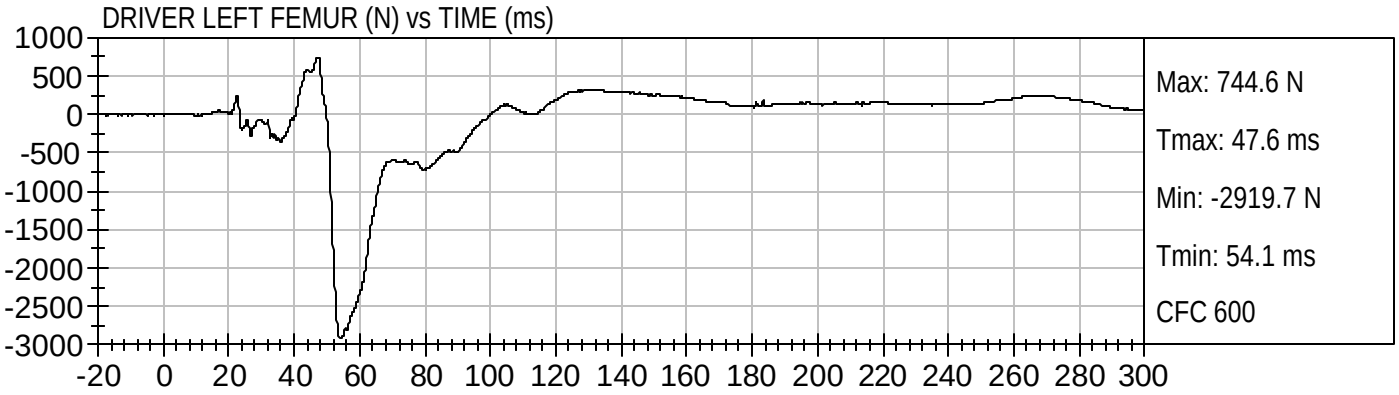

DRIVER CHEST X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-30
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.5 kph
Tmax: 0.0 ms
Min: -20.4 kph
Tmin: 117.9 ms
CFC 180

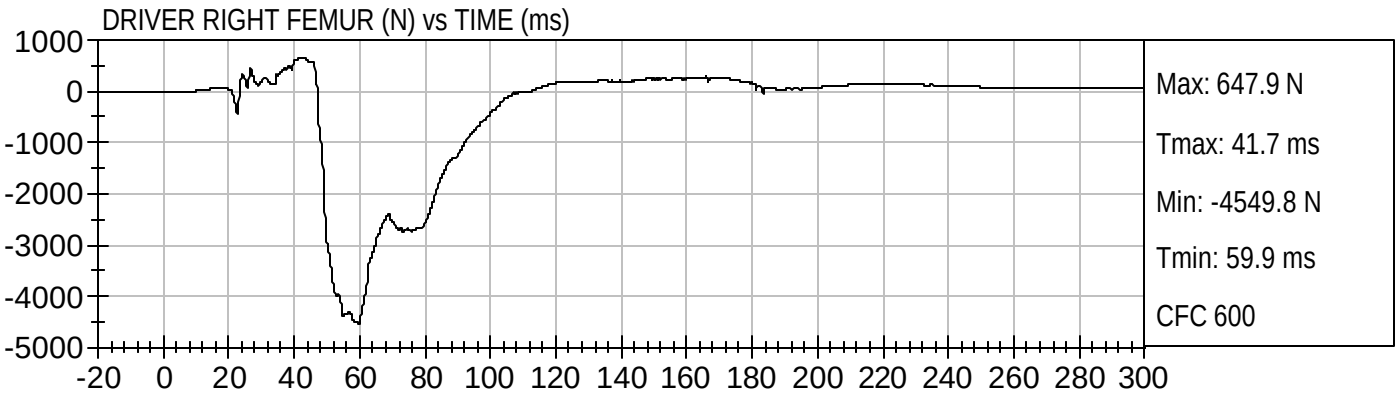

DRIVER CHEST Y Velocity (kph) vs TIME (ms)
0
-1
-2
-3
-4
-5
-6
-7
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -6.7 kph
Tmin: 87.4 ms
CFC 180


DRIVER CHEST Z Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 9.5 kph
Tmax: 81.4 ms
Min: -4.0 kph
Tmin: 126.7 ms
CFC 180

35MPH NCAP FRONTAL
2006 FORD FUSION (M60203)

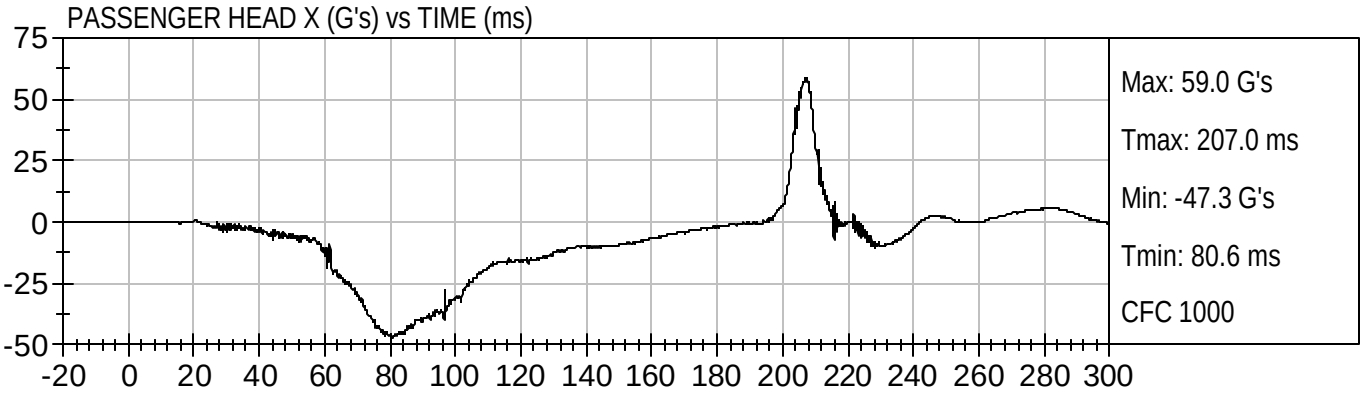
Test Date: 10/19/2005
Speed: 35.1 mph (56.5 km/h)

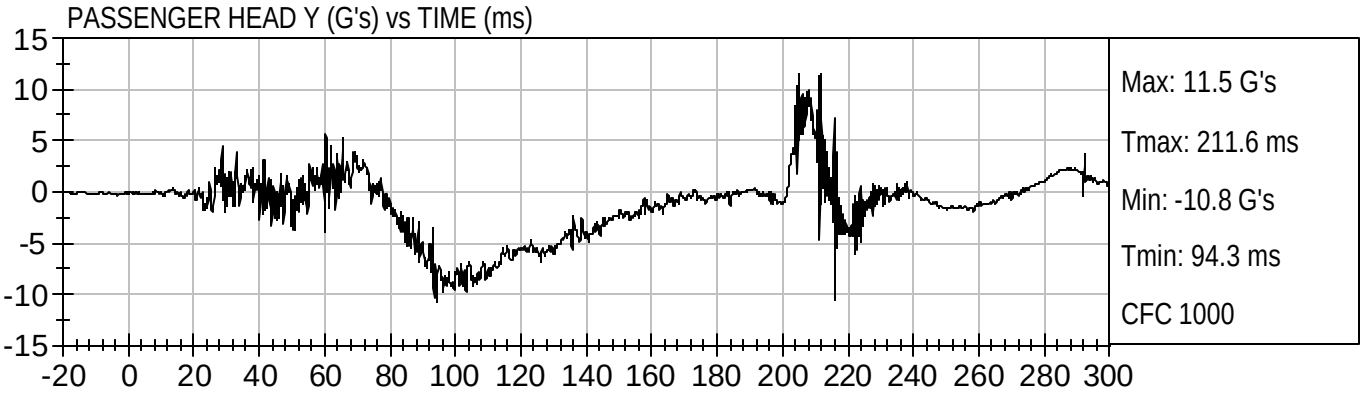


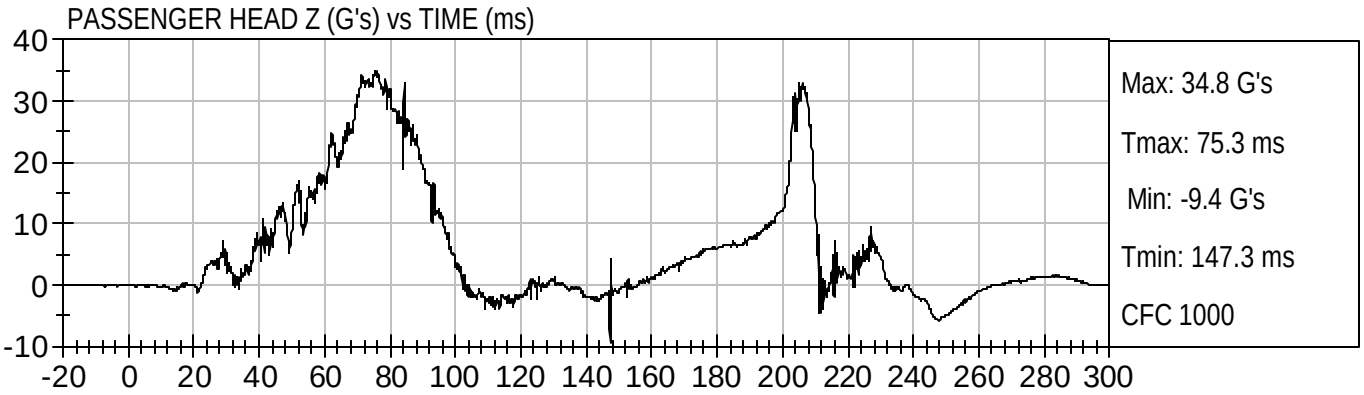


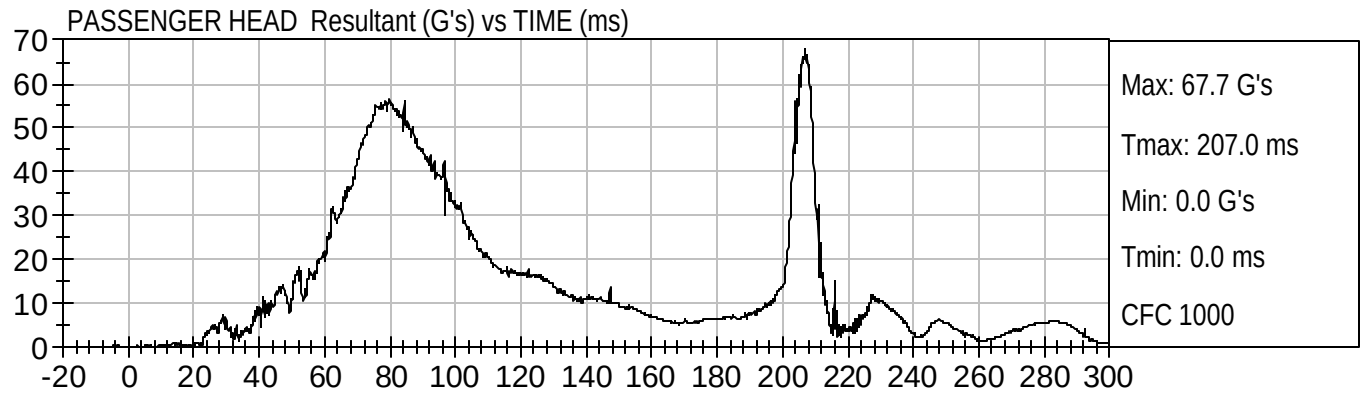
35MPH NCAP FRONTAL
2006 FORD FUSION (M60203)

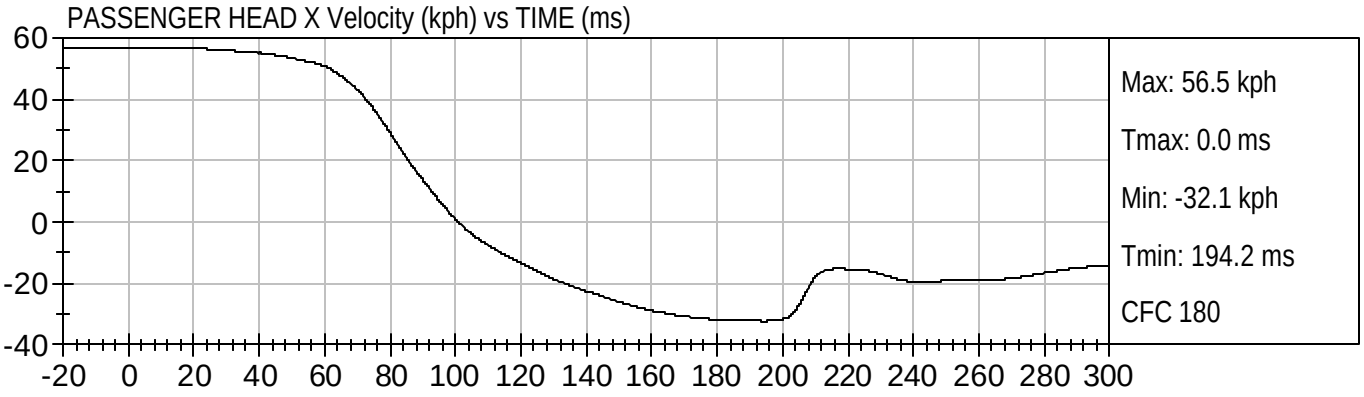
Test Date: 10/19/2005
Speed: 35.1 mph (56.5 km/h)

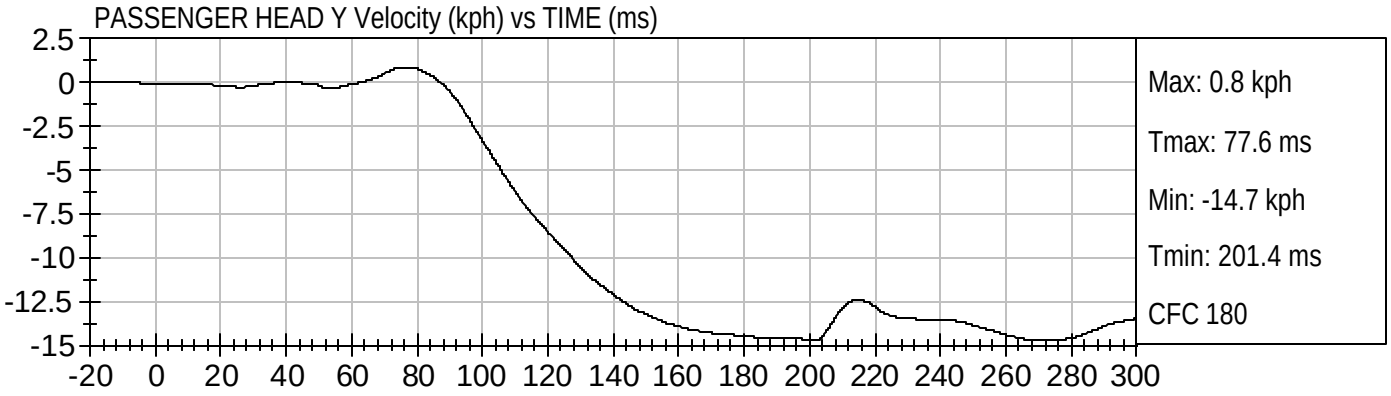


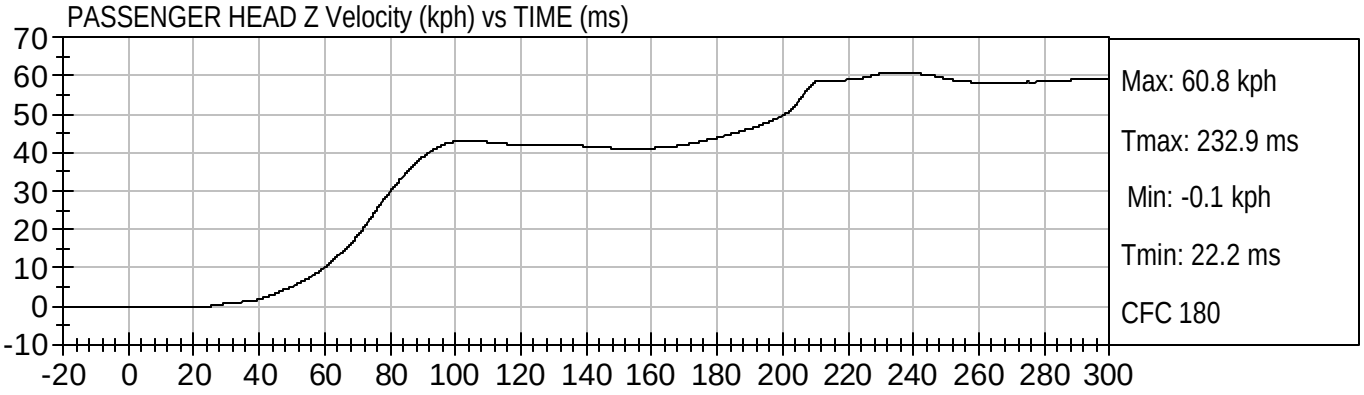






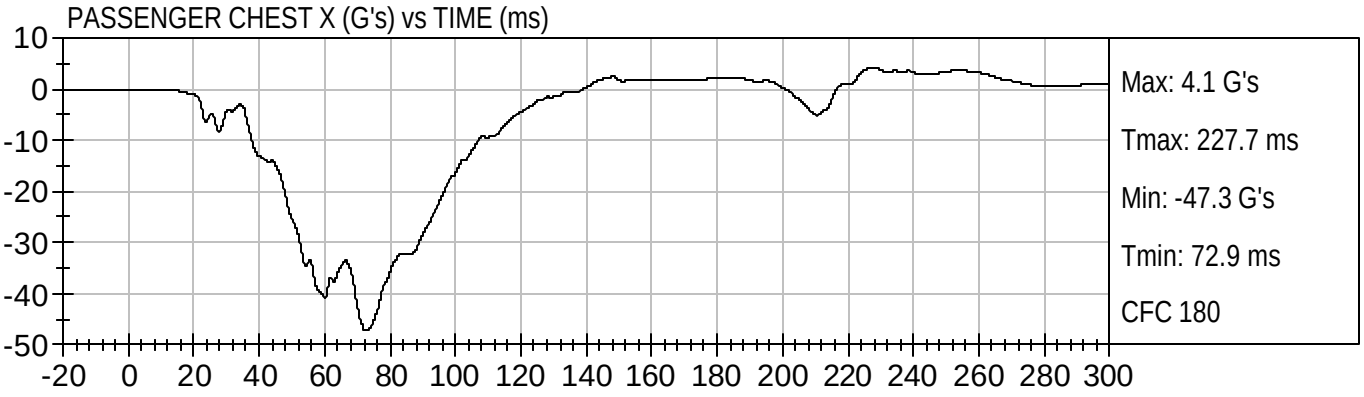

PASSENGER HEAD X Velocity (kph) vs TIME (ms)
60
40
20
0
-20
-40
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.5 kph
Tmax: 0.0 ms
Min: -32.1 kph
Tmin: 194.2 ms
CFC 180

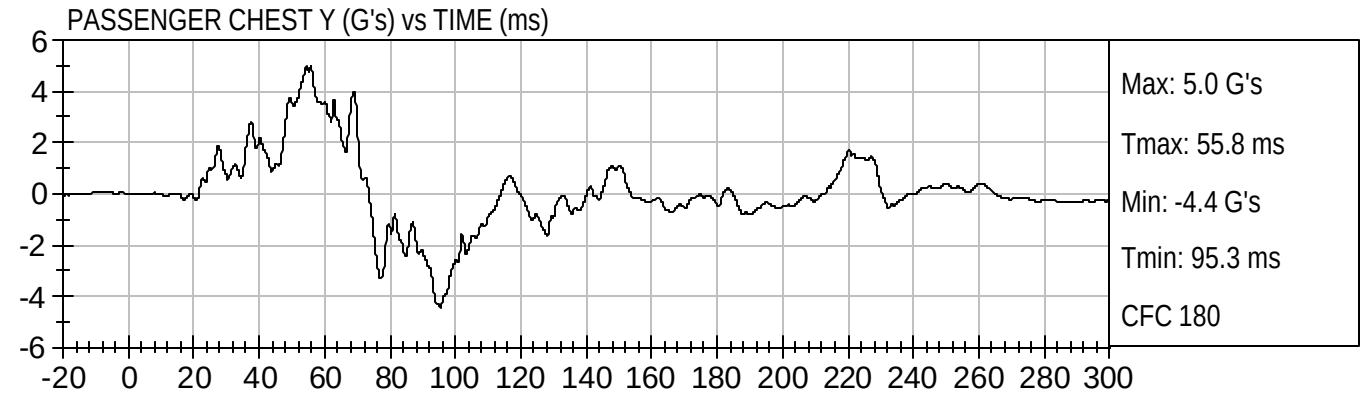

PASSENGER HEAD Y Velocity (kph) vs TIME (ms)
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.8 kph
Tmax: 77.6 ms
Min: -14.7 kph
Tmin: 201.4 ms
CFC 180

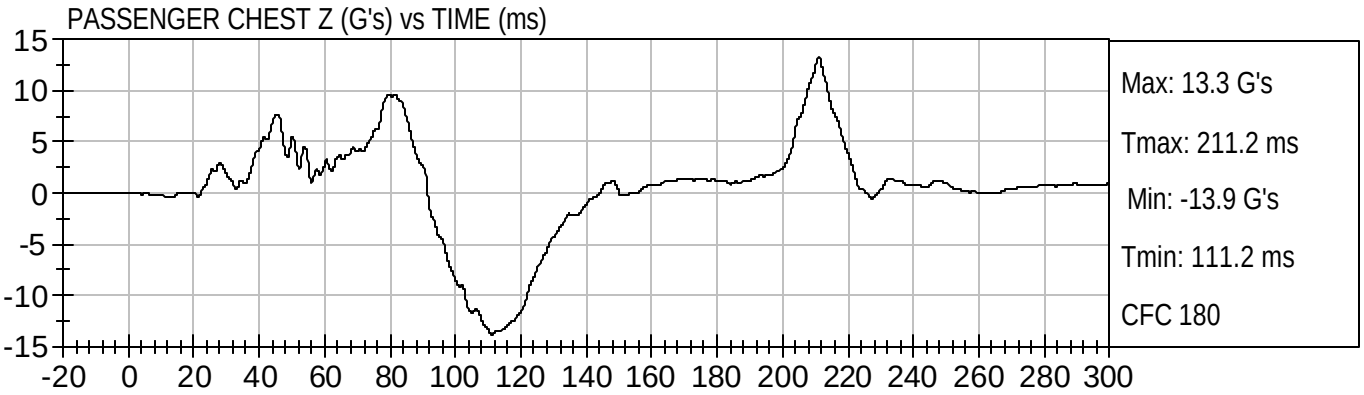

PASSENGER HEAD Z Velocity (kph) vs TIME (ms)
70
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 60.8 kph
Tmax: 232.9 ms
Min: -0.1 kph
Tmin: 22.2 ms
CFC 180

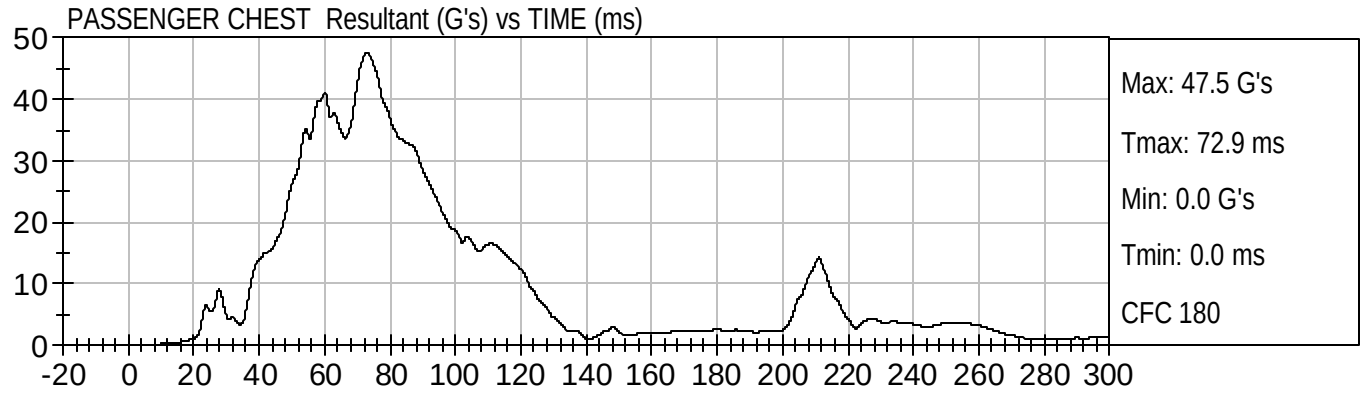
35MPH NCAP FRONTAL
2006 FORD FUSION (M60203)

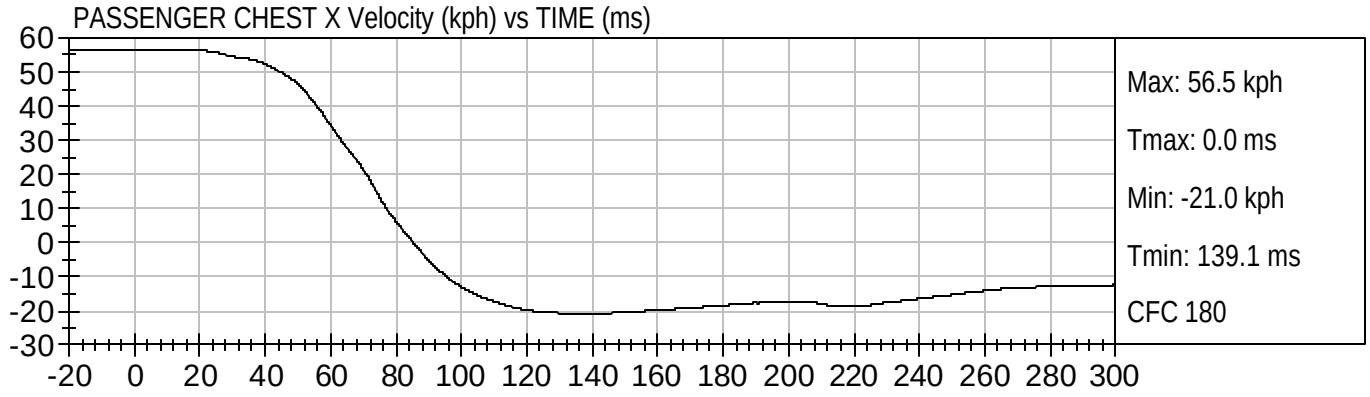
Test Date: 10/19/2005
Speed: 35.1 mph (56.5 km/h)

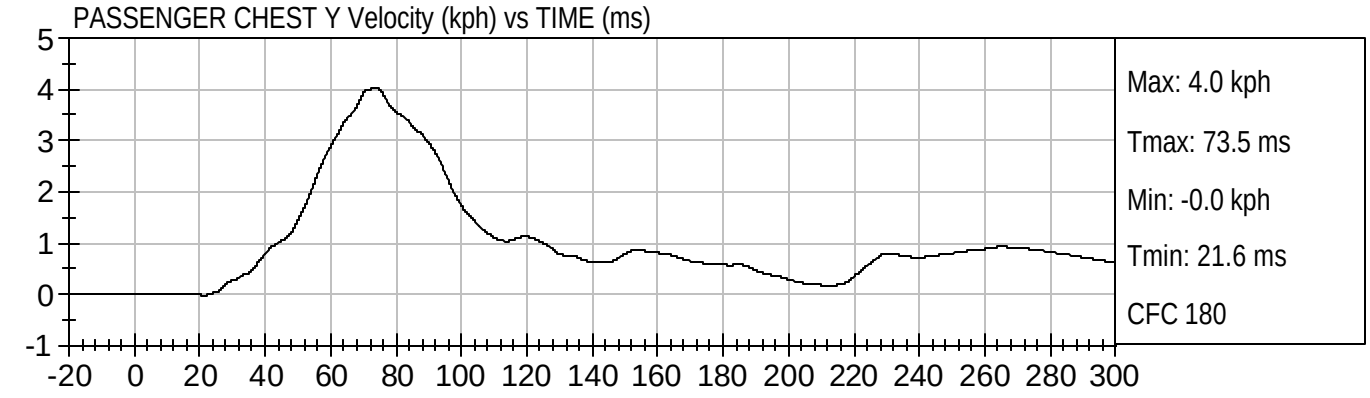


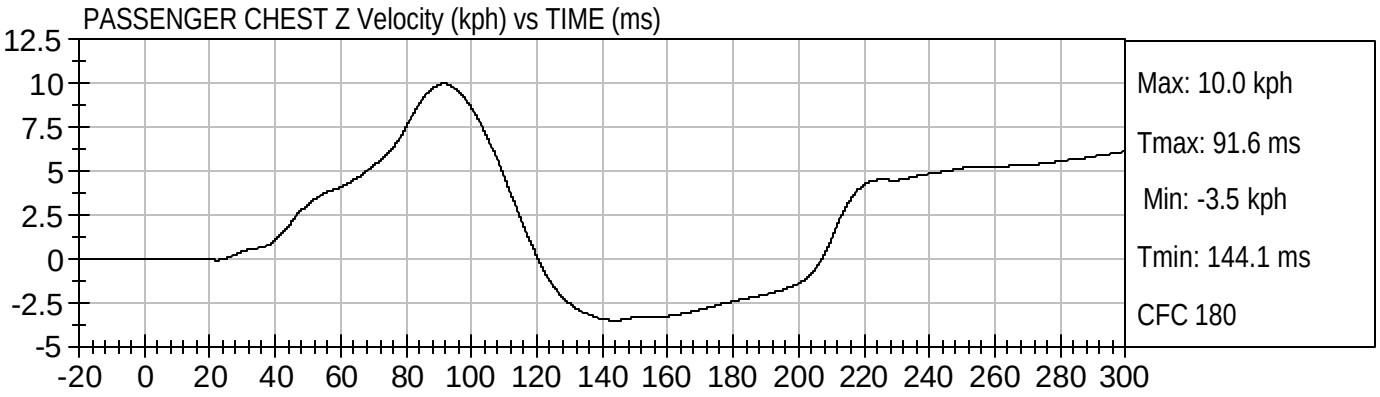


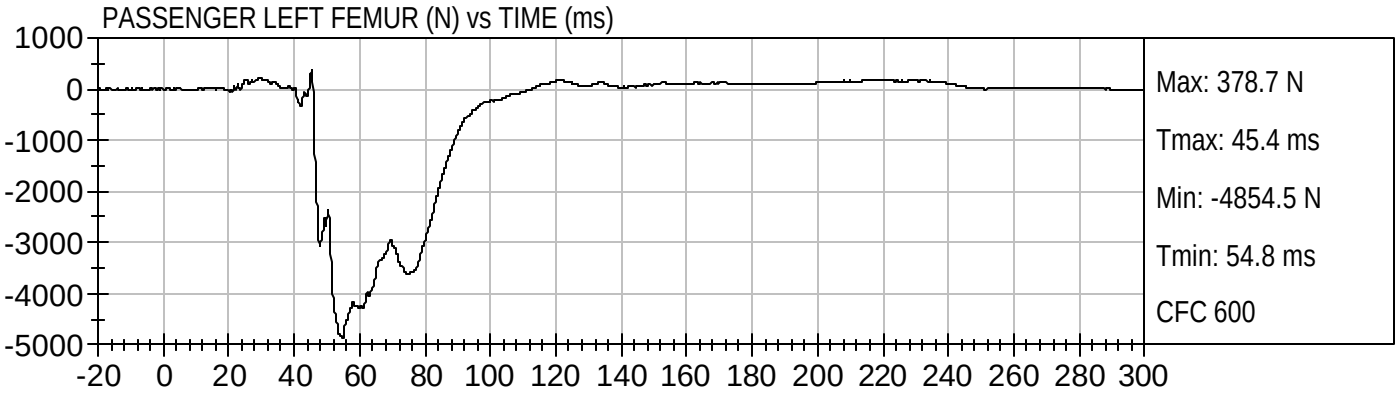


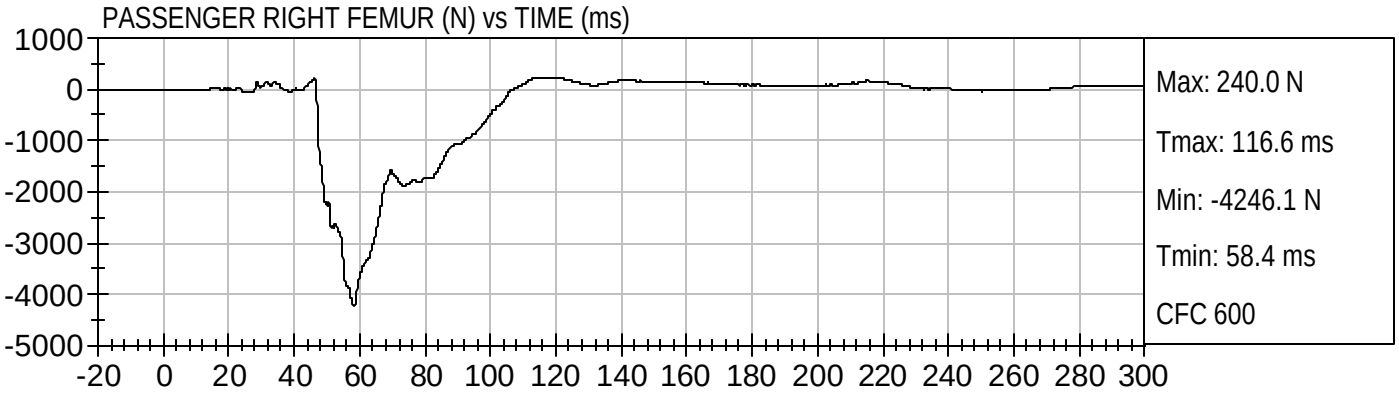



PASSENGER CHEST X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-30
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.5 kph
Tmax: 0.0 ms
Min: -21.0 kph
Tmin: 139.1 ms
CFC 180


PASSENGER CHEST Y Velocity (kph) vs TIME (ms)
5
4
3
2
1
0
-1
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 4.0 kph
Tmax: 73.5 ms
Min: -0.0 kph
Tmin: 21.6 ms
CFC 180


PASSENGER CHEST Z Velocity (kph) vs TIME (ms)
12.5
10
7.5
5
2.5
0
-2.5
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 10.0 kph
Tmax: 91.6 ms
Min: -3.5 kph
Tmin: 144.1 ms
CFC 180


PASSENGER LEFT FEMUR (N) vs TIME (ms)
1000
0
-1000
-2000
-3000
-4000
-5000
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 378.7 N
Tmax: 45.4 ms
Min: -4854.5 N
Tmin: 54.8 ms
CFC 600


PASSENGER RIGHT FEMUR (N) vs TIME (ms)
1000
0
-1000
-2000
-3000
-4000
-5000
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 240.0 N
Tmax: 116.6 ms
Min: -4246.1 N
Tmin: 58.4 ms
CFC 600

APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test ID:** D052651

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	225 - 275	266	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	12.8	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

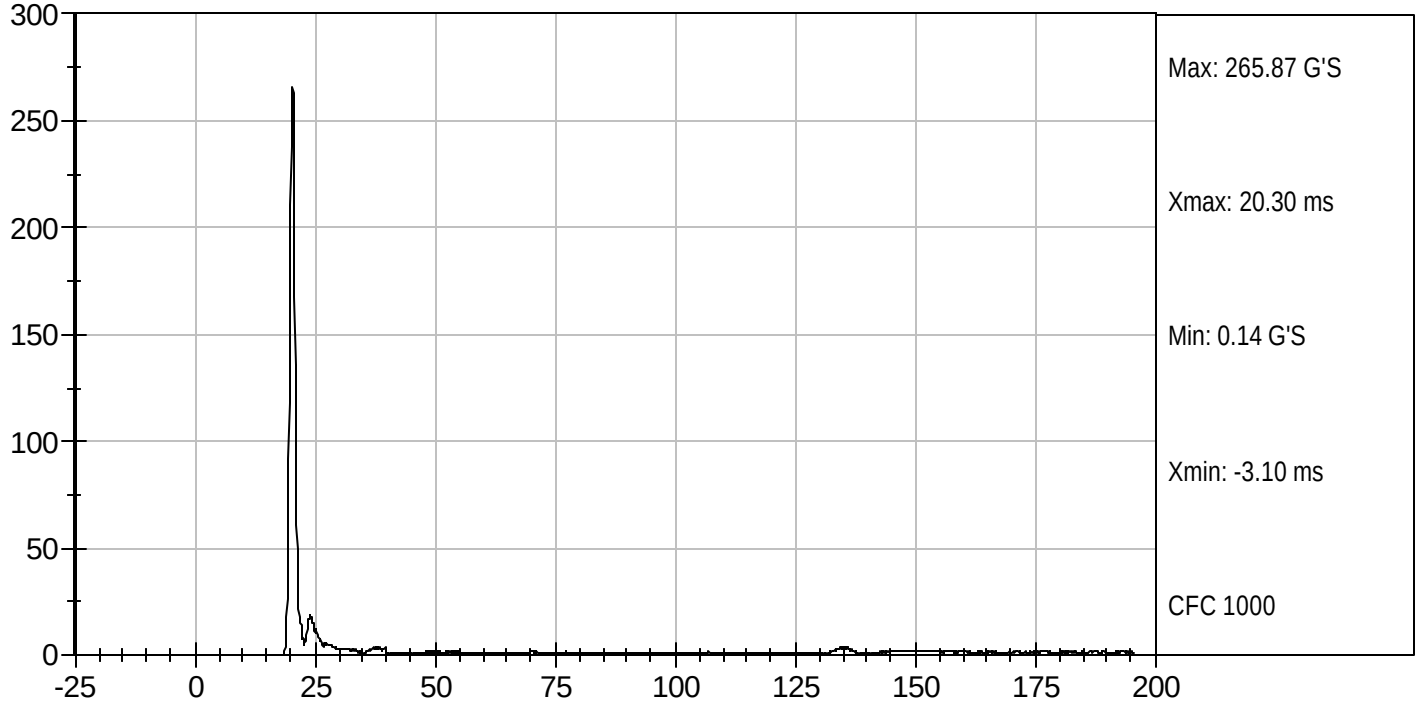
09/27/2005
Test Date

Approved By

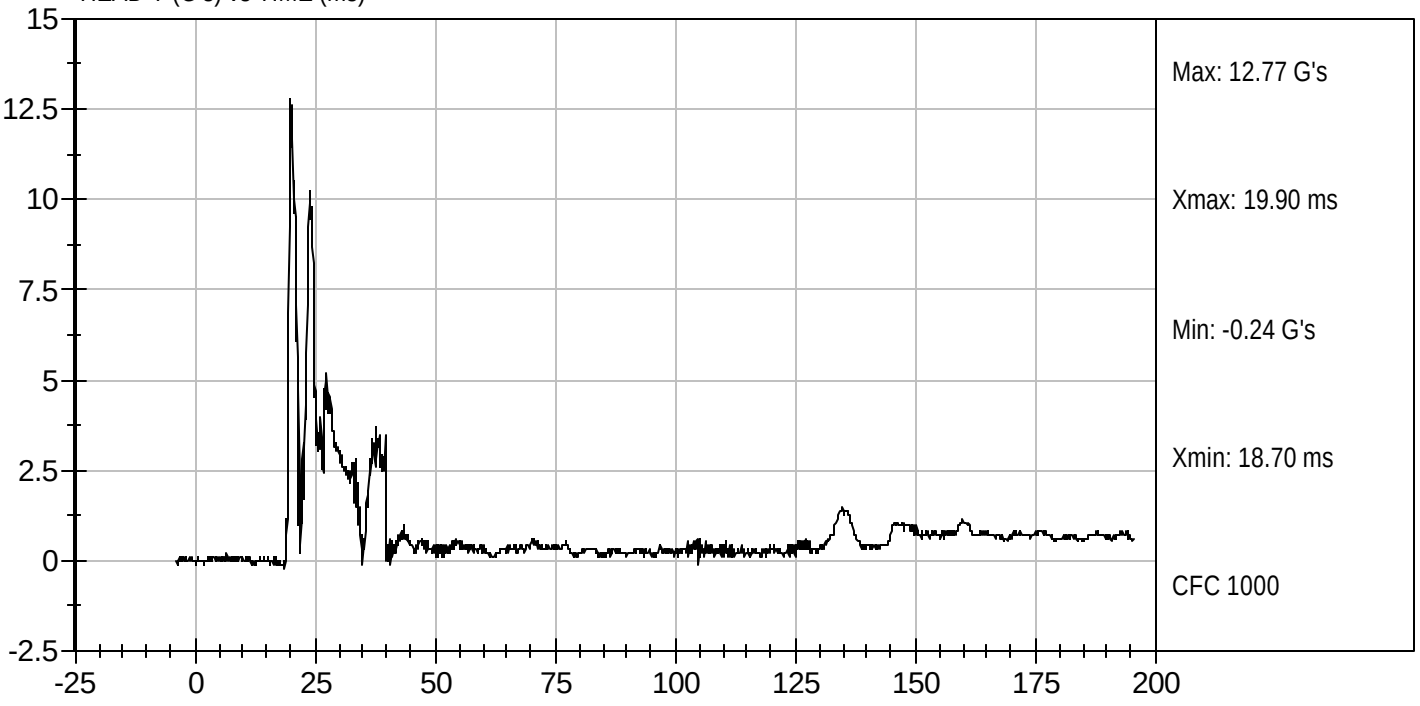
Test Desc: Head Drop
Componet ID: D052651

Test Date: 09/27/2005
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:** D052652

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.90	Pass
	20 msec	G's	17.60 to 22.60	21.15	Pass
	30 msec	G's	12.50 to 18.50	16.17	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	16.15	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	37.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	75.2	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	114.3	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	97.9	Pass
	Time	msec	47.0 to 58.0	49.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	100.9	Pass
			Overall Test Results		Pass

Laboratory Technician

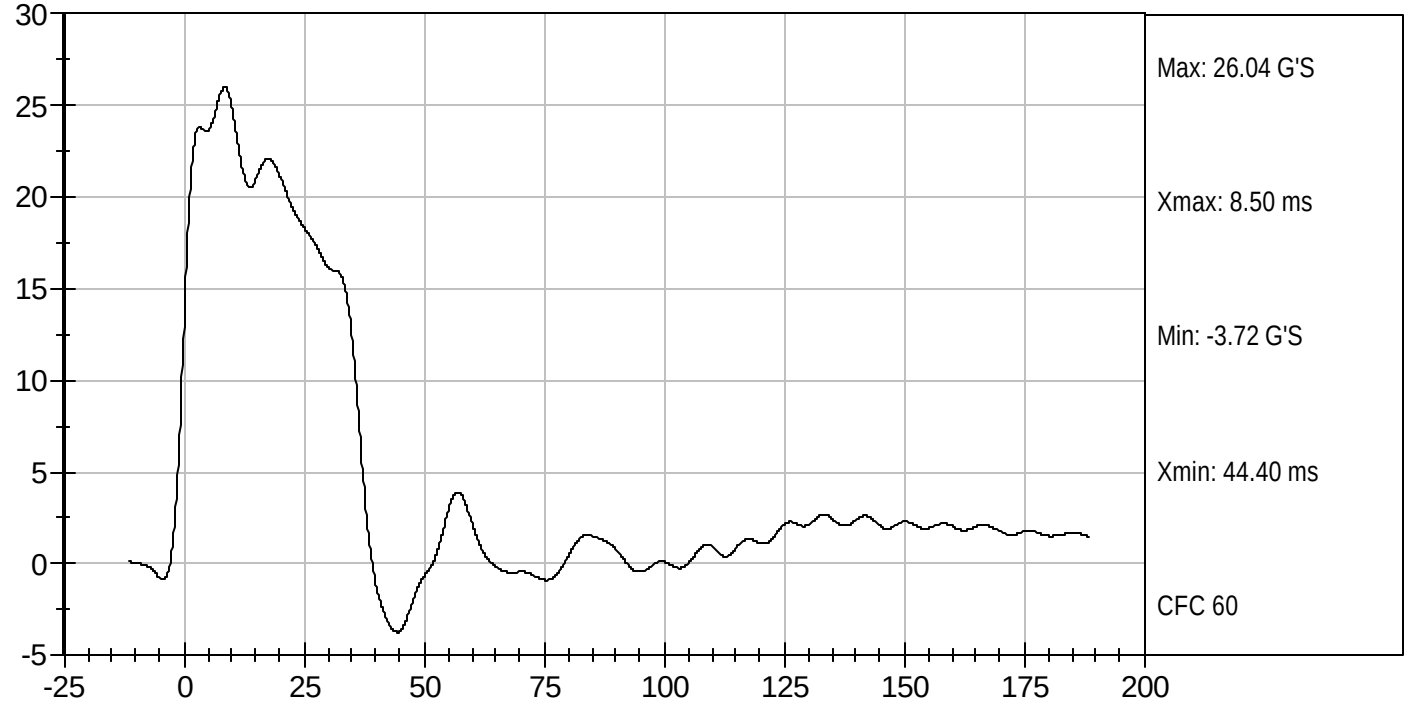
09/28/2005
Test Date

David Winkelbauer
Approved By

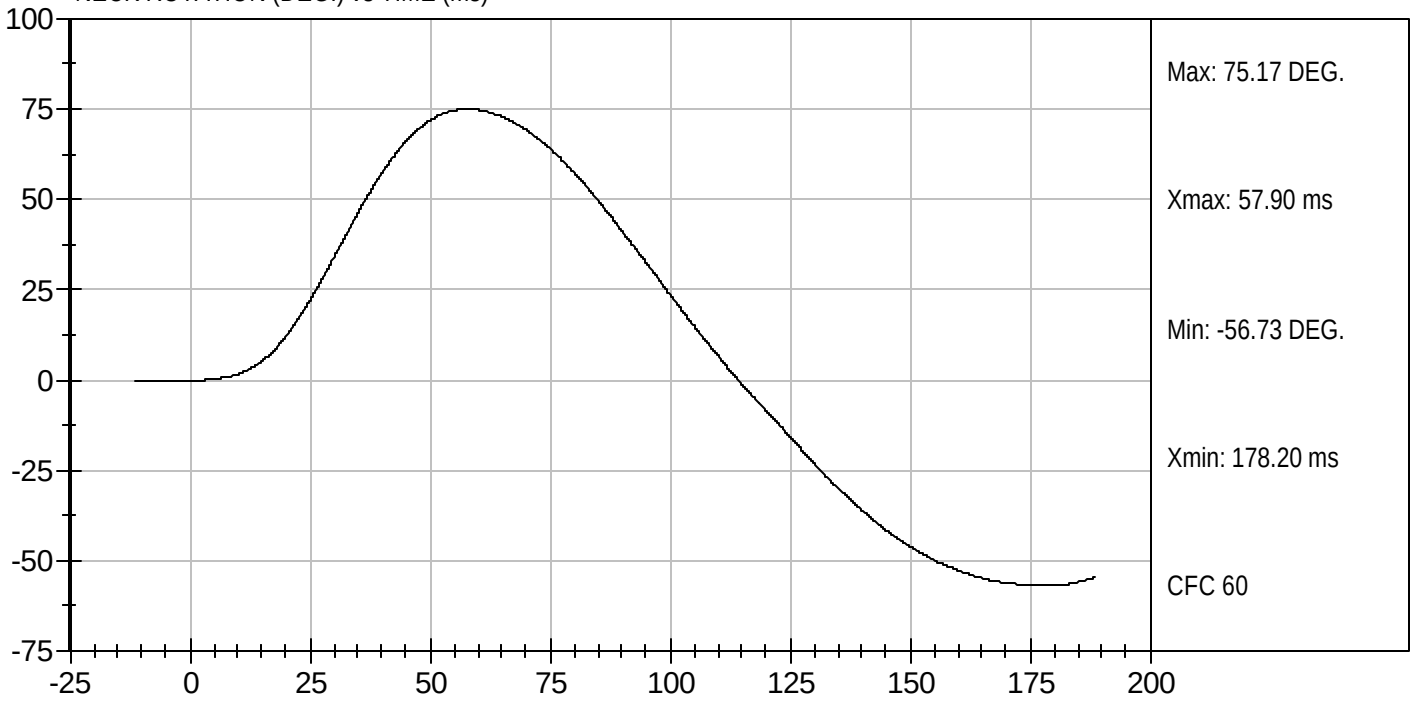
Test Desc: Neck Flexion
Componet ID: D052652

Test Date: 09/28/2005
Velocity: 23.12 ft/s, 7.05 m/s

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

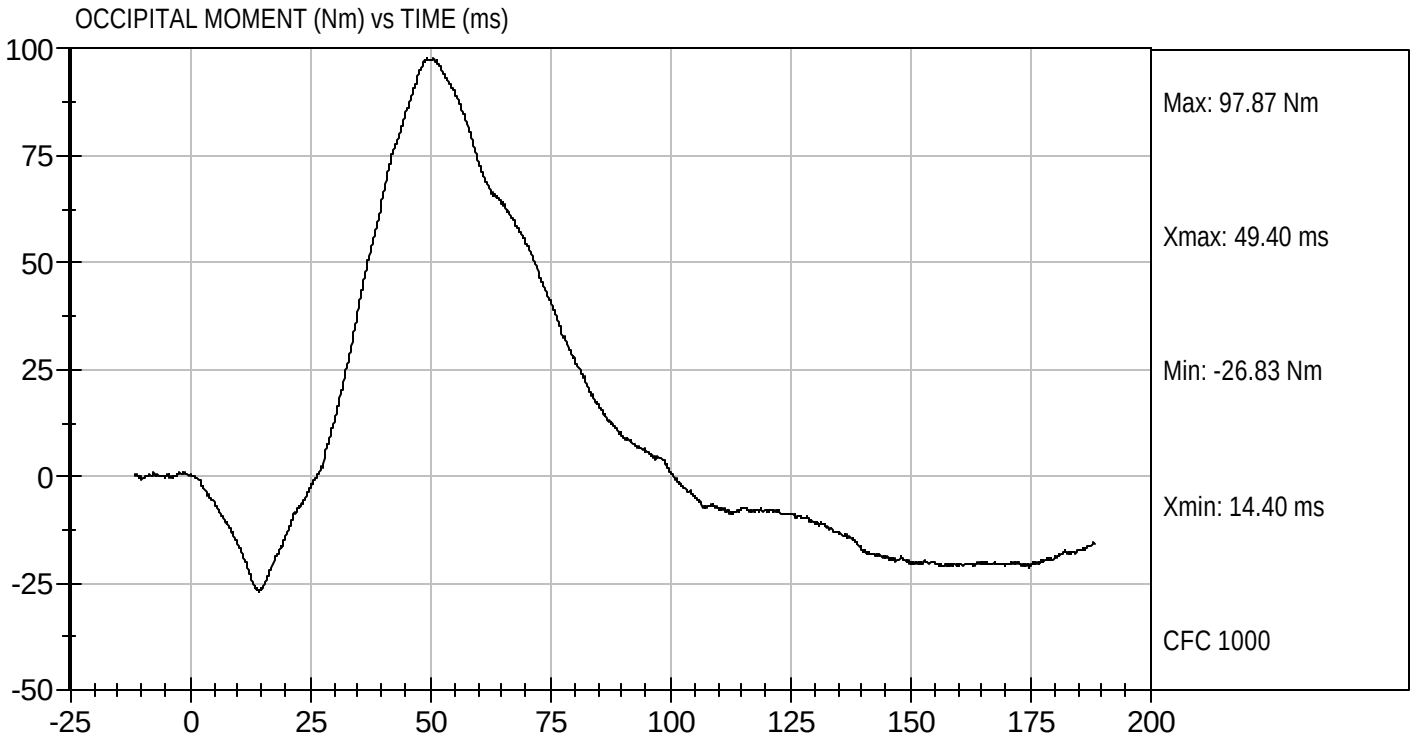


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D052652

Test Date: 09/28/2005
Velocity: 23.12 ft/s, 7.05 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D052653

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.10	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.18	Pass
	20 msec	G's	14.00 to 19.00	16.51	Pass
	30 msec	G's	11.00 to 16.00	14.44	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	14.71	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.3	Pass
	Time	msec	72.0 to 82.0	78.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	155.3	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-73.9	Pass
	Time	msec	65.0 to 79.0	73.0	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	146.8	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

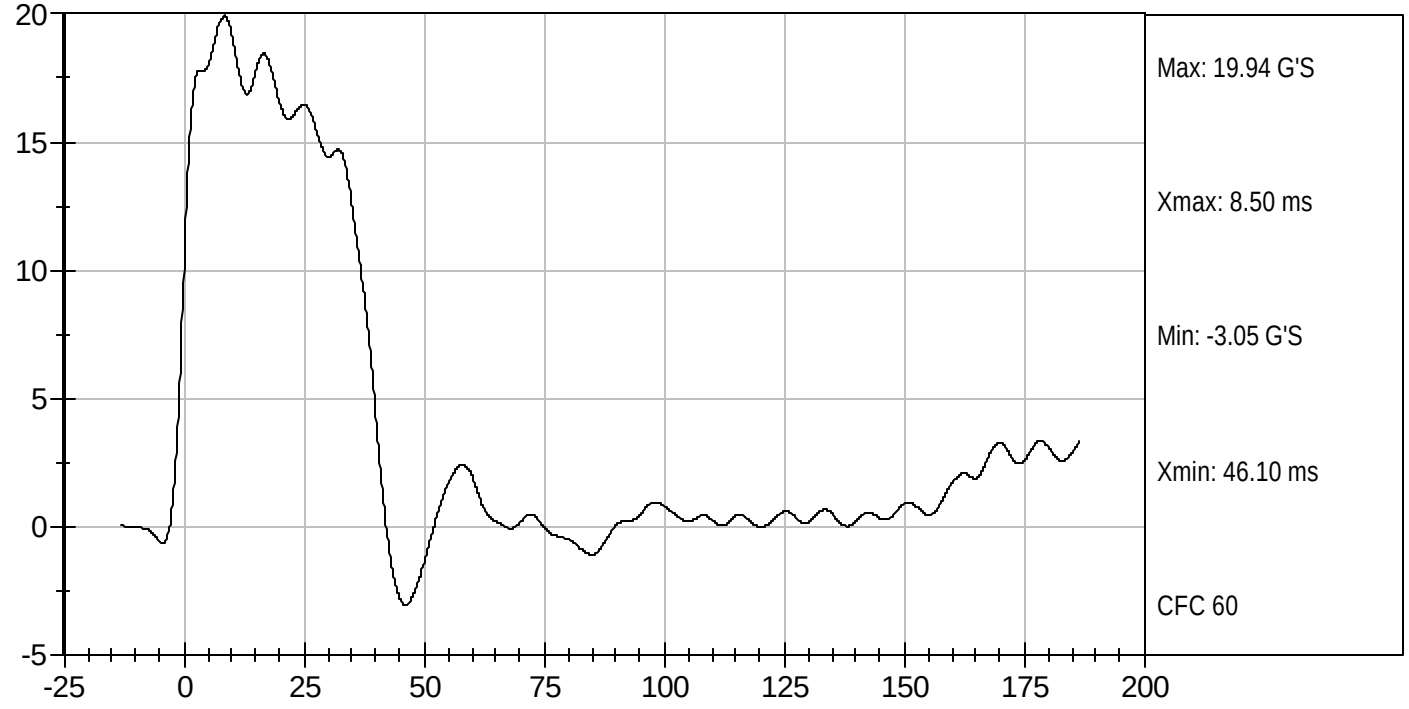
09/28/2005
Test Date

David Winkelbauer
Approved By

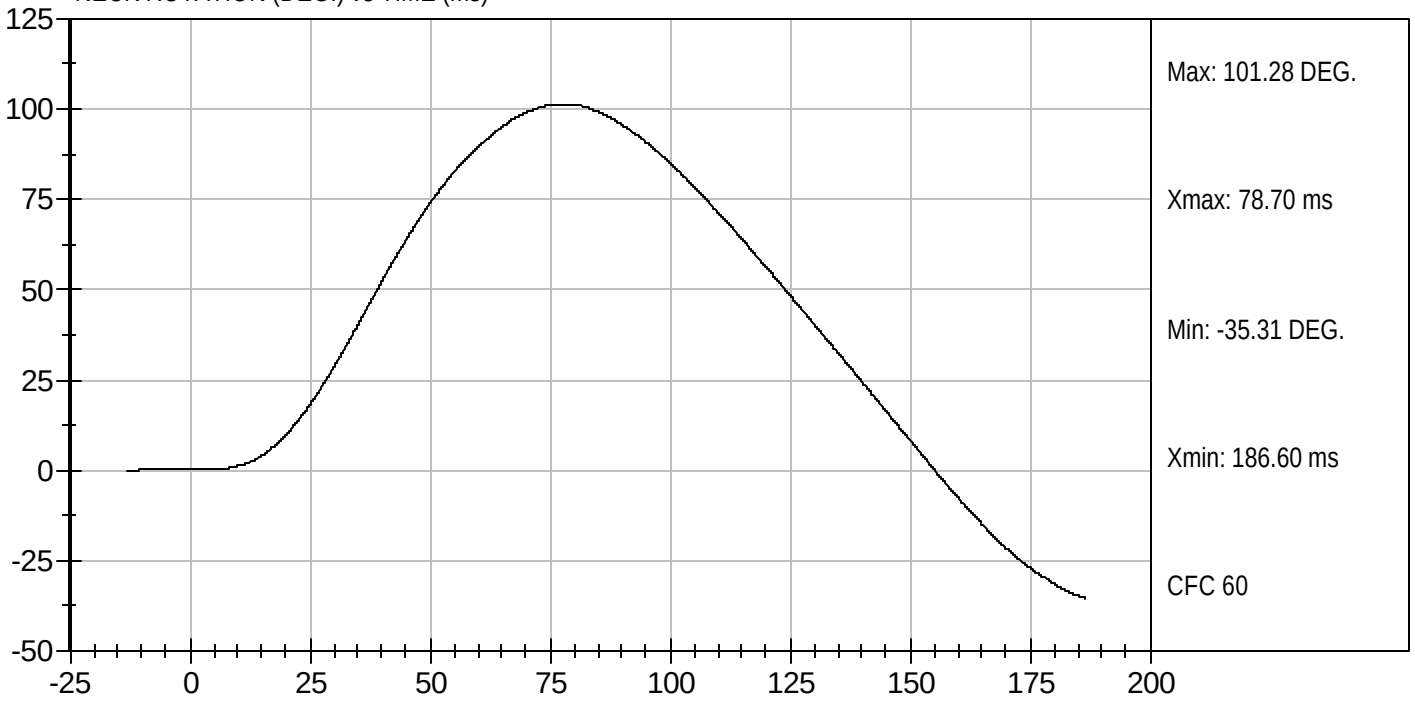
Test Desc: Neck Extension
Componet ID: D052653

Test Date: 09/28/2005
Velocity: 20.01 ft/s, 6.10 m/s

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

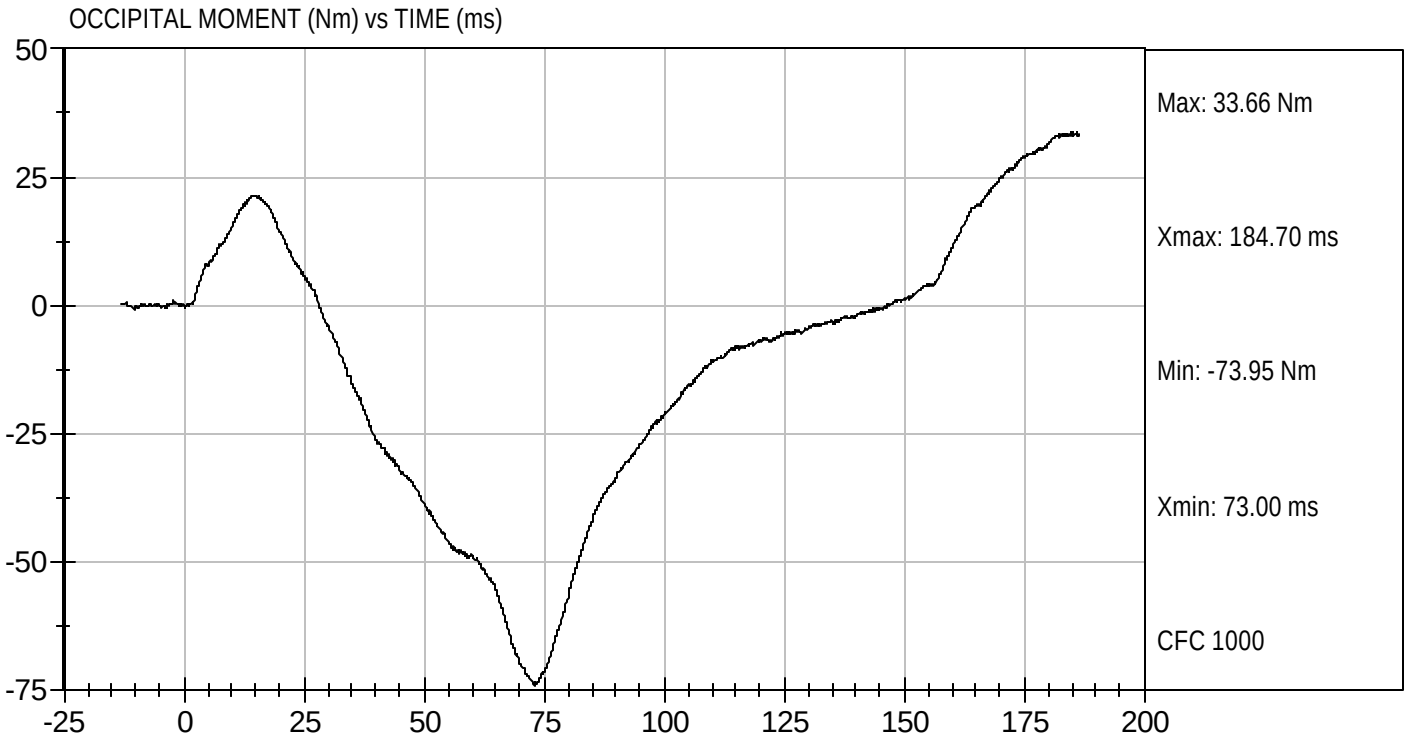


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D052653

Test Date: 09/28/2005
Velocity: 20.01 ft/s, 6.10 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D052654

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	6.58 to 6.82	6.59	Pass
Peak Probe Force	N	5159 to 5893	5,557	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.38	Pass
Internal Hysteresis	%	69 to 85	72.5	Pass
		Overall Test Results		Pass

Laboratory Technician

09/28/2005

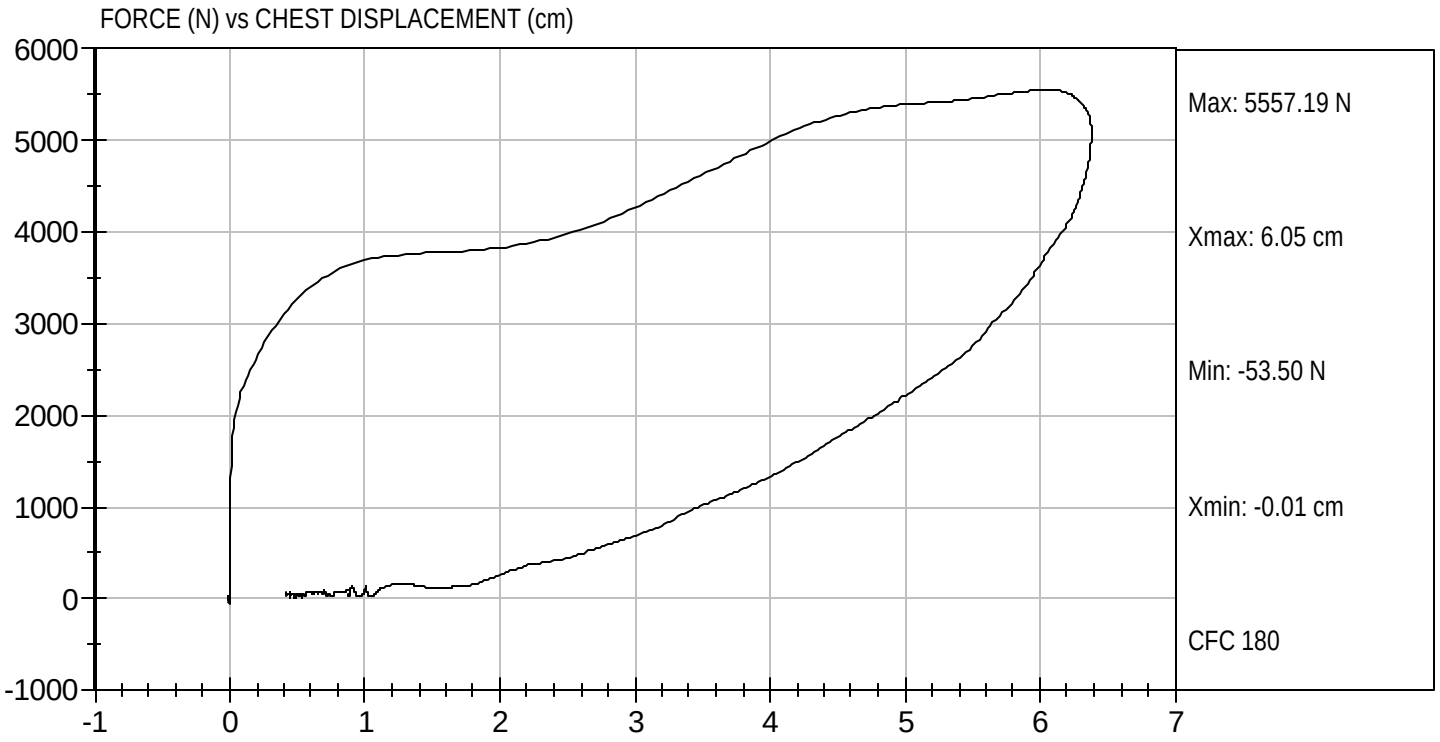
Test Date

David Winkelbauer

Approved By

Test Desc: Thorax Impact
Componet ID: D052654

Test Date: 09/28/2005
Velocity: 21.62 ft/s, 6.59 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D052655

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,393	Pass
		Overall Test Results		Pass

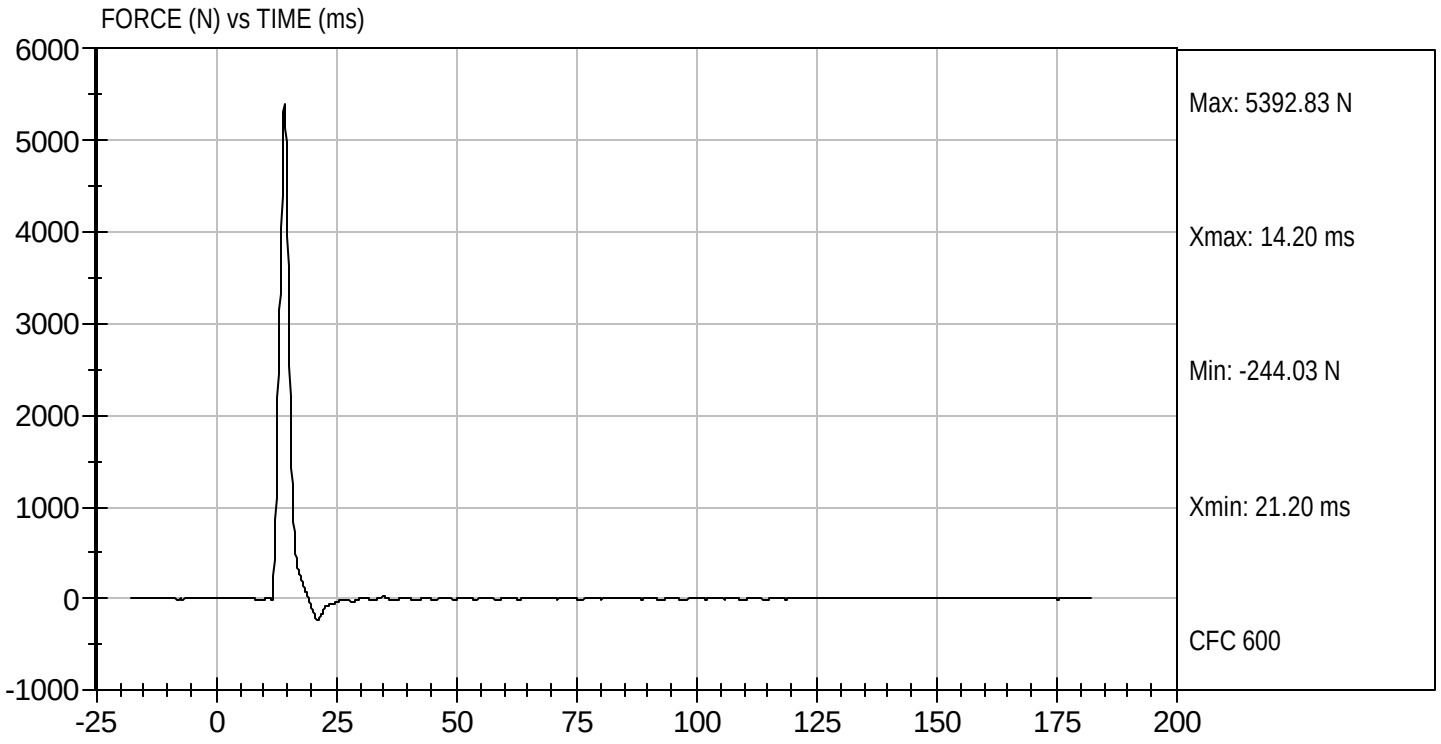
Laboratory Technician

09/28/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D052655

Test Date: 09/28/2005
Velocity: 6.94 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D052656

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.09	Pass
Peak Probe Force	Newtons	4715 to 5782	4,952	Pass
		Overall Test Results		Pass

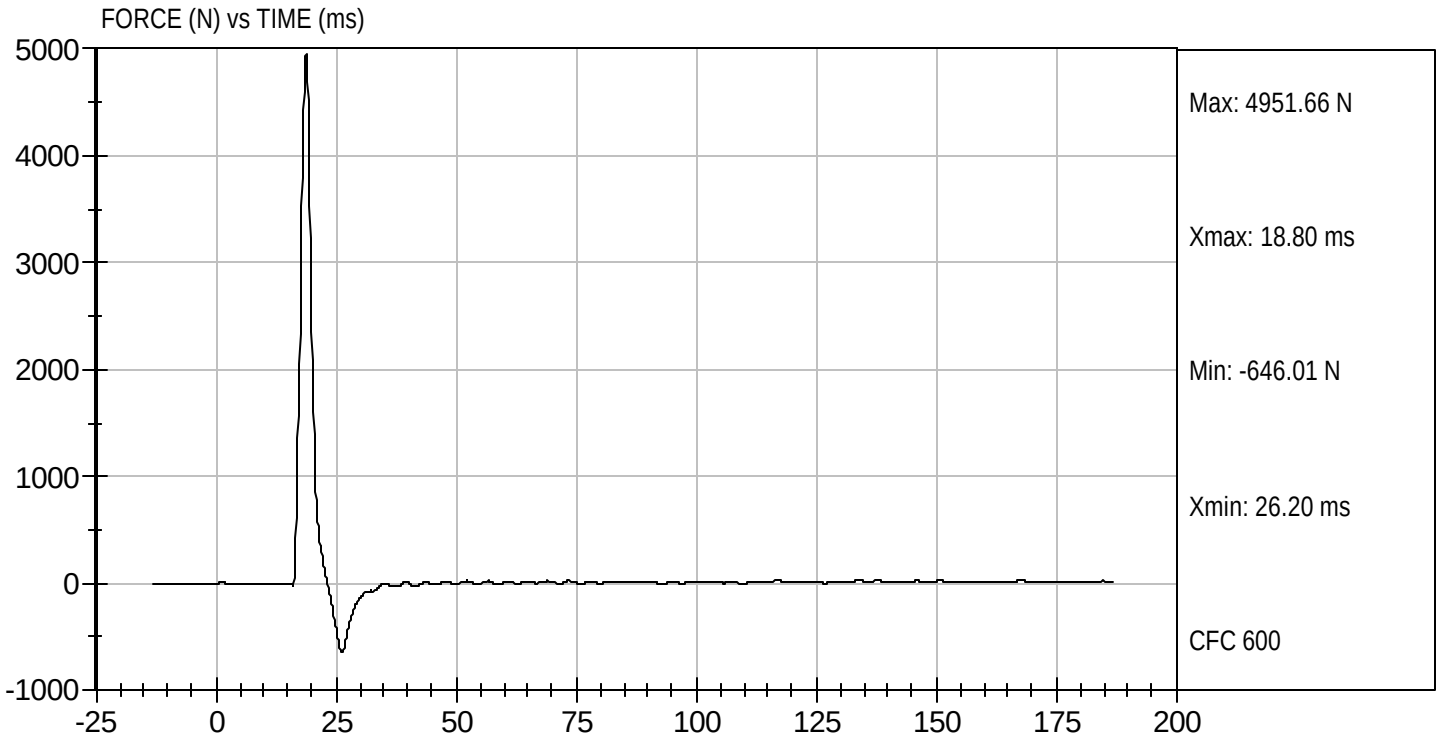
Laboratory Technician

09/28/2005
Test Date

Approved By

Test Desc: Left Knee
Componet ID: D052656

Test Date: 09/28/2005
Velocity: 6.87 ft/s, 2.09 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D052659

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.4	22.4	Pass
Laboratory Relative Humidity	%	10 to 70	42	42	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	84.4	85.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	40	Pass
		Overall Test Results			Pass

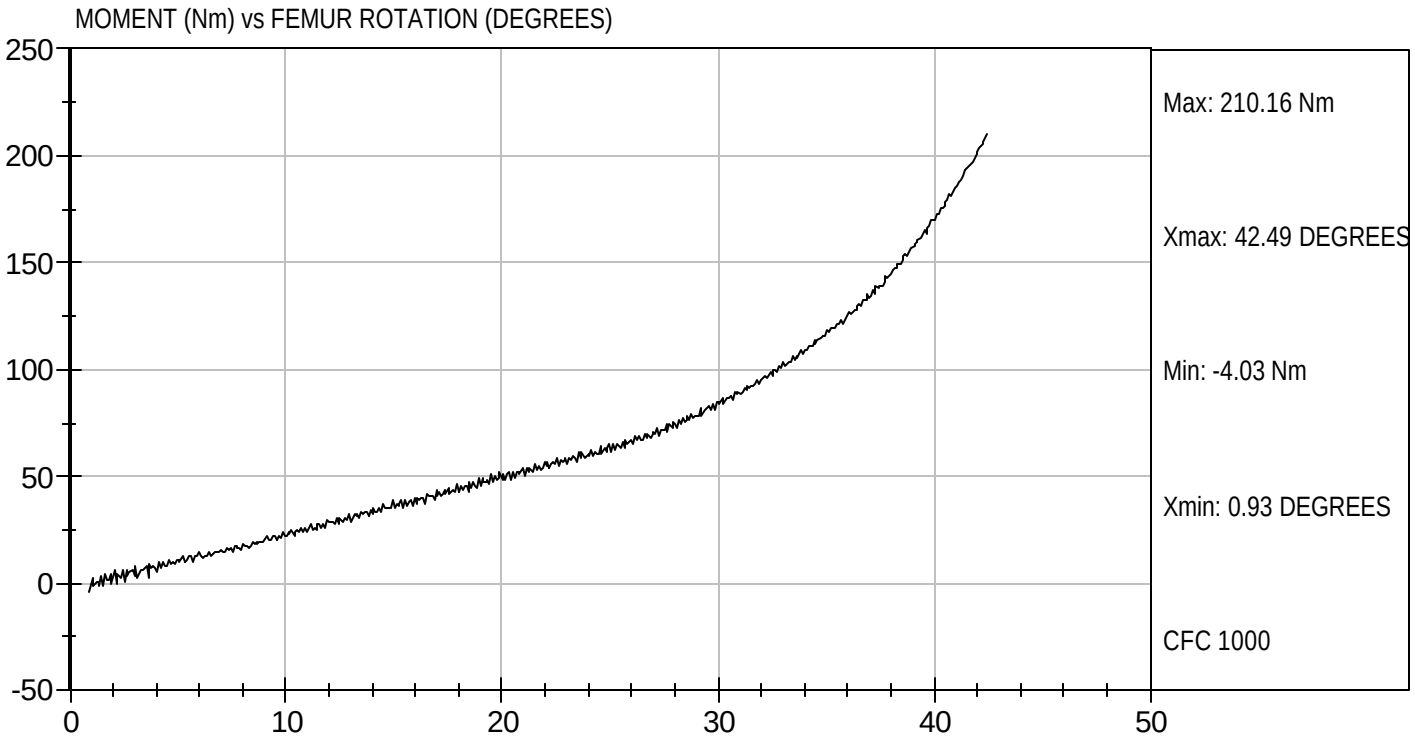
Laboratory Technician

09/28/2005
Test Date

David Winkelbauer
Approved By

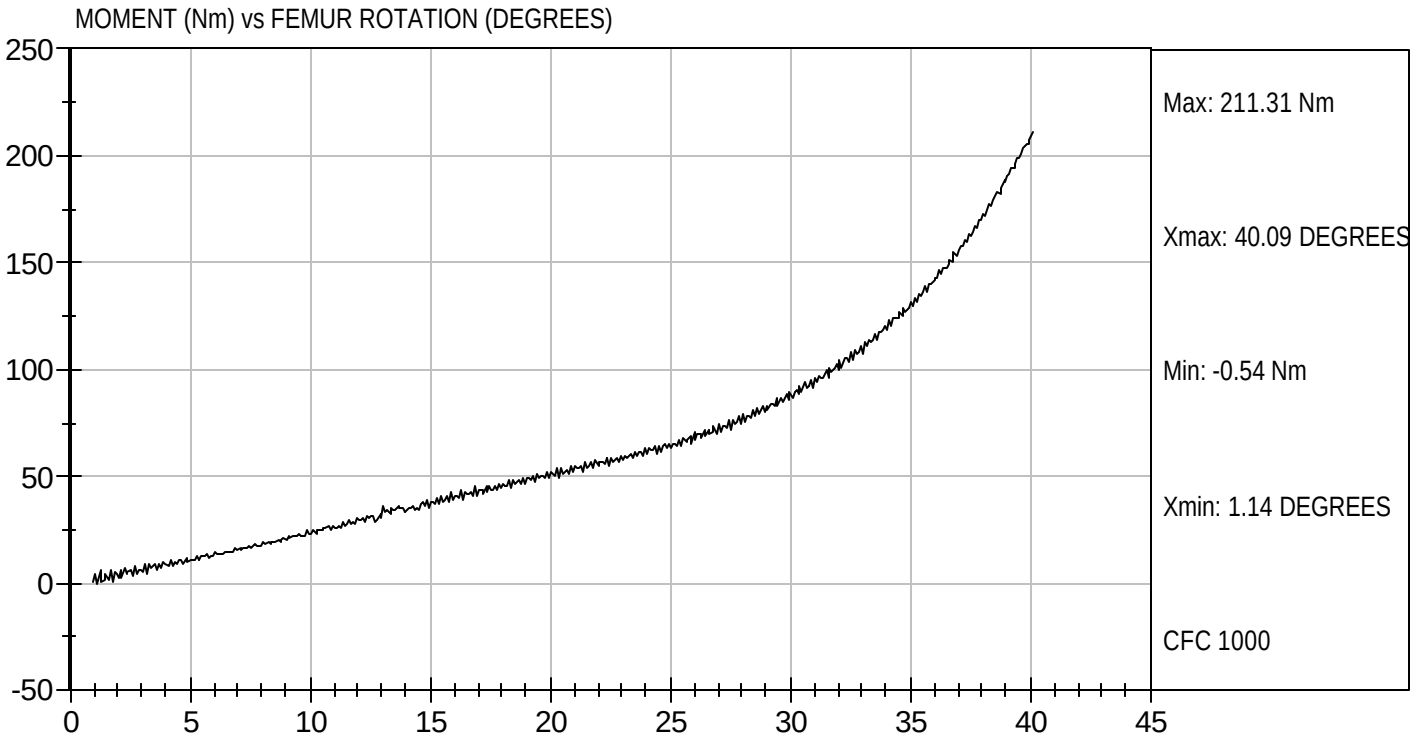
Test Desc: Hip Femur Flexion
Componet ID: D052659

Test Date: 09/28/2005
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D052650

Test Date: 09/29/2005
Velocity: 0 ft/s, 0.00 m/s



MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test ID:** D052641

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	22.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	225 - 275	246	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	8.0	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

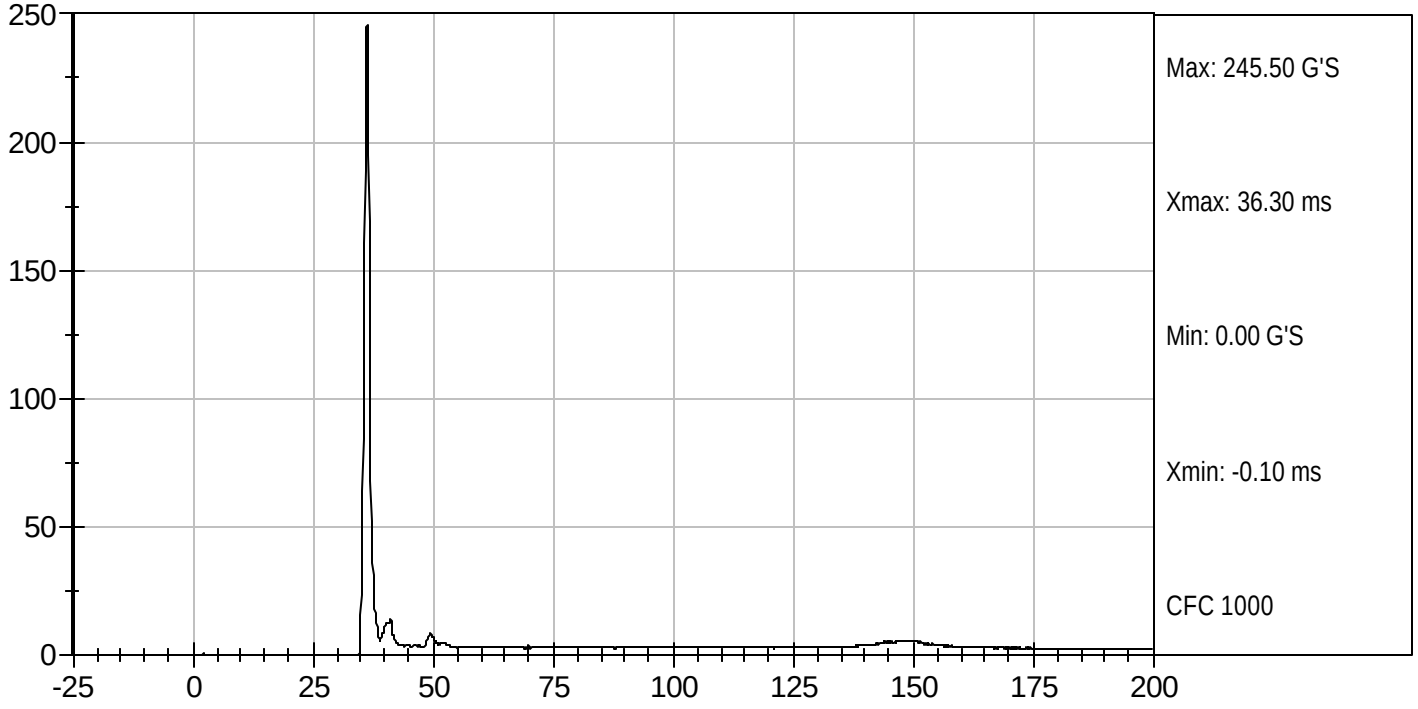
09/28/2005
Test Date

Approved By

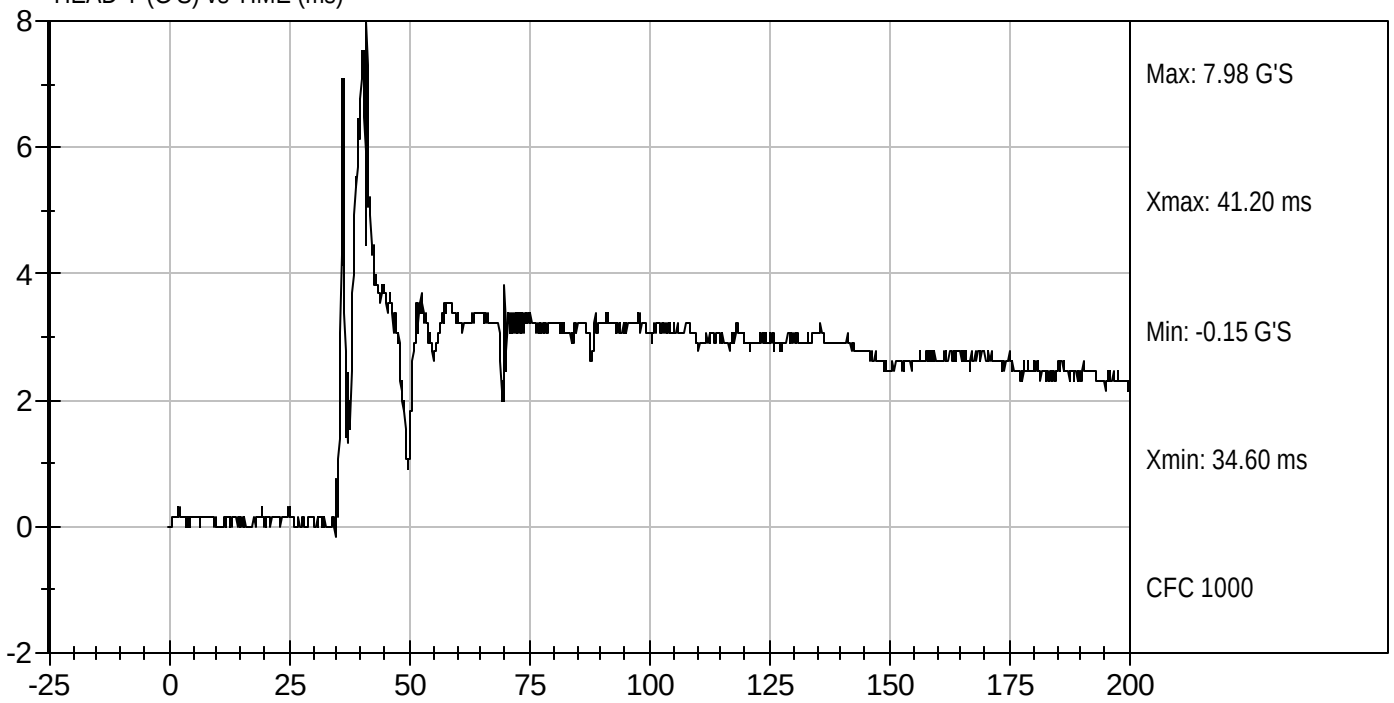
Test Desc: Head Drop
Componet ID: D052641

Test Date: 09/28/2005
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:** D052642

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	26.07	Pass
	20 msec	G's	17.60 to 22.60	21.56	Pass
	30 msec	G's	12.50 to 18.50	17.10	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	17.02	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	34.6	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	78.0	Pass
	Time	msec	57.0 to 64.0	57.7	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	97.4	Pass
	Time	msec	47.0 to 58.0	48.6	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	103.0	Pass
			Overall Test Results		Pass

Laboratory Technician

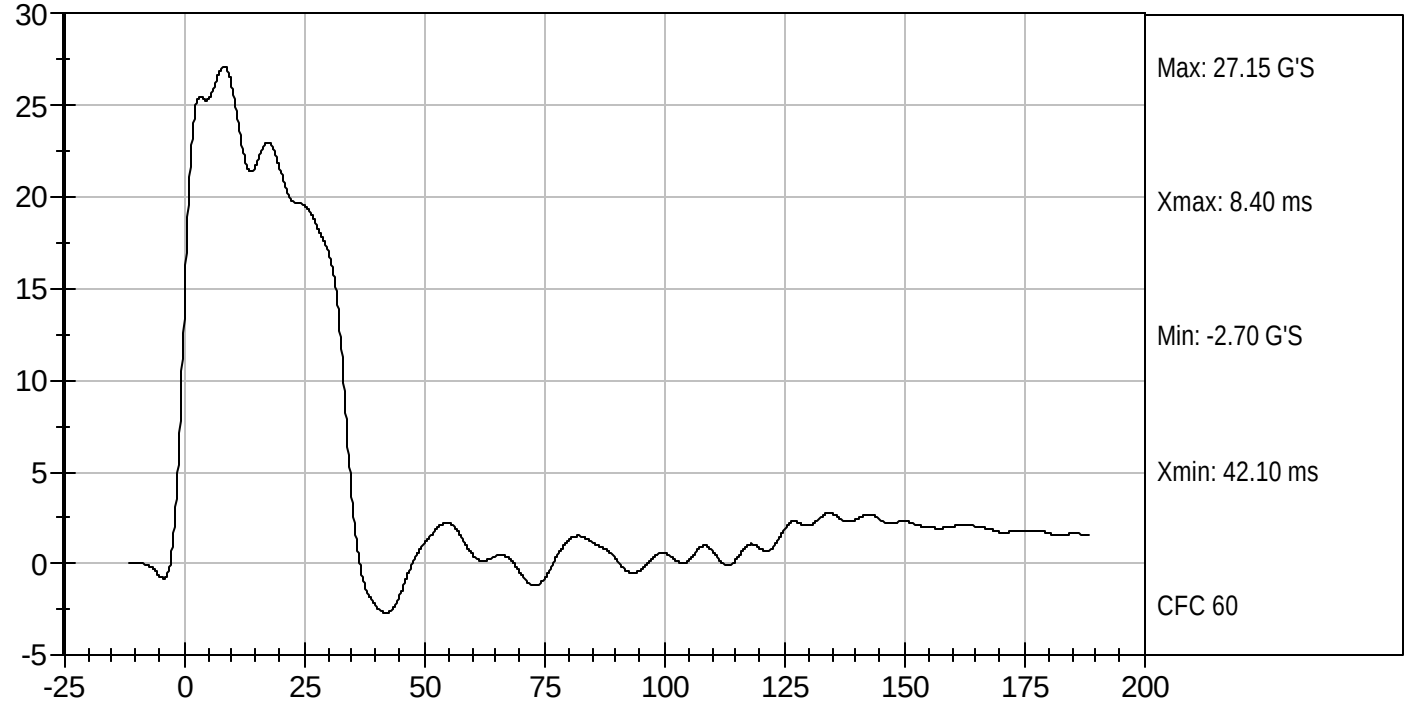
09/28/2005
Test Date

David Winkelbauer
Approved By

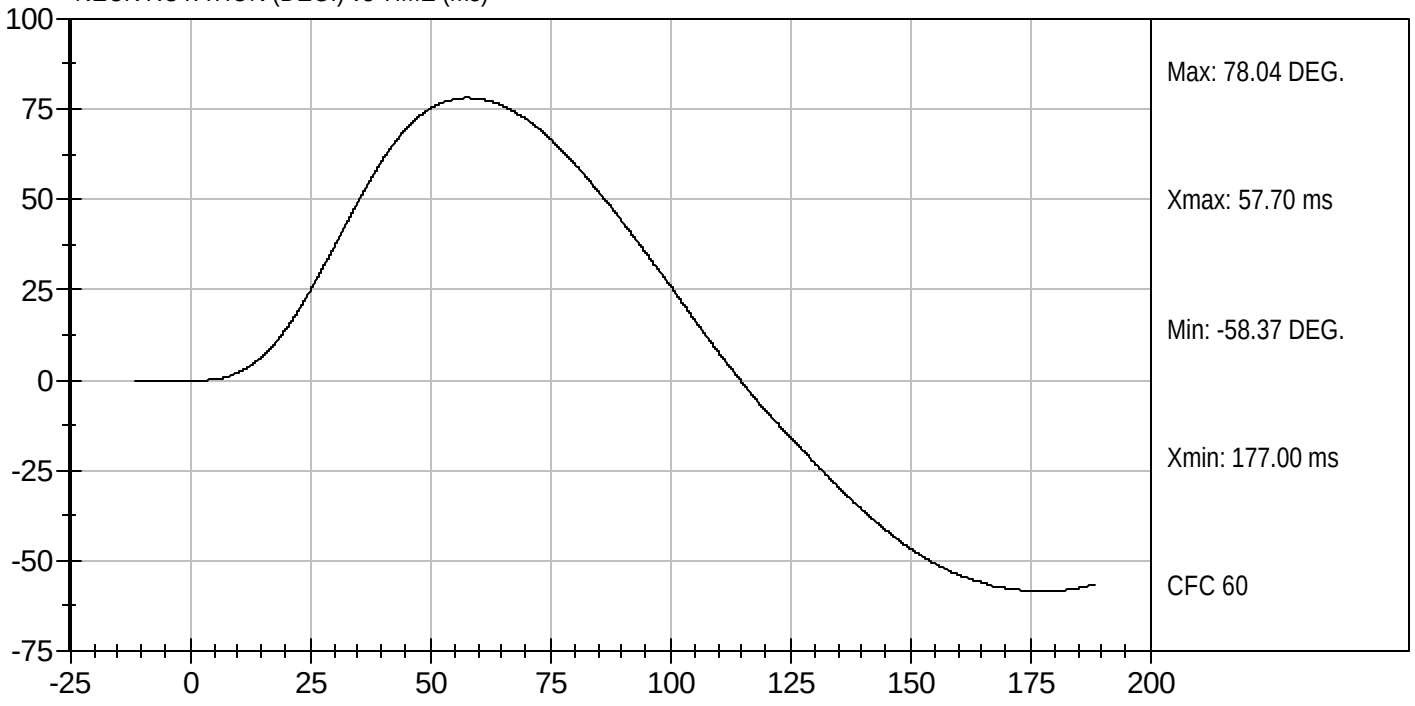
Test Desc: Neck Flexion
Componet ID: D052642

Test Date: 09/28/2005
Velocity: 23.06 ft/s, 7.03 m/s

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

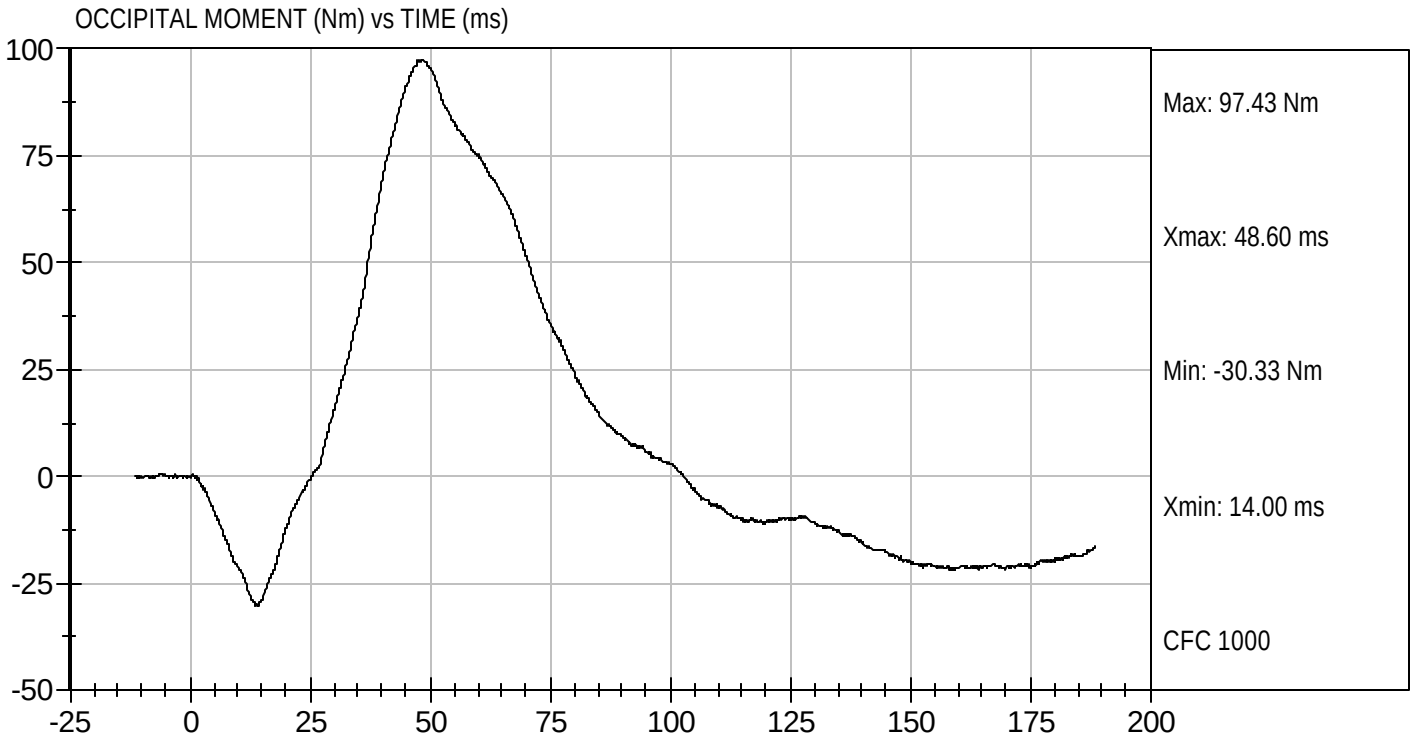


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Componet ID: D052642

Test Date: 09/28/2005
Velocity: 23.06 ft/s, 7.03 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D052643

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.09	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.92	Pass
	20 msec	G's	14.00 to 19.00	16.76	Pass
	30 msec	G's	11.00 to 16.00	14.36	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	14.66	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	39.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.6	Pass
	Time	msec	72.0 to 82.0	78.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	157.0	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-72.2	Pass
	Time	msec	65.0 to 79.0	73.8	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	144.9	Pass
			Overall Test Results		Pass

Tim Brady
Laboratory Technician

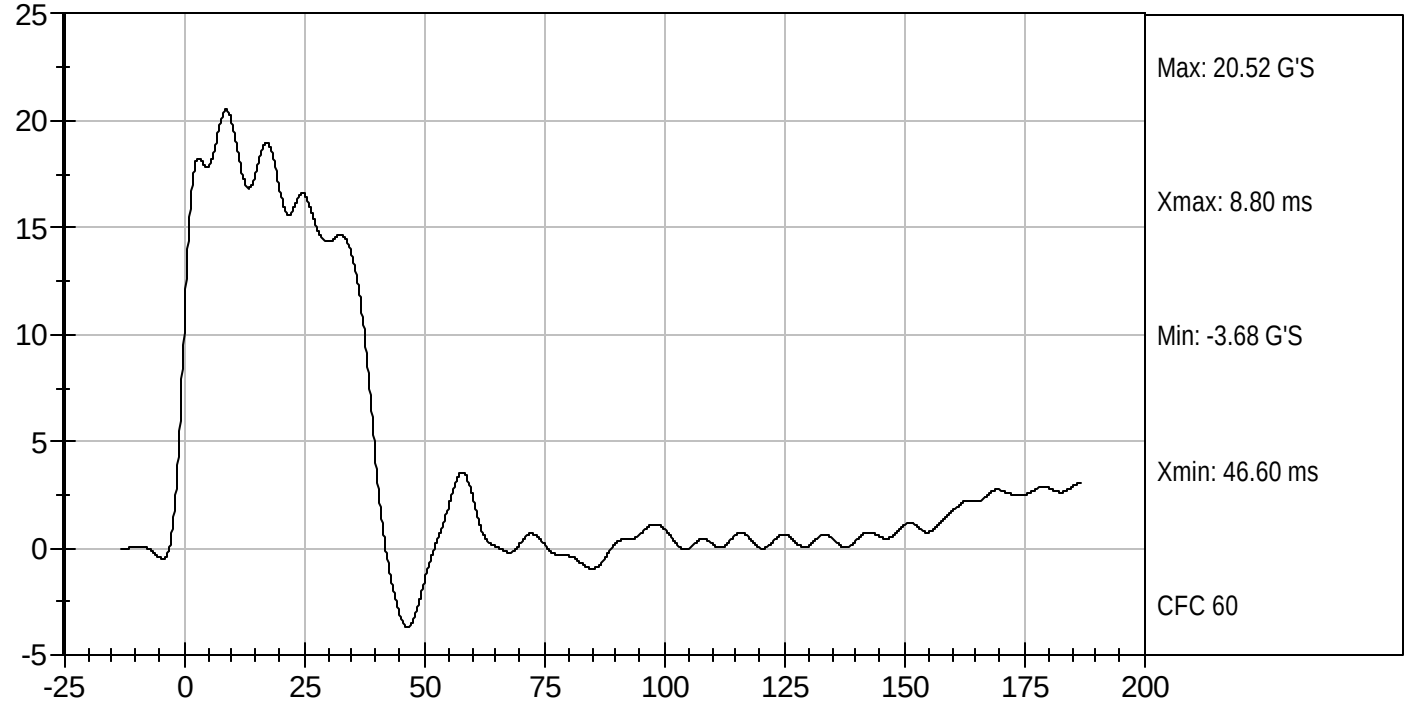
09/28/2005
Test Date

David Winkelbauer
Approved By

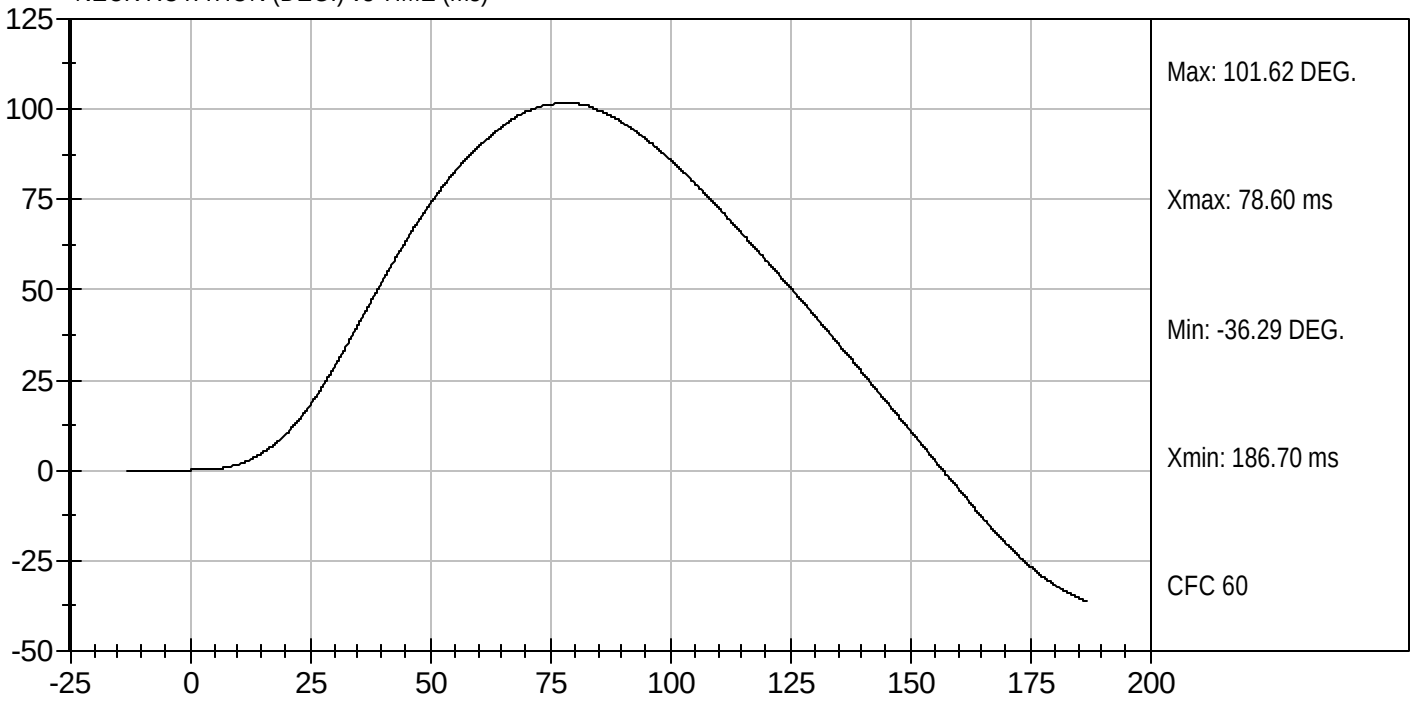
Test Desc: Neck Extension
Componet ID: D052643

Test Date: 09/28/2005
Velocity: 19.98 ft/s, 6.09 m/s

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

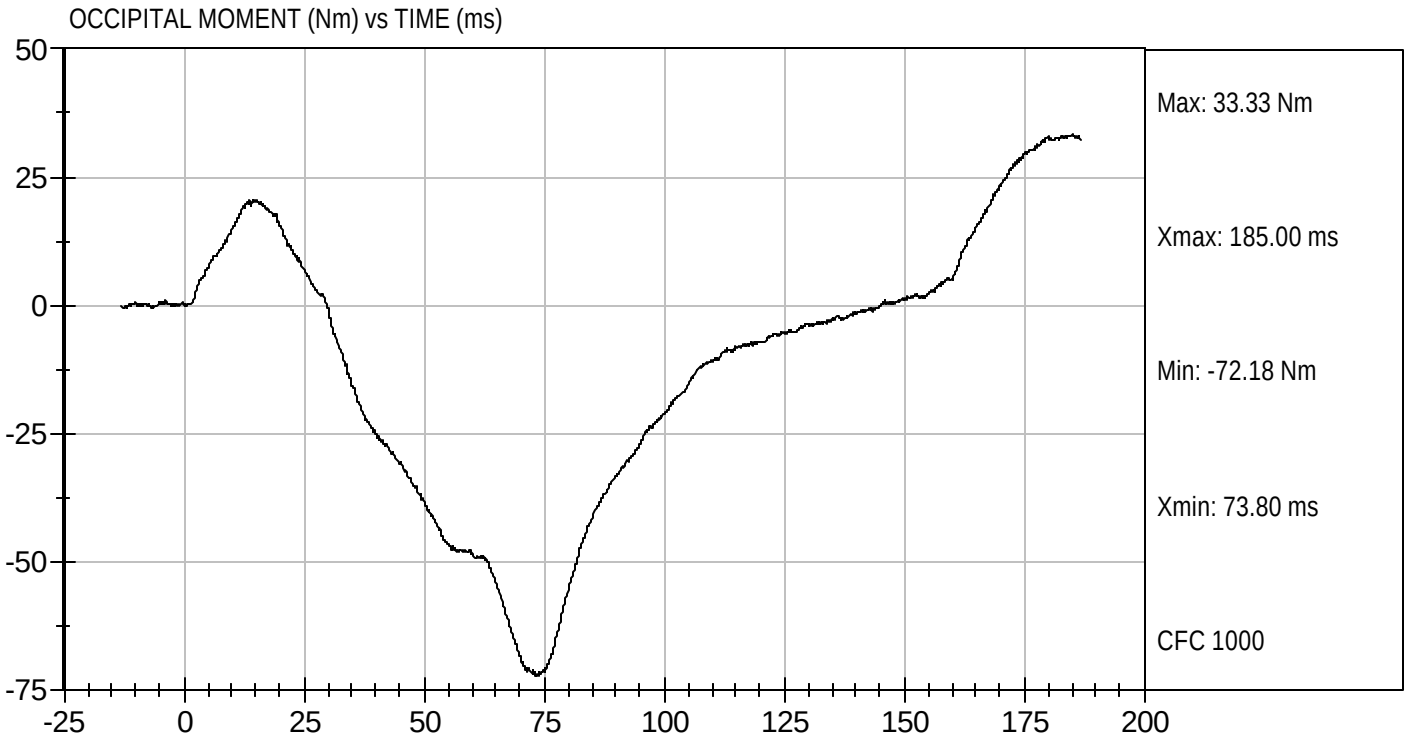


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Componet ID: D052643

Test Date: 09/28/2005
Velocity: 19.98 ft/s, 6.09 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D052644

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/s	6.58 to 6.82	6.66	Pass
Peak Probe Force	N	5159 to 5893	5,397	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.80	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

Laboratory Technician

09/28/2005

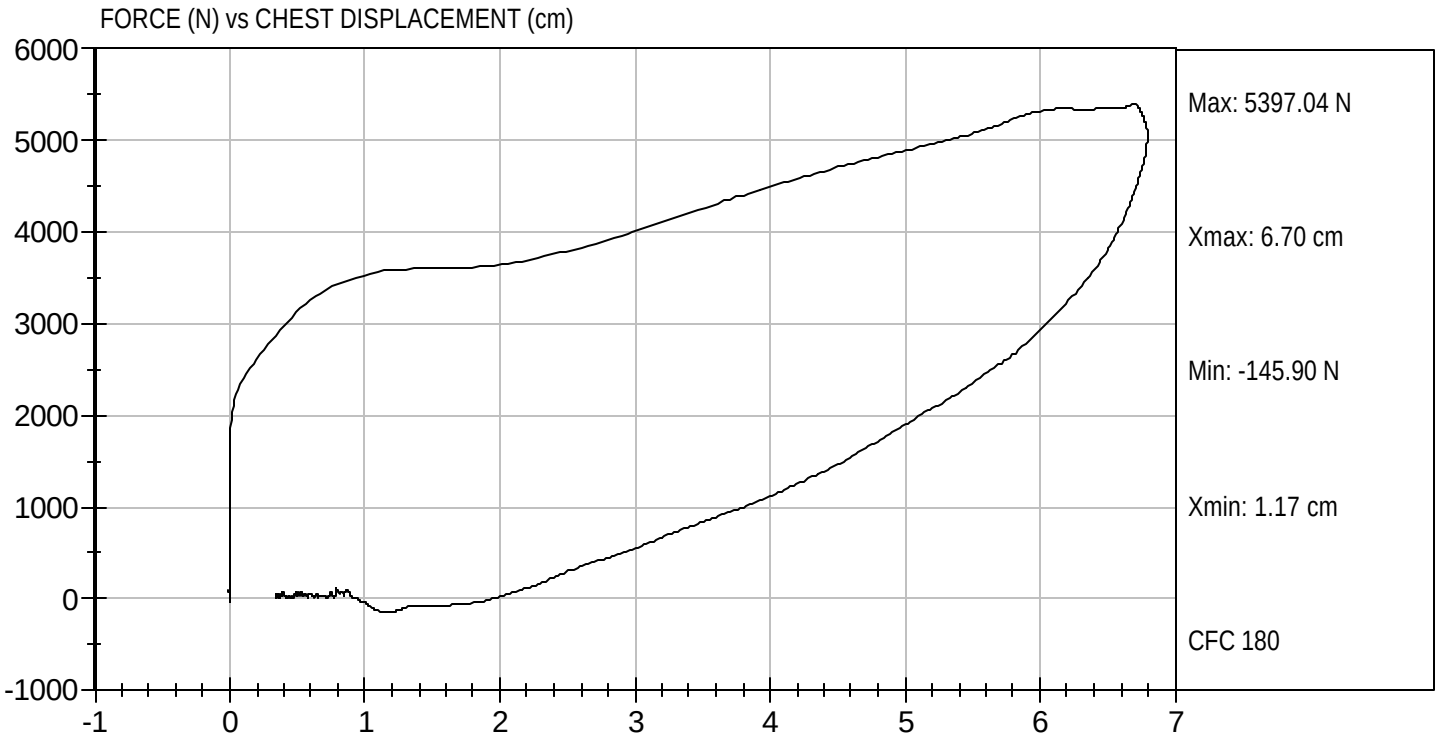
Test Date

David Winkelbauer

Approved By

Test Desc: Thorax Impact
Componet ID: D052644

Test Date: 09/28/2005
Velocity: 21.86 ft/s, 6.66 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D052645

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.07	Pass
Peak Probe Force	Newtons	4715 to 5782	5,291	Pass
		Overall Test Results		Pass

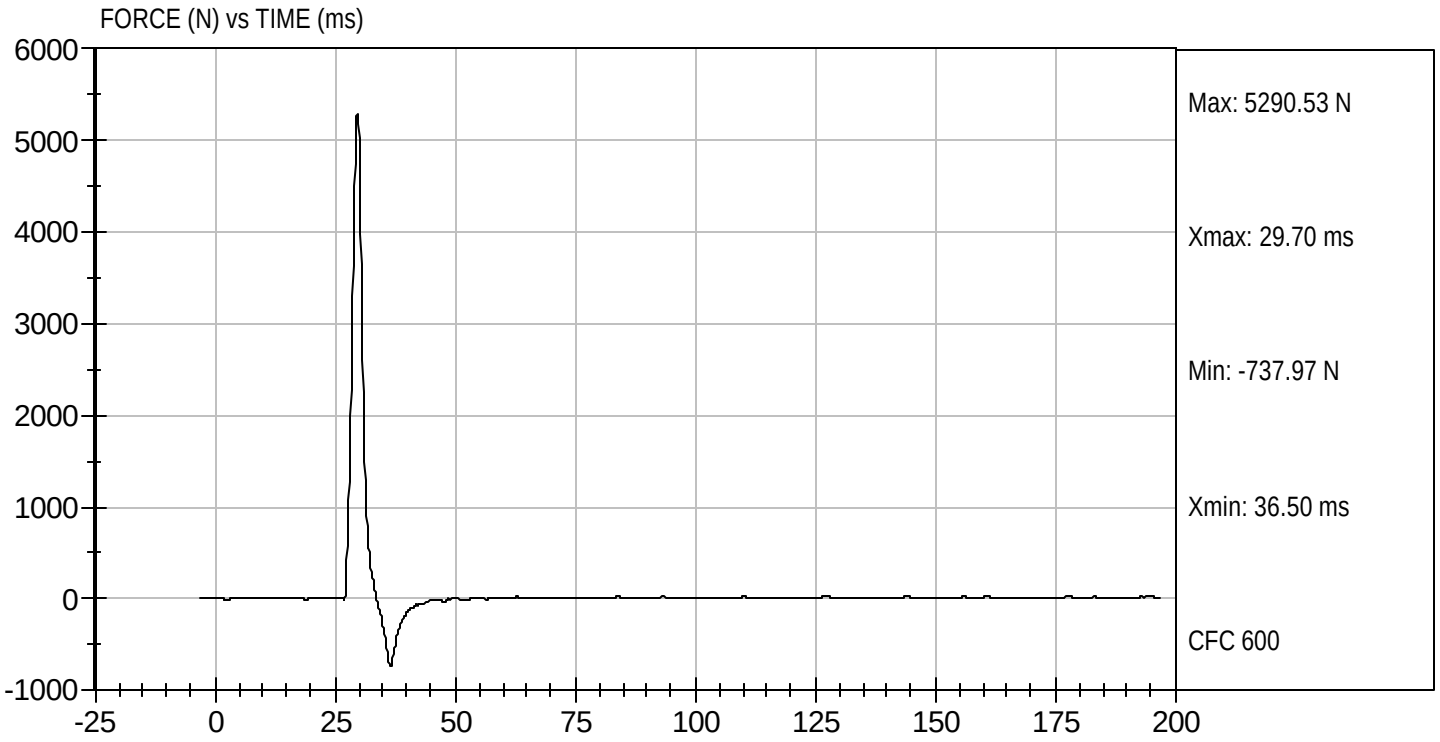
Laboratory Technician

09/28/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Right Knee
Componet ID: D052645

Test Date: 09/28/2005
Velocity: 6.8 ft/s, 2.07 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D052646

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.12	Pass
Peak Probe Force	Newtons	4715 to 5782	5,680	Pass
		Overall Test Results		Pass

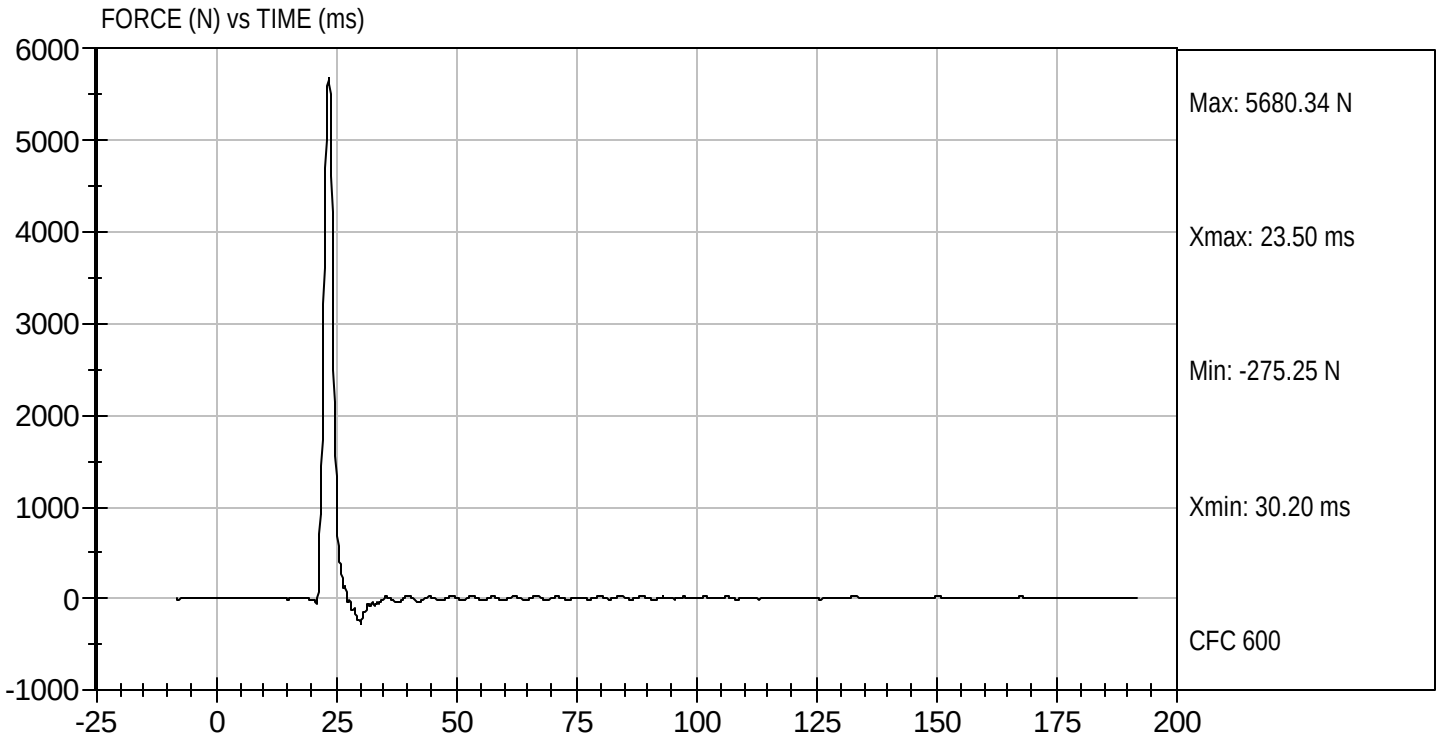
Laboratory Technician

09/28/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Left Knee
Componet ID: D052646

Test Date: 09/28/2005
Velocity: 6.96 ft/s, 2.12 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D052640

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.1	22.1	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	82.0	80.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	42	Pass
		Overall Test Results			Pass

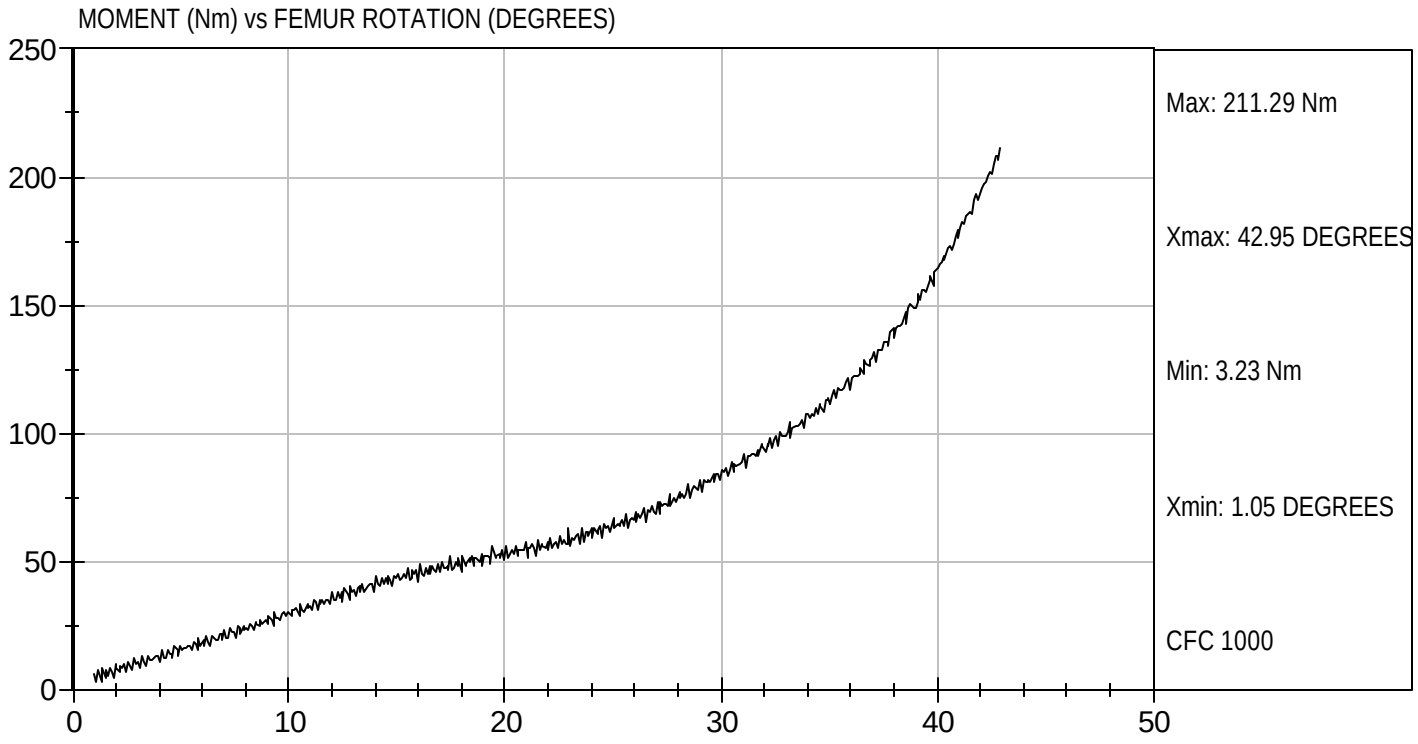
Laboratory Technician

09/28/2005
Test Date

David Winkelbauer
Approved By

Test Desc: Hip Femur Flexion
Componet ID: D052649

Test Date: 09/28/2005
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Componet ID: D052640

Test Date: 09/28/2005
Velocity: 0 ft/s, 0.00 m/s