REPORT NUMBER: NCAP-MGA-2008-017

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

TOYOTA MOTOR MANUFACTURING, CANADA, INC.
2009 TOYOTA COROLLA MATRIX 5-DOOR S AWD
NHTSA NUMBER: M95103

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

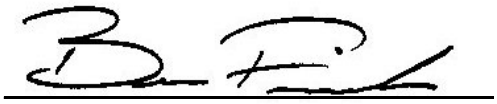
Test Date: April 18, 2008

Final Report Date: May 9, 2008

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: 5/09/08

Ben Fischer, Project Engineer

Reviewed by:  Date: 5/09/08

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Technical Report Documentation Page

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15. Supplementary Notes			

16. Abstract

A frontal barrier impact was conducted on a 2009 Toyota Corolla Matrix 5-Door S AWD at MGA Research Corporation on April 18, 2008. 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 566 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	398	473
Max. Thorax Accel. (3ms Clip)	G's	60	44	43
Left Femur Force	Newton	10009	-2443	-1530
Right Femur Force	Newton	10009	-3764	-2596

17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No: M95103		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Adm. Technical Ref. Division, 1200 New Jersey Ave, SE Washington, D.C. 20590	
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

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

SUMMARY

A load cell barrier was impacted by a 2009 Toyota Corolla Matrix 5-Door S AWD at a velocity of 56.5 kph. The test was performed at MGA Research Corporation on March 20, 2008. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

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

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

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

The maximum static crush of the vehicle was 566 mm and both the driver and passenger side doors remained closed and latched during the impact event and were operable after the impact.

The driver's head and chest contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's head and chest contacted the airbag. The passenger's head also contacted the headrest and 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	398	61.7	91.6	44	84.0	87.0	-18	-2443	-3764
Passenger	473	60.8	92.9	43	83.3	86.3	-19	-1530	-2596

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

TEST NOTES

There was no valid data collected for:

Driver Left Upper Tibia Moment Y after 105 msec.
Bottom of Engine X after 20 msec.
Left Brake Caliper X after 30 msec.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1

CRASH TEST SUMMARY

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

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	Windshield cracked	

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1720
Center	mm	1730
Right Side	mm	1655
Average	mm	1702

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	865	920
Lap belt length as measured on ATD	mm	865	900
Remainder of belt on reel	mm	1555	1565
Total belt length for continuous webbing systems	mm	3285	3385

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

TEST VEHICLE INFORMATION

Manufacturer	Toyota
Model	Corolla Matrix
Body Style	Sedan
NHTSA No.	M95103
VIN	2T1LE40E99C002446
Color	Super White
Delivery Date	4/11/08
Odometer Reading (mile)	46
Dealer	Wilde Toyota
Transmission	Automatic
Final Drive	AWD
Number of Cylinders	4
Engine Displacement (L)	2.4
Engine Placement	Lateral
Automatic Door Lock (ADL)	No
Owners Manual Details Instructions on Disabling ADLs	N/A
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	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	Yes
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing, Canada, Inc.
Date of Manufacture	02/08

GVWR (kg)	1930
GAWR Front (kg)	1025
GAWR Rear (kg)	925

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: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	436.3	317.1		467.7	384.2	
Right	kg	446.8	282.6		477.6	347.0	
Ratio	%	59.6	40.4		56.4	43.6	
Totals	kg	883.1	599.7	1482.8	945.3	731.2	1676.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1482.8
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	45
Calculated Vehicle Target Weight (TVTW)	kg	1683.8

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	701	699	709	712	1052
As Tested	mm	689	689	680	681	1134
Post Test	mm	687	676	683	661	

Vehicle Wheelbase (mm): 2601
Weight of Ballast secured in cargo area (kg): 20.4

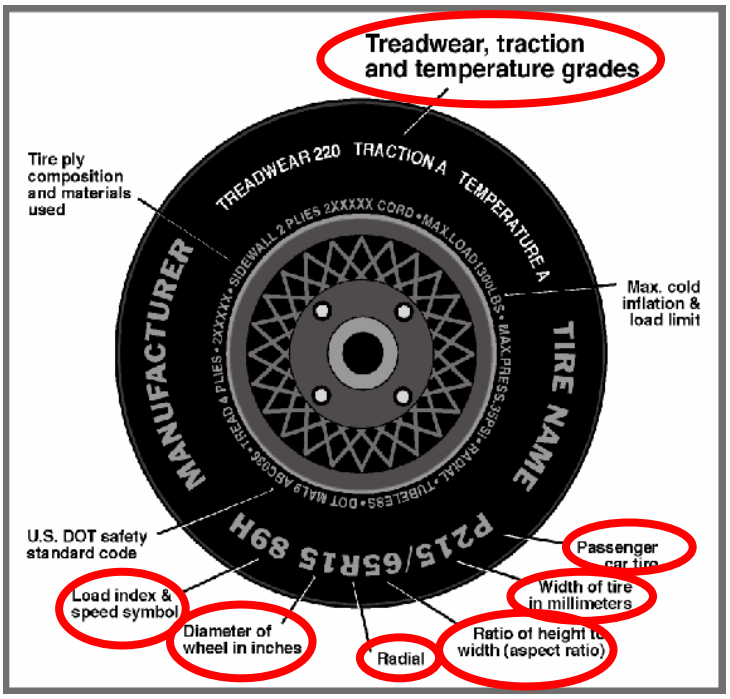
Vehicle Components Removed: Jack, spare tire, tools, cargo carpet, rear seat bottom, and right rear tail light

Ballast weight does not include instrumentation and data acquisition system.

DATA SHEET NO. 3

TEST VEHICLE TIRE INFORMATION

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	220
Recommended Tire Size	P215/45R17	P215/45R17
Tire Size on Vehicle	P215/45R17	P215/45R17
Tire Manufacturer	Goodyear	Goodyear
Tire Name	Eagle RS-A	Eagle RS-A
Tire Type	Passenger	Passenger
Tire Width (mm)	215	215
Ratio of Height to Width (aspect ratio)	45	45
Radial	R	R
Wheel Diameter	17	17
Load Index & Speed Symbol	87W	87W
Treadwear	260	260
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 4

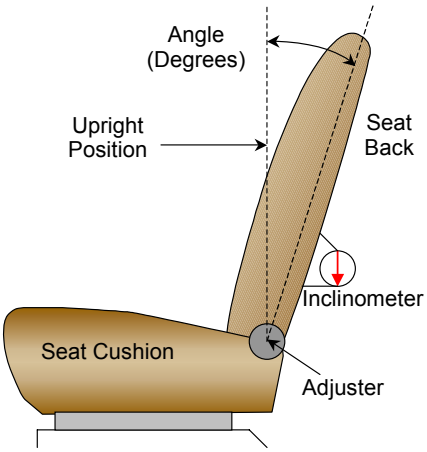
TEST VEHICLE INFORMATION

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

NORMAL DESIGN RIDING POSITION

The driver and passenger seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Set driver seat back angle at the 3rd detent (forward-most detent defined as 0). Set passenger seat back angle at the 4th detent (forward-most detent defined as 0).

Driver seat back angle: 3rd detent (forward-most as 0)
Passenger seat back angle: 4th detent (forward-most as 0)



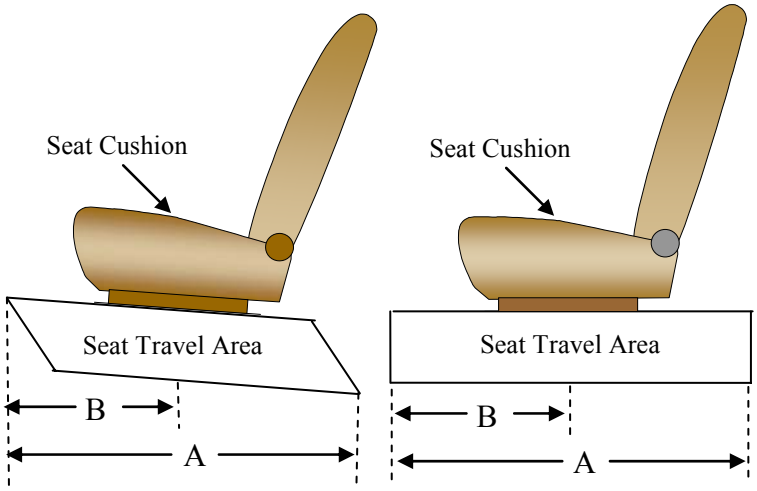
FRONT SEAT ASSEMBLY

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	17 detents	8th detent (forward-most as 0)
Passenger Seat	17 detents	8th detent (forward-most as 0)

ADJUSTABLE D-RING POSITION

The driver and passenger D-rings were set at the uppermost position.



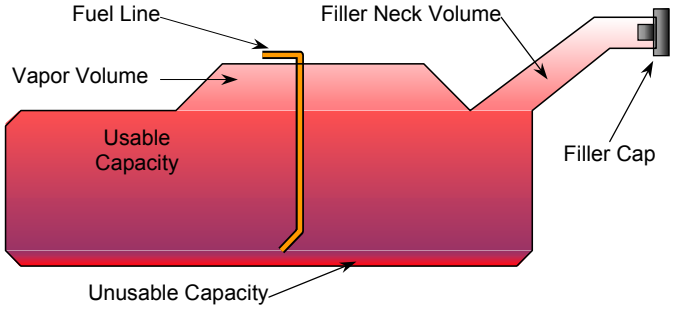
DATA SHEET NO. 4…(CONTINUED)
TEST VEHICLE INFORMATION

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	50.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	46.0 to 47.0
Actual Amount of Solvent used	46.2
1/3 of Usable Capacity	16.7

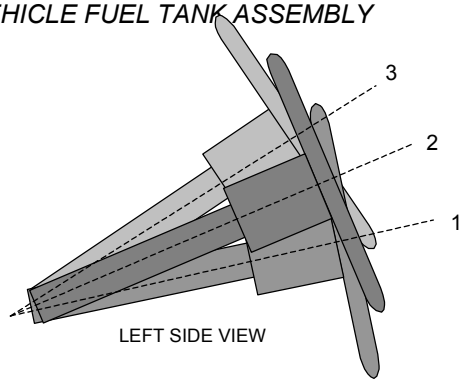
The test vehicle is equipped with an electric fuel pump. The fuel pump will pump fuel when the ignition is on.



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

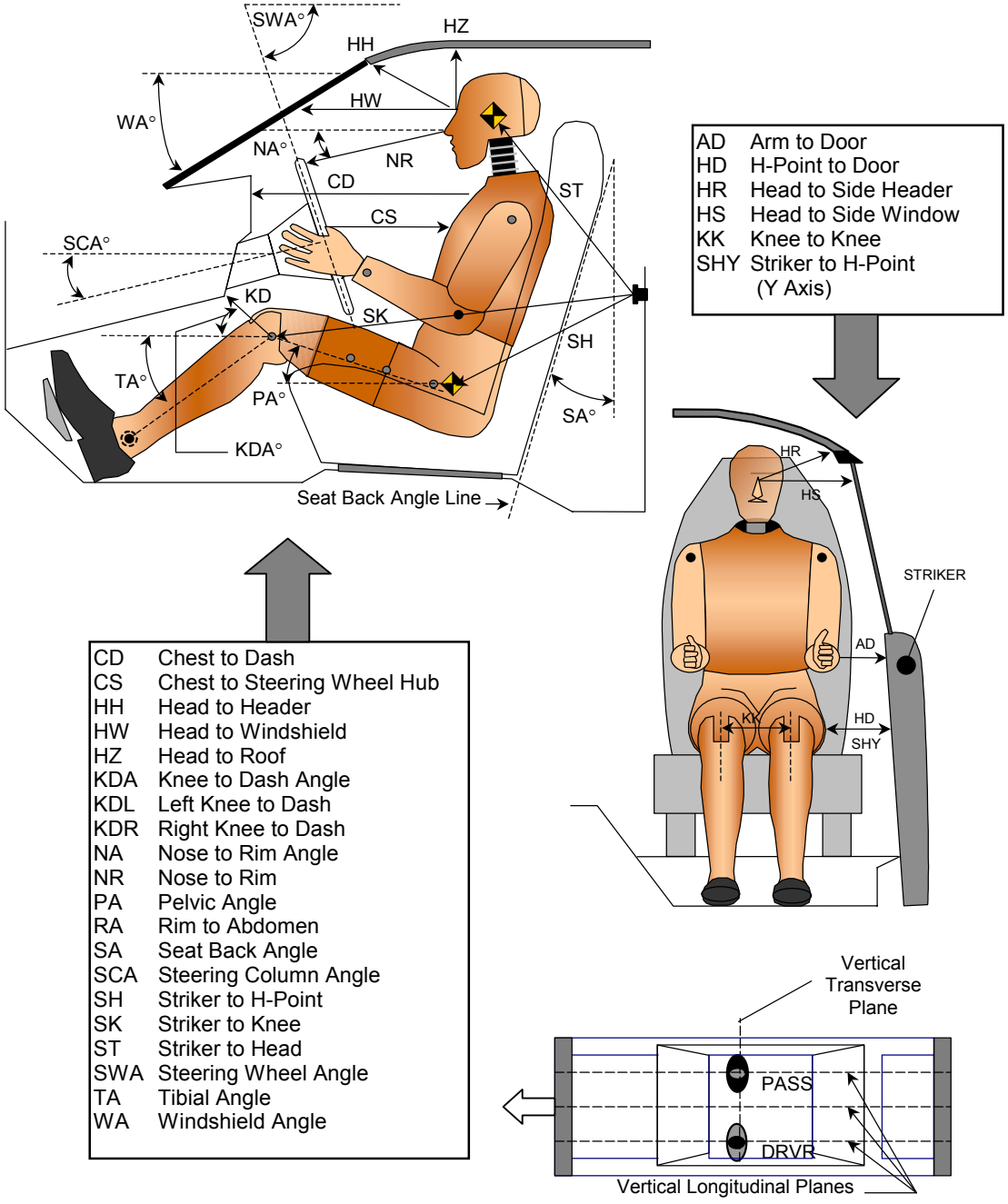
	Fore/Aft Position (mm)	Degrees
Lowermost position No. 1	0	62.4
Geometric center position No. 2	20 mm	63.8
Uppermost position No. 3	40 mm	65.2

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

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: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

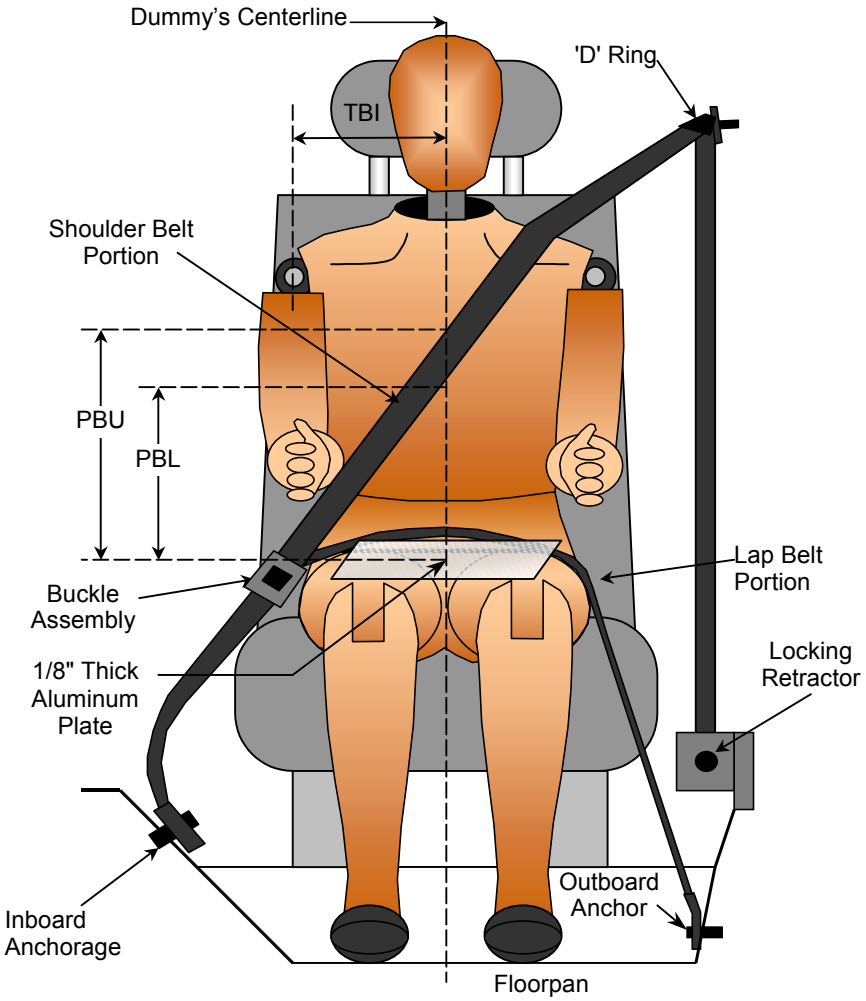
TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		26.3		
SWA	Steering Wheel Angle		63.8		
SCA	Steering Column Angle		27.4		
SA	Seat Back Angle		3.1		2.0
HZ	Head to Roof (Z)	187	90	155	90
HH	Head to Header	329	26.5	297	23.7
HW	Head to Windshield	652	0	577	0
HR	Head to Side Header (Y)	225		214	
NR	Nose to Rim	408	11.1		
CD	Chest to Dash	528		498	
CS	Chest to Steering Hub	316	1.8		
RA	Rim to Abdomen	194	0		
KDL	Left Knee to Dash	143	17.9	85	
KDR	Right Knee to Dash	95		105	27.1
PA	Pelvic Angle		23.3		22.6
TA	Tibia Angle		53.2		51.0
KK	Knee to Knee (Y)	322		270	
SK	Striker to Knee	565	98.9	617	102.7
ST	Striker to Head	422	10.2	454	13.9
SH	Striker to H-Point	308	139.8	301	138.6
SHY	Striker to H-Point (Y)	254		250	
HS	Head to Side Window	322		321	
HD	H-Point to Door (Y)	155		141	
AD	Arm to Door (Y)	120		115	
AA	Ankle to Ankle	330		200	

DATA SHEET NO. 6

SEAT BELT POSITIONING DATA

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	375	375
PBL - To surface of reference to belt lower edge	mm	295	295

DATA SHEET NO. 7

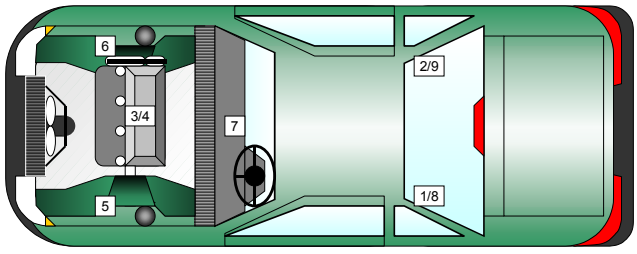
VEHICLE ACCELEROMETER LOCATIONS

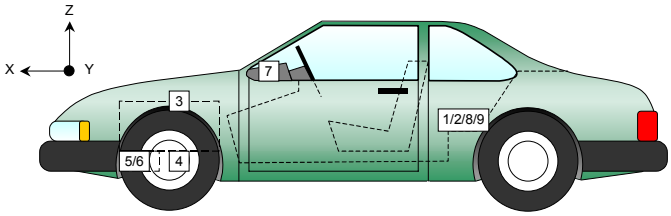
Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member X	1604	-237	453
2	Right Rear X-Member X	1604	221	453
3	Engine Top X	3606	0	823
4	Engine Bottom X	3573	231	171
5	Left Brake Caliper X	3524	-660	220
6	Right Brake Caliper X	3524	660	220
7	Instrument Panel X			
8	Left Rear X-Member Z	1604	-237	453
9	Right Rear X-Member Z	1604	221	453

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: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

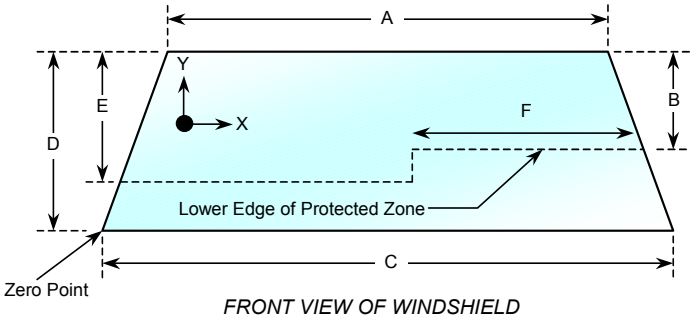
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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	2076	2076	100
Right Side	2076	2076	100
Total	4152	4152	100



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1152
B	mm	501
C	mm	1440
D	mm	780
E	mm	515
F	mm	455

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: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21° C Test Time: 10:45 am

Stoddard Solvent Spillage Measurements

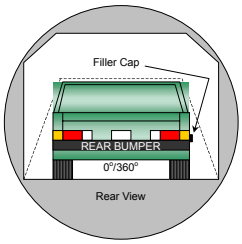
A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)

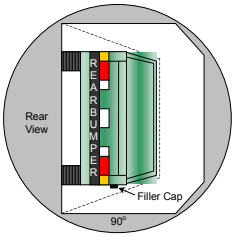
B. For the 5 minute period after motion ceases: 0 oz.
(Maximum Allowable = 5 ounces)

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

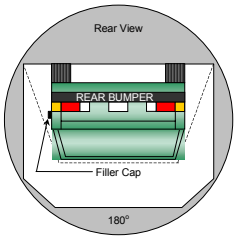
D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA

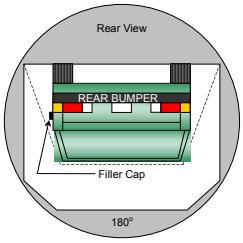




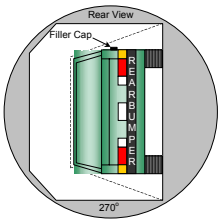
0° to 90°

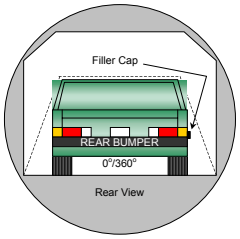


90° to 180°



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°	124	300	0
90° to 180°	118	300	0
180° to 270°	110	300	0
270° to 360°	116	300	0

DATA SHEET NO. 10

VEHICLE MEASUREMENTS

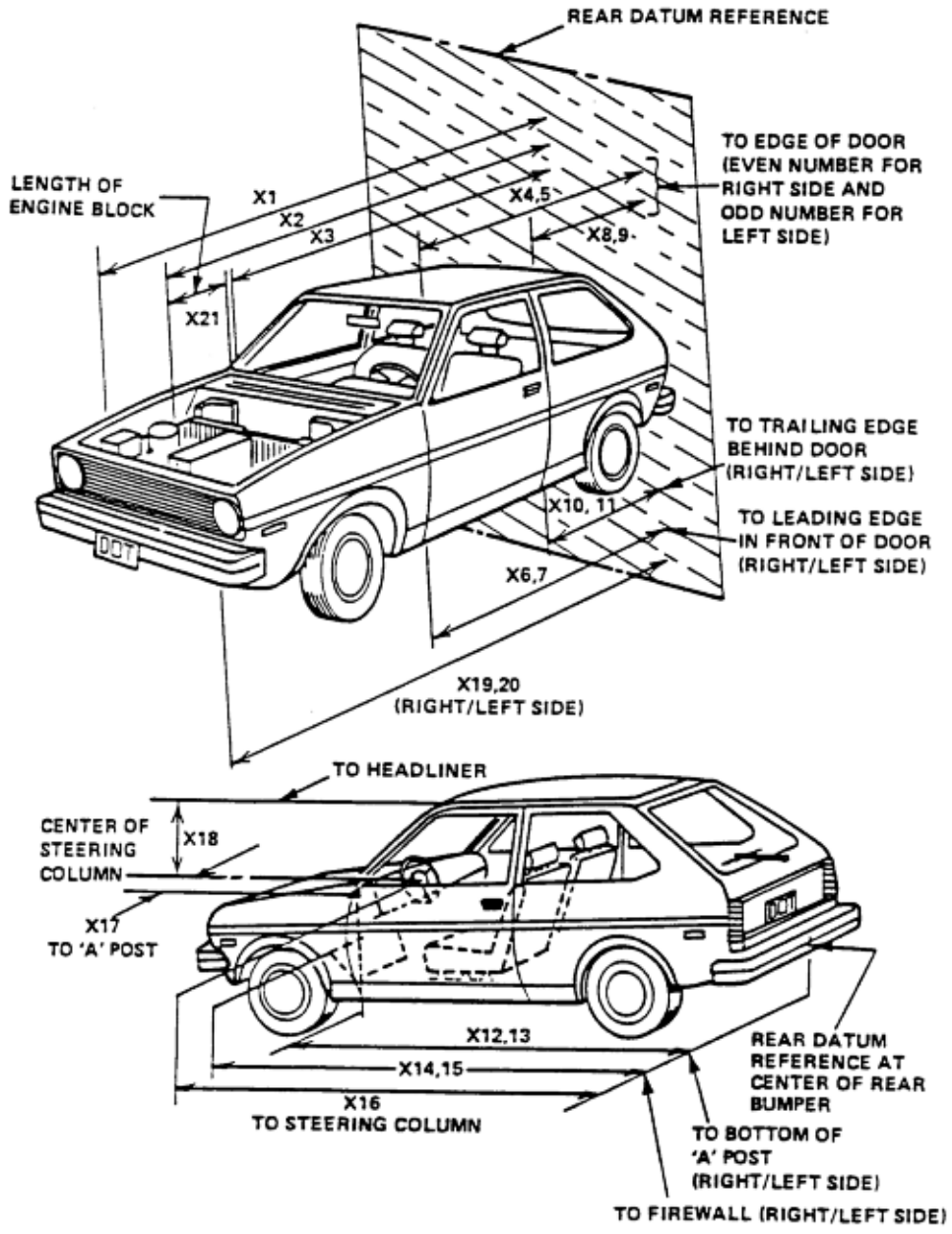
Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4346	3789	557
2	RSOV to front of engine	mm	3878	3625	253
3	RSOV to firewall centerline	mm	3389	3378	11
4	RSOV to leading edge of right door	mm	2973	2978	-5
5	RSOV to leading edge of left door	mm	2970	2985	-15
6	RSOV to lower leading edge of right door	mm	2910	2913	-3
7	RSOV to lower leading edge of left door	mm	2907	2911	-4
8	RSOV to upper leading edge of right door	mm	1906	1920	-14
9	RSOV to upper leading edge of left door	mm	1909	1921	-12
10	RSOV to lower trailing edge of right door	mm	1902	1904	-2
11	RSOV to lower trailing edge of left door	mm	1896	1905	-9
12	RSOV to bottom of right 'A' pillar	mm	2946	2859	87
13	RSOV to bottom of left 'A' pillar	mm	2881	2885	-4
14	RSOV to firewall on right side	mm	3303	3253	50
15	RSOV to firewall on left side	mm	3329	3249	80
16	RSOV to steering column	mm	2506	2529	-23
17	Center of steering column to left 'A' pillar	mm	380	399	-19
18	Center of steering column to headlining	mm	445	441	4
19	RSOV to right side of front bumper	mm	4159	3689	470
20	RSOV to left side of front bumper	mm	4153	3727	426
21	Length of engine block	mm	449	449	0
RD	RSOV to right side of dash panel	mm	2771	2779	-8
CD	RSOV to center of dash panel	mm	2668	2655	13
LD	RSOV to left side of dash panel	mm	2781	2785	-4

DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008



DATA SHEET NO. 10... (continued)

VEHICLE MEASUREMENTS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

Target Vehicle Structural Measurement

	Elements	Pre-Test (mm)
1	Total Length	4346
2	Total Width	1726
3	Bumper Top Height	589
4	Bumper Bottom Height	450
5	Longitudinal Member Top Height	550
6	Distance between Longitudinal Members	1046
7	Longitudinal Member Width	64
8	Engine Top Height	833
9	Engine Bottom Height	171
10	Engine and gearbox width	853
11	Front bumper-engine distance	451
12	Front shock absorber fixing height	851
13	Bonnet leading edge height	701
14	Front shock absorber fixing width	1135
15	Front bumper – front axle distance	898
16	Front axle – a pillar distance	413
17	A-pillar – B-pillar distance	1060
18	B-Pillar – rear axle distance	1119
19	B-pillar – C-pillar distance	988
20	Roof sill bottom height	1438
21	Roof sill top height	1509
22	Floor sill bottom height	214
23	Floor sill top height	324

DATA SHEET NO. 11

CAMERA LOCATIONS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side View				13	24
2	Left Front View	1170	-5005	1165	24	1000
3	Steering Column Top	1020	-5520	1280	25	1000
4	Steering Column Bottom	1020	-5440	885	25	1000
5	Driver Close-up	1305	-5660	1420	35	1000
6	Driver Angle	5690	-5150	2120	50	1000
7	On board Driver Side					
8	On board Passenger Side					
9	Right Overall	1760	5675	1220	24	1000
10	Right Passenger Half	1075	5095	1150	24	1000
11	Right Close-up	1320	5330	1440	35	1000
12	Right Angle	5605	5030	2145	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	1350	0	-3150	24	1000
17	Pit Rear	3120	0	-3150	24	1000

*COORDINATES:

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

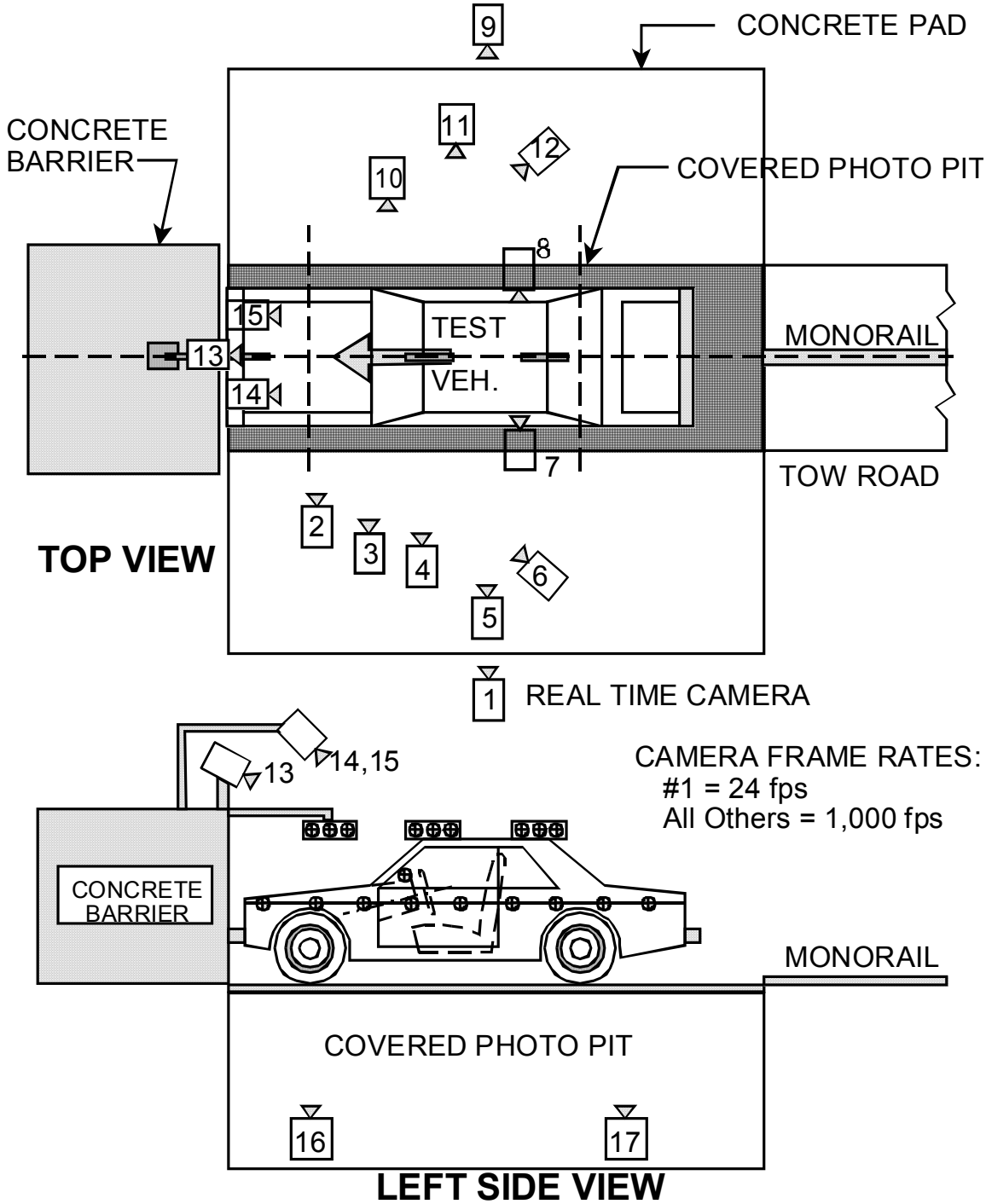
Cameras 7 & 8 were not used for this test.

DATA SHEET NO. 11... (continued)

CAMERA LOCATIONS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

CAMERA POSITIONS FOR FRONTAL IMPACTS

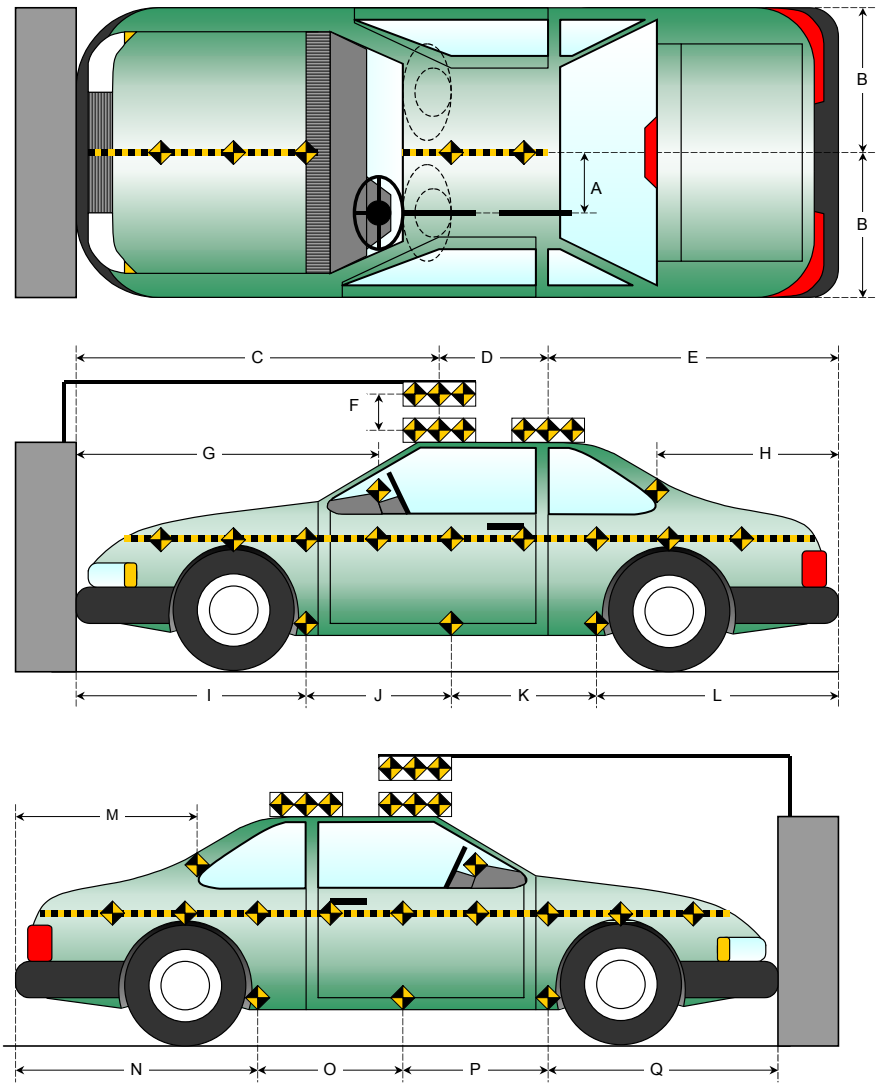


DATA SHEET NO. 12

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

Item	Value
A	362
B	863
C	2315
D	660
E	1371
F	
G	
H	885
I	1386
J	862
K	871
L	1227
M	874
N	1228
O	867
P	869
Q	1382



DATA SHEET NO. 13

VEHICLE INTRUSION MEASUREMENTS

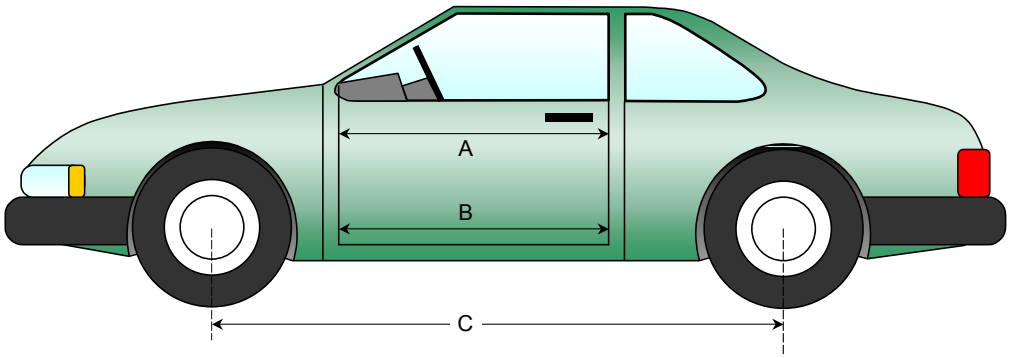
Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

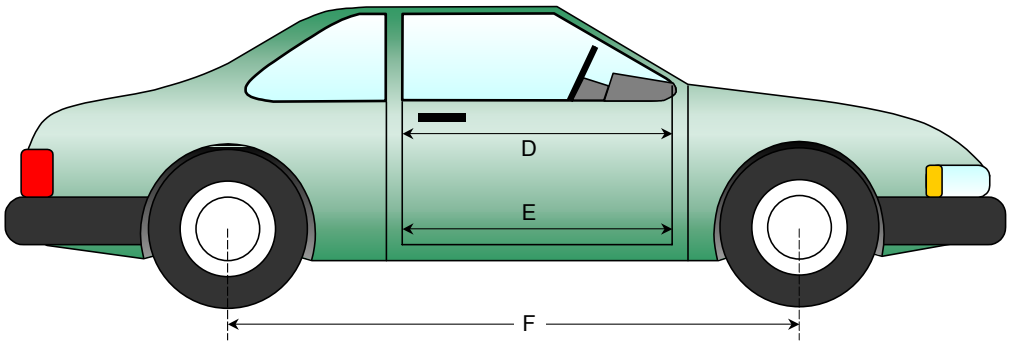
DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	969	969	0
B	Left Side Lower	mm	839	835	4
D	Right Side Upper	mm	968	969	-1
E	Right Side Lower	mm	865	863	2

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2601	2532	69
F	Right Side Wheelbase	mm	2601	2539	62





DATA SHEET NO. 13... (continued)

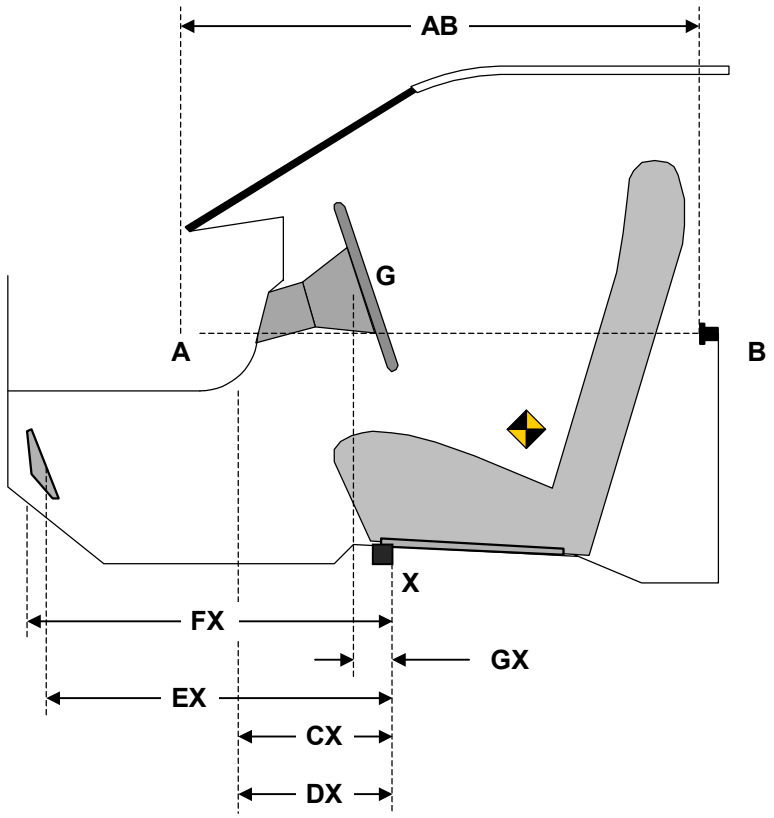
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	810	815	-5
CX	Left Knee Bolster to X	mm	263	308	-45
DX	Right Knee Bolster to X	mm	255	317	-62
EX	Brake Pedal to X	mm	542	473	69
FX	Foot Rest to X	mm	547	521	26
GX	Center of Steering Column Wheel Hub to X	mm	78	109	-31

X = Front of Seat Track (stationary)

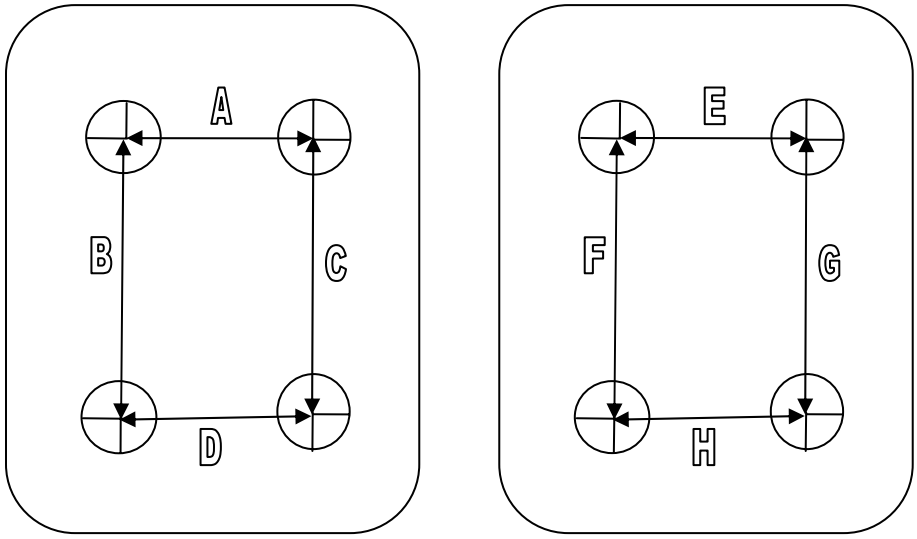


DRIVER COMPARTMENT

DATA SHEET NO. 13... (continued)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008



Driver Passenger

UNDERBODY FLOORBOARD DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	280	265	15
B	269	269	0
C	258	254	4
D	284	281	3
E	263	262	1
F	240	240	0
G	231	231	0
H	250	248	2

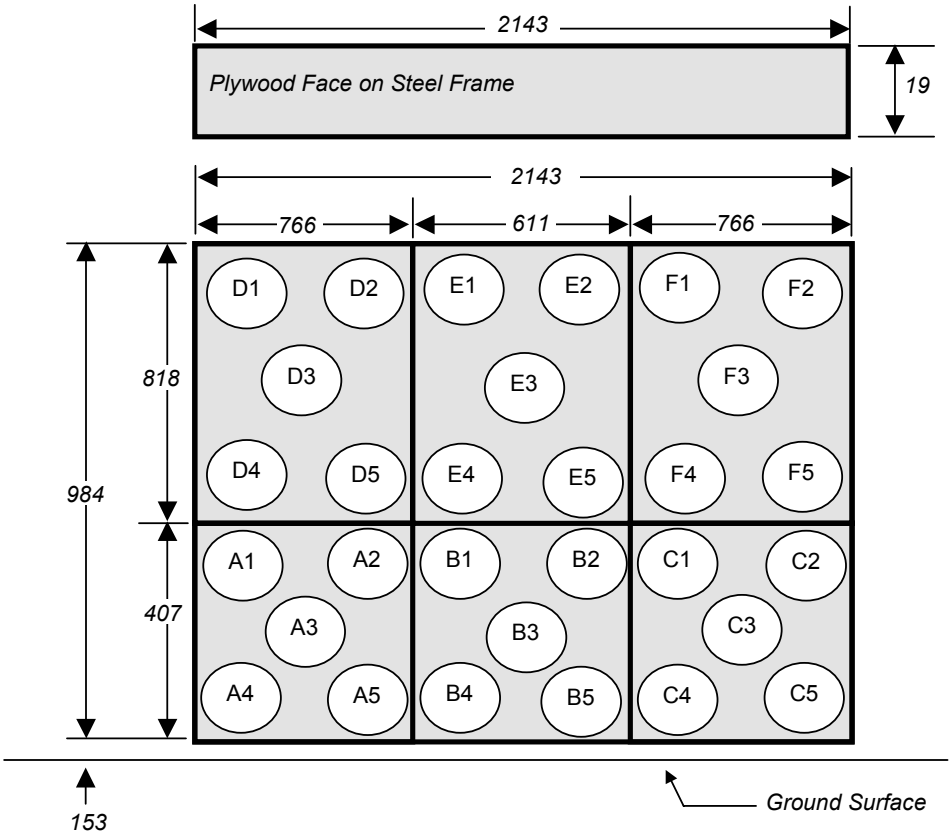
DATA SHEET NO. 14

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

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: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008

VEHICLE INFORMATION

VIN: 2T1LE40E99C002446 Wheelbase (mm): 2601
Vehicle Size Category: Sedan Test Weight (kg): 1676.5

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): 63.6 Time of Separation (msec): 181

CRUSH PROFILE

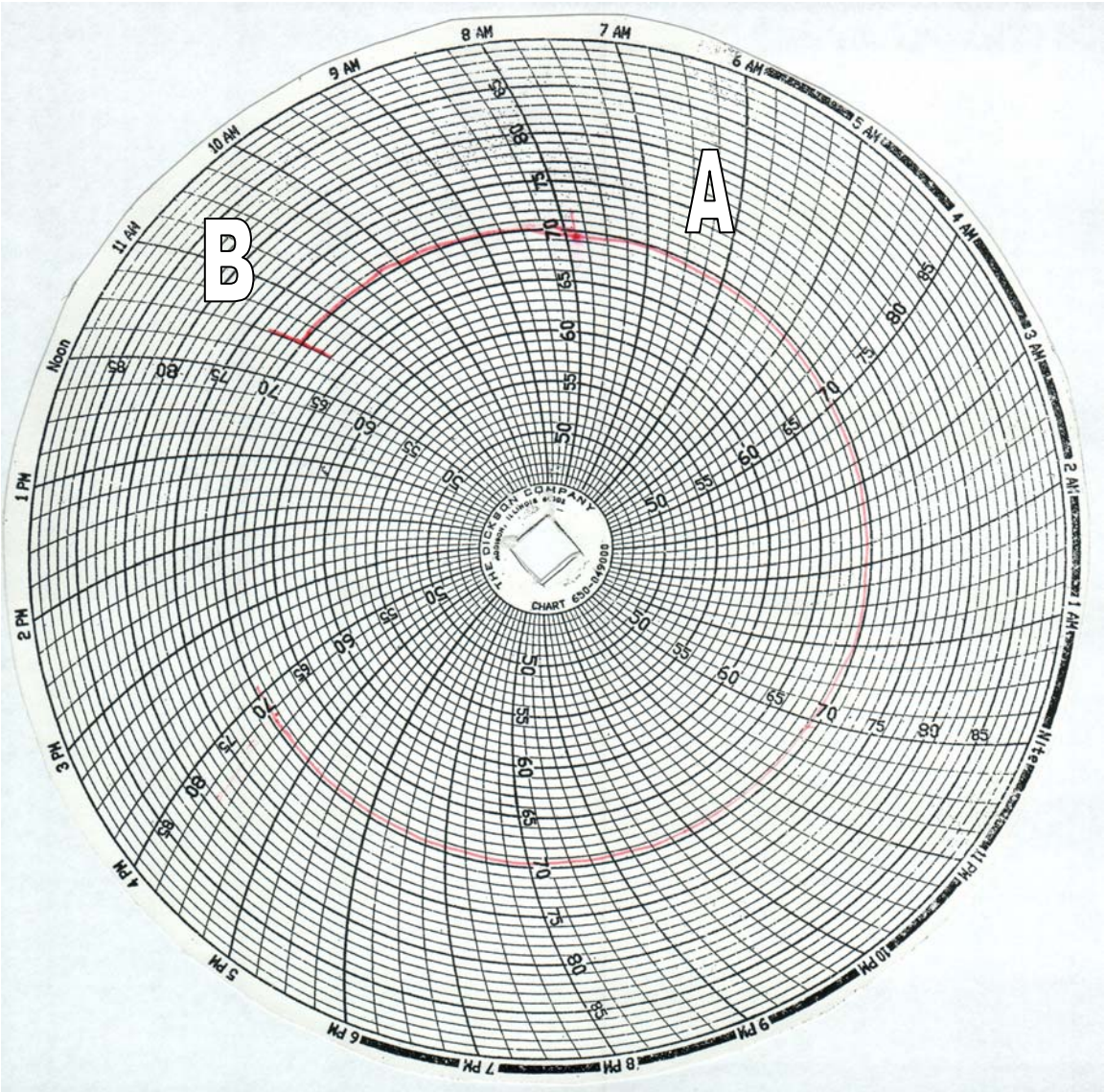
Collision Deformation Classification: Frontal Midpoint of Damage: Centerline
Damage Region Length (mm): 1377 Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4153	3727	426
C2	Crush zone 2 at left side	mm	4265	3717	548
C3	Crush zone 3 at left side	mm	4308	3796	512
C4	Crush zone 4 at right side	mm	4311	3778	533
C5	Crush zone 5 at right side	mm	4267	3701	566
C6	Crush zone 6 at right side	mm	4159	3689	470
L	C1 TO C6	mm	1377	1446	-69

DATA SHEET NO. 16

DUMMY / VEHICLE TEMPERATURE STABILIZATION CHART

Test Vehicle: 2009 Toyota Corolla Matrix 5-Door S AWD NHTSA No.: M95103
Test Program: 35mph Frontal Impact Test Date: 4/18/2008



A = Dummies installed in vehicle at 6:00 am

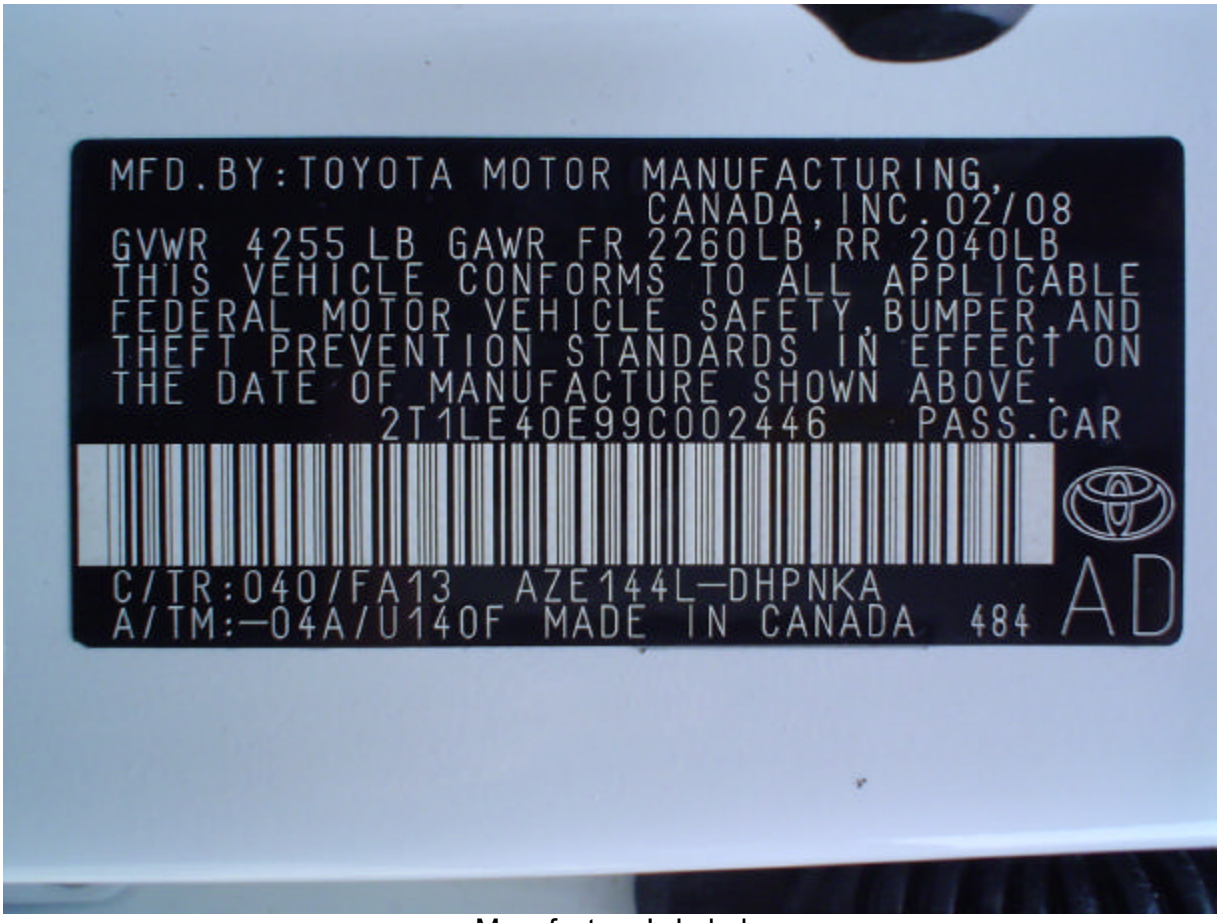
B = Test conducted at 11:30 am

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

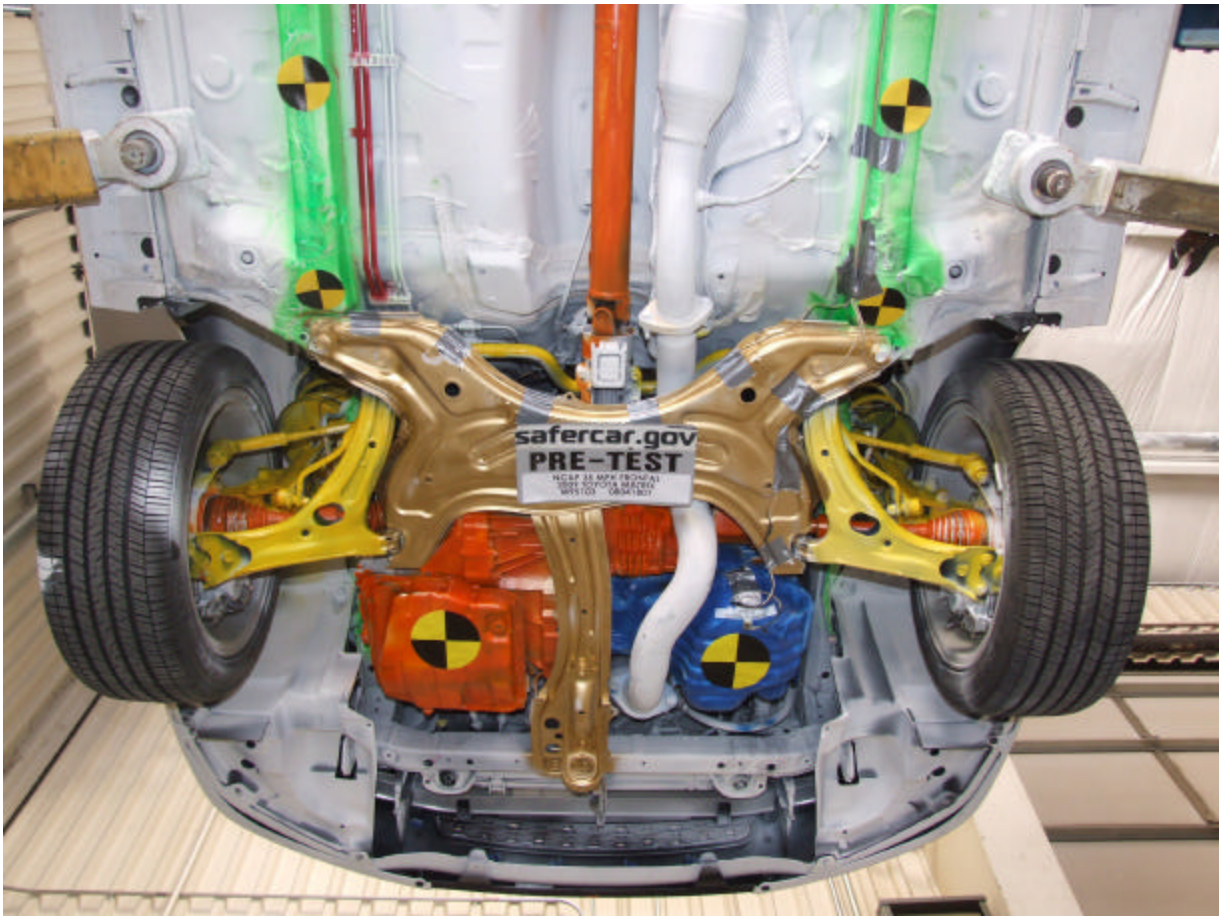
Post-Test Windshield View

Pre-Test Engine Compartment View

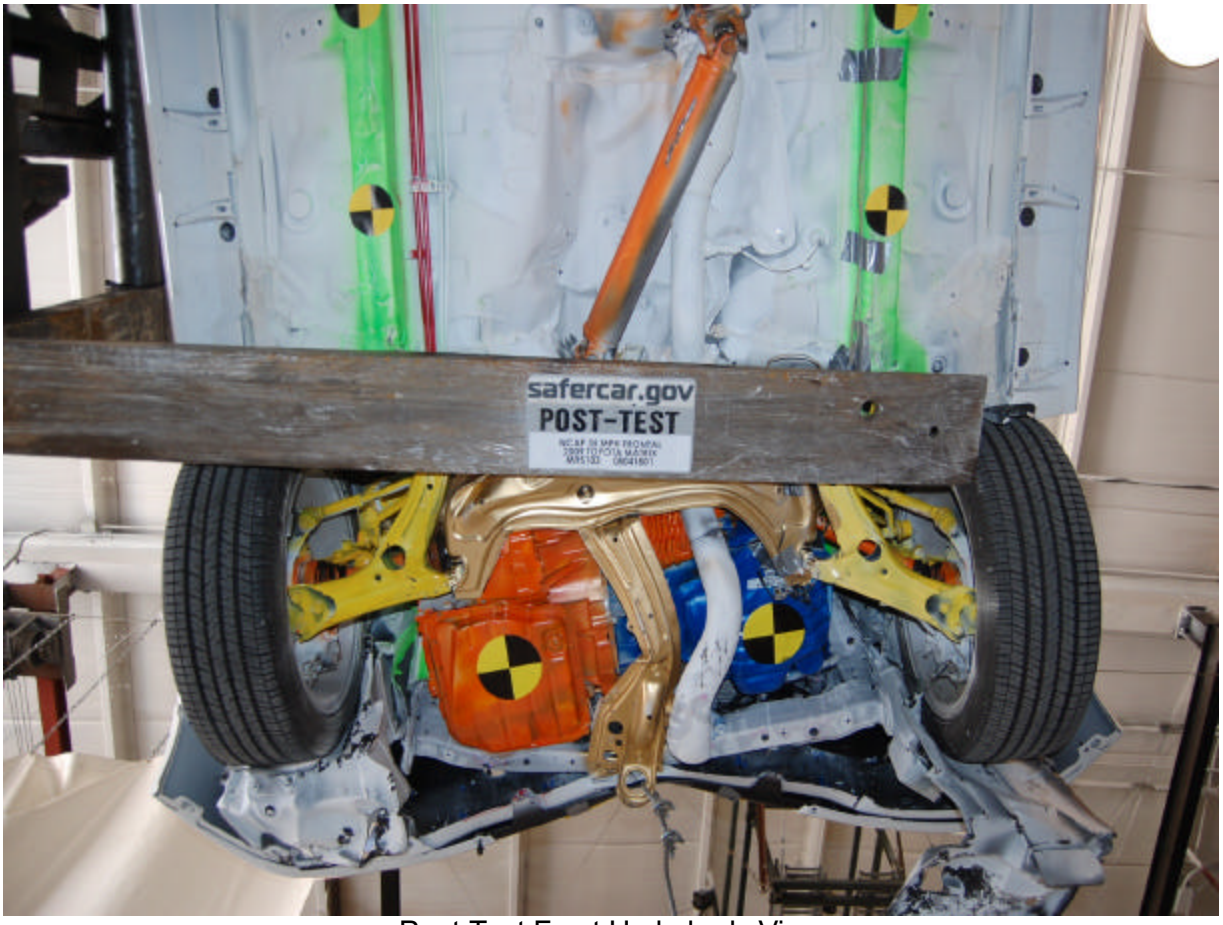
Post-Test Engine Compartment View

Pre-Test Fuel Cap View

Post-Test Fuel Cap View

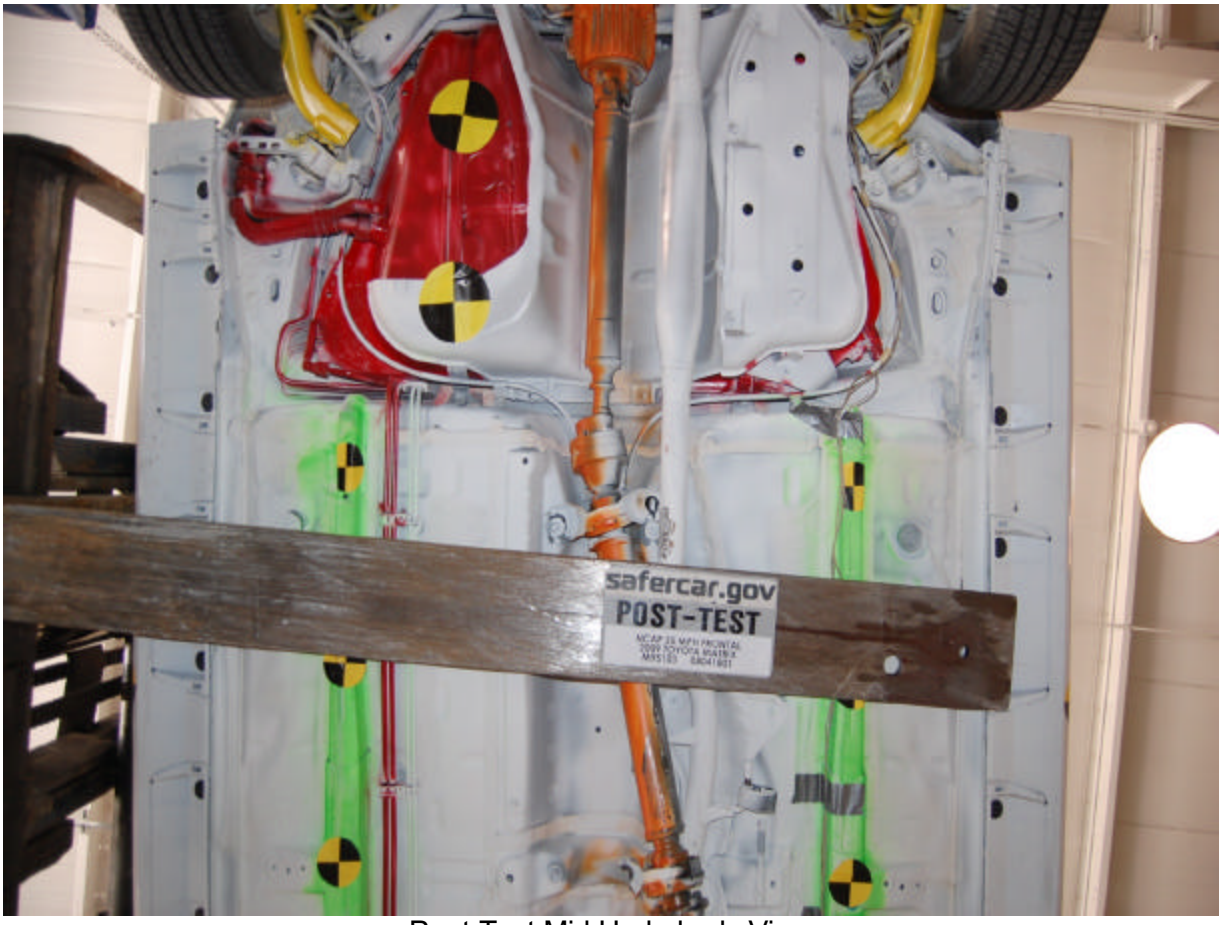


Pre-Test Front Underbody View

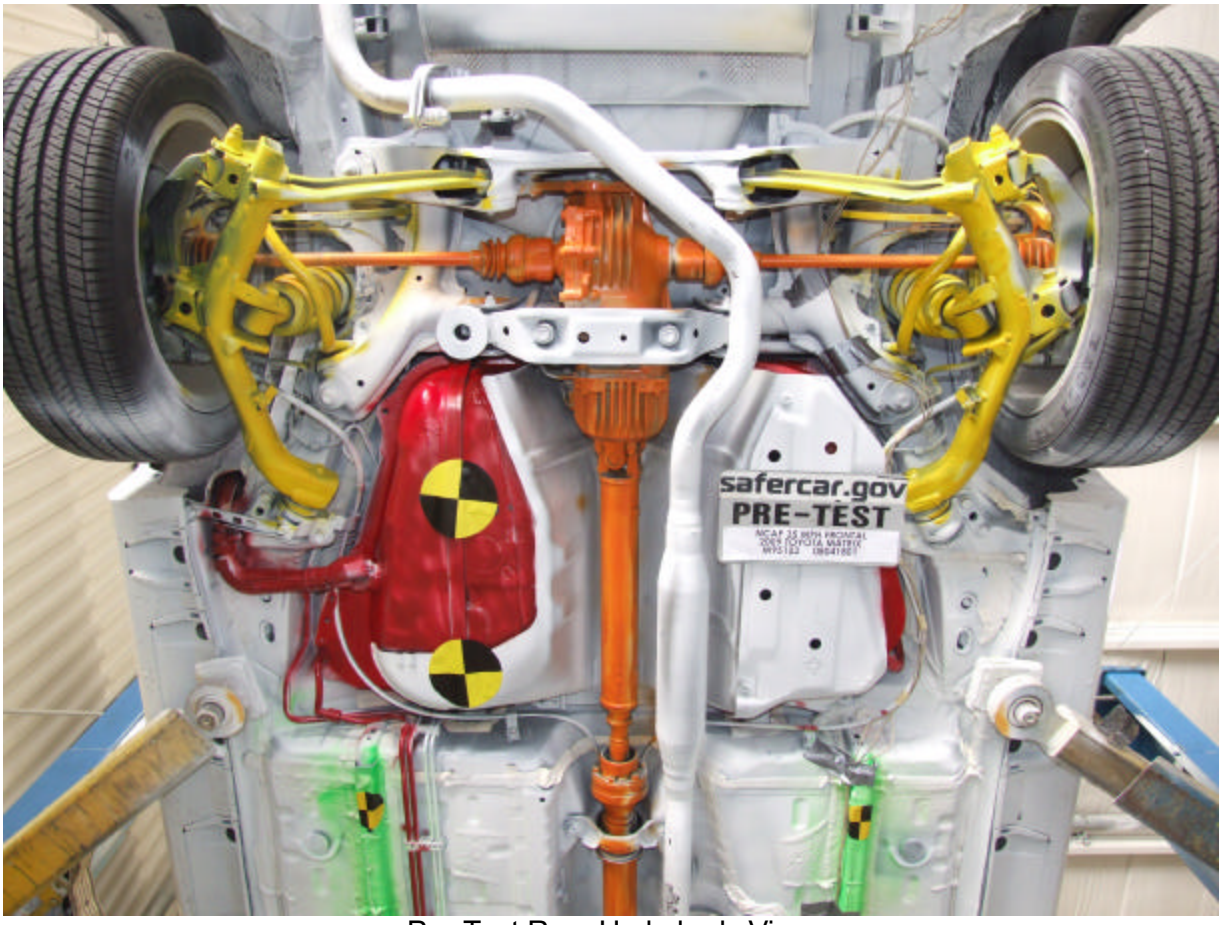


Post-Test Front Underbody View

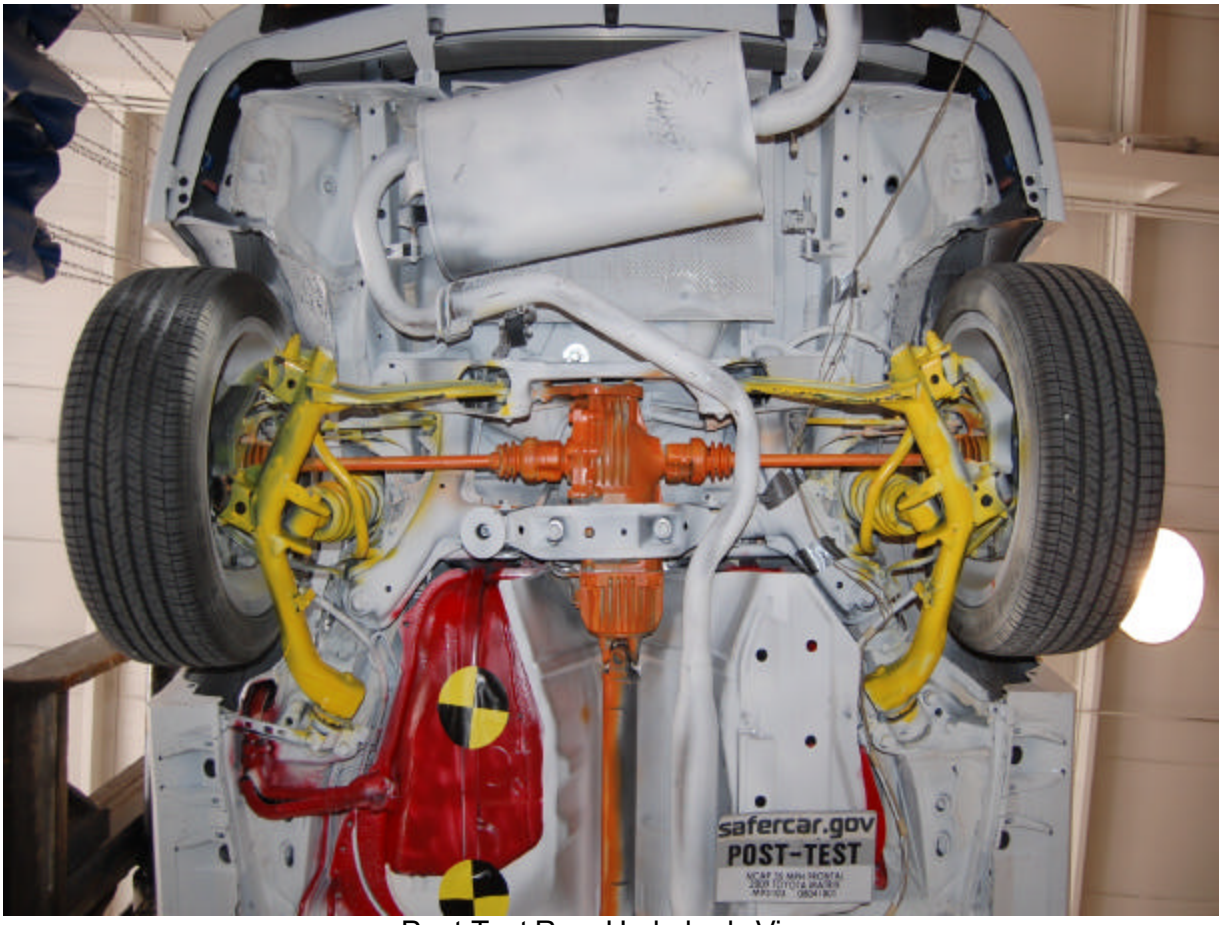
Pre-Test Mid Underbody View



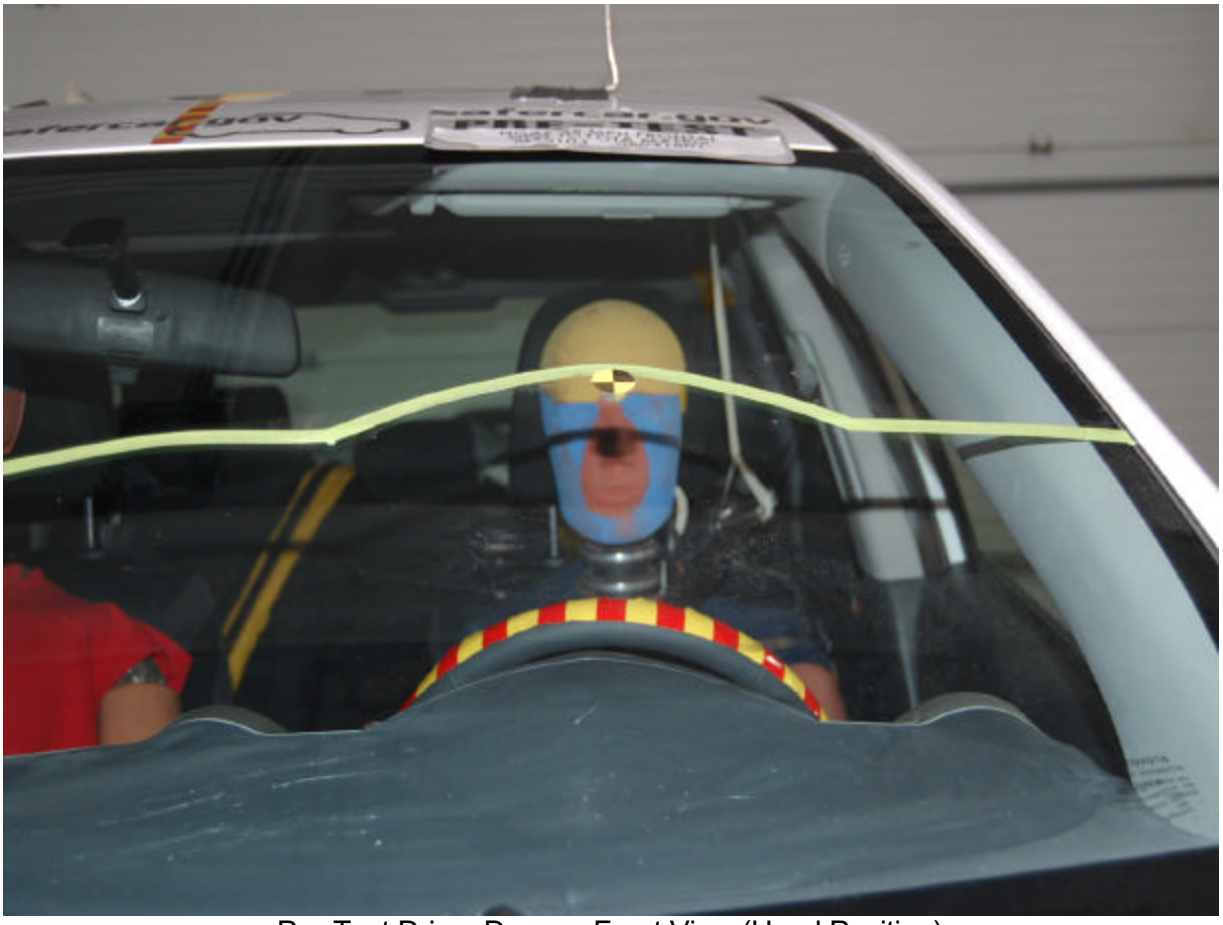
Post-Test Mid Underbody View



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)

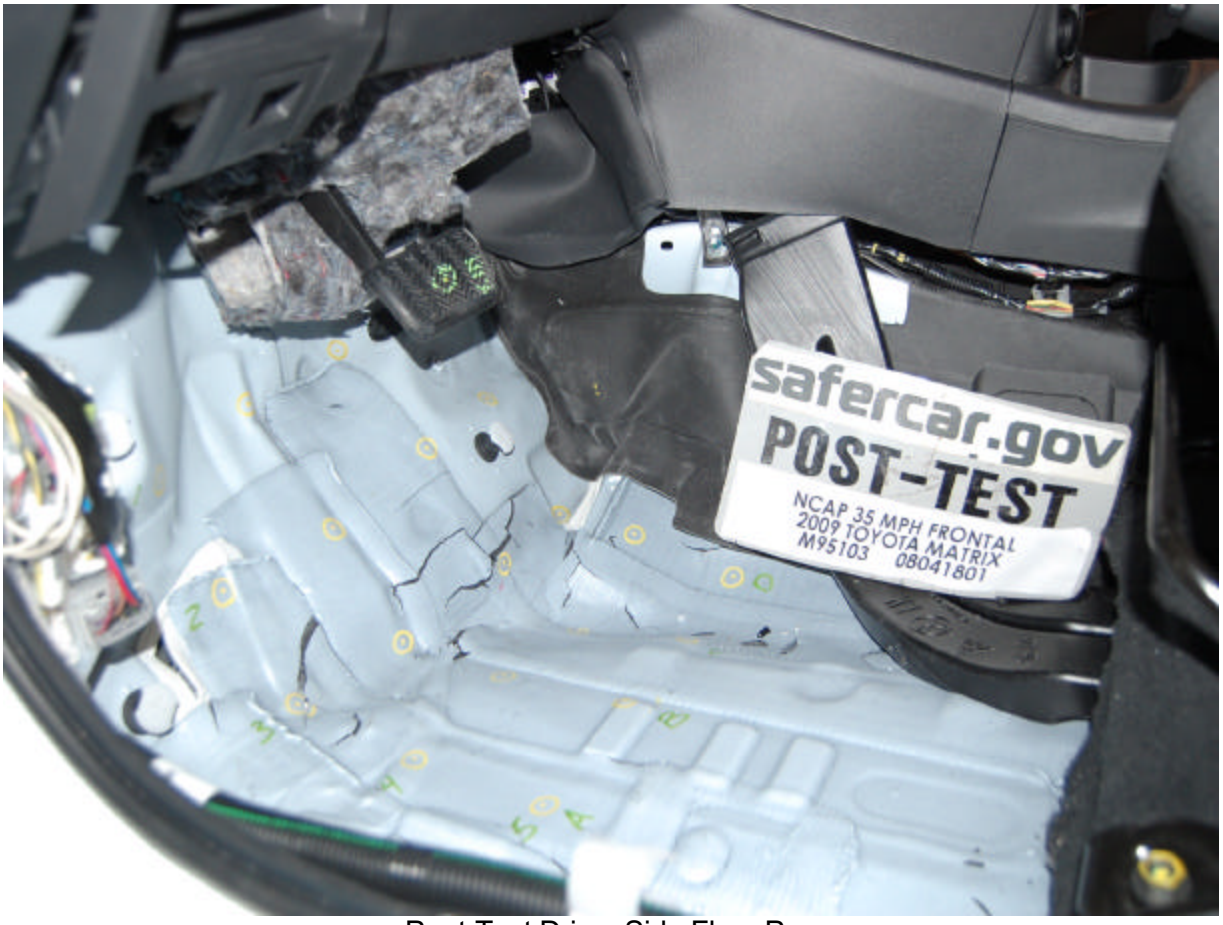
Pre-Test Driver Dummy Feet

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 (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)

Pre-Test Passenger Dummy Feet

Post-Test Passenger Dummy Feet

Pre-Test Passenger Side Glove Box

Post-Test Passenger Side Glove Box

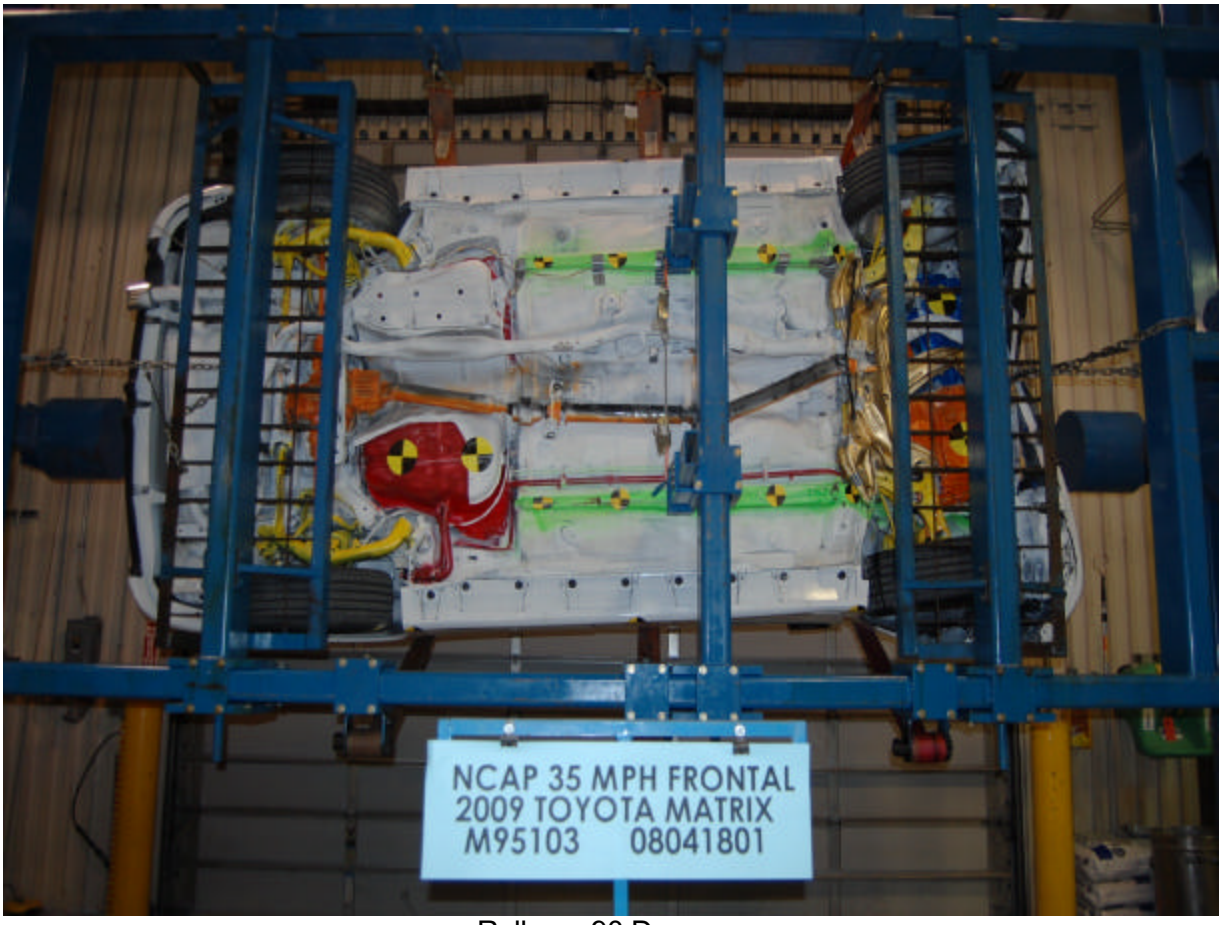
Pre-Test Passenger Side Floor Pan

Post-Test Passenger Side Floor Pan

Post-Test Passenger Dummy Head Contact (Headrest)

Post-Test Passenger Dummy Knee Contact

Post-Test Passenger Dummy Airbag Contact



Rollover 90 Degrees

Rollover 180 Degrees

Rollover 270 Degrees

Rollover 360 Degrees

Vehicle Impact

APPENDIX B

DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

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

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Upper Neck Force X

Driver Upper Neck Force Y

Driver Upper Neck Force Z

Driver Upper Neck Moment X

Driver Upper Neck Moment Y

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Chest Displacement

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Shoulder Belt Force

Driver Lap Belt Force

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Upper Neck Force X

Passenger Upper Neck Force Y

Passenger Upper Neck Force Z

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Y

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Chest Displacement

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Shoulder Belt Force

Passenger Lap Belt Force

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Left Rear Seat Crossmember X

Left Rear Seat Crossmember Z

Right Rear Seat Crossmember X

Right Rear Seat Crossmember Z

Vehicle Engine Top X

Vehicle Engine Bottom X

Vehicle Left Brake Caliper X

Vehicle Right Brake Caliper X

Barrier Force – Upper Left

Barrier Force – Upper Center

Barrier Force – Upper Right

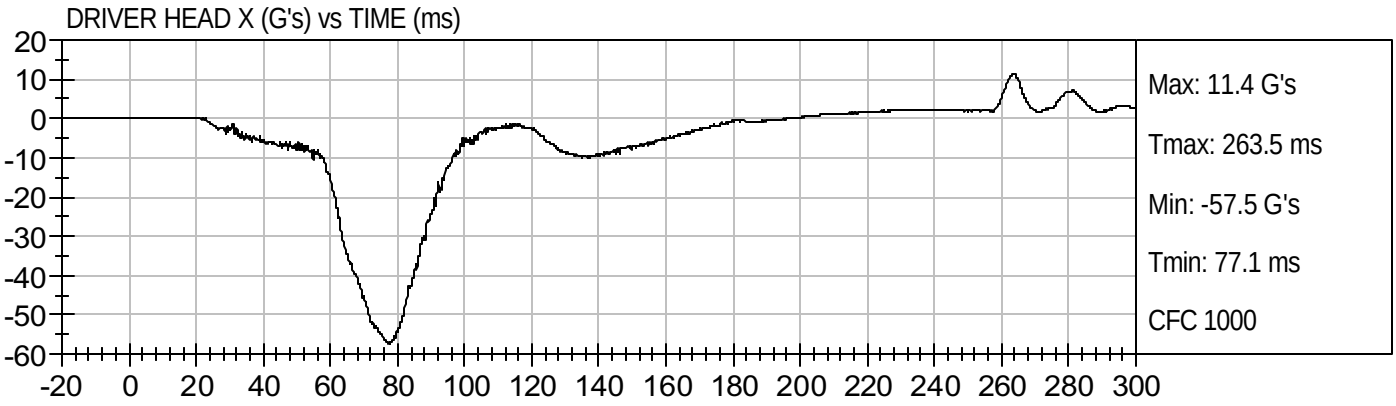
Barrier Force – Lower Left

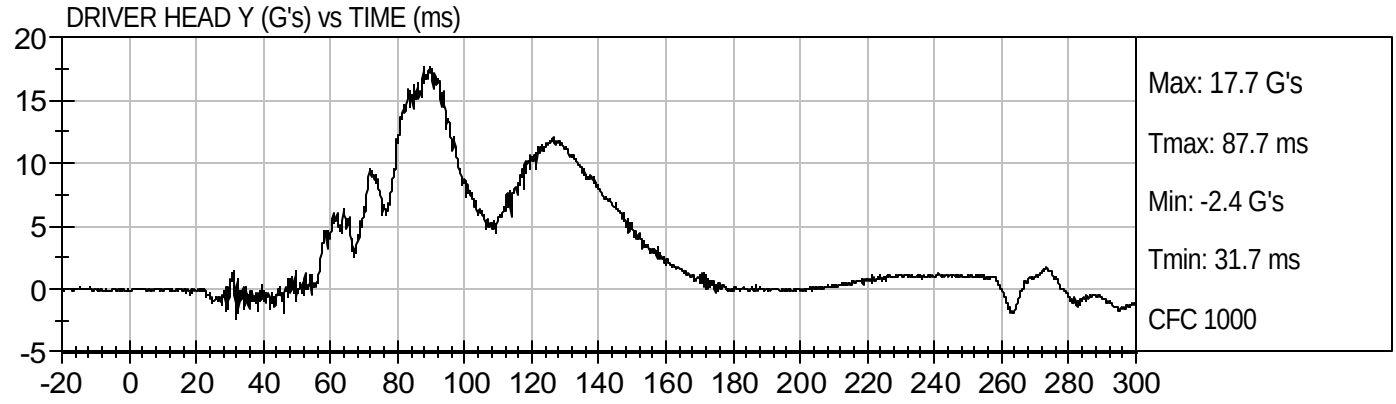
Barrier Force – Lower Center

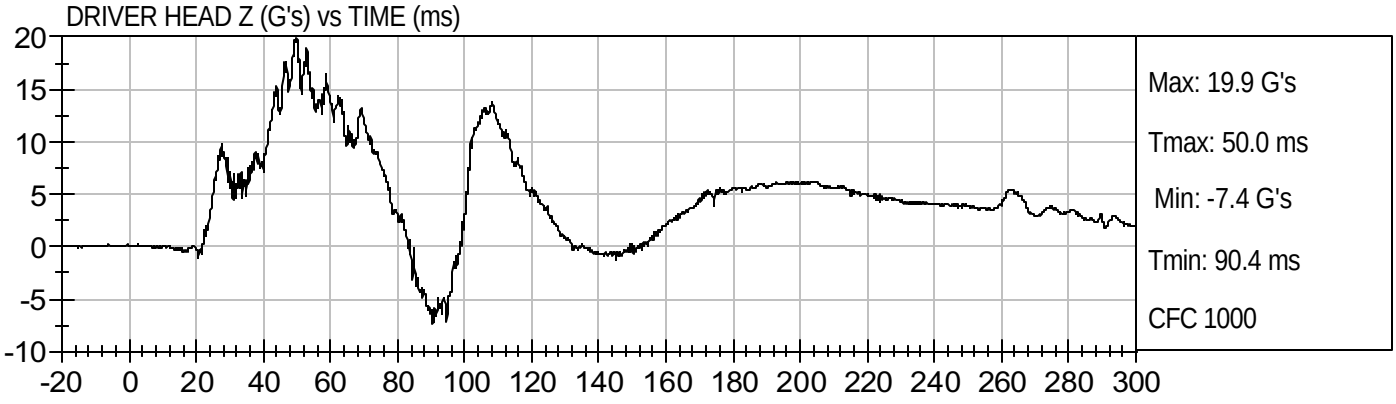
Barrier Force – Lower Right

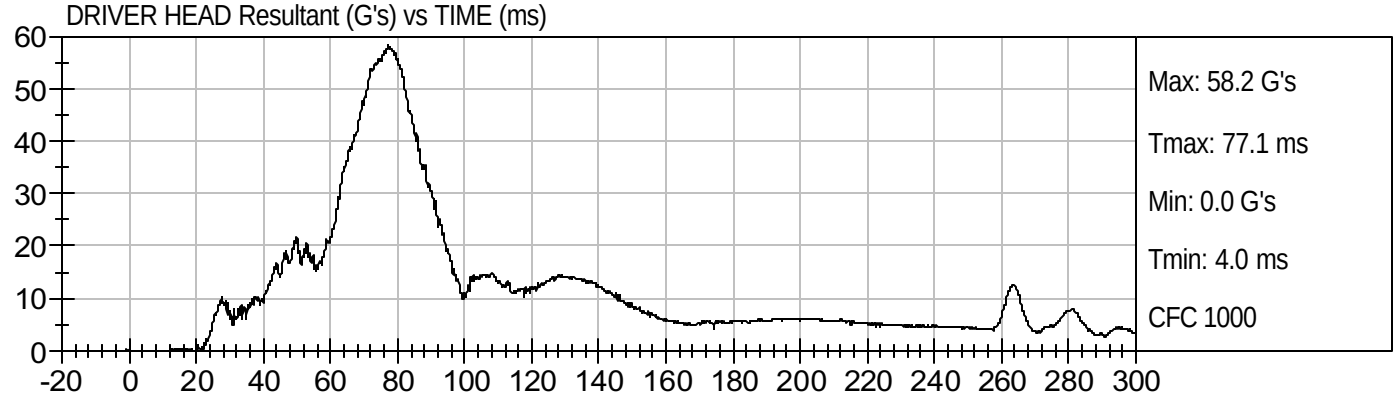
NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

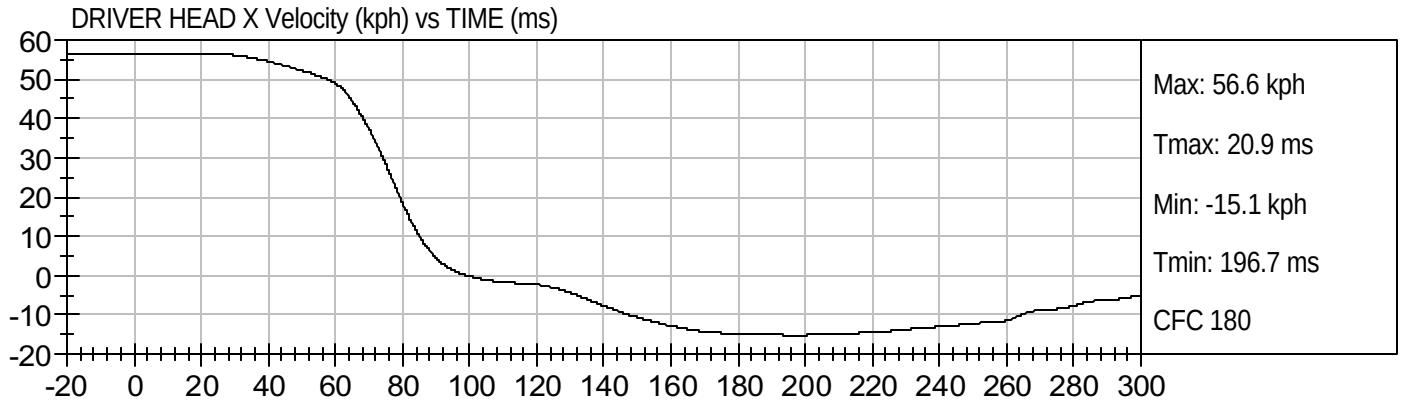


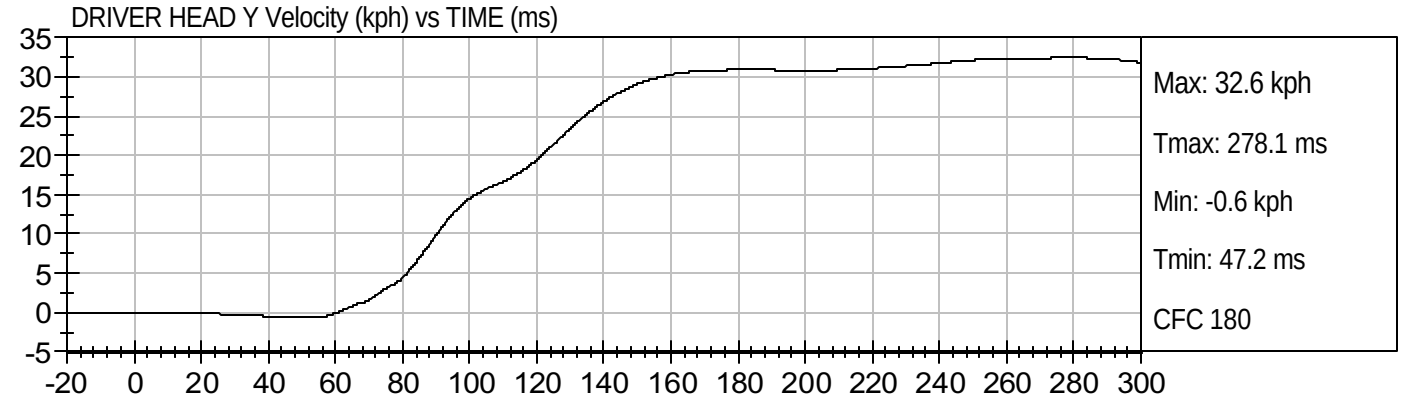


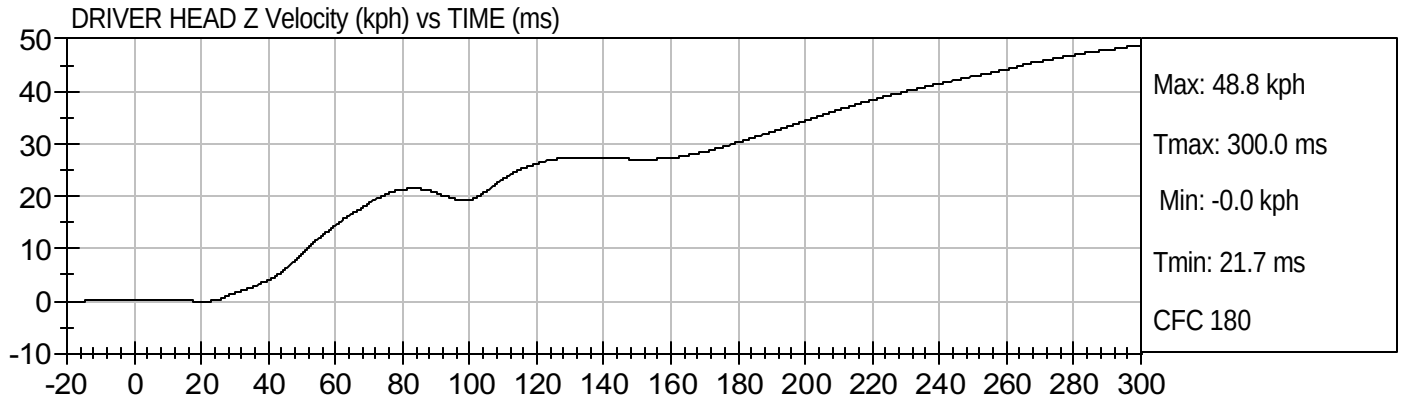




NCAP FRONTAL
2009 TOYOTA MATRIX M95103
Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)



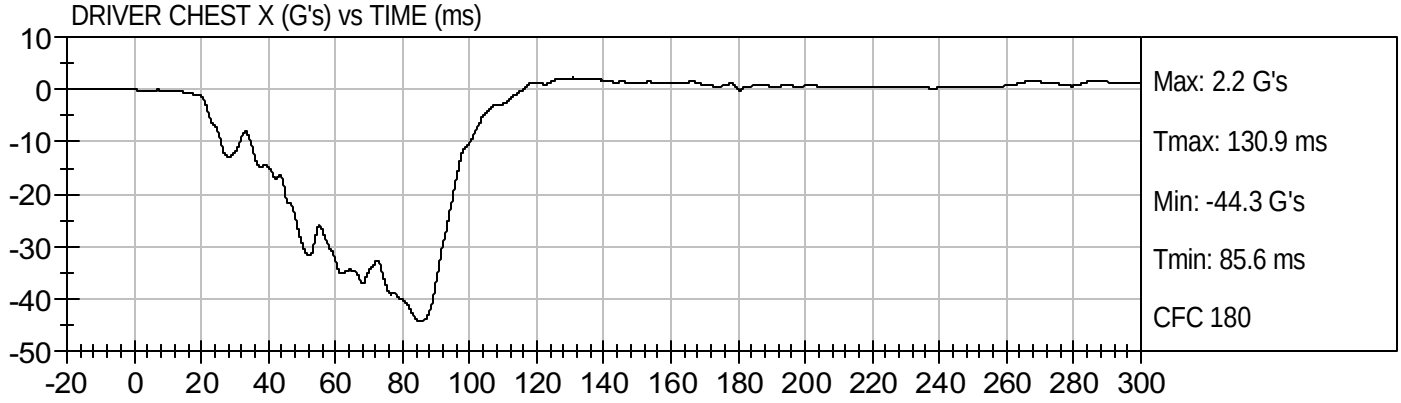




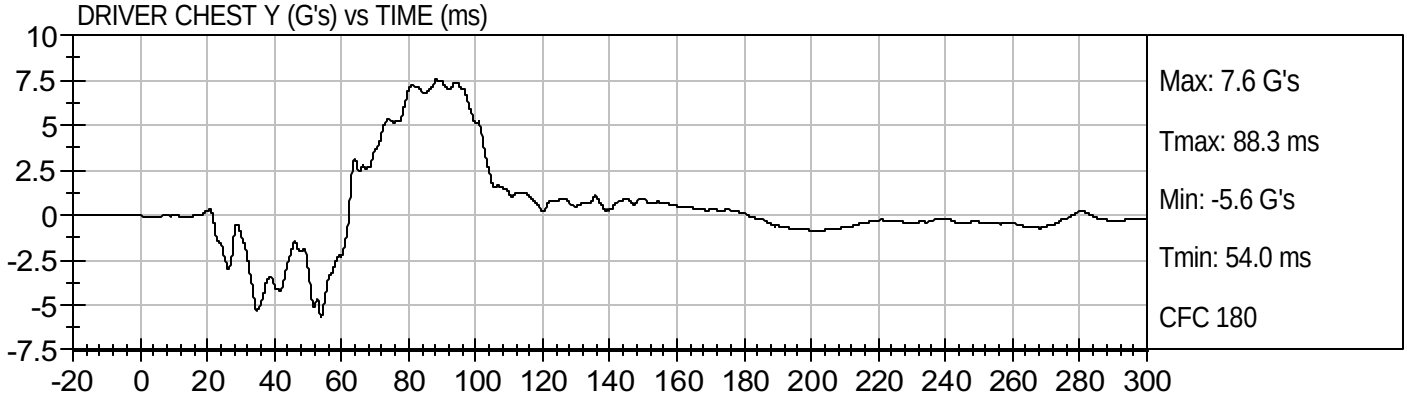
NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

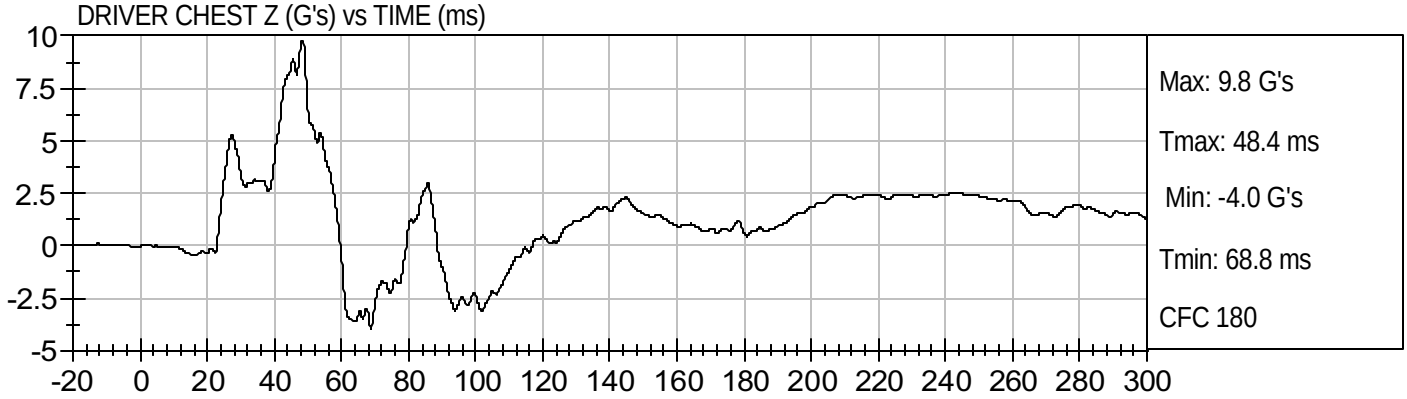
DRIVER CHEST X (G's) vs TIME (ms)



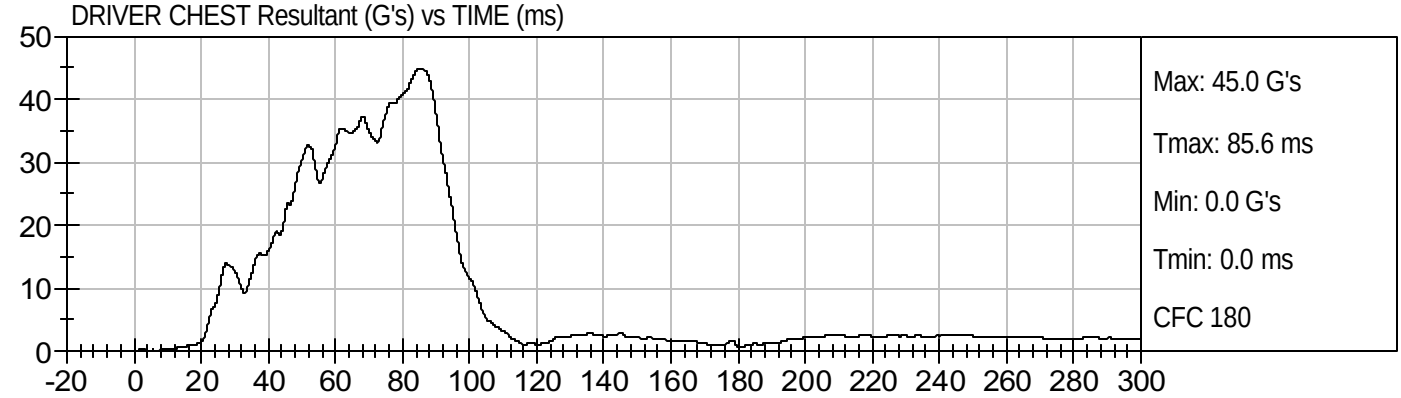
DRIVER CHEST Y (G's) vs TIME (ms)



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

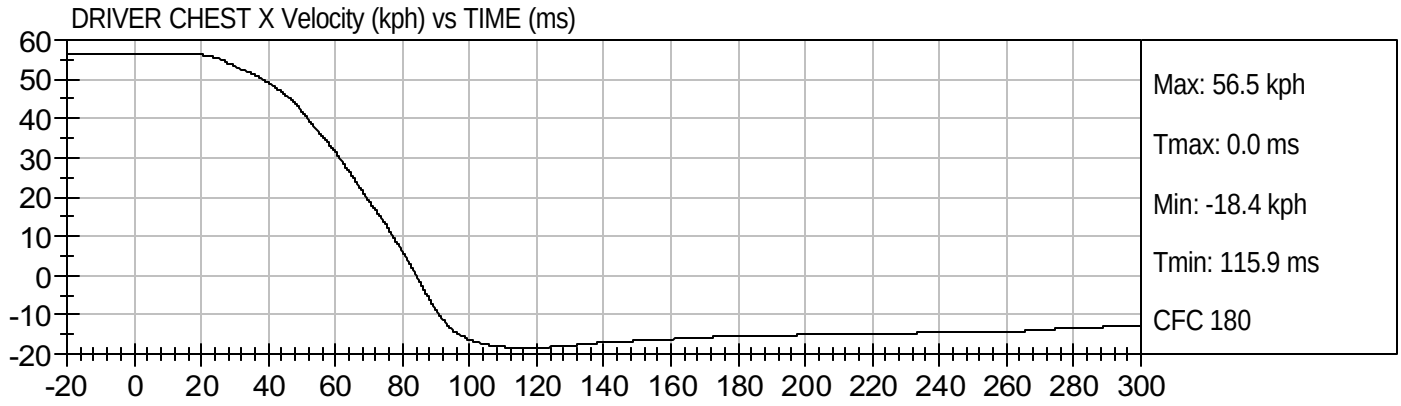


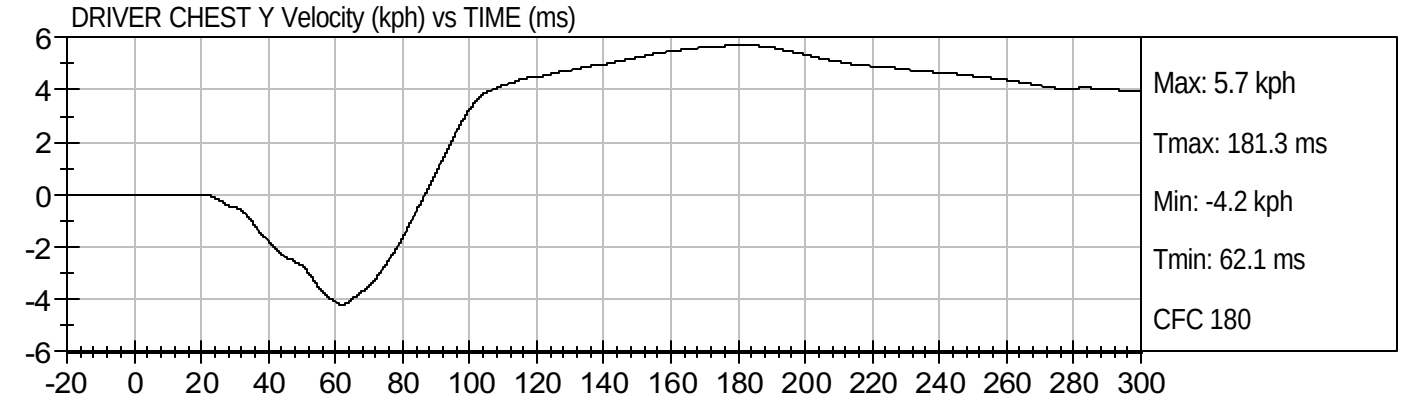
DRIVER CHEST Resultant (G's) vs TIME (ms)

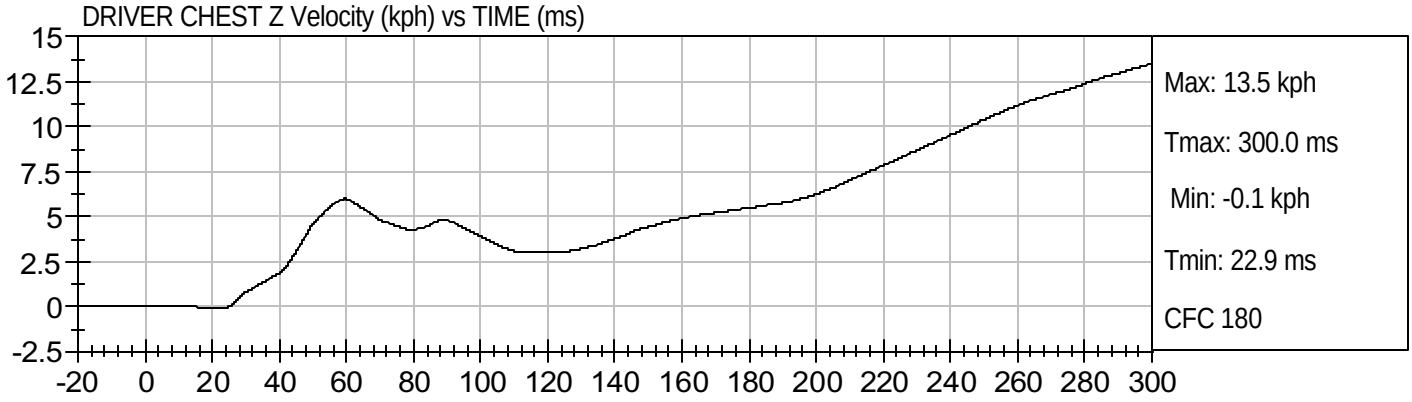


NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

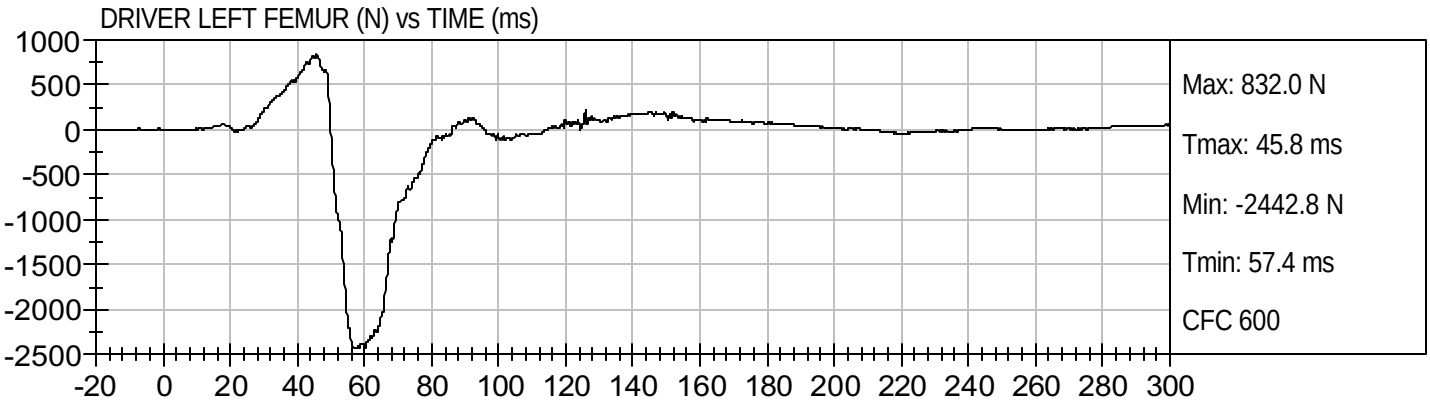


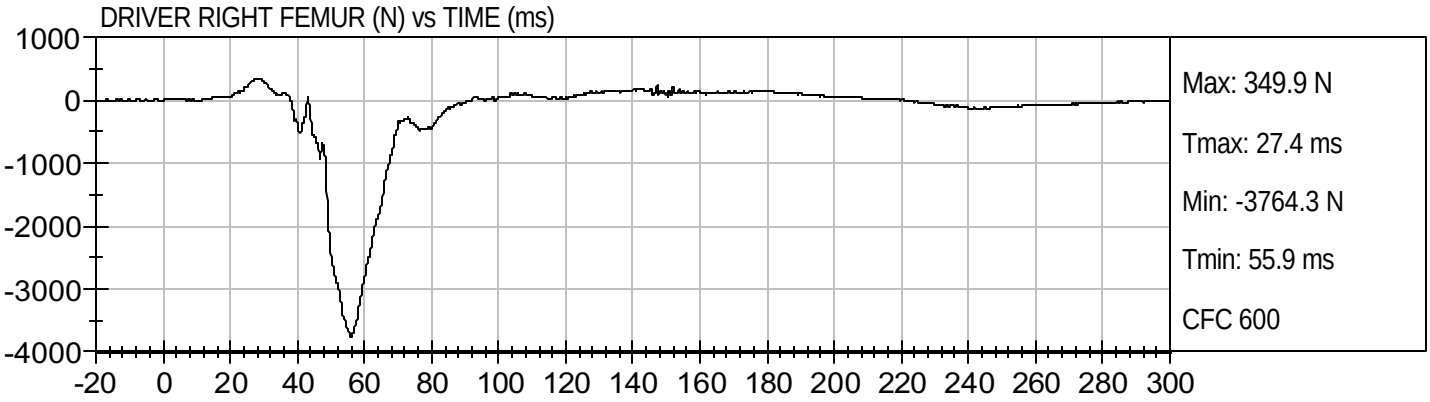




NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

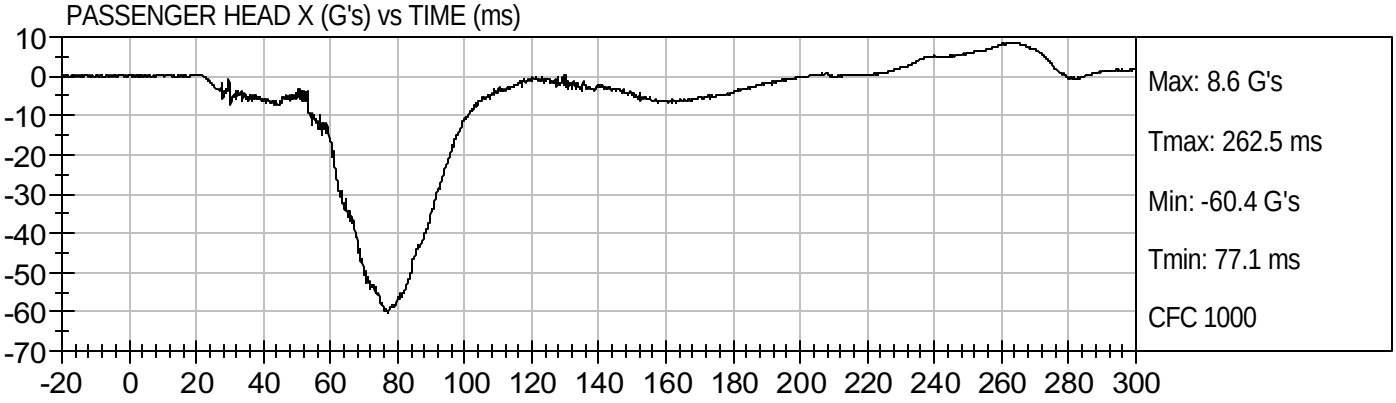




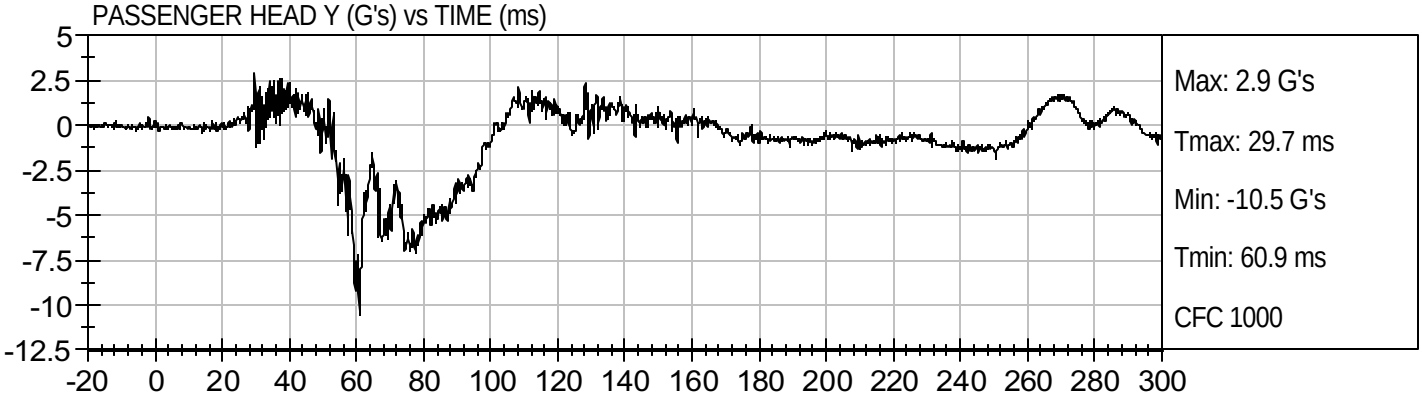
NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

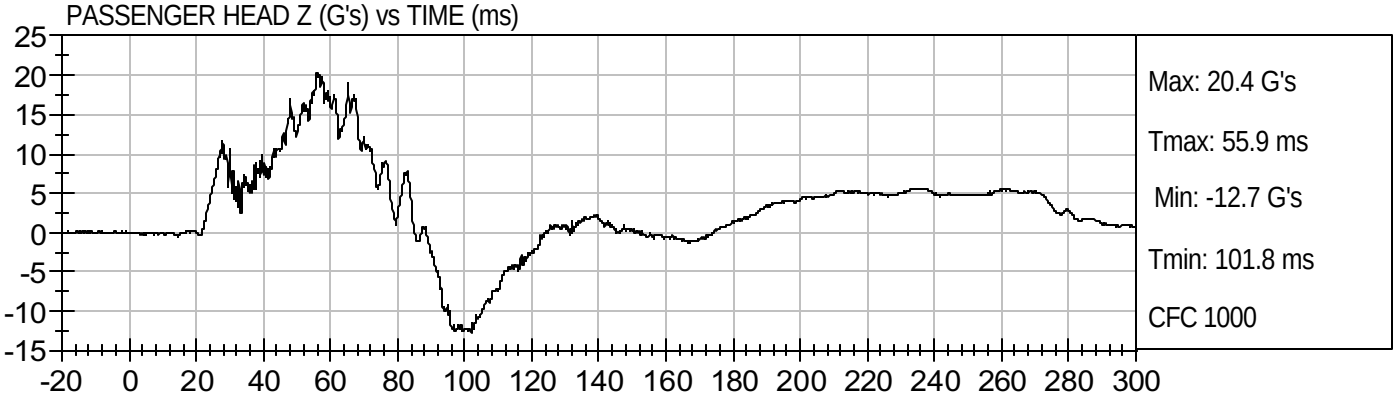
PASSENGER HEAD X (G's) vs TIME (ms)



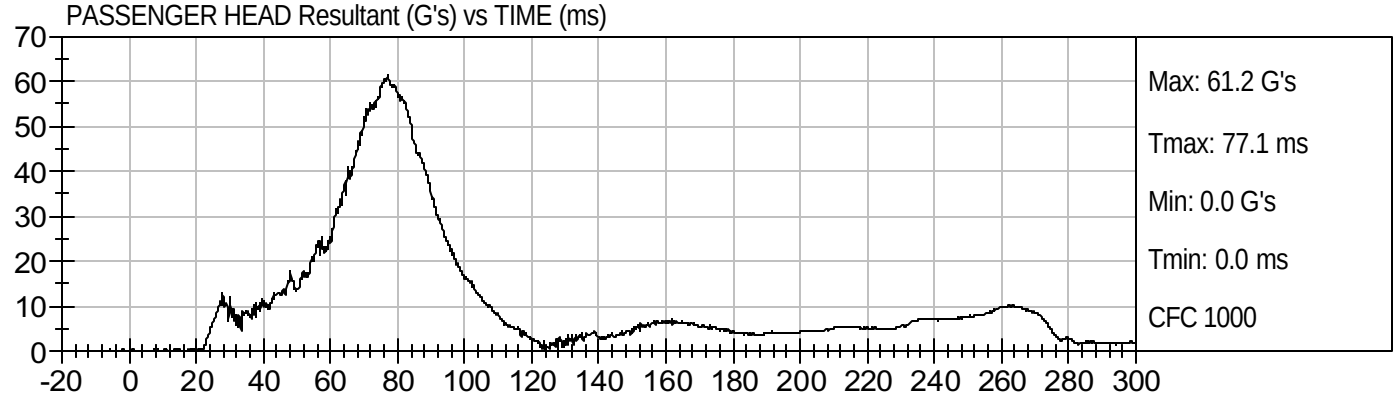
PASSENGER HEAD Y (G's) vs TIME (ms)



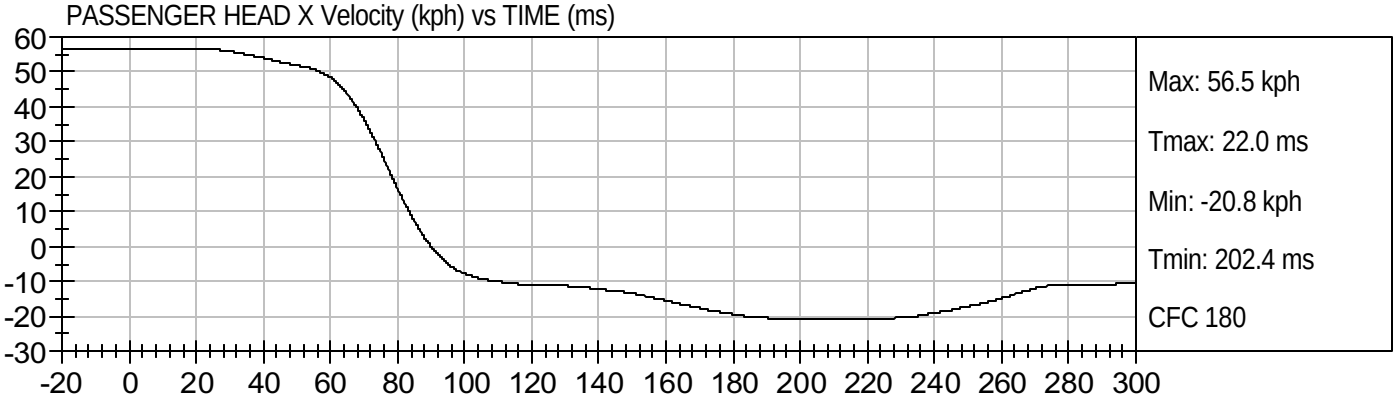
PASSENGER HEAD Z (G's) vs TIME (ms)



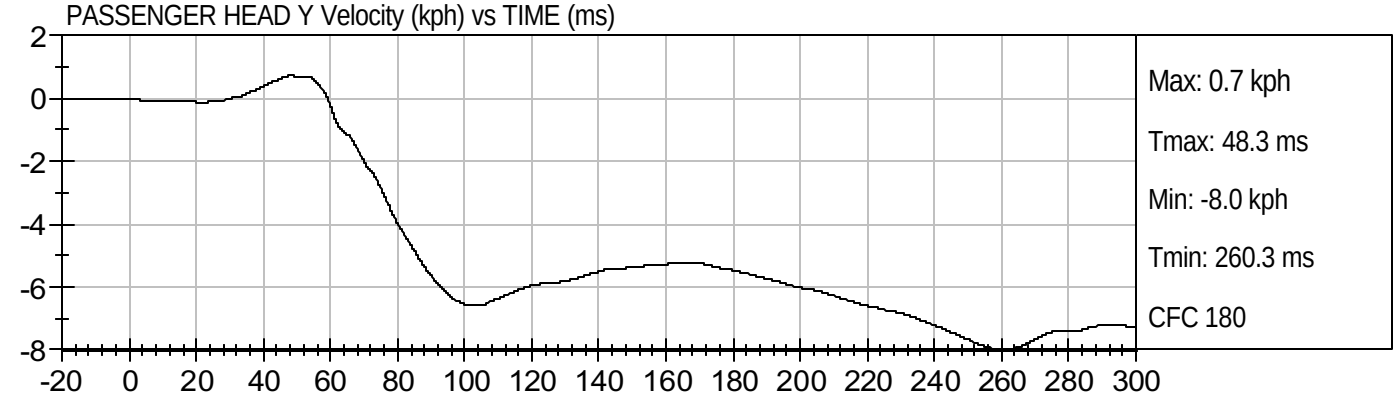
PASSENGER HEAD Resultant (G's) vs TIME (ms)



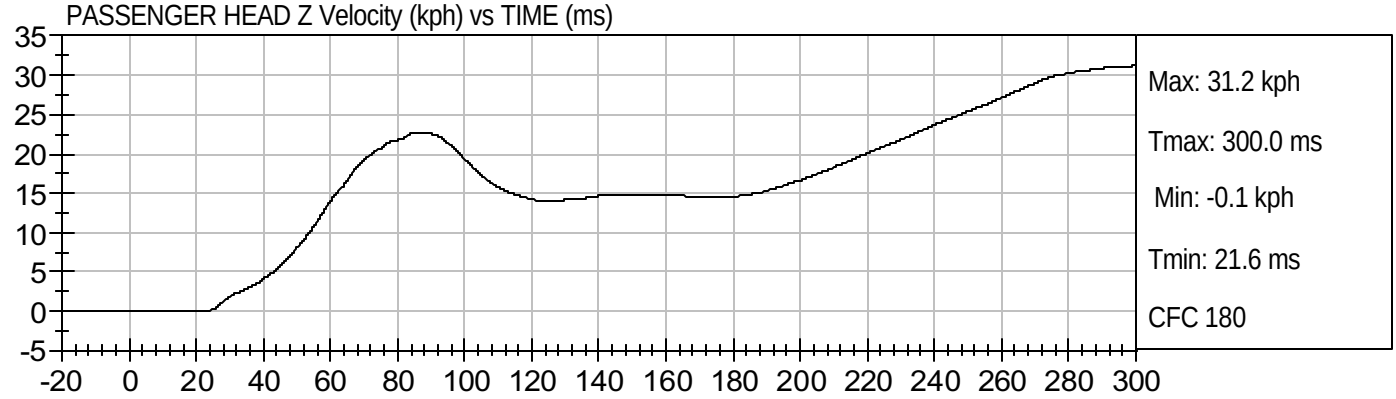
PASSENGER HEAD X Velocity (kph) vs TIME (ms)



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



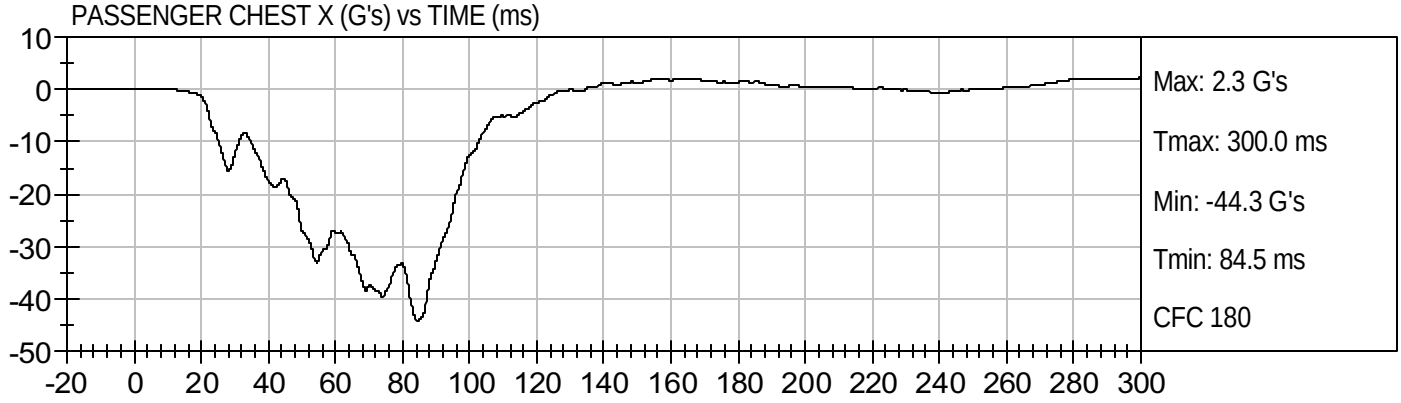
PASSENGER HEAD Z Velocity (kph) vs TIME (ms)



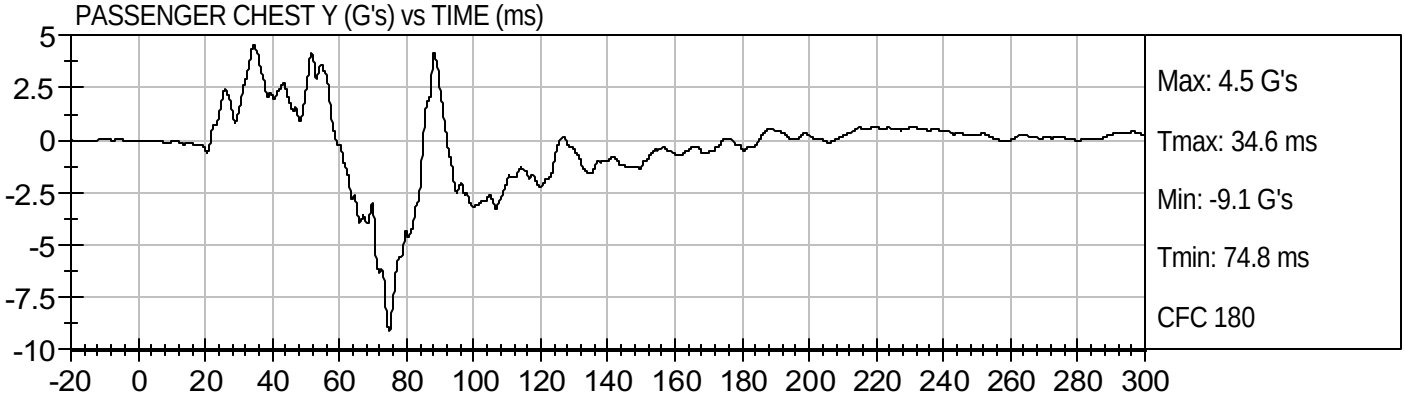
NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

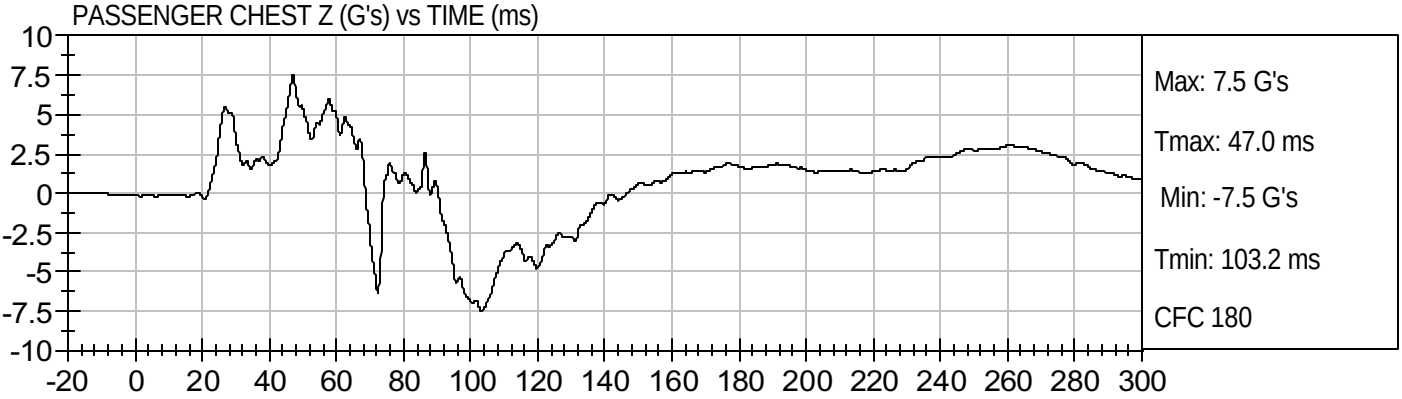
PASSENGER CHEST X (G's) vs TIME (ms)



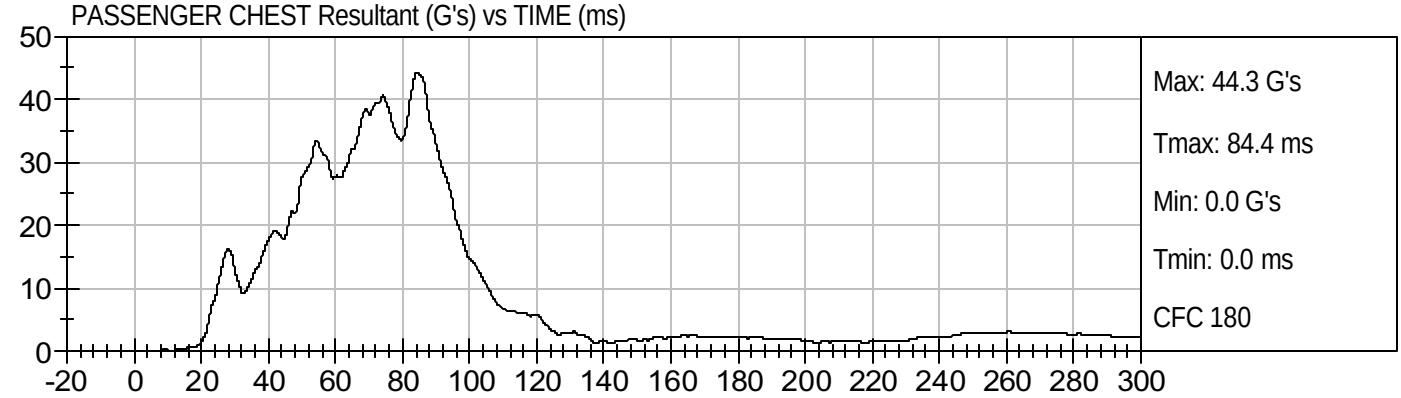
PASSENGER CHEST Y (G's) vs TIME (ms)



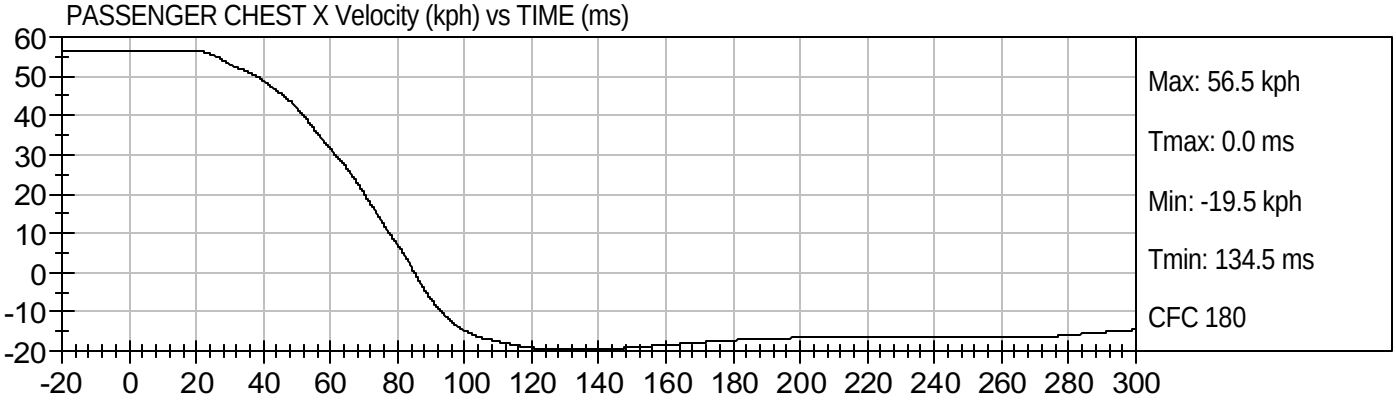
PASSENGER CHEST Z (G's) vs TIME (ms)



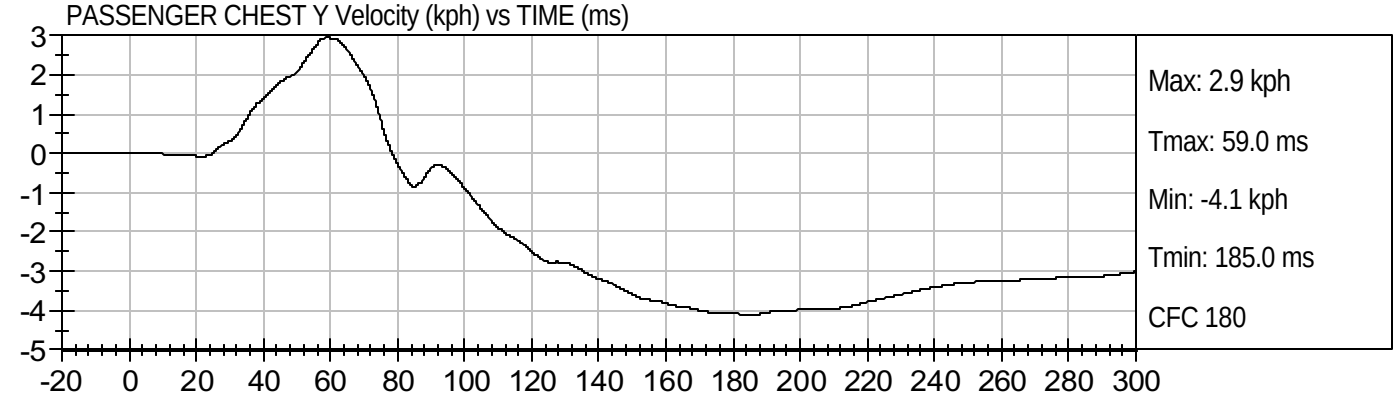
PASSENGER CHEST Resultant (G's) vs TIME (ms)



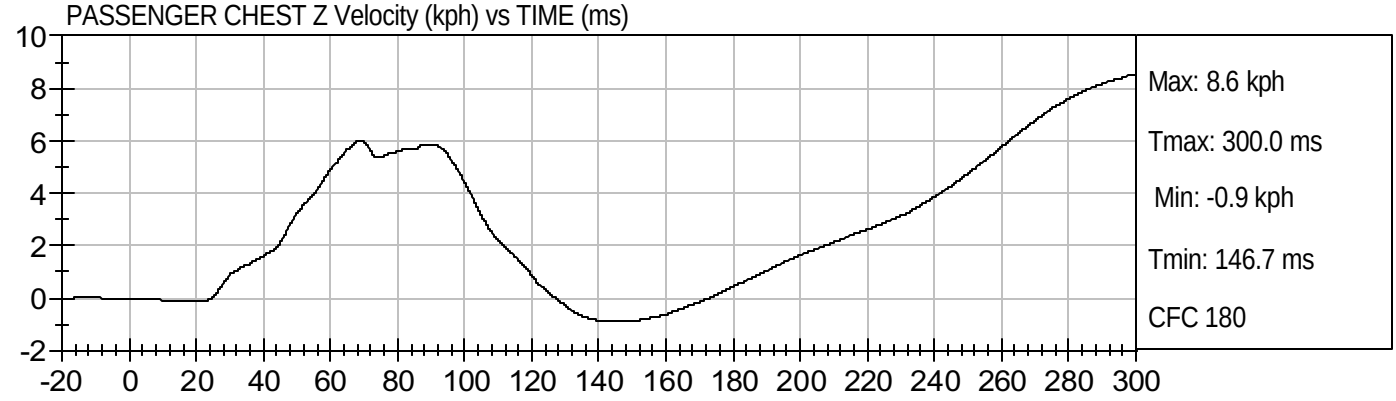
PASSENGER CHEST X Velocity (kph) vs TIME (ms)



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



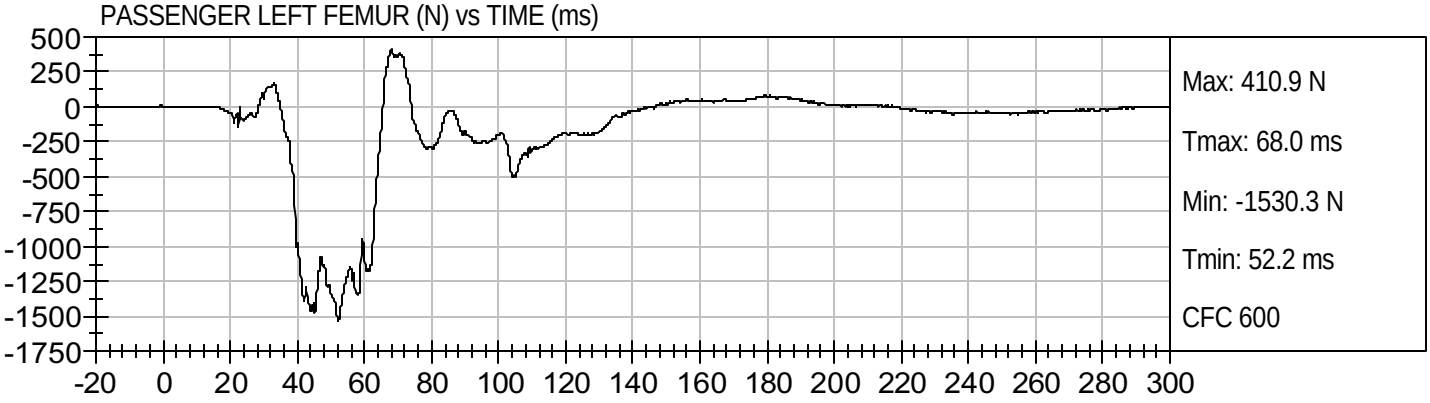
PASSENGER CHEST Z Velocity (kph) vs TIME (ms)



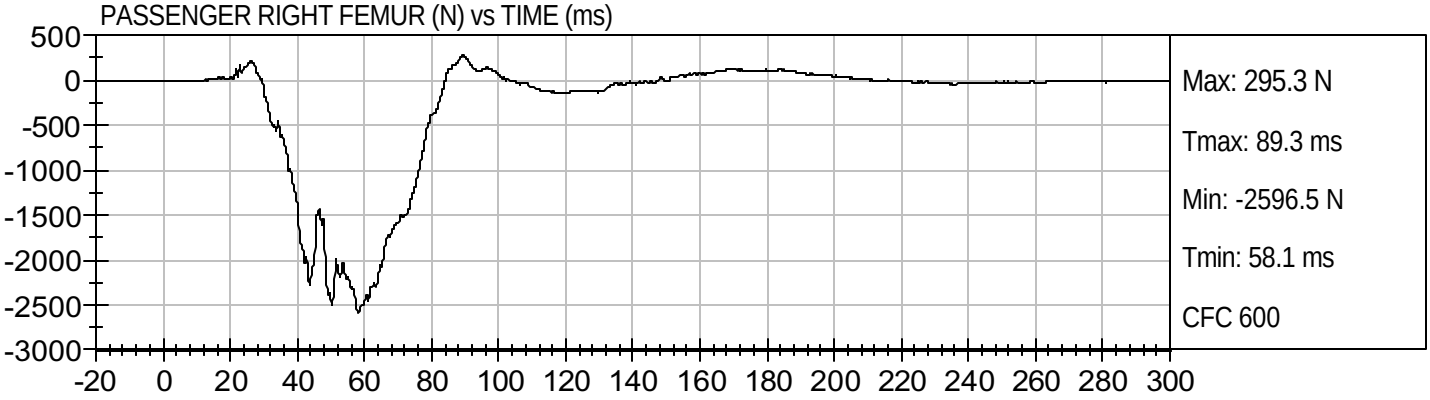
NCAP FRONTAL
2009 TOYOTA MATRIX M95103

Test Date: 04/18/2008
Speed: 35.1 mph (56.5 km/h)

PASSENGER LEFT FEMUR (N) vs TIME (ms)



PASSENGER RIGHT FEMUR (N) vs TIME (ms)



APPENDIX C

DUMMY CALIBRATION DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test ID:** D08861

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	225 - 275	244	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-13.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

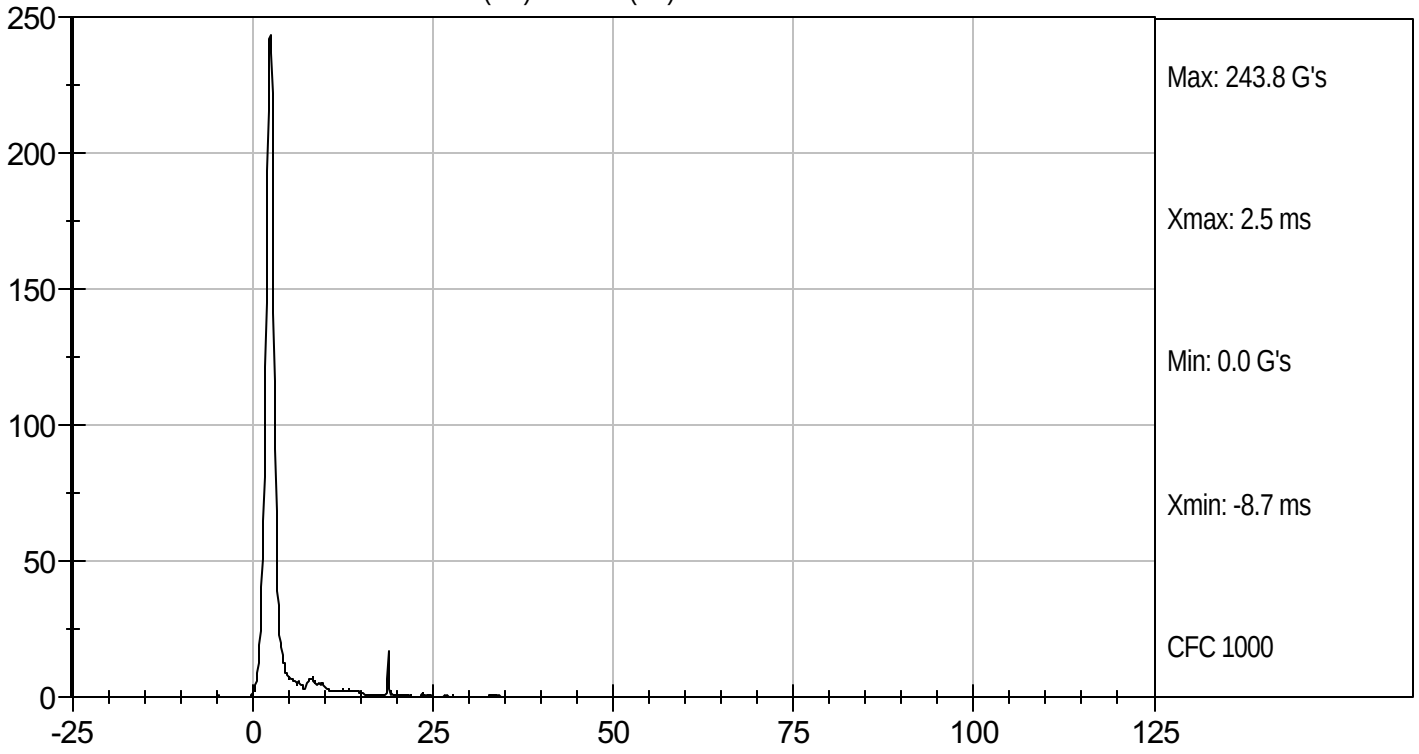
3/24/08
Test Date

David Winkelbauer
Approved By

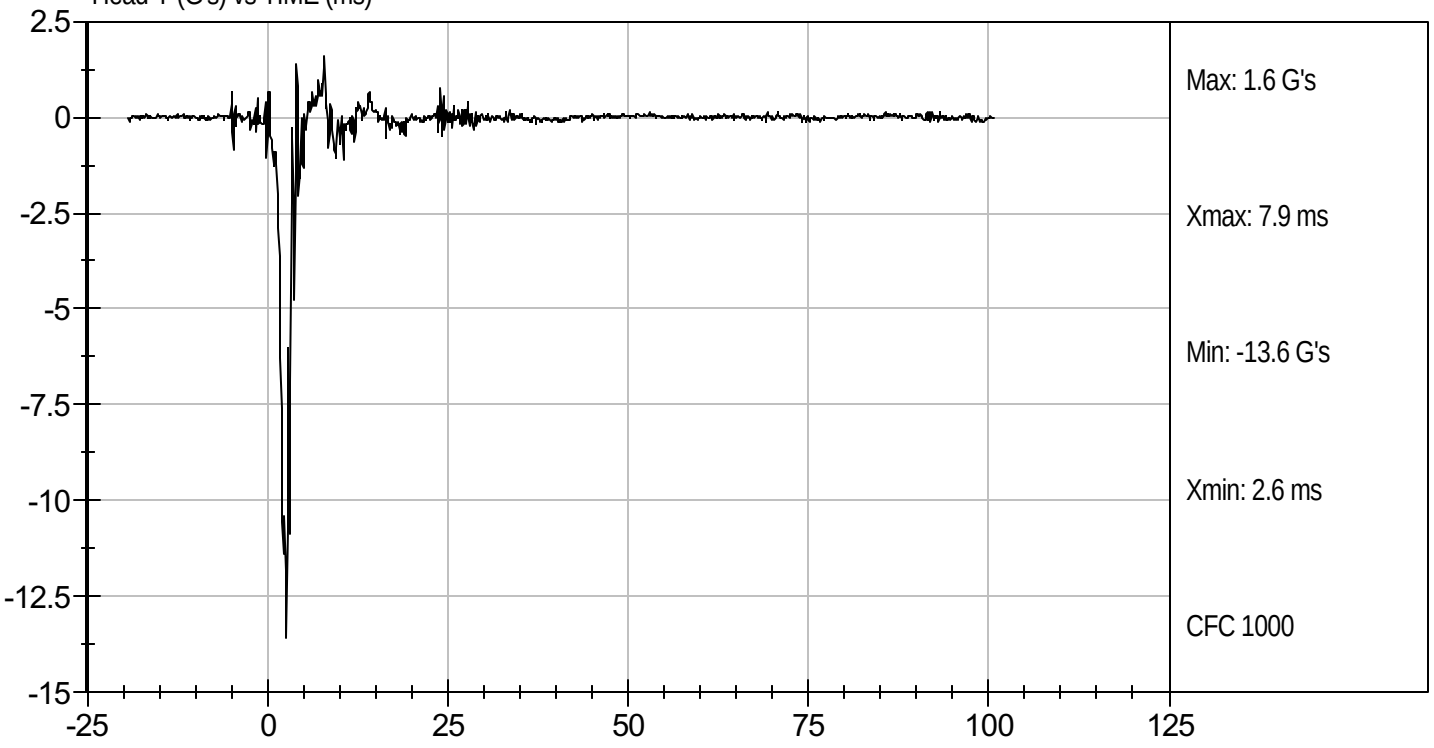
Test Desc: Head Drop
Component ID: D08861

Test Date: 3/24/08
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:** D08862

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	19	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.24	Pass
	20 msec	G's	17.60 to 22.60	18.44	Pass
	30 msec	G's	12.50 to 18.50	13.89	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	13.84	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	35.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	70.1	Pass
	Time	msec	57.0 to 64.0	57.1	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	93.3	Pass
	Time	msec	47.0 to 58.0	47.0	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	97.7	Pass
			Overall Test Results		Pass

Laboratory Technician

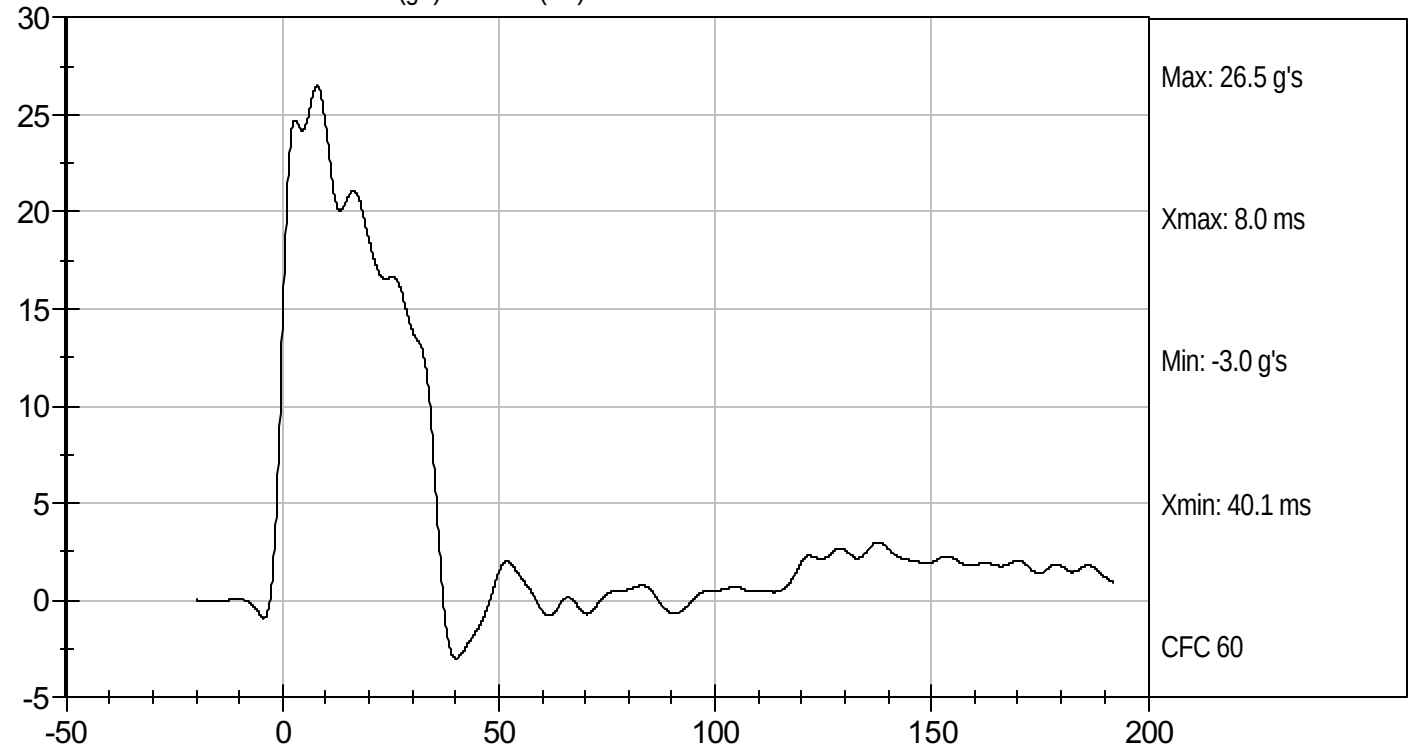
3/25/08
Test Date

Approved By

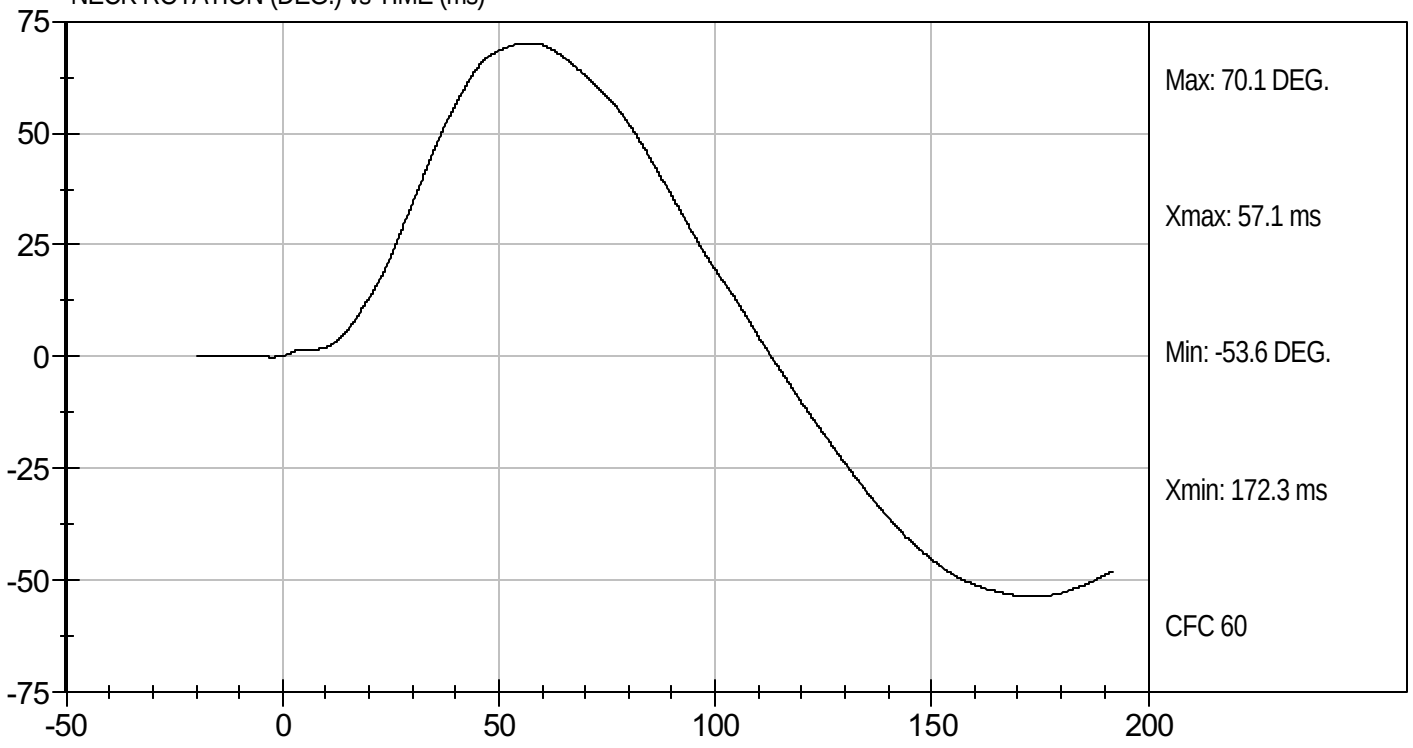
Test Desc: Neck Flexion
Component ID: D08862

Test Date: 3/25/08
Velocity: 23.14 ft/s, 7.05 m/s

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

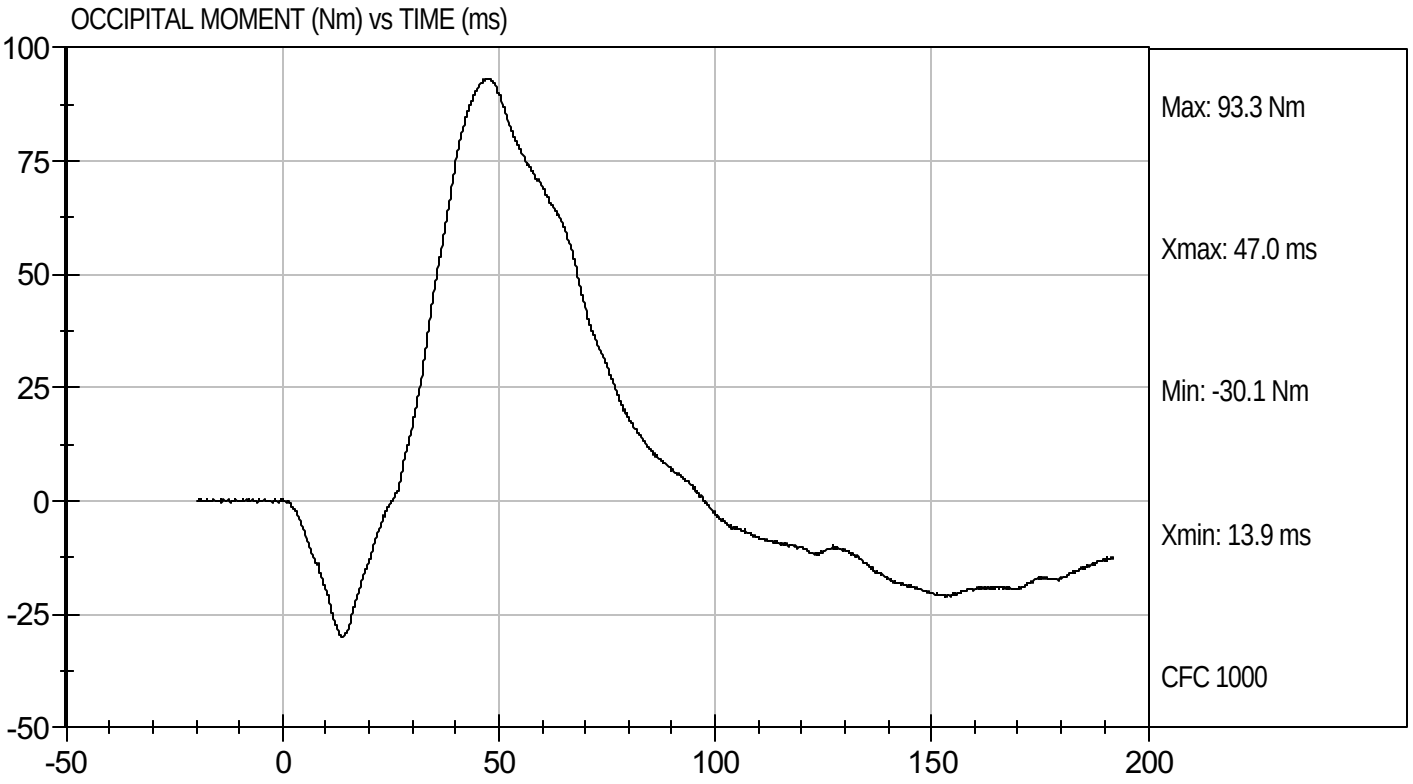


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D08862

Test Date: 3/25/08
Velocity: 23.14 ft/s, 7.05 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D08863

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.42	Pass
	20 msec	G's	14.00 to 19.00	15.05	Pass
	30 msec	G's	11.00 to 16.00	11.64	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	11.62	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	41.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.4	Pass
	Time	msec	72.0 to 82.0	76.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	154.7	Pass
Moment About Occipital Condyle	Maximum	N m	-52.9 to -79.9	-63.8	Pass
	Time	msec	65.0 to 79.0	72.0	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	143.7	Pass
			Overall Test Results		Pass

Laboratory Technician

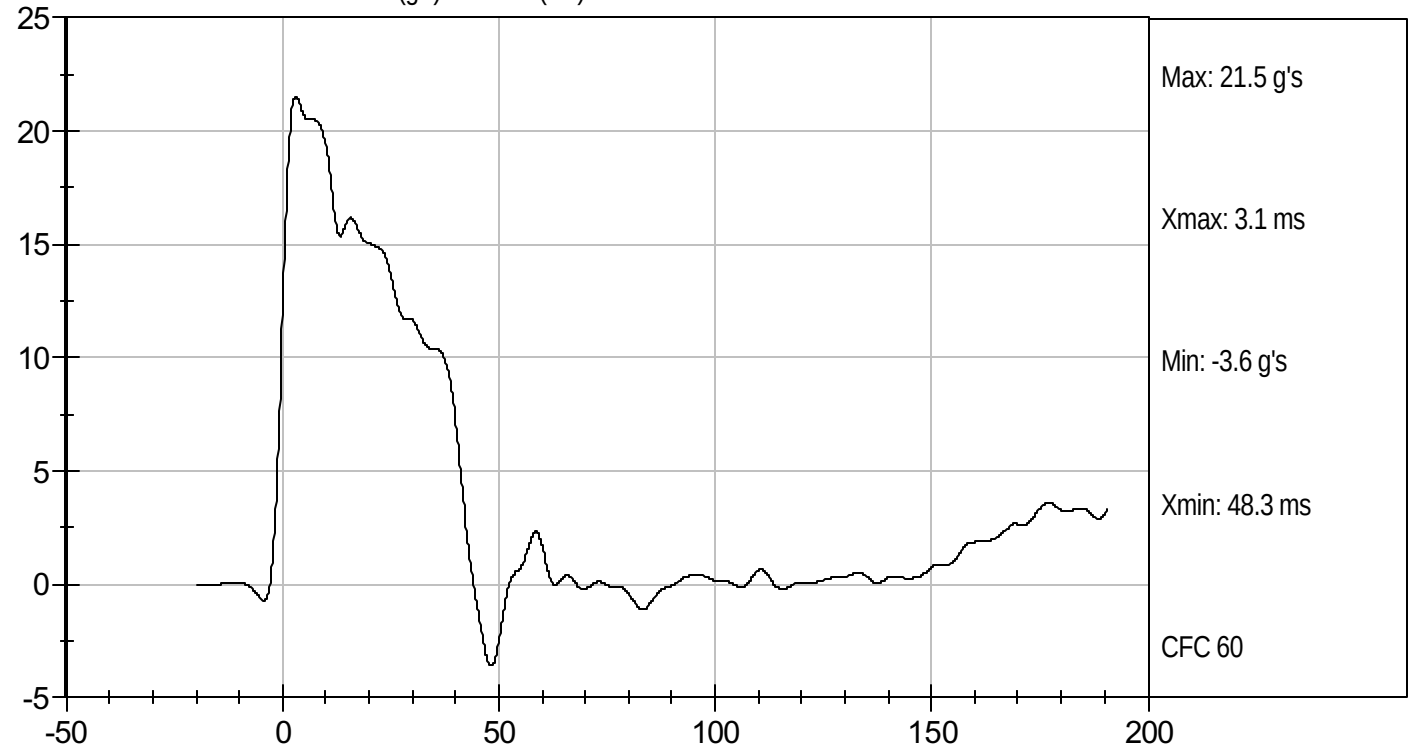
3/25/08
Test Date

David Winkelbauer
Approved By

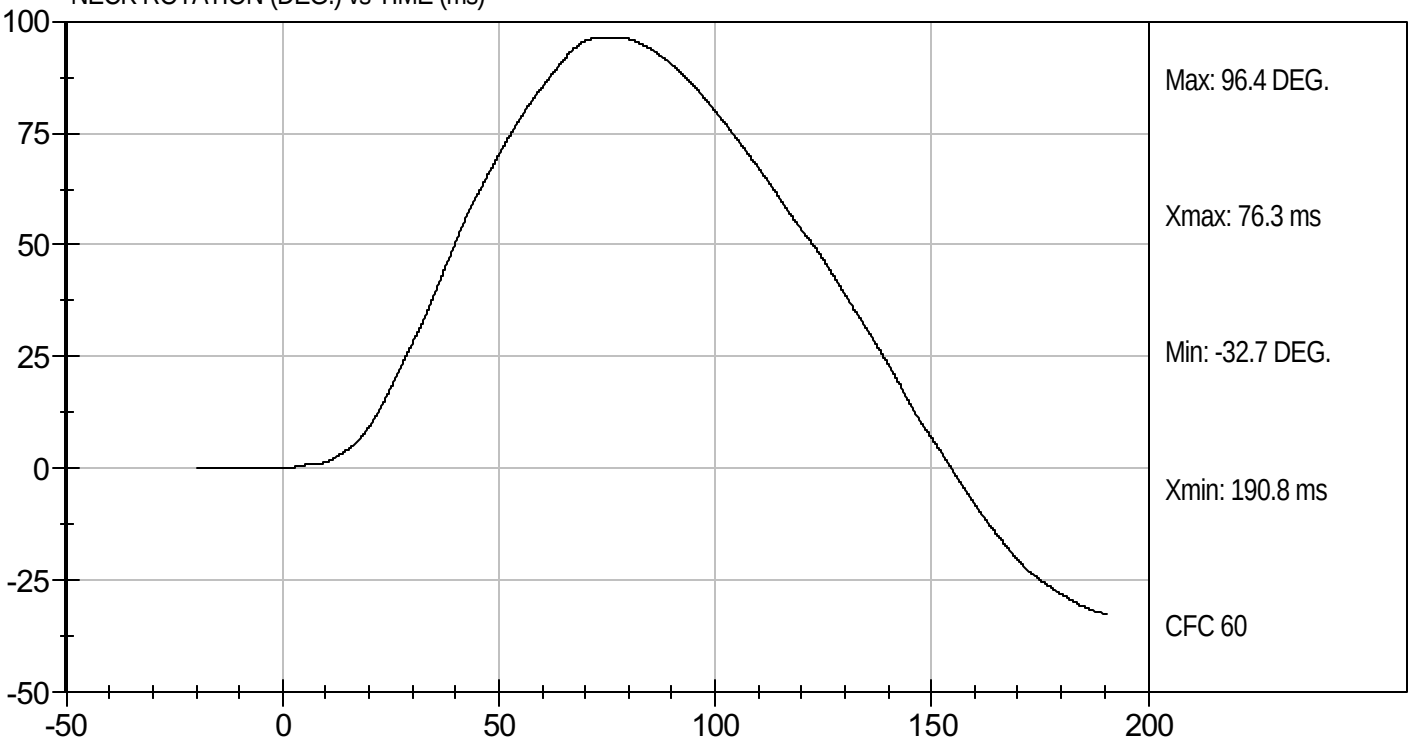
Test Desc: Neck Extension
Component ID: D08863

Test Date: 3/25/08
Velocity: 20.08 ft/s, 6.12 m/s

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

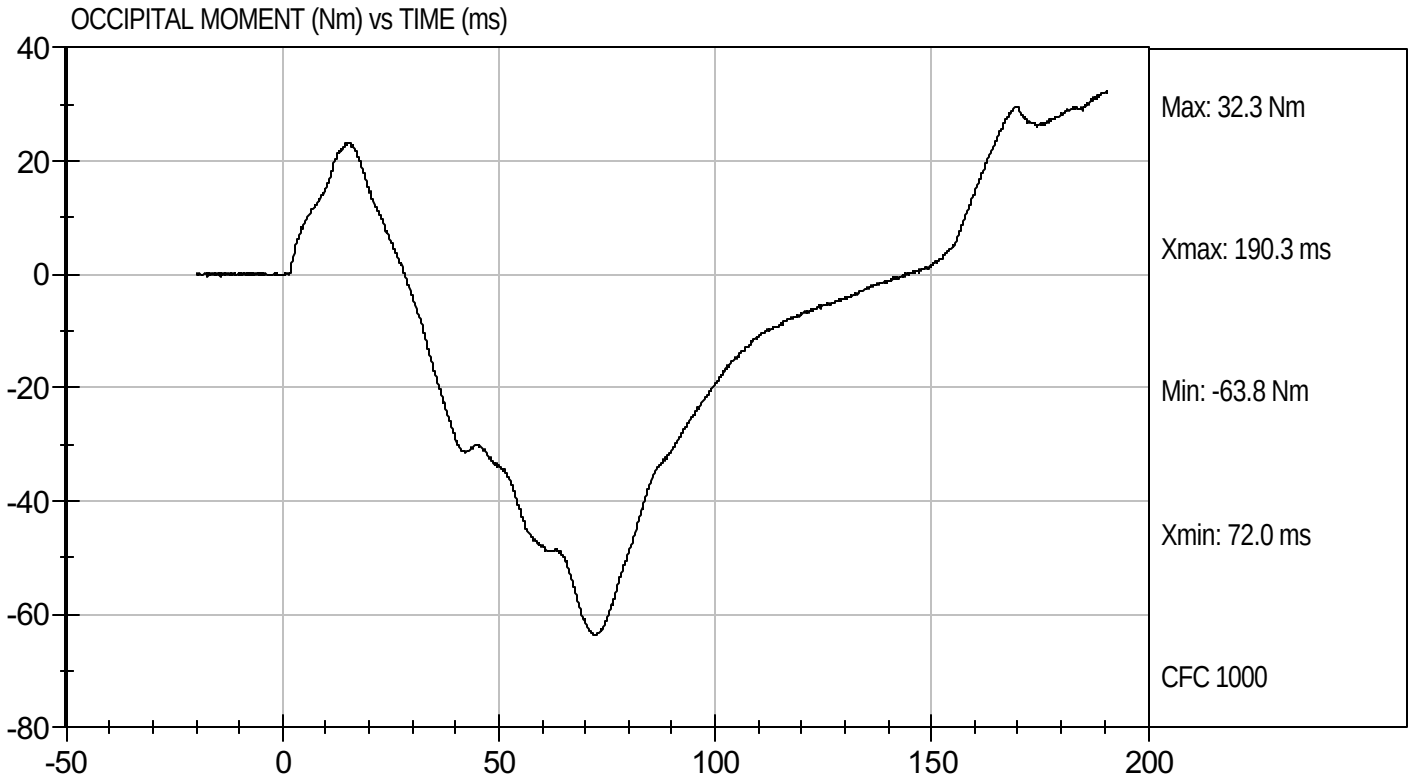


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D08863

Test Date: 3/25/08
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:** D08864

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	21	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,406	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.65	Pass
Internal Hysteresis	%	69 to 85	72	Pass
		Overall Test Results		Pass

Laboratory Technician

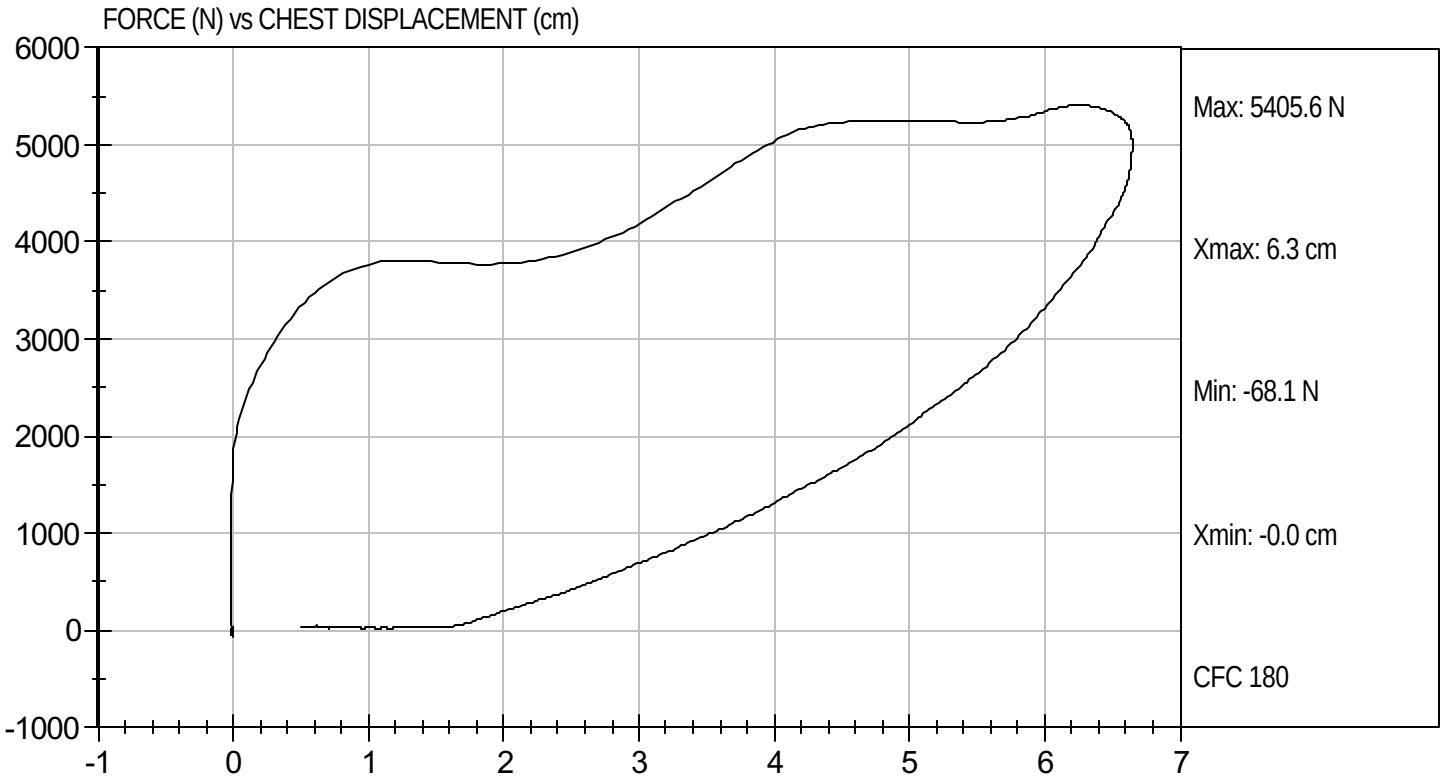
3/25/08

Test Date

Approved By

Test Desc: Thorax Impact
Component ID: D08864

Test Date: 3/25/08
Velocity: 22.22 ft/s, 6.77 m/s



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D08865

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	19	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,026	Pass
		Overall Test Results		Pass

Laboratory Technician

3/24/08

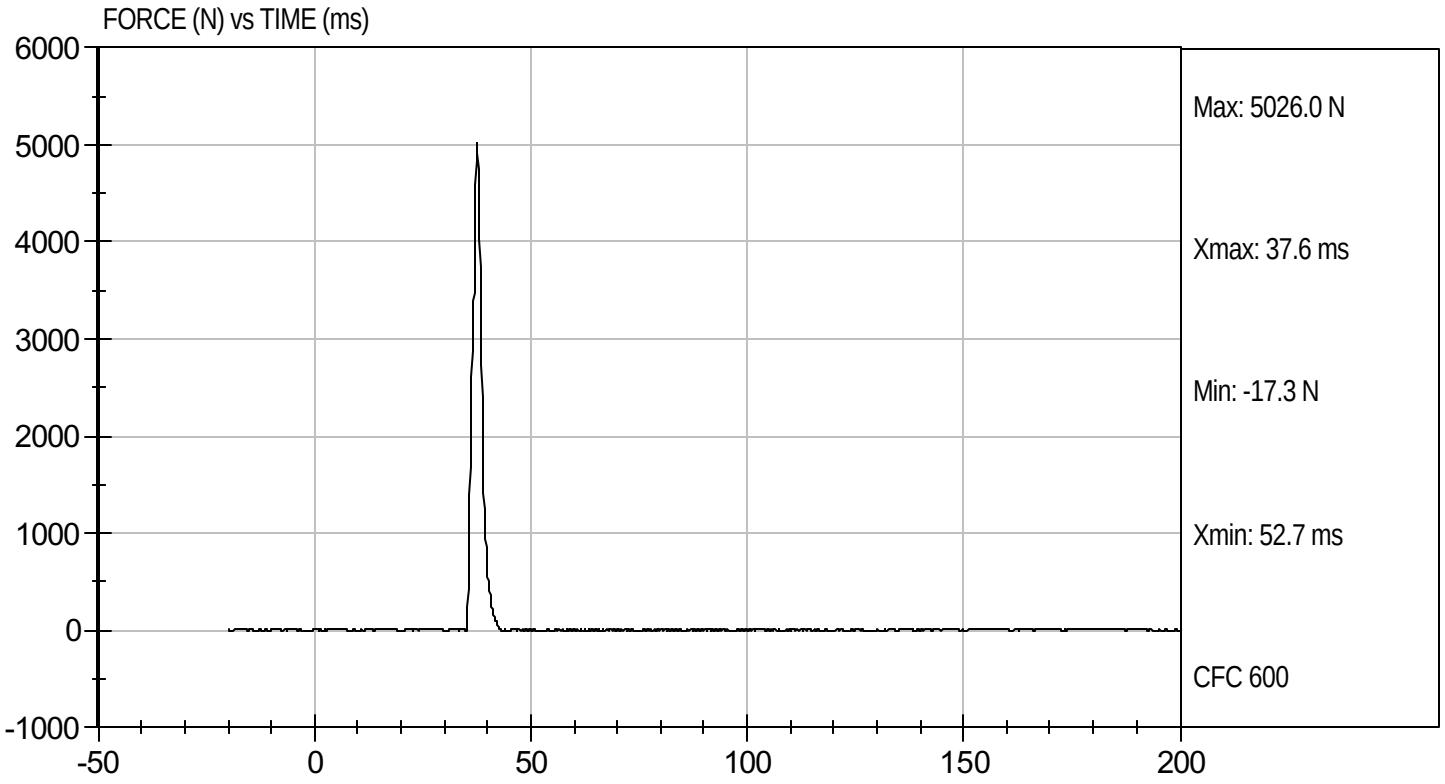
Test Date

David Winkelbauer

Approved By

Test Desc: Right Knee
Component ID: D08865

Test Date: 3/24/08
Velocity: 6.83 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D08866

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	19	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,370	Pass
		Overall Test Results		Pass

Laboratory Technician

3/24/08

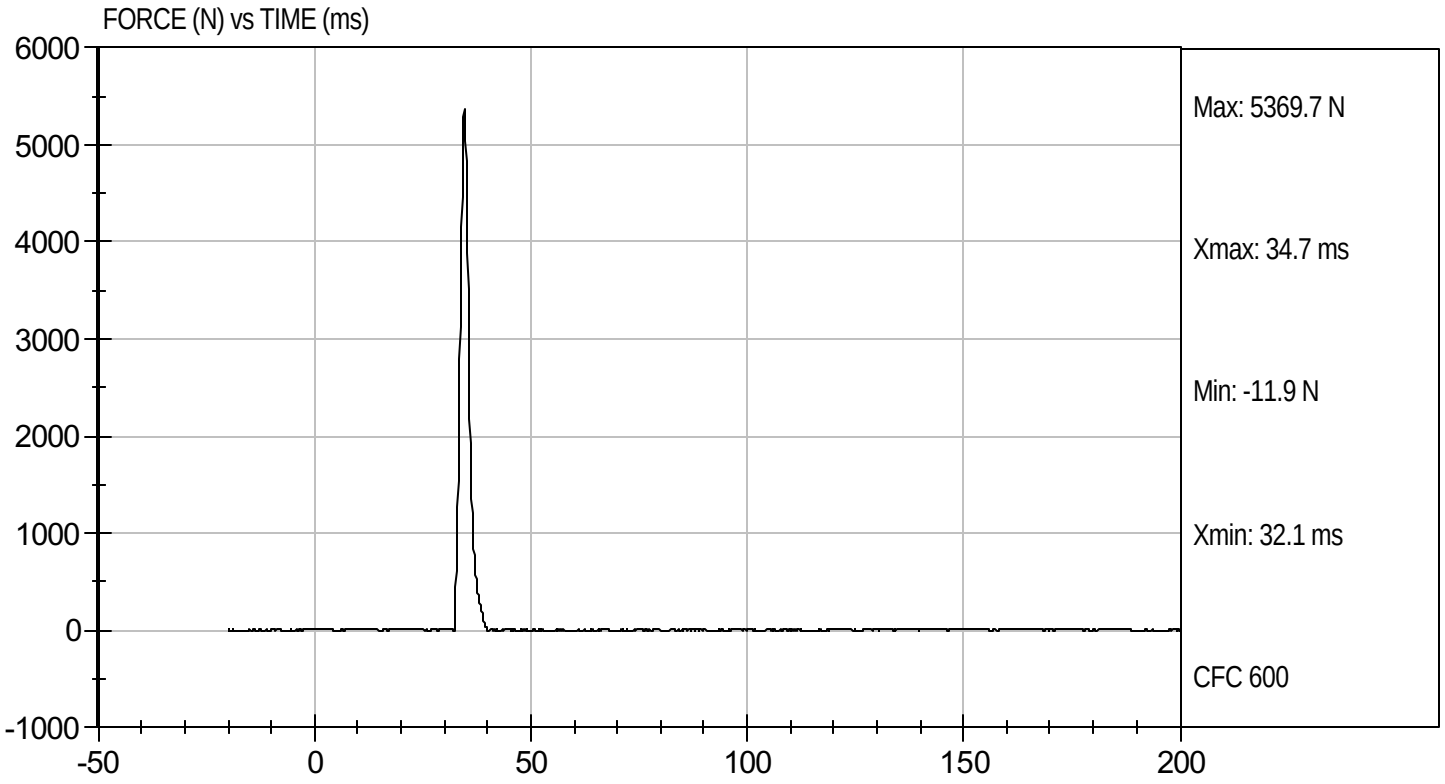
Test Date

David Winkelbauer

Approved By

Test Desc: Left Knee
Component ID: D08866

Test Date: 3/24/08
Velocity: 6.83 ft/s, 2.08 m/s



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 066 **Test I.D:** D08860

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	19	19	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	72.3	62.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	40	41	Pass
		Overall Test Results			Pass

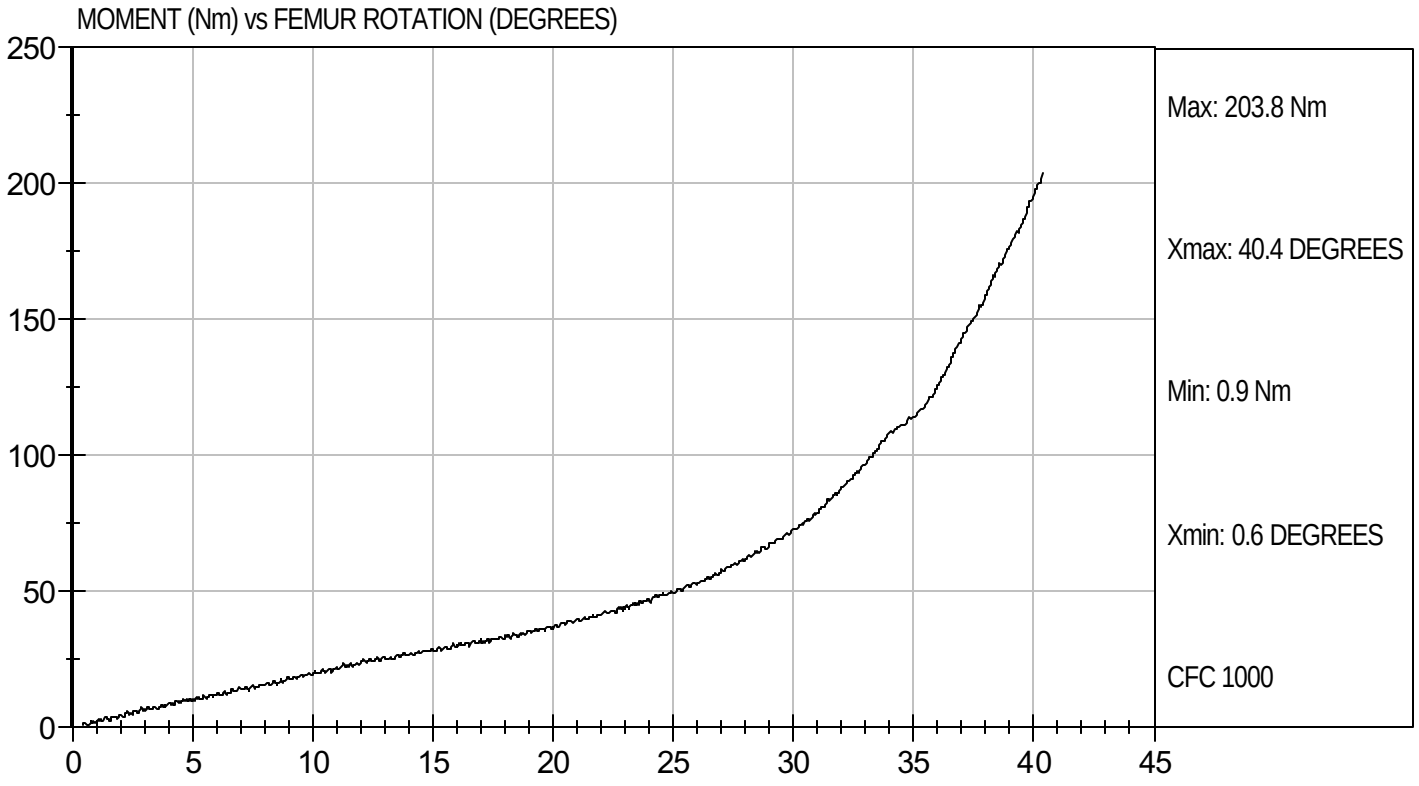
Laboratory Technician

3/24/08
Test Date

David Winkelbauer
Approved By

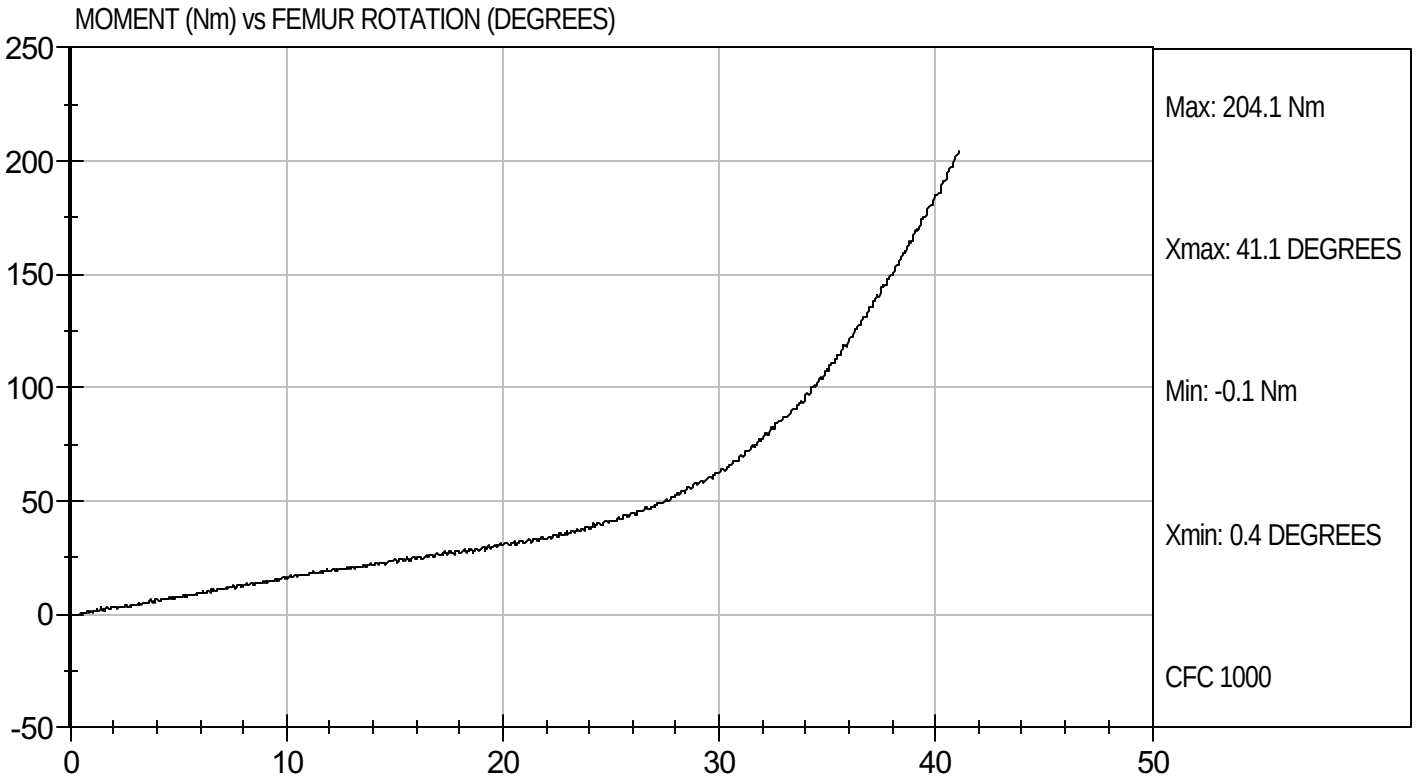
Test Desc: Hip Femur Flexion
Component ID: D08869

Test Date: 3/24/08
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D08860

Test Date: 2/24/08
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:** D08851

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	225 - 275	230	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-13.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

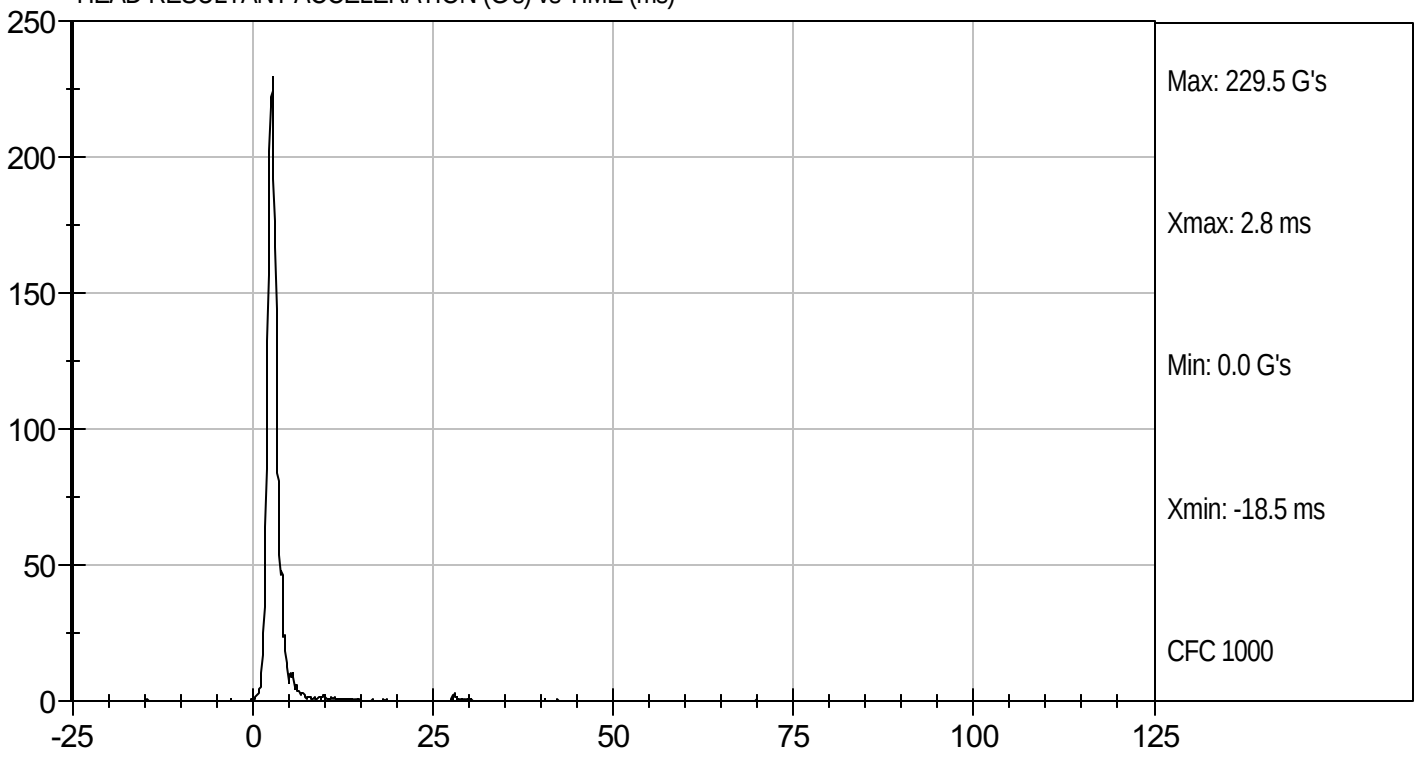
3/24/08
Test Date

David Winkelbauer
Approved By

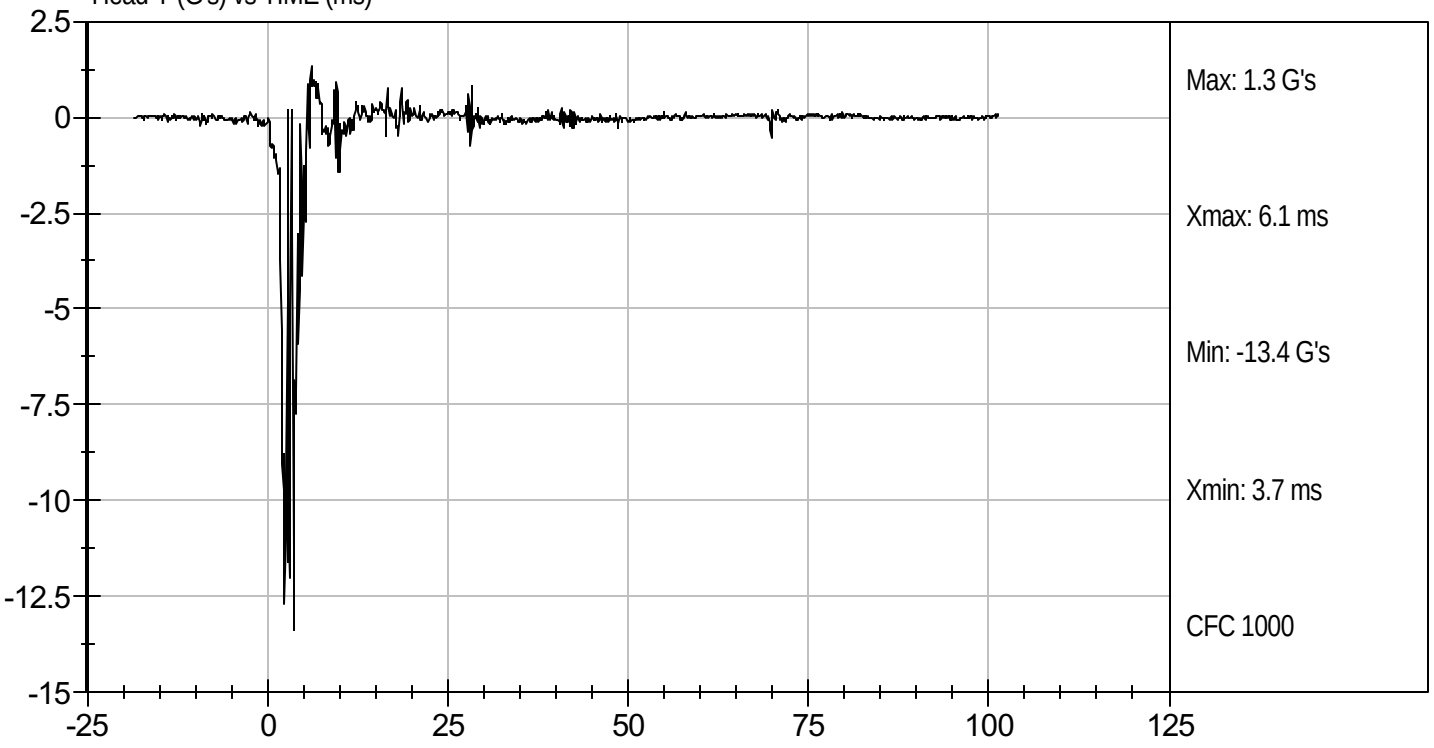
Test Desc: Head Drop
Component ID: D08851

Test Date: 3/24/08
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:** D08852

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	19	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	22.66	Pass
	20 msec	G's	17.60 to 22.60	19.61	Pass
	30 msec	G's	12.50 to 18.50	14.43	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	14.69	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	37.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	71.0	Pass
	Time	msec	57.0 to 64.0	59.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	113.6	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	94.5	Pass
	Time	msec	47.0 to 58.0	50.4	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	102.5	Pass
			Overall Test Results		Pass

Laboratory Technician

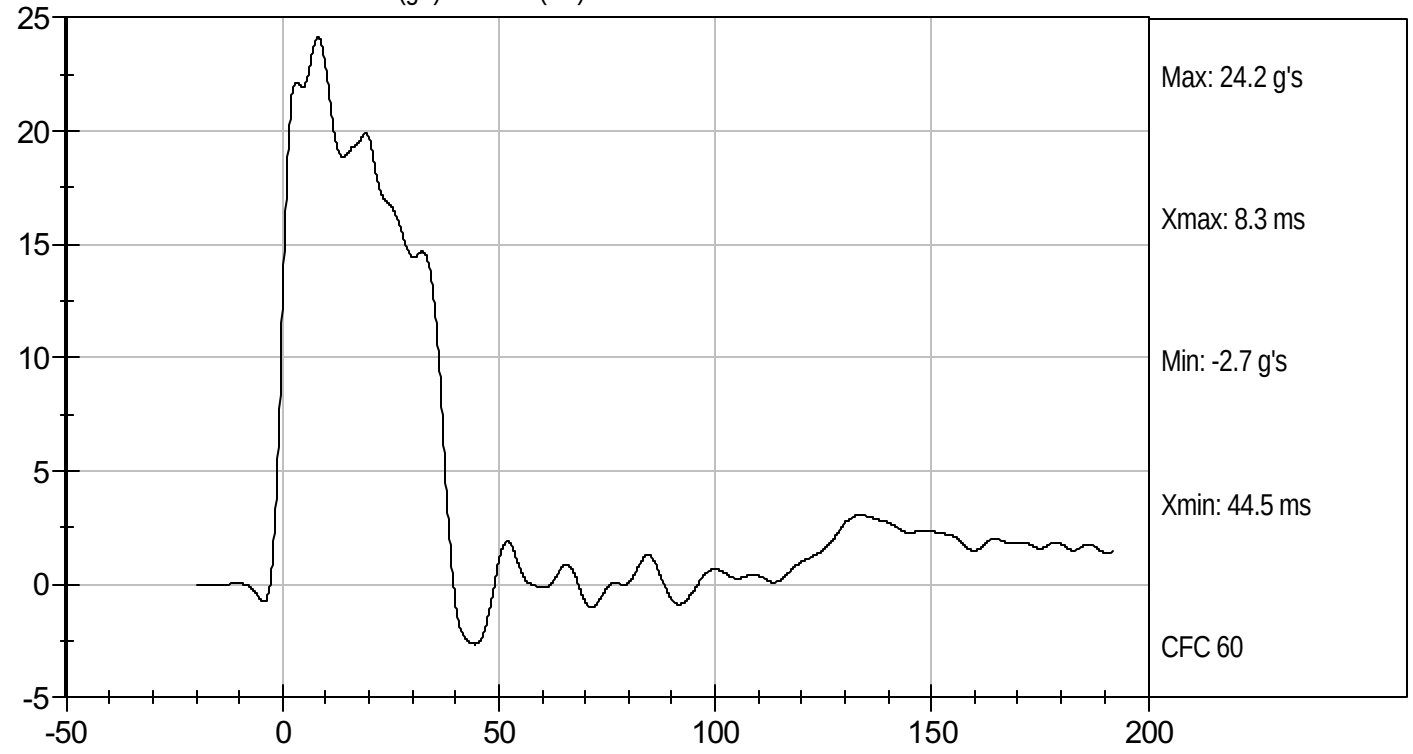
3/24/08
Test Date

David Winkelbauer
Approved By

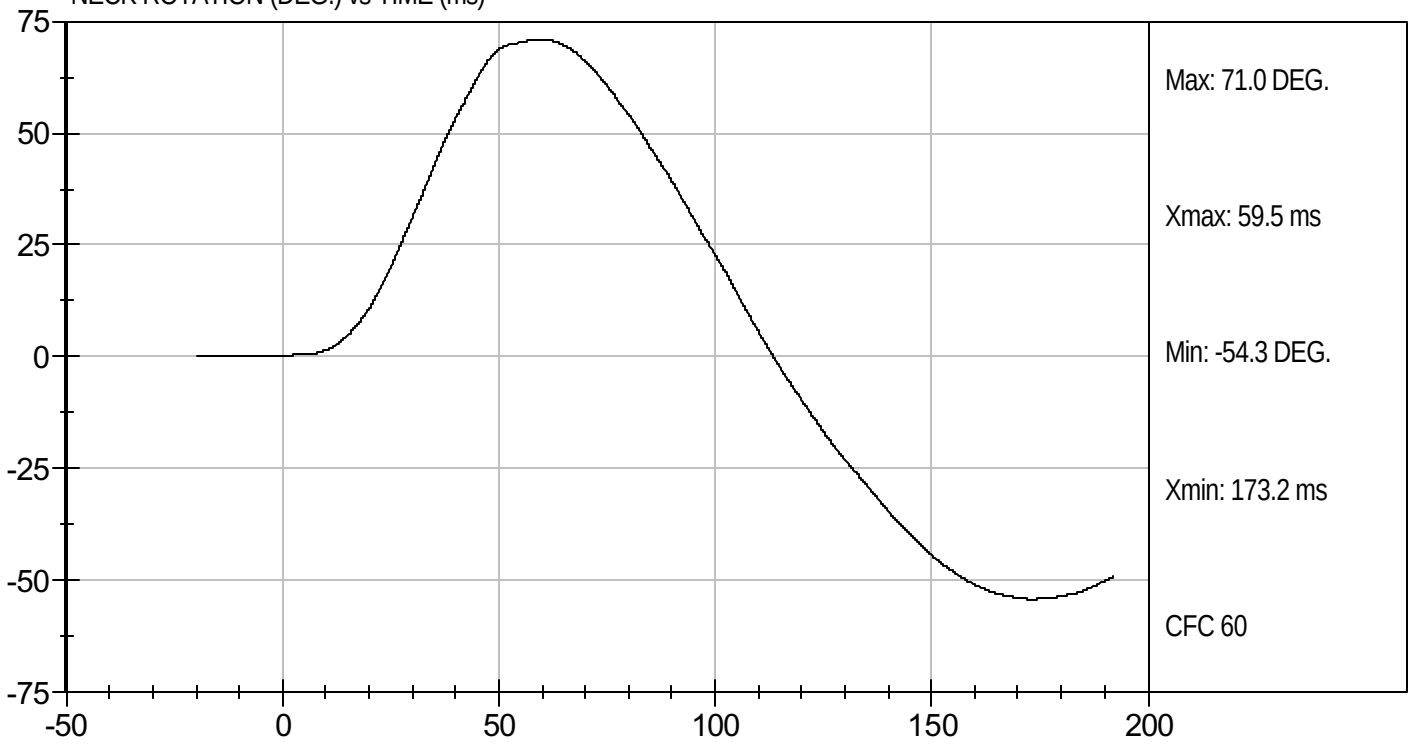
Test Desc: Neck Flexion
Component ID: D08852

Test Date: 3/24/08
Velocity: 23.148 ft/s, 7.06 m/s

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

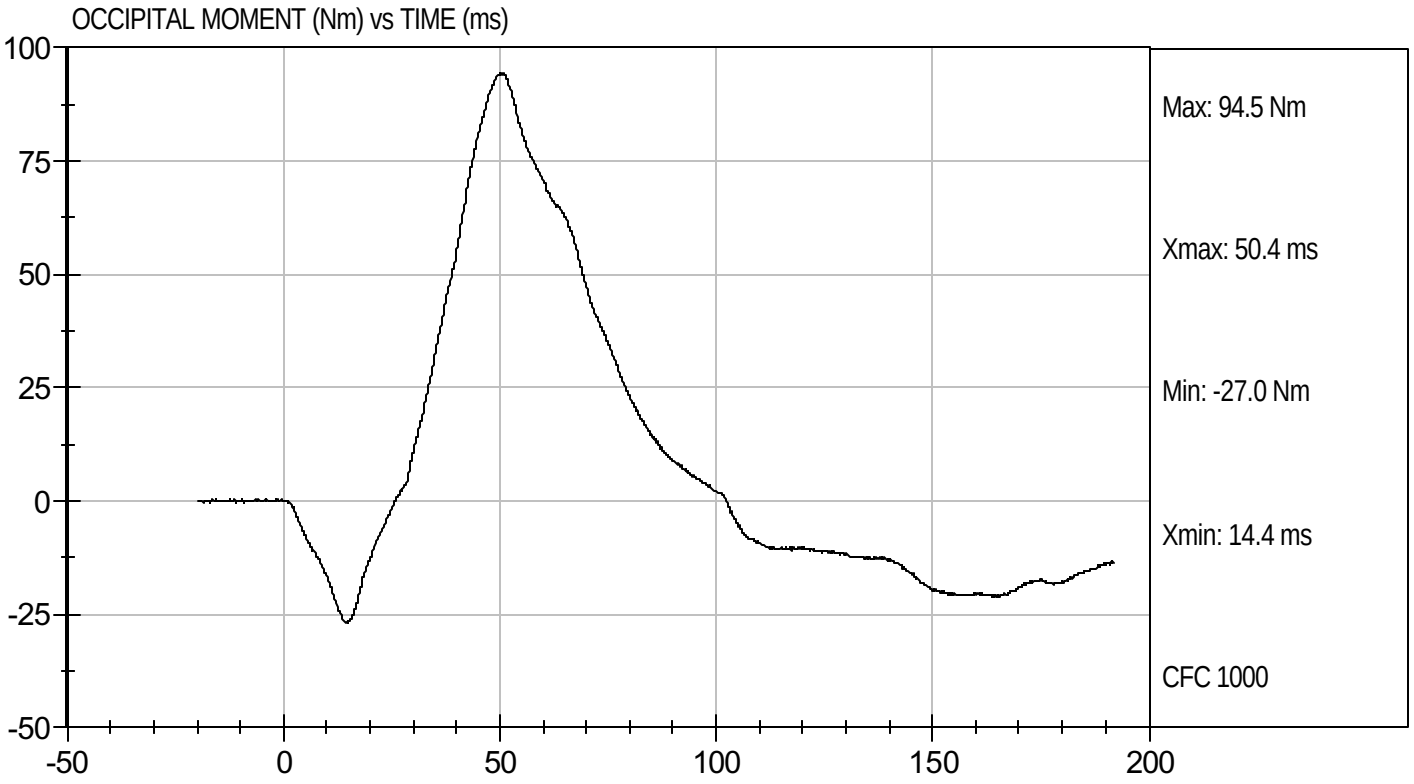


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Flexion
Component ID: D08852

Test Date: 3/24/08
Velocity: 23.148 ft/s, 7.06 m/s



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D08853

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	19	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	17.25	Pass
	20 msec	G's	14.00 to 19.00	15.40	Pass
	30 msec	G's	11.00 to 16.00	13.01	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	13.08	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	40.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	97.8	Pass
	Time	msec	72.0 to 82.0	76.6	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	-62.4	Pass
	Time	msec	65.0 to 79.0	72.4	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	143.1	Pass
			Overall Test Results		Pass

Laboratory Technician

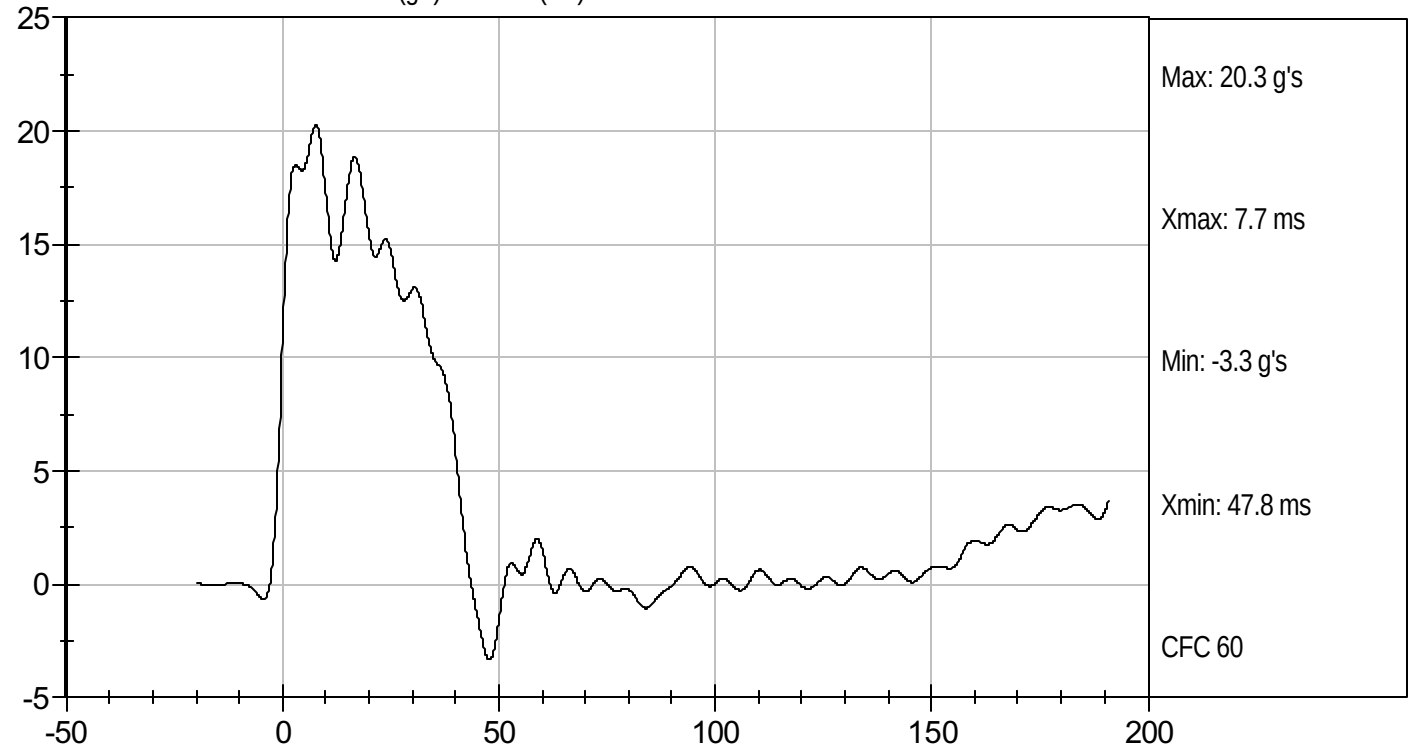
3/24/08
Test Date

David Winkelbauer
Approved By

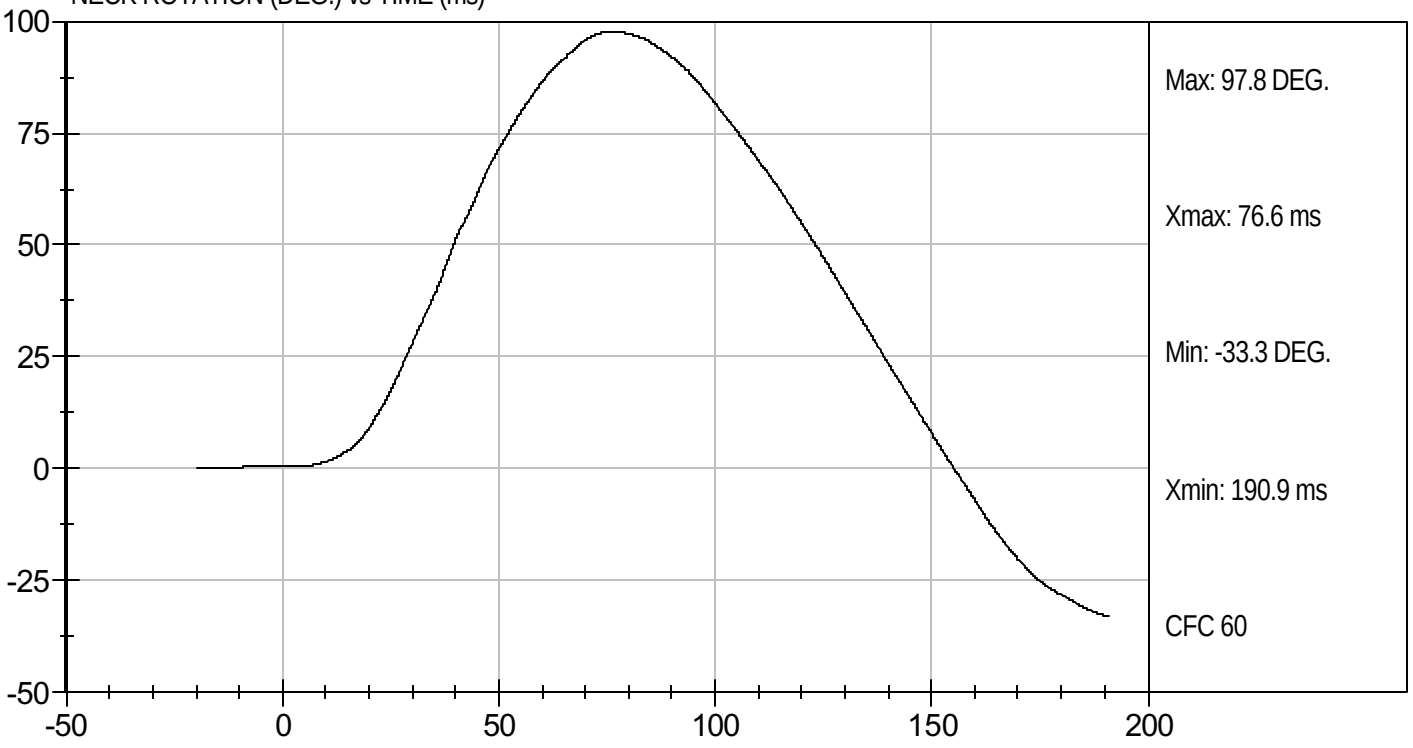
Test Desc: Neck Extension
Component ID: D08853

Test Date: 3/24/08
Velocity: 19.841 ft/s, 6.05 m/s

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

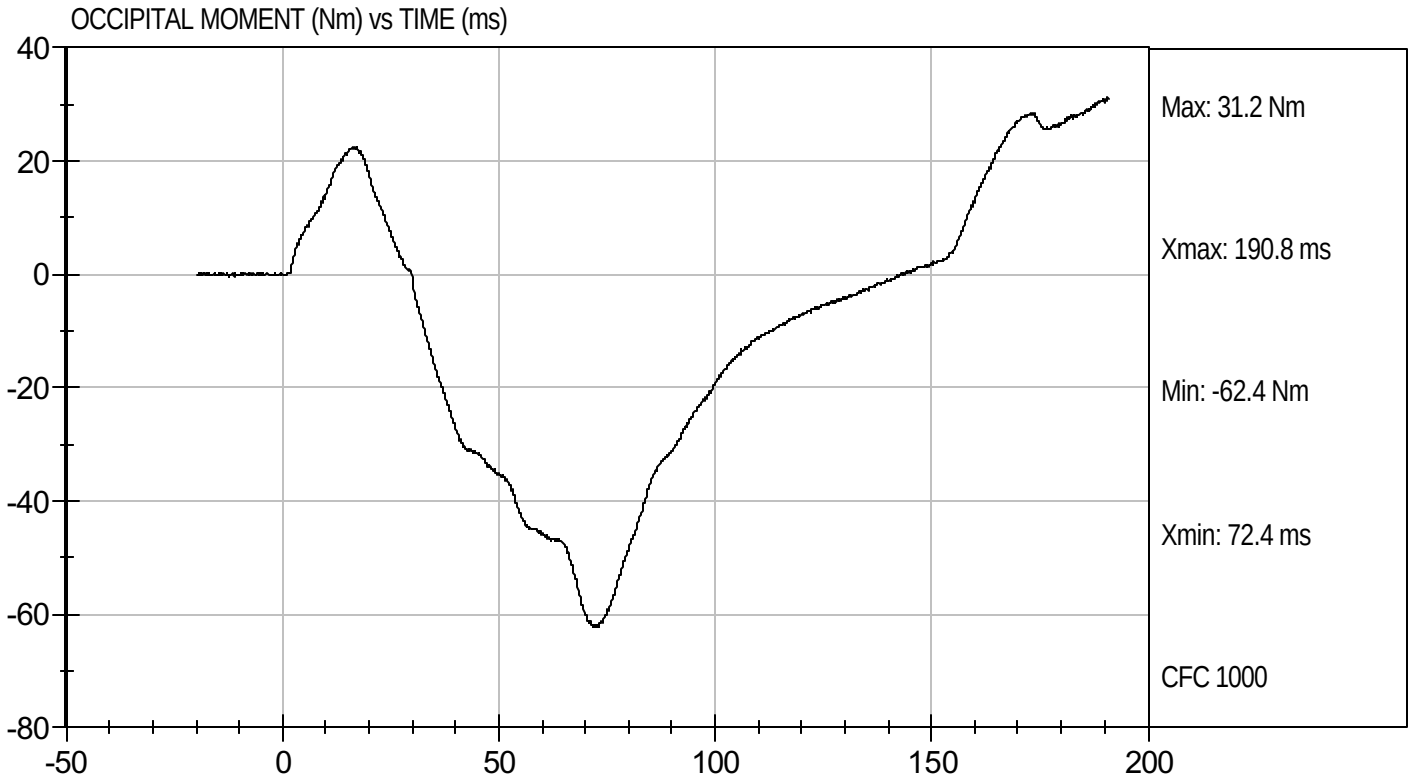


NECK ROTATION (DEG.) vs TIME (ms)



Test Desc: Neck Extension
Component ID: D08853

Test Date: 3/24/08
Velocity: 19.841 ft/s, 6.05 m/s



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D08854

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,380	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.71	Pass
Internal Hysteresis	%	69 to 85	72	Pass
		Overall Test Results		Pass

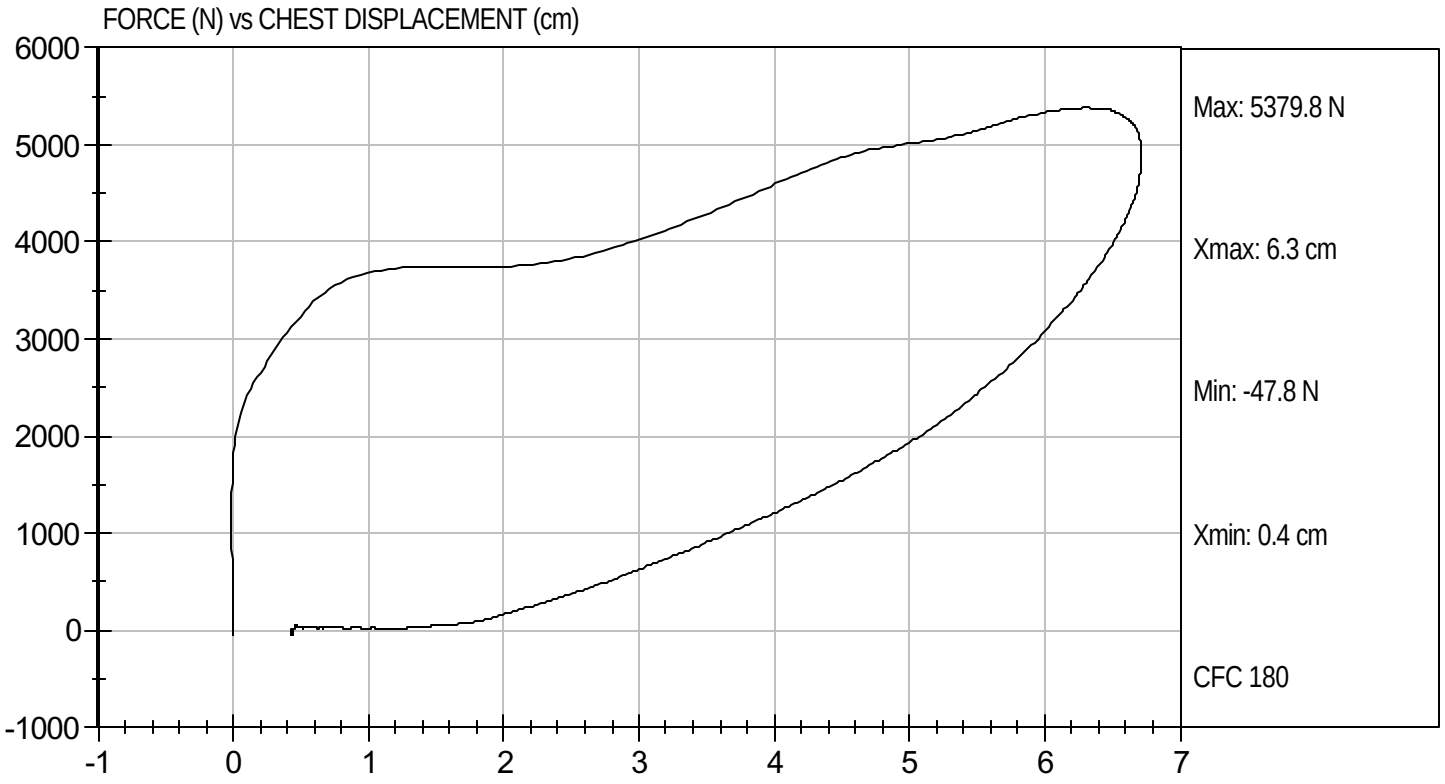
Laboratory Technician

3/25/08
Test Date

David Winkelbauer
Approved By

Test Desc: Thorax Impact
Component ID: D08854

Test Date: 3/25/08
Velocity: 22.22 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:** D08855

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	19	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5,665	Pass
		Overall Test Results		Pass

Laboratory Technician

3/24/08

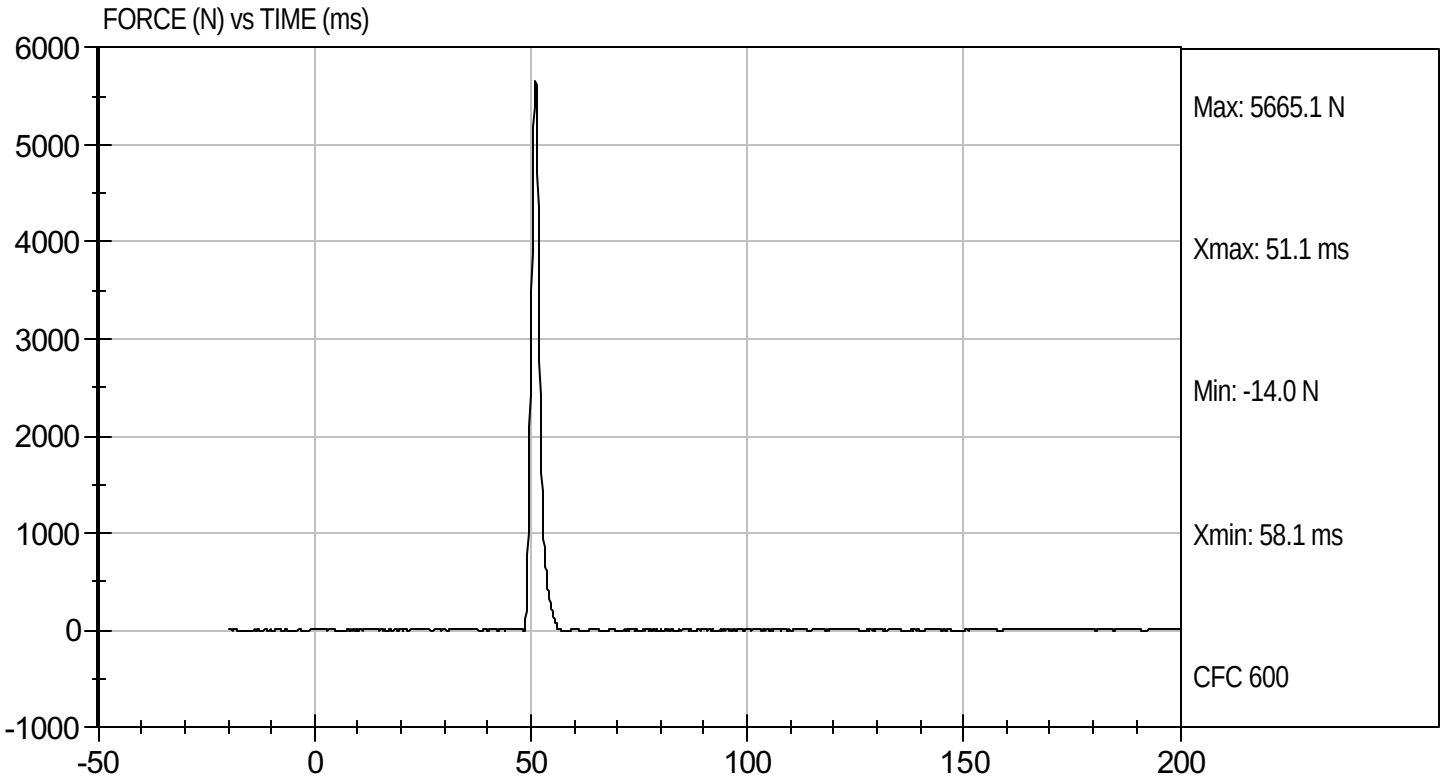
Test Date

David Winkelbauer

Approved By

Test Desc: Right Knee
Component ID: D08855

Test Date: 3/24/08
Velocity: 6.91 ft/s, 2.11 m/s



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 065 **Test I.D:** D08856

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	19	Pass
Probe Velocity	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	4,979	Pass
		Overall Test Results		Pass

Laboratory Technician

3/24/08

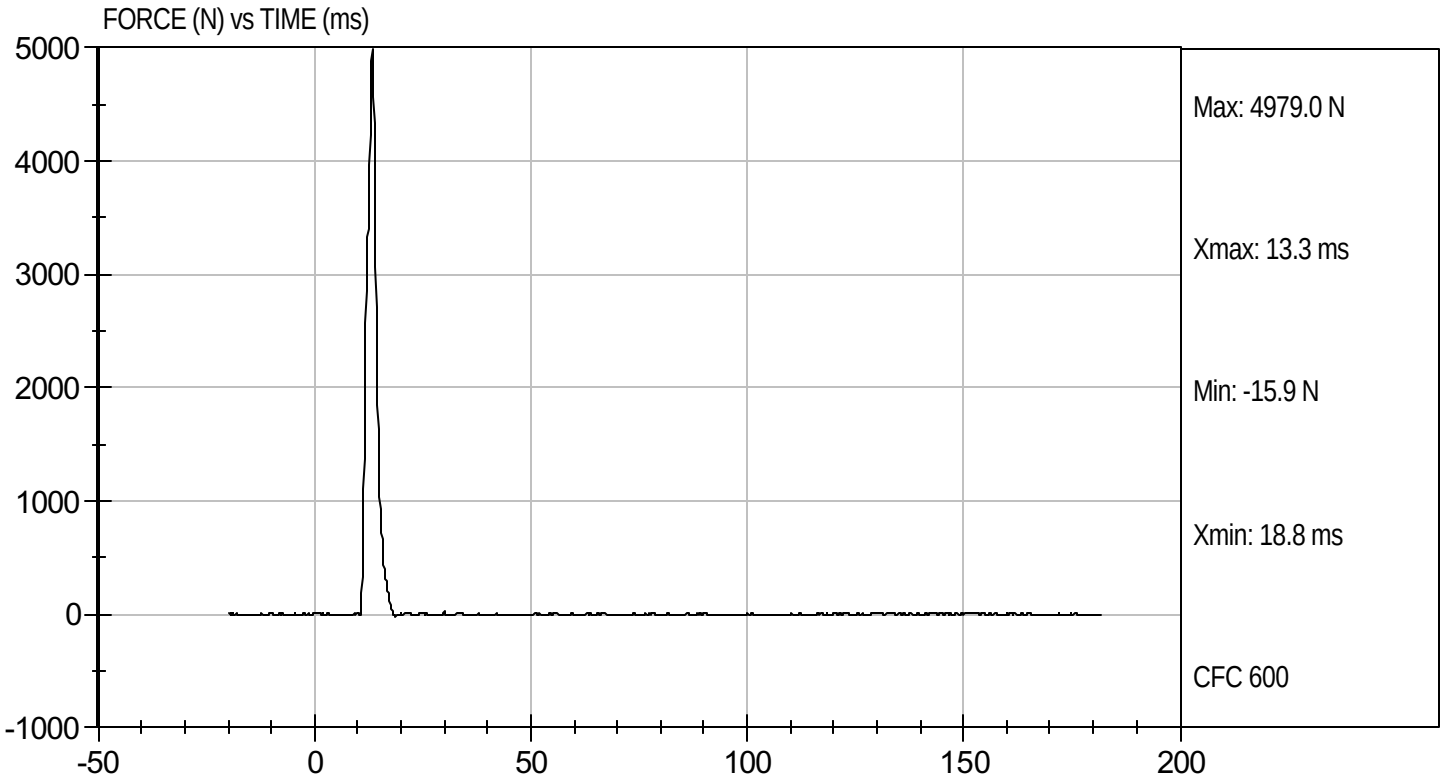
Test Date

David Winkelbauer

Approved By

Test Desc: Left Knee
Component ID: D08856

Test Date: 3/24/08
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:** D08850

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	19	19	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	70.2	61.9	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	42	41	Pass
		Overall Test Results			Pass

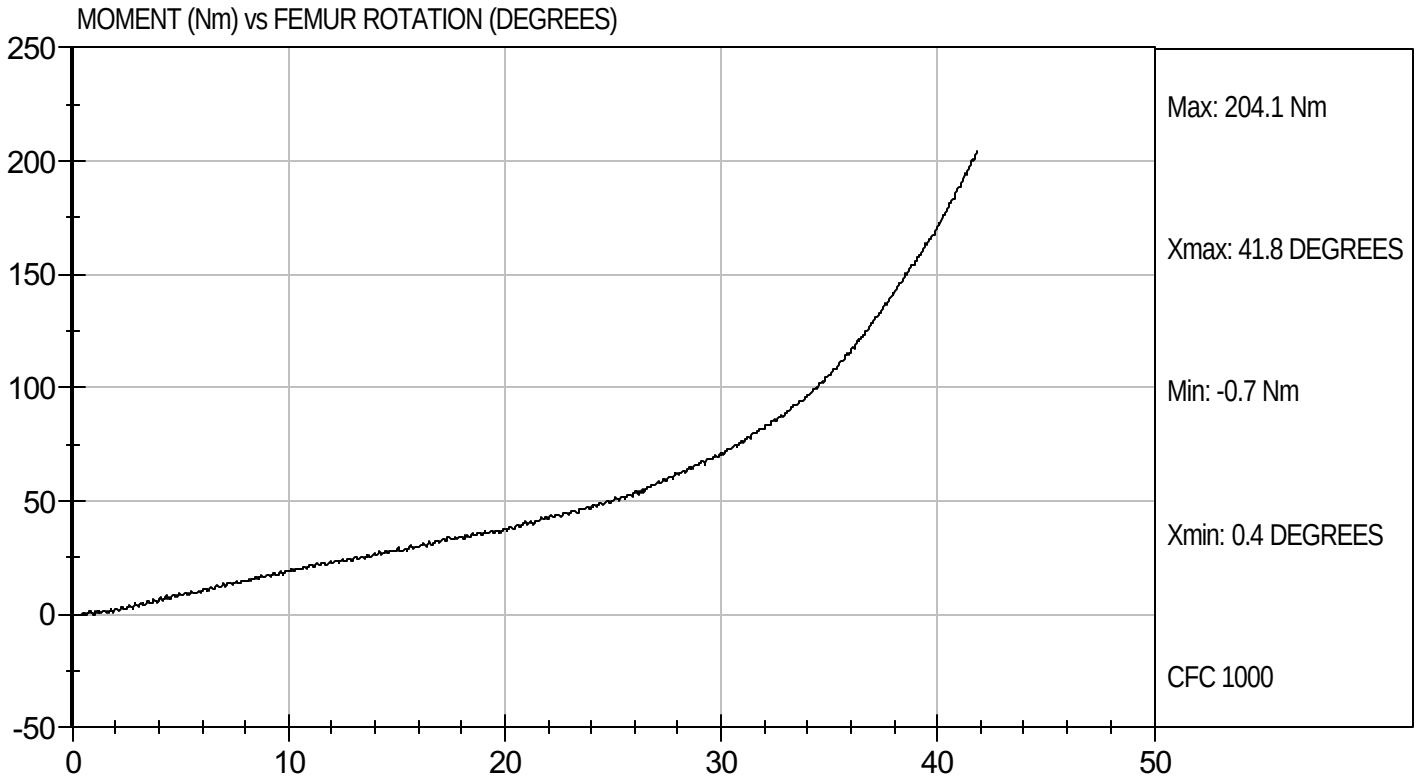
Laboratory Technician

3/24/08
Test Date

David Winkelbauer
Approved By

Test Desc: Hip Femur Flexion
Component ID: D08859

Test Date: 3/24/08
Velocity: 0 ft/s, 0.00 m/s



Test Desc: Hip Femur Flexion
Component ID: D08850

Test Date: 2/24/08
Velocity: 0 ft/s, 0.00 m/s