

**NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST**

**BAYERISCHE MOTORENWERKE
2008 BMW 528i
4-DOOR SEDAN**

NHTSA NUMBER: M80500

**PREPARED BY:
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OCTOBER 10, 2007

FINAL REPORT

**PREPARED FOR:
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Technical Report Documentation Page

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16. Abstract A 35 mph (56.3 km/h) frontal barrier impact was conducted on a 2008 BMW 528i 4-Door Sedan at Karco Engineering, LLC on October 10, 2007. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and footwell intrusion performance. The impact velocity is 56.19 km/h. The ambient temperature at the barrier face at the time of impact is 25.0 degrees Celcius. The vehicle's maximum post-test static crush is 555 mm to the right of the vehicle's centerline. The test vehicle is equipped with a 3-point continuous belt system and second generation supplemental airbags 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	Passenger ATD
Head Injury Criteria (HIC)		N/A	1000	720.6	320.8
Max. Chest Accel. (3 msec Clip)		Gs	60	56.6	43.7
Left Femur Force		Newtons	10008	-444.9	-4717.3
Right Femur Force		Newtons	10008	-1698.9	-1006.2
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SECTION 1

PURPOSE AND SUMMARY OF TEST M80500

1.1 PURPOSE

This 35 mph (56.3 km/h) frontal barrier impact test is part of the New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-06-D-00027. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph (48.3 km/h) requirements.

The 35 mph (56.3 km/h) frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards (OCS) New Car Assessment Program (NCAP) Laboratory Indicant Test Procedure, dated July 2005. Data was obtained indicant of FMVSS 208 "Occupant Crash Protection", FMVSS 212, "Windshield Retention", FMVSS 219, "Windshield Zone Intrusion (Partial)", and FMVSS 301 "Fuel System Integrity", performance. Procedures for receiving, inspection, testing and reporting of test results are described in the test procedures and are not repeated in this report.

1.2 SUMMARY

A load cell barrier consisting of 36 load cells was impacted by a 2008 BMW 528i 4-Door Sedan at a velocity of 56.19 km/h. The test was performed at Karco Engineering, LLC on October 10, 2007.

Three (3) real-time and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in Data Sheet number 14 (page number 24) of 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 (primary and redundant), chest (primary and redundant) and pelvis triaxial accelerometers, chest displacement potentiometers, six-axis upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were placed on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. Shoulder belt spool-off was measured for the driver and passenger dummies. The driver (position 1) ATD (Serial No. 034) and the right-front passenger (position 2) ATD (Serial No. 035) were calibrated one test prior to this test.

One hundred and thirty-two (132) channels of data were recorded using a TDAS data acquisition system. Appendix A contains Pre and Post-Test Photographs, Appendix B contains the Dummy Response data traces, Appendix C contains the Dummy Calibration data, and Appendix D contains the Child Restraint System Report.

There was 100 percent windshield retention and there was no intrusion into the protected zone of the windshield during the impact 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 555 mm at DPD 4 to the right of the vehicle's centerline. Both the driver and the passenger side doors remained closed and latched during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver ATD's head contacted the airbag and headrest. The ATD's chest also contacted the airbag. Both knees contacted the knee bolster.

The passenger's visible contact points were as follows: The passenger ATD's head and chest contacted the airbag. The head also contacted the headrest. Both knees contacted the glove box.

Occupant injury data is contained in table below.

OCCUPANT DATA SUMMARY					
ATD Position	HIC	3 msec Clip (g)	Chest Defl. (mm)	Left Femur (N)	Right Femur (N)
Driver	720.6	56.6	-31.6	-444.9	-1698.9
Passenger	320.8	43.7	-34.1	-4717.3	-1006.2

Additional data plots for this test are available in the research and development section of the NHTSA website. The website can be found at: www.NHTSA.Dot.Gov

SECTION 2

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lbf/in ²	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	$=(tf - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

* Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1
CRASH TEST SUMMARY

Test Vehicle: 2008 BMW 528i 4-Door Sedan
Test Program: NHTSA 35mph NCAP

NHTSA No.: M80500
Test Date: 10/10/07

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
Velocity at Impact	km/h	56.19
Test Weight	kg	1924
Impact Angle	degrees	0
Average Rebound	mm	907
Maximum Static Crush	mm	555

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Front Door opening	Remained closed and latched, opened w/o tools	Remained closed and latched, opened w/o tools
Rear Door Opening	Remained closed and latched, opened w/o tools	Remained closed and latched, opened w/o tools
Seat Track Shift (mm)	None	None
Seat Back Failure	No	No

TEST DUMMY INFORMATION

Description	Driver	Passenger
Dummy Type/ Serial No.	50% Male Hybrid III No. 034	50% Male Hybrid III No. 035
Head Contact	Airbag, Headrest	Airbag, Headrest
Chest Contact	Airbag	Airbag
Abdomen Contact	None	None
Left Knee Contact	Knee Bolster	Glovebox
Right Knee Contact	Knee Bolster	Glovebox

MOME COVERAGE

Cameras	Standard	Additional
High Speed	14	0
Real Time	1	2
Total	15	2

DATA CHANNELS

Driver ATD Sensors	40
Passenger ATD Sensors	40
Belt Assessment Sensors	8
Vehicle Structure Accelerometers	8
Rigid Barrier Load Cells	36
Total	132

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M80500	Anti-Lock Brakes	Yes
Make	BMW	All Wheel Drive	No
Model	528i	Power Steering	Yes
Body Style	4-Door Sedan	Driver Front Airbag	Yes
Vin No.	WBANU53548CT07726	Driver Side Airbag	Yes
Color	Silver	Driver Head Airbag	No
Delivery Date	9/18/2007	Driver Curtain Airbag	Yes
Odometer (Miles)	67.0	Pass. Airbag	Yes
Dealer	BMW of Riverside	Pass. Side Airbag	Yes
Transmission	6-Speed Automatic	Pass. Head Airbag	No
Final Drive	Rear	Pass. Curtain Airbag	Yes
Type/No. Cyl.	Inline 6	Pre-Tensioners	Yes
Engine Disp. (L)	3.0	Load Limiters	Yes
Engine Placement	Longitudinal	Bucket Seats	Yes
Roof Rack	No	Air. Cond.	Yes
Sunroof/T-Top	Yes	AM/FM CD	Yes
Tinted Glass	No	Tilt Steering	Yes
Traction Control	Yes	Automatic Door Locks	Yes
Power Brakes	Yes	Power Windows	Yes
Front Disc	Yes	Power Seats	Yes
Rear Disc	Yes	Other	n/a

Does Owners Manual provide instructions to turn off automatic door locks.

Yes

DATA FROM MANUFACTURER

Manufactured By	Bayerische Motorenwerke	GVWR (kg)	2120
Date of Manufacture	Jul-07	GAWR Front (kg)	1010
		GAWR Rear (kg)	1180

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				500
Cargo Weight (RCLW) (kg)				136

DATA SHEET NO. 2...(CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

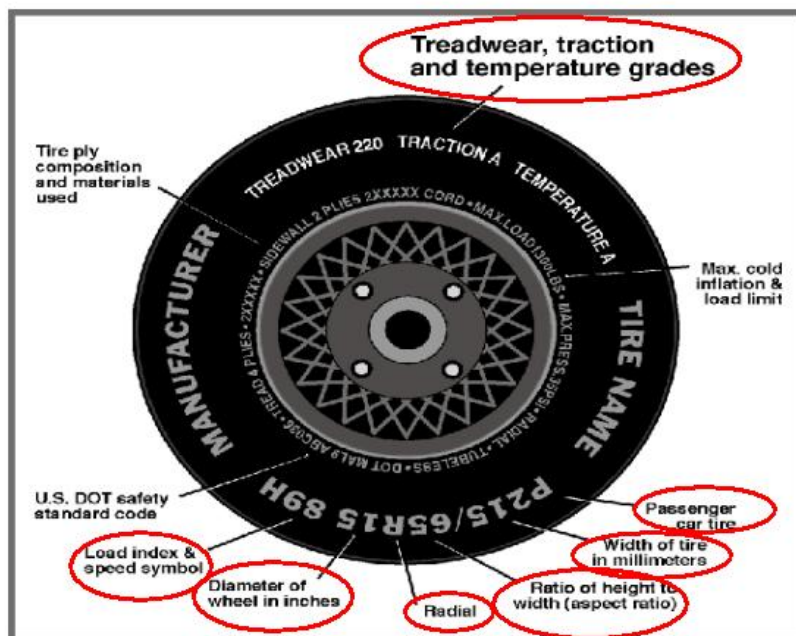
Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

Collect year, make, model, VIN, items circled in red, and tire manufacturer and tire name.



TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	357	357
Cold Pressure (kpa)	220	250
Recommended Tire Size	225/50R17	225/50R17
Tire Size on Vehicle	225/50R17	225/50R17
Tire Manufacturer	Continental	Continental
Treadwear	360	360
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Rayon	1 Rayon
Tire Plies Body	1 Rayon, 2 Steel, 2 Nylon	1 Rayon, 2 Steel, 2 Nylon
Load Index/Speed Symbol	94V	94V
Tire Material	Rayon, Steel, Nylon	Rayon, Steel, Nylon
DOT Safety Code Right	LMCT P1HP 2607	LMCT P1HP 2607
DOT Safety Code Left	LMCT P1HP 2607	LMCT P1HP 2607

DATA SHEET NO. 2...(CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2008 BMW 528i 4-Door Sedan NHTSA No.: M80500
 Test Program: NHTSA 35mph NCAP Test Date: 10/10/07

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	399	416	815	417	542	959
Right	kg	407	418	825	425	540	965
Ratio	%	49.1	50.9	100.0	43.8	56.2	100.0
Totals	kg	806	834	1640	842	1082	1924

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1640
Weight of 2 P572 ATD's	kg	152
Rated Cargo/Luggage Wt. (RCLW)	kg	136
Calculated Vehicle Target Wt. (TVTW)	kg	1928

TEST VEHICLE ATTITUDE AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	693	690	693	692	1468
As Tested	mm	687	678	650	647	1623

Vehicle Wheel Base (mm) 2886
 Weight of Ballast Secured in cargo area (kg) 56
 Weight of Items Removed (kg) 57
 Vehicle Components Removed Rear Door Panels, rear window, rear lights, trunk door, spare tire, carpeting in trunk, rear bumper.

* Ballast weight does not include cameras, instrumentation and brake abort system.

FUEL SYSTEM DATA

Fuel System Capacity From Owners Manual (L) 69.64
 Actual Test Volume with entire fuel System Filled (L) 64.76
 Test Fluid Type: Stoddard Solvent
 Kinematic Viscosity: as per ASTM Standard D484-71 Red
 Is Vehicle Fuel Pump Electric or Mechanical? Electric
 If electric, does pump operate with ignition switch "On" & engine "OFF" Yes
 Fuel System Particulars: Electric fuel pump. Activated when electrical system is activated.
Fuel pump will run during the operation of the engine.

DATA SHEET NO. 3**POST-TEST IMPACT DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**SPEED TRAP DATA**

Measured Parameter	Units	Requirement	Value
Trap No.1 Velocity (Primary)	km/h	55.51 to 57.12	56.19
Trap No.2 Velocity (Redun.)	km/h	55.51 to 57.12	56.17

VEHICLE STATIC CRUSH

Measured Parameter	Units	Pre-Test	Post-Test	Difference
Left Side	mm	4654	4365	289
Center	mm	4845	4343	502
Right Side	mm	4654	4310	344

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	910
Center	mm	900
Right Side	mm	912
Average	mm	907

DATA SHEET NO. 4

TEST VEHICLE INFORMATION

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

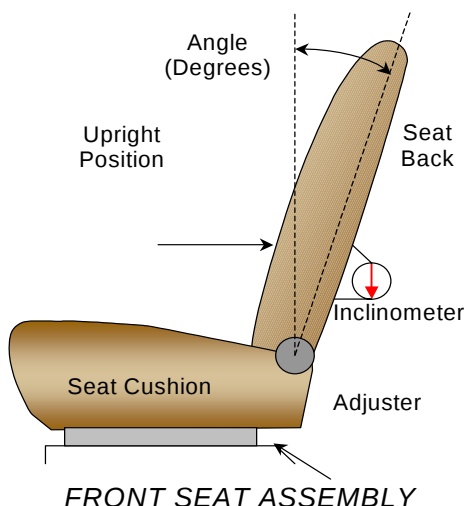
Test Date: 10/10/07

NOMINAL DESIGN RIDING POSITION

The driver and passenger seat backs are positioned to the manufacturer's designated angle. The procedure is as follows: Seat back angle was measured using a straight edge across the rear of the seat with a digital inclinometer.

SEAT BACK ANGLES

	Deg.
Driver w/seated Dummy	21.0 @ Seatback
Passenger w/seated Dummy	21.0 @ Seatback

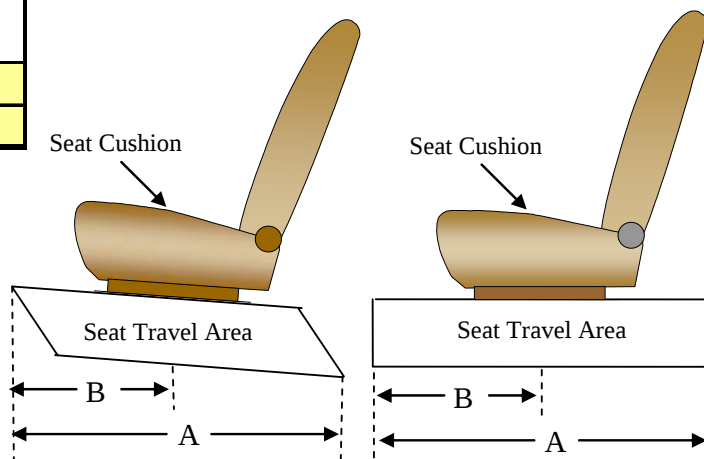


SEAT FORE/AFT POSITIONS

The total seat travel was measured from forward most position to rearmost position, irrespective of vertical seat height in those positions. The seat was set at the longitudinal mid position. There were vertical adjustments on the seats that were equipped with the vehicle. They were placed at the lowermost position.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position
Driver Seat	285 mm	142 mm
Passenger Seat	285 mm	142 mm



SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage was fixed.

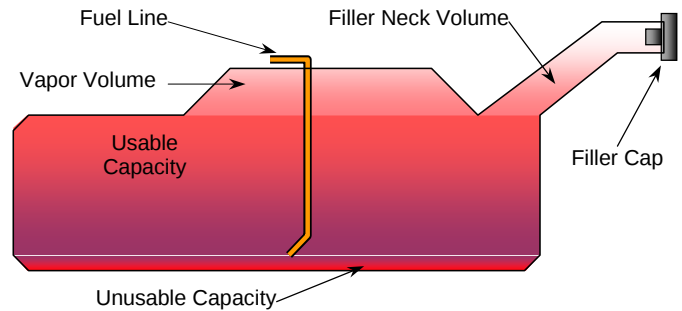
SEAT BELT UPPER ANCHORAGE

	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Fixed
Passenger Seat	Fixed	Fixed

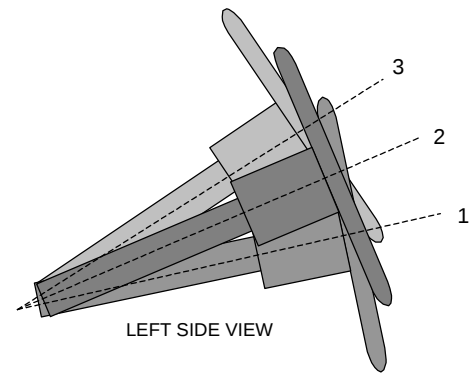
DATA SHEET NO. 4...(CONTINUED)**TEST VEHICLE INFORMATION**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**FUEL TANK CAPACITY**

	Liters
Usable Capacity of "Standard Tank"	69.94
Usable Capacity of "Optional" Tank	
Usable Capacity used for FMVSS 301	64.04 to 65.44
Actual Amount of Solvent used	64.76

The test vehicle is equipped with an electric fuel pump. The fuel pump operates for approximately two seconds after the ignition is placed in the "ON" position, after which the fuel pump automatically shuts off. The fuel filler door is located on the right rear fender. The standard fuel tank occupies the area under the rear seat.

**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**

	Degrees	Fore/Aft Position (mm)
Lowermost position No. 1	19.4	0.0
Geometric center position No. 2	21.3	20.0
Uppermost position No. 3	23.2	40.0

DATA SHEET NO. 5

DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (deg)	Length (mm)	Angle (deg)
WA	Windshield Angle		26.0		
SWA	Steering Wheel Angle		69.3		
SCA	Steering Column Angle		20.7		
SA	Seat Back Angle		21.0 @ Seatback		21.0 @ Seatback
HZ	Head to Roof (Z)	230	90.0	211	90.0
HH	Head to Header	368		355	
HW	Head to Windshield	642		617	
HR	Head to Side Header (Y)	255		250	
NR	Nose to Rim	392	1.6		
CD	Chest to Dash	522		528	
CS	Chest to Steering Hub	315			
RA	Rim to Abdomen	205			
KDL	Left Knee to Dash	155	29.0	118	
KDR	Right Knee to Dash	120		161	21.5
PA	Pelvic Angle		24.8		23.5
TA	Tibia Angle		47.3		41.0
KK	Knee to Knee (Y)	313		274	
SK	Striker to Knee	575	11.6	580	9.4
ST	Striker to Head	387	84.4	390	82.5
SH	Striker to H-Point	165	0.0	162	0.0
SHY	Striker to H-Point (Y)	237		200	
HS	Head to Side Window	325		305	
HD	H-Point to Door (Y)	135		135	
AD	Arm to Door (Y)	105		102	

DATA SHEET NO. 5...(CONTINUED)

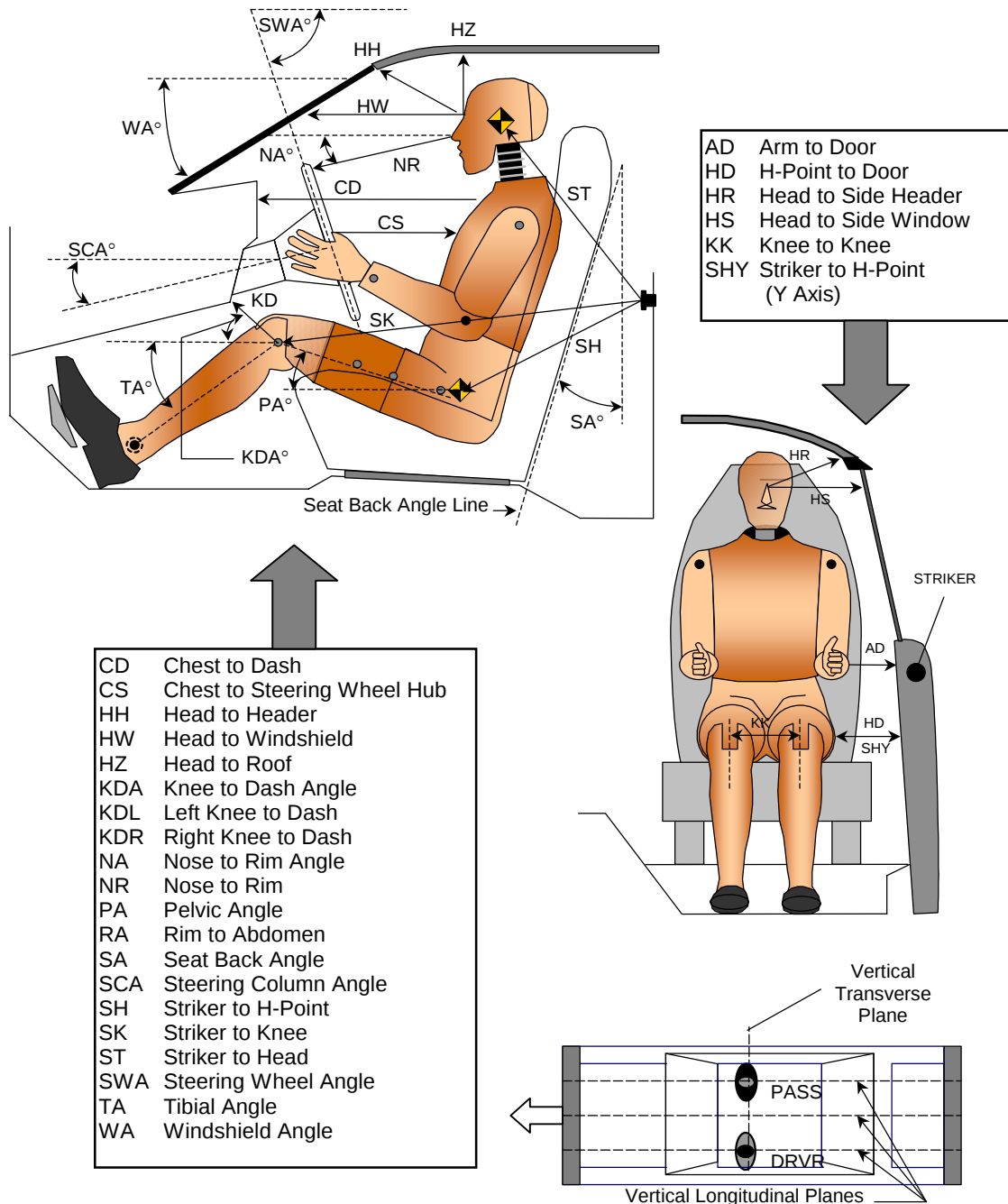
DUMMY POSITIONING IN VEHICLE

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS

DATA SHEET NO. 6

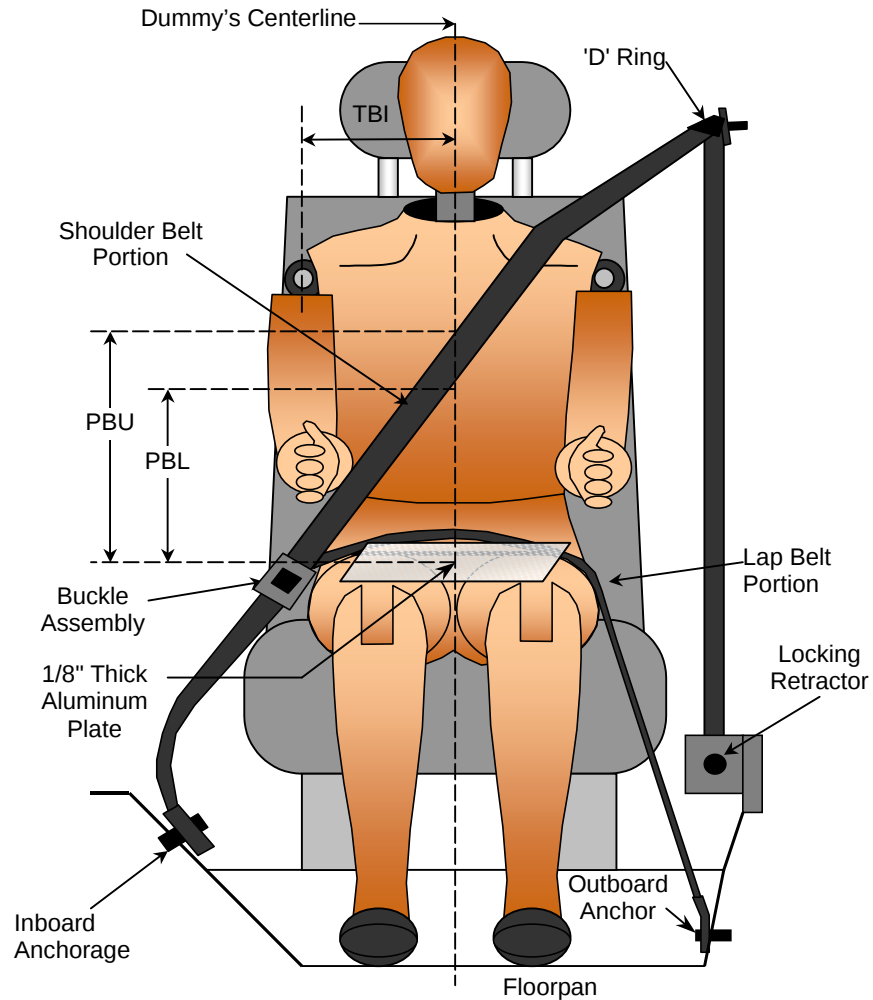
SEAT BELT POSITIONING DATA

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



SEAT BELT POSITIONING MEASUREMENTS

Measured Parameter	Units	Driver	Passenger
TBI - Dummy C/L to Lap/Shoulder Belt Intersect	mm	190	195
PBU - Top Surface of reference to belt upper edge	mm	285	295
PBL - Top Surface of reference to belt lower edge	mm	210	220
Lap Belt Tension	Newtons	10	10
Shoulder Belt Tension	N/A	Retractor	Retractor

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATION

Test Vehicle: 2008 BMW 528i 4-Door Sedan

Test Date: 10/10/07

Test Program: NHTSA 35mph NCAP

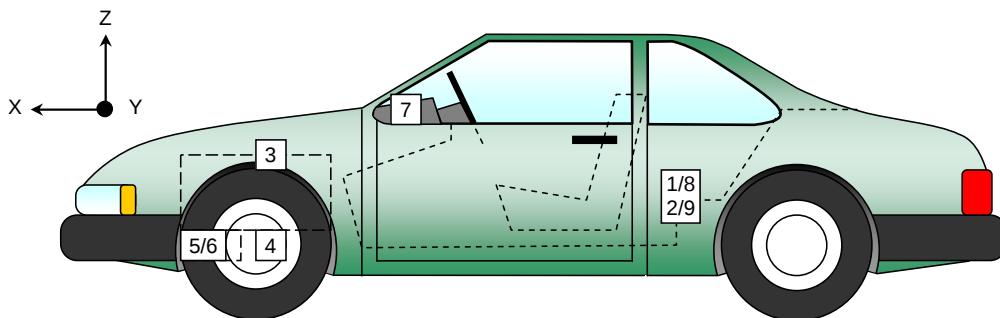
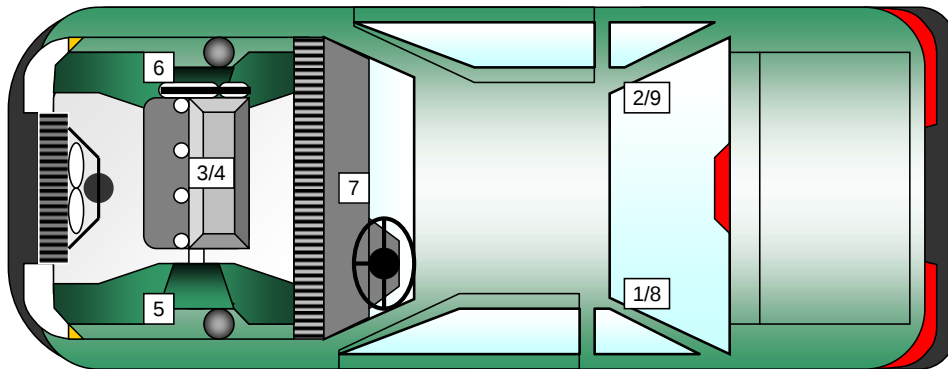
NHTSA No.: M80500

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear X-Member	2020	-715	375
2	Right Rear X-Member	2030	710	370
3	Engine Top	4010	-90	840
4	Engine Bottom	3965	-50	145
5	Left Brake Caliper	3875	-700	280
6	Right Brake Caliper	3875	780	280
7	Instrument Panel			
8	Left Rear X-Member (Z-Axis)	2020	-715	375
9	Right Rear X-Member (Z-Axis)	2030	710	370

Reference Planes: X=From Rear Surface of Vehicle, Y=Vehicle Centerline, Z=Ground Plane

1.) Instrument Panel no longer used by NHTSA



DATA SHEET NO. 8**SEAT BELT ASSESSMENT TEST DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**SEAT BELT POSITIONING MEASUREMENTS**

Measurement Description	Units	Driver	Passenger
Retractor Reel to "D" ring	mm	750	750
Shoulder Belt length as measured on ATD	mm	825	820
Lap Belt length as measured on ATD	mm	580	550
Remainder of belt on reel	mm	1035	1110
Total belt length for continuous webbing systems	mm	3190	3230

SHOULDER BELT SPOOL-OFF DATA

Measurement Description	Units	Driver	Passenger
As determined mechanically	mm	328	347
As determined electronically	mm	397	391

BELT STRETCH DATA

Measurement Description	Units	Driver	Passenger
Electronically between belt load cell and "D" ring	mm/cm	*	*
Mechanically	mm/cm		

* Not used with shoulder belt pre-tensioner systems

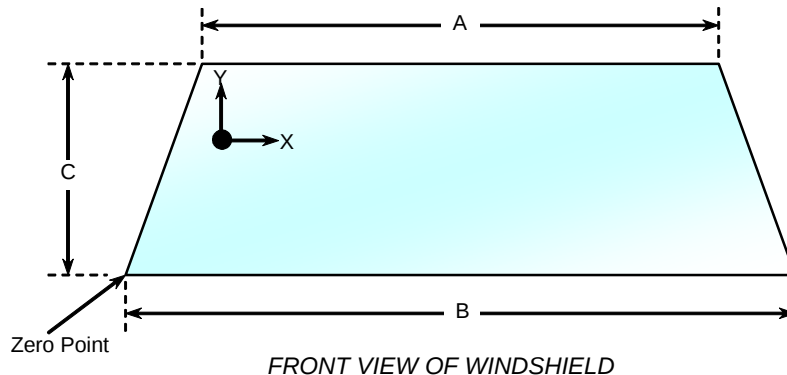
DATA SHEET NO. 9**SUMMARY OF FMVSS 212 DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07

Windshield Mounting Details: Windshield glass is secured to the vehicle frame with a rubber type adhesive, and rubber and plastic molding.

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 that are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.7 °C**WINDSHIELD PERIPHERY MEASUREMENTS**

Measurement	Pre-Test(mm)	Post-Test(mm)	% of Retention
Left Side	2108	2108	100
Right Side	2108	2108	100
Total	4216	4216	100

**WINDSHIELD DIMENSIONS**

Item	Units	Segment Length	Molding Width
A	mm	1180	20
B	mm	1505	100
C-Left	mm	765	25
C-Right	mm	765	25

DATA SHEET NO. 10

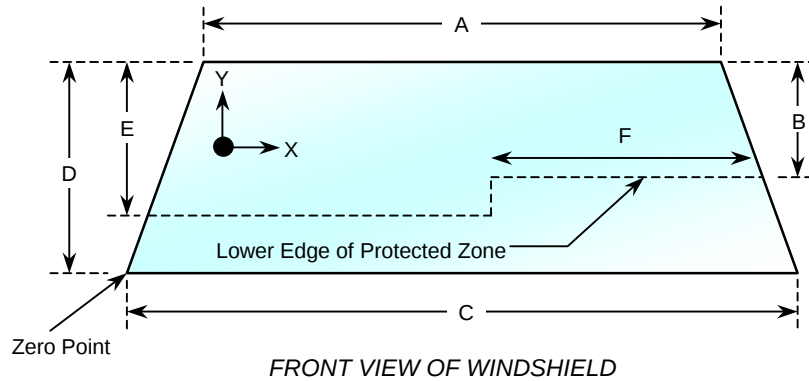
WINDSHIELD ZONE INTRUSION FMVSS 219 DATA (PARTIAL)

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



WINDSHIELD AND PROTECTED ZONE

Item	Units	Value
A	mm	1180
B	mm	480
C	mm	1505
D	mm	765
E	mm	468
F	mm	495

AREA OF PROTECTED ZONE FAILURES

- A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 in. by a vehicle component other than one that is normally in contact with the windshield.

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.

X	Y

DATA SHEET NO. 11

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA

Test Vehicle: 2008 BMW 528i 4-Door Sedan NHTSA No.: M80500
Test Program: NHTSA 35mph NCAP Test Date: 10/10/07

Test Time: 12:52 PM

Temperature: 25.0 deg. C

STODDARD SOLVENT SPILLAGE MEASUREMENTS

- A. From impact until vehicle motion ceases: 0.0 oz.
(Maximum Allowable = 1 ounce)
- B. For the 5 minute period after motion ceases: 0.0 oz.
(Maximum Allowable = 5 ounces)
- C. For the following 25 minutes: 0.0 oz.
(Maximum Allowable = 1 oz./minute)
- D. Spillage Location Details: No leakage occurred

DATA SHEET NO. 12

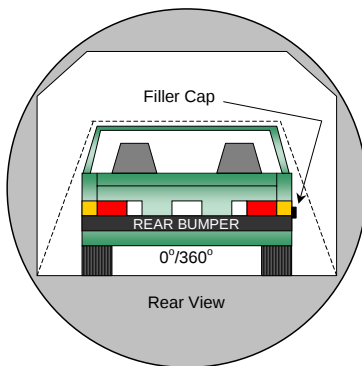
FMVSS 301 STATIC ROLLOVER DATA

Test Vehicle: 2008 BMW 528i 4-Door Sedan

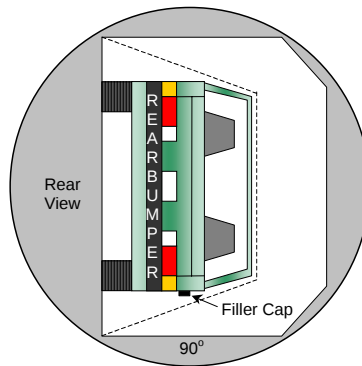
NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

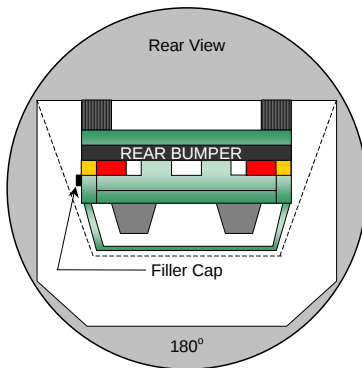
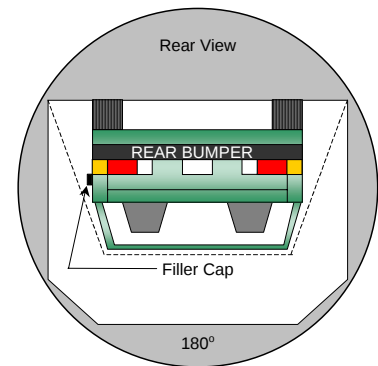
Test Date: 10/10/07



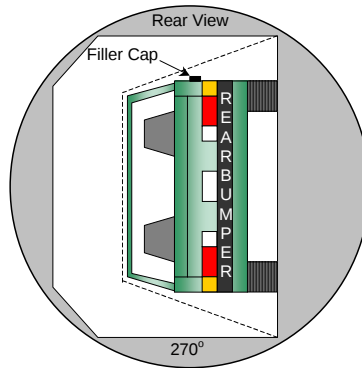
0° to 90°



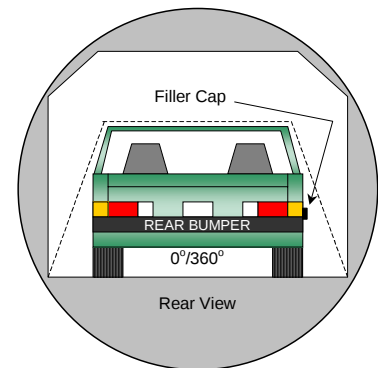
90° to 180°



180° to 270°



270° to 360°



1. The specified fixture rollover rate for each 90° of rotation is 60 to 120 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. No solvent leakage occurred during rollover.

DATA SHEET NO. 12...(CONTINUED)**FMVSS 301 STATIC ROLLOVER DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**SOLVENT COLLECTION TIME TABLE IN SECONDS**

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	86	304	390
90° to 180°	83	312	395
180° to 270°	78	306	384
270° to 360°	80	302	382

FMVSS 301 SPILLAGE TABLE REQUIREMENT (oz.)

First 5 Minutes	5.0
Sixth Minute	1.0
Seventh Minute	1.0
Eighth Minute	1.0

ACTUAL TEST VEHICLE SOLVENT SPILLAGE TABLE (oz.)

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 13**VEHICLE MEASUREMENTS**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**VEHICLE MEASUREMENT TABLE**

No.	Measurement Description	Units	Pre-Test	Post-Test	Diff.
1	Total length of vehicle at centerline	mm	4845	4343	-502
2	RSOV to front of engine	mm	4310	4060	-250
3	RSOV to firewall centerline	mm	3635	3580	-55
4	RSOV to leading edge of right door	mm	3261	3251	-10
5	RSOV to leading edge of left door	mm	3264	3260	-4
6	RSOV to lower leading edge of right door	mm	3328	3325	-3
7	RSOV to lower leading edge of left door	mm	3330	3318	-12
8	RSOV to upper trailing edge of right door	mm	2222	2214	-8
9	RSOV to upper trailing edge of left door	mm	2230	2226	-4
10	RSOV to lower trailing edge of right door	mm	2276	2276	0
11	RSOV to lower trailing edge of left door	mm	2280	2276	-4
12	RSOV to bottom of right 'A' pillar	mm	3288	3291	3
13	RSOV to bottom of left 'A' pillar	mm	3289	3291	2
14	RSOV to firewall on right side	mm	3585	3554	-31
15	RSOV to firewall on left side	mm	3585	3559	-26
16	RSOV to steering column	mm	2890	2868	-22
17	Center of steering column to left 'A' pillar	mm	400	314	-86
18	Center of steering column to headlining	mm	375	425	50
19	RSOV to right side of front bumper	mm	4654	4310	-344
20	RSOV to left side of front bumper	mm	4654	4365	-289
21	Length of engine block	mm	650	650	0
RD	RSOV to right side of dash panel	mm	3033	3023	-10
CD	RSOV to center of dash panel	mm	2925	2935	10
LD	RSOV to left side of dash panel	mm	3029	3021	-8

DATA SHEET NO. 13...(CONTINUED)

VEHICLE STRUCTURAL MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

VEHICLE STRUCTURAL MEASUREMENT TABLE

No.	Measurement Description	Units	Pre-Test	Post-Test	Diff.
1	Total length	mm	4845	4343	-502
2	Total width	mm	1825	1832	7
3	Bumper top height	mm	580	683	103
4	Bumper bottom height	mm	320	505	185
5	Longitudinal member top height	mm	515	605	90
6	Longitudinal member bottom height	mm	313	403	90
7	Distance between longitudinal members	mm	780	770	-10
8	Longitudinal member width	mm	70	70	0
9	Engine top height	mm	840	960	120
10	Engine bottom height	mm	154	187	33
11	Engine and gear box width	mm	540	540	0
12	Front bumper to engine distance	mm	535	346	-189
13	Front shock absorber fixing width	mm	830	915	85
14	Bonnet leading edge height	mm	720	998	278
15	Front shock absorber fixing width	mm	1140	1125	-15
16	Front bumper to front axle distance	mm	844	510	-334
17	Front axle to 'A' pillar distance	mm	633	594	-39
18	'A' pillar to 'B' pillar distance	mm	1067	1062	-5
19	'B' pillar to rear axle distance	mm	1182	1179	-3
20	'B' pillar to 'C' pillar distance	mm	880	882	2
21	Roof sill bottom height	mm	1250	1330	80
22	Roof sill top height	mm	1300	1386	86
23	Floor sill bottom height	mm	110	102	-8
24	Floor sill top height	mm	390	415	25

DATA SHEET NO. 13...(CONTINUED)

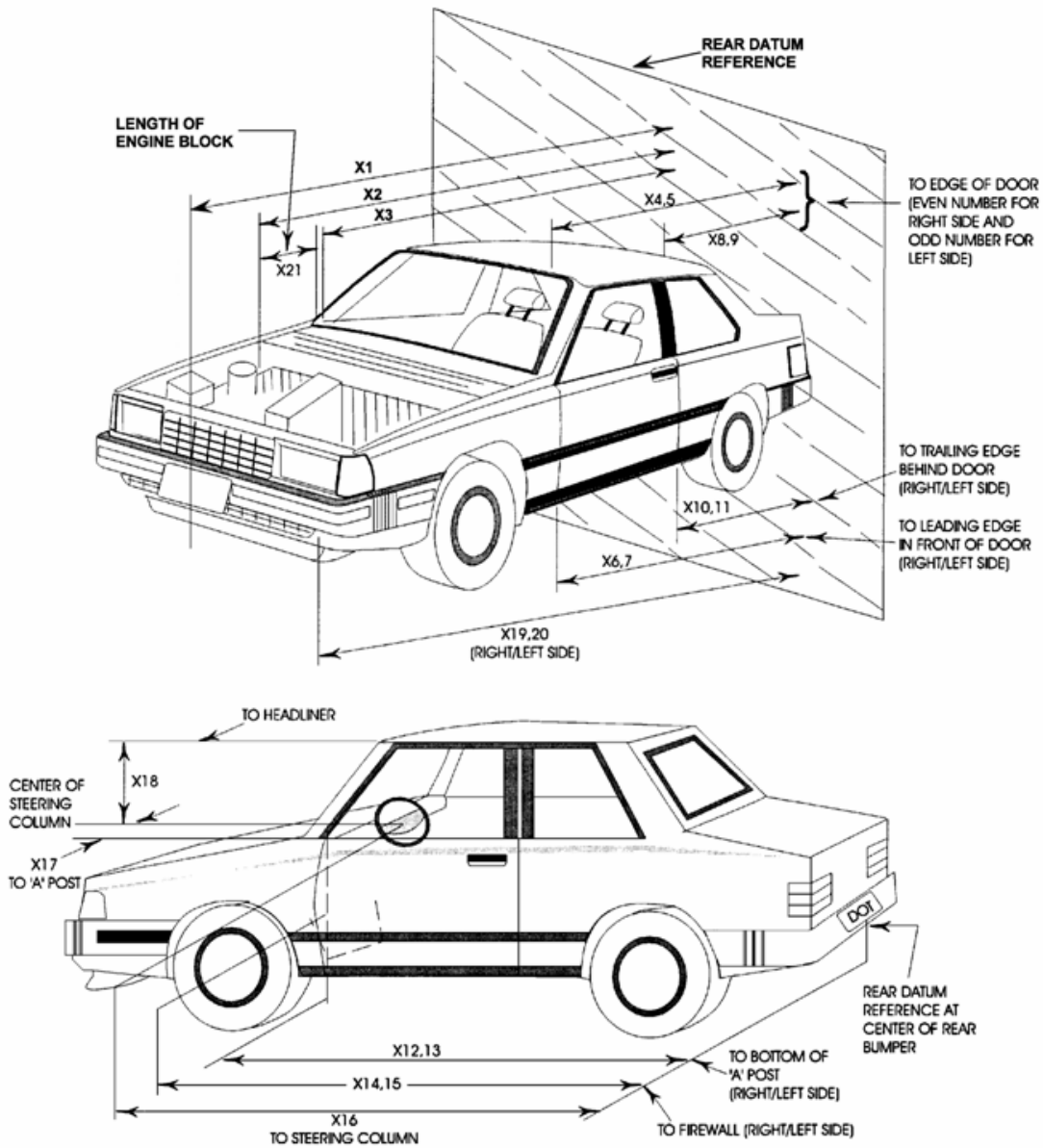
VEHICLE MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



DATA SHEET NO. 14

CAMERA LOCATIONS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

VEHICLE CAMERA MEASUREMENT TABLE

No.	Camera View	Location (mm)			Angle (deg.)	Film Plane to Head	Lens (mm)	Speed (fps)
		X	Y	Z				
1	Real Time Camera (Panning)	-11412	-8150	-1484	0			30
2	Overall Left Side	-1678	-6963	-998	0	7666	20mm	1000
3	Closeup Left Side	-2346	-7761	-1018	0	8425	50mm	1000
4	Driver and Interior View	-6696	-10949	-4730	-17	13557	ZOOM	1000
5	Steering Column (Bottom)	-1972	-8184	-2829	-13	9456	35mm	1000
6	Steering Column (Top)	-1966	-8141	-3258	-13	9610	35mm	1000
7	Overall Right Side	-1771	6738	-1102	0	6800	20mm	1000
8	Closeup Right Side	-2269	7735	-1081	0	7727	50mm	1000
9	Passenger and Interior View	-5136	9516	-2460	-10	10306	ZOOM	1000
10	Right Side View	-1582	7995	-1713	-6	8201	ZOOM	1000
11	Windshield View	-354	0	-5749	-90		24mm	1000
12	Driver Front View	363	-543	-2548	-34		25mm	1000
13	Passenger Front View	381	445	-2548	-34		25mm	1000
14	Pit View of Engine	-756	0	1495	90		12mm	1000
15	Pit View of Fuel Tank	-3398	0	1495	90		8mm	1000
16	Real Time Driver	-1926	-8089	-1704	-1			30
17	Real Time Passenger	-1433	8047	-1704	-1			30

All measurements are made relative to the point of impact.

DATA SHEET NO. 15

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

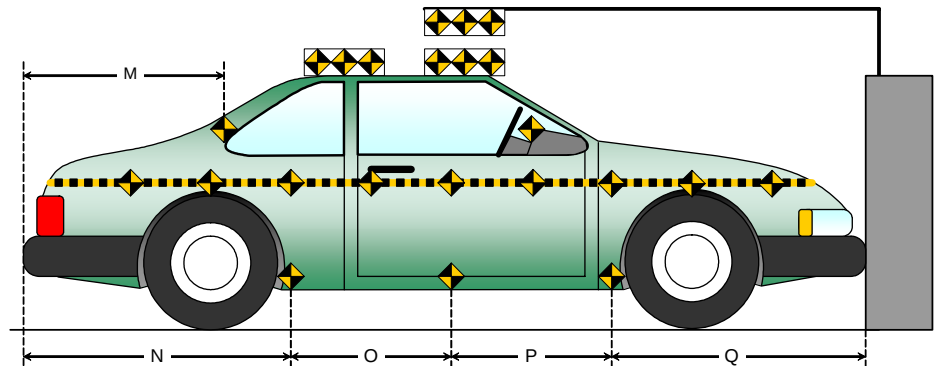
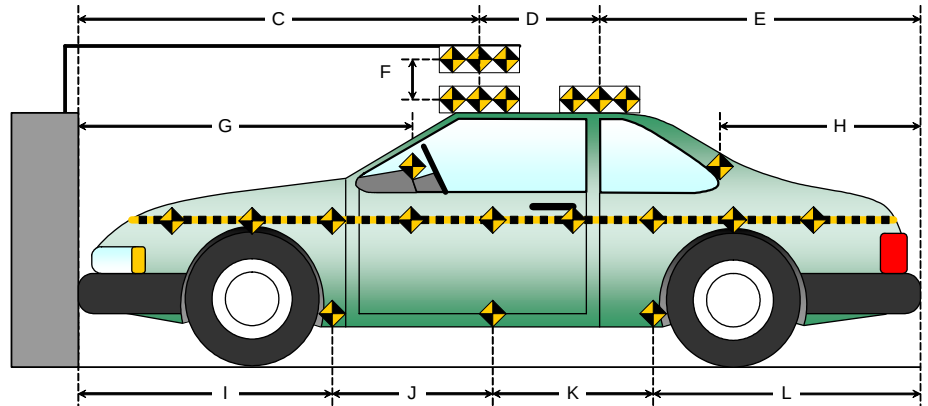
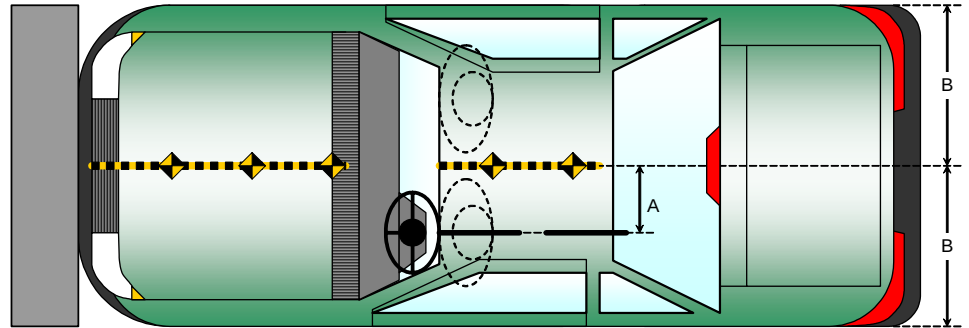
Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

All Dimensions in (mm)	
Item	Value
A	
B	912
C	
D	615
E	
F	155
G	2985
H	1100
I	1306
J	1002
K	1002
L	1540
M	1098
N	1541
O	1001
P	1001
Q	306



DATA SHEET NO. 16

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

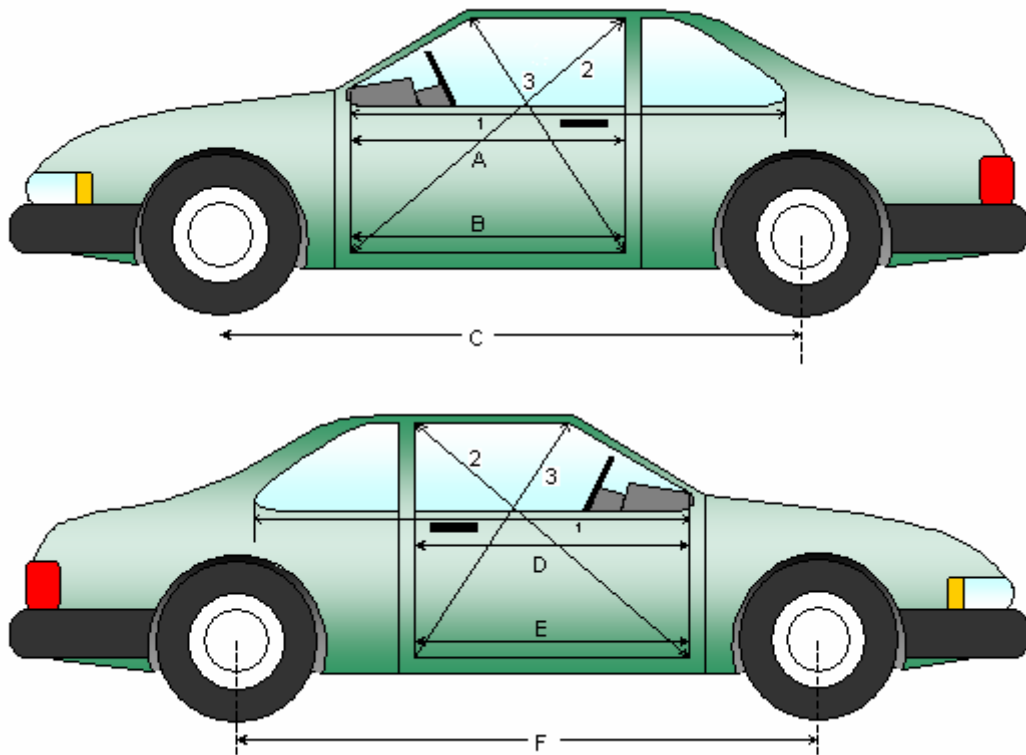
Test Date: 10/10/07

DOOR OPENING WIDTH TABLE

Item	Description	Units	Pre-Test	Post-Test	Diff.
1L	Left Side	mm	967	967	0
2L	Left Side (Diagonally)	mm	1415	1415	0
3L	Left Side (Diagonally)	mm	937	938	1
1R	Right Side	mm	967	967	0
2R	Right Side (Diagonally)	mm	1417	1415	-2
3R	Right Side (Diagonally)	mm	936	938	2

WHEELBASE MEASUREMENT TABLE

Item	Description	Units	Pre-Test	Post-Test	Diff.
C	Left Side Wheel Base	mm	2886	2800	-86
F	Right Side Wheel Base	mm	2886	2810	-76



DATA SHEET NO. 16...(CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

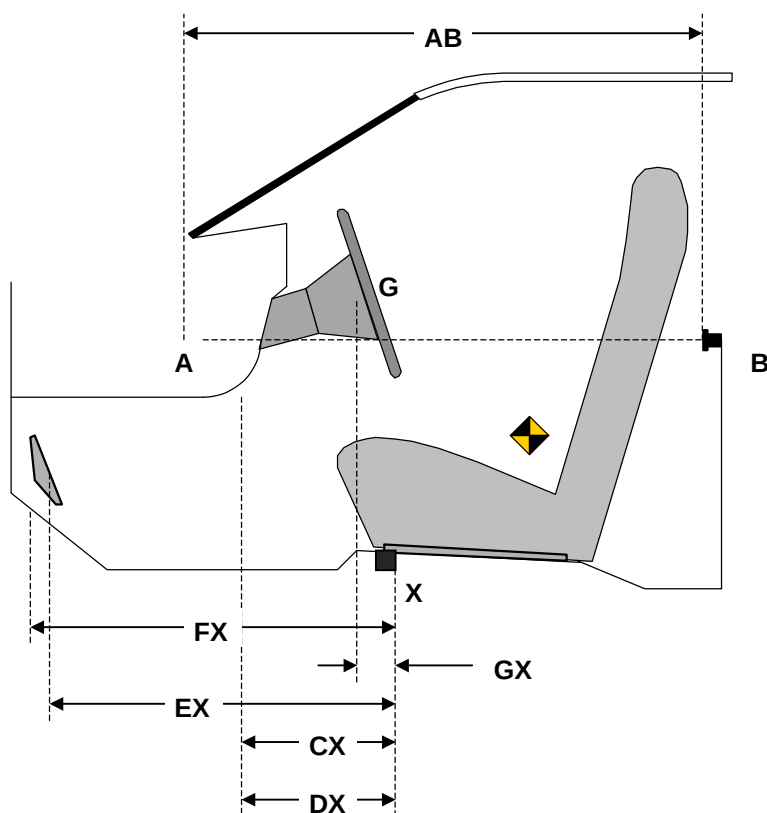
NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

DRIVER COMPARTMENT INTRUSION TABLE

Item	Description	Units	Pre-Test	Post-Test	Diff.
AB	Door Opening (Inside window jam)	mm	967	967	0
CX	Left Knee Bolster to X	mm	300	255	-45
DX	Right Knee Bolster to X	mm	240	235	-5
EX	Brake Pedal to X	mm	580	524	-56
FX	Foot Rest to X	mm	630	647	17
GX	Center of Steering Wheel Hub to X	mm	50	62	12



DATA SHEET NO. 16...(CONTINUED)

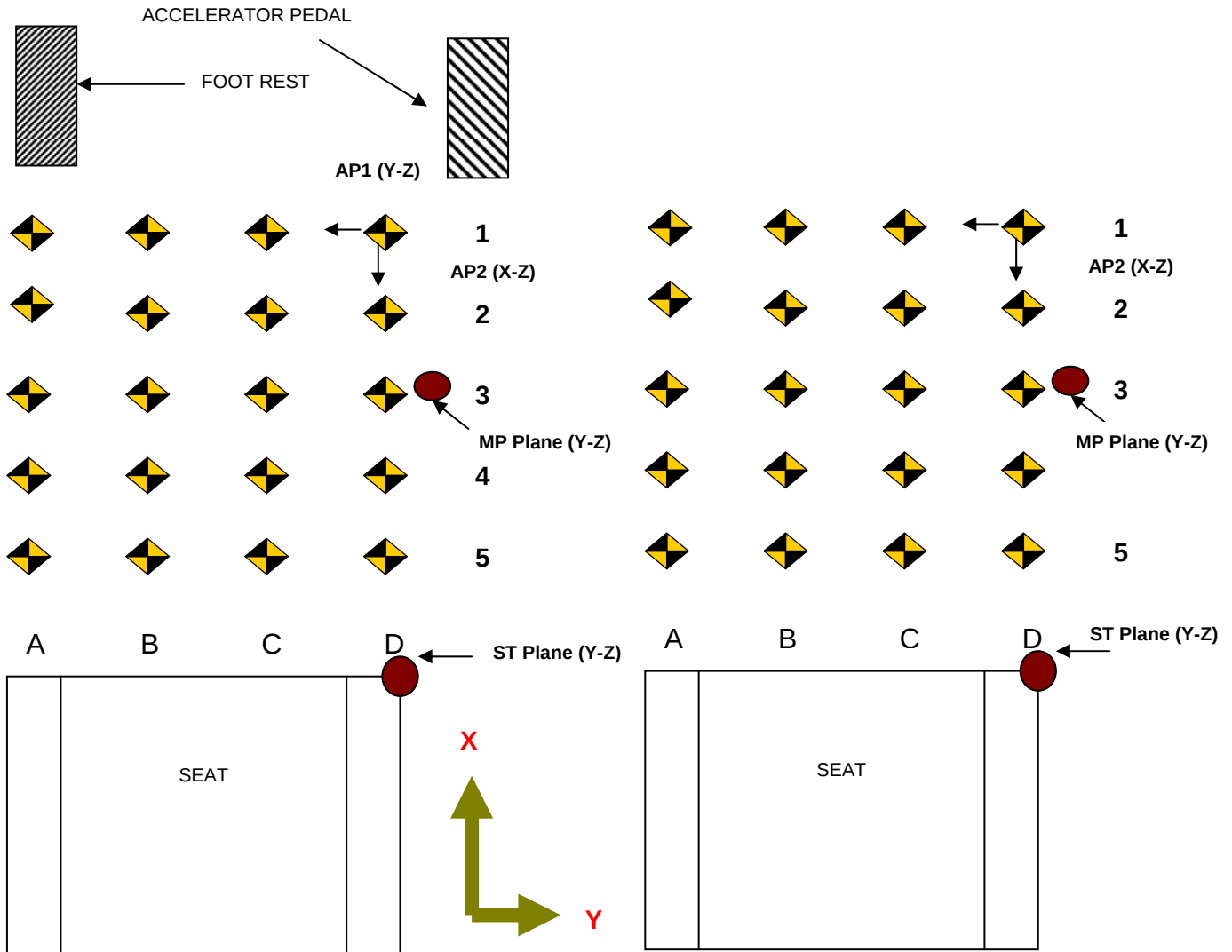
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



AP1: Y-Z Plane passing through D1

AP2: X-Z Plane passing through D1

AP3: X-Y plane passing through D1

MP: Y-Z plane, halfway between the ST plane and AP1 plane

CF Plane: X-Z plane passes through center of footrest.

BP Plane: X-Z plane passes through center of brake pedal

TP Plane: Y-Z plane, intersection of BP Plane and the intersection of the toe pan and floorboard

Column A: intersection of vehicle and CF plane

Column D: Intersection of vehicle and AP2 plane

Row 1: intersection of the vehicle and the AP3 Plane

Row 3: intersection of the vehicle and TP plane

Row 5: intersection of the vehicle and MP plane

Row 2: evenly spaced between row 1 and 3

Row 4: evenly spaced between row 3 and 5

DATA SHEET NO. 16...(CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

All measurements in mm

DRIVER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	747	736	726	716	718	707	692	682	-29	-29	-34	-34
2	662	654	646	635	637	631	619	611	-25	-23	-27	-24
3	579	564	554	539	558	543	532	518	-21	-21	-22	-21
4	454	443	437	421	434	426	416	401	-20	-17	-21	-20
5	346	343	327	317	325	316	305	296	-21	-27	-22	-21

DRIVER FLOOR PAN Y-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	47	136	226	323	77	166	253	350	30	30	27	27
2	45	126	216	315	70	155	242	344	25	29	26	29
3	36	116	205	307	65	147	234	335	29	31	29	28
4	25	102	195	300	54	133	226	329	29	31	31	29
5	13	87	180	289	44	120	212	320	31	33	32	31

DRIVER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-42	-40	-38	-35	-67	-67	-68	-63	-25	-27	-30	-28
2	16	17	17	18	-6	-3	-1	1	-22	-20	-18	-17
3	73	66	67	49	53	46	48	40	-20	-20	-19	-9
4	72	66	76	56	55	53	72	52	-17	-13	-4	-4
5	72	64	71	61	60	55	67	58	-12	-9	-4	-3

DATA SHEET NO. 16...(CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

All measurements in mm

PASSENGER FLOOR PAN X-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	775	764	759	751	724	729	740	742	-51	-35	-19	-9
2	688	682	676	668	653	657	663	663	-35	-25	-13	-5
3	605	598	590	588	601	593	586	588	-4	-5	-4	0
4	487	491	484	479	484	488	483	478	-3	-3	-1	-1
5	360	359	350	347	358	354	348	347	-2	-5	-2	0

PASSENGER FLOOR PAN Y-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-236	-118	-42	45	-280	-166	-90	-5	-44	-48	-48	-50
2	-240	-127	-43	43	-277	-162	-81	6	-37	-35	-38	-37
3	-238	-127	-46	41	-272	-164	-84	2	-34	-37	-38	-39
4	-241	-133	-51	35	-272	-168	-83	-1	-31	-35	-32	-36
5	-244	-147	-55	32	-276	-178	-88	-2	-32	-31	-33	-34

PASSENGER FLOOR PAN Z-AXIS

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-69	-67	-66	-64	-70	-76	-70	-67	-1	-9	-4	-3
2	-8	-10	-6	-3	3	3	1	-5	11	13	7	-2
3	31	42	45	51	52	57	50	48	21	15	5	-3
4	45	85	83	88	64	100	88	96	19	15	5	8
5	51	89	92	95	65	100	104	110	14	11	12	15

DATA SHEET NO. 17

FIXED BARRIER LOAD CELL LOCATIONS

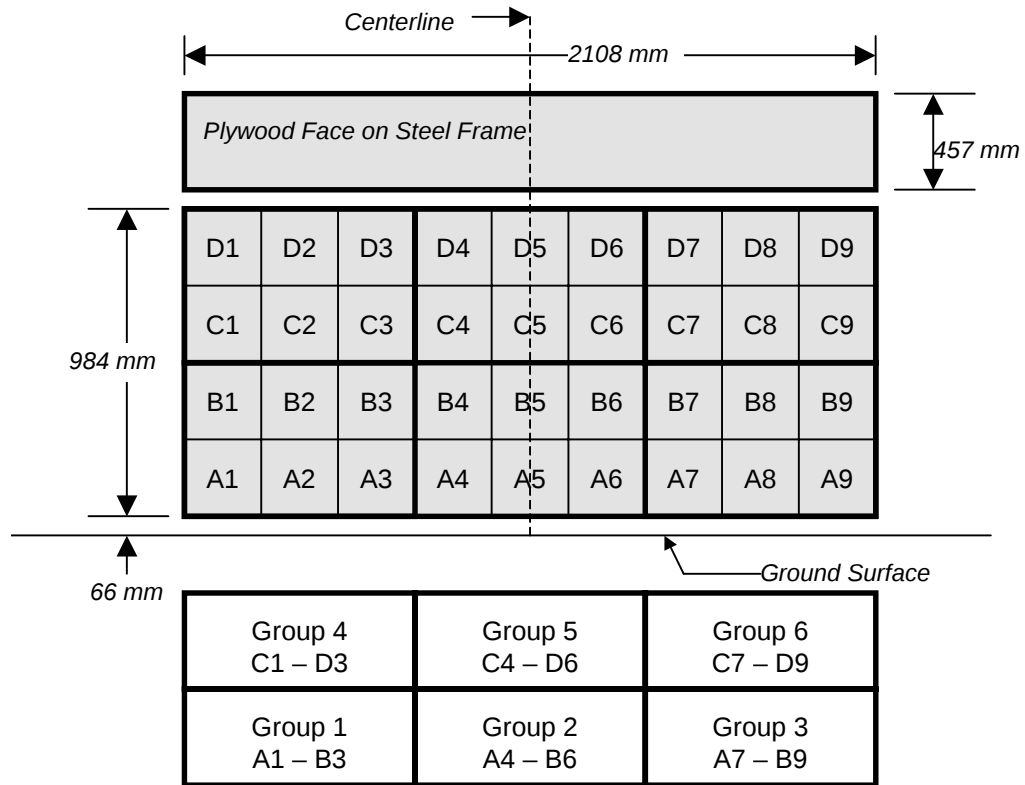
Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

36 Load Cell Rigid Barrier (NHTSA Standard) Load Cell Locations on Fixed Barrier



6 Groups of 6 Load Cells Each

DATA SHEET NO. 18

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

VEHICLE INFORMATION

VIN: WBANU53548CT07726

Wheel base (mm): 2886

Vehicle Size Category: 4-Door Sedan

Test Weight (kg): 1924

ACCELEROMETER DATA

Accelerometer Location: Left rear cross member

Cal. Procedure/Interval: 6 months / drop test

Integration Algorithm: NHTSA Standard

Linearity: Good

Impact Velocity (km/h): 56.19

Velocity Change (km/h): 66.2

Time of Separation (msec): 73.4

CRUSH PROFILE

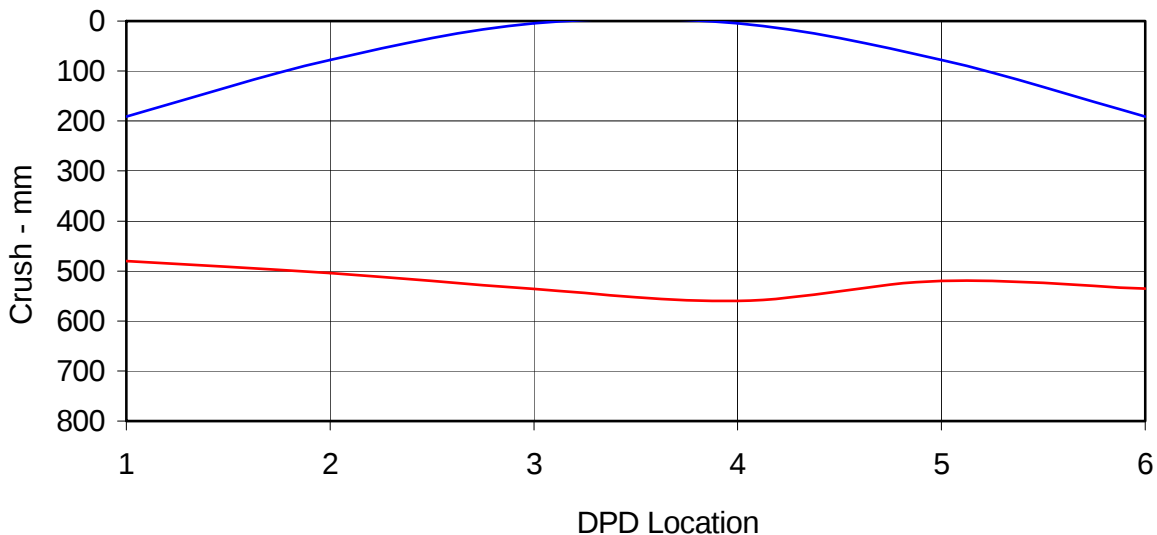
Collision Deformation Classification: 12FDEW6

Midpoint of Damage: Vehicle Centerline

Damage Region Length (mm): 1480

Impact Mode: Full Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	191	480	-289
C2	Crush zone 2 on left side	mm	78	504	-426
C3	Crush zone 3 on left side	mm	5	536	-531
C4	Crush zone 4 on right side	mm	5	560	-555
C5	Crush zone 5 on right side	mm	78	520	-442
C6	Crush zone 6 at right side	mm	191	535	-344



DATA SHEET NO. 19

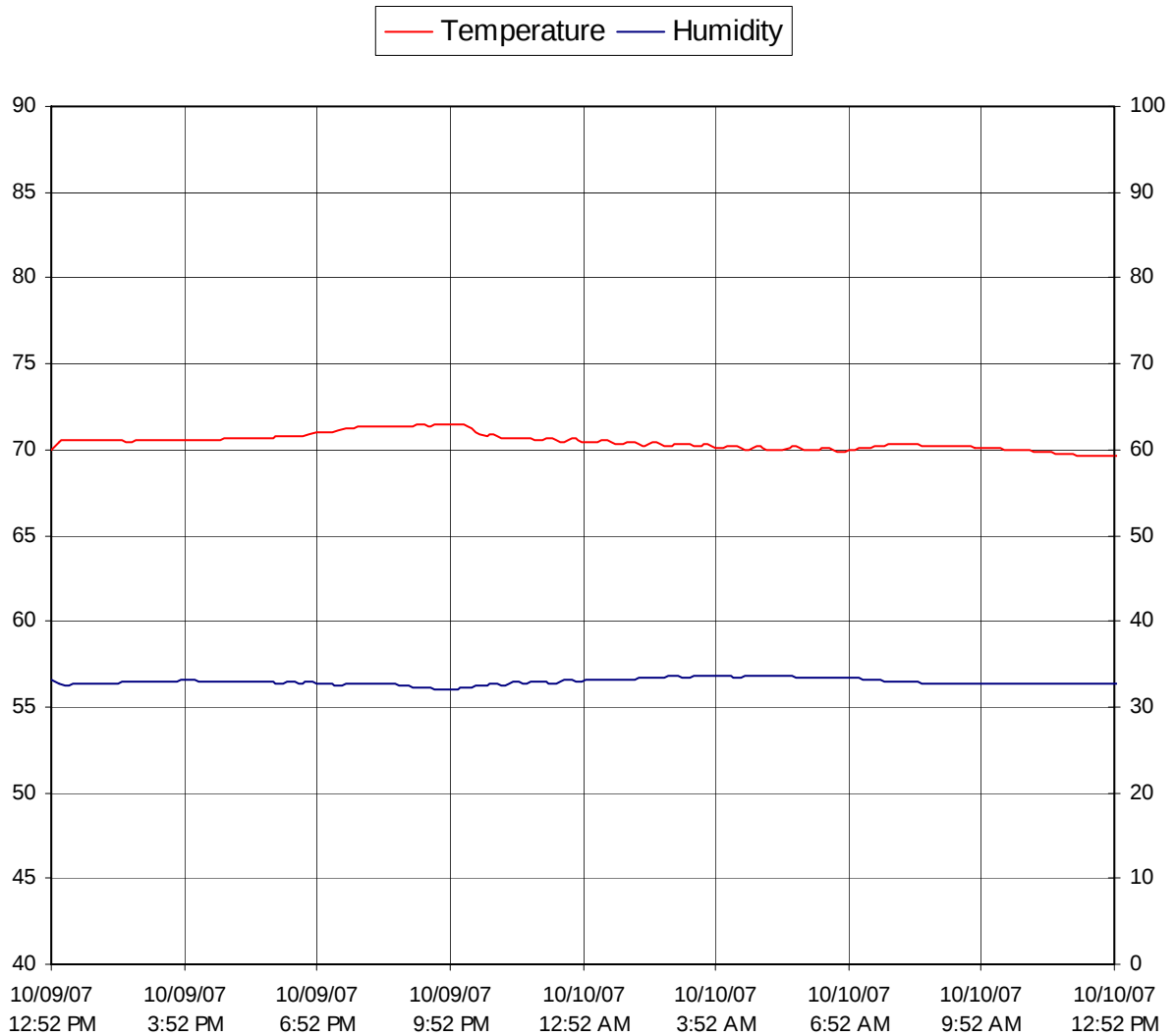
DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



APPENDIX A
PHOTOGRAPHS

LIST OF PHOTOGRAPHS

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A-20	Pre-Test Engine Compartment	A-20
A-21	Post-Test Engine Compartment (Vehicle Moved)	A-21
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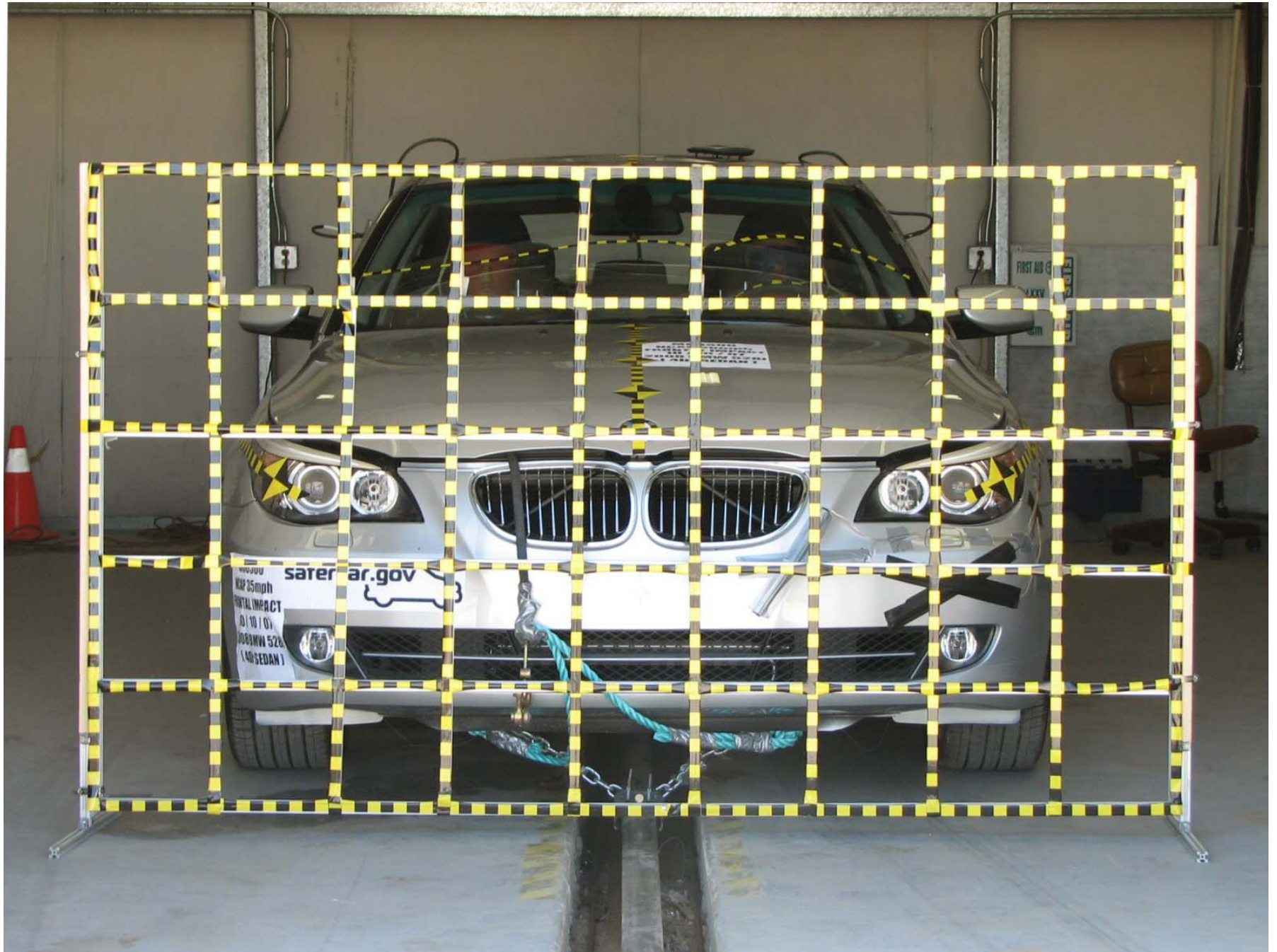


Figure A-1: Load Cell Location

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528iA

VEHICLE TYPE: PASSENGER CAR
MFD BY BAYERISCHE MOTORENWERKE 07/07

GVWR 4674 lbs 2120 kg

GAWR FRONT 2227 lbs 1010 kg REAR 2601 lbs 1180 kg

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S.
FEDERAL MOTOR VEHICLE SAFETY, BUMPER AND THEFT
PREVENTION STANDARDS IN EFFECT ON THE DATE OF
MANUFACTURE SHOWN ABOVE.

WBANU53548CT07726



2 122 606

Figure A-2: Manufacturer's Label



TIRE AND LOADING INFORMATION

SEATING CAPACITY TOTAL 5 FRONT 2 REAR 3

The combined weight of occupants and cargo should never exceed 500 kg or 1102 lbs.

ORIGINAL TIRE SIZE	COLD TIRE INFLATION PRESSURE				SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION
225/50 R 17	FRONT	220	kPa,	32 PSI	
225/50 R 17	REAR	250	kPa,	36 PSI	
COMPACT SPARE TIRE	COLD TIRE INFLATION PRESSURE				
T 135/80 R 17		420	kPa	61 PSI	

BMW
6779329



Figure A-3: Tire Placard



Figure A-4: Right Front $\frac{3}{4}$ View, As Received



Figure A-5: Left Rear $\frac{3}{4}$ View, as Received



Figure A-6: Pre-Test Front View

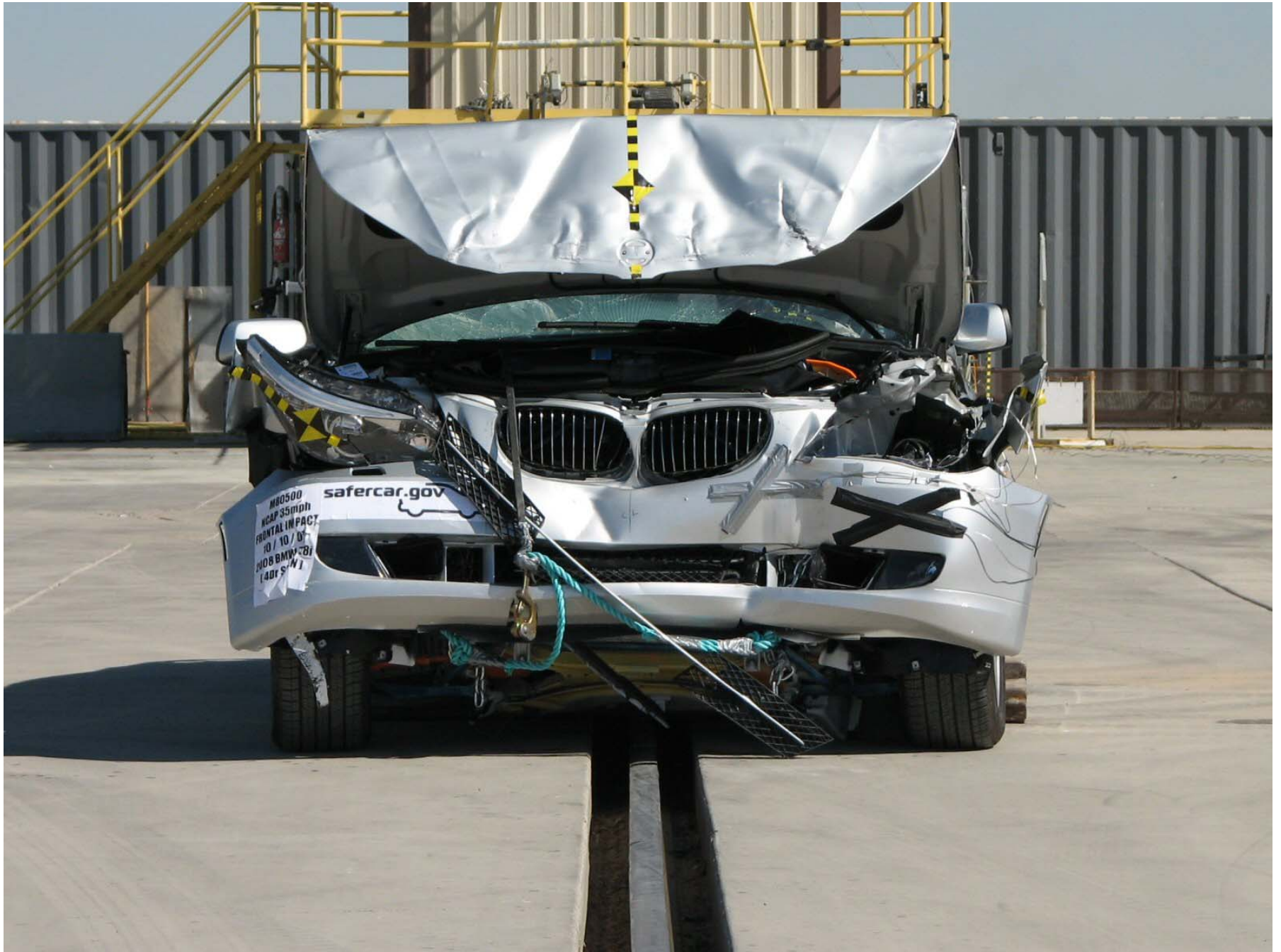


Figure A-7: Post-Test Front View (Vehicle Moved)



Figure A-8: Pre-Test Left Side View



Figure A-9: Post-Test Left Side View



Figure A-10: Pre-Test Right Side View



Figure A-11: Post-Test Right Side View



Figure A-12: Pre-Test Right Front 3/4 View

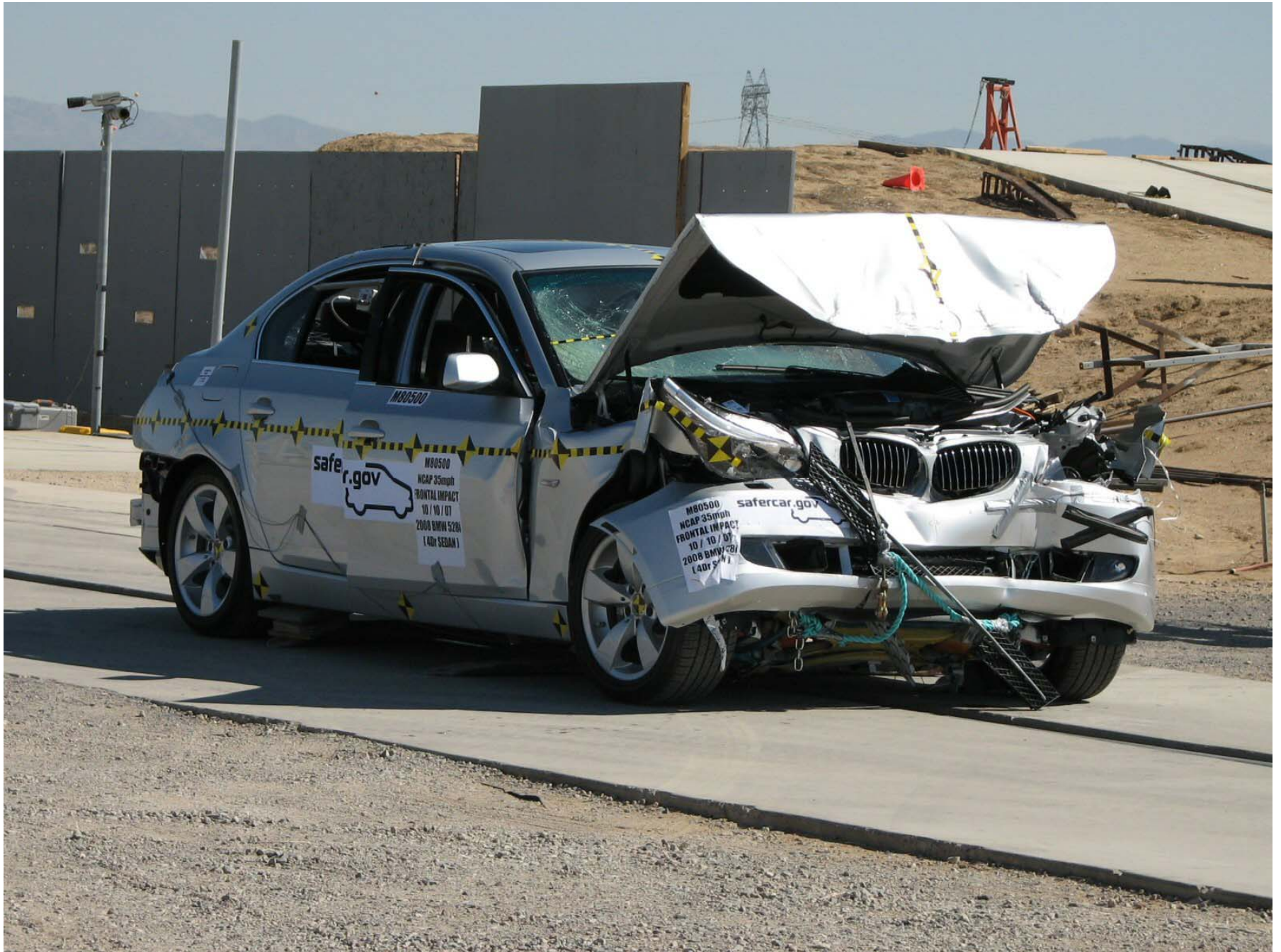


Figure A-13: Post-Test Right Front ¾ View (Vehicle Moved)



Figure A-14: Pre-Test Left Rear $\frac{3}{4}$ View



Figure A-15: Post-Test Left Rear $\frac{3}{4}$ View



Figure A-16: Post-Test Left Side $\frac{3}{4}$ View of Doors After Impact



Figure A-17: Post-Test Right Side $\frac{3}{4}$ View of Doors After Impact

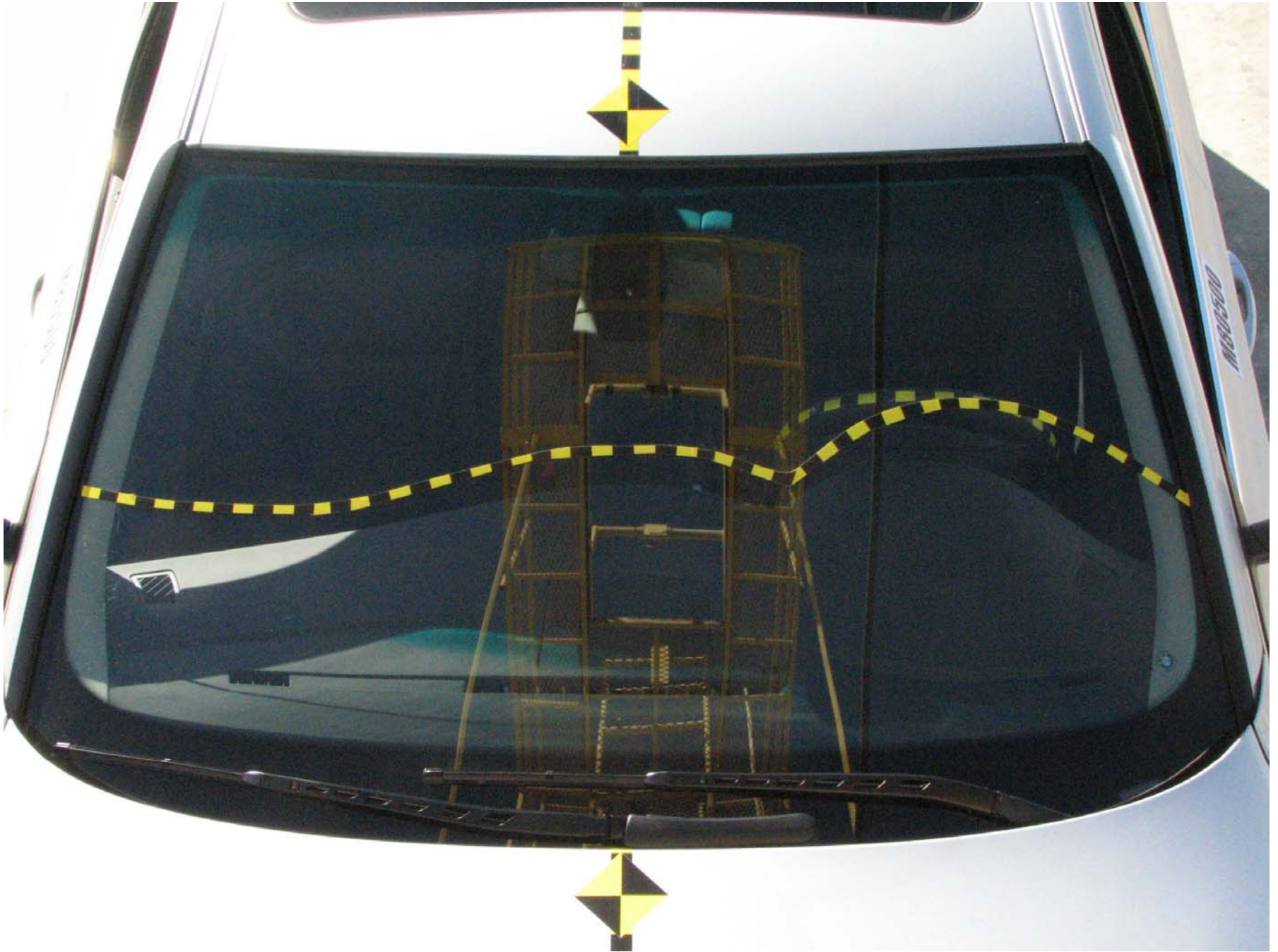


Figure A-18: Pre-Test Windshield



Figure A-19: Post-Test Windshield



Figure A-20: Pre-Test Engine Compartment

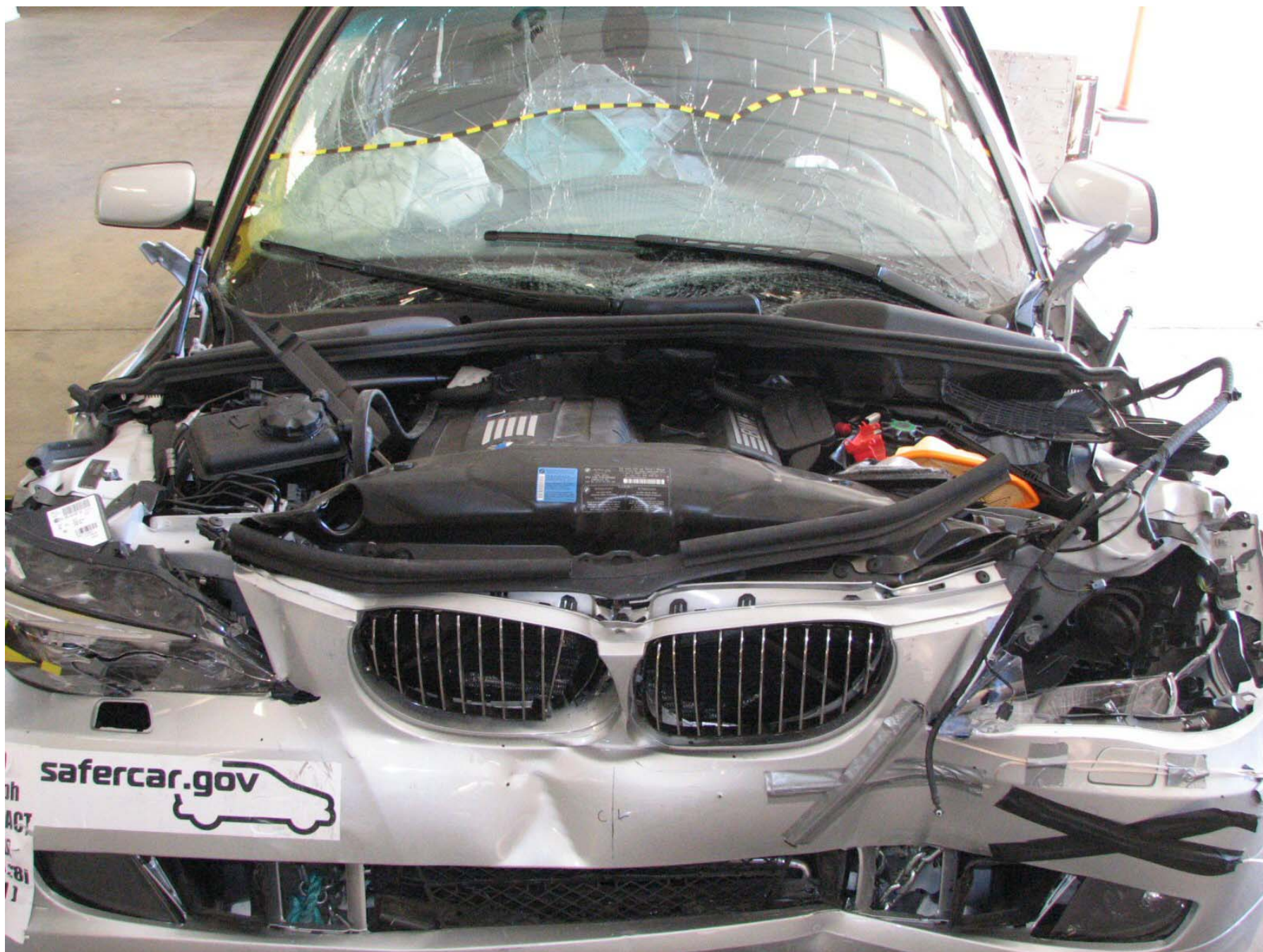


Figure A-21: Post-Test Engine Compartment (Vehicle Moved)



2008 BMW 528i
M80500
STODDARD SOLVENT ADDED
17.11 GALLONS
(64.76 LITERS)

Figure A-22: Pre-Test Fuel Cap



Figure A-23: Post-Test Fuel Cap

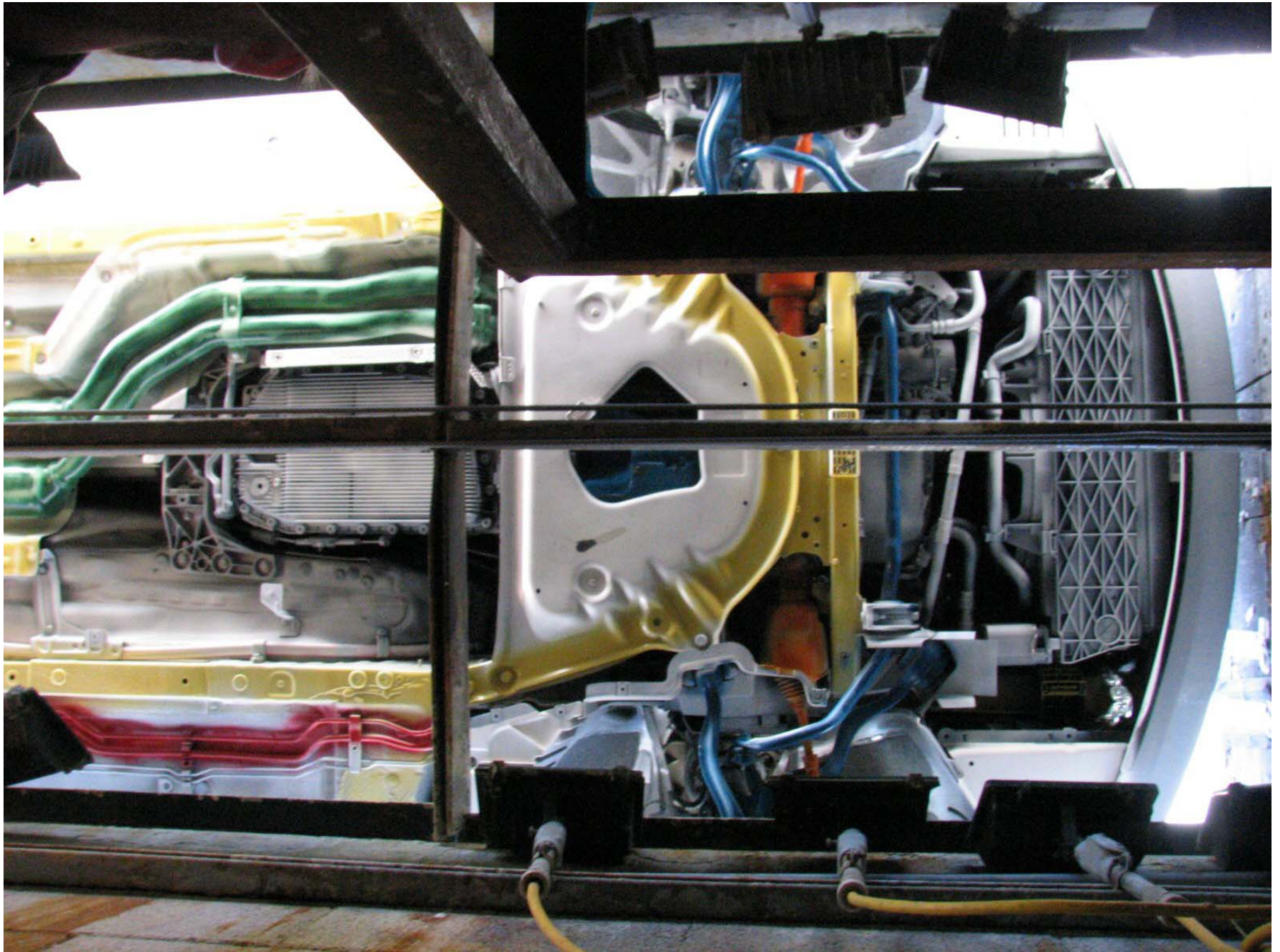


Figure A-24: Pre-Test Front Underbody

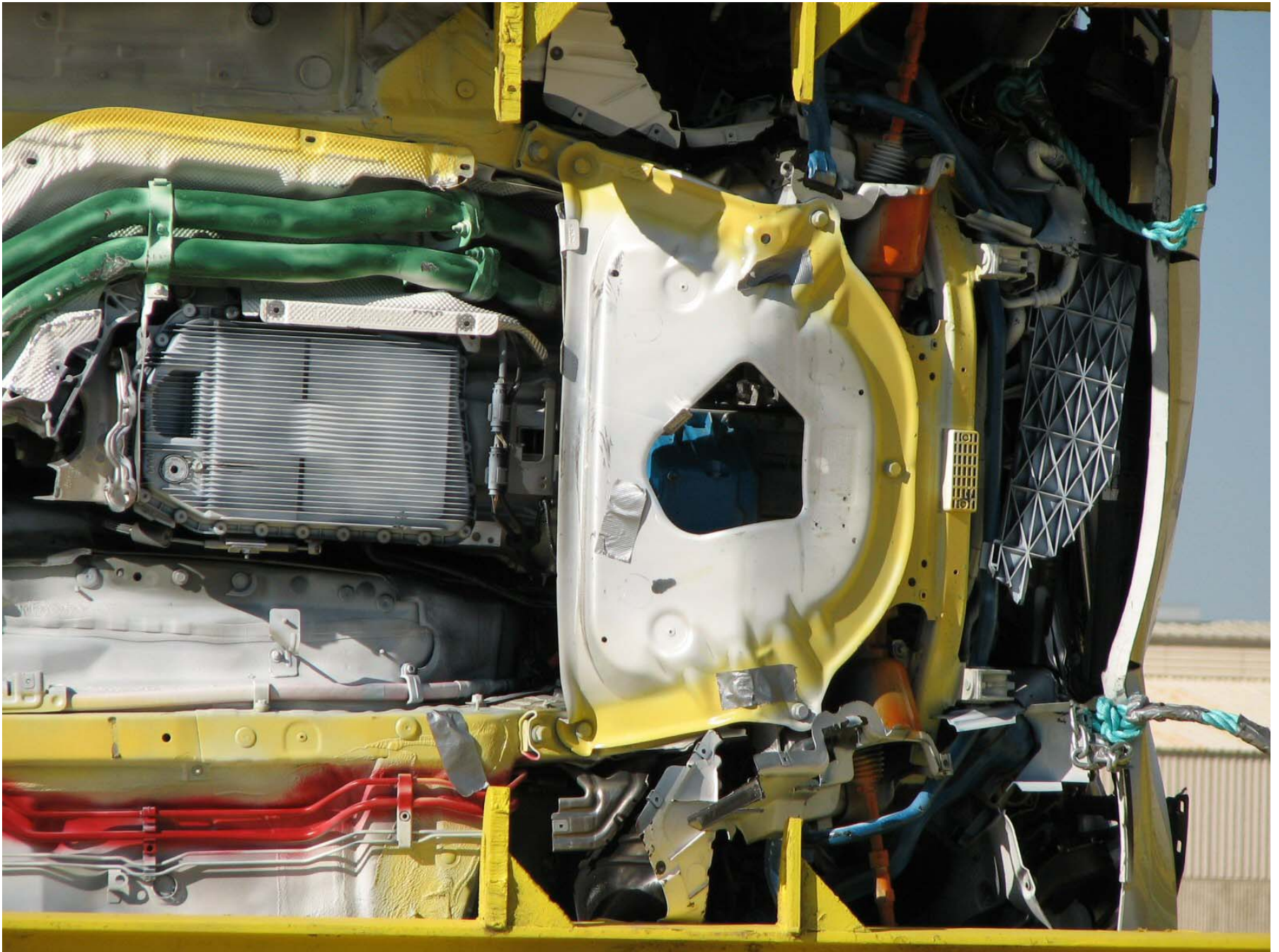


Figure A-25: Post-Test Front Underbody

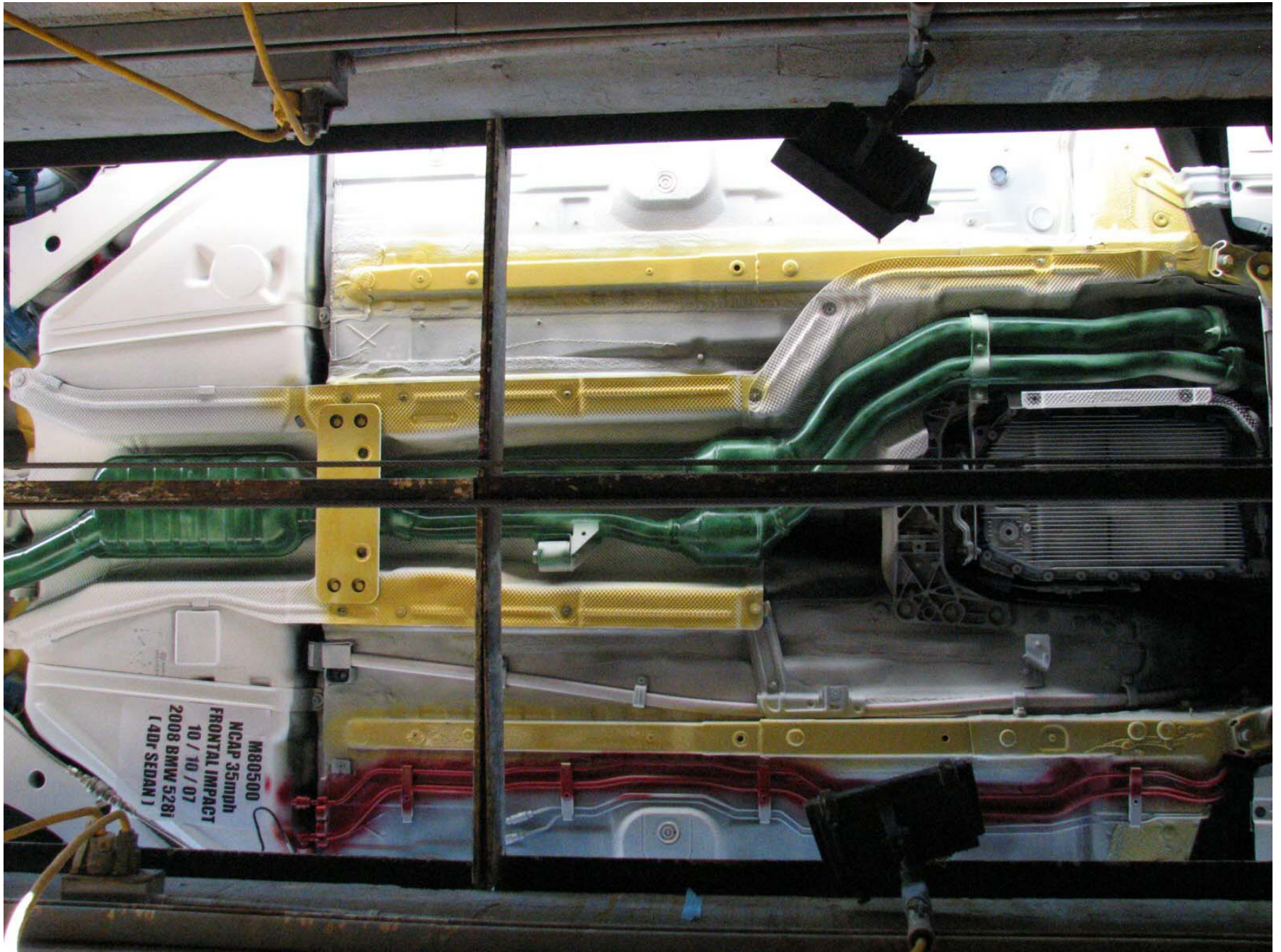


Figure A-26: Pre-Test Mid Underbody

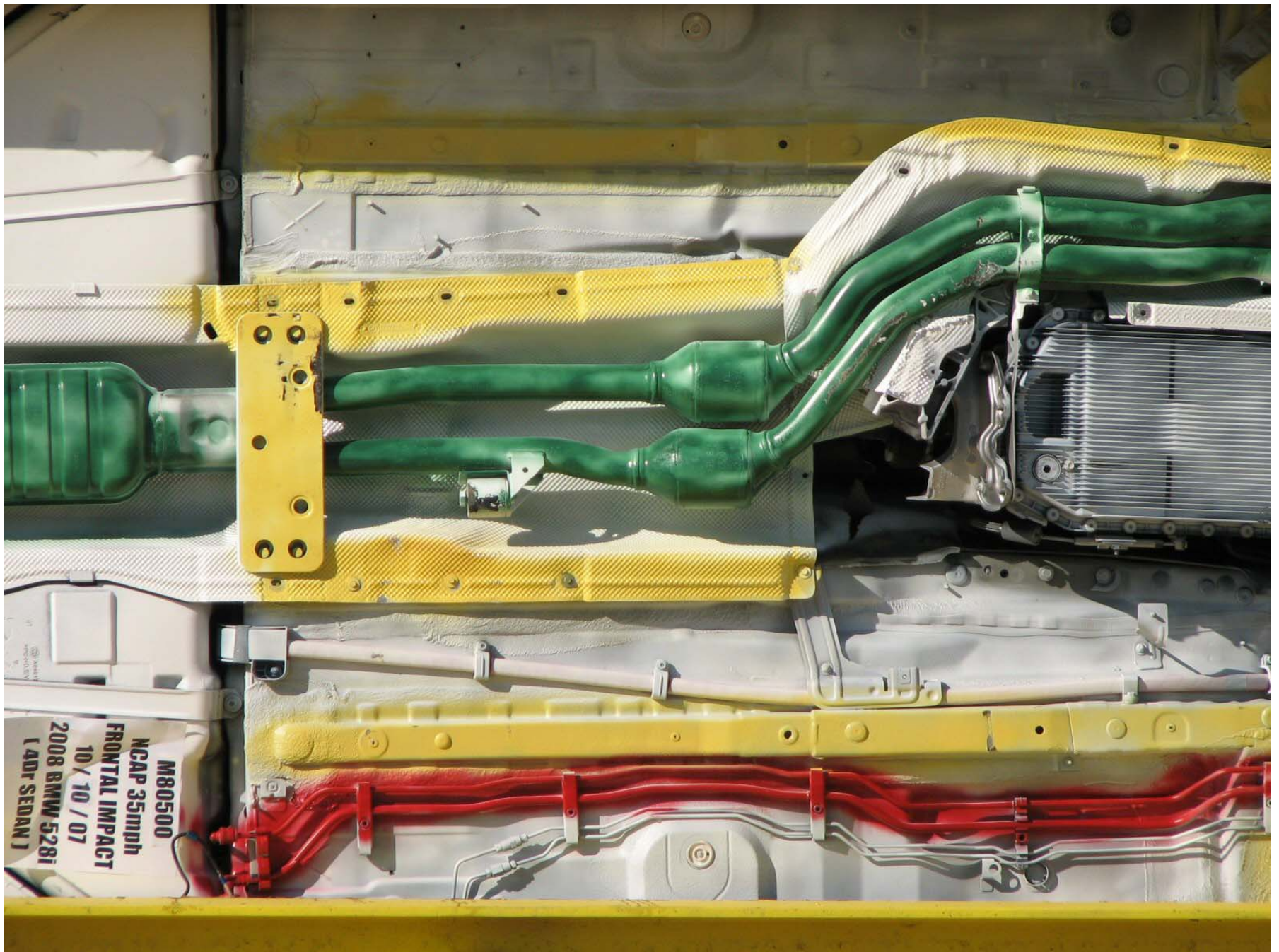


Figure A-27: Post-Test Mid Underbody

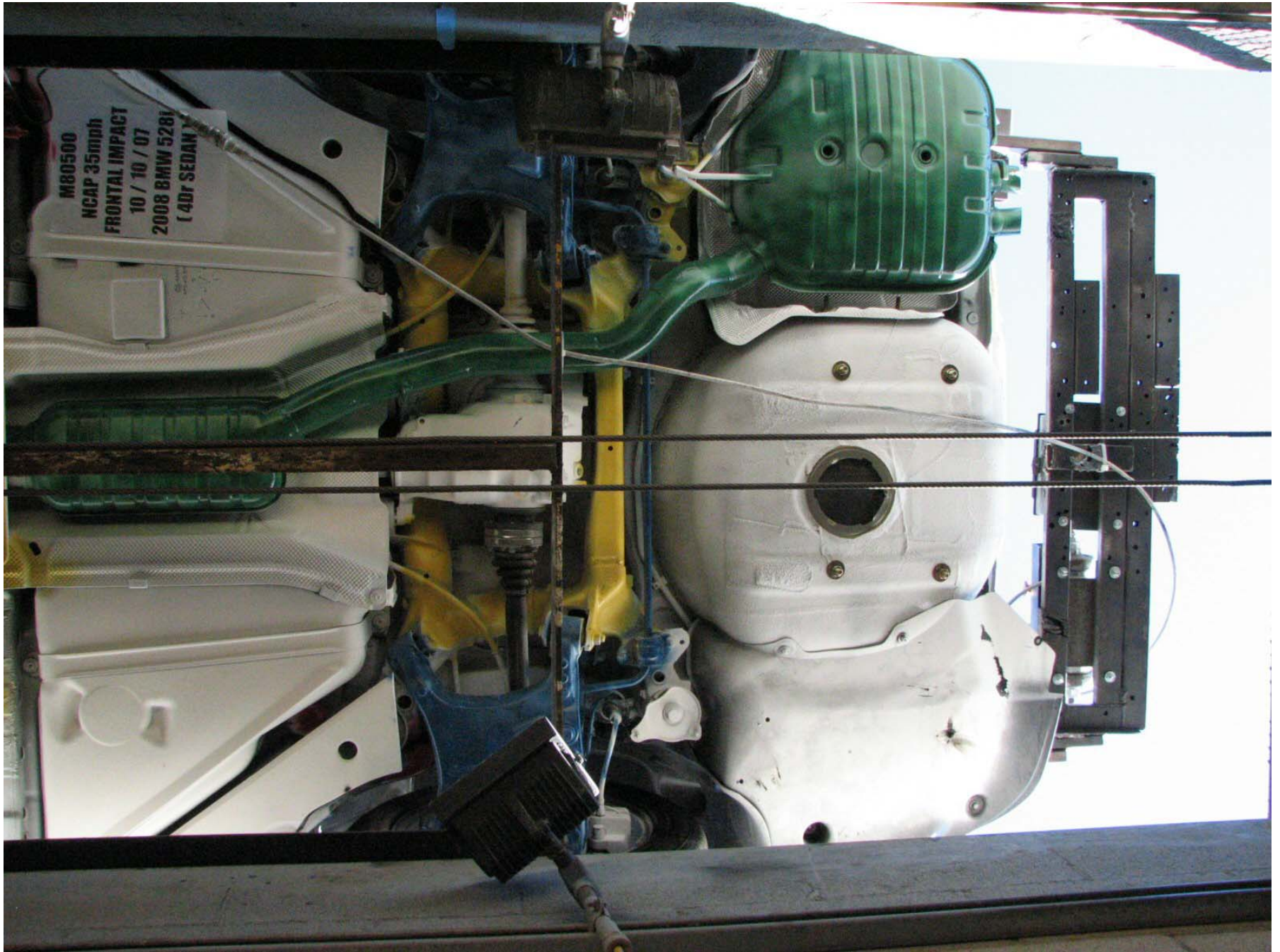


Figure A-28: Pre-Test Rear Underbody

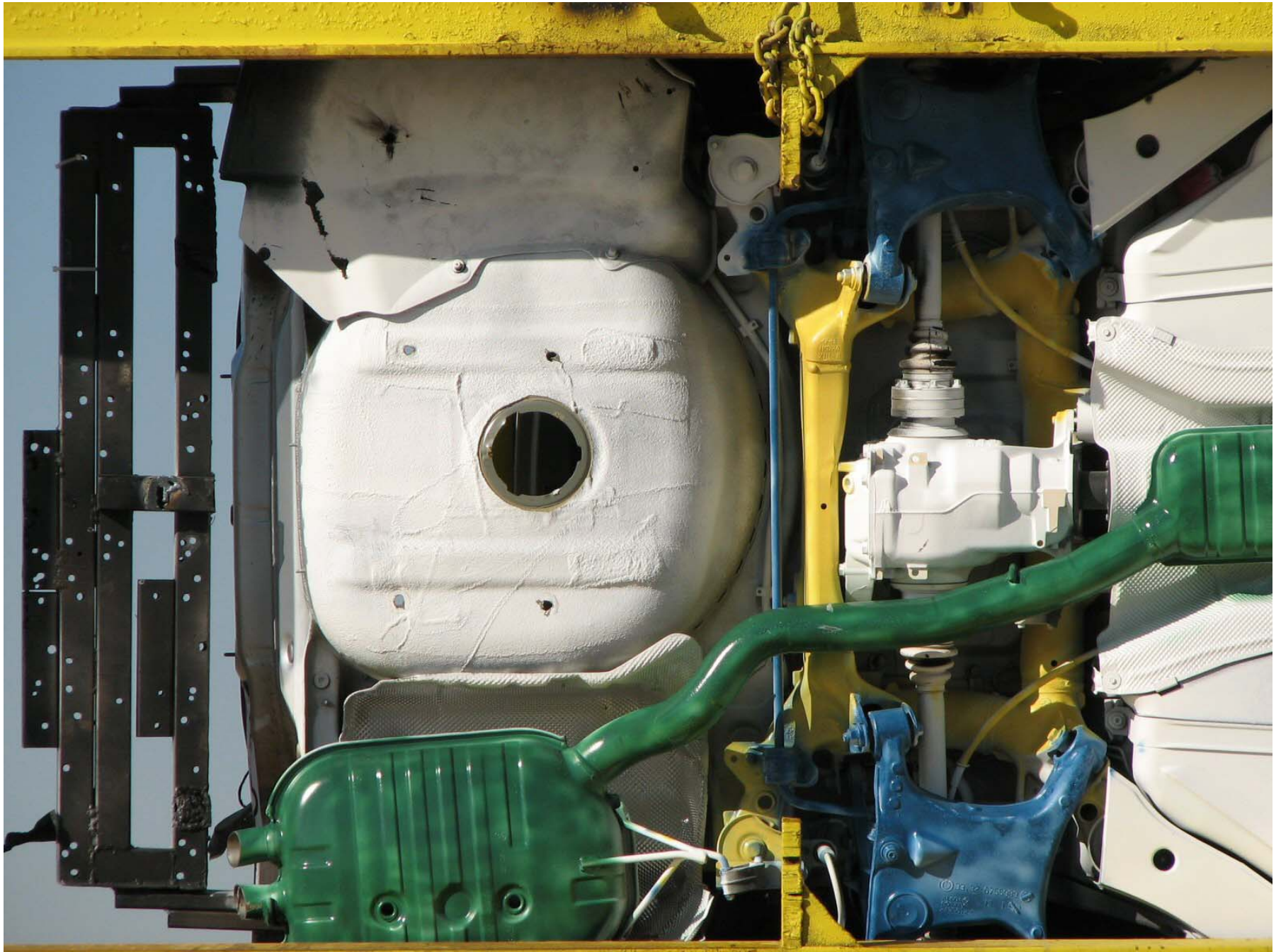


Figure A-29: Post-Test Rear Underbody



Figure A-30: Pre-Test Driver Dummy Front View (Head Position)



Figure A-31: Post-Test Driver Dummy Front View (Head Position)



Figure A-32: Pre-Test Driver Dummy (Through Window)



Figure A-33: Post-Test Driver Dummy (Through Window)



Figure A-34: Pre-Test Driver Dummy (Door Open)



Figure A-35: Post-Test Driver Dummy (Door Open)



Figure A-36: Pre-Test Driver Dummy Feet



Figure A-37: Post-Test Driver Dummy Feet



Figure A-38: Pre-Test Driver Side Knee Bolster



Figure A-39: Post-Test Driver Side Knee Bolster

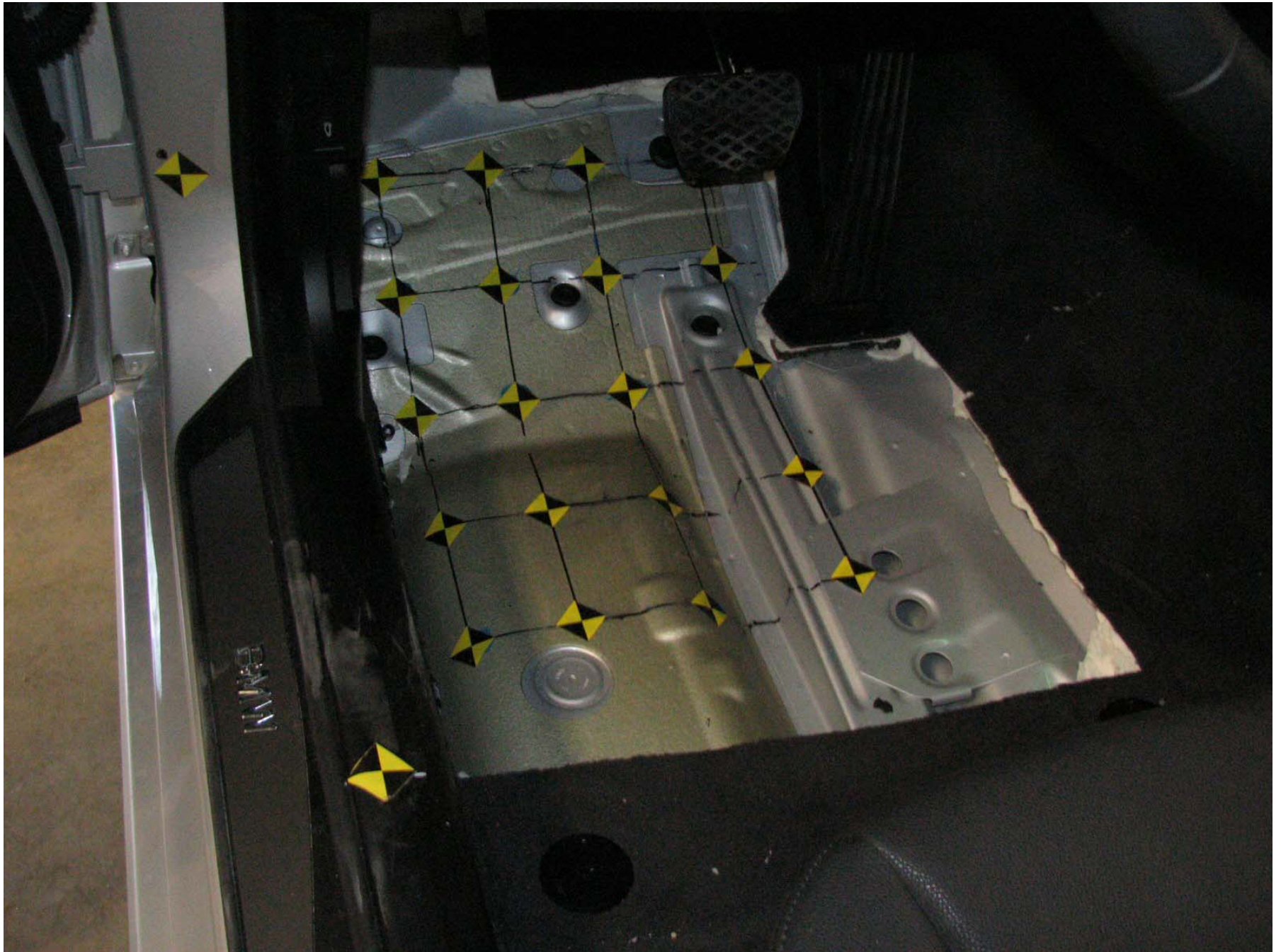


Figure A-40: Pre-Test Driver Side Floor Pan



Figure A-41: Post-Test Driver Side Floor Pan



Figure A-42: Post-Test Driver Dummy Head



Figure A-43: Post-Test Driver Dummy Airbag Contact



Figure A-44: Pre-Test Passenger Dummy Front View (Head Position)



Figure A-45: Post-Test Passenger Dummy Front View (Head Position)



Figure A-46: Pre-Test Passenger Dummy (Through Window)



Figure A-47: Post-Test Passenger Dummy (Through Window)



Figure A-48: Pre-Test Passenger Dummy (Door Open)



Figure A-49: Post-Test Passenger Dummy (Door Open)



Figure A-50: Pre-Test Passenger Dummy Feet



Figure A-51: Post-Test Passenger Dummy Feet



Figure A-52: Pre-Test Passenger Side Glove Box



Figure A-53: Post-Test Passenger Side Glove Box

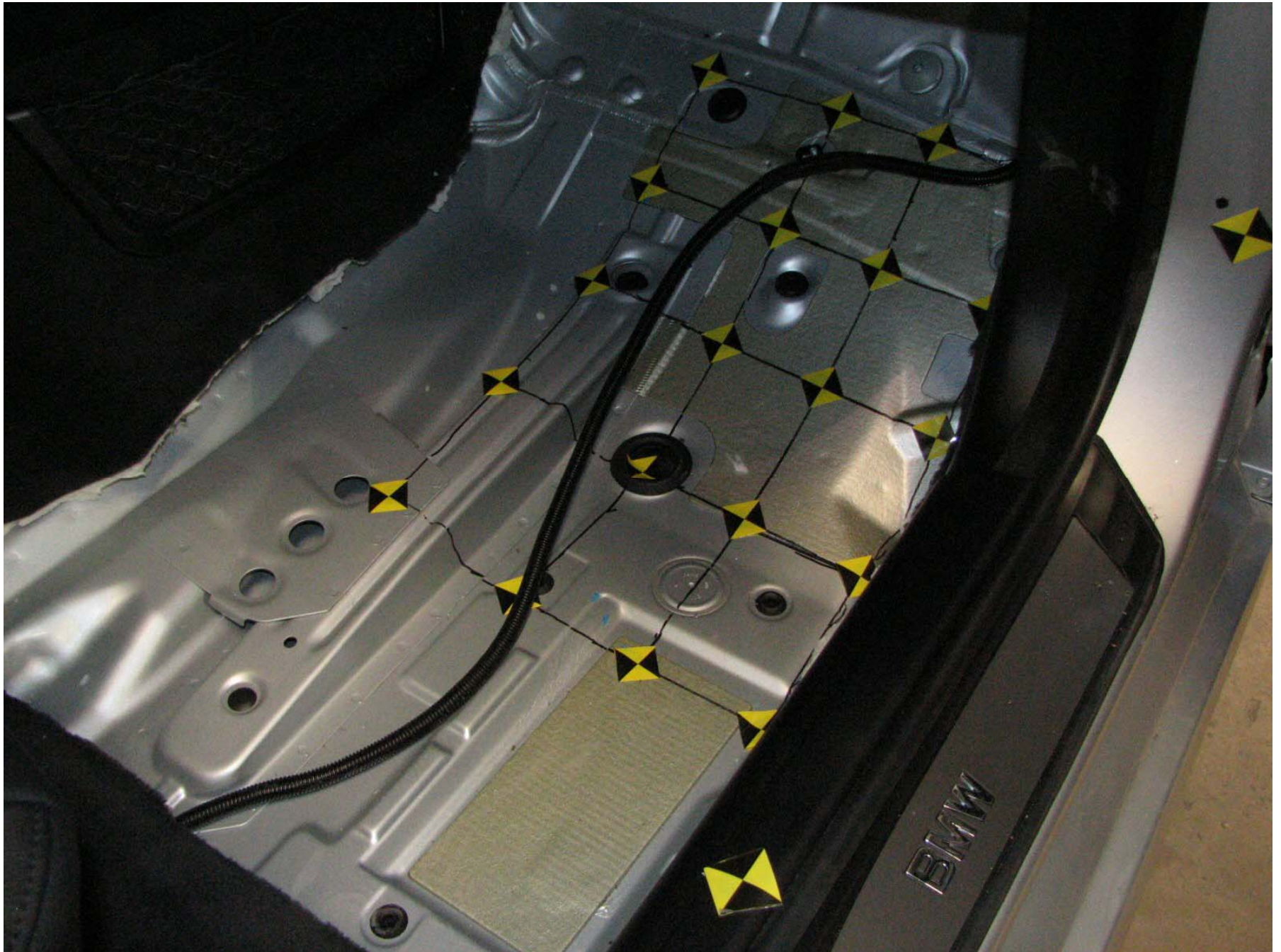


Figure A-54: Pre-Test Passenger Side Floor Pan

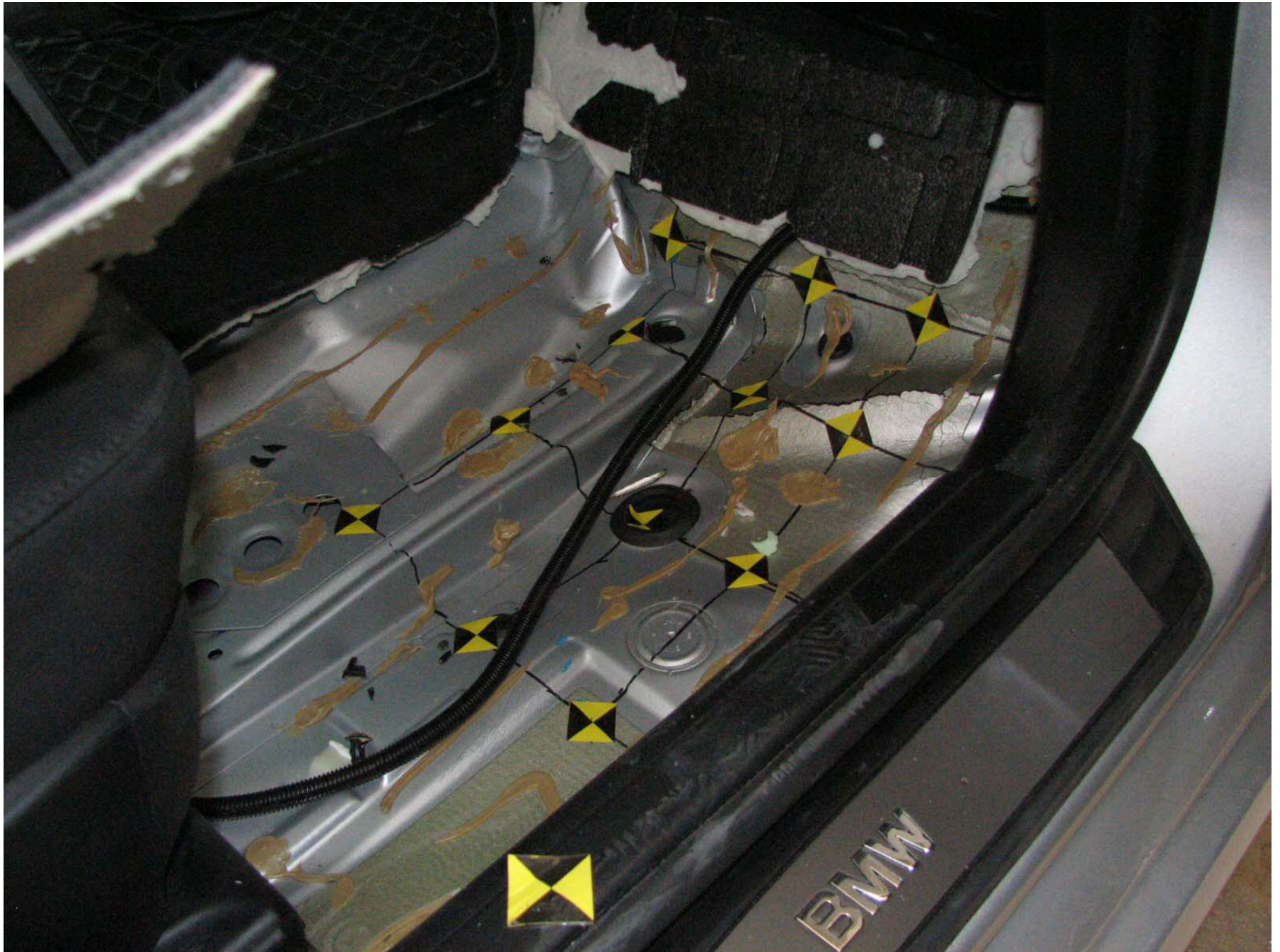


Figure A-55: Post-Test Passenger Side Floor Pan



Figure A-56: Post-Test Passenger Dummy Head



Figure A-57: Post-Test Passenger Dummy Airbag Contact



Figure A-58: Vehicle on Rollover Device (0°)



Figure A-59: Vehicle on Rollover Device (90°)



Figure A-60: Vehicle on Rollover Device (180°)



Figure A-61: Vehicle on Rollover Device (270°)



Figure A-62: Vehicle Impact

APPENDIX B
DATA PLOTS

LIST OF DATA PLOTS

Data Plot	Page
B-1	Driver Head Primary X
	Driver Head Primary Y
	Driver Head Primary Z
	Driver Head Resultant Primary
B-2	Driver Chest Primary X
	Driver Chest Primary Y
	Driver Chest Primary Z
	Driver Chest Resultant Primary
B-3	Driver Left Femur Force Z
	Driver Right Femur Force Z
B-4	Passenger Head Primary X
	Passenger Head Primary Y
	Passenger Head Primary Z
	Passenger Head Resultant Primary
B-5	Passenger Chest Primary X
	Passenger Chest Primary Y
	Passenger Chest Primary Z
	Passenger Chest Resultant Primary
B-6	Passenger Left Femur Force Z
	Passenger Right Femur Force Z

LIST OF DATA PLOTS...(CONTINUED)

The following additional data plots for this test can be obtained from the research and development section of the NHTSA website. The website can be found at www.NHTSA.dot.gov.

- Driver Head Primary X Velocity
- Driver Head Primary X Displacement
- Driver Head Redundant X
- Driver Head Redundant Y
- Driver Head Redundant Z
- Driver Head Resultant Redundant
- Driver Head Redundant X Velocity
- Driver Head Redundant X Displacement
- Driver Upper Neck Force X
- Driver Upper Neck Force Y
- Driver Upper Neck Force Z
- Driver Upper Neck Force Resultant
- Driver Upper Neck Moment X
- Driver Upper Neck Moment Y
- Driver Upper Neck Moment Z
- Driver Upper Neck Moment Resultant
- Driver Chest Primary X Velocity
- Driver Chest Primary X Displacement
- Driver Chest Redundant X
- Driver Chest Redundant Y
- Driver Chest Redundant Z
- Driver Chest Resultant Redundant
- Driver Chest Redundant X Velocity
- Driver Chest Redundant X Displacement
- Driver Chest Displacement
- Driver Pelvis X
- Driver Pelvis Y
- Driver Pelvis Z
- Driver Pelvis Resultant
- Driver Pelvis X Velocity
- Driver Pelvis X Displacement
- Driver Left Upper Tibia Moment X
- Driver Left Upper Tibia Moment Y
- Driver Right Upper Tibia Moment X

LIST OF DATA PLOTS...(CONTINUED)

Driver Right Upper Tibia Moment Y
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Left Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Right Foot Fore Z
Driver Lap Belt Force
Driver Shoulder Belt Force
Driver Shoulder Belt Pullout
Driver Shoulder Belt Elongation
Passenger Head Primary X Velocity
Passenger Head Primary X Displacement
Passenger Head Redundant X
Passenger Head Redundant Y
Passenger Head Redundant Z
Passenger Head Resultant Redundant
Passenger Head Redundant X Velocity
Passenger Head Redundant X Displacement
Passenger Upper Neck Force X
Passenger Upper Neck Force Y
Passenger Upper Neck Force Z
Passenger Upper Neck Force Resultant
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Y
Passenger Upper Neck Moment Z
Passenger Upper Neck Moment Resultant
Passenger Chest Primary X Velocity
Passenger Chest Primary X Displacement
Passenger Chest Redundant X

LIST OF DATA PLOTS...(CONTINUED)

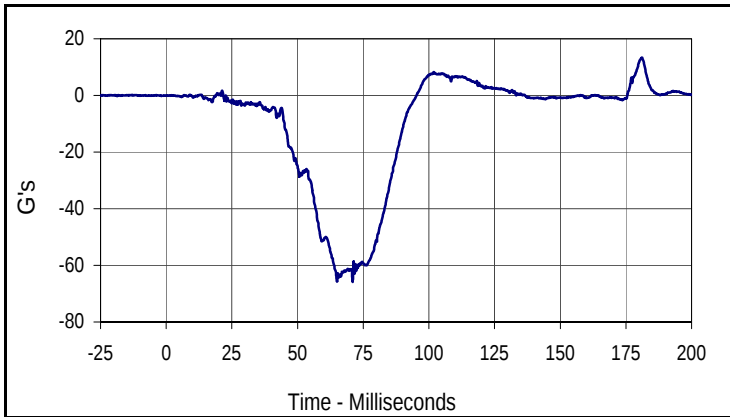
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Passenger Chest Redundant Z
Passenger Chest Resultant Redundant
Passenger Chest Redundant X Velocity
Passenger Chest Redundant X Displacement
Passenger Chest Displacement
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Passenger Pelvis Y
Passenger Pelvis Z
Passenger Pelvis Resultant
Passenger Pelvis X Velocity
Passenger Pelvis X Displacement
Passenger Left Femur Force
Passenger Right Femur Force
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Left Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Right Foot Fore Z
Passenger Lap Belt Force
Passenger Shoulder Belt Force
Passenger Shoulder Belt Pullout
Passenger Shoulder Belt Elongation
Vehicle Left Rear X
Vehicle Left Rear X Velocity

LIST OF DATA PLOTS...(CONTINUED)

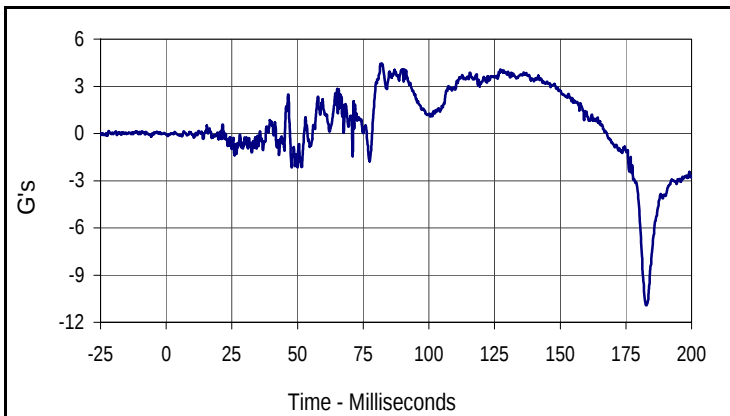
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Vehicle Right Rear X
Vehicle Right Rear X Velocity
Vehicle Right Rear X Displacement
Vehicle Engine Top
Vehicle Engine Top Velocity
Vehicle Engine Top Displacement
Vehicle Engine Bottom
Vehicle Engine Bottom Velocity
Vehicle Engine Bottom Displacement
Vehicle Left Brake Caliper
Vehicle Left Brake Caliper Velocity
Vehicle Left Brake Caliper Displacement
Vehicle Right Brake Caliper
Vehicle Right Brake Caliper Velocity
Vehicle Right Brake Caliper Displacement
Vehicle Instrument Panel
Vehicle Instrument Panel Velocity
Vehicle Instrument Panel Displacement
Vehicle Left Rear Z
Vehicle Left Rear Z Velocity
Vehicle Left Rear Z Displacement
Vehicle Right Rear Z
Vehicle Right Rear Z Velocity
Vehicle Right Rear Z Displacement

Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

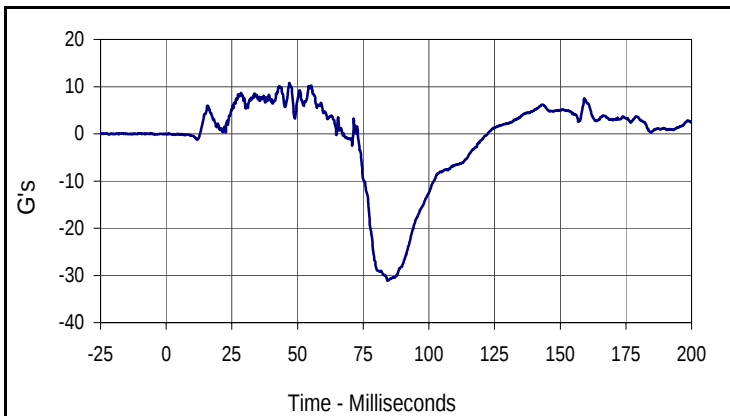
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 NHTSA No.: M80500



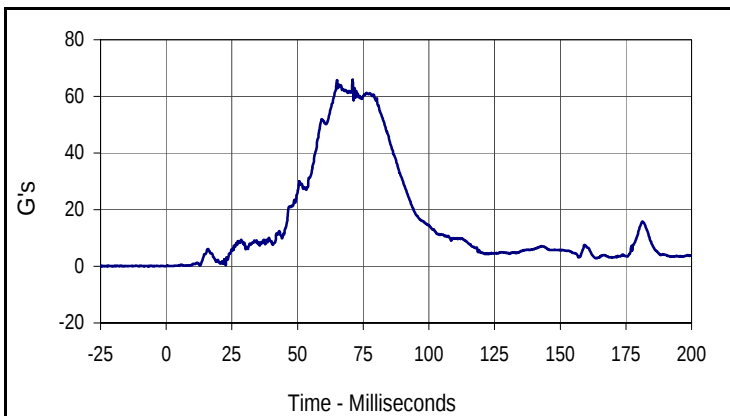
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Driver Head Primary X			
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Max	Time	Min	Time
13.3	181.1	-65.9	71.0



Curve Description			
Driver Head Primary Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
4.5	82.1	-10.9	182.8



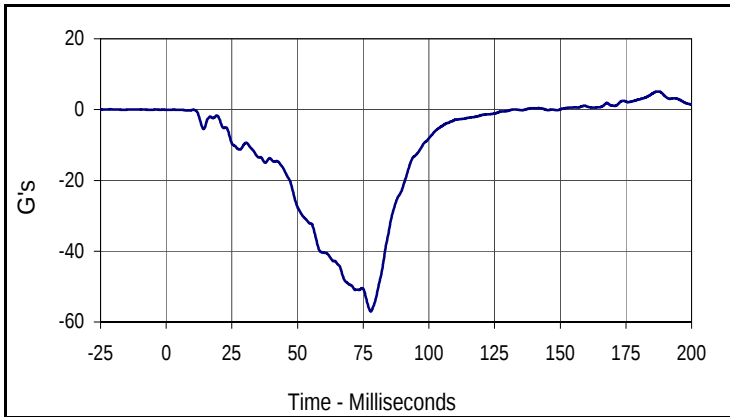
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Max	Time	Min	Time
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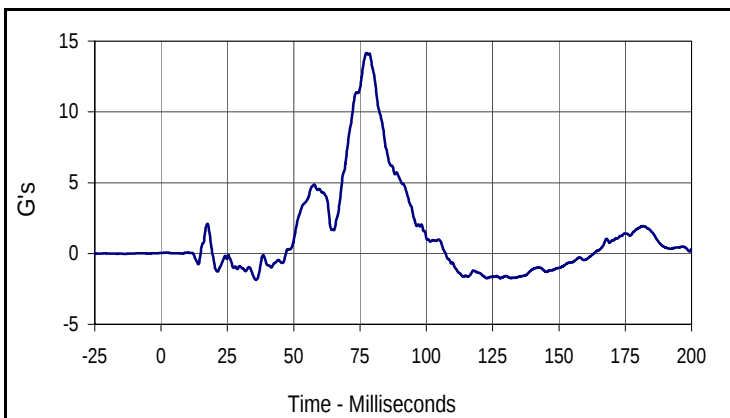
Curve Description			
Driver Head Resultant Primary			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
66.0	71.0	0.1	1.8

Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

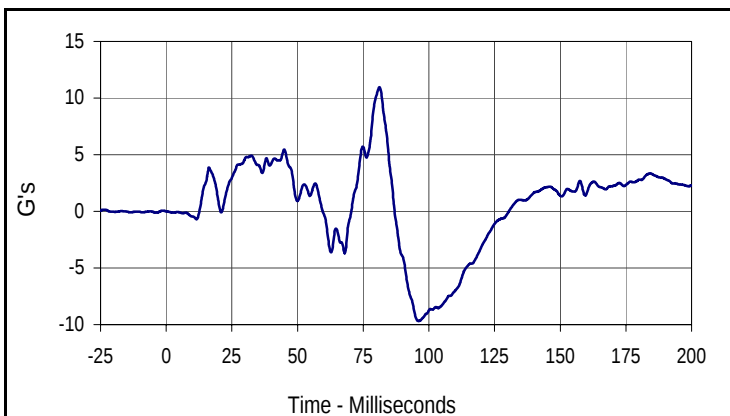
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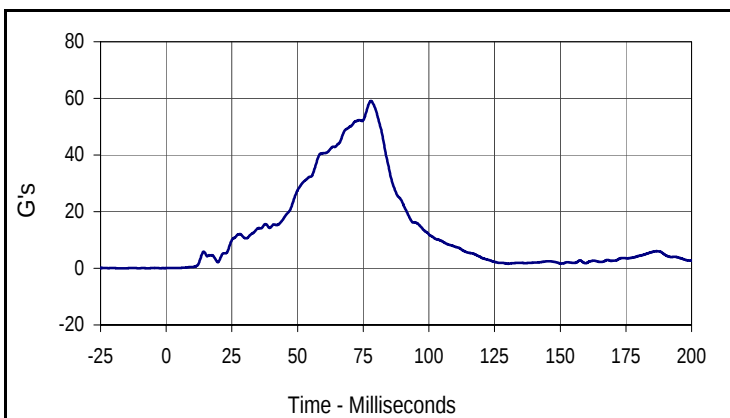
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Max	Time	Min	Time
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Driver Chest Primary Y			
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005	FIL	180	G's
Max	Time	Min	Time
14.2	77.4	-1.9	35.8



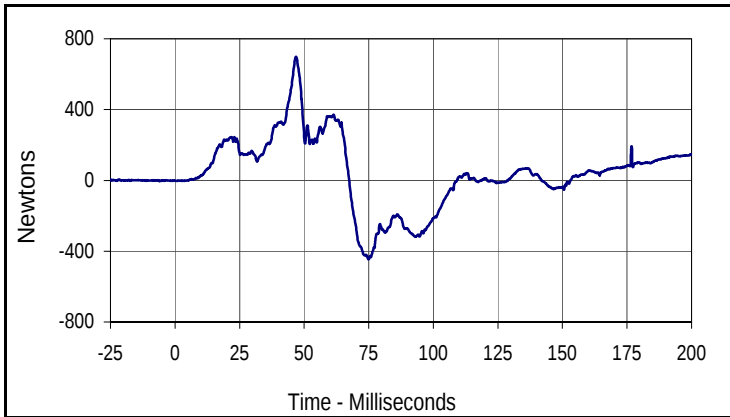
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Driver Chest Primary Z			
CURNO	Type	SAE Class	Units
006	FIL	180	G's
Max	Time	Min	Time
11.0	81.2	-9.7	96.1



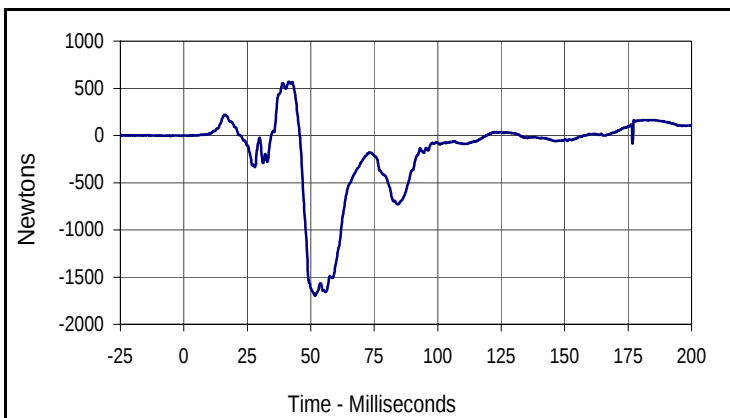
Curve Description			
Driver Chest Resultant Primary			
CURNO	Type	SAE Class	Units
004	RES	180	G's
Max	Time	Min	Time
59.1	77.9	0.1	0.0

Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07
 NHTSA No.: M80500



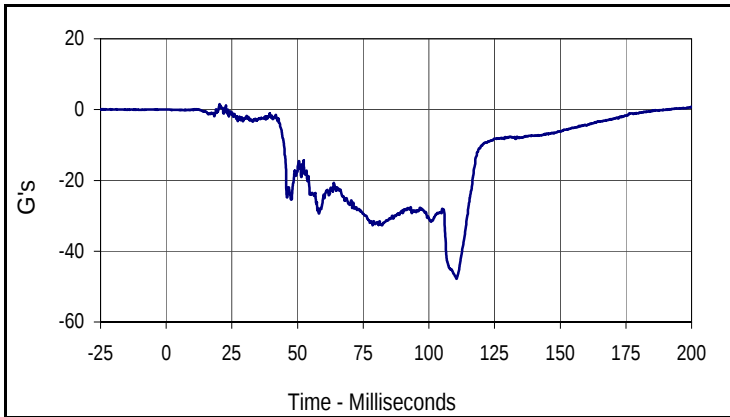
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Driver Left Femur Force Z			
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Max	Time	Min	Time
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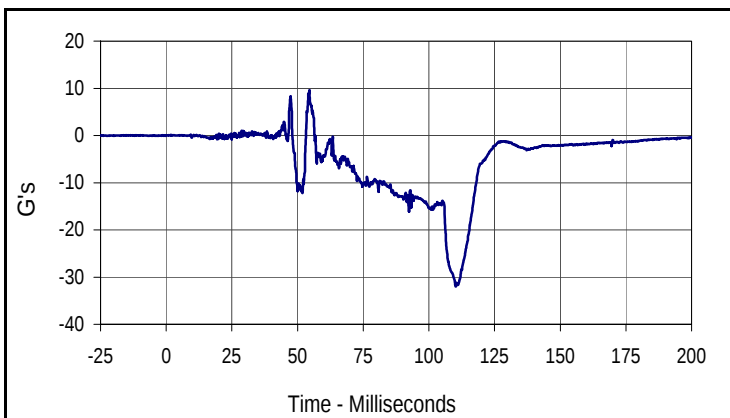
Curve Description			
Driver Right Femur Force Z			
CURNO	Type	SAE Class	Units
008	FIL	600	Newtons
Max	Time	Min	Time
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Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

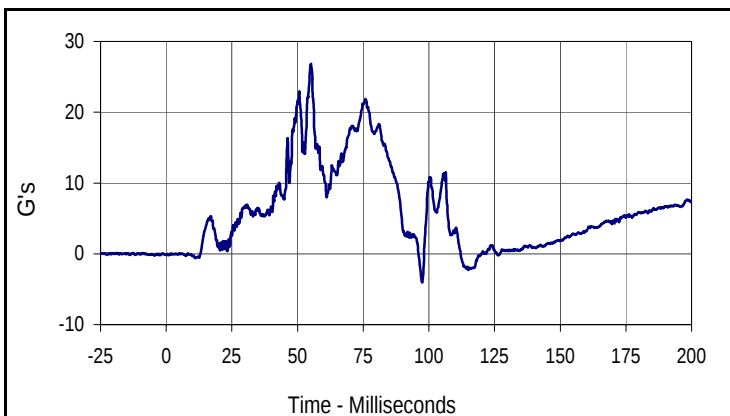
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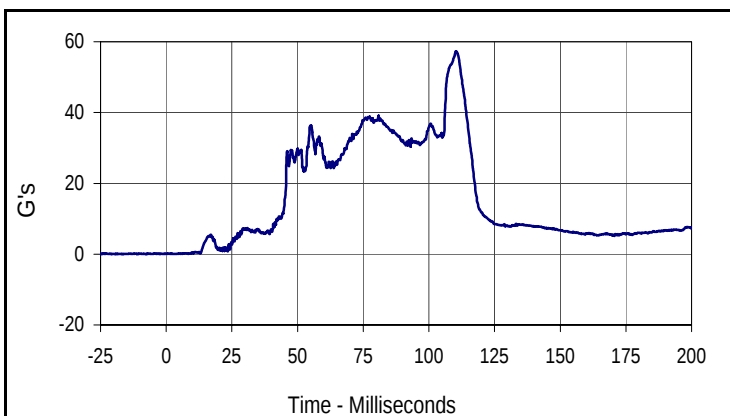
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Passenger Head Primary X			
CURNO	Type	SAE Class	Units
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Max	Time	Min	Time
1.5	20.3	-47.8	110.6



Curve Description			
Passenger Head Primary Y			
CURNO	Type	SAE Class	Units
010	FIL	1000	G's
Max	Time	Min	Time
9.6	54.5	-32.0	110.2



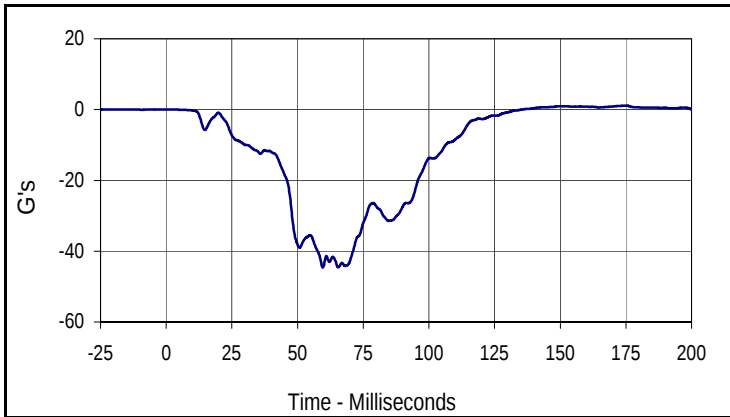
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Max	Time	Min	Time
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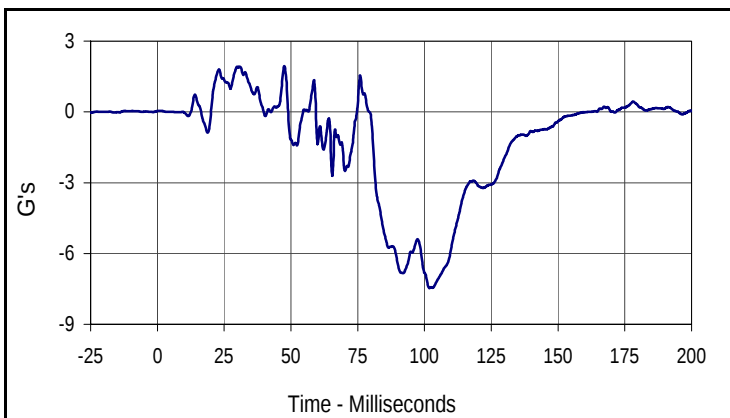
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Passenger Head Resultant Primary			
CURNO	Type	SAE Class	Units
009	RES	1000	G's
Max	Time	Min	Time
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Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

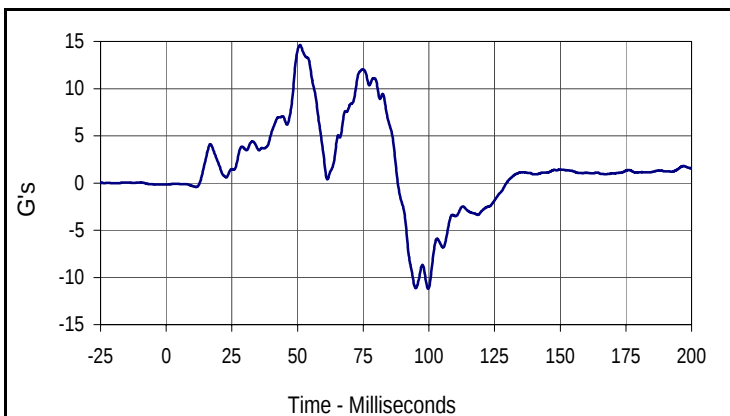
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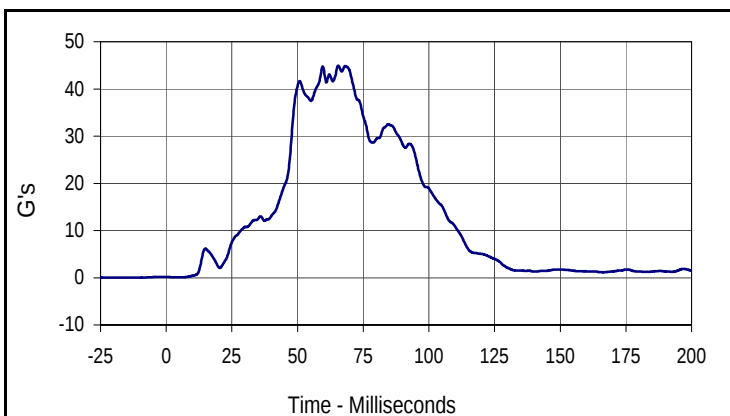
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012	FIL	180	G's
Max	Time	Min	Time
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Curve Description			
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013	FIL	180	G's
Max	Time	Min	Time
1.9	47.5	-7.5	101.8



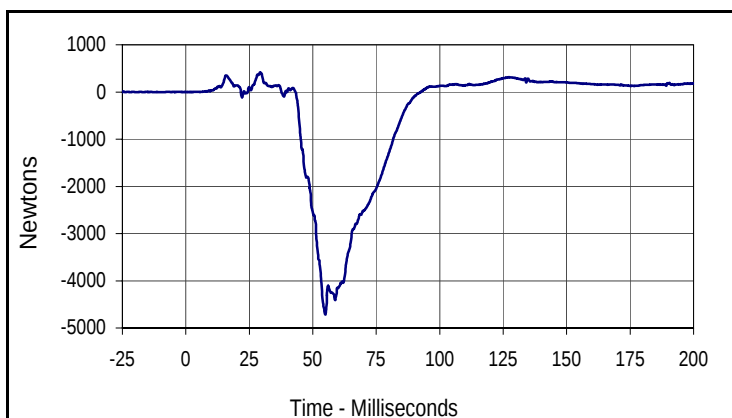
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Max	Time	Min	Time
14.6	50.9	-11.2	99.7



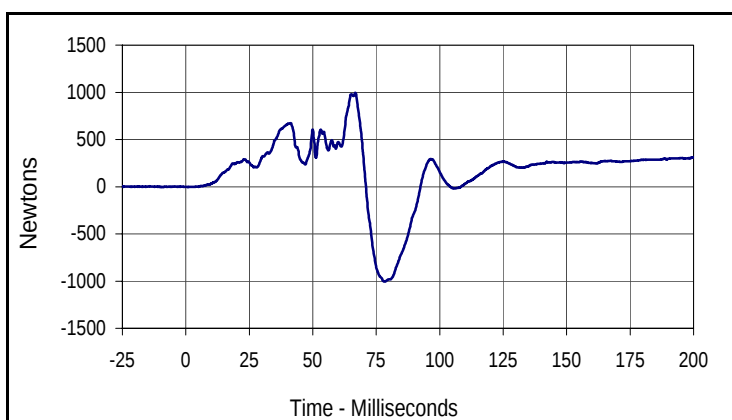
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Passenger Chest Resultant Primary			
CURNO	Type	SAE Class	Units
012	RES	180	G's
Max	Time	Min	Time
44.9	65.5	0.1	3.1

Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07
 NHTSA No.: M80500



Curve Description			
Passenger Left Femur Force Z			
CURNO	Type	SAE Class	Units
015	FIL	600	Newtons
Max	Time	Min	Time
418.2	29.3	-4717.3	55.0



Curve Description			
Passenger Right Femur Force Z			
CURNO	Type	SAE Class	Units
016	FIL	600	Newtons
Max	Time	Min	Time
994.6	66.7	-1006.2	78.5

APPENDIX C
DUMMY CALIBRATION DATA

Test Program: Hybrid III 50th Percentile Male Head Drop Test

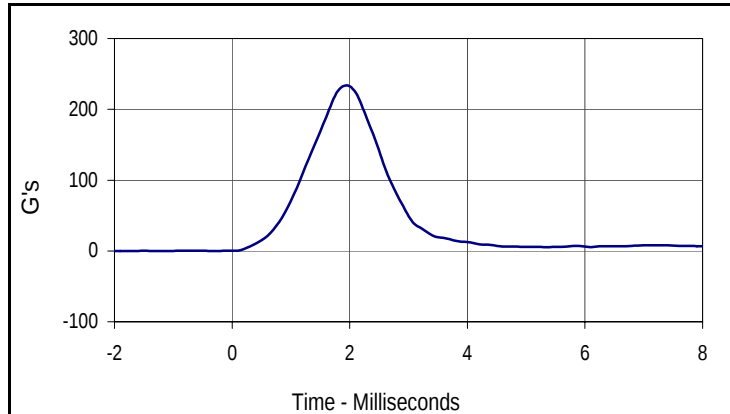
Test Date: 10/3/07

ATD Serial No.: 034

Test I.D.: HD10E



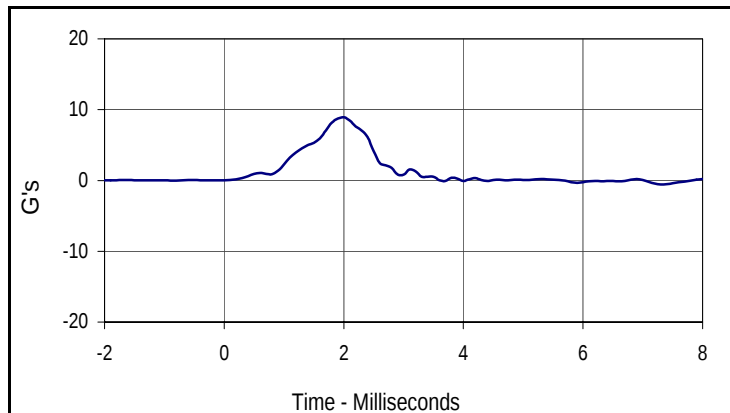
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	233.1	Pass
Peak Lateral Acceleration	G's	≤15.0	8.9	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description

Head Resultant

CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
233.1	1.9	0.0	-1.3



Curve Description

Head Y

CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
8.9	2.0	-0.3	5.9

Test Program: Hybrid III 50th Percentile Male Thorax Impact Test

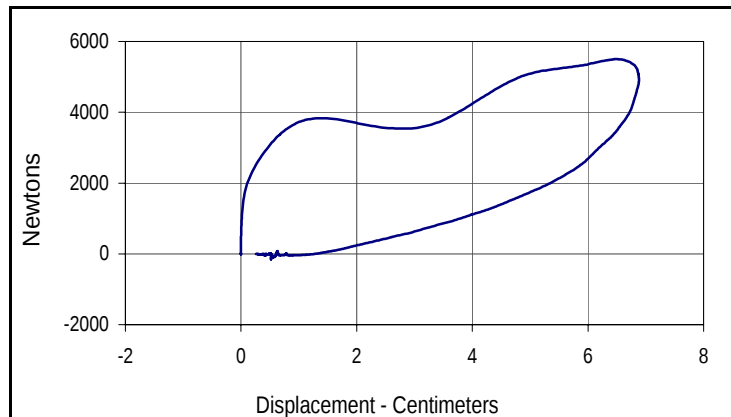
Test Date: 10/3/07

ATD Serial No.: 034

Test I.D.: CH10E



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	6.58 to 6.82	6.66	Pass
Peak Probe Force	Newtons	5159 to 5893	5500	Pass
Peak Sternum Deflection	CM	6.35 to 7.26	6.88	Pass
Internal Hysteresis	%	69 to 85	72.2	Pass
Overall Test Results				Pass



Curve Description			
Probe Force vs. Chest Deflection			
CURNO	Type	SAE Class	Hysteresis
001	FIL	180	72.2
Peak Probe Force		Peak Chest Deflection	
5500		6.88	

Test Program: Hybrid III 50th Percentile Male Neck Flexion Test

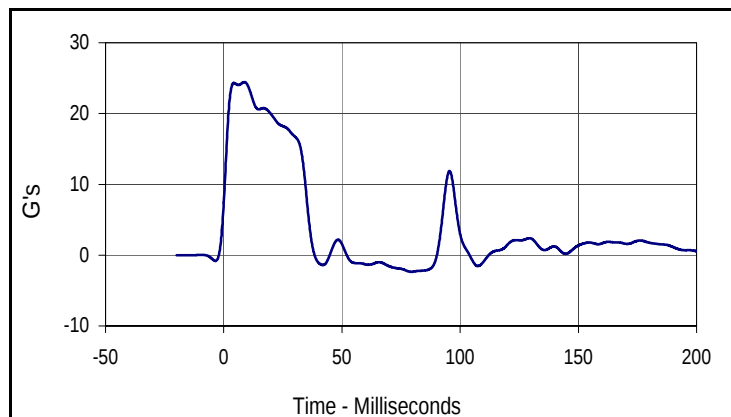
Test Date: 10/3/07

ATD Serial No.: 034

Test I.D.: NF10E



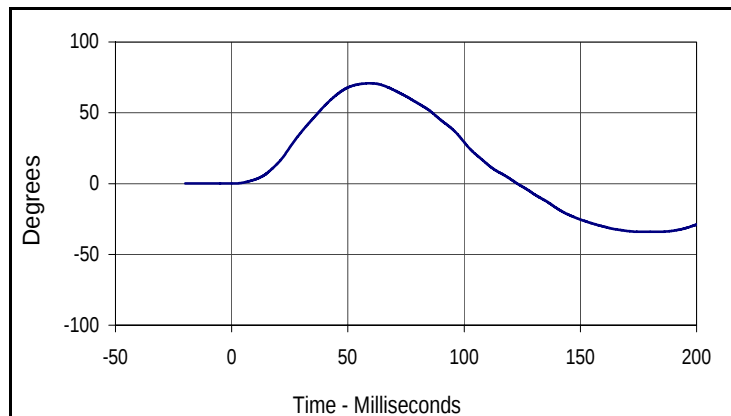
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.04	Pass
Pendulum Deceleration	10 Msec.	G's	22.5 to 27.5	24.1	Pass
	20 Msec.	G's	17.6 to 22.6	19.9	Pass
	30 Msec.	G's	12.5 to 18.5	16.8	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 29.0	16.8	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	34.0 to 42.0	36	Pass
Maximum "D" Plane Rotation	Max	Degrees	64.0 to 78.0	70.8	Pass
	Time	Msec.	57.0 to 64.0	59.4	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	113.0 to 128.0	122.9	Pass
Moment About Occ. Condyle	Max	Nm	84.1 to 108.5	84.7	Pass
	Time	Msec.	47.0 to 58.0	48.0	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	97.0 to 107.0	97.6	Pass
Overall Test Results					Pass



Curve Description

Pendulum Deceleration

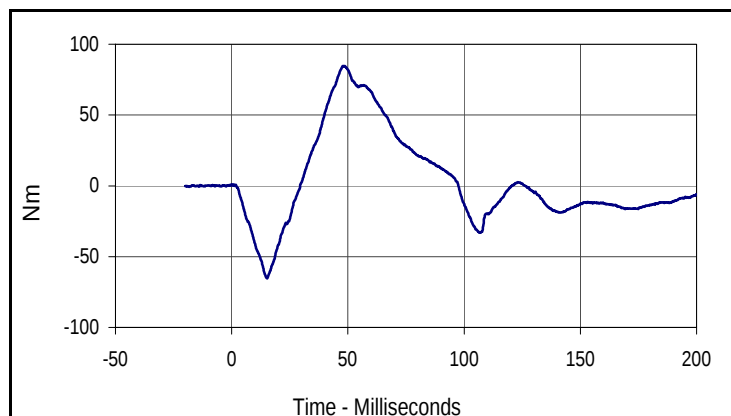
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
24.4	8.7	-2.4	79.4



Curve Description

"D" Plane Rotation

CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
70.8	59.4	-34.1	177.0



Curve Description

Moment About Occipital Condyle

CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
84.7	48.0	-65.3	15.2

Test Program: Hybrid III 50th Percentile Male Neck Extension Test

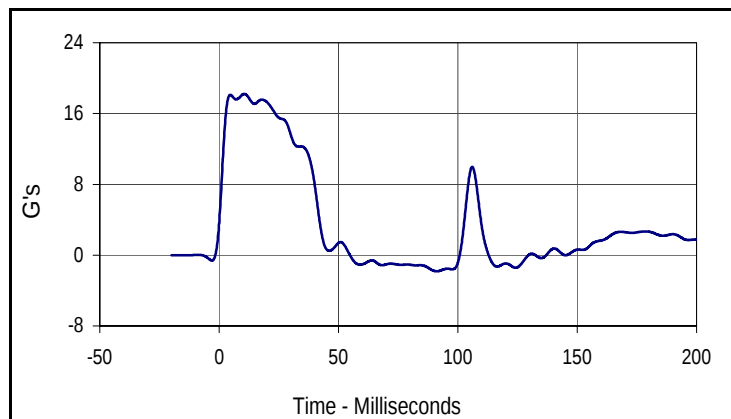
Test Date: 10/3/07

ATD Serial No.: 034

Test I.D.: NE10E



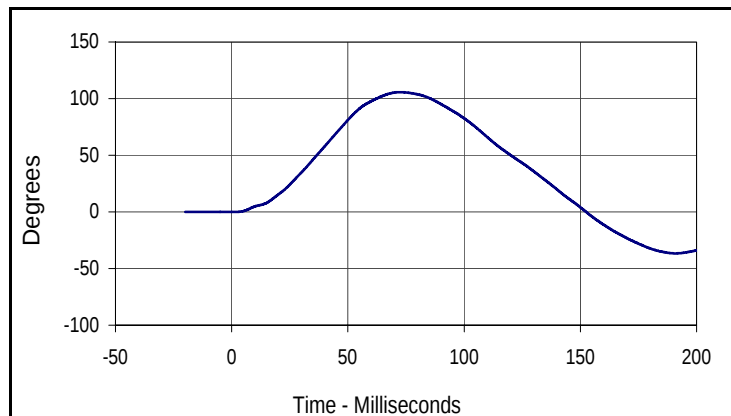
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.94 to 6.19	6.16	Pass
Pendulum Deceleration	10 Msec.	G's	17.2 to 21.2	18.2	Pass
	20 Msec.	G's	14.0 to 19.0	17.3	Pass
	30 Msec.	G's	11.0 to 16.0	13.6	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 22.0	13.6	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	38.0 to 46.0	41.5	Pass
Maximum "D" Plane Rotation	Max	Degrees	81.0 to 106.0	105.7	Pass
	Time	Msec.	72.0 to 82.0	72.4	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	147.0 to 174.0	152.5	Pass
Moment About Occ. Condyle	Max	Nm	-52.9 to- 79.9	-78.7	Pass
	Time	Msec.	65.0 to 79.0	67.0	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	120.0 to 148.0	140.9	Pass
Overall Test Results					Pass



Curve Description

Pendulum Deceleration

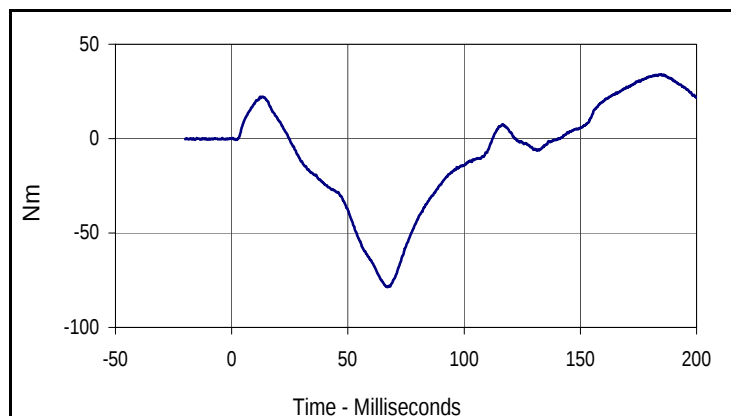
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
18.2	10.5	-1.8	91.2



Curve Description

"D" Plane Rotation

CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
105.7	72.4	-36.6	190.9



Curve Description

Moment About Occipital Condyle

CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
34.0	184.8	-78.7	67.0

Test Program: Hybrid III 50th Percentile Male Knee Impact Test

Test Date: 10/3/07

ATD Serial No.: 034

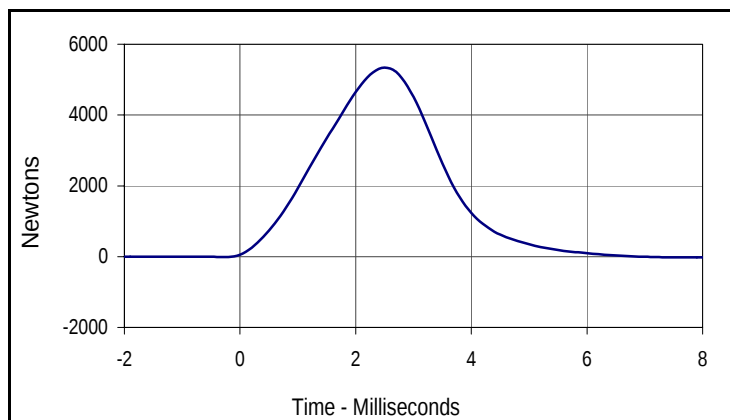
Test I.D.: LK10E , RK10E

**Left Knee**

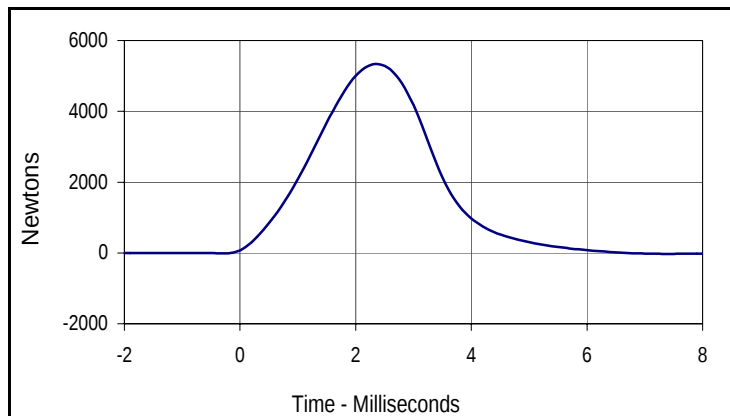
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5341	Pass
Overall Test Results				Pass

Right Knee

Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5335	Pass
Overall Test Results				Pass

**Curve Description****Left Knee Probe Force**

CURNO	Type	SAE Class	Units
001	FIL	600	Newtons
Max	Time	Min	Time
5341.5	2.5	-24.4	9.5

**Curve Description****Right Knee Probe Force**

CURNO	Type	SAE Class	Units
002	FIL	600	Newtons
Max	Time	Min	Time
5335.1	2.4	-26.7	7.4

Test Program: Hybrid III 50th Percentile Male External Measurements

Test Date: 10/3/07

ATD Serial No.: 034

Test I.D.: N/A



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	879 to 889	884	Pass
B - Shoulder pivot height	mm	505 to 521	510	Pass
C - "H" point height	mm	84 to 89	88	Pass
D - "H" point from seat back	mm	135 to 140	138	Pass
E - Shoulder pivot from back	mm	84 to 94	90	Pass
F - Thigh clearance	mm	140 to 155	147	Pass
G - Elbow back to wrist pivot	mm	290 to 305	296	Pass
H - Skull cap to back line	mm	41 to 46	45	Pass
I - Shoulder to elbow length	mm	330 to 345	336	Pass
J - Elbow rest height	mm	190 to 211	197	Pass
K - Buttock to knee length	mm	579 to 604	581	Pass
L - Popliteal length	mm	429 to 455	439	Pass
M - Knee pivot height	mm	485 to 500	492	Pass
N - Buttock popliteal length	mm	452 to 477	470	Pass
O - Chest depth	mm	213 to 229	225	Pass
P - Foot length	mm	251 to 267	260	Pass
V - Shoulder breadth	mm	422 to 437	424	Pass
W - Foot breadth	mm	91 to 107	100	Pass
Y - Chest circumference	mm	970 to 1001	982	Pass
Z - Waist circumference	mm	836 to 866	841	Pass
AA - Location for chest circumference	mm	429 to 434	430	Pass
BB - Location for waist circumference	mm	226 to 231	229	Pass
Overall Test Results				Pass

Test Program: Hybrid III 50th Percentile Male Head Drop Test

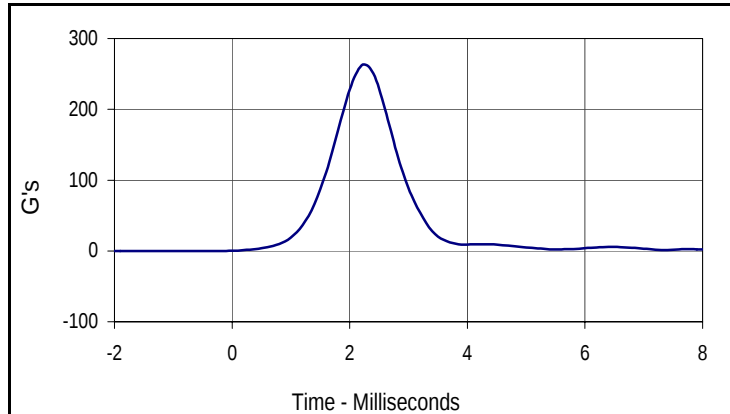
Test Date: 10/3/07

ATD Serial No.: 035

Test I.D.: HD10F



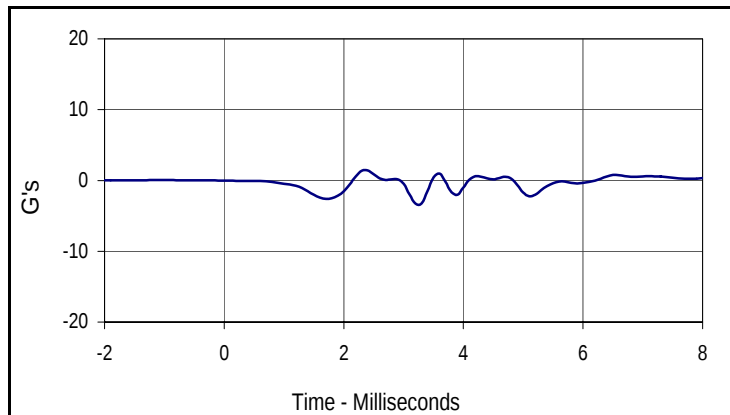
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	262.3	Pass
Peak Lateral Acceleration	G's	≤15.0	3.3	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description

Head Resultant

CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
262.3	2.3	0.0	-0.1



Curve Description

Head Y

CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
1.4	2.4	-3.3	3.2

Test Program: Hybrid III 50th Percentile Male Thorax Impact Test

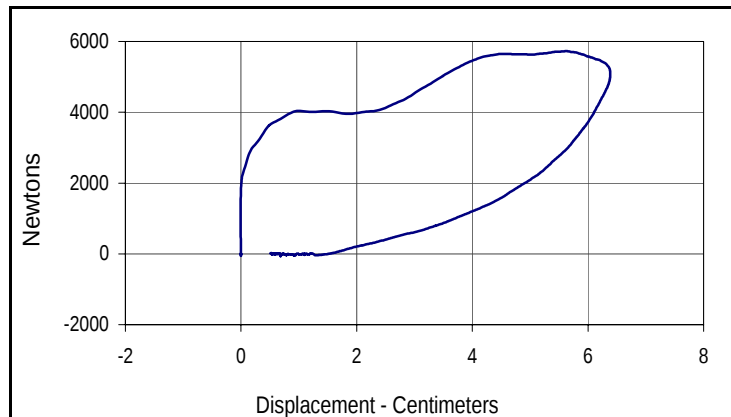
Test Date: 10/3/07

ATD Serial No.: 035

Test I.D.: CH10F



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	Newtons	5159 to 5893	5725	Pass
Peak Sternum Deflection	CM	6.35 to 7.26	6.39	Pass
Internal Hysteresis	%	69 to 85	75.4	Pass
Overall Test Results				Pass



Curve Description			
Probe Force vs. Chest Deflection			
CURNO	Type	SAE Class	Hysteresis
001	FIL	180	75.4
Peak Probe Force		Peak Chest Deflection	
5725		6.39	

Test Program: Hybrid III 50th Percentile Male Neck Flexion Test

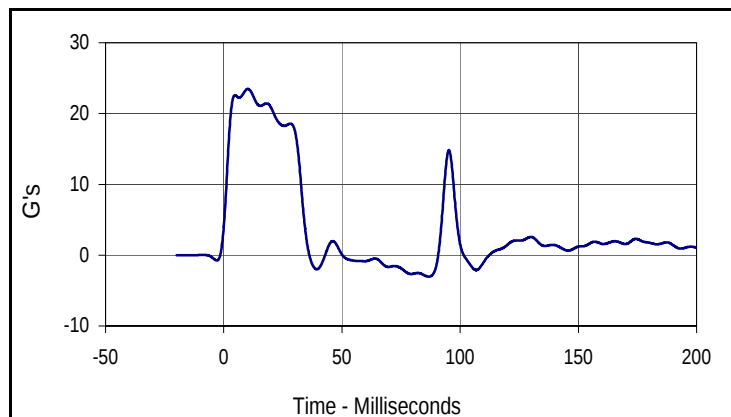
Test Date: 10/3/07

ATD Serial No.: 035

Test I.D.: NF10F



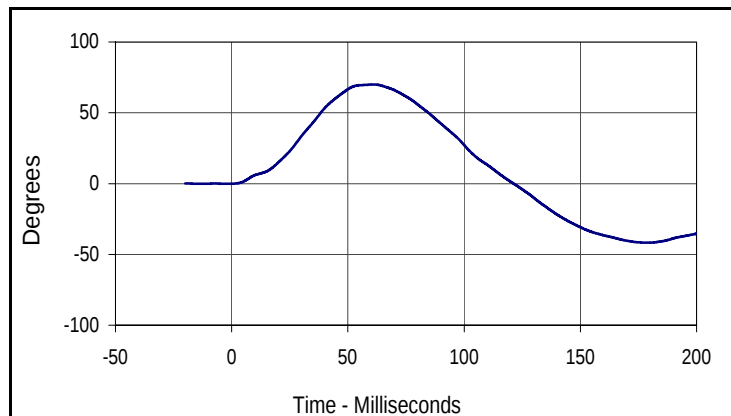
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.08	Pass
Pendulum Deceleration	10 Msec.	G's	22.5 to 27.5	23.5	Pass
	20 Msec.	G's	17.6 to 22.6	20.8	Pass
	30 Msec.	G's	12.5 to 18.5	17.7	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 29.0	17.7	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	34.0 to 42.0	34.1	Pass
Maximum "D" Plane Rotation	Max	Degrees	64.0 to 78.0	70.0	Pass
	Time	Msec.	57.0 to 64.0	61.0	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	113.0 to 128.0	121.3	Pass
Moment About Occ. Condyle	Max	Nm	84.1 to 108.5	87.2	Pass
	Time	Msec.	47.0 to 58.0	47.4	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	97.0 to 107.0	97.9	Pass
Overall Test Results					Pass



Curve Description

Pendulum Deceleration

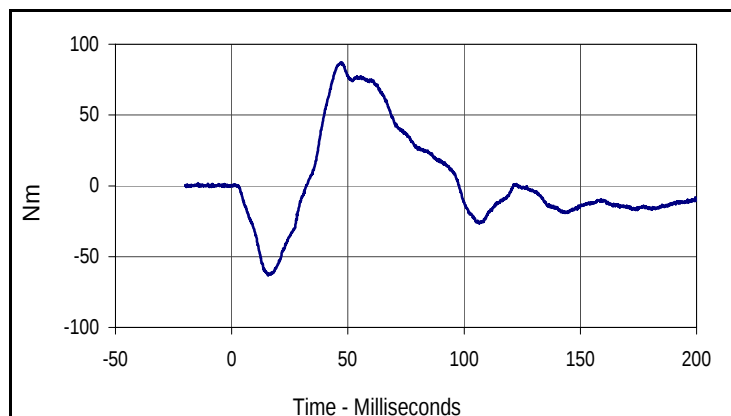
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
23.5	10.1	-3.0	86.7



Curve Description

"D" Plane Rotation

CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
70.0	61.0	-41.8	179.2



Curve Description

Moment About Occipital Condyle

CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
87.2	47.4	-63.2	15.7

Test Program: Hybrid III 50th Percentile Male Neck Extension Test

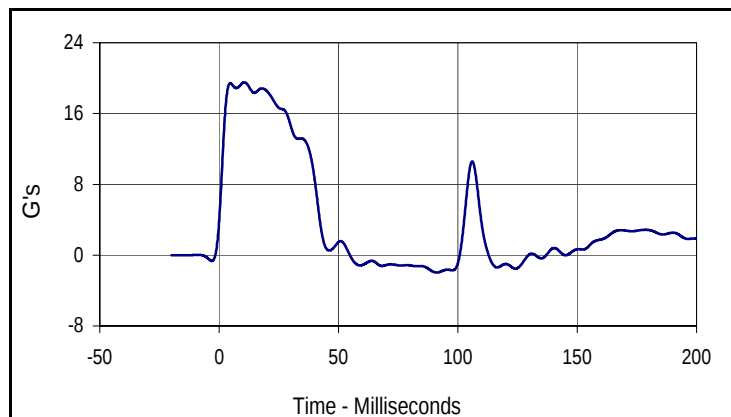
Test Date: 10/3/07

ATD Serial No.: 035

Test I.D.: NE10F



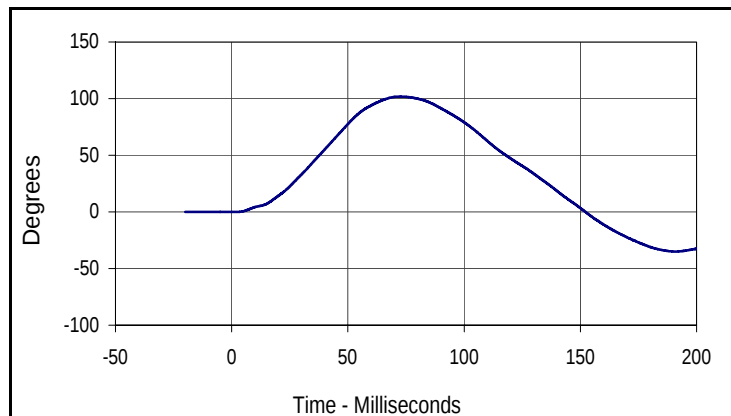
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.94 to 6.19	6.18	Pass
Pendulum Deceleration	10 Msec.	G's	17.2 to 21.2	19.5	Pass
	20 Msec.	G's	14.0 to 19.0	18.6	Pass
	30 Msec.	G's	11.0 to 16.0	14.6	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 22.0	14.6	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	38.0 to 46.0	41.7	Pass
Maximum "D" Plane Rotation	Max	Degrees	81.0 to 106.0	101.8	Pass
	Time	Msec.	72.0 to 82.0	72.3	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	147.0 to 174.0	152.2	Pass
Moment About Occ. Condyle	Max	Nm	-52.9 to- 79.9	-77.0	Pass
	Time	Msec.	65.0 to 79.0	67.0	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	120.0 to 148.0	140.8	Pass
Overall Test Results					Pass



Curve Description

Pendulum Deceleration

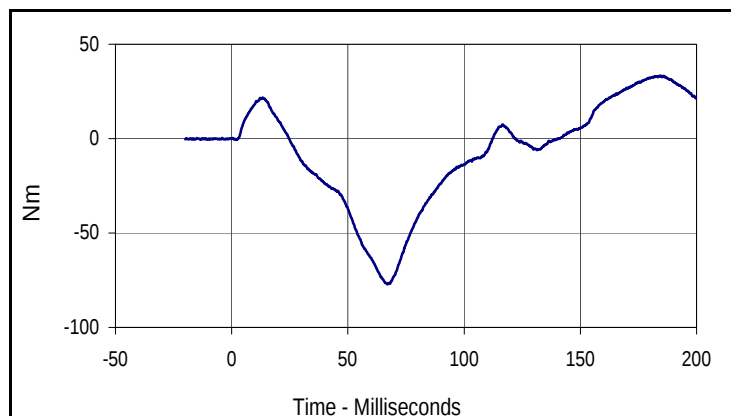
CURNO	Type	SAE Class	Units
001	FIL	60	G's
Max	Time	Min	Time
19.5	10.5	-2.0	91.2



Curve Description

"D" Plane Rotation

CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
101.8	72.3	-35.0	190.8



Curve Description

Moment About Occipital Condyle

CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
33.3	184.8	-77.0	67.0

Test Program: Hybrid III 50th Percentile Male Knee Impact Test

Test Date: 10/3/07

ATD Serial No.: 035

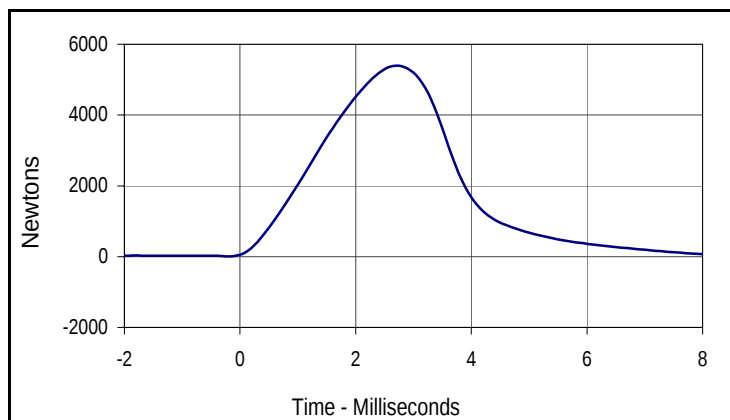
Test I.D.: LK10F , RK10F

**Left Knee**

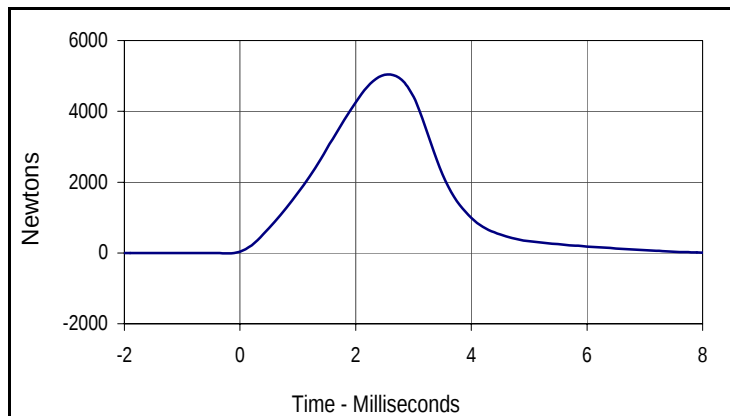
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	Newtons	4715 to 5782	5393	Pass
Overall Test Results				Pass

Right Knee

Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5044	Pass
Overall Test Results				Pass

**Curve Description****Left Knee Probe Force**

CURNO	Type	SAE Class	Units
001	FIL	600	Newtons
Max	Time	Min	Time
5393.0	2.7	3.7	9.7

**Curve Description****Right Knee Probe Force**

CURNO	Type	SAE Class	Units
002	FIL	600	Newtons
Max	Time	Min	Time
5043.6	2.6	-13.6	-0.2

Test Program: Hybrid III 50th Percentile Male External Measurements

Test Date: 10/3/07

ATD Serial No.: 035

Test I.D.: N/A



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	879 to 889	887	Pass
B - Shoulder pivot height	mm	505 to 521	511	Pass
C - "H" point height	mm	84 to 89	85	Pass
D - "H" point from seat back	mm	135 to 140	139	Pass
E - Shoulder pivot from back	mm	84 to 94	89	Pass
F - Thigh clearance	mm	140 to 155	144	Pass
G - Elbow back to wrist pivot	mm	290 to 305	293	Pass
H - Skull cap to back line	mm	41 to 46	42	Pass
I - Shoulder to elbow length	mm	330 to 345	340	Pass
J - Elbow rest height	mm	190 to 211	200	Pass
K - Buttock to knee length	mm	579 to 604	582	Pass
L - Popliteal length	mm	429 to 455	440	Pass
M - Knee pivot height	mm	485 to 500	490	Pass
N - Buttock popliteal length	mm	452 to 477	460	Pass
O - Chest depth	mm	213 to 229	221	Pass
P - Foot length	mm	251 to 267	257	Pass
V - Shoulder breadth	mm	422 to 437	431	Pass
W - Foot breadth	mm	91 to 107	99	Pass
Y - Chest circumference	mm	970 to 1001	985	Pass
Z - Waist circumference	mm	836 to 866	855	Pass
AA - Location for chest circumference	mm	429 to 434	432	Pass
BB - Location for waist circumference	mm	226 to 231	227	Pass
Overall Test Results				Pass

Test Program: Dummy Damage Checklist
 ATD Serial No.: 034

Test Date: 10/3/07
 Test I.D.: N/A



GENERAL	DAMAGED	OK
Outer skin on entire dummy		X
Head ballast secure		X
Gashes, rips, general appearance, etc.		X
Neck-Broken or cracks in rubber		X
Check that upper neck bracket is firmly attached to lwr neck bracket		X
Three rubber bumpers in place		X
Spine- Broken or cracks in rubber		X
Check for looseness at the condyle joint		X
Nodding blocks- cracked or out of position		X
Ribs- Check all ribs and rib supports for damage (bent or broken)		X
Check damping material or separation or cracks		X
OTHER		
CHEST DISPLACEMENT ASSEMBLY		
Bent shaft		X
Slider arm riding correctly, in track		X
TRANSDUCER LEADS		
Torn cables		X
ACCELEROMETER MOUNTINGS		
Check for secure mounting		X
KNEES		
Check outer skin, insert and casting (without removing insert)		X
Knee sliders - Wires intact		X
Knee sliders- Rubber returned to "at rest position"		X
LIMBS		
Check for normal movement and adjustment		X
PELVIS		
Inspect for breakage, especially at iliac crest		X

Comments on repair or replacement parts:

Test Program: Dummy Damage Checklist
 ATD Serial No.: 035

Test Date: 10/3/07
 Test I.D.: N/A



GENERAL	DAMAGED	OK
Outer skin on entire dummy		X
Head ballast secure		X
Gashes, rips, general appearance, etc.		X
Neck-Broken or cracks in rubber		X
Check that upper neck bracket is firmly attached to lwr neck bracket		X
Three rubber bumpers in place		X
Spine- Broken or cracks in rubber		X
Check for looseness at the condyle joint		X
Nodding blocks- cracked or out of position		X
Ribs- Check all ribs and rib supports for damage (bent or broken)		X
Check damping material or separation or cracks		X
OTHER		
CHEST DISPLACEMENT ASSEMBLY		
Bent shaft		X
Slider arm riding correctly, in track		X
TRANSDUCER LEADS		
Torn cables		X
ACCELEROMETER MOUNTINGS		
Check for secure mounting		X
KNEES		
Check outer skin, insert and casting (without removing insert)		X
Knee sliders - Wires intact		X
Knee sliders- Rubber returned to "at rest position"		X
LIMBS		
Check for normal movement and adjustment		X
PELVIS		
Inspect for breakage, especially at iliac crest		X

Comments on repair or replacement parts:

APPENDIX D
CHILD RESTRAINT SYSTEM

**NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST**

**BAYERISCHE MOTORENWERKE
2008 BMW 528i
4-DOOR SEDAN**

NHTSA NUMBER: M80500

**PREPARED BY:
KARCO ENGINEERING, LLC
9270 HOLLY ROAD
ADELANTO, CALIFORNIA 92301**



OCTOBER 10, 2007

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NVS-111
1200 NEW JERSEY AVE, 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-00027.

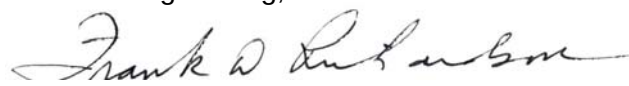
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Prepared by: 
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Date: October 10, 2007

Reviewed by: 
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KARCO Engineering, LLC

Date: October 10, 2007

Approved by: 
Mr. Frank D. Richardson, Program Manager
KARCO Engineering, LLC

Date: October 10, 2007

FINAL REPORT ACCEPTED BY:

Manager, New Car Assessment Program

Date of Acceptance

COTR, NCAP Frontal Impact Program

Date of Acceptance

Technical Report Documentation Page

1. Report No. TR-P28001-06-NC		2. Government Accession No.		3. Recipients Catalog No.	
4. Title and Subtitle Final Report of one (2) Graco Snugride CRS NHTSA NO. M80500				5. Report Date October 10, 2007	
				6. Performing Organization Code KAR	
7. Authors Mr. Kelsey A. Chiu, Project Engineer, Karco Mr. Frank Richardson, Program Manager, Karco				8. Performing Organization Report No. TR-P28001-06-NC	
9. Performing Organization Name and Address Karco Engineering, LLC 9270 Holly Rd. Adelanto, CA, 92301				10. Work Unit No.	
				11. Contract or Grant No. DTNH22-06-D-00027	
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Rulemaking Office of Crashworthiness Standards Mail Code NVS-111 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C 20590				13. Type of Report and Period Covered Final Test Report Base Year	
				14. Sponsoring Agency Code DOT/NHTSA/NRM/OCS	
15. Supplementary Notes					
16. Abstract A frontal impact test was conducted on two (2) Graco Snugride CRSs in conjunction with frontal barrier impact NCAP testing on a 2008 BMW 528i 4-Door Sedan and in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the determination of CRS crashworthiness. This test was conducted at Karco Engineering, LLC on October 10, 2007.					
Measurement Description		Units	Threshold	Left Rear (P4)	Right Rear (P3)
Head Injury Criteria (HIC15)		N/A	390	422.6	385.1
3 msec. Chest Clip		G's	50	49.8	51.5
17. Key Words New Car Assessment Program (Frontal NCAP) Frontal Barrier Impact Test Final Report of a Graco Snugride CRS				18. Distribution of Statement Copies of this report available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590	
19. Security Classification (this report) Unclassified		20. Security Classification (this page) Unclassified		21. No. of Pages 69	22. Price

Form DOT F1700.7 (8-72)

TR-P28001-06-NC

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D3	CRABI Response and CRS Data Traces	D3-1 to D3-4
D4	CRABI Calibration Information	D4-1 to D4-12
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2	Vehicle Parameter Data	D1-3
3	CRABI Positioning in Vehicle	D1-4
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SECTION D1

PURPOSE AND SUMMARY OF TEST M80500

The purpose of this test is to obtain CRS performance data during 35 mph (56.3 km/h) frontal barrier impact NCAP test.

The frontal barrier impact NCAP test was conducted in accordance with the Office of Crashworthiness Standards (OCS) NCAP Laboratory Test Procedure.

SUMMARY

Two 12-month old CRABI's (P3 & P4) were instrumented with head, chest, and six-axis upper neck load cells. Tri-axial accelerometers were installed on both CRS's and the CRS bases.

The left rear (Serial No. 022) and right rear (Serial No. 017) CRABI's were calibrated prior to this test. CRABI calibration information is found in Section D-4.

CHILD DUMMY VALUES		
Location	HIC15 Values	3 Msec. Chest Clip
CRABI (P3)	385.1	51.5
CRABI (P4)	422.6	49.8

DATA SHEET NO.1
CRASH TEST SUMMARY

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07

CHILD RESTRAINT SYSTEM INFORMATION

Description	Position #3 CRS	Position #4 CRS
Manufacturer	Graco	Graco
Model Name	Snugride	Snugride
Serial No.	8645HEM3	8645HEM3
Type	Infant	Infant
Forward/Rearward	Rearward	Rearward

VISIBLE DUMMY CONTACT POINTS

Description	Position #3 CRS	Position #4 CRS
Head Contact	None	None
Chest Contact	None	None
Abdomen Contact	None	None
Left Knee Contact	None	None
Right Knee Contact	None	None
Left Toe Contact	None	None
Right Toe Contact	None	None

POST-TEST DOOR OPENINGS

Description	Position #3 CRS	Position #4 CRS
Right Rear Door	Door remained closed and latched, opened without tools.	Door remained closed and latched, opened without tools

CAMERA COVERAGE

Description	Standard
High Speed	4
Real Time	0
Total	4

DATA CHANNELS

CRABI (P3 & P4) Sensors	26
Belt Sensors	4
CRS Sensors	12
Total	42

DATA SHEET NO.2**VEHICLE PARAMETER DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**TEST VEHICLE WEIGHTS**

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	398	416	815	417	542	959
Right	kg	407	418	826	425	540	965
Ratio	%	49.1%	50.9%	100.0%	43.8%	56.2%	100.0%
Totals	kg	806	835	1640	843	1081	1924

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1640
Weight of 2 P572 ATD's	kg	152
Rated Cargo/Luggage Wt. (RCLW)	kg	136
Calculated Vehicle Target Wt. (TVTW)	kg	1928

DATA SHEET NO.3

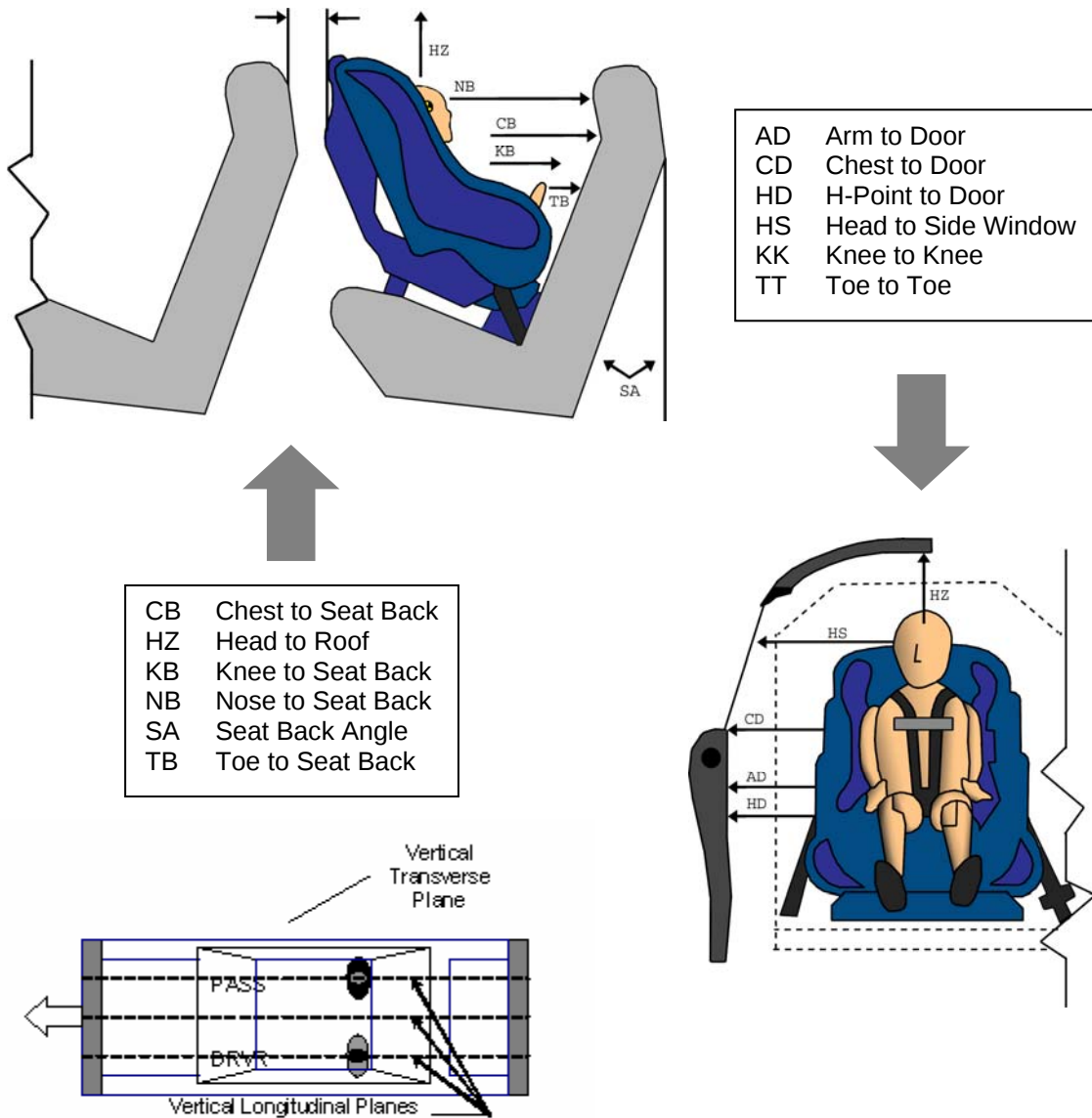
CRABI POSITIONING IN VEHICLE

Test Vehicle: 2008 BMW 528i 4-Door Sedan

NHTSA No.: M80500

Test Program: NHTSA 35mph NCAP

Test Date: 10/10/07



DUMMY MEASUREMENTS FOR REAR SEAT OCCUPANTS

DATA SHEET NO.3**CRABI POSITIONING IN VEHICLE...(CONTINUED)**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**CRABI POSITION MEASUREMENTS**

Code	Measurement	P3 (Passenger's Side)		P4 (Driver's Side)	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
SA	Seat Back Angle		13.2		17.0
HZ	Head to Roof (Z)	366		384	
CD	Chest to Door	398		394	
KK	Knee to Knee (Y)	112		120	
HS	Head to Side Window	435		432	
HD	H-Point to Door (Y)	328		308	
AD	Arm to Door	292		293	
NB	Nose to Seat Back	538		545	
CB	Chest to Seat Back	453		472	
FF	Foot to Foot	85		90	
KB-Left	Knee to Seat Back	210		220	
KB-Right	Knee to Seat Back	195		220	
TB-Left	Toe to Seat Back	65		70	
TB-Right	Toe to Seat Back	95		70	

DATA SHEET NO.4**CRS PERFORMANCE DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**CRS PERFORMANCE DATA**

Location	CRS (P4)		CRS (P3)	
	Damage	Post-Test	Damage	Post-Test
Upper Tether Strap				
Upper Tether Buckle				
Upper Tether Hook				
Veh. Upper Tether Anchor				
Lower Anchor Strap				
Lower Anchor Buckle				
Lower Anchor Hooks	No	None	No	None
Veh. Lower CRS Anchors	No	None	No	None
5-Point Harness Connections	No	None	No	None
Cracks on CRS	No	None	No	None
Fabric Tears on CRS	No	None	No	None
Vehicle Seat Structure	No	None	No	None
Vehicle Seat Fabric Tears	No	None	No	None

DATA SHEET NO. 5
CRS ACCELEROMETER LOCATIONS

Test Vehicle: 2008 BMW 528i 4-Door Sedan

Test Program: NHTSA 35mph NCAP

NHTSA No.: M80500

Test Date: 10/10/07

CRS ACCELEROMETER PRE-TEST LOCATIONS

Loc. No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	CRS (P4)	1925	-535	785
2	CRS Base (P4)	1855	455	665
3	CRS (P3)	1915	505	780
4	CRS Base (P3)	1840	525	665

Reference Planes: X=From Rear Surface of Vehicle, Y=Vehicle Centerline, Z=Ground Plane

DATA SHEET NO.6**CRS CAMERA LOCATIONS AND DATA**Test Vehicle: 2008 BMW 528i 4-Door SedanNHTSA No.: M80500Test Program: NHTSA 35mph NCAPTest Date: 10/10/07**CAMERA LOCATIONS**

No.	Camera View	Location(mm)			Angle (Deg.)	Film Plane to Head	Lens (mm)	Speed (fps)
		X	Y	Z				
1	Driver Side Upper CRS View	-3209	631	-1341	-2		12	1000
2	Passenger Side Upper CRS View	-3209	-631	-1341	2		12	1000

SECTION D2

PHOTOGRAPHS

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MODEL **8645HEM3**

NAME **SNUGRIDE**

Manufactured in 081607 10

GRACO CHILDREN'S PRODUCTS, INC.

EXTON, PA 19341 1-800-345-4109

Made in U.S.A.

PB-25777

Figure D2-1: Position 3 CRS Label



Figure D2-2: Pre-Test Frontal View of Position 3 CRS



Figure D2-3: Post-Test Frontal View of Position 3 CRS



Figure D2-4: Pre-Test Rear View of Position 3 CRS



Figure D2-5: Post-Test Rear View of Position 3 CRS



Figure D2-6: Pre-Test Right Side View of Position 3 CRS



Figure D2-7: Post-Test Right Side View of Position 3 CRS



Figure D2-8: Pre-Test Left Side View of Position 3 CRS



Figure D2-9: Post-Test Left Side View of Position 3 CRS



Figure D2-10: Pre-Test Position 3 Front View (Head and Seat Belt Position)



Figure D2-11: Post-Test Position 3 Front View (Head and Seat Belt Position)



Figure D2-12: Pre-Test Position 3 Front View (Seat Belt Position)



Figure D2-13: Post-Test Position 3 Front View (Seat Belt Position)



Figure D2-14: Pre-Test Position 3 Right Side View



Figure D2-15: Post-Test Position 3 Right Side View



Figure D2-16: Pre-Test Position 3 Right Side View (Through Window)



Figure D2-17: Post-Test Position 3 Right Side View (Through Window)



Figure D2-18: Post-Test Position 3 Dummy Legs

MODEL **8645HEM3**

NAME **SNUGRIDE**

Manufactured in 081607 10

GRACO CHILDREN'S PRODUCTS, INC.

EXTON, PA 19341 1-800-345-4109

Made in U.S.A.

PB-25777

Figure D2-19: Position 4 CRS Label



Figure D2-20: Pre-Test Frontal View of Position 4 CRS



Figure D2-21: Post-Test Frontal View of Position 4 CRS



Figure D2-22: Pre-Test Rear View of Position 4 CRS



Figure D2-23: Post-Test Rear View of Position 4 CRS



Figure D2-24: Pre-Test Right Side View of Position 4 CRS



Figure D2-25: Post-Test Right Side View of Position 4 CRS



Figure D2-26: Pre-Test Left Side View of Position 4 CRS



Figure D2-27: Post-Test Left Side View of Position 4 CRS



Figure D2-28: Pre-Test Position 4 Front View (Head & Seat Belt Position)



Figure D2-29: Post-Test Position 4 Front View (Head & Seat Belt Position)



Figure D2-30: Pre-Test Position 4 Front View (Seat Belt Position)



Figure D2-31: Post-Test Position 4 Front View (Seat Belt Position)



Figure D2-32: Pre-Test Position 4 Left Side View



Figure D2-33: Post-Test Position 4 Left Side View



Figure D2-34: Pre-Test Position 4 Left Side View



Figure D2-35: Post-Test Position 4 Left Side View



Figure D2-36: Post-Test Position 4 Dummy Legs

SECTION D3

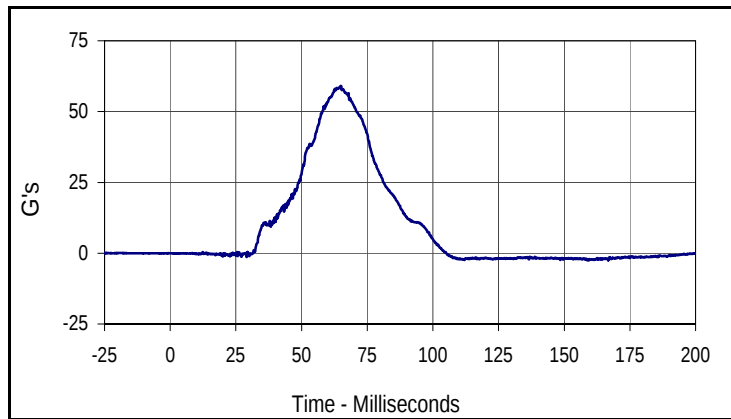
CRABI RESPONSE AND CRS DATA TRACES

LIST OF DATA PLOTS

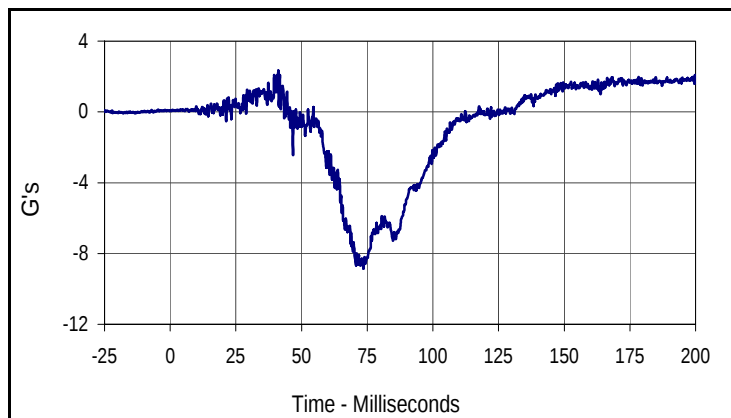
<u>Data Plot</u>		<u>Page</u>
D3-1	Right Rear CRABI (P4) Head X	D3-1
	Right Rear CRABI (P4) Head Y	D3-1
	Right Rear CRABI (P4) Head Z	D3-1
	Right Rear CRABI (P4) Head Resultant	D3-1
D3-2	Right Rear CRABI (P4) Chest X	D3-2
	Right Rear CRABI (P4) Chest Y	D3-2
	Right Rear CRABI (P4) Chest Z	D3-2
	Right Rear CRABI (P4) Chest Resultant	D3-2
D3-3	Right Rear CRABI (P3) Head X	D3-3
	Right Rear CRABI (P3) Head Y	D3-3
	Right Rear CRABI (P3) Head Z	D3-3
	Right Rear CRABI (P3) Head Resultant	D3-3
D3-4	Right Rear CRABI (P3) Chest X	D3-4
	Right Rear CRABI (P3) Chest Y	D3-4
	Right Rear CRABI (P3) Chest Z	D3-4
	Right Rear CRABI (P3) Chest Resultant	D3-4

Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

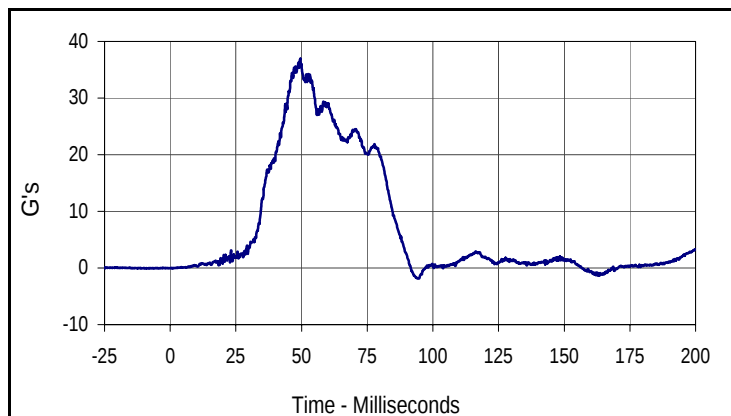
Test Date: 10/10/07
 NHTSA No.: M80500



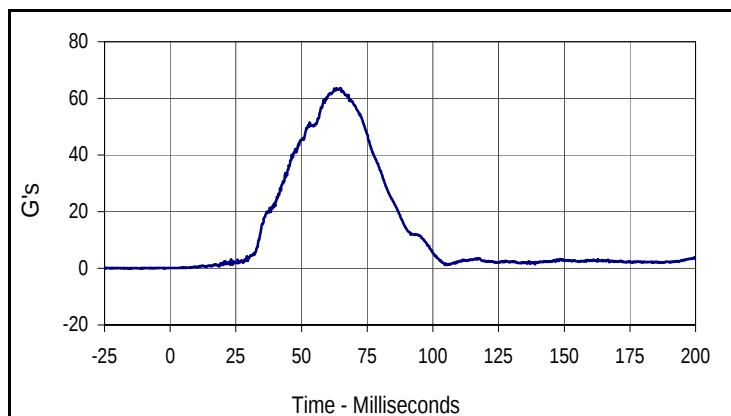
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CRABI Head X (P4)			
CURNO	Type	SAE Class	Units
142	FIL	1000	G's
Max	Time	Min	Time
59.1	65.0	-2.5	166.8



Curve Description			
CRABI Head Y (P4)			
CURNO	Type	SAE Class	Units
143	FIL	1000	G's
Max	Time	Min	Time
2.3	41.1	-8.8	73.5



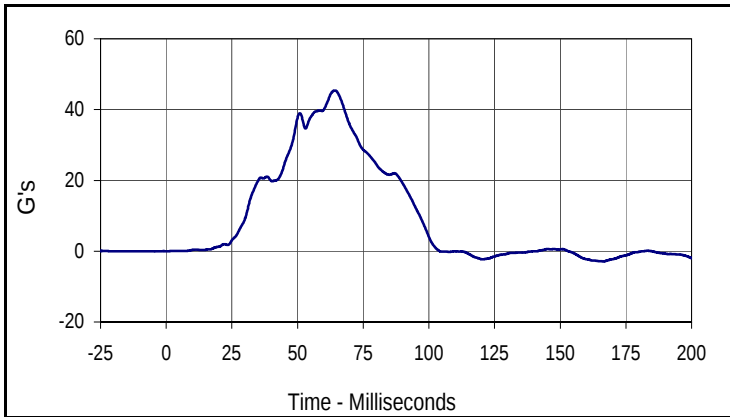
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Max	Time	Min	Time
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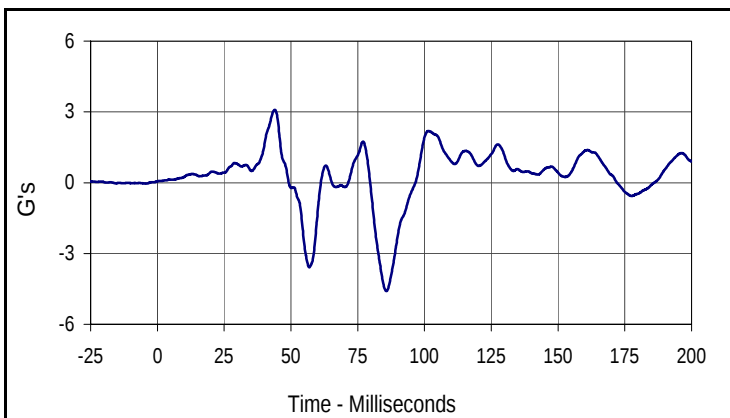
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CRABI Head Resultant (P4)			
CURNO	Type	SAE Class	Units
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Max	Time	Min	Time
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Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

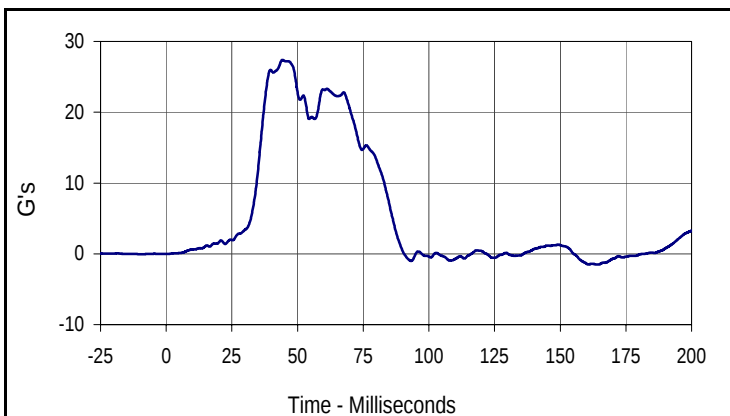
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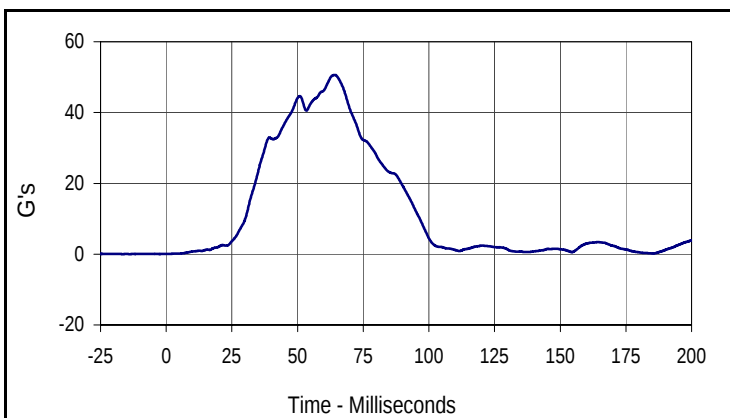
Curve Description			
CRABI Chest X (P4)			
CURNO	Type	SAE Class	Units
145	FIL	180	G's
Max	Time	Min	Time
45.4	64.2	-2.9	166.5



Curve Description			
CRABI Chest Y (P4)			
CURNO	Type	SAE Class	Units
146	FIL	180	G's
Max	Time	Min	Time
3.1	43.9	-4.6	85.7



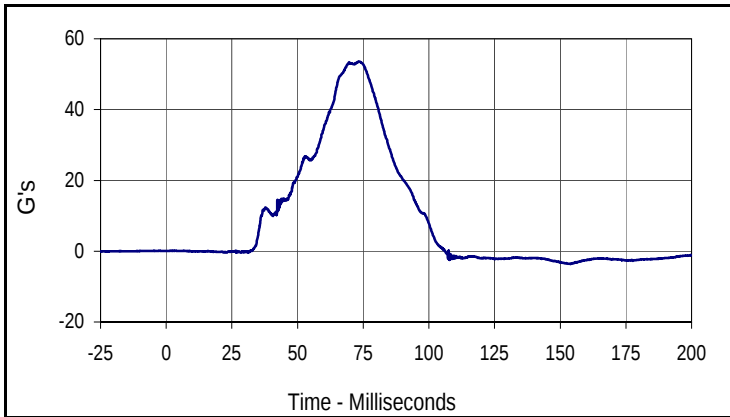
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CRABI Chest Z (P4)			
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Max	Time	Min	Time
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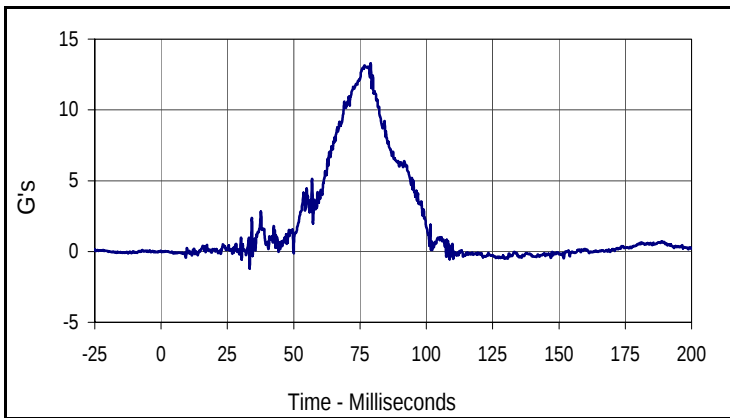
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CRABI Chest Resultant (P4)			
CURNO	Type	SAE Class	Units
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Max	Time	Min	Time
50.6	64.1	0.1	0.0

Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

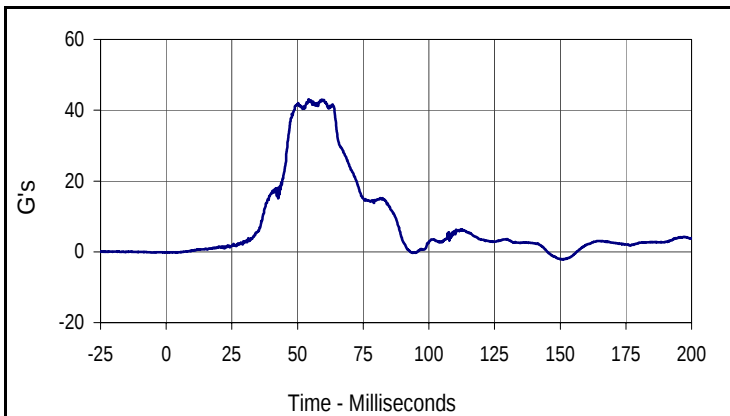
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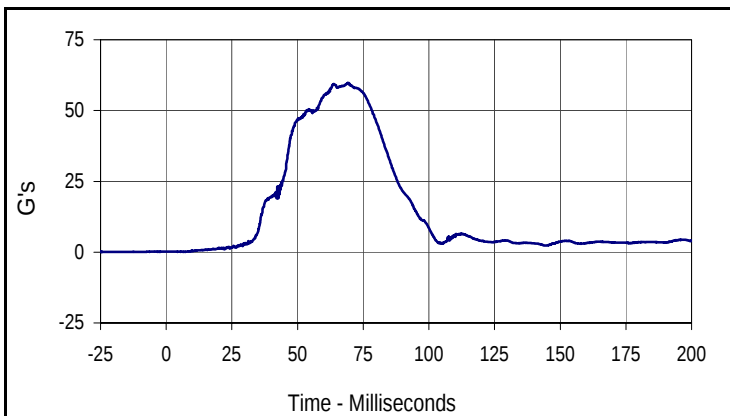
Curve Description			
CRABI Head X (P3)			
CURNO	Type	SAE Class	Units
163	FIL	1000	G's
Max	Time	Min	Time
53.6	73.5	-3.6	153.9



Curve Description			
CRABI Head Y (P3)			
CURNO	Type	SAE Class	Units
164	FIL	1000	G's
Max	Time	Min	Time
13.3	79.0	-1.2	33.4



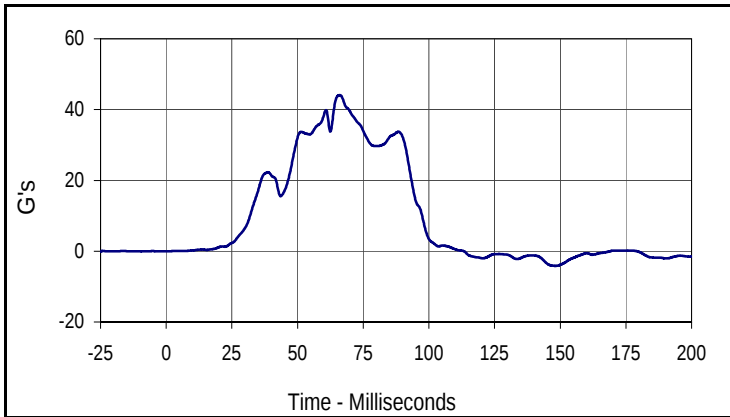
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Max	Time	Min	Time
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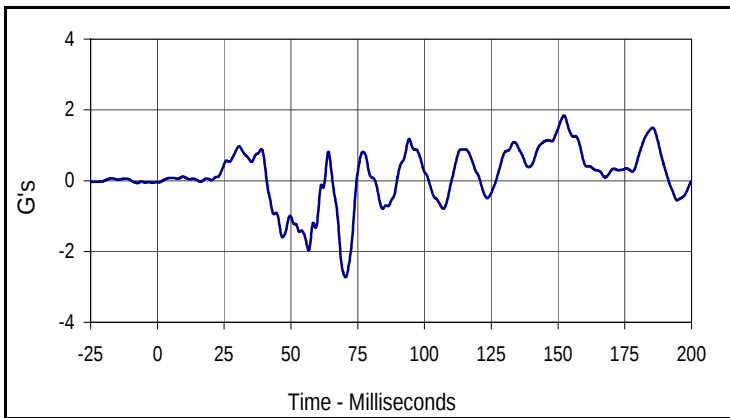
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CRABI Head Resultant (P3)			
CURNO	Type	SAE Class	Units
163	RES	1000	G's
Max	Time	Min	Time
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Test Vehicle: 2008 BMW 528i 4-Door Sedan
 Test Program: NHTSA 35mph NCAP

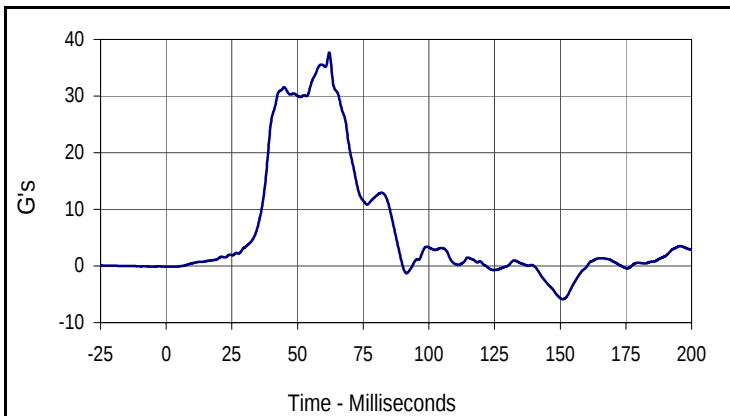
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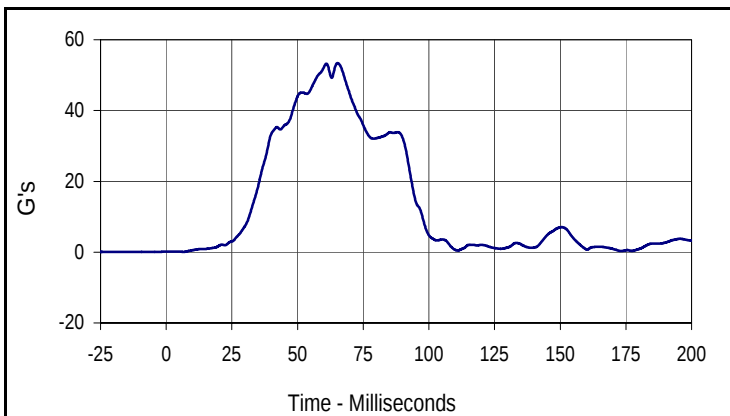
Curve Description			
CRABI Chest X (P3)			
CURNO	Type	SAE Class	Units
166	FIL	180	G's
Max	Time	Min	Time
44.1	66.1	-4.1	148.1



Curve Description			
CRABI Chest Y (P3)			
CURNO	Type	SAE Class	Units
167	FIL	180	G's
Max	Time	Min	Time
1.8	152.2	-2.7	70.5



Curve Description			
CRABI Chest Z (P3)			
CURNO	Type	SAE Class	Units
168	FIL	180	G's
Max	Time	Min	Time
37.7	62.1	-5.9	151.0



Curve Description			
CRABI Chest Resultant (P3)			
CURNO	Type	SAE Class	Units
166	RES	180	G's
Max	Time	Min	Time
53.4	65.2	0.1	6.6

SECTION D4

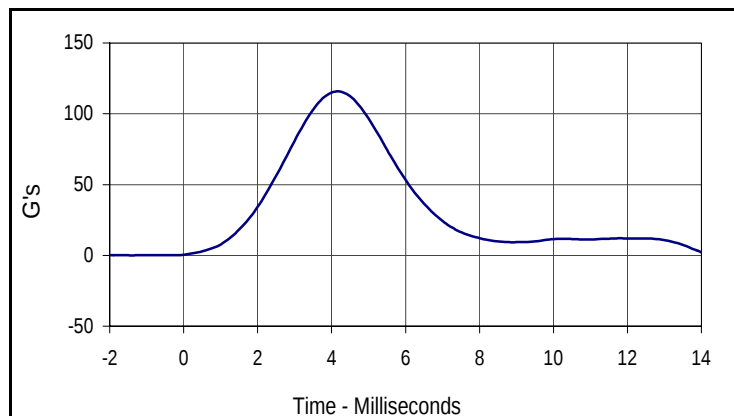
CRABI CALIBRATION INFORMATION

Test Program: CRABI 12 Month Old Frontal Head Drop Test
 ATD Serial No.: 017

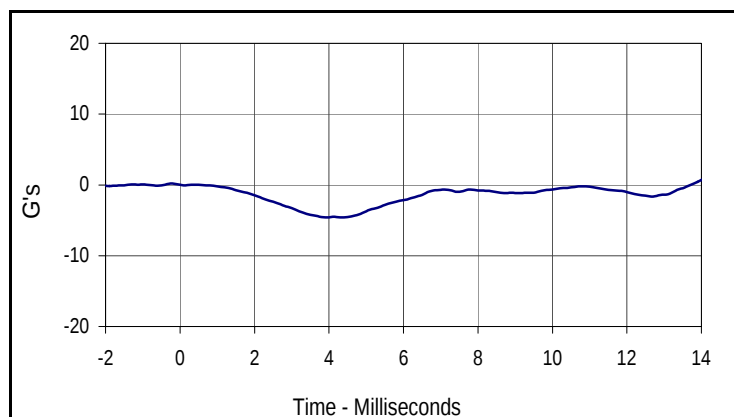
Test Date: 10/8/07
 Test I.D.: FHD10K



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	100.0 to 120.0	115.8	Pass
Peak Lateral Acceleration	G's	≤15.0	4.6	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
115.8	4.2	0.0	-1.4



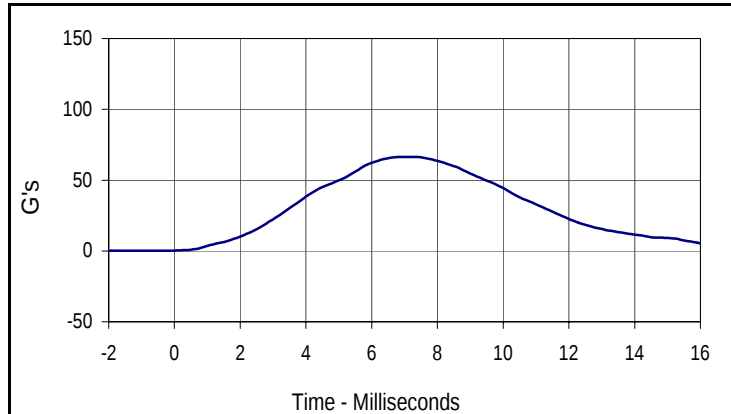
Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
0.2	-0.2	-4.6	3.9

Test Program: CRABI 12 Month Old Rear Head Drop Test
 ATD Serial No.: 017

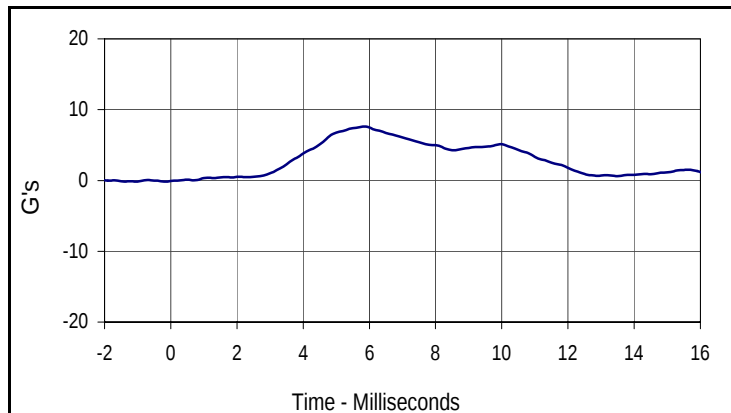
Test Date: 10/8/07
 Test I.D.: RHD10K



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	55.0 to 71.0	62.2	Pass
Peak Lateral Acceleration	G's	≤15.0	7.6	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
62.2	6.0	0.1	-0.9



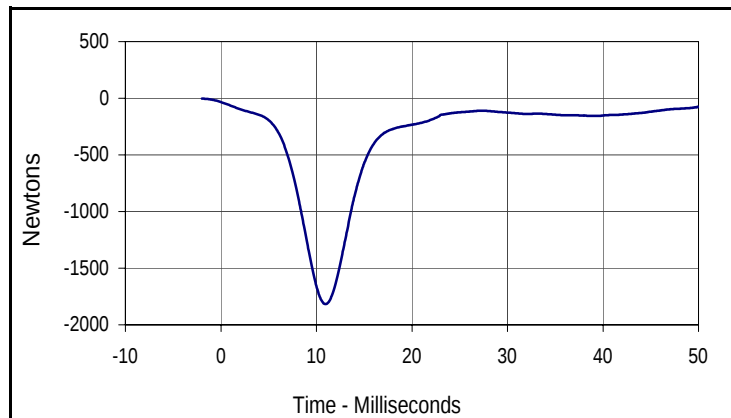
Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
7.6	5.8	-0.2	-1.4

Test Program: CRABI 12 Month Old Thorax Impact Test
 ATD Serial No.: 017

Test Date: 10/8/07
 Test I.D.: CH10K



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	4.90 to 5.10	4.96	Pass
Peak Probe Force	Newtons	-1514 to -1796	-1657	Pass
Overall Test Results				Pass



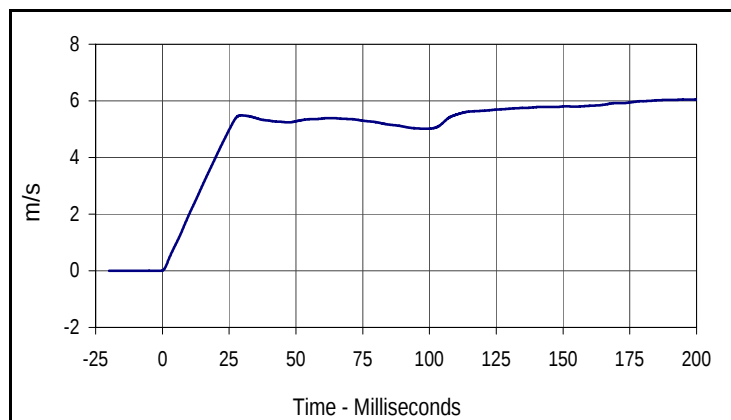
Curve Description			
Probe Force			
CURNO	Type	SAE Class	Units
001	FIL	60	Newtons
Max	Time	Min	Time
-2.3	-2.0	-1657.2	10.0

Test Program: CRABI 12 Month Old Neck Flexion Test
 ATD Serial No.: 017

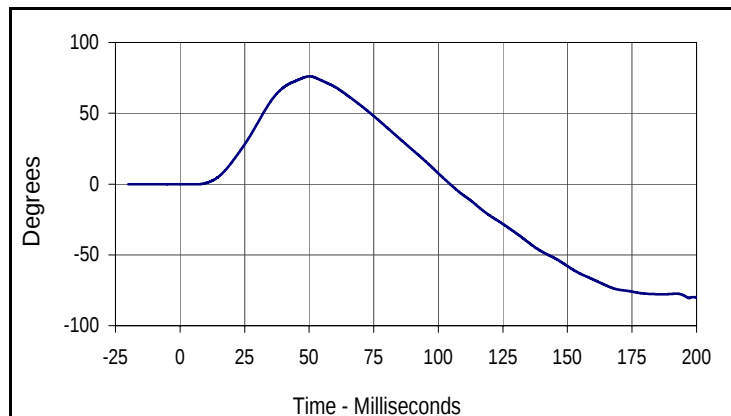
Test Date: 10/8/07
 Test I.D.: NF10K



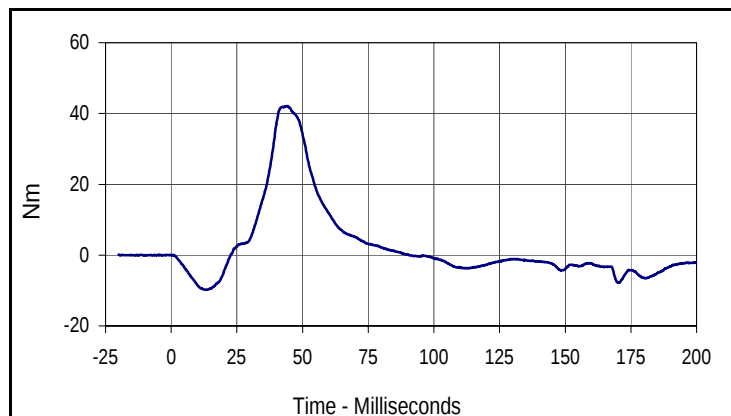
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.10 to 5.30	5.15	Pass
Pendulum Deceleration	10 Msec.	m/s	1.6 to 2.3	2.0	Pass
	20 Msec.	m/s	3.4 to 4.2	4.0	Pass
	25 Msec.	m/s	4.3 to 5.2	5.0	Pass
"D" Plane Rotation	Max	Degrees	75.0 to 86.0	76.1	Pass
Peak Moment in Rotation	Max	Nm	36.0 to 45.0	39.4	Pass
Positive Moment Decay, Time To 5 Nm		Msec.	60.0 to 80.0	70.6	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
6.0	199.3	0.0	-0.7



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
76.1	50.1	-80.5	197.1



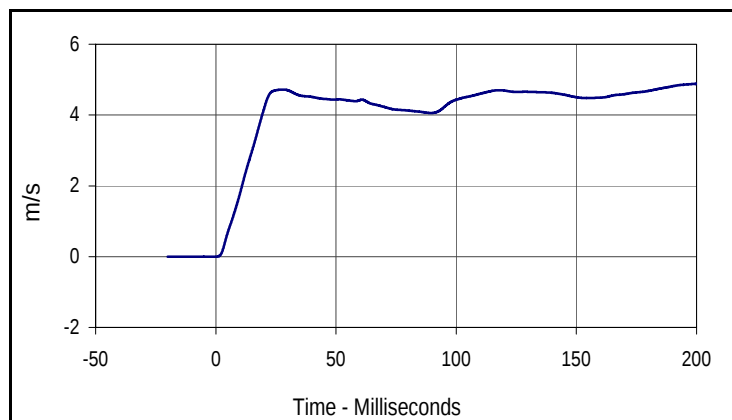
Curve Description			
Upper Neck Force Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
42.1	44.3	-9.8	13.5

Test Program: CRABI 12 Month Old Neck Extension Test
 ATD Serial No.: 017

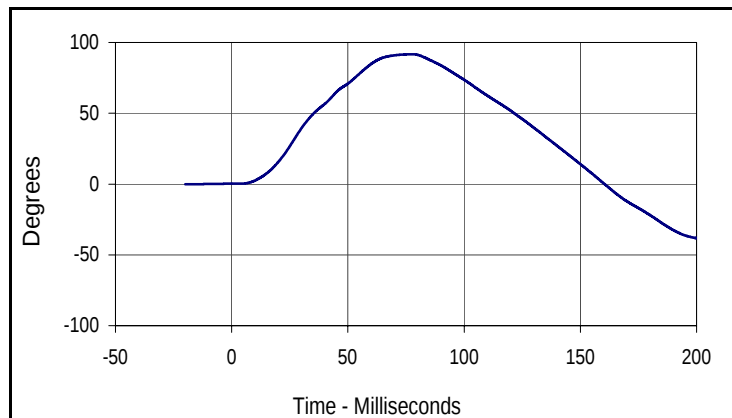
Test Date: 10/8/07
 Test I.D.: NE10K



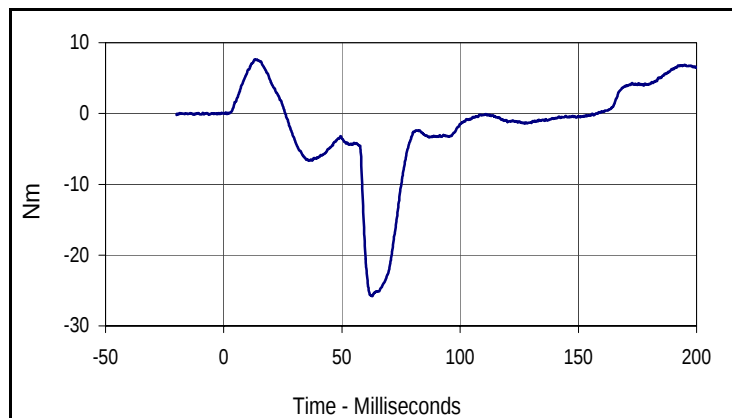
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	2.4 to 2.6	2.41	Pass
Pendulum Deceleration	6 Msec.	m/s	0.8 to 1.2	0.9	Pass
	10 Msec.	m/s	1.5 to 2.1	1.8	Pass
	14 Msec.	m/s	2.2 to 2.9	2.8	Pass
"D" Plane Rotation	Max	Degrees	80.0 to 92.0	91.7	Pass
Peak Moment in Rotation	Max	Nm	-12 to -23	-21.1	Pass
Positive Moment Decay, Time To -5 Nm		Msec.	76.0 to 90.0	77.9	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
4.9	200.0	0.0	0.1



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
91.7	77.7	-38.2	200.0



Curve Description			
Upper Neck Moment Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
7.6	13.2	-25.8	62.8

Test Program: CRABI 12 Month Old External Dimensions
 ATD Serial No.: 017

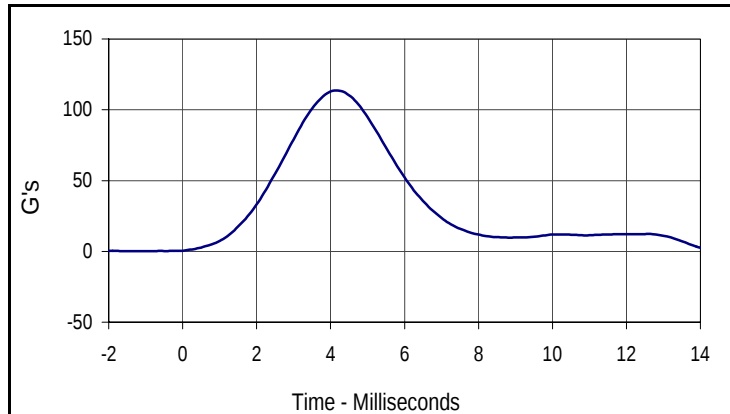
Test Date: 10/8/07
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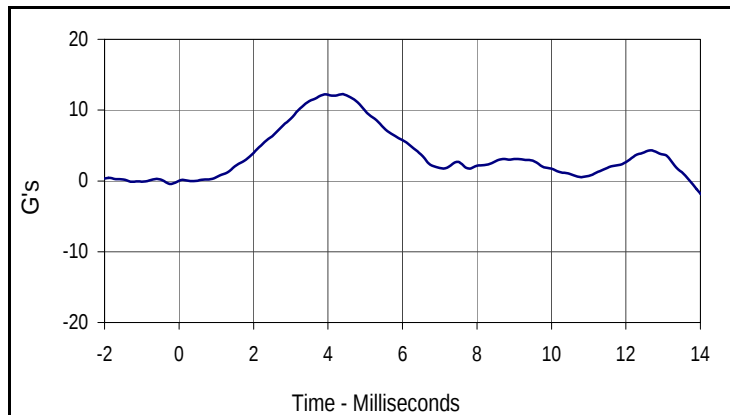
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	456.0 to 471.2	467	Pass
B - Shoulder pivot height	mm	276.6 to 291.8	285	Pass
C - "H" point height	mm	27.9 to 38.1	33	Pass
D - "H" point from backline	mm	40.1 to 50.3	45	Pass
E - Shoulder pivot from back	mm	50.3 to 60.5	52	Pass
F - Thigh clearance	mm	63.0 to 73.2	68	Pass
G - Elbow pivot to fingertip	mm	176.6 to 191.8	184	Pass
I - Shoulder pivot to elbow pivot	mm	99.1 to 114.3	109	Pass
J - Elbow rest height	mm	150.1 to 165.3	160	Pass
K - Buttock to knee length	mm	202.7 to 217.9	204	Pass
L - Popliteal length	mm	138.7 to 153.9	144	Pass
M - Knee pivot height	mm	165.1 to 180.3	179	Pass
N - Buttock popliteal length	mm	144.8 to 160.0	150	Pass
O - Chest depth with jacket	mm	107.5 to 122.7	113	Pass
P - Foot length	mm	92.4 to 102.6	95	Pass
Q- Stature	mm	727.7 to 753.1	N/A	N/A
R - Buttock to knee pivot length	mm	178.5 to 188.7	180	Pass
S - Head Breadth	mm	124.4 to 134.6	130	Pass
T - Head Depth	mm	149.9 to 165.1	154	Pass
U - Hip breadth	mm	158.5 to 173.7	160	Pass
V - Shoulder breadth	mm	200.7 to 215.9	212	Pass
W - Foot breadth	mm	39.1 to 49.3	46	Pass
Y - Chest circumference with jacket	mm	452.4 to 477.8	459	Pass
Z - Waist circumference	mm	447.0 to 472.4	450	Pass
AA - Reference location for dimension Y & O	mm	256.5 to 266.7	263	Pass
BB - Reference Location For dimension Z	mm	106.7 to 116.9	112	Pass
CC - Shoulder Height	mm	299.7 to 314.9	301	Pass
DD - Chin Height	mm	289.6 to 304.8	296	Pass
Overall Test Results				Pass

Test Program: CRABI 12 Month Old Frontal Head Drop TestTest Date: 10/4/07ATD Serial No.: 022Test I.D.: FHD10J

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	100.0 to 120.0	113.6	Pass
Peak Lateral Acceleration	G's	≤15.0	12.3	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results			Pass	



Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
113.6	4.2	0.1	-1.4



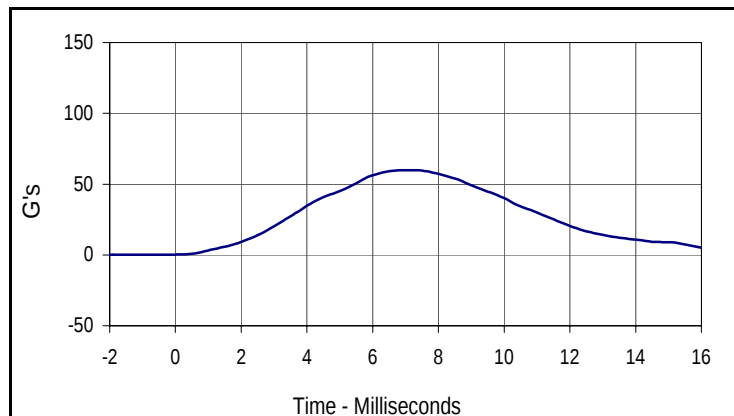
Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
12.3	4.4	-0.4	-0.2

Test Program: CRABI 12 Month Old Rear Head Drop Test
 ATD Serial No.: 022

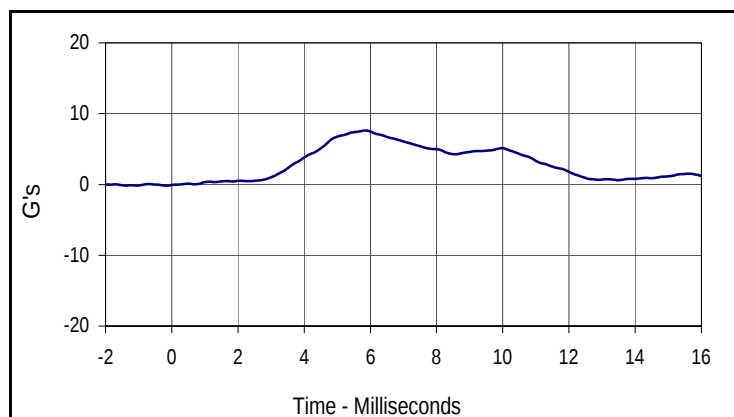
Test Date: 10/4/07
 Test I.D.: RHD10J



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	55.0 to 71.0	56.2	Pass
Peak Lateral Acceleration	G's	≤15.0	7.6	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
56.2	6.0	0.1	-0.9



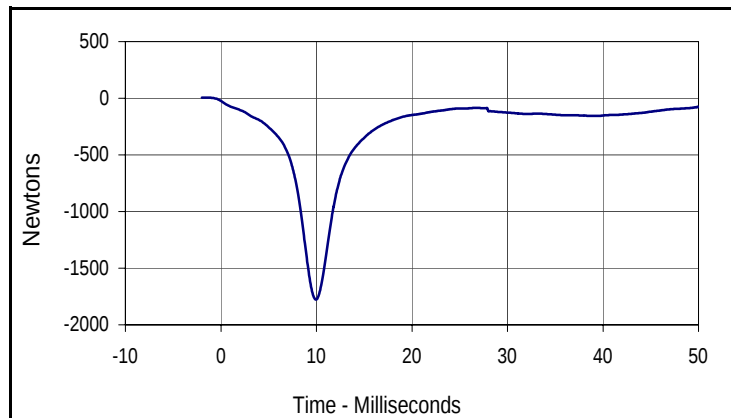
Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
7.6	5.8	-0.2	-1.4

Test Program: CRABI 12 Month Old Thorax Impact Test
 ATD Serial No.: 022

Test Date: 10/4/07
 Test I.D.: CH10J



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	4.90 to 5.10	4.95	Pass
Peak Probe Force	Newtons	-1514 to -1796	-1776	Pass
Overall Test Results				Pass



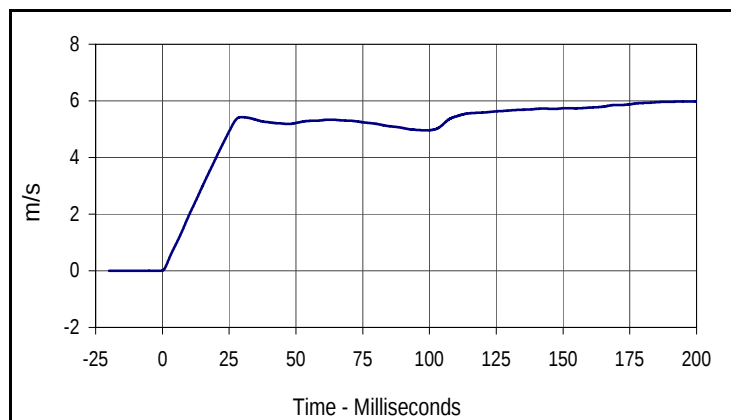
Curve Description			
Probe Force			
CURNO	Type	SAE Class	Units
001	FIL	180	Newtons
Max	Time	Min	Time
6.1	-1.6	-1776.2	10.0

Test Program: CRABI 12 Month Old Neck Flexion Test
 ATD Serial No.: 022

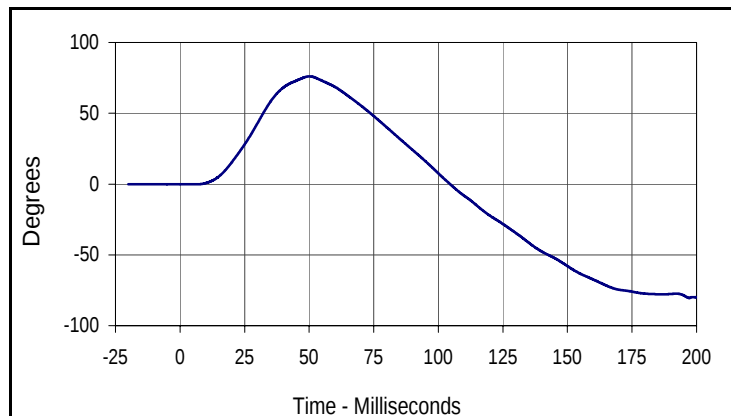
Test Date: 10/4/07
 Test I.D.: NF10J



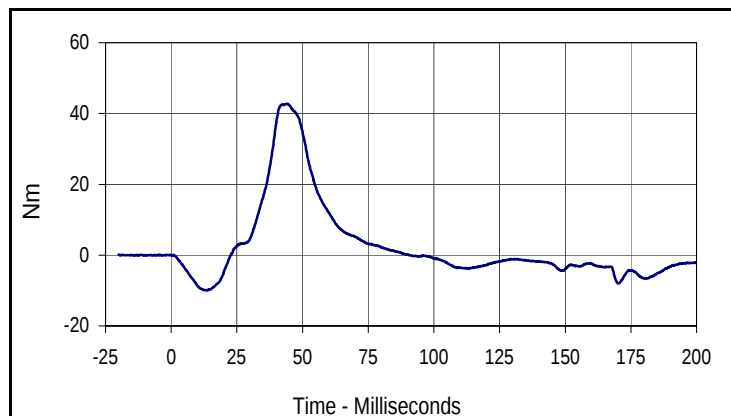
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.10 to 5.30	5.20	Pass
Pendulum Deceleration	10 Msec.	m/s	1.6 to 2.3	2.0	Pass
	20 Msec.	m/s	3.4 to 4.2	4.0	Pass
	25 Msec.	m/s	4.3 to 5.2	4.9	Pass
"D" Plane Rotation	Max	Degrees	75.0 to 86.0	76.1	Pass
Peak Moment in Rotation	Max	Nm	36.0 to 45.0	40.0	Pass
Positive Moment Decay, Time To 5 Nm		Msec.	60.0 to 80.0	70.7	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
6.0	199.3	0.0	-0.7



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
76.1	50.1	-80.5	197.1



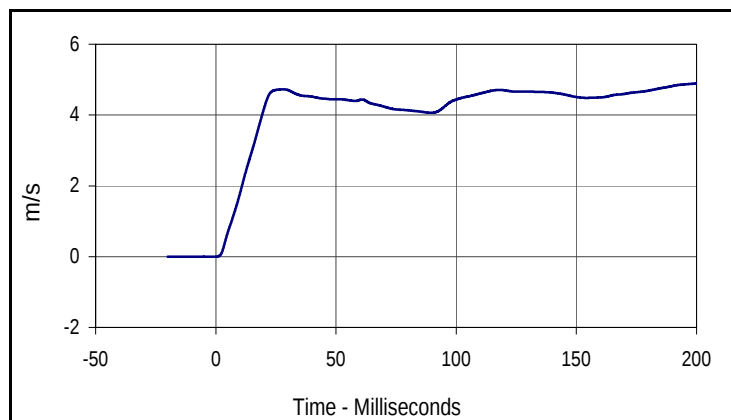
Curve Description			
Upper Neck Force Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
42.8	44.3	-9.9	13.5

Test Program: CRABI 12 Month Old Neck Extension Test
 ATD Serial No.: 022

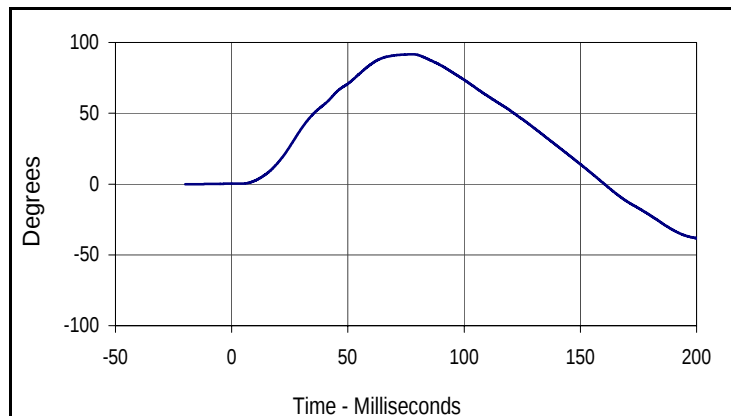
Test Date: 10/4/07
 Test I.D.: NE10J



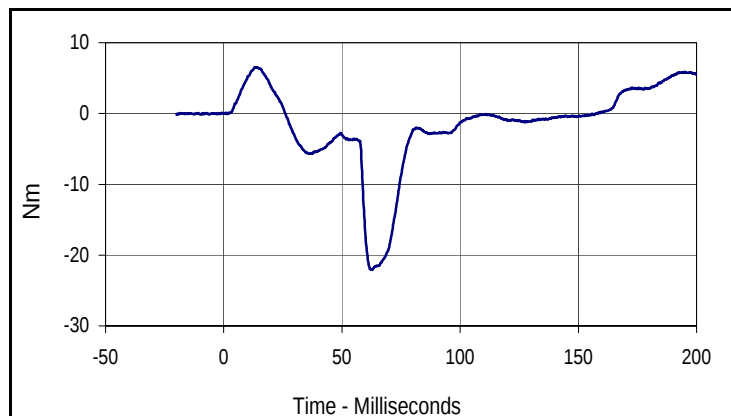
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	2.4 to 2.6	2.40	Pass
Pendulum Deceleration	6 Msec.	m/s	0.8 to 1.2	0.9	Pass
	10 Msec.	m/s	1.5 to 2.1	1.8	Pass
	14 Msec.	m/s	2.2 to 2.9	2.8	Pass
"D" Plane Rotation	Max	Degrees	80.0 to 92.0	91.7	Pass
Peak Moment in Rotation	Max	Nm	-12 to -23	-17.8	Pass
Positive Moment Decay, Time To -5 Nm		Msec.	76.0 to 90.0	77.3	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
4.9	200.0	0.0	0.1



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
91.7	77.7	-38.2	200.0



Curve Description			
Upper Neck Moment Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
6.5	13.2	-22.1	62.8

Test Program: CRABI 12 Month Old External Dimensions
 ATD Serial No.: 022

Test Date: 10/4/07
 Test I.D.: N/A



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	456.0 to 471.2	462	Pass
B - Shoulder pivot height	mm	276.6 to 291.8	286	Pass
C - "H" point height	mm	27.9 to 38.1	30	Pass
D - "H" point from backline	mm	40.1 to 50.3	47	Pass
E - Shoulder pivot from back	mm	50.3 to 60.5	52	Pass
F - Thigh clearance	mm	63.0 to 73.2	69	Pass
G - Elbow pivot to fingertip	mm	176.6 to 191.8	188	Pass
I - Shoulder pivot to elbow pivot	mm	99.1 to 114.3	106	Pass
J - Elbow rest height	mm	150.1 to 165.3	160	Pass
K - Buttock to knee length	mm	202.7 to 217.9	209	Pass
L - Popliteal length	mm	138.7 to 153.9	143	Pass
M - Knee pivot height	mm	165.1 to 180.3	170	Pass
N - Buttock popliteal length	mm	144.8 to 160.0	156	Pass
O - Chest depth with jacket	mm	107.5 to 122.7	113	Pass
P - Foot length	mm	92.4 to 102.6	96	Pass
Q- Stature	mm	727.7 to 753.1	N/A	N/A
R - Buttock to knee pivot length	mm	178.5 to 188.7	180	Pass
S - Head Breadth	mm	124.4 to 134.6	127	Pass
T - Head Depth	mm	149.9 to 165.1	159	Pass
U - Hip breadth	mm	158.5 to 173.7	166	Pass
V - Shoulder breadth	mm	200.7 to 215.9	210	Pass
W - Foot breadth	mm	39.1 to 49.3	43	Pass
Y - Chest circumference with jacket	mm	452.4 to 477.8	458	Pass
Z - Waist circumference	mm	447.0 to 472.4	460	Pass
AA - Reference location for dimension Y & O	mm	256.5 to 266.7	263	Pass
BB - Reference Location For dimension Z	mm	106.7 to 116.9	112	Pass
CC - Shoulder Height	mm	299.7 to 314.9	303	Pass
DD - Chin Height	mm	289.6 to 304.8	291	Pass
Overall Test Results				Pass