

FINAL REPORT NUMBER 201UI-MGA-07-05

**SAFETY COMPLIANCE TESTING FOR FMVSS 201
Occupant Protection In Interior Impact
Upper Interior Head Impact Protection**

**HYUNDAI MOTOR COMPANY
2007 Hyundai Veracruz GLS, 4-Door SUV
NHTSA No. C70507**

**MGA RESEARCH CORPORATION
446 Executive Drive
Troy, Michigan 48083**



Test Dates: August 31-September 4-5, 2007
Report Date: September 7, 2007

FINAL REPORT

PREPARED FOR:

**U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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16. Abstract A compliance test series was conducted on the subject 2007 Hyundai Veracruz GLS, 4-Door SUV, NHTSA No. C70507, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-201U-01 for the determination of FMVSS 201 compliance. The testing was conducted at MGA Research Corporation in Troy, Michigan on August 31-September 4-5, 2007. Test failures identified were as follows: None The data recorded indicates that the 2007 Hyundai Veracruz GLS, 4-Door SUV, tested appears to comply with the upper interior requirements of FMVSS 201.			
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1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this head impact compliance test was to determine whether the subject vehicle, a 2007 Hyundai Veracruz GLS, 4-Door SUV, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact - Upper Interior Head Impact Protection.

Tests were conducted on August 31-September 4-5, 2007 on a 2007 Hyundai, 4-Door SUV, manufactured by Hyundai Motor Company.

All tests were conducted in accordance with the U. S. Department of Transportation, National Highway Traffic Safety Administration's Laboratory Test Procedure TP-201U-01 dated April 3, 1998 and the corresponding MGA Research Corporation's FMVSS 201U procedure number MGATP201U_FRAME#2 dated July 1, 2005.

All tests were conducted at MGA Research Corporation in Troy, Michigan and were performed by MGA engineers and technicians. The FMVSS 201U impactor test machine was used to conduct the testing. Target locations were determined by using a Coordinate Measurement Machine in conjunction with the MGA EZ-Target™ program and MGA procedure MGATP201U_Test Series dated July 1, 2005.

2.0 COMPLIANCE TEST DATA SUMMARY

The 2007 Hyundai Veracruz GLS, 4-Door SUV, was equipped with A, B, Other, and rear-pillars, an adjustable seat belt anchorage on each B-pillar, a fixed seat belt anchorage on each Other and rear pillar, a grab assist handle on the front passenger side rail and on the rear side rails, an overhead console located in the center of the front upper roof, and a dome light located on the center of the rear upper roof.

Upon completion of targeting the test vehicle, twelve (12) targets were chosen to be impacted based upon engineering judgment and certification test data provided by the manufacturer. The twelve (12) targets chosen were:

AP1	BP2	RP2	SR3-2
AP2	BP3	SR1	RH
AP3	OP1	SR2-B	UR4@BPR

The Hyundai Veracruz GLS, 4-Door SUV, tested appears to comply with the upper interior performance criteria for FMVSS 201. The HIC(d) measured using the Part 572L (Free Motion Headform) was below 1000 for each tested component.

TABLE 2-1

SUMMARY TABLE OF TEST RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2007 Hyundai Veracruz GLS, 4-Door SUV

VEH. NHTSA NO.: C70507 VIN: KM8NU13C97U009204 COLOR: Blue Titanium

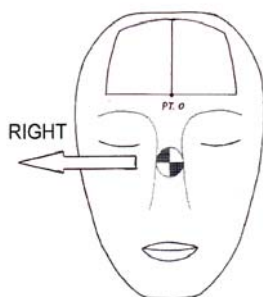
VEH. BUILD DATE: February 7, 2007 TEST DATES: August 31-September 4-5, 2007

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen A. Kaletto, Louis Campbell, Scott Keyser

TARGET	VEHICLE SIDE	HORIZONTAL ANGLE (deg)	VERTICAL ANGLE (deg)	VELOCITY (kph)	HIC(d)	FMH HIC	IMPACT ON FMH (mm)	
							Above	Left/Right
AP1	Right	110	38	18.9	606	582	7	4 Left
AP2	Left	203	48	18.7	599	574	12	8 Left
AP3	Right	140	47	23.7	731	748	17	1 Right
BP2	Left	270	2	24.0	673	671	16	3 Right
BP3	Right	90	-4	23.7	783	817	20	10 Right
OP1	Left	270	6	23.6	637	624	9	10 Left
RP2	Left	270	0	23.5	590	562	14	1 Left
SR1	Left	270	42	24.1	716	728	55	5 Left
SR2-B	Right	90	50	18.7	297	173	9	9 Left
SR3-2	Right	90	48	23.5	570	535	13	2 Left
RH	Right	0	50	23.8	754	778	3	5 Left
UR4@BPR	Right	90	42	24.2	558	519	23	4 Left

Above and left/right refers to the position relative to reference pt. 0 where the target made contact with the Free Motion Headform. See the diagram below for details.



POST TEST COMMENTS:

The following description lists any post-test damage or other test observations for each target.

BP2 Left: D-ring cover displacement.

BP3 Right: D-ring cover cracked.

OP1 Left: O-pillar cracked.

RP2 Left: Seat belt path trim displacement.

REMARKS:

The targets listed were impacted in the following order:

Left: AP2, SR1, BP2, OP1, RP2

Right: AP3, AP1, SR2-B, BP3, UR4@BPR, SR3-2, RH

The 150 mm rule was observed for targets horizontal to each other and the 200 mm rule was observed for vertical components.

RECORDED BY: Louis Campbell

DATE: September 5, 2007

APPROVED BY: Helen A. Kaleto

TABLE 2-2

GENERAL TEST AND VEHICLE PARAMETER DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2007 Hyundai Veracruz GLS, 4-Door SUV

VEH. NHTSA NO.: C70507 VIN: KM8NU13C97U009204 COLOR: Blue Titanium

VEH. BUILD DATE: February 7, 2007 TEST DATES: August 31-September 4-5, 2007

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen A. Kaleto, Louis Campbell, Scott Keyser

INTERIOR TRIM INFORMATION: A, B, Other, and rear-pillars, an adjustable seat belt anchorage on each B-pillar, a fixed seat belt anchorage on each Other and rear pillar, a grab assist handle on the front passenger side rail and on the rear side rails, an overhead console located in the center of the front upper roof, and a dome light located on the center of the rear upper roof.

SUNROOF INFORMATION:

Installed: Yes No

Operation: Electric Manual

SIDE RAIL CURTAIN AIRBAG INFORMATION:

Installed: Yes No

ROLL-BAR INFORMATION:

Installed: Yes No

Padded: Yes No

Braces: Yes No

GENERAL INFORMATION:

Date Received: 08/02/07; Odometer Reading 26 miles

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: Hyundai Motor Company

Date of Manufacture: February 7, 2007; VIN: KM8NU13C97U009204
GVWR: 5732 lb; GAWR FRONT: 3230 lb;
GAWR REAR: 3197 lb

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load:

FRONT: 210 kPa REAR: 210 kPa

Recommended Tire Size: P245/65R17

Recommended Cold Tire Pressure:

FRONT: 210 kPa REAR: 210 kPa

Size of Tire on Test Vehicle: P245/65R17

Type of Spare Tire: T165/90R17; Space Saver: X; Standard _

VEHICLE CAPACITY DATA:

Type of Front Seats: Bench _; Bucket X; Split Bench _

Number of Occupants: Front 2; 2nd Row 3; 3rd Row 2; TOTAL 7

VEHICLE CAPACITY WEIGHT:

Vehicle Capacity Weight (VCW) = 526 kg

No. of Occupants x 68 kg = 476 kg

Rated Cargo/Luggage Weight (RCLW) = 50 kg (difference)

WEIGHT OF TEST VEHICLE AS DELIVERED AT LABORATORY: (with maximum fluids)

Right Front = 544.0 kg Right Rear = 430.0 kg

Left Front = 585.0 kg Left Rear = 391.5 kg

TOTAL FRONT = 1129.0 kg TOTAL REAR = 821.5 kg

% Total Weight = 57.9 % % Total Weight = 42.1 %

TOTAL DELIVERED WEIGHT = 1950.5 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight = 1950.5 kg
Max. Test Cargo/Luggage Weight = 50.0 kg
Target Test Weight = 2000.5 kg

WEIGHT OF TEST VEHICLE FULLY LOADED:

Right Front =	<u>544.0</u> kg	Right Rear =	<u>455.0</u> kg
Left Front =	<u>584.5</u> kg	Left Rear =	<u>415.5</u> kg
TOTAL FRONT =	<u>1128.5</u> kg	TOTAL REAR =	<u>870.5</u> kg
% Total Weight =	<u>56.4</u> %	% Total Weight =	<u>43.6</u> %

TOTAL TEST WEIGHT = 1999.0 kg

Weight of ballast secured in vehicle's cargo area = 48.5 kg

TEST VEHICLE ATTITUDE:

AS DELIVERED: Right Front 814 mm; Left Front 810 mm;
Right Rear 829 mm; Left Rear 831 mm;
Pitch Angle at Right Door Sill = 0.7 Rear is higher
Pitch Angle at Left Door Sill = 0.0
Roll Angle at Front Bumper = 0.3 Right is higher
Roll Angle at Rear Bumper = 0.3 Left is higher

FULLY LOADED: Right Front 814 mm; Left Front 810 mm;
Right Rear 820 mm; Left Rear 827 mm;
Pitch Angle at Right Door Sill = 0.6 Rear is higher
Pitch Angle at Left Door Sill = 0.1 Front is higher
Roll Angle at Front Bumper = 0.3 Right is higher
Roll Angle at Rear Bumper = 0.3 Left is higher

AS TARGETED: Right Front 986 mm; Left Front 975 mm;
 Right Rear 997 mm; Left Rear 989 mm;
 Pitch Angle at Right Door Sill = 0.7 Rear is higher
 Pitch Angle at Left Door Sill = 0.0
 Roll Angle at Front Bumper = 0.3 Right is higher
 Roll Angle at Rear Bumper = 0.3 Left is higher

AS TESTED ON RIGHT SIDE:

Pitch Angle at Right Door Sill = 0.7 Rear is higher
Pitch Angle at Left Door Sill = 0.1 Front is higher
Roll Angle at Front Bumper = 0.3 Right is higher
Roll Angle at Rear Bumper = 0.3 Left is higher

AS TESTED ON LEFT SIDE:

Pitch Angle at Right Door Sill = 0.7 Rear is higher
Pitch Angle at Left Door Sill = 0.0
Roll Angle at Front Bumper = 0.3 Right is higher
Roll Angle at Rear Bumper = 0.3 Left is higher

VEHICLE WHEELBASE = 2795 mm

REMARKS: The seat travel distance was measured to be 240 mm for the driver front seat and 240 mm for the passenger front seat.

RECORDED BY: Louis Campbell

DATE: August 30, 2007

APPROVED BY: Helen A. Kalet

TABLE 2-3
HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

VEH. MOD YR/MAKE/MODEL/BODY: 2007 Hyundai Veracruz GLS, 4-Door SUV
VEH. NHTSA NO.: C70507 VIN: KM8NU13C97U009204 COLOR: Blue Titanium
VEH. BUILD DATE: February 7, 2007 TEST DATES: August 31-September 4-5, 2007
TEST LABORATORY: MGA Research Corporation
OBSERVERS: Helen A. Kaleto, Louis Campbell, Scott Keyser

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B

PILLARS

	HORIZONTAL ANGLE SPECIFIED RANGE	MINIMUM HORIZONTAL ANGLE	MAXIMUM HORIZONTAL ANGLE
A-PILLAR	L 195°-255°	L 203.3°	L 250.7°
	R 105°-165°	R 110.0°	R 160.7°
B-PILLAR	L 195°-345°	L 201.3°	L 278.5°
	R 15°-165°	R 80.9°	R 158.8°

AS DETERMINED USING THE PROCEDURES SPECIFIED IN S8.13.4.1

REMARKS:

RECORDED BY: Louis Campbell

DATE: August 30,2007

APPROVED BY: Helen A. Kaleto

TABLE 2-4

VERTICAL IMPACT ANGLE RANGES

VEH. MOD YR/MAKE/MODEL/BODY: 2007 Hyundai Veracruz GLS, 4-Door SUV

VEH. NHTSA NO.: C70507 VIN: KM8NU13C97U009204 COLOR: Blue Titanium

VEH. BUILD DATE: February 7, 2007 TEST DATES: August 31-September 4-5, 2007

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen A. Kaleto, Louis Campbell

VERTICAL IMPACT ANGLE RANGES

		VERTICAL ANGLE SPECIFIED RANGE		MINIMUM VERTICAL ANGLE		MAXIMUM VERTICAL ANGLE	
FRONT HEADER	FH1	L	0°-50°	L	0°	L	50°
		R	0°-50°	R	0°	R	50°
	FH2	L	0°-50°	L	0°	L	50°
		R	0°-50°	R	0°	R	50°
SIDE RAIL	SR1	L	0°-50°	L	0°	L	42°
		R	0°-50°	R	0°	R	42°
	SR2A	L	0°-50°	L	0°	L	30°
		R	0°-50°	R	0°	R	50°
	SR2B	L	0°-50°	L	0°	L	32°
		R	0°-50°	R	0°	R	50°
	SR3-1	L	0°-50°	L	0°	L	48°
		R	0°-50°	R	0°	R	48°
	SR3-2	L	0°-50°	L	0°	L	49°
		R	0°-50°	R	0°	R	48°
	SR3-3	L	0°-50°	L	0°	L	27°
		R	0°-50°	R	0°	R	25°
REAR HEADER	RH	L	0°-50°	L	0°	L	50°
		R	0°-50°	R	0°	R	50°

		VERTICAL ANGLE SPECIFIED RANGE		MINIMUM VERTICAL ANGLE		MAXIMUM VERTICAL ANGLE	
A-PILLAR	AP1	L	-5°-50°	L	-5°	L	36°
		R	-5°-50°	R	-5°	R	38°
	AP2	L	-5°-50°	L	-5°	L	48°
		R	-5°-50°	R	-5°	R	47°
	AP3	L	-5°-50°	L	-5°	L	47°
		R	-5°-50°	R	-5°	R	47°
B-PILLAR	BP1	L	-10°-50°	L	-10°	L	16°
		R	-10°-50°	R	-10°	R	18°
	BP2*	L	0°-50°	L	0°	L	2°
		R	0°-50°	R	0°	R	3°
	BP3	L	-10°-50°	L	-10°	L	-6°
		R	-10°-50°	R	-10°	R	-4°
	BP4	L	-10°-50°	L	-10°	L	-10°
		R	-10°-50°	R	-10°	R	-10°
OTHER PILLAR	OP1*	L	10°-50°	L	-10°	L	6°
		R	0°-50°	R	0°	R	6°
	OP2	L	-10°-50°	L	-10°	L	4°
		R	-10°-50°	R	-10°	R	5°
REAR PILLAR	RP1	L	-10°-50°	L	-10°	L	14°
		R	-10°-50°	R	-10°	R	12°
	RP2*	L	10°-50°	L	-10°	L	0°
		R	0°-50°	R	0°	R	0°
UPPER ROOF 1		0°-50°		0°		50°	
UPPER ROOF 2		0°-50°		0°		50°	
UPPER ROOF 3		0°-50°		0°		50°	
UPPER ROOF 4		0°-50°		0°		42°	
UPPER ROOF 5		0°-50°		0°		50°	

	VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
UPPER ROOF 6	0°-50°	0°	19°

As determined using the Procedures specified in S8.13.4.2. *Targets BP2, OP1, and RP2 are seat belt anchorage locations.

RECORDED BY: Louis Campbell

DATE: August 30, 2007

APPROVED BY: Helen A. Kaleto

TABLE 2-5

TARGET MEASUREMENTS

VEH. MOD YR/MAKE/MODEL/BODY: 2007 Hyundai Veracruz GLS, 4-Door SUV

VEH. NHTSA NO.: C70507 VIN: KM8NU13C97U009204 COLOR: Blue Titanium

VEH. BUILD DATE: February 7, 2007 TEST DATES: August 31-September 4-5, 2007

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen A. Kaleto, Louis Campbell, Scott Keyser

Measurement	Description	Left Side	Right Side
M	Seat Fore/Aft Travel (Front seats)	240 mm	240 mm
T ^o	Horizontal < {CG-F1 (Left Seat) to (Right A-Pillar)}	109.3 ^o	--
A1 ^o	360 ^o - T ^o	250.7 ^o	--
W ^o	Horizontal < {CG-2 (Left Seat) to (Left A-Pillar)}	203.3 ^o	--
A2 ^o	A2 ^o = W ^o	203.3 ^o	--
U ^o	Horizontal < {CG-2 (Left Seat) to (Left B-Pillar)}	278.5 ^o	--
B1 ^o	B1 ^o = U ^o	278.5 ^o	--
V ^o	Horizontal < {CG-R (Left Seat) to (Left B-Pillar)}	201.3 ^o	--
B2 ^o	B2 ^o = V ^o	201.3 ^o	--
W ^o (right)	Horizontal < {CG-F2 (Right Seat) to (Right A-Pillar)}	--	160.7 ^o
A1 ^o (right)	A1 ^o (right) = W ^o (right)	--	160.7 ^o
T ^o (right)	Horizontal < {CG-F1 (Right Seat) to (Left A-Pillar)}	--	250.0 ^o
A2 ^o (right)	360 ^o -T ^o (right)	--	110.0 ^o
V ^o (right)	Horizontal < {CG-R (Right Seat) to (Right B-Pillar)}	--	158.8 ^o
B1 ^o (right)	B1 ^o (right) = V ^o (right)	--	158.8 ^o
U ^o (right)	Horizontal < {CG-F2 (Right Seat) to (Right B-Pillar)}	--	80.9 ^o
B2 ^o (right)	B2 ^o (right) = U ^o (right)	--	80.9 ^o
J	A-Pillar {(Plane 3) - (Plane 5)}	363.7 mm	360.1 mm
J/2	J ÷ 2	181.9 mm	180.1 mm
D1	Upper Roof {(Plane A) - (Plane B)}	2231.0 mm	
D1/2	D1 ÷ 2	1115.5 mm	
D2	Upper Roof {(Plane C) - (Plane D)}	1306.8 mm	

Measurement	Description	Left Side	Right Side
D2/2	$D2 \div 2$	653.4 mm	
.35D1	.35 x D1	780.9 mm	
.35D2	.35 x D2	457.4 mm	
N	B-Pillar {(BPR) - (lowest point on daylight opening forward of B-Pillar)}	495.0 mm	496.7 mm
N/2	B-Pillar {(BP3) - (lowest point on daylight opening forward of B-Pillar)}	247.5 mm	248.4 mm
N/4	B-Pillar {(BP4) - (lowest point on daylight opening forward of B-Pillar)}	123.8 mm	124.2 mm
Q	O-Pillar (Plane 13 – Plane 14)	453.2 mm	452.7 mm
Q/2	$Q \div 2$	226.6 mm	226.4 mm
D	R-Pillar (Point 7 – Point M)	1010.0 mm	1016.0 mm
3D/7	$3 \cdot D / 7$	432.9 mm	435.4 mm

As determined using the Procedures specified in S10.1-10.13.

SgRP Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	Z
Front	1967.5	-399.4	697.9	1967.8	400.6	699.0
2 nd Row	2817.2	-389.7	737.1	2817.5	390.2	738.2
3 rd Row	3577.2	-272.5	750.6	3577.4	302.5	751.4

SgRP Locations (vehicle coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	Z
Front	1395.0	-400.0	355.0	1395.0	400.0	355.0
2 nd Row	2245.0	-390.0	385.0	2245.0	390.0	385.0
3 rd Row	3005.0	-272.5	390.0	3005.0	302.5	390.0

CG Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	Z
CGF1	1887.5	-399.4	1357.9	1887.8	400.6	1359.0
CGF2	2127.5	-399.4	1357.9	2127.8	400.6	1359.0
CGR - 2 nd Row	2977.2	-389.7	1397.1	2977.5	390.2	1398.2
CGR - 3 rd Row	3737.2	-272.5	1410.6	3737.4	302.5	1411.4

REFERENCE FOR VEHICLE COORDINATE SYSTEM (measured in millimeters):

Passenger front outboard seat bolt hole (x, y, z) = 1007.9, 626.0, 87.7

Driver front outboard seat bolt hole (x, y, z) = 1007.9, -626.0, 87.7

Driver rear outboard seat bolt hole (x, y, z) = 1460.8, -626.0, 60.8

REMARKS:

RECORDED BY: Louis Campbell

DATE: August 30, 2007

APPROVED BY: Helen A. Kaleto

TABLE 2-6

SUMMARY OF TARGETING RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2007 Hyundai Veracruz GLS, 4-Door SUV

VEH. NHTSA NO.: C70507 VIN: KM8NU13C97U009204 COLOR: Blue Titanium

VEH. BUILD DATE: February 7, 2007 TEST DATES: August 31-September 4-5, 2007

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen A. Kaleto, Louis Campbell, Scott Keyser

SUMMARY OF TARGETING RESULTS								
Target	Location (mm)			Horizontal Angle (deg)	Vertical Angle (deg)	Relocation (Yes/No)	Extension (# of 25 mm Spheres)	Impact (Yes/No)
	x	y	z					
A-Pillar Left Side								
AP1	1109.1	-590.1	1150.8	--	--	Yes	--	--
REL	1087.8	-614.0	1113.2	251	36	--	2	No
AP2	1026.2	-651.7	1064.2	203	48	No	--	Yes
AP3	855.6	-681.0	972.6	203	47	No	--	No
A-Pillar Right Side								
AP1	1110.5	599.1	1146.0	--	--	Yes	--	--
REL	1093.3	623.8	1108.8	110	38	--	2	Yes
AP2	1013.9	620.0	1059.4	--	--	Yes	--	--
REL	997.0	608.7	1039.5	161	47	--	1	No
AP3	850.2	666.7	968.9	--	--	Yes	--	--
REL	869.3	653.7	975.6	140	47	--	1	Yes
B-Pillar Left Side								
BP1	1667.0	-525.1	1248.2	270	16	No	--	No
BP2	1637.9	-658.1	974.2	270	2	No	--	Yes
BP3	1600.8	-666.8	1001.9	270	-6	No	--	No
BP4	1698.9	-712.9	878.2	201	-10	No	--	No
B-Pillar Right Side								
BP1	1668.9	526.2	1249.2	90	18	No	--	No
BP2	1635.8	663.9	967.9	90	3	No	--	No

SUMMARY OF TARGETING RESULTS								
Target	Location (mm)			Horizontal Angle (deg)	Vertical Angle (deg)	Relocation (Yes/No)	Extension (# of 25 mm Spheres)	Impact (Yes/No)
	x	y	z					
BP3	1603.1	669.3	1002.3	90	-4	No	--	Yes
BP4	1701.9	717.2	877.9	159	-10	No	--	No
Other Pillar Left Side								
OPR	2475.6	-516.1	1248.3					
OP1	2549.7	-655.0	1039.0	270	6	No	--	Yes
OP2	2580.4	-659.5	1021.8	270	4	No	--	No
Other Pillar Right Side								
OPR	2468.9	514.4	1249.6					
OP1	2553.9	650.5	1044.6	90	6	No	--	No
OP2	2582.9	658.9	1021.5	90	5	No	--	No
Rear Pillar Left Side								
RP1	3009.0	-544.5	1136.9	300	14	No	--	No
RP2	3194.4	-577.8	1022.8	270	0	No	--	Yes
Rear Pillar Right Side								
RP1	3005.7	546.3	1131.2	60	12	No	--	No
RP2	3193.2	572.2	1028.7	90	0	No	--	No
Front Header Left Side								
FH1	1043.6	-472.9	1161.9	180	50	No	--	No
FH2	1028.0	-324.7	1173.1	180	50	No	--	No
Front Header Right Side								
FH1	1046.8	483.3	1162.8	180	50	No	--	No
FH2	1030.3	333.1	1173.6	180	50	No	--	No
Side Rail Left Side								
SR1	1255.9	-540.3	1195.8	--	--	Yes	--	--
REL	1265.4	-519.4	1194.5	270	42	--	1	Yes
SR2A	1406.4	-534.7	1225.7	270	30	No	--	No
SR2B	1366.0	-537.3	1218.6	270	32	No	--	No
SR3-1	2010.3	-495.2	1253.9	270	48	No	--	No

SUMMARY OF TARGETING RESULTS								
Target	Location (mm)			Horizontal Angle (deg)	Vertical Angle (deg)	Relocation (Yes/No)	Extension (# of 25 mm Spheres)	Impact (Yes/No)
	x	y	z					
SR3-2	2201.0	-496.8	1250.8	270	49	No	--	No
SR3-3	2624.1	-570.2	1192.5	270	27	No	--	No
Side Rail Right Side								
SR1	1253.0	543.2	1201.6	--	--	Yes	--	--
REL	1268.0	521.3	1197.1	90	42	--	1	No
SR2A	1403.7	528.7	1210.1	90	50	No	--	No
SR2B	1369.2	528.4	1203.3	90	50	No	--	Yes
SR3-1	2012.9	500.7	1251.7	90	48	No	--	No
SR3-2	2202.1	500.2	1248.3	90	48	No	--	No
SR3-3	2618.3	568.9	1193.8	90	25	No	--	Yes
Rear Header Left Side								
RH	2980.4	-271.6	1247.5	0	50	No	--	No
Rear Header Right Side								
RH	2990.4	304.6	1240.9	0	50	No	--	Yes
Upper Roof Left Side								
UR1@ Front Side Rail	1518.0	-442.6	1259.1	270	50	No	--	No
UR2@Rear of B-Pillar	1852.3	-446.9	1278.5	270	50	No	--	No
UR3@O-Pillar	2476.0	-446.0	1276.7	270	50	No	--	No
Upper Roof Right Side								
UR4@BPR	1668.1	447.8	1272.8	90	42	No	--	Yes
UR5@SR3-1	2039.2	397.7	1285.4	90	50	No	--	No
UR6@Rear Corner	2806.7	445.8	1267.2	90	19	No	--	No

As determined using the Procedures specified in S10.1-10.13.

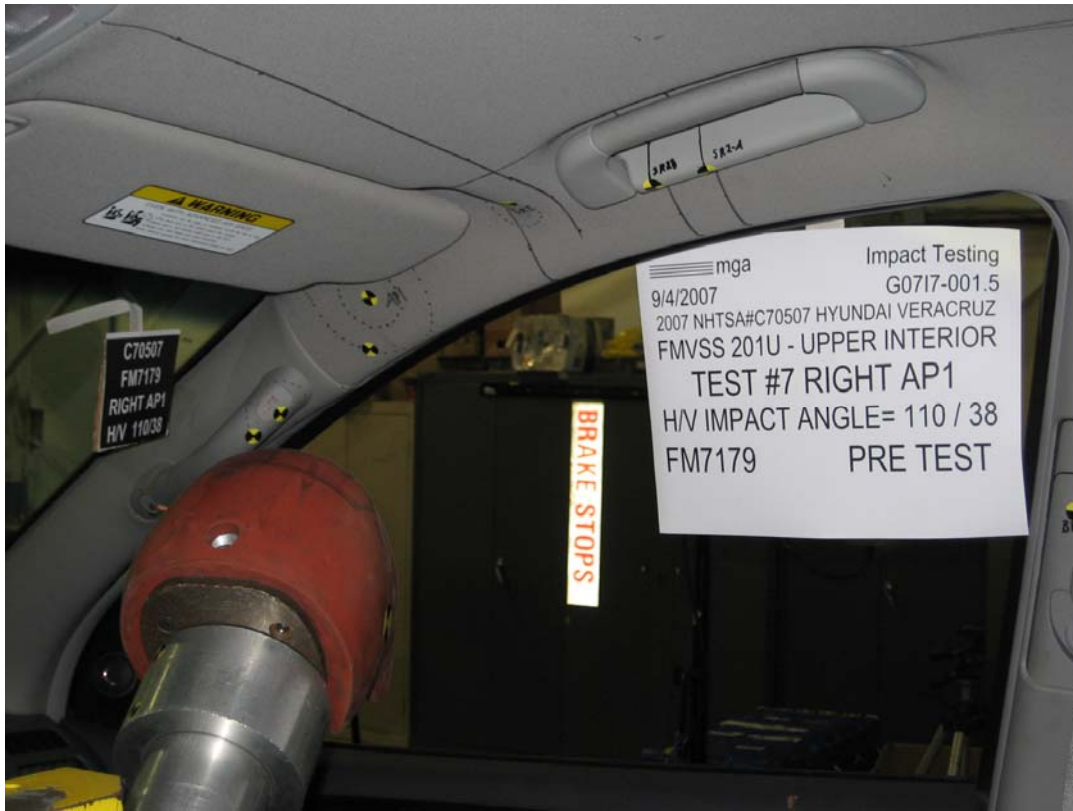
REMARKS: Targets AP1, AP2, AP3, BP1, SR1, SR2-A, SR2-B, and SR3-3 are located in the curtain airbag zone and are subject to a reduced velocity impact if tested.

RECORDED BY: Louis Campbell

DATE: August 30, 2007

APPROVED BY: Helen A. Kaleto

3.0 TEST DATA (Including Acceleration and Velocity Plots)

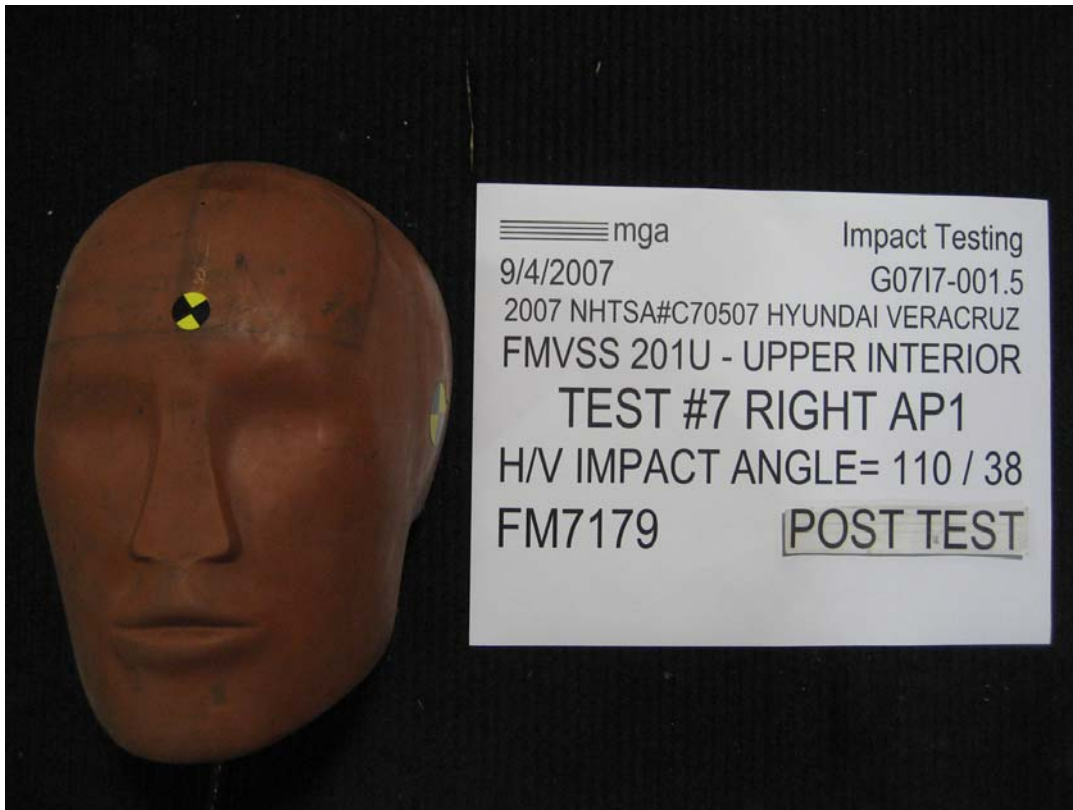




mga Impact Testing
9/4/2007 G0717-001.5
2007 NHTSA#C70507 HYUNDAI VERACRUZ
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT AP1
H/V IMPACT ANGLE= 110 / 38
FM7179 POST TEST

C70507
FM7179
RIGHT AP1
HV 110/38

mga Impact Testing
9/4/2007 G0717-001.5
2007 NHTSA#C70507 HYUNDAI VERACRUZ
FMVSS 201U - UPPER INTERIOR
TEST #7 RIGHT AP1
H/V IMPACT ANGLE= 110 / 38
FM7179 POST TEST



SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#7
Target (Vehicle Side): AP1 Right Temperature:22C
MGA Test Reference No.:FM7179 Humidity:56%
Approach Horizontal Angles:110° Time of Test:2:09:20 PM
Approach Vertical Angles:38° FMH Serial No:[035]
Additional Description: 2 Relocations

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
606	582	4.9	18.9	7	4 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22664	-94.161	1.32	1.32
Y	6	J35919	97.442	1.88	1.88
Z	7	J35924	93.891	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

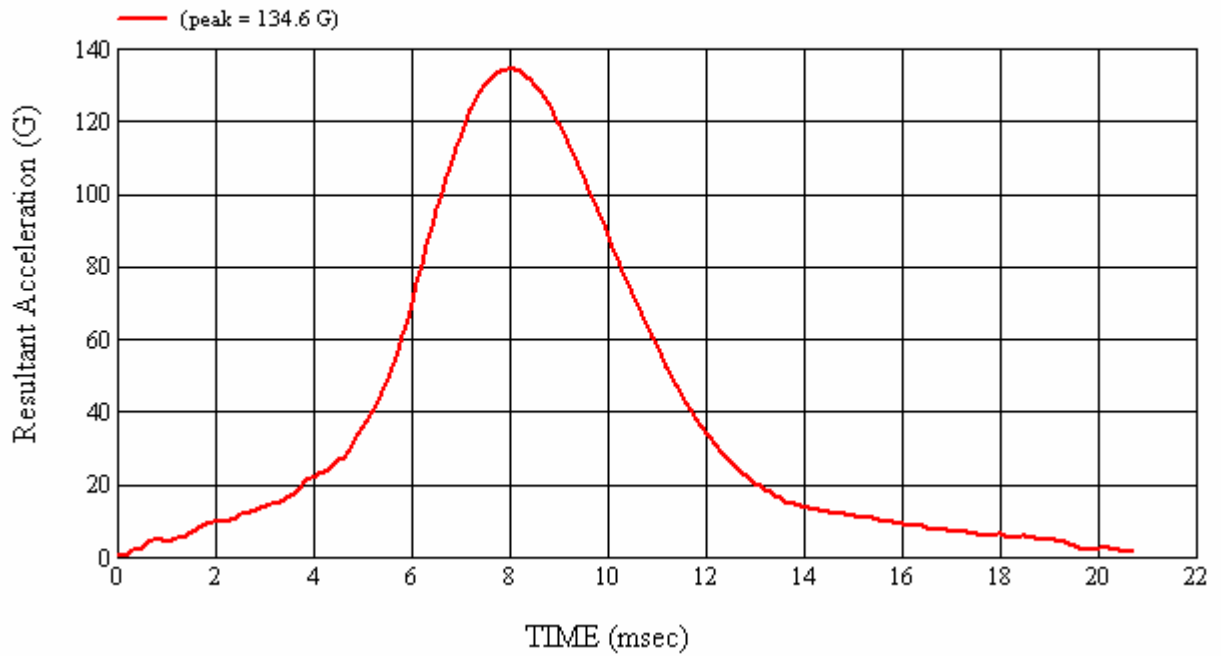
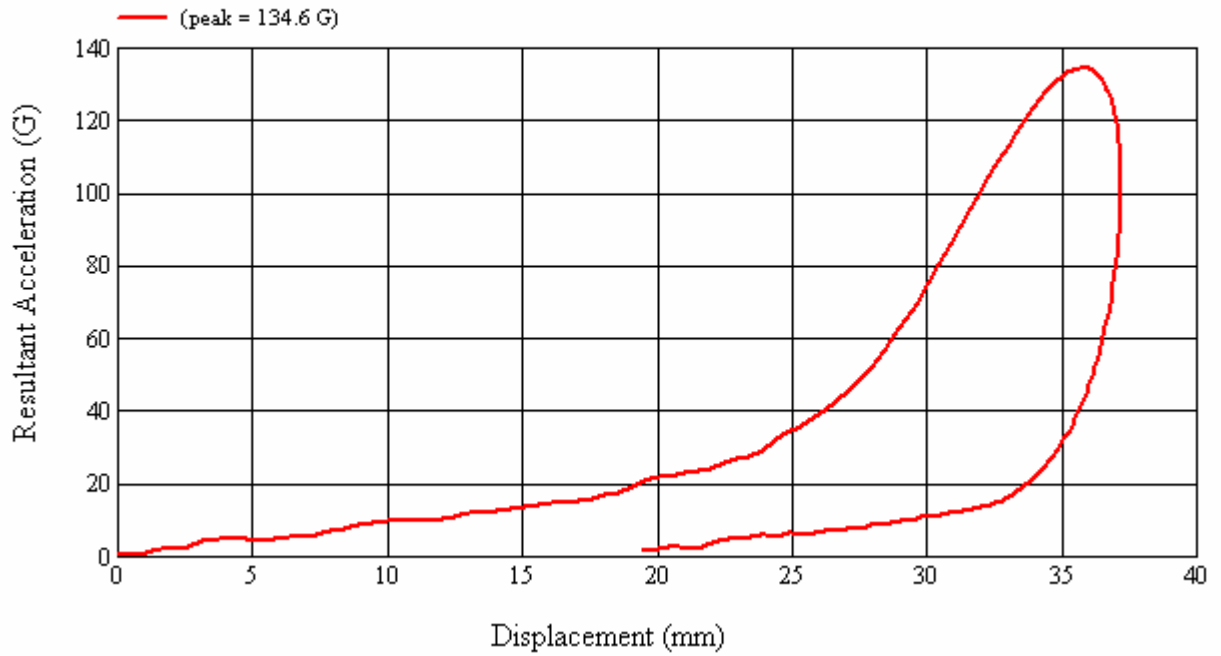
No visible damage.

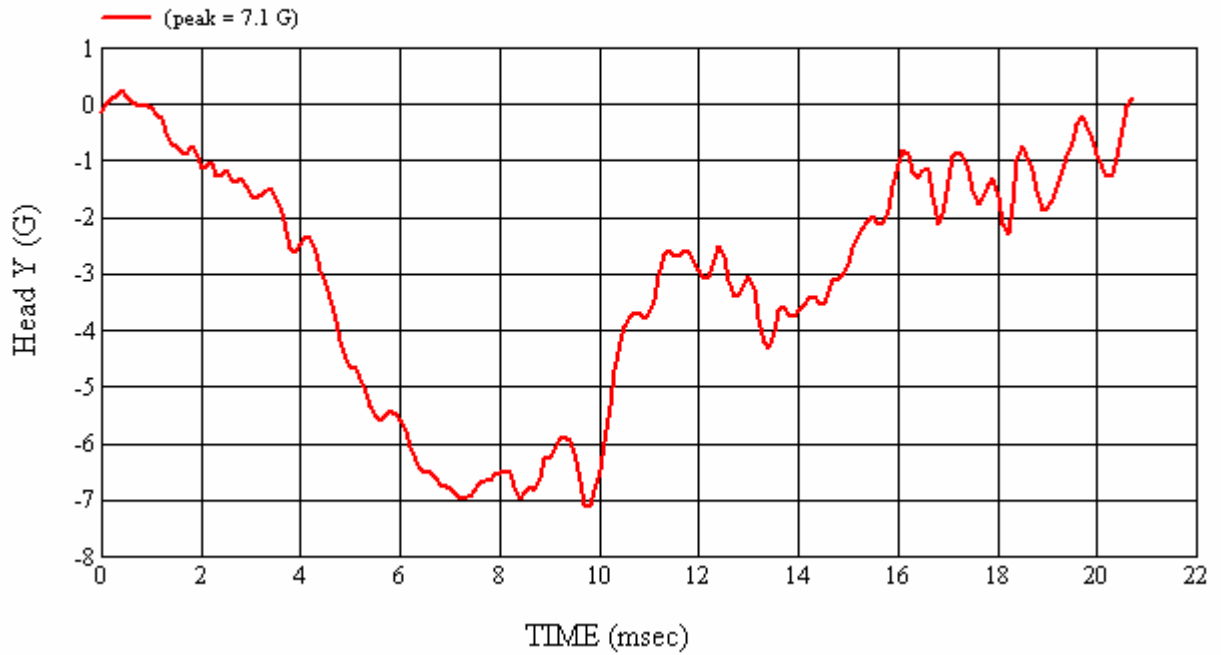
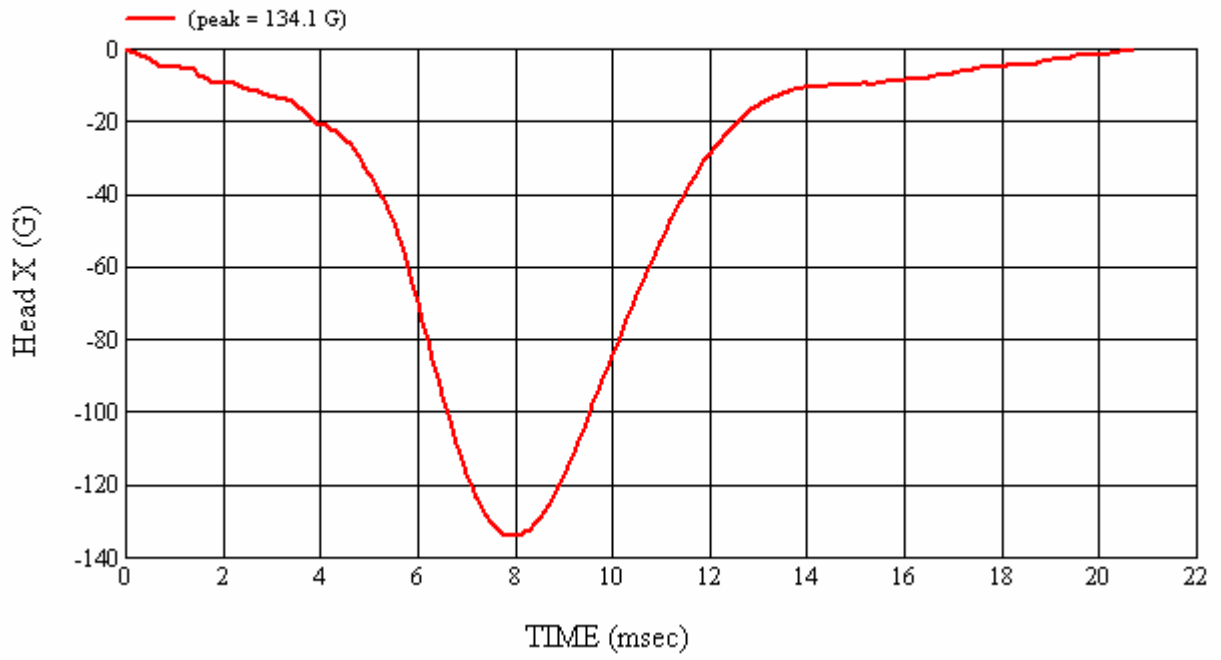
Recorded By: *Janis Campbell* Approved By*: *Heena A. Kalita* Date: 9/4/2007
*Only necessary for NHTSA (Government) Compliance testing.

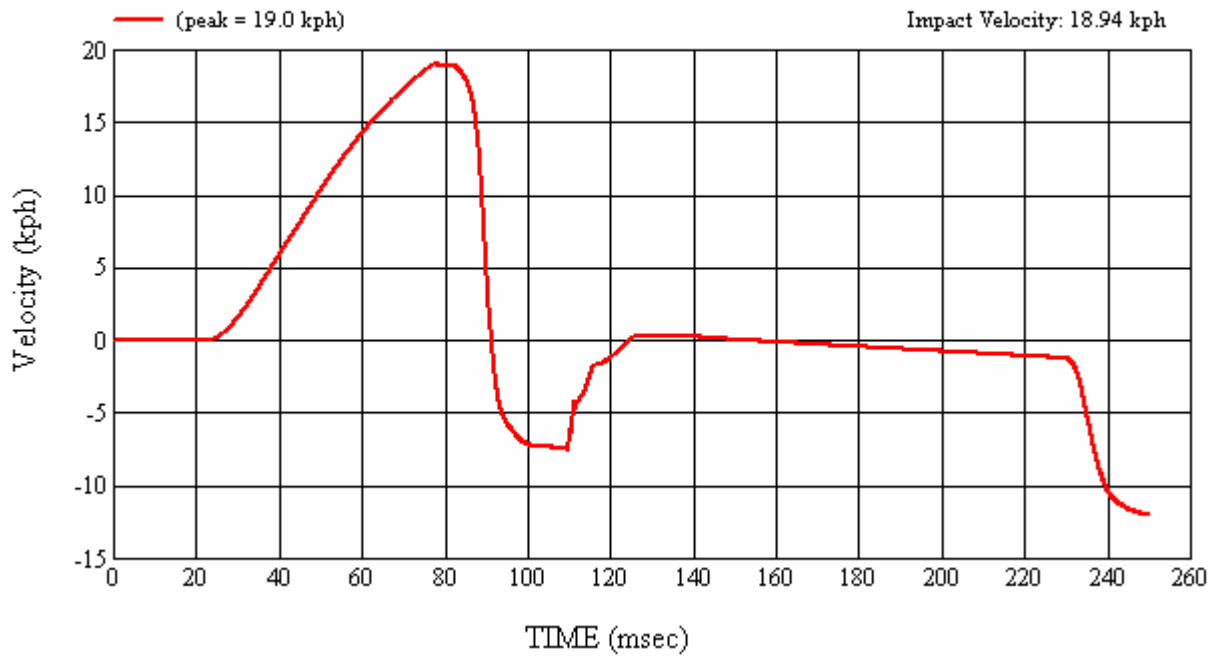
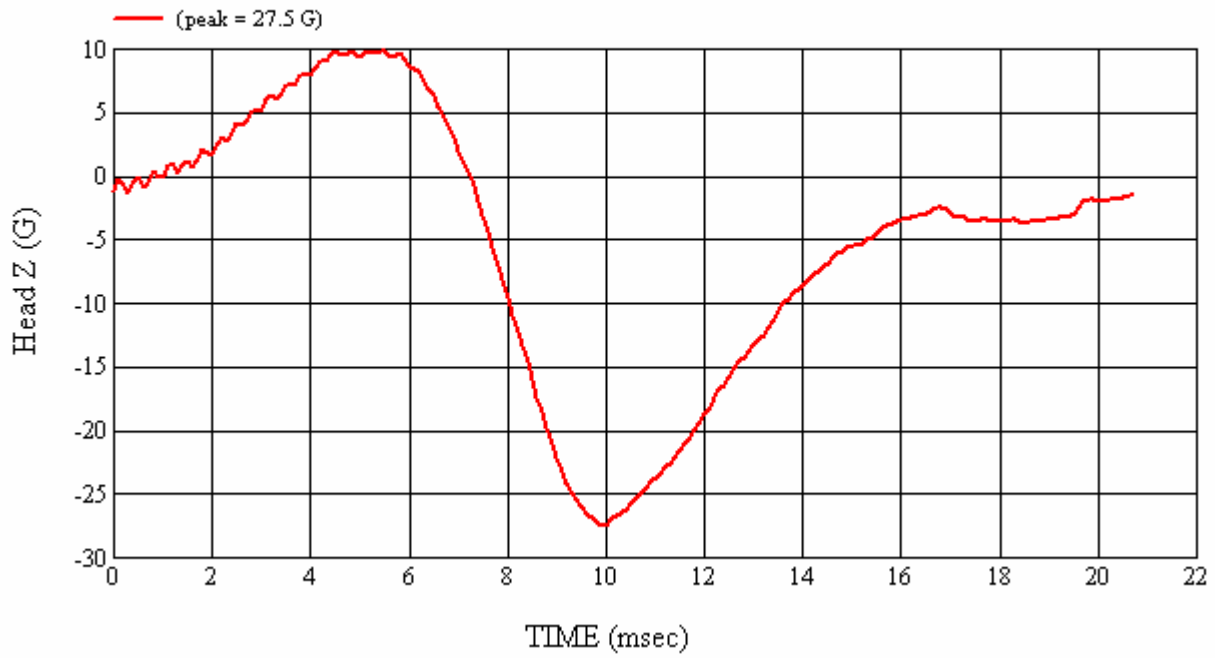
MGA Test #: FM7179

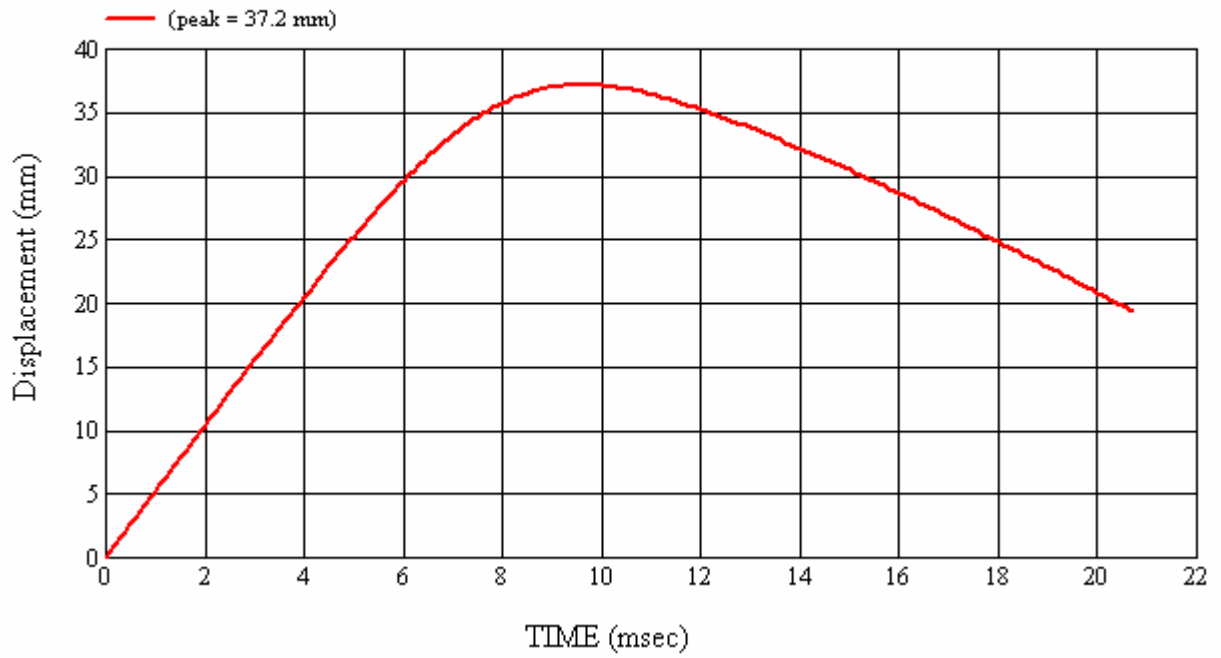
Target Location: API, Right Side

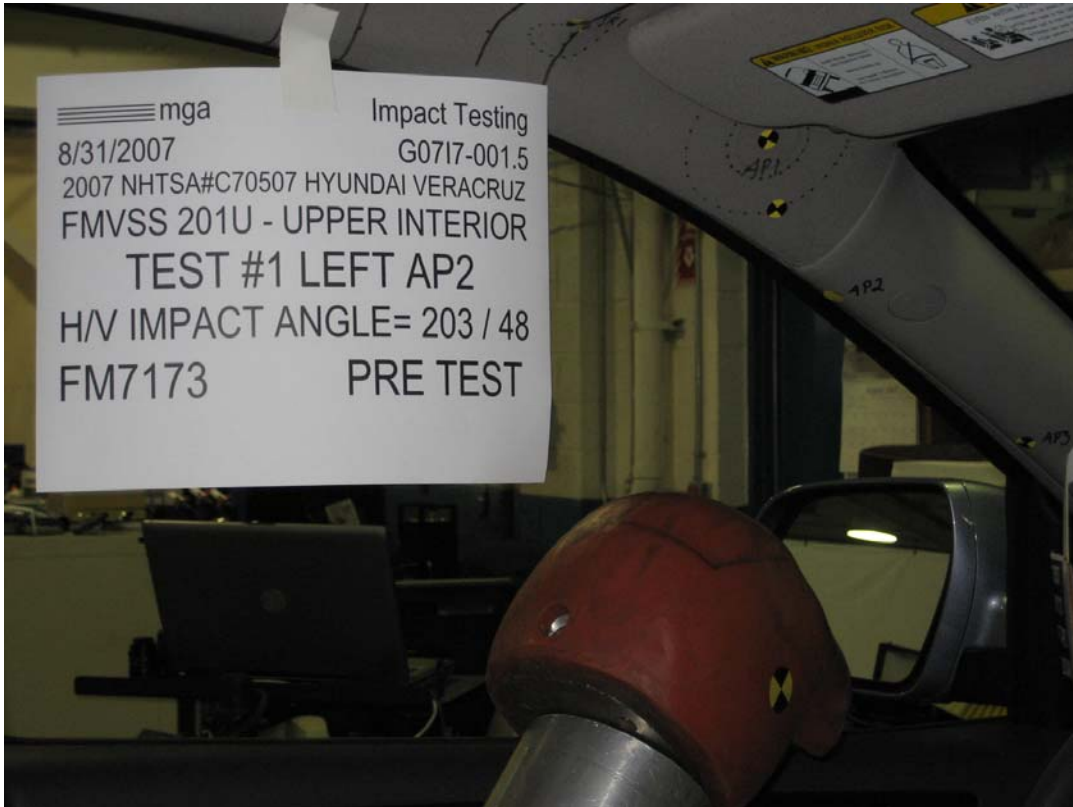
Test Date: 9/4/2007

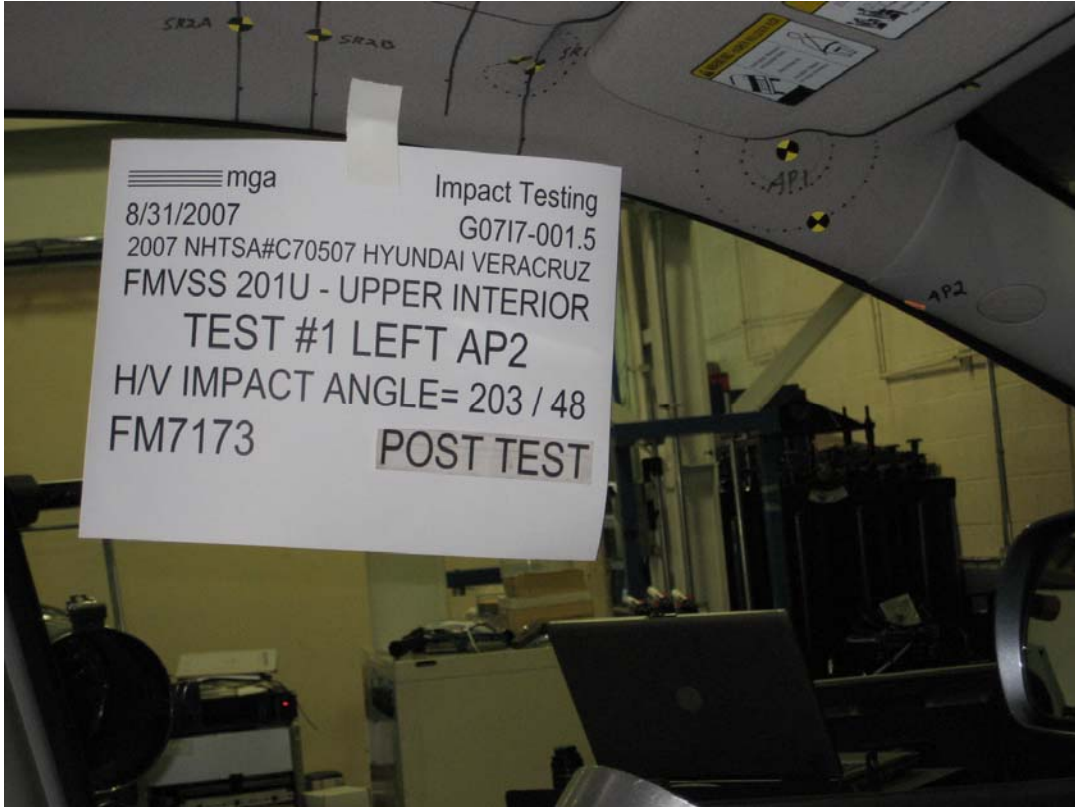












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Target (Vehicle Side): AP2 Left Test Number:#1
 MGA Test Reference No.:FM7173 Temperature:22C
 Approach Horizontal Angles:203° Humidity:54%
 Approach Vertical Angles:48° Time of Test:1:12:34 PM
 Additional Description: FMH Serial No:[035]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
599	574	4.3	18.7	12	8 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22664	-94.161	1.32	1.32
Y	6	J35919	97.442	1.89	1.89
Z	7	J35924	93.891	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

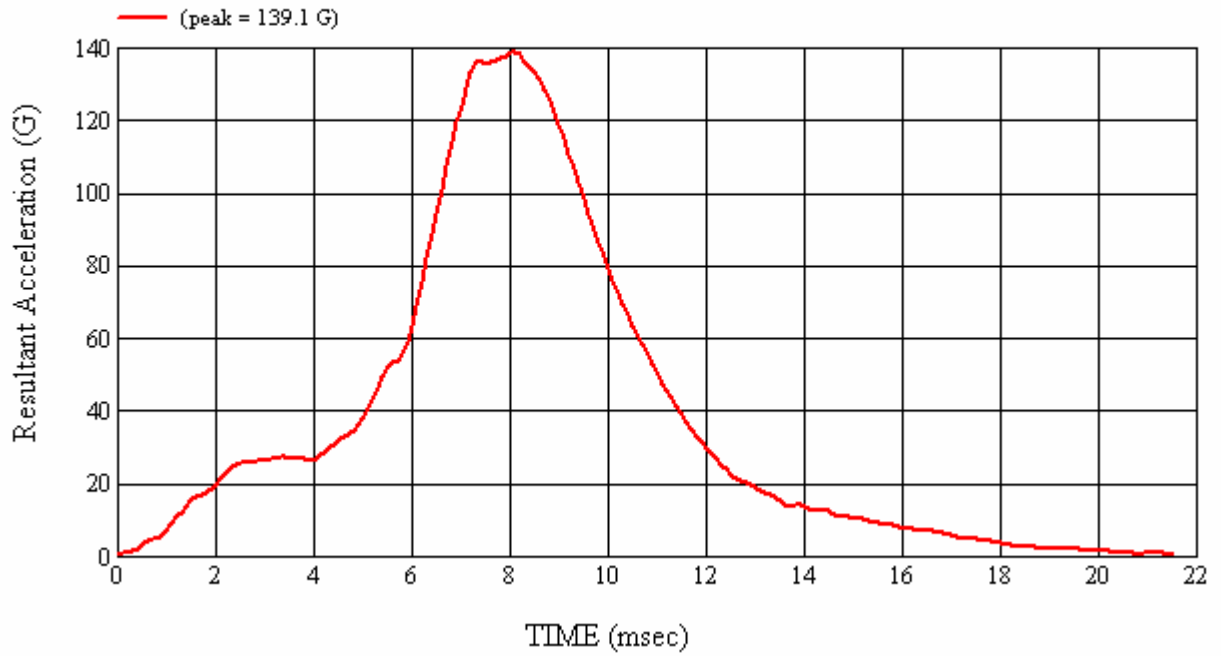
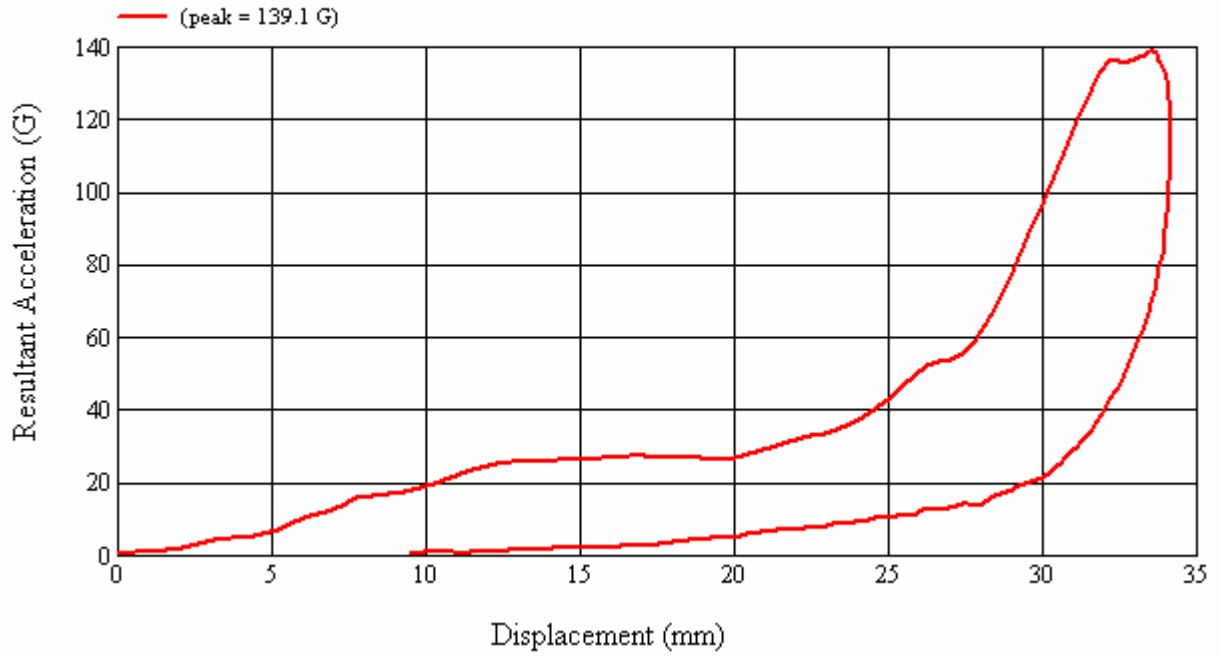
No visible damage.

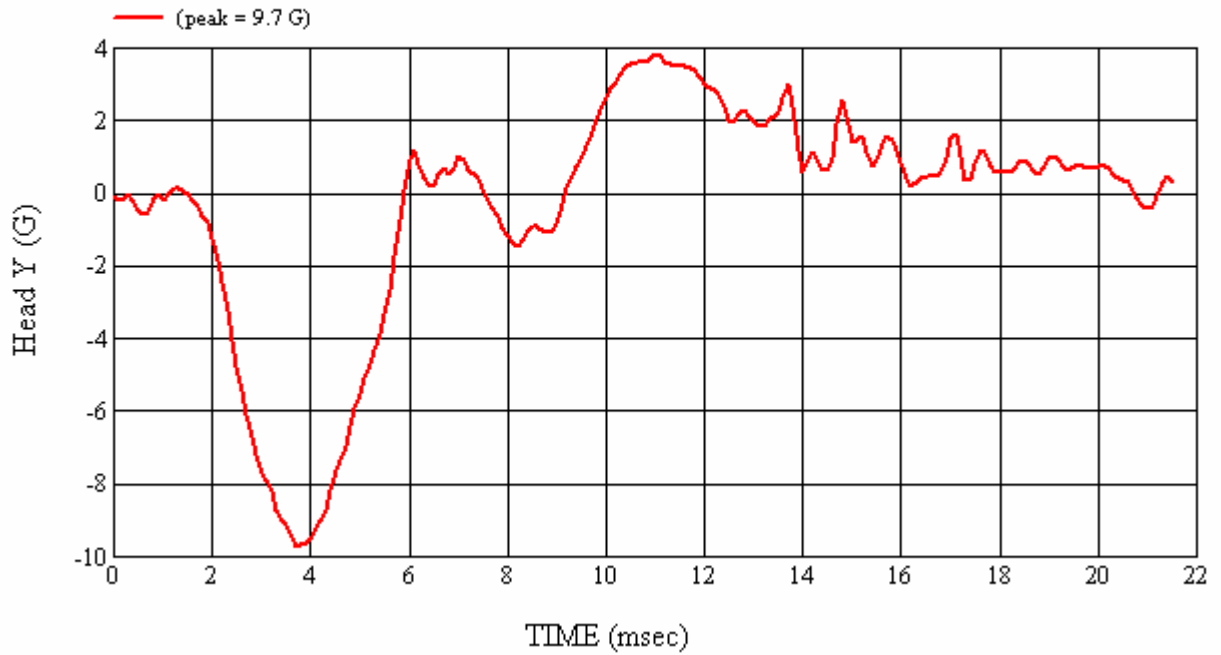
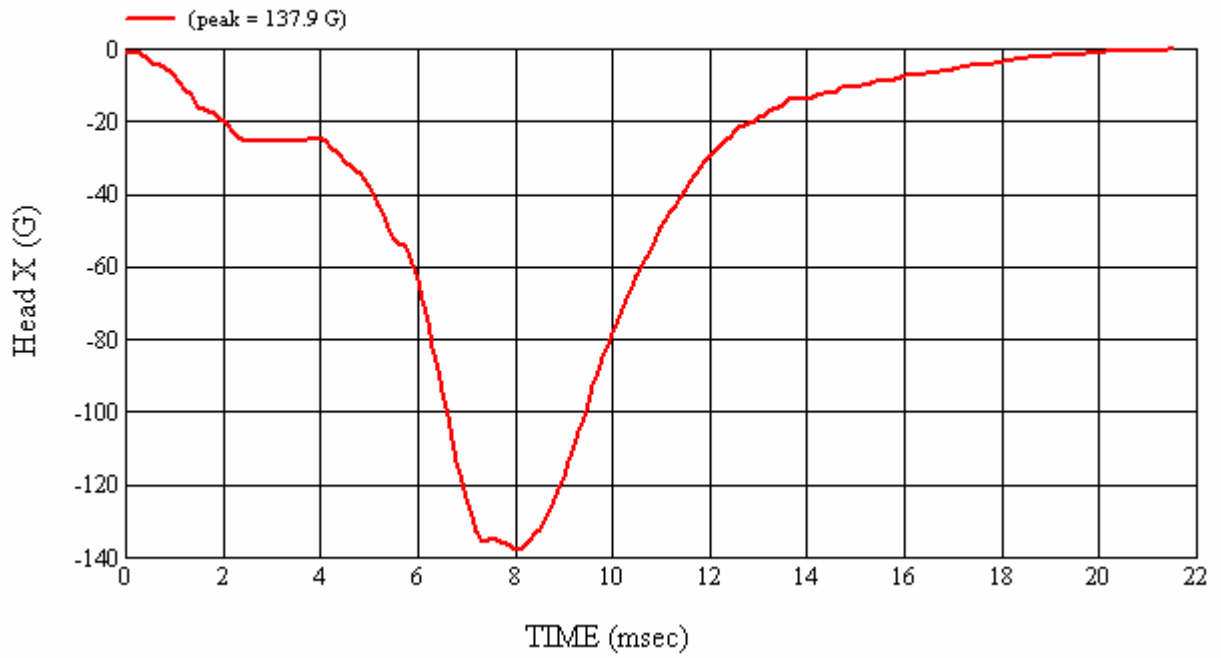
Recorded By: *Janita Campbell* Approved By*: *Heena A. Kalita* Date: 8/31/2007
 *Only necessary for NHTSA (Government) Compliance testing.

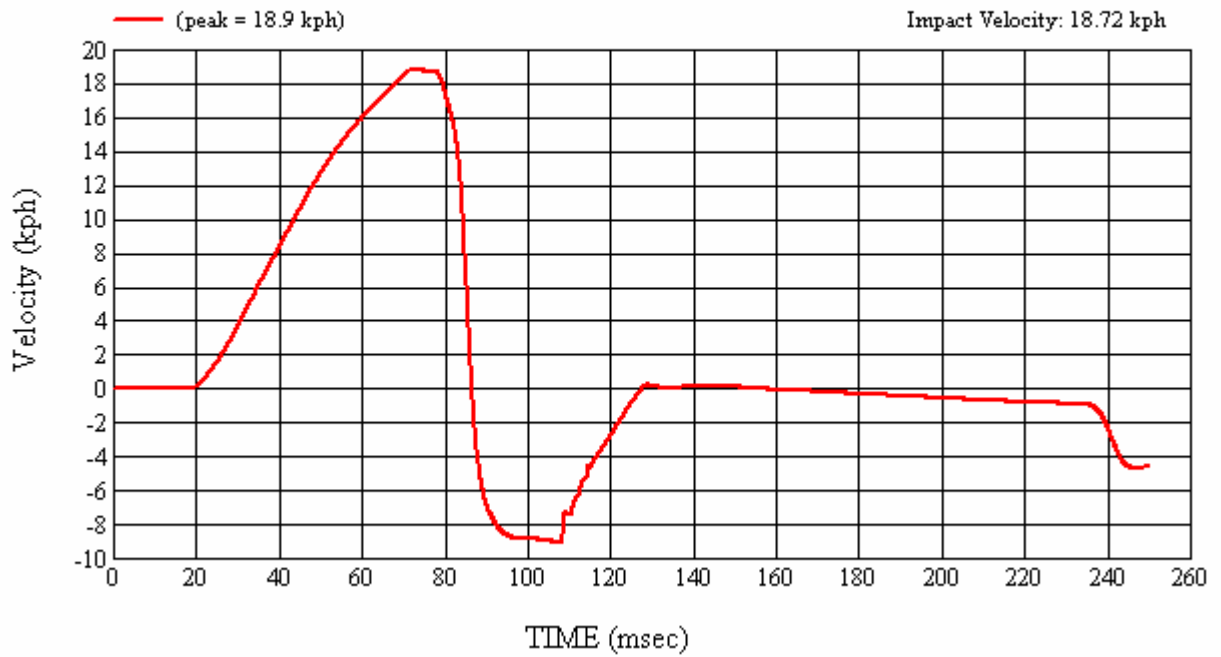
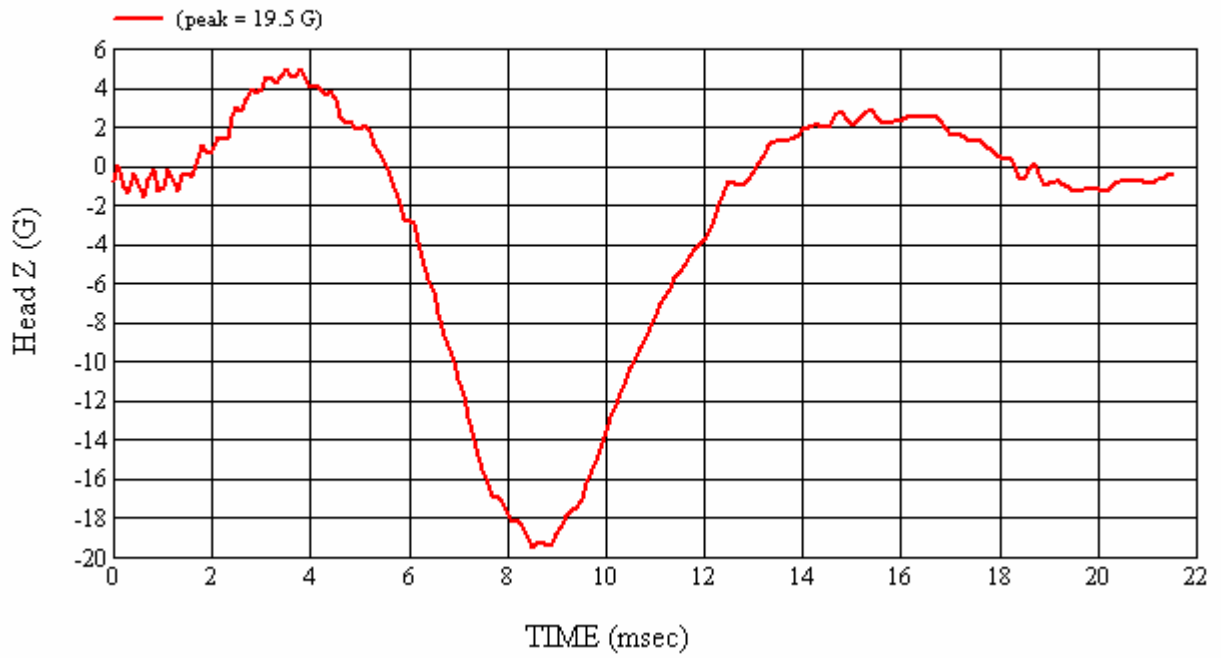
MGA Test #: FM7173

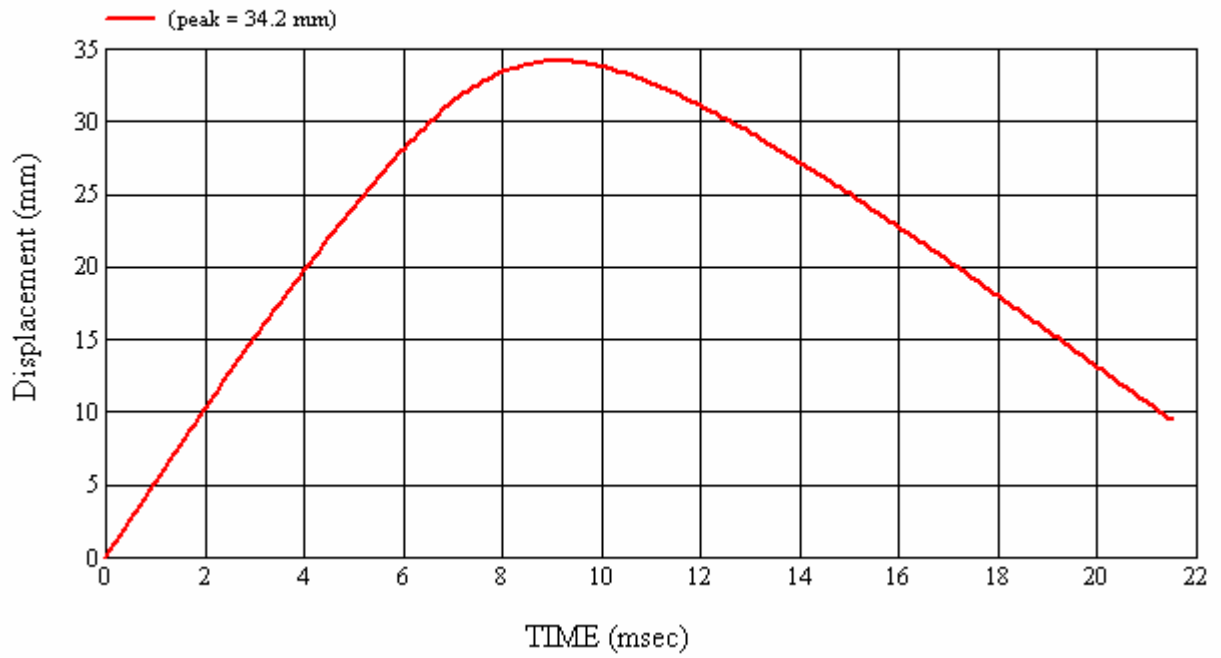
Target Location: AP2, Left Side

Test Date: 8/31/2007

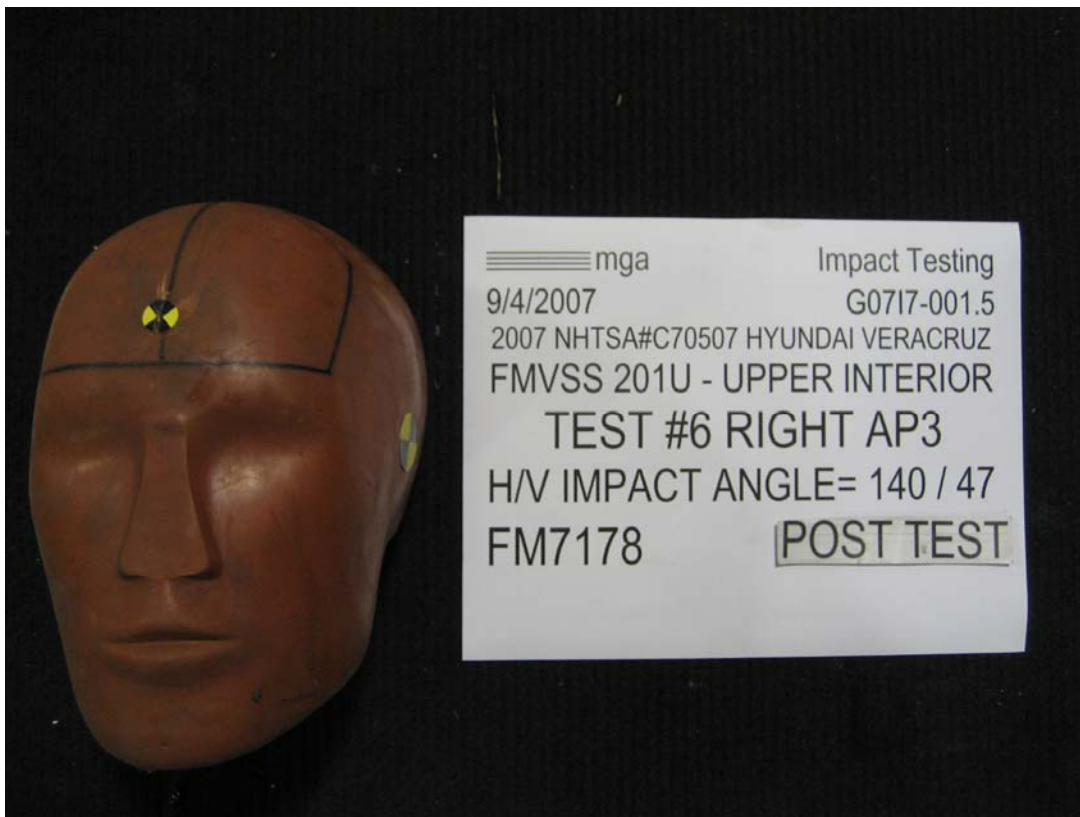












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#6
 Target (Vehicle Side): AP3 Right Temperature:22C
 MGA Test Reference No.:FM7178 Humidity:56%
 Approach Horizontal Angles:140° Time of Test:12:53:00 PM
 Approach Vertical Angles:47° FMH Serial No:[038]
 Additional Description: 1 Relocation

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
731	748	6.8	23.7	17	1 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J14103	-94.598	1.32	1.32
Y	6	J36197	110.692	1.89	1.89
Z	7	J36353	99.391	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

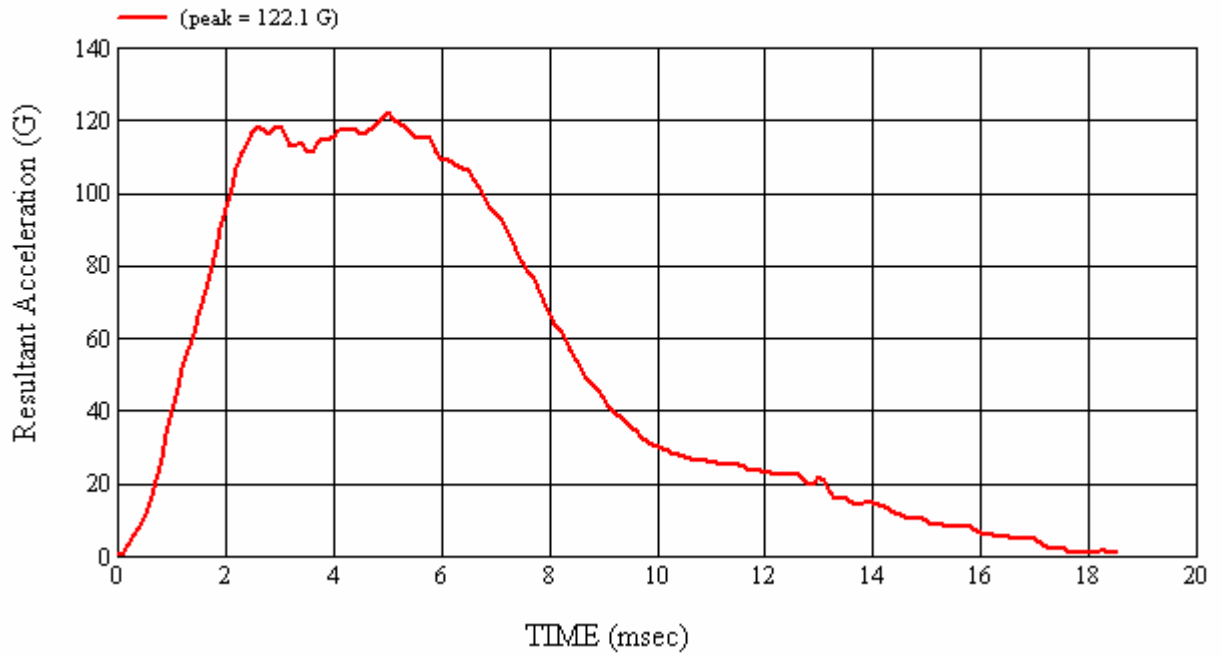
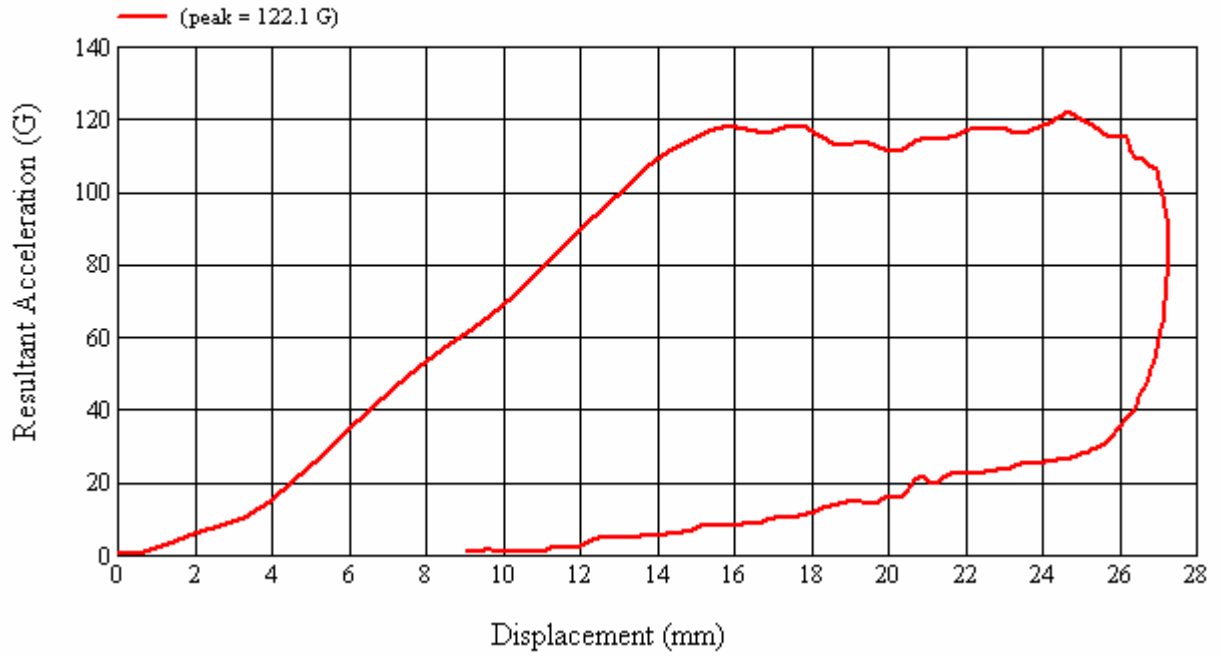
No visible damage.

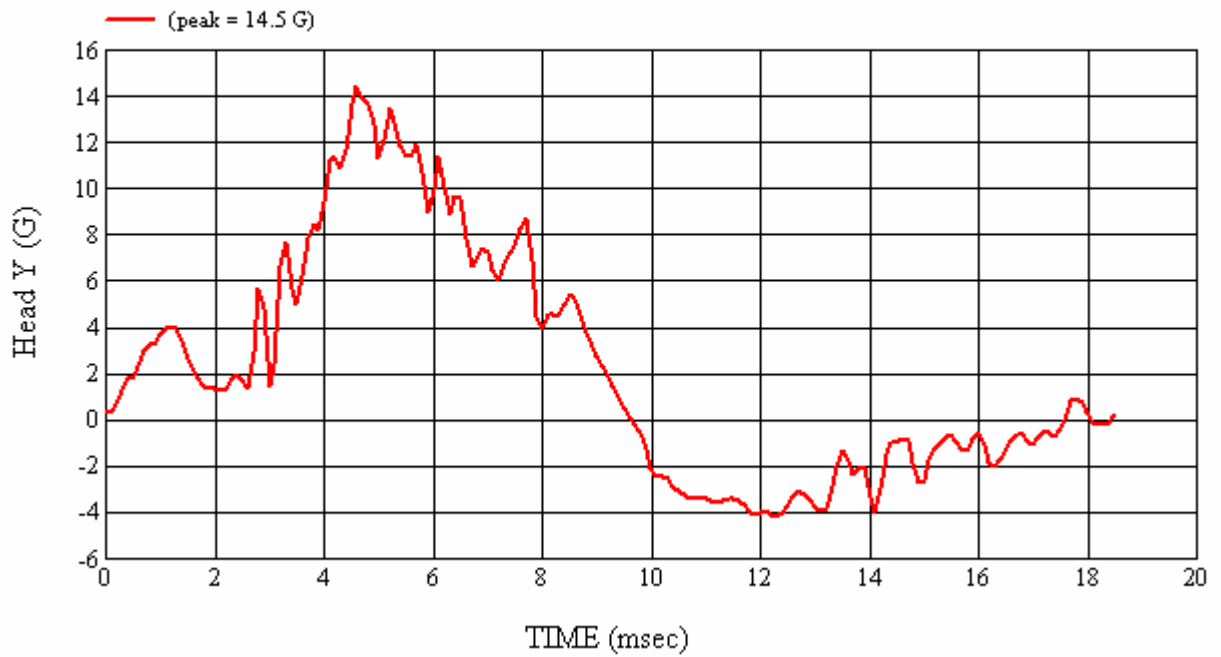
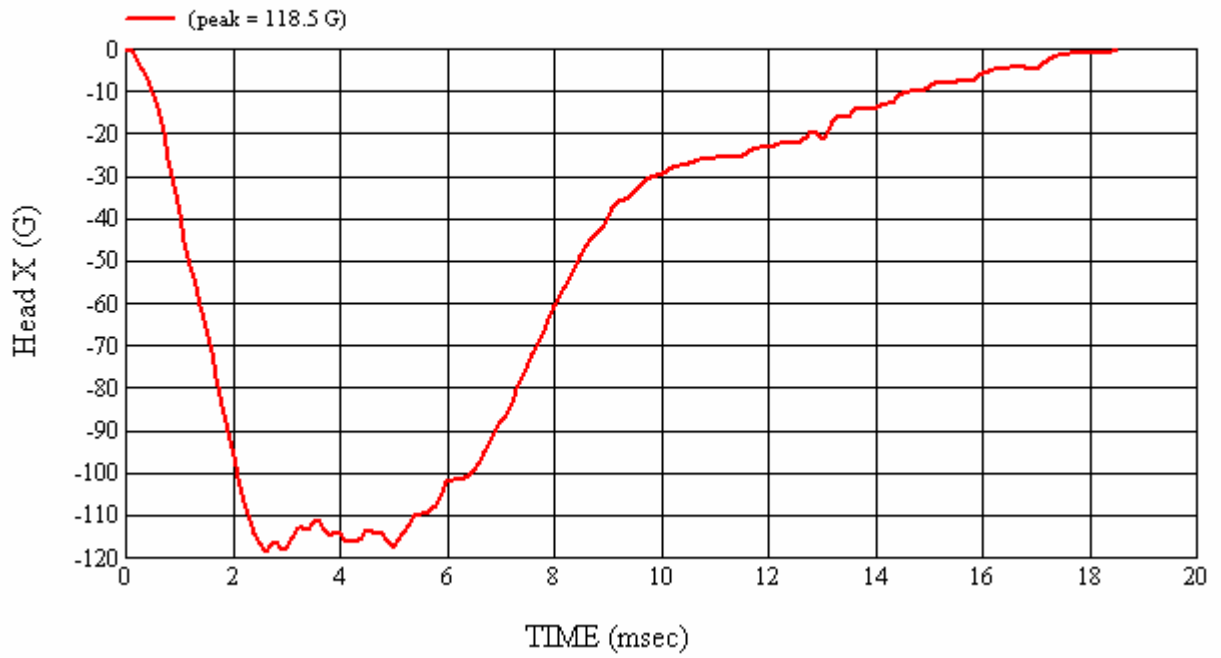
Recorded By: *Janita Campbell* Approved By*: *Heena A. Kalita* Date: 9/4/2007
 *Only necessary for NHTSA (Government) Compliance testing.

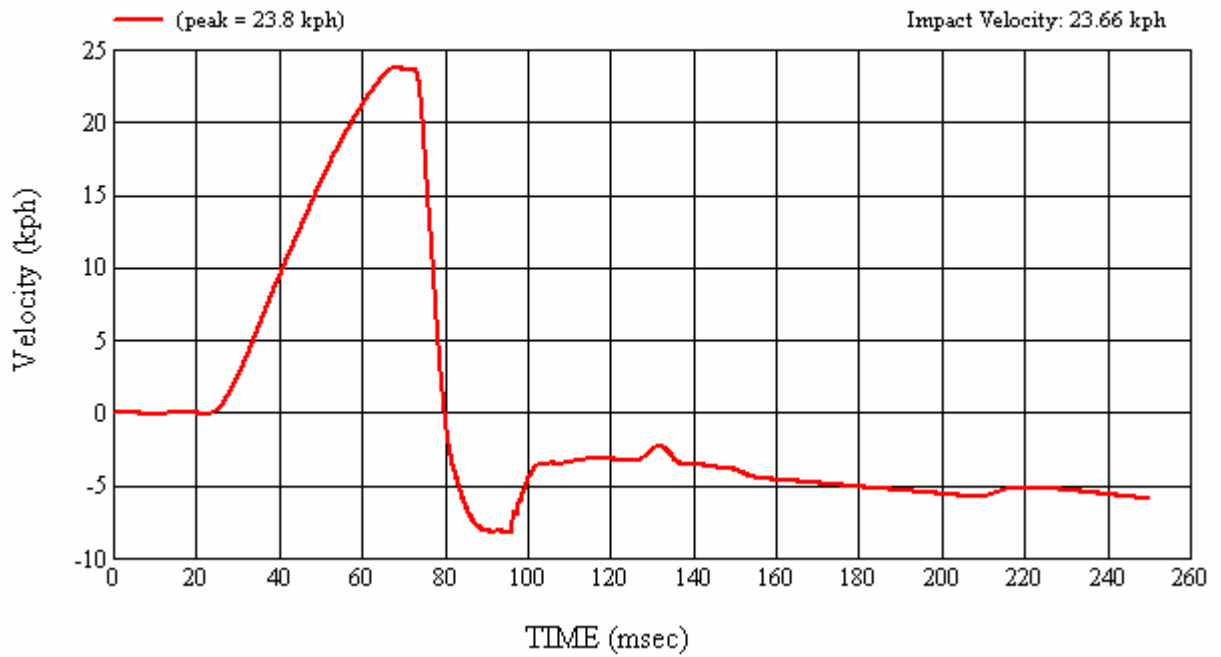
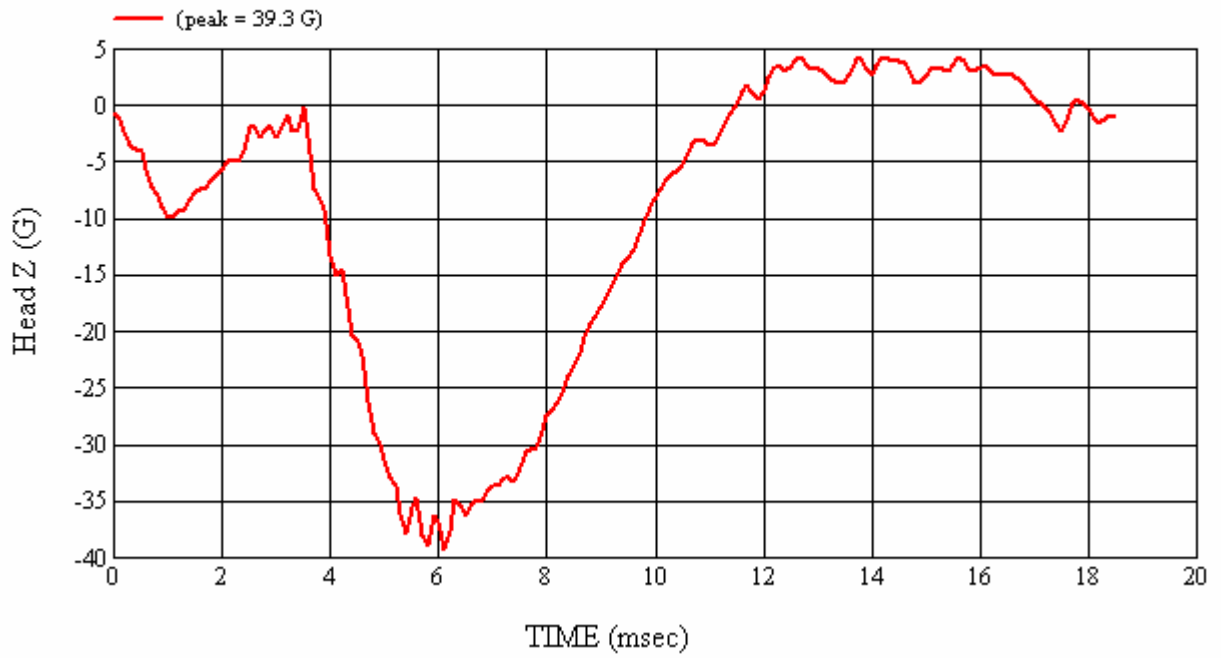
MGA Test #: FM7178

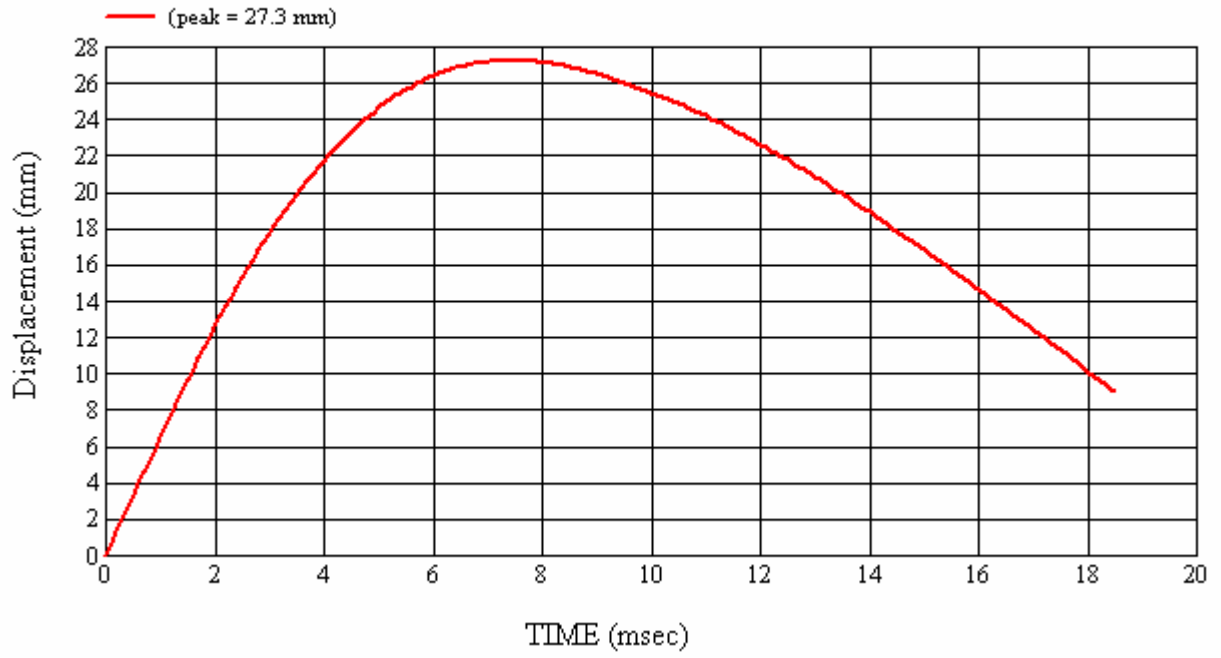
Target Location: AP3, Right Side

Test Date: 9/4/2007













SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#3
 Target (Vehicle Side): BP2 Left Temperature:22C
 MGA Test Reference No.:FM7175 Humidity:56%
 Approach Horizontal Angles:270° Time of Test:3:34:12 PM
 Approach Vertical Angles:2° FMH Serial No:[038]
 Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
673	671	7.1	24.0	16	3 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J14103	-94.598	1.32	1.32
Y	6	J36197	110.692	1.89	1.89
Z	7	J36353	99.391	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

D-ring cover displacement.

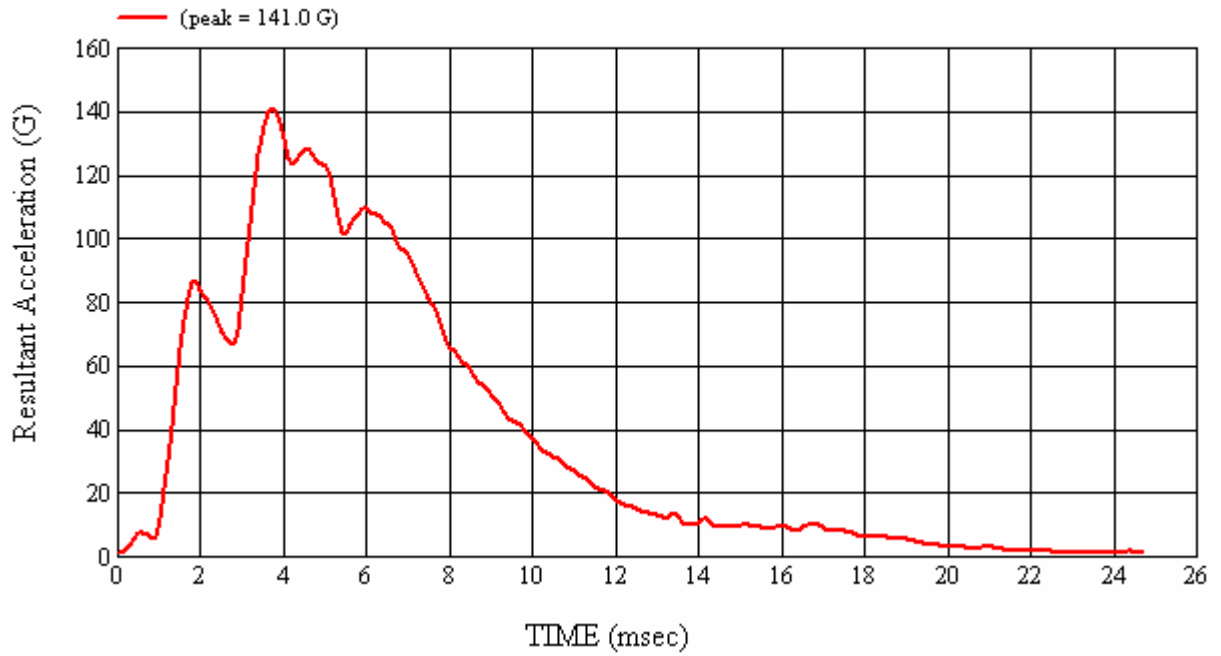
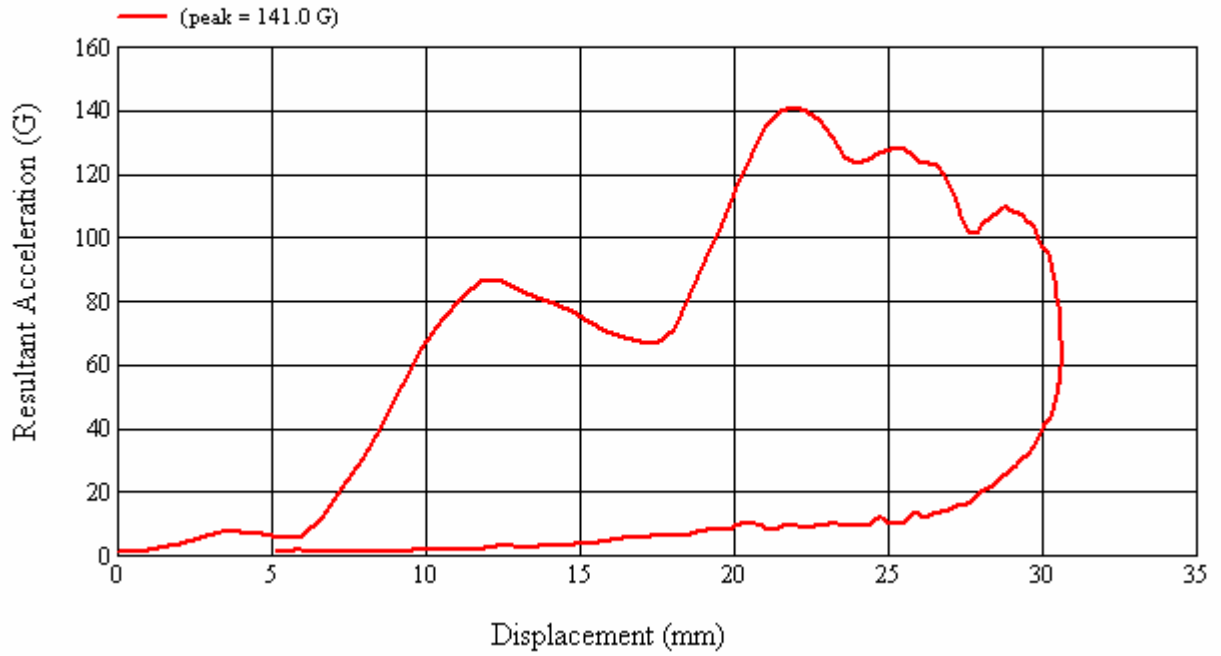
Recorded By: *Janis Campbell* Approved By*: *Heena A. Kalita* Date: 8/31/2007

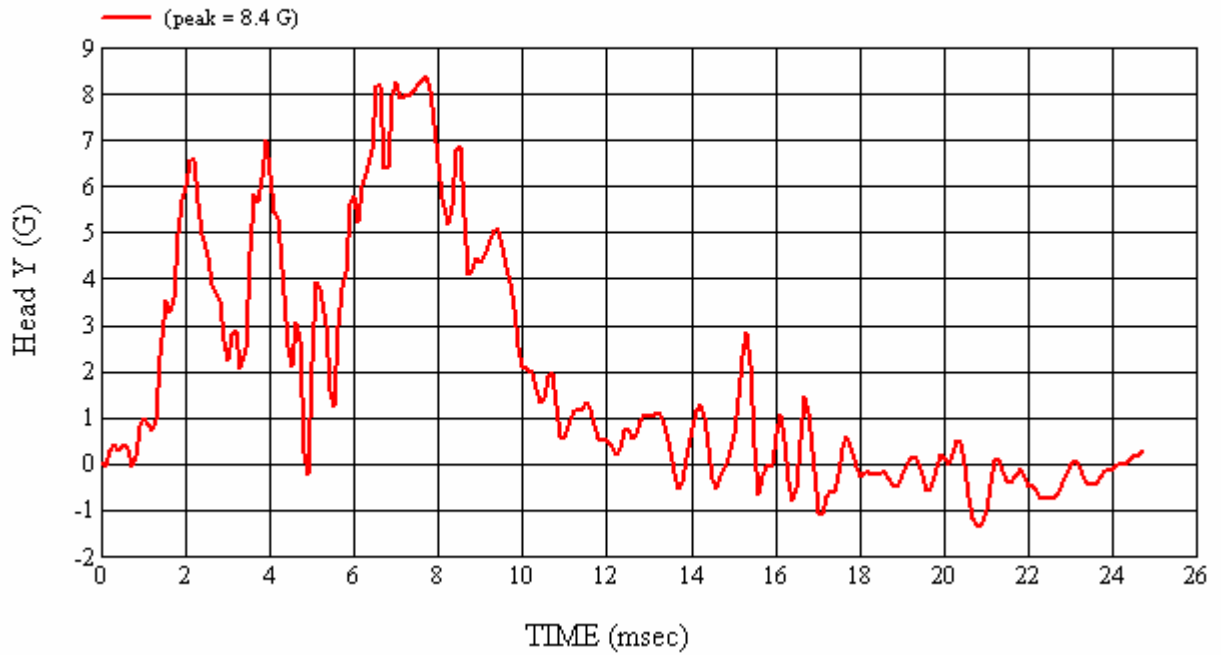
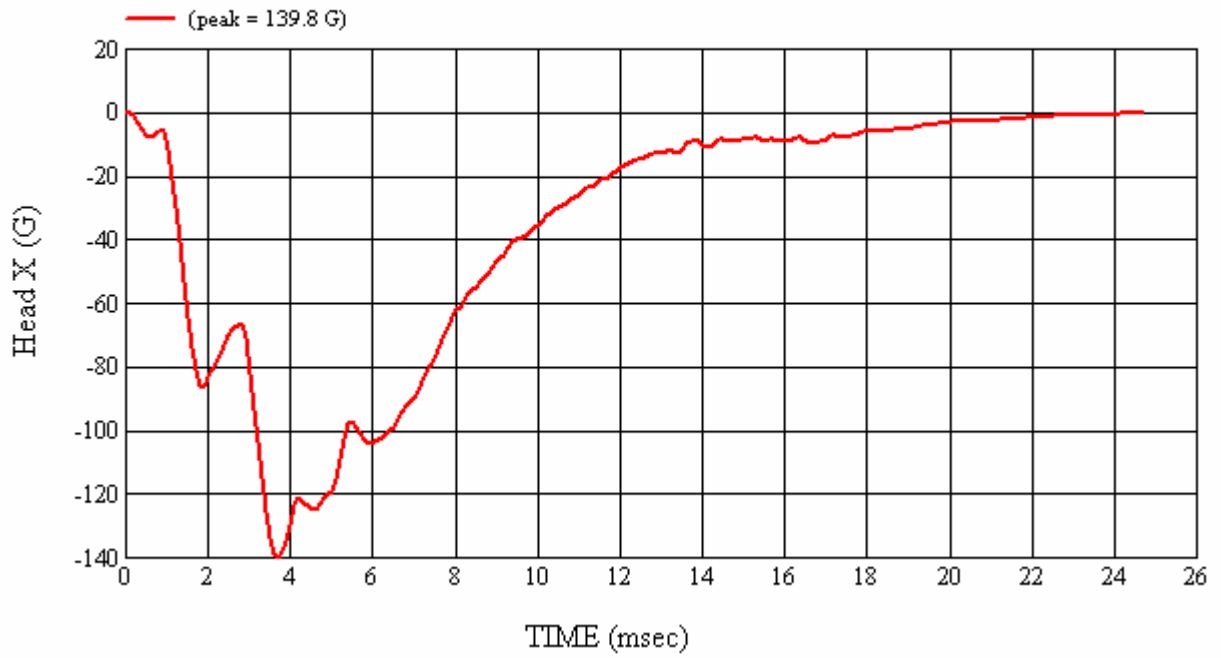
*Only necessary for NHTSA (Government) Compliance testing.

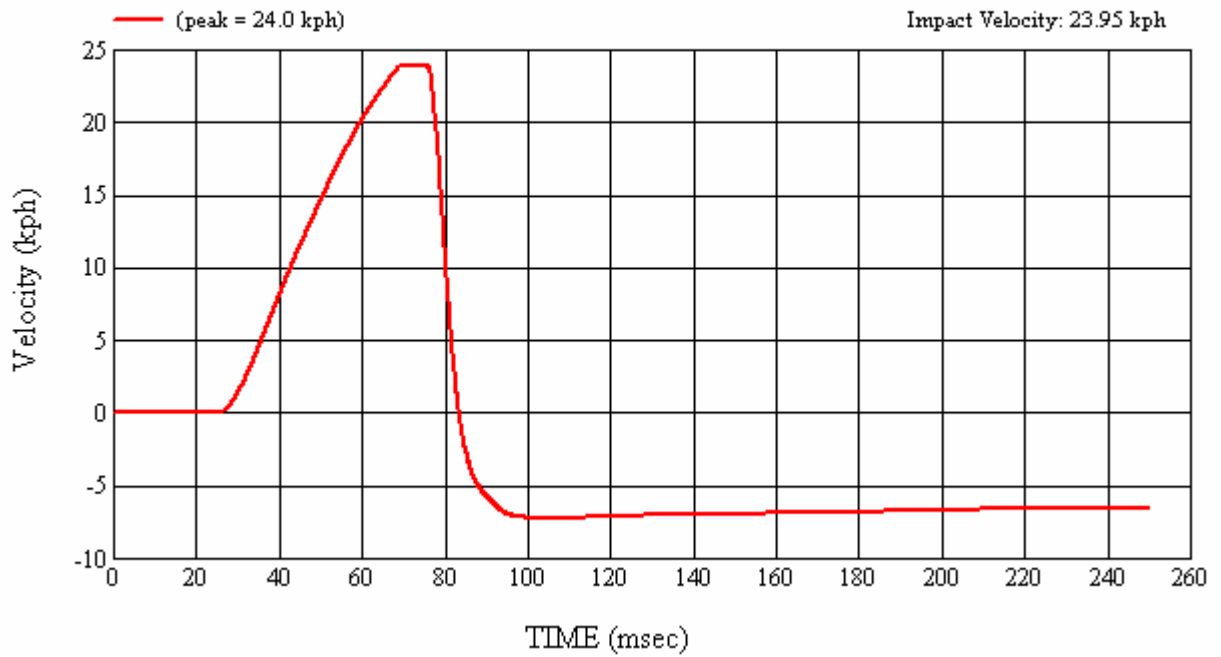
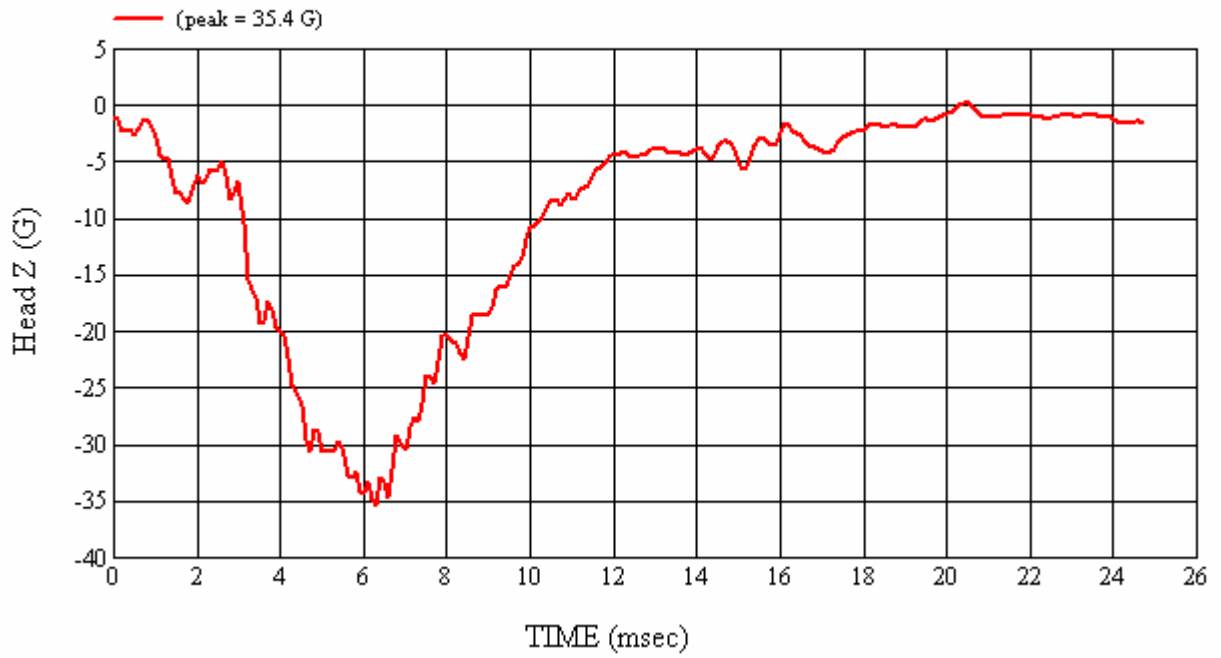
MGA Test #: FM7175

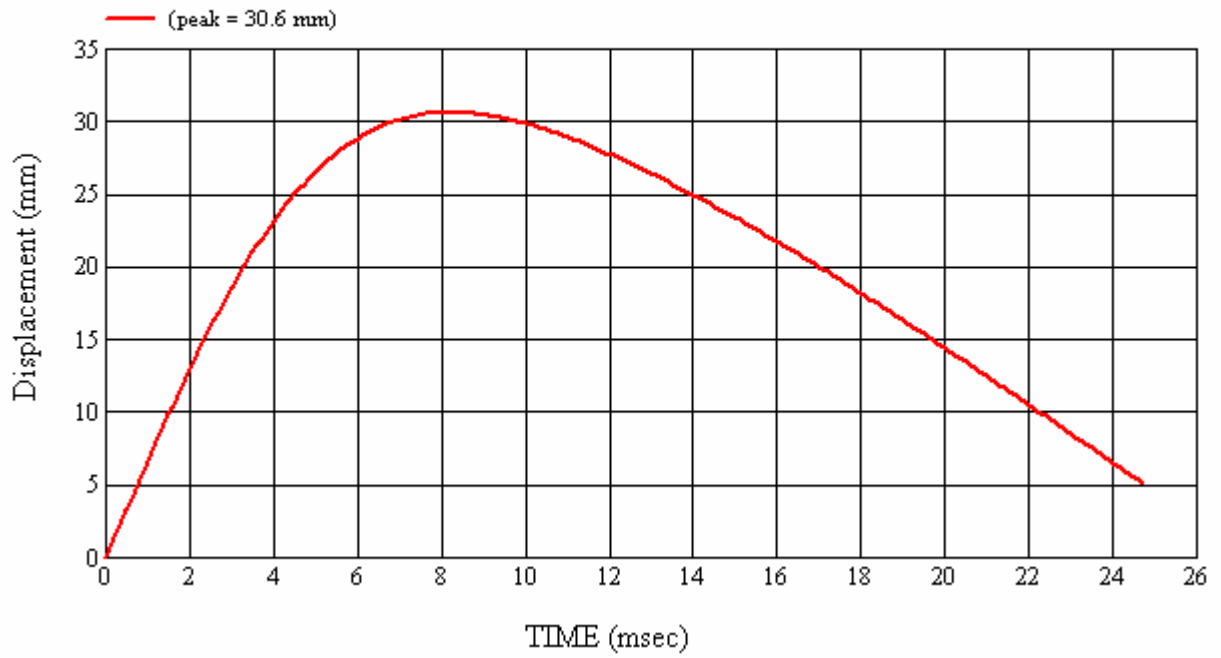
Target Location: BP2, Left Side

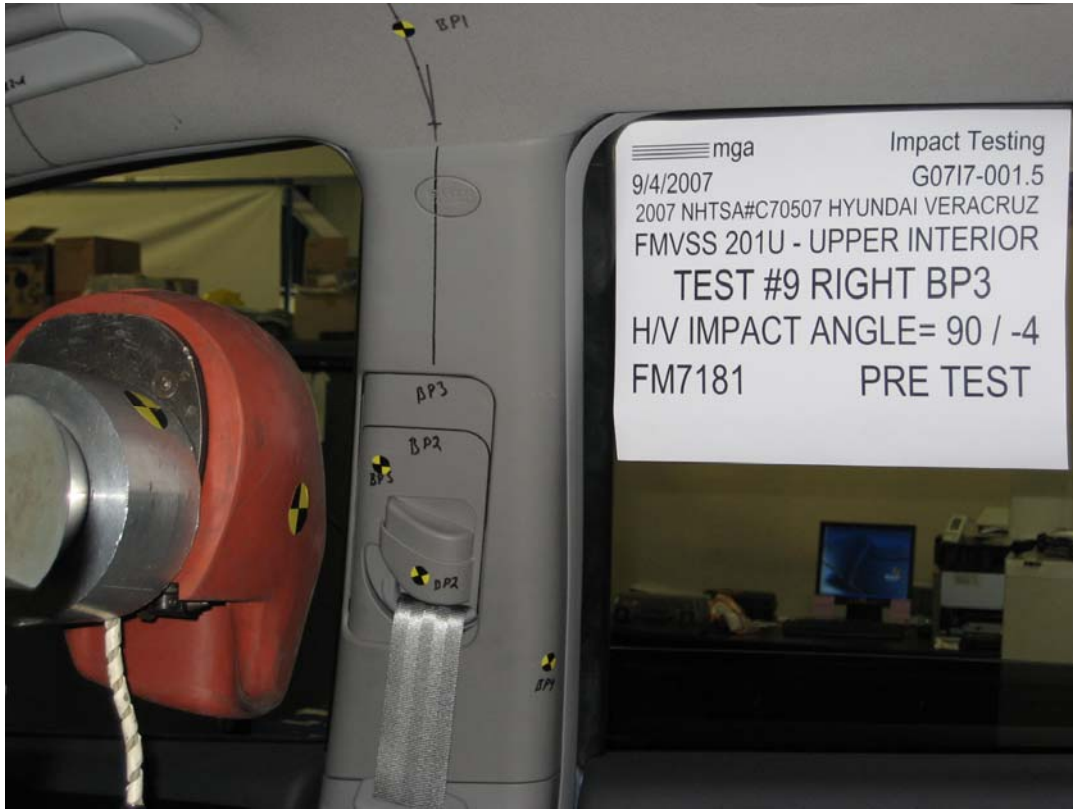
Test Date: 8/31/2007

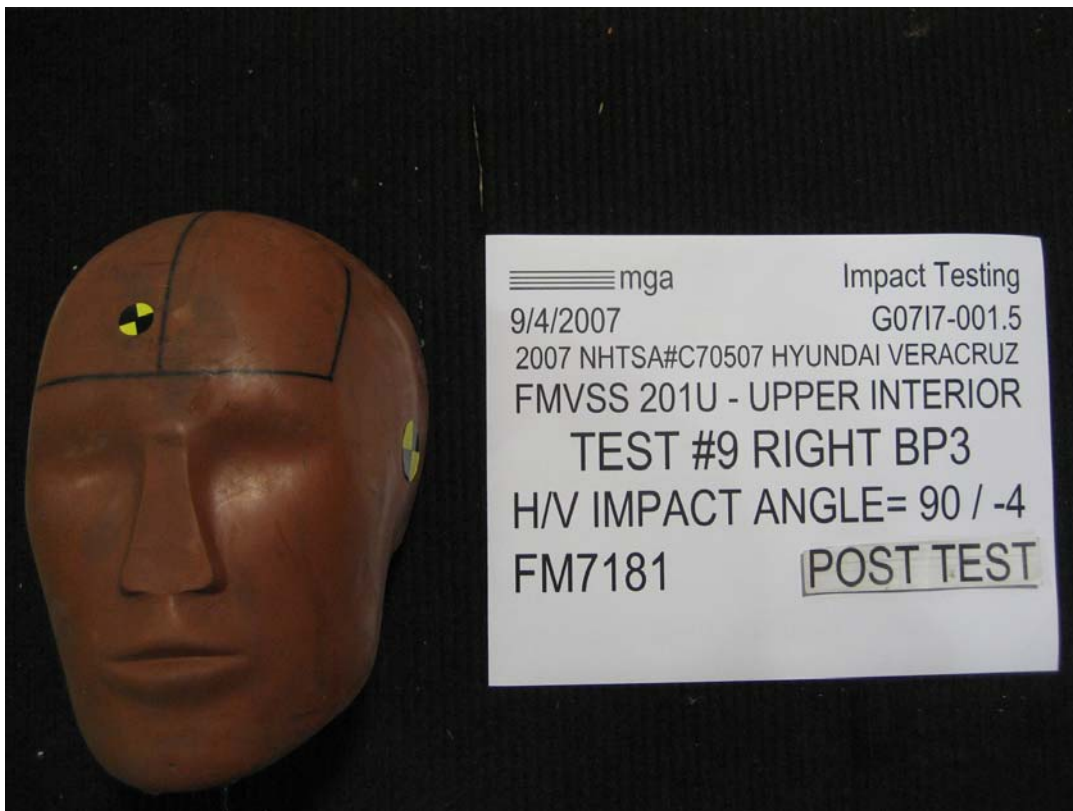












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#9
 Target (Vehicle Side): BP3 Right Temperature:22C
 MGA Test Reference No.:FM7181 Humidity:57%
 Approach Horizontal Angles:90° Time of Test:3:54:00 PM
 Approach Vertical Angles:-4° FMH Serial No:[038]
 Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
783	817	5.6	23.7	20	10 Right

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J14103	-94.598	1.32	1.32
Y	6	J36197	110.692	1.89	1.89
Z	7	J36353	99.391	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

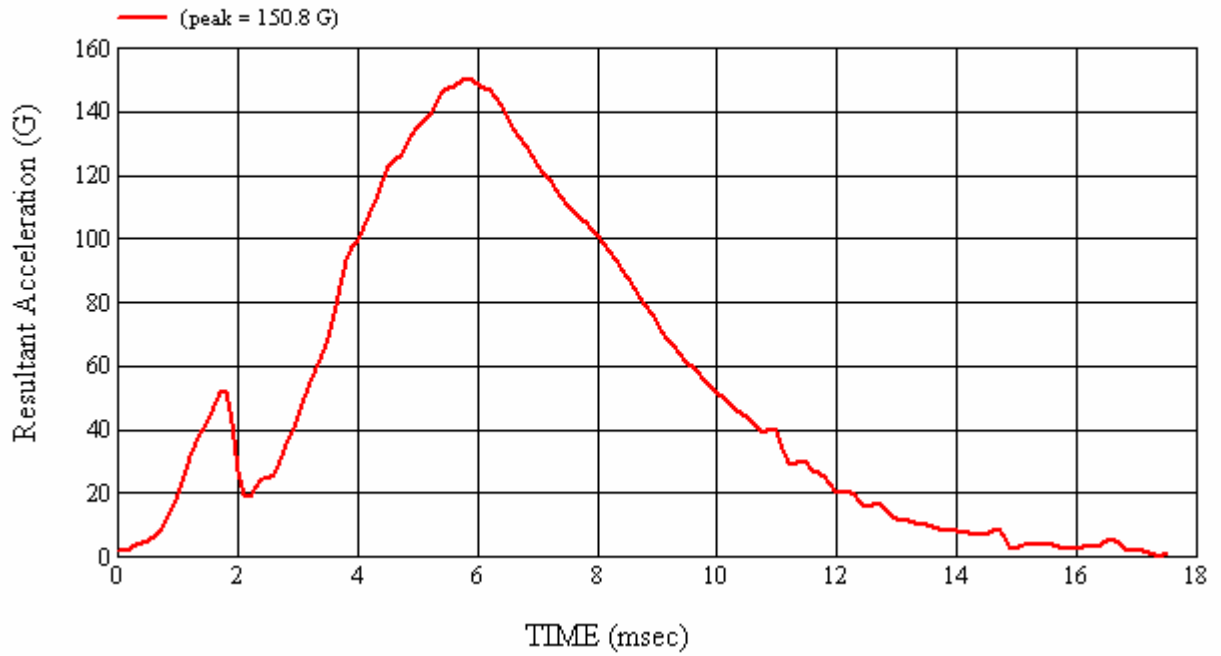
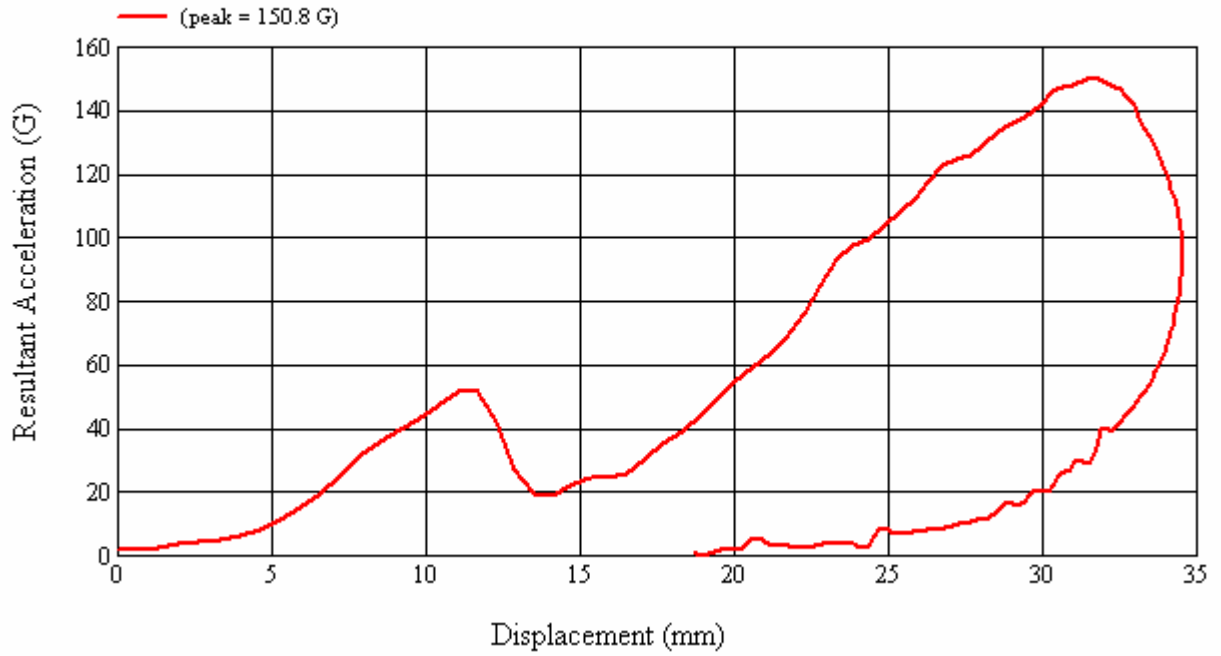
D-ring cover cracked.

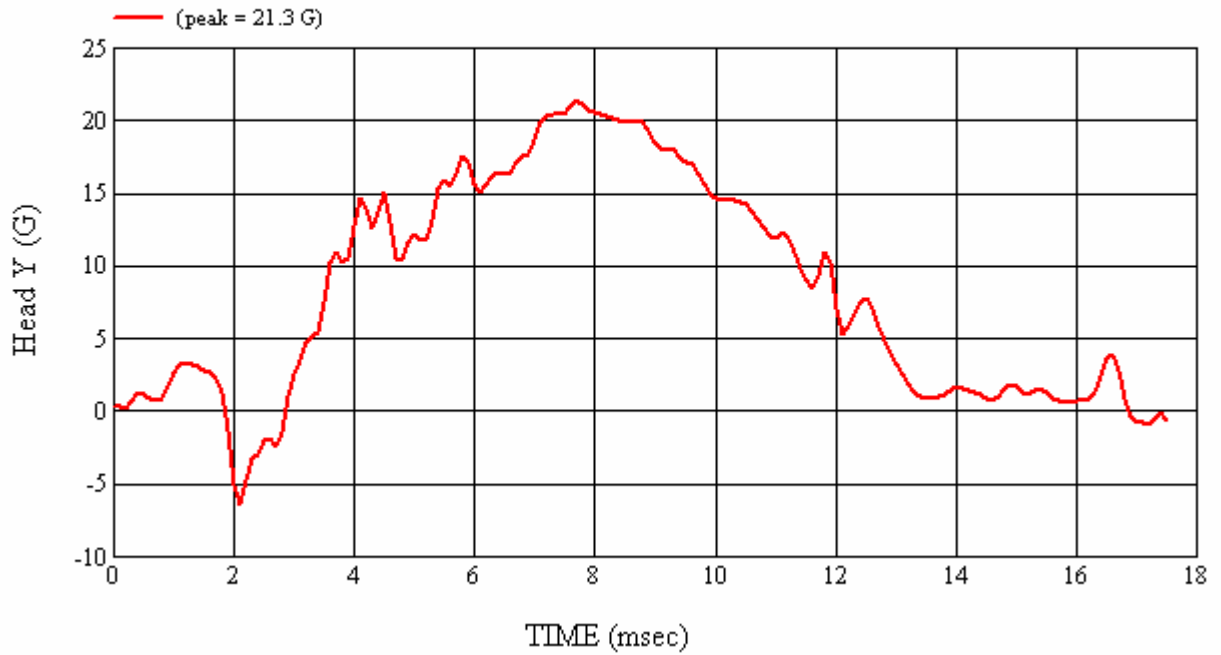
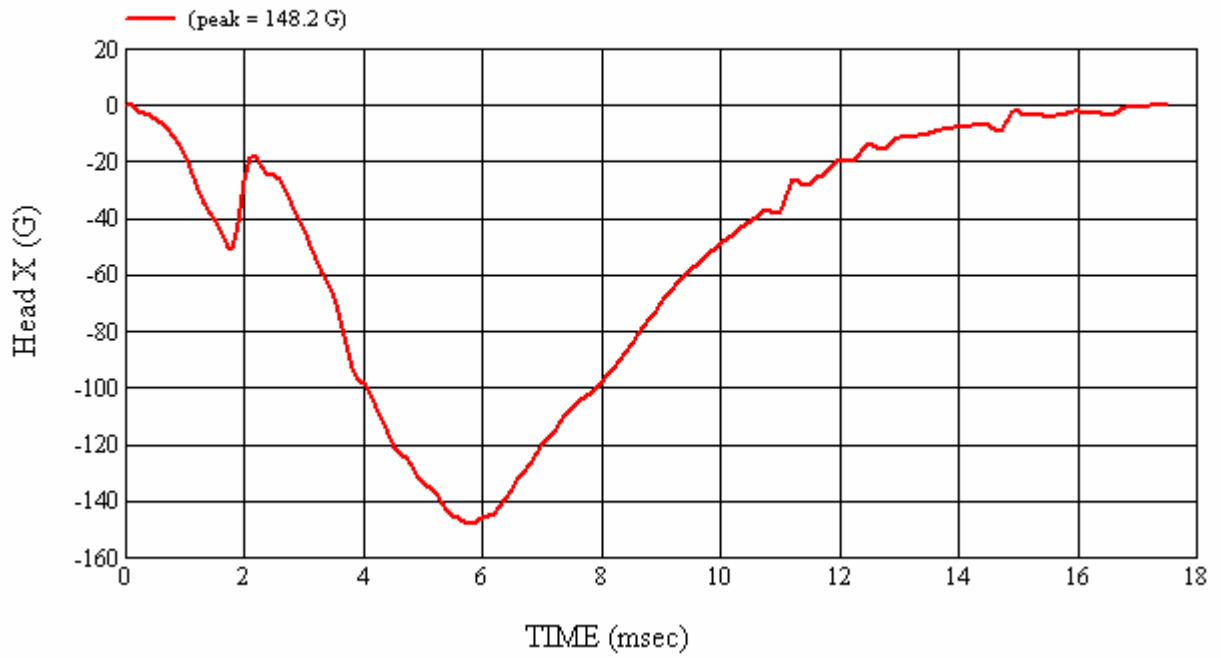
Recorded By: *Scott Campbell* Approved By*: *Heena A. Kalita* Date: 9/4/2007
 *Only necessary for NHTSA (Government) Compliance testing.

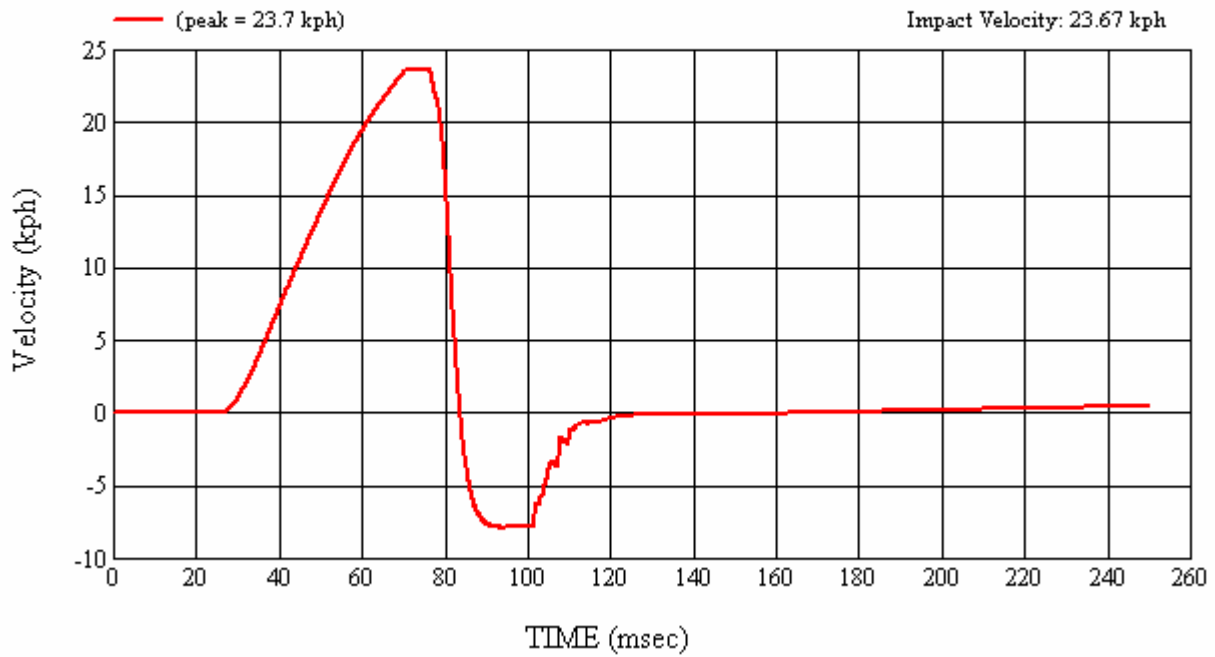
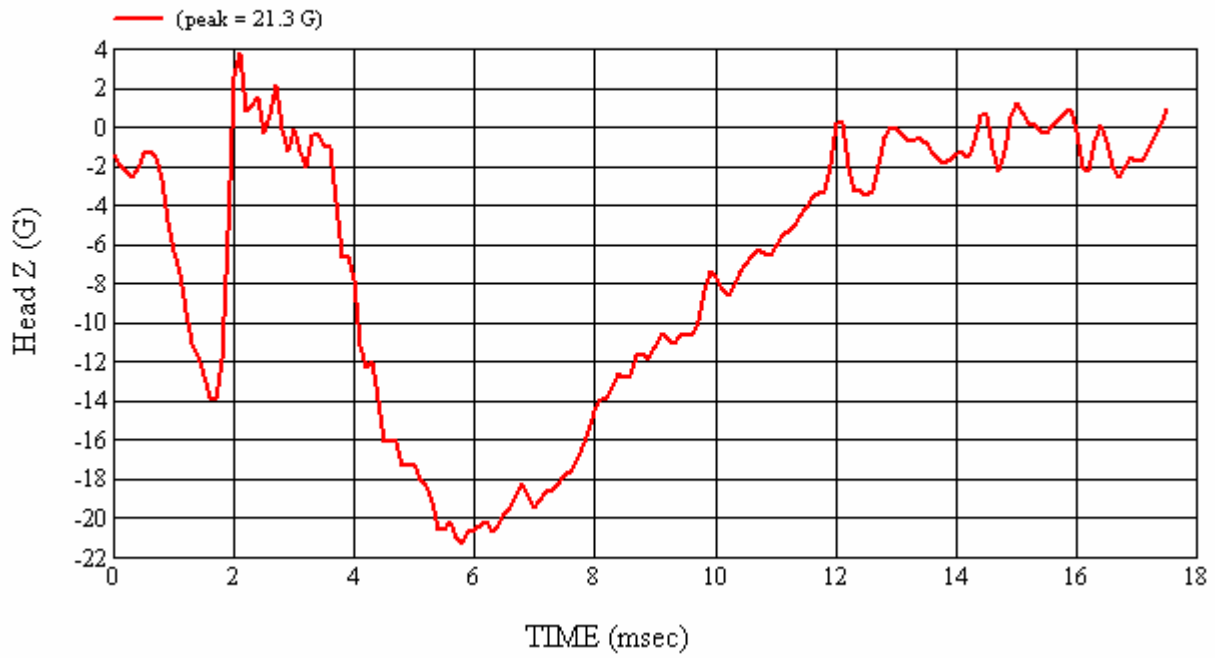
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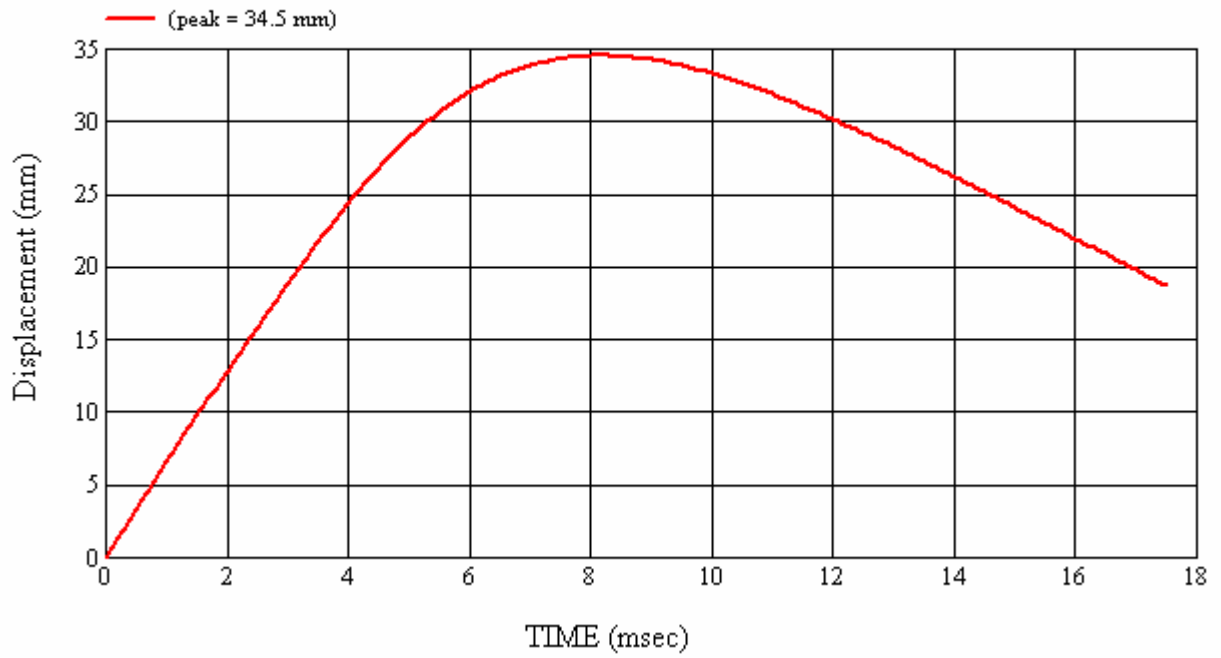
Target Location: BP3, Right Side

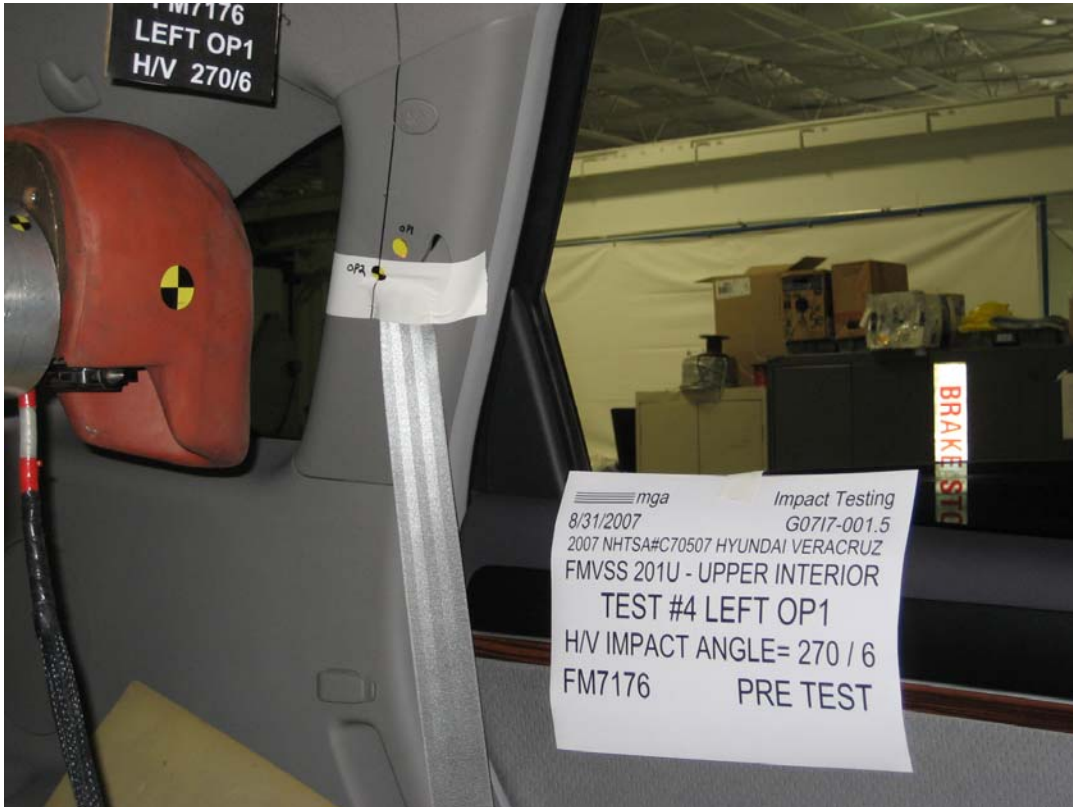
Test Date: 9/4/2007

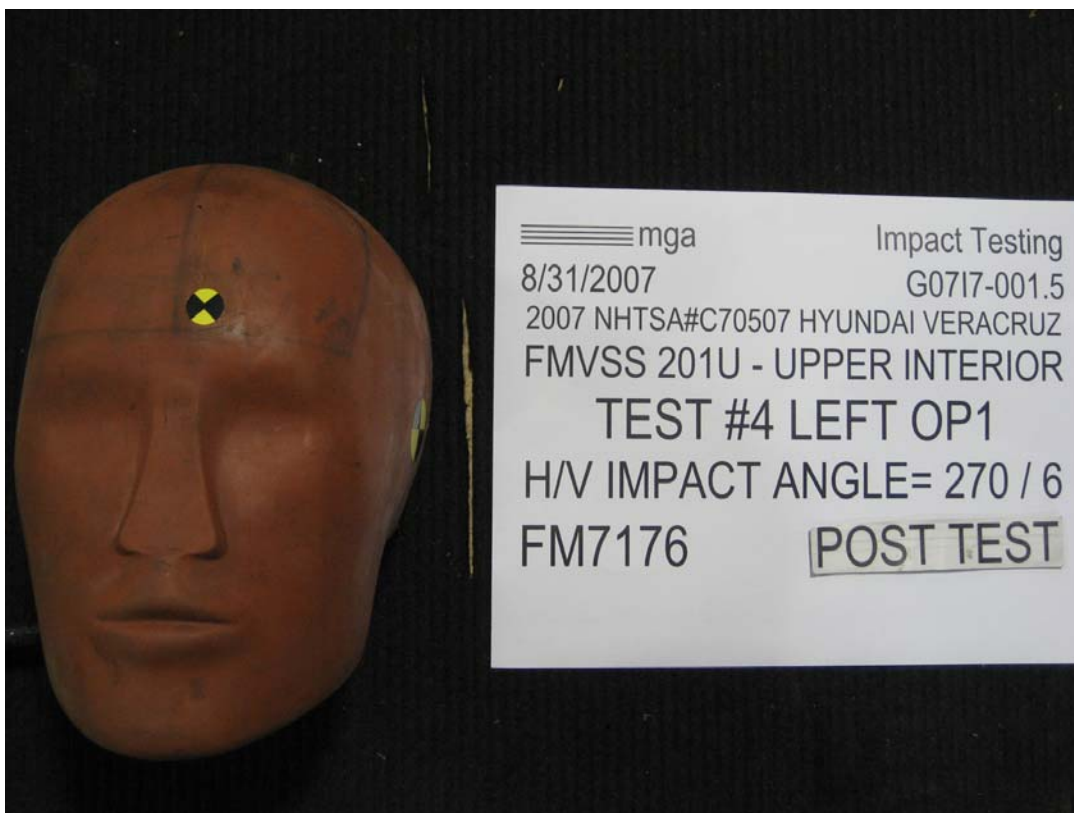












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#4
Target (Vehicle Side): OP1 Left Temperature:22C
MGA Test Reference No.:FM7176 Humidity:57%
Approach Horizontal Angles:270° Time of Test:4:53:36 PM
Approach Vertical Angles:6° FMH Serial No:[035]
Additional Description:

TEST RESULTS:



HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
637	624	9.8	23.6	9	10 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22664	-94.161	1.32	1.32
Y	6	J35919	97.442	1.89	1.88
Z	7	J35924	93.891	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

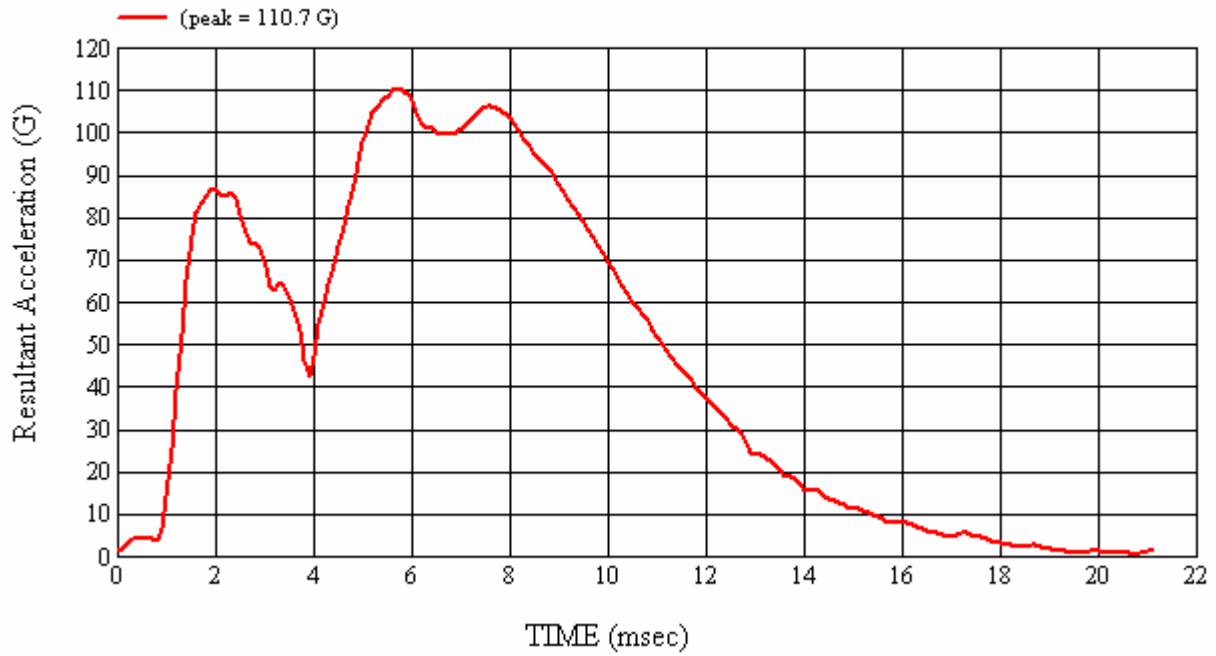
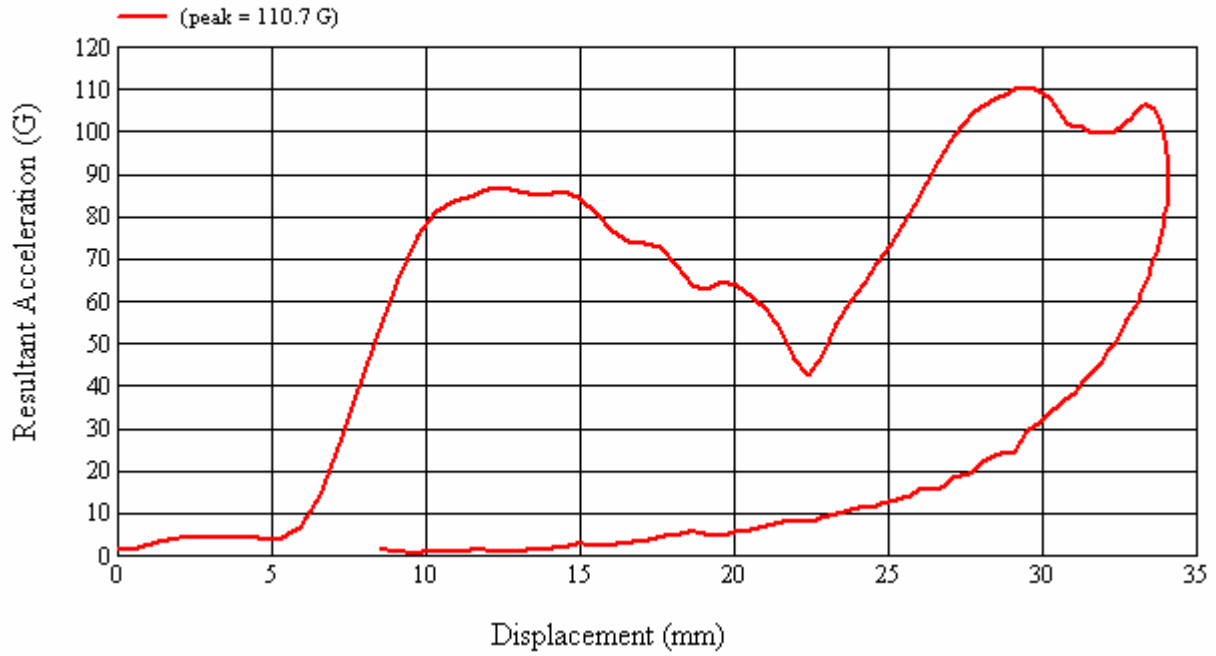
O-pillar cracked.

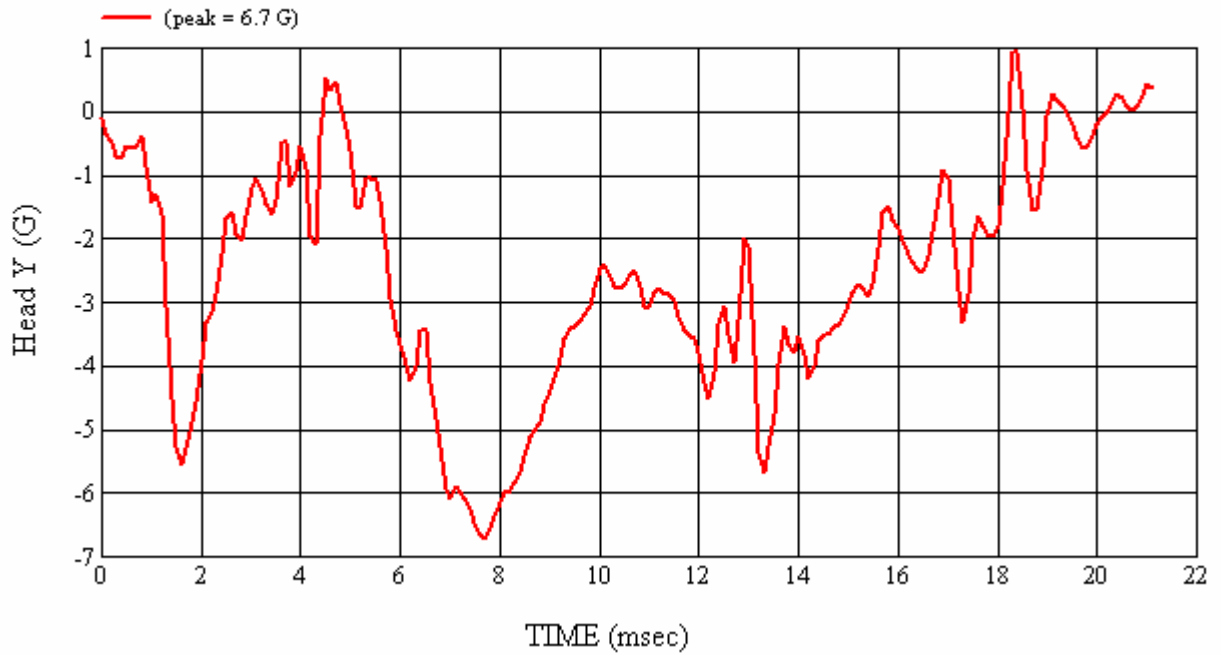
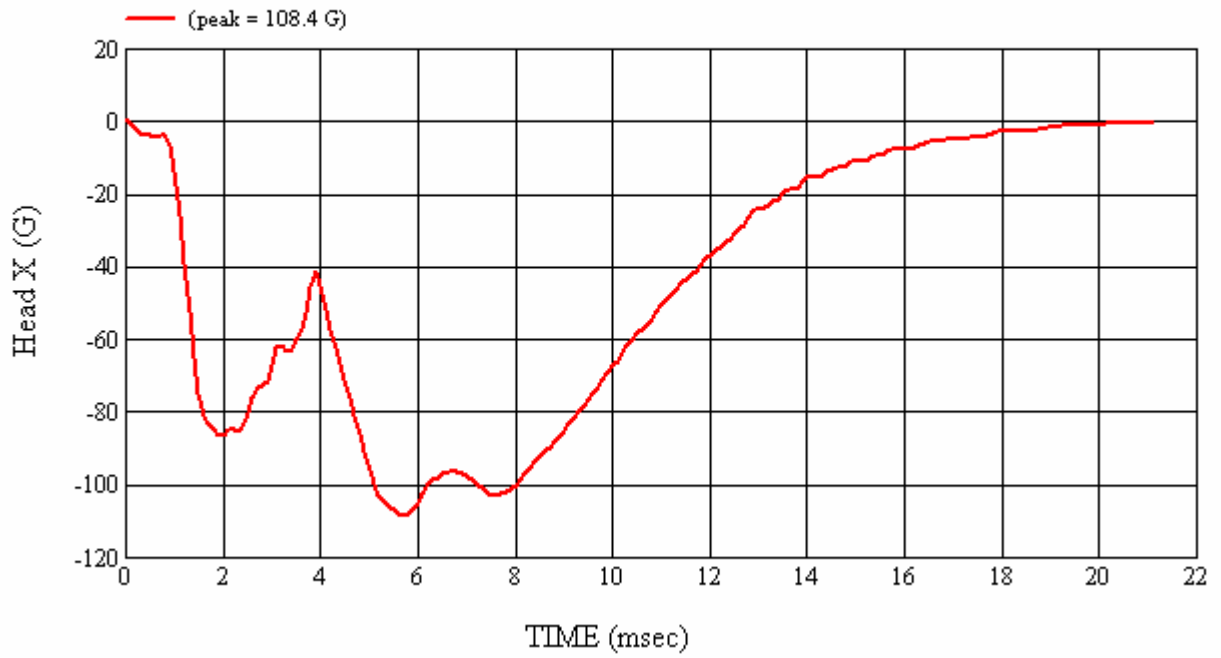
Recorded By:  Approved By*:  Date: 8/31/2007
*Only necessary for NHTSA (Government) Compliance testing.

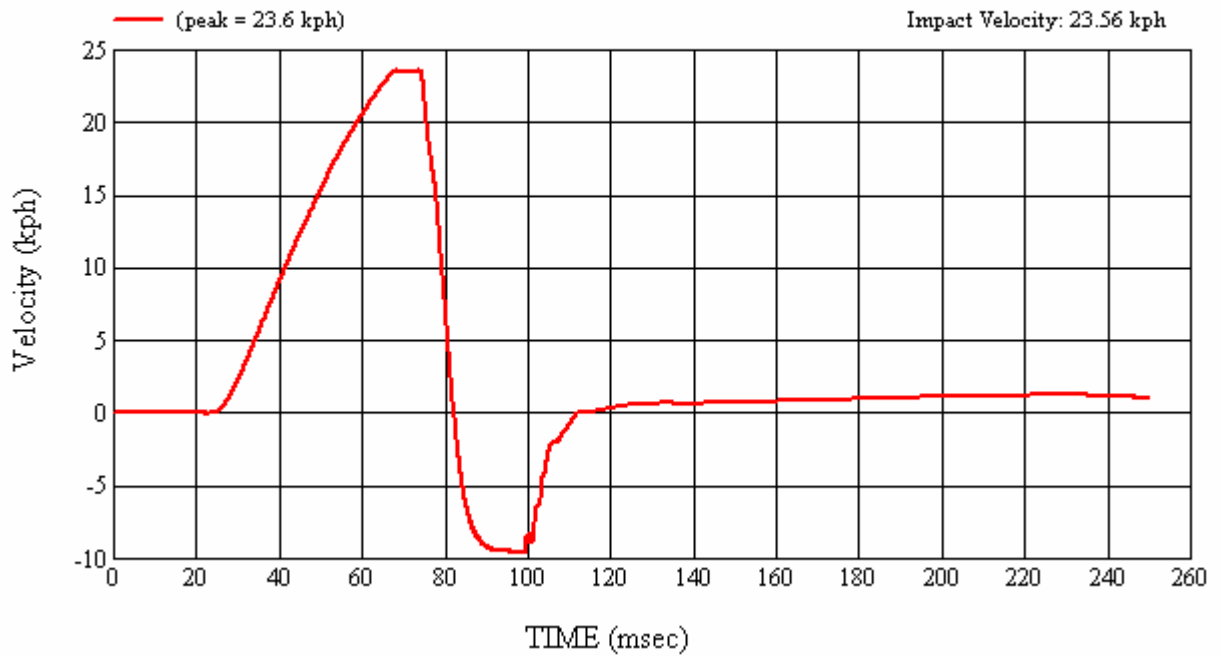
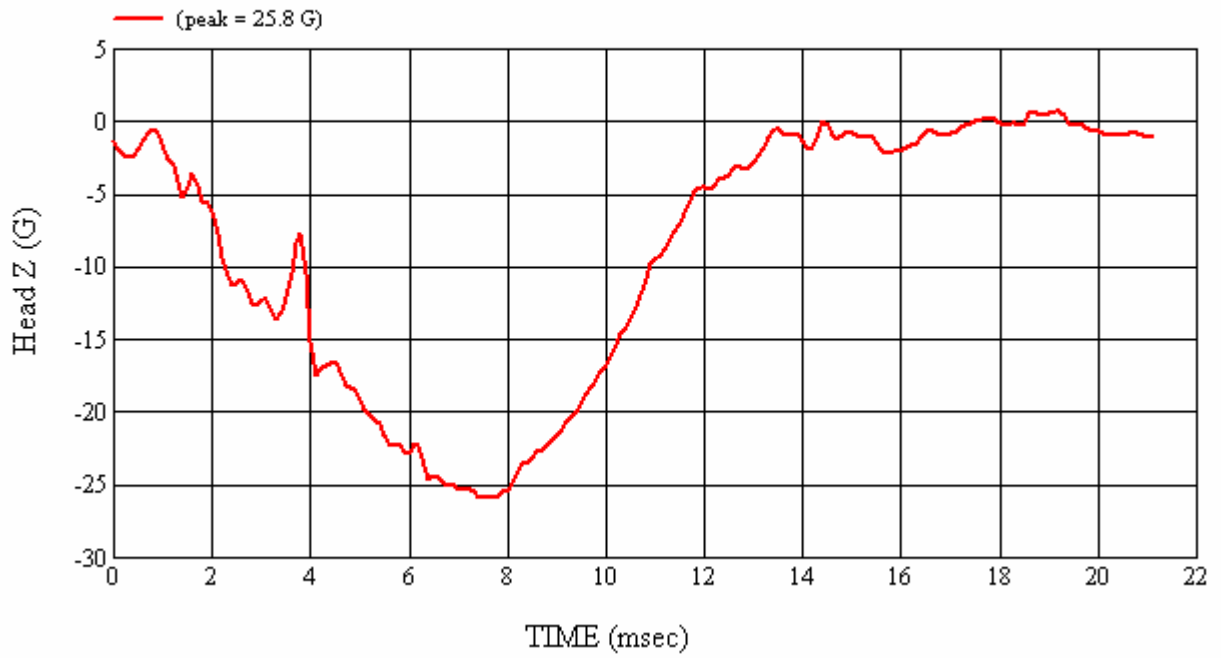
MGA Test #: FM7176

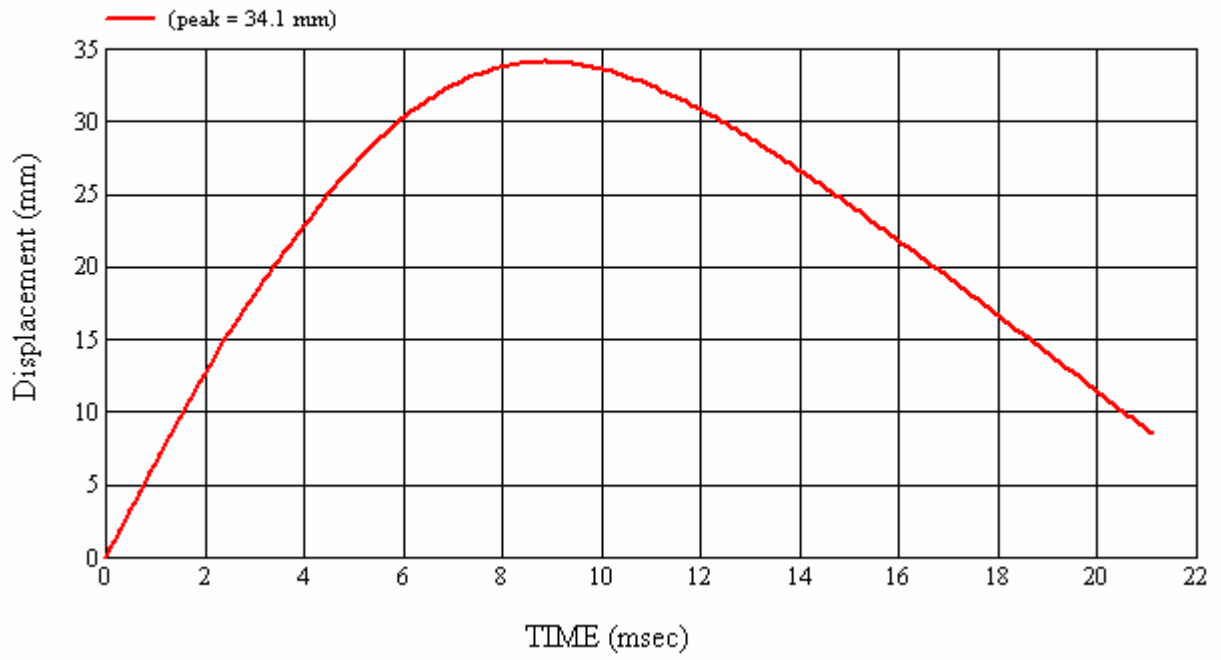
Target Location: OPI, Left Side

Test Date: 8/31/2007

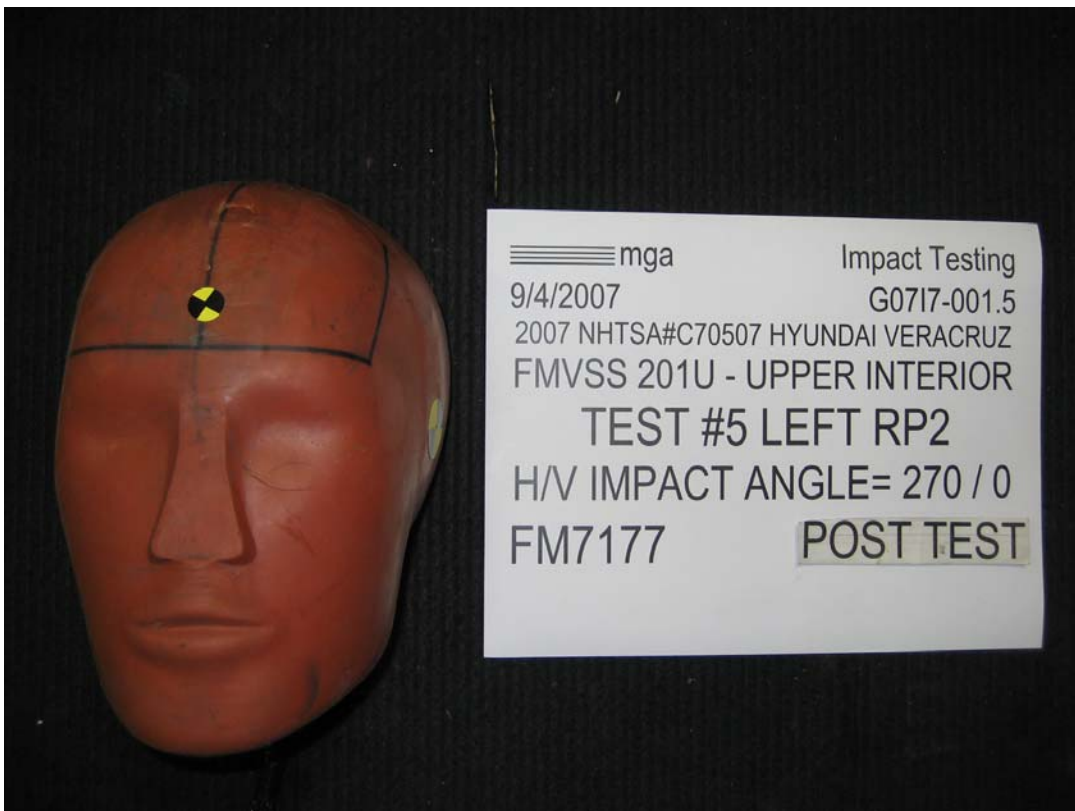












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#5
Target (Vehicle Side): RP2 Left Temperature:22C
MGA Test Reference No.:FM7177 Humidity:57%
Approach Horizontal Angles:270° Time of Test:10:03:15 AM
Approach Vertical Angles:0° FMH Serial No:[037]
Additional Description:

TEST RESULTS:



HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
590	562	7.4	23.5	14	1 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22696	-100.013	1.33	1.33
Y	6	J35791	91.856	1.89	1.89
Z	7	J35800	97.996	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

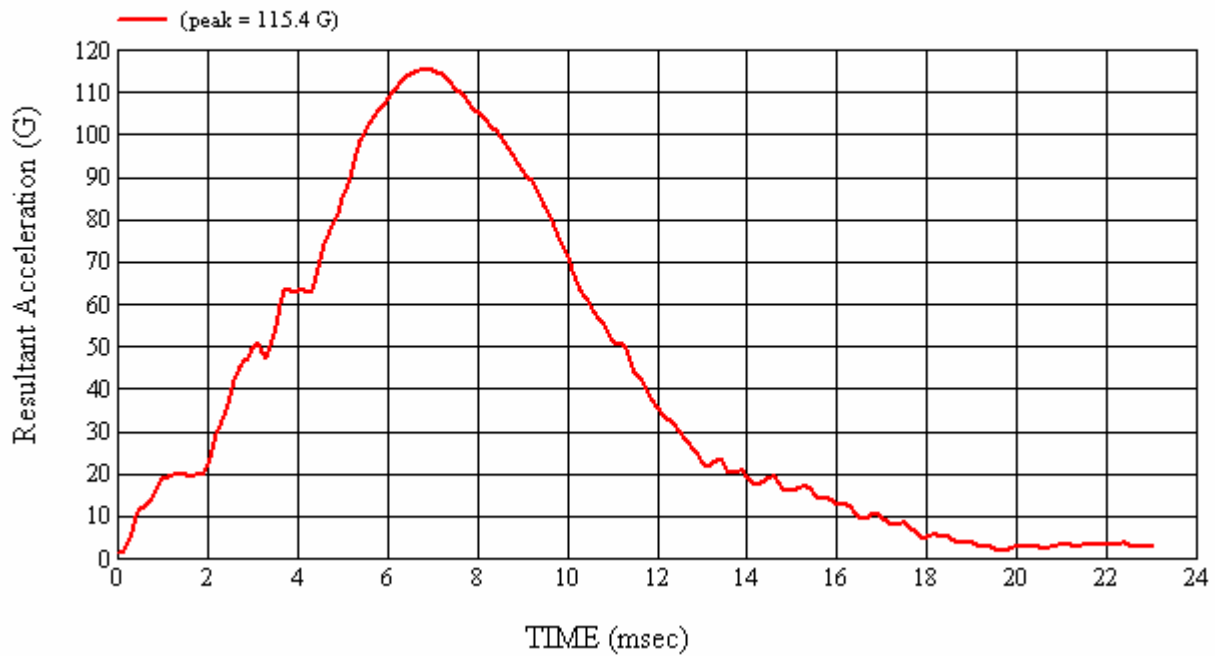
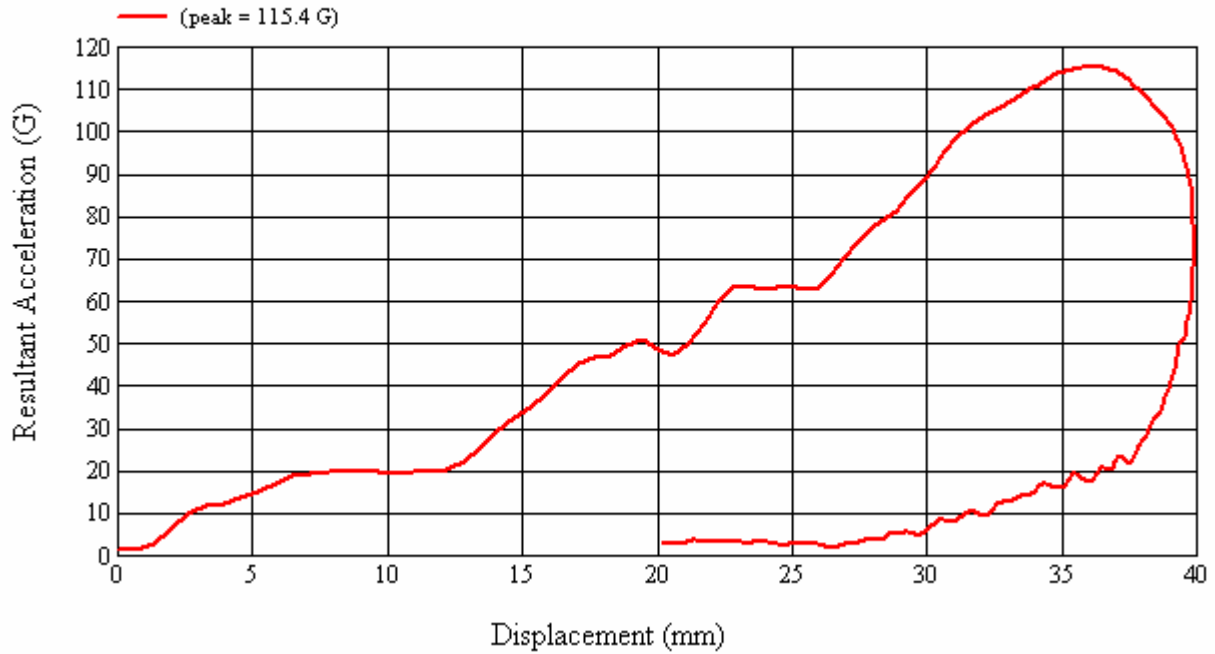
Seatbelt path trim displacement.

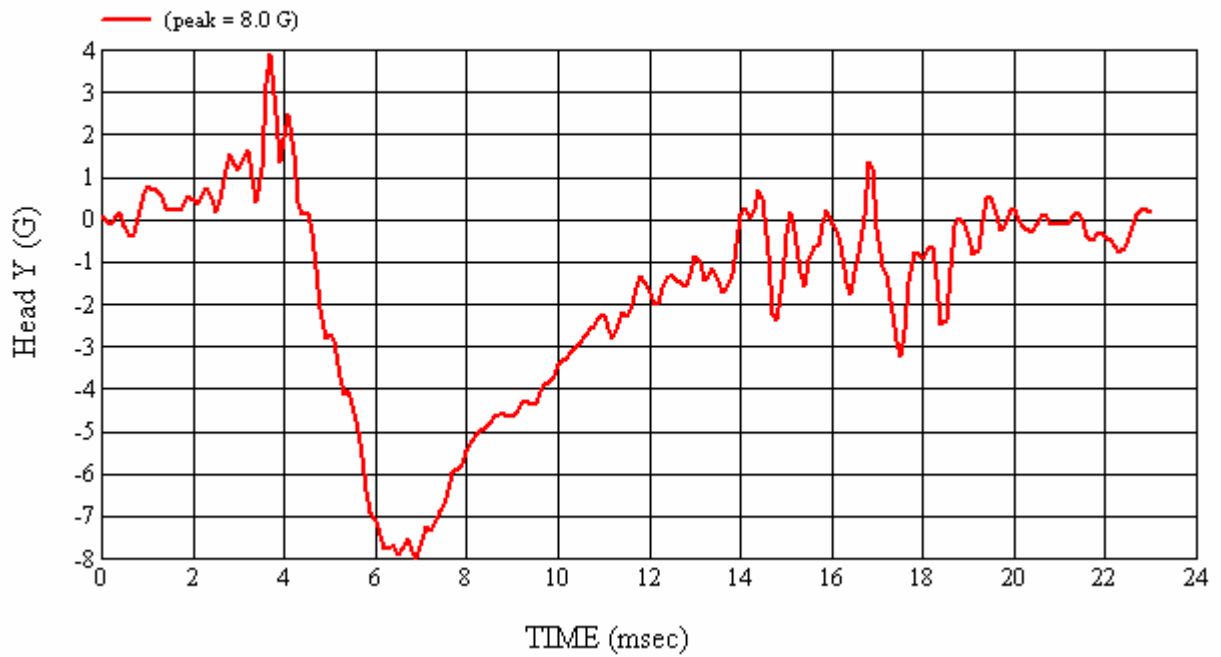
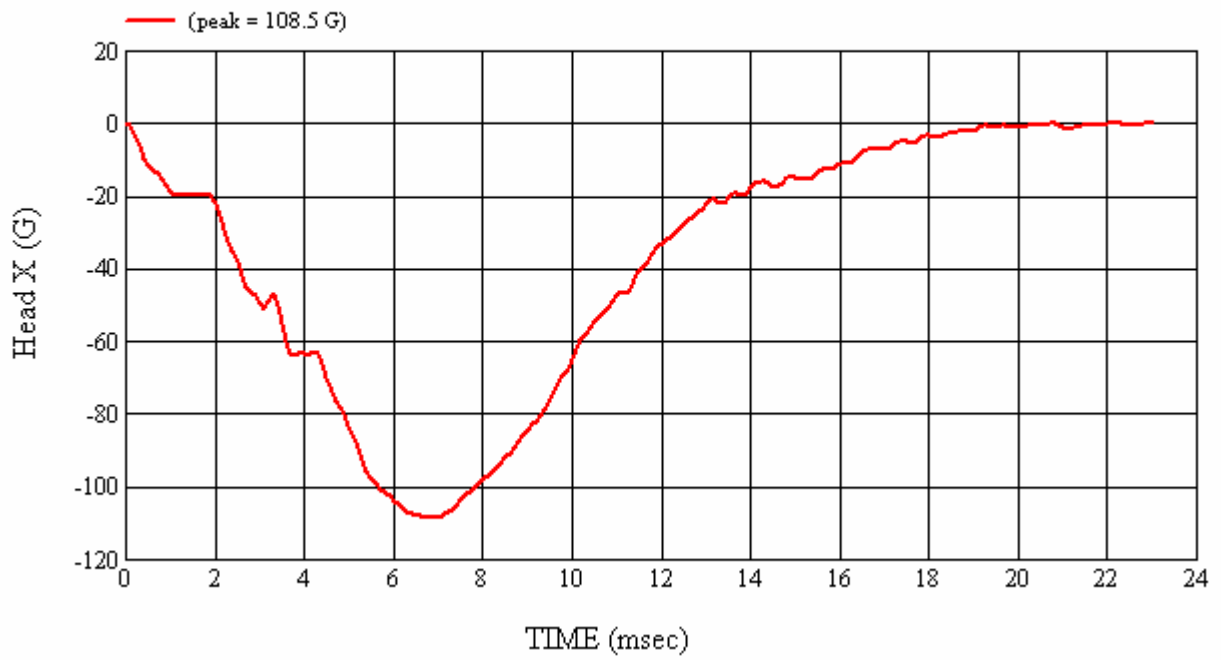
Recorded By:  Approved By*:  Date: 9/4/2007
*Only necessary for NHTSA (Government) Compliance testing.

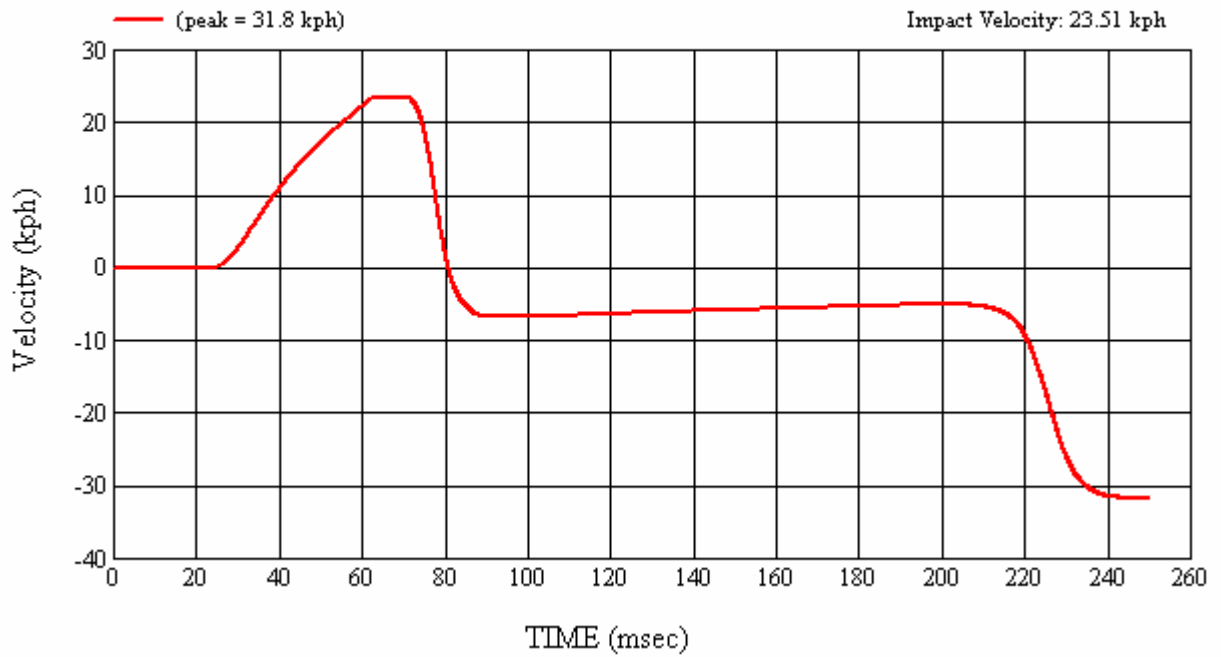
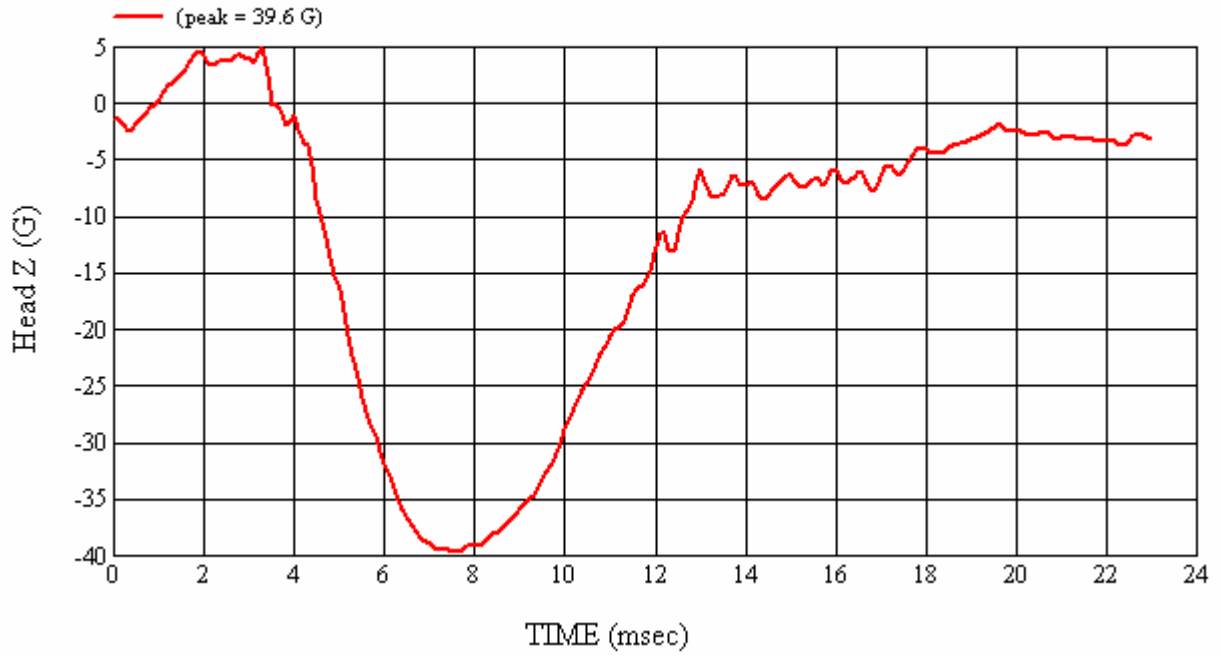
MGA Test #: FM7177

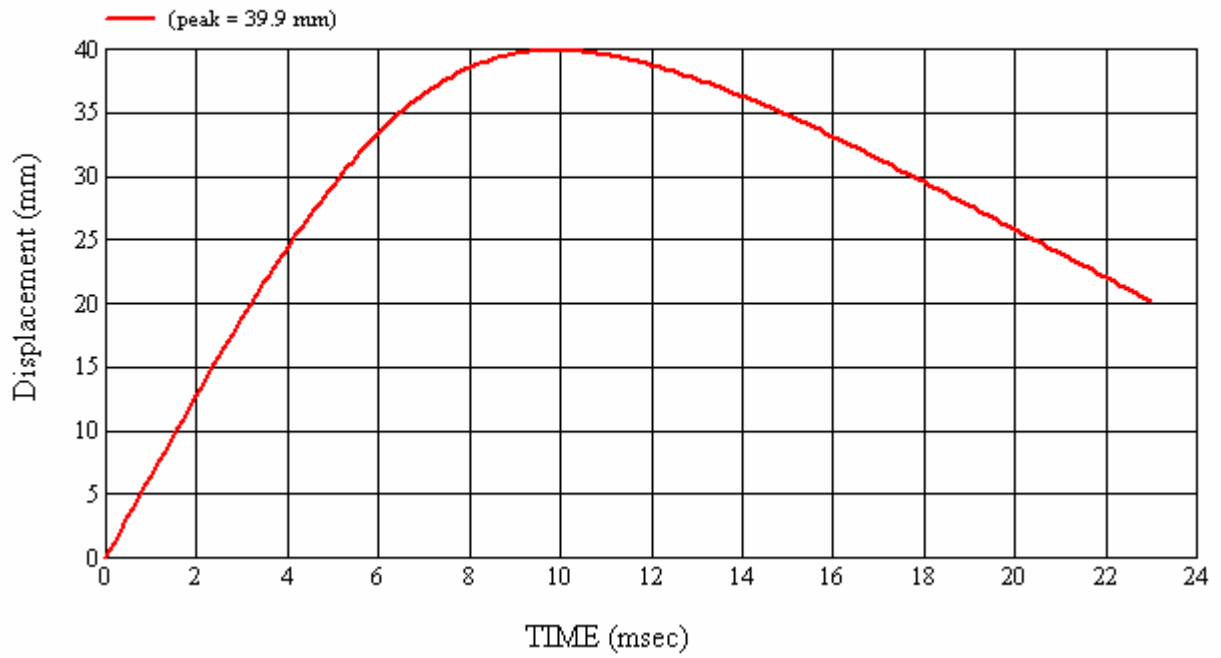
Target Location: RP2, Left Side

Test Date: 9/4/2007













SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#2
 Target (Vehicle Side): SR1 Left Temperature:22C
 MGA Test Reference No.:FM7174 Humidity:56%
 Approach Horizontal Angles:270° Time of Test:2:50:28 PM
 Approach Vertical Angles:42° FMH Serial No:[037]
 Additional Description: 1 Relocation

TEST RESULTS:



HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
716	728	6.3	24.1	55	5 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22696	-100.013	1.32	1.33
Y	6	J35791	91.856	1.89	1.89
Z	7	J35800	97.996	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

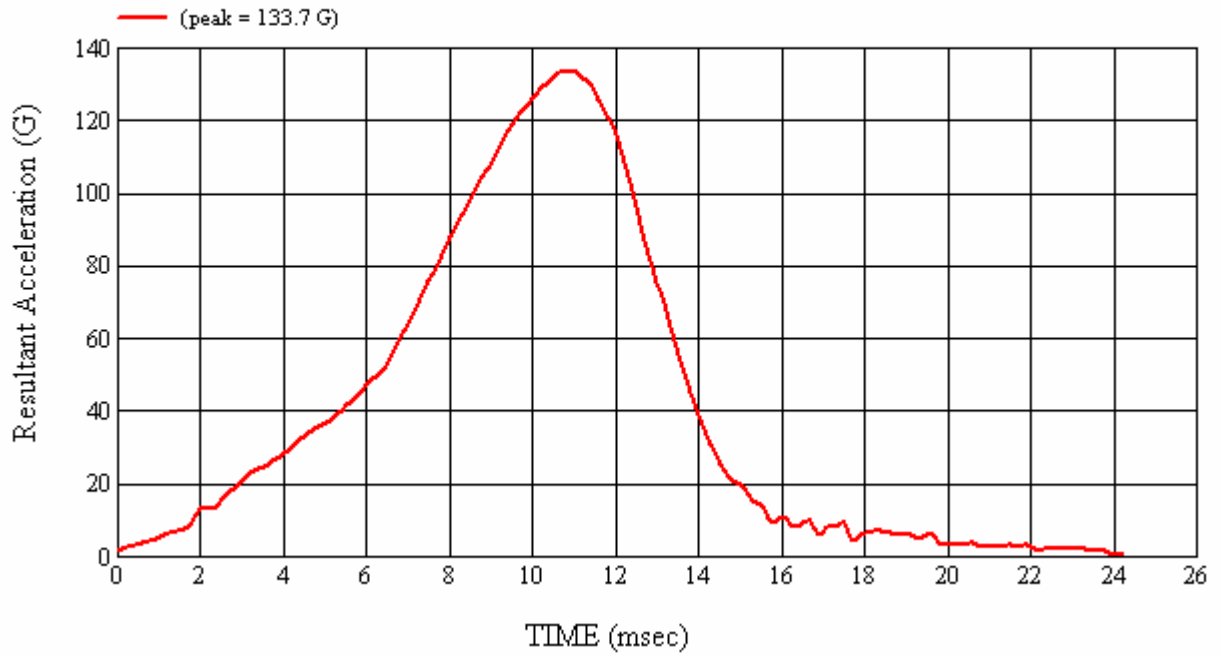
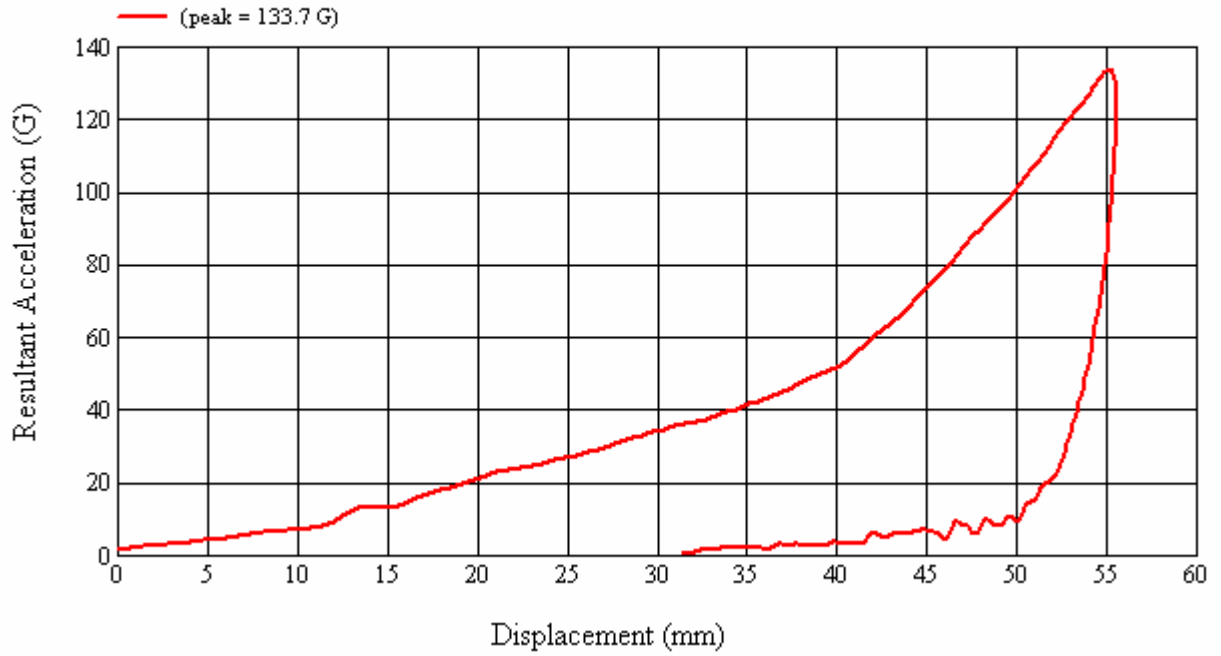
No visible damage.

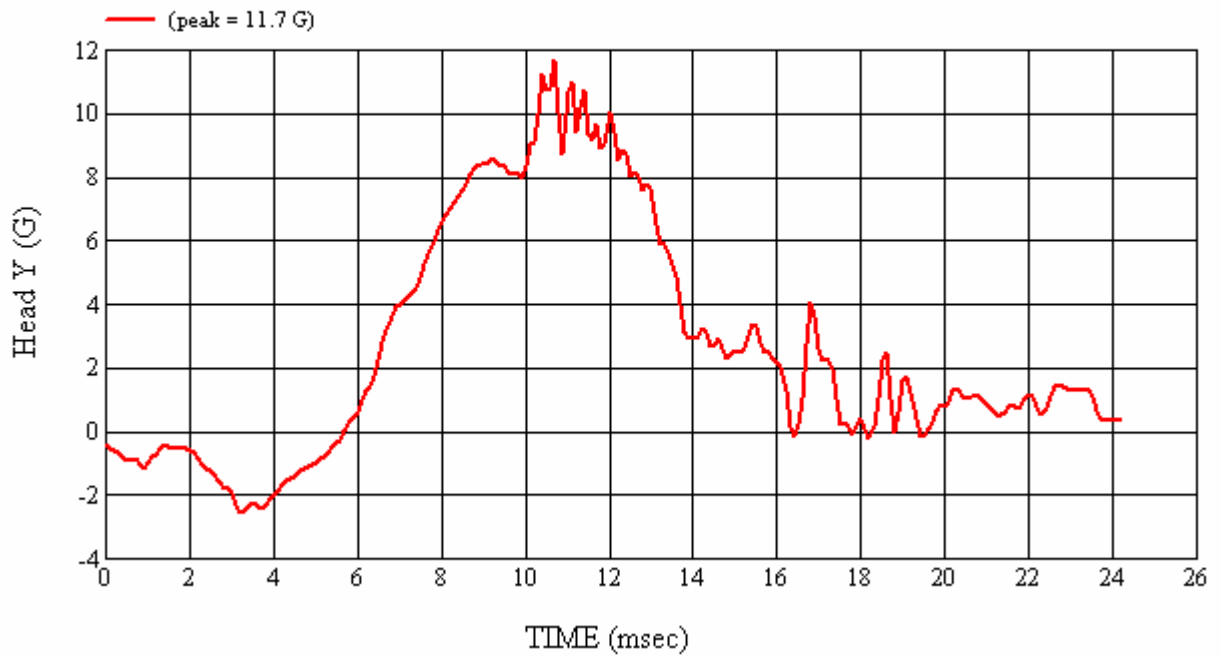
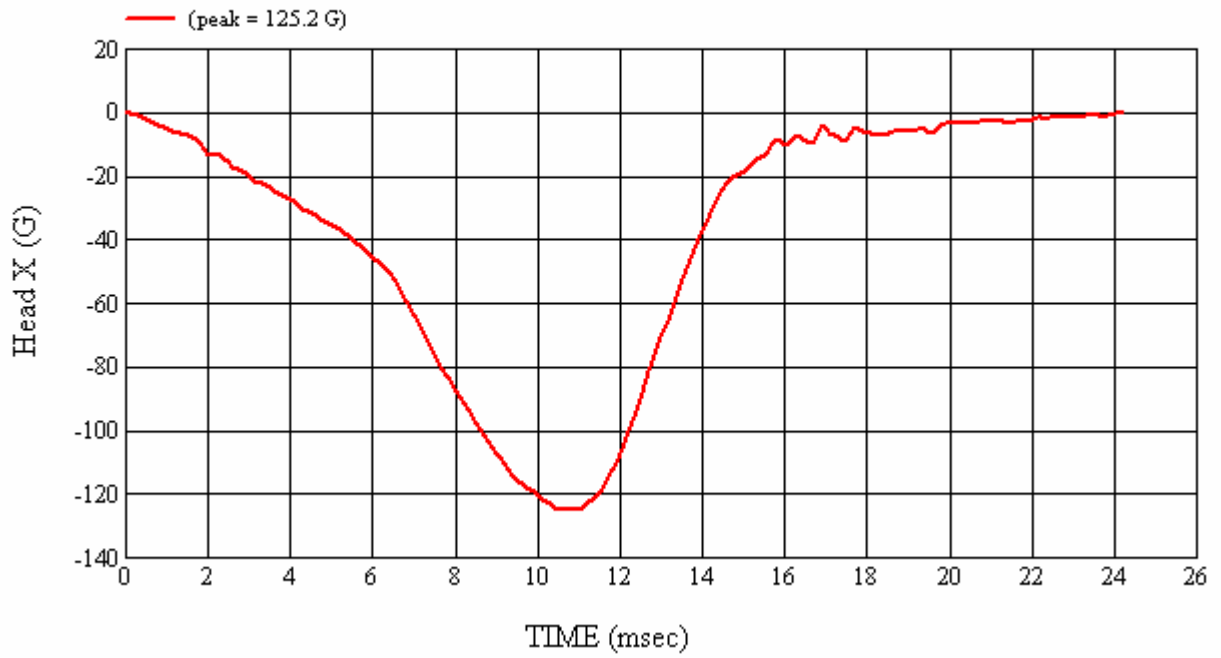
Recorded By:  Approved By*:  Date: 8/31/2007
 *Only necessary for NHTSA (Government) Compliance testing.

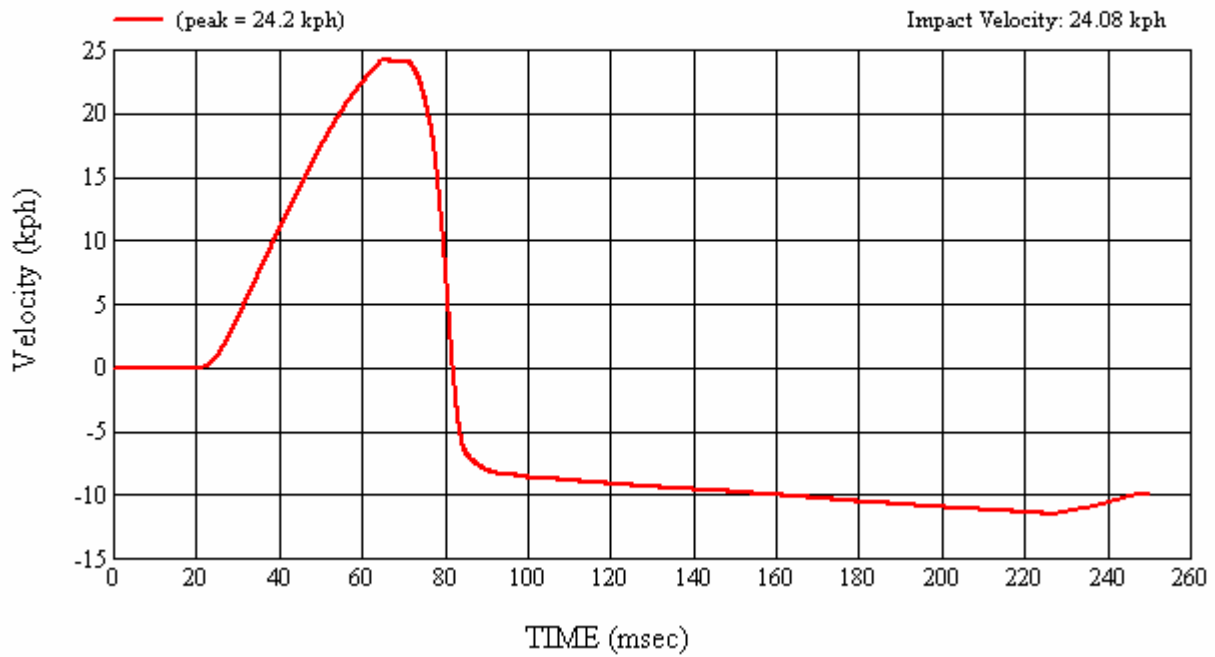
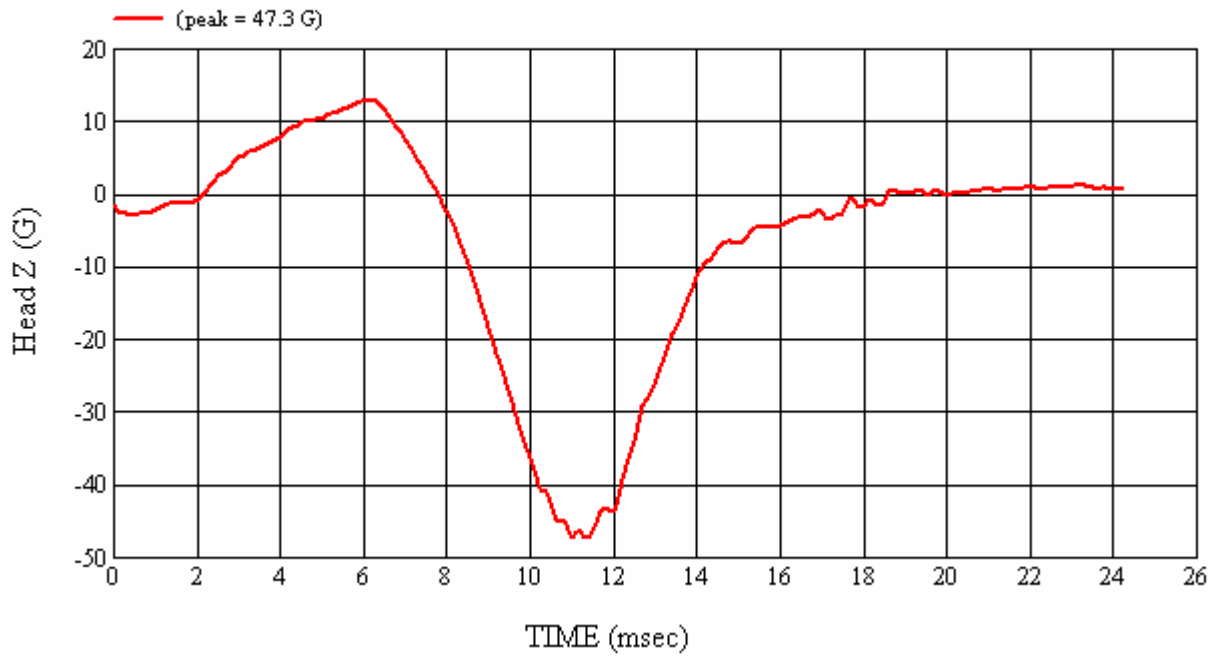
MGA Test #: FM7174

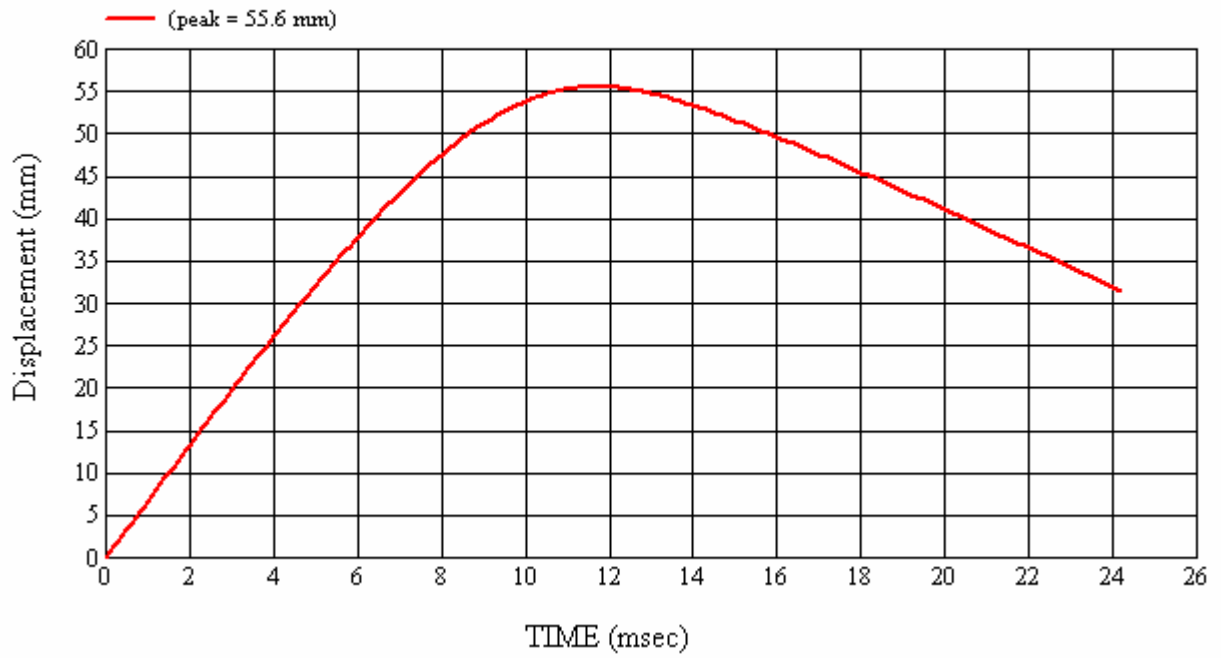
Target Location: SR1, Left Side

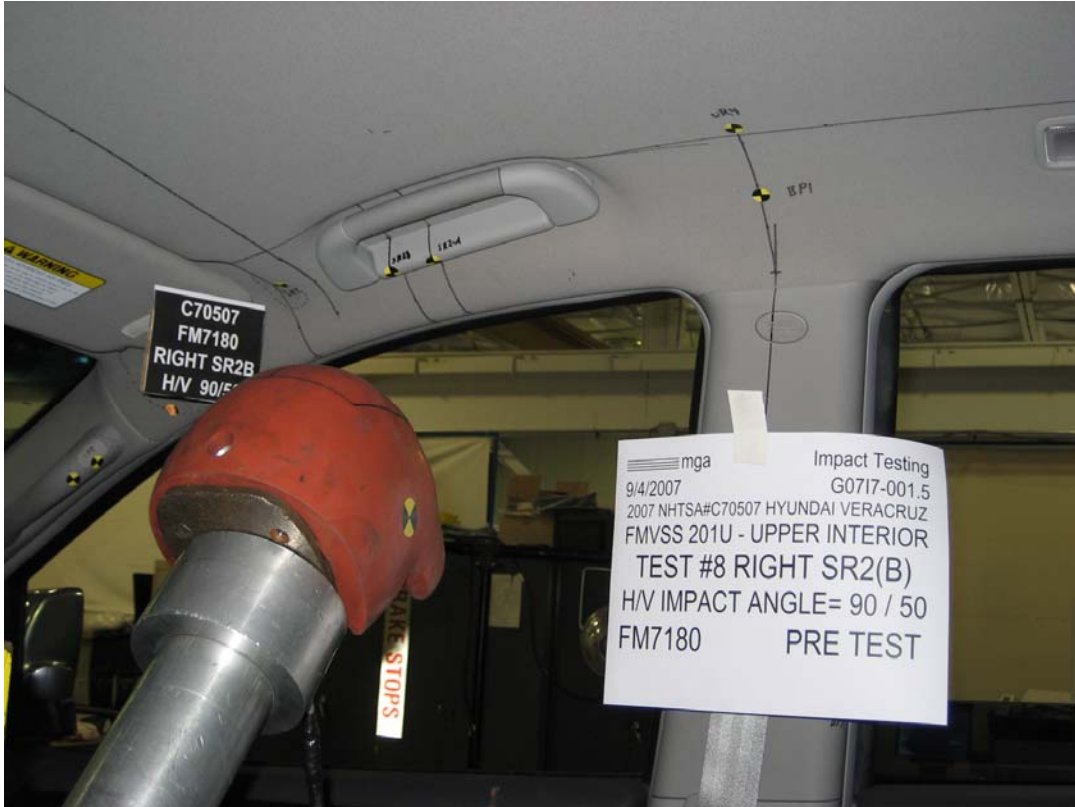
Test Date: 8/31/2007

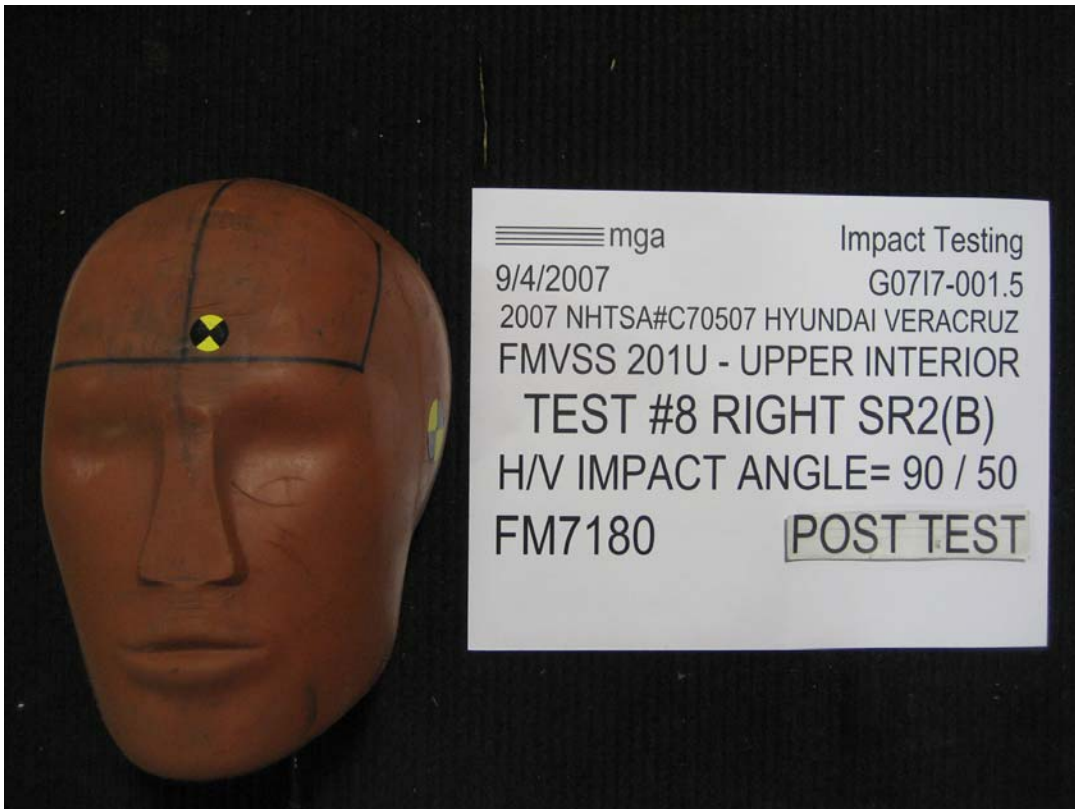












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#8
 Target (Vehicle Side): SR2(b) Right Temperature:22C
 MGA Test Reference No.:FM7180 Humidity:56%
 Approach Horizontal Angles:90° Time of Test:3:03:00 PM
 Approach Vertical Angles:50° FMH Serial No:[037]
 Additional Description:

TEST RESULTS:



HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
297	173	13.5	18.7	9	9 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22696	-100.013	1.33	1.32
Y	6	J35791	91.856	1.89	1.89
Z	7	J35800	97.996	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

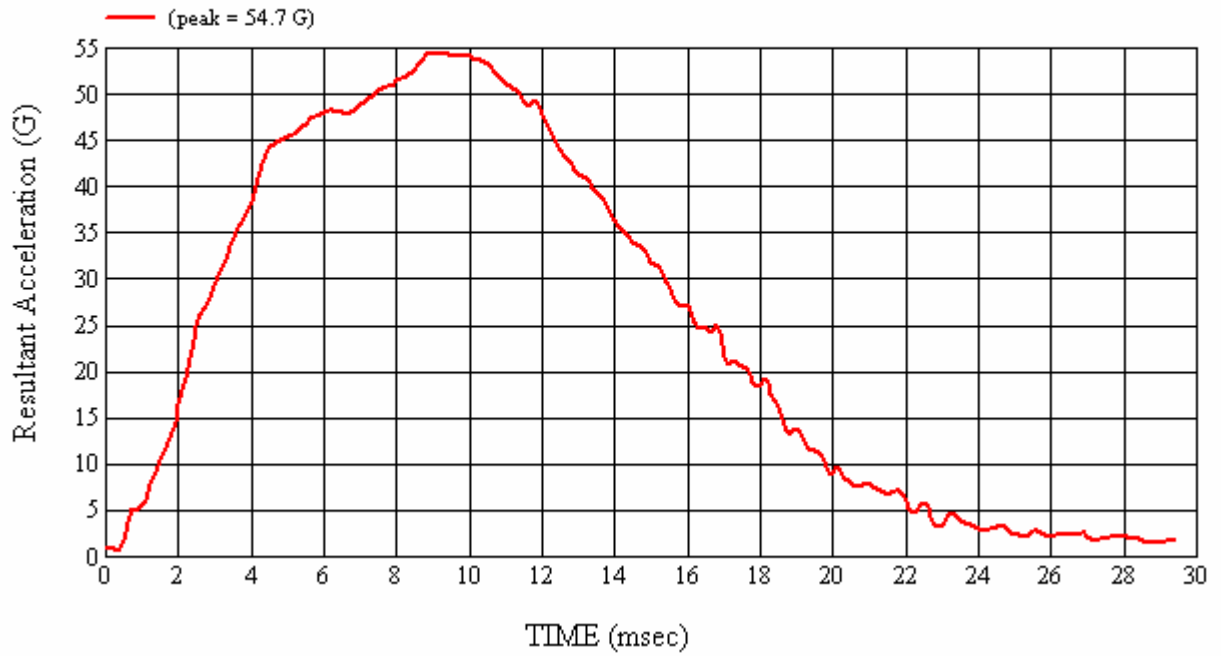
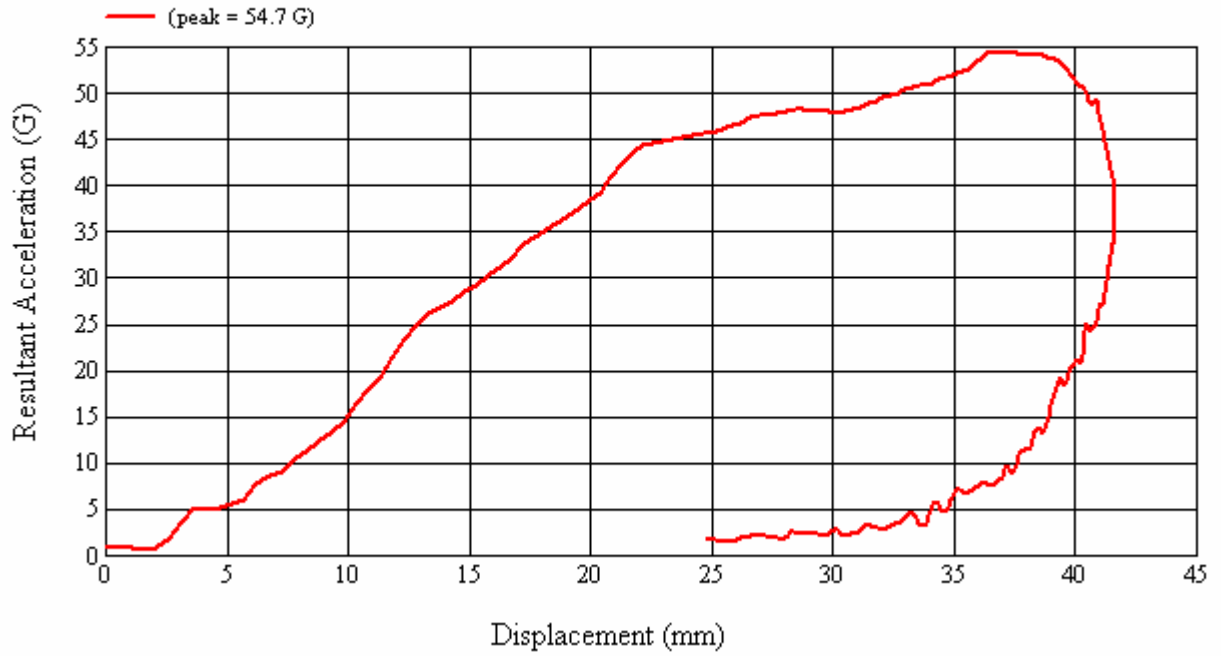
No visible damage.

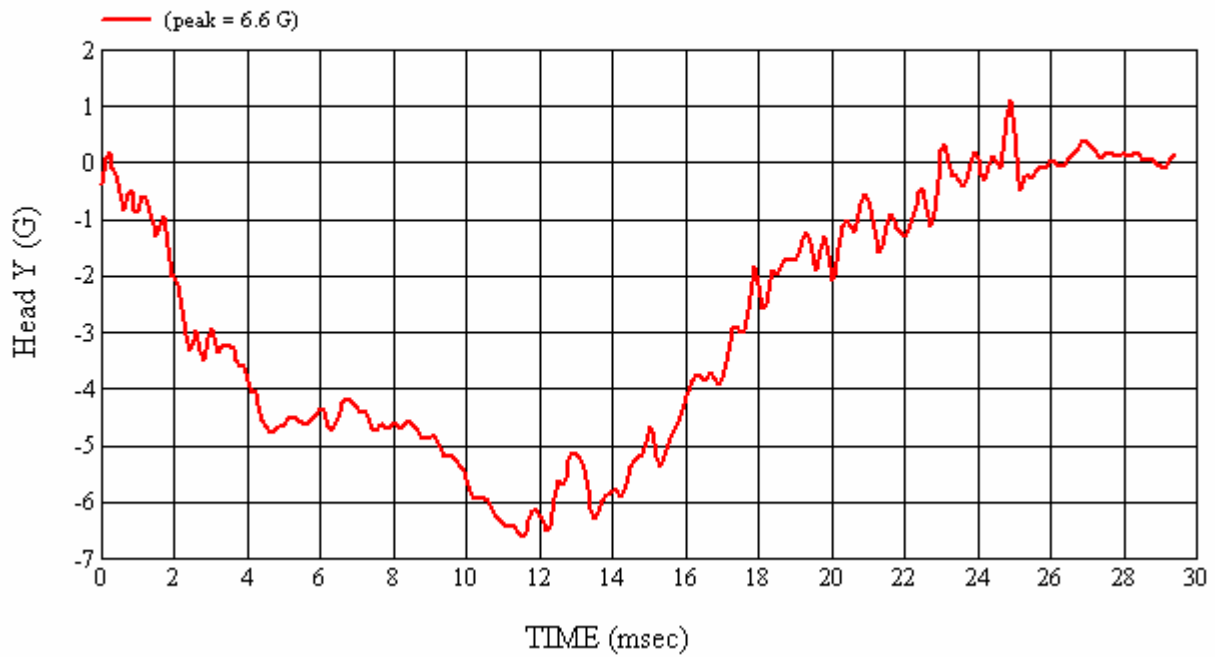
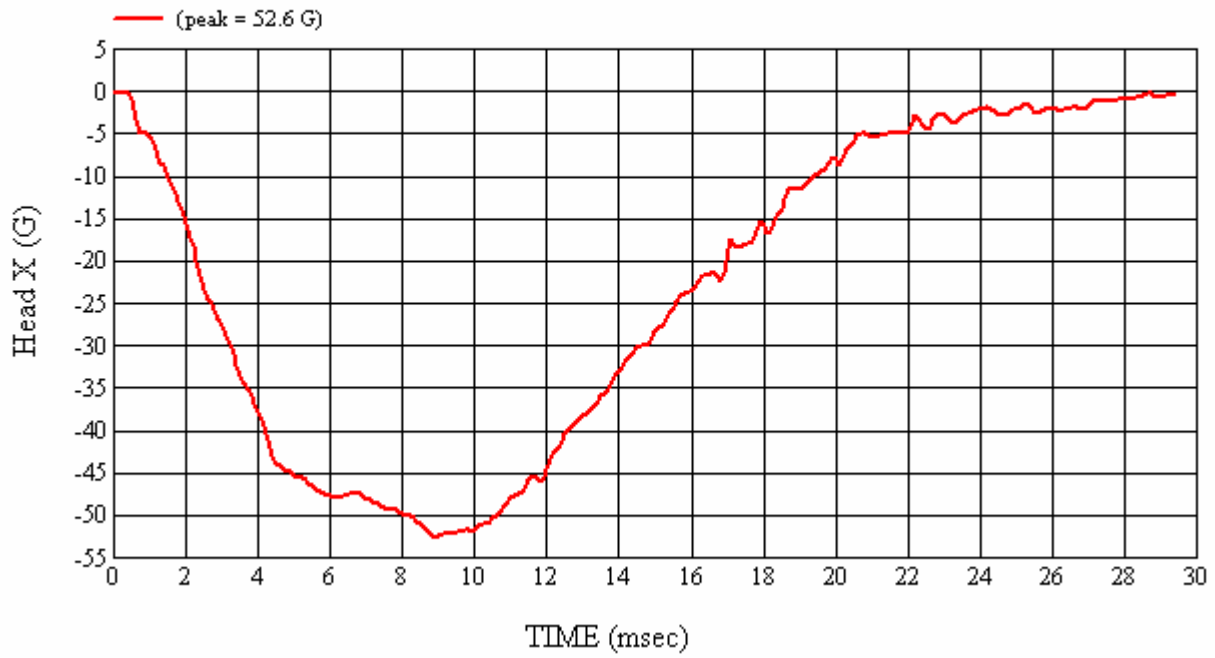
Recorded By:  Approved By*:  Date: 9/4/2007
 *Only necessary for NHTSA (Government) Compliance testing.

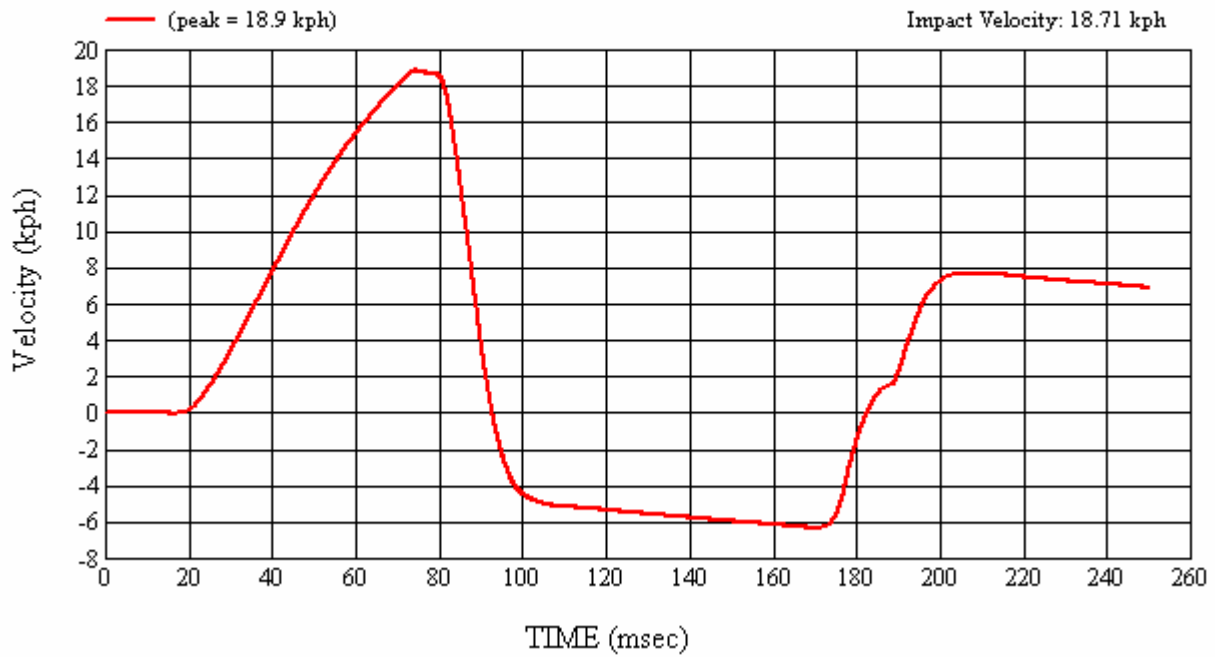
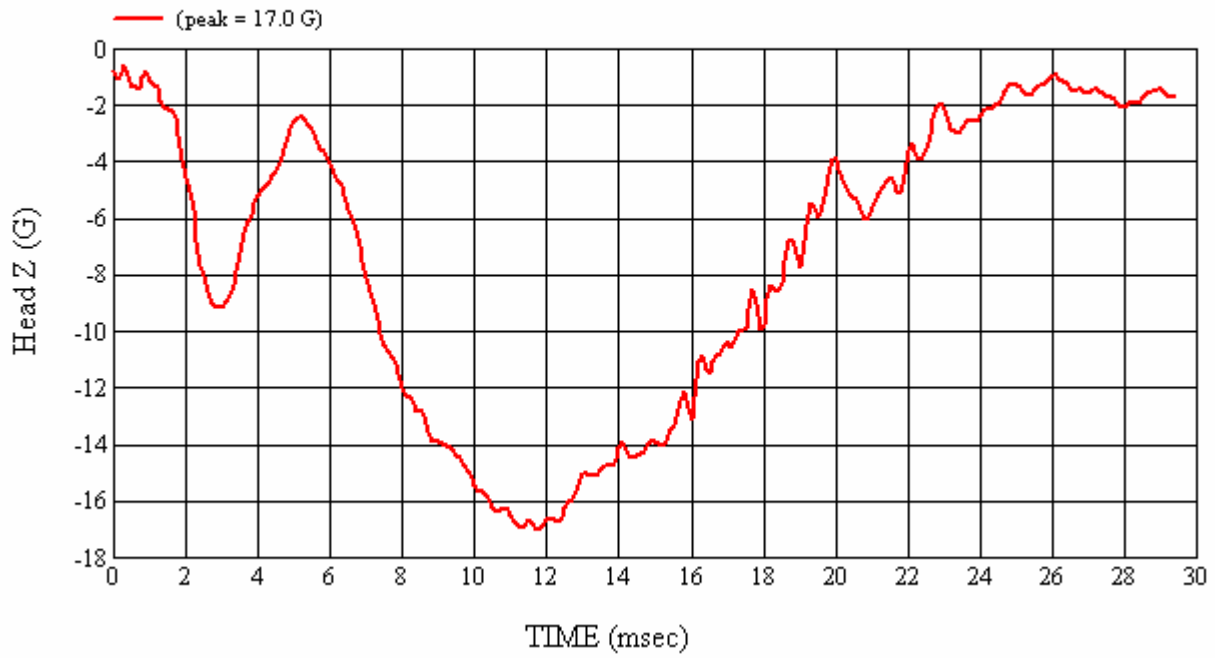
MGA Test #: FM7180

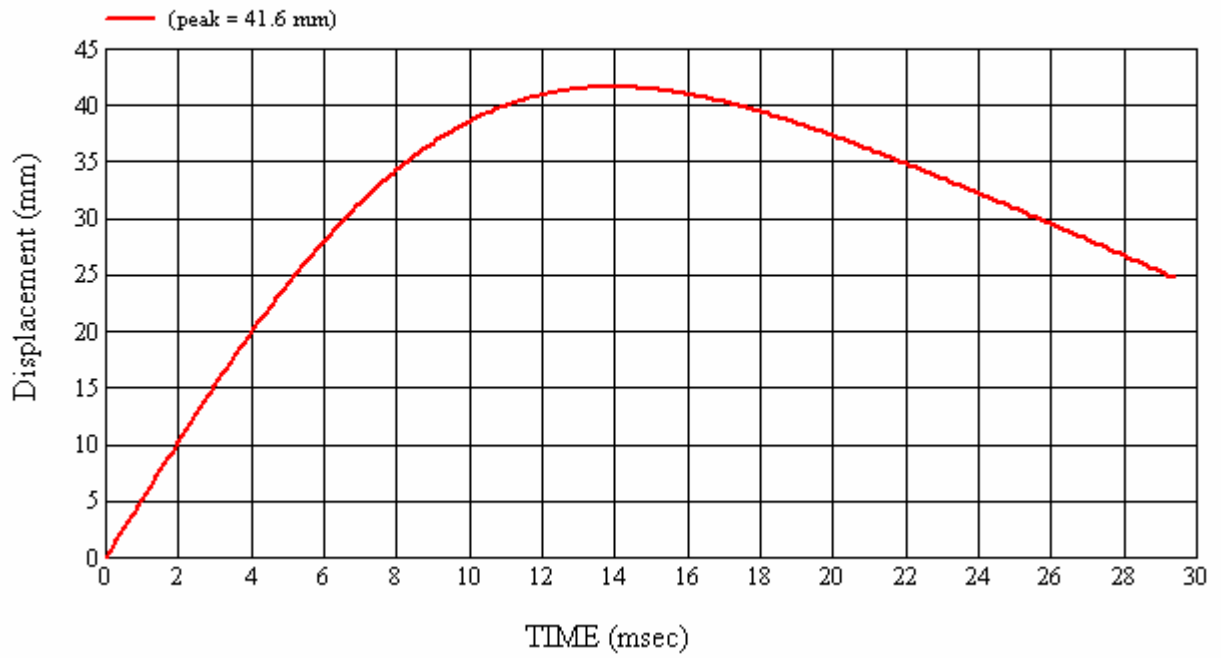
Target Location: SR2(b), Right Side

Test Date: 9/4/2007

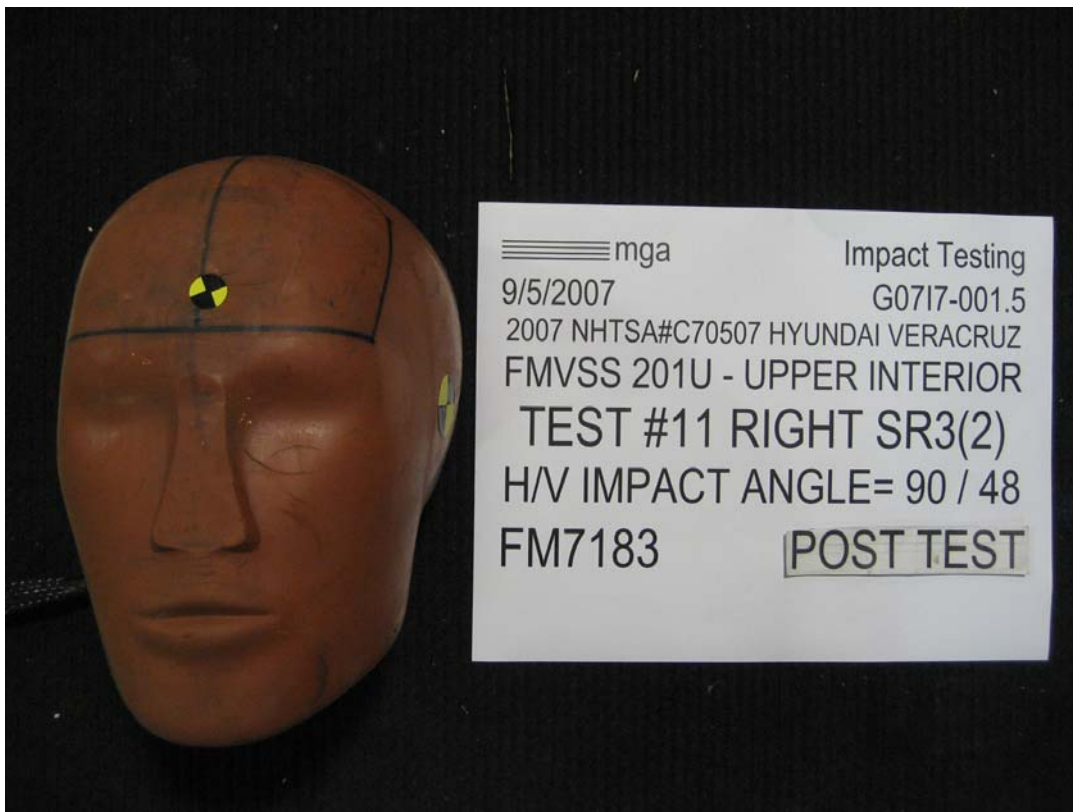












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#11
 Target (Vehicle Side): SR3(2) Right Temperature:22C
 MGA Test Reference No.:FM7183 Humidity:70%
 Approach Horizontal Angles:90° Time of Test:11:08:12 AM
 Approach Vertical Angles:48° FMH Serial No:[037]
 Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
570	535	9.1	23.5	13	2 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22696	-100.013	1.33	1.33
Y	6	J35791	91.856	1.89	1.89
Z	7	J35800	97.996	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

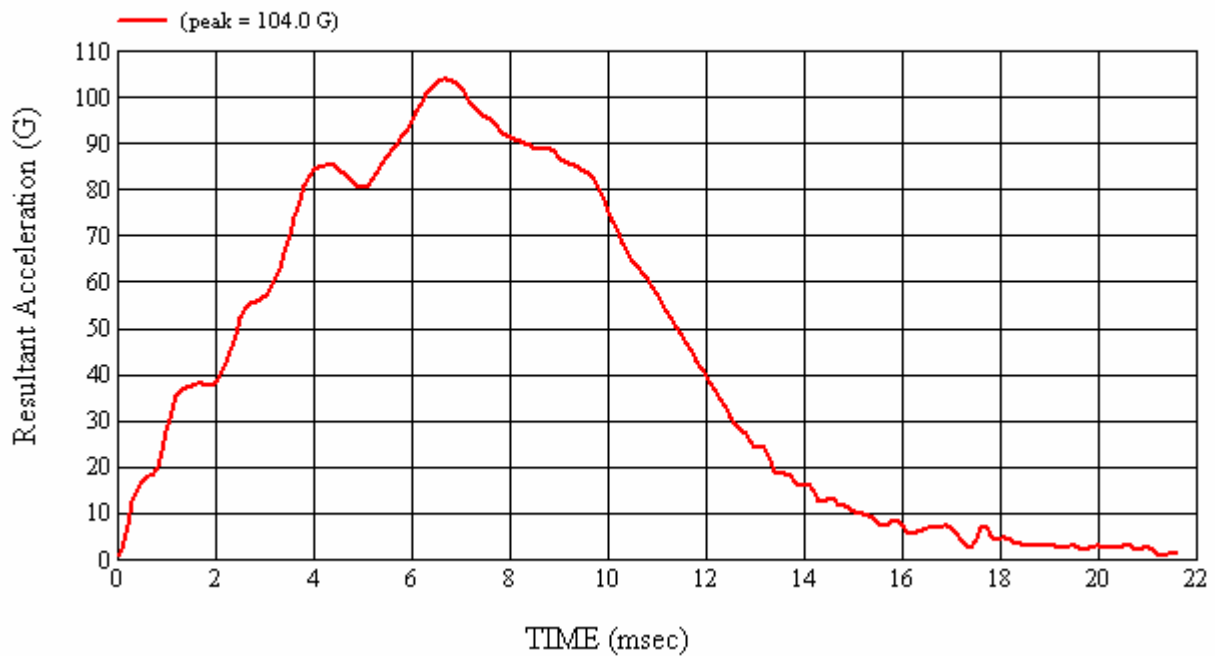
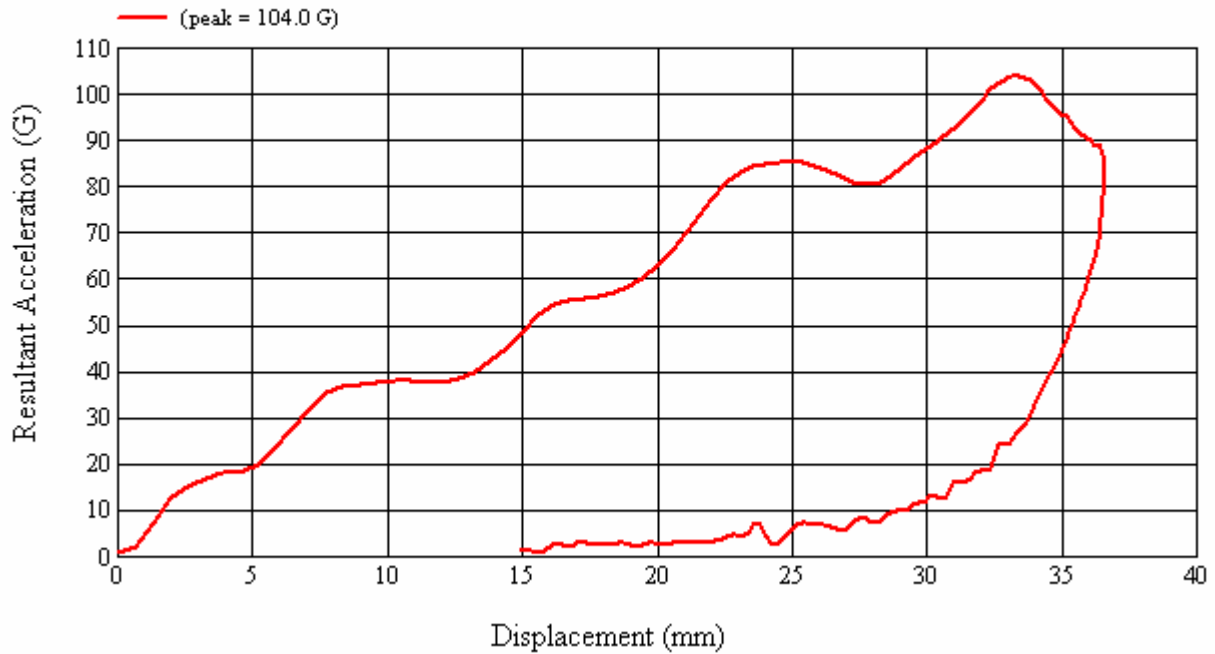
No visible damage.

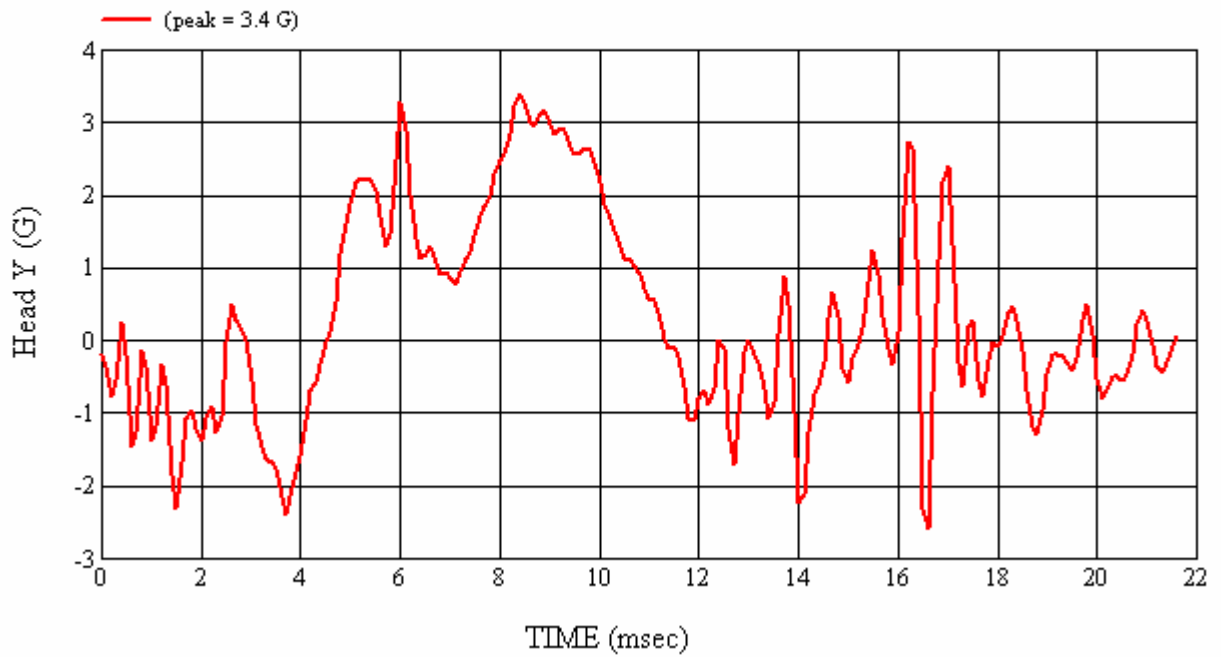
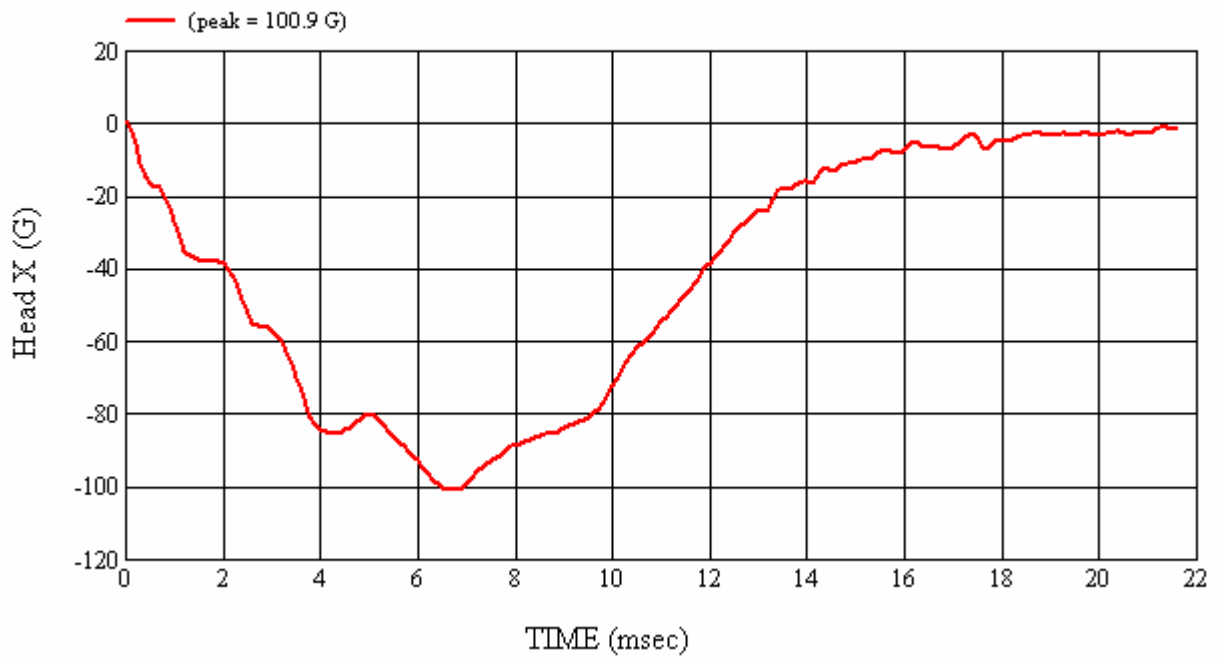
Recorded By: *Janis Campbell* Approved By*: *Heena A. Kalita* Date: 9/5/2007
 *Only necessary for NHTSA (Government) Compliance testing.

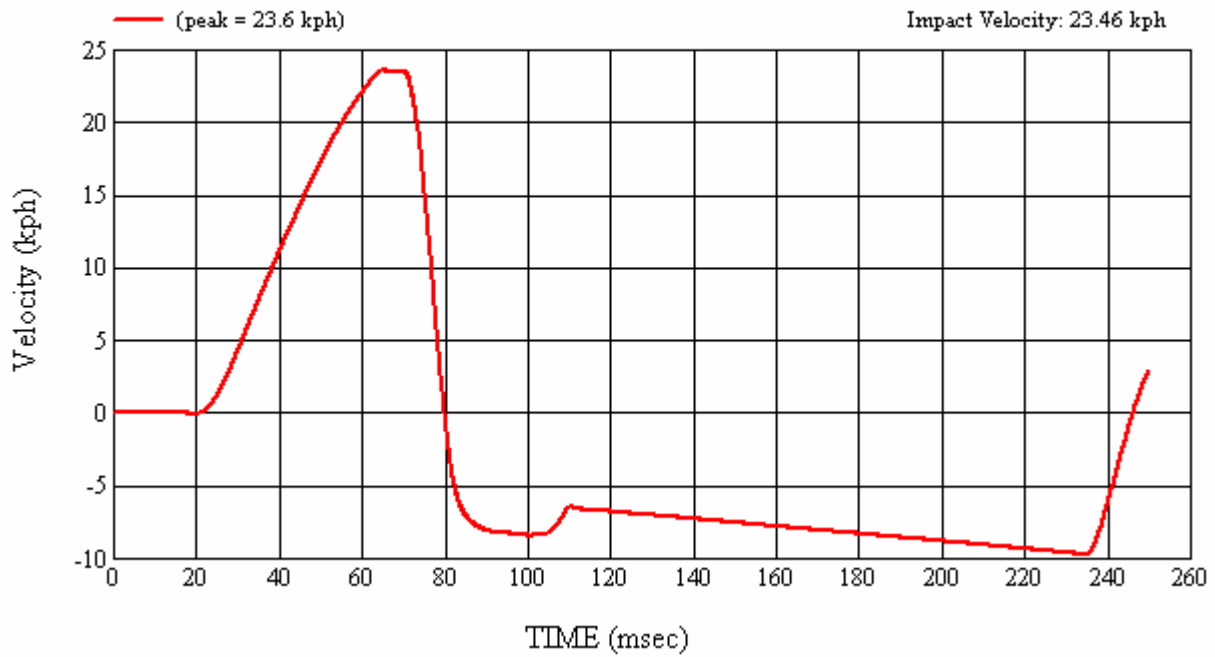
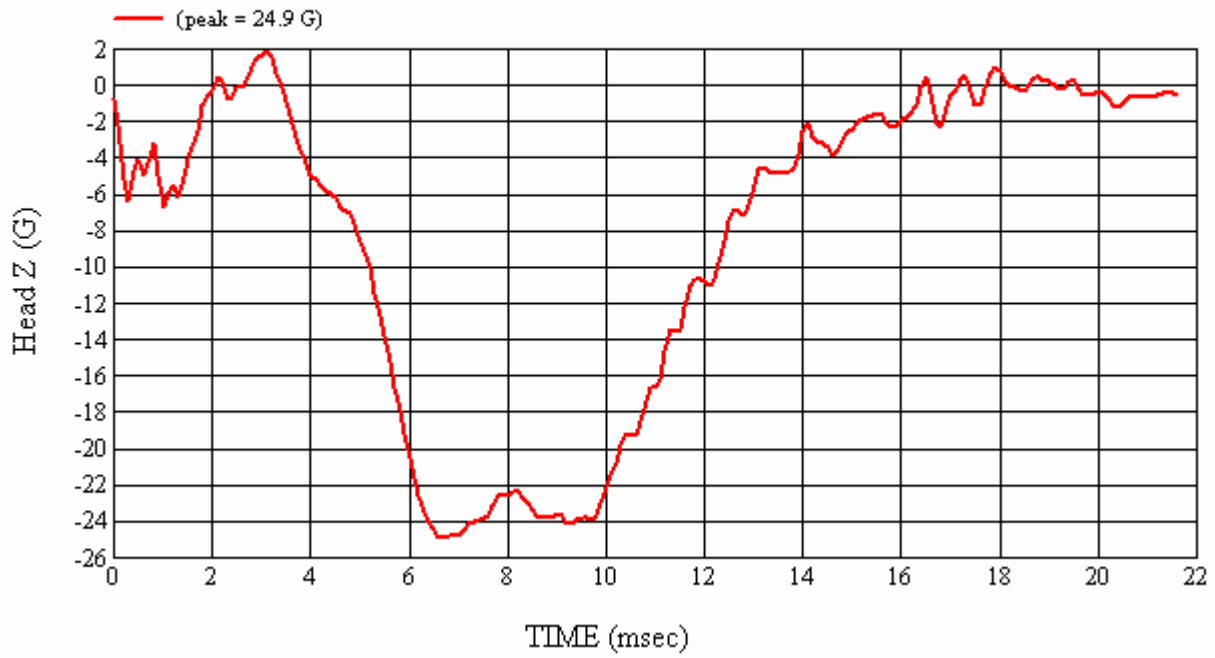
MGA Test #: FM7183

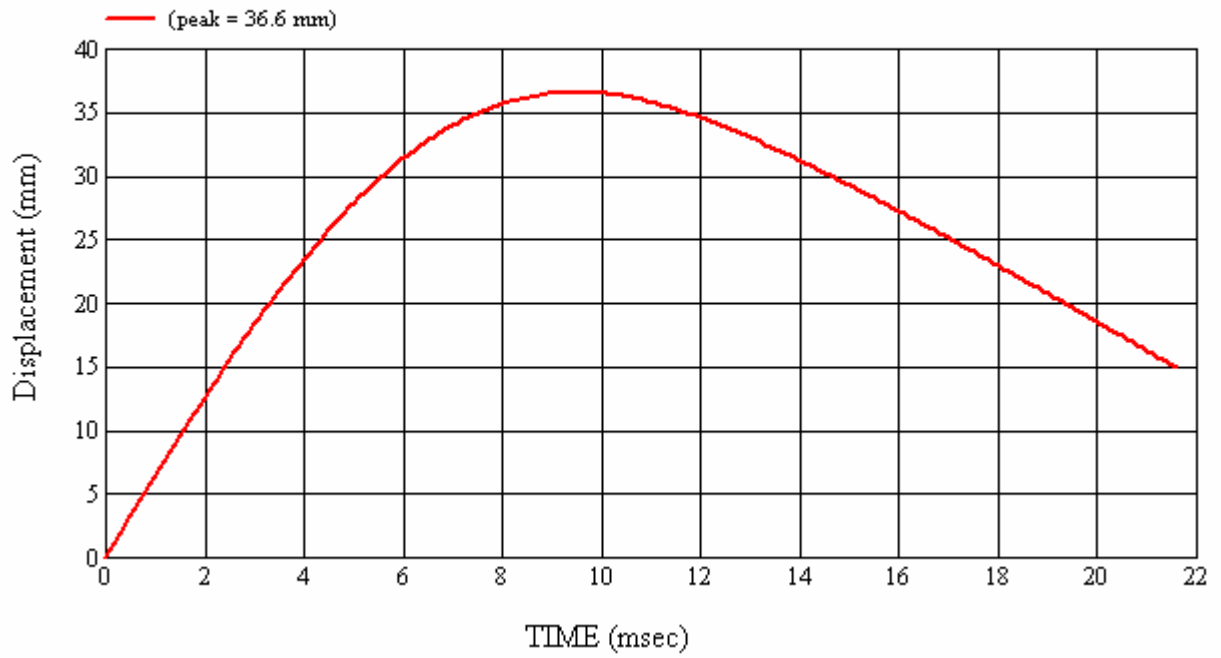
Target Location: SR3(2), Right Side

Test Date: 9/5/2007

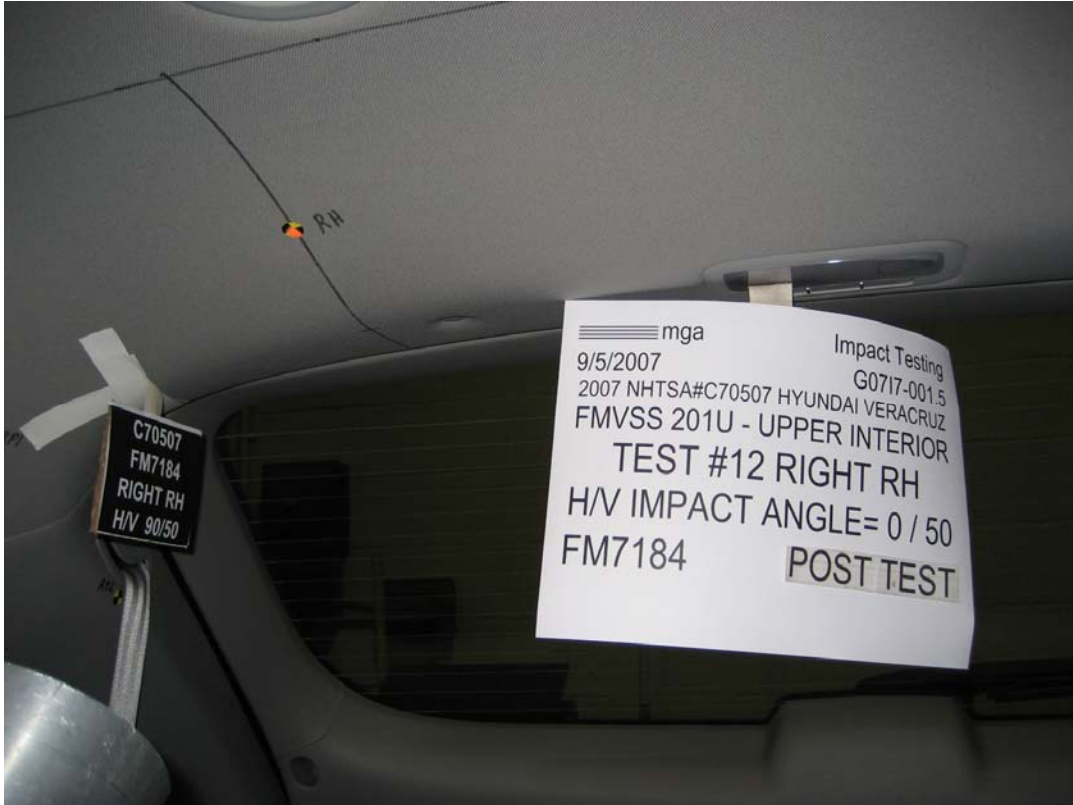












SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#12
Target (Vehicle Side): RH Right Temperature:22C
MGA Test Reference No.:FM7184 Humidity:66%
Approach Horizontal Angles:0° Time of Test:11:51:51 AM
Approach Vertical Angles:50° FMH Serial No:[038]
Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
754	778	7	23.8	3	5 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J14103	-94.598	1.32	1.33
Y	6	J36197	110.692	1.89	1.89
Z	7	J36353	99.391	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

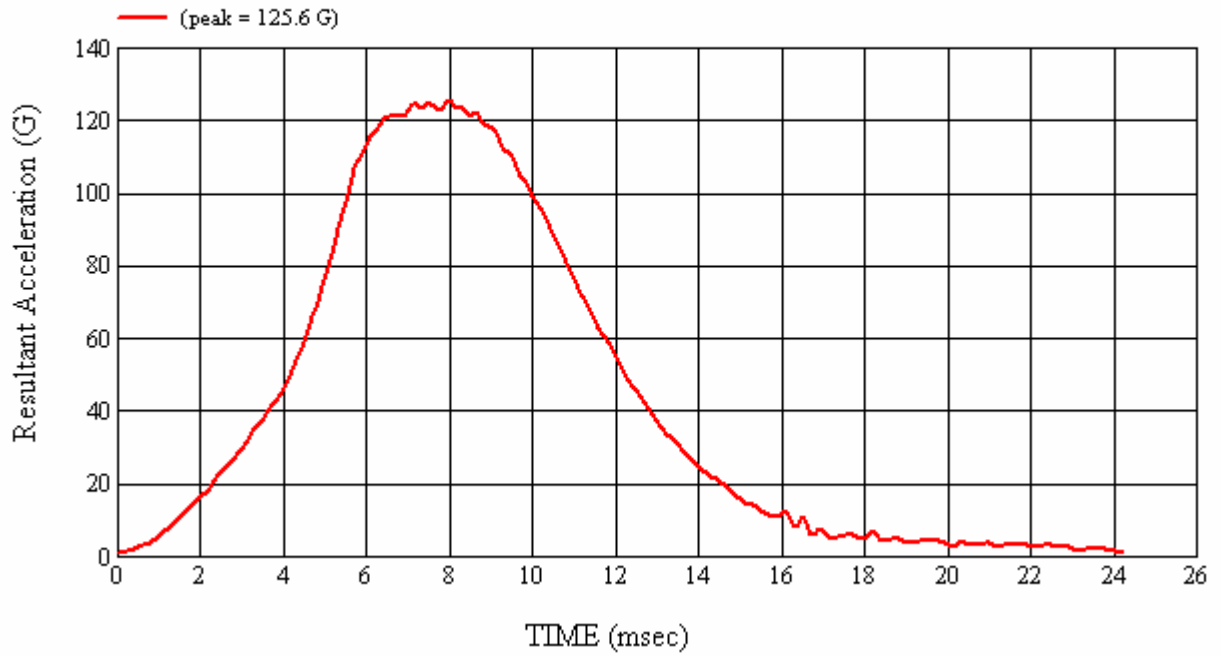
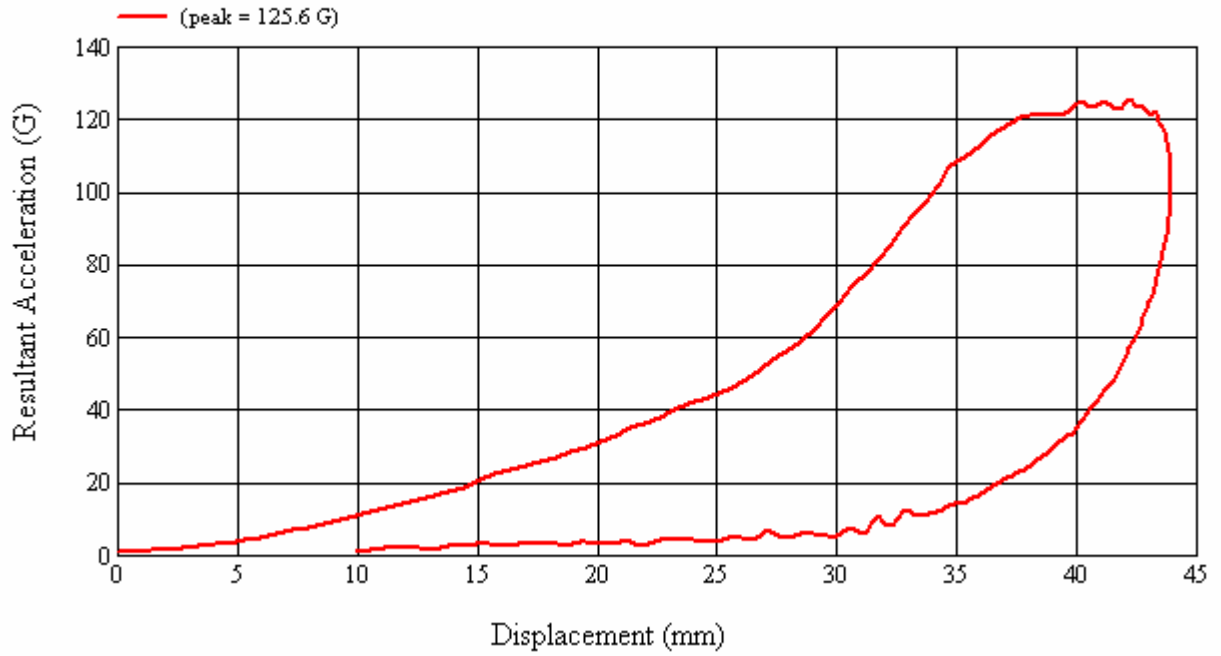
No visible damage.

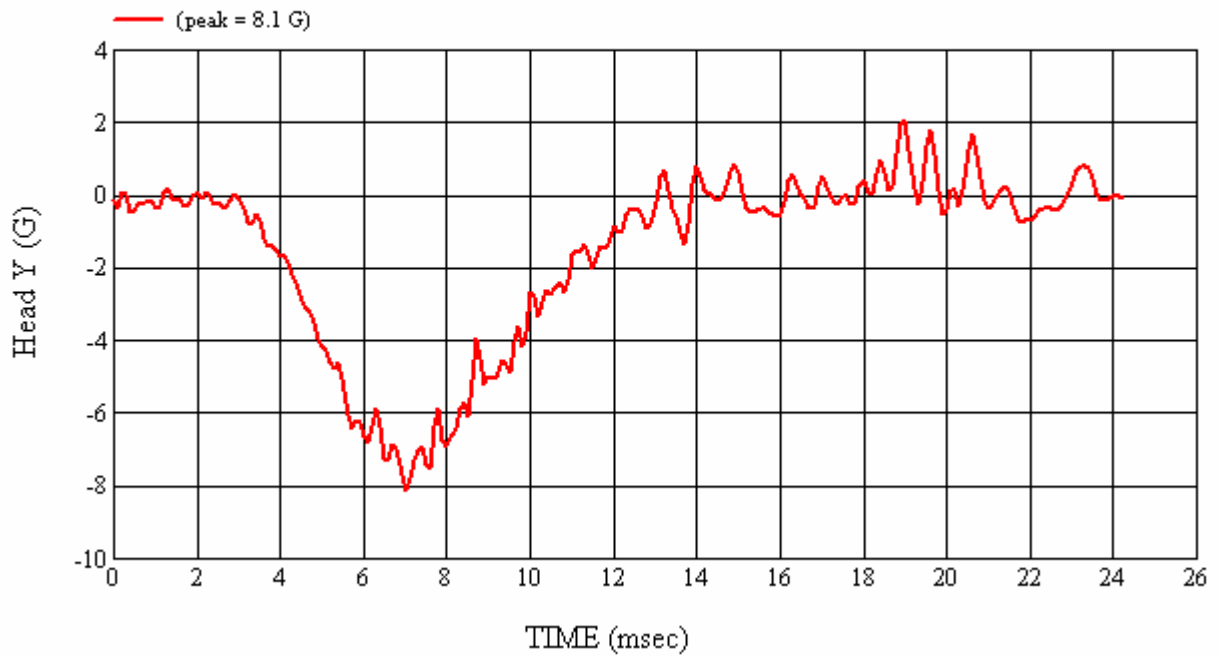
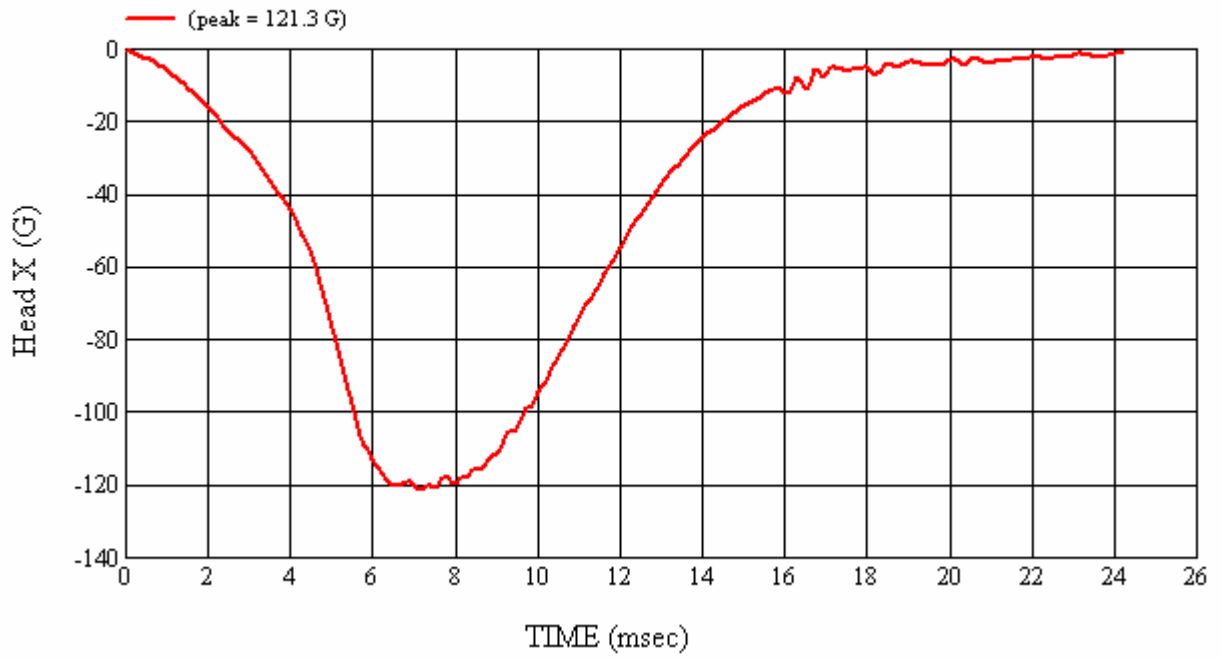
Recorded By: *Janis Campbell* Approved By*: *Heena A. Kalita* Date: 9/5/2007
*Only necessary for NHTSA (Government) Compliance testing.

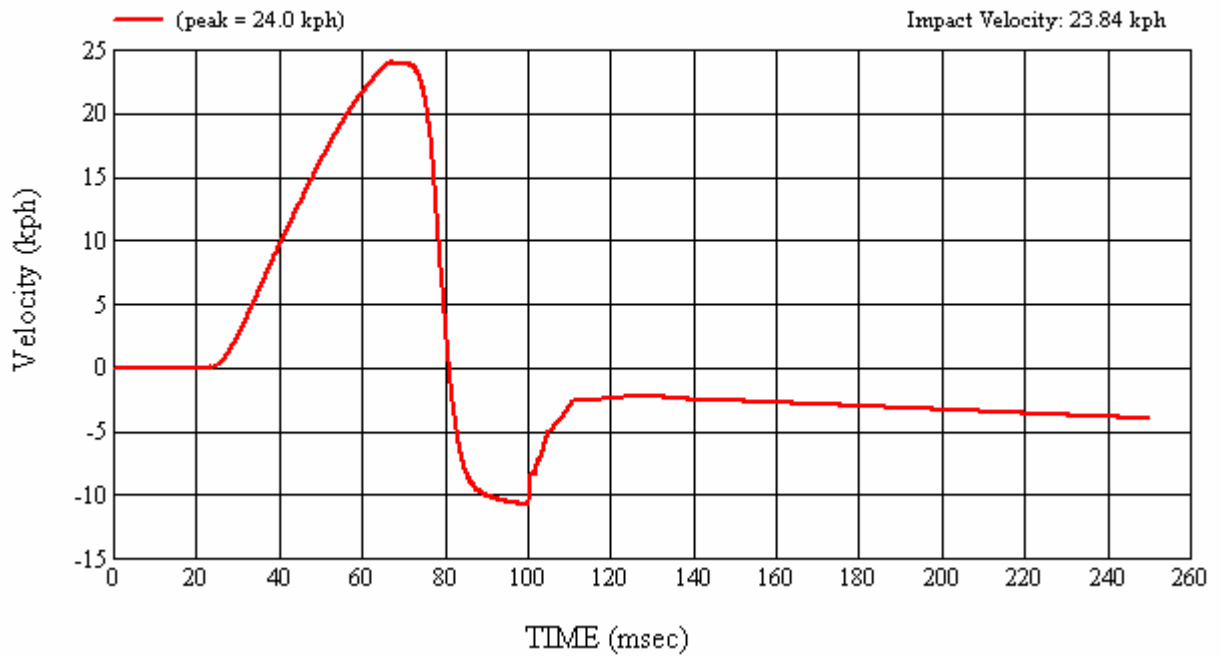
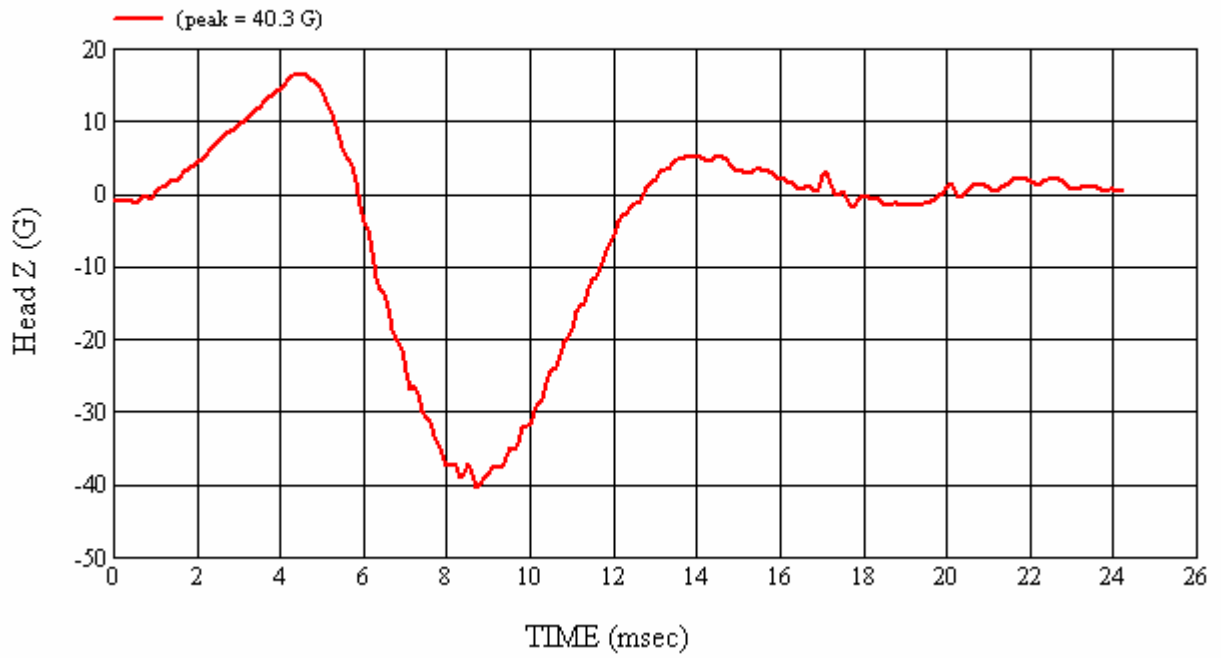
MGA Test #: FM7184

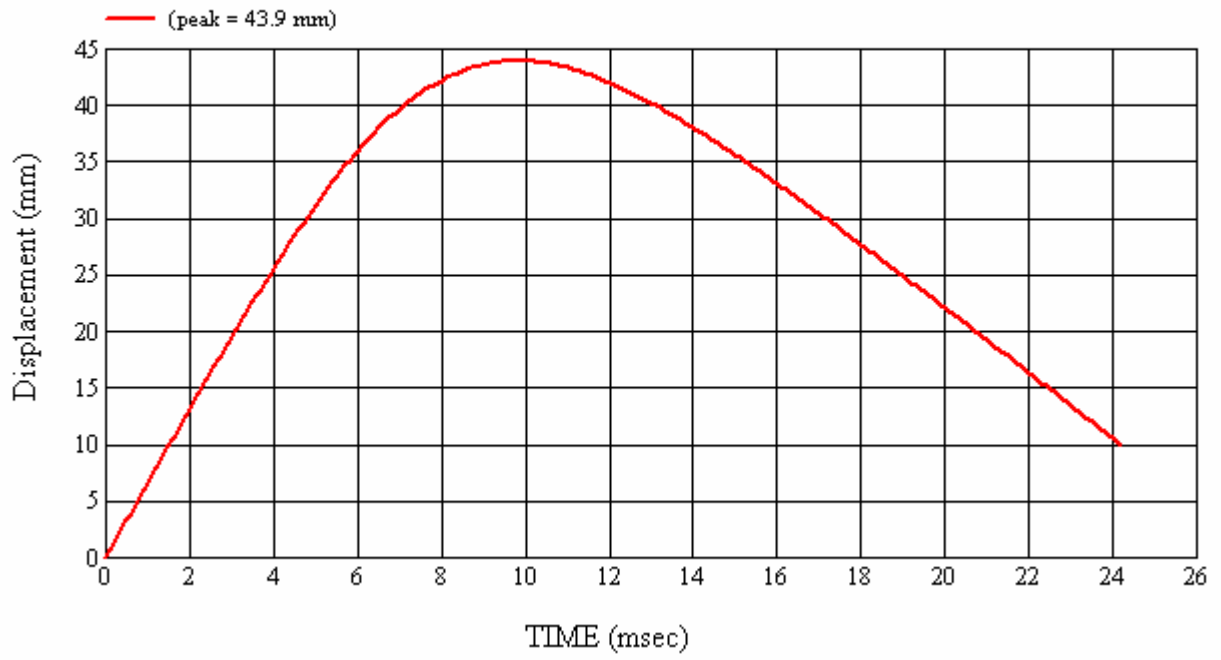
Target Location: RH, Right Side

Test Date: 9/5/2007













SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G0717-001.5 VEHICLE YR/MAKE/MODEL:2007/NHTSA#C70507/Hyundai Veracruz

GENERAL TEST PARAMETERS:

Test Number:#10
Target (Vehicle Side): UR4 Right Temperature:22C
MGA Test Reference No.:FM7182 Humidity:55%
Approach Horizontal Angles:90° Time of Test:5:19:37 PM
Approach Vertical Angles:42° FMH Serial No:[035]
Additional Description:

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
558	519	10.7	24.2	23	4 Left

INSTRUMENTATION INFORMATION: (all accelerometers are Endevco 7264-2000)

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22664	-94.161	1.32	1.32
Y	6	J35919	97.442	1.89	1.89
Z	7	J35924	93.891	1.83	1.83

REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

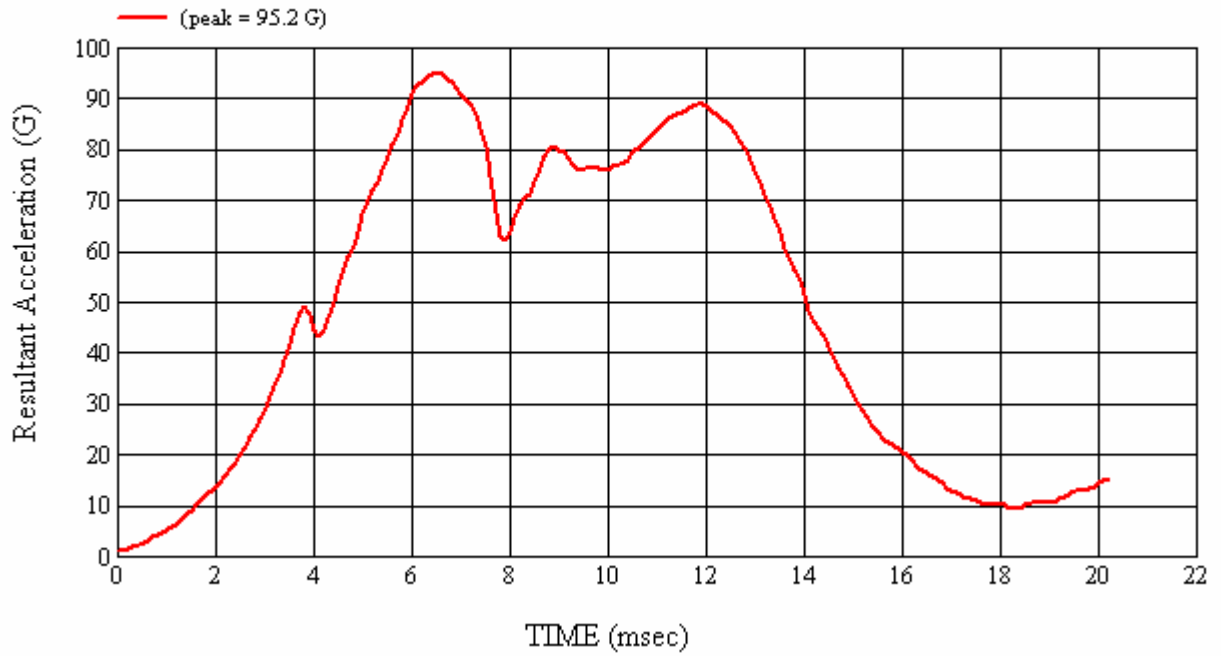
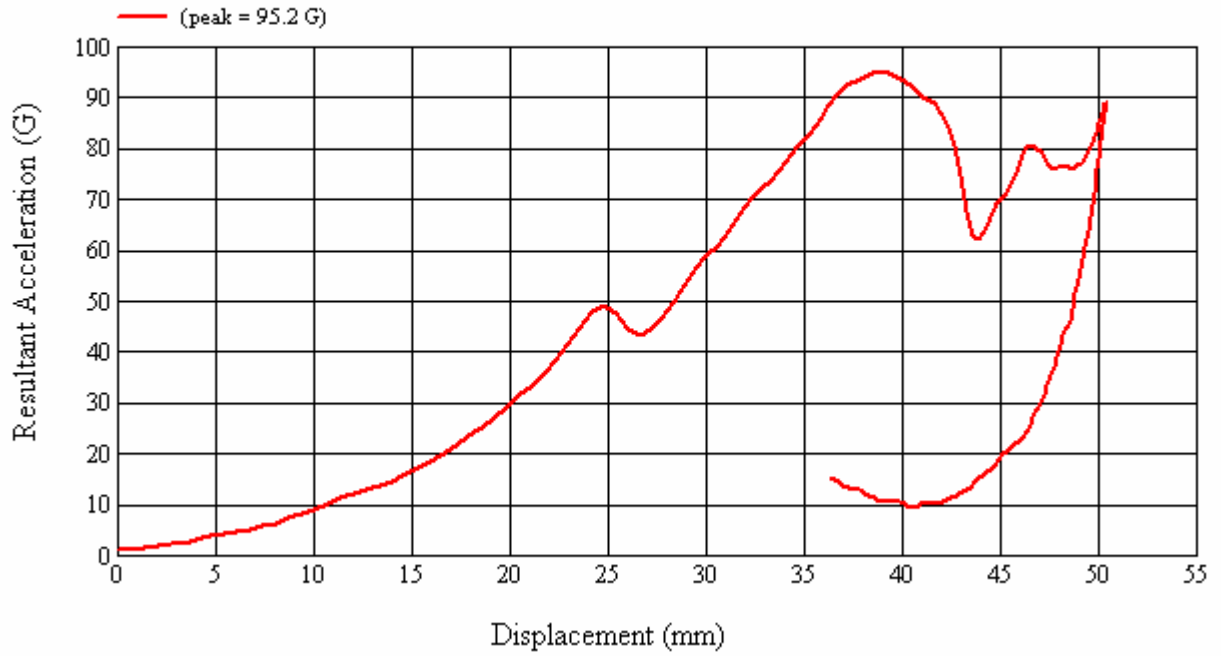
No visible damage.

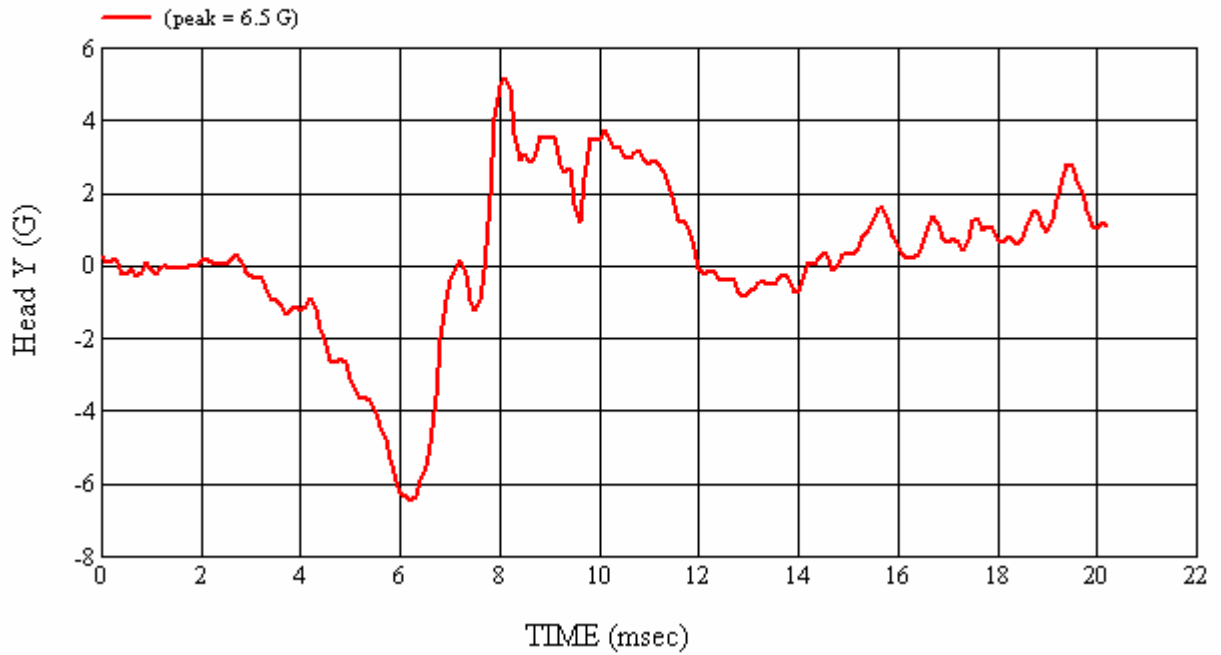
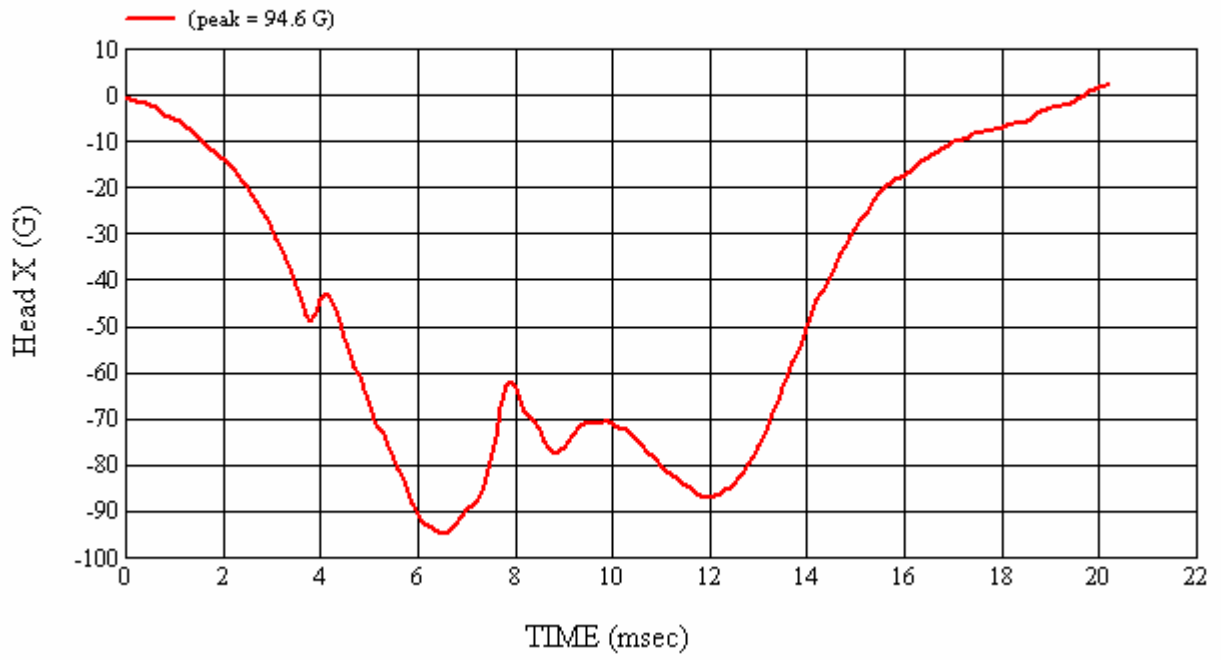
Recorded By: *Janis Campbell* Approved By*: *Heena A. Kalita* Date: 9/4/2007
*Only necessary for NHTSA (Government) Compliance testing.

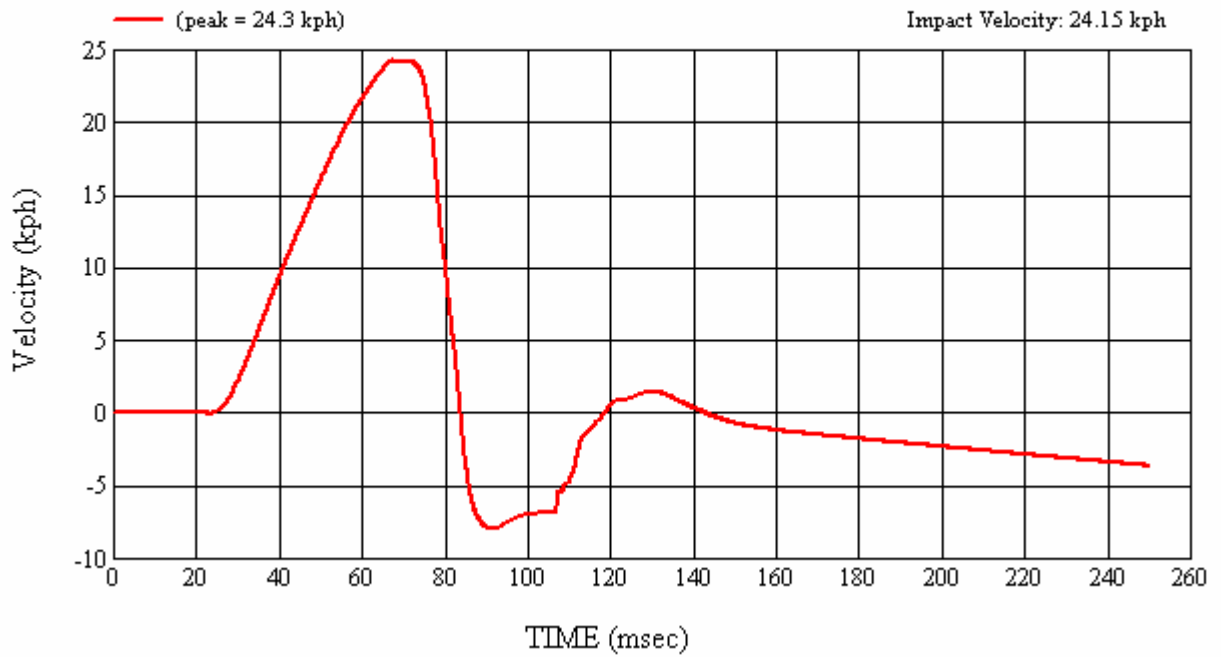
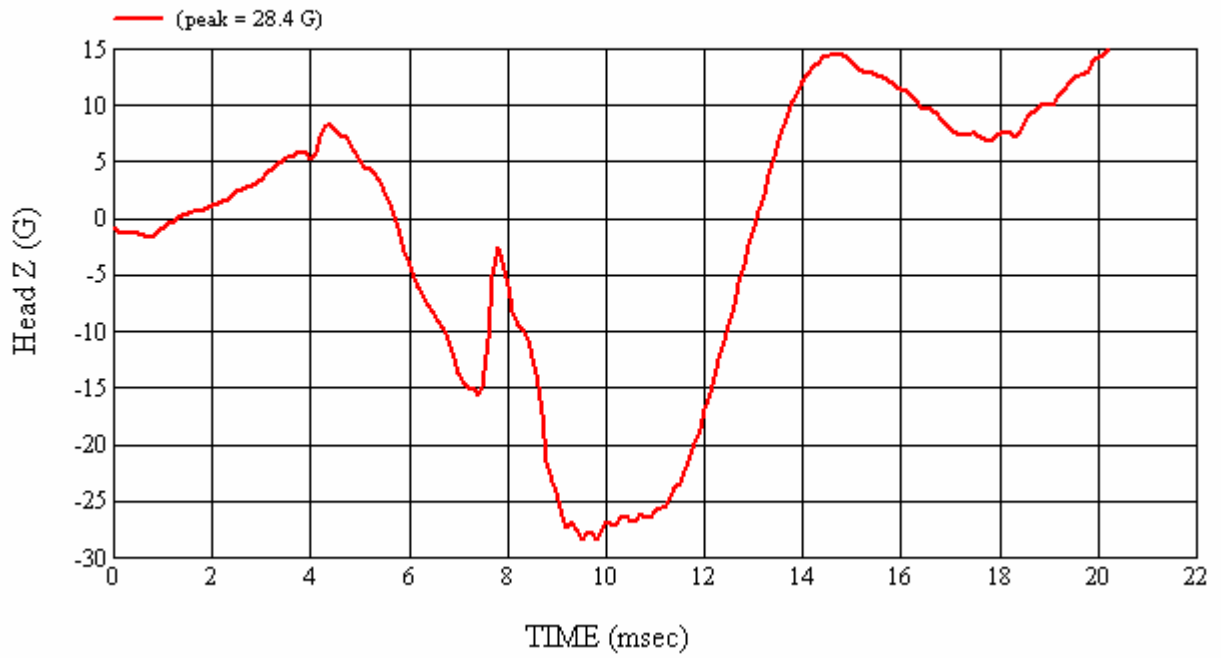
MGA Test #: FM7182

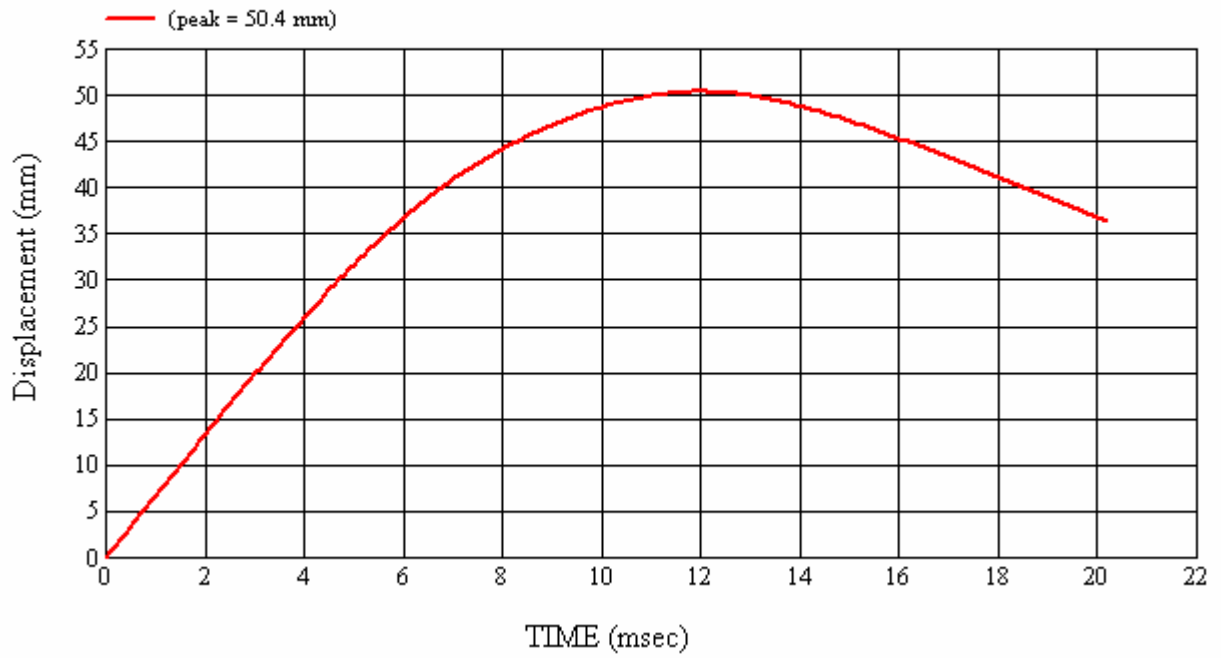
Target Location: UR4, Right Side

Test Date: 9/4/2007









4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

The following section lists the test equipment for the compliance test series. Items marked with an asterisk are calibrated by an external lab. An additional summary table is given for the pre and post-test calibration data for the Free Motion Headforms. The temperature trace to confirm testing was conducted between 66°F and 78°F (19°C - 26°C) is included in Appendix A. Calibration certificates can be found in Appendix B.

TABLE 4-1 LIST OF ITEMS USED

ITEM	MANUFACTURER NAME	MODEL #	FUNCTION OF ITEM	ACCURACY	CAL. INTERNAL
Head Drop Tower (includes test frame and DAS)	MGA Research Corp.	MGA-100-DC	FMH Calibration	N/A	N/A
Accelerometers	Endevco	7264-2000	Acceleration Data	±0.5%	6 months
*Digital Inclinometer	Macklanburg-Duncan	PRO 360 (MGA00048)	Set Angle of FMH/Targeting	0.1°	Annual
FMVSS 201U Test Frame (includes the propulsion control system, actuator, test frame, and DAS)	MGA Research Corp.	MGA-100-FMH	Test System	N/A	N/A
Free Motion Headforms	UTAMA UTAMA UTAMA	035 037 038	Test Device	N/A	Pre and Post-Test Series
High Speed Video	Redlake	HGLE	Record Event	N/A	N/A
*FARO™	Faro Technologies	G08020203045	Targeting	0.1 mm	Annual
Measuring Devices: - Tape Measure - Plumb Bobs - Digital Protractor	Stanley N/A Macklanburg-Duncan	TPM748 -- MGA00048	Measurement Targeting FMH setup Horizontal Measurement	1 mm N/A 0.5°	Annual
*Temperature Recorder	Dickson	FH125	Record Temperature and Humidity	± 1°C ± 1% RH	Annual
* Scale	Detecto	MGA00081	Weigh FMH Head	± 0.01 lb	Annual

ITEM	MANUFACTURER NAME	MODEL #	FUNCTION OF ITEM	ACCURACY	CAL. INTERNAL
*Vehicle Scale	Sterling Scale Co.	26032389	Weighing Vehicle	± .5 kg	Annual

Each headform was calibrated by an engineer after the headform had soaked in an environment of 66°F to 78°F (19°C to 26°C) for a period of at least four hours.

Each headform was found to comply with the performance criteria under Part 572L for pre and post-test calibrations. That is, the peak resultant acceleration was between 225 and 275 G's, the peak lateral acceleration was less than 15 G's, the headform weighed between 9.9 and 10.1 lbs., the pulse was determined to be unimodal, and there was no major damage to the headform.

DATA SUMMARY TABLE

FMH Serial #		Headform Calibration Date	Weight (lbs)	Temp (°C)	% Humidity	Peak Resultant Acceleration (G's)	Peak Lateral Acceleration (G's)	Unimodal
Pre	#035	8/31/2007	10.08	24.0	38.0	233.9	3.0	Yes
Post	#035	9/6/2007	10.08	24.0	38.0	237.2	2.5	Yes
Pre	#037	8/31/2007	9.96	24.0	39.0	241.3	5.0	Yes
Post	#037	9/6/2007	9.96	24.0	48.0	246.5	5.8	Yes
Pre	#038	8/31/2007	9.90	23.0	39.0	270.5	12.2	Yes
Post	#038	9/6/2007	9.90	23.0	49.0	269.6	4.3	Yes

4.1 Pre-Test Calibration

**HEAD DROP TEST SUMMARY
 PART 572L**

HEADFORM SERIAL NUMBER: 035		CALIBRATION DATE: 8/31/2007
CALIBRATION TIME: 7:20:25 AM		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Weight	9.90 to 10.10 lbs.	10.08
Temperature	19° C to 26° C	24
Relative Humidity	10% to 70%	38
Peak Resultant Acceleration	225 G's to 275 G's	233.9
Peak Lateral Acceleration	15 G's Maximum	3.0
Unimodal Acceleration Curve	YES	YES

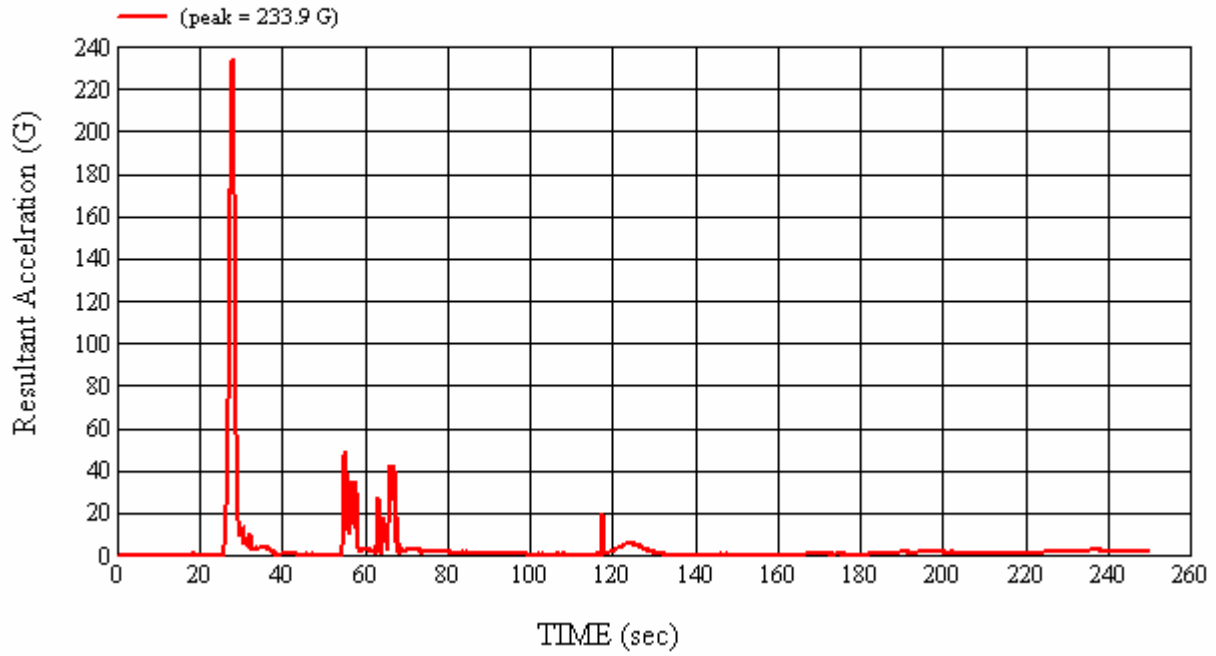
FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22664	04/30/07	10/30/07
2	ENDEVCO	7264-2000	J35919	04/30/07	10/30/07
3	ENDEVCO	7264-2000	J35924	04/30/07	10/30/07

REMARKS:

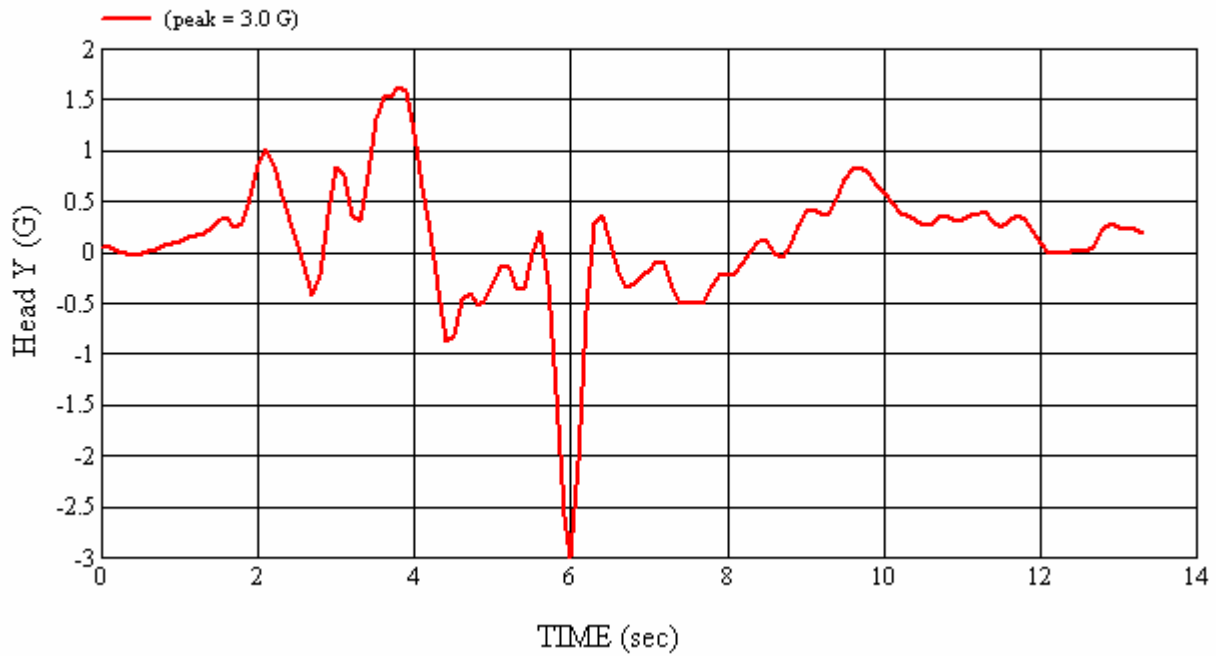
RECORDED BY: 

DATE: 8/31/2007

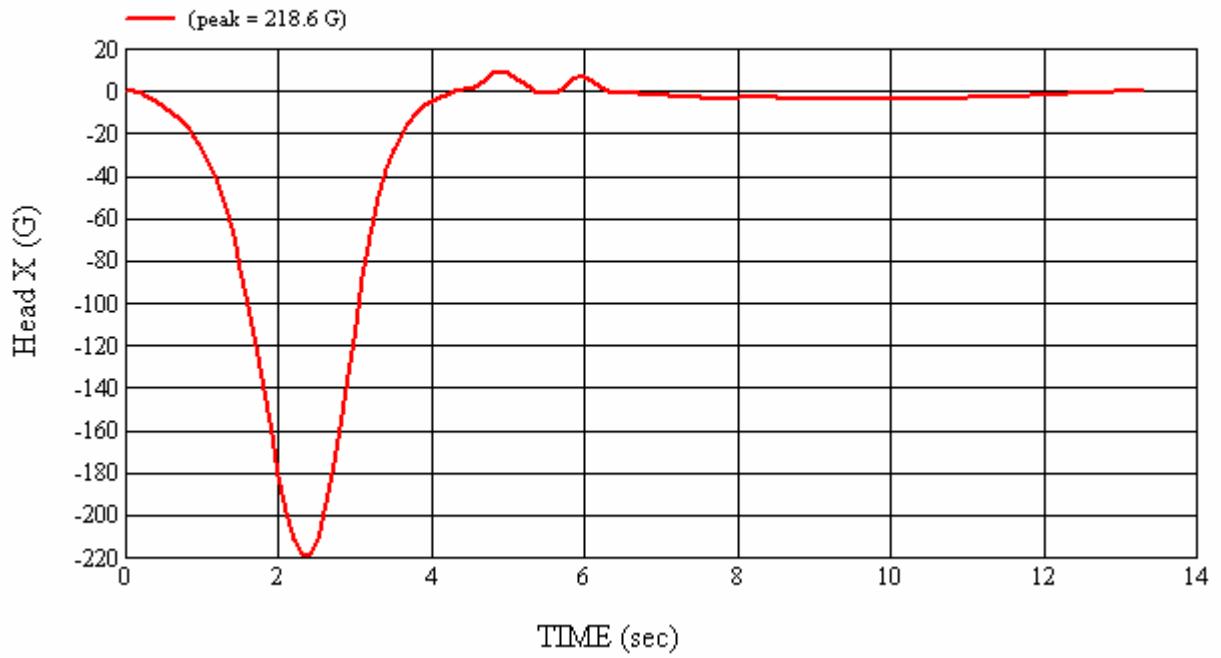
APPROVED BY: 



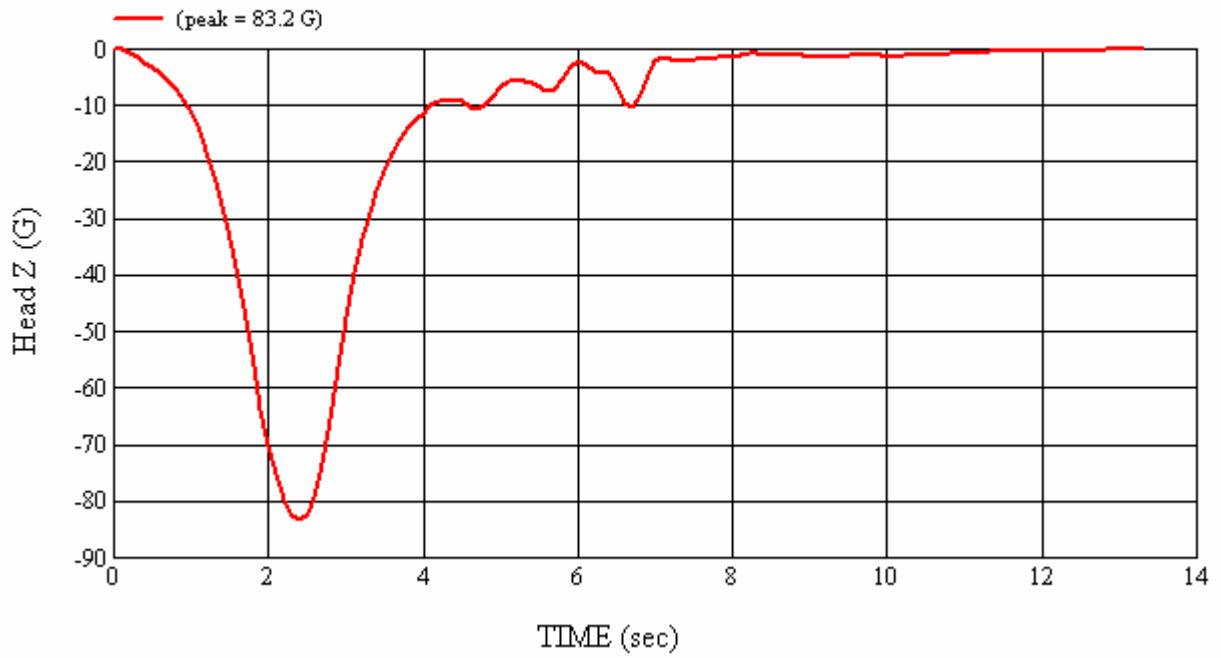
Head 035 (Pre) Calibration #H35005



Head 035 (Pre) Calibration #H35005



Head 035 (Pre) Calibration #H35005



Head 035 (Pre) Calibration #H35005

4.2 Post-Test Calibration

**HEAD DROP TEST SUMMARY
 PART 572L**

HEADFORM SERIAL NUMBER: 035		CALIBRATION DATE: 9/6/2007
CALIBRATION TIME: 9:23:21 AM		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Weight	9.90 to 10.10 lbs.	10.08
Temperature	19° C to 26° C	24
Relative Humidity	10% to 70%	38
Peak Resultant Acceleration	225 G's to 275 G's	237.2
Peak Lateral Acceleration	15 G's Maximum	2.5
Unimodal Acceleration Curve	YES	YES

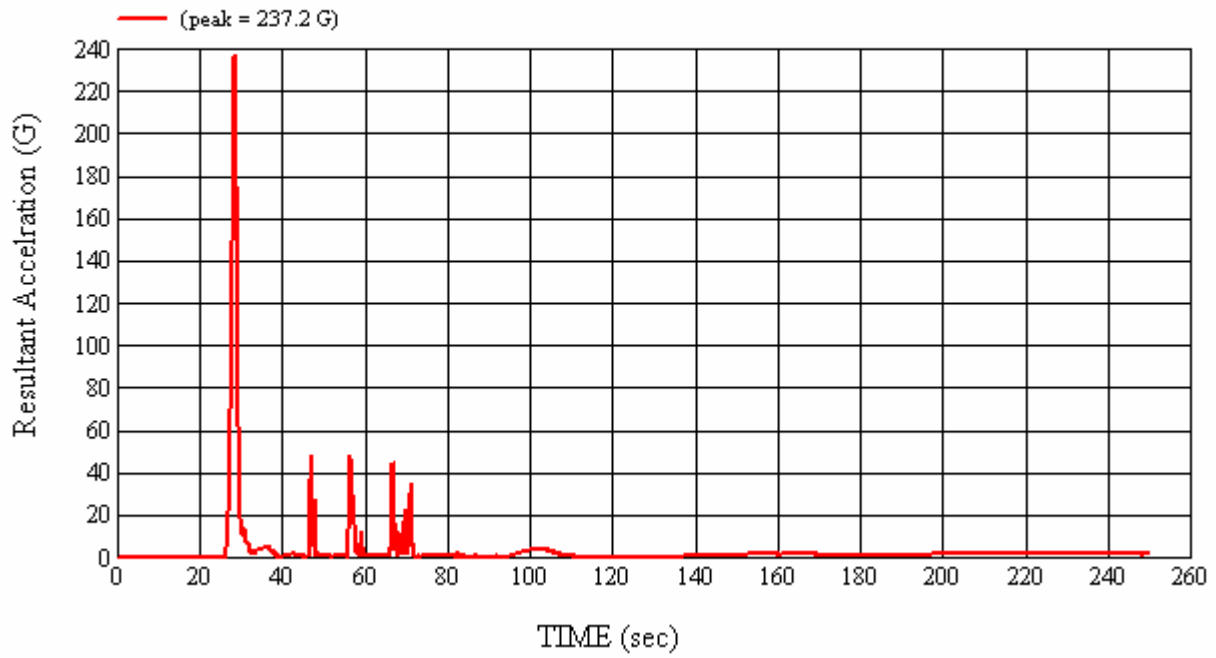
FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22664	04/30/07	10/30/07
2	ENDEVCO	7264-2000	J35919	04/30/07	10/30/07
3	ENDEVCO	7264-2000	J35924	04/30/07	10/30/07

REMARKS:

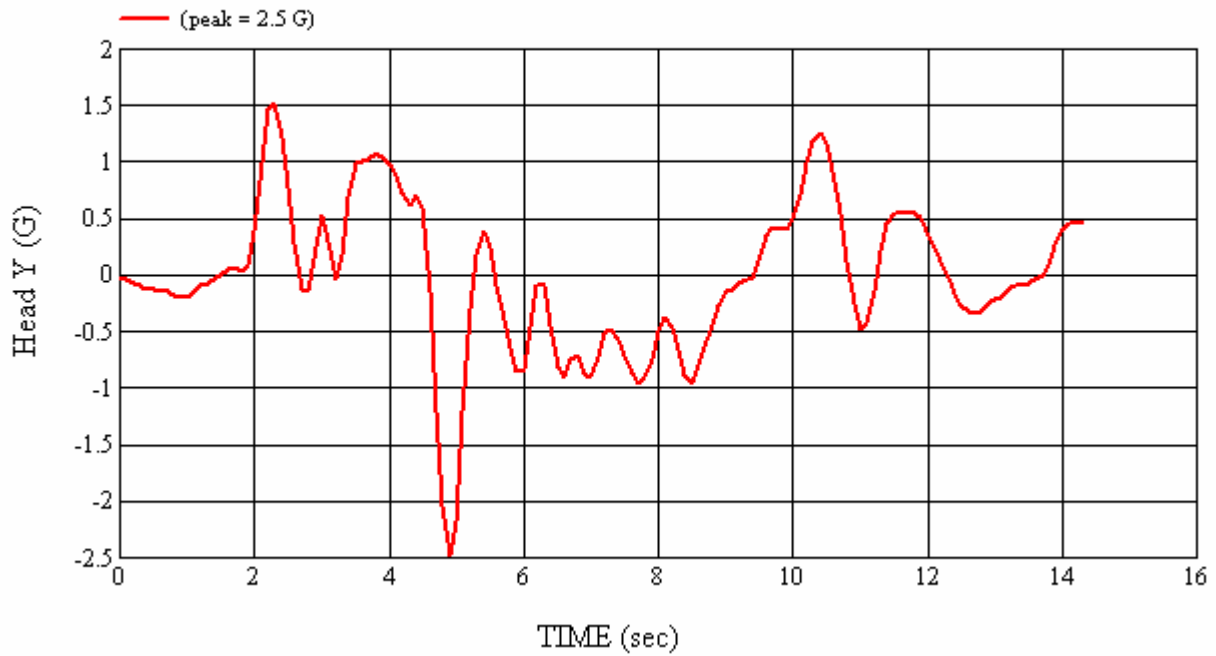
RECORDED BY: *Jane Campbell*

DATE: 9/6/2007

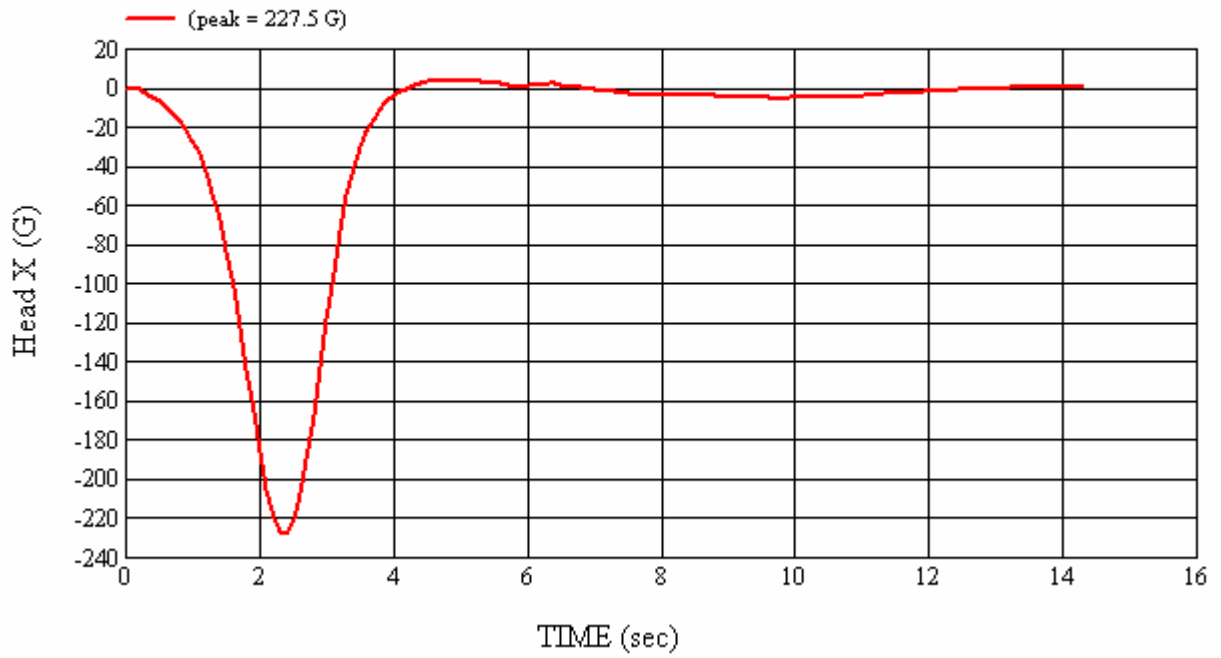
APPROVED BY: *Heena Kalita*



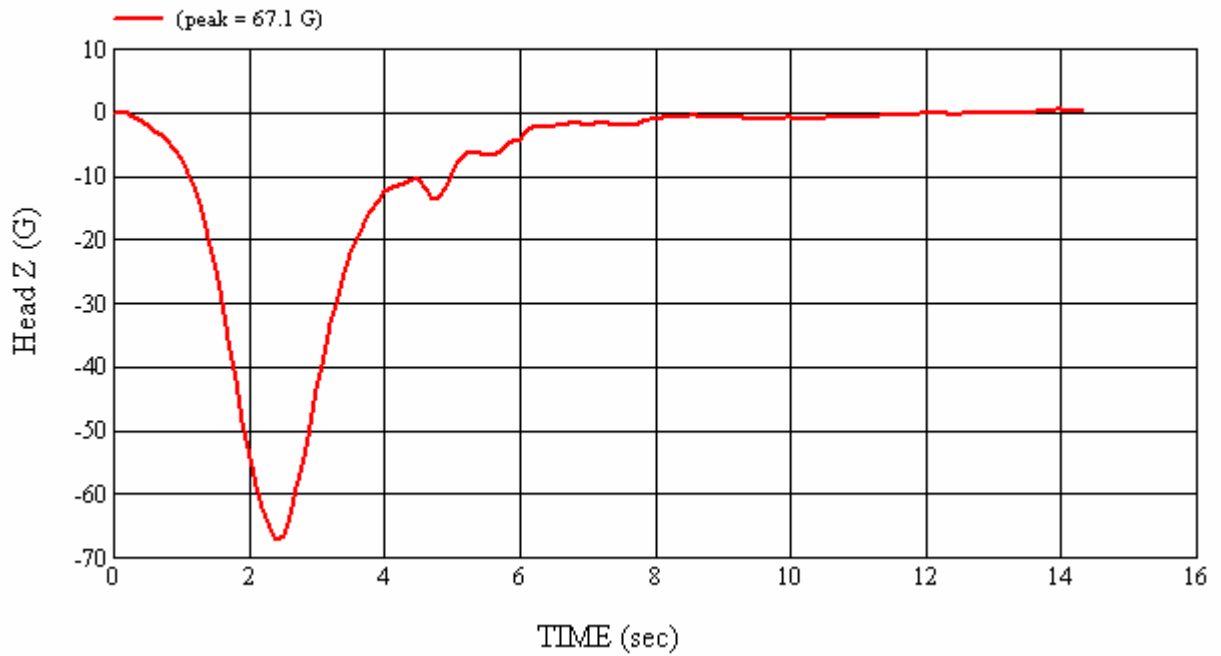
Head 035 (Post) Calibration #H35006



Head 035 (Post) Calibration #H35006



Head 035 (Post) Calibration #H35006



Head 035 (Post) Calibration #H35006

4.3 Pre-Test Calibration

**HEAD DROP TEST SUMMARY
 PART 572L**

HEADFORM SERIAL NUMBER: 037		CALIBRATION DATE: 8/31/2007
CALIBRATION TIME: 7:35:08 AM		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	24
Relative Humidity	10% to 70%	39
Peak Resultant Acceleration	225 G's to 275 G's	241.3
Peak Lateral Acceleration	15 G's Maximum	5.0
Unimodal Acceleration Curve	YES	YES

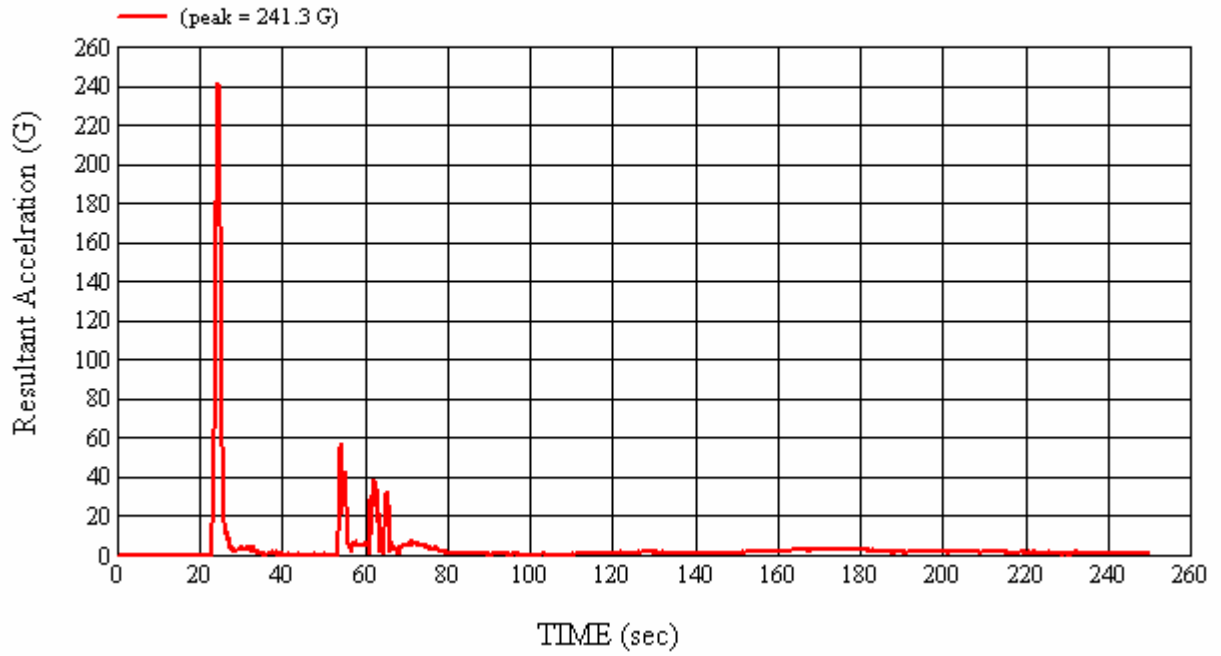
FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22696	04/30/07	10/30/07
2	ENDEVCO	7264-2000	J35791	04/30/07	10/30/07
3	ENDEVCO	7264-2000	J35800	04/30/07	10/30/07

REMARKS:

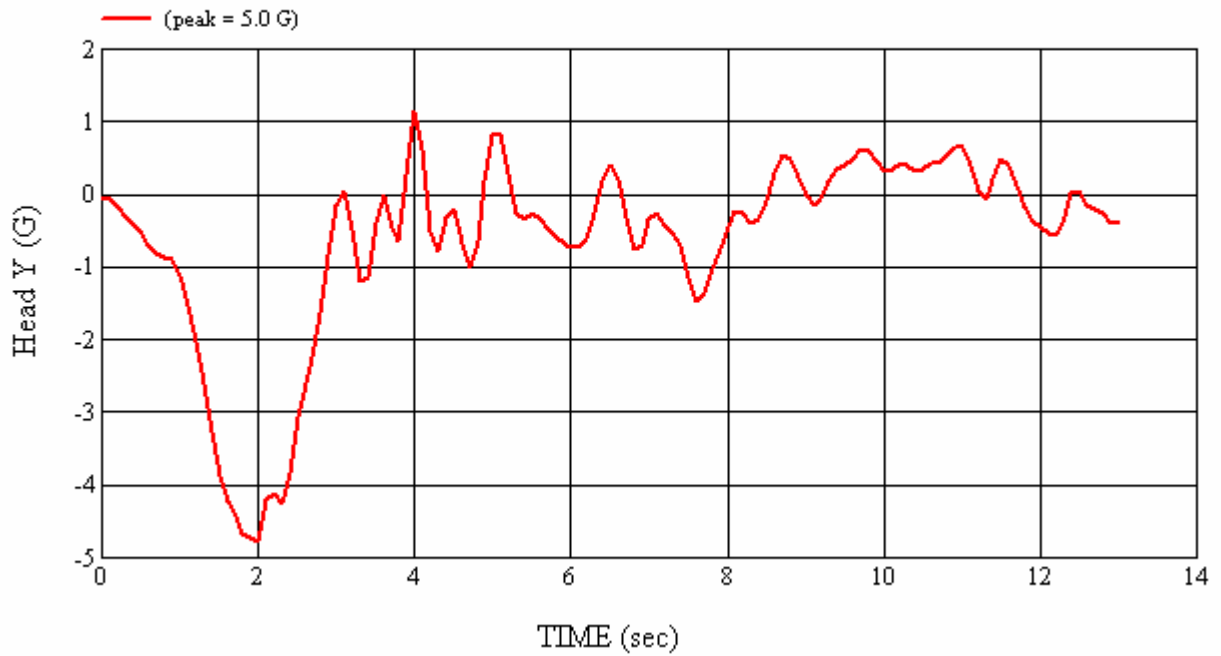
RECORDED BY: *Janis Campbell*

DATE: 8/31/2007

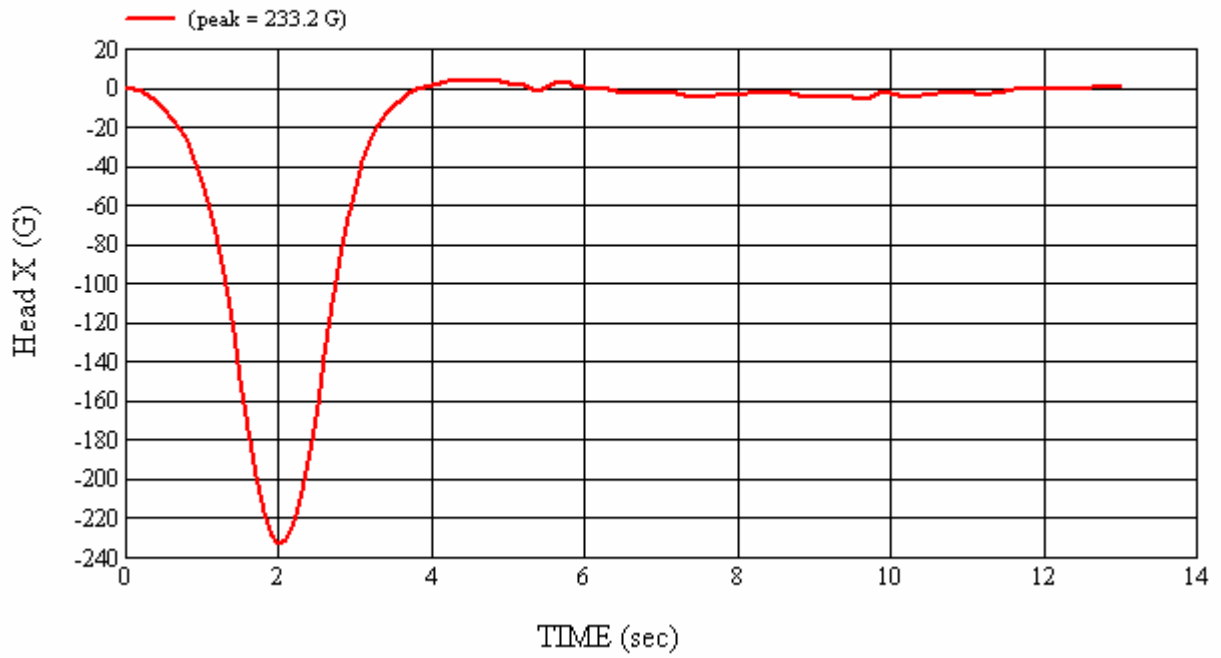
APPROVED BY: *Heena A. Kalita*



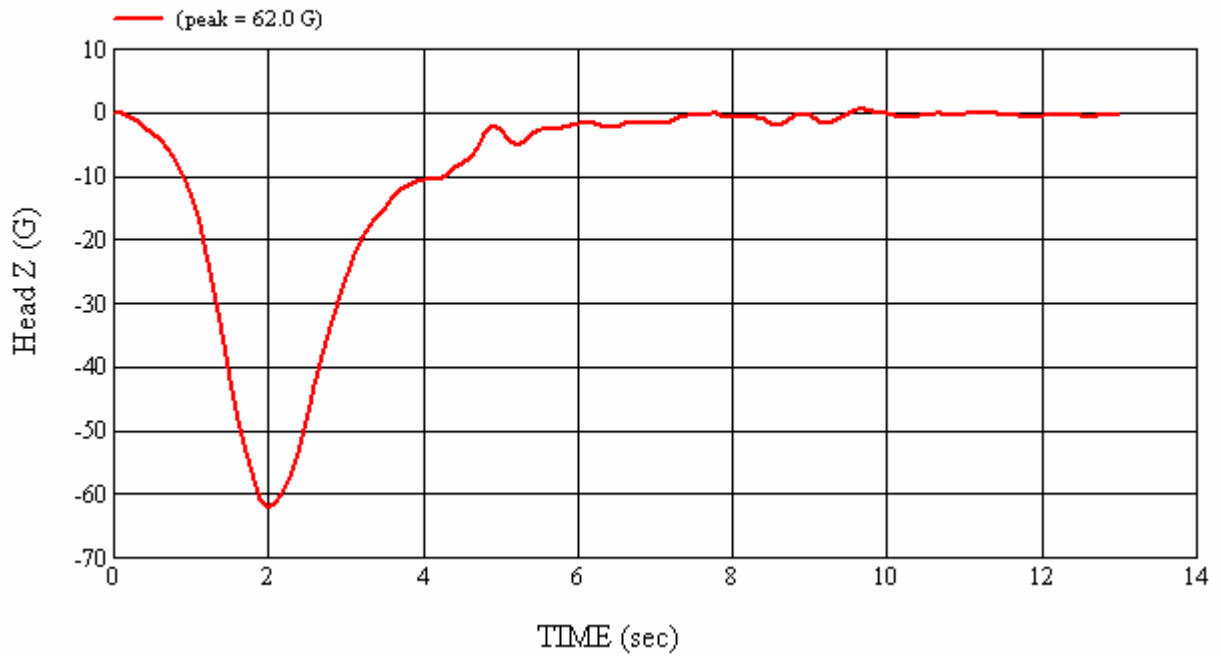
Head 037 (Pre) Calibration #H37009



Head 037 (Pre) Calibration #H37009



Head 037 (Pre) Calibration #H37009



Head 037 (Pre) Calibration #H37009

4.4 Post-Test Calibration

**HEAD DROP TEST SUMMARY
 PART 572L**

HEADFORM SERIAL NUMBER: 037		CALIBRATION DATE: 9/6/2007
		CALIBRATION TIME: 9:55:09 AM
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	24
Relative Humidity	10% to 70%	48
Peak Resultant Acceleration	225 G's to 275 G's	246.5
Peak Lateral Acceleration	15 G's Maximum	5.8
Unimodal Acceleration Curve	YES	YES

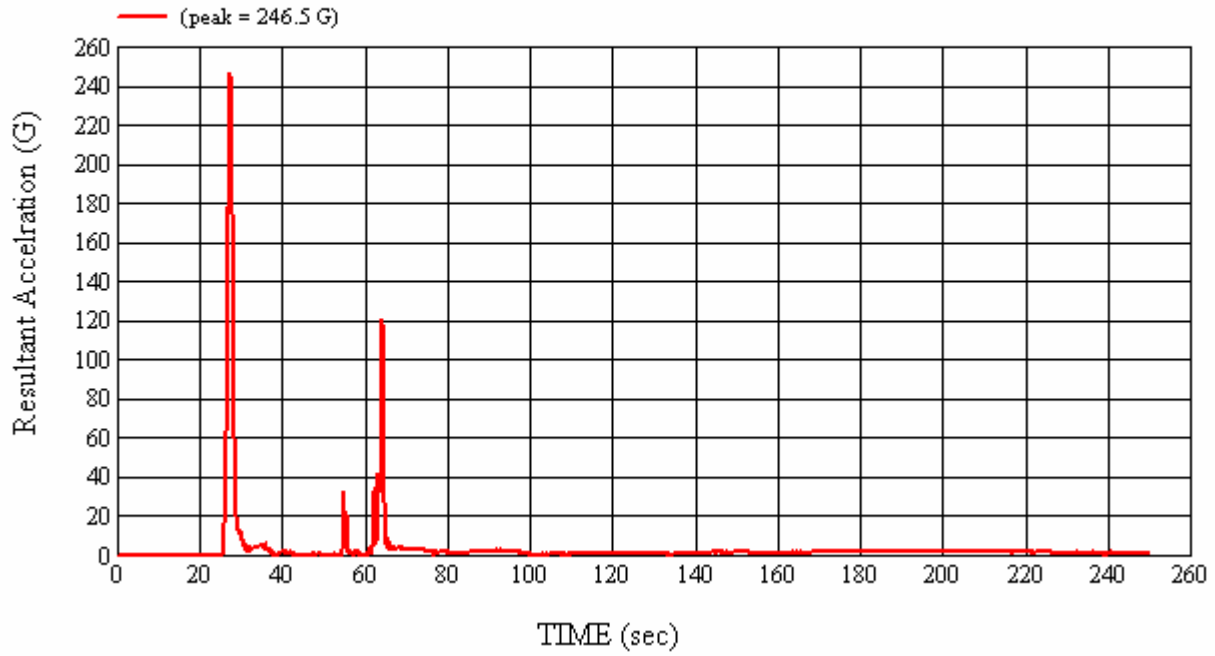
FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22696	04/30/07	10/30/07
2	ENDEVCO	7264-2000	J35791	04/30/07	10/30/07
3	ENDEVCO	7264-2000	J35800	04/30/07	10/30/07

REMARKS:

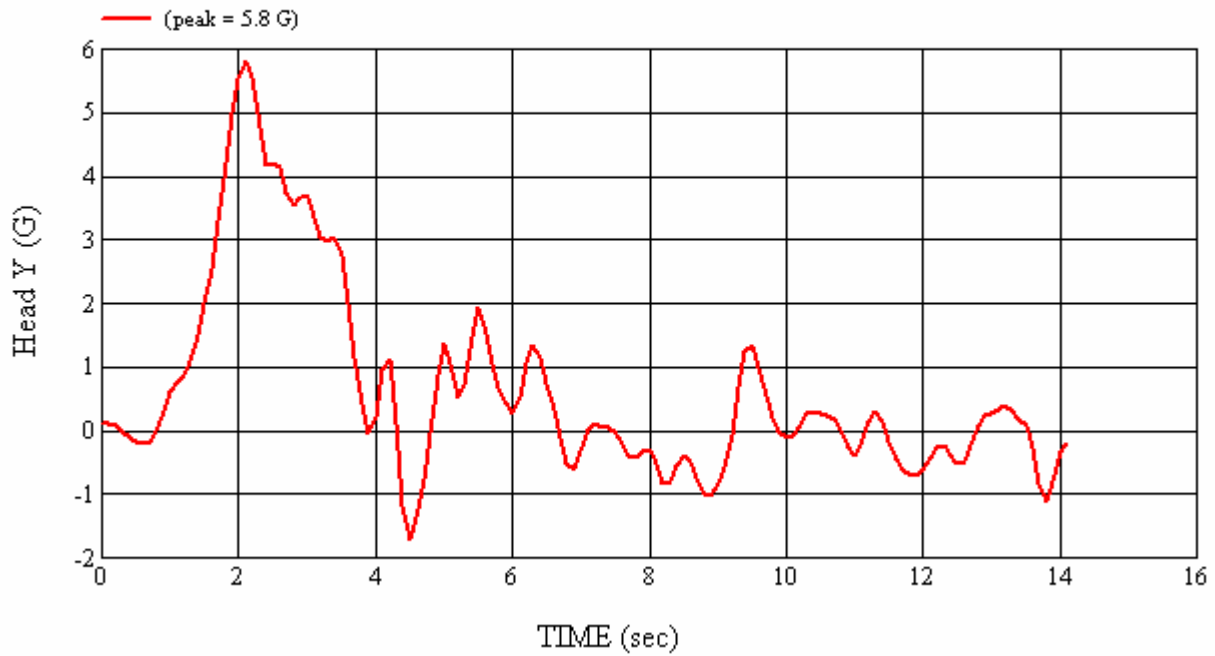
RECORDED BY: 

DATE: 9/6/2007

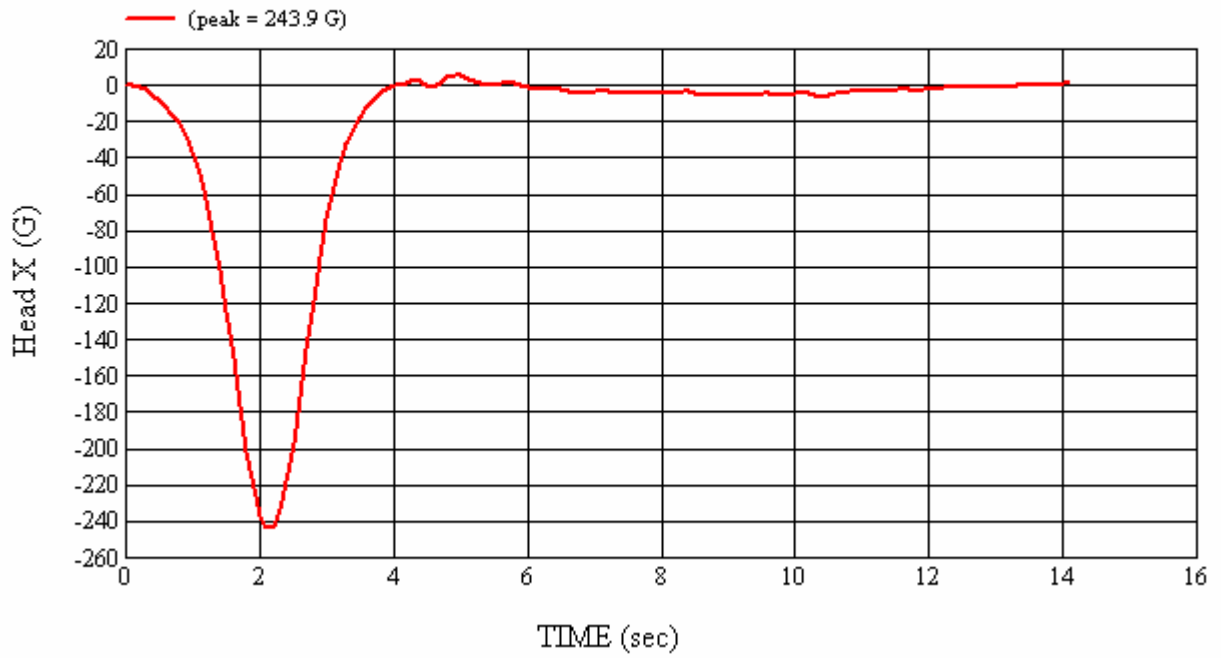
APPROVED BY: 



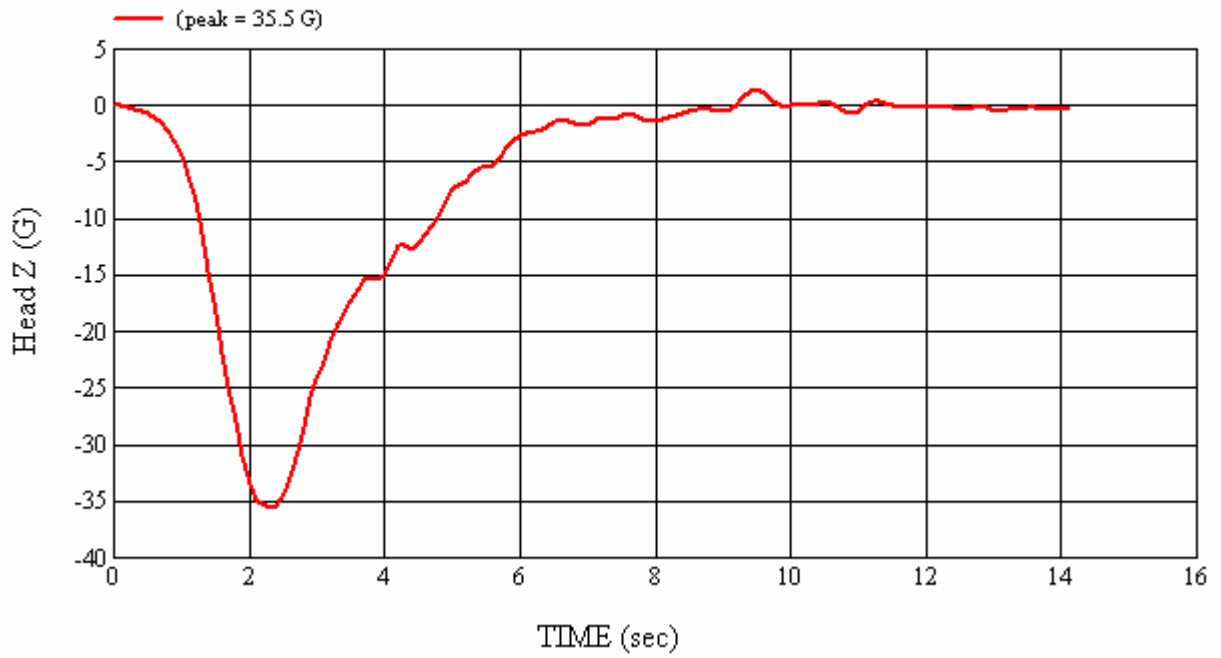
Head 037 (Post) Calibration #H37010



Head 037 (Post) Calibration #H37010



Head 037 (Post) Calibration #H37010



Head 037 (Post) Calibration #H37010

4.5 Pre-Test Calibration

**HEAD DROP TEST SUMMARY
 PART 572L**

HEADFORM SERIAL NUMBER: 038		CALIBRATION DATE: 8/31/2007
CALIBRATION TIME: 7:47:25 AM		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	23
Relative Humidity	10% to 70%	39
Peak Resultant Acceleration	225 G's to 275 G's	270.5
Peak Lateral Acceleration	15 G's Maximum	12.2
Unimodal Acceleration Curve	YES	YES

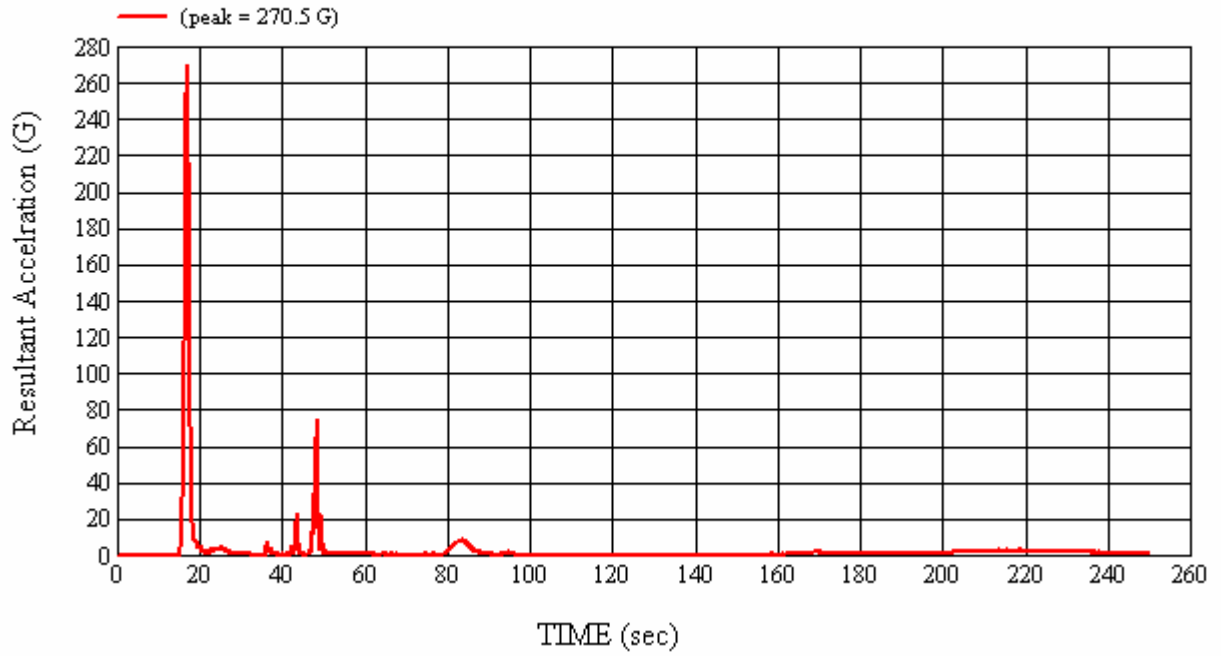
FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J14103	04/30/07	10/30/07
2	ENDEVCO	7264-2000	J36197	04/30/07	10/30/07
3	ENDEVCO	7264-2000	J36353	04/30/07	10/30/07

REMARKS:

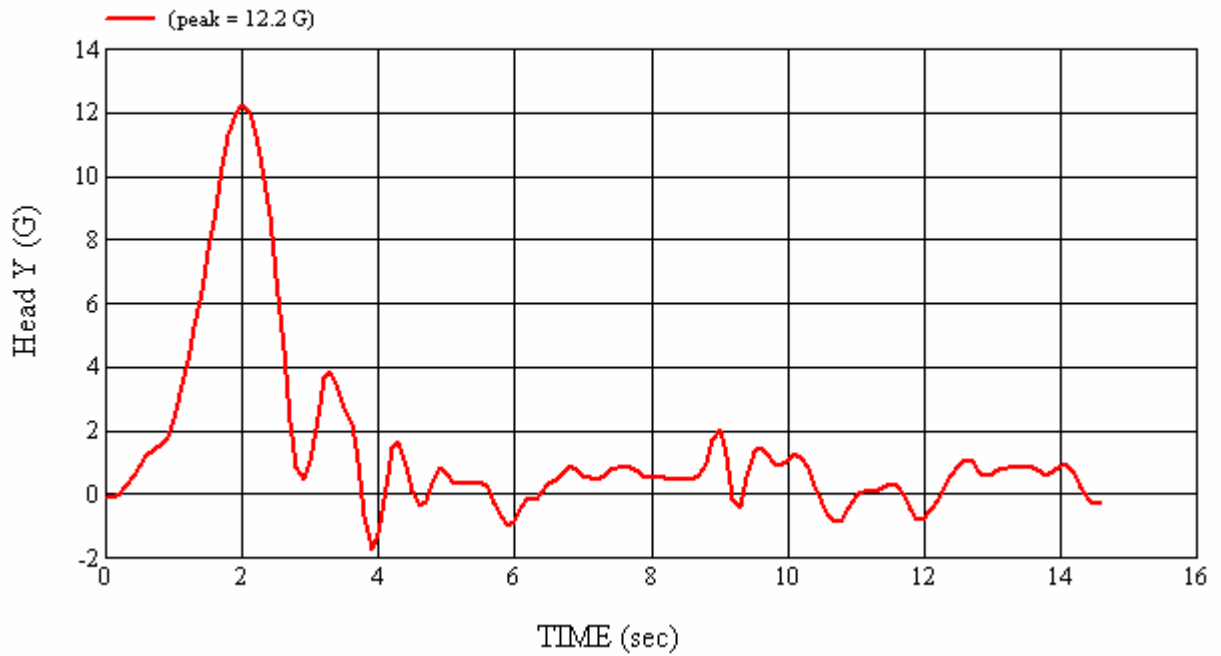
RECORDED BY: 

DATE: 8/31/2007

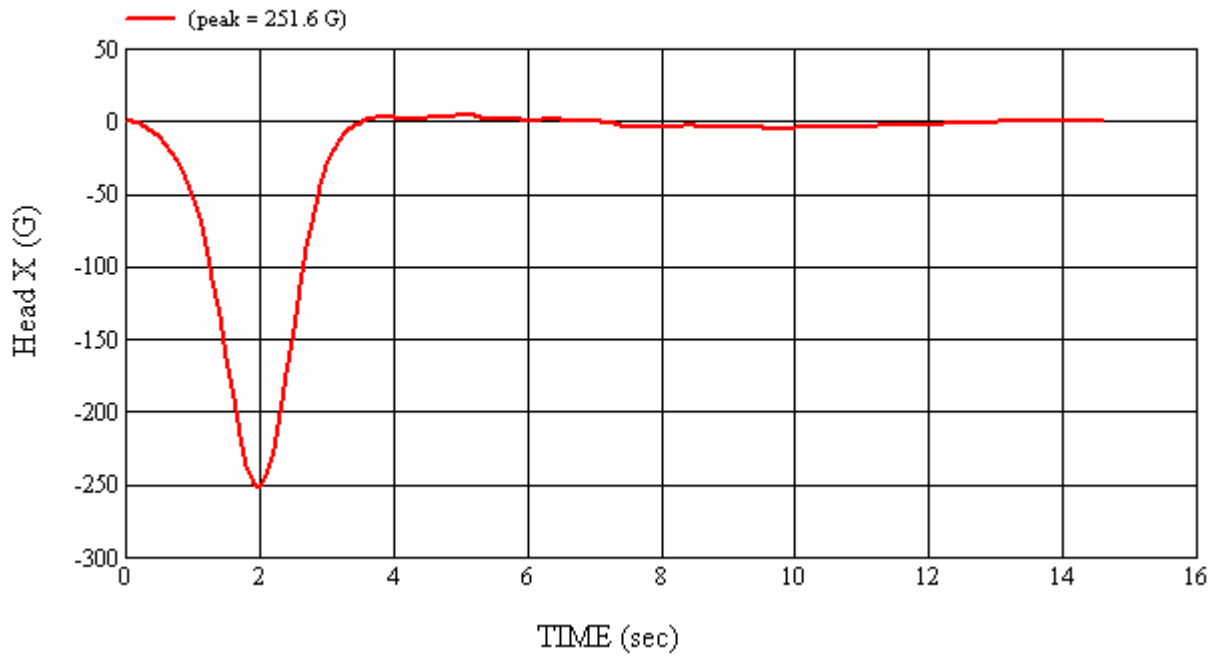
APPROVED BY: 



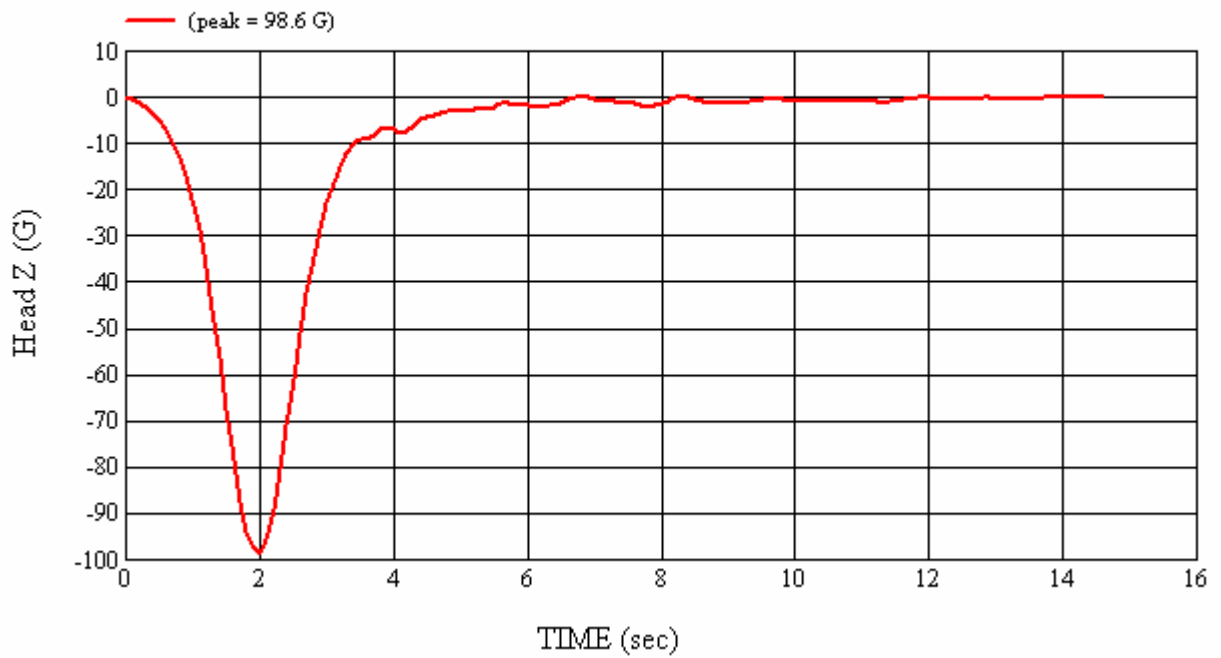
Head 038 (Pre) Calibration #H38009



Head 038 (Pre) Calibration #H38009



Head 038 (Pre) Calibration #H38009



Head 038 (Pre) Calibration #H38009

4.6 Post-Test Calibration

**HEAD DROP TEST SUMMARY
 PART 572L**

HEADFORM SERIAL NUMBER: 038		CALIBRATION DATE: 9/6/2007
CALIBRATION TIME: 10:31:49 AM		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	23
Relative Humidity	10% to 70%	49
Peak Resultant Acceleration	225 G's to 275 G's	269.6
Peak Lateral Acceleration	15 G's Maximum	4.3
Unimodal Acceleration Curve	YES	YES

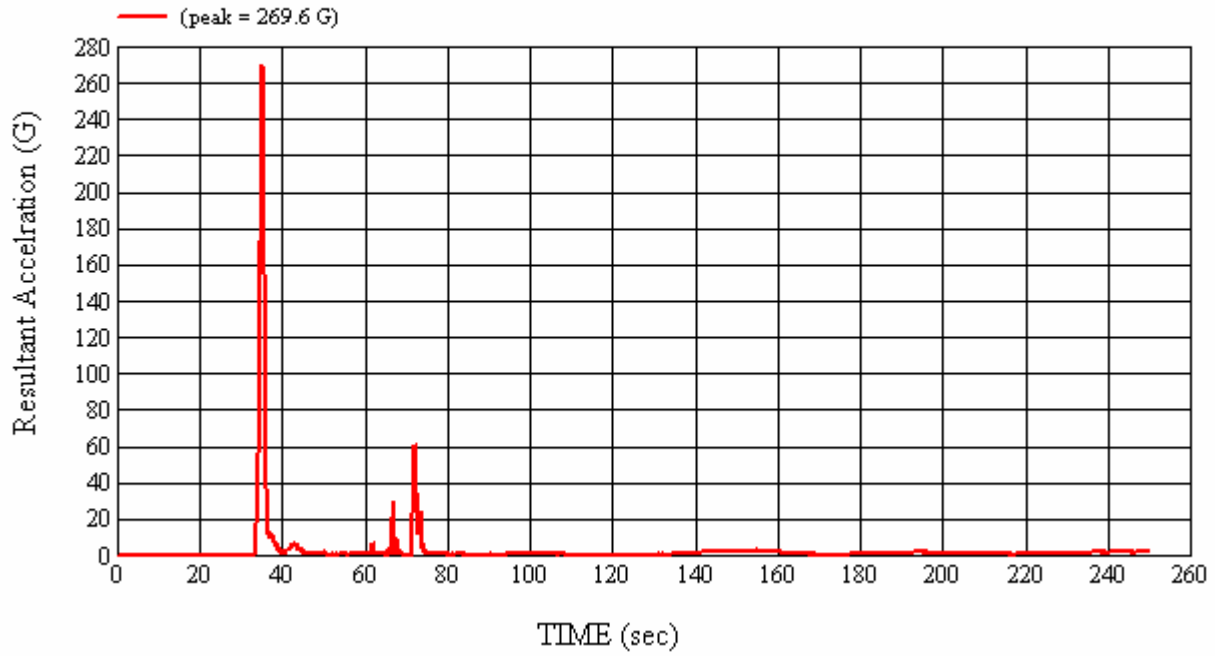
FMH INSTRUMENTATION					
HEAD ACCELEROMETERS					
Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J14103	04/30/07	10/30/07
2	ENDEVCO	7264-2000	J36197	04/30/07	10/30/07
3	ENDEVCO	7264-2000	J36353	04/30/07	10/30/07

REMARKS:

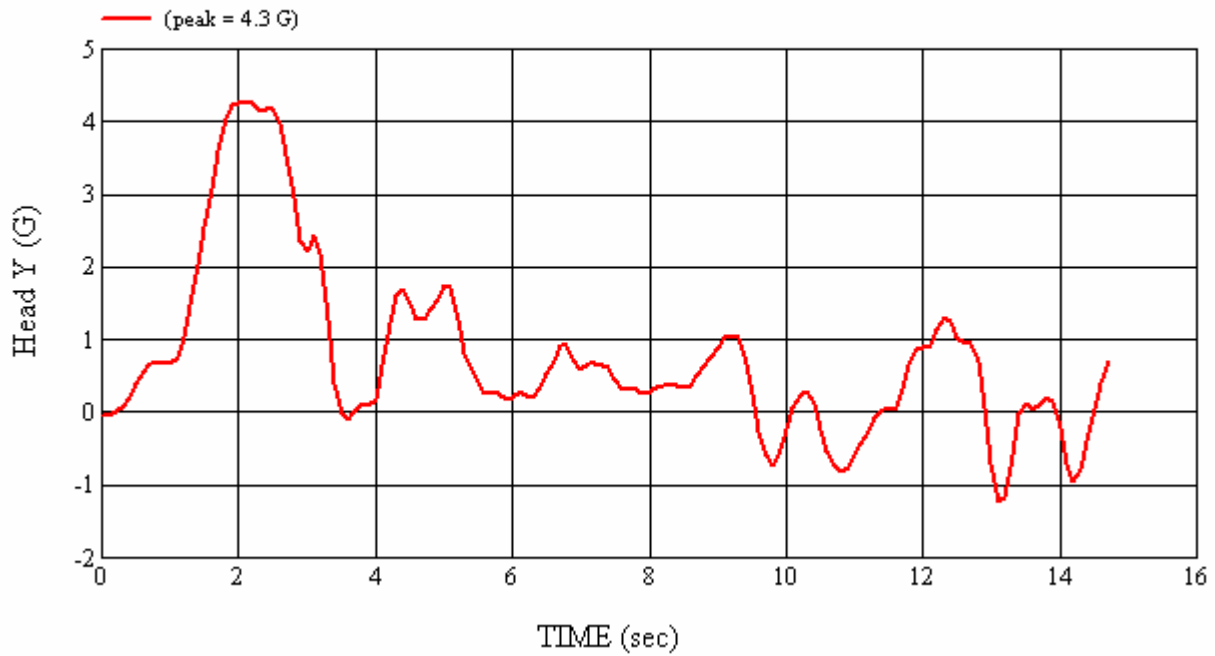
RECORDED BY: *Janis Campbell*

DATE: 9/6/2007

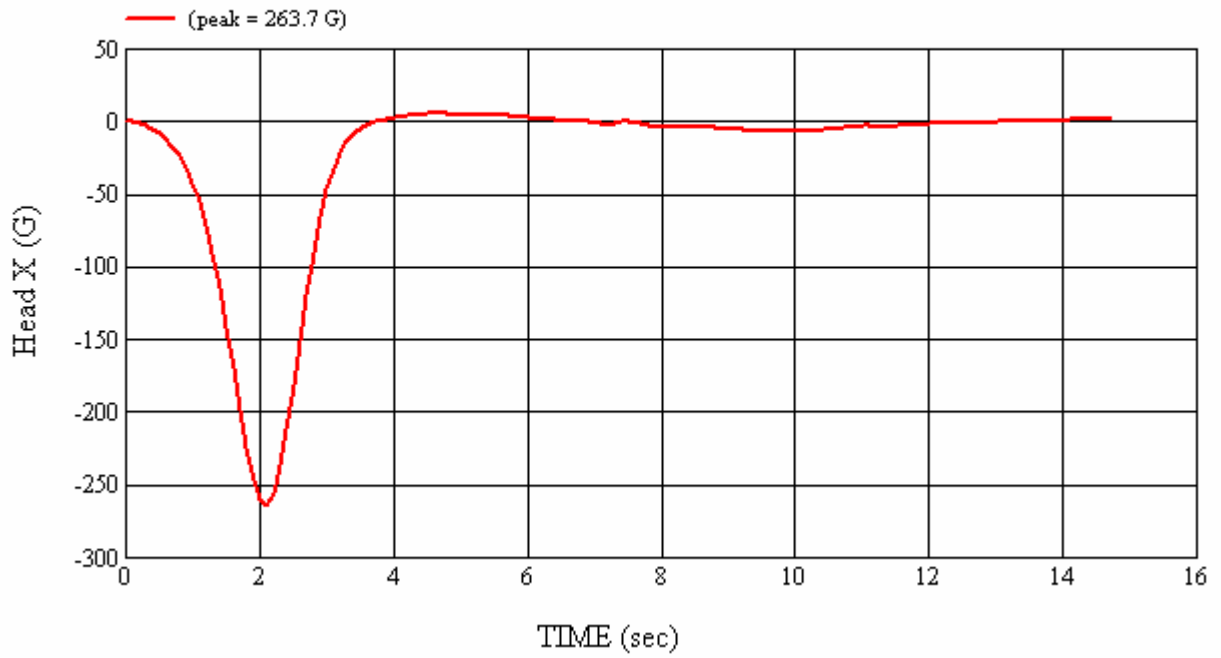
APPROVED BY: *Aileen A. Kalata*



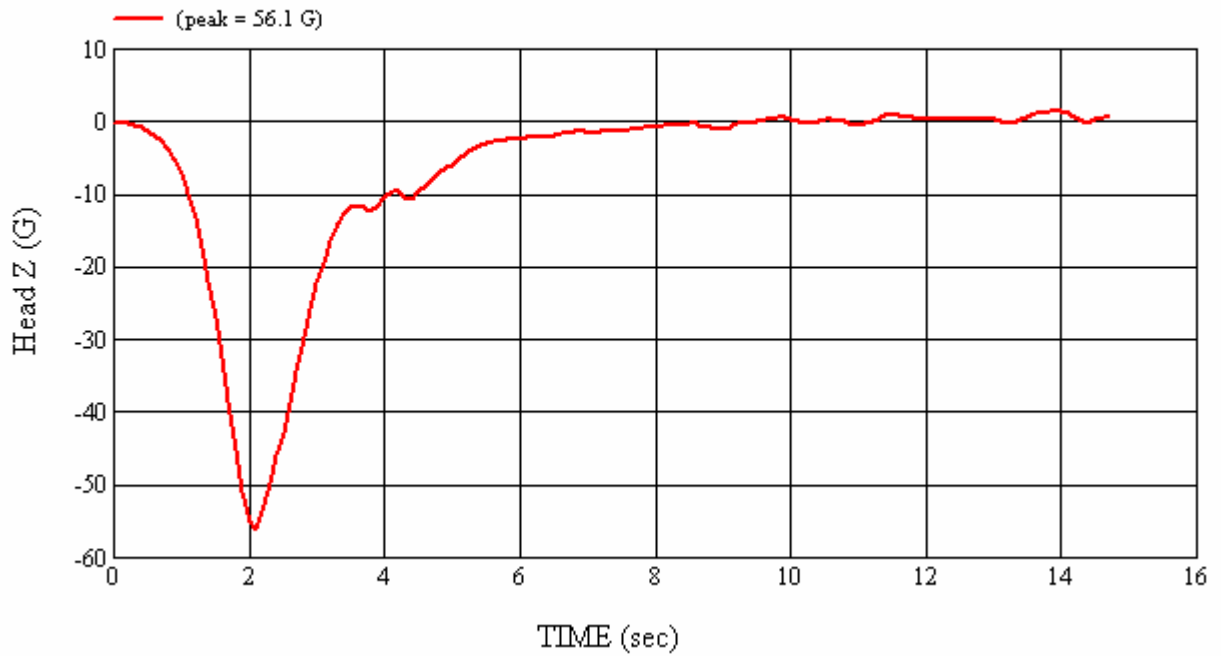
Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010



Head 038 (Post) Calibration #H38010

5.0 PHOTOGRAPHS



As Delivered – Left Side View



As Delivered – Right Side View



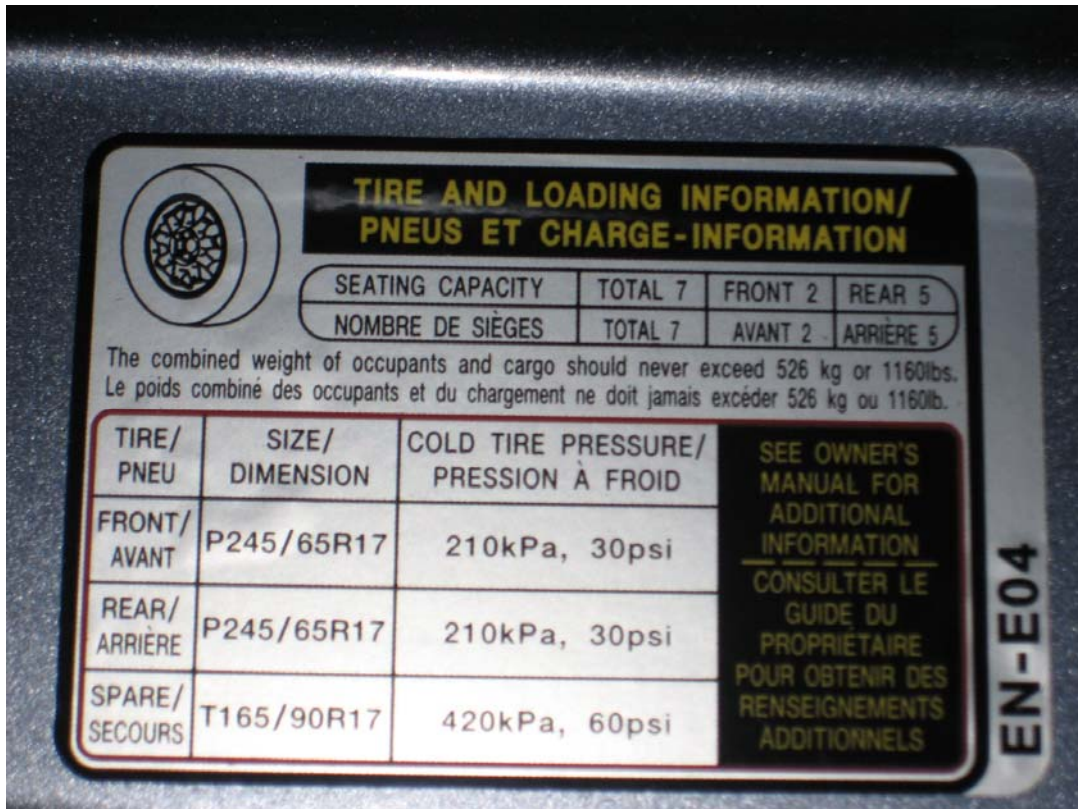
As Delivered – ¾ Front View From Left Side



As- Delivered – Rear View From Right Side



As Delivered – Vehicle’s Certification Label



As Delivered – Vehicle’s Tire Information Label

Pre-Test Component Photographs







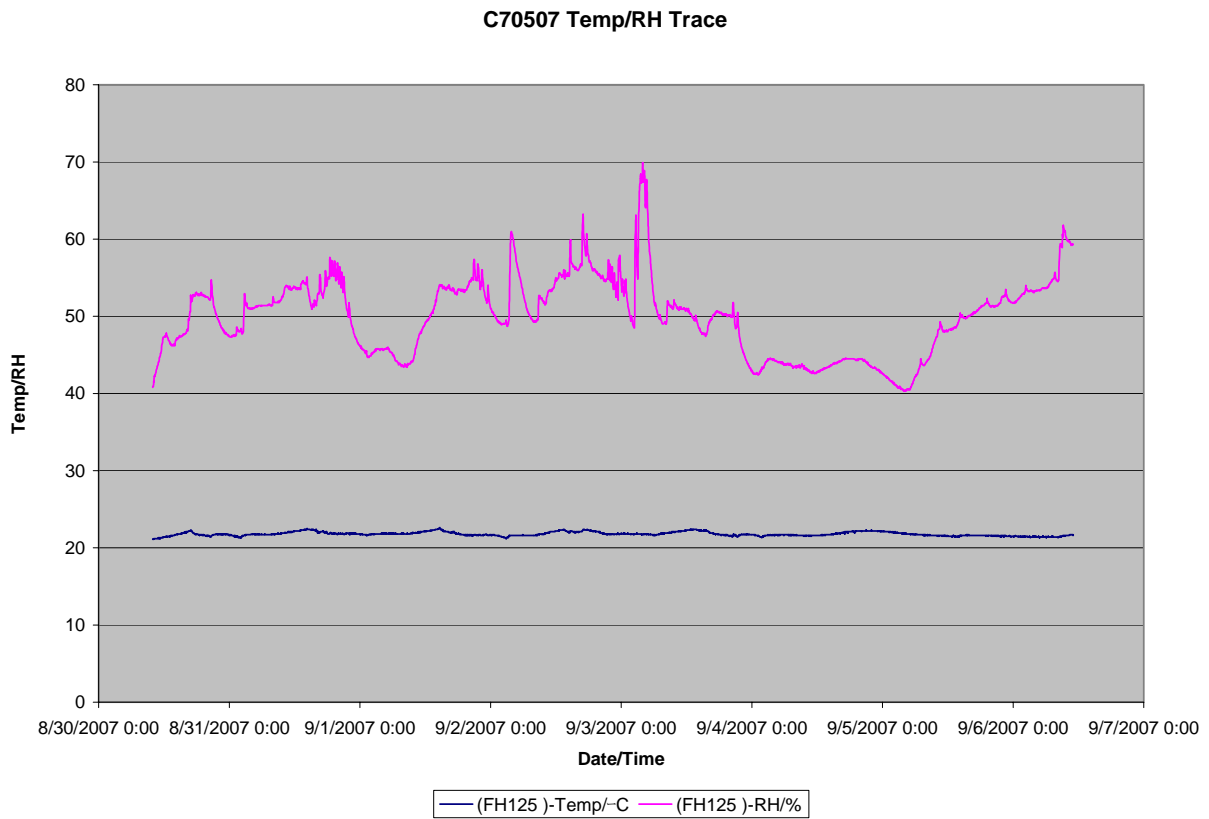
Post-Test Component Photographs







Appendix A - Temperature Trace



Appendix B - Calibration Certificates

Interim Certification Document

Part Description: Gold Certification Date: 01/26/07 Serial#: G08-02-02-03045
 Single Point 2 Sigma: G08-02 +/- .051mm (+/- .0020") Certificate#: G0304539108
 Linear Displacement 2 Sigma: G08-02 +/- .072mm (+/- .0028") Temperature: See attached data

Measurement Standards Traceability
 Ball Bar Kit Asset Number: 1041 Calibration Date: 11/18/06 *SI Traceability: METAS-L611EK055e
 10mm Step Gauge, Mitutoyo Asset Number: 682 Calibration Date: 10/03/05 *SI Traceability: NIST-821270467-04
 Code No.: 515-744
 Measuring range: 1.5m

*The artifact above has been calibrated with a device traceable to the International System of Units (SI) through a National Metrological Institute (NMI) or through an ISO 17025 Accredited Laboratory. Expanded measurement uncertainty is 3.0 + 5.5X micrometers, where X=measured value in meters. Uncertainty is expressed at approximately the 95% Level of Confidence using k=2.00.

Certification Results
 A basic four quadrant certification included with all FARO Arms and comprised of: 2 vertical level single point repeatability test in 4 quadrants with 5 repeats from 4 directions
 Step Gauge Test in 4 quadrants, 3 orientations per quadrant
 3 Length, 3 position free ball bar test in 4 quadrants
 Calibration and certification conforms to procedures developed in accordance with ASME B89.4.22-200X.

Instrument condition as received
 Within specifications

Instrument condition outgoing
 Within specifications


Technician: Neil Maclean Date: 1/26/07
 Neil Maclean

FARO Technologies, Inc.
 PH1: 1-800-736-2771
 PH2: 407-333-6911
 FAX: 407-333-8056
 L-A-B Cert Number: L1147

125 Technology Park
 Lake Mary, FL 32746
 USA

FARO

LABORATORY ACCREDITATION BUREAU
 ISO/IEC 17025 Accredited



This certificate shall not be reproduced, except in full, without permission of FARO Technologies, Inc.
 The results of this certificate relate only to the items calibrated or tested.

Revised November 22, 2005
 © 2006 FARO Technologies, Inc.

file:controlrecords\05manual\parts\spec\XHP06\60657\SPS\FILEV\FARO\PH1\060716\0607160804



4700 Barden Court S.E. • Kentwood, MI 49512 • Telephone: 616.698.3124 • Fax: 616.698.2364

Certificate of Calibration

MGA Research
 446 Executive Drive
 Troy, MI 48083

Order Number: 51186
 Report Number: 060926810
 Page: 1 of 1

Gauge Number: MGA00048
 Gauge Desc: Digital Protractor
 Manufacturer: N/A
 Model Number: Pro 360
 Serial Number: N/A

Customer PO: 07-06-0081
 Last Calibration: 8/29/05
 Calibration Date: 9/26/06
 Next Calibration: 9/26/07

As Found Condition: In Tolerance

As Left Condition: In Tolerance

MetroCal Inc. maintains reference standards of measurement which are traceable to the National Institute of Standards and Technology, or other authorized National Standards. Calibration was performed in accordance with MetroCal Proc. No. CP045 and complies with the ANSI/NC SL Z540-1 and ISO/IEC 17025 Standards. Results shall not be reproduced except in full without the written approval of MetroCal, Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired. Statements of compliance made using simple acceptance rule.

Standard Used
 Gage Blk Set ID# 105
 DoAll Sine Bar ID#1879

Cal Date
 6/14/06
 12/6/05

Due Date
 6/14/07
 12/6/06

Traceable No.
 821/271641-05
 821/270003-04 & 3600042619

Calibration Procedure
Uncertainty Expressed at
95% confidence (K=2)
 0.0015 Decimal Deg.

Results:

Units	As Found Readings		
	Nominal	Actual	Deviation
Decimal Deg.	5.0	5.0	0.0
	10.0	10.0	0.0
	20.0	20.0	0.0
Tolerance	30.0	30.1	0.1
$\pm 0.1^\circ$	40.0	40.0	0.0

Reference Level Check: Within +/- 0.1 degrees

As Left Readings		
Nominal	Actual	Deviation
5.0	5.0	0.0
10.0	10.0	0.0
20.0	20.0	0.0
30.0	30.1	0.1
40.0	40.0	0.0

Reference Level Check: Within +/- 0.1 degrees

Comments: Environmental conditions during calibration: 68 deg. F., 37 % RH.

Shannon Kubicek
 Shannon Kubicek
 Calibration Technician
 issued: 9-26-06

Checked box indicate this calibration was performed at the customers facility.

9/27/06

Certificate of Instrument Calibration and Testing

Calibration report shall not be reproduced, except in full, without written authorization from Dickson.

Customer Instrument

Dickson Model Number: FH125
Serial Number: 06018122
Calibration Technician Dan Gawel
Calibration Date: 05/01/2007

Calibration Standards

General Eastern: Model # M3
 Ser. # 0850800 / 2360502
 Accuracy: $\pm .4\%$ FS RH and $\pm .4$ °F
 Certified April, 2006
 Azonix Model # A1011 Ser. # T2513-9027
 RTD Platinum Probe Ser. # 496013 Accuracy: $\pm .2$ °F
 Certified April, 2006



*The calibration standards are traceable through the
 National Institute of Standards and Technology.*

Calibration Procedure P1130

The customer instrument was compared to the calibration standard. Drifts and faults were determined, and any necessary mechanical or electronic adjustments were taken. The Dickson calibration system conforms to the requirements of MIL-STD-45662A, ANSI/NCCL Z540, and ISO 17025 as appropriate. Recalibration of the customer instrument is recommended within 6-12 months after the unit is placed into service. Any number of factors may cause the calibration item to drift before the recommended interval has expired. This certificate only relates to this specific unit.

Environmental Conditions

72 °F 41 %RH

Calibration Standard Reading	Customer Instrument Reading	Unit Specification
Humidity (%RH)	Humidity (%RH)	Humidity
14.9	16.6	$\pm 2\% \text{ RH}$
67.8	68.5	$\pm 2\% \text{ RH}$
85.3	86.4	$\pm 3\% \text{ RH}$
Temperature °F (°C)	Temperature °F (°C)	Temperature
12.8 (-10.7)	13.1 (-10.5)	$\pm 1.8 \text{ °F } (\pm 1.0 \text{ °C})$
73.3 (22.9)	73.2 (22.9)	
112.3 (44.6)	112.1 (44.5)	

The FH125 has an ISO/IEC 17025 required NIST Technical note 1297, Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results, estimated measurement uncertainty at 95% CL (K=2) of $\pm 0.7\%$ F and $\pm 1.1\%$ RH

FOR YOUR NEXT CALIBRATION NO PHONE CALLS REQUIRED

Fill out and send this form along with your instrument to Dickson. Label the outside of the box with "CCM" - that is your RA#.

That's all there is to it!

1. Purchase Order #: _____
 Name: _____
 Phone: _____
 Model #: **FH125**
 Serial #: **06018122**

3. Please return via:

- Ground Freight*
- 2nd Day Air*
- Next Day Air*

*Charges added at factory

A 3-pt Deluxe NIST will be performed unless otherwise requested

Returned UPS 2nd Day unless otherwise requested

2. 1-Point Deluxe NIST Calibration \$149.00
 3-Point Deluxe NIST Calibration \$199.00
 3-Point Ultima Deluxe A2LA NIST \$299.00 (with incoming reading)
 N995 - User selectable NIST Temperature points \$50.00 each
 (to be selected in addition to one of the above calibration options)
 N997- Next Day Service \$50.00 (Not available for ULTIMA service)

4. Ship To: _____

Bill To: _____

Charts/Pens

(Order now and receive them with your calibrated unit)

	Order No.	Qty.	Price Ea
<input type="checkbox"/> 6 Red Pens	P222	_____	\$36 pk
<input type="checkbox"/> 3 Red/3 Blue Pens	P246	_____	\$36 pk
<input type="checkbox"/> Charts* (60 per box)	C_ _ _	_____	\$24 box

*Please fill in the chart order number. For a listing of available charts got to www.dicksonweb.com, click on "product search" and select the product type, "Parts . Accessories"

Prices are subject to change

Let Dickson remind you the next time your unit is due for calibration. Register for our FREE Calibration Club now at www.dicksonweb.com

Dickson Calibration Services

930 South Westwood Avenue Addison, Illinois 60101 630-543-3747 Fax 630-543-0498

OK 5/5/07

ULTIMA (Data as Received)

Customer Instrument

Dickson Model Number: FH125
Serial Number: 06018122
Calibration Technician: Dan Gawel
Calibration Date: 05/01/2007

Unit was received in working condition, or received repairs not related to it's calibration or accuracy.

Calibration Procedure P1130

The customer instrument was compared to the calibration standard. The Dickson calibration system conforms to the requirements of MIL-STD-45662A and ANSI/NCSL Z540, and ISO 17025 as appropriate. Recalibration of the customer instrument is recommended within 6-12 months after the unit is placed into service.

Environmental Conditions 72 °F 41 %RH

Calibration Standard Reading	Customer Instrument Reading	Unit Specification
Humidity (%RH)	Humidity (%RH)	Humidity
16.4	18.8	± 2% RH
62.4	58.3	± 2% RH
84	79	± 3% RH
Temperature °F	Temperature °F	Temperature
13.1	13.9	± 1.8 °F (± 1.0 °C)
71.3	71	
110.5	110.8	

FOR YOUR NEXT CALIBRATION NO PHONE CALLS REQUIRED

Fill out and send this form along with your instrument to Dickson. Label the outside of the box with "CCM" - that is your RA#
 That's all there is to it!

1. Purchase Order #: _____
 Name: _____
 Phone: _____
 Model #: **FH125**
 Serial #: **06018122**

3 Please return via:
 Ground Freight*
 2nd Day Air*
 Next Day Air*
 *Charges added at factory.

- A 3-pt Deluxe NIST will be performed unless otherwise requested
2. 1-Point Deluxe NIST Calibration \$149.00
 3-Point Deluxe NIST Calibration \$199.00
 3-Point Ultima Deluxe A2LA NIST \$299.00 (with incoming reading)
 N995 - User selectable NIST Temperature points \$50.00 each
 (to be selected in addition to one of the above calibration options)
 N997- Next Day Service \$50.00 (Not available for ULTIMA service)

Returned UPS 2nd Day unless otherwise requested

4 Ship To: _____

Charts/Pens

(Order now and receive them with your calibrated unit)

	Order No	Qty	Price Ea
<input type="checkbox"/> 6 Red Pens	P222	_____	\$36 pk
<input type="checkbox"/> 3 Red/3 Blue Pens	P246	_____	\$36 pk
<input type="checkbox"/> Charts* (60 per box)	C_ _ _	_____	\$24 box

Bill To: _____

*Please fill in the chart order number. For a listing of available charts got to www.dicksonweb.com, click on "product search" and select the product type, "Parts ,Accessories."

Prices are subject to change

Let Dickson remind you the next time your unit is due for calibration. Register for our FREE Calibration Club now at www.dicksonweb.com

Dickson Calibration Services

930 South Westwood Avenue Addison, Illinois 60101 630-543-3747 Fax 630-543-0498



4700 Barden Court S.E. • Kentwood, MI 49512 • Telephone: 616.698.3124 • Fax: 616.698.2364

Certificate of Calibration

MGA Research
 446 Executive Drive
 Troy, MI 48063

Order Number: 55304
 Certificate Number: 070709906
 Page: 1 of 1

Gauge Number: MGA00081
 Gauge Desc: 0 to 20.00lb x 0.01lb Digital Scale
 Manufacturer: Detecto
 Model Number: AP-20
 Serial Number: E33603-0213

Customer PO: N/A
 Last Calibration: 7/7/06
 Calibration Date: 7/9/07
 Next Calibration: 7/9/08

As Found Condition: In Tolerance

As Left Condition: In Tolerance

MetroCal Inc. maintains reference standards of measurement which traceable to the National Institute of Standards and Technology, or other authorized National Standards. Calibration was performed in accordance with MetroCal's Procedure No CP-042 and the relevant sections of the manufacturers manual. This Calibration complies with the ISO/IEC 17025 and ANSI/NCSL Z540-1 Standards. Results shall not be reproduced except in full without the written approval of MetroCal Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired. Statements of compliance made using simple acceptance rule.

Calibration Procedure
 Uncertainty Expressed at
 95% confidence, (K=2)
 +/-0.001% of Load

Standard Used	Cal. Date	Due Date	Traceable No.
Dead Weight Set ID#2463	8/10/06	8/10/08	MI-04-06-8325

Results:
 Tolerance used: ± 0.02

Weight Test	As Found			As Left		
	Nominal	Indication	Deviation	Nominal	Indication	Deviation
0-25% fs	5.00	5.00	0.00	5.00	5.00	0.00
26-50% fs	10.00	9.99	-0.01	10.00	9.99	-0.01
51-75% fs	15.00	14.99	-0.01	15.00	14.99	-0.01
76-100% fs	20.00	19.99	-0.01	20.00	19.99	-0.01
Beam 2						
0-25% fs						
26-50% fs						
51-75% fs						
76-100% fs						
Beam 3						
0-25% fs						
26-50% fs						
51-75% fs						
76-100% fs						
Shift Test: Pass			Shift Test: Pass			
Half Load Test: Pass			Half Load Test: Pass			

Comments: Environmental conditions during calibration: 87 deg F., 47% RH

Chad Rosema issued: 7/9/07
 Chad Rosema/bjk
 Calibration Technician

Checked box indicate this calibration was performed at the customers facility

CA 7/24/07

MICHIGAN OPERATIONS
 DATE: 2/7/04
 SUPERCEDES: MGATPTMC.5

DOC. NO.: MGATPTMC
 REVISION NO.: 6
 PAGE 3 OF 3

Tape Measure Calibration Certificate

Reference Steel Rule

Brand: Johnson
 S/N: M6A00122
 Calibration Date: 9.21.06

Subject Tape Measure

Brand: STANLEY
 S/N: TPM 748
 Calibration Date: 3.30.07

Reference in (mm)	Subject Tape Measure	Difference	Reference in (mm)	Subject Tape Measure	Difference
0 (0)	0	0	18 (450)	18	0
1 (25)	1	0	19 (475)	19	0
2 (50)	2	0	20 (500)	20	0
3 (75)	3	0	21 (525)	21	0
4 (100)	4	0	22 (550)	22	0
5 (125)	5	0	23 (575)	23	0
6 (150)	6	0	24 (600)	24	0
7 (175)	7	0	25 (625)	25	0
8 (200)	8	0	26 (650)	26	0
9 (225)	9	0	27 (675)	27	0
10 (250)	10	0	28 (700)	28	0
11 (275)	11	0	29 (725)	29	0
12 (300)	12	0	30 (750)	30	0
13 (325)	13	0	31 (775)	31	0
14 (350)	14	0	32 (800)	32	0
15 (375)	15	0	33 (825)	33	0
16 (400)	16	0	34 (850)	34	0
17 (425)	17	0	35 (875)	35	0

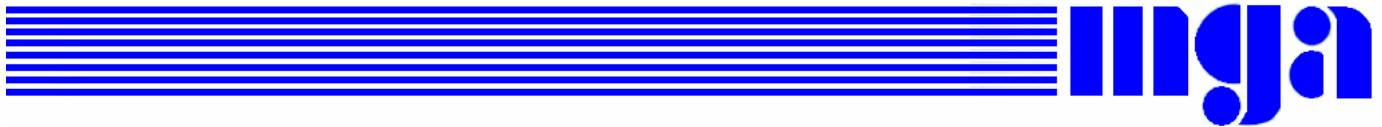
If all differences are $\pm 1/32$ of an inch (1 mm), then the tape measure is acceptable.

Pass Fail Maximum Difference = 0

Date: 3.30.07 Performed By: Dymilk

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 0.2\%$.
 All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor k=2.

OK 3/30/07



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J22664	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0712
New DLR (100k , Units:G): 94.2
StdDeviation (%) 0.496
% Difference in DLR (New vs. Old): -1.807
Temperature (°F): 74
Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J35919	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0712

New DLR (100k , Units:G): 97.4

StdDeviation (%) 0.299

% Difference in DLR (New vs. Old): -1.589

Temperature (°F): 74

Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J35924	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0712
New DLR (100k , Units:G): 93.9
StdDeviation (%) 0.188
% Difference in DLR (New vs. Old): 0.228
Temperature (°F): 74
Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J14103	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0713

New DLR (100k , Units:G): 94.6

StdDeviation (%) 0.172

% Difference in DLR (New vs. Old): 1.175

Temperature (°F): 74

Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J36197	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0713

New DLR (100k , Units:G): 110.7

StdDeviation (%) 0.159

% Difference in DLR (New vs. Old): 0.612

Temperature (°F): 74

Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



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CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J36353	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0713

New DLR (100k , Units:G): 99.4

StdDeviation (%) 0.346

% Difference in DLR (New vs. Old): 1.014

Temperature (°F): 74

Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J22696	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0713

New DLR (100k , Units:G): 100.0

StdDeviation (%) 0.559

% Difference in DLR (New vs. Old): -1.242

Temperature (°F): 74

Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

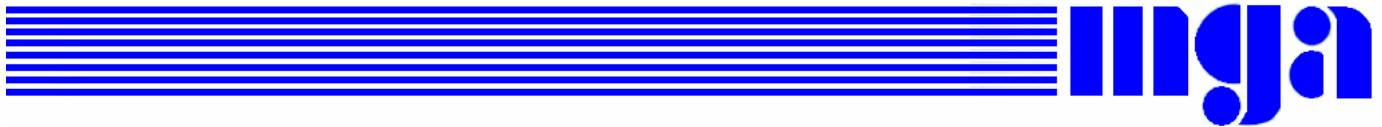
Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J35791	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0713
New DLR (100k , Units:G): 91.9
StdDeviation (%) 0.194
% Difference in DLR (New vs. Old): 1.127
Temperature (°F): 74
Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



mga research corporation

CALIBRATION CERTIFICATE

Sensor Information	Reference Sensor Information
Name: 2000 G Accelerometer	Name: <i>Reference Accelerometer</i>
Model: 7264-2000	Model: <i>301M09/484B</i>
S/N: J35800	S/N: <i>862/247</i>
Capacity: 2000 G	Capacity: <i>170 G</i>
Calibration Date: 4/30/2007	Calibration Date: <i>7/27/2006</i>
	Calibrated By: <i>Chuck DiMaggio</i>

Test Reference Number: A0713

New DLR (100k , Units:G): 98.0

StdDeviation (%) 0.78

% Difference in DLR (New vs. Old): -1.192

Temperature (°F): 74

Humidity (%): 36

Performed By:

Approved By:

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 3.7\%$.
All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.

~ Calibration Certificate ~

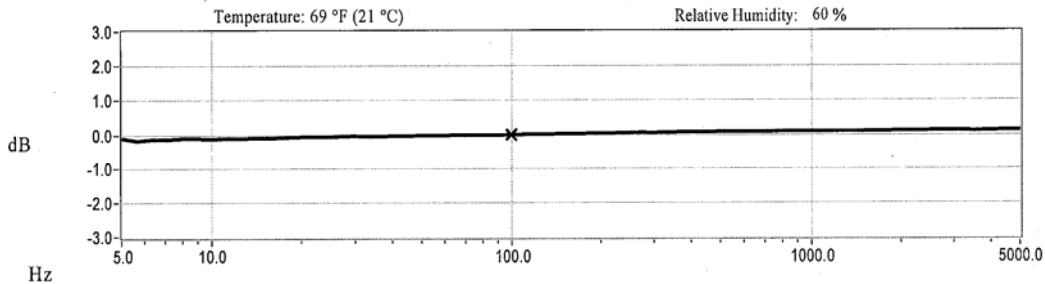
Per ISO 18663-21

Model Number: 301M09/484B (394M17 SYSTEM)
Serial Number: 862/2470
Description: ICP® Accelerometer **Method:** Back-to-Back Comparison Calibration
Manufacturer: PCB

Calibration Data

Sensitivity @ 100.0 Hz **31.03 mV/g** **Output Bias** **8.6 VDC**
 (3.16 mV/m/s²) **Transverse Sensitivity** **3.0 %**

Sensitivity Plot



Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
5.0	-1.2	REF. FREQ.	0.0	5000.0	1.5
10.0	-1.4	300.0	0.6		
15.0	-1.0	500.0	0.9		
30.0	-0.4	1000.0	1.0		
50.0	-0.3	3000.0	1.4		

Mounting Surface: Stainless Steel w/Silicone Grease Coating Fastener: Stud Mount Fixture Orientation: Vertical
 Acceleration Level (rms): 10.0 g (98.1 m/s²)
 *The acceleration level may be limited by shaker displacement at low frequencies. If the listed level cannot be obtained, the calibration system uses the following formula to set the vibration amplitude: Acceleration Level (g) = 0.010 x (freq).
 *The gravitational constant used for calculations by the calibration system is: 1 g = 9.80665 m/s².

Condition of Unit

As Found: In Tolerance, No Adjustment Necessary
As Left: In Tolerance

Notes



1. Calibration is NIST Traceable thru Project 822/271196 and PTB Traceable thru Project 5399.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NC SL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for frequency ranges tested during calibration are as follows: 5-9 Hz; +/- 2.0%, 10-99 Hz; +/- 1.5%, 100-1999 Hz; +/- 1.0%, 2-10 kHz; +/- 2.5%.

Technician: Chuck DiMaggio CD SSD 7/27/06 **Date:** 07/27/06



3425 Walden Avenue Depew, NY 14043
 TEL: 888-684-0013 FAX: 716-685-3886 www.pcb.com

~Certificate of Calibration~

Model Number: 484B	PCB Control #: QC214/QC184/QC198/CA514
Serial Number: 2470	Calibration Date: 07/22/2006
Description: Signal Conditioner	Recalibration Date:
Test Procedure: AT-106-1	Calibration Technician: James Higbee 2b 
Temperature: 70° F	Relative Humidity: 58% 

Volts	Current (mA)	Gain*
24.0	3.9	1.000

As Received: In tolerance, no adjustment required.

As Left: In tolerance.

Special Notes:

This document certifies that the equipment referenced above meets published specifications. The calibration procedure is in compliance with ISO 10012-1, and former MIL-STD-45662A and is traceable to NIST. *Measurement uncertainty (95% confidence level w/coverage factor of 2) for scale factors is +/- 0.2%.

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PCB Piezotronics, Inc.



 **PCB PIEZOTRONICS™**

3425 Walden Avenue Depew, New York, USA 14043-2495

For any questions concerning this certificate, please call PCB at (716) 684-0001 and ask for an application engineer.