FINAL REPORT NUMBER 201UI-MGA-11-01

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

HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
2011 HYUNDAI ELANTRA GLS M/T
NHTSA No. CB0509

MGA RESEARCH CORPORATION
446 Executive Drive
Troy, Michigan 48083

Test Dates: March 24-28, 2011
Report Date: April 1, 2011

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Accepted By: _____

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15. Supplementary Notes			
16. Abstract A compliance test series was conducted on the subject 2011 Hyundai Elantra GLS M/T, NHTSA No. CB0509, 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 March 24-28, 2011. Test failures identified were as follows: None The data recorded indicates that the 2011 Hyundai Elantra GLS M/T 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 2011 Hyundai Elantra GLS M/T, meets the performance requirements of FMVSS 201, Occupant Protection in Interior Impact - Upper Interior Head Impact Protection.

Tests were conducted on March 24-28, 2011 on a 2011 Hyundai Elantra GLS M/T, manufactured by Hyundai Motor Manufacturing Alabama, LLC.

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 August 21, 2009.

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 November 9, 2009.

2.0 COMPLIANCE TEST DATA SUMMARY

The 2011 Hyundai Elantra GLS M/T was equipped with A, B, and rear-pillars, an adjustable seat belt anchorage on each B-pillar, a grab handle located on the side rail above the front passenger door and on the side rail above each rear door, and an overhead console located on the front 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	BP1	FH1	UR4@SR3-1
AP2	BP3	UR2@SR2A	UR5@SR3-2
AP3	BP4	UR3@BP	UR6@RP

The 2011 Hyundai Elantra GLS M/T 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: 2011 Hyundai Elantra GLS M/T

VEH. NHTSA NO.: CB0509 VIN: 5NPDH4AE2BH016427 COLOR: Radiant Silver

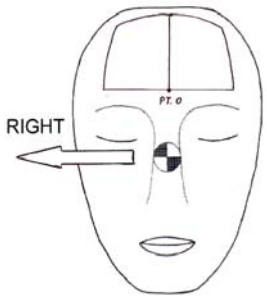
VEH. BUILD DATE: December, 2010 TEST DATES: March 24-28, 2011

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen Kaleto, Nathaniel Newth, Kevin McKenna, Sean Moran, Ryan Jones

TARGET	VEHICLE SIDE	HORIZONTAL ANGLE (deg)	VERTICAL ANGLE (deg)	VELOCITY (kph)	HIC(d)	FMH HIC	IMPACT ON FMH (mm)	
							Above	Left/Right
AP1	Right	122	30	19.0	559	521	9	19 Right
AP2	Left	203	50	18.8	410	323	22	7 Left
AP3	Right	157	50	18.8	469	400	10	5 Left
BP1	Right	90	12	18.5	389	295	51	3 Left
BP3	Left	270	-8	24.1	572	537	16	22 Left
BP4	Left	204	-7	23.7	842	896	13	8 Left
FH1	Left	180	50	23.8	428	346	42	0
UR2@SR2A	Right	90	45	23.7	770	799	39	4 Left
UR3@BP	Left	270	50	23.7	680	681	23	2 Left
UR4@SR3-1	Right	90	50	23.8	693	697	25	1 Left
UR5@SR3-2	Left	270	50	24.0	842	895	29	2 Left
UR6@RP	Right	90	50	23.6	564	527	28	3 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.

AP2 Left: Cracked and dislodged trim.

AP3 Right: Dislodged pillar trim.

BP3 Left: Cracked trim.

BP4 Left: Cracked trim.

FH1 Left: Sunglass holder opened.

UR2 Right: Grab handle compression.

UR4 Right: Headliner deformation; grab handle compression.

UR5 Left: Minor headliner deformation with grab handle compression.

UR6 Left: Headliner deformation.

REMARKS:

The targets listed were impacted in the following order:

Left: BP4, UR5@SR3-2, FH1, AP2, BP3, UR3@BP,

Right: BP1, UR4@SR3-1, UR6@RP, AP3, AP1, UR2@SR2A

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

RECORDED BY: Kevin McKenna DATE: March 28, 2011

APPROVED BY: Helen A. Kaleto

TABLE 2-2

GENERAL TEST AND VEHICLE PARAMETER DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2011 Hyundai Elantra GLS M/T

NHTSA NO.: CB0509 VIN: 5NPDH4AE2BH016427 COLOR: Radiant Silver

VEH. BUILD DATE: December, 2010 TEST DATES: March 24-28, 2011

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen Kaleto, Nathaniel Newth, Kevin McKenna, Sean Moran, Ryan Jones

INTERIOR TRIM INFORMATION: A, B, and rear-pillars, an adjustable seat belt anchorage on each B-pillar, a grab handle located on the side rail above the front passenger door and on the side rail above each rear door, and an overhead console located on the front upper roof.

SUNROOF INFORMATION:

Installed: _____Yes __X__ No

Operation: _____Electric ____ Manual

SIDE RAIL CURTAIN AIRBAG INFORMATION:

Installed: __X__Yes ____ No

ROLL-BAR INFORMATION:

Installed: _____Yes __X__ No

Padded: _____Yes __X__ No

Braces: _____Yes __X__ No

GENERAL INFORMATION:

Date Received: February 10, 2011; Odometer Reading 72 miles

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured By: Hyundai Motor Manufacturing Alabama, LLC

Date of Manufacture: December, 2010; VIN: 5NPDH4AE2BH016427

GVWR: 1720 kg; GAWR FRONT: 940 kg;

GAWR REAR: 800 kg;

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load:

FRONT: 220 kPa REAR: 220 kPa

Recommended Tire Size: P205/55R16

Recommended Cold Tire Pressure:

FRONT: 220 kPa REAR: 220 kPa

Size of Tire on Test Vehicle: P205/55R16

Type of Spare Tire: None; Space Saver:___; Standard__

VEHICLE CAPACITY DATA:

Type of Front Seats: Bench__; Bucket X; Split Bench __

Number of Occupants: Front 2; Rear 3; TOTAL 5

VEHICLE CAPACITY WEIGHT:

Vehicle Capacity Weight (VCW) = 385 kg

No. of Occupants x 68 kg = 340 kg

Rated Cargo/Luggage Weight (RCLW) = 45 kg (difference)

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

Right Front =	355.5 kg	Right Rear =	255.0 kg
Left Front =	394.0 kg	Left Rear =	228.5 kg
TOTAL FRONT =	749.5 kg	TOTAL REAR =	483.5 kg
% Total Weight =	60.8 %	% Total Weight =	39.2 %

TOTAL DELIVERED WEIGHT = 1233.0 kg

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight = 1233.0 kg

Max. Test Cargo/Luggage Weight = 45.0 kg

Target Test Weight = 1278.0 kg

WEIGHT OF TEST VEHICLE FULLY LOADED:

Right Front =	352.0 kg	Right Rear =	280.5 kg
Left Front =	391.0 kg	Left Rear =	254.0 kg
TOTAL FRONT =	743.0 kg	TOTAL REAR =	534.5 kg
% Total Weight =	58.2 %	% Total Weight =	41.8 %

TOTAL TEST WEIGHT = 1277.5 kg

Weight of ballast secured in vehicle's cargo area = 44.5 kg

TEST VEHICLE ATTITUDE:

AS DELIVERED:
Right Front 682 mm; Left Front 679 mm;
Right Rear 679 mm; Left Rear 683 mm;
Pitch Angle at Right Door Sill = 0.3 Rear is higher
Pitch Angle at Left Door Sill = 0.6 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

FULLY LOADED:
Right Front 685 mm; Left Front 682 mm;
Right Rear 668 mm; Left Rear 674 mm;
Pitch Angle at Right Door Sill = 0.0
Pitch Angle at Left Door Sill = 0.3 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

AS TARGETED:
Right Front 868 mm; Left Front 865 mm;
Right Rear 850 mm; Left Rear 852 mm;
Pitch Angle at Right Door Sill = 0.0
Pitch Angle at Left Door Sill = 0.3 Rear is higher
Roll Angle at Front Bumper = 0.0
Roll Angle at Rear Bumper = 0.0

AS TESTED ON RIGHT SIDE:

Pitch Angle at Right Door Sill =	0.2 Rear is higher
Pitch Angle at Left Door Sill =	0.3 Rear is higher
Roll Angle at Front Bumper =	0.0
Roll Angle at Rear Bumper =	0.0

AS TESTED ON LEFT SIDE:

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

VEHICLE WHEELBASE = 2705 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: Kevin McKenna DATE: March 21, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-3

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

VEH. MOD YR/MAKE/MODEL/BODY: 2011 Hyundai Elantra GLS M/T

VEH. NHTSA NO.: CB0509 VIN: 5NPDH4AE2BH016427 COLOR: Radiant Silver

VEH. BUILD DATE: December, 2010 TEST DATES: March 24-28, 2011

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen Kaleto, Nathaniel Newth, Kevin McKenna, Sean Moran, Ryan Jones

HORIZONTAL IMPACT ANGLE RANGE FOR A AND B PILLARS

	HORIZONTAL ANGLE SPECIFIED RANGE	MINIMUM HORIZONTAL ANGLE	MAXIMUM HORIZONTAL ANGLE
A-PILLAR	L 195º-255º	L 203.2º	L *238.0º
	R 105º-165º	R *121.9º	R 157.3º
B-PILLAR	L 195º-345º	L 203.3º	L 283.1º
	R 15º-165º	R 77.1º	R 157.4º

AS DETERMINED USING THE PROCEDURES SPECIFIED IN S8.13.4.1

REMARKS:

*During the horizontal approach angle calculations, the A-Pillar Maximum Left and Minimum Right were not calculated properly. The correct values are 249° (Maximum Left) and 112° (Minimum Right). Horizontal impact angles were calculated with zero seat travel distance instead of 240 mm used to locate CG-F1.

RECORDED BY: Kevin McKenna DATE: March 21, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-4

VERTICAL IMPACT ANGLE RANGES

VEH. MOD YR/MAKE/MODEL/BODY: 2011 Hyundai Elantra GLS M/T

VEH. NHTSA NO.: CB0509 VIN: 5NPDH4AE2BH016427 COLOR: Radiant Silver

VEH. BUILD DATE: December, 2010 TEST DATES: March 24-28, 2011

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen Kaleto, Nathaniel Newth, Kevin McKenna, Sean Moran, Ryan Jones

VERTICAL IMPACT ANGLE RANGES

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
FRONT HEADER	FH1	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
	FH2	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º
SIDE RAIL	SR1	L 0º-50º	L 0º	L 38º
		R 0º-50º	R 0º	R 46º
	SR2A	L 0º-50º	L 0º	L 28º
		R 0º-50º	R 0º	R 23º
	SR2B	L 0º-50º	L 0º	L 34º
		R 0º-50º	R 0º	R 33º
	SR3-1	L 0º-50º	L 0º	L 45º
		R 0º-50º	R 0º	R 45º
	SR3-2	L 0º-50º	L 0º	L 40º
		R 0º-50º	R 0º	R 40º
REAR HEADER	RH	L 0º-50º	L 0º	L 50º
		R 0º-50º	R 0º	R 50º

		VERTICAL ANGLE SPECIFIED RANGE	MINIMUM VERTICAL ANGLE	MAXIMUM VERTICAL ANGLE
A-PILLAR	AP1	L -5º-50º	L -5º	L 30º
		R -5º-50º	R -5º	R 30º
	AP2	L -5º-50º	L -5º	L 50º
		R -5º-50º	R -5º	R 50º
	AP3	L -5º-50º	L -5º	L 50º
		R -5º-50º	R -5º	R 50º
B-PILLAR	BP1	L -10º-50º	L -10º	L 12º
		R -10º-50º	R -10º	R 12º
	BP2*	L 0º-50º	L 0º	L 5º
		R 0º-50º	R 0º	R 5º
	BP3	L -10º-50º	L -10º	L -8º
		R -10º-50º	R -10º	R -8º
	BP4	L -10º-50º	L -10º	L -7º
		R -10º-50º	R -10º	R -10º
REAR PILLAR	RP1	L -10º-50º	L -10º	L 20º
		R -10º-50º	R -10º	R 20º
	RP2	L -10º-50º	L -10º	L -2º
		R -10º-50º	R -10º	R -2º
UPPER ROOF 1		0º-50º	0º	50º
UPPER ROOF 2		0º-50º	0º	45º
UPPER ROOF 3		0º-50º	0º	50º
UPPER ROOF 4		0º-50º	0º	50º
UPPER ROOF 5		0º-50º	0º	50º
UPPER ROOF 6		0º-50º	0º	50º

As determined using the Procedures specified in S8.13.4.2. *Target BP2 is a seat belt anchorage location.

RECORDED BY: Kevin McKenna DATE: March 21, 2010

APPROVED BY: Helen A. Kaleto

TABLE 2-5

TARGET MEASUREMENTS

VEH. MOD YR/MAKE/MODEL/BODY: 2011 Hyundai Elantra GLS M/T

VEH. NHTSA NO.: CB0509 VIN: 5NPDH4AE2BH016427 COLOR: Radiant Silver

VEH. BUILD DATE: December, 2010 TEST DATES: March 24-28, 2011

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen Kaleto, Nathaniel Newth, Kevin McKenna, Sean Moran, Ryan Jones

Measurement	Description	Left Side	Right Side
M	Seat Fore/Aft Travel (Front seats)	240 mm	240 mm
Tº	Horizontal < {CG-F1 (Left Seat) to (Right A-Pillar)}	122.0º	--
A1º	360º - Tº	238.0º	--
Wº	Horizontal < {CG-2 (Left Seat) to (Left A-Pillar)}	203.2º	--
A2º	A2º = Wº	203.2º	--
Uº	Horizontal < {CG-2 (Left Seat) to (Left B-Pillar)}	283.1º	--
B1º	B1º = Uº	283.1º	--
Vº	Horizontal < {CG-R (Left Seat) to (Left B-Pillar)}	203.3º	--
B2º	B2º = Vº	203.3º	--
Wº (right)	Horizontal < {CG-F2 (Right Seat) to (Right A-Pillar)}	--	157.3º
A1º (right)	A1º (right) = Wº (right)	--	157.3º
T º (right)	Horizontal < {CG-F1 (Right Seat) to (Left A-Pillar)}	--	238.1º
A2º (right)	360º-Tº (right)	--	121.9º
V º (right)	Horizontal < {CG-R (Right Seat) to (Right B-Pillar)}	--	157.4º
B1º (right)	B1º (right) = Vº (right)	--	157.4º
U º (right)	Horizontal < {CG-F2 (Right Seat) to (Right B-Pillar)}	--	77.1º
B2º (right)	B2º (right) = Uº (right)	--	77.1º
J	A-Pillar {(Plane 3) – (Plane 5)}	307.5 mm	312.9 mm
J/2	J ÷ 2	153.8 mm	156.5 mm
D1	Upper Roof {(Plane A) – (Plane B)}	1572.0 mm	
D1/2	D1 ÷ 2	786.0 mm	

Measurement	Description	Left Side	Right Side
D2	Upper Roof {(Plane C) – (Plane D)}	1232.4 mm	
D2/2	D2 ÷ 2	616.2 mm	
.35D1	.35 x D1	550.2 mm	
.35D2	.35 x D2	431.3 mm	
N	B-Pillar {(BPR) – (lowest point on daylight opening forward of B-Pillar)}	383.8 mm	389.6 mm
N/2	B-Pillar {(BP3) – (lowest point on daylight opening forward of B-Pillar)}	191.9 mm	194.8 mm
N/4	B-Pillar {(BP4) – (lowest point on daylight opening forward of B-Pillar)}	96.0 mm	97.4 mm
D	R-Pillar (Point 7 – Point M)	704.0 mm	704.0 mm
3D/7	3*D / 7	301.7 mm	301.7 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	1345.0	-360.0	266.0	1345.0	360.0	266.0
Rear	2160.0	-340.0	266.7	2160.0	340.0	266.7

SgRP Locations (vehicle coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
Front	1345.0	-360.0	266.0	1345.0	360.0	266.0
Rear	2160.0	-340.0	266.7	2160.0	340.0	266.7

CG Locations (world coordinates)						
	Left (mm)			Right (mm)		
	x	y	z	x	y	z
CGF1	1265.0	-360.0	926.0	1265.0	360.0	926.0
CGF2	1505.0	-360.0	926.0	1505.0	360.0	926.0
CGR	2320.0	-340.0	926.7	2320.0	340.0	926.7

REFERENCE FOR VEHICLE COORDINATE SYSTEM (measured in millimeters):

Rear driver door striker upper bolt (x, y, z) = 2500.0, -752.0, 552.0

Front driver seat outboard front bolt (x, y, z) = 982.7, -600.5, 49.97

Front passenger door striker lower bolt (x, y, z) = 1503.0, 772.0, 501.0

REMARKS:

RECORDED BY: Kevin McKenna DATE: March 21, 2011

APPROVED BY: Helen A. Kaleto

TABLE 2-6

SUMMARY OF TARGETING RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2011 Hyundai Elantra GLS M/T

VEH. NHTSA NO.: CB0509 VIN: 5NPDH4AE2BH016427 COLOR: Radiant Silver

VEH. BUILD DATE: December, 2010 TEST DATES: March 24-28, 2011

TEST LABORATORY: MGA Research Corporation

OBSERVERS: Helen Kaleto, Nathaniel Newth, Kevin McKenna, Sean Moran, Ryan Jones

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	1101.4	-552.8	1044.5	--	--	Yes	--	--
REL	1128.4	-572.3	1008.4	238	30	--	2	No
AP2	980.3	-600.1	955.6	203	50	No	--	Yes
AP3	806.8	-630.3	891.6	203	50	No	--	No
A-Pillar Right Side								
AP1	1099.4	551.6	1045.5	--	--	Yes	--	--
REL	1135.3	561.7	1019.4	122	30	--	2	Yes
AP2	994.6	597.1	957.6	157	50	No	--	No
AP3	802.8	628.1	889.9	157	50	No	--	Yes
B-Pillar Left Side								
BP1	1633.0	-503.1	1097.0	270	12	No	--	No
BP2	1593.4	-612.5	851.9	270	5	No	--	No
BP3	1568.1	-614.2	905.7	270	-8	No	--	Yes
BP4	1665.5	-656.7	810.7	204	-7	No	--	Yes
B-Pillar Right Side								
BP1	1622.9	505.4	1097.9	90	12	No	--	Yes
BP2	1585.8	614.0	854.0	90	5	No	--	No
BP3	1557.7	616.8	903.2	90	-8	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**					
BP4	1651.7	655.0	806.2	157	-10	No	--	No
Rear Pillar Left Side								
RP1	2383.3	-520.0	1035.7	270	20	No	--	No
RP2	2465.4	-613.9	886.2	300	-2	No	--	No
Rear Pillar Right Side								
RP1	2381.4	516.1	1038.6	90	20	No	--	No
RP2	2464.8	612.1	888.3	60	-2	No	--	No
Front Header Left Side								
FH1	1022.8	-438.5	1053.6	180	50	No	--	Yes
FH2	1005.5	-291.0	1059.5	180	50	No	--	No
Front Header Right Side								
FH1	1019.0	429.7	1054.9	180	50	No	--	No
FH2	1005.1	285.0	1059.8	180	50	No	--	No
Side Rail Left Side								
SR1	1251.9	-531.9	1064.7	--	--	Yes	--	--
REL	1248.3	-493.3	1085.0	270	38	--	2	No
SR2A	1402.3	-521.8	1081.8	--	--	Yes	--	--
REL	1401.6	-538.8	1065.0	270	28	--	1	No
SR2B	1332.7	-525.4	1076.8	--	--	Yes	--	--
REL	1324.3	-540.7	1060.4	270	34	--	1	No
SR3-1	1977.0	-478.6	1080.8	270	45	No	--	No
SR3-2	2127.7	-487.5	1066.3	270	40	No	--	No
Side Rail Right Side								
SR1	1250.1	527.9	1073.2	--	--	Yes	--	--
REL	1274.7	483.0	1076.4	90	46	--	2	No
SR2A	1399.6	522.8	1091.4	--	--	Yes	--	--
REL	1427.6	478.0	1095.3	90	23	--	2	No
SR2B	1323.4	522.8	1087.8	--	--	Yes	--	--

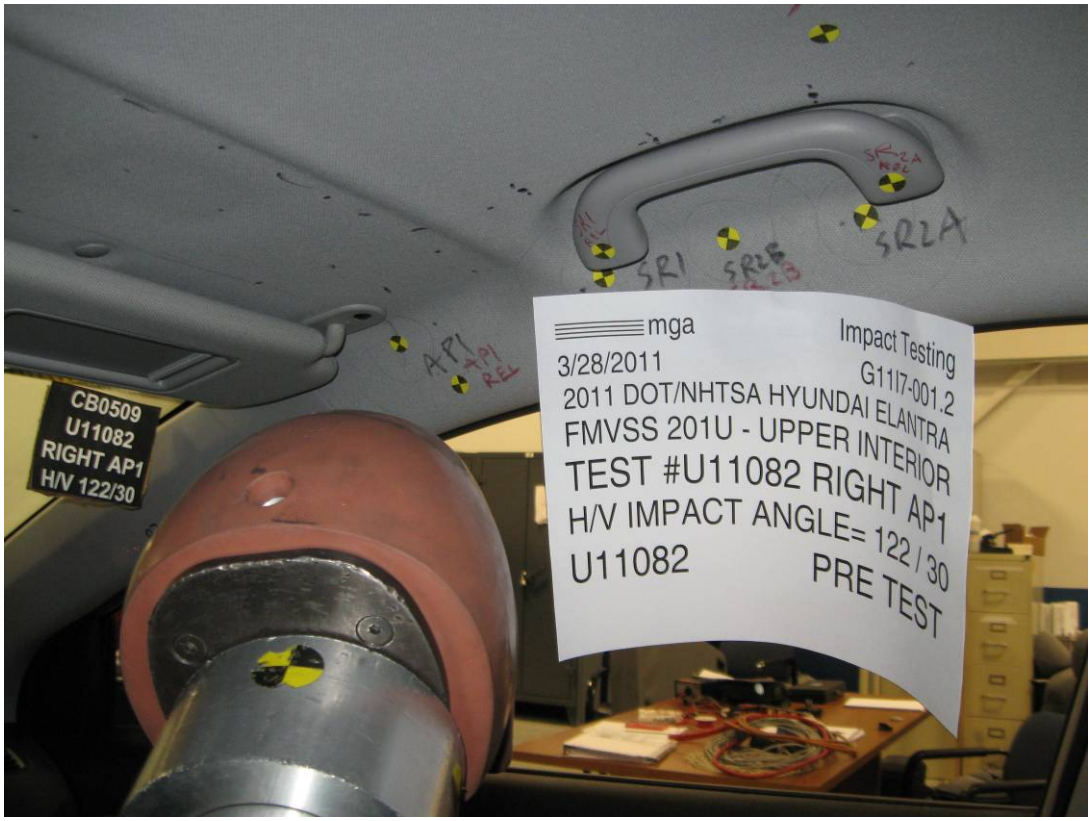
SUMMARY OF TARGETING RESULTS								
Target	**Location (mm)**			**Horizontal Angle (deg)**	**Vertical Angle (deg)**	**Relocation (Yes/No)**	**Extension (# of 25 mm Spheres)**	**Impact (Yes/No)**
	x	**y**	**z**					
REL	1351.7	543.1	1052.8	90	33	--	2	No
SR3-1	1970.0	490.6	1076.1	90	45	No	--	No
SR3-2	2127.3	502.8	1061.4	90	40	No	--	No
Rear Header Left Side								
RH	2390.2	-339.7	1072.4	0	50	No	--	No
Rear Header Right Side								
RH	2395.0	340.2	1070.6	0	50	No	--	No
Upper Roof Left Side								
UR1@SR1	1218.2	-408.9	1086.1	270	50	No	--	No
UR3@BP	1650.9	-409.8	1122.5	270	50	No	--	Yes
UR5@SR3-2	2128.4	-397.6	1112.1	270	50	No	--	Yes
Upper Roof Right Side								
UR2@SR2A	1417.3	396.3	1135.1	90	45	No	--	Yes
UR4@SR3-1	1974.7	390.1	1118.4	90	50	No	--	Yes
UR6@RP	2262.7	417.3	1100.9	90	50	No	--	Yes

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

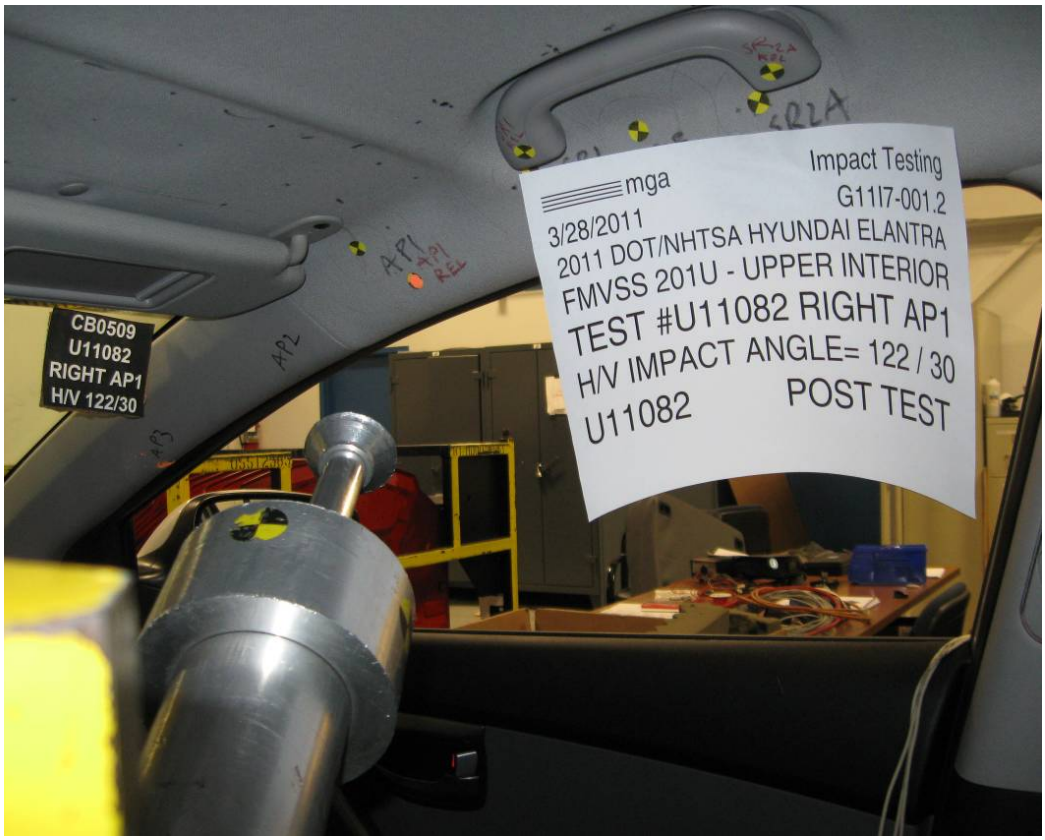
RECORDED BY: Kevin McKenna DATE: March 21, 2011

APPROVED BY: Helen A. Kaleto

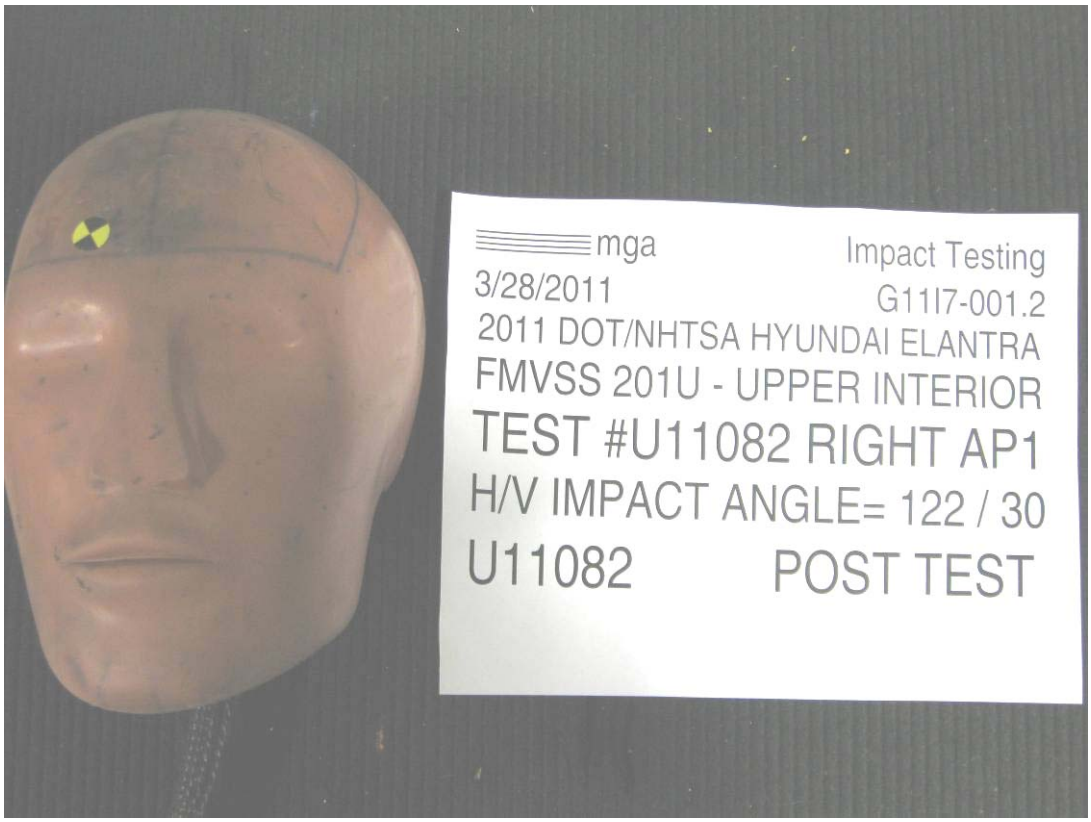
3.0 TEST DATA (Including Acceleration and Velocity Plots)




CB0509
U11082
RIGHT AP1
H/V 122/30
mga
Impact Testing
G11I7-001.2
3/28/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11082 RIGHT AP1
H/V IMPACT ANGLE= 122 / 30
U11082
POST TEST


CB0509
U11082
RIGHT AP1
H/V 122/30
mga
Impact Testing
G11I7-001.2
3/28/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11082 RIGHT AP1
H/V IMPACT ANGLE= 122 / 30
U11082
POST TEST


CB0509
U11082


mga
Impact Testing
3/28/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11082 RIGHT AP1
H/V IMPACT ANGLE= 122 / 30
U11082
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11082

Target (Vehicle Side): AP1Right

Temperature:21.1C

MGA Test Reference No.:U11082

Humidity:13.7%

Approach Horizontal Angles:122º

Time of Test:9:45:08 AM

Approach Vertical Angles:30º

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
559	521	3.3	19.0	9	19 Right

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.4	1.07	1.07
Y	6	J36197	108.7	0.85	0.85
Z	7	J36353	99.1	0.94	0.94

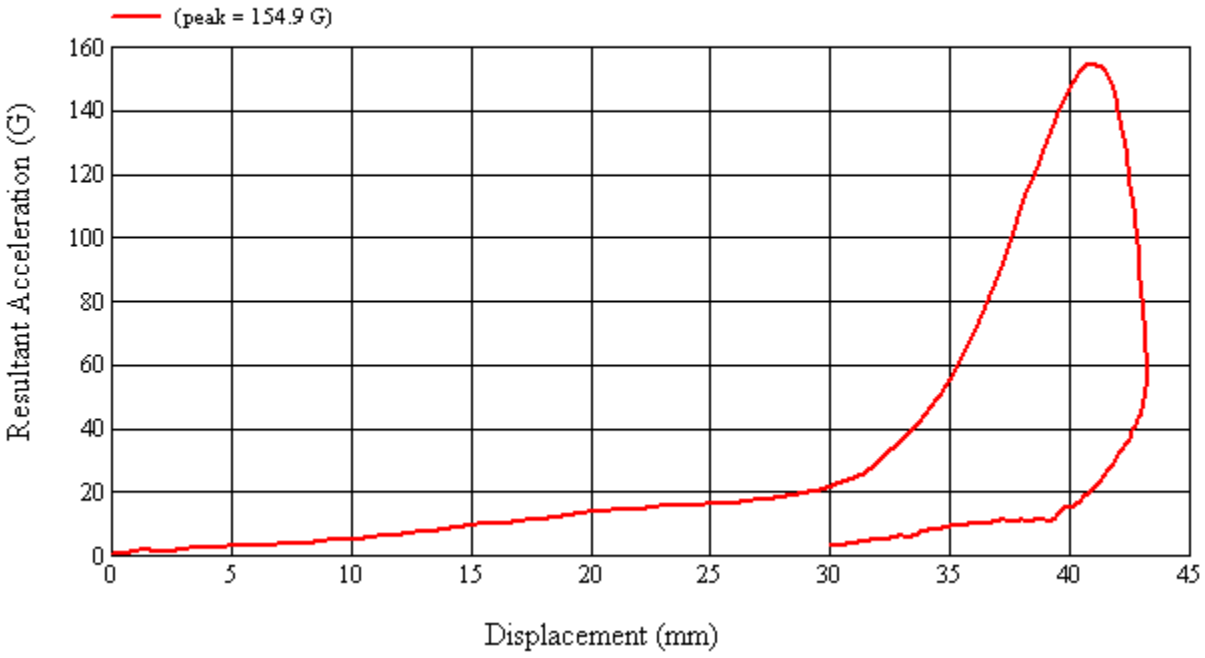
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

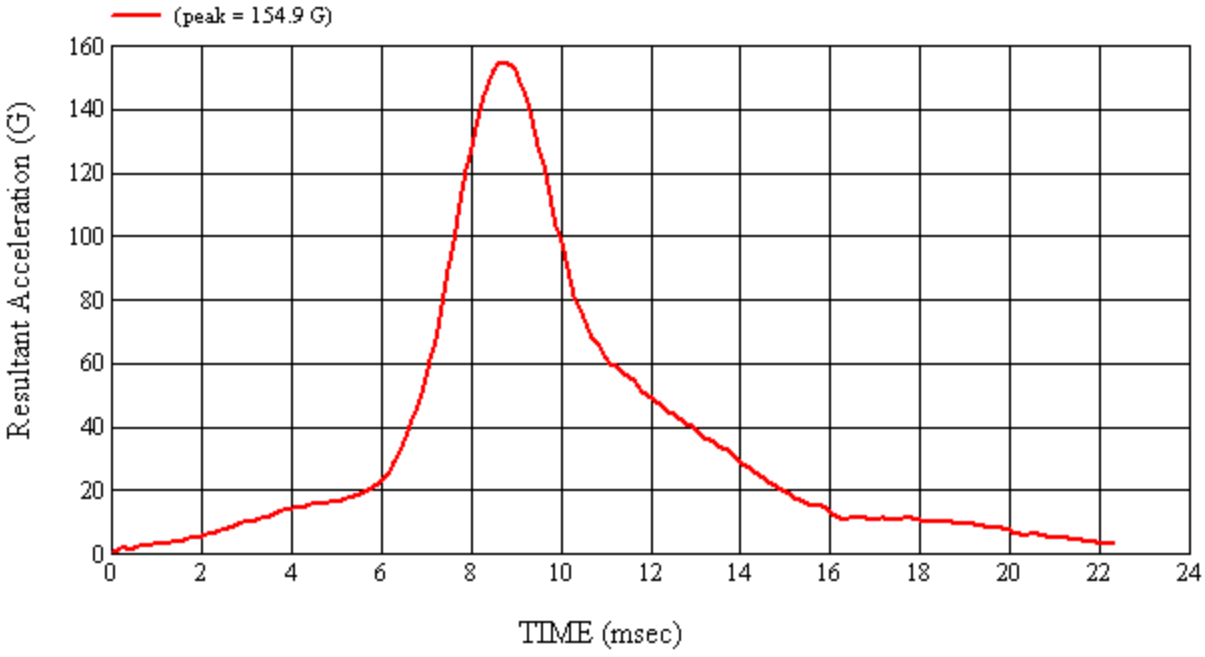
No visible damage

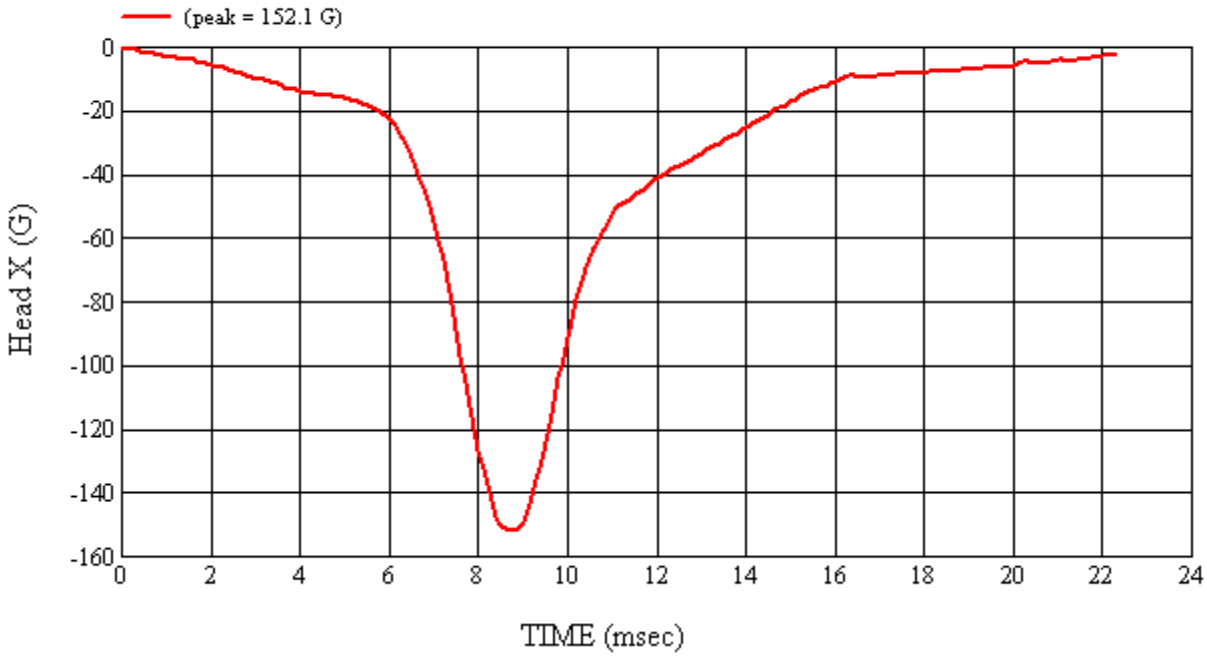
Recorded By: _____ Approved By*: _____ Date: 3/28/2011

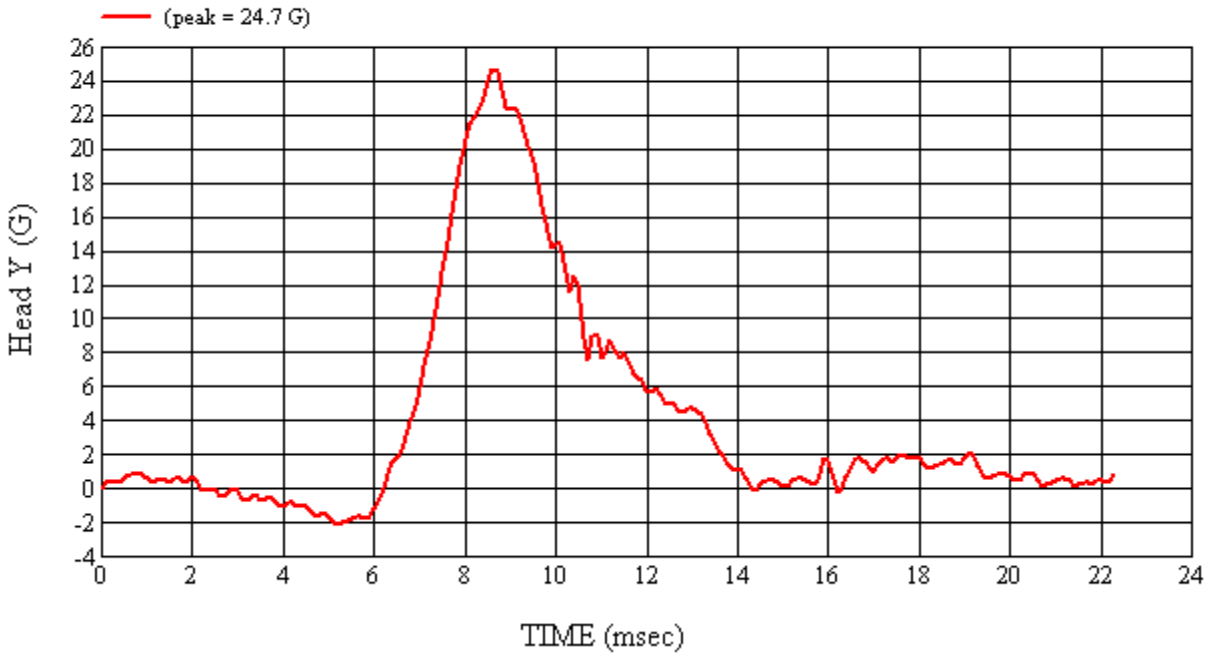
*Only necessary for NHTSA (Government) Compliance testing.

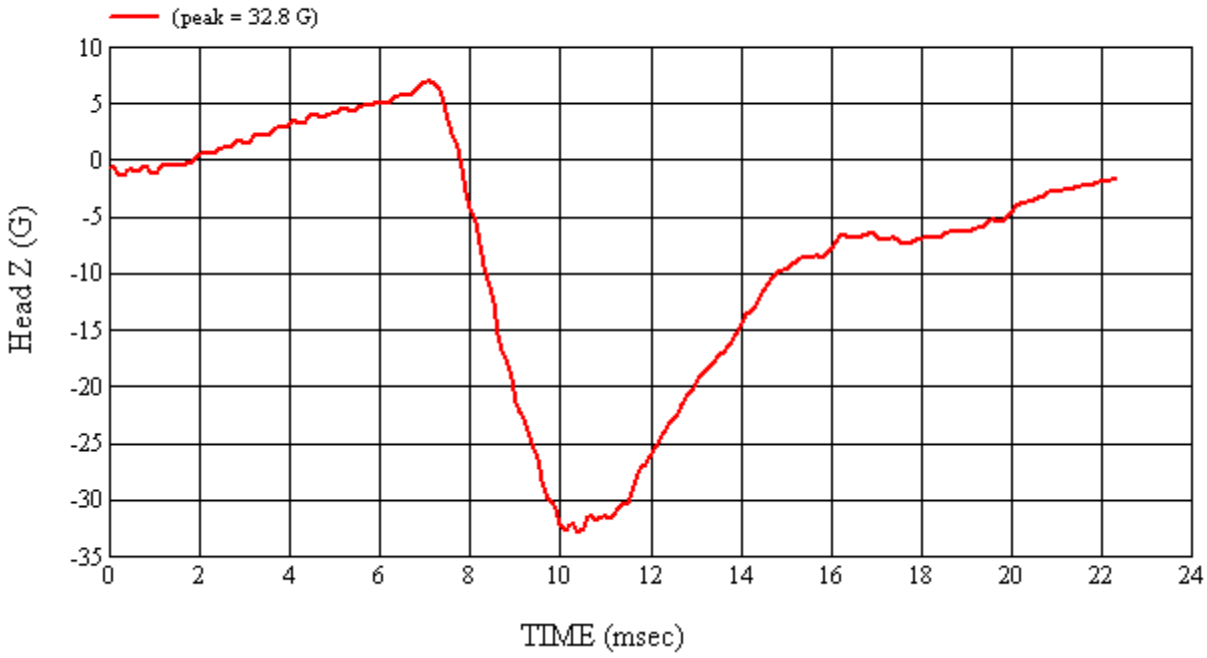
MGA Test #: U11082 Target Location: AP1, Right Side Test Date: 3/28/2011

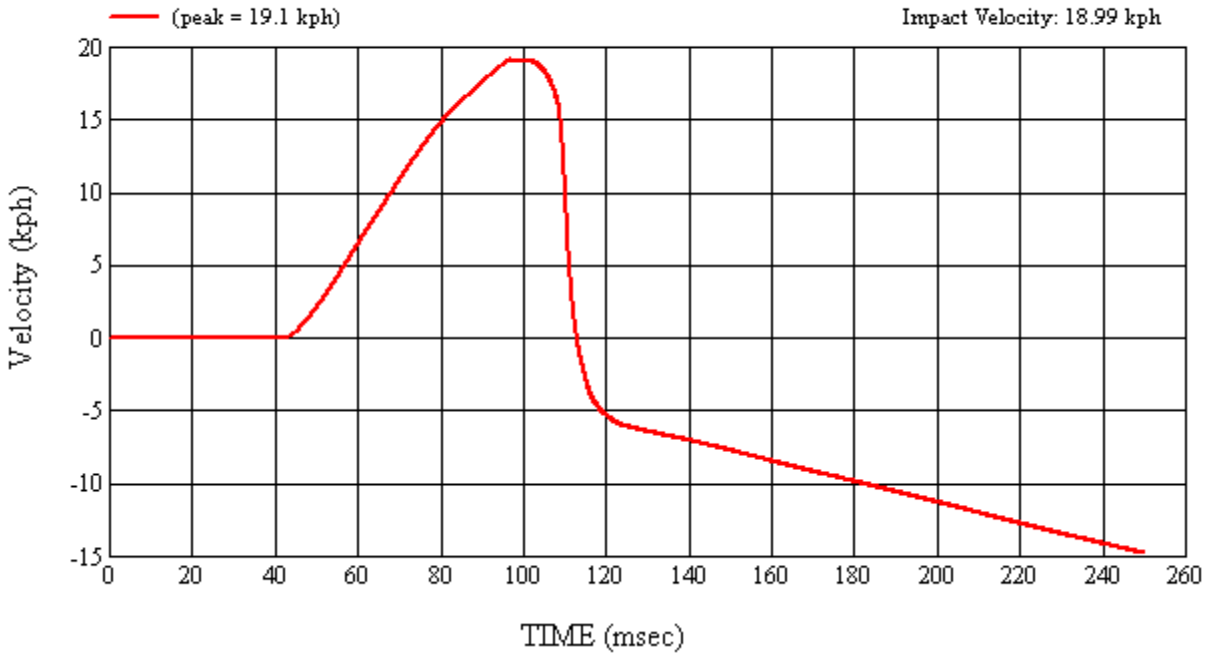


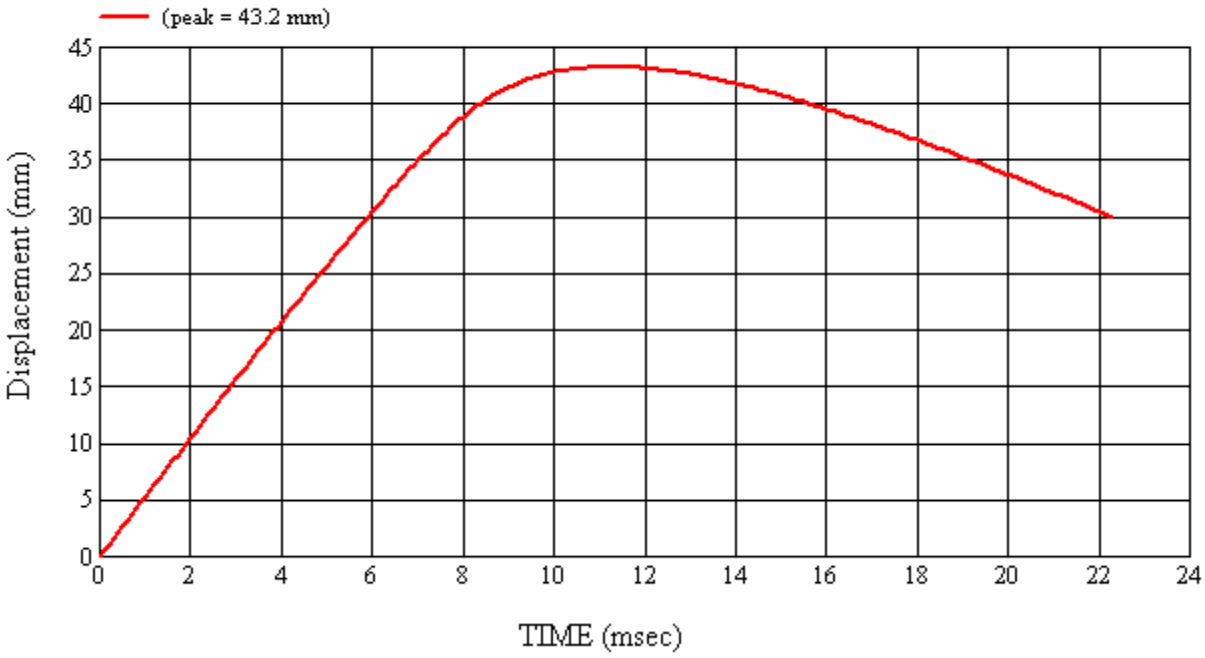


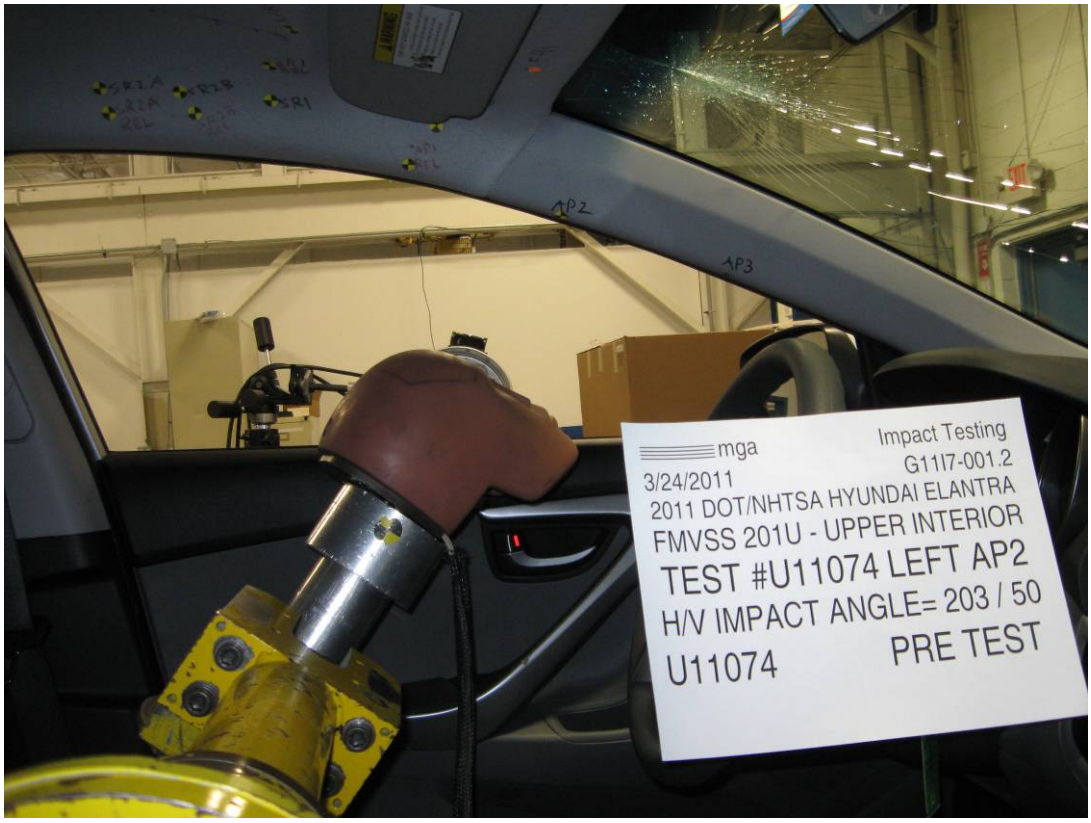

(peak = 152.1 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
-160
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 24.7 G)
Head Y (G)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 32.8 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 19.1 kph)
Impact Velocity: 18.99 kph
Velocity (kph)
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

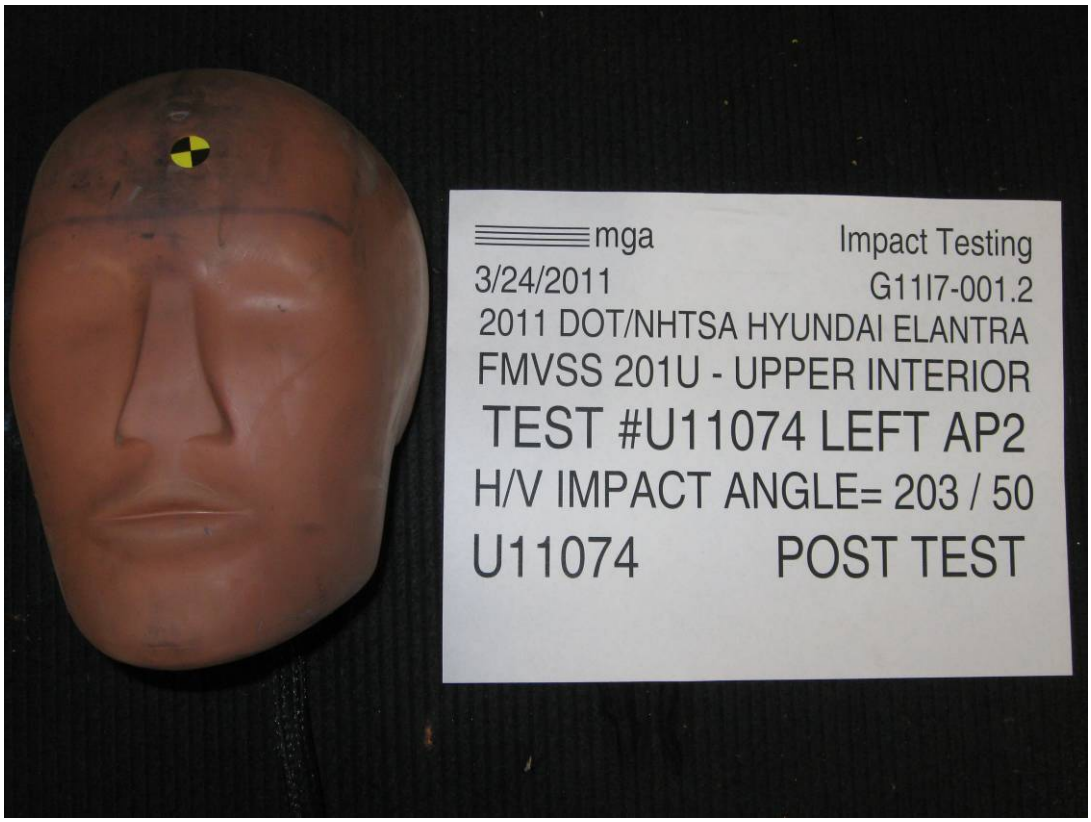

(peak = 43.2 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


AP2
AP3
mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11074 LEFT AP2
H/V IMPACT ANGLE= 203 / 50
U11074
PRE TEST


AP2
AP3
mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11074 LEFT AP2
H/V IMPACT ANGLE= 203 / 50
U11074
PRE TEST


WARNING
mga
Impact Testing
3/24/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11074 LEFT AP2
H/V IMPACT ANGLE= 203 / 50
U11074
POST TEST


mga
Impact Testing
3/24/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11074 LEFT AP2
H/V IMPACT ANGLE= 203 / 50
U11074
POST TEST
AP2
AP3


mga
Impact Testing
3/24/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11074 LEFT AP2
H/V IMPACT ANGLE= 203 / 50
U11074
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11074

Target (Vehicle Side): AP2Left

Temperature:22.2C

MGA Test Reference No.:U11074

Humidity:19.2%

Approach Horizontal Angles:203º

Time of Test:5:38:29 PM

Approach Vertical Angles:50º

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
410	323	3.8	18.8	22	7 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.8	1.07	1.07
Y	6	J22664	94.2	0.85	0.85
Z	7	J35924	92.8	0.94	0.93

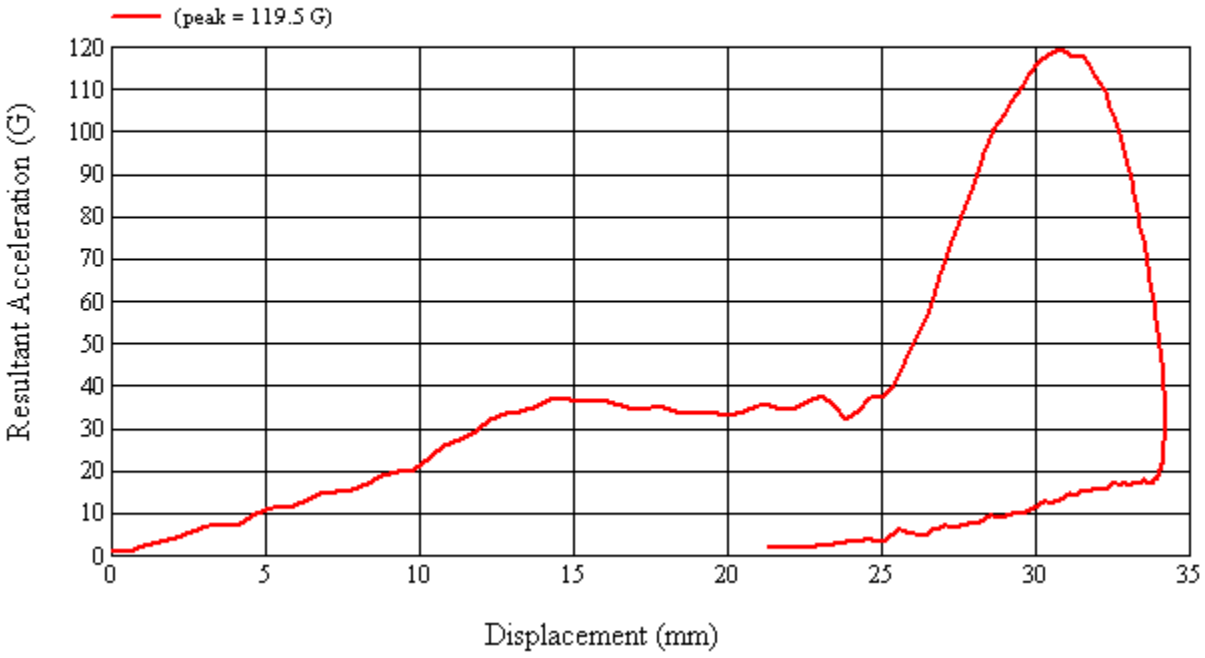
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

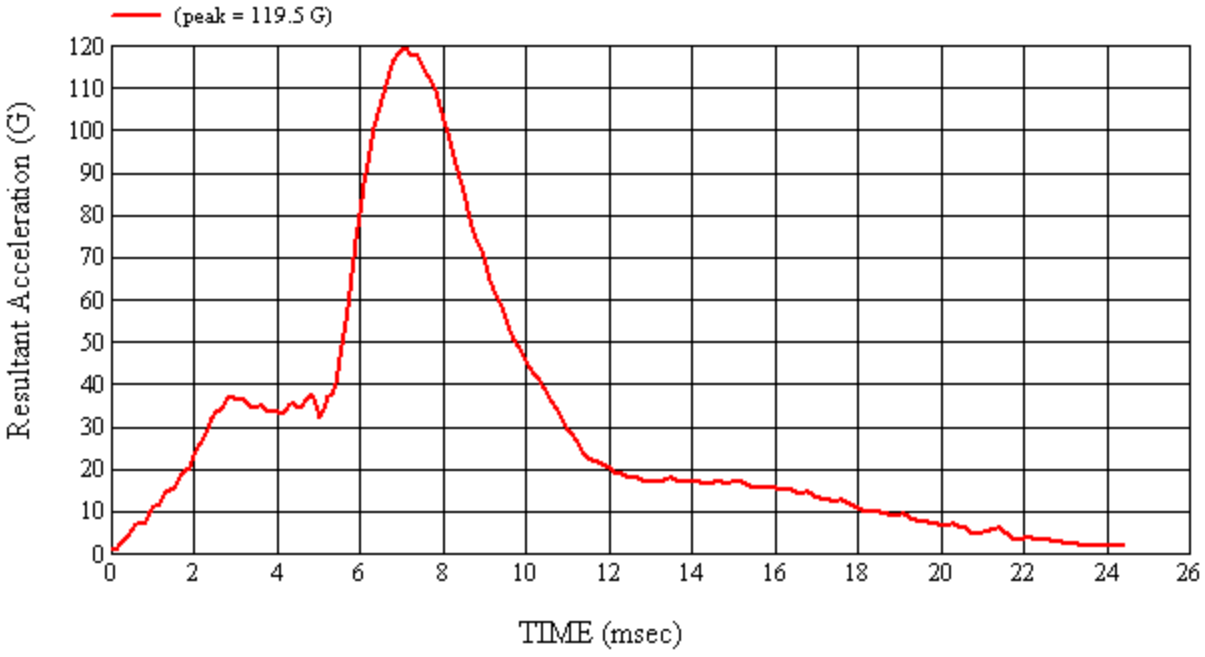
Cracked and dislodged trim.

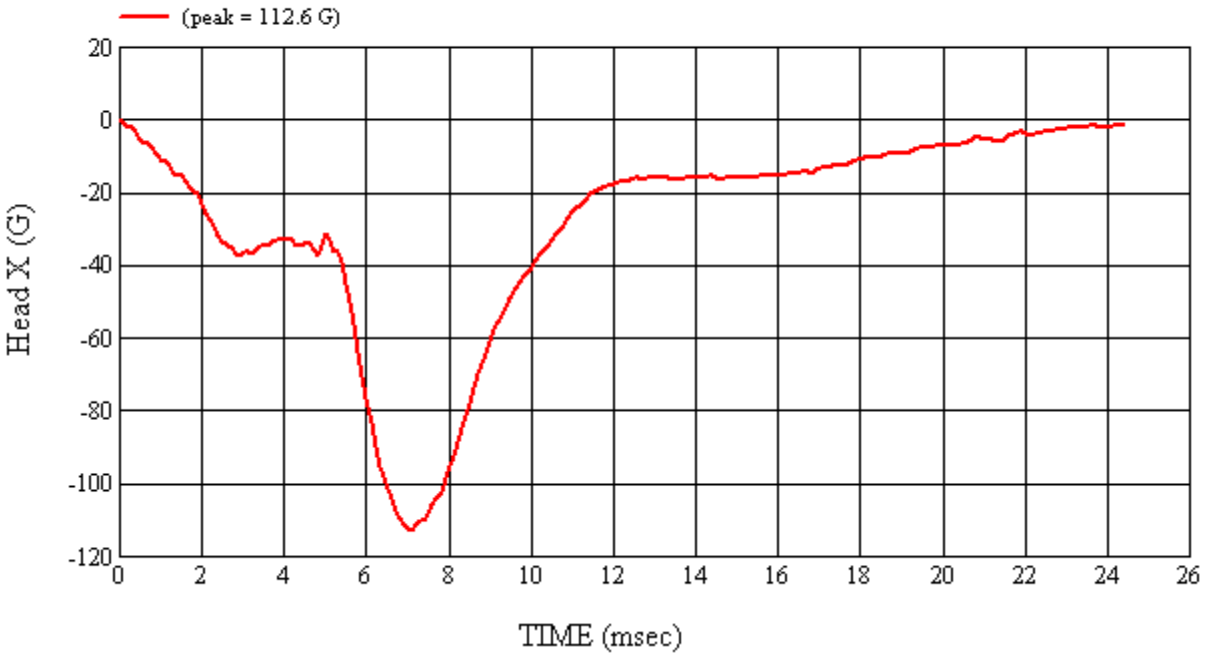
Recorded By: _____ Approved By*: _____ Date: 3/24/2011

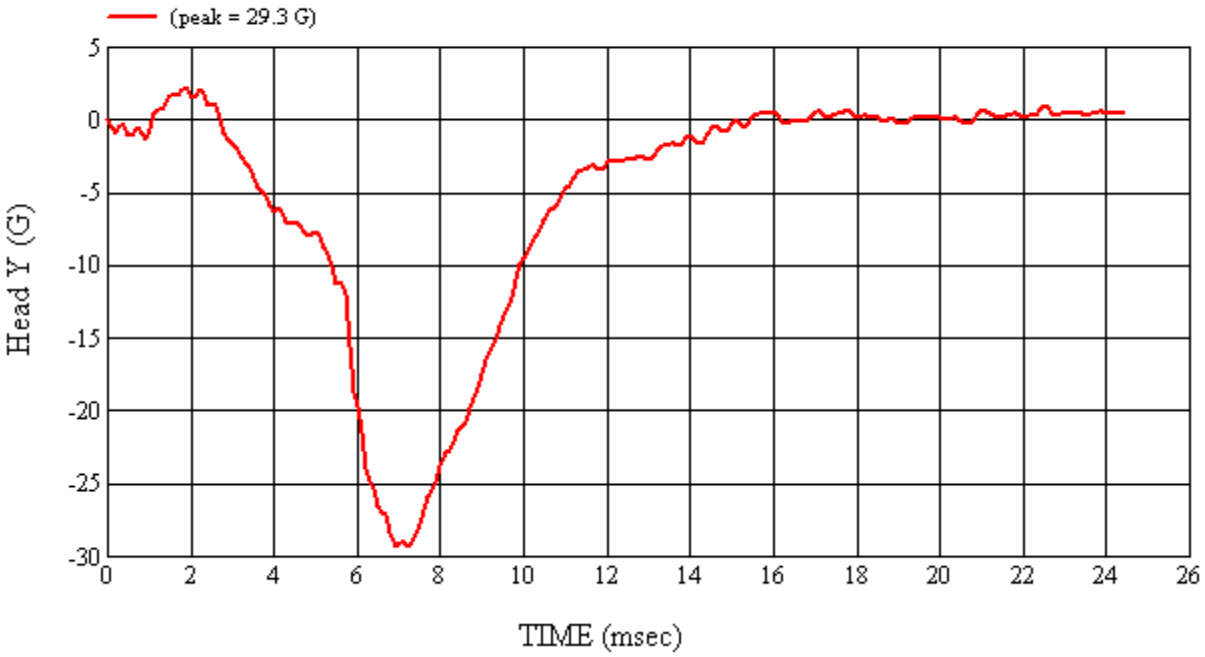
*Only necessary for NHTSA (Government) Compliance testing.

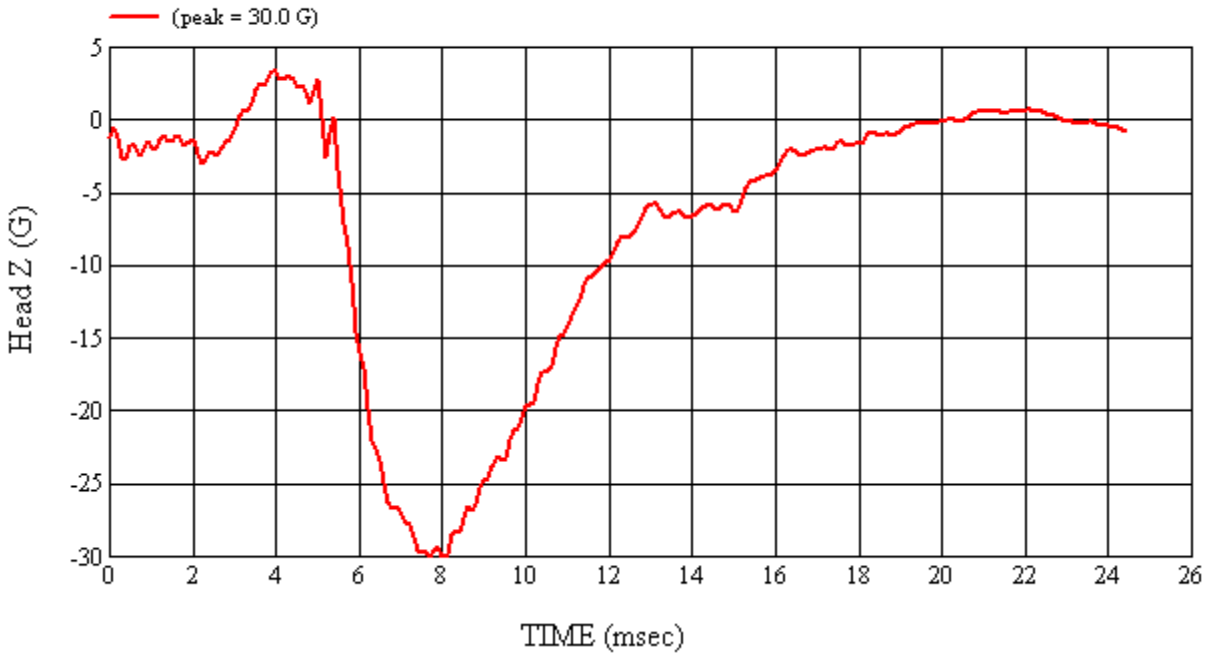
MGA Test #: U11074 Target Location: AP2, Left Side Test Date: 3/24/2011

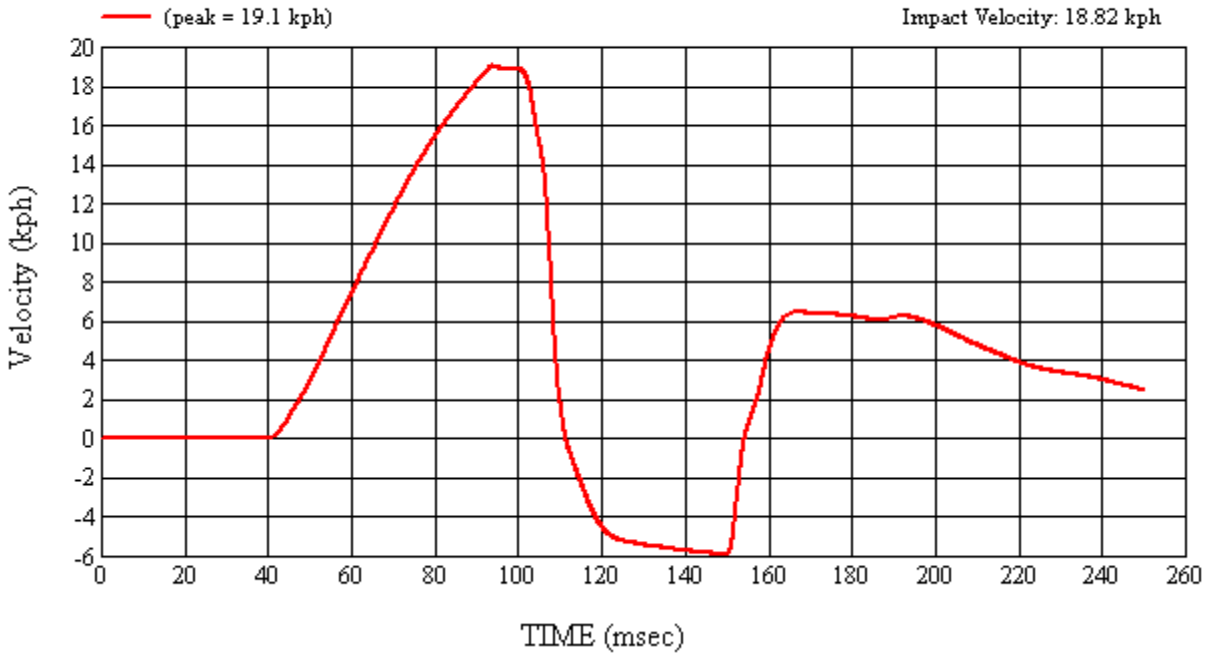


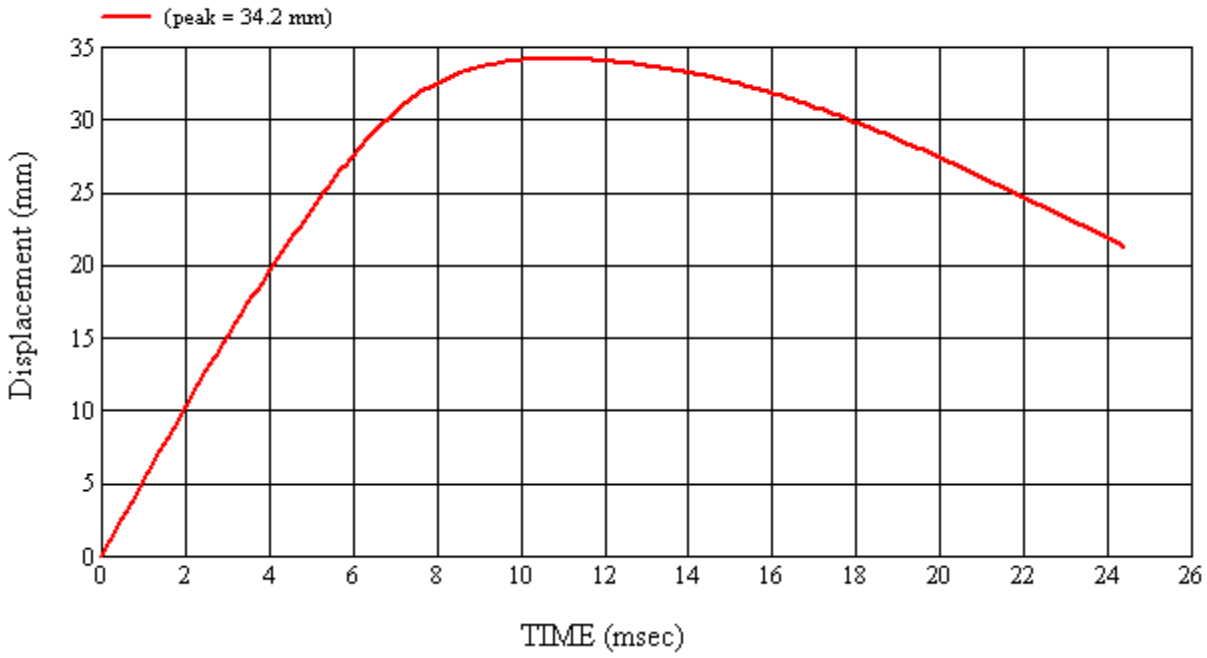



(peak = 112.6 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

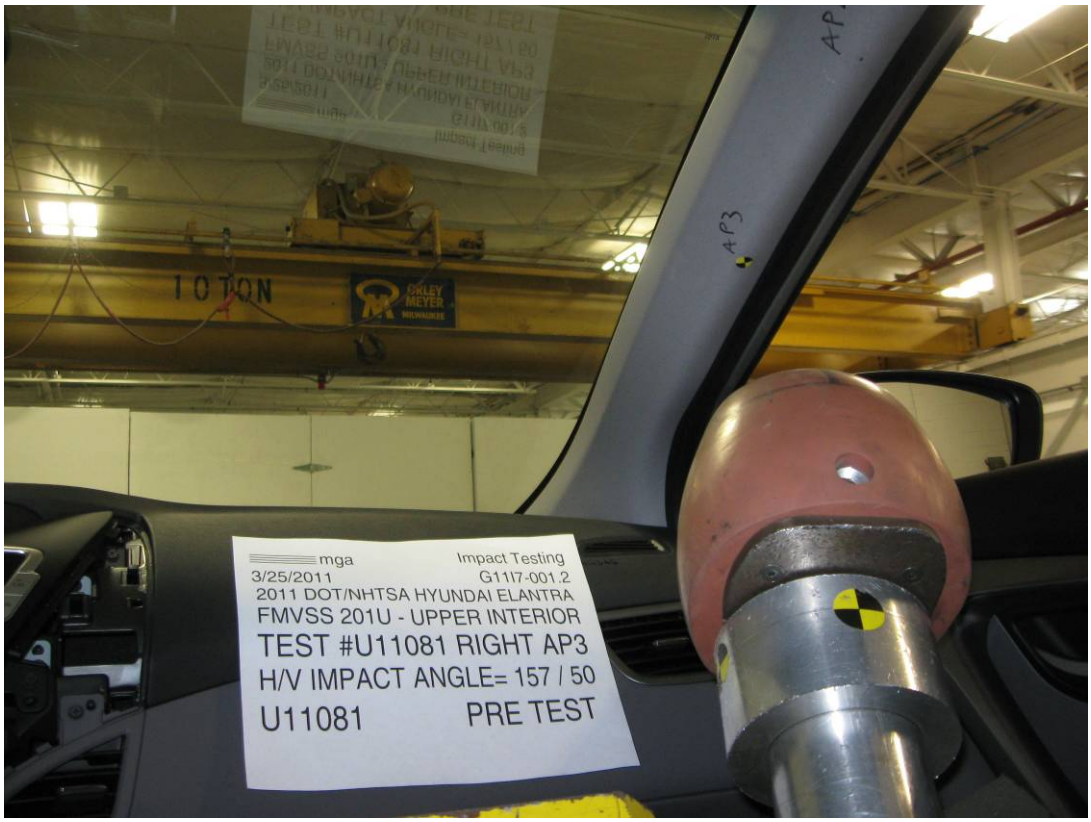

(peak = 29.3 G)
Head Y (G)
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 30.0 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 19.1 kph)
Impact Velocity: 18.82 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 34.2 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


AP3
AP2
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11081 RIGHT AP3
H/V IMPACT ANGLE= 157 / 50
U11081
PRE TEST


10 TON
AP3
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11081 RIGHT AP3
H/V IMPACT ANGLE= 157 / 50
U11081
PRE TEST


AP3
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11081 RIGHT AP3
H/V IMPACT ANGLE= 157 / 50
U11081
POST TEST


AP3
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11081 RIGHT AP3
H/V IMPACT ANGLE= 157 / 50
U11081
POST TEST


AP2
AP3


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11081 RIGHT AP3
H/V IMPACT ANGLE= 157 / 50
U11081
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11081

Target (Vehicle Side): AP3Right

Temperature:22.1C

MGA Test Reference No.:U11081

Humidity:13.8%

Approach Horizontal Angles:157º

Time of Test:5:18:39 PM

Approach Vertical Angles:50º

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
469	400	5.4	18.8	10	5 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J32177	-113.7	1.07	1.07
Y	6	J14103	93.9	0.85	0.85
Z	7	J35800	97.8	0.94	0.94

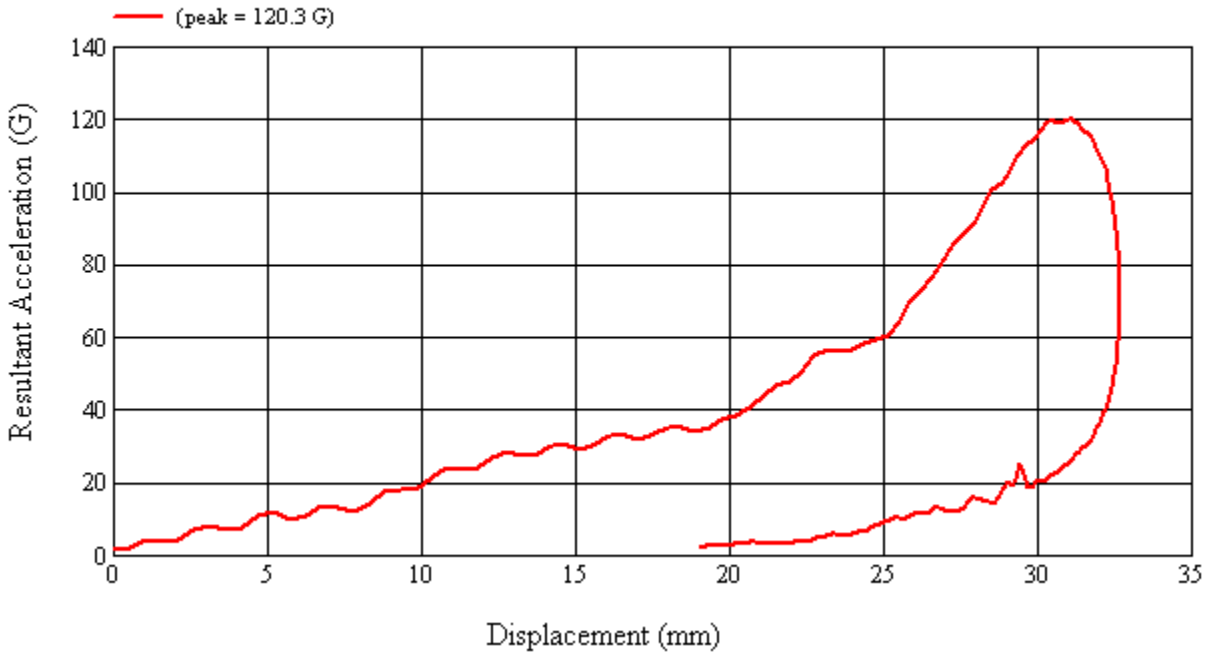
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

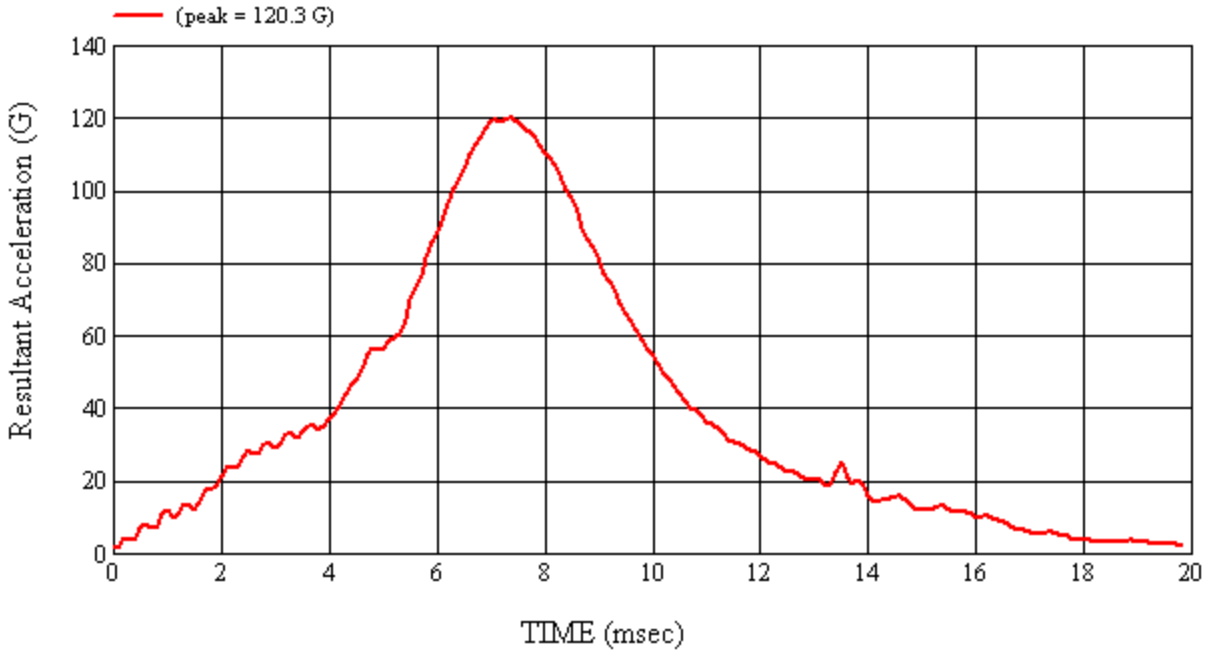
Dislodged pillar trim

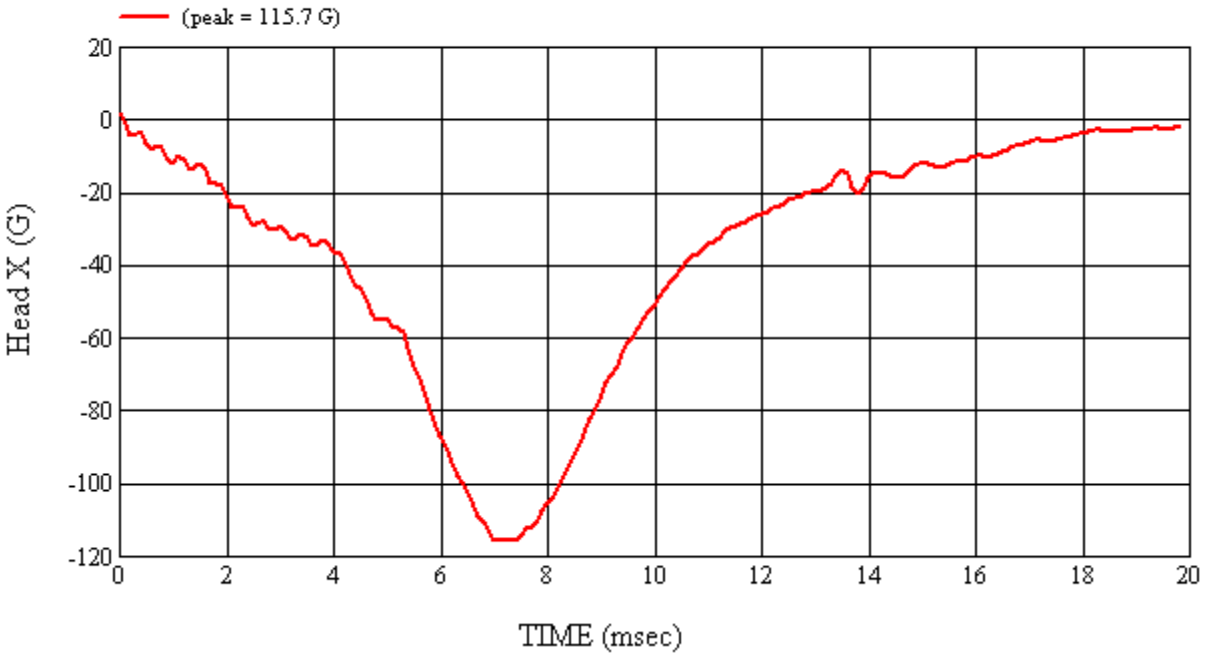
Recorded By: _____ Approved By*: _____ Date: 3/25/2011

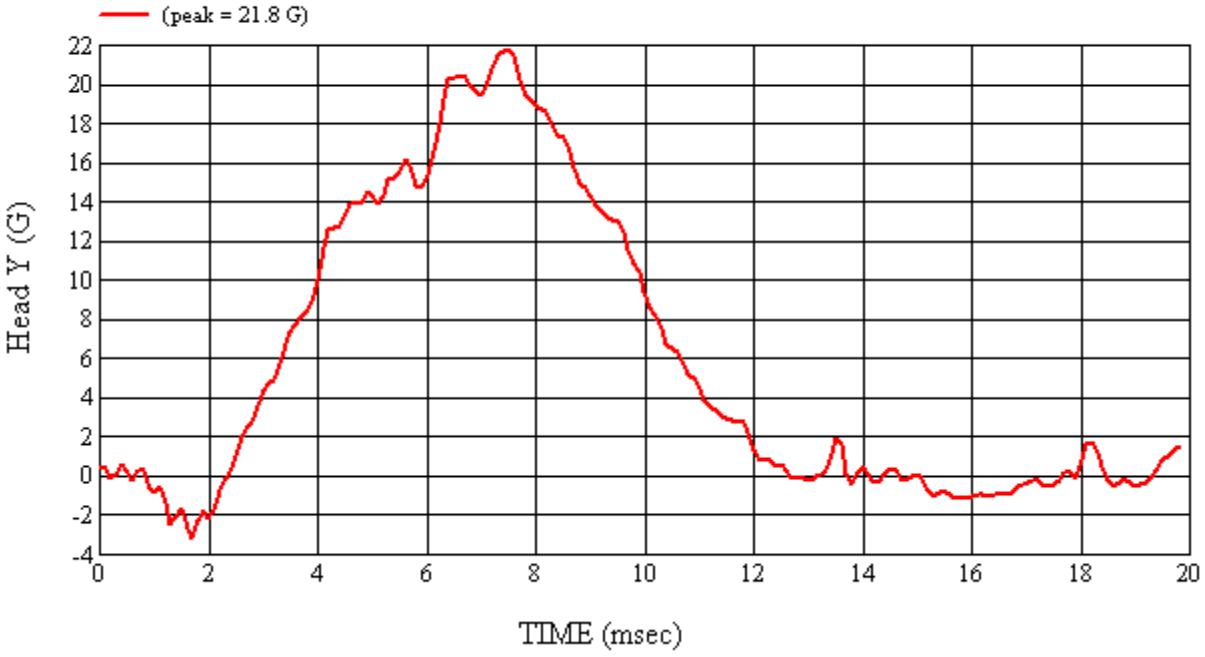
*Only necessary for NHTSA (Government) Compliance testing.

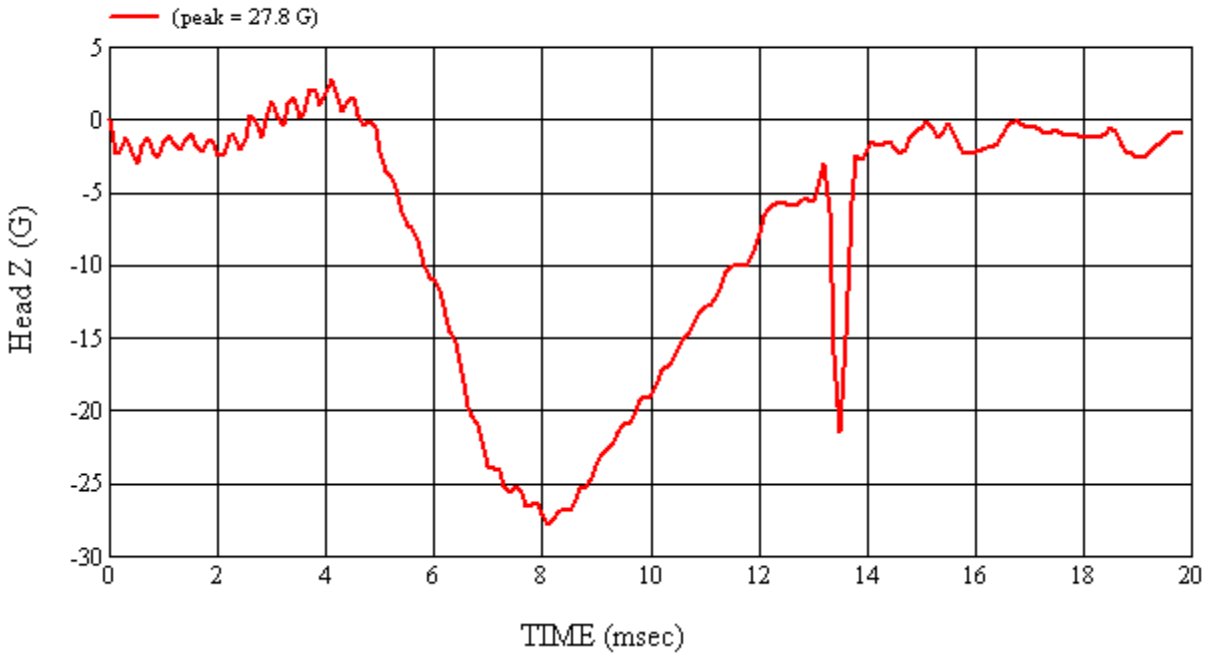
MGA Test #: U11081 Target Location: AP3, Right Side Test Date: 3/25/2011

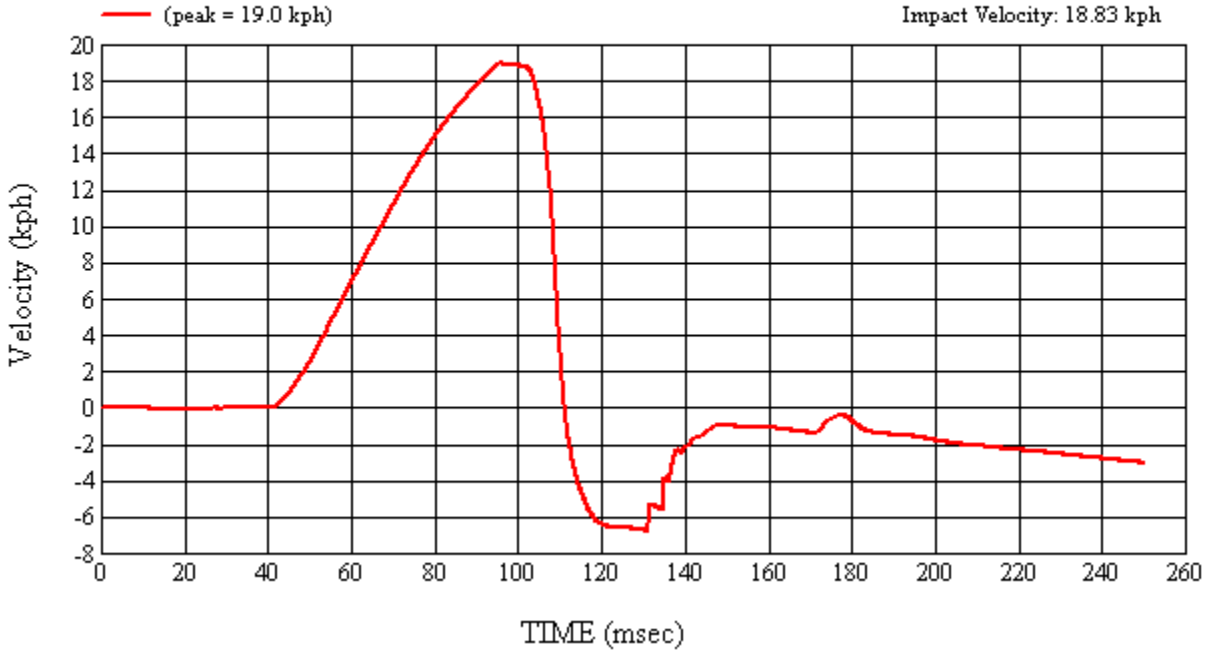


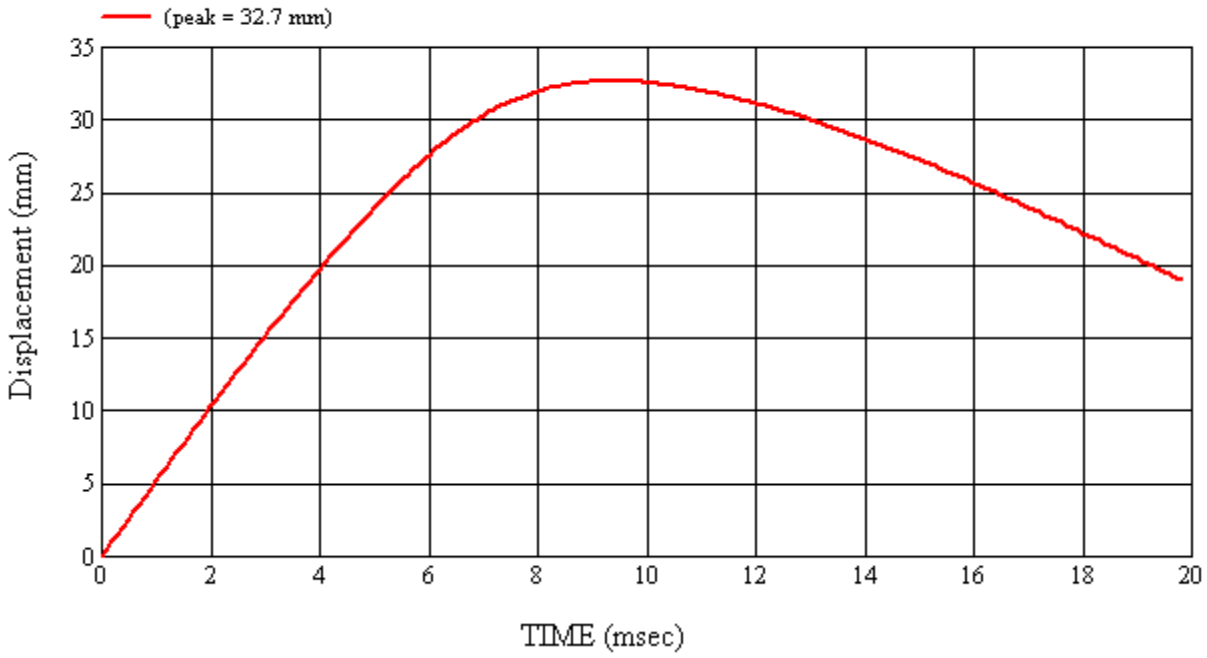



(peak = 115.7 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 21.8 G)
Head Y (G)
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 27.8 G)
Head Z (G)
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

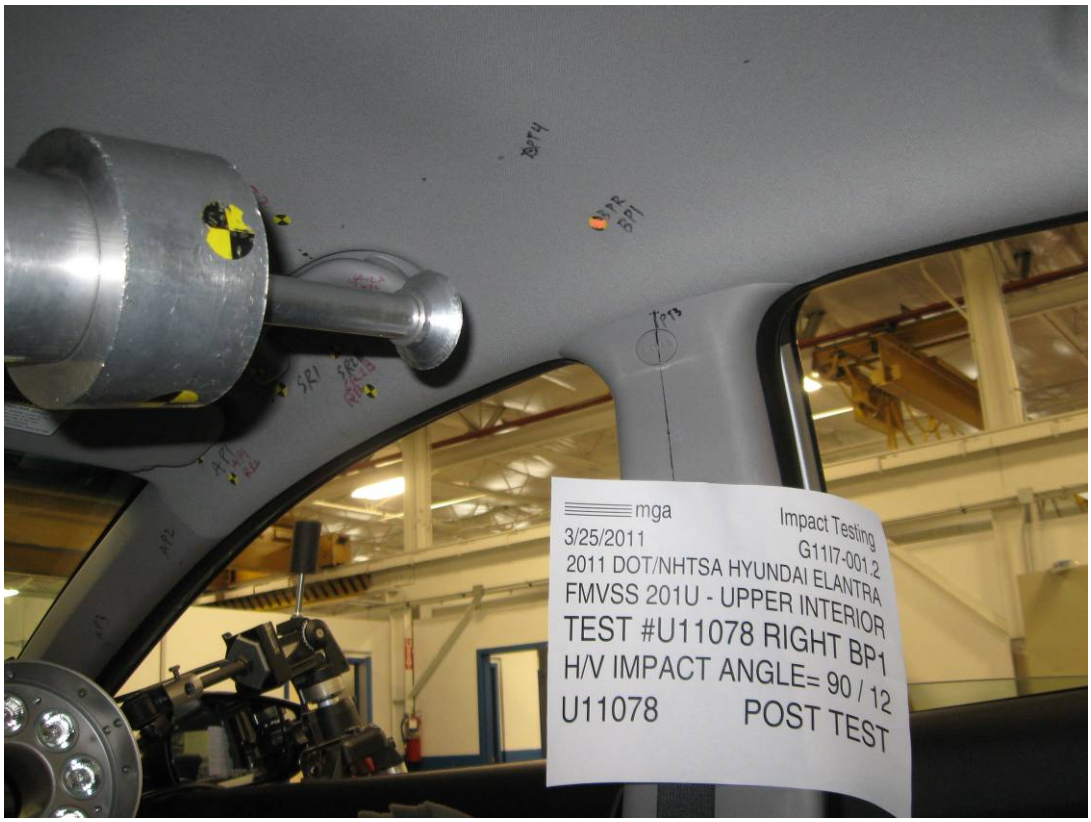

(peak = 19.0 kph)
Impact Velocity: 18.83 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

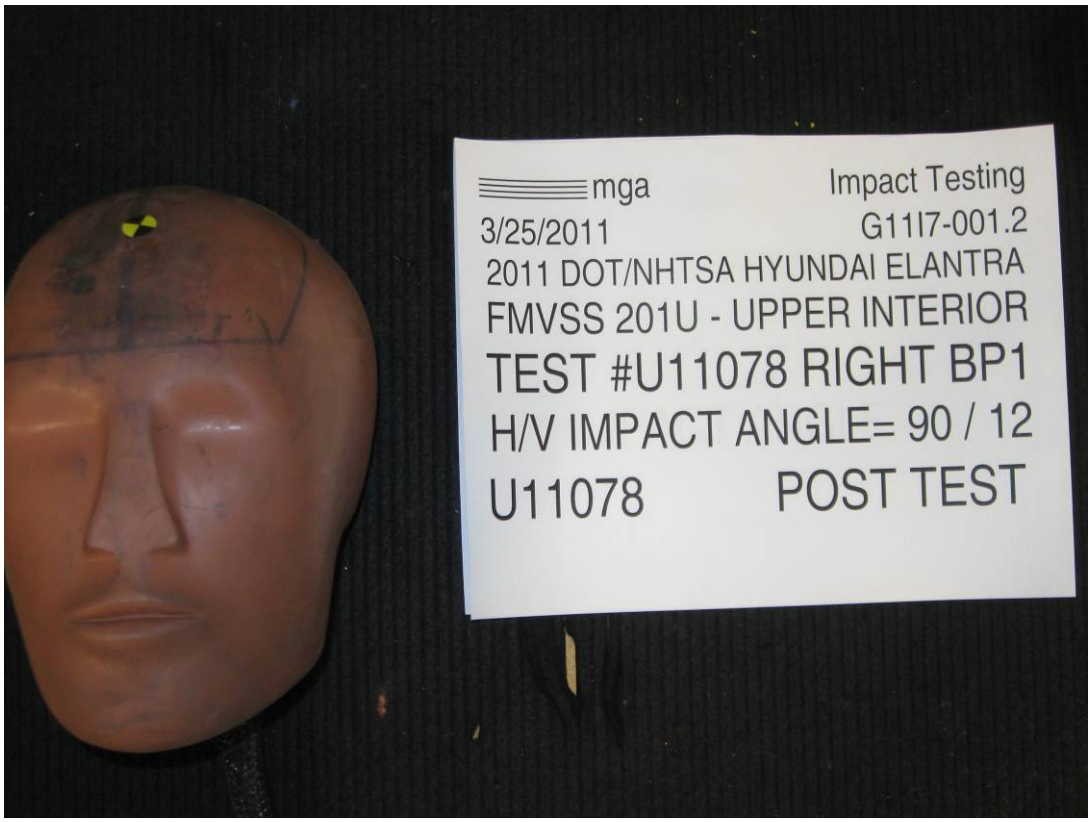

(peak = 32.7 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11078 RIGHT BP1
H/V IMPACT ANGLE= 90 / 12
U11078
PRE TEST


UR4
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11078 RIGHT BP1
H/V IMPACT ANGLE= 90 / 12
U11078
PRE TEST


mga
Impact Testing
G11I7-001.2
3/25/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11078 RIGHT BP1
H/V IMPACT ANGLE= 90 / 12
U11078
POST TEST


mga
Impact Testing
G11I7-001.2
3/25/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11078 RIGHT BP1
H/V IMPACT ANGLE= 90 / 12
U11078
POST TEST


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11078 RIGHT BP1
H/V IMPACT ANGLE= 90 / 12
U11078
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11078

Target (Vehicle Side): BP1Right

Temperature:22.2C

MGA Test Reference No.:U11078

Humidity:13.0%

Approach Horizontal Angles:90º

Time of Test:2:04:09 PM

Approach Vertical Angles:12º

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
389	295	7.6	18.5	51	3 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J32177	-113.7	1.07	1.07
Y	6	J14103	93.9	0.85	0.85
Z	7	J35800	97.8	0.94	0.94

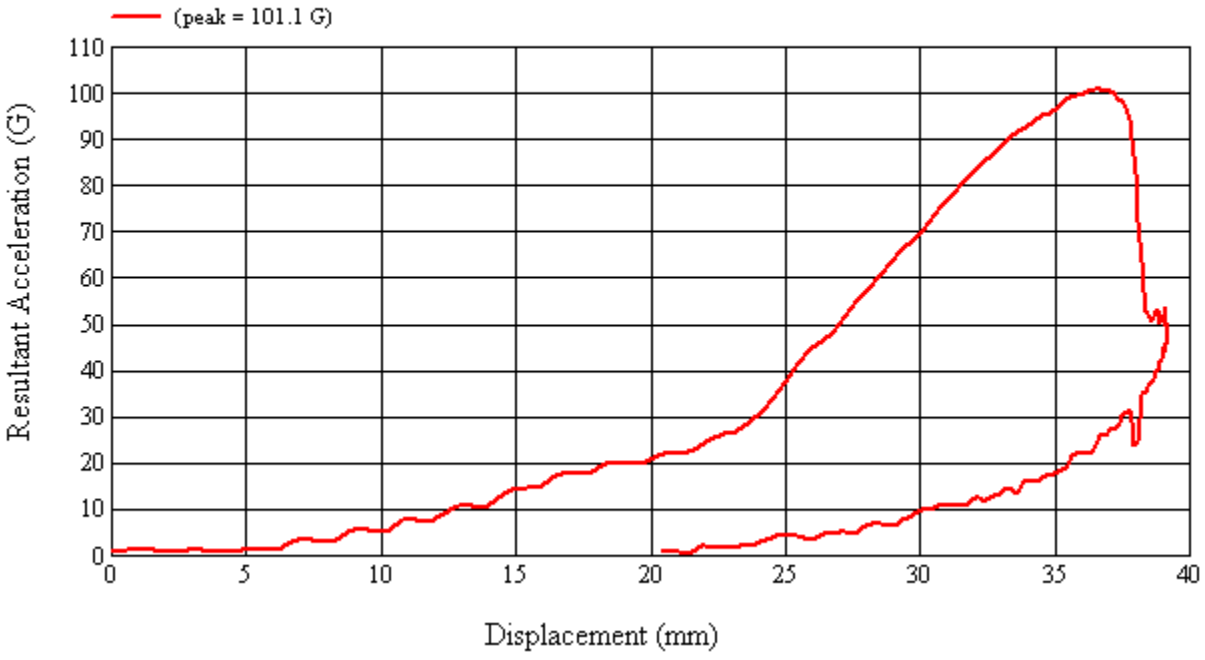
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

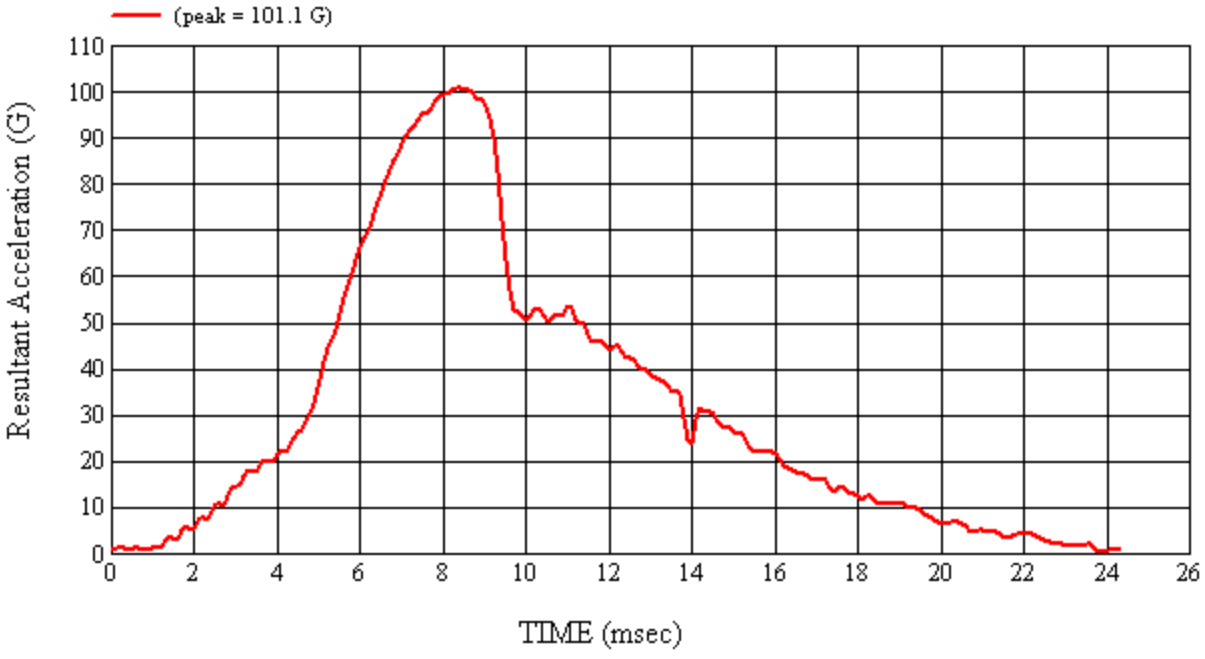
No visible damage

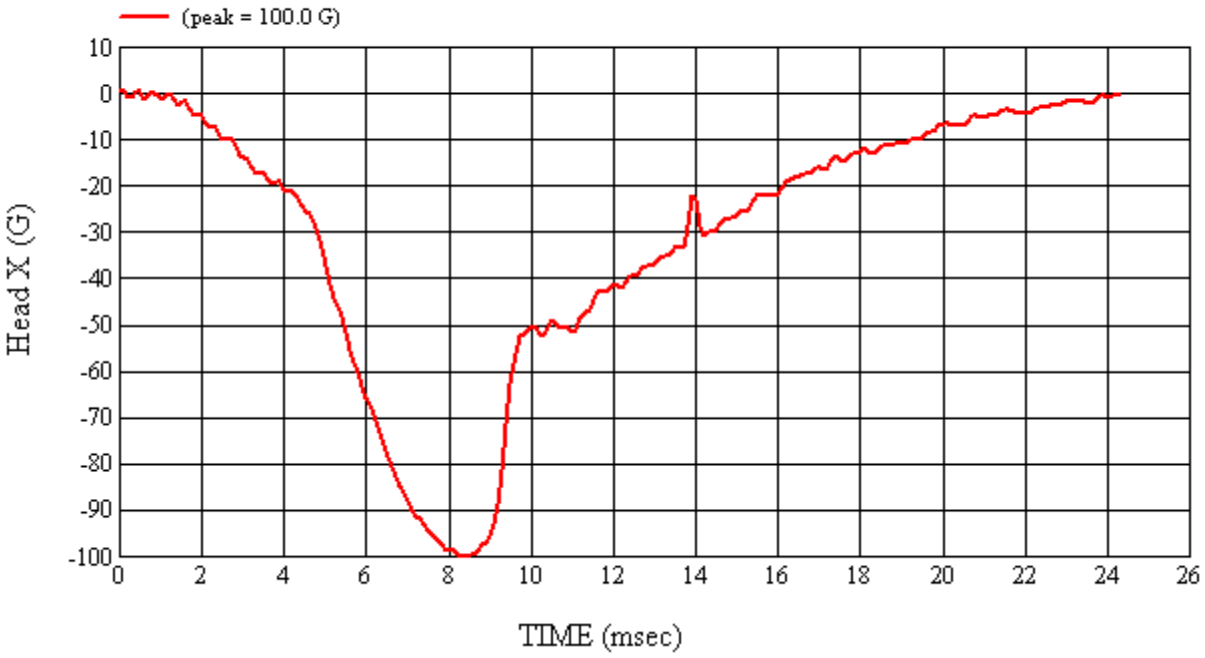
Recorded By: _____ Approved By*: _____ Date: 3/25/2011

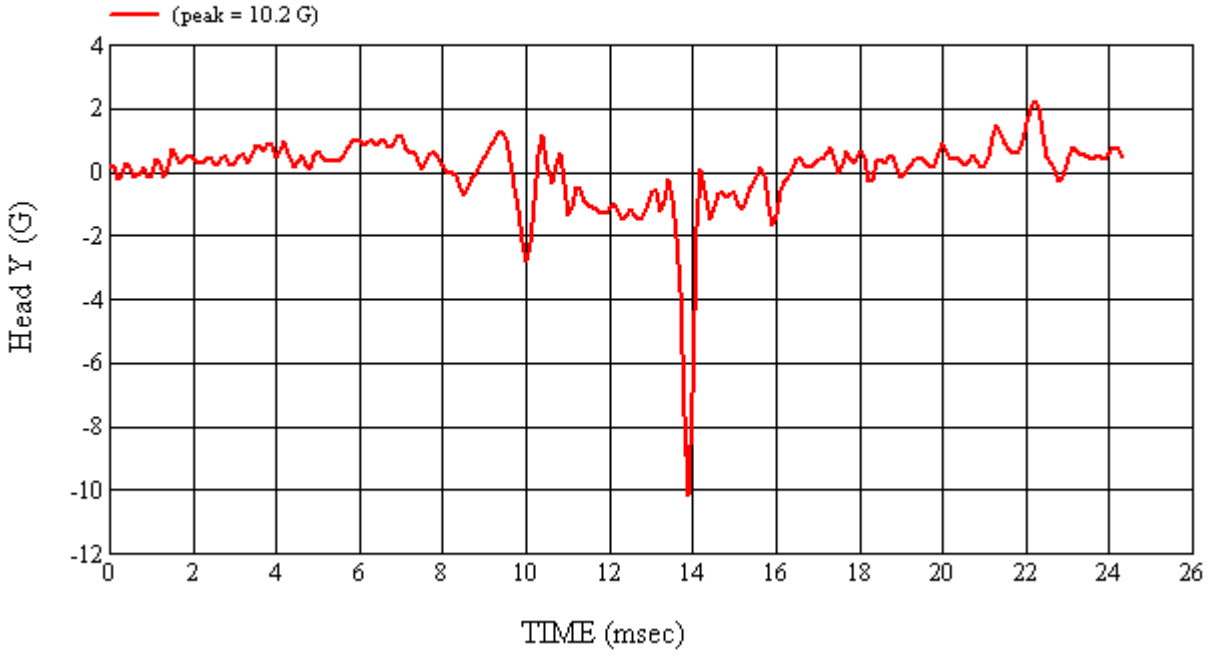
*Only necessary for NHTSA (Government) Compliance testing.

MGA Test #: U11078 Target Location: BP1, Right Side Test Date: 3/25/2011

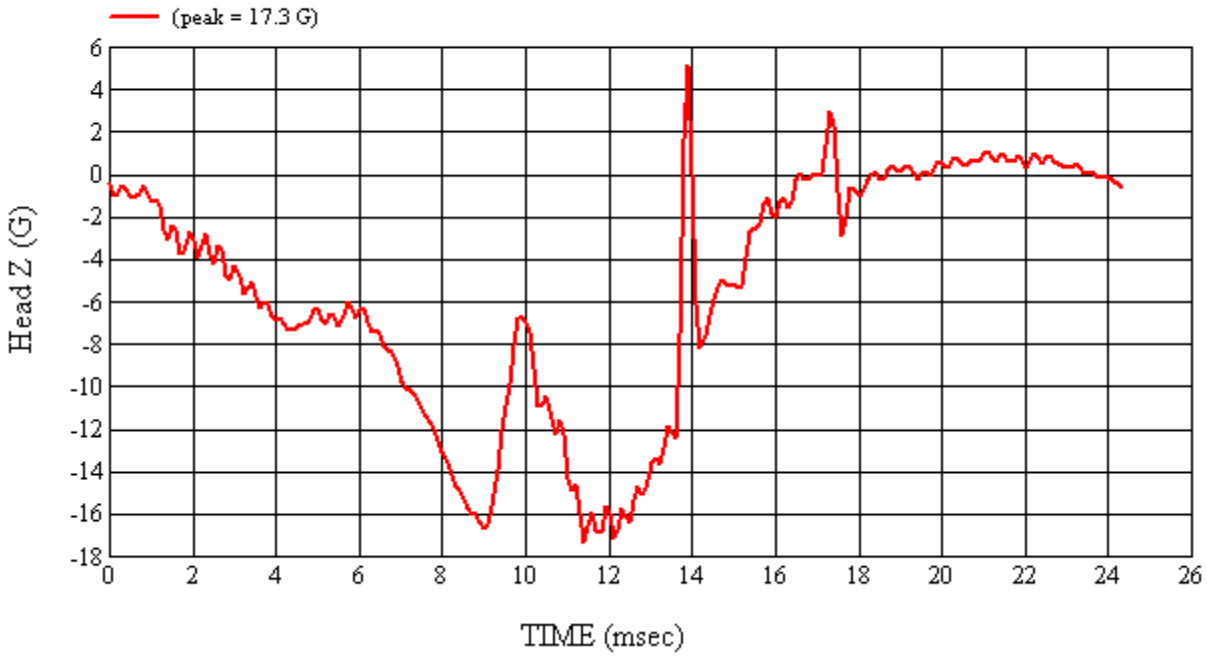


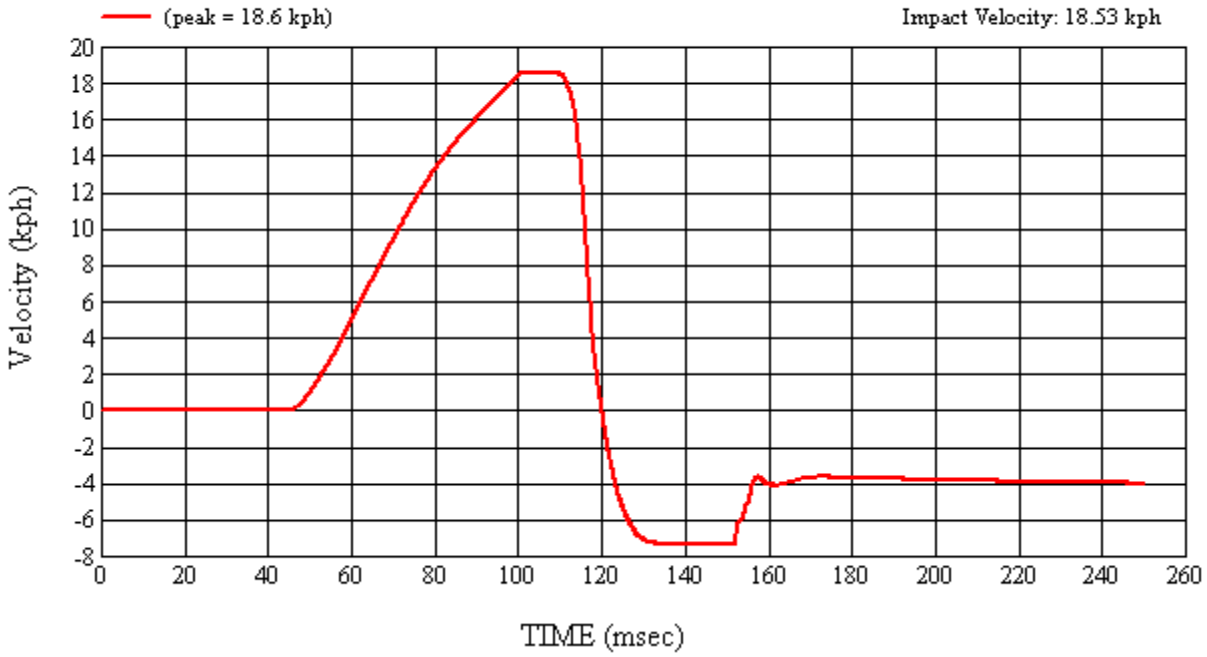


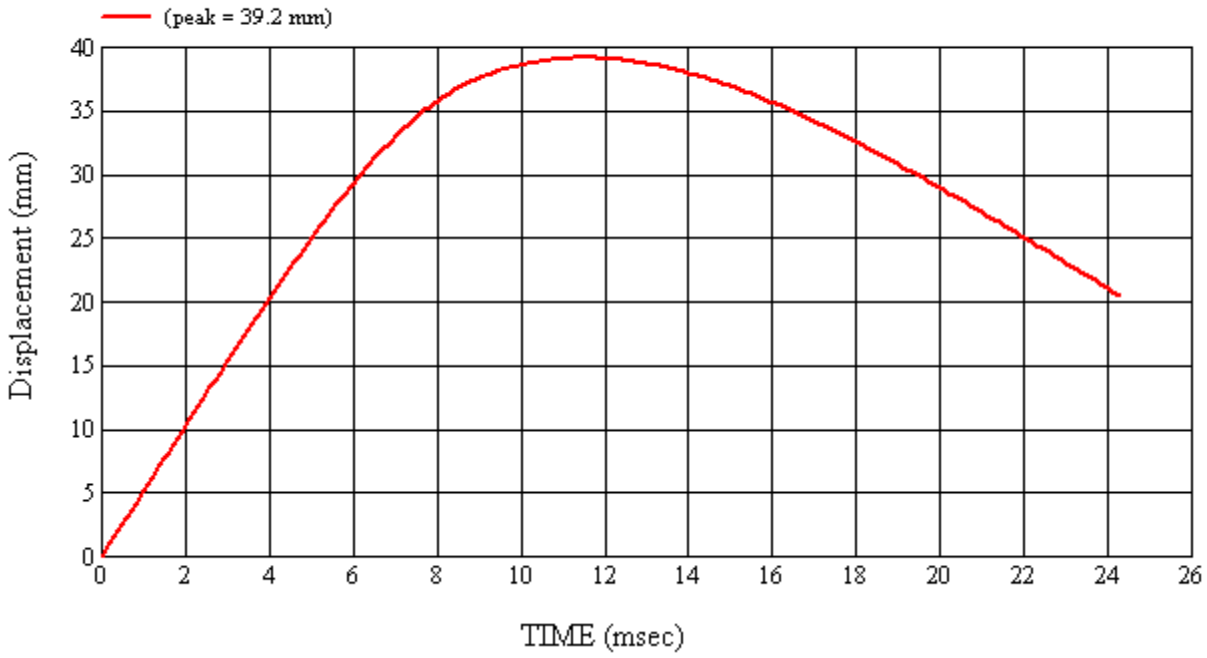

(peak = 100.0 G)
Head X (G)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 10.2 G)
Head Y (G)
4
2
0
-2
-4
-6
-8
-10
-12
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

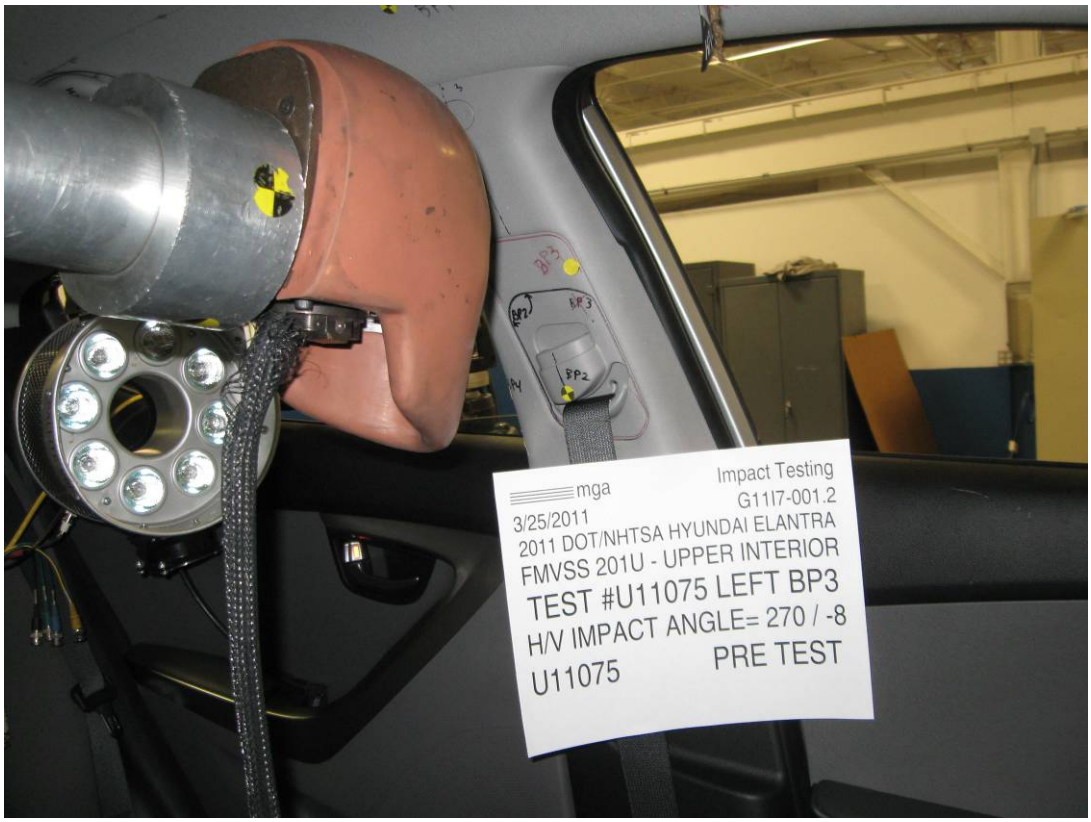
F


(peak = 17.3 G)
Head Z (G)
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)


(peak = 18.6 kph)
Impact Velocity: 18.53 kph
Velocity (kph)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 39.2 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
22
24
26
TIME (msec)

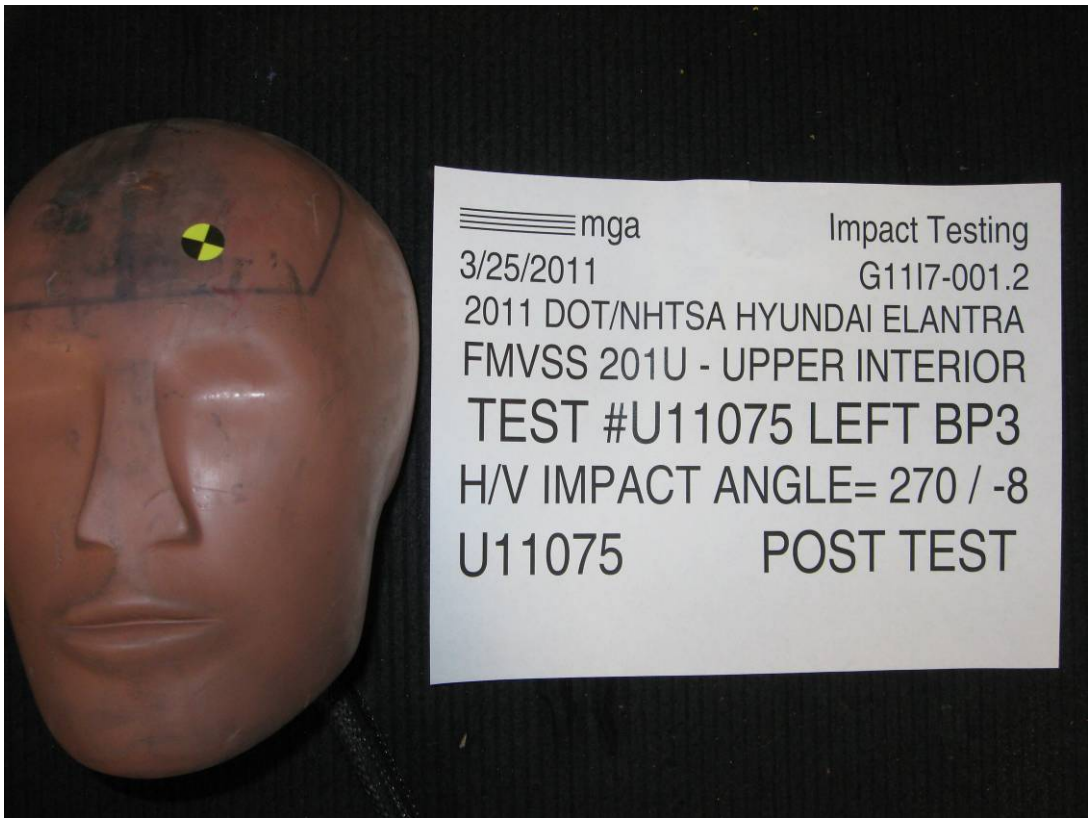

mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11075 LEFT BP3
H/V IMPACT ANGLE= 270 / -8
U11075
PRE TEST


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11075 LEFT BP3
H/V IMPACT ANGLE= 270 / -8
U11075
PRE TEST


mga
3/25/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11075 LEFT BP3
H/V IMPACT ANGLE= 270 / -8
U11075
POST TEST


BP3
BP2
mga
3/25/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11075 LEFT BP3
H/V IMPACT ANGLE= 270 / -8
U11075
POST TEST


BP3
BP2


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11075 LEFT BP3
H/V IMPACT ANGLE= 270 / -8
U11075
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11075

Target (Vehicle Side): BP3Left

Temperature:22.2C

MGA Test Reference No.:U11075

Humidity:16.4%

Approach Horizontal Angles:270º

Time of Test:9:26:06 AM

Approach Vertical Angles:-8º

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
572	537	9.7	24.1	16	22 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J32177	-113.7	1.07	1.07
Y	6	J14103	93.9	0.85	0.85
Z	7	J35800	97.8	0.94	0.94

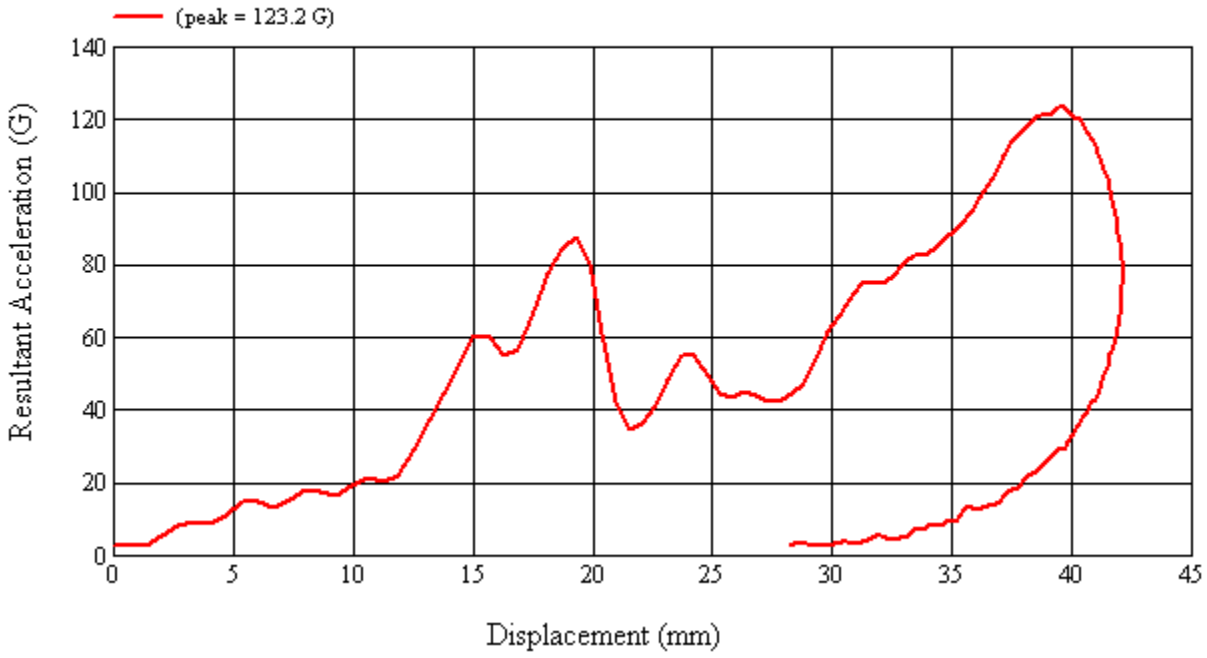
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

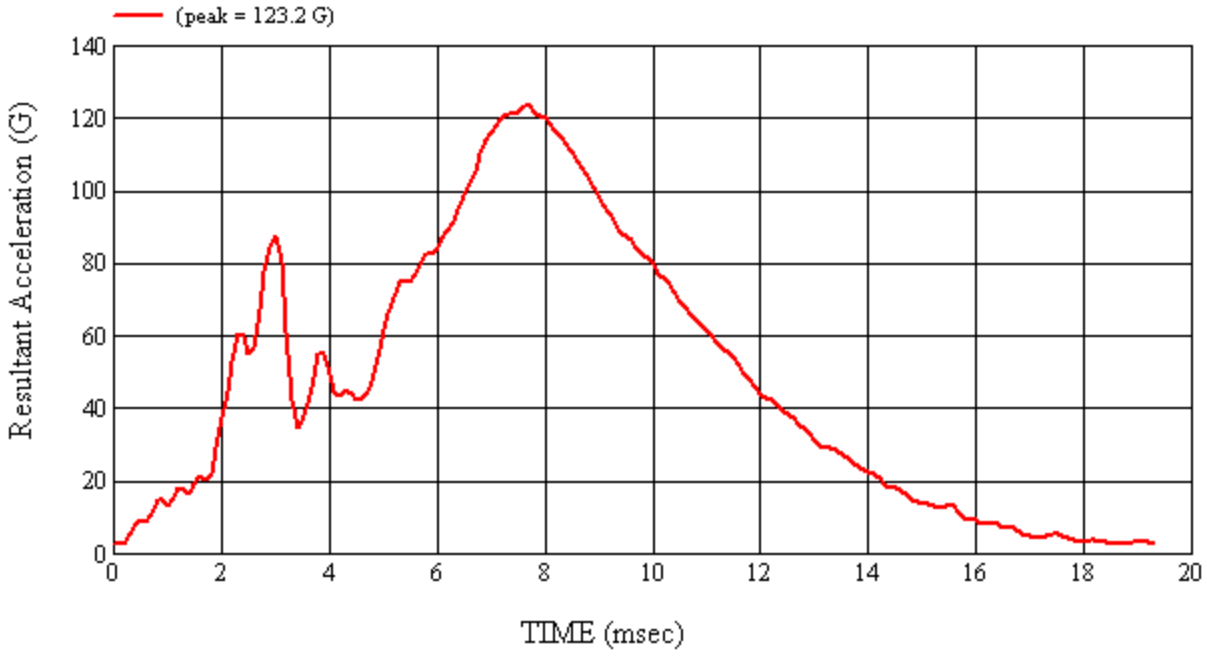
Cracked trim

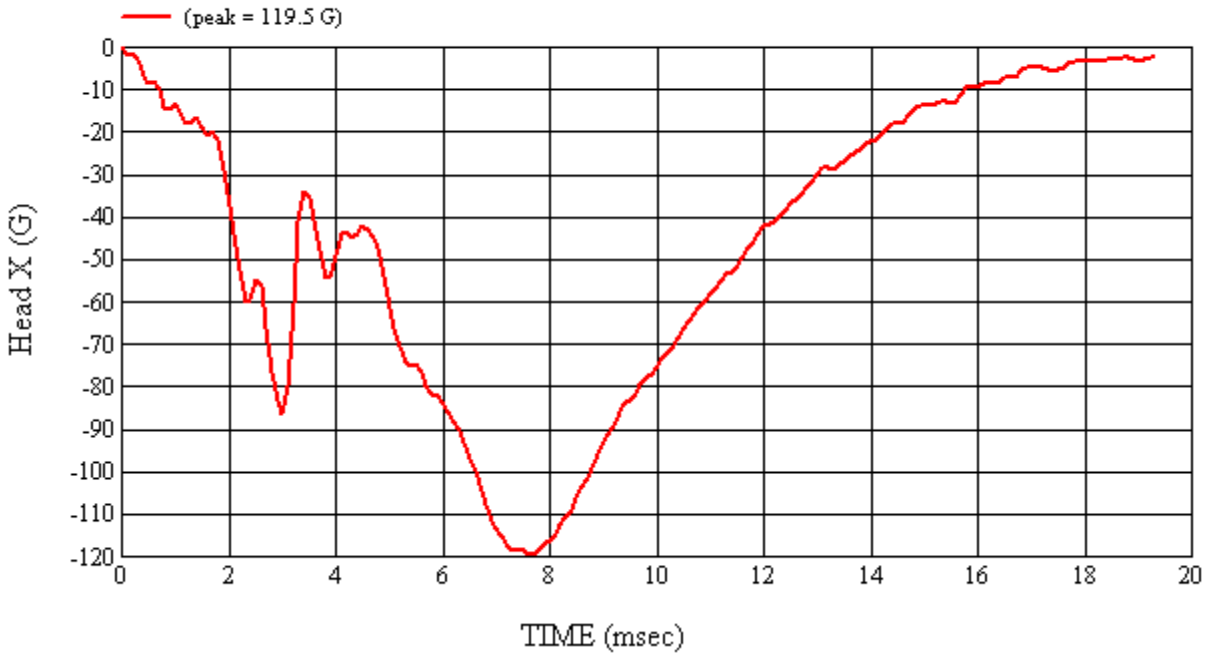
Recorded By: _____ Approved By*: _____ Date: 3/25/2011

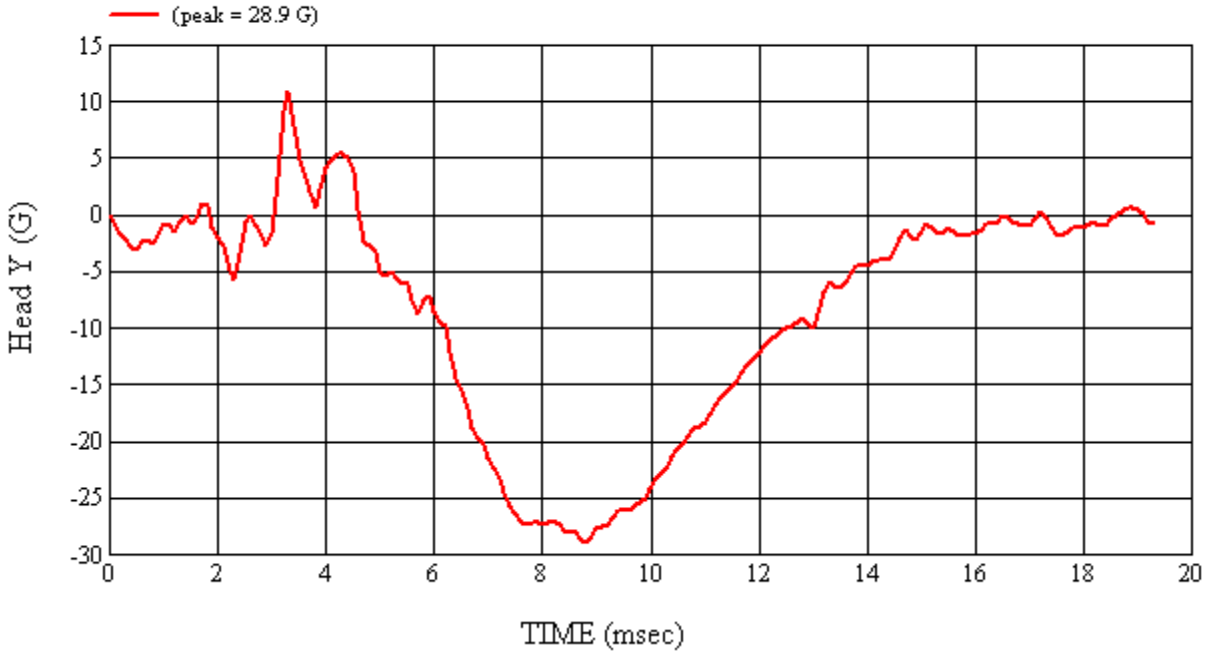
*Only necessary for NHTSA (Government) Compliance testing.

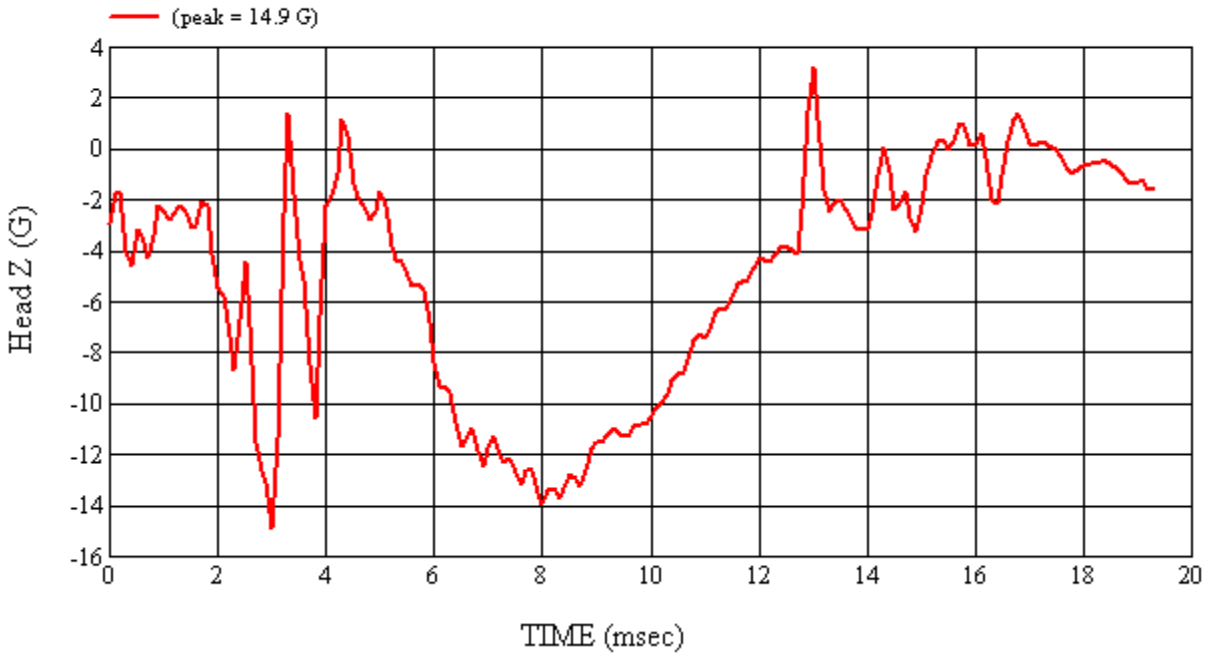
MGA Test #: U11075 Target Location: BP3, Left Side Test Date: 3/25/2011

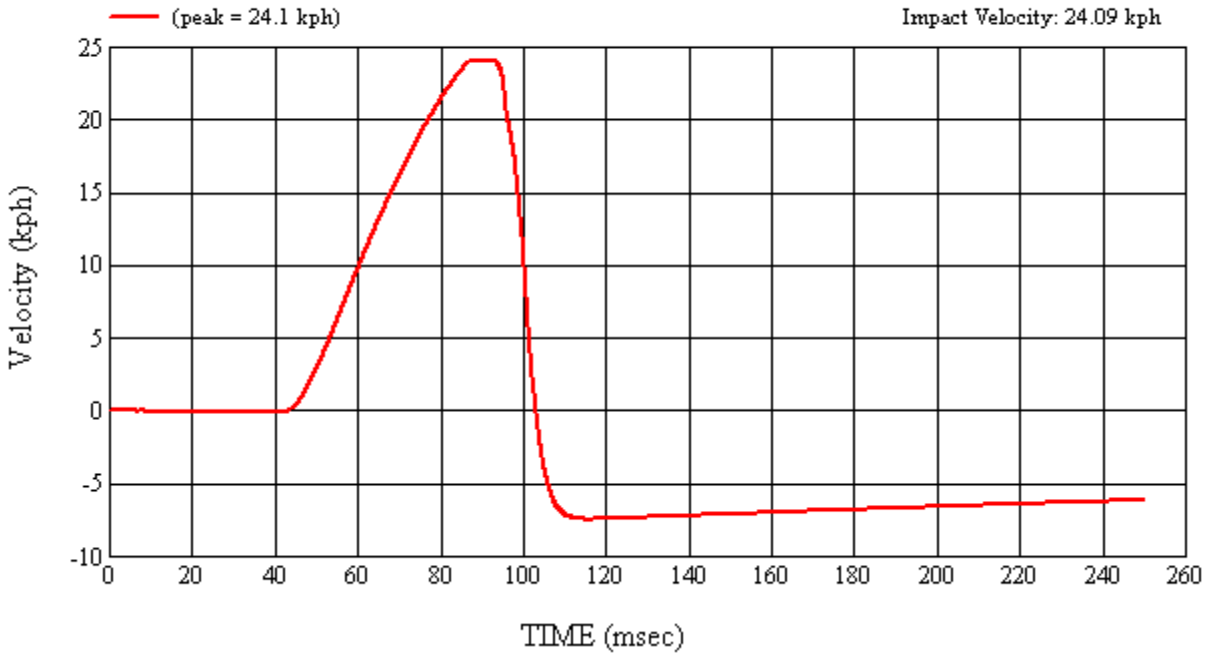


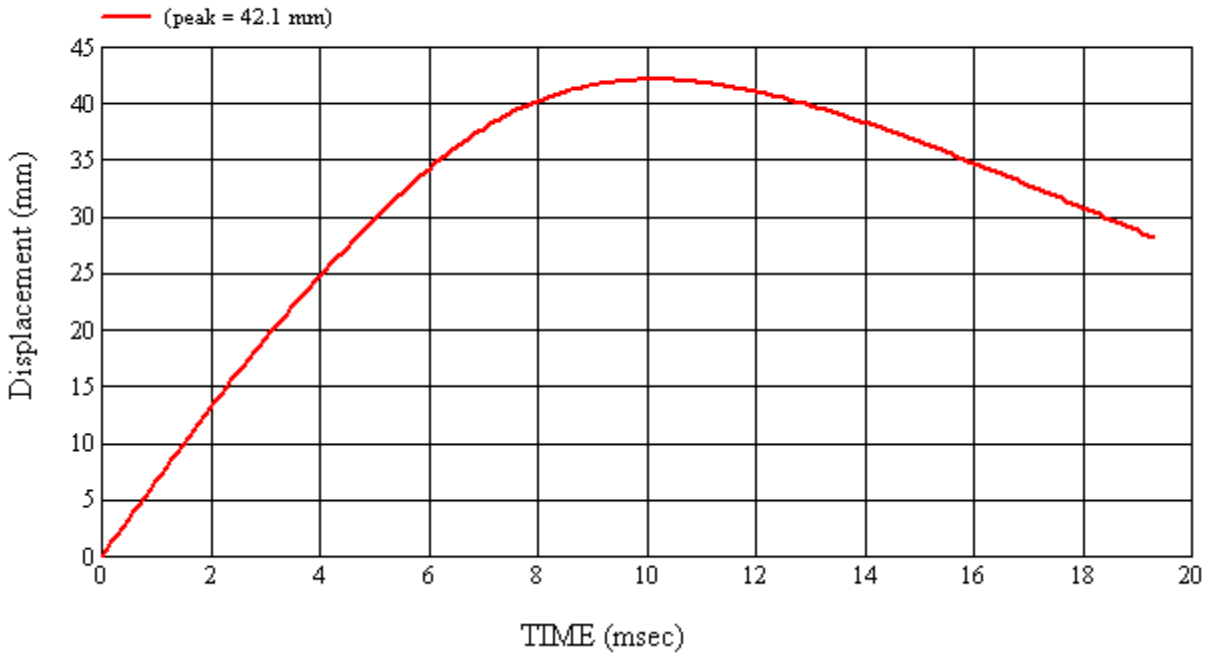



(peak = 119.5 G)
Head X (G)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 28.9 G)
Head Y (G)
15
10
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 14.9 G)
Head Z (G)
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 24.1 kph)
Impact Velocity: 24.09 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 42.1 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

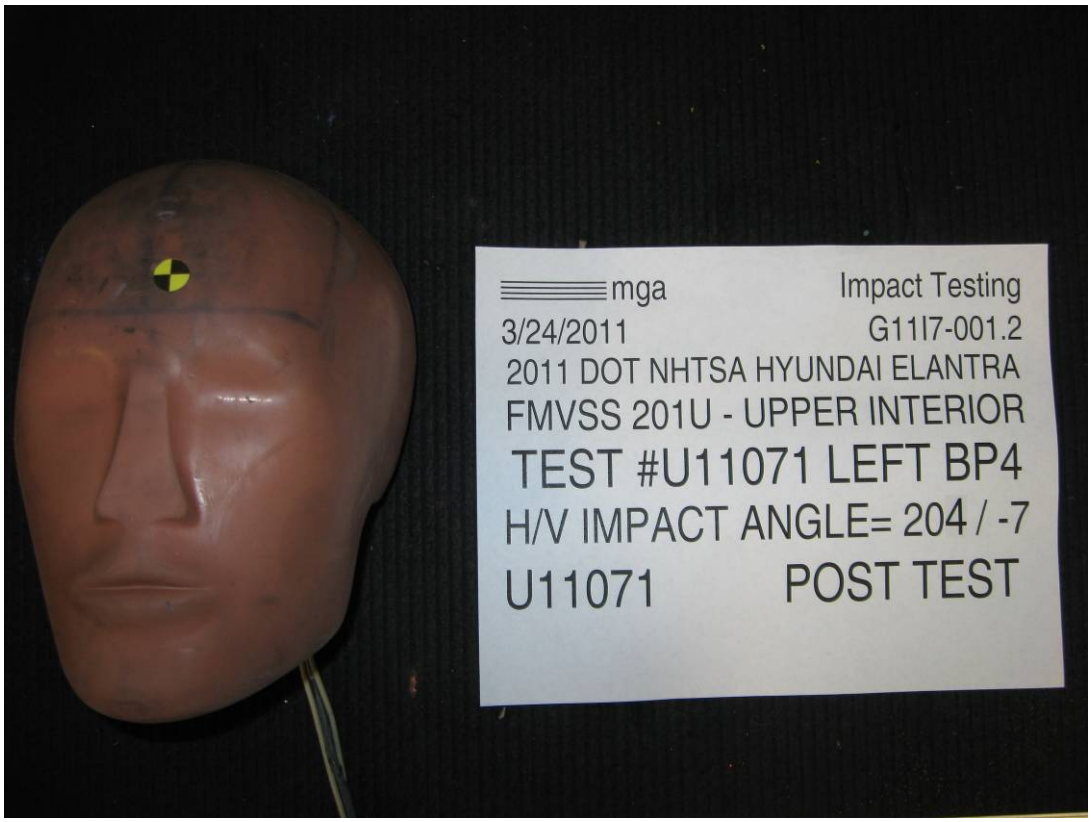

CB0509
U11071
LEFT BP4
H/V 204/-7
mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11071 LEFT BP4
H/V IMPACT ANGLE= 204/-7
U11071
PRE TEST


mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11071 LEFT BP4
H/V IMPACT ANGLE= 204/-7
U11071
PRE TEST


H/V 204/-7
mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11071 LEFT BP4
H/V IMPACT ANGLE= 204 / -7
U11071
POST TEST


mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11071 LEFT BP4
H/V IMPACT ANGLE= 204 / -7
U11071
POST TEST


BP4


mga
Impact Testing
3/24/2011
G11I7-001.2
2011 DOT NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11071 LEFT BP4
H/V IMPACT ANGLE= 204 / -7
U11071
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11071

Target (Vehicle Side): BP4Left

Temperature:22.6C

MGA Test Reference No.:U11071

Humidity:21.5%

Approach Horizontal Angles:204º

Time of Test:1:39:48 PM

Approach Vertical Angles:-7º

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
842	896	3.4	23.7	13	8 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.8	1.07	1.07
Y	6	J22664	94.2	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

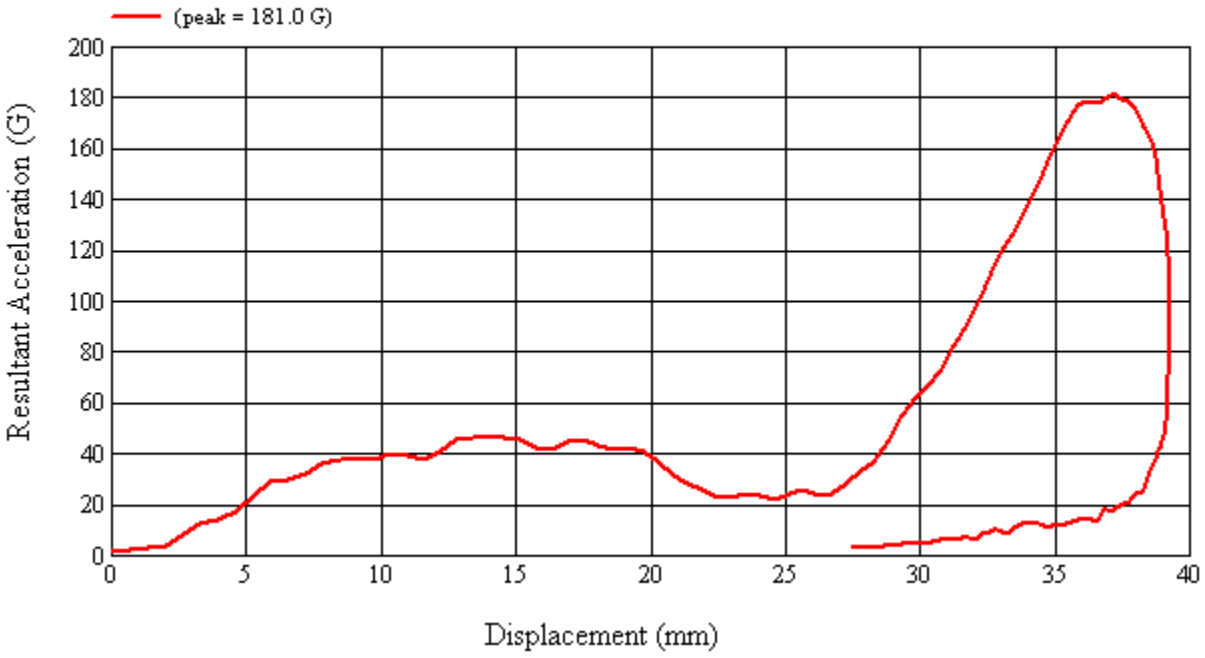
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

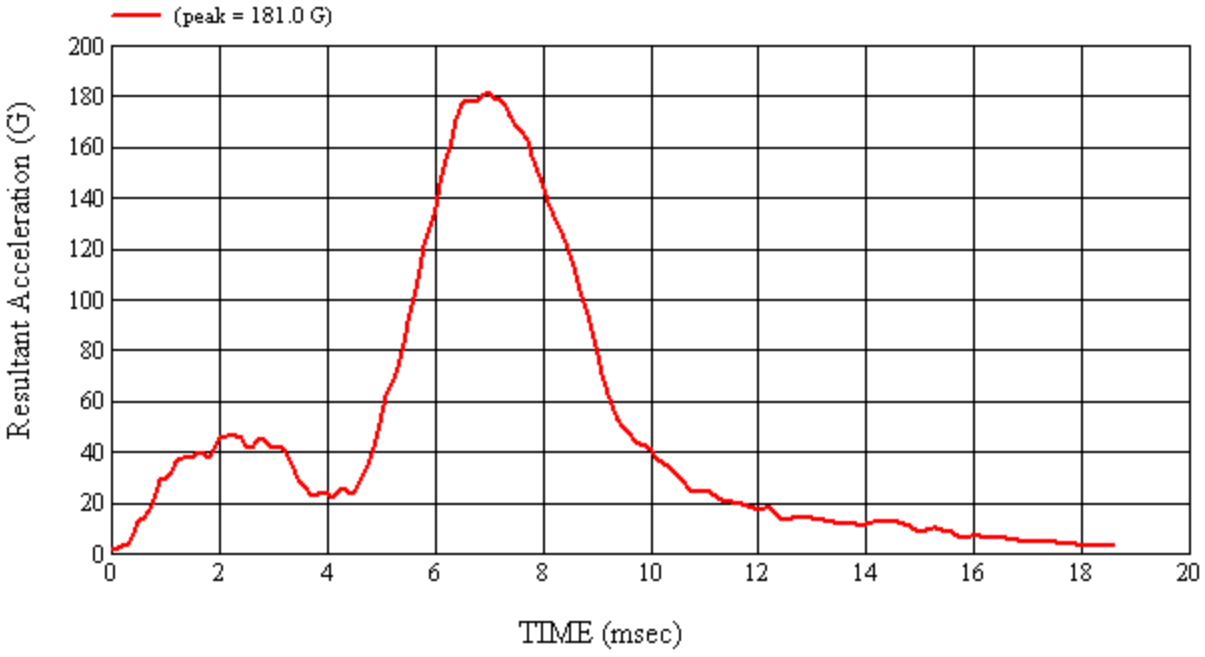
Cracked trim.

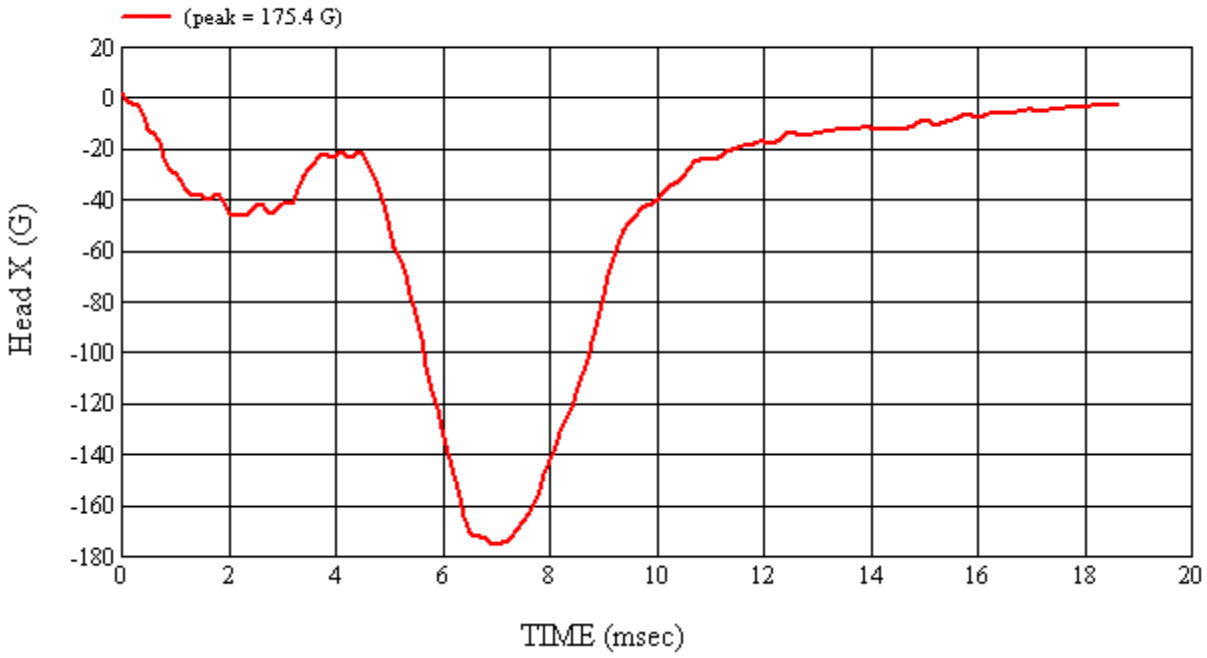
Recorded By: _____ Approved By*: _____ Date: 3/24/2011

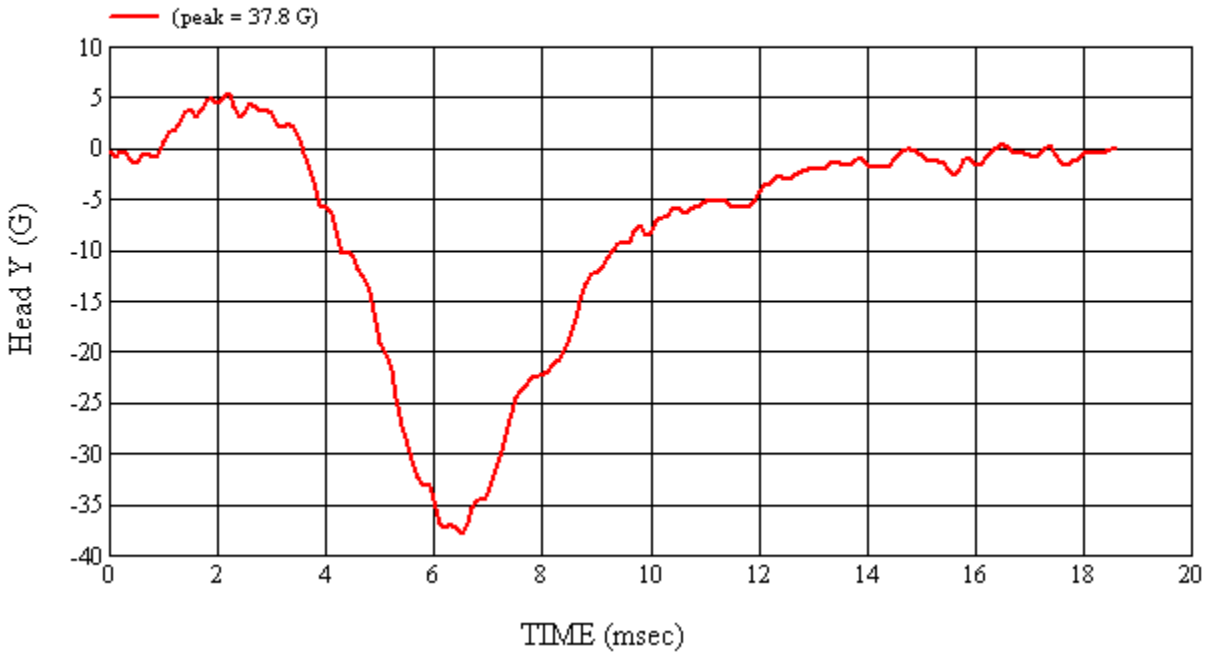
*Only necessary for NHTSA (Government) Compliance testing.

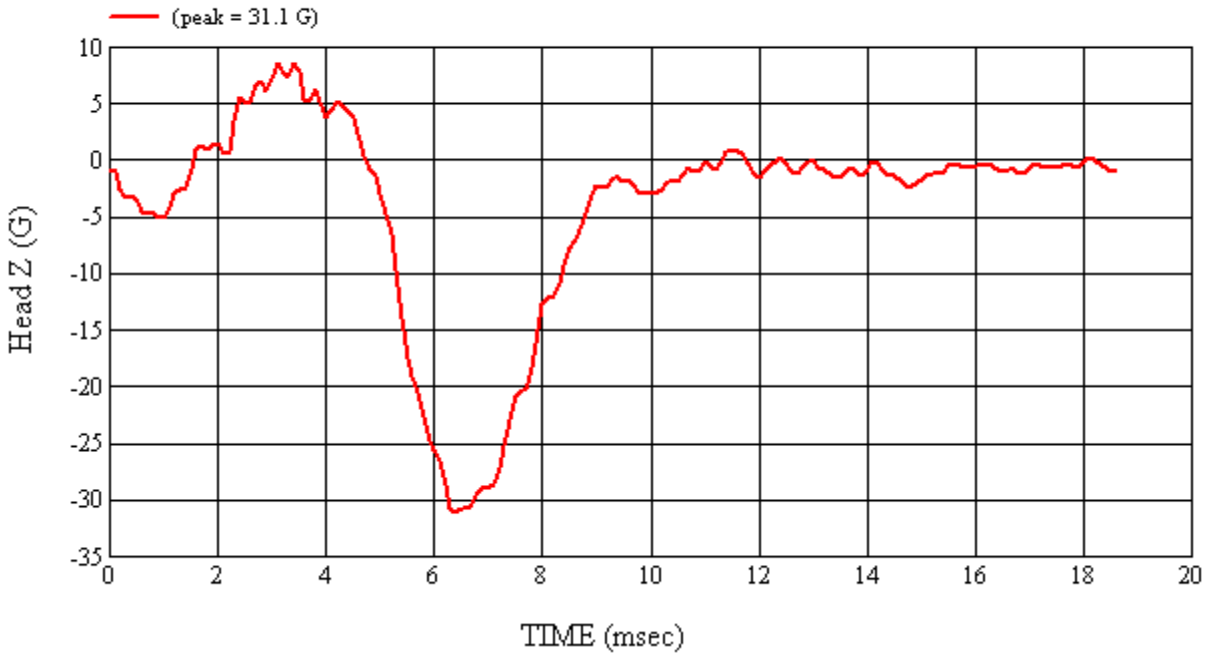
MGA Test #: U11071 Target Location: BP4, Left Side Test Date: 3/24/2011

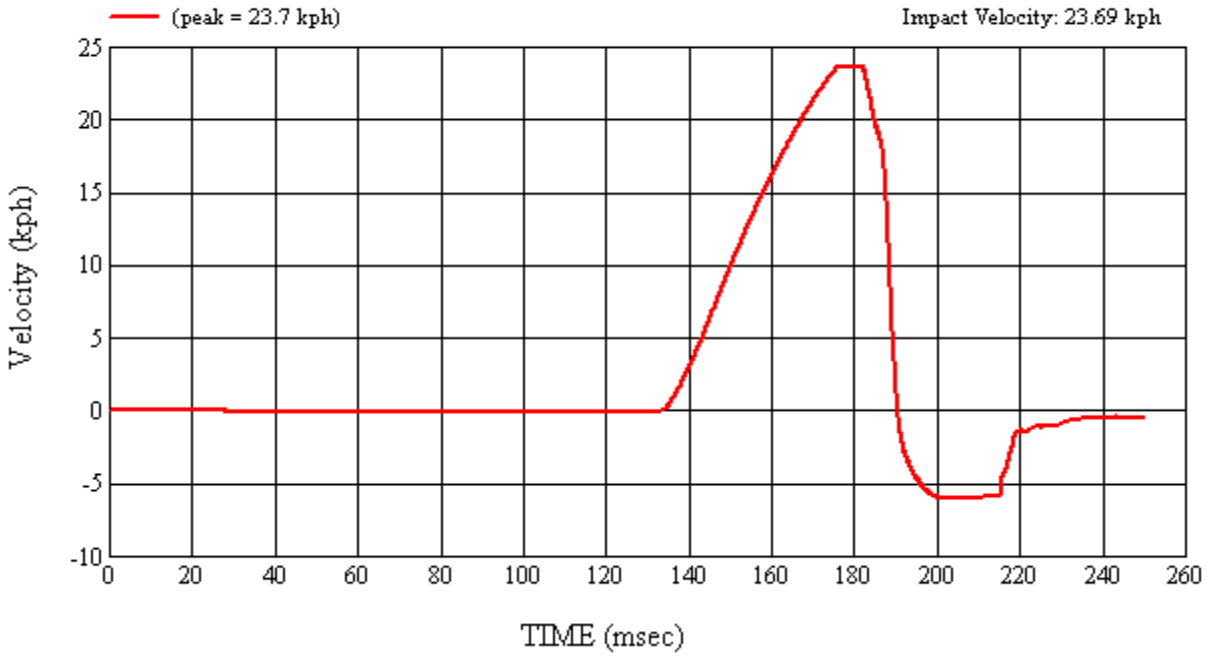


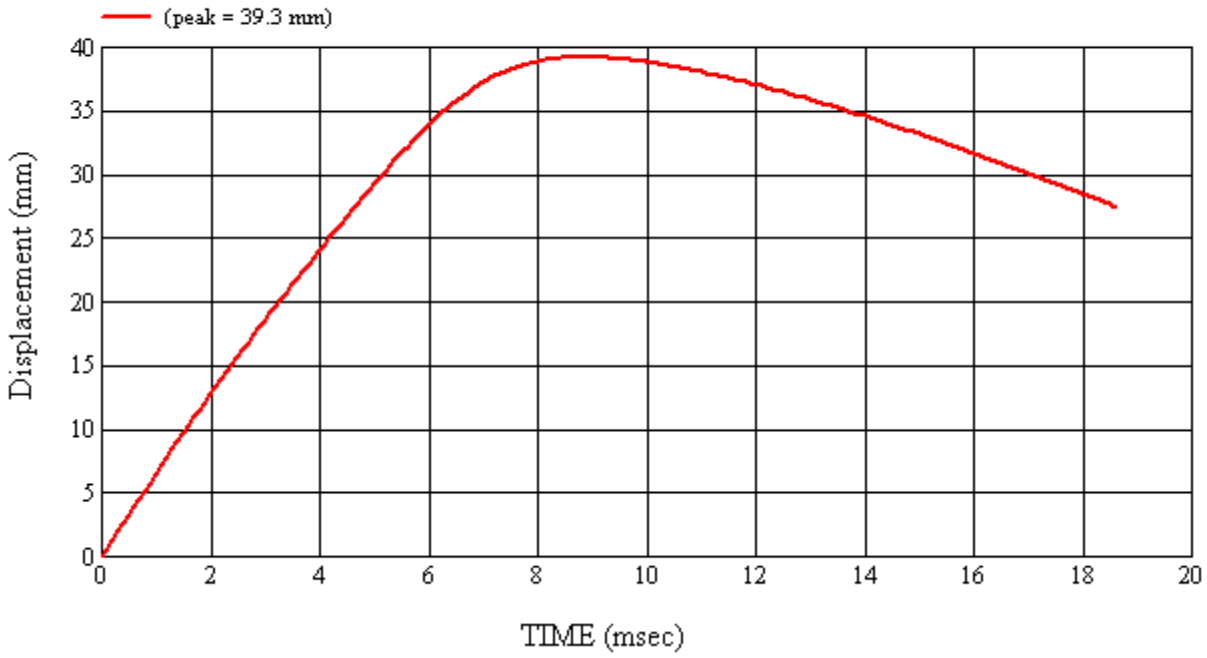



(peak = 175.4 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 37.8 G)
Head Y (G)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 31.1 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 23.7 kph)
Impact Velocity: 23.69 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 39.3 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


CB0509
U11073
LEFT FH1
H/V 180/50
mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11073 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U11073
PRE TEST


CB0509
U11073
LEFT FH1
H/V 180/50
mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11073 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U11073
PRE TEST


CB0509
U11073
LEFT FH1
H/V 180/50
mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11073 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U11073
POST TEST


mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11073 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U11073
POST TEST


FH1


mga
Impact Testing
3/24/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11073 LEFT FH1
H/V IMPACT ANGLE= 180 / 50
U11073
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11073

Target (Vehicle Side): FH1Left

Temperature:22.6C

MGA Test Reference No.:U11073

Humidity:20.3%

Approach Horizontal Angles:180º

Time of Test:4:38:10 PM

Approach Vertical Angles:50º

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
428	346	5.5	23.8	42	0

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.4	1.07	1.07
Y	6	J36197	108.7	0.85	0.86
Z	7	J36353	99.1	0.94	0.94

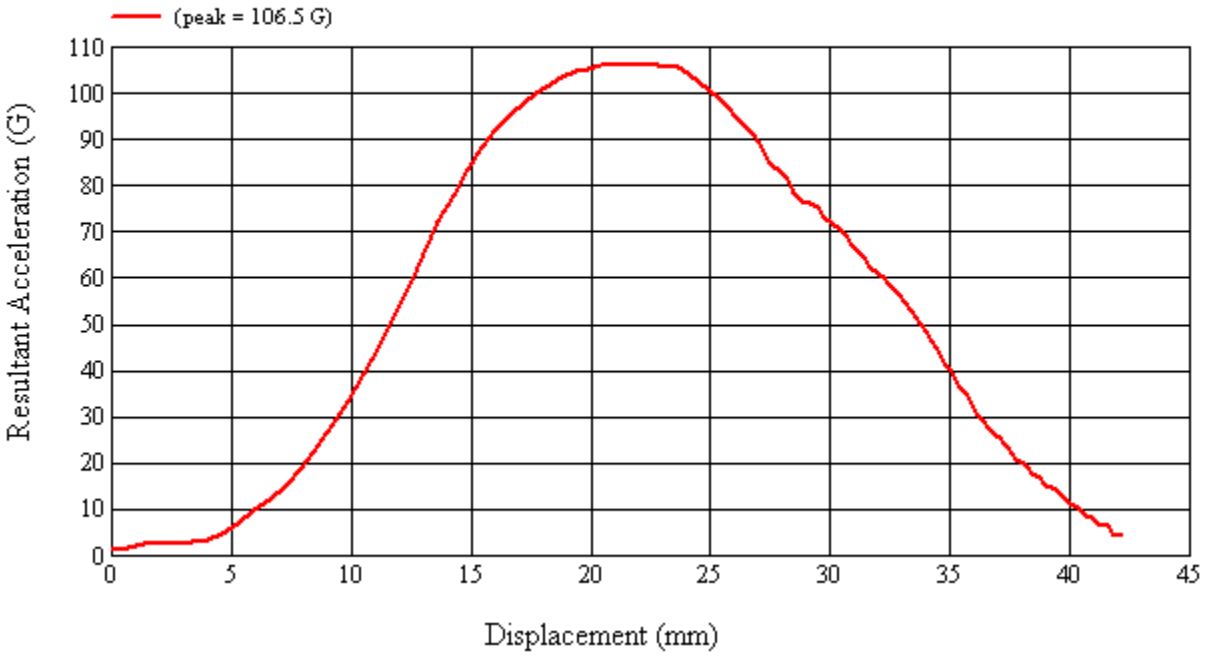
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

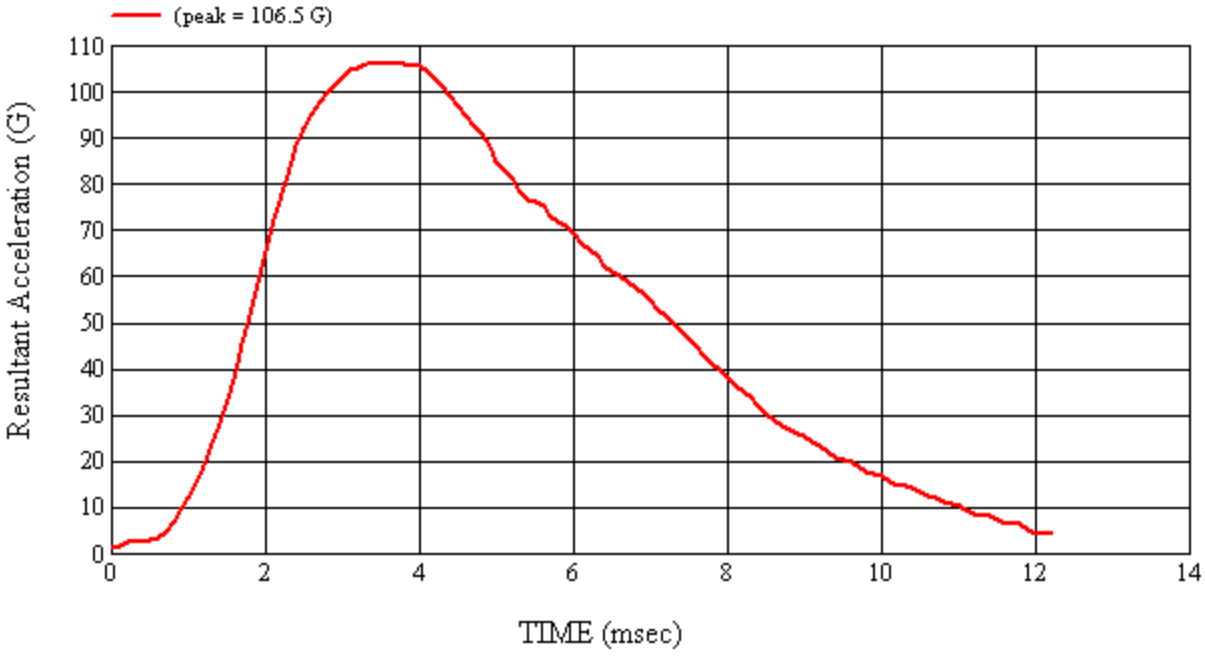
Sunglass holder opened.

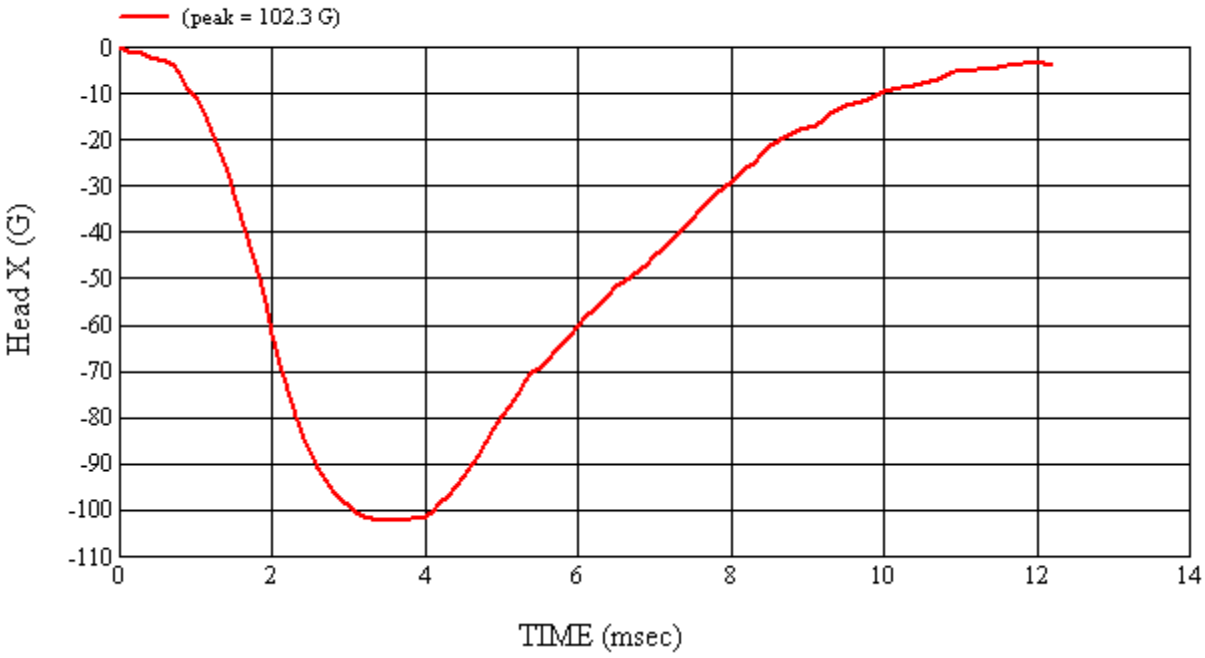
Recorded By: _____ Approved By*: _____ Date: 3/24/2011

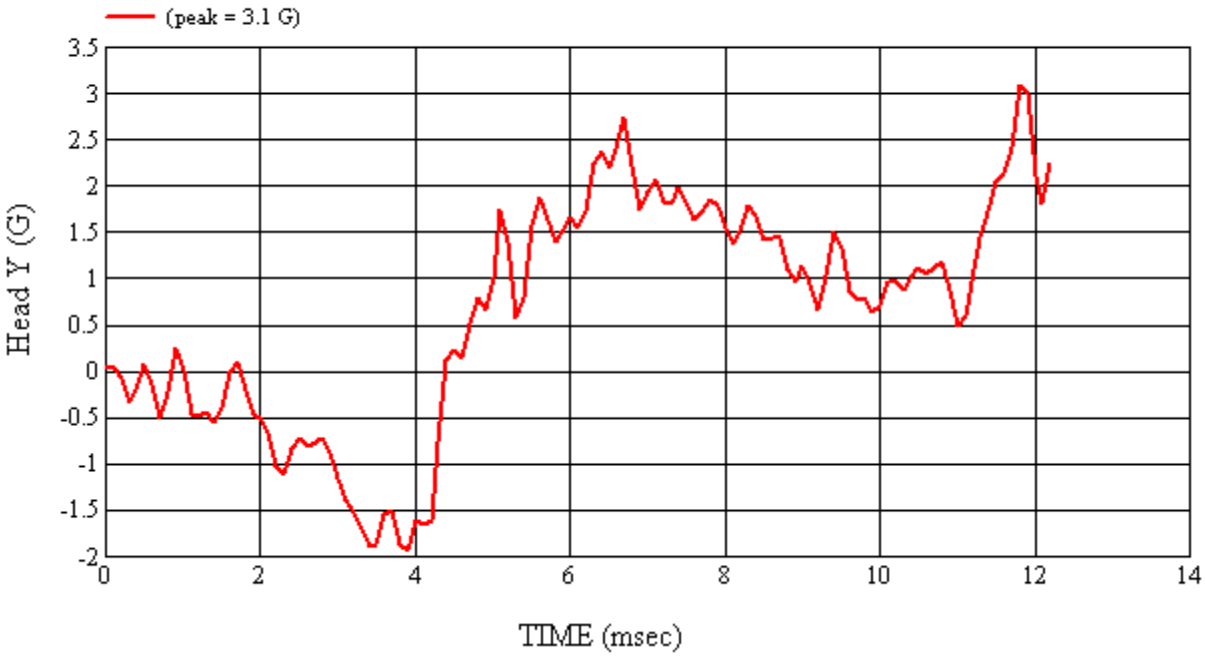
*Only necessary for NHTSA (Government) Compliance testing.

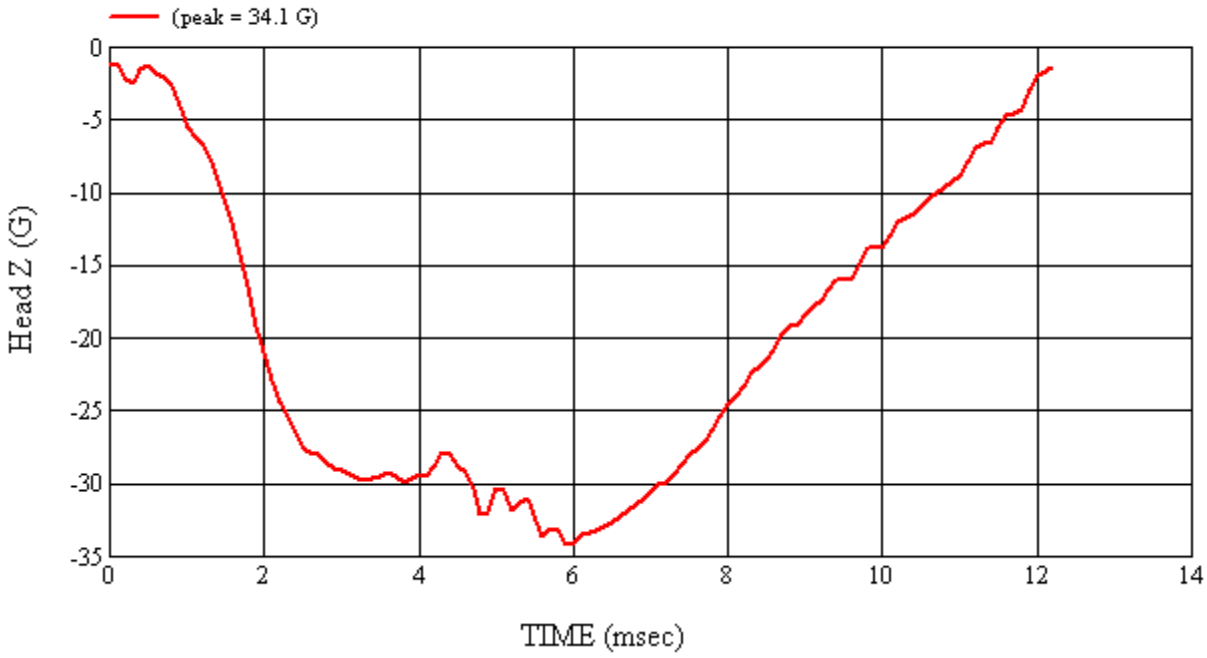
MGA Test #: U11073 Target Location: FH1, Left Side Test Date: 3/24/2011

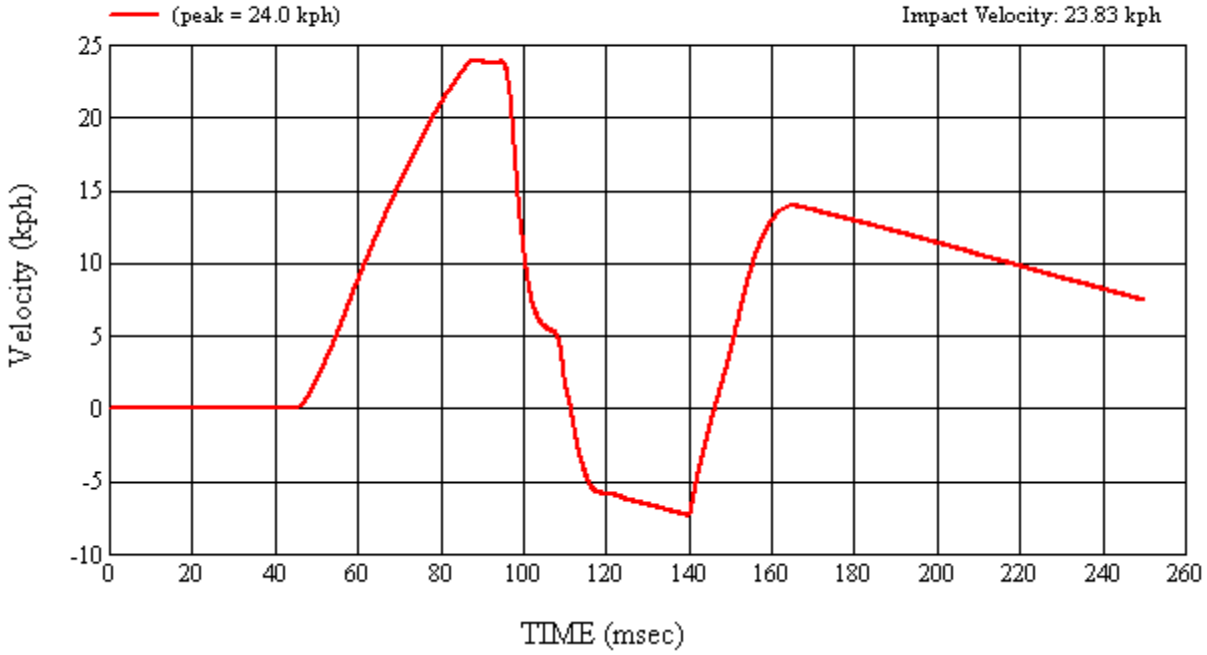


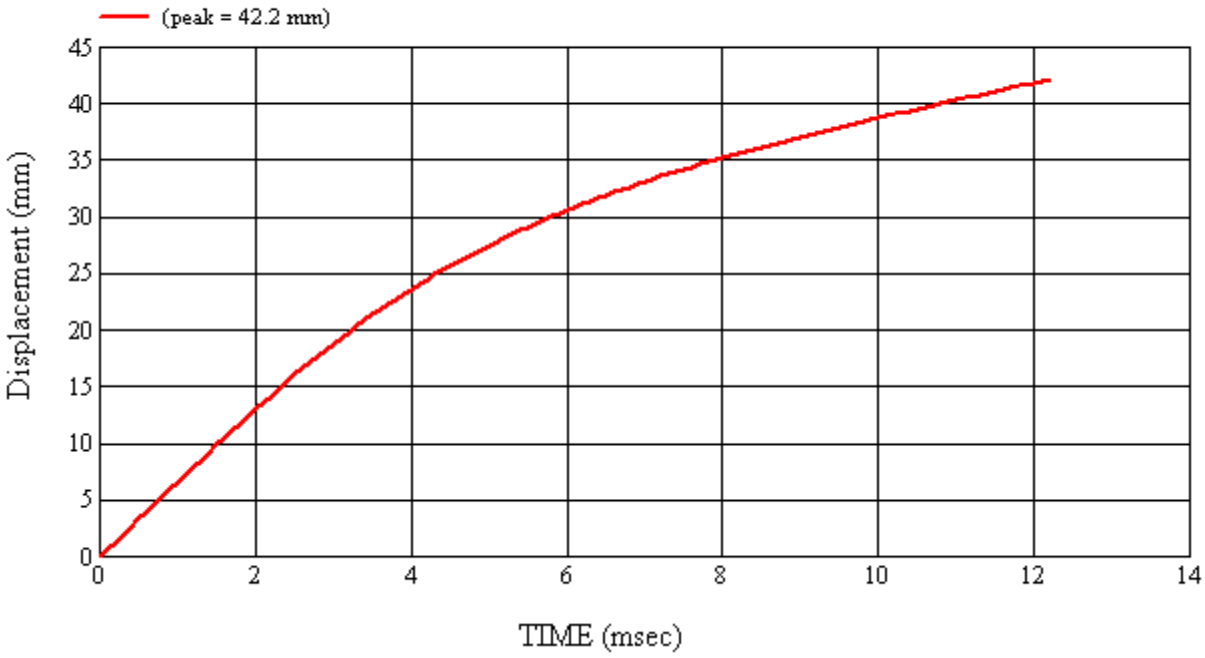



(peak = 102.3 G)
Head X (G)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
0
2
4
6
8
10
12
14
TIME (msec)


(peak = 3.1 G)
Head Y (G)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
2
4
6
8
10
12
14
TIME (msec)

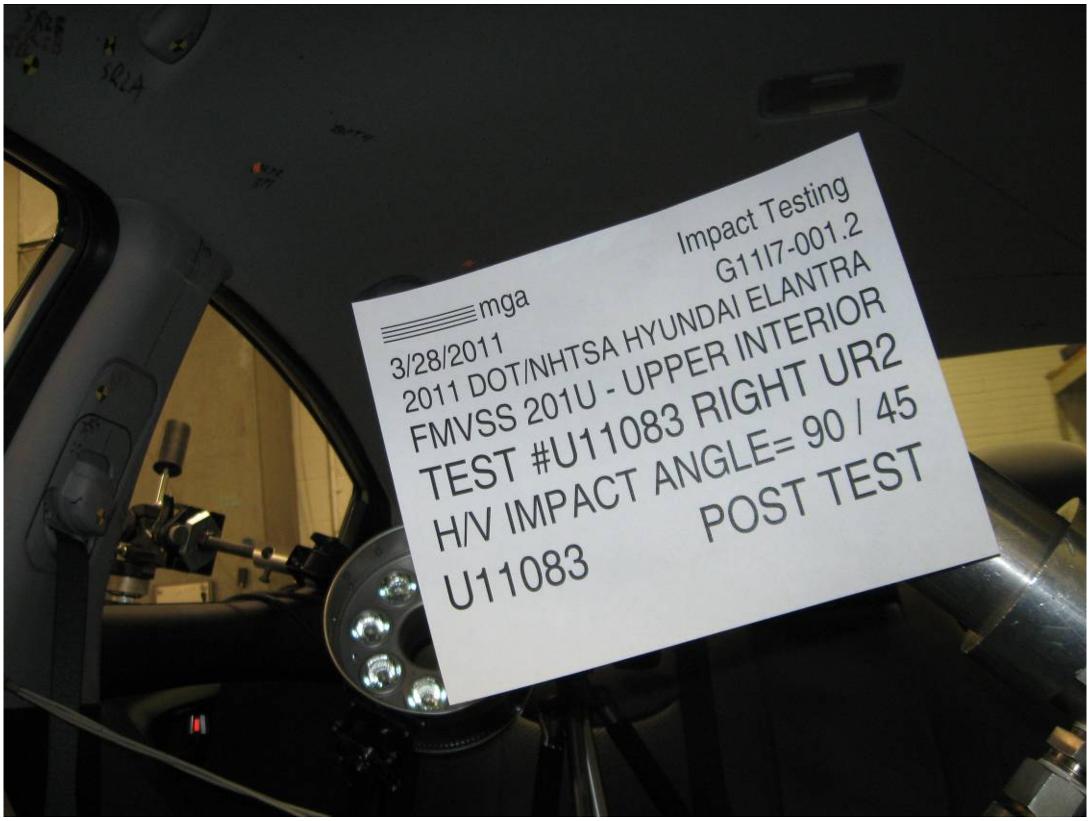

(peak = 34.1 G)
Head Z (G)
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
TIME (msec)

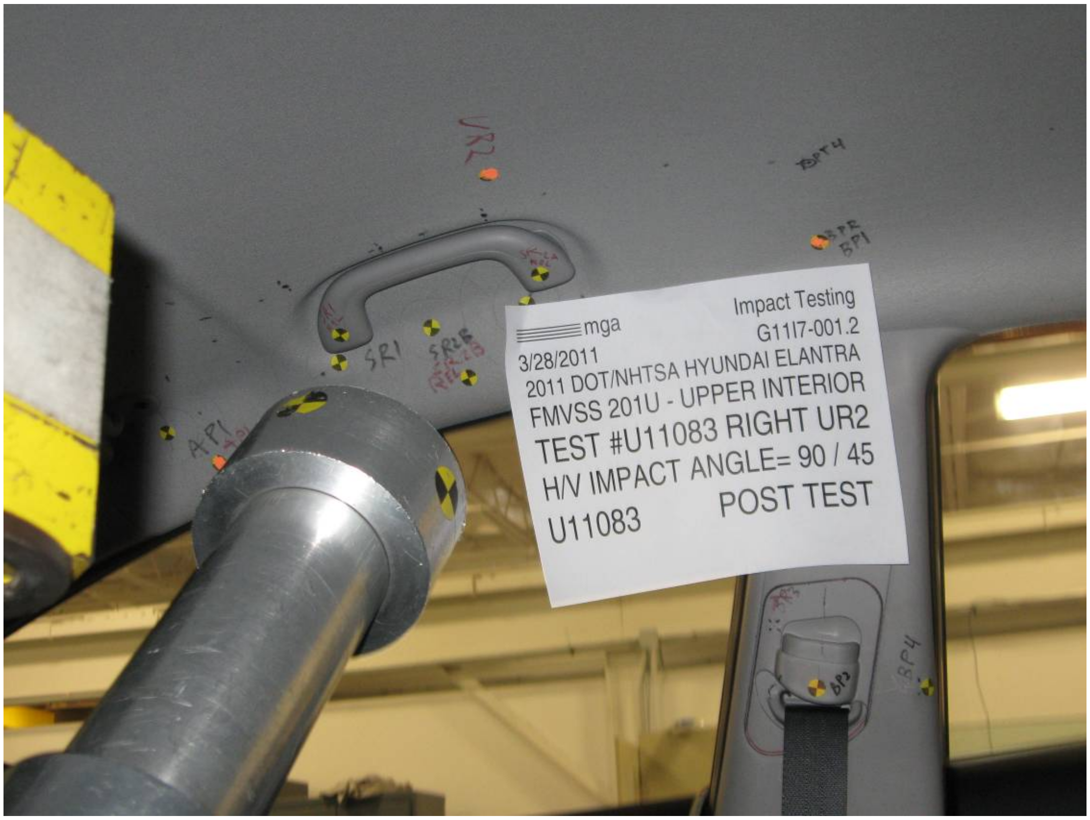

(peak = 24.0 kph)
Impact Velocity: 23.83 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 42.2 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
TIME (msec)


mga
Impact Testing
3/28/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11083 RIGHT UR2
H/V IMPACT ANGLE= 90 / 45
U11083
PRE TEST


mga
Impact Testing
3/28/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11083 RIGHT UR2
H/V IMPACT ANGLE= 90 / 45
U11083
PRE TEST


mga
Impact Testing
G11I7-001.2
3/28/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11083 RIGHT UR2
H/V IMPACT ANGLE= 90 / 45
POST TEST
U11083


mga
Impact Testing
G11I7-001.2
3/28/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11083 RIGHT UR2
H/V IMPACT ANGLE= 90 / 45
POST TEST
U11083


UR2
SR1
SR2B
SR2A
SR2A
REL
SR1
REL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Impact Testing
3/28/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11083 RIGHT UR2
H/V IMPACT ANGLE= 90 / 45
U11083
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11083

Target (Vehicle Side): UR2Right

Temperature:20.9C

MGA Test Reference No.:U11083

Humidity:15.1%

Approach Horizontal Angles:90º

Time of Test:10:18:54 AM

Approach Vertical Angles:45º

FMH Serial No:[035]

Additional Description: @SR2A

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
770	799	8.3	23.7	39	4 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.8	1.07	1.07
Y	6	J22664	94.2	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

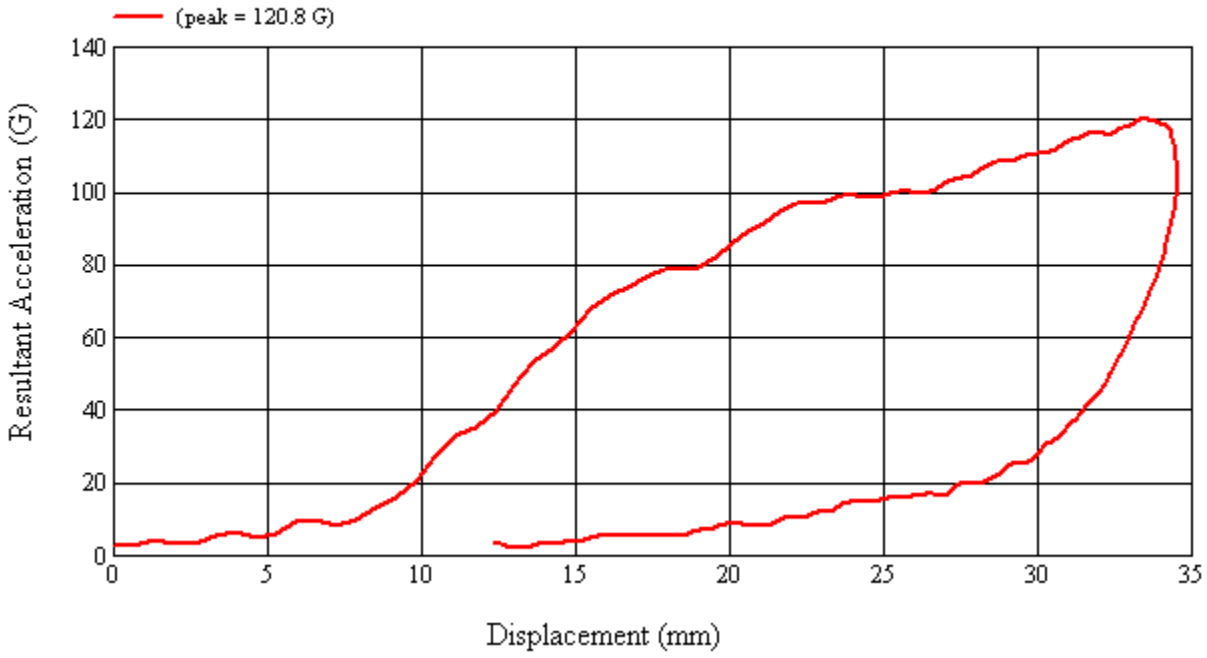
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

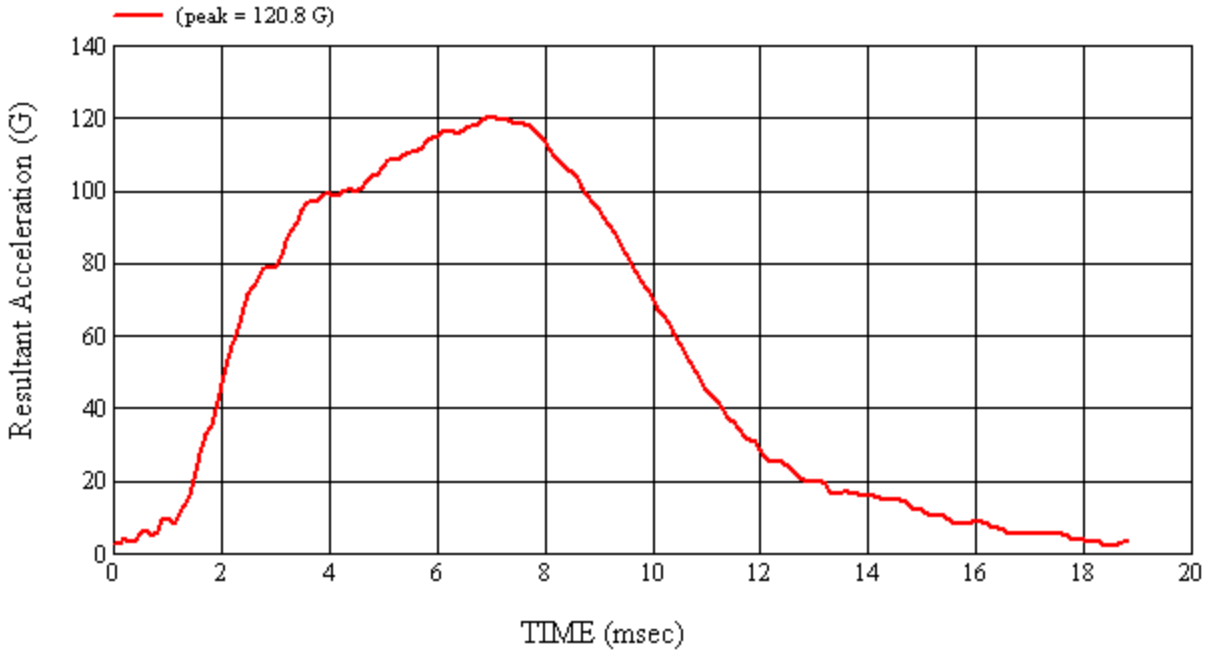
Grab handle compression

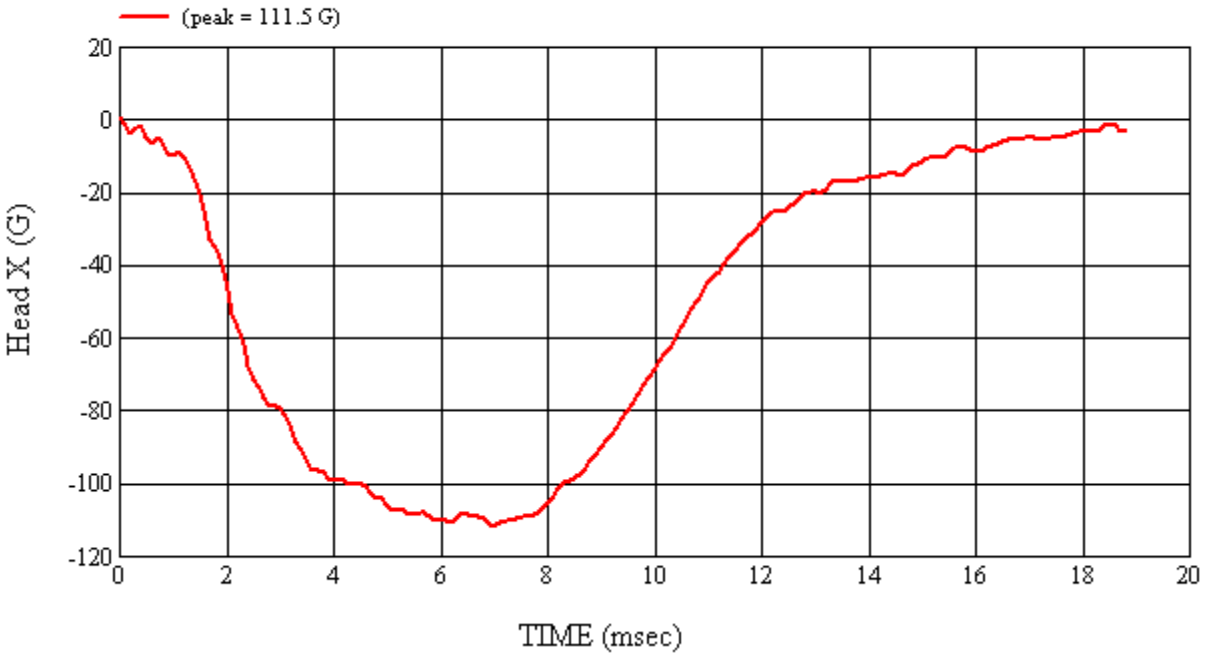
Recorded By: _____ Approved By*: _____ Date: 3/28/2011

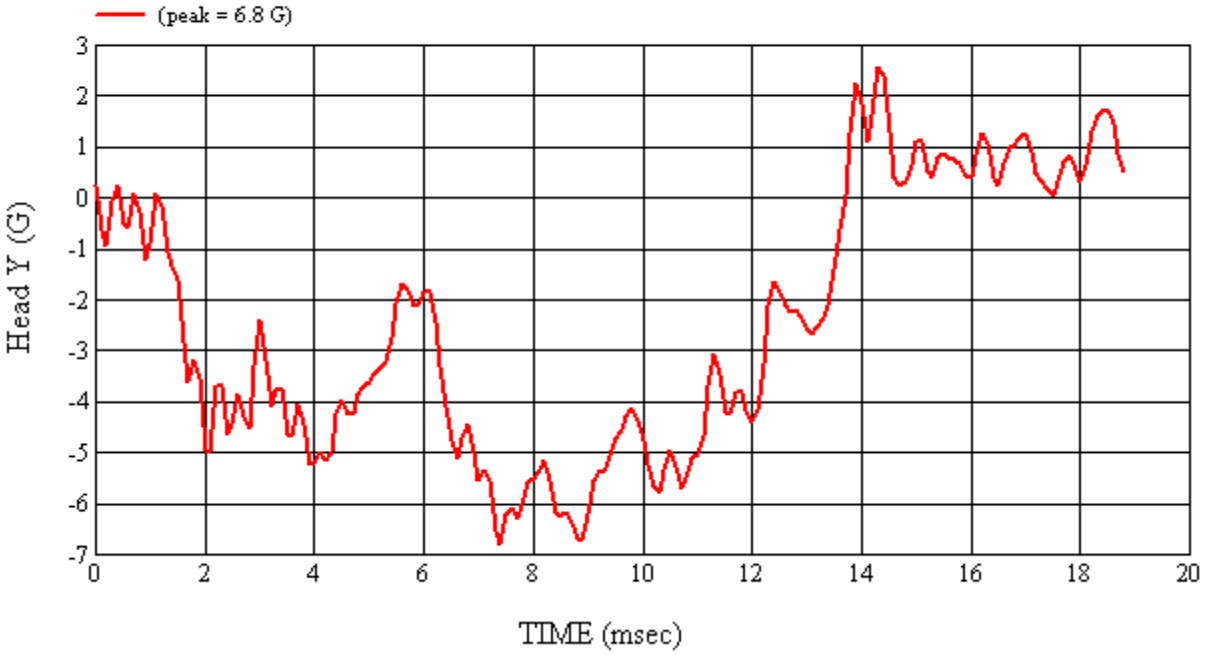
*Only necessary for NHTSA (Government) Compliance testing.

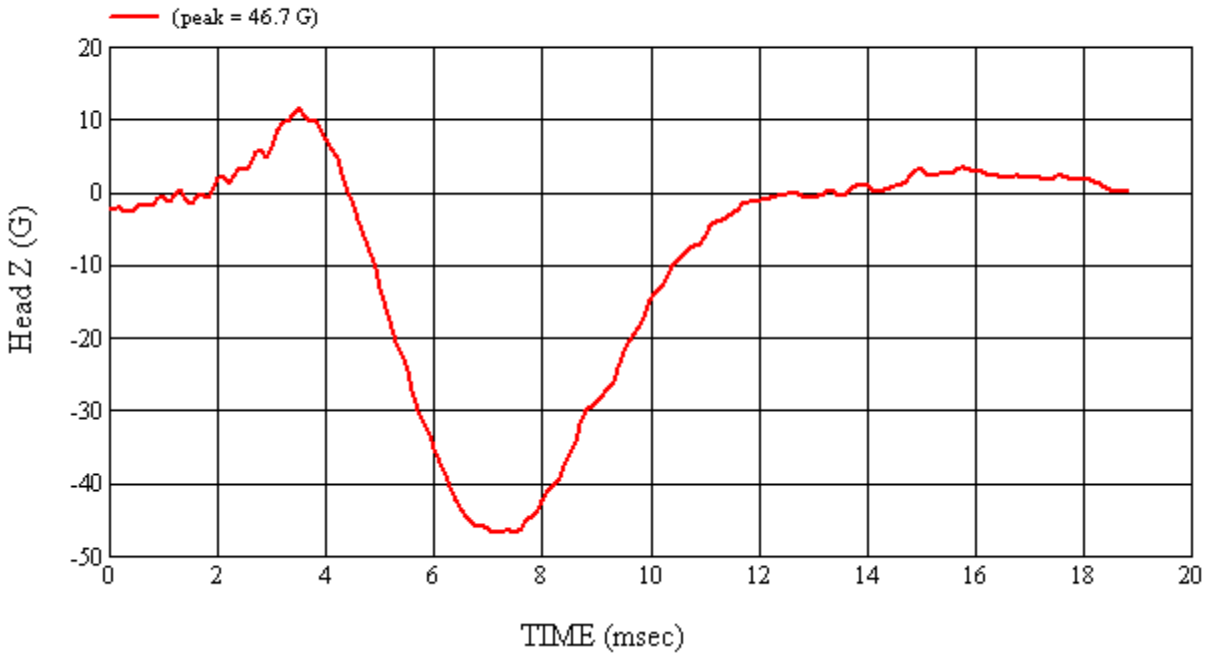
MGA Test #: U11083 Target Location: UR2, Right Side Test Date: 3/28/2011

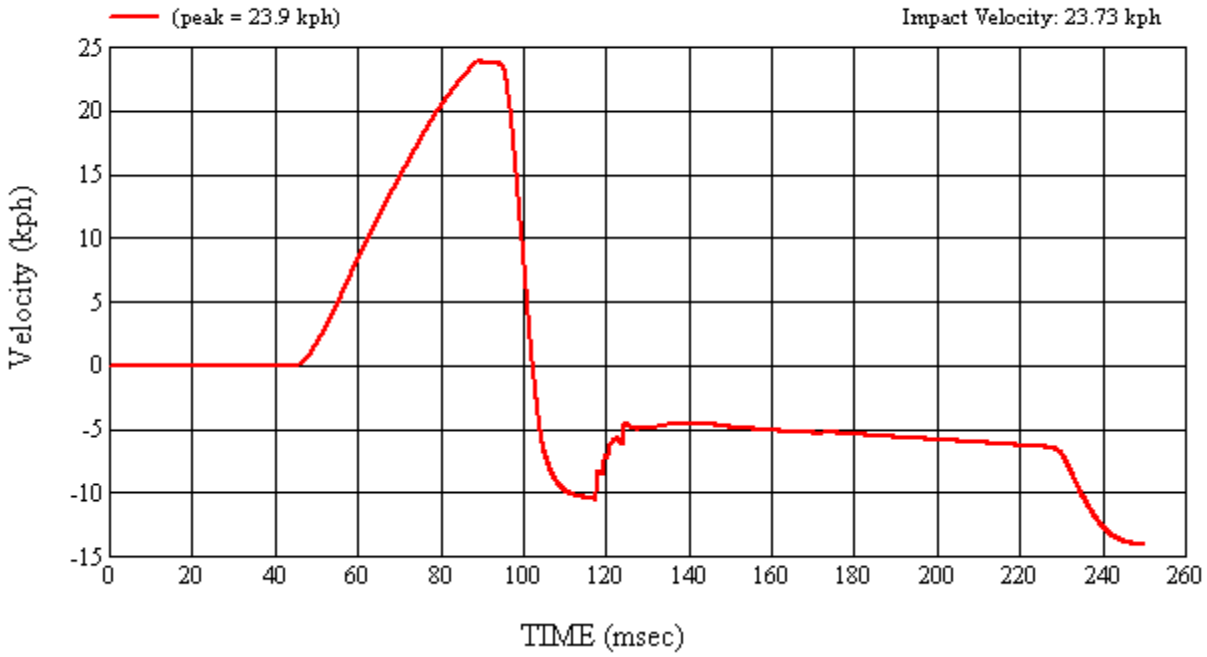


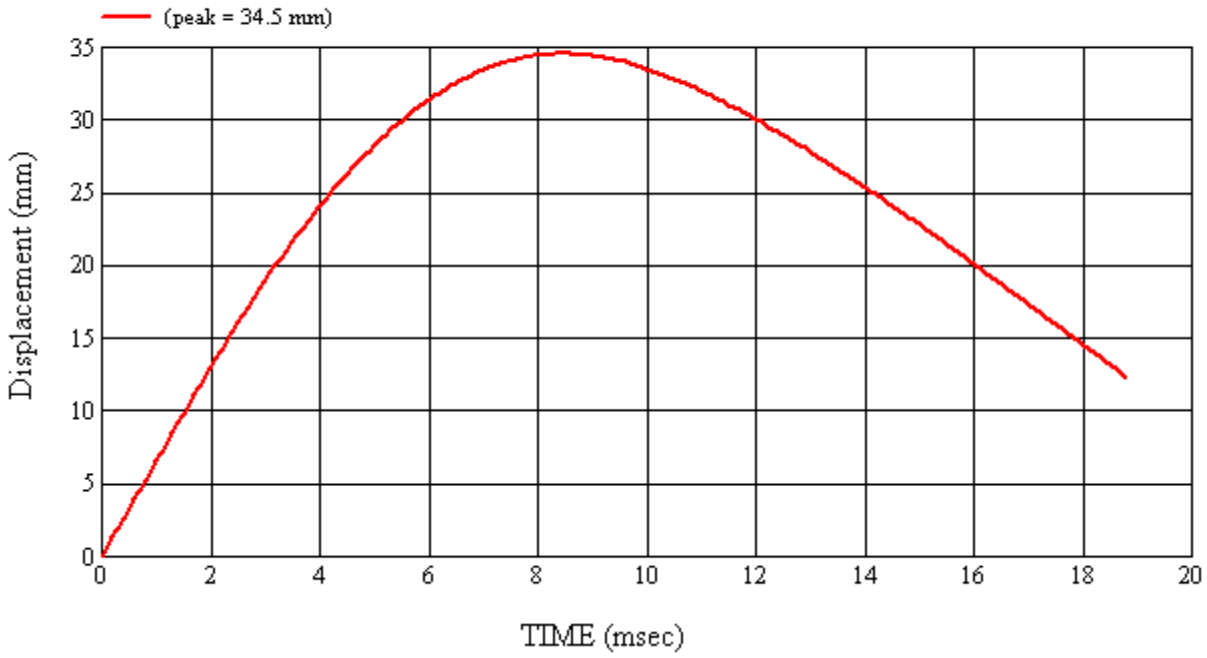



(peak = 111.5 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 6.8 G)
Head Y (G)
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 46.7 G)
Head Z (G)
20
10
0
-10
-20
-30
-40
-50
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 23.9 kph)
Impact Velocity: 23.73 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

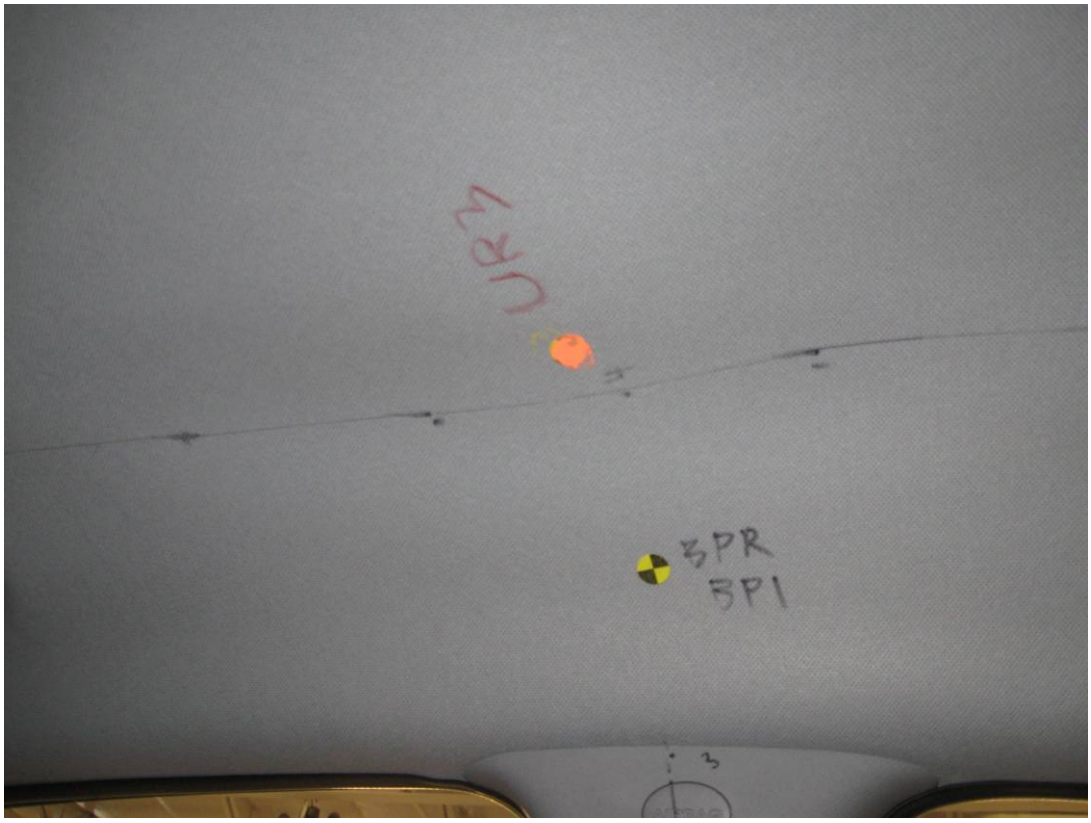

(peak = 34.5 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


mga
Impact Testing
G11I7-001.2
3/25/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11076 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
U11076
PRE TEST


mga
Impact Testing
G11I7-001.2
3/25/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11076 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
U11076
PRE TEST


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11076 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
U11076
POST TEST


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11076 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
U11076
POST TEST


UR3
3PR
3P1


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11076 LEFT UR3
H/V IMPACT ANGLE= 270 / 50
U11076
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Test Number:#U11076

Target (Vehicle Side): UR3Left

Temperature:21.6C

MGA Test Reference No.:U11076

Humidity:14.0%

Approach Horizontal Angles:270º

Time of Test:11:06:54 AM

Approach Vertical Angles:50º

FMH Serial No:[038]

Additional Description: @BP

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
680	681	8.4	23.7	23	2 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.4	1.07	1.07
Y	6	J36197	108.7	0.85	0.85
Z	7	J36353	99.1	0.94	0.94

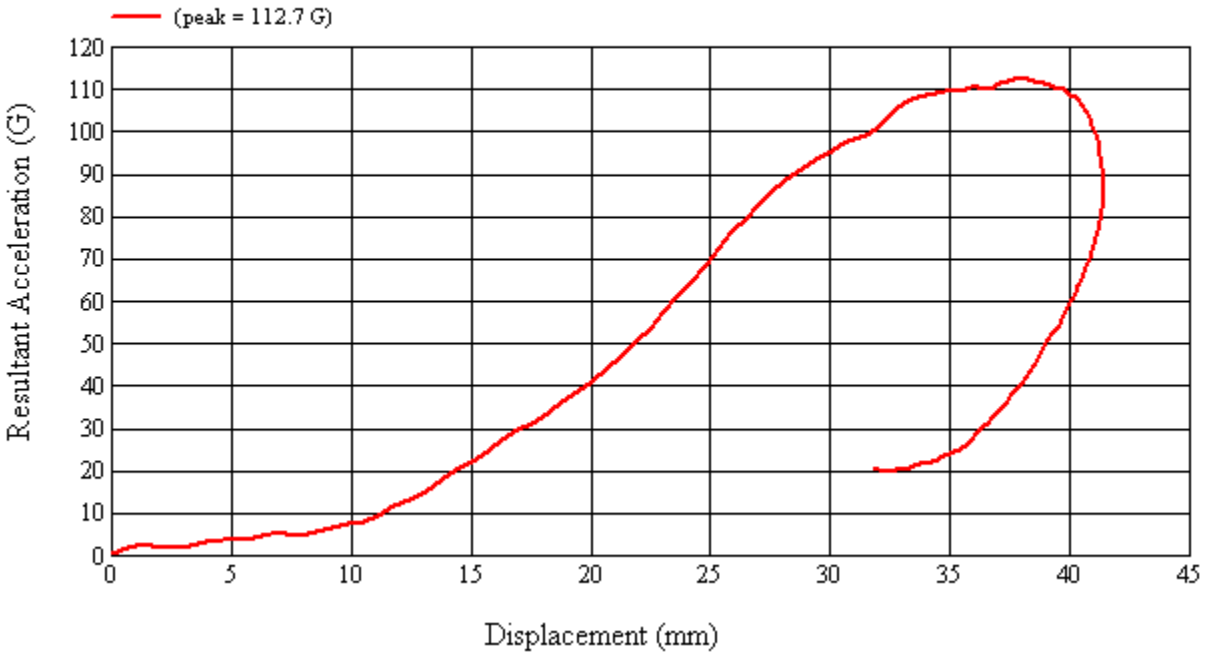
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

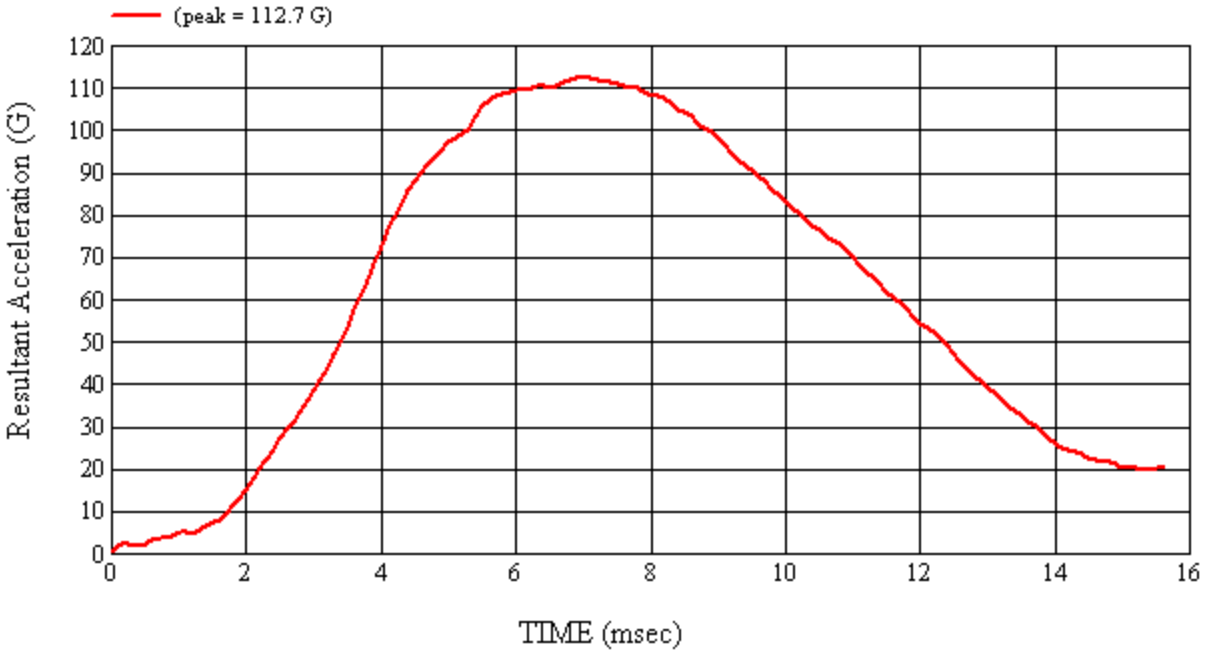
No visible damage

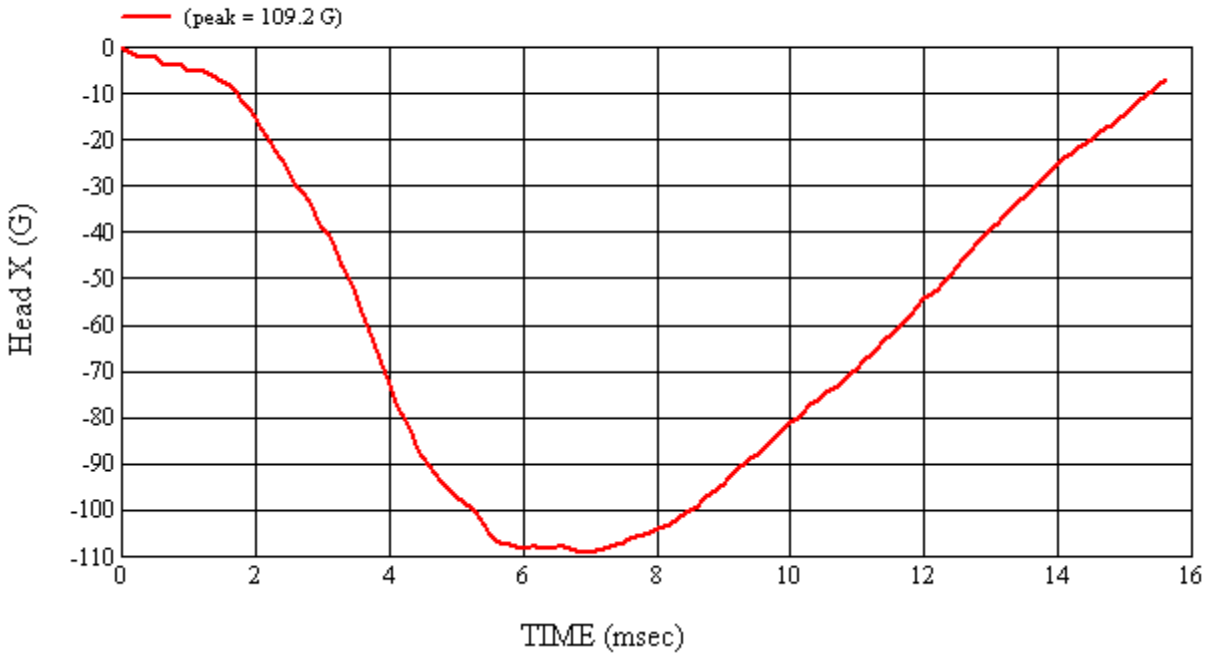
Recorded By: _____ Approved By*: _____ Date: 3/25/2011

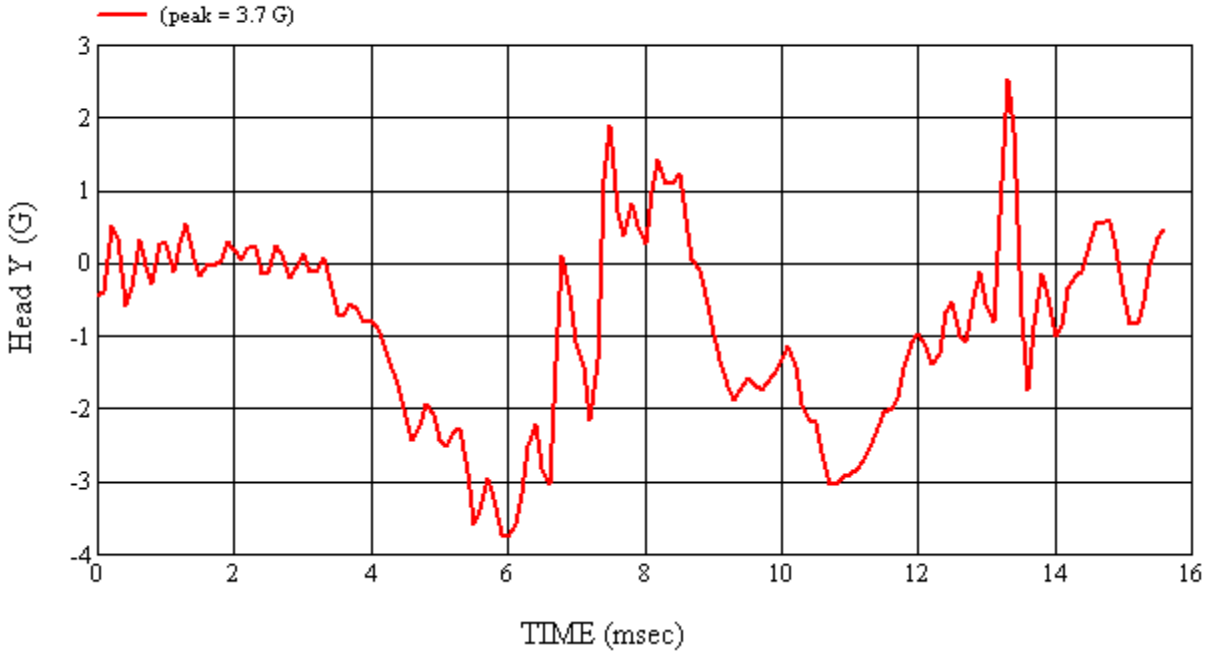
*Only necessary for NHTSA (Government) Compliance testing.

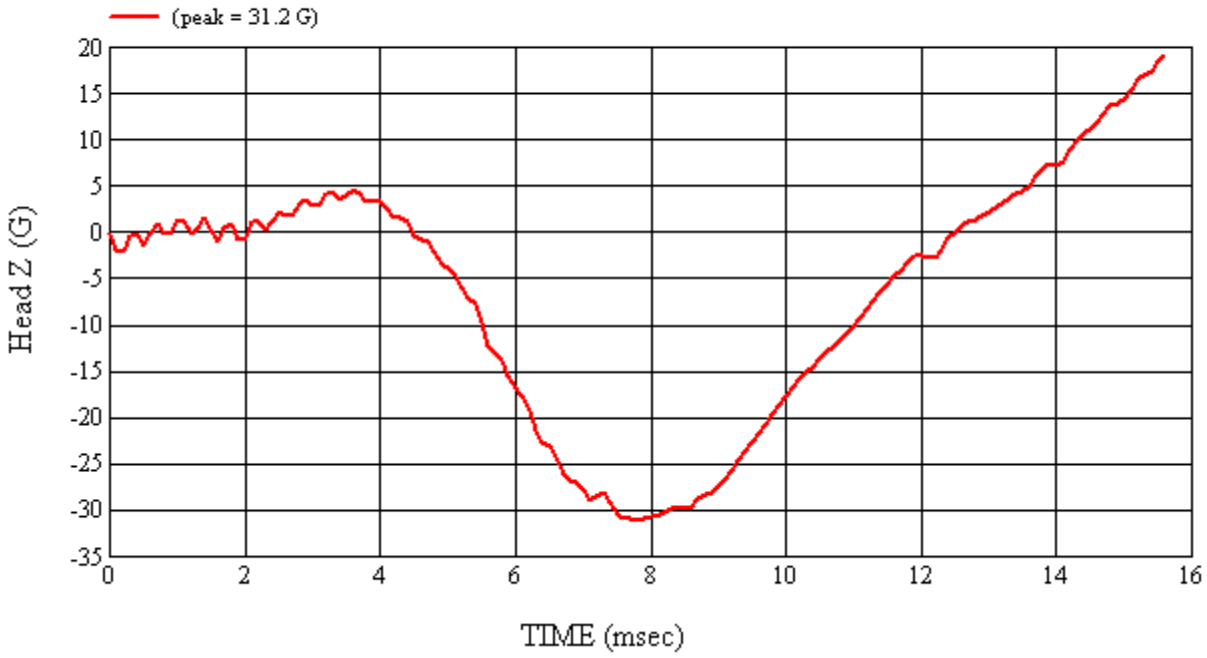
MGA Test #: U11076 Target Location: UR3, Left Side Test Date: 3/25/2011

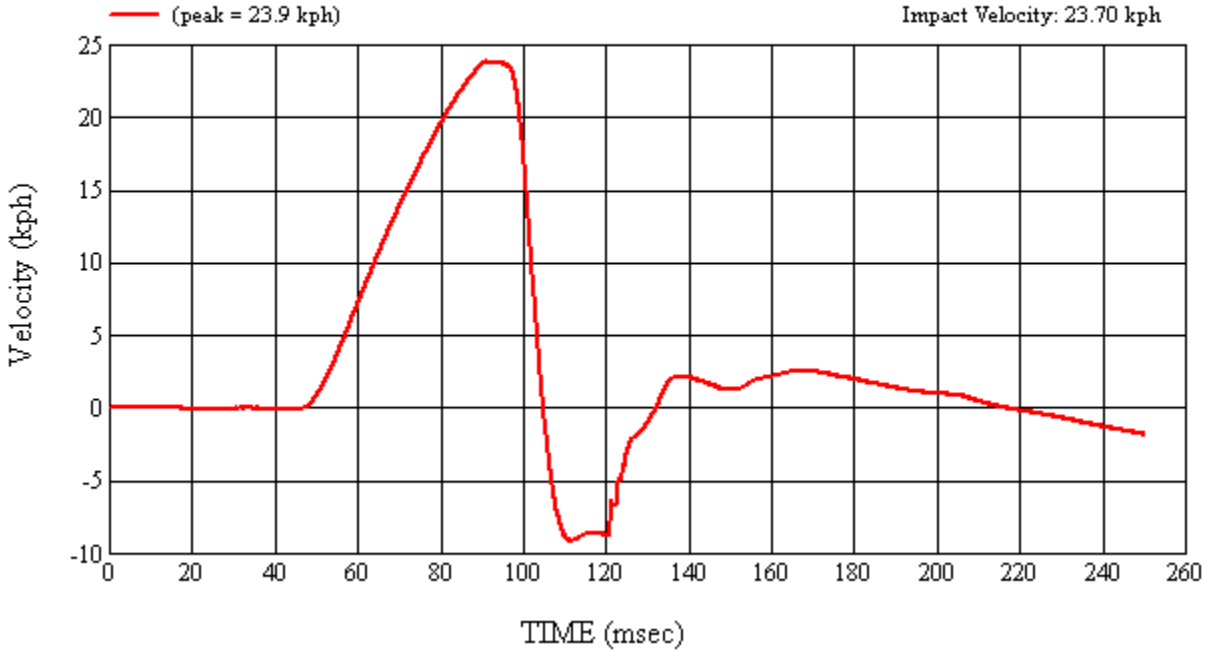


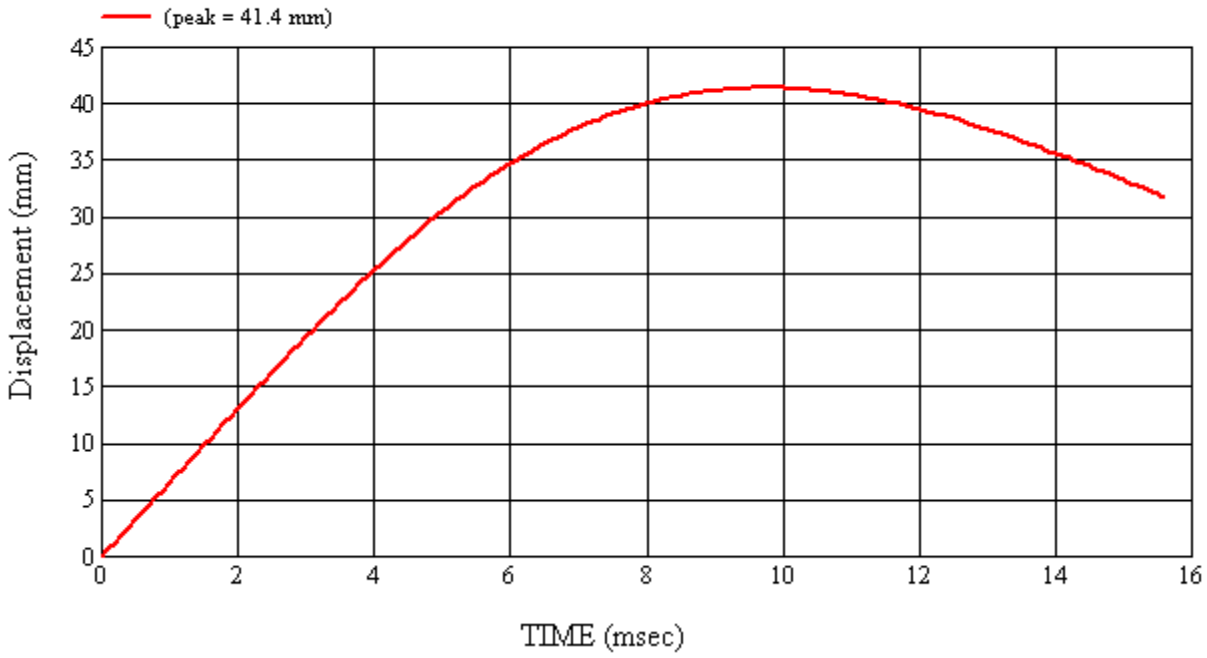



(peak = 109.2 G)
Head X (G)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
0
2
4
6
8
10
12
14
16
TIME (msec)

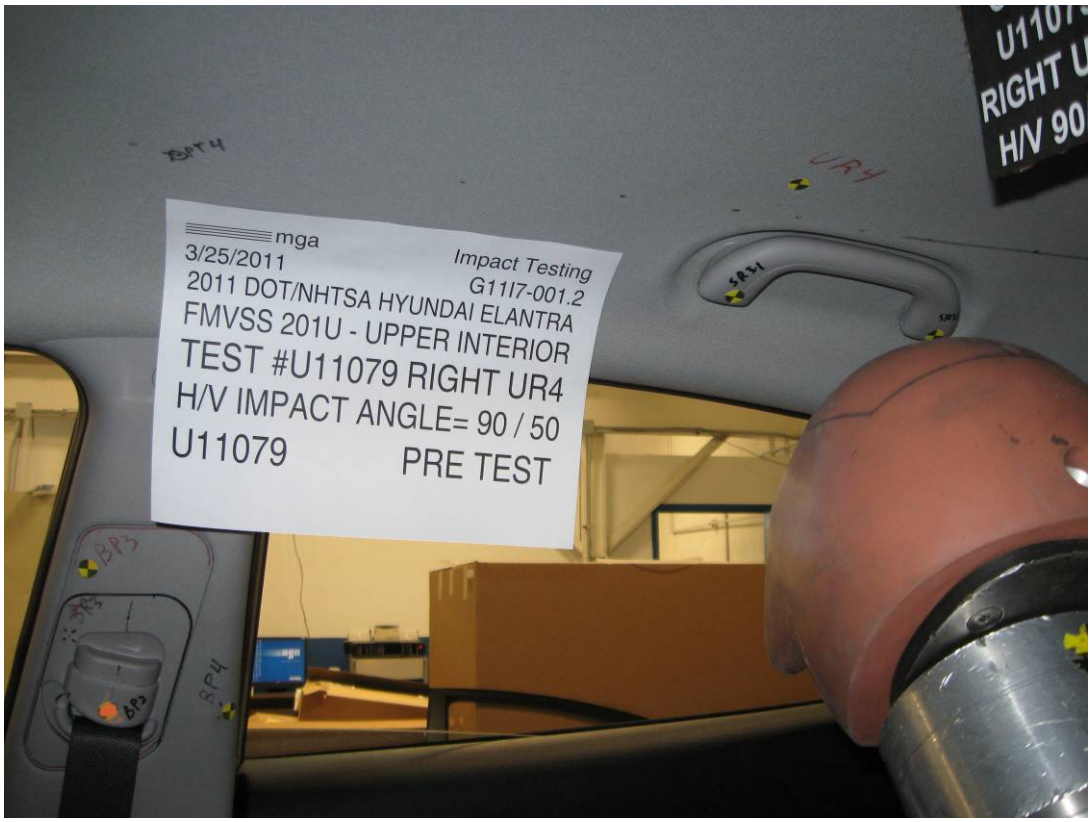

(peak = 3.7 G)
Head Y (G)
3
2
1
0
-1
-2
-3
-4
0
2
4
6
8
10
12
14
16
TIME (msec)


(peak = 31.2 G)
Head Z (G)
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
TIME (msec)


(peak = 23.9 kph)
Impact Velocity: 23.70 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

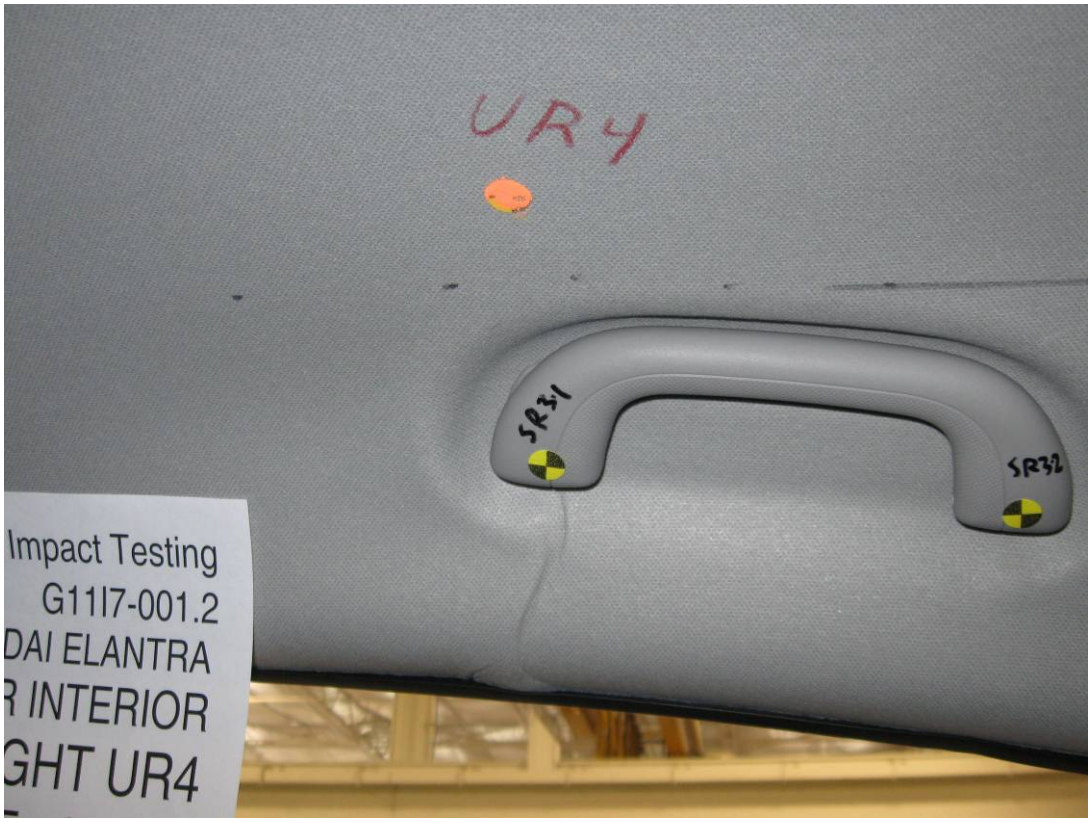

(peak = 41.4 mm)
Displacement (mm)
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
TIME (msec)


mga
3/25/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11079 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
U11079
PRE TEST


mga
3/25/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11079 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
U11079
PRE TEST


CB0509
U11079
RIGHT UR4
H/V 90/50
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11079 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
U11079
POST TEST


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11079 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
U11079
POST TEST


UR4
SR31
SR32
Impact Testing
G11I7-001.2
DAI ELANTRA
R INTERIOR
GHT UR4


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11079 RIGHT UR4
H/V IMPACT ANGLE= 90 / 50
U11079
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Target (Vehicle Side): UR4Right

MGA Test Reference No.:U11079

Approach Horizontal Angles:90º

Approach Vertical Angles:50º

Additional Description: @SR3-1

Test Number:#U11079

Temperature:22.3C

Humidity:13.3%

Time of Test:3:04:32 PM

FMH Serial No:[038]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
693	697	9.3	23.8	25	1 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J22700	-96.4	1.07	1.07
Y	6	J36197	108.7	0.85	0.85
Z	7	J36353	99.1	0.94	0.94

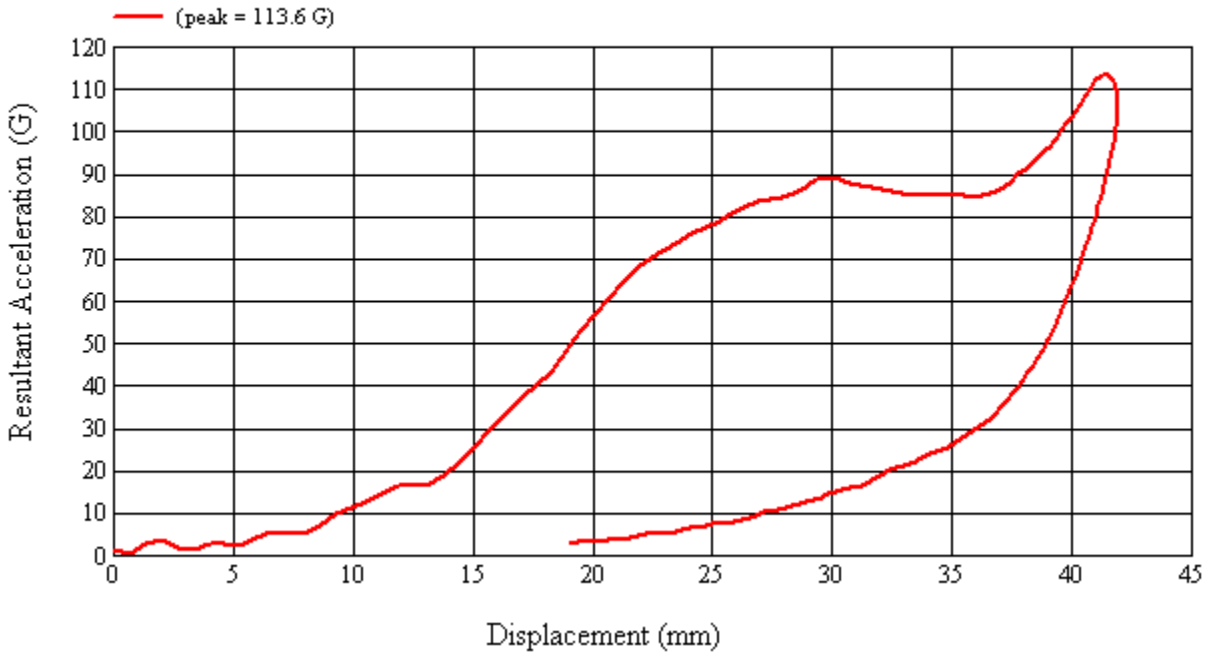
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

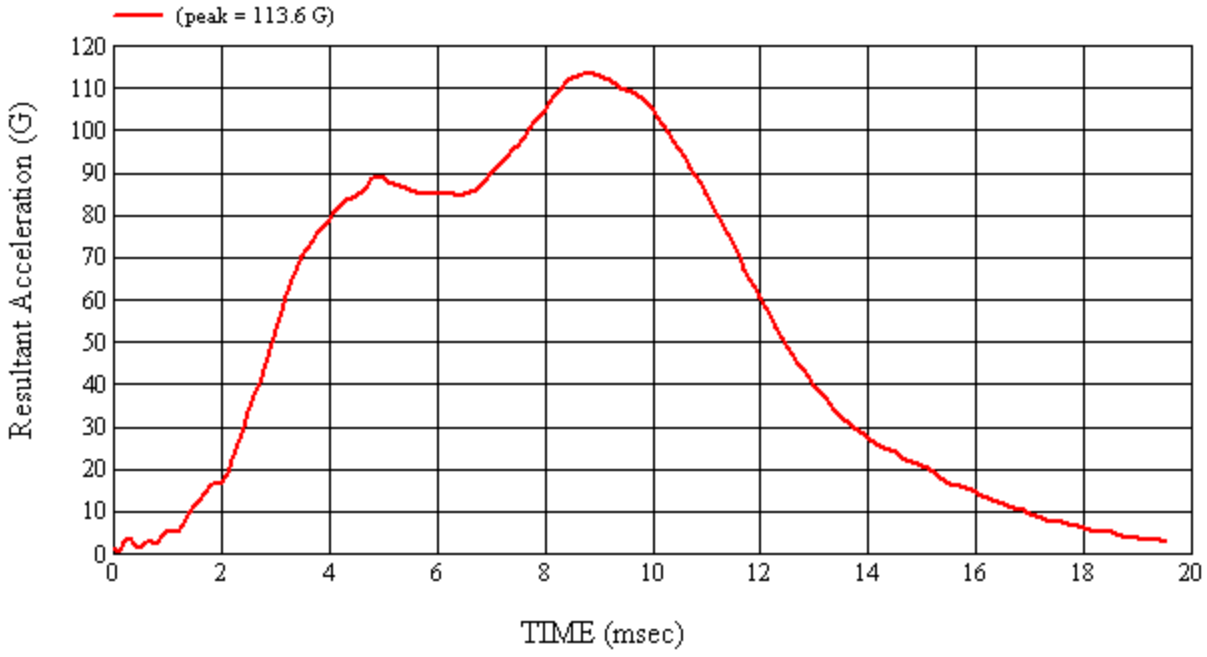
Headliner deformation, grab handle compression.

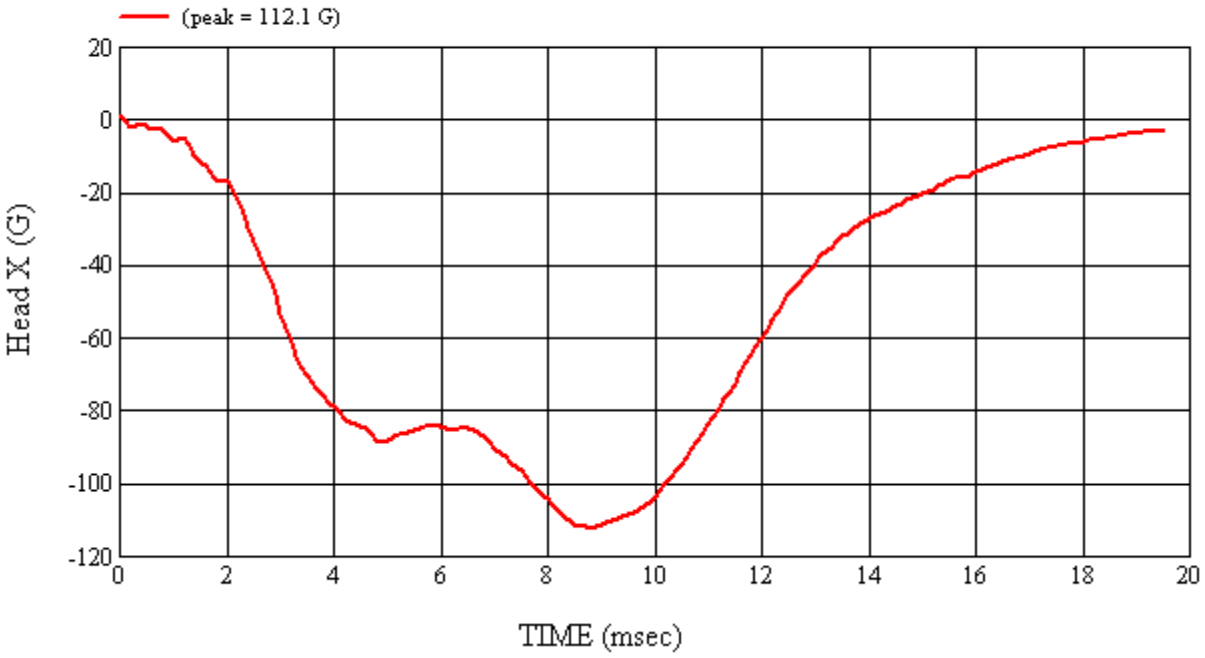
Recorded By: _____ Approved By*: _____ Date: 3/25/2011

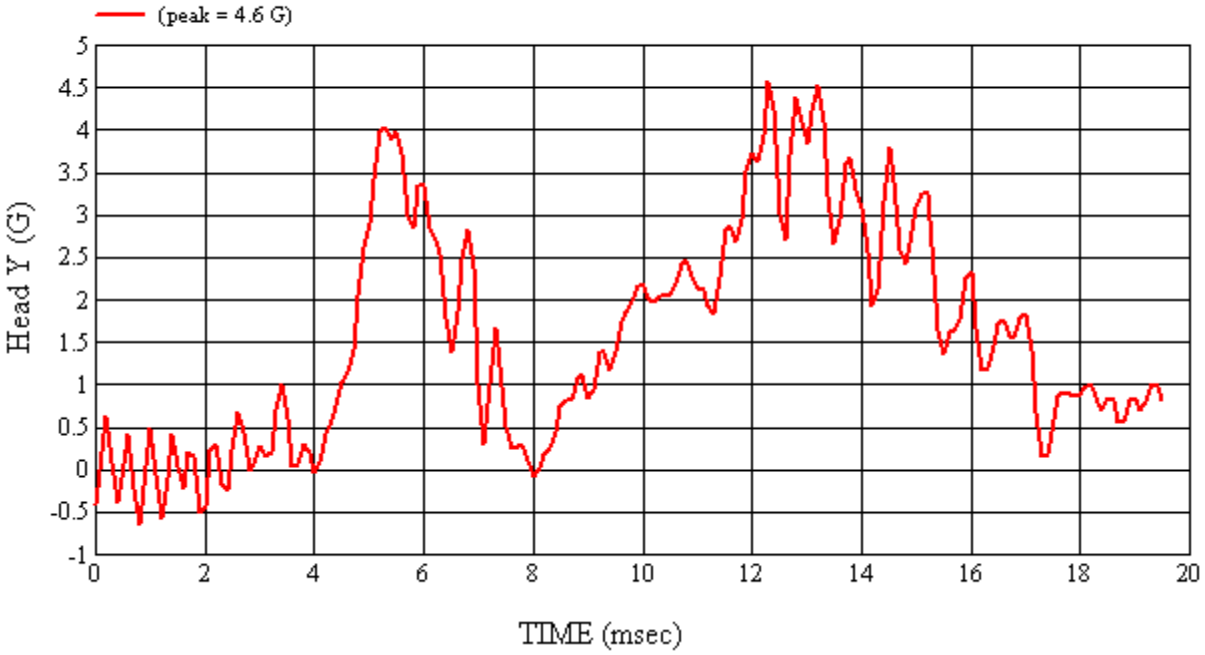
*Only necessary for NHTSA (Government) Compliance testing.

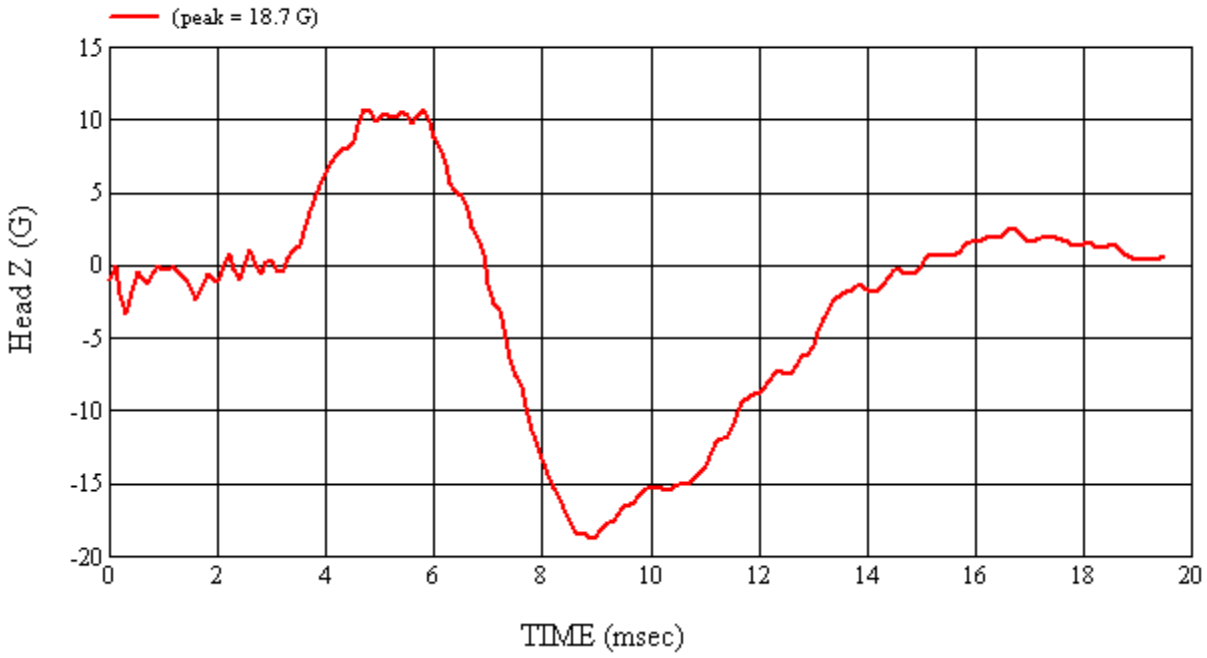
MGA Test #: U11079 Target Location: UR4, Right Side Test Date: 3/25/2011

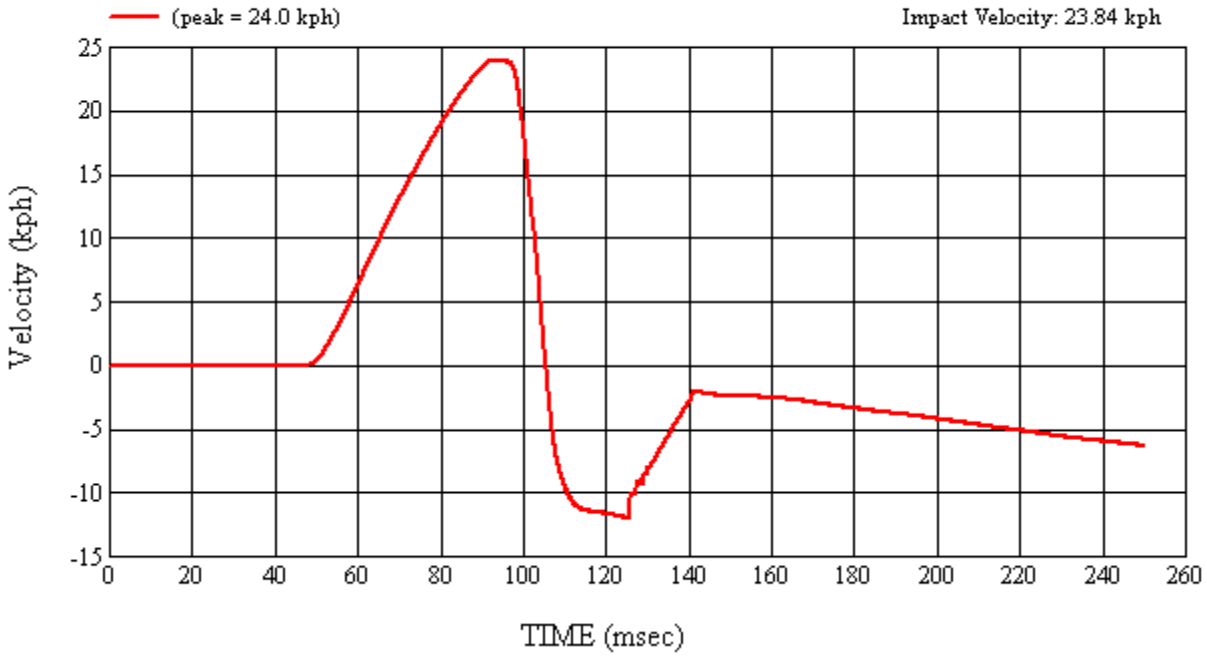


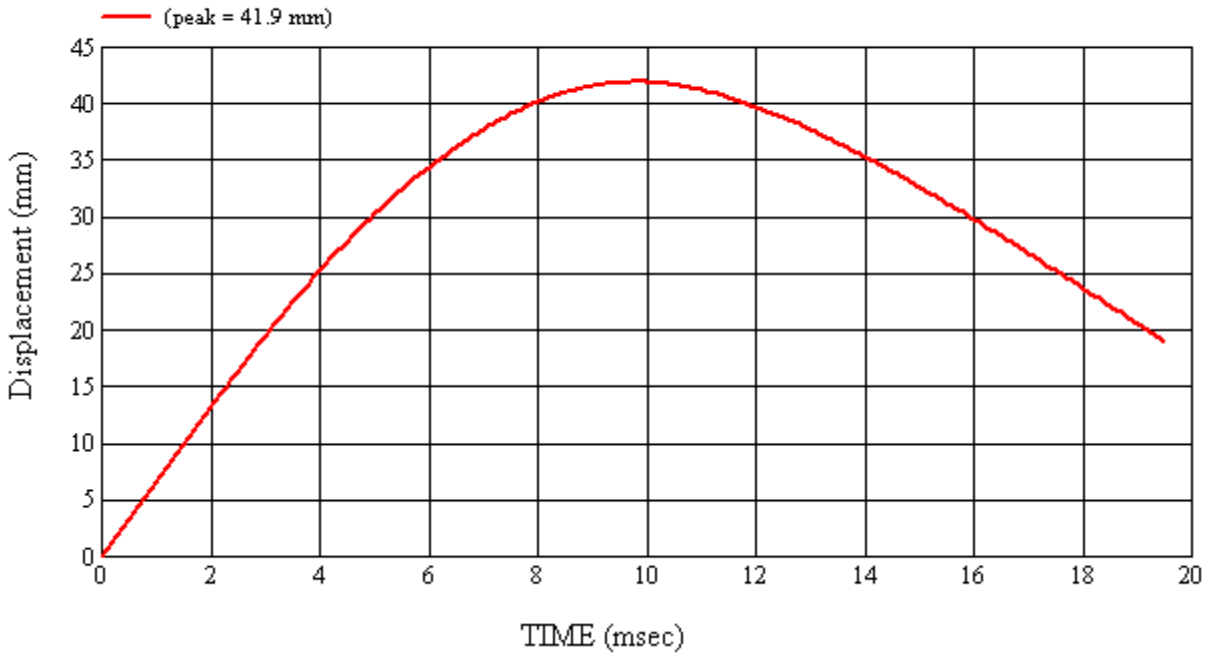


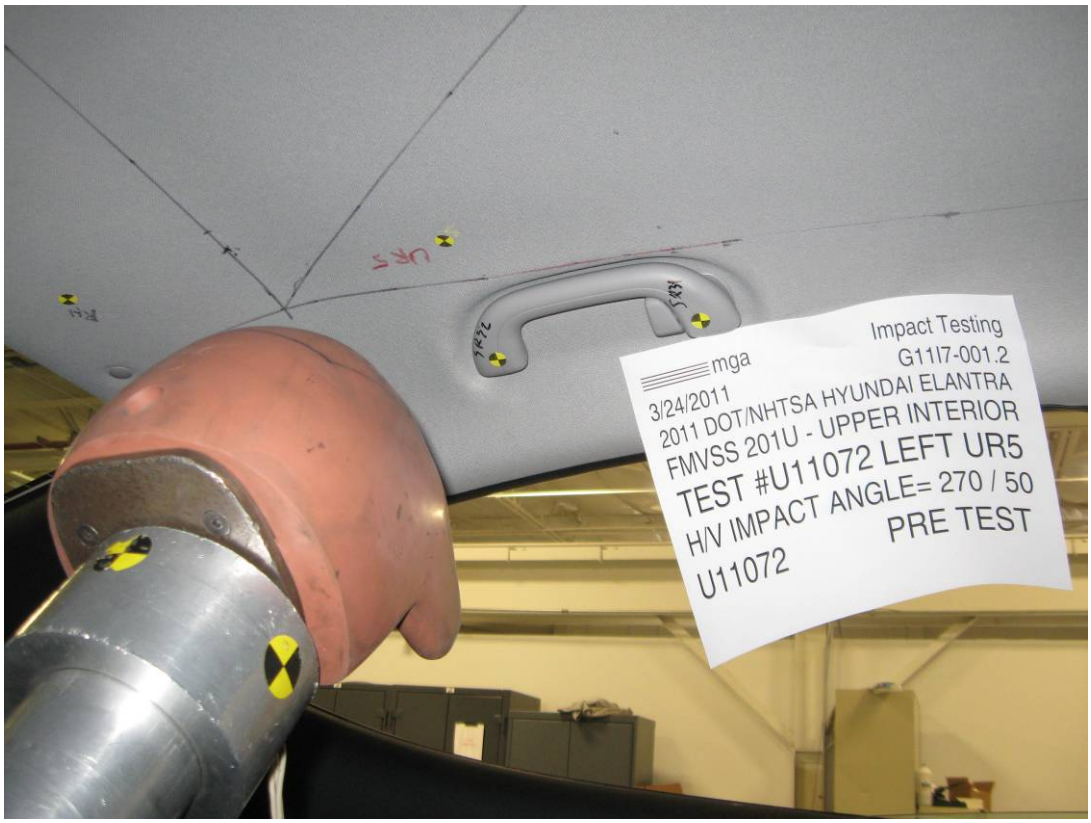

(peak = 112.1 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 4.6 G)
Head Y (G)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)


(peak = 18.7 G)
Head Z (G)
15
10
5
0
-5
-10
-15
-20
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

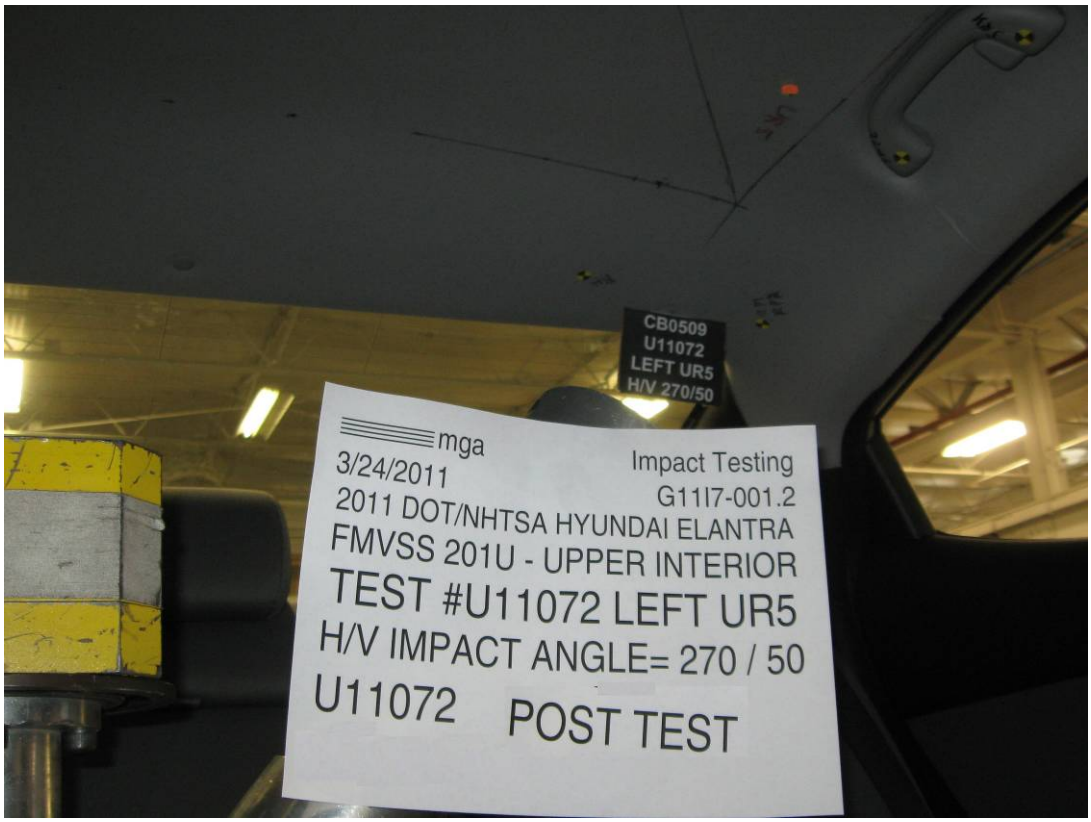

(peak = 24.0 kph)
Impact Velocity: 23.84 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)

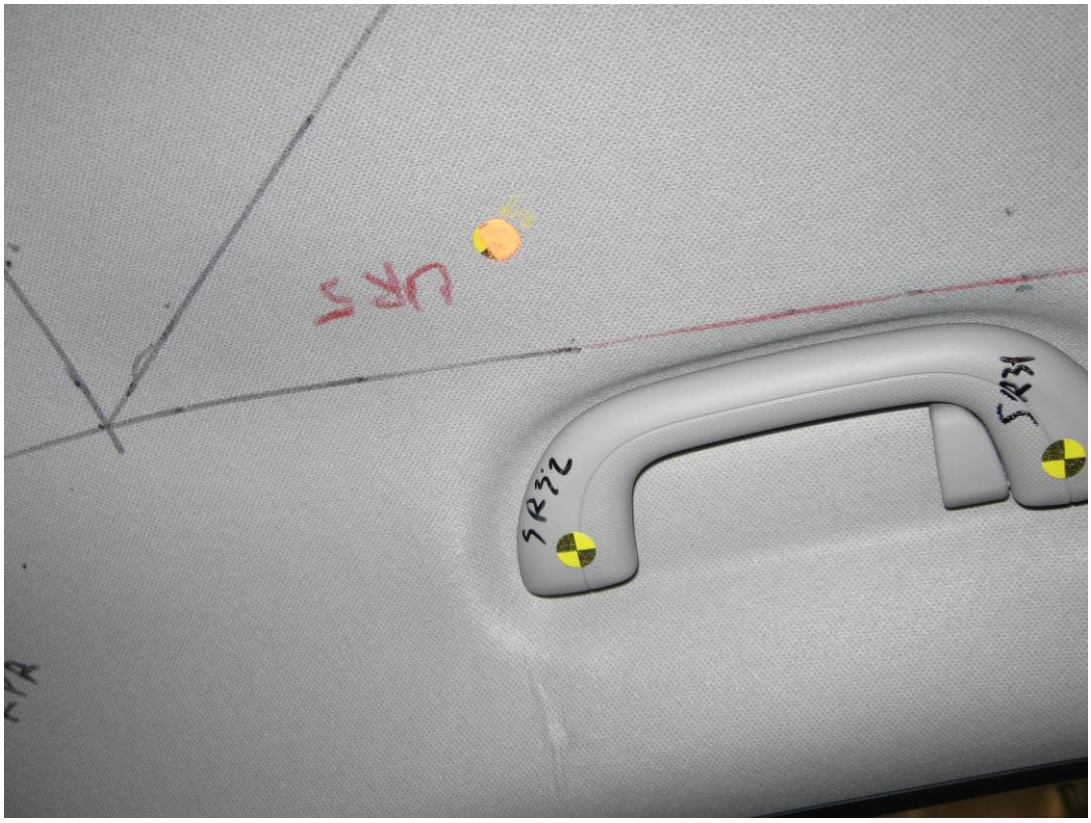

(peak = 41.9 mm)
Displacement (mm)
0
5
10
15
20
25
30
35
40
45
0
2
4
6
8
10
12
14
16
18
20
TIME (msec)

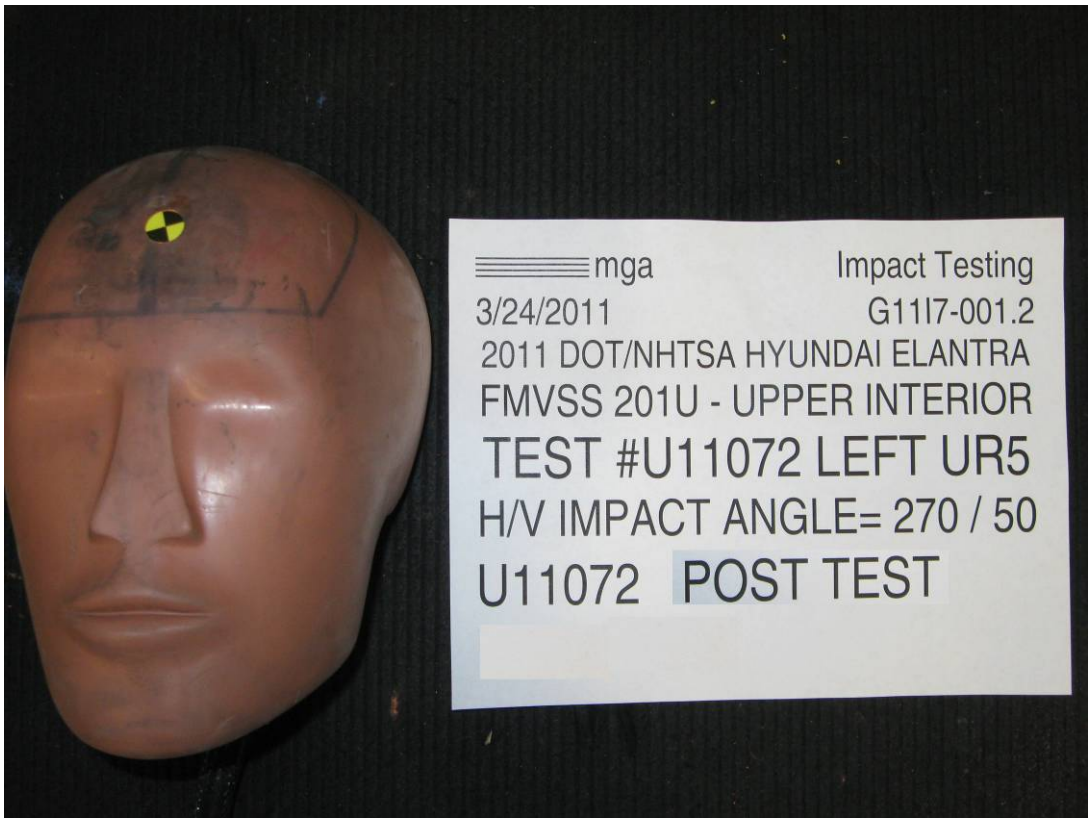

mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11072 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U11072
PRE TEST


mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11072 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U11072
PRE TEST


CB0509
U11072
LEFT UR
mga
Impact Testing
G11I7-001.2
3/24/2011
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11072 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U11072 POST TEST


CB0509
U11072
LEFT UR5
H/V 270/50
mga
3/24/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11072 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U11072 POST TEST


UR5
5R32
5R31


mga
Impact Testing
3/24/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11072 LEFT UR5
H/V IMPACT ANGLE= 270 / 50
U11072 POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Target (Vehicle Side): UR5Left

MGA Test Reference No.:U11072

Approach Horizontal Angles:270º

Approach Vertical Angles:50º

Additional Description:@SR3-2

Test Number:#U11072

Temperature:22.5C

Humidity:20.7%

Time of Test:3:07:56 PM

FMH Serial No:[037]

TEST RESULTS:

HIC(d)	HIC	Δt (msec)	Velocity (kph)	Impact location on FMH (mm)	
				Above Pt. O	Left/Right Pt. O
842	895	8.2	24.0	29	2 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J32177	-113.7	1.07	1.07
Y	6	J14103	93.9	0.85	0.85
Z	7	J35800	97.8	0.94	0.94

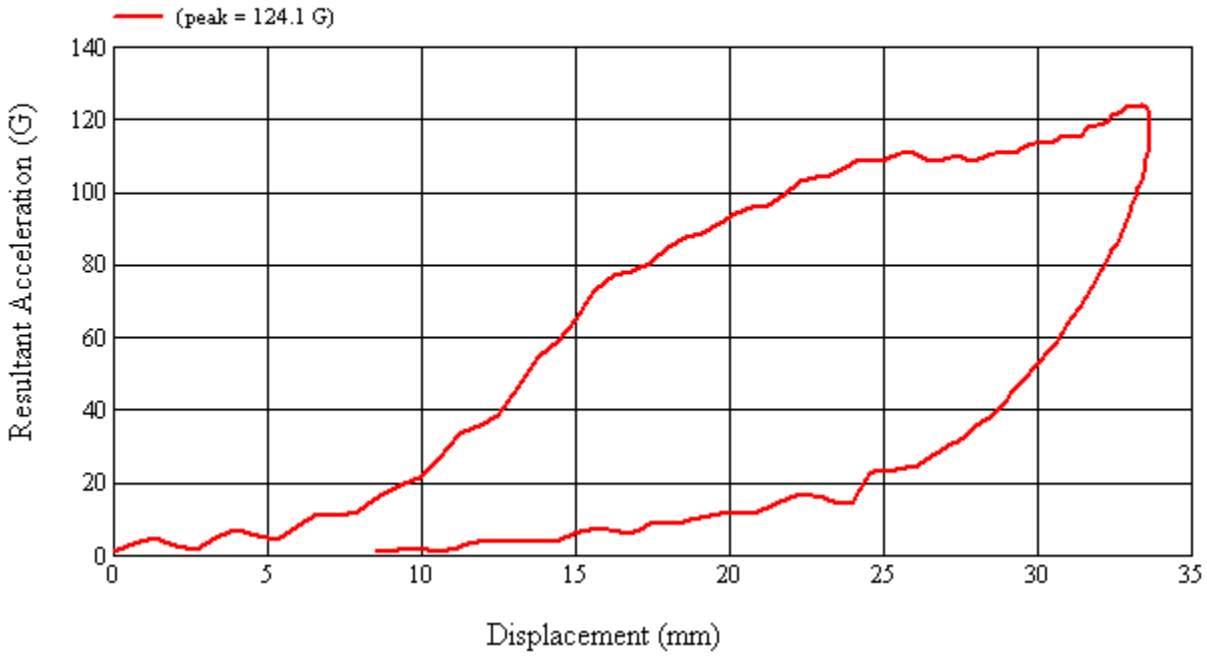
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

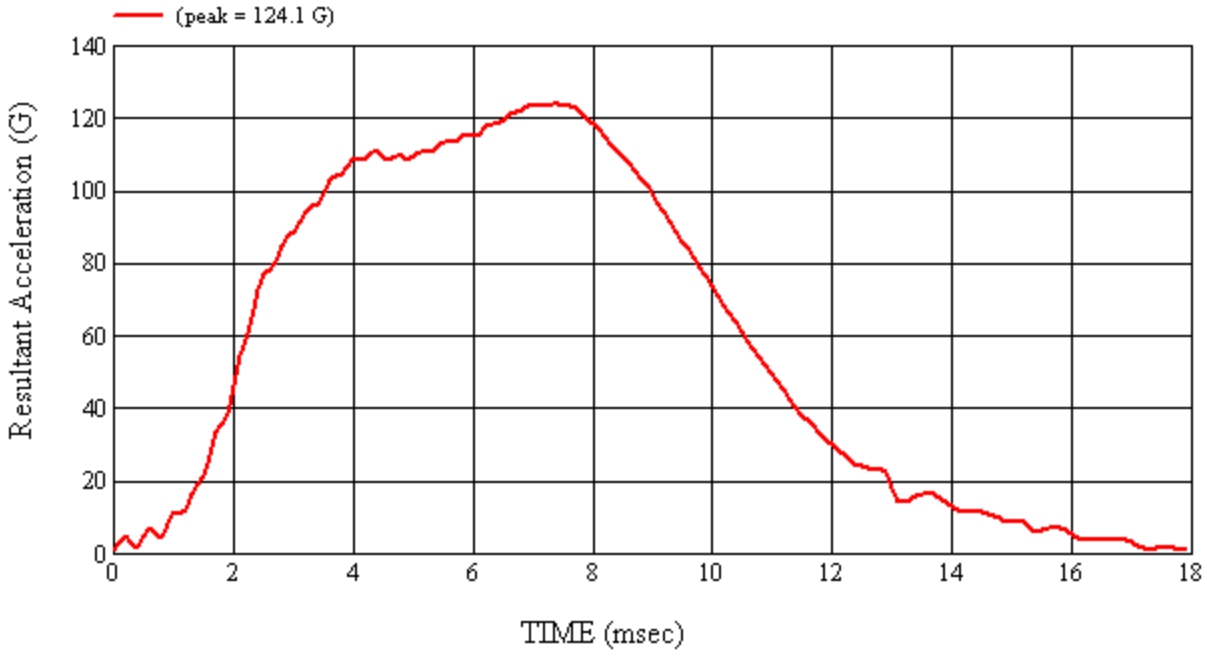
Minor headliner deformation with grab handle compression.

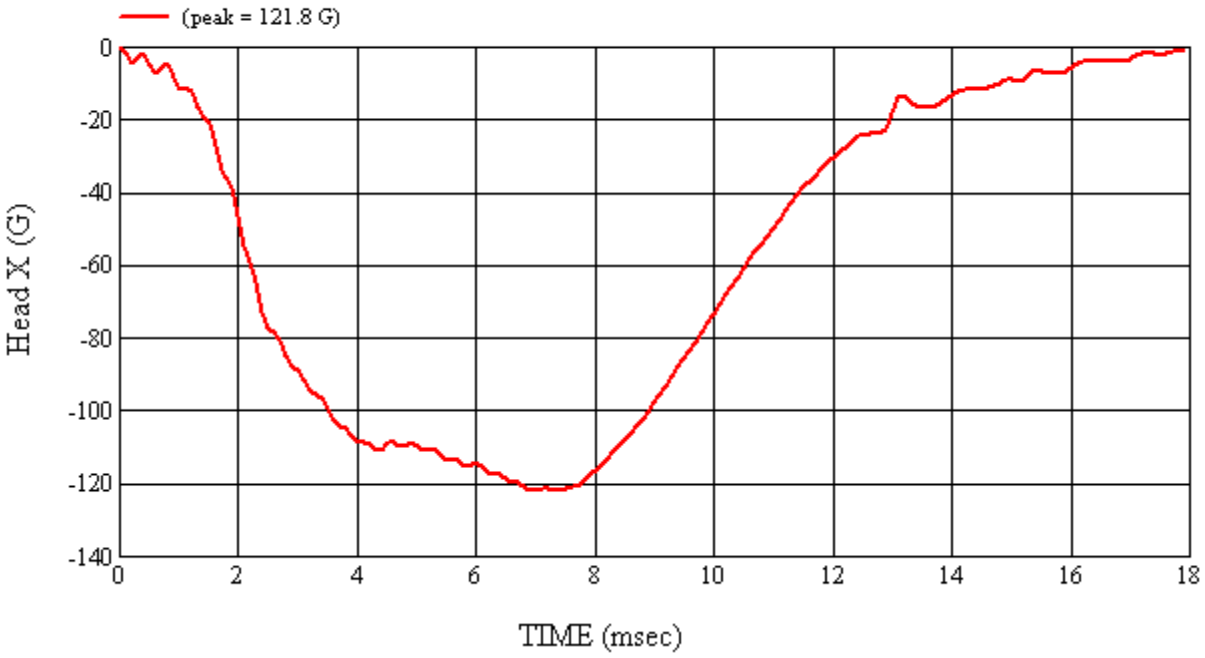
Recorded By: _____ Approved By*: _____ Date: 3/24/2011

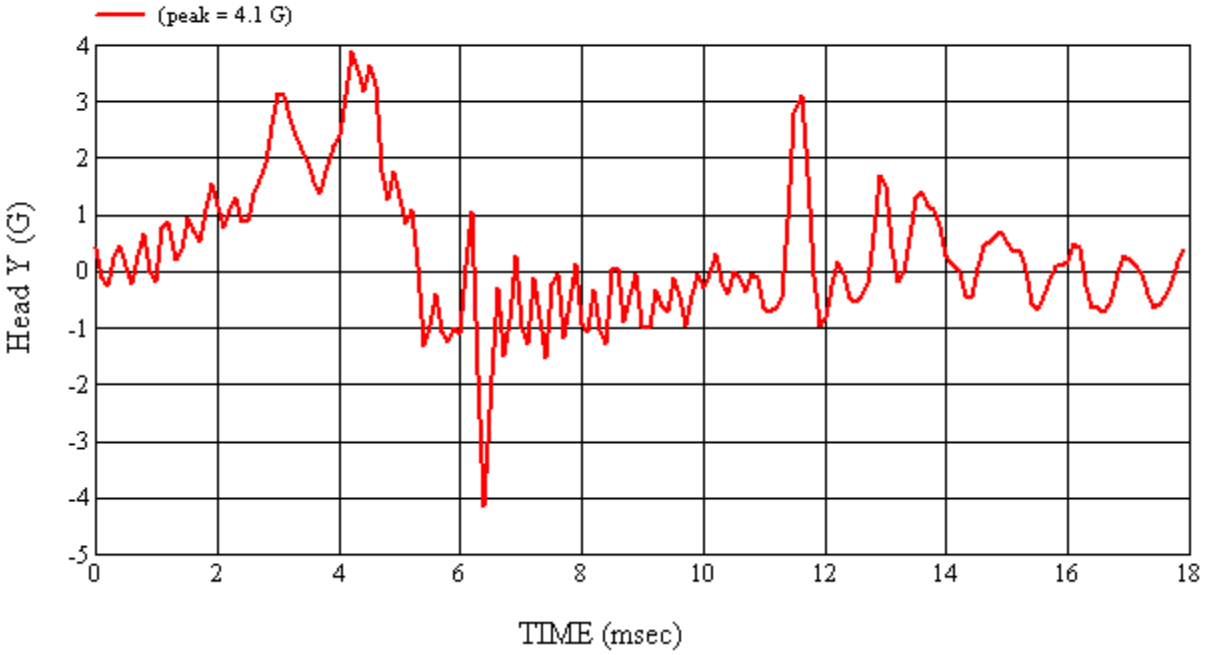
*Only necessary for NHTSA (Government) Compliance testing.

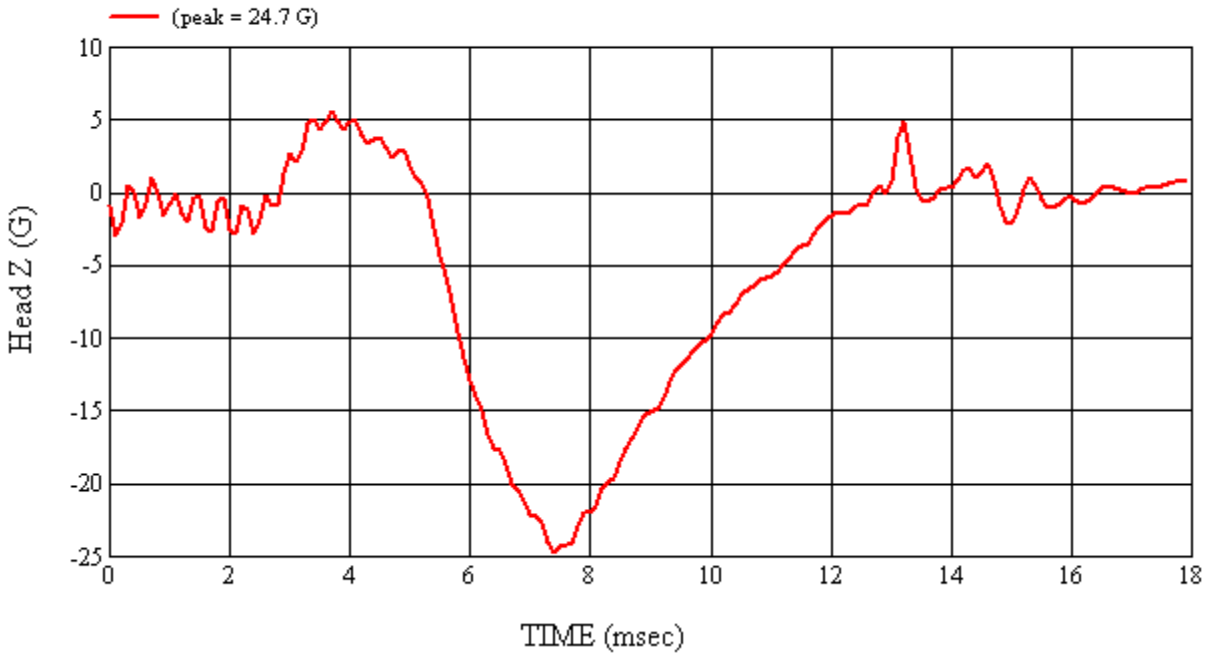
MGA Test #: U11072 Target Location: UR5, Left Side Test Date: 3/24/2011

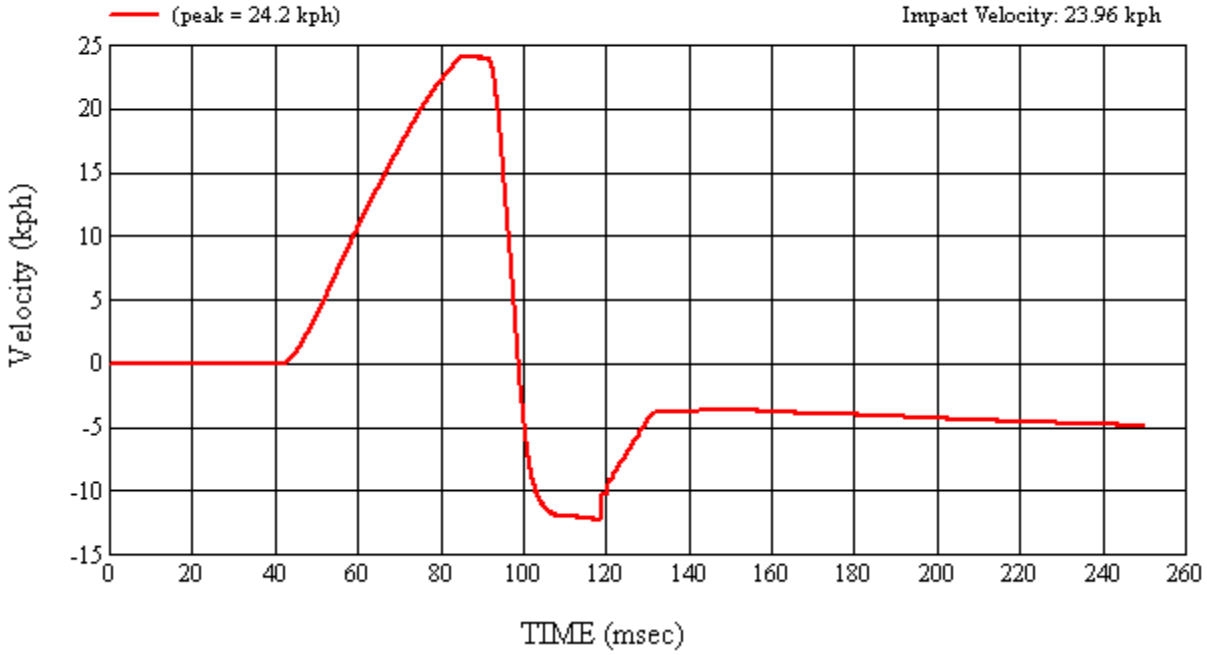


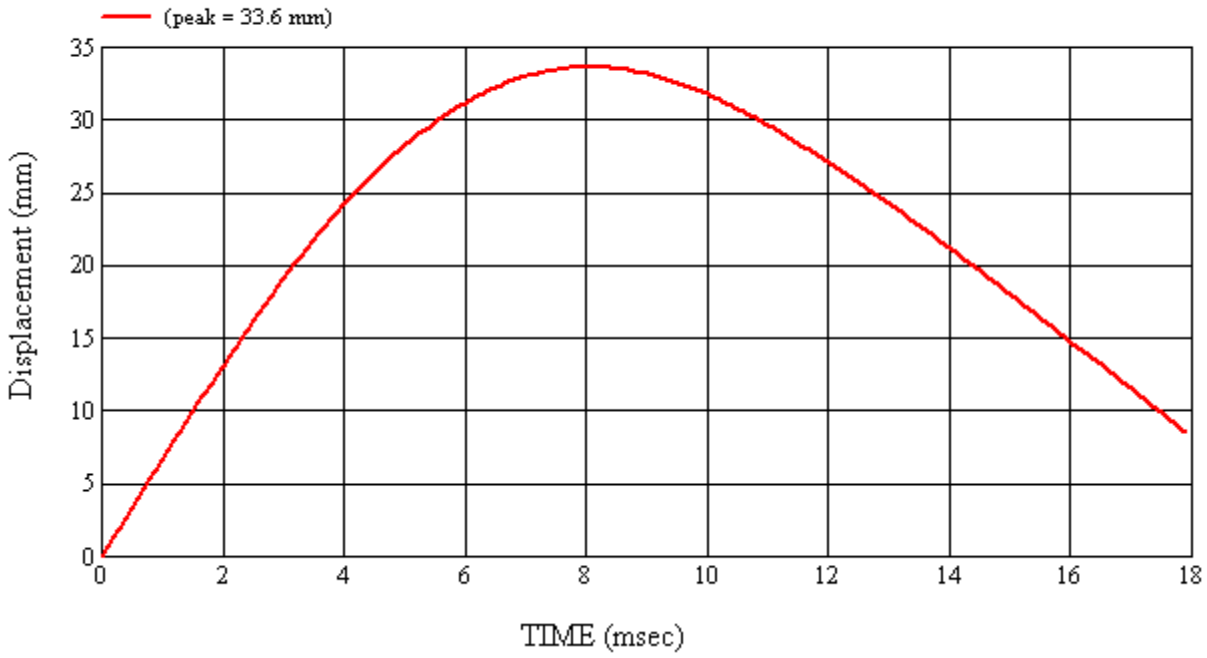


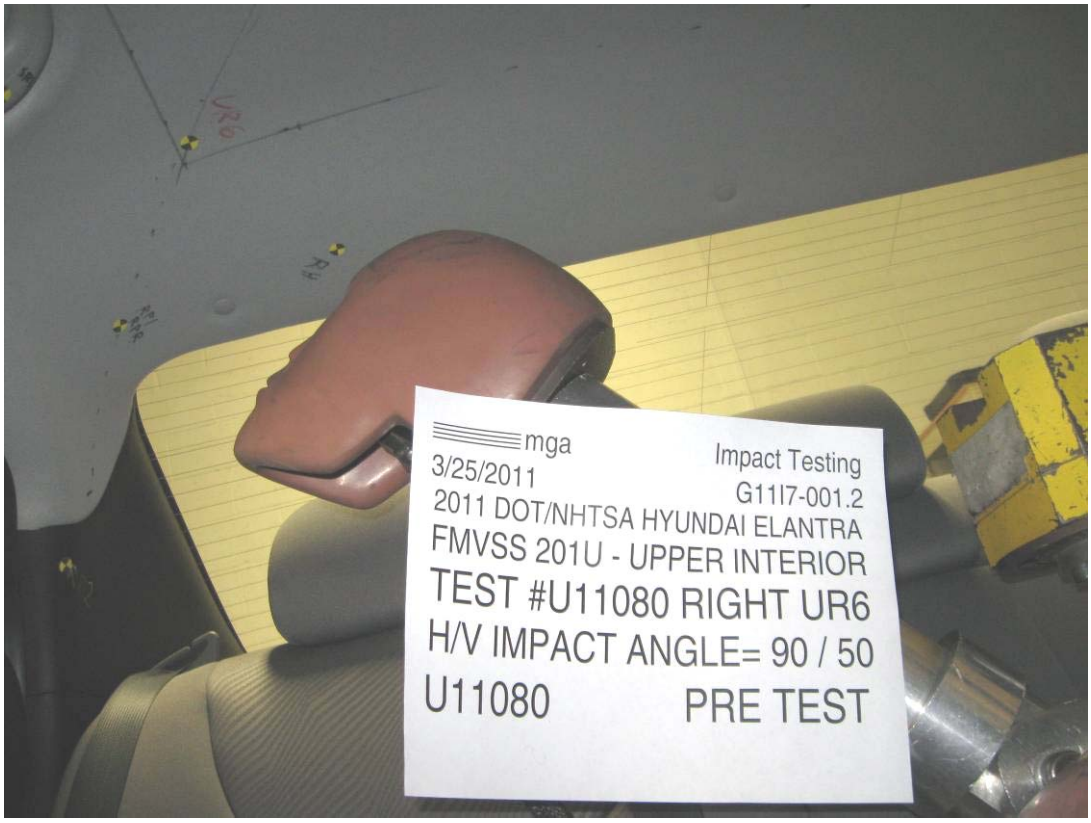

(peak = 121.8 G)
Head X (G)
0
-20
-40
-60
-80
-100
-120
-140
0
2
4
6
8
10
12
14
16
18
TIME (msec)


(peak = 4.1 G)
Head Y (G)
4
3
2
1
0
-1
-2
-3
-4
-5
0
2
4
6
8
10
12
14
16
18
TIME (msec)


(peak = 24.7 G)
Head Z (G)
10
5
0
-5
-10
-15
-20
-25
0
2
4
6
8
10
12
14
16
18
TIME (msec)


(peak = 24.2 kph)
Impact Velocity: 23.96 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
-15
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 33.6 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
TIME (msec)


UR6
mga
3/25/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11080 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U11080
PRE TEST


UR4
UR6
mga
3/25/2011
Impact Testing
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11080 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U11080
PRE TEST


CB0509
U11080
RIGHT UR6
H/V 90/50
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11080 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U11080
POST TEST


UR4
UR6
mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11080 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U11080
POST TEST
CB0509
U11080
RIGHT UR6
H/V 90/50


mga
Impact Testing
3/25/2011
G11I7-001.2
2011 DOT/NHTSA HYUNDAI ELANTRA
FMVSS 201U - UPPER INTERIOR
TEST #U11080 RIGHT UR6
H/V IMPACT ANGLE= 90 / 50
U11080
POST TEST

SUMMARY OF FMVSS 201U TEST

JOB/NHTSA NO: G11I7-001.2 VEHICLE YR/MAKE/MODEL:2011/DOT/NHTSA/Hyundai Elantra

GENERAL TEST PARAMETERS:

Target (Vehicle Side): UR6Right

MGA Test Reference No.:U11080

Approach Horizontal Angles:90º

Approach Vertical Angles:50º

Additional Description: @RP

Test Number:#U11080

Temperature:20.9C

Humidity:12.1%

Time of Test:4:25:12 PM

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
564	527	7	23.6	28	3 Left

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

Axis	Channel	Serial No.	DLR Value	ΔV Pre-Test	ΔV Post-Test
X	5	J35919	-95.8	1.07	1.07
Y	6	J22664	94.2	0.85	0.85
Z	7	J35924	92.8	0.94	0.94

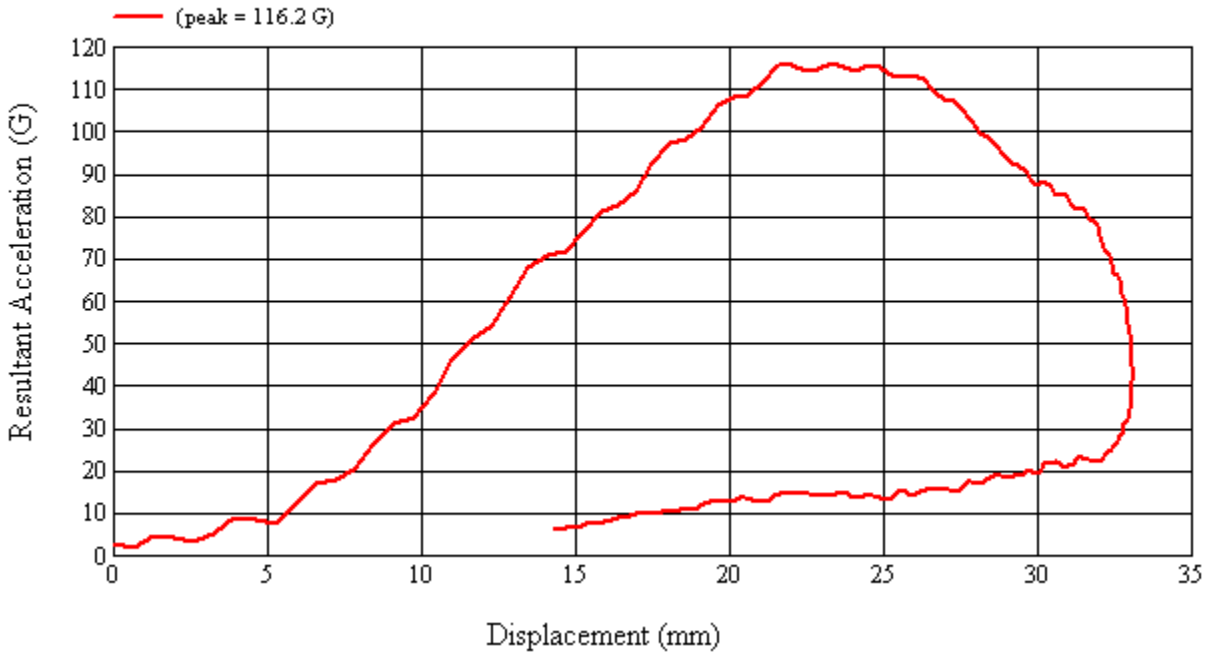
REMARKS (Summary of test, damage, non-compliance, invalid test, etc.):

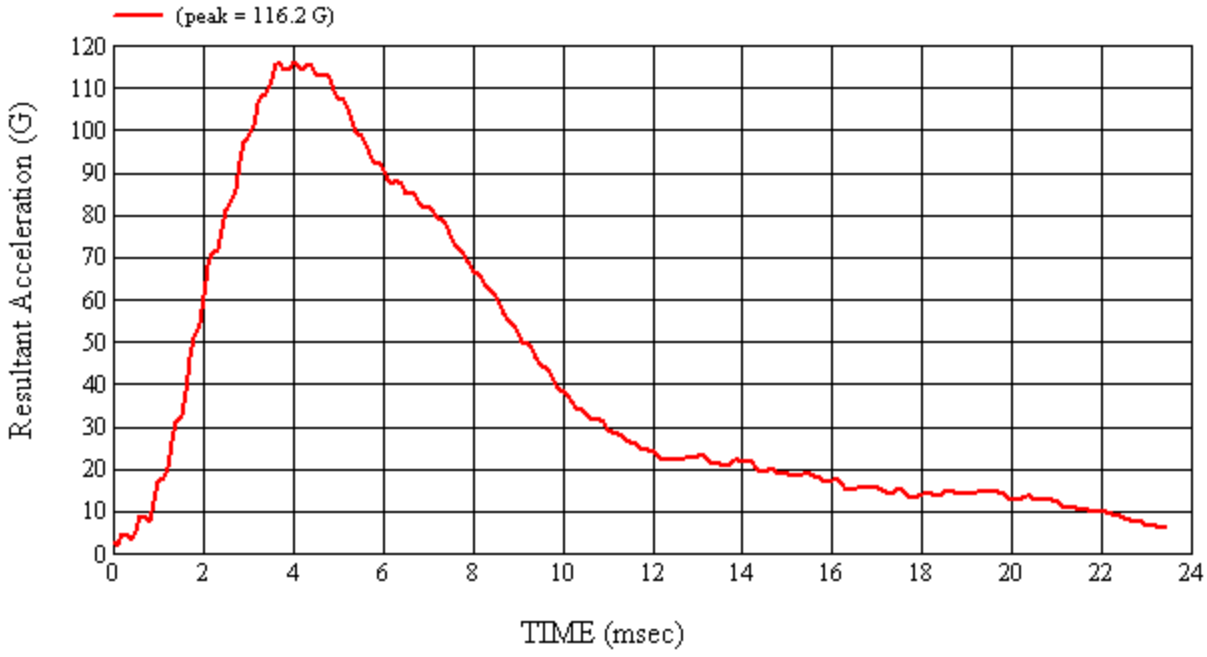
Headliner deformation

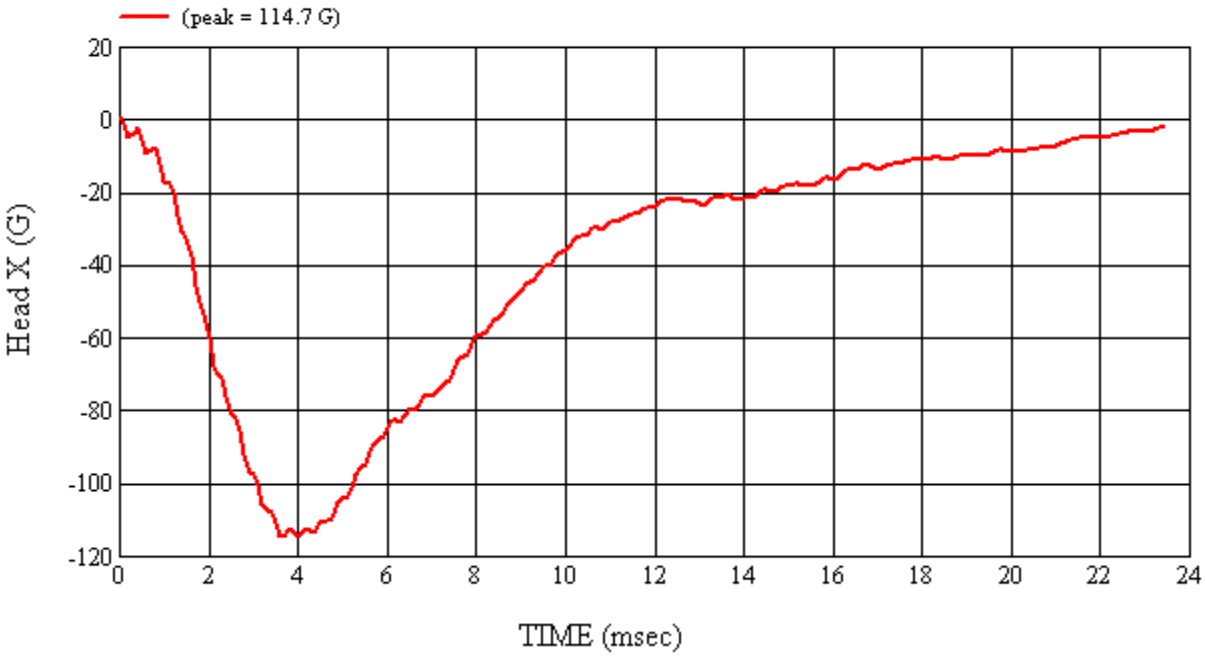
Recorded By: _____ Approved By*: _____ Date: 3/25/2011

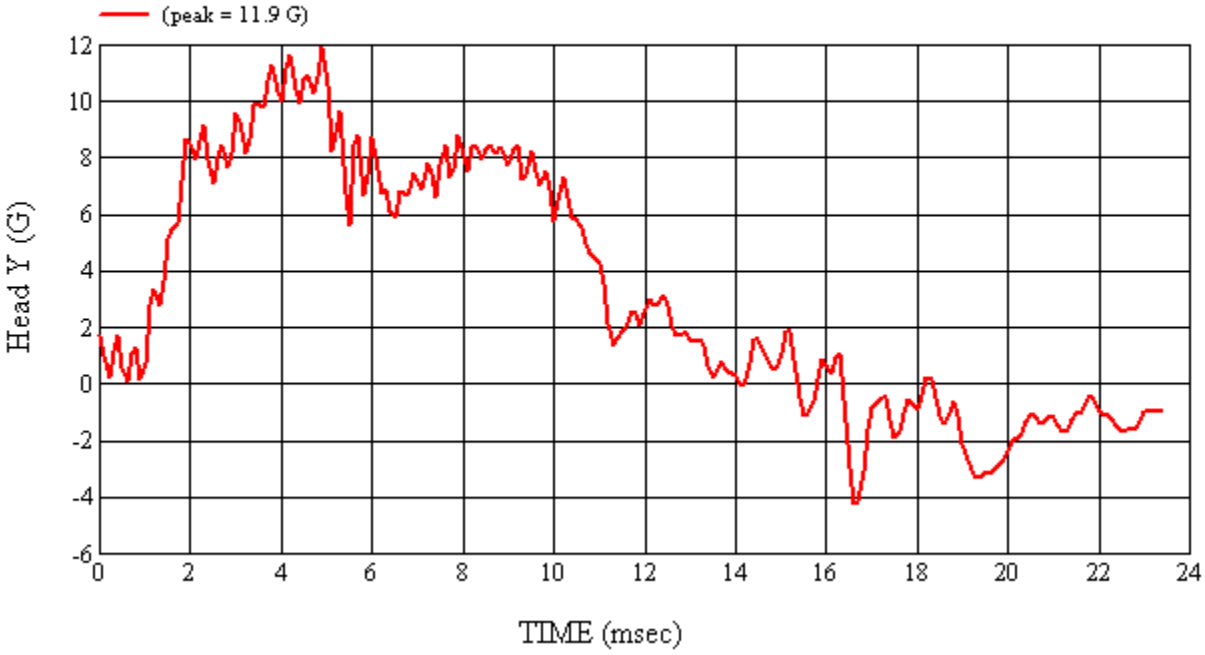
*Only necessary for NHTSA (Government) Compliance testing.

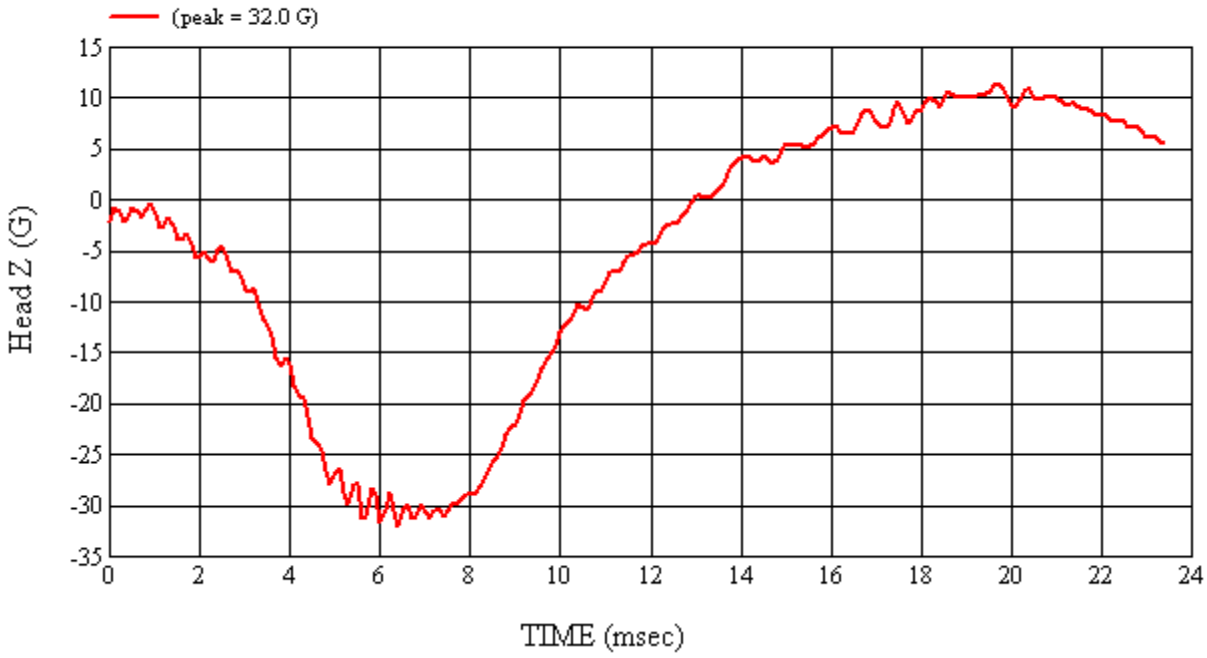
MGA Test #: U11080 Target Location: UR6, Right Side Test Date: 3/25/2011

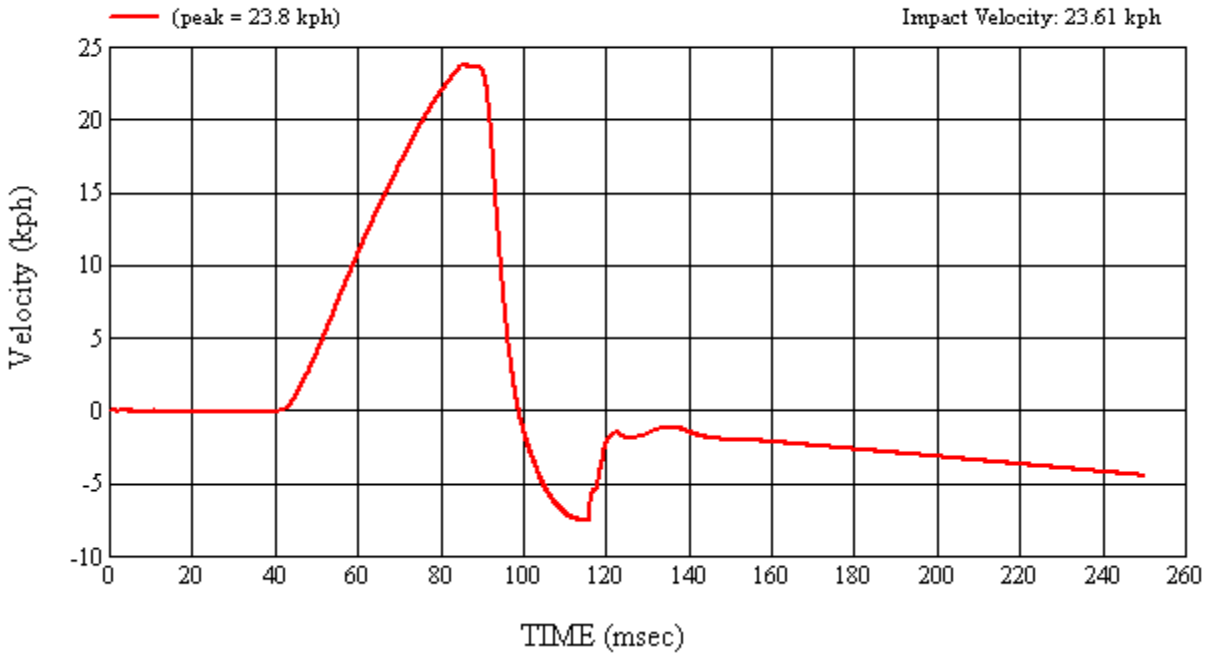


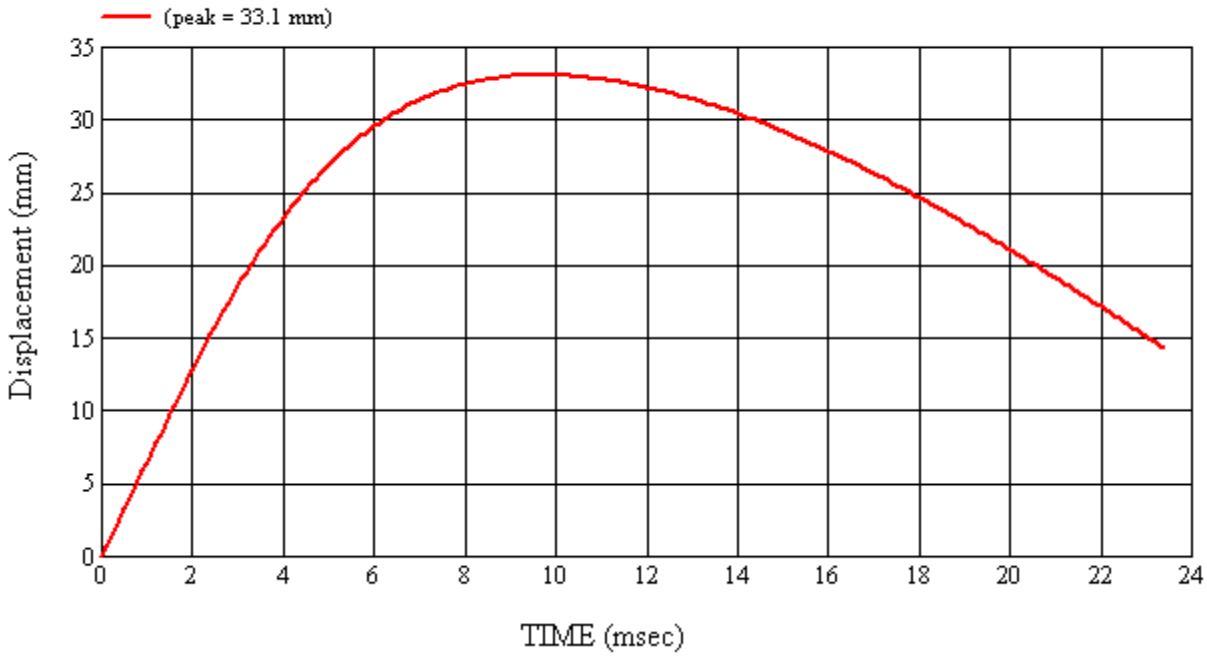



(peak = 114.7 G)
Head X (G)
20
0
-20
-40
-60
-80
-100
-120
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 11.9 G)
Head Y (G)
12
10
8
6
4
2
0
-2
-4
-6
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 32.0 G)
Head Z (G)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)


(peak = 23.8 kph)
Impact Velocity: 23.61 kph
Velocity (kph)
25
20
15
10
5
0
-5
-10
0
20
40
60
80
100
120
140
160
180
200
220
240
260
TIME (msec)


(peak = 33.1 mm)
Displacement (mm)
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (msec)

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 66ºF and 78ºF (19ºC – 26ºC) 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
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	Vision Research	Miro Ex4	Record Event	N/A	N/A
*FARO™	Faro Technologies	S08059801273	Targeting	0.1 mm	Annual
Measuring Devices: - Tape Measure - Plumb Bobs - Digital Protractor	 Stanley N/A Mitutoyo	 TPM112 -- MGA00712	 Measurement Targeting FMH setup Horizontal Measurement	 1 mm N/A 0.5°	Annual
*Temperature Recorder	Dickson	MGA00894	Record Temperature and Humidity	± 1°C ± 1% RH	Annual
* Scale	Detecto	MGA00783	Weigh FMH Head	± 0.01 lb	Annual
*Vehicle Scale	Intercomp	26032389	Weighing Vehicle	± .5 kg	Annual

Each headform was calibrated by an engineer after the headform had soaked in an environment of 66ºF to 78ºF (19ºC to 26ºC) 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.

TABLE 4-2 FMH CALIBRATION SUMMARY

FMH Serial #		Headform Calibration Date	Weight (lbs)	Temp (ºC)	% Humidity	Peak Resultant Acceleration (G's)	Peak Lateral Acceleration (G's)	Unimodal
Pre	#35	3/23/2011	9.90	21.6	25.5	245.9	6.0	Yes
Post	#35	3/29/2011	9.90	22.1	15.8	248.4	2.4	Yes
Pre	#37	3/23/2011	9.96	21.4	25.7	256.3	3.3	Yes
Post	#37	3/29/2011	9.96	22.0	15.7	260.0	3.4	Yes
Pre	#38	3/23/2011	9.90	21.3	25.8	261.6	14.9	Yes
Post	#38	3/29/2011	9.90	21.7	16.0	255.9	5.2	Yes

4-1 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

HEADFORM SERIAL NUMBER: 035	CALIBRATION DATE: 3/23/2011 CALIBRATION TIME: 4:36:38 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	21.6
Relative Humidity	10% to 70%	25.5
Peak Resultant Acceleration	225 G's to 275 G's	245.9
Peak Lateral Acceleration	15 G's Maximum	6.0
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION

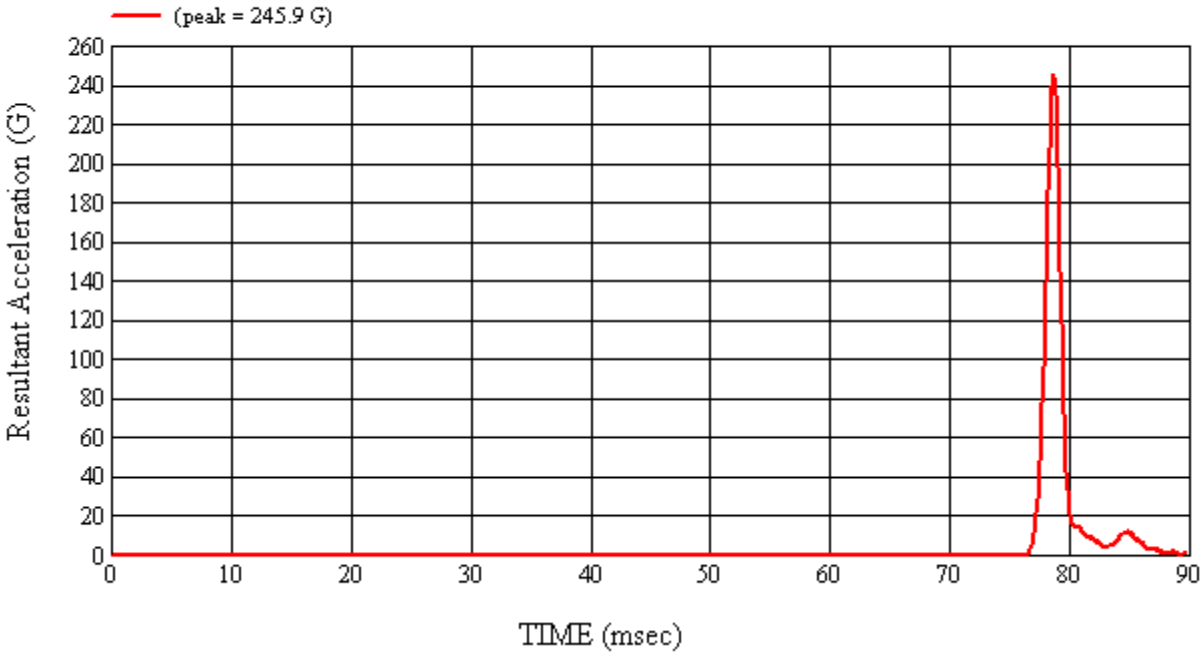
HEAD ACCELEROMETERS

Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J35919	02/04/11	08/04/11
2	ENDEVCO	7264-2000	J22664	02/04/11	08/04/11
3	ENDEVCO	7264-2000	J35924	02/04/11	08/04/11

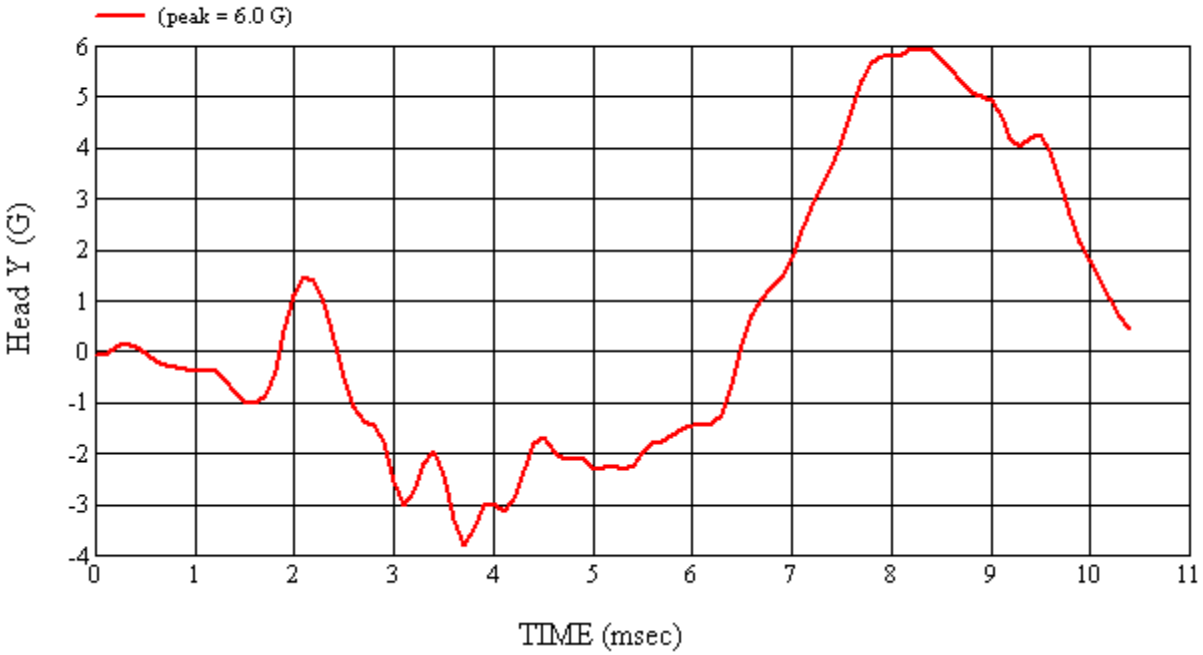
REMARKS:

RECORDED BY: _____ DATE: 3/23/2011

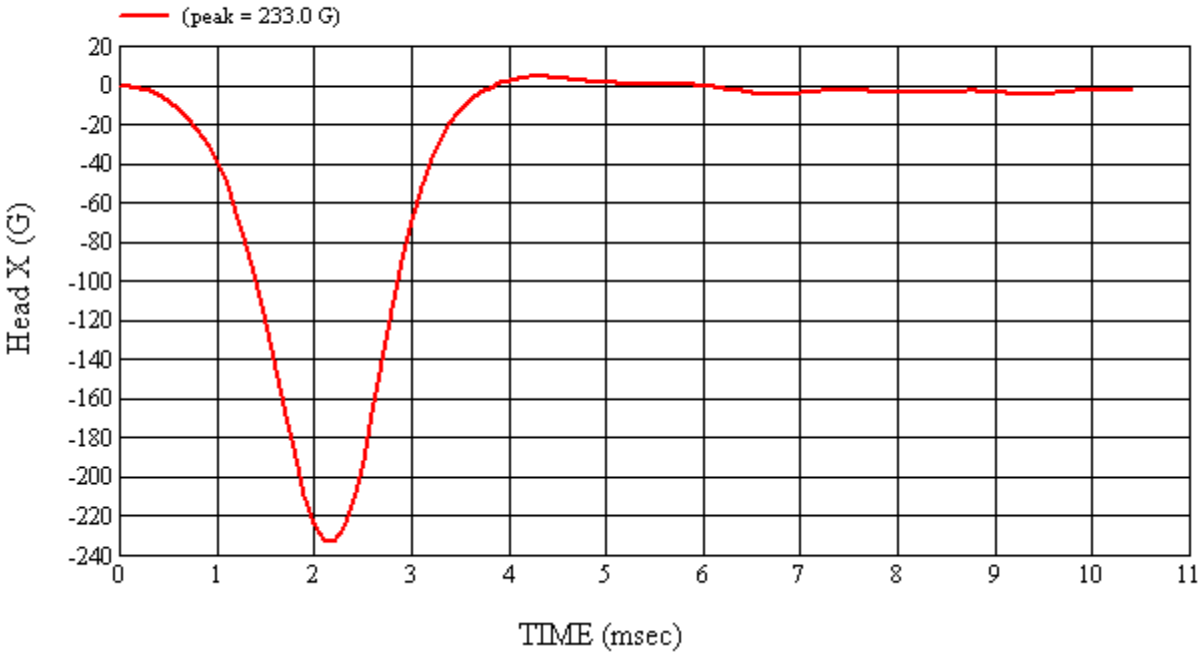
APPROVED BY: _____



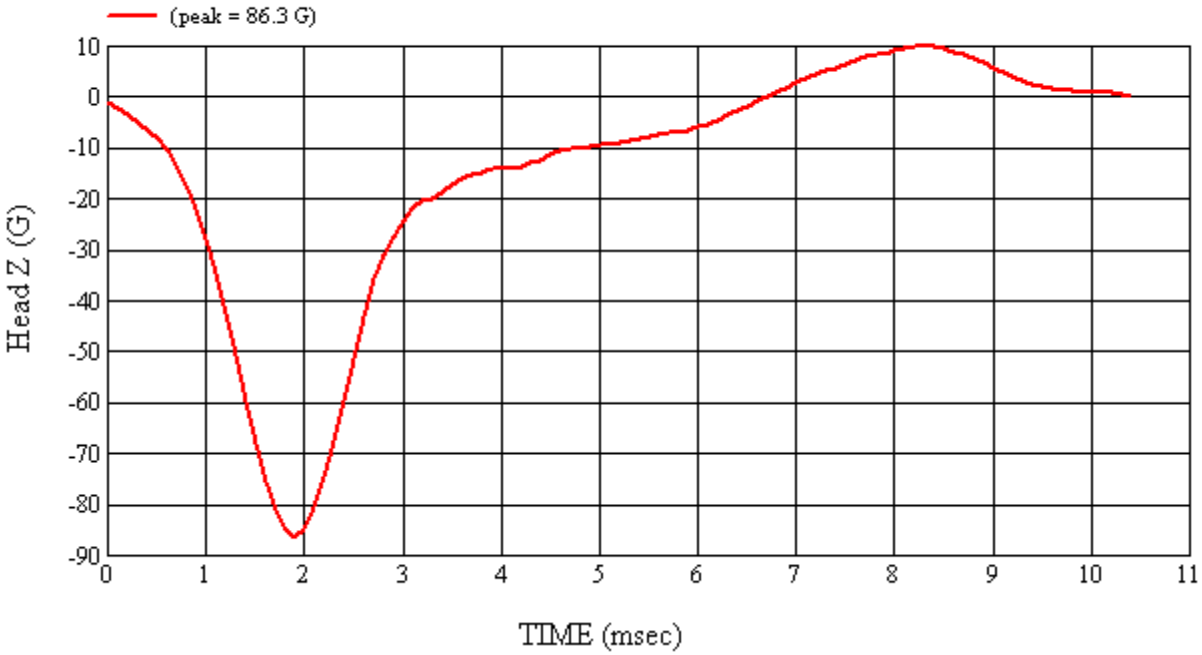
Head 035 (Pre) Calibration #H35005



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

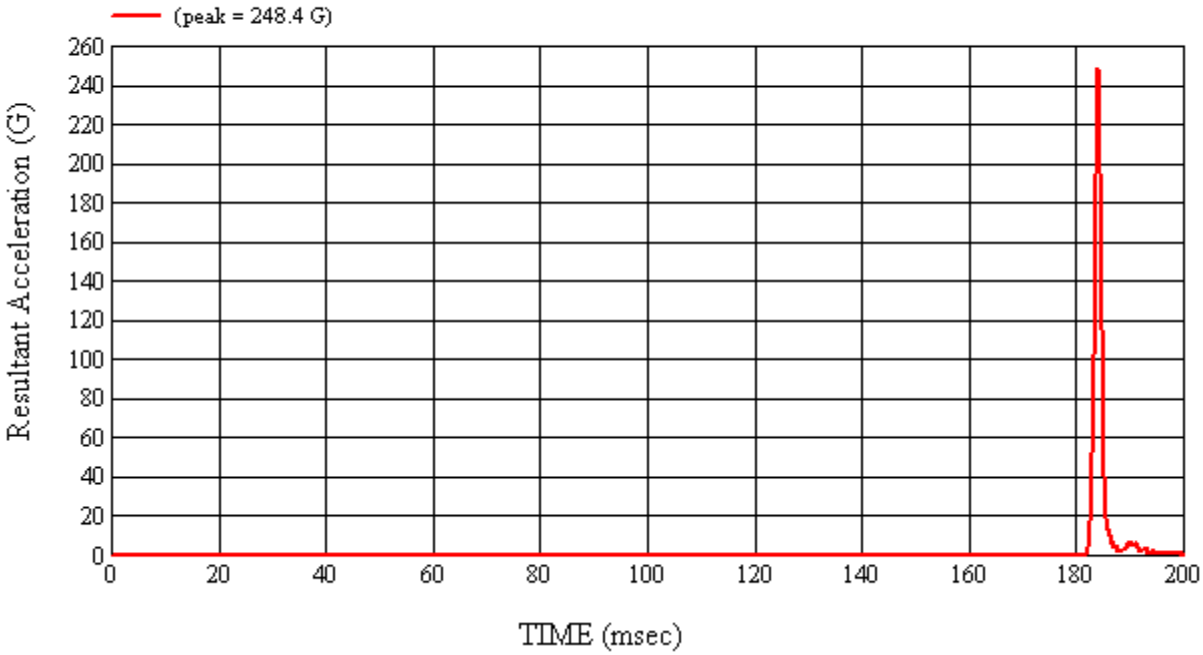
HEADFORM SERIAL NUMBER: 35	CALIBRATION DATE: 3/29/2011 CALIBRATION TIME: 8:23:13 AM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	22.1
Relative Humidity	10% to 70%	15.8
Peak Resultant Acceleration	225 G's to 275 G's	248.4
Peak Lateral Acceleration	15 G's Maximum	2.4
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	J35919	02/04/11	08/04/11
2	ENDEVCO	7264-2000	J22664	02/04/11	08/04/11
3	ENDEVCO	7264-2000	J35924	02/04/11	08/04/11

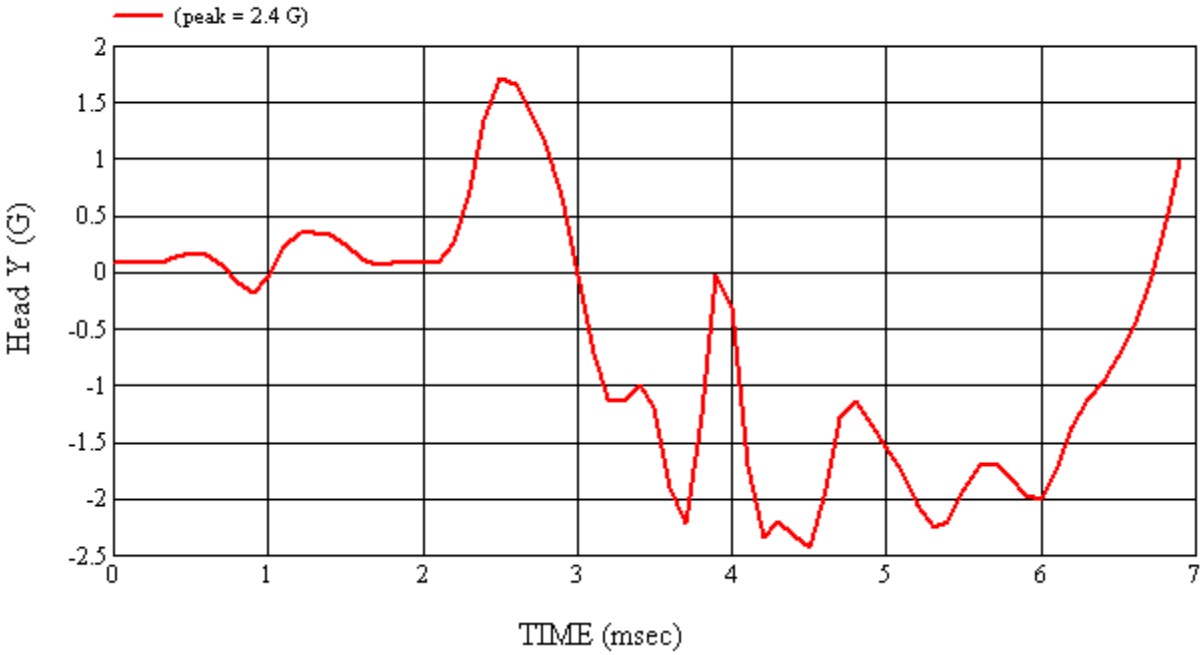
REMARKS:

RECORDED BY: _____ DATE: 3/29/2011

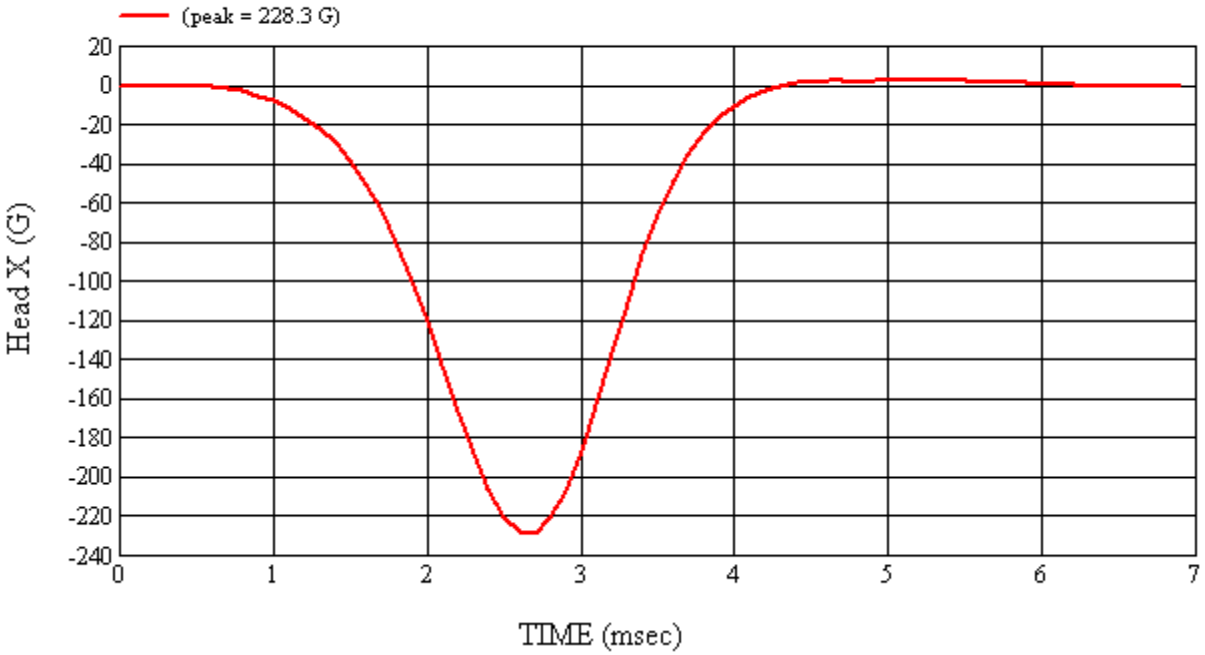
APPROVED BY: _____



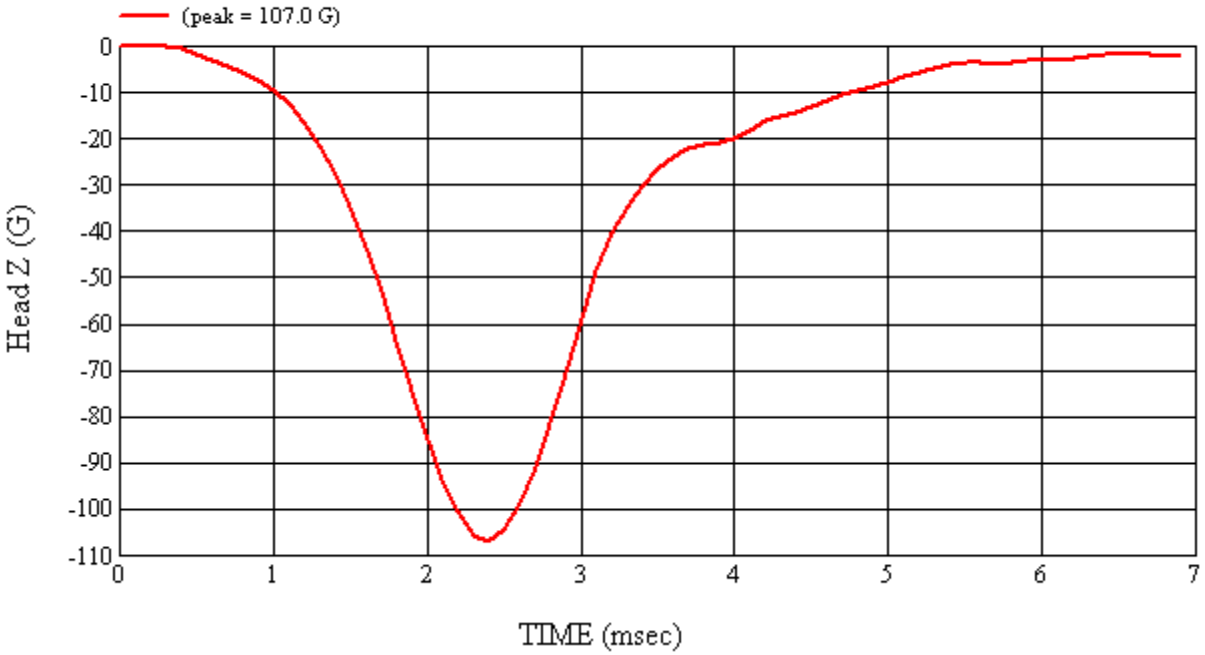
Head 35 (Post) Calibration #H35006



Head 35 (Post) Calibration #H35006



Head 35 (Post) Calibration #H35006



Head 35 (Post) Calibration #H35006

4-3 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

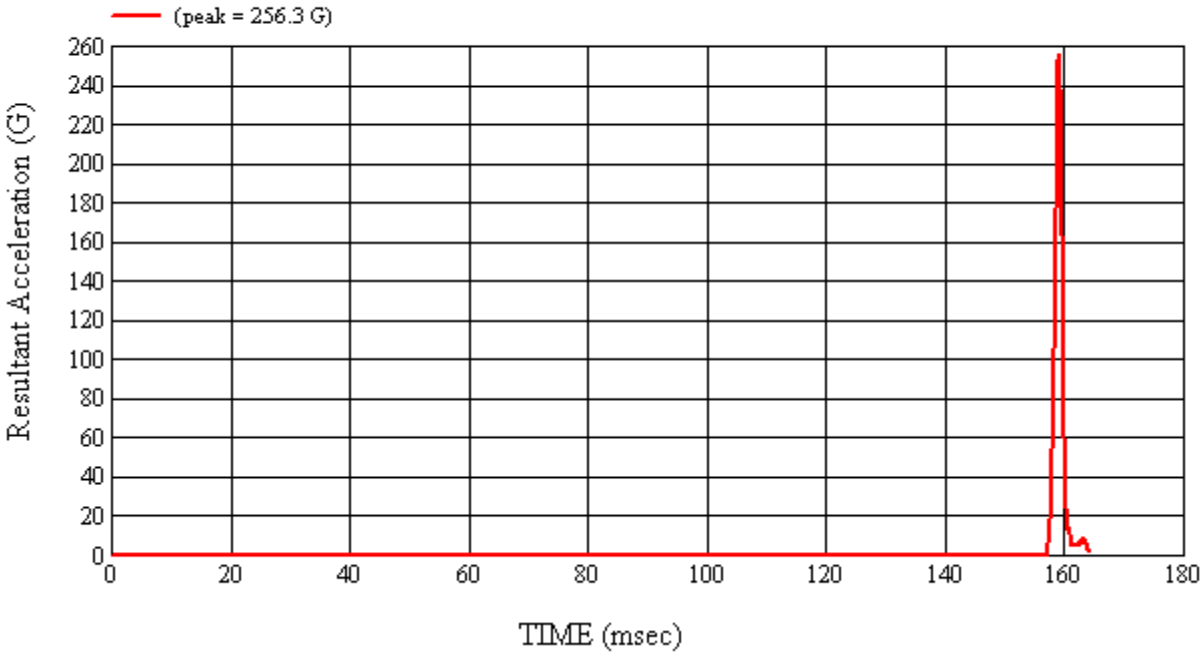
HEADFORM SERIAL NUMBER: 037	CALIBRATION DATE: 3/23/2011 CALIBRATION TIME: 5:11:42 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	21.4
Relative Humidity	10% to 70%	25.7
Peak Resultant Acceleration	225 G's to 275 G's	256.3
Peak Lateral Acceleration	15 G's Maximum	3.3
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	J32177	02/04/11	08/04/11
2	ENDEVCO	7264-2000	J14103	02/04/11	08/04/11
3	ENDEVCO	7264-2000	J35800	02/04/11	08/04/11

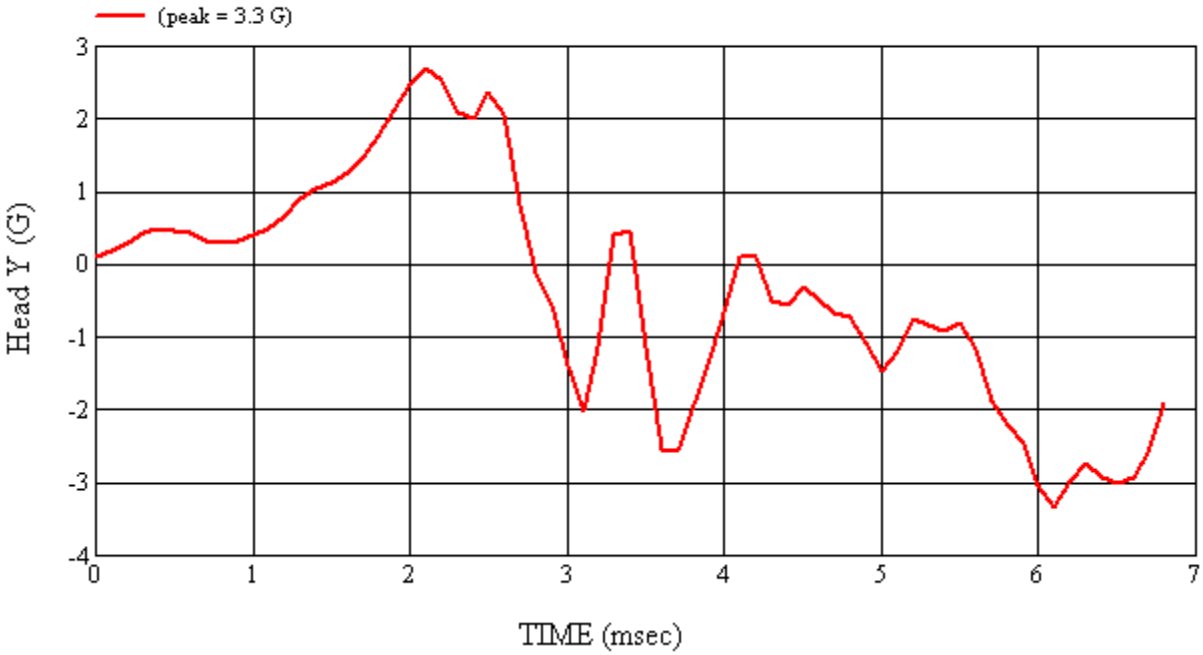
REMARKS:

RECORDED BY: _____ DATE: 3/23/2011

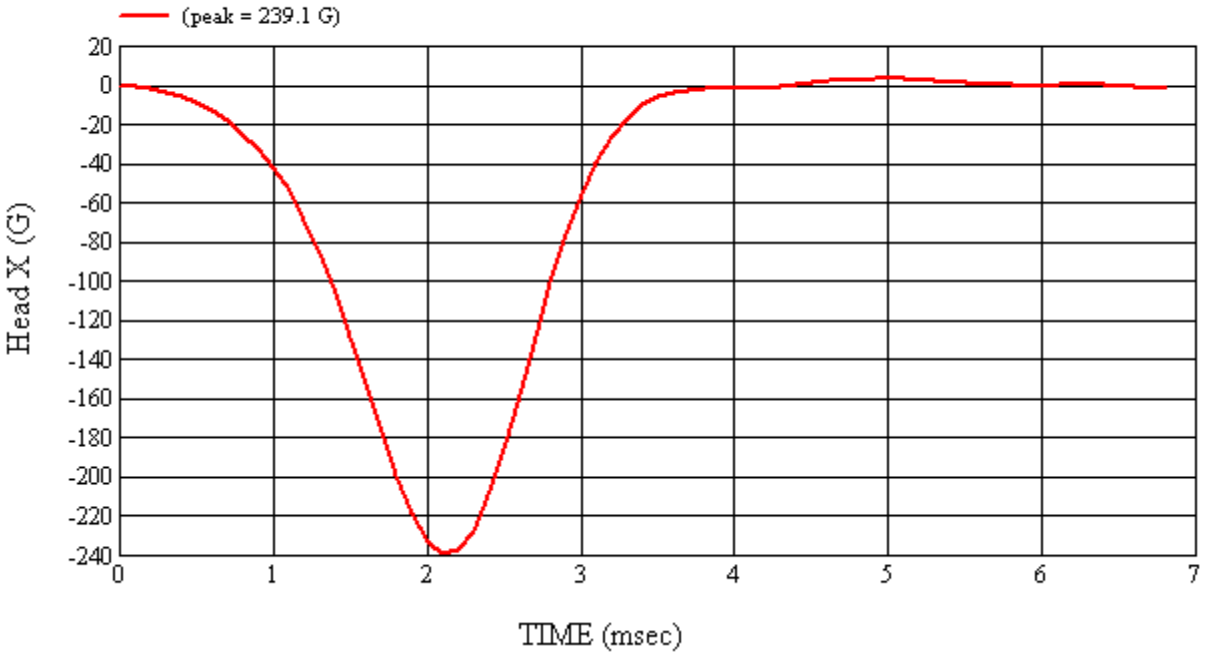
APPROVED BY: _____



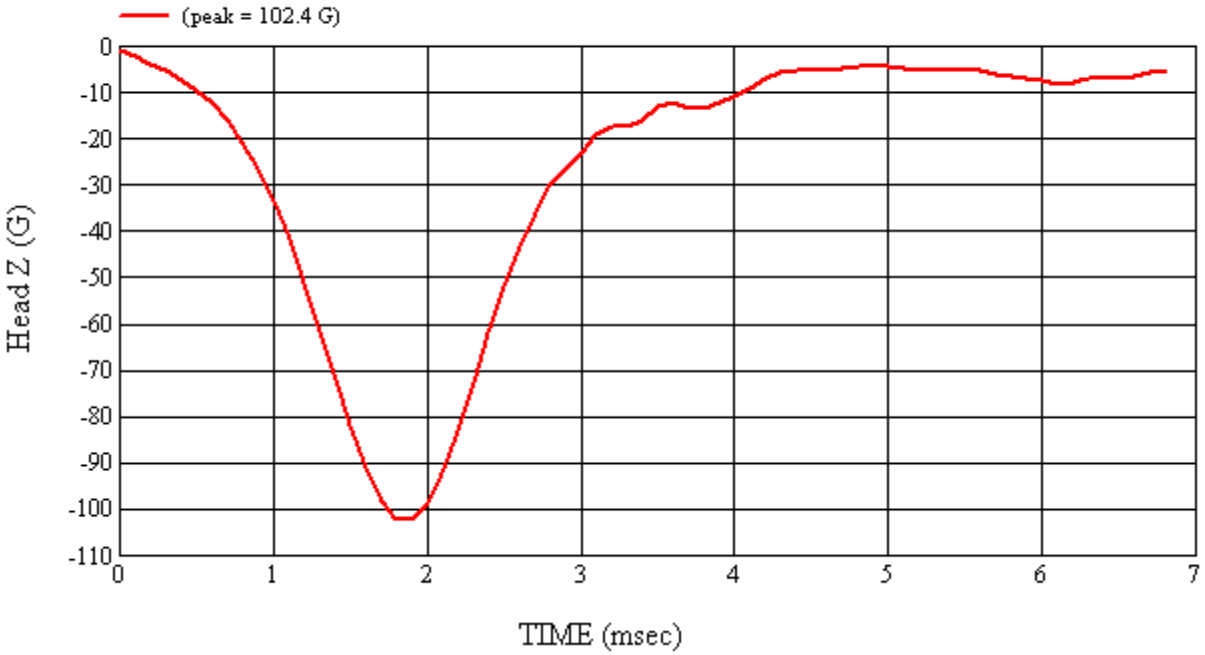
Head 037 (Pre) Calibration #H37005



Head 037 (Pre) Calibration #H37005



Head 037 (Pre) Calibration #H37005



Head 037 (Pre) Calibration #H37005

4-4 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

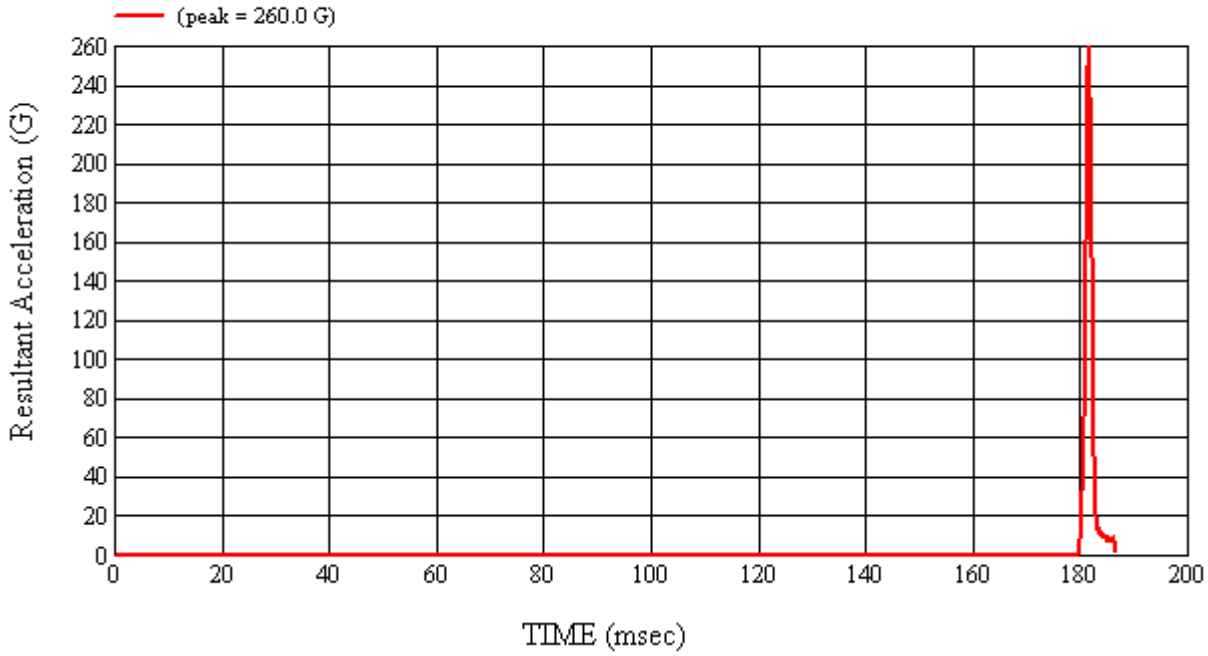
HEADFORM SERIAL NUMBER: 37	CALIBRATION DATE: 3/29/2011 CALIBRATION TIME: 10:06:17 AM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.96
Temperature	19° C to 26° C	22.0
Relative Humidity	10% to 70%	15.7
Peak Resultant Acceleration	225 G's to 275 G's	260.0
Peak Lateral Acceleration	15 G's Maximum	3.4
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	J32177	02/04/11	08/04/11
2	ENDEVCO	7264-2000	J14103	02/04/11	08/04/11
3	ENDEVCO	7264-2000	J35800	02/04/11	08/04/11

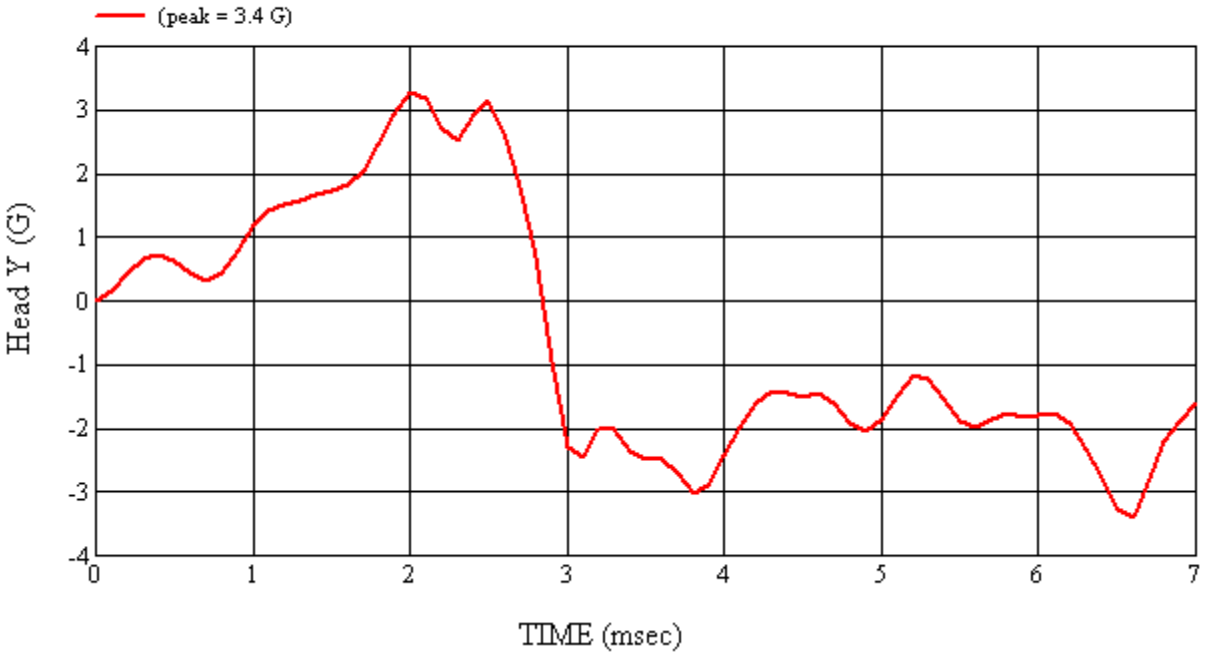
REMARKS:

RECORDED BY: _____ DATE: 3/29/2011

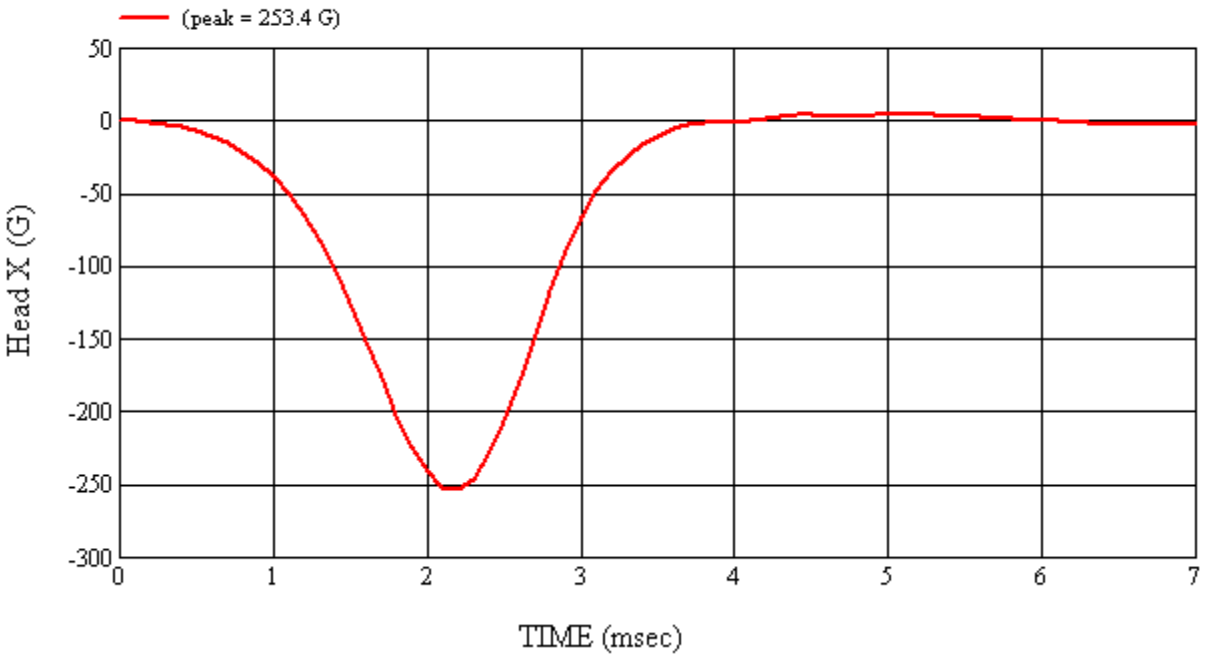
APPROVED BY: _____



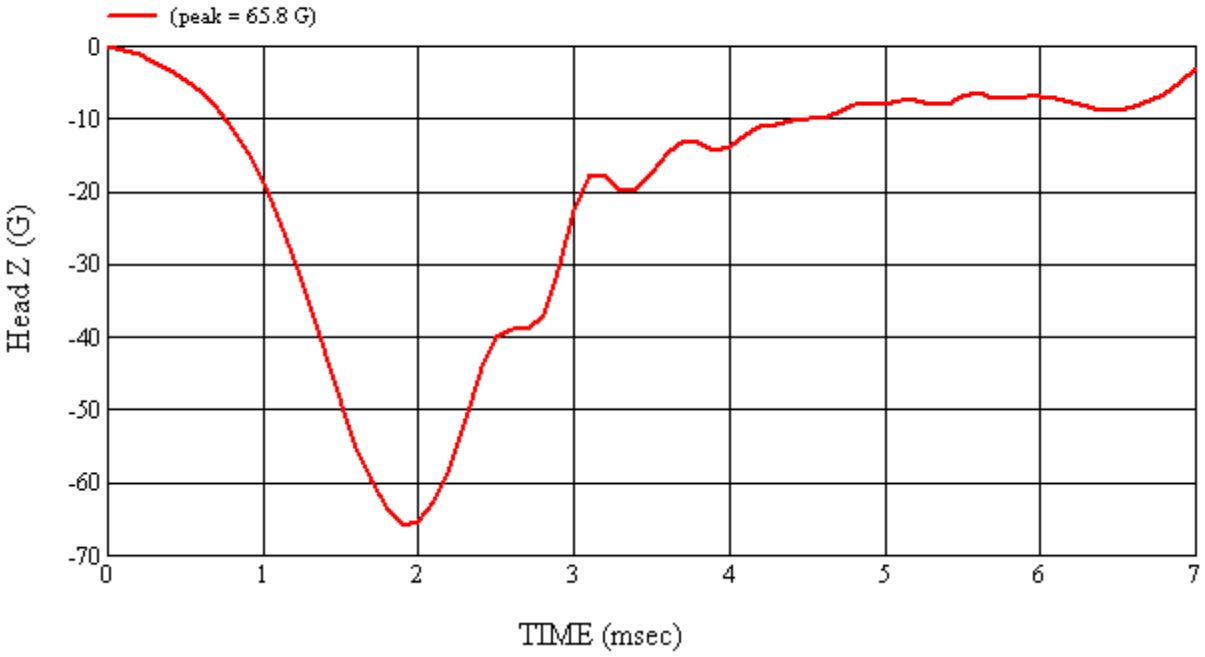
Head 37 (Post) Calibration #H37006



Head 37 (Post) Calibration #H37006



Head 37 (Post) Calibration #H37006



Head 37 (Post) Calibration #H37006

4-5 Pre-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

HEADFORM SERIAL NUMBER: 038	CALIBRATION DATE: 3/23/2011 CALIBRATION TIME: 5:24:34 PM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	21.3
Relative Humidity	10% to 70%	25.8
Peak Resultant Acceleration	225 G's to 275 G's	261.6
Peak Lateral Acceleration	15 G's Maximum	14.9
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION

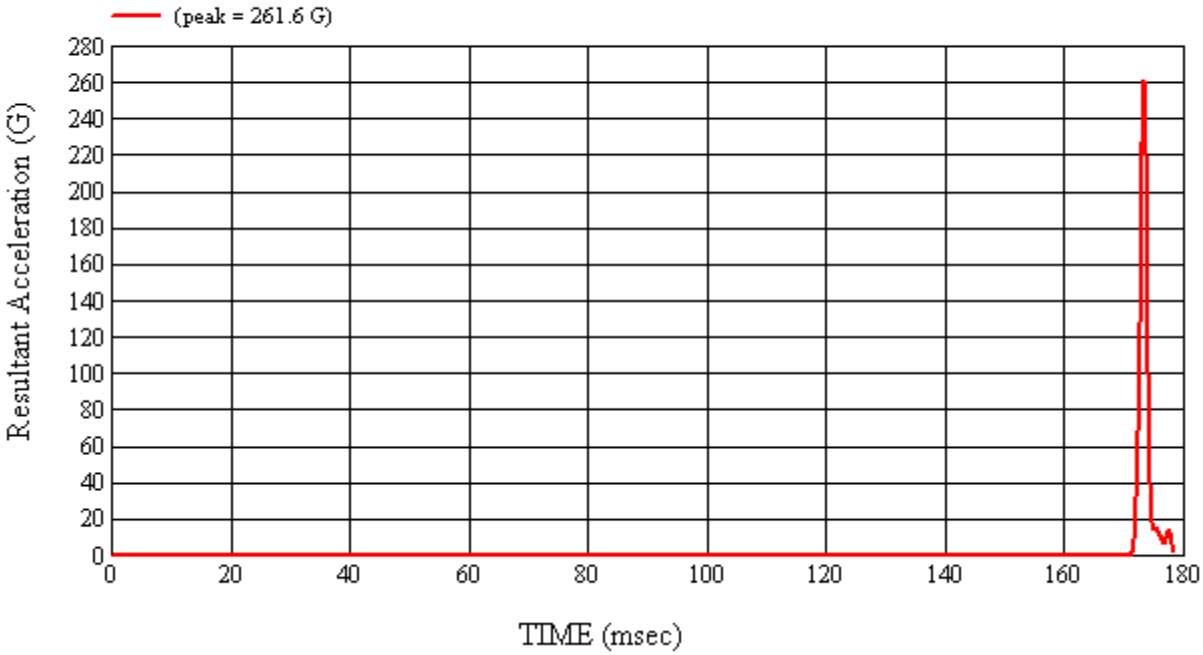
HEAD ACCELEROMETERS

Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22700	02/07/11	08/07/11
2	ENDEVCO	7264-2000	J36197	02/07/11	08/07/11
3	ENDEVCO	7264-2000	J36353	02/07/11	08/07/11

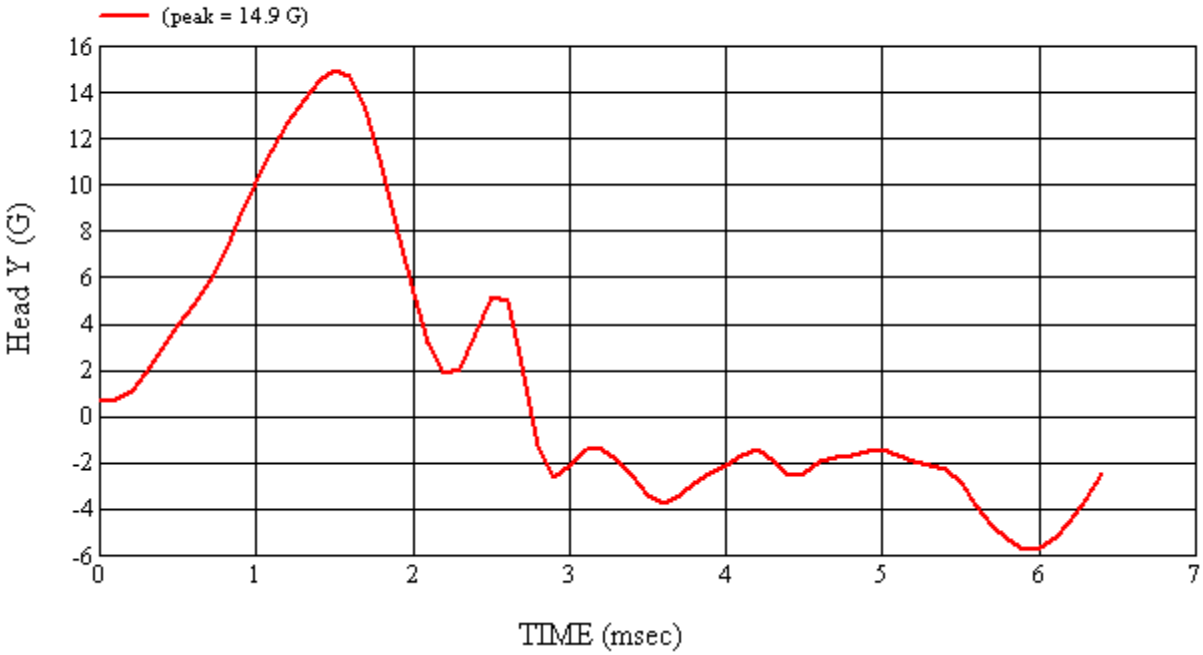
REMARKS:

RECORDED BY: Kevin D. McKenna DATE: 3/23/2011

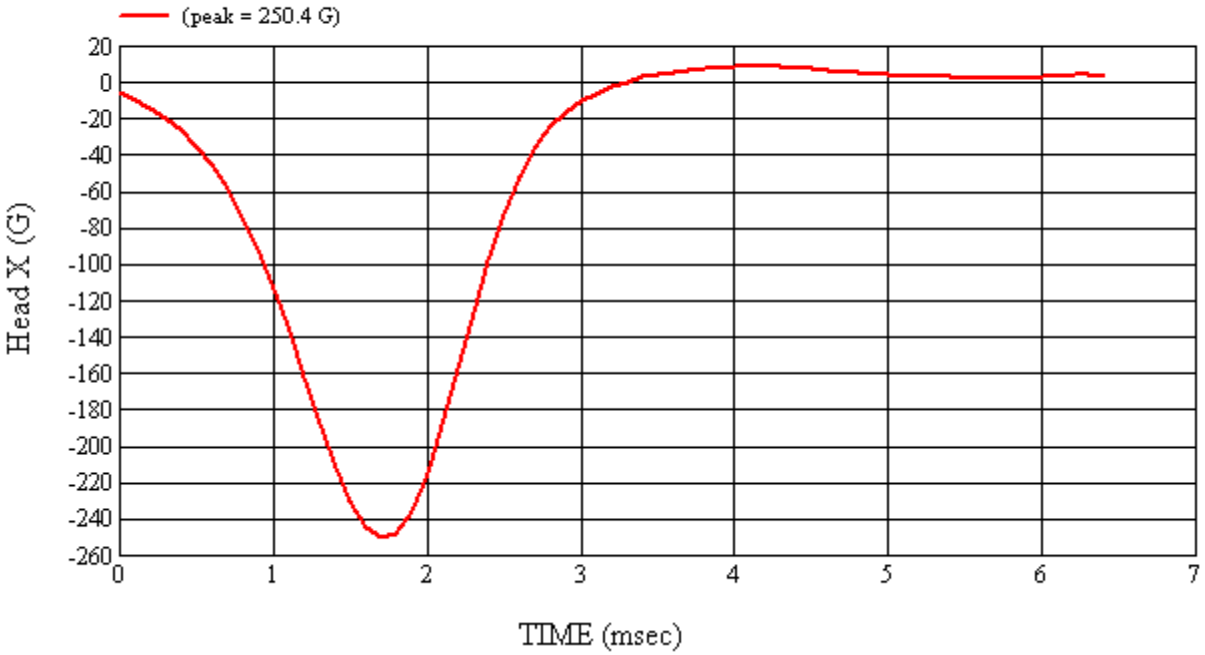
APPROVED BY: Nathaniel Hamlin



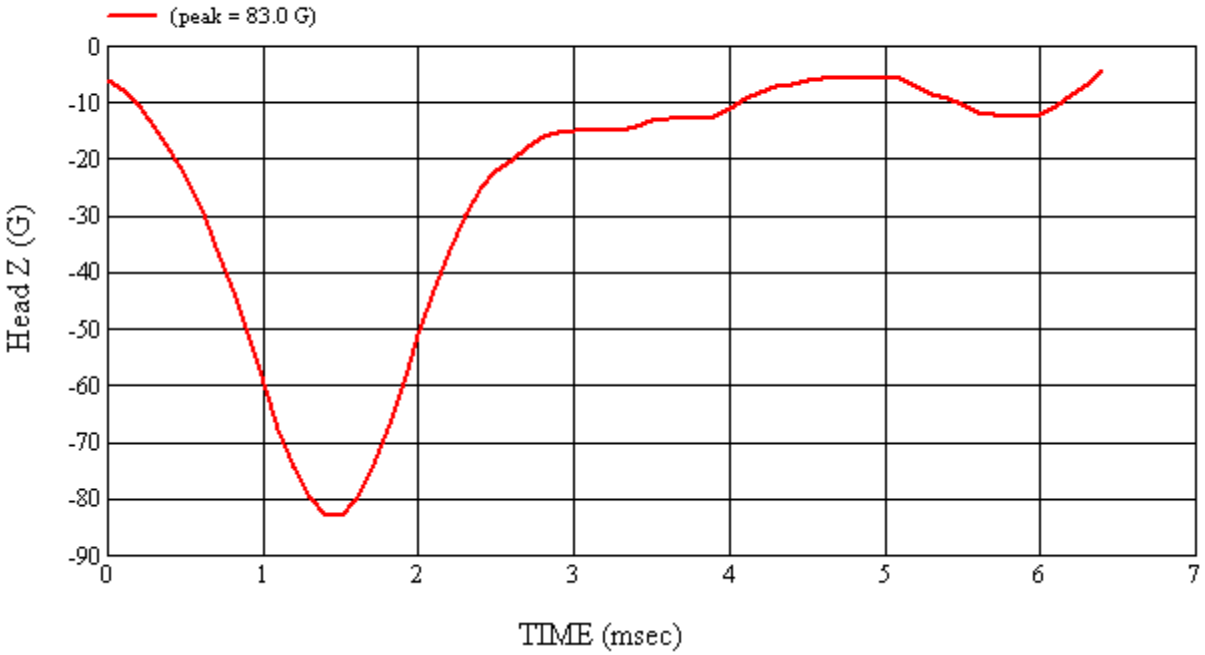
Head 038 (Pre) Calibration #H38005



Head 038 (Pre) Calibration #H38005



Head 038 (Pre) Calibration #H38005



Head 038 (Pre) Calibration #H38005

4-6 Post-Test Calibration

HEAD DROP TEST SUMMARY
PART 572L

HEADFORM SERIAL NUMBER: 38	CALIBRATION DATE: 3/29/2011 CALIBRATION TIME: 10:48:17 AM	
TEST PARAMETER	**SPECIFICATION**	**TEST RESULTS**
Weight	9.90 to 10.10 lbs.	9.90
Temperature	19° C to 26° C	21.7
Relative Humidity	10% to 70%	16.0
Peak Resultant Acceleration	225 G's to 275 G's	255.9
Peak Lateral Acceleration	15 G's Maximum	5.2
Unimodal Acceleration Curve	YES	YES

FMH INSTRUMENTATION

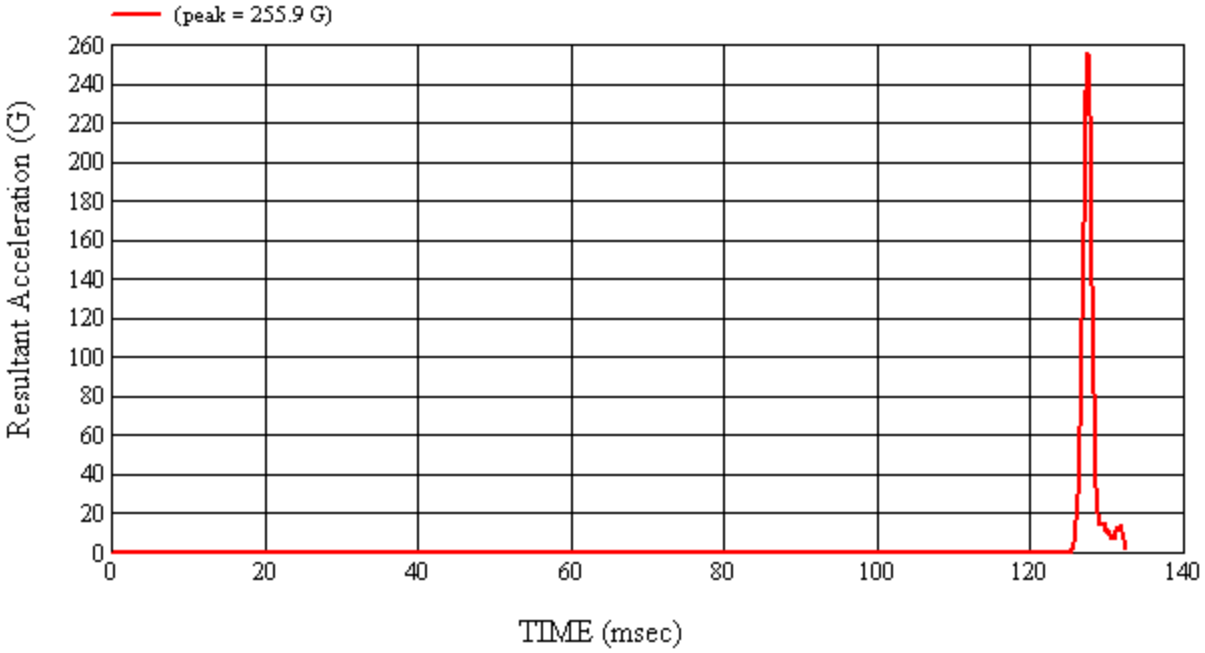
HEAD ACCELEROMETERS

Channel Number	Manufacturer	Model Number	Serial Number	Date of Last Calibration	Date of Next Calibration
1	ENDEVCO	7264-2000	J22700	02/07/11	08/07/11
2	ENDEVCO	7264-2000	J36197	02/07/11	08/07/11
3	ENDEVCO	7264-2000	J36353	02/07/11	08/07/11

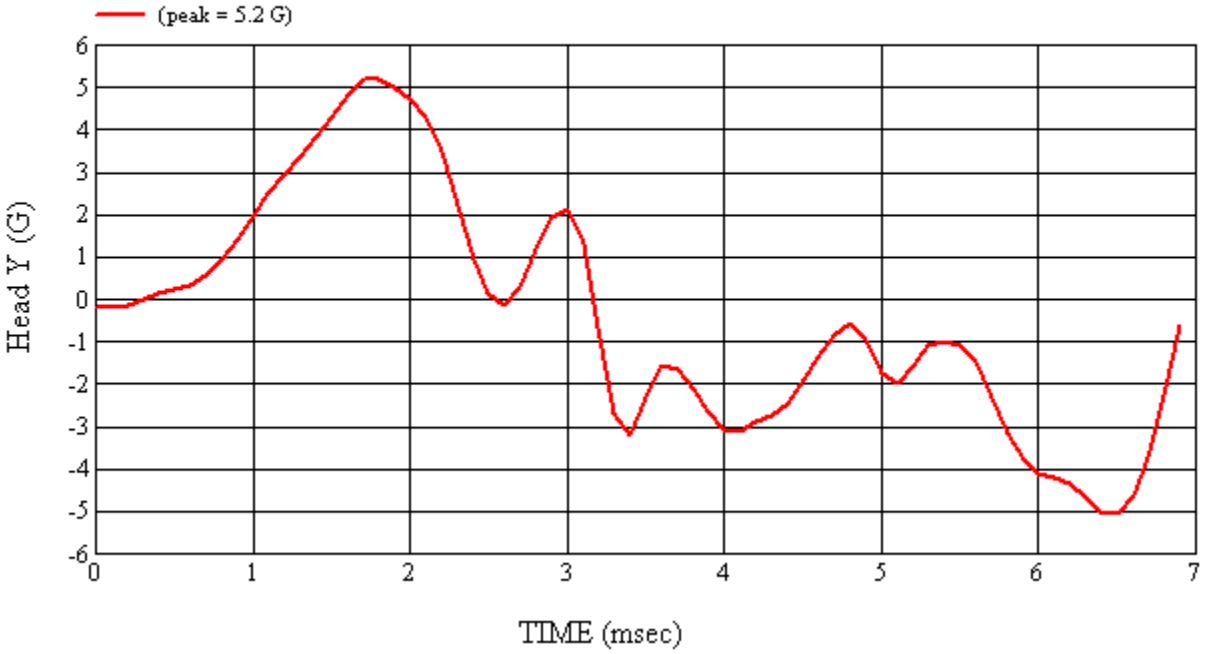
REMARKS:

RECORDED BY: _____ DATE: __3/29/2011____

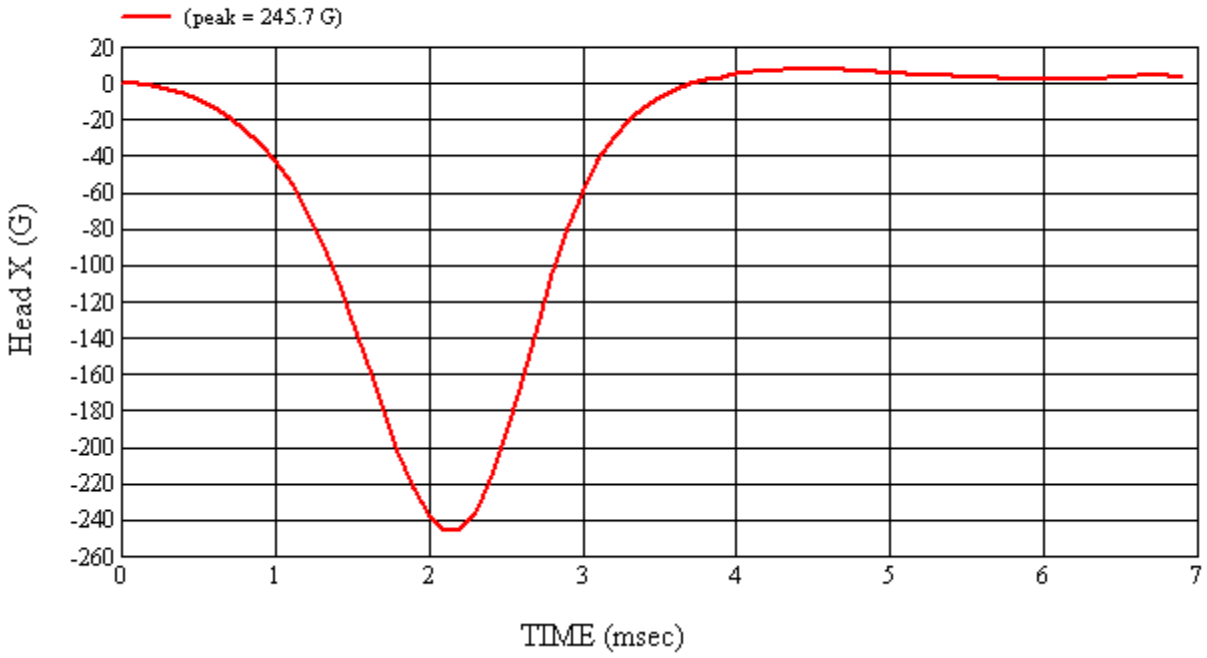
APPROVED BY: _____



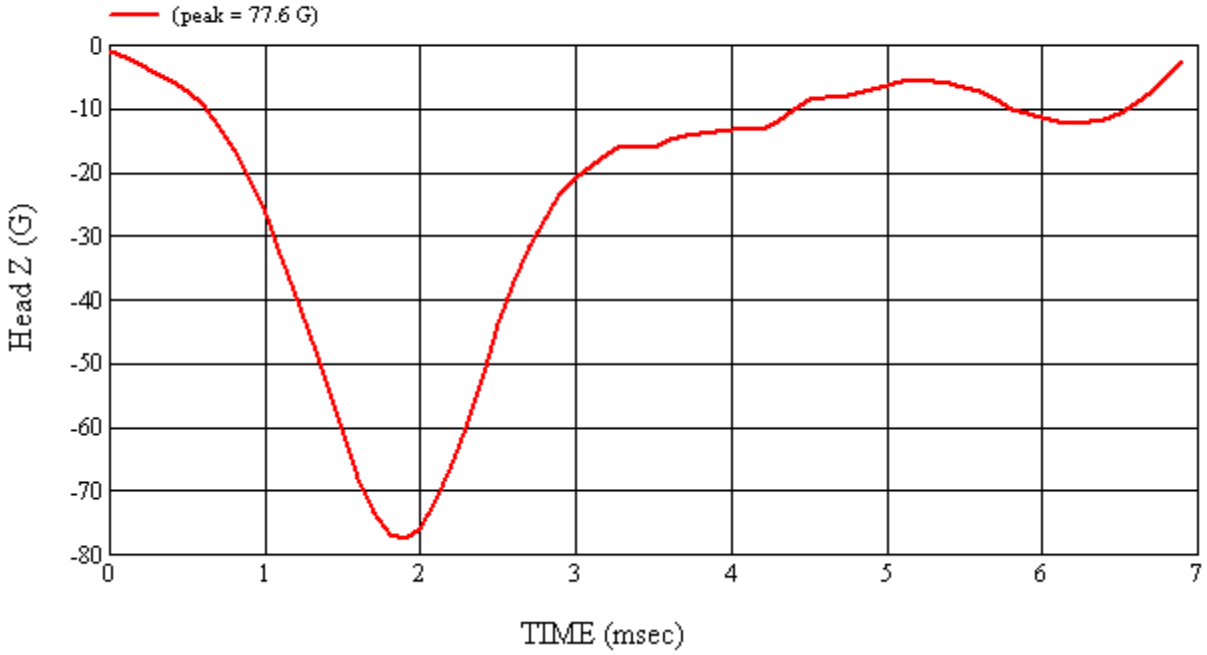
Head 38 (Post) Calibration #H38006



Head 38 (Post) Calibration #H38006



Head 38 (Post) Calibration #H38006



Head 38 (Post) Calibration #H38006

5.0 PHOTOGRAPHS

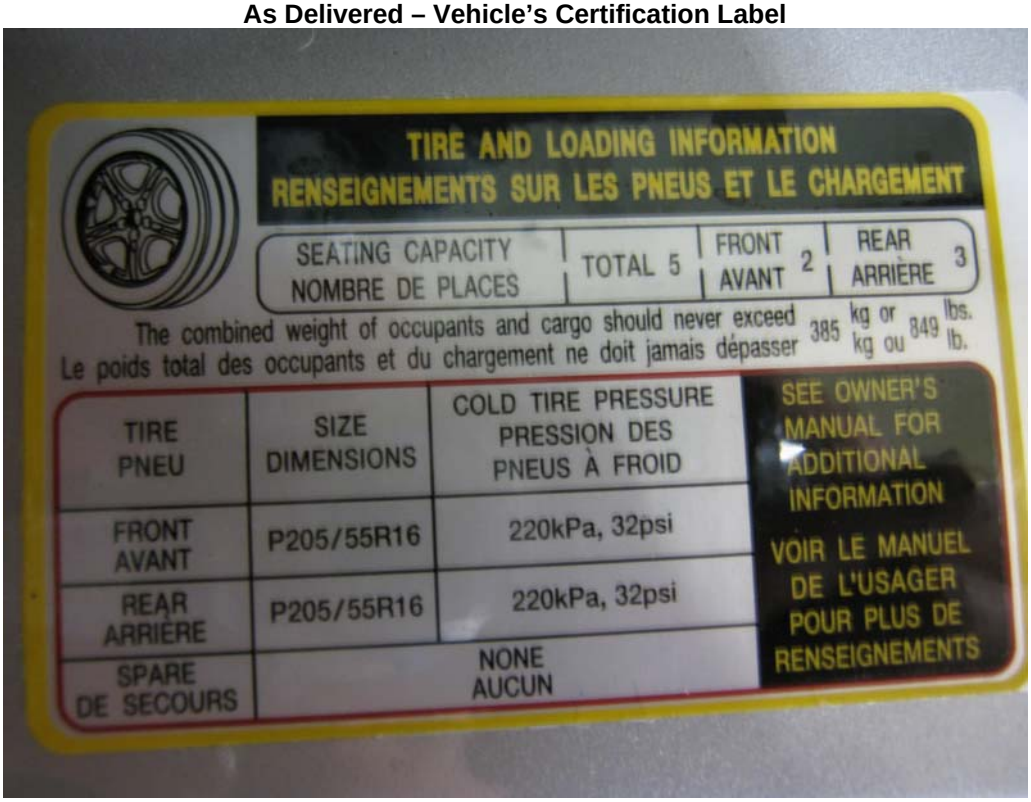
As Delivered – Left Side View

As Delivered – Right Side View

As Delivered – ¾ Front View From Left Side

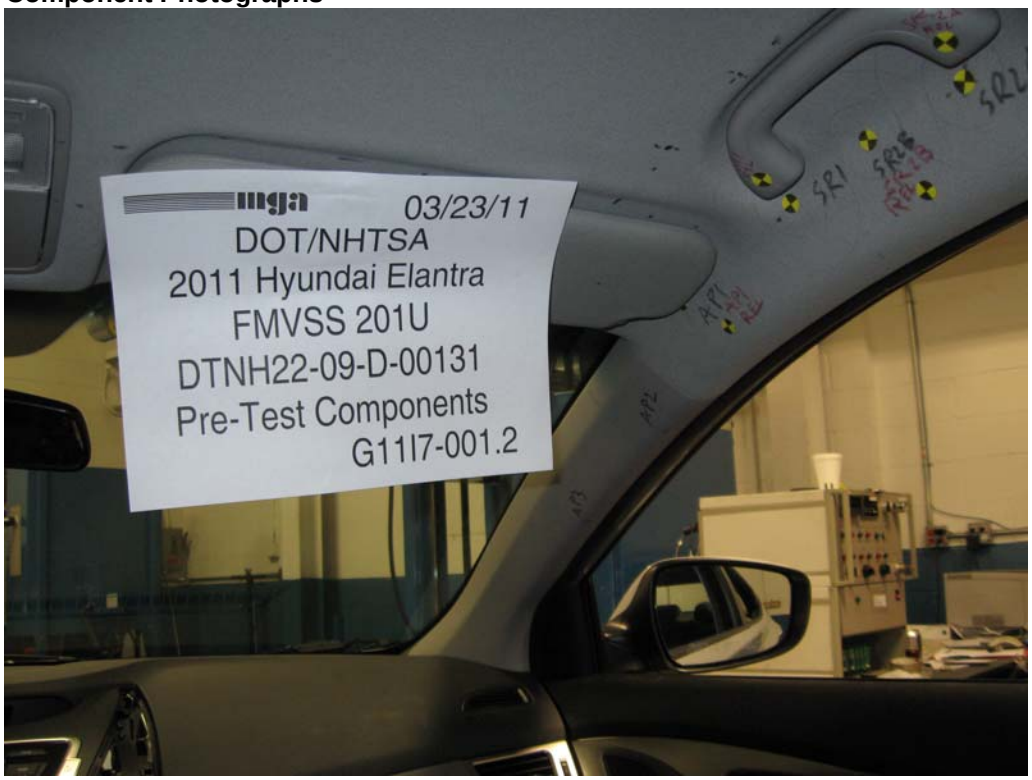
As Delivered – ¾ Rear View From Right Side

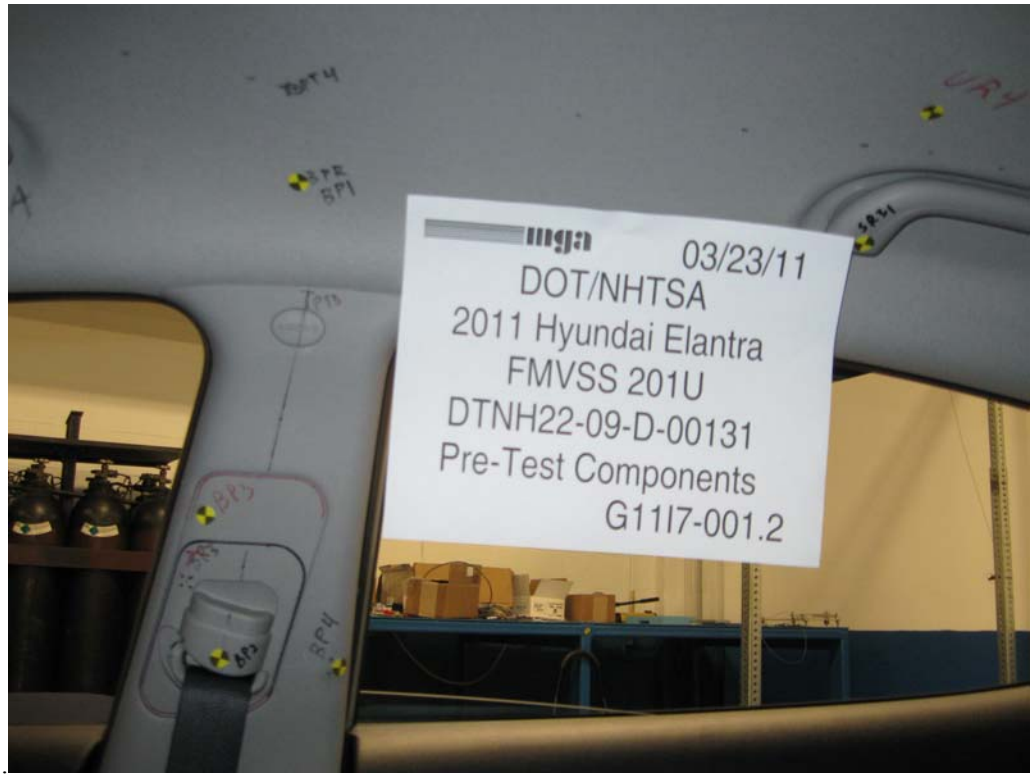
As Delivered – Vehicle's Certification Label



As Delivered – Vehicle's Tire Information Label

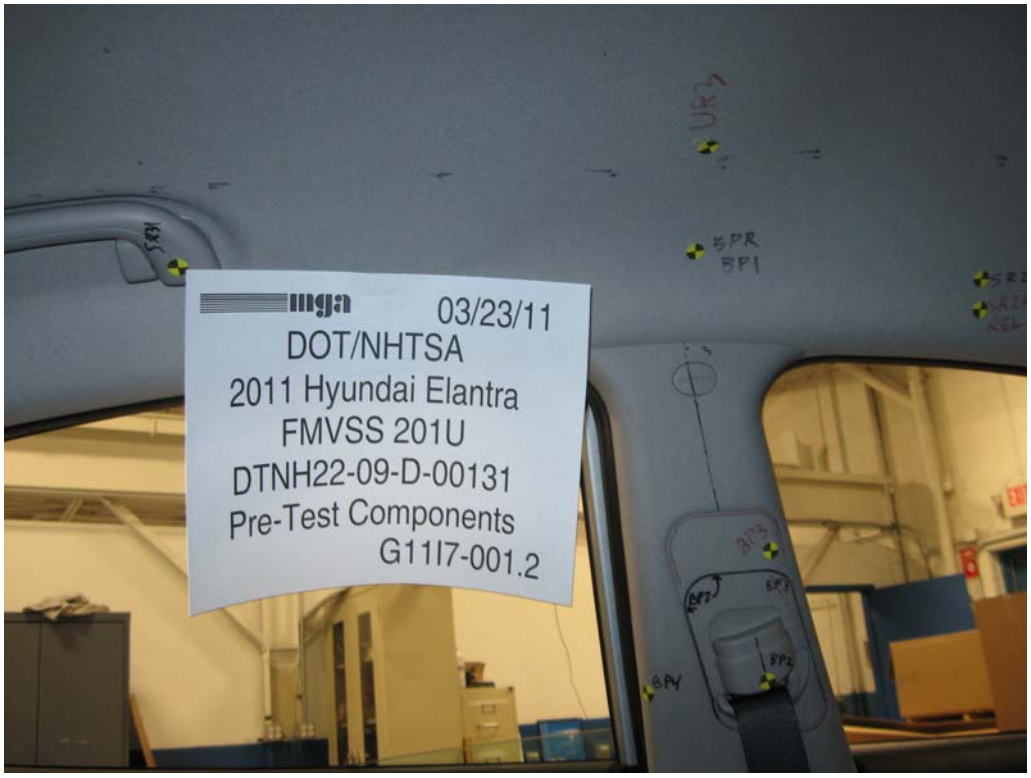
Pre-Test Component Photographs



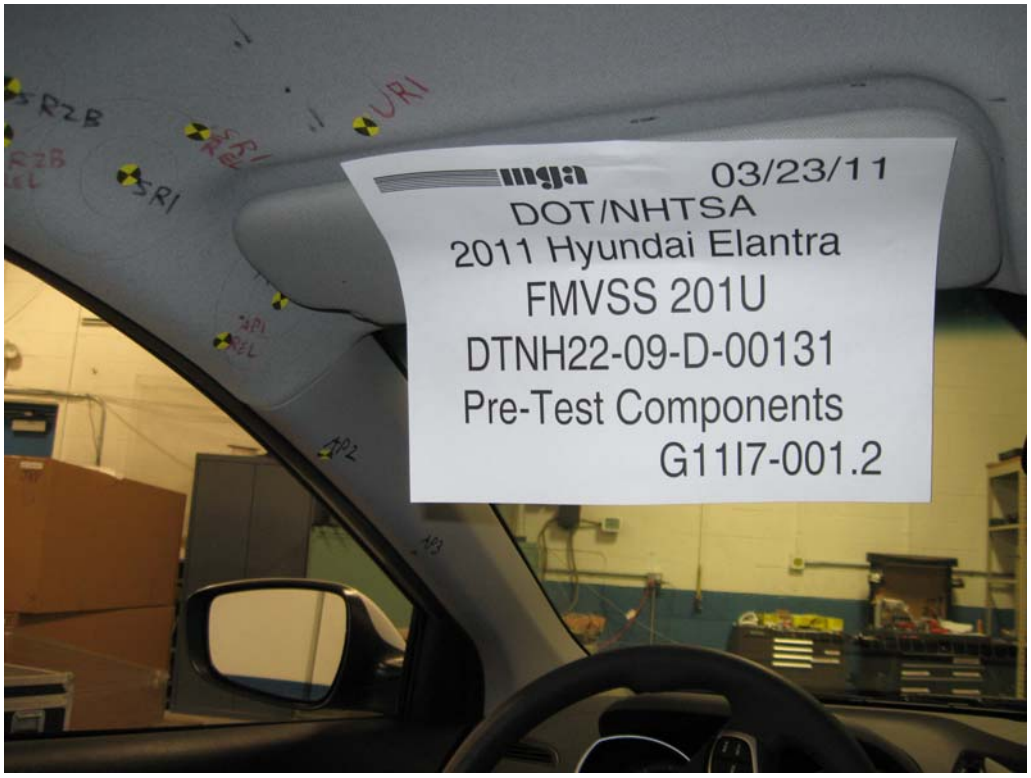

mga
03/23/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Pre-Test Components
G11I7-001.2


mga
03/23/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Pre-Test Components
G11I7-001.2

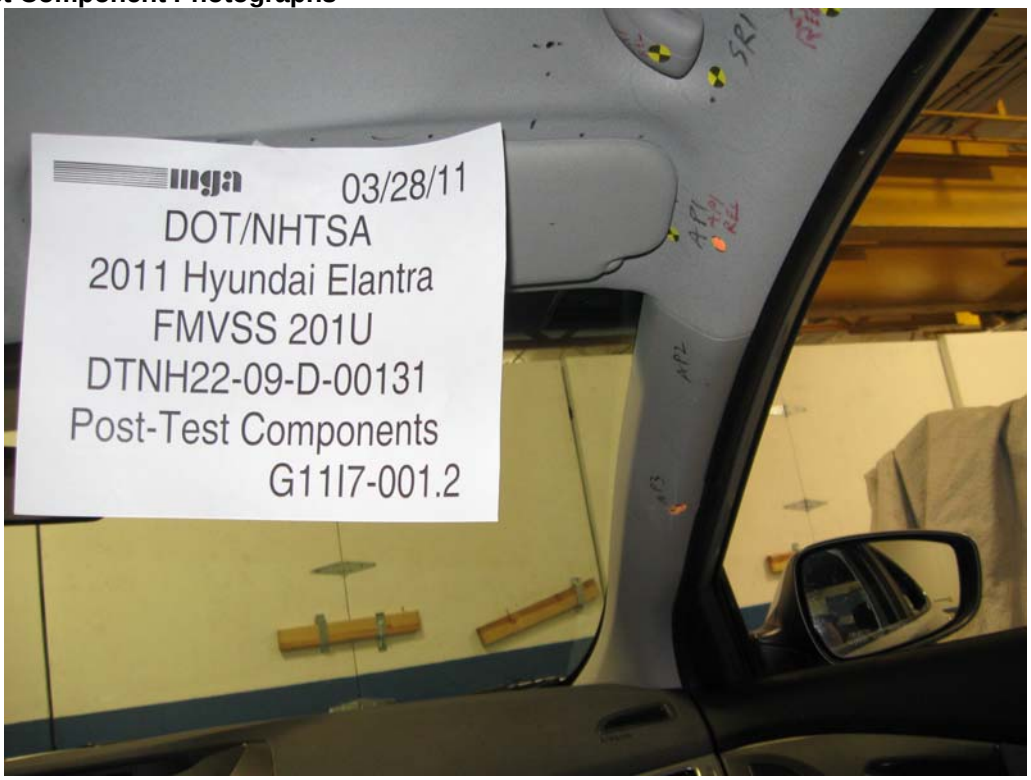

mga
03/23/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Pre-Test Components
G11I7-001.2

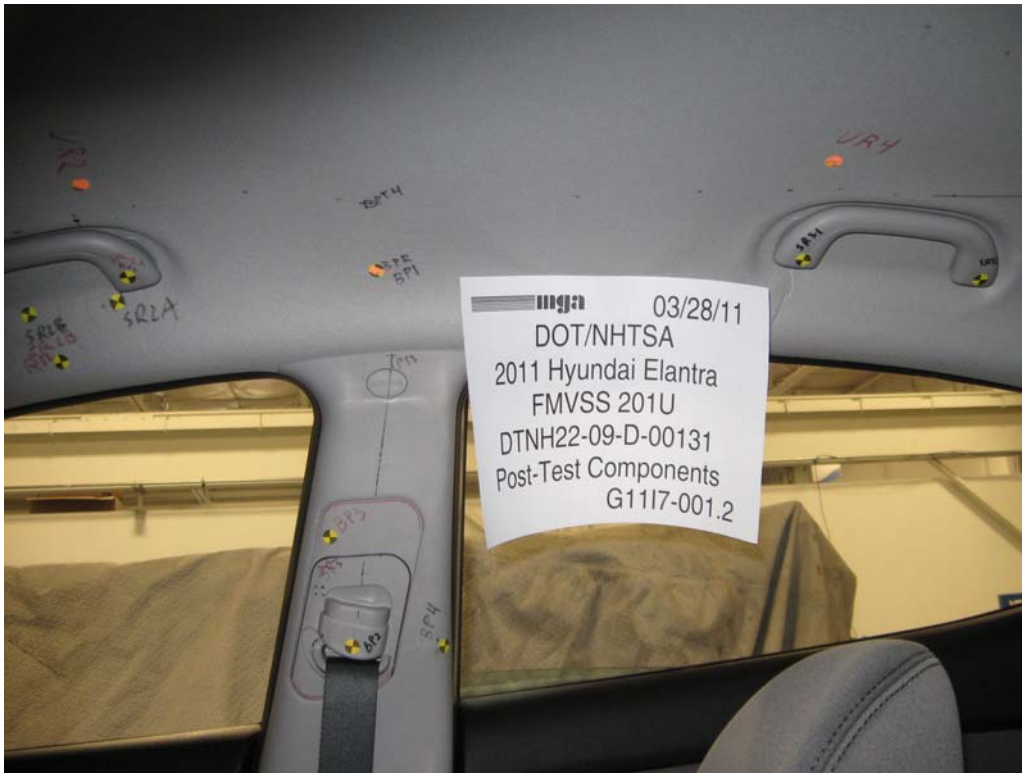

mga
03/23/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Pre-Test Components
G11I7-001.2


03/23/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Pre-Test Components
G11I7-001.2


03/23/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Pre-Test Components
G11I7-001.2

Post-Test Component Photographs



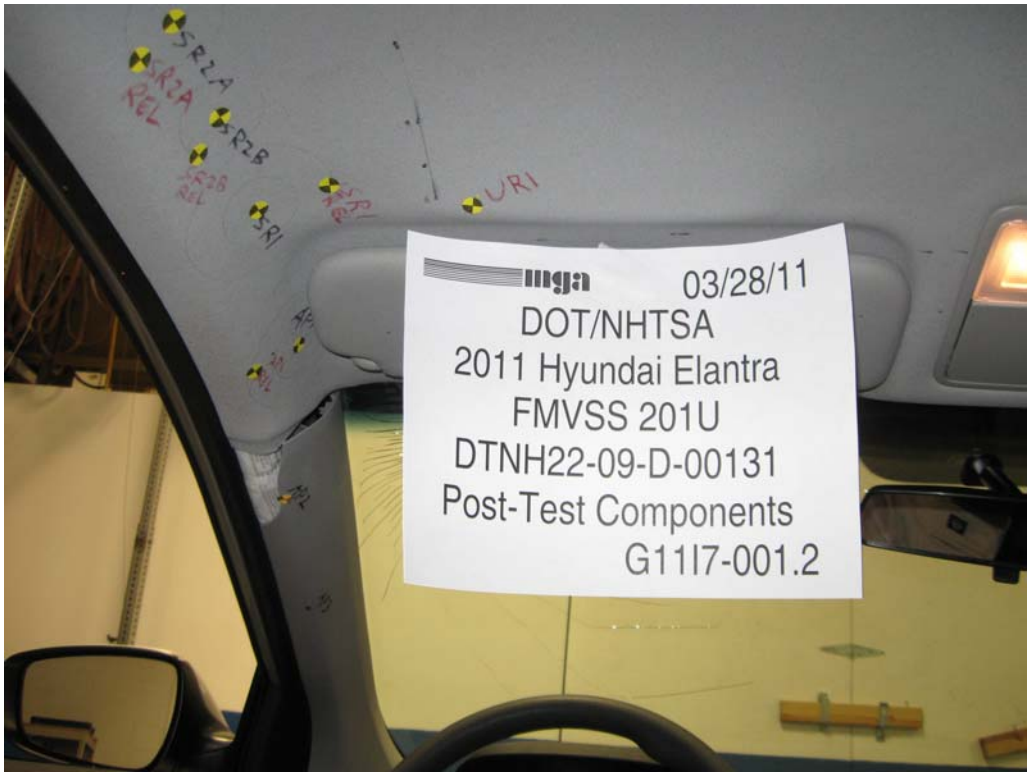

mga
03/28/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Post-Test Components
G11I7-001.2


mga
03/28/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Post-Test Components
G11I7-001.2

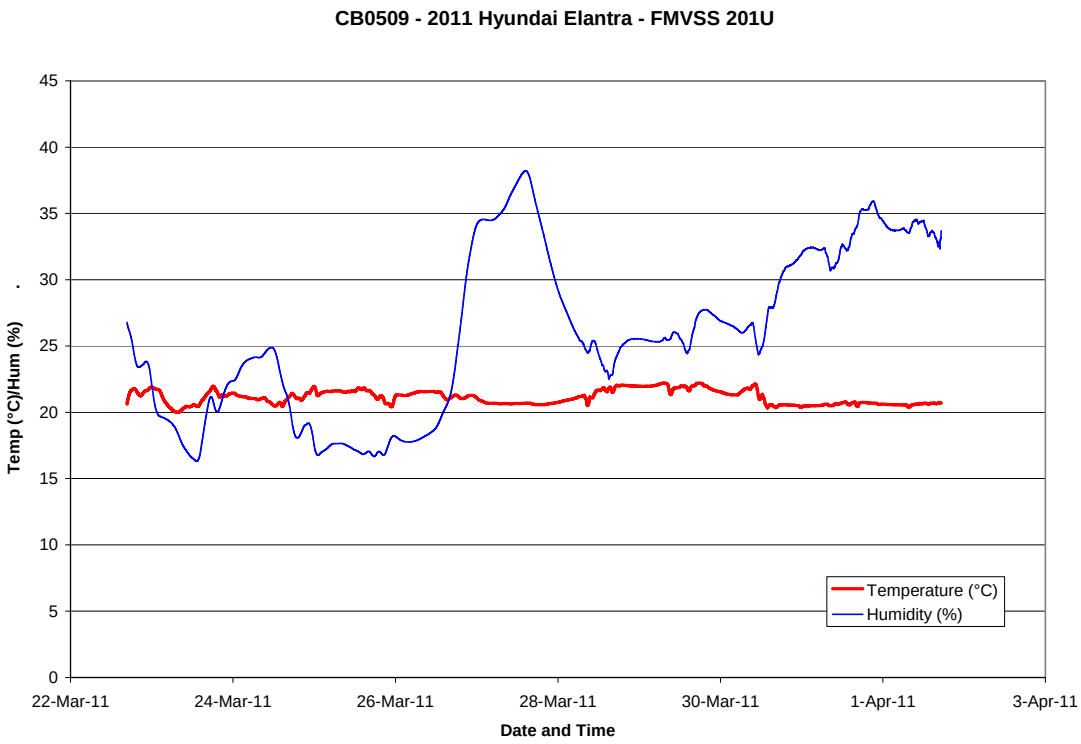

inga
03/28/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Post-Test Components
G11I7-001.2


inga
03/28/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Post-Test Components
G11I7-001.2


SR2A
SR2A REL
SR2B
SRI
URI
mga
03/28/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Post-Test Components
G11I7-001.2


SR2A
SR2A REL
SR2B
SRI
URI
mga
03/28/11
DOT/NHTSA
2011 Hyundai Elantra
FMVSS 201U
DTNH22-09-D-00131
Post-Test Components
G11I7-001.2

Appendix A – Temperature Trace



Appendix B – Calibration Certificates

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35919
Capacity/Range: (G's)	2,000

Calibration Date:	2/4/2011
New DLR(Units:G'S) [1] 100K SHUNT	95.8
Linearity:[2]	0.99951
New vs Old Sensitivit (% Difference)	0.7
Temperature:	72 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.025975
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Edward A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J22664
Capacity/Range: (G's)	2,000

Calibration Date:	2/4/2011
New DLR(Units:G'S) [1] 100K SHUNT	94.2
Linearity:[2]	0.99938
New vs Old Sensitivit (% Difference)	1.2
Temperature:	72 ^{0}F
Humidity:	20 %
Sensitivity (mV/V/G):	0.026447
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35924
Capacity/Range: (G's)	2,000

Calibration Date:	2/4/2011
New DLR(Units:G'S) [1] 100K SHUNT	92.8
Linearity:[2]	0.99947
New vs Old Sensitivit (% Difference)	1.2
Temperature:	72 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.026824
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Steven A. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J32177
Capacity/Range: (G's)	2,000

Calibration Date:	2/4/2011
New DLR(Units:G'S) [1] 100K SHUNT	113.7
Linearity:[2]	0.9997
New vs Old Sensitivit (% Difference)	-0.2
Temperature:	72 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.021883
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Helen Q. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J14103
Capacity/Range: (G's)	2,000

Calibration Date:	2/4/2011
New DLR(Units:G'S) [1] 100K SHUNT	93.9
Linearity:[2]	0.99955
New vs Old Sensitivit (% Difference)	-0.1
Temperature:	72 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.026479
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Helen A. Kalata

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J35800
Capacity/Range: (G's)	2,000

Calibration Date:	2/4/2011
New DLR(Units:G'S) [1] 100K SHUNT	97.8
Linearity:[2]	0.9995
New vs Old Sensitivit (% Difference)	0.6
Temperature:	72 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.025451
Calibrated By:	Ryan Jones

Signature: _____

Approved by: Edward R. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J22700
Capacity/Range: (G's)	2,000

Calibration Date:	2/7/2011
New DLR(Units:G'S) [1] 100K SHUNT	96.4
Linearity: [2]	0.99966
New vs Old Sensitivit (% Difference)	0.5
Temperature:	70 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.025819
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Steven A. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J36197
Capacity/Range: (G's)	2,000

Calibration Date:	2/7/2011
New DLR(Units:G'S) [1] 100K SHUNT	108.7
Linearity:[2]	0.99976
New vs Old Sensitivit (% Difference)	0.9
Temperature:	70 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.022869
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen A. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

MGA Research Corporation-Calibration Certificate

ACCELEROMETER

Reference	
Name:	Accel Standard
Model #	352C03
Serial #:	95980
Capacity:	G's:250
Calibration Date:	9/14/2010
Calibrated By:	Modal Shop

Sensor	
Name:	MGA MI
Manufacturer	Endevco
Model #:	7264-2000
Serial #:	J36353
Capacity/Range: (G's)	2,000

Calibration Date:	2/7/2011
New DLR(Units:G'S) [1] 100K SHUNT	99.1
Linearity:[2]	0.99988
New vs Old Sensitivit (% Difference)	0.9
Temperature:	70 °F
Humidity:	20 %
Sensitivity (mV/V/G):	0.025114
Calibrated By:	Chris Collins

Signature: Chris Collins

Approved by: Helen R. Kaleto

1. Actual data of reference and sensor instruments is found in calibration files

2. Linearity is defined as 1- (Standard Deviation/ Mean)

All calibrations are traceable to the National Institute of Standards and Technology

Calibration uncertainty no greater than 4.0 % at the 95% confidence level.

THE MODAL SHOP INC

~Calibration Certificate~

3149 East Kemper Rd.
Cincinnati, OH 45241
Ph: 513-351-9919
Fax: 513-458-2172
www.modalshop.com

Sensor Information
Model Number: 352C03
Serial Number: 95980
Manufacturer: PCB
ID Number:
Description: ICP® Accelerometer

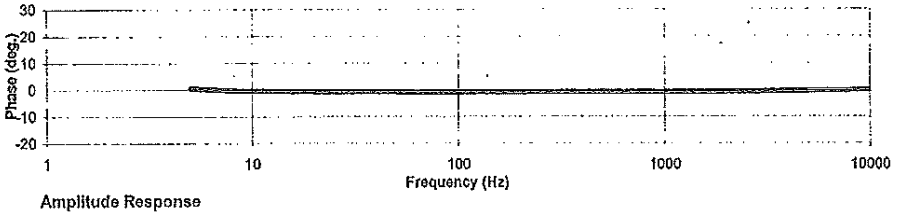
Calibration Data

Sensitivity @ 100 Hz:	9.94	mV/g
Phase @ 100 Hz:	-0.87	deg.
Test Level:	10.00	g

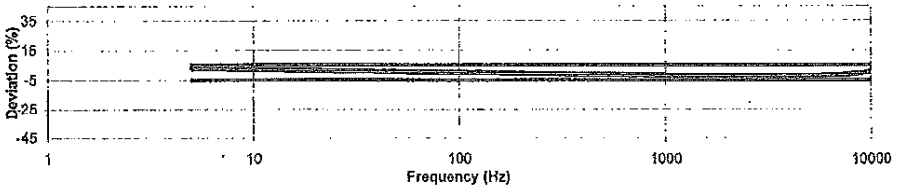
Transducer Specifications

Amp. Range:	± 500	g
Resolution:	0.0005	g
Resonant Freq:	≥ 50000	Hz
Temp. Range:	-54 to 121	°C
	-65 to 250	°F
Axis:	Uni-Axial	

Phase Response



Amplitude Response



Data Table

Freq. (Hz)	Deviation (%)	Phase (deg)
5	3.15	0.41
10	2.18	-0.36
30	0.99	-0.71
50	0.62	-0.68
100	0.00	-0.87
300	-0.88	-0.81
500	-1.29	-0.77
1000	-1.87	-0.77
2000	-2.45	-0.68
3000	-2.46	-0.61
4000	-2.59	-0.49
5000	-2.40	-0.40
6000	-2.09	-0.26
7000	-1.63	-0.23
8000	-1.10	-0.13
9000	-0.30	0.02
10000	0.76	-0.01

Notes
Results relate only to the items calibrated.
This certificate may not be reproduced except in full, without written permission.
Method: Calibration is performed in compliance with ISO 9001 and ISO 17025
This calibration was performed with TMS 9155C Calibration Workstation version 4.6.1
Calibration traceable to primary method which has been proficiency validated through interlaboratory comparison to NIST (project number 822/271196).
Back-to-Back Comparison Calibration per ISO16063-21 .
Procedure Used: PRD-P220
Measurement uncertainty (95% confidence level with coverage factor 2) for frequency ranges tested during calibration are as follows: 0.5-4.99 Hz; ± 3.00%, 5-9.99 Hz; ± 2.50%, 10-99 Hz; ± 1.70%, 100 Hz; ± 1.25%, 101-920 Hz; ± 1.40%, 921-5000 Hz; ± 1.70%, 5001-10,000 Hz; ± 2.20%, 10,001-15,000 Hz; ± 3.65%, 15,001-20,000 Hz; ± 4.75%.

Customer
MGA Research Corp.

User Notes

Unit Condition
As Found: In Tolerance
As Left: In Tolerance

Lab Conditions
Temperature: 73 (23) °F (°C)
Humidity: 32 %

Approval Information
Technician: Ed Devlin
Approval:

Cal Date: 9/14/2010
Due Date:

ACCREDITED

Cal ID: 15600 264901

THE MODAL SHOP INC
3149 East Kemper Rd.
Cincinnati, OH 45241
Ph: 513-351-9919
Fax: 513-458-2172
www.modalshop.com

~Calibration Certificate~

Sensor Information

Model Number	352C03
Serial Number	95980
Manufacturer	PCB
ID Number	

Note

This certificate may not be reproduced except in full, without written permission.

Standards and/or Equipment Used During Calibration

Description	Manufacturer	Model	Serial	Due Date
Data Aquisition Card	NI	4461	15004324	6/29/2011
Std Accelerometer	PCB	080A200	110553	12/8/2010
Air Bearing Shaker	PCB	396C11	603	n/a
Std Sig Conditioner	PCB	442A102	173	12/8/2010
SUT Signal Conditioner	PCB	443B101	379	9/19/2010
Power Amplifier	TMS	2100E21-C	1002	n/a

Technician: Ed Devlin

Cal Date: 9/14/2010

Customer: MGA Research Corp.

Due Date:

ACCREDITED

Cal ID: 16800 2849.01

Calibration Certificate

Part Description: Silver **Certification Date:** 10/19/2010 (M/d/yyyy) **Serial#:** S08-05-98-01273

Single Point - (Max-Min)/2 Specification: S08-05 .076mm (.0030") **Certificate#:** S0127340470

Volumetric (Max Deviation) Specification: S08-05 +/-.108mm (+/-.0042") **Temperature:** See attached data

Measurement Standards Traceability

Ball Bar Kit	Asset Number: 1039	Calibration Due: 10/23/2010	*SI Traceability: METAS-L20100204RG1
Thermometer	Asset Number: TQ023	Calibration Due: 11/20/2010	*SI Traceability: A2LA-1001059862
Reference Sphere	Asset Number: 1241	Calibration Due: 11/21/2011	*SI Traceability: NIST-821/276660-08

The artifacts above have been calibrated with a device traceable to the International System of Units (SI) through a National Metrological Institute (NMI) or through an ISO17025 Accredited Laboratory.
Measurement uncertainty is 3.9 + 3.0X micrometers, where X = length in meters.
Uncertainty is expressed at approximately a 95% Level of Confidence using k=2.00.

Calibration Results*

3 Single Point Articulation Tests at <=20%, 20%-80% and >=80% range.	PASSED
1 Effective diameter sphere test.	PASSED
20 Volumetric ball bar tests in 4 quadrants and 2 orientations.	PASSED

*Calibration conforms to procedures developed in accordance with ASME B89.4.22-2004. See attached data for measurement results.

Instrument condition as received:
Not Within Specification

Instrument condition outgoing:
Within specifications

Technician: Anthony Parker Date: 10/19/10

FARO Technologies, Inc:
PH1:1-800-736-2771
PH2:407-333-9911
FAX:407-333-8056
L-A-B Cert Number:L1147-1

125 Technology Park
Lake Mary, FL 32746
USA

BMC 9/1/10

FARO®

Page 1 of 6

LABORATORY ACCREDITATION BUREAU
ISO/IEC 17025 Accredited

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

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

Tape Measure Calibration Certificate

Reference Steel Rule
Brand: SWANSON
S/N: MGA007999
Calibration Date: 1/15/10

Subject Tape Measure
Brand: STANLEY
S/N: TPM 112
Calibration Date: 12/13/10

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

If all differences are ± 1/32 of an inch (1 mm), then the tape measure is acceptable.
Pass X Fail ____ Maximum Difference = 0

Date: 12/13/2010 Performed By: [signature]

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is ± 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.

gary.hockin@midwayproducts.com

MetroCal Inc.

ACCREDITED
CALIBRATION CERT #0513.01

4700 Barden Court SE, Kentwood MI 49512, Telephone: 616-698-3124, Fax: 616-698-2364, www.metrocal.com

Certificate of Calibration

MGA Research
446 Executive Drive
Troy, MI 48083

Order Number: **69370**
Certificate Number: **100903801**
Page: **1 of 1**

Gauge Number: **MGA00712**
Gauge Desc: **Digital Protractor**
Manufacturer: **Mitutoyo**
Model Number: **950-315**
Serial Number: **06091641**

Customer PO: **N/A**
Last Calibration: **N/A**
Calibration Date: **9/3/10**
Next Calibration: **9/3/11**

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 Procedure CP045 and complies with the ANSI/NCSL 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	Cal Date	Due Date	Traceable No.	Calibration Procedure Uncertainty Expressed at 95% confidence (K=2)
Gage Block Set	8/2/10	8/2/11	ID# 105	0.0015°
DoAll Sine Bar	1/21/10	1/21/11	ID# 1879	0.0015°

Results:

As Found Readings

Units	Nominal	Actual	Deviation
Decimal Deg.	5.00	5.0	0.00
	10.00	10.1	0.10
	20.00	20.0	0.00
Tolerance	30.00	30.0	0.00
± 0.1° Level	40.00	39.9	-0.10
± 0.2° Maximum Error			

Reference Level Check: Within ± 0.1 degrees

As Left Readings

Nominal	Actual	Deviation
5.00	5.0	0.00
10.00	10.1	0.10
20.00	20.0	0.00
30.00	30.0	0.00
40.00	39.9	-0.10

Reference Level Check: Within ± 0.1 degrees

Comments: Environmental conditions during calibration: 68 °F, 44% RH.
No adjustment required.

Shannon Kubicek
Calibration Technician

Issued: 9/3/10

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

@ 9/8/10

NovaStar SOLUTIONS

Calibration Certificate

ACCREDITED
CALIBRATION # 1277.01

Metrology Management Services
Remit to address:
35200 Plymouth Rd.
Livonia, MI 48150

Calibration Certificate #:
Z52549:1300715528

DICKSON TM325 TEMP/HUMD DISP

SERIAL NUMBER:	N/A	WORK ORDER:	1300715528
ASSET NUMBER:	Z52549		
CUST. ASSET NUM:	MGA00894		
PROCEDURE NAME:	1012		
PROCEDURE REV:	A	TEST RESULT:	PASS
CALIBRATED BY:	JOE McCONNAUGHHAY	PERFORMED ON:	3/21/2011
CUSTOMER:	MGA RESEARCH	CAL DUE DATE:	3/21/2012
	446 Executive Drive	DATA TYPE:	FOUND-LEFT
	Troy, MI 48083	TEMPERATURE:	21.00 °C
PRIMARY CONTACT:	BOB MILLER	HUMIDITY:	38 %

This instrument has been processed and calibrated in accordance with the NovaStar Solutions Quality System Manual and is traceable to the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. The NovaStar Solutions quality system is accredited to ISO/IEC 17025:2005 and ANSI/NCSL Z540-1-1994.

The results reported herein apply only to the calibration of the item described above. No sampling plan was used for this calibration.

The ratio of the tolerance of the instrument or parameter being calibrated to the expanded uncertainty of the standard (TUR) is greater than 4:1 unless otherwise specified. Expanded uncertainties are expressed at the approximate 95% level of confidence using a K=2.
Due to any number of factors, the recommended due date on the item does not imply continuing conformance to specifications during the recommended interval. Unless otherwise stated the unit under test meets or exceeds manufacturer specifications.

For range and best measurement capability specifications for the standards used to perform this calibration, see the most recent calibration report maintained by this calibration laboratory (available upon request).

As Received Condition: IN TOLERANCE **As Returned Condition:** IN TOLERANCE

Action Taken: FULL CALIBRATION

REMARKS:

Standards Used

Asset #	Cert#	Description	Cal Date	Due Date
1504	1504:1296548177	HART SCIENTIFIC 1502A THERMOMETER READOUT	2/7/2011	2/7/2012
1541	1541:1300372477	NEWPORT CT485AL HYGROTHERMOGRAPH	3/17/2011	3/17/2012
1717	1717:1297150241	HART SCIENTIFIC 5614 PRT	2/7/2011	2/7/2012
1917	1917:1296319659	VAISALA M170/HMP76 MEASUREMENT INDICATOR/PROBE	1/29/2011	1/29/2012

***** End of Certificate *****

@ 3/28/11

QA approved: Steve Hall **Date:** 3-22-11
Signature:

Asset Barcode:

MetroCal Inc.

ACCREDITED
CALIBRATION CERT #0513.01

4700 Barden Court SE, Kentwood MI 49512, Telephone: 616-698-3124, Fax: 616-698-2364, www.metrocal.com

Certificate of Calibration

MGA Research
446 Executive Drive
Troy, MI 48083

Order Number: 69370
Certificate Number: 100826804
Page: 1 of 1

Gauge Number: MGA00783
Gauge Desc: 0 to 20lb x 0.01lb Digital Scale
Manufacturer: Detecto
Model Number: AP-20
Serial Number: E10807-0187

Customer PO: N/A
Last Calibration: 8/14/09
Calibration Date: 8/26/10
Next Calibration: 8/26/11

As Found Condition: See Results

As Left Condition: See Results

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 Procedure CP042 and relevant sections of the manufacturer's manual. This calibration complies with 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.

Standard Used	Cal. Date	Due Date	Traceable No.	Calibration Procedure Uncertainty Expressed at 95% confidence , (K=2)
Dead Weight Set	3/3/09	3/3/11	ID# 16992	+/-0.001% of Load
Weight Set	9/3/08	9/3/10	ID# 2463	+/-0.001% of Load

Results:
Tolerance used: Class III

Units: lbs TI Division/Increment: 0.01

	As Found				As Left		
Weight Test	Nominal	Indication	Deviation		Nominal	Indication	Deviation
Zero	0.00	0.00	0.00		0.00	0.00	0.00
0-25% fs	5.00	5.01	0.01		5.00	5.01	0.01
26-50% fs	10.00	10.02	0.02		10.00	10.02	0.02
51-75% fs	15.00	15.02	0.02		15.00	15.02	0.02
76-100% fs	20.00	20.03	0.03		20.00	20.03	0.03
1/2 load test	10.00	10.02	0.02		10.00	10.02	0.02
return to zero	0.00	0.00	0.00		0.00	0.00	0.00
4 quad/Shift Test:	Pass			4 quad/Shift Test:	Pass		

Comments: Environmental conditions during calibration: 75 °F, 39 % RH.
The adapter that was sent in with the scale has loose components, be careful when using.
No adjustments required.

Shannon Kubicek
Calibration Technician

Issued: 8/26/10

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

@ 9/8/10

Sterling Scale Co., Inc.
20950 Boening St.
Southfield, MI 48076

Certificate of Calibration

F410/12-3
Rev. Date 11/23/05

calibration cert. 1448.01

Customer: MGA Research *Cert#* 10-6914 *Temp/Humidity:* ok
Location of Calibration: 2839 Elliot Rd Troy MI 48083
Calibration Date: 7/21/2010 *Due Date:* Jul-11 *Condition of Item:* Fair
Equipment Make: Intercomp *Model:* SW Deluxe *Serial Number* 26032389 *Capacity:* 2200 lb x 1 lb Per weigh pad
8800 lb x 1 lb Scale system total capacity

Applied Test Wt	*Before Adustment*	*Tolerance*	*In-Tolerance Y/N*	*After Adjustment*	*In-Tolerance Y/N*	*Unc*	
10 lb	9 lb	1 lb	y	n/a	y	0.002 lb	Right Rear Pad
100 lb	100 lb	1 lb	y	n/a	y	0.11 lb	
1000 lb	1000 lb	2 lb	y	n/a	y	0.14 lb	
10 lb	10 lb	1 lb	y	n/a	y	0.002 lb	Right Front Pad
100 lb	100 lb	1 lb	y	n/a	y	0.11 lb	
1000 lb	999 lb	2 lb	y	n/a	y	0.14 lb	

shift test
n/a

	Platform #1	*Platform #2*	*Platform #3*
	☐ Pass	☐ Pass	☐ Pass
	☐ Fail	☐ Fail	☐ Fail

Tests performed: ☑ Repeatability ☑ Linearity ☐ Sensitivity ☑ Discrimination

Technician COMMENTS/ weights used: This scale is a wheel weigh system, there are a total of 4 wheel pads. Each pad has a capacity of 2200lb. A lb. All 4 pads together have a total capacity of 8800 lb. Scale passes tests sn on file

Page 2 of 2

☑ Scale Certified ☐ Scale Rejected

Sterling Scale Service Rep: E.Denny Date: 7/21/2010 1 of 1

The above item has been calibrated using the relevant EPO or OEM procedures utilizing test weights
Traceable to International Systems of Units (SI), through the Michigan Department of Agriculture.
Test numbers on file. Expanded uncertainty(k=2) confidence level of 95% as reported.
Results relate only to items listed.
The reported uncertainty is valid only for the environment in which it is determined.
Any number of factors may cause the item to drift out of calibration before recommended interval has expired
This report shall not be reproduced, except in full without approval of the laboratory
Tolerances followed are maintenance/acceptance per HB 44 or as detremined by the customer
Sterling Scale does not warranty calibration.