REPORT NO. 111-KAR-10-002

SAFETY COMPLIANCE TESTING FOR FMVSS 111

REARVIEW MIRRORS (Other Than School Buses)

2010 CHEVROLET CAMARO

2-DOOR COUPE

NHTSA NO: CA0106

PREPARED BY:
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JUNE 10, 2010

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
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Technical Report Documentation Page

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16. *Abstract* Compliance tests were conducted on the subject 2010 Chevrolet Camaro 2-door Coupe on June 1, 2010 through June 10, 2010 in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP111V-00 for the determination of FMVSS 111 compliance. There were no apparent test failures.			
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1. PURPOSE OF COMPLIANCE TEST

Tests were conducted on a 2010 Chevrolet Camaro 2-Door Coupe, manufactured by General Motors of Canada LTD., to determine compliance with FMVSS 111, “Rearview Mirrors (Other than School Buses)”. The purpose of this standard is to reduce the number of deaths and injuries that occur when the driver of a motor vehicle does not have a clear and reasonably unobstructed view to the rear.

All tests were conducted based on the current National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures, TP111V-00, dated October 28, 1999, and corresponding KARCO Engineering test procedure KTP-111, dated April 18, 2001. Detailed procedures for receiving, inspecting, testing and reporting of test results are described in the test procedures and are not repeated in this report.

This report is organized in sections containing pertinent test information and data tables as follows:

Section 1	Purpose of Compliance Test
Section 2	Compliance Test Procedure and Data Summary
Section 3	Test Results
Appendix A	Photographs
Appendix B	Data Plots
Appendix C	Test Equipment List and Calibration Information
Appendix D	Eyelipse Location Supplied By Manufacturer

2. COMPLIANCE TEST PROCEDURE AND DATA SUMMARY

A 2010 Chevrolet Camaro 2-Door Coupe was subjected to FMVSS 111 compliance testing. The tests were conducted at KARCO Engineering LLC. in Adelanto, California on June 1, 2010 through June 10, 2010. Summary data is shown on page 24, Data Sheet No. 8. The following tests were performed:

- Inspection
- Mounting Adequacy Test
- Field-of-View Test, Inside Rearview Mirror
- Field-of-View Test, Driver's Side Outside Mirror
- Reflectance Test
- Breakaway Test
- Unit Magnification and Convex Mirror Tests

The tests were conducted per the FMVSS 111 test procedure. The significant aspects of the test procedure are described in the following paragraphs.

A. INSPECTION

Inspect the installation of the inside and outside rearview mirrors.

B. MOUNTING ADEQUACY TEST – ALL REARVIEW MIRRORS

B.1 INSIDE MIRROR (S5.1.2)

Determine that the mirror is securely mounted and determine the positive and negative angles of adjustment for both the vertical and horizontal directions.

B.2 OUTSIDE MIRROR(S) (S5.2.2 and S5.3)

Determine that the mirror(s) is (are) securely mounted. Determine that the driver's side mirror can be tilted in both horizontal and vertical directions from the driver's seated position. Determine that the passenger's side mirror is capable of adjustment by tilting in both the horizontal and vertical directions. Determine the positive and negative angles of adjustment for both horizontal and vertical directions for all outside mirrors. Determine that all outside mirrors are free of sharp points or edges that could contribute to pedestrian injury.

C. FIELD-OF-VIEW TEST – INSIDE REARVIEW MIRROR

C.1 REQUIREMENTS (S5.1.1)

The mirror shall provide a field of view with an included horizontal angle measured from the projected eye point of at least 20 degrees, and sufficient vertical angle to provide a view of a level road surface extending to the horizon beginning at a point not greater than 61m (200 feet) to the rear of the vehicle when the vehicle is occupied by the driver and four passengers or the designated occupant capacity, if less. The line of sight may be partially obscured by seated occupants or by head restraints.

Each car whose inside mirror does not meet the field of view requirements of S5.1.1 shall have an outside mirror of unit magnification or a convex mirror installed on the passenger's side. (S5.3)

D. FIELD-OF-VIEW TEST, DRIVER'S SIDE OUTSIDE REARVIEW MIRROR

D.1 REQUIREMENTS (S5.2)

Each passenger car shall have an outside mirror of unit magnification. The mirror shall provide the driver a view of a level road surface extending to the horizon from a line, perpendicular to a longitudinal plane tangent to the driver's side of the vehicle at the widest point, extending 2.4 meters (8 feet) out from the tangent plane 10.7 meters (35 feet) behind the driver's eyes, with the seat in the rearmost position. The line of sight may be partially obscured by rear body or fender contours. (S5.2.1)

Neither the mirror nor the mounting shall protrude farther than the widest part of the vehicle body except to the extent necessary to produce a field of view meeting or exceeding the requirements of S5.2.1. The mirror shall not be obscured by the un-wiped portion of the windshield. (S5.2.2)

E. REFLECTANCE TEST – ALL MIRRORS

E.1 REQUIREMENT (S11)

All single reflectance mirrors shall have an average reflectance of at least 35 percent. If a mirror is capable of multiple reflectance levels, the minimum reflectance level in the day mode shall be at least 35 percent and the minimum reflectance level in the night mode shall be at least 4 percent. The average reflectance of any mirror required by this standard shall be determined in accordance with SAE Recommended Practice J964, OCT 84.

F. BREAKAWAY TEST – INSIDE REARVIEW MIRROR

F.1 REQUIREMENTS (S5.1.2)

If the mirror is in the head impact area, the mounting shall deflect, collapse, or break away without leaving sharp edges when the reflective surface of the mirror is subjected to a force of 400 N (90 lb) in any forward direction that is not more than 45 degrees from the longitudinal direction.

G. UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

G.1 REQUIREMENTS FOR PASSENGER CARS (S5.3 and S5.4)

The driver's side rearview mirror and the inside rearview mirror shall be unit magnification. If the field-of-view requirements are not met with the inside rearview mirror then the passenger's side rearview mirror is required. It can be either unit magnification or convex.

If the passenger's side mirror is convex, the average radius of curvature shall be not less than 889 mm (35 inches) and not more than 1651 millimeters (65 inches) and shall not deviate from the average by more than plus or minus 12.5 percent. The convex mirror shall have permanently and indelibly marked at the lower edge of the mirror's reflective surface in letters not less than 4.8 mm (3/16 inch) nor more than 6.4 mm (0.25 inch) high the words, "**Objects in Mirror Are Closer Than They Appear**."

3. TEST DATA

The results of FMVSS 111 compliance tests that were conducted on the 2010 Chevrolet Camaro 2-door Coupe on June 1, 2010 through June 10, 2010 to determine compliance with FMVSS 111, “Rearview Mirrors (other than School Buses)” are presented in this section.

DATA SHEET NO. 1

VEHICLE INSPECTION AND IDENTIFICATION

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	CA0106	Anti-Lock Brakes	Yes
Make	Chevrolet	All Wheel Drive	No
Model	Camaro	Power Steering	Yes
Body Style	2 Door Coupe	Driver Front Airbag	Yes
Vin No.	2G1FA1EV1A9178422	Driver Side Airbag	Yes
Color	White	Driver Head Airbag	No
Delivery Date	5/18/2010	Driver Curtain Airbag	Yes
Odometer (Miles)	520	Pass. Airbag	Yes
Dealer	Baily Toliver Chevrolet	Pass. Side Airbag	Yes
Transmission	Auto	Pass. Head Airbag	No
Final Drive	Rear	Pass. Curtain Airbag	Yes
Type/No. Cyl.	V6	Pre-Tensioners	Yes
Engine Disp. (L)	3.6	Load Limiters	Yes
Engine Placement	Longitudinal	Bucket Seats	Yes
Tire Press./ Max (Front)	300 kPa	Cold Tire Press. (Front)	240 kPa
Tire Press./ Max (Rear)	300 kPa	Cold Tire Press. (Rear)	240 kPa
Recommended Tire Size	P245/55R18	Tilt Steering	Yes
Tire Size on vehicle	P245/55R18	Automatic Door Locks	Yes
Air Conditioning	Yes	Power Windows	Yes
Disc Brakes (Front)	Yes	Power Seats	Yes
Disc Brakes (Rear)	Yes	Other	N/A

DATA FROM MANUFACTURER

Manufactured By	General Motors of Canada LTD.	GVWR (kg)	2079
Date of Manufacture	Dec-09	GAWR Front (kg)	975
		GAWR Rear (kg)	1104

TEST VEHICLE ATTITUDES (mm)

ATTITUDE	LF	RF	LR	RR
As Delivered	770	772	775	770
As Tested	755	756	744	738
Rearview Mirror	1182			

DATA SHEET NO. 1… (Continued)

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-01-10	**Temperature**	80

LEGEND: LE = Left Eye; RE = Right Eye; P = Neck Pivot Point, SRP = Seating Reference Point

COORDINATE SYSTEM:

X = Longitudinal Dimension
Y = Lateral Dimension
Z = Vertical Dimension

Positive Values are as follows:

X = Forward of Reference Point
Y = Outboard of Reference Point (to driver's side)
Z = Above Reference Point

Provide Reference Point or Body Fiduciary Point that dimensions below are measured from. (Point should be usable by laboratory personnel, i.e., center of an anchorage bolt, door jam latch, etc.).

COORDIN-ATES	**LEFT SIDE MIRROR**			**INSIDE MIRROR**			**RIGHT SIDE MIRROR**			**SRP**
	P1	LE1	RE1	P2	LE2	RE2	P3	LE3	RE3	
X	[redacted]	-55	-33	[redacted]	-40	-56	[redacted]	-21	-62	[redacted]
Y	[redacted]	-185	-246	[redacted]	-195	-258	[redacted]	-223	-273	[redacted]
Z	[redacted]	855	855	[redacted]	856	856	[redacted]	854	854	[redacted]
Mirror Mfr., Model And Part No.	Magna Electric 92247439			Gentex IAuto- Dim, No Onstar 13503047			Magna Electric 92247440			
SRP Travel and Eye-llipse										

Reference Point – Driver Seat Rear Outboard Mounting Bolt.

DATA SHEET NO. 1… (Continued)

Date of Inspection/Identification		6-01-10
Types of Rearview Mirrors		
	Inside Rearview	Unit Magnification
	Driver' Side Outside	Unit Magnification
	Passenger's Side Outside	Convex
Location and Description of Fiducial Marks		See previous page
Maximum Number of Occupants		4

RESULTS OF RECEIVING INSPECTION:

TEST STATUS	PASSED —	**X**	FAILED —	

CONDITIONS:

DISPOSITION/ACTION:

REMARKS:

RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-01-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

DATA SHEET NO. 2

MOUNTING AND TILTING ADEQUACY TEST

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-01-10	**Temperature**	80

MIRROR MOUNTING PROVIDES A STABLE SUPPORT	PASS	FAIL	CONDITIONAL
INSIDE REARVIEW MIRROR	X		
DRIVER SIDE OUTSIDE MIRROR	X		
PASSENGER SIDE OUTSIDE MIRROR	X		

OUTSIDE MIRRORS FREE OF SHARP POINTS OR EDGES	PASS	FAIL
DRIVER SIDE OUTSIDE MIRROR	X	
PASSENGER SIDE OUTSIDE MIRROR	X	

MIRROR IS ADJUSTABLE VERTICALLY & HORIZONTALLY	PASS	FAIL	CONDITIONAL
INSIDE REARVIEW MIRROR	X		
DRIVER SIDE OUTSIDE MIRROR	X		
PASSENGER SIDE OUTSIDE MIRROR	X		

DRIVER'S OUTSIDE MIRROR ADJUSTABLE FROM THE DRIVER'S SEATED POSITION	PASS	FAIL
DRIVER SIDE OUTSIDE MIRROR	X	

MIRROR ADJUSTMENT ANGLE	V+	V-	H+	H-
INSIDE REARVIEW MIRROR	17.8	-89	56	-56
DRIVER SIDE OUTSIDE MIRROR	16.2	-12.2	30	5
PASSENGER SIDE OUTSIDE MIRROR	16	-12.6	35	15

THIS SECTION IS RESERVED FOR MPVs, TRUCKS AND BUSES, OTHER THAN SCHOOL BUSES, NOT CONFORMING TO PASSENGER CAR REQUIREMENTS

MIRROR PROVIDES A VIEW TO THE REAR ALONG BOTH SIDES OF THE VEHICLE	PASS	FAIL	CONDITIONAL
DRIVER SIDE OUTSIDE MIRROR	N/A		
PASSENGER SIDE OUTSIDE MIRROR	N/A		

TEST STATUS	PASSED —	X	FAILED —	

RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-01-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

DATA SHEET NO. 3

FIELD OF VIEW TEST - INSIDE REARVIEW MIRROR

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-01-10	**Temperature**	80

E Distance from center of mirror to projected eye point location = **610mm**

A Distance from rear of vehicle to projected eye point location = **2376mm**

X1 Distance from rear of vehicle to field of view grid = **8370mm**

Z1 Vertical distance to lowest point of field of view at distance X1 **490mm**

Z2 Height of center of mirror = **1182mm**

X2 Distance from rear of vehicle where the road surface is first visible
X2 = [(Z2 x X1) + (Z1 x A)]/(Z2 - Z1) =
(S111 REQUIREMENT = 61m maximum) **15.979m**

EYE LOCATION	MONOCULAR DATA (ALR & ARL ARE ANGLES)			
	YL (mm)	YR (mm)	ALR (°)	ARL (°)
LEFT EYE POINT	YLL =1189	YRL =2673		**14.1**
RIGHT EYE POINT	YLR =2335	YRR =2222	**12.4**	

CALCULATED HORIZONTAL AMBINOCULAR VIEW ANGLE (AB)

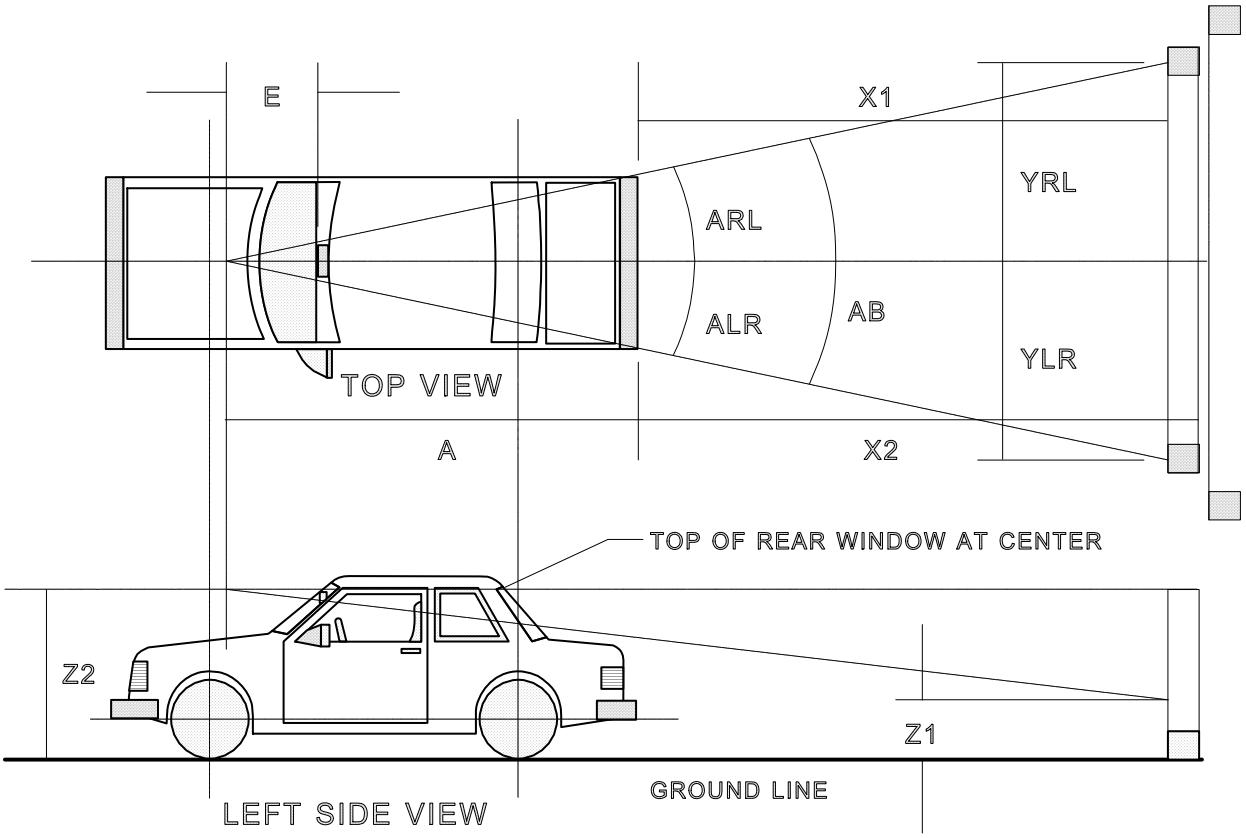
ANGLE AB = ANGLE ALR + ANGLE ARL

ALR = TAN - [1YLR/(X1 + A)] ARL = TAN - [1YRL/(X1 + A)]

ANGLE AB = **26.5°** (S111 REQUIREMENT = 20 degrees minimum)

TEST STATUS	PASSED —	**X**	FAILED —	

INSIDE REARVIEW MIRROR FIELD OF VIEW
TEST GRID AND MARKER SETUP



DATA SHEET NO. 3… (Continued)

DRIVER SIDE MIRROR (S5.2)

MIRROR OBSCURED BY UNWIPED PORTION OF WINDSHIELD YES _____ NO __X__

HEIGHT OF TARGET DISC ON MIRROR **1044mm**

DISTANCE OF TARGET DISC ON MIRROR FROM VEHICLE TANGENT PLANE **79mm**

TARGET DISC LOCATION RELATIVE TO VEHICLE TANGENT PLANE **Inboard**
(Inboard or Outboard)

ENTIRE TRIANGULAR TEST TARGET AREA ON SCREEN VISIBLE YES __X__ NO _____

MIRROR PROTRUDES BEYOND VEHICLE TANGENT PLANE YES __X__ NO _____

PROTRUSION REQUIRED TO MEET FIELD OF VIEW REQUIREMENT YES __X__ NO _____

TEST STATUS:	PASSED —	X	FAILED —	

PASSENGER SIDE MIRROR (S5.3 or MFG. OPTION)

PASSENGER SIDE MIRROR TYPE (convex or unit magnification) **Convex**

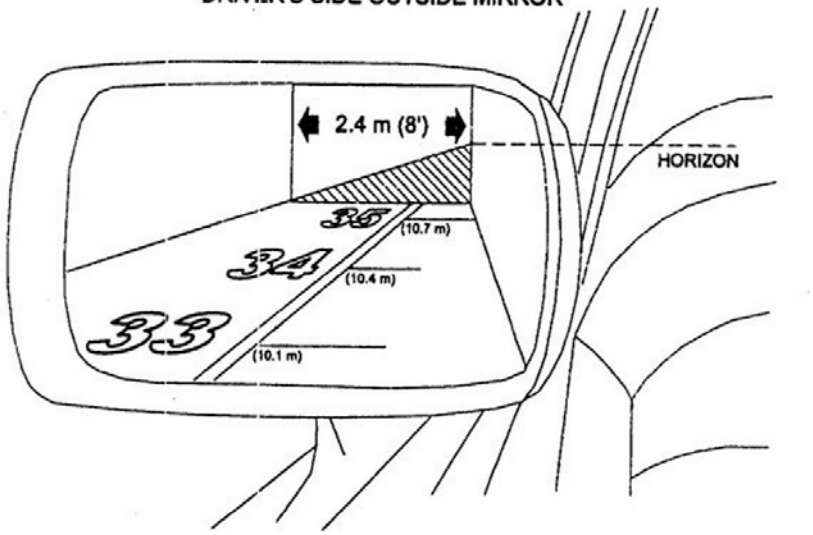
REMARKS:

VEHICLE ATTITUDE AND GROUND LEVEL WERE RAISED 4” (101.6) TO PERFORM THE TEST.

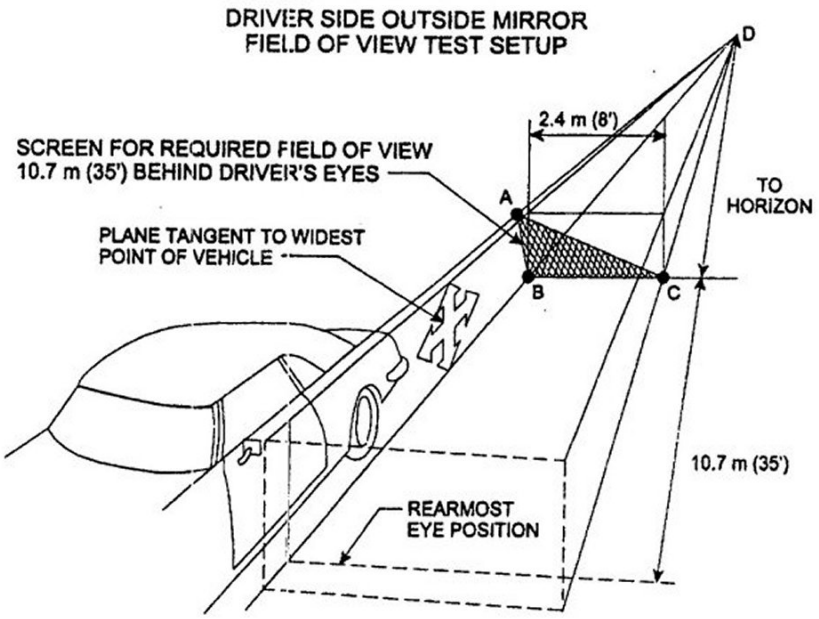
RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-01-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

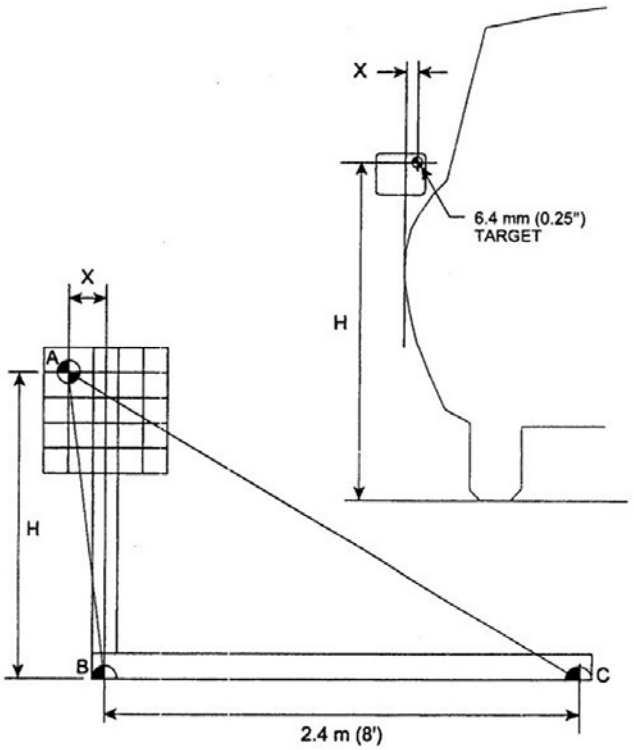
REQUIRED FIELD OF VIEW AS SEEN IN DRIVER'S SIDE OUTSIDE MIRROR



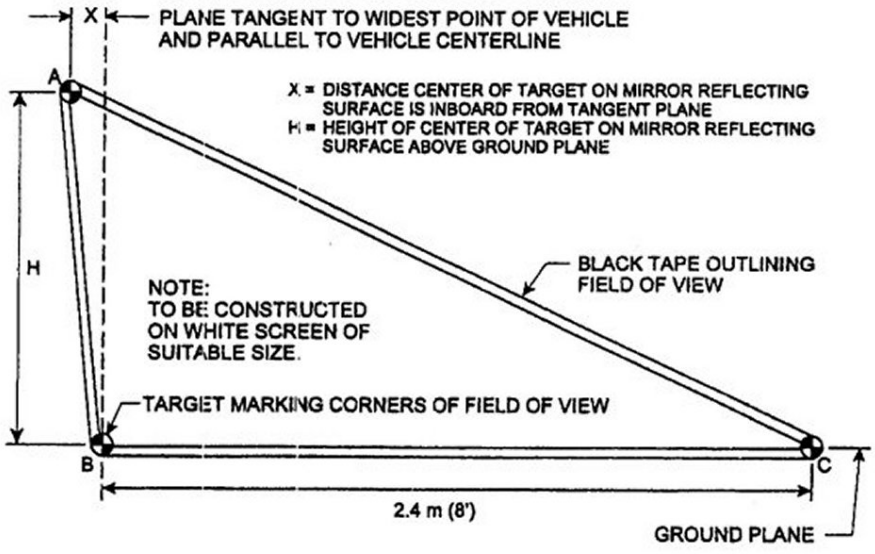
DRIVER SIDE OUTSIDE MIRROR FIELD OF VIEW TEST SETUP



DRIVER SIDE OUTSIDE MIRROR TARGET DISC
LOCATION WITH X AND H DIMENSIONS



DRIVER SIDE OUTSIDE MIRROR REQUIRED
FIELD OF VIEW TRIANGLE



DATA SHEET NO. 4

REFLECTANCE TEST

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA N.o	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-07-10	**Temperature**	70

DESCRIPTION OF TEST APPARATUS: **THE APPARATUS CONSISTS OF AN INCANDESCENT TUNGSTEN FILAMENT LAMP OPERATING AT A NOMINAL COLOR TEMPERATURE OF 2,856 K, COLLIMATING OPTICS, A SAMPLE HOLDER POSITIONED AT 25°, A SILICON PHOTOCELL, AND A FLUKE 45 DUAL DISPLAY MULTIMETER (CALIBRATION DUE DATE 3-26-08). REFLECTANCE TESTS ARE CONDUCTED IN A 4'X6' WOODEN CABINET PAINTED FLAT BLACK. FOR CONVEX MIRROR A 6" INTEGRATING SPHERE WAS INCORPORATED INTO THE RECEIVER.**

MIRROR DESCRIPTION: **INTERIOR DAY/NIGHT REARVIEW MIRROR**

VOLTAGE READING FROM CALIBRATION (Average Value): **270mV**

VOLTAGE READING FROM LIGHT REFLECTED BY DAY MIRROR (Average Value): **259mV**

REFLECTOMETER VOLTAGE READINGS		
	DAY MIRROR	NIGHT MIRROR
TEST NO. 1	**259**	**163**
TEST NO. 2	**259**	**164**
TEST NO. 3	**259**	**164**
TEST NO. 4	**259**	**163**
TEST NO. 5	**259**	**164**

REFLECTANCE (Day) = Voltage (Refl)/Voltage (Cal) = **.9593** x 100 = **95.9** percent
(Min. Required = 35%)

VOLTAGE READING FROM CALIBRATION (Average Value) = **270**

VOLTAGE READING FROM LIGHT REFLECTED BY NIGHT MIRROR (Average Value): **163.9**

REFLECTANCE (Night) = Voltage (Refl)/Voltage (Cal) = **.6059** x 100 = **60.6** percent
(Min. Required = 4%)

NOTE: If meter reading directly in percent is used, record only percent

DATA SHEET NO. 4… (Continued)

MIRROR DESCRIPTION: **DRIVER SIDE OUTSIDE MIRROR**.

VOLTAGE READING FROM CALIBRATION (Average Value): **270**

VOLTAGE READING FROM LIGHT REFLECTED BY DAY MIRROR (Average Value): **256**

REFLECTOMETER VOLTAGE READINGS	
TEST NO. 1	**256**
TEST NO. 2	**256**
TEST NO. 3	**256**
TEST NO. 4	**256**
TEST NO. 5	**256**

REFLECTANCE (Day) = Voltage (Refl)/Voltage (Cal) = 0.**.9481** x 100 = **94.8** percent
(Min. Required = 35%)

NOTE: If meter reading directly in percent is used, record only percent

DATA SHEET NO. 4… (Continued)

MIRROR DESCRIPTION: **PASSENGER SIDE OUTSIDE MIRROR**.

VOLTAGE READING FROM CALIBRATION (Average Value): **345**

VOLTAGE READING FROM LIGHT REFLECTED BY DAY MIRROR (Average Value): **350**

REFLECTOMETER VOLTAGE READINGS	
TEST NO. 1	**350**
TEST NO. 2	**350**
TEST NO. 3	**351**
TEST NO. 4	**350**
TEST NO. 5	**349**

REFLECTANCE (Day) = Voltage (Refl)/Voltage (Cal) = **1.0144** x 100 = **101.4** percent

REFERANCE MIRROR VALUE **93.4** X **101.4** (reflectance value) = **94.8 %**
(Min. Required = 35%)

NOTE: If meter reading directly in percent is used, record only percent

TEST STATUS	PASSED —	**X**	FAILED —	

RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-07-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

DATA SHEET NO. 5

BREAKAWAY TEST - INSIDE REARVIEW MIRROR

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-10-10	**Temperature**	77

MOUNTING OF MIRROR (INSIDE) DESCRIPTION: **TAB GLUED TO WINDSHIELD. MIRROR BASE SLIPS OVER BASE AND HELD IN PLACE WITH SPRING CLIP.**

(Requirement: the mirror shall deflect, collapse or break away when it is subjected to a force of 400 N or less)

TEST NO.	LOAD DIRECTION VERTICAL/HORIZONTAL	MAXIMUM FORCE (N)	DISPLACEMENT (MM)	PASS	FAIL
1	**0-90 DEGREES**	**277.9**	**10.0**	**X**	
2	**+45/90 DEGREES**	**137.7**	**22.1**	**X**	
3	**-45/90 DEGREES**	**241.7**	**10.0**	**X**	
4	**-45/+45 DEGREES**	**177.8**	**15.8**	**X**	
5	**+45/+45 DEGREES**	**47.7**	**36.0**	**X**	
6	**+45/-45 DEGREES**	**116.8**	**18.7**	**X**	
7	**-45/-45 DEGREES**	**99.7**	**9.2**	**X**	

REMARKS:

DATA SHEET NO. 5… (Continued)

BREAKAWAY TEST - INSIDE REARVIEW MIRROR FAILURE TYPE – DESCRIPTION:

FAILURE TYPE – DESCRIPTION:

NONE

TEST STATUS	PASSED —	**X**	FAILED —	

REMARKS:

RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-10-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

DATA SHEET NO. 6

UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-08-10	**Temperature**	70

DRIVER'S SIDE & INSIDE REARVIEW MIRRORS:

DRIVER SIDE MIRROR	
TEST POSITION	DIAL READINGS
1	**0**
2	**0**
3	**0**
4	**0**
5	**0**
6	**0**
7	**0**
8	**0**
9	**0**
10	**0**

INSIDE MIRROR	
TEST POSITION	DIAL READINGS
1	**0**
2	**0**
3	**0**
4	**0**
5	**0**
6	**0**
7	**0**
8	**0**
9	**0**
10	**0**

All dial indicator readings for unit magnification mirrors must be zero.

DATA SHEET NO. 6… (Continued)

UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

PASSENGER SIDE REARVIEW MIRROR:

CONVERSION TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

TEST POSITION	DIAL READINGS (inches) Passenger	RADIUS OF CURVATURE (mm)	DEVIATION BETWEEN THE AVERAGE RADIUS OF CURVATURE AND THE TEST POSITION RADIUS OF CURVATURE (mm)	PERCENT DEVIATION FROM THE AVERAGE RADIUS OF CURVATURE
1	.0058	**1231.9**	**34.8**	**2.7**
2	.0056	**1272.4**	**5.7**	**0.4**
3	.0056	**1272.4**	**5.7**	**0.4**
4	.0057	**1253.7**	**13.0**	**1.0**
5	.0058	**1231.7**	**34.8**	**2.7**
6	.0055	**1299.5**	**32.8**	**2.6**
7	.0058	**1231.9**	**34.8**	**2.7**
8	.0055	**1299.5**	**32.8**	**2.6**
9	.0057	**1253.7**	**13.0**	**1.0**
10	.0054	**1320.0**	**53.3**	**4.2**
Average Radius of Curvature		**1266.7**	Greatest Percent Deviation	**4.2**

REMARKS:

DATA SHEET NO. 6… (Continued)

UNIT MAGNIFICATION AND CONVEX MIRROR TESTS

PASSENGER'S SIDE REARVIEW MIRROR

IF CONVEX, ARE THERE ANY DISCONTINUITIES IN THE SLOPE OF THE MIRROR SURFACE	YES ____ NO __**X**__
IF CONVEX, ARE THE WORDS, **"OBJECTS IN THE MIRROR ARE CLOSER THAN THEY APPEAR"** PRESENT	YES __**X**__ NO_____
IF CONVEX, MEASURE LETTER HEIGHT OF WORDS	_____**5**_____ mm
IF CONVEX, LETTERS ARE NOT < 4.8 mm OR > 6.4 mm HIGH	YES __**X**__ NO_____
IF CONVEX, RADIUS OF CURVATURE NOT < 889 mm OR > 1651 mm	YES __**X**__ NO_____
IF CONVEX, THE GREATEST PERCENT DEVIATION FROM AVERAGE RADIUS OF CURVATURE IS ± 12.5 %	YES __**X**__ NO_____
IF UNIT MAGNIFICATION, ALL DIAL READINGS ARE ZERO ± 0.	YES__**X**__ NO ____

NOTE: PASSENGER MIRROR NOT REQUIRED

TEST STATUS	PASSED —	**X**	FAILED —	

RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-08-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

DATA SHEET NO. 7

MIRROR REFLECTIVE SURFACE AREA TEST

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-08-10	**Temperature**	70

MPVs, TRUCKS & BUSES (OTHER THAN SCHOOL BUSES)

DATA TABLE FOR SURFACE AREA

MIRRORS	AREA (cm^2)	REQUIREMENT		RESULTS	
		GVWR ≤ 4536 kg	GVWR ≥ 4536 kg	PASS	FAIL
Outside Driver's Side	**184**	126 cm^2	323cm^2	**X**	
Outside Passenger Side	**182**	126 cm^2	323 cm^2	**X**	

MIRRORS LOCATED SO AS TO PROVIDE DRIVER A VIEW TO THE REAR:

LEFT SIDE YES **X** NO ____

RIGHT SIDE YES **X** NO ____

TEST STATUS:	PASSED —	**X**	FAILED —	

REMARKS: For informational purpose only. There is no surface area requirement for passenger cars.

RECORDED BY: **Mr. Jonathan F. Williams** DATE: **6-08-10**

APPROVED BY: **Mr. Michael L. Dunlap** DATE: **7-09-10**

DATA SHEET NO. 8

TEST SUMMARY-FMVSS 111-REARVIEW MIRRORS

Vehicle Information			
Year	2010	**Make**	Chevrolet
Model	Camaro	**Body Style**	2 Door Coupe
NHTSA No.	CA0106	**VIN**	2G1FA1EV1A9178422
Test Date	6-10-10	**Temperature**	N/A

PASSENGER VEHICLE TESTING:

OUTSIDE DRIVER SIDE MIRROR	PASS	FAIL	COMMENTS
STABLE SUPPORT	X		
DOES NOT PROTRUDE BEYOND VEHICLE BODY	X		
NOT OBSCURED BY UNWIPED PORTION OF WINDSHIELD	X		
ADJUSTABLE BY TILTING	X		
ADJUSTABLE FROM DRIVER SEAT	X		
FREE OF SHARP EDGES	X		
FIELD-OF-VIEW	X		
REFLECTANCE	X		
UNIT MAGNIFICATION	X		

INSIDE REARVIEW MIRROR	PASS	FAIL	COMMENTS
STABLE SUPPORT	X		
ADJUSTABLE BY TILTING	X		
FIELD-OF-VIEW	X		
REFLECTANCE	X		
BREAK AWAY	X		
UNIT MAGNIFICATION	X		

OUTSIDE PASSENGER MIRROR *	PASS	FAIL	COMMENTS
STABLE SUPPORT	X		
ADJUSTABLE BY TILTING	X		
FREE OF SHARP EDGES	X		
UNIT OR CONVEX			Convex
LABELING	X		
REFLECTANCE	X		

* MIRROR NOT REQUIRED

APPENDIX A

PHOTOGRAPHS

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 1: LEFT FRONT ¾ VIEW

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 2: LEFT SIDE VIEW

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 3: RIGHT REAR ¾ VIEW

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 4: RIGHT SIDE VIEW

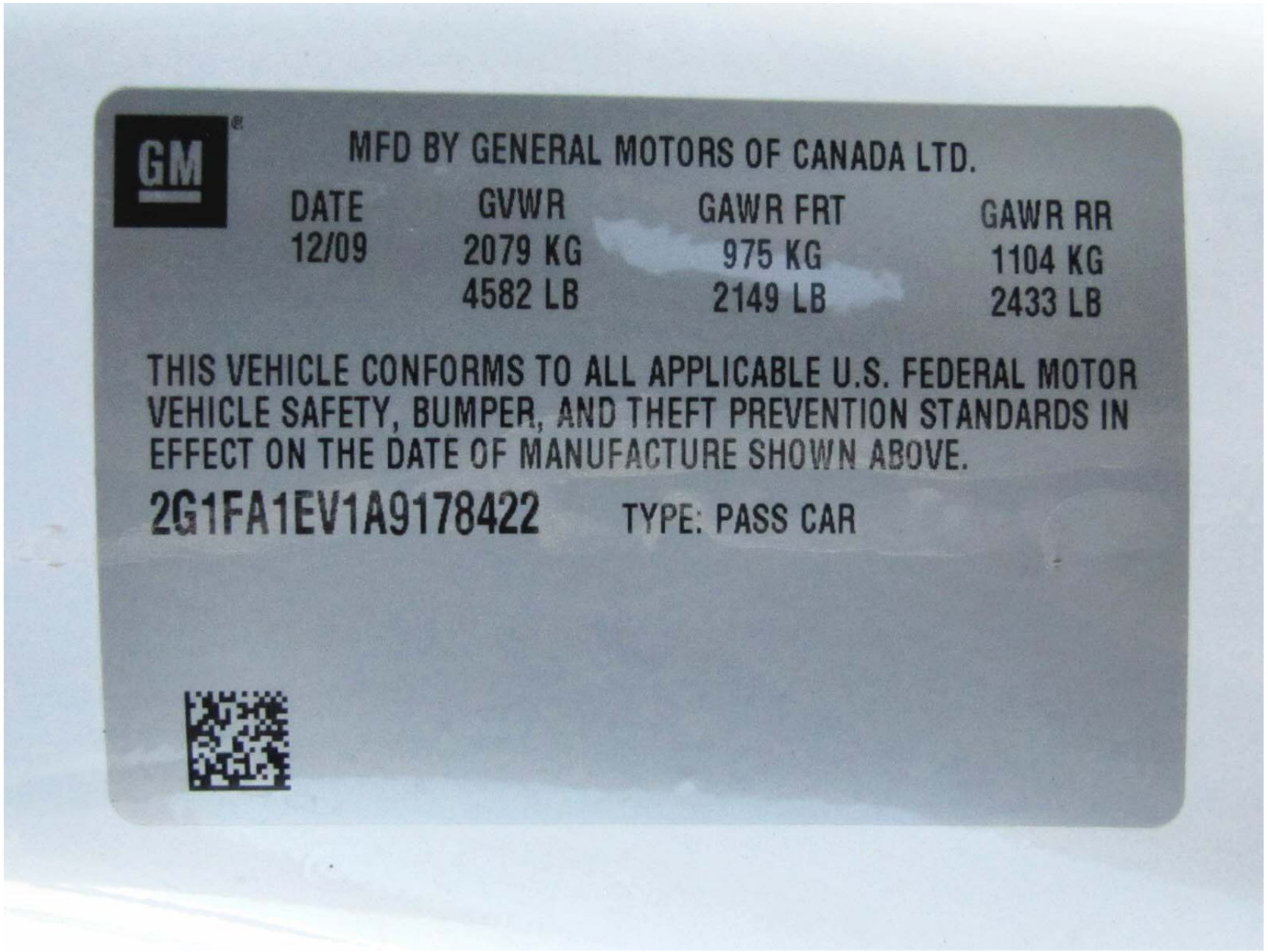
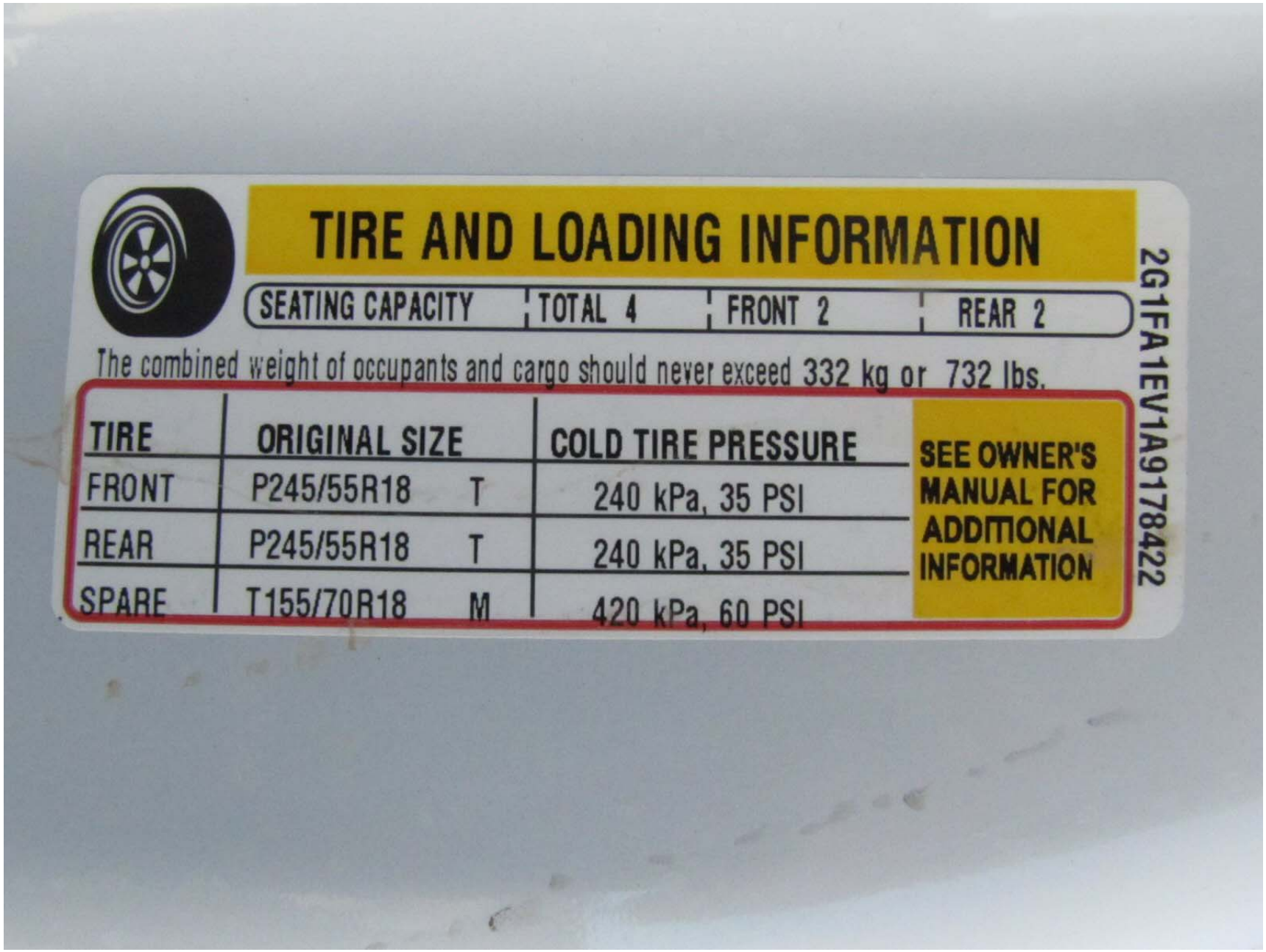


FIGURE 5: MANUFACTURER'S LABEL

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111



2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 6:TIRE PLACARD

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 7: DRIVER SIDE REARVIEW MIRROR AND MOUNTING

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 8: PASSENGER SIDE REARVIEW MIRROR AND MOUNTING

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 9: INSIDE REARVIEW MIRROR AND MOUNTING

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 10:TEST SET-UP

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 11:CAMERA SET-UP FOR PHOTOGRAPHING REFERENCE BOARD

2010 CHEVROLET CAMARO FIGURE 12: OVERALL SET-UP AND INSTRUMENTATION FOR MIRROR BREAK- AWAY TEST
NHTSA NO. CA0106
FMVSS NO. 111

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

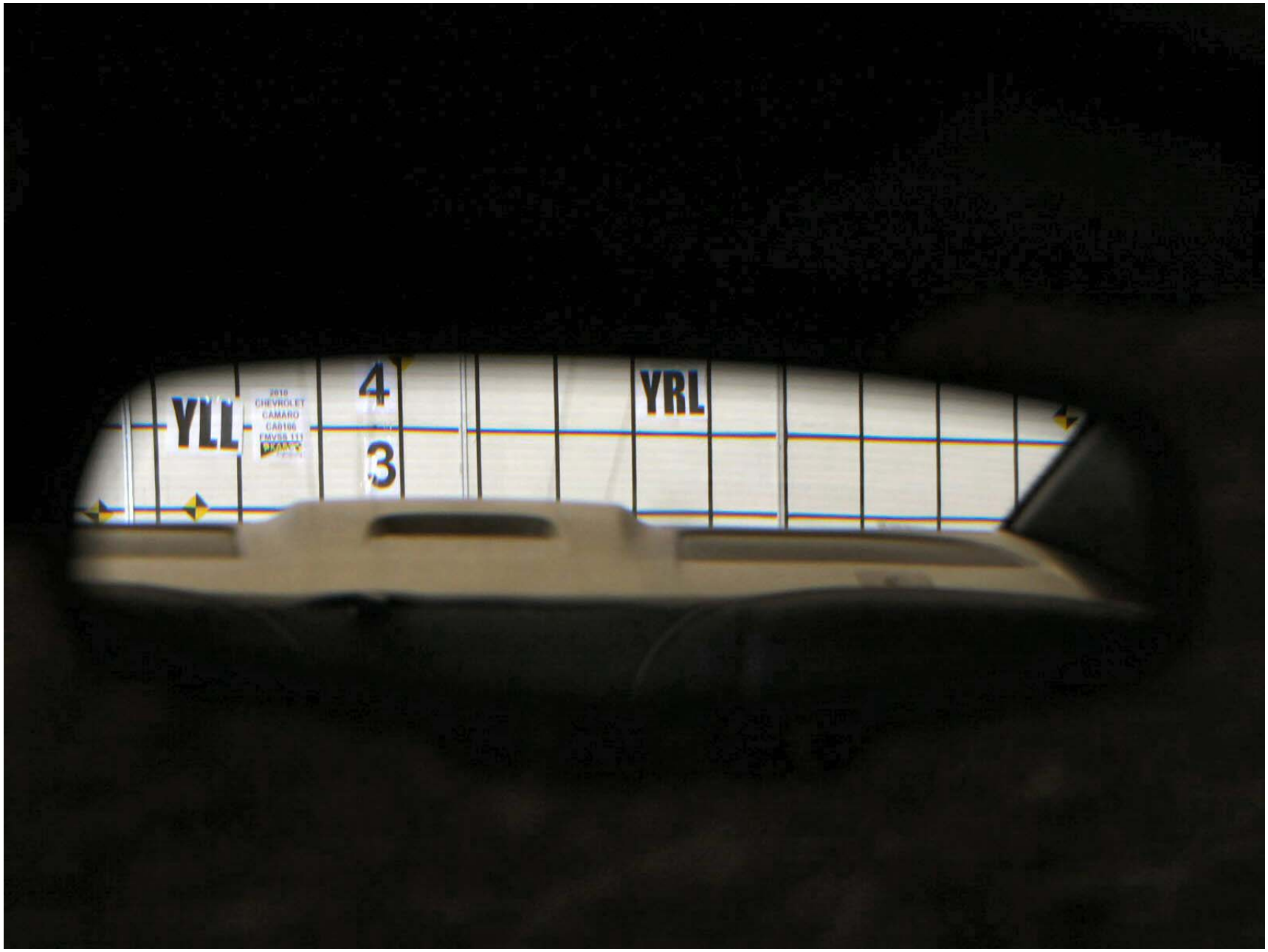
FIGURE 13:CLOSE-UP OF MIRROR BREAK- AWAY TEST

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 14:REFLECTION TEST SET-UP

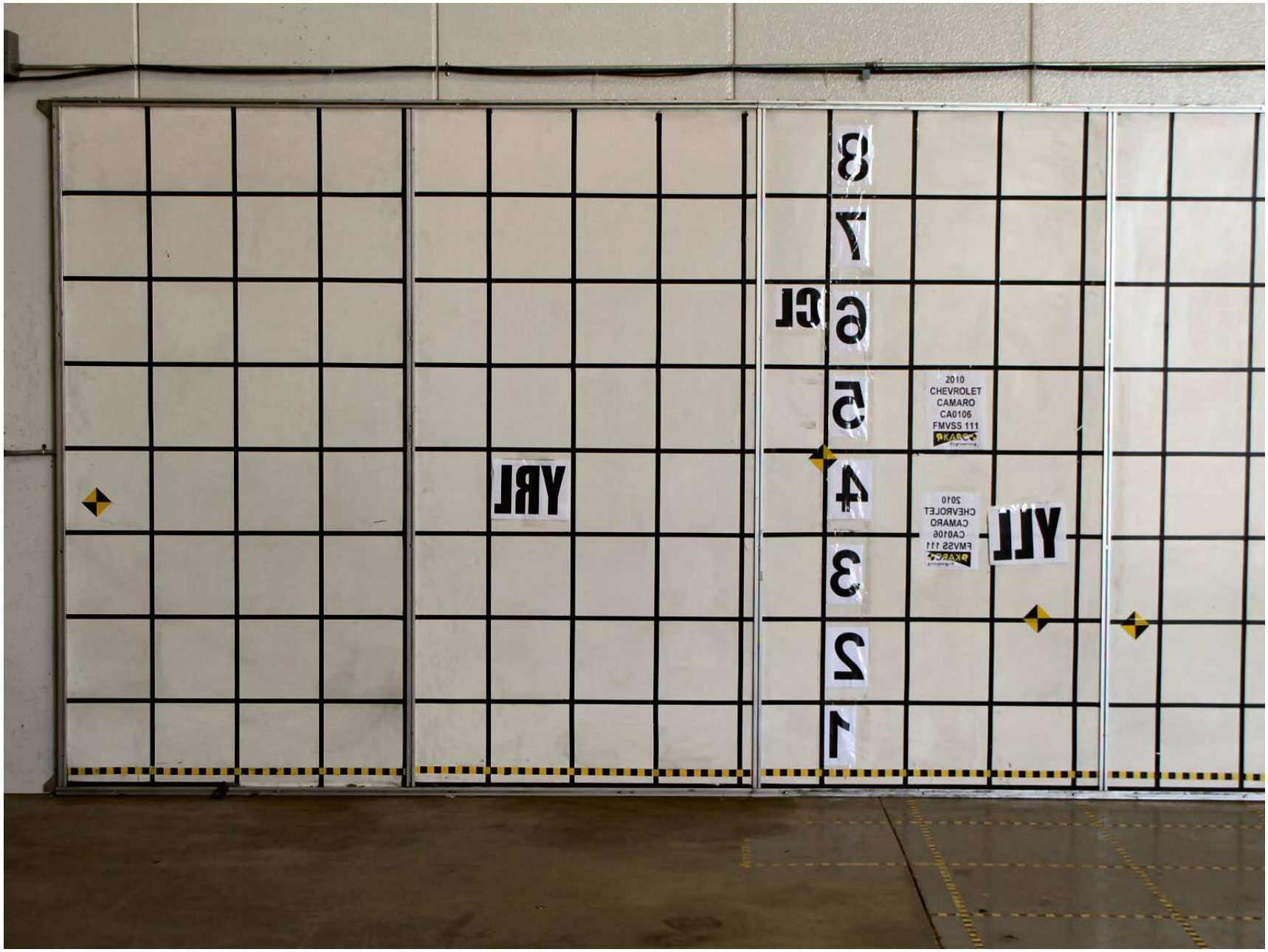
2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 15: MIRROR SET-UP FOR AREA MEASUREMENT



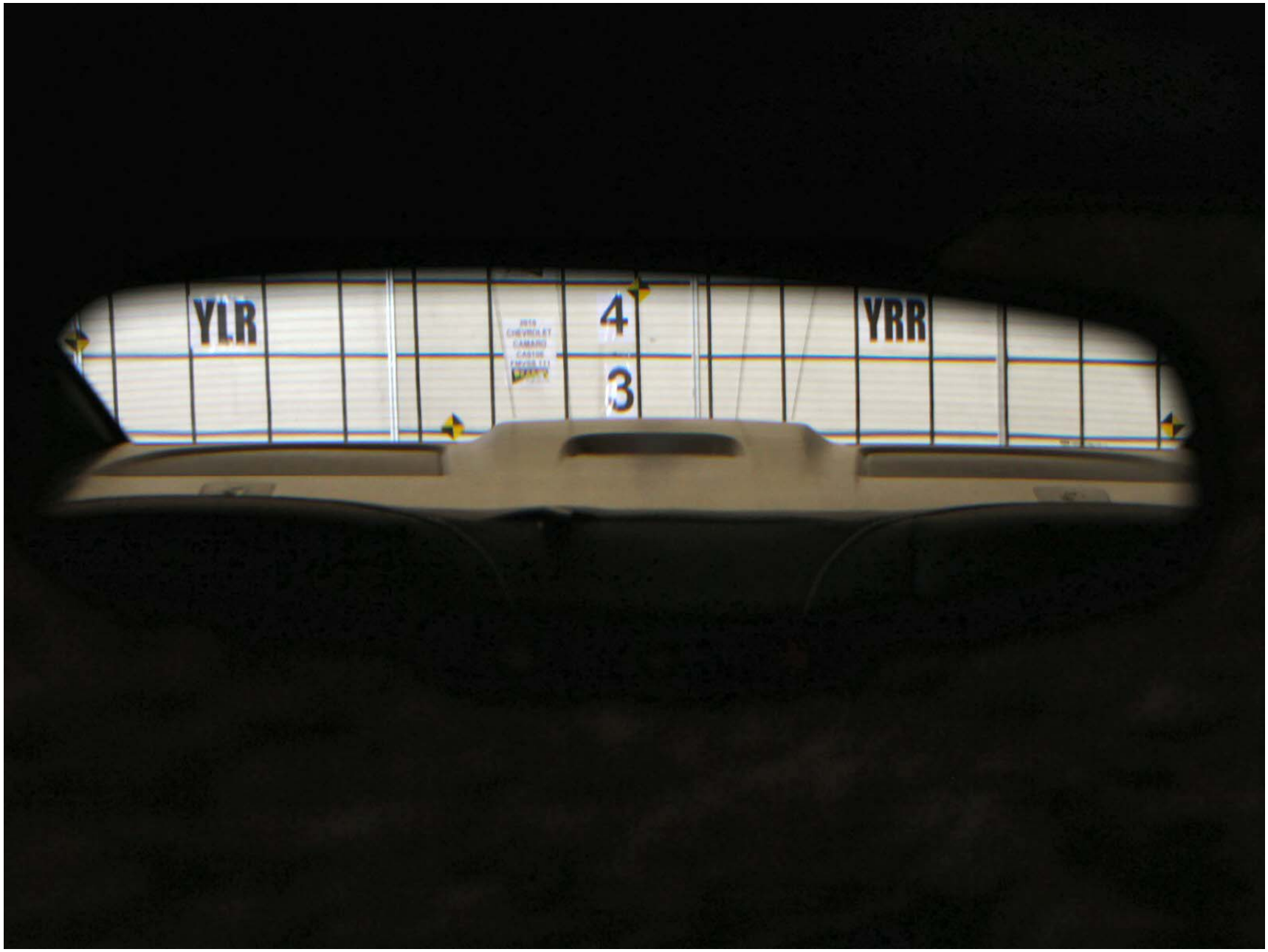
2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 16:LEFT EYE FIELD OF VIEW TEST (INSIDE MIRROR)



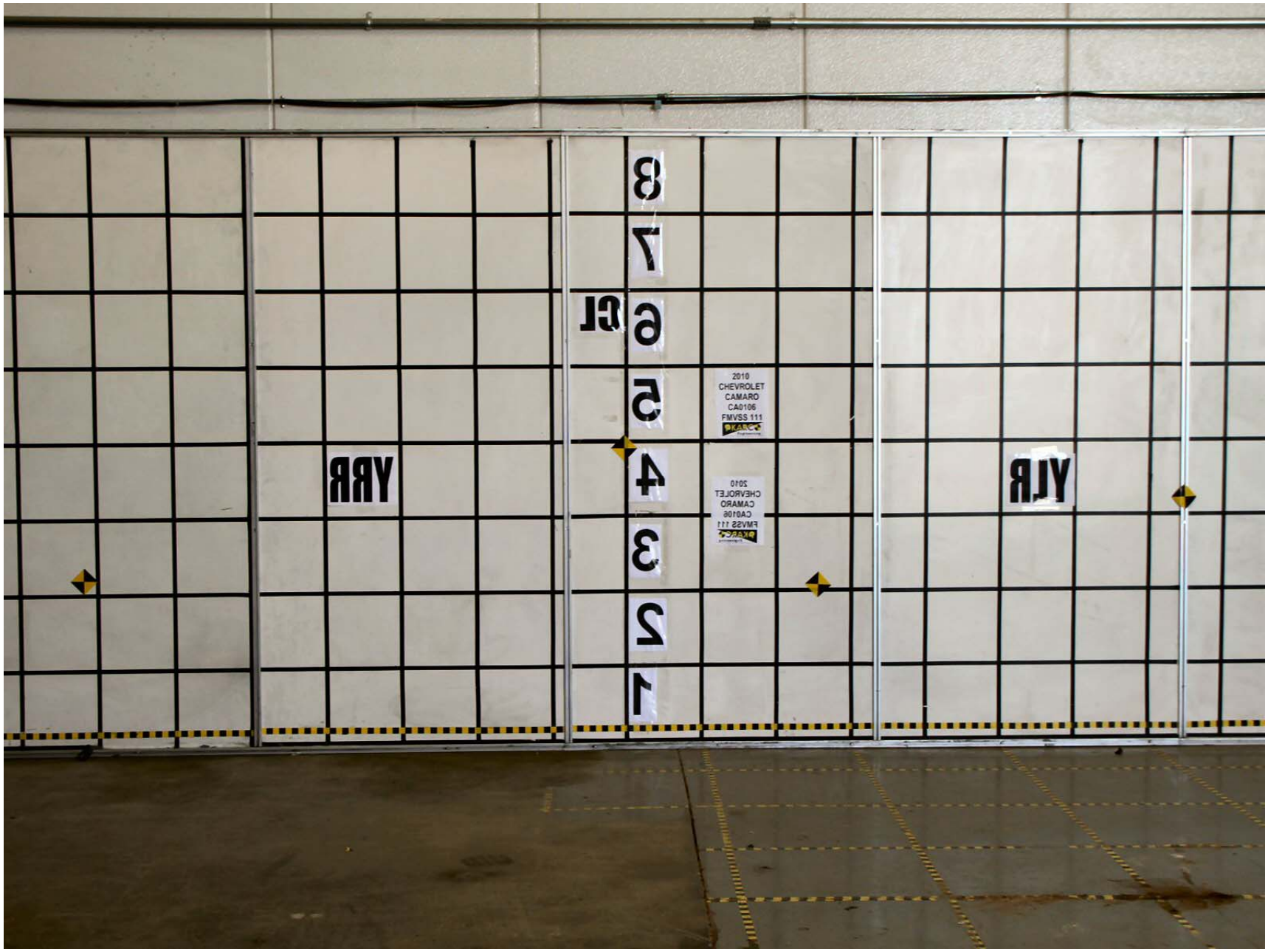
2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 17:REFERENCE BOARD FOR INSIDE MIRROR, LEFT EYE



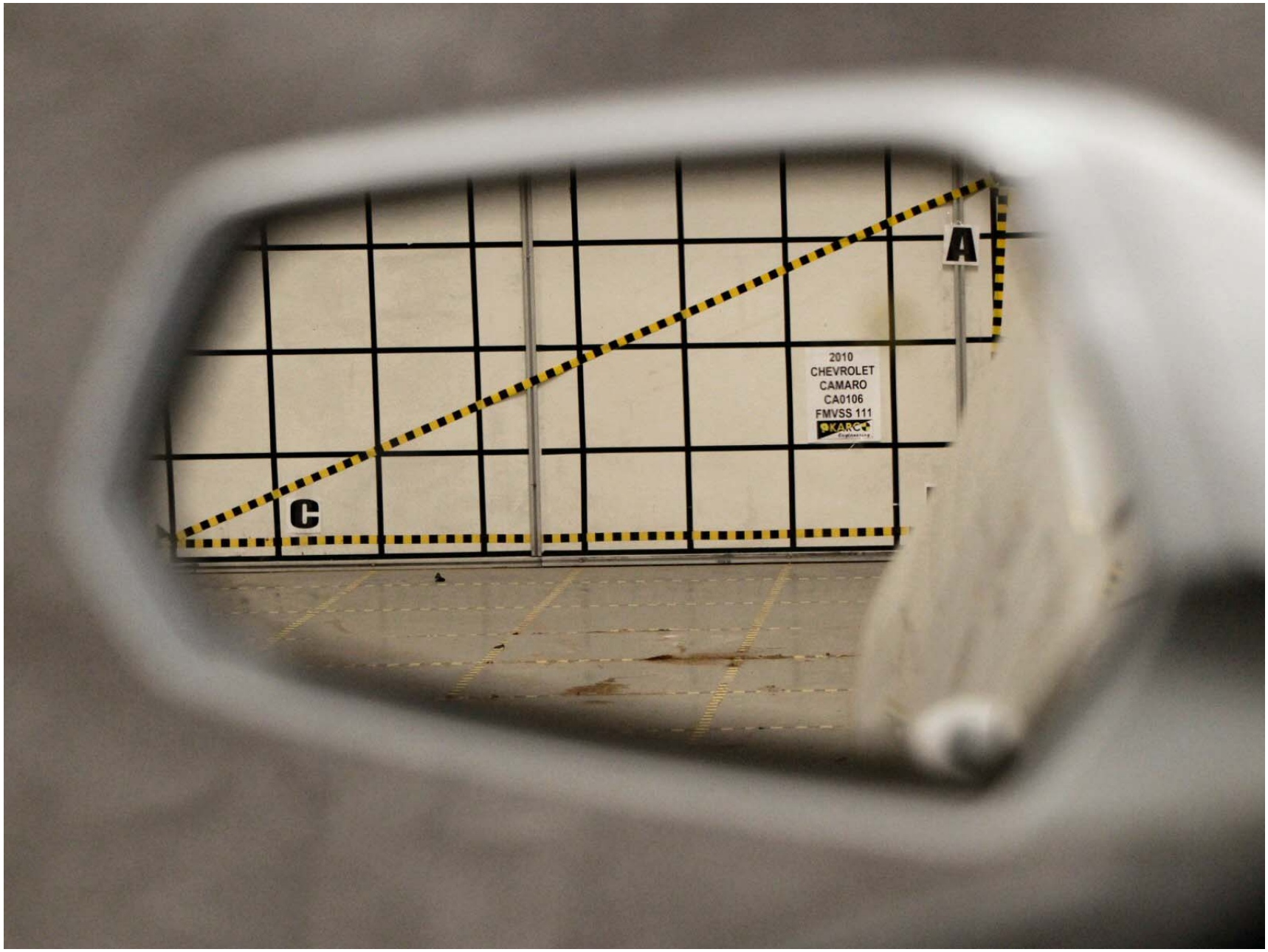
2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 18:RIGHT EYE FIELD OF VIEW TEST (INSIDE MIRROR)



2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 19:REFERENCE BOARD FOR INSIDE MIRROR, RIGHT EYE

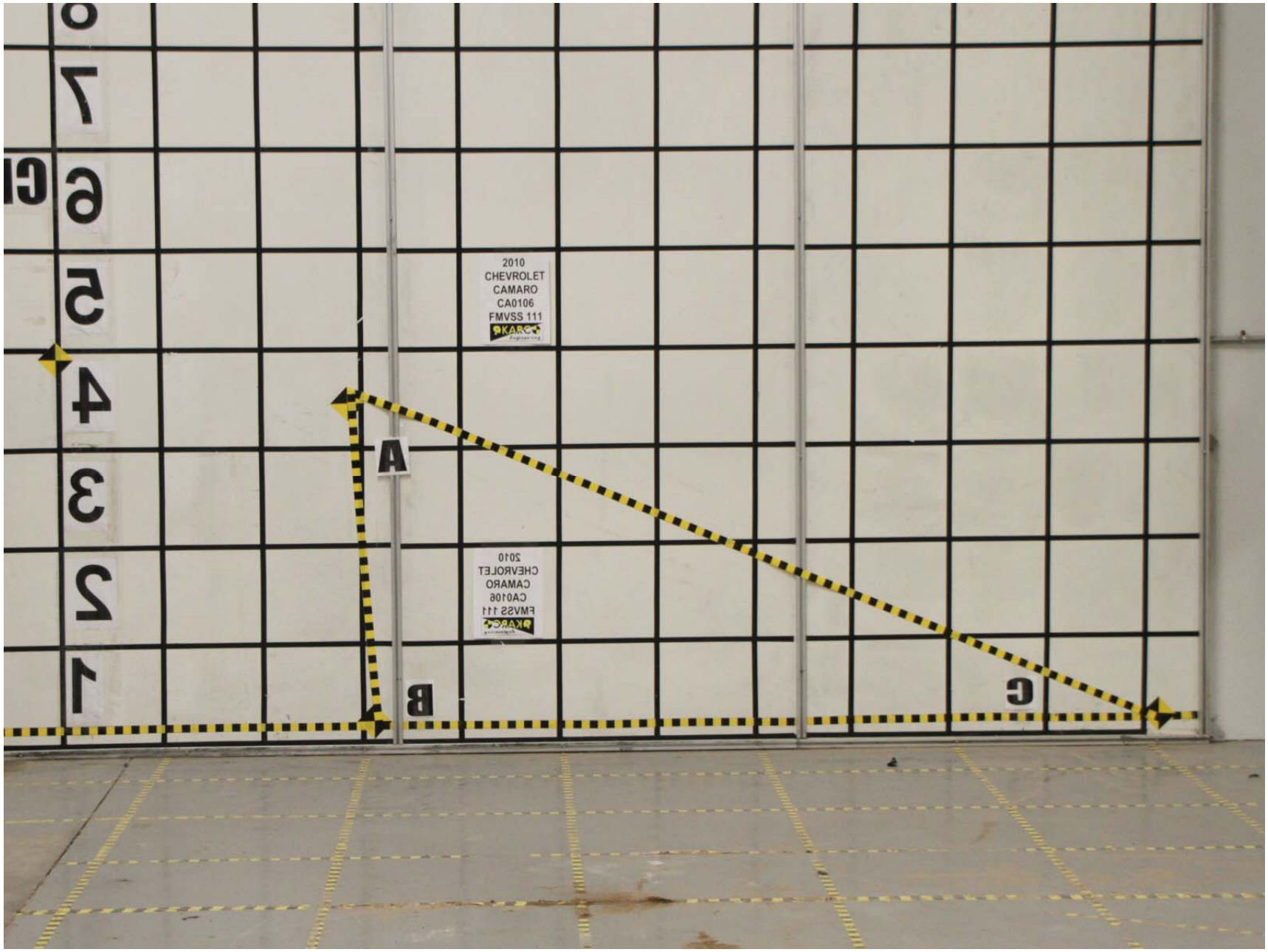


2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 20:LEFT EYE FIELD OF VIEW TEST (DRIVER SIDE MIRROR)

2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 21:RIGHT EYE FIELD OF VIEW TEST (DRIVER SIDE MIRROR)

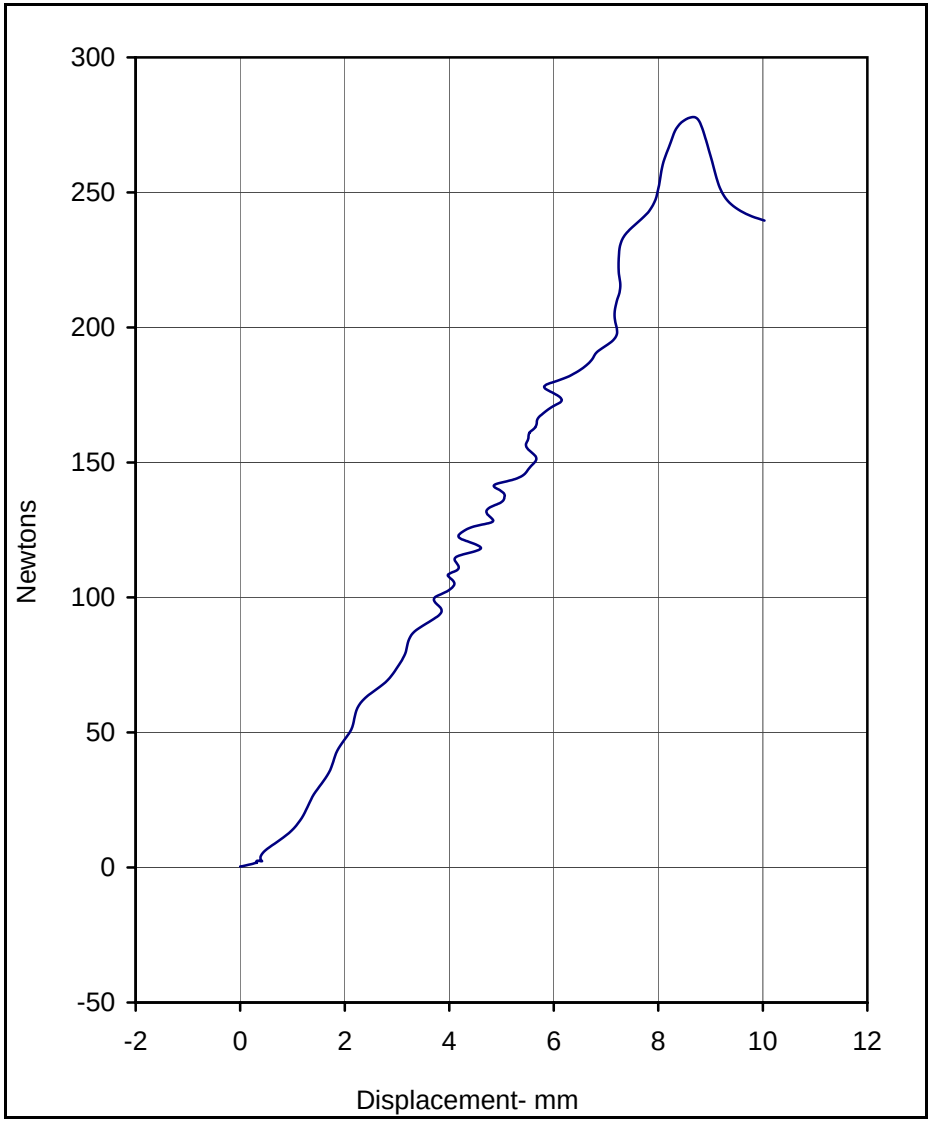


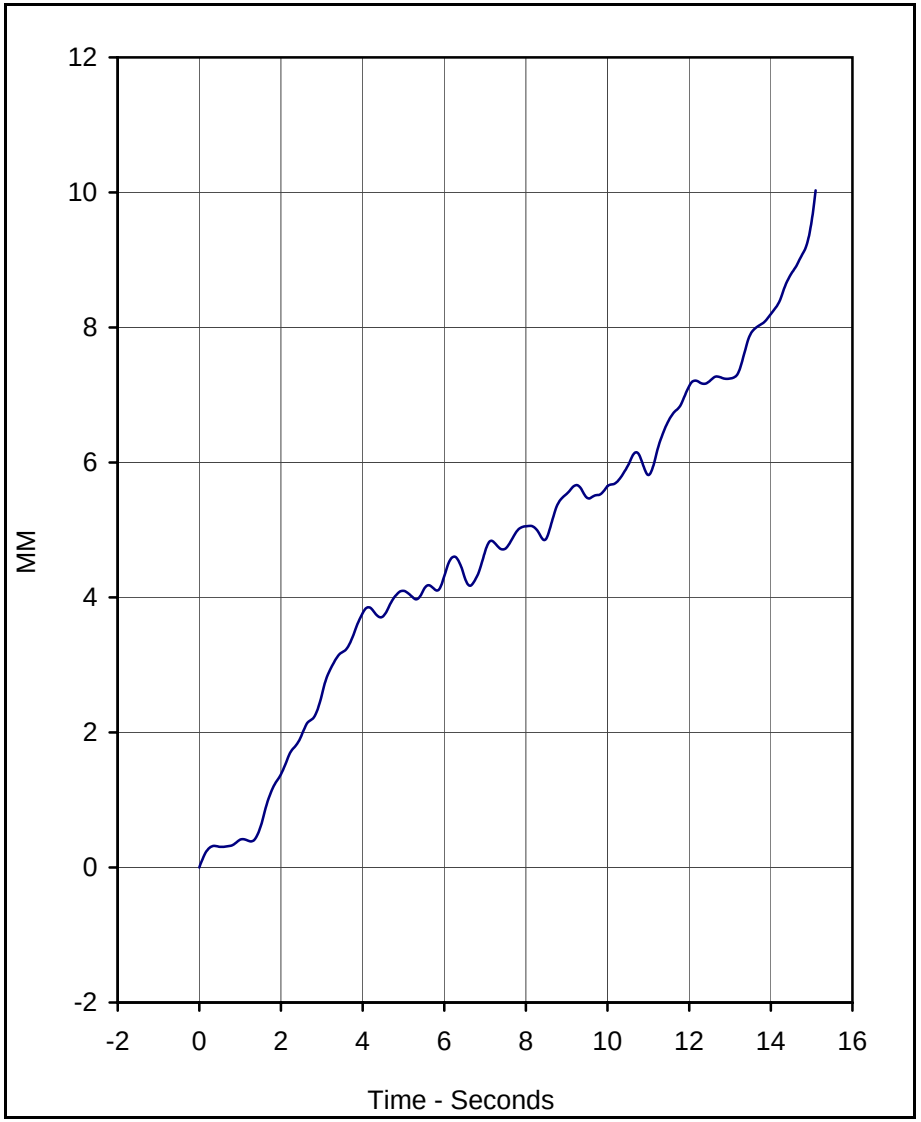
2010 CHEVROLET CAMARO
NHTSA NO. CA0106
FMVSS NO. 111

FIGURE 22:REFERENCE BOARD FOR DRIVER SIDE MIRROR

APPENDIX B

DATA PLOTS





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	277.9	8.7	1

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	10.0	15.1	39.9	1

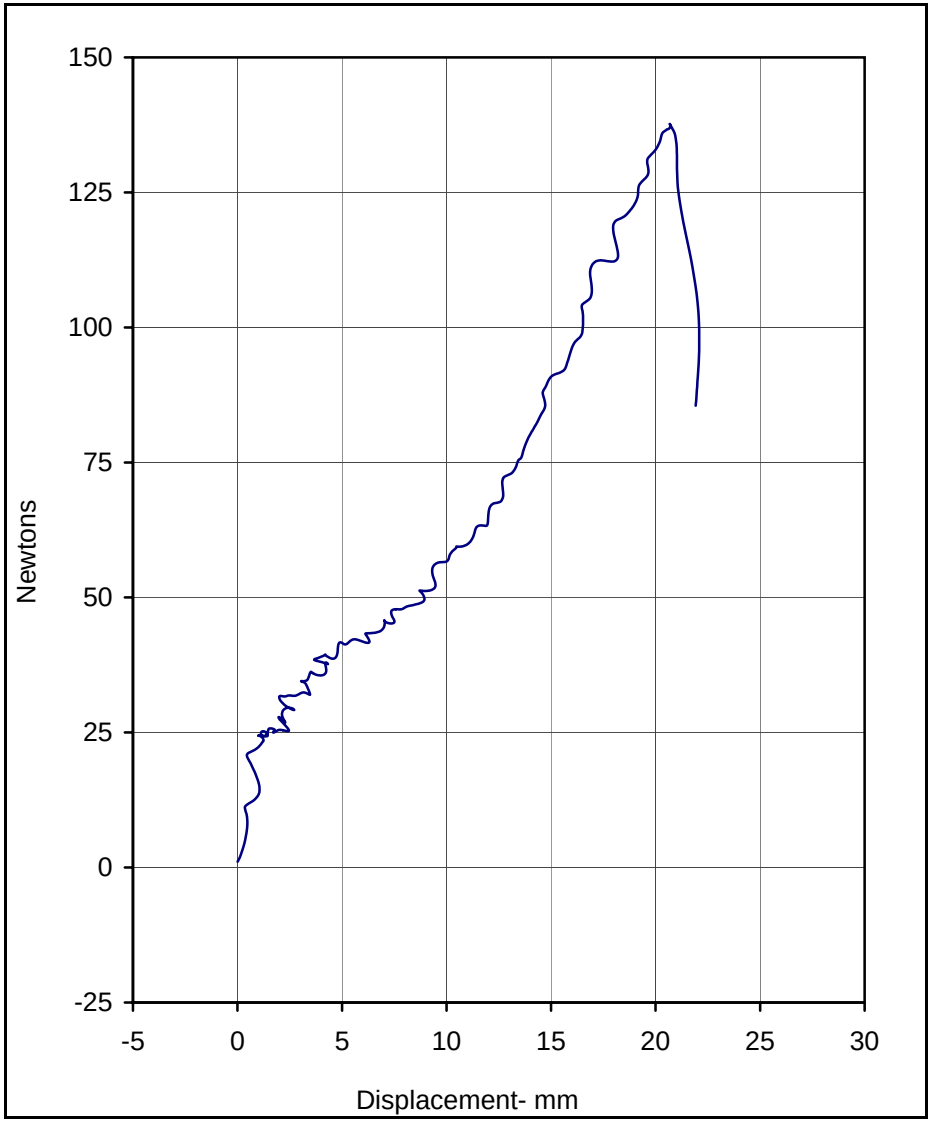
Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 1

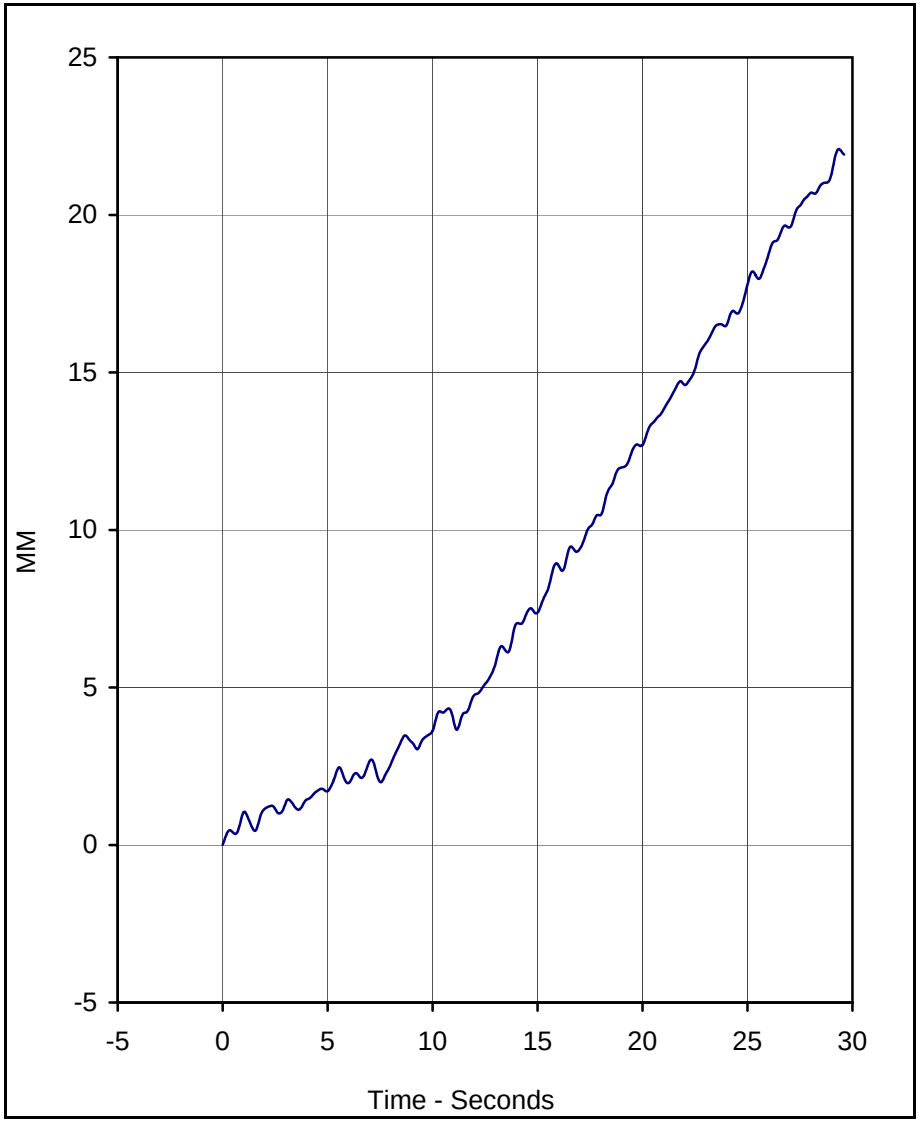
Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: 0 / 90

Test Date: 6/10/10

KARCO Engineering LLC





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	137.7	20.7	1

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	22.1	29.4	44.6	1

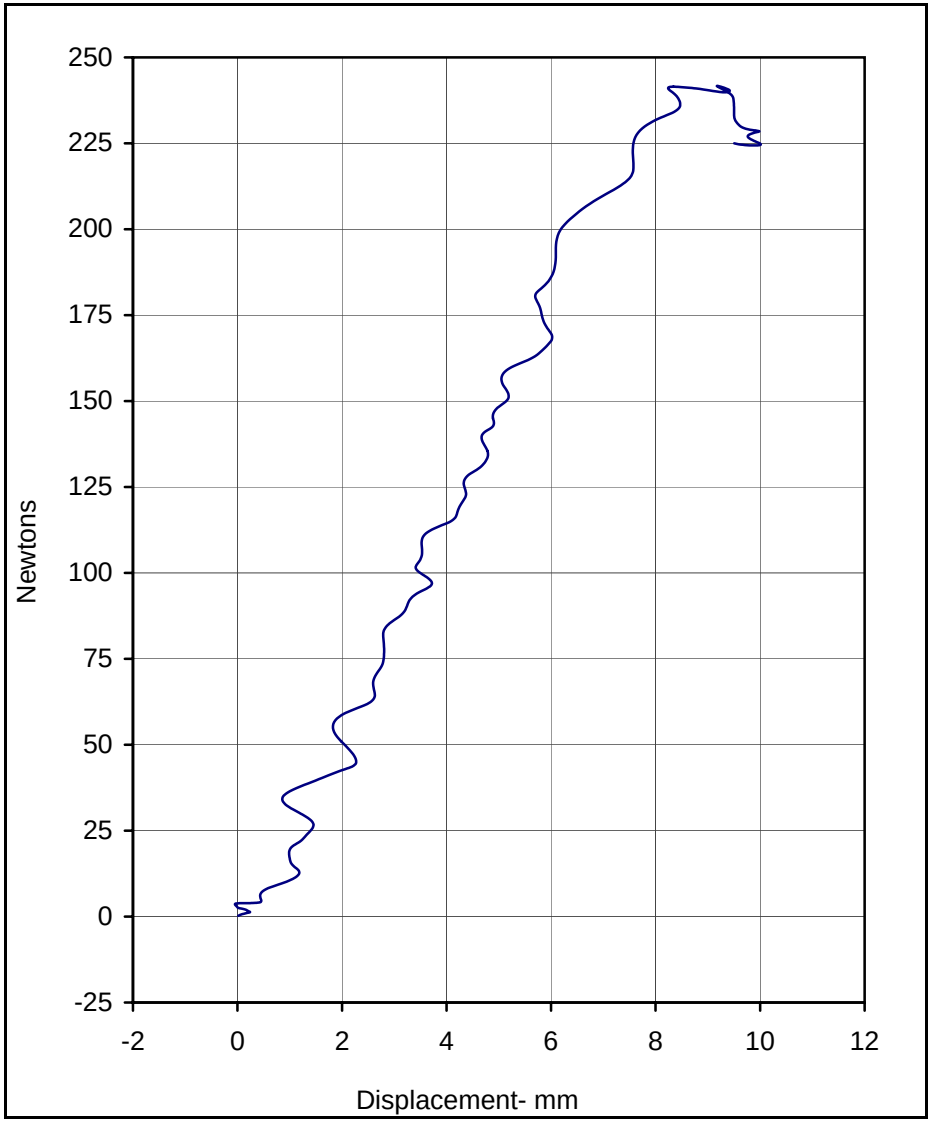
Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 2

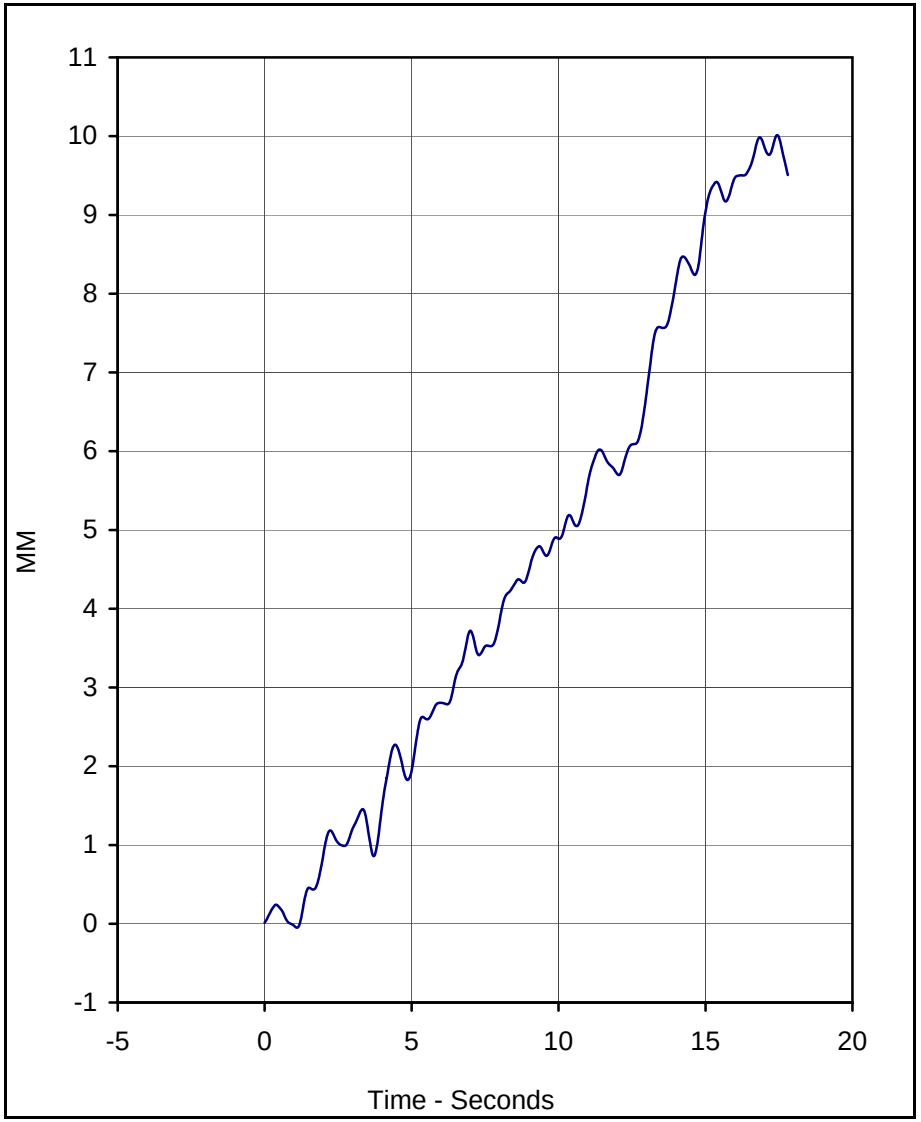
Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: +45 / 90

Test Date: 6/10/10

KARCO Engineering LLC





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	241.7	9.2	1

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

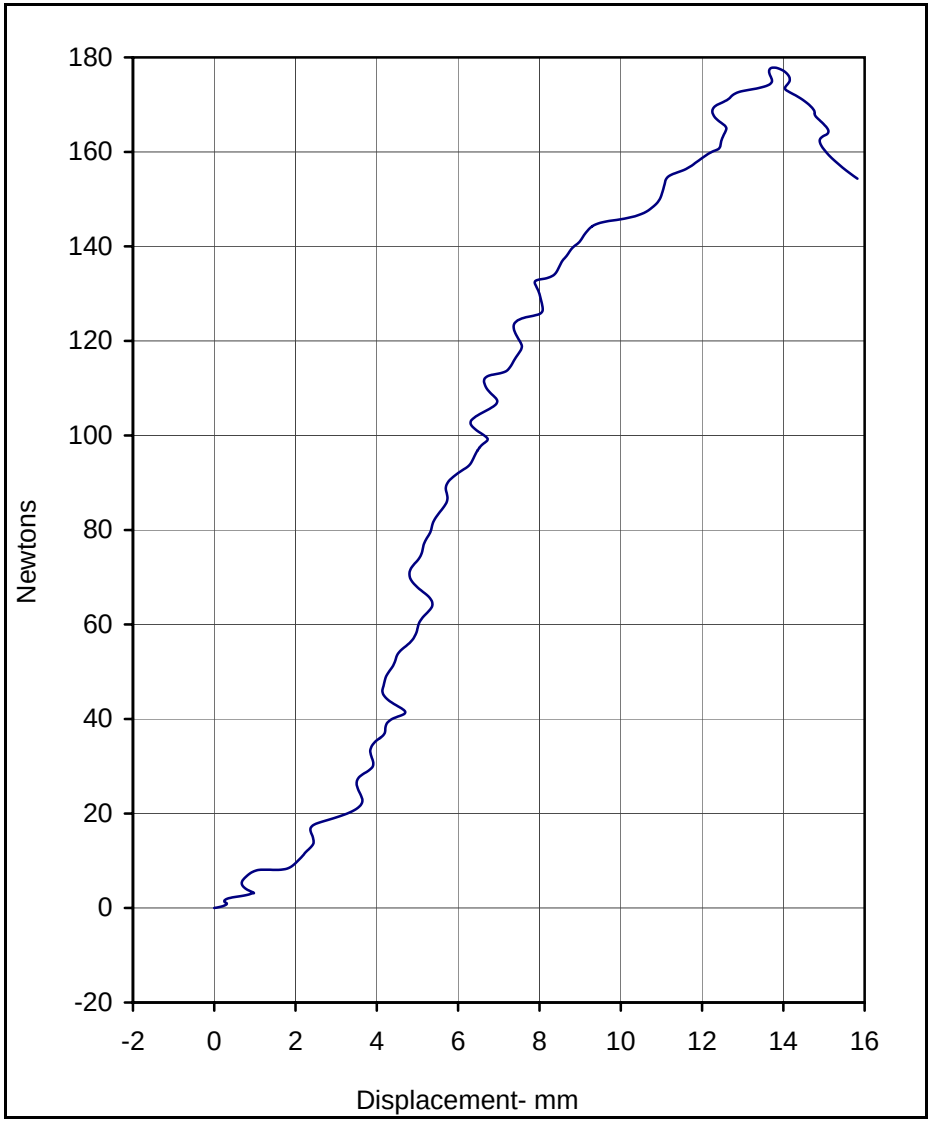
Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	10.0	17.5	33.7	1

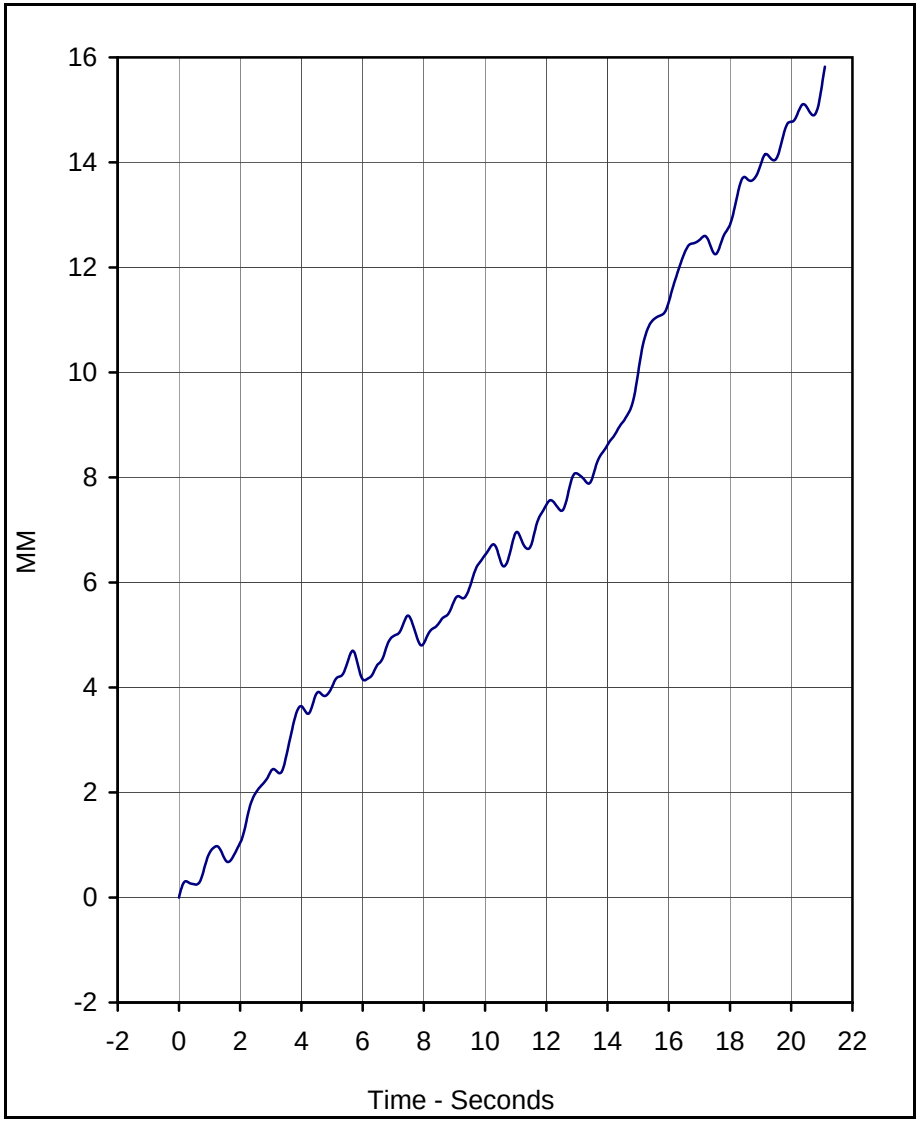
Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 3

Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: -45 / 90

Test Date: 8/25/08





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	177.8	13.7	1

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	15.8	21.1	44.2	1

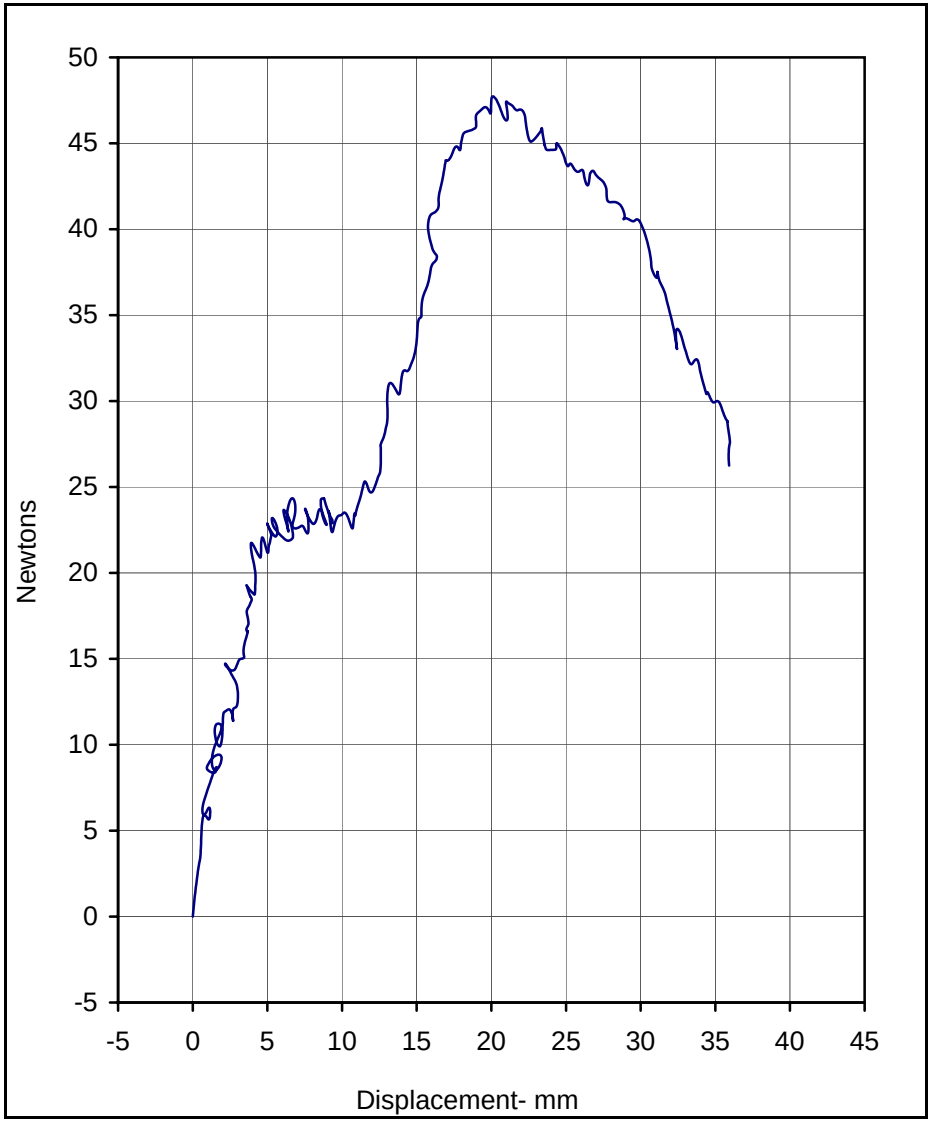
Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 4

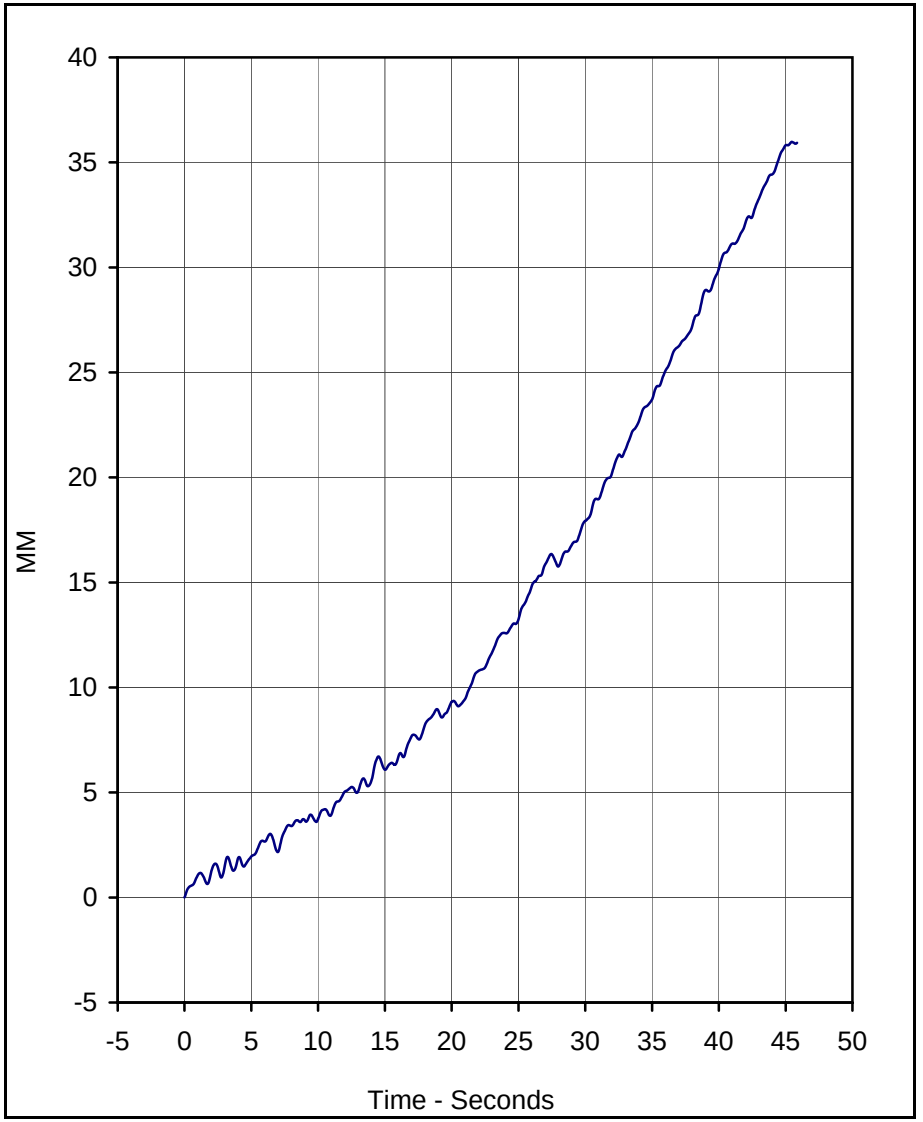
Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: -45 / +45

Test Date: 6/10/10

KARCO Engineering LLC





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	47.7	20.1	1

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	36.0	45.5	46.9	1

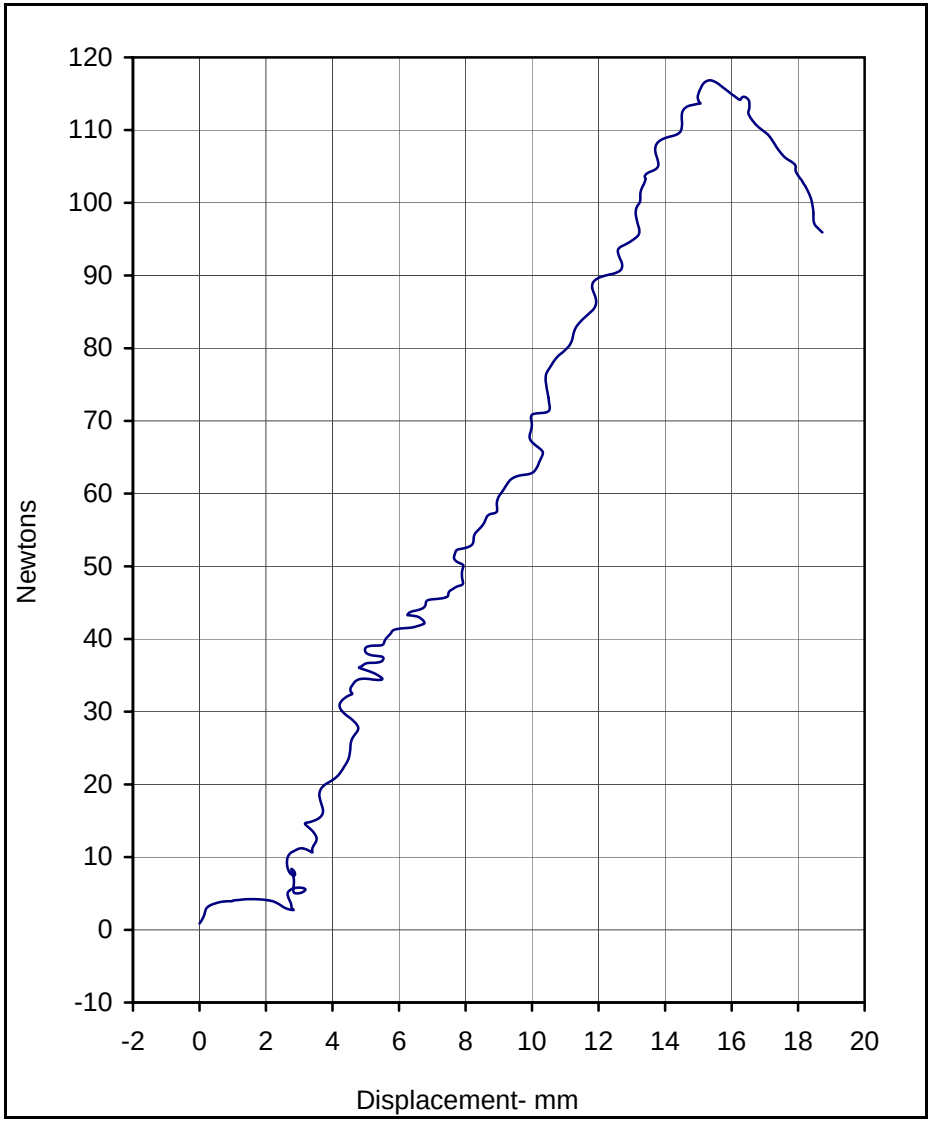
Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 5

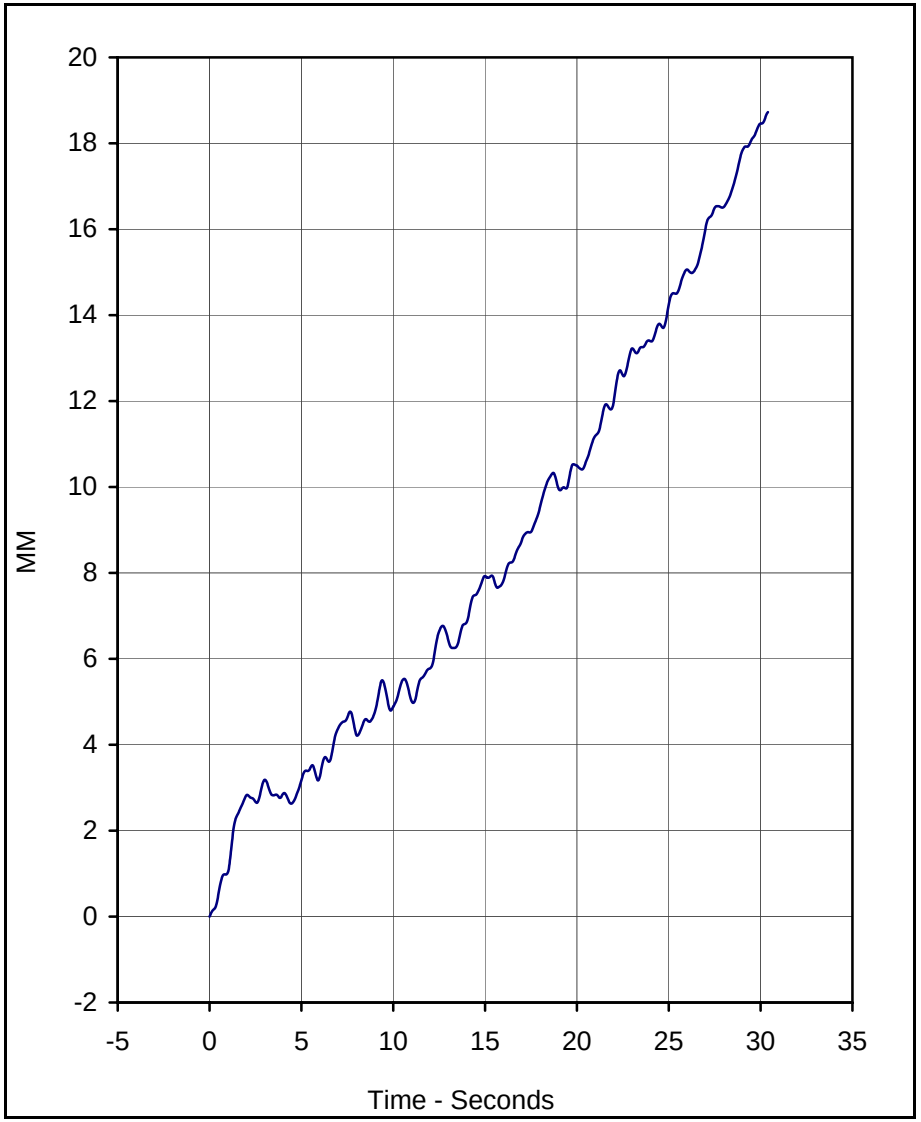
Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: +45 / +45

Test Date: 6/10/10

KARCO Engineering LLC





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	116.8	15.4	1

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	18.7	30.4	36.7	1

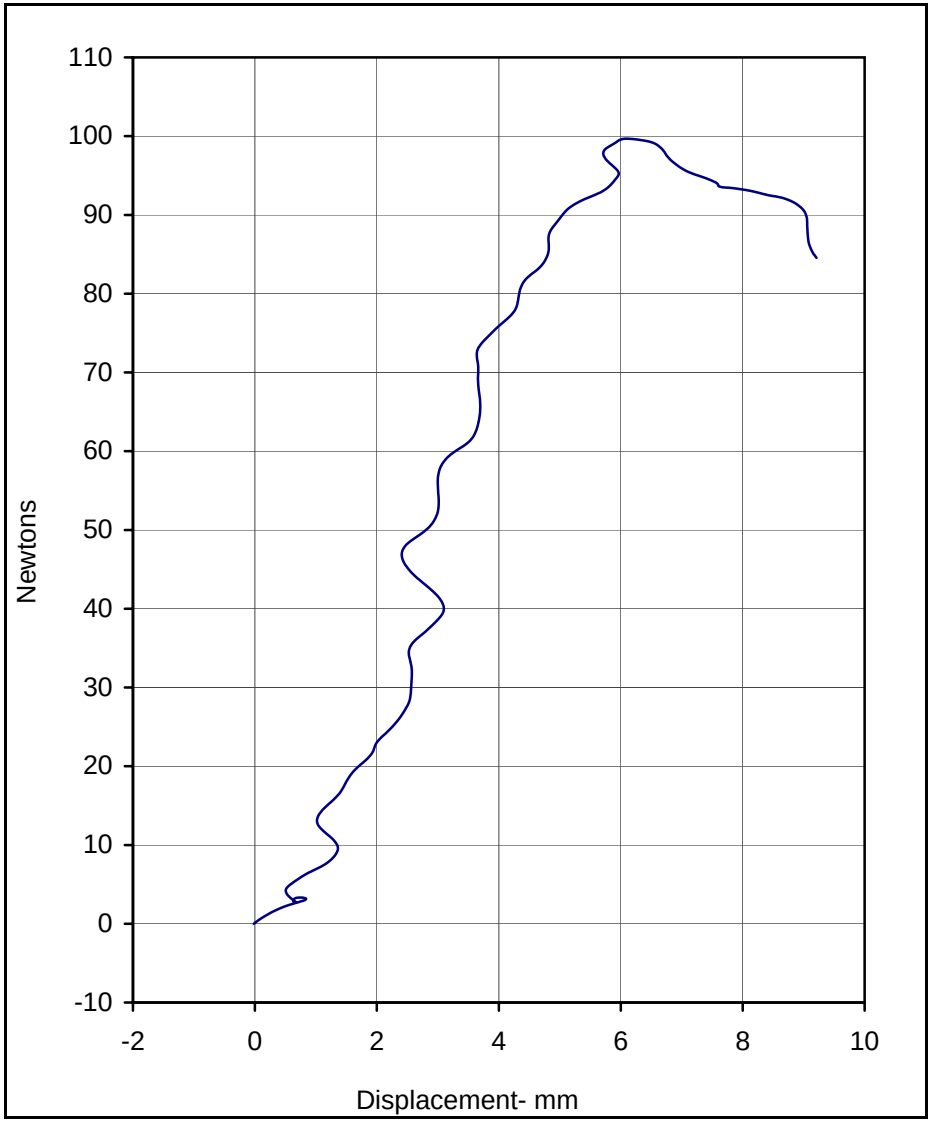
Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 6

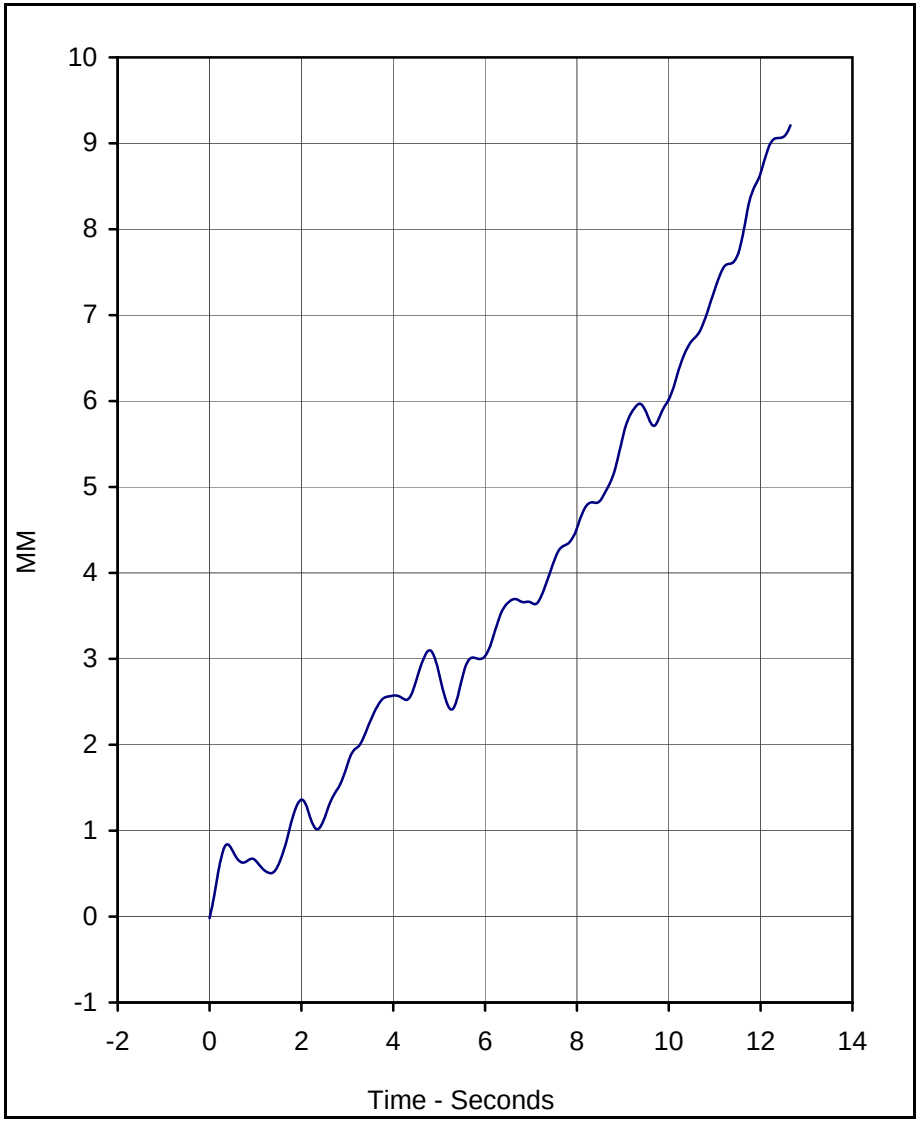
Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: +45 / -45

Test Date: 6/10/10

KARCO Engineering LLC





Curve Description	CURNO	Type
Force vs. Displacement	001	FIL

Units	Peak Force	Displacement	Filter (Hz)
Newtons	99.7	6.1	1

Curve Description	CURNO	Type
Displacement vs. Time	002	FIL

Units	Max	Time	Displ. Rate (mm/min.)	Filter (Hz)
MM	9.2	12.7	41.4	1

Test Program: 2010 FMVSS 111 Rearview Mirrors Test No.: 7

Test Vehicle: 2010 Chevrolet Camaro 2-Dr Coupe No.: CA0106

Load Direction: -45 / -45

Test Date: 6/10/10

KARCO Engineering LLC

APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

2010 FMVSS 111 Rearview Mirrors

Test Equipment List

6/10/10

2010 Chevrolet Camaro 2-Dr Coupe

Description	Manufacturer	Model No.	Serial No.	Limit	Accuracy	Cal. Date	Due Cal.
Hydraulic Pump	Lincoln	T-3825-C	2460952	8 gpm @ 2700 psi	N/A	N/A	N/A
Computer	Panasonic	CF-71	8IMAA01852	N/A	N/A	N/A	N/A
TDAS	DTS	TDAS	DM0100	N/A	SAE J211	11/25/09	11/25/10
Load Cell	Interface	1500ASK-300	230965A	1334 N	± 1.0%	5/12/10	5/12/11
Displacement Xdcr.	Celesco	PTX101-0030	J0654652	76 CM	± 1.0%	5/10/10	5/10/11

APPENDIX D

EYELIPSE LOCATIONS SUPPLIED BY MANUFACTURER

USG 4146 - December 10, 2009

Attachment 3

2010 Chevrolet Camaro

Form 111

FORM – 111
Rev. 10/10/08

VEHICLE INFORMATION / TEST SPECIFICATIONS

FMVSS No. 111

Vehicle Make/Model/Year: 2010 Chevrolet Camaro Coupe (2-Dr Hardtop) – GMX521

Driver's Eye Reference Points:

Coordinate System:

X = Longitudinal Dimension
Y = Lateral Dimension
Z = Vertical Dimension

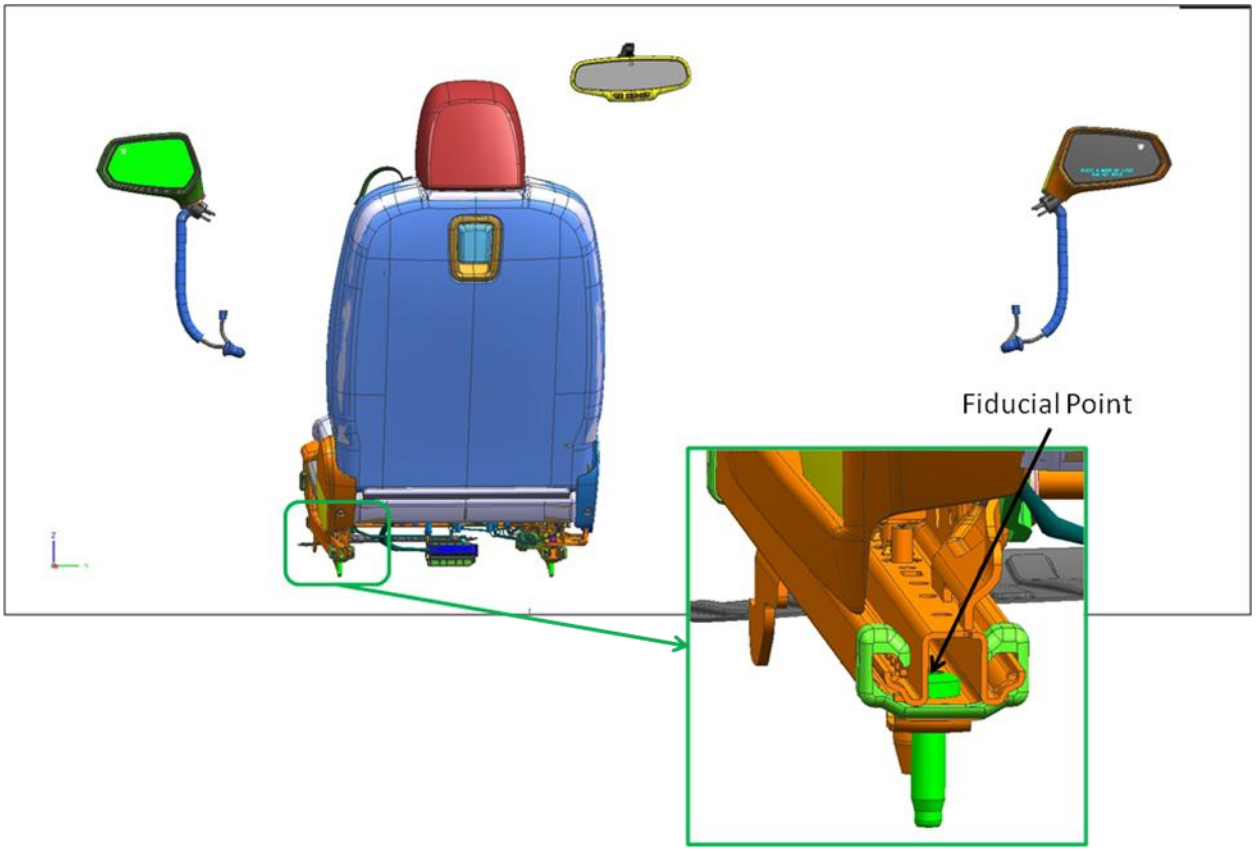
Positive Values are as follows:

X = Forward of Reference Point
Y = Outboard of Reference Point (to driver's side)
Z = Above Reference Point

Provide Reference/Body Fiducial Point that dimensions below are measured from**. Point must be easily accessible and usable by test laboratory personnel, i.e. seat track mounting bolt, seat belt anchorage bolt, door latch at B pillar striker.** (Provide sketch of reference point if necessary.)

Driver's Seat Rear Outboard Mounting Bolt (see attached sketch)

COORDINATES	LEFT SIDE MIRROR		INSIDE MIRROR		RIGHT SIDE MIRROR	
	LE1 (left eye)	RE1 (right eye)	LE2	RE2	LE3	RE3
X	-55	-33	-40	-56	-21	-62
Y	-185	-246	-195	-258	-223	-273
Z	855	855	856	856	854	854
Mirror Mfr., Model Part No.	Magna Electric 92247439		Gentex Auto-Dim, no OnStar 13503047		Magna Electric 92247440	


Fiducial Point