

REPORT NUMBER: TR-P34135-03-NC
SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT
79.3 KM/H 70% OVERLAP REAR IMPACT

MAZDA MOTOR CORPORATION
2014 MAZDA 6 4-DOOR SEDAN

NHTSA NUMBER: C20145405

PREPARED BY:
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TEST DATE:
SEPTEMBER 16, 2014

REPORT DATE:
SEPTEMBER 30, 2014

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
ROOM 6111, NVS-220
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WASHINGTON, DC 20590

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FINAL REPORT ACCEPTANCE BY OVSC:

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. TR-P34135-03-NC	2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Final Report of FMVSS 301R 70% Overlap Rear Impact Testing of a 2014 Mazda 6 4-Door Sedan NHTSA No. C20145405			5. Report Date September 30, 2014	
			6. Performing Organization Code KAR	
7. Authors Mr. Matthew S. Hubbard, Test Engineer, KARCO Mr. Frank Richardson, Program Manager, KARCO			8. Performing Organization Report No. TR-P34135-03-NC	
9. Performing Organization Name and Address KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301			10. Work Unit No.	
			11. Contract or Grant No. DTNH22-11-D-00245	
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance Room 6111, NVS-220 400 Seventh Street, SW Washington, D.C. 20590			13. Type of Report and Period Covered Final Test Report, Sept. 16 - 30, 2014	
			14. Sponsoring Agency Code	
15. Supplementary Notes				
16. Abstract A 79.3 km/h 70% overlap rear impact test was conducted on the subject 2014 Mazda 6 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Laboratory Test Procedure for FMVSS 301R. The test was conducted at the KARCO Engineering, LLC. facility in Adelanto, California on September 16, 2014. The impact velocity was 78.8 km/h and the outside ambient temperature was 40.0 deg. C. There was no Stoddard solvent leakage immediately after the impact or during any portion of the static rollover				
17. Key Words FMVSS 301R Overlap Rear Impact MDB 2014 Mazda 6			18. Distribution Statement	
19. Security Classification of this report UNCLASSIFIED	20. Security Classification of this page UNCLASSIFIED	21. No. of Pages 38	22. Price	

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SECTION 1

SUMMARY OF TEST

SUMMARY

The purpose of this rear impact test series is to measure the performance of the subject vehicle, a 2014 Mazda 6 4-door sedan, for FMVSS 301R '*Fuel System Integrity – Rear Impact*'.

This 79.3 km/h 70% Overlap Rear Impact is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-11-D-00245. It was conducted in accordance with the Office of Vehicle Safety Compliance Laboratory Test Procedure TP-301R-02 for FMVSS 301R '*Fuel System Integrity – Rear Impact*', dated January, 2007.

The test was performed at KARCO Engineering, LLC. on September 16, 2014. Pre- and post-test photographs of the vehicle and ATD's can be found in Appendix A of this report.

Two (2) real-time cameras and three (3) high-speed cameras were used to document the rear impact event.

Two Part 572E 50th percentile male anthropomorphic test devices (ATD) were placed in the driver and right front passenger seating positions. Both ATD's were not instrumented for this test.

There was no Stoddard solvent leakage after the impact or during any portion of the static rollover. FMVSS 301 data is summarized in Data Sheets 4 and 5.

SECTION 2
DATA SHEETS

Test Vehicle: 2014 Mazda 6 4-Door Sedan

NHTSA No.: C20145405

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 09/16/14

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(T_f - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1**TEST VEHICLE SPECIFICATIONS**Test Vehicle: 2014 Mazda 6 4-Door SedanNHTSA No.: C20145405Test Program: 79.3 km/h 70% Overlap Rear ImpactTest Date: 09/16/14**TEST VEHICLE INFORMATION AND OPTIONS**

NHTSA Number	C20145405
Model Year	2014
Make	Mazda
Model	6
Body Style	4-Door Sedan
VIN	JM1GJ1U63E1157152
Body Color	Silver
Odometer Reading (km / mi)	2155 / 1339
Engine Displacement (L)	2.5
Type / No. of Cylinders	Inline 4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	Front
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

Traction Control System	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
Driver Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Front Pass. Seat Belt Pretensioner	Yes
Front Pass. Load Limiter	Yes
Other	No

Does Owner's Manual provide instructions to turn off automatic door locks?

DATA FROM CERTIFICATION LABEL

Manufactured By	Mazda Motor Corporation
Date of Manufacture	Nov-13

GVWR (kg)	1945
GAWR Front (kg)	1029
GAWR Rear (kg)	921

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				385.0	A
DSC x 68 (kg)				340.0	B
Cargo Weight (RCLW) (kg)				45.0	A-B

DATA SHEET NO. 1 ... (CONTINUED)

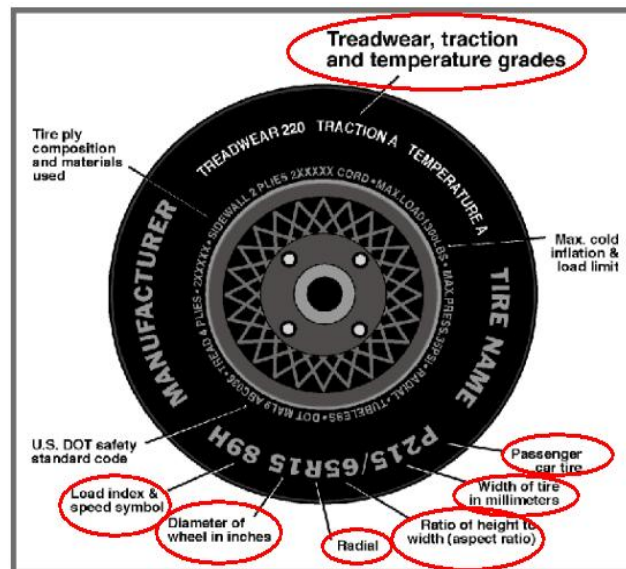
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2014 Mazda 6 4-Door Sedan

NHTSA No.: C20145405

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 09/16/14



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max Tire Pressure (kPa)	350	350
Cold Tire Pressure (kPa)	250	250
Max Load Tire Pressure (kPa)		
Recommended Tire Size	P225/55R17	P225/55R17
Tire Size on Vehicle	P225/55R17	P225/55R17
Tire Manufacturer	Yokohama	Yokohama
Tire Model	Advan A83	Advan A83
Load Range	690	690
Treadwear Rating	280	280
Traction Rating	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Nylon	1 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	95V	95V
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	FDUP PPW 4113	FDUP PPW 4113
DOT Safety Code Right	FDUP PPW 4113	FDUP PPW 4113
Type of Spare Tire	Compact Size Spare Tire T125/70D17	
Location of Tire Placard on Vehicle	Driver Side 'B' Pillar Panel	

DATA SHEET NO. 2**PRE-TEST DATA**Test Vehicle: 2014 Mazda 6 4-Door SedanNHTSA No.: C20145405Test Program: 79.3 km/h 70% Overlap Rear ImpactTest Date: 09/16/14**TEST VEHICLE AXLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	440.0	307.0		486.5	352.5		475.5	368.0	
Right	kg	416.5	288.5		462.5	336.0		454.0	348.0	
Ratio	%	59.0%	41.0%	100.0%	58.0%	42.0%	100.0%	56.5%	43.5%	100.0%
Total	kg	856.5	595.5	1452.0	949.0	688.5	1637.5	929.5	716.0	1645.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1452.0	A
Actual Weight of 2 P572 ATDs Used	kg	148.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	45.0	C
Target Vehicle Test Weight (TVTW)	kg	1645.0	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	731	730	736	740	1162
As Tested	mm	710	709	716	722	1191
Fully Loaded	mm	714	718	716	710	1233
Post-Test	mm	734	690	869	749	

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Total Vehicle Wheel Base	mm	2820
Total Vehicle Length	mm	4885
Total Vehicle Width	mm	1840
Amount of Stoddard Solvent in Fuel Tank	L	57.7

DATA SHEET NO. 2... (CONTINUED)**PRE-TEST DATA**

Test Vehicle: 2014 Mazda 6 4-Door Sedan NHTSA No.: C20145405
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/16/14

BALLAST DATA

Description	Value
Type of Ballast	Ballast Dummies
Method of Securing Ballast	Seat Belt
Weight of Ballast in Cargo Area	0 kg
Weight of Vehicle Components Removed	0 kg

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

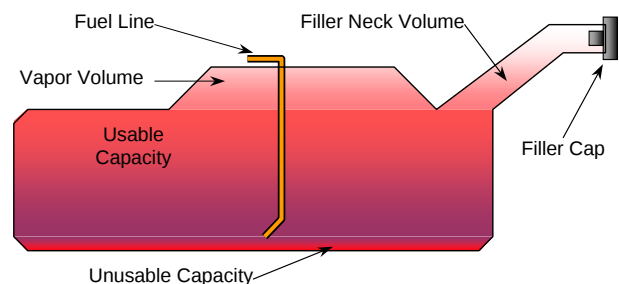
No vehicle components were removed

FUEL TANK CAPACITY

Description	Liters
Fuel System Capacity Listed in Owners Manual	62.00
Usable Capacity of "Standard Tank"	62.00
91 - 94% of Usable Capacity	56.42 - 58.28
Actual Amount of Stoddard Solvent Used	57.66

FUEL PUMP

The vehicle is equipped with an electric fuel pump.
The fuel pump operates when starter or engine is activated.



VEHICLE FUEL TANK ASSEMBLY

TEST FLUID

Description	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.76
Test Fluid Kinematic Viscosity	
Test Fluid Color	Purple

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2014 Mazda 6 4-Door Sedan

NHTSA No.: C20145405

Test Program: 79.3 km/h 70% Overlap Rear Impact

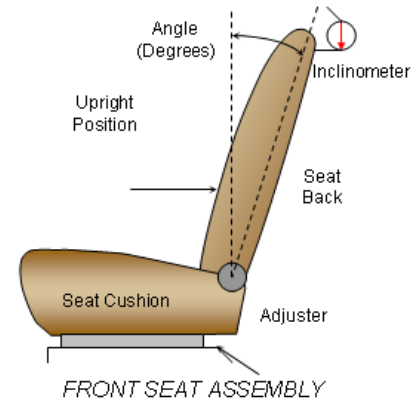
Test Date: 09/16/14

NOMINAL DESIGN RIDING POSITION

Seat back angle is measured at the headrest post using a digital inclinometer.

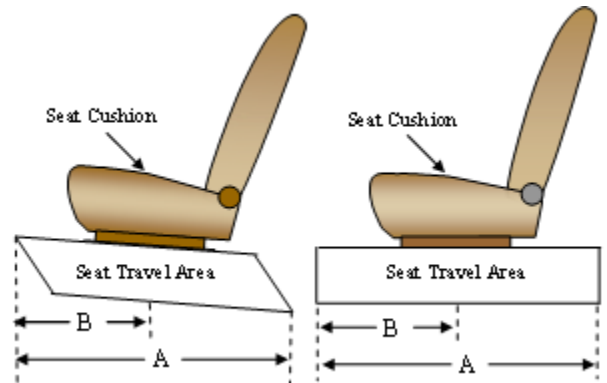
SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	10.1
Passenger Seat Back Angle	7.0



SEAT FORE / AFT POSITIONING

The total seat travel is measured from the forward most possible position to the rear most possible position. The driver's seat is set to the middle of the fore-aft travel. The passenger's seat is set to the middle of the fore-aft travel.



SEAT FORE/AFT POSITIONS

Seating Position	Total Fore-Aft Travel	Placed in Position
Driver Seat	308 mm	160 mm
Passenger Seat	260 mm	130 mm

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2014 Mazda 6 4-Door Sedan

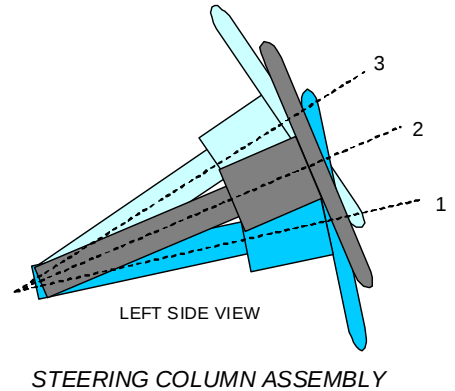
NHTSA No.: C20145405

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 09/16/14

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. A digital inclinometer is used to measure a plate which is placed across the rim of the steering wheel for angular measurements. A tape measure is used to measure telescoping steering wheel travel.



STEERING COLUMN POSITIONING

	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	21.2	162
Geometric Center Position, No. 2	23.6	136
Uppermost Position, No. 3	25.9	110
Telescoping Steering Wheel Travel	4.7	52
Test Position	23.6	136

DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2014 Mazda 6 4-Door Sedan NHTSA No.: C20145405
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/16/14

MOVING BARRIER TEST WEIGHT

	Units	As Delivered Weights (UVW)		
		Front Axle	Rear Axle	Total
Left	kg	402.0	298.0	700.0
Right	kg	377.0	292.0	669.0
Ratio	%	56.9%	43.1%	100.0%
Total	kg	779.0	590.0	1369.0

MOVING BARRIER TIRE INFORMATION

Measured Parameter	Front	Rear
Recommended Tire Size	205/75R15	205/75R15
Tire Size on Vehicle	205/75R15	205/75R15
Tire Manufacturer	Pacemark	Pacemark
Tire Model	All Weather	All Weather
Treadwear	420	420
Traction	A	A
Temperature Grades	B	B
Tire Pressure - Front	220	220
Tire Pressure - Rear	220	220

MOVING BARRIER DIMENSIONS

Measurement Description	Length (mm)
Overall Width	1677
Overall Height	559
Honeycomb Depth	380
Overall Depth	484
Bottom Honeycomb to Bottom Bumper	51
Bumper Height	203
Ground to Top of MDB	788
Ground to Bottom of MDB	230
Ground to Bottom of Bumper	280
Ground to Top of Bumper	485

DATA SHEET NO. 4**POST-TEST DATA**Test Vehicle: 2014 Mazda 6 4-Door SedanNHTSA No.: C20145405Test Program: 79.3 km/h 70% Overlap Rear ImpactTest Date: 09/16/14Temperature at Time of Impact: 40.0°CTest Time: 12:43 PMVIN: JM1GJ1U63E1157152**IMPACT VELOCITY DATA**

Measured Parameter	Units	Value
Trap No. 1 Velocity (Primary)	km/h	78.80
Trap No. 2 Velocity (Redundant)	km/h	78.83

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Width	mm		1840
Vertical Impact Reference Line (Right of Vehicle Center Line)	mm		368
Actual Impact Point (Right of Vehicle Center Line)	mm		357
Horizontal Offset (+ right / - left)	mm	± 50 of Intended Impact Point	-11
Vertical Offset (+ down / - up)	mm	± 40 of Intended Impact Point	8

TARGET VEHICLE PRE- AND POST- TEST STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length at Centerline	4885	4500	385
2	Total Length	4885	4693	192
3	Total Width	1840	2098	258
4	Left Side Wheelbase	2820	2735	85
5	Right Side Wheelbase	2820	2815	5

MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

Vertical Location			From Centerline		Max. Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Right	236
B	Top of Bumper	533	800	Right	259
C	Mid Level	686	800	Right	348
D	Top of Stack	813	800	Right	277

DATA SHEET NO. 4... (CONTINUED)**POST-TEST DATA**

Test Vehicle: 2014 Mazda 6 4-Door Sedan NHTSA No.: C20145405
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 09/16/14

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Front Door Opening	Remained closed and latched	Remained closed and latched
Rear Door Opening	Jammed Shut	Jammed Shut
Hatch and other doors	Jammed Shut	

FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA**Stoddard Solvent Spillage Measurements**

- A. From impact until vehicle motion ceases: 0 g
(Maximum allowable = 28 g)
- B. For the 5 minute period after motion ceases: 0 g
(Maximum allowable = 28 g)
- C. For the following 25 minutes: 0 g
(Maximum allowable = 28 g/minute)
- D. Spillage: No Stoddard Solvent leakage

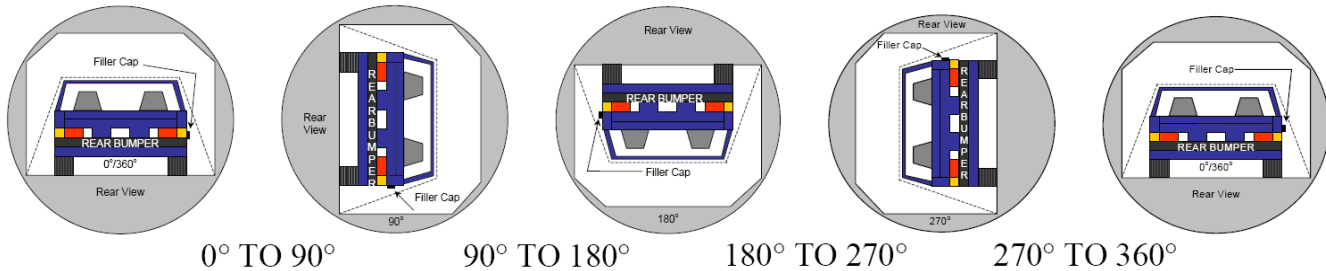
DATA SHEET NO. 5
STATIC ROLLOVER TEST DATA

Test Vehicle: 2014 Mazda 6 4-Door Sedan

NHTSA No.: C20145405

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 09/16/14



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).

Details of Stoddard solvent spillage: No Stoddard solvent spillage

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	85	300	385
90° To 180°	82	300	382
180° To 270°	78	300	378
270° To 360°	81	300	381

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° To 90°	No Spillage
90° To 180°	No Spillage
180° To 270°	No Spillage
270° To 360°	No Spillage

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PHOTOGRAPHS

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FIGURE 1. As Received Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 2. As Received Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 3. Test Vehicle Manufacturer's Label



FIGURE 4. Test Vehicle Tire Information Placard



FIGURE 5. Pre-Test Front View of Test Vehicle



FIGURE 6. Post-Test Front View of Test Vehicle



FIGURE 7. Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 8. Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 9. Pre-Test Left Side View of Test Vehicle



FIGURE 10. Post-Test Left Side View of Test Vehicle



FIGURE 11. Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 12. Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 13. Pre-Test Rear View of Test Vehicle

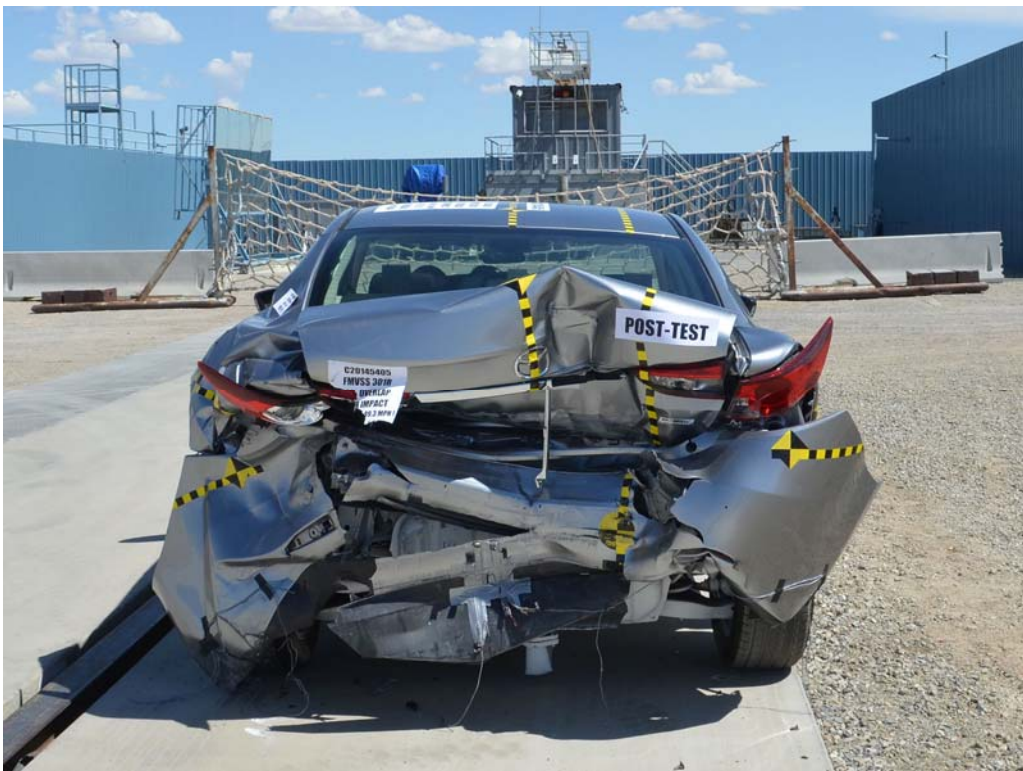


FIGURE 14. Post-Test Rear View of Test Vehicle



FIGURE 15. Pre-Test Right Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 16. Post-Test Right Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 17. Pre-Test Right Side View of Test Vehicle



FIGURE 18. Post-Test Right Side View of Test Vehicle



FIGURE 19. Pre-Test Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 20. Post-Test Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 21. Pre-Test Close-Up View of Impact Point Target



FIGURE 22. Post-Test Close-Up View of Impact Point Target



FIGURE 23. Pre-Test View of Fuel Filler Cap



FIGURE 24. Post-Test View of Fuel Filler Cap



FIGURE 25. Pre-Test Rear Underbody View of Test Vehicle

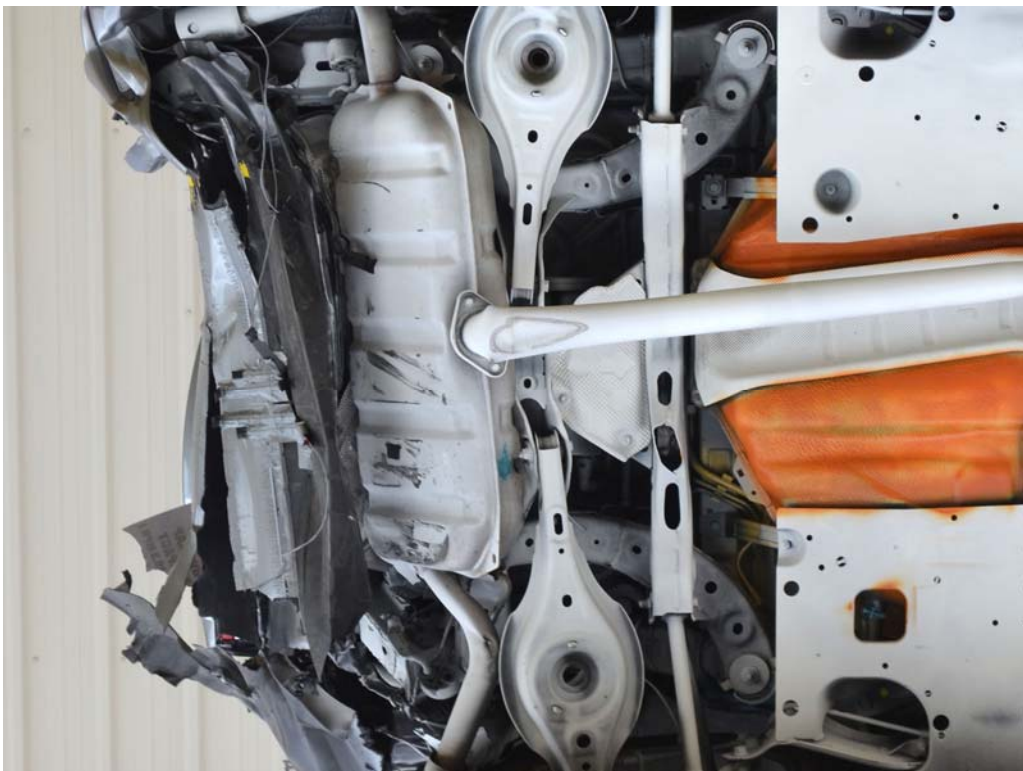


FIGURE 26. Post-Test Rear Underbody View of Test Vehicle



FIGURE 27. Pre-Test Underbody View of Fuel Tank

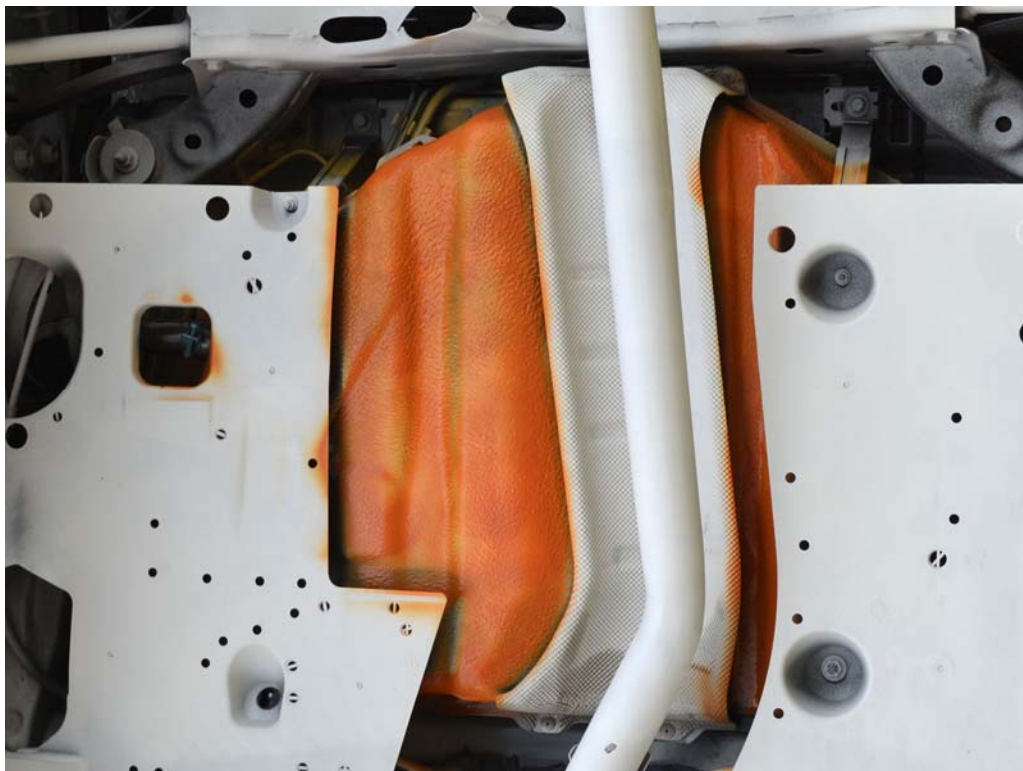


FIGURE 28. Post-Test Underbody View of Fuel Tank

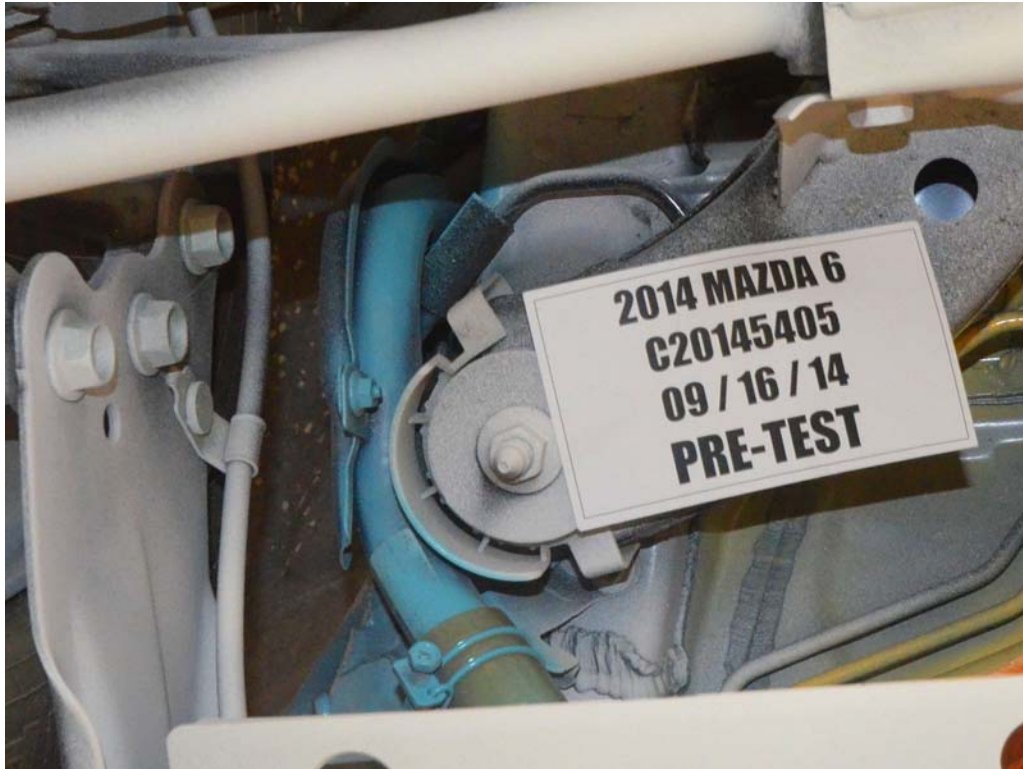


FIGURE 29. Pre-Test Underbody View of Fuel Filler Neck

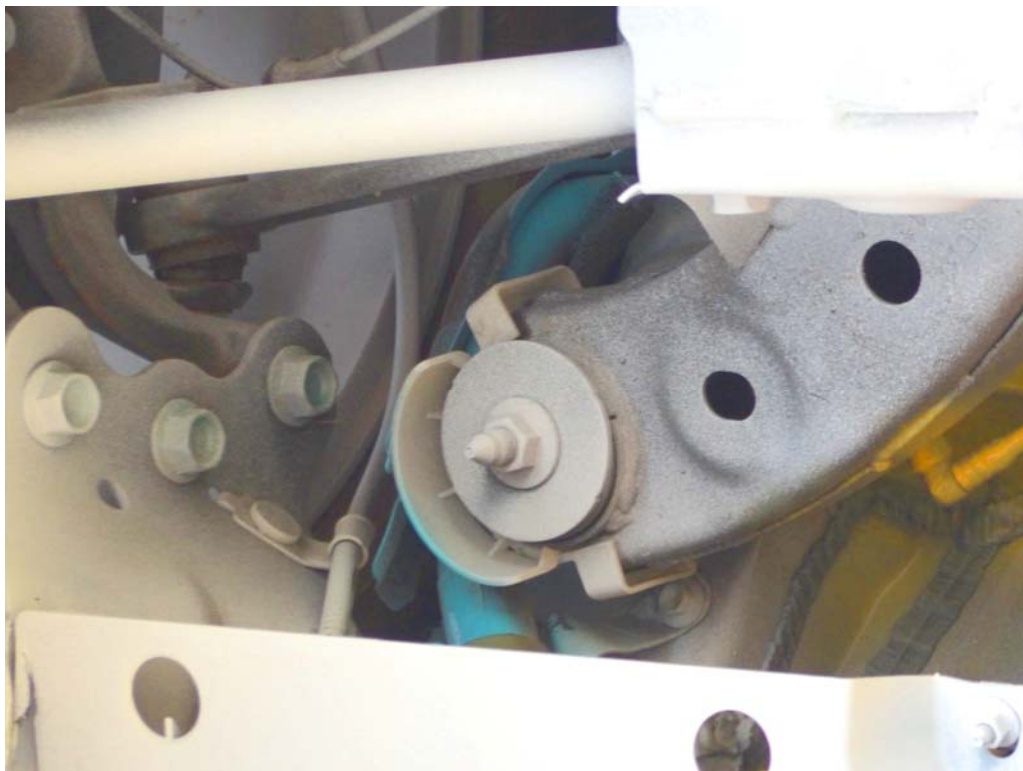


FIGURE 30. Post-Test Underbody View of Fuel Filler Neck



FIGURE 31. Pre-Test Underbody View of Fuel Lines

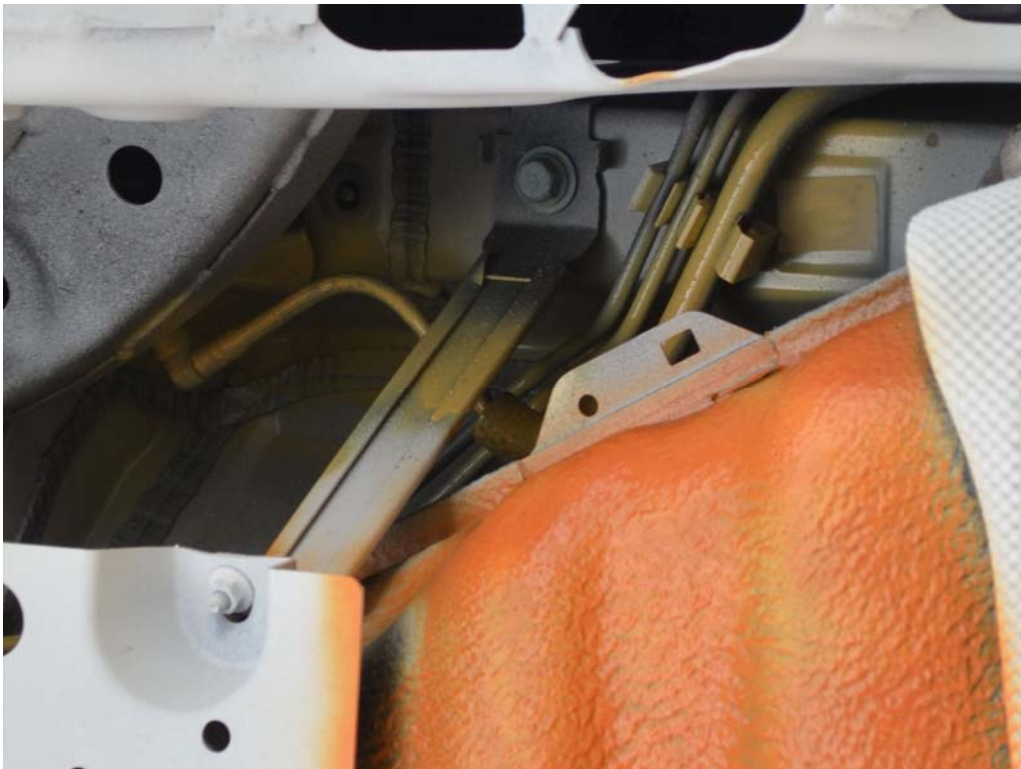


FIGURE 32. Post-Test Underbody View of Fuel Lines



FIGURE 33. Test Vehicle at 0° on FMVSS 301 Static Rollover Device



FIGURE 34. Test Vehicle at 90° on FMVSS 301 Static Rollover Device



FIGURE 35. Test Vehicle at 180° on FMVSS 301 Static Rollover Device



FIGURE 36. Test Vehicle at 270° on FMVSS 301 Static Rollover Device



FIGURE 37. Test Vehicle at 360° on FMVSS 301 Static Rollover Device



FIGURE 38. Impact Event