

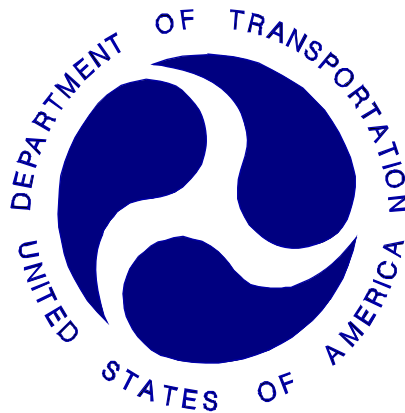
**REPORT NUMBER: 301R-CAL-14-009**

**SAFETY COMPLIANCE TESTING FOR FMVSS 301R  
FUEL SYSTEM INTEGRITY – REAR IMPACT**

**Mitsubishi Motors Corporation  
2014 Mitsubishi Outlander  
SUV**

**NHTSA NUMBER: C20145600**

**PREPARED BY:  
CALSPAN CORPORATION  
TRANSPORTATION TEST OPERATIONS  
P.O. BOX 400  
BUFFALO, NEW YORK 14225**



**September 12, 2014**

**FINAL REPORT**

**PREPARED FOR:  
U. S. DEPARTMENT OF TRANSPORTATION  
National Highway Traffic Safety Administration Enforcement  
Office of Vehicle Safety Compliance  
Mail Code: NVS-220  
1200 New Jersey Avenue, SE  
Washington, DC 20590**

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-11-D-00243.

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof.

If trade or manufactures' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: *Vanessa Walsh*  
Vanessa Walsh, Project Engineer

Approved By: *Edward Dutton*  
Edward J. Dutton, Test Engineer Director  
Transportation Test Operations

Approval Date: September 12, 2014

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: \_\_\_\_\_

Acceptance Date: \_\_\_\_\_

**TECHNICAL REPORT STANDARD TITLE PAGE**

<b>1. Report No.</b> 301R-CAL-14-009		<b>2. Government Accession No.</b>		<b>3. Recipient's Catalog No.</b>	
<b>4. Title and Subtitle</b> Final Report of FMVSS 301R Compliance Rear Impact Testing of a 2014 Mitsubishi Outlander SUV NHTSA No.: C20145600				<b>5. Report Date</b> September 12, 2014	
				<b>6. Performing Organization Code</b> CAL	
<b>7. Author(s)</b> Vanessa Walsh, Project Engineer Edward Dutton, Senior Test Engineer				<b>8. Performing Organization Report No.</b> CAL-DOT-2014-009	
<b>9. Performing Organization Name and Address</b> Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225				<b>10. Work Unit No.</b>	
				<b>11. Contract or Grant No.</b> DTNH22-11-D-00243	
<b>12. Sponsoring Agency Name and Address</b> U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance- Enforcement  Mail Code: NVS-220 1200 New Jersey Avenue, SE Washington, D.C. 20590				<b>13. Type of Report and Period Covered</b> Final Test Report August 28, 2014 - September 12, 2014	
				<b>14. Sponsoring Agency Code</b> NVS-220	
<b>15. Supplementary Notes</b>					
<b>16. Abstract</b>  A compliance test was conducted on a 2014 Mitsubishi Outlander SUV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301R-02 for the determination of FMVSS 301R compliance. Test failures identified were as follows:  <b>None - The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity – Rear Impact."</b>					
<b>17. Key Words</b> Compliance Testing Safety Engineering FMVSS 301R			<b>18. Distribution Statement</b> <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Technical Reference Division (TIS) (NPO-230) 1200 New Jersey Avenue, SE Washington, D.C. 20590 Telephone No. (202) 366-4946		
<b>19. Security Classification of Report</b> UNCLASSIFIED		<b>20. Security Classification of Page</b> UNCLASSIFIED		<b>21. No. of Pages</b> 39	<b>22. Price</b>

## TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Purpose and Test Procedure	1-1
2	Compliance Test Results Summary	2-1
3	Data Sheets	3-1

<u>Data Sheet</u>		<u>Page</u>
1	Test Vehicle Specifications	3-2
2	Pre-Test Data	3-3
3	Moving Deformable Barrier (MDB) Data	3-6
4	High Speed Camera Locations and Data Summary	3-7
5	Post-Test Data	3-8
6	FMVSS No. 301 Static Rollover Test Data	3-10

<u>Appendix</u>		<u>Page</u>
A	Photographs	A-1

## **SECTION 1**

### **PURPOSE AND TEST PROCEDURE**

This rear impact test is part of the FMVSS 301R Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-11-D-00243. The purpose of this test was to determine if the subject vehicle, a 2014 Mitsubishi Outlander SUV, meets the performance requirements of FMVSS No. 301R "Fuel System Integrity – Rear Impact." The test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-301R-02, dated January 17, 2007).

## SECTION 2

### COMPLIANCE TEST RESULTS SUMMARY

A 1,681 kg 2014 Mitsubishi Outlander SUV was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.18 kph (49.2 mph). The test was performed by Calspan Corporation on 9/5/2014.

The test vehicle was equipped with a 63 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (40 kg) was secured in the vehicle's rear passenger footwell. Two ballast Part 572E 50th percentile male Anthropomorphic Test Devices (ATD) were placed in the front occupant seating positions.

The crash event was recorded by three high-speed cameras and one real-time camera. High-speed camera locations and other pertinent camera information can be found on page 3-7 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact and including all portions of the static rollover test. The maximum vehicle longitudinal crush was 315 millimeters of which the average was 235 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

## **SECTION 3**

### **SUMMARY OF TEST RESULTS**

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 – Test Vehicle Specifications

Data Sheet No. 2 – Pre-Test Data

Data Sheet No. 3 – Moving Deformable Barrier (MDB) Data

Data Sheet No. 4 – High Speed Camera Locations and Data Summary

Data Sheet No. 5 – Post-Test Data

Data Sheet No. 6 – FMVSS No. 301 Static Rollover Test Data

**DATA SHEET NO. 1  
TEST VEHICLE SPECIFICATIONS**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014

**TEST VEHICLE INFORMATION AND OPTIONS**

NHTSA No.	C20145600
Model Year	2014
Make	Mitsubishi
Model	Outlander
Body Style	SUV
Body Color	Gray
Odometer Reading (km/mi)	25.7 km / 16 mi
Engine Displacement (L)	2.4
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	CVT
Final Drive	Front Wheel Drive

Overdrive	Yes
Air Conditioning (AC)	Yes
All-Wheel Drive (AWD)	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADL)	No
Power Brakes	Yes
Power Seats	No
Power Steering	Yes
Power Windows	Yes
Stability Control (Auto-Leveling)	No
Sunroof/T-Top	No
Tilt Steering Wheel	Yes
Traction Control System (TCS)	Yes

**DEALER AND DELIVERY INFORMATION FROM CERTIFICATION LABEL**

Manufactured By	Mitsubishi Motors Corporation
Date of Manufacture	OCT 2013
VIN	JA4AD2A32EZ016856

GVWR (kg)	2175
GAWR Front (kg)	1150
GAWR Rear (kg)	1250

**TIRE PLACARD & SIDEWALL INFORMATION**

Tire Placard Location: Driver's Door Sill

Spare Tire Type: T155/90D16

Measured Parameter	Front	Rear
Tire Manufacturer	Yokohama	Yokohama
Tire Name	Geolander	Geolander
Tire Type	All Season	All Season
Max. Tire Pressure (kPa)	300	300
Recommended Tire Size	P215/70R16	P215/70R16
Load Index/Speed Symbol	99H	99H
Recommended Cold Tire Pressure (kPa)	240	240
Tire Size on Vehicle	P215/70R16	P215/70R16
Treadwear/ Traction Grade/ Temperature Grade	200 / B / A	200 / B / A

**VEHICLE CAPACITY DATA**

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	2	7
Seat Type (Bench, Bucket, or Split Bench)	Bucket	Bench	Bench	
Capacity Weight (VCW) (kg)				525
DSC X 68.04 (kg)				476.28
Cargo Weight (RCLW) (kg)				48.7

**DATA SHEET NO. 2  
PRE-TEST DATA**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014

**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	433	325		444	414	
Right	kg	406	328		490	333	
Ratio	%	56%	44%		56%	44%	
Totals	kg	839	653	1492	934	747	1681

**TARGET TEST WEIGHT CALCULATION (TTW)**

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1492	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	48.72	(B)
Weight of two P572E ATDS @ 74kg each	kg	148	(C)
Target Vehicle Test Weight (TVTW)	kg	1688.72	(A+B+C)

\*As tested Weight = (TVTW -10kg) <=ATW < (TVTW -5kg); TVTW = Weight of Test Vehicle with 2 dummies and 48.72kg of Cargo Weight

**GENERAL TEST VEHICLE DATA**

Measured Parameter	Units	Value
Vehicle Wheelbase	mm	2670
Vehicle Length (at Centerline)	mm	4661
Vehicle Width	mm	1773
Weight of Ballast Secured in Cargo Area <sup>1</sup>	kg	40
Type of Ballast		Steel Plate
Method of Securing Ballast		Rear Foot well
Components Removed for Weight Reduction		0
Vehicle Width at Widest Point	mm	1810
Vehicle Width at Widest Point Location		Rear Wheel Well
Centerline offset for impact line	mm	362
Filler neck side (left/right )		Left

<sup>1</sup> Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

**TEST VEHICLE ATTITUDE AND CG**

	Units	Left		Right		CG (aft of front axle)
		Front	Rear	Front	Rear	
As Delivered (UVW)	mm	779	789	778	799	1169
As Tested (ATW)	mm	758	769	765	778	1186

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

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

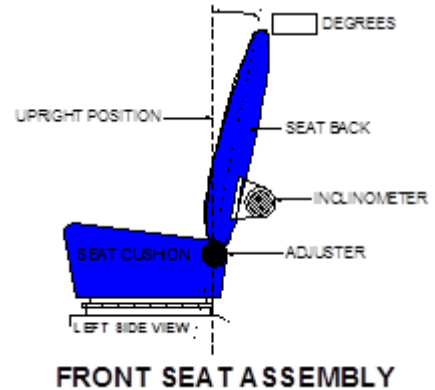
NHTSA No.: C20145600  
 Test Date: 9/5/2014

**SEATING**

**Nominal Design Riding Position** (for adjustable driver and passenger seat backs). *Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.*

**Driver Seat Instructions:** The driver seat back was positioned according to the Nominal Design Riding position listed in FORM 1.

**Passenger Seat Instructions:** The passenger seat back was positioned to the Nominal Design Riding position listed in FORM 1.

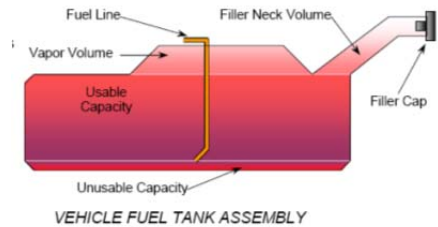


Measured Parameter	Deg.
Driver Seat Back Angle	21.3
Passenger Seat Back Angle	21.3

**SEAT FORE/AFT POSITIONING**

Driver Seat: Was positioned according to the Nominal Design Riding position listed in FORM1.  
 Passenger Seat: Was positioned according to the Nominal Design Riding position listed in FORM1.

	Total # of Positions	Placed in Position #
Driver Seat	22	10
Passenger Seat	22	11



**FUEL TANK CAPACITY DATA**

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	63
COTR Usable Capacity (Standard Tank)	Form No. 1	63
Test Volume Range	92-94% of Usable Capacity	58 – 59.2
Actual Test Volume (Solvent Used)	93% of Usable Capacity	58.6

**FUEL SYSTEM DATA**

Measured Parameter	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.764
Test Fluid Kinematic Viscosity ( centistokes)	0.96
Test Fluid Color	Purple
Electric Fuel Pump?	Yes
Can Activate Electric Fuel Pump with Ignition Switch On but Engine Off?	Yes

Fuel Pump Comments : None

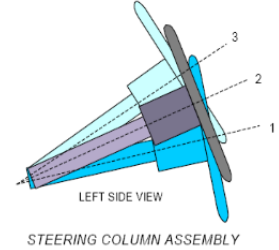
**DATA SHEET NO. 2 (Continued)**  
**PRE-TEST DATA**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
Test Date: 9/5/2014

**STEERING COLUMN ADJUSTMENT**

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.



Operational Instructions: Tilt wheel was positioned to mid-range at 26.1 degrees and mid fore/aft position at 20 mm

**SEAT BELT UPPER ANCHORAGE**

Nominal design riding position

Operational Instructions: Anchorage were set to the most upright position

**COMMENTS:** None  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**DATA SHEET NO. 3  
MOVING DEFORMABLE BARRIER (MDB) DATA**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014

MDB Face Manufacturer: Plascore      MDB Face Serial No. A0713077

**MDB SPECIFICATIONS**

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1250
Overall Length of MDB (incl. honeycomb impactor face)	4120
Wheelbase of Framework Carriage	2591
Tread of Framework Carriage (Front & Rear)	1880
CG Location of Front Axle	1136

**MDB WEIGHTS**

	Units	Front	Rear	Total
Left	kg	358.0	322.0	680.0
Right	kg	404.0	273.0	677.0
Ratio	%	56.2%	43.8%	100.0%
Totals	kg	762.0	595.0	1357.0

**MDB TIRE SIZE & PRESSURES**

	Units	Requirement	Left Front	Right Front	Left Rear	Right Rear
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

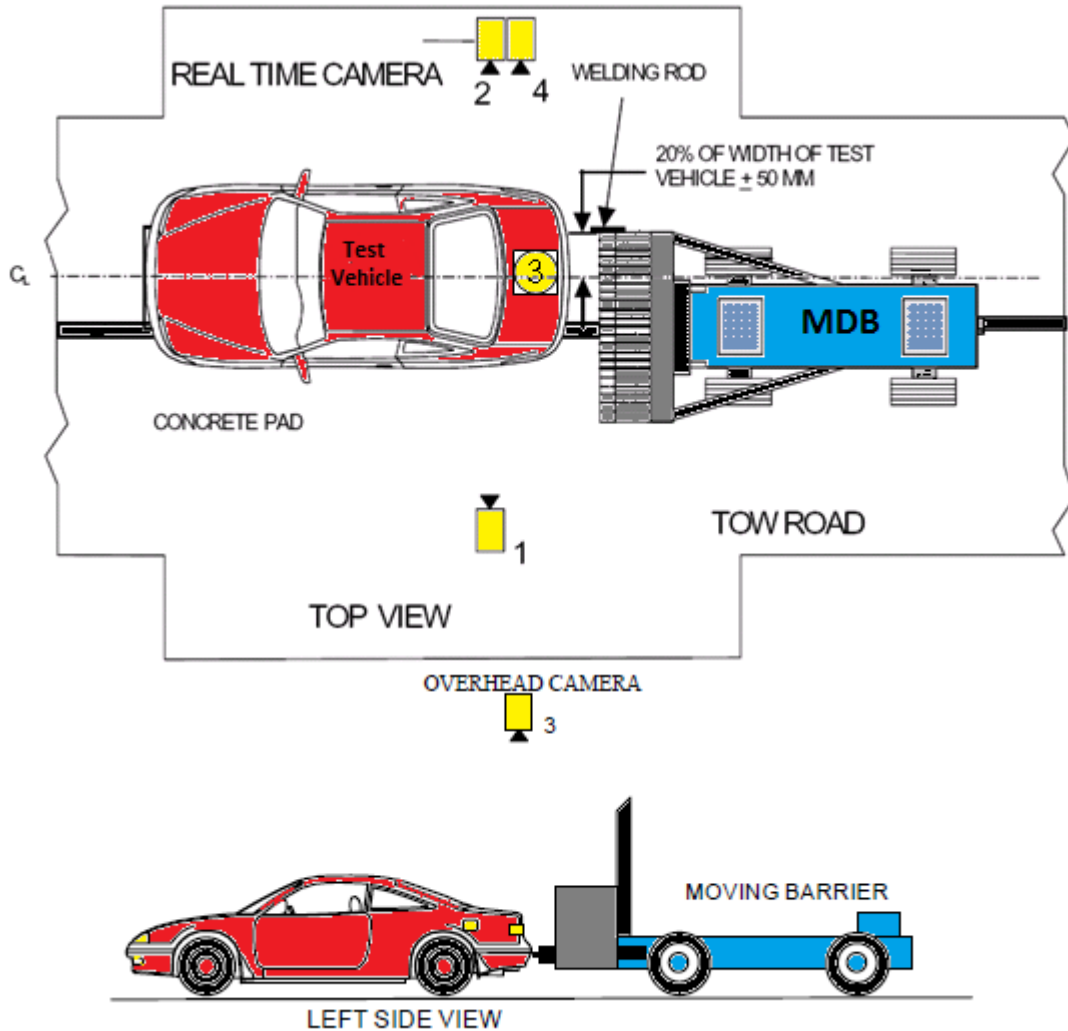
Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15, 2010

**DATA SHEET NO. 4  
HIGH SPEED CAMERA LOCATIONS AND DATA SUMMARY**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014



No.	Camera View	Coordinates (mm)			Angle (Deg)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	1747	10677	1012	-0.3	24	1000
2	Real-Time Camera						30
3	Overhead View	315	0	5273	90	14	1000
4	Right Side View	1574	9979	930	-1.2	24	1000

\* Reference (from point of impact); all measurements accurate to within ±6 mm.

X = (Impact Point) + Forward

Y = (Impact Point) + To Right

Z = (Ground Level) + Down

**DATA SHEET NO. 5  
POST-TEST DATA**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014

VIN: JA4AD2A32EZ016856

REQUIRED IMPACT VELOCITY RANGE: 78.5 to 80.1 km/h

**ACTUAL IMPACT VELOCITY (WITHIN 1.5 M OF IMPACT PLANE)**

Measurement Description	Units	Speed
Trap No. 1	km/h	N/A
Trap No. 2	km/h	79.18
Average Impact Speed	km/h	79.18

**WELDING ROD IMPACT POINT**

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	-7
Horizontal distance from target center (+ is right)	±50 mm	mm	-7

**STODDARD SOLVENT SPILLAGE MEASUREMENT:**

- A. From impact until vehicle motion ceases:  
 (Maximum allowable is 28 grams) 0 grams
- B. For the 5-minute period after motion ceases:  
 (Maximum allowable is 28 grams) 0 grams
- C. For the next 25 minutes:  
 (Maximum allowable is 28 grams/minute) 0 grams
- D. Spillage Details: No Spillage Occurred

**DATA SHEET NO. 5  
POST-TEST DATA (Continued)**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014

**DOOR OPENING AND SEAT TRACK INFORMATION**

Description	Driver	Passenger
Locked/Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Closed & Operational	Closed & Operational
Rear Door Opening	Jammed	Jammed
Seat Track Shift (mm)	4	0
Seat Back Failure	Failed	Reclined
Glazing Damage	None	None

**POST TEST STRUCTURAL OBSERVATIONS**

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	Rear Windshield shattered during impact event

**VEHICLE CRUSH MEASUREMENTS: LENGTH**

Measurement	Left Side	Centerline	Right Side
Pre-Test	4575	4661	4579
Post-Test	4260	4412	4437
Crush	-315	-249	-142

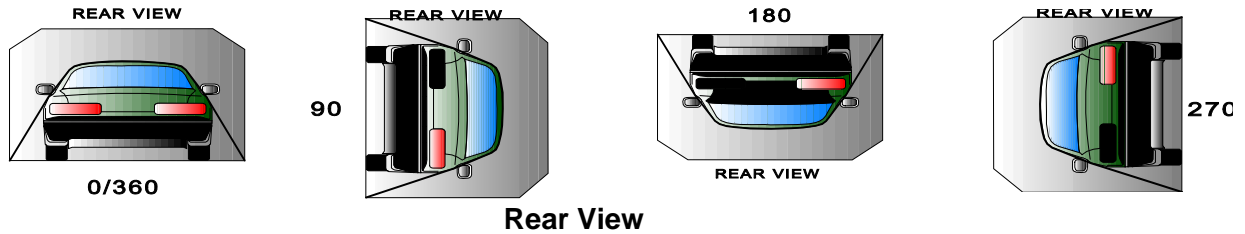
**VEHICLE CRUSH MEASUREMENTS: WHEELBASE**

Measurement	Left Side	Right Side
Pre-Test	2668	2673
Post-Test	2587	2667
Crush	-81	-6

**DATA SHEET NO. 6  
FMVSS NO. 301 STATIC ROLLOVER TEST DATA**

Test Vehicle: 2014 Mitsubishi Outlander SUV  
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20145600  
 Test Date: 9/5/2014



**ROLLOVER SOLVENT COLLECTION TIME TABLE**

Test Phase	Rotation Time (spec. 1 -3 min)		Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds	Minutes	Minutes	Seconds	Minutes
0° to 90°	1	10	5	6	10	7
90° to 180°	1	2	5	6	2	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	9	5	6	9	7

**FMVSS 301 REQUIREMENTS TABLE (Maximum allowable solvent spillage)**

First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
142	28	28	28

**ACTUAL TEST VEHICLE STODDARD SOLVENT SPILLAGE TABLE**

Test Phase	First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

**ROLLOVER STODDARD SOLVENT SPILLAGE LOCATION TABLE**

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

**APPENDIX A**  
**PHOTOGRAPHS**

## TABLE OF PHOTOGRAPHS

Fig.	Description	Page
1	Vehicle Certification Placard	A-3
2	Vehicle Tire Placard	A-3
3	Pre-Test Front View	A-4
4	Post-Test Front View	A-4
5	Pre-Test Left Side View	A-5
6	Post-Test Left Side View	A-5
7	Pre-Test Right Side View	A-6
8	Post-Test Right Side View	A-6
9	Pre-Test Left Front 3/4 View	A-7
10	Post-Test Left Front 3/4 View	A-7
11	Pre-Test Right Front 3/4 View	A-8
12	Post-Test Right Front 3/4 View	A-8
13	Pre-Test Left Rear 3/4 View	A-9
14	Post-Test Left Rear 3/4 View	A-9
15	Pre-Test Right Rear 3/4 View	A-10
16	Post-Test Right Rear 3/4 View	A-10
17	Pre-Test Rear View	A-11
18	Post-Test Rear View	A-11
19	Pre-Test MDB Front View	A-12
20	Post-Test MDB Front View	A-12
21	Pre-Test MDB Left Side View	A-13
22	Post-Test MDB Left Side View	A-13
23	Pre-Test MDB Right Side View	A-14
24	Post-Test MDB Right Side View	A-14
25	Pre-Test MDB Top View	A-15
26	Post-Test MDB Top View	A-15
27	Pre-Test Overhead Vehicle and MDB View	A-16
28	Post-Test Impact Target View	A-16
29	Pre-Test Front Underbody View	A-17
30	Post-Test Front Underbody View	A-17
31	Pre-Test Mid Underbody View	A-18
32	Post-Test Mid Underbody View	A-18
33	Pre-Test Rear Underbody View	A-19
34	Post-Test Rear Underbody View	A-19
35	Pre-Test Fuel Filler Cap View	A-20
36	Post-Test Fuel Filler Cap View	A-20
37	Impact View	A-21
38	Speed Trap View	A-21
39	Rollover 90° View	A-22
40	Rollover 180° View	A-22
41	Rollover 270° View	A-23
42	Rollover 360° View	A-23



Figure A-1: Vehicle Certification Placard



Figure A-2: Vehicle Tire Placard



**Figure A-3: Pre-Test Front View**



**Figure A-4: Post-Test Front View**



**Figure A-5: Pre-Test Left Side View**



**Figure A-6: Post-Test Left Side View**



**Figure A-7: Pre-Test Right Side View**



**Figure A-8: Post-Test Right Side View**



**Figure A-9: Pre-Test Left Front 3/4 View**



**Figure A-10: Post-Test Left Front 3/4 View**



**Figure A-11: Pre-Test Right Front 3/4 View**



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



**Figure A-13: Pre-Test Left Rear 3/4 View**



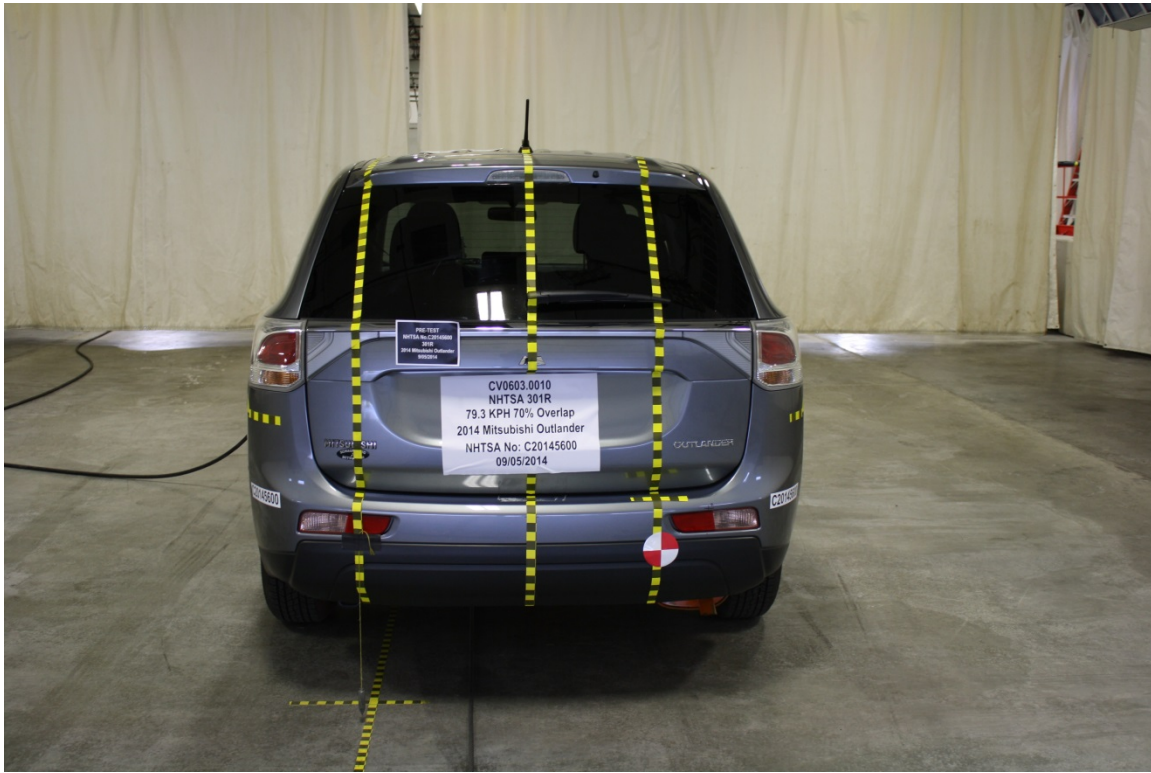
**Figure A-14: Post-Test Left Rear 3/4 View**



**Figure A-15: Pre-Test Right Rear 3/4 View**



**Figure A-16: Post-Test Right Rear 3/4 View**



**Figure A-17: Pre-Test Rear View**



**Figure A-18: Post-Test Rear View**



**Figure A-19: Pre-Test MDB Front View**



**Figure A-20: Post-Test MDB Front View**



**Figure A-21: Pre-Test MDB Left Side View**



**Figure A-22: Post-Test MDB Left Side View**



**Figure A-23: Pre-Test MDB Right Side View**



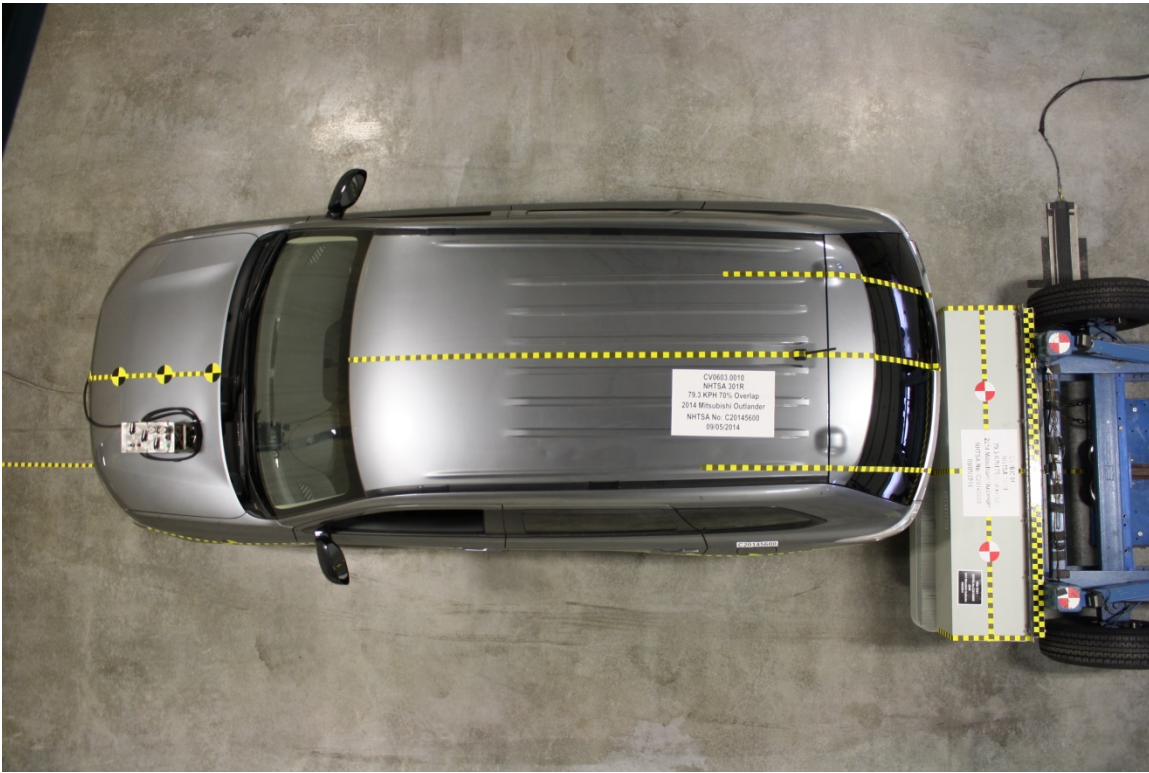
**Figure A-24: Post-Test MDB Right Side View**



Figure A-25: Pre-Test MDB Top View



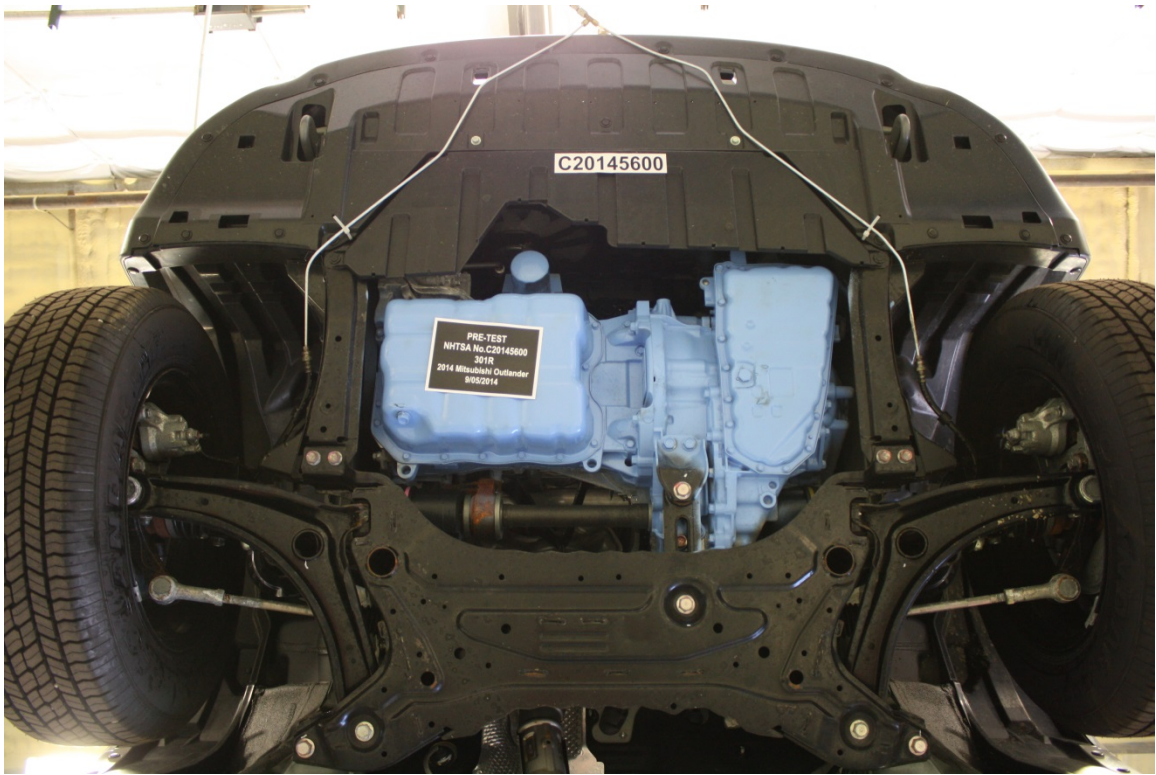
Figure A-26: Post-Test MDB Top View



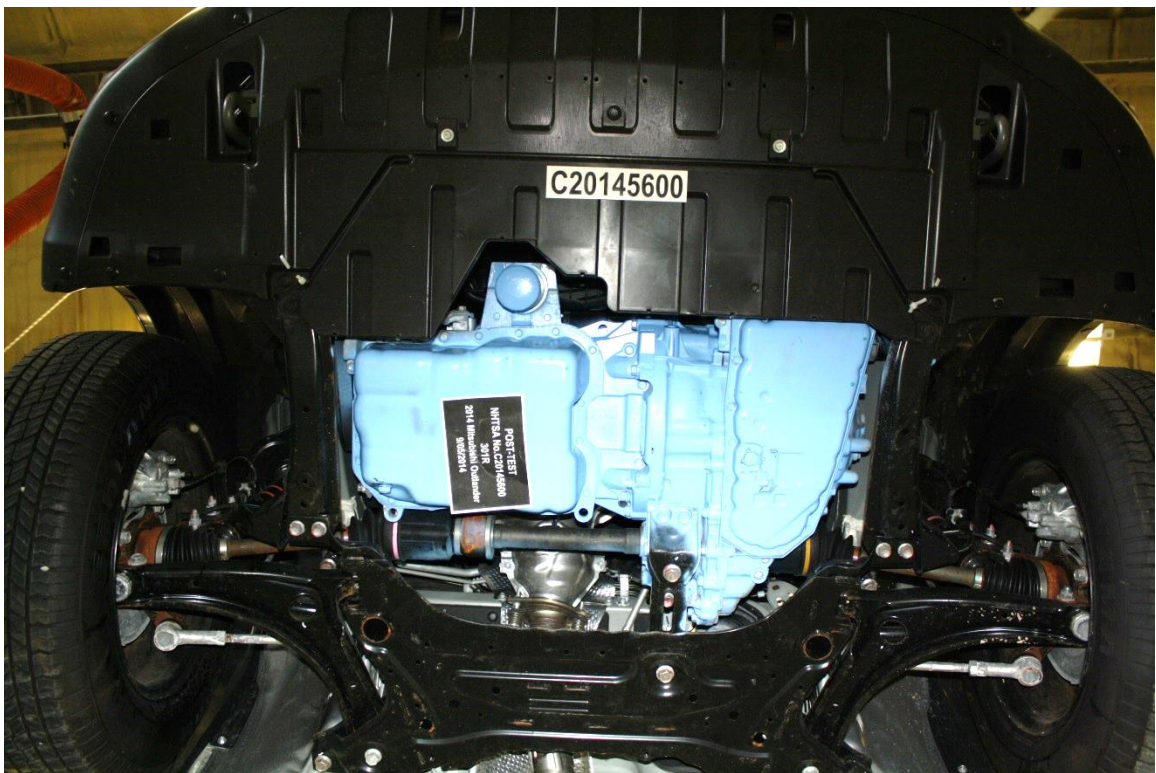
**Figure A-27: Pre-Test Overhead Vehicle and MDB View**



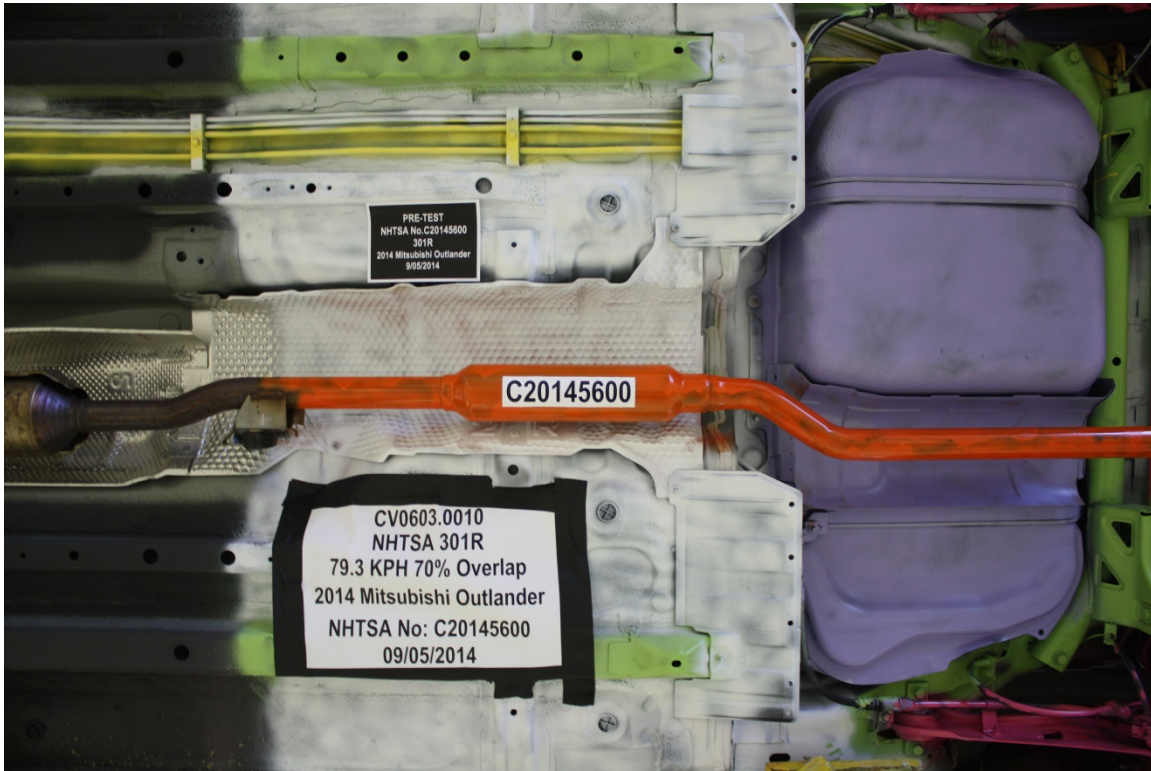
**Figure A-28: Post-Test Impact Target View**



**Figure A-29: Pre-Test Front Underbody View**



**Figure A-30: Post-Test Front Underbody View**



**Figure A-31: Pre-Test Mid Underbody View**



**Figure A-32: Post-Test Mid Underbody View**



**Figure A-33: Pre-Test Rear Underbody View**



**Figure A-34: Post-Test Rear Underbody View**



Figure A-35: Pre-Test Fuel Filler Cap View



Figure A-36: Post-Test Fuel Filler Cap View



**Figure A-37: Impact View**



**Figure A-38: Speed Trap View**



**Figure A-39: Rollover 90° View**



**Figure A-40: Rollover 180° View**



**Figure A-41: Rollover 270° View**



**Figure A-42: Rollover 360° View**