

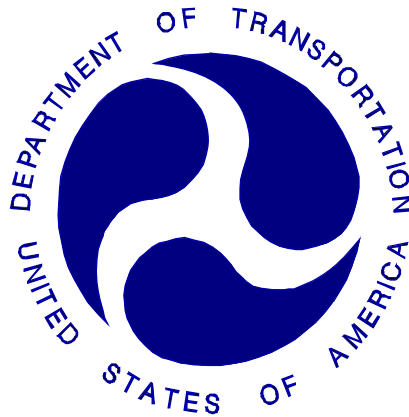
REPORT NUMBER: 301R-CAL-15-003

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

**Fuji Heavy Industries LTD.
2015 Subaru Outback**

NHTSA NUMBER: C20155501

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



January 9, 2016

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.

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Approval Date: January 9, 2016

FINAL REPORT ACCEPTANCE BY OVSC:

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15. Supplementary Notes				
16. Abstract A compliance test was conducted on a 2015 Subaru Outback wagon 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: None - The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity – Rear Impact."				
17. Key Words Compliance Testing Safety Engineering FMVSS 301R			18. Distribution Statement <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	
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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 2015 Subaru Outback wagon , 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 1,863 kg 2015 Subaru Outback wagon was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.27 kph (49.26 mph). The test was performed by Calspan Corporation on January 5, 2015.

The test vehicle was equipped with a 70.0 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (68.0 kg) was secured in the vehicle's rear passenger foot well. 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 601 millimeters of which the average was 513 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: 2015 Subaru Outback wagon
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
Test Date: 01/05/2016

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	C20155501	Overdrive	Yes
Model Year	2015	Air Conditioning (AC)	Yes
Make	Subaru	All-Wheel Drive (AWD)	Yes
Model	Outback	Anti-Lock Brakes (ABS)	Yes
Body Style	Wagon	Automatic Door Locks (ADL)	No
Body Color	Red	Power Brakes	Yes
Odometer Reading (km/mi)	214 km / 133 mi	Power Seats	Yes
Engine Displacement (L)	2.5	Power Steering	Yes
Type/No. Cylinders	I4	Power Windows	Yes
Engine Placement	Transverse	Stability Control (Auto-Leveling)	No
Transmission Type	CVT	Sunroof/T-Top	No
Transmission Speeds	N/A	Tilt Steering Wheel	Yes
Final Drive	AWD	Traction Control System (TCS)	Yes

DEALER AND DELIVERY INFORMATION FROM CERTIFICATION LABEL

Manufactured By	Fuji Heavy Industries LTD	GVWR (kg)	2130
Date of Manufacture	05/15	GAWR Front (kg)	1150
VIN	4S4BSBCC7F3334761	GAWR Rear (kg)	1200

TIRE PLACARD & SIDEWALL INFORMATION

Tire Placard Driver's Door Sill Spare Tire Type: T155/80R17

Measured Parameter	Front	Rear
Tire Manufacturer	Bridgestone	Bridgestone
Tire Name	Dueler H/P Sport AS	Dueler H/P Sport AS
Tire Type	Passenger	Passenger
Max. Tire Pressure (kPa)	300	300
Recommended Tire Size	P225/65/R17	P225/65/R17
Load Index/Speed Symbol	102H	102H
Recommended Cold Tire Pressure (kPa)	240	230
Tire Size on Vehicle	P225/65/R17	P225/65/R17
Treadwear/ Traction Grade/ Temperature Grade	500 / A / A	500 / A / A

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	-	5
Seat Type (Bench, Bucket, or Split Bench)	Bucket	Bench	-	
Capacity Weight (VCW) (kg)				408
DSC X 68.04 (kg)				340.2
Cargo Weight (RCLW) (kg)				67.8

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

Test Vehicle: 2015 Subaru Outback wagon
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
Test Date: 01/05/2016

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	475	373		535	421	
Right	kg	461	337		505	402	
Ratio	%	56.9	43.1		55.8	44.2	
Totals	kg	936	710	1646	1040	823	1863

TARGET TEST WEIGHT CALCULATION (TTW)

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1646	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	67.8	(B)
Weight of two P572E ATDS @ 78 kg each	kg	156	(C)
Target Vehicle Test Weight (TVTWT)	kg	1869.8	(A+B+C)

*As tested Weight = (TVTWT - 10kg) <= ATW < (TVTWT - 5kg); TVTWT = Weight of Test Vehicle with 2 dummies and 136.0 kg of Cargo Weight

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Vehicle Wheelbase	mm	2737
Vehicle Length (at Centerline)	mm	4825
Vehicle Width	mm	1825
Weight of Ballast Secured in Cargo Area ¹	kg	68
Type of Ballast		Weight Plates
Method of Securing Ballast		Bolted to Rear Foot Well
Components Removed for Weight Reduction		0
Vehicle Width at Widest Point	mm	1845
Vehicle Width at Widest Point Location		Rear Wheel Axle
Centerline offset for impact line	mm	369
Filler neck side (left/right)		Right

¹ 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	811	824	813	831	1181
As Tested (ATW)	mm	792	804	797	808	1209

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

Test Vehicle: 2015 Subaru Outback wagon
Test Program: FMVSS 301R Compliance Rear Impact Test

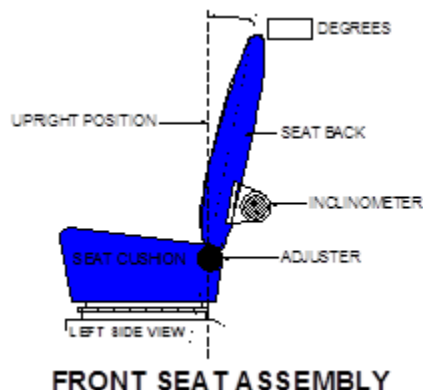
NHTSA No.: C20155501
Test Date: 01/05/2016

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.



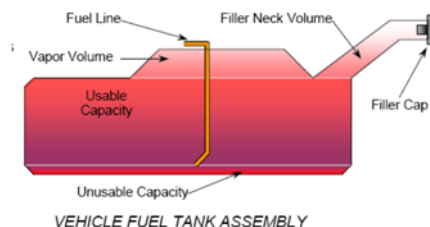
Measured Parameter	Deg.
Driver Seat Back Angle	1.1
Passenger Seat Back Angle	1.1

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	250 mm	125 mm
Passenger Seat	26	13



FUEL TANK CAPACITY DATA

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	70
COTR Usable Capacity (Standard Tank)	Form No. 1	70
Test Volume Range	92-94% of Usable Capacity	64.4 - 65.8
Actual Test Volume (Solvent Used)	93% of Usable Capacity	65.1

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

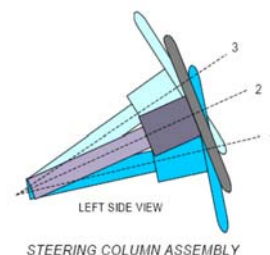
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PRE-TEST DATA

Test Vehicle: 2015 Subaru Outback wagon
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
Test Date: 01/05/2016

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 26.8 degrees and mid fore/aft position at 18 mm

SEAT BELT UPPER ANCHORAGE

Nominal design riding position

Operational Instructions: Anchorage were set to 1 detent below the most upright position.

COMMENTS: None

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

Test Vehicle: 2015 Subaru Outback wagon
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
 Test Date: 01/05/2016

MDB Face Manufacturer: Plascore MDB Face Serial No. A1215030

MDB SPECIFICATIONS

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

MDB WEIGHTS

Measurement Description	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

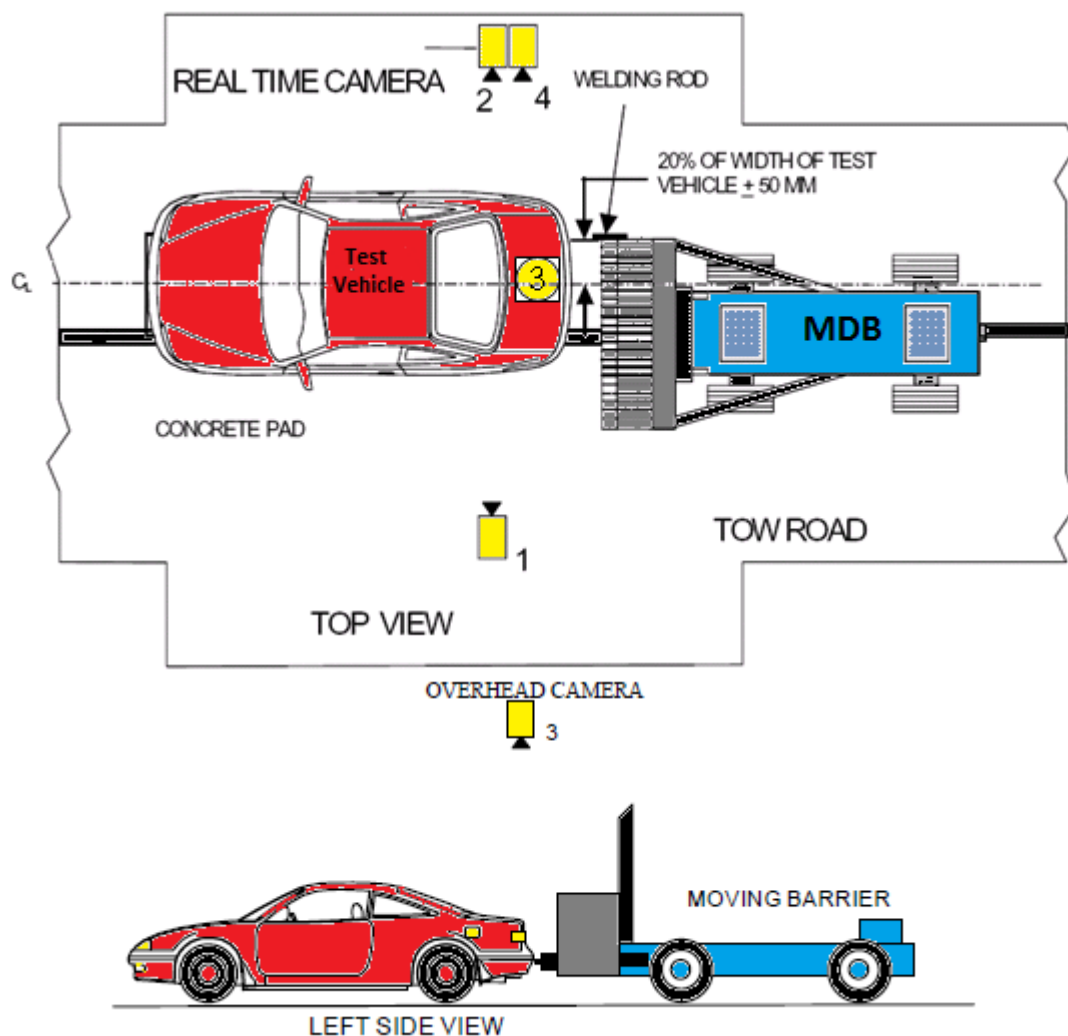
Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15, 2010

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

Test Vehicle: 2015 Subaru Outback wagon
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
 Test Date: 01/05/2016



No.	Camera View	Coordinates (mm)			Angle (Deg)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	-1102	-9425	-1134	-2.5	24	1000
2	Real-Time Camera						60
3	Overhead View	0	0	-5344	90	14	1000
4	Right Side View	-1114	-10192	-1198	-2.5	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: 2015 Subaru Outback wagon
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
Test Date: 01/05/2016

VIN: 4S4BSBCC7F3334761

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	79.27
Trap No. 2	km/h	4.95

WELDING ROD IMPACT POINT

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	-6
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: 2015 Subaru Outback wagon
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
Test Date: 01/05/2016

DOOR OPENING AND SEAT TRACK INFORMATION

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

POST TEST STRUCTURAL OBSERVATIONS

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

VEHICLE CRUSH MEASUREMENTS: LENGTH

Measurement	Units	Left Side	Centerline	Right Side
Pre-Test	mm	4747	4825	4748
Post-Test	mm	4287	4224	4270
Crush	mm	460	601	478

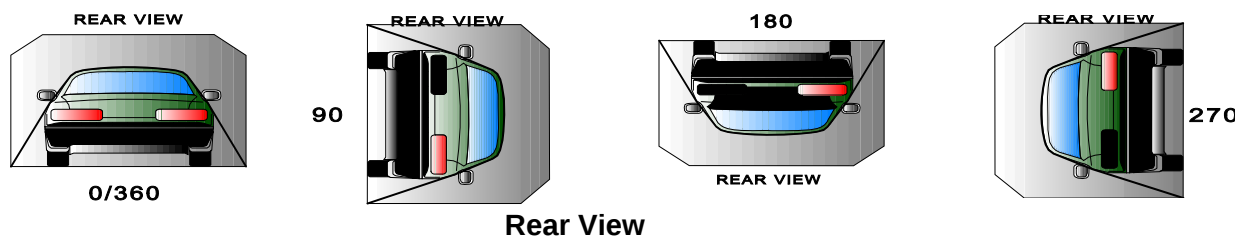
VEHICLE CRUSH MEASUREMENTS: WHEELBASE

Measurement	Units	Left Side	Right Side
Pre-Test	mm	2739	2735
Post-Test	mm	2738	2627
Crush	mm	1	108

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

Test Vehicle: 2015 Subaru Outback wagon
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20155501
 Test Date: 01/05/2016



ROLLOVER SOLVENT COLLECTION TIME TABLE

Test Phase	Rotation Time (spec. 1 -3 min)		Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds		Minutes	Seconds	
0° to 90°	1	12	5	6	12	7
90° to 180°	1	3	5	6	03	7
180° to 270°	1	2	5	6	02	7
270° to 360°	1	4	5	6	04	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	None
270° to	None

APPENDIX A
PHOTOGRAPHS

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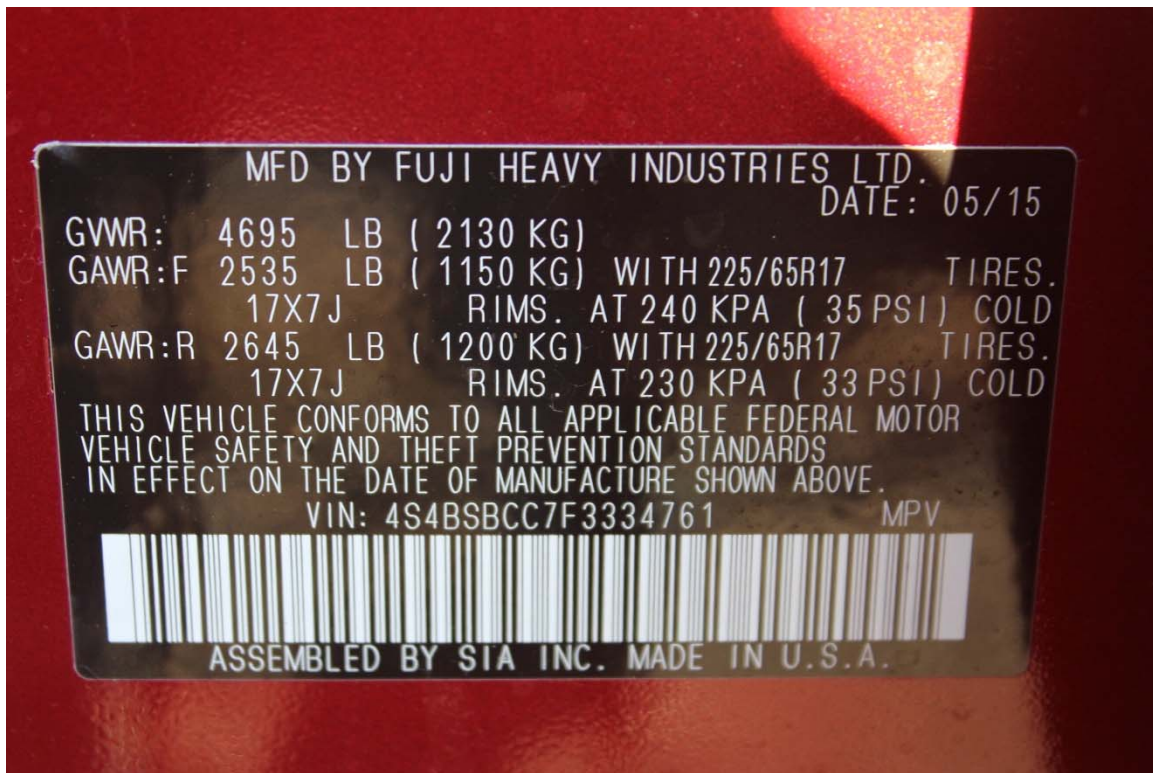


Figure A-1: Vehicle Certification Placard

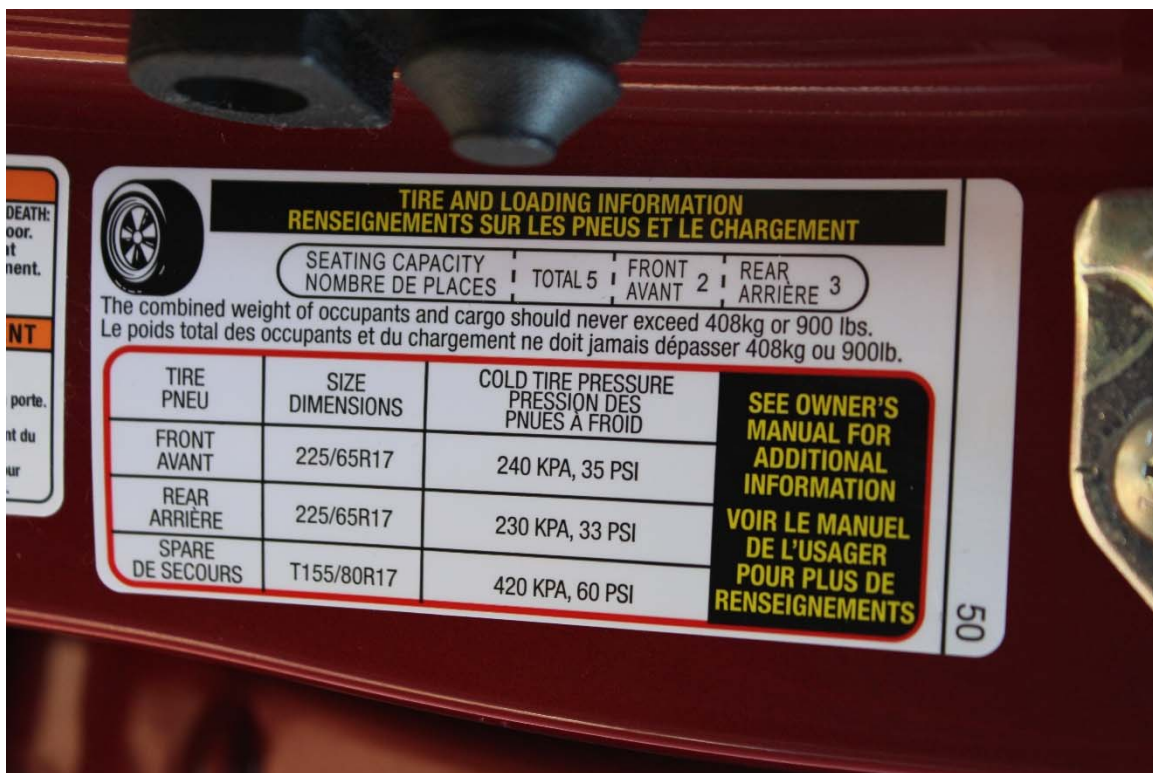


Figure A-2: Vehicle Tire Placard

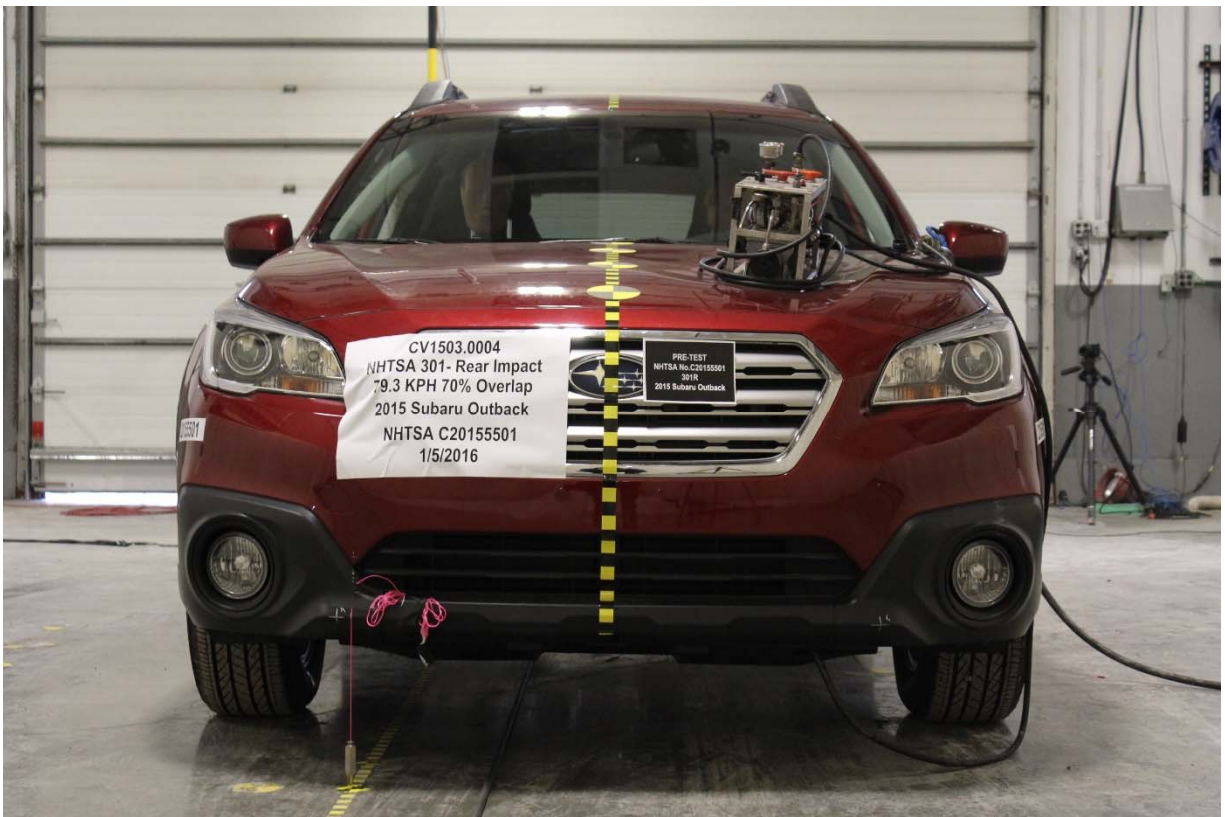


Figure A-3: Pre-Test Front View

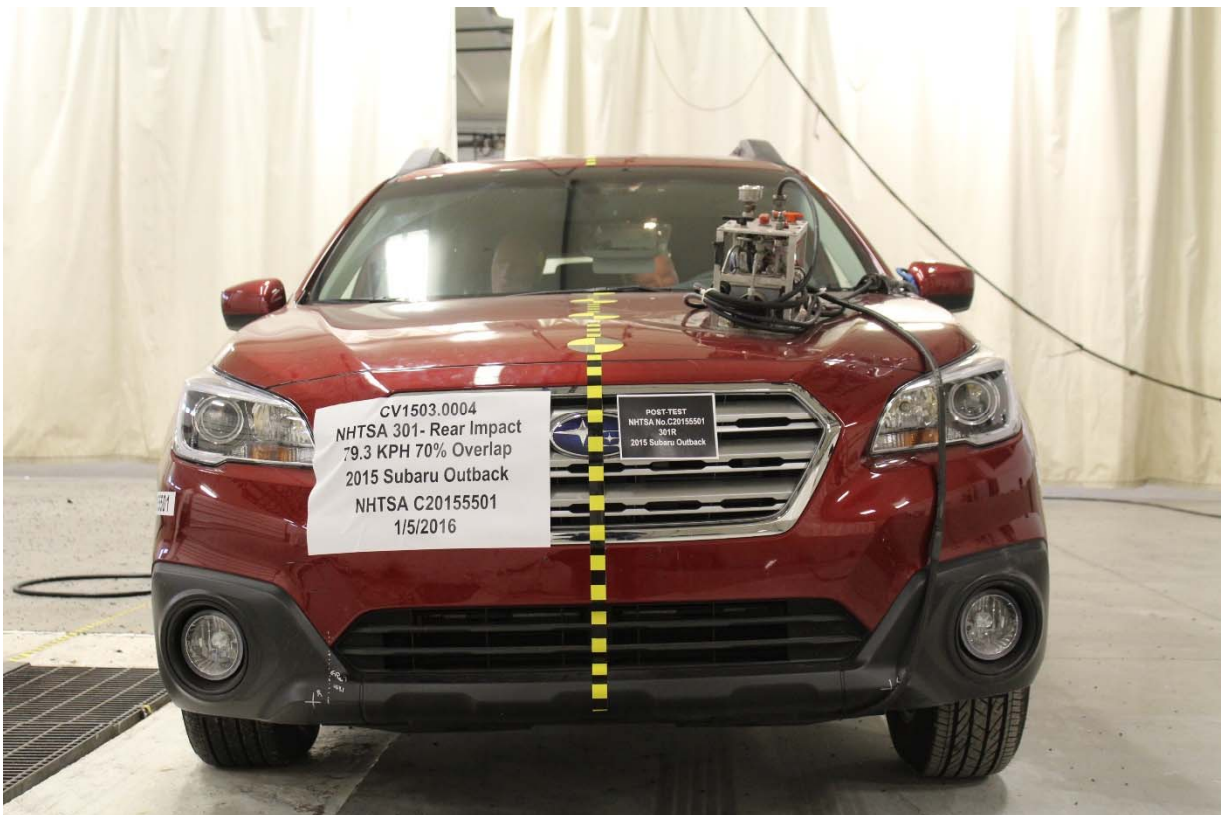


Figure A-4: Post-Test Front View



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

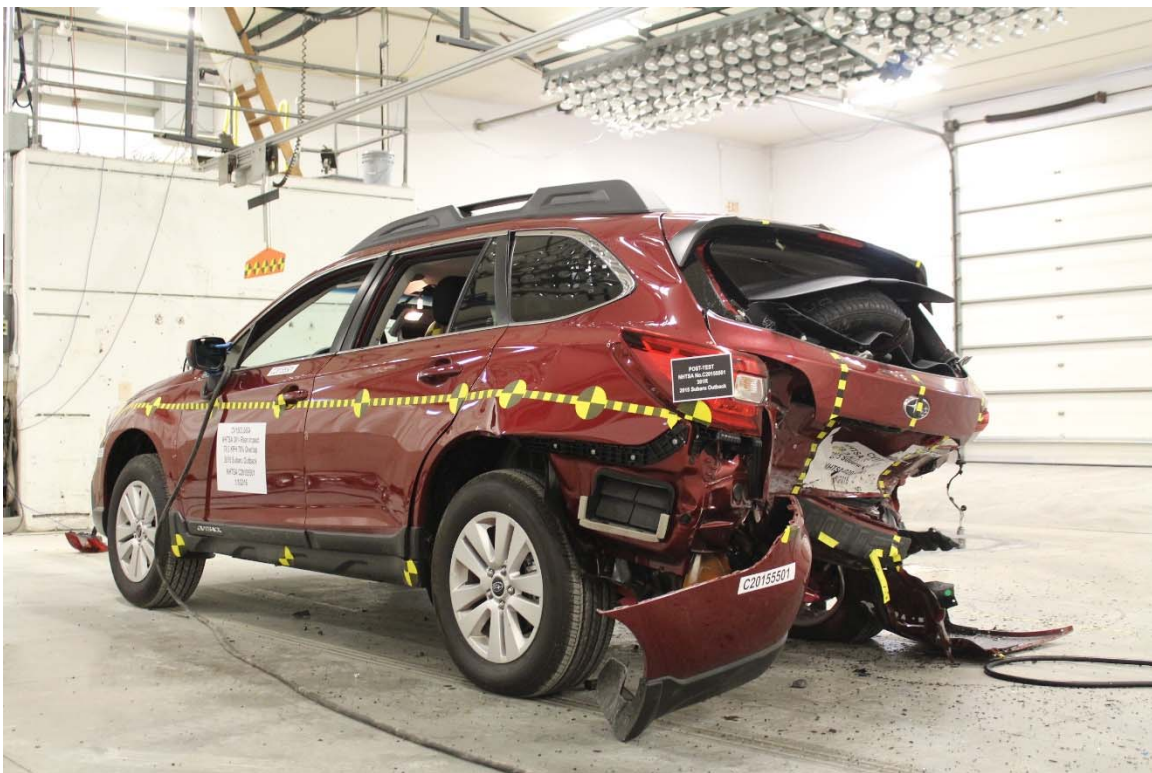


Figure A-14: Post-Test Left Rear 3/4 View



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

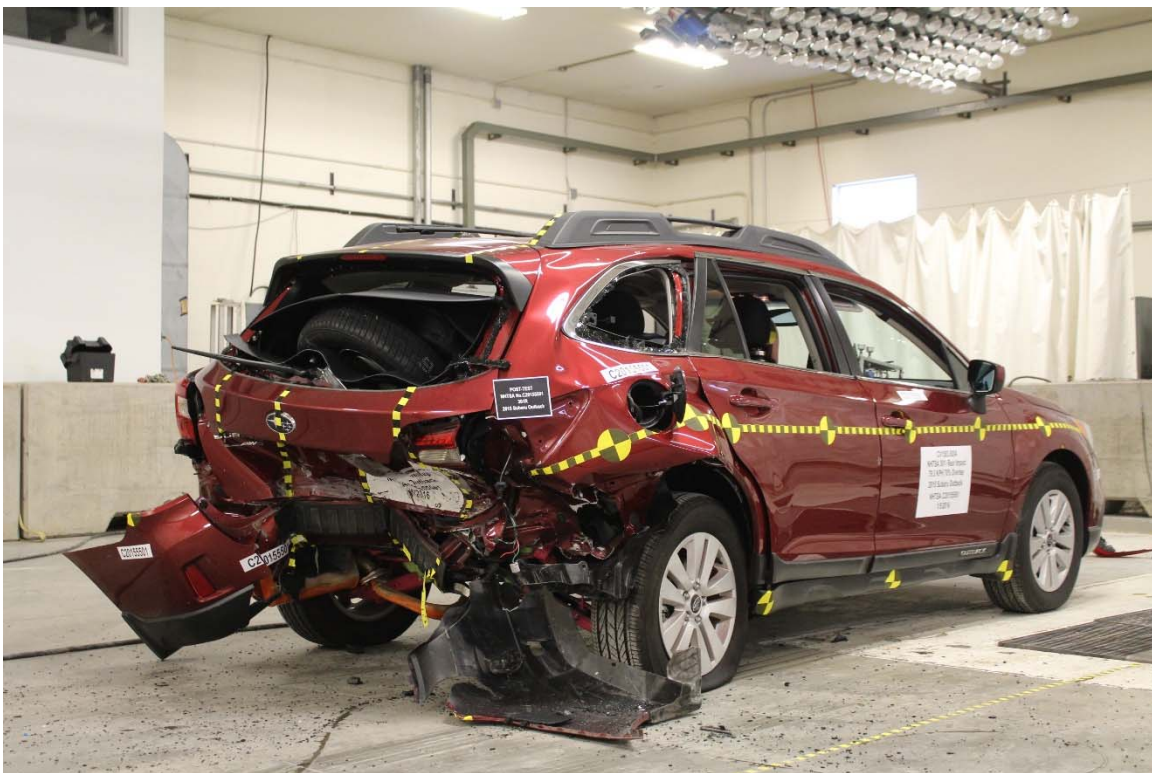


Figure A-16: Post-Test Right Rear 3/4 View



Figure A-17: Pre-Test Rear View

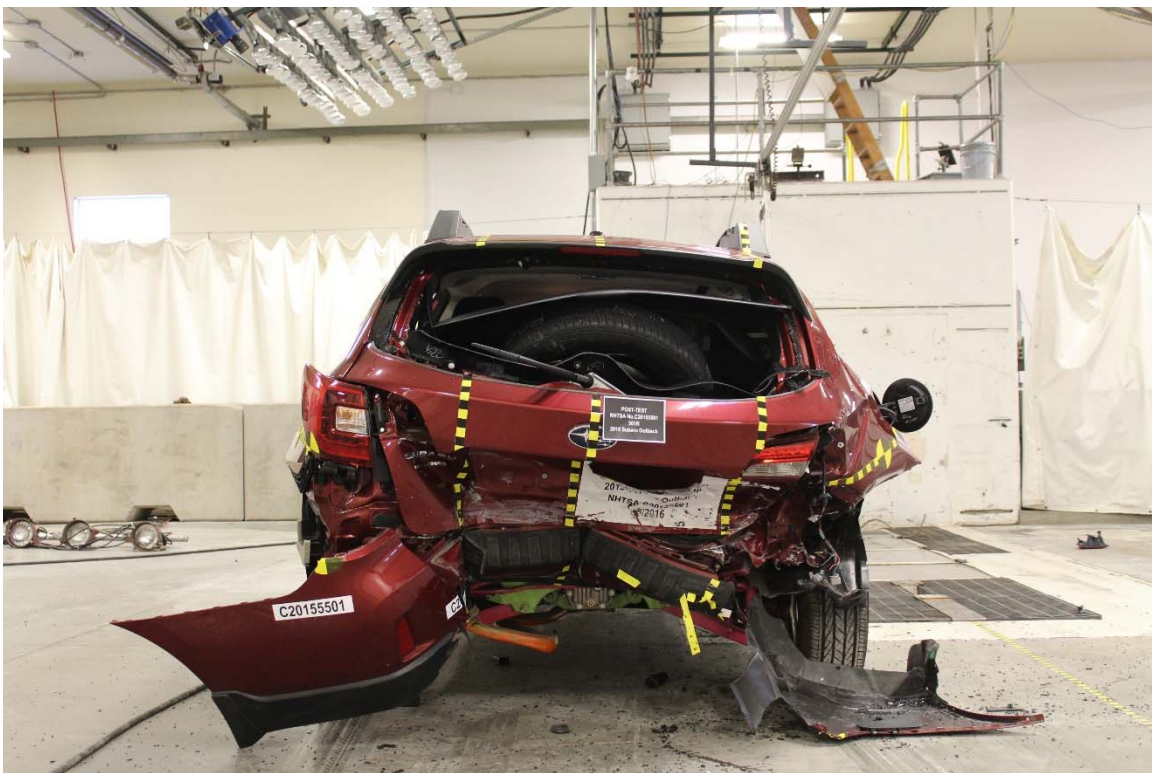


Figure A-18: Post-Test Rear View



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

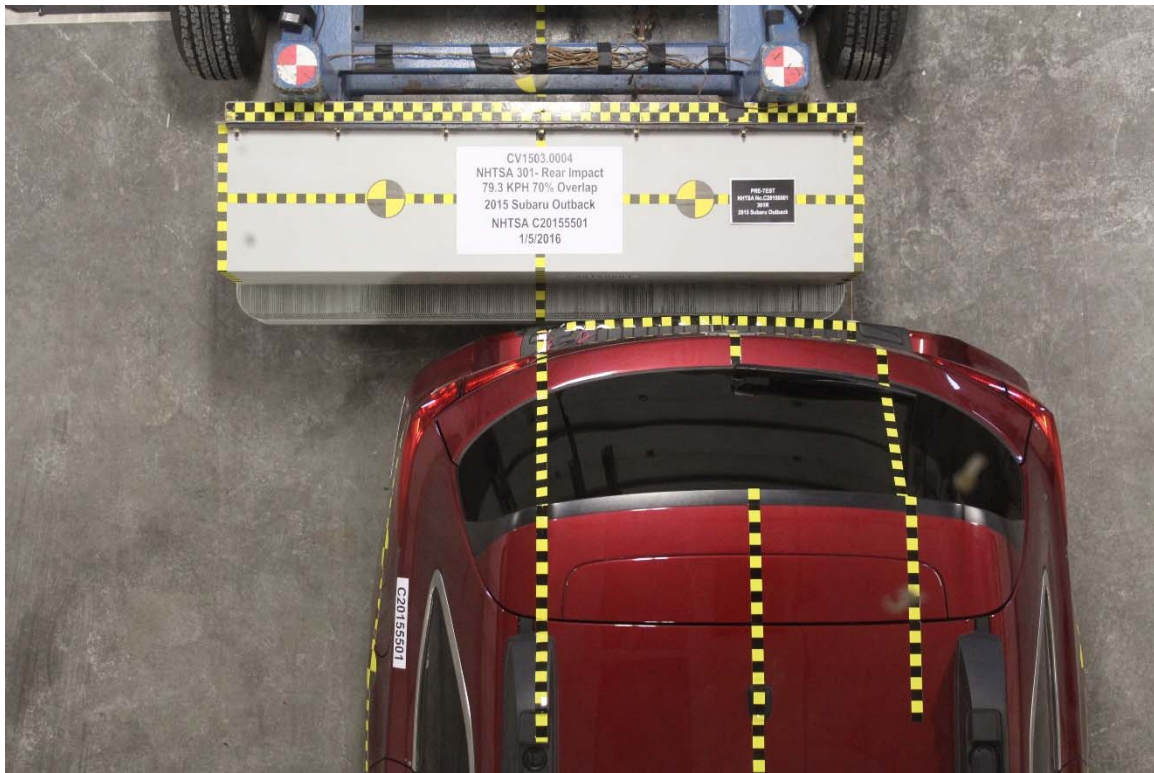


Figure A-27: Pre-Test Overhead Vehicle and MDB View



Figure A-28: Post-Test Impact Target View

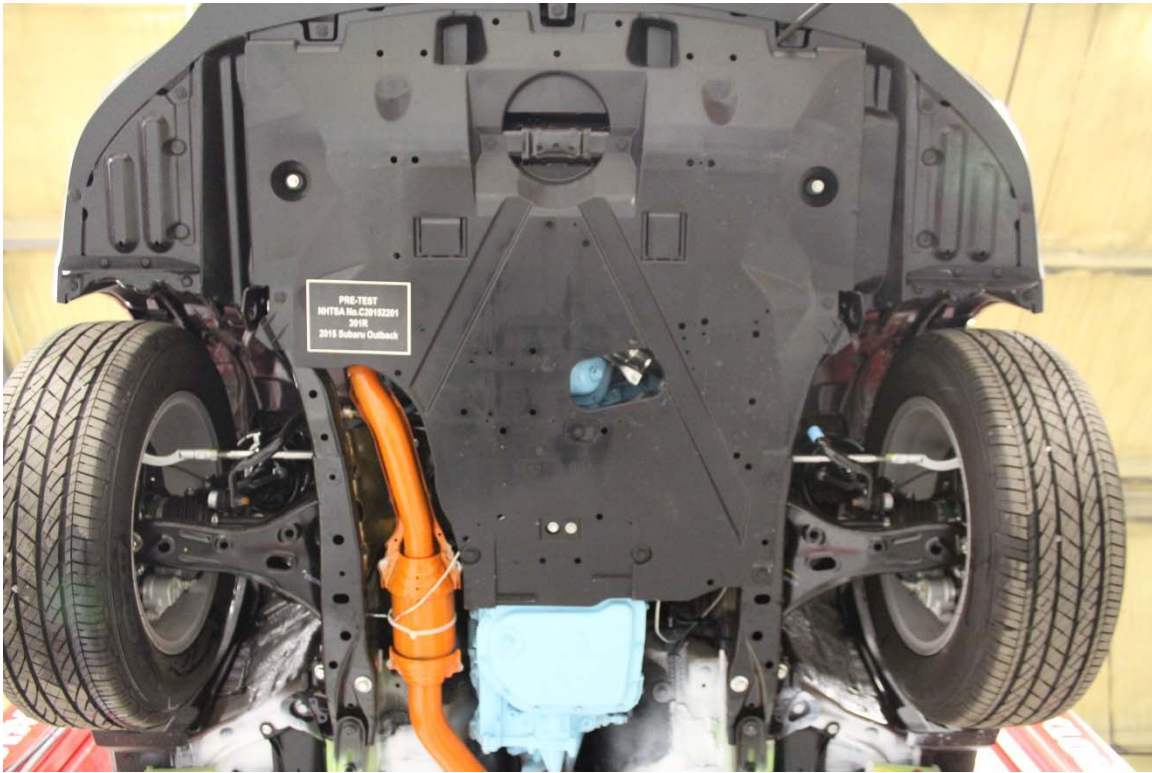


Figure A-29: Pre-Test Front Underbody View



Figure A-30: Post-Test Front Underbody View

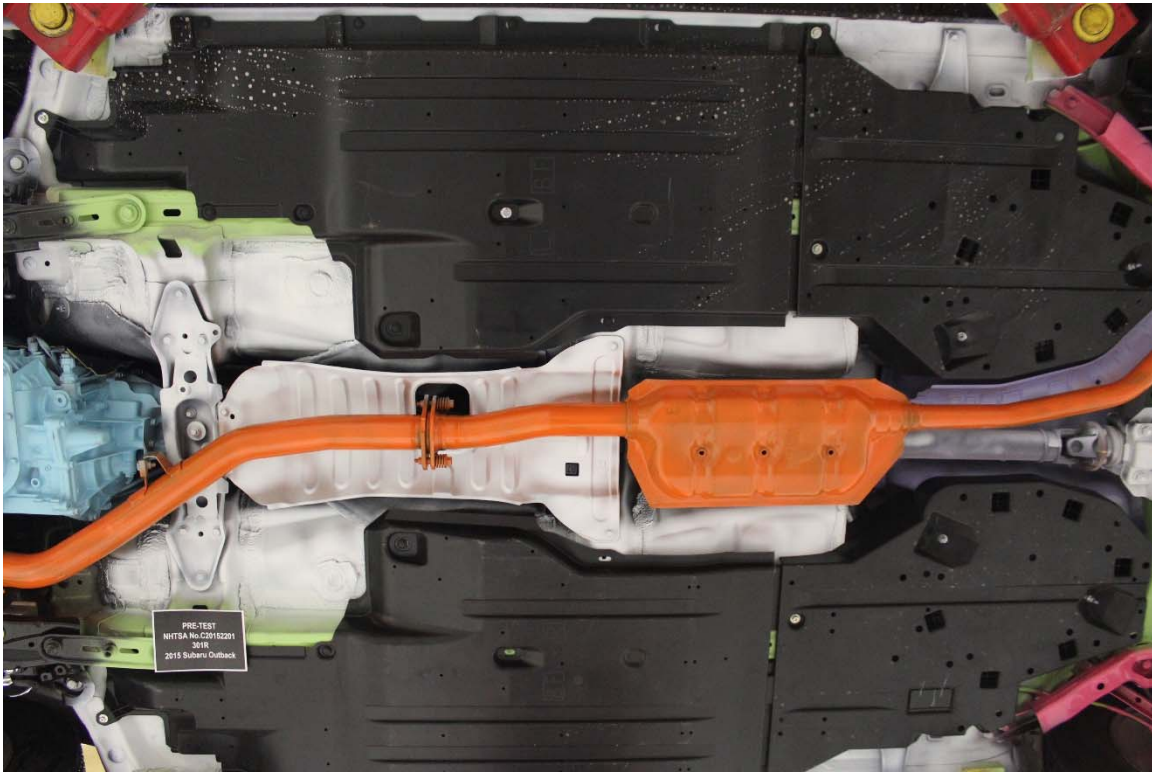


Figure A-31: Pre-Test Mid Underbody View



Figure A-32: Post-Test Mid Underbody View

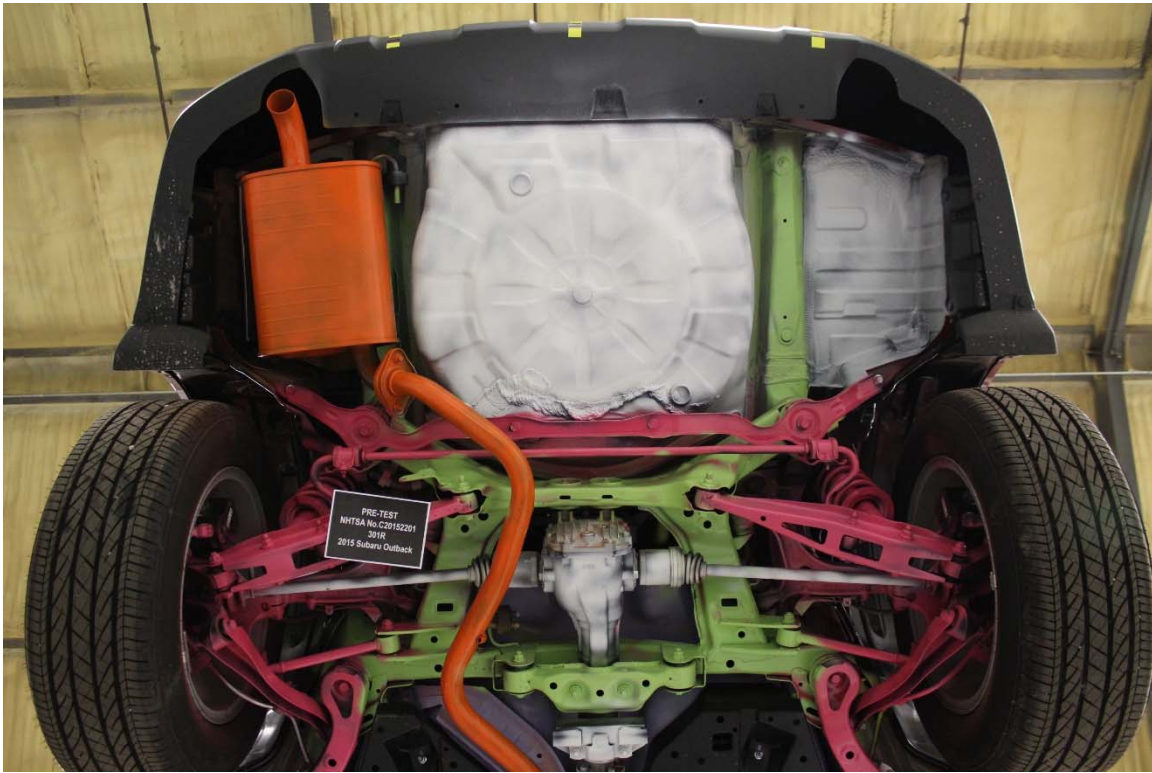


Figure A-33: Pre-Test Rear Underbody View

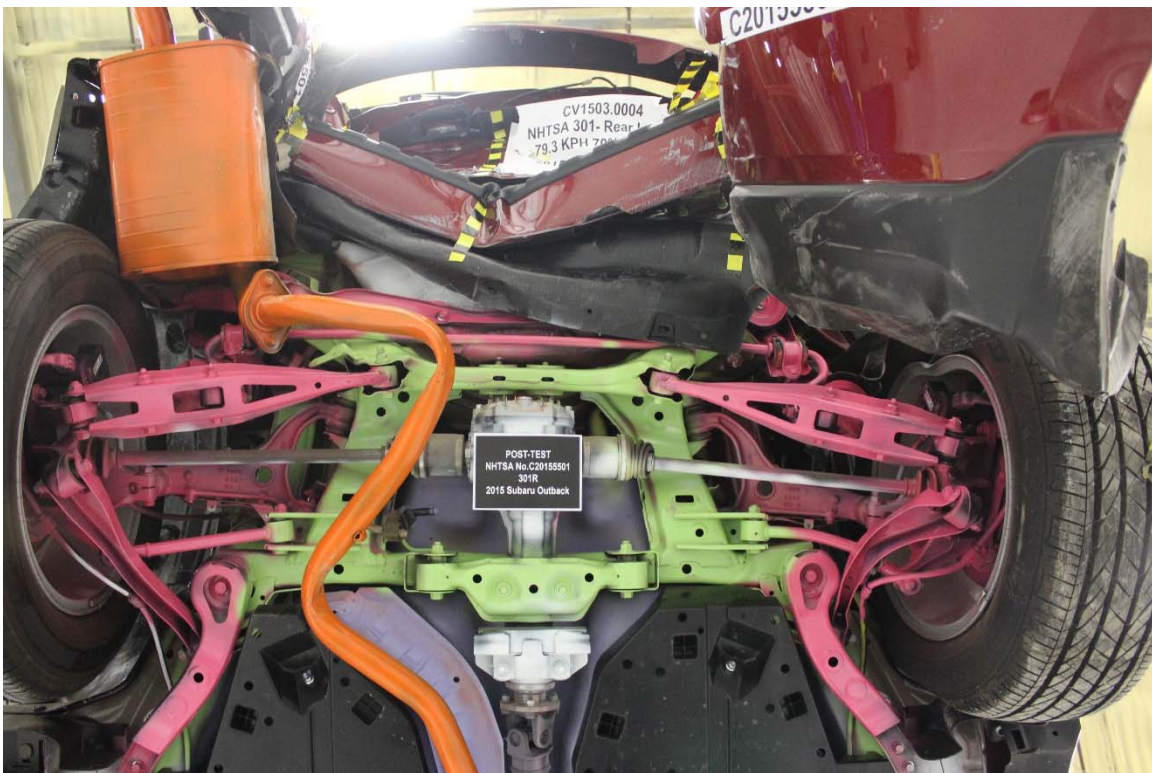


Figure A-34: Post-Test Rear Underbody View



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

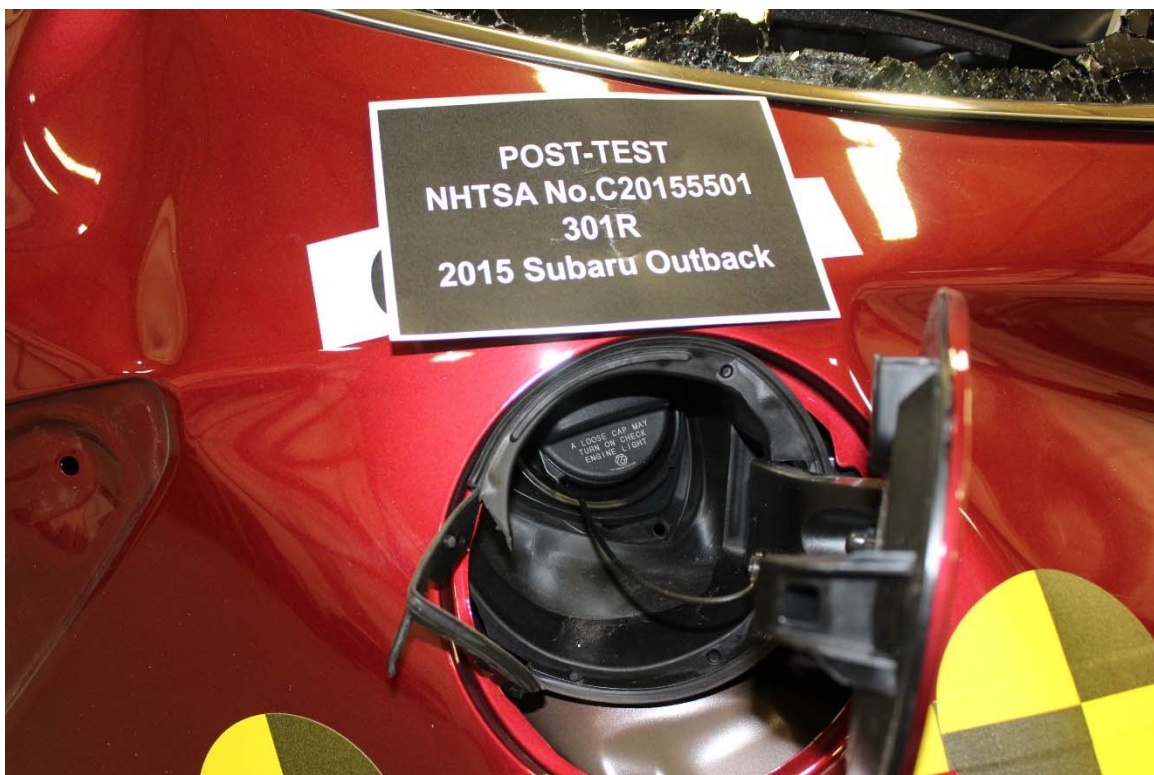


Figure A-36: Post-Test Fuel Filler Cap View



Figure A-37: Impact View



Figure A-38: Speed Trap View*

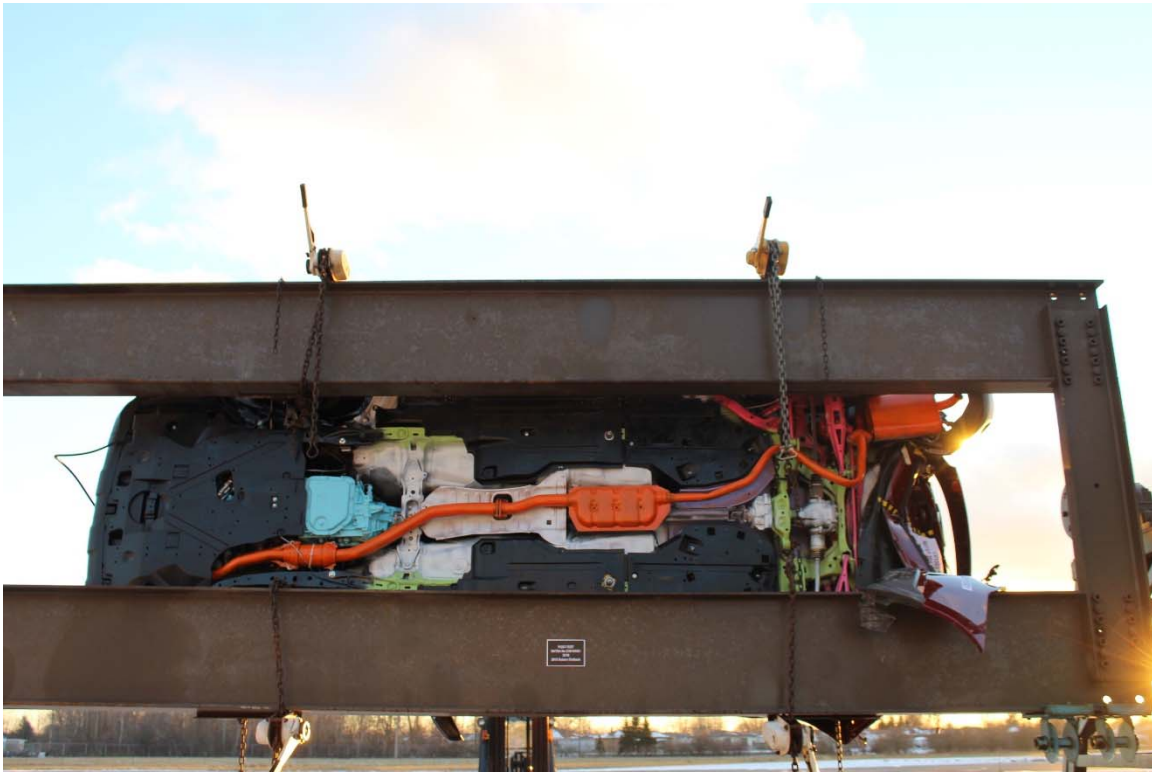


Figure A-39: Rollover 90° View



Figure A-40: Rollover 180° View



Figure A-41: Rollover 270° View



Figure A-42: Rollover 360° View