

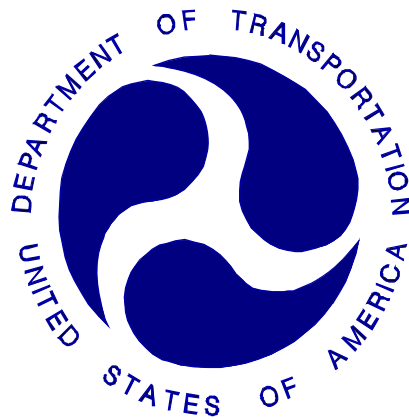
REPORT NUMBER: 301R-CAL-16-003

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

**FCA Italy S.p.A.
2016 Fiat 500X**

NHTSA NUMBER: C20160303

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



May 25, 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.

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: Alexander Rudniski
Alexander Rudniski, Engineer Technician

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

Approval Date: May 25, 2016

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance
Date: _____

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 301R-CAL-16-003	2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Final Report of FMVSS 301R Compliance Rear Impact Testing of a 2016 Fiat 500X NHTSA No.: C20160303		5. Report Date May 25, 2016		
		6. Performing Organization Code CAL		
7. Author(s) Alexander Rudniski, Engineer Technician Edward Dutton, Senior Test Engineer		8. Performing Organization Report No. CAL-DOT-2016-003		
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		10. Work Unit No.		
		11. Contract or Grant No. DTNH22-11-D-00243		
12. Sponsoring Agency Name and Address 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		13. Type of Report and Period Covered Final Test Report May 12, 2016 - May 25, 2016		
		14. Sponsoring Agency Code NVS-220		
15. Supplementary Notes				
16. Abstract A compliance test was conducted on a 2016 Fiat 500X 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		
19. Security Classification of Report UNCLASSIFIED	20. Security Classification of Page UNCLASSIFIED		21. No. of Pages 39	22. Price

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 2016 Fiat 500X, 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 1,628 kg 2016 Fiat 500X was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.13 kph (49.17 mph). The test was performed by Calspan Corporation on May 12, 2016.

The test vehicle was equipped with a 48 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (125 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 708 millimeters of which the average was 478 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: 2016 Fiat 500X
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
Test Date: 5/12/2016

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	C20160303
Model Year	2016
Make	Fiat
Model	500X
Body Style	5 Door Hatchback
Body Color	Silver
Odometer Reading (km/mi)	53.1 km / 33 mi
Engine Displacement (L)	1.4
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Manual
Transmission Speeds	6-Speed
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)	Yes
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	FCA Italy S.p.A
Date of Manufacture	08/15
VIN	ZFBCFXAW2GP382267

GVWR (kg)	1940
GAWR Front (kg)	1050
GAWR Rear (kg)	900

TIRE PLACARD & SIDEWALL INFORMATION

Tire Placard Location: Driver's Door Sill

Spare Tire Type: None

Measured Parameter	Front	Rear
Tire Manufacturer	Continental	Continental
Tire Name	ProContact	ProContact
Tire Type	All Season	All Season
Max. Tire Pressure (kPa)	350	350
Recommended Tire Size	P215/60R16	P215/60R16
Load Index/Speed Symbol	95H	95H
Recommended Cold Tire Pressure (kPa)	240	240
Tire Size on Vehicle	P215/60R16	P215/60R16
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)				490
DSC X 68.04 (kg)				340.2
Cargo Weight (RCLW) (kg)				136

DATA SHEET NO. 2 PRE-TEST DATA

Test Vehicle: 2016 Fiat 500X
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
Test Date: 5/12/2016

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	444	239		512	318	
Right	kg	379	282		438	360	
Ratio	%	61	39		58	42	
Totals	kg	823	521	1344	950	678	1628

TARGET TEST WEIGHT CALCULATION (TTW)

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1344	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	136	(B)
Weight of two P572E ATDS @ 74kg each	kg	155.4	(C)
Target Vehicle Test Weight (TVTW)	kg	1635.4	(A+B+C)

*As tested Weight = (TVTW -10kg) <=ATW < (TVTW -5kg); TVTW = 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	2562
Vehicle Length (at Centerline)	mm	4248
Vehicle Width	mm	1783
Weight of Ballast Secured in Cargo Area ¹	kg	125
Type of Ballast		Lead Shot
Method of Securing Ballast		Rear Foot Well
Components Removed for Weight Reduction		0
Vehicle Width at Widest Point	mm	1794
Vehicle Width at Widest Point Location		C-Pillar
Centerline offset for impact line	mm	359
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	806	830	809	833	993
As Tested (ATW)	mm	782	802	787	804	1067

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

Test Vehicle: 2016 Fiat 500X
Test Program: FMVSS 301R Compliance Rear Impact Test

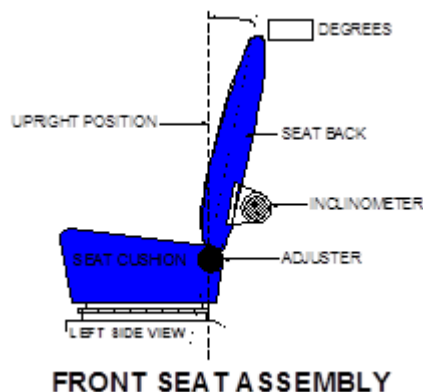
NHTSA No.: C20160303
Test Date: 5/12/2016

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.



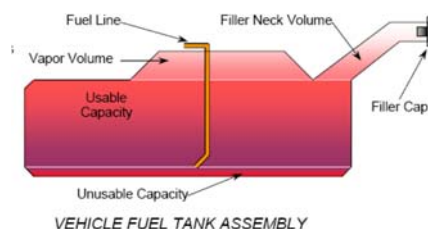
Measured Parameter	Deg.
Driver Seat Back Angle	2.3
Passenger Seat Back Angle	2.3

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	220	110
Passenger Seat	260	130



FUEL TANK CAPACITY DATA

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	48
COTR Usable Capacity (Standard Tank)	Form No. 1	48
Test Volume Range	92-94% of Usable Capacity	44.16 – 45.12
Actual Test Volume (Solvent Used)	93% of Usable Capacity	44.64

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

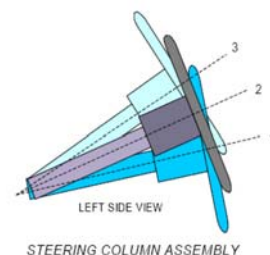
DATA SHEET NO. 2 (Continued)
PRE-TEST DATA

Test Vehicle: 2016 Fiat 500X
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
Test Date: 5/12/2016

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 26.65 degrees and mid fore/aft position at 25 mm

SEAT BELT UPPER ANCHORAGE

Nominal design riding position

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

COMMENTS: None

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

Test Vehicle: 2016 Fiat 500X
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
 Test Date: 5/12/2016

MDB Face Manufacturer: Cellbond MDB Face Serial No. 101561

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

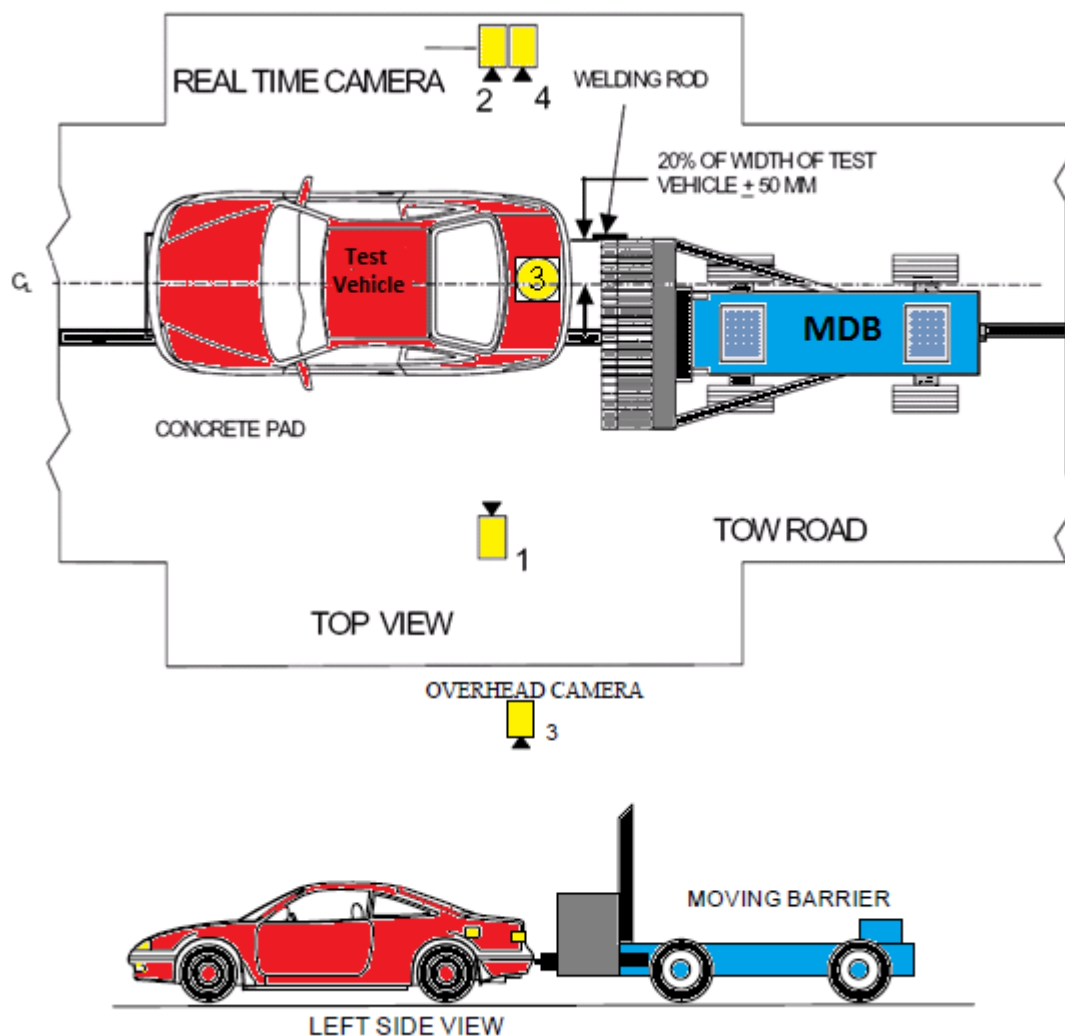
Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15, 2010

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

Test Vehicle: 2016 Fiat 500X
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
 Test Date: 5/12/2016



No.	Camera View	Coordinates (mm)			Angle (Deg)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	1600	-9729	1206	-0.5	24	1000
2	Real-Time Camera						60
3	Overhead View	0	0	5326	90	14	1000
4	Right Side View	1668	9570	1152	0.8	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: 2016 Fiat 500X
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
Test Date: 5/12/2016

VIN: ZFBCFXAW2GP382267

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	79.13
Trap No. 2	km/h	79.37

WELDING ROD IMPACT POINT

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	+2
Horizontal distance from target center (+ is right)	±50 mm	mm	0

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: 2016 Fiat 500X
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
Test Date: 5/12/2016

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)	0	0
Seat Back Failure	No (Reclined)	No (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	None

VEHICLE CRUSH MEASUREMENTS: LENGTH

Measurement	Left Side	Centerline	Right Side
Pre-Test	4147	4248	4147
Post-Test	3915	3540	3652
Crush	-232	-708	-495

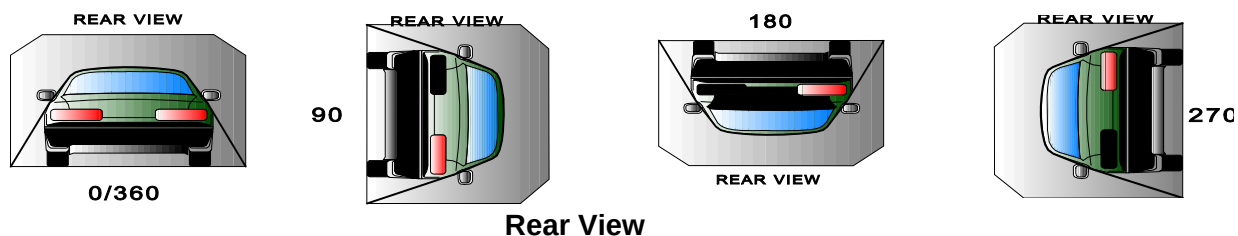
VEHICLE CRUSH MEASUREMENTS: WHEELBASE

Measurement	Left Side	Right Side
Pre-Test	2562	2562
Post-Test	2596	2406
Crush	34	-156

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

Test Vehicle: 2016 Fiat 500X
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160303
 Test Date: 5/12/2016



ROLLOVER SOLVENT COLLECTION TIME TABLE

Test Phase	Rotation Time (spec. 1 -3 min)		Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds	Minutes	Minutes	Seconds	Minutes
0° to 90°	1	8	5	6	8	7
90° to 180°	1	1	5	6	1	7
180° to 270°	1	2	5	6	2	7
270° to 360°	1	8	5	6	8	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

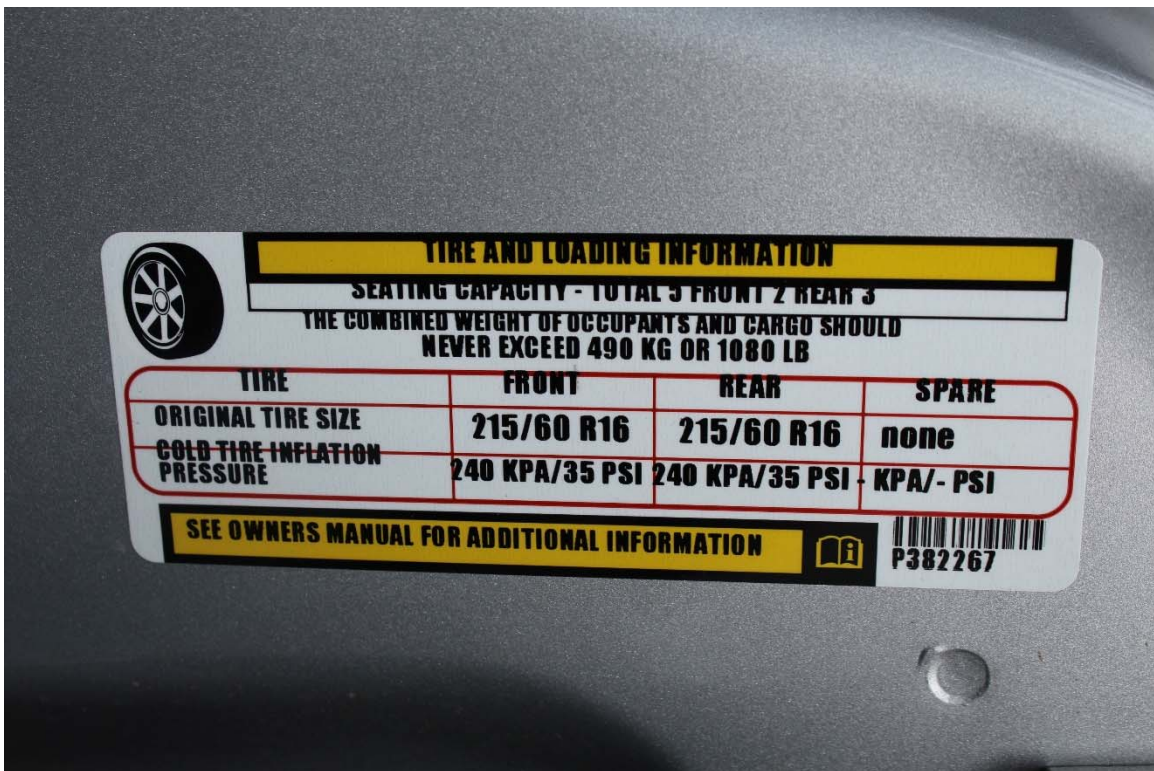


Figure A-2: Vehicle Tire Placard



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

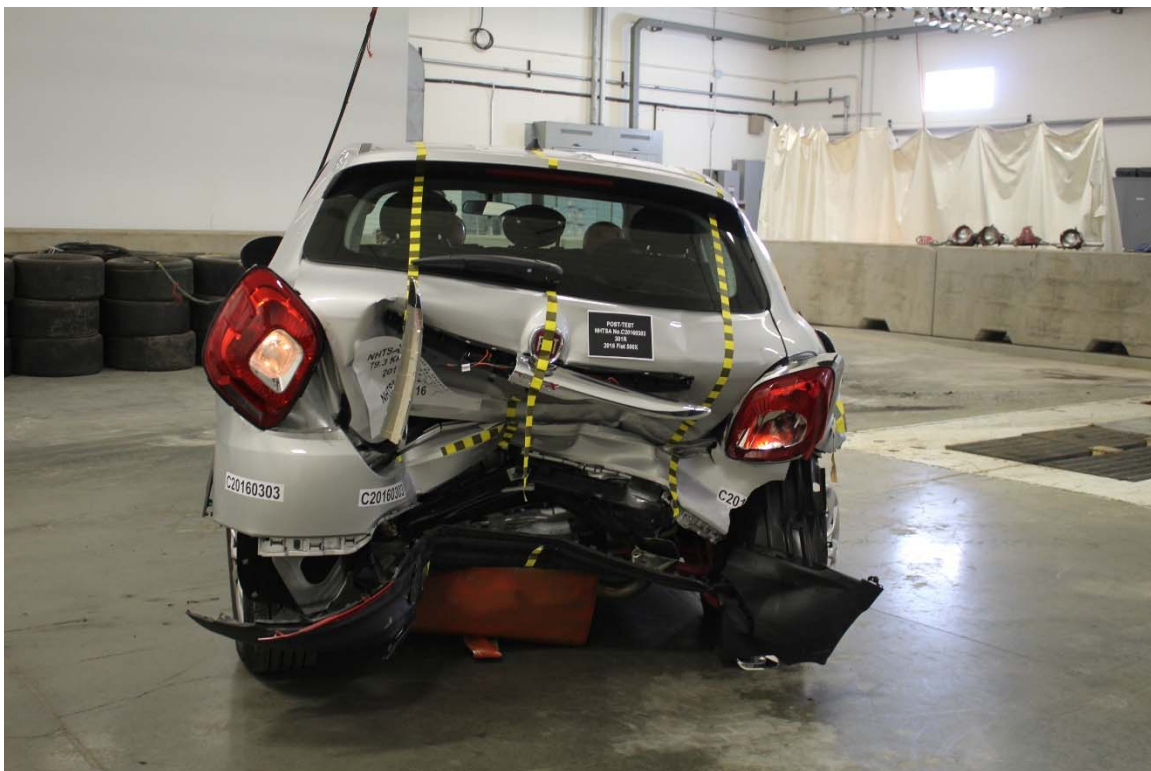


Figure A-18: Post-Test Rear View



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

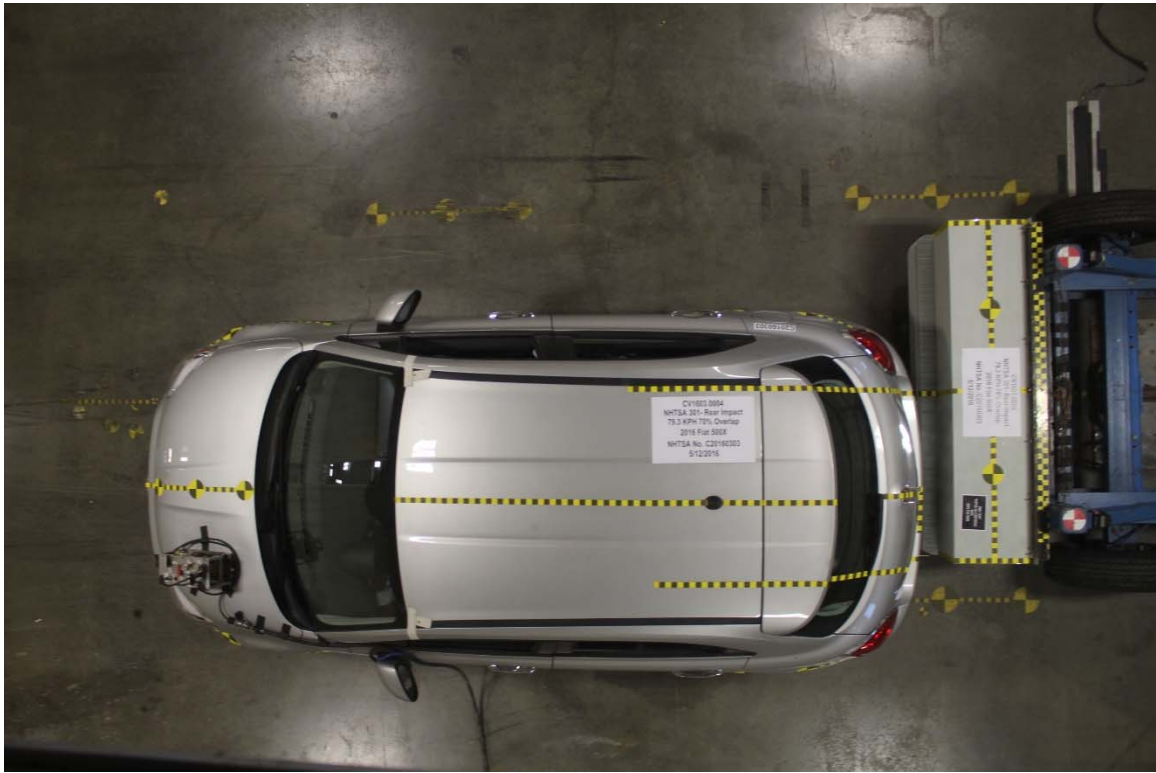


Figure A-27: Pre-Test Overhead Vehicle and MDB View



Figure A-28: Post-Test Impact Target View

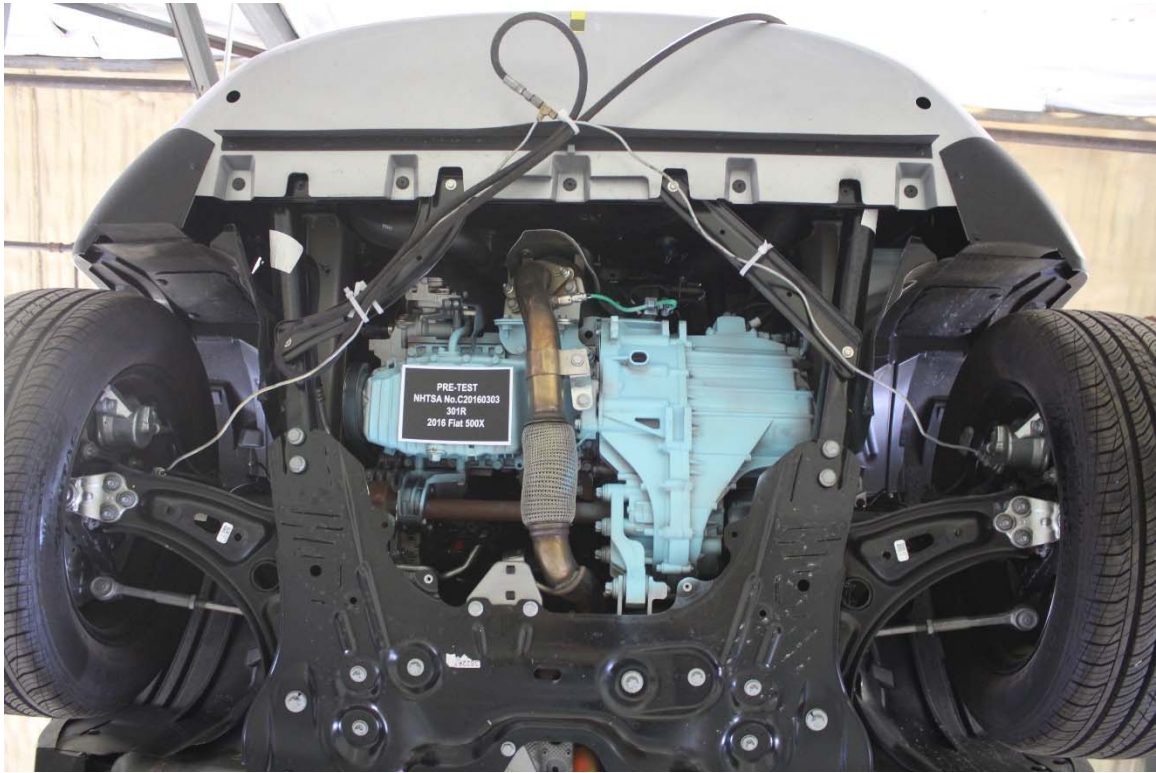


Figure A-29: Pre-Test Front Underbody View



Figure A-30: Post-Test Front Underbody View



Figure A-31: Pre-Test Mid Underbody View



Figure A-32: Post-Test Mid Underbody View

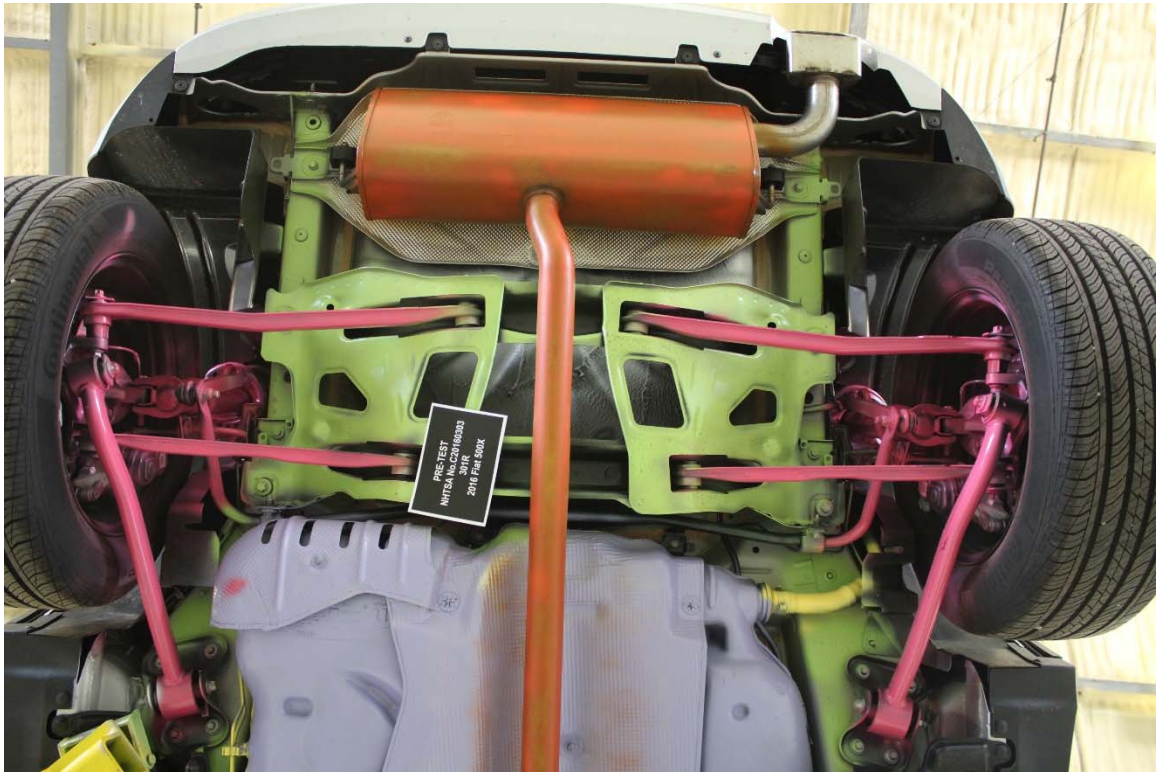


Figure A-33: Pre-Test Rear Underbody View



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