

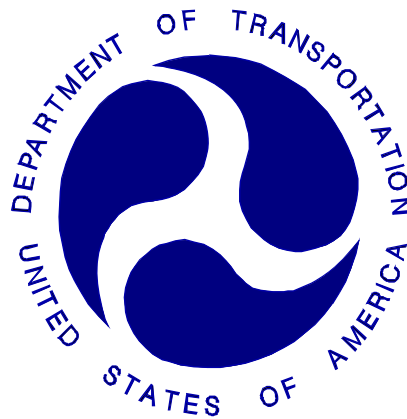
REPORT NUMBER: 301R-CAL-16-002

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

**GM Korea Company
2016 Chevrolet Spark**

NHTSA NUMBER: C20160103

**PREPARED BY:
CALSPAN CORPORATION
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May 24, 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: May 24, 2016

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15. Supplementary Notes				
16. Abstract A compliance test was conducted on a 2016 Chevrolet Spark five door hatchback 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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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 Chevrolet Spark five door hatchback, 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 1,176 kg 2016 Chevrolet Spark five door hatchback was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.1 kph (49.15 mph). The test was performed by Calspan Corporation on May 11, 2016.

The test vehicle was equipped with a 35 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (10 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 301 millimeters of which the average was 203 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 Chevrolet Spark five door hatchback
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
Test Date: 5/11/2016

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	C20160103
Model Year	2016
Make	Chevrolet
Model	Spark
Body Style	5 Door Hatchback
Body Color	White
Odometer Reading (km/mi)	19.3 km / 12 mi
Engine Displacement (L)	1.4
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Manual
Transmission Speeds	5-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	No
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	GM Korea Company
Date of Manufacture	11/15
VIN	KL8CA6SA0GC560492

GVWR (kg)	1366
GAWR Front (kg)	780
GAWR Rear (kg)	750

TIRE PLACARD & SIDEWALL INFORMATION

Tire Placard Location: Driver's Door Sill

Spare Tire Type: T105/70D14

Measured Parameter	Front	Rear
Tire Manufacturer	Kumho	Kumho
Tire Name	Solus TA31	Solus TA31
Tire Type	All Season	All Season
Max. Tire Pressure (kPa)	300	300
Recommended Tire Size	P185/55R15	P185/55R15
Load Index/Speed Symbol	82H	82H
Recommended Cold Tire Pressure (kPa)	240	240
Tire Size on Vehicle	P185/55R15	P185/55R15
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	2	-	4
Seat Type (Bench, Bucket, or Split Bench)	Bucket	Bench	-	
Capacity Weight (VCW) (kg)				300
DSC X 68.04 (kg)				272.16
Cargo Weight (RCLW) (kg)				27.84

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

Test Vehicle: 2016 Chevrolet Spark five door hatchback
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
Test Date: 5/11/2016

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	308	201		355	243	
Right	kg	316	177		361	217	
Ratio	%	62	38		61	39	
Totals	kg	624	378	1002	716	460	1176

TARGET TEST WEIGHT CALCULATION (TTW)

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1002	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	27.84	(B)
Weight of two P572E ATDS @ 74kg each	kg	155.4	(C)
Target Vehicle Test Weight (TVTWT)	kg	1185.24	(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	2388
Vehicle Length (at Centerline)	mm	3637
Vehicle Width	mm	1588
Weight of Ballast Secured in Cargo Area ¹	kg	10
Type of Ballast		Lead Shot
Method of Securing Ballast		Rear Foot Well
Components Removed for Weight Reduction		0
Vehicle Width at Widest Point	mm	1599
Vehicle Width at Widest Point Location		C-Pillar
Centerline offset for impact line	mm	320
Filler neck side (left/right)		Left

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	638	655	643	650	901
As Tested (ATW)	mm	623	632	627	630	934

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

Test Vehicle: 2016 Chevrolet Spark five door hatchback
Test Program: FMVSS 301R Compliance Rear Impact Test

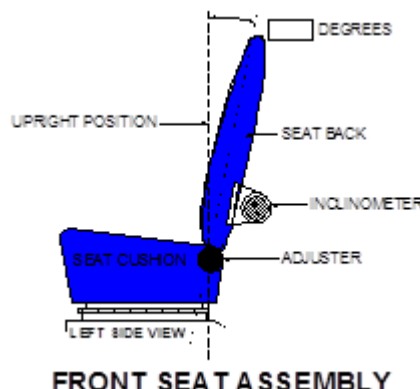
NHTSA No.: C20160103
Test Date: 5/11/2016

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.



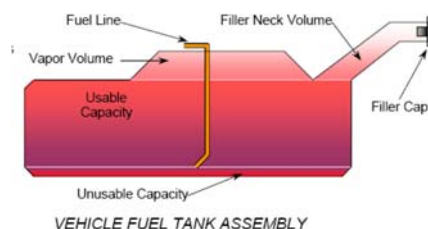
Measured Parameter	Deg.
Driver Seat Back Angle	3.9
Passenger Seat Back Angle	3.7

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	11
Passenger Seat	22	11



FUEL TANK CAPACITY DATA

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	35
COTR Usable Capacity (Standard Tank)	Form No. 1	35
Test Volume Range	92-94% of Usable Capacity	32.2 – 32.9
Actual Test Volume (Solvent Used)	93% of Usable Capacity	32.55

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

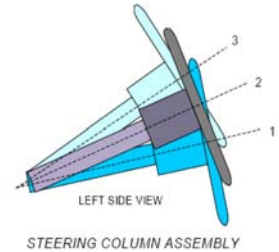
DATA SHEET NO. 2 (Continued)
PRE-TEST DATA

Test Vehicle: 2016 Chevrolet Spark five door hatchback
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
Test Date: 5/11/2016

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 22.2 degrees.

SEAT BELT UPPER ANCHORAGE

Nominal design riding position

Operational Instructions: Anchorage were not adjustable

COMMENTS: None

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

Test Vehicle: 2016 Chevrolet Spark five door hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
 Test Date: 5/11/2016

MDB Face Manufacturer: Cellbond MDB Face Serial No. A0812098

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

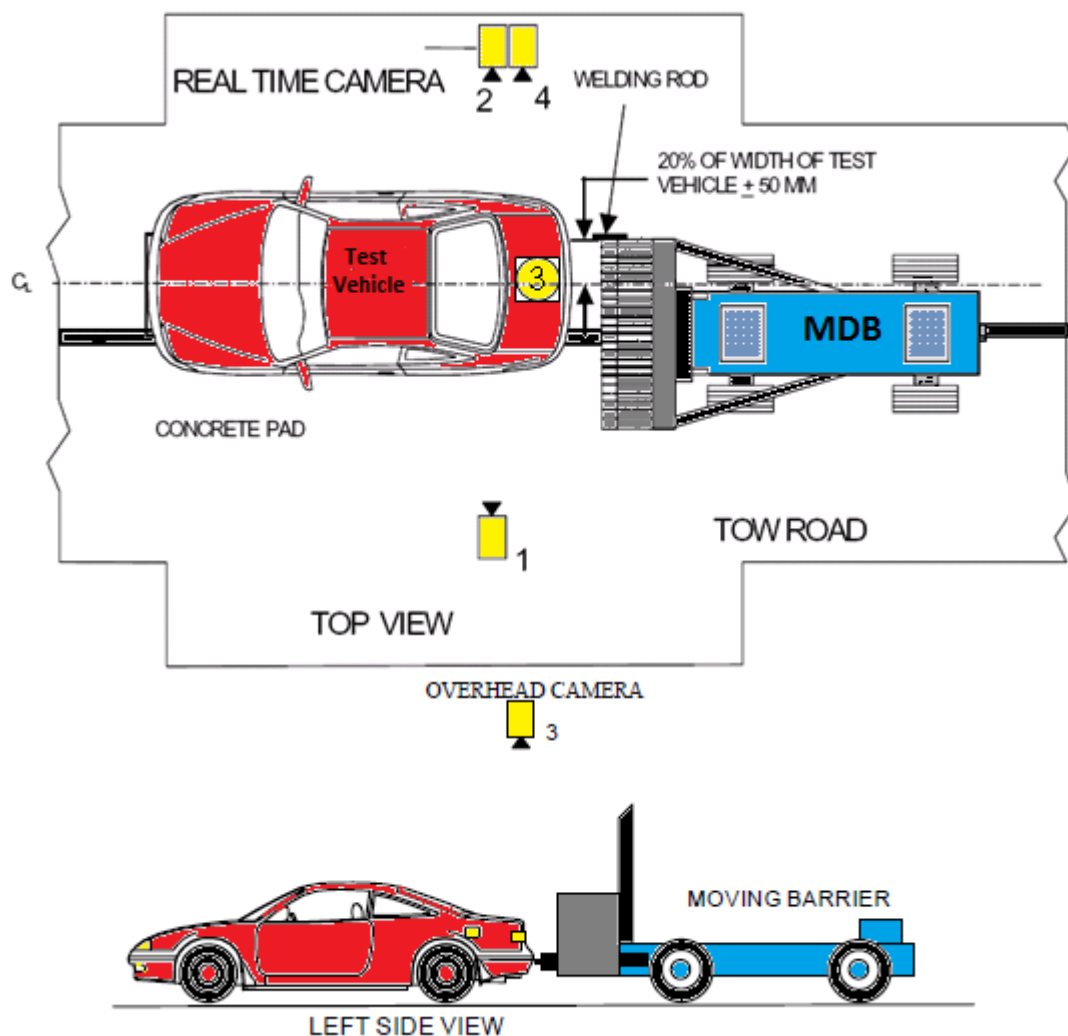
Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15, 2010

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

Test Vehicle: 2016 Chevrolet Spark five door hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
 Test Date: 5/11/2016



No.	Camera View	Coordinates (mm)			Angle (Deg)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	1257	-9446	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	1.4	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 Chevrolet Spark five door hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
 Test Date: 5/11/2016

VIN: KL8CA6SA0GC560492

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	79.1
Trap No. 2	km/h	79.31

WELDING ROD IMPACT POINT

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	0
Horizontal distance from target center (+ is right)	±50 mm	mm	+10

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 Chevrolet Spark five door hatchback
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
Test Date: 5/11/2016

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	Rear Windshield Shattered on impact

VEHICLE CRUSH MEASUREMENTS: LENGTH

Measurement	Left Side	Centerline	Right Side
Pre-Test	3546	3637	3547
Post-Test	3427	3336	3358
Crush	-119	-301	-189

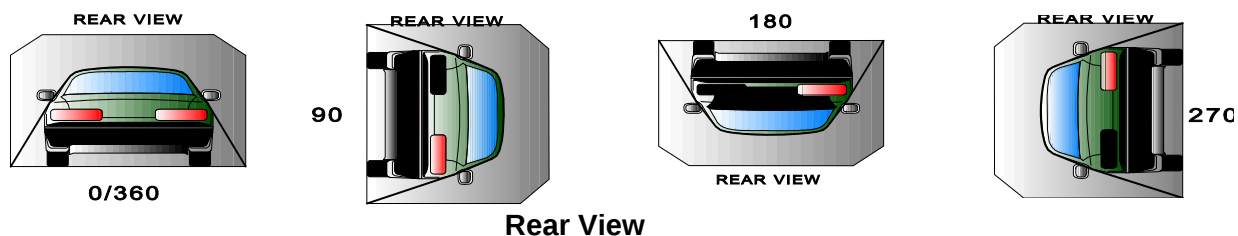
VEHICLE CRUSH MEASUREMENTS: WHEELBASE

Measurement	Left Side	Right Side
Pre-Test	2388	2388
Post-Test	2385	2343
Crush	-3	-45

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

Test Vehicle: 2016 Chevrolet Spark five door hatchback
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20160103
 Test Date: 5/11/2016



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	9	5	6	9	7
90° to 180°	1	1	5	6	1	7
180° to 270°	1	1	5	6	1	7
270° to 360°	1	11	5	6	11	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

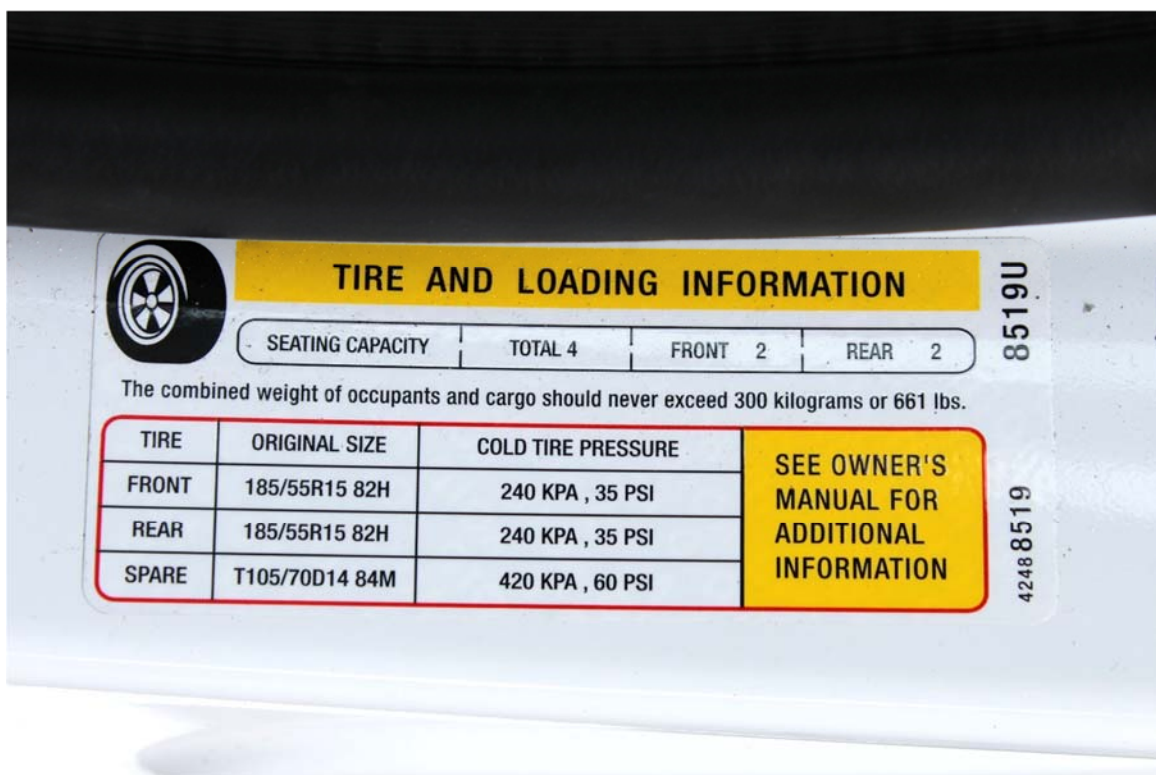


Figure A-2: Vehicle Tire Placard



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

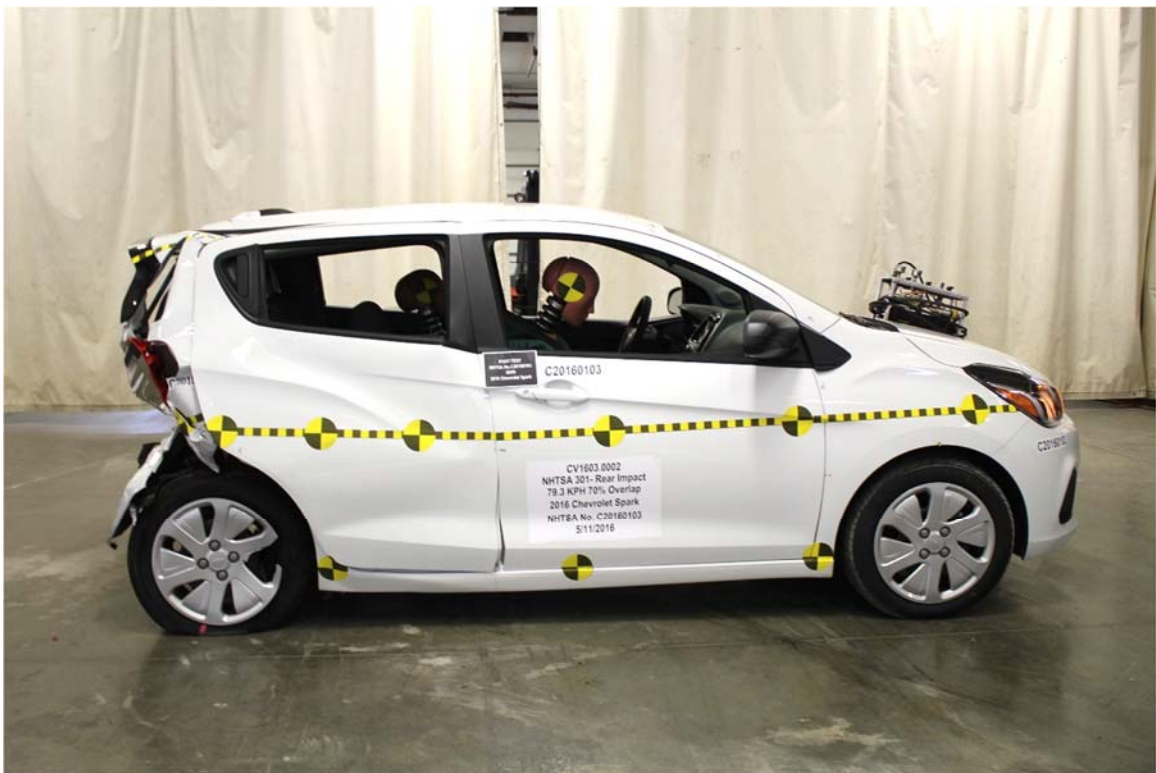


Figure A-8: Post-Test Right Side View



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

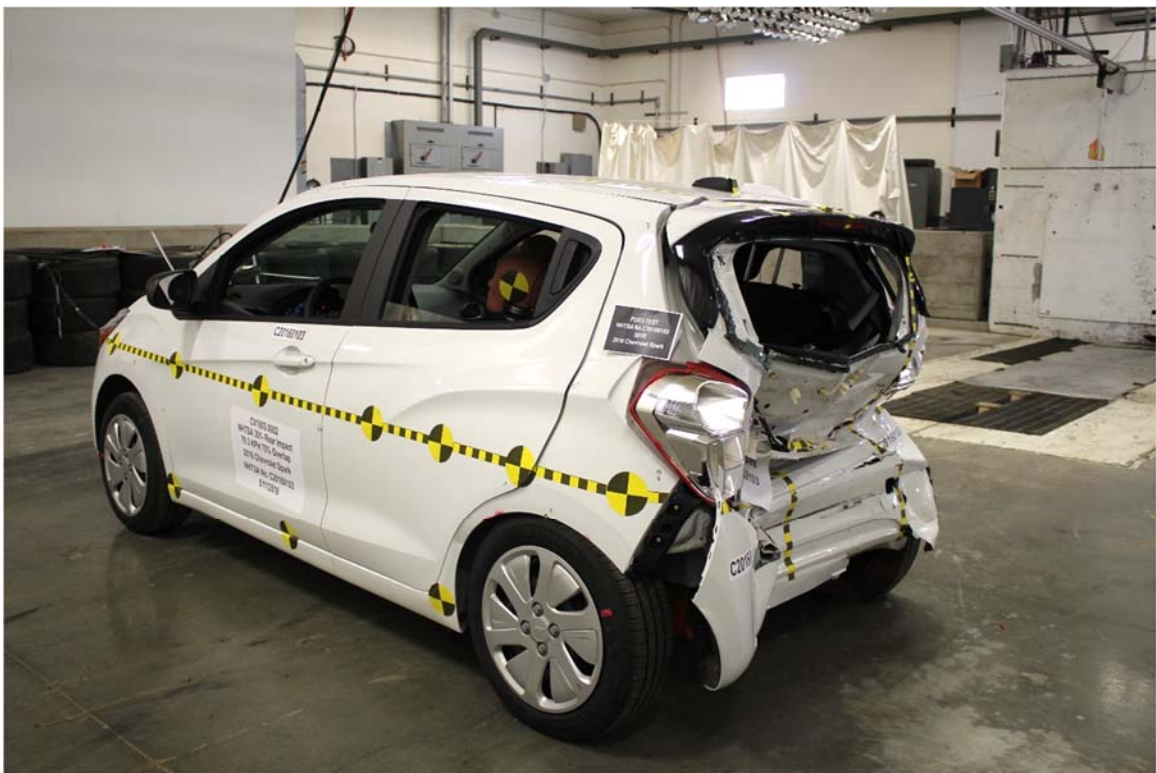


Figure A-14: Post-Test Left Rear 3/4 View



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

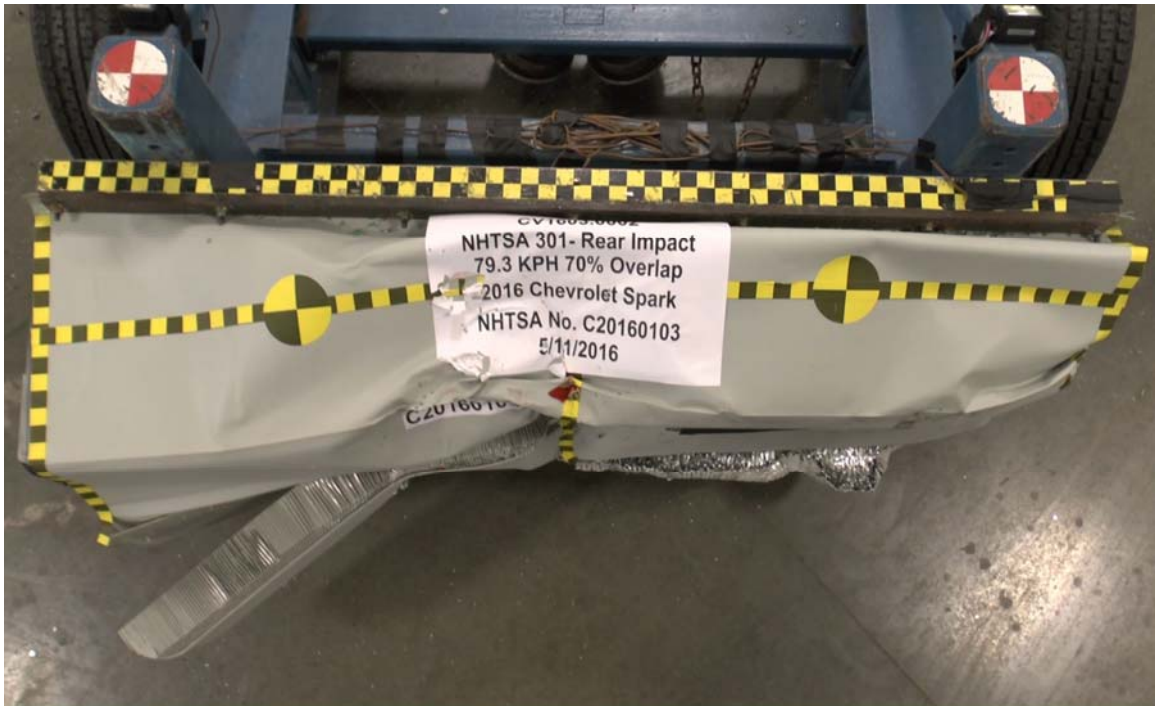


Figure A-26: Post-Test MDB Top View

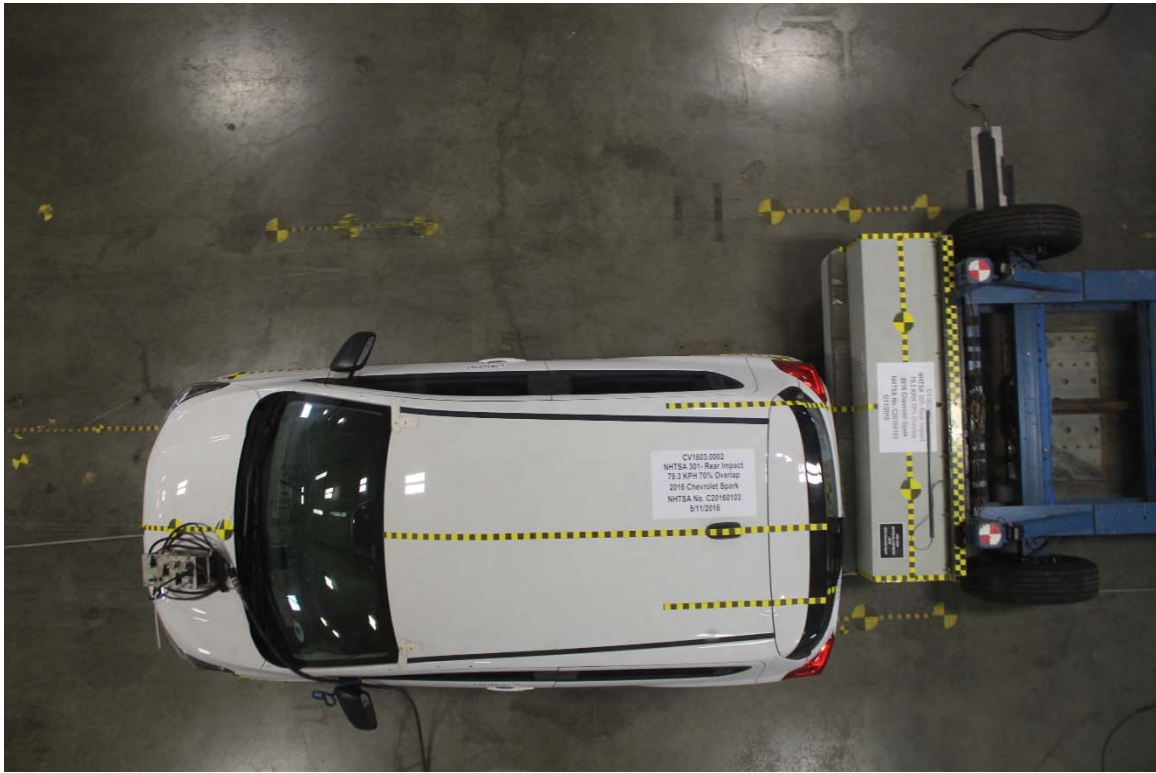


Figure A-27: Pre-Test Overhead Vehicle and MDB View



Figure A-28: Post-Test Impact Target View

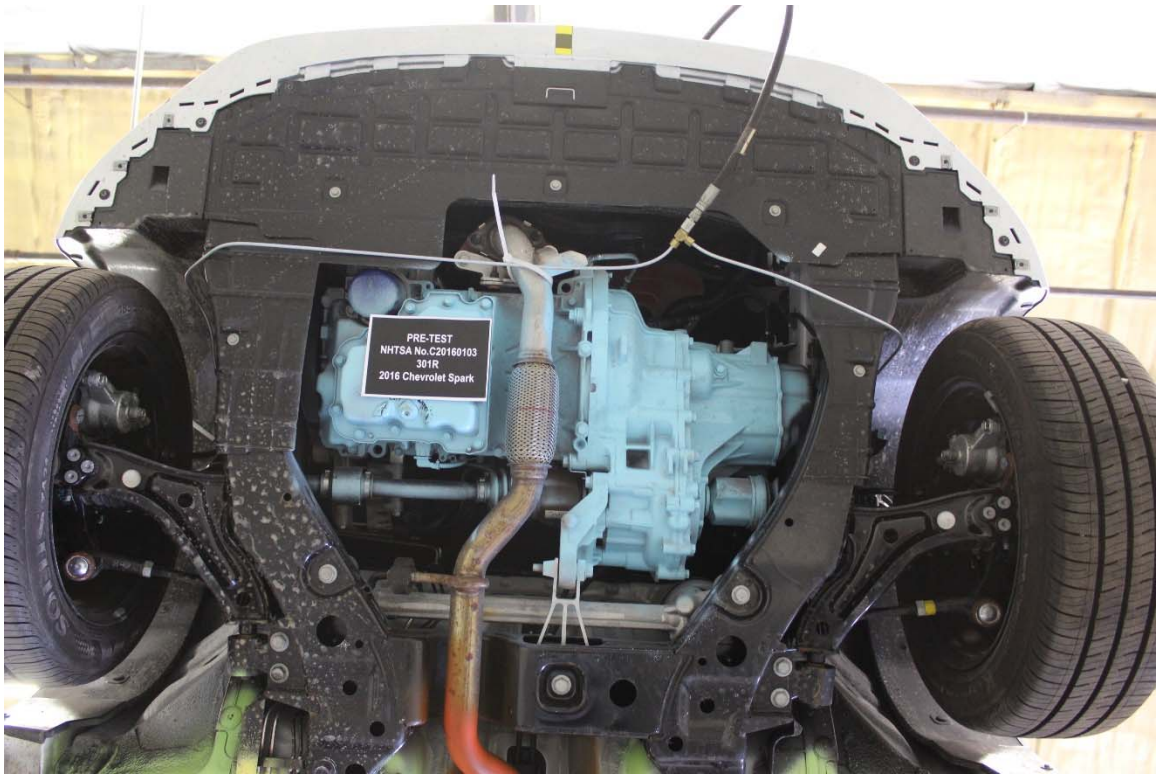


Figure A-29: Pre-Test Front Underbody View

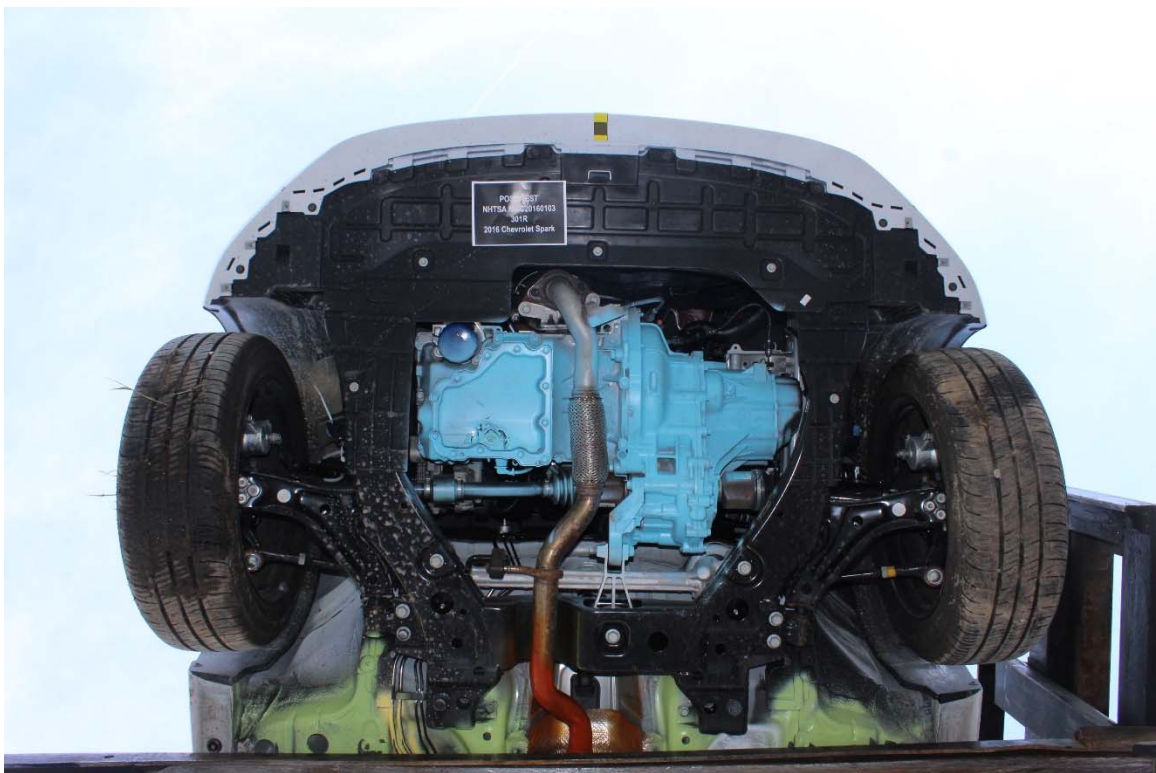


Figure A-30: Post-Test Front Underbody View



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

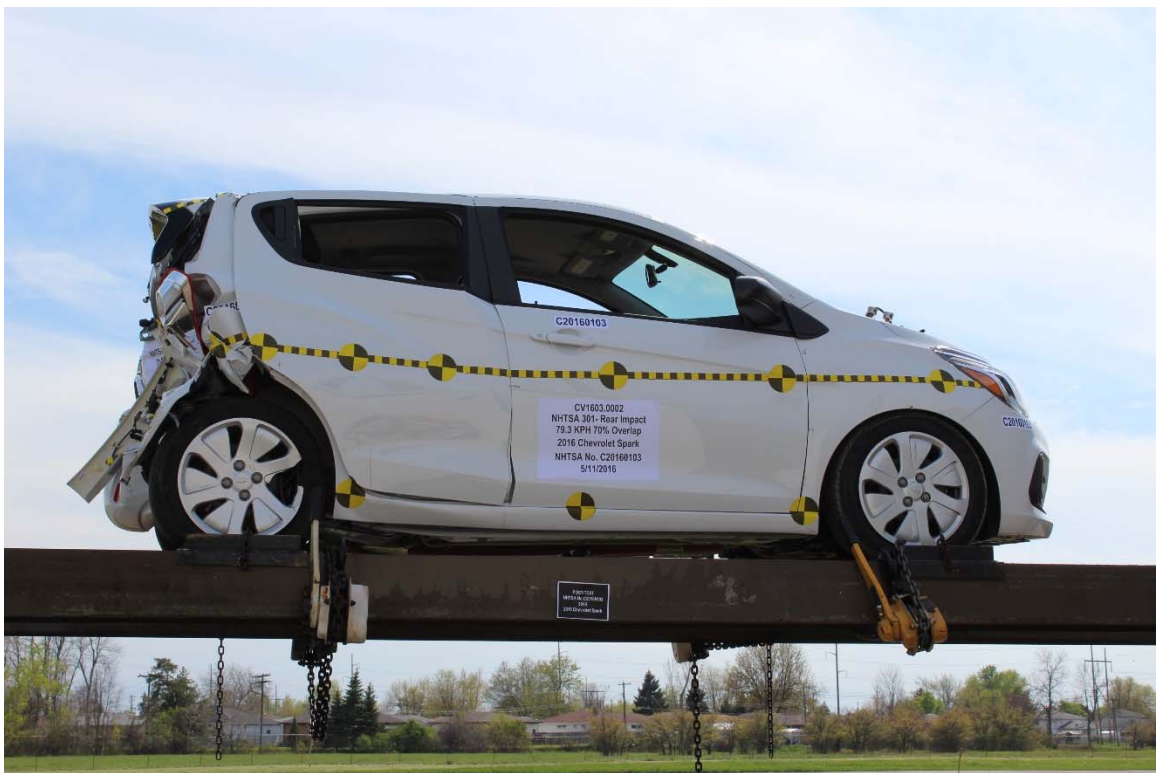


Figure A-42: Rollover 360° View