REPORT NUMBER: 301-CAL-10-01

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

TOYOTA MOTOR CORPORATION
2010 LEXUS RX450
4-DOOR SUV

NHTSA NUMBER: CA5100

CALSPAN
TRANSPORTATION SCIENCES CENTER
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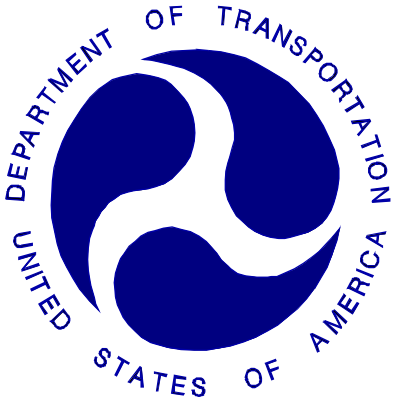
BUFFALO, NEW YORK 14225



February 9, 2010

FINAL REPORT

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance (NVS-224)
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. DTNH22-06-C-00031. 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.

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SECTION 1

PURPOSE AND TEST PROCEDURE

This rear impact test is part of the FMVSS 301 Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-06-C-00031. The purpose of this test was to determine if the subject vehicle, a 2010 Lexus RX450 4-Door SUV, meets the performance requirements of FMVSS No. 301R-02 "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 2331 kg 2010 Lexus RX450 4-Door SUV was impacted from the rear by a 1362.5 kg moving barrier at a velocity of 79.2 kph (49.2 mph). The test was performed by Calspan Corporation on February 9, 2010.

The test vehicle was equipped with a 65.1 liter fuel tank which was filled to 92 percent capacity with stoddard fluid prior to impact. Additional ballast (25 kg) was secured in the vehicle cargo area. Two ballast Part 572E 50th percentile male Anthropomorphic Test Device (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 are found on page 3-6 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 or during any portion of the static rollover test. The average vehicle longitudinal crush was 391 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 3

SUMMARY OF TEST RESULTS

DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2010 Lexus RX450 4-Door SUV

Vehicle Color: Black NHTSA Number: CA5100

Engine Data: 6 Cylinders; - CID; 3.5 Liters; - cc

Transmission: ECVT Speed; - Manual; X Automatic; - Overdrive

Final Drive: - Rear Wheel Drive; - Front Wheel Drive; X Four Wheel Drive

MAJOR TEST VEHICLE OPTIONS:

X AC; X Pwr Steering; X Power Brakes; X Power Locks; X Power Seats

X ABS; X Tilt Wheel; X Stab Control X Traction Control X Anti-Theft

DEALER AND DELIVERY INFORMATION:

Date Received: 9/11/09 ; Odometer Reading 217 km

Selling Dealer: Northtown Lexus

Dealer Address: 3930 Sheridan Drive Amherst, NY 14226

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufacturer: Toyota Motor Corporation

Vehicle Build Date: 06/09

VIN:: JTJBC1BAXA2006516

GVWR: 2710 kg; GAWR: 1360 kg FRONT; 1385 kg REAR

DATA FROM VEHICLE'S TIRE LABEL AND SIDEWALL:

Location of Tire Placard: Driver side door along front lower B-pillar sheet metal

Type of Spare Tire: Temporary

	Front	Rear
Maximum Tire Pressure (sidewall - kPa)	350	350
Cold Pressure (tire placard - kPa) – test pressure	230	230
Recommended Tire Size (tire placard)	P235/55R19	P235/55R19
Vehicle Tire Size with load index & speed symbol	P235/55R19 101V	P235/55R19 101V
Tire Manufacturer	Bridgestone	Bridgestone
Tire Name	Dueler H/L	Dueler H/L
Treadwear, Traction, Temperature	260 A A	260 A A

VEHICLE CAPACITY DATA:

Type of Front Seats: - Bench; X Bucket; - Split Bench

Number of Occupants: 2 Front; 3 Rear; 5 Total

Vehicle Capacity Weight (VCW) = 370 kg

No. of Occupants x 68.04 kg = 340 kg

Rated Cargo/Luggage Weight (RCLW) = 30 kg

DATA SHEET 2

PRE-TEST DATA

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids)= UDW:

	Left Side (kg)	Right Side (kg)	Ratio (%)	Total (kg)
Front =	620.0	591.5	56.1	1211.5
Rear =	485.0	464.5	43.9	949.5
			Total Delivered Weight (UDW) =	2161.0

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight (UDW) =	2161.0	kg
Rated Cargo/Luggage Weight (RCLW) =	30.0	kg
Weight of 2 p.572 Dummies @ 74 each =	148	kg
TARGET TEST WEIGHT =	2339.0	kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 22.0 KG OF CARGO WEIGHT:

	Left Side (kg)	Right Side (kg)	Ratio (%)	Total (kg)
Front =	655.0	636.0	55.4	1291.0
Rear =	529.0	511.0	44.6	1040.0
			Total Vehicle Test Weight (ATW) =	2331.0

Weight of Ballast Secured in Vehicle[1] = 25 kg Ballast Type Lead shot

Method of securing Ballast: Location placement

Components Removed for Weight Reduction: None

VEHICLE ATTITUDE (all dimension in millimeters):

	Left Front	Right Front	Left Rear	Right Rear	CG[2]
AS DELIVERED:	820	825	833	834	1206.1
AS TESTED:	813	815	824	824	1224.7

Vehicle's Wheel Base: 2745 mm

[1]Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

[2]Rearward of the front axle centerline.

VEHICLE PRE-TEST WIDTH AND IMPACT OFFSET MEASUREMENT:

Vehicle Width at Widest Point: 1892 mm Location: Front Axle Center - Body Trim Quarter Panel

Centerline offset for impact line: 378 mm

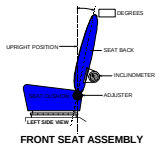
Filler neck side (left/right) Left

DATA SHEET 2 (continued)

PRE-TEST DATA

Vehicle: 2010 Lexus RX450 4-Door SUV NHTSA No. CA5100

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.



FRONT SEAT ASSEMBLY

Seat back angle for driver's seat: 88

Measurement instructions: Measured 88 degrees from back of head restraint post

Seat back angle for passenger's seat: 88

Measurement instructions: Measured 88 degrees from back of head restraint post

2. SEAT FORE AND AFT POSITIONING:

Positioning of the driver's seat: 300 mm of travel – full up forward to full down rearward

Placed in middle at 150 mm

Positioning of the passenger's seat: 288 mm of travel – full up forward to full down rearward

Placed in middle at 144 mm

3. FUEL TANK CAPACITY DATA:

3.1 A. "Usable Capacity" of the standard equipment fuel tank is 65.1 liters

B. "Usable Capacity" of the optional equipment fuel tank is - liters

C. "Usable Capacity" of the vehicle(s) used for certification testing to requirements of FMVSS 301 = 59.9 to 61.2 liters

3.2 Actual Amount of Stoddard solvent added to vehicle for test = 20.2 liters

Stoddard Fluid: specific gravity: 0.764 ; kinematic viscosity: 0.96 centistokes; color: Red

3.3 Is vehicle equipped with electric fuel pump? Yes- x ; No- -

If YES, explain the vehicle operating conditions under which the fuel pump will pump fuel.

The fuel pump is activated with ignition turned “ON”

4. STEERING COLUMN ADJUSTMENTS:

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. If the tested vehicle has any of these adjustments, does your company use any specific procedures to determine the geometric center.

Operational Instructions: Mechanical middle is 24.2 degrees and 20 mm travel

5. SEAT BELT UPPER ANCHORAGE:

Nominal design riding position:

4 detents – placed in top or 0

6. COMMENTS:

None

DATA SHEET 3

MOVING DEFORMABLE BARRIER (MDB) DATA

Vehicle: 2010 Lexus RX450 4-Door SUV NHTSA No. CA5100

MDB FACE MANUFACTURER AND SERIAL NUMBER:

-

MDB DETAILS:

Overall Width of Framework Carriage	=	1250	millimeters
Overall Length of MDB (incl. honeycomb impact face)	=	4120	millimeters
Wheelbase of Framework Carriage	=	2591	millimeters
Tread of Framework Carriage (Front & Rear)	=	1875	millimeters
C.G. Location Rearward of Front Axle	=	1139	millimeters

MDB WEIGHT:

Left Front	=	357.0	kg	Left Rear	=	323.0	kg
Right Front	=	404.0	kg	Right Rear	=	273.5	kg
TOTAL FRONT =		761.0	kg	TOTAL REAR	=	596.5	kg
TOTAL MDB WEIGHT =		1357.5	kg				
Tires (Mfr, line, size):							

TIRE PRESSURE:

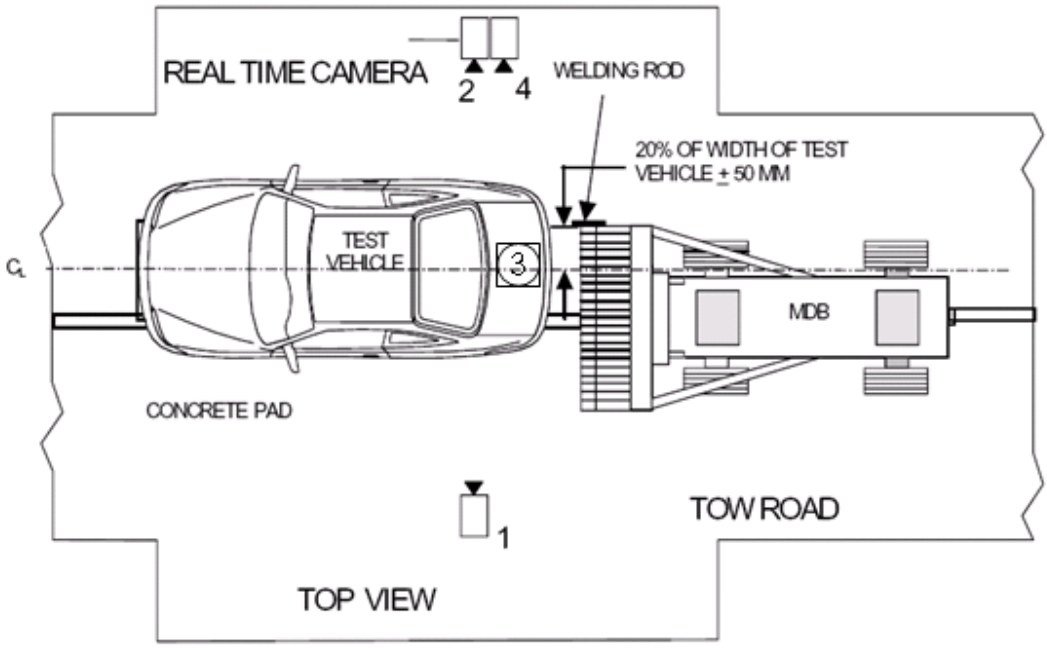
Left Front	=	207	kPa	Left Rear	=	207	kPa
Right Front	=	207	kPa	Right Rear	=	207	kPa

Brake Abort System? (Yes/No)	Yes
Date of Last Calibration:	06/07

DATA SHEET 4

HIGH SPEED CAMERA LOCATIONS AND DATA SUMMARY

Vehicle: 2010 Lexus RX450 4-Door SUV NHTSA No. CA5100



Camera No.	View	Coordinates (millimeters)			Angle (deg.)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	8475	2130	1165	1.7	24	1000
2	Real-Time Camera	-	-	-	-	-	30
3	Overhead View	0	0	4880	90	20	1000
4	Right Side View	9505	1730	940	3.2	28	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 5

POST-TEST DATA

Vehicle: 2010 Lexus RX450 4-Door SUV NHTSA No. CA5100

REQUIRED IMPACT VELOCITY RANGE:: 78.5 to 80.1 km/h

ACTUAL IMPACT VELOCITY WITHIN 1.5 M OF IMPACT PLANE:

Trap No. 1 = 79.2 km/h Trap No. 2 = 79.2 km/h

Average Impact Speed = 79.2 km/h

WELDING ROD IMPACT POINT:

-23 Vertical distance from target center (+ is above) Tolerance: ±40 mm

-5 Horizontal distance from target center (+ is right) Tolerance: ±50 mm

STODDARD SOLVENT SPILLAGE MEASUREMENT:

A. Front impact until vehicle motion ceases -

Actual = 0 g Maximum Allowable = 28 g

B. For 5 minute period after vehicle motion ceases -

Actual = 0 g Maximum Allowable = 28 g

C. For next 25 minutes -

Actual = 0 g/minute Maximum Allowable = 28 g/minute

D. Provide Spillage Details:

None

DATA SHEET 5

POST-TEST DATA (Continued)

Vehicle: 2010 Lexus RX450 4-Door SUV NHTSA No. CA5100

POST TEST SEAT DATA

LOCATION	SEAT MOVEMENT (mm)	SEAT BACK FAILURE
P1 (Left Front)	0	Reclined
P2 (Right Front)	0	Reclined

POST TEST ATD CONTACT DATA

LOCATION	Position 1 (Driver)	Position 2 (Passenger)
Head	Back of head to head restraint	Back of head to head restraint
Chest	-	-
Abdomen	-	-
Left Knee	-	-
Right Knee	-	-

VEHICLE DIMENSIONS:

Vehicle length:

	Left Side	Centerline	Right Side
Pre-Test	4736	4774	4736
Post-Test	4345	4468	4428
Crush	391	306	308

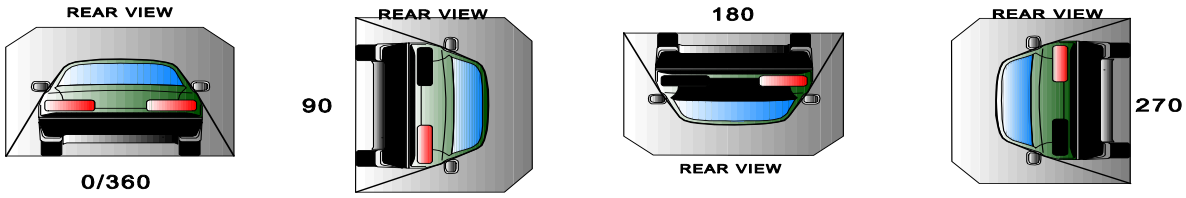
Vehicle Wheel Base:

	Left Side	Right Side
Pre-Test	2745	2745
Post-Test	2683	2745
Crush	52	0

DATA SHEET 6

FMVSS 301 ROLLOVER DATA

Vehicle: 2010 Lexus RX450 4-Door SUV NHTSA No.: CA5100



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Stage	Rotation Time (spec. 1 -3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0º - 90º	1	minutes	20	seconds	5	minutes	6	minutes	20	seconds	7	minutes
90º - 180º	1	minutes	10	seconds	5	minutes	6	minutes	10	seconds	7	minutes
180º-270º	1	minutes	15	seconds	5	minutes	6	minutes	15	seconds	7	minutes
270º-360º	1	minutes	20	seconds	5	minutes	6	minutes	20	seconds	7	minutes

II. FMVSS 301 REQUIREMENTS: (Maximum allowable solvent spillage):

First 5 minutes from onset of rotation	6th min.	7th min.	8th min. (if required)
142 g	28 g	28 g	28 g

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

Rollover Stage	First 5 minutes from onset of rotation (g)	6th min. (g)	7th min. (g)	8th min. (if required) (g)
0º - 90º	0	0	0	N/A
90º - 180º	0	0	0	N/A
180º-270º	0	0	0	N/A
270º-360º	0	0	0	N/A

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

Rollover Stage	Spillage Location
0º - 90º	None
90º - 180º	None
180º-270º	None
270º-360º	None

APPENDIX A

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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 Three-Quarter View

Figure A-10: Post-Test Left Front Three-Quarter View

Figure A-11: Pre-Test Right Front Three-Quarter View

Figure A-12: Post-Test Right Front Three-Quarter View

Figure A-13: Pre-Test Left Rear Three-Quarter View

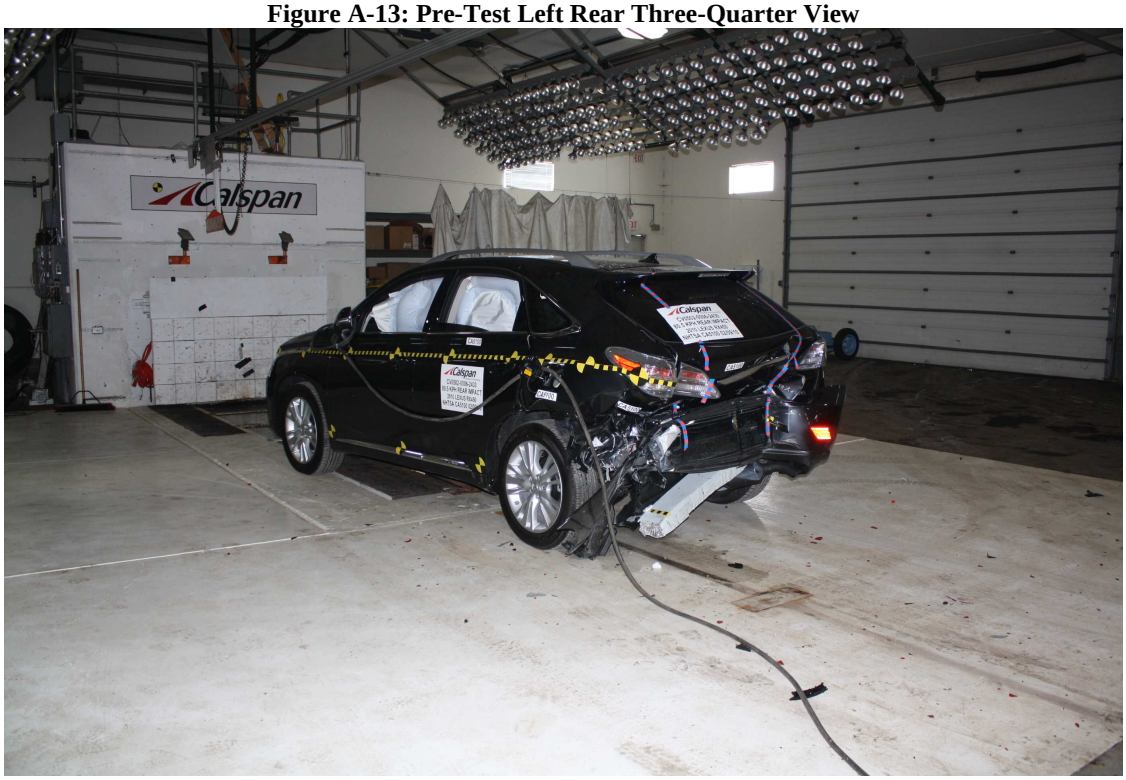

Figure A-14: Post-Test Left Rear Three-Quarter View

Figure A-15: Pre-Test Right Rear Three-Quarter View

Figure A-16: Pre-Test Right Rear Three-Quarter 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

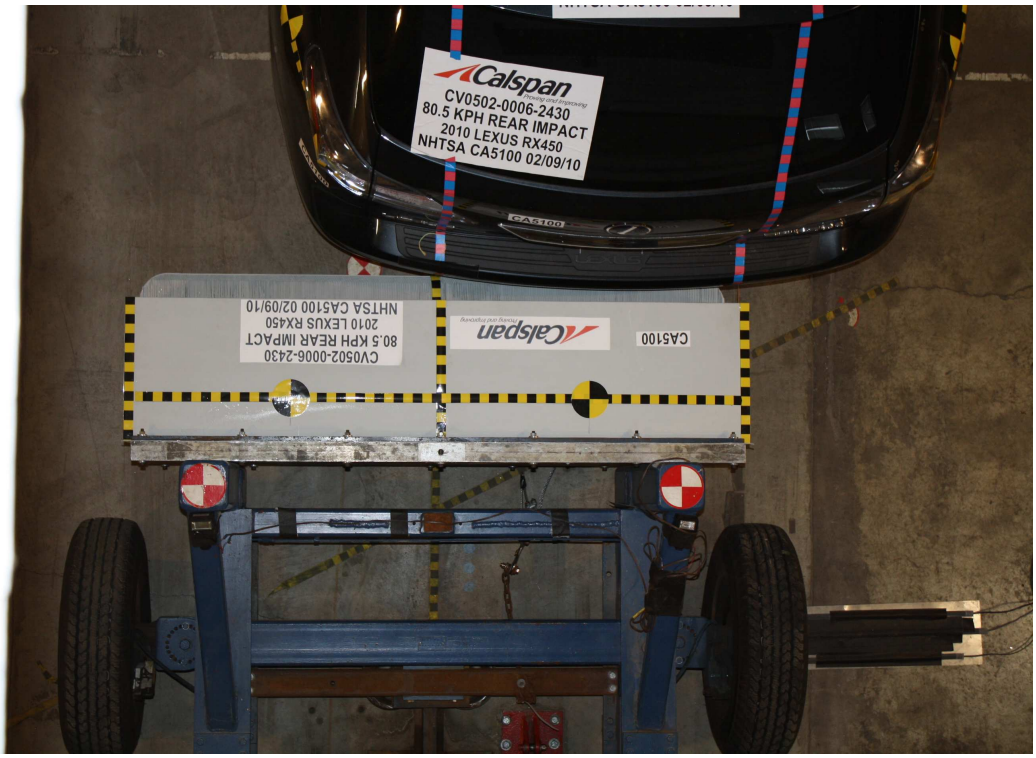

Figure A-25: Pre-Test MDB Top View

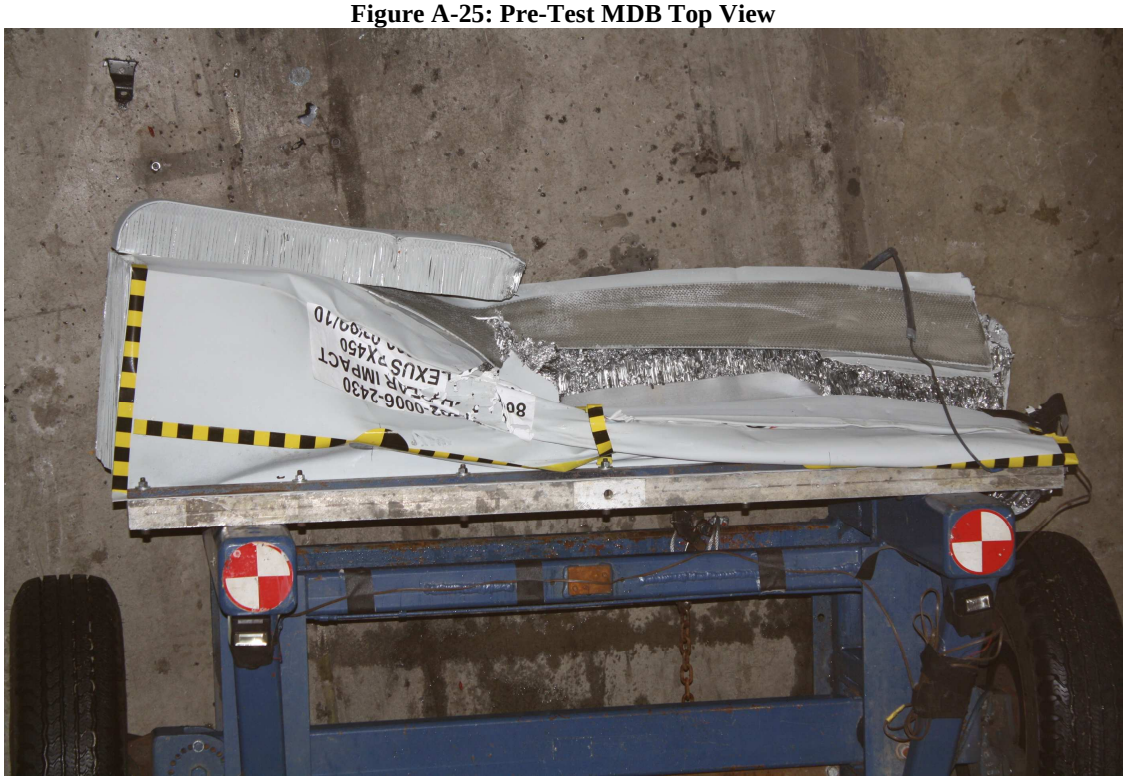

Figure A-26: Post-Test MDB Top View

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

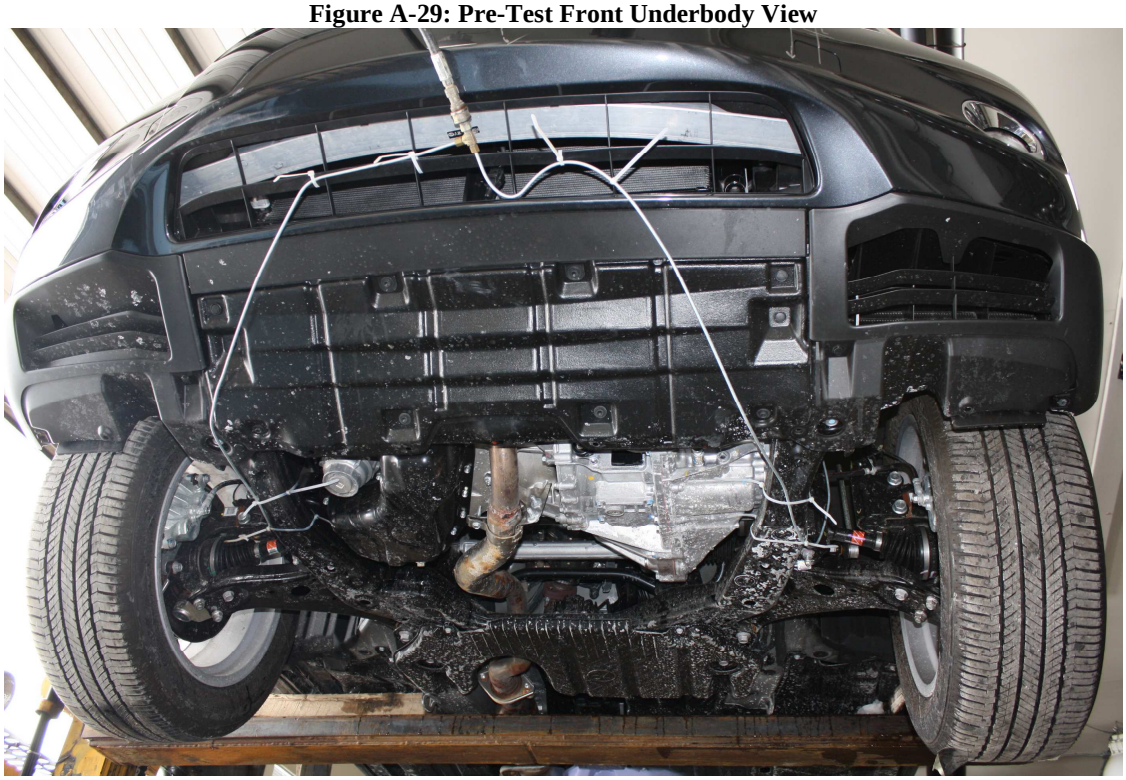

Figure A-30: Post-Test Front Underbody View

Figure A-31: Pre-Test Mid Underbody View

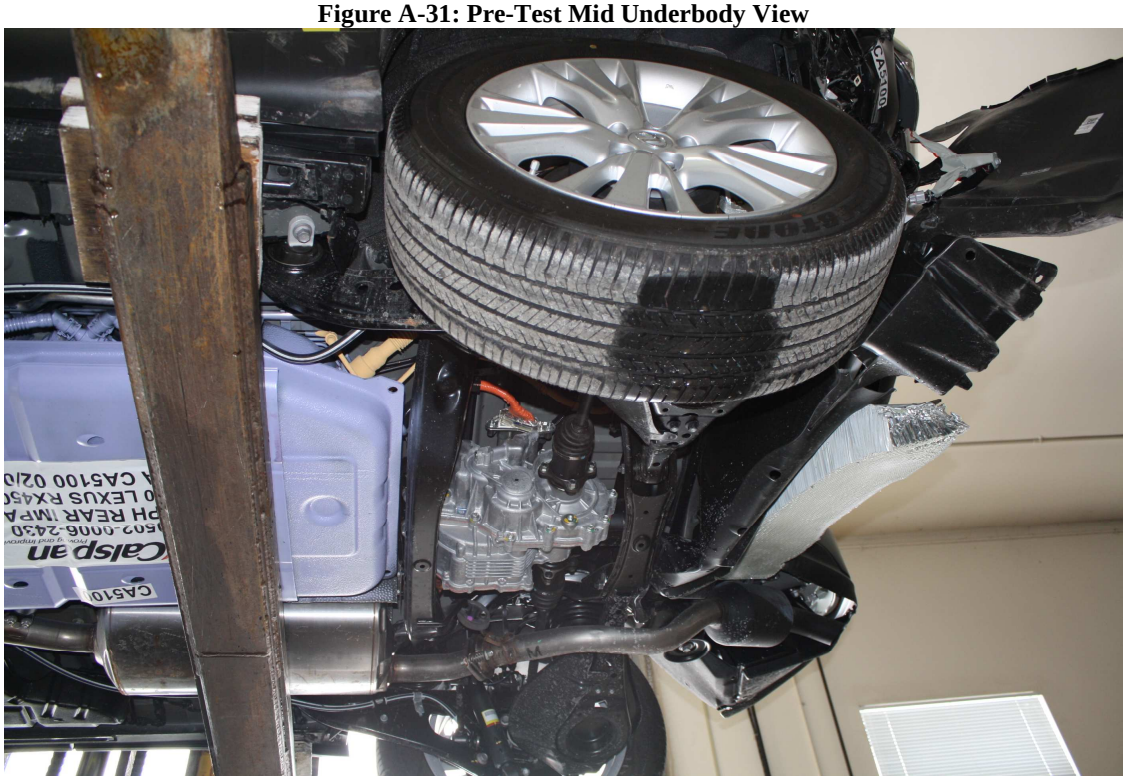

Figure A-32: Post-Test Mid Underbody View

Figure A-33:Pre-Test Rear Underbody View

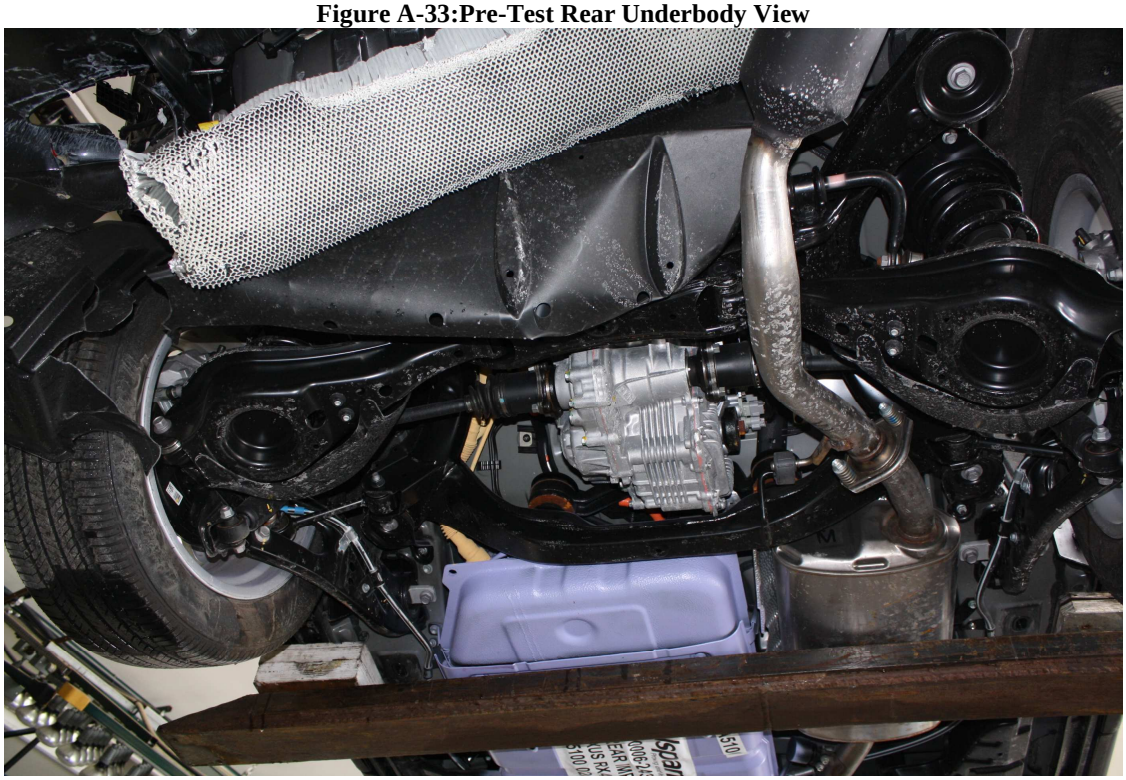

Figure A-34: Post-Test Rear Underbody View

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

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

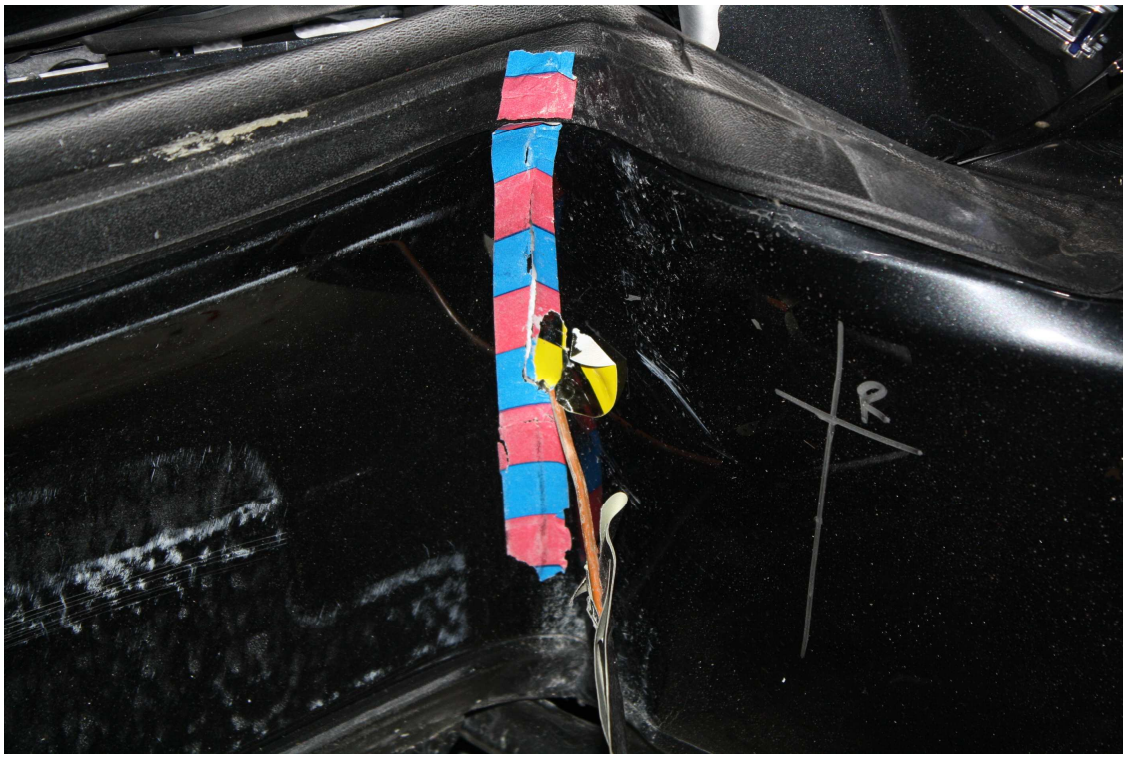

Figure A-37: Impact View

Figure A-38: Rollover 90° View

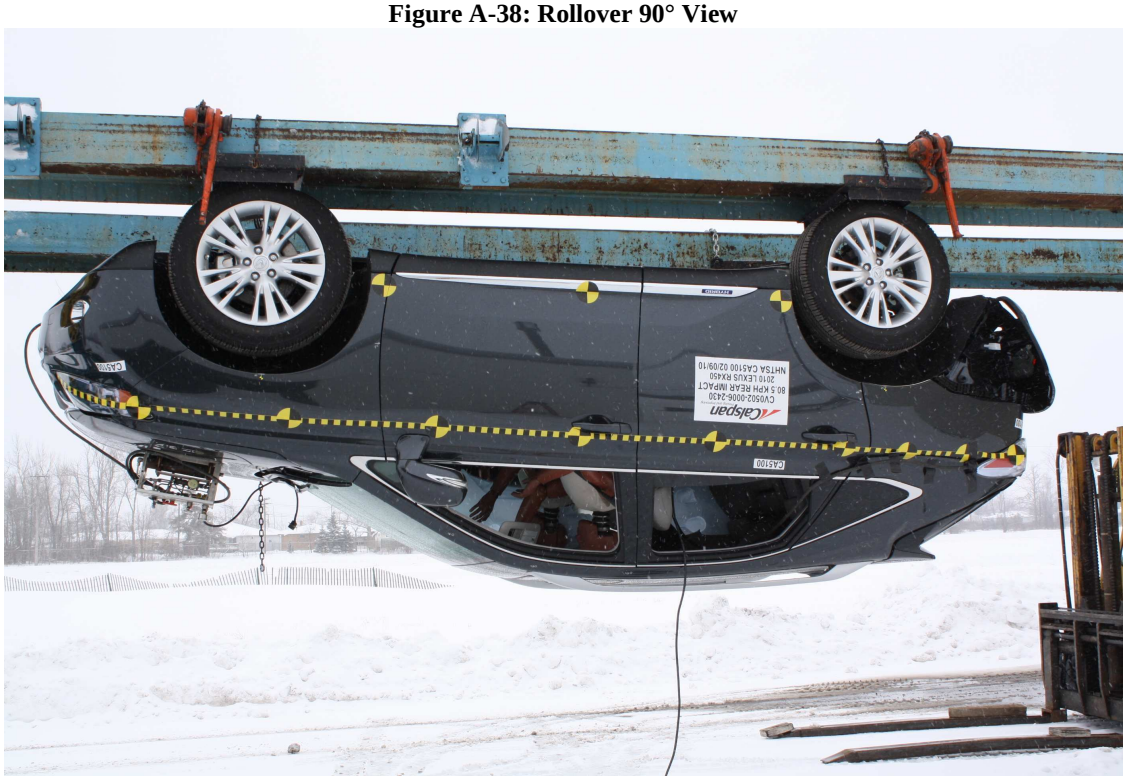

Figure A-39: Rollover 180° View

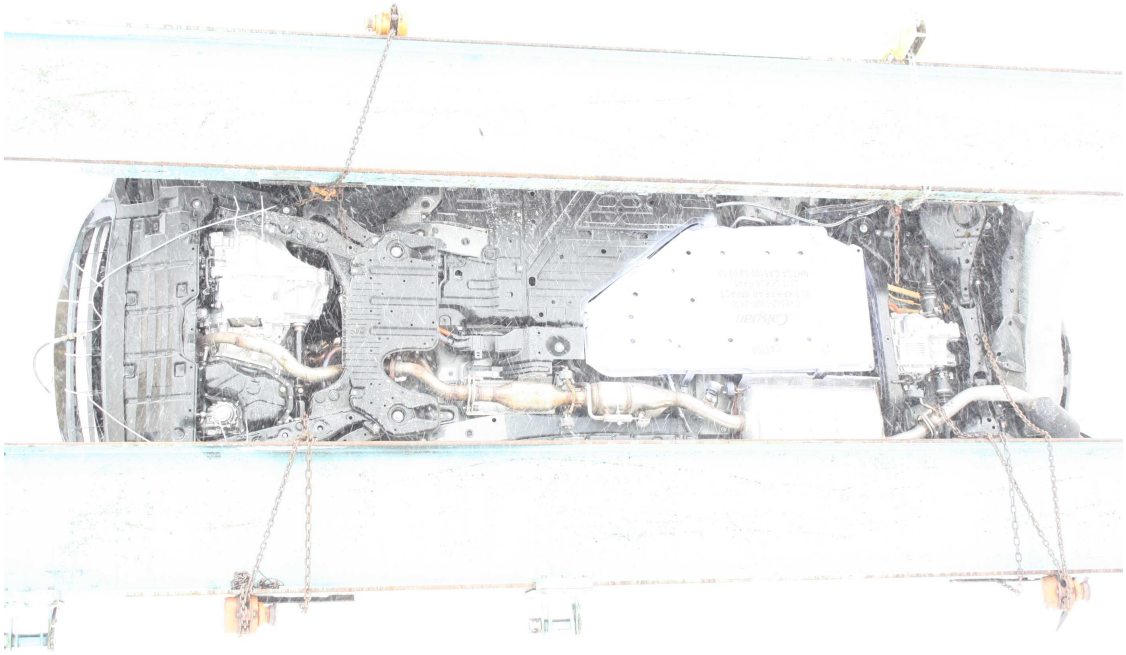

Figure A-40: Rollover 270° View

Figure A-41: Rollover 360° View