REPORT NUMBER: 301-CAL-10-3

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

Toyota Motor Corporation
2010 Lexus HS250h
Sedan

NHTSA NUMBER: CA5102

CALSPAN
TRANSPORTATION SCIENCES CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225

June 10, 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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16. Abstract

Compliance tests were conducted on the subject 2010 Lexus HS250h Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301R-02 for the determination of FMVSS 301 compliance. Test failures identified were as follows:

The test vehicle appeared to exceed the fuel leakage requirements of FMVSS 301R-02 "Fuel System Integrity – Rear Impact."

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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 HS250h Sedan, 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 kg 2010 Lexus HS250h Sedan was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 78.7 kph (48.9 mph). The test was performed by Calspan Corporation on June 10, 2010.

The test vehicle was equipped with a 55 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (27 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 and.

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.

Post-impact, 1463 grams of fuel leakage was collected during the first 5 minutes of the 0 to 90 degree static roll performed after the impact. The FMVSS 301 standard allows a maximum or 142 grams to leak during this time period. The fuel leakage rate was also exceeded during the 6^{th} and 7^{th} minute of the collection period. Based on this data, the vehicle does not appear to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity." The average vehicle longitudinal crush was 599 millimeters.

SECTION 3

SUMMARY OF TEST RESULTS

DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2010 Lexus HS250h Sedan

Vehicle Body Color: red NHTSA Number: CA5102

Engine Data: 4 Cylinders; ____ CID; 2.4 Liters; ____ cc

Transmission: VT Speed; ____ Manual; x Automatic; ____ Overdrive

Final Drive: ____ Rear Wheel Drive; x Front Wheel Drive; ____ 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; ____ Stab Control ____ Traction Control ____ Anti-Theft

DEALER AND DELIVERY INFORMATION:

Date Received: March 12, 2010 ; Odometer Reading 19 km

Selling Dealer: Classic Lexus

2551 Som Center Rd; Willoughby, OH 44094

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufacturer: Toyota Motor Corporation

Vehicle Build Date: 11/09

VIN:: JTHBB1BA5A2014110

GVWR: 2125 kg; GAWR: 1160 kg FRONT; 1000 kg REAR

DATA FROM VEHICLE'S TIRE LABEL AND SIDEWALL:

Location of Tire Placard: Driver sill

Type of Spare Tire: T145/70D17

	Front	Rear
Maximum Tire Pressure (sidewall - kPa)	300	300
Cold Pressure (tire placard - kPa) – test pressure	230	230
Recommended Tire Size (tire placard)	P215/55R17	P215/55R17
Vehicle Tire Size with load index & speed symbol	P215/55R17	P215/55R17
Tire Manufacturer	Michelin	Michelin
Tire Name	Energy MXV4	Energy MXV4
Treadwear, Traction, Temperature	440, A, A	440, 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) = 375 kg

No. of Occupants x 68.04 kg = 340.2 kg

Rated Cargo/Luggage Weight (RCLW) = 34.8 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 =	507.0	501.0	60.6	1008.0
Rear =	338.0	318.5	39.4	656.5
			Total Delivered Weight (UDW) =	1664.5

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight (UDW) =	1664.5	kg
Rated Cargo/Luggage Weight (RCLW) =	34.8	kg
Weight of 2 p.572E Dummies @ 78 each =	156	kg
TARGET TEST WEIGHT =	1856.1	kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 27.0 KG OF CARGO WEIGHT:

	Left Side (kg)	Right Side (kg)	Ratio (%)	Total (kg)
Front =	558.5	542.0	59.6	1100.5
Rear =	383.0	362.5	40.4	745.5
			Total Vehicle Test Weight (ATW) =	1846.0

Weight of Ballast Secured in Vehicle[1] = 27 kg Ballast Type Shot bags

Method of securing Ballast: Ballast taped to rear seat floor pan resting against seat

Components Removed for Weight Reduction: None

VEHICLE ATTITUDE (all dimension in millimeters):

	Left Front	Right Front	Left Rear	Right Rear	CG[2]
AS DELIVERED:	720	728	721	723	
AS TESTED:	705	713	701	702	

Vehicle's Wheel Base: 2704 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: 1800 mm Location: Front wheel fender

Centerline offset for impact line: 36 mm

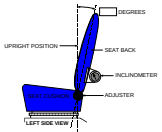
Filler neck side (left/right) left

DATA SHEET 2 (continued)

PRE-TEST DATA

Vehicle: 2010 Lexus HS250h Sedan NHTSA No. CA5102

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: See below

Measurement instructions: Headrest post set at 89 degrees with vertical defined as 90 degrees.

Seat back angle for passenger's seat: Same as driver

Measurement instructions: Headrest post set at 89 degrees with vertical defined as 90 degrees.

2. SEAT FORE AND AFT POSITIONING:

Positioning of the driver's seat: Full range of travel 298mm. Seat set in mid fore/aft position, 149 mm. from front. With seat cushion full down.

Positioning of the passenger's seat: Full range of travel 290mm. Seat set in mid fore/aft position, 145 mm. from front. With seat cushion full down.

3. FUEL TANK CAPACITY DATA:

3.1 A. "Usable Capacity" of the standard equipment fuel tank is 55.0 liters

B. "Usable Capacity" of the optional equipment fuel tank is n/a liters

C. "Usable Capacity" of the vehicle(s) used for certification testing to requirements of FMVSS 301 = 50.6 to 51.7 liters

3.2 Actual Amount of Stoddard solvent added to vehicle for test = 51.1 liters

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

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.

Hybrid vehicle. Fuel pump starts when vehicle ignition is on and gasoline engine is operating.

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: Telescoping column and tilt wheel set to midpoint of adjustable range.

5. SEAT BELT UPPER ANCHORAGE:

Nominal design riding position:

6. COMMENTS:

None

DATA SHEET 3

MOVING DEFORMABLE BARRIER (MDB) DATA

Vehicle: 2010 Lexus HS250h Sedan NHTSA No. CA5102

MDB FACE MANUFACTURER AND SERIAL NUMBER:

Plascore serial number A1209037

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	=	1136	millimeters

MDB WEIGHT:

Left Front	=	358.0	kg	Left Rear	=	322.0	kg
Right Front	=	404.0	kg	Right Rear	=	273.0	kg
TOTAL FRONT =		762.0	kg	TOTAL REAR	=	595.0	kg
TOTAL MDB WEIGHT =		1357.0	kg				

Tires (Mfr, line, size): Dunlop Radial Rover AT P205/75R15

TIRE PRESSURE:

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

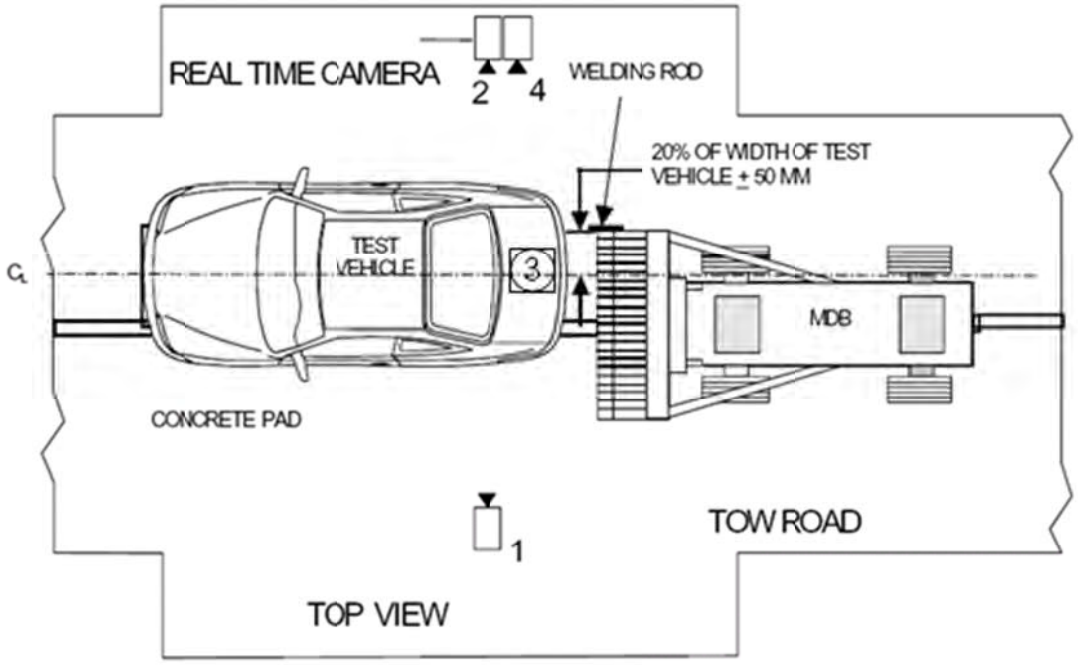
Brake Abort System? (Yes/No) Yes

Date of Last Calibration: 5/15/2010

DATA SHEET 4

HIGH SPEED CAMERA LOCATIONS AND DATA SUMMARY

Vehicle: 2010 Lexus HS250h Sedan NHTSA No. CA5102



Camera No.	View	Coordinates (millimeters)			Angle (deg.)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	8010	1880	975	-0.5	24	1000
2	Real-Time Camera	-	-	-	-	-	30
3	Overhead View	0	775	4900	-90	20	1000
4	Right Side View	8705	1680	1010	-1.5	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 5

POST-TEST DATA

Vehicle: 2010 Lexus HS250h Sedan NHTSA No. CA5102

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

ACTUAL IMPACT VELOCITY WITHIN 1.5 M OF IMPACT PLANE:

Trap No. 1 = 78.7 km/h Trap No. 2 = 78.8 km/h

Average Impact Speed = 78.75 km/h

WELDING ROD IMPACT POINT:

3 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 HS250h Sedan NHTSA No. CA5102

POST TEST SEAT DATA

LOCATION	SEAT MOVEMENT (mm)	SEAT BACK FAILURE
P1 (Left Front)	none	Slightly reclined
P2 (Right Front)	none	Slightly reclined

POST TEST ATD CONTACT DATA

LOCATION	Position 1 (Driver)	Position 2 (Passenger)
Head	Headrest	Headrest
Chest	None	None
Abdomen	None	None
Left Knee	None	None
Right Knee	None	None

VEHICLE DIMENSIONS:

Vehicle length (mm.):

	Left Side	Centerline	Right Side
Pre-Test	4632	4700	4630
Post-Test	3878	4105	4181
Crush	754	595	449

Vehicle Wheel Base(mm.):

	Left Side	Right Side
Pre-Test	2704	2704
Post-Test	2620	2713
Crush	84	-9

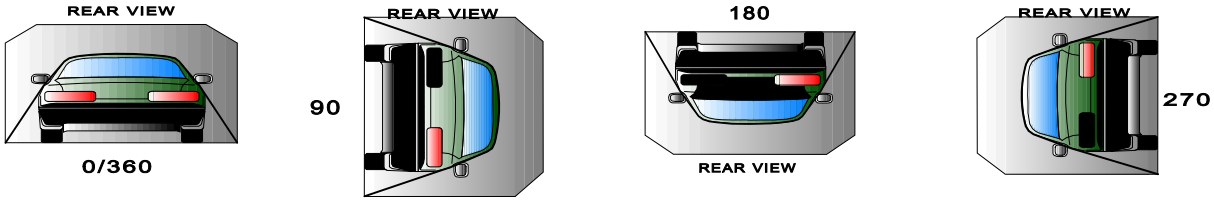
Comments:

The left side curtain airbag and left rear seat airbag deployed during the impact event. Both the left and right side doors were closed and operable after the impact. The rear hatch was closed but not operable.

DATA SHEET 6

FMVSS 301 ROLLOVER DATA

Vehicle: 2010 Lexus HS250h Sedan NHTSA No.: CA5102



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	05	seconds	5	minutes	6	minutes	5	seconds	7	minutes
90º - 180º	-	minutes		seconds	5	minutes	5	minutes	0	seconds	6	minutes
180º-270º	-	minutes		seconds	5	minutes	5	minutes	0	seconds	6	minutes
270º-360º	-	minutes		seconds	5	minutes	5	minutes	0	seconds	6	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	1463	340	335	N/A
90º - 180º	Not collected – stage 1 exceeded			N/A
180º-270º	Not collected – stage 1 exceeded			N/A
270º-360º	Not collected – stage 1 exceeded			N/A

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

IV. SOLVENT SPILLAGE LOCATION(S):

Rollover Stage	Spillage Location
0º - 90º	Stoddard appeared to leak from the fuel filler neck area that was pulled from the left rear fender area during the impact.
90º - 180º	Not collected – stage 1 exceeded
180º-270º	Not collected – stage 1 exceeded
270º-360º	Not collected – stage 1 exceeded

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

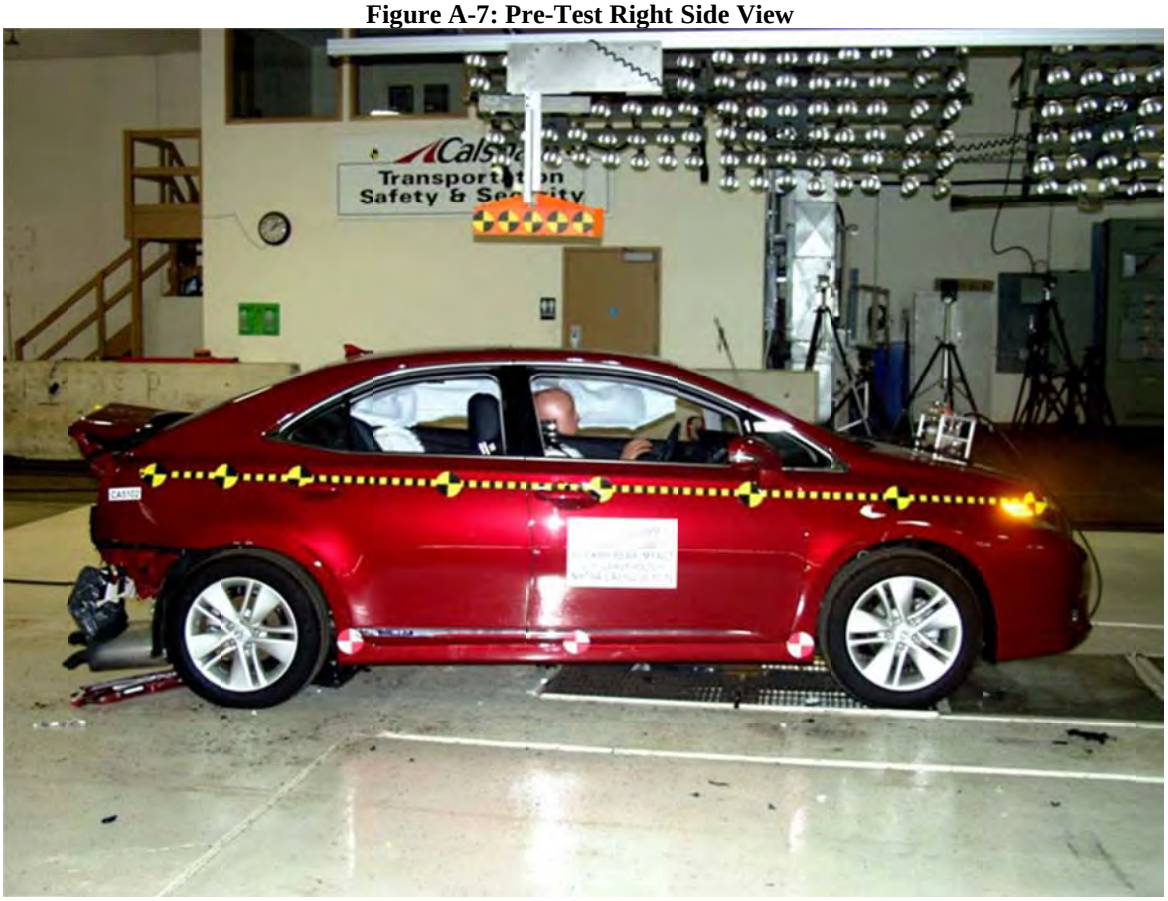


Figure A-8: Post-Test Right Side View

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: Post-Test Right Rear Three-Quarter View

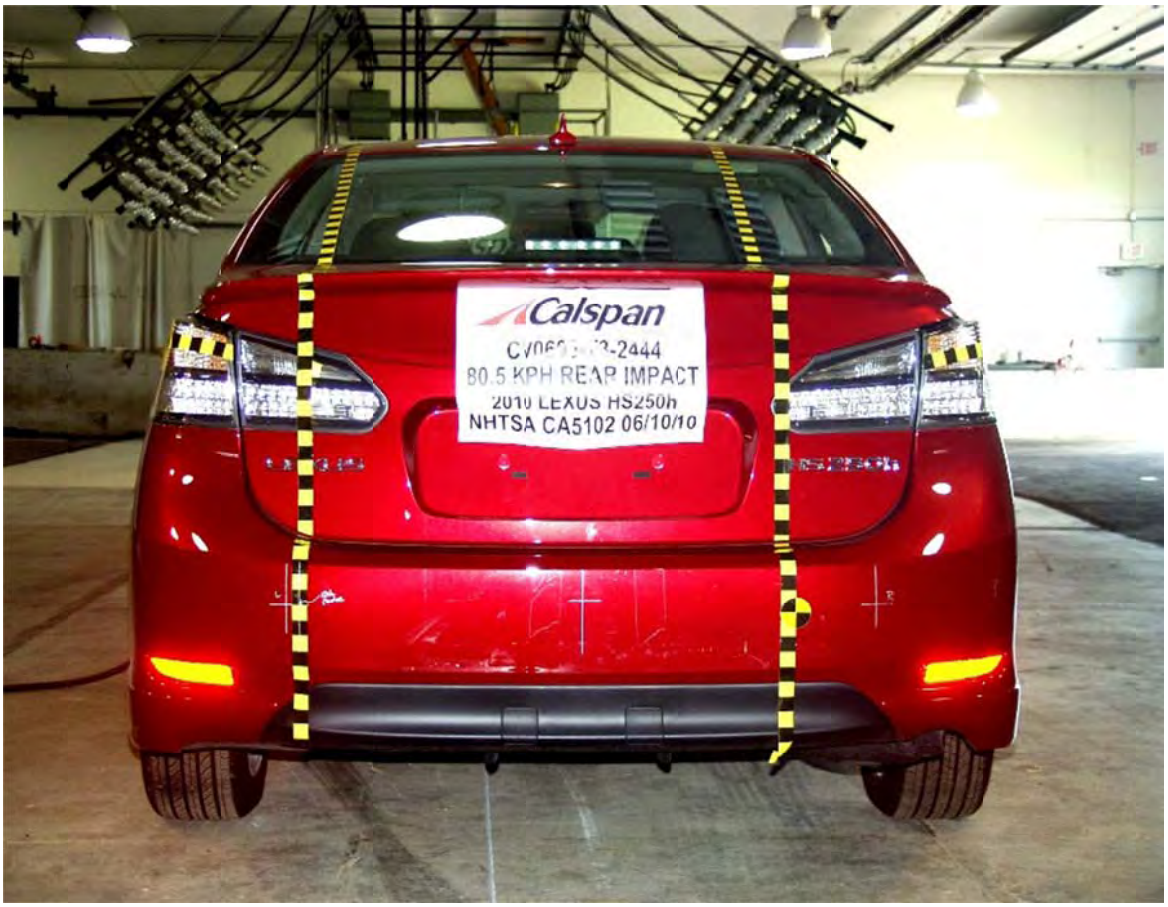


Figure A-17: Pre-Test Rear View

Figure A-18: Post-Test Rear View

Figure A-19: Pre-Test MDB Front View

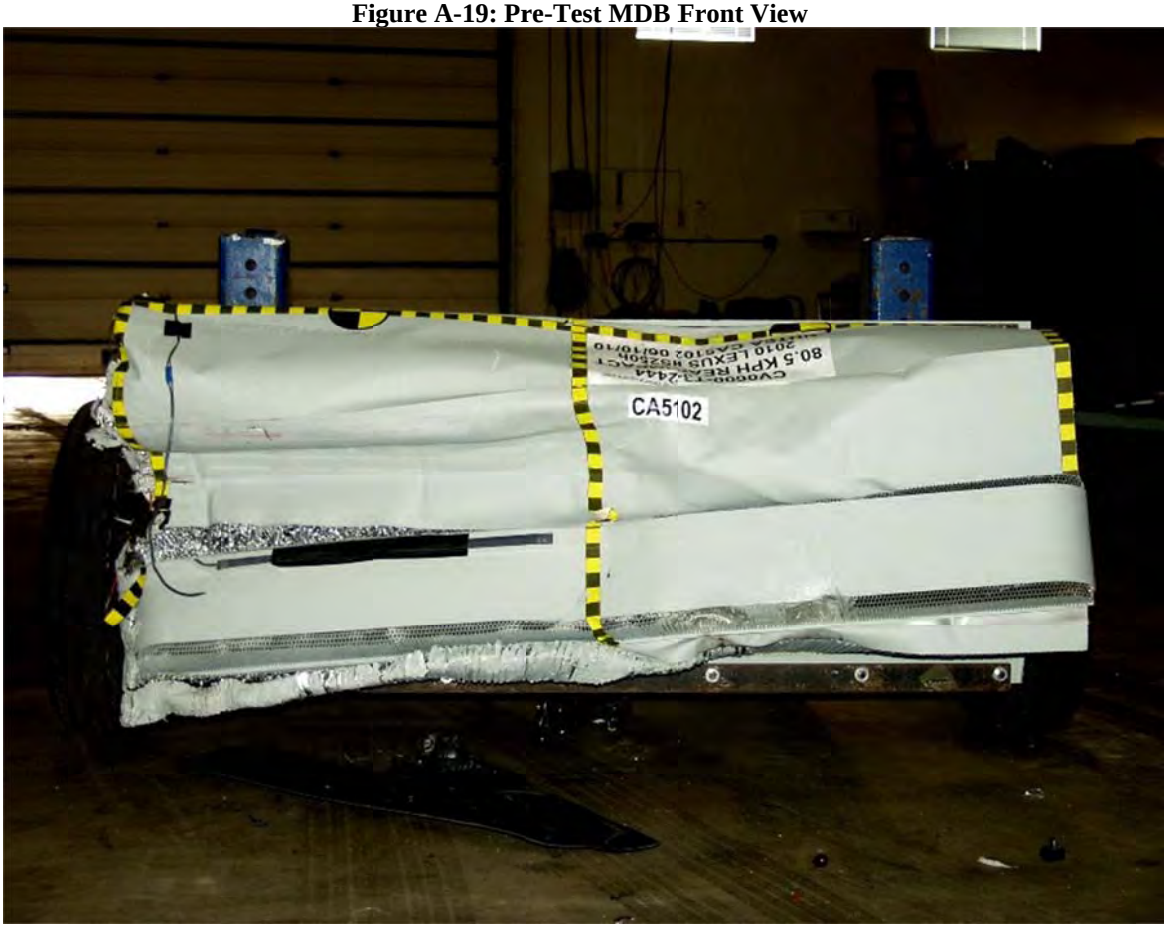


Figure A-20: Post-Test MDB Front View

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

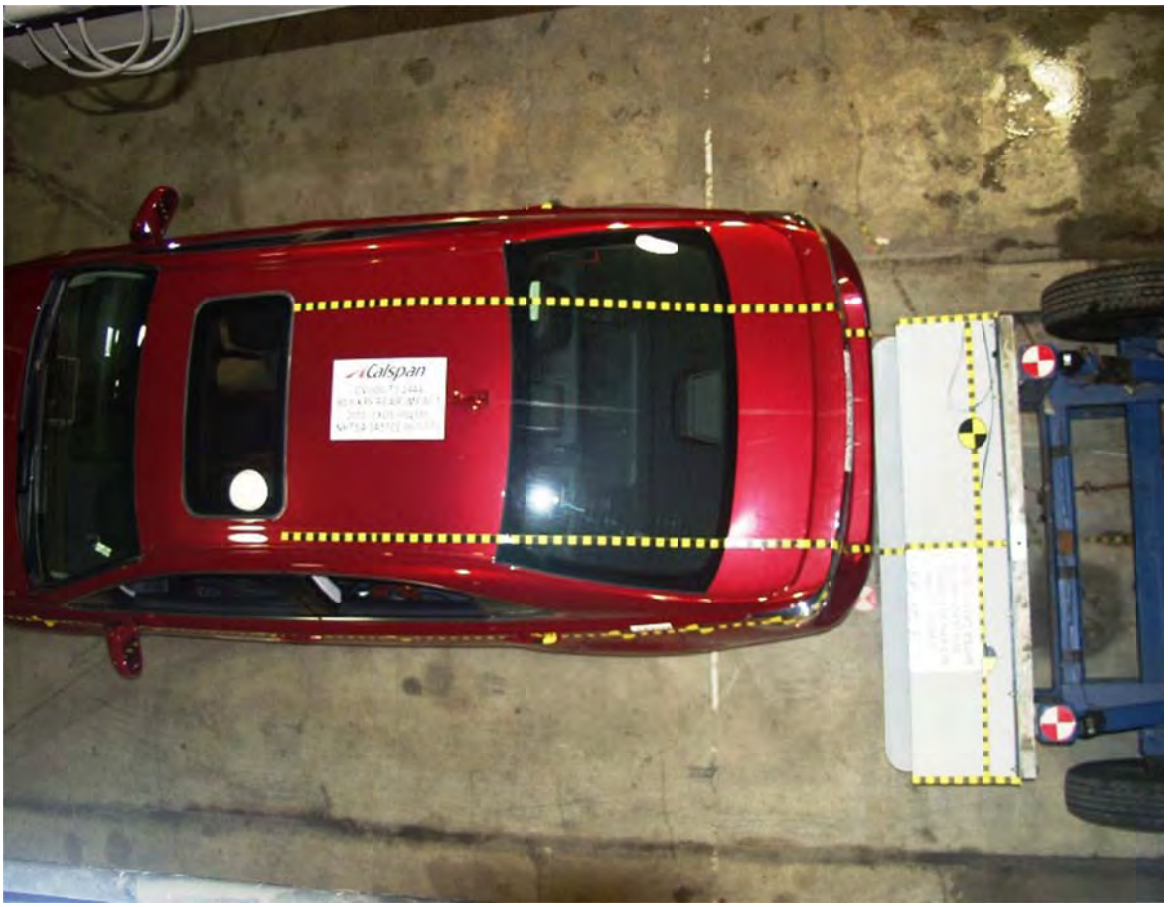


Figure A-27: Pre-Test Overhead Vehicle and MDB View

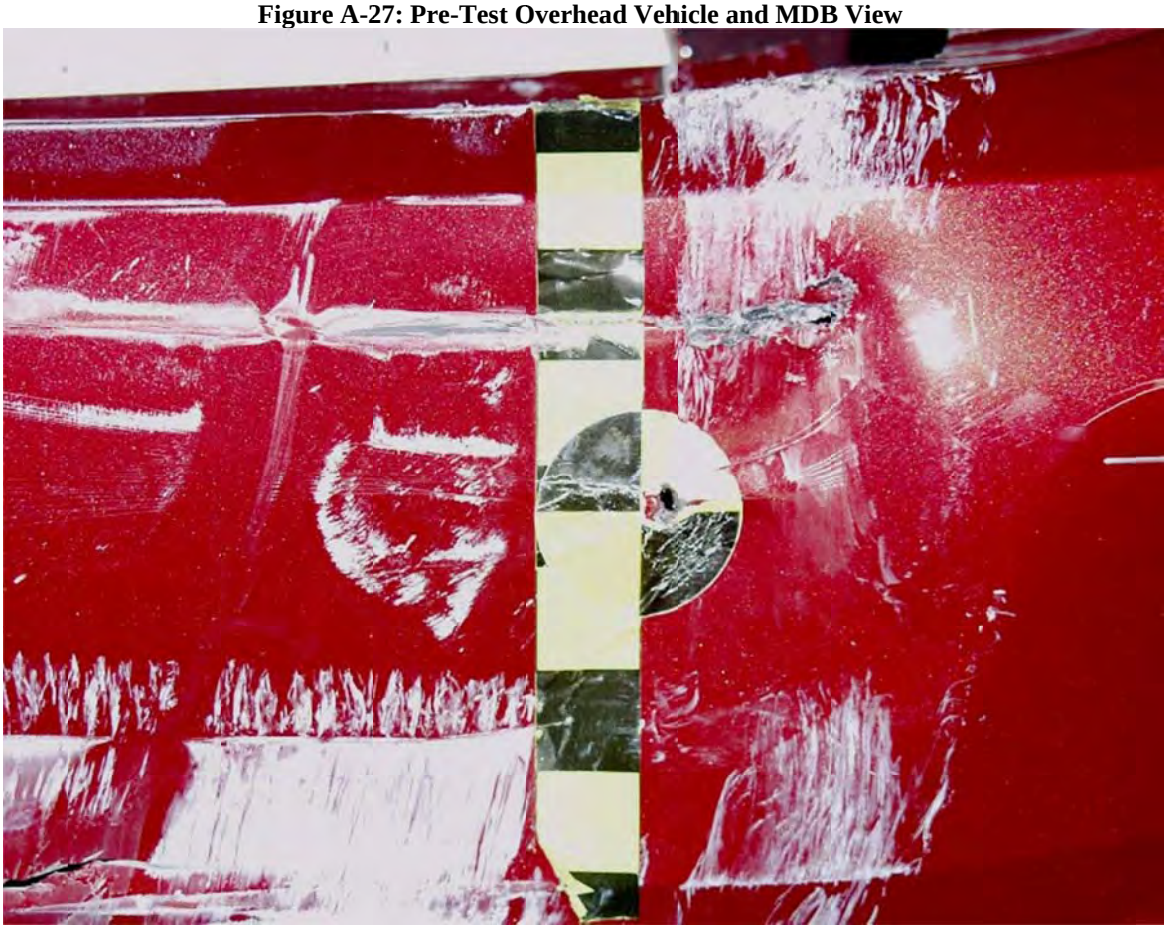


Figure A-28: Post-Test Impact Target View

Figure A-29: Pre-Test Front Underbody View

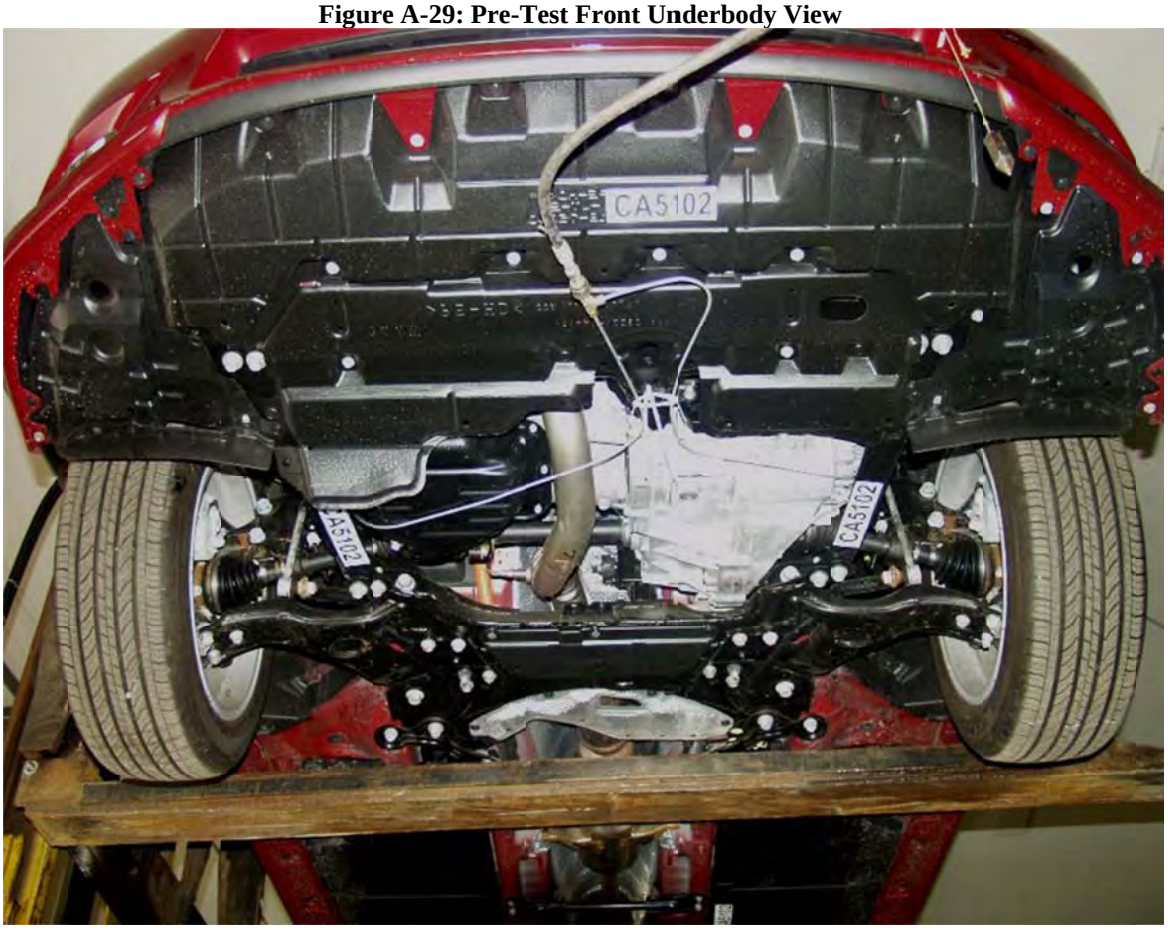


Figure A-30: Post-Test Front Underbody View

Figure A-31: Pre-Test Mid Underbody View

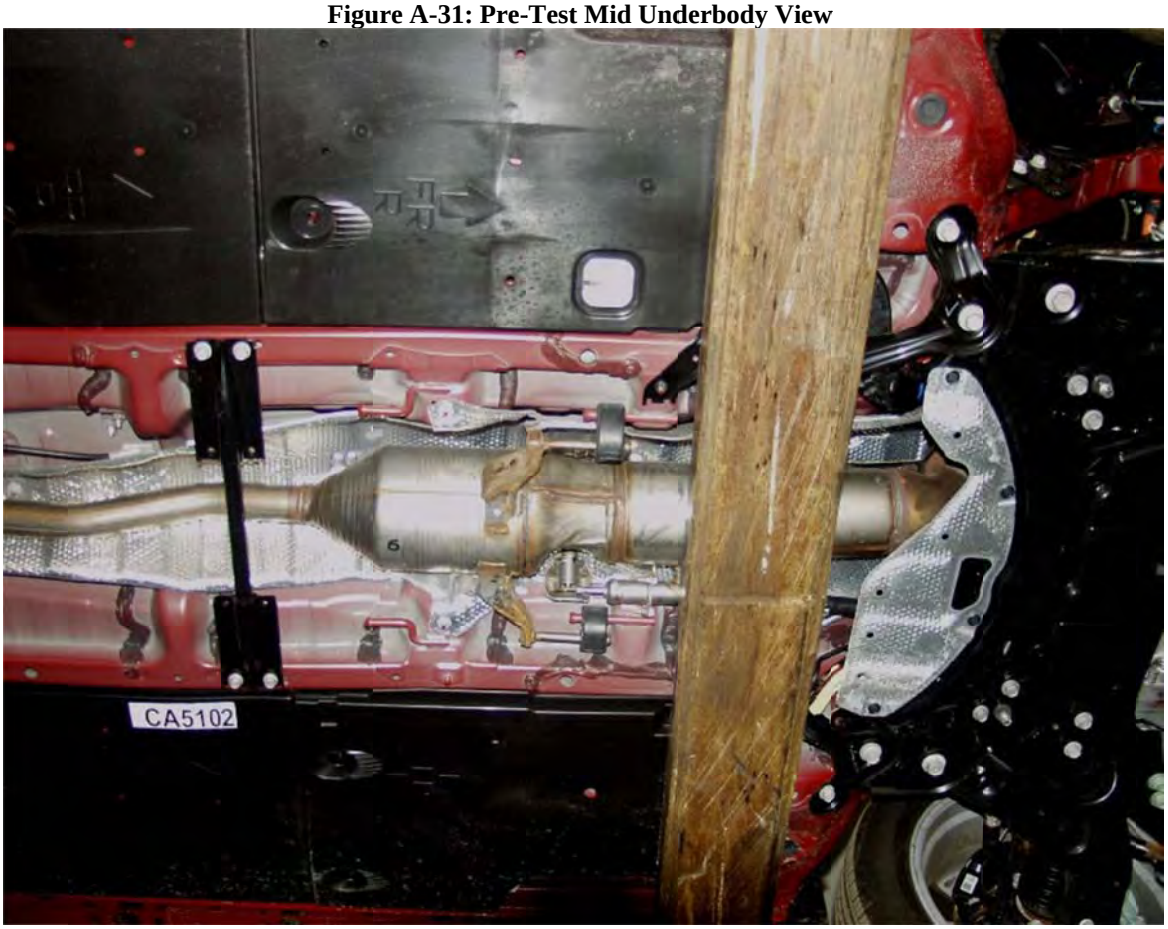


Figure A-32: Post-Test Mid Underbody View

Figure A-33:Pre-Test Rear Underbody View

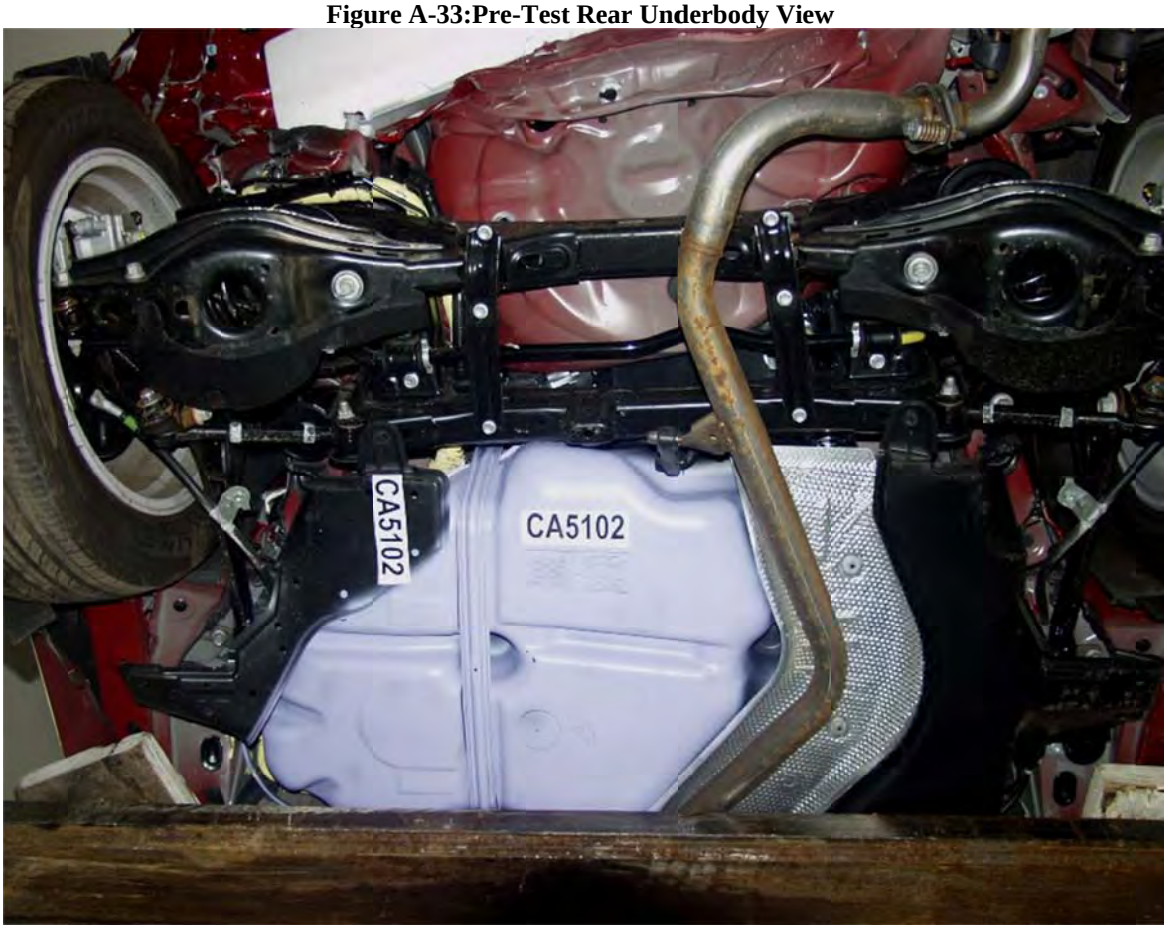


Figure A-34: Post-Test Rear Underbody View

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

Figure A-42: leak collection at 90°

REPORT OF VEHICLE CONDITION

Contract Number: DTNH22-06-C-00031 Date: 3/12/10
From:
To: Calspan

This vehicle was inspected upon delivery at the laboratory and was found to contain all the equipment listed below. This form should be submitted to Alpha Technology Associate, Inc. within 2 working days of the vehicle arrival. Any and all variances should be noted. Alpha Technology Associate, Inc. should be notified immediately if the received vehicle is not in good working order or is damaged. Submission of this form acknowledges that the vehicle was received in good working order and was undamaged.

NHTSA No.	CA5102
Model Year	2010
Make	Lexus
Model	250h
Body Style	Sedan
VIN	JTHBB1BA5A2014110
Body Color	Red
Delivery Date	3/12/2010
Odometer Reading (km/mi)	12
Dealer	Classic Lexus
Transmission	Auto
Final Drive	FWD
Type/No. Cylinders	4
Engine Displacement (L)	2.4
Engine Placement	Front
Roof Rack	no
Sunroof/T-Top	yes
Tinted Glass	yes
Traction Control	no
Power Brakes	yes
Front Disc	yes
Rear Disc	yes
Other	

Anti-Lock Brakes	yes
All-Wheel Drive	no
Power Steering	yes
Driver Front Airbag	yes
Driver Side Torso Airbag	
Driver Side Head Airbag	
Driver Curtain Airbag	yes
Driver Knee Airbag	yes
Driver Head/Torso Combo Airbag	
Rear Pass. Front Airbag	no
Rear Pass. Side Torso Airbag	
Rear Pass. Side Head Airbag	
Rear Pass. Curtain Airbag	yes
Rear Pass. Combo Airbag	
Pretensioners	yes
Load Limiters	
Air Conditioning	yes
AM/FM CD	yes
Tilt Steering	yes
Automatic Door Locks	yes
Power Windows	yes
Power Seats	yes
Other	

PLEASE LIST OTHER PERTINENT STANDARD OR OPTIONAL EQUIPMENT BELOW:

RECORDED BY: D.W.Hess DATE: 3/12/2010
APPROVED BY: P. Miller