REPORT NUMBER: 301-MGA-2011-001

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

KIA MOTORS CORPORATION
2011 KIA OPTIMA
NHTSA NUMBER: CB0506

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

Test Date: May 26, 2011

Final Report Date: June 15, 2011

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, S.E., NVS-220
WASHINGTON, D.C. 20590

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Prepared by: Joe Fleck
Joe Fleck, Project Engineer

Date: 6/1/11

Reviewed by: David Winkelbauer
David Winkelbauer, Facility Director

Date: 6/1/11

FINAL REPORT ACCEPTED BY:

Edward E. Chan

Digitally signed by Edward E. Chan
DN: cn=Edward E. Chan, o=National Highway Traffic Safety Administration, ou=Office of Vehicle Safety Compliance, email=ed.chan@dot.gov, c=US
Date: 2011.06.15 15:27:57 -04'00'

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Technical Report Documentation Page

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16. Abstract A rear impact was conducted on a 2011 Kia Optima at MGA Research Corporation on May 26, 2011. This test was conducted to obtain data indicant of FMVSS 301R. The impact velocity was 79.3 km/h. The ambient temperature at the time of impact was 12 degrees Celsius.			
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This rear impact test is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-C-00030. The purpose of this test is to reduce deaths and injuries occurring from fires that result from fuel spillage during and after motor vehicle crashes and resulting from ingestion of fuels during siphoning.

SUMMARY

A 2011 Kia Optima was impacted by a Moving Deformable Barrier (MDB) at a velocity of 79.3 km/h. The test was performed at MGA Research Corporation on May 26, 2011. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and five high-speed cameras were used to document the impact event.

- Left Rear Half 1000 fps
- Right Rear Half 1000 fps
- Overhead Overall 1000 fps
- Left Overall 1000 fps
- Right Overall 1000 fps
- Real Time Pan 30 fps

Two ballast Part 572E, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The vehicle appeared to comply with all the requirements of FMVSS No. 301 “Fuel System Integrity.”

SECTION 2

DATA SHEETS

DATA SHEET NO. 1

TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2011 Kia Optima NHTSA No.: CB0506
Test Program: FMVSS 301 Fuel System Integrity Test Date: 5/26/2011

TEST VEHICLE INFORMATION

Manufacturer	KIA Motors Corporation
Model	Optima
Body Style	Passenger Car
Major Options	None
NHTSA No.	CB0506
VIN	KNAGM4A76B5056405
Color	Spicy Red
Delivery Date	4/29/11
Odometer Reading (mile)	85
Dealer	Lafontaine Kia
Transmission	Manual
Final Drive	Front Wheel Drive
Number of Cylinders	4
Engine Displacement (L)	2.4
Engine Placement	Lateral

DATA FROM VEHICLE'S CERTIFICATION LABEL

Manufactured By	KIA Motor Corporation
Date of Manufacture	10/10

GVWR (kg)	1950
GAWR Front (kg)	1100
GAWR Rear (kg)	960

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				410
Number of Occupants x 68 kg.				340
Cargo Wt. (RCLW) (kg)				70

DATA SHEET NO. 1 (continued)

TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2011 Kia Optima NHTSA No.: CB0506
Test Program: FMVSS 301 Fuel System Integrity Test Date: 5/26/2011

DATA FROM VEHICLE'S TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	225	225
Recommended Tire Size	P205/65R16	P205/65R16
Recommended Load Range	94H	94H
Tire Size on Vehicle	P205/65R16	P205/65R16
Tire Manufacturer	Nexen	Nexen
Location of Placard of Vehicle	Lower B-Post	
Type of Spare Tire (full size/space saver)	Space Saver	

DATA SHEET NO. 2

PRE-TEST DATA

Test Vehicle: 2011 Kia Optima NHTSA No.: CB0506
Test Program: FMVSS 301 Fuel System Integrity Test Date: 5/26/2011

WEIGHT OF TEST VEHICLE

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	431.4	311.2		492.6	368.8	
Right	kg	433.2	298.0		484.0	339.3	
Ratio	%	58.7	41.3		58.0	42.0	
Totals	kg	864.6	609.2	1473.8	976.6	708.1	1684.7

CALCULATION OF TARGET TEST WEIGHT (TTW)

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1473.8
Rated Cargo/Luggage Weight (RCLW)	kg	70
Weight of 2 P572E ATDs	kg	148
Calculated Vehicle Target Weight (TVTW)	kg	1691.8

Vehicle Wheelbase	2800 mm
Vehicle Width	1834 mm
Weight of Ballast Secured in Rear Seat	72.6 kg
Method of Securing Ballast	Ratchet Straps
Vehicle Components Removed for Weight Reduction	None

VEHICLE ATTITUDES

	Units	LF	RF	LR	RR
As Delivered	mm	703	703	698	700
As Tested	mm	691	690	678	678

DATA SHEET NO. 2 (continued)

PRE-TEST DATA

Test Vehicle:	2011 Kia Optima	NHTSA No.:	CB0506
Test Program:	FMVSS 301 Fuel System Integrity	Test Date:	5/26/2011

FUEL SYSTEM DATA

	Units: Liters
Usable Capacity of "Standard Tank" (Owner's Manual)	70.0
Usable Capacity Figure Furnished by COTR	70.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	64.4 to 65.8
Actual Test Volume (entire fuel system filled)	65.1

Test Fluid Type	Stoddard Solvent
Test Fluid Kinematic Viscosity (centistokes)	2.1 cSt @ 20° C
Test Fluid Color	Purple
Type of Vehicle Fuel Pump	Electrical
Activate Electric Fuel Pump Operation with Ignition Switch ON, but Engine OFF	Yes

Comments (noticeable attributes of fuel system components, capacity, etc.)	None

DATA SHEET NO. 3

MOVING BARRIER DATA

Test Vehicle:	2011 Kia Optima	NHTSA No.:	CB0506
Test Program:	FMVSS 301 Fuel System Integrity	Test Date:	5/26/2011

MOVING BARRIER'S TEST WEIGHT

	Units	Front	Rear	Total
Left	kg	374.2	308.8	
Right	kg	389.5	291.2	
Ratio	%	56.0	44.0	
Totals	kg	763.7	600.0	1363.7

Tires (Mfr, line, size)	Kumho
Tire Pressure (kPa)	207
Brake Abort System (Yes/No)?	Yes
Date of Last Calibration	8/6/2008

DATA SHEET NO. 4

POST-TEST DATA

Test Vehicle: 2011 Kia Optima NHTSA No.: CB0506
Test Program: FMVSS 301 Fuel System Integrity Test Date: 5/26/2011

IMPACT VELOCITY

	Units: km/h
Required Impact Velocity	80.0
Actual Impact Velocity (Trap No. 1)	79.3
Actual Impact Velocity (Trap No. 2)	79.3
Average Impact Speed	79.3

Temperature at Time of Impact (°C)	12
Test Time	10:08 am

WELDING ROD IMPACT POINT

	Units: mm
Vertical distance from target center (+ above target / - below target)	17 up
Horizontal distance from target center (+ to the right / - to the left)	2 right

DATA SHEET NO. 5

STATIC ROLLOVER TEST DATA

Test Vehicle:	2011 Kia Optima	NHTSA No.:	CB0506
Test Program:	FMVSS 301 Fuel System Integrity	Test Date:	5/26/2011

STODDARD SOLVENT SPILLAGE MEASUREMENT

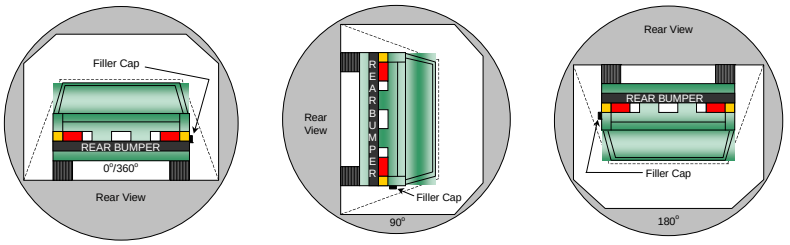
A. From impact until vehicle motion ceases: 0 g
(Maximum Allowable = 28 grams)

B. For the 5 minute period after motion ceases: 0 g
(Maximum Allowable = 28 grams)

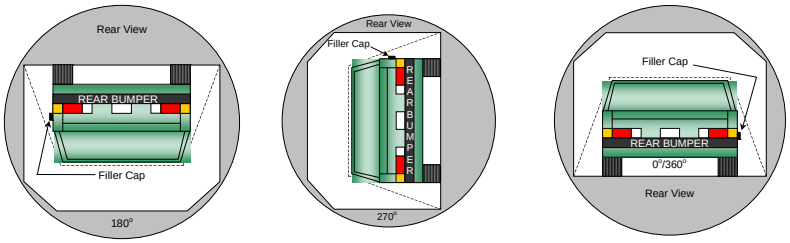
C. For the following 25 minutes: 0 g
(Maximum Allowable = 28 grams/minute)

D. Spillage: **None**

FMVSS 301 STATIC ROLLOVER DATA



0° to 90° 90° to 180°



180° to 270° 270° to 360°

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations: **Not Applicable**

DATA SHEET NO. 5 (continued)

STATIC ROLLOVER TEST DATA

Test Vehicle: 2011 Kia Optima NHTSA No.: CB0506
Test Program: FMVSS 301 Fuel System Integrity Test Date: 5/26/2011

STODDARD SOLVENT SPILLAGE MEASUREMENT
Hold Time = 5 minutes at all intervals

0° TO 90° Rotation Time (sec) = 117 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

90° TO 180° Rotation Time (sec) = 113 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

180° TO 270° Rotation Time (sec) = 107 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

270° TO 360° Rotation Time (sec) = 111 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

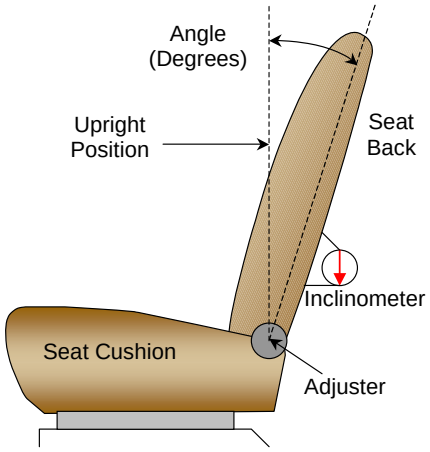
FORM 1

TEST VEHICLE INFORMATION

Test Vehicle:	2011 Kia Optima	NHTSA No.:	CB0506
Test Program:	FMVSS 301 Fuel System Integrity	Test Date:	5/26/2011

NORMAL DESIGN RIDING POSITION

With the seat in the mid fore-aft seat track position the angle of the driver's seat back when it is in the nominal riding position is set at a headrest post angle of 7.5 degrees.



FRONT SEAT ASSEMBLY

Driver Seat Back Angle	7.8°
Passenger Seat Back Angle	8.1°

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	24 detents	12th detent forward most, 1st as 0
Passenger Seat	24 detents	12th detent forward most, 1st as 0

D-RING ADJUSTMENT

The driver and passenger D-rings were full up.

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position.

APPENDIX A

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Vehicle's Certification Label

A-2.

Vehicle's Tire Placard

Pre-Test Front View of Vehicle

Post-Test Front View of Vehicle

Pre-Test Left Side View of Vehicle

Post-Test Left Side View of Vehicle

Pre-Test Left Rear Close-up View of Vehicle

Post-Test Left Rear Close-up View of Vehicle

Pre-Test Right Side View of Vehicle

Post-Test Right Side View of Vehicle

Pre-Test Right Rear Close-up View of Vehicle

Post-Test Right Rear Close-up View of Vehicle

Pre-Test Rear View of Vehicle

Post-Test Rear View of Vehicle

Pre-Test ¾ Frontal View From Right Side of Vehicle

Post-Test ¾ Frontal View From Right Side of Vehicle

Pre-Test ¾ Rear View From Right Side of Vehicle

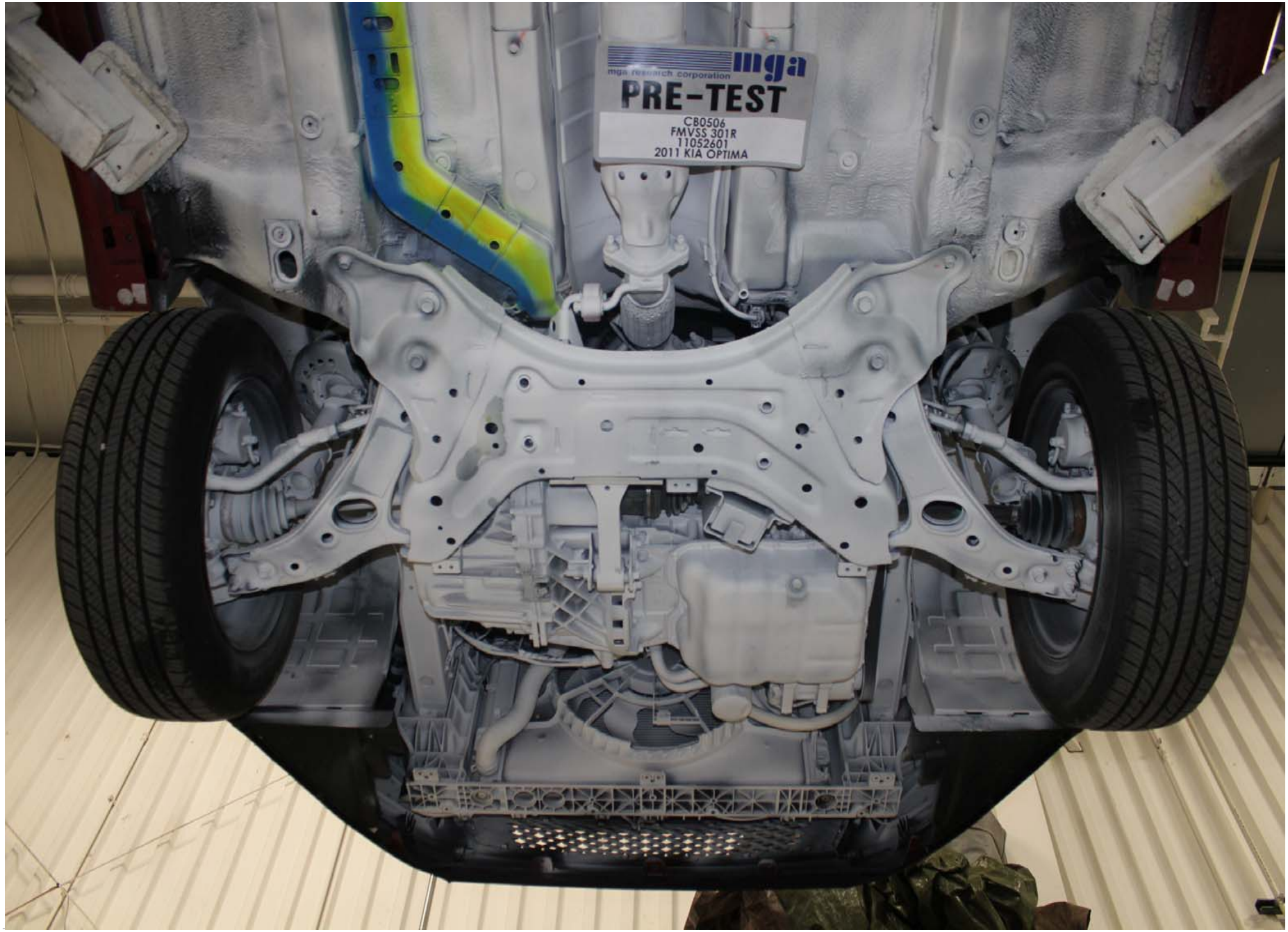
Post-Test ¾ Rear View From Right Side of Vehicle

Pre-Test ¾ Rear View From Left Side of Vehicle

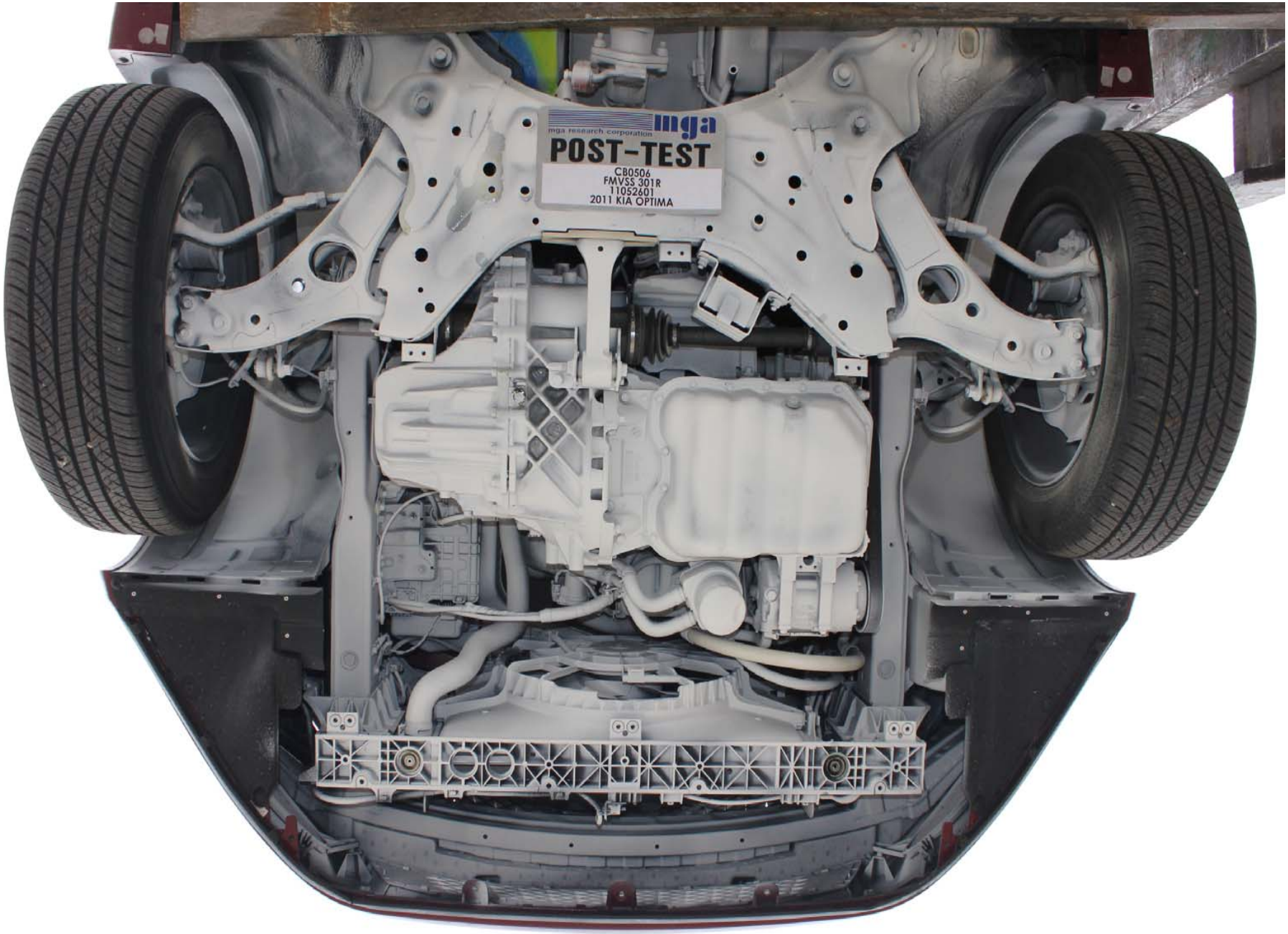
Post-Test ¾ Rear View From Left Side of Vehicle

Pre-Test Impact Point

Post-Test Impact Point

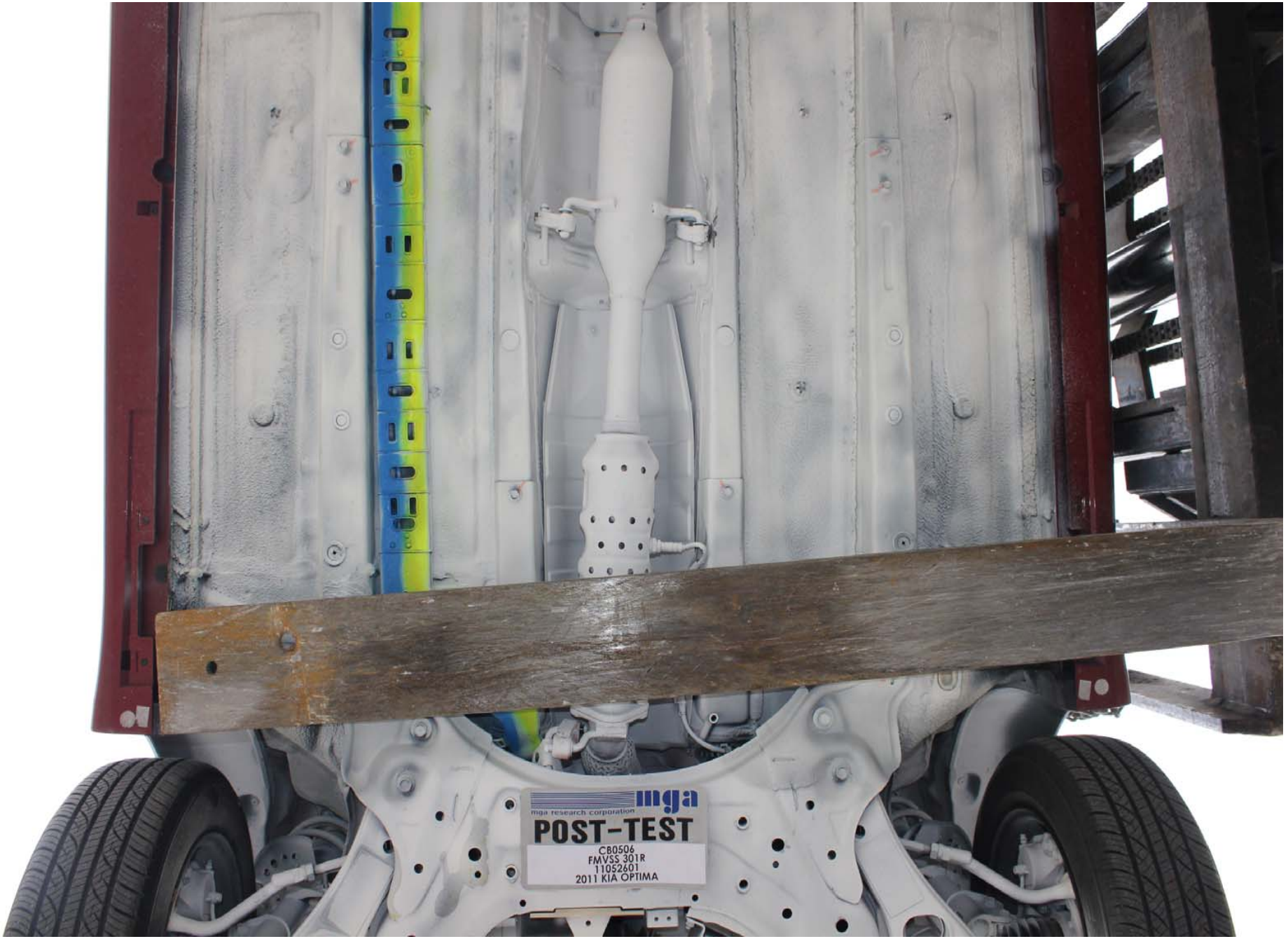


Pre-Test Underbody View 1

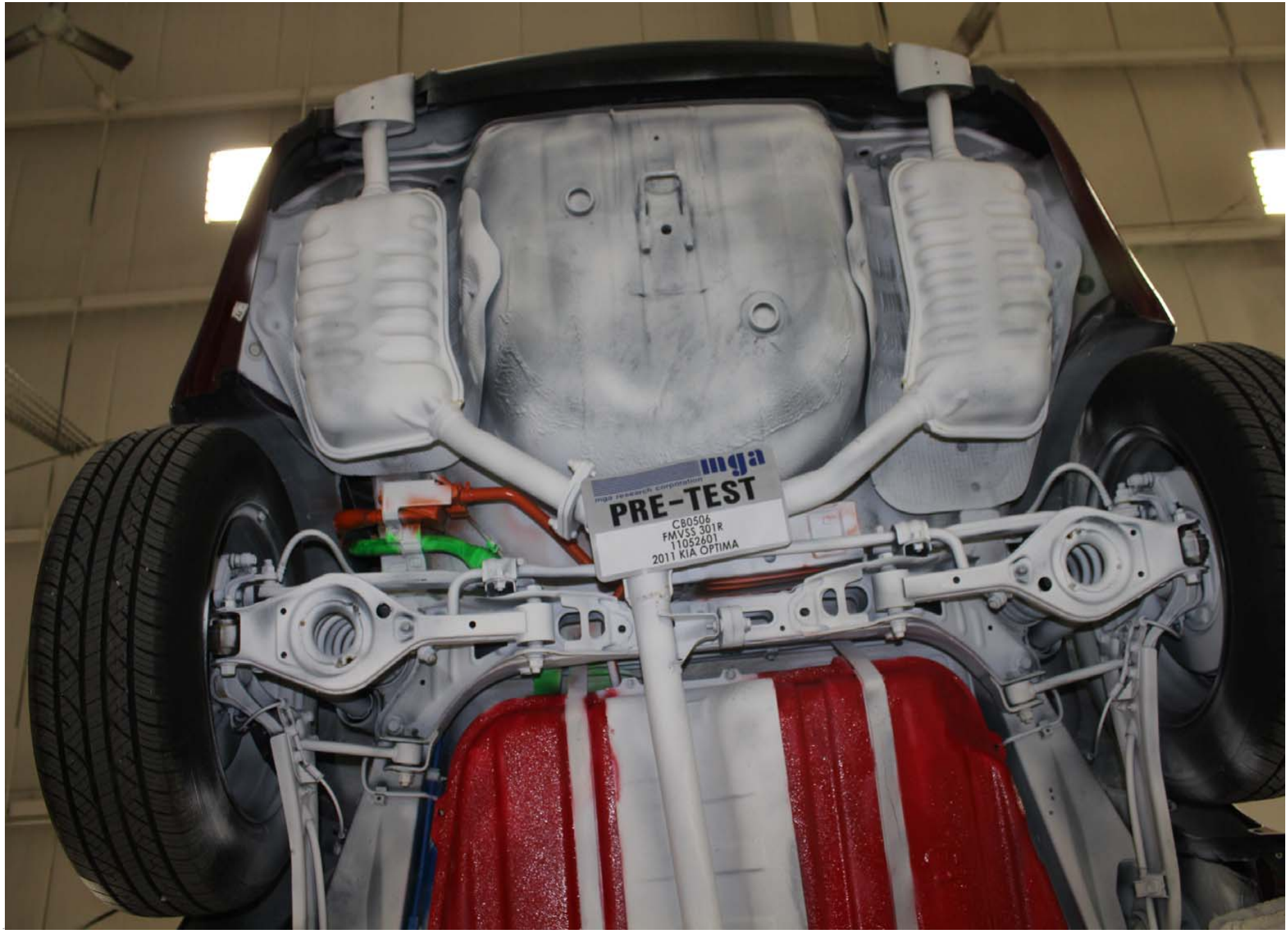


Post-Test Underbody View 1

Pre-Test Underbody View 2

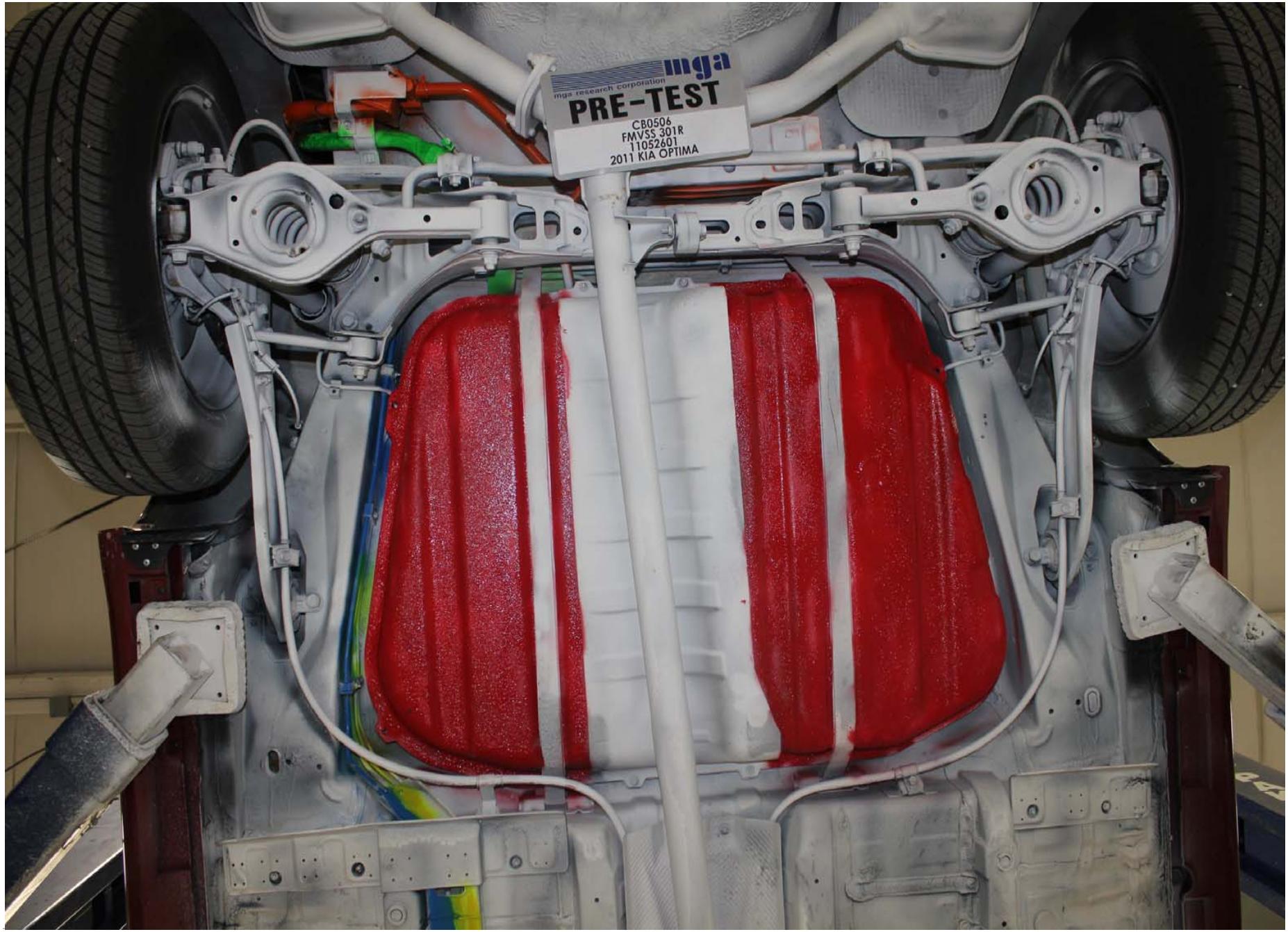


Post-Test Underbody View 2

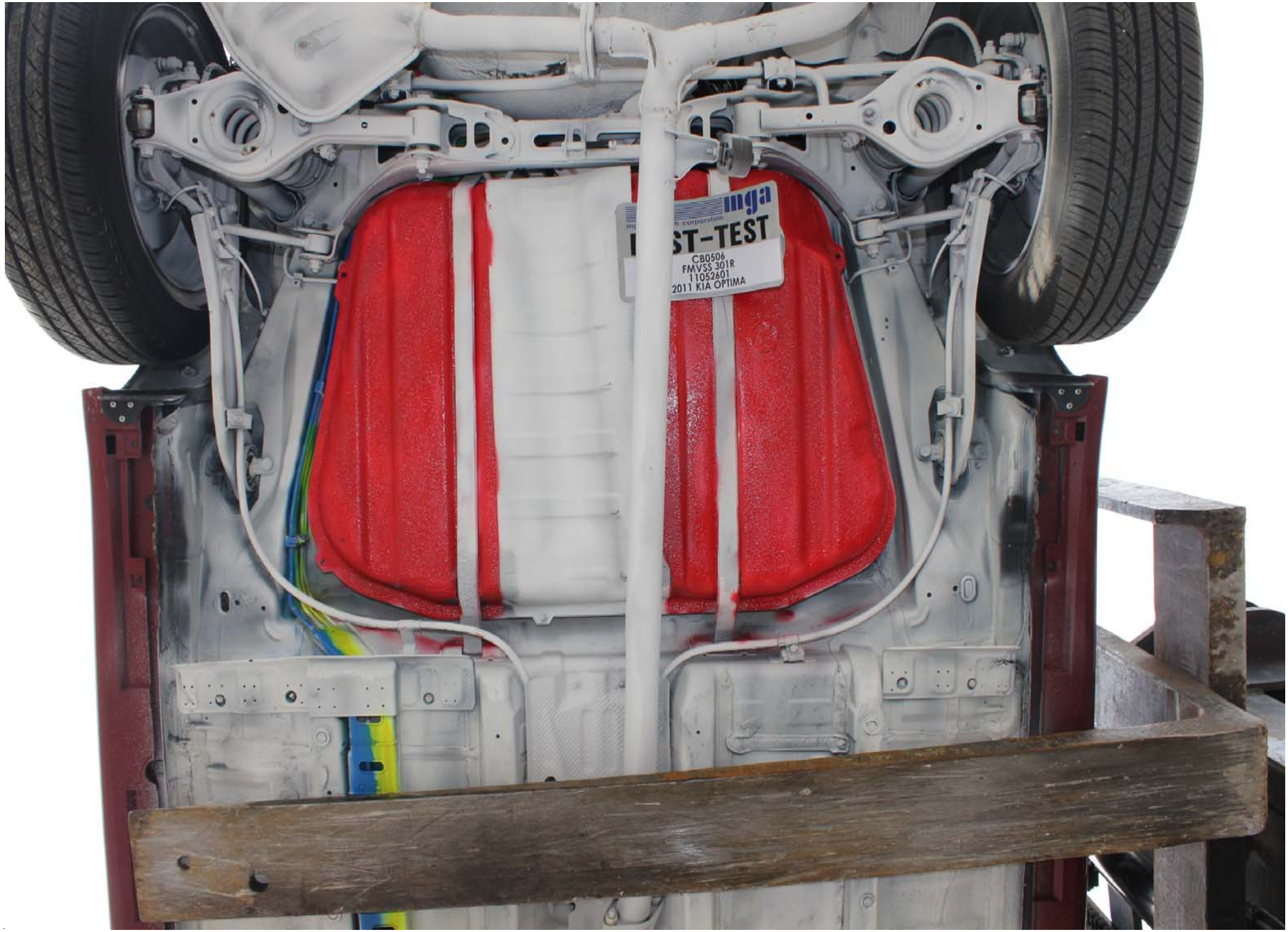


Pre-Test Underbody View 3

Post-Test Underbody View 3



Pre-Test Underbody View 4



Post-Test Underbody View 4

Pre-Test Front View of MDB

Post-Test Front View of MDB

Pre-Test ¾ Right Side View of MDB

Post-Test ¾ Right Side View of MDB

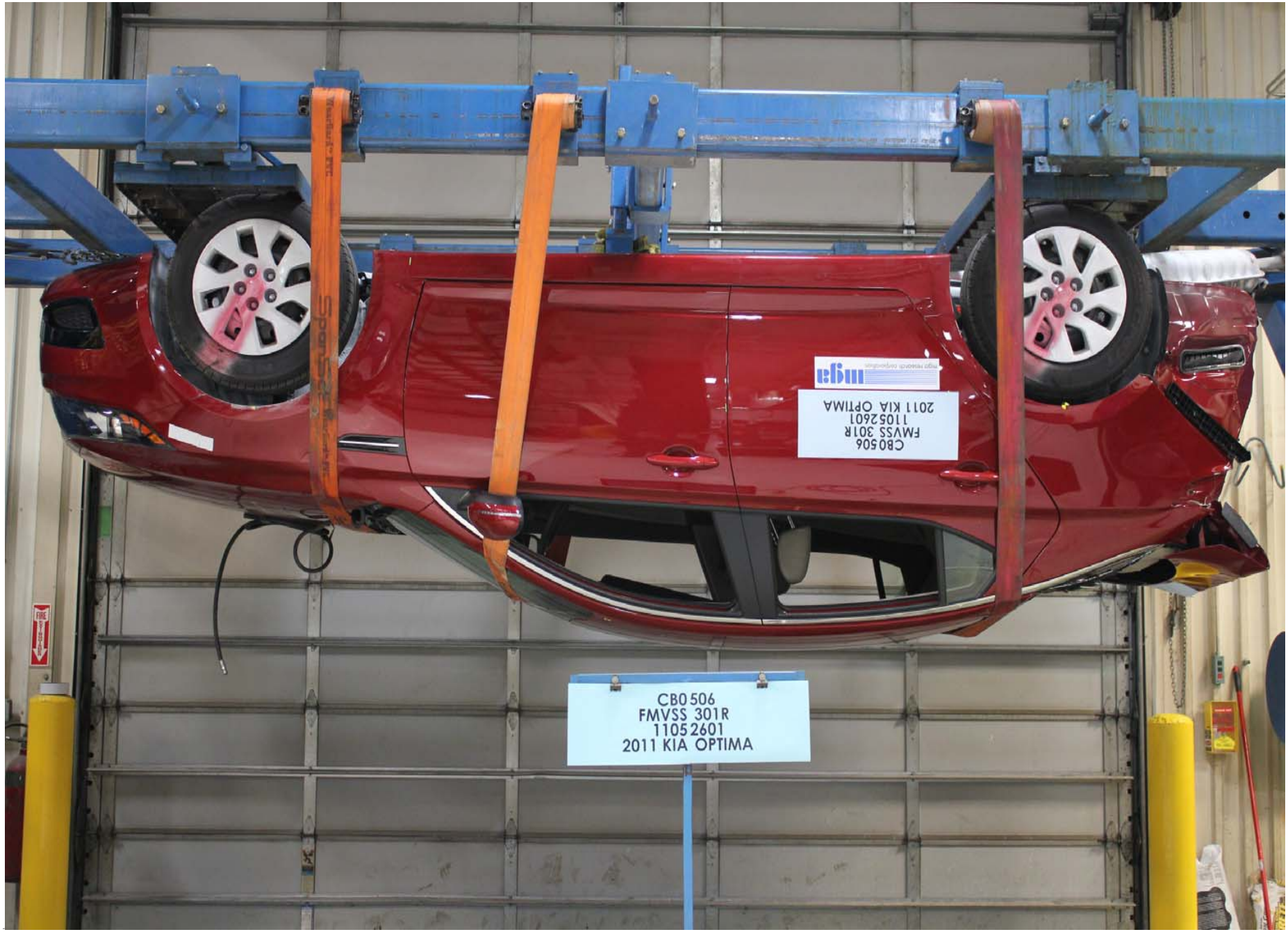
Pre-Test ¾ Left Side View of MDB

Post-Test ¾ Left Side View of MDB

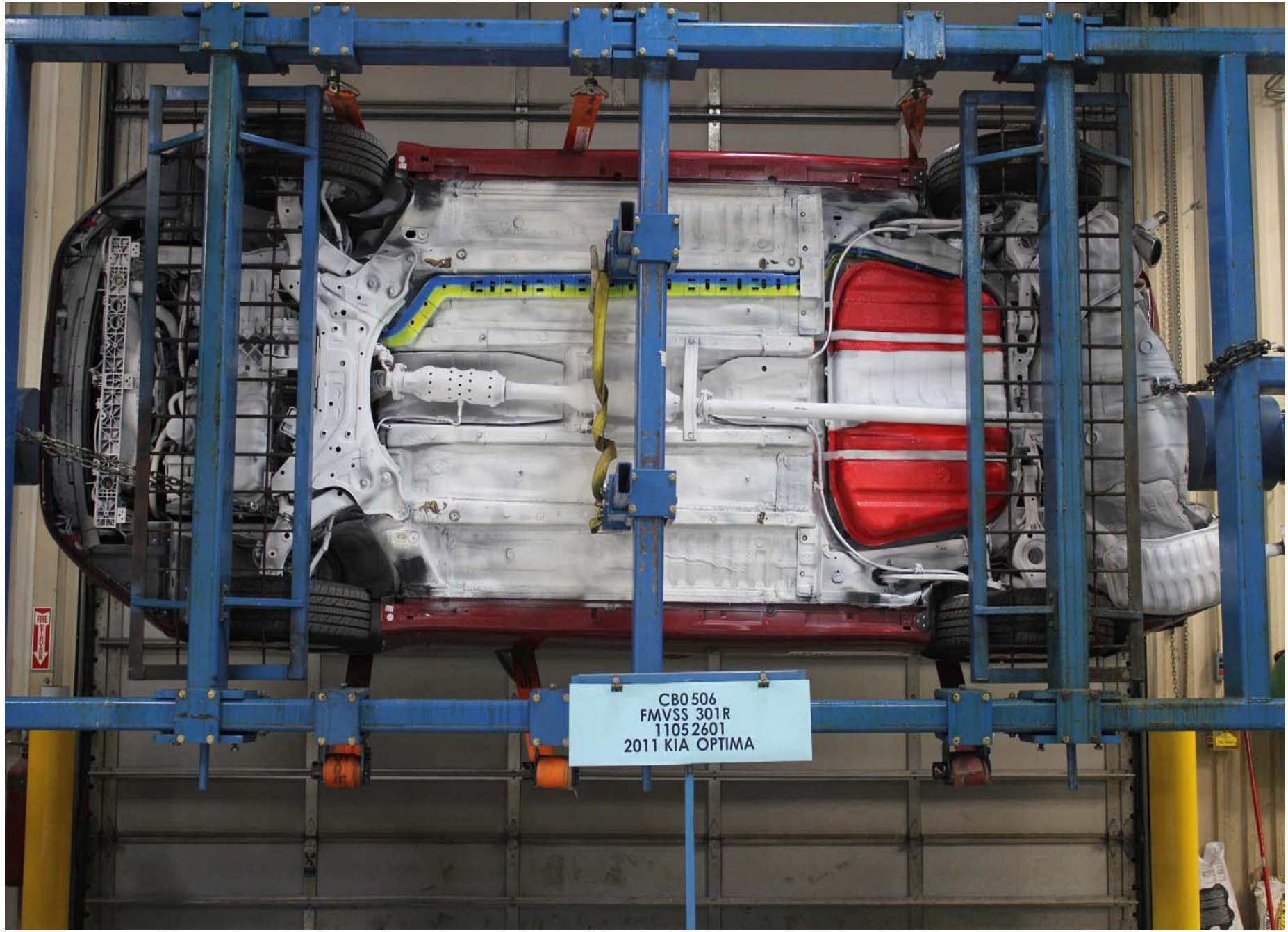
Pre-Test Top View of MDB

Post-Test Top View of MDB

Static Rollover at 90 Degrees



Static Rollover at 180 Degrees



Static Rollover at 270 Degrees

Static Rollover at 360 Degrees