

**REPORT NUMBER: TR-P36135-03-NC**  
**SAFETY COMPLIANCE TESTING FOR FMVSS 301R**  
**FUEL SYSTEM INTEGRITY – REAR IMPACT**  
**79.3 KM/H 70% OVERLAP REAR IMPACT**

**KIA MOTORS MANUFACTURING GEORGIA, INC.**  
**2016 KIA SORENTO 5-DOOR MPV**

**NHTSA NUMBER: C20164200**

**PREPARED BY:**  
**KARCO ENGINEERING, LLC.**  
**9270 HOLLY ROAD**  
**ADELANTO, CA 92301**



**TEST DATE:**  
**JUNE 7, 2016**

**REPORT DATE:**  
**JUNE 21, 2016**  
**FINAL REPORT**

**U.S. DEPARTMENT OF TRANSPORTATION**  
**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**  
**ENFORCEMENT**  
**OFFICE OF VEHICLE SAFETY COMPLIANCE**  
**ROOM 6111, NVS-220**  
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Approval Date: June 21, 2016

FINAL REPORT ACCEPTANCE BY OVSC:

\_\_\_\_\_

Date: \_\_\_\_\_

# **TECHNICAL REPORT DOCUMENTATION PAGE**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                 |  |                                                                                           |                  |
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| <b>4. Title and Subtitle</b><br>Final Report of FMVSS 301R<br>70% Overlap Rear Impact Testing of a 2016 Kia Sorento 5-door MPV<br>NHTSA No. C20164200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                                 |  | <b>5. Report Date</b><br>June 21, 2016                                                    |                  |
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| <b>9. Performing Organization Name and Address</b><br>KARCO Engineering, LLC.<br>9270 Holly Rd.<br>Adelanto, CA 92301                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                                 |  | <b>10. Work Unit No.</b>                                                                  |                  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                 |  | <b>14. Sponsoring Agency Code</b>                                                         |                  |
| <b>15. Supplementary Notes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                 |  |                                                                                           |                  |
| <b>16. Abstract</b><br><p>A 79.3 km/h 70% overlap rear impact test was conducted on the subject 2016 Kia Sorento 5-door MPV in accordance with the specifications of the Office of Vehicle Safety Compliance Laboratory Test Procedure for FMVSS 301R. The test was conducted at the KARCO Engineering, LLC. facility in Adelanto, California on June 7, 2016.</p> <p>The impact velocity was 79.64 km/h and the outside ambient temperature was 35 deg. C. There was no Stoddard solvent leakage immediately after the test or during any portion of the static rollover. Upon post test inspection, it was noted that the fuel filler cap unfastened. Pictures for the fuel filler cap can be found in Appendix A of this report. The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity- Rear Impact".</p> |  |                                                                 |  |                                                                                           |                  |
| <b>17. Key Words</b><br>FMVSS 301R<br>70% Overlap Rear Impact<br>MDB<br>2016 Kia Sorento 5-Door MPV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                                 |  | <b>18. Distribution Statement</b>                                                         |                  |
| <b>19. Security Classification of this report</b><br>UNCLASSIFIED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | <b>20. Security Classification of this page</b><br>UNCLASSIFIED |  | <b>21. No. of Pages</b><br>37                                                             | <b>22. Price</b> |

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## **SECTION 1**

### **SUMMARY OF TEST**

#### **SUMMARY**

The purpose of this rear impact test is to measure the performance of the subject vehicle, a 2016 Kia Sorento 5-door MPV, for FMVSS 301R “Fuel System Integrity – Rear Impact”.

This 79.3 km/h 70% Overlap Rear Impact is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-11-D-00245. It was conducted in accordance with the Office of Vehicle Safety Compliance Laboratory Test Procedure TP-301R-02 for FMVSS 301R “Fuel System Integrity – Rear Impact”, dated January, 2007.

The test was performed at KARCO Engineering, LLC. on June 7, 2016. Pre- and post- test photographs of the vehicle and ATD's can be found in Appendix A of this report.

Two (2) real-time cameras and three (3) high-speed cameras were used to document the rear impact event.

Two Part 572E 50<sup>th</sup> percentile male anthropomorphic test devices (ATD) were placed in the driver and right front passenger seating positions. Both ATD's were not instrumented for this test.

There was no Stoddard solvent leakage after the impact or during any portion of the static rollover. Upon post test inspection, it was noted that the fuel filler cap unfastened. Pictures for the fuel filler cap can be found in Appendix A of this report. The test vehicle appeared to comply with all requirements of FMVSS 301R “Fuel System Integrity – Rear Impact”. FMVSS 301 data is summarized in Data Sheets 4 and 5.

**SECTION 2**  
**DATA SHEETS**

Test Vehicle: 2016 Kia Sorento 5-Door MPV NHTSA No.: C20164200  
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 6/7/16

**CONVERSION FACTORS**

| Quantity           | Typical Application | Std Units           | Metric Unit | Multiply By       |
|--------------------|---------------------|---------------------|-------------|-------------------|
| Mass               | Vehicle Weight      | lb                  | kg          | 0.4536            |
| Linear Velocity    | Impact Velocity     | miles/hr            | km/hr       | 1.609344          |
| Length or Distance | Measurements        | in                  | mm          | 25.4              |
| Volume             | Fuel Systems        | gal                 | liter       | 3.785             |
| Volume             | Small Fluids        | oz                  | mL          | 29.574            |
| Pressure           | Tire Pressures      | lbf/in <sup>2</sup> | kPa         | 6.895             |
| Temperature        | General Use         | °F                  | °C          | $=(T_f - 32)/1.8$ |
| Force              | Dynamic Forces      | lbf                 | N           | 4.448             |
| Moment             | Torque              | lbf-ft              | N•m         | 1.355             |

## DATA SHEET NO. 1

### TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2016 Kia Sorento 5-Door MPV NHTSA No.: C20164200  
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 6/7/16

### TEST VEHICLE INFORMATION AND OPTIONS

|                             |                   |
|-----------------------------|-------------------|
| NHTSA Number                | C20164200         |
| Model Year                  | 2016              |
| Make                        | Kia               |
| Model                       | Sorento           |
| Body Style                  | 5-Door MPV        |
| VIN                         | 5XYPG4A3XGG035790 |
| Body Color                  | Titanium Silver   |
| Odometer Reading (km / mi)  | 394 / 245         |
| Engine Displacement (L)     | 2.4               |
| Type / No. of Cylinders     | Inline 4          |
| Engine Placement            | Transverse        |
| Transmission Type           | Automatic         |
| Transmission Speeds         | 6                 |
| Overdrive                   | Yes               |
| Final Drive                 | FWD               |
| Roof Rack                   | No                |
| Sunroof / T-Top             | No                |
| Running Boards              | No                |
| Tilt Steering Wheel         | Yes               |
| Power Seats                 | No                |
| Anti-Lock Brakes (ABS)      | Yes               |
| Automatic Door Locks (ADLs) | Yes               |

|                                    |     |
|------------------------------------|-----|
| Traction Control System            | Yes |
| Power Steering                     | Yes |
| Power Window Auto-Reverse          | Yes |
| Driver Frontal Airbag              | Yes |
| Driver Curtain Airbag              | Yes |
| Driver Head/Torso Airbag           | No  |
| Driver Torso Airbag                | No  |
| Driver Torso/Pelvis Airbag         | Yes |
| Driver Pelvis Airbag               | No  |
| Driver Knee Airbag                 | No  |
| Front Pass. Frontal Airbag         | Yes |
| Front Pass. Curtain Airbag         | Yes |
| Front Pass. Head/Torso Airbag      | No  |
| Front Pass. Torso Airbag           | No  |
| Front Pass. Torso/Pelvis Airbag    | Yes |
| Front Pass. Pelvis Airbag          | No  |
| Front Pass. Knee Airbag            | No  |
| Driver Seat Belt Pretensioner      | Yes |
| Driver Load Limiter                | Yes |
| Front Pass. Seat Belt Pretensioner | Yes |
| Front Pass. Load Limiter           | Yes |
| Other                              | No  |

Does Owner's Manual provide instructions to turn off automatic door locks?

Yes

### DATA FROM CERTIFICATION LABEL

|                     |                                           |
|---------------------|-------------------------------------------|
| Manufactured By     | Kia Motors Manufacturing<br>Georgia, Inc. |
| Date of Manufacture | Mar-15                                    |

|                  |      |
|------------------|------|
| GVWR (lbs)       | 5026 |
| GAWR Front (lbs) | 2976 |
| GAWR Rear (lbs)  | 3075 |

### VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

| Measured Parameter          | Front  | Rear  | Third | Total |     |
|-----------------------------|--------|-------|-------|-------|-----|
| Type of Seats               | Bucket | Bench |       |       |     |
| Designated Seating Capacity | 2      | 3     |       | 5     |     |
| Capacity Weight (VCW) (kg)  |        |       |       | 420.0 | A   |
| DSC x 68 (kg)               |        |       |       | 340.0 | B   |
| Cargo Weight (RCLW) (kg)    |        |       |       | 80.0  | A-B |

## DATA SHEET NO. 1 ... (CONTINUED)

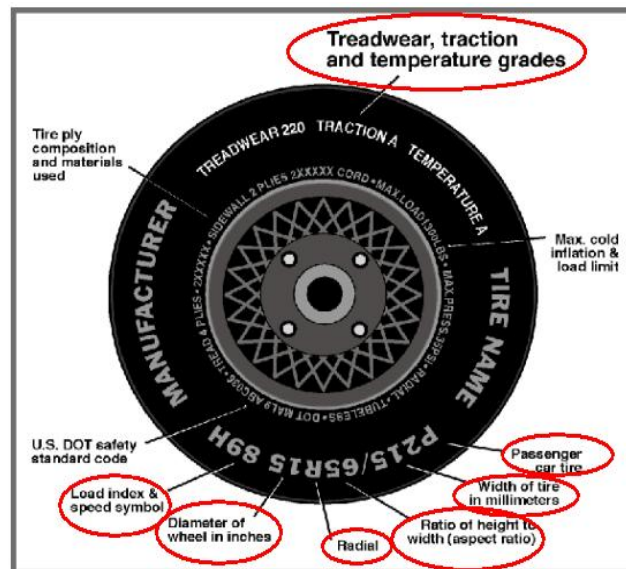
### TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2016 Kia Sorento 5-Door MPV

NHTSA No.: C20164200

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 6/7/16



### VEHICLE TIRE INFORMATION

| Measured Parameter                  | Front                            | Rear                             |
|-------------------------------------|----------------------------------|----------------------------------|
| Max Tire Pressure (kPa)             | 350                              | 350                              |
| Cold Tire Pressure (kPa)            | 235                              | 235                              |
| Max Load Tire Pressure (kPa)        | 235                              | 235                              |
| Recommended Tire Size               | P235/65R17                       | P235/65R17                       |
| Tire Size on Vehicle                | P235/65R17                       | P235/65R17                       |
| Tire Manufacturer                   | Hancock                          | Hancock                          |
| Tire Model                          | Dynapro HP2                      | Dynapro HP2                      |
| Load Range                          | 900                              | 900                              |
| Treadwear Rating                    | 540                              | 540                              |
| Traction Rating                     | A                                | A                                |
| Temperature Grades                  | A                                | A                                |
| Tire Plies Sidewall                 | 2 Polyester                      | 2 Polyester                      |
| Tire Plies Body                     | 2 Steel, 2 Polyester,<br>1 Nylon | 2 Steel, 2 Polyester,<br>1 Nylon |
| Load Index/Speed Symbol             | 104H                             | 104H                             |
| Tire Material                       | Steel, Polyester, Nylon          | Steel, Polyester, Nylon          |
| DOT Safety Code Left                | 5M8R RT H                        | 5M8R RT H                        |
| DOT Safety Code Right               | 5M8R RT H                        | 5M8R RT H                        |
| Type of Spare Tire                  | T165/90R17                       |                                  |
| Location of Tire Placard on Vehicle | Driver B-Pillar                  |                                  |

**DATA SHEET NO. 2****PRE-TEST DATA**Test Vehicle: 2016 Kia Sorento 5-Door MPVNHTSA No.: C20164200Test Program: 79.3 km/h 70% Overlap Rear ImpactTest Date: 6/7/16**TEST VEHICLE AXLE WEIGHTS**

|       | Units | As Delivered (UVW) |       |        | As Tested (ATW) |       |        | Fully Loaded |       |        |
|-------|-------|--------------------|-------|--------|-----------------|-------|--------|--------------|-------|--------|
|       |       | Front              | Rear  | Total  | Front           | Rear  | Total  | Front        | Rear  | Total  |
| Left  | kg    | 500.0              | 373.5 | 873.5  | 540.0           | 417.5 | 957.5  | 536.5        | 449.0 | 985.5  |
| Right | kg    | 470.5              | 339.5 | 810.0  | 538.5           | 407.0 | 945.5  | 507.0        | 417.5 | 924.5  |
| Ratio | %     | 57.6%              | 42.4% | 100.0% | 56.7%           | 43.3% | 100.0% | 54.6%        | 45.4% | 100.0% |
| Total | kg    | 970.5              | 713.0 | 1683.5 | 1078.5          | 824.5 | 1903.0 | 1043.5       | 866.5 | 1910.0 |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                  | Units | Value  |       |
|-------------------------------------|-------|--------|-------|
| Total Delivered Weight (UVW)        | kg    | 1683.5 | A     |
| Actual Weight of 2 P572 ATDs Used   | kg    | 148.0  | B     |
| Rated Cargo/Luggage Wt (RCLW)       | kg    | 80.0   | C     |
| Calculated Vehicle Target Wt (TVTW) | kg    | 1911.5 | A+B+C |

**TEST VEHICLE ATTITUDES**

| Condition    | Units | LF  | RF  | LR  | RR  | CG Aft of Front Axle |
|--------------|-------|-----|-----|-----|-----|----------------------|
| As Delivered | mm    | 868 | 876 | 874 | 882 | 1175                 |
| As Tested    | mm    | 850 | 863 | 863 | 862 | 1202                 |
| Fully Loaded | mm    | 858 | 869 | 851 | 857 | 1259                 |
| Post-Test    | mm    | 845 | 66  | 896 | 874 |                      |

**GENERAL TEST VEHICLE DATA**

| Measured Parameter                      | Units | Value |
|-----------------------------------------|-------|-------|
| Total Vehicle Wheel Base                | mm    | 2775  |
| Total Vehicle Length                    | mm    | 4740  |
| Total Vehicle Width                     | mm    | 1890  |
| Amount of Stoddard Solvent in Fuel Tank | L     | 66.01 |

**DATA SHEET NO. 2... (CONTINUED)****PRE-TEST DATA**

Test Vehicle: 2016 Kia Sorento 5-Door MPV NHTSA No.: C20164200  
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 6/7/16

**BALLAST DATA**

| Description                          | Value                     |
|--------------------------------------|---------------------------|
| Type of Ballast                      | Sand Bottle Dummies       |
| Method of Securing Ballast           | Belted into the rear seat |
| Weight of Ballast                    | 53.5 kg                   |
| Weight of Vehicle Components Removed | 0.0 kg                    |

**VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:**

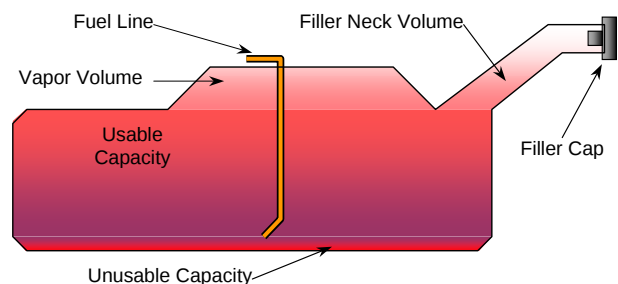
No vehicle components were removed

**FUEL TANK CAPACITY**

| Description                                  | Liters        |
|----------------------------------------------|---------------|
| Fuel System Capacity Listed in Owners Manual | 70.98         |
| Usable Capacity of "Standard Tank"           | 70.98         |
| 91 - 94% of Usable Capacity                  | 64.59 - 66.72 |
| Actual Amount of Stoddard Solvent Used       | 66.01         |

**FUEL PUMP**

The vehicle is equipped with an electric fuel pump. The fuel pump operates when the vehicle is running. The fuel pump starts when the ignition is on.



VEHICLE FUEL TANK ASSEMBLY

**TEST FLUID**

| Description                    | Value            |
|--------------------------------|------------------|
| Test Fluid Type                | Stoddard Solvent |
| Test Fluid Specific Gravity    | 0.76             |
| Test Fluid Kinematic Viscosity |                  |
| Test Fluid Color               | Purple           |

## DATA SHEET NO. 2... (CONTINUED)

### PRE-TEST DATA

Test Vehicle: 2016 Kia Sorento 5-Door MPV

NHTSA No.: C20164200

Test Program: 79.3 km/h 70% Overlap Rear Impact

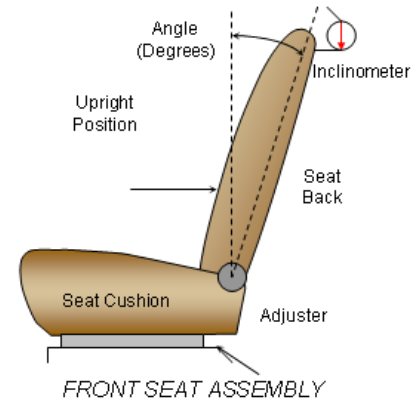
Test Date: 6/7/16

### NOMINAL DESIGN RIDING POSITION

Seat back angle is measured a digital inclinometer on the head rest post.

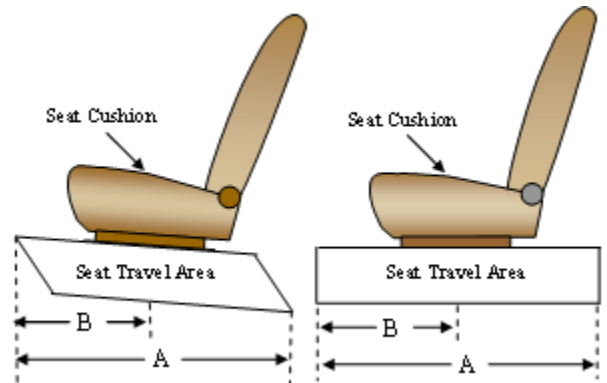
#### SEAT BACK ANGLE

| Seating Position          | Degrees |
|---------------------------|---------|
| Driver Seat Back Angle    | 1.7     |
| Passenger Seat Back Angle | 1.7     |



### SEAT FORE / AFT POSITIONING

The total seat travel is measured from the forward most possible position to the rear most possible position. The driver's seat is set to the middle of the fore-aft travel. The passenger's seat is set to the middle of the fore-aft travel.



#### SEAT FORE/AFT POSITIONS

| Seating Position | Total Fore-Aft Travel | Placed in Position |
|------------------|-----------------------|--------------------|
| Driver Seat      | 298 mm                | 149 mm             |
| Passenger Seat   | 265 mm                | 133 mm             |

## DATA SHEET NO. 2... (CONTINUED)

### PRE-TEST DATA

Test Vehicle: 2016 Kia Sorento 5-Door MPV

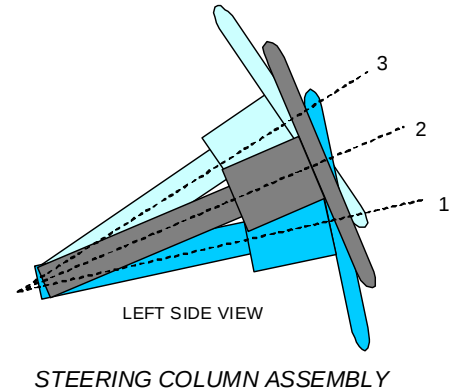
NHTSA No.: C20164200

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 6/7/16

### STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. A digital inclinometer is used to measure a plate which is placed across the rim of the steering wheel for angular measurements. A tape measure is used to measure telescoping steering wheel travel.



### STEERING COLUMN POSITIONING

|                                   | Degrees | Fore-Aft Position (mm) |
|-----------------------------------|---------|------------------------|
| Lowermost Position, No. 1         | 23.4    | 94                     |
| Geometric Center Position, No. 2  | 26.9    | 119                    |
| Uppermost Position, No. 3         | 29.8    | 143                    |
| Telescoping Steering Wheel Travel | 6.4     | 49                     |
| Test Position                     | 26.9    | 119                    |

**DATA SHEET NO. 3**  
**MOVING BARRIER DATA**

Test Vehicle: 2016 Kia Sorento 5-Door MPV NHTSA No.: C20164200  
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 6/7/16

**MOVING BARRIER TEST WEIGHT**

|       | Units | As Delivered Weights (UVW) |           |        |
|-------|-------|----------------------------|-----------|--------|
|       |       | Front Axle                 | Rear Axle | Total  |
| Left  | kg    | 377.0                      | 292.5     | 669.5  |
| Right | kg    | 389.5                      | 301.5     | 691.0  |
| Ratio | %     | 56.3%                      | 43.7%     | 100.0% |
| Total | kg    | 766.5                      | 594.0     | 1360.5 |

**MOVING BARRIER TIRE INFORMATION**

| Measured Parameter    | Front       | Rear        |
|-----------------------|-------------|-------------|
| Recommended Tire Size | 205/75R15   | 205/75R15   |
| Tire Size on Vehicle  | 205/75R15   | 205/75R15   |
| Tire Manufacturer     | Pacemark    | Pacemark    |
| Tire Model            | All Weather | All Weather |
| Treadwear             | 420         | 420         |
| Traction              | A           | A           |
| Temperature Grades    | B           | B           |
| Tire Pressure - Front | 220         | 220         |
| Tire Pressure - Rear  | 220         | 220         |

**MOVING BARRIER DIMENSIONS**

| Measurement Description           | Length (mm) |
|-----------------------------------|-------------|
| Overall Width                     | 1676        |
| Overall Height                    | 560         |
| Honeycomb Depth                   | 382         |
| Overall Depth                     | 484         |
| Bottom Honeycomb to Bottom Bumper | 51          |
| Bumper Height                     | 202         |
| Ground to Top of MDB              | 788         |
| Ground to Bottom of MDB           | 228         |
| Ground to Bottom of Bumper        | 281         |
| Ground to Top of Bumper           | 482         |

**DATA SHEET NO. 4****POST-TEST DATA**

Test Vehicle: 2016 Kia Sorento 5-Door MPV NHTSA No.: C20164200  
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 6/7/16

Temperature at Time of Impact: 35°C Test Time: 11:15 AM  
 VIN: 5XYPG4A3XGG035790

**IMPACT VELOCITY DATA**

| Measured Parameter              | Units | Value |
|---------------------------------|-------|-------|
| Trap No. 1 Velocity (Primary)   | km/h  | 79.64 |
| Trap No. 2 Velocity (Redundant) | km/h  | 79.64 |

**IMPACT POINT LOCATION DATA**

| Measured Parameter                                           | Units | Tolerance                     | Value |
|--------------------------------------------------------------|-------|-------------------------------|-------|
| Vehicle Width                                                | mm    |                               | 1890  |
| Vertical Impact Reference Line (Left of Vehicle Center Line) | mm    |                               | 378   |
| Actual Impact Point (Left of Vehicle Center Line)            | mm    |                               | 399   |
| Horizontal Offset (+ right / - left)                         | mm    | ± 50 of Intended Impact Point | -21   |
| Vertical Offset (+ down / - up)                              | mm    | ± 40 of Intended Impact Point | -3    |

**TARGET VEHICLE STRUCTURAL MEASUREMENTS**

| No. | Description                | Pre-Test | Post-Test | Difference |
|-----|----------------------------|----------|-----------|------------|
| 1   | Total Length at Centerline | 4740     | 4620      | 120        |
| 2   | Total Length               | 4740     | 4710      | 30         |
| 3   | Total Width                | 1890     | 2075      | 185        |
| 4   | Left Side Wheelbase        | 2775     | 2715      | 60         |
| 5   | Right Side Wheelbase       | 2775     | 2770      | 5          |

**MAXIMUM STATIC CRUSH OF HONEYCOMB FACE**

| Vertical Location |                  |             | From Centerline |           | Max. Crush (mm) |
|-------------------|------------------|-------------|-----------------|-----------|-----------------|
| Row               | Description      | Height (mm) | Distance (mm)   | Direction |                 |
| A                 | Center of Bumper | 382         | 800             | Right     | 214             |
| B                 | Top of Bumper    | 483         | 800             | Right     | 313             |
| C                 | Mid Level        | 636         | 800             | Right     | 283             |
| D                 | Top of Stack     | 763         | 800             | Right     | 316             |

**DATA SHEET NO. 4... (CONTINUED)****POST-TEST DATA**

Test Vehicle: 2016 Kia Sorento 5-Door MPV NHTSA No.: C20164200  
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 6/7/16

**DOOR OPENING AND SEAT TRACK INFORMATION**

| Description           | Driver                      | Passenger                   |
|-----------------------|-----------------------------|-----------------------------|
| Front Door Opening    | Remained closed and latched | Remained closed and latched |
| Rear Door Opening     | Jammed Shut                 | Remained closed and latched |
| Hatch and other doors | Rear Hatch Jammed Shut      |                             |

**FMVSS 301 FUEL SYSTEM INTEGRITY POST-IMPACT DATA****Stoddard Solvent Spillage Measurements**

From impact until vehicle motion ceases: 0 g

(Maximum allowable = 28 g)

For the 5 minute period after motion ceases: 0 g

(Maximum allowable = 28 g)

For the following 25 minutes: 0 g

(Maximum allowable = 28 g/minute)

Spillage: None

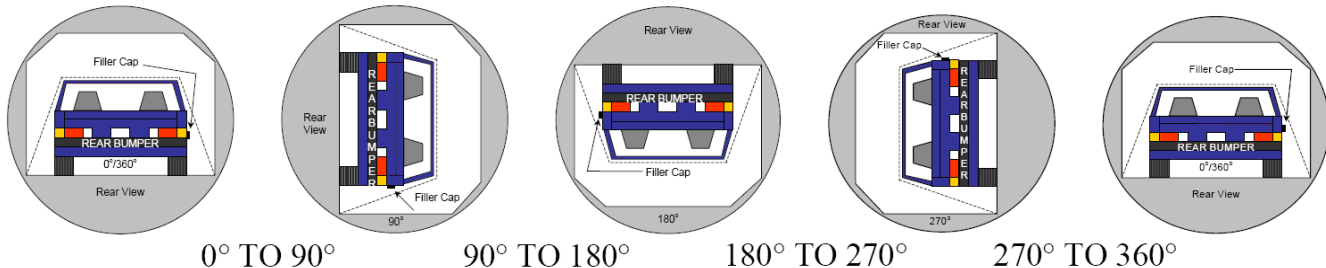
**DATA SHEET NO. 5**  
**STATIC ROLLOVER TEST DATA**

Test Vehicle: 2016 Kia Sorento 5-Door MPV

NHTSA No.: C20164200

Test Program: 79.3 km/h 70% Overlap Rear Impact

Test Date: 6/7/16



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).

Details of Stoddard solvent spillage: No Stoddard solvent spillage

**SOLVENT COLLECTION TIME TABLE IN SECONDS**

| Test Phase   | Rotation Time | Hold Time | Total Time |
|--------------|---------------|-----------|------------|
| 0° To 90°    | 81            | 300       | 381        |
| 90° To 180°  | 81            | 300       | 381        |
| 180° To 270° | 80            | 300       | 380        |
| 270° To 360° | 76            | 300       | 376        |

**FMVSS 301 SPILLAGE TABLE**

| Test Phase   | First 5 Minutes | Sixth Minute | Seventh Minute | Eighth Minute |
|--------------|-----------------|--------------|----------------|---------------|
| 0° To 90°    | 0 g             |              |                |               |
| 90° To 180°  | 0 g             |              |                |               |
| 180° To 270° | 0 g             |              |                |               |
| 270° To 360° | 0 g             |              |                |               |

**SOLVENT SPILLAGE LOCATION TABLE**

| Test Phase   | Spillage Location |
|--------------|-------------------|
| 0° To 90°    | No Spillage       |
| 90° To 180°  | No Spillage       |
| 180° To 270° | No Spillage       |
| 270° To 360° | No Spillage       |

**APPENDIX A**  
**PHOTOGRAPHS**

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FIGURE 1. As Received Right Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 2. As Received Left Rear  $\frac{3}{4}$  View of Test Vehicle

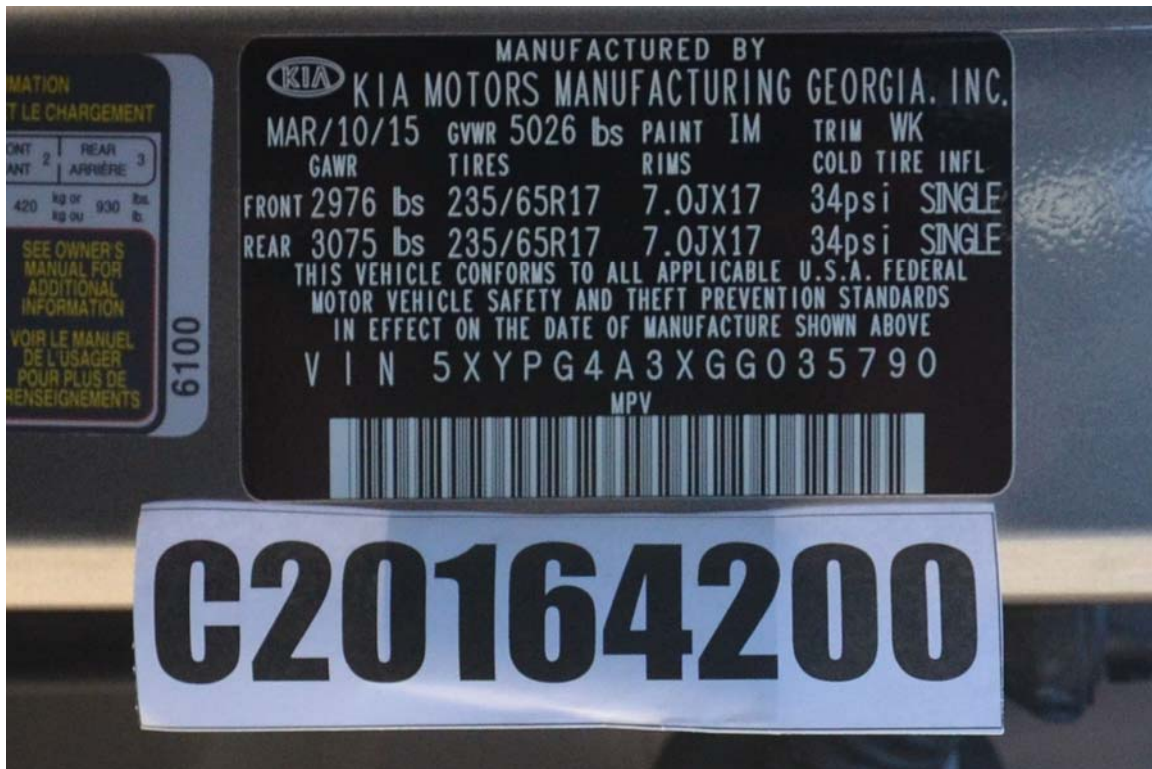


FIGURE 3. Test Vehicle Manufacturer's Label

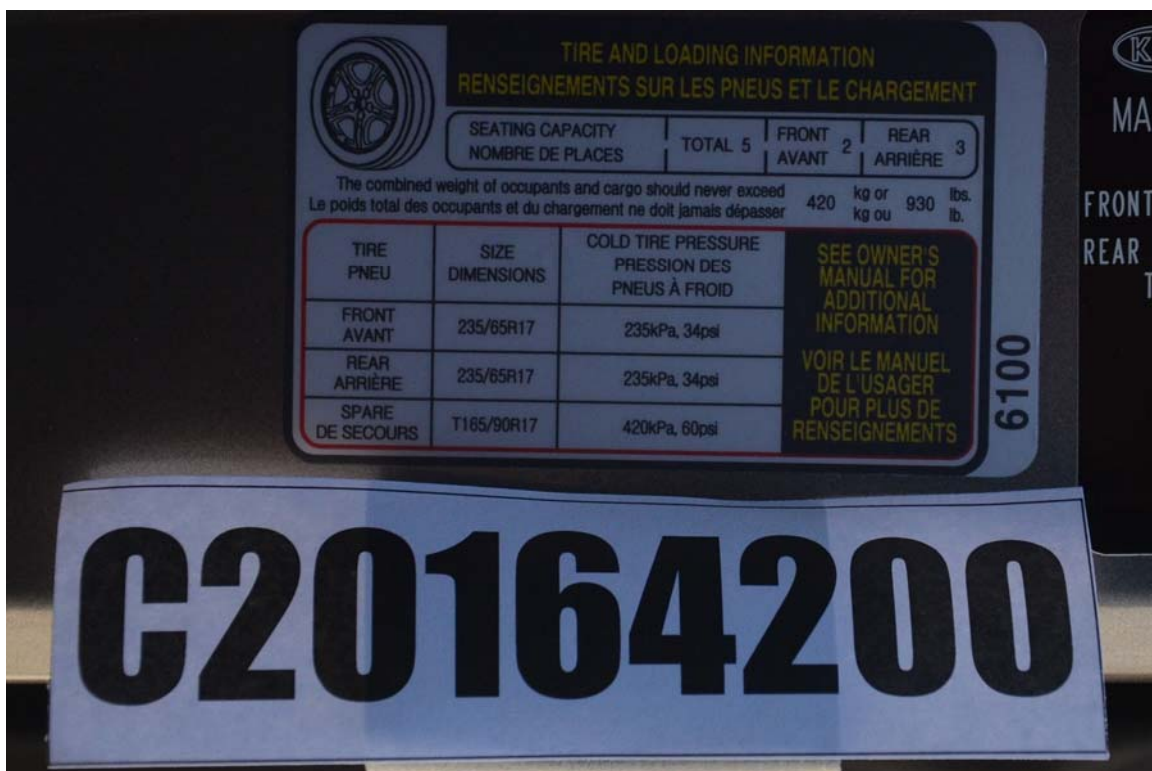


FIGURE 4. Test Vehicle Tire Information Placard



FIGURE 5. Pre-Test Front View of Test Vehicle



FIGURE 6. Post-Test Front View of Test Vehicle



FIGURE 7. Pre-Test Left Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 8. Post-Test Left Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 9. Pre-Test Left View of Test Vehicle



FIGURE 10. Post-Test Left View of Test Vehicle



FIGURE 11. Pre-Test Left Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 12. Post-Test Left Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 13. Pre-Test Rear View of Test Vehicle

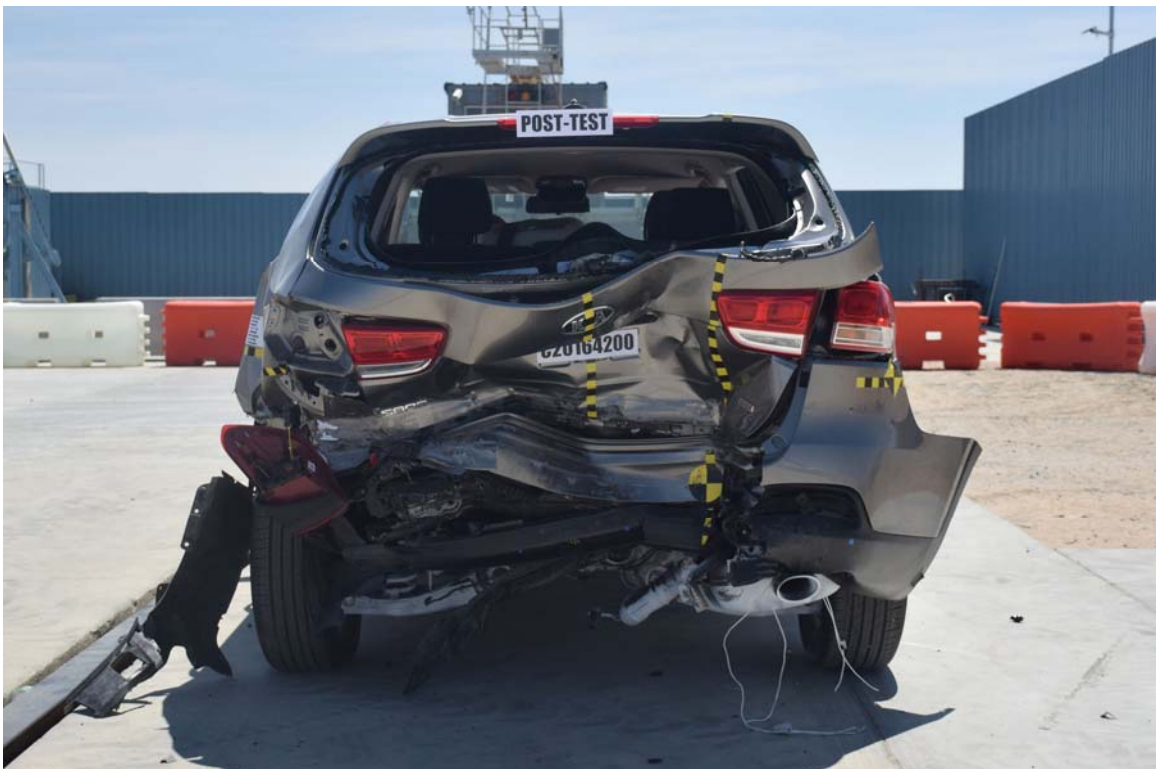


FIGURE 14. Post-Test Rear View of Test Vehicle



FIGURE 15. Pre-Test Right Rear  $\frac{3}{4}$  View of Test Vehicle

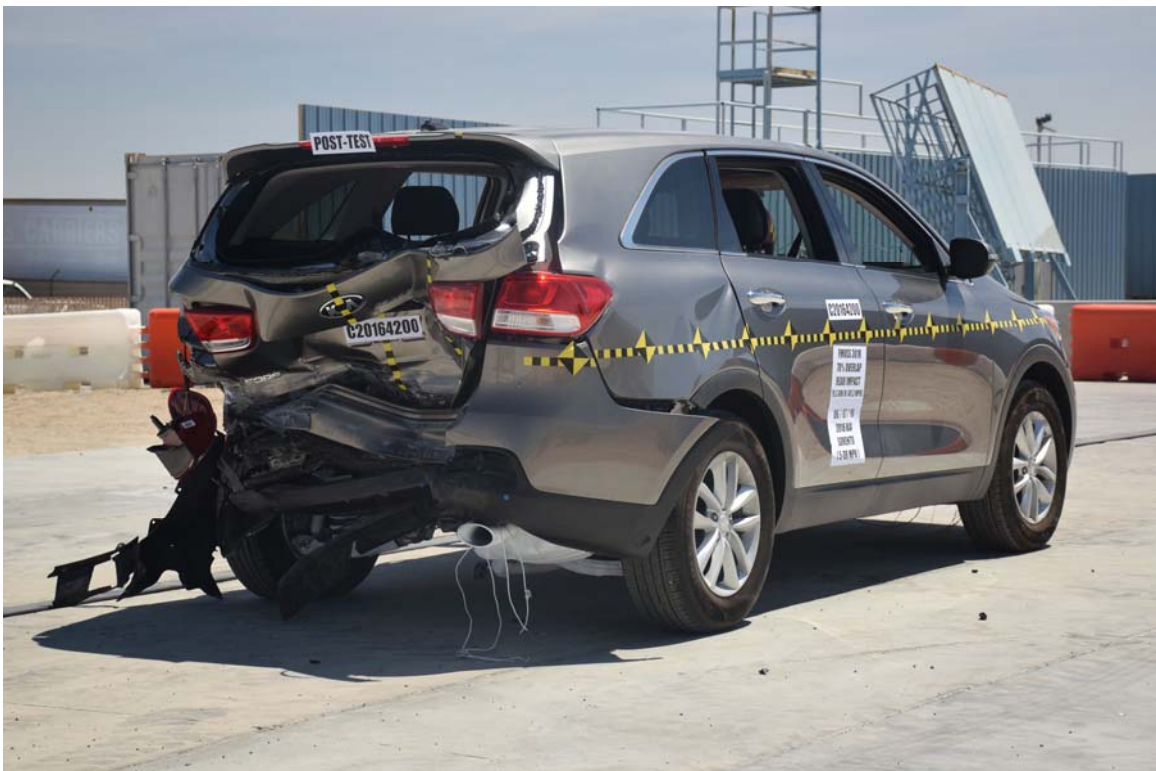


FIGURE 16. Post-Test Right Rear  $\frac{3}{4}$  View of Test Vehicle



FIGURE 17. Pre-Test Right View of Test Vehicle



FIGURE 18. Post-Test Right View of Test Vehicle



FIGURE 19. Pre-Test Right Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 20. Post-Test Right Front  $\frac{3}{4}$  View of Test Vehicle



FIGURE 21. Pre-Test Close-Up View of Impact Point Target

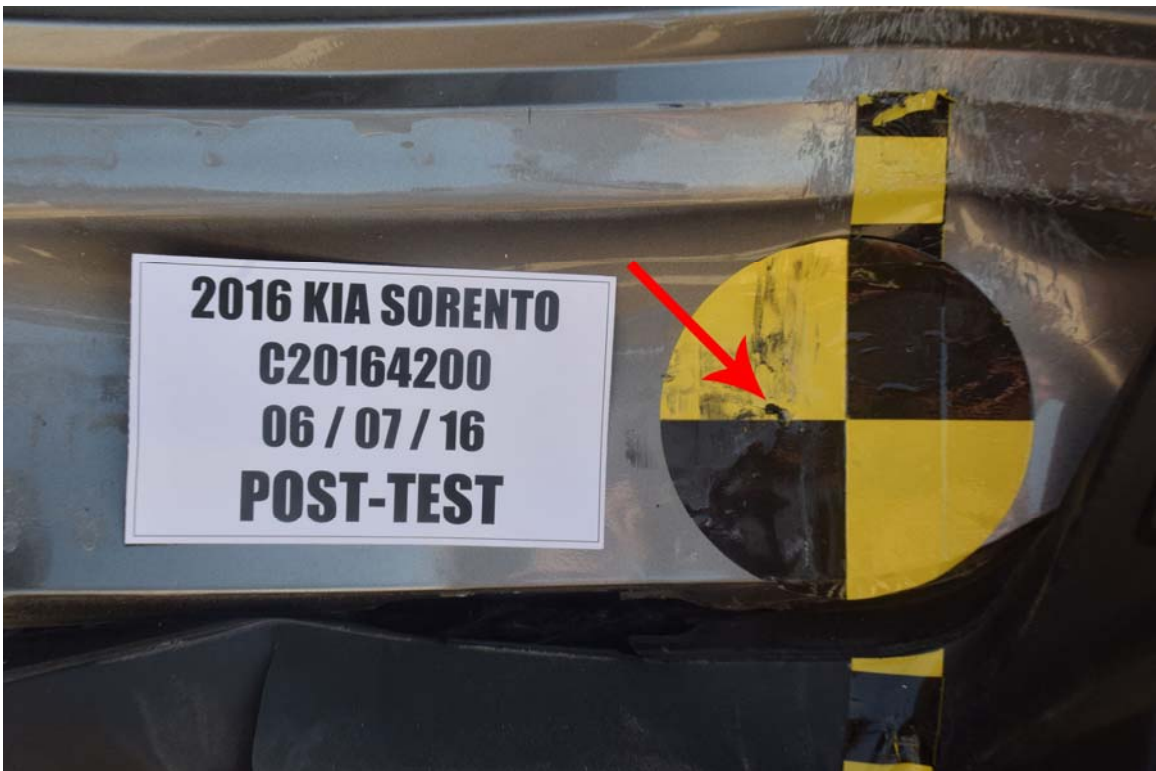


FIGURE 22. Post-Test Close-Up View of Impact Point Target



FIGURE 23. Pre-Test View of Fuel Filler Cap

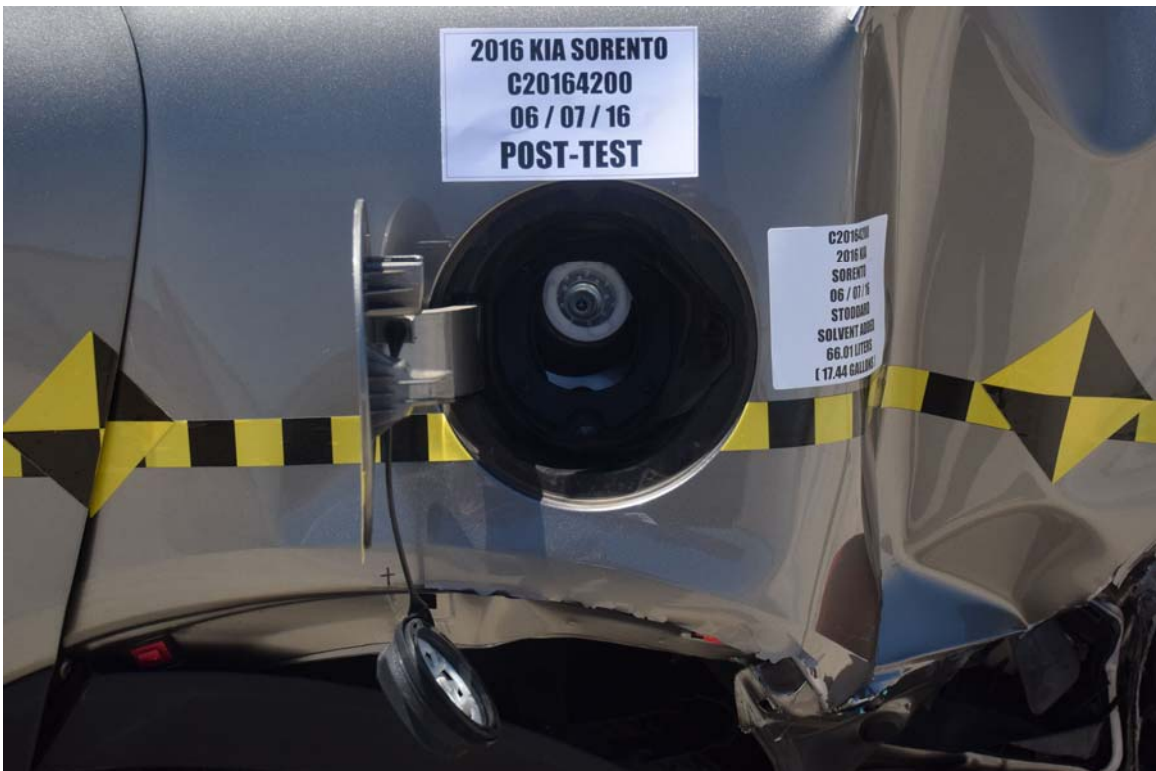


FIGURE 24. Post-Test View of Fuel Filler Cap



FIGURE 25. Pre-Test Rear Underbody View of Test Vehicle



FIGURE 26. Post-Test Rear Underbody View of Test Vehicle



FIGURE 27. Pre-Test Underbody View of Fuel Tank



FIGURE 28. Post-Test Underbody View of Fuel Tank



FIGURE 29. Pre-Test Underbody View of Fuel Lines



FIGURE 30. Post-Test Underbody View of Fuel Lines



FIGURE 31. Test Vehicle at 0° on FMVSS 301 Static Rollover Device



FIGURE 32. Test Vehicle at 90° on FMVSS 301 Static Rollover Device



FIGURE 33. Test Vehicle at 180° on FMVSS 301 Static Rollover Device



FIGURE 34. Test Vehicle at 270° on FMVSS 301 Static Rollover Device



FIGURE 35. Test Vehicle at 360° on FMVSS 301 Static Rollover Device



FIGURE 36. Impact Event