

REPORT NUMBER: 301-KAR-19-004
SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT
79.3 KM/H 70% OVERLAP REAR IMPACT

TOYOTA MOTOR MANUFACTURING CANADA INC.
2019 TOYOTA RAV4 5-DOOR MPV

NHTSA NUMBER: C20195101

PREPARED BY:
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TEST DATE:
JULY 25, 2019

REPORT DATE:
AUGUST 8, 2019
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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FINAL REPORT ACCEPTANCE BY OVSC:

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 301-KAR-19-004	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Final Report of FMVSS 301R Compliance Testing of a 2019 Toyota RAV4 5-Door MPV NHTSA No. C20195101		5. Report Date August 8, 2019	
		6. Performing Organization Code KAR	
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9. Performing Organization Name and Address Applus+ IDIADA KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-16-D-00029	
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance Room 6111, NVS-220 400 Seventh Street, SW Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report, July 25 -August 8, 2019	
		14. Sponsoring Agency Code NVS-220	
15. Supplementary Notes			
16. Abstract A 79.3 km/h 70% overlap rear impact test was conducted on the subject 2019 Toyota RAV4 5-Door MPV in accordance with the Office of Vehicle Safety Compliance Laboratory Test Procedure No. TP-301R-02 for the determination of FMVSS 301 compliance. The test was conducted at the Applus+ IDIADA KARCO Engineering, LLC. facility in Adelanto, California on July 25, 2019. The impact velocity was 79.44 km/h and the outside ambient temperature was 35.6° C. There was no Stoddard solvent leakage immediately after the test nor during any portion of the static rollover. The test vehicle appeared to comply with all requirements of FMVSS 301R.			
17. Key Words FMVSS 301R 70% Overlap Rear Impact MDB 2019 Toyota RAV4 5-Door MPV		18. Distribution Statement Copies of this report are available from the following: U.S. Department of Transportation NHTSA Technical Information Services (TIS) Mail Code: NIO-120, Room E-12 -100 1200 New Jersey Avenue, SE Washington, DC 20590 Telephone No. 202-366-4946	
19. Security Classification of this report UNCLASSIFIED	20. Security Classification of this page UNCLASSIFIED	21. No. of Pages 35	22. Price

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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 2019 Toyota RAV4 5-door MPV, for FMVSS 301 compliance.

This 79.3 km/h 70% Overlap Rear Impact is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-16-D-00029. 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 Applus+ IDIADA KARCO Engineering, LLC. on July 25, 2019. Pre- and post- test photographs of the vehicle and ATD's can be found in Appendix A of this report.

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

Two Part 572E 50th percentile male anthropomorphic test devices (ATD) were placed in the driver and right front passenger seating positions. Neither of the ATD's were instrumented for this test.

There was no Stoddard solvent leakage after the impact or during any portion of the static rollover. The test vehicle appeared to comply with all requirements of FMVSS 301R-02 "Fuel System Integrity – Rear Impact". FMVSS 301 data is summarized in Data Sheets 4 and 5.

SECTION 2
DATA SHEETS

Test Vehicle: 2019 Toyota RAV4 5-Door MPV NHTSA No.: C20195101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 07/25/19

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 ²	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: 2019 Toyota RAV4 5-Door MPV NHTSA No.: C20195101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 07/25/19

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	C20195101
Model Year	2019
Make	Toyota
Model	RAV4
Body Style	5-Door MPV
VIN	2T3K1RFV5KW004427
Body Color	Silver Sky Metallic
Odometer Reading (km / mi)	64 / 40
Engine Displacement (L)	2.5
Type / No. of Cylinders	Inline 4 Cylinder
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	8
Overdrive	Yes
Final Drive	FWD
Roof Rack	Yes
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	Yes
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	Yes
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? N/A

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing Canada Inc.
Date of Manufacture	01/19

GVWR (kg)	2090
GAWR Front (kg)	1150
GAWR Rear (kg)	1150

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)				410.0	A
DSC x 68 (kg)				340.0	B
Cargo Weight (RCLW) (kg)				70.0	A-B

DATA SHEET NO. 1 ... (CONTINUED)

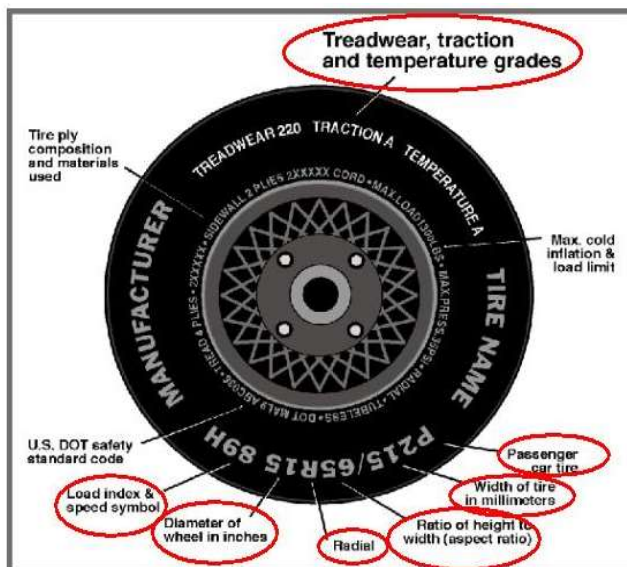
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2019 Toyota RAV4 5-Door MPV

NHTSA No.: C20195101

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

Test Date: 07/25/19



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max Tire Pressure (kPa)	350	350
Cold Tire Pressure (kPa)	240	240
Recommended Tire Size	225/65R17	225/65R17
Tire Size on Vehicle	225/65R17	225/65R17
Tire Manufacturer	Dunlop	Dunlop
Tire Model	GrandTrek PT20	GrandTrek PT20
Treadwear Rating	360	360
Traction Rating	B	B
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polymide	2 Polyester, 2 Steel, 1 Polymide
Load Index/Speed Symbol	102H	102H
Tire Material	Polyester, Steel, Polymide	Polyester, Steel, Polymide
DOT Safety Code Left	R8FS DM9R 3718	R8FS DM9R 3718
DOT Safety Code Right	R8FS DM9R 3718	R8FS DM9R 3718
Type of Spare Tire	T165/80D17	
Location of Tire Placard on Vehicle	Driver Side B-Pillar	

DATA SHEET NO. 2

PRE-TEST DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV

NHTSA No.: C20195101

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

Test Date: 07/25/19

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	449.0	319.0	768.0	507.0	380.0	887.0	494.5	400.0	894.5
Right	kg	452.5	302.5	755.0	487.0	360.5	847.5	469.0	379.5	848.5
Ratio	%	59.2%	40.8%	100.0%	57.3%	42.7%	100.0%	55.3%	44.7%	100.0%
Total	kg	901.5	621.5	1523.0	994.0	740.5	1734.5	963.5	779.5	1743.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1523.0	A
Actual Weight of 2 P572 ATDs Used	kg	148.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	70.0	C
Calculated Vehicle Target Wt (TVTWT)	kg	1741.0	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	903	904	930	930	1100
As Tested	mm	869	870	885	887	1151
Fully Loaded	mm	890	890	885	890	1205

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Total Vehicle Wheel Base	mm	2695
Total Vehicle Length	mm	4590
Total Vehicle Width	mm	1855
Amount of Stoddard Solvent in Fuel Tank	L	50.34

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV NHTSA No.: C20195101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 07/25/19

BALLAST DATA

Description	Value
Type of Ballast	Ballast Bottles
Method of Securing Ballast	Strapped to Rear Seat
Total Weight of Ballast	63.50
Weight of Vehicle Components Removed	0.0 kg

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

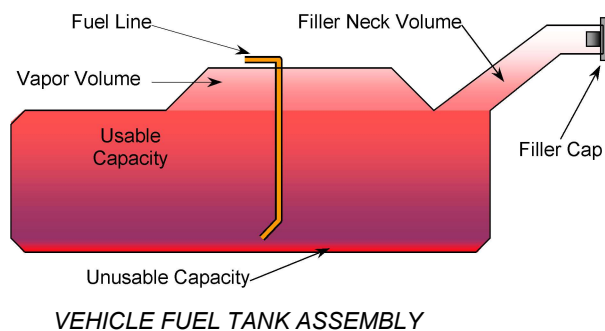
None

FUEL TANK CAPACITY

Description	Liters
Fuel System Capacity Listed in Owners Manual	54.13
Usable Capacity of "Standard Tank"	54.13
91 - 94% of Usable Capacity	49.81-51.44
Actual Amount of Stoddard Solvent Used	50.34

FUEL PUMP

The vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned to the "ON" position. The fuel pump will run when the engine is running.



TEST FLUID

Description	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.758
Test Fluid Kinematic Viscosity	
Test Fluid Color	Purple

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV

NHTSA No.: C20195101

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

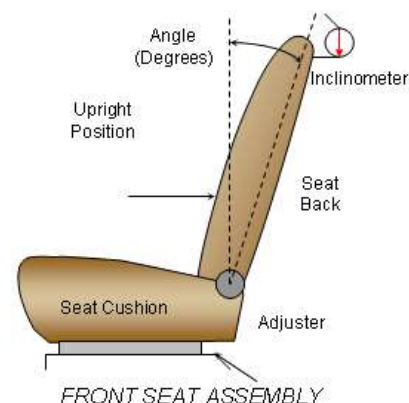
Test Date: 07/25/19

NOMINAL DESIGN RIDING POSITION

Seat back angle is measured using a digital inclinometer placed on the headrest post.

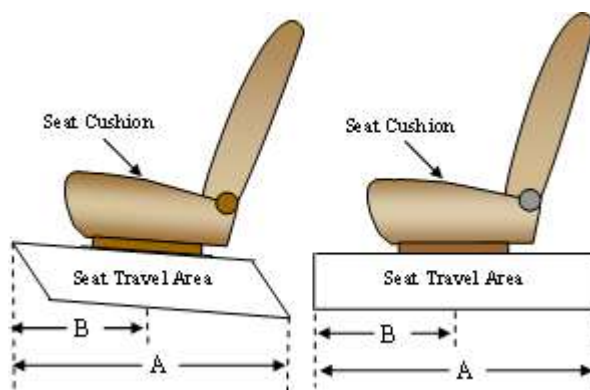
SEAT BACK ANGLE

Seating Position	Degrees
Driver Seat Back Angle	2.6
Passenger Seat Back Angle	0.3



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 and passenger's seats are set to the middle of the fore-aft travel.



SEAT FORE/AFT POSITIONS

Seating Position	Total Fore-Aft Travel	Placed in Position
Driver Seat	240 mm	100 mm
Passenger Seat	240 mm	120 mm

DATA SHEET NO. 2... (CONTINUED)

PRE-TEST DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV

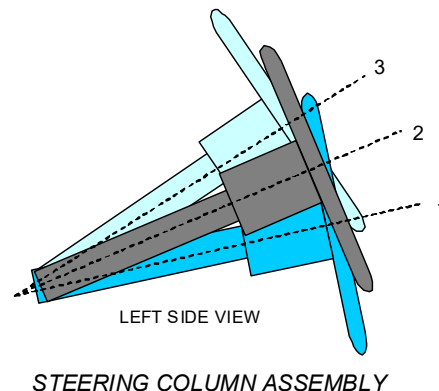
NHTSA No.: C20195101

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

Test Date: 07/25/19

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	20.7	95
Geometric Center Position, No. 2	23.0	124
Uppermost Position, No. 3	25.2	152
Telescoping Steering Wheel Travel		57
Test Position	22.9	124

DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV NHTSA No.: C20195101
 Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 07/25/19

MOVING BARRIER TEST WEIGHT

	Units	As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total
Left	kg	386.5	316.5	703.0
Right	kg	385.5	271.5	657.0
Ratio	%	56.8%	43.2%	100.0%
Total	kg	772.0	588.0	1360.0

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	559
Honeycomb Depth	381
Overall Depth	483
Bottom Honeycomb to Bottom Bumper	51
Bumper Height	203
Ground to Top of MDB	788
Ground to Bottom of MDB	229
Ground to Bottom of Bumper	280
Ground to Top of Bumper	483

DATA SHEET NO. 4**POST-TEST DATA**Test Vehicle: 2019 Toyota RAV4 5-Door MPV NHTSA No.: C20195101Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 07/25/19Temperature at Time of Impact: 35.6°C Test Time: 4:38 PMVIN: 2T3K1RFV5KW004427**IMPACT VELOCITY DATA**

Measured Parameter	Units	Value
Trap No. 1 Velocity (Primary)	km/h	79.44
Trap No. 2 Velocity (Redundant)	km/h	79.41

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Width	mm		1855
Vertical Impact Reference Line (Right of Vehicle Center Line)	mm		371
Actual Impact Point (Right of Vehicle Center Line)	mm		356
Horizontal Offset (+ right / - left)	mm	± 50 of Intended Impact Point	-15
Vertical Offset (- down / + up)	mm	± 40 of Intended Impact Point	8

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length at Centerline	4590	4280	310
2	Total Length	4590	4540	50
3	Total Width	1855	2220	365
4	Left Side Wheelbase	2695	2570	125
5	Right Side Wheelbase	2695	2680	15

MAXIMUM STATIC CRUSH OF HONEYCOMB FACE

Row	Vertical Location		From Centerline		Max. Crush (mm)
	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	785	800	Right	223
B	Top of Bumper	846	800	Right	376
C	Mid Level	919	800	Right	303
D	Top of Stack	664	800	Right	242

DATA SHEET NO. 4... (CONTINUED)

POST-TEST DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV NHTSA No.: C20195101
Test Program: 79.3 km/h 70% Overlap Rear Impact Test Date: 07/25/19

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

- A. From impact until vehicle motion ceases: 0 g
(Maximum allowable = 28 g)
- B. For the 5 minute period after motion ceases: 0 g
(Maximum allowable = 142 g)
- C. For the following 25 minutes: 0 g
(Maximum allowable = 28 g/minute)
- D. Spillage: None

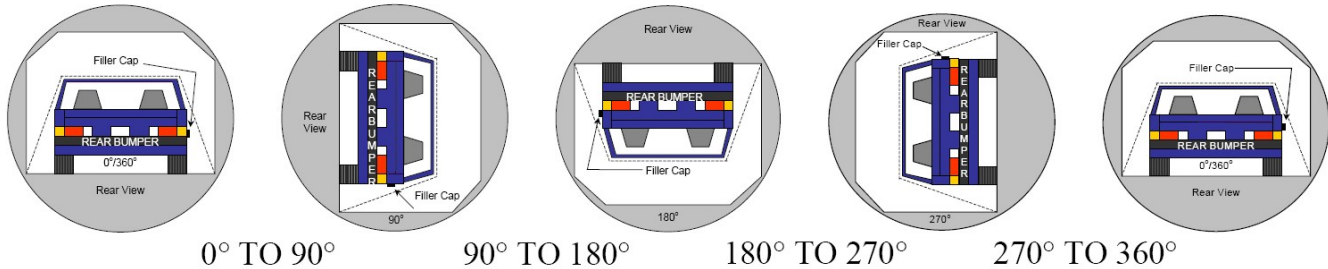
DATA SHEET NO. 5
STATIC ROLLOVER TEST DATA

Test Vehicle: 2019 Toyota RAV4 5-Door MPV

NHTSA No.: C20195101

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

Test Date: 07/25/19



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: None

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	80	300	380
90° To 180°	85	300	385
180° To 270°	80	300	380
270° To 360°	78	300	378

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

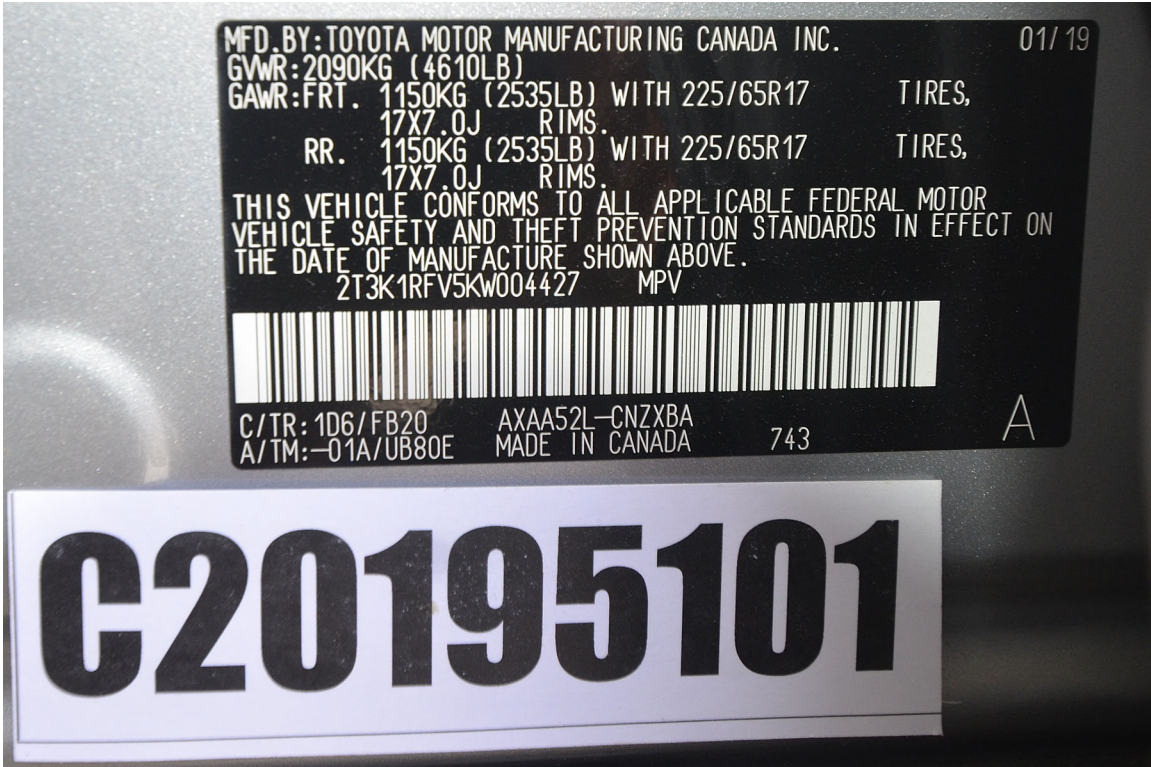


FIGURE 3. Test Vehicle Manufacturer's Label

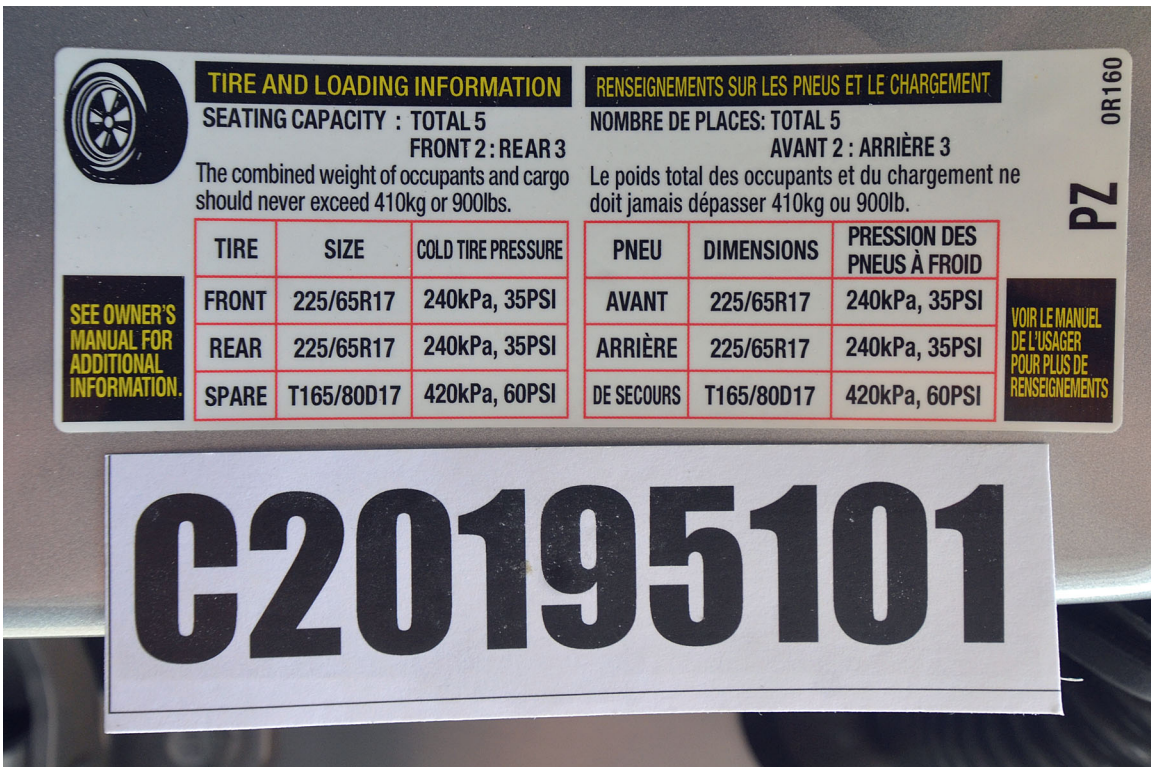


FIGURE 4. Test Vehicle Tire Information Placard



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

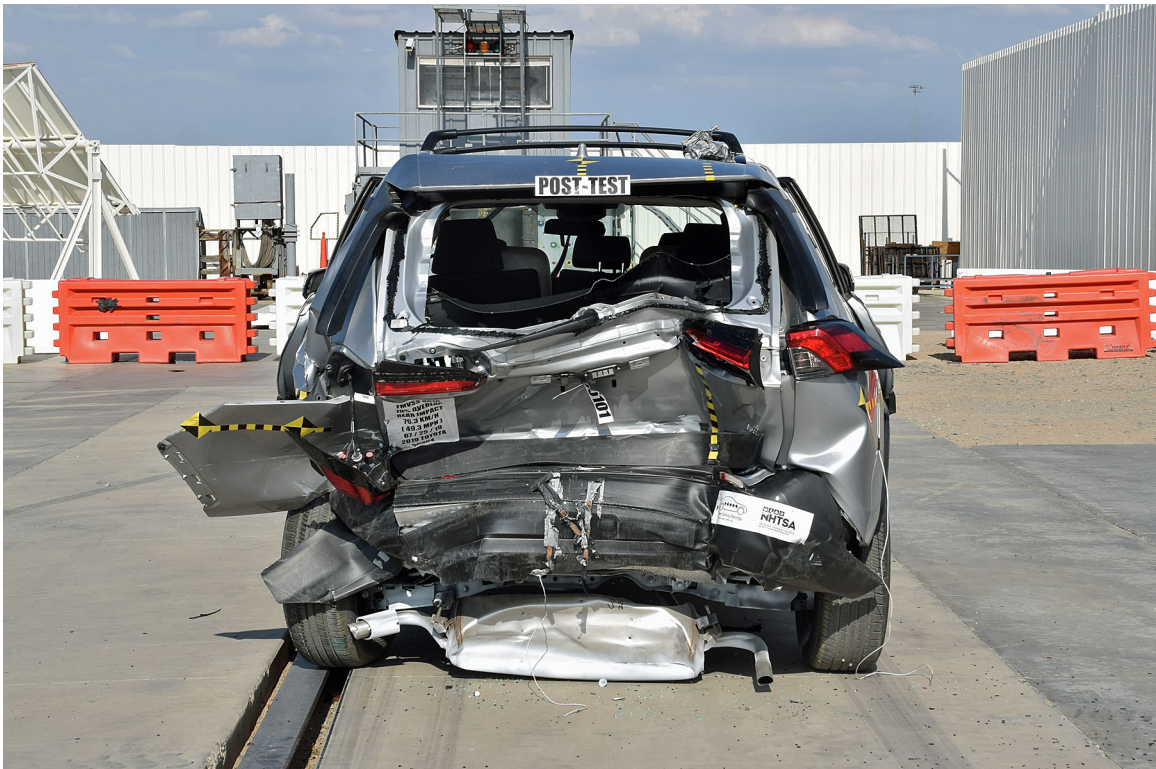


FIGURE 14. Post-Test Rear View of Test Vehicle



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

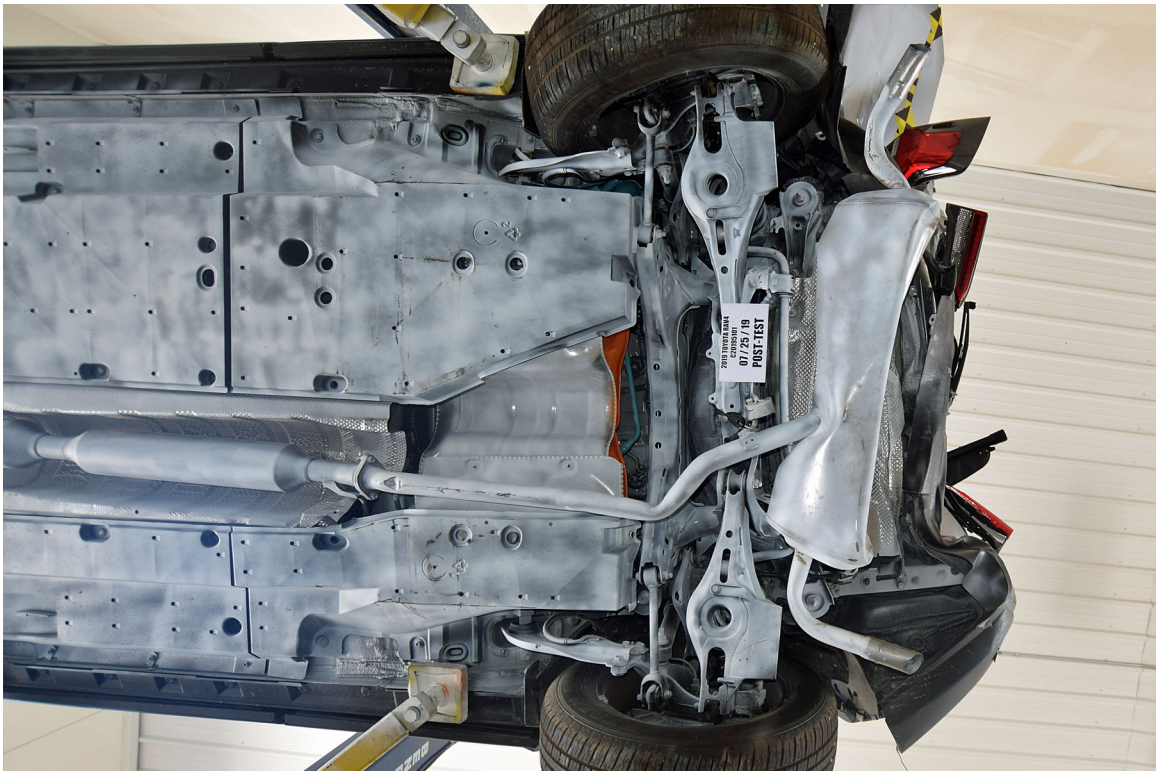


FIGURE 26. Post-Test Rear Underbody View of Test Vehicle



FIGURE 27. Test Vehicle at 0° on FMVSS 301 Static Rollover Device



FIGURE 28. Test Vehicle at 90° on FMVSS 301 Static Rollover Device



FIGURE 31. Test Vehicle at 360° on FMVSS 301 Static Rollover Device



FIGURE 32. Impact Event