

REPORT NUMBER: 301-CAL-03-08

**SAFETY COMPLIANCE TESTING FOR FMVSS 301
FUEL SYSTEM INTEGRITY**

TOYOTA MOTOR CORPORATION
2003 TOYOTA PRIUS
4-DOOR SEDAN

NHTSA NUMBER: C35105

VERIDIAN TEST NUMBER: 8655-F301-17

August 28, 2003

VERIDIAN ENGINEERING
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BUFFALO, NEW YORK 14225



FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance
400 Seventh Street, S. W.
Room No. 6115 (NVS-220)
Washington, DC 20590

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16. Abstract Compliance tests were conducted on the subject 2003 Toyota Prius 4-Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301-03 for the determination of FMVSS 301 compliance. For the purpose of acquiring information for applied research, two instrumented Anthropomorphic Test Devices (ATDs) were placed in the front occupant seating positions and various instrumentation was added to the test vehicle. Test failures identified were as follows: The test vehicle appeared to comply with all requirements of FMVSS 301 "Fuel System Integrity."					
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SECTION 1

PURPOSE OF COMPLIANCE TEST

This 30 mph rear moving barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 301 Compliance Test Program conducted for the National Highway Traffic Safety Administration (NHTSA) by Veridian Engineering under Contract No. DTNH22-01-C-01025. The purpose of this test was to determine if the subject vehicle, a 2003 Toyota Prius 4-Door Sedan, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity." This compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-301-03, dated February 28, 2003.

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1429.5 kg 2003 Toyota Prius 4-Door Sedan was impacted from the rear by an 1797 pound moving barrier at a velocity of 46.51 kph (28.9 mph). The test was performed by Veridian Engineering on August 28, 2003.

The test vehicle was equipped with a 45 liter fuel tank which was filled to 92 percent capacity with stoddard fluid prior to impact. No additional ballast was required to achieve test weight. For the purpose of acquiring information for applied research, one instrumented Part 572 O 5th percentile female Anthropomorphic Test Device (ATD) and one instrumented Part 572 E 50th percentile male ATD were placed in the front occupant seating positions and various instruments were added to the test vehicle. Research data is presented in a separate report.

The crash event was recorded by ten high-speed cameras and one real-time camera. Camera locations and other pertinent camera information are found on pages 3-9 and 3-10 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 259 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 3
COMPLIANCE TEST DATA

DATA SHEET 1

TEST VEHICLE SPECIFICATIONS

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2003 Toyota Prius 4-Door Sedan

NHTSA No.: C35105; Color: Silver

Engine Data: 4 Cylinders; - CID; 1.5 Liters; - cc

Placement: - Longitudinal or In-Line; X Transverse or Lateral

Transmission Data: Variable Speeds; - Manual; X Automatic; - Overdrive

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

Major Options: X A/C; X Power Steering; X Power Brakes

X Power Windows; X Power Door Locks; X Tilt Wheel

Date Received: 4/30/2003; Odometer Reading 20 km

Selling Dealer: Northtown Toyota

& Address: 1135 Millersport Highway, Amherst NY 14226

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Toyota Motor Corporation

Date of Manufacture: 11/02

VIN: JT2BK12U430079260

GVWR: 1639.8 kg; GAWR-FRONT: 1970 kg; GAWR-REAR: 1685 kg

DATA FROM VEHICLE'S TIRE LABEL:

Location of Placard on Vehicle: Left B-Pillar

Recommended Tire Size: P175/65R14 84S

* Recommended Cold Tire Pressure: FRONT: 240 kPa; REAR: 230 kPa

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P175/65R14 84S Manufacturer: Bridgestone

Tire Pressure with Maximum Capacity Vehicle Load: FRONT: 340 kPa; REAR: 340 kPa

Type of Spare Tire: Temporary T125/70D16 96M

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) = 363 kg

No. of Occupants x 68.04 kg = 340.2 kg

Rated Cargo/Luggage Weight (RCLW) = 22.8 kg

*Tire pressure used for test

DATA SHEET 2

PRE-TEST DATA

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

Right Front	=	<u>366.5</u>	kg	Right Rear	=	<u>241.5</u>	kg
Left Front	=	<u>393.5</u>	kg.	Left Rear	=	<u>259.5</u>	kg
TOTAL FRONT	=	<u>760.0</u>	kg	TOTAL REAR	=	<u>501.0</u>	kg
TOTAL DELIVERED WEIGHT =		<u>1261.0</u>	kg				
% of Total Front of Vehicle Weight =		<u>60.3%</u>		of Total Rear Weight =		<u>39.7%</u>	

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight	=	<u>1261.0</u>	kg
Rated Cargo/Luggage Weight (RCLW)	=	<u>22.8</u>	kg
Weight of 2 p.572 Dummies, 74.4 kg	=	<u>148.8</u>	kg
TARGET TEST WEIGHT	=	<u>1432.6</u>	kg

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 19.2 KG OF CARGO WEIGHT:

Right Front	=	<u>427.0</u>	kg	Right Rear	=	<u>270.0</u>	kg
Left Front	=	<u>452.5</u>	kg	Left Rear	=	<u>279.5</u>	kg
TOTAL FRONT	=	<u>879.5</u>	kg	TOTAL REAR	=	<u>549.5</u>	kg
TOTAL TEST WEIGHT =		<u>1429.0</u>	kg				
% of Total Front of Vehicle Weight =		<u>61.5%</u>		of Total Rear Weight =		<u>38.5%</u>	

* Weight of Ballast Secured in Vehicle Trunk Area = 0 kg

Type of Ballast: None

Method of Securing Ballast: -

Vehicle Components Removed for Weight Reduction: Front bumper, door trim and windows, engine intake ducts, headlights, windshield wiper assembly.

VEHICLE ATTITUDE (all dimension in millimeters):

AS DELIVERED:	RF	<u>668</u>	LF	<u>657</u>	RR	<u>651</u>	LR	<u>644</u>
AS TESTED:	RF	<u>640</u>	LF	<u>630</u>	RR	<u>638</u>	LR	<u>630</u>
Vehicle's Wheel Base:		<u>2550</u>	mm					
Location of Vehicle's C.G.:		<u>981</u>	millimeters rearward of front wheel center.					

FUEL SYSTEM DATA:

Fuel System Capacity From Owner's Manual =	<u>45</u>	liters
Usable Capacity Figure Furnished by COTR =	<u>45.0</u>	liters
Test Volume Range (91 to 94% of Usable Capacity) =	<u>40.95</u>	to <u>42.3</u> liters

ACTUAL TEST VOLUME= 41.4 liters (with entire fuel system filled)

* Ballast weight includes the RCLW, the weight of drained vehicle fluids and the weight of any removed vehicle components less the weight of onboard instrumentation, cameras, and hardware.

DATA SHEET 2 (continued)

PRE-TEST DATA

FUEL SYSTEM DATA (continued):

Test Fluid Type:	Stoddard Solution
Test Fluid Specific Gravity:	0.764
Test Fluid Kinematic Viscosity:	0.96 centistokes
Test Fluid Color:	Orange ("red" is preferred)
Type of Vehicle Fuel Pump:	Electric
Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF -	
When ignition is switched on without starting the engine, the fuel pump operates for several seconds then shuts off.	
Details of Fuel System: Fuel filler is located on the right rear quarter panel aft of the rear axle; Fuel tank is located on the vehicle underbody beneath the rear seat and forward of the rear axle; Fuel lines are routed along the right side of the vehicle underbody.	
Comments: None	

DATA SHEET 3

MOVING BARRIER DATA

WEIGHT OF MOVING BARRIER:

Right Front	=	<u>504.9</u>	kg	Right Rear	=	<u>393.7</u>	kg.
Left Front	=	<u>499.9</u>	kg	Left Rear	=	<u>398.3</u>	kg
TOTAL FRONT	=	<u>1004.8</u>	kg	TOTAL REAR	=	<u>792.0</u>	kg
TOTAL BARRIER WEIGHT =		<u>1796.8</u>	kg				

MOVING BARRIER DIMENSIONS:

Barrier Face Height: 1524 mm

Barrier Face Width: 1981 mm

Barrier Face Ground Clearance: 127 mm

Tread Width: 1511 mm

Wheel Base: 3048 mm

Location of C.G.: X: 1344 mm rearward of front wheel center.

Y: 0 mm from longitudinal-vertical plane of symmetry.

Z: 414 mm above ground.

MOVING BARRIER TIRES:

Manufacturer: Classic

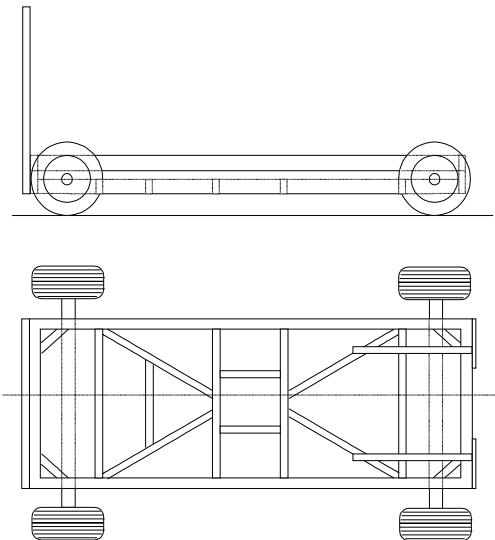
Model: Poly IV

Size: 215/75D15

Recommended Max Pressure: 240 kPa:

MOVING BARRIER ABORT SYSTEM:

Type: Trailing cable



DATA SHEET 4

POST TEST DATA

TYPE OF TEST:

Type of Test: Rear Barrier Impact Angle: 0°
Test Date: August 28, 2003 Time: 12:51 Temperature: 22.2 °C
Vehicle NHTSA No.: C35105 VIN: JT2BK12U430079260
Required Impact Velocity Range: 46.51 to 48.12 kph

BARRIER IMPACT VELOCITY: (Speed traps within 5 feet of impact plane.)

Trap No. 1 = 46.51 kph; Trap No. 2 = 46.51 kph
Average Impact Speed = 46.51 kph

VEHICLE STATIC CRUSH:

Vehicle Length:

Pre-Test	Left =	<u>4150</u>	; C/L =	<u>4210</u>	Right =	<u>4150</u>
Post-Test	Left =	<u>3868</u>	; C/L =	<u>4014</u>	Right =	<u>3850</u>
Crush	Left =	<u>282</u>	; C/L =	<u>196</u>	Right =	<u>300</u>
AVERAGE	=	<u>259</u>	millimeters			

DATA SHEET 4 (continued)

POST TEST DATA

TEST VEHICLE NHTSA NO.: C35105 TEST DATE: August 28, 2003

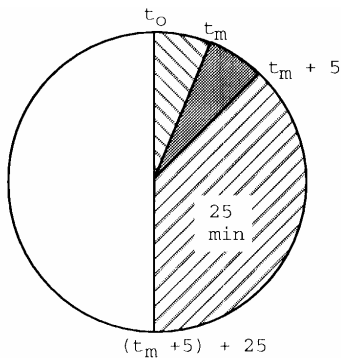
Vehicle Mfgr./Make/Model: 2003 Toyota Prius 4-Door Sedan

Test vehicle fuel tank filled to 91% to 94% of manufacturer's "usable" capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

TEST VEHICLE IMPACT TYPE:

- Frontal (42.28 kph target velocity)
- Oblique (42.28 kph target velocity) with -° barrier face first contacting - (driver/passenger) side
- X Rear Moving Barrier (42.28 kph target velocity)
- Lateral Moving Barrier (32.19 kph target velocity)

FUEL SPILLAGE MEASUREMENT:



1. From impact until vehicle motion ceases
2. For five minute period after vehicle motion ceases
3. For next 25 minutes

ACTUAL	MAX ALLOWED
0	28 g
0	28 g.
0	28 g/min.

SOLVENT SPILLAGE DETAILS:

None

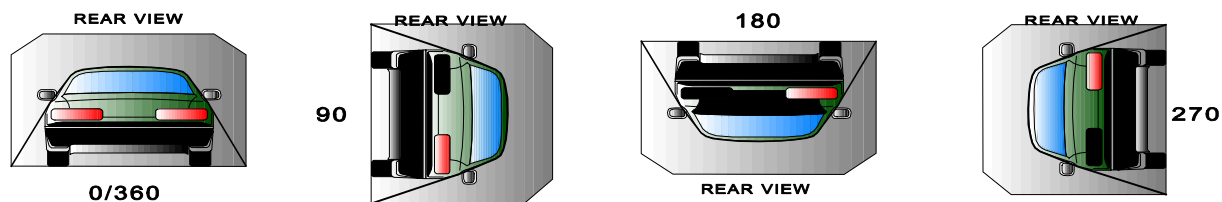
DATA SHEET 5

STATIC ROLLOVER TEST DATA

Table 7 FMVSS NO. 301 - STATIC ROLLOVER DATA SHEET

Vehicle: 2003 Toyota Prius 4-Door Sedan

NHTSA No.: C35105



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	
0° - 90°	1	minutes	19	seconds	5	minutes	6	minutes	19	seconds	7	minutes
90° - 180°	1	minutes	9	seconds	5	minutes	6	minutes	9	seconds	7	minutes
180°-270°	1	minutes	4	seconds	5	minutes	6	minutes	4	seconds	7	minutes
270°-360°	1	minutes	5	seconds	5	minutes	6	minutes	5	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)
0° - 90°	0	0	0	-
90° - 180°	0	0	0	-
180°-270°	0	0	0	-
270°-360°	0	0	0	-

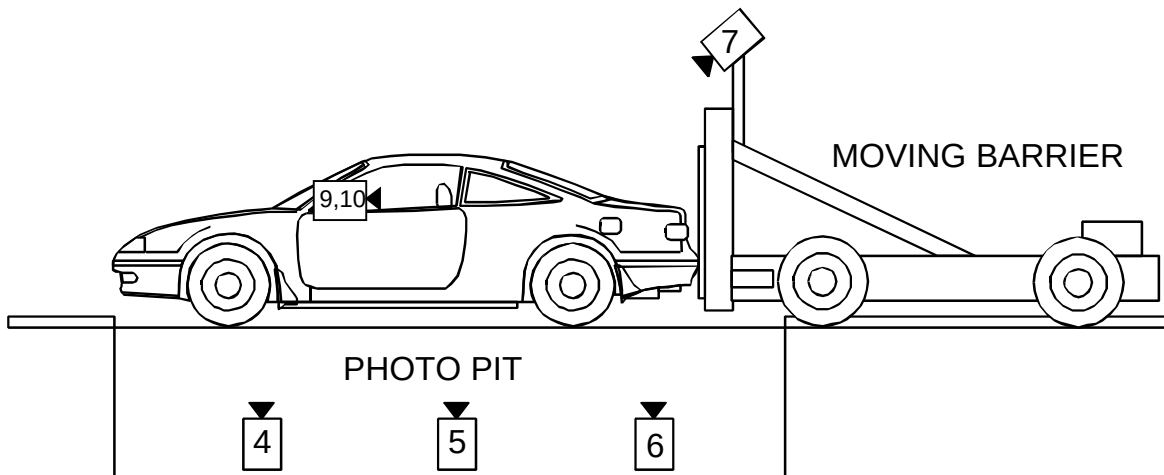
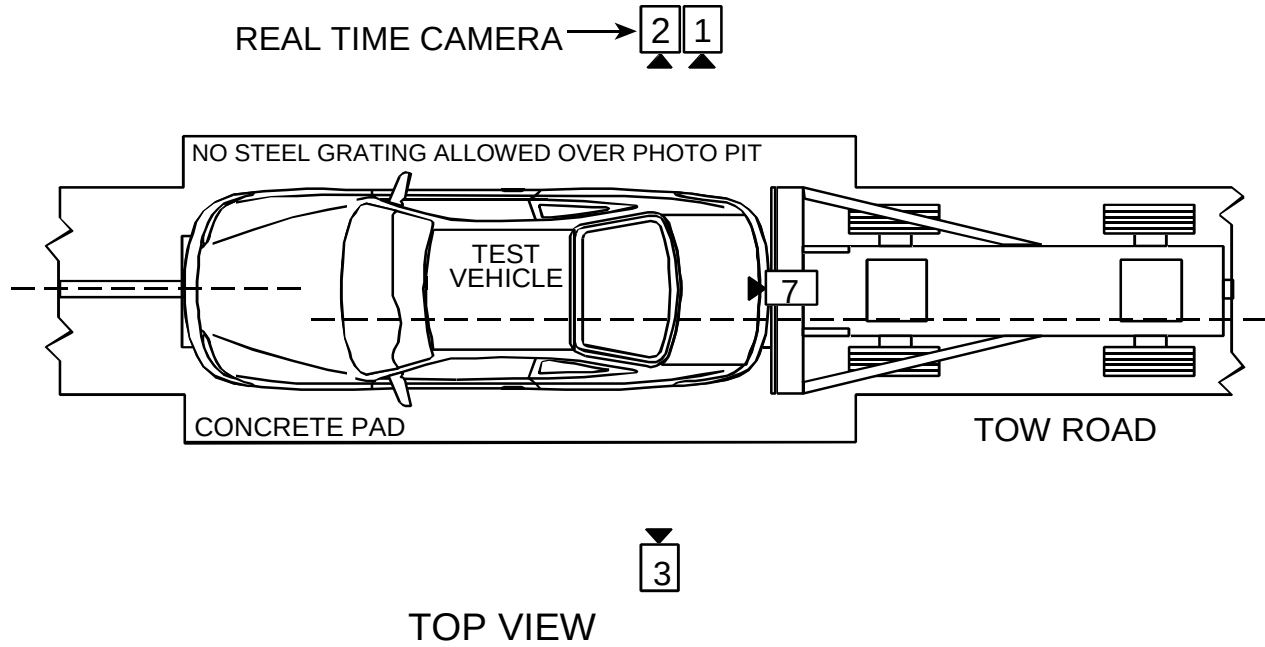
Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

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

DATA SHEET 6

HIGH SPEED CAMERA LOCATIONS



LEFT SIDE VIEW

DATA SHEET 6 (continued)

HIGH SPEED CAMERA LOCATIONS

NHTSA No. : C35105

Vehicle : 2003 Toyota Prius 4-Door Sedan

CAMERA NO.	VIEW	CAMERA POSITIONS (mm)*			ANGLE** (degrees)	LENS (mm)	SPEED (fps)
		X	Y	Z			
1	Real-Time Camera	-	-	-	-	-	24
2	Right Side View	14856	670	1105	-0.5	35	1000
3	Left Side View	13785	655	1125	0.0	35	1000
4	Vehicle Front Underbody View	0	2485	-1956	90.0	13	1005
5	Vehicle Mid-Section Underbody View	0	1825	-1956	90.0	13	990
6	Vehicle Rear Underbody View	0	690	-1956	90.0	13	1035
7	Moving Barrier View	0	0	2515	-105.0	13	1000
8	Overhead Overall View	-508	0	9804	-90.0	13	1000
9†	Onboard Driver View	965	2640	1015	-8.5	8	1000
10†	Onboard Passenger View	815	2645	995	-1.0	8	1000

* X = film plant to monorail centerline (+ to left of rail)
Y = film plane to impact location (+ ahead of impact location)
Z = film plane to ground (+ above ground)
** = referenced to horizontal plane

† Research cameras.

Appendix A
PHOTOGRAPHS

LIST OF PHOTOGRAPHS

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Figure A-1 PRE-TEST FRONT VIEW

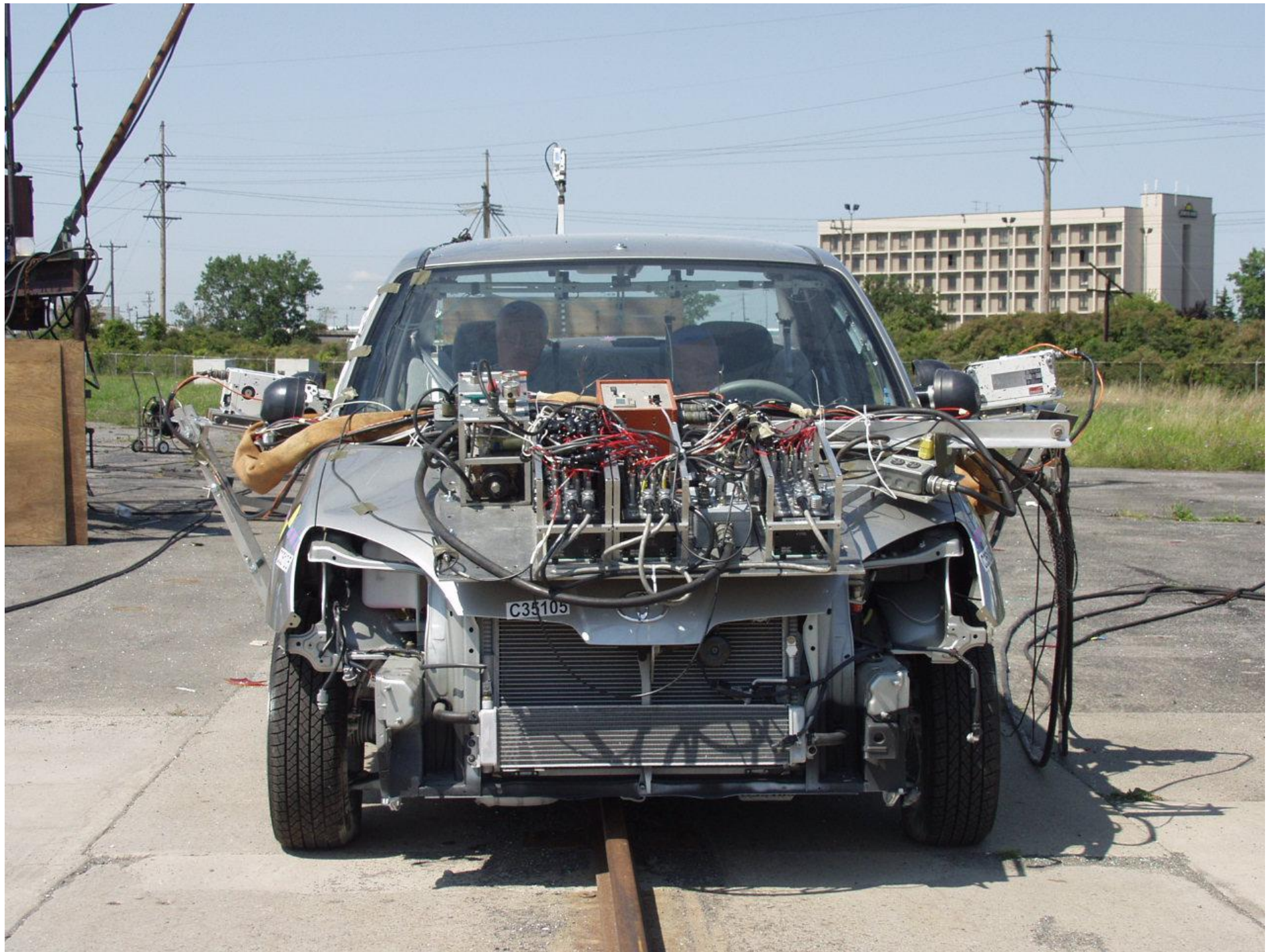


Figure A-2 POST-TEST FRONT VIEW



Figure A-3 PRE-TEST LEFT SIDE VIEW



Figure A-4 POST-TEST LEFT SIDE VIEW



Figure A-5 PRE-TEST RIGHT SIDE VIEW



Figure A-6 POST-TEST RIGHT SIDE VIEW



Figure A-7 PRE-TEST REAR VIEW



Figure A-8 POST-TEST REAR 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 REAR THREE-QUARTER VIEW



Figure A-12 POST-TEST RIGHT REAR THREE-QUARTER VIEW



Figure A-13 PRE-TEST FRONT UNDERBODY VIEW



Figure A-14 POST-TEST FRONT UNDERBODY VIEW

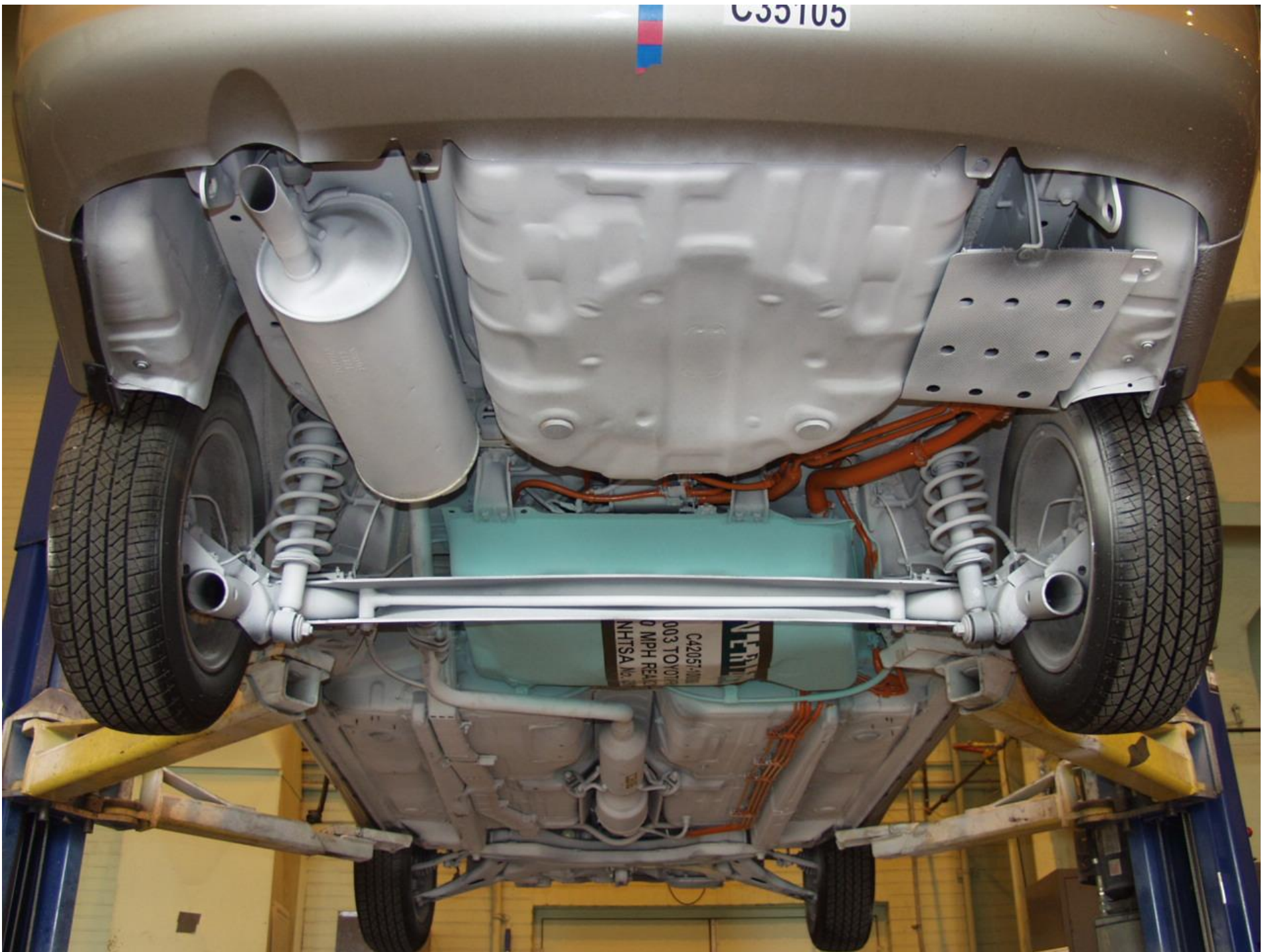


Figure A-15 PRE-TEST REAR UNDERBODY VIEW



Figure A-16 POST-TEST REAR UNDERBODY VIEW

*
MFD. BY: TOYOTA MOTOR CORPORATION 11/02
GVWR 3615LB GAWR FR 1970LB RR 1685LB
THIS VEHICLE CONFORMS TO ALL APPLICABLE
FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND
THEFT PREVENTION STANDARDS IN EFFECT ON
THE DATE OF MANUFACTURE SHOWN ABOVE.
JT2BK12U430079260 PASS. CAR



C/TR: 1C5/FC95 MODEL: NHW11L-AEEEEBA
A/TM: -01A/P111 MADE IN JAPAN
* NO. 642 *

Figure A-17 CERTIFICATION PLACARD

AIR FILTER SERVICE FOR AIR CONDITIONING SYSTEM

THE AIR CONDITIONING SYSTEM HAS AN AIR FILTER TO ELIMINATE DUST, POLLEN, ETC. FOR YOUR COMFORTABLE DRIVING, PERFORM AIR FILTER SERVICE PERIODICALLY. FOR MORE INFORMATION, SEE OWNER'S MANUAL OR CONSULT YOUR DEALER.

ENTRETIEN DU FILTRE A AIR DU SYSTEME DE CLIMATISATION

LE SYSTEME DE CLIMATISATION EST MUNI D'UN FILTRE A AIR SERVANT A ELIMINER POUSSIERE, POLLEN ET AUTRES IMPURETES. POUR VOTRE CONFORT, EFFECTUEZ REGULIEREMENT L'ENTRETIEN DE CE FILTRE A AIR. POUR PLUS DE DETAILS, VOYEZ LE MANUEL DU PROPRIETAIRE OU CONSULTEZ VOTRE CONCESSIONNAIRE.

47020

TIRE - LOADING INFORMATION

VEHICLE CAPACITY WEIGHT : 363kg (800lbs)
OCCUPANTS : FRT. 2 RR. 3 TOTAL 5
TIRE SIZE : P175/65R14 84S
SPARE TIRE : T125/70D16 96M
COLD TIRE PRESSURES : kPa (psi)
P175/65R14 84S : FRT. 240(35), RR. 230(33)
SPARE TIRE : 420 (60)
SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION

CHARGE MAXIMALE DU VEHICULE : 363kg (800LIVRES)
PERSONNES : AVANT 2 ARRIERE 3 TOTAL 5
DIMENSION DES PNEUS : P175/65R14 84S
PNEU DE RECHANGE : T125/70D16 96M
PRESSION DE PNEUS : kPa (LB/PO2)
P175/65R14 84S : AVANT 240 (35), ARRIERE 230 (33)
PNEU DE RECHANGE : 420 (60)
POUR DE PLUS AMPLES DETAILS, VOIR LE MANUEL DU PROPRIETAIRE

5 P

Figure A-18 TIRE PLACARD



Figure A-19 ROLLOVER 90°



Figure A-20 ROLLOVER 180°



Figure A-21 ROLLOVER 270°



Figure A-22 ROLLOVER 360°