SAFETY COMPLIANCE TESTING FOR FMVSS 126
Electronic Stability Control Systems

Toyota Motor Manufacturing, Kentucky, Inc.
2011 Toyota Camry
NHTSA No. CB5110

TRANSPORTATION RESEARCH CENTER INC.
10820 State Route 347
East Liberty, Ohio 43319

September 14, 2011

FINAL REPORT

Prepared Under Contract No.: DTNH22-08-D-00097

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
1200 New Jersey Avenue, SE
West Building, 4th Floor (NVS-221)
Washington, DC 20590
Prepared for the Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-08-D-00097.

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 manufacturers' 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 of manufacturers.

Prepared By: Alan Ida

Approved By: Ken Webster

Approval Date: 8/29/11

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: [Signature]

Acceptance Date: 9/14/11
1. Report No. 126-TRC-11-009

2. Government Accession No. 3. Recipient's Catalog No.

4. Title and Subtitle
   Final Report of FMVSS 126 Compliance Testing of 2011 Toyota Camry, NHTSA No. CB5110

5. Report Date September 14, 2011

6. Performing Organization Code TRC 20080734 / 1109

7. Author(s)
   Alan Ida, Project Engineer
   Ken Webster, Manager, DDO Project Operations


9. Performing Organization Name and Address
   Transportation Research Center Inc.
   10820 State Route 347
   East Liberty, OH 43319

10. Work Unit No.

11. Contract or Grant No. DTNH22-08-D-00097

12. Sponsoring Agency Name and Address
    U.S. Department of Transportation
    National Highway Traffic Safety Administration
    Enforcement
    Office of Vehicle Safety Compliance
    1200 New Jersey Avenue, SE, West Building, 4<sup>th</sup> Floor (NVS-221)
    Washington, D.C. 20590

13. Type of Report and Period Covered
    Final test report
    August 24, 2011 to September 14, 2011


15. Supplementary Notes

16. Abstract

A test was conducted on a 2011 Toyota Camry, NHTSA No. CB5110, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-126-02 for the determination of FMVSS 126 compliance. Test failures identified were as follows: None

17. Key Words
    Compliance Testing
    Safety Engineering
    FMVSS 126

18. Distribution Statement
    Copies of this report are available from:
    NHTSA Technical Information Services (TIS) (NPO 411)
    1200 New Jersey Avenue, SE
    Washington, D.C. 20590
    Email: tis@nhtsa.dot.gov
    FAX: (202) 493-2833

19. Security Classif. (of this report) Unclassified

20. Security Classif. (of this page) Unclassified

21. No. of Pages 63

22.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>PURPOSE OF COMPLIANCE TEST</td>
</tr>
<tr>
<td>2.0</td>
<td>TEST PROCEDURE AND DISCUSSION OF RESULTS</td>
</tr>
<tr>
<td>3.0</td>
<td>TEST DATA</td>
</tr>
<tr>
<td>4.0</td>
<td>TEST EQUIPMENT LIST AND CALIBRATION INFORMATION</td>
</tr>
<tr>
<td>5.0</td>
<td>PHOTOGRAPHS</td>
</tr>
<tr>
<td>6.0</td>
<td>DATA PLOTS</td>
</tr>
<tr>
<td>7.0</td>
<td>OTHER DOCUMENTATION</td>
</tr>
<tr>
<td></td>
<td>7.1 Owner's Manual Pages</td>
</tr>
<tr>
<td></td>
<td>7.2 Vehicle Arrival Condition Report</td>
</tr>
<tr>
<td></td>
<td>7.3 Vehicle Completion Condition Report</td>
</tr>
<tr>
<td></td>
<td>7.4 Sine with Dwell Test Results</td>
</tr>
<tr>
<td></td>
<td>7.5 Slowly Increasing Steer Test Results</td>
</tr>
<tr>
<td></td>
<td>7.6 Inertial Sensing System Location Coordinates</td>
</tr>
</tbody>
</table>
1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this test is to determine if the test vehicle, a MY 2011 Toyota Camry meets the minimum equipment and performance requirements stated in Federal Motor Vehicle Safety Standard (FMVSS) 126, "Electronic Stability Control Systems."

This standard establishes performance and equipment requirements for Electronic Stability Control (ESC) Systems installed in passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating of 4,536 kilograms or less.

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS

Testing of the MY 2011 Toyota Camry was conducted at Transportation Research Center Inc. (TRC Inc.) in accordance with NHTSA TP-126-02, dated November 19, 2008.

The vehicle was inspected to ensure it was equipped with an ESC System that:

- Augments vehicle directional stability by applying and adjusting brake torques individually at each wheel to induce a correcting yaw moment to a vehicle;
- Is computer controlled with the computer using a closed-loop algorithm to limit vehicle oversteer and to limit vehicle understeer;
- Has a means to determine the vehicle’s yaw rate and to estimate its side slip or side slip derivative with respect to time;
- Has a means to monitor driver steering inputs;
- Has an algorithm to determine the need, and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle, and
- Is operational over the full speed range of the vehicle (except at vehicle speeds less than 20km/h (12.4mph), when being driven in reverse, or during system initialization).

The vehicle was subjected to a 0.7Hz Sine with Dwell (SWD) Steering Maneuver to ensure that it would meet the stability and responsiveness requirements of the standard as follows:

- At 1.0 second after completion of a required sine with dwell steering input, the yaw rate of the vehicle must not exceed 35 percent of the first peak value of yaw rate recorded after the steering wheel angle changes sign (between first and second peaks during the same test run).
- At 1.75 seconds after completion of a required sine with dwell steering input, the yaw rate of the vehicle must not exceed 20 percent of the first peak value of yaw rate recorded after the steering wheel angle changes sign (between first and second peaks during the same test run).
The lateral displacement of the vehicle center of gravity with respect to its initial straight path must be at least 1.83 m (6 feet) (for vehicles with a GVWR of 3,500kg (7,716 lb) or less) when computed 1.07 seconds after the Beginning of Steer (BOS) at the specified steering wheel angles.

System malfunction simulations were executed to verify vehicle could identify and indicate a malfunction.

The vehicle's ESC System appears to meet the performance and equipment requirements as required by FMVSS 126. The test results are summarized on the following summary sheet.
### DATA SUMMARY (Sheet 1 of 2)

**VEHICLE MAKE/MODEL/BODY STYLE:** Toyota / Camry / Passenger Car

**VEHICLE NHTSA NO.:** CB5110

**VIN:** 4T1BF3EK0BU762724

**VEHICLE TYPE:** Passenger Car

**DATE OF MANUFACTURE:** 07/11

**LABORATORY:** Transportation Research Center Inc.

### REQUIREMENTS

<table>
<thead>
<tr>
<th><strong>ESC Equipment and Operational Characteristics (Data Sheet 2)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The vehicle is to be equipped with an ESC System that meets the equipment and operational characteristics requirements. (S126, S5.1, S5.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ESC Malfunction Telltale (Data Sheet 3)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The vehicle is equipped with a telltale that indicates one or more ESC System malfunctions. (S126, S5.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>“ESC Off” and other System Controls and Telltale (Data Sheet 3 &amp; 4)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The vehicle is equipped with an ESC off telltale indicating the vehicle has been put into a mode that renders the ESC System unable to satisfy the performance requirements of the standard, if such a mode exists. (S5.5.1)</td>
</tr>
</tbody>
</table>

If provided, off control and other system controls as well as the ESC off telltale meets the operational requirements (S126, S5.4, S5.4.1, S5.4.2, S5.5.4, and S5.5.9)
### REQUIREMENTS

If provided, off control and other system controls as well as the ESC off telltale meets the operational requirements (S126, S5.4, S5.4.1, S5.4.2, S5.5.4, and S5.5.9)  

#### Vehicle Lateral Stability (Data Sheet 8)

- **Yaw Rate Ratio at 1 second after COS** is less than 35% of peak value.  
  (S126, S5.2.1)  
  __PASS__

- **Yaw Rate Ratio at 1.75 seconds after COS** is less than 20% of peak value.  
  (S126, S5.2.2)  
  __PASS__

#### Vehicle Responsiveness (Data Sheet 8)

- Lateral displacement at 1.07 seconds after BOS is at least 1.83 m (6 feet) for vehicles with a GVWR of 3,500 kg (7,716 lbs.) or less, and 1.52 m (5 feet) for vehicles with a GVWR greater than 3,500 kg (7,716 lbs.).  
  (S126 S5.2.3)  
  __PASS__

#### ESC Malfunction Warning (Data Sheet 9)

- Warning is provided to driver after malfunction occurrence.  
  (S126. S5.3)  
  __PASS__

- Malfunction telltale stayed illuminated as long as malfunction existed and must extinguish after malfunction was corrected.  
  (S126, S5.3.7)  
  __PASS__

### REMARKS
3.0 TEST DATA

DATA SHEET 1 (Sheet 1 of 2)
TEST VEHICLE INSPECTION AND TEST PREPARATION

VEHICLE MAKE/MODEL/BODY STYLE: ___ Toyota / Camry / Passenger Car

NHTSA No.: ___ CB5110 _______ TEST DATE: ___ 8-25-11 _______

VIN: ___ 4T1BF3EK0BU762724 _______ MANUFACTURE DATE: ___ 07/11 _______

GVWR: 1,971 KG  FRONT GAWR: 1,210 KG  REAR GAWR: 1,070 KG

SEATING POSITIONS:  FRONT___ 2 ___  REAR___ 3 ___

ODOMETER READING AT START OF TEST: ___ 16 (26) Miles (Kilometers)

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front Axle ___ P215 / 60R 16 _______ Rear Axle ___ P215 / 60R 16 ___

INSTALLED TIRE SIZE(S) ON VEHICLE:

<table>
<thead>
<tr>
<th>From Tire Sidewall</th>
<th>Front Axle</th>
<th>Rear Axle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer and Model</td>
<td>Michelin Energy MXV4 S8</td>
<td>Michelin Energy MXV4 S8</td>
</tr>
<tr>
<td>Tire Size Designation</td>
<td>P215 / 60R 16 94V</td>
<td>P215 / 60R 16 94V</td>
</tr>
</tbody>
</table>

Are installed tire sizes same as labeled tire sizes?  ____ Yes  ____ No
If no, contact COTR for further guidance.

DRIVE CONFIGURATIONS (MARK ALL THAT APPLY):

____ X Two Wheel Drive (2WD): ( X ) Front Wheel Drive ( ) Rear Wheel Drive
____ ( ) All Wheel Drive (AWD)
____ X Four Wheel Drive Automatic – differential not locked full time (4WD Automatic)
____ ( ) Four Wheel Drive High Gear Unlocked Center Differential
____ ( ) Four Wheel Drive High Gear Locked Center Differential
____ ( ) Four Wheel Drive Low Gear Unlocked Center Differential
____ ( ) Four Wheel Drive Low Gear Locked Center Differential
____ ( ) Other (define ____________________________________________ )
DATA SHEET 1 (Sheet 2 of 2)
TEST VEHICLE INSPECTION AND TEST PREPARATION

DRIVE CONFIGURATIONS AND MODES: (ex. default, performance, off)
(For each of the vehicle’s drive configurations identify available operating modes)

<table>
<thead>
<tr>
<th>Drive Configuration</th>
<th>Mode(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2WD</td>
<td>default</td>
</tr>
</tbody>
</table>

VEHICLE STABILITY SYSTEMS (Check applicable technologies):

- ESC
- Traction Control
- Roll Stability Control
- Active Suspension
- Electronic Throttle Control
- Active Steering
- ABS
- VSC Computer, Brake Actuator

REMARKS:

RECORDED BY: Alan Ida          DATE: 8-25-11
APPROVED BY: Ken Webster       DATE: 8-29-11
Vehicle Make/Model/Body Style: Toyota / Camry / Passenger Car

NHTSA No.: CB5110 TEST DATE: 8-26-11

ESC System Identification:

Manufacturer / Model Robert Bosch LLC. / 44540 - 06050

ESC System Hardware (Check applicable hardware):

- [X] Electronic Control Unit
- [X] Hydraulics Control Unit
- [X] Wheel Speed Sensors
- [X] Steering Angle Sensor
- [X] Yaw Rate Sensor
- [X] Lateral Acceleration Sensor

List other components;

ESC System Operational Characteristics:

System is capable of generating brake torques at each wheel [X] Yes (PASS) [ ] No (FAIL)

List and describe component(s): VSC computer by way of solenoid valves in the brake actuator

System is capable of determining yaw rate [X] Yes (PASS) [ ] No (FAIL)

List and describe component(s): Yaw Rate and Acceleration Sensor

System is capable of monitoring driver steering input [X] Yes (PASS) [ ] No (FAIL)

List and describe component(s): Steering wheel angle sensor

System is capable of estimating side slip or side slip derivation [X] Yes (PASS) [ ] No (FAIL)

List and describe component(s): To estimate the vehicle side slip derivative, the VSC (Vehicle Stability Control) system collects wheel speed, lateral acceleration, and yaw rate data. The estimated vehicle side slip derivative is obtained as the difference between the estimated yaw rate and actual yaw rate detected by the yaw sensor. The VSC system estimates vehicle side slip by the integration of the estimated vehicle side slip derivative.
ESC SYSTEM OPERATIONAL CHARACTERISTICS (continued):

System is capable of modifying engine torque during ESC activation. Yes (PASS) No (FAIL)

Method used to modify engine torque: During traction control and VSC (ESC) operation, the VSC computer outputs an engine output control signal to the ECM. Upon receiving this signal, the ECM effects throttle control to regulate the engine output.

System is capable of activation at speeds of 20 km/h (12.4 mph) and higher. Yes (PASS) No (FAIL)

Speed system becomes active. above 15 km/h (9.3 mph)

System is capable of activation during the following driving phases (acceleration, deceleration, coasting, and during activation of ABS or traction control). Yes (PASS) No (FAIL)

Driving phases that the system is capable of activation. The ESC system is active during acceleration, deceleration, coasting, and during activation of ABS or traction control in the forward driving direction.

Vehicle manufacturer submitted documentation explaining how the ESC system mitigates understeer? Yes (PASS) No (FAIL)

DATA INDICATES COMPLIANCE PASS/FAIL PASS

RECORDED BY: Alan Ida DATE: 8-26-11
APPROVED BY: Ken Webster DATE: 8-29-11
DATA SHEET 3 (Sheet 1 of 2)
ESC MALFUNCTION AND OFF TELLTALES

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Camry / Passenger Car

VEHICLE NHTSA NO. CB5110 TEST DATE: 7-06-11

ESC Malfunction Telltale

Vehicle is equipped with malfunction telltale? Yes (Pass) No (Fail)

Telltale Location Instrument cluster, below the speedometer

Telltale Color Amber

Telltale symbol or abbreviation used.

[X] Vehicle uses this symbol

[ ] Vehicles uses this abbreviation

[ ] Neither symbol or abbreviation is used

If different than identified above, make note of any message, symbol or abbreviation used.

Is telltale part of a common space? Yes No

Is telltale also used to indicate activation of the ESC system? Yes No

If yes, explain telltale operation during ESC activation: During ESC Activation, the ESC telltale flashes.
DATA SHEET 3 (Sheet 2 of 2)
ESC MALFUNCTION AND OFF TELLTALES

“ESC OFF” Telltale (if provided)

Vehicle is equipped with “ESC Off” telltale?  
  X Yes  No

Is “ESC OFF” telltale combined with “ESC Malfunction” telltale utilizing a two part telltale?  
  Yes  No

Telltale Location  Instrument cluster, right side, below the fuel gauge

Telltale Color  Amber

Telltale symbol or abbreviation used.

  Or ESC OFF  
  OFF

  X Vehicle uses this symbol

  Vehicle uses this abbreviation

  Neither symbol or abbreviation is used

If different than identified above, make note of any message, symbol or abbreviation used.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Is telltale part of a common space?  
  Yes  No

DATA INDICATES COMPLIANCE  PASS/FAIL  PASS  
(Vehicle is compliant if equipped with a malfunction telltale)

REMARKS:

RECORDED BY:  Alan Ida  DATE:  8-29-11
APPROVED BY:  Ken Webster  DATE:  8-29-11
"ESC OFF" Controls Identification and Operational Check:

Is the vehicle equipped with a control or controls whose purpose is to deactivate the ESC system or place the ESC system in a mode or modes that may no longer satisfy the performance requirements of the standard?

_____ X  Yes  _____ No

Type of control or controls provided?
(mark all that apply)

_____ Dedicated “ESC Off” control

_____ X  Multi-functional control with an “ESC Off” mode

_____ Other (describe)

Identify each control location, labeling and selectable modes.

First Control:

Location  Lower left instrument panel, by driver’s left knee

Labeling  Skidding car symbol with “Off” underneath

Modes  Traction Control Off

ESC Off & Traction Control Off

ESC On & Traction Control On

Identify standard or default drive configuration  Default – 2WD

Verify standard or default drive configuration selected.  _____ X  Yes  _____ No

Does the “ESC Off” telltale illuminate upon activation of the dedicated ESC off control or selection of the “ESC Off” mode on the multi-function control?

_____ X  Yes  _____ No (fail)

Does the “ESC Off” telltale extinguish when the ignition is cycled from “On” (“Run”) to “Lock” or “Off” and then back again to the “On” (“Run”) position?

_____ X  Yes  _____ No (fail)

If no, describe how the off control functions:

__________________________________________________________________________
3.0 TEST DATA….continued

DATA SHEET 4 (Sheet 2 of 3)
ESC AND ANCILLARY SYSTEM CONTROLS

If a multi-function control is provided, cycle through each mode setting on the control and record which modes illuminate the “ESC Off” telltale. Also, for those modes that illuminate the ESC Off” telltale identify if the telltale extinguishes upon cycling the ignition system.

<table>
<thead>
<tr>
<th>Control Modes</th>
<th>“ESC Off” telltale illuminates upon activation of control? (Yes/No)</th>
<th>“ESC Off” telltale extinguishes upon cycling ignition? (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traction Control Off</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>ESC Off &amp; Traction Control Off</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

For each mode that illuminates the “ESC Off” telltale, did the telltale extinguish when the ignition was cycled from “On” (“Run”) to “Lock” or “Off” and then back again to the “On” (“Run”) position?

___ X ___ Yes ______ No (fail)

Other System Controls that have an ancillary effect on ESC Operation:

Is the vehicle equipped with any ancillary controls that upon activation may deactivate the ESC System or place the ESC System in a mode or modes that may no longer satisfy the performance requirements of the standard?

_____ Yes ___ X__ No

List and describe each control (i.e. alternate drive configuration selection controls):

Ancillary Control: System N/A
Control Description
Labeling

Ancillary Control: System N/A
Control Description
Labeling
DATA SHEET 4 (Sheet 3 of 3)
ESC AND ANCILLARY SYSTEM CONTROLS

Activate each control listed above and record whether the control illuminates the “ESC Off” telltale. Also, record warnings or messages provided regarding the ESC System.

<table>
<thead>
<tr>
<th>Ancillary Control</th>
<th>Control Activates “ESC Off” Telltale? (Yes/No)</th>
<th>Warnings or Messages Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For those controls that illuminate the “ESC Off” telltale above identify if the “ESC Off” telltale extinguishes upon cycling the ignition system.

<table>
<thead>
<tr>
<th>Ancillary Control</th>
<th>“ESC Off” telltale extinguishes upon cycling ignition? (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

For each control that illuminates the “ESC Off” telltale, did the telltale extinguish when the ignition is cycled from “On” (“Run”) to “Lock” or “Off” and then back again to the “On” (“Run”) position? If the control activated places the vehicle into a low-range four-wheel drive configuration designed for low-speed, off-road driving, the ESC System may remain turned off after the ignition has been cycled off and then back on and therefore the “ESC Off” telltale may not extinguish.

_____ Yes _____ No (fail)

DATA INDICATES COMPLIANCE: PASS/FAIL PASS

REMARKS:

RECORDED BY: Alan Ida                DATE: 8-29-11
APPROVED BY: Ken Webster              DATE: 8-29-11
DATA SHEET 5 (Sheet 1 of 3)
VEHICLE AND TEST TRACK DATA

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Camry / Passenger Car
NHTSA No.: CB5110  TEST DATE: 8-25-11

Test Track Requirements:
- Test Surface Slope (0-1 %)  1 %
- Peak Friction Coefficient (at least 0.9)  0.97

Full Fluid Levels: Fuel X  Coolant X  Other Fluids Washer (specify)

Tire Pressures:
- Required: Front Axle 230 kPa  Rear Axle 230 kPa

Vehicle Dimensions:
- Track Width 157.6 cm  Wheelbase 277.3 cm
- Roof Height 145.8 cm

Vehicle weight ratings:
- GAWR Front 1,210 KG  GAWR Rear 1,070 KG

Unloaded Vehicle Weight (UVW):
- Front Axle 911.0 KG  Left Front 450.8 KG  Right Front 460.2 KG
- Rear Axle 591.4 KG  Left Rear 306.2 KG  Right Rear 285.2 KG
- Total UVW 1,502.4 KG

Baseline Weight and Outrigger Selection (only for MPVs, Trucks, Buses):
- Calculated Baseline Weight (UVW + 73 kg) 1,575.4 KG
- Outrigger size required (“Standard” or “Heavy”) N/A
  - Standard - Baseline weight under 2,722 kg (6,000 lbs.)
  - Heavy - Baseline weight equal to or greater than 2,722 kg (6,000 lbs.)
### VEHICLE AND TEST TRACK DATA

**Loaded Vehicle Weight w/ Driver and Instrumentation (No Ballast)**

<table>
<thead>
<tr>
<th>Axle</th>
<th>Weight (KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Axle</td>
<td>989.6</td>
</tr>
<tr>
<td>Left Front</td>
<td>496.6</td>
</tr>
<tr>
<td>Right Front</td>
<td>493.0</td>
</tr>
<tr>
<td>Rear Axle</td>
<td>649.6</td>
</tr>
<tr>
<td>Left Rear</td>
<td>340.4</td>
</tr>
<tr>
<td>Right Rear</td>
<td>309.2</td>
</tr>
</tbody>
</table>

**Total Loaded Vehicle Weight** = 1,639.2 KG

**Ballast Required** = [Total Unloaded Vehicle Weight + 168 KG] - Total Loaded Weight w/ Driver and Instrumentation

\[
= \left[1,502.4 \text{ KG} + 168 \text{ KG}\right] - 1,639.2 \text{ KG}
\]

= 31.2 KG

**Total Loaded Vehicle Weight**

<table>
<thead>
<tr>
<th>Axle</th>
<th>Weight (KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Axle</td>
<td>1,003.8</td>
</tr>
<tr>
<td>Left Front</td>
<td>498.8</td>
</tr>
<tr>
<td>Right Front</td>
<td>505.0</td>
</tr>
<tr>
<td>Rear Axle</td>
<td>666.6</td>
</tr>
<tr>
<td>Left Rear</td>
<td>345.4</td>
</tr>
<tr>
<td>Right Rear</td>
<td>321.2</td>
</tr>
</tbody>
</table>

**Total Loaded Vehicle Weight** = 1,670.4 KG
DATA SHEET 5 (Sheet 3 of 3)
VEHICLE AND TEST TRACK DATA

Center of Gravity and Inertial Sensing System Location at Loaded Vehicle Condition

x-distance (longitudinal)  
Point of reference is the front axle centerline.  
(Positive from front axle toward rear of vehicle.)

y-distance (lateral)  
Point of reference is the vehicle centerline.  
(Positive from the center toward the right.)

z-distance (vertical)  
Point of reference is the ground plane.  
(Positive from the ground up.)

Locations:

<table>
<thead>
<tr>
<th></th>
<th>Center of Gravity</th>
<th>Inertial Sensing System</th>
</tr>
</thead>
<tbody>
<tr>
<td>x-distance</td>
<td>110.7 cm</td>
<td>164.8 cm</td>
</tr>
<tr>
<td>y-distance</td>
<td>-0.8 cm</td>
<td>-3.4 cm</td>
</tr>
<tr>
<td>z-distance</td>
<td>55.4 cm</td>
<td>84.9 cm</td>
</tr>
</tbody>
</table>

Distance Between Ultrasonic Sensors: 184.9 cm

TEST TRACK DATA MEETS REQUIREMENTS: YES

If no, explain:                                                                                     

REMARKS:                                                                                             

RECORDED BY: Alan Ida  DATE: 8-25-11  
APPROVED BY: Ken Webster  DATE: 8-29-11
VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Camry / Passenger Car

VEHICLE NHTSA No.: CB5110

Measured Cold Tire Pressures:  
- LF 230 kPa  
- RF 230 kPa  
- LR 230 kPa  
- RR 230 kPa

Wind Speed 0.4 m/sec  
(10m/sec (22mph) max for passenger cars; 5m/s (11mph) max. for MPVs and Trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) 16.1 °C

**Brake Conditioning**  
Time: 7:00 AM  
Date: 8-26-11

56 km/h (35 mph) Brake Stops  
Number of stops executed (10 required) 10 stops  
Observed deceleration rate range (.5g target) 0.50 – 0.55 g

72 km/h (45 mph) Brake Stops  
Number of stops executed (3 required) 3 stops  
Number of stops ABS activated (3 required) 3 stops  
Observed deceleration rate range 1.00 – 1.10 g

72 km/h (45 mph) Brake Cool Down Period  
Duration of cool down period (5 minutes min.) 5:14 minutes
3.0 TEST DATA….continued

DATA SHEET 6 (Sheet 2 of 3)
BRAKE AND TIRE CONDITIONING

Tire Conditioning Series No. 1  Time: 8:08 AM  Date: 8-26-11

Measured Tire Pressures:  
  LF 248 kPa  RF 250 kPa  
  LR 243 kPa  RR 241 kPa

Wind Speed 0.0 m/sec  
(10m/sec (22mph) max for passenger cars; 5m/s (11mph) max. for MPVs and Trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) 17.2°C

<table>
<thead>
<tr>
<th>30 meter (100 ft) Diameter Circle Maneuver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Runs</td>
</tr>
<tr>
<td>1-3</td>
</tr>
<tr>
<td>4-6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1 Hz 5 Cycle Sinusoidal Steering Maneuver to Determine Steering Wheel Angle For 0.5-0.6g Lateral Acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Runs</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

Steering wheel angle that corresponds to a peak 0.5–0.6g lateral acceleration; 80 degrees

<table>
<thead>
<tr>
<th>1 Hz 10 Cycle Sinusoidal Steering Maneuver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Runs</td>
</tr>
<tr>
<td>1 - 3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

* The steering wheel angle used for cycle 10 should be twice the angle used for cycles 1-9.
DATA SHEET 6 (Sheet 3 of 3)
BRAKE AND TIRE CONDITIONING

Tire Conditioning Series No. 2  
Time: 9:30 AM  
Date: 8-26-11  

Measured Tire Pressures:  
LF ___ 255 kPa  
RF ___ 258 kPa  
LR ___ 245 kPa  
RR ___ 245 kPa  

Wind Speed ___ 0.4 ___ m/sec  
(10m/sec (22mph) max for passenger cars; 5m/s (11mph) max. for MPVs and Trucks)  

Ambient Temperature (7°C (45°F) - 40°C (104°F)) _______ 19.4°C  

<table>
<thead>
<tr>
<th>Test Runs</th>
<th>Steering Direction</th>
<th>Target Lateral Acceleration (g)</th>
<th>Observed Lateral Acceleration (g)</th>
<th>Observed Vehicle Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>clockwise</td>
<td>0.5-0.6</td>
<td>0.55</td>
<td>32.2</td>
</tr>
<tr>
<td>4-6</td>
<td>counterclockwise</td>
<td>0.5-0.6</td>
<td>0.55</td>
<td>32.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Runs</th>
<th>Vehicle Speed Km/h (mph)</th>
<th>Steering Wheel Angle (degrees)</th>
<th>Target Peak Lateral Acceleration (g)</th>
<th>Observed Peak Lateral Acceleration (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56±2 (35±1)</td>
<td>N/A</td>
<td>0.5-0.6</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>56±2 (35±1)</td>
<td>0.5-0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>56±2 (35±1)</td>
<td>0.5-0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>56±2 (35±1)</td>
<td>0.5-0.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Steering wheel angle that corresponds to a peak 0.5–0.6g lateral acceleration: ___ 80 ____ degrees  

<table>
<thead>
<tr>
<th>Test Runs</th>
<th>Vehicle Speed (mph)</th>
<th>Steering Wheel Angle (degrees)</th>
<th>Target Peak Lateral Acceleration (g)</th>
<th>Observed Peak Lateral Acceleration (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>56±2 (35±1)</td>
<td>80 (cycles 1-10)</td>
<td>0.5-0.6</td>
<td>0.54</td>
</tr>
<tr>
<td>4</td>
<td>56±2 (35±1)</td>
<td>80 (cycles 1-9)</td>
<td>0.5-0.6</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>160 (cycle 10)*</td>
<td>N/A</td>
<td>0.92</td>
<td></td>
</tr>
</tbody>
</table>

* The steering wheel angle used for cycle 10 should be twice the angle used for cycles 1-9.

REMARKS:

RECORDED BY: Alan Ida  
DATE: 8-26-11  
APPROVED BY: Ken Webster  
DATE: 8-29-11
3.0 TEST DATA....continued

DATA SHEET 7 (1 of 2)
SLOWLY INCREASING STEER (SIS) MANEUVER

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Camry / Passenger Car

VEHICLE NHTSA No.: CB5110 TEST DATE: 8-26-11

Wind Speed 0.4 m/sec
(10 m/sec (22 mph) max for passenger cars; 5 m/s (11 mph) max for MPVs and Trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) 18.3°C

Static Data File Number: 0008

Selected Drive Configuration: 2WD

Selected Mode: default

Preliminary Left Steer Maneuver:

Lateral Acceleration measured at 30 degrees steering wheel angle ($a_{y,30\,\text{degrees}}$)

$$a_{y,30\,\text{degrees}} = 0.32 \, g$$

Assuming a linear relationship the following ratio should be used to calculate the steering wheel angle at .55g.

$$\frac{30\,\text{degrees}}{a_{y,30\,\text{degrees}}} = \frac{\delta_{\text{SIS}}}{0.55 \, g}$$

$$\delta_{\text{SIS}} = 51.6 \, \text{degrees} @ 0.55 \, g$$

$$\delta_{\text{SIS}} = 50 \, \text{degrees} \text{ (rounded)}$$

Steering Wheel Angle at Corrected 0.3 g Lateral Acceleration:

<table>
<thead>
<tr>
<th>Maneuver #</th>
<th>Initial Steer Direction</th>
<th>Time Clock (5 min max between runs)</th>
<th>Steering Wheel Angle to nearest 0.1 degree (degrees)</th>
<th>All Conditions Met?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0011</td>
<td>Left</td>
<td>8:32 am</td>
<td>-33.8</td>
<td>Yes</td>
</tr>
<tr>
<td>0013</td>
<td>Left</td>
<td>8:39 am</td>
<td>-34.1</td>
<td>Yes</td>
</tr>
<tr>
<td>0014</td>
<td>Left</td>
<td>8:42 am</td>
<td>-34.1</td>
<td>Yes</td>
</tr>
<tr>
<td>0015</td>
<td>Right</td>
<td>8:45 am</td>
<td>34.0</td>
<td>Yes</td>
</tr>
<tr>
<td>0016</td>
<td>Right</td>
<td>8:49 am</td>
<td>34.7</td>
<td>Yes</td>
</tr>
<tr>
<td>0017</td>
<td>Right</td>
<td>8:52 am</td>
<td>33.3</td>
<td>Yes</td>
</tr>
</tbody>
</table>
3.0 TEST DATA….continued

DATA SHEET 7 (2 of 2)
SLOWLY INCREASING STEER (SIS) MANEUVER

Average Overall Steering Wheel Angle:

\[ \delta_{0.3 \text{ g, overall}} = \left( \left| \delta_{0.3 \text{ g, left (1)}} \right| + \left| \delta_{0.3 \text{ g, left (2)}} \right| + \left| \delta_{0.3 \text{ g, left (3)}} \right| + \delta_{0.3 \text{ g, right (1)}} + \delta_{0.3 \text{ g, right (2)}} + \delta_{0.3 \text{ g, right (3)}} \right) / 6 \]

\[ \delta_{0.3 \text{ g, overall}} = \frac{34.0}{\text{degrees}} \]

[to nearest 0.1 degree]

REMARKS:

File 0012 was omitted due to brake application at the end of the maneuver. Therefore, the time clock indicates more than 5 minutes between maneuvers 0011 and 0013.
DATA SHEET 8 (1 of 3)
VEHICLE LATERAL STABILITY AND RESPONSIVENESS

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Camry / Passenger Car

VEHICLE NHTSA No.: CB5110  TEST DATE: 8-26-11

Tire conditioning completed  X  Yes  ____ No
ESC system is enabled  X  Yes  ____ No
On track calibration checks have been completed  X  Yes  ____ No
On track static data file for each sensor obtained  X  Yes  ____ No

Selected Drive Configuration: 2WD
Selected Mode: default

Overall steering wheel angle (Δ0.3g, overall)  34.0 degrees

Static Data File Number  0022

### Lateral Stability Test Series No. 1 – Counterclockwise Initial Steer Direction

<table>
<thead>
<tr>
<th>Maneuver #</th>
<th>Clock Time (1.5 – 5 min between each test run)</th>
<th>Commanded Steering Wheel Angle¹ (degrees)</th>
<th>Yaw Rates (degrees/sec)</th>
<th>YRR at 1.0 sec after COS [≤ 35%]</th>
<th>YRR at 1.75 sec after COS [≤ 20%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scalar</td>
<td>Angle</td>
<td>ψₚₑᵃᵏ</td>
<td>ψ_{1.0}sec</td>
<td>ψ_{1.75}sec</td>
</tr>
<tr>
<td>0023</td>
<td>9:45 am</td>
<td>1.5°Δ0.3g</td>
<td>51</td>
<td>12.53</td>
<td>-0.04</td>
</tr>
<tr>
<td>0024</td>
<td>9:49 am</td>
<td>2.0°Δ0.3g</td>
<td>68</td>
<td>17.08</td>
<td>-0.04</td>
</tr>
<tr>
<td>0025</td>
<td>9:53 am</td>
<td>2.5°Δ0.3g</td>
<td>85</td>
<td>21.63</td>
<td>-0.12</td>
</tr>
<tr>
<td>0026</td>
<td>9:56 am</td>
<td>3.0°Δ0.3g</td>
<td>102</td>
<td>26.11</td>
<td>-0.17</td>
</tr>
<tr>
<td>0027</td>
<td>9:59 am</td>
<td>3.5°Δ0.3g</td>
<td>119</td>
<td>29.84</td>
<td>-0.16</td>
</tr>
<tr>
<td>0028</td>
<td>10:03 am</td>
<td>4.0°Δ0.3g</td>
<td>136</td>
<td>32.78</td>
<td>-0.18</td>
</tr>
<tr>
<td>0029</td>
<td>10:06 am</td>
<td>4.5°Δ0.3g</td>
<td>153</td>
<td>38.23</td>
<td>-0.16</td>
</tr>
<tr>
<td>0030</td>
<td>10:10 am</td>
<td>5.0°Δ0.3g</td>
<td>170</td>
<td>40.29</td>
<td>-0.14</td>
</tr>
<tr>
<td>0031</td>
<td>10:13 am</td>
<td>5.5°Δ0.3g</td>
<td>187</td>
<td>45.36</td>
<td>-0.38</td>
</tr>
<tr>
<td>0032</td>
<td>10:17 am</td>
<td>6.0°Δ0.3g</td>
<td>204</td>
<td>46.77</td>
<td>-0.28</td>
</tr>
<tr>
<td>0033</td>
<td>10:20 am</td>
<td>6.5°Δ0.3g</td>
<td>221</td>
<td>50.60</td>
<td>-0.12</td>
</tr>
<tr>
<td>0034</td>
<td>10:23 am</td>
<td>7.0°Δ0.3g</td>
<td>238</td>
<td>51.48</td>
<td>-0.51</td>
</tr>
<tr>
<td>0035</td>
<td>10:26 am</td>
<td>7.5°Δ0.3g</td>
<td>255</td>
<td>53.02</td>
<td>0.70</td>
</tr>
<tr>
<td>0036</td>
<td>10:30 am</td>
<td>7.9°Δ0.3g</td>
<td>270</td>
<td>52.88</td>
<td>-0.06</td>
</tr>
</tbody>
</table>

1. Maneuver execution should continue until a steering wheel angle magnitude factor of 6.5°Δ0.3g overall or 270 degrees is utilized, whichever is greater provided the calculated magnitude of 6.5°Δ0.3g overall is less than or equal to 300 degrees. If 6.5°Δ0.3g overall is less than 270 degrees maneuver execution should continue by increasing the steering wheel angle magnitude by multiples of 0.5°Δ0.3g overall without exceeding the 270 degree steering wheel angle.
### Lateral Stability Test Series No. 2 – Clockwise Initial Steer Direction

<table>
<thead>
<tr>
<th>Maneuver #</th>
<th>Clock Time (1.5 – 5 min between each test run)</th>
<th>Commanded Steering Wheel Angle (degrees)</th>
<th>Yaw Rates (degrees/sec)</th>
<th>YRR at 1.0 sec after COS (&lt; 35%)</th>
<th>YRR at 1.75 sec after COS (&lt; 20%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Scalar</td>
<td>Angle</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>0037</td>
<td>10:33 am 1.5° δ₀.₃grese</td>
<td>51</td>
<td>-12.57 0.28 0.16</td>
<td>-2.26</td>
<td>Pass</td>
</tr>
<tr>
<td>0038</td>
<td>10:37 am 2.0° δ₀.₃grese</td>
<td>68</td>
<td>-16.77 0.12 0.13</td>
<td>-0.70</td>
<td>Pass</td>
</tr>
<tr>
<td>0039</td>
<td>10:41 am 2.5° δ₀.₃grese</td>
<td>85</td>
<td>-21.55 0.11 0.14</td>
<td>-0.49</td>
<td>Pass</td>
</tr>
<tr>
<td>0040</td>
<td>10:44 am 3.0° δ₀.₃grese</td>
<td>102</td>
<td>-26.06 0.19 0.15</td>
<td>-0.73</td>
<td>Pass</td>
</tr>
<tr>
<td>0041</td>
<td>10:47 am 3.5° δ₀.₃grese</td>
<td>119</td>
<td>-30.37 -0.05 0.00</td>
<td>0.15</td>
<td>Pass</td>
</tr>
<tr>
<td>0042</td>
<td>10:50 am 4.0° δ₀.₃grese</td>
<td>136</td>
<td>-36.04 -0.02 -0.10</td>
<td>0.05</td>
<td>Pass</td>
</tr>
<tr>
<td>0043</td>
<td>10:53 am 4.5° δ₀.₃grese</td>
<td>153</td>
<td>-39.78 0.05 -0.09</td>
<td>-0.11</td>
<td>Pass</td>
</tr>
<tr>
<td>0044</td>
<td>10:56 am 5.0° δ₀.₃grese</td>
<td>170</td>
<td>-43.29 0.00 -0.08</td>
<td>0.01</td>
<td>Pass</td>
</tr>
<tr>
<td>0045</td>
<td>11:00 am 5.5° δ₀.₃grese</td>
<td>187</td>
<td>-45.89 0.01 -0.01</td>
<td>-0.02</td>
<td>Pass</td>
</tr>
<tr>
<td>0046</td>
<td>11:03 am 6.0° δ₀.₃grese</td>
<td>204</td>
<td>-50.72 -0.13 0.04</td>
<td>0.26</td>
<td>Pass</td>
</tr>
<tr>
<td>0047</td>
<td>11:06 am 6.5° δ₀.₃grese</td>
<td>221</td>
<td>-49.95 0.12 0.17</td>
<td>-0.25</td>
<td>Pass</td>
</tr>
<tr>
<td>0048</td>
<td>11:09 am 7.0° δ₀.₃grese</td>
<td>238</td>
<td>-53.45 0.01 0.09</td>
<td>-0.02</td>
<td>Pass</td>
</tr>
<tr>
<td>0049</td>
<td>11:12 am 7.5° δ₀.₃grese</td>
<td>255</td>
<td>-56.06 -0.57 -0.05</td>
<td>1.02</td>
<td>Pass</td>
</tr>
<tr>
<td>0050</td>
<td>11:15 am 8.0° δ₀.₃grese</td>
<td>270</td>
<td>-57.11 -0.45 0.01</td>
<td>0.78</td>
<td>Pass</td>
</tr>
</tbody>
</table>

1. Maneuver execution should continue until a steering wheel angle magnitude factor of 6.5°δ₀.₃grese overall or 270 degrees is utilized, whichever is greater provided the calculated 6.5°δ₀.₃grese overall is less than or equal to 300 degrees. If 6.5°δ₀.₃grese overall is less than 270 degrees maneuver execution should continue by increasing the steering wheel angle magnitude by multiples of 0.5°δ₀.₃grese overall without exceeding the 270 degree steering wheel angle.

During execution of the sine with dwell maneuvers were any of the following events observed?

- Rim-to-pavement contact
- Tire debeading
- Loss of pavement contact of vehicle tires
- Did the test driver experience any vehicle loss of control or spinout?

If “Yes” explain the event and consult with the COTR.
### Responsiveness – Lateral Displacement

<table>
<thead>
<tr>
<th>Maneuver #</th>
<th>Initial Steer Direction</th>
<th>Commanded Steering Wheel Angle &amp; Overall Acceleration (5.0°*δ₀.₃g)</th>
<th>Calculated Lateral Displacement¹</th>
<th>Distance (m)</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>0030</td>
<td>Counter Clockwise</td>
<td>5.0° δ₀.₃g</td>
<td></td>
<td>2.87</td>
<td>Pass</td>
</tr>
<tr>
<td>0031</td>
<td>Counter Clockwise</td>
<td>5.5° δ₀.₃g</td>
<td></td>
<td>2.99</td>
<td>Pass</td>
</tr>
<tr>
<td>0032</td>
<td>Counter Clockwise</td>
<td>6.0° δ₀.₃g</td>
<td></td>
<td>3.11</td>
<td>Pass</td>
</tr>
<tr>
<td>0033</td>
<td>Counter Clockwise</td>
<td>6.5° δ₀.₃g</td>
<td></td>
<td>3.18</td>
<td>Pass</td>
</tr>
<tr>
<td>0034</td>
<td>Counter Clockwise</td>
<td>7.0° δ₀.₃g</td>
<td></td>
<td>3.26</td>
<td>Pass</td>
</tr>
<tr>
<td>0035</td>
<td>Counter Clockwise</td>
<td>7.5° δ₀.₃g</td>
<td></td>
<td>3.25</td>
<td>Pass</td>
</tr>
<tr>
<td>0036</td>
<td>Counter Clockwise</td>
<td>7.9° δ₀.₃g</td>
<td></td>
<td>3.25</td>
<td>Pass</td>
</tr>
<tr>
<td>0044</td>
<td>Clockwise</td>
<td>5.0° δ₀.₃g</td>
<td></td>
<td>2.84</td>
<td>Pass</td>
</tr>
<tr>
<td>0045</td>
<td>Clockwise</td>
<td>5.5° δ₀.₃g</td>
<td></td>
<td>3.01</td>
<td>Pass</td>
</tr>
<tr>
<td>0046</td>
<td>Clockwise</td>
<td>6.0° δ₀.₃g</td>
<td></td>
<td>3.09</td>
<td>Pass</td>
</tr>
<tr>
<td>0047</td>
<td>Clockwise</td>
<td>6.5° δ₀.₃g</td>
<td></td>
<td>3.13</td>
<td>Pass</td>
</tr>
<tr>
<td>0048</td>
<td>Clockwise</td>
<td>7.0° δ₀.₃g</td>
<td></td>
<td>3.16</td>
<td>Pass</td>
</tr>
<tr>
<td>0049</td>
<td>Clockwise</td>
<td>7.5° δ₀.₃g</td>
<td></td>
<td>3.22</td>
<td>Pass</td>
</tr>
<tr>
<td>0050</td>
<td>Clockwise</td>
<td>7.9° δ₀.₃g</td>
<td></td>
<td>3.25</td>
<td>Pass</td>
</tr>
</tbody>
</table>

1. Lateral displacement should be ≥ 1.83 m (6 ft) for vehicles with a GVWR of 3,500 kg (7,716 lb) or less; and ≥ 1.52 m (5ft) for vehicles with a GVWR greater than 3,500 kg (7,716 lb).

**DATA INDICATES COMPLIANCE:**  PASS/Fail  PASS

**REMARKS:**

**RECORDED BY:** Alan Ida  **DATE:** 8-26-11

**APPROVED BY:** Ken Webster  **DATE:** 8-29-11
VEHICLE MAKE/MODEL/MOBDY STYLE: Toyota / Camry / Passenger Car

VEHICLE NHTSA No.: CB5110 TEST DATE: 8-29-11

METHOD OF MALFUNCTION SIMULATION:
Describe method of malfunction simulation: Disconnect the Left Rear wheel speed sensor connector.

MALFUNCTION TELLTEALE ILLUMINATION:
Telltales illuminate and remains illuminated after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

X Yes  No

Time for telltales to illuminate after ignition system is activated.
0 Seconds (must be within 2 minutes)  Pass  Fail

ESC SYSTEM RESTORATION:
Telltales extinguishes after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

X Yes  No

Time for telltales to extinguish after ignition system is activated and vehicle speed of 48+ 8 km/h (30+ 5mph) is reached.
0 Seconds (must be within 2 minutes)  Pass  Fail

DATA INDICATES COMPLIANCE: PASS/FAIL  PASS

REMARKS:
The vehicle did not require driving to illuminate or extinguish the malfunction telltales. When the wheel speed sensor was disconnected, the ESC and ABS malfunction telltales illuminated. After the wheel speed sensor connector was restored, the ESC and ABS malfunction telltales extinguished.

RECORDED BY: Alan Ida DATE: 8-29-11
APPROVED BY: Ken Webster DATE: 8-29-11
DATA SHEET 9 (Sheet 2 of 2)
MALFUNCTION WARNING TEST

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Camry / Passenger Car

VEHICLE NHTSA No.: CB5110 TEST DATE: 8-29-11

METHOD OF MALFUNCTION SIMULATION:
Describe method of malfunction simulation: Disconnect the brake pedal switch sensor connector.

MALFUNCTION TELLTEALE ILLUMINATION:
Telltale illuminates and remains illuminated after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

X Yes No

Time for telltale to illuminate after ignition system is activated.
3 Seconds (must be within 2 minutes) X Pass Fail

ESC SYSTEM RESTORATION:
Telltale extinguishes after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

X Yes No

Time for telltale to extinguish after ignition system is activated.
0 Seconds (must be within 2 minutes) X Pass Fail

DATA INDICATES COMPLIANCE: PASS/FAIL PASS

REMARKS:
The vehicle did not require driving to illuminate or extinguish the malfunction telltales. However, the brake pedal required to be depressed for 3 seconds in order to illuminate the ESC and ABS malfunction telltales. After the brake pedal switch connector was restored, the ESC and ABS malfunction telltales extinguished without any brake pedal application.

RECORDED BY: Alan Ida DATE: 8-29-11
APPROVED BY: Ken Webster DATE: 8-29-11
### 4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

<table>
<thead>
<tr>
<th>Type</th>
<th>Output</th>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy Description</th>
<th>Specifics</th>
<th>Serial Number</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tire Pressure Gauge</td>
<td>Vehicle Tire Pressure</td>
<td>0-60psi</td>
<td>0.5 psi</td>
<td>±0.5% of applied pressure</td>
<td>Moroso Model: 89562</td>
<td>N/A</td>
<td>By: TRC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0-60psi</td>
<td></td>
<td>Date: 6-14-11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: 9-12-11</td>
</tr>
<tr>
<td>Platform Scales</td>
<td>Vehicle Total, Wheel, and Axle Load</td>
<td>0-2500 lb</td>
<td>0.5 lb</td>
<td>±1.0% of applied load</td>
<td>Mettler Toledo Model: JXGA1000</td>
<td>5225831-5JC</td>
<td>By: Mettler Toledo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>per each of four</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date: 8-11-11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pads</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: 11-11-11</td>
</tr>
<tr>
<td>Automated Steering Machine with</td>
<td>Handwheel Angle</td>
<td>±800 deg</td>
<td>0.25 deg</td>
<td>±0.25 deg</td>
<td>Heitz Automotive Testing Model: Sprint 3</td>
<td>60303</td>
<td>By: ATI-Heitz</td>
</tr>
<tr>
<td>Steering Machine with Steering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date: 2-18-11</td>
</tr>
<tr>
<td>Angle Encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: 2-18-12</td>
</tr>
<tr>
<td>Multi-Axis Inertial Sensing System</td>
<td>Longitudinal, Lateral, and Vertical</td>
<td>Accelero-</td>
<td>Accelero-</td>
<td>Accelerom-</td>
<td>BEI Technologies Model: MotionPAK MP-1</td>
<td>0768</td>
<td>By: BEI Tech</td>
</tr>
<tr>
<td></td>
<td>Acceleration</td>
<td>meters: ±2 g</td>
<td>meters:</td>
<td>full range</td>
<td></td>
<td></td>
<td>Date: 1-10-11</td>
</tr>
<tr>
<td></td>
<td>Roll, Yaw, and Pitch Rate</td>
<td>±10 ug</td>
<td>±0.05% of</td>
<td>full range</td>
<td></td>
<td></td>
<td>Due: 1-10-12</td>
</tr>
<tr>
<td></td>
<td>Roll, Yaw, and Pitch Rate</td>
<td>±100 deg/s</td>
<td>±0.004 deg/s</td>
<td>full range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radar Speed Sensor and Dashboard</td>
<td>Vehicle Speed</td>
<td>0-125 mph</td>
<td>0.009 mph</td>
<td>±0.25% of full scale</td>
<td>A-DAT Corp. Radar Model: DRS-6 Display Model:</td>
<td>1400603</td>
<td>By: B+S Multidata</td>
</tr>
<tr>
<td>Display</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RD-2</td>
<td></td>
<td>Date: 2-14-12</td>
</tr>
<tr>
<td>Ultrasonic Distance Measuring</td>
<td>Left and Right</td>
<td>5-24 inches</td>
<td>0.01 inches</td>
<td>±0.25% of maximum distance</td>
<td>Massa Products Corporation Model: M-5000/220</td>
<td>104619 &amp; 104613</td>
<td>By: Consumers Energy Laboratory Services</td>
</tr>
<tr>
<td>System</td>
<td>Side Vehicle Height</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date: 1-20-11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: 1-20-12</td>
</tr>
<tr>
<td>Data Acquisition System</td>
<td>Record Time; Velocity; Distance;</td>
<td>Sufficient to</td>
<td>Sufficient</td>
<td>Sufficient to meet or exceed</td>
<td>Dewtron Sidehand DAS Model: DA-121-16 Digitizer Model: Dewe-Onion-1616-100 Amplifier/AntiAliasing: MDAQ-FILT-10-S</td>
<td>12060-1105</td>
<td>By: Dewtron</td>
</tr>
<tr>
<td></td>
<td>Lateral, Longitudinal, and Vertical</td>
<td>meet or exceed</td>
<td>meet or exceed</td>
<td>individual sensors</td>
<td></td>
<td></td>
<td>Date: 12-02-10</td>
</tr>
<tr>
<td></td>
<td>Accelerations; Roll, Yaw, and Pitch Rates;</td>
<td>individual sensors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: 12-02-11</td>
</tr>
<tr>
<td></td>
<td>Steering Wheel Angle.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Cell</td>
<td>Vehicle Brake Pedal Force</td>
<td>0-300 lb</td>
<td>1 lb</td>
<td>±0.05% of full scale</td>
<td>DATRON Model: DTM-LPA</td>
<td>4970-1103</td>
<td>By: TRC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date: per test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: per test</td>
</tr>
<tr>
<td>Coordinate Measurement Machine</td>
<td>Inertial Sensing System Location</td>
<td>0-10 feet</td>
<td>0.001 inch</td>
<td>±0.003% of full scale</td>
<td>FARO International Model: Faro Arm N10</td>
<td>U12-05-08-07108</td>
<td>By: FARO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date: 8-19-11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Due: 8-19-12</td>
</tr>
<tr>
<td>Outriggers</td>
<td>No output. Safety Item.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>NHTSA Titanium Outriggers Model: Docket 2007-27662-11</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.0 PHOTOGRAPHS

5.1 ¾ FRONT VIEW FROM LEFT SIDE OF VEHICLE
5.2 ¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE
5.3 VEHICLE CERTIFICATION LABEL
5.4 TIRE AND LOADING INFORMATION LABEL
5.5 WINDOW STICKER (MONRONEY LABEL)
5.6 ESC OFF TELLTALE
5.7 ESC MALFUNCTION TELLTALE
5.8 ESC OFF CONTROL
5.9 ¾ FRONT VIEW - TEST VEHICLE INSTRUMENTED
5.10 ¾ REAR VIEW – TEST VEHICLE INSTRUMENTED
5.11 STEERING WHEEL CONTROLLER AND DATA ACQUISITION SYSTEM
5.12 STEERING CONTROLLEER BATTERY BOX
5.13 INERTIA MEASUREMENT UNIT
5.14 VEHICLE SPEED SENSOR
5.15 BODY ROLL SENSOR (DRIVER SIDE)
5.16 BODY ROLL SENSOR (PASSENGER SIDE)
5.17 BRAKE PEDAL FORCE TRANSDUCER
5.1 ¾ FRONT VIEW FROM LEFT SIDE OF VEHICLE
5.2 ¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE
### Tire and Loading Information Label

The combined weight of occupants and cargo should never exceed 410 kg or 900 lbs. Le poids total des occupants et du chargement ne doit jamais dépasser 410 kg ou 900 lbs.

<table>
<thead>
<tr>
<th>TIRE PNEU</th>
<th>SIZE DIMENSIONS</th>
<th>COLD TIRE PRESSURE</th>
<th>SEE OWNER’S MANUAL FOR ADDITIONAL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRONT AVANT</td>
<td>P215/60R16</td>
<td>230 kPa, 34 PSI</td>
<td>VOIR LE MANUEL DE L’USAGER POUR PLUS DE RENSEIGNEMENTS</td>
</tr>
<tr>
<td>REAR ARRIÈRE</td>
<td>P215/60R16</td>
<td>230 kPa, 34 PSI</td>
<td></td>
</tr>
<tr>
<td>SPARE DE SECOURS</td>
<td>T155/70D17</td>
<td>420 kPa, 60 PSI</td>
<td></td>
</tr>
</tbody>
</table>
5.6 ESC OFF TELTALE
5.7 ESC MALFUNCTION TELLTALE
5.8 ESC OFF CONTROL
5.11 STEERING WHEEL CONTROLLER AND DATA ACQUISITION SYSTEM
5.13 INERTIA MEASUREMENT UNIT
5.14 VEHICLE SPEED SENSOR

2011 TOYOTA CAMRY
FMVSS 126
VEHICLE No.: CB5110
AUGUST 2011
5.15 BODY ROLL SENSOR (DRIVER SIDE)
5.16 BODY ROLL SENSOR (PASSENGER SIDE)
5.17 BRAKE PEDAL FORCE TRANSDUCER
6.0 DATA PLOTS

Figure 1.  Steering Angle and Yaw Rate Time History, Counter-Clockwise Initial Steer Tests

Figure 2.  Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Counter-Clockwise Initial Steer Tests

Figure 3.  Steering Angle and Yaw Rate Time History, Clockwise Initial Steer Tests

Figure 4.  Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Clockwise Initial Steer Tests
Figure 1. Steering Angle and Yaw Rate Time History, Counter-Clockwise Initial Steer Tests
Figure 2. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Counter-Clockwise Initial Steer Tests
Figure 3. Steering Angle and Yaw Rate Time History, Clockwise Initial Steer Tests
Figure 4. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Clockwise Initial Steer Tests
7.0 OTHER DOCUMENTATION

7.1 OWNER’S MANUAL PAGES
7.2 VEHICLE ARRIVAL CONDITION REPORT
7.3 VEHICLE COMPLETION CONDITION REPORT
7.4 SINE WITH DWELL TEST RESULTS
7.5 SLOWLY INCREASING STEER TEST RESULTS
7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES
7.1 OWNER’S MANUAL PAGES
2-4. Using other driving systems

Driving assist systems

To help enhance driving safety and performance, the following systems operate automatically in response to various driving situations. Be aware, however, that these systems are supplementary and should not be relied upon too heavily when operating the vehicle.

- **ABS (Anti-lock Brake System)**
  Helps to prevent wheel lock when the brakes are applied suddenly, or if the brakes are applied while driving on a slippery road surface.

- **Brake assist**
  Generates an increased level of braking force after the brake pedal is depressed, when the system detects a panic stop situation.

- **VSC (Vehicle Stability Control)**
  Helps the driver to control skidding when swerving suddenly or turning on slippery road surfaces.

- **TRAC (Traction Control)**
  Maintains drive power and prevent the front wheels from spinning when starting the vehicle or accelerating on slippery roads.

### When VSC and TRAC are operating

If the vehicle is in danger of slipping or the front wheels spin, the indicator flashes to indicate that VSC/TRAC have been engaged.
To disable TRAC and/or VSC

If the vehicle gets stuck in fresh snow or mud, TRAC and VSC may reduce power from the engine to the wheels. You may need to turn the system off to enable you to rock the vehicle in order to free it.

Turning off TRAC

Quickly push and release the button to turn off TRAC.

The “TRAC OFF” indicator light should come on.

Push the button again to turn the system back on.

Turning off TRAC and VSC

Push and hold the button for more than 3 seconds while the vehicle is stopped to turn off TRAC and VSC.

The “TRAC OFF” and VSC OFF indicator lights should come on.

Push the button again to turn the system back on.
2-4. Using other driving systems

Automatic reactivation of TRAC and VSC

- Vehicles with smart key system
  Turning the “ENGINE START STOP” switch OFF after turning off the TRAC and VSC systems will automatically re-enable them.

- Vehicles without smart key system
  Turning the engine switch OFF after turning off the TRAC and VSC systems will automatically re-enable them.

Automatic TRAC reactivation

If only the TRAC system is turned off, the TRAC system will turn on when vehicle speed increases.

Automatic TRAC and VSC reactivation

If the TRAC and VSC systems are turned off, the systems will not turn on even when vehicle speed increases.

Sounds and vibrations caused by ABS, brake assist, VSC and TRAC

1. A sound may be heard from the engine compartment when the engine is started or just after the vehicle begins to move. This sound does not indicate that a malfunction has occurred in any of these systems.

1. Any of the following conditions may occur when the above systems are operating. None of these indicates that a malfunction has occurred.
   - Vibrations may be felt through the vehicle body and steering.
   - A motor sound may be heard after the vehicle comes to a stop.
   - The brake pedal may pulsate slightly after ABS is activated.
   - The brake pedal may move down slightly after ABS is activated.

If the slip indicator comes on...

It may indicate a malfunction in the VSC and TRAC. Contact your Toyota dealer.
2-4. Using other driving systems

---

**CAUTION**

- **ABS does not operate effectively when**
  1. Tires with inadequate gripping ability are used (such as excessively worn tires on a snow covered road).
  1. The vehicle hydroplanes while driving at high speed on the wet or slick road.

- **Stopping distance when ABS is operating on the wet or slick roads**
  ABS is not designed to shorten the vehicle's stopping distance. Always maintain a safe distance from the vehicle in front of you in the following situations.
  1. When driving on dirt, gravel or snow-covered roads
  1. When driving with tire chains
  1. When driving over bumps in the road
  1. When driving over roads with potholes or uneven roads

- **TRAC may not operate effectively when**
  Directional control and power may not be achievable while driving on slippery road surfaces, even if the TRAC system is operating.
  Do not drive the vehicle in conditions where stability and power may be lost.
2-4. Using other driving systems

**CAUTION**

- **When VSC is activated**
  The slip indicator light flashes. Always drive carefully. Reckless driving may cause an accident. Exercise particular care when the indicator light flashes.

- **When TRAC and VSC are off**
  Be especially careful and drive at a speed appropriate to the road conditions. As these are systems to ensure vehicle stability and driving force, do not turn off TRAC and VSC unless necessary.

- **Replacing tires**
  Make sure that all tires are of the same size, brand, tread pattern and total load capacity. In addition, make sure that the tires are inflated to the recommended tire pressure level.
  The ABS and VSC system will not function correctly if different tires are fitted on the vehicle.
  Contact your Toyota dealer for further information when replacing tires or wheels.

- **Handling of tires and suspension**
  Using tires with any kind of problem or modifying the suspension will affect the driving assist systems, and may cause the system to malfunction.
**7.2 VEHICLE ARRIVAL CONDITION REPORT**

**CONTRACT NO.** DTNH22-08-D-00097 **DATE:** 8/24/11

**FROM:** Automotive Allies

**TO:** TRC

**PURPOSE:** (X) Initial ( ) Received ( ) Present via Transfer vehicle condition

**MODEL YEAR/MAKE/MODEL/BODY STYLE:** 2011 / Toyota / Camry / Passenger Car

**MANUFACTURE DATE:** 07/11 **NHTSA NO.:** CB5110

**BODY COLOR:** Black **VIN:** 4T1BF3EK0BU762724

**ODOMETER READING:** 71 miles **GVWR:** 1,971 KG

**PURCHASE PRICE:** $ rented / leased **DEALER’S NAME:** Automotive Allies, 209 W. Alameda Avenue, Suite 101, Burbank, CA 91502

- **X** ALL OPTIONS LISTED ON “WINDOW STICKER” ARE PRESENT ON THE TEST VEHICLE
- **X** TIRES AND WHEEL RIMS ARE NEW AND THE SAME AS LISTED
- **X** THERE ARE NO DENTS OR OTHER INTERIOR OR EXTERIOR FLAWS
- **X** THE VEHICLE HAS BEEN PROPERLY PREPARED AND IS IN RUNNING CONDITION
- **X** THE GLOVE BOX CONTAINS AN OWNER’S MANUAL, WARRANTY DOCUMENT, CONSUMER INFORMATION, AND EXTRA SET OF KEYS
- **X** PROPER FUEL FILLER CAP IS SUPPLIED ON THE TEST VEHICLE
- **X** PLACE VEHICLE IN STORAGE AREA
- **X** INSPECT THE VEHICLE’S INTERIOR AND EXTERIOR, INCLUDING ALL WINDOWS, SEATS, DOORS, ETC., TO CONFIRM THAT EACH SYSTEM IS COMPLETE AND FUNCTIONAL PER THE MANUFACTURER’S SPECIFICATIONS. ANY DAMAGE, MISADJUSTMENT, OR OTHER UNUSUAL CONDITION THAT COULD INFLUENCE THE TEST PROGRAM OR TEST RESULTS SHALL BE RECORDED. REPORT ANY ABNORMAL CONDITION TO THE NHTSA COTR BEFORE BEGINNING ANY TEST

**RECORDED BY:** Alan Ida **DATE:** 8-24-11

**APPROVED BY:** Ken Webster **DATE:** 8-29-11
7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO. DTNH22-08-D-00097 DATE: 8/29/11

MODEL YEAR/MAKE/MODEL/BODY STYLE: 2011 / Toyota / Camry / Passenger Car

MANUFACTURE DATE: 07/11 NHTSA NO.: CB5110

BODY COLOR: Black VIN: 4T1BF3EK0BU762724

ODOMETER READING: 89 miles GVWR: 1,971 KG

LIST OF FMVSS TESTS PERFORMED BY THIS LAB: 126, 135

X THERE ARE NO DENTS OR OTHER INTERIOR OR EXTERIOR FLAWS

X THE VEHICLE HAS BEEN PROPERLY MAINTAINED AND IS IN RUNNING CONDITION

X THE GLOVE BOX CONTAINS AN OWNER'S MANUAL, WARRANTY DOCUMENT, CONSUMER INFORMATION, AND EXTRA SET OF KEYS

X PROPER FUEL FILLER CAP IS SUPPLIED ON THE TEST VEHICLE

REMARKS:

Equipment that is no longer on the test vehicle as noted on Vehicle Arrival Condition Report:
   None.

Explanation for equipment removal:
   N/A

Test Vehicle Condition:
   Like new.

RECORDED BY: Alan Ida DATE: 8-29-11

APPROVED BY: Ken Webster DATE: 8-29-11
### 7.4 SINE WITH DWELL TEST RESULTS

**2011 Toyota Camry**  
**NHTSA No.: CB5110**

Date Created: 26-Aug-11

---

#### LEFT-TO-RIGHT (INITIAL COUNTER-CLOCKWISE STEER)

<table>
<thead>
<tr>
<th>File</th>
<th>SWA @ 5deg Ct</th>
<th>MES</th>
<th>Time@5deg</th>
<th>COS</th>
<th>Time@COS</th>
<th>MOS</th>
<th>Time@MOS</th>
<th>YRR1(%)</th>
<th>YR1 (deg/sec)</th>
<th>YRR1 Ct</th>
<th>YRR175(%)</th>
<th>YR175 (deg/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0023</td>
<td>618</td>
<td>50.357</td>
<td>3.080</td>
<td>999</td>
<td>4.984</td>
<td>755</td>
<td>3.766</td>
<td>-0.321</td>
<td>-0.040</td>
<td>1198</td>
<td>-0.215</td>
<td>-0.027</td>
</tr>
<tr>
<td>0024</td>
<td>617</td>
<td>50.522</td>
<td>3.076</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.767</td>
<td>-0.217</td>
<td>-0.037</td>
<td>1198</td>
<td>-0.032</td>
<td>-0.005</td>
</tr>
<tr>
<td>0025</td>
<td>616</td>
<td>50.417</td>
<td>3.074</td>
<td>999</td>
<td>4.988</td>
<td>755</td>
<td>3.770</td>
<td>-0.555</td>
<td>-0.120</td>
<td>1199</td>
<td>-0.128</td>
<td>-0.028</td>
</tr>
<tr>
<td>0026</td>
<td>616</td>
<td>50.383</td>
<td>3.071</td>
<td>999</td>
<td>4.986</td>
<td>755</td>
<td>3.769</td>
<td>-0.645</td>
<td>-0.168</td>
<td>1199</td>
<td>0.086</td>
<td>0.023</td>
</tr>
<tr>
<td>0027</td>
<td>615</td>
<td>50.270</td>
<td>3.070</td>
<td>999</td>
<td>4.987</td>
<td>755</td>
<td>3.770</td>
<td>-0.544</td>
<td>-0.162</td>
<td>1199</td>
<td>-0.640</td>
<td>-0.191</td>
</tr>
<tr>
<td>0028</td>
<td>615</td>
<td>50.367</td>
<td>3.067</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.768</td>
<td>-0.556</td>
<td>-0.182</td>
<td>1199</td>
<td>-0.056</td>
<td>-0.018</td>
</tr>
<tr>
<td>0029</td>
<td>614</td>
<td>50.364</td>
<td>3.064</td>
<td>999</td>
<td>4.981</td>
<td>755</td>
<td>3.765</td>
<td>-0.409</td>
<td>-0.156</td>
<td>1198</td>
<td>-0.236</td>
<td>-0.090</td>
</tr>
<tr>
<td>0030</td>
<td>614</td>
<td>50.436</td>
<td>3.064</td>
<td>999</td>
<td>4.981</td>
<td>755</td>
<td>3.765</td>
<td>-0.352</td>
<td>-0.142</td>
<td>1198</td>
<td>-0.013</td>
<td>-0.005</td>
</tr>
<tr>
<td>0031</td>
<td>614</td>
<td>50.507</td>
<td>3.064</td>
<td>999</td>
<td>4.981</td>
<td>755</td>
<td>3.766</td>
<td>-0.839</td>
<td>-0.380</td>
<td>1198</td>
<td>-0.015</td>
<td>-0.007</td>
</tr>
<tr>
<td>0032</td>
<td>615</td>
<td>50.314</td>
<td>3.069</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.770</td>
<td>-0.606</td>
<td>-0.283</td>
<td>1199</td>
<td>-0.263</td>
<td>-0.123</td>
</tr>
<tr>
<td>0033</td>
<td>615</td>
<td>50.306</td>
<td>3.066</td>
<td>999</td>
<td>4.982</td>
<td>755</td>
<td>3.768</td>
<td>-0.243</td>
<td>-0.123</td>
<td>1198</td>
<td>0.076</td>
<td>0.038</td>
</tr>
<tr>
<td>0034</td>
<td>615</td>
<td>50.504</td>
<td>3.068</td>
<td>999</td>
<td>4.983</td>
<td>755</td>
<td>3.769</td>
<td>-0.995</td>
<td>-0.512</td>
<td>1198</td>
<td>-0.105</td>
<td>-0.054</td>
</tr>
<tr>
<td>0035</td>
<td>615</td>
<td>50.343</td>
<td>3.069</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.770</td>
<td>1.312</td>
<td>0.696</td>
<td>1198</td>
<td>-0.063</td>
<td>-0.033</td>
</tr>
<tr>
<td>0036</td>
<td>615</td>
<td>50.277</td>
<td>3.068</td>
<td>999</td>
<td>4.983</td>
<td>755</td>
<td>3.768</td>
<td>-0.115</td>
<td>-0.061</td>
<td>1198</td>
<td>-0.096</td>
<td>-0.051</td>
</tr>
</tbody>
</table>

#### RIGHT-TO-LEFT (INITIAL CLOCKWISE STEER)

<table>
<thead>
<tr>
<th>File</th>
<th>SWA @ 5deg Ct</th>
<th>MES</th>
<th>Time@5deg</th>
<th>COS</th>
<th>Time@COS</th>
<th>MOS</th>
<th>Time@MOS</th>
<th>YRR1(%)</th>
<th>YR1 (deg/sec)</th>
<th>YRR1 Ct</th>
<th>YRR175(%)</th>
<th>YR175 (deg/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0037</td>
<td>618</td>
<td>50.407</td>
<td>3.083</td>
<td>999</td>
<td>4.988</td>
<td>755</td>
<td>3.769</td>
<td>-2.264</td>
<td>0.284</td>
<td>1199</td>
<td>-1.279</td>
<td>0.161</td>
</tr>
<tr>
<td>0038</td>
<td>617</td>
<td>50.245</td>
<td>3.076</td>
<td>999</td>
<td>4.987</td>
<td>755</td>
<td>3.767</td>
<td>-0.698</td>
<td>0.117</td>
<td>1199</td>
<td>-0.789</td>
<td>0.132</td>
</tr>
<tr>
<td>0039</td>
<td>616</td>
<td>50.219</td>
<td>3.071</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.766</td>
<td>-0.495</td>
<td>0.107</td>
<td>1198</td>
<td>-0.631</td>
<td>0.138</td>
</tr>
<tr>
<td>0040</td>
<td>616</td>
<td>50.335</td>
<td>3.070</td>
<td>999</td>
<td>4.987</td>
<td>755</td>
<td>3.766</td>
<td>-0.727</td>
<td>0.190</td>
<td>1199</td>
<td>-0.575</td>
<td>0.150</td>
</tr>
<tr>
<td>0041</td>
<td>615</td>
<td>50.185</td>
<td>3.066</td>
<td>999</td>
<td>4.983</td>
<td>754</td>
<td>3.765</td>
<td>0.150</td>
<td>-0.045</td>
<td>1198</td>
<td>0.015</td>
<td>-0.005</td>
</tr>
<tr>
<td>0042</td>
<td>615</td>
<td>50.277</td>
<td>3.069</td>
<td>999</td>
<td>4.988</td>
<td>755</td>
<td>3.769</td>
<td>0.047</td>
<td>-0.017</td>
<td>1199</td>
<td>0.286</td>
<td>-0.103</td>
</tr>
<tr>
<td>0043</td>
<td>615</td>
<td>50.633</td>
<td>3.067</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.768</td>
<td>-0.114</td>
<td>0.045</td>
<td>1199</td>
<td>0.233</td>
<td>-0.093</td>
</tr>
<tr>
<td>0044</td>
<td>615</td>
<td>50.448</td>
<td>3.068</td>
<td>999</td>
<td>4.986</td>
<td>755</td>
<td>3.769</td>
<td>0.009</td>
<td>-0.004</td>
<td>1199</td>
<td>0.176</td>
<td>-0.076</td>
</tr>
<tr>
<td>0045</td>
<td>615</td>
<td>50.374</td>
<td>3.065</td>
<td>998</td>
<td>4.983</td>
<td>755</td>
<td>3.766</td>
<td>-0.017</td>
<td>0.008</td>
<td>1198</td>
<td>0.028</td>
<td>-0.013</td>
</tr>
<tr>
<td>0046</td>
<td>615</td>
<td>50.060</td>
<td>3.067</td>
<td>998</td>
<td>4.984</td>
<td>755</td>
<td>3.768</td>
<td>0.259</td>
<td>-0.131</td>
<td>1198</td>
<td>-0.070</td>
<td>0.035</td>
</tr>
<tr>
<td>0047</td>
<td>615</td>
<td>50.337</td>
<td>3.068</td>
<td>998</td>
<td>4.983</td>
<td>755</td>
<td>3.768</td>
<td>-0.246</td>
<td>0.123</td>
<td>1198</td>
<td>-0.333</td>
<td>0.168</td>
</tr>
<tr>
<td>0048</td>
<td>615</td>
<td>50.295</td>
<td>3.068</td>
<td>998</td>
<td>4.984</td>
<td>755</td>
<td>3.769</td>
<td>-0.024</td>
<td>0.013</td>
<td>1198</td>
<td>-0.172</td>
<td>0.092</td>
</tr>
<tr>
<td>0049</td>
<td>615</td>
<td>50.228</td>
<td>3.070</td>
<td>999</td>
<td>4.985</td>
<td>755</td>
<td>3.770</td>
<td>1.023</td>
<td>-0.574</td>
<td>1199</td>
<td>0.083</td>
<td>-0.046</td>
</tr>
<tr>
<td>0050</td>
<td>615</td>
<td>50.438</td>
<td>3.066</td>
<td>998</td>
<td>4.981</td>
<td>755</td>
<td>3.766</td>
<td>0.783</td>
<td>-0.447</td>
<td>1198</td>
<td>-0.012</td>
<td>0.007</td>
</tr>
</tbody>
</table>
## 7.4 SINE WITH DWELL TEST RESULTS
### 2011 Toyota Camry
#### NHTSA No.: CB5110

Date Created: 26-Aug-11

---

### LEFT-TO-RIGHT (INITIAL COUNTER-CLOCKWISE STEER)

<table>
<thead>
<tr>
<th>File</th>
<th>YRR175 Ct</th>
<th>2nd Yaw Peak(deg/sec)</th>
<th>2nd Yaw Peak Ct</th>
<th>Lat Disp (ft)</th>
<th>Lat. Acc. 1.07s (g)</th>
<th>1st SWA Peak(deg)</th>
<th>1st SWA Peak Ct</th>
<th>2nd SWA Mean(deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0023</td>
<td>1348</td>
<td>12.526</td>
<td>857</td>
<td>-3.811</td>
<td>0.357</td>
<td>51.083</td>
<td>683</td>
<td>50.842</td>
</tr>
<tr>
<td>0024</td>
<td>1348</td>
<td>17.076</td>
<td>849</td>
<td>-5.090</td>
<td>0.451</td>
<td>68.116</td>
<td>684</td>
<td>67.844</td>
</tr>
<tr>
<td>0025</td>
<td>1349</td>
<td>21.628</td>
<td>854</td>
<td>-6.125</td>
<td>0.508</td>
<td>84.987</td>
<td>684</td>
<td>84.780</td>
</tr>
<tr>
<td>0026</td>
<td>1349</td>
<td>26.106</td>
<td>847</td>
<td>-7.053</td>
<td>0.572</td>
<td>102.116</td>
<td>684</td>
<td>101.992</td>
</tr>
<tr>
<td>0027</td>
<td>1349</td>
<td>29.842</td>
<td>835</td>
<td>-7.804</td>
<td>0.658</td>
<td>119.095</td>
<td>684</td>
<td>118.993</td>
</tr>
<tr>
<td>0028</td>
<td>1348</td>
<td>32.779</td>
<td>830</td>
<td>-8.396</td>
<td>0.686</td>
<td>136.059</td>
<td>684</td>
<td>135.942</td>
</tr>
<tr>
<td>0029</td>
<td>1348</td>
<td>38.235</td>
<td>835</td>
<td>-8.953</td>
<td>0.697</td>
<td>152.813</td>
<td>684</td>
<td>153.006</td>
</tr>
<tr>
<td>0030</td>
<td>1348</td>
<td>40.289</td>
<td>837</td>
<td>-9.402</td>
<td>0.681</td>
<td>169.487</td>
<td>684</td>
<td>170.021</td>
</tr>
<tr>
<td>0031</td>
<td>1348</td>
<td>45.361</td>
<td>841</td>
<td>-9.816</td>
<td>0.704</td>
<td>186.927</td>
<td>684</td>
<td>187.040</td>
</tr>
<tr>
<td>0032</td>
<td>1349</td>
<td>46.775</td>
<td>842</td>
<td>-10.216</td>
<td>0.658</td>
<td>203.681</td>
<td>686</td>
<td>204.328</td>
</tr>
<tr>
<td>0033</td>
<td>1348</td>
<td>50.596</td>
<td>843</td>
<td>-10.423</td>
<td>0.657</td>
<td>221.083</td>
<td>685</td>
<td>221.227</td>
</tr>
<tr>
<td>0034</td>
<td>1348</td>
<td>51.477</td>
<td>846</td>
<td>-10.681</td>
<td>0.594</td>
<td>236.331</td>
<td>686</td>
<td>238.230</td>
</tr>
<tr>
<td>0035</td>
<td>1348</td>
<td>53.021</td>
<td>847</td>
<td>-10.666</td>
<td>0.580</td>
<td>253.295</td>
<td>685</td>
<td>255.068</td>
</tr>
<tr>
<td>0036</td>
<td>1348</td>
<td>52.878</td>
<td>845</td>
<td>-10.669</td>
<td>0.658</td>
<td>268.188</td>
<td>685</td>
<td>269.854</td>
</tr>
</tbody>
</table>

### RIGHT-TO-LEFT (INITIAL CLOCKWISE STEER)

<table>
<thead>
<tr>
<th>File</th>
<th>YRR175 Ct</th>
<th>2nd Yaw Peak(deg/sec)</th>
<th>2nd Yaw Peak Ct</th>
<th>Lat Disp (ft)</th>
<th>Lat. Acc. 1.07s (g)</th>
<th>1st SWA Peak(deg)</th>
<th>1st SWA Peak Ct</th>
<th>2nd SWA Mean(deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0037</td>
<td>1349</td>
<td>-12.565</td>
<td>854</td>
<td>4.044</td>
<td>-0.342</td>
<td>51.597</td>
<td>684</td>
<td>51.323</td>
</tr>
<tr>
<td>0038</td>
<td>1349</td>
<td>-16.766</td>
<td>847</td>
<td>5.060</td>
<td>-0.434</td>
<td>68.604</td>
<td>684</td>
<td>68.322</td>
</tr>
<tr>
<td>0039</td>
<td>1348</td>
<td>-21.551</td>
<td>847</td>
<td>6.308</td>
<td>-0.492</td>
<td>85.556</td>
<td>683</td>
<td>85.247</td>
</tr>
<tr>
<td>0040</td>
<td>1349</td>
<td>-25.063</td>
<td>849</td>
<td>7.199</td>
<td>-0.509</td>
<td>102.749</td>
<td>684</td>
<td>102.418</td>
</tr>
<tr>
<td>0041</td>
<td>1348</td>
<td>-30.371</td>
<td>834</td>
<td>7.944</td>
<td>-0.622</td>
<td>119.768</td>
<td>683</td>
<td>119.464</td>
</tr>
<tr>
<td>0042</td>
<td>1349</td>
<td>-36.043</td>
<td>836</td>
<td>8.505</td>
<td>-0.612</td>
<td>136.699</td>
<td>684</td>
<td>136.429</td>
</tr>
<tr>
<td>0044</td>
<td>1349</td>
<td>-43.289</td>
<td>843</td>
<td>9.318</td>
<td>-0.575</td>
<td>170.181</td>
<td>685</td>
<td>170.498</td>
</tr>
<tr>
<td>0045</td>
<td>1348</td>
<td>-45.889</td>
<td>845</td>
<td>9.888</td>
<td>-0.561</td>
<td>187.583</td>
<td>684</td>
<td>187.520</td>
</tr>
<tr>
<td>0046</td>
<td>1348</td>
<td>-50.723</td>
<td>848</td>
<td>10.134</td>
<td>-0.516</td>
<td>205.004</td>
<td>684</td>
<td>204.654</td>
</tr>
<tr>
<td>0047</td>
<td>1348</td>
<td>-49.948</td>
<td>850</td>
<td>10.269</td>
<td>-0.484</td>
<td>220.772</td>
<td>686</td>
<td>221.757</td>
</tr>
<tr>
<td>0048</td>
<td>1348</td>
<td>-53.448</td>
<td>848</td>
<td>10.373</td>
<td>-0.569</td>
<td>237.321</td>
<td>685</td>
<td>238.643</td>
</tr>
<tr>
<td>0049</td>
<td>1349</td>
<td>-56.063</td>
<td>853</td>
<td>10.560</td>
<td>-0.378</td>
<td>253.957</td>
<td>685</td>
<td>255.096</td>
</tr>
<tr>
<td>0050</td>
<td>1348</td>
<td>-57.114</td>
<td>851</td>
<td>10.665</td>
<td>-0.458</td>
<td>269.099</td>
<td>684</td>
<td>270.352</td>
</tr>
</tbody>
</table>
### 7.5 SLOWLY INCREASING STEER TEST RESULTS

**2011 Toyota Camry**  
NHTSA No.: CB5110

Date Created: 26-Aug-11

<table>
<thead>
<tr>
<th>File</th>
<th>Vehicle</th>
<th>EventPt</th>
<th>DOS</th>
<th>MES [mph]</th>
<th>Mean SPD [mph]</th>
<th>AYcount_3</th>
<th>THETAENCF_3 [degree]</th>
<th>AYCG_CD2_3 [g]</th>
<th>r_squared</th>
<th>ZeroBegin</th>
<th>ZeroEnd</th>
</tr>
</thead>
<tbody>
<tr>
<td>0011</td>
<td>2011 Toyota Camry</td>
<td>703</td>
<td>1</td>
<td>50.315</td>
<td>50.538</td>
<td>1204</td>
<td>-33.779</td>
<td>-0.296</td>
<td>0.999</td>
<td>503</td>
<td>703</td>
</tr>
<tr>
<td>0013</td>
<td>2011 Toyota Camry</td>
<td>704</td>
<td>1</td>
<td>50.101</td>
<td>50.097</td>
<td>1210</td>
<td>-34.094</td>
<td>-0.306</td>
<td>0.998</td>
<td>504</td>
<td>704</td>
</tr>
<tr>
<td>0014</td>
<td>2011 Toyota Camry</td>
<td>705</td>
<td>1</td>
<td>49.622</td>
<td>49.868</td>
<td>1211</td>
<td>-34.116</td>
<td>-0.299</td>
<td>0.998</td>
<td>505</td>
<td>705</td>
</tr>
<tr>
<td>0015</td>
<td>2011 Toyota Camry</td>
<td>697</td>
<td>0</td>
<td>49.762</td>
<td>49.861</td>
<td>1204</td>
<td>34.034</td>
<td>0.298</td>
<td>0.999</td>
<td>497</td>
<td>697</td>
</tr>
<tr>
<td>0016</td>
<td>2011 Toyota Camry</td>
<td>704</td>
<td>0</td>
<td>49.252</td>
<td>49.802</td>
<td>1213</td>
<td>34.681</td>
<td>0.306</td>
<td>0.997</td>
<td>504</td>
<td>704</td>
</tr>
<tr>
<td>0017</td>
<td>2011 Toyota Camry</td>
<td>702</td>
<td>0</td>
<td>50.256</td>
<td>50.349</td>
<td>1192</td>
<td>33.315</td>
<td>0.300</td>
<td>0.999</td>
<td>502</td>
<td>702</td>
</tr>
</tbody>
</table>

**Averages**  
- ZeroBegin: 503  
- ZeroEnd: 703  
- AYcount_3: 34  
- THETAENCF_3: 0.301

**Scalars**  
- Steering Angles (deg)
  - 1.5: 51
  - 2: 68
  - 2.5: 85
  - 3: 102
  - 3.5: 119
  - 4: 136
  - 4.5: 153
  - 5: 170
  - 5.5: 187
  - 6: 204
  - 6.5: 221
  - 7: 238
  - 7.5: 255
  - 7.9: 270
7.6 INERTIA SENSOR MEASUREMENTS

2011 Toyota Camry
NHTSA No.: CB5110

Device: U12-05-08-07108
device version: 2.24
device certification date: 08/19/11
today is: 8/25/2011
units: Millimeters

<table>
<thead>
<tr>
<th>Label</th>
<th>ActualX</th>
<th>ActualY</th>
<th>ActualZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_DEVICEPOS001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M_PLANE001</td>
<td>1229.026</td>
<td>-443.326</td>
<td>-316.553</td>
</tr>
<tr>
<td>M_LINE001</td>
<td>638.548</td>
<td>144.690</td>
<td>-111.805</td>
</tr>
<tr>
<td>M_ORIGIN_FRT_AXLE_CENTER</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>CCOORDSYS001</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>M_TIRE_TREAD_CENTER</td>
<td>282.509</td>
<td>86.863</td>
<td>-171.284</td>
</tr>
<tr>
<td>M_INERTIA_PACK</td>
<td>1648.248</td>
<td>841.247</td>
<td>576.339</td>
</tr>
<tr>
<td>M_ROOF</td>
<td>1816.612</td>
<td>878.727</td>
<td>1141.209</td>
</tr>
<tr>
<td>M_GROUND</td>
<td>1816.524</td>
<td>-27.429</td>
<td>-316.830</td>
</tr>
</tbody>
</table>

Track Width: 1576.387

Roof Height (relative to ground): 1458.039

Motion Pak - x-distance (mm): 1648.248
Motion Pak - y-distance (mm): -33.810
Motion Pak - z-distance (mm): 848.720

Motion Pak - x-distance (inches): 64.891
Motion Pak - y-distance (inches): -1.331
Motion Pak - z-distance (inches): 33.414

x-distance (longitudinal): Point of reference is the front axle centerline. (Positive from front axle toward rear of vehicle.)
y-distance (lateral): Point of reference is the vehicle centerline. (Positive from the center toward the right.)
z-distance (vertical): Point of reference is the ground plane. (Positive from the ground up.)