

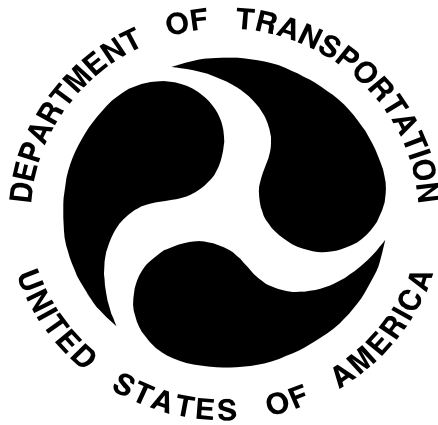
126-TRC-07-004

SAFETY COMPLIANCE TESTING FOR FMVSS 126 (Indicant) Electronic Stability Control Systems

Toyota Motor Company
2008 Toyota Highlander
NHTSA No. C85104

TRANSPORTATION RESEARCH CENTER INC.

10820 State Route 347
East Liberty, Ohio 43319



December 13, 2007

FINAL REPORT

Prepared Under Contract No.: DTNH22-07-P-00332

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

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| 16. Abstract A test was conducted on a 2008 Toyota Highlander, NHTSA No. C85104, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-126-00 for the determination of FMVSS 126 compliance. Test failures identified were as follows: None | | | |
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1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this test is to determine if the test vehicle, an MY 2008 Toyota Highlander meets the minimum equipment and performance requirements stated in Federal Motor Vehicle Safety Standard (FMVSS) 126, "Electronic Stability Control Systems."

This test is considered an "Indicant" Test because manufacturers are not required to certify vehicles to FMVSS 126 until on or after September 1, 2008.

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 2008 Toyota Highlander was conducted at Transportation Research Center Inc. (TRC Inc.) in accordance with NHTSA TP-126-00, dated April 6, 2007.

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 15km/h (9.3mph) or when being driven in reverse).

The vehicle was subjected to a 0.7Hz sine with dwell 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.

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS ...continued

DATA SUMMARY SHEET (1 of 2)

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

VEHICLE NHTSA NO.: C85104 VIN: JTEES41A582004636

VEHICLE TYPE: MPV DATE OF MANUFACTURE: 06/07

LABORATORY: Transportation Research Center Inc.

| REQUIREMENTS | PASS/FAIL |
|---|------------------|
| ESC Equipment and Operational Characteristics (Data Sheet 2) | |

The vehicle is be equipped with an ESC system that meets the equipment PASS
and operational characteristics requirements. (S126, S5.1, S5.6)

ESC Malfunction Telltale – Location, Labeling and Bulb Check
(Data Sheet 3)

Telltale meets the requirements for mounting, symbol or text, color SEE REMARKS
and check of lamp function. (S126, S5.3.1*, S5.3.2*, S5.3.4* and S5.3.5,
S5.3.6)

“ESC Off” and other System Controls and Telltale* (Data Sheet 3)

If provided, ESC OFF telltale meets the requirements for mounting, SEE REMARKS
symbol or abbreviation, color and check of lamp function. (S126,
S5.5.1, S5.5.2*, S5.5.3*, S5.5.6*, S5.5.7, and S5.5.8)

If provided, dedicated off control meets the label requirements PASS
(S126, S5.4.2*)

If provided, off control and other system controls meets the operational PASS
requirements (S126, S5.4, S5.4.1, S5.4.3*, S5.5.4, and
S5.5.9)

Vehicle Lateral Stability (Data Sheet 7)

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

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

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS ...continued

DATA SUMMARY SHEET (2 of 2)

REQUIREMENTS

PASS/FAIL

Vehicle Responsiveness (Data Sheet 7)

Lateral displacement at 1.07 seconds after BOS is at least 1.83 m (6 feet) for vehicles with a GVWR of 3,500kg (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 8)

Warning is provided to driver after malfunction occurrence. (S126. S5.3.3*)

PASS

Malfunction telltale stayed illuminated as long as malfunction existed and must extinguished after malfunction was corrected. (S126, S5.3.3*, S5.3.7)

PASS

*Requirements effective on and after September 1, 2011.

REMARKS:

ESC System malfunction and off telltales and controls do not have to meet the requirements of FMVSS No. 126 until on or after September 1, 2011.

3.0 TEST DATA

**DATA SHEET 1
TEST VEHICLE INSPECTION AND TEST PREPARATION**

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

NHTSA No.: C85104 TEST DATE: 9-20-07

VIN: JTEES41A582004636 MANUFACTURE DATE: 06/07

GVWR: 2,720 KG FRONT GAWR: 1,340 KG REAR GAWR 1,585 KG

SEATING POSITIONS: FRONT 2 MID 3 REAR 2

ODOMETER READING AT START OF TEST: 3,314 (5,333) Miles (Kilometers)

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front Axle P245 / 65R 17 Rear Axle P245 / 65R 17

INSTALLED TIRE SIZE(S) ON VEHICLE:

| <u>From Tire Sidewall</u> | <u>Front Axle</u> | <u>Rear Axle</u> |
|---------------------------|-----------------------------------|-----------------------------------|
| Manufacturer and Model | <u>Bridgestone Dueler H/L 400</u> | <u>Bridgestone Dueler H/L 400</u> |
| Tire Size Designation | <u>P245 / 65R 17 105S</u> | <u>P245 / 65R 17 105S</u> |

Are installed tire sizes same as labeled tire sizes? Yes No

If no, contact COTR for further guidance.

DRIVETRAIN CONFIGURATION:

Front Wheel Drive (FWD) Rear Wheel Drive (RWD)
 Four Wheel Drive (4WD) All Wheel Drive (AWD)

VEHICLE STABILITY SYSTEMS (Check applicable technologies):

ESC Traction Control Roll Stability Control
 Active Suspension Electronic Throttle Control Active Steering
 ABS

List other systems; Steering torque assist (Enhanced VSC)

REMARKS:

RECORDED BY: Alan Ida

DATE: 10-26-07

APPROVED BY: Jeff Sankey

DATE: 10-26-07

3.0 TEST DATA....continued

**DATA SHEET 2 (Sheet 2 of 2)
ESC SYSTEM HARDWARE AND OPERATIONAL CHARACTERISTICS**

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: ESC actuates Engine Control System

System is capable of activation at speeds of 15 km/h (9.3 mph) and higher. Yes (PASS)
 No (FAIL)

Speed system becomes active. 15 km/h

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 system is capable of activation. All phases listed above

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

DATA INDICATES COMPLIANCE PASS/FAIL PASS

REMARKS:

RECORDED BY: Alan Ida

DATE: 10-26-07

APPROVED BY: Jeff Sankey

DATE: 10-26-07

3.0 TEST DATA....continued

DATA SHEET 3 (Sheet 1 of 5)
ESC MALFUNCTION AND OFF TELLTALES AND CONTROLS – Location,
Labeling and Bulb Check

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

NHTSA No.: C85104 TEST DATE: 9-25-07

ESC Malfunction Telltale

Malfunction Telltale Location Instrument Panel Cluster - Inside Tachometer Gauge

Telltale is mounted inside the occupant compartment in front of and in clear view of the driver?

Yes No (fail) If no, explain: _____

Telltale is part of a common space? Yes No

Malfunction Telltale symbol or abbreviation required by FMVSS No. 101.



Or **ESC** Vehicle uses this symbol
 Vehicles uses this abbreviation

Note any words or additional symbols used.

Also, "VSC Off" abbreviation located next to above symbol flashes _____

"ESC OFF" Telltale (if provided)

"ESC OFF" Telltale Location "VSC Off" telltale is combined with ESC malfunction telltale located in the instrument panel cluster inside the tachometer gauge.

"ESC OFF" telltale is mounted inside the occupant compartment in front of and in clear view of the driver?

Yes No (fail) If no, explain: _____

Telltale is part of a common space? Yes No

3.0 TEST DATA....continued

DATA SHEET 3 (Sheet 2 of 5)
ESC MALFUNCTION AND OFF TELLTALES AND CONTROLS

“ESC OFF” Telltale symbol or abbreviation required by FMVSS No. 101.



Or **ESC OFF** Partial Vehicle uses this symbol
_____ Vehicle uses this abbreviation
_____ Neither symbol nor abbreviations used

Note any words or additional symbols used.

The ESC Symbol above is used without the word “OFF” below the symbol.
In addition the “VSC OFF” abbreviation located next to the above symbol
illuminates.

Malfunction Telltale Lamp Function:

Identify position of ignition locking system when malfunction telltale illuminates.

- | | |
|--|--|
| <input type="checkbox"/> OFF/LOCK | <input type="checkbox"/> Between OFF/LOCK and ON/RUN |
| <input checked="" type="checkbox"/> ON/RUN | <input type="checkbox"/> Between ON/RUN and Start |

Is telltale yellow in color? X Yes _____ No (fail)

Time telltale remains illuminated 3 seconds

Note: If telltale is part of common space, it is not required to illuminate during this check of lamp function.

Starter Interlock:

Does vehicle have any starter, transmission or other interlocks that affect operation of the Mal-function telltale lamp check functions? _____ Yes X No

If yes, describe the interlock feature:

3.0 TEST DATA....continued

DATA SHEET 3 (Sheet 3 of 5)
ESC MALFUNCTION AND OFF TELLTALES AND CONTROLS

“ESC OFF” Telltale Lamp Function:

Identify position of ignition locking system when “ESC OFF” telltale illuminates.

- | | |
|--|--|
| <input type="checkbox"/> OFF/LOCK | <input type="checkbox"/> Between OFF/LOCK and ON/RUN |
| <input checked="" type="checkbox"/> ON/RUN | <input type="checkbox"/> Between ON/RUN and Start |

Is telltale yellow in color? X Yes No (fail)

Time telltale remains illuminated 3 seconds

Note: If telltale is part of common space, it is not required to illuminate during the check of lamp function.

Starter Interlock:

Does vehicle have any starter, transmission or other interlocks that affect operation of the “ESC OFF” telltale lamp check functions? Yes X No

If yes, describe the interlock feature:

ESC OFF Control Operational Check:

Is the vehicle equipped with a control whose sole purpose is to deactivate the ESC System? X Yes No

“ESC OFF” Control identification symbol or abbreviation required by FMVSS No. 101.



Or **ESC OFF** X Vehicle uses this symbol
 Vehicle uses this abbreviation

Note any words or additional symbols used.

3.0 TEST DATA....continued

**DATA SHEET 3 (Sheet 4 of 5)
ESC MALFUNCTION AND OFF TELLTALES AND CONTROLS**

Does the "ESC Off" telltale illuminate upon activation of the ESC off control?
 Yes No (fail)

If no, describe off control function:

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?

Yes No (fail)

If no, describe the off control function:

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

List other controls (i.e. low speed off-road axle/transfer case):

none

Does the "ESC OFF" telltale illuminate upon activation of each control system listed above?

Yes No

If no, describe off control function:

For electrical controls, does the "ESC OFF" telltale extinguish and remain extinguished when the ignition is cycled from "On" ("Run") to "Lock" or "Off" and then back again to the "On" ("Run") position?

Yes No

If no, describe the off control function:

3.0 TEST DATA....continued

**DATA SHEET 3 (Sheet 5 of 5)
ESC MALFUNCTION AND OFF TELLTALES AND CONTROLS**

For mechanical controls, does the "ESC OFF" telltale extinguish after de-activation of mechanical control?

_____ Yes _____ No

If no, describe the off control function:

DATA INDICATES COMPLIANCE:

PASS/FAIL PASS

REMARKS:

The Highlander uses ESC malfunction and off telltales that differ from those required by FMVSS No. 126 and 101. However, the telltale symbols or abbreviations used are not required to meet the standard requirements until on or after September 1, 2011.

RECORDED BY: Alan Ida
APPROVED BY: Jeff Sankey

DATE: 10-26-07
DATE: 10-26-07

3.0 TEST DATA....continued

**DATA SHEET 4 (Sheet 1 of 3)
VEHICLE AND TEST TRACK DATA**

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

NHTSA No.: C85104 TEST DATE: 9-25-07

Test Track Requirements: Test Surface Slope (0-1 %) 1 %
Peak Friction Coefficient (at least 0.9) 0.96

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

Tire Pressures: Required: Front Axle 210.0 KPA Rear Axle 210.0 KPA
Actual: LF 210.0 KPA RF 210.0 KPA LR 210.0 KPA RR 210.0 KPA

Vehicle Dimensions: Track Width 162.5 cm Wheelbase 279.0 cm
Roof Height 169.8 cm

Vehicle weight ratings: GAWR Front 1,340 KG GAWR Rear 1,585 KG

Unloaded Vehicle Weight (UVW)

Front Axle 1,097.0 KG Right Front 548.0 KG Left Front 549.0 KG
Rear Axle 867.0 KG Right Rear 427.0 KG Left Rear 440.0 KG
Total UVW 1,964.0 KG

Baseline Weight and Outrigger Selection (only for MPVs, Trucks, Buses)

Calculated Baseline Weight (UVW+ 73 kg) 2,037 KG

Outrigger size required ("Standard" or "Heavy") Standard

Standard - Baseline weight under 2,722 kg (6,000 lbs)

Heavy - Baseline weight equal to or greater than 2,722 kg (6,000 lbs)

3.0 TEST DATA....continued

**DATA SHEET 4 (Sheet 2 of 3)
VEHICLE AND TEST TRACK DATA**

UVW with Outriggers (only for MPVs, Trucks, Buses)

Front Axle 1,143.0 KG Right Front 570.0 KG Left Front 573.0 KG

Rear Axle 911.0 KG Right Rear 449.0 KG Left Rear 462.0 KG

Total UVW w/ Outriggers 2,054.0 KG

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

Front Axle 1,222.0 KG Right Front 599.0 KG Left Front 623.0 KG

Rear Axle 980.0 KG Right Rear 477.0 KG Left Rear 503.0 KG

Total Loaded weight w/ Driver 2,202.0 KG

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

= [2,054.0 KG + 168 KG] - 2,202.0 KG

= 20.0 KG

Total Loaded Vehicle Weight

Front Axle 1,228.0 KG Right Front 607.0 KG Left Front 621.0 KG

Rear Axle 993.0 KG Right Rear 485.0 KG Left Rear 508.0 KG

Total Loaded Vehicle Weight 2,221.0 KG

3.0 TEST DATA....continued

**DATA SHEET 4 (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:

| | Center of Gravity | Inertial Sensing System |
|------------|-------------------|-------------------------|
| x-distance | <u>124.7</u> cm | <u>176.8</u> cm |
| y-distance | <u>-1.32</u> cm | <u>-1.63</u> cm |
| z-distance | <u>64.5</u> cm | <u>43.9</u> cm |

Distance Between Ultrasonic Sensors: 196.2 cm

TEST TRACK DATA MEETS REQUIREMENTS: YES/NO YES
If no, explain: _____

REMARKS:

RECORDED BY: Alan Ida
APPROVED BY: Jeff Sankey

DATE: 10-26-07
DATE: 10-26-07

3.0 TEST DATA....continued

**DATA SHEET 5 (Sheet 1 of 3)
BRAKE AND TIRE CONDITIONING**

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

VEHICLE NHTSA No.: C85104

Measured Cold Tire Pressures: LF 210 KPA LR 210 KPA

RF 210 KPA RR 210 KPA

Wind Speed 1.3 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

Brake Conditioning Time; 3:30 PM Date; 9-27-07

56 km/h (35 mph) Brake Stops

Number of stops executed (10 required) 10 stops

Observed deceleration rate range (.5g target) 0.45 – 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 0.9 – 1.0 g

72 km/h (45 mph) Brake Cool Down Period

Duration of cool down period (5 minutes min.) 5.5 minutes

3.0 TEST DATA....continued

**DATA SHEET 5 (Sheet 2 of 3)
BRAKE AND TIRE CONDITIONING**

Tire Conditioning Series No. 1 Time: 9:00 am Date: 9-28-07

Measured Tire Pressures: LF 210 KPA LR 210 KPA

RF 210 KPA RR 210 KPA

Wind Speed 3.1 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)) 15.0 °C

| 30 meter (100 ft) Diameter Circle Maneuver | | | | |
|---|--------------------|---------------------------------|-----------------------------------|-------------------------------|
| Test Runs | Steering Direction | Target Lateral Acceleration (g) | Observed Lateral Acceleration (g) | Observed Vehicle Speed (km/h) |
| 1-3 | Clockwise | 0.5-0.6 | 0.55 | 44 |
| 4-6 | Counterclockwise | 0.5-0.6 | 0.55 | 44 |

| 1 Hz 3 Cycle Sinusoidal Steering Maneuver to Determine Steering Wheel Angle For 0.5-0.6g Lateral Acceleration | | | | |
|--|-------------------------|--------------------------------|--------------------------------------|--|
| Test Runs | Vehicle Speed Km/h(mph) | Steering Wheel Angle (degrees) | Target Peak Lateral Acceleration (g) | Observed Peak Lateral Acceleration (g) |
| 1 | 56±2 (35±1) | 30 | 0.5-0.6 | 0.20 |
| 2 | 56±2 (35±1) | 90 | 0.5-0.6 | 0.52 |
| 3 | 56±2 (35±1) | | 0.5-0.6 | |
| 4 | 56±2 (35±1) | | 0.5-0.6 | |

Steering wheel angle that corresponds to a peak 0.5–0.6g lateral acceleration; 90 degrees

| 1 Hz 10 Cycle Sinusoidal Steering Maneuver | | | | |
|---|--------------------------|--------------------------------|--------------------------------------|--|
| Test Runs | Vehicle Speed Km/h (mph) | Steering Wheel Angle (degrees) | Target Peak Lateral Acceleration (g) | Observed Peak Lateral Acceleration (g) |
| 1 - 3 | 56±2 (35±1) | 90 (cycles 1-10) | 0.5-0.6 | 0.52 |
| 4 | 56±2 (35±1) | 90 (cycles 1-9) | 0.5-0.6 | 0.52 |
| | | 180 (cycle 10)* | N/A | N/A |

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

3.0 TEST DATA....continued

**DATA SHEET 6 (1 of 2)
SLOWLY INCREASING STEER (SIS) MANEUVER**

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

VEHICLE NHTSA No.: C85104 TEST DATE: 9-28-07

Wind Speed 3.6 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)) 15.6 °C

Preliminary Left Steer Maneuver:

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

$$a_{y,30 \text{ degrees}} = \underline{0.26} \text{ g}$$

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

$$\frac{30 \text{ degrees}}{a_{y,30 \text{ degrees}}} = \frac{\delta_{SIS}}{0.55 \text{ g}} \quad \delta_{SIS} = \underline{70} \text{ degrees}$$

Steering Wheel Angle at Corrected 0.3 g Lateral Acceleration:

| Maneuver # | Initial Steer Direction | Time Clock (5 min max between runs) | Steering Wheel Angle to nearest 0.1 degree (degrees) | All Conditions Met? |
|------------|-------------------------|--|--|---------------------|
| 1 | Left | 9:32 am | -37.1 | Yes |
| 2 | Left | 9:47 am | -36.4 | Yes |
| 3 | Left | 9:50 am | -36.7 | Yes |
| 4 | Right | 9:52 am | 37.7 | Yes |
| 5 | Right | 9:56 am | 36.8 | Yes |
| 6 | Right | 9:58 am | 36.2 | Yes |
| | | | | |
| | | | | |

3.0 TEST DATA....continued

**DATA SHEET 6 (2 of 2)
SLOWLY INCREASING STEER (SIS) MANEUVER**

Average Overall Steering Wheel Angle:

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

$$\delta_{0.3 \text{ g, overall}} = \underline{\quad 36.8 \quad} \text{ degrees}$$

[to nearest 0.1 degree]

REMARKS:

RECORDED BY: Alan Ida

APPROVED BY: Jeff Sankey

DATE: 10-26-07

DATE: 10-26-07

3.0 TEST DATA....continued

DATA SHEET 7 (1 of 3) VEHICLE LATERAL STABILITY AND RESPONSIVENESS

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

VEHICLE NHTSA No.: C85104 TEST DATE: 9-28-07

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

Overall steering wheel angle ($\delta_{0.3g, overall}$) 36.8 degrees

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

| Maneuver # | Clock Time (1.5 – 5 min between each test run) | Commanded Steering Wheel Angle ¹ (degrees) | | Yaw Rates (degrees/sec) | | | YRR at 1.0 sec after COS [$\leq 35\%$] | | YRR at 1.75 sec after COS [$\leq 20\%$] | |
|------------|---|---|-------|-------------------------|-----------------------|------------------------|--|-----------|---|-----------|
| | | Scalar | Angle | $\dot{\psi}_{Peak}$ | $\dot{\psi}_{1.0sec}$ | $\dot{\psi}_{1.75sec}$ | % | Pass/Fail | % | Pass/Fail |
| 1 | 10:57 am | 1.5* $\delta_{0.3g}$ | 55 | 12.52 | -0.42 | -0.26 | -3.34 | Pass | -2.05 | Pass |
| 2 | 11:00 am | 2.0* $\delta_{0.3g}$ | 74 | 16.17 | -0.17 | -0.03 | -1.07 | Pass | -0.16 | Pass |
| 3 | 11:04 am | 2.5* $\delta_{0.3g}$ | 92 | 20.46 | -0.04 | -0.02 | -0.22 | Pass | -0.11 | Pass |
| 4 | 11:07 am | 3.0* $\delta_{0.3g}$ | 110 | 25.49 | -0.15 | -0.01 | -0.60 | Pass | -0.02 | Pass |
| 5 | 11:10 am | 3.5* $\delta_{0.3g}$ | 129 | 31.28 | -0.25 | -0.18 | -0.80 | Pass | -0.56 | Pass |
| 6 | 11:13 am | 4.0* $\delta_{0.3g}$ | 147 | 38.28 | 0.19 | 0.05 | 0.50 | Pass | 0.14 | Pass |
| 7 | 11:16 am | 4.5* $\delta_{0.3g}$ | 166 | 44.68 | 1.16 | 0.09 | 2.59 | Pass | 0.21 | Pass |
| 8 | 11:19 am | 5.0* $\delta_{0.3g}$ | 184 | 49.66 | 1.22 | -0.08 | 2.45 | Pass | -0.16 | Pass |
| 9 | 11:22 am | 5.5* $\delta_{0.3g}$ | 202 | 53.10 | 2.71 | 0.14 | 5.10 | Pass | 0.26 | Pass |
| 10 | 11:25 am | 6.0* $\delta_{0.3g}$ | 221 | 53.04 | 0.94 | -0.06 | 1.78 | Pass | -0.11 | Pass |
| 11 | 11:28 am | 6.5* $\delta_{0.3g}$ | 239 | 54.62 | 0.44 | 0.08 | 0.81 | Pass | 0.14 | Pass |
| 12 | 11:31 am | 7.0* $\delta_{0.3g}$ | 258 | 54.67 | 1.57 | 0.10 | 2.86 | Pass | 0.18 | Pass |
| 13 | 11:34 am | 7.3* $\delta_{0.3g}$ | 270 | 53.28 | -0.84 | -0.09 | -1.57 | Pass | -0.17 | Pass |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

1. Maneuver execution should continue until a steering wheel angle magnitude factor of $6.5 * \delta_{0.3g, overall}$ or 270 degrees is utilized, whichever is greater provided the calculated magnitude of $6.5 * \delta_{0.3g, overall}$ is less than or equal to 300 degrees. If $6.5 * \delta_{0.3g, overall}$ is less than 270 degrees maneuver execution should continue by increasing the steering wheel angle magnitude by multiples of $0.5 * \delta_{0.3g, overall}$ without exceeding the 270 degree steering wheel angle.

3.0 TEST DATA....continued

**DATA SHEET 7 (3 of 3)
VEHICLE LATERAL STABILITY AND RESPONSIVENESS**

Responsiveness – Lateral Displacement

| Maneuver # | Initial Steer Direction | Commanded Steering Wheel Angle ($5.0 * \delta_{0.3g, overall}$ or greater) | | Calculated Lateral Displacement ¹ | |
|------------|-------------------------|--|-----------------|--|-----------|
| | | Scalar | Angle (degrees) | Distance (m) | Pass/Fail |
| 8 | Counter Clockwise | $5.0 * \delta_{0.3g}$ | 184 | 2.91 | Pass |
| 9 | Counter Clockwise | $5.5 * \delta_{0.3g}$ | 202 | 2.98 | Pass |
| 10 | Counter Clockwise | $6.0 * \delta_{0.3g}$ | 221 | 2.98 | Pass |
| 11 | Counter Clockwise | $6.5 * \delta_{0.3g}$ | 239 | 3.01 | Pass |
| 12 | Counter Clockwise | $7.0 * \delta_{0.3g}$ | 258 | 3.06 | Pass |
| 13 | Counter Clockwise | $7.3 * \delta_{0.3g}$ | 270 | 2.99 | Pass |
| | Counter Clockwise | | | | |
| | Counter Clockwise | | | | |
| 8 | Clockwise | $5.0 * \delta_{0.3g}$ | 184 | 2.97 | Pass |
| 9 | Clockwise | $5.5 * \delta_{0.3g}$ | 202 | 3.05 | Pass |
| 10 | Clockwise | $6.0 * \delta_{0.3g}$ | 221 | 3.01 | Pass |
| 11 | Clockwise | $6.5 * \delta_{0.3g}$ | 239 | 3.06 | Pass |
| 12 | Clockwise | $7.0 * \delta_{0.3g}$ | 258 | 3.04 | Pass |
| 13 | Clockwise | $7.3 * \delta_{0.3g}$ | 270 | 3.07 | Pass |
| | Clockwise | | | | |
| | Clockwise | | | | |

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
APPROVED BY: Jeff Sankey

DATE: 10-26-07
DATE: 10-26-07

3.0 TEST DATA....continued

**DATA SHEET 8
MALFUNCTION WARNING TEST**

VEHICLE MAKE/MODEL/BODY STYLE: Toyota / Highlander / MPV

VEHICLE NHTSA No.: C85104 TEST DATE: 10-19-07

CHECK MALFUNCTION TELLTALE BULB CHECK FUNCTION:

Before simulating an ESC system malfunction activate the vehicle ignition locking system and verify telltale illuminates for the bulb check and then extinguishes.

X Yes No

METHOD OF MALFUNCTION SIMULATION:

Describe method of malfunction simulation: 1) Remove ECU B Fuse to simulate steering angle sensor failure. 2) Disconnect LR Wheel Speed Sensor

MALFUNCTION TELLTALE 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 and vehicle speed of 48± 8 km/h (30± 5mph) is reached.

SEE REMARKS Seconds (must be within 2 minutes) X Pass Fail

Cycle ignition locking system and start the vehicle's engine. Verify that the malfunction telltale illuminates and stays illuminated. X Yes No

After the ESC system is restored to normal operation verify that the telltale does not remain illuminated. X Yes No

DATA INDICATES COMPLIANCE: PASS/FAIL PASS

REMARKS:

Malfunction telltale illuminated immediately upon cycling ignition locking system without driving vehicle.

RECORDED BY: Alan Ida

DATE: 10-26-07

APPROVED BY: Jeff Sankey

DATE: 10-26-07

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

| Type | Output | Range | Resolution | Accuracy | Specifics | Serial Number | Calibration |
|---|---|--|--|---|--|-----------------------------|---|
| Tire Pressure Gage | Vehicle Tire Pressure | 0-100psi | 1 psi | ±2.0% of applied pressure | Marsh Model: Series J 0-100psi | <u>AG-102</u> | By: <u>TRC</u> Date: <u>11-6-06</u> Due: <u>11-6-07</u> |
| Platform Scales | Vehicle Total, Wheel, and Axle Load | 0-2500 lb per each of four pads | 0.5 lb | ±1.0% of applied load | Mettler Toledo Model: JXGA1000 | <u>5225831-5JC</u> | By: <u>Mettler</u> Date: <u>8-20-07</u> Due: <u>11-20-07</u> |
| Automated Steering Machine with Steering Angle Encoder | Handwheel Angle | ±800 deg | 0.25 deg | ±0.25 deg | Heitz Automotive Testing Model: Sprint 3 | <u>60303</u> | By: <u>TRC</u> Date: <u>6-18-07</u> Due: <u>6-18-08</u> |
| Multi-Axis Inertial Sensing System | Longitudinal, Lateral, and Vertical Acceleration Roll, Yaw, and Pitch Rate | Accelerometers: ±2 g Angular Rate Sensors: ±100 deg/s | Accelerometers: ≤10 ug Angular Rate Sensors: ≤0.004 deg/s | Accelerometers: ≤0.05% of full range Angular Rate Sensors: 0.05% of full range | BEI Technologies Model: MotionPAK MP-1 | <u>0767</u> | By: <u>BEI Tech.</u> Date: <u>6-21-07</u> Due: <u>6-21-08</u> |
| Radar Speed Sensor and Dashboard Display | Vehicle Speed | 0-125 mph | 0.009 mph | ±0.25% of full scale | A-DAT Corp. Radar Model: DRS-6 Display Model: RD-2 | <u>1400603</u> | By: <u>A-DAT</u> Date: <u>9-9-06</u> Due: <u>9-9-07</u> |
| Ultrasonic Distance Measuring System | Left and Right Side Vehicle Height | 5-24 inches | 0.01 inches | ±0.25% of maximum distance | Massa Products Corporation Model: M-5000/220 | <u>104619 & 104613</u> | By: <u>TRC</u> Date: <u>per test</u> Due: <u>per test</u> |
| Data Acquisition System [Amplify, Anti-Alias, and Digitize] | Record Time; Velocity; Distance; Lateral, Longitudinal, and Vertical Accelerations; Roll, Yaw, and Pitch Rates; Steering Wheel Angle. | Sufficient to meet or exceed individual sensors | 200 Hz | Sufficient to meet or exceed individual sensors | Dewetron Sidehand DAS Model: DA-121-16 Digitizer Model: Dewe-Orion-1616-100 Amplifier/AntiAliasing: MDAQ-FILT-10-S | <u>12060</u> <u>1105</u> | By: <u>Dewetron</u> Date: <u>3-20-07</u> Due: <u>3-20-08</u> |
| Load Cell | Vehicle Brake Pedal Force | 0-300 lb | 1 lb | ±0.05% of full scale | DATRON Model: DTM-LPA | <u>4970-1103</u> | By: <u>TRC</u> Date: <u>per test</u> Due: <u>per test</u> |
| Coordinate Measurement Machine | Inertial Sensing System Location | 0-10 feet | 0.001 inch | ±0.003% of full scale | FARO International Model: Faro Arm N10 | <u>N10-02-03-01310</u> | By: <u>FARO</u> Date: <u>12-04-06</u> Due: <u>12-04-07</u> |
| Outriggers | No output. Safety Item. | N/A | N/A | N/A | NHTSA Titanium Outriggers Model: Docket 2007-27662-11 | N/A | N/A |

5.0 PHOTOGRAPHS

- 5.1 ¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE
- 5.2 VEHICLE CERTIFICATION LABEL
- 5.3 VEHICLE PLACARD
- 5.4 WINDOW STICKER (MONRONEY LABEL)
- 5.5 ESC MALFUNCTION AND ESC OFF TELLTALE
- 5.6 ESC OFF CONTROL
- 5.7 TEST VEHICLE WITH OUTRIGGERS
- 5.8 TEST INSTRUMENTATION - STEERING WHEEL CONTROLLER AND DATA ACQUISITION SYSTEM
- 5.9 TEST INSTRUMENTATION - STEERING CONTROLLER BATTERY BOX AND BALLAST
- 5.10 TEST INSTRUMENTATION - VEHICLE SPEED SENSOR
- 5.11 TEST INSTRUMENTATION - BODY ROLL SENSOR (DRIVER SIDE)
- 5.12 TEST INSTRUMENTATION - BODY ROLL SENSOR (PASSENGER SIDE)



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5.1 3/4 FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

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06/07

MFD. BY: TOYOTA MOTOR CORPORATION
GVWR: 2720KG (6000LB)
GAWR: FRT. 1340KG (2955LB) WITH P245/65R17 TIRES.
17X7 1/2J RIMS, AT 210KPA (30PSI) COLD.
RR. 1585KG (3505LB) WITH P245/65R17 TIRES.
17X7 1/2J RIMS, AT 210KPA (30PSI) COLD.
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR
VEHICLE SAFETY AND THEFT PREVENTION STANDARDS IN EFFECT ON
THE DATE OF MANUFACTURE SHOWN ABOVE.
JTEES41A582004636 MPV



C/TR: 202/FC40 GSU45L-BRANKA
A/TM: -01B/U151F MADE IN JAPAN 538

5.2 VEHICLE CERTIFICATION LABEL

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TIRE AND LOADING INFORMATION

SEATING CAPACITY: TOTAL 7
 FRONT 2: REAR 5
 The combined weight of occupants and cargo should never exceed 544 kg or 1200 lbs.

| TIRE | SIZE | COLD TIRE PRESSURE |
|-------|------------|--------------------|
| FRONT | P245/65R17 | 210kPa, 30PSI |
| REAR | P245/65R17 | 210kPa, 30PSI |
| SPARE | P245/65R17 | 210kPa, 30PSI |

INFORMATION SUR LES PNEUS ET LE CHARGEMENT

NOMBRE DE PLACES ASSISES: TOTAL 7
 AVANT 2: ARRIÈRE 5
 Le poids total des occupants et du chargement ne doit jamais être supérieur à 544 kg ou 1200 lb.

| PNEUS | DIMENSION | PRESSION DE GONFLAGE À FROID |
|---------|------------|------------------------------|
| AVANT | P245/65R17 | 210kPa, 30PSI |
| ARRIÈRE | P245/65R17 | 210kPa, 30PSI |
| SECOURS | P245/65R17 | 210kPa, 30PSI |

POUR DE PLUS
 AMPLES INFOR-
 MATIONS, VOIR
 LE MANUEL DU
 PROPRIÉTAIRE.

9 N 48430

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SEE OWNER'S
 MANUAL FOR
 ADDITIONAL
 INFORMATION.

5.3 VEHICLE PLACARD

TOYOTA
oving forward ▶

DESC.: **HIGHLANDER 4-DOOR 4X4 SUV**
 VIN: **JTEES41A582004636**
 YR/MDL: 2008/6948A CLR: BLACK/FC40 (0202/40)
 PORT/PLANT: Portland, OR

MANUFACTURER'S SUGGESTED RETAIL PRICE **\$28,750.00**

| OPTIONAL EQUIPMENT | | |
|--------------------|--|--------|
| CQ | Convenience Package (Black Roof Rails and Tonneau Cover) | 240.00 |
| EH | Cold Weather Package includes: Heated Power Outside Mirrors, Windshield Wiper De-icer Grid | 60.00 |
| FE | 50 State Emissions | |
| QM | Manual Rear Air Conditioning System w/ Rear Vents for 2nd & 3rd Row | 415.00 |
| TO | Tow Prep Package includes: 5,000lbs towing capacity, Heavy Duty Radiator w/Engine Oil Cooler, 200 watt fan coupling, Transmission Oil Cooler w/ Water Cooler, 150 amp alternator, and Pre-Wire Harness | 220.00 |
| H8 | Fleet Credit | |

STANDARD EQUIPMENT

- MECHANICAL & PERFORMANCE**
- 270HP 24-Valve V6 Eng w/Dual VVT-i
 - Wheel Drive/4-Wheel Ind Suspension
 - 5-Speed Automatic Trans w/Sequential Shift
 - Electronic Power Steering System
 - 4-Wheel Pwr Ass Vent Fr/Solid Rr Disc Brake
 - Hill-Start Assist & Downhill Assist Ctrl
 - 17" 6-Spoke Alloy Wheels/245/65R17 Tires
 - Full Size Spare Tire on 17" Alloy Wheel
- SAFETY**
- Star Safety System Includes:
 - Enhanced Veh Stability Ctrl w/TRAC
 - Anti-Lock Brakes w/Brake Assist & EBD
 - Dr & Fr Pass Advanced Front Airbags/ Driver Knee Airbag, Dr & Fr Pass Seat Mounted Side Airbags, 3 Row Roll-Sensing Side Curtain Airbags
 - Dr & Fr Pass Active Headrests
 - Direct Tire Pressure Monitoring System
 - 3-Pt Seat Belts - All Seating Positions
 - 2nd Row CRS Lower/Top Tether Anchors
- EXTERIOR**

- Color-Keyed Bumpers/Dr Handles/Foldable Pwr Outside Mirrors/Small Rear Spoiler
 - Silver Painted Fr Grille/Rr Lic Garnish
 - Blk Fog Lamp & Rr Step/Bumper Lower Cvr
 - Fr Variable & Rr Intermittent Wipers
 - Flexible Mast Antenna / Rr Privacy Glass
 - Multi-Reflector Auto-off Headlamps
- COMFORT AND CONVENIENCE**
- Front Air Conditioner w/Clean Air Filter
 - AM/FM/CD w/6 Spks, Mini Plug
 - Power Windows & Door Locks/Cruise Ctrl
 - Remote Keyless Entry/Conversation Mirror
 - Urethane Tilt&Telescopic Steering Wheel
 - Cloth Int, 8-way Frt Dr/ 4-way Pass, 40/20/40 Splt 2nd Row Seat,w/Fold-Flat, Recline, Fore & Aft Slide Adj & Rt-Hand Walk-in Function + Center Stow Seat & Center Stow Console, 3rd Row Seat w/fold headrests / Fold Flat into Floor
 - 3-12V Pwr Outlets/10 Cup/4 Bottle Holders
 - Optitron illuminated instrument meters


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The New Vehicle Limited Warranty provides 36-month/50,000-mile comprehensive coverage, 5-year/50,000-mile powertrain coverage, plus 5-year body panel corrosion perforation warranty. See Owner's Warranty Information booklet for details. An extended service contract may be available for the vehicle. Ask dealer for details. Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service, Gasoline, license and title fees, applicable federal, state and local taxes and dealer and distributor installed options and accessories are not included in the manufacturer's suggested retail price.

Compare this vehicle to others in the **FREE FUEL ECONOMY GUIDE** available at the dealer.

These estimates reflect new EPA methods beginning with 2008 models.

| | | |
|--|--|---|
| CITY MPG | Fuel Economy Information | HIGHWAY MPG |
| 17 |  | 23 |
| Actual Mileage will vary with options, driving conditions, driving habits and vehicle's condition. Results reported to EPA indicate that the majority of vehicles with these estimates will achieve between | 2008 HIGHLANDER 4WD 6-CYL., 3.5 LITER DISP., VVT-I ENGINE, 5-SPEED ECT-I AUTOMATIC TRANSMISSION. | For Comparison Shopping , all vehicles classified as |
| 14 and 20 mpg in the city and between | Estimated Annual Fuel Cost: | SPEC PURPOSE have been issued mileage ratings ranging from |
| 19 and 27 mpg on the highway. | \$2,091 | 08 to 31 mpg city and 12 to 29 mpg highway. |

see www.fueleconomy.gov

DELIVERY PROCESSING AND HANDLING FEE **645.00**

TOTAL \$30,330.00

Dealer Name / Address: 34967 TRAC PROGRAM-CINC. REGION 4550 CREEK ROAD CINCINNATI OH45242
 Ship to: 34026 JIM WHITE TOYOTA 6123 WEST CENTRAL AVENUE TOLEDO OH43615



WC 454

5.4 WINDOW STICKER (MONRONEY LABEL)



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5.5 ESC MALFUNCTION AND ESC OFF TELLTALE

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5.6 ESC OFF CONTROL



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5.7 TEST VEHICLE WITH OUTRIGGERS



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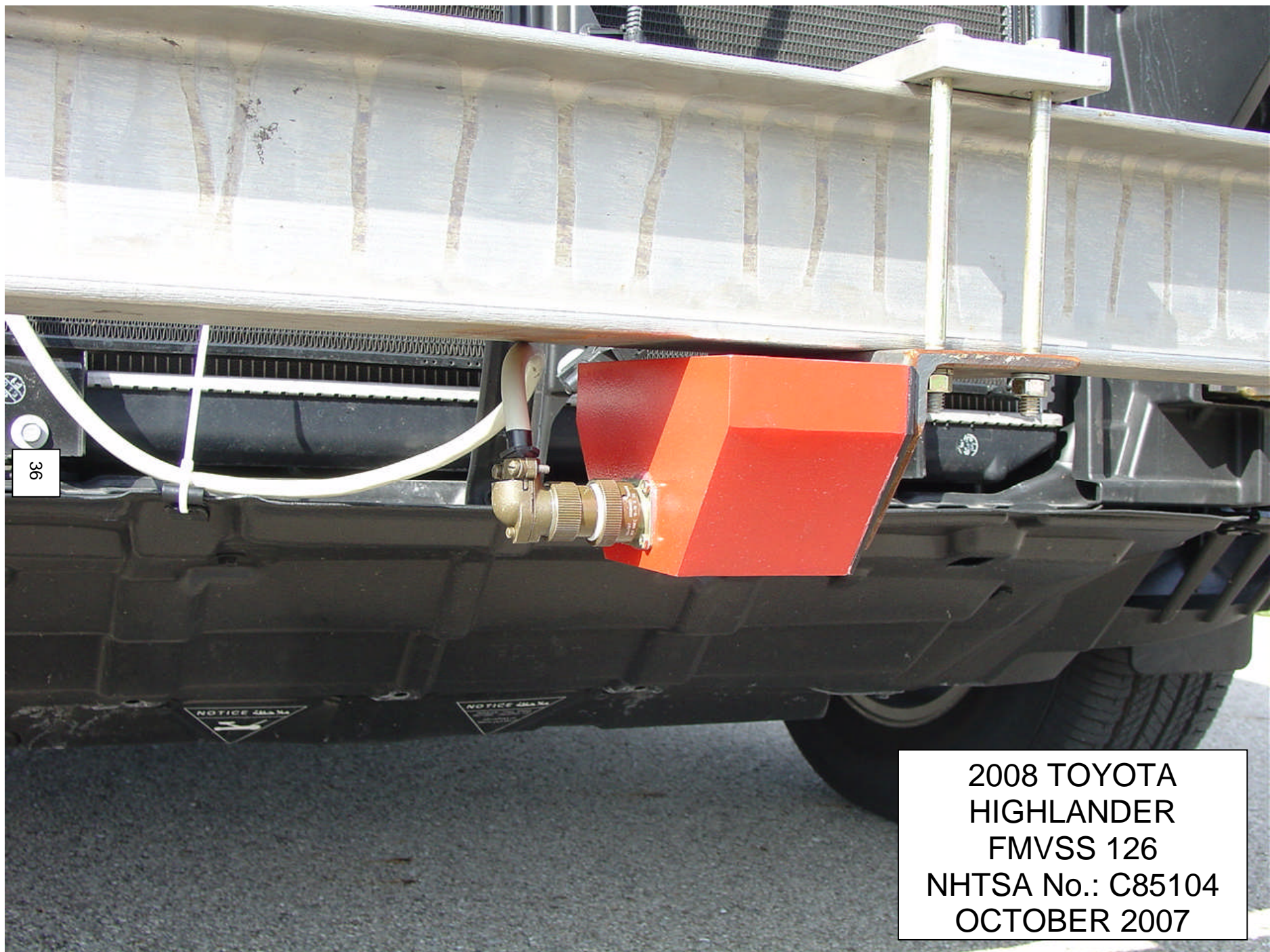
5.8 STEERING WHEEL CONTROLLER AND DATA ACQUISITION SYSTEM



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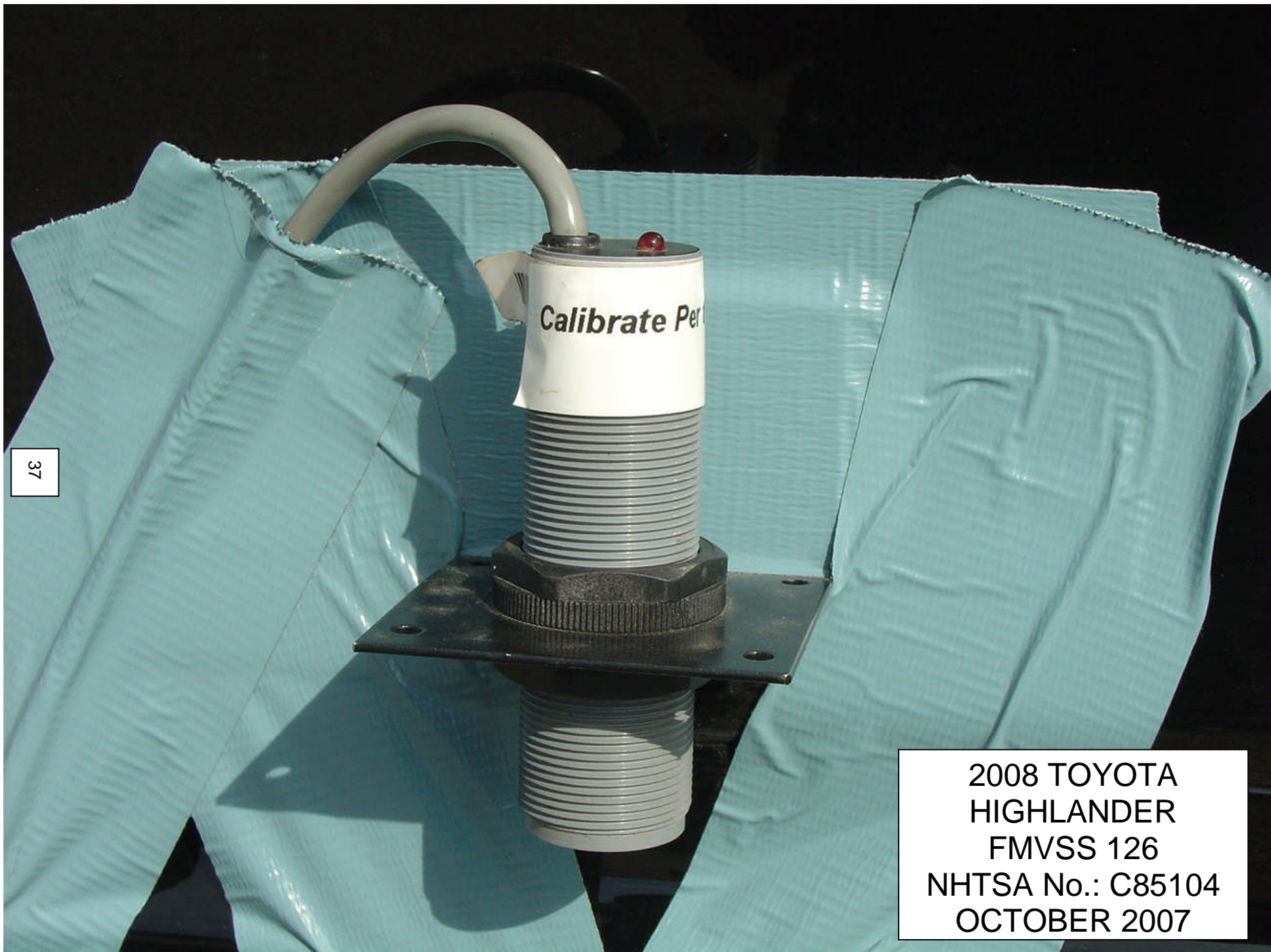
5.9 STEERING CONTROLLER BATTERY BOX AND BALLAST



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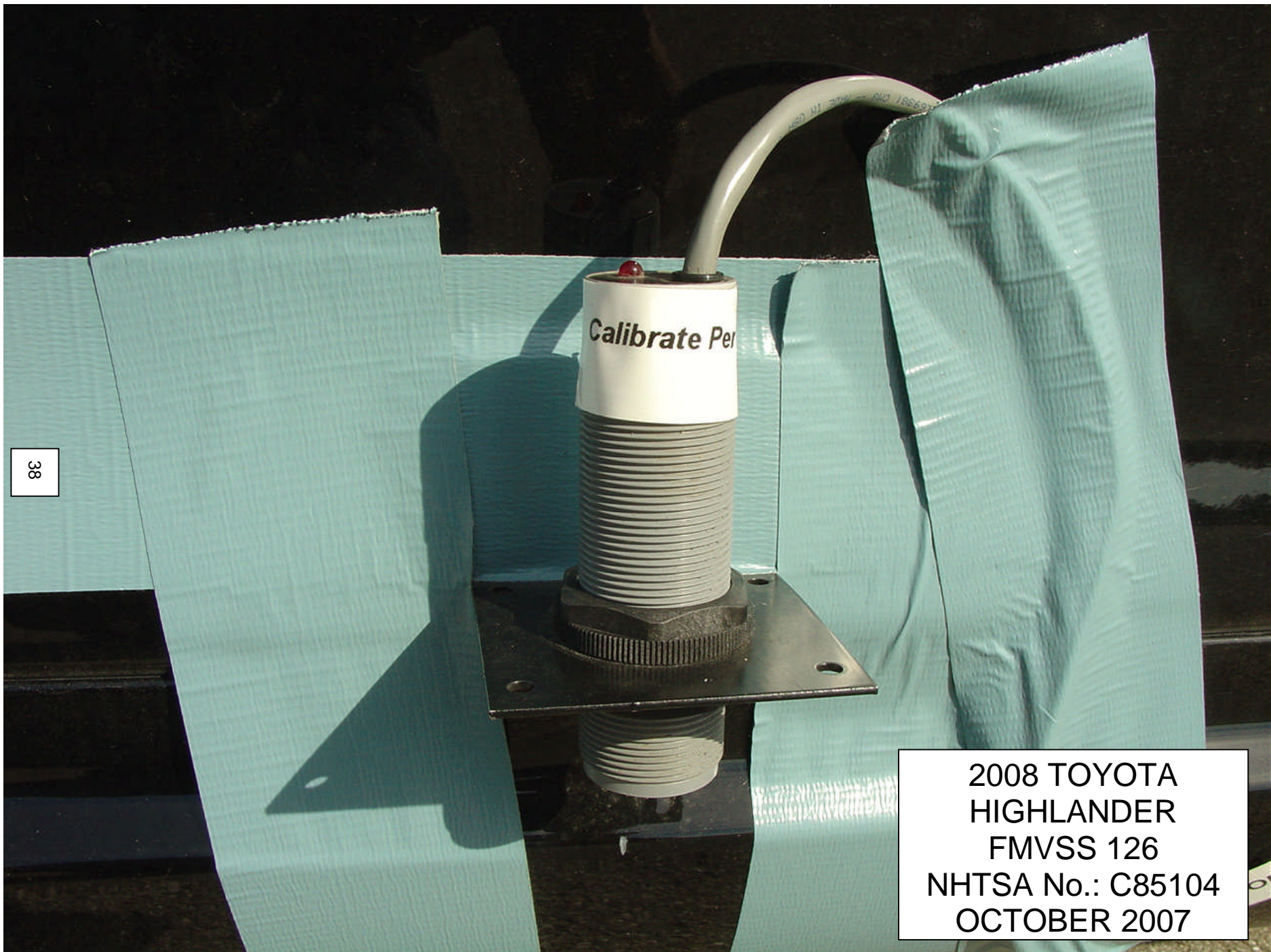
5.10 VEHICLE SPEED SENSOR



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5.11 BODY ROLL SENSOR (DRIVER SIDE)



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5.12 BODY ROLL SENSOR (PASSENGER SIDE)

6.0 DATA PLOTS

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

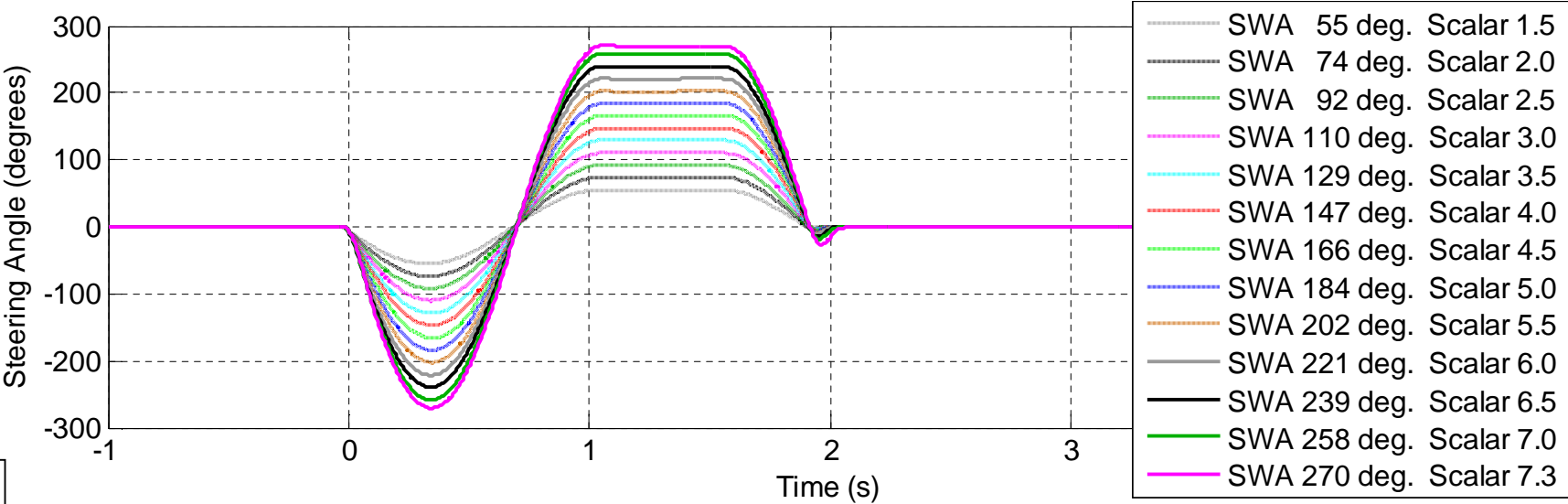
Figure 2. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Counter-Clockwise Initial Steer Tests

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

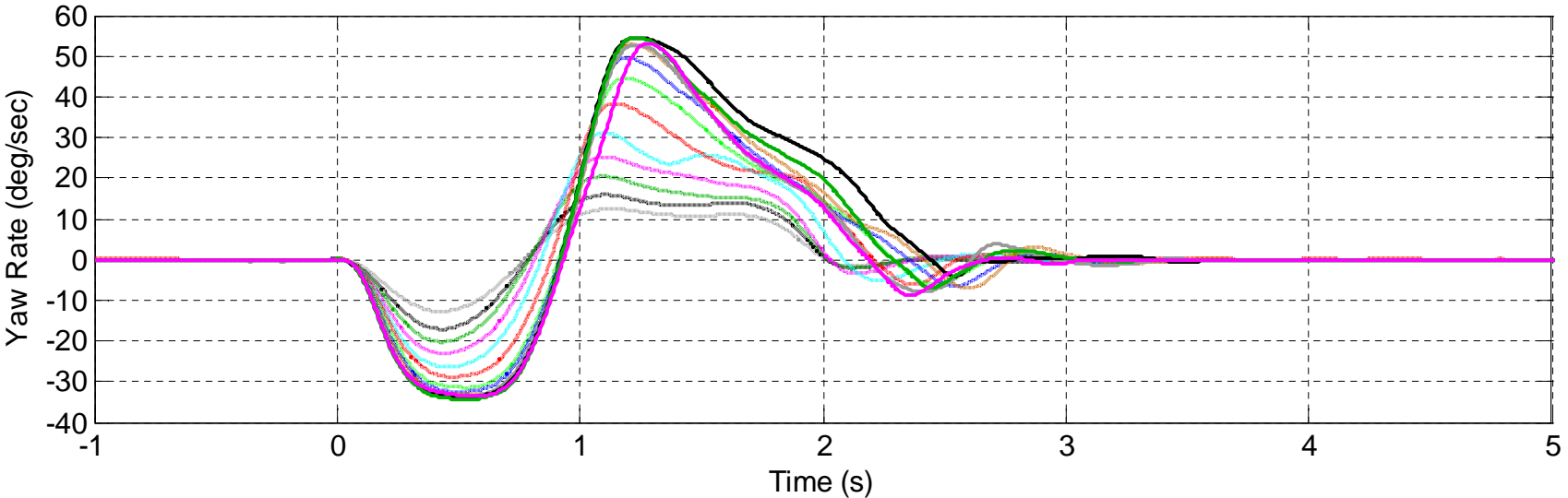
Figure 4. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Clockwise Initial Steer Tests

6.0 DATA PLOTS

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

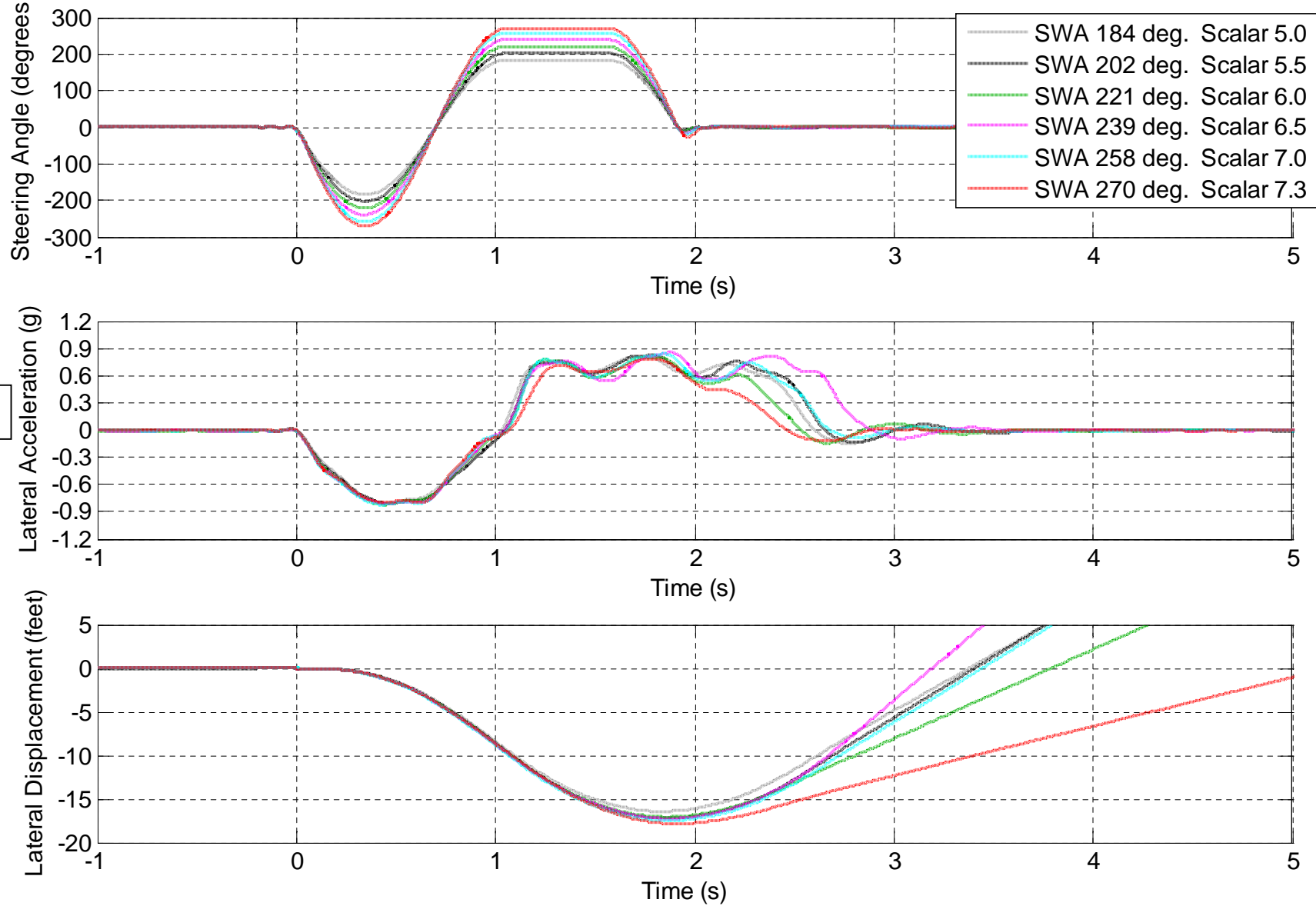


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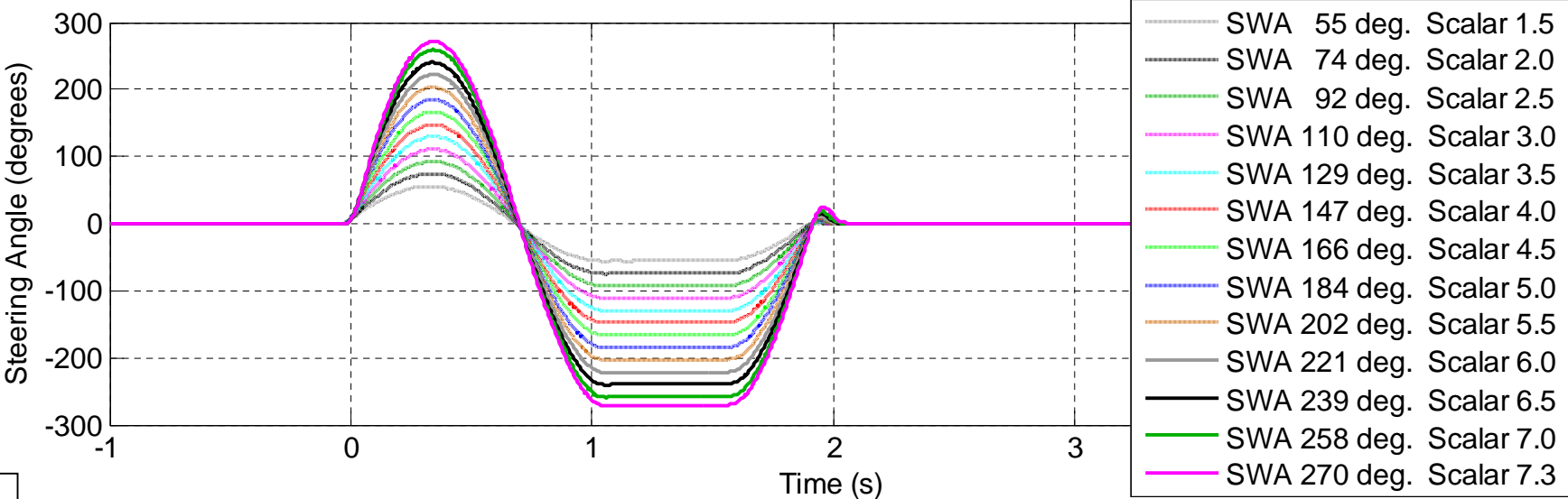
6.0 DATA PLOTS...continued

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

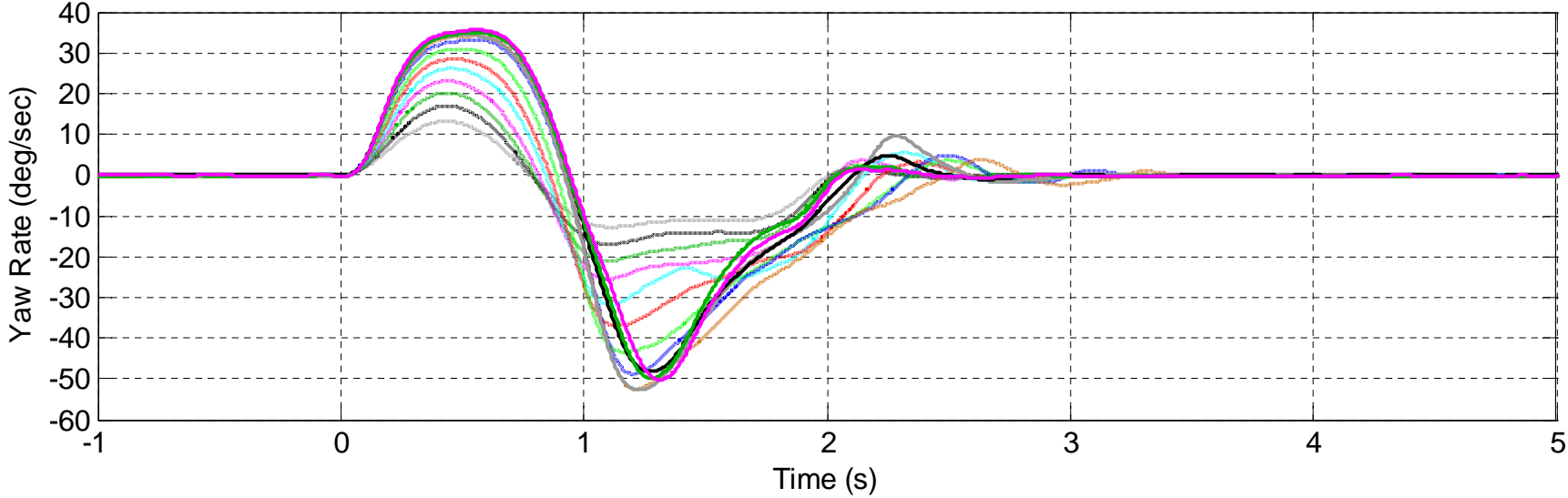


6.0 DATA PLOTS...continued

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

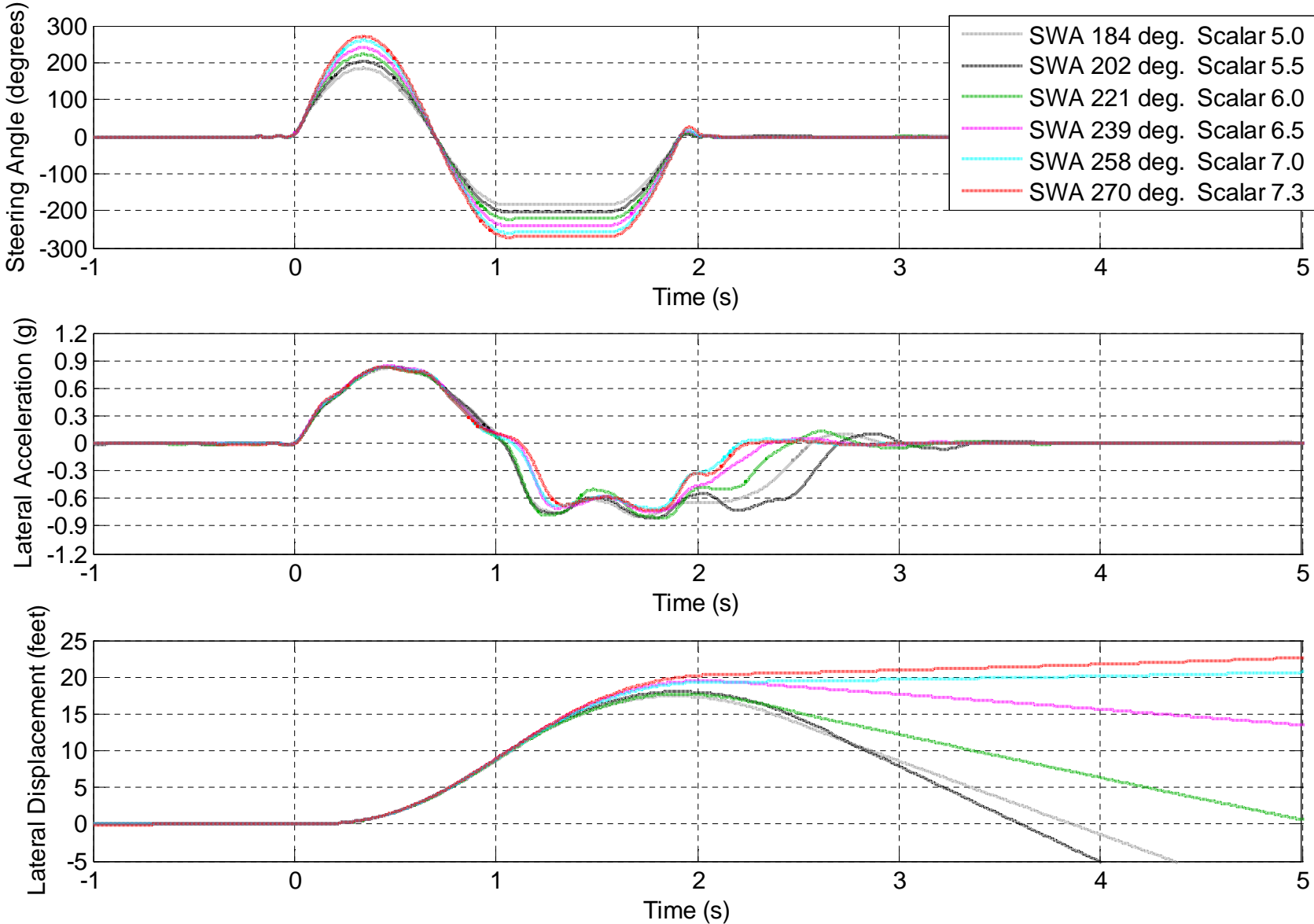


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6.0 DATA PLOTS...continued

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

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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)

Restraints the vehicle from slipping when driving on slick road surfaces or in the event of sudden braking.

■ BA (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 prevents the front wheels (2WD models) or four wheels (4WD models) from spinning when starting the vehicle or accelerating on slippery roads.

■ Hill-start assist control

Prevents the vehicle from rolling backwards when starting on incline or slippery slope.

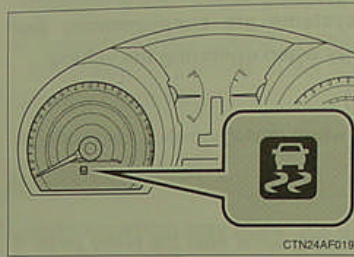
■ EPS (Electric Power Steering)

Employs an electric motor to reduce the amount of effort needed to turn the steering wheel.

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When driving

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When the VSC/TRAC/hill-start assist control systems are operating



If the vehicle is in danger of slipping, rolling backwards when starting on an incline, or the front wheels (2WD models) or four wheels (4WD models) spin, the indicator flashes to indicate that the VSC/TRAC/hill-start assist control systems have been engaged.

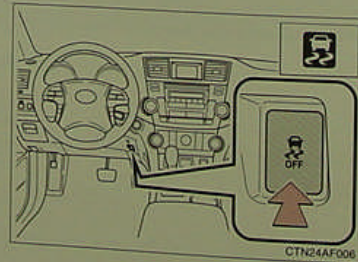
A buzzer (intermittent) sounds to indicate that VSC is operating.

The stop lights and high mounted stoplight turn on when the hill-start assist control system is operating.

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

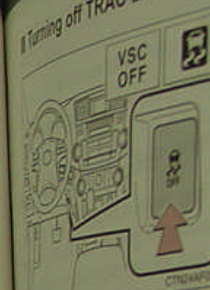


Quickly push and release the button to turn off TRAC.

The slip indicator light should come on.

Push the button again to turn the system back on.

Turning off TRAC and VSC



Push and hold the vehicle's TRAC and VSC OFF indicator on.

The slip indicator light should come on.

Push the button again to turn the system back on.

Automatic reactivation of TRAC and VSC

Turning the "ENGINE START STOP" switch or the engine off and starting the engine will automatically turn the TRAC and VSC systems back on.

Automatic TRAC reactivation

When the TRAC system is turned off, the TRAC system will automatically reactivate when vehicle speed increases.

Automatic TRAC and VSC reactivation

When the TRAC and VSC systems are turned off, the systems will automatically reactivate when vehicle speed increases.

Sounds and vibrations caused by the ABS, TRAC and hill-start assist control

A sound may be heard from the engine compartment when the vehicle is started or just after the vehicle begins to move. This sound indicates that a malfunction has occurred in any of these systems.

Any of the following conditions may occur when the system is operating. None of these indicates that a malfunction has occurred.

Vibrations may be felt through the vehicle body and steering wheel.

A motor sound may be heard after the vehicle comes to a stop.

The brake pedal may pulsate slightly when the ABS system is operating.

The brake pedal may move down slightly after the ABS system has been activated.

the VSC/TRAC/hill-start assist control systems are open



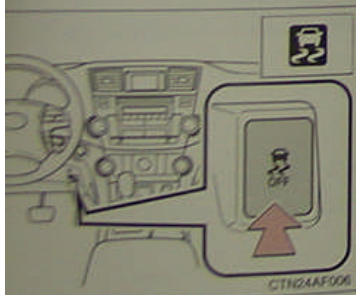
If the vehicle is in danger of slipping, rolling backwards starting on an incline, or the wheels (2WD models) or wheels (4WD models) the indicator flashes to indicate the VSC/TRAC/hill-start assist control systems have engaged.

A buzzer (intermittent) will indicate that VSC is open. The stop lights and high beam stoplight turn on when the hill-start assist control system is operating.

able TRAC and/or VSC

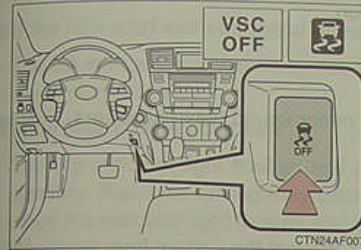
vehicle gets stuck in fresh snow or mud, TRAC and VSC power from the engine to the wheels. You may need to turn the system off to enable you to rock the vehicle in order to free it.

Turning off TRAC



Quickly push and release the button to turn off TRAC and VSC. The slip indicator light and VSC OFF indicator light will come on. Push the button again to turn the system back on.

Turning off TRAC and VSC



Push and hold the button while the vehicle is stopped to turn off TRAC and VSC.

The slip indicator light and VSC OFF indicator light should come on.

Push the button again to turn the system back on.

Automatic reactivation of TRAC and VSC

Turning the "ENGINE START STOP" switch or 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 the ABS, TRAC, VSC, BA and hill-start assist control

- 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.
- 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 when the ABS is activated.
 - The brake pedal may move down slightly after the ABS is activated.

When driving

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HIGHLANDER
FMVSS 126
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start assist control is operational when

the shift lever is in the D or S position.
the brake pedal is not depressed.

operation sound

When the steering wheel operates, a motor sound (whirring sound) may be heard.
This does not indicate a malfunction.

Reduced effectiveness of EPS

The effectiveness of EPS is reduced to prevent the system from overheating when there is frequent steering input over an extended period of time. The steering wheel may feel heavy as a result. Should this occur, refrain from excessive steering input or stop the vehicle and turn the engine off. The system should return to normal within 10 minutes.

CAUTION

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not operate effectively when

When tires with inadequate gripping ability are used (such as excessively worn tires on a snow covered road).

The vehicle hydroplanes while driving at high speed on wet or slick roads.

Stopping distance when the ABS is operating on the wet or slick roads.

The 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.

When driving on dirt, gravel or snow-covered roads

When driving with tire chains

When driving over bumps in the road

When driving over roads with potholes or uneven roads

C may not operate effectively when

When the steering wheel is locked, the power steering assist system 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.

CAUTION

■ If the hill- start assist control does not operate effectively

The hill start assist control may not operate effectively on steep inclines and roads covered in ice.

■ When the VSC is activated

The slip indicator light flashes and a warning buzzer sounds. Always drive carefully. Reckless driving may cause an accident. Exercise particular care when the indicator light flashes and a buzzer sounds.

■ 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 appropriate tire pressure level.

The ABS and VSC systems 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.

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When driving

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HIGHLANDER
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OWNERS MANUAL PAGES

7.2 VEHICLE ARRIVAL CONDITION REPORT

CONTRACT NO. DTNH22- 07-P-00332 DATE: 9/21/07

FROM: Event Vehicles (Leasing Company)

TO: TRC

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

MODEL YEAR/MAKE/MODEL/BODY STYLE: 2008 / Toyota / Highlander / MPV

MANUFACTURE DATE: 06/07 NHTSA NO.: C85104

BODY COLOR: black VIN: JTEES41A582004636

ODOMETER READING: 3314 miles GVWR: 2,720 KG

PURCHASE PRICE: \$ (leased) DEALER'S NAME: (leased)

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: 10-26-07

APPROVED BY: Jeff Sankey

DATE: 10-26-07

7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO. DTNH22- 07-P-00332 DATE: 10/21/07

MODEL YEAR/MAKE/MODEL/BODY STYLE: 2008 / Toyota / Highlander / MPV

MANUFACTURE DATE: 06/07 NHTSA NO.: C85104

BODY COLOR: black VIN: JTEES41A582004636

ODOMETER READING: 3,374 miles GVWR: 2,720 KG

LIST OF FMVSS TESTS PERFORMED BY THIS LAB: 126

- THERE ARE NO DENTS OR OTHER INTERIOR OR EXTERIOR FLAWS
- THE VEHICLE HAS BEEN PROPERLY MAINTAINED AND IS IN RUNNING CONDITION
- THE GLOVE BOX CONTAINS AN OWNER'S MANUAL, WARRANTY DOCUMENT, CONSUMER INFORMATION, AND EXTRA SET OF KEYS
- 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
APPROVED BY: Jeff Sankey

DATE: 10-26-07
DATE: 10-26-07

7.4 SINE WITH DWELL TEST RESULTS

2008 Toyota Highlander

NHTSA No.: C85104

Date Created

28-Sep-07

| File | SWA @ 5deg | Ct | MES | Time@5deg | COS | Time@COS | MOS | Time@MOS | YRR1(%) | YR1 (deg/sec) | YRR1 Ct | YRR175(%) | YR175 (deg/sec) |
|------|------------|------|----------|------------|------|------------|------|------------|----------|---------------|---------|------------|-----------------|
| 14 | | 1336 | 50.35287 | 6.67183409 | 1718 | 8.58048254 | 1474 | 7.3603153 | -3.34155 | -0.418221188 | 1918 | -2.0464843 | -0.256133237 |
| 15 | | 1963 | 50.2523 | 9.80800314 | 2346 | 11.7217771 | 2102 | 10.5024782 | -1.07308 | -0.173515441 | 2546 | -0.1615136 | -0.026116593 |
| 16 | | 1294 | 50.18086 | 6.46034841 | 1677 | 8.37729518 | 1433 | 7.15781439 | -0.21667 | -0.044327769 | 1877 | -0.1120791 | -0.022929827 |
| 17 | | 1423 | 50.53729 | 7.10812267 | 1807 | 9.02664525 | 1563 | 7.80789015 | -0.6019 | -0.153440574 | 2007 | -0.0247002 | -0.006296779 |
| 18 | | 1170 | 50.55209 | 5.84217783 | 1554 | 7.76069044 | 1310 | 6.54311025 | -0.80381 | -0.251433729 | 1754 | -0.5644588 | -0.176563544 |
| 19 | | 1310 | 50.3161 | 6.54497547 | 1694 | 8.4634531 | 1451 | 7.24631029 | 0.497559 | 0.190470006 | 1894 | 0.1377384 | 0.052727513 |
| 20 | | 1302 | 50.29846 | 6.50484161 | 1686 | 8.42375739 | 1443 | 7.20656628 | 2.591054 | 1.157667514 | 1886 | 0.2062441 | 0.092148644 |
| 21 | | 1760 | 50.23561 | 8.79338939 | 2144 | 10.7119523 | 1901 | 9.49530921 | 2.446715 | 1.215043082 | 2344 | -0.1642748 | -0.081579173 |
| 22 | | 1527 | 50.37615 | 7.62871739 | 1911 | 9.54645755 | 1668 | 8.33047937 | 5.096837 | 2.706252464 | 2111 | 0.2624135 | 0.139332934 |
| 23 | | 1183 | 50.44118 | 5.90664649 | 1566 | 7.82351856 | 1323 | 6.60818544 | 1.781624 | 0.944957116 | 1766 | -0.1070086 | -0.056756359 |
| 24 | | 1998 | 50.36339 | 9.98124927 | 2381 | 11.8977911 | 2138 | 10.6824784 | 0.806362 | 0.440412929 | 2581 | 0.1377116 | 0.075214367 |
| 25 | | 1479 | 50.44882 | 7.38783871 | 1862 | 9.30454964 | 1619 | 8.08907741 | 2.862816 | 1.565146507 | 2062 | 0.1825769 | 0.099817649 |
| 26 | | 1697 | 50.24941 | 8.47944804 | 2081 | 10.396341 | 1838 | 9.18066888 | -1.57295 | -0.838078185 | 2281 | -0.1650176 | -0.087922599 |
| 27 | | 1258 | 50.35521 | 6.28256333 | 1640 | 8.19154334 | 1396 | 6.97097387 | 0.17225 | -0.022143794 | 1840 | 0.2750597 | -0.035360595 |
| 28 | | 1584 | 50.24713 | 7.91237104 | 1967 | 9.82673597 | 1723 | 8.6059945 | -0.03622 | 0.006130778 | 2167 | 0.6765707 | -0.114532988 |
| 29 | | 1497 | 50.10659 | 7.47671096 | 1880 | 9.39405279 | 1636 | 8.17403588 | -0.80313 | 0.167490216 | 2080 | -0.5274894 | 0.110006874 |
| 30 | | 1513 | 50.31676 | 7.55774635 | 1897 | 9.47635944 | 1653 | 8.25712282 | -0.2508 | 0.063896666 | 2097 | 0.2303611 | -0.058690495 |
| 31 | | 1452 | 50.24453 | 7.25411448 | 1836 | 9.17266365 | 1592 | 7.95494554 | 0.645692 | -0.20547284 | 2036 | 0.1357054 | -0.04318431 |
| 32 | | 1549 | 50.33576 | 7.7363704 | 1933 | 9.6555194 | 1689 | 8.4375794 | 1.152526 | -0.426416975 | 2133 | 0.2466498 | -0.091256642 |
| 33 | | 1618 | 50.39916 | 8.08304691 | 2002 | 10.0019482 | 1758 | 8.78451737 | 2.228002 | -0.966775234 | 2202 | 0.4084412 | -0.177230944 |
| 34 | | 1681 | 50.45794 | 8.39531141 | 2064 | 10.3137415 | 1821 | 9.09674994 | 3.358998 | -1.637643835 | 2264 | -0.1923019 | 0.093754731 |
| 35 | | 1483 | 50.3661 | 7.40708502 | 1866 | 9.32479124 | 1623 | 8.10854238 | 3.877222 | -2.030339695 | 2066 | 0.2236727 | -0.11712808 |
| 36 | | 1513 | 50.17387 | 7.55810014 | 1896 | 9.47480756 | 1653 | 8.25924366 | 1.505072 | -0.79138522 | 2096 | -0.0050554 | 0.002658178 |
| 37 | | 1092 | 50.22345 | 5.45263764 | 1475 | 7.36893641 | 1232 | 6.15377892 | -0.40564 | 0.195899593 | 1675 | 0.3678251 | -0.177638793 |
| 38 | | 1305 | 50.32246 | 6.51897987 | 1689 | 8.43520817 | 1446 | 7.22030737 | -0.10599 | 0.052671383 | 1889 | 0.1293879 | -0.064298871 |
| 39 | | 1923 | 50.11842 | 9.60865997 | 2307 | 11.5254061 | 2064 | 10.3102851 | -0.13403 | 0.067230246 | 2507 | 0.1139941 | -0.057178565 |

7.4 SINE WITH DWELL TEST RESULTS

2008 Toyota Highlander

NHTSA No.: C85104

Date Created

28-Sep-07

| File | YRR175 Ct | 2nd Yaw Peak(deg/sec) | 2nd Yaw Peak Ct | Lat Disp (ft) | Lat. Acc. 1.07s (g) | 1st SWA Peak(deg) | 1st SWA Peak Ct | 2nd SWA Mean(deg) |
|------|-----------|-----------------------|-----------------|---------------|---------------------|-------------------|-----------------|-------------------|
| 14 | 2068 | 12.51576845 | 1561 | -3.9996353 | 0.387640496 | 54.96414341 | 1402 | 55.0060593 |
| 15 | 2696 | 16.16990118 | 2185 | -5.2103978 | 0.475908422 | 73.86165598 | 2030 | 73.82237915 |
| 16 | 2027 | 20.45860251 | 1513 | -6.2705909 | 0.530522359 | 91.72023703 | 1362 | 91.78527463 |
| 17 | 2157 | 25.4928247 | 1643 | -7.1550766 | 0.563287805 | 110.0146459 | 1492 | 110.0001333 |
| 18 | 1904 | 31.28014702 | 1391 | -8.0794526 | 0.568674431 | 128.9836835 | 1239 | 129.0573852 |
| 19 | 2044 | 38.28091455 | 1539 | -8.7432745 | 0.462604853 | 146.9352894 | 1379 | 147.0249315 |
| 20 | 2036 | 44.67940027 | 1540 | -9.3626565 | 0.218248533 | 165.7251672 | 1372 | 166.0021774 |
| 21 | 2494 | 49.66017329 | 1998 | -9.5418456 | 0.180712685 | 184.1189722 | 1829 | 183.9392804 |
| 22 | 2261 | 53.09670455 | 1769 | -9.7758799 | 0.079032802 | 202.4360344 | 1596 | 202.218944 |
| 23 | 1916 | 53.03907506 | 1429 | -9.7792991 | 0.051835005 | 221.561067 | 1251 | 221.0465636 |
| 24 | 2731 | 54.6172936 | 2245 | -9.8615336 | 0.077832091 | 239.5231784 | 2066 | 239.0551247 |
| 25 | 2212 | 54.67157733 | 1725 | -10.024013 | 0.026302845 | 258.6525909 | 1547 | 258.0190582 |
| 26 | 2431 | 53.28073801 | 1954 | -9.8114356 | 0.001370068 | 270.5151653 | 1766 | 269.8599042 |
| 27 | 1990 | -12.85560559 | 1481 | 4.0927071 | -0.395788993 | 55.6818774 | 1324 | 55.46534357 |
| 28 | 2317 | -16.9284572 | 1805 | 5.2122404 | -0.482125017 | 74.5683289 | 1651 | 74.40787238 |
| 29 | 2230 | -20.8548041 | 1717 | 6.3347205 | -0.532542611 | 92.50611169 | 1565 | 92.25567379 |
| 30 | 2247 | -25.47760293 | 1733 | 7.0193885 | -0.576857133 | 110.7903962 | 1581 | 110.5976792 |
| 31 | 2186 | -31.82209286 | 1675 | 7.8596755 | -0.583155021 | 129.8643484 | 1521 | 129.5490716 |
| 32 | 2283 | -36.99846813 | 1776 | 8.6298972 | -0.518302326 | 147.7295888 | 1617 | 147.611176 |
| 33 | 2352 | -43.39202888 | 1852 | 9.2448203 | -0.370784959 | 166.8085516 | 1687 | 166.5680503 |
| 34 | 2414 | -48.75393446 | 1922 | 9.7406495 | -0.090172515 | 185.028724 | 1749 | 184.4344995 |
| 35 | 2216 | -52.36583425 | 1726 | 10.019237 | -0.085473401 | 203.2607378 | 1551 | 202.6824442 |
| 36 | 2246 | -52.58120445 | 1759 | 9.8662297 | -0.055321624 | 222.2136364 | 1582 | 221.6565103 |
| 37 | 1825 | -48.29436329 | 1347 | 10.040385 | 0.056286086 | 240.4257419 | 1160 | 239.552181 |
| 38 | 2039 | -49.69464442 | 1561 | 9.9866329 | 0.020806108 | 259.3339088 | 1374 | 258.3328309 |
| 39 | 2657 | -50.15921259 | 2186 | 10.068616 | 0.072641579 | 271.3590917 | 1992 | 270.2414164 |

7.5 SLOWLY INCREASING STEER TEST RESULTS

2008 Toyota Highlander

NHTSA No.: C85104

Date Created

28-Sep-07

| File | Vehicle | EventPt | DOS | MES [mph] | Mean SPD [mph] | AYcount | THETAENC [degree] | AYCG [g] | r_squared | ZeroBegin | ZeroEnd |
|----------|------------------------|---------|-----|-----------|----------------|---------|-------------------|----------|-----------|-----------|---------|
| 6 | 2008 Toyota Highlander | 1800 | 1 | 49.316429 | 49.58965835 | 2350 | -37.08287741 | -0.30368 | 0.996557 | 1600 | 1800 |
| 8 | 2008 Toyota Highlander | 1635 | 1 | 49.67412 | 49.92447386 | 2176 | -36.44449039 | -0.30148 | 0.999631 | 1435 | 1635 |
| 9 | 2008 Toyota Highlander | 1292 | 1 | 49.657496 | 49.78635623 | 1836 | -36.68911726 | -0.3037 | 0.99731 | 1092 | 1292 |
| 10 | 2008 Toyota Highlander | 1293 | 0 | 49.428071 | 49.75390576 | 1849 | 37.74113407 | 0.304508 | 0.996949 | 1093 | 1293 |
| 11 | 2008 Toyota Highlander | 1642 | 0 | 50.203326 | 50.30838145 | 2188 | 36.7721179 | 0.305091 | 0.996646 | 1442 | 1642 |
| 12 | 2008 Toyota Highlander | 1869 | 0 | 49.219816 | 49.59087297 | 2408 | 36.19727003 | 0.303305 | 0.998522 | 1669 | 1869 |
| Averages | | | | | | | 36.8 | 0.303627 | | | |

FN

Scalars

Steering Angles (deg)

| | |
|-----|-----|
| 1.5 | 55 |
| 2 | 74 |
| 2.5 | 92 |
| 3 | 110 |
| 3.5 | 129 |
| 4 | 147 |
| 4.5 | 166 |
| 5 | 184 |
| 5.5 | 202 |
| 6 | 221 |
| 6.5 | 239 |
| 7 | 258 |
| 7.3 | 270 |

7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

2008 Toyota Highlander

NHTSA No.: C85104

Device : N10-02-03-01310
device version : 1.55
device certification date : 12/04/06
today is : 09/27/07
units : Millimeters

| Label | ActualX | ActualY | ActualZ |
|----------------------------------|----------|-----------|-----------|
| C_DEVICEPOS001 | | | |
| M_PLANE001 | 1337.43 | -196.689 | -348.4759 |
| M_LINE001 | 695.9805 | 49.0924 | 36.5446 |
| M_FRONT_AXLE_-_ORIGIN | 0 | 0 | 0 |
| C_COORDSYS001 | 0 | 0 | 0 |
| M_LEFT_FRT_TIRE_TREAD_CENTER | 350.4818 | 89.916 | -139.1184 |
| M_TOP_OF_SENSOR | 1768.141 | 886.1192 | 178.4596 |
| M_TOP_OF_ROOF | 2176.578 | 910.6262 | 1349.12 |
| M_FLOOR | 2104.18 | -489.4826 | -349.3051 |
| Track Width | | 1625 | |
| Roof Height (relative to ground) | | | 1698.425 |
| Motion Pak - x-distance | 1768.141 | | |
| Motion Pak - y-distance | | -16.2968 | |
| Motion Pak - z-distance | | | 438.8647 |