126-DRI-10-008
SAFETY COMPLIANCE TESTING FOR FMVSS 126
Electronic Stability Control Systems

Chrysler Group LLC
2010 Chrysler Town and Country
NHTSA No. CA0305

DYNAMIC RESEARCH, INC.
355 Van Ness Avenue, STE 200
Torrance, California 90501

23 November, 2010

Final Report

Prepared Under Contract No.: DTNH22-08-D-00098

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
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Prepared By: Brian K. Kebschull

Approved By: [signature]

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16. Abstract A test was conducted on a 2010 Chrysler Town and Country , NHTSA No. CA0305, 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			
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1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this test is to determine if the test vehicle, a 2010 Chrysler Town and Country, meets the minimum equipment and performance requirements stated in Federal Motor Vehicle Safety Standard (FMVSS) 126, "Electronic Stability Control Systems."

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS

Testing of the 2010 Chrysler Town and Country was conducted at Dynamic Research, Inc (DRI) 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 20 km/h (12.4 mph), when being driven in reverse, or during system initialization).

The vehicle was subjected to a 0.7 Hz 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).

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS (CONTINUED)

- 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 (CONTD)

Data Summary Sheet (Page 1 of 2)

Vehicle: *2010 Chrysler Town and Country*

NHTSA No. *CA0305* VIN: *2A4RR4DE5AR240558*

Vehicle Type: *MPV* Manufacture Date: *2/10*

Laboratory: *Dynamic Research, Inc.*

REQUIREMENTS:	**PASS/FAIL**
ESC Equipment and Operational Characteristics (Data Sheet 2)	
The vehicle is to be equipped with an ESC system that meets the equipment and operational characteristics requirements. (S126, S5.1, S5.6)	***PASS***
ESC Malfunction Telltale (Data Sheet 3)	
Vehicle is equipped with a telltale that indicates one or more ESC system malfunctions. (S126, S5.3)	***PASS***
"ESC Off" and other System Controls and Telltale (Data Sheet 3,4)	
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)	***PASS***
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)	***PASS***

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS (CONTD)

Data Summary Sheet (Page 2 of 2)

REQUIREMENTS:	PASS/FAIL
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 3,500kg (7,716 lb) or less, and 1.52 m (5 feet) for vehicles with a GVWR greater than 3,500 Kg (7,716 lb). (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***

3.0 TEST DATA

Data Sheet 1 (Page 1 of 2)

TEST VEHICLE INSPECTION AND TEST PREPARATION

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data Sheet Completion Date: *5/24/2010*

VIN *2A4RR4DE5AR240558* Manufacture Date: *2/10*

GVWR (kg): *2745* Front GAWR (kg): *1339* Rear GAWR (kg): *1407*

Seating Positions Front: *2* Mid: Rear: *5*

Odometer reading at time of inspection: *6 miles (9.6 km)*

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front axle: *225/65 R16* Rear axle: *225/65 R16*

INSTALLED TIRE SIZE(S) ON VEHICLE (from tire sidewall)

		Front Axle		Rear Axle
	Tire Manufacturer:	*Yokohama*		*Yokohama*
	Tire Model:	*Avid S33*		*Avid S33*
	Tire Size:	*225/65 R16*		*225/65 R16*
TIN	Left Front:	*4UF2 6B4 4409*	Right Front:	*4UF2 6B4 4409*
	Left Rear:	*4UF2 6B4 4409*	Right Rear:	*4UF2 6B4 4409*

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

DRIVE CONFIGURATION(S):(mark all that apply)

[X] Two Wheel Drive (2WD) [X] Front Wheel Drive [ ] Rear Wheel Drive

[ ] All Wheel Drive (AWD)

[ ] Four Wheel Drive Automatic - differential no locked full time (4WD Automatic)

[ ] Four Wheel Drive (High Gear Locked Differential 4WD HGLD)

[ ] Four Wheel Drive Low Gear (4WD Low)

[ ] Other (Describe)

3.0 TEST DATA (CONTD)

Data Sheet 1 (Page 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)

Drive Configuration: *FWD*
Mode: *Default- ESC on*
Drive Configuration: *FWD*
Mode: *ESP "Partial off" mode*
Drive Configuration:
Mode:

VEHICLE STABILITY SYSTEMS (Check applicable technologies):

List other systems:

- [X] ESC
- [X] Traction Control
- [ ] Roll Stability Control
- [ ] Active Suspension
- [X] Electronic Throttle Control
- [ ] Active Steering
- [X] ABS

REMARKS: Note that this manufacturer refers to ESC as ESP

RECORDED BY: *Peter Broen* DATE RECORDED: *5/24/2010*
APPROVED BY: *Brian Kebschull* DATE APPROVED: *5/27/2010*

3.0 TEST DATA (CONTD)

Data Sheet 2 (Page 1 of 2)
ESC SYSTEM HARDWARE AND OPERATIONAL CHARACTERISTICS

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No *CA0305* Data Sheet Completion Date: *5/21/2010*

ESC SYSTEM IDENTIFICATION

Manufacturer/Model *Continental Teves – Mk25e*

ESC SYSTEM HARDWARE (Check applicable hardware)

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

List other Components: *Brake actuation (vac booster)*

ESC OPERATIONAL CHARACTERISTICS

System is capable of generating brake torque at each wheel — [X] Yes (Pass) [ ] No (Fail)
Brief explanation: *The Hydraulic Control Unit (HCU) is able to adjust brake pressure at each wheel individually, by switching valves and activation of the pump, independent of the driver's brake actuation.*

System is capable of determining yaw rate — [X] Yes (Pass) [ ] No (Fail)
Brief explanation: *Yaw rate is measured directly with a yaw rate sensor.*

System is capable of monitoring driver steering input — [X] Yes (Pass) [ ] No (Fail)
Brief explanation: *Steering wheel angle is measured directly.*

System is capable of estimating side slip or side slip derivative — [X] Yes (Pass) [ ] No (Fail)
Brief explanation: *The ESC system estimates the side slip derivative. This estimate is based on the measured lateral acceleration, measured wheel speeds, measured yaw rate, and derived bicycle model.*

3.0 TEST DATA (CONTD)

Data Sheet 2 (Page 2 of 2)
ESC SYSTEM HARDWARE AND OPERATIONAL CHARACTERISTICS

ESC OPERATIONAL CHARACTERISTICS (continued)

System is capable of modifying engine torque during ESC activation. **X** Yes (Pass) ___ No (Fail)

Method used to modify torque: *ESC performs a reduction of engine torque by sending an engine torque request via the engine management interface. Torque reduction is achieved by changing ignition and spark timing, fuel delivery, and/or a combination of all the above in order to achieve the smoothest possible performance..*

System is capable of activation at speeds of 20 km/h (12.4 mph) and higher **X** Yes (Pass) ___ No (Fail)

Speed system becomes active: *14.4 km/h*

System is capable of activation during the following driving phases: **X** Yes (Pass) ___ No (Fail)

- acceleration
- braking
- coasting
- during activation of ABS or traction control

Driving phases during which ESC is capable of activation:
Acceleration, braking, coasting, during activation of ABS or traction control.

Vehicle manufacturer submitted documentation explaining how the ESC mitigates understeer **X** Yes (Pass) ___ No (Fail)

DATA INDICATES COMPLIANCE: **X** Yes (Pass) ___ No (Fail)

REMARKS:

RECORDED BY: *Joe Kelly* DATE RECORDED: *5/21/2010*
APPROVED BY: *Brian Kebschull* DATE APPROVED: *5/8/2010*

3.0 TEST DATA (CONTD)

Data Sheet 3 (Page 1 of 2)
ESC MALFUNCTION AND OFF TELLTALES

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data Sheet completion date: *5/21/2010*

ESC Malfunction Telltale

Vehicle is equipped with malfunction telltale? *Yes*

Telltale Location: *Between speedometer and tachometer, in the top center area of the instrument cluster*

Telltale Color: *Yellow*

Telltale symbol or abbreviation used

or **ESC**

	Vehicle uses this symbol
	Vehicle uses this abbreviation
X	Neither symbol or abbreviation is used

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

An "ESP BAS" (the "BAS" is underneath the "ESP") telltale is used for ESC malfunction indication. (Figure 5.6)

Is telltale part of a common space? *No*

Is telltale also used to indicate activation of the ESC system? *No (see explanation below)*

If yes explain telltale operation during ESC activation:

The malfunction telltale "ESP BAS" is not used to indicate ESP system activation. However the "ESP/TCS Indicator Light" ("Skidding car") flashes to indicate traction control and/or ESC activation.

3.0 TEST DATA (CONTD)

Data Sheet 3 (Page 2 of 2)
ESC MALFUNCTION AND OFF TELLTALES

"ESC OFF" Telltale (if provided)

Vehicle is equipped with "ESC OFF" telltale? *Yes*

Is "ESC Off" telltale combined with "ESC Malfunction" telltale utilizing a two part telltale? *No*

Telltale Location: *Between speedometer and tachometer, in the top center area of the instrument cluster*

Telltale Color: *Yellow*

Telltale symbol or abbreviation used

or **ESC OFF**

- [ ] Vehicle uses this symbol
- [ ] Vehicle uses this abbreviation
- [x] Neither symbol or abbreviation is used

If different than identified above, make note of any message, symbol or abbreviation used. *The skidding car symbol above without the word OFF is used to indicate that the ESP system has been partially turned off. This telltale also flashes to indicate ESC/TCS activation.*

Is telltale part of a common space? *No*

DATA INDICATES COMPLIANCE *Yes*

(Vehicle is compliant if equipped with a malfunction telltale)

Remarks:

RECORDED BY: *Joe Kelly* DATE RECORDED: *5/21/2010*

APPROVED BY: *Brian Kebschull* DATE APPROVED: *5/27/2010*

3.0 TEST DATA (CONTD)

Data Sheet 4 (Page 1 of 3)
ESC AND ANCILLARY SYSTEM CONTROLS

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data Sheet completion date: *5/24/2010*

"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)

- [X] Dedicated "ESC Off" Control
- [ ] Multi-functional control with an "ESC Off" mode
- [ ] Other (describe)

Identify each control location, labeling and selectable modes.

First Control:
- Location: *Center of dashboard (beneath AC vents) (Figure 5.7)*
- Labeling: *ESP OFF*
- Modes: *Pressing this button partially deactivates the ESC and traction control. The ESC system remains partially active, but without engine torque management.*

Second Control:
- Location: ___
- Labeling: ___
- Modes: ___

Identify standard or default drive configuration *FWD*

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 (CONTD)

Data Sheet 4 (Page 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.

Control Mode	"ESC Off" telltale illuminates upon activation of control? (Yes/No)	"ESC Off" telltale extinguishes upon cycling ignition? (Yes/No)
NA		

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_ NA ___ Yes ___ No

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

Ancillary Control: System __None__

Control Description _____

Labeling _____

Ancillary Control: System _____

Control Description _____

Labeling _____

Ancillary Control: System _____

Control Description _____

Labeling _____

3.0 TEST DATA (CONTD)

Data Sheet 4 (Page 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.

Ancillary Control	Control Activates "ESC Off" Telltale? (Yes/No)	Warnings or Messages Provided
None		

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

Ancillary Control	"ESC Off" telltale extinguishes upon cycling ignition? (Yes/No)
None	

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 activating the control 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.

X Yes ____ No (Fail)

DATA INDICATES COMPLIANCE: PASS

Remarks:

RECORDED BY: *Peter Broen* DATE RECORDED: *5/24/2010*

APPROVED BY: *Brian Kebschull* DATE APPROVED: *5/27/2010*

3.0 TEST DATA (CONTD)

Data Sheet 5 (Page 1 of 3)
TEST TRACK AND VEHICLE DATA

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data Sheet completion date: *5/27/2010*

Test Track Requirements: Test surface slope (0-1%): *0.5%*

Peak Friction Coefficient (at least 0.9) *0.931*

Test track data meets requirements: *Yes* If no, explain:

Full Fluid Levels: Fuel *Yes* Other Fluids *Yes* (specify)

Coolant *Yes* *Oil, washer fluid, brake fluid*

Tire Pressures:

Required; Front Axle *250* KPA Rear Axle *250* KPA

Actual; LF *250* KPA RF *250* KPA

LR *250* KPA RR *250* KPA

Vehicle Dimensions: Front Track Width *166.9* cm Wheelbase *307.8* cm

Rear Track Width *165.1* cm

Vehicle Weight Ratings: GAWR Front *1339* KG GAWR Rear *1407* KG

Unloaded Vehicle Weight (UVW):

Front Axle *1117.2* KG Left Front *570.2* KG Right Front *547.0* KG

Rear Axle *878.6* KG Left Rear *439.5* KG Right Rear *439.1* KG

Total UVW *1995.8* KG

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

Calculated baseline weight (UVW + 73kg) *2068.8* KG

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

Standard - Baseline weight under 2772 kg (6000 lb)
Heavy - Baseline weight equal to or greater than 2772 kg (6000 lb)

3.0 TEST DATA (CONTD)

Data Sheet 5 (Page 2 of 3)
TEST TRACK AND VEHICLE DATA

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

Front axle *1150.8* KG Left front *587.4* KG Right front *563.4* KG

Rear axle *921.3* KG Left rear *459.5* KG Right rear *461.8* KG

Total UVW with outriggers *2072.1* KG

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

Front axle *1228.7* KG Left front *641.8* KG Right front *586.9* KG

Rear axle *983.4* KG Left rear *495.3* KG Right rear *488.1* KG

Vehicle Weight *2212.1* KG

Ballast Required =

[Total UVW with Outriggers (if applicable)]		+ *168*	KG	- [Loaded Weight w/Driver and Instrumentation)]	
= *2072.1*	KG	+ *168*	KG	- 2212.1	KG

= *28.0* KG

Total Loaded Vehicle Weight w/Driver and Instrumentation and Ballast

Front axle *1241.5* KG Left front *640.5* KG Right front *601.0* KG

Rear axle *997.9* KG Left rear *499.9* KG Right rear *498.0* KG

Total UVW *2239.4* KG

3.0 TEST DATA (CONTD)

Data Sheet 5 (Page 3 of 3)
TEST TRACK AND VEHICLE 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	*54.0*	in	*137.2*	cm	*59.9*	in	*152.1*	cm
y-distance	*-0.6*	in	*-1.5*	cm	*-0.2*	in	*-0.6*	cm
z-distance	*25.9*	in	*65.7*	cm	*21.1*	in	*53.6*	cm
Roof Height					*68.1*	in	*173.0*	cm
Distance between ultrasonic sensors					*90.5*	in	*229.9*	cm

Remarks:

RECORDED BY: *PCB* DATE RECORDED: *5/27/2010*
APPROVED BY: *BKK* DATE APPROVED: *5/27/2010*

3.0 TEST DATA (CONTD)

Data Sheet 6 (Page 1 of 3)
BRAKE AND TIRE CONDITIONING

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305*

Measured tire pressure: LF *258* KPA RF *257* KPA

LR *254* KPA RR *253* KPA

Wind Speed *2.2* m/s (10 m/sec (22 mph) max for passenger cars; 5m/sec (11 mph) max for MPVs and trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) *17.1* °C

Brake Conditioning Time: *9:01:00 AM* Date: *5/27/2010*

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	*0.7-0.9*	g

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

Duration of cool down period (5 minutes min.)	*5*	Minutes

3.0 TEST DATA (CONTD)

Data Sheet 6 (Page 2 of 3)
BRAKE AND TIRE CONDITIONING

Tire Conditioning series No. 1	Time:	*9:15:00 AM*		Date:	*5/27/2010*	
Measured cold tire pressure	LF	*276*	KPA	RF	*278*	KPA
	LR	*265*	KPA	RR	*271*	KPA
Wind Speed *1.2* m/s	(10 m/sec (22 mph) max for passenger cars; 5m/sec (11 mph) max for MPVs and trucks)					

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

30 meter (100 ft) Diameter Circle Maneuver				
Test Run	Steering Direction	Target Lateral Acceleration (g)	Observed Lateral Acceleration (g)	Observed Vehicle Speed (Km/h)
1-3	Clockwise	0.5 – 0.6	*0.5-0.6*	*30.4 - 32*
4-6	Counterclockwise	0.5 – 0.6	*0.5-0.6*	*30.4 - 32*

5-1 Hz Cycle Sinusoidal Steering Maneuver to Determine Steering Wheel Angle for 0.5-0.6 g Lateral Acceleration					
Test Run	Data File	Vehicle Speed Km/h(mph)	Steering Wheel Angle (degrees)	Target Peak Lateral Acceleration (g)	Observed Peak Lateral Acceleration (g)
1	2	56 ± 2 (35 ± 1)	*60*	0.5 - 0.6	*0.28*
2	3	56 ± 2 (35 ± 1)	*120*	0.5 - 0.6	*0.48*
3	4	56 ± 2 (35 ± 1)	*140*	0.5 - 0.6	*0.53*
4		56 ± 2 (35 ± 1)		0.5 - 0.6	

Steering wheel angle that corresponds to a peak 0.5-0.6 g lateral acceleration:
140 **degrees**

10-1 Hz Cycle Sinusoidal Steering Maneuver					
Test Run	Data File	Vehicle Speed Km/h (mph)	Steering Wheel Angle (degrees)	Target Peak Lateral Acceleration (g)	Observed Peak Lateral Acceleration (g)
1-3	*5-7*	56 ± 2 (35 ± 1)	*140* (cycles 1-10)	0.5 - 0.6	*0.53*
4	*8*	56 ± 2 (35 ± 1)	*140* (cycles 1-9)	0.5 - 0.6	*0.53*
			280 (cycle10)*	NA	*0.76*

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

3.0 TEST DATA (CONTD)

Data Sheet 6 (Page 3 of 3)
BRAKE AND TIRE CONDITIONING

Tire Conditioning series No. 2 Time: *10:47:00 AM* Date: *5/27/2010*

Measured cold tire pressure LF *276* KPA RF *278* KPA

LR *266* KPA RR *272* KPA

Wind Speed *2.6* m/s (10 m/sec (22 mph) max for passenger cars; 5m/sec (11 mph) max for MPVs and trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) *21.4* °C

30 meter (100 ft) Diameter Circle Maneuver				
Test Run	Steering Direction	Target Lateral Acceleration (g)	Observed Lateral Acceleration (g)	Observed Vehicle Speed (Km/h)
1-3	Clockwise	0.5 - 0.6	*0.5-0.6*	*30.4 - 32*
4-6	Counterclockwise	0.5 - 0.6	*0.5-0.6*	*30.4 - 32*

Steering wheel angle that corresponds to a peak 0.5-0.6 g lateral acceleration:

140 **degrees**

10-1 Hz Cycle Sinusoidal Steering Maneuver					
Test Run	Data File	Vehicle Speed Km/h (mph)	Steering Wheel Angle (degrees)	Target Peak Lateral Acceleration (g)	Observed Peak Lateral Acceleration (g)
1-3	*17-19*	56 ± 2 (35 ± 1)	*140* (cycles 1-10)	0.5 - 0.6	*0.53*
4	*20*	56 ± 2 (35 ± 1)	*140* (cycles 1-9)	0.5 - 0.6	*0.53*
			280 (cycle 10)*	NA	*0.77*

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

Remarks:

RECORDED BY: *B Kebschull* DATE RECORDED: *5/27/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *6/4/2010*

3.0 TEST DATA (CONTD)

Data Sheet 7 (Page 1 of 2)
SLOWLY INCREASING STEER (SIS) MANEUVER

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305*

Measured tire pressure: LF *275* KPA RF *277* KPA

LR *267* KPA RR *270* KPA

Wind Speed *1.4* m/s

(10 m/sec (22 mph) max for passenger cars; 5m/sec (11 mph) max for MPVs and trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) *17.4* °C

Selected drive configuration *FWD*

Selected Mode: *Standard "ESP ON"*

Preliminary Left Steer Maneuver:

Lateral Acceleration measured at 30 degrees steering wheel angle

$a_{y,30degrees}$ = *0.26* g

Assuming a linear relationship the following ratio should be used to calculate the steering wheel angle at 0.55g:

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

δ_{sis} = *63.5* degrees (@.55g)

δ_{sis} = *60* degrees (rounded)

Steering Wheel Angle at Corrected 0.3g Lateral Acceleration:

Maneuver	Initial Steer Direction	Time Clock (5 min max between runs)	Steering Wheel Angle to nearest 0.1° (degrees)	Data Run	Good/NG
1	Left	*9:56:44 AM*	*-36.9*	*11*	*Good*
2	Left	*10:01:38 AM*	*-36.1*	*12*	*Good*
3	Left	*10:05:28 AM*	*-36.7*	*13*	*Good*
4	Left				
5	Left				
1	Right	*10:12:00 AM*	*36.4*	*14*	*Good*
2	Right	*10:15:47 AM*	*37.4*	*15*	*Good*
3	Right	*10:19:17 AM*	*37.5*	*16*	*Good*
4	Right				
5	Right				

3.0 TEST DATA (CONTD)

Data Sheet 7 (Page 2 of 2)
SLOWLY INCREASING STEER (SIS) MANEUVER

Average Overall Steering Wheel Angle:

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

$\delta_{0.3\ g,\ overall}$ = *36.8* degrees

[to nearest 0.1 degree]

Remarks:

RECORDED BY: *Brian Kebschull* DATE RECORDED: *5/27/2010*
APPROVED BY: *J Lenkeit* DATE APPROVED: *6/7/2010*

3.0 TEST DATA (CONTD)

Data Sheet 8 (Page 1 of 3)
VEHICLE LATERAL STABILITY AND RESPONSIVENESS

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data sheet completion date: *5/27/2010*

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: *FWD*

Selected Mode: *Standard "ESP ON"*

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

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

Maneuver #	Clock Time (1.5 – 5.0 min max between runs)	Commanded Steering Wheel Angle[1]		Yaw Rates (degrees/sec)			YRR at 1.0 sec after COS [≤ 35%]		YRR at 1.75 sec after COS [≤ 20%]	
		Scalar (* $\delta_{0.3\ g}$)	Angle (degrees)	$\dot{\psi}_{Peak}$	$\dot{\psi}_{1.0sec}$	$\dot{\psi}_{1.75sec}$	%	Pass/Fail	%	Pass/Fail
23	*11:16*	*1.5*	*55*	*13.42*	*0.02*	*0.04*	*0.15*	*Pass*	*0.29*	*Pass*
24	*11:20*	*2.0*	*74*	*17.93*	*0.04*	*-0.01*	*0.21*	*Pass*	*-0.08*	*Pass*
25	*11:23*	*2.5*	*92*	*22.06*	*0.03*	*-0.02*	*0.13*	*Pass*	*-0.11*	*Pass*
26	*11:26*	*3.0*	*110*	*26.47*	*-0.04*	*-0.19*	*-0.16*	*Pass*	*-0.74*	*Pass*
27	*11:30*	*3.5*	*129*	*30.52*	*0.08*	*-0.10*	*0.27*	*Pass*	*-0.34*	*Pass*
28	*11:33*	*4.0*	*147*	*34.82*	*0.3*	*-0.16*	*0.87*	*Pass*	*-0.45*	*Pass*
29	*11:37*	*4.5*	*166*	*39.05*	*0.58*	*-0.01*	*1.48*	*Pass*	*-0.03*	*Pass*
30	*11:41*	*5.0*	*184*	*43.62*	*1.17*	*-0.16*	*2.69*	*Pass*	*-0.36*	*Pass*
31	*11:44*	*5.5*	*202*	*46.46*	*1.04*	*-0.24*	*2.23*	*Pass*	*-0.52*	*Pass*
32	*11:47*	*6.0*	*221*	*48.32*	*1.04*	*0.00*	*2.15*	*Pass*	*0.00*	*Pass*
33	*11:50*	*6.5*	*239*	*51.31*	*-1.9*	*-0.07*	*-3.7*	*Pass*	*-0.13*	*Pass*
34	*11:54*	*7.0*	*258*	*52.31*	*-1.71*	*0.10*	*-3.27*	*Pass*	*0.20*	*Pass*
35	*11:59*		*270*	*53.16*	*-5.96*	*-0.29*	*-11.2*	*Pass*	*-0.54*	*Pass*

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

3.0 TEST DATA (CONTD)

DATA SHEET 8 (2 of 3)
VEHICLE LATERAL STABILITY AND RESPONSIVENESS

LATERAL STABILITY TEST SERIES NO. 2 – Clockwise Initial Steer Direction

Maneuver #	Clock Time (1.5 – 5.0 min max between runs)	Commanded Steering Wheel Angle[1]		Yaw Rates (degrees/sec)			YRR at 1.0 sec after COS [≤ 35%]		YRR at 1.75 sec after COS [≤ 20%]	
		Scalar (* $\delta_{0.3\,g}$)	Angle (degrees)	$\dot{\psi}_{Peak}$	$\dot{\psi}_{1.0sec}$	$\dot{\psi}_{1.75sec}$	%	Pass/Fail	%	Pass/Fail
36	*12:04*	*1.5*	*55*	*-13.86*	*-0.08*	*0.02*	*0.56*	*Pass*	*-0.13*	*Pass*
37	*12:09*	*2.0*	*74*	*-18.53*	*-0.18*	*-0.17*	*0.97*	*Pass*	*0.91*	*Pass*
38	*12:13*	*2.5*	*92*	*-22.89*	*-0.28*	*0.02*	*1.21*	*Pass*	*-0.08*	*Pass*
39	*12:16*	*3.0*	*110*	*-27.09*	*-0.16*	*0.01*	*0.58*	*Pass*	*-0.05*	*Pass*
40	*12:19*	*3.5*	*129*	*-30.92*	*-0.32*	*-0.14*	*1.05*	*Pass*	*0.46*	*Pass*
41	*12:22*	*4.0*	*147*	*-35.07*	*-0.42*	*-0.04*	*1.21*	*Pass*	*0.13*	*Pass*
42	*12:25*	*4.5*	*166*	*-39.62*	*-0.76*	*0.00*	*1.92*	*Pass*	*0.01*	*Pass*
43	*12:29*	*5.0*	*184*	*-43.52*	*-1.00*	*-0.16*	*2.31*	*Pass*	*0.38*	*Pass*
44	*12:32*	*5.5*	*202*	*-47.29*	*-0.69*	*-0.15*	*1.47*	*Pass*	*0.31*	*Pass*
45	*12:35*	*6.0*	*221*	*-49.67*	*-0.34*	*-0.06*	*0.69*	*Pass*	*0.12*	*Pass*
46	*12:39*	*6.5*	*239*	*-51.32*	*1.72*	*-0.07*	*-3.35*	*Pass*	*0.13*	*Pass*
47	*12:43*	*7.0*	*258*	*-52.96*	*5.54*	*0.27*	*-10.46*	*Pass*	*-0.51*	*Pass*
48	*12:46*		*270*	*-53.92*	*4.13*	*0.11*	*-7.66*	*Pass*	*-0.20*	*Pass*

1. Maneuver execution should continue until a steering wheel angle magnitude factor of 6.5*$\delta_{0.3\,g,\,overall}$ or 270 degrees is utilized, whichever is greater provided the calculated 6.5*$\delta_{0.3\,g,\,overall}$ is less than or equal to 300 degrees. If 6.5*$\delta_{0.3\,g,\,overall}$ is less than 270 degrees maneuver execution should continue by increasing the steering wheel angle magnitude by multiples of 0.5*$\delta_{0.3\,g,\,overall}$ 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	☐ Yes	☒ No
Tire debeading	☐ Yes	☒ No
Loss of pavement contact of vehicle tires	☐ Yes	☒ No
Did the test driver experience any vehicle loss of control or spinout?	☐ Yes	☒ No

If "Yes" explain the event and consult with the COTR.

3.0 TEST DATA (CONTD)

DATA SHEET 8 (3 of 3)
VEHICLE LATERAL STABILITY AND RESPONSIVENESS

Responsiveness – Lateral Displacement

Maneuver #	Initial Steer Direction	Commanded Steering Wheel Angle (5.0*$\delta_{0.3\ g,\ overall}$ or greater)		Calculated Lateral Displacement[1]	
		Scalar *$\delta_{0.3\ g}$	Angle (degrees)	Distance (m)	Pass/Fail
30	*Counter Clockwise*	*5.0*	*184*	*-2.6*	*PASS*
31	*Counter Clockwise*	*5.5*	*202*	*-2.7*	*PASS*
32	*Counter Clockwise*	*6.0*	*221*	*-2.7*	*PASS*
33	*Counter Clockwise*	*6.5*	*239*	*-2.7*	*PASS*
34	*Counter Clockwise*	*7.0*	*258*	*-2.8*	*PASS*
35	*Counter Clockwise*	-	*270*	*-2.8*	*PASS*
43	*Clockwise*	*5.0*	*184*	*2.5*	*PASS*
44	*Clockwise*	*5.5*	*202*	*2.6*	*PASS*
45	*Clockwise*	*6.0*	*221*	*2.6*	*PASS*
46	*Clockwise*	*6.5*	*239*	*2.7*	*PASS*
47	*Clockwise*	*7.0*	*258*	*2.7*	*PASS*
48	*Clockwise*	-	*270*	*2.8*	*PASS*

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

DATA INDICATES COMPLIANCE: ☑ PASS ☐ FAIL

Remarks:

RECORDED BY: *Brian Kebschull* DATE RECORDED: *5/27/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *6/7/2010*

3.0 TEST DATA (CONTD)

Data Sheet 9 (Page 1 of 2)
MALFUNCTION WARNING TESTS

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data Sheet Completion Date: *5/27/2010*

TEST 1

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnected rear 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.

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

0 Seconds (must be within 2 minutes) [X] Pass [ ] Fail

TEST 1 DATA INDICATES COMPLIANCE: *PASS*

Remarks: *After the malfunction was caused, telltales illuminated immediately upon vehicle ignition. Telltales included sliding car symbol, "ESP BAS", and ABS. After the system was restored, the telltales did not extinguish immediately, but rather after the vehicle had been driven a short distance (less than 30m)at a vehicle speed under 48 km/h.*

RECORDED BY: *Brian Kebschull* DATE RECORDED: *5/27/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED *6/10/2010*

3.0 TEST DATA (CONTD)

Data Sheet 9 (Page 2 of 2)
MALFUNCTION WARNING TESTS

Vehicle: *2010 Chrysler Town and Country MPV*

NHTSA No. *CA0305* Data Sheet Completion Date: *5/27/2010*

TEST 2

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnected inertial sensor package.

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.

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

0 Seconds (must be within 2 minutes) [X] Pass [ ] Fail

TEST 2 DATA INDICATES COMPLIANCE: PASS

Remarks: *After the malfunction was caused, telltales illuminated immediately upon vehicle ignition. Telltales included sliding car symbol and "ESP BAS". After the system was restored, the telltales extinguished immediately upon vehicle ignition. No driving was required.*

RECORDED BY: *Brian Kebschull* DATE RECORDED: 5/27/2010

APPROVED BY: *J Lenkeit* DATE APPROVED *6/10/2010*

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION (1 OF 2)

TABLE 1. TEST INSTRUMENTATION

Type	Output	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Tire Pressure Gauge	Vehicle Tire Pressure	0-100 psi 0-690 kPa	1 psi 6.89 kPa	0.5 psi 3.45 kPa	Ashcroft D1005PS	1039350	By: DRI Date:2/25/10 Due: 2/25/11
Platform Scales	Vehicle Total, Wheel, and Axle Load	8000 lb 35.6 kN	0.5 lb 2.2 N	±1.0% of applied load	Intercomp Model SWII	24032361	By: American Scale Date: 2/25/10 Due: 2/25/11
Automated Steering Machine with Steering Angle Encoder	Handwheel Angle	±800 deg	0.25 deg	±0.25 deg	Heitz Automotive Testing Model: Sprint 3	60304	By: DRI Date: 2/25/10 Due: 2/25/11
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	0767	By: Systron Donner Date:11/23/09 Due: 11/23/10
Radar Speed Sensor and Dashboard Display	Vehicle Speed	0-125 mph 0-200 km/h	0.009 mph .014 km/h	±0.25% of full scale	A-DAT Corp. Radar Model: DRS-6 Display Model: RD-2	1400.604	By: DRI Date:3/2/10 Due:3/2/11
Ultrasonic Distance Measuring System	Left and Right Side Vehicle Height	5-24 inches 127-610 mm	0.01 inches .254 mm	±0.25% of maximum distance	Massa Products Corporation Model: M-5000/220	DOT-NHTSA D2646	By: DRI Date:2/26/10 Due: 2/26/11
						DOT-NHTSA D3272	By: DRI Date:2/26/10 Due: 2/26/11

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION (2 OF 2)

TABLE 1. TEST INSTRUMENTATION (CONTD)

Type	Output	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Data Acquisition System [Includes amplification, anti-aliasing, and analog to digital conversion.]	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	SoMat eDaq ECPU processor	MSHLB.03-2476	By: DRI Date:2/9/10 Due: 2/9/11
					SoMat High level Board EHLS	MSHLS.03-3182	By: DRI Date: 2/9/10 Due: 2/9/11
Load Cell	Vehicle Brake Pedal Force	0-300 lb 0-1.33 kN	1 lb 4.44 N	±0.05% of full scale	Lebow 3663-300	767	Operationally verified by DRI prior to test
Coordinate Measurement Machine	Inertial Sensing System Coordinates	0-8 ft 0-2.4 m	±.0020 in. ±.051 mm	±.0020 in. ±.051 mm (Single point articulation accuracy)	Faro Arm Fusion	UO8-05-08-06636	By: Faro Date: 8/18/09 Due: 8/18/10
Outriggers	No output. Safety Item.	NA	NA	NA	DRI manufactured Aluminum meeting the weight and MOI specifications of Docket 2007-27662-11	NA	NA

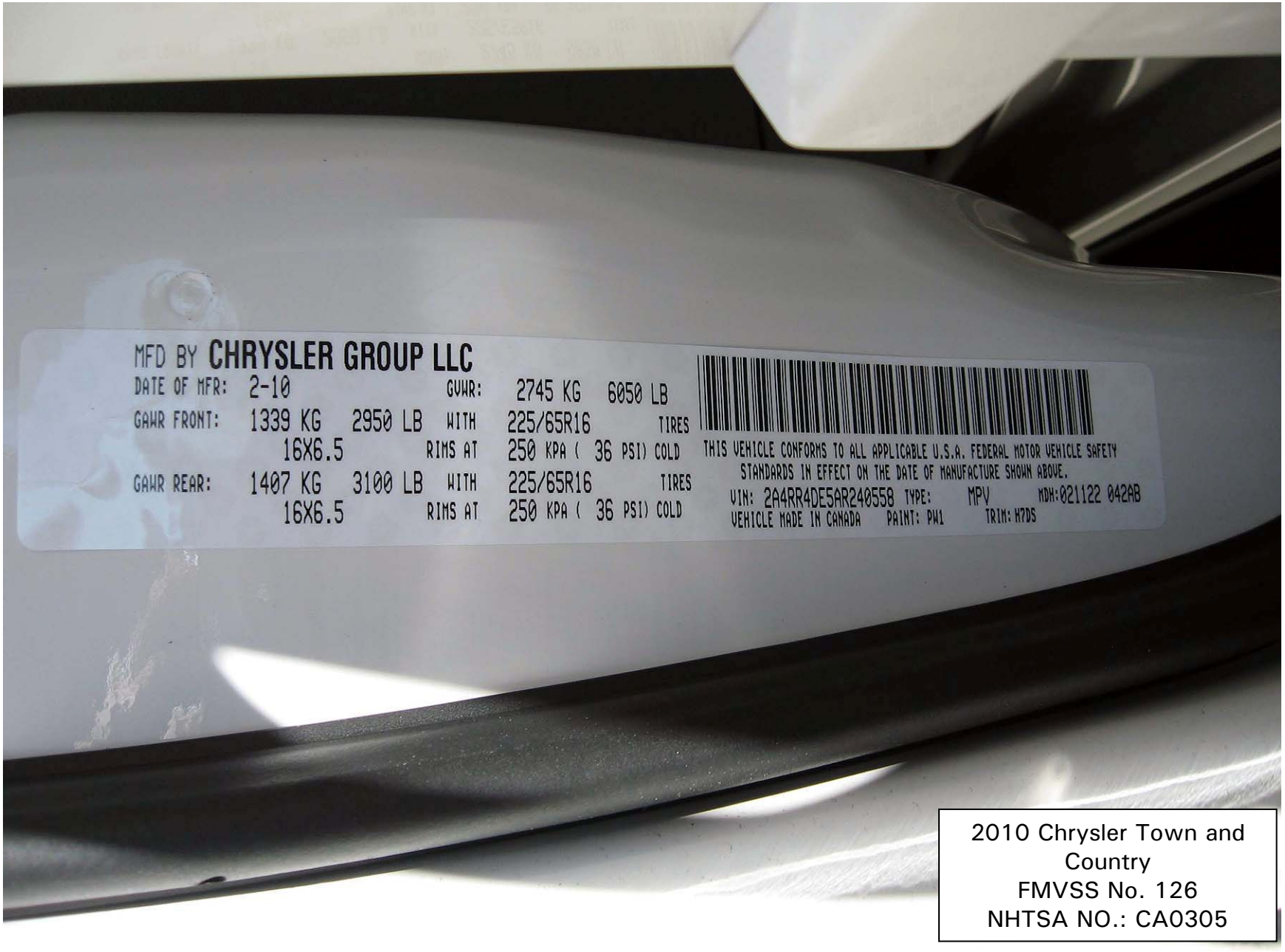
5.0 PHOTOGRAPHS (1 of 14)

Figure 5.1. Front View of Test Vehicle

5.0 PHOTOGRAPHS (2 of 14)

Figure 5.2. Rear View of Test Vehicle

5.0 PHOTOGRAPHS (3 of 14)



2010 Chrysler Town and Country
FMVSS No. 126
NHTSA NO.: CA0305

Figure 5.3. Vehicle Certification Label

5.0 PHOTOGRAPHS (4 of 14)

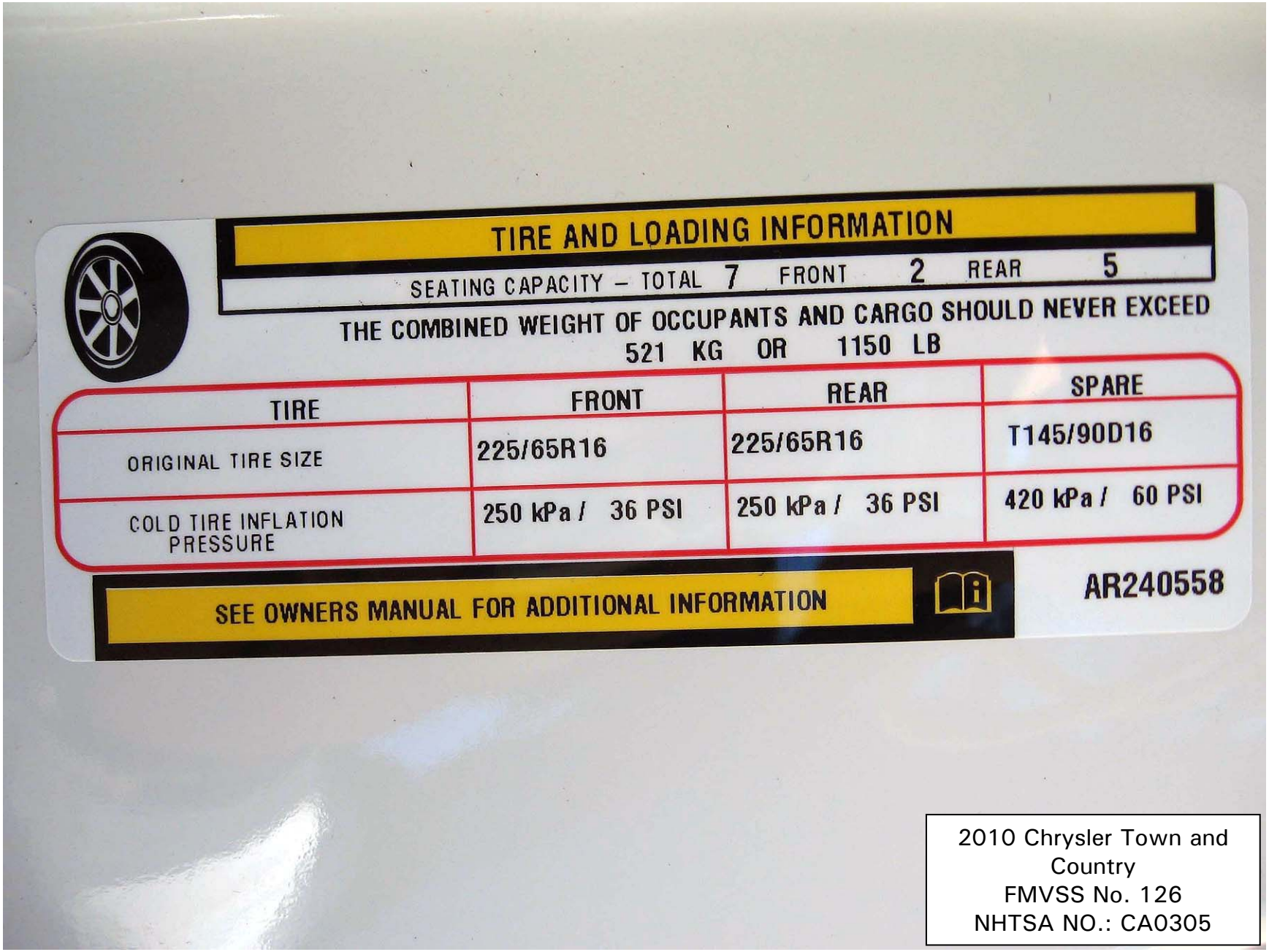


Figure 5.4. Vehicle Placard

5.0 PHOTOGRAPHS (5 of 14)

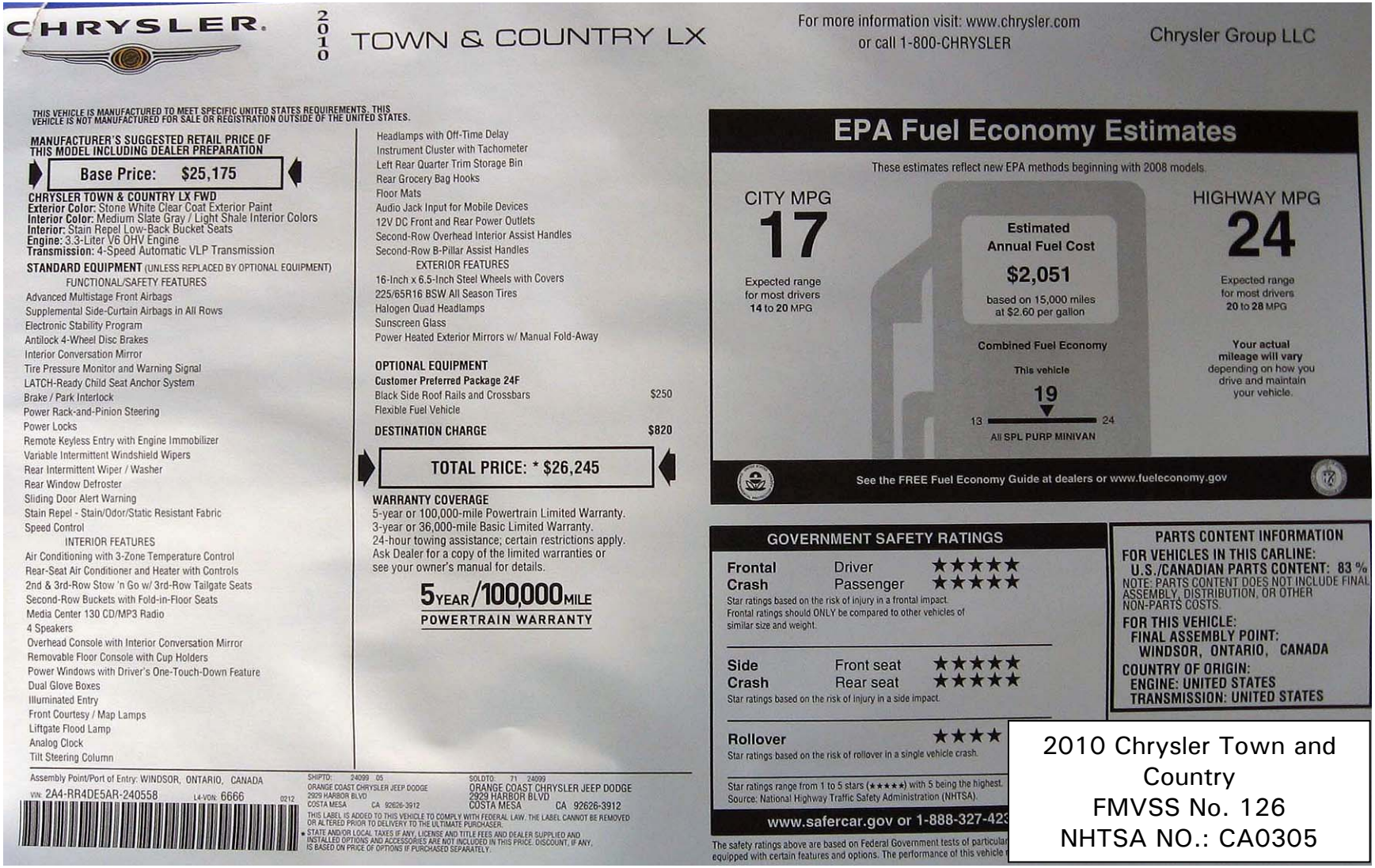


Figure 5.5. Window Sticker (Monroney Label)

5.0 PHOTOGRAPHS (6 of 14)

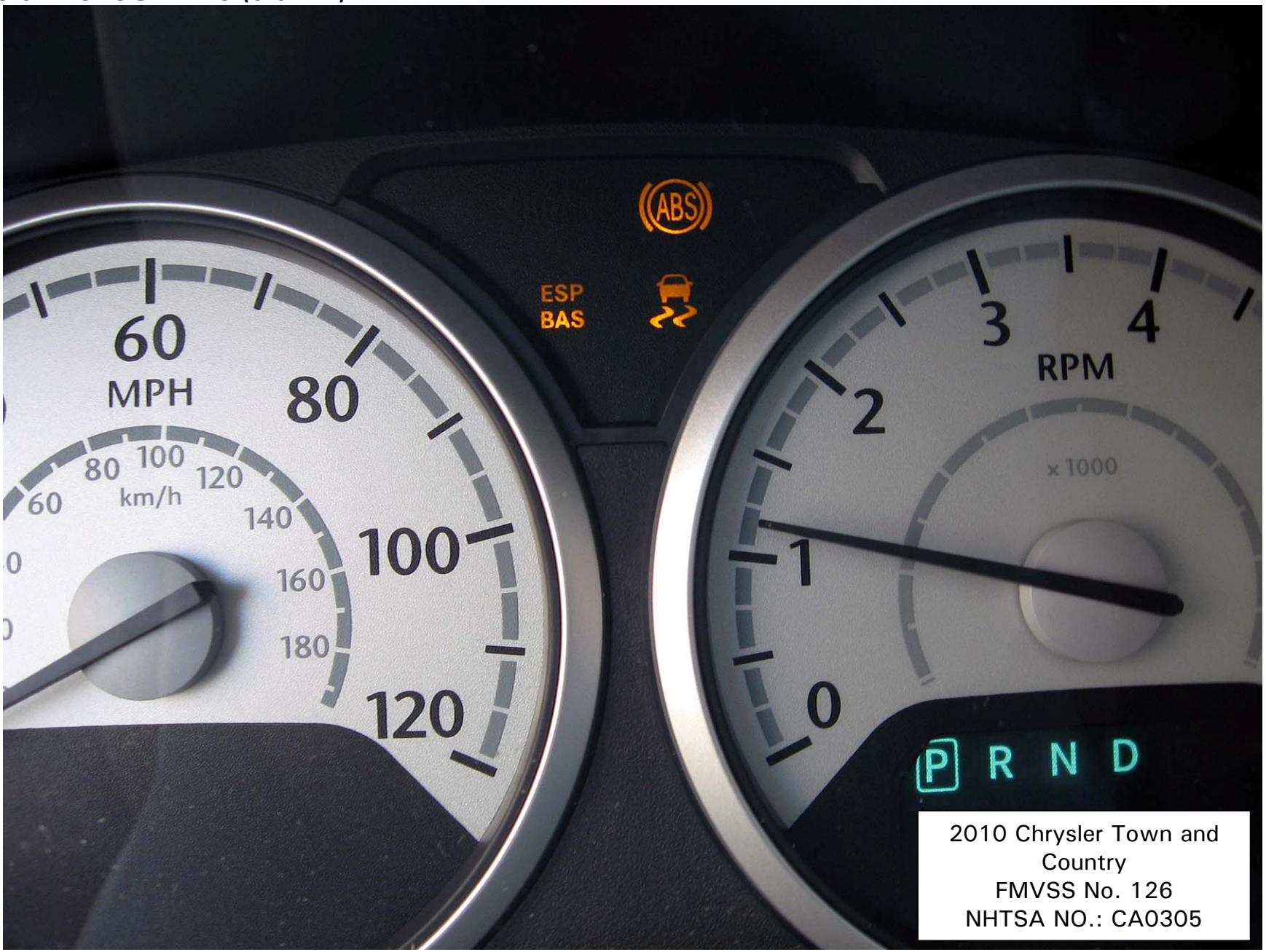


Figure 5.6. Telltale for ESC Malfunction and ESC Off

5.0 PHOTOGRAPHS (7 of 14)

Figure 5.7. ESC Off Control Switch

5.0 PHOTOGRAPHS (8 of 14)

Figure 5.8. Front View of Vehicle As-Tested

5.0 PHOTOGRAPHS (9 of 14)

Figure 5.9. Rear View of Vehicle As-Tested

5.0 PHOTOGRAPHS (10 of 14)

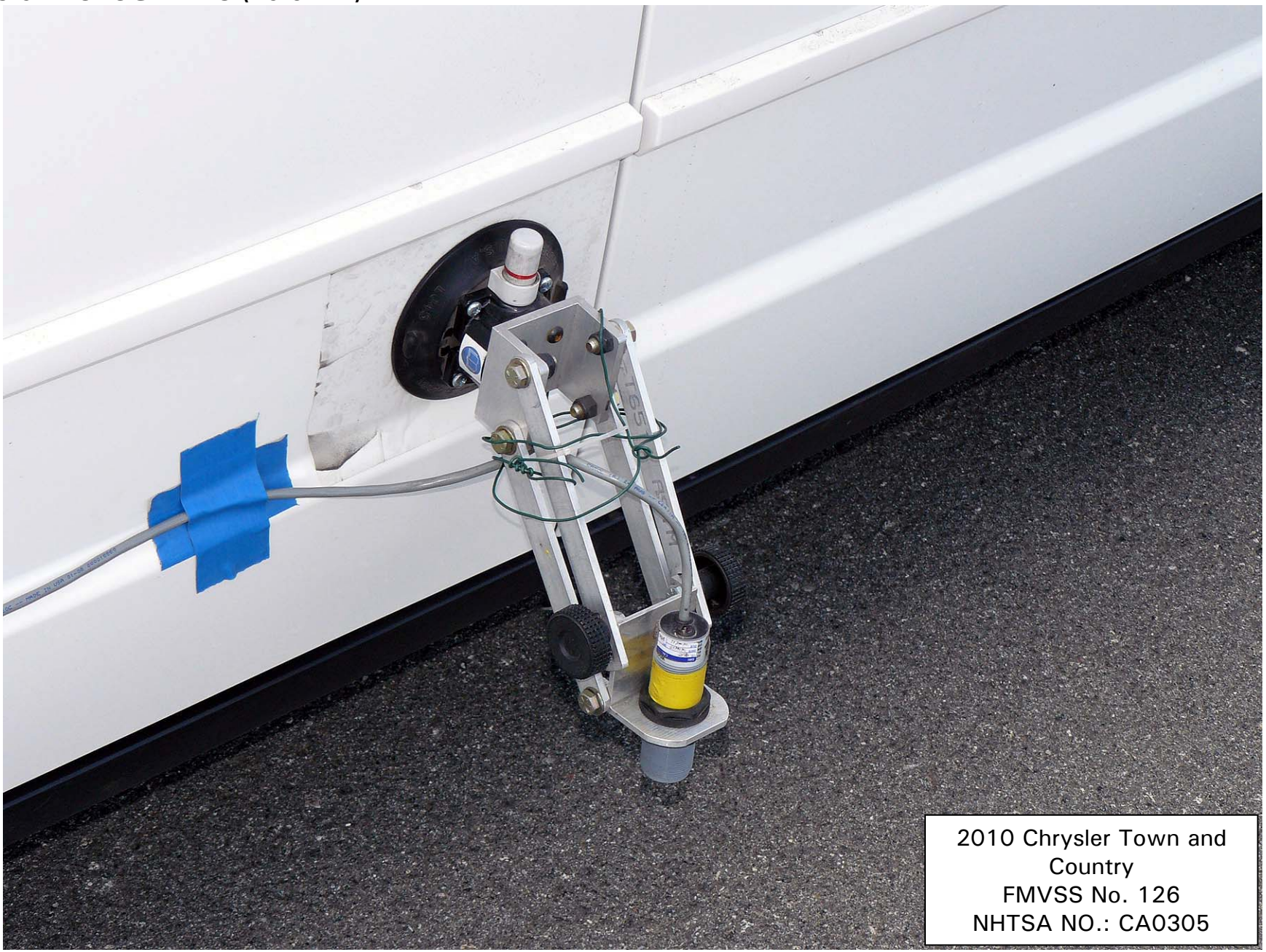


Figure 5.10. Ultrasonic Height Sensor Mounted on Left Side of Vehicle for Determining Body Roll Angle

5.0 PHOTOGRAPHS (11 of 14)

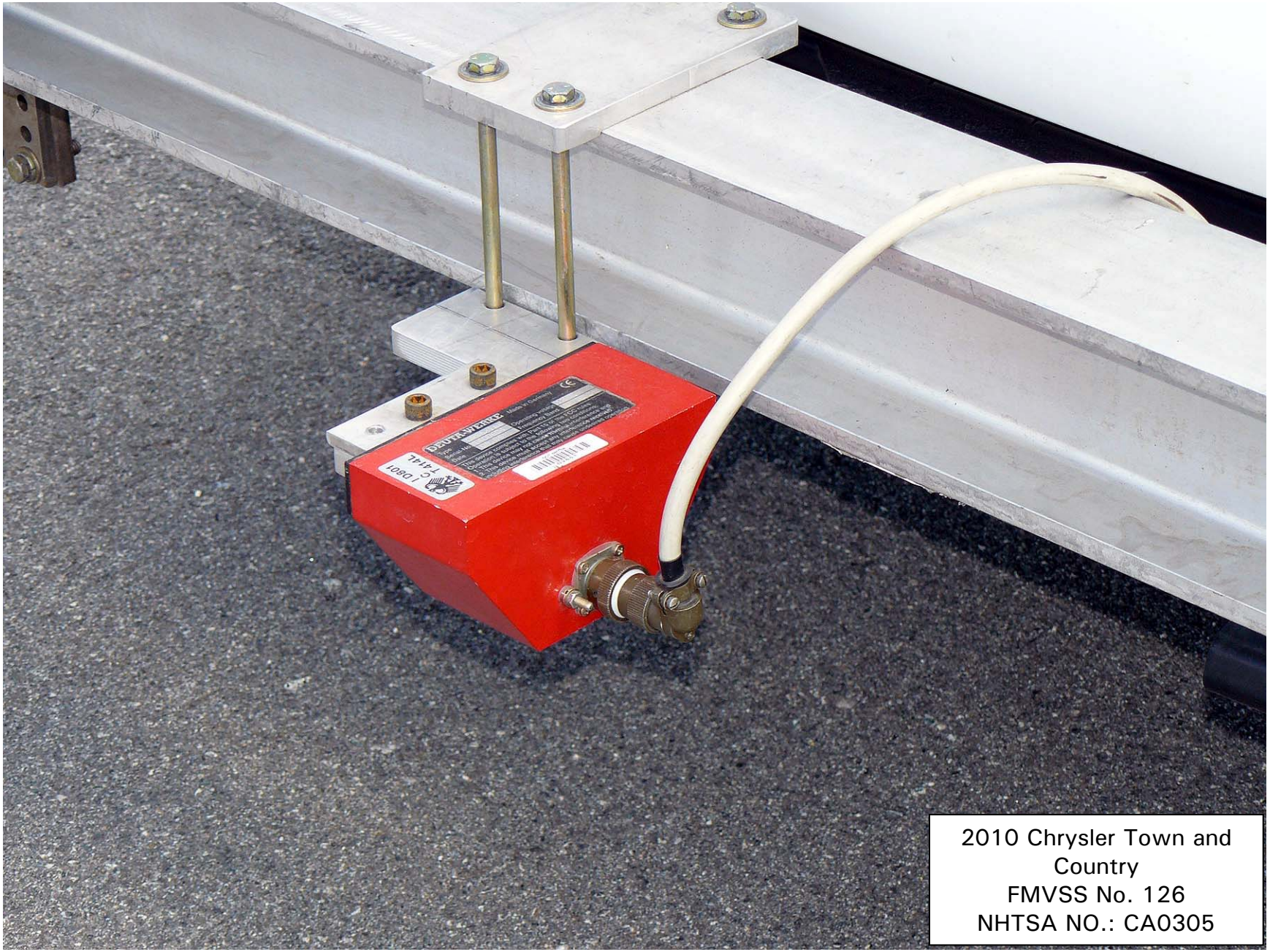


Figure 5.11. Rear Outrigger, Mount and Speed Sensor

5.0 PHOTOGRAPHS (12 of 14)

Figure 5.12. Steering Controller and Data Acquisition Computer

5.0 PHOTOGRAPHS (13 of 14)

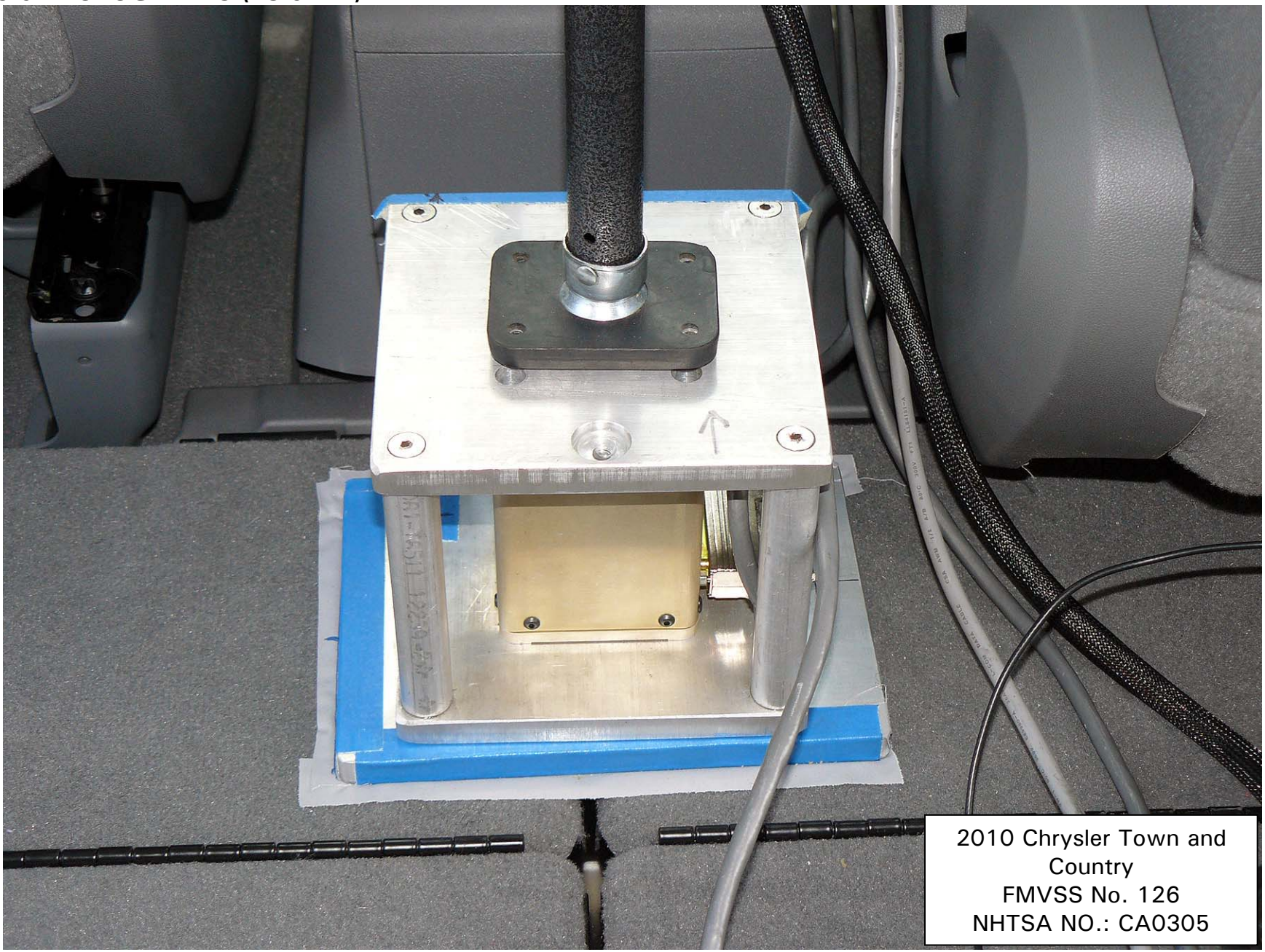


Figure 5.13. Inertial Measurement Unit Mounted in Vehicle

5.0 PHOTOGRAPHS (14 of 14)

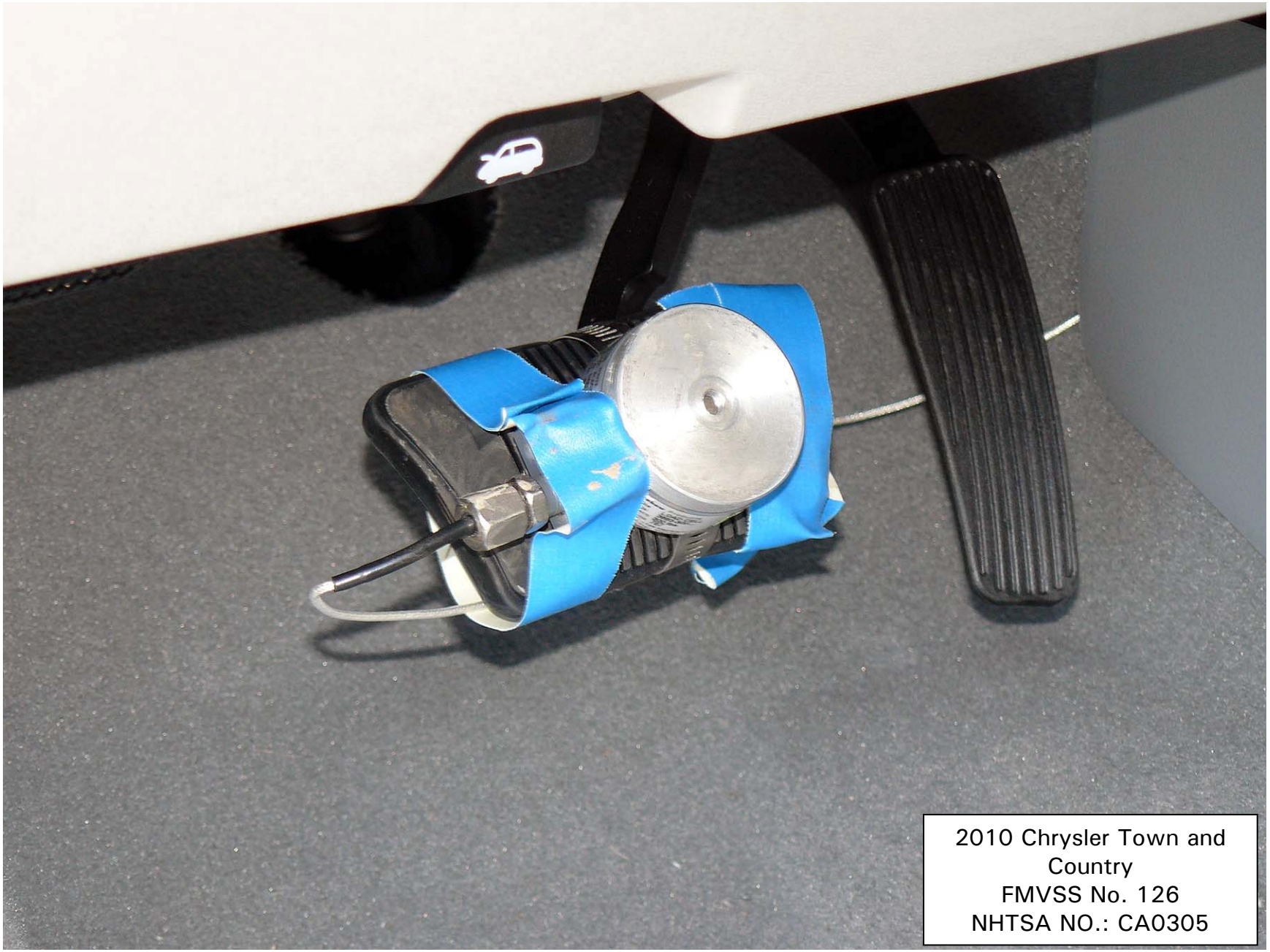


Figure 5.14. Brake Pedal Load Cell

6.0 DATA PLOTS (1 of 4)

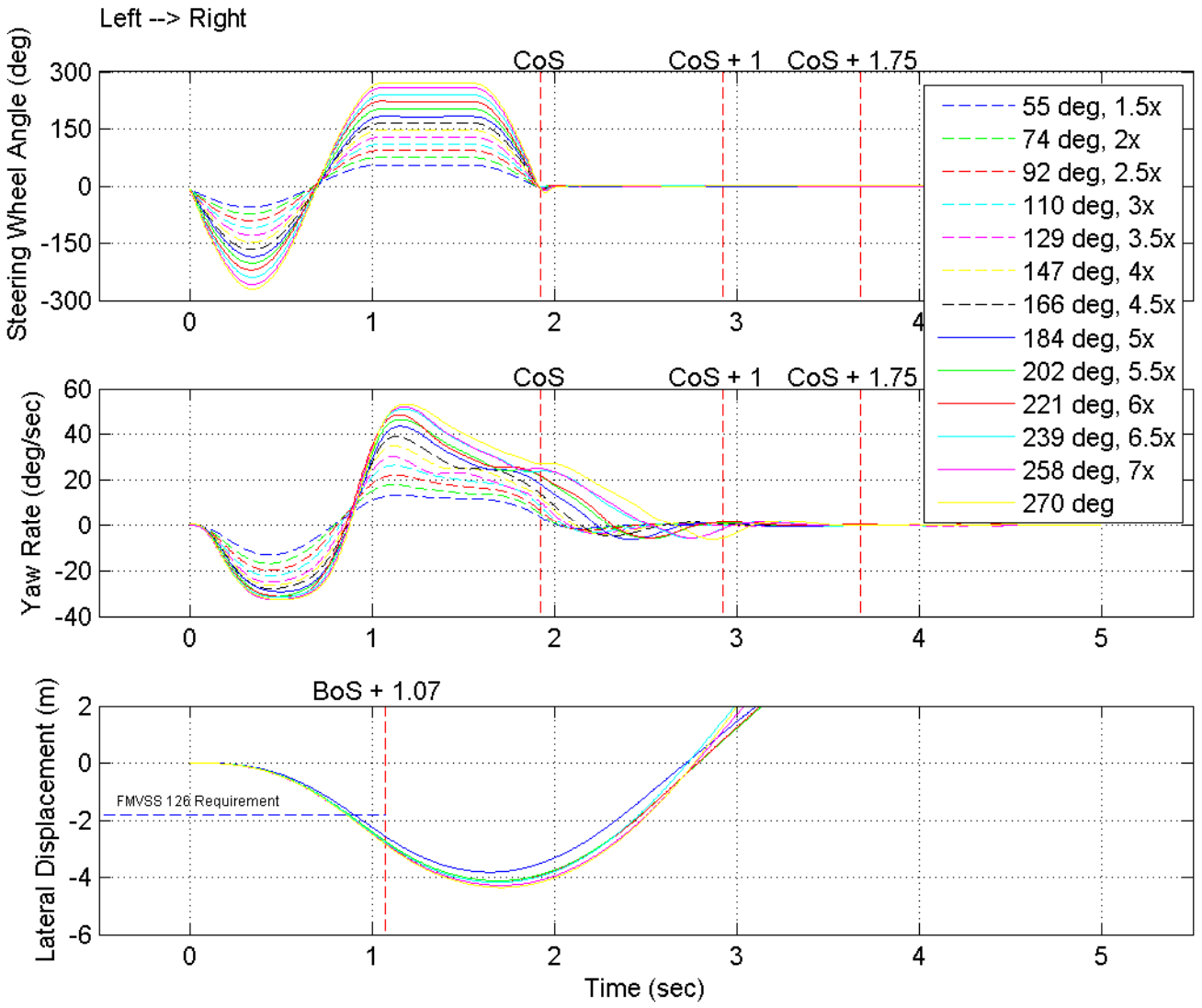


Figure 6.1. Steering Wheel Angle, Yaw Rate and Lateral Displacement for L-R Series

6.0 DATA PLOTS (2 of 4)

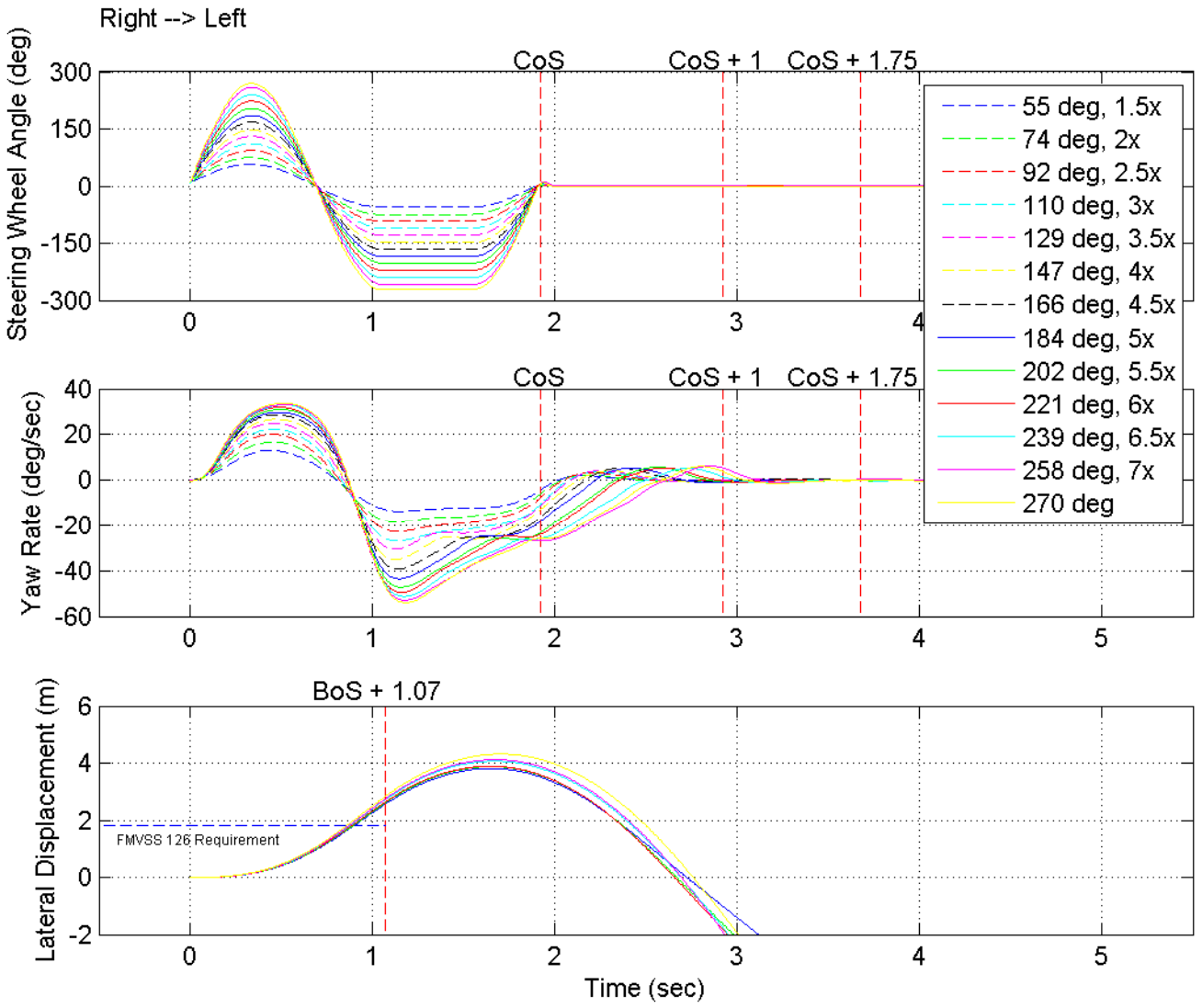


Figure 6.2. Steering Wheel Angle, Yaw Rate and Lateral Displacement for R-L Series

6.0 DATA PLOTS (3 of 4)

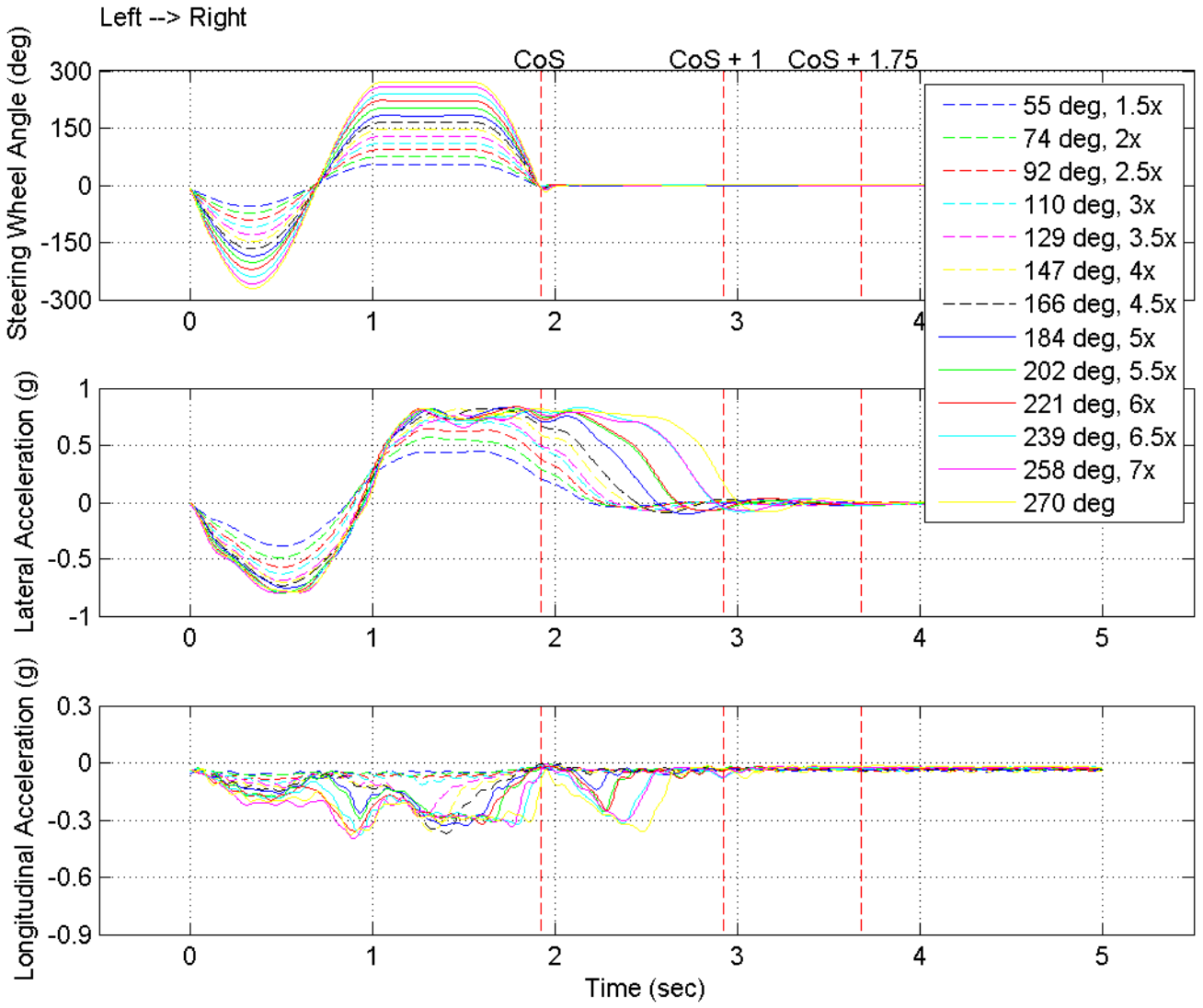


Figure 6.3. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for L-R Series

6.0 DATA PLOTS (4 of 4)

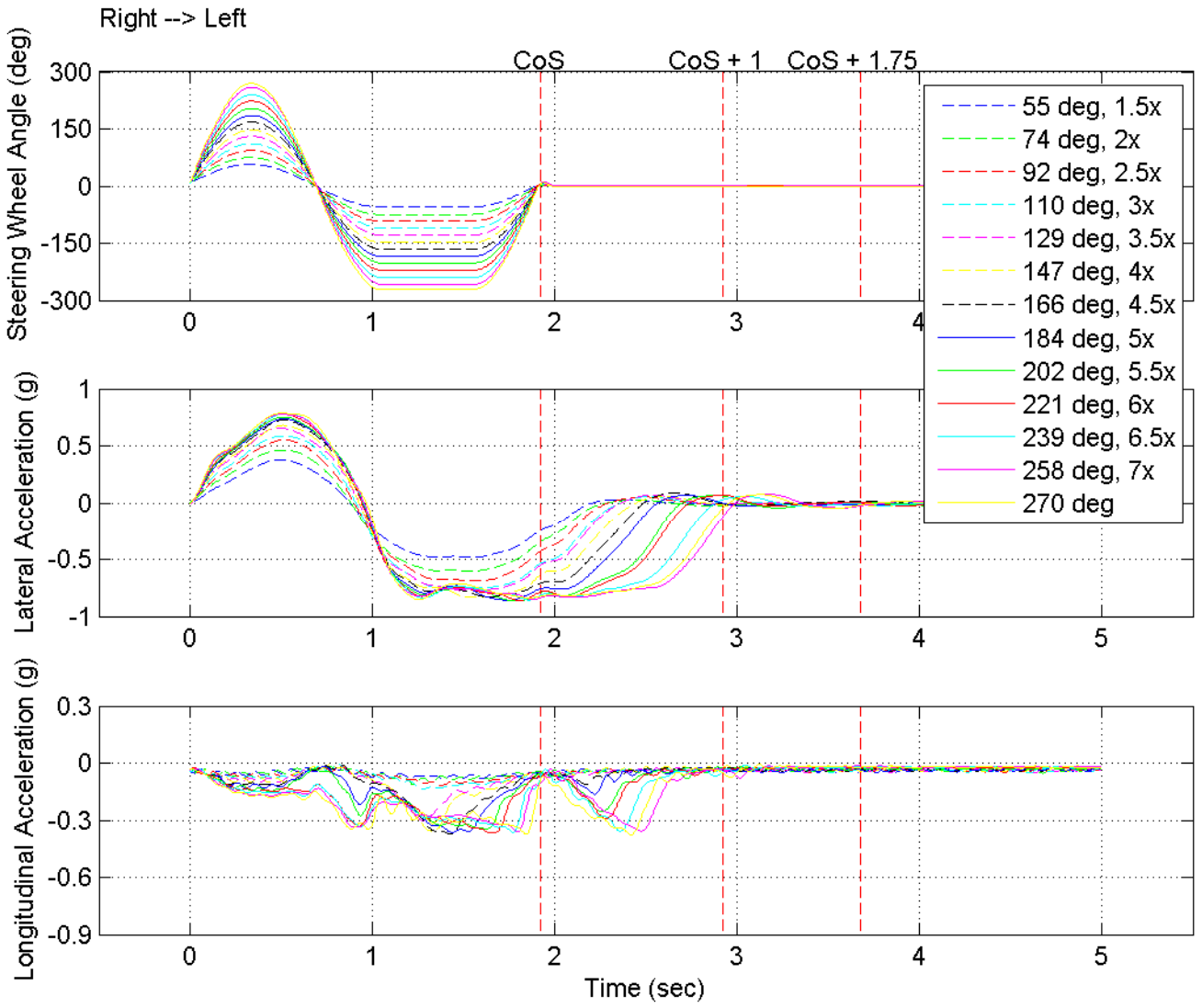


Figure 6.4. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for R-L Series

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

10. Electronic Stability Program (ESP) Indicator Light / Brake Assist System (BAS) Warning Light

ESP BAS

The malfunction light for the Electronic Stability Program (ESP) is combined with Brake Assist System (BAS). The yellow "ESP/BAS Warning Light" comes on when the ignition switch is turned to the "ON" position. They should go out with the engine running. If the "ESP/BAS Warning Light" comes on continuously with the engine running, a malfunction has been detected in either the ESP or the BAS system. If this light remains on after several ignition cycles, and the vehicle has been driven several miles (kilometers) at speeds greater than 30 mph (48 km/h), see an authorized dealer as soon as possible.

WARNING!

If a warning light remains on the system may not be working and you will not have the benefit of ESP or BAS. Under certain driving conditions, where ESP or BAS would be beneficial, you - if you have not adjusted your driving speeds and stopping in or to account for the lack of the feature, may be in accident.

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11. Brake Warning Light

BRAKE

This light monitors various brake functions, including brake fluid level and parking brake application. If the brake light turns on, it may indicate that the parking brake is applied, that the brake fluid level is low, or that there is a problem with the anti-lock brake system reservoir.

7.1 OWNER'S MANUAL PAGES

If the light remains on when the parking brake has been disengaged, and the fluid level is at the full mark on the master cylinder reservoir, it indicates a possible brake hydraulic system malfunction or that a problem with the Brake Booster has been detected by the Anti-Lock Brake System (ABS) / Electronic Stability Program (ESP) system. In this case, the light will remain on until the condition has been corrected. If the problem is related to the brake booster, the ABS pump will run when applying the brake and a brake pedal pulsation may be felt during each stop.

The dual brake system provides a reserve braking capacity in the event of a failure to a portion of the hydraulic system. A leak in either half of the dual brake system is indicated by the Brake Warning Light, which will turn on when the brake fluid level in the master cylinder has dropped below a specified level.

The light will remain on until the cause is corrected.

NOTE: The light may flash momentarily during sharp cornering maneuvers, which change fluid level conditions. The vehicle should have service performed, and the brake fluid level checked.

If brake failure is indicated, immediate repair is necessary.

WARNING!

Driving a vehicle with the red brake light on is dangerous. Part of the brake system may have failed. It will take longer to stop the vehicle. You could have an accident. Have the vehicle checked immediately.

Vehicles equipped with the Anti-Lock Brake System (ABS), are also equipped with Electronic Brake Force Distribution (EBD). In the event of an EBD failure, the Brake Warning Light will turn on along with the ABS Light. Immediate repair to the ABS system is required.

14. Electronic Stability Program (ESP) Indicator Light / Traction Control System (TCS) Indicator Light

If this indicator light flashes during acceleration, apply as little throttle as possible. While driving, ease up on the accelerator. Adapt your speed and driving to the prevailing road conditions, and do not switch off the Electronic Stability Program (ESP), or Traction Control System (TCS).

15. Tachometer

The red segments indicate the maximum permissible engine revolutions per minute (RPM x 1000) for each gear range. Before reaching the red area, ease up on the accelerator.

16. High Beam Indicator

This indicator shows that the high beam headlights are on. Push the multifunction lever forward to switch the headlights to high beam, and pull toward yourself (normal position) to return to low beam.

17. Front Fog Light Indicator — If Equipped

This indicator will illuminate when the front fog lights are on.

18. Seat Belt Reminder Light

When the ignition switch is first turned ON, this light will turn on for five to eight seconds as a bulb check. During the bulb check, if the driver's seat belt is unbuckled, a chime will sound. After the bulb check or when driving, if the driver's seat belt remains unbuckled, the Seat Belt Reminder Light will illuminate and the chime will sound. Refer to "Occupant Restraints" in "Things To Know Before Starting Your Vehicle" for further information.

19. Malfunction Indicator Light (MIL)

The Malfunction Indicator Light (MIL) is part of an onboard diagnostic system, called OBD, that monitors engine and automatic transmission control systems. The light will illuminate when the key is in

Anti-Lock Brake Warning Light

The "Anti-Lock Brake Warning Light" monitors the anti-lock brake system. The light will come on when the ignition switch is turned to the ON position and may stay on for as long as four seconds.

If the "Anti-Lock Brake Warning Light" remains on or comes on while driving, it indicates that the anti-lock portion of the brake system is not functioning and that service is required. However, the conventional brake system will continue to operate normally if the "Brake Warning Light" is not on.

If the "Anti-Lock Brake Warning Light" is on, the brake system should be serviced as soon as possible to restore the benefits of anti-lock brakes. If the "Anti-Lock Brake Warning Light" does not come on when the ignition switch is turned to the ON position, have the bulb repaired as soon as possible.

If both the "Brake Warning Light" and the "Anti-Lock Brake Warning Light" remain on, the ABS and Electronic Brake Force Distribution (EBD) systems are not functioning. Immediate repair to the ABS system is required. Consult with your authorized dealer service center as soon as possible.

ELECTRONIC BRAKE CONTROL SYSTEM

Your vehicle is equipped with an advanced electronic brake control system that includes the Traction Control System (TCS), Brake Assist System (BAS) and Electronic Stability Program (ESP). These systems complement the Anti-Lock Brake System (ABS) by optimizing the vehicle braking capability during emergency braking maneuvers.

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Traction Control System (TCS)

The Traction Control System (TCS) monitors the amount of wheel spin of each of the driven wheels. If wheel spin is detected, brake pressure is applied to the slipping

wheel(s) and engine power is reduced, to provide enhanced acceleration and stability. A feature of the TCS functions similarly to a limited-slip differential, and controls the wheel spin across a driven axle. If one wheel on a driven axle is spinning faster than the other, the system will apply the brake of the spinning wheel. This will allow more engine torque to be applied to the wheel that is not spinning. This feature remains active even if the ESP is in the "Partial Off" mode.

The "ESP/TCS Indicator Light" (in the instrument cluster) will start to flash as soon as the tires lose traction and the wheels begin to spin. This indicates that the TCS is active. If the indicator light flashes during acceleration, ease up on the accelerator and apply as little throttle as possible. Be sure to adapt your speed and driving to the prevailing road conditions, and do not switch off the ESP or TCS.

WARNING!

- The TCS cannot prevent the natural laws of physics from acting on the vehicle, nor can it increase the traction afforded.
- The TCS cannot prevent accidents, including those resulting from excessive speed in turns, or hydroplaning. Only a safe, attentive, and skillful driver can prevent accidents.
- The capabilities of a TCS-equipped vehicle must never be exploited in a reckless or dangerous manner, which could jeopardize the user's safety or the safety of others.

Electronic Stability Program (ESP)

The Electronic Stability Program (ESP) enhances directional control and stability of the vehicle under various driving conditions. ESP corrects for over/under steering of the vehicle by applying the brake of the appropriate wheel to assist in counteracting the over/under steer condition. Engine power may also be reduced to help the vehicle maintain the desired path.

ESP uses sensors in the vehicle to determine the vehicle path intended by the driver and compares it to the actual path of the vehicle. When the actual path does not match the intended path, ESP applies the brake of the appropriate wheel to assist in counteracting the oversteer or understeer condition.

- Oversteer - when the vehicle is turning more than appropriate for the steering wheel position.
- Understeer - when the vehicle is turning less than appropriate for the steering wheel position.

ESP On

This mode is the normal operating mode for ESP on two-wheel drive vehicles. Whenever the vehicle is started, the ESP system will be in this mode. This mode should be used for most driving situations. ESP should only be turned off for specific reasons as noted below.

ESP Partial Off

This mode is entered by momentarily pressing the "ESP OFF" switch (located in the center switch bank, next to the hazard flasher switch).

ESP OFF

When in the "Partial Off" mode, the TCS portion of ESP, except for the "limited slip" feature described in the TCS section, has been disabled and the "ESP/TCS Indicator Light" will be illuminated. When in the "Partial Off" mode, ESP will operate without engine torque management. This mode is intended to be used if the vehicle is in deep snow, sand or gravel conditions and more wheel spin

than ESP would normally allow is required to gain traction. To turn ESP on again, momentarily press the "ESP OFF" switch. This will restore the normal "ESP On" mode of operation.

NOTE: To improve the vehicle's traction when driving with snow chains, or starting off in deep snow, sand or gravel, it may be desirable to switch to the "Partial Off" mode by pressing the "ESP OFF" switch. Once the situation requiring ESP to be switched to the "Partial Off" mode is overcome, turn ESP back on by momentarily pressing the "ESP OFF" switch. This may be done while the vehicle is in motion.

ESP/BAS Warning Light

ESP
BAS

The malfunction indicator light for the ESP is combined with BAS. The "ESP/BAS Warning Light" and the "ESP/TCS Indicator Light" (in the instrument cluster) come on for four seconds when the ignition switch is turned to the ON position, then goes out. If the "ESP/BAS Warning Light" comes on continuously with the engine running, a malfunction has been detected in either the ESP or the BAS system. If this light remains on after several ignition cycles, and the vehicle has been driven several miles/kilometers at speeds greater than 30 mph (48 km/h), see your authorized dealer as soon as possible to have the problem diagnosed and corrected.

NOTE:

- The "ESP/TCS Indicator Light" and the "ESP/BAS Warning Light" come on momentarily, each time the ignition switch is turned ON.
- Each time the ignition is turned ON, the ESP System will be ON, even if it was turned off previously.
- The ESP Control System will make buzzing or clicking sounds when it is active. This is normal. The sounds will stop when ESP becomes inactive, following the maneuver that caused the ESP activation.

FREEING A STUCK VEHICLE

If your vehicle becomes stuck in mud, sand or snow, it can often be moved by a rocking motion. Turn your steering wheel right and left to clear the area around the front wheels. Then move the shift lever back and forth between REVERSE and DRIVE. Using minimal accelerator pedal pressure to maintain the rocking motion, without spinning the wheels, is most effective.

CAUTION!

- **When "rocking" a stuck vehicle by moving between 1st and REVERSE, do not spin the wheels faster than 15 mph (24 km/h), or drivetrain damage may result.**

(Continued)

CAUTION! (Continued)

- **Revving the engine or spinning the wheels too fast may lead to transmission overheating and failure. It can also damage the tires. Do not spin the wheels above 30 mph (48 km/h) while in gear (no transmission shifting occurring).**

NOTE: To improve the vehicle's traction when starting off in deep snow, sand or gravel, it may be desirable to switch the Electronic Stability Program (ESP) to "Partial Off" mode. Refer to "Electronic Brake Control System" in "Starting and Operating" for further information.

7.2 VEHICLE ARRIVAL CONDITION REPORT

CONTRACT NO.: DTNH22-08-D-00098
DATE:

From: *Automotive Allies*

To: Dynamic Research, Inc

Purpose ☒ Initial Receipt
☐ Received via Transfer
☐ Present Vehicle Condition

Vehicle VIN: *2A4RR4DE5AR240558* NHTSA NO.: *CA0305*
Model Year: *2010* Odometer Reading: *6* Miles
Make *Chrysler* Body Style: *MPV*
Model: *Town and Country* Body Color: *White*
Manufacture Date: *2/10* Dealer: *Automotive Allies*
GVWR (kg/lb) *2745/6050* Price: *Leased*

☒ All options listed on the "Window Sticker" are present on the test vehicle

☒ Tires and wheel rims are new and the same as listed

☒ There are no dents or other interior or exterior flaws

☒ The vehicle has been properly prepared 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

☒ Place vehicle in storage area

☒ 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.

NOTES:

RECORDED BY: *J Lenkeit* DATE RECORDED: *4/30/2010*

APPROVED BY: *P Broen* DATE APPROVED: *4/30/2010*

7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO.: *DTNH22-08-D-00098*
DATE: 6/10/2010

Vehicle VIN: *2A4RR4DE5AR240558* NHTSA NO.: *CA0305*
Model Year: *2010* Odometer Reading: *68* Miles
Make: *Chrysler* Body Style: *MPV*
Model: *Town and Country* Body Color: *White*
Manufacture Date: *2/10* Dealer: *Automotive Allies*
GVWR (kg/lb) *2745 (6050)* Price: *Leased*

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:

Explanation for equipment removal:

Test Vehicle Condition: *As new*

RECORDED BY: *J Lenkeit* DATE RECORDED: *6/10/2010*

APPROVED BY: *P Broen* DATE APPROVED: *6/10/2010*

7.4 SINE WITH DWELL TEST RESULTS

2010 Chrysler Town and Country MPV
NHTSA No.: CA0305
Date of Test : *5/27/2010*
Date Created: *5/27/2010*

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

File	SWA @ 5deg Ct	MES	Time @ 5deg	COS	Time @ COS	MOS	Time @ MOS	YRR1	YR1	YRR 1 Ct	YRR 175	YR175	YRR17 5 Ct	2nd Yaw Peak	2nd Yaw Peak Ct	Lat Disp	Lat. Acc. 1.07 s	1st SWA Peak	1st SWA Peak Ct	2nd SWA Mean
	(deg)	(mph)	(s)		(s)		(sec)	(%)	(deg/s)		(%)	(deg/s)		(deg/s)		(ft)	(g)	(deg)		(deg)
23	709	50	3.539	1090	5.443	846	4.225	0.15	0.02	1290	0.29	0.04	1440	13.42	941	-3.86	0.33	55.16	775	54.98
24	708	50.08	3.533	1090	5.443	846	4.225	0.21	0.04	1290	-0.08	-0.01	1440	17.93	934	-4.97	0.38	74.15	775	73.88
25	707	50.12	3.53	1090	5.443	846	4.225	0.13	0.03	1290	-0.11	-0.02	1440	22.06	935	-5.98	0.42	92.07	775	91.79
26	707	50.11	3.527	1090	5.442	846	4.224	-0.16	-0.04	1290	-0.74	-0.19	1440	26.47	932	-6.62	0.45	109.93	775	109.68
27	707	50.09	3.526	1090	5.443	846	4.225	0.27	0.08	1290	-0.34	-0.1	1440	30.52	930	-7.29	0.46	129.14	775	128.8
28	706	50.09	3.525	1090	5.443	846	4.225	0.87	0.3	1290	-0.45	-0.16	1440	34.82	931	-7.67	0.47	147.2	775	146.86
29	706	50.15	3.524	1090	5.442	846	4.225	1.48	0.58	1290	-0.03	-0.01	1440	39.05	933	-8.08	0.47	166.21	775	165.84
30	706	50.3	3.524	1090	5.441	846	4.225	2.69	1.17	1290	-0.36	-0.16	1440	43.62	937	-8.37	0.48	184.33	775	183.81
31	706	49.83	3.524	1090	5.441	847	4.226	2.23	1.04	1290	-0.52	-0.24	1440	46.46	938	-8.84	0.47	202.41	775	201.77
32	706	50.07	3.524	1090	5.441	846	4.225	2.15	1.04	1290	0	0	1440	48.32	937	-8.97	0.48	221.61	775	220.94
33	706	50.22	3.524	1090	5.442	846	4.225	-3.7	-1.9	1290	-0.13	-0.07	1440	51.31	942	-8.98	0.48	239.53	775	238.88
34	706	50.09	3.524	1090	5.443	847	4.227	-3.27	-1.71	1290	0.2	0.1	1440	52.31	942	-9.15	0.47	258.58	775	257.85
35	706	49.81	3.525	1090	5.444	847	4.227	-11.2	-5.96	1290	-0.54	-0.29	1440	53.16	944	-9.21	0.44	270.22	775	269.77

7.4 SINE WITH DWELL TEST RESULTS

2010 Chrysler Town and Country MPV
NHTSA No.: CA0305
Date of Test : *5/27/2010*
Date Created: *5/27/2010*

Lateral Stability Test Series No. 2 – Clockwise Initial Steer Direction

File	SWA @ 5deg Ct	MES	Time @ 5deg	COS	Time @ COS	MOS	Time @ MOS	YRR1	YR1	YRR 1 Ct	YRR 175	YR175	YRR17 5 Ct	2nd Yaw Peak	2nd Yaw Peak Ct	Lat Disp	Lat. Acc. 1.07 s	1st SWA Peak	1st SWA Peak Ct	2nd SWA Mean
	(deg)	(mph)	(s)		(s)		(sec)	(%)	(deg/s)		(%)	(deg/s)		(deg/s)		(ft)	(g)	(deg)		(deg)
36	709	49.81	3.538	1090	5.442	846	4.225	0.56	-0.08	1290	-0.13	0.02	1440	-13.86	939	3.84	-0.31	55.83	775	55.49
37	708	49.87	3.533	1090	5.443	846	4.225	0.97	-0.18	1290	0.91	-0.17	1440	-18.53	935	4.97	-0.39	74.92	775	74.46
38	707	50.04	3.529	1090	5.442	846	4.225	1.21	-0.28	1290	-0.08	0.02	1440	-22.89	936	5.73	-0.42	92.88	775	92.31
39	707	50.09	3.526	1090	5.442	846	4.225	0.58	-0.16	1290	-0.05	0.01	1440	-27.09	934	6.41	-0.45	110.73	775	110.23
40	706	50.02	3.525	1090	5.442	846	4.225	1.05	-0.32	1290	0.46	-0.14	1440	-30.92	931	7.04	-0.47	129.95	775	129.35
41	706	50.05	3.524	1090	5.442	846	4.225	1.21	-0.42	1290	0.13	-0.04	1440	-35.07	932	7.57	-0.47	148	775	147.42
42	706	49.83	3.523	1090	5.441	846	4.225	1.92	-0.76	1290	0.01	0	1440	-39.62	935	7.89	-0.47	167.14	775	166.25
43	706	49.92	3.523	1090	5.441	847	4.226	2.31	-1	1290	0.38	-0.16	1440	-43.52	936	8.29	-0.48	185.13	775	184.32
44	706	50.04	3.523	1089	5.44	846	4.225	1.47	-0.69	1289	0.31	-0.15	1439	-47.29	938	8.42	-0.47	203.12	775	202.21
45	706	50.03	3.523	1089	5.44	847	4.226	0.69	-0.34	1289	0.12	-0.06	1439	-49.67	939	8.55	-0.5	222.23	775	221.36
46	706	49.96	3.523	1090	5.443	846	4.225	-3.35	1.72	1290	0.13	-0.07	1440	-51.32	942	8.79	-0.48	240.02	775	239.43
47	706	50.07	3.524	1090	5.443	847	4.226	-10.46	5.54	1290	-0.51	0.27	1440	-52.96	942	8.89	-0.48	258.97	775	258.39
48	706	50.02	3.524	1090	5.445	847	4.228	-7.66	4.13	1290	-0.2	0.11	1440	-53.92	945	9.1	-0.44	270.7	775	270.22

7.5 SLOWLY INCREASING STEER TEST RESULTS

2010 Chrysler Town and Country MPV
NHTSA No.: *CA0305*
Date of Test: *5/27/2010*
Date Created: *5/27/2010*

File	EventPt	DOS	MES	Mean SPD	AYcount_3	THETAENCF_3	AYCG_CD2_3	r_squared	ZeroBegin	ZeroEnd
			(mph)	(mph)		(deg)	(g)			
11	700	1	50.4	50.4	1250	-36.9	-0.31	1.00	500	700
12	700	1	50.5	50.4	1241	-36.1	-0.30	0.99	500	700
13	700	1	50.6	50.5	1249	-36.7	-0.29	0.99	500	700
14	692	0	50.3	50.5	1243	36.4	0.30	1.00	492	692
15	717	0	50.5	50.5	1257	37.4	0.30	0.99	517	717
16	700	0	50.5	50.5	1259	37.5	0.31	1.00	500	700
				Averages		36.8	0.30			

Scalars	Steering Angles (deg)
1.5	55
2.0	74
2.5	92
3.0	110
3.5	129
4.0	147
4.5	166

Scalars	Steering Angles (deg)
5.0	184
5.5	202
6.0	221
6.5	239
7.0	258
7.3	270

7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

Vehicle: **2010 Chrysler Town and Country MPV** NHTSA No.: CA0305

Wheelbase: 121.2 Inches Faro Arm S/N: U08-05-08-06636

Measurement date: 5/18/2010 Certification date: 8/18/2009

CMM Measurements

Coordinate system: SAE (X,Y,Z positive forward, to the right, and downward, respectively)

Origin defined at 48" point on lateral arm of measurement fixture, projected onto the ground plane

	Ref X	Ref Y	Ref Z
M_PLANE001_Ground_Plane	-	-	0.000
M_Line_Y_Axis	2.398	14.834	0.000
M_Point_48_Ref	0.000	0.000	-
M_CIRCLE001_I_Left_Rear_Wheel_Axle	-47.550	10.974	-12.890
M_Point_IMU_side	13.760	46.257	-21.091
M_Point_ROOF	-	-	-68.119
Motion Pak reference point taken from mid height of unit left side			
Motion Pak Width = 3.05" ==> 1/2 W = 1.525			
Motion_PAK_Location	13.760	47.782	-21.091

Measurement Notes

1. The Faro arm is positioned just to the left of the vehicle, near the rear door.

2. A "centerline jig" is used in the Faro arm measurement. The jig consists of a long beam with a 4 ft lateral arm that is perpendicular to the beam. The jig is placed on the ground underneath the vehicle with the long beam positioned along the centerline of the vehicle, such that the lateral arm extends to the left, slightly forward of the left rear tire. The lateral arm has a marked indentation point which is located 48.00" from the edge of the centerline beam.

3. The Faro arm is used to make the following measurements:
   - Three points on the ground, which establishes the ground plane.
   - Two points along the lateral arm, and projected onto the ground plane. This establishes the y axis.
   - One point at the 48 inch reference point on the lateral arm. This establishes the origin.
   - Three points on the left rear wheel or wheel cover. The Faro arm then computes the center point of the wheel.
   - One point to establish the height of the highest point on the roof of the vehicle.

Coordinate Measurements Calculated for S7D (Matlab Program)

Coordinate system: X,Y,Z positive rearward, to the right, and upward, respectively

Origin defined as follows: X axis: front axle, Y axis: vehicle centerline, Z axis: ground plane

	Ref X	Ref Y	Ref Z
Motion_PAK_Location in S7D (Matlab program) coordinate system	**59.890**	**-0.218**	**21.091**

Calculation Notes:

1. X axis value is the difference between the wheelbase and the calculated distance from the rear axle centerline to the IMU (the value must be positive and less than the wheelbase).

2. Y axis value is -48.00 (the Y axis offset of the measurement origin in the S7D coordinate system) plus the measured Y axis value (a negative value indicates the IMU is to the left of the vehicle centerline, and a positive value indicates it is to the right)

3. Z axis value is from the ground plane up to the center of the IMU (value must be positive).