126-DRI-11-002
SAFETY COMPLIANCE TESTING FOR FMVSS 126
Electronic Stability Control Systems

Daimler AG
2011 Mercedes-Benz Sprinter
NHTSA No. CB0515

DYNAMIC RESEARCH, INC.
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5 December 2011

Final Report

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

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
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16. Abstract A test was conducted on a 2011 Mercedes-Benz Sprinter, NHTSA No. CB0515, 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 2011 Mercedes-Benz Sprinter, 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 2011 Mercedes-Benz Sprinter 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).

- For steering inputs of scalar 5 and greater, 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 3,500 kg (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: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* VIN: *WD4PE7CC7B5518178*

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

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 3,500 kg (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: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data Sheet Completion Date: *7/14/2011*

VIN *WD4PE7CC7B5518178* Manufacture Date: *10/10*

GVWR (kg): *3878* Front GAWR (kg): *1801* Rear GAWR (kg): *2431*

Seating Positions Front: *2* Mid: Rear: *0*

Odometer reading at time of inspection: *28 miles (44.8 km)*

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front axle: *LT245/75R16* Rear axle: *LT245/75R16*

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

		Front Axle	Rear Axle
	Tire Manufacturer:	*Continental*	*Continental*
	Tire Model:	*Vanco Four Season*	*Vanco Four Season*
	Tire Size:	*LT245/75R16*	*LT245/75R16*
TIN	Left Front:	*HW11 FRF1 3810*	Right Front: *HW11 FRF1 3810*
	Left Rear:	*HW11 FRF1 3810*	Right Rear: *HW11 FRF1 3810*

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) [ ] Front Wheel Drive [X] 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: *2WD*
Mode: *Default- ESC on*
Drive Configuration: _____
Mode: _____
Drive Configuration: _____
Mode: _____

VEHICLE STABILITY SYSTEMS (Check applicable technologies):

List other systems:

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

REMARKS:

RECORDED BY: *P Broen* DATE RECORDED: *7/14/2011*
APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No *CB0515* Data Sheet Completion Date: *6/28/2011*

ESC SYSTEM IDENTIFICATION

Manufacturer/Model *Bosch Model 8.1*

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: _____

ESC OPERATIONAL CHARACTERISTICS

System is capable of generating brake torque at each wheel — X Yes (Pass) / ___ No (Fail)
Brief explanation: *The hydraulic controller and circuit can apply independent brake torques to each wheel*

System is capable of determining yaw rate — X Yes (Pass) / ___ No (Fail)
Brief explanation: *System measures yaw rate directly using yaw rate sensor*

System is capable of monitoring driver steering input — X Yes (Pass) / ___ No (Fail)
Brief explanation: *System measures steering angle directly*

System is capable of estimating side slip or side slip derivative — X Yes (Pass) / ___ No (Fail)
Brief explanation: *Side slip is estimated using measured yaw rate and Ackerman yaw rate (calculated using speed and steer angle)*

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. Method used to modify torque: *Fuel delivery is reduced to modify engine torque during ESC activation*

X Yes (Pass)
___ No (Fail)

System is capable of activation at speeds of 20 km/h (12.4 mph) and higher

Speed system becomes active: *14.4 km/h*

X Yes (Pass)
___ No (Fail)

System is capable of activation during the following driving phases:
- acceleration
- braking
- coasting
- during activation of ABS or traction control

X Yes (Pass)
___ No (Fail)

Driving phases during which ESC is capable of activation:
The ESC is capable of activation during the listed driving phases

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: *P Broen* DATE RECORDED: *6/28/2011*
APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data Sheet completion date: *7/19/2011*

ESC Malfunction Telltale

Vehicle is equipped with malfunction telltale? *Yes*

Telltale Location: *Top center of instrument cluster*

Telltale Color: *Yellow*

Telltale symbol or abbreviation used

or **ESC**

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

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

Is telltale part of a common space? *No*

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

If yes explain telltale operation during ESC activation:

If ESP (ESC) intervenes the ⚠ warning lamp flashes in the instrument cluster.

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? *No*

Is "ESC Off" telltale combined with "ESC Malfunction" telltale utilizing a two part telltale? *NA*

Telltale Location:___

Telltale Color: __

Telltale symbol or abbreviation used

or **ESC OFF**

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

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

Is telltale part of a common space? *NA*

DATA INDICATES COMPLIANCE ***Yes***

(Vehicle is compliant if equipped with a malfunction telltale)

Remarks: *This vehicle does not have provision for turning ESC off*

RECORDED BY: *P Broen* DATE RECORDED: *7/19/2011*

APPROVED BY: *J Lenkeit* DATE APPROVED: *7/26/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data Sheet completion date: *7/13/2011*

"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? ___ Yes X No

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

- ☐ 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 *NA*
Labeling ___
Modes ___

Second Control: Location ___
Labeling ___
Modes ___

Identify standard or default drive configuration *RWD*

Verify standard or default drive configuration **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 NA ___ 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 NA ___ Yes ___ No (Fail)

If no, describe how the "Off" control functions

Not applicable, no ESC off capability

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 *NA*

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 ancillary 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
NA		

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)
NA	

For each ancillary 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.

___ Yes ___ No (Fail) X NA

DATA INDICATES COMPLIANCE: PASS

Remarks: This vehicle does not have provision for turning ESC off

RECORDED BY: *P Broen* DATE RECORDED: *7/13/2011*
APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data Sheet completion date: *7/20/2011*

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

Peak Friction Coefficient (at least 0.9) *0.939*

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 *320* kPa Rear Axle *480* kPa

Actual; LF *320* kPa RF *320* kPa

LR *480* kPa RR *480* kPa

Vehicle Dimensions: Front Track Width *170.8* cm Wheelbase *365.8* cm

Rear Track Width *176.5* cm

Vehicle Weight Ratings: GAWR Front *1801* kg GAWR Rear *2431* kg

Unloaded Vehicle Weight (UVW):

Front Axle *1333.1* kg Left Front *674.0* kg Right Front *659.1* kg

Rear Axle *1011.6* kg Left Rear *505.8* kg Right Rear *505.8* kg

Total UVW *2344.7* kg

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

Calculated baseline weight (UVW + 73kg) *2417.7* 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 *1401.6* kg Left front *707.2* kg Right front *694.4* kg

Rear axle *1057.3* kg Left rear *527.5* kg Right rear *529.8* kg

Total UVW with outriggers *2458.9* kg

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

Front axle *1470.1* kg Left front *732.6* kg Right front *737.5* kg

Rear axle *1134.9* kg Left rear *571.5* kg Right rear *563.4* kg

Vehicle Weight *2605.0* kg

Ballast Required =

[Total UVW with Outriggers (if applicable)]		+ *168*	kg	- [Loaded Weight w/Driver and Instrumentation)]	
= *2458.9*	kg	+ *168*	kg	- 2605.0	kg

= *21.9* kg

Total Loaded Vehicle Weight w/Driver and Instrumentation and Ballast

Front axle *1480.1* kg Left front *733.5* kg Right front *746.6* kg

Rear axle *1144.9* kg Left rear *572.9* kg Right rear *572.0* kg

Total UVW *2625.0* 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	*62.8*	in	*159.5*	cm	*65.0*	in	*165.2*	cm
y-distance	*0.2*	in	*0.4*	cm	*-0.9*	in	*-2.4*	cm
z-distance	*39.7*	in	*100.9*	cm	*28.9*	in	*73.4*	cm
Roof Height					*104.5*	in	*265.4*	cm
Distance between ultrasonic sensors					*90.0*	in	*228.6*	cm

Remarks:

RECORDED BY: *P Broen* DATE RECORDED: *7/20/2011*
APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515*

Measured tire pressure: LF *332* kPa RF *331* kPa

LR *493* kPa RR *487* kPa

Wind Speed: *3.3* 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)) *29* °C

Brake Conditioning Time: *11:05:00 AM* Date: *7/20/2011*

56 km/h (35 mph) Brake Stops

Number of stops executed (10 required) *10* Stops

Observed deceleration range (0.5g 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 range *0.8-0.9* 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: *11:28:00 AM* Date: *7/20/2011*

Measured cold tire pressure LF *348* kPa RF *349* kPa

LR *508* kPa RR *506* 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)) *31*°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 - 0.55*	*30.4 - 32*
4-6	Counterclockwise	0.5 – 0.6	*0.5 - 0.55*	*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	*0.22*
2	3	56 ± 2 (35 ± 1)	*150*	0.5 - 0.6	*0.5*
3	4	56 ± 2 (35 ± 1)	*150*	0.5 - 0.6	*0.5*
4		56 ± 2 (35 ± 1)		0.5 - 0.6	

Steering wheel angle that corresponds to a peak 0.5-0.6 g lateral acceleration: *150* 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)	*150* (cycles 1-10)	0.5 - 0.6	*0.5*
4	*8*	56 ± 2 (35 ± 1)	*150* (cycles 1-9)	0.5 - 0.6	*0.5*
			300 (cycle10)*	NA	*0.68*

* 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: *3:02:00 PM* Date: *7/20/2011*

Measured cold tire pressure LF *346* kPa RF *347* kPa

LR *504* kPa RR *504* kPa

Wind Speed *3.7* 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)) *33* °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	*0.5-0.55*	*30.4 - 32*
4-6	Counterclockwise	0.5 - 0.6	*0.5-0.55*	*30.4 - 32*

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

150 **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	*23-25*	56 ± 2 (35 ± 1)	*150* (cycles 1-10)	0.5 - 0.6	*0.5*
4	*26*	56 ± 2 (35 ± 1)	*150* (cycles 1-9)	0.5 - 0.6	*0.5*
			300 (cycle 10)*	NA	*0.68*

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

Remarks:

RECORDED BY: *P Broen* DATE RECORDED: *7/20/2011*

APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515*

Measured tire pressure: LF *352* kPa RF *353* kPa

LR *513* kPa RR *509* kPa

Wind Speed *2.9* m/s

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

Ambient Temperature (7°C (45°F) - 40°C (104°F)) *31* °C

Selected drive configuration *RWD*

Selected Mode: *Default- ESC 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:

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

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	*1:01 pm*	*-37.7*	*11*	*Good*
2	Left	*1:07 pm*	*-37.2*	*12*	*Good*
3	Left	*1:09 pm*	*-37.0*	*13*	*Good*
4	Left				
5	Left				
1	Right	*1:12 pm*	*34.0*	*14*	*Good*
2	Right	*1:15 pm*		*15*	*NG*
3	Right	*1:19 pm*	*34.0*	*16*	*Good*
4	Right	*1:23 pm*	*33.7*	*17*	*Good*
5	Right				

3.0 TEST DATA (CONTD)

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

Average Overall Steering Wheel Angle:

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

$\delta_{0.3\ g,\ overall}$ = *35.6* degrees

[to nearest 0.1 degree]

Remarks:

RECORDED BY: *P Broen* DATE RECORDED: *7/20/2011*
APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data sheet completion date: *7/20/2011*

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: *RWD*

Selected Mode: *Default, ESC on*

Overall steering wheel angle ($\delta_{0.3\ g,\ overall}$) *35.6* 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
28	15:21	1.5	53	12.85	-0.16	-0.02	-1.23	PASS	-0.16	PASS
29	15:25	2.0	71	16.62	0.18	0.29	1.07	PASS	1.74	PASS
30	15:28	2.5	89	19.42	0.15	0.19	0.77	PASS	0.97	PASS
31	15:32	3.0	107	21.25	-0.14	-0.17	-0.66	PASS	-0.82	PASS
32	15:34	3.5	125	21.17	0.06	0.07	0.29	PASS	0.33	PASS
33	15:38	4.0	142	22.68	-0.15	-0.16	-0.67	PASS	-0.70	PASS
34	15:41	4.5	160	25.09	0.16	0.09	0.62	PASS	0.37	PASS
35	15:43	5.0	178	25.58	-0.15	-0.19	-0.57	PASS	-0.76	PASS
36	15:46	5.5	196	29.18	0.11	0.08	0.38	PASS	0.26	PASS
37	15:48	6.0	214	31.29	-0.12	-0.16	-0.37	PASS	-0.50	PASS
38	15:51	6.5	231	30.95	-0.07	-0.09	-0.24	PASS	-0.30	PASS
39	15:55	7.0	249	32.15	-0.05	-0.02	-0.15	PASS	-0.07	PASS
40	15:57	7.5	267	31.50	-0.06	-0.05	-0.18	PASS	-0.17	PASS
41	16:00	-	270	31.75	-0.24	-0.12	-0.74	PASS	-0.38	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
42	16:04	1.5	53	-12.64	0.01	-0.04	-0.09	*PASS*	0.34	*PASS*
43	16:07	2.0	71	-16.32	-0.03	0.01	0.21	*PASS*	-0.08	*PASS*
44	16:09	2.5	89	-19.68	-0.05	0.00	0.27	*PASS*	0.02	*PASS*
45[2]	16:12	3.0	107	-22.00	-0.11	-0.15	0.49	*PASS*	0.70	*PASS*
47	16:18	3.5	125	-21.97	-0.11	-0.21	0.49	*PASS*	0.95	*PASS*
48	16:22	4.0	142	-24.34	-0.07	-0.14	0.30	*PASS*	0.57	*PASS*
49	16:25	4.5	160	-25.04	0.00	-0.12	0.00	*PASS*	0.49	*PASS*
50	16:27	5.0	178	-28.18	-0.24	-0.29	0.84	*PASS*	1.03	*PASS*
51	16:30	5.5	196	-30.89	-0.10	0.07	0.31	*PASS*	-0.21	*PASS*
52	16:33	6.0	214	-32.18	-0.05	-0.01	0.15	*PASS*	0.02	*PASS*
53	16:35	6.5	231	-31.82	-0.14	-0.12	0.43	*PASS*	0.39	*PASS*
54	16:38	7.0	249	-33.70	-0.06	-0.15	0.17	*PASS*	0.44	*PASS*
55	16:40	7.5	267	-33.47	0.02	0.01	-0.07	*PASS*	-0.04	*PASS*
56	16:44	-	270	-31.76	0.13	0.05	-0.42	*PASS*	-0.15	*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.
2. Run 46 was no good; this was the reason why the time interval was greater than 5 minutes between runs 45 and 46.

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
35	Counter Clockwise	5.0	178	-2.5	*PASS*
36	Counter Clockwise	5.5	196	-2.6	*PASS*
37	Counter Clockwise	6.0	214	-2.7	*PASS*
38	Counter Clockwise	6.5	231	-2.7	*PASS*
39	Counter Clockwise	7.0	249	-2.7	*PASS*
40	Counter Clockwise	7.5	267	-2.6	*PASS*
41	Counter Clockwise	8.0	270	-2.8	*PASS*
50	Clockwise	5.0	178	2.4	*PASS*
51	Clockwise	5.5	196	2.4	*PASS*
52	Clockwise	6.0	214	2.5	*PASS*
53	Clockwise	6.5	231	2.6	*PASS*
54	Clockwise	7.0	249	2.6	*PASS*
55	Clockwise	7.5	267	2.6	*PASS*
56	Clockwise	8.0	270	2.5	*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: *P Broen* DATE RECORDED: *7/20/2011*

APPROVED BY: *B Kebschull* DATE APPROVED: *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data Sheet Completion Date: *7/20/2011*

TEST 1

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnect stop lamp switch at connector

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 ± 5 mph) 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 ± 5 mph) is reached.

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

TEST 1 DATA INDICATES COMPLIANCE: ***PASS***

Remarks: *Telltale illuminated immediately upon ignition after malfunction was caused. The "acceleration skid control" (ASR) telltale also illuminated. Both telltales extinguished immediately upon ignition after the malfunction was removed (brake light reconnected). No driving was necessary.*

RECORDED BY: *B Kebschull* DATE RECORDED: *7/20/2011*

APPROVED BY: *P Broen* DATE APPROVED *7/20/2011*

3.0 TEST DATA (CONTD)

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

Vehicle: *2011 Mercedes-Benz Sprinter*

NHTSA No. *CB0515* Data Sheet Completion Date: *7/20/2011*

TEST 2

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnect rear speed sensor at connector

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 ± 5 mph) 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 ± 5 mph) is reached.

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

TEST 2 DATA INDICATES COMPLIANCE: PASS

Remarks: *Telltale illuminated immediately upon ignition after malfunction was caused. The "acceleration skid control" (ASR) and ABS telltales also illuminated. All telltales extinguished immediately upon ignition after the malfunction was removed (rear wheel speed sensor reconnected). No driving was necessary.*

RECORDED BY: *B Kebschull* DATE RECORDED: *7/20/2011*

APPROVED BY: *P Broen* DATE APPROVED *7/20/2011*

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:2/22/11 Due: 2/22/12
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: DRI Date: 2/23/11 Due: 2/23/12
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: 3/30/11 Due: 3/30/12
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: 3/8/11 Due: 3/8/12
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: 5/3/11 Due: 5/3/12
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: 2/22/11 Due: 2/21/12
						DOT-NHTSA D3272	By: DRI Date: 2/22/11 Due: 2/22/12

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: 3/29/11 Due: 3/29/12
					SoMat High level Board EHLS	MSHLS.03-3182	By: DRI Date: 3/29/11 Due: 3/29/12
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; DRI Date: 11/7/10 Due: 11/7/11
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 13)

Figure 5.1. Front View of Test Vehicle

5.0 PHOTOGRAPHS (2 of 13)

Figure 5.2. Rear View of Test Vehicle

5.0 PHOTOGRAPHS (3 of 13)

Figure 5.3. Vehicle Certification Label

5.0 PHOTOGRAPHS (4 of 13)

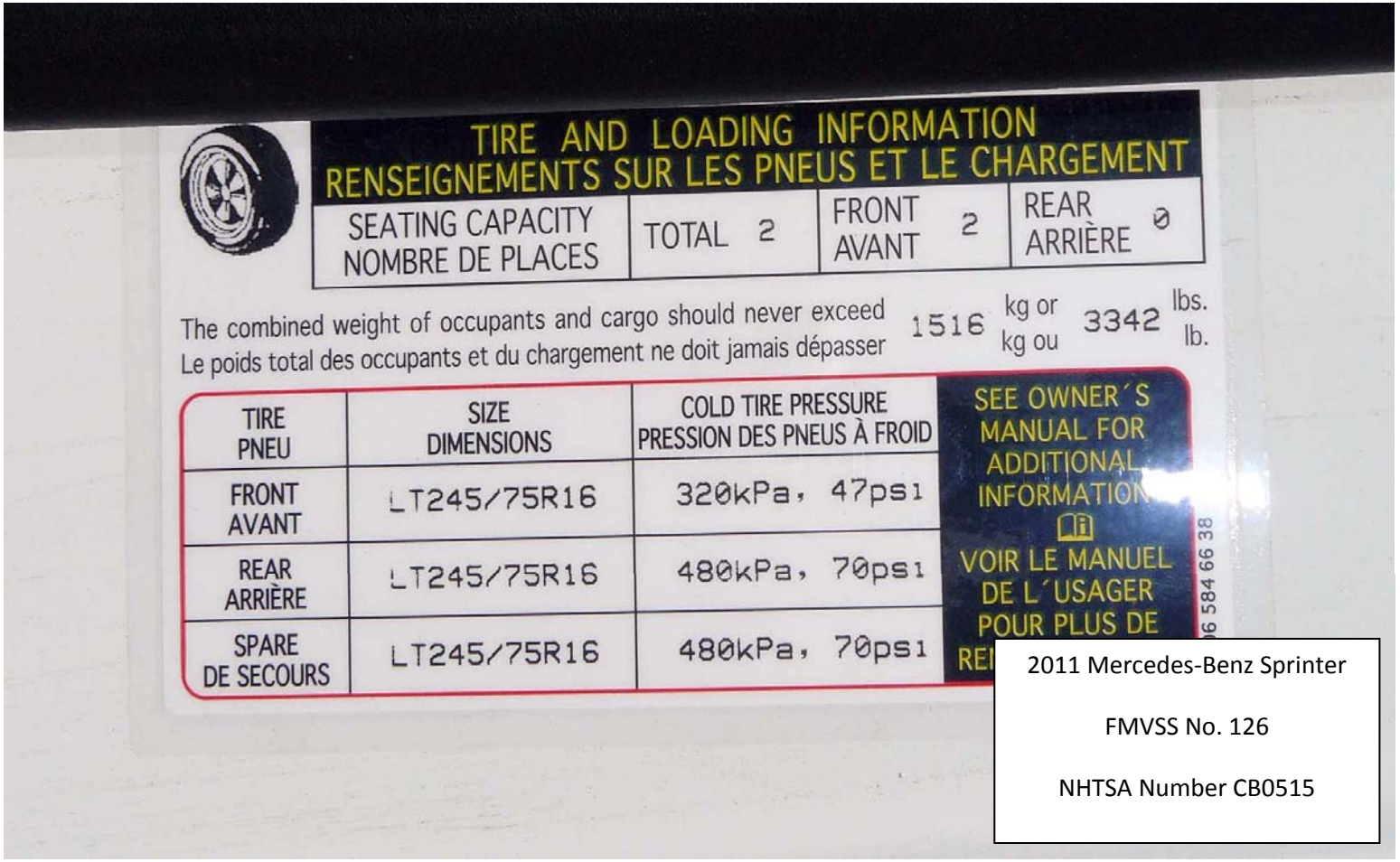

Figure 5.4. Vehicle Placard

5.0 PHOTOGRAPHS (5 of 13)

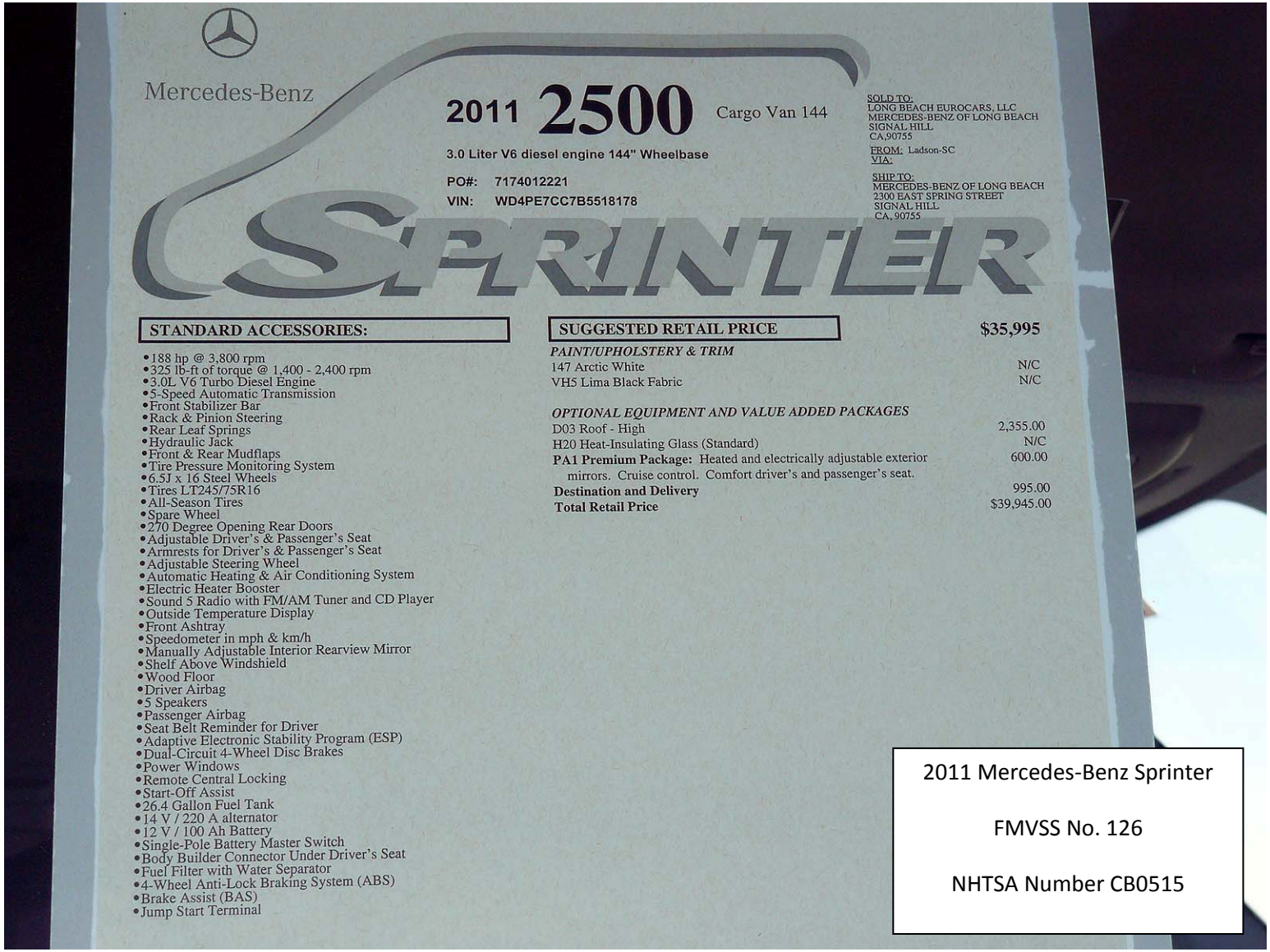

Figure 5.5. Window Sticker (Monroney Label)

5.0 PHOTOGRAPHS (6 of 13)

Figure 5.6. Front View of Vehicle as Tested

5.0 PHOTOGRAPHS (7 of 13)

Figure 5.7. Rear View of Vehicle as Tested

5.0 PHOTOGRAPHS (8 of 13)

Figure 5.8. Ultrasonic Height Sensor Mounted on Side of Vehicle for Determining Body Roll Angle

5.0 PHOTOGRAPHS (9 of 13)

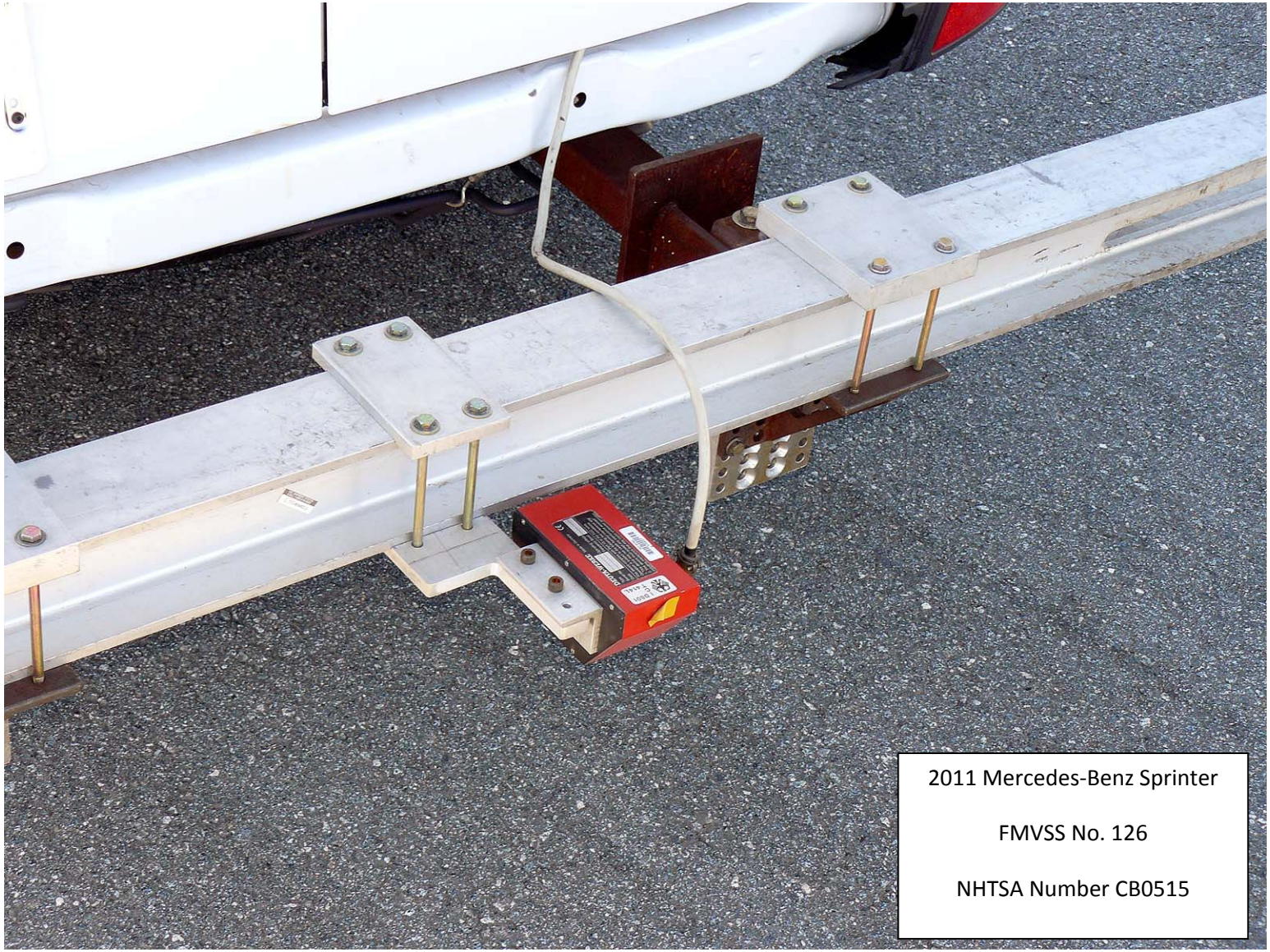

Figure 5.9. Rear Mounted Speed Sensor

5.0 PHOTOGRAPHS (10 of 13)

Figure 5.10. Steering Controller and Data Acquisition Computer

5.0 PHOTOGRAPHS (11 of 13)

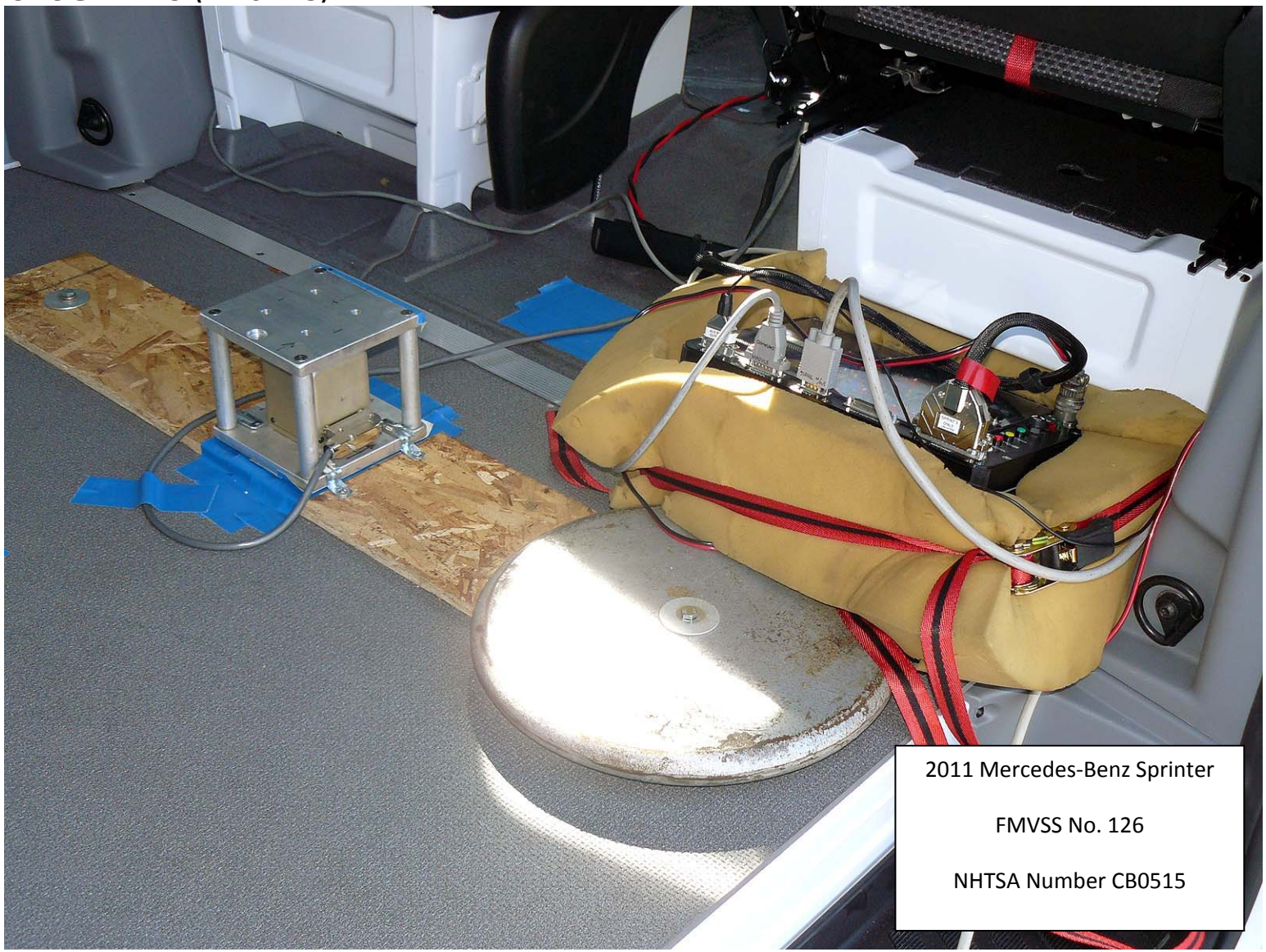

Figure 5.11. Inertial Measurement Unit Mounted in Vehicle

5.0 PHOTOGRAPHS (12 of 13)

Figure 5.12. Brake Pedal Load Cell

5.0 PHOTOGRAPHS (13 of 13)

Figure 5.13. Telltale for ESC Malfunction and Activation

6.0 DATA PLOTS (1 of 4)

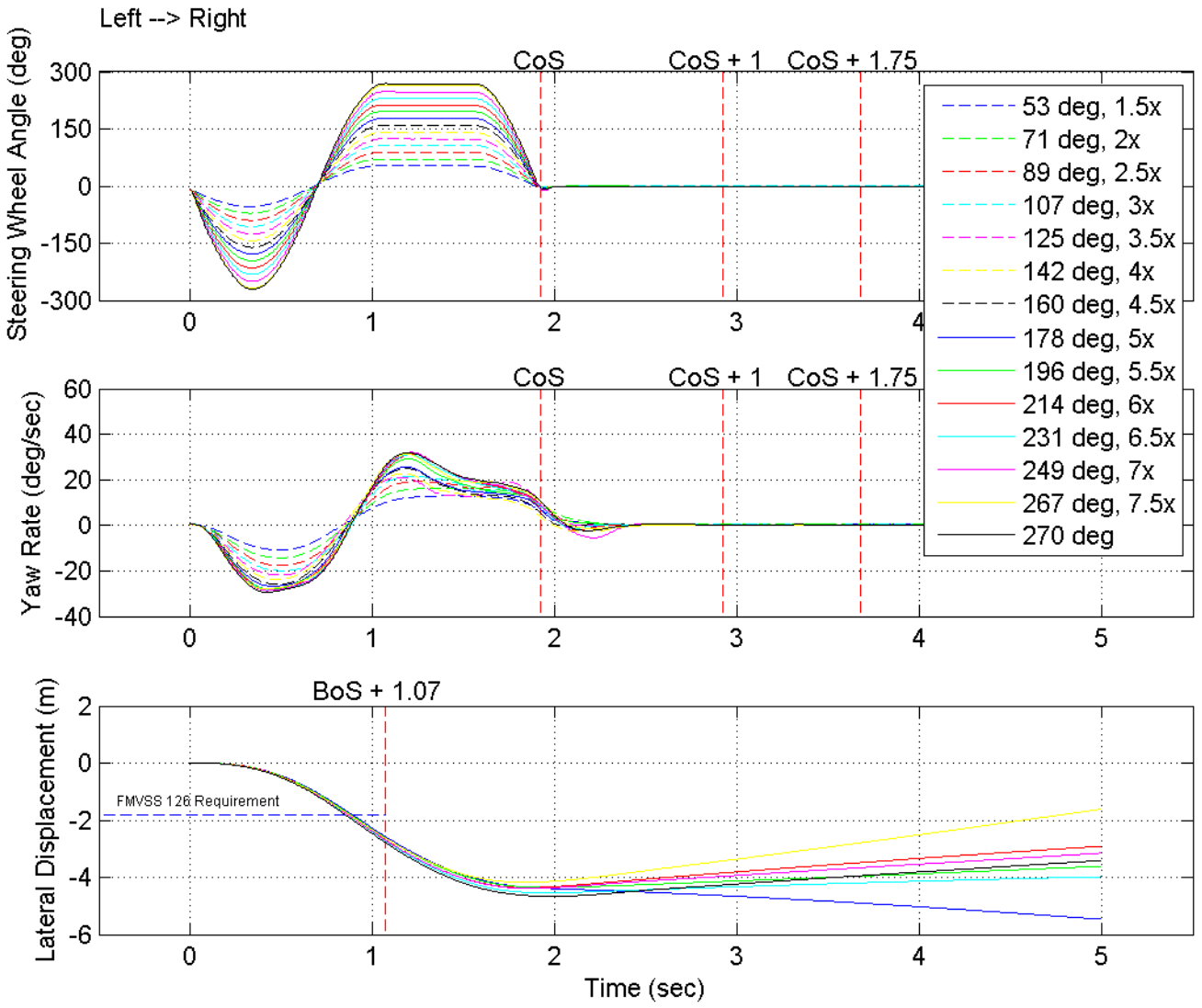

Figure 6.1. Steering Wheel Angle, Yaw Rate and Lateral Displacement for L-R Series

6.0 DATA PLOTS (2 of 4)

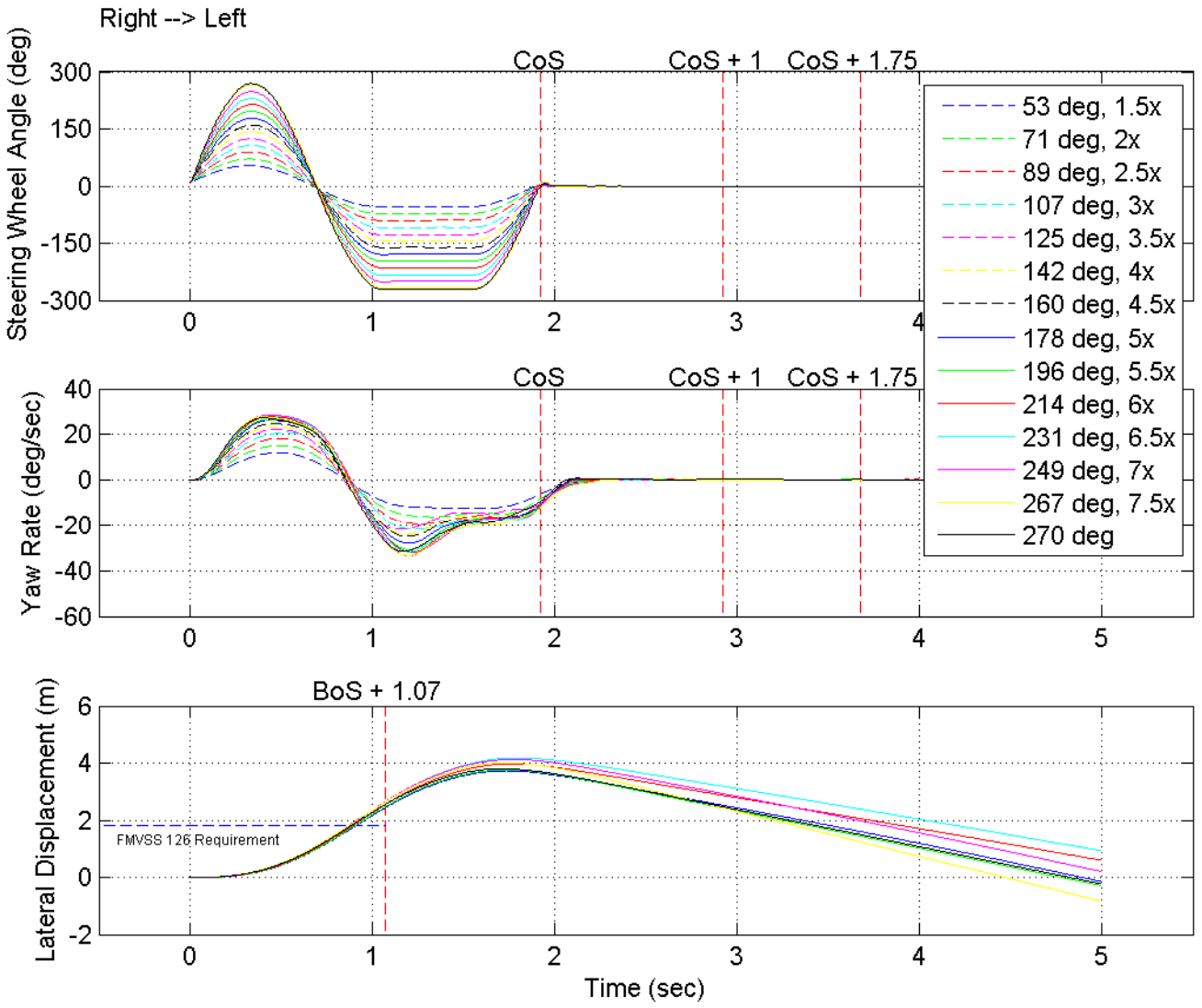

Figure 6.2. Steering Wheel Angle, Yaw Rate and Lateral Displacement for R-L Series

6.0 DATA PLOTS (3 of 4)

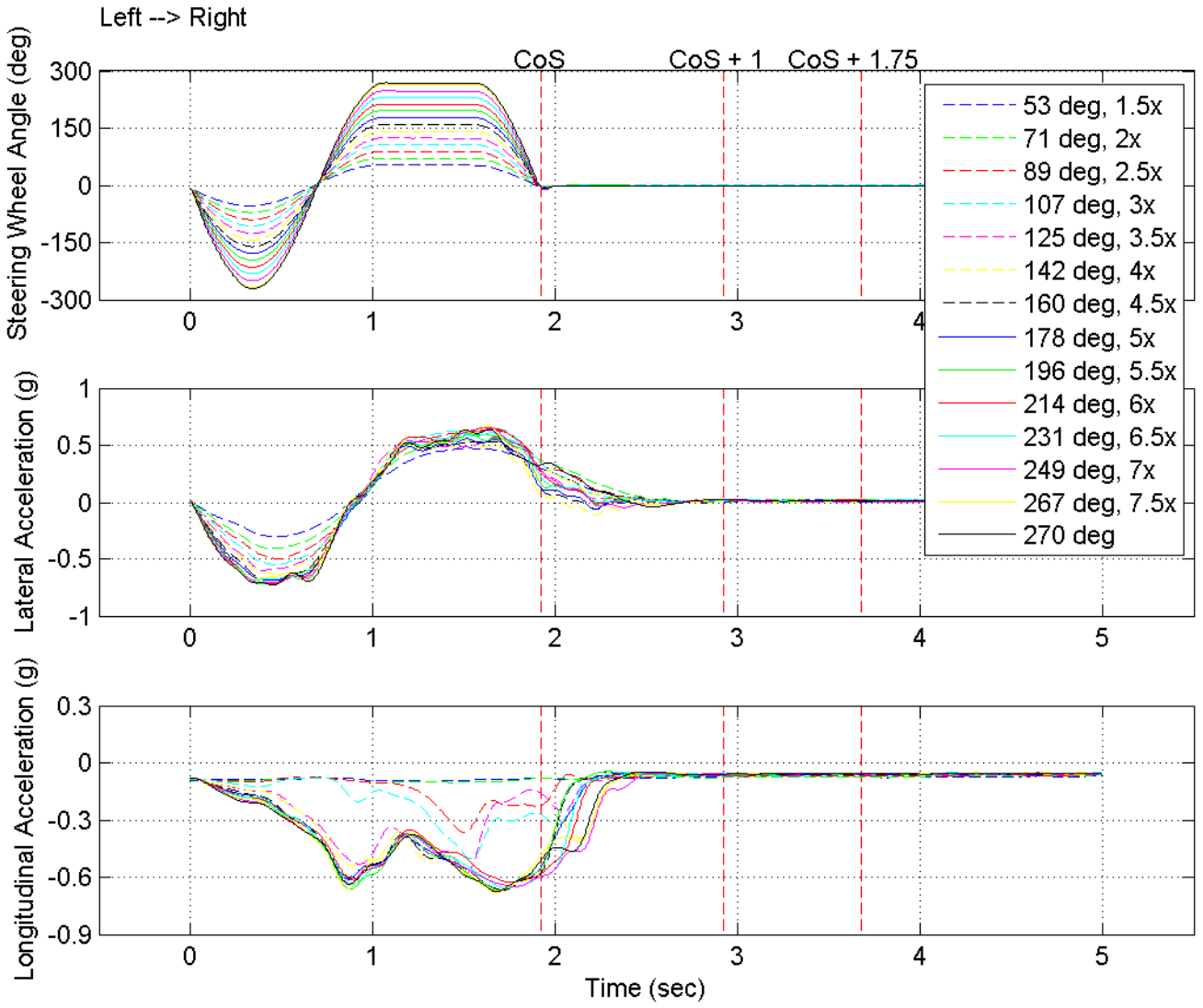

Figure 6.3. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for L-R Series

6.0 DATA PLOTS (4 of 4)

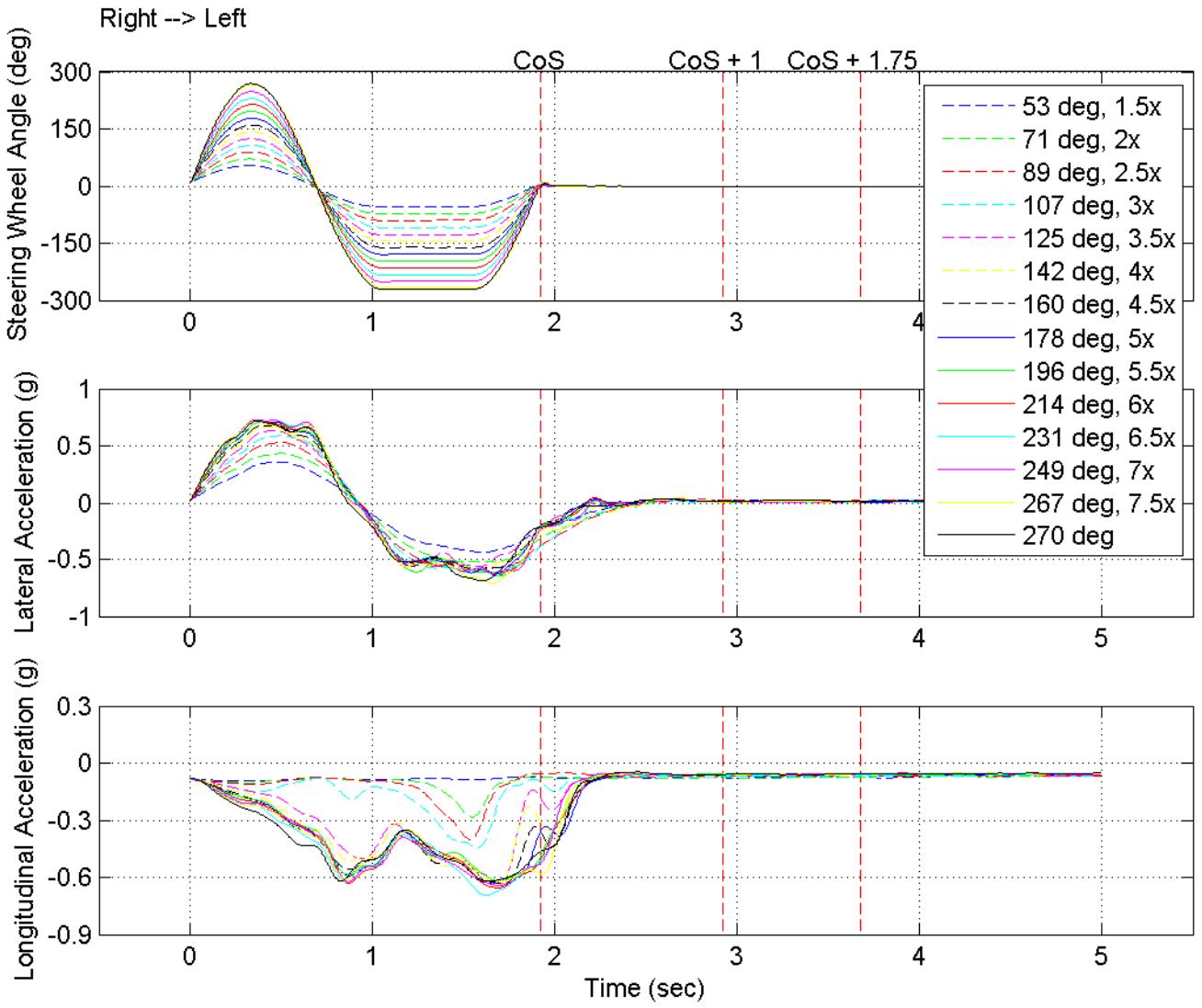

Figure 6.4. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for R-L Series

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

7.1 OWNER'S MANUAL PAGES

serves as a reminder to take extra care while driving.

- ▶ **If ABS intervenes:** continue to depress the brake pedal with force until the braking situation is over.
- ▶ **To make a full brake application:** depress the brake pedal with full force.

⚠ Warning

If the ABS malfunctions, other driving systems such as the BAS or the ESP® are also switched off. Observe indicator and warning lamps that may come on as well as messages in the multifunction display that may appear.

If the ABS malfunctions, the wheels may lock during hard braking, reducing the steering capability and extending the braking distance.

BAS (Brake Assist System)

⚠ Warning

Observe "Important safety notes" (▷ page 47).

BAS operates in emergency braking situations. If you depress the brake pedal quickly, BAS automatically boosts the braking force, potentially reducing the stopping distance.

- ▶ Keep the brake pedal firmly depressed until the emergency braking situation is over. ABS prevents the wheels from locking.

The brakes will function as usual once you release the brake pedal. BAS is deactivated.

⚠ Warning

If the BAS malfunctions, the brake system still functions, but without the additional brake boost available that the BAS would normally provide in an emergency braking maneuver. Therefore, the braking distance may increase.

EBD (Electronic Brake force Distribution)

⚠ Warning

Observe "Important safety notes" (▷ page 47).

EBD monitors and controls the brake pressure on the rear wheels to improve driving stability while braking.

⚠ Warning

If the [ ], [ ], [ ] and [ ] indicator lamps light up while the vehicle is in motion, EBD may be defective.

If EBD malfunctions, the brake system will still function with full brake boost. However, the rear wheels could lock up during emergency braking situations, for example. You could lose control of the vehicle and cause an accident.

Adapt your driving style to the changed driving characteristics.

ASR (acceleration skid control)

Important safety notes

⚠ Warning

Observe "Important safety notes" (▷ page 47).

ASR can significantly improve traction, i.e. the transmission of power from the tires to the road surface, and thus may increase the vehicle's driving stability. ASR assists in pulling away and accelerating, particularly on smooth and slippery surfaces.

ASR can brake individual wheels and limits the engine torque to help prevent the drive wheels from spinning.

If ASR intervenes, the [⚠] warning lamp flashes in the instrument cluster.

7.1 OWNER'S MANUAL PAGES

ESP® (Electronic Stability Program)

⚠ Warning
Observe "Important safety notes" (▷ page 47).

If ESP® detects that the vehicle is deviating from the direction desired by the driver, one or more wheels are braked to help stabilize the vehicle. If necessary, the engine output is also modified to help keep the vehicle on the desired course within physical limits. ESP® assists the driver when pulling away on wet or slippery roads. ESP® can also help stabilize the vehicle during braking.

If ESP® intervenes, the ⚠ warning lamp flashes in the instrument cluster.

⚠ Warning
If the indicator lamp remains lit, ESP® is not available due to a malfunction. Vehicle stability in standard driving maneuvers is reduced.

Adapt your speed and driving style to the prevailing road conditions and to the non-operating status of ESP®.

If ESP® is malfunctioning, the engine output may be reduced.

! Only operate the vehicle for a maximum of ten seconds on a brake test dynamometer. Switch off the ignition.

Application of the brakes by ESP® may otherwise destroy the brake system.

! Do not operate the vehicle on a dynamometer (e.g. for a performance test). If you would like to operate the vehicle on a dynamometer, consult an authorized Sprinter Dealer beforehand. The drive train or brake system could otherwise be damaged.

i Only use wheels with the recommended tire sizes. Only then will ESP® function properly.

7.1 OWNER'S MANUAL PAGES

Problem	Possible causes/consequences and ▶ Solutions
The yellow ABS indicator lamp is lit while the engine is running.	⚠ **Warning!** ABS has been deactivated due to undervoltage. It is possible that the battery is not being charged. The brake system continues to function normally, but without electronic support. The wheels could therefore lock, e.g. if the brakes are applied with maximum force. ▶ Drive on with care. ▶ Visit a qualified specialist workshop immediately.
The yellow DEF indicator lamp lights up while the engine is running.	The exhaust gas aftertreatment is malfunctioning or the current Diesel Exhaust Fluid (DEF) supply is limiting the vehicle range. ▶ Observe the messages in the display (▷ page 199).
The yellow ESP® warning lamp is lit while the engine is running.	⚠ **Warning!** ESP® has been deactivated due to a malfunction. This also deactivates cruise control. The vehicle's stability is no longer automatically regulated at an early stage. Engine power output may be reduced. ▶ On vehicles with steering wheel buttons, also observe the messages in the display (▷ page 197). ▶ Drive on with care. ▶ Consult a qualified specialist workshop as soon as possible.
The yellow ESP® warning lamp is lit while the engine is running.	⚠ **Warning!** ESP® has been deactivated due to undervoltage. This also deactivates cruise control. It is possible that the battery is not being charged. The vehicle's stability is no longer automatically regulated at an early stage. Engine power output may be reduced. ▶ Drive on with care. ▶ Consult a qualified specialist workshop as soon as possible.

7.1 OWNER'S MANUAL PAGES

Display messages	Possible causes/consequences and ▶ Solutions
ABS Unavailable	⚠ **Warning!** ABS has been deactivated due to undervoltage. The battery might not be charging. The brake system is still available with the normal braking effect. ▶ Drive on carefully. ▶ Visit a qualified specialist workshop immediately.
Check Diesel Exhaust Fluid see Operator's Manual	The Diesel Exhaust Fluid (DEF) supply has dropped below 1.5 US gal (5.5 l). After the message appears for the first time and under normal driving conditions, the remaining DEF supply will last for approximately 1000 miles (1600 km). After that, the 0.8 US gal (3.0 l) reserve mark is reached. A warning tone sequence sounds. The engine can then only be started another sixteen times. ▶ add DEF supply (▷ page 143). After topping up, the system check takes approximately 20 seconds. The display message then disappears.
Check Diesel Exhaust Fluid see Operator's Manual	If the yellow engine diagnosis indicator lamp lights up in addition, the DEF reducing agent is contaminated, diluted or not compliant with ISO 22241. After the message appears for the first time, and under normal driving conditions, you can continue driving for approximately 50 miles(80 km). After this, a warning tone sequence sounds. The engine can then only be started another sixteen times. Have the DEF tank cleaned and refilled at a qualified specialist workshop as soon as possible.
ESP Visit workshop	⚠ **Warning!** ESP® has been deactivated due to a malfunction. This also deactivates cruise control. The vehicle's stability is no longer automatically regulated at an early stage. Engine power output may be reduced. ▶ Drive on carefully. ▶ Visit a qualified specialist workshop immediately.

7.1 OWNER'S MANUAL PAGES

Display messages	Possible causes/consequences and ▶ Solutions
ESP Unavailable	ESP® has been deactivated due to undervoltage. This also deactivates cruise control. The battery might not be charging. The vehicle's stability is no longer automatically regulated at an early stage. Engine power output may be reduced. ▶ Drive on carefully. ▶ Visit a qualified specialist workshop as soon as possible.
Tire pres. Adj. pres.	The pressure in one or more tires is too low or there is a significant difference between tire pressures on individual wheels. ▶ Check the tire pressure at the next opportunity and correct it if necessary (▷ page 281).
Tire pres. monitor inoperative	The tire pressure monitor has malfunctioned. ▶ Have the tire pressure monitor and the wheels checked at a qualified specialist workshop.
Tire press. monitor currently unavail.	The tire pressure monitor function is temporarily unavailable due to radio interference or undervoltage. ▶ As soon as the causes have been remedied, the tire pressure monitor activates itself automatically.
Tire press. monitor inoperative No wheel sensors	The tire pressure monitor is not receiving signals from one or more wheels because: • a wheel has been replaced with the spare wheel without wheel electronics. • the maximum temperature on one of the wheel electronics units has been exceeded. • the wheel electronics are malfunctioning. ▶ Have wheels with suitable wheel electronics units installed at a qualified specialist workshop.
Cruise control Visit workshop	Cruise control has been deactivated due to a malfunction. ▶ Have cruise control checked at a qualified specialist workshop.
SRS Restraint system Visit workshop	⚠ **Warning!** The restraint systems have malfunctioned. The air bags or belt tensioners could be triggered unintentionally or might not be triggered at all in the event of an accident. ▶ Drive on carefully. ▶ Visit a qualified specialist workshop as soon as possible.

7.2 VEHICLE ARRIVAL CONDITION REPORT

CONTRACT NO.: *DTNH22-08-D-00098*
DATE: *6/28/2011*

From: *Automotive Allies*

To: *Dynamic Research, Inc*

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

Vehicle VIN: *WD4PE7CC7B5518178* NHTSA NO.: *CB0515*
Model Year: *2011* Odometer Reading: *28* Miles
Make *Mercedes-Benz* Body Style: *MPV*
Model: *Sprinter* Body Color: *White*
Manufacture Date: *10/10* Dealer: *Automotive Allies*
GVWR (kg/lb) *3878/8550* 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: *No owner's manual, requested from vehicle supplier*

This is a cargo van.

RECORDED BY: *J.Lenkeit* DATE RECORDED: *6/28/2011*

APPROVED BY: *B Kebschull* DATE APPROVED: *6/28/2011*

7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO.: *DTNH22-08-D-00098*
DATE: *7/29/2011*

Vehicle VIN: *WD4PE7CC7B5518178* NHTSA NO.: *CB0515*
Model Year: *2011* Odometer Reading: *80* Miles
Make: *Mercedes-Benz* Body Style: *MPV*
Model: *Sprinter* Body Color: *White*
Manufacture Date: *10/10* Dealer: *Automotive Allies*
GVWR (kg/lb) *3878 (8550)* 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 delivered, like new

RECORDED BY: *J Lenkeit* DATE RECORDED: *7/29/2011*

APPROVED BY: *B Kebschull* DATE APPROVED: *8/1/2011*

7.4 SINE WITH DWELL TEST RESULTS

2011 Mercedes-Benz Sprinter
NHTSA No.: *CB0515*
Date of Test : *7/20/2011*
Date Created: *7/20/2011*

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)
28	710	50.35	3.541	1090	5.444	847	4.226	-1.23	-0.16	1290	-0.16	-0.02	1440	12.85	998	-3.59	0.21	53.03	775	52.88
29	708	50.75	3.534	1090	5.444	846	4.225	1.07	0.18	1290	1.74	0.29	1440	16.62	986	-4.52	0.27	71.02	775	70.89
30	708	50.47	3.531	1090	5.444	846	4.225	0.77	0.15	1290	0.97	0.19	1440	19.42	958	-5.42	0.30	89.06	775	88.85
31	707	50.54	3.528	1090	5.444	846	4.225	-0.66	-0.14	1290	-0.82	-0.17	1440	21.25	951	-6.34	0.32	106.97	775	106.72
32	707	50.68	3.527	1090	5.445	846	4.224	0.29	0.06	1290	0.33	0.07	1440	21.17	937	-6.80	0.40	125.03	775	124.85
33	707	50.43	3.526	1090	5.445	846	4.225	-0.67	-0.15	1290	-0.70	-0.16	1440	22.68	941	-7.23	0.35	142.04	775	141.72
34	707	50.58	3.526	1090	5.444	846	4.225	0.62	0.16	1290	0.37	0.09	1440	25.09	945	-7.83	0.31	159.99	775	159.66
35	706	50.56	3.525	1090	5.444	846	4.225	-0.57	-0.15	1290	-0.76	-0.19	1440	25.58	944	-8.32	0.27	178.11	775	177.57
36	706	50.54	3.524	1090	5.443	846	4.225	0.38	0.11	1290	0.26	0.08	1440	29.18	946	-8.47	0.26	196.06	775	195.44
37	706	50.62	3.525	1090	5.443	846	4.225	-0.37	-0.12	1290	-0.50	-0.16	1440	31.29	952	-8.70	0.26	214.09	775	213.26
38	706	50.72	3.525	1090	5.443	846	4.225	-0.24	-0.07	1290	-0.30	-0.09	1440	30.95	948	-8.81	0.27	231.12	775	230.31
39	707	50.50	3.526	1090	5.444	847	4.226	-0.15	-0.05	1290	-0.07	-0.02	1440	32.15	950	-8.74	0.28	249.38	775	248.12
40	707	50.50	3.526	1091	5.450	847	4.227	-0.18	-0.06	1291	-0.17	-0.05	1441	31.50	945	-8.53	0.30	267.21	775	266.06
41	707	50.66	3.526	1091	5.447	847	4.227	-0.74	-0.24	1291	-0.38	-0.12	1441	31.75	947	-9.04	0.27	270.12	775	269.08

7.4 SINE WITH DWELL TEST RESULTS

2011 Mercedes-Benz Sprinter
NHTSA No.: *CB0515*
Date of Test : *7/20/2011*
Date Created: *7/20/2011*

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)
42	709	50.49	3.540	1090	5.444	847	4.227	-0.09	0.01	1290	0.34	-0.04	1440	-12.64	1031	3.66	-0.18	53.92	775	53.56
43	708	50.66	3.534	1090	5.444	847	4.226	0.21	-0.03	1290	-0.08	0.01	1440	-16.32	978	4.67	-0.22	71.90	775	71.45
44	707	50.62	3.530	1090	5.443	847	4.226	0.27	-0.05	1290	0.02	0.00	1440	-19.68	962	5.52	-0.27	89.95	775	89.40
45	707	50.19	3.527	1090	5.443	847	4.226	0.49	-0.11	1290	0.70	-0.15	1440	-22.00	954	6.24	-0.29	107.78	775	107.22
47	706	50.52	3.525	1090	5.444	847	4.226	0.49	-0.11	1290	0.95	-0.21	1440	-21.97	942	6.67	-0.38	125.95	775	125.36
48	706	50.49	3.523	1090	5.442	846	4.225	0.30	-0.07	1290	0.57	-0.14	1440	-24.34	945	7.20	-0.37	142.87	775	142.27
49	706	50.51	3.522	1091	5.447	848	4.234	0.00	0.00	1291	0.49	-0.12	1441	-25.04	946	7.50	-0.30	161.80	776	159.20
50	706	50.69	3.523	1090	5.442	847	4.226	0.84	-0.24	1290	1.03	-0.29	1440	-28.18	947	7.88	-0.34	178.89	775	178.20
51	706	50.64	3.523	1090	5.441	847	4.226	0.31	-0.10	1290	-0.21	0.07	1440	-30.89	948	7.99	-0.34	196.74	775	196.12
52	706	50.53	3.523	1090	5.442	847	4.226	0.15	-0.05	1290	0.02	-0.01	1440	-32.18	952	8.25	-0.33	214.54	775	214.02
53	706	50.54	3.524	1090	5.442	847	4.227	0.43	-0.14	1290	0.39	-0.12	1440	-31.82	949	8.51	-0.31	231.51	775	231.01
54	706	50.57	3.524	1090	5.442	847	4.227	0.17	-0.06	1290	0.44	-0.15	1440	-33.70	948	8.54	-0.33	249.26	775	249.11
55	706	50.71	3.524	1091	5.449	848	4.235	-0.07	0.02	1291	-0.04	0.01	1441	-33.47	948	8.49	-0.34	267.38	777	266.46
56	706	50.76	3.524	1092	5.454	847	4.227	-0.42	0.13	1292	-0.15	0.05	1442	-31.76	942	8.21	-0.37	270.20	775	269.97

7.5 SLOWLY INCREASING STEER TEST RESULTS

2011 Mercedes-Benz Sprinter
NHTSA No.: *CB0515*
Date of Test: *7/20/2011*
Date Created: *7/20/2011*

File	EventPt	DOS	MES (mph)	Mean SPD (mph)	AYcount_3	THETAENCF_3 (deg)	AYCG_CD2_3 (g)	r_squared	ZeroBegin	ZeroEnd
11	700	1	49.624	49.769	1265	-37.714	-0.294	0.996	500	700
12	700	1	49.704	49.719	1257	-37.217	-0.318	0.983	500	700
13	640	1	49.819	49.738	1254	-36.986	-0.294	0.995	440	640
14	731	0	49.817	49.856	1209	33.960	0.315	0.996	531	731
16	700	0	49.921	49.914	1207	33.975	0.289	0.995	500	700
17	700	0	49.908	49.816	1204	33.678	0.309	0.994	500	700
				Averages		35.6	0.303			

Scalars	Steering Angles (deg)
1.5	53
2.0	71
2.5	89
3.0	107
3.5	125
4.0	142
4.5	160
5.0	178

Scalars	Steering Angles (deg)
5.5	196
6.0	214
6.5	231
7.0	249
7.5	267
7.6	270

7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

Vehicle:	**2011 Mercedes-Benz Sprinter**	NHTSA No.:	CB0515
Wheelbase:	144 Inches	Faro Arm S/N:	U08-05-08-06636
Measurement date:	7/20/2011	Certification date:	11/7/10

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	2.059		0.000
M_Point_48_Ref	0.000	0.000	-
M_CIRCLE001_I_Right_Rear_Wheel_Axle	-60.294	-10.117	-14.482
M_Point_IMU_right_side	18.681	-47.402	-28.896
M_Point_ROOF	-	-	-104.50
Motion Pak reference point taken from mid height of unit right side			
Motion Pak Width = 3.05" ==> 1/2 W = 1.525			
Motion_PAK_Location	18.681	-48.927	-28.896

Measurement Notes

1. The Faro arm is positioned just to the right 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 right, 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 right 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	**65.025**	**-0.927**	**28.896**

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).