126-DRI-10-001
SAFETY COMPLIANCE TESTING FOR FMVSS 126
Electronic Stability Control Systems

Nissan Motor Co., Ltd.
2010 Nissan Altima
NHTSA No. CA5206

DYNAMIC RESEARCH, INC.
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Torrance, California 90501

March 24, 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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16. Abstract A test was conducted on a 2010 Nissan Altima , NHTSA No. CA5206, 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 Nissan Altima, 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 Nissan Altima 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 Nissan Altima*

NHTSA No. *CA5206* VIN: *1N4AL2AP3AN403449*

Vehicle Type: *Passenger Car* Manufacture Date: *9/09*

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 Nissan Altima Passenger Car*

NHTSA No. *CA5206* Data sheet completion *1/5/2010*

VIN *1N4AL2AP3AN403449* Manufacture Date: *9/09*

GVWR (kg): *1941* Front GAWR (kg): *1017* Rear GAWR (kg): *993*

Seating Positions Front: *2* Mid: Rear: *3*

Odometer reading at time of inspection: *13 miles (20.8 km)*

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front Axle: *P215/60 R16* Rear Axle: *P215/60 R16*

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

		Front Axle		Rear Axle
	Tire Manufacturer:	*Continental*		*Continental*
	Tire Model:	*ContiProContact*		*ContiProContact*
	Tire Size:	*P215/60 R16*		*P215/60 R16*
TIN	Left Front:	*A3X8 3WH 3609*	Right Front:	*A3X8 3WH 3609*
	Left Rear:	*A3X8 3WH 3609*	Right Rear:	*A3X8 3WH 3609*

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: *Standard*
Drive Configuration:
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
- [ ] ABS

REMARKS:

RECORDED BY: *P Broen* DATE RECORDED: *1/5/2010*
APPROVED BY: *J Lenkeit* DATE APPROVED: *1/12/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car*

NHTSA No *CA5206* Data Sheet Completion Date: *1/28/2010*

ESC SYSTEM IDENTIFICATION

Manufacturer/Model *Bosch ABS/TCS/VDC Unit Bosch ESP8*

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: *Stoplamp switch*

ESC OPERATIONAL CHARACTERISTICS

System is capable of generating brake torque at each wheel — [X] Yes (Pass) [ ] No (Fail)
List and describe Components: *ESC controller, master cylinder, individual wheel brake systems, hydraulic modulator,*

System is capable of determining yaw rate — [X] Yes (Pass) [ ] No (Fail)
List and describe Components: *Yaw rate sensor*

System is capable of monitoring driver steering input — [X] Yes (Pass) [ ] No (Fail)
List and describe Components: *Steer angle sensor*

System is capable of estimating side slip or side slip derivative — [X] Yes (Pass) [ ] No (Fail)
List and describe Components: *Observer module block of control system estimates side slip based on yaw rate, steer angle, vehicle speed, lateral acceleration and other vehicle conditions.*

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: *The engine controller module receives the engine torque command from the ESC controller unit and modifies the engine torque by varying the throttle opening and fuel delivery.*

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: *2.8 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:
ESC is capable of activation under most critical conditions in the forward driving direction - at full (ABS-control) and partial braking, coasting, drive and acceleration (including TCS), engine drag, gear shift and transients from drive to drag

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: *J Lenkeit* DATE RECORDED: *1/28/2010*
APPROVED BY: *B Kebschull* DATE APPROVED: *1/28/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car*

NHTSA No. *CA5206* Data sheet completion date: *1/5/2010*

ESC Malfunction Telltale

Vehicle is equipped with malfunction telltale? *Yes*

Telltale Location: *Inside tachometer on left side of instrument cluster (See Figure 5.6)*

Telltale Color: *Amber*

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.

"VDC OFF" "SLIP"; both are continuously illuminated to indicate failure

Is telltale part of a common space? *No*

Is telltale also used to indicate activation of the ESC system? *Yes*

If yes explain telltale operation during ESC activation:

"SLIP" indicator blinks

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: *Inside tachometer on left side of instrument cluster (See Figure 5.6)*

Telltale Color: *Amber*

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. ***"VDC OFF"; amber color***

Is telltale part of a common space? *No*

DATA INDICATES COMPLIANCE

(Vehicle is compliant if equipped with a malfunction telltale)

Remarks:

RECORDED BY: *P Broen* DATE RECORDED: *1/5/2010*

APPROVED BY: *B Kebschull* DATE APPROVED: *1/6/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car*

NHTSA No. *CA5206* Data sheet completion date: *1/6/2010*

"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 *On dashboard, left of steering wheel (Figure 5.7)*
Labeling *VDC OFF*
Modes *ESC off/on*

Second Control: Location
Labeling
Modes

Identify standard or default drive configuration *FWD Standard*

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)
TCS off (ESC on)	*No*	
ESC and TCS off	*Yes*	*Yes*

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

X Yes ____ No

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 _____

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)

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: *B Kebschull* DATE RECORDED: *1/6/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *1/10/2009*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car*

NHTSA No. *CA5206* Data sheet completion date: *1/6/2010*

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

Peak Friction Coefficient (at least 0.9) *0.96*

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

Full Fluid Levels: Fuel *Yes* Other *Yes*

Coolant *Yes* (specify) *washer, power steering, brakes*

Tire Pressures:

Required; Front Axle *220* KPA Rear Axle *220* KPA

Actual; LF *220* KPA RF *220* KPA

LR *220* KPA RR *220* KPA

Vehicle Dimensions: Front Track Width *154.9* cm Wheelbase *267.5* cm

Rear Track Width *155.4* cm

Vehicle Weight Ratings: GAWR Front *1017* KG GAWR Rear *993* KG

Unloaded Vehicle Weight (UVW):

Front axle *862.7* KG Left Front *438.1* KG Right Front *424.6* KG

Rear axle *577.9* KG Left Rear *291.7* KG Right Rear *286.2* KG

Total UVW *1440.6* KG

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

Calculated baseline weight (UVW + 73kg) *1513.6* KG

Outrigger size required ("Standard" or "Heavy") *none*

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	*N/A* KG	Left Front	*N/A* KG	Right Front	*N/A* KG
Rear axle	*N/A* KG	Left Rear	*N/A* KG	Right Rear	*N/A* KG

Total UVW with outriggers *N/A* KG

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

Front axle	*938.3* KG	Left Front	*483* KG	Right Front	*455.3* KG
Rear axle	*650.8* KG	Left Rear	*335.6* KG	Right Rear	*315.2* KG

Vehicle Weight *1589.1* KG

Ballast Required =

[Total UVW with Outriggers (if applicable)]		+ *168*	KG	- [Loaded Weight w/Driver and Instrumentation)]	
= 1440.6	KG	+ *168*	KG	- 1589.1	KG

= *19.5* KG

Total Loaded Vehicle Weight w/Driver and Instrumentation and Ballast

Front axle	*946.9* KG	Left Front	*483.4* KG	Right Front	*463.5* KG
Rear axle	*662.1* KG	Left Rear	*339.2* KG	Right Rear	*322.9* KG

Total UVW *1609.0* 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	*43.3*	in	*110.1*	cm	*66.9*	in	*170.0*	cm
y-distance	*-0.7*	in	*-1.7*	cm	*-0.6*	in	*-1.5*	cm
z-distance	*21.9*	in	*55.5*	cm	*17.0*	in	*43.1*	cm
Roof Height					*57.52*	in	*146.1*	cm
Distance between ultrasonic sensors					*87.8*	in	*223.0*	cm

Remarks:

RECORDED BY: *B Kebschull* DATE RECORDED: *1/6/2010*
APPROVED BY: *J Lenkeit* DATE APPROVED: *1/10/2101*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car*

NHTSA No. *CA5206*

Measured tire pressure: LF *220* KPA RF *220* KPA

LR *220* KPA RR *220* KPA

Wind Speed *1.5* 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)) *7.1* °C

Brake Conditioning Time: *8:40:00 AM* Date: *1/6/2010*

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 *0.9 - .095* 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: *8:55:00 AM* Date: *1/6/2010*

Measured cold tire pressure LF *235* KPA RF *241* KPA

LR *230* KPA RR *230* KPA

Wind Speed *1.9* 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)) *7.2*°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*	*32.8 - 33.6*
4-6	Counterclockwise	0.5 – 0.6	*0.5 - 0.6*	*32 - 33.6*

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	*0.41*
2	3	56 ± 2 (35 ± 1)	*80*	0.5 - 0.6	*0.54*
3		56 ± 2 (35 ± 1)		0.5 - 0.6	
4		56 ± 2 (35 ± 1)		0.5 - 0.6	

Steering wheel angle that corresponds to a peak 0.5-0.6 g lateral acceleration: 80 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	*4-6*	56 ± 2 (35 ± 1)	*80* (cycles 1-10)	0.5 - 0.6	*0.54*
4	*7*	56 ± 2 (35 ± 1)	*80* (cycles 1-9)	0.5 - 0.6	*0.54*
			160 (cycle10)*	NA	*0.85*

* 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: *11:22:00 AM* Date: *1/6/2010*

Measured cold tire pressure LF *236* KPA RF *243* KPA

LR *230* KPA RR *229* KPA

Wind Speed *0.5* 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)) *7.9* °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*	*32.8 - 33.6*
4-6	Counterclockwise	0.5 - 0.6	*0.5 - 0.6*	*32.8 - 33.6*

Steering wheel angle that corresponds to a peak 0.5-0.6 g lateral acceleration: *80* 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)	*80* (cycles 1-10)	0.5 - 0.6	*0.54*
4	*20*	56 ± 2 (35 ± 1)	*80* (cycles 1-9)	0.5 - 0.6	*0.54*
			160 (cycle 10)*	NA	*0.85*

* 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: *1/6/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *1/10/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car*

NHTSA No. *CA5206*

Measured tire pressure: LF *234* KPA RF *239* KPA

LR *227* KPA RR *226* KPA

Wind Speed *0.6* 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)) *7.2* °C

Selected drive configuration *FWD*

Selected Mode: *Normal*

Preliminary Left Steer Maneuver:

Lateral Acceleration measured at 30 degrees steering wheel angle

$a_{y,30degrees}$ = 0.3 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} = *55.0* 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	*9:57:00 AM*	*-30.1*	*9*	*Good*
2	Left	*10:02:00 AM*	*-29.2*	*10*	*Good*
3	Left	*10:06:00 AM*	*-30.9*	*11*	*Good*
4	Left				
5	Left				
1	Right	*10:11:00 AM*	*30.0*	*12*	*Good*
2	Right	*10:16:00 AM*	*29.6*	*13*	*Good*
3	Right	*10:21:00 AM*		*14*	*NG*
4	Right	*11:04:00 AM*	*29.9*	*16*	*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:

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

$\delta_{0.3\,g,\,overall}$ = *29.9* degrees

[to nearest 0.1 degree]

Remarks:

RECORDED BY: *B Kebschull* DATE RECORDED: *1/6/2010*
APPROVED BY: *J Lenkeit* DATE APPROVED: *1/10/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car :*

NHTSA No. *CA5206* Data sheet completion date: *1/6/2010*

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*

Overall steering wheel angle ($\delta_{0.3\ g,\ overall}$) *29.9* 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
1	11:42 AM	1.5	44.9	12.6	-0.2	-0.1	-1.3	PASS	-1.0	PASS
2	11:47 AM	2.0	59.8	16.2	-0.2	0.0	-1.2	PASS	-0.3	PASS
3	11:51 AM	2.5	74.8	19.8	-0.2	-0.2	-1.2	PASS	-1.1	PASS
4	11:54 AM	3.0	89.7	23.6	-0.2	-0.2	-1.0	PASS	-0.8	PASS
5	11:57 AM	3.5	104.7	26.5	-0.2	0.0	-0.8	PASS	0.1	PASS
6	12:00 PM	4.0	119.6	29.6	-0.3	-0.1	-1.2	PASS	-0.4	PASS
7	12:04 PM	4.5	134.6	33.4	-0.2	0.0	-0.6	PASS	0.1	PASS
8	12: 06 PM	5.0	149.5	37.0	-0.3	0.0	-0.7	PASS	0.0	PASS
9	12: 09 PM	5.5	164.5	39.3	-0.1	0.0	-0.1	PASS	-0.1	PASS
10	12: 12 PM	6.0	179.4	42.6	0.4	-0.1	0.9	PASS	-0.1	PASS
11	12: 15 PM	6.5	194.4	44.4	0.4	-0.6	0.8	PASS	-1.3	PASS
12	12:18 PM	7.0	209.3	47.3	0.8	0.0	1.6	PASS	0.0	PASS
13	12:21 PM	7.5	224.3	48.6	0.4	-0.2	0.7	PASS	-0.3	PASS
14	12:25 PM	8.0	239.2	49.3	0.7	-0.3	1.5	PASS	-0.6	PASS
15	12:28 PM	8.5	254.2	52.8	3.0	-0.1	5.7	PASS	-0.2	PASS
16	12:32 PM	9.0	269.1	52.7	1.0	-0.1	1.8	PASS	-0.3	PASS
17	12:36 PM	-	270.0	55.2	1.0	-0.3	1.8	PASS	-0.5	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
1	12:40 PM	1.5	44.9	-12.2	0.1	-0.1	-1.0	PASS	0.7	PASS
2	12:46 PM	2.0	59.8	-16.4	0.0	0.0	-0.3	PASS	-0.1	PASS
3	12:50 PM	2.5	74.8	-20.3	0.2	0.1	-0.8	PASS	-0.5	PASS
4	12:52 PM	3.0	89.7	-24.6	0.2	0.1	-0.6	PASS	-0.3	PASS
5	12:55 PM	3.5	104.7	-28.8	0.2	0.1	-0.7	PASS	-0.5	PASS
6	12:59 PM	4.0	119.6	-30.9	0.2	0.2	-0.8	PASS	-0.6	PASS
7	1:02 PM	4.5	134.6	-35.6	0.2	0.2	-0.7	PASS	-0.4	PASS
8	1:05 PM	5.0	149.5	-38.0	0.1	-0.1	-0.3	PASS	0.2	PASS
9	1:08 PM	5.5	164.5	-42.7	0.2	0.1	-0.4	PASS	-0.3	PASS
10	1:11 PM	6.0	179.4	-46.4	0.4	0.1	-0.8	PASS	-0.3	PASS
11	1:14 PM	6.5	194.4	-48.1	0.0	0.1	-0.1	PASS	-0.2	PASS
12	1:18 PM	7.0	209.3	-51.5	-0.4	0.0	0.7	PASS	0.0	PASS
13	1:21 PM	7.5	224.3	-52.6	0.1	0.1	-0.2	PASS	-0.1	PASS
14	2:24 PM	8.0	239.2	-54.6	-0.1	0.0	0.1	PASS	0.0	PASS
15	2:27 PM	8.5	254.2	-55.9	0.1	0.0	-0.2	PASS	0.0	PASS
16	2:30 PM	9.0	269.1	-57.0	0.1	0.1	-0.3	PASS	-0.2	PASS
17	2:33 PM	-	270.0	-56.3	0.0	-0.1	0.0	PASS	0.1	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	[X] No
Tire debeading	[ ] Yes	[X] No
Loss of pavement contact of vehicle tires	[ ] Yes	[X] No
Did the test driver experience any vehicle loss of control or spinout?	[ ] Yes	[X] 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
8	Counter Clockwise	5.0	149.5	-3.1	*PASS*
9	Counter Clockwise	5.5	164.5	-3.1	*PASS*
10	Counter Clockwise	6.0	179.4	-3.3	*PASS*
11	Counter Clockwise	6.5	194.4	-3.3	*PASS*
12	Counter Clockwise	7.0	209.3	-3.3	*PASS*
13	Counter Clockwise	7.5	224.3	-3.4	*PASS*
14	Counter Clockwise	8.0	239.2	-3.4	*PASS*
15	Counter Clockwise	8.5	254.2	-3.4	*PASS*
16	Counter Clockwise	9.0	269.1	-3.4	*PASS*
17	Counter Clockwise	-	270.0	-3.4	*PASS*
25	Clockwise	5.0	149.5	3.0	*PASS*
26	Clockwise	5.5	164.5	3.1	*PASS*
27	Clockwise	6.0	179.4	3.1	*PASS*
28	Clockwise	6.5	194.4	3.2	*PASS*
29	Clockwise	7.0	209.3	3.3	*PASS*
30	Clockwise	7.5	224.3	3.3	*PASS*
31	Clockwise	8.0	239.2	3.3	*PASS*
32	Clockwise	8.5	254.2	3.3	*PASS*
33	Clockwise	9.0	269.1	3.4	*PASS*
34	Clockwise	-	270.0	3.4	*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: *B Kebschull* DATE RECORDED: *1/6/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *1/10/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car :*

NHTSA No. *CA5206* Data Sheet Completion Date: *1/6/2010*

TEST 1

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnected steering angle 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 as specified in section 13.12.B.

[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 as specified in section 13.12.B

[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: Both "VDF OFF" and "SLIP" telltales illuminate immediately after malfunction is simulated and ignition is activated.
After system is restored, both telltales extinguish immediately when ignition is activated

RECORDED BY: *B Kebschull* DATE RECORDED: *1/6/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED *1/10/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Nissan Altima Passenger Car :*

NHTSA No. *CA5206* Data Sheet Completion Date: *1/6/2010*

TEST 2

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnected LF 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 as specified in section 13.12.B.

[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 as specified in section 13.12.B

[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: "VDF OFF" , "SLIP" and "ABS" telltales illuminate immediately after malfunction is simulated and ignition is activated.
After system is restored, both telltales extinguish immediately when ignition is activated

RECORDED BY: *B Kebschull* DATE RECORDED: 1/6/2010

APPROVED BY: *J Lenkeit* DATE APPROVED *1/10/2010*

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: Innocal Date:1/15/09 Due: 1/15/10
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: Intercomp Date:1/29/09 Due: 1/29/10
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: Heitz Date:1/29/09_ Due: 1/29/10
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:11/18/09 Due: 11/18/10
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: ADAT Date:1/5/09 Due:1/5/10*
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:3/16/09 Due: 3/16/10
						DOT-NHTSA D2647	By: DRI Date:3/16/09 Due: 3/16/10

* Speed sensor was checked and verified on the test track prior to test

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: Somat Date:1/13/09 Due: 1/14/10
					SoMat High level Board EHLS	MSHLS.03-3182	By: Somat Date:1/14/09 Due: 1/15/10
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	By: Davis Date:2/3/09 Due: 2/3/10
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.	N/A	N/A	N/A	DRI manufactured Aluminum meeting the weight and MOI specifications of Docket 2007-27662-11	N/A	N/A

5.0 PHOTOGRAPHS (29 of 14)

Figure 5.1. Front View of Test Vehicle as Delivered

5.0 PHOTOGRAPHS (2 of 14)

Figure 5.2. Rear View of Test Vehicle as Delivered

5.0 PHOTOGRAPHS (3 of 14)

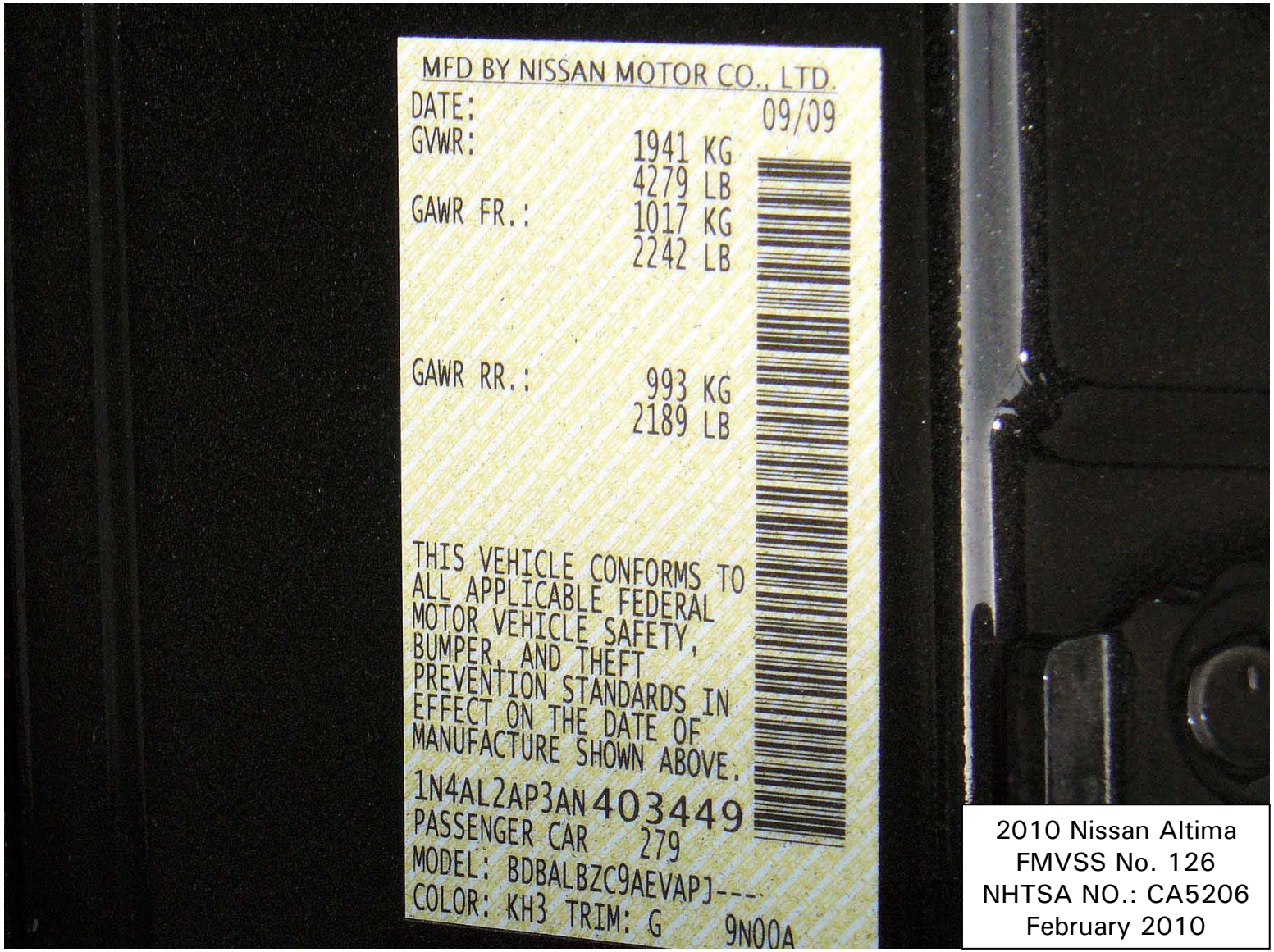


Figure 5.3. Vehicle Certification Label

5.0 PHOTOGRAPHS (4 of 14)

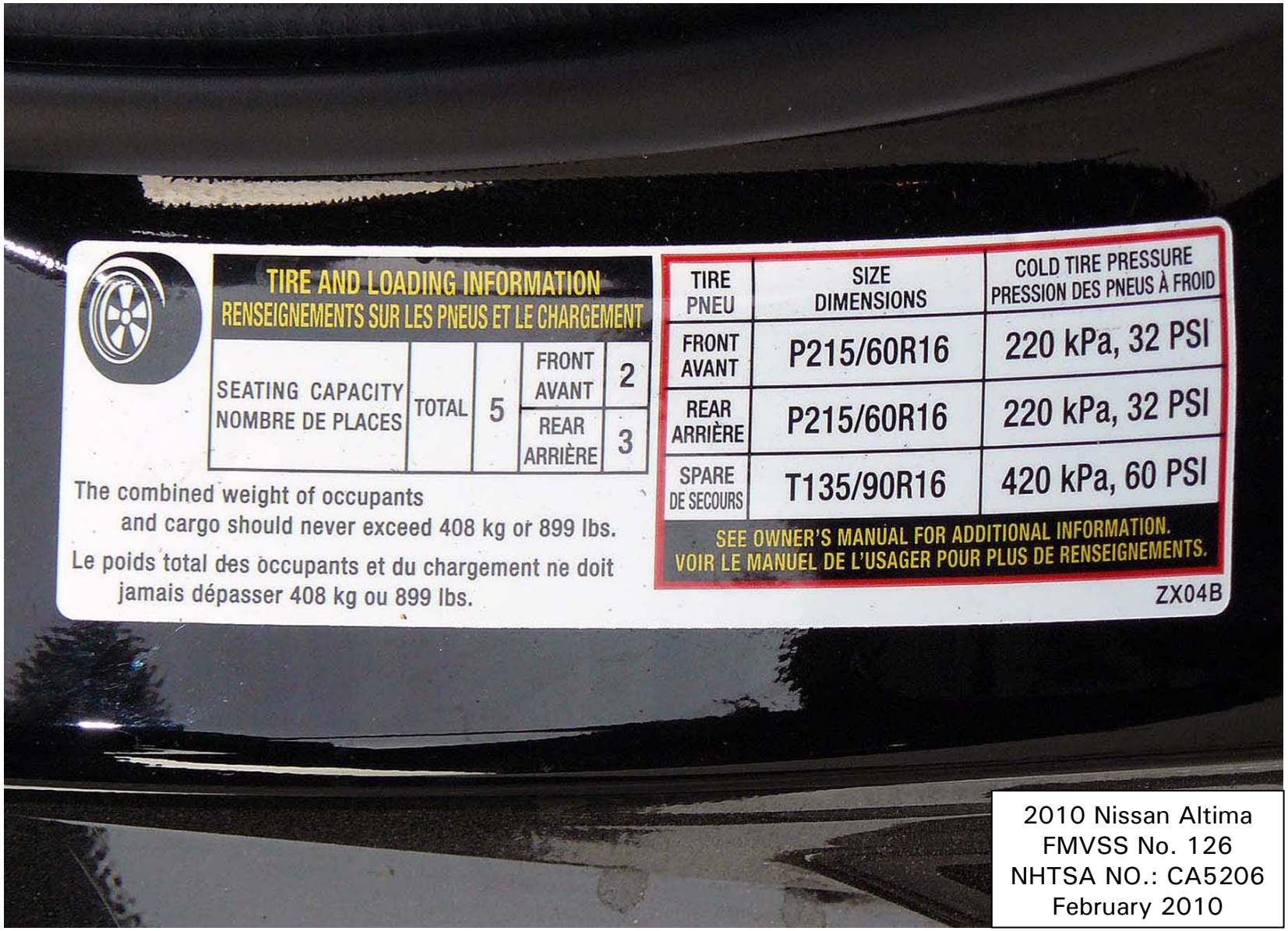


Figure 5.4. Vehicle Placard

5.0 PHOTOGRAPHS (5 of 14)

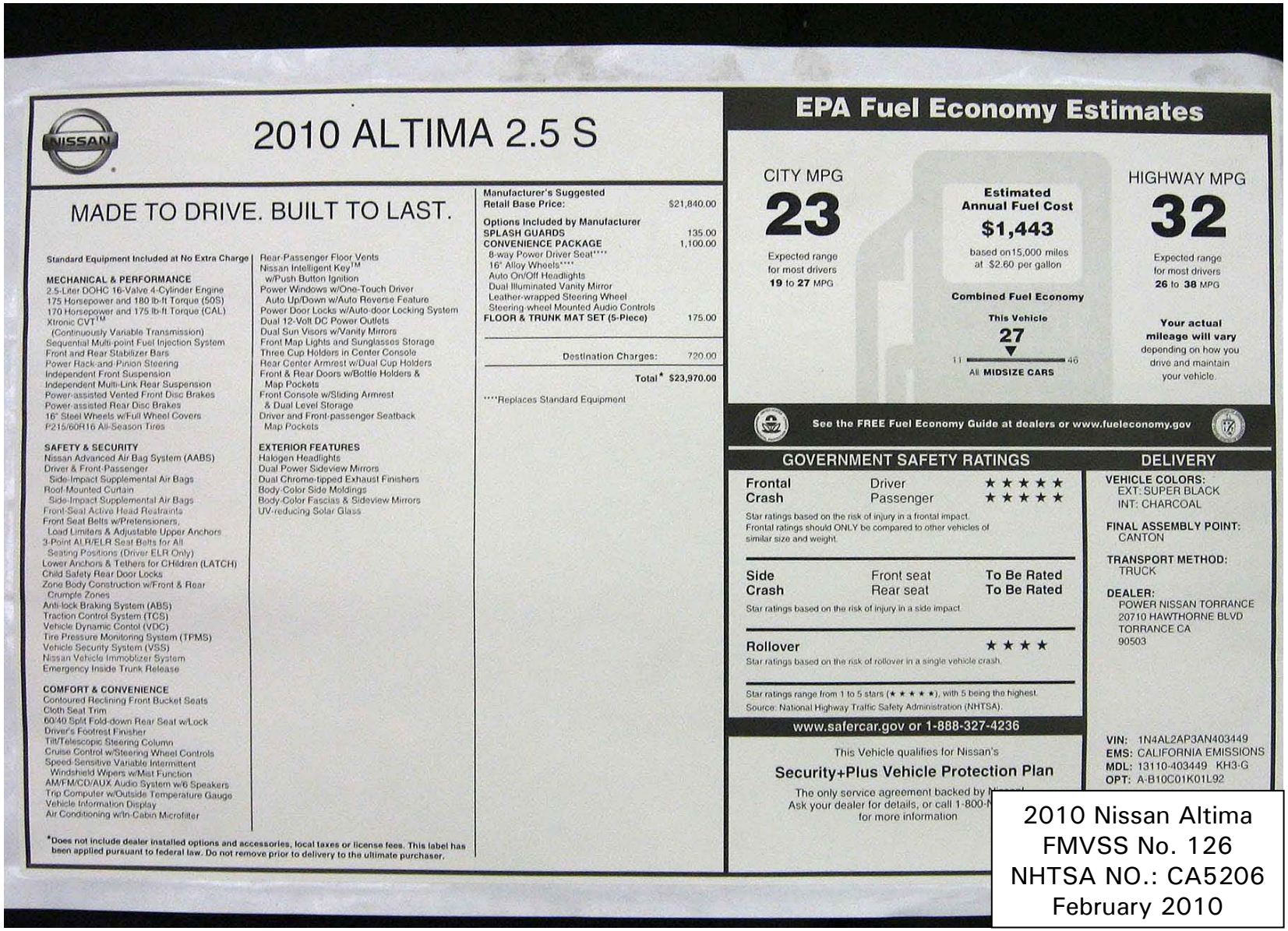


Figure 5.5. Window Sticker (Monroney Label)

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)

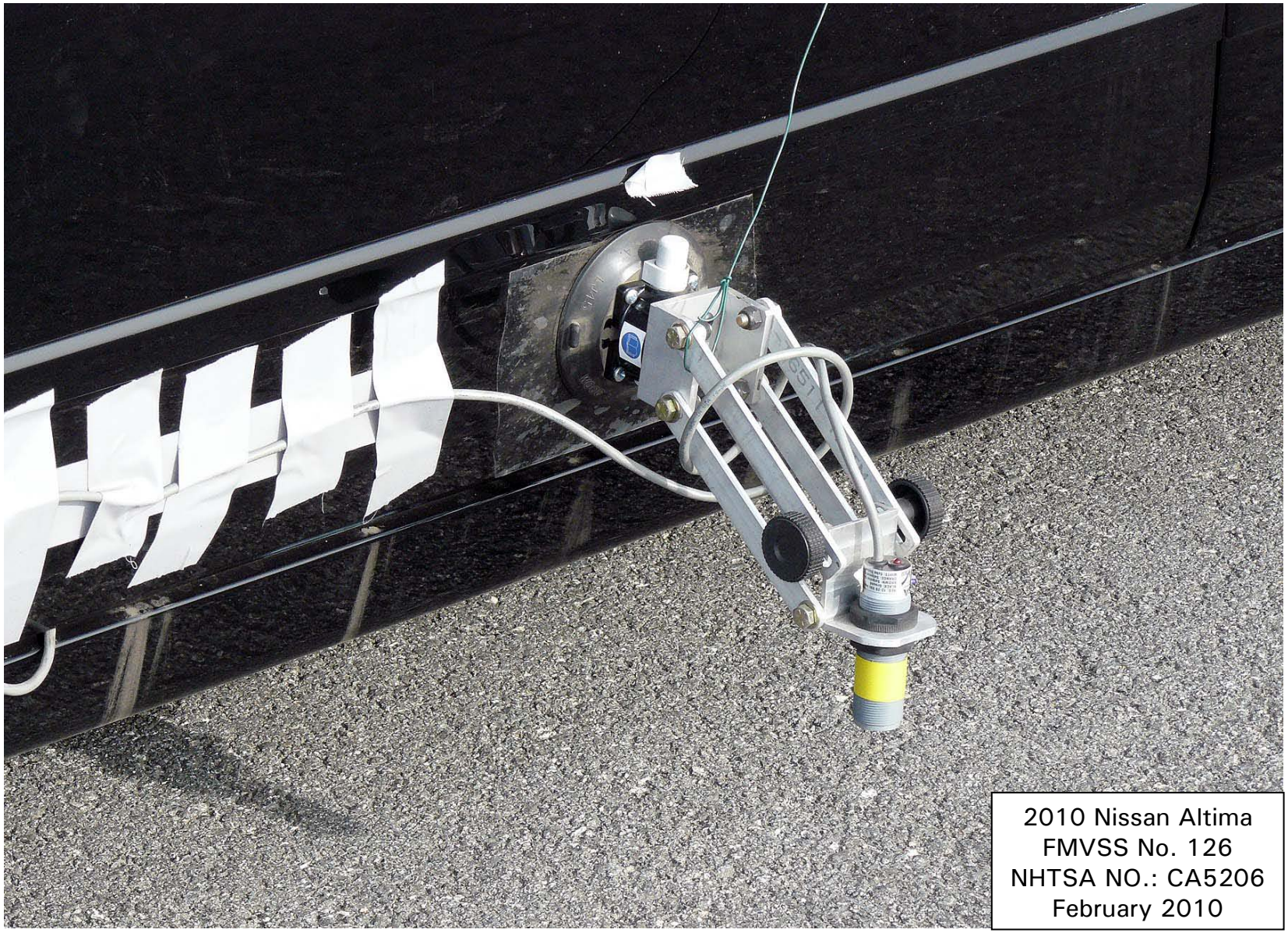


Figure 5.10. Ultrasonic Height Sensor Mounted on Left side of Vehicle for Determining Body Roll Angle

5.0 PHOTOGRAPHS (11 of 14)

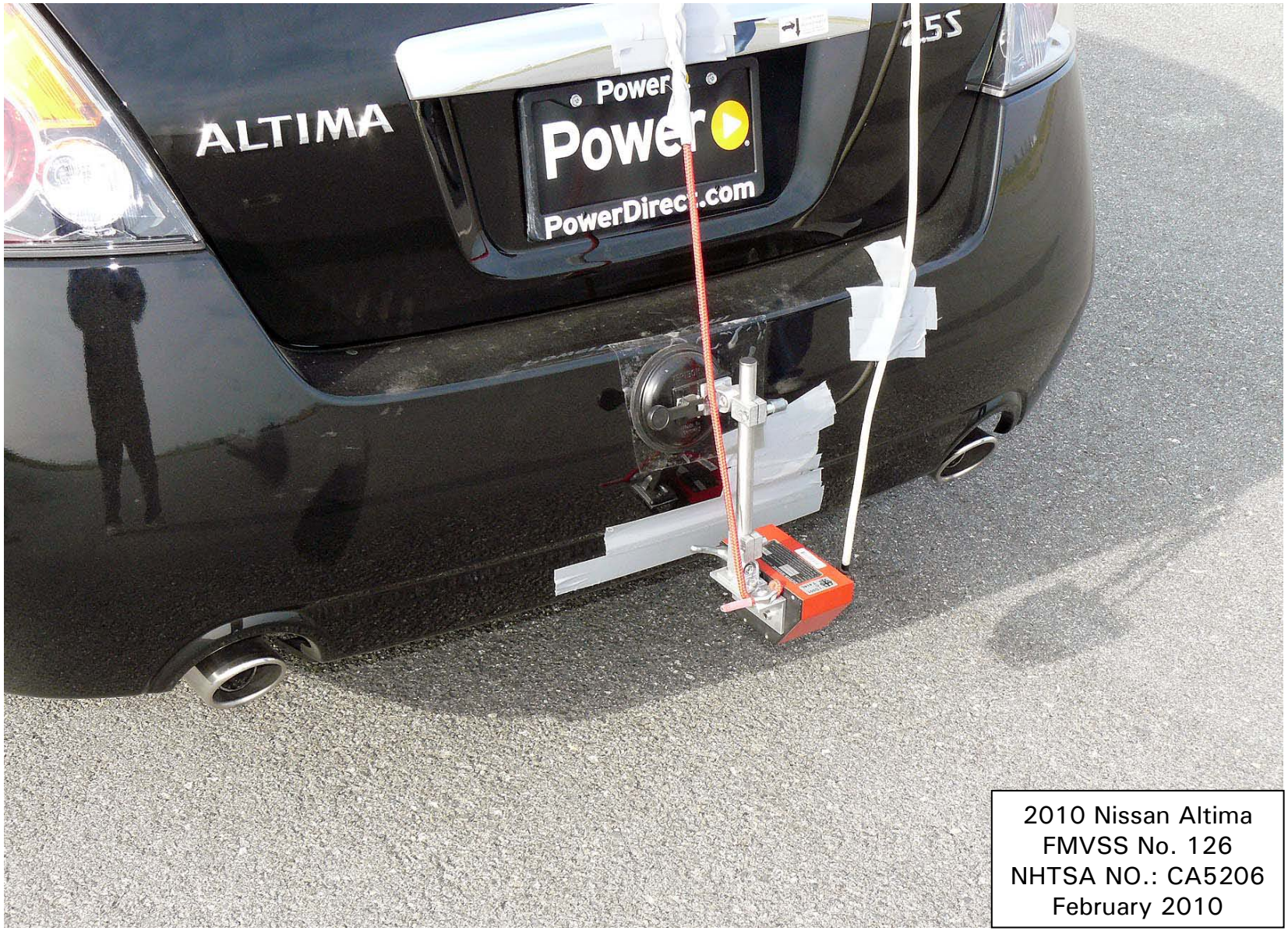


Figure 5.11. Rear Bumper Mounted Speed Sensor

5.0 PHOTOGRAPHS (12 of 14)

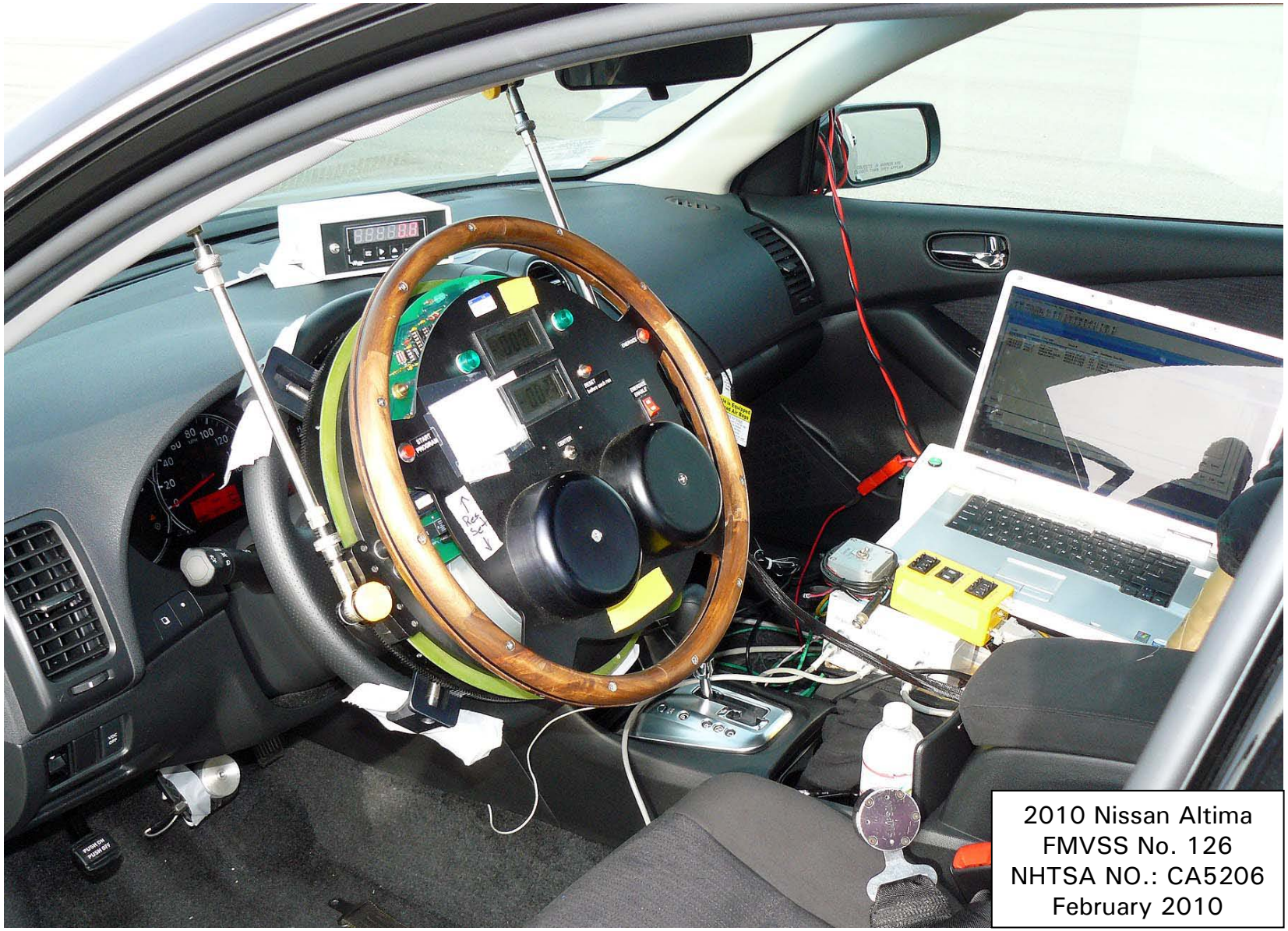


Figure 5.12. Steering Controller and Data Acquisition Computer

5.0 PHOTOGRAPHS (13 of 14)

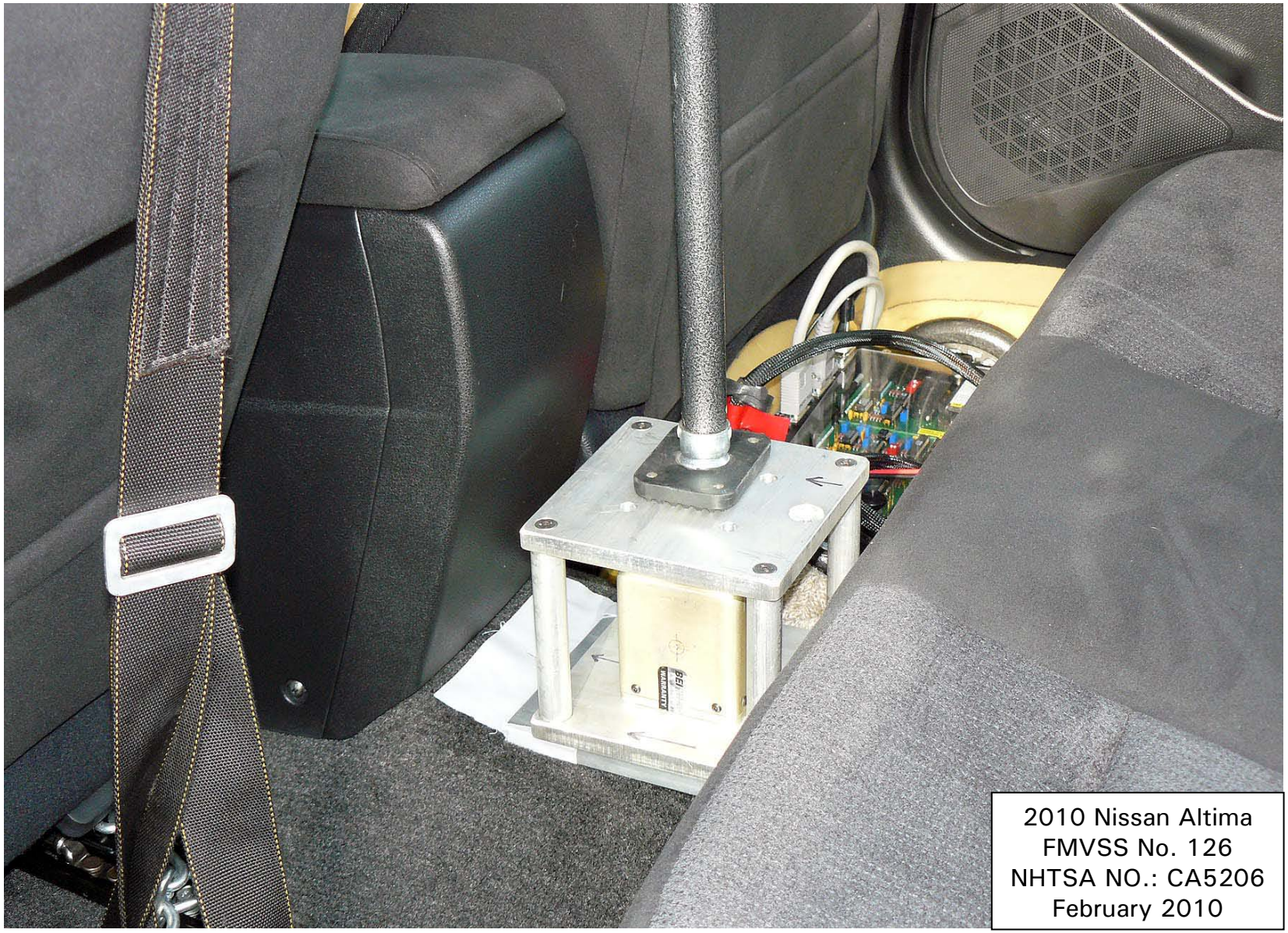


Figure 5.13. Inertial Measurement Unit Mounted in Vehicle

5.0 PHOTOGRAPHS (14 of 14)

Figure 5.14. Brake Pedal Load Cell

6.0 DATA PLOTS (1 of 4)

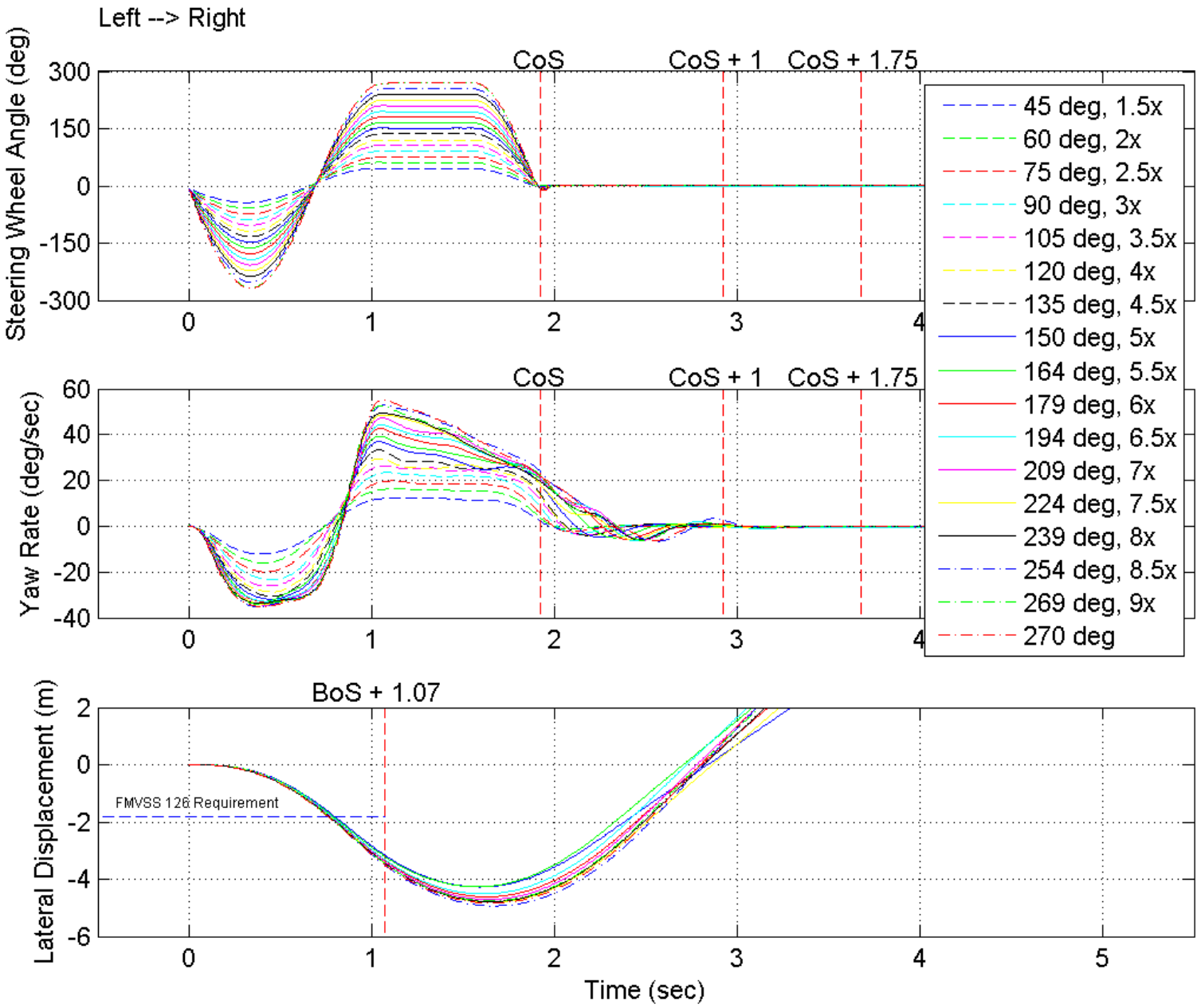


Figure 6.1. Steering Wheel Angle, Yaw Rate and Lateral Displacement for L-R Series

6.0 DATA PLOTS (2 of 4)

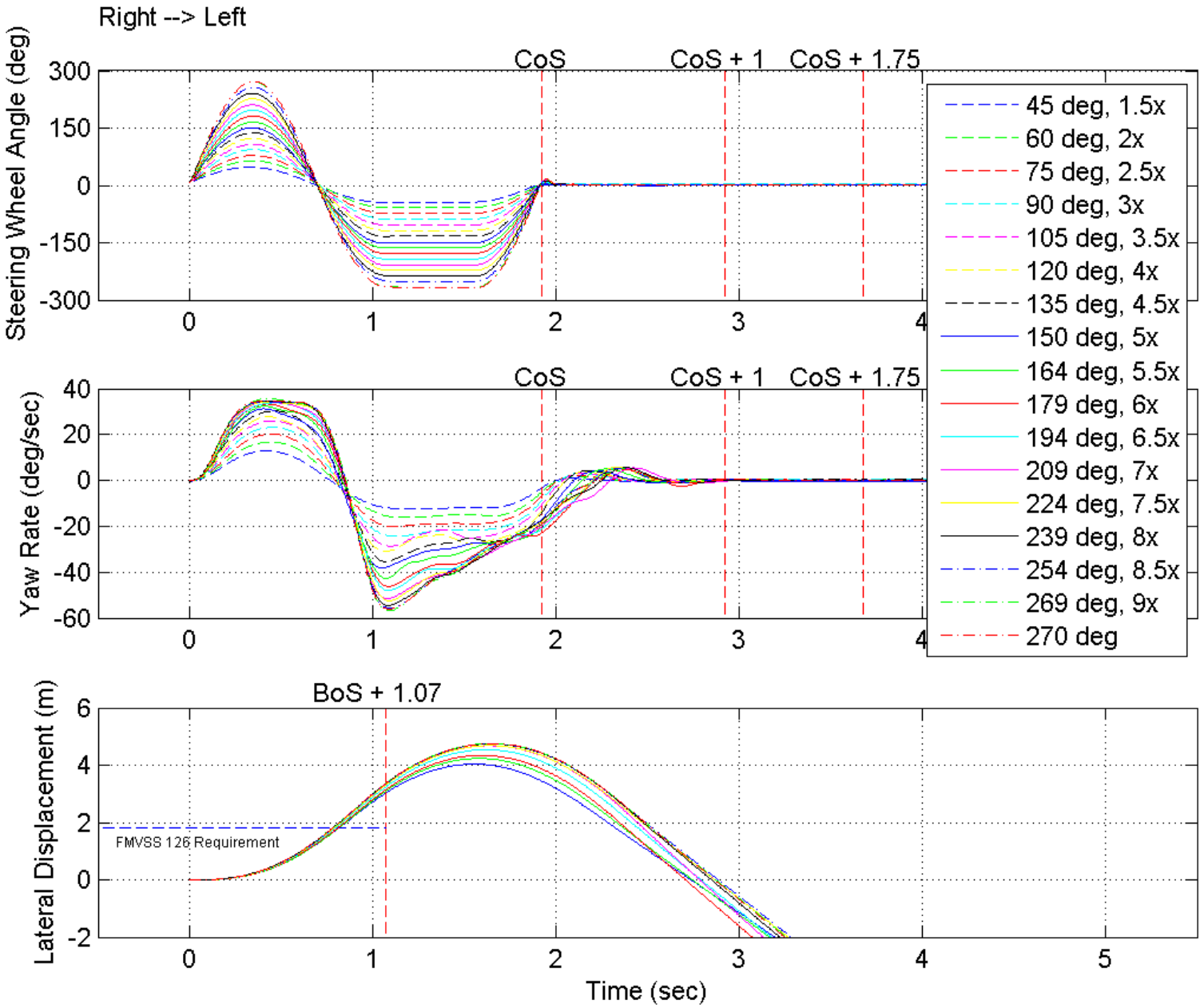


Figure 6.2. Steering Wheel Angle, Yaw Rate and Lateral Displacement for R-L Series

6.0 DATA PLOTS (3 of 4)

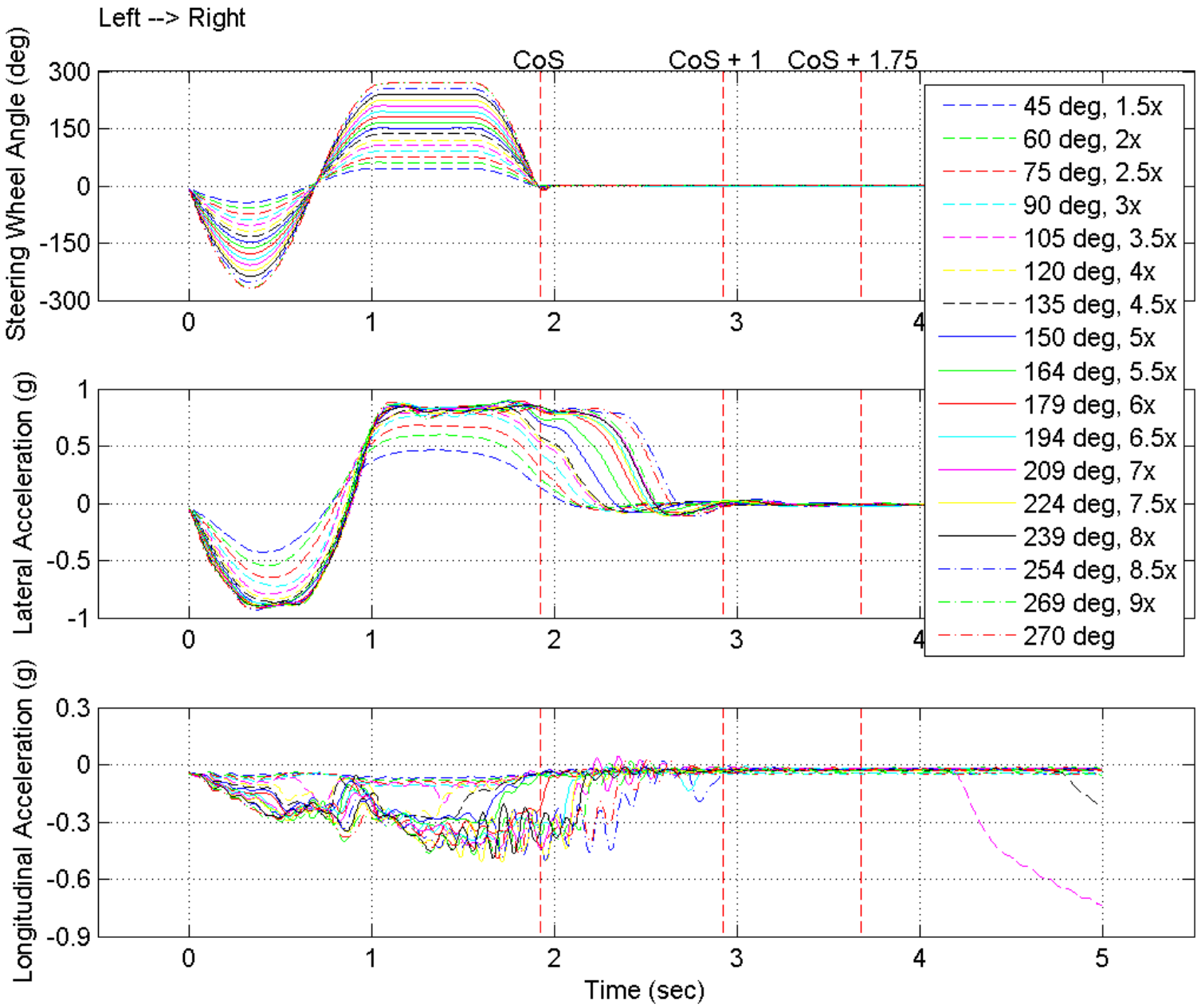


Figure 6.3. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for L-R Series

6.0 DATA PLOTS (4 of 4)

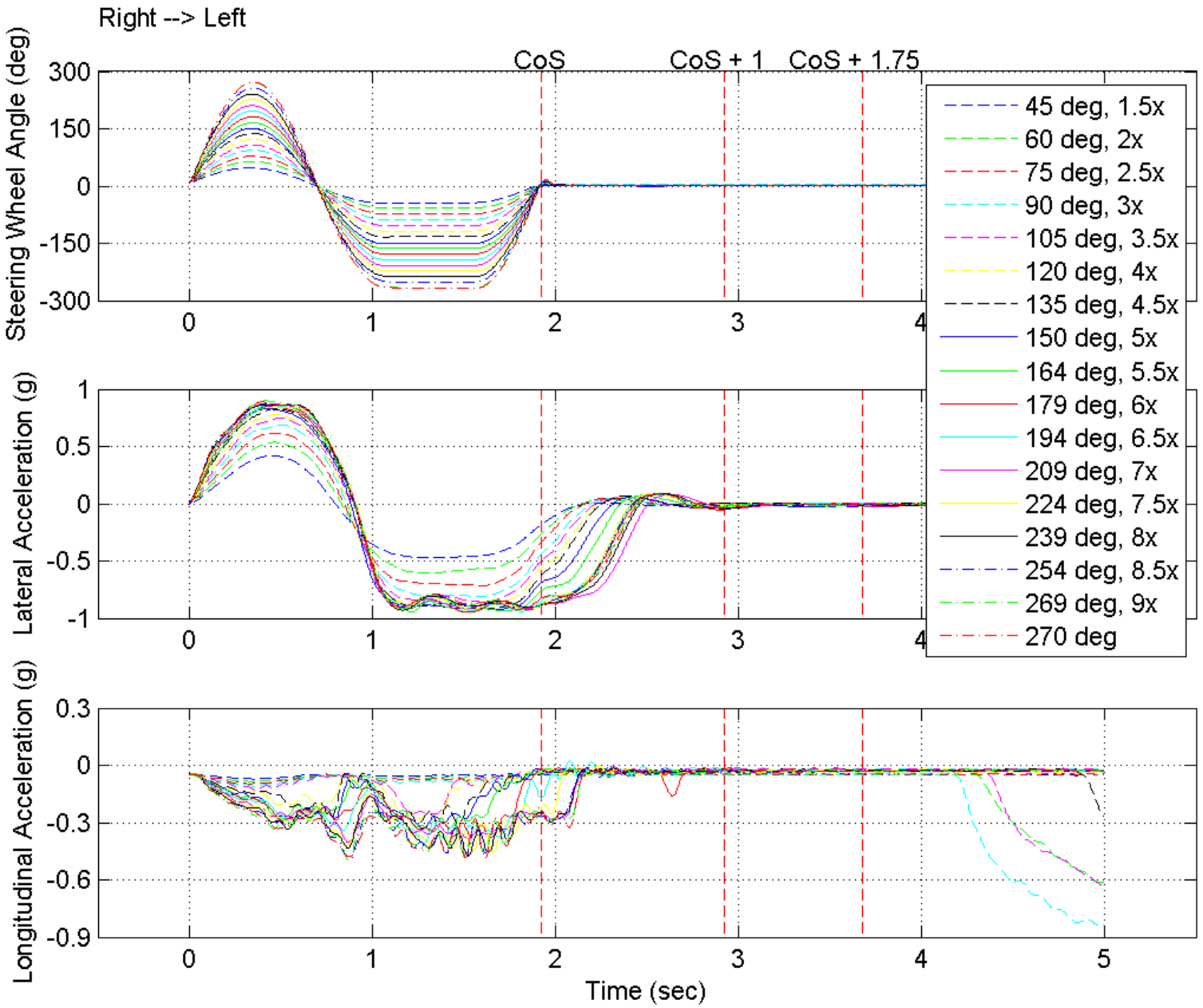


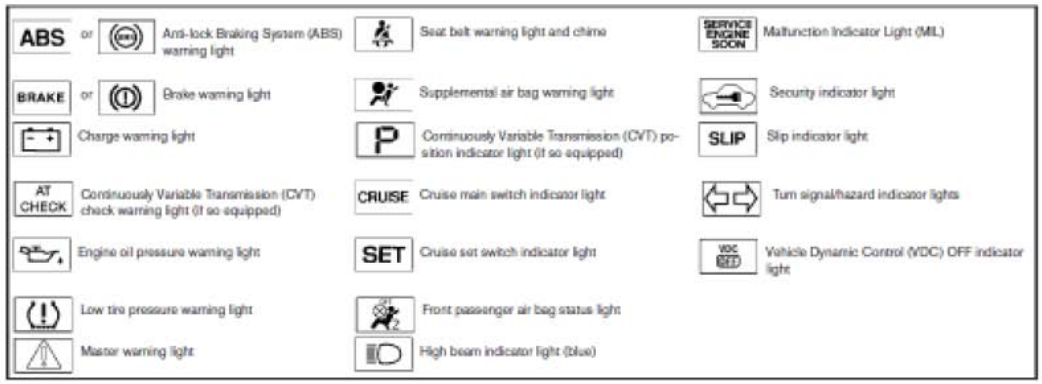
Figure 6.4. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for R-L Series

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

7.1 OWNER'S MANUAL PAGES

WARNING/INDICATOR LIGHTS AND AUDIBLE REMINDERS



CHECKING BULBS

With all doors closed, apply the parking brake and place the ignition switch in the ON position without starting the engine. The following lights will come on:

, BRAKE or , , SERVICE ENGINE SOON, ,

The following lights come on briefly and then go off:

ABS or , , VDC OFF, SLIP, AT CHECK

If any light fails to come on, it may indicate a burned-out bulb or an open circuit in the electrical system. Have the system repaired promptly.

WARNING LIGHTS

ABS or Anti-lock Braking System (ABS) warning light

When the ignition switch is placed in the ON position, the Anti-lock Braking System (ABS) warning light illuminates and then turns off. This indicates the ABS is operational.

If the ABS warning light illuminates while the engine is running, or while driving, it may indicate the ABS is not functioning properly. Have the system checked by a NISSAN dealer.

If an ABS malfunction occurs, the anti-lock function is turned off. The brake system then operates normally, but without anti-lock assistance. See "Brake system" in the "Starting and driving" section.

BRAKE or Brake warning light

This light functions for both the parking brake and the foot brake systems.

Parking brake indicator

When the ignition switch is placed in the ON position, the light comes on when the parking brake is applied.

Low brake fluid warning light

When the ignition switch is placed in the ON position, the light warns of a low brake fluid level. If the light comes on while the engine is running with the parking brake not applied, stop the vehicle and perform the following:

1. Check the brake fluid level. Add brake fluid as necessary. See "Brake fluid" in the "Maintenance and do-it-yourself" section of this manual.
2. If the brake fluid level is correct, have the warning system checked by a NISSAN dealer.

⚠WARNING

- **Your brake system may not be working properly if the warning light is on. Driving could be dangerous. If you judge it to be safe, drive carefully to the nearest service station for repairs. Otherwise, have your vehicle towed because driving it could be dangerous.**
- **Pressing the brake pedal with the engine stopped and/or a low brake fluid level may increase your stopping distance and braking will require greater pedal effort as well as pedal travel.**
- **If the brake fluid level is below the MINIMUM or MIN mark on the brake fluid reservoir, do not drive until the brake system has been checked at a NISSAN dealer.**

Anti-lock Braking System (ABS) warning indicator

When the parking brake is released and the brake fluid level is sufficient, if both the brake warning light and the Anti-lock Braking System (ABS) warning light illuminate, it may indicate the ABS is not functioning properly. Have the brake system checked, and if necessary repaired by a NISSAN dealer promptly. Avoid high-speed driving and abrupt braking. (See "Anti-lock Braking System (ABS) warning light" in this section.)

Charge warning light

If this light comes on while the engine is running, it may indicate the charging system is not functioning properly. Turn the engine off and check the generator belt. If the belt is loose, broken, missing, or if the light remains on, see a NISSAN dealer immediately.

The high beam indicator light also comes on when the passing signal is activated.

Malfunction Indicator Light (MIL)

If this indicator light comes on steady or blinks while the engine is running, it may indicate a potential emission control malfunction.

The Malfunction Indicator Light may also come on steady if the fuel-filler cap is loose or missing, or if the vehicle runs out of fuel. Check to make sure the fuel-filler cap is installed and closed tightly, and that the vehicle has at least 3 gallons (11.4 liters) of fuel in the fuel tank.

After a few driving trips, the light should turn off if no other potential emission control system malfunction exists.

If this indicator light comes on steady for 20 seconds and then blinks for 10 seconds when the engine is not running, it indicates that the vehicle is not ready for an emission control system inspection/maintenance test. See "Readiness for inspection/maintenance (I/M) test" in the "Technical and consumer information" section of this manual.

Operation

The Malfunction Indicator Light will come on in one of two ways:

- Malfunction Indicator Light on steady — An emission control system malfunction has been detected. Check the fuel-filler cap. If the fuel-filler cap is loose or missing, tighten or install the cap and continue to drive the vehicle. The light should turn off after a few driving trips. If the light does not turn off after a few driving trips, have the vehicle inspected by a NISSAN dealer. You do not need to have your vehicle towed to the dealer.
- Malfunction Indicator Light blinking — An engine misfire has been detected which may damage the emission control system. To reduce or avoid emission control system damage:
  - do not drive at speeds above 45 MPH (72 km/h).
  - avoid hard acceleration or deceleration.
  - avoid steep uphill grades.
  - if possible, reduce the amount of cargo being hauled or towed.

The Malfunction Indicator Light may stop blinking and come on steady. Have the vehicle inspected by a NISSAN dealer. You do not need to have your vehicle towed to the dealer.

⚠ CAUTION

Continued vehicle operation without having the emission control system checked and repaired as necessary could lead to poor driveability, reduced fuel economy, and possible damage to the emission control system.

Security indicator light

This light blinks when the ignition switch is placed in the OFF, LOCK or ACC position.

The blinking security indicator light indicates that the security systems equipped on the vehicle are operational.

For additional information, see "Security systems" later in this section.

SLIP Slip indicator light

This indicator will blink when the VDC system is operating, thus alerting the driver to the fact that the road surface is slippery and the vehicle is nearing its traction limits.

You may feel or hear the system working; this is normal.

The light will blink for a few seconds after the VDC system stops limiting wheel spin.

The SLIP indicator light also comes on when you place the ignition switch in the ON position. The light will turn off after approximately 2 seconds if the system is operational. If the light does not come on have the system checked by a NISSAN dealer or qualified workshop.

Turn signal/hazard indicator lights

The appropriate light flashes when the turn signal switch is activated.

Both lights flash when the hazard switch is turned on.

VDC OFF Vehicle Dynamic Control (VDC) OFF indicator light

This indicator light comes on when the Vehicle Dynamic Control off switch is pushed to OFF. This indicates the Vehicle Dynamic Control has been turned off.

Push the Vehicle Dynamic Control off switch again or restart the engine and the system will operate normally. See "Vehicle Dynamic Control (VDC) system" in the "Starting and driving" section of this manual.

The Vehicle Dynamic Control light also comes on when you push the push-button ignition switch to the ON position. The light will turn off after about 2 seconds if the system is operational. If the light stays on or comes on along with the SLIP indicator light while you are driving, have the Vehicle Dynamic Control system checked by a NISSAN dealer.

While the Vehicle Dynamic Control system is operating, you might feel slight vibration or hear the system working when starting the vehicle or accelerating, but this is normal.

AUDIBLE REMINDERS

Brake pad wear warning

The disc brake pads have audible wear warnings. When a disc brake pad requires replacement, it makes a high pitched scraping sound when the vehicle is in motion, whether or not the brake pedal is depressed. Have the brakes checked as soon as possible if the warning sound is heard.

Key reminder chime

A chime sounds if the driver's door is opened while the ignition switch is placed in the ACC or OFF position or placed in the OFF or LOCK position with the Intelligent Key left in the Intelligent Key port. Make sure the ignition switch is placed in the LOCK position, and take the Intelligent Key with you when leaving the vehicle.

Light reminder chime

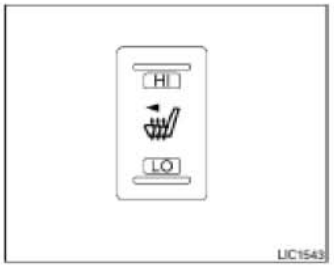
With the ignition switch placed in the OFF position, a chime sounds when the driver's door is opened if the headlights or parking lights are on.

Turn the headlight control switch off before leaving the vehicle.

NISSAN Intelligent Key™ door buzzer

The Intelligent Key door buzzer sounds if the Intelligent Key is left inside the vehicle when locking the doors. When the buzzer sounds, be sure to check both the vehicle and the Intelligent Key. See "NISSAN Intelligent Key™ " in the "Pre-driving checks and adjustments" section.

HEATED SEAT (if so equipped)



The front seats are warmed by built-in heaters.

1. Start the engine.
2. Push the low or high position of the switch, as desired, depending on the temperature. The indicator light in the switch will illuminate.

   The heater is controlled by a thermostat, automatically turning the heater on and off. The indicator light will remain on as long as the switch is on.
3. When the seat is warmed or before you leave the vehicle, be sure to turn the switch off.

CAUTION

- **Do not use the seat heater for extended periods or when no one is using the seat.**
- **Do not put anything on the seat which insulates heat, such as a blanket, cushion, seat cover, etc. Otherwise, the seat may become overheated.**
- **Do not place anything hard or heavy on the seat or pierce it with a pin or similar object. This may result in damage to the heater.**
- **Any liquid spilled on the heated seat should be removed immediately with a dry cloth.**
- **When cleaning the seat, never use gasoline, benzine, thinner, or any similar materials.**
- **If any abnormalities are found or the heated seat does not operate, turn the switch off and have the system checked by your NISSAN dealer.**
- **The battery could run down if the seat heater is operated while the engine is not running.**

VEHICLE DYNAMIC CONTROL (VDC) OFF SWITCH

The vehicle should be driven with the Vehicle Dynamic Control (VDC) system on for most driving conditions.

If the vehicle is stuck in mud or snow, the VDC system reduces the engine output to reduce wheel spin. The engine speed will be reduced even if the accelerator is depressed to the floor. If maximum engine power is needed to free a stuck vehicle, turn the VDC system off.

To turn off the VDC system, push the VDC OFF switch. The VDC OFF indicator will come on.

Push the VDC OFF switch again or restart the engine to turn on the system. See "Vehicle Dynamic Control (VDC) system" in the "Starting and driving" section.

To dry the brakes, drive the vehicle at a safe speed while lightly pressing the brake pedal to heat up the brakes. Do this until the brakes return to normal. Avoid driving the vehicle at high speeds until the brakes function correctly.

ANTI-LOCK BRAKING SYSTEM (ABS)

WARNING

- **The Anti-lock Braking System (ABS) is a sophisticated device, but it cannot prevent accidents resulting from careless or dangerous driving techniques. It can help maintain vehicle control during braking on slippery surfaces. Remember that stopping distances on slippery surfaces will be longer than on normal surfaces even with ABS. Stopping distances may also be longer on rough, gravel or snow covered roads, or if you are using tire chains. Always maintain a safe distance from the vehicle in front of you. Ultimately, the driver is responsible for safety.**
- **Tire type and condition may also affect braking effectiveness.**
  - **When replacing tires, install the specified size of tires on all four wheels.**
  - **When installing a spare tire, make sure that it is the proper size and type as specified on the Tire and Loading Information label. See "Tire and Loading Information label" in the "Technical and consumer information" section of this manual.**
  - **For detailed information, see "Wheels and tires" in the Maintenance and do-it-yourself" section of this manual.**

The Anti-lock Braking System (ABS) controls the brakes so the wheels do not lock during hard braking or when braking on slippery surfaces. The system detects the rotation speed at each wheel and varies the brake fluid pressure to prevent each wheel from locking and sliding. By preventing each wheel from locking, the system helps the driver maintain steering control and helps to minimize swerving and spinning on slippery surfaces.

Using the system

Depress the brake pedal and hold it down. Depress the brake pedal with firm steady pressure, but do not pump the brakes. The ABS will operate to prevent the wheels from locking up. Steer the vehicle to avoid obstacles.

WARNING

Do not pump the brake pedal. Doing so may result in increased stopping distances.

Self-test feature

The ABS includes electronic sensors, electric pumps, hydraulic solenoids and a computer. The computer has a built-in diagnostic feature that tests the system each time you start the engine and move the vehicle at a low speed in forward or reverse. When the self-test occurs, you may hear a "clunk" noise and/or feel a pulsation in the brake pedal. This is normal and does not indicate a malfunction. If the computer senses a malfunction, it switches the ABS off and illuminates the ABS warning light on the instrument panel. The brake system then operates normally, but without anti-lock assistance.

If the ABS warning light illuminates during the self-test or while driving, have the vehicle checked by a NISSAN dealer.

VEHICLE DYNAMIC CONTROL (VDC) SYSTEM

Normal operation

The ABS operates at speeds above 3 - 6 MPH (5 - 10 km/h). The speed varies according to road conditions.

When the ABS senses that 1 or more wheels are close to locking up, the actuator rapidly applies and releases hydraulic pressure. This action is similar to pumping the brakes very quickly. You may feel a pulsation in the brake pedal and hear a noise from under the hood or feel a vibration from the actuator when it is operating. This is normal and indicates that the ABS is operating properly. However, the pulsation may indicate that road conditions are hazardous and extra care is required while driving.

The Vehicle Dynamic Control (VDC) system uses various sensors to monitor driver inputs and vehicle motion. Under certain driving situations, the system will control braking and engine output to help keep the vehicle on its steered path.

- When the Vehicle Dynamic Control (VDC) system is operating, the **SLIP** indicator in the instrument panel blinks.
- If the **SLIP** indicator blinks, the road conditions may be slippery. Be sure to adjust your speed and driving to these conditions. See "Slip indicator light", and "Vehicle Dynamic Control (VDC) off indicator light" in the "Instruments and controls" section.
- Indicator light
  If a malfunction occurs in the system, the **SLIP** and VDC OFF indicator lights come on in the instrument panel.
  As long as these indicator lights are on, the traction control function is canceled.

If the vehicle is operated with the Vehicle Dynamic Control system off using the VDC OFF switch, VDC and the Traction Control System (TCS) functions will be turned off. The **SLIP** indicator will flash if wheel spin is detected. The ABS will still operate with the VDC system off.

When the VDC system is operating, you may feel a pulsation in the brake pedal and hear a noise or vibration from under the hood. This is normal and indicates that the VDC system is working properly.

The computer has a built in diagnostic feature that tests the system each time you start the engine and move the vehicle forward or in reverse at a slow speed. When the self-test occurs, you may hear a clunk noise and/or feel a pulsation in the brake pedal. This is normal and is not an indication of a malfunction.

⚠WARNING

- **The Vehicle Dynamic Control system is designed to help improve driving stability but does not prevent accidents due to abrupt steering operation at high speeds or by careless or dangerous driving techniques. Reduce vehicle speed and be especially careful when driving and cornering on slippery surfaces and always drive carefully.**
- **Do not modify the vehicle's suspension. If suspension parts such as shock absorbers, struts, springs, stabilizer bars, bushings and wheels are not NISSAN approved for your vehicle or are extremely deteriorated the Vehicle Dynamic Control system may not operate properly. This could adversely affect vehicle handling performance, and the VDC OFF indicator light may come on.**
- **If brake related parts such as brake pads, rotors and calipers are not standard equipment or are extremely deteriorated, the Vehicle Dynamic Control system may not operate properly and the Vehicle Dynamic Control off indicator light may come on.**
- **When driving on extremely inclined surfaces such as higher banked corners, the Vehicle Dynamic Control system may not operate properly and the VDC OFF indicator light may come on. Do not drive on these types of roads.**
- **When driving on an unstable surface such as a turntable, ferry, elevator or ramp, the Vehicle Dynamic Control off indicator light may illuminate. This is not a malfunction. Restart the engine after driving onto a stable surface.**
- **If wheels or tires other than the recommended ones are used, the Vehicle Dynamic Control system may not operate properly and the Vehicle Dynamic Control off indicator light may come on.**
- **The Vehicle Dynamic Control system is not a substitute for winter tires or tire chains on a snow covered road.**

COLD WEATHER DRIVING

FREEING A FROZEN DOOR LOCK

To prevent a door lock from freezing, apply de-icer through the key hole. If the lock becomes frozen, heat the key before inserting it into the key hole or use the remote keyless entry function on the intelligent key.

ANTI-FREEZE

In the winter when it is anticipated that the temperature will drop below 32°F (0°C), check the anti-freeze to assure proper winter protection. For details, see "Engine cooling system" in the "Maintenance and do-it-yourself" section of this manual.

BATTERY

If the battery is not fully charged during extremely cold weather conditions, the battery fluid may freeze and damage the battery. To maintain maximum efficiency, the battery should be checked regularly. For details, see "Battery" in the "Maintenance and do-it-yourself" section of this manual.

7.2 VEHICLE ARRIVAL CONDITION REPORT

CONTRACT NO.: DTNH22-08-D-00098
DATE: *12/7/2009*

From: *Competitive Vehicle Services* Purpose ☒ Initial Receipt
☐ Received via Transfer
To: *Dynamic Research, Inc* ☐ Present Vehicle

Vehicle VIN: *1N4AL2AP3AN403449* NHTSA NO.: *CA5206*
Model Year: *2010* Odometer Reading: *13* Miles
Make *Nissan* Body Style: *Passenger Car*
Model: *Altima* Body Color: *Black*
Manufacture Date: *9/09* Dealer: *Competitive Vehicle Services*
GVWR (kg/lb) *1941/4279* 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: *12/7/2009*

APPROVED BY: *P Broen* DATE APPROVED: *12/7/2009*

7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO.: DTNH22-08-D-00098
DATE: *1/14/2010*

Vehicle VIN: *1N4AL2AP3AN403449* NHTSA NO.: *CA5206*

Model Year: *2010* Odometer Reading: *66* Miles
Make: *Nissan* Body Style: *Passenger Car*
Model: *Altima* Body Color: *Black*
Manufacture Date: *9/09* Dealer: *Competitive Vehicle Services*
GVWR (kg/lb) *1941 (4279)* 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:

None

Explanation for equipment removal:

NA

Test Vehicle Condition:

Like New

RECORDED BY: *J Lenkeit* DATE RECORDED: *1/14/2010*

APPROVED BY: *B Kebschull* DATE APPROVED: *1/14/2010*

7.4 SINE WITH DWELL TEST RESULTS

2010 Nissan Altima Passenger Car
NHTSA No.: *CA5206*
Date of Test: *1/6/2010*
Date Created: *1/6/2010*

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	YR 175	YRR 175 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)
22	710	49.9	3.5	1091	5.4	847	4.2	-1.3	-0.2	1291	-1.0	-0.1	1441	12.6	953	-3.9	0.4	45.0	775	44.9
23	709	50.0	3.5	1091	5.4	847	4.2	-1.2	-0.2	1291	-0.3	0.0	1441	16.2	939	-5.3	0.5	60.1	775	59.8
24	708	49.7	3.5	1090	5.4	847	4.2	-1.2	-0.2	1290	-1.1	-0.2	1440	19.8	932	-6.4	0.6	75.0	776	74.8
25	707	49.9	3.5	1090	5.4	846	4.2	-1.0	-0.2	1290	-0.8	-0.2	1440	23.6	926	-7.5	0.7	89.9	775	89.7
26	707	49.8	3.5	1090	5.4	847	4.2	-0.8	-0.2	1290	0.1	0.0	1440	26.5	923	-8.4	0.7	104.8	775	104.6
27	707	49.9	3.5	1090	5.4	846	4.2	-1.2	-0.3	1290	-0.4	-0.1	1440	29.6	917	-9.2	0.7	119.9	775	119.5
28	706	49.9	3.5	1090	5.4	846	4.2	-0.6	-0.2	1290	0.1	0.0	1440	33.4	916	-9.6	0.7	134.9	775	134.4
29	706	49.9	3.5	1090	5.4	846	4.2	-0.7	-0.3	1290	0.0	0.0	1440	37.0	916	-10.2	0.8	149.8	775	149.4
30	706	49.9	3.5	1090	5.4	846	4.2	-0.1	-0.1	1290	-0.1	0.0	1440	39.3	916	-10.3	0.8	163.9	775	163.4
31	706	49.8	3.5	1090	5.4	846	4.2	0.9	0.4	1290	-0.1	-0.1	1440	42.6	917	-10.7	0.8	178.9	775	178.4
32	706	50.0	3.5	1090	5.4	847	4.2	0.8	0.4	1290	-1.3	-0.6	1440	44.4	918	-10.7	0.8	193.8	775	193.5
33	706	50.0	3.5	1090	5.4	847	4.2	1.6	0.8	1290	0.0	0.0	1440	47.3	920	-10.9	0.8	208.7	775	208.5
34	706	50.0	3.5	1090	5.4	847	4.2	0.7	0.4	1290	-0.3	-0.2	1440	48.6	922	-11.1	0.8	223.8	775	223.6
35	706	50.0	3.5	1090	5.4	847	4.2	1.5	0.7	1290	-0.6	-0.3	1440	49.3	920	-11.1	0.8	238.8	775	238.6
36	706	50.1	3.5	1090	5.4	846	4.2	5.7	3.0	1290	-0.2	-0.1	1440	52.8	921	-11.3	0.8	253.8	776	253.6
37	706	49.8	3.5	1090	5.4	847	4.2	1.8	1.0	1290	-0.3	-0.1	1440	52.7	918	-11.1	0.9	268.9	776	268.6
38	706	50.1	3.5	1090	5.4	847	4.2	1.8	1.0	1290	-0.5	-0.3	1440	55.2	921	-11.3	0.9	269.9	776	269.6

7.4 SINE WITH DWELL TEST RESULTS

2010 Nissan Altima Passenger Car
NHTSA No.: *CA5206*
Date of Test : *1/6/2010*
Date Created: *1/6/2010*

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)
39	710	49.9	3.5	1091	5.4	847	4.2	-1.0	0.1	1291	0.7	-0.1	1441	-12.2	941	4.3	-0.4	45.7	776	45.5
40	709	49.9	3.5	1090	5.4	847	4.2	-0.3	0.0	1290	-0.1	0.0	1440	-16.4	939	5.4	-0.5	60.5	776	60.5
41	708	49.9	3.5	1090	5.4	847	4.2	-0.8	0.2	1290	-0.5	0.1	1440	-20.3	929	6.5	-0.6	75.4	776	75.4
42	707	50.0	3.5	1090	5.4	847	4.2	-0.6	0.2	1290	-0.3	0.1	1440	-24.6	932	7.4	-0.7	90.3	775	90.5
43	707	49.6	3.5	1090	5.4	846	4.2	-0.7	0.2	1290	-0.5	0.1	1440	-28.8	926	8.3	-0.7	105.2	775	105.3
44	706	50.1	3.5	1090	5.4	847	4.2	-0.8	0.2	1290	-0.6	0.2	1440	-30.9	921	8.7	-0.8	120.2	776	120.4
45	706	49.9	3.5	1090	5.4	847	4.2	-0.7	0.2	1290	-0.4	0.2	1440	-35.6	920	9.5	-0.8	135.2	776	135.4
46	706	50.0	3.5	1090	5.4	847	4.2	-0.3	0.1	1290	0.2	-0.1	1440	-38.0	917	9.8	-0.8	150.3	775	150.3
47	706	49.9	3.5	1090	5.4	846	4.2	-0.4	0.2	1290	-0.3	0.1	1440	-42.7	921	10.1	-0.8	164.4	775	164.4
48	706	49.9	3.5	1090	5.4	847	4.2	-0.8	0.4	1290	-0.3	0.1	1440	-46.4	923	10.3	-0.8	179.6	775	179.3
49	706	50.0	3.5	1090	5.4	846	4.2	-0.1	0.0	1290	-0.2	0.1	1440	-48.1	923	10.6	-0.8	194.7	775	194.1
50	706	50.0	3.5	1090	5.4	847	4.2	0.7	-0.4	1290	0.0	0.0	1440	-51.5	923	10.8	-0.8	209.7	775	209.0
51	706	49.7	3.5	1090	5.4	847	4.2	-0.2	0.1	1290	-0.1	0.1	1440	-52.6	924	10.8	-0.8	224.8	775	224.1
52	706	49.9	3.5	1090	5.4	847	4.2	0.1	-0.1	1290	0.0	0.0	1440	-54.6	924	10.9	-0.8	239.7	775	239.2
53	706	50.0	3.5	1090	5.4	847	4.2	-0.2	0.1	1290	0.0	0.0	1440	-55.9	925	11.0	-0.8	254.6	776	254.2
54	706	49.6	3.5	1090	5.4	846	4.2	-0.3	0.1	1290	-0.2	0.1	1440	-57.0	924	11.0	-0.8	269.6	776	269.2
55	706	50.0	3.5	1090	5.4	847	4.2	0.0	0.0	1290	0.1	-0.1	1440	-56.3	924	11.0	-0.8	270.5	776	270.2

7.5 SLOWLY INCREASING STEER TEST RESULTS

2010 Nissan Altima Passenger Car
NHTSA No.: *CA5206*
Date of Test : *1/6/2010*
Date Created: *1/6/2010*

File	EventPt	DOS	MES	Mean SPD	AYcount_3	THETAENCF_3	AYCG_CD2_3	r_squared	ZeroBegin	ZeroEnd
			(mph)	(mph)		(deg)	(g)			
10	700	1	50.87	50.15	1151	-30.13	-0.2947	0.9914	500	700
11	700	1	49.44	50.70	1137	-29.22	-0.2980	0.9973	500	700
12	700	0	50.27	50.19	1147	29.96	0.2981	0.9970	500	700
13	700	0	50.03	50.01	1139	29.61	0.2964	0.9954	500	700
16	700	0	50.16	49.78	1143	29.86	0.3002	0.9978	500	700
9	700	1	50.36	50.26	1163	-30.91	-0.3005	0.9834	500	700
					Averages	29.9	0.2980			

Scalars	Steering Angles (deg)
1.5	45
2.0	60
2.5	75
3.0	90
3.5	105
4.0	120
4.5	135
5.0	150

Scalars	Steering Angles (deg)
5.5	164
6.0	179
6.5	194
7.0	209
7.5	224
8.0	239
8.5	254
9.0	269
	270

7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

Vehicle:	**2010 Nissan Altima Passenger Car**	NHTSA No.:	CA5206
Wheelbase:	105.3 Inches	Faro Arm S/N:	U08-05-08-06636
Measurement date:	1/5/2010	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	2.393	-3.795	0.000
M_Point_48_Ref	0.000	0.000	-
M_CIRCLE001_I_Left_Rear_Wheel_Axle	-34.581	13.036	-12.474
M_Point_IMU_side	3.784	45.888	-16.967
M_Point_ROOF	-	-	-57.516

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	3.784	47.413	-16.967

Measurment 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 meaurements:
   - 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	**66.935**	**-0.587**	**16.967**

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).