126-DRI-10-007
SAFETY COMPLIANCE TESTING FOR FMVSS 126
Electronic Stability Control Systems

Mitsubishi Motors Corporation, Japan
2010 Mitsubishi Lancer
NHTSA No. CA5600

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

11 November, 2010

Final Report

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

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

Approved By: [signature]

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16. Abstract A test was conducted on a 2010 Mitsubishi Lancer , NHTSA No. CA5600, 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 Mitsubishi Lancer, 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 Mitsubishi Lancer 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 Mitsubishi Lancer*

NHTSA No. *CA5600* VIN: *JA32U1FU4AU007104*

Vehicle Type: *Passenger Car* Manufacture Date: *8/09*

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 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data Sheet Completion Date: *4/16/2010*

VIN *JA32U1FU4AU007104* Manufacture Date: *8/09*

GVWR (kg): *1850.0* Front GAWR (kg): *1010.0* Rear GAWR (kg): *910.0*

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: *P205/60 R16* Rear axle: *P205/60 R16*

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

		Front Axle		Rear Axle
	Tire Manufacturer:	*Yokohama*		*Yokohama*
	Tire Model:	*Avid S34*		*Avid S34*
	Tire Size:	*P205/60 R16*		*P205/60 R16*
TIN	Left Front:	*FDNO N2L 2409*	Right Front:	*FDNO N2L 2409*
	Left Rear:	*FDNO N2L 2409*	Right Rear:	*FDNO N2L 2409*

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: *Front Wheel Drive*
Mode: *Default- ESC on*
Drive Configuration: *Front Wheel Drive*
Mode: *Default- ESC off*
Drive Configuration:
Mode:

VEHICLE STABILITY SYSTEMS (Check applicable technologies):

List other systems:

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

REMARKS:

RECORDED BY: *J Lenkeit* DATE RECORDED: *4/16/2010*
APPROVED BY: *B Kebschull* DATE APPROVED: *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No *CA5600* Data Sheet Completion Date: *4/19/2010*

ESC SYSTEM IDENTIFICATION

Manufacturer/Model *Continental Automotive, MK60E1*

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: *ECUs include engine ECU and transmission ECU*

ESC OPERATIONAL CHARACTERISTICS

System is capable of generating brake torque at each wheel — [X] Yes (Pass) / [ ] No (Fail)
List and describe Components: *Hydraulic control unit is able to adjust brake pressure at each wheel individually by switching valves and activation of the pump independent of driver's brake actuation.*

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: *Steering wheel angle sensor*

System is capable of estimating side slip or side slip derivative — [X] Yes (Pass) / [ ] No (Fail)
List and describe Components: *Side slip derivative is estimated from yaw rate and lateral acceleration data.*

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: *Torque reduction is achieved by means of throttle position control by the ECM.*

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:
Acceleration, braking, coasting, and during activation of ABS or traction control

Vehicle manufacturer submitted documentation explaining how the ESC mitigates understeer

X Yes (Pass)
___ No (Fail)

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

REMARKS:

RECORDED BY: *Brian Kebschull* DATE RECORDED: *4/19/2010*
APPROVED BY: *J lenkeit* DATE APPROVED: *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data Sheet completion date: *4/16/2010*

ESC Malfunction Telltale

Vehicle is equipped with malfunction telltale? *Yes*

Telltale Location: *Multi-information display between speedometer and tachometer*

Telltale Color: *Amber*

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.

In addition to the above symbol the message information center displays the abbreviation "ASC OFF", an exclamation point to the right of the symbol, and the words,"SERVICE REQUIRED"below the symbol. Refer to figure 5.6 and p 3-142 in the owner's manual.

Is telltale part of a common space? *Yes*

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

If yes explain telltale operation during ESC activation:

Vehicle "slip" symbol in center of multi-information display blinks when ESC is operating, see p 3-142 in the owner's manual.

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: *Multi-information display between speedometer and tachometer*

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. *"ASC OFF" displayed in upper right of common display area. See figure 5.6 and p 3-141 of owner's manual.*

Is telltale part of a common space? *Yes*

DATA INDICATES COMPLIANCE ***Yes***

(Vehicle is compliant if equipped with a malfunction telltale)

Remarks:

RECORDED BY: *J Lenkeit* DATE RECORDED: *4/16/2010*

APPROVED BY: *Brian Kebschull* DATE APPROVED: *4/20/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data Sheet completion date: *4/16/2010*

"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 *Left knee bolster (Figure 5.7)*
Labeling *ASC OFF*
Modes *ESC On/Off*

Second Control: Location ___
Labeling ___
Modes ___

Identify standard or default drive configuration *FWD*

Verify standard or default drive configuration selected **X** Yes ___ No

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

X Yes ___ No (Fail)

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

X Yes ___ No (Fail)

If no, describe how the "Off" control functions

3.0 TEST DATA (CONTD)

Data Sheet 4 (Page 2 of 3)
ESC AND ANCILLARY SYSTEM CONTROLS

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

Control Mode	"ESC Off" telltale illuminates upon activation of control? (Yes/No)	"ESC Off" telltale extinguishes upon cycling ignition? (Yes/No)
None		

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?

___ Yes ___ No X NA

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

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

Ancillary Control: System None

Control Description _____

Labeling _____

Ancillary Control: System _____

Control Description _____

Labeling _____

Ancillary Control: System _____

Control Description _____

Labeling _____

3.0 TEST DATA (CONTD)

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

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

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

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

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

For each 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: ESC off switch must be held down for 3 seconds or longer to turn ESC off. When ESC is turned off, traction control is also turned off. There is no way to turn off ESC and traction control separately.

RECORDED BY: *J Lenkeit* DATE RECORDED: *4/16/2010*
APPROVED BY: *Brian Kebschull* DATE APPROVED: *4/20/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data Sheet completion date: *4/22/2010*

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

Peak Friction Coefficient (at least 0.9) *0.97*

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

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

Coolant *Yes* *Oil, Washer fluid*

Tire Pressures:

Required; Front Axle *240* KPA Rear Axle *240* KPA

Actual; LF *240* KPA RF *240* KPA

LR *240* KPA RR *240* KPA

Vehicle Dimensions: Front Track Width *153.0* cm Wheelbase *262.6* cm

Rear Track Width *152.7* cm

Vehicle Weight Ratings: GAWR Front *1010.0* KG GAWR Rear *910.0* KG

Unloaded Vehicle Weight (UVW):

Front Axle *820.1* KG Left Front *422.3* KG Right Front *397.8* KG

Rear Axle *533.0* KG Left Rear *264.0* KG Right Rear *269.0* KG

Total UVW *1353.1* KG

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

Calculated baseline weight (UVW + 73kg) *1426.1* KG

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

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 *NA* KG Left front *NA* KG Right front *NA* KG

Rear axle *NA* KG Left rear *NA* KG Right rear *NA* KG

Total UVW with outriggers *NA* KG

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

Front axle *907.7* KG Left front *469.0* KG Right front *438.7* KG

Rear axle *606.1* KG Left rear *315.5* KG Right rear *290.6* KG

Vehicle Weight *1513.8* KG

Ballast Required =

[Total UVW with Outriggers (if applicable)]		+ *168*	KG	- [Loaded Weight w/Driver and Instrumentation)]	
= *1353.1*	KG	+ *168*	KG	- 1513.8	KG

= *7.3* KG

Total Loaded Vehicle Weight w/Driver and Instrumentation and Ballast

Front axle *909.4* KG Left front *470.1* KG Right front *439.3* KG

Rear axle *611.9* KG Left rear *317.2* KG Right rear *294.7* KG

Total UVW *1521.3* 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	*41.6*	in	*105.6*	cm	*65.5*	in	*166.3*	cm
y-distance	*-1.1*	in	*-2.7*	cm	*0.4*	in	*1.0*	cm
z-distance	*22.3*	in	*56.6*	cm	*18.0*	in	*45.6*	cm
Roof Height					*58.6*	in	*148.8*	cm
Distance between ultrasonic sensors					*79.75*	in	*202.6*	cm

Remarks:

RECORDED BY: *Brian Kebschull* DATE RECORDED: *4/22/2010*
APPROVED BY: *J Lenkeit* DATE APPROVED: *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600*

Measured tire pressure: LF *247* KPA RF *247* KPA

LR *245* KPA RR *247* KPA

Wind Speed *1.6* 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)) *10.8* °C

Brake Conditioning Time: *10:25:00 AM* Date: *4/22/2010*

56 km/h (35 mph) Brake Stops

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

Observed deceleration rate range (.5g target) *.45-.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 *0.8-0.9* 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:	*10:37:00 AM*		Date:	*4/22/2010*	
Measured cold tire pressure	LF	*258*	KPA	RF	*258*	KPA
	LR	*250*	KPA	RR	*250*	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)) *11.1* °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 - 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	*0.42*
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	*0.82*

* 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: *12:31:00 PM* Date: *4/22/2010*

Measured cold tire pressure LF *254* KPA RF *250* KPA

LR *249* KPA RR *248* KPA

Wind Speed *1* 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)) *15.3* °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 - 33.6*
4-6	Counterclockwise	0.5 - 0.6	*0.5-0.6*	*32 - 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	*16-18*	56 ± 2 (35 ± 1)	*80* (cycles 1-10)	0.5 - 0.6	*0.54*
4	*19*	56 ± 2 (35 ± 1)	*80* (cycles 1-9)	0.5 - 0.6	*0.54*
			160 (cycle 10)*	NA	*0.82*

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

Remarks:

RECORDED BY: *Brian Kebschull* DATE RECORDED: *4/22/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600*

Measured tire pressure: LF *258* KPA RF *256* KPA

LR *251* KPA RR *250* KPA

Wind Speed *0.7* 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)) *11.2* °C

Selected drive configuration *FWD*

Selected Mode: *Default- ESC on*

Preliminary Left Steer Maneuver:

Lateral Acceleration measured at 30 degrees steering wheel angle

$a_{y,30degrees}$ = *0.36* 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} = *45.8* degrees (@.55g)

δ_{sis} = *50* 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	*11:20:25 AM*	*-29.1*	*10*	*Good*
2	Left	*11:24:57 AM*	*-28.6*	*11*	*Good*
3	Left	*11:28:56 AM*	*-28.5*	*12*	*Good*
4	Left				
5	Left	*6:23:37 PM*			
1	Right	*11:32:36 AM*	*28.8*	*13*	*Good*
2	Right	*11:35:44 AM*	*27.9*	*14*	*Good*
3	Right	*11:38:33 AM*	*28*	*15*	*Good*
4	Right				
5	Right				

3.0 TEST DATA (CONTD)

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

Average Overall Steering Wheel Angle:

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

$\delta_{0.3\ g,\ overall}$ = *28.5* degrees

[to nearest 0.1 degree]

Remarks:

RECORDED BY: *Brian Kebschull* DATE RECORDED: *4/22/2010*
APPROVED BY: *J Lenkeit* DATE APPROVED: *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data sheet completion date: *4/22/2010*

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 (Default)*

Selected Mode: *Default*

Overall steering wheel angle ($\delta_{0.3\ g,\ overall}$) *28.5* 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
21	13:00	1.5	43	12.74	-0.2	-0.19	-1.60	Pass	-1.46	Pass
22	13:04	2.0	57	16.35	-0.13	-0.12	-0.82	Pass	-0.75	Pass
23	13:07	2.5	71	20.28	-0.16	-0.17	-0.76	Pass	-0.83	Pass
24	13:10	3.0	86	24.28	-0.27	-0.28	-1.09	Pass	-1.15	Pass
26	13:16	3.5	100	27.49	-0.11	0.00	-0.39	Pass	0.01	Pass
27	13:19	4.0	114	31.52	-0.20	-0.14	-0.64	Pass	-0.43	Pass
28	13:22	4.5	128	36.55	-0.18	-0.16	-0.48	Pass	-0.44	Pass
29	13:26	5.0	142	39.66	-0.24	-0.25	-0.60	Pass	-0.63	Pass
30	13:29	5.5	157	45.5	-0.18	-0.18	-0.39	Pass	-0.40	Pass
31	13:32	6.0	171	49.19	-0.17	-0.04	-0.35	Pass	-0.08	Pass
32	13:35	6.5	185	48.69	-0.19	-0.17	-0.39	Pass	-0.35	Pass
33	13:38	7.0	200	52.24	-0.02	-0.05	-0.03	Pass	-0.09	Pass
34	13:41	7.5	214	52.66	-0.15	-0.14	-0.28	Pass	-0.27	Pass
35	13:44	8.0	228	55.18	-0.22	-0.06	-0.40	Pass	-0.11	Pass
36	13:47	8.5	242	55.84	-0.17	-0.07	-0.30	Pass	-0.12	Pass
37	13:50	9.0	256	62.72	-0.23	-0.07	-0.36	Pass	-0.12	Pass
38	13:54	9.5	270	56.3	-0.05	0.07	-0.09	Pass	0.13	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
41	14:03	1.5	43	-12.5	0.02	-0.1	-0.19	Pass	0.81	Pass
42	14:06	2.0	57	-16.43	-0.10	-0.17	0.63	Pass	1.01	Pass
43	14:09	2.5	71	-20.35	0.09	0.21	-0.43	Pass	-1.03	Pass
44	14:12	3.0	86	-26.01	-0.98	-1.04	3.78	Pass	4.00	Pass
45	14:15	3.5	100	-29.72	0.07	0.00	-0.22	Pass	0.01	Pass
46	14:19	4.0	114	-34.16	0.09	0.07	-0.26	Pass	-0.19	Pass
47	14:22	4.5	128	-36.69	0.23	0.07	-0.62	Pass	-0.20	Pass
49	14:29	5.0	143	-42.40	0.04	0.10	-0.09	Pass	-0.24	Pass
50	14:31	5.5	157	-45.43	0.04	0.10	-0.08	Pass	-0.21	Pass
51	14:35	6.0	171	-49.84	-0.11	0.02	0.22	Pass	-0.05	Pass
52	14:37	6.5	185	-51.33	0.00	-0.01	0.01	Pass	0.03	Pass
53	14:41	7.0	200	-54.34	0.19	0.20	-0.34	Pass	-0.36	Pass
54	14:44	7.5	214	-56.91	-0.06	0.01	0.11	Pass	-0.03	Pass
55	14:46	8.0	228	-57.82	0.05	0.09	-0.08	Pass	-0.16	Pass
58	14:55	8.5	242	-61.19	0.20	0.20	-0.33	Pass	-0.33	Pass
60	15:02	9.0	257	-61.76	0.18	0.03	-0.29	Pass	-0.05	Pass
63	16:27	9.5	270	-64.15	-0.89	-0.98	1.38	Pass	1.53	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
29	Counter Clockwise	5.0	142	-3.1	PASS
30	Counter Clockwise	5.5	157	-3.3	PASS
31	Counter Clockwise	6.0	171	-3.3	PASS
32	Counter Clockwise	6.5	185	-3.3	PASS
33	Counter Clockwise	7.0	200	-3.4	PASS
34	Counter Clockwise	7.5	214	-3.3	PASS
35	Counter Clockwise	8.0	228	-3.4	PASS
36	Counter Clockwise	8.5	242	-3.4	PASS
37	Counter Clockwise	9.0	256	-3.5	PASS
38	Counter Clockwise	-	270	-3.4	PASS
49	Clockwise	5.0	143	3.1	PASS
50	Clockwise	5.5	157	3.2	PASS
51	Clockwise	6.0	171	3.3	PASS
52	Clockwise	6.5	185	3.3	PASS
53	Clockwise	7.0	200	3.3	PASS
54	Clockwise	7.5	214	3.4	PASS
55	Clockwise	8.0	228	3.4	PASS
58	Clockwise	8.5	242	3.4	PASS
60	Clockwise	9.0	257	3.4	PASS
63	Clockwise	-	270	3.5	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: *B Kebschull* DATE RECORDED: *4/22/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED: *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data Sheet Completion Date: *4/22/2010*

TEST 1

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnect left rear wheel speed sensor

MALFUNCTION TELLTALE ILLUMINATION:

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

X Yes No

Time for telltale to illuminate after ignition system is activated and vehicle speed of 48 ± 8 km/h (30 ± 5mph) is reached.

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

ESC SYSTEM RESTORATION

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

X Yes No

Time for telltale to extinguish after ignition system is activated and vehicle speed of 48 ± 8 km/h (30 ± 5mph) is reached.

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

TEST 1 DATA INDICATES COMPLIANCE: *PASS*

Remarks: *The "slip" indicator and "ASC OFF" with exclamation point telltales illuminated immediately upon ignition after sensor was disconnected. The ABS telltale also illuminated. After ESC system was restored, all telltales extinguished immediately upon ignition (no driving required).*

RECORDED BY: *Brian Kebschull* DATE RECORDED: *4/22/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED *5/3/2010*

3.0 TEST DATA (CONTD)

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

Vehicle: *2010 Mitsubishi Lancer Passenger Car*

NHTSA No. *CA5600* Data Sheet Completion Date: *4/22/2010*

TEST 2

MALFUNCTION SIMULATION: Describe method of malfunction simulation

Disconnected steering wheel 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.

[X] Yes [ ] No

Time for telltale to illuminate after ignition system is activated and vehicle speed of 48 ± 8 km/h (30 ± 5mph) is reached.

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

ESC SYSTEM RESTORATION

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

[X] Yes [ ] No

Time for telltale to extinguish after ignition system is activated and vehicle speed of 48 ± 8 km/h (30 ± 5mph) is reached.

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

TEST 2 DATA INDICATES COMPLIANCE: PASS

Remarks: *The "slip" indicator and "ASC OFF" with exclamation point telltales illuminated immediately upon ignition after sensor was disconnected. After ESC system was restored, both telltales extinguished immediately upon ignition (no driving required).*

RECORDED BY: *Brian Kebschull* DATE RECORDED: *4/22/2010*

APPROVED BY: *J Lenkeit* DATE APPROVED *5/3/2010*

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

TABLE 1. TEST INSTRUMENTATION

Type	Output	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Tire Pressure Gauge	Vehicle Tire Pressure	0-100 psi 0-690 kPa	1 psi 6.89 kPa	0.5 psi 3.45 kPa	Ashcroft D1005PS	1039350	By: DRI Date:2/25/10 Due: 2/25/11
Platform Scales	Vehicle Total, Wheel, and Axle Load	8000 lb 35.6 kN	0.5 lb 2.2 N	±1.0% of applied load	Intercomp Model SWII	24032361	By: American Scale Date: 2/25/10 Due: 2/25/11
Automated Steering Machine with Steering Angle Encoder	Handwheel Angle	±800 deg	0.25 deg	±0.25 deg	Heitz Automotive Testing Model: Sprint 3	60304	By: DRI Date: 2/25/10 Due: 2/25/11
Multi-Axis Inertial Sensing System	Longitudinal, Lateral, and Vertical Acceleration Roll, Yaw, and Pitch Rate	Accelerometers: ±2 g Angular Rate Sensors: ±100 deg/s	Accelerometers: ≤10 ug Angular Rate Sensors: ≤0.004 deg/s	Accelerometers: ≤0.05% of full range Angular Rate Sensors: 0.05% of full range	BEI Technologies Model: MotionPAK MP-1	0767	By: Systron Donner Date:11/23/09 Due: 11/23/10
Radar Speed Sensor and Dashboard Display	Vehicle Speed	0-125 mph 0-200 km/h	0.009 mph .014 km/h	±0.25% of full scale	A-DAT Corp. Radar Model: DRS-6 Display Model: RD-2	1400.604	By: DRI Date:3/2/10 Due:3/2/11
Ultrasonic Distance Measuring System	Left and Right Side Vehicle Height	5-24 inches 127-610 mm	0.01 inches .254 mm	±0.25% of maximum distance	Massa Products Corporation Model: M-5000/220	DOT-NHTSA D2646	By: DRI Date:2/26/10 Due: 2/26/11
						DOT-NHTSA D3272	By: DRI Date:2/26/10 Due: 2/26/11

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

TABLE 1. TEST INSTRUMENTATION (CONTD)

Type	Output	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Data Acquisition System [Includes amplification, anti-aliasing, and analog to digital conversion.]	Record Time; Velocity; Distance; Lateral, Longitudinal, and Vertical Accelerations; Roll, Yaw, and Pitch Rates; Steering Wheel Angle.	Sufficient to meet or exceed individual sensors	200 Hz	Sufficient to meet or exceed individual sensors	SoMat eDaq ECPU processor	MSHLB.03-2476	By: DRI Date:2/9/10 Due: 2/9/11
					SoMat High level Board EHLS	MSHLS.03-3182	By: DRI Date: 2/9/10 Due: 2/9/11
Load Cell	Vehicle Brake Pedal Force	0-300 lb 0-1.33 kN	1 lb 4.44 N	±0.05% of full scale	Lebow 3663-300	767	Functionally verified by DRI prior to test
Coordinate Measurement Machine	Inertial Sensing System Coordinates	0-8 ft 0-2.4 m	±.0020 in. ±.051 mm	±.0020 in. ±.051 mm (Single point articulation accuracy)	Faro Arm Fusion	UO8-05-08-06636	By: Faro Date: 8/18/09 Due: 8/18/10
Outriggers	No output. Safety Item.	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 (1 of 14)

Figure 5.1. Front View of Test Vehicle

5.0 PHOTOGRAPHS (2 of 14)

Figure 5.2. Rear View of Test Vehicle

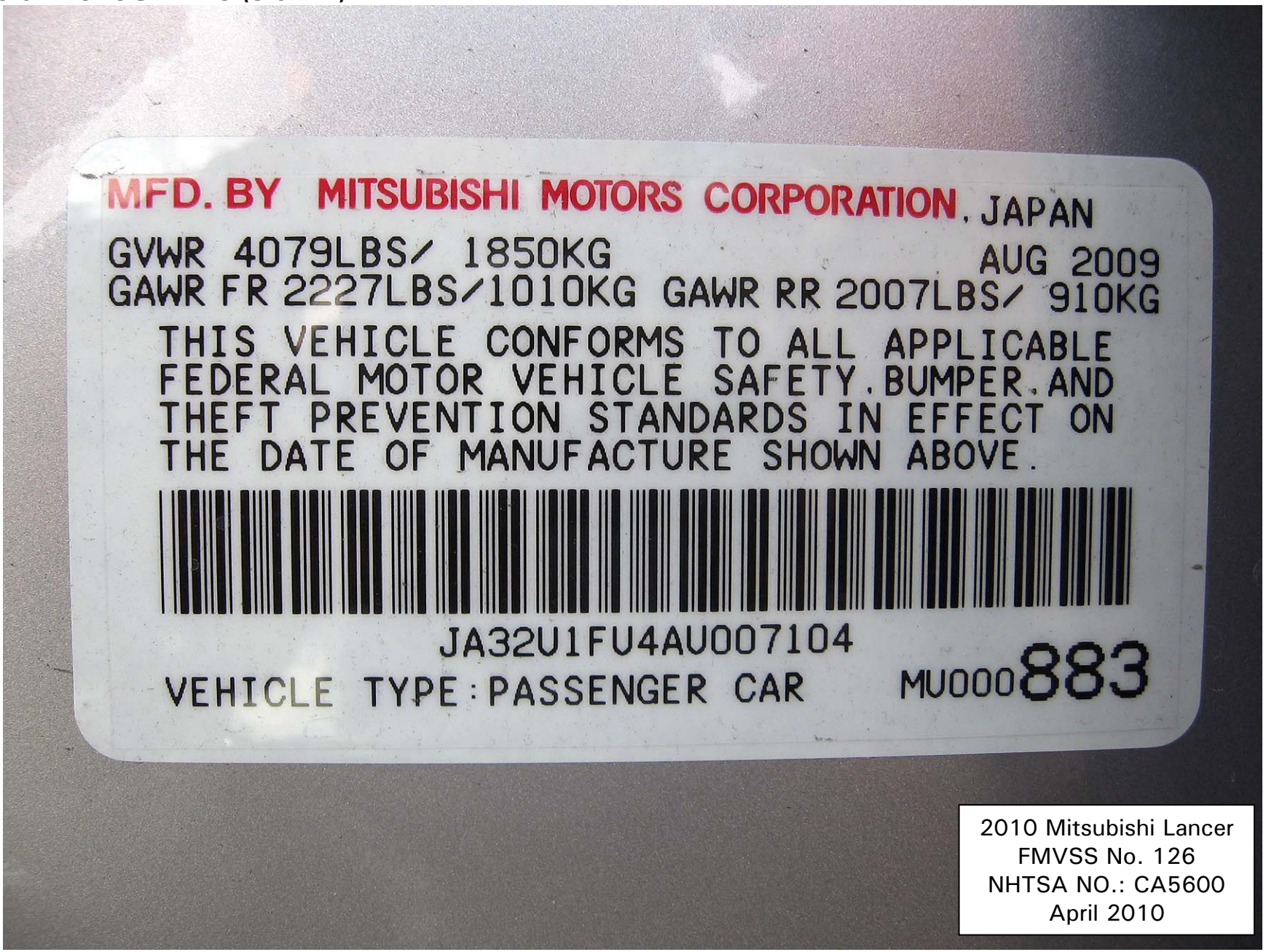


Figure 5.3. Vehicle Certification Label

Figure 5.4. Vehicle Placard

5.0 PHOTOGRAPHS (5 of 14)

2010 Mitsubishi Lancer
FMVSS No. 126
NHTSA NO.: CA5600
April 2010

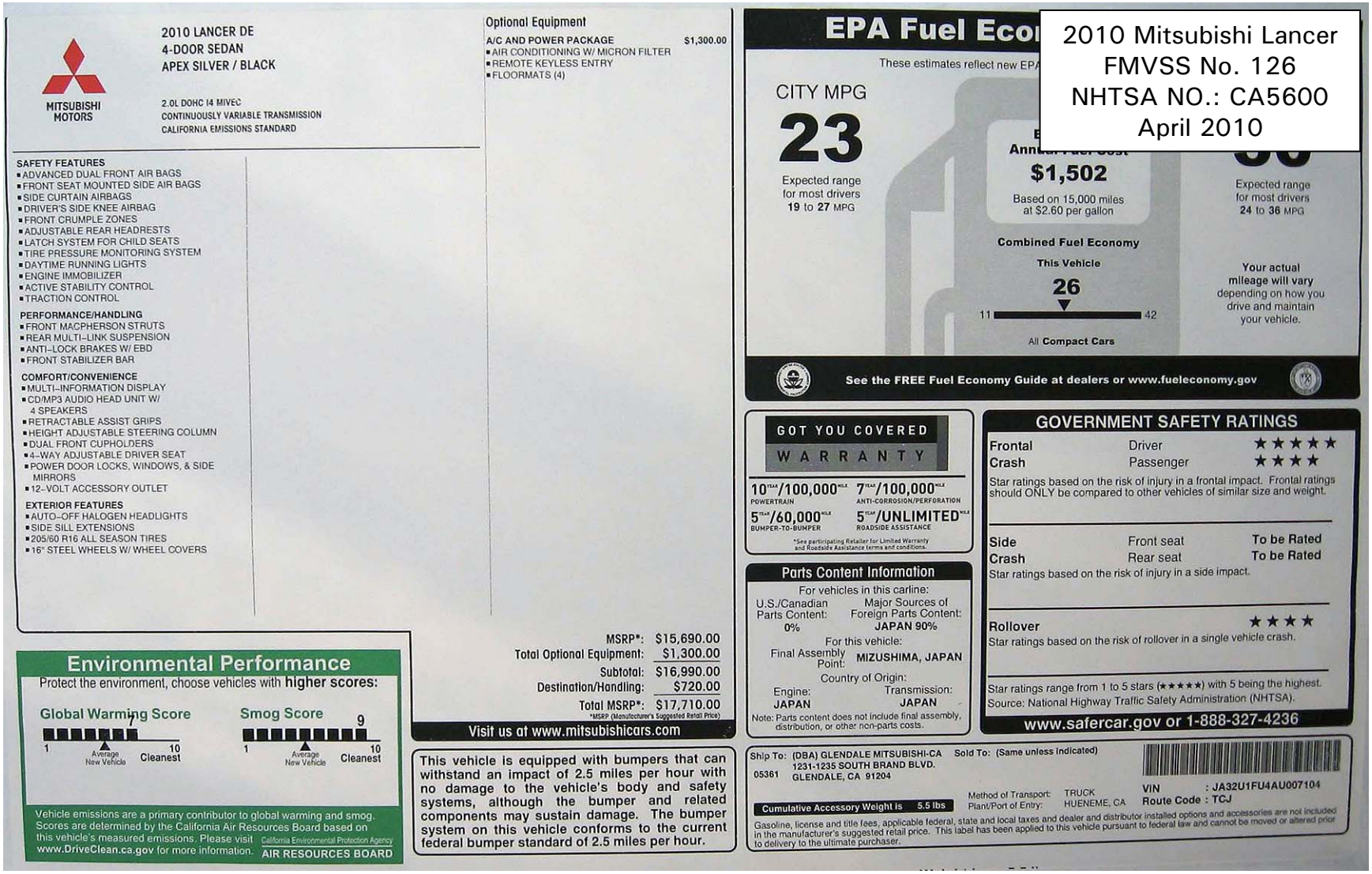


Figure 5.5. Window Sticker (Monroney Label)

5.0 PHOTOGRAPHS (6 of 14)

Figure 5.6. Telltale for ESC Malfunction and ESC Off

5.0 PHOTOGRAPHS (7 of 14)

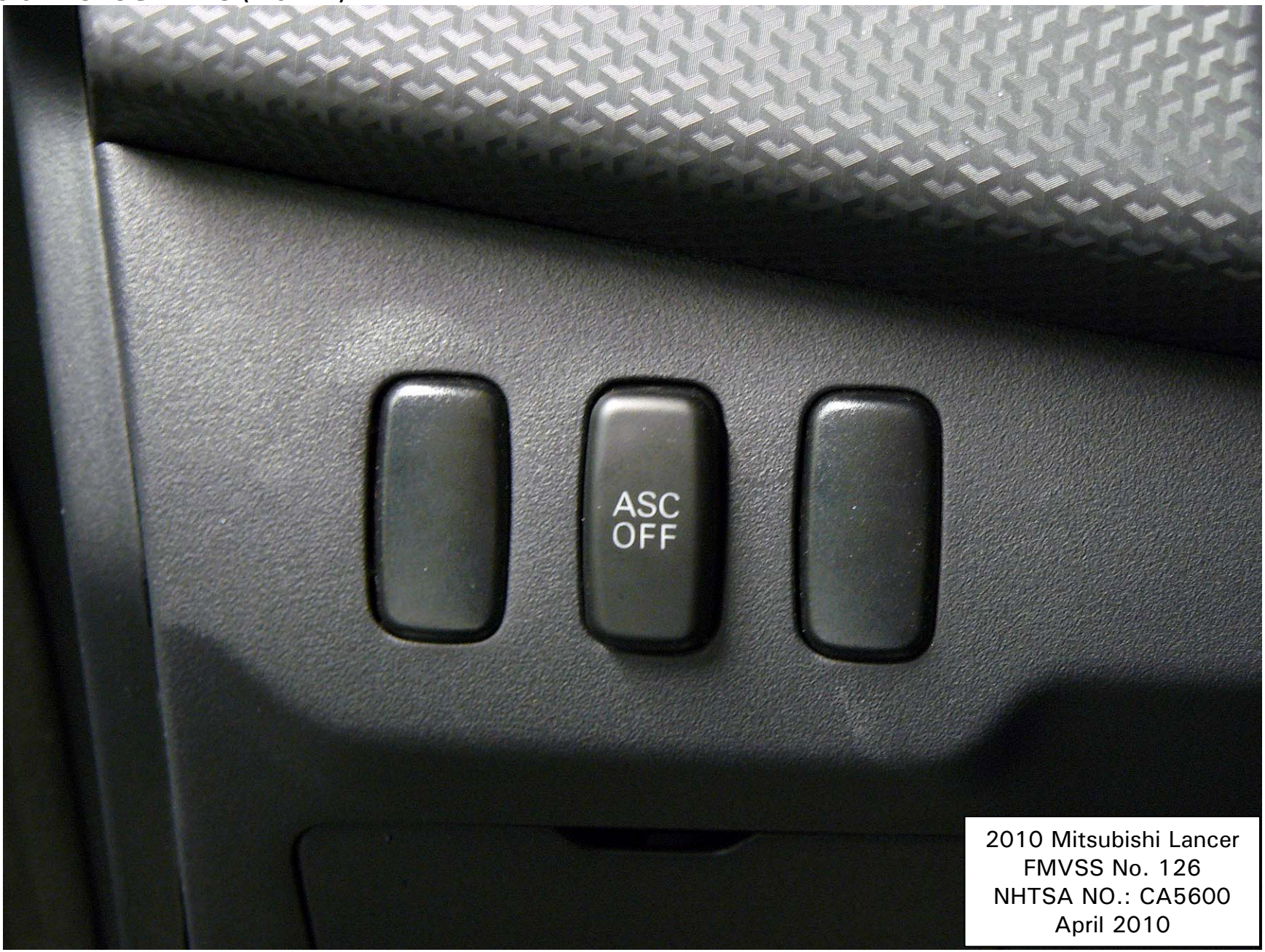


Figure 5.7. ESC Off Control Switch

5.0 PHOTOGRAPHS (8 of 14)

Figure 5.8. Front View of Vehicle As-Tested

5.0 PHOTOGRAPHS (9 of 14)

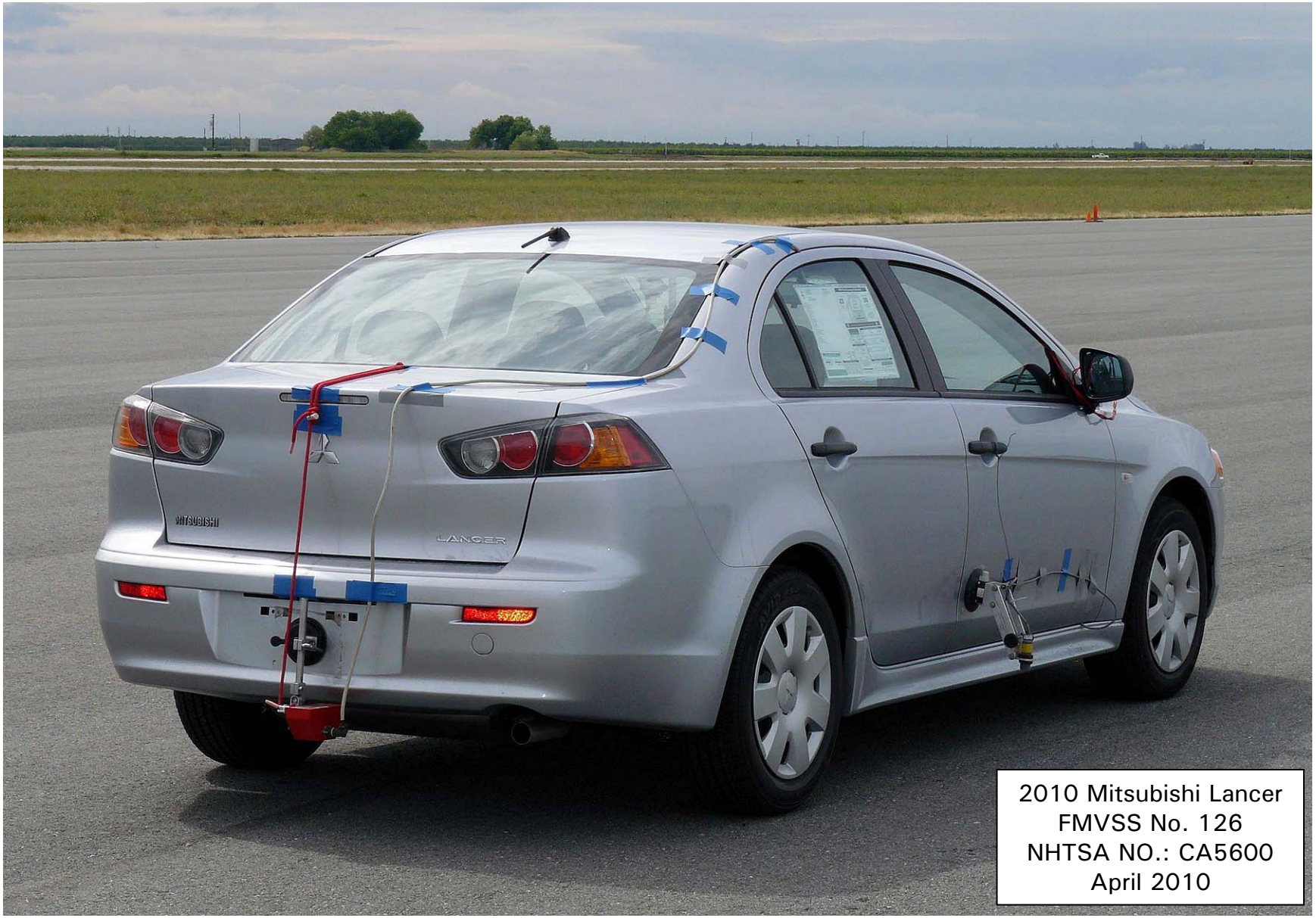


Figure 5.9. Rear View of Vehicle As-Tested

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

5.0 PHOTOGRAPHS (11 of 14)

Figure 5.11. Rear Outrigger, Mount and Speed Sensor

5.0 PHOTOGRAPHS (12 of 14)

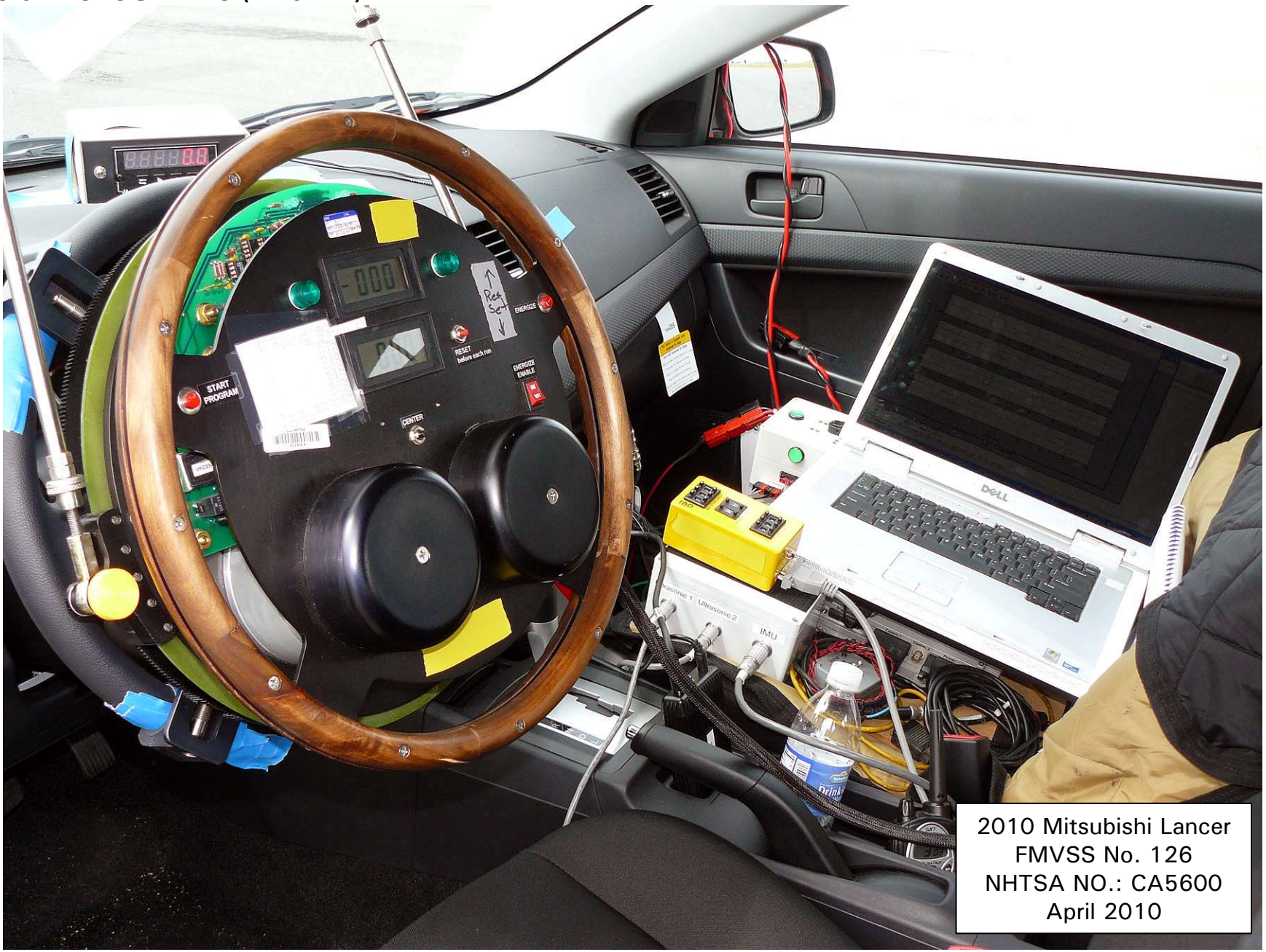


Figure 5.12. Steering Controller and Data Acquisition Computer

5.0 PHOTOGRAPHS (13 of 14)

Figure 5.13. Inertial Measurement Unit Mounted in Vehicle

5.0 PHOTOGRAPHS (14 of 14)

Figure 5.14. Brake Pedal Load Cell

6.0 DATA PLOTS (1 of 4)

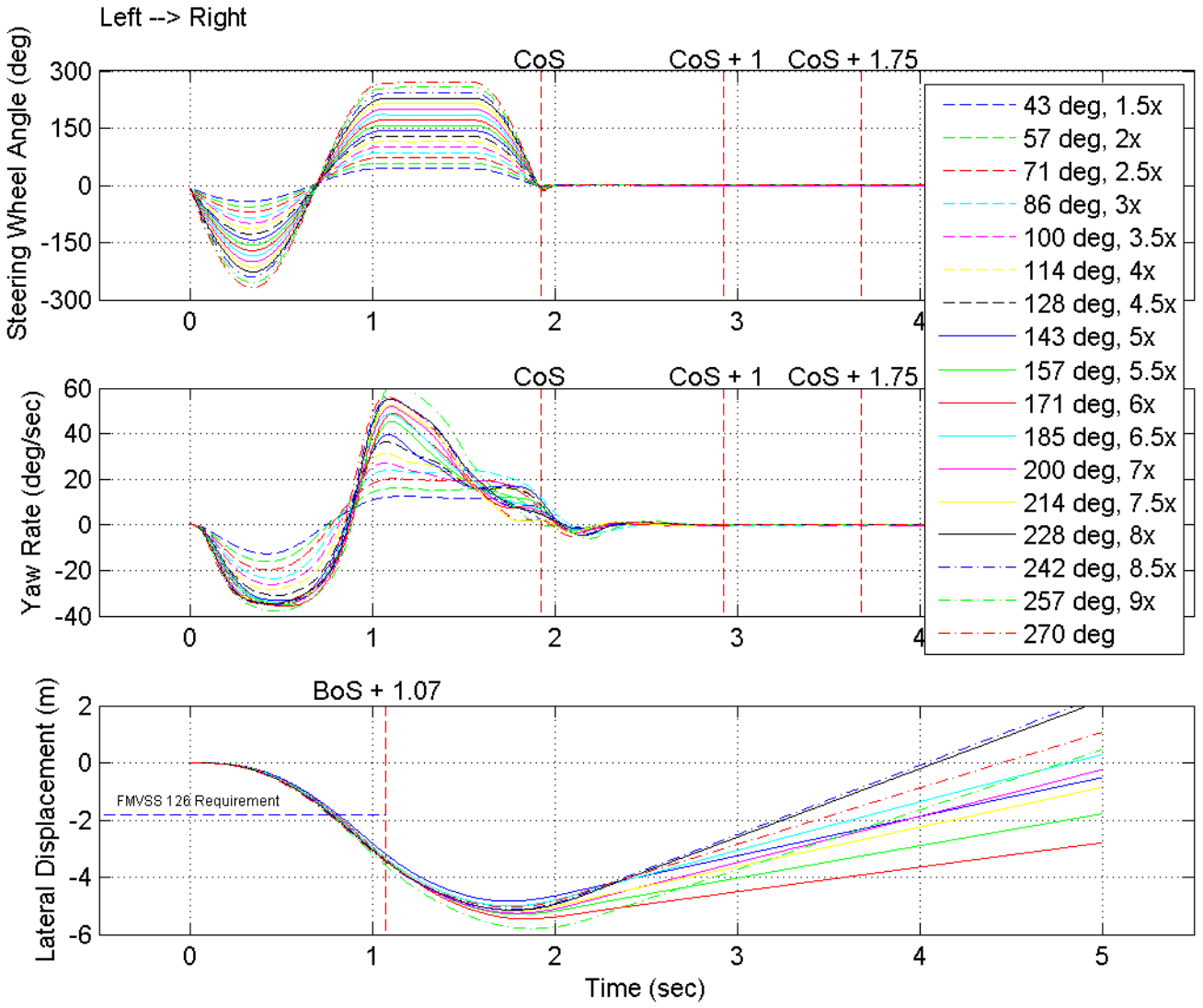


Figure 6.1. Steering Wheel Angle, Yaw Rate and Lateral Displacement for L-R Series

6.0 DATA PLOTS (2 of 4)

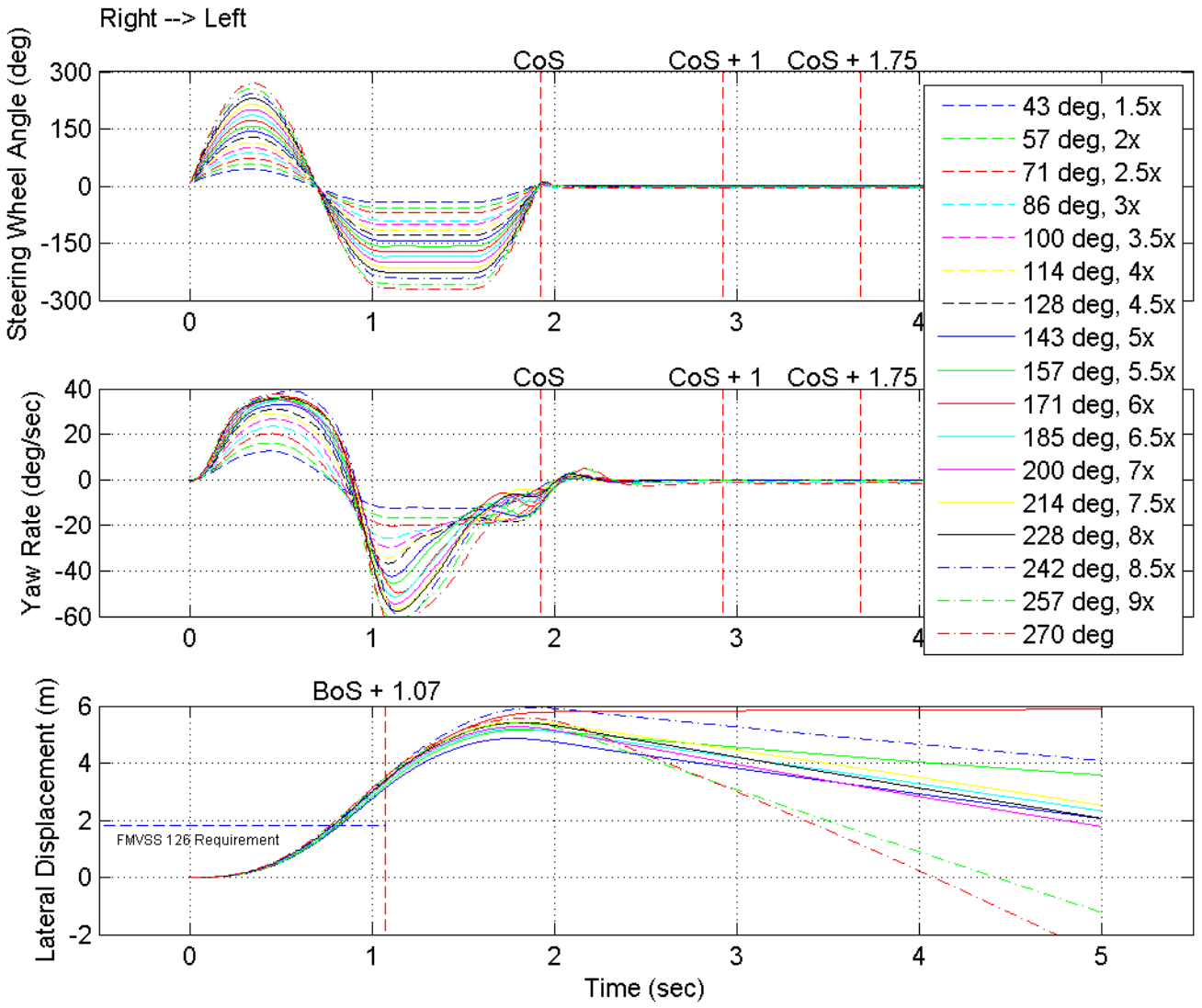


Figure 6.2. Steering Wheel Angle, Yaw Rate and Lateral Displacement for R-L Series

6.0 DATA PLOTS (3 of 4)

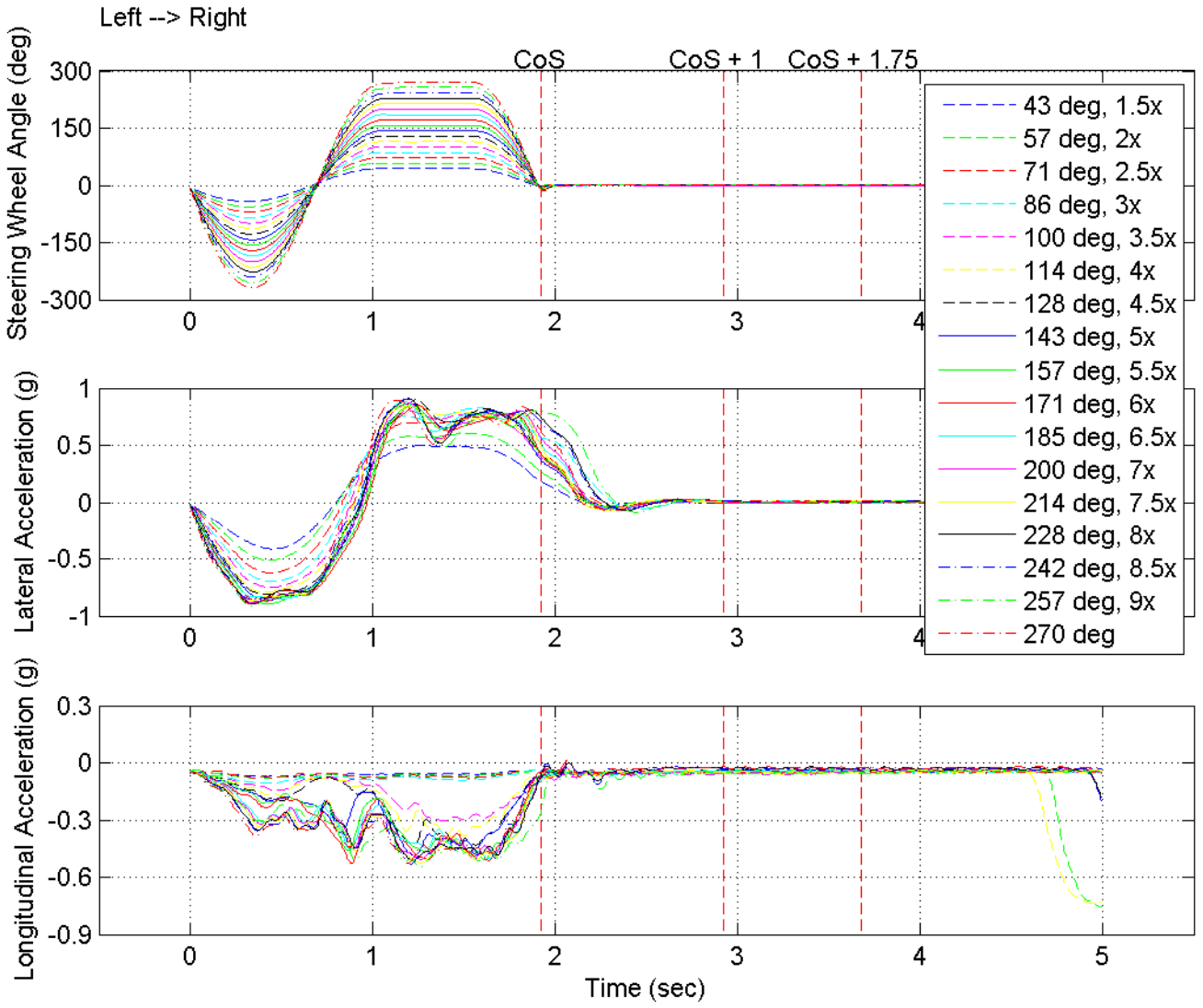


Figure 6.3. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for L-R Series

6.0 DATA PLOTS (4 of 4)

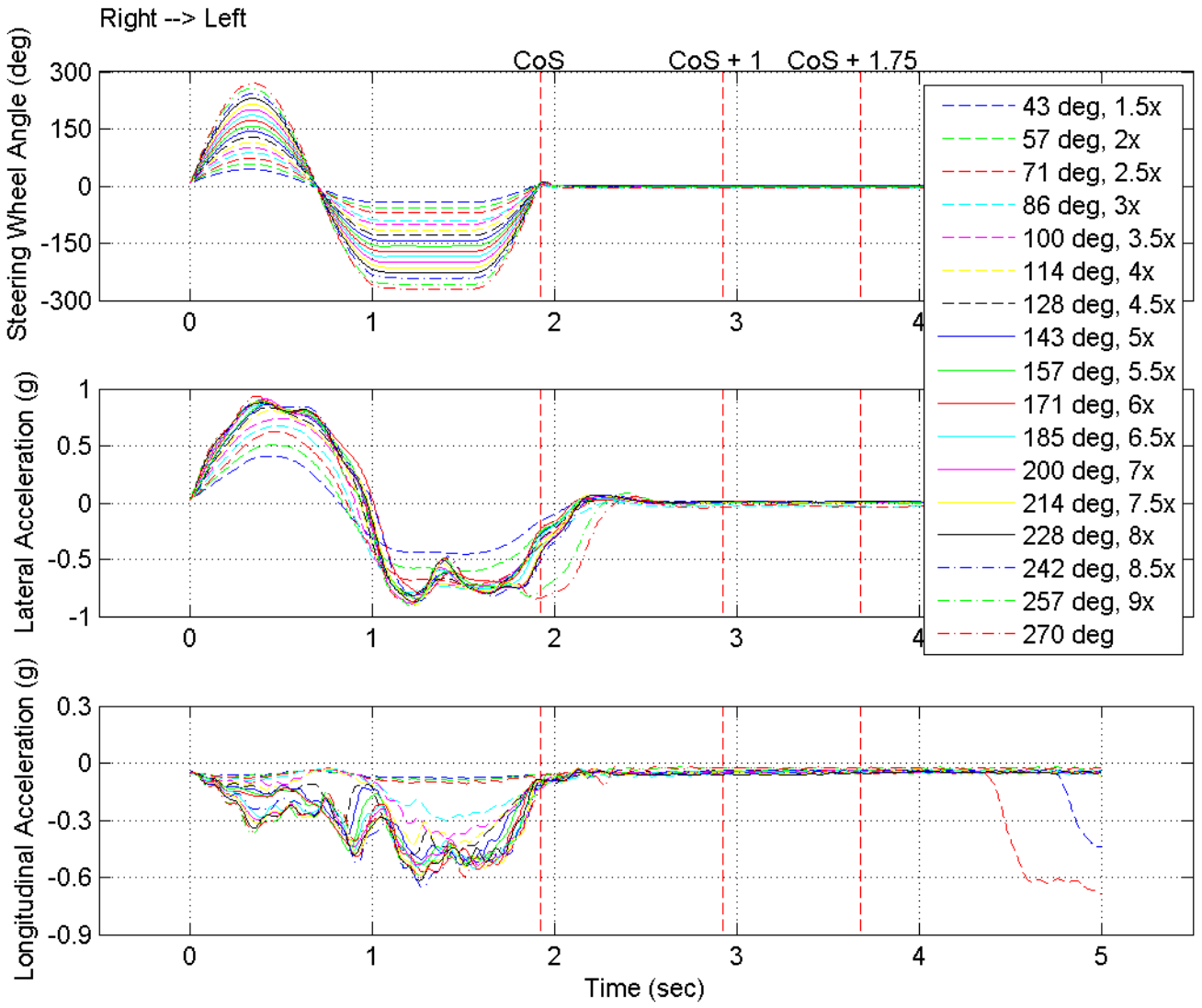


Figure 6.4. Steering Wheel Angle, Lateral Acceleration and Longitudinal Acceleration for R-L Series

7.0 OTHER DOCUMENTATION

7.1 OWNER'S MANUAL PAGES
7.2 VEHICLE ARRIVAL CONDITION REPORT
7.3 VEHICLE COMPLETION CONDITION REPORT
7.4 SINE WITH DWELL TEST RESULTS
7.5 SLOWLY INCREASING STEER TEST RESULTS
7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

Warning display

N00502900034

Warning light

Warning display

3 In the event of an abnormal condition in the system while driving, the warning display will be displayed.

⚠ CAUTION

- **If the warning is displayed, the hill start assist will not operate. Start off carefully.**
- **Park your vehicle in a safe place and stop the engine. Restart the engine and check whether the warning display went out, in which case the hill start assist is again working normally.**
  If the warning remains displayed or reappears frequently, it is not necessary to stop the vehicle immediately, but the vehicle should be inspected by an authorized Mitsubishi Motors dealer or a repair facility of your choice as soon as possible.

Anti-lock braking system (if so equipped)

N00517900266

The anti-lock braking system helps prevent the wheels from locking up when braking. This helps you keep control of your vehicle and its direction.

Driving hints

- When using the anti-lock brakes (sudden braking), steering is slightly different from normal driving conditions. Use the steering wheel carefully.
- Always keep a safe distance from the vehicle in front of you. Even if your vehicle is equipped with the anti-lock braking system, leave a greater braking distance when:
  - Driving on gravel or snow-covered roads.
  - Driving on uneven road surfaces.
- Operation of anti-lock braking system is not restricted to situations where brakes are applied suddenly. This system may also prevent the wheels from locking when you drive over manholes, steel roadwork plates, road markings, or any uneven road surface.
- When the anti-lock braking system is in use, you may feel the brake pedal vibrating and hear a unique sound. You may also feel as if the pedal resists being pressed.
  In this situation, simply hold the brake pedal down firmly. Do not pump the brake, which will result in reduced braking performance.

⚠ CAUTION

- **The anti-lock braking system cannot prevent accidents. It is your responsibility to take safety precautions and to drive carefully.**
- **To prevent failure of the anti-lock braking system, be sure all four wheels and tires are the same size and the same type.**
- **Never install a limited slip differential as the ABS may not function normally.**
  Please consult an authorized Mitsubishi Motors dealer.

NOTE

- After your vehicle is driven a short distance after starting the engine, you will hear the sound coming from the engine compartment. These are the normal sounds the anti-lock braking system makes when performing a self-check. It does not indicate a malfunction.
- The anti-lock braking system can be used after the vehicle has reached a speed over approximately 6 mph (10 km/h). It stops working when the vehicle slows below approximately 3 mph (5 km/h).

Anti-lock braking system warning light / display

N00531600573

Warning light

Warning display type 1

Warning display type 2

If there is a malfunction in the system, the anti-lock braking system warning light will come on and the warning display will appear on the information screen in the multi-information display.
Under normal conditions, the anti-lock braking system warning light only comes on when the ignition switch is turned to the "ON" position and goes off a few seconds later.

3

7.1 OWNER'S MANUAL PAGES

⚠ CAUTION

- **Any of the following warning light/display behavior indicates that the anti-lock braking system is not functioning and only the standard brake system is working. (The standard brake system will still work properly.) If this happens, take your vehicle to an authorized Mitsubishi Motors dealer or a repair facility of your choice as soon as possible.**
  - **When the ignition switch is in the "ON" position, the warning light does not come on or it remains on and does not go off**
  - **The warning light comes on while driving**
  - **The warning display appears while driving**

3

If the warning light / display comes on while driving

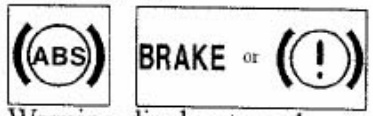
N00531700303

If only the anti-lock braking system warning light / display comes on

- Avoid hard braking and high-speed driving. Stop the vehicle in a safe place.
  Test the system by restarting the engine and driving at a speed of about 12 mph (20 km/h) or higher.
  If the warning light / display then remain off during driving, there is no problem.
  However, if the warning light / display do not disappear, or if they come on again when the vehicle is driven, have the vehicle checked by an authorized Mitsubishi Motors dealer or repair facility of your choice as soon as possible.

If the anti-lock braking system warning light / display and brake warning light / display come on at the same time

Warning light



Warning display type 1

Warning display type 2

The anti-lock braking system and brake force distribution function may not work, so hard braking could make the vehicle unstable.
Avoid hard braking and high-speed driving. Stop the vehicle in a safe place and contact an authorized Mitsubishi Motors dealer or repair facility of your choice.

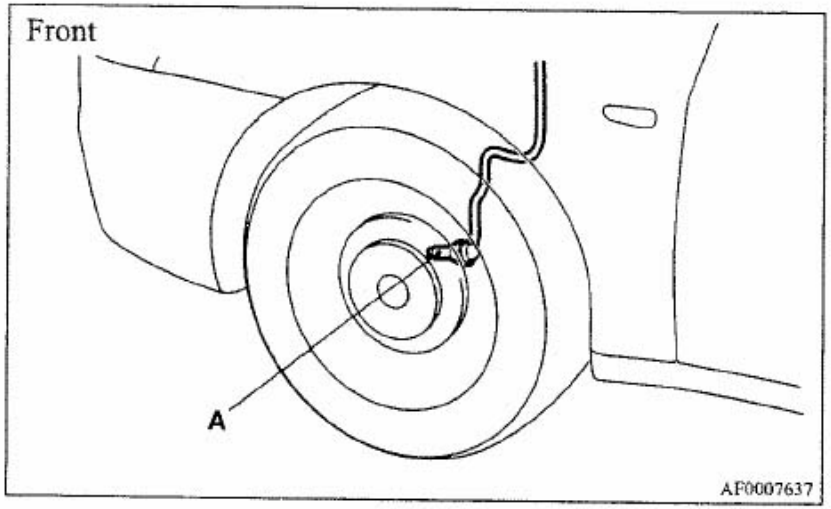
NOTE

- The anti-lock braking system warning light and brake warning light illuminate at the same time and the warning displays appear alternately on the information screen in the multi-information display.

After driving on icy roads

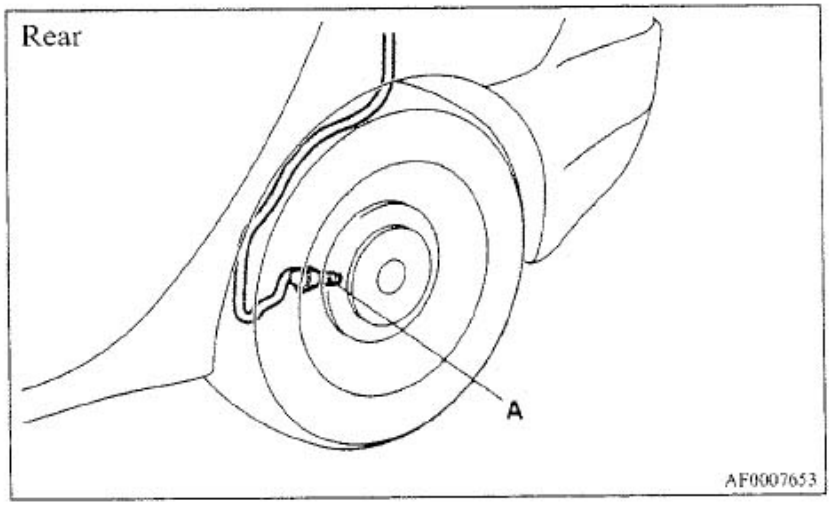
N00529200022

After driving on snow or icy roads, remove any snow and ice which may have been left around the wheels. On vehicles that have an anti-lock braking system, be careful not to damage the wheel speed sensors (A) or the cables located at each wheel.



3

7.1 OWNER'S MANUAL PAGES



3

Active Stability Control (ASC) (if so equipped)

N00559300118

The Active Stability Control (ASC) takes overall control of the anti-lock braking system, traction control function and skid control function to help maintain the vehicle's control and traction. Please read this section in conjunction with the page on the anti-lock braking system, traction control function and skid control function.

Anti-lock braking system (ABS) → P.3-134
Traction control function → P.3-139
Skid control function → P.3-139

⚠ CAUTION

- **Do not over-rely on the ASC. Even the ASC cannot prevent the natural laws of physics from acting on the vehicle. This system, like any other system, has limits and cannot help you to maintain traction and control of the vehicle in all circumstances. Reckless driving can lead to accidents. It is the driver's responsibility to drive carefully, This means taking into account the traffic, road and environmental conditions.**
- **Be sure to use the same specified type and size of tire on all four wheels. Otherwise, the ASC may not work properly.**
- **Do not install any aftermarket limited slip differential (LSD) on your vehicle. The ASC may stop functioning properly.**

NOTE
- An operation noise may be emitted from the engine compartment in the following situations. The sound is associated with checking the operations of the ASC. At this time, you may feel a shock from the brake pedal if you depress it. These do not indicate a malfunction.
  - When the ignition switch is set to the "ON" position.
  - When the vehicle is driven for a while after the engine is turned on.
- When the ASC is activated, you may feel a vibration in the vehicle body or hear a whining sound from the engine compartment.
  This indicates that the system is operating normally. It does not indicate a malfunction.
- When the anti-lock braking system warning light is illuminated, the ASC is not active.

Traction control function

N00559200034

On slippery surfaces, the traction control function prevents the drive wheels from spinning excessive, thus helping the vehicle to start moving from a stopped condition. It also provides sufficient driving force and steering performance as the vehicle turns while pressing the acceleration pedal.

⚠ CAUTION

- **When driving a vehicle on a snowy or icy road, be sure to install snow tires and drive the vehicle at moderate speeds.**

Skid control function

N00559300035

The skid control function is designed to help the driver maintain control of the vehicle on slippery roads or during rapid steering maneuvers. It works by controlling the engine output and the brake on each wheel.

NOTE
- The skid control function operates at speeds of about 9 mph (15 km/h) or higher.

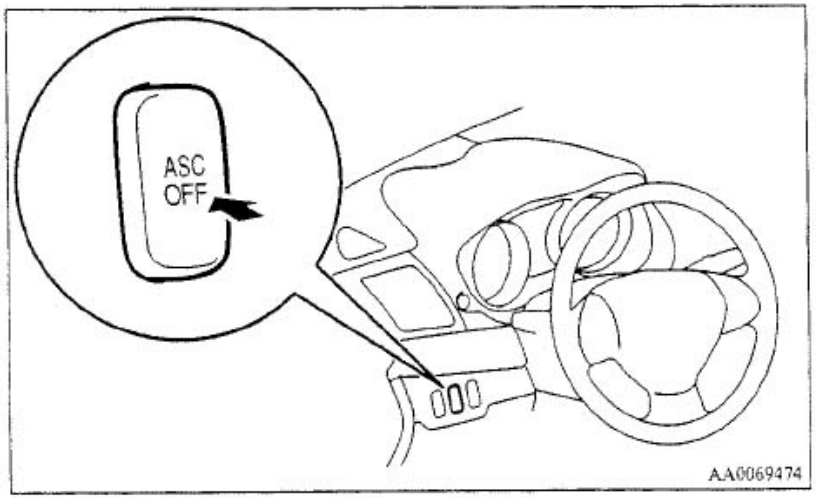
"ASC OFF" switch

N00559400111

The ASC is automatically activated when the ignition switch is turned to the "ON" position. You can deactivate the system by pressing down the "ASC OFF" switch for 3 seconds or longer.

When the ASC is deactivated, the ASC OFF display will be illuminated in the multi-information display. To reactivate the ASC, momentarily press the "ASC OFF" switch; the ASC OFF display is turned off.

3



⚠ CAUTION

- **For safety reasons, the "ASC OFF" switch should be operated when your vehicle is stopped.**
- **Be sure to keep the ASC on while driving in normal circumstances.**

NOTE

- Using the "ASC OFF" switch turns off both the skid control function and the traction control function.
- When moving out of mud, sand or fresh snow, pressing the accelerator pedal may not allow the engine speed to increase. In such situations, temporarily turning off ASC with the "ASC OFF" switch will make it easier to move out your vehicle.
- If you continue to press the "ASC OFF" switch after the ASC is turned off, the "mistaken operation protection function" will activate and the ASC will turn back on.

ASC operation display, ASC OFF display or ASC indicator (if so equipped)

ND0559500125

Indicator (if so equipped)

Display type 1

Display type 2

- ASC operation display
  When the ASC is operating, the information screen in the multi-information display will change and the ASC operation display will blink.
- ASC OFF display
  The ASC OFF display is displayed when the ASC has been deactivated with the "ASC OFF" switch.
- ASC indicator (if so equipped)
  Indicator blinks when the ASC is operating.

⚠ CAUTION

- **When display blinks, ASC is operating, which means that the road is slippery or that your vehicle's wheels are beginning to slip. If this happens, drive slower.**
- **If the temperature in the braking system continues to increase due to continuous brake control on a slippery road surface, the ASC OFF display will blink. To prevent the brake system from overheating, the brake control of the traction control function will be temporarily suspended. The engine control of the traction control function and normal brake operation will not be affected. Park your vehicle in a safe place. When the temperature in the braking system has come down, the ASC OFF display will be turned off and the traction control function will start operating again.**

NOTE

- The ASC OFF display may come on when you start the engine. This means that the battery voltage momentarily dropped when the engine was started. It does not indicate a malfunction, provided that the display goes out immediately.
- When a spare tire has been put on your vehicle, the gripping ability of the tire will be lower, making it more likely that the display will blink.

ASC warning display

N00559500138

Indicator (if so equipped)

Warning display type 1

Warning display type 2

If an abnormal condition occurs in the system while driving, the warning display will be displayed at the same time.

⚠ CAUTION

- **The system may be malfunctioning.**
  Park your vehicle in a safe place and stop the engine. Restart the engine again and check whether the ABS warning display and the ASC OFF display go out. If the warning display goes out, there is no abnormal condition. If the warning display does not go out or appears frequently, it is not necessary to stop the vehicle immediately, but you should have your vehicle inspected by an authorized Mitsubishi Motors dealer or a repair facility of your choice as soon as possible.

Towing

N00546300015

⚠ CAUTION

- **When towing the vehicle with only the front wheels or only the rear wheels raised off the ground, do not place the ignition switch in the "ON" position. Placing the ignition switch in the "ON" position could cause the ASC to operate, resulting in an accident.**
  Note that the correct towing method depends on the transmission type and the vehicle's drive configuration.
  For details, refer to "Towing" on page 6-22.

7.2 VEHICLE ARRIVAL CONDITION REPORT

CONTRACT NO.: DTNH22-08-D-00098
DATE: *4/13/2010*

From: *Automotive Allies*

To: Dynamic Research, Inc

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

Vehicle VIN: *JA32U1FU4AU007104* NHTSA NO.: *CA5600*
Model Year: *2010* Odometer Reading: *13* Miles
Make *Mitsubishi* Body Style: *Passenger Car*
Model: *Lancer* Body Color: *Silver*
Manufacture Date: *8/09* Dealer: *Automotive Allies*
GVWR (kg/lb) *1850/4079* Price: *Leased*

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

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

☒ There are no dents or other interior or exterior flaws

☒ The vehicle has been properly prepared and is in running condition

☒ The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys

☒ Proper fuel filler cap is supplied on the test vehicle

☒ Place vehicle in storage area

☒ Inspect the vehicle's interior and exterior, including all windows, seats, doors, etc., to confirm that each system is complete and functional per the manufacturer's specifications. Any damage, misadjustment, or other unusual condition that could influence the test program or test results shall be recorded. Report any abnormal condition to the NHTSA COTR before beginning any test.

NOTES:

RECORDED BY: *J Lenkeit* DATE RECORDED: *4/13/2010*

APPROVED BY: *P Broen* DATE APPROVED: *4/13/2010*

7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO.: *DTNH22-08-D-00098*
DATE: *5/6/2010*

Vehicle VIN: *JA32U1FU4AU007104* NHTSA NO.: *CA5600*
Model Year: *2010* Odometer Reading: *99* Miles
Make: *Mitsubishi* Body Style: *Passenger Car*
Model: *Lancer* Body Color: *Silver*
Manufacture Date: *8/09* Dealer:
GVWR (kg/lb) *1850 (4079)* Price: *Leased*

LIST OF FMVSS TESTS PERFORMED BY THIS LAB: *126*

☒ THERE ARE NO DENTS OR OTHER INTERIOR OR EXTERIOR FLAWS

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

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

☒ PROPER FUEL FILLER CAP IS SUPPLIED ON THE TEST VEHICLE

REMARKS:

Equipment that is no longer on the test vehicle as noted on Vehicle Arrival Condition Report:

Explanation for equipment removal:

Test Vehicle Condition:

As new

RECORDED BY: *J Lenkeit* DATE RECORDED: *5/6/2010*

APPROVED BY: *P Broen* DATE APPROVED: *5/6/2010*

7.4 SINE WITH DWELL TEST RESULTS

2010 Mitsubishi Lancer Passenger Car
NHTSA No.: CA5600
Date of Test : *4/22/2010*
Date Created: *4/22/2010*

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

File	SWA @ 5deg Ct	MES	Time @ 5deg	COS	Time @ COS	MOS	Time @ MOS	YRR1	YR1	YRR 1 Ct	YRR 175	YR175	YRR17 5 Ct	2nd Yaw Peak	2nd Yaw Peak Ct	Lat Disp	Lat. Acc. 1.07 s	1st SWA Peak	1st SWA Peak Ct	2nd SWA Mean
	(deg)	(mph)	(s)		(s)		(sec)	(%)	(deg/s)		(%)	(deg/s)		(deg/s)		(ft)	(g)	(deg)		(deg)
21	710	51.63	3.545	1090	5.445	847	4.226	-1.6	-0.2	1290	-1.46	-0.19	1440	12.74	949	-4.2	0.4	43.11	775	42.88
22	709	49.88	3.538	1090	5.444	846	4.225	-0.82	-0.13	1290	-0.75	-0.12	1440	16.35	939	-5.23	0.5	57.11	775	56.95
23	708	51.18	3.534	1090	5.443	846	4.225	-0.76	-0.16	1290	-0.83	-0.17	1440	20.28	933	-6.66	0.57	71.07	775	70.87
24	707	50.09	3.53	1090	5.443	846	4.224	-1.09	-0.27	1290	-1.15	-0.28	1440	24.28	927	-7.63	0.63	86.04	775	85.9
26	707	49.92	3.529	1090	5.444	846	4.225	-0.39	-0.11	1290	0.01	0	1440	27.49	922	-8.45	0.64	99.92	775	99.78
27	707	49.89	3.526	1090	5.443	846	4.224	-0.64	-0.2	1290	-0.43	-0.14	1440	31.52	922	-9.3	0.63	113.98	775	113.77
28	707	50.08	3.526	1090	5.443	846	4.225	-0.48	-0.18	1290	-0.44	-0.16	1440	36.55	923	-9.81	0.63	128.14	775	127.96
29	706	49.63	3.525	1090	5.443	846	4.225	-0.6	-0.24	1290	-0.63	-0.25	1440	39.66	924	-10.33	0.62	143.15	775	142.89
30	706	49.99	3.524	1090	5.442	846	4.224	-0.39	-0.18	1290	-0.4	-0.18	1440	45.5	928	-10.84	0.57	157.15	775	156.9
31	706	50.14	3.524	1090	5.442	846	4.225	-0.35	-0.17	1290	-0.08	-0.04	1440	49.19	930	-10.88	0.53	171.13	775	170.89
32	706	49.73	3.524	1090	5.442	846	4.225	-0.39	-0.19	1290	-0.35	-0.17	1440	48.69	926	-10.81	0.71	185.19	775	184.93
33	706	49.91	3.523	1090	5.442	846	4.225	-0.03	-0.02	1290	-0.09	-0.05	1440	52.24	927	-11.02	0.67	200.19	775	199.77
34	706	49.62	3.523	1090	5.441	846	4.225	-0.28	-0.15	1290	-0.27	-0.14	1440	52.66	926	-10.99	0.71	214.25	775	213.9
35	706	49.99	3.524	1090	5.441	846	4.225	-0.4	-0.22	1290	-0.11	-0.06	1440	55.18	927	-11.07	0.73	228.27	776	227.97
36	706	49.74	3.524	1090	5.441	847	4.226	-0.3	-0.17	1290	-0.12	-0.07	1440	55.84	926	-11.11	0.72	241.95	776	241.95
37	706	50.01	3.525	1090	5.441	847	4.226	-0.36	-0.23	1290	-0.12	-0.07	1440	62.72	933	-11.56	0.57	256.19	776	257
38	706	49.85	3.525	1090	5.441	847	4.226	-0.09	-0.05	1290	0.13	0.07	1440	56.3	923	-11.16	0.81	268.92	776	269.87

7.4 SINE WITH DWELL TEST RESULTS

2010 Mitsubishi Lancer Passenger Car
NHTSA No.: CA5600
Date of Test : *4/22/2010*
Date Created: *4/22/2010*

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)
41	710	49.52	3.545	1091	5.446	847	4.227	-0.19	0.02	1291	0.81	-0.1	1441	-12.5	935	4.02	-0.39	43.72	775	43.53
42	709	50.2	3.538	1090	5.444	847	4.227	0.63	-0.1	1290	1.01	-0.17	1440	-16.43	936	5.31	-0.5	57.91	775	57.49
43	708	49.84	3.534	1090	5.443	847	4.226	-0.43	0.09	1290	-1.03	0.21	1440	-20.35	930	6.43	-0.57	71.82	775	71.43
44	707	49.82	3.53	1092	5.453	845	4.216	3.78	-0.98	1292	4	-1.04	1442	-26.01	926	7.35	-0.63	86.84	775	91.07
45	707	49.91	3.528	1090	5.443	846	4.225	-0.22	0.07	1290	0.01	0	1440	-29.72	927	8.39	-0.62	100.73	775	100.29
46	706	50.23	3.525	1090	5.442	846	4.225	-0.26	0.09	1290	-0.19	0.07	1440	-34.16	926	9.26	-0.6	114.79	775	114.32
47	706	49.9	3.525	1090	5.443	846	4.225	-0.62	0.23	1290	-0.2	0.07	1440	-36.69	925	9.65	-0.61	128.9	775	128.47
49	706	49.86	3.523	1090	5.442	846	4.225	-0.09	0.04	1290	-0.24	0.1	1440	-42.4	929	10.11	-0.58	143.9	775	143.44
50	706	49.48	3.523	1090	5.442	846	4.225	-0.08	0.04	1290	-0.21	0.1	1440	-45.43	931	10.41	-0.52	157.95	775	157.42
51	706	49.94	3.522	1090	5.442	846	4.225	0.22	-0.11	1290	-0.05	0.02	1440	-49.84	936	10.79	-0.33	171.91	775	171.42
52	706	49.92	3.523	1090	5.442	846	4.225	0.01	0	1290	0.03	-0.01	1440	-51.33	932	10.7	-0.56	185.91	775	185.48
53	706	49.89	3.523	1090	5.441	847	4.226	-0.34	0.19	1290	-0.36	0.2	1440	-54.34	933	10.93	-0.61	200.82	775	200.39
54	706	49.8	3.523	1090	5.441	847	4.226	0.11	-0.06	1290	-0.03	0.01	1440	-56.91	936	11.01	-0.53	214.86	775	214.48
55	706	49.67	3.523	1090	5.441	847	4.226	-0.08	0.05	1290	-0.16	0.09	1440	-57.82	934	11.02	-0.56	228.76	775	228.48
58	706	49.6	3.523	1089	5.44	847	4.226	-0.33	0.2	1289	-0.33	0.2	1439	-61.19	940	11.29	-0.34	242.66	776	242.34
60	706	49.61	3.524	1089	5.44	847	4.226	-0.29	0.18	1289	-0.05	0.03	1439	-61.76	934	11.21	-0.63	257.01	776	257.37
63	706	49.74	3.524	1092	5.454	847	4.226	1.38	-0.89	1292	1.53	-0.98	1442	-64.15	933	11.42	-0.61	269.73	776	270.3

7.5 SLOWLY INCREASING STEER TEST RESULTS

2010 Mitsubishi Lancer Passenger Car
NHTSA No.: *CA5600*
Date of Test: *4/22/2010*
Date Created: *4/22/2010*

File	EventPt	DOS	MES	Mean SPD	AYcount_3	THETAENCF_3	AYCG_CD2_3	r_squared	ZeroBegin	ZeroEnd
			(mph)	(mph)		(deg)	(g)			
10	701	1	49.277	49.8187	1136	-29.0825	-0.2988	0.9941	501	701
11	702	1	49.424	50.0102	1129	-28.6167	-0.3043	0.9975	502	702
12	699	1	50.088	50.2871	1127	-28.5310	-0.3002	0.9950	499	699
13	705	0	49.748	49.6846	1130	28.8298	0.3031	0.9979	505	705
14	705	0	49.716	50.0850	1118	27.9450	0.3070	0.9976	505	705
15	716	0	50.503	50.8629	1119	28.0437	0.3066	0.9982	516	716
				Averages		28.5	0.3033			

Scalars	Steering Angles (deg)
1.5	43
2.0	57
2.5	71
3.0	86
3.5	100
4.0	114
4.5	128
5.0	143
5.5	157

Scalars	Steering Angles (deg)
6.0	171
6.5	185
7	200
7.5	214
8	228
8.5	242
9	257
9.5	270

7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

Vehicle: **2010 Mitsubishi Lancer Passenger Car** NHTSA No.: CA5600

Wheelbase: 103.375 Inches Faro Arm S/N: U08-05-08-06636

Measurement date: 4/15/2010 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	-9.399	0.965	0.000
M_Point_48_Ref	0.000	0.000	-
M_CIRCLE001_I_Left_Rear_Wheel_Axle	-28.422	13.817	-12.163
M_Point_IMU_side	9.473	46.868	-17.970
M_Point_ROOF	-	-	-58.600
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	9.473	48.393	-17.970

Measurement Notes

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

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

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

Coordinate Measurements Calculated for S7D (Matlab Program)

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

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

	Ref X	Ref Y	Ref Z
Motion_PAK_Location in S7D (Matlab program) coordinate system	**65.481**	**0.392**	**17.970**

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).