SAFETY COMPLIANCE TESTING FOR FMVSS NO. 214S
SIDE IMPACT PROTECTION (STATIC)

GENERAL MOTORS OF CANADA LTD.
2009 CHEVROLET IMPALA LS, PASSENGER CAR
NHTSA NO. C90100

GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443

August 12, 2009
FINAL REPORT
PREPARED FOR
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVE., SE
WASHINGTON, D.C. 20590
This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers’ names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: Debbie Messick
Approved By: Grant Farrand
Approval Date: 08/12/09

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: James A Jones
Acceptance Date: 

Compliance tests were conducted on the subject 2009 Chevrolet Impala LS Passenger Car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-214S-05 for the determination of FMVSS 214 compliance. Test failures identified were as follows: NONE
### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2 Test Procedure and Summary of Results</td>
<td>2</td>
</tr>
<tr>
<td>3 Compliance Test Data</td>
<td>4</td>
</tr>
<tr>
<td>4 Test Equipment List</td>
<td>10</td>
</tr>
<tr>
<td>5 Photographs</td>
<td>11</td>
</tr>
<tr>
<td>5.1 Front View of Vehicle Pre-test</td>
<td></td>
</tr>
<tr>
<td>5.2 Left Side View of Vehicle Pre-test</td>
<td></td>
</tr>
<tr>
<td>5.3 Right Side View of Vehicle Pre-test</td>
<td></td>
</tr>
<tr>
<td>5.4 Rear View of Vehicle Pre-test</td>
<td></td>
</tr>
<tr>
<td>5.5 3/4 Frontal View from Left Side of Vehicle Pre-test</td>
<td></td>
</tr>
<tr>
<td>5.6 3/4 Rear View from Right Side of Vehicle Pre-test</td>
<td></td>
</tr>
<tr>
<td>5.7 Vehicle’s Certification Label</td>
<td></td>
</tr>
<tr>
<td>5.8 Vehicle Tire Information Label</td>
<td></td>
</tr>
<tr>
<td>5.9 Vehicle VIN Plate</td>
<td></td>
</tr>
<tr>
<td>5.10 Instrumentation Setup</td>
<td></td>
</tr>
<tr>
<td>5.11 Rear Vehicle Tie Down Test 1</td>
<td></td>
</tr>
<tr>
<td>5.12 Front Vehicle Tie Down Test 1</td>
<td></td>
</tr>
<tr>
<td>5.13 Inclinometer Pre-Test 1</td>
<td></td>
</tr>
<tr>
<td>5.14 Dial Indicator Pre-Test 1</td>
<td></td>
</tr>
<tr>
<td>5.15 Load Device Against Door Pre-Test 1</td>
<td></td>
</tr>
<tr>
<td>5.16 Load Device Against Door at Max Load Test 1</td>
<td></td>
</tr>
<tr>
<td>5.17 Inclinometer at Max Load Test 1</td>
<td></td>
</tr>
<tr>
<td>5.18 Dial Indicator at Max Load Test 1</td>
<td></td>
</tr>
<tr>
<td>5.19 Post Test Door Outside Test 1</td>
<td></td>
</tr>
<tr>
<td>5.20 Post Test Door Inside Test 1</td>
<td></td>
</tr>
<tr>
<td>5.21 Rear Vehicle Tie Down Test 2</td>
<td></td>
</tr>
<tr>
<td>5.22 Front Vehicle Tie Down Test 2</td>
<td></td>
</tr>
<tr>
<td>5.23 Inclinometer Pre-Test 2</td>
<td></td>
</tr>
<tr>
<td>5.24 Dial Indicator Pre-Test 2</td>
<td></td>
</tr>
<tr>
<td>5.25 Load Device Against Door Pre-Test 2</td>
<td></td>
</tr>
<tr>
<td>5.26 Load Device Against Door at Max Load Test 2</td>
<td></td>
</tr>
<tr>
<td>5.27 Inclinometer at Max Load Test 2</td>
<td></td>
</tr>
<tr>
<td>5.28 Dial Indicator at Max Load Test 2</td>
<td></td>
</tr>
<tr>
<td>5.29 Post Test Door Outside Test 2</td>
<td></td>
</tr>
<tr>
<td>5.30 Post Test Door Inside Test 2</td>
<td></td>
</tr>
<tr>
<td>5.31 Front View of Vehicle Post Test</td>
<td></td>
</tr>
<tr>
<td>5.32 Left Side View of Vehicle Post Test</td>
<td></td>
</tr>
<tr>
<td>5.33 Right Side View of Vehicle Post Test</td>
<td></td>
</tr>
<tr>
<td>5.34 Rear View of Vehicle Post Test</td>
<td></td>
</tr>
<tr>
<td>5.35 ¾ Frontal View from Left Side of Vehicle Post Test</td>
<td></td>
</tr>
<tr>
<td>5.36 ¾ Rear View from Right Side of Vehicle Post Test</td>
<td></td>
</tr>
<tr>
<td>6 Test Data Plots</td>
<td>48</td>
</tr>
</tbody>
</table>
SECTION 1
INTRODUCTION

1.0 PURPOSE OF COMPLIANCE TEST

A 2009 Chevrolet Impala LS passenger car was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 214 testing to determine if the vehicle was in compliance with the requirements of the standard. FMVSS No. 214 establishes requirements for the side doors of a Motor Vehicle to minimize the safety hazard caused by intrusion into the passenger compartment as a result of a side impact accident.

1.1 TEST VEHICLE

The test vehicle was a 2009 Chevrolet Impala LS Passenger Car. Nomenclature applicable to the test vehicle are:

A. **Vehicle Identification Number**: 2G1WB57K991103176

B. **NHTSA No.**: C90100

C. **Manufacturer**: GENERAL MOTORS OF CANADA LTD.

D. **Manufacture Date**: 07/08

The vehicle’s front and rear seating systems were removed for this test. All vehicle windows were closed and all doors were locked for this test.

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 214 testing on July 29, 2009.
SECTION 2
TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 TEST PROCEDURE

All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedure, TP-214S-05 dated 14 September 1993 and General Testing Laboratories, Inc. (GTL) Test Procedure, TP-214S-05, "Static – Side Impact Protection".

Each vehicle shall be able to meet the requirements of either, at the manufacturer's option, 2.1 or 2.2 when any of its side doors that can be used for occupant egress are tested.

2.1 OPTION ONE

With any seats that may affect load upon or deflection of the side of the vehicle removed from the vehicle, each vehicle must be able to meet the requirements of 2.1.1 through 2.1.3.

2.1.1 INITIAL CRUSH RESISTANCE

The initial crush resistance shall not be less than 2,250 pounds.

2.1.2 INTERMEDIATE CRUSH RESISTANCE

The intermediate crush resistance shall not be less than 3,500 pounds.

2.1.3 PEAK CRUSH RESISTANCE

The peak crush resistance shall not be less than two times the curb weight of the vehicle or 7,000 pounds, whichever is less.

2.2 OPTION TWO

With seats installed in the vehicle, and located in any horizontal or vertical position to which they can be adjusted and at any seat back angle to which they can be adjusted, each vehicle must be able to meet the requirements of 2.2.1 through 2.2.3.

2.2.1 INITIAL CRUSH RESISTANCE

The initial crush resistance shall not be less than 2,250 pounds.

2.2.2 INTERMEDIATE CRUSH RESISTANCE

The intermediate crush resistance shall not be less than 4,375 pounds.
SECTION 2 CONTINUED

2.2.3 PEAK CRUSH RESISTANCE

The peak crush resistance shall not be less than three and one half times the curb weight of the vehicle or 12,000 pounds, whichever is less.
SECTION 3
COMPLIANCE TEST DATA
DATA SHEET 1
TEST VEHICLE RECEIVING-INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2009 CHEVROLET IMPALA LS PASSENGER CAR
VEH. NHTSA NO.: C90100; VIN: 2G1WB57K991103176
VEH. BUILD DATE: 07/08; TEST DATE: JULY 29, 2009
TEST LABORATORY: GENERAL TESTING LABS
OBSERVERS: G. FARRAND, J. LATANE

A. First compliance test by laboratory for this vehicle is the static FMVSS 214 test.

   _   Yes   _   No (Go to item 2)
   X   (1) Label test vehicle with NHTSA Number
   X   (2) Verify all options on the "window sticker" are present on the vehicle
   X   (3) Verify tires and wheel rims are new and the same as listed
   X   (4) Verify there are no dents or other interior or exterior flaws
   X   (5) Verify the glove box contains an owner's manual, warranty document, consumer information, and extra keys
   X   (6) Verify the vehicle is equipped with the proper fuel filler cap
   X   (7) If the vehicle has been delivered from the dealer, verify the vehicle has been properly prepared and is in running condition

B. Verify seat adjusters are working

   X   Yes   _   No

C. Verify there is a seat belt at each seating position

   X   Yes   _   No

D. Without disturbing the integrity of each seat belt and anchorage, verify that each seat belt is attached to the anchorage. For seat belts that are attached to the seat, also verify the seats are attached to the seat anchors and the seat anchors are attached to the vehicle.

   X   Yes   _   No

E. Curb Weight of Vehicle: 3532 LBS. (1602 KG)

F. COMMENTS: (Explain any problems here)

RECORDED BY: G. FARRAND DATE: 07/29/09
APPROVED BY: D. MESSICK
DATA SHEET 2
PRETEST PREPARATION

VEH. MOD YR/MAKE/MODEL/BODY: 2009 CHEVROLET IMPALA LS PASSENGER CAR
VEH. NHTSA NO.: C90100; VIN: 2G1WB57K991103176
VEH. BUILD DATE: 07/08; TEST DATE: JULY 29, 2009
TEST LABORATORY: GENERAL TESTING LABS
OBSERVERS: G. FARRAND, J. LATANE

Prior to testing the following will be accomplished:

1  2
A. Check the manufacturers certification statement to determine if the vehicle should be tested with or without seats installed. X  X
B. Remove all seats unless the vehicle has been certified with the seats installed. If the seats remain in the vehicle, they are to be adjusted per the COTR's instructions. X  X
C. Close all windows X  X
D. Lock All doors X  X
E. State door tested LF  RR
F. State the length of a horizontal line drawn on door through a point 5 inches vertically above lowest point of test door 42.7  29.7
G. State vertical distance from the lowest part of test door to bottom of loading device 5"  5"
H. State position of vertical centerline of loading device on the midpoint of line determined step F 21.3  14.8
I. Determine that the vertical axis of the loading device is perpendicular to the longitudinal and lateral axis of the test vehicle X  X
J. Determine that the top of the loading device is above the door window opening but not touching any structure above the window opening X  X

RECORDED BY: G. FARRAND DATE: 07/29/09
APPROVED BY: D. MESSICK
DATA SHEET 3
STATIC LOAD TEST - BACK-UP SYSTEM DATA

VEH. MOD YR/MAKE/MODEL/BODY: 2009 CHEVROLET IMPALA LS PASSENGER CAR
VEH. NHTSA NO.: C90100; VIN: 2G1WB57K991103176
VEH. BUILD DATE: 07/08; TEST DATE: JULY 29, 2009
TEST LABORATORY: GENERAL TESTING LABS
OBSERVERS: G. FARRAND, J. LATANE

RESULTS: Plots of load versus displacement and time versus displacement obtained from the back-up data (attach plots to data sheet) showed that:

TEST #1 - GTL #6269 (LEFT FRONT DOOR)

A. The initial crush resistance was _______ 3692 lbs.
B. The intermediate crush resistance was ___6395_ lbs.
C. The peak crush resistance was _______ 11,367 lbs at __12.1__ inches
D. The rate of loading was _______ .2"/sec_____

The dial indicator and the inclinometer showed the following deflections.

<table>
<thead>
<tr>
<th>LOADING DEVICE TRAVEL</th>
<th>DIAL INDICATOR</th>
<th>INCLINOMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 inches</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>2 inches</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>4 inches</td>
<td>0.10</td>
<td>0</td>
</tr>
<tr>
<td>6 inches</td>
<td>0.16</td>
<td>0</td>
</tr>
<tr>
<td>12 inches</td>
<td>0.32</td>
<td>0</td>
</tr>
<tr>
<td>12.1 inches (full travel)</td>
<td>0.31</td>
<td>0</td>
</tr>
<tr>
<td>0 inches (removal)</td>
<td>0.09</td>
<td>0</td>
</tr>
</tbody>
</table>

TEST #2 - GTL #6270 (RIGHT REAR DOOR)

A. The initial crush resistance was _______ 4655 lbs.
B. The intermediate crush resistance was ___7816_ lbs.
C. The peak crush resistance was _______ 13,318 lbs at __10.9__ inches
D. The rate of loading was _______ .2"/sec_____

7
The dial indicator and the inclinometer showed the following deflections.

<table>
<thead>
<tr>
<th>LOADING DEVICE TRAVEL</th>
<th>DIAL INDICATOR</th>
<th>INCLINOMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 inches</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>2 inches</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>4 inches</td>
<td>0.10</td>
<td>0</td>
</tr>
<tr>
<td>6 inches</td>
<td>0.16</td>
<td>0</td>
</tr>
<tr>
<td>12 inches</td>
<td>0.31</td>
<td>0</td>
</tr>
<tr>
<td>12.0 inches (full travel)</td>
<td>0.42</td>
<td>0</td>
</tr>
<tr>
<td>0 inches (removal)</td>
<td>0.09</td>
<td>0</td>
</tr>
</tbody>
</table>

RECORDED BY: G. FARRAND  DATE: 07/29/09
APPROVED BY: D. MESSICK
DATA SHEET 4
DATA REDUCTION

VEH. MOD YR/MAKE/MODEL/BODY: 2009 CHEVROLET IMPALA LS PASSENGER CAR
VEH. NHTSA NO.: C90100; VIN: 2G1WB57K991103176
VEH. BUILD DATE: 07/08; TEST DATE: JULY 29, 2009
TEST LABORATORY: GENERAL TESTING LABS
OBSERVERS: G. FARRAND, J. LATANE

Data from the primary data systems will be analyzed and the plots attached to the data sheet.

RESULTS - The load versus displacement plot showed that - -

**TEST #1** - GTL #6269 (LEFT FRONT DOOR)

A. The initial crush resistance was 3692 lbs.
B. The intermediate crush resistance was 6395 lbs.
C. The peak crush resistance was 11,367 lbs at 12.1 inches

The time versus displacement plot showed that - -

The rate of loading was .2"/sec

**TEST #2** - GTL #6270 (RIGHT REAR DOOR)

A. The initial crush resistance was 4655 lbs.
B. The intermediate crush resistance was 7816 lbs.
C. The peak crush resistance was 13,318 lbs at 10.9 inches

The time versus displacement plot showed that - -

The rate of loading was .2"/sec

Comparison of the ABOVE DATA with the BACKUP DATA indicates the following - -

Primary and Backup data agree.

RECORDED BY: G. FARRAND DATE: 07/29/09
APPROVED BY: D. MESSICK
## SECTION 4

### TEST EQUIPMENT LIST

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>DESCRIPTION</th>
<th>MODEL/ SERIAL NO.</th>
<th>CAL. DATE</th>
<th>NEXT CAL. DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPUTER</td>
<td>AT&amp;T</td>
<td>486DX266</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>TEST FIXTURE</td>
<td>GTL 214</td>
<td>214</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>A/D INTERFACE</td>
<td>METRABYTE</td>
<td>DAS-16(F)</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>SCALES</td>
<td>INTERCOMP</td>
<td>199744</td>
<td>04/09</td>
<td>04/10</td>
</tr>
<tr>
<td>SIGNAL CONDITIONER</td>
<td>METRABYTE</td>
<td>EXP-RES</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>LOAD CELL</td>
<td>TRANSDUCER INC.</td>
<td>18550</td>
<td>11/08</td>
<td>11/09</td>
</tr>
<tr>
<td>LINEAR POT.</td>
<td>WALDALE</td>
<td>123456A</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>123456B</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>INCLINOMETER</td>
<td>STARRETT</td>
<td>360/002</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>DIAL INDICATOR</td>
<td>MIOTO</td>
<td>0001-2</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
</tbody>
</table>
SECTION 5

PHOTOGRAPHS
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.2
LEFT SIDE VIEW OF VEHICLE PRE-TEST
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.4
REAR VIEW OF VEHICLE PRE-TEST
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.5
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE
PRE-TEST
MFD BY GENERAL MOTORS OF CANADA LTD.

DATE   GVWR   GAWR FRT   GAWR RR
07/08   2066 KG 1118 KG  948 KG
4554 LB 2464 LB 2090 LB

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

2G1WB57K991103176    TYPE: PASS CAR

2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.7
VEHICLE CERTIFICATION LABEL
<table>
<thead>
<tr>
<th>TIRE</th>
<th>ORIGINAL SIZE</th>
<th>COLD TIRE PRESSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRONT</td>
<td>P225/60R16</td>
<td>210 kPa, 30 PSI</td>
</tr>
<tr>
<td>REAR</td>
<td>P225/60R16</td>
<td>210 kPa, 30 PSI</td>
</tr>
<tr>
<td>SPARE</td>
<td>T125/70D16</td>
<td>420 kPa, 60 PSI</td>
</tr>
</tbody>
</table>

The combined weight of occupants and cargo should never exceed 428 kg or 944 lbs.
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.10
INSTRUMENTATION SET-UP
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.14
DIAL INDICATOR PRE-TEST 1
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.15
LOAD DEVICE AGAINST DOOR – PRE-TEST 1
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.17
INCLINOMETER AT MAX LOAD – TEST 1
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.18
DIAL INDICATOR AT MAX LOAD – TEST 1
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.24
DIAL INDICATOR – PRE-TEST 2
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.25
LOAD DEVICE AGAINST DOOR – PRE-TEST 2
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.26
LOAD DEVICE AGAINST DOOR @ MAX LOAD – TEST 2
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.27
INCLINOMETER AT MAX LOAD – TEST 2
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.28
DIAL INDICATOR AT MAX LOAD – TEST 2
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.30
POST TEST DOOR INSIDE – TEST 2
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.31
FRONT VIEW OF VEHICLE POST TEST
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.32
LEFT SIDE VIEW OF VEHICLE POST TEST
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.34
REAR VIEW OF VEHICLE POST TEST
2009 CHEVROLET IMPALA LS
NHTSA NO. C90100
FMVSS NO. 214

FIGURE 5.35
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE
POST TEST
SECTION 6
TEST DATA PLOTS