REPORT NUMBER: 220-MGA-2009-006

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 220 SCHOOL BUS ROLLOVER PROTECTION

2008 COLLINS GRAND BANTAM SCHOOL BUS
NHTSA NO.: C80900

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

TEST DATE: DECEMBER 8, 2010

FINAL REPORT DATE: JANUARY 14, 2011

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Prepared by: _____ Date: January 14, 2011
Eric Peschman, Project Engineer

Reviewed by: _____ Date: January 14, 2011
Michael Janovicz, Program Manager

FINAL REPORT ACCEPTED BY:

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Date of Acceptance

Technical Report Documentation Page

1. Report No. 220-MGA-2009-006	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Final Report of FMVSS 220 Compliance Testing of 2008 Collins Grand Bantam School Bus NHTSA No.: C80900		*5. Report Date* January 14, 2011 *6. Performing Organization Code* MGA	
7. Author(s) Eric Peschman, Project Engineer Michael Janovicz, Program Manager		*8. Performing Organization Report No.* 220-MGA-2009-006	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-08-D-00075	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance Mail Code: NVS-220 1200 New Jersey Avenue, S.E. Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Report December 8, 2010 *14. Sponsoring Agency Code* NVS-220	
15. Supplementary Notes			
16. Abstract Compliance tests were conducted on the subject 2008 Collins Grand Bantam School Bus NHTSA No.: C80900, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-220-02 for the determination of FMVSS 220 compliance. Test failures were as follows: None			
17. Key Words Compliance Testing Safety Engineering FMVSS 220		*18. Distribution Statement* Copies of this report are available from: NHTSA Technical Information Services (TIS) Mail Code: NPO-411 1200 New Jersey Avenue, S.E. Washington, D.C. 20590 Fax No.: (202) 493-2833 E-mail: tis@dot.gov	
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Form DOT F1700.7 (8-72)

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SECTION 1

PURPOSE OF COMPLIANCE TEST

Tests were conducted on a 2008 Collins Grand Bantam School Bus NHTSA No.: C80900, in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedure, TP-220-02, to determine compliance to the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 220, “School Bus Rollover Protection”.

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No.: DTNH22-08-D-00075.

SECTION 2

TEST DATA SUMMARY

Based on the tests performed, the 2008 Collins Grand Bantam School Bus, NHTSA No.: C80900 appears to meet the requirements of FMVSS 220. The ambient temperature during testing was 23° C.

TEST RESULTS

S4.a	The downward vertical movement of any point on the application plate shall not exceed 130 mm.	**PASS**
S4.b	Each emergency exit shall be capable of:	
	Unlatching per FMVSS 217	**PASS**
	Opening per FMVSS 217	**PASS**

Comments: None

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the 2008 Collins Grand Bantam School Bus, NHTSA No. C80900.

DATA SHEET 1

VEHICLE INFORMATION

Test Vehicle: **2008 COLLINS GRAND BANTAM SCHOOL BUS** NHTSA No.: **C80900**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **12/08/10**

Contract No.:	DTNH22-08-D-00075
Laboratory Name:	MGA Research Corporation

INCOMPLETE VEHICLE

Manufacturer:	General Motors Corporation
Model:	G33803
VIN:	1GDJG31K981197124
Certification Date:	03/08

COMPLETED VEHICLE (SCHOOL BUS)

Manufacturer:	Collins Bus Corporation
Make/Model:	Collins Grand Bantam
VIN:	1GDJG31K981197124
NHTSA No.:	C80900
Color:	Yellow
GVWR:	5,579 kg / 12,300 lbs
Build Date:	06/08
Certification Date:	06/08

DATES

Vehicle Receipt:	12/04/08
Start of Compliance Test:	12/08/10
Completion of Compliance Test:	12/08/10

Comments: All tests were performed in accordance with the references outlined in: TP-220-02.

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

SCHOOL BUS UNLOADED VEHICLE WEIGHT (UVW)

	Units	As Delivered (UVW) (Axle)		
		Front	Rear	Total
Left	kg	728	1,214	
Right	kg	768	1,388	
Ratio	%	36.5	63.5	
Totals	kg	1,496	2,602	4,098

SCHOOL BUS ROOF AND APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	5,585	5,280	5,182
Width (mm):	2,370	914	914

Note: The vehicle was centered laterally and longitudinally under the roof load application plate.

School Bus Has: X Rigid Frame; __ Unibody

Components Removed From Vehicle Before Testing: Gas tank removed.

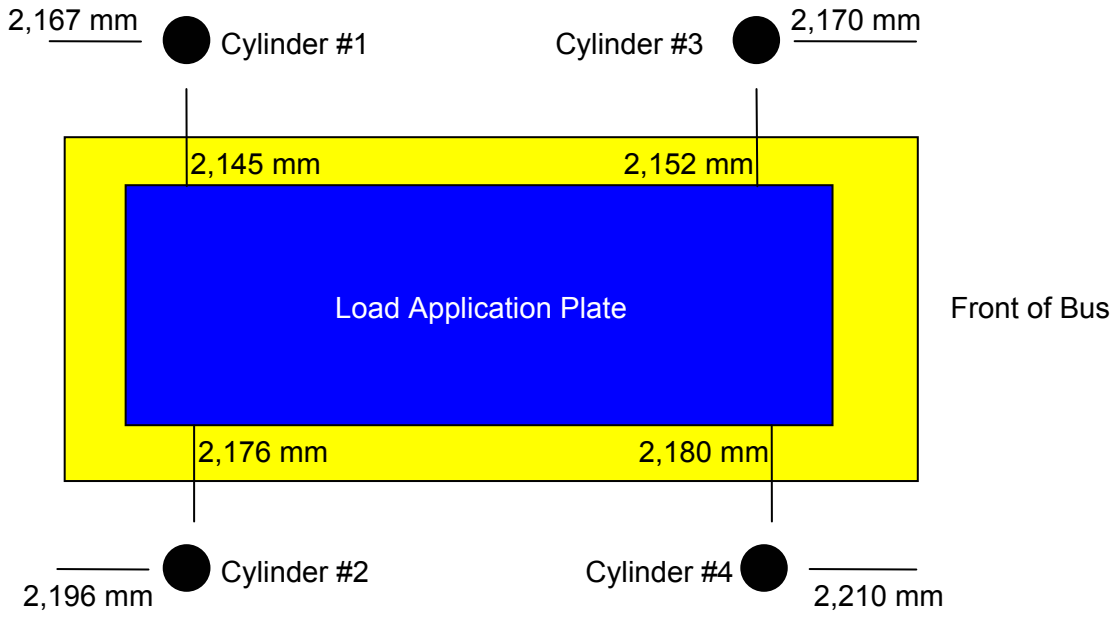
DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION

Description	LF	RF	LR	RR
Perpendicular Distance from closest corner of load application plate (mm)	2,170	2,210	2,167	2,196
From closest outside edge of load application plate (mm)	2,152	2,180	2,145	2,176

Note: LR = Left Rear, RR = Right Rear, LF = Left Front, and RF = Right Front



Comments: Horizontal lasers were used at each roof corner to show individual crush at each corner. Tape was placed on the bus sidewall at the nearest point to the roof corners. This tape was marked at each indicated point of interest during the profile. These marks were measured with a calibrated steel rule at the conclusion of the testing. These are used as the delivered displacement values. Displacement transducers were also used at the cylinders. The measurements in reference to the nearest bus corner can give triangulation coordinates. These measurements are used as secondary to the laser measurements.

Recorded By: _____

Approved By: _____ Date: 12/08/10

DATA SHEET 2

FORCE APPLICATION AND DEFLECTION INFORMATION

Test Vehicle: **2008 COLLINS GRAND BANTAM SCHOOL BUS** NHTSA No.: **C80900**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **12/08/10**

FORCE APPLICATION PLATE LOAD CALCULATION

Unloaded Delivered Weight (UVW):	4,098 kg
Calculated Test Load = 1.5 * UVW:	6,147 kg (60,281.5 N)
Range of Test Load (-1% to -3%):	58,473.1 N – 59,678.7 N

FORCE APPLICATION PLATE LOAD

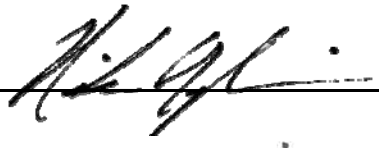
		Pre-load		Maximum Load		Deflection B-A (mm)
		Displacement A (mm)	Load (N)	Displacement B (mm)	Load (N)	
Cylinder	1 (LR)	1	451.1	4	14,550.6	3
	2 (RR)	2	437.5	71	14,784.0	69
	3 (LF)	0	532.6	23	14,462.9	23
	4 (RF)	2	569.2	88	14,651.7	86
Total Load			1,990.4		58,449.2	

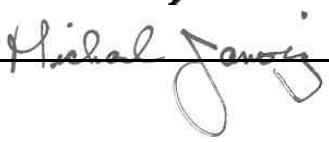
FORCE APPLICATION PLATE DEFLECTION

		Pre-load	Maximum Load	Deflection B-A (mm)	Deflection ≤ 130 mm?	
		Displacement A (mm)	Displacement B (mm)		Yes - Pass	No - Fail
Corner of Force Application Plate	1 (LR)	2	13	11	**PASS**	
	2 (RR)	2	41	39	**PASS**	
	3 (LF)	3	31	28	**PASS**	
	4 (RF)	1	51	50	**PASS**	
Average Deflection				32		

Note: LR = Left Rear, RR = Right Rear, LF = Left Front, and RF = Right Front

Comments: Deflection at each corner of the required force application plate area was measured with the use of laser indicators positioned near the four most outboard corners of the vehicle's roof.

Recorded By: 

Approved By:  Date: 12/08/10

DATA SHEET 3

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS

Test Vehicle: **2008 COLLINS GRAND BANTAM SCHOOL BUS** NHTSA No.: **C80900**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **12/08/10**

		Yes - Pass	No - Fail
Can all exits be manually released and extended by a single person without tools, remote controls, and without the engine running?		**PASS**	
Is emergency exit door releasable from inside the school bus?	BEFORE LOAD:	**PASS**	
	MAXIMUM LOAD:	**PASS**	
	AFTER LOAD:	**PASS**	
Is emergency exit door releasable from outside the school bus?	BEFORE LOAD:	**PASS**	
	MAXIMUM LOAD:	**PASS**	
	AFTER LOAD:	**PASS**	

Note: BEFORE, MAXIMUM & AFTER LOAD, refer to the time when the assessment was made relative to load being applied to the school bus roof with the force application plate.

Comments: None

Recorded By: _____

Approved By: _____ Date: 12/08/10

DATA SHEET 4

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

Test Vehicle: **2008 COLLINS GRAND BANTAM SCHOOL BUS** NHTSA No.: **C80900**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **12/08/10**

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Door	28.2	PASS		26.8	PASS		22.5	PASS		Rotary
	27.0			23.7			27.0			
	28.1			25.8			23.7			
	Average: 27.8			Average: 25.4			Average: 24.4			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Door	114.0	PASS		103.0	PASS		127.0	PASS		Push Out
	109.0			96.0			131.0			
	109.0			107.0			126.0			
	Average: 110.7			Average: 102.0			Average: 128.0			

Note: BEFORE, MAXIMUM & AFTER LOAD, refer to the time when the assessment was made relative to load being applied to the school bus roof with the force application plate.

Comments: None

Recorded By: _____

Approved By: _____ Date: 12/08/10

DATA SHEET 5

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (EXTERIOR)

Test Vehicle: **2008 COLLINS GRAND BANTAM SCHOOL BUS** NHTSA No.: **C80900**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **12/08/10**

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

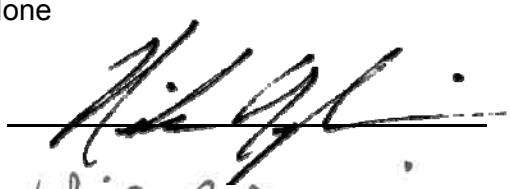
Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Door	112.0	PASS		133.0	PASS		108.0	PASS		Rotary
	128.0			119.0			132.0			
	129.0			113.0			128.0			
	Average: 123.0			Average: 121.7			Average: 122.7			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N?		MAXIMUM LOAD (N)	Force ≤ 178 N?		AFTER LOAD (N)	Force ≤ 178 N?		Type of Motion
		Yes - Pass	No - Fail		Yes - Pass	No - Fail		Yes - Pass	No - Fail	
Rear Door	105.0	PASS		134.0	PASS		112.0	PASS		Pull Out
	100.0			110.0			107.0			
	99.0			100.0			104.0			
	Average: 101.3			Average: 114.7			Average: 107.7			

Note: BEFORE, MAXIMUM & AFTER LOAD, refer to the time when the assessment was made relative to load being applied to the school bus roof with the force application plate.

Comments: None

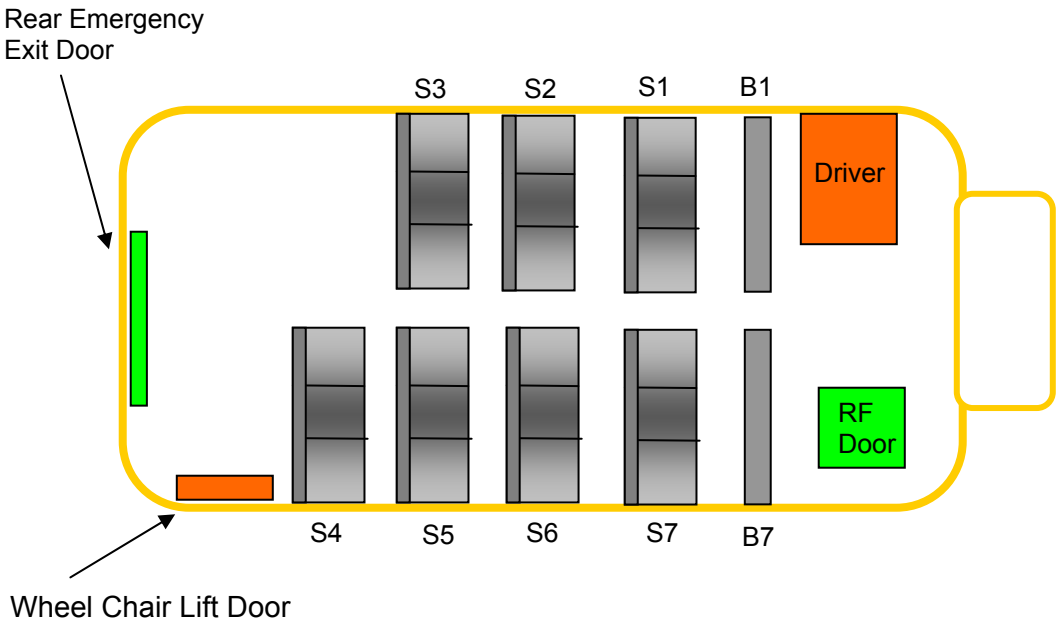
Recorded By: 

Approved By:  Date: 12/08/10

DATA SHEET 6

EMERGENCY EXIT MEASUREMENTS

Test Vehicle: **2008 COLLINS GRAND BANTAM SCHOOL BUS** NHTSA No.: **C80900**
Test Lab: **MGA RESEARCH CORPORATION** Test Date: **12/08/10**



		Height (mm)	Width (mm)	Required Test Form (Ellipsoid or Parallelepiped)	Opening allowed unobstructed passage of the test form?	
					Yes – Pass	No – Fail
1	Rear Door	1,369	935	Parallelepiped	**PASS**	

Comments: None

Recorded By: _____

Approved By: _____ Date: 12/08/10

SECTION 4

INSTRUMENTATION AND EQUIPMENT LIST

Equipment	Manufacturer	Serial No.	Cal. Date	Next Cal. Date
Steel Tape	Stanley	551	08/16/10	02/16/11
Cylinder #1 Load Cell	Interface	315453	09/30/10	03/30/11
Cylinder #1 Displacement Pot.	Ametek	0108-27166	10/05/10	04/05/11
Cylinder #2 Load Cell	Interface	321811	10/04/10	04/04/11
Cylinder #2 Displacement Pot.	Ametek	0304-21633	10/05/10	04/05/11
Cylinder #3 Load Cell	Interface	326710	10/01/10	04/01/11
Cylinder #3 Displacement Pot.	Ametek	0108-27168	10/05/10	04/05/11
Cylinder #4 Load Cell	Interface	321788	09/30/10	03/30/11
Cylinder #4 Displacement Pot.	Ametek	0108-27167	10/05/10	04/05/11
Force Gauge	Quantrol	DMLC1120014	12/08/10	04/15/11
Inclinometer	Pro 360	006	09/24/10	03/24/11

SECTION 5

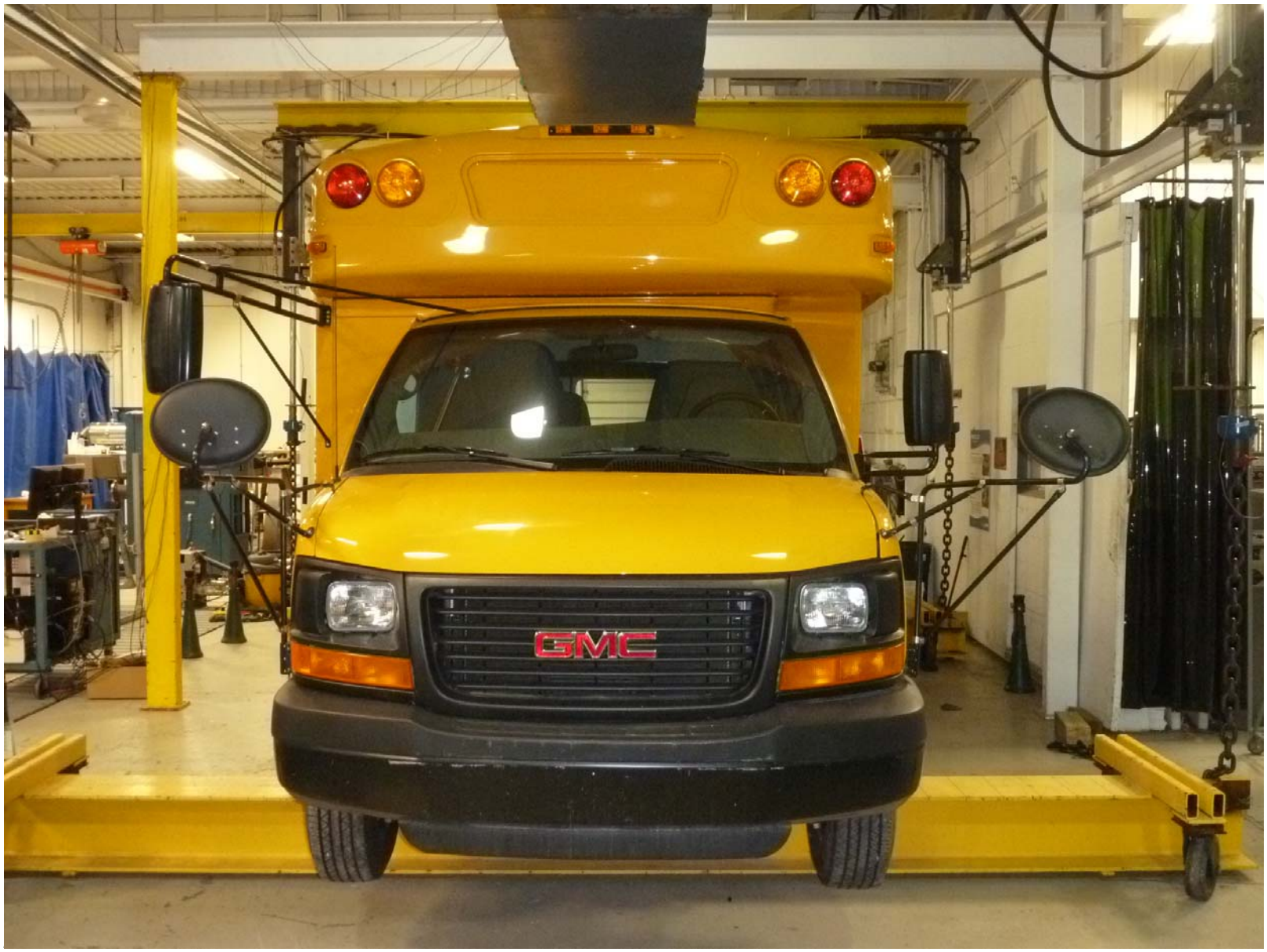
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Frontal View of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**



Frontal View of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Rear View of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Rear View of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Full View of Left Side of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Full View of Right Side of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Full View of Right Side of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Left Front ¾ View of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Left Front ¾ View of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Right Front ¾ View of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Right Front ¾ View of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Left Rear ¾ View of School Bus Before Testing (as received by MGA)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Left Rear ¾ View of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Right Rear ¾ View of School Bus Before Testing (as received by MGA)

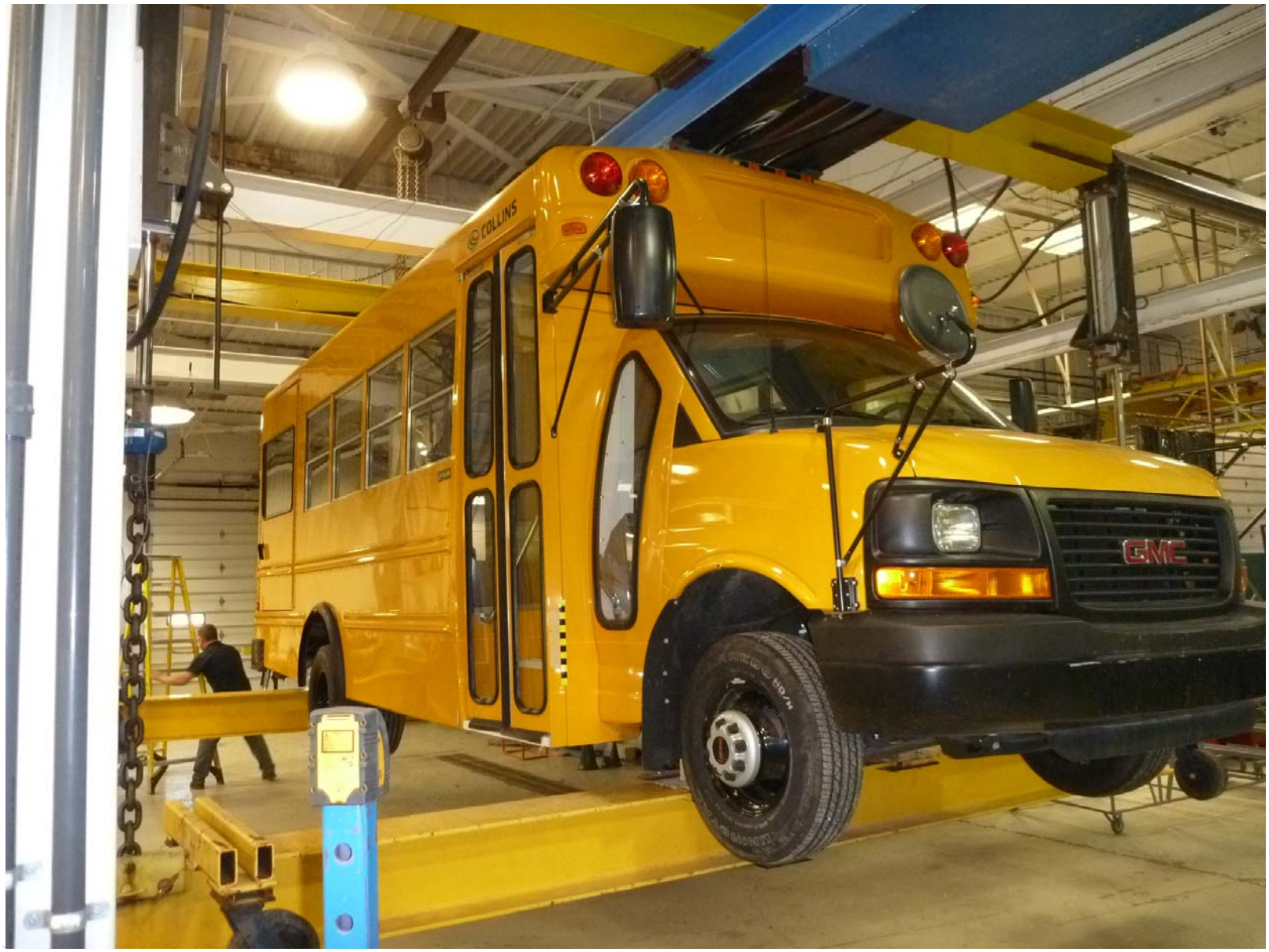
Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Right Rear ¾ View of School Bus After Testing

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Loading Device Placed Against Bus's Roof at Beginning of Test (Right Front)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**



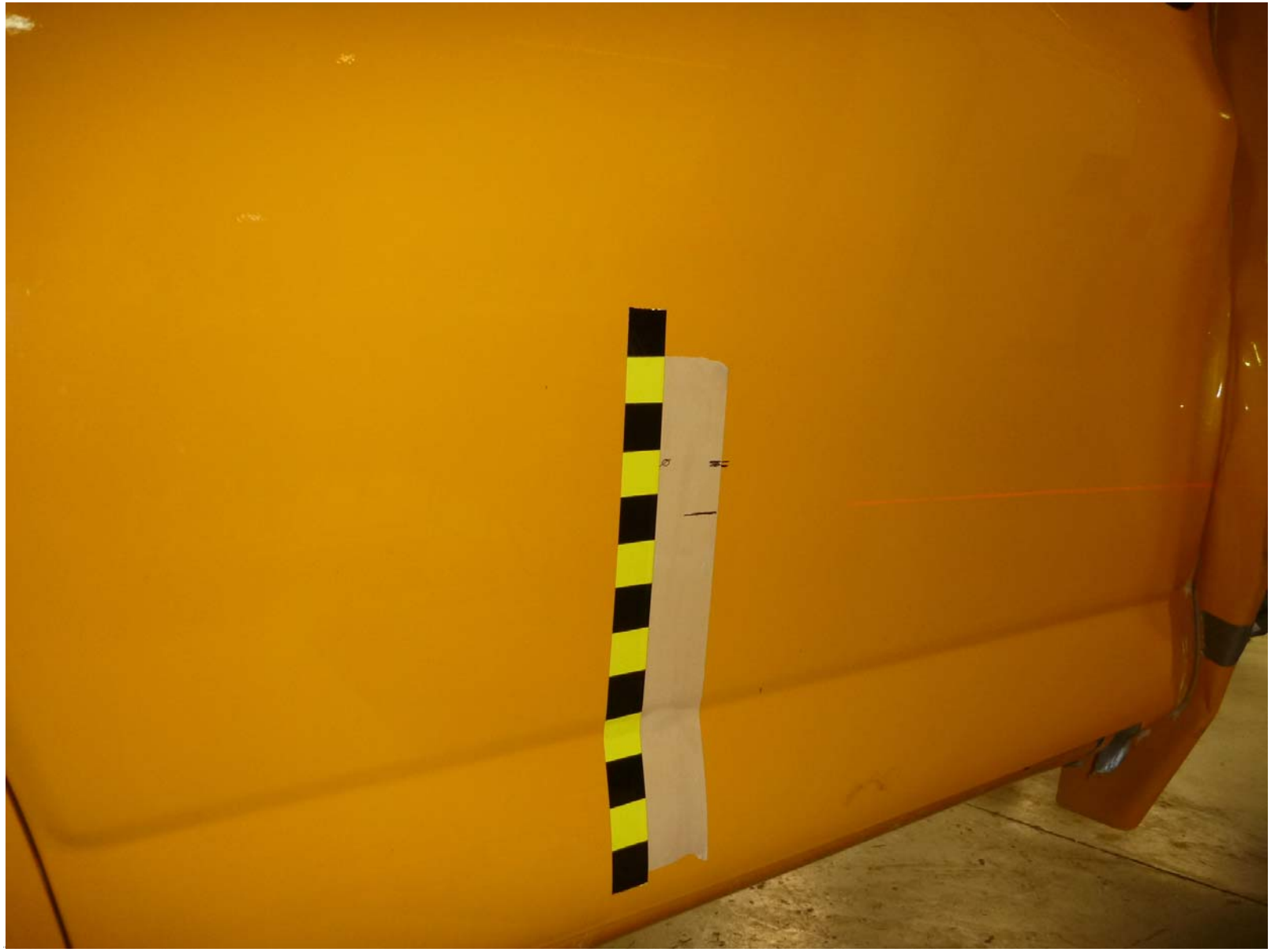
Loading Device Placed Against Bus's Roof at Maximum Load Condition (Right Front)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Loading Device Placed Against Bus's Roof at Beginning of Test (Right Rear)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Loading Device Placed Against Bus's Roof at Maximum Load Condition (Right Rear)



Backup Roof Deflection Measuring Device at Maximum Load Condition (Left Front)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Backup Roof Deflection Measuring Device at Maximum Load Condition (Left Rear)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Backup Roof Deflection Measuring Device at Maximum Load Condition (Right Front)

Backup Roof Deflection Measuring Device at Maximum Load Condition (Right Rear)

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Roof, After Removal of Loading Device, Viewed From the Bus Exterior

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

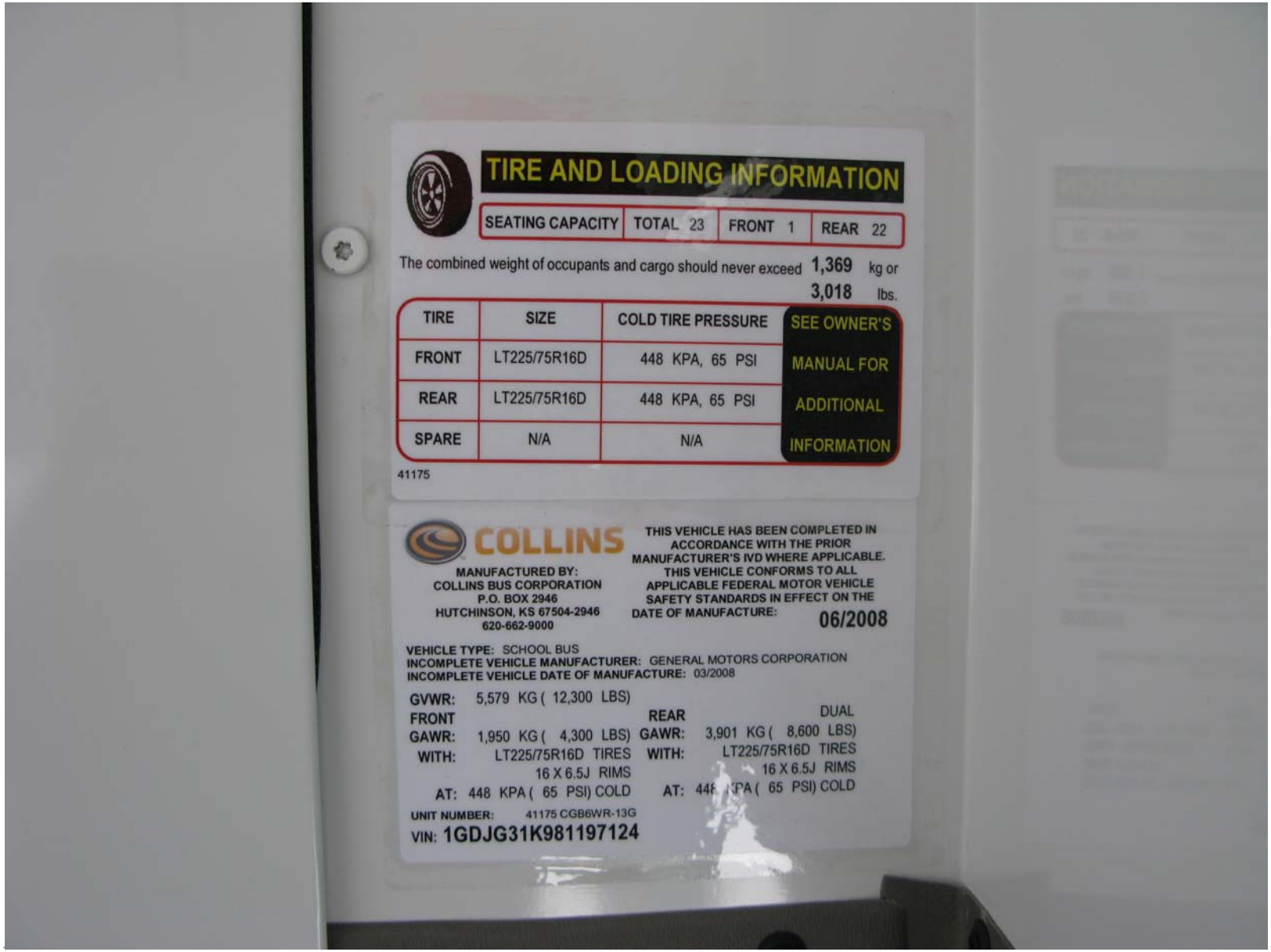
Roof, After Removal of Loading Device, Viewed From the Bus Interior

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

Rear Exit Door Open With Parallelepiped In Place

Test Vehicle:	**2008 COLLINS GRAND BANTAM SCHOOL**	NHTSA No.:	**C80900**
Procedure:	**FMVSS 220**	Test Dates:	**12/08/10**

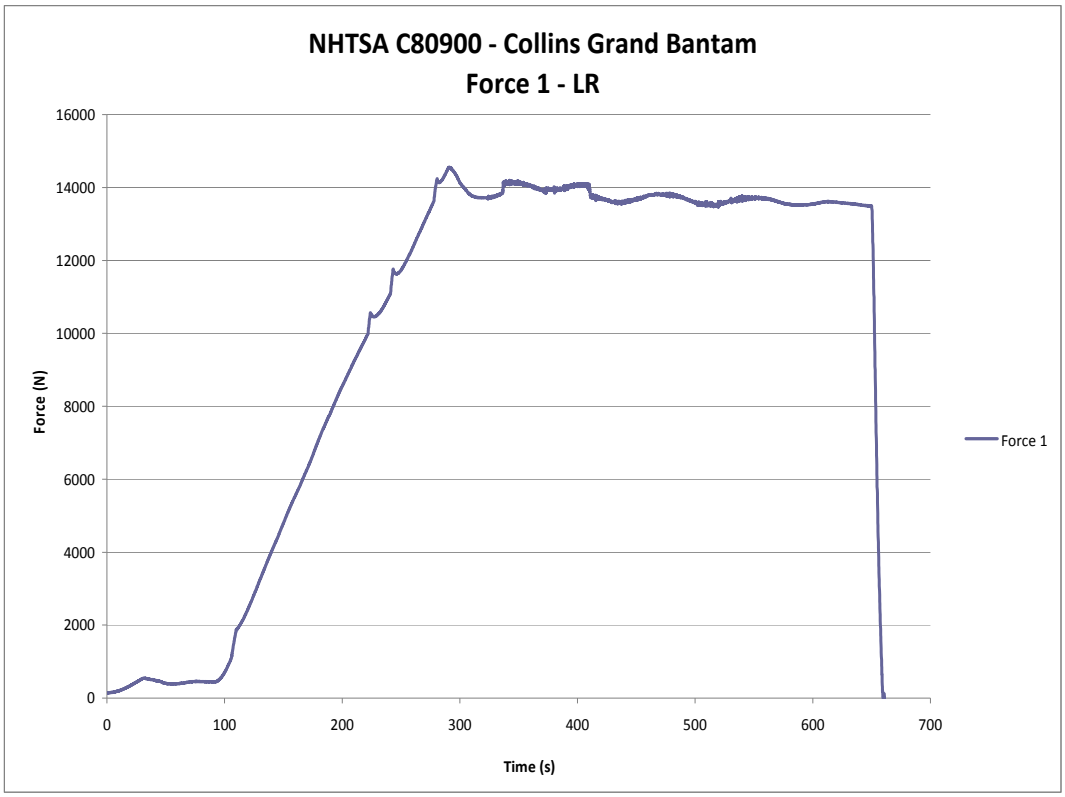
Certification Label and Tire Placard

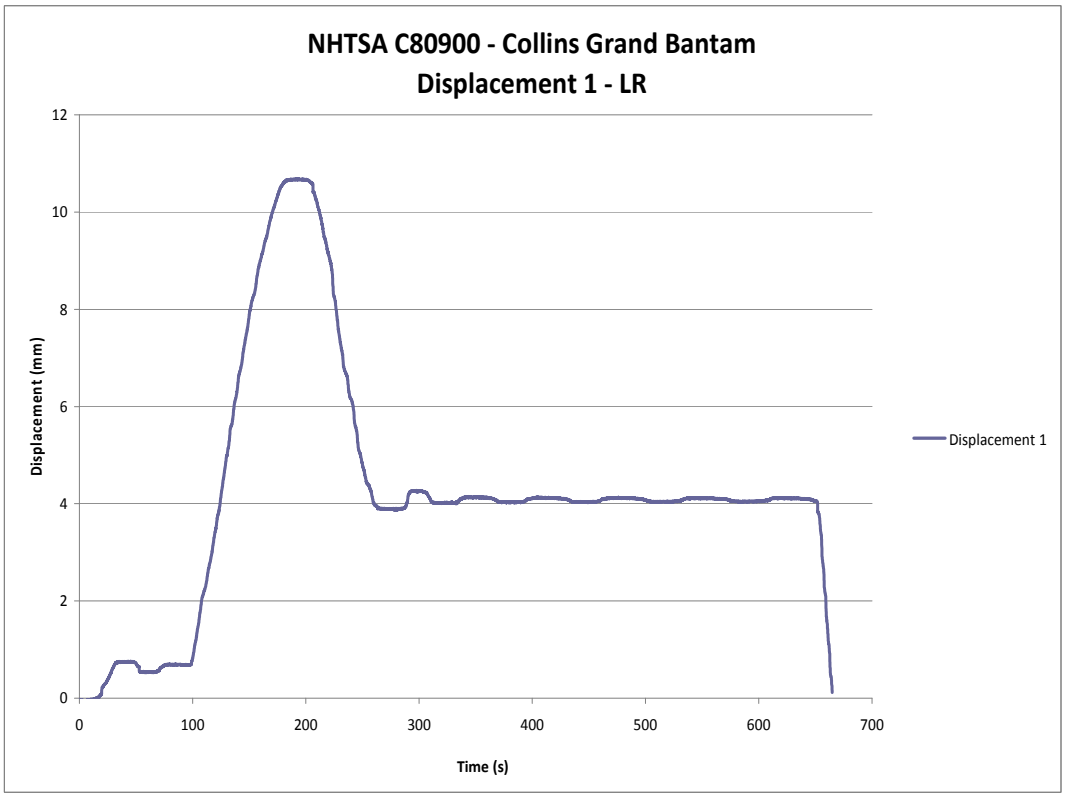


Incomplete Vehicle Label

SECTION 6

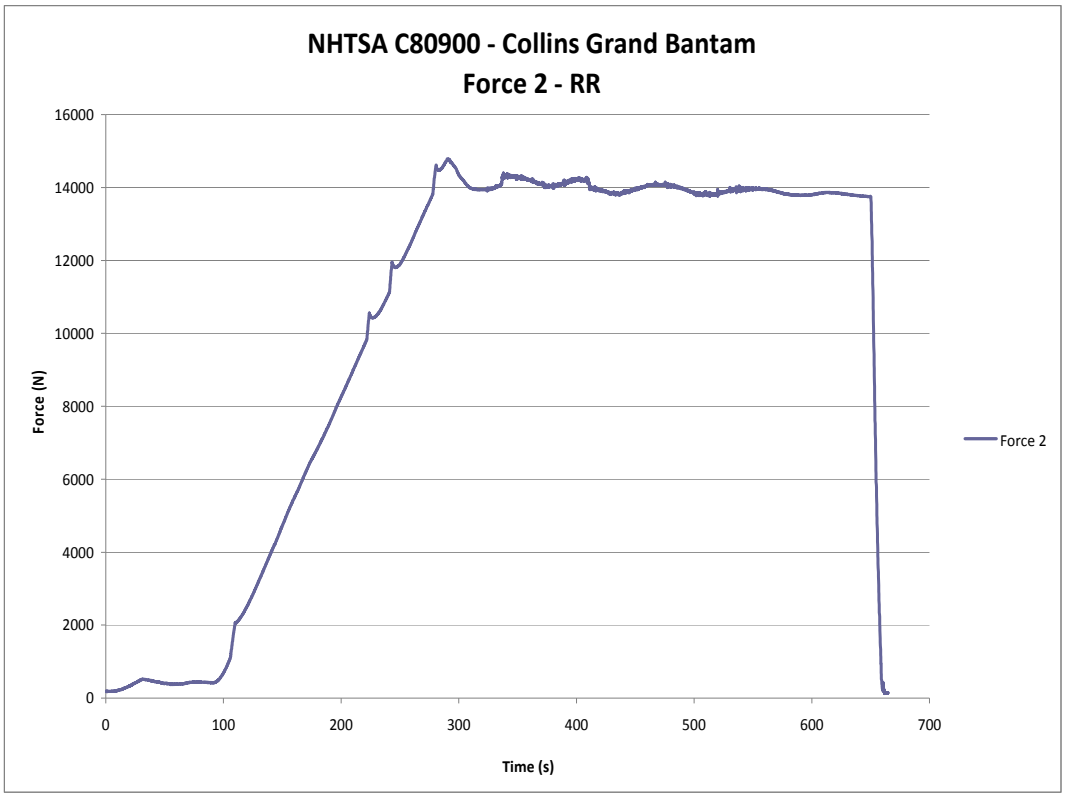
TEST PLOTS

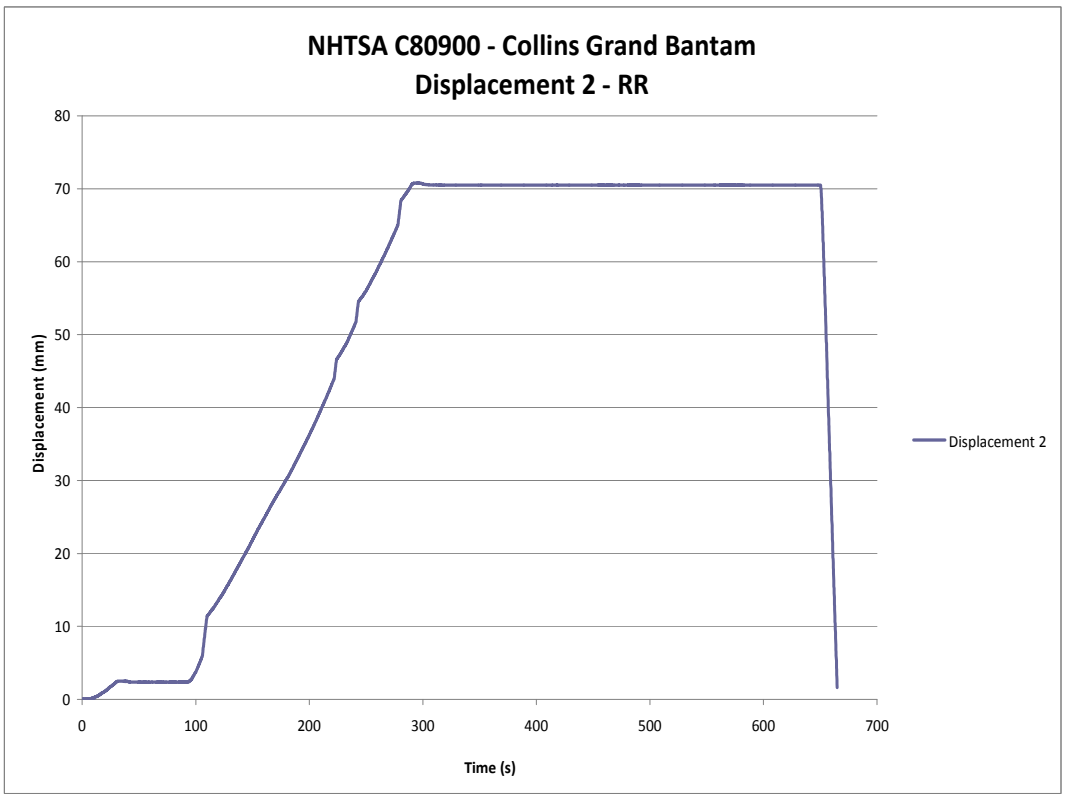




SECTION 6

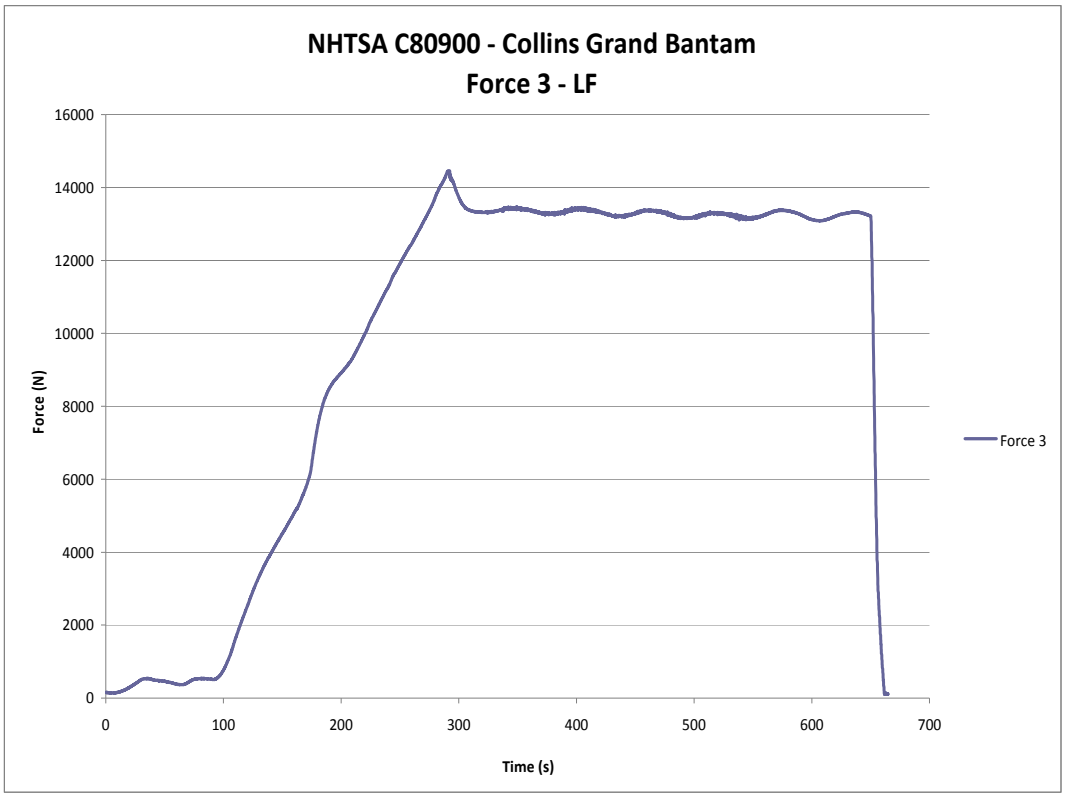
TEST PLOTS

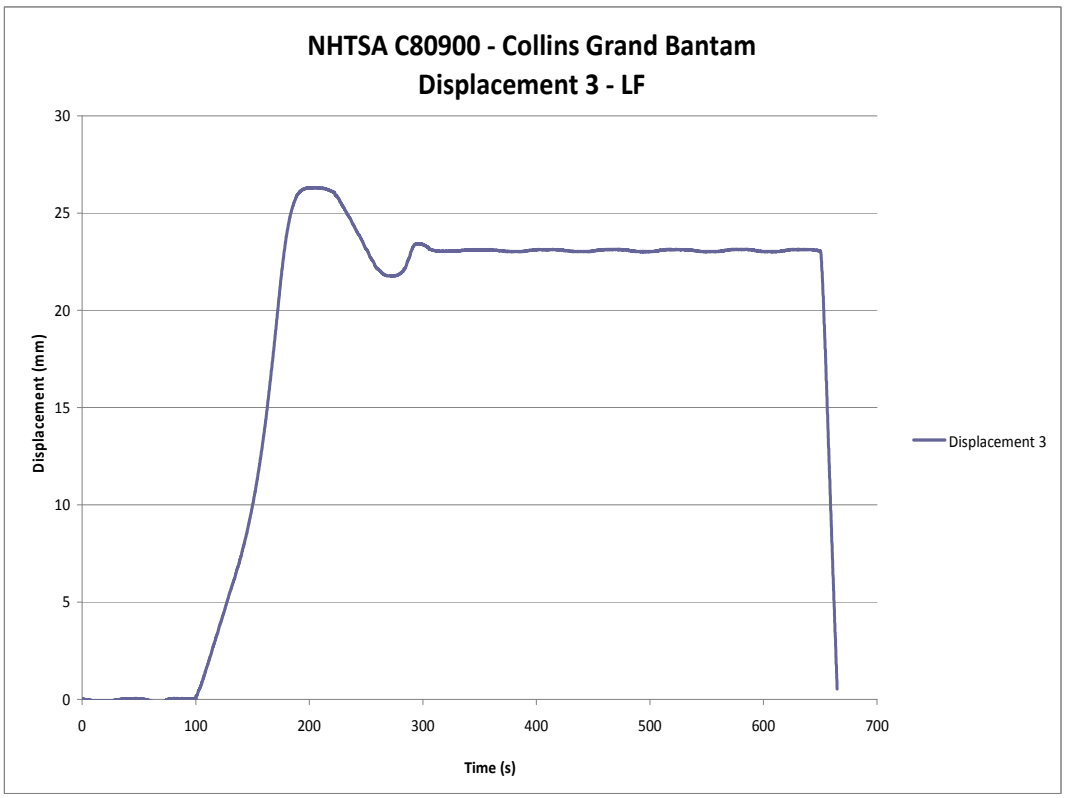




SECTION 6

TEST PLOTS





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TEST PLOTS