REPORT NUMBER: 220-MGA-2009-002

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

BLUE BIRD BODY COMPANY
2009 BLUE BIRD MICRO BIRD SCHOOL BUS
NHTSA NO.: C90902

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

TEST DATES: JUNE 18, 2009 – JUNE 19, 2009

FINAL REPORT DATE: OCTOBER 7, 2010

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
MAILCODE: NVS-220
1200 NEW JERSEY AVENUE, S.E.
WASHINGTON, D.C. 20590

Prepared by: _____ Date: June 26, 2009
Eric Peschman, Project Engineer

Reviewed by: _____ Date: June 26, 2009
Michael Janovicz, Program manager

FINAL REPORT ACCEPTED BY:

_____
October 7, 2010
Date of Acceptance

Technical Report Documentation Page

1. Report No. 220-MGA-2009-002	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Final Report of FMVSS 220 Compliance Testing of 2009 Blue Bird Micro Bird School Bus NHTSA No.: C90902		*5. Report Date* October 7, 2010 *6. Performing Organization Code* MGA	
7. Author(s) Eric Peschman, Project Engineer Michael Janovicz, Program Manager		*8. Performing Organization Report No.* 220-MGA-2009-002	
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 6/18/09 – 10/07/10 *14. Sponsoring Agency Code* NVS-220	
15. Supplementary Notes			
16. Abstract Compliance tests were conducted on the subject 2009 Blue Bird Micro Bird School Bus, NHTSA No.: C90902, 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 MY 2009 Blue Bird Micro Bird School Bus, NHTSA No.: C90902, 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 MY 2009 Blue Bird Micro Bird School Bus, NHTSA No.: C90902 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

DATA SHEET 1

VEHICLE INFORMATION

Test Vehicle: **2009 BLUE BIRD MICRO BIRD SCHOOL BUS** NHTSA No.: **C90902**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **6/18/2009-6/19/2009**

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

INCOMPLETE VEHICLE (if applicable)	
Manufacturer:	Ford Motor Company
Model:	138 E350 SD E35Q
VIN:	1FDDE35L19DA17396
Build Date:	10/2008

COMPLETED VEHICLE (SCHOOL BUS)	
Manufacturer:	Blue Bird Body Company
Make/Model:	Micro Bird
VIN:	1FDDE35L19DA17396
NHTSA No.:	C90902
Color:	Yellow
GVWR (kg/lb):	4356 kg / 9600 lbs
Build Date:	12/2008
Certification Date:	10/2008

DATES	
Vehicle Receipt:	12/29/08
Start of Compliance Test:	06/18/09
Completion of Compliance Test:	06/19/09

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	694	889	
Right	kg	700	919	
Ratio	%	44	56	
Totals	kg	1,394	1,808	3,202

SCHOOL BUS ROOF AND APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	4,280	4,405	5,410
Width (mm):	2,159	2,284	2,438

Notes: The vehicle was centered laterally and longitudinally under the force application plate.

School Bus Has: X Rigid Frame; __ Unibody

Components Removed From Vehicle Before Testing : Front – Center roof air vent

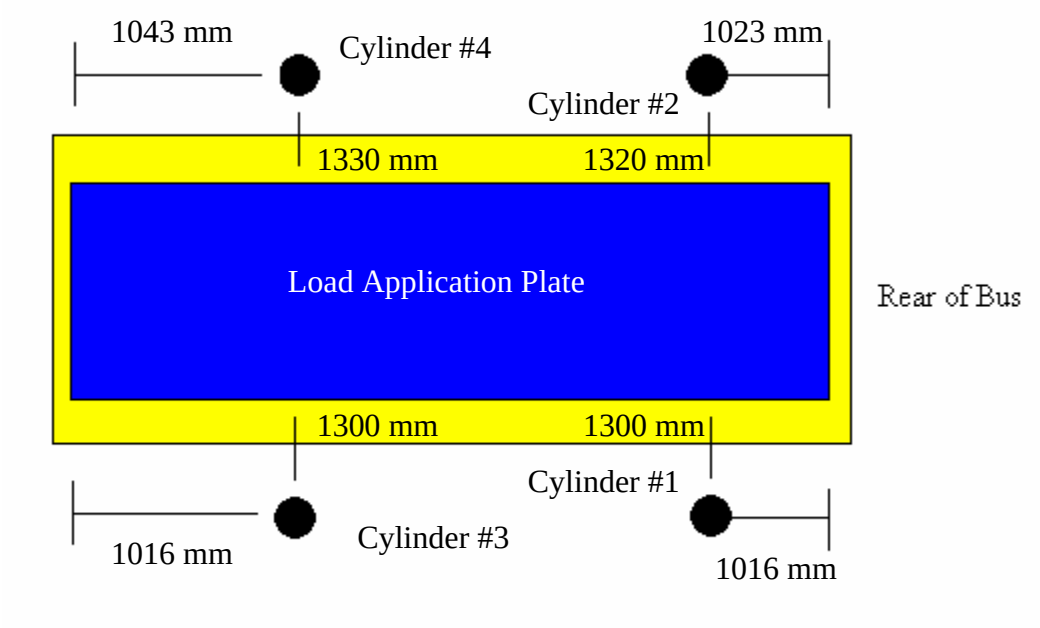
DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION

Description	LF	RF	LR	RR
Perpendicular Distance from closest corner of force application plate (mm)	1,016	1,043	1,016	1,023
From closest outside edge of force application plate (mm)	1,300	1,330	1,300	1,320

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



COMMENTS: NONE

Recorded By: _____

Approved By: _____ Date: June 26, 2009

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the 2009 Blue Bird Micro Bird School Bus, NHTSA No. C90902.

DATA SHEET 2

FORCE APPLICATION AND DEFLECTION INFORMATION

Test Vehicle: **2009 BLUE BIRD MICRO BIRD SCHOOL BUS** NHTSA No.: **C90902**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **6/18/2009-6/19/2009**

FORCE APPLICATION PLATE LOAD CALCULATION

Unloaded Delivered Weight (UDW):	3,202 kg
Calculated Test Load = 1.5 * UDW:	4,803 kg
Range of Test Load (-1% to -3%):	4,755 kg – 4,659 kg

FORCE APPLICATION PLATE LOAD

		Pre-load		Maximum Load	
		Displacement (mm)	Load (kg)	Displacement (mm) **	Load (kg)
Cylinder	1 (LR)	8	57	18	1,222
	2 (RR)	20	57	95	1,213
	3 (LF)	23	57	67	1,212
	4 (RF)	26	57	121	1,282
Total Load			228		4,929

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

FORCE APPLICATION PLATE DEFLECTION

		Pre-load	Maximum Load	Deflection (B-A)	Deflection ≤ 130 mm?	
		Displacement (A) (mm)	Displacement (B) (mm) **	(mm)	Yes - Pass	No - Fail
Corner of Force Application Plate*	1 (LR)	8	18	10	X	
	2 (RR)	10	44	34	X	
	3 (LF)	18	47	29	X	
	4 (RF)	24	80	56	X	
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: Michael Janosz Date: June 26, 2009

DATA SHEET 3

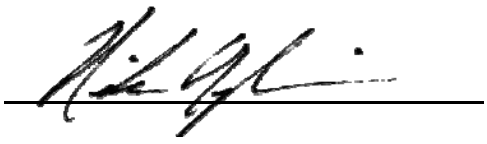
EMERGENCY EXIT OPERATION

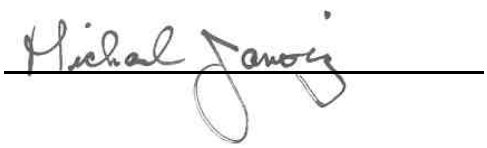
Test Vehicle: **2009 IC CORPORATION RE300 SCHOOL BUS** NHTSA No.: **C90900**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **03/27/09 – 05/07/09**

		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?		X	
Is emergency exit door releasable from inside the school bus?	BEFORE LOAD:	X	
	MAXIMUM LOAD:	X	
	AFTER LOAD:	X	
Is emergency exit door releasable from outside the school bus?	BEFORE LOAD:	X	
	MAXIMUM LOAD:	X	
	AFTER LOAD:	X	

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: June 26, 2009

DATA SHEET 4

EMERGENCY EXIT OPERATING FORCES - INTERIOR

Test Vehicle: **2009 BLUE BIRD MICRO BIRD SCHOOL BUS** NHTSA No.: **C90902**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **6/18/2009-6/19/2009**

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	MAXIMUM LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	AFTER LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	Type of Motion
Rear Emergency Exit Door	31.4			34.4			34.4			Rotary
	30.9			36.6			36.6			
	31.8	X		34.0	X		33.4	X		
	Average: 31.4			Average: 35.0			Average: 34.8			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	MAXIMUM LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	AFTER LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	Type of Motion
Rear Emergency Exit Door	27.7			27.2			20.3			Push To Open
	23.1			27.0			20.5			
	26.1	X		30.4	X		20.3	X		
	Average: 25.6			Average: 28.2			Average: 20.4			

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: June 26, 2009

DATA SHEET 5

EMERGENCY EXIT OPERATING FORCES - EXTERIOR

Test Vehicle: **2009 BLUE BIRD MICRO BIRD SCHOOL BUS** NHTSA No.: **C90902**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **6/18/2009-6/19/2009**

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

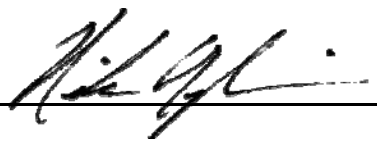
Exit Location	BEFORE LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	MAXIMUM LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	AFTER LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	Type of Motion
Rear Emergency Exit Door	138.9	X		141.0	X		143.6	X		Rotary
	139.1			147.5			128.3			
	140.8			147.5			143.1			
	Average: 139.6			Average: 145.3			Average: 138.3			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit Location	BEFORE LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	MAXIMUM LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	AFTER LOAD (N)	Force ≤ 178 N? Yes - Pass	Force ≤ 178 N? No - Fail	Type of Motion
Rear Emergency Exit Door	14.2	X		22.3	X		17.4	X		Pull To Open
	15.2			18.4			17.4			
	22.0			22.2			17.9			
	Average: 17.1			Average: 21.0			Average: 17.6			

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

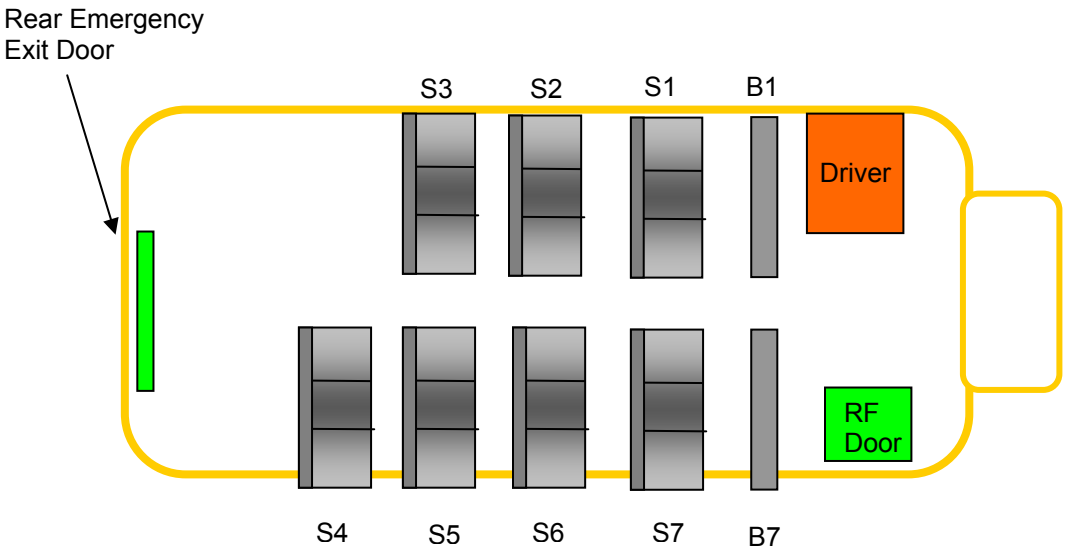
Recorded By: 

Approved By:  Date: June 26, 2009

DATA SHEET 6

EMERGENCY EXIT MEASUREMENTS

Test Vehicle: **2009 BLUE BIRD MICRO BIRD SCHOOL BUS** NHTSA No.: **C90902**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **6/18/2009-6/19/2009**



		Height (mm)	Width (mm)	Required Test Form (Ellipsoid or Parallelepiped)	Opening allowed unobstructed passage of the test form?	
					Yes – Pass	No – Fail
1	Rear Emergency Exit Door	1,400	880	Parallelepiped	X	

COMMENTS: NONE

Recorded By: _____

Approved By: _____ Date: June 26, 2009

SECTION 4

INSTRUMENTATION AND EQUIPMENT LIST

Equipment	Manufacturer	Serial No.	Cal. Date	Next Cal. Date
Steel Tape	Stanley	33 – 428	11/11/08	05/11/09
Cylinder #1 Load Cell	Interface	315453	04/30/09	10/30/09
Cylinder #1 Displacement Pot.	Ametek	27166	02/06/09	08/06/09
Cylinder #2 Load Cell	Interface	321811	04/30/09	10/30/09
Cylinder #2 Displacement Pot.	Ametek	27165	02/06/09	08/06/09
Cylinder #3 Load Cell	Interface	326701	04/30/09	10/30/09
Cylinder #3 Displacement Pot.	Ametek	21782	02/06/09	08/06/09
Cylinder #4 Load Cell	Interface	321788	04/30/09	10/30/09
Cylinder #4 Displacement Pot.	Ametek	27167	02/06/09	08/06/09
Parallelepiped	MGA	PARA – 1A	When Used	When Used
Force Gauge	Wagner	2668	01/08/09	07/08/09

SECTION 5

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

School Bus Front Axle Being Weighed (as received by MGA)

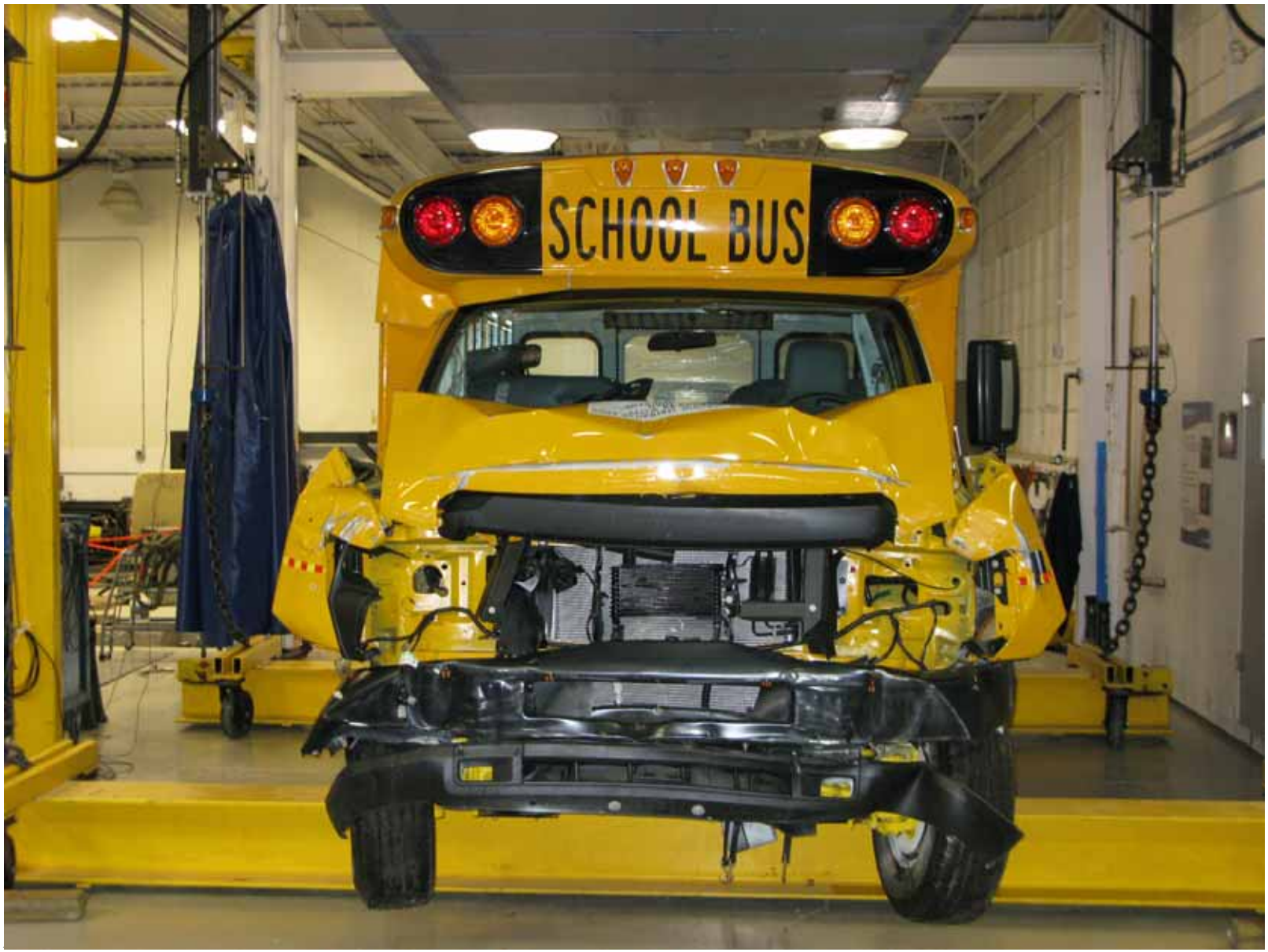
Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

School Bus Rear Axle Being Weighed (as received by MGA)

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**



Frontal View of School Bus After Testing

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

Rear View of School Bus After Testing

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

Right Front ¾ View of School Bus After Testing

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

Full View of Right Side of School Bus After Testing

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle: **2009 Blue Bird Micro Bird School Bus** NHTSA No.: **C90902**
Procedure: **FMVSS 220** Test Dates: **6/18/09-6/19/09**

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:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

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

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

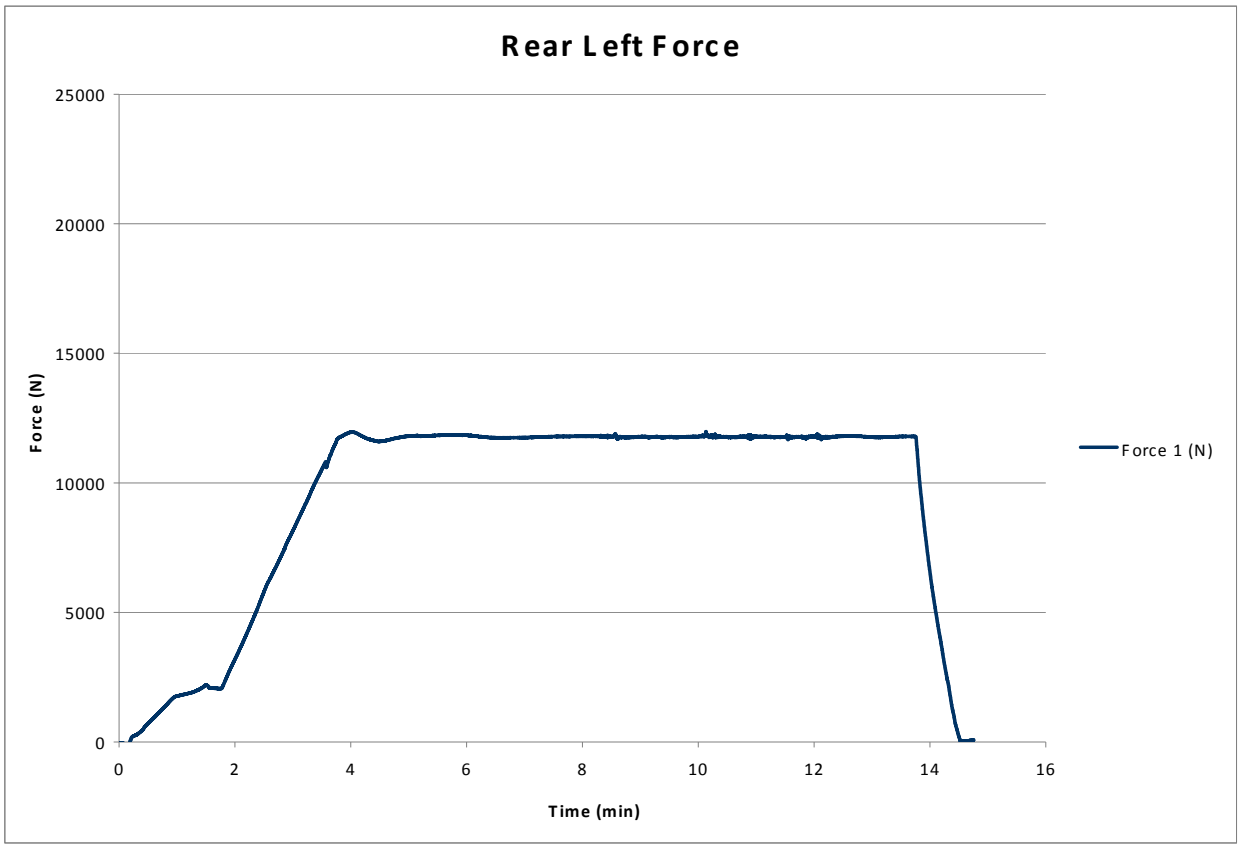
Test Vehicle:	**2009 Blue Bird Micro Bird School Bus**	NHTSA No.:	**C90902**
Procedure:	**FMVSS 220**	Test Dates:	**6/18/09-6/19/09**

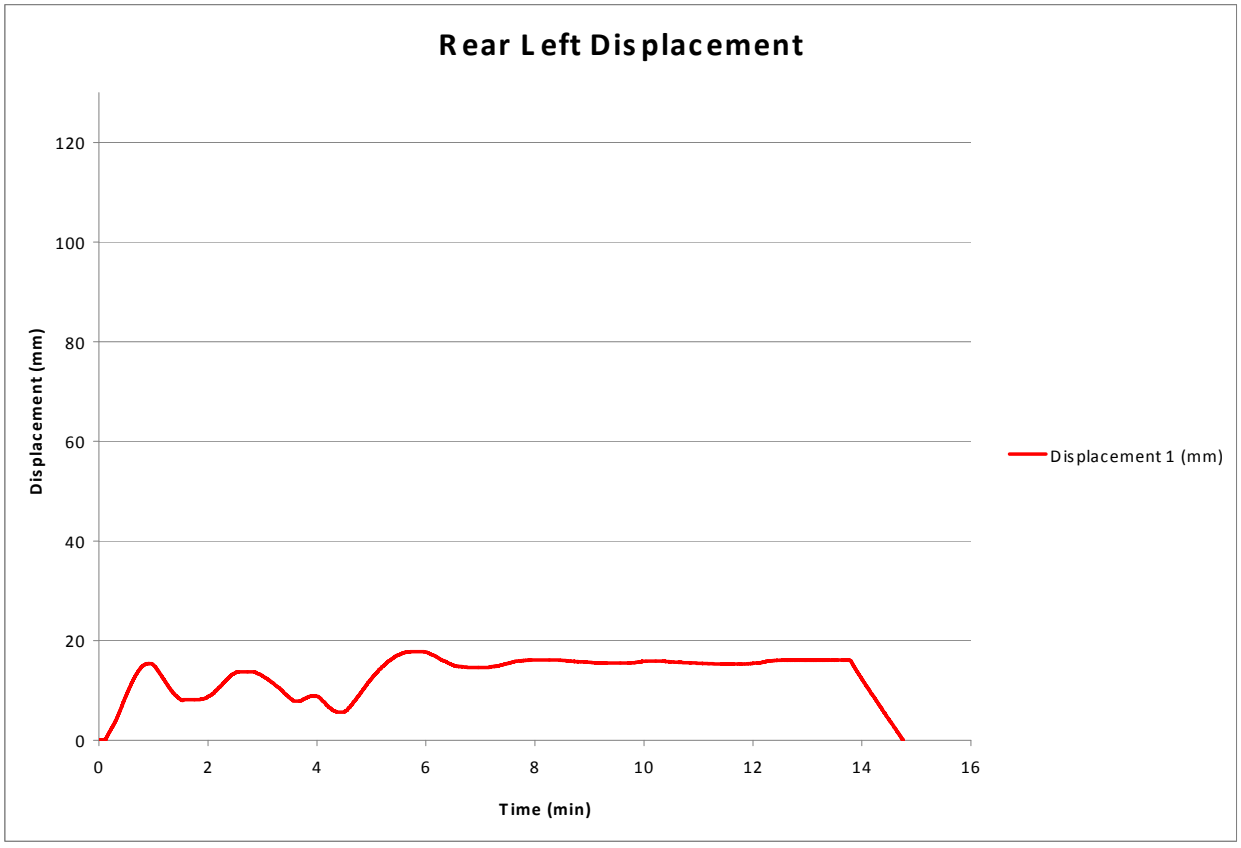
Rear Exit Door Open With Parallelepiped In Place

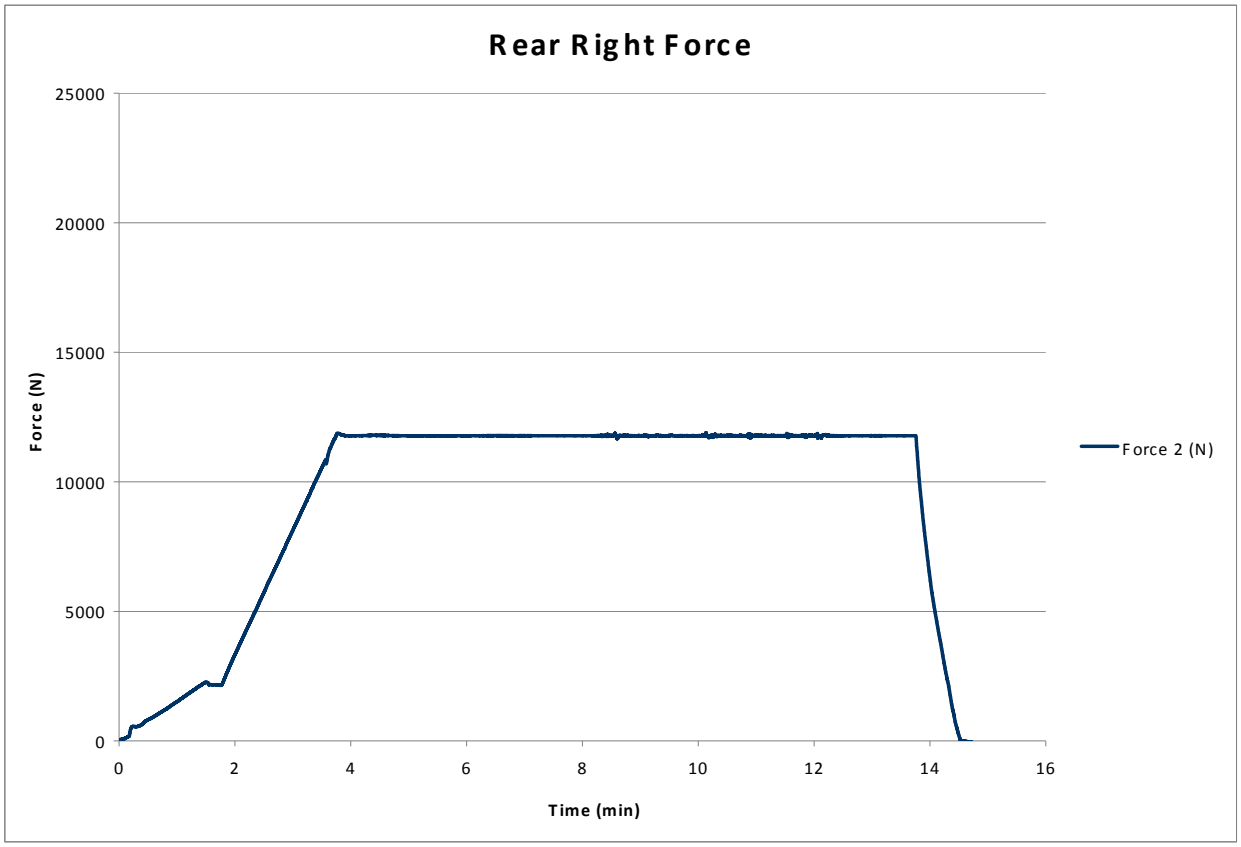
Close-up View of School Bus Certification Label

SECTION 6

TEST PLOTS



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15000
10000
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Force (N)
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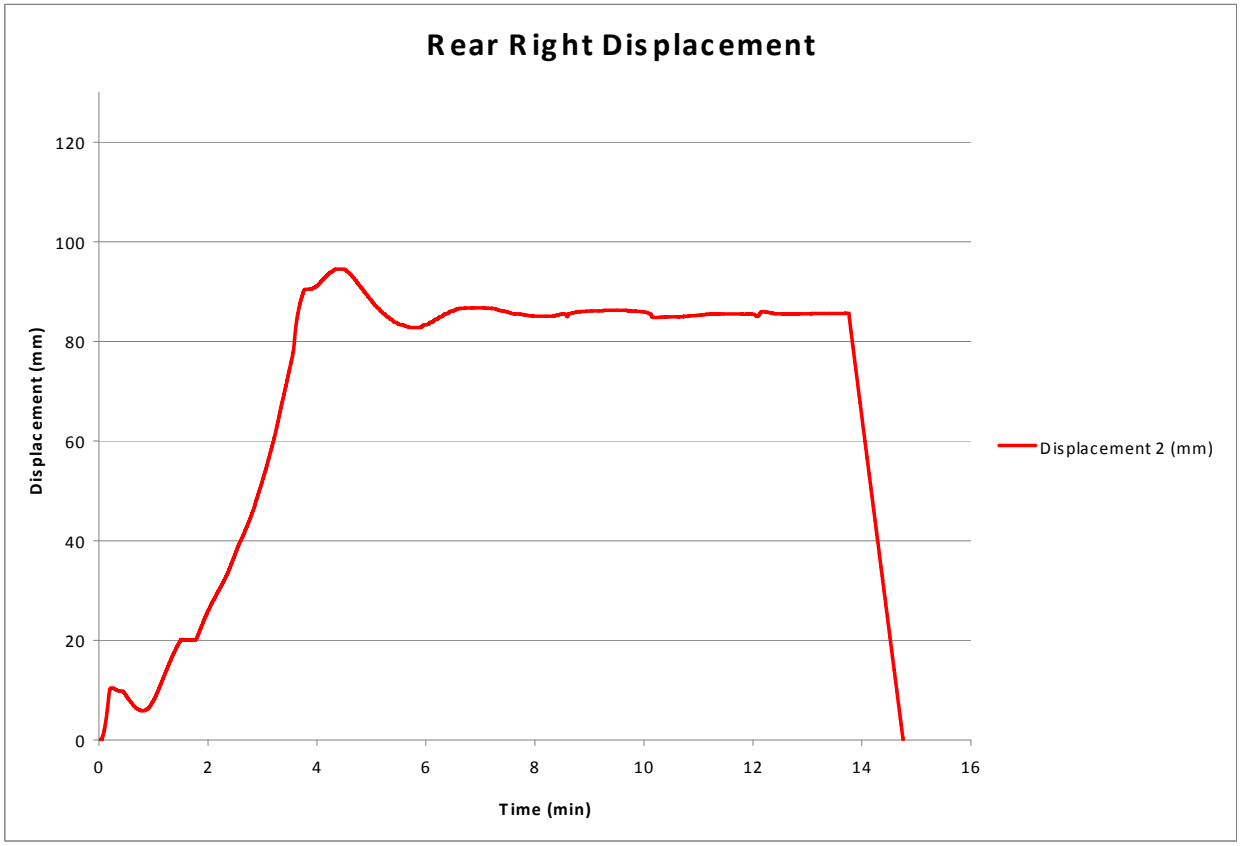
4
6
8
10
12
14
16
Time (min)
Force 2 (N)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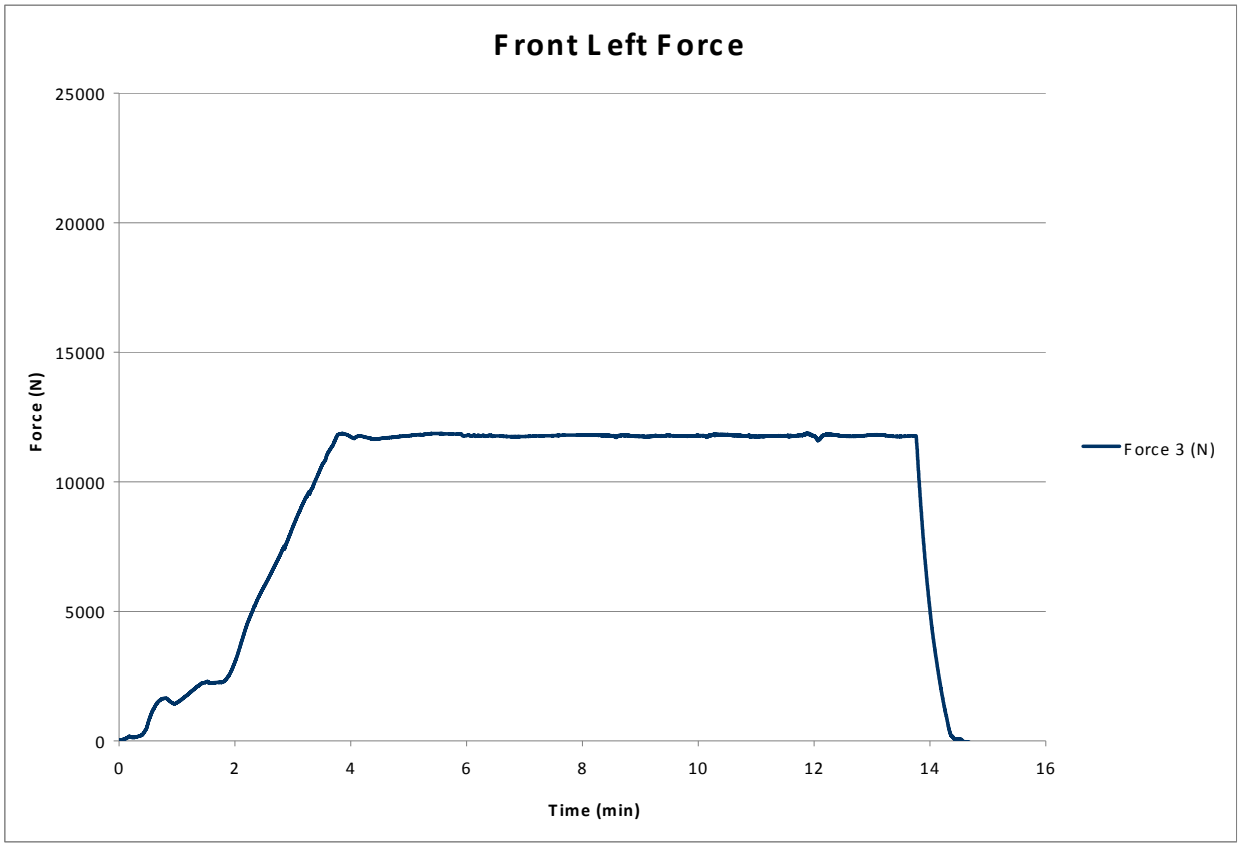
16
Time (min)
Displacement 2 (mm)


Front Left Force
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4
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8
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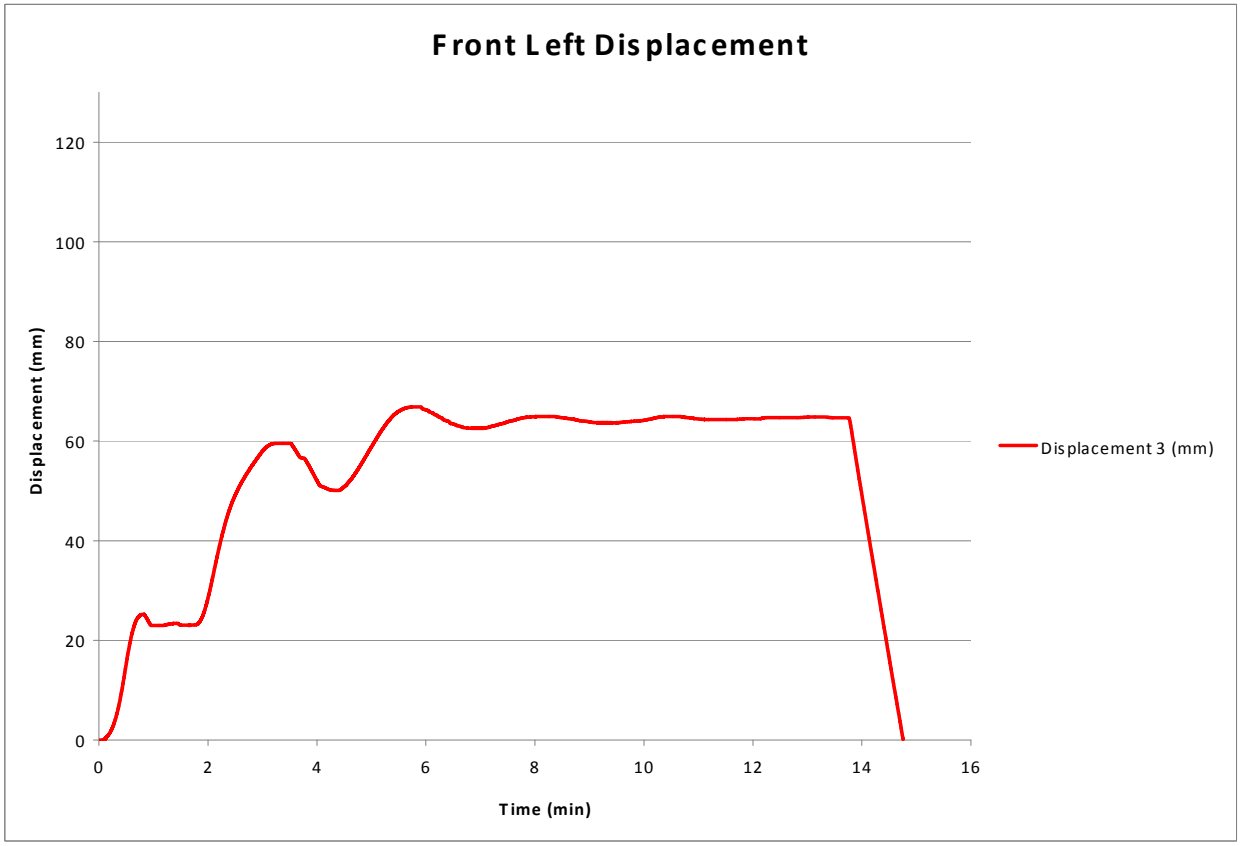
12
14
16
Time (min)
Force 3 (N)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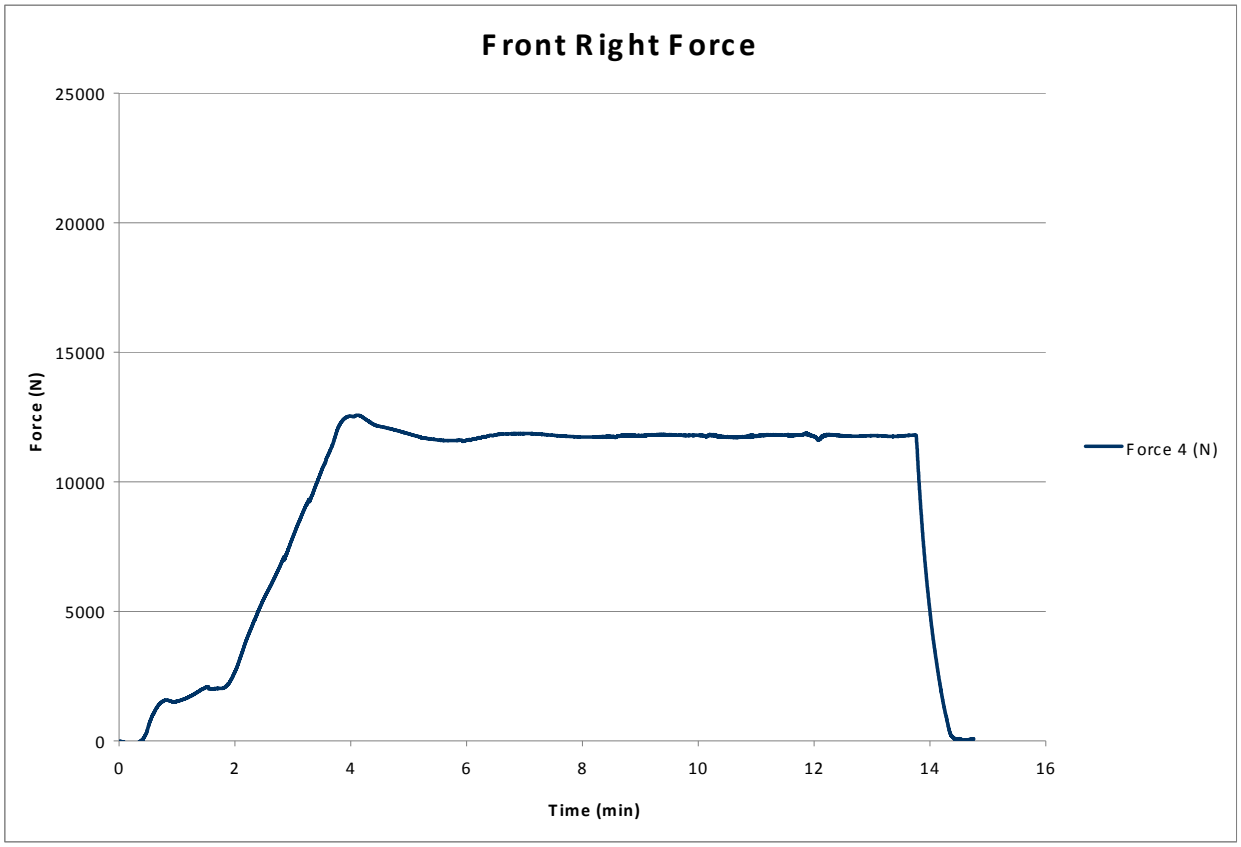
Time (min)
Displacement 3 (mm)


Front Right Force
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Force (N)
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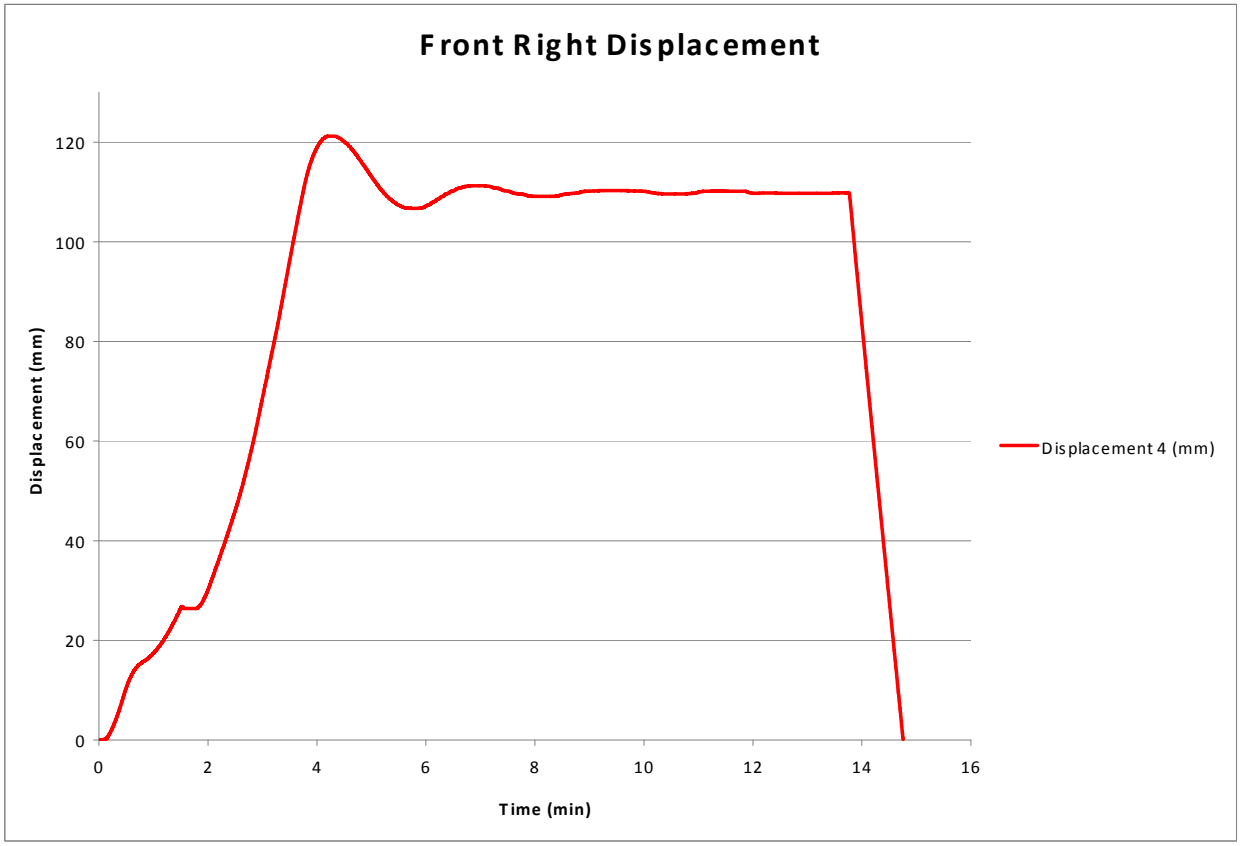
10
12
14
16
Time (min)
Force 4 (N)


Front Right Displacement
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80
60
40
20
0
Displacement (mm)
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2
4
6
8
10
12
14
16
Time (min)
Displacement 4 (mm)