REPORT NUMBER: 220-MGA-2009-001

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

IC CORPORATION
2009 IC CORPORATION RE300 SCHOOL BUS
NHTSA NO.: C90900

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

TEST DATES: MARCH 27, 2009 – MAY 7, 2009

FINAL REPORT DATE: JUNE 25, 2009

FINAL REPORT

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

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Prepared by: _____ Date: June 25, 2009
Eric Peschman, Project Engineer

Reviewed by: _____ Date: June 25, 2009
Michael Janovicz, Program manager

FINAL REPORT ACCEPTED BY:

June 25, 2009
Date of Acceptance

Technical Report Documentation Page

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16. Abstract Compliance tests were conducted on the subject 2009 IC Corporation RE300 School Bus, NHTSA No.: C90900, 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			
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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY 2009 IC Corporation RE300 School Bus, NHTSA No.: C90900, 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 IC Corporation RE300 School Bus, NHTSA No.: C90900, appears to meet the requirements of FMVSS 220. The ambient temperature during testing was 23.2° 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 IC CORPORATION RE300 SCHOOL BUS** NHTSA No.: **C90900**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **03/27/09 – 05/07/09**

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

INCOMPLETE VEHICLE (if applicable)	
Manufacturer:	
Model:	
VIN:	
Build Date:	

COMPLETED VEHICLE (SCHOOL BUS)	
Manufacturer:	IC Corporation
Make/Model:	IC Corporation RE300
VIN:	4DRBWAAN29A083456
NHTSA No.:	C90900
Color:	Yellow
GVWR (kg/lb):	14,424 kg / 31,800 lbs
Build Date:	04/2008
Certification Date:	04/2008

DATES	
Vehicle Receipt:	09/08/08
Start of Compliance Test:	03/27/09
Completion of Compliance Test:	05/07/09

COMMENTS:

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

Recorded By: _____

Approved By: _____ Date: May 7, 2009

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

SCHOOL BUS UNLOADED VEHICLE WEIGHT (UVW)

	Units	As Delivered (UVW) (Axle)		
		Front	Rear	Total
Left	kg	1354	2966	
Right	kg	1128	3412	
Ratio	%	28.0	72.0	
Totals	kg	2,482	6,378	8,860

SCHOOL BUS ROOF AND APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	10,800	10,495	10,363
Width (mm):	925	914	914

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

School Bus Has: X Rigid Frame; __ Unibody

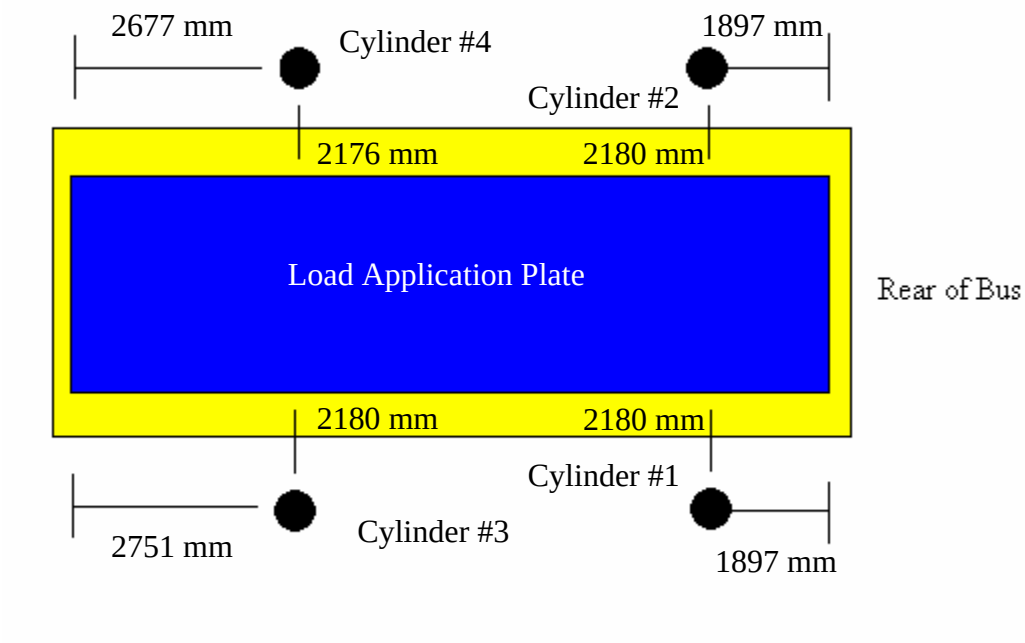
Components Removed From Vehicle Before Testing : Front and center roof air vent

DATA SHEET 1 (CONTINUED)

VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION

Description	LF	RF	LR	RR
Perpendicular Distance From closest corner of load application plate (mm)	2,751	2,677	1,897	1,897
From closest outside edge of load application plate (mm)	2,180	2,176	2,180	2,180



COMMENTS: NONE

Recorded By: _____

Approved By: _____ Date: May 7, 2009

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the 2009 IC Corporation RE300 School Bus, NHTSA No. C90900.

DATA SHEET 2

FORCE APPLICATION AND DEFLECTION INFORMATION

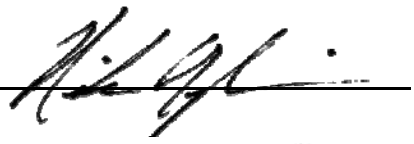
Test Vehicle: **2009 IC CORPORATION RE300 SCHOOL BUS** NHTSA No.: **C90900**
Test Lab: **MGA RESEARCH CORPORATION** Test Dates: **03/27/09 – 05/07/09**

Unloaded Delivered Weight (UDW):	8,860 kg
Calculated Test Load = 1.5 * UDW:	13,290 kg
Range of Test Load (-1% to -3%):	13,157 kg – 13,689 kg

		Pre-Load (227 kg)	Maximum		Pass/Fail
		Deflection (mm)	Deflection (mm)	Load (kg)	
Cylinder	1	2	63	3,358	**Pass**
	2	4	83	3,358	**Pass**
	3	4	42	3,367	**Pass**
	4	7	115	3,354	**Pass**
Total Load				13,437	
Average Deflection			76		
Backup Measurement	1	0	34		
	2	2	49		
	3	7	45		
	4	5	55		

COMMENTS:

Backup measurements were taken with a laser at four most outboard and longitudinal locations on the roof.

Recorded By: 

Approved By:  Date: May 7, 2009

DATA SHEET 3

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS

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

	Pass/Fail
Can all exits be manually released and extended by a single person without tools, remote controls, and without the engine running?	**Pass**

NOTE: BEFORE, DURING & AFTER, refer to the point in time in relation to the load applied to the load application plate on the school bus roof.

Is emergency exit door releasable from inside the school bus?					Pass/Fail
BEFORE LOAD:	X	Yes		No	**Pass**
DURING LOAD:	X	Yes		No	**Pass**
AFTER LOAD:	X	Yes		No	**Pass**

Is emergency exit door releasable from outside the school bus?					Pass/Fail
BEFORE LOAD:	X	Yes		No	**Pass**
DURING LOAD:	X	Yes		No	**Pass**
AFTER LOAD:	X	Yes		No	**Pass**

COMMENTS: None

DATA SHEET 4

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

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

FORCE TEST TO UNLATCH THE EMERGENCY EXITS

Exit Location	Maximum Force (N)	Actual Before (N)	Pass/ Fail	Actual During (N)	Pass/ Fail	Actual After (N)	Pass/ Fail	Type of Motion
Left Middle Exit Door	178	1. 39 2. 36 3. 35 Average: 37	**Pass**	1. 34 2. 33 3. 34 Average: 34	**Pass**	1. 37 2. 37 3. 34 Average: 36	**Pass**	Rotary and Push
Left Middle Exit Window	89	1. 21 2. 21 3. 22 Average: 21	**Pass**	1. 31 2. 34 3. 34 Average: 33	**Pass**	1. 20 2. 22 3. 23 Average: 22	**Pass**	Rotary Lift and Push
Right Middle Exit Window	89	1. 64 2. 60 3. 62 Average: 62	**Pass**	1. 65 2. 79 3. 67 Average: 70	**Pass**	1. 64 2. 65 3. 66 Average: 65	**Pass**	Rotary Lift and Push
Rear Window Exit	178	1. 7 2. 7 3. 7 Average: 7	**Pass**	1. 12 2. 12 3. 7 Average: 10	**Pass**	1. 8 2. 6 3. 9 Average: 8	**Pass**	Rotary Handle and Push

FORCE TESTS TO OPEN THE EMERGENCY EXITS

Exit Location	Maximum Force (N)	Actual Before (N)	Pass/ Fail	Actual During (N)	Pass/ Fail	Actual After (N)	Pass/ Fail	Type of Motion
Left Middle Exit Door	178	1. 18 2. 18 3. 19 Average: 18	**Pass**	1. 32 2. 25 3. 24 Average: 27	**Pass**	1. 20 2. 23 3. 19 Average: 21	**Pass**	Rotary and Push
Left Middle Exit Window	89	1. 17 2. 18 3. 22 Average: 19	**Pass**	1. 42 2. 40 3. 41 Average: 41	**Pass**	1. 35 2. 25 3. 19 Average: 26	**Pass**	Rotary Lift and Push
Right Middle Exit Window	89	1. 23 2. 20 3. 20 Average: 21	**Pass**	1. 32 2. 22 3. 23 Average: 26	**Pass**	1. 28 2. 26 3. 35 Average: 30	**Pass**	Rotary Lift and Push
Rear Window Exit	178	1. 80 2. 80 3. 80 Average: 80	**Pass**	1. 83 2. 84 3. 80 Average: 82	**Pass**	1. 81 2. 81 3. 82 Average: 81	**Pass**	Rotary Handle and Push

DATA SHEET 5

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (EXTERIOR)

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

FORCE TEST TO UNLATCH THE EMERGENCY EXITS

Exit Location	Maximum Force (N)	Actual Before (N)	Pass/ Fail	Actual During (N)	Pass/ Fail	Actual After (N)	Pass/ Fail	Type of Motion
Left Middle Exit Door	178	1. 64	Pass	1. 87	Pass	1. 50	Pass	Rotary and Pull
		2. 60		2. 63		2. 55		
		3. 76		3. 70		3. 46		
		Average: 67		Average: 73		Average: 50		
Rear Window Exit	178	1. 14	Pass	1. 14	Pass	1. 11	Pass	Pull Out
		2. 19		2. 14		2. 12		
		3. 17		3. 14		3. 16		
		Average: 17		Average: 14		Average: 13		

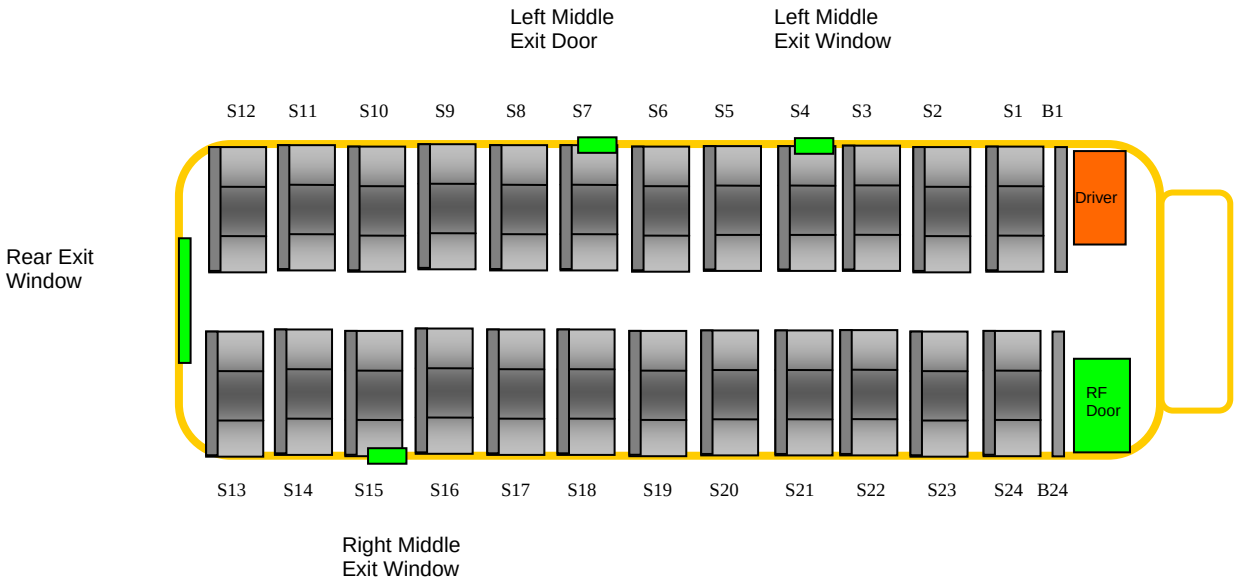
FORCE TESTS TO OPEN THE EMERGENCY EXITS

Exit Location	Maximum Force (N)	Actual Before (N)	Pass/ Fail	Actual During (N)	Pass/ Fail	Actual After (N)	Pass/ Fail	Type of Motion
Left Middle Exit Door	178	1. 20	Pass	1. 28	Pass	1. 21	Pass	Rotary and Pull
		2. 18		2. 22		2. 24		
		3. 18		3. 20		3. 25		
		Average: 19		Average: 23		Average: 23		
Rear Window Exit	178	1. 102	Pass	1. 99	Pass	1. 106	Pass	Pull Out
		2. 87		2. 107		2. 91		
		3. 82		3. 86		3. 102		
		Average: 90		Average: 97		Average: 100		

DATA SHEET 6

EMERGENCY EXIT MEASUREMENTS

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



		Height (mm)	Width (mm)	Passage of Ellipsoid or Parallelepiped	Pass/ Fail
1	Left Middle Exit Door	1,421	636	Parallelepiped	**Pass**
2	Left Middle Exit Window	634	582	Ellipsoid	**Pass**
3	Right Middle Exit Window	636	584	Ellipsoid	**Pass**
4	Rear Window Exit	502	1,346	Ellipsoid	**Pass**

COMMENTS: NONE

Recorded By: _____

Approved By: _____ Date: May 7, 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
Ellipsoid	MGA	ELLIP – 1A	When Used	When Used
Parallelepiped	MGA	PARA – 1A	When Used	When Used
Force Gauge	Wagner	2668	01/08/09	07/08/09

SECTION 5

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

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

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

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

Frontal View of School Bus After Testing

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

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

Rear View of School Bus After Testing

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

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

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

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

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

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

Right Front ¾ View of School Bus After Testing

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

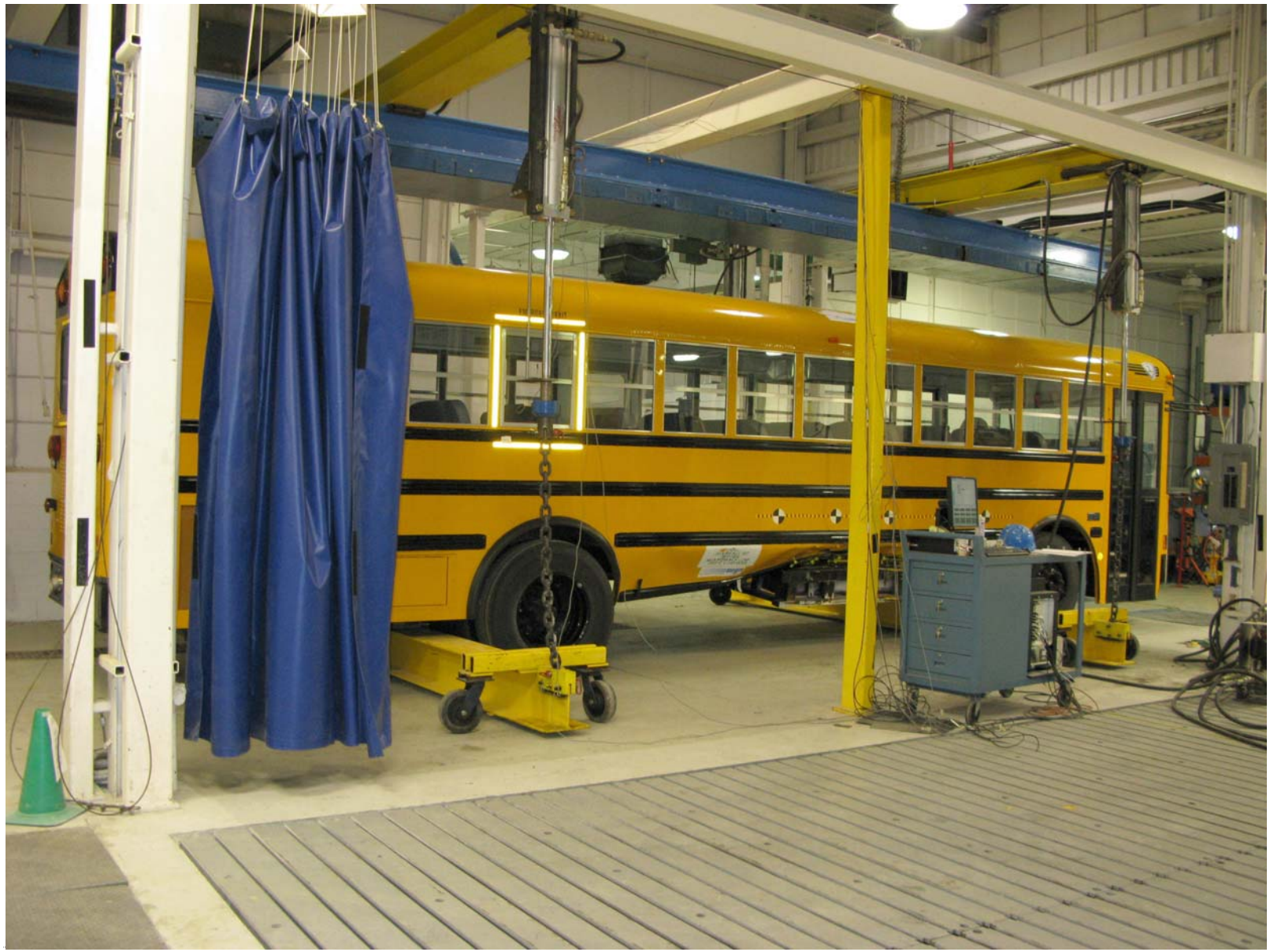
Test Vehicle:	**2009 IC CORPORATION RE300 SCHOOL BUS**	NHTSA No.:	**C90900**
Test Lab:	**MGA RESEARCH CORPORATION**	Test Dates:	**03/27/09 – 05/07/09**

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

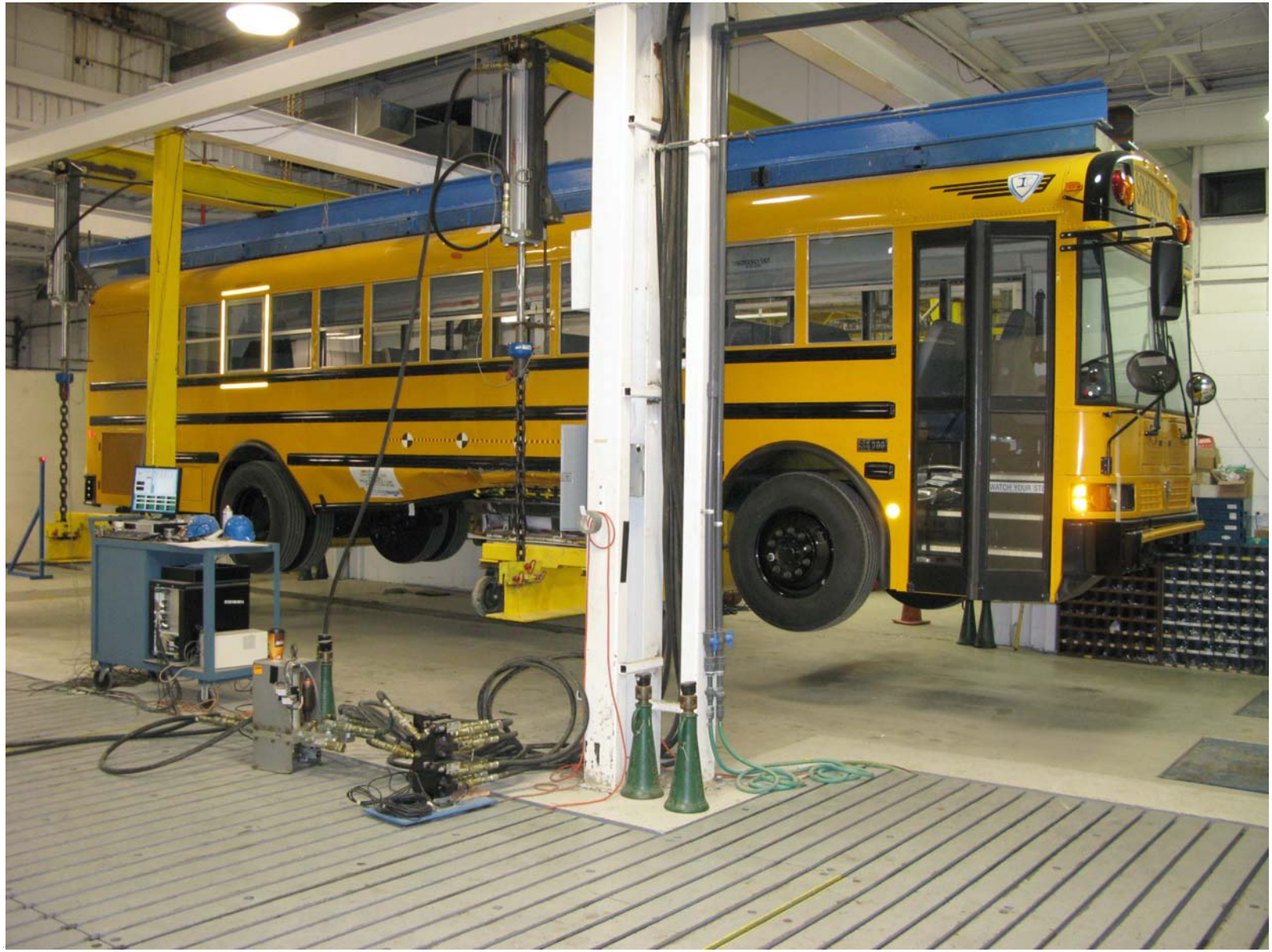
Full View of Right Side of School Bus Before Testing (as received by MGA)

Full View of Right Side of School Bus After Testing

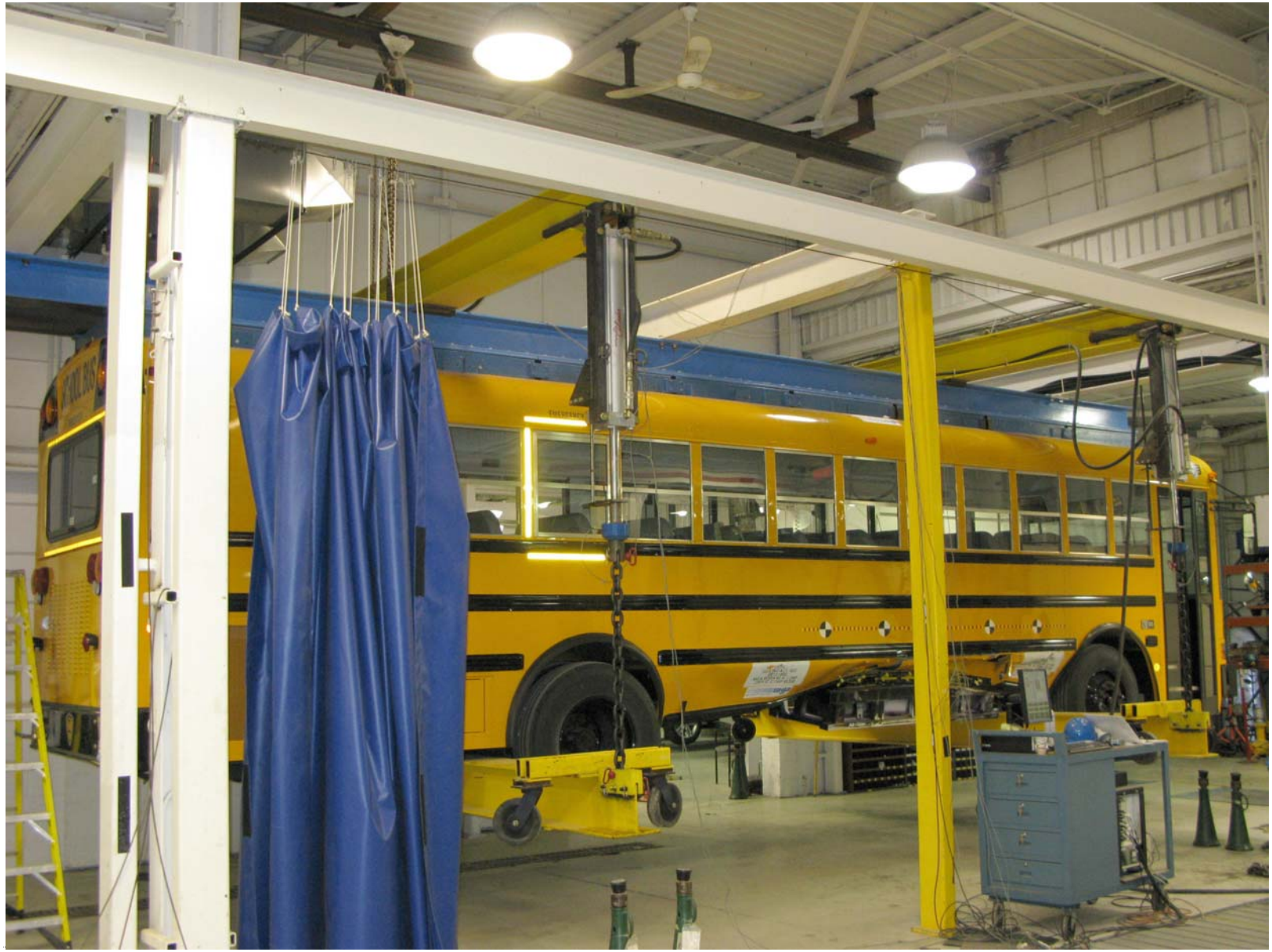
Loading Device Placed Against Bus's Roof at Beginning of Test (Right Front)



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



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



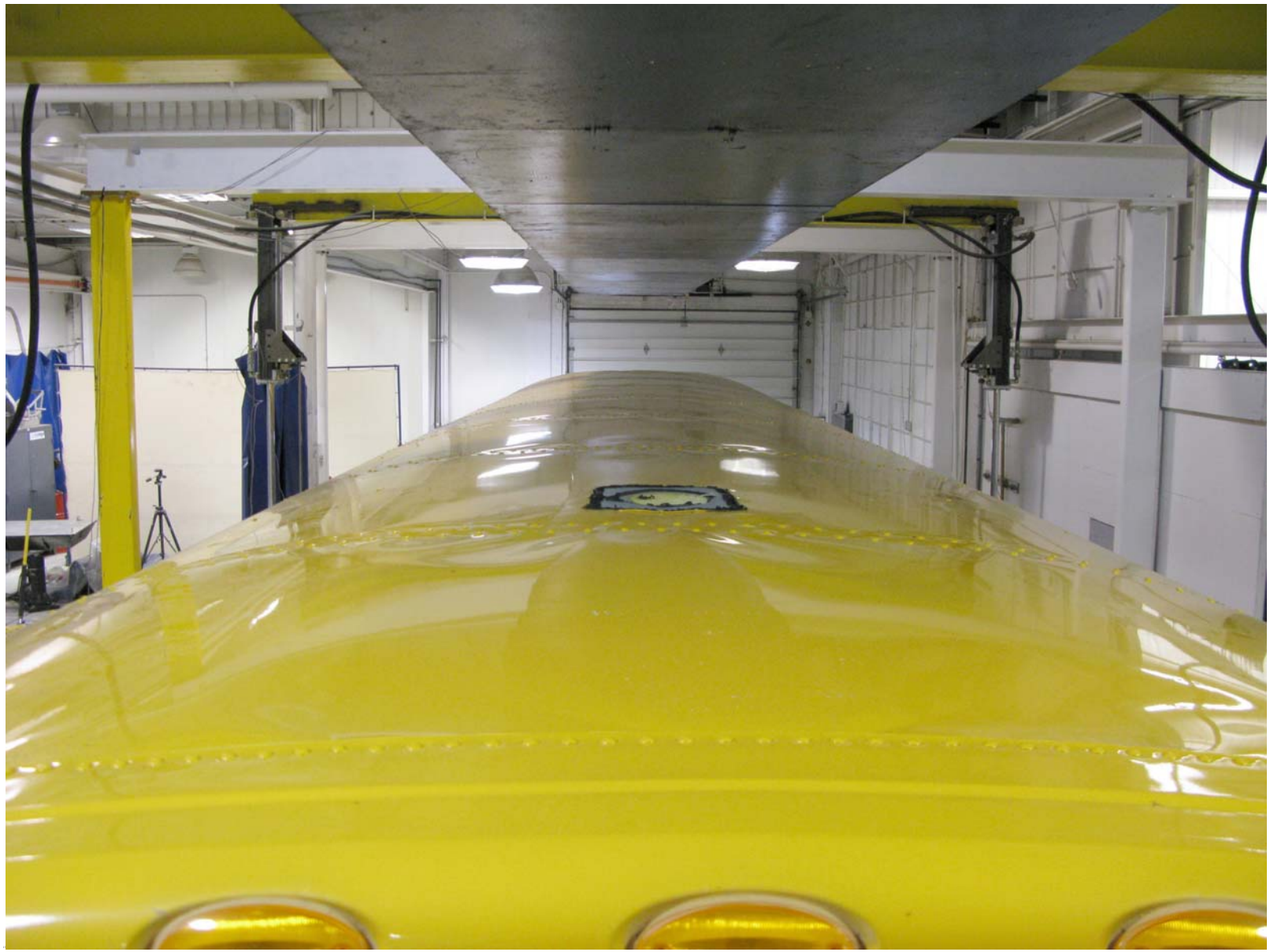
Loading Device Placed Against Bus's Roof at Maximum Load Condition (Right Rear)

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

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

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

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



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

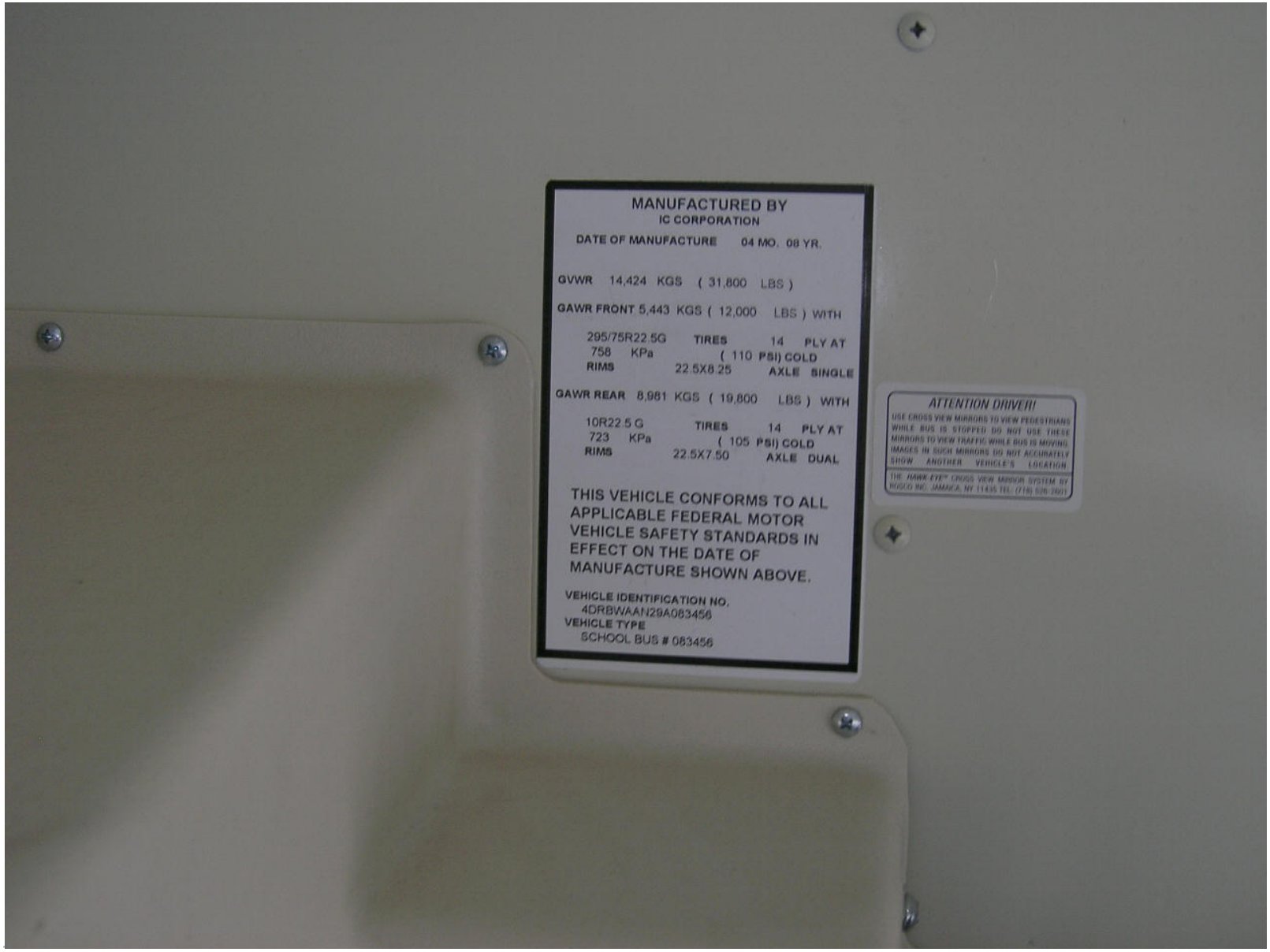
Roof, After Removal of Loading Device, Viewed From the Bus Interior

Left Middle Exit Door Open With Parallelepiped In Place

Left Middle Exit Window Open With Ellipsoid In Place

Right Middle Exit Window Open With Ellipsoid In Place

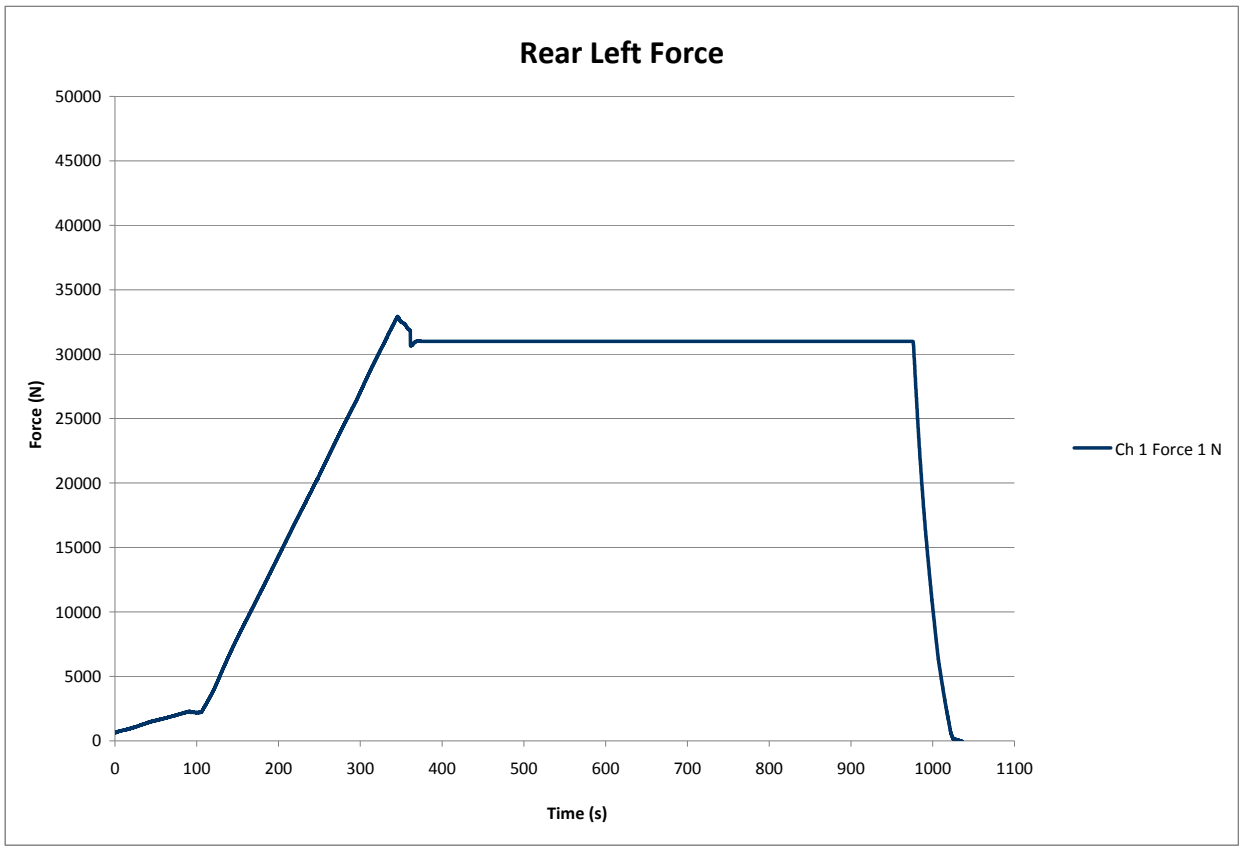
Rear Exit Window Open With Ellipsoid In Place

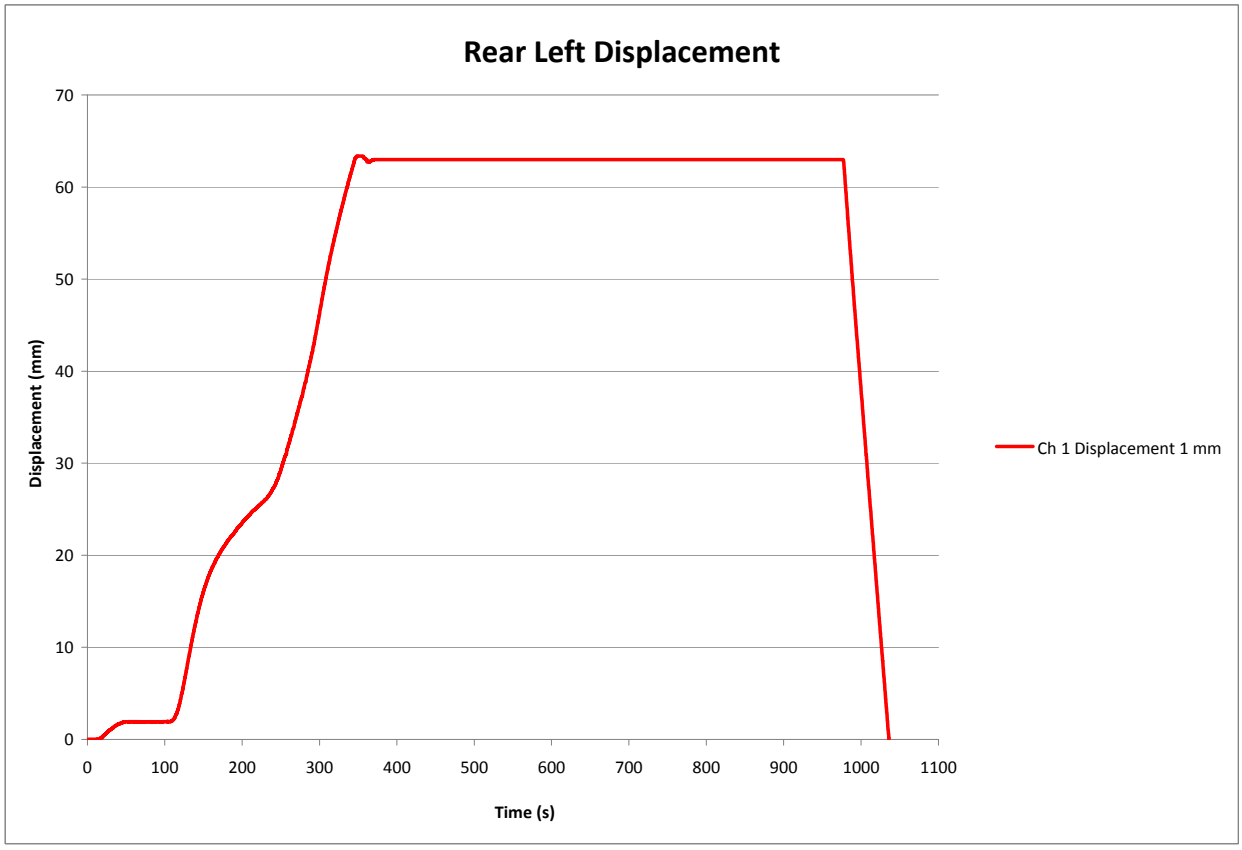


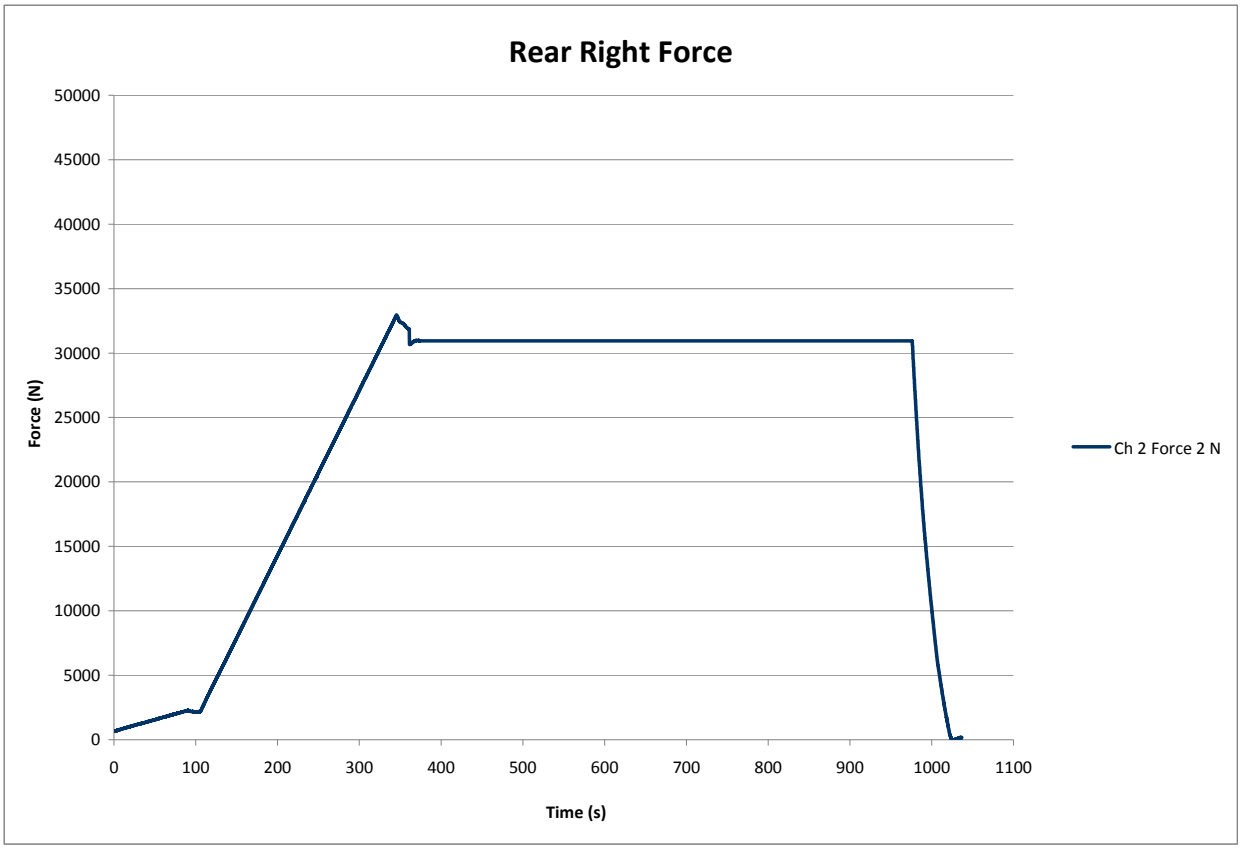
Close-up View of School Bus Certification Label

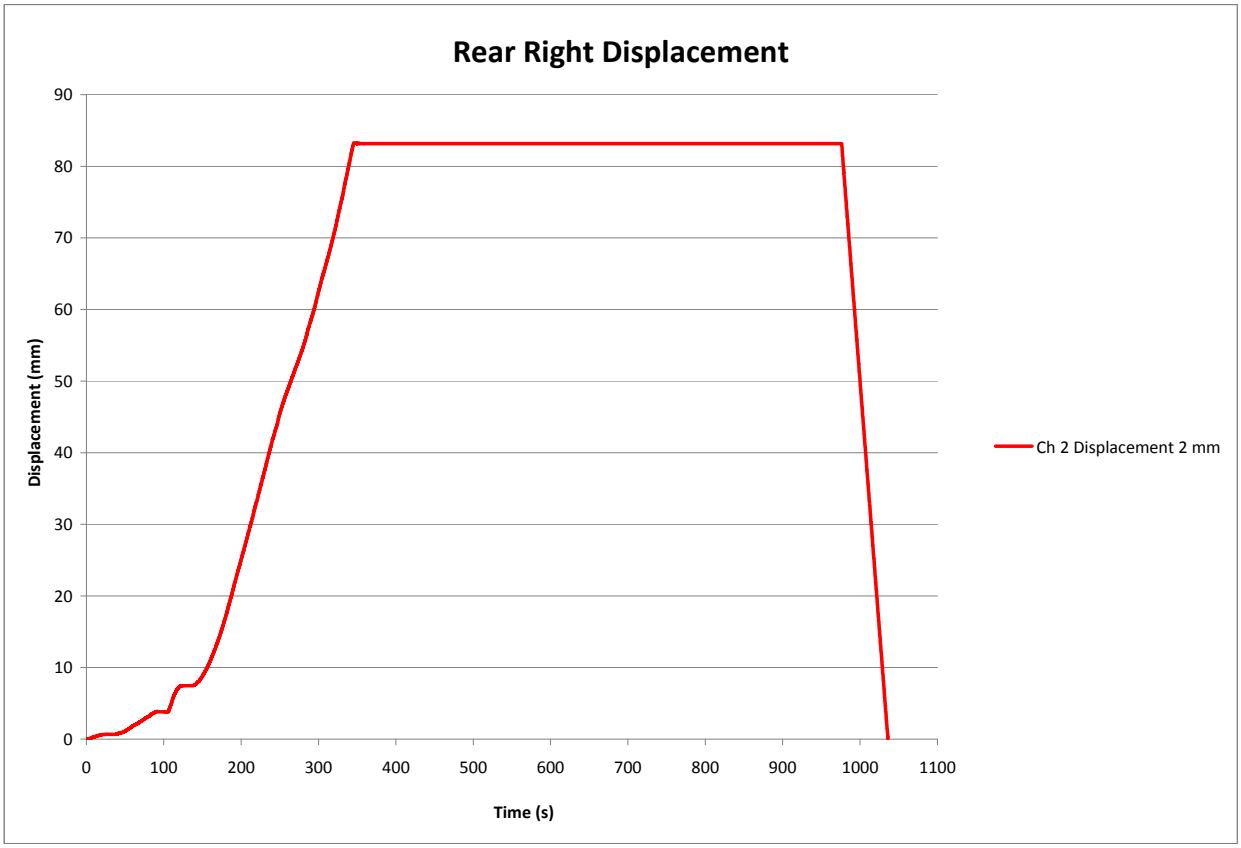
SECTION 6

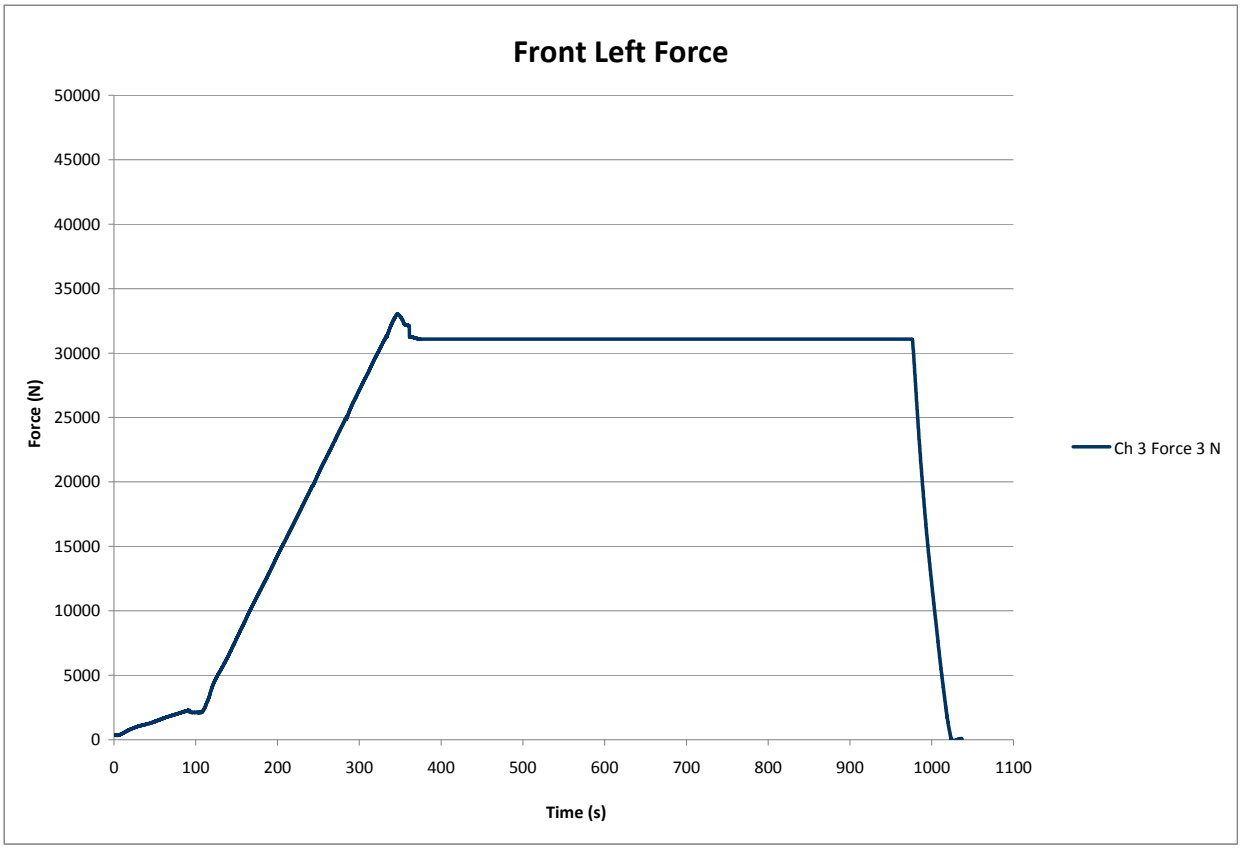
TEST PLOTS

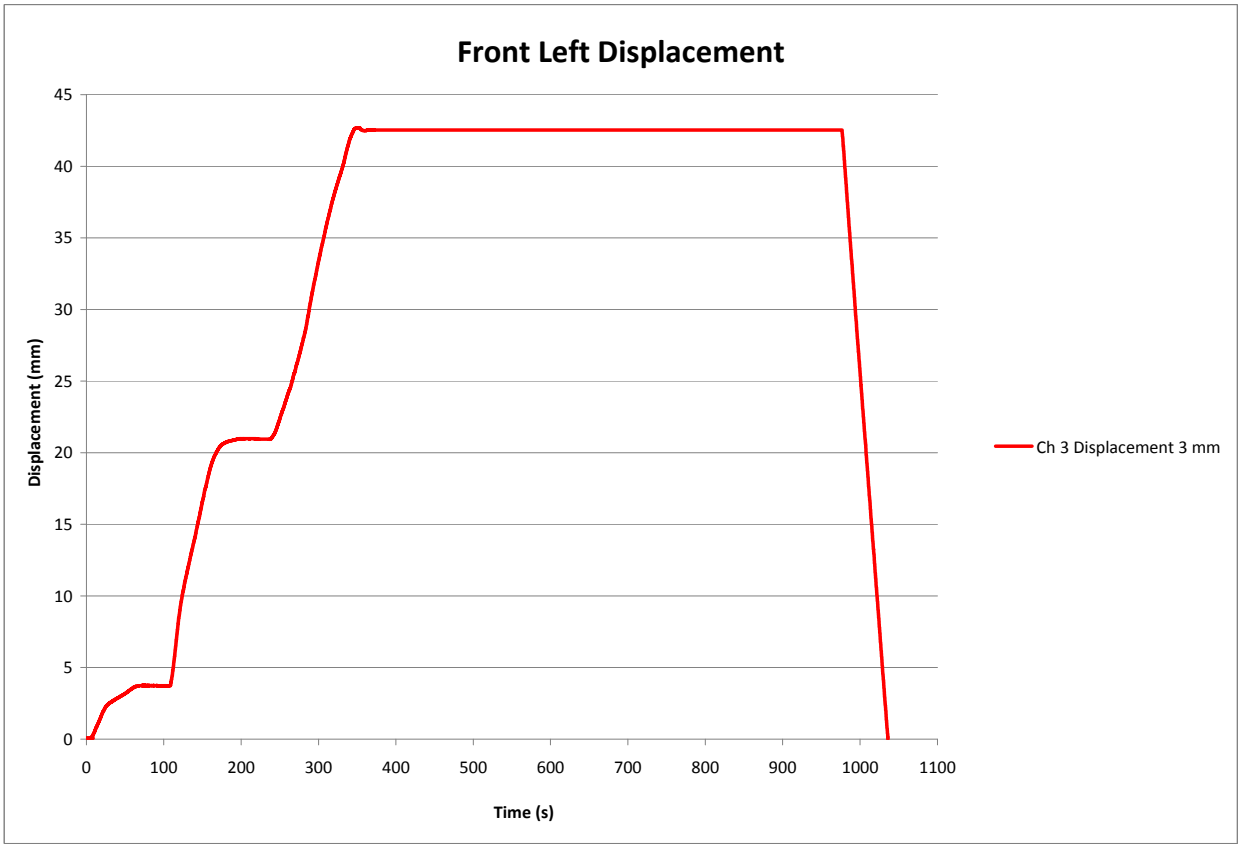


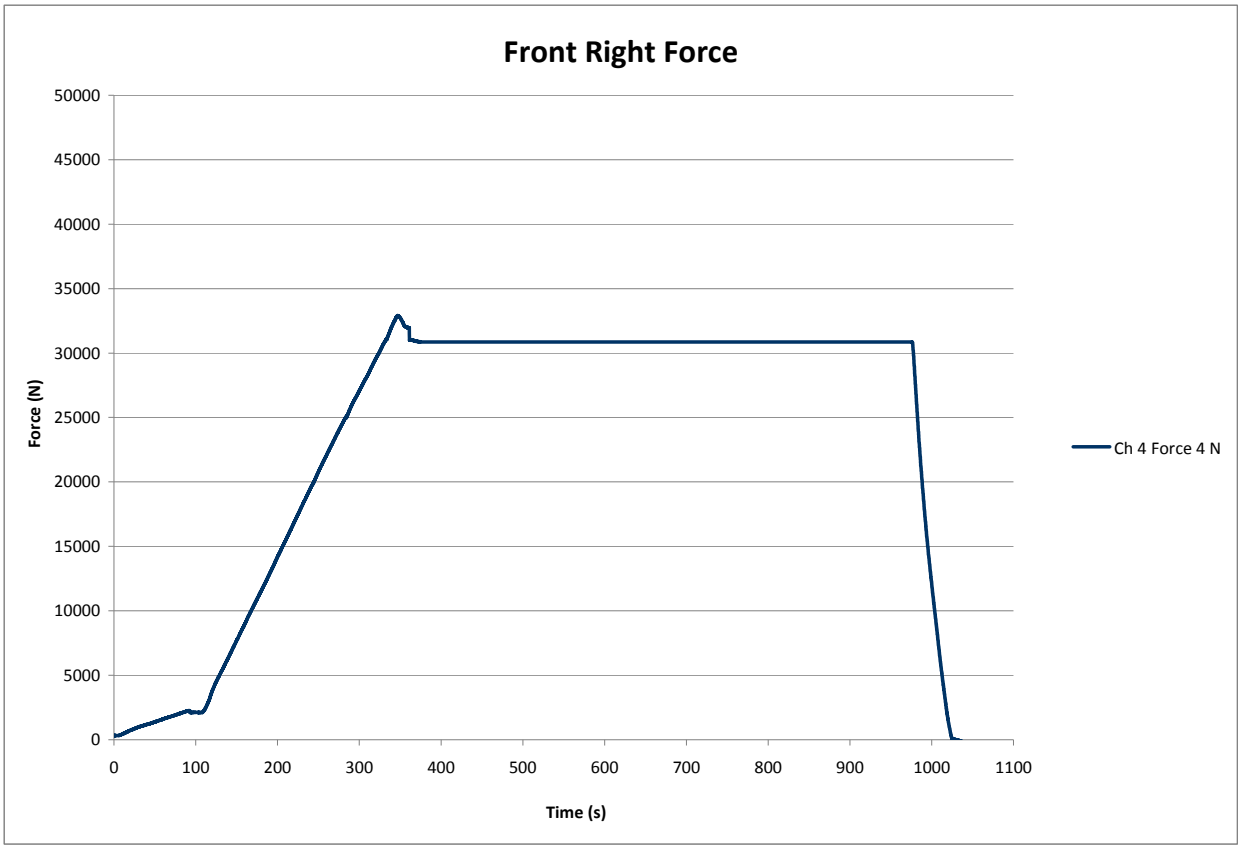


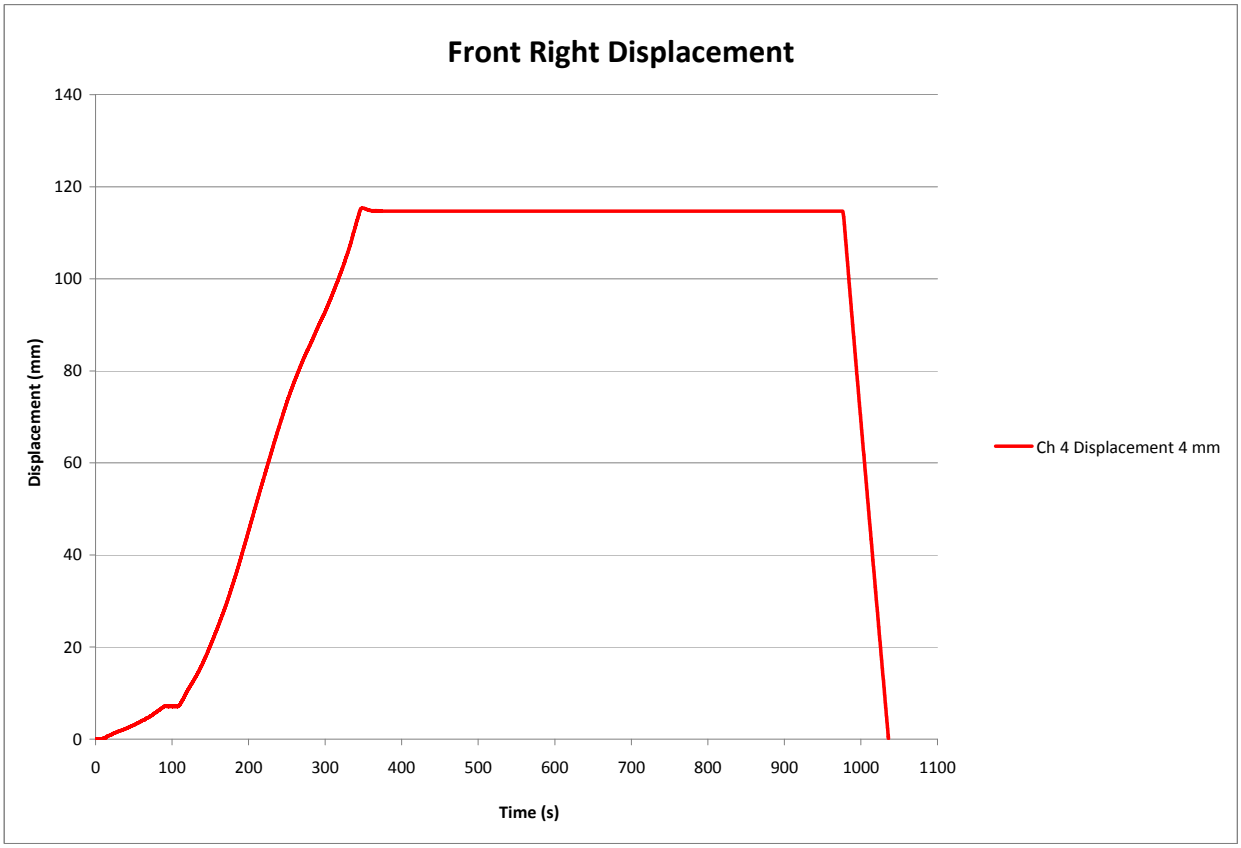

Rear Right Force
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Force (N)
0
100
200
300
400
500
600
700
800
900
1000
1100
Time (s)
Ch 2 Force 2 N


Rear Right Displacement
90
80
70
60
50
40
30
20
10
0
Displacement (mm)
0
100
200
300
400
500
600
700
800
900
1000
1100
Time (s)
Ch 2 Displacement 2 mm


Front Left Force
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Force (N)
0
100
200
300
400
500
600
700
800
900
1000
1100
Time (s)
Ch 3 Force 3 N


Front Left Displacement
45
40
35
30
25
20
15
10
5
0
Displacement (mm)
0
100
200
300
400
500
600
700
800
900
1000
1100
Time (s)
Ch 3 Displacement 3 mm


Front Right Force
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Force (N)
0
100
200
300
400
500
600
700
800
900
1000
1100
Time (s)
Ch 4 Force 4 N


Front Right Displacement
140
120
100
80
60
40
20
0
Displacement (mm)
0
100
200
300
400
500
600
700
800
900
1000
1100
Time (s)
Ch 4 Displacement 4 mm