REPORT NUMBER: 220-MGA-2009-004

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

TRANS TECH BUS 2009 TRANS TECH RONDAK BUS NHTSA NO.: C90903

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



TEST DATE: OCTOBER 15, 2010

FINAL REPORT DATE: FEBRUARY 25, 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:	150 / 200 had	Date: February 25, 2011

Eric Peschman, Project Engineer

Reviewed by: ______ Date: February 25, 2011

Michael Janovicz, Program manager

FINAL REPORT ACCEPTED BY:

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15. Supplementary Notes	1

Compliance tests were conducted on the subject 2009 Trans Tech Rondak Bus NHTSA No.: C90903, 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 2009 Trans Tech Rondak Bus NHTSA No.: C90903, 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 2009 Trans Tech Rondak Bus, NHTSA No.: C90903 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
	Each emergency exit shall be capable of:	
S4.b	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 2009 Trans Tech Rondak Bus, NHTSA No. C90903.

DATA SHEET 1 VEHICLE INFORMATION

Test Vehicle: 2009 TRANS TECH RONDAK BUS NHTSA No.: C90903
Test Lab: MGA RESEARCH CORPORATION Test Date: 10/15/10

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

INCOMPLETE VEHICLE

Manufacturer:	Ford Motor Company	
Model:	E-350 SRW	
VIN:	1FD2E35L88DB33670	
Certification Date:	05/08	

COMPLETED VEHICLE (SCHOOL BUS)

Manufacturer:	Trans Tech Bus
Make/Model:	Trans Tech Rondak
VIN:	1FD2E35L88DB33670
NHTSA No.:	C90903
Color:	White
GVWR:	4,355 kg / 9,600 lb
Build Date:	08/09
Certification Date:	05/08

DATES

Vehicle Receipt:	10/01/09
Start of Compliance Test:	10/15/10
Completion of Compliance Test:	10/15/10

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)		
	Offiles	Front	Rear	Total
Left	kg	679.9	1001.1	
Right	kg	661.3	1024.2	
Ratio	%	39.8	60.2	
Totals	kg	1,341.2	2,025.3	3,366.5

SCHOOL BUS ROOF AND APPLICATION PLATE DATA

Dimensions	School Bus Roof	Calculated Roof Plate	Actual Roof Plate
Length (mm):	4,674	4,799	5,486
Width (mm):	2,159	2,284	2,616

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

School Bus Has: X Rigid Frame; Unibody

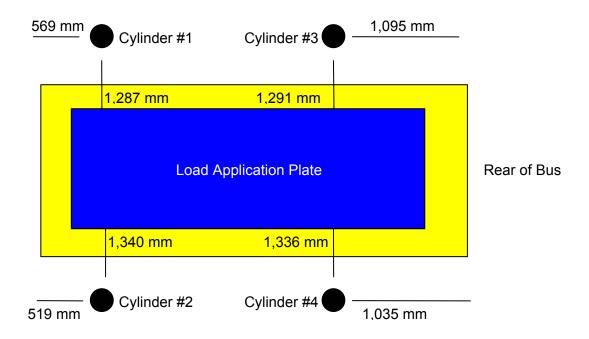
Components Removed From Vehicle Before Testing: Front – Center roof air vent

DATA SHEET 1 (CONTINUED) VEHICLE INFORMATION

LINEAR DISPLACEMENT TRANSDUCER LOCATION

Description	LF	RF	LR	RR
Perpendicular Distance from closest corner of load application plate (mm)	519	569	1,035	1,095
From closest outside edge of load application plate (mm)	1,340	1,287	1,336	1,291

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



Comments: Horizontal lasers were used at the corner of each roof 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. Bus body offset from frame 10 mm on rear.

Recorded By:

Approved By:

DATA SHEET 2 FORCE APPLICATION AND DEFLECTION INFORMATION

Test Vehicle: 2009 TRANS TECH RONDAK BUS NHTSA No.: C90903
Test Lab: MGA RESEARCH CORPORATION Test Date: 10/15/10

FORCE APPLICATION PLATE LOAD CALCULATION

Unloaded Delivered Weight (UDW):	3,366.5 kg
Calculated Test Load = 1.5 * UDW:	5,049.8 kg (49,521.6 N)
Range of Test Load (-1% to -3%):	48,035.9 N – 49,026.4 N

FORCE APPLICATION PLATE LOAD

		Pre-load		Maximum Loa	ad	Deflection B-A
		Displacement A (mm)	Displacement A (mm) Load (N) Displacement		Load (N)	(mm)
	1 (RF)	1	500.1	154	12,944.8	153
Cylinder	2 (LF)	2	490.3	125	12,287.7	123
Cyllildei	3 (RR)	1	529.6	70	12,444.6	69
	4 (LR)	2	519.8	54	12,474.1	52
Total Load			2039.8		50,151.2	

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	1 (RF)	2	128	126	PASS	
Force	2 (LF)	3	116	113	PASS	
Application Plate*	3 (RR)	2	39	37	PASS	
Flate	4 (LR)	5	31	26	PASS	
Average Def	lection			76		

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:

DATA SHEET 3 FORCE AND OPENING AREA TEST OF EMERGENCY EXITS

Test Vehicle: 2009 TRANS TECH RONDAK BUS
Test Lab: MGA RESEARCH CORPORATION NHTSA No.: C90903
Test Date: 10/15/10

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

DATA SHEET 4

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

Test Vehicle: 2009 TRANS TECH RONDAK BUS NHTSA No.: C90903
Test Lab: MGA RESEARCH CORPORATION Test Date: 10/15/10

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force :		MAXIMUM LOAD	Force :		AFTER LOAD	Force :		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	20.0			15.6			17.8			
Rear	20.0			17.8			13.3			
Emergency	22.2	PASS		20.0	PASS		15.6	PASS		Rotary
Exit Door	Average: 20.7			Average: 17.8			Average: 15.6			

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force N		MAXIMUM LOAD	Force N		AFTER LOAD	Force N		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	8.9			11.1			8.9			
Left	8.9			11.1			8.9			
Window	8.9	PASS		11.1	PASS		8.9	PASS		Rotary
Willidow	Average: 8.9			Average: 11.1			Average: 8.9			

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force N		MAXIMUM LOAD	Force N		AFTER LOAD	Force N		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	15.6			26.7			31.1			
Right	13.3			26.7			31.1			
Window	15.6	PASS		28.9	PASS		28.9	PASS		Rotary
VVIIIdow	Average: 14.8			Average: 27.4			Average: 30.4			

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

DATA SHEET 4 (CONTINUED) FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (INTERIOR)

Test Vehicle: 2009 TRANS TECH RONDAK BUS NHTSA No.: C90903
Test Lab: MGA RESEARCH CORPORATION Test Date: 10/15/10

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force :		MAXIMUM LOAD	Force :		AFTER LOAD	Force s		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	13.3			17.8			13.3			
Rear	13.3			22.2			15.6			Push
Emergency	15.6	PASS		17.8	PASS		15.6	PASS		То
Exit Door	Average: 14.1			Average: 19.3			Average: 14.8			Open

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force : N'		MAXIMUM LOAD	Force : N'		AFTER LOAD	Force : N		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	8.9			4.4			4.4			
Left	4.4			4.4			4.4			Push
Window	4.4	PASS		4.4	PASS		4.4	PASS		То
VVIIIGOW	Average:			Average:			Average:			Open
	5.9			4.4			4.4			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force : N'		MAXIMUM LOAD	Force : N'		AFTER LOAD	Force :		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	4.4			4.4			4.4			
Right	4.4			4.4			4.4			Push
Window	4.4	PASS		4.4	PASS		4.4	PASS		То
VVIIIGOVV	Average: 4.4			Average: 4.4			Average: 4.4			Open

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: 10/15/10

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DATA SHEET 5

FORCE AND OPENING AREA TEST OF EMERGENCY EXITS (EXTERIOR)

Test Vehicle: 2009 TRANS TECH RONDAK BUS NHTSA No.: C90903
Test Lab: MGA RESEARCH CORPORATION Test Date: 10/15/10

FORCE TO RELEASE (UNLATCH) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force : N		MAXIMUM LOAD	Force :		AFTER LOAD	Force :		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	75.6			89.0			53.4			
Rear	71.2			71.2			62.3			
Emergency	80.1	PASS		71.2	PASS		62.3	PASS		Rotary
Exit Door	Average: 75.6			Average: 77.1			Average: 59.3			

FORCE TO EXTEND (OPEN) THE EMERGENCY EXITS

Exit	BEFORE LOAD	Force ≤ 178 N?		MAXIMUM LOAD	Force ≤ 178 N?		AFTER LOAD	Force ≤ 178 N?		Type of
Location	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	(N)	Yes - Pass	No - Fail	Motion
	20.0			20.0			24.5			
Rear Emergency Exit Door	17.8			17.8			17.8			Pull
	17.8	PASS		17.8	PASS		17.8	PASS		То
	Average: 18.5			Average: 18.5			Average: 20.0			Open

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.

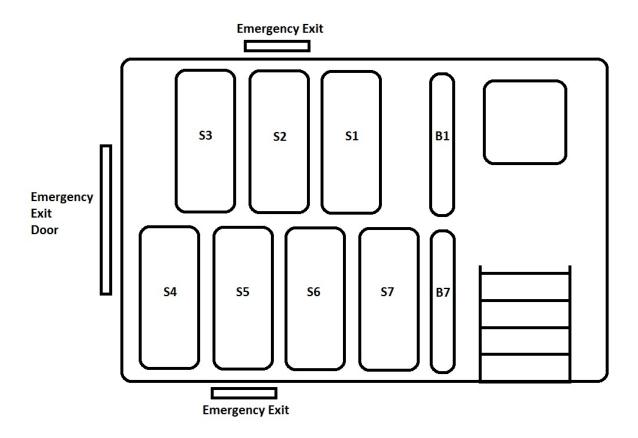
Comments: None

Recorded By:

Approved By:

DATA SHEET 6 EMERGENCY EXIT MEASUREMENTS

Test Vehicle: 2009 TRANS TECH RONDAK BUS NHTSA No.: C90903
Test Lab: MGA RESEARCH CORPORATION Test Date: 10/15/10



		Height	Width (mm)	Required Test Form	Opening allowed unobstructed passage of the test form?	
		(mm)	(111111)	(Ellipsoid or Parallelepiped)	Yes – Pass	No – Fail
1	Rear Emergency Exit Door	1,360	930	Parallelepiped	PASS	
2	Left Middle Window Exit Door	650	630	Ellipsoid	PASS	
3	Right Middle Window Exit Door	650	630	Ellipsoid	PASS	

Comments: None

Recorded By:

Approved By:

SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

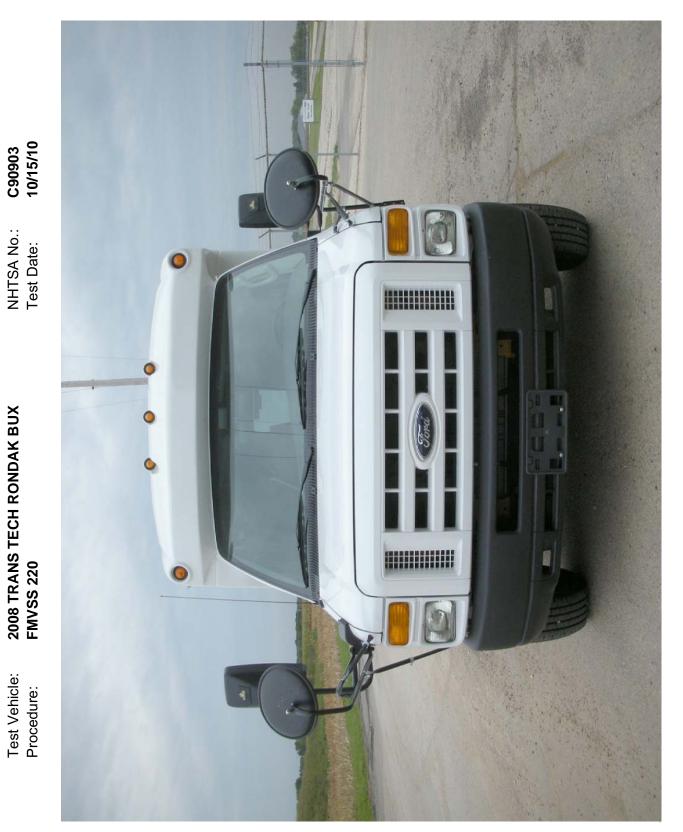
Equipment	Manufacturer	Serial No.	Cal. Date	Next Cal. Date
Steel Tape	Stanley	580	04/22/10	10/22/10
Cylinder #1 Load Cell	Interface	315453	09/30/10	03/30/11
Cylinder #1 Displacement Pot.	Ametek	0108-27166	10/05/10	04/05/11
Cylinder #2 Load Cell	Interface	321811	10/04/10	04/04/11
Cylinder #2 Displacement 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	10/15/10	04/15/11
Inclinometer	Pro 360	006	09/24/10	03/24/11

SECTION 5 PHOTOGRAPHS

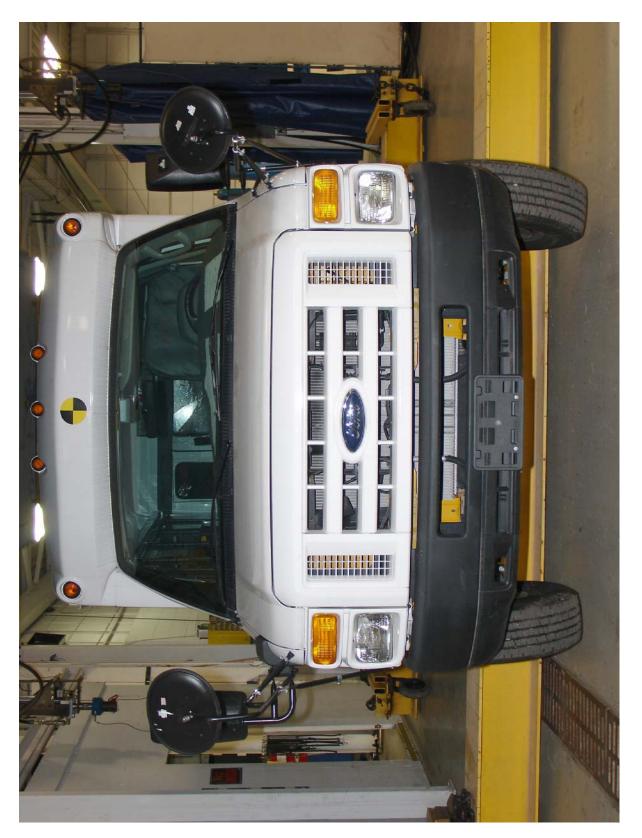
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NHTSA No.: Test Date:





2008 TRANS TECH RONDAK BUX FMVSS 220 Test Vehicle: Procedure:



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Test Vehicle:

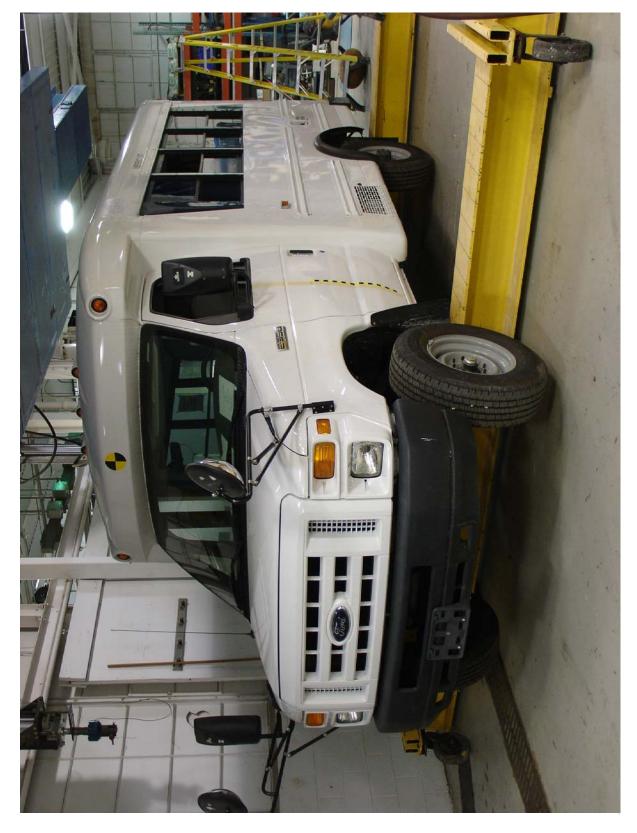
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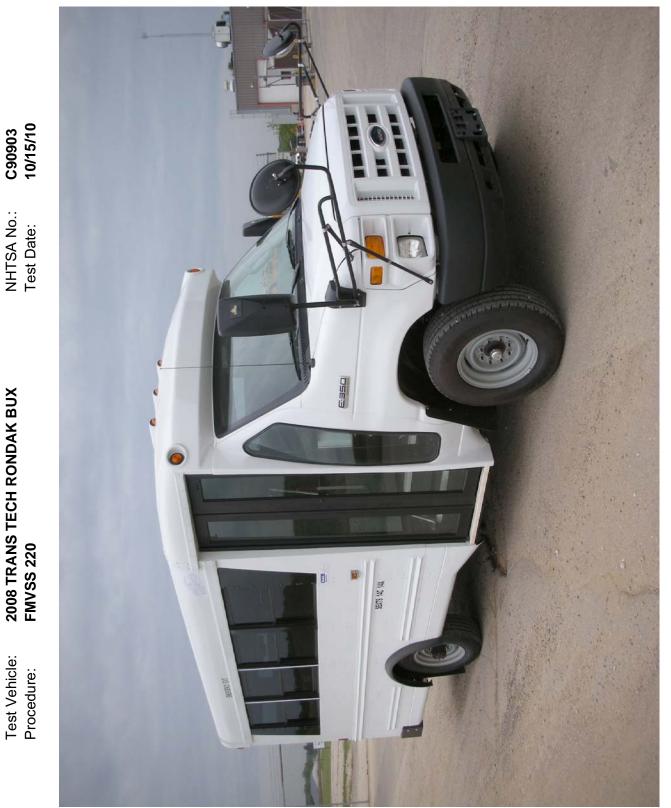


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NHTSA No.: **C90903** Test Date: **10/15/10**



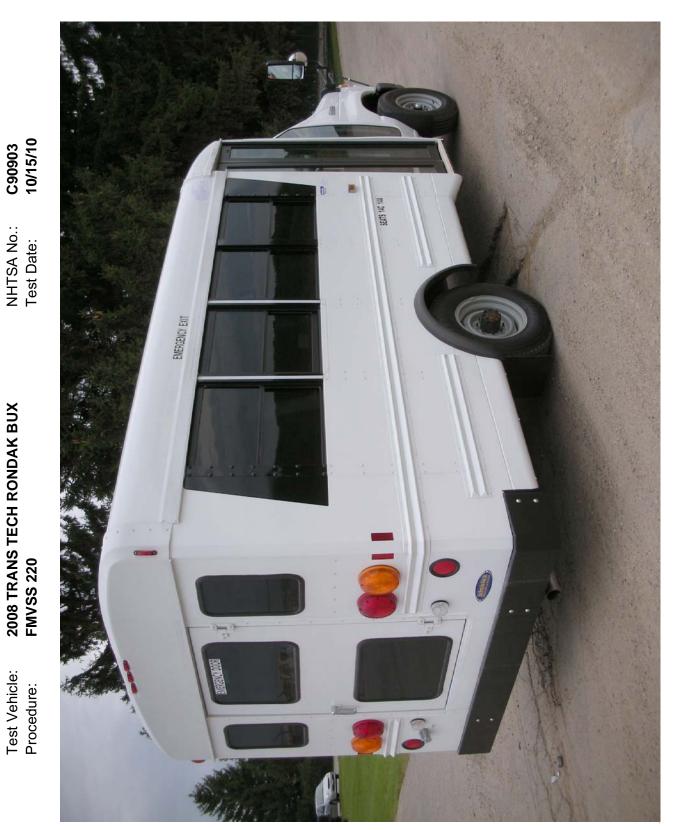
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Test Vehicle:

2008 TRANS TECH RONDAK BUX FMVSS 220 Test Vehicle: Procedure:





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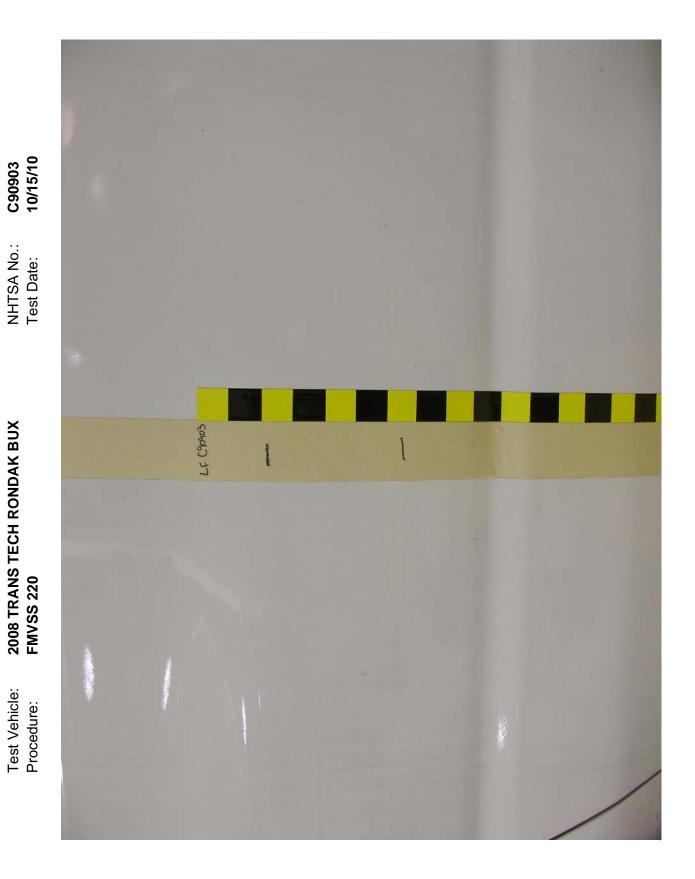
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2008 TRANS TECH RONDAK BUX FMVSS 220 Test Vehicle: Procedure:



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



2008 TRANS TECH RONDAK BUX FMVSS 220 Test Vehicle: Procedure:

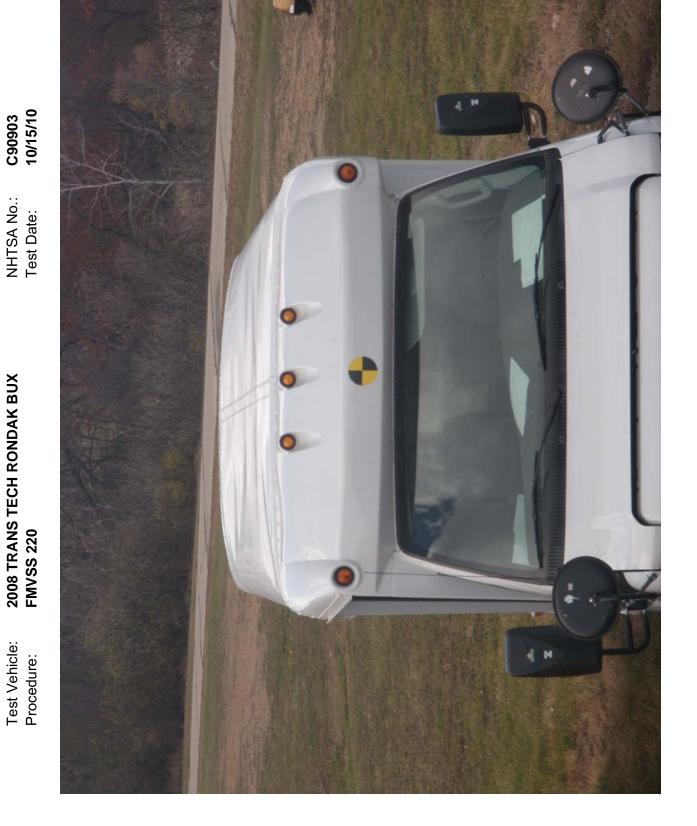


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2008 TRANS TECH RONDAK BUX FMVSS 220 Test Vehicle:



2008 TRANS TECH RONDAK BUX FMVSS 220 Test Vehicle: Procedure:





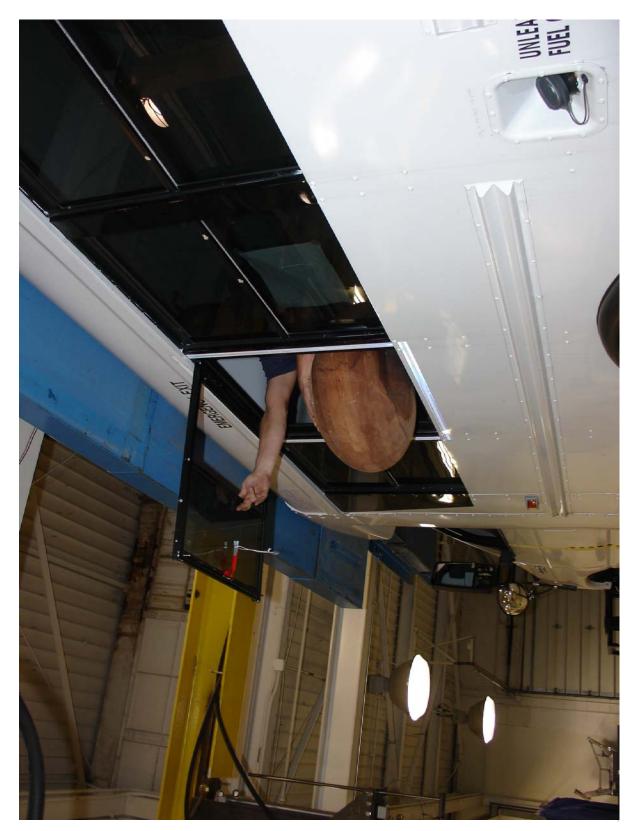
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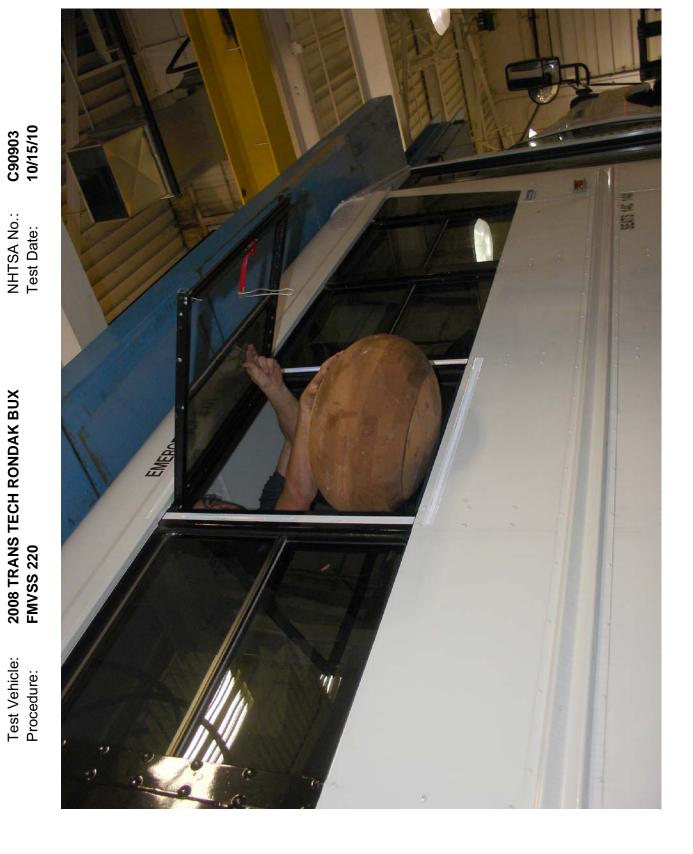
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2008 TRANS TECH RONDAK BUX FMVSS 220

Test Vehicle: Procedure: Test Vehicle: 2008 TRANS TECH RONDAK BUX Procedure: FMVSS 220

3UX NHTSA No.: **C90903** Test Date: 10/15/10







Test Vehicle: 2008 TRANS TECH RONDAK BUX Procedure: FMVSS 220

C90903

NHTSA No.:

C90903 10/15/10

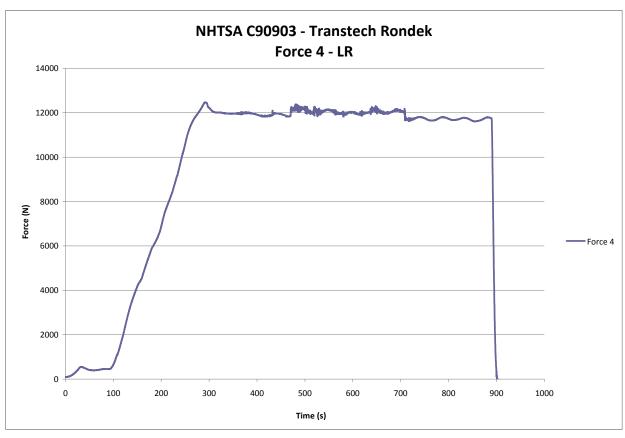
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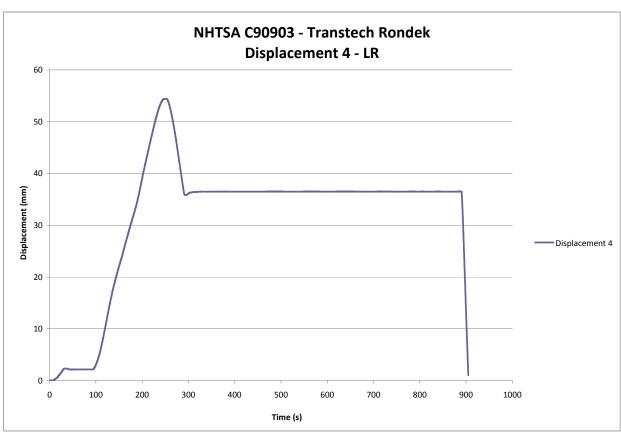
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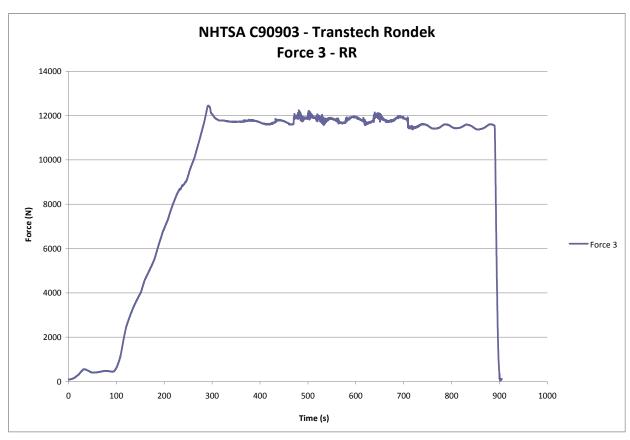
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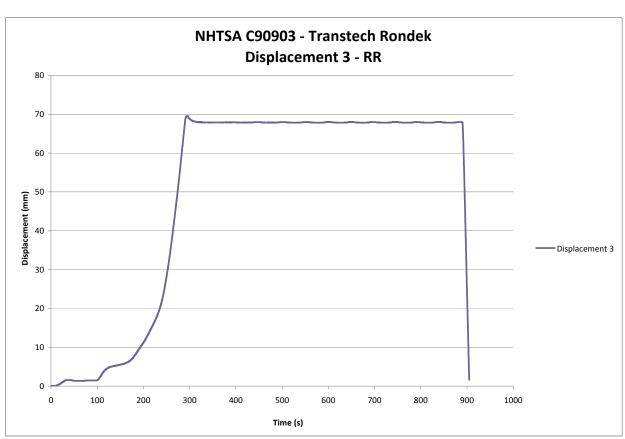
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TEST PLOTS



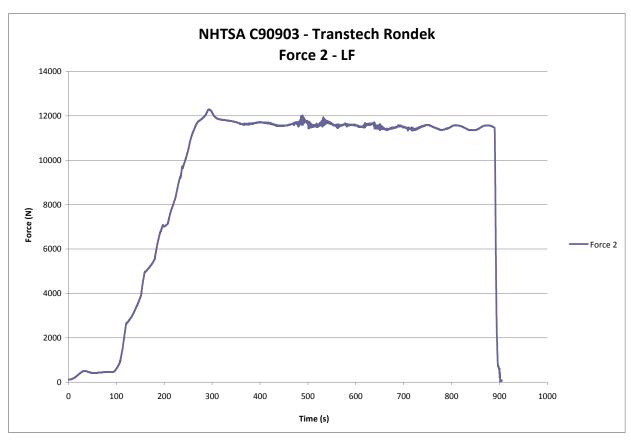


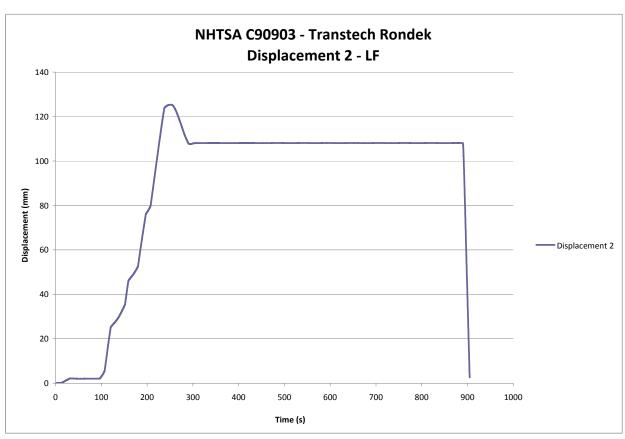
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TEST PLOTS





SECTION 6
TEST PLOTS

