REPORT NUMBER: 111-MGA-05-004

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 111 SCHOOL BUS REARVIEW MIRRORS

US Bus Corporation
2005 US Bus Sturdibus HD
NHTSA No. C50900

PREPARED BY:
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Final Report Date: April 25, 2005

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: April 25, 2005

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Date of Acceptance

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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY2005 US Bus School Bus Model Sturdibus HD, NHTSA No. C50900, in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedures TP-111SB-00 to determine compliance to the requirements of Federal Motor Vehicle Safety Standard (FMVSS) 111, “School Bus Rearview Mirrors.”

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-02-D-01057.

SECTION 2
TEST DATA SUMMARY

Based on the tests performed, the MY2005 US Bus School Bus, Model Sturdibus HD, NHTSA No. C50900 appears to meet all of the requirements of FMVSS 111. See Test Summary Data Sheets on the following pages.

FMVSS 111SB, SCHOOL BUS REARVIEW MIRRORS
TEST SUMMARY DATA SHEETS

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

System A Mirrors

A. Outside Driver Side Mirror #3 - Unit Magnification

Requirements	Pass/Fail	Comments
Mounting	PASS	--
Field of View	PASS	--
Surface Area	PASS	--
Reflectance	PASS	--
Unit Magnification	PASS	--

B. Outside Passenger Side Mirror #4 - Unit Magnification

Requirements	Pass/Fail	Comments
Mounting	PASS	--
Field of View	PASS	--
Surface Area	PASS	--
Reflectance	PASS	--
Unit Magnification	PASS	--

C. Outside Driver Side Mirror #5 - Convex

Requirements	Pass/Fail	Comments
Mounting	PASS	--
Field of View	PASS	--
Reflectance	PASS	--

D. Outside Passenger Side Mirror #6 - Convex

Requirements	Pass/Fail	Comments
Mounting	PASS	--
Field of View	PASS	--
Reflectance	PASS	--

FMVSS 111SB, SCHOOL BUS REARVIEW MIRRORS
TEST SUMMARY DATA SHEET…continued

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

System B Mirrors

E. Driver Side Front Mirror #1 - Cross View

Requirements	Pass/Fail	Comments
Mounting	PASS	--
Field of View	PASS	--
Overlap with System A	PASS	--
Distance to Eye Point	PASS	--
No Surface Discontinuities	PASS	--
Surface Area	PASS	--
If Convex – Radius of Curvature	PASS	--
Radius of Curvature Label	PASS	--
Arc Separation	PASS	--
Reflectance	PASS	--

F. Passenger Side Front Mirror #2 - Cross View

Requirements	Pass/Fail	Comments
Mounting	PASS	--
Field of View	PASS	--
Overlap with System A	PASS	--
Distance to Eye Point	PASS	--
No Surface Discontinuities	PASS	--
Surface Area	PASS	--
If Convex – Radius of Curvature	PASS	--
Radius of Curvature Label	PASS	--
Arc Separation	PASS	--
Reflectance	PASS	--

SECTION 3
COMPLIANCE TEST DATA

FMVSS 111SB – DATA SHEET 1
SCHOOL BUS INSPECTION AND IDENTIFICATION

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

GENERAL VEHICLE IDENTIFICATION

Final Stage Manufacturer	US Bus	Date of Mfg.	3/05
Chassis Manufacturer	Chevrolet	Date of Mfg.	12/04
Seating Capacity (including driver)	30	GVWR (kg)	8845
VIN No.	1GBE5V1255F515430	GAWR Front (kg)	3175
		GAWR Rear (kg)	6123

DESCRIPTION OF MIRRORS

Mirror No.	Type			Description	Manufacturer
	Unit Mag	Convex	Cross View		
1			X	Driver Side	Rosco Mirror
2			X	Passenger Side	
3	X			Driver Side	
4	X			Passenger Side	
5		X		Driver Side	
6		X		Passenger Side	

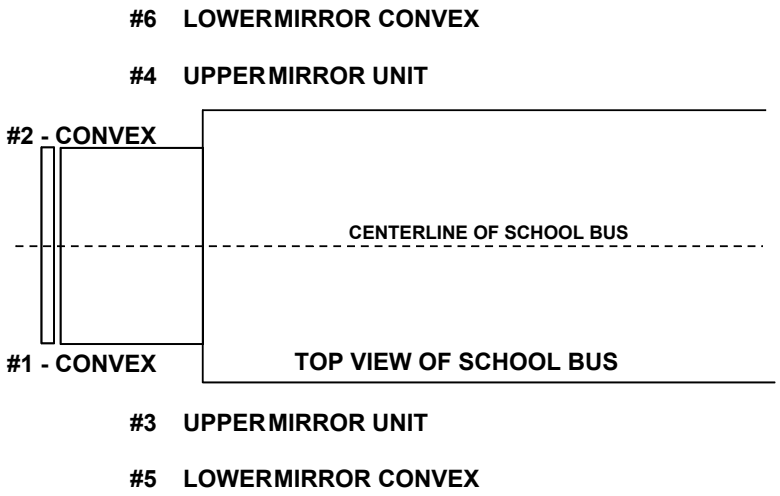
Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

FMVSS 111SB – DATA SHEET 2
MIRROR LOCATION AND FIELD OF VIEW

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

MIRROR DIAGRAM



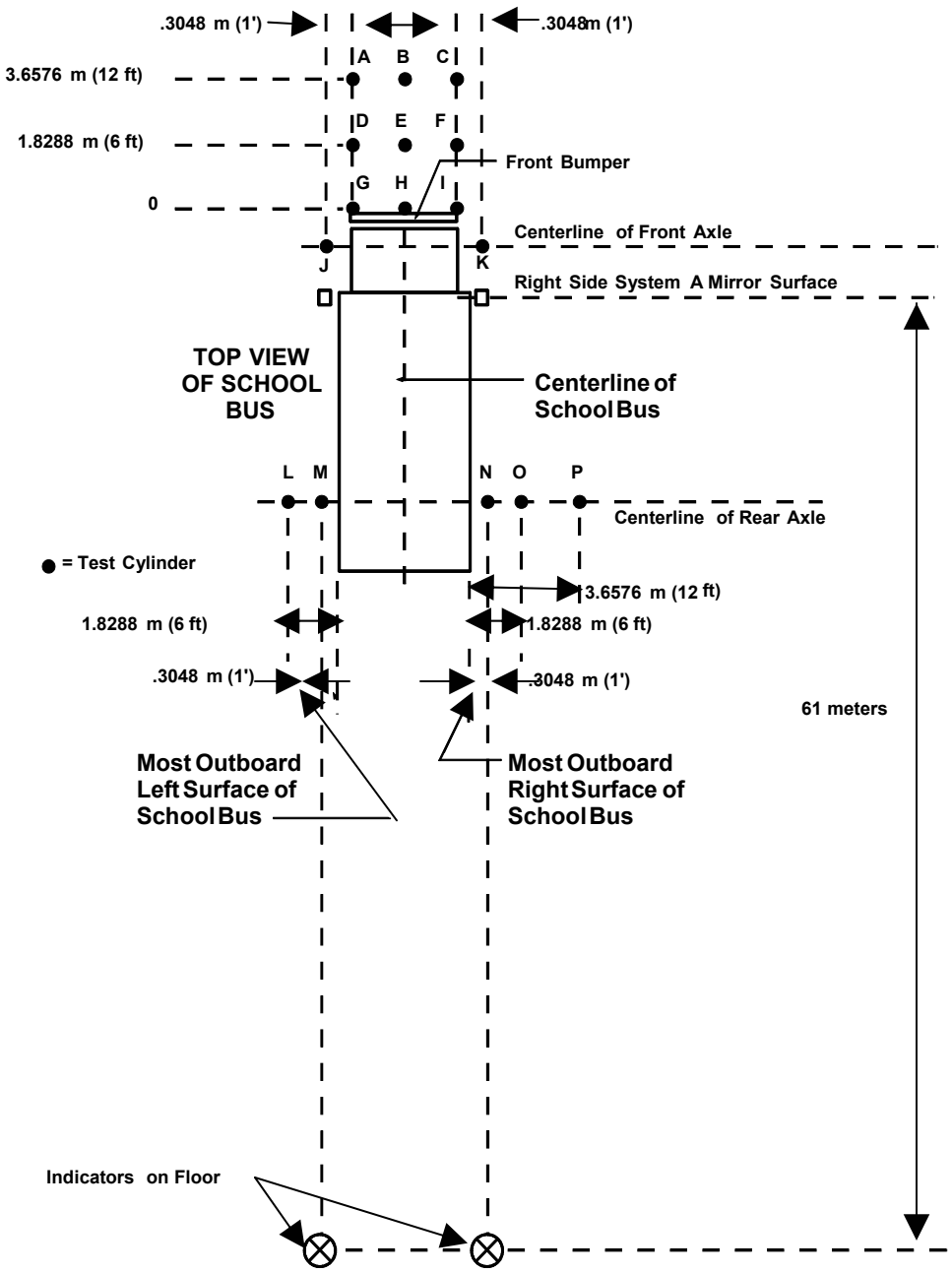
MIRROR NO.	TYPE	MIRROR SYSTEM	CYLINDERS VIEWED **(entire top surface)**
1	CROSS VIEW/CONVEX	B	B,C,D,E,F,G,H,I,J,L,M
2	CROSS VIEW/CONVEX	B	A,B,D,E,F,G,H,I,K,N,O,P
3	UNIT MAGNIFICATION	A	61 Meter INDICATOR
4	UNIT MAGNIFICATION	A	61 Meter INDICATOR
5	CONVEX	A	L,M
6	CONVEX	A	N,O

SEE FIGURE ON NEXT PAGE

FMVSS 111SB – DATA SHEET 2…continued
MIRROR LOCATION AND FIELD OF VIEW

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

MIRROR LOCATIONS OF TEST CYLINDERS AND INDICATOR



NOTES:
1. The cylinders shall be a color which provides a high contrast with the surface on which the bus is parked (S13.1).
2. The cylinders are 0.3048 m high and 0.3048 m in diameter, except for cylinder P which is 0.9144 m high and 0.3048 m in diameter.

FMVSS 111SB DATA SHEET 2…continued
MIRROR LOCATION AND FIELD OF VIEW

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

SYSTEM A AND DIRECT VISION

System A Mirrors	Pass/Fail
Entire top surface of cylinder N and the indicator 61 meters (200 feet) rearward of the mirror surface be viewed in the photograph	PASS
Entire top surface of cylinder M and indicator 61 meters (200 feet) rearward of the mirror surface be viewed in the photograph	PASS
Which test cylinders A through P can not be photographed directly from the driver's eye location within the semi-circle viewing area using no mirror system:	B,C,D,E,F,G,H, I,J,K,L,M,N,O,P

SYSTEM B ARC'S AND DISTANCE

Mirror Number (from data sheet 2)	Mirror Location	Distance from the Driver's Eye Point to the Center of the Mirror (cm)	3 Minutes of Arc (cm)	9 Minutes of Arc (cm)
#1	Left Front	242.7	0.212	--
#2	Right Front	284.7	0.249	0.745

Distance determined in column 3 multiplied by 0.000873 yield 3 minutes of arc, for column 4, for that mirror as viewed from the driver's eye point; the distances determined in column 3 multiplied by 0.002618 yield 9 minutes of arc, for column 5, for that mirror as viewed from the driver's eye point. The minimum distance for any system B mirror between the driver's eye point and the center of the mirror is more than 95 centimeters:

Requirements	Distance	Pass/Fail
Distance between center of System B mirror #1 and driver's eye point	242.7 cm	PASS
Distance between center of System B mirror #2 and driver's eye point	284.7 cm	PASS

Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

FMVSS 111SB DATA SHEET 3
FIELD OF VIEW TEST – PHOTOGRAPHS System B

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

Requirements		Pass/Fail
All test cylinders with entire top surface not directly visible from the driver's semi-circle eye location are able to be viewed with System B mirrors from the driver's semi-circle location:		PASS
All test cylinders with entire top surface not directly visible from the driver's semi-circle eye location but the image can be viewed with System B mirrors. The image is separated for the edge of the effective mirror surface of the mirror providing that image by a distance of not less than 3 minutes of arc:		PASS
If the entire top surface of test cylinder P is not directly visible from the driver's semi-circle eye location, the image can be viewed with System B mirrors from the driver's semi-circle eye location, where the angular size of the shortest dimension of that cylinder's image is not less than 3 minutes of arc, and the angular size of the longest dimension of that cylinder's image is not less than 9 minutes of arc:		PASS
Shortest arc length dimension	0.249 cm	
Longest arc length dimension	0.745 cm	
For each of the test cylinders whose entire top surface is not directly visible from the driver's eye location, System B provides a view of the ground that overlaps with the view of the ground provided by System A.		PASS

Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

FMVSS 111SB DATA SHEET 4
MOUNTING ADEQUACY TEST

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

MOUNTING SUPPORT OF ALL MIRRORS

Mirror No. (from data sheet 2)	Type	System	Stable Support Yes/No
1	Cross View/Convex	B	Yes
2	Cross View/Convex	B	Yes
3	Unit Magnification	A	Yes
4	Unit Magnification	A	Yes
5	Convex	A	Yes
6	Convex	A	Yes

Requirements	Pass/Fail
Outside mirrors free of sharp points or edges that could contribute to pedestrian injury	PASS
System B mirrors have no discontinuities in the slope of the surface of the mirror	PASS

Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

FMVSS 111SB DATA SHEET 5
REFLECTANCE TEST – ALL MIRRORS

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

Mirror No.	Type	Light meter reading from calibration (FC)	Light meter reading from light reflected by mirror (FC)	Pass/Fail	Observations
1	Crossview/Convex	119	90	PASS	
2	Crossview/Convex	119	90	PASS	
3	Unit	117	77	PASS	
4	Unit	117	85	PASS	
5	Convex	117	88	PASS	
6	Convex	117	90	PASS	

Note: Reflectance% = [(Reflected Reading) / (Cal Reading)] x 100
Minimum Requirement = 35 percent

Mirror No.	Type	Reflectance	Requirement
1	Crossview/Convex	76%	>35%
2	Crossview/Convex	76%	>35%
3	Unit	66%	>35%
4	Unit	73%	>35%
5	Convex	75%	>35%
6	Convex	77%	>35%

Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

FMVSS 111SB DATA SHEET 6
UNIT MAGNIFICATION/CONVEX MIRROR TEST – ALL MIRRORS

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

CONVERSION DATA TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

MIRROR NO. 1 (CONVEX)

Test Postion	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Precent Deviation from the Average Radius of Curvature
1	0.05265	136.4	44.7	24.7%
2	0.03555	201.4	-20.3	-11.2%
3	0.02565	278.8	-97.8	-54.0%
4	0.05130	139.9	41.2	22.7%
5	0.05120	140.2	40.9	22.6%
6	0.03585	199.7	-18.7	-10.3%
7	0.05125	140.0	41.0	22.7%
8	0.03030	236.2	-55.1	-30.4%
9	0.05320	135.0	46.1	25.5%
10	0.03525	203.1	-22.0	-12.2%
Average Radius of Curvature - The Summation of the Radius of Curvature readings divided by 10 **181.1mm**			Greatest Percent Deviation from the Average Radius of Curvature **54.0%**	

MIRROR NO. 2 (CONVEX)

Test Postion	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Precent Deviation from the Average Radius of Curvature
1	0.05235	137.1	43.7	24.2%
2	0.03570	200.6	-19.8	-10.9%
3	0.02580	277.2	-96.4	-53.3%
4	0.05115	140.3	40.5	22.4%
5	0.05065	141.7	39.1	21.6%
6	0.03565	200.8	-20.0	-11.1%
7	0.05210	137.8	43.0	23.8%
8	0.03065	233.5	-52.7	-29.1%
9	0.05215	137.6	43.2	23.9%
10	0.03555	201.4	-20.6	-11.4%
Average Radius of Curvature - The Summation of the Radius of Curvature readings divided by 10 **180.8mm**			Greatest Percent Deviation from the Average Radius of Curvature **53.3%**	

FMVSS 111SB DATA SHEET 6…continued
UNIT MAGNIFICATION/CONVEX MIRROR TEST – ALL MIRRORS

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

CONVERSION DATA TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

MIRROR NO. 3 (UNIT MAGNIFICATION)

Test Postion	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Precent Deviation from the Average Radius of Curvature
1	0.000	N/A	N/A	N/A
2	0.000	N/A	N/A	N/A
3	0.000	N/A	N/A	N/A
4	0.000	N/A	N/A	N/A
5	0.000	N/A	N/A	N/A
6	0.000	N/A	N/A	N/A
7	0.000	N/A	N/A	N/A
8	0.000	N/A	N/A	N/A
9	0.000	N/A	N/A	N/A
10	0.000	N/A	N/A	N/A
Average Radius of Curvature - The Summation of the Radius of Curvature readings divided by 10 **N/A**			Greatest Percent Deviation from the Average Radius of Curvature **N/A**	

MIRROR NO. 4 (UNIT MAGNIFICATION)

Test Postion	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Precent Deviation from the Average Radius of Curvature
1	0.000	N/A	N/A	N/A
2	0.000	N/A	N/A	N/A
3	0.000	N/A	N/A	N/A
4	0.000	N/A	N/A	N/A
5	0.000	N/A	N/A	N/A
6	0.000	N/A	N/A	N/A
7	0.000	N/A	N/A	N/A
8	0.000	N/A	N/A	N/A
9	0.000	N/A	N/A	N/A
10	0.000	N/A	N/A	N/A
Average Radius of Curvature - The Summation of the Radius of Curvature readings divided by 10 **N/A**			Greatest Percent Deviation from the Average Radius of Curvature **N/A**	

FMVSS 111SB DATA SHEET 6…continued
UNIT MAGNIFICATION/CONVEX MIRROR TEST – ALL MIRRORS

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

CONVERSION DATA TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

MIRROR NO. 5 (CONVEX)

Test Postion	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Precent Deviation from the Average Radius of Curvature
1	0.01435	498.0	-0.8	-0.2%
2	0.01475	484.5	12.7	2.6%
3	0.01435	498.0	-0.8	-0.2%
4	0.01430	499.7	-2.5	-0.5%
5	0.01445	494.6	2.6	0.5%
6	0.01445	494.6	2.6	0.5%
7	0.01445	494.6	2.6	0.5%
8	0.01430	499.7	-2.5	-0.5%
9	0.01410	506.8	-9.6	-1.9%
10	0.01425	501.5	-4.3	-0.9%
Average Radius of Curvature - The Summation of the Radius of Curvature readings divided by 10 **497.2**			Greatest Percent Deviation from the Average Radius of Curvature **2.6%**	

MIRROR NO. 6 (CONVEX)

Test Postion	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Precent Deviation from the Average Radius of Curvature
1	0.01420	503.3	-8.1	-1.6%
2	0.01440	496.3	-1.2	-0.2%
3	0.01445	494.6	0.6	0.1%
4	0.01445	494.6	0.6	0.1%
5	0.01450	492.9	2.3	0.5%
6	0.01465	487.8	7.3	1.5%
7	0.01465	487.8	7.3	1.5%
8	0.01445	494.6	0.6	0.1%
9	0.01425	501.5	-6.4	-1.3%
10	0.01435	498.0	-2.9	-0.6%
Average Radius of Curvature - The Summation of the Radius of Curvature readings divided by 10 **495.1**			Greatest Percent Deviation from the Average Radius of Curvature **1.6%**	

FMVSS 111SB DATA SHEET 6…continued
UNIT MAGNIFICATION/CONVEX MIRROR TEST – ALL MIRRORS

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

UNIT MAGNIFICATION IN SYSTEM A

Requirements	Pass/Fail
At least one System A Mirror on the left and right sides of the bus is unit magnification -0 Radius of Curvature	PASS

AVERAGE RADIUS OF CURVATURE
OF CONVEX MIRRORS USED IN SYSTEM B

Mirror No.	Radius of Curvature	If needed, wording printed properly* Pass/Fail
1	181.1 mm	PASS
2	180.8 mm	PASS

* If any of the Convex Mirrors in System B have an average radius of curvature less than 889 mm, then the following words must be printed on a label in type face and color that are clear and conspicuous to the driver:

"USE CROSS VIEW MIRRORS TO VIEW PEDESTRIANS WHILE BUS IS STOPPED. DO NOT USE THESE MIRRORS TO VIEW TRAFFIC WHILE BUS IS MOVING, IMAGES IN SUCH MIRRORS DO NOT ACCURATELY SHOW ANOTHER VEHICLE'S LOCATION."

Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

FMVSS 111SB DATA SHEET 7
MIRROR REFLECTIVE SURFACE AREA TEST
SYSTEM A & B

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

DATA TABLE FOR SURFACE AREA

System A Mirrors Mirror No.	Area	Requirement Min. 323 cm²	Pass/Fail
3	380 cm^2	323 cm^2	PASS
4	380 cm^2	323 cm^2	PASS
System B Mirrors Mirror No.	Area	Requirement Min. 258 cm²	Pass/Fail
1	570 cm^2	258 cm^2	PASS
2	570 cm^2	258 cm^2	PASS

Recorded By: Brian Roach

Approved By: _____ Date: April 6, 2005

SECTION 4

INSTRUMENTATION AND EQUIPMENT LIST

Test Vehicle: **US Bus 2005 Sturdibus HD** NHTSA No.: **C50900**
Test Lab: **MGA Research-Wisconsin Operations** Test Date: **4/6/05**

	Digital Caliper	Light Meter	Tape Measure	Spherometer
Make	Mitutoyo	AEMC	Stanley	MGA
Model	Digimatic	CA813	Powerlock	001
Serial # (s)	04401288	04L1017Y	SN232	001
Range	0 to 150 mm	2000fc, 2000lux	0-8 m	2.25×10^{13} $(cm * Hz^{1/2}) \div W$
Accuracy	0.01 mm	0.0 fc or 0.01 lux	1 mm	1.1×10^{-13} $W/H^{1/2}$
Cal. Date	4/1/05	9/27/04	2/3/05	Daily when used
Cal. Due Date	4/1/06	9/27/05	8/3/05	N/A

SECTION 5
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Three-Quarter Left Front View of School Bus

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Three-Quarter Left Rear View of School Bus

Close-up View of Certification Label

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Right Front Cross View Mirror and Mounting

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Passenger Side Rearview Mirror and Mounting

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Left Front Cross View Mirror and Mounting

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Driver Side Rearview Mirror and Mounting

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Field of View Instrument Setup

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

View of Cylinders using no System Mirrors

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Mirror #2 System B Field of View

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Mirror #1 System B Field of View

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Mirror #4 and #6 System A Field of View

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Mirror #3 and #5 System A Field of View

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

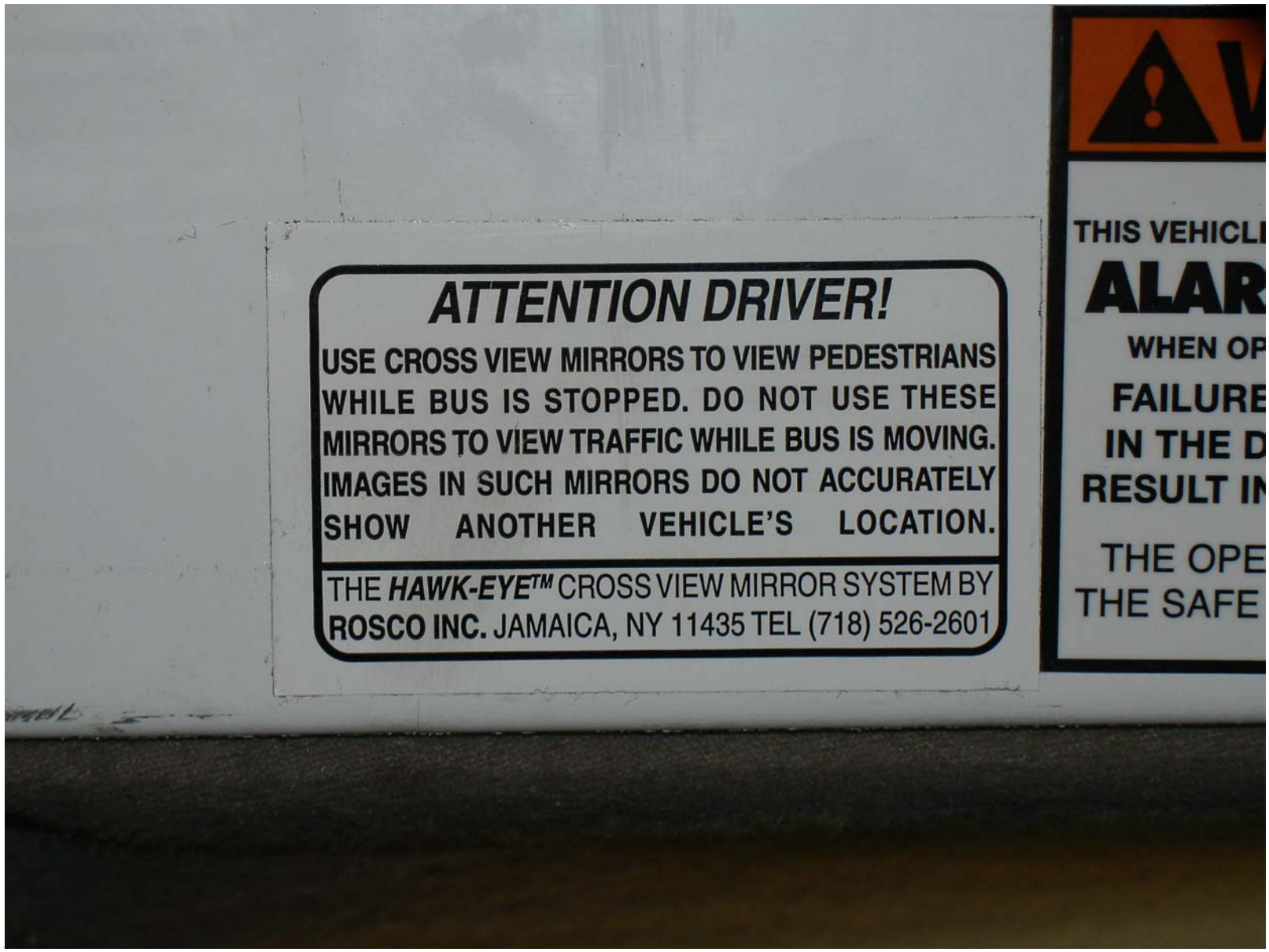
View of Cone Setup from Front

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Three-Quarter Left Front View of Cone Setup

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Three-Quarter Right Front View of Cone Setup



Label for Cross View Mirror Warning

Test Vehicle: **2005 US Bus Sturdibus HD School Bus**
Procedure: **FMVSS 111** NHTSA No.: **C50900**

Reflectance Test Setup