REPORT NUMBER: 111SB-MGA-2007-003

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

Les Entreprises Michel Corbeil Inc. 2006 Corbeil School Bus NHTSA No. C60902

PREPARED BY:
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BURLINGTON, WI 53105



Final Report Date: November 28, 2006

FINAL REPORT

PREPARED FOR:
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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
MAIL CODE: NVS-220
400 SEVENTH STREET, SW, ROOM 6115
WASHINGTON, D.C. 20590

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FINAL REPORT ACCEPTED BY:

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Technical Report Documentation Page

1. Report No.	2. Government Accession	3. Recipient's Ca	atalog No.
111SB-MGA-2007-003 <i>No</i> .			
4. Title and Subtitle	5. Report Date	0000	
Final Report of FMVSS 111 2006 Corbeil School Bus	November 28,	2006	
NHTSA No.:C60902		0.5.6	
141116/110666662		6. Performing Or MGA	ganization Code
7. Author(s)			ganization Report
Jeff Koehler, Project Engine	eer	No.	gamzation report
Michael Janovicz, Project		111SB-MGA-2	2007-003
9. Performing Organization I		10. Work Unit No	D.
MGA Research Corporation	l		
5000 Warren Road Burlington, WI 53105		11. Contract or C	Crant No
Builington, Wi 33103		DTNH22-02-D	
12. Sponsoring Agency Nam	ne and Address	13. Type of Repo	
		Covered	
U.S. Department of Transpo		Final Report	
National Highway Traffic Sat	fety Administration	10/11/06 to 11/	/28/06
Enforcement Office of Vehicle Safety Con	nnliance	14. Sponsoring A	Agency Code
Mail Code: (NVS-220)	ipilatice	NVS-220	agency code
400 Seventh Street, S.W. Ro	oom 6115		
Washington, D.C. 20590			
45 Cumplementer Notes			
15. Supplementary Notes			
16. Abstract	wated on the authorst 2006 Co.	shail Cahaal Dua N	UITCA No. CCOOO
	ucted on the subject 2006 Colfications of the Office of Vehic		
	termination of FMVSS 111 cor		nee restricted
Test failures were as follows	: NONE		
17. Key Words		18. Distribution S	Statement
-		Copies of this re	port are available
Compliance Testing	from:		
Safety Engineering FMVSS 111	NHTSA, Technic		
FMV55 111		Services (TIS), F (NPO-405)	(UUIII 2330
		400 Seventh Stre	eet, S.W.
	Washington, D.C	•	
19. Security Classif. (of	20. Security Classif. (of this	21. No. of	22. Price
this report)	page) Unclassified	Pages	
Unclassified Form DOT F1700.7 (8-72)	47		
1 31111 20 1 1 11 00.1 (0-12)			

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SECTION 1 PURPOSE OF COMPLIANCE TEST

Tests were conducted on a 2006 Corbeil School Bus, NHTSA No. C60902, in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedure 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 2006 Corbeil School Bus, NHTSA No. C60902, 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 <u>TEST SUMMARY DATA SHEET</u>

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

System A Mirrors

A. Driver Side Mirror #3 - Unit Magnification

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

B. Passenger Side Mirror #4 - Unit Magnification

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

C. Driver Side Mirror #5 - Convex

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

D. Passenger Side Mirror #6 - Convex

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

FMVSS 111SB, SCHOOL BUS REARVIEW MIRRORS <u>TEST SUMMARY DATA SHEET...continued</u>

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

System B Mirrors

E. Driver Side Front Mirror #1 - Cross View

	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

	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: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

GENERAL VEHICLE IDENTIFICATION

Final Stage Manufacturer	Corbeil	Date of Mfg.	06/29/2006
Chassis Manufacturer	Ford	Date of Mfg.	04/2006
VIN No.	1FDSE35L66DA60778	GVWR (kg)	4355
Seating Capacity (including driver)	21	GAWR Front (kg)	1610
		GAWR Rear (kg)	2760

DESCRIPTION OF MIRRORS

	Туре				
Mirror No.	Unit Mag	Convex	Cross View	Description	Manufacturer
1			Χ	Driver Side Dagge Mi	
2			Χ	Passenger Side	Rosco Mirror
3	Χ			Driver Side	
4	Χ			Passenger Side	MLC
5		Χ		Driver Side	IVILO
6		X		Passenger Side	

Recorded By:

Approved By:

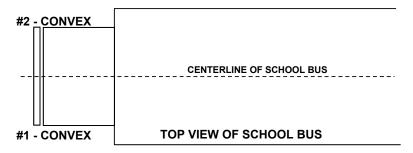
FMVSS 111SB – DATA SHEET 2 MIRROR LOCATION AND FIELD OF VIEW

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

MIRROR DIAGRAM

#6 LOWERMIRROR CONVEX

#4 UPPERMIRROR UNIT



#3 UPPERMIRROR UNIT

#5 LOWERMIRROR CONVEX

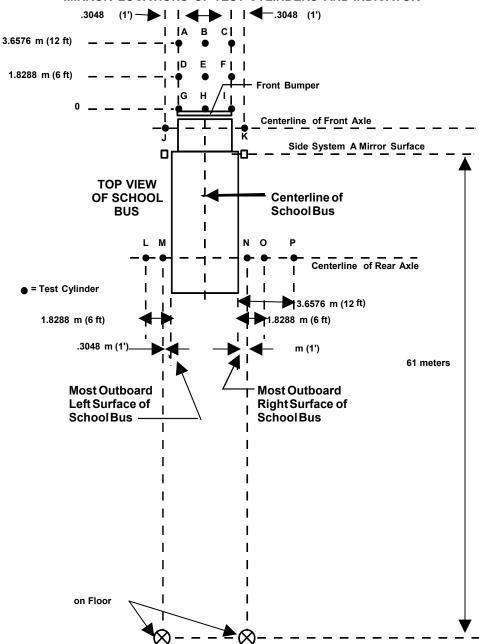
MIRROR NO.	TYPE	MIRROR SYSTEM	CYLINDERS VIEWED (entire top surface)
1	CROSS VIEW/CONVEX	В	B,C,D,E,F,H,I,J,L,M
2	CROSS VIEW/CONVEX	В	A,D,E,G,H,I,K,N,O,P
3	UNIT MAGNIFICATION	Α	61 Meter INDICATOR
4	UNIT MAGNIFICATION	Α	61 Meter INDICATOR
5	CONVEX	Α	L,M
6	CONVEX	А	N,O

SEE FIGURE ON NEXT PAGE

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

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: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

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 can be viewed in the photograph	PASS
Entire top surface of cylinder M and indicator 61 meters (200 feet) rearward of the mirror surface can 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:	A,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	211	0.184	
#2	Right Front	262	0.229	0.686

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 (37.5 inches):

	Distance	Pass/Fail
Distance between center of System B mirror #1 and driver's eye point	211 cm	PASS
Distance between center of System B mirror #2 and driver's eve point	262 cm	PASS

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

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

Recorded By:

Approved By:

FMVSS 111SB DATA SHEET 4 MOUNTING ADEQUACY TEST

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

MOUNTING SUPPORT OF ALL MIRRORS

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

	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:

Approved By:

FMVSS 111SB DATA SHEET 5 REFLECTANCE TEST – ALL MIRRORS

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

Mirror No.	Туре	Light meter reading from calibration (FC)	Light meter reading from light reflected by mirror (FC)	Pass/Fail	Observations
1	Crossview/Convex	125.0	80.7	PASS	
2	Crossview/Convex	124.3	80.3	PASS	
3	Unit	123.3	53.3	PASS	
4	Unit	123.7	54.0	PASS	
5	Convex	123.0	76.0	PASS	
6	Convex	123.0	76.0	PASS	

Note: Reflectance % = [Reflectance Reading / Calibration reading] x 100
Minimum Requirement = 35 percent

Mirror No.	Туре	Reflectance	Requirement
1	Crossview/Convex	65%	>35%
2	Crossview/Convex	65%	>35%
3	Unit	43%	>35%
4	Unit	44%	>35%
5	Convex	62%	>35%
6	Convex	62%	>35%

Recorded By:

Approved By:

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

CONVERSION DATA TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

MIRROR NO. 1 (CONVEX)

Test Position	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Percent Deviation from the Average Radius of Curvature
1	0.05395	133.1	38.5	22.4%
2	0.03590	199.4	-27.9	-16.2%
3	0.02855	250.6	-79.0	-46.0%
4	0.05245	136.9	34.7	20.2%
5	0.05245	136.9	34.7	20.2%
6	0.03685	194.3	-22.7	-13.3%
7	0.05290	135.7	35.9	20.9%
8	0.03325	215.3	-43.7	-25.5%
9	0.05650	127.2	44.4	25.9%
10	0.03840	186.5	-14.9	-8.7%
Avg. Radius of Curvature – the Summation of Column 3 divided by 10: 171.6 mm		Greatest Percent Deviation fro Radius of Curvature, Co 46%	•	

MIRROR NO. 2 (CONVEX)

WIRKUR NO.	Z (CONVEX)			
Test Position	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Percent Deviation from the Average Radius of Curvature
1	0.05540	129.7	37.1	22.3%
2	0.03720	192.5	-25.7	-15.4%
3	0.02985	239.7	-72.9	-43.7%
4	0.05215	137.6	29.1	17.5%
5	0.05460	131.5	35.2	21.1%
6	0.03895	183.9	-17.1	-10.3%
7	0.05545	129.5	37.2	22.3%
8	0.03445	207.8	-41.0	-24.6%
9	0.05570	129.0	37.8	22.7%
10	0.03840	186.5	-19.7	-11.8%
Avg. Radius of Curvature – the Summation of Column 3 divided by 10: 166.8 mm		Greatest Percent Deviation fro Radius of Curvature, Co 43.7%		

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

CONVERSION DATA TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

MIRROR NO. 3 (UNIT MAGNIFICATION)

MINITAL TOTAL	S (ONL) MAC	JNII ICATION		
Test Position	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Percent Deviation from the Average Radius of Curvature
1	0.00000	N/A	N/A	N/A
2	0.00000	N/A	N/A	N/A
3	0.00000	N/A	N/A	N/A
4	0.00000	N/A	N/A	N/A
5	0.00000	N/A	N/A	N/A
6	0.00000	N/A	N/A	N/A
7	0.00000	N/A	N/A	N/A
8	0.00000	N/A	N/A	N/A
9	0.00000	N/A	N/A	N/A
10	0.00000	N/A	N/A	N/A
Avg. Radius of Curvature – the Summation of Column 3 divided by 10: N/A		Greatest Percent Deviation fro Radius of Curvature, Co N/A	•	

MIRROR NO. 4 (UNIT MAGNIFICATION)

MINITAGE 110.	T (ONL)	JNII ICATION		
Test Position	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Percent Deviation from the Average Radius of Curvature
1	0.00000	N/A	N/A	N/A
2	0.00000	N/A	N/A	N/A
3	0.00000	N/A	N/A	N/A
4	0.00000	N/A	N/A	N/A
5	0.00000	N/A	N/A	N/A
6	0.00000	N/A	N/A	N/A
7	0.00000	N/A	N/A	N/A
8	0.00000	N/A	N/A	N/A
9	0.00000	N/A	N/A	N/A
10	0.00000	N/A	N/A	N/A
Avg. Radius of Curvature – the Summation of Column 3 divided by 10: N/A		Greatest Percent Deviation fro Radius of Curvature, Co N/A		

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

CONVERSION DATA TABLE FROM SPHEROMETER DIAL READING TO RADIUS OF CURVATURE

MIRROR NO. 5 (CONVEX)

Test Position	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Percent Deviation from the Average Radius of Curvature
1	0.01685	424.2	6.1	1.4%
2	0.01440	496.3	-66.0	-15.3%
3	0.01725	414.3	15.9	3.7%
4	0.01795	398.2	32.1	7.5%
5	0.01765	405.0	25.3	5.9%
6	0.01715	416.8	13.5	3.1%
7	0.01400	510.4	-80.2	-18.6%
8	0.01620	441.2	-10.9	-2.5%
9	0.01775	402.7	27.6	6.4%
10	0.01815	393.8	36.5	8.5%
Avg. Radius of Curvature – the Summation of Column 3 divided by 10: 430.3 mm		Greatest Percent Deviation fro Radius of Curvature, Co 18.6%	9	

MIRROR NO. 6 (CONVEX)

Test Position	Dial Reading (inches)	Radius of Curvature (mm)	Deviation between the Average Radius of Curvature and the Test Position Radius of Curvature (mm)	Percent Deviation from the Average Radius of Curvature
1	0.01760	406.1	3.1	0.7%
2	0.01755	407.3	1.9	0.5%
3	0.01765	405.0	4.2	1.0%
4	0.01750	408.4	0.7	0.2%
5	0.01725	414.3	-5.2	-1.3%
6	0.01755	407.3	1.9	0.5%
7	0.01735	412.0	-2.8	-0.7%
8	0.01765	405.0	4.2	1.0%
9	0.01740	410.8	-1.6	-0.4%
10	0.01720	415.6	-6.4	-1.6%
Avg. Radius of Curvature – the Summation of Column 3 divided by 10: 409.2 mm		Greatest Percent Deviation from the Average Radius of Curvature, Column 5: 1.6%		

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

UNIT MAGNIFICATION IN SYSTEM A

	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	171.6 mm	PASS
2	166.8 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:

Approved By:

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

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

DATA TABLE FOR SURFACE AREA

System A Mirrors Mirror No.	Area	Requirement Min. 323 cm ²	Pass/Fail
3	495 cm ²	323 cm ²	PASS
4	498 cm ²	323 cm ²	PASS
System B Mirrors Mirror No.	Area	Requirement Min. 258 cm ²	Pass/Fail
1	558 cm ²	258 cm ²	PASS
2	562 cm ²	258 cm ²	PASS

Recorded By:

Approved By:

SECTION 4 INSTRUMENTATION AND EQUIPMENT LIST

Test Vehicle: 2006 Corbeil School Bus NHTSA No.: C60902
Test Lab: MGA Research-Wisconsin Operations Test Date: 10/11/06

	Digital Caliper	Light Meter	Tape Measure	Spherometer
Make	Mitutoyo	AEMC	Stanley	MGA
Model	ID-F150HE	CA813	Powerlock	001
Serial # (s)	001462	04L1017Y	SN101	001
Range	0-50.8 mm	2000 fc 2000 lux	0-8 m	2.25 x 10 ¹³ (cm * Hz ^{1/2}) ÷ W
Accuracy	.001 mm	0.0 fc or 0.01 lux	1 mm	1.1 x 10 ⁻¹³ W/H ^{1/2}
Cal. Date	7/26/06	4/18/06	8/16/06	Daily when used
Cal. Due Date	7/26/07	4/18/07	2/16/07	N/A

SECTION 5 PHOTOGRAPHS

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Photo 1 -Three-Quarter Left Front View of School Bus



Photo 2 -Three-Quarter Left Rear View of School Bus



Photo 3 -Incomplete Vehicle Manufacturer Label

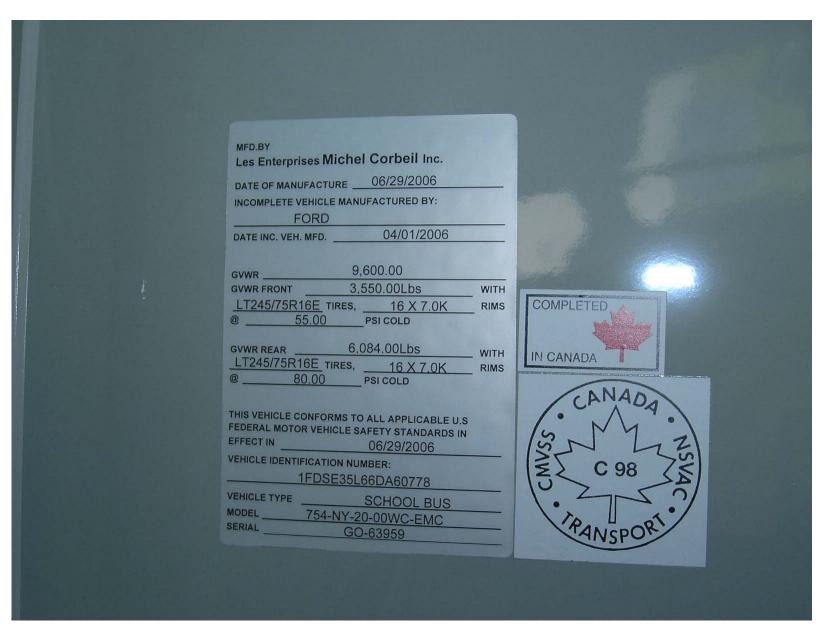


Photo 4 - Vehicle Certification Label



Photo 5 - Vehicle Tire Placard



Photo 6 -Right Front Cross View Mirror and Mounting



Photo 7 -Passenger Side Rearview Mirror and Mounting



Photo 8 -Inside Rearview Mirror and Mounting



Photo 9 -Left Front Cross View Mirror and Mounting



Photo 10 -Driver Side Rearview Mirror and Mounting



Photo 11 -Field of View Instrument Setup



Photo 12 -Field of View without mirrors



Photo 13 -Mirror #2 System B Field of View



Photo 14 -Mirror #1 System B Field of View



Photo 15 -Mirror #4 System A Field of View



Photo 16 -Mirror #3 System A Field of View



Photo 17 -Mirror #6 System A Field of View



Photo 18 -Mirror #5 System A Field of View



Photo 19 -View of Cylinder Setup from Front



Photo 20 -Three-Quarter Left Front View of Cylinder Setup



Photo 21 -Three-Quarter Right Front View of Cylinder Setup



Photo 22 -Reflectance Test Set-up



C60902

Photo 23 -Label for Cross View Mirror Warning