



# Federal Motor Vehicle Safety Standard #111

# FMVSS #111

## Federal Motor Vehicle Safety Standard

### §571.111 Standard No. 111; Rearview Mirrors

**S1. Scope.** This standard specifies requirements for the **performance and location of rearview mirrors.**

**S2. Purpose.** The purpose of this standard is **to reduce the number of deaths and injuries** that occur when the driver of a motor vehicle **does not have a clear and reasonably unobstructed view to the rear.**

**S3. Application.** This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, ***school buses*** and motorcycles.

# Sections of Safety Standard FMVSS #111

## S4. **Mirror Definitions.**

**Convex mirror** means a mirror having a curved reflective surface whose shape is the same as that of the exterior surface of a section of a sphere.

Effective mirror surface means the portions of a mirror that reflect images, excluding the mirror rim or mounting brackets.

**Unit magnification mirror** means a **plane or flat mirror** with a reflective surface through which the angular height and width of the image of an object is equal to the angular height and width of the object when viewed directly at the same distance except for flaws that do not exceed normal manufacturing tolerances. For the purposes of this regulation a prismatic day-night adjustment rearview mirror one of whose positions provides unit magnification is considered a unit magnification mirror.

## S5. **Requirements for passenger cars.**

**S5.1 Inside rearview mirror.** Each passenger car shall have an inside rearview mirror of unit magnification.

### S5.1.1 **Field of view.**

Except as provided in S5.3, the mirror shall provide a field of view with an included horizontal angle measured from the projected eye point of at least **20 degrees, and a sufficient vertical angle to provide a view of a level road surface extending to the horizon beginning at a point not greater than 61 m to the rear of the vehicle** when the vehicle is occupied by the driver and four passengers or the designated occupant capacity, if less, based on an average occupant weight of 68 kg. The line of sight may be partially obscured by seated occupants or by head restraints. The location of the driver's eye reference points shall be those established in Motor Vehicle Safety Standard No. 104 (§571.104) or a nominal location appropriate for any 95th percentile male driver

**S5.1.2 Mounting.** The mirror mounting shall provide a stable support for the mirror, and shall provide for mirror adjustment by tilting in both the horizontal and vertical directions. If the mirror is in the head impact area, the mounting shall deflect, collapse or break away without leaving sharp edges when the reflective surface of the mirror is subjected to a force of 400 N in any forward direction that is not more than 45° from the forward longitudinal direction.

## **S6 Requirements for multipurpose passenger vehicles, trucks, and buses, other than school buses, with GVWR of 4,536 kg or less.**

S6.1 Each multipurpose passenger vehicle, truck and bus, other than a school bus, with a GVWR of 4,536 kg or less shall have either—

- (a) Mirrors that conform to the requirements of S5.; or
- (b) Outside mirrors of unit magnification, each with not less than **126 cm<sup>2</sup>** of reflective surface, installed with stable supports on both sides of the vehicle, located so as to provide the driver a view to the rear along both sides of the vehicle, and adjustable in both the horizontal and vertical directions to view the rearward scene.

## **S7. GVWR of more than 4,536 kg and less than 11,340 kg and buses, other than school buses, with a GVWR of more than 4,536 kg.**

S7.1 Each multipurpose passenger vehicle and truck with a GVWR of more than 4,536 kg and less than 11,340 kg and each bus, other than a school bus, with a GVWR of more than 4,536 kg shall have outside mirrors of unit magnification, each with not less than **323 cm<sup>2</sup>** of reflective surface, installed with stable supports on both sides of the vehicle. The mirrors shall be located so as to provide the driver a view to the rear along both sides of the vehicle and shall be adjustable both in the horizontal and vertical directions to view the rearward scene.

## **s8. GVWR of 11,340 kg or more.**

S8.1 Each multipurpose passenger vehicle and truck with a **GVWR of 11,340 kg or more shall have outside mirrors of unit magnification, each with not less than 323 cm<sup>2</sup>** of reflective surface, installed with stable supports on both sides of the vehicle. The mirrors shall be located so as to provide the driver a view to the rear along both sides of the vehicle and shall be adjustable both in the horizontal and vertical directions to view the rearward scene.

## S9. Requirements for School Buses.

When a school bus is tested in accordance with the procedures of S13, it shall meet the requirements of S9.1 through S9.4.

### S9.1 **Outside Rearview Mirrors.** Each school bus shall have two outside rearview mirror systems:

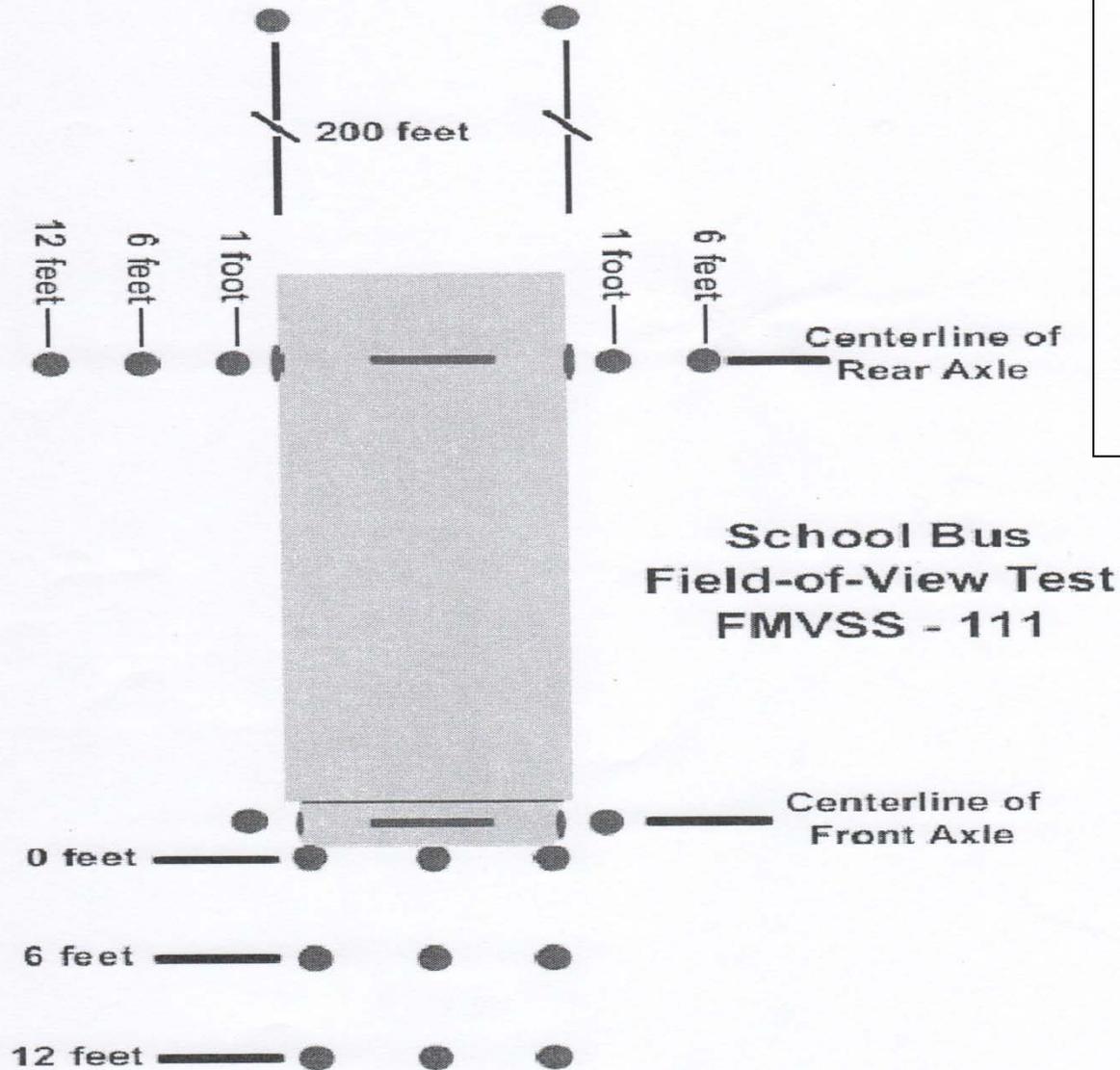
#### **System A and System B.**

S9.2. **System A (Post mirrors)** shall be located with stable supports so that the portion of the system on the bus's left side, and the portion on its right side, each:

- (a) Includes at least one mirror of unit magnification with not less than 323 cm<sup>2</sup> of reflective surface**
- (b) Includes one or more mirrors which together provide, at the driver's eye location, a view of:**
  - (1) For the mirror system on the right side of the bus, the entire top surface of cylinder N in Figure 2, and that area of the ground which extends rearward from cylinder N to a point not less than 61 meters from the mirror surface.

# Placement of markers for mirror adjustment according to FMVSS-111

**Federal  
Motor  
Vehicle  
Safety  
Standard #  
111**



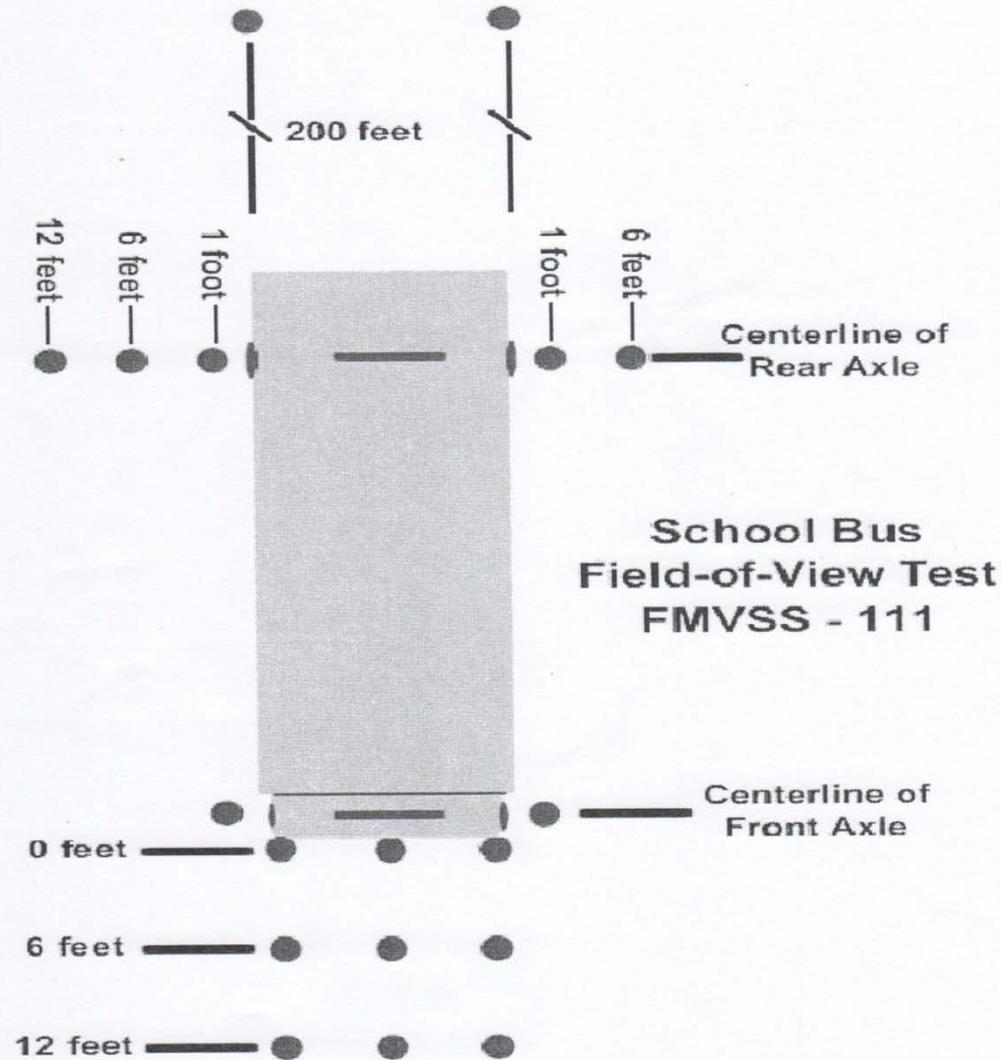
# How to Comply With FMVSS # 111

Place 16 markers around the bus. There will be 2 additional markers placed 200 ft. behind the bus.

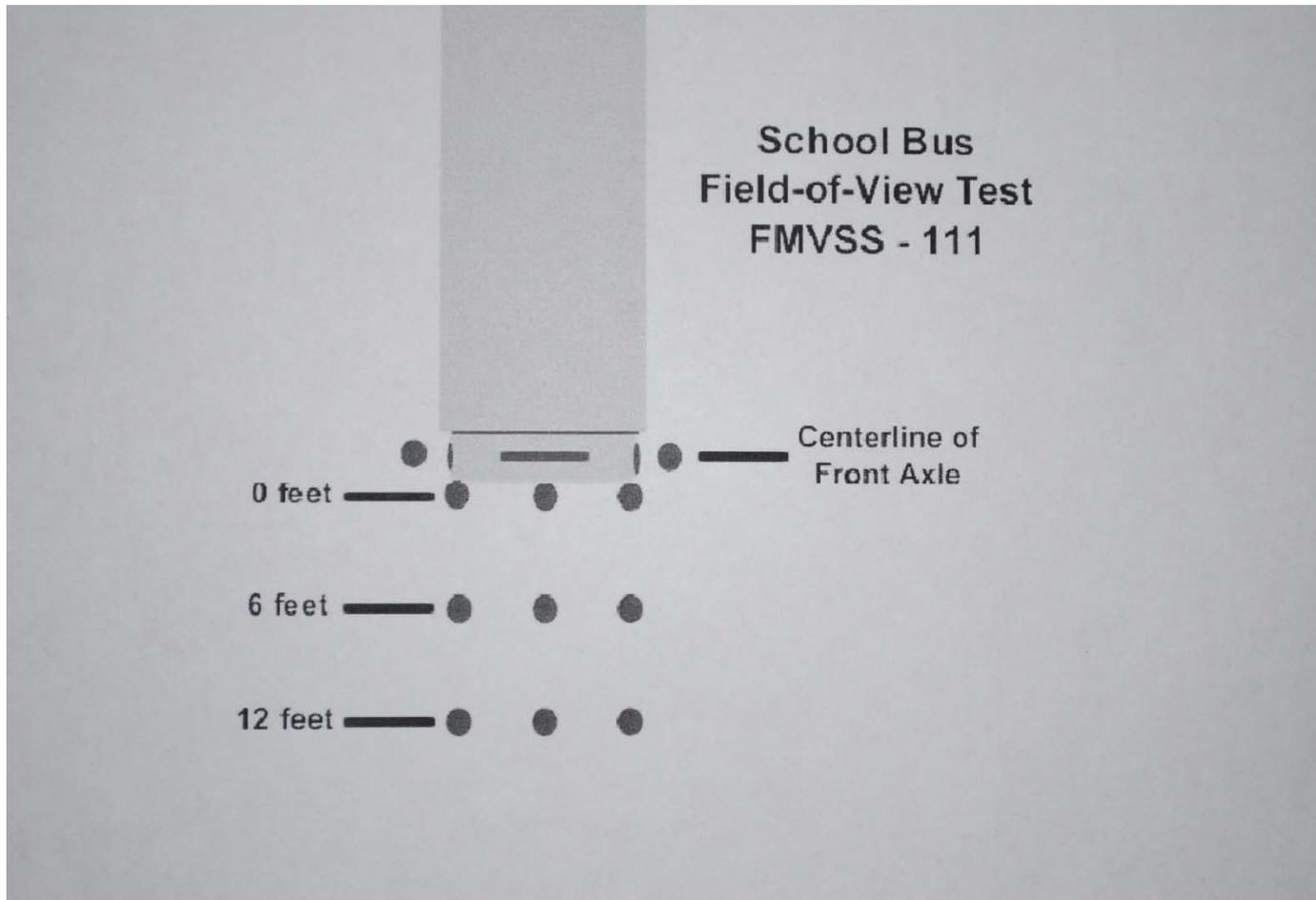
These markers should be visible either through real vision and/or reflective vision, both working together.

**Placement of markers for mirror adjustment according to FMVSS-111**

**FMVSS #111  
Marker  
Placement**



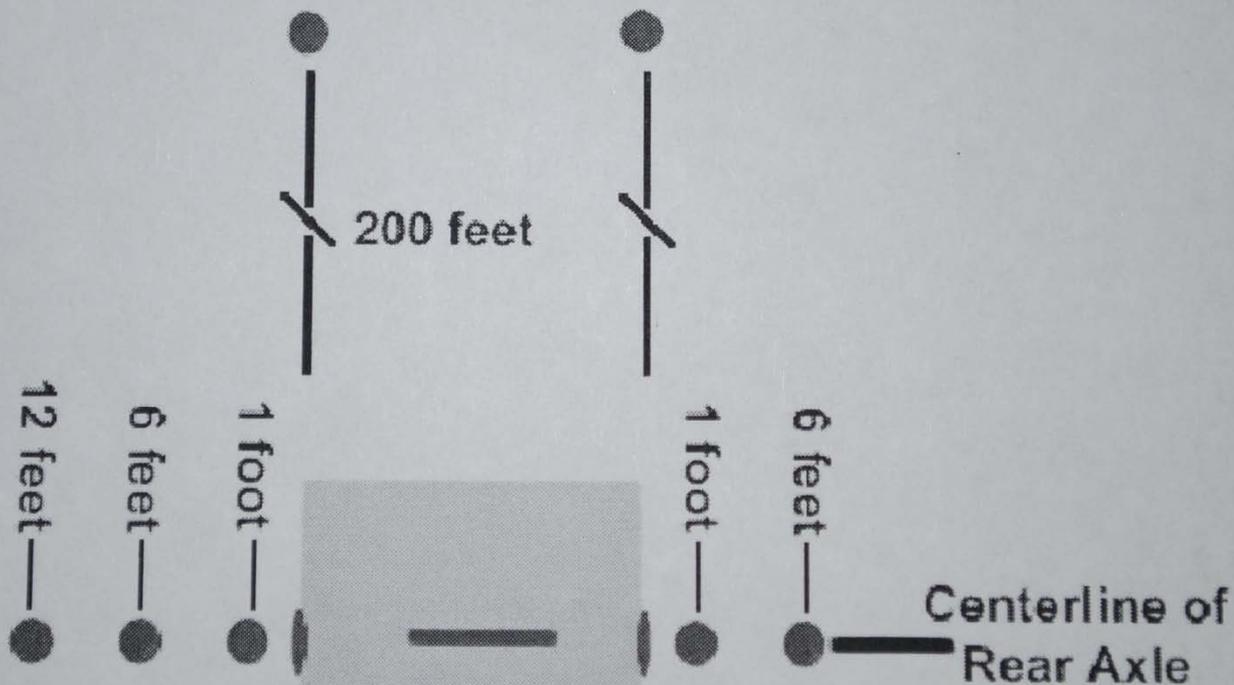
# 9 Markers in Front of Bus and 1 Marker at Each Front Wheel



# 5 Markers at Rear Wheels and 2 Markers at 200 Ft.

## Appendix A

Placement of markers for mirror adjustment according to FMVSS-111



# Gwinnett County Mirror Grid System

14 cones strapped together on 5 grids(2 more cones stand alone), laid out per FMVSS 111



# Mirror Grid Set Up

**Nine cones in front of bus**

**Two single cones either side  
of front tires**



# Front and Left Side

**Side view of front cones**



**2 cones against left rear tire**



# Right Side Rear Cones

**Three cones right side**

**Must see 12 ft. door side,  
students exit to safety**



# Left Side Rear Cones

**Hinge stop up against the  
bottom of left rear tire**

**First Cone 1 ft. from Rear tire  
second cone at 6 ft.**



# Right Rear Cones

**Right rear hinge stop at  
bottom of right rear tire**

**Cones at 1 - 6 - 12 ft.**



# Rear Cones

**Left Rear (Driver Side) marked on hinge**

**Right Rear (Door Side) marked also**



# Front Cones

**Three cones under “forward most surface” of the front bumper**

**Center cones in middle of bus, left and right cones at the outer edge of the front bumper**



# Front Cones

**Center cones 6 ft. out**

**Outer cones 12 ft. out**



# Front Wheel Cones

**Approx. 1 ft. out from tire**



# 16 Cone Layout

## Right Side View



## Left Side View



# Visibility from Driver's Seat

**Cones at 12 ft. visible by direct sight over hood**



**View from right crossover: cones at bumper, then at 6 ft. and one at front wheel**



# From Driver's Seat

**Right front crossover**



**Left front: 6 cones plus 1 cone at front wheel**



# Crossovers.

These photos were taken from outside of the bus to give a clearer picture of the cones.



# Post Mirrors From Driver's Seat

**Left side: Cones at 1 and 6 ft.**



**Right side: Cones 1 – 6 – 12 ft**



# Visibility From Driver's Seat

**Cone at back of bus and student at 200 ft.**



**Cones at 1 – 6 – 12 ft. door side**



# Other Views

**Interior mirror set so rear door padding is just visible in top of mirror**

**View of crossover mirror outside of bus**



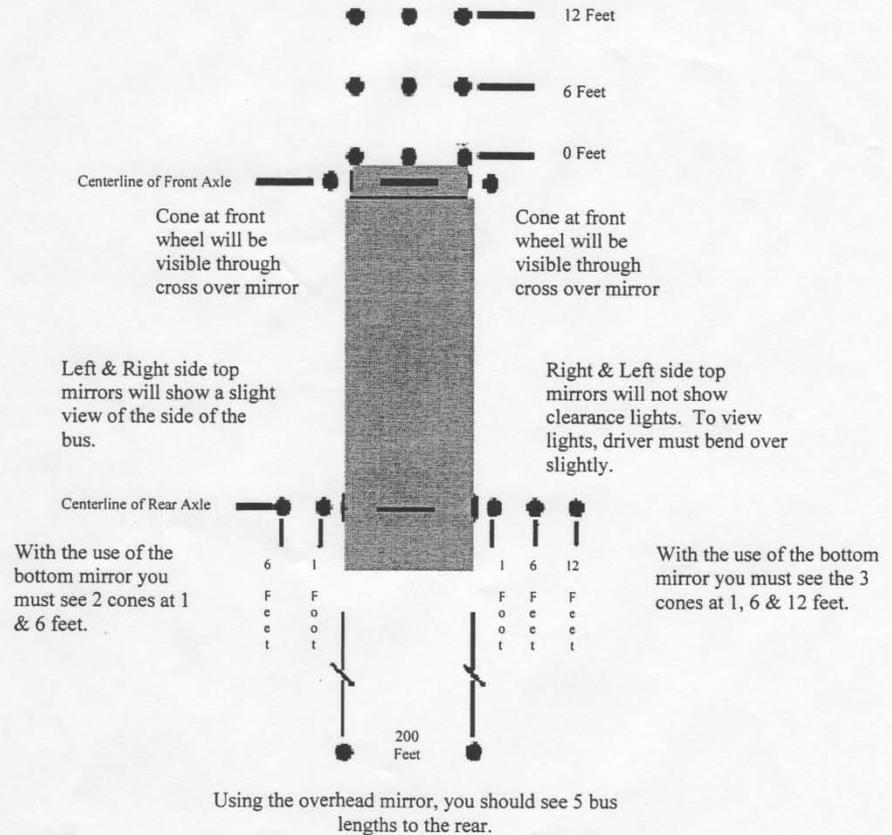
# FMVSS #111 Vision Grid

Includes dimensions between cones and instructions to drivers describing which mirror they must be using to view all 16 cones.

If all the mirrors are set correctly, driver will be able to view 200 Ft to the rear through the post mirrors and interior student mirror.

## SCHOOL BUS FIELD OF VISION GRID FMVSS 111

Using your cross over mirrors, you will see 3 cones at 0 feet and 3 cones at 6 feet. Through your windshield, you will see 3 cones at 12 feet. (Some older buses will see all cones in the cross over mirrors.)



With the use of the Mirror Grid System, you will be able to see all of the cones in the top, bottom and cross over mirrors. If this cannot be accomplished, your mirrors are not properly adjusted. Seek help through your Supervisor.

# Right Side

**Can you see the front wheel cone in your right crossover?**



**Can you see the 3 cones against your rear tire, door side?**



# Left Side

Same for left crossover

Only 2 cones against left rear tire, driver's side

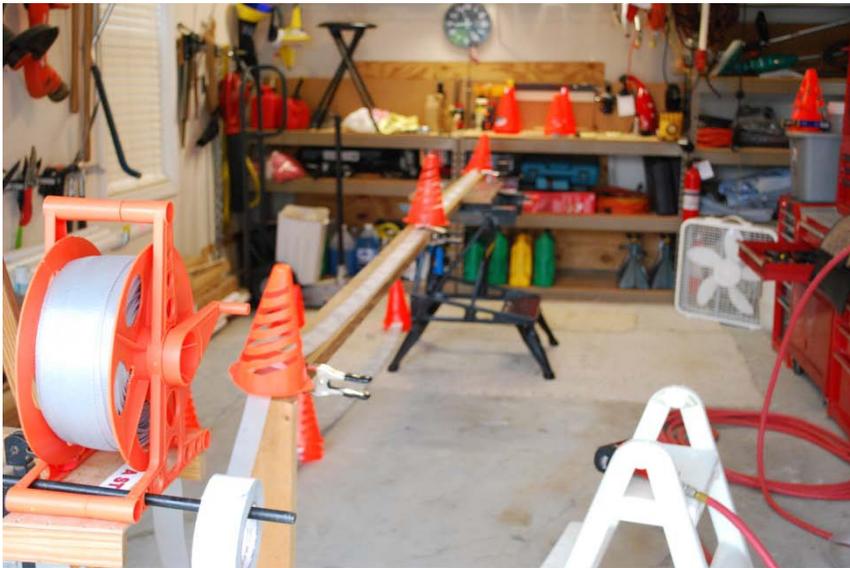


# Constructing Mirror Grids

## Marking Template

12 ft. long 2x4 template, drilled to line up with cone base mounting holes

Line up the center of the front cone to the front end of the template, and clamp it



# Marking and Drilling Template

Mark template through the back hole of the front cone as shown

Drill  $\frac{1}{4}$  inch hole about  $\frac{1}{4}$  inch deep



# Marking and Drilling for Middle Cone

Measure 6 ft. along template and Place cone top over center line, mark and draw a center line and drill holes as shown



# Marking and Drilling for Rear Cone Starting Assembly

Place top of rear cone over end of template, mark and drill hole

Pull strapping over front of template, wrap two widths of duct tape around end



# Building Front Grid

Clamp hinge over end, pierce a hole through tape and strap

Insert  $\frac{1}{4}$  x  $\frac{3}{4}$  bolt, 2 washers either side of hinge and nut.



# Front Grid (Cont'd.)

Measure and mark 2 inches from the hinge



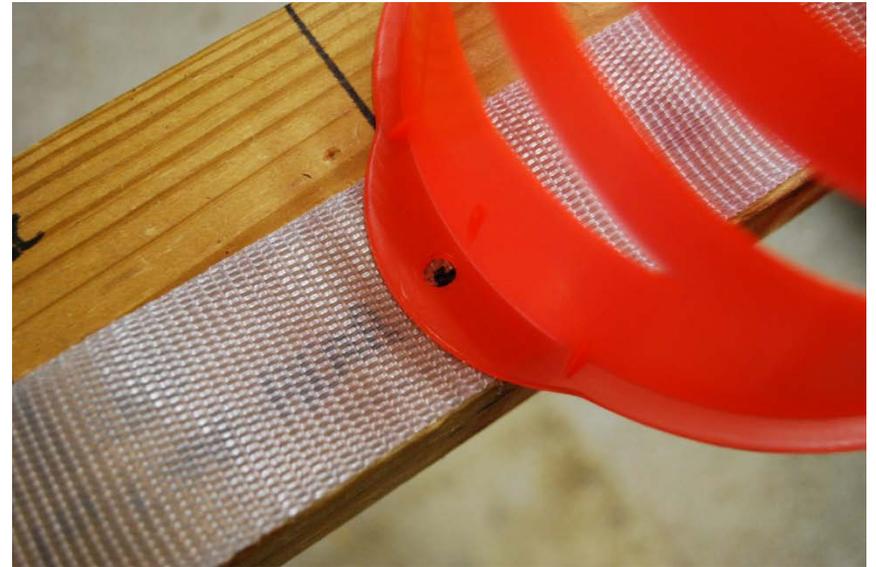
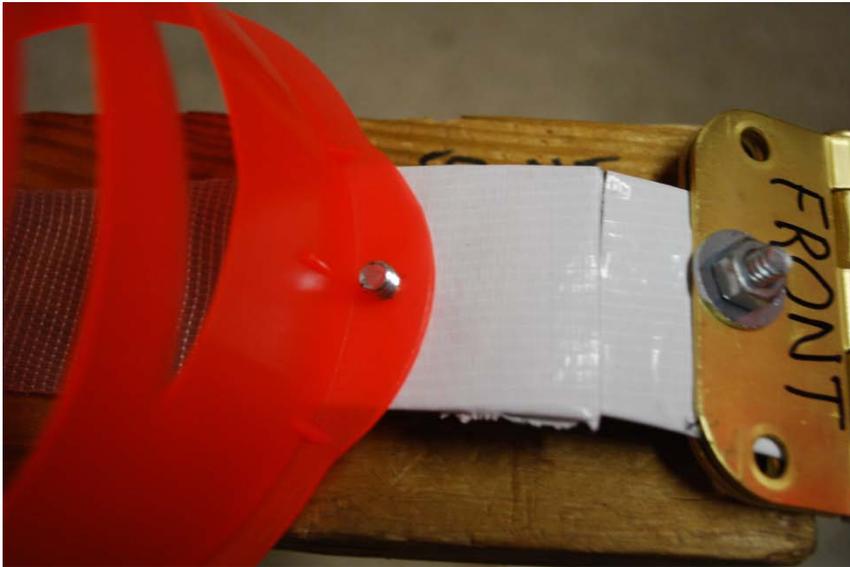
Pierce another hole



# Front Cone

Insert bolt, cone, washers and nut

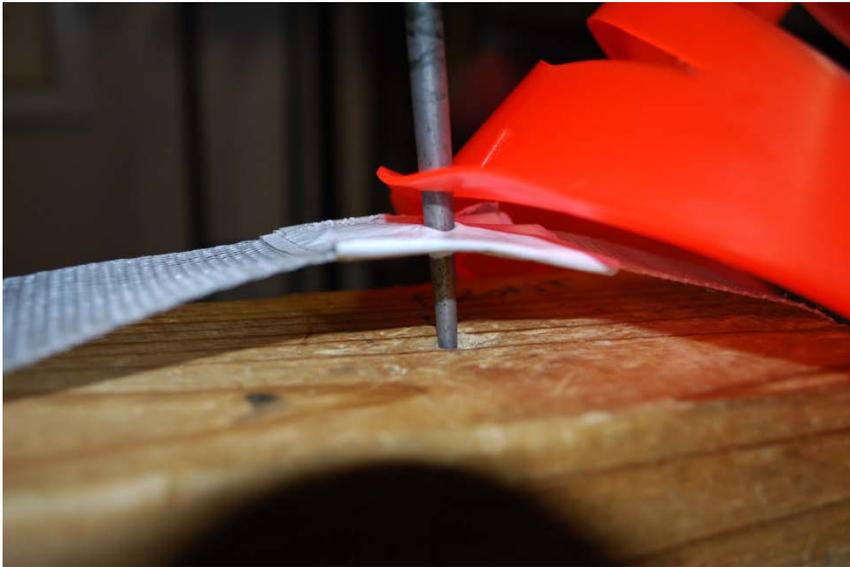
Mark strap at second hole  
through cone



# Front Cone (Cont'd.)

Wrap tape over strap, pierce through cone and tape

Insert bolt, washers and nut, and then clamp bolt head over front hole in template

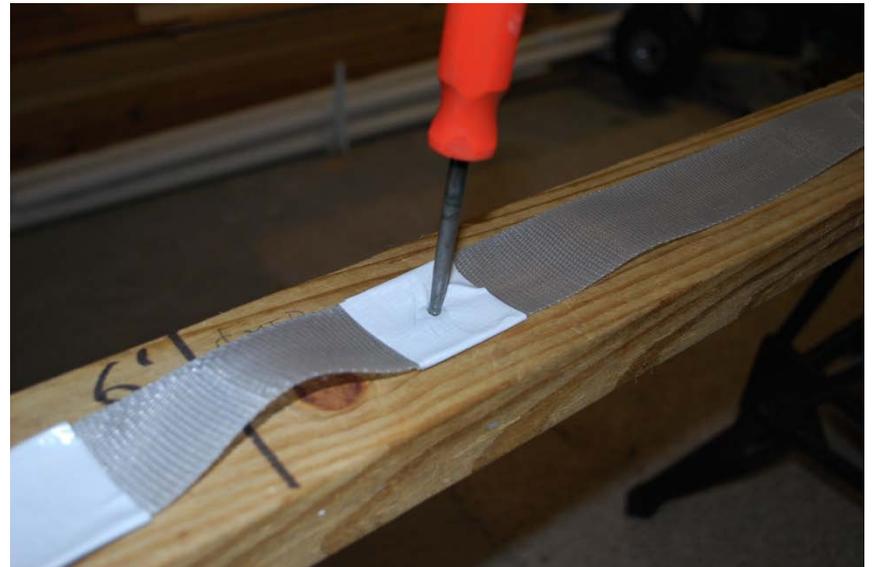


# Center Cone

Wrap tape over strap in line with center cone holes



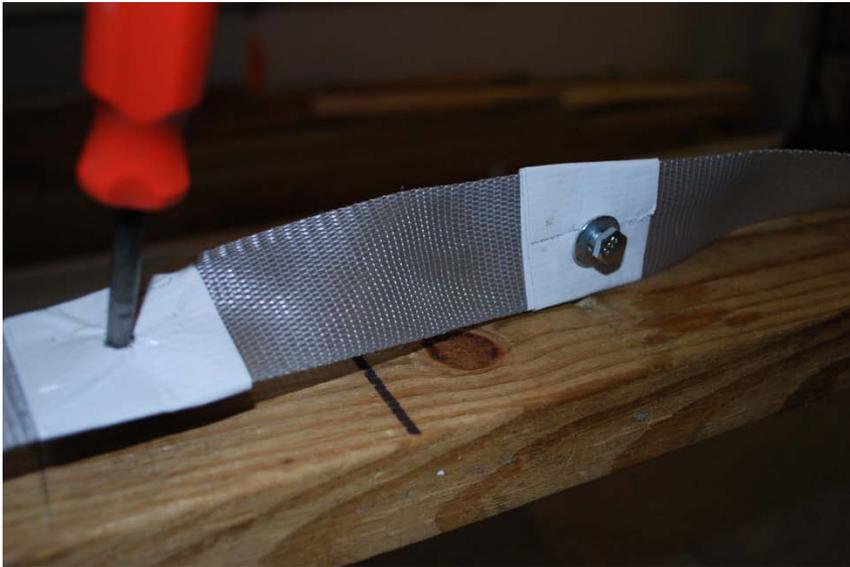
Pierce tape and strap into template holes



# Center Cone (Cont'd.)

Insert bolts and washers

Mount center cone over bolts  
add washers and nuts



# Rear Cone

Line up tape with the front hole

Punch hole through it and strap into template



# Rear Cone (Cont'd.)

Insert bolt and washer

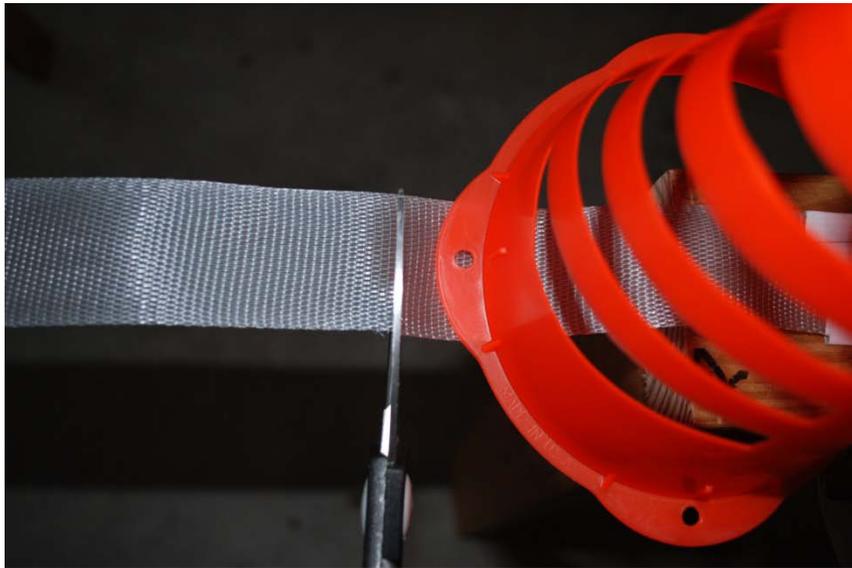


Mount rear cone



# Rear Cone (Cont'd.)

Stretch strap under cone, leave about 1 inch overhang and cut it



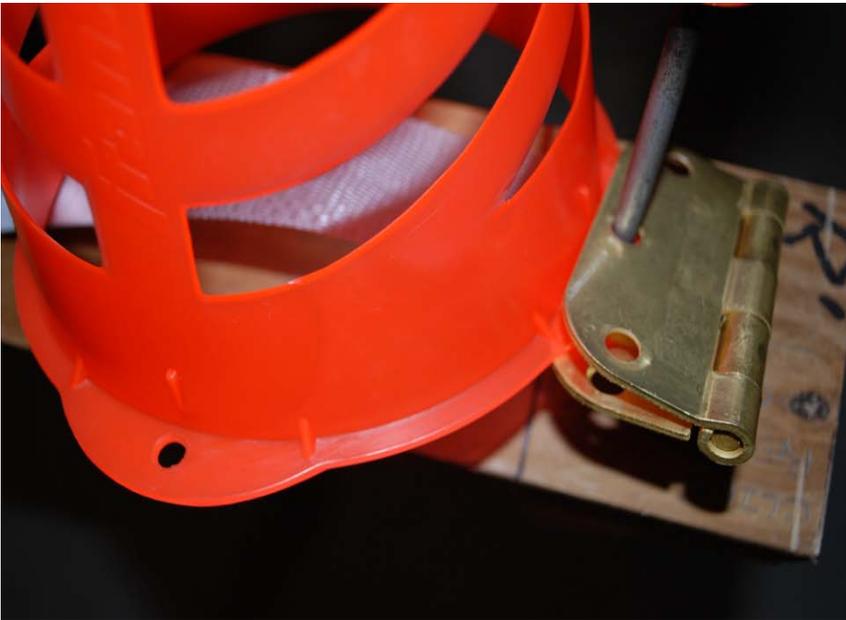
Wrap the end with tape



# Rear Cone (Final Step of Front Grid)

Clamp hinge over cone and tape.  
Pierce through center hole in hinge

Insert bolt washers and nut



# Marking and Drilling for Right and Left Grids

The first cone is mounted 1 ft. behind the hinge stop

Measure back 1 ft. mark template, straddle it with a cone and drill 2 holes



# Building Right And Left Grids

Wrap tape around strap, mount hinge, pierce hole, install bolt, washer and nut

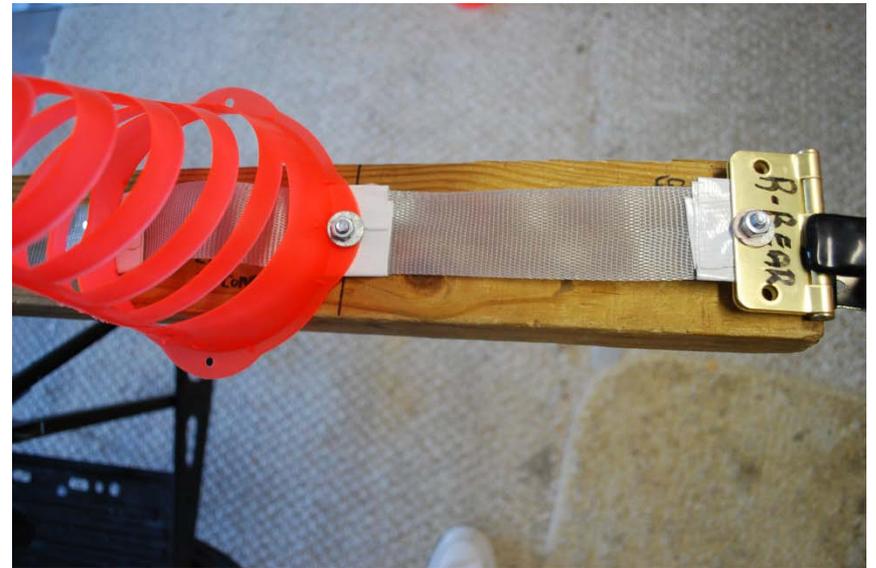
Tape around strap, in line with template holes, pierce holes into template



# Rear Grids Front Cone

Insert bolts through tape and strap

Mount cone, clamp hinge on top of and at end of template



# Right Rear Grid (Cont'd.)

Install center cone the same as front grid

Install rear cone the same as front grid



# Left Rear Grid

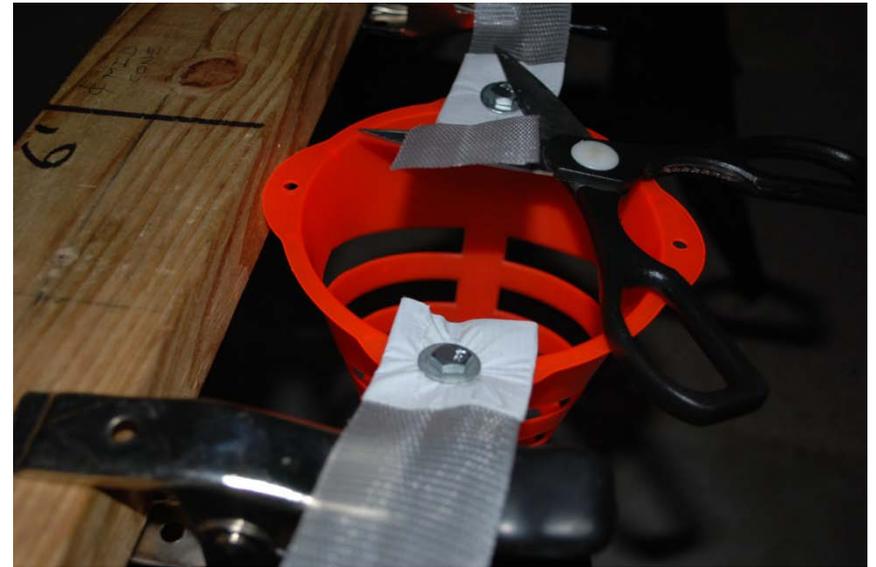
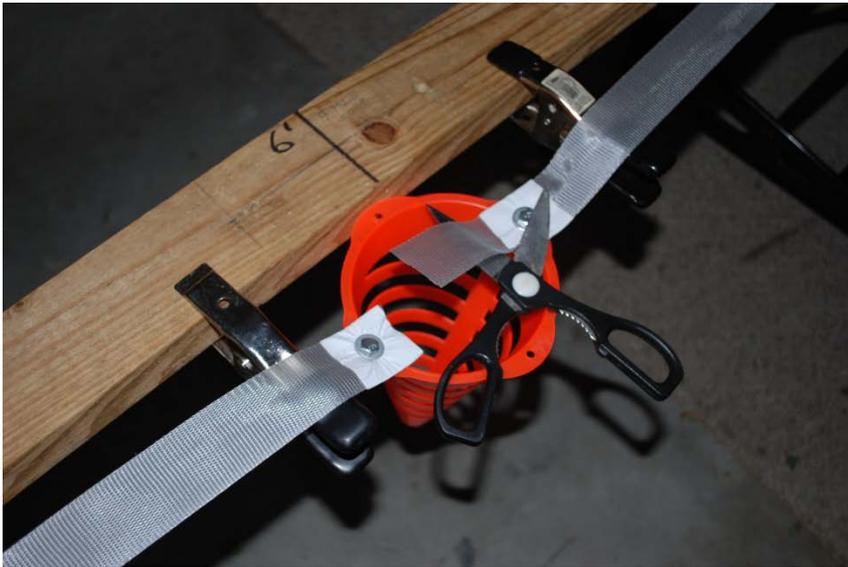
Construct the same as right rear grid, just stop at center cone.

Stop at 6 ft (center cone) and install hinge



# To Stack Grid

- If you want to stack the grids, cut and remove the tape between the bolts



# Final Assembly Tools Needed

Tighten all bolts using a power tool if available

7/16 inch socket & wrench, clamps, scissors, AWL (piercing tool ),cup of soapy water



**MIRROR GRID PARTS /QTY/ PRICES**

VENDOR	ITEM	COST	QUANTITY REQUIRED	COST PER GRID
TARGET	9 INCH FLEX MLS SOCCER CONE SKU # 2572527773	\$3.79 FOR A 4 PACK	16	\$15.16
LOWES	3 INCH BRASS DOOR HINGE Part # 0308903 SKU# 935080 600670	\$1.68 (BULK PRICE 30+)	10	\$16.80
HOME DEPOT	HANGER STRAP 1.75 INCH WOVEN VINYL PART 3 915793 SKU 50206 95506 300 FOOT ROLL MIN QTY WILL MAKE 5 M/GRID SETS (FIND IN H/VAC SECTION)	\$16.95/ROLL	54FT	\$3.40
	NASHUA 11 MILL THICK ALL WEATHER WHITE DUCT TAPE 1.89 INCH WIDE 90FOOT ROLL WILL MAKE APPROX 3 SETS	\$7.98/ROLL	35FT APPROX	\$2.70
	BOLTS 1/4 X 3/4 CODE ACC BOX OF 100 COST 11C EACH	\$8.57	33	\$3.63
	NUTS 1/4 COARSE CODE AAB BOX 100	\$5.37	33	\$1.98
	FLAT WASHERS 1/4 CODE AAA	0.10 EA	66	\$6.60
WALL MART	10 GALLON PLASTIC TOTE BOX ( TO STORE GRID)	\$4.47EA	1	\$4.47
<b>TOTAL COST</b>				<b>\$54.74</b>

# Packing and Storing Grid

Stack the 3 front sets



On top of each other



# Packing and Storing

Stack the rear 2 sets

6 ft. on top of 12 ft.



# Packing Into Box

Stack into two groups

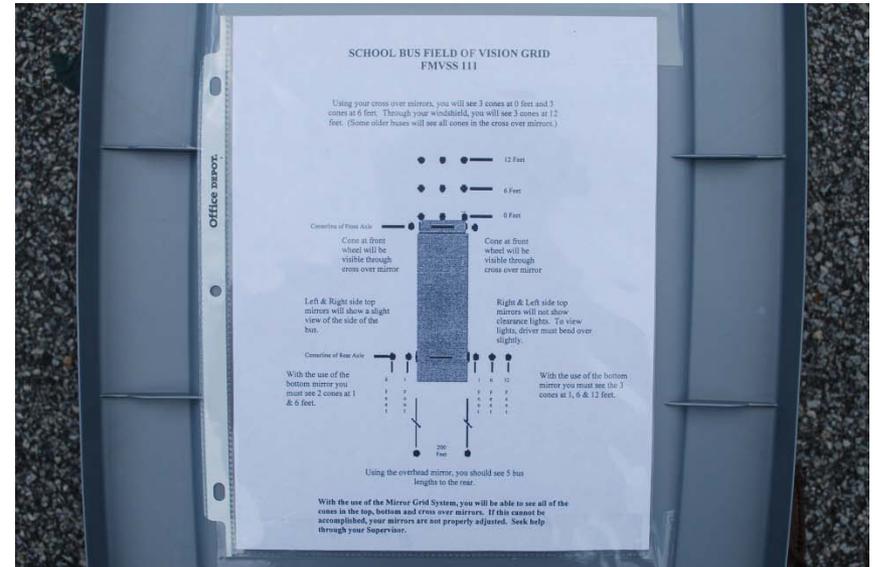
Put in box leave strapping overlapping sides



# Closing Box

Fold over strapping on top of cones to reduce creasing

“Field of Vision” Mirror grid diagram taped to lid



# Mirror Lite Safety Cross Award Mirror Grid System - Designed and Developed by

David Hart –Gwinnett County  
Public Schools

Charlene Majors – Gwinnett  
County Public Schools

