

9. School Bus

This is a popular toy with both girls and boys. It's lots of fun loading the students and driver into the bus, driving them around, and then unloading them.



Figure 9-1. School Bus

Materials and Tools

Following are the materials required to build the school bus. Included is information on selecting the wood for this project and the list of drill bits needed.

Wood Cut List

Part	Material	Size (thickness, width, length)	Qty
Body	Any wood	1 1/2" x 3 1/2" x 8 1/8"	1
Roof	Any wood	3/4" x 3 1/2" x 3 1/2"	1
Bumper	Any wood	1/4" x 5/8" x 3 1/2"	1
Wheels	Any wood	1 1/2" diameter with 1/4" center hole	4
Roof supports	Dowel	3/8" diameter x 3 1/4"	6
Handle	Dowel	3/8" diameter x 6"	1

Selecting the Wood

The body of the school bus can be made from a piece of 2 x 4 construction lumber. However, this type of wood is not recommended because it can have very coarse grain, making it difficult to accurately locate holes and obtain a smooth finish. If construction lumber is used select the piece carefully.

A better choice would be several pieces of clear pine glued together to obtain a block thick enough for the body of the bus. Poplar or perhaps mahogany will also work very well for

the body. It is suggested that the same type of wood be used for the roof that is used for the body of the bus.

Making Thicker and Wider Toy Blanks

See Chapter 18, p. 151-2.

Since the finished toy will be painted, it is not necessary to use a good piece of hardwood.

Other Parts

Part	Material	Size	Qty
Wheel axles	Axle peg	7/32"	4
Washers	Metal or plastic	1/4"	4
Little people ²⁰	Any wood	7/8" diameter x 2 1/2"	7
Headlights	Wood buttons	1/2" mushroom head	2
Warning lights	Wood buttons	1/2" mushroom head	7
Body	Paint	School bus yellow	
Little people	Craft paint	A variety of colors	
Lights	Craft paint	Red and white	

²⁰ These are purchased. See the list of wooden toy part suppliers in the Appendix.

Tools Required

- Woodworking tools and supplies (see Chapter 2, pp. 14-15)
- Special tools needed for this toy:
 - $\frac{25}{64}$ " , $\frac{15}{64}$ " , $\frac{1}{4}$ " , $\frac{3}{8}$ " twist drill bits
 - 1" Forstner bit

Plans and Steps

Body

1 – Blank. Prepare a piece of wood $1\frac{1}{2}$ " thick, $3\frac{1}{2}$ " wide and $8\frac{1}{8}$ " long. If using 2" by 4" construction lumber, the thickness can vary a bit from $1\frac{1}{2}$ " without changing the plans, but the width and length should be as given.

2 – Round the four corners. Draw a $\frac{1}{4}$ " radius on the top of the bus body at the corners. Use a sanding block, stationary belt sander or disk sander to round the four corners as shown in Figure 9-2 – top view.

3 – Round over edges. Select the side that will be the bottom and round over the two side edges and rear edge of the bottom of the body to a radius of $\frac{1}{4}$ ". This could be done using a sanding block, although a router with a $\frac{1}{4}$ " roundover bit is preferred. If using a router, go slowly at the corners to avoid splintering. Put a slight round over on the edges on the top of the body either by sanding or using a $\frac{1}{8}$ " router roundover bit.

4 – Lay out hole locations. Use a square and ruler to locate the centers of the holes for the six $\frac{3}{8}$ " dowel roof supports and seven little people, following the top view plan given in Figure 9-2. Use a punch to mark these holes for drilling. The location of the holes for the roof supports must be very accurate to align with the corresponding holes in the roof. The locations of the holes for the little people are not as critical.

Template for Locating Holes

See Chapter 19 (pp. 171-2) for a template that can be made to locate holes in the body and roof of the school bus. This template can be very useful if making several school buses.

5 – Drill holes in body. Drill the six holes for the roof supports $\frac{1}{2}$ " deep using a $\frac{25}{64}$ " drill bit. These holes need to provide a loose fit for the $\frac{3}{8}$ " dowel supports to align easily with the roof.

The seven 1" holes should be drilled $\frac{11}{16}$ " deep. Clamping the body against a fence is suggested to safely and accurately drill these holes.

Router Safety

DO NOT USE a router to round over edges of toy parts **UNLESS** the router is stationary, that is attached to a router table. See Ch. 18, p. 158.

7 – Drill holes for lights. Locate the centers of the holes for the two headlights on the front and the two warning lights on the rear of the body (see Figure 9-2). Mark with a punch these holes for drilling. Drill the two headlight and warning light holes $\frac{5}{16}$ " deep using a $\frac{25}{64}$ " diameter twist bit or brad point bit.

The wooden buttons used for the lights have a head that is $\frac{1}{2}$ " in diameter and a tenon that is $\frac{3}{8}$ " in diameter. It is usually necessary to use a $\frac{25}{64}$ " bit to drill holes for the tenons because they are tapered. To verify using the correct size drill bit for the buttons purchased for this project, drill a test hole in a piece of scrap wood.

If wood buttons are not available, substitute with $\frac{11}{32}$ " axle pegs, which have heads that are close in size to the $\frac{1}{2}$ " buttons. Use a $\frac{11}{32}$ " diameter drill bit to drill the holes for these axle pegs and shorten their tenons to suit the hole depth.

Glue Joints

See Chapter 2 (pp. 18-9) for ways to achieve good glue joints for axle pegs and wood buttons and suggestions for overcoming problems with a poor fit.

8 – (Optional) Cut recess for bumper. Use a table saw or hand saw to cut the recess for the bumper. See the plan (Figure 9-2 – side view) to determine the location of this recess. The recess is optional. The bumper can be glued directly to the front of the body.

9 – Sand body. Sand the entire body, starting with 100 grit sandpaper and finishing with 150 grit sandpaper. Break all sharp edges.

Roof

1 – Prepare wood. Figure 9-3 is the plan for the roof. Begin by cutting a single piece of wood $\frac{3}{4}$ " thick, $3 \frac{1}{2}$ " wide and $3 \frac{1}{2}$ " long. This piece will eventually be divided into two pieces, as shown in Figure 9-3, after all the holes are drilled and the top edges are rounded over.

2 – Locate roof support holes. Use a square and ruler to locate the centers of the $\frac{25}{64}$ " holes for the six dowel roof supports. The location of these holes must be very accurate to align with the corresponding holes in the body of the bus.

Do not be concerned that the two rear support holes do not appear to be over the rear holes in the body. This piece of wood will eventually be divided into two pieces. Then the rear holes will line up.

It is also very important to pay attention to the direction of the grain of the wood used for the roof in relation to the holes for the roof supports.

The grain must be at a right angle to the handle that will be used to connect the front and rear roof pieces, to avoid any weakness in the roof. The proper grain direction is shown in Figure 9-3. Use a punch to mark the location of the six holes.

3 – Round over corners and edges. Draw a $\frac{1}{4}$ " radius on the top of the bus roof at the corners. Use a sanding block, belt sander or disk sander to round the four corners as shown in Figure 9-3. If using a router to round over the top edges, go slowly at the corners to avoid splintering.

4 – Locate handle and light holes. On the rear edge of the bus roof (see Figure 9-3) locate the holes for the three warning lights. On the front edge of the bus roof locate the holes for the two warning lights. Use a punch to mark these holes for drilling.

5 – Drill holes in roof. Use a $\frac{25}{64}$ " bit to drill the six roof support holes for the $\frac{3}{8}$ " dowel supports. These holes should be $\frac{1}{2}$ " deep.

Using a $\frac{25}{64}$ " bit, drill the center warning light hole 2" deep on the rear edge of the roof, then

use it to drill the remaining warning light holes $\frac{5}{16}$ " deep.

6 – Cut roof and sand. At the location $\frac{7}{8}$ " from the rear edge, saw roof into two pieces as shown in Figure 9-3. Then sand both pieces.

Painting Body, Roof and Accessories

1 – Shellac and paint body and roof. Put masking tape over the spot on the front of the bus where the bumper will be glued. Apply dewaxed shellac to all surfaces of the body and roof, avoiding the holes where glue will be applied – the holes for the roof supports and the holes on the sides for the axle pegs and lights. Allow the shellac to dry, then sand lightly and apply yellow paint. More than one coat of yellow paint may be required to achieve a bright yellow school bus finish.

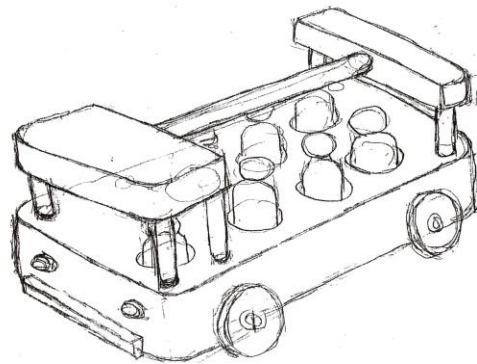
2 – Little people. Applying a coat of shellac to seal the surfaces of the little people will avoid “bleeding” along grain lines when they are painted. Allow the shellac to dry, then sand lightly. Use acrylic paints to “dress” the people.

The small jars of acrylic paint sold at craft stores are ideal for this purpose. A fine point permanent ink pen is useful for painting facial features.

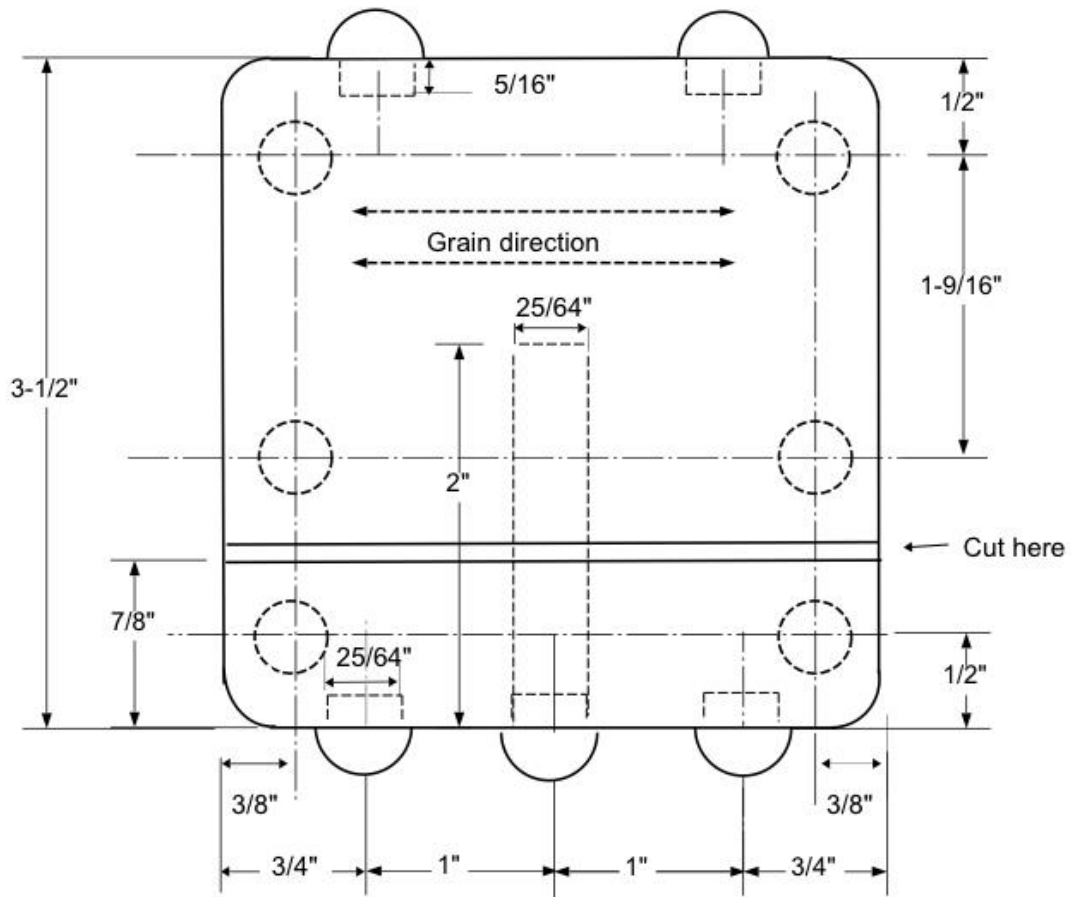
3 – Paint accessory items. Paint the heads of the two wooden buttons (the headlights)

white or silver; paint the heads of the seven remaining wooden buttons red (the warning lights); paint the heads of the four axle pegs silver, white, or yellow (the hubcaps); paint the four wheels black; and paint the front and edges of the bumper black or silver.

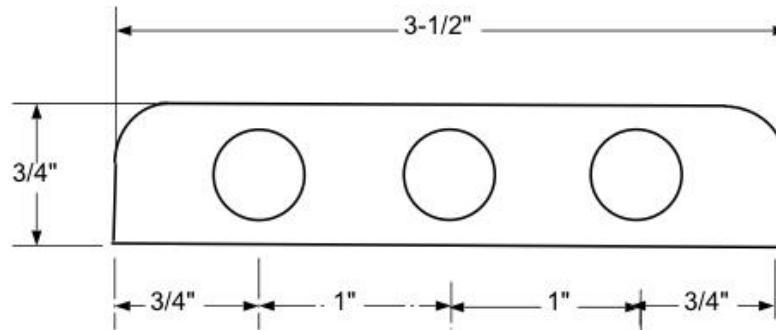
4 – Finish coat. Once all the painted parts are dry, apply one or two coats of water-based polyurethane.



9. School Bus



This is the bottom view of the roof (looking up from the body). The roof is cut into two parts along the line shown above after all the holes are drilled, the corners and top edges are rounded over, and the entire piece is sanded.



Back view of roof

Figure 9-3. School Bus Roof (actual size)

Assemble

1 – Dry assemble. Ream out all holes into which parts are to be glued.

Reaming Out Holes

See Chapter 19, p. 169.

Before gluing the parts in place, assemble them “dry”²¹, including the handle that connects the two pieces of roof. Cut the $\frac{3}{8}$ " dowels used for the roof supports to size, making sure when dry assembled to hold up the roof that there is a $2\frac{1}{4}$ " space from the top of the body to the roof to enable the “little people” to easily fit into the bus.

Correct any part fitting issues at this point. See Figure 9-4 for a side view of the assembled roof and bus body. When checking the fit of the handle, make sure it is recessed $\frac{1}{4}$ " in the hole through the back-roof piece so that there will be

room to glue the middle warning light.

2 – Glue body, roof, lights and bumper. Begin by gluing the six roof supports into the body. While the glue is still wet, glue and assemble the handle connecting the two pieces of roof while also gluing the roof assembly to roof supports that have already been placed in the body.

Next glue in place the lights and bumper. Use a clamp or masking tape to hold the bumper in place until the glue dries.

3 – Attach wheels. Put glue into the holes on the body, not on the axle pegs. When gluing the wheels in place, insert a washer between each wheel and the body, and leave a $\frac{1}{32}$ " to $\frac{1}{16}$ " gap between the wheels and the body.²²

4 – Place the people. Load the “little people” onto the bus and they are ready to go to school.

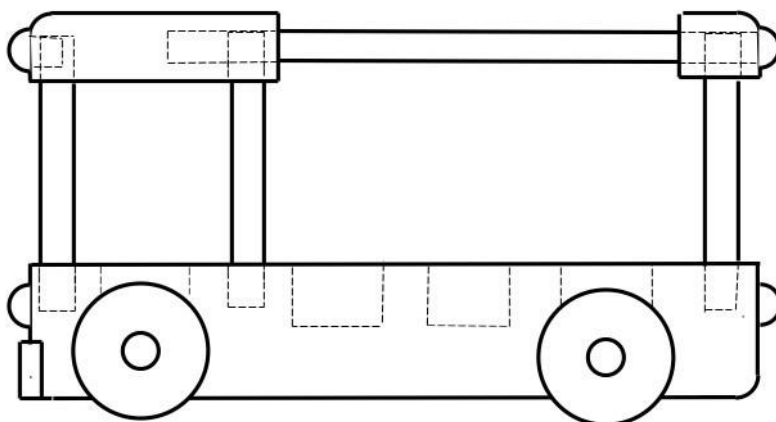


Figure 9-4. School Bus Assembled – Side View

²¹ To assemble “dry” means to assemble the parts without glue.

²² The plastic clip used to seal a loaf bread or a piece of cardboard from a cereal box will serve as ideal spacers between the washer and the bus body.