Cheap, Sturdy Workbench

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Introduction

The following bench is an inexpensive version of the Roubo workbenches shown in *The Workbench Book* by Scott Landis[1]. It's basically just a sturdy table with a thick top using timber frame joinery. Once the basic structure is built, I'll add bench hooks, a leg vice, board jacks, a couple planing stops, and holes for iron holdfasts. The space between the long stretchers can be covered to form a shelf under the bench, or for a set of small cabinets.

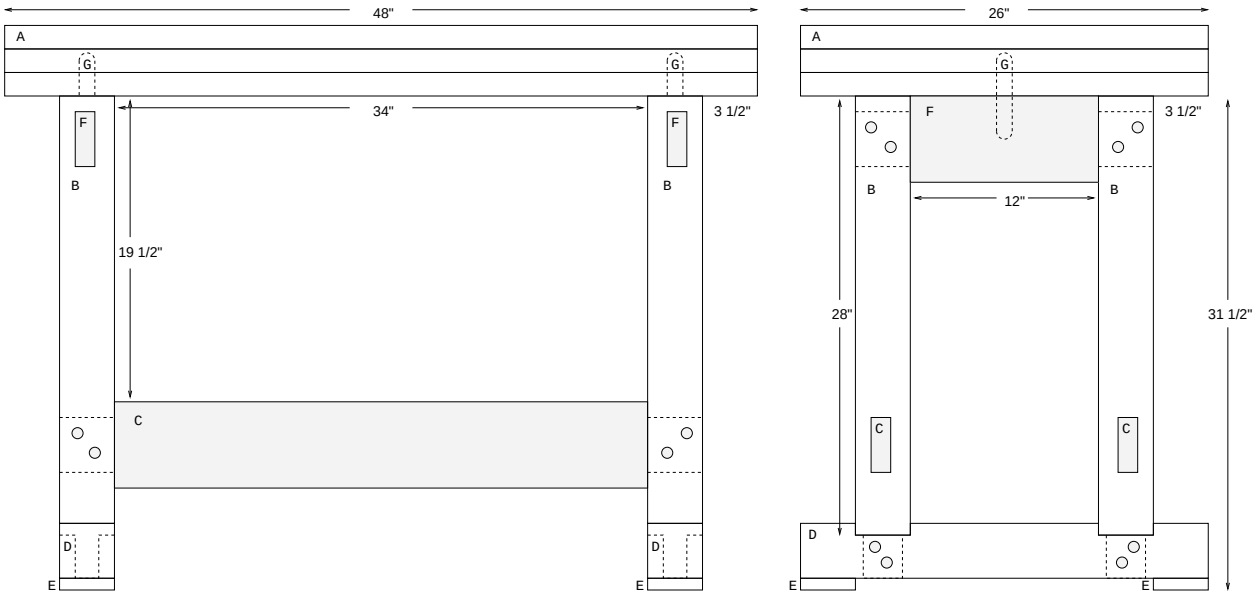
Plans

These plans show the design of my workbench. The length was determined by how much space I had available. There's no reason you can't redesign the bench to be longer, although the longer it is, the more racking stress is applied to the long stretchers (`C`).

I'm six feet, three inches tall, so a comfortable working height for me is between 35 and 36 inches. If you are shorter, you may want to reduce the height of the legs (`B`). I used the height at which I could rest the palm of my hand flat on the top.

The majority of the wood for the bench is either 2×6 or 4×4 lumber, except the pads on the ends of the trestle feet (`E`), which can be cut from a short section of a 1×4. The pegs that support the top (`G`) and the pins that hold the parts together should be made from a strong hardwood like oak or hickory.

Dotted lines on the plans indicate tenons, and the small circles are pins that hold the tenons tight in the mortises. The top (`A`) is connected to the base with a pair of large pegs (`G`) in the trestle tops (`F`). Glue is used to assemble the boards for the top, and to attach the pads to the trestle feet. All other joints are dry.



Cut List

Key	Qty	Description	T	W	L	Notes
A	1	Top	4 1/2	26	48	Three layers of five 2 × 6 edge-jointed boards (fifteen 48 inch long boards total), laminated to form a single unit.
B	4	Leg	3 1/2	3 1/2	28	Dimensions do not include a 2 3/4 inch tenon on the lower end.
C	2	Long Stretcher	1 1/2	5 1/2	34	Dimensions do not include 3 1/2 inch tenons on each end.
D	2	Trestle Foot	3 1/2	3 1/2	26	
E	4	Pads	3/4	3 1/2	3 1/2	
F	2	Short Stretcher	1 1/2	5 1/2	12	Dimensions do not include 3 1/2 inch tenons on each end.
G	2	Pegs	3/4	3/4	6	These pegs should be bored deeply into the short stretchers and extend at least halfway through the top.
	24	Pins	3/4	3/4	3 1/2	Pins should be made from hardwood and are cut slightly long so they can be trimmed flush after driving them.
H	1	Back of leg vise	3 1/2	3 1/2	31 3/4	Rests on the top of the trestle foot, let into a dovetailed slot in the top of the bench.Dimensions do not include a 1 inch tenon on the lower end.
I	1	Front of leg vise	3 1/2	3 1/2	36	

All dimensions are in inches.

Construction Notes

Creating the layers for the top is the first step. The top is built from of three layers of edge-jointed 2 × 6 lumber. Each layer is composed of five boards, four feet long, edge-jointed together. When constructing these layers it is important that the joints do not overlap when the pieces are laminated together. My middle layer has an additional 2 × 4 laminated on the end to provide an offset in the middle joints.

Once the glue is dry, we must build the base so each layer can be flattened. Be careful when selecting lumber for the legs – construction grade 4 × 4 lumber will often split and twist when it dries in your shop. Try to select pieces that do not contain entire growth rings in the end grain.

Start by cutting the legs (B) and trestle feet (D) pieces from 4 × 4 lumber. Remember that the legs need to be 2 3/4″ longer than the dimensions in the cut list and plans, to accommodate the tenons that will fit into mortises in the feet.

Next, we need to chop through mortises into the legs for the stretchers. Each leg has a mortise at the top for the shorter stretchers, and a mortise near the bottom for the long stretchers. My largest mortising chisel is 1″ wide, so my mortises are 1″ × 3 1/2″. This leaves close to a one inch shoulder on the top and bottom of the through tenons. The upper mortises start one inch down from the top, and the lower mortises (on the opposite face of the legs!) start four inches from the shoulder of the tenon on the end of the legs (or 6 3/4″ from the bottom).

The mortises are marked with a two-point marking gauge, and chopped using a 1″ mortise chisel. I used a wide chisel and a rasp to clean up the sides of the mortises.

The trestle feet have a 3/4″ deep, 3 1/2″ wide dado cut into them for the legs to fit into. The dadoes start 3 1/2″ from the ends of the trestle feet. Saw the edges of this dado and use chisels and a router plane to remove the waste. Into this dado is cut a through mortise running parallel to the trestle. The mortise is 1″

Tools Used

Tool	Uses	Substitutes
Saws		
Disston D-23, 8 tpi	· Cutting all lumber to size	Crosscut handsaw
H. Peace, 5 1/2 tpi rip	· Trimming top edges	Rip handsaw
Disston D-7, 8 tpi rip	· Cutting tenon cheeks	Fine toothed rip saw
IT dovetail saw	· Starting tenon cheeks	Backsaw, filed rip
Disston #4 backsaw	· Defining dadoes in trestle feet	Backsaw, filed crosscut
	· Cutting tenon shoulders	
Handplanes		
Stanley #3	· Final smoothing of top	Smoothing plane
Stanley #4	· Smoothing of top	Smoothing plane
Steve Knight Smoother	· Smoothing of top	
Swingley jack plane	· Smoothing top endgrain	Block / jack plane set very fine
Marsh #5 1/2	· Initial edge jointing of top layers	Jack / fore plane, rank setting
	· Flattening the top	
Stanley #6C	· Truing the top	
Stanley #7	· Jointing edges of top layers	Your longest plane set for a fine cut
	· Flattening top	
Steve Knight Jointer	· Final flattening of top	Longest plane with a really fine cut
Stanley #40	· Initial flattening of top	Jack / fore plane with radiused iron
Stanley #60 1/2	· Squaring tenons	Any block plane
	· Trimming tenon ends	
Stanley #71	· Flattening dadoes in trestle feet	Chisels
Stanley #92	· Squaring tenon shoulders	Wide bevel edge chisel
Chisels		
Marples Blue chisels	· Squaring mortise walls	Large bevel edge or mortise chisel
	· Truing tenons	
Sorby 1″ mortise chisel	· Cutting mortises	Use the bore and chop method
Wide shallow gouge	· Trimming pins	Wide chisel
Boring Tools		
Stanley #945 brace	· Boring holes for pins & pegs	Large 10″ or larger brace
Miscellaneous		
Starrett folding rule	· All measurements	Your favorite measuring tool
Tredle lathe	· Turning pins & pegs	A spokeshave or whittling knife

wide and 2 1/2″ long. Once the dadoes and mortises are cut, glue the pads onto the ends of the trestle feet and plane the assembly smooth.

Cut the long and short stretchers from 2×6 lumber. Each stretcher is seven inches longer than the assembled length due to the tenons on each end. All tenons are full width, 3 1/2″ long and have 1″ shoulders on the top and bottom. Use a crosscut backsaw to define the shoulders, and remove them using a rip saw or chisels. The tenons are fitted to their mortises using shoulder and block planes, or bevel edge chisels. Tenons in the bottom of the legs are formed using the same methods except they are 1″ × 2 1/2″ and are 2 3/4″ deep. The tenons are oriented in the same direction as the upper mortises in the legs.

Once all the mortises and tenons have been fitted, drill two holes through both sides of each mortise. Insert the tenon into the mortise and mark the position of the holes just bored. Remove the tenon and bore holes through the tenon approximately 1/16″ closer to the shoulder than the mark you made earlier. This will

cause the tenon to be drawn into the mortise when the pins are driven home.

I formed the pins from the off-cuts created when cutting the shoulders on the top and bottom of the tenons. These were trimmed to be approximately octagonal and turned on my tredle lathe until they fit snugly into the holes. It's better if the pins are too narrow rather than too wide because an oversized pin will split the legs or break out the end of the tenon – especially if you use construction-grade lumber.

Assembly the trestles by seating the tenons, and driving the pins. Once the pins are in place, the ends are sawn or chiseled flush with the surface and the entire assembly is smoothed and finished. Finally, connect the two trestles with the long stretchers, drive the pins, and smooth and finish these parts.

The final step in finishing the base is to bore holes in the middle of the top stretchers to receive the pegs (`G`) that will hold the top.

Now that the base is completed, use the following steps to get each layer flat enough for lamination. First, install a set of short pegs (`G`) that will hold a single layer. The lowest layer is bored through to fit onto these pegs and both surfaces are flattened. When flattening the second side (the top surface in this case) be sure to plane right to a mark struck around the edge of the boards parallel to the layer you just flattened. This will insure the layer is of a consistent thickness, in addition to being flat on both sides.

Once the lowest layer is flattened, install longer pegs into the holes in the base, bore holes through the middle layer, and flatten one side of the middle layer. Glue the bottom and middle layers together, and once the glue has dried, flatten the top of these two layers. Again, use a marking gauge to strike a line parallel to the bottom of the layers and plane down to this mark when leveling the top surface.

The top layer is last, and it can be affixed to the other layers by using pinch dogs or by nailing a couple boards across the end grain of the set of layers. You may be able to further support the connection between the top and lower layers by clamping the long edges of the boards together. At this stage it is only necessary to flatten the underside of the top layer so it can be glued to the other layers.

After the top layer has been flattened and glued to the other layers, the entire top can be sawed down to size. Plane the edges, flatten and smooth the top, and finish it with linseed oil, shellac, and paste wax.

The leg vise is installed next. The vise jaws are constructed of 4×4 lumber, with the inner jaw fitting into a dovetailed slot all the way through the top of the bench, and into a shallow mortise in the trestle foot. The outer jaw rests on the floor, and is connected to the inner jaw (and the leg of the bench) with a large metal or wooden screw.

The weakness in the design is that the expansion and contraction of the top may result in the movement of the inner jaw relative to the base of the bench. If expansion and contraction present a problem, the dovetailed slot can be enlarged to allow for movement in the top.

References

[1]Scott Landis. 1998. *The Workbench Book*. Taunton Press, Newton, Connecticut. 256 pages.

Notes
