

Building The Perfect Workbench

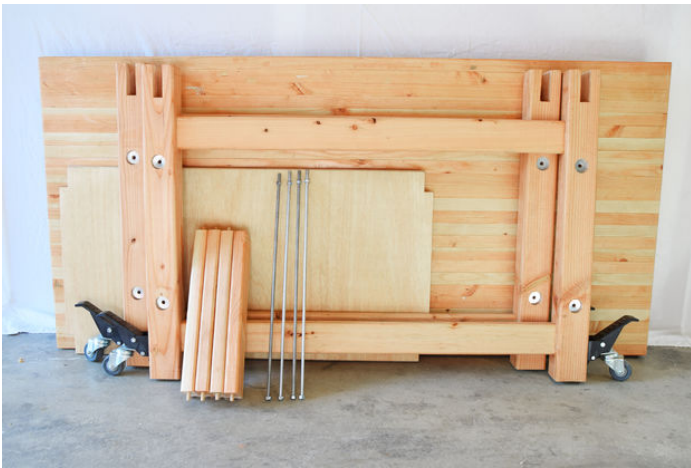
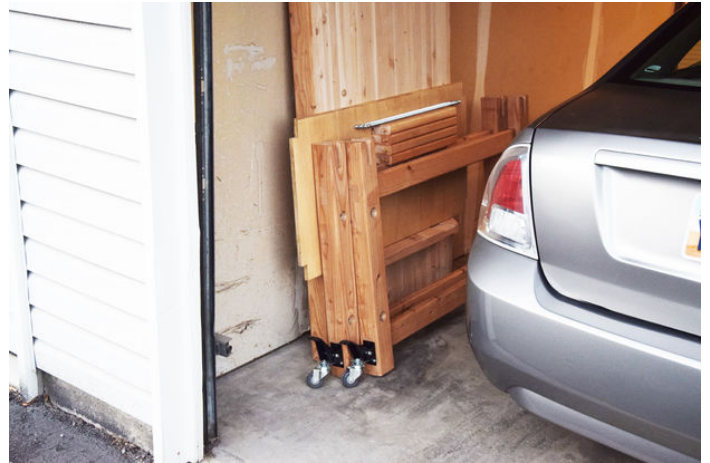
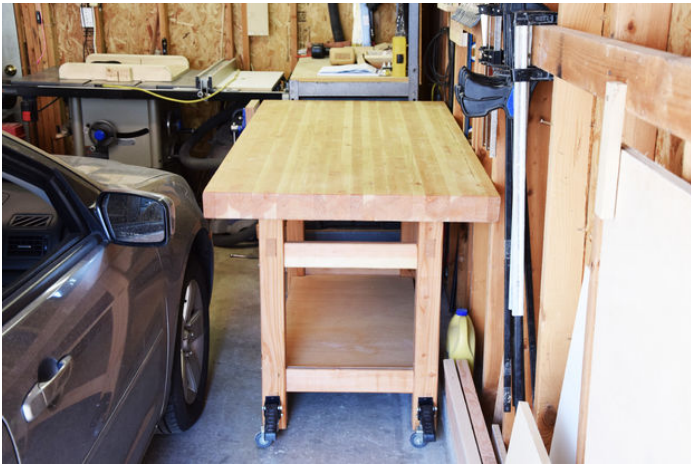
Intro: Perfect Workbench

Everyone has their own idea of the 'perfect' workbench. After years of working on a sheet of plywood supported by sawhorses, I felt that almost anything would be more 'perfect' than that. Not wanting to settle for just anything better, I decided to put in some time and effort into something that will last me for many years to come. This workbench is strong and heavy. It is fastened together using both mechanical fasteners (for easy disassembly) and extremely strong wedged mortise and tenon joints. If you are looking for a new workbench and some new skills, the perfect workbench is for you.



Step 1: The Problem and the Plan

The problem with most home shops is that they serve as a garage when more important things aren't taking place. I've got a few requirements for the workbench: It needed to be as big as possible - while still being able to fit my car in the garage. It needed to be inexpensive - I still need to eat. It must be easily moved around the shop so that it can be used as an out feed table for my table saw. And it needed to be easily taken apart.



Step 2: Tools and Materials

Tools:

- Circular Saw
- Table Saw w/ flat tooth blade
- Drill
- Drill Press
- Bar Clamps
- Level
- Belt Sander
- Power Hand Planer
- Planer
- Band saw
- Cheap Plastic Putty Knife with 1/8 inch notches cut with table saw
- 1 1/2 inch Forstner Bit
- Calipers
- Digital Height Gauge

- Calculator
- Chisel
- Cross-Cut Sled

Materials:

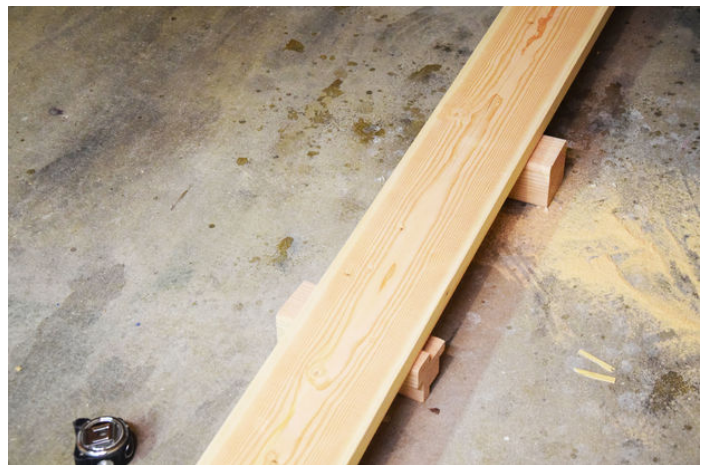
- 6 - 2" x 8" x 12' Dimensional Lumber (Get Yellow Pine or Douglass Fir and Heat Treated if possible)
- 4 - 2" x 4" x 6" Dimensional Lumber (Get Yellow Pine or Douglass Fir and Heat Treated if possible)
- 4 - 4" x 4" x 6" Dimensional Lumber (Get Yellow Pine or Douglass Fir and Heat Treated if possible)
- 3/8 inch Dowel Pins
- 4 - two foot sections of 3/8 inch Threaded Rod
- 8 - 3/8 inch fender washers
- 8 - 3/8 inch nuts
- 4 - 3/8 inch lag bolts
- 4 - 1/2 inch lag bolts
- 1/2 inch Plywood (roughly 2' x 4')
- Caster Wheels
- Danish Oil
- 1 Gallon Wood Glue
- Woodworking Vice

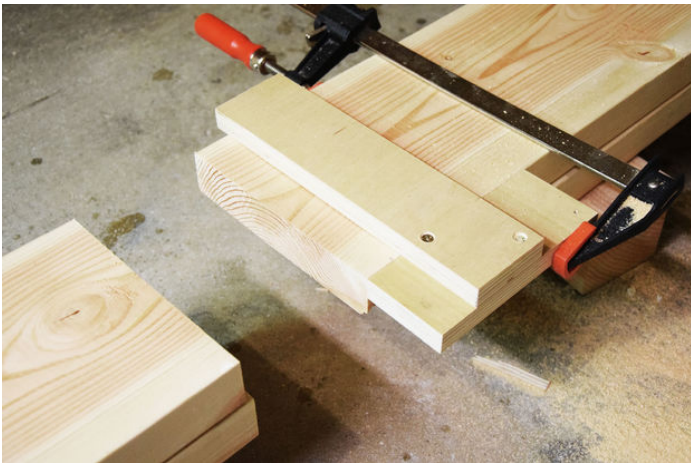
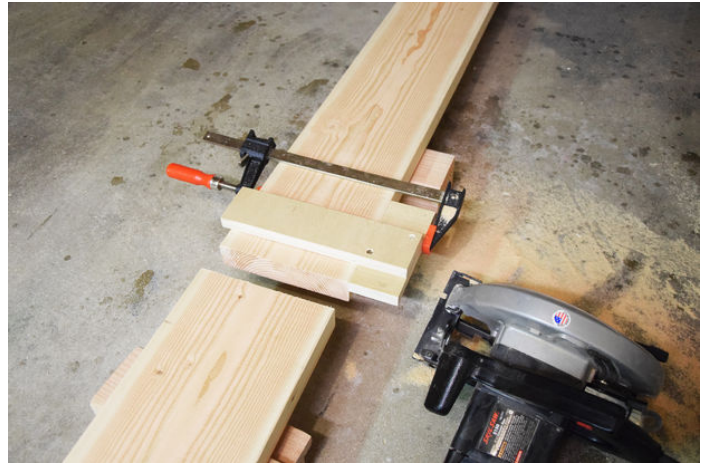
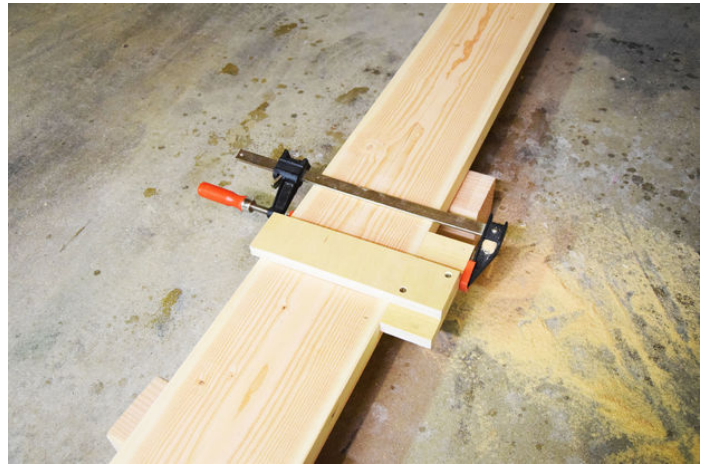




Step 3: Crosscut Dimensional Lumber

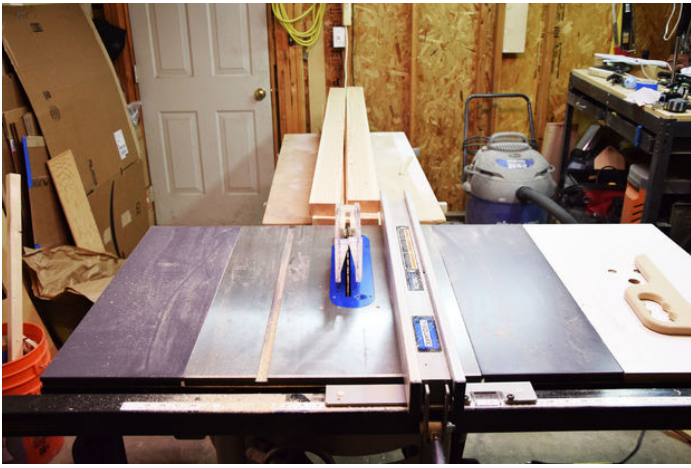
I first let all my lumber sit in my garage for two months. This allowed the moisture content of the wood to equalize. If you have more time, longer would be better. To form the length of the top of the workbench, cut the 12 foot boards in half first. Big box stores love to cover their lumber in staples. This may be good for their advertising, but it's bad for my saw blades. Be sure to remove any and all staples before proceeding. Mark the middle of each 12 foot board. To make these repeated cuts as easy as possible, make your own custom square/fence that can be clamped to any board. To do this, make a T shape out of two straight boards. Pass your circular saw over the square to cut it in the exact location without needing to measure a thing. Use this cut edge of the square to line up the fence for easy cuts.





Step 4: Rip Boards in Half

To form the thickness of the workbench top, rip the dimensional lumber in half. If possible, use a table saw with a riving knife and pawls. This will reduce the risk of kickback that are caused by the internal stresses of the wood.



Step 5: Flatten the wood

I ran each board through my planer once or twice to flatten each side. This will create a strong glue joint for the top of the workbench.



Step 6: Prepare to Glue

Layout the wood and decide what side you'd like the top to be. I decided that I wanted as few knots on the top of my workbench as possible. Lay out your bar clamps on cardboard as there will be a lot of glue squeeze out. Cover the clamps in painters tape, this will make clean up once the glue dries much easier. Place your wood back down in a way that you know what is the top and bottom of each board is. Walking through the glue-up process mentally will help ease the tension during the actual glue-up in the next step.

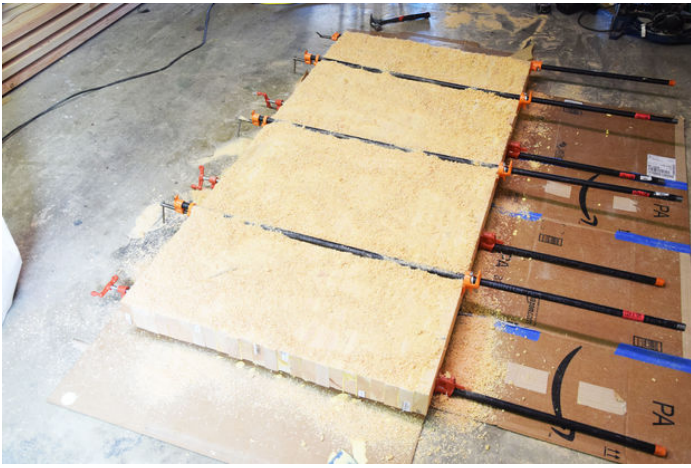




Step 7: Glue

I've seen others glue up their workbenches in sections. After deciding to do it all at once, I see the wisdom in their process. None the less, it is possible to do it all at once. Tilt every board down in the same direction and pour large quantities of glue over the face. Using the prepared putty knife with grooves cut in it (shown in step 2), spread the glue evenly across the faces of the wood. repeat this until there is sufficient glue on every board. Start applying even pressure across all bar clamps (top and bottom clamps). Watch to ensure that the workbench top isn't bowing from uneven pressure.



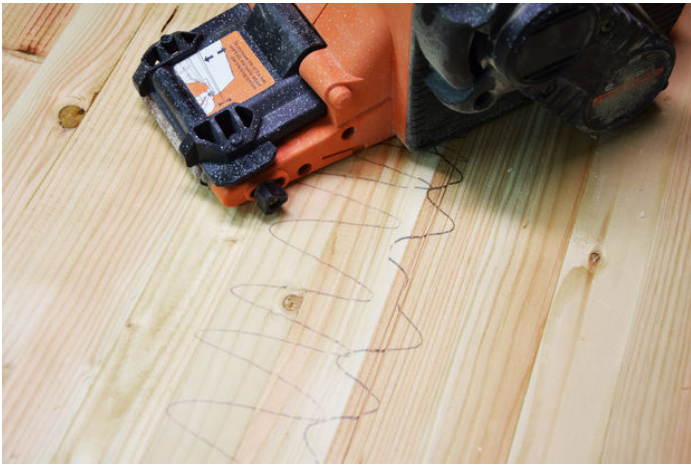


Step 8: Flatten the Top

Once the workbench top has dried for at least 24 hours, use a power hand plane to take all the large chunks of uneven wood and glue off. If you are like me and generally work in the shop alone, use a pair of clamps on the edge of your saw horses to help when flipping your workbench top. Since this large piece of wood weighs in around 80 to 90 pounds, they will help in the event that something starts to slip when flipping it to work on the bottom. Once the top and bottom are roughly flat, use a large level or straight edge to locate high spots and remove them using a belt sander.

Note: Save the sawdust crated in this step. It will be useful for filling cracks and voids that the workbench may have.





Step 9: Square the Ends

Using a square and straight edge, mark where to cut the end of the workbench. Move the straight edge to use it as a fence for the circular saw. Make multiple passes increasing the depth of cut with each pass until you reach the maximum depth of cut (verify that your circular saw is square to its face plate - mine was not and I had to sand it flat with the belt sander). Transfer the mark and fence to the other side of the workbench top. Repeat the cutting procedure until the end has been removed.





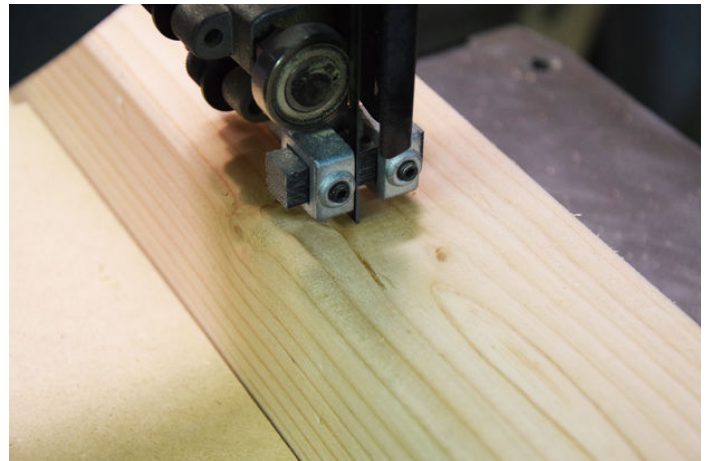
Step 10: Cut Legs

Decide what height you'd like your workbench to be. Since I wanted mine to serve as an out feed table for my table saw, I used the height of my saw as a place to start. All you need to do is take the desired height and subtract the thickness of your workbench top to determine the desired length of your 4x4 legs. If you want your workbench to serve as an outfeed table like mine, you want the finished height be about 1/4 inch below the height of your table saw. This will keep anything from hitting your workbench that you are running through the t-slot on your table saw.



Step 11: Resaw Workbench Legs

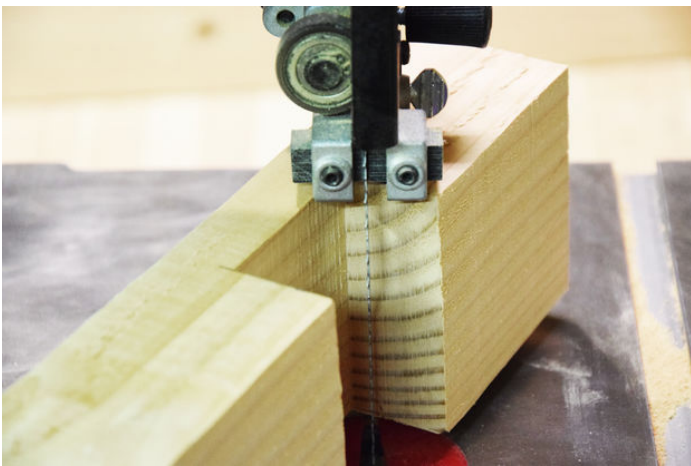
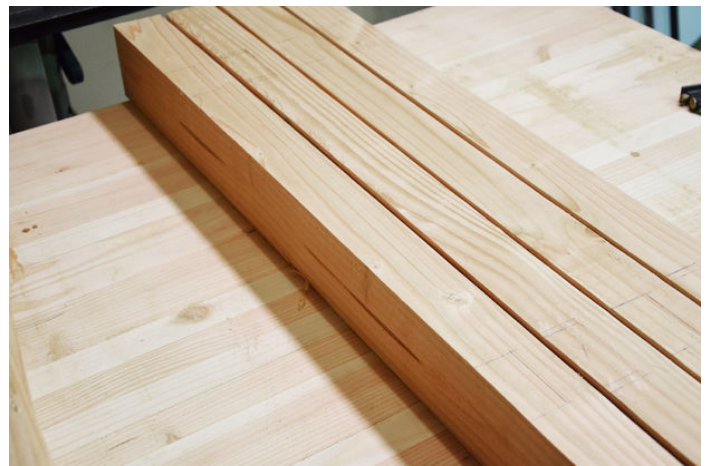
Set up a fence (a simple straight piece of scrap wood worked for me) on your band saw and remove 1 1/2 inches off one side.





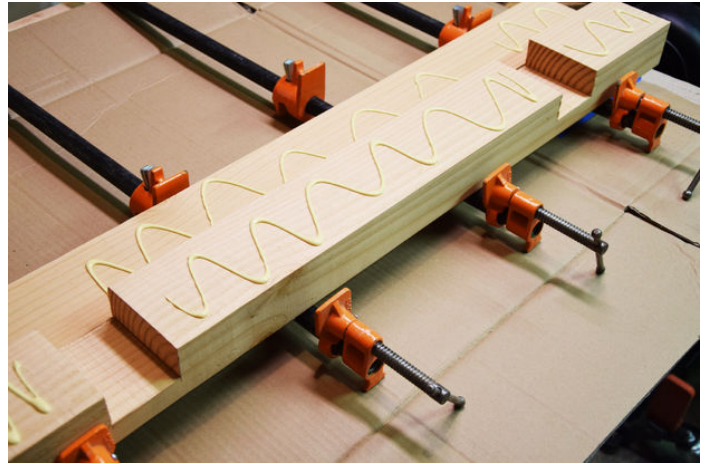
Step 12: Mark and Cut Mortise

Cut a "mortise" in the top and bottom of each leg an inch wide and two and a half inches tall.



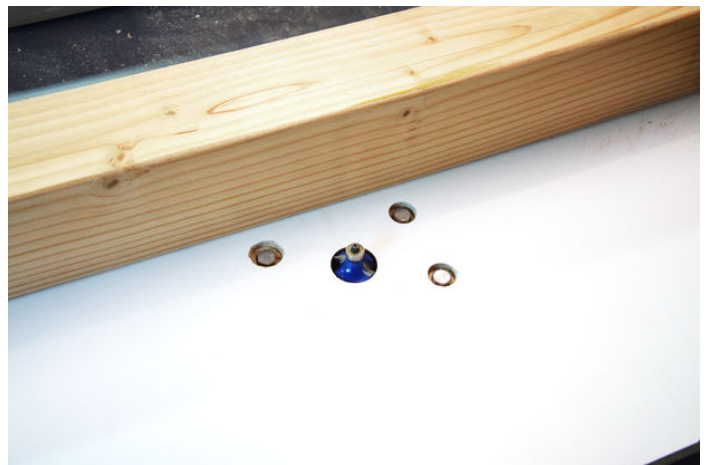
Step 13: Glue Legs Back Together

Using the grain to match up the pieces, glue together the two halves to form the workbench legs.



Step 14: Flatten and Router Legs

Using a planer, flatten each glue seam. Use a router with a 1/4 inch round-over bit to round all the lengthwise edges of the legs.



Step 15: Drill Legs

Using a 1 1/2 inch forstner bit, drill a hole a half inch deep at both 10 and 25 inches from the top on the outside of the leg. Drill a 3/8 inch hole in the center of the hole through the leg.



Step 16: Cut and Router Short Crossmembers

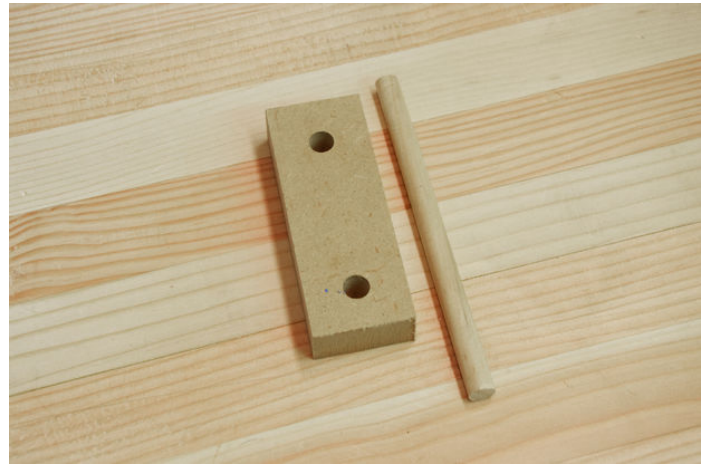
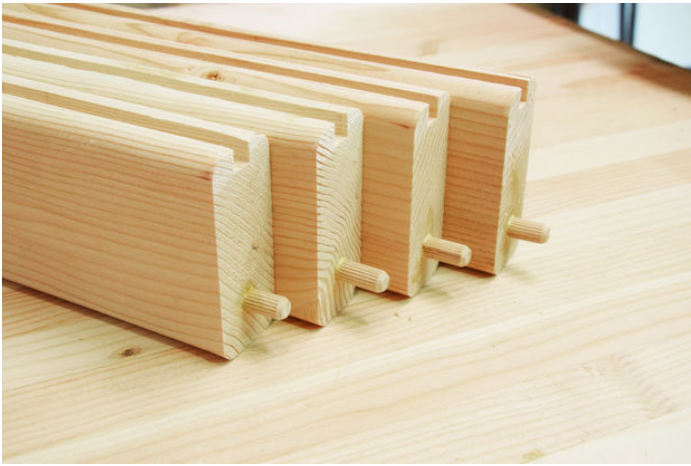
Cut the short 2x4 supports to 17 1/2 inches long. Cut a 3/8 inch dado down the length of one side with a straight router bit. This will accept the 3/8 inch threaded rod that will hold the workbench legs together. Use a 1/4 inch round-over bit on the lengthwise edges.

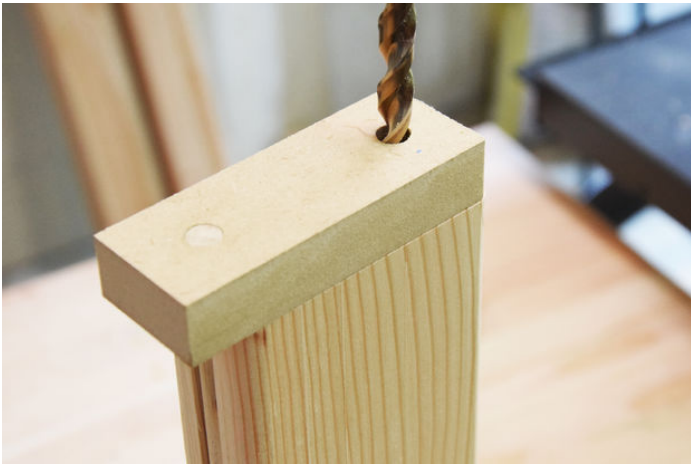




Step 17: Place Dowel Pins

Make a jig using scrap wood and a 3/8 inch dowel. The dowel will fit in the groove created in the previous step and the second hole should allow the hole for the dowel pin to be centered and 3/4 inch away from the opposite edge.





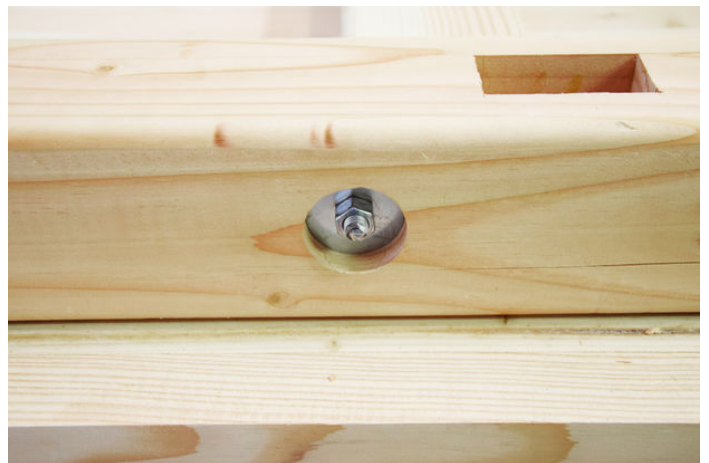
Step 18: Drill Dowel Pin Hole

Using the same jig, drill a hole on the inside of each leg deep enough to clear the dowel pin. This hole should be above the previously drilled hole on the top and below the previously drilled hole on the bottom. Doing this will allow the most support laterally and give the most space to access the lower shelf.



Step 19: Test Assemble Trestle

Assemble everything you have created so far. This will verify that everything was drilled and cut correctly. Make sure that everything is square. From experience, if something isn't square then one or more of the holes was drilled incorrectly.



Step 20: Cut Rest for Workbench Top Support

Cut a inch wide dado 3 1/4 inches deep using the band saw. This will accept the supports that will be attached the the workbench top. They will be created in a later step.



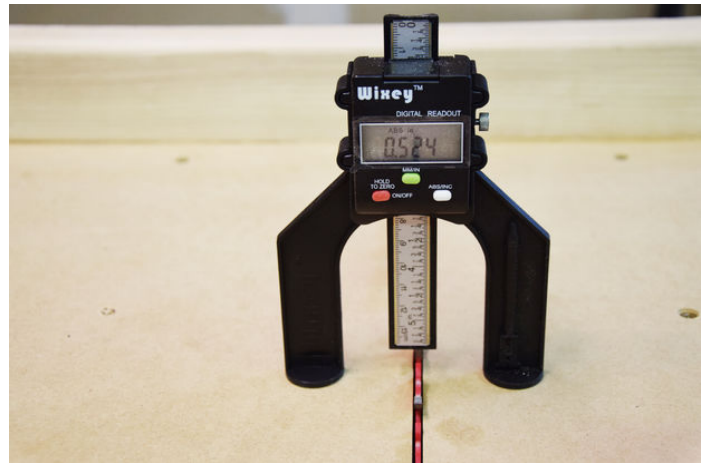
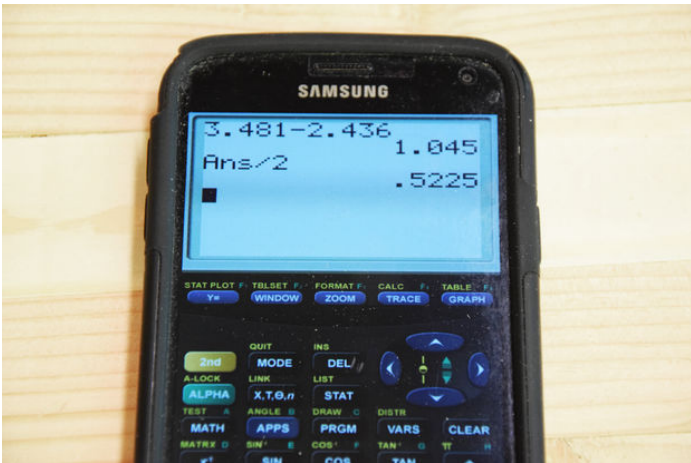
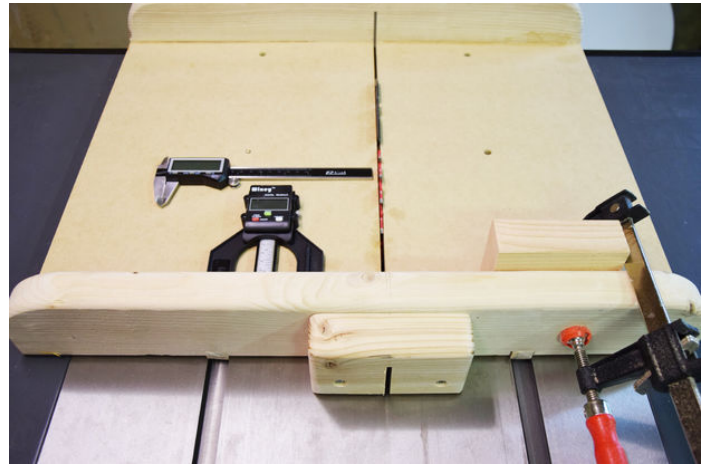
Step 21: Cut Tenons

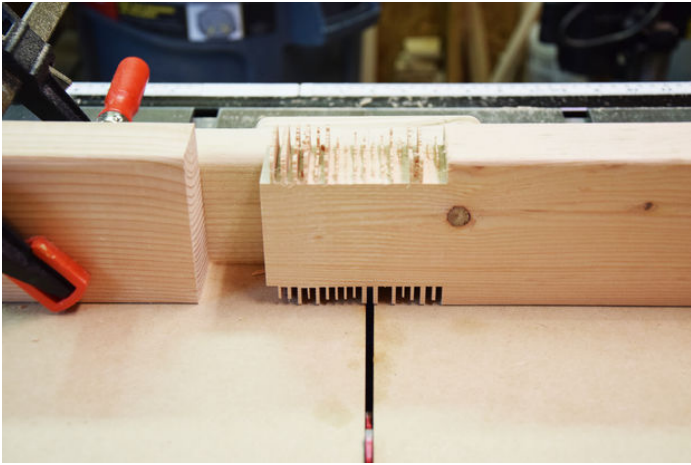
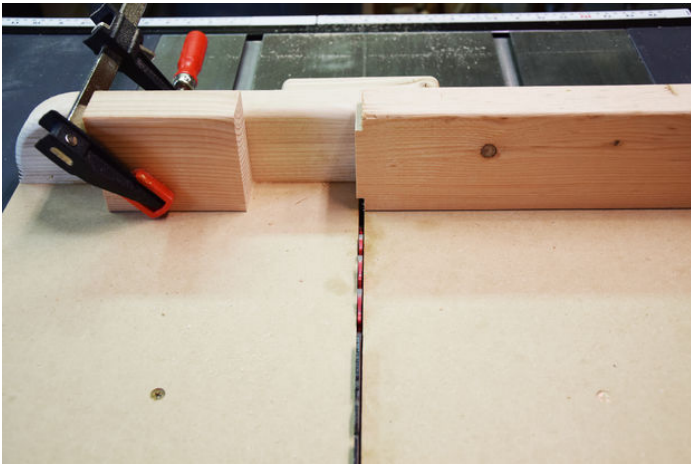
To cut the tenons using this method on the table saw you will need a few things:

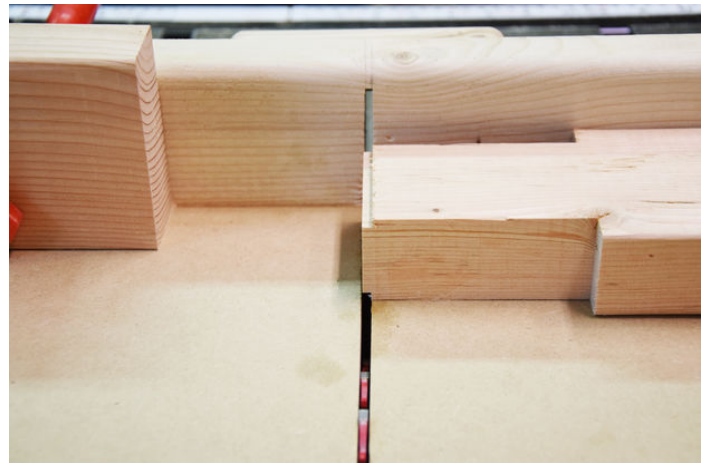
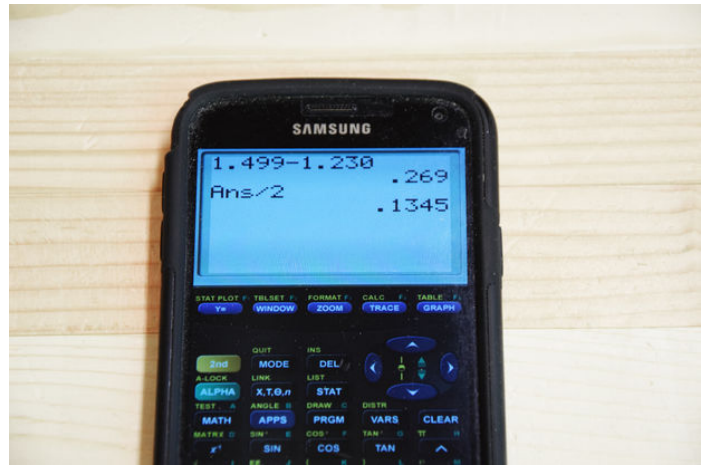
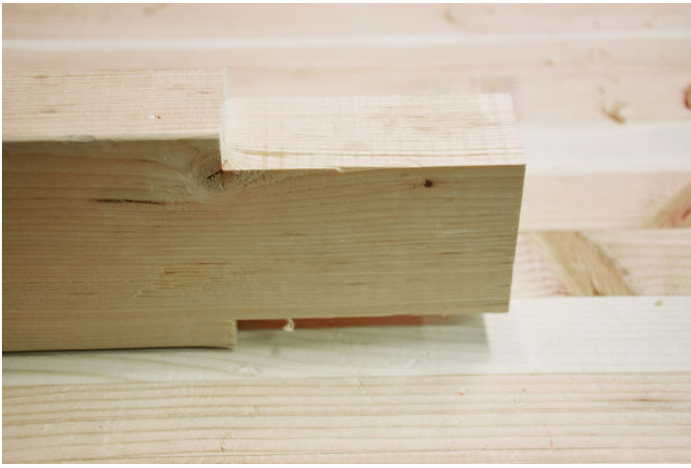
- Cross-cut sled
- Calipers
- Digital Height Gauge
- Flat Tooth Ripping Saw Blade
- Calculator
- Chisel

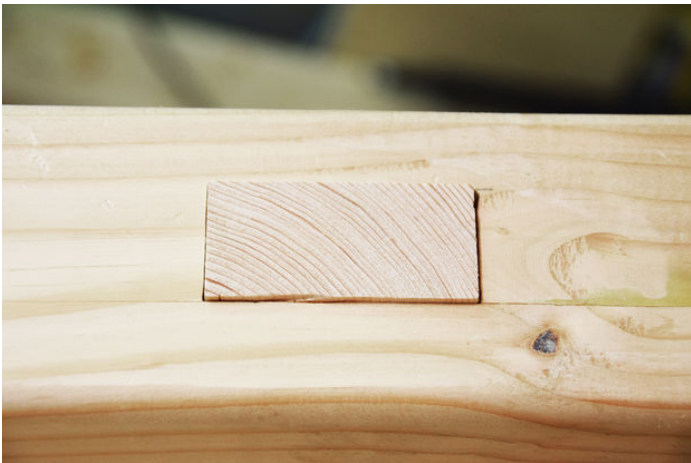
Each tenon belongs to its own mortise. Keep track of what goes where and make notes of it on your wood pieces. This will make the glue up in future steps much easier.

- You need 4 - 4 foot lengths of 2x4s
- Set up the sled so that it cuts between a 1/16 and 1/8 of an inch more than 3 1/2 inches
- Measure the height of the mortise (2.436 inches)
- Measure the height of the 2x4 (3.481 inches)
- Subtract the smaller from the larger and divide by two (0.5225 inches)
- Set the height of the saw blade as close as possible to that number while rounding up (this gauge is accurate to 0.002 inches)
- Make test cut on the end of the board
- Test to ensure that it fits
- Cut the rest of the board bumping up to the stop on the sled
- You can either break off all the remaining pieces and clean up with a chisel, or make many many passes on the table saw
- Measure the width of the mortise (1.230 inches)
- Measure the width of the 2x4 (1.499 inches)
- Subtract the smaller from the larger and divide by two (0.145 inches)
- Set the height of the saw blade to that number
- Take another test cut from the end to ensure that everything was done correctly
- Finish the tenon and test fit









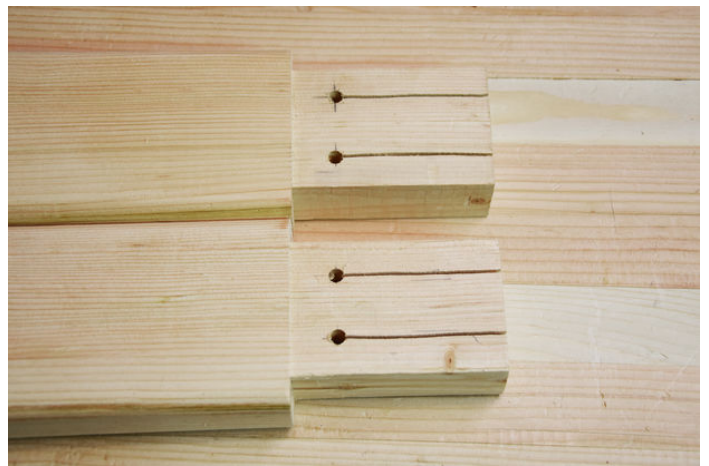
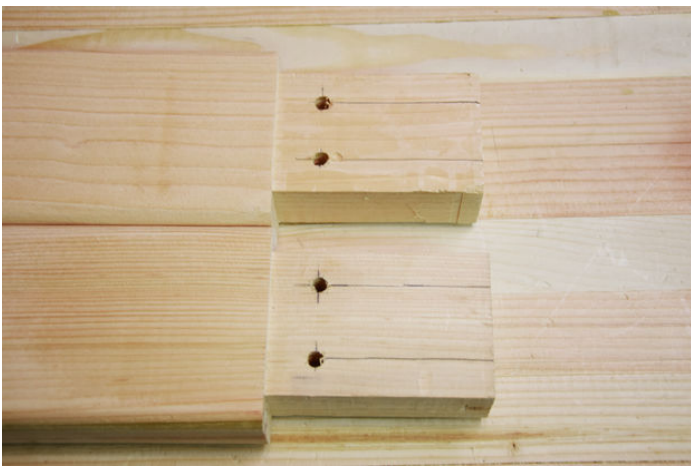
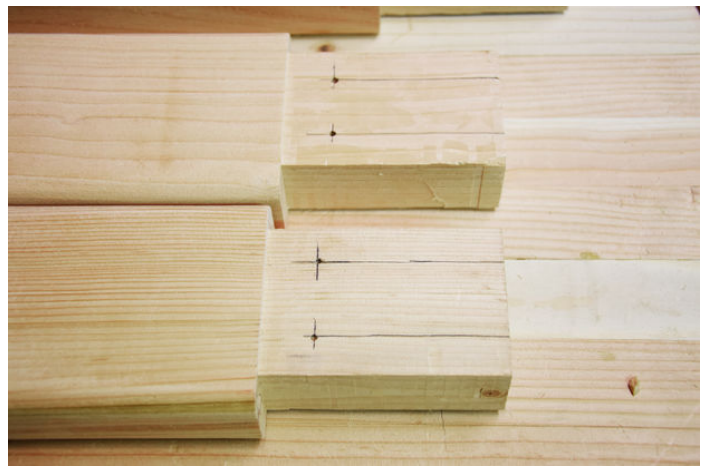
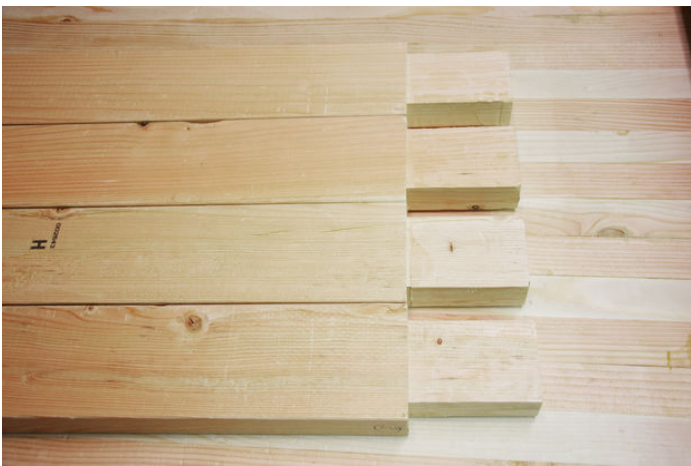
Step 22: Sand All Support Pieces

Using a random orbital sander, smooth all legs and support cross pieces.



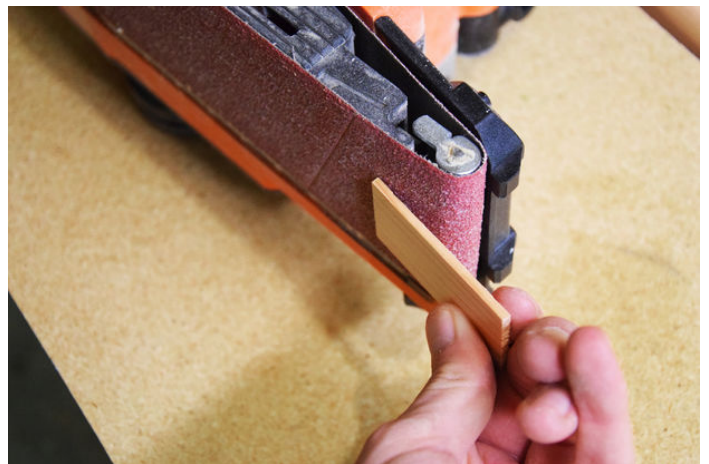
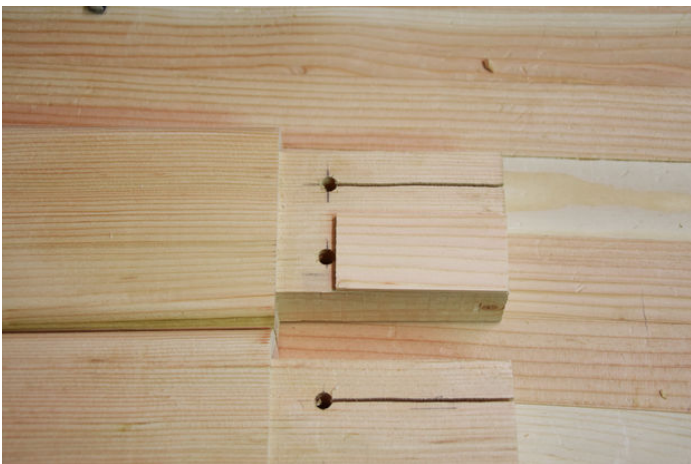
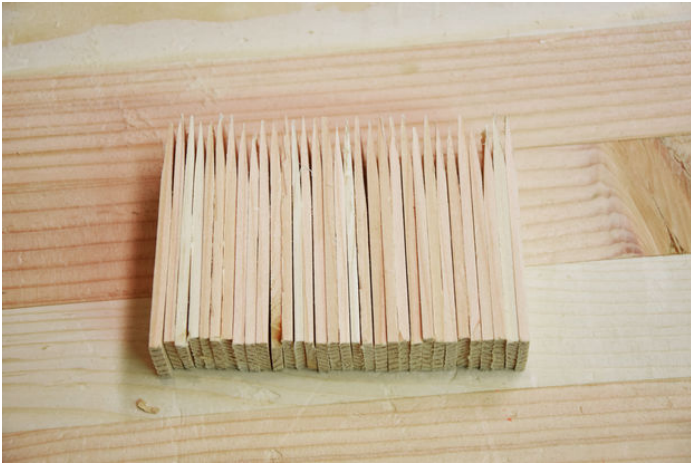
Step 23: Cut Relief for Wedged Tenon

Mark 3/4 of an inch from each side of the tenon. Drill a 5/16 inch hole 3/4 of an inch from the shoulder of the tenon. Using the band saw, cut along the line to the hole.



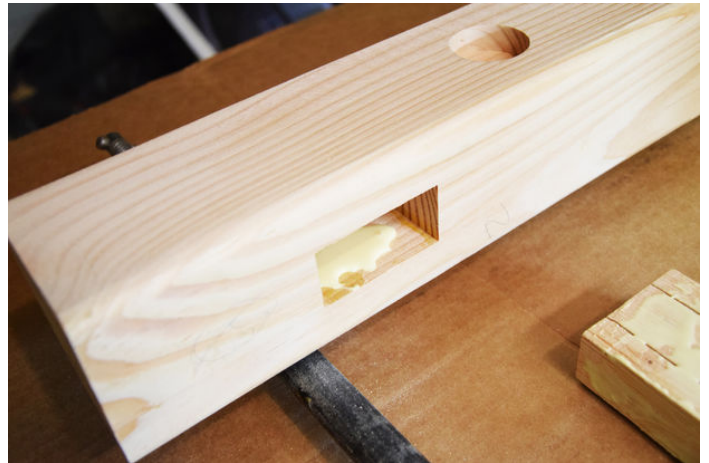
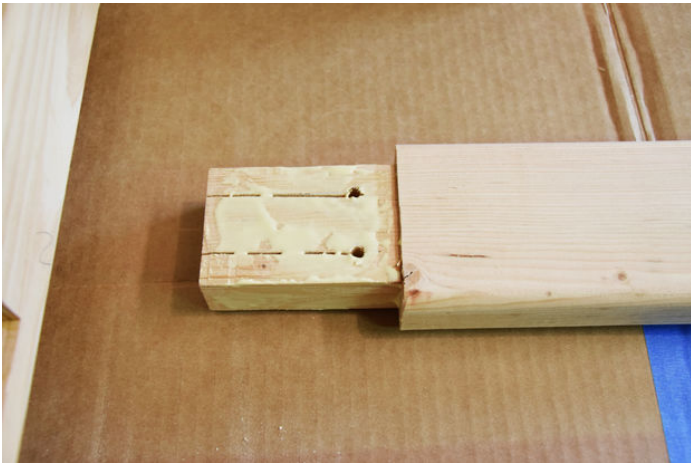
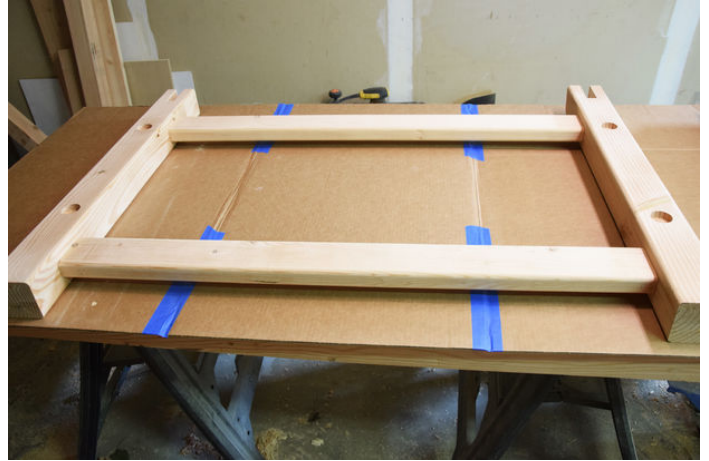
Step 24: Make Wedges

Cut wedges the width of your tenon and 1/8 inch thick. Sharpen one end using a belt or disk sander.



Step 25: Assemble Wedged Tenons

Test fit everything to ensure that it is set up correctly. Apply glue to both tenon and mortise and clamp together. Measure corner to corner to verify that everything is square. Apply glue to wedges and insert using a mallet.





Step 26: Remove Excess Wedges and Tenon
Using a flush cut saw, remove the excess tenon and wedges.

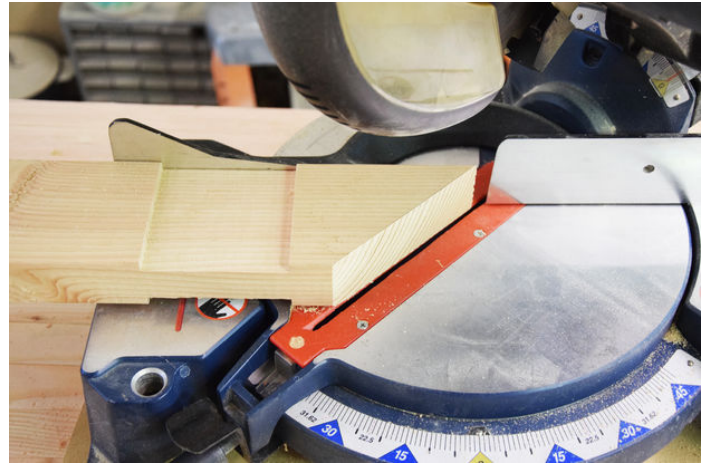
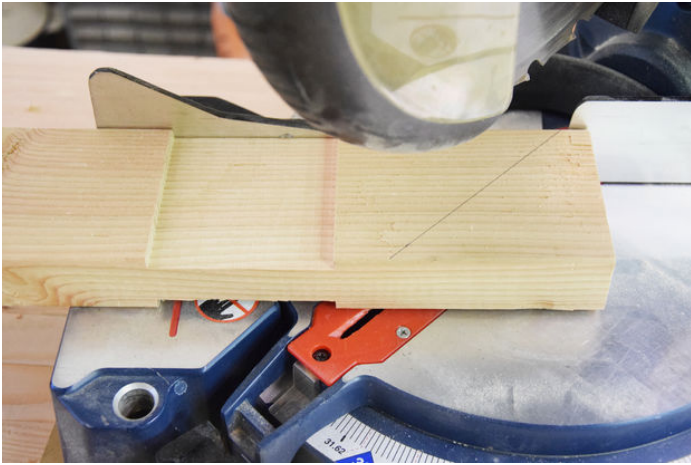




Step 27: Create Supports for Workbench Top

Using the same technique for making tenons, cut down sections of the 2x4 support to fit in the grooves on top of the legs. Using a miter saw, cut the ends of the supports to 45 degrees.





Step 28: Attach Supports

Make sure to center the workbench top on the supports. Use 3/8 inch lag bolts to attach the supports to the workbench top. Drill a 3/8 inch clearance hole through the support and a 15/64 inch hole in the top.



Step 29: Cutout Bottom Shelf

Measure the length and width of the opening for the bottom shelf. Using a fence with the circular saw, cut the length and width of the shelf. Measure and cut the corner cutouts with a jigsaw. Using a 1/4 inch round-over bit router the front and back only. No need to do the ends as they will be bumping against the 2x4 supports.





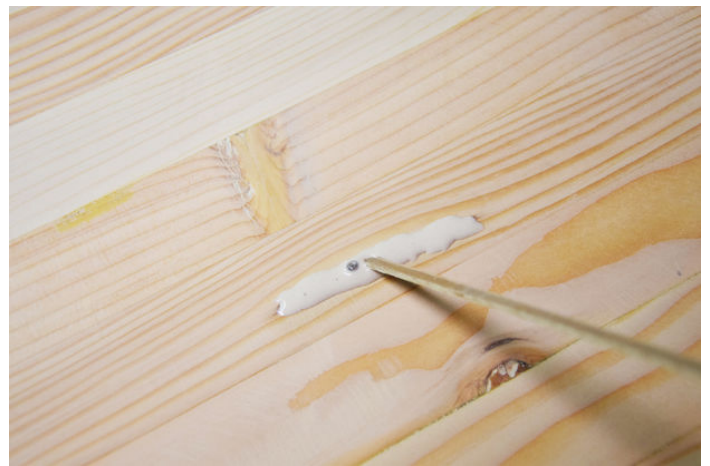
Step 30: Sand the Top of the Workbench

Using a random orbital sander, sand the top smooth. It probably got banged up a bit from making the bottom half of the bench.



Step 31: Fill Any Cracks

Using the sawdust saved from the mass amount of sanding, fill any voids with glue then quickly press the sawdust into it. Wait for it to dry and sand flat.





Step 32: Finish

There is much debate among woodworking forums about whether to apply a finish to workbench or not. Some say that any finish will cause your work surface to be unusable and slick, while others say that it's mandatory to protect the surface from glue squeeze out. While it's true that any work surface will be beat up over time, I chose to finish mine with a light coat of Danish Oil to protect it from squeeze out. Since finishing it, I haven't noticed it being slippery at all.



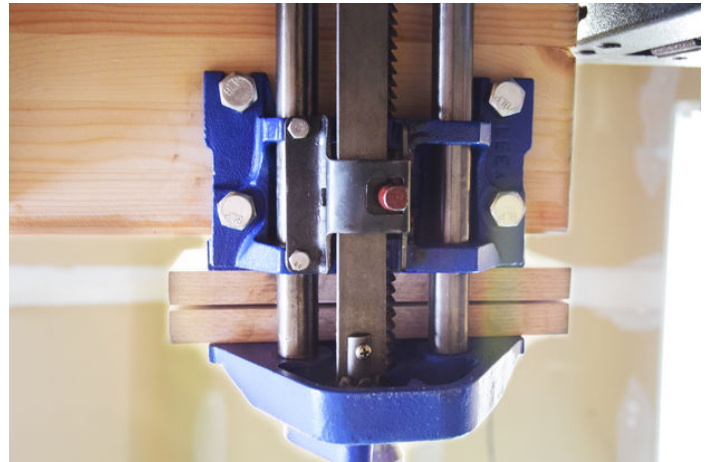
Step 33: Attach Casters

Follow the directions that come with your particular set of casters to attach them to your workbench.



Step 34: Attach Vice

Follow any directions given on your particular vice. This is the one I purchased based on its price and quick release mechanism. I used 1/2 inch lag screws to attach this vice. Using this technique still allows for a strong hold while not leaving bolts showing on the top of your workbench. I decided not to route out my workbench to integrate the vice further. If you plan on using bench dogs you will want to do this.



Step 35: Final Thoughts

Looking back on this project, the most difficult part was the mortise and tenons. I practiced on many boards and I suggest you do the same. I tried many techniques, but I was never pleased with any of the results. I'm sure that woodworking purists will scoff at my resawing technique, but this method turned out great and I couldn't be happier. Feel free to try a few techniques of your own. I found that the scraps of my practice joints made excellent mallets.

If you happen to make your own workbench from these plans or any others, leave a comment with a picture telling me what makes yours perfect for you.

