



How to create a Step Stool

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CNC Creator Guides
by **LONGMILL**

Intro Info

Hey Folks!

Here's a quick step-by-step guide on how we created, cut, and assembled our handy dandy step stool. From start to finish, follow along and by the time you're done, you'll be able to reach the cookies hidden on the top shelf!

Files and Softwares

The initial design for the step stool was created by Andy in Onshape. He added a few variables to allow you full customization to your heart's desire.

The design files were imported into VCarve where we added toolpaths, tweaked the settings, and saved the toolpaths into gcode.

We fired up gSender to carve the pieces out and once all the techy stuff was out of the way we got our hands dirty and put it all together.

Bits and Materials

Bits

Sienci 1/4" Downcut End Mill

<https://sienci.com/product/1-4-spiral-down-cut-end-mill/>

or

Sienci 1/4" Compression End Mill

<https://sienci.com/product/1-4-flat-compression-end-mill/>

Materials

1 x 4'x8' Maple veneer plywood

Any wood glue you have available

Mallet

120, 180, 220 grit sandpaper

Machine Settings

Feeds and Speeds:

DOC: .25"

Stepover: 40%

Router: 19000rpm

Feed: 100 IPM

Plunge: 75 IPM

Download the Project Files

We've included all the files you'll need to create the stepstool.

If you want to make changes to the initial Onshape design use the link below.

<http://cuts2.com/nhKqt>

For the project files used to create the step stool:

Files Included in the Folder:

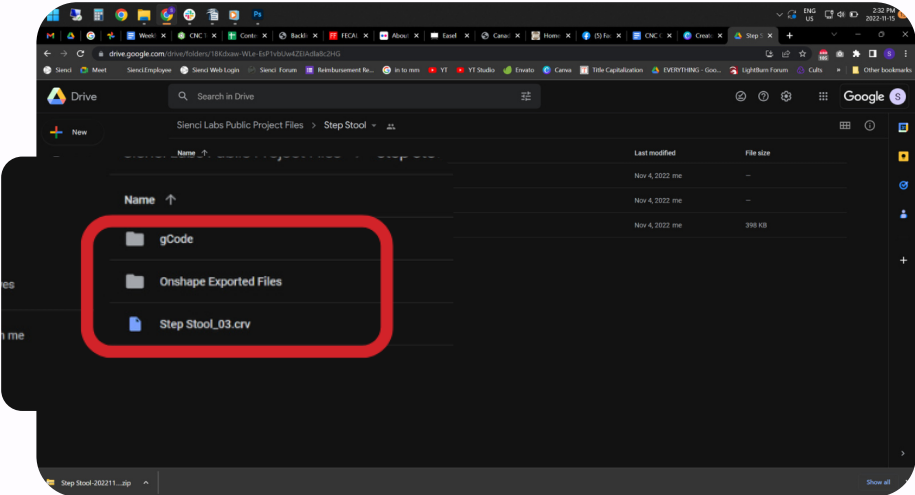
Onshape exported DXF/DWG files.

Vcarve file complete with toolpaths set up

Gcode files to load in gSender to cut everything out.

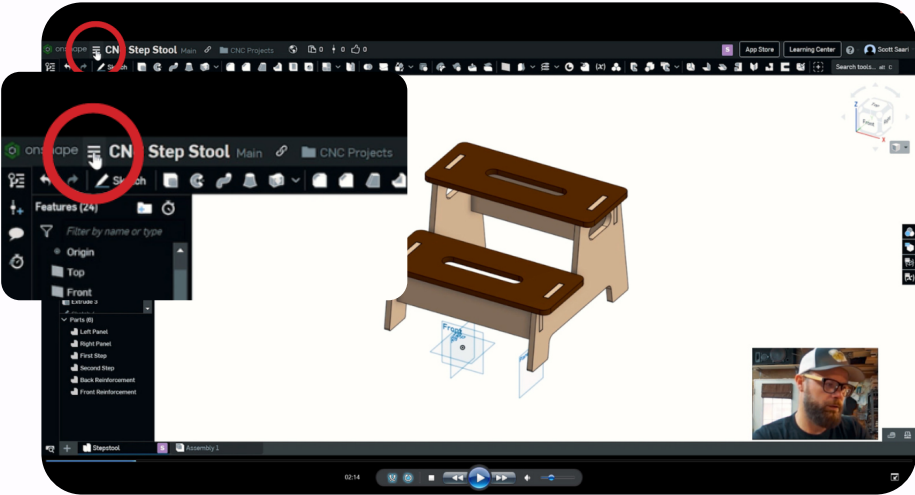
[Click here to download files](#)

Download Project Files



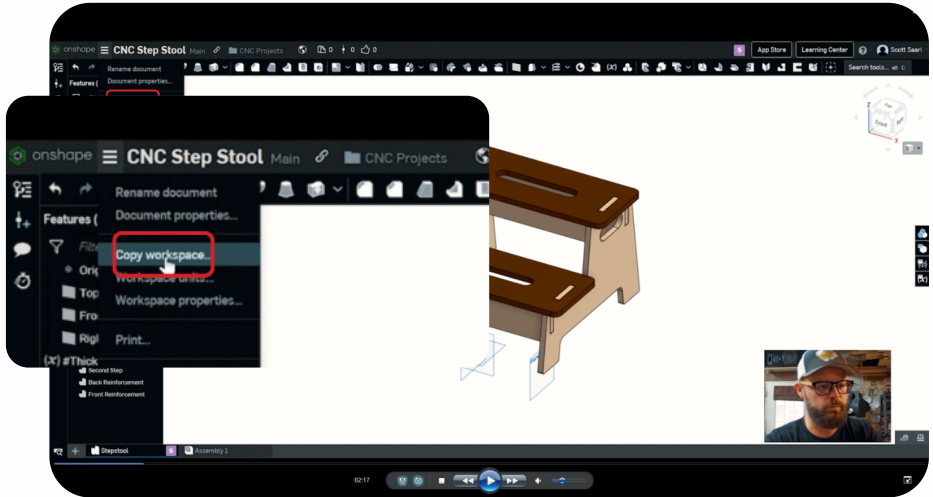
With the link above, download the project folder we've provided and place in the location of your choosing.

Open Onshape and Copy File



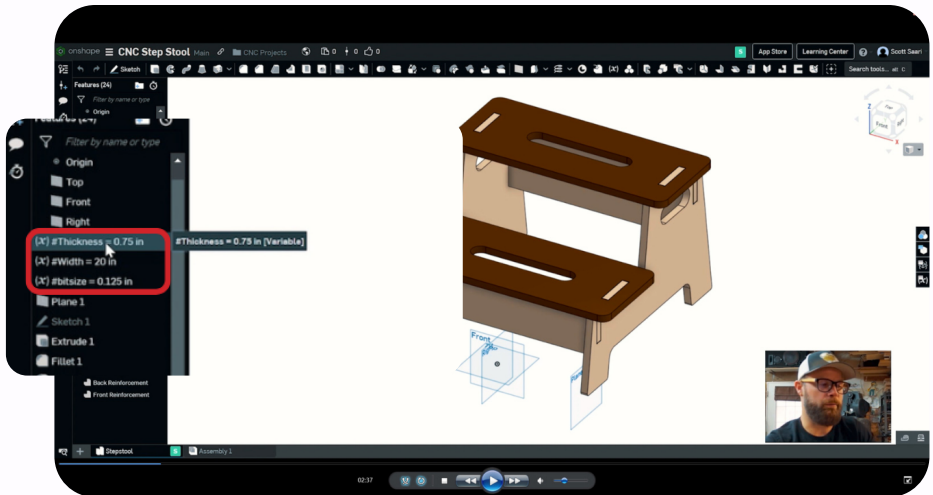
Once you open the Onshape link, click on the 3 lines in the top left corner to copy the workspace.

Copy Workspace



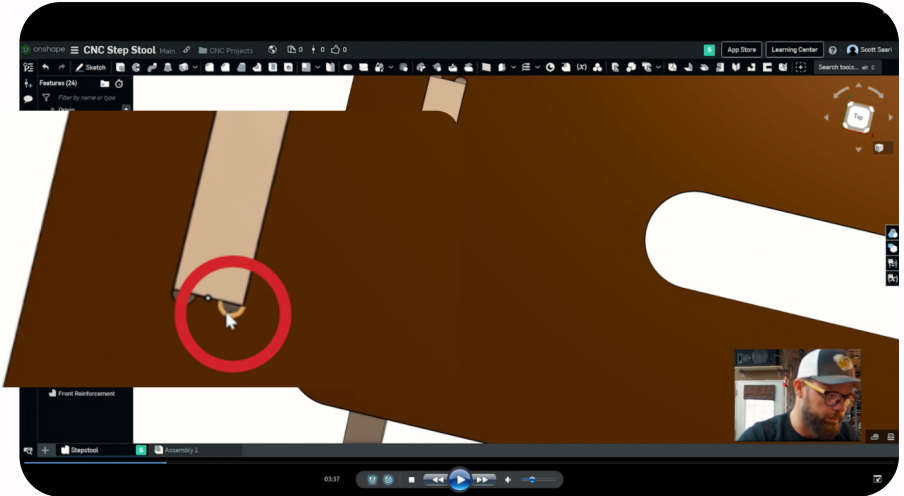
Click on "Copy workspace" and rename the file to whatever you'd like. With the free version, the document will be public.

Variables



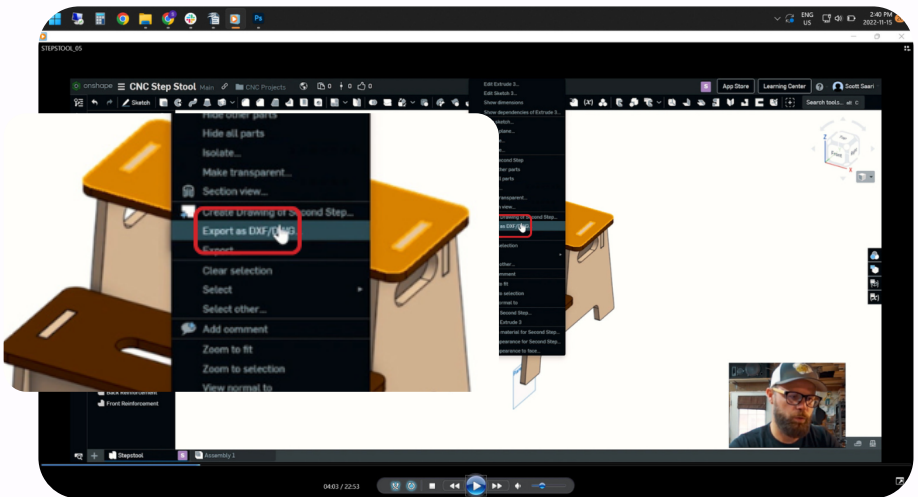
We've programmed some helpful variables into the project to allow you to customize it to your specific needs. Just double-click on a variable, change the number and green check it and you're good to go.

Variable Project Double-check



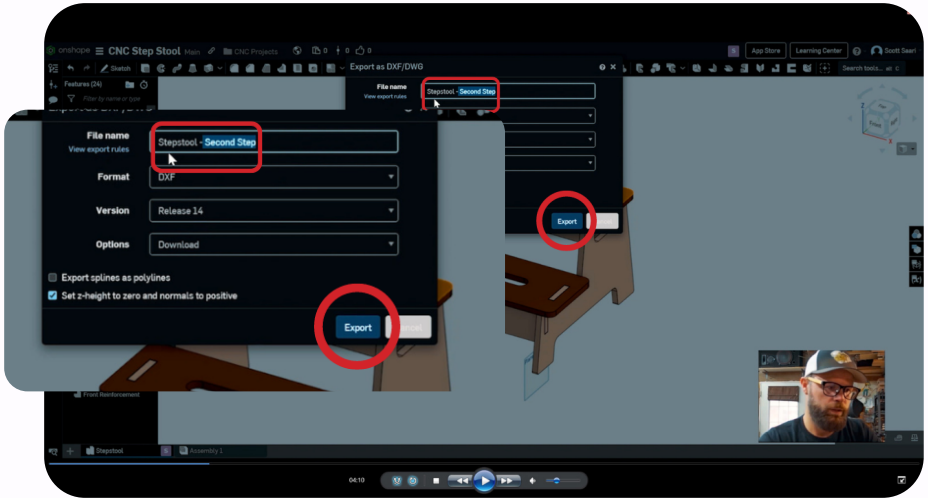
If you are going to change variables, especially the bit size, double-check to make sure you understand what and how it affects other parts of the project.

Exporting DXF/DWG



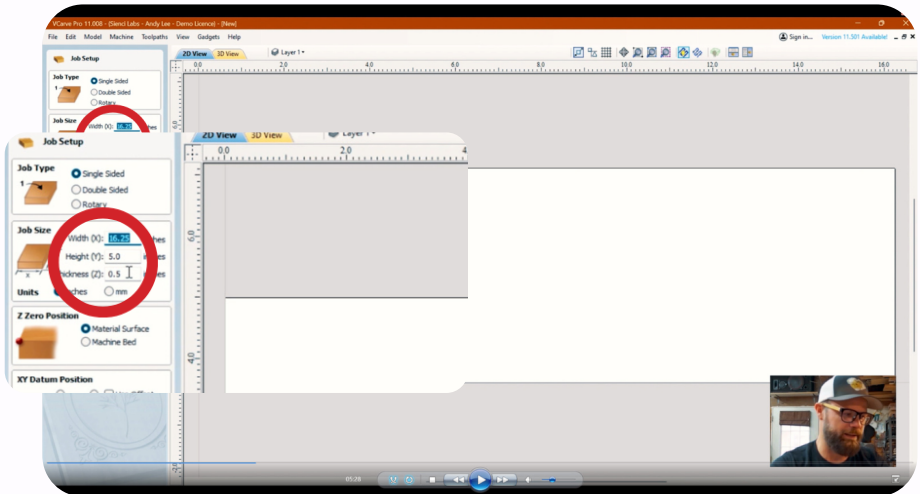
Once you're happy with the settings, select an object's main "face," right-click and select "Export DXF/DWG." Save the files to your selected location.

Saving Files



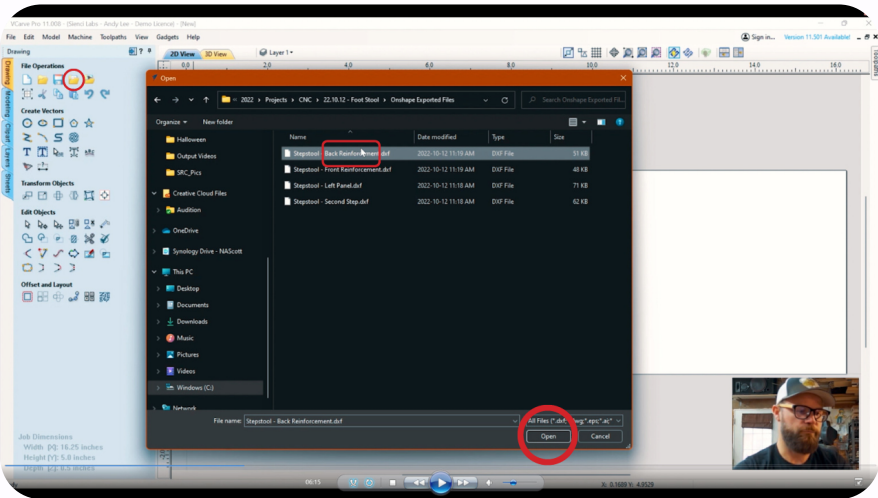
Rename and save the files to your desired location. Repeat the process for each piece of the step stool. Remember, you only need to save the steps and sides once as they're identical.

Create New File



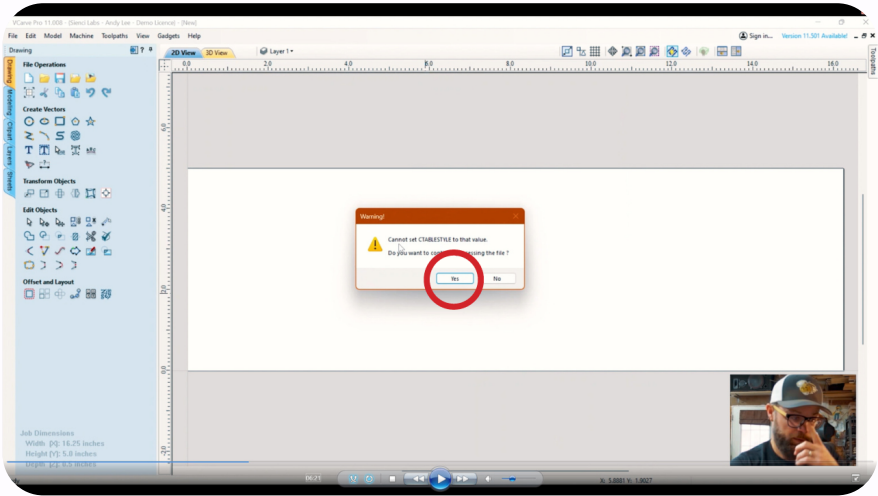
We used Vcarve to create this project. Create a new file, the dimensions can be changed at any point so it's not super important that the size is correct right now.

Select Files to Import



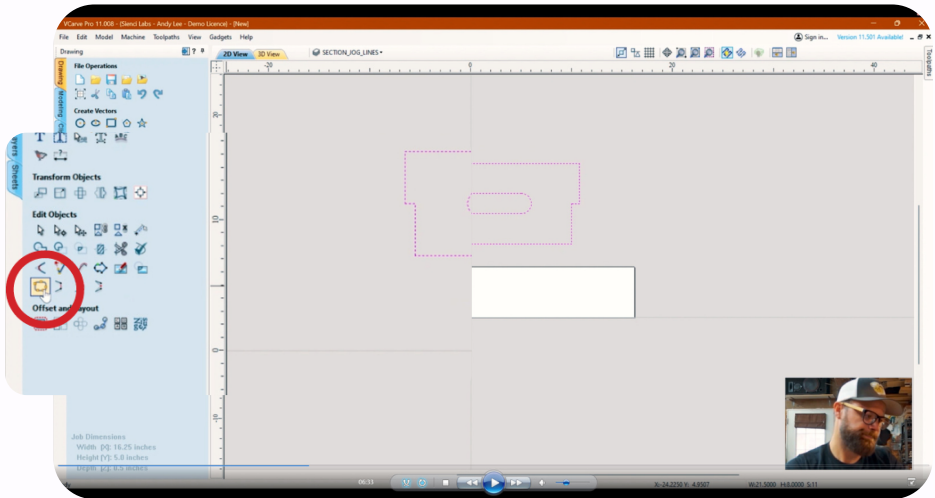
Select the file to import and click "open."

Pop Up Window



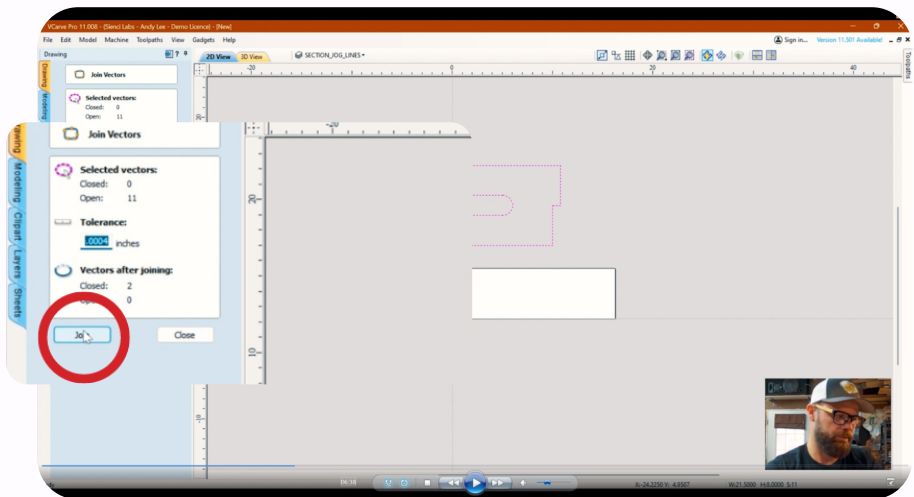
After you select "open," you will get this pop up about "CTABLESTYLE." Select "yes" and continue importing.

Join Open Vectors



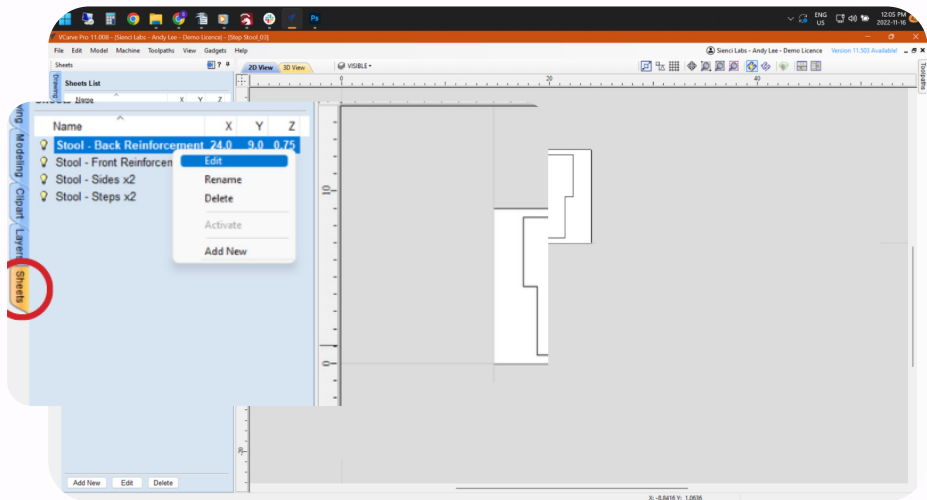
Select all the vectors imported and click on the "join open vectors" icon.

Joining Open Vectors



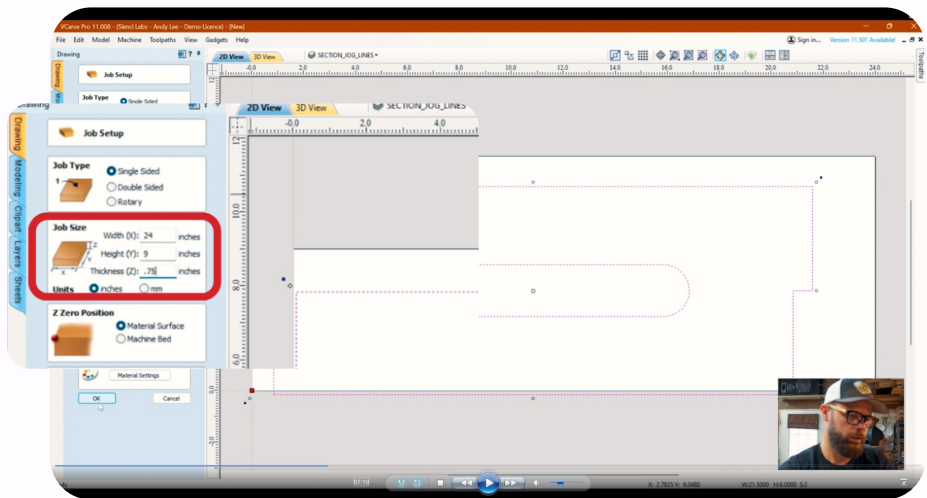
A menu will come up displaying stats for closed and open vectors within the sheet. Once you click on "join" any open vectors will now be closed. This means all segments will be joined instead of individual segments as they were.

Create Sheets



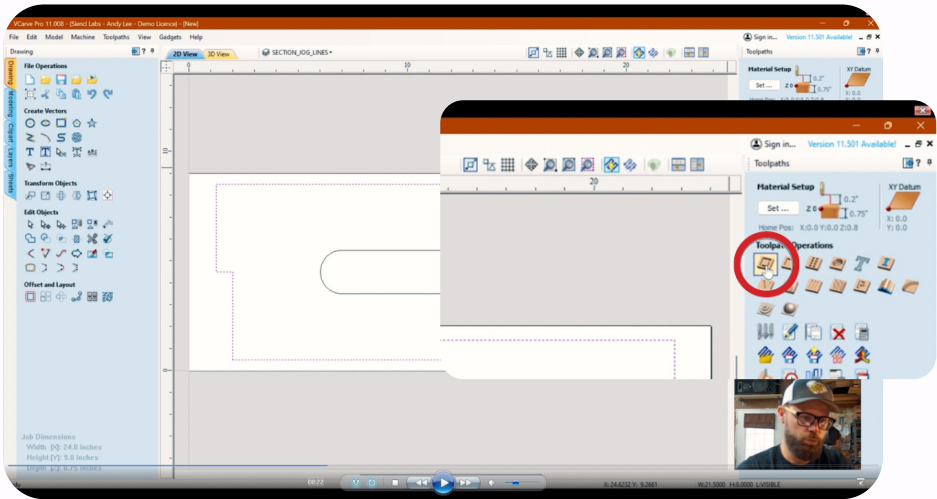
By creating sheets for each piece of the stool you'll be able to adjust the dimensions for each one. This will allow you to have all the pieces for the project in 1 file. In order to edit the sheet dimensions, right-click on the sheet you wish to adjust and click "edit."

Adjust Sheet Size



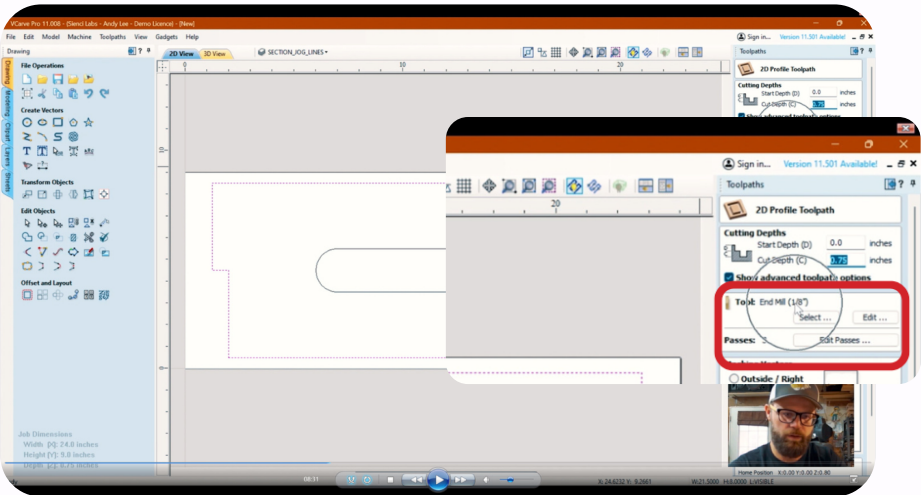
You're able to adjust the sheet dimensions for each sheet individually. Now that you know what size your vectors are, you can change them to fit each piece.

Vcarve Profile Toolpath



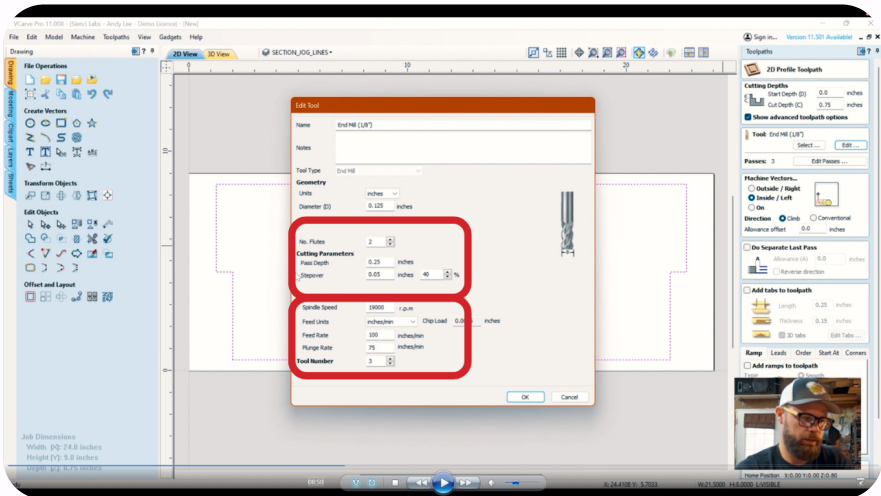
Selecting the outside path, the click on "profile toolpath."

Edit Bit Settings



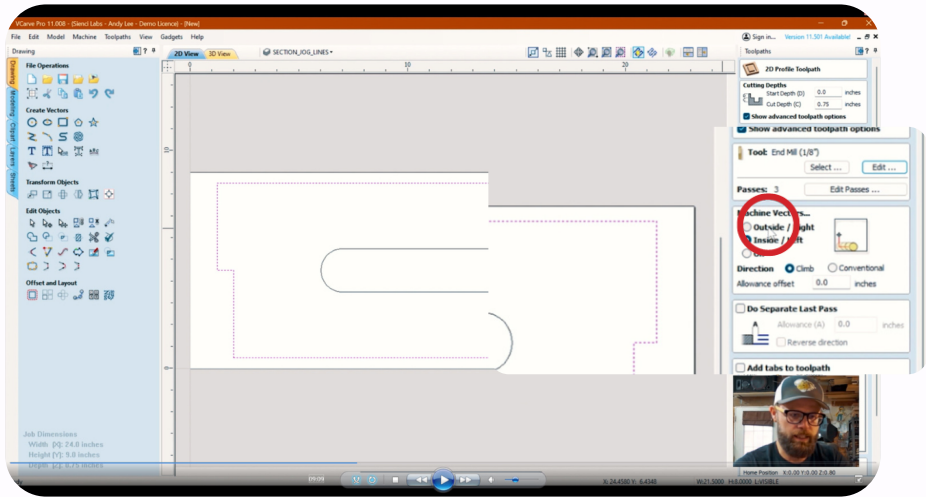
Within this menu, you're able to select what type and size of the bit is being used. We've selected a 1/8" down cut endmill. You can adjust the depth of cut, and if you select "edit" it will open up speed and feed settings for the chosen bit.

Changing Bit Settings



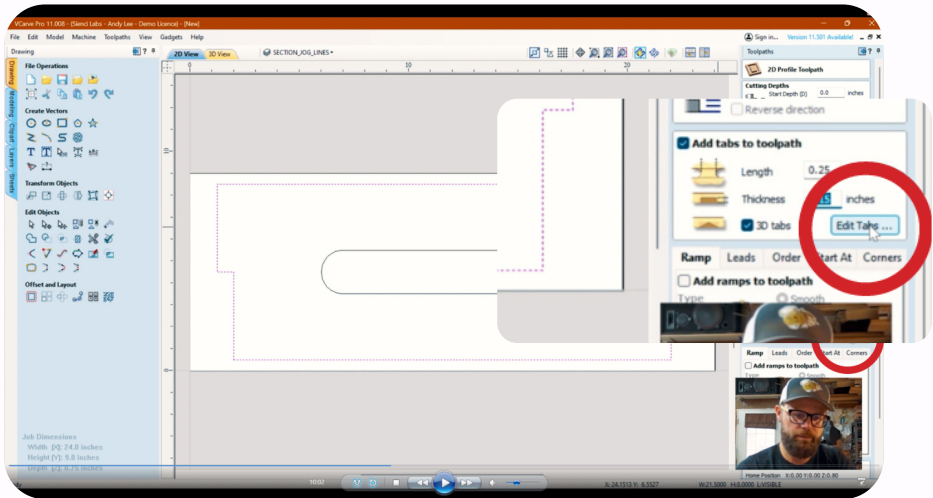
Within this menu, you'll find all the settings you need to adjust the feeds and speeds for the selected bit. We've chosen a .25" pass depth, 100 ipm feed and 75 ipm plunge rate.

Outside Machine Vector



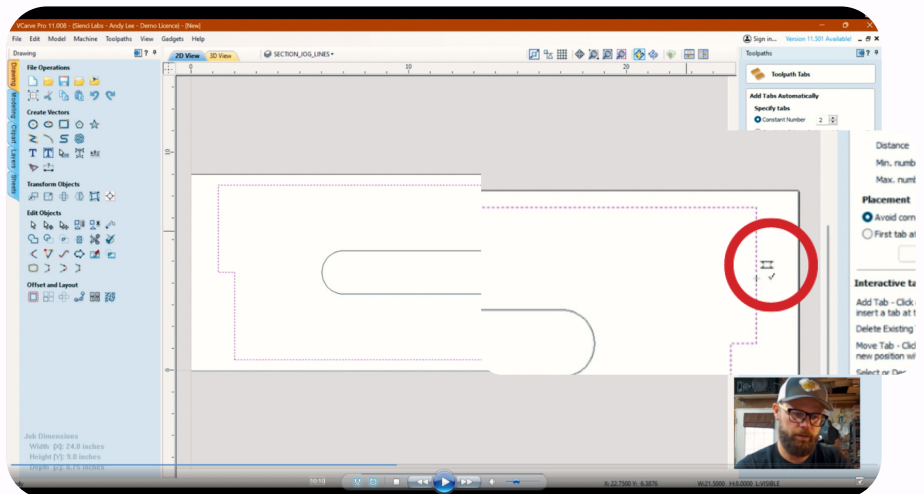
Selecting "outside" for the machine vector will ensure the bit follows the outside of the path selected. This is what we need for this part of the step stool.

Adding Tabs



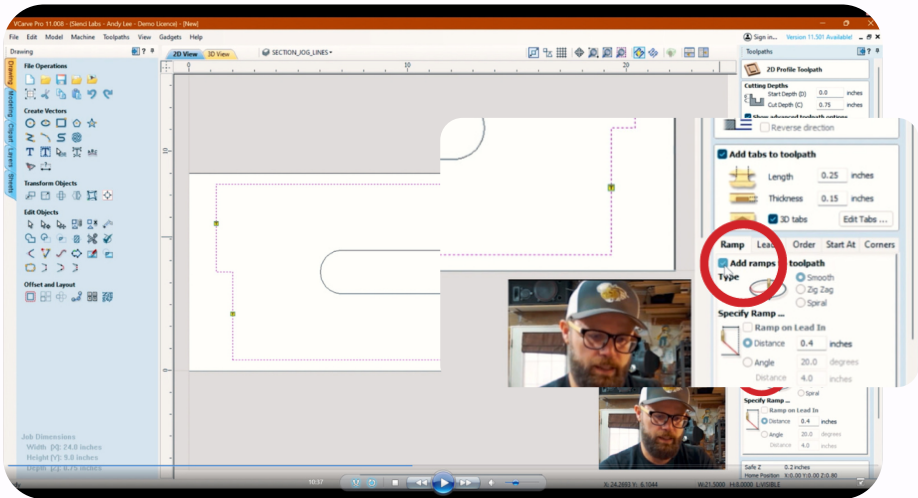
We're adding tabs to ensure the pieces cut out don't come loose during carving. In order to add them, you have to select "edit tabs."

Adding Tabs Manually



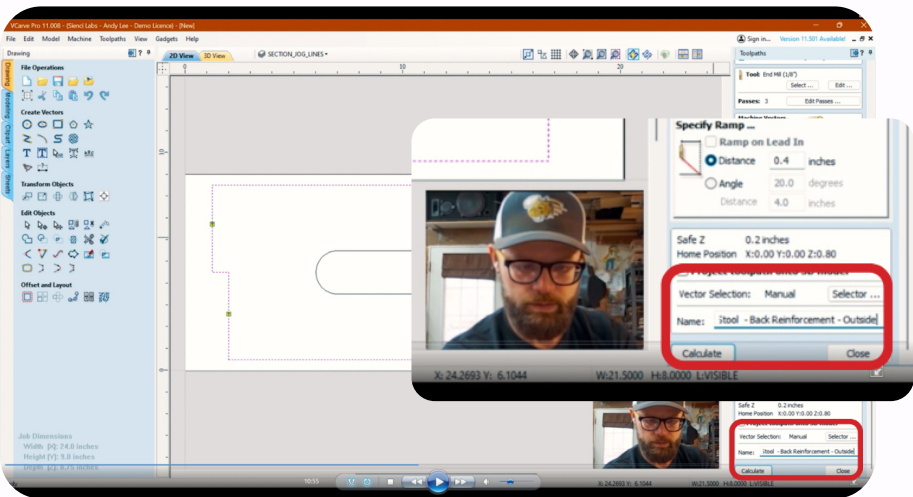
In this menu, you can decide if you'd like to add tabs automatically. You can also decide on how many and hit "add tabs." Otherwise, you can add them manually as we have by hovering over the selected line and watching for a checkmark to come up at which point you can add a tab there.

Adding Ramps



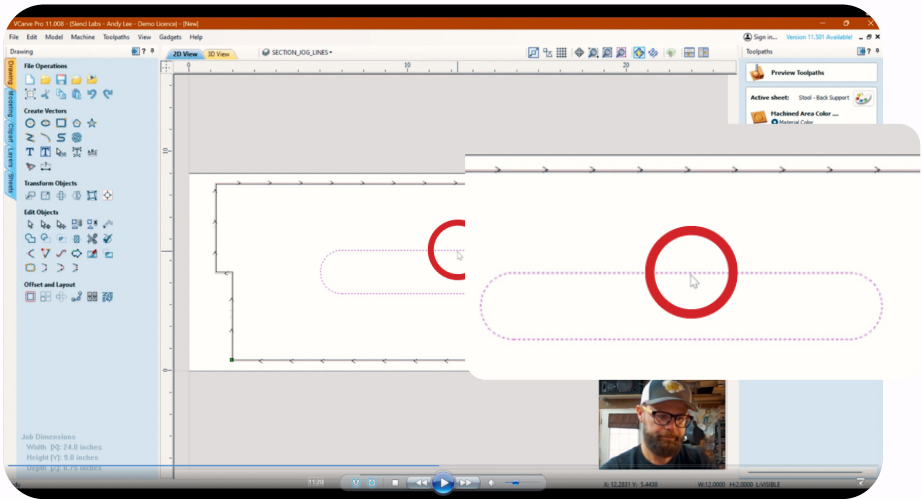
By ramping out toolpaths it will save unnecessary wear and tear on the bit, so we'll check that on and set to .5 in.

Rename Toolpath



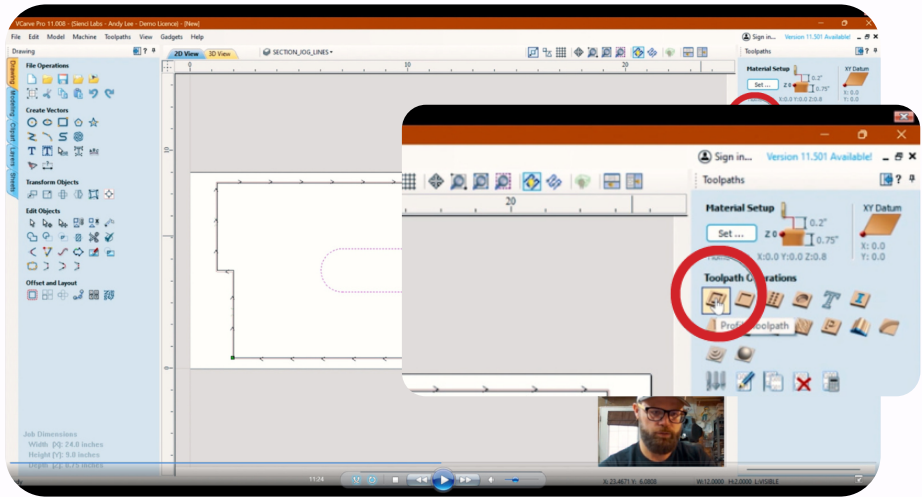
Renaming the toolpath will ensure you're able to keep things organized. So we'll rename our toolpath now. As this is the outside toolpath, we'll add that to the name.

Select Inside Vector



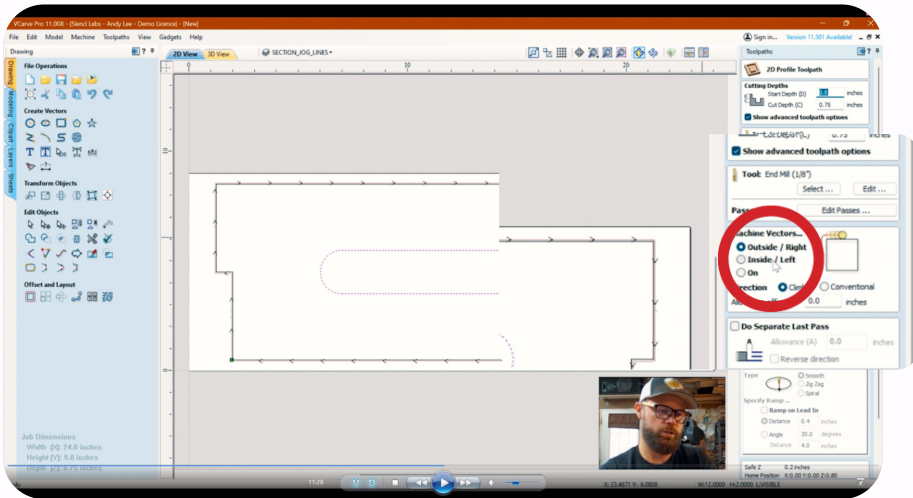
We'll repeat the same process for the inside toolpath that we just did for the outside toolpath. So let's select the inside vector for the stool.

Profile Toolpath



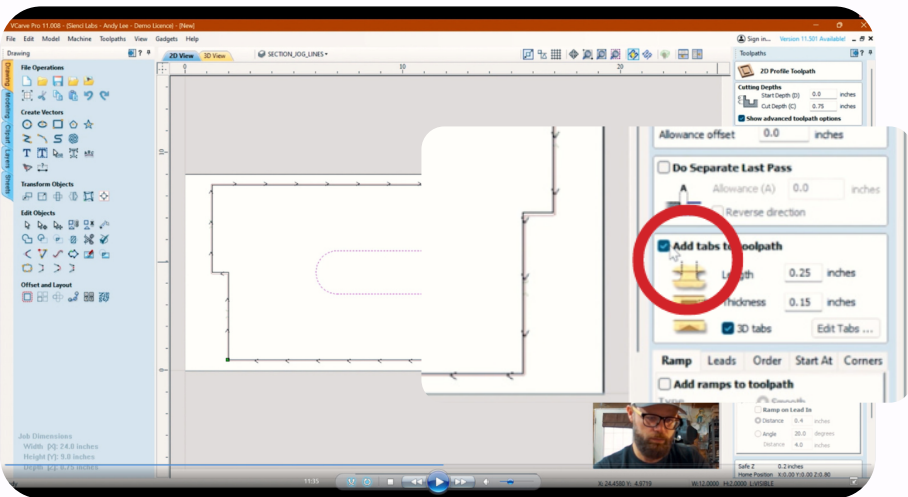
We'll select profile toolpath for the inside vector.

Inside Toolpath



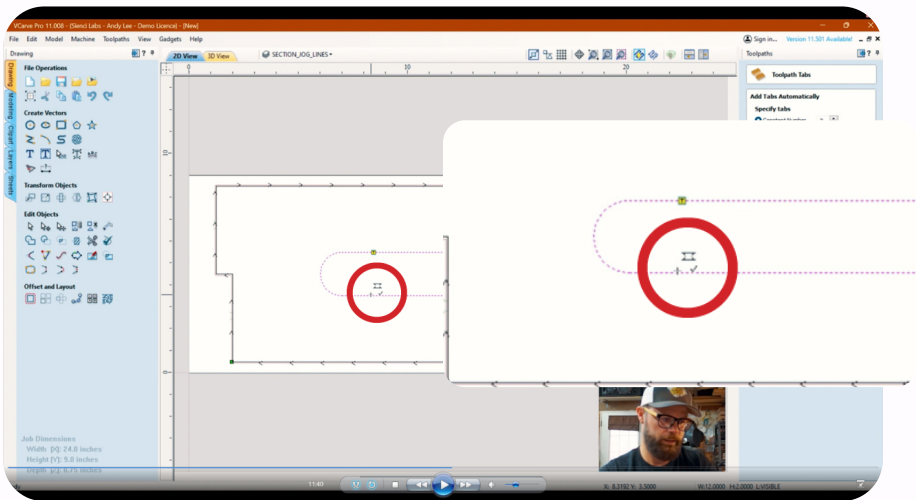
We'll change the machine vectors to "inside"

Add Tabs Again



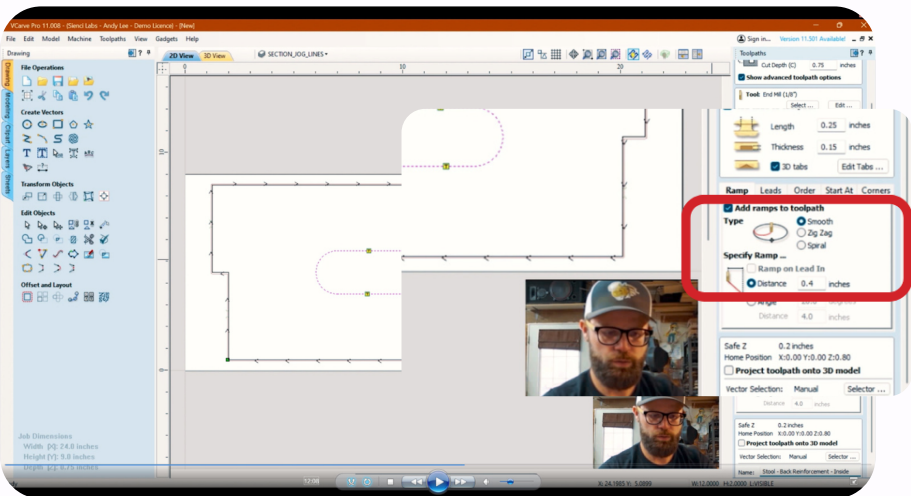
We'll add tabs as we did for the outside toolpath. Click on "edit tabs" to open the options menu.

Add Tabs Manually



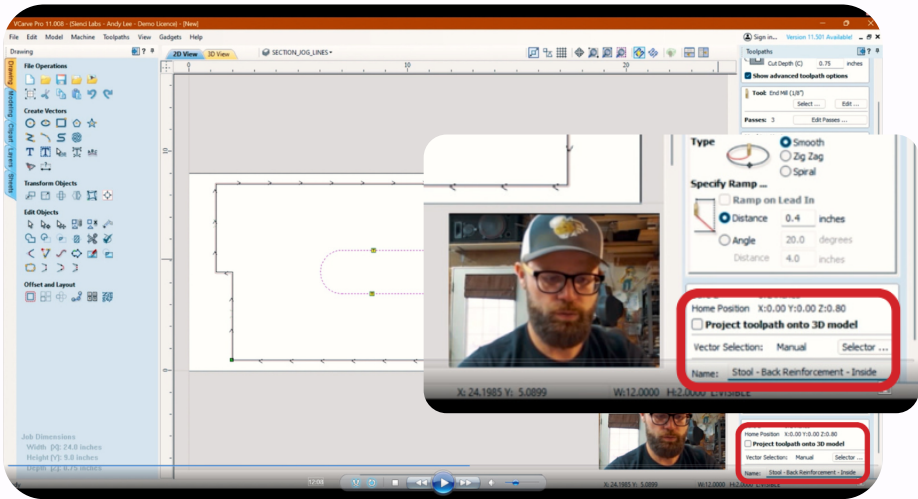
Again you can decide to add tabs automatically or manually. We chose manual and dropped in 4 tabs to hold the centre piece in place.

Ramping plunge



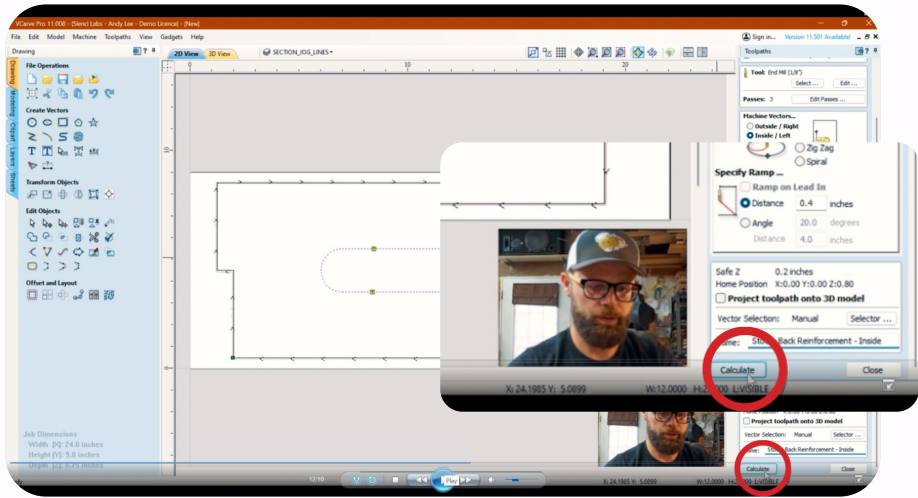
Adding ramping will ensure our bits aren't subject to unnecessary wear, so we'll check that on.

Rename Toolpath



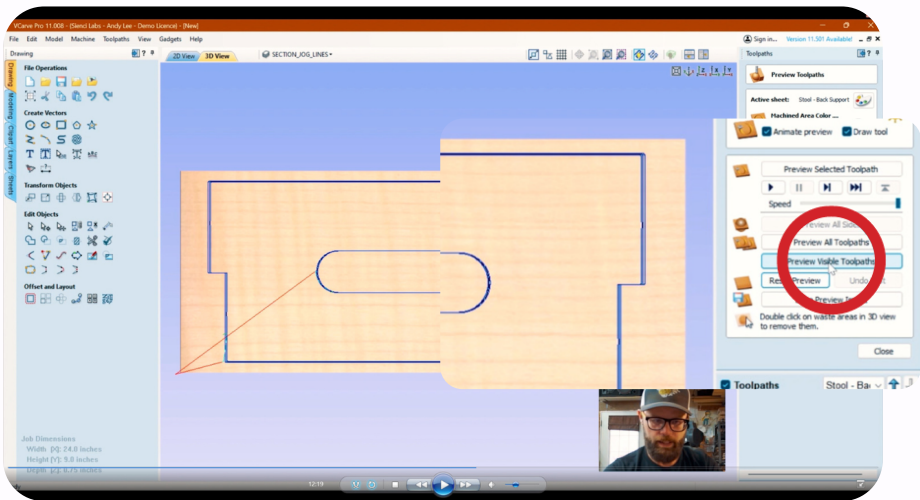
We'll rename the toolpath to include "inside" so we can tell them apart. We'll also drag the inside to the top of the toolpath list so it is cut out first, and then the outside toolpath second.

Calculate Toolpaths



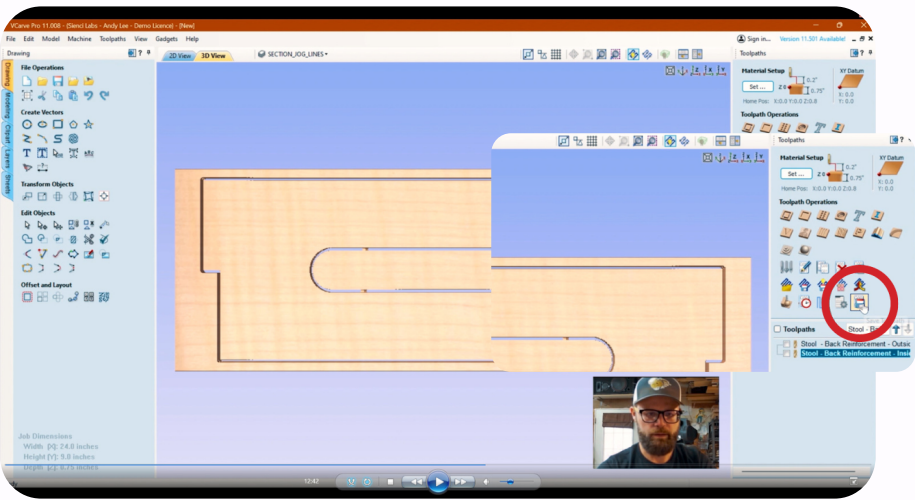
We'll click "calculate" now to see the results of our toolpaths and to get a time estimate for how long they will take.

Preview Toolpath



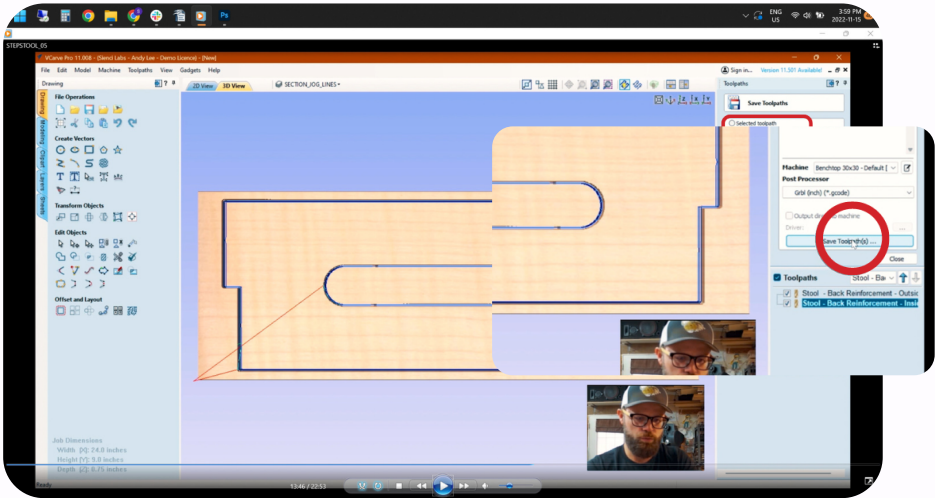
By clicking on "Preview Visible Toolpaths" we'll be able to see the checked-on toolpaths we've created and be able to visualize what the cuts will look like.

Save Toolpaths



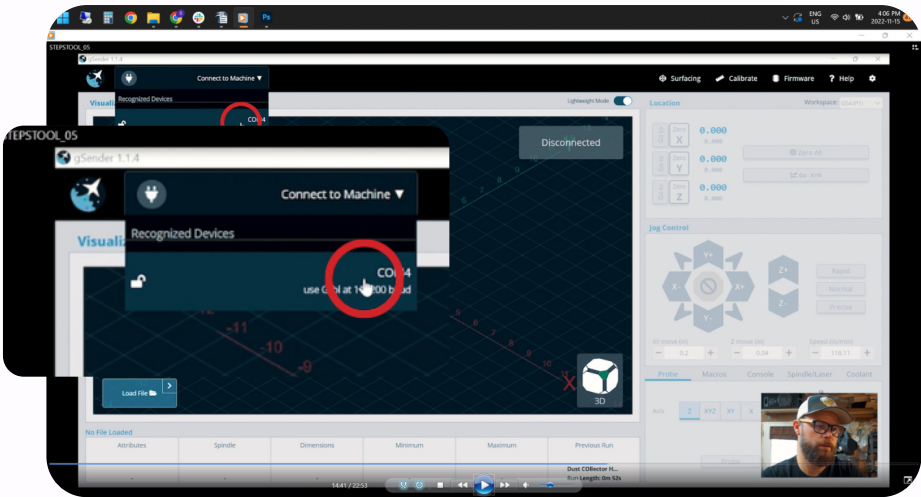
Click on "save toolpaths."

Save Selected Toolpaths



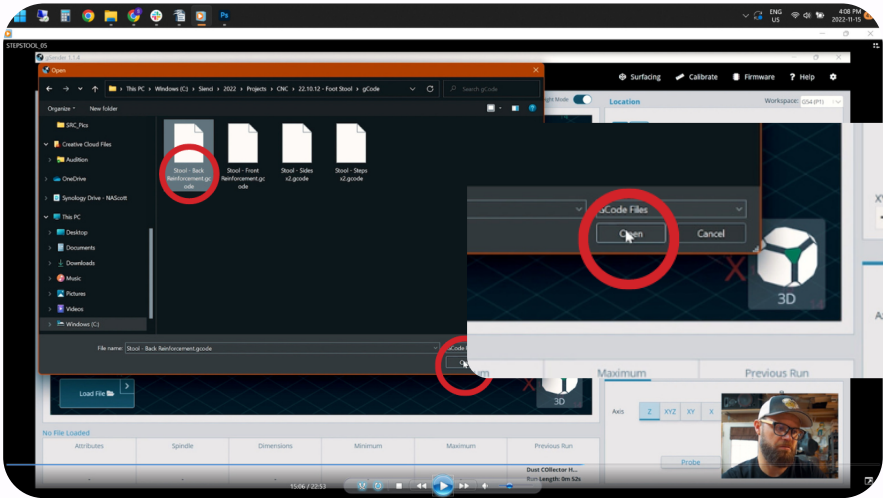
Make sure the toolpaths you want to be saved have a check beside them. We've selected "all visible toolpaths to one file" so the inside and outside toolpaths will be saved to a single file. Once loaded, they will run one after the other to complete the cut. Repeat all steps for each of the other pieces for the step stool.

Open gSender



Open gSender and connect to your machine.

Load Gcode File



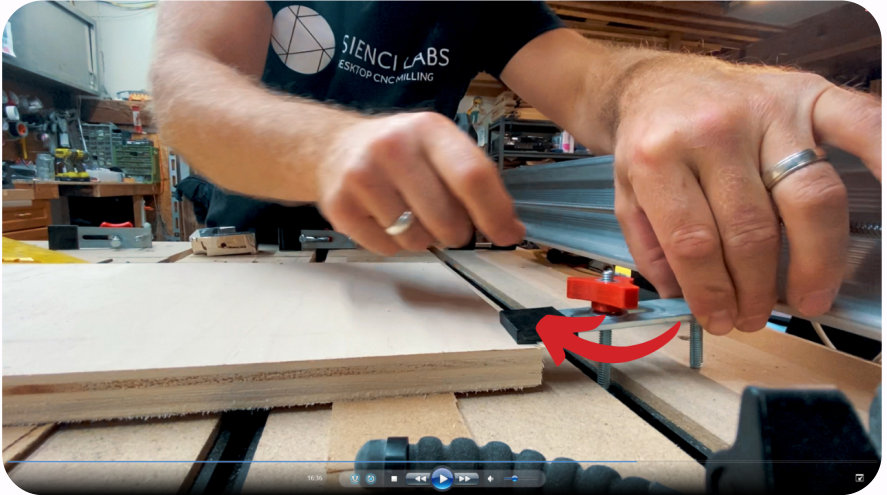
Load the Gcode file that you've saved for each piece.

Securing Bit



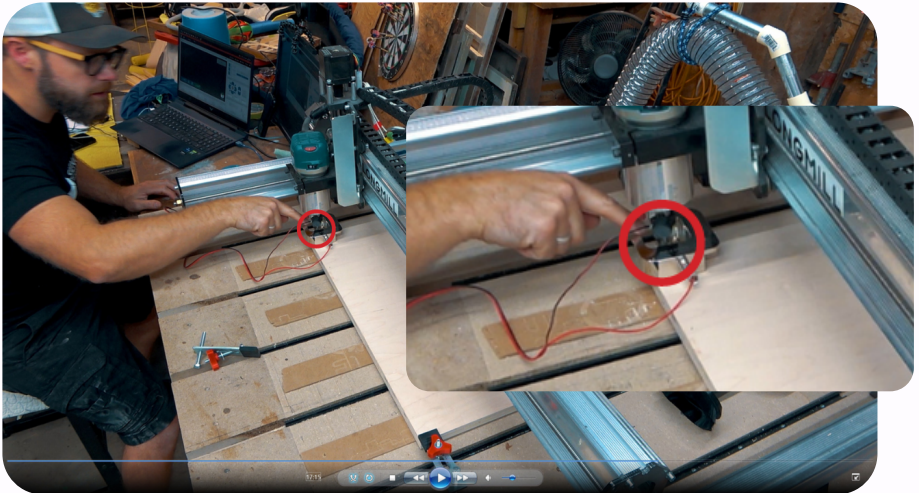
If you haven't already done so, secure the chosen bit in the router. We've chosen a 1/8" down-cut end mill (we later changed to a 1/8" compression bit as they do a solid job of cutting all the way through most materials). be sure to tighten the collet with the proper 2 wrench method.

Square and Clamp



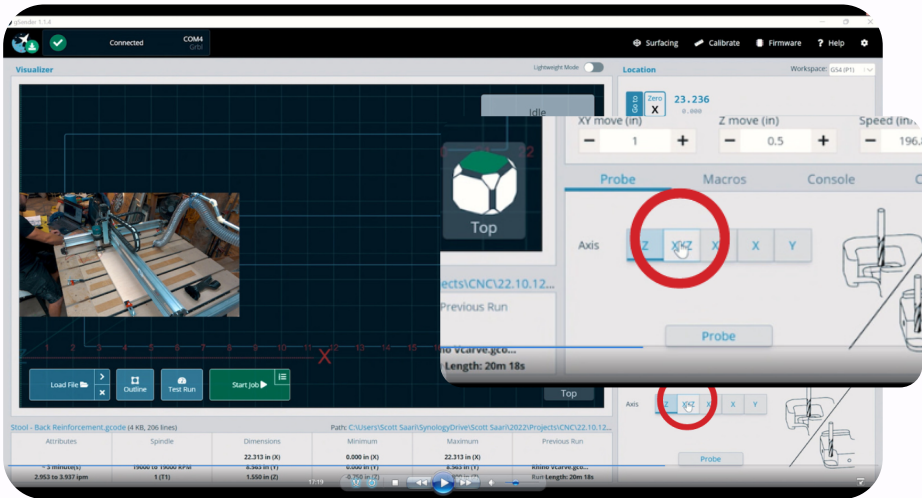
Make sure your workpiece is square to the machine (assuming it needs to be) and clamp your piece down with the appropriate work-holding method. We've chosen Sienci's metal clamps as we have lots of space around the workpieces to secure them without interfering.

Zero'ing the Machine



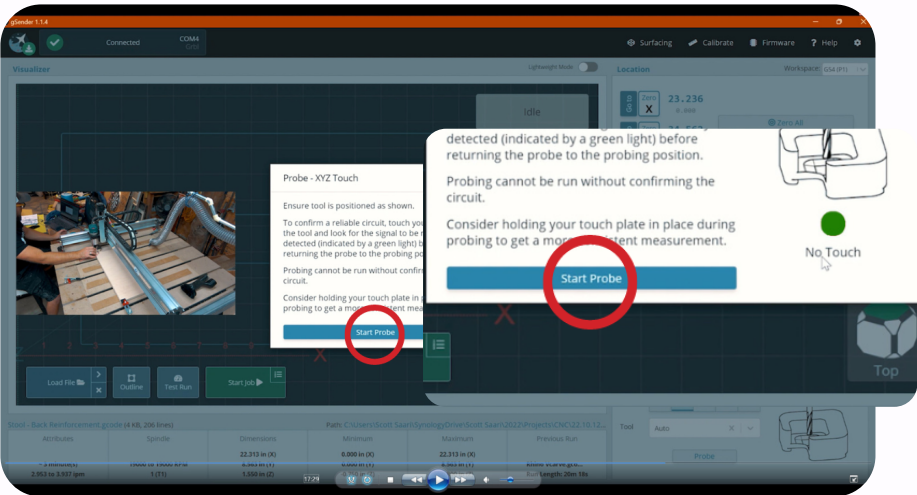
We're using Sienci's Autozero Touch Plate to find 0 for our project. We've got the bit centered over the touch plate inside the square target zone. We've also hooked up the magnet to the collet nut for conductivity in the next steps.

Zero Settings in gSender



We've selected "XYZ" from the Probe menu because we need to find all 3 axis' 0 locations. We chose "tip" from the drop-down menu because we're using Vbits. For end mill bits, "auto" can be selected.

Probing



Once your desired axis' and bit type are selected, we hit "probe." gSender will wait for us to touch the autozero touch plate to the bit in the router to ensure conductivity. Once it has detected the touch, we can click on "Start Probing." It will cycle through the selected axis, and once complete move to 0.

Dust Collection and Carving



Before we begin carving we'll remove the AZTP and attach our dust collection system and turn it on, then we can begin carving the piece out. Make sure you do not leave your machine unattended and that you're paying attention while it's cutting.

Carve Out All the Pieces



You'll carve out all the other pieces with the same methods shown in the previous steps. Happy carving!

Knocking Down Tabs



Because we used tabs to keep the pieces in place, we need to get rid of the 'nubs' left behind. I used a utility knife to remove all the nubs on all the pieces. Just don't cut yourself. You can also sand these down instead, that's personal preference.

Sand All the Pieces



We used 120-grit sandpaper and a random orbit sander to sand the edges of all the pieces. We used 220 grit to break the corners and 180 for fronts and backs to make everything nice and smooth and splinter free.

Filing and Assembly



Some of the slotted parts may be a little wee bit tight when assembling. That's where files, sandpaper, and a rubber mallet come to the rescue. I dry fit everything before gluing all the pieces together.

Carrying the Weight



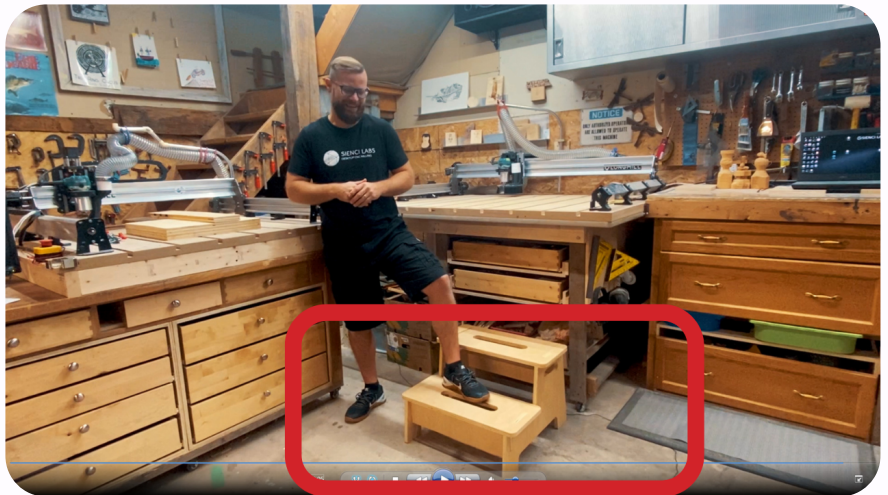
To make sure all the pieces had sufficient weight I added some to the steps to make sure it was all held in place. I decided that was easier than standing on the stool for the next 8 hours.

Protection



We added some varnish to protect the stool from everyday wear and tear. You don't have to finish it, but doing so will likely extend the life of the stool.

Stepping Up



Now it's time to put it to good use! I'm average height, but I'm always in need of some extra lift. This step stool is perfect as it's sturdy and gives me the boost I need when I need it! We hope you enjoyed this!