If you are a luthier just starting out, I strongly encourage you to keep track of how many bridges you make during your career, simply for your own records/bragging rights. Having failed to do that myself, my best guess is that I’ve made between 300 and 400 bridges over the last ten years— a good portion of them cello bridges. Here, I attempt to take the reader through the process of making a new cello bridge as if I were sitting next to you, teaching you for the first time. Think of this as a practical guide, not a theoretical discussion.

MATERIALS AND TOOLS

- Bridge blank (I’ll get into picking the style and size of blank below)
- 2 Parchment pieces
- Block plane
- Bridge foot spreader
- Digital calipers
- Chisel (at least 11 mm)
- Smaller chisel (roughly 4 mm wide)
- Bridge knife
- Dividers
- Flat hand file (0 or 1 cut)
- Nut files (0.75 mm up to 2.0 mm) or a Rat-tail File
- Bridge and fingerboard templates
- Soft graphite stick (8B)
- Small office labels
- Alephetic resin (aka, wood glue)
- 220, 320 and 600 Grit sandpaper with a hard backing surface such as a clipboard
- Carpet square dusted with dry earth colors (mostly raw sienna with a little burnt umber)
- Hairdryer
- Set of cello strings
- Always place a pad of some sort under the tailpiece when you are bringing an instrument up to tension, or adjusting the bridge. This will protect the top of the instrument from the tailpiece and fine tuners if for any reason the bridge falls over.

CHOOSING THE RIGHT BLANK

On the left is a French style blank and, on the right, a Belgian style blank. Which one you select, will depend both on the cello and the playing style of its owner. A French bridge, because it brings out more low frequencies, can help a very bright sounding instrument be more subdued and blend in better with an ensemble. A Belgian bridge generally brings out the high frequencies and can help brighten a darker tone.

SIZE AND PLACEMENT

You will need to determine the size of bridge needed by plotting out its position on the cello. Find the center line at the cello’s stop length (usually between 395-405 mm, at the notches of the f-holes) by measuring across the narrowest part of the c-bout and, then, the widest part of the lower bout. I measure from the inside of the purfling because edges often wear unevenly. I place a small sticker on each spot and mark the center line with a pencil. (See photo, below) It’s important that the bridge straddle this line to make the set-up the most effective. Next, I determine the width of the bridge by finding the distance from the outside edge of the bass bar to the center line. Let’s say that distance is 43.5 mm. I add 5, multiply that number by 2, and subtract 3. This gives me 94 mm, which is the size blank I need. The above formula accounts for the bridge to overhang the bass bar 5 mm and for the bridge legs to be spread 3 mm.\footnote{1}

This is what the cello looks like after I finish mapping out my bridge placement.
PREPPING THE BLANK

Begin by reducing the thickness of the legs and feet. At the tops of the legs, the final thickness should be about 8.5 mm, which widens at the feet to 10.5mm for French bridges and 11mm for Belgian. I like to set my digital calipers to slightly above the desired final
dimension and use them as a marking gauge to scribe a line to work down to.

Often, I go back over the scribed line with a pencil to make it more visible. Make sure you are measuring from the back of the bridge, not the front. (For reference, the back of the bridge is the side with the manufacturers’ brand, ie: Aubert or Despiau. On cello, this is the side that faces away from the player.) To plane the bridge down to thickness, I generally hold the bridge against the edge of my bench and plane against my hand. At this point, we are only removing wood from the front of the bridge.
Some luthiers use a special jig to hold the bridge, but I’ve found that just holding it in my hand helps me to feel exactly where the plane is cutting (with practice, you’ll eventually be able to do this without planing the tips of your fingers). With the legs and feet at thickness, insert bridge foot spreader and expand it until the bridge span is correct (97 mm, if we’re using my example from above).

FITTING THE FEET

Before starting, ensure that the instrument has a good-fitting soundpost. Because of how much a soundpost can alter the arching, fitting the bridge without a soundpost, or with an ill-fitting post, is an exercise in futility. Place the bridge blank in position and trace the shape of
the top on the back of each foot. It is useful to make a small jig to guide your pencil.

This will give you a starting point to fit from. The soft graphite is used as an aid in fitting. Rub the graphite stick directly onto the cello top in the areas that will be in contact with the bridge feet. Slightly dampen the bottoms of the bridge feet and place the bridge in position, sliding it forwards and backwards almost imperceptibly. When you look at the bottoms of the feet, everywhere that’s in contact with the cello top will be highlighted in graphite. This shows you where to remove wood.

The graphite is just an aid, you also want to fit by feel and sight.
As you fit, check that the angle of the back of the bridge to the top of the cello is ever so slightly more than 90 degrees. Doing so directs the vibrations from the strings down to the top in as straight a path as possible (at least that’s what I tell myself). When fitting bridge feet, I like to use a chisel because it creates a nice flat surface.

I may from time to time use my bridge knife if I need a more convex surface. You want to avoid have any kind of rounding across the surface of the foot and take heed that the feet are not twisted in relation to each other. Using a straight edge to sight across the feet will help. If the bridge rocks when placed in position, that indicates a twist. Try to go slowly and carefully. My “aha” moment back when I was learning bridges was realizing just how miniscule the shavings you’re removing have to be, especially towards the end of the fitting process. Otherwise, you just end up chasing gaps around, and nobody enjoys doing that.

Often, when fitting the feet, you will have to compensate for either distortions in the top of the instrument or the neck being slightly crooked. You can determine whether or not this is the case by sighting down the fingerboard. If the fingerboard is not centered on the bridge (assuming the bridge is centered), you will have to remove more material from one foot or the other while still ensuring a good fit. This will keep the feet centered, but the top of the bridge will be tilted over to be in line with the fingerboard for ease of playing. If fitting bridge feet is like riding a bike, tilting the bridge while fitting it is like riding with no hands.

STRING HEIGHTS

When the feet are close to fitting, I like to string the cello up, both to see how the fit changes under pressure and, also, to see where the top of the bridge is vis-a-vis approximate string heights. I set my digital calipers to 47mm to represent the distance from A-C and mark that on the bridge (see that the calipers are centered by eye).
I take my knife and make two V cuts, that I then widen with my nut files, for the A and C strings. Now we can string up the cello, just using the two outside strings. Be sure to place a protector between the tailpiece and the top of the cello, just in case. It can be a simple square of cloth, folded over, or a special leather “tailpiece condom.”
To get the rough string heights, it’s not necessary to bring the strings up to pitch, just have a moderate amount of tension on. Make a note of the current string heights from the end of the fingerboard to the center of the string (probably quite high). Subtract from that number the final heights: 5.5 mm for the A and 8.5 for the C. For example, if you initially measure the A at 12.5 mm, subtract the final height (5.5 mm). Set your digital calipers to 7.5 and make a little mark 7.5 mm directly below the A notch. Repeat for the C string, so if it’s 14 mm from the fingerboard, subtract 8.5. That tells you to make a little mark 5.5 mm below the C notch. Grab your cello bridge template and align it on these marks.
I trace the top of the template onto the bridge to get a sense for how the bridge would look with the feet at their current thickness. For French bridges, you want the amount of wood above the heart to be greater than the amount below the heart.
For Belgian bridges, unless you are working on a cello with an unusually high projection, you will want to remove as much wood as possible from the bridge feet in order to obtain the proper amount of wood above the heart. In general, there is no substitute for experience.
when eyeballing the proportions of a bridge (see picture of completed bridges below as a guide).
When the appropriate amount of material has been removed from the bridge feet and they fit well, I cut the bridge to a rough height using the process described above. I carefully take some of the excess wood off with a bandsaw before using a file, working down to the curve marked out my the bridge template.
The next step is to relieve the back of the bridge. Adding just a tiny arch to the top portion of the bridge back will make it stronger and better able to resist warping. Again, I brace the bridge against the bench and plane it in my hand. Here, I am using the flat of the plane to gauge how much I’ve taken off. You want to end up with about a 1-1.5 mm gap when doing this.
Set your calipers to 2.5mm and scribe a line across the top of the bridge, ensuring that you take your measurement from the back.
At this point, I use a chisel or knife to make a chamfer (it doesn’t have to be pretty) on the front of the bridge, working down almost to my final thickness of 2.5 mm. The purpose of this is to make it easier to put the strings on and get them down to finished heights.
Now it is time to mark out all four positions of the strings. Find the A and C again at a distance of 47 mm from each other. I then take a small compass and “walk” my way between the outer notches until I locate the other two equidistant from each other.
(Note: in this picture, I have already mostly finished the arching on the front of the bridge. That is not necessary at this point). Don’t forget to make a small V-notch at each string placement, before widening the groove with a rat tail or nut file. Make sure the grooves are free of sharp edges that may catch the winding of the string, causing unnecessary wear and tear. I will often lubricate the grooves with pencil lead at this point.

We get the final string heights by putting all four strings up to tension. It is very important to get the strings all the up to pitch. If the cello is even a little bit flat, the heights will be incorrect. This is because of how much everything on a cello stretches and moves as it is pulled up to full tension.
Once the A and C strings are at the correct heights, I use the fingerboard template (non-Romberg) to find the heights of the middle strings. The template should rest evenly on all four strings, with no rocking.

As I am dialing in the final heights of the middle two strings, I also like to check that all four strings are an equal distance apart. I measure with my digital calipers.
If I need to move a string groove over, I use a small knife to take a tiny shaving off the appropriate side of the groove, before smoothing it out with my nut file. This is a good maneuver to combine with lowering the string height.

With the strings at final heights, make any adjustments needed to the top edge of the bridge so that the string grooves are not too deep. You’ll want to file this edge down until the grooves are about a third of the thickness of the string in depth.

FINISHING THE FRONT ARCH

With the strings at final heights, or at least very close, it’s time to put an arch on the front of
the bridge. Mark again the top thickness at 2.5 mm. Working from a point just below the heart, you want your plane cuts to radiate out from there to get a consistent curve in every direction. Again, I hold the bridge against the bench and plane against my hand. I like doing it this way because I can feel what the plane is doing.
When you’ve gone about as far as you can with the plane, switch to a 00 file to blend the plane cuts together. Use a straight-edge to gauge the shape, making sure there are no big bumps or flat spots.

I finish the front arch on sandpaper attached to a clipboard. Hit it with 220, 320 and 600 grit, always sanding against the flat of a clipboard or some other flat surface to avoid rounding the edges of the bridge.

CARVING

The last part of the process, once the bridge is fitting, string heights done and arching
complete, is to carve or "cut" the bridge. The object is to remove excess wood from the profile, while maintaining its structural integrity. Removing wood not only makes the bridge more attractive in appearance, it also improves the acoustical properties of the bridge by allowing it to vibrate more freely.

Different shops have adapted their own individual styles and nuances of bridge carving. Luthiers tend to take great pride in the quality of their cut. This picture illustrates how much material is removed in the carving. I have done the right-hand side only for comparison.
A sharp double-bevel knife with a slightly curved blade works best for this process.
I like to start with the heart, mostly just cleaning it up a little to remove the machining marks.

You will also need to chamfer the little part with hangs down into the heart (the uvula?) with a small sharp chisel. Do this gently, or you’ll be very sorry!
Next, I finish the outsides of the “arms” taking them down by eye to a reasonable size. As an extra touch on Belgian bridges only, we round the bottom portion on the arm as it curves around the kidney. I carve this down with a knife or chisel, before making it nice and round with a file and sandpaper. The very end of the arm should come to a point.
I open up the “kidneys” a fair amount, and I carve them so they appear to tilt inward slightly.
I work my way down, smoothing out the flank just above the “kneecap.” My goal is to make the legs a little less bowed, so I remove the wood that bulges out in this section. Sometimes it’s easier to cut a chamfer on each side as a guide and then remove the bulk in between.
When I get to the kneecap, I like to start by putting a chamfer on each side to bring it to a point.
Working with my chisel and knife, I make more chamfers, gradually arriving at a dome shape for a French bridge and a more gothic-looking point for a Belgian bridge. I alternate working on the kneecaps and rolling my knife at the point where the top of the knee begins to jut out, to make a stop-cut. This will help the junction look nice and crisp.

When I’m happy with the overall shape of the knee, I carefully blend together the chamfers with a fine file, and finish it off with a small piece 320 grit sandpaper folded into thirds. Here
is a French kneecap, before and after filing and sanding:
And for comparison, here is a finished Belgian kneecap:
The last step is to get the feet and the legs carved to shape.

The dimensions to shoot for are, 10 mm wide for the legs and 2.5 mm thick at the “toes.” As I remove wood, I want to shape the legs so that they come down towards the cello like two sides of triangle, especially for Belgian bridges. This shape is much stronger than very bowed legs when it comes to withstanding the downward force exerted by the strings.

Think about the St. Louis Arch:

To achieve this, you want to remove material from the outside of the upper leg –just below
For my taste, the legs look best when fairly uniform in thickness between the kneecap and the ankle. No bellbottoms or tapers! There is often quite a bit of wood to remove at the feet and, like before, I often find it easier to put a quick chamfer on each side and then carve away what’s left in between.
You will want to pay attention to which direction of cut works with the grain of the wood in particular areas. For example, I like to put a little recurve on the ends of the toes, which means coming in with my knife like so:
When I’m done with the feet, I look back over all my cuts and clean up anything that needs
smoothing out. Anywhere that does not need cutting down, like the top inside curve of the “St Louis Arch,” should at least be cleared of machine marks with your knife.

Lastly, I go in with a small sharp knife and add decorative chamfers to outside of legs leading into the kidneys and then outside of arms. Concentrate on making the chamfers nice and even.
FINISHING THE TOP CURVE

Almost done, hang in there! We make the top of the bridge rounded, by filing a bevel on each side, followed by a secondary bevel.
These bevels are blended together with 320 grit sandpaper, being careful to leave the edges that meet the front and back of the bridge crisp.
COLORING THE BRIDGE

A slightly colored bridge is much more appealing than a bright white one, so always burnish the bridge on a carpet swatch that’s been dusted with earth color (raw sienna with a little bit of burnt umber).
BRANDING THE BRIDGE

Make sure your stamp is cleaned with a bit of alcohol to get a nice, crisp impression. Hold stamp in the flame of a candle until blackened with soot. Check that you have it the right way around! Center the stamp by eye on the front side of the bridge, just above the “St Louis Arch.” I like to use both hands, with my forearms braced against the bench for stability. Rock the stamp side to side and up and down as you press down.
PARCHMENTS

Finally, take two cello parchments and soak them in a few drops of water until they are fairly pliable, but not to the point of complete saturation. They will swell up and be difficult to apply. I like lay the parchments on a little paper towel square to remove the excess water.
Using a flattened toothpick, apply a small amount of alaphetic resin to one side of the parchment. Be conservative with the glue, you can always dab a little more on. Too much glue and the parchment will just slide off leaving nothing but sticky fingerprints all over your nice bridge (ask me how I know). I like to glue one half of the parchment down at a time, pressing it onto the bridge with my finger, making sure that it is centered on the string groove.
I like to push them down slightly into the groove with my fingernail. Avoid stringing up the cello until the parchments are fully dry. If the customer is walking in the front door, you can use a hairdryer to speed this up.

The final touch, in our shop, is to dot the bridge with the tip of a scriber in whatever spot marks it as yours. That way, anytime an instrument comes in with a ‘Pasewicz’ bridge we can look for the dot to see which luthier is responsible for such beautiful handiwork.
PUTTING THE BRIDGE ON THE CELLO

Clean the graphite and the stickers off of the cello using a few drops of mineral spirits. Be very careful when removing the stickers not to pull any varnish off (using mineral spirits to loosen the adhesive should prevent this).

When installing the new bridge, use the bridge foot spreader again to widen the legs and get the feet in the right position. I like to put little rubber pads on the ends of the spreader so that I don’t mar my cut.
Lubricate the string grooves with graphite. With protection from the tailpiece in place, bring the strings gradually up to pitch, stopping to push the top of the bridge upright if it begins to pull forward. Make any necessary adjustments to the foot placement.
All that’s left to do now is tidy up, because, if you’re like me, every tool you own will be strewn about your bench!

Notes
1. We currently get our parchments through Wiessmeyer Violins. They have 2 sizes available – cello and violin/viola. The parchments have not been available on the website, but they do take phone orders. BACK TO POST

2. Regarding ‘spread’: The bridge sustains so much downward pressure from the the strings that it naturally forces the feet apart. In order to have a good fit when the cello is strung up, luthiers “pre-load” the spread with a specialized tool. You can see my bridge spreader in the first picture up top, wedged into the legs of the French bridge. BACK TO POST

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