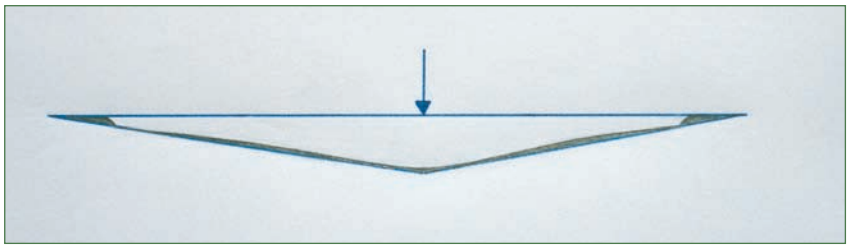
INSTALLING A BASS-BAR

A chance meeting with a structural engineer inspired JOSEPH CURTIN to redesign his bass-bars. He explains where it took him

One evening in 1985 at the bar of a hotel in Mittenwald, I met a young German structural engineer. Thinking he might help me understand more about the violin bass-bar, I unfolded a napkin and drew a line representing a flat violin top, viewed from the side. 'Let's say I wanted to design a beam to support a load here,' I said, drawing a downward-pointing arrow in place of the bridge. He asked me to clarify a few details and then drew a shallow, upside-down triangle, its apex hanging directly beneath the bridge. Explaining the engineering as he went, he rounded the apex, changed the straight lines into curves and gradually came up with the design I now use. It is deepest directly under the bridge. The portion of the bar extending from the bridge to the bottom end of the instrument is slightly more scooped than the portion extending to the top. The curves flow into each other the way they do on the hull of a racing yacht.

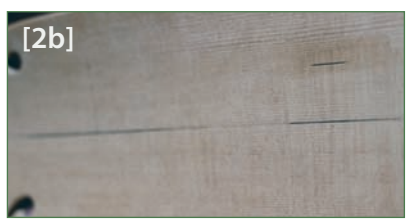
STEPS 1–2B



This simple drawing of a load-bearing beam led to the development of a new bass-bar design

PHOTO LUCCHI & SONS

The Lucchi meter is used to measure the speed of sound in wood



Marking up the inside of the back to fix the position of the bass-bar

[1]
In selecting wood for a bass-bar, I choose spruce with a low density and/or a high speed of sound along the grain. The speed of sound is most easily measured with a Lucchi meter. Divide the Lucchi number by the density and you get the 'radiation ratio', typically between 12 and 16 for spruce. All else being equal, wood with a high radiation ratio results in a bar that is lighter in weight for a given stiffness. With spruce, a high radiation ratio correlates fairly well with low density, so if I didn't have a Lucchi meter handy I'd simply choose the lightest wood. The grain should be straight; I prefer it on the fine side. I cut and plane a piece to 5.5mm on the quarter-cut face, about 300mm long and 20mm wide.

[2a]
I use the centre joint to establish a centreline on the inside of the top, then I draw a line representing the back of the bridge. Next, I mark a point 1mm inside the outside edge of the bass bridge foot (1.5mm for viola), then another 5.5mm inside this first point. The bar passes between these two points.

[2b]
After measuring the upper bouts from the centreline to the widest point of one edge, I divide the measurement by seven then mark a point that distance to the right of the centreline. I do the same for the lower bouts; the bass-bar will run parallel to a line connecting these two points.

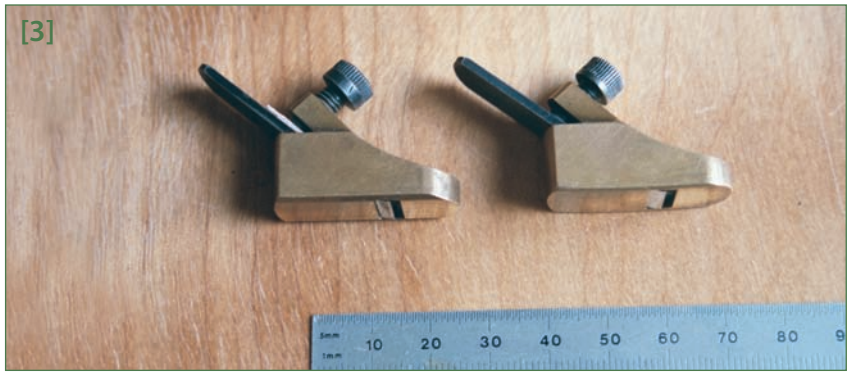
STEPS 3–6

[3]
I trim the length of the blank so that its ends are 35mm from the upper and lower edges of the top (40mm for viola). After gluing, 5mm will be trimmed off each end. I fit the bar roughly, by eye, using a knife and the thumb planes shown. One has a flat sole; the other is curved slightly along its length.

[4]
The jig was designed and built by Sharon Que, an artist, violin maker and former colleague. The violin top is held flat by a perspex plate. Two adjustable guide arms allow the bass-bar blank to be slid quickly and accurately into position during fitting. The arms are angled so that the bar leans four degrees off vertical toward the centre of the instrument.

[5]
I clamp the top on to the jig using cardboard strips to prevent dents. The guide arms are positioned so that the bass-bar is in its intended position, then the mounting screws are tightened to secure the arms. I draw a vertical line on each side of the bar at the point where it crosses the back-of-bridge line. These lines, along with the guide arms, make it easy to place and replace the bar in exactly the same position.

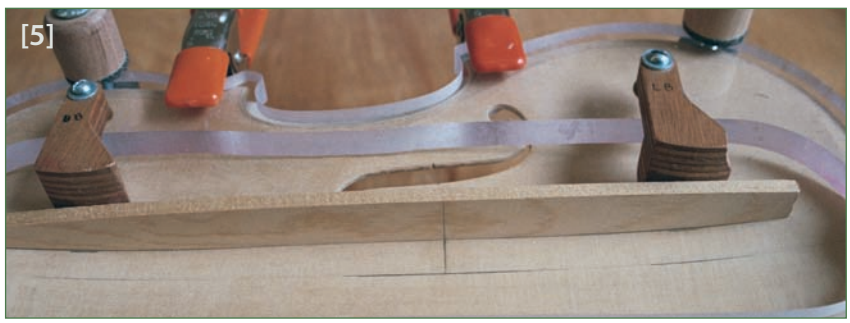
[6]
I fit the bar using red pigment rather than the traditional yellow or white chalk because I can see it better. Though almost all the pigment is removed with a soft eraser before glue-up, there is sometimes a faint pink blush around the finished bar, which doesn't bother me, but I only work on my own instruments. I spring the bar by about 1.5mm – when the centre of the bar is just touching the top, there is a 1.5 mm gap at each end. As pressure is applied at the ends, the gap gradually and evenly closes from the centre outwards. ▸



VIOLIN PHOTOS: JOSEPH CURTIN

The bass-bar is shaped to fit using thumb planes. The one on the right has a curved sole

The violin top is held flat against a perspex plate



The bass-bar is held in its position at four degrees to the vertical by the guide arms, which are locked with the mounting screws

The bar is sprung by about 1.5mm

STEPS 7–9

[7]

I bevel the top of the bar so that during gluing the clamping force goes directly through the bar's centre, minimising any tendency for it to tilt off-axis. I dry-clamp the bar in preparation, then remove the clamps and warm the gluing surfaces of the bar and the violin top with a hairdryer, which hangs beneath my bench and is activated by a foot switch. After gluing and clamping, I allow any excess glue to gel before removing it with a pointed stick and a slightly moistened rag. (Wetting the top wood can cause distortion.)

[8]

Once the glue is dry, I plane the bar down to about 14.5mm at the centre and 3.5mm at the ends and then trim the extra length from each end. Next, I plane the entire length of the bar to the desired profile, keeping the top flat. The function of the bass-bar is, I believe, to stiffen the top while adding the least possible mass, so I deviate somewhat from the traditional cross section, which resembles a parabolic arch. Because the stiffness increases far more quickly by adding height rather than width, I leave the bar rather high but flatten its sides with a plane, a sanding stick and a scraper so that the finished cross section resembles a triangle with a rounded tip. My bass-bars typically measure 14mm at the centre, 3.5mm at the ends and weigh 3–3.5g; 16 mm, 4 mm and 4–5g respectively for violas.

[9]

I adjust the final dimensions to bring the tap-tone, known as mode 5, up from about 310Hz without the bar to about 370Hz with the bar (from 240Hz to between 300Hz and 315Hz for violas). These figures work well for me and are typical for the old Italian instruments I have measured. ■

The top of the bar is bevelled so that the clamping force acts in the correct direction

The bar is planed to the desired profile – about 14.5mm in the middle and 3.5mm at the ends

The final dimensions are tweaked to bring the mode-5 resonance to about 370Hz

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