Timber Lamination

Bow Stave Lamination

Frater João Baptiste de Olivieri

7/27/2009

This document describes the process that is used to glue layers of timber together for strength and for an appealing appearance.

In this document I will describe the basic process required for the lamination of timber sections to give an attractive and strong stock for making stuff out of wood. I use this method for the construction of bow staves in the production of longbows, recurve bows and (soon) horse bows.

Lamination Background

Lamination is the sticking together of two or more materials (or slices) using an adhesive and pressure. We know from physical evidence and documentary evidence that lamination has been used in many fields throughout history. Homer tells us of bronze laminated shields in "*The Iliad*" and in 1937 an iron laminate was found that may date back to 2750BC.

Timber lamination for the production of bows was improved through the invention of waterproof adhesives. Early timber lamination using hide glues are rarely found as they tend not to survive in archaeological contexts. There are documentary sources for timber laminated bows including eastern horse bows and Chinese and Japanese bows. The highly favoured Yew bows of England are made of a natural lamination of two types of timber occurring in the cross-section of the Yew tree. A hard and less flexible dark wood that is favoured for the core of a bow and the softer and more flexible light wood favoured for the belly of the bow.

The purpose of manmade lamination is to improve the durability and strength of timber by supporting the timbers natural grain with a straight and flat pseudo grain (the glue). In this way, the carpenter can rely on a straight and even manufactured grain.

Laminating Considerations

When you are considering how to laminate, there are a number of questions that you will need to address. The answers to these questions are very much dependent on what you are making with your manufactured timber.

How many lames?

Essentially, the answer to the first question is artistic. But it is also a question of overall thickness and how many layers you want for the appearance and strength. Ideally, the number of lames should not be less than three. So if you want to have the minimum number of lames, then you divide the width of the finished profile by the number of lames to give you the thickness of the lames you want. For my bows, I tend to have 6 lames. 2 lames for the body and 4 lames for the core of the bow. Typically, my lames are 4mm thick.

Lame Materials

You can make your lames from pretty much any material you want. You must give consideration to the way that the original stock performs when choosing what materials to laminate. If you are making a bow … don't use softwood and don't use anything with a coarse grain.

I have used Tea Tree and Sassafras so far for bow stave material (Sass is used as the body material) and it is a satisfying timber combination.

Lamination Adhesives

The question of adhesives is also a question of application. If you are making a laminate for furniture or for something that will be rigid and inflexible, the right glue for you would be a solid epoxy, pretty much any of the marine epoxies are good for this sort of thing. However, if you want flexibility and strength, then you are going to have to go for a more specialized epoxy. I tried using a marine gel epoxy that claimed to be flexible, but unfortunately, the glue failed and I had an exploding bow in my workshop. What one industry says is flexible, may not be considered flexible enough in another industry.

I now use specialised epoxy glue that is manufactured for the bow making industry.

You can also purchase epoxy tints to add some colour to the adhesive, this gives a nice separation from the timber lames if you want to highlight the construction of the laminate.

Clamping the Lames

Setting up and clamping your lames is probably the most important part of lamination. Ideally, you will have enough clamps (g-clamps or f-clamps) so that you can squeeze the lames together evenly across the surface of the material. Again this is going to depend on what your end purpose is for your manufactured timber.

For my first bow stave, I used an L shaped piece of timber 2400mm long and 15 f-clamps. The f-clamps were spaced about 150mm apart along the length of my bow stave. I glued up the first two lames and then clamped; waited for the glue to set up and then glued and clamped the next lame to the structure. Of course this took a lot of time as I needed to wait 6 hours between lames and my lovely wife was a bit put out that I kept disappearing into the workshop every six hours (including adding a final lame at bed-time).

I have now made a lamination jig constructed from two pieces of Tassie oak. The Tassie oak pieces are 100mm x 18mm x 2400mm. I drilled two rows of 24 holes (set in 15mm from the outer edges along the length approximately 100mm apart). 48 ¼ " x 800mm bolts, 96 washers and 48 wing nuts are used to clamp the two Tassie oak planks together. This jig provides a lot better even pressure along the length of the bow stave and can be used to glue up and clamp the entire 6 lame stave in one go. So I can happily glue up, clamp and set aside for the full 24 hour curing time.

Where to from here?

When the glue has completely cured, you can then turn your attention to using the laminated timber. Cutting the timber with a table saw or chop saw is pretty straight forward, as is shaping the timber with a plane, draw knife, etc. When you are cutting the timber on the oblique with a band saw, coping saw or any other flexible blade, remember to cut well away from the line (at least 3mm) because the blade will wander when it gets to the lamination point (the epoxy is harder than the timber).