EXPERIMENTS IN VALUE-ADDED PROCESSING FOR RURAL MICRO-SAWING ENTERPRISES

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WOODWORKERS' SAWMILL AND KILN'
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EXECUTIVE SUMMARY

An overview of the emerging micro-sawing industry and the importance of value-added processing is given. Four value-added products are investigated and presented as positive examples of what is possible with simple skills and basic shop equipment. The equipment used to process the special products is reviewed as to function, performance and cost. Total cost of equipment needed to begin value-added work is suggested to be roughly $12,000. Trial results of a veneer-style glued flooring system, a kit of parts for heavy workbenches, and a sample bentwood rib are discussed. An outline of wainscoting options is given as an example of an architectural treatment. Suggestions for expanding and customizing local value-added opportunities is presented in the context of a viable and integrated harvesting-sawing-drying-processing-marketing business. A bibliography directs the reader to further reading and resources.

ACKNOWLEDGEMENT

The author wishes to thank the director and staff of the Natural Resources Canada - Forestry Service in Winnipeg for their continued support of research to assist this province's rural small-scale sawyers. Through the various parts of this research and training effort, an emerging industry can find guidance and encouragement in developing methods to better serve Manitoba's woodlot sector.

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INTRODUCTION

This report is the third part of a body of work aimed at rural micro-sawing enterprises. Funded under the Canada-Manitoba Partnership Agreement in Forestry, this research is in support of Manitoba's emerging woodlot sector: the many small-scale sawyers provide a means for the lumber from private woodlots to come to market. A portion of the success of woodlots for those who desire an economic return, then, rests with the skills and attitudes of the small-scale sawyers.

The rise of rural micro-sawing businesses is in part a response to an increasing awareness of the virtues of private lands forestry and in part a response to the public's desire for more responsible forestry practises. Areas close to forestry resources are demanding more local employment, local control, and local benefits than has been typical in the past.

To keep in step with new attitudes towards sustainable forestry, the small rural sawmills need to radically change their focus. Where it was common in the past to simply rough cut lumber to one or two sizes and send it to an urban area for processing, the local consequences were minimal low-level employment and minimal economic spin-offs. For woodlot owners, the return on log sales was so low that they chose instead to let their trees fall over from old age. The concept of a high volume, high waste, rough-cutting sawmill that remains perpetually marginal in an attempt to satisfy wholesalers has more or less died out.

Fortunately, some recent improvements in small-scale bandsaw mills and simple kiln equipment have facilitated great changes in small rural sawing operations. It is now far more likely that the sawyer is doing a combination of custom sawing and log buying, sawing the logs with specific markets in mind, performing his own drying, and selling directly to end users. The benefits of this activity to the local economy are obvious.

As they gain confidence in selling to end-users, sawyers are now looking for value-added opportunities to increase the return from their lumber. This report tells of trials with four types of value-added products that are available to rural sawyers. It is intended to give a few concrete examples of workable products using Manitoba woods, but also to give encouragement to all the other small businesses who will develop and market the special products that suit their

local resources and local needs. Along the lines of catalogues of value-added opportunities in forestry being developed in the United States, this report looks at Manitoba's potential.

THE ROLE OF VALUE-ADDED PROCESSING

Traditionally, lumber processing - drying, planing, and conversion into products for market - was of little concern to sawyers. The log resource was cheap and plentiful, the circular mill sawed quickly, if a bit wastefully, and transportation costs were low. The key to staying in business was to crank out the highest possible volume of rough lumber and keep expenses on par with, or under, the competition. The wholesale buyers, likely near the urban areas, took care of drying and sorting the rough product for resale to other processors, who might in turn sell to a cabinet shop who later sold a retail product. All in all, it was not a system that helped the rural areas - the only activity done near the resource was rough sawing, and that was marginal at best. All the profitable operations, drying in particular, seemed to occur elsewhere.

Many events have now conspired to render the traditional system unworkable and obsolete. Foremost is our realization that our supply of mature wood is diminishing both in volume and quality. Secondly, as the easily accessible and underpriced crown timber supplies diminish and buyers turn to private forests, woodlot owners are demanding a more equitable share of elevated lumber and wood product prices. Thirdly, rural communities are closely scrutinizing the industries active in their region and will no longer accept being hewers of wood and haulers of water simply so that inexpensive raw material is supplied to urban processors. They see no reason why the profitable secondary processing cannot be done locally. And finally, sawyers with new and efficient mills are wanting to do something more interesting and profitable than simply supply rough lumber to others.

Where wood formerly passed through many hands between the log and the end-user, it is becoming much more likely that the same small sawmill operation has harvested the log, sawed it, dried it, processed it into a finished product and sold it locally. As pointed out in earlier reports in this series, the addition of a kiln is the essential first value-added step. It gives the sawmill access to an end-user market. However, there are limits as to how much dried lumber one can sell to woodworking hobbyists, cabinet shops, and wood-using manufacturers. A much larger market opens up if one can process the dried lumber into finished products for retail sale.

If a sawyer is going to perform some value-added processing to his lumber, the important question is what products can be produced without the addition of specialized equipment and the need for special skills? There is little sense trying to add a furniture factory onto a sawmill business - the making of furniture is a complex business unto itself, and requires full-time management. An appropriate value-added opportunity for a small sawmill operation, then, has to be a reasonably simple and straightforward operation.

Would it be appropriate to obtain the equipment needed to make a variety of mouldings as a strategy for getting into value-added products? It may make sense for a specific mill with access to lots of very clear material in the right species, but generally, there are two problems with mouldings as a widely applicable addition to a sawmill operation. Firstly, it requires quite expensive machinery that is both elaborate and suited to only one purpose. If mouldings do not sell as expected, the equipment may be hard to adapt to any other purpose and difficult to sell off. Secondly, only a small portion of a given log is suitable for moulding uses - it must be virtually clear and quite long. If your log supply includes short logs and mostly logs of only average quality, you will have little raw material for mouldings. So, two points are obvious: it is wise to avoid expensive and specialized equipment and the value-added product has to suit your log supply.

These basic concepts, then, form the limits for an appropriate value-added product for a small rural sawmill:

1. the processing must involve only *basic and simply mastered skills* - it is not desirable to add an operation or process that requires the sawyer to turn his focus away from lumber production to learn a whole new set of special skills,
2. any additional equipment required must be obtainable for a *reasonable capital cost,* and,
3. additional equipment required must be *non-specialized and versatile: able to perform many jobs.* If the product fails to be popular, the equipment must be usable for other jobs and/or common enough so as to present no problems for resale.

The above limitations will help determine the type of processes that can be undertaken in pursuit of value-added products. But what about the products themselves? Are there obvious or desirable features required in the type of products selected? Two broad aspects come to mind:

1. a desirable product will be one which is *common in both rural and urban markets.* Rural markets have the advantage of being close at hand, but they may be lightly populated. Urban markets may be distant, but are densely populated. Try for a product that will sell in both.

2. an easily marketed product is one with *wide public acceptance.* The more 'basic' the product is, the more potential customers there are.

In summary, there are some important limits to be heeded if a small sawyer looks for value-added opportunities with a chance of success. The whole equipment aspect has to be manageable, and the product has to be widely saleable. However, one should not be discouraged in the belief that there will be very few opportunities that will fit within the limitations. Hardwood and softwood are incredibly widely used in Canada. The construction and furniture industries are obviously major users, but, so too are the transportation industry, the agriculture industry, boatbuilders, trailer makers, and many others. Added to those is the whole woodworker and hobbyist sector, and the do-it-yourself home improvement market. The opportunities for selling wood in a form other than rough boards are truly vast!

The objective of this report is to research and present ideas and methods for four value-added products as examples of what a small-scale sawyer might undertake to improve the return on his wood sales. The following products were chosen for study:

1. hardwood flooring - square-edge, thin-cut, glue-based application,
2. kit of parts - pre-sized package of parts for a woodworking bench,
3. bentwood and arch-ribs - thin-cut laminated products, and
4. wainscoting - decorative wall panelling using short stock.

SHOP EQUIPMENT AND TOOLS

As stated above, the broad parameters for equipment purchase are reasonable capital cost and versatility. Fortunately, several lines of stationary shop equipment are currently available at very reasonable cost. Not so many years back, one chose between the very highly priced industrial units or very light and underpowered units aimed at hobbyists. There now exists a wide choice in heavy equipment that is too expensive for occasional users but much less expensive than fully industrial units. One can follow the various articles in magazines like *Fine Woodworking* (Taunton Press) that describe vast improvements in castings from the Orient. Some of the equipment is built entirely overseas, while some is 'North American made' using castings and other parts from overseas.

Of course, the old proviso holds, 'you get what you pay for.' This equipment is not of equal durability and precision to units from the traditional

industrial equipment makers. But realistically, a sawyer pursuing some value-added processing is not likely to run the machines 8 hours per day, week in and week out, as might be common in industrial applications.

It is also perhaps a wise strategy to purchase modest equipment that is affordable and get started working with it. If the application proves successful, upgrade to better equipment as warranted.

The following equipment was purchased to facilitate work on the four products to be studied:

1. 20" thickness planer
2. 25" thickness sander
3. 8" jointer
4. 16" resaw bandsaw

Two other pieces of equipment were already on hand as part of the normal sawmill and drying operation - a 10" table saw, and a 10" mitre saw, used principally for trimming stock for kiln loading or prior to sale.

1. **Thickness planer** - King Canada model CT508, 20" width, 4 knife, 3 hp, 2 speed infeed, 220 volt-20 amp., $2200.

Thickness planers are used to surface lumber one side at a time. Powerful rollers grab the stock and push it under the knives at a controlled rate. This type of planer will not straighten warped lumber but will simply press it flat through the machine and remove an even cut from the entire face.

2. **Thickness sander** - King Canada model KC24DS, 25" width, double drum, 5 hp, fixed rate infeed, 220 volt-30 amp., $2200.

Abrasive thicknessing equipment has become common in order to handle finishing work on glued panels and doors with grain running two directions. Its purpose here was to be able to handle surfacing of material with no risk of tear-out near knots, and to handle surfacing of elm wood which is said to tear-out on planers due to its interlocked and reversing grain pattern. Thickness sanders perform stock removal much slower than planers.

3. **Jointer** - King Canada model CT200, 8" width, long table, 3 knife, 2 hp, 220 volt-15 amp., $1300.

The jointer's long tables allow one to true up edges of boards and to flatten faces up to the unit's knife width. A rough twisted board can be given one flat face on the jointer, then thickness planed in the planer. As well, a substantial fence allows boards to be given a 90°corner, producing two true surfaces.

4. **Resaw bandsaw** - Hitachi model CB75F, 16" throat, 3" x 1/16" blade, 1-1/2 hp, 120 volt-20 amp., $4200.

A bandsaw designed for resawing has a very wide blade and will hold a straight course while cutting with the grain. A power-feed unit is available to allow a portable bandsaw mill to do resaw work, however, to do such a task as sawing 1/4 inch thick slices from 2-1/2" stock, it is a simpler matter to use a proper resaw. As well, the resaw blade has a thinner kerf than the bandsaw mill. The principle use for the resaw was to cut thin flooring material from common 1" and 2" stock, and to prepare the various sizes of stock needed for workbench construction. This particular resaw has accessories that allow for the use of conventional widths of bandsaw blades for cutting curves.

The four pieces of equipment together represent an expense of just under $10,000 (as of early 1995). If also purchasing a 10" table saw and 10" mitre saw, add roughly $2,200. For a total investment in the range of $12,000, one can assemble 6 very versatile basic shop machines that open up a range of value-added possibilities.

FLOORING

MARKET OVERVIEW

Wood flooring is a product with a long tradition and a consistent popularity. Its use fluctuates somewhat in residential construction according to changing styles, but a solid market is always present if one can cover the renovation and commercial uses as well as the new home construction sector. The public is now recognizing wood flooring as a durable and beautiful alternative to any man-made floor covering. It is both repairable and easier to maintain than other surfaces. Wood flooring offers a healthier floor surface than carpeting which many now see as a hazard for holding dust, pet hair, and micro-organisms. Both rural and urban residential markets are active for wood flooring as well as a growing commercial market for showrooms, offices, etc.

Red oak, tongue and groove, strip flooring in 2-1/4 width is by far the most common. The same size in hard maple probably fills the second most popular spot, considering all the gymnasiums done with maple. No single species occupies third place in popularity, but it can be divided among birch, ash, white oak, cherry, hickory, mahogany, teak, fir, and poplar, while pine finds use for some residential

floors and dance surfaces. Thicknesses include the common 3/4", and 5/8", 1/2" 3/8" and 5/16. The tongue and groove edge is used as a way to hold edges in alignment and to provide a location for blind nailing. Square edge flooring has been used for many years, typically face-nailed or screwed down. Board widths can be as narrow as 1-1/2", 2-1/4 is common, and widths to 6" or more can be found. Wide boards are usually fastened through the face in addition to edge nailing. Some flooring is factory finished and may have a slight V-joint at the edge to hide any irregularities in thickness because it cannot be sanded flush after installation. Another factory floor product involves applying several boards to a backing of plywood or particle board to produce a wide panel. Parquet flooring can be found in great variety and offers a clever application for short stock and cut-offs from other wood production processes.

European wood flooring manufacturers have dealt with the shortage of wood and increasing prices by developing veneer-type products that use only a thin layer of high-value wood applied to a backing of lower grade wood strips, plywood, or particle board. One would be hard pressed to find any 3/4" solid stock flooring in use because it is simply too expensive. In the face of our own shrinking wood resources, and decreasing quality in some species, there is little doubt that systems using less high grade wood will appear on the North American market as well.

OUTLINE OF RESEARCH ACTIVITIES

The objective in finding a suitable flooring product for small-scale sawyers was to develop a square edge, thin-cut stock that could be installed entirely with glue. Avoiding tongue and groove edges is not simply a way to avoid the need for tongue and groove (T&G) equipment. Traditional T&G flooring has a usable surface extending only as deep as the top of the tongue, regardless of how thick the flooring may be. Three quarter inch flooring, then, has a usable surface roughly 1/4 inch thick, after which one would sand into the fasteners and the tongue. Thinner material with a T&G edge offers even less usable thickness. By using square edge stock free of fasteners, almost the same durability can be accomplished with 1/4" thick stock as is offered by 3/4" T&G.

Thin material can be produced directly off the the bandsaw mill, kiln drying proceeds more quickly, and square edges are simple to produce in the shop, so there are attractive benefits from the production side. Perhaps most important are the potential to stretch our wood resources and to obtain a higher return for a given log.

In essence, this is an attempt to duplicate an existing factory process on site. That is, thin stock is routinely glued to sheet backing in a factory setting - can it also be done directly onto a existing floor? One benefit of installing veneer on site as opposed to using a pre-cut product is that on-site work will fit exactly while pre-cut materials will be wasteful in matching existing room dimensions. As well, one has the option of doing special treatments such as borders or patterns, and the opportunity to use accents with other species.

Sawing: Stock for the flooring trials was typically rift-sawn hardwood cut from the high grade outer portion of the log. The 1/4" bur oak stock was resawn from 1" and 2" boards, some rift-sawn, some quarter-sawn. Ash was cut in 1/2" thickness according to common grade-sawing practise. Elm was cut in the same manner, but 3/8" thick. One benefit of sawing thin material directly from the log is that initial slabbing is very light, after which usable material is produced even from the flared butt portion. As shown in Figure 1, it should also be possible to cut a board of 2-1/2" thickness, with waney edges, and then slice out thin material using the resaw to produce quarter-sawn stock. Material from the angle-cut portion will be wider than 2-1/2". The wasted triangular sections are an unavoidable consequence of any attempt to cut quarter-sawn lumber. This method was not tried for this report, and is only speculation. It is unknown if one should dry the stock as 2-1/2" or slice it into thin material before kiln drying.

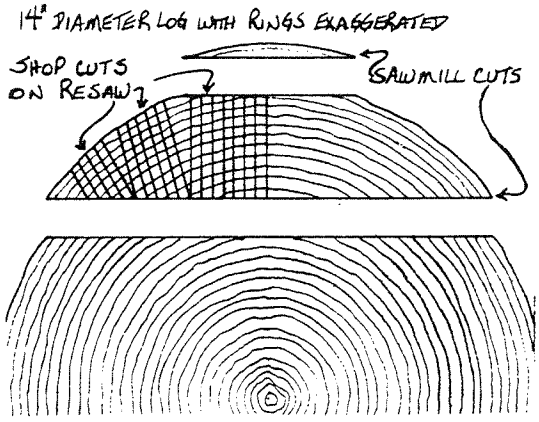


Figure 1 - variation on quarter-sawing

Drying: Consult the second work in this series regarding operation of small-scale dehumidification kilns for more information on drying stock under 1" in thickness. Close stickering and stack weighting will be helpful in drying thin stock. A final moisture content of 6-8% is appropriate for flooring stock.

Processing: Stock was given a straight edge, ripped to width and surfaced in various ways depending on the wood's condition after kiln drying.

Oak: One and two inch thick bur oak boards were ripped to 2-3/8" wide on the table saw, then jointed to give one true edge. They were then resawn on the Hitachi saw to give 1/4"x2-3/8" pieces. This material was returned to the table saw set for 2-1/4" and ripped to final width with the jointed edge against the fence. Finally, the strips were fed through the thickness planer with the poorer face being planed smooth. Ends were trimmed, random length, on the mitre saw.

Ash: Half inch thick boards up to 8" in width were jointed to give one true edge and then ripped to 2-1/4" on the table saw. The poorer face was planed smooth in the thickness planer.

Elm: Three eighths thick boards up to 15" wide were jointed to give one true edge and then ripped to 2-1/4" on the the table saw. The poorer face was surfaced by the thickness sander using a coarse abrasive on the leading drum and a medium abrasive on the second drum. A portion of the material was also passed through the thickness planer and, surprisingly, showed no tear-out despite the highly changeable grain pattern.

Glue: The ability to successfully glue the flooring stock is obviously the key to this whole approach. Many glues were investigated as to suitability. The main problem is how to hold the stock in place while the glue sets. Contact cements are attractive for their instant hold, but have a long drying period before the instant hold is possible, and are also prone to slippage after the initial grab. They are also quite weak in comparison to more common wood glues.

Hot melt systems were attractive in that a pair of beads of hot melt adhesive could be pre-applied in the shop so that on-site installation would be not unlike 'ironing' down the flooring. However, heating even thin stock of 1/8" caused instant cupping across the width by driving out the remaining moisture from the face. The glue did hold very tightly, though.

The notion of using radio-frequency equipment to set hot-melt glues without heating the wood led to a company in the United States that manufactures a portable 'microwave' unit for instant glue setting. One unexpected feature of this equipment is that it uses common white or yellow wood glue rather than the more expensive hot-melt glues. It was not possible to obtain a unit for testing, but correspondence is underway to learn of how others are using this tool for flooring work. The $4500 cost of the unit may be justified in order to pursue this flooring system in earnest.

It was finally decided to test common and inexpensive glues that were very strong and readily available. Elmer's yellow carpenter's glue was used as well as Lee Valley's GF202 woodworking glue. Both are water based for easy clean-up and offer joint strength in excess of the wood's strength. Lee Valley's product has additional gap filling ability and is a superior glue for general woodworking. These same glues would probably be appropriate for use with the radio-frequency equipment as well.

Installation: All stock was stacked and stickered in the room to be re-floored for at least one week to allow it to acclimatize and reach the correct moisture content to suit the home. A portable humidity sensor was used to monitor

Photo 1 - installation over plywood

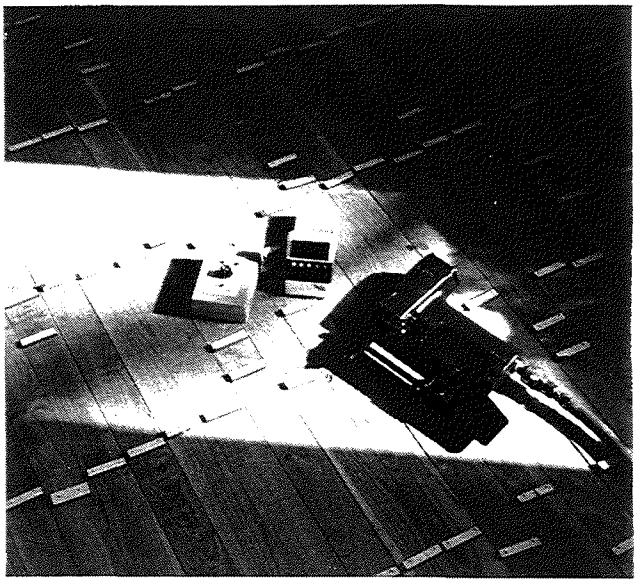
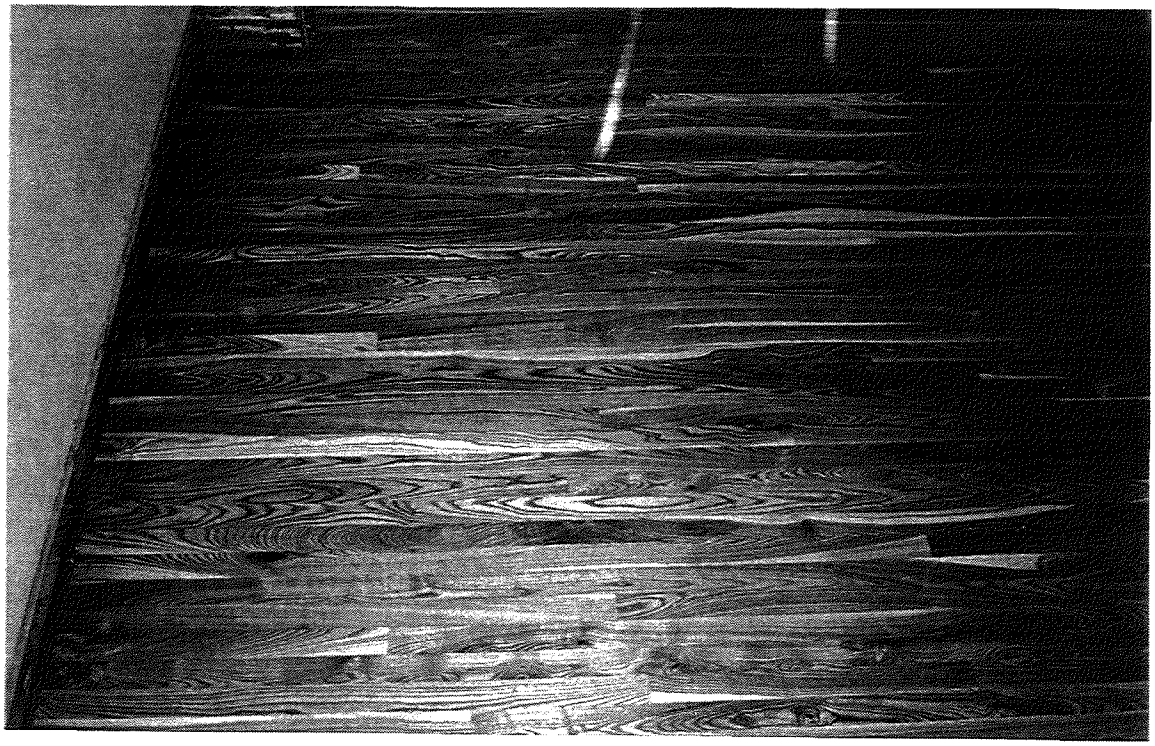


Photo 2 - meters and brad nailer

relative humidity in the home - typically near 40% during the heating season. After a conditioning period, the flooring was laid out loose on the subfloor to arrange the end-joints in random pattern. Installation began with a wide, generous layer of glue spread onto the plywood with a 4" putty knife (not a notched trowel). The first row was laid and secured with a pair of 18 gauge brads driven through a 1/4" masonite block at 16" intervals. Photo 1 shows installation progressing. The red lines indicate the exact location of plastic radiant floor piping on the plywood's underside, so as to avoid nailing near these. Brad length is selected to avoid penetrating through the plywood as an added precaution. In addition to the glue

Photo 3 - finished ash floor



on the subfloor, glue was applied to the edge of the strips that would meet the strips already laid. Before driving the brads, the strips were pushed tight against the edge and end of preceding strips. Occasionally, extra levers were used to pry curved stock into place, as it common with 3/4" T&G installation. Recall that the poorer face was planed, and this is the face that goes down. Contrary to the common opinion that slightly rough surfaces glue well, wood glue performs better on a well planed, smooth surface. The planing, then, is for the sake of the glue, and it is unimportant if minor tear-out occurs near knots on the glued face. Glue coverage is roughly 4 liters per 70 square feet.

Every effort is made to fit the strips tightly together but small gaps do occur. This is not unusual for any wood floor application - it simply does not install as tightly as cabinet work. However, the filling process hides these imperfections. By the time the last strip is glued down, the masonite blocks can be pried off and the brads pulled out on the first section of floor laid. If the air nailer was set properly, the brads will have penetrated the surface of the masonite slightly and, thus, be easy to pull out when the masonite is pried away.

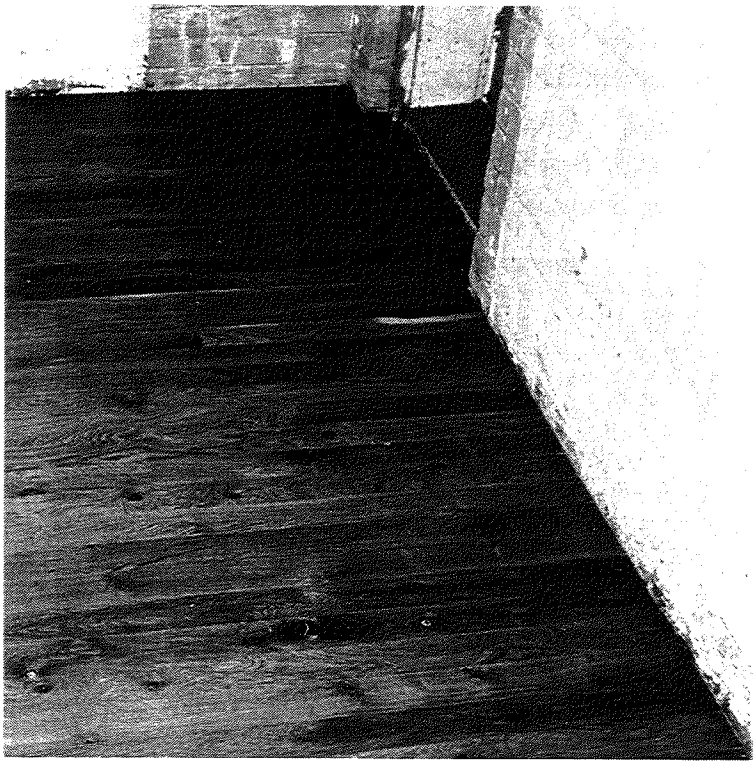


Photo 4 - bur oak installation

After installation, the bandsawn surface is facing up, and numerous small gaps plus all the brad holes will be visible. As well, there may be differences in height at many edges, termed 'over-wood'. While the overall appearance may be rough at this point, sanding and filling will result in a good final appearance.

From this point on, the floor is like any other, and the good advice given in Bollinger's installation books and videos should be followed. Initial sanding was at 45° to the grain with 36 grit paper, then parallel, followed by 60 grit medium sanding, then filling, then fine sanding with 120 grit. Large drum sanders are commonly rented, along with edging sanders. Again, Bollinger's book explains all the procedures in detail.

Filler used was a water-based, pre-coloured product for oak, however it was too light for use with bur oak which finished to a walnut-like shade of brown. Filler for oak flooring would normally be intended for red oak stock which finishes much lighter than bur oak. The oak filler was a good match for the ash floor, however. Filler can also be made using the sanding dust from the final sanding of the floor plus a lacquer or other base. The colour match would then be exact. The brad holes virtually disappear when filled - it is possible to find them if bent close to the floor and aware of their location, but are otherwise not noticed.

Final finish used was 'Street Shoe' commercial coating by Basic.

The elm flooring is being used to make a portable display of this flooring system for promotional purposes, and will include oak and ash samples as well.

RESULTS

The finished appearance of the floors is very pleasing and shows no variation from the normal quality of more common wood flooring. They should allow many re-sandings before penetrating through their thickness.

Installation was slower than nailing T&G flooring - the use of glue slows the process considerably. However, with some practise and more suitable glue applicators, the extra labour should be reasonable. The process of laying out the strips ahead of time to plan joint locations is common to T&G flooring as well, and the use of an air nailer is also similar to both systems. Spreading the glue and later pulling out the brads are the extra steps with this system.

One concern often expressed with a glued system is that it cannot accommodate any movement. The belief is that a nailed floor can swell and contract slightly to adjust to changing humidity in the home. Moisture certainly does play havoc with large areas of wood, whether it is table top or a floor. In this case, however, the generous glue layer on three sides of the wood strip should act as a barrier to moisture, and the 4-layer top coat provides good surface protection. It is therefore unlikely that the flooring can readily pick up the seasonal changes in humidity likely in a home. As well, a high strength glue applied to the entire surface gives a very solid connection between the wood strips and the plywood subfloor, which resists any tendency to movement. Obviously, wood strip flooring is a risky choice over a damp surface like concrete, or in an area likely to be damp on a continuing basis. And certainly, care should be taken to refinish the surface once the original coatings show signs of wearing through. But in most applications, one would expect this system to perform as well as more conventional ones.

FURTHER INFORMATION, SUPPLIERS

Books: Hardwood Floors - Laying, sanding, and finishing, Don Bollinger, The Taunton Press, Newtown, CT., 1990, 137 pages - an excellent guide to all the details of wood flooring. Companion videos are also available.

Glues: Lee Valley Tools, 1080 Morrison Drive, Ottawa. Wide variety of woodworking glues available by mail order.

Adhere Distributors, 29 Keith Road, Winnipeg. Consultants and suppliers of adhesive products.

Equipment: Bortons Industrial Sales, 464 Hargrave Street, Winnipeg. Suppliers of several lines of industrial and semi-industrial woodworking equipment, including King and Hitachi.

WorkRite Inc., 1315 South Flower Street, Burbank, CA., manufacturer of the WorkRite Wood Welder, radio-frequency glue setting tool.

Finishing supplies: Bill Knight Flooring, 895 Century St., Winnipeg - source for filler and finishing supplies by Basic Coatings.

KIT OF PARTS

MARKET OVERVIEW

The number of serious amateur woodworkers and hobbyists has grown dramatically in recent years. The whole 'do-it-yourself' movement has been strong since manufacturers started introducing products for simple use in the 1970's, and one off-shoot has been a great many people doing woodworking projects for enjoyment. The more serious and dedicated woodworking enthusiasts have similarly grown in number as evidenced by the number of tool stores aimed at the non-professional, the vast selection of high quality tools for the amateur, and the many books and magazines currently in print.

However, Manitoba has seen little effort to supply the lumber needs of the non-professional woodworker. What is available is typically a sideline for a store that deals primarily in home construction or home renovation products. Lumber sizes are geared to construction needs - 3/4" red oak boards are easily found, but not 4/4 or 5/4 or 6/4 - all of which suit cabinet and furniture making. There is also a great lack of grade selection, so that only the highest grade of hardwood is offered. The serious woodworker has access to only a small sliver of the full range of hardwoods and softwoods traded on a commercial basis.

Especially disappointing is the near total lack of any native Manitoba woods. It would be easier to locate a piece of obscure African hardwood than to find any bur oak for sale in local shops. We now have a population with a taste for a great many woods that do not grow here, and no appreciation for the ones that do.

This represents an opportunity and a challenge for Manitoba sawyers. One strong advantage in favour of supplying serious woodworkers is the ability to offer a wide variety of special sizes and a variety of grades. Any hobbyist would much rather come to a sawmill location and pick out his boards instead of buying it in a home renovation store. He will likely also ask for some custom planing or sawing, which is another small value-added service the sawyer can offer.

If this line of reasoning is pursued further, it will be realized that woodworkers making only one item at a time face another problem. Often a small quantity of a specific sized material is needed. For instance, a table project may require enough 10/4 hardwood to make four legs of 30" length. With some diligent searching, one may find a large piece of clear 12/4 material. Not only is it the wrong thickness, but there is much more than needed. If any grade other than clear would have sufficed, then he is also buying a better quality than necessary. One strategy for the small sawyer is to try to provide the needed amount of the correct size and quality.

'Kit of parts' is simply the concept of putting all the pieces needed, in rough cut form, together into one package. The attraction for the buyer is being able to get the right amount of what he needs in the right sizes.

Take, for example, the traditional woodworking benches seen in the better tool shops. It is a solid hardwood bench with two vises arranged in the pattern evolved by woodworkers over the centuries. It might also be referred to as a 'Scandanavian' bench. Prices start in the $500 range and go quickly to over $1,000. One alternative is to purchase a 'hardware package' such as Lee Valley offers for just over $110. This includes plans and drawings for the bench plus the steel vise parts and special hardware to simplify the assembly. The cutting list asks for 70 board feet of hardwood, starting with 12/4 stock and progressing through 9/4, 7/4, 6/4, 5/4, and 4/4. It would be nearly impossible to find these sizes of material locally in any species, and very expensive and wasteful to resaw all the sizes from thick stock, even if the woodworker had a resaw capable of the work. Consider, also, that this application does not require the highest grade of material - the pieces are oversize and overstrength partly in order to add weight to the bench. This is one example in which a package of rough-cut lumber pieces of the correct size would be a tremendous saving to the buyer.

RESEARCH ACTIVITIES

Pursuing the kit of parts concept for demonstration purposes, a package of hardwood pieces was prepared to match the cutting list for a Lee Valley 'Scandanavian Bench Kit'. The pieces were then fabricated according to the instructions to make the bench.

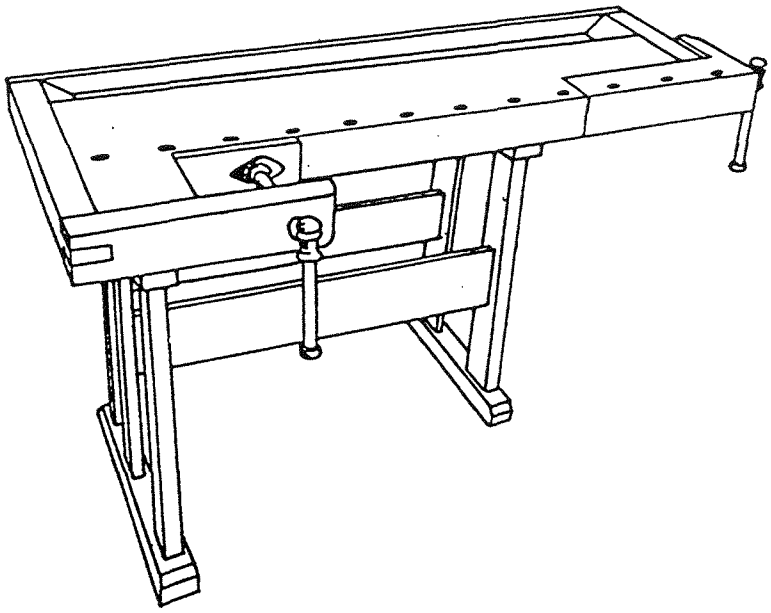
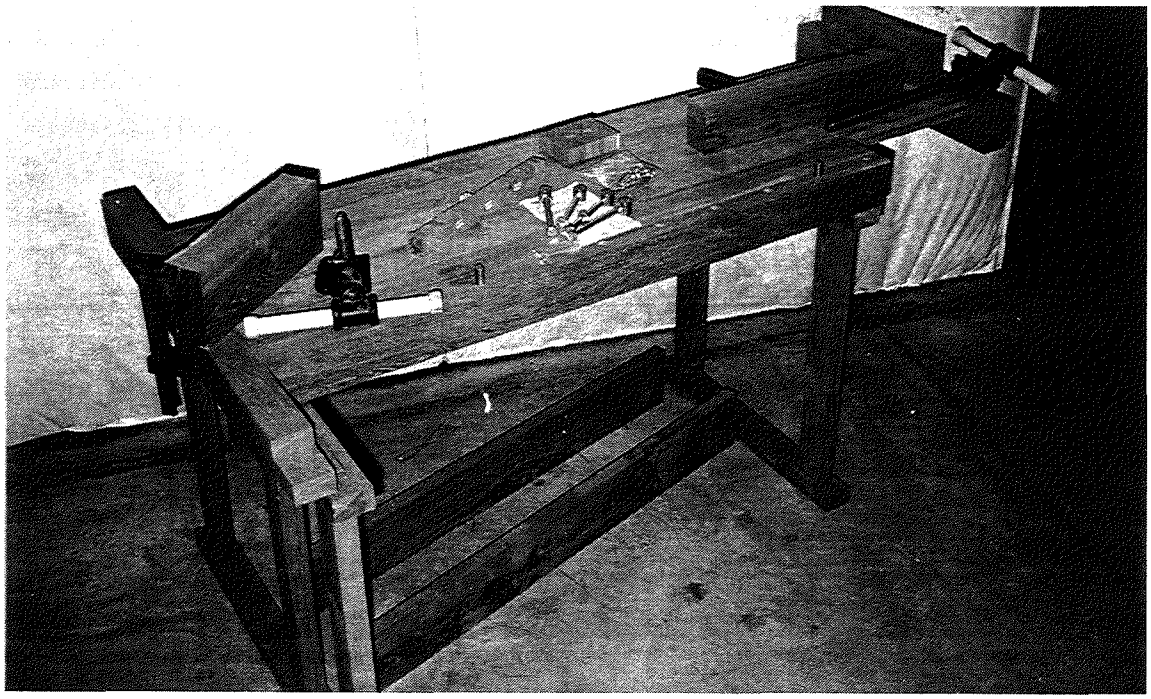


Figure 2 - Scandanavian workbench

From existing kiln-dried supplies, the cutting list was filled using bur oak. The resaw was used to resize the stock to fit the sizes listed, and it was then cut to length with the mitre saw. Some planing was done to true up any twisted stock, but it was otherwise left rough. With prior knowledge of the common sizes needed in the kits chosen to produce, the sawyer would, of course, be cutting to the correct thickness right off the log. The only other processing would then

Photo 5 - bench in bur oak nearing completion



be ripping to width and cutting to length.

As noted earlier, this application does not demand first grade or clear material. Sound wood with tight knots is quite suitable. Photos 6 and 7 show the

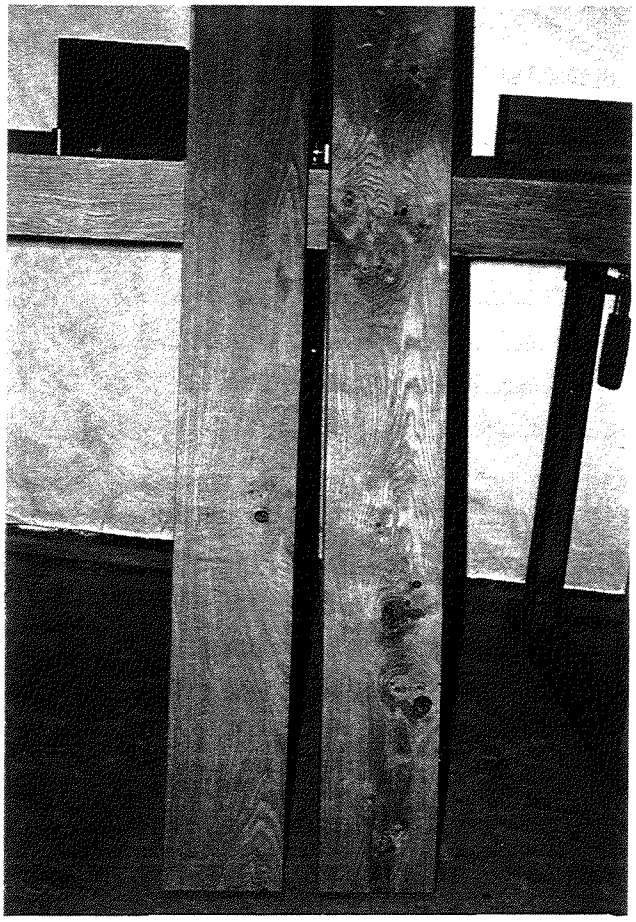


Photo 6 - base stretchers

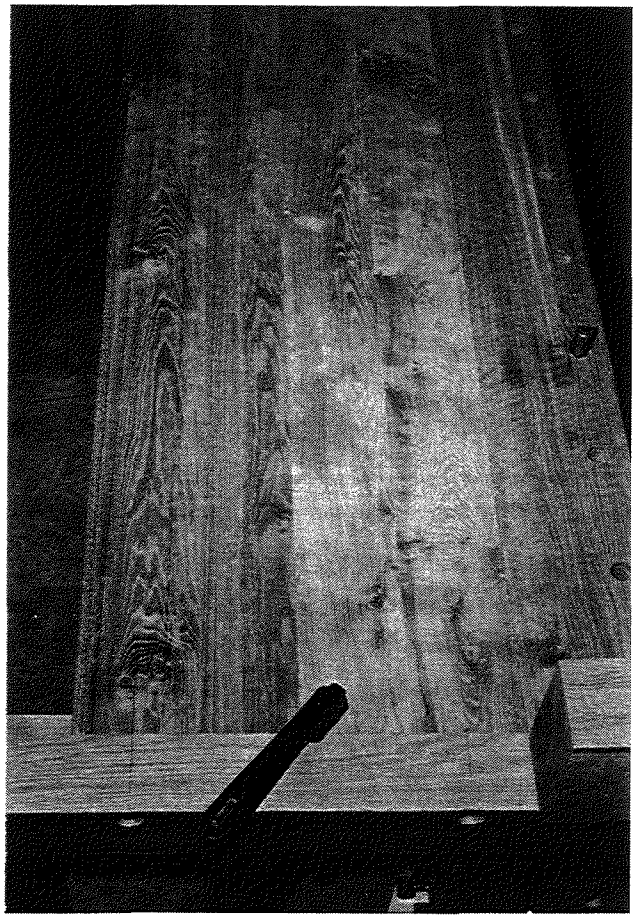


Photo 7 - bench top

quality of wood that can be used. The stock is more than strong enough for the application and quite attractive. However, because of the knots, these same boards have little value in the traditional hardwood market: they would end up as container decking or pallet stock and return to the sawyer less than the cost of sawing. But as a bench part, they are worth much more.

PACKAGING, PRESENTATION, AND MARKETING

While construction of the bench was undertaken as a demonstration piece, the value-added operation is simply to prepare a package of rough-cut lumber pieces for sale. It would be a selling feature to have a finished bench on display, but the suggestion for kits of parts is not to be in the business of making

finished articles, but simply preparing bundles of wood correctly sized.

Local lumber yards may be interested in re-selling kits of parts, and may prove a simple solution to marketing. Woodworking tool shops are more likely to be receptive because a good wood supply is complimentary to their main task of selling tools.

As to selling price, in the case of the workbench kit, 70 board feet of material is involved. If the hardware kit sells for about $110, a prospective builder might expect to pay at least that much for the wood components. In fact, the alternative of searching out thick stock and buying whole boards would be very expensive with 12/4 hardwood running in the range of $5 per board foot, 8/4 at $3, and 4/4 at $2.50. A pre-sized package should bring in the range of $125-150. Recalling that the material is not high grade, a return of $1.75-2.15 per board foot is good. It is a good return to the sawyer for offering exact quantities and sizes, and it a very good option for the woodworker needing small quantities of special sizes.

The workbench kit was chosen to show the type of value-added possible using the kit of parts concept, and it had some nice aspects - a wide range of unusual sizes in small quantities, the opportunity to use lower grades of wood, and a readily available hardware package with plans, prepared by others.

The same concepts will bring to mind many other wooden articles that can be approached with a kit of parts. The key is to look for articles that require unusual sizes - either very thick or very thin, or falling between the common sizes. Full one inch lumber is attractive to someone with access to only 3/4" and 1-1/2" stock. Look also for opportunities to use lower grades of material.

Softwood applications might include outdoor furniture like Adirondack chairs, rugged benches, wooden swing sets, outdoor tables, and so on. Many furniture and cabinet projects can be done with softwood or hardwood.

Hardwood applications might include common furniture projects, bunk beds, shelving systems, benches, and even architectural treatments like stairs and railings.

The concept can be adapted slightly to become a service offered rather than a pre-packaged product. A sawyer could offer to fill a cutting list for any project that woodworkers bring in. The sawyer charges a higher price for the package over the ordinary per.board foot price and provides all the stock rough-cut. The buyer has the benefit of buying exactly the quantity needed and avoiding expensive leftovers and unusable cut-offs. By dealing with projects by request, the sawyer avoids the need to second guess the market and prepare items which may not sell as expected.

FURTHER INFORMATION, SUPPLIERS

Workbench kits: Lee Valley Tools, 1080 Morrison Drive, Ottawa - mail order and retail locations in Canada, supplier of bench hardware kits and supplies, as well as a complete range of tools and supplies for woodworkers.

Woodworking supplies: The Canadian Woodworker, 1054 Portage Avenue, Winnipeg - wide selection of books, magazines, tools and equipment for woodworkers. Woodworking school on site.

Lee Valley Tools - as above.

Magazines: Fine Woodworking, The Taunton Press, Newtown, CT - well-established journal of the best woodworking in North America, published since 1975.

Fine Homebuilding, The Taunton Press, Newtown, CT - the journal for the best in home construction and renovation, published since 1981.

Canadian Workshop, Camar Publications, 130 Spy Court, Markham, Ontario - monthly magazine for the do-it-yourself handyman.

BENTWOOD AND ARCH-RIBS

MARKET OVERVIEW

The practise of slicing lumber into thin slats and gluing them into curved shapes has applications in area ranging from agricultural buildings to curved window caps. Quonset buildings of all sizes, as well as many barns, are built using curved ribs laminated from 3/4" or 1-1/2" softwood lumber. One can find special architectural features such as 'eyebrow' dormers which employ curved structural members. One of the more striking recent applications is for support members in sunrooms attached to residences (photo 8, overleaf)

Regardless of the scale, the concept of cutting wood into pieces and gluing it back together is part of a general trend being necessitated by the condition of our wood resources. Finger-joint mouldings have long been a way to overcome a shortage of long clear moulding stock and a way to use cut-offs. 'Glu-lam' beams offer a structurally superior alternative to long solid timbers. Some products even grind up wood to small dimensions and then recombine the fibres into solid material.

Arch-ribs have been made for many years and were not developed to deal with wood supply problems, but rather to make economical use of medium

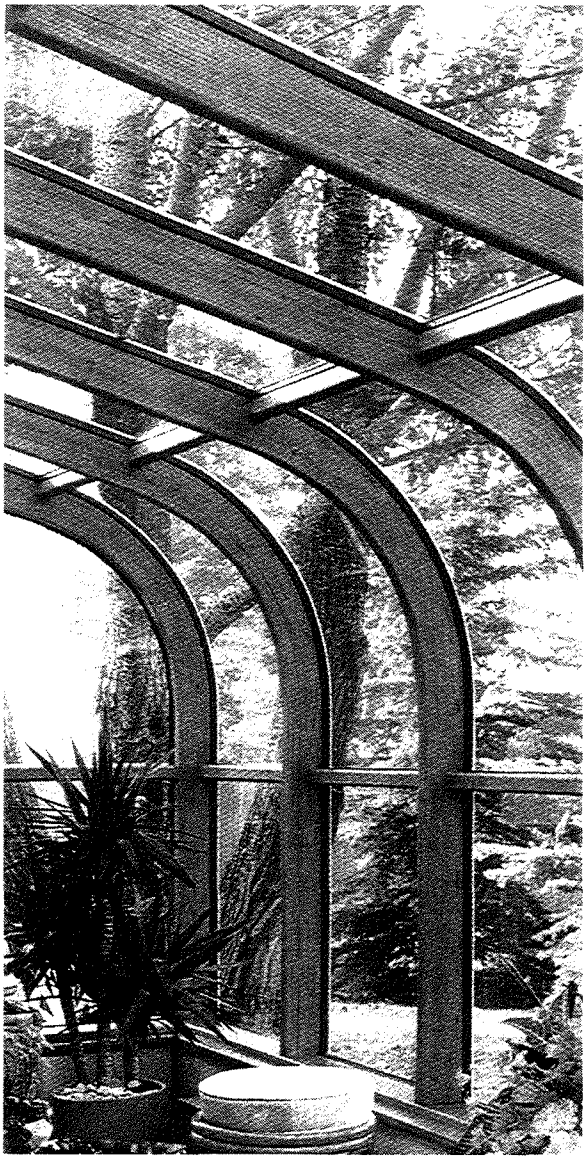


Photo 8 - sunroom arch-rib

quality lumber in a very durable and strong architectural member. The use of a curved rib to form walls and a roof is a great saving of material and labour compared to building vertical walls and a sloped roof. The rib also offers very good snowload capacities and wind resistance.

RESEARCH ACTIVITIES

The objective with bentwood applications was to investigate the possibilities for using Manitoba's native woods in various arch-rib uses and to create a demonstration piece. There was a specific desire to find uses for elm, for two reasons. Firstly, it is a unique wood with good bending qualities and a resistance to splitting. Secondly, given the ravages of Dutch Elm Disease, Manitoba has a huge surplus of dead and dying elm on the stump. Some will yield furniture grade material, but there will also be a large volume of lower grades - what are the best uses for it?

Quonset ribs: There are at least two manufacturers of ribs for arch-rib construction in Manitoba - Western Archrib in Boissevain, and Dueck's Laminated Rafters in Rosenort. The fabrication of construction ribs is subject to CSA approved materials and methods, so lumber sold into the rib manufacturing plant must be limited to certain grades of softwood lumber. No work is currently done with hardwoods, partly because the Canadian Code does not allow its use. Small-scale sawyers could approach the manufacturers with graded softwood, provided that the lumber is dried to 15% moisture content. Current codes call for the use of S-P-F, or spruce-pine-fir. Nominal 1x4 and 1x6 stock (3/4" x 3-1/2" and 3/4" x 5-1/2") is used by one maker, in lengths 8' and longer. CSA standards outline acceptable knot frequency, size and location, as well as other defects.

Small quonsets: The author has had experience building small quonsets with laminated members. Quonsets 14 feet in width with 8' headroom were built using common 1x4 construction spruce. A steel jig was welded up to allow the use of C-clamps to hold a total of 5 layers of 3/4" lumber into a rib pattern. A basic carpenter's glue was used, and nailing with coated nails helped in assembly. Erected on five foot centres, strapped, and sheathed with 1/2 plywood and metal, the resulting buildings were extremely strong. Following more conventional practise, the same building would be built using ribs made from 1x2 or 1x3, to give a profile closer to a 2x4 on edge rather than a 4x4. Slightly thinner stock, perhaps 1/2" or 5/8" would bend more easily for small ribs. A superior glue, such as plastic resin glue or resorcinol glue would give better service than common carpenter's glue.

The intent here is not to find a low-grade use for high grade woods, but to suggest economical uses for that portion of hardwood that falls down into the lower grades. Even the presence of pin knots forces otherwise sound and usable boards into the lower grades where the sale price may be below the cost of sawing. Similarly, any staining from mildew or fungus pushes a board out of the high grades. Perhaps a value-added construction application like arch-ribs is a better use than having the wood be sent for pallet making or blocking in the trucking industry.

While CSA standards prevent the use of our hardwoods in large-scale rib manufacturing, anyone wishing to fabricate a smaller rib for a use such as garages or sheds can have a structural engineer specify the correct size of member to meet strength requirements. As a very rough rule of thumb, one would estimate the necessary arch-rib to be similar in size to a framing member doing the same work. The rib will be stronger than a solid member and an engineer can calculate the correct dimensions but the rule can serve as a rough estimate. Tables exist for all the common softwoods and hardwoods, so the rib size can suit the strength of the specific species used. Important to good glue performance are a planed surface, correct moisture content of the wood, and adequate clamping.

Architectural ribs: As a demonstration piece, a rib sized for a small eyebrow dormer was made up. Elm strips were produced by thickness planing both sides of 3/8" stock directly from the sawmill, kiln dried to 12% moisture content. A very simple jig was made by bolting 2-1/2" oak blocks to a sheet of 3/4" plywood, forming the desired curve. Wax paper was used under the rib during gluing to prevent the strips from bonding to the jig. Ends were scarfed at 60° to give some gluing surface in the overlap. Joints were staggered throughout the assembly as 7

Photo 9 - rib in jig

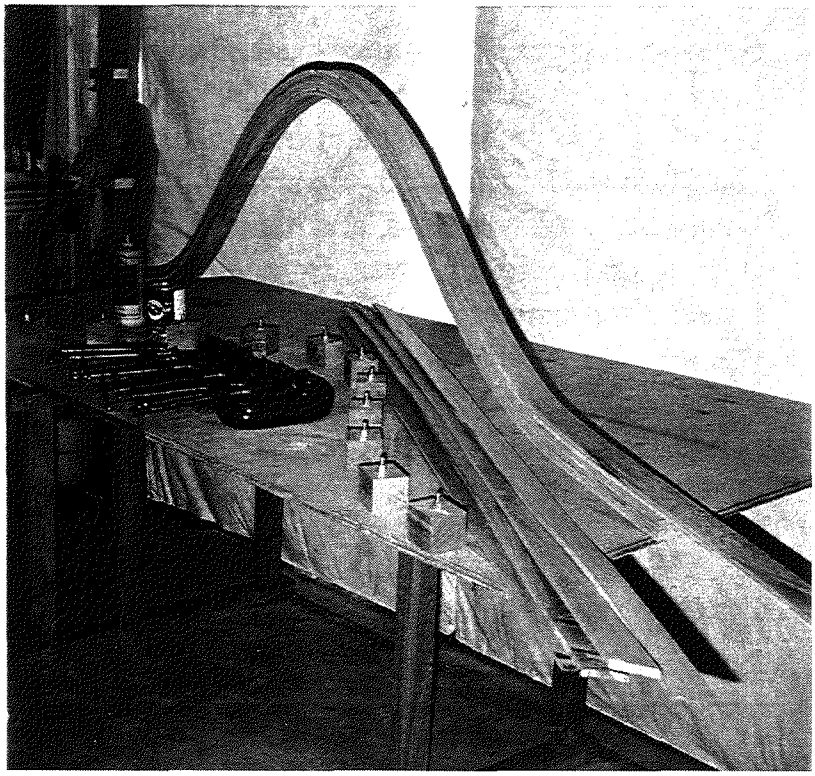


Photo 10 - finished rib

layers of wood were used to complete the rib. Plastic resin glue was used to provide waterproof glue joints. No metal fasteners were used during assembly, however, short nails in an air nailer would have made assembly easier and would have lessened the need for accurate clamping. After surfacing in the thickness sander, the rib will be incorporated into a value-added display for public showing.

DISCUSSION

The ability of the bandsaw mill to cut very accurate thin lumber and access to a drying kiln open up possibilities for the sawyer to develop curved members in hardwood or softwood. Jigs can be simply fabricated, and assembly is straightforward. Engineering assistance is available for situations where strength is critical. Appropriate glues are easy to work with and readily available.

Effort is required to locate niche markets for these products. For instance, garden centres may be interested in gentle arches for making backyard bridges, as well as curved members over gates and trellises. Some areas may hold possibilities for fabricating ribs for small quonsets or garages. Architectural uses may be available through custom home builders. Hardwood ribs are in use for sunrooms.

FURTHER INFORMATION, SUPPLIERS

Books: no books or even single articles have been located on this topic. Engineers use no special reference for this area, but rather, apply standard formulae and design criteria.

Glue: Adhere Distributors, 29 Keith Road, Winnipeg - consultants and suppliers of various adhesive products.

Lee Valley Tools, 1080 Morrison Drive, Ottawa - mail order and retail stores in Canada, supplier of a wide selection of glues and gluing tools.

Arch-rib makers: Dueck's Laminated Rafters, Box 11, Rosenort - manufacturer of ribs for quonsets, barns, cottages and sheds.

Western Archrib, P.O. Box 580, Boissevain - manufacturer of ribs for hangers, curling rinks, agricultural buildings, shops, halls, and storage, offices in Alberta, Saskatchewan, Manitoba and Ontario.

WAINSCOTING

MARKET OVERVIEW

The use of wainscoting, or a wooden panel system from the floor to chair height, goes back hundreds of years. The term, 'wainscot', is a reference to wagon sides, because the wall panelling followed the pattern set by wagon builders. Wide panels were bevelled at their edges to fit into thick uprights - a method that allowed for swelling and contracting of the wide panel in response to the humidity.

Wainscoting can occasionally be seen running to heights of 6 feet from the floor, in which case it is combined with a plate rail - not uncommon in dining rooms. It is typically close to 36" - just above the height of chair backs. Chair rails originally installed to protect wall surfaces became a convenient cap for wainscoting and the two functions were combined. For residences with 10 foot ceilings, the wainscoting may have run to 48" in height.

Like wood flooring, wainscoting has wide appeal and is used in many applications. It is of interest to the small-scale sawyer because it is one of the few products that uses short lumber. For example, a wainscot extending to 36" from the floor may require only 30-32" stock for the upright members between the baseboard and top cap. In total, then, one long top rail and one long baseboard can be sold together with dozens of 32" pieces.

As of mid-1994, wholesale buyers were not even accepting 3 foot material, regardless of its grade. For a sawyer with a mixture of long and short logs, much material will be rejected by the buyers. However, the portable band mills can easily handle the short material, and there is no need to waste short sections of butt log if an alternative use can be found.

PROCESSING AND MARKETING

In addition to being a good use for short lumber, wainscoting offers an opportunity for a kit of parts product. There are currently no pre-packaged sets of material aimed at the wainscoting market - a buyer is left to select a top mould and a baseboard and then cut long material to length to make the in-fill pieces. To offer a kit of parts, the sawyer would provide an 8' top rail and an 8' baseboard of, perhaps, 6" height, together with 96" of in-fill coverage. The infill could be 1/2" stock ripped to 3" width and V-jointed. Running a shallow sawcut along the edge and providing a loose tongue to fit is a simple alternative to tongue and groove treatment. For every pair of 8' boards sold, 32 pieces of short narrow stock is also sold. As shown in Figure 3, many variations are possible using this concept.

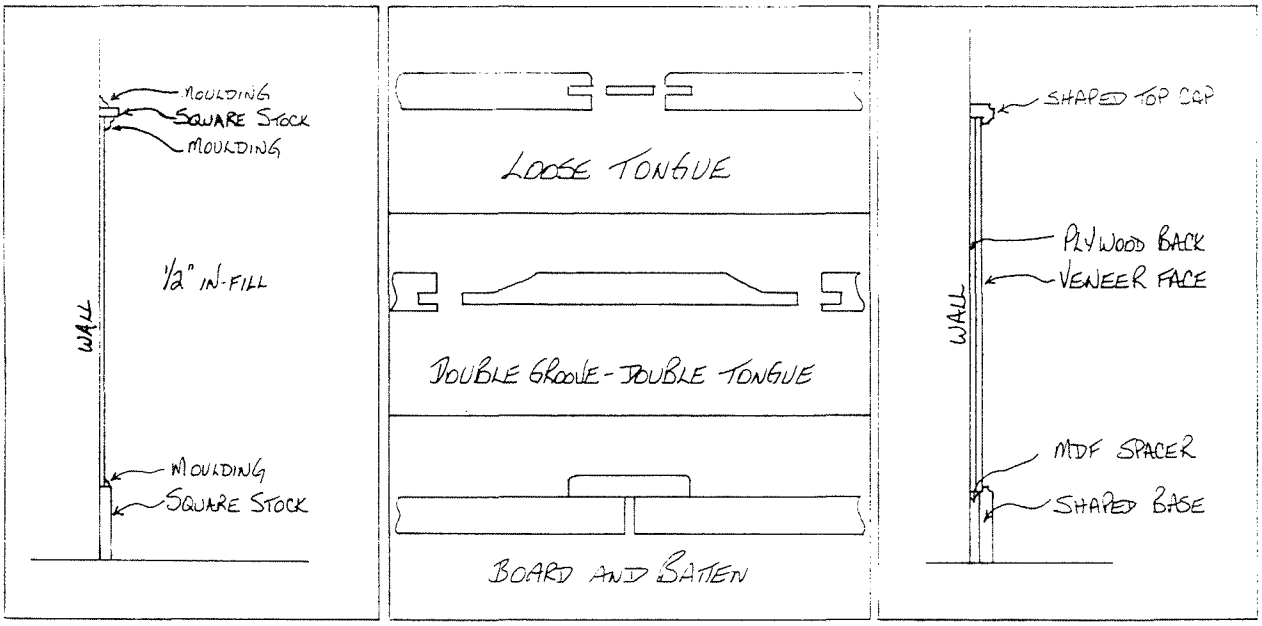


Figure 3 - variations on wainscoting construction

It is also possible to prepare the in-fill panel in long sheets - perhaps gluing thin stock to plywood to give 8' lengths of in-fill 32" in height. Lapping the last member over the plywood edge and insetting the leading member of the next panel allow for hiding the seam.

The most attractive wainscoting will usually involve a shaped top rail

and possibly a coved section in the baseboard. A shaper could be purchased for roughly $1,300 but the volume of shaped material needed may not justify the purchase. One could have moulding custom shaped by a larger shop, using one's own stock. Top rails and baseboards are often made up as two pieces, so that the shaped stock is a small edge treatment applied to common surfaced lumber.

As to in-fill treatments, great variety is possible as will be seen if one notices the many styles to be found in older buildings and some of the better new construction. Plain boards may be V-jointed and employ a shiplap edge or a loose tongue or proper tongue and groove treatment if desired. One of the more traditional methods involved narrow uprights with grooves on both sides and wide uprights bevelling down to tongues on both sides. Plain boards can also be assembled side by side with a slight gap to be capped by a batten of thinner stock possibly 1 to 1-1/2" wide. More intricate systems can involve the traditional 3/4" uprights with 3/4" stiles to form squares of between 12 and 18" which are in-filled with bevel-edge panels of the same wood or a contrasting material. Certain commercially available 1/4" hardwood plywoods can be matched to our native woods (birch and ash, for example) and used for in-fill panels.

Options range from the very simple, with all square edge stock, to the very elaborate, with shaped edges and true frame and panel construction. In either case, the sawyer is able to produce a valuable architectural treatment by essentially cutting stock to size, surfacing it, and (possibly) performing some edge shaping. This constitutes a very high return for material under 36" in length.

FURTHER INFORMATION, SUPPLIERS

Magazines: Fine Homebuilding, The Taunton Press, Newtown, CT - good source of interior finishing details like wainscoting in both new construction and renovation work. Indexes are available for checking back issues.

Fine Woodworking, The Taunton Press, Newtown, CT - often covers interior finishing work from the cabinetmaker's viewpoint. Check the indexes for articles in back issues.

Equipment: Bortons Industrial Sales, 464 Hargrave Street, Winnipeg - source of shapers and bits by King, Powermatic, and others.

THE VALUE-ADDED SAWYER

The basic shift taking place in Manitoba's small sawmills has many aspects, but perhaps the single most important change is that the sawyer is now likely to know exactly what end use a given board will have before he cuts it from the log. This gives the best possible chance for finding the highest and most valuable use for each piece of wood. By taking advantage of advances in small-scale bandsaw mills and kilns, and having some knowledge of value-added opportunities with basic shop equipment, the sawyer can have an efficient, flexible and viable business rooted in the rural economy.

In the past, a sawyer cut a few standard thicknesses, a helper fed the board into a pre-set edger and then the whole lot was trucked away. Someone else selected the better material for drying and resizing, then re-sold the rest to another processor who, in turn, cut his sizes out of the stock and did some more processing. We no longer have the luxury of an abundant mature wood resource to support such a wasteful system. Nor are today's sawyers willing to struggle with a marginal sawing operation that supplies raw material for everyone else's greater benefit.

To maintain a profitable sawmill operation in the face of a shrinking resource, the sawyer has to train himself in all the details of extracting the best material possible from his log supply. This involves a good knowledge of wood itself - how it dries, how it machines, which grain orientation is needed for special uses, what sizes suit each end use, and what determines the grade of material being sawn. The bandsaw mills offer accuracy and versatility not possible with previous equipment, but the sawyer needs to understand all the different patterns that have evolved over time for sawing a log - plain sawing, rift sawing, sawing for grade, quarter sawing- as well as some new ones -'sawing from the inside out', and so-on.

But all this knowledge about producing lumber is of little use without knowing what the lumber will be used for, what the ***markets*** are. And, hence, the need to understand the basic operations that lumber undergoes to become a finished product. It only makes sense for the sawyer to perform some of the more basic value-added operations and be able to benefit from the knowledge that went into his sawing efforts. Aside from the obvious economic benefits of turning a raw material into a finished product, there is much greater satisfaction in completing a process rather than perpetually doing only the first one or two steps.

This research has tried to give some general direction and some concrete examples in the area of value-added processing suited to small sawmill operations. If it has been at all successful, then the sawyer will have realized that

areas like wood flooring and arch-ribs need not be huge and mysterious industrial processes that could never be tackled on a small scale. Ingenuity and a sound knowledge of wood will carry one far along the road to producing valuable finished products.

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