AN EXAMINATION OF JAPANESE WOOD LAMINATING TECHNOLOGY

WP-OI 95.10

by

Derek Williams

Funding for this study was provided through the Opportunity Identification Program of the Canada-British Columbia Partnership Agreement on Forest Resource Development: FRDA II

Project Director

Bill Wilson
Pacific Forestry Centre
Canadian Forest Service
506 West Burnside Road
Victoria, B.C. V8Z 1M5

January, 1996

Author

Derek Williams is a secondary wood processsing specialist with Forintek Canada Corporation, Western Division, 2265 East Mall, Vancouver, B.C., V6T 1W5.

Disclaimer

The views expressed in this report do not necessarily represent those of the Canadian Forest Service, the B.C. Ministry of Forests, or Forintek Canada Corp.

This report is available from:

Publications
Pacific Forestry Centre
Canadian Forest Service
506 West Burnside Road
Victoria, B.C. V8Z 1M5

fax 250 363 0797

TABLE OF CONTENTS

LIST OF DRAWINGS (Not available in Acrobat version)

LIST OF FIGURES (Not available in Acrobat version

1.0 Introduction

This report looks at the Japanese laminating industry from the perspective of the technology and techniques used in manufacturing laminated products. Through contact sessions held with Canadian embassy officials, B.C. Trade officials and with members of the various Japanese laminating industry associations, information on the potential of laminated wood products in the Japanese market was made available. On completing the plant tours, a visit was made to the most prominent woodworking machinery trade fair in Japan, the Nagoya International Woodworking Machinery Fair. This fair provided a window on the latest developments in wood processing technology of Japanese origin.

This mission was planned and organized by the B.C. Wood Specialties Group Association for its member companies to learn more about the Japanese laminating industry and to meet face to face with potentially new customers. (See **Appendix A** for a list of the participants.) The small, medium and large laminating plants visited gave the tour participants a broad spectrum of what processes, techniques and technology is used in the laminated wood products industry in three locales: near Tokyo, Osaka and Nagoya. The majority of plants toured were involved with the laminating components for the traditional post and beam house or for the traditional room found in any Japanese home. The post and beam method of construction has undergone considerable change recently after experiencing catastrophic destruction in the Kobe earthquake and as a result of a shortage of carpenters skilled in building these houses.

As a compliment to this report, the author would like to recommend the B.C. Trade publication *REPORT ON THE LAMINATING INDUSTRY IN JAPAN* by Blake Willson. This report will give the reader some interesting background information on the types of laminated products, general standards for laminating stock, testing procedures and a host of other relevant information to anyone considering manufacturing laminated products for the Japanese market.

2.0 Summary of Canadian Government and B.C. Trade Information Sessions

Over the week long visit to Japan the group of tour participants had three meetings with members from the federal government and with representatives from B.C. Trade. One of the federal government officers was a specialist in forest products trade while the others were from the Osaka consulate. B.C. Trade personnel, some of whom are Japanese nationals, were equally well versed in trade and business opportunities in the forest products sector as they relate to B.C. interests.

The federal government's role in forest products trade in Japan is to look into issues that revolve around markets for Canadian forest products, the distribution system for these products and with JAS standards. They provided the group with some interesting statistics on Japanese home construction for the upcoming year. These corresponded

fairly well with the numbers provided by the various companies contacted. The emphasis on what the forest product specialist said centred around the potential for sales in pre-fab housing components and in imported housing. Unfortunately as interesting as this information was, the mission had its focus on the laminating industry and not the 2x4 imported home construction industry.

Some interesting comments were made with regard to dealing promptly with customer inquiries, aftersales service and in the shipping costs of getting product to the Japanese customer. The Japanese put a high value on prompt answers to their enquiries yet when Canadian suppliers make return enquiries the same promptness is not provided by the Japanese customer. However, the Japanese treat their own suppliers the same way. Canadian firms, that have geared up to sell wood products in Japan, have a good reputation for good aftersales service. Finally, transportation costs for getting a container from a Japanese dock to a customer can be equal to the cost of shipping the container from Canada to Japan. If anything these comments suggest that Canadian companies exporting to Japan need to carefully plan their actions and reactions to the realities of the Japanese market.

The embassy staff handed out a report titled *JAPAN TO 2000*. This is an informative account of what is currently happening in Japan and how this will impact certain Canadian products exported to Japan. Building products are one of the products this report deals with in depth. A copy of this report can be found in **Appendix B**.

The B.C. Trade office personnel provided the group with further information on wood products trade in Japan. A quarter of B.C.'s overall trade is done with Japan and most of this in forest products. The level of trade in laminated wood products is expected to grow and many countries are coming to Japan to sell these products. The last note about laminated wood products dealt with market share -- the U.S. has 28% of the laminating business in Japan. This gave the impression that B.C. Trade expects B.C. companies to win over some of the market share in laminated wood products.

B.C. Trade offers its B.C. client companies a variety of services with one of the more beneficial being a trade intelligence service. This involves market research and trade support for companies interested in entering the Japanese market. There is a user-based fee for this service which is available to all B.C. companies.

The above assessments provided by the Government of Canada and B.C. Trade on the changes occurring in the laminating wood products market place with the resulting opportunities this presents were closely echoed by what the participants heard from the members of the various laminating association.

3.0 Summary of Laminating Industry Contact Sessions

Contact sessions were held with various laminating associations and with individual companies that did not belong to any laminating association. These sessions provided some additional insights as to what is happening in the Japanese market for laminated products, where the Japanese home building industry is headed, who is the competition, how satisfied are they with the competitions products and finally, advice on how to deal with smaller size Japanese buyers of these wood products.

All companies that participated in a contact session were asked about what they perceived to be the future outlook for their industry. Virtually all responded with the same answer: they have all suffered this last year and they foresee the same for the next year as housing starts will be down. There was good news from those in the Kobe area though. This area seemed to be weathering the slowdown better as efforts in rebuilding and renovating houses after the earthquake has presented them with plenty of business opportunities.

Many companies are buying lumber and laminated lumber core from Europe and New Zealand. The Nara Laminating Association claims that 80% of the laminated core stock its members currently import comes from Europe though they say North American glulam stock is of higher quality. Canadian lumber for laminated stock was singled out by one company for not having sufficient control over its moisture content below 12% whereas the Scandinavians have better control in this important area. Another company had a bad experience with kamoi laminated in Canada; it seems that problems were encountered with the laminals not being glued up evenly and that some laminated cores had crook. Refer to **Drawing A** for explanation of this problem given by the complainant. It was claimed that 10% of the order suffered defects like these. On the other hand the New Zealanders make a better product with 100% of the order being defect free. The New Zealanders, it was claimed, have made great strides with their production techniques and in improving quality in the last three years.

There is a push on by Japanese builders to squeeze their wood laminate suppliers to lower their costs. Laminating plants seem to be in a bit of a bind; they are very vulnerable to price fluctuations in their input material from overseas. The biggest cause of this price variation is currency exchange rates. Many are interested in buying laminated cores from outside of Japan in order to remain competitive. There is a growing use of laminated products in traditional Japanese homes with non-decorative hashira (used within a wall) experiencing an increase in use of 100% in just one year. This increase in usage is expected to be matched this year. With decorative laminated products with its veneer overlay, the Japanese still prefer to do this work in Japan though one company did suggest that if the quality was good enough it would consider buying this product from overseas.

Most companies agreed that JAS certification was not needed in non-structural glued wood products. Some companies would prefer it if a plant manufacturing laminated products for them had a JAS stamp as it gives them a degree of comfort. Most agrees that for non-structural products any type of glue would do (PVA, isocyanate or resorcinol)

and that any type of curing system would do as well (RF or cold set).

With the deregulation going on in the Japanese economy the rigid distribution system is being replaced with more direct buying from foreign sources. For the small and medium size laminating company this means that they will have to deal more directly with overseas suppliers. One company suggested, in future, that suppliers have a Japanese speaker available so that faxes and other communications could be handled more expeditiously. This seems like good advice especial if B.C. producers wish to reach Japanese customers new to the importing of these products. This might be an area where some of the secondary wood processing industry associations could help in arranging for translational and interpreter services.

4.0 Laminating Plant Tours

Within the body of this report the names of machinery manufacturers is found in bold lettering. Further information about these manufacturers can be found in **Appendix C**.

4.1 Koike Lumber Company

Contact: Mr. Kigoshi Koike

Koike Lumber is structured into six divisions which are involved in the following types of business activities: planting and tending forests, sawmilling, cement board production, log home components, laminated wood products for traditional Japanese homes and, the most recent addition, a building systems division which machines post and beam structural elements. It was noted that the laminating, sawmill and cement board production centres all occupied the same building. In North American terms this would not constitute separate divisions but only different product lines. Only the building systems division had its own dedicated building a short distance from the main production buildings. The production facilities of the laminated wood products and the building systems divisions were visited.

This company was started in 1911 as a sawmill cutting cedar (sugi) and cypress (hanoki). Today it employs 145 people in all its divisions. It is situated in the Saitama Prefecture which is only 70 km. from Tokyo. The Tokyo region is the largest market for laminated products of the type produced by Koike Lumber.

The laminating division produced 158,000 hashira structural posts in the 105 mm by 105 mm configuration and 60,000 non-structural kamachi (a step used in the ceremonial room measuring approximately 105 mm by 150 mm) last year. The hashira laminals were all clear and of the same thickness dimension. In contrast kamachi laminals, made from radiata pine core material from either New Zealand or Chile, contained a mix of different laminal thicknesses some with heart centres and some that were edge glued and/or

fingerjointed using a fine fingerjoint pattern. **Figure 1** clearly shows kamachi cores made of laminals of different thickness and some that are edge glued. This indicates the extent which the Japanese will go to increase the recovery of the fibre they purchase from overseas. The structural hashira were made from hemlock and SPF on account of their tighter growth rings. Only the hashira was produced under the JAS specifications. **Figure 2** shows a typical lift of shrinkwrapped hashira with its JAS labelling clearly visible.

The core laminating process at Koike begins with the fingerjointing of the laminals using a **Kikukawa** fingerjoint machine. This line was positioned on a mezzanine level in order to reduce space requirements. It was not determined if the defect cutting of lumber was carried out up in that section of the plant or if fingerjoint blocks were bought from another Japanese remanufacturer or from overseas. Once fingerjointed the laminals are surfaced S4S on a **Taihei** moulder. No automatic infeed and outfeed devices were in use for this operation which was strange considering the weight of these products. The core laminating line looked new. It was was comprised of a **Sugii** glue spreader, two core lay-up sections each with **Suzuko** vacuum lift system to automatically pick up and position the glued laminals and a **Kobayashi** rotary composer or press. This press is similar to the the German presses made by Hess and Maweg. Two of the latter presses are installed in a laminating plant in the Okanagan.

Kamachi cores were inspected to determine if any of the knots present were loose. Defective knots were drilled out and plugged using a **Ayen** knot hole plugger.[1] The repair person uses a hand planer to dress off any raised portion of the plug so that it is flush with the surrounding wood. All laminated cores whether they are hashira or kamachi are surfaced S4S by a moulder to correctly size the core and generally clean the surfaces for the laminating of veneer.

Koike produces it own veneer using two **Amitec** lengthwise slicers. One of the slicers was an older model that had a vertically positioned knife. This machine was set in an automatic reciprocating mode to slice veneer. This allowed the machine to be staffed by only one person. The other slicer had the more frequently seen horizontally mounted knife. To provide stiffness to the flitch (as it gets thinner from slicing), a backer board is placed between the flitch and the overhead power feed belt. The backer board has a rubber strip glued to the one side so that the flitch can be firmly griped during the slicing operation. This rubber strip is similar to the infeed belt used on most wide belt sanding machines. Koike has found a use for the remaining portion of the flitch that cannot be sliced further: they are sold to chop stick manufacturers for use in the production of disposable chop sticks.

[1] Detailed descriptions of this method of repairing knots can be found in a Forintek report titled *Trip Report of German and Austrian Remanufacturing Plants* by Derek Williams and a FRDA report titled *Assessment of the Danish and Swedish Wood Gluing Machine Technology* by Derek Williams.

A **Kobayashi** press was used to apply pressure and heat to adhere the veneer to the cores. This line was staffed by 3 people. The applying of veneer was not well understood by the author at this stage of the mission. However, as more plants were visited and the veneering process was seen in more detail, a clearer picture of the entire process emerged.

The input material used in the building systems division is JAS stamped structural glulam blanks made from Douglas-fir and southern pine. For the most part they are supplied by Bohemia, a large US supplier of structural glued wood products, and to a lesser degree by Willamette Industries and Weyerhaeuser. There was the odd B.C. lumber wrap in the yard indicating that some B.C. companies are supplying this plant. These laminated blanks are approximately 12 x 4 inches thick by 5 meters in length.

The technology used in the building systems division, having been recently installed (June 1995), was still in the commissioning stage. There are still bugs to be worked out in its operation. This plant was put into operation in June of this year. The total investment for building, land and machinery was $6.6 million of which the machinery portion mounted to $3 million. The line is designed to produce machined structural elements or pre-cut system as it is known in Japan, for traditional houses. This new method of construction uses metal fasteners instead of the more traditional joinery used by old time carpenters. These metal fasteners make this type of home able to withstand the stresses on the structure generated by earthquakes. More will appear about this new method later in this report.

The line began with the use of a vacuum lift system to load the line with the heavy laminated blanks. The first machining operation is to S1S so that a good reference surface can be obtained for subsequent machining operations. An automatic programmable chop saw cuts the blanks to pre-determined lengths. Small leftover pieces are dumped onto the floor whereas larger leftover pieces are side tracked onto a vacant roller conveyor line to be picked up later and placed back into inventory. The next machining operation is to machine a groove down the length of each element. This deep profile is machined out using two inline grooving heads. **Drawing B** shows a profile of this machining operation.

The machining of the ends is performed by a series of machine centres connected together by a network of conveyors similar to what is seen on the lumber trim line in a sawmill. Each of the elements are moved in unison to the next machine centre and machined simultaneously. A total of 8 machine centres are used, four for each end. **Figure 3** give an example of the type of machining performed on the ends. This line is but one example of the pre-cut systems that have been recently developed to gain efficiency by using mass production techniques in the construction of Japanese traditional post and beam houses. Further details on the equipment used to perform this type of machining can be found in the section on the Nagoya show.

4.2 Yoshimei Wood Material

Contact: Mr. Terumi Kiaimoto

This plant produces glued wood products for the interior of Japanese traditional homes. It experienced sales of $53 million last year generated by a staff of 100 employees. Five production areas of the plant were toured: a veneer production area, three veneer laminating lines and a small area where large laminated billets are resawn to smaller sizes. No actual laminating of cores was performed at this plant. Large billets are all imported whereas the smaller billets are supplied by Japanese core laminating plants. Yoshimei concentrated its production activities on veneer production and the application of veneer onto various core products. This focus lets Yoshimei add the greatest value to the product hence the relatively high sales ratio per employee.

Most of the cores used in the plant were glued using resorcinol adhesive though some isocyanate adhesive was being used. Though it is not necessary to use these high performance adhesives on the products that Yoshiemei manufactures, they feel that it gives them an extra degree of margin in product reliability.

The veneer production area was comprised of 5 conditioning ponds for the flitches, 5 veneer slicing machines, 3 separate veneer drying systems, a veneer grading area and a room to store flitches prior to processing into veneer.

The conditioning ponds are basically tanks with steam pipes coursing along the bottom to provide heat to the water in the tank. To submerse the veneer flitches while they are in the tanks large logs were placed on top of the flitches. An overhead hoist is used to lift these logs. Three **Amitec** VT-13 veneer slicers were in use with one person operating each of the slicers. Operating thee machines in the reciprocating mode allowed this staffing level. Slicing material at the time of the tour were flitches the size of 2x6 in cross section and approximately 8 feet in length. Backer boards were used with these machines as they were with all the smaller veneer slicers of this kind. The layout of the area was simple: a skid load of flitches, the veneer slicer and a factory truck holding veneer bundles tied together with ribbon. **Figure 4** shows the layout of two of the **Amitec** slicers that were side by side.

Adjacent to the two **Amitec** slicers was a more elaborate veneer slicing line by **Marunaka**. This larger machine, the SL-350V, had a flitch return merry-go-round to aid in the handling of the heavier flitches being sliced on this machine. Two flitches were being processed during the tour though the capacity to handle more was available. The flitch width capacity of this machine is 350 mm whereas the small **Amitec** VT-13 are only capable of slicing flitches up to 130 mm wide. A staff of two manned this slicing line. The remaining slicer was an old fashioned type of slicer, large and heavy and one in which the knife moved laterally across the stationary flitch. It, too, was manned by two people.

Three different methods were used to dry the veneer which spanned from a low tech manual method to a high-tech radio frequency vacuum drying chamber. The manual method involved the placement of each strip of veneer in a vertical position on a drying rack. These racks are stacked on a cart and wheeled into one of three kilns. This labour intensive method is to be phased out shortly. The second method of drying veneer is accomplished by using a feed through Marunaka veneer dryer. This kerosene burning dryer uses rollers to keep the veneer flat as they pass through the dryer. One person fed the dryer while another person tailed it.

The state-of-the-art RF vacuum veneer drying chamber, aptly named High Elec Dryer, is manufactured by **Fiji Electronic Industrial Co.** It is capable of drying 4.3 m^3 of bundled veneer with initial m.c. of 100% to a final m.c. of 12% in 22 hours. Drying in a vacuum chamber allows the veneer fibre to retain its original lustre and hue. This would be an important feature to have when drying an appearance product such as veneer. A hydraulic ram is used within the chamber to apply pressure to the top of the pile thus preventing the veneer from curling. Handling of the veneer into and out of the chamber is done by a carriage and track system. **Figure 5** shows this veneer dryer just prior to being loaded.

Yoshimei has three separate veneer laminating lines. Two of the lines were highly automated whereas the third line involved more manual material handling activity. Perhaps this third line is used for custom or short run specials. The processing done on each of the lines is virtually identical: core surface preparation, veneering two opposing faces of the core with the wider face being done first, flushing off the overhanging veneer. The remaining two faces are then veneered and, likewise, the overhanging veneer is flushed off as well as having the edges chamfered. Depending on the end product the veneered surfaces are either sanded if the product is going to receive a stain or lacquer coating or they are planing using a super surfacer to give it a ultra smooth finish free of visible knife marks. The final operation is to shrinkwrap and box the veneer laminate in its own carton. This entire process was basically repeated in all the veneer laminating plants that followed.

Surfacing S4S of the core prior to lamination was performed on a moulder. Every plant visit used a moulder to get the core surfaces ready for laminating. The application of glue was handled in two ways depending on whether or not the line was automated. On the manual line it was the veneer that was passed through the glue spreader whereas on the automated lines the core was glued. The laying up of the veneer was always performed by hand, usually by two people. Radio frequency spot welders from either **Yamamoto Vinita** and **Fuji Electronic Industrial** were used to tack the veneer to the core. Each lay-up person had a gun suspended on a retractable cable over the work area. In every plant visited which laminated veneer to a core these RF spot welders were used extensively.

Two different styles of presses were in use on these lines: a single opening press and a three opening press. The former type of press was installed on only one of the automated

lines whereas the latter type of press was installed on both the automated and the more manual operated line. The single opening **Kobayashi** press used belt conveyors to infeed and outfeed the press. To give this style of press the same capacity as a three opening press, its pressing surface was wider thus allowing from 9 to 10 cores to be pressed per batch. The three opening press, manufactured by both **Kobayashi** and **Yasuda**, required the manual placement of the cores into each of the openings. These presses could hold three 4x4 cores per opening which gave them a batch capacity of 9 cores. Both styles of presses used heated platens to assist in the curing of the PVA glue.

The flushing and chamfering of the overhanging veneer was performed by a Perfect Chamfer Trimmer from **Daito.** This machine is shown in **Figures 6** and **7**. There is, as far as the author knows, only one manufacturer of this type of machine. As a result it was seen in every plant visited that laminated veneer onto cores. This machine uses heads similar to those found on edgebanding machines to flush off overhanging tape veneer or plastic edgebanding tape. **Figure 8** gives a close-up view of the flushing cutter head. Four heads are used to flush off the veneer overhang on cores that have veneer on two opposite surfaces. For a line that veneers all four sides of a core two of these machines are used. The second machine possesses chamfering heads as well as flushing heads in order to round the four edges. **Drawing C** gives an example of what cutting action is performed by this machine.

The next step in the process was to precision trim to length the veneered laminated cores. A double end tenoner or any double trim saw can be used for this precise operation. Precision in cutting to length is critical therefore only machines with saws at both ends (as opposed to a single chop saw) can guarantee the tolerance demanded by the customer.

Two options are available for finish machining a veneered surface: sanding or planing. At Yoshimei both finishing treatments were performed. On one of the automated lines two in-line **Amitec** narrow belt sanders were used to sand top, bottom and the two sides of the cores. This finishing method was for products that were to receive a coating of some sort. Products, such as decorative hashira, do not receive a coating therefore they must have an extremely smooth surface. Moulders with their peripheral cutting action leave knife marks that would show up under certain lighting. To the Japanese customers this is unacceptable. Therefore, to give a product a finish that shows no sign of any cutting action, fixed knife planers or super surfacers are used to remove what amounts to an onion skin like layer from the surface of the veneered faces. The design and operation of the super surfacer is similar to that of lengthwise veneer slicers. Not surprisingly, **Amitec** and **Marunaka** both manufacture a line of super surfacers. The laminating line manufacturing decorative hashira posts used two in-line **Amitec** super surfacers, a MKB 300W and a MKS14S. One did a vertical cut and the other did a horizontal cut.

The final stage in any manufacturing process is the packaging of the product. Without exception all veneered products were shrinkwrapped and placed in either a corrugated

carton singularly or in groups of 2 or 4 to a carton depending on their size and weight. Exterior carton surfaces were well labeled (in Japanese) indicating its contents. All this processing seems worth it when the market will pay 8000¥ or approximately $105 for a 120x120x3150 mm decorative hashira post with a ponderosa pine core and a hinoki veneer covering.

4.3 Nara Ken Shusezai KKK

Contact: Mr. Kazunobu Tsuchiya

Though this was not a laminating plant, a tour of the Nara Ken Shusezai KKK auction facility provided some background information on the value of honoki to the Japanese decorative building products industry. During the visit to the auction yard the tour saw recently felled hinoki logs from a region close to Osaka that were to be sold at an upcoming auction. This auction draws buyers from all over Japan. One of the hinoki logs in the yard had a floor price set at 2.1 million ¥ per m^3 or $28,000 per m^3. It was stated that hinoki logs over 4 metres in length double in price for every metre of this length. Hinoki cut stock or flitches stored within a warehouse were for sale at prices ranging from $13,500 to $16,200 per m^3. With prices like these it can be appreciated why the Japanese designed their own technology to slice and dry veneer without generating a great deal of waste.

4.4 Maru Shoten

Contact: Mr. Shigeki Maru

This laminating plant manufactures structural laminated cores for traditional post and beam houses, large structural beams for commercial buildings and fingerjointed structural lumber. This laminating production facility is both JAS 1 and JAS 3 certified. The majority of the lumber used in this plant is imported kiln dried material. Kilns, situated on site, are used to dry a small quantity of locally milled lumber.

The first process in the manufacture of laminated cores is surface preparation (planing) and sorting. The planer line consists of a vacuum lift that lifts one row at a time onto the planer infeed chain. Once planed the lumber is manually sorted into three grades. The sorter was able to direct the lumber to the correct lumber stacker by positioning the lumber on the chain in such a way that trip switches would be activated by the passing lumber. The grade of lumber that was most common did not require special positioning on the chain; it was in the position against the fence. All three sorts use automatic stackers to pile the lumber though these were small compared to the lumber stackers seen in lumber mills in B.C. The third sort station (the one with the least volume of lumber) was located up on a mezzanine level above the other two sort stations to save on space. The better grade of lumber is used for the outer core laminals.

The laminating line for the production of posts and beams was, unfortunately, not operational during the visit. The glue spreader was in need of some repairs. Five laminals are used in the construction of the laminated cores. An aid used in maintaining edge alignment during the manual laying up of the laminals was basically a right angle jig made of sheet metal. These jigs were approximately of the same dimensions as the laminated cores. The cores were stacked 6 wide per row and 10 rows high in a frame clamp. **Figure 9** shows an end view of the cores prior to being pressed. Initial pressure is applied to the frame clamp by using a hydraulic press. While the cores are under pressure, the top platen is secured to the frame thus maintaining pressure during the curing process. By using a network of roller conveyors each of the frame clamps could be pushed into a heated chamber to cure the resorcinol glue for an eight hour time period. This line has a capacity to process 40 frames per shift with 60 cores per frame.

In the large structural beam production area were a fingerjoint machine, two types of planers, glue spreader, a floor-mounted clamping system and an overhead crane to move the large beams. The species used in this product is Douglas-fir from both Canada and the U.S. The first step in the process is to fingerjoint standard length lumber to get laminals of the necessary long lengths. A specialized **Kikukawa** fingerjointer able to fingerjoint long sections of lumber was used for this purpose. After the fingerjointed laminals are given a sufficient period of time for the resorcinol glue to cure, the laminals are surfaced S2S on the wide faces to prepare them for laminating.

The clamping of the beams, be they straight or curved, was accomplished by an in-the-floor clamping system. To set the radius of the curved beam, a set of templates made from thin plywood was used to position each of the individual clamps. Once positioned an air ratchet is used to fasten the clamps to the guide rails. Once the laminals are glued, laid up, clamped into place and allowed to cure over a period of time an overhead crane is used to bring the beam to a 48 inch wide single head **Taihei** planer. This machine surfaces the two sides of the beam and cleans up any glue squeeze out.

The remaining production area of the plant produced structural fingerjoint lumber. A **Taihei** fingerjoint machine with an extra long crowder section was used to make fingerjoint lumber using resorcinol adhesive.

4.5 Naruse Tokushi Mokuzai

Contact: Mr. Kazhyoshi Yamakado

This plant produces stair parts, counter tops and other interior laminated products for the home. Stairs components comprise 80% of total sales and counter tops account for the remaining 20% of the sales. Most if not all the products receive a stain or lacquer finish. The majority of the wood fibre utilized in the plant is hardwood with only a small but

growing portion (5%) being softwood. At present hemlock from the U.S. is the preferred softwood species though inroads are being made by radiata pine from Chile for use as laminated cores for counter tops. In the plant while the tour was passing through were edge glued, fingerjointed softwood panels (1½ x 10 inches) in various lengths from West Coast Forest Products of Arlington, Washington. Also present were large Chilean edge glued panels. These panels were all 4 meters long and 25 mm thick in widths from 300 to 500 mm. This product appeared to be well made with its tight glue joints and generally pleasing appearance. An interesting point made by Mr. Yamakado that could be of interest to B.C. interior plants was the growing acceptance of tight knot lumber in Japan.

Stair sides with their edge glued and fingerjointed cores, are laminated with veneer using the now usual method of glue spreader, spot welders and **Kobayashi** press with multiple openings. Being a wide product the veneer on the edges cannot be applied using a standard press instead a **Homag** edgebander is used to apply veneer tape to both edges. This hides the visible fingerjoint pattern as seen from the edge. From the laminating area the stair components are moved to the machine shop where a **Heian** router is used to mortice the channels for the stair steps and risers. A second **Heian** router with a shorter bed is used for other machining operations where precision is necessary. The stair components are sanded on a **Amitec** wide belt sander prior to being finished.

The finishing line is, at present, a very labour intensive process with much of the work performed manually. Stain, for instance, is brushed or wiped on with rags. The spraying of the lacquer is done manually as well. The odd thing about the finishing line was its location; it was situated in an open area under an overhead canopy. It appears that no concern is paid to dust settling on the wet lacquer as it dries. Perhaps there are different finishing requirement and expectations for finishing stair components than for furniture. Management will be replacing the current finishing line next January with an up-to-date machine finishing line. This move is intended to improve productivity and quality.

The management at Naruse Tokushi said they have quite an outlay of capital tied up in the plant at present but as the plant equipment depreciates they will be giving serious consideration at bringing in more finished products from overseas suppliers.

4.6 Katagiri Meimoko Kogyo

Contact: Mr. Nobu Katagiri

This company specializes in the manufacture of alcove assemblies, top and bottom track rails (kamoi and shikii) for the shoji screens, and bashira posts found in the Tatami room. This is the room in a typical Japanese house where ceremonial functions are performed. A number of the products found in this specialty market require laminated cores. These would be bashira posts, kamachi or the alcove step, kamoi and shikii. **Figure 10** shows a typical kamoi and shikii rails with grooves running down their length.

The bashira posts appear to be of more cultural significance to the Japanese than other elements of the tatami room. At the high end bashira posts are made from distressed small diameter peeled logs with ingrown ripples on the outer surface. The lower end of the market for bashira use a simulated knobbly surface effect, or an exotic dark veneer such as rosewood is laminated onto a flat post. Katagiri specializes in the production of the latter two styles of bashira posts.

Katagiri buy their laminated cores and veneers. The cores are a 4 ply western red cedar though they are about to try cores made from SPF. The source of their present supply of cores was not mentioned. The veneer used was for kamoi and shikii was spruce whereas for the bashira posts more exotic hardwood veneers were used. To prepare the veneer for laminating a guillotine is used for sizing and to give the veneer a straight edge. The gluing of veneer to the core is accomplished in the manner seen in other plants. The only difference was that a **Taihei** 2-opening press is used for the laminating work rather than the customary 3-opening press.

The most interesting process in this plant involved the production of bashira posts. This unique process began with the further laminating of the bashira cores with a layer of thin MDF panelling material on two sides and a thicker layer on what would be the front side. The thicker front covering was machined on a **Heian** CNC router to give it either a rounded front or a knobbly effect with raised bumps. Veneer was somehow laminated onto these surfaces but it was not seen how this was accomplished. The other processing in this plant was the cutting, edgebanding, machining and sanding of veneered panels for the walls of the alcove. Since Katagiri sell finished products a finishing line had to exist somewhere in the plant but it was not seen.

The Katagiri plant was not as well automated as some of the other plants visited but they were sophisticated in their ability to manufacture difficult to produce products using CNC technology and specialize veneer laminating techniques. This ability gave them a good toe hold in what is no doubt a niche market.

4.7 Hattori Sangyo

Contact: Mr. George Kuromiya

This company has been in existence for over 270 years. Being in business that long would suggest that its early activities involved the sale of imported and domestic lumber and perhaps some sawmilling activity. Today Hattori is composed of six divisions: tropical and radiata pine lumber, North American lumber, domestic sawn lumber, housing components, kiln drying and laminated wood products. They supply the construction industry and other glulam manufacturers with lumber and builders with laminated veneer wood products for interior applications. Hattori finds that it cannot compete with

B.C. producers of laminated cores. Instead they have concentrated their efforts in producing special sizes of cores and not so much the standard sizes. These special sizes require input lumber sizes that is hard for B.C. mills to produce.

Hattori imports fingerjoint blocks from Canada and the U.S. though this material comes to them indirectly through trading houses. The species used are hem-fir and SPF in clear and knotty grades. They would prefer to import 8 inch wide blocks as this would be a better fit to the final size of their end product. All secondary wood processors, no matter where they are situated, make this type of request!

Hattori has experienced some quality problems with U.S. grown yellow cedar and spruce veneer even though this veneer was sliced in Japan. Sliced spruce veneer presently costs them 700,000 ¥ to 800,000 ¥ or about $9200 to $10,500 per m^3. This would be for a clear grade of 1 mm thick veneer with no defects. It is equivalent to what is generally called "sound board grade" veneer; the same as that used for making musical instruments.

The core laminating production processes were no different in this plant than what was already seen in other plants except that there were no automated lines in this plant. Hattori's management admitted that their plant was not very good; however, they do intend to upgrade the plant to improve its production capacity. Much of the material handling was performed manually. It appeared that production flow was handled in batches; no flow seemed to be present from one operation to the next.

The fingerjointing process started with the pre-ripping of input blocks so that the width was a closer match to the end product width. A standard manual fed multi-rip saw with no mechanical infeed aids was used to rip 2x10 into 2 pieces and to edge the sides. Two people ran this process. Some of the FJ blocks were solid pieces and others were edge glued. The fingerjoint line, a **Kikukawa**, was set up to do a horizontal type of fingerjoint cut.

The other type of core laminating done in the plant was edge gluing of panels. A RF glue line resembling those available from the U.S. manufacturers of RF presses, **Rosenquist** and **Radio Frequency Services**, was used for his purpose.

The veneer laminating of shikii, kamoi and other similar products was identical to that seen in other plants, therefore it will not be repeated here. However, one interesting practice that was done differently in this plant involved the laying up of veneer for shikii and kamoi rails. Instead of one wide strip of veneer being glued to the top surface, two narrow strips were glued. A ½ inch wide space was left between the two strips where a channel will be grooved down the middle. A regular shaper with a power feed was used to groove the channel. This is but one example of how the clever use of material can be used to reduce costs and not diminish the quality of a product.

4.8 Benihiro Mokuzai

Contact: Mr. Yukimasa Beniya

Benihiro Mokuzai produces veneer laminated interior products for the major pre-fabricated home builders and the small local home builders in the prefecture. Presently 30% of their production goes to the major builders; this is expected to go up to 50%.

Benihiro belongs to a local laminating co-op association. Part of the activities of this co-op is to jointly purchase stock from overseas suppliers. To date, 80% of their core material is purchased from North America. One of the key suppliers is Shelton Structures Inc. of Shelton, Washington. They supply large dimension glulam in the 12 metre lengths in widths of 225, 355 or 455 mm. and in thicknesses of 185 and 455 mm. As all Shelton products use resorcinol glue in their construction, Benihiro is able to offer a superior laminated product in its non-structural products as well. This strategy of providing a better glue bond than required could be jeopardized by Shelton rasing their price of late. Currently, they are asking 75,000 ¥ or $986 per m^3 for their products.

Another one of the suppliers is Maher Forest Products of Seattle. They supply 3 ply kamoi in 2, 3 and 4 metre lengths that is carefully packaged in a plastic wrap with a corrugated cardboard sheet on top of the load and the usual strapping and dunnage for ease of handling. This was indicative of the degree of packaging protection required when shipping product of this nature. Benihiro would like to do business with Canadian suppliers of core material if they can ensure a steady stable supply. The co-op of 10 laminators currently buys approximately 40,000 5 ply posts per year.

Most of the other laminating plants visited so far have used relatively few species of veneer overlay material. Benihiro, on the other hand, stocks about 40 different types of veneer. They did claim to be having difficulty in obtaining spruce veneer from North America of the right quality. As a way around this problem they are considering trying veneer made from either white spruce or engelmann spruce. This veneer would have to be sliced with the vertical grain showing. The current price for this type of product is about 500,000 ¥ or $6600 per m^3. As a comparison, Port Orford cedar veneer from Washington is currently selling for 3,000,000 ¥ or $40,000 per m^3!

For its size Benihiro performs quite a few cutting and laminating processes in a relatively small plant. These include primary breakdown of veneer logs, veneer production, fingerjointing core laminals, laminating cores and veneer overlay of cores.

The band headrig was used to saw logs into veneer flitches as well as to resaw large dimension glulam beams from Shelton into laminated boards. This process of resawing large size beams was also done in another plant (Yoshimei Wood Materials). The veneer flitch conditioning tanks, situated outside in a pit, were not very sophisticated considering the value of the flitches found in them. No control system was evident to monitor the

water temperature of the steam heated water.

The veneer was sliced on an **Amitec** veneer slicer as seen in many of the other plants. The species being sliced at the time was Douglas-fir though it curled significantly upon being sliced. This would seem to indicate that some internal stresses were present in the flitch. Perhaps the conditioning process was somehow accountable for this condition. An **Amitec** veneer dryer heated with kerosene oil was situated next to the slicer but in such a way that the veneer could not be fed directly into the dryer as it came off the slicer. The veneer had to be handled a second time in order to get it to the dryer. This machine alignment problem occurred on account of the lack of space within the plant.

The chop line used to defect lumber for the fingerjoint machine was essentially the same set up as found in many small B.C. reman plants: a manual chop saw, an old **Yasuda** planer to S2S the cut stock and a rotating table for sorting. The 4.25 by 2.5 inch size lumber being cut appeared to be a shop grade. Fingerjointing was performed using a **Kikukawa** fingerjointer set to produce a horizontal joint. An **Iida** moulder surfaced the laminals prior to lamination into cores. The resorcinol glued cores were produced in a similar manner as that performed at the Maru Shoten plant.

The veneer storage, grading and matching area was located on the second floor of the plant. Here there were numerous racks of veneer were held in inventory. A **Sugii** guillotine was used to product narrow strips of veneer from wider strips produced by the slicer. Grading, matching and trimming of veneer was performed by two women. This is an important function requiring keen judgement in knowing what to look for with respect to colour, grain pattern and defects.

The process of laminating veneer to the core material was again similar to what was seen in other plants though actual lines as such did not exist, just individual machine centres. The only real difference was the use of another type of press, a **Takagi** press with 2-openings rather than 3-openings. The ubiquitous **Daito** chamfer trimming machine performed double duty as it was used machine off veneer overhang on all four surfaces.

4.9 Seven Industries

Contact: Mr.Ken Sugiyama

Seven Industries is a major manufacturer of decorative laminated wood products for the traditional Japanese home. They have 9 factories in the Nagoya area. Each of the factories either make a particular product or they supply others factories with sliced veneer and laminated cores. Seven Industries also has a plant in Washington that produces fingerjoint laminals from hemlock and alder. From their Nagoya and area base, they service the major population areas of Tokyo and Osaka as well. This broad range of distribution makes Seven Industries national in scope. All the other plants visited were very much

regional in scope. Seven Industries sells a third of its products to major builders, a third to wholesalers and a third to small builders. Sales are $160 million per year with a profit of $6.5 million.

Seven Industries buys 850,000 FBM per month from North American suppliers. The Scandinavians are also supplying them with 25,000 pieces of glulam products per month. Another threat to the dominance of North American fibre identified by Seven Industries comes from Russia. Glulam cores made from Russian pine from the Vladivostok region is appearing in the Japan market via a joint venture with one of the trading houses. It is being sold for about 50,000 ¥ or $660 per m^3. Seven Industries is under pressure to cooperate with this venture though they appear to be hesitant about buying this fibre. Quality would be one of the more obvious concerns but other might be delivery consistency and price stability.

The first of the two laminating plants visited produced finished stair sets. This plant was large when compared to other stair component plants visited. It was laid out in a logical fashion with input material entering the plant at one end and packaged product leaving the plant at the other end. The start of the process began with the production of fingerjointed laminals. The odd thing about the input fingerjoint blocks was that they were all the same length, 14 1/8 inches. They were shipped in on skids with shrinkwrap around the load. A **Kikukawa** fingerjointer using the vertical joint pattern was operated by just one person. He was aided by an automatic stacker at the rear of the line. **Figure 9** shows this stacker in action.

The surface of the laminals was dressed S4S using a **Kikukawa** moulder. Aiding the two people staffing this line were scissor lifts at both the front and tail of the line. As this plant uses factory trucks to move laminated material from machine to machine, they have come up with an innovative way of using scissor lifts with factory trucks. They position these trucks on top of the scissor lifts. Once the trucks are loaded, the scissor lift is raised to floor level and the truck wheeled away. This requires the scissor lifts to be set in deeper than normal pits. **Figure 11** shows this material handling arrangement.

The laminating of core used for stair sides was the next process to be performed. Here three rotary type presses from **Kobayashi** were used. PVA type adhesive was the only glue used in this plant. A number of **Timesaver** wide belt sanders (one capable of sanding panels up to 48 inches wide) were used to remove any glue squeeze out and to dimension the panels. As in the other stair plant, a number of **Heian** CNC routers (one with an extra long bed) were used to machine grooves in the stair sides and to perform a multitude of other machining tasks accurately. This is essential for any ready-to-assemble product, be it stair sets or furniture.

The finishing of the stair components was performed in a conventional finishing line with manual spraying of components. In addition to this line a large and expensive looking

automatic finishing line was seen but it appeared not to have been used in awhile. Perhaps it is a white elephant!

The second laminating plant visited produced kamoi, shikii, handrails and other veneer-covered products. This plant was situated at the corporate headquarters with several other building on the same site. A total of 4 automated lines were installed in this one plant though no fingerjoint or core laminating was done in this plant. These cores were supplied by one of the other Seven Industries plants. These lines were virtual duplicates of the automated lines seen at the Yoshimei Wood Materials plant.

The first two veneer laminating lines were laid out side by side in such a way that it made it difficult to follow the order of operations. It was noted however, that both lines shared an **Iida** moulder to surface (S4S) the input material. After surfacing the laminated cores were positioned at the start of whatever line it was intended to be run on. As in other automated lines it was the cores that were glued instead of the veneer. Here a **Tanouchi** double glue roller was used to glue both wide faces of the cores. The lay-up of veneer strips is done in the usual manner with RF spot welders. This process was always staffed by two persons no matter what plant was visited.

The presses used were a single opening **Taihei** press with a capacity to laminate 10 cores in one cycle. Having a single opening permits automatic infeed and outfeed by conveyor belt. Upon leaving the press the cores are transferred to the **Daito** chamfer / trimmer. The whole process of applying veneer to the other two sides was repeated further down the line. After the last chamfering and trimming operation was performed, the cores would go through a Daito double trim saw to cut the cores to a precise length. As these products will receive a finish they need to be sanded. Two in-line narrow belt sanders accomplish this task. Prior to entering the packaging section of the line the edges of the laminated cores are sanded by a hand held pneumatic sander and a final inspection is made of the product. Shrinkwrapping and the placement of the laminated cores into cartons follows. With smaller sized products 4 of the laminated cores are packaged together.

At the time of the tour one of the lines was manufacturing a 6-foot long product with veneer wrapped on all four sides. The other line was manufacturing 12-foot long handrails. This product only had veneer on one wide and two narrow faces.

The other two lines on the other side of the building were similar in design but they did not appear to be as lengthy. Some sort of expansion was in progress which indicates the growing potential for this type of product.

5.0 Nagoya International Woodworking Machinery Show

This show presented a unique opportunity to obtain information on Japanese wood processing technology seen during the tour of the laminating plants. It provided a chance to see what new developments were occurring within the Japanese wood processing

machinery industry. Brochures were obtained on machinery that could be of interest to B.C.'s secondary wood processors however, the majority of brochures are written in Japanese only. A list of the brochures obtained appears in **Appendix D**.

The Nagoya show is the one big woodworking show held in Japan at the beginning of October in odd numbered years. As would be expected the technology on display is predominately of Japanese origin with some technology from other Asian countries and Germany. For the most part the Japanese have focused their attention on certain types of wood processing technology: moulders, CNC routers, veneer slicers and super surfacers, sanders, tooling and an assortment of material handling system with vacuum lift capability.

From the perspective of a B.C. secondary wood processor this is a good show to attend as the show's main focus is on machinery designed for machining solid wood products and not so much panel processing machinery. Communication problems can be encountered for anyone who does not speak Japanese. This is unfortunate as it prevents the visitor from having in-depth discussions about interesting machinery. Nevertheless, walking around the show booths was enough for anyone to see what new trends were emerging in Japanese wood processing technology.

A trend that was very apparent was the proliferation of machines designed to machining components for Japanese post and beam or traditional homes. The Japanese refer to this method of mass producing house components as the "pre-cut system". The impetus to building post and beam houses using new technology came about for a number of reasons. As stated in the beginning of this report, older post and beam housing did not fair well in the Kobe earthquake. Many of these homes collapsed on their occupants. The other disadvantage of this style of home is the cost of construction when compared to the new forms of house construction such as 2x4 houses. The solution to building stronger and less costly post and beam houses was to use metal brackets and plates at key joints within the structure and to use mass production technology to machine complex joints within tight tolerances. Both these objectives are achievable by using specially designed machines in conjunction with using more dimensionally stable wood elements in the building - laminated posts and beams.

Three distinct levels of pre-cut technology were available with each one being targeted for a specific user. The most technologically advanced systems utilized computer aided design and computer aided manufacturing (CADCAM) to manufacture custom house components. Once designed on a computer, each of the house components are downloaded from the CAD computer to the computer that controls the machining processes. These machines, controlled by CNC technology, had the capability of doing all the machining of the components: cut to size, boring of holes, machining of tenons, notching of mortices and grooving of various channels. Two of the three manufacturers of these CNC workcentres are **Heian** and **Shoda** - two of the world's leading CNC router manufacturers. The third manufacturer, **Miyagawa**, is a little known outside of Japan.

The Shoda line was of particular interest because of its use of bar coding to identify the components once they are cut to length on a computer controlled chop saw. The cut to length components receive a bar coded label to identify it from other similar components. When all the components for a complete house are cut to length, they are transferred over to the CNC machine centre where the bar coded labels for each component are scanned by a bar code reader. The specific instructions to machine that particular component is called up and the part is machined. After machining, each component has its name written in Japanese characters sprayed on the edge with an ink jet printer. All Japanese traditional house components are given a particular name. At the house construction site, the job of building the house is basically reduced to assembly work for the carpenter and his helpers. Instead of taking months to construct, traditional houses can be completed within much shorter time interval thus reducing carrying costs for the builder.

The next most advanced system involves a series of specialized machines connected together by an elaborate conveyor system. The absence of CNC control signifies that this form of machining components is ideally suited for making standard design house components and not customized components as permitted in the above mentioned systems. Each machine performs a specific machining operation: cutting grooves, tenons and boring holes. Most of this machining takes place at the ends of the components. This is the system seen at Koike Lumber Co. This arrangement of machines does take a considerable amount of floor space when compared to the above mentioned CNC systems. **Tokiwa**, **Shinx** and **Marunaka** are the key manufacturers of machinery for this method of manufacturing pre-cut house components.

The least advanced method of manufacturing pre-cutting components uses machines virtually identical to those used by Tokiwa, Shinx and Marunaka but these machines are smaller and lighter in design and they require the operator to use physical force to bring the cutting head in contact with the part to be machined. Even with these machines laser illumination of the tool position is used to assist the operator position the cutting tool in the exact spot. **Hitachi** and **Makita**, both well known names in North America, manufacture a line of these machines. This range of pre-cut machines with their lower cost and production capacity would appeal to either the small house builder or to a regional house component manufacturer. If B.C. secondary wood processors were to consider getting into the market of producing pre-cut post and beam house components, then this method of production would be a logical starting point as the capital investment would be the lowest.

One of the most frequently seen machines at the show were the single and double-head right angle planers with their long infeed or straightening tables. These machines can be used to surface, dimension, provide a true right angle at all edges and straighten small to large size structural components. The smaller versions of these planers appeared to be aimed at the small builder using the least advanced pre-cut system. The planers with the larger size capacity would be ideally suited to handle structural components for such

building projects as wood bridges, religious shrines and public buildings. These machines were manufactured by a number of different companies but the offerings from **Makita, Shimohira** and **Tokiwa** covered a wider range of machine sizes.

Veneer lengthwise slicing machinery and the associated super surfacing machinery were on display by the leaders in this technology, **Marunaka** and **Amitec**. Both of these manufacturers have their veneer slicing machines operating in North America though their super surfacing machines are not as widely used here if at all. Both Marunaka and Amitec are significant wood processing machinery manufacturers in the Japanese market with the former having a marketing alliance with the well known Italian woodworking machinery manufacturer SCM.

The machine that was seen in every veneer laminating plant visited and its presence in these plants was indispensable was the veneer overhang chamfer trimmer. This machine is manufactured by only one company, **Daito.** Upon closer examination of the Daito chamfer trimmer as it stood in the show booth, it could be seen that the cutting heads closely resembled the cutter heads used on edgebanders to flush. trim and chamfer edgebanding tape. From the brochures provided by Daito it was easy to see that they borrowed ideas for their unique machine from their line of edgebanders. **Daito** also manufactures a double trim saw to cut laminated components to exact length. This machine was seen as part of a line at the second Seven Industries laminating plant.

The category of machines that was seen in every plants visited were presses be they used for laminating cores together and for the laminating veneer onto cores. **Kobayashi** and **Seibu** had the largest selection of presses with the former manufacturer providing a line of veneer presses with automatic infeed and outfeed of the cores. These presses are distinguished from other presses by having a layup conveyor, a single, wide opening and by an outfeed conveyor. These were seen in both the Yoshimei Wood Materials and the Seven Industries plants; both being the two most highly automated plants visited. **Kobayashi**'s other line of presses are the rotary presses for the production of laminated cores. Kobayashi also had on display a new collection of machines to cut trusses components to exact length and to cut compound angles. These machines are probably a prelude to their entering the production of pre-cut machines.

As mentioned previous there were only two manufacturers of high frequency spot welders (for use to temporarily hold veneer strips to a glued core so that the core can be rotated or moved in some manner). Both **Yamamoto Vinita** and **Fuji Electronic Industrial** manufacture these spot gluers. The author was able to find a U.S. manufacturer of RF spot welders that are a fifth of the cost of the Japanese counterparts. **WorkRite** makes a line of spot welders that could be used to do the some job.

The use of radio frequency energy to cure glue joints was not that evident in the plants visited nor was there any on display at the show. The use of electrical energy for curing

glue joints is not cost effective in Japan as electricity costs are considerably higher when compared to those of B.C. One company, **Fuji Electronic Industrial**, does specialize in the manufacture of this RF equipment for the rapid glue curing of laminated beams and curved furniture components to name a few of the possibilities. Along the same lines Fuji also manufacture a RF vacuum chamber for the drying of veneer and large section timbers.

Considering the current hot market for 2x4 prefab housing and the potential for this market, it was surprising that there was only one manufacturer present at the show that manufactured a system to automatically nail and assemble 2x4 wall sections. There again this might not be the show where most of these manufacturers display their machinery.

The most lasting impression of the Japanese wood processing technology was not so much the sophistication but its cost. In a country like Japan with its high cost of living, it can be expected that the cost of a well made machine would be exorbitant, and they were. This is [Bunfortunate as this places it out of reach for most B.C. secondary wood processors. If B.C. secondary wood processors are to duplicate the laminating processes described in this report, they must find a way of do so with less costly North American technology wherever possible. Fortunately, just about every machine seen in the laminating plants has a North American equivalent except for the lengthwise veneer slicer and the Daito chamfer trimmer. It is not necessary to possess a veneer slicer; some of the most profitable plants seen on this mission bought their veneer from another company who specialize in it production. This option is available in North America; veneer can be bought from wood processors which specialize in producing veneer for the Japanese market. For example, **Interforest Ltd.** of Durham, Ontario have a division in Oregon that slices veneer for the Japanese market. They would be a good source of knowledge as to what a typical Japanese customer looks for in quality veneer.

The Daito chamfer trimmer machining capability can be partially duplicated by using a stripped down edgebander as both machines use the same type of cutter head. The problem with using an edgebander is their inability to process material thicker than 2 inches as they are designed to process panel products. Unless they can be modified the only foreseeable option is to use a veneer hand trimmer available from **Veneer Systems Inc.**; however, this would be a slow process. Nevertheless, it would be an inexpensive way a getting into production. Once the market potential for a B.C. produced veneer laminated product has been established, a Daito chamfer trimmer can be acquired to do the job more economically.

6.0 Summary

The opportunities to sell laminated core wood products in Japan is at an all time high. With the dismantling of the rigid distribution system going on in Japan, opportunities exist to do business with many smaller businesses that never before would consider

looking overseas for themselves. In this new arena both Japanese customer and B.C. producer gain as one is paying less of a markup on and the other is receiving a more attractive price for this product. The only roadblock to concluding successful business dealings with these new customers is communications and with that a deep understanding of what the customer wants. The onus in improving communications is with the producer.

The other clear message received was the Japanese will not wait for B.C. secondary wood processors to enter get into this market in earnest; other countries are getting their products established with these new customers. The window of opportunity for B.C. secondary wood processors is still open but they should consider moving into this market with a quality product as soon as possible or else they will be giving up market share, and with that customer loyalties.

8.0 Appendices

Appendix A

LIST OF LAMINATING TOUR PARTICIPANTS:

Brian Hawrysh	BCWSGA
Barry Metzner	Repap International
David Turnbull	MacMillan Bloedel
Don Garrett	Western Quality Wood Products
John Scott	J.D. Scott Industries
Michael Nikkel	Bridgeside Higa Forest Industries
Rob Mitchell	Lamwood
Rod McKay	Kam-Pac
Ted Dergousoff	Goose Creek
Doug Lanes	Pinnacle Wood Products
Doug Tracy	Tolko Industries
Stephen Demharter	Compwood
Bill Reedy	Gorman Bros.
Stuart Wilson	Norbord Industries
Hal Hanlon	Clearwood Industries
Derek Williams	Forintek Canada Corp.
David Wallace	Cranefield & Co.
Wayne Tryon	Milestone Wood Products

Patrick Dunn	Arbutus Manufacturing
Russ Maximuik	Imperial Lumber
Carl Huang	H Y T Import & Export

Appendix C

LIST OF COMPANY NAMES HIGHLIGHTED IN THE REPORT (in the order they appeared):

Company Name and Address:	Fax:	Machine Type:
Kikukawa Iron Works, Inc. 85, Ominato-cho, Ise Mie-pref., 516 Japan	0596-36-4198	Fingerjointers moulders
Taihei Machinery Works, Ltd. 3-33, Midorigi 2-chome Suminoe-ku, Osaka 559 Japan	06-685-9559	Fingerjointers moulders
Suzuko Co. Ltd. 656-2, Nishinakamachi Ominato-cho, Ise Mie-pref., 516 Japan	0596-31-0021	Stackers and pre- cut machines
Kobayashi Kikai Kogyo Co. Ltd. 60, Matsumoto, Mishima Shizuoka-pref., 411 Japan	0559-77-2307	Presses and truss cutting system
Ayen Machinenfabrik GmbH Represented in B.C. by Progressive Mill Supplies Ltd.	604 279-9877	Knot plugging machine
Amitec Corporation 31-25, Uchihama-cho Mizuho-ku, Nagoya 467 Japan	052-821-8840	Veneer slicers and driers, super surfacers, wide belt sanders
Marunaka Tekkosho Inc. 1-5-5, Kitamariko Shizuoka 421-01 Japan	054-257-0498	Veneer slicers and driers, super surfacers, pre- cut machines
Fuji Electronic Industrial Co. Ltd 6-2-22, Fujimi Tsurugashima-city	0492-86-5581	RF panel gluing machines, RF spot welders, RF

Saitama-pref. 350-02 Japan		vacuum drier
Yamamoto Vinita Co. Ltd. 6-3-12, Ueshio Tennoji-ku. Osaka 543 Japan	06-771-6898	RF presses and RF spot welders
Yasuda Iron Works Co. Ltd. 413, Kamishinkiri Ichinomiya-cho Hoi-gun, Aichi-pref., 441-12 Japan	05339-3-6277	Presses and tenoners
Daito Kiki Co. Ltd. 65, Nishikaido, Yokooji Fushimi-ku, Kyoto 612 Japan	075-632-0043	Veneer chamfer trimmers, double trim saws
Homag Maschinenbau AG Represented in B.C. by Akhurst Machinery Ltd.	604 876-4191	Edgebanders
Heian Corporation 1418, Mishima-cho Hamamatsu, Shizuoka-pref. 430 Japan	053-442-1856	CNC routers and pre-cut systems
Rosenquist, Inc. Old Highway #421 West North Wilkesboro, NC 28659	910 667-0635	RF presses
Radio Frequency Services, Inc. 1202 Woodfield Way, P.O. Box 1084 North Wilkesboro, NC 28659	910 667-0749	RF presses
Iida Kogyo Co. Ltd. 153, Marunaka, Komaki Aichi-pref. 485 Japan	0568-75-5329	Moulders
Sugii Machinery Works, Ltd. 354, Sukaguchi	052-400-0460	Veneer machinery

Shinkawa-cho Nishikausugai-gun Aichi-pref. 452 Japan		
Takagi Kinzoku Kogyo Co. Ltd. 7-12, Fukue 2-chome Showa-ku, Nagoya 466 Japan	052-872-6921	Presses
Timesavers, Inc. Represented in B.C. by Akhurst Machinery Ltd	604 876-4191	Wide belt sanders
Tanouchi Iron Works Co. Ltd. 2-1, Tamafune-chu Nakagawa-ku, Nagoya 454 Japan	052-651-1200	Glue spreader and veneer lathes
Shoda Iron Works Co. Ltd. 116-6, Ohkaba-cho Hamamatsu, Shizuoka-pref. 435 Japan	053-464-1210	CNC routers, pre-cut system
Miyagawa Koki Co. Ltd. 53, Nakanotsubo, Hanada-cho, Toyohashi Aichi-pref. 441 Japan	053-234-1956	Pre-cut system
Tokiwa Industry Co. Ltd. 58, Kinzoku-danchi Kakamigahara, Gifu-pref. 504 Japan	058-382-2297	Right angle planer,tenoning machine, hollow chisel morticer
Shinx Ltd. 2-1, Matsutomi 4-chome Shizuoka 420 Japan	054-272-1164	Pre-cut machining system
Hitachi Koki Co. Ltd. Nippon Bldg. 6-2, Ohte-machi	03-3270-2847	Single planer, super surfacer, groover, tenoner

2-chome, Chiyoda-ku Tokyo, 100 Japan		
Makita Corporation 12-5, Meieki Minami 4-chome, Nakamura-ku Nagoya, 450 Japan	052-561-4035	Right angle planer, pre-cut machine
Shimohira Manufacturing Co. Ltd. 2-13, Higashi-ueno 1-chome Taito-ku, Tokyo 110 Japan	03-3835-0844	Single, double surfacing planers
Seibu Co. Ltd. 52, Totomae, Akita Oguchi-cho, Niwa-gun Aichi-pref. 480-01 Japan	0587-95-2178	Presses
WorkRite Inc. 1315 South Flower Street Burbank, CA 91502	818 559-5457	RF welders for wood
Interforest Ltd. Box 170, Hwy 4 West Durham, Ontario	519 369-3310	Veneer production

Appendix D

LIST OF BROCHURES AND PUBLICATIONS:

Nagoya International Woodworking Machinery Fair *Official Guide Book* for the 1993 and 1995 events

Amitec Corp.	Super Surfacer
Daito Kiko Co. Ltd.	Chamfer Trimmer, double trim saw
Fuji Electronic Industrial Co. Ltd.	RF presses and vacuum driers
Hitachi Kiki Co. Ltd.	Booklet with complete line of small machines
Kobayashi Kikai Kigyo Co. Ltd.	Presses, truss saw, chop saw, fingerjoint machine
Marunaka Tekkosho Inc.	General catalogue, super surfacer
Miyagawa Koki Co. Ltd.	Pre-cut line
Nishino Works Co. Ltd.	Double surface planers
Seibu Co. Ltd.	General catalogue of presses
Shimohira Manufacturing Co. Ltd.	Large beam 4 sided planer
Suzuko Co. Ltd.	Infeed and outfeed material handling machines
Tokiwa Industry Co. Ltd.	Right angle planer, stand alone pre-cut machines