# SEMI-ANNUAL PROGRESS REPORT

# GREEN HARDWOOD ROUGH DIMENSION

By

John S. Gephart
Senior Scientist

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Prepared for:

Minnesota Technology, Inc.
111 Third Avenue South, Suite 400
Minneapolis, MN 55401

Natural Resources Research Institute
University of Minnesota, Duluth
5013 Miller Trunk Highway
Duluth, Minnesota 55811

# Green Hardwood Rough Dimension

## Semi-Annual Progress and Financial Report for Minnesota Technology, Inc.

**Coordinator:** John Gephart

**Reporting Period:** July 1, 1993 - December 31, 1993

**Objective:** To implement the technology and processes needed to improve the efficiency of manufacturing hardwood dimension parts from logs, low grade lumber, and slabs.

Specific objectives are:

1. To evaluate the use of low-grade logs, slabs, and lumber from several common species for defected and sized parts.

2. To assist in marketing these products based on the needs of manufacturers utilizing dimension and to assist the end-user by evaluating performance and modifying operations to accommodate their product needs.

3. To transfer the information and technology to sawmills and secondary manufacturers by implementing the process at manufacturing facilities as well as through publications, seminars, workshops.

This program covers process steps from timber harvesting to market. The objectives are being implemented through cooperative efforts of a number of agencies, companies, and individuals.

**Introduction:** Green hardwood rough dimension is manufactured by defecting and dimensioning a piece of wood while the wood is green. Defects vary by market and typically consist of knots, decay, split, wane, and stain. After the "dimensioning green" operation the wood is dried and shipped for further manufacturing. Manufacturing costs are lowered by not drying and shipping defects. The relative importance of defecting green increases substantially as the quality of logs and lumber decreases.

Today there is a shortage of higher quality hardwood lumber in grades traditionally used in the manufacture of furniture and cabinets. Dimensioning green lowers costs and increases the supply, through improving utilization and permitting the use of more abundant lower quality logs. Use of these logs will also increase opportunities for selective harvesting and timber stand improvements (e.g. thinning) resulting in more diverse forest management opportunities.

There are technical barriers and market perception problems associated with the handling of green parts, their drying, and their eventual use. To overcome these barriers the project has been broken into phases, each of which correlate to increasingly complex products.

This is the second year of a program which received funding from several agencies in 1992. In the first year most of the infrastructure (organizational structure and equipment) was put into place and efforts were initiated to produce material for evaluation. Results to date have been encouraging. At the moment, companies are filling the opportunities for expanded production to meet the needs of the initial markets developed.

**Background:** Since the early 1900s the hardwood lumber manufacturing trade has traditionally been governed by grading rules. These rules were necessary so that the lumber broker could accurately communicate the quality and value between the producer and customer. Because only the best logs were processed, the resulting lumber was of the highest yielding grades. The system of removing defects after drying and shipping became the standard. In this system as much as 60 percent of the raw material input is removed as waste at the secondary manufacturers.

The "green dimension" process differs from current processes in that defects are removed from hardwood boards prior to drying and shipping to secondary manufacturers. This practice is common in Europe and Japan. The concept of the project started in 1991 with a tour of Japanese mills. These mills defect lumber green into standard sizes (width, length, and thickness). In the fall of 1991, Product R & D of Roy Lake, MN, investigated green dimension processing and help was provided by NRRI in the development of a handling system "sticker mats" for the drying process.

In January 1992, NRRI was contacted by Mr. Robert Bartz of Palisade Supply, Palisade, Minnesota, who had been investigating the potential for manufacturing green dimension products in parallel with NRRI. Bartz has become a leader in developing the system and the project has expanded to include a number of public agencies and private companies.

**Justification:** This program assists rural development in Minnesota and will greatly increase the utilization of the states' low grade hardwood resource. This is a win-win opportunity for Minnesota's residents, timber land owners, loggers, sawmillers, and secondary users.

Of the 600 sawmills in Minnesota, we estimate that there are at least 10 sawmills with the capabilities and desire to implement the results. Employment in the order of 2 to 10 employees per mill is likely for a total of 20 to 100 jobs. In addition, there are approximately 50 smaller mills that could implement parts of the operation. Per-company employment impact from these smaller mills will be less, but, the value of the products will be considerably more.

As discussed previously, the removal of defects from boards before drying and shipping will lower the overall manufacturing costs. Regionally located secondary manufacturers will benefit from a lower cost raw material which will process more efficiently in their plant. Employment will shift secondary manufacturers located in urban areas towards sawmills located in rural areas. However, employment gains at the secondary manufacturers are anticipated due to increased sales resulting from lower raw material costs and increased plant efficiency.

Many of the state's secondary manufacturers need to import raw materials from other states. By utilizing more readily available lower grade logs, this material can come from local sawmills. This savings and increased competitiveness will be passed along to end users of the dimension products (cabinet and furniture manufacturers) and increase their competitiveness.

Lower grade logs are likely to rise in value due to the higher value products which can be made from them. Increased log utilization will occur thereby extending the region's hardwood resource. The increased value of lower quality logs provides increased opportunities for selective harvesting and timber stand improvements (e.g. thinning) resulting in improved future log grade quality and supply.

Another benefit will be the removal of waste before kiln drying. Green waste can be used with more types of manufacturing industries, such as of paper and hardboard, than dry waste, further extending the state's forest resource. Disposal of dry waste is becoming a challenge in many areas of the state.

**Summary of Progress:** Progress on the project is presented for each of the major objectives.

**Objective One: Investigate Use of Low Grade Material for Defected Parts**

This is a broad objective and to summarize results it has been further broken down into the areas of:

background investigations (literature searches),
development of a processing and demonstration site,
processing parameters and yield studies,
development of handling systems, and
development of drying methods

**Background Investigations**: A detailed analysis of the material and process flow was completed. This analysis resulted in development of a detailed process flow chart showing current and proposed systems. This information is being used to assist in the identification of research and development needs. This has been shared with many of the public and private cooperators and is available upon request.

To determine past research an intensive literature search was undertaken. Preliminary information shows that the concept of green dimension is not a new one. Intensive research in this area was conducted in the 1920s and 1930s; and again in the 1950s and early 1960s. This research is providing invaluable knowledge in the area of sawing, drying and marketing. One recurring problem which was not adequately addressed was handling systems.

**Development of a processing and demonstration site:** Process development has been undertaken at Palisade Supply located near Palisade, Minnesota. Equipment requirements for the first year of the project was mostly provided by Palisade Supply. This equipment included a scrag saw, a circle saw, a cant gang resaw, a chop saw, and loading equipment. Additional

equipment which was added by Palisade Supply in the second year has included a small low temperature dry kiln and a planer. During the last year the project has helped purchase a straight line rip and de-humidification dry kiln. In addition a bolter saw for sawing short logs was donated to Palisade Supply by the University of Minnesota's Department of Forest Products. Funds from the project were provided to cover the installation of the straight line rip, planer, bolter, and the dehumidification dry kiln.

**Processing parameters and yield studies.**: Processing parameters are being studied to determine the optimum set which will optimize yield, minimize manufacturing costs, and maintain flexibility to respond to end product requirements. Processing techniques (excluding drying) requiring evaluation are methods of defecting logs, sawing the cants, re-sawing cants, and cross-cutting for defect removal.

To determine yields, log studies have started on aspen, red oak, and paper birch. For aspen, Forest Service factory log grades 1, 2, 3 and below grade 3 logs have been processed. Small diameter red oak logs are also being processed. These red oak logs are generally less than 10" in diameter and are being grouped based on the number of clear defect-free faces (sides). Data are being collected on log quality and volumes by the Minnesota DNR. Significant progress on the actual yield studies has been limited during the last reporting period. This has been due to a number of factors the most important of which has been inadequate drying capacity at Palisade Supply.

A computer program for data analysis has been developed. This program is being used for data entry, analysis and reporting.

A key to processing hardwood dimension at the sawmill prior to drying is the development of a method to handle the short pieces. Stickers, the narrow strips of wood used to separate the boards from each other, are required in drying to allow air to pass between dimension parts. A system developed at NRRI, employs the use of side rails to keep the stickers in place and in turn keep the dimension parts in place.

Sticker mats have been manufactured for the use in a Koetter dry kiln at Palisade Supply. A sticker mat jig was made and is being used to manufacture sticker mats which are the first in a series evaluating design and species. A new design for the sticker mats was developed consisting of a removable side rail. Advantages include ease in changing sticker spacing, reduced sticker mat storage requirements, and easier adaptation of sticker packages to standard handling systems.

Incorrect drying can result in defects to the boards which can have a significant impact on yield and manufacturing costs. To date, Palisade Supply has not encountered major drying problems in the red oak. This is due to a number of factors including the use of lower temperatures in the dry kiln; evenly spaced stickers of uniform thickness; sawing of dimension to uniform thickness; and placement of dimension in the dry kilns soon after defecting.

## Objective Two: Market Testing and Evaluation

After drying, defected green parts are similar to conventionally produced rough dimension parts and can be used in most of the same applications. When all the different types of markets are considered, a wide range of thickness, widths, and lengths are required. However, within a given market segment, specific sizes of parts are generally needed.

In preparing green dimension for the market several considerations are needed. When the boards are dimensioned green and then dried they will undergo natural dimensional changes. These include shrinkage (radial and tangential), cupping, diamonding, bowing, and crook. To be used directly as a moulder blank, "dimensioned green" material has to be oversized to allow for the removal of these shrinkage defects. Information of determination of these tolerances has been found in research studies completed in the 1930s.

During the last year, samples of green dimensioned products have been taken to several manufacturing facilities for evaluation. Results from these samples were very encouraging with a parts yields of 98.5 percent, surface area yields of 94.5, and volume yields of 71 percent. In comparison, two common lumber when processed in a rough mill results in surface area yields of 55 percent and volume yields of 35 to 40 percent.

Studies were also undertaken at a truck flooring plant in Red Wing. Efforts at this plant were hampered by the equipment at the plant which was unable to handle the shorter "green dimensioned" lengths. This study will be redone later in the project by ripping and planing the parts at Palisade Supply before shipping.

## Objective Three: Information/Technology Transfer, and Process Demonstration

To determine business feasibility and assure minimal technology transfer delays, the project is being undertaken at Palisade Supply. The facility is being used partly as a manufacturing plant and partly for research and demonstrations. Many site tours have been given at Palisade Supply to interested parties.

The goal of this approach is to immediately transfer technology as the results are generated. Research will be implemented at the plant as it is completed. Information transfer time to other companies has been minimized by having the facility and the data open for review as the research is completed.

This method of technology transfer appears to be working. However, the amount of time the owner of Palisade Supply, Robert Bartz, is spending in technology transfer has become a barrier to increasing his production.

The number of companies involved with the project continues to grow. A poster session on the green dimensioning process for the National Society of American Foresters meeting was held in November in Indianapolis. The poster received first place in the Utilization and Marketing Poster Session.

The concept of dimensioning green is becoming widely accepted in the region. Increased efforts will aid in the implementation of the green dimensioning process at several of these companies. This is illustrated in the list of the companies, associations, and agencies which have been contacted and given presentations on the project as listed below.

**Green Hardwood Dimension Contact List 7-1-93 through 12-31-93**

**Industry**

Aristokraft Incorporated, Wi
Bergstrom Wood Products
Cedar Knoll Log Homes, NY
Custom Lumber Products
Davis Furniture, Wi
Designer Wood Products
Ebener Box, Wi
Industrial Hardwoods
Koetter Kilns, In
Minnesota Power
Palisade Supply
Pallet Minnesota
Product Research and Development
Rajala Timber Company
Woodland Container
Woodline Manufacturing

**Associations**

Aitkin County Private Woodlands

**Economic Development Groups**

Iron Range Resources & Rehabilitation Board
Itasca Development Corporation
Koochiching Development Authority

**Public Agencies**

Aitkin County Land Department
Headwaters R D C
Indiana DNR
Minnesota Dept Trade & Econ
Minnesota DNR
Onanegozie Res Conservation Dist.
U of M, Forest Products
USFS North Central
USFS Princeton West Virginia
Wisconsin DNR
USFS Blacksburg