

## Turn Scraps and Shorts into Profits

### *PRF/Soy 2000 Makes Green Finger-Jointing a Reality*

Every year, the forest products industry throws tons of profit in the chipper. But today these scraps are turned into a more valuable product at Hampton Affiliates' Willamina, Ore., finger-joint mill. Since 1997, Hampton has turned wasted wood scraps into engineered lumber that has not only improved the appearance of the stud over solid-sawn lumber and reduced the mill's energy costs, but also has increased the fiber efficiency from the logs by 1 percent for overall increased savings. Mills have been finger-jointing for years. However, the big limitation was that finger-jointing could only be done with dry lumber. For several years now, the soy-based-adhesive system PRF/Soy 2000 developed with funds from the United Soybean Board (USB) has offered the flexibility to finger-joint green and/or dry lumber efficiently and economically.

The PRF/Soy 2000 adhesive system involves the mixing of the soy-based Eka 3050, manufactured by Eka Chemicals, Inc., and a conventional, off-the-shelf, phenol resorcinol-formaldehyde (PRF) resin. The PRF resin is applied to one end of a finger-jointed block of wood, and the soy-based Eka 3050 is put on the other. When "honeymooned" together, the glue line that is formed gels within 60 seconds and develops quick tensile strength for handling the finger-jointed lumber. The PRF/Soy 2000 adhesive works with pressure-treated lumber and provides a fully structural bond line that is boil-proof and waterproof.

These adhesives offer many advantages to the lumber industry:

- Transforms yesterday's wood waste into an engineered wood product
- Increases lumber yield from logs by 1 percent
- Improves appearance, since green-jointed lumber can be surfaced on all sides to remove offsets
- Green finger-jointed lumber is straighter with fewer defects and yard loss than solid-sawn lumber
- Flexibility to finger-joint green and/or dry blocks together
- Provides fully structural adhesive
  - Boil-proof
  - Waterproof
  - Insect-proof
  - Type 1 exterior glue bond
- Bonds pressure-treated lumber
- Lowest cost of all green-lumber adhesives at about \$.01 (1 cent) per joint
- Saves energy costs for green-block or dry-block mill operations
  - Finger-jointed studs do not need to be kiln-dried and can be sold green
  - If kiln-dried, jointing green allows only defected, sellable lumber to be dried
  - Dry-block finger-joint mills can glue above 19 percent moisture content (MC) without sorting or redrying
- Improves grade of lumber and profits by reducing need to overdry wood
- Faster curing time than standard wood adhesives because mating of adhesives causes gelling
- Gelling of the adhesives gives quick handling strength that occurs even on frozen wood
- Environmentally friendly, since Eka 3050 is made from soybeans, a renewable resource



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**A natural,  
renewable  
feedstock for  
industry.**

- Accepted by the Western Wood Products Association (WWPA) for structural lumber of all grades to finger-joint studs, dimensional lumber, I-beam flanges, trusses, decking, lam stock, posts and others.
- Meets TPI standards for finger-jointing “vertical use only” Southern Yellow Pine (SYP) studs
- Usable in Canada under SPS 3 per Forintek Report No. 2407 published April 2000
- Provides opportunity for sizable profits
- Finger-jointed stud prices are less volatile than chip or solid-sawn lumber prices
- Increase log utilization and build more profits into lumber manufacturing

## **Advantages of Finger-Jointing Green Wood**

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Finger-jointing green wood is an economically and environmentally attractive means of increasing the yield of high-grade lumber and increasing the value of low-grade wood. By offering a more efficient and profitable use of our forest resource with less environmental impact, finger-jointing green wood is the wave of the future. It is a win-win scenario for the mills.

Because wood blocks are jointed green, the efficiency of turning a log into lumber is increased by 1 percent. At a \$500/mbf log cost, this means \$5/mbf is saved in marketable wood fiber. If a sawmill cuts 50 million feet per year, this amounts to a saving of \$250,000 by finger-jointing green scraps into an engineered product.

## **PRF/Soy 2000 Advantages**

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**Versatility.** Mills experience many advantages with the PRF/Soy 2000 adhesive. Mills can finger-joint material with varying moisture contents. In many industrial situations, wood processed at widely different time periods requires finger-jointing material with highly variable moisture contents. Different softwood species of various moisture contents can be joined together, and a mixture of green and dry blocks can be finger-jointed together. Shrinkage of the different blocks does not become a factor, because the adhesive is stronger than the wood and holds the fingers together through the drying process, whether it is air dried or dried in a kiln. The appearance of the finger-jointed product is also improved, since all sides can be surfaced to remove any offsets between the blocks. The finger-jointed lumber is straighter and has fewer defects than solid-sawn lumber, resulting in less yard loss for the end user.

**Strength.** Traditionally, finger-jointing makes lumber much stronger. Even at the joint, finger-jointed lumber can easily handle horizontal or vertical stresses. Despite its versatility, the PRF/Soy 2000 adhesive is among the strongest on the market. It has a high tensile strength and has passed exterior product standards, as outlined by the American Society for Testing and Materials (ASTM). As a result of these tests, PRF/Soy 2000 has been accepted by the WWPA as an exterior-type adhesive meeting the requirements of ASTM D2559, or the equivalent. The adhesive is suitable for the bonding of wood, including finger-jointed lumber of all structural grades, because it provides a fully structural Type 1 exterior glue line that is boil-proof, waterproof and insect-proof. The PRF/Soy 2000 adhesive also works with pressure-treated lumber.

**Cost.** Green finger-jointing with PRF/Soy 2000 is extremely cost-effective. This process can be used easily on typical finger-jointing machines made by a variety of manufacturers. The only necessary piece of equipment that must be added is a second resin applicator system. This applicator applies the soy-based adhesive to the first set of fingers profiled. The normal applicator applies the PRF resin to the second set of fingers profiled. An estimated cost of this additional applicator is \$5,000-\$7,000, and it can be purchased from several manufacturers. Overall, costs of the combined PRF/Soy 2000 glues are about half of the other green glues available on the market today. When finger-jointing green, 2x4 blocks, with a 5/8-inch profile and averaging 15 inches in length, adhesive costs are only \$18/MBF, or about \$.01 per joint.

**Efficiency.** Major economic benefits of using the PRF/Soy 2000 in green wood are realized in the drying process. First of all, the green finger-jointed studs do not need to be dried and can be sold as green. If kiln drying is desired, jointing of the green blocks prior to the kiln allows only defected, sellable lumber to be dried. Kiln efficiency has increased dramatically, and costs have been reduced substantially. In a dry-block finger-joint mill operation, moisture targets can be set higher because the PRF/Soy 2000 will join together wood of any MC percentage.

Nineteen percent MC can still be a target, but there is no need to sort out any blocks to be redried. By not overdrying the wood blocks, splits and drying defects are reduced, and the grade out of the finished product can be increased substantially, resulting in increased profits.

**Cure rate.** For mills concerned about high productivity, PRF/Soy 2000 cures faster than other adhesives on the market. Gelling of the mixed adhesives can occur at temperatures near freezing. Both laboratory and production tests have shown that the honeymoon system even works with frozen wood that is being finger-jointed. After the initial gel takes place, the wood needs to warm up to room temperature for complete curing of the glue line.

**Environment.** Green finger-jointing offers environmental benefits, and the PRF/Soy 2000 helps the environment in several additional ways. Volatile organic compounds (VOCs) are reduced when wood defects, including knots, are removed prior to finger-jointing and drying. Knots are considered a major source of VOC emissions. VOC and formaldehyde emissions are also decreased because the more environmentally friendly soy-based Eka 3050 replaces half of the PRF resin. The soy-based adhesive is made from a renewable resource, soybeans, grown by over 600,000 U.S. farmers.

## **Current Developments**

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In 1997, the WWPA certified the PRF/Soy 2000 at Willamina Lumber Company. The Oregon mill certified PRF/Soy 2000 for manufacturing vertical-use-only, finger-jointed studs using green Douglas fir and green hemlock lumber shorts. Willamina continues to use PRF/Soy 2000 to manufacture these studs.

In 1999, the WWPA accepted PRF/Soy 2000 as an exterior-type adhesive meeting the requirements of ASTM D2559, or the equivalent. The adhesive can now be used for the bonding of wood, including finger-jointed lumber of all structural grades. In the South, the PRF/Soy 2000 adhesive continues to draw closer to certification for horizontal or structural use of finger-jointed studs. At first there was some reason to suspect that finger-jointing of SYP would prove more difficult than it would for Western species. However, laboratory tests and mill trials, sponsored by USB, indicate that the green finger-jointing of SYP can be just as successful as for the Western species.

Without question, the next frontier for green finger-jointing of SYP is the structural market, and USB is working hard to certify the honeymoon system for both vertical-use-only studs and structural lumber with the Southern grading agencies.

In Canada, the PRF/Soy 2000 adhesive can be used under SPS 3-00, the NLGA Special Products Standard for Finger-Jointed Stud Lumber "vertical use only." Forintek Canada did a full-scale test using various ASTM and SPS 3-00 standards. The results are in their report #2407, published in April 2000. Successful tests have been completed in several Canadian mills, and when the questions of export duties are clarified, the PRF/Soy 2000 adhesive will be certified in a Canadian mill.

Today, there are still tons of green softwood shorts being tossed into the chipper, even with a low return for chip prices. USB believes these scraps present lumber mills, pallet manufacturers, remanufacturers and wood processors the opportunity for sizable profits if the scraps and shorts are finger-jointed instead. History has shown that the finger-jointed stud market fluctuates less in price compared with the more volatile chip or solid-sawn-lumber prices.

Turning these scraps into sellable lumber by using the advantages of PRF/Soy 2000 allows companies to increase their wood utilization today and build more profits into their company for a long time into the future.

**The United Soybean Board is made up of 64 farmer-directors who oversee the investments of the soybean checkoff on behalf of all U.S. soybean farmers. Checkoff funds are invested in the areas of animal utilization, human utilization, industrial utilization, industry relations, market access and supply. As stipulated in the Soybean Promotion, Research and Customer Information Act, USDA's Agricultural Marketing Service has oversight responsibilities for USB and the soybean checkoff.** 

