

Technology Profile



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Presorting to Improve Drying – An Overview

Pre-sorting green lumber offers Canadian lumber producers the potential to increase both productivity and product quality. Another reason why many have adopted this practice is in response to demands from customers for greater product uniformity. Secondary manufacturers will often pay a premium to producers who can consistently deliver lumber dried to their specific moisture content (MC) requirements.

This Profile provides some background on the green lumber characteristics that have the greatest impact on drying uniformity within the SPF and Hem-fir lumber groupings. It also presents information on current technology being used in Canadian sawmills to pre-sort green lumber to improve recovery grade, reduce energy consumption, reduce drying times, improve final moisture content uniformity, and minimize excessive shrinkage. The challenge for lumber producers is to find a pre-sorting technology that can be implemented in their specific sawmill environment, and that will deliver a tangible return on investment.

Background

Canada has pioneered the development of pre-sorting equipment and still has a competitive edge, even considering the number of technologies available in this country. Canadian lumber producers involved in the manufacture of SPF dimension lumber, for example, have been pre-sorting lumber for the past decade. Many companies have made the transition from drying SPF lumber together, to

sorting by species, and more recently, to sorting by species and other characteristics such as initial moisture content, weight or a combination of moisture content and density.

Equipment has been developed to assist producers to sort lumber into groups that will ultimately exhibit similar drying characteristics and therefore show the same potential “dry-ability.” However, there has not been a definitive approach regarding the development of drying schedules for each of these sorting technologies. Although there seems to be little doubt regarding the impact of sorting on kiln productivity, other important operational aspects, such as energy



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conservation gains and quality improvement as a result of green sorting, have not been fully assessed. Therefore lumber producers should not only inquire about the technical capabilities of sorting equipment, but also what the supplier is prepared to offer in terms of technical support to help develop drying schedules based on information generated by the sorting technology.

Issues that impact on drying uniformity

Three general characteristics of green lumber are known to have a critical impact on drying uniformity: initial moisture content, initial moisture content variability, and density. Research institutes and equipment manufacturers have developed tools, equipment and methods to track and measure variances within these characteristics. One need look no further than the challenge of the Hem-fir species grouping, where the initial moisture content for each stick of lumber is quite variable, to get a feel for the potential benefits of sorting based on tracking initial moisture content. Drying rates are also affected by basic density, as high density lumber requires slower drying rates. Log quality, as well as storage and handling practices, can have a significant influence on the initial moisture content characteristics of green lumber. Insect- or fire-killed timber may have dried considerably before even leaving the forest. Logs stacked in inventory for an extended period of time may demonstrate a significantly different initial moisture content than freshly cut logs. Some producers have therefore taken steps to improve inventory tracking in the yard so that logs entering the production line are more similar with regard to initial MC.

The consequence of ignoring variances in the above three characteristics and not pre-sorting green lumber is the tendency for kiln operators to over-dry or under-dry charges. This will either result in higher incidences of drying downgrade and shrinkage or an unacceptably high proportion of wets.

In addition to producing more uniform lumber, pre-sorting green lumber with similar characteristics has the potential to improve productivity. A charge of drier green lumber, for example, will take less time to attain its moisture content target than a charge of wetter green lumber. Also, kiln operators can design special drying treatments to address specific challenges such as wet pockets in a charge of sub-alpine fir.

Current technologies

Species sorting:

The strategy behind a species sorting system is to allow drying of a single species in the kiln rather than a mixture of species each with different drying characteristics. A system must be capable of separating lumber into groups that will have more similar drying characteristics. The Spruce & Fir Drying Optimizer conceived by Forintek and commercialised by Autolog is one example of this

type of technology. It uses an alcohol-based chemical agent, which when sprayed onto the end of lumber pieces, reacts with wood chemical constituents to produce a colour change. A sophisticated fibre-optic vision system analyzes the colour change of the wood. Depending on the resulting colour, lumber pieces are then sorted and accumulated for drying. The system is installed right after the trimmer, and transmits its data to a sorter controller. According to Autolog, the system is simple to assemble and operate, and is designed to function at normal mill speeds.

Infrared-based sorting:

Aquaviewer, a new system manufactured by MPB Technologies Inc., uses sophisticated spectral imaging technology. Instead of relying on specific points along the length of the lumber, the system analyzes the whole piece. The entire lumber piece is mapped and a graphical representation of the water distribution is available to the user. The Aquaviewer is based on the relationships that exist between wood temperature, ambient temperature, ambient relative humidity and moisture content of the wood. In addition to the ability to measure wood temperature, the system is equipped with probes to measure ambient temperature and relative humidity. The system is constantly calibrating itself to reflect the ambient conditions of temperature and relative humidity. It sorts lumber based on the lumber's ability to release moisture, or put another way, on its potential ability to dry.

Moisture/Density sorting:

A popular system developed by Northern Milltech Inc., senses the dielectric properties of wood, which are influenced by moisture content and density. Full contact sensors are located above and beneath the lumber as it is moved on the conveyor. This arrangement gathers measurement data on both wider faces of the lumber. Typically, four pairs of sensors are transversally arranged to carry out measurements along the length of the lumber. This system examines and analyzes variations in the moisture/density relationship

along the length of the board both between and within species to determine its 'dryability'. Taken a step further, this information can also be used to assess, for example, extreme variations in such species as sub-alpine fir and hemlock.

Weight-based sorting:

An example of a weight-based sorting system is one manufactured and distributed by Optifor. The sorting system dynamically weighs lumber pieces on the green chain at normal mill speeds. According to the manufacturer, the system is easily adapted to existing installations and basically is maintenance free since it has no moving parts. The weight of lumber is related to its initial moisture content and density, both of which can have a significant impact on drying. The weight sorter allows the user to develop a 'weight database' for species and/or species groups. The ranking of weight obtained then allows the user to establish sorts, which according to Optifor, will have similar drying characteristics.

« What is more likely, in the near future, is that we will identify opportunities to combine some of the various pre-sorting technologies currently available. It is the physical sorting requirements, i.e. bins, chain lines, and buildings that scare many mills away from pre-sorting. »

Decision-assist tool: OASiS™

When it comes time to justify or implement pre-sorting strategies, mill personnel need information to help choose the best sorting strategy specific to their fibre supply and mill constraints, allowing them make the most cost-effective capital investment decisions. This information can be obtained by using Forintek's pre-sorting and drying simulation software package, called OASiS™. This decision-assist tool has been developed by Forintek scientists to optimize the entire sawmill pre-sorting and drying strategies based on impact on drying degrade and kiln productivity. This software is available directly to industry but the best results are obtained when Forintek staff gets involved to develop a site-specific database.

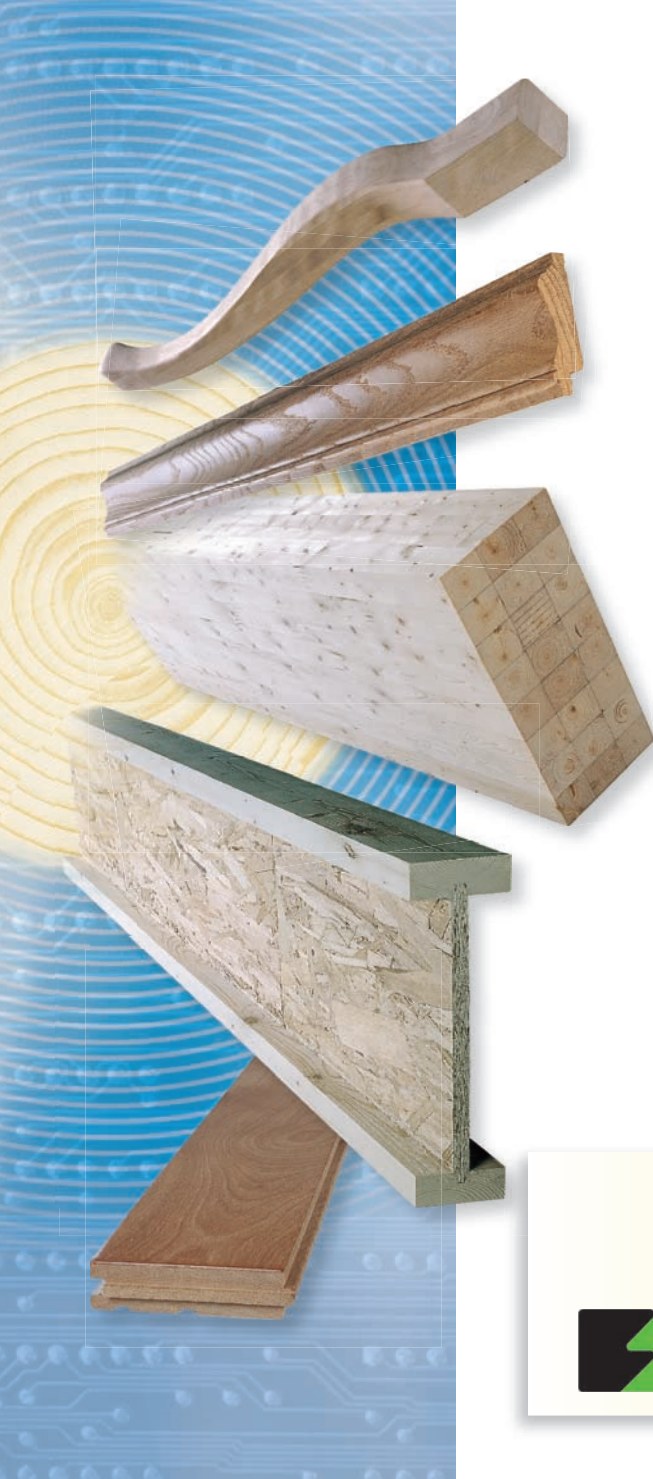
Future possibilities

In addition to stringent quality requirements imposed by end-users, it is expected that rising production and energy costs will encourage researchers and equipment manufacturers to develop new systems and/or strategies to achieve better drying.

There is a need for more research directed at relating green lumber characteristics to drying results. Manufacturers of existing sorting equipment would benefit from this research, as it could help them improve the performance of their systems and/or stimulate further development of their technologies. Greater knowledge of material drying characteristics may also generate ideas for different sorting strategies using new, innovative technologies.

An old concept that is receiving new attention is the idea of post-sorting. Lumber producers may want to investigate the potential benefits of post-sorting dried lumber. Some of the same technologies used for pre-sorting can also be used to sort lumber after drying. The concept of post-sorting is attracting interest because it has the potential to eliminate over-drying. Lumber with a moisture content that is well above its target range can be identified through post-sorting before the planer and then re-dried, while properly dried lumber can continue on to the planer. This avoids having to over-dry the majority of a charge just to ensure that a small percentage of slow-drying material is at an acceptable MC. This is another strategy that results in greater final MC uniformity and the associated benefits of marketing a uniformly-dried product.

It has become apparent that there is no one solution that is good for all mills. The species proportions, log handling and storage practices, and drying demands are sufficiently different from mill to mill that site-specific evaluations must be conducted. Increased awareness of material drying properties and competent in-house technical capabilities allow many mills to conduct a review of the material sorting options themselves, or with the assistance of Forintek.



More Information

For more information on OASiS™, please contact the Lumber Manufacturing Department – Drying Group at either laboratory.

For information on the 2003-2004 *Value to Wood* research program, visit www.valuetowood.ca



Ce Profil technologique est également disponible en français.



As part of the *Value to Wood* program, funded by Natural Resources Canada, Forintek's Industry Advisors are providing technical services to value-added wood product manufacturers in all regions of Canada. If you need information on any technical issue related to wood product manufacturing, you can:

- Send a request via valuetowood.ca (Help Desk).
- Contact a *Value to Wood* co-ordinator at one of the following locations:

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