Improving Grade Recovery Through New Concepts & Tools for the Drying and Moisture Measurement Processes

A Comprehensive Drying QC Seminar
Hosted by Wagner Electronics

Oregon Convention Center
Room E141
Portland, Oregon
March 13, 2008
1:00pm - 5:00pm
You Don’t Cook Your Turkey and Cake in the Same Oven at the Same Time - Presorting Your Lumber Before Drying

Presenter: Dr. Gavin Wallace, Isoscan Division of the Geologic and Nuclear Sciences Institute of New Zealand

The aim of kiln drying is to dry lumber quickly and as economically as possible with a minimum loss of degrade. Green softwoods have a large variation of moisture content. Kiln charges with these large variations, which are rapidly dried under the same conditions, will be degraded and also have a large variation in final moisture content. Presorting lumber by green density has reinvented the way mills presort their green lumber and has proven to be better than sorting by moisture content. The benefits of presorting using green density and the range of techniques to achieve reduced degrade will be presented.

Gavin Wallace is Manager of the Isoscan team of scientists, engineers and software developers at GNS Science. He has a background of nuclear physics and for the last 15 years has been developing instrumentation to tackle industrial problems. These include erosion/corrosion of metal, imaging of timber structures using portable computed tomography scanners, and gamma ray backscatter for timber assessment. Eight years ago, his team developed an on-line density gauge based on gamma ray absorption to measure the green density of freshly cut lumber at processing speeds. His latest invention is an impact grader that measures both the density and strength of lumber, without involving the use of radiation.


Presenter: Catalin Ristea, Universite of British Columbia

Quality control programs in process manufacturing are typically concerned with monitoring the process’ central tendency and its variability. However, the paradigm in much of the applied quality control work in kiln-drying is concerned with measuring and reporting simply on the “average” moisture content and its “standard deviation” – measures which were historically derived for and are appropriate to use with “normally” distributed quality characteristics because they define the normal distribution’s central tendency and variability. It will be shown that moisture content measurements are often not normally distributed; hence appropriate quality control methods need to be used for a meaningful and accurate process monitoring. Goodness-of-fit methods for analyzing the distribution of moisture content in kiln-dried lumber will be introduced. Formal mathematical test results of our study show the moisture content of kiln-dried lumber is well modeled by the three-parameter lognormal distribution for lognormally distributed moisture content data. Three lognormal control charts that monitor quality characteristics that follow a 3-parameter lognormal distribution should be used. The “scale chart” and the “chart for geometric means” monitor the central tendency of the process. The “shape chart” monitors the process variability. A rationale for using geometric means rather than arithmetic means for assessing process central tendency will be explored.

Catalin Ristea is a Research Project Manager in the Faculty of Forestry at Univ. of British Columbia. He holds a BSc in Wood Industry from Transylvania Univ., and a MSc in Forestry from Univ. of BC. Catalin’s work is concerned with formal methods and procedures for determining the distribution of moisture content in kiln-dried lumber using goodness-of-fit analysis, and application of statistical process control principles to monitor the lumber kiln-drying process: through the use of innovative quality control charts.

Real World Effects of Using Improper SPC Models

Presenter: Megan Wahrenbrock, Quality Analyst, Wagner Electronics

A combination of normally and lognormally distributed moisture content measurements can be found among the same kilns, species, and dimensions of lumber. It is critical to determine the type of distribution observed prior to performing any statistical process controls. Using normal distribution variables such as “average” and “standard deviation” on a lognormally distributed data set will lead to drastically incorrect assumptions. This will lead to making bad managerial decisions and could ultimately cost a mill hundreds of thousands of dollars per year. First determining whether moisture measurements are normally or lognormally distributed and then calculating the appropriate statistical variables will allow for accurate quality control and sound managerial decisions.

Megan Wahrenbrock graduated in June, 2005 with a Bachelor’s of Science in Mathematics. Since then she has been working as an Engineering Assistant, performing detailed data analysis for Wagner Electronics. Her focus is on researching and analyzing ‘real-world’ data to improve quality and develop new methodologies. She plays an integral part in creating a density compensation technology for measuring moisture content in wood.
You Need to Know Where You Are So You Know Where to Go: Improved Tools for Gathering, Viewing and Analyzing Your Drying and Moisture Data

Presenter: Ron Smith, Sales Manager, Wagner Electronics

Items discussed will include new software and databases along with developments in barcoding and scanning of package tags. Viewing and interpreting 3-D moisture data relating to the physical location within a kiln can often times be very challenging and many times downright misleading. A new methodology for viewing and analyzing moisture data has been re-invented. New software will provide lognormal as well as normal Trending Charts to perform statistical process control (SPC). Tracking central tendency and variance using the appropriate distribution model from charge to charge and package to package within kiln becomes the standard. Upper and lower control limits (UCL, LCL) readily determine when a kiln drying process has gone “Out of Control”. Data mining 3-D moisture data will be demonstrated by slicing segments in any of the three planar dimensions (xy, xz, yz) and graphical 2-D representations of the moisture data similar to topographical maps will be shown. Wet spots, dry spots, and large moisture variations become readily visible.

Ron Smith has over 25 years of experience as a Regional Sales Manager, Product Manager and Sales Manager in the field of instrumentation, controls, telemetry and data acquisition in the forest products, water/wastewater, and power utilities industries and defense industries. He has co-developed switched horn network-based emergency communication systems used by government defense and nuclear power facilities, as well as for a number of the US national laboratories. During his 15-years with Wagner Electronics, Ron has been part of project teams in the development of state-of-the-art moisture measurement systems and software. He has participated in moisture measurement system accuracy studies and associated data analysis conducted by international institutes. For a number of years, Mr. Smith has taught the moisture measurement systems and instrument class at the annual Oregon State University Forest Products Department Dry Kiln School.


Presenter: Tim Duncan, Engineering Manager, Wagner Electronics

Capacitive Technology-based moisture measurement systems are inherently prone to inaccuracies due to variations of density within wood species. This variance is also the largest natural mode of inaccuracies which then characterizes the lower limit threshold of moisture measurement accuracy. While it is easy to maintain repeatable precision of measurements down to 0.1 % MC, this inherent density variation obstacle must be overcome to achieve improved levels of accuracy. Re-inventing moisture measurement technology and using density compensated moisture measurement systems that achieve the above stated precision with more than twice the accuracy of current systems can be achieved. With such a system, each board is accurately graded based not only on the absolute amount of moisture present, but on the actual ASTM oven dried based MC value. Dense boards no longer “appear” wet, but are actually upgraded” appropriately. Package to package statistics no longer become the norm.

Tim Duncan is Engineering Manager and R&D Engineer at Wagner Electronics, and is currently performing research and development in density compensated moisture measurement systems. He received his B.A. in Physics from the University of California at Berkeley. He spent the next seven years developing highly customized equipment interfaces for the Berkeley Microfabrication Laboratory and providing support for the Berkeley Computer Aided Manufacturing research group at UC Berkeley’s Electronics Research Laboratory. He then spent three years helping start up OnWafer Technologies, a semiconductor metrology equipment manufacturing firm, in the Silicon Valley by designing and developing their core statistical viewing, analysis, and reporting software suite. Since moving back to his home state of Oregon three years ago, Tim has worked exclusively for Wagner Electronic Products Incorporated, where his primary focus has been research and development. Tim is also actively pursuing his MBA degree at Capella University, an online institution.

From the Sawmill Through the Planer Mill: What We Have Learned and Can Learn by Tying It All Together

Presenter: Michael Milota, Associate Professor, Oregon State University Forest Products Department on sabbatical from OSU

There is tremendous variability in many of the measurements made during lumber production. Precisely comparing what was done yesterday with today is difficult due to changes in log supply and natural wood variability. Trends need to be looked at over longer periods; weeks or even months. Besides final quality assurance, data from the moisture measurement system at the planer can be a valuable tool for analyzing trends in processes in other parts of the mill. The data is often already collected and just needs to be related back to the process. Examples would be looking at moisture trends by location in a kiln or moisture differences between kilns or detecting small differences in the moisture contents at which an operator shuts down kilns. The feedback may not be immediate; however, many problems develop slowly. Seasonal changes in log supply, for example may gradually affect final moisture contents necessitating changes in drying times or shut-down moisture contents. In this presentation we will look at some ways that the moisture content data can be analyzed and related back to the sorting, drying, and storage of lumber.

Mike Milota is a Professor in the Wood Science and Engineering Department at OSU. He is currently on sabbatical leave and working with Wagner Electronics and several sawmills to implement grade recovery programs which utilize the moisture measuring system. He holds a BS in Forestry from Iowa State University and MS and PhD degrees from Oregon State. He is a registered professional engineer in Oregon and has over 25 years experience working with the forest products industry. He is the coordinator of OSU’s Lumber Drying Workshop held annually in December.
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