

# **IMPLEMENTATION OF A DENSITY SORTING STRATEGY TO IMPROVE DRYING**

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## **Introduction to the Problem - Dave Reader**

### **What Was RFP (Roseburg Forest Products) Looking For?**

RFP (like many other lumber producers) was looking for a good way to sort green lumber prior to being stacked for drying. As we all know, there is a very large difference in the amount of moisture in different pieces of lumber – thus requiring a different amount of time to dry to perfection. If lumber can be sorted into groups that require close to the same amount of drying time it would save drying time (saving energy and improving kiln capacity) while also improving recovery (less shrinkage and warp from over-dried lumber).

### **Where and When We Found It**

One of the things on my list of things to look for at the 2004 Portland Wood Show was a new way of sorting green lumber for drying. While at one of the new product demonstrations, I heard about the LDS 200 (Density Sorter). Wagner had just, the night before, reached an agreement with TRUEVIEW to be the sales representatives in North America. They talked about using gamma rays to find the density of the lumber and that this density would work for sorting as to drying time needed. I was interested in knowing more. After the product demonstration, I met with Wagner and TRUEVIEW representatives and offered RFP as a partner to set up the first system in the U.S.A. After about nine months of negotiations, we had reached an agreement and started on the project.

### **What Were the Claims about the Machine?**

They claimed that this system was working very well in Australia and New Zealand, that it was cutting 15% off their drying times and improving recoveries significantly.

### **Investigating the Machine**

Because RFP was looking at not only the Density Sort but another brand new technology from the same company we decided it was worth a trip to Australia to investigate fully these new machines. I know it is tough but somebody had to do it. So I and two other RFP representatives went to Australia for a week. We looked at three different mills seeing the Density Sort at all three mills. We heard nothing but rave reviews from the mill operators and observed it operating flawlessly on Radiata Pine at speeds of up to 120 lugs per minute.

## **The “Stickman”**

While in Australia we saw another device they call the “Stickman”. While not of interest to us at RFP, it is worthy of a quick note here. All framing lumber in Australia must be MSR (machine stress rated). They use the LDS200 to measure the density of a board and then they use the “Stickman” to measure the stiffness of a board (by measuring sound waves). With both of these measurements, they can figure the elasticity of a board and get very close to a machine stress rating. They use this machine to pre-sort for the MSR machine – thus avoiding sending a lot of low grade lumber into the MSR machine and possible break ups and downtime.

### **Equipment Description - Gavin Wallace**

#### **How Does the LDS200 (Density Sorter) Work?**

The LDS200 measures the green densities of freshly cut boards. It does this by combining the measured absorption of gamma ray beams through the boards with laser estimates of board thicknesses. Green density is the combination of wood fibre and water, and gamma ray absorption cannot be used to distinguish between these constituents, so it is not possible to measure moisture contents. However, it is more difficult to extract water from higher density wood in the drying process, and green density has been proven to be a good indicator of the ‘dryability’ of green timber.

The standard LDS200 gauge uses four gamma ray beams spread along a board, and combines the individual measurements. While the inherent accuracy in green density is about 1.5% standard deviation, the combination of different types of wood results in an overall precision of about 4.5%.

#### **What Safety Issues Are There?**

The gamma rays used are 60 keV in energy, and are equivalent to x-rays. These are easily shielded by metal; ¼” of steel will effectively block a beam. The gamma ray sources are 200 mCi Am-241 in the form of ceramic beads encased in stainless steel. These sources are housed in shuttered brass enclosures such that gamma rays can only be emitted as pencil beams. The shutters are spring-loaded, and are operated by solenoids that can be controlled from the gauge cabinet. They are also interlocked to the mill chain power system so that the shutters are automatically closed when lumber processing is suspended.

The source enclosures are mounted below the chains, and the pencil beams are directed vertically to intercept on the gamma ray detectors above. While there is a small amount of dispersion, most of the beam is completely stopped by the detectors. Radiation can only be detected within 4” of the beam, and certainly not alongside the timber line. Even if the interlock safety system was bypassed, and someone was out on the line with the shutters open, the radiation hazard is still very small. You would need to leave your hand at a distance of 4” in the direct beam for 24 minutes to receive the same dose as a medical chest x-ray. At a one yard distance, the exposure time for the same dose increases to 4 hours. A flight from New Zealand to Europe realizes an additional radiation dose from cosmic radiation of five times that of a chest x-ray.

The LDS200 meets all US safety requirements, and is listed on the Sealed Source Device Register approved by the Nuclear Regulatory Commission.

## **What Maintenance Is Required?**

All units of the gauge are sealed and, other than keeping surfaces clean (particularly bottom laser), there is no regular physical maintenance required. The gauge is non-contact, and is self-calibrating. The latter feature arises because it continuously measures gamma rays and uses ratios of count rates with and without the presence of boards. This means that a buildup of sawdust on a source box is ignored. Because there are usually four source/detector pairs, the loss of one or two does not disable the gauge. However, the loss of a laser unit will. It is important that the boards are presented to the gamma and laser beams at about the same time; skewed boards, and other similar conditions, will result in 'vetoed' measurements. These generate error messages, and are logged to flash memory. These log files can be retrieved and sent to the manufacturer to assist in prompt diagnosis of any problems.

Ownership and maintenance of radioactive sources is subject to strict State regulations. These demand that source enclosures are wipe-tested every six months, a procedure that needs to be done by a suitably qualified person. Access to source enclosures is inhibited through the use of security screws.

## **Performance - Dave Reader**

### **Installation at RFP**

RFP installed the LDS200 in at RFP on the weekend of July 4<sup>th</sup> 2005. We have a studmill that runs 6' to 10' 1x4, 1x6, 2x4, 2x6, 4x4, and 4x6. We have two sorter lines and we put a density sort system on each line. Both systems have two gamma ray sources and receivers. Line 1 runs a top speed of 120 lugs per minute with 32" between lugs. Line 2 runs up to 165 lugs per minute with 16" between lugs. The speed of line 2 was a discussion point during the planning stages. The installation of both lines took 48 hours and went in very well. Start up cost us no downtime but did take a few days to "tune" for sorting purposes.

### **What Problems Did We Encounter and What Solutions Did We Come up With?**

We did have a few problems that have been and are being addressed.

- 1) Speed problems on line 2. We have had the system "lock up" on line 2. It seems to be a computer software problem. TRUEVIEW has worked on this and has it almost taken care of. We now run between 140 and 160 lugs per minute with few lock ups.
- 2) Mis-marking and/or placement of units once sorted. Our sorter is very large, and at times the reloader operators have put the wrong tag on a unit and at times the drivers have stacked a sinker unit in a floater crib. Communication and education have been the main tools to fix this problem. We have also ordered an ink jet marker to go right behind the density sort so it will mark all the sinkers and floaters with their own mark. So in the near future, each board will be clearly marked.

## Does it Perform up to Expectations?

Our expectations for the density sort at RFP were:

- 1) To reduce drying time at the kilns by 15% overall.  
We feel we achieved this
- 2) To reduce trim loss by 1/4 %.  
We more than achieved this.
- 3) To reduce economy grade by ½ %.  
We missed this one. Some of the improvement on trim loss reduction, was based on being able to run some of the lumber, that before the density sort, was too warped to make it through our planer. This did happen - but then a higher percentage goes to economy. Our overall economy percentage has remained the same.
- 4) Overall we feel the LDS200 did what we expected and we are very pleased with the results.