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Grading on a Curve: Automating the Woodyard

Challenges and Automation for Log Grading and Prep

North American veneer, lumber, and plywood mills have adopted their share of automated technologies, which have enabled them to manufacture higher volumes of product efficiently. One area has largely resisted automation, however: log grading. Mills in the United States and Canada still rely on methods developed in the 1800s to grade logs despite advancements in Europe, where high fiber prices and a labor shortage have driven change. Those same drivers are now pressing North American mills to catch up, though. The market is now opening to automated log grading.

The Case for Automation

Steady changes in the labor market have pressed North American manufacturers toward automation for years. Due to mills' often-rural locations, the shortage of and expense of hiring skilled laborers has hit wood-processing industries particularly hard. And the problem is unlikely to go away, as the shift away from blue-collar work is a decades-old trend. Manufacturers have even had difficulty hiring workers during the 2020-21 COVID-19 crisis, which has resulted in millions of people losing their jobs. Few, it seems, are interested in blue-collar work, and many are unwilling to relocate. Further automation is necessary if mills desire to thrive—or continue to exist—in the years to come.

Because the labor market is so tight, mills must take full advantage of the laborers they have, but current grading methods are hardly conducive to this. Consider a study from 1966 that determined it took three minutes longer to grade logs to Forest Service log grades per 1,000 board feet than measuring the volume through scaling[1]. Thus, a mill that produced 20-million board feet of lumber per year would require one thousand more man-hours of work per year than an operation that scaled its logs.

Things have grown more efficient than in 1966, of course, but the system as a whole is little different than during the study. It relies heavily on human labor: Employee A first unloads the logs into the yard, then Employee B inspects them. Employee A then stacks the logs, and later the same employee picks them up again to feed them into the mill. All this movement consumes time, energy, and employee work hours. Plus, it's wasteful when compared to merely having an employee place logs onto the infeed deck as they arrive.

The cost of logs is another issue that calls for green-end automation. Fiber costs are rising in North America, especially in areas where timber has become scarce (British Columbia) or

[1] T.W. Church Jr., *The Cost of Scaling and Grading Hardwood Sawlogs*. (Pennsylvania: USDA Forest Service, 1966), 21.

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sought after due to demand. A higher cost of raw goods means that if mills want to maintain their margins, they must either cut costs or increase their prices. Mills don't wish to do the latter if the demand hasn't risen accordingly. And mills cannot cut costs by dismissing laborers, as these are already in short supply. Their only option is to run more efficiently. Efficiency requires automation.

Yet another issue that mills face regarding grading is accuracy. While grading generally favors the log purchaser[2], mistakes do impact the bottom line negatively. And human graders will make mistakes. It's hard to determine a log's internal properties from what it looks like externally, especially when it's -15°F outside and snowing sideways. Undoubtedly, even during the best conditions, no grader will grade logs perfectly. Grown-over knots, resin pockets, rot, compression wood, and mineral stains can all be invisible from outside the log.

Mistakes with grading are even more costly in the veneer and plywood industries, as veneer-quality logs cost more, and minor differences in characteristics can determine whether mills can use the logs at all. Say a mill operates an 8' veneer lathe with which they produce 4'x8' plywood. Because the lathe will peel at 101", logs must have a minimum length between 103" and 105". If a 99" log makes it to the lathe, all the veneer from that log will go to scrap. That is an expensive loss considering that logs represent about 60 percent of the production cost.

Lengths aren't the only critical dimension for peeler logs. Crooks have a large impact on production, as well. As a general rule of thumb, a 1" crook will deduct ten board-feet of veneer from a log. If a grader overlooks such a defect, the mill will pay 17 percent too much for the log (assuming it is a 60-board-foot log).

Automating the grading process has the potential of relieving mills of these errors. Not only will they have an objective computer analyzing log qualities, but workers needn't even go outside during the process: automated grading can take place indoors.

Automated Systems

Automated solutions for log grading have been around for at least two decades in Europe. With these systems, sawyers place logs onto a log deck and feed them through a grading system rather than laying them out in the yard. Logs pass through scanners and metal detectors, are prepped with butt reduction, debarking, and end waxing, and are then sorted. This process is wholly or partially automated.

Scanners for grading are virtually the same as for merchandising. It isn't inconceivable that a mill could use a single scanner for both functions. For this to work, tags that refer to stored merchandizing data could be placed on the logs after they have passed through the scanner. A reader would then scan these tags as they enter the mill. Alternatively, the logs could pass through the scanner twice—once for grading and a second for merchandising.

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[2] Most mills in the United States rely on the Scriber Decimal C system to grade their logs, a system that was developed in 1825. Studies sixty years ago showed the average sawyer surpassed Scribner's estimated volumes by 10 to 20 percent; those numbers are undoubtedly higher today.

Scanning methods include 3D photos, ultrasonic waves, X-rays, and lasers. Early tests showed that the best results came by combining multiple types of scanners, which is why current scanners include a variety of scanning methods.

Automated log preparation is just as essential to reducing costs as automated grading—for the same reasons. This process is already highly automated in high-volume softwood lumber mills in North America through drum, rotary, and ring debarkers. These debarkers are not a perfect fit for every application, however. Ring debarkers can have more difficulty with hardwood logs, which are not as uniform as softwood logs. Drum or rotary debarkers require high volumes to work effectively and will not debark hardwood logs at the quality required. These limitations are why many hardwood mills rely on rosserhead debarkers. Rosserheads can be automated, too, however. Green-end automation is hardly an option available only to softwood mills.

Automatic butt reduction is another preparation step mill personnel need to consider. A study by the USDA Forest Service noted that butt flares are "a classic example of customary and usual downtime."[3] According to Robert Mayer and Jan Wiedenbeck, authors of the study, sawyers often have difficulty loading logs with large butts onto carriages. And difficulty stabilizing them on the carriage. And difficulty handling them on the waste conveyor. And (we know from experience) difficulties at the chipper. Flares result in wasted time and effort. Mills do well to eliminate them early in the process.

Automation and Layout

Automating green-end processes is undoubtedly easier said than done. Current grading systems require mills to singulate logs. Singulating logs isn't difficult for hardwood mills, as the volume is low enough that sawyers can singulate and scan the logs longitudinally. But singulation is problematic for softwood mills because volumes processed at these mills are already high and keep increasing. Because these mills singulate their logs to accommodate the ring debarker, the only way to increase the volume is to increase the speed. Doing so requires massive, heavy-duty equipment to take the impact loads, and the violence with which the logs are thrown around damages them. At such speeds, there are additional safety risks, too. If a log gets rejected off the line and doesn't hit the kicker just right, it can go flying—an event we witnessed while visiting a mill. (Fortunately, nobody was standing where the log landed!)

To address this problem, mills could instead slow down the process and grade the logs crosswise like a lumber scanner. The logs would then drop into pockets like a sorter and thereafter piled. This is the approach we took in the veneer industry, which had a similar problem with speed. Traditional veneer grading methods processed the veneer longitudinally and took a long time. Grading, therefore, limited production. To speed things up, mills put the veneer on conveyors. However, workers struggled to keep up, and mistakes they made due to the pace reduced the system's effectiveness. Our solution was to flip the veneer so workers

[3] Robert Mayer and Jan Wiedenbeck, *Continuous Sawmill Studies: Protocols, Practices, and Profits* (USDA Forest Service, 2005), 6.

could grade it crosswise and a machine sort the veneer into pockets. The solution worked perfectly and allowed the mill to increase their production without the high-speed mistakes.

Conclusion

The trend away from blue-collar work is unlikely to reverse anytime soon, and the price of labor will continue to rise. At the same time, the cost of automation will only fall as the technology becomes more commonplace. Automated log grading and green-end processing are established technologies that address issues in the labor market and ultimately create a more efficient mill. Such improvements are necessary for the well-being of mills in the wood-processing industry.

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