Sawing Options to Improve Profits

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Abstract

The current state of the lumber industry is forcing mills to look for new ways to improve profits. The traditional imperative of high feed speeds is no longer valid for all mills, although improvements in machine design and saw preparation will continue. The paper discusses how some mills have increased their profits by simple and sometimes counter-intuitive changes to how the sawing centers are operated. For example, some mills have discovered that slowing down actually improves production.

Introduction

The traditional approach to increasing profits is to invest in new machinery and computer systems. While this option does work, major upgrades are risky in terms of system integration, training issues and reliability. Furthermore, the competition is also buying the same equipment. This leads to the conclusion that the competitive advantage comes from how the equipment is used and optimized more than what type of equipment you have.

The changes needed for equipment to be used to its full potential are neither expensive, nor risky. The process of optimizing a machine is usually done in incremental steps, none of which cost much and can easily be reversed if a problem shows up. Frequently, the change is just a change in how things are done and cost nothing.

In the automotive and other manufacturing industries, this process is call “continuous improvement” and is one of the cornerstones of the manufacturing philosophy originally developed by the Japanese. One of the other time-tested cornerstones is that consistent and quality production result in significant profits and happy customers.

Production Imperative

The traditional goal in a sawmill is to increase feed speeds. It’s second nature and part of the sawmill culture. Faster feeds, improved accuracy, higher recovery and increased production have been achieved because of:

1) Improvements in saw plates and saw guides
2) Improvements in saw sharpening and maintenance technology
3) Scanning and automation
4) Improvements in the mechanical accuracy and strength of the machines that result in better control of the wood

All of the above technology can be purchased and is now utilized by most mills. However, by fine-tuning these machines even more can be achieved.

There are genuine reasons why increasing feed speeds applies, but only if:

1. There are no other bottlenecks in the mill (sawing is the bottleneck)
2. Can sell all lumber produced
3. Logs are not expensive.
4. Percentage of down-graded boards due to thickness variation or mismatch will be small
5. Few unscheduled saw changes or stoppages for maintenance.

To achieve consistent increases in production, the first goal is to get good before going faster Some indication that quality will not decrease and downtime not increase as a result of going faster is needed first. Otherwise, going faster will only accentuate existing problems.

Contrary to intuition, slower feed speeds can give more production. The reason is that most of the problems that interfere with production can be caused by feeding too fast. There are also many secondary benefits downstream from the sawing center due to having accurately sawn boards.

1. Improved sawing accuracy. Selecting the correct feed speed for the saw design in terms of gullet loading can have a major effect on sawing deviation. Reduced target sizes results in a profitable recovery increase, but it also means less jamming at the planer, and more pieces can be put in the kiln. Also, because the boards have move uniform thickness, air-flow is more uniform and the boards are better restrained and therefore less likely to warp or split in the kiln.
2. Sometimes a slower flow of boards eliminates overloading of surge decks so that the operator at, say the board edger, can fully concentrate on running the edger, not unscrambling the decks.
3. One of the common problems with increasing feed speeds is re-timing the press rolls and the time lost from crashes if the timing is not correct. Slowing the feed speed makes timing less critical. Better control of wood also results in better accuracy and less damage to saws.
4. Slowing the feed speed automatically reduces the gap between pieces. Although the feed rate is slower, the utilization of the machine stays the same.
5. With the high price of logs, a significant profit occurs if thinner saws can be used. A recovery improvement results in more boards out for same amount of logs cut. Although the saw will not be as stiff, cutting forces proportional to feed speed and kerf.
6. Less damage to saws due to better control of the wood and less heat going into the saws. In the long term, this means the saws returning from the filing room will be in better shape and will cut better.

Regardless of whether slower speeds will be tried, having the correct feed speed, based on the sawdust capacity of the teeth, for each depth of cut is critical. Often the settings are too fast on deep cuts and too slow on shallow cuts. To fast means accuracy and quality problems: too slow means loss of production. Since the majority of logs used by mills is at the smaller end of the log size range, optimizing feed speeds based on depth of cut usually results in an increase in production.

Increases in production will come as the machine is improved, but only after the improvements are made. Furthermore, the production increases will not result in quality problems and will be sustainable over the long term. This is not a theoretical conclusion: it is based on seeing several mills simultaneously achieving production, recovery and quality records.

Saw Design

Several mills have increased saw stiffness because the saw diameter could be reduced. In general, saw stiffness reduces with square of the diameter. For example, reducing the diameter from 22" to 20" increases by a factor of $(22/20)^2 = 1.21$. This should result in a 20% reduction in sawing deviation. Or, since the stiffness is proportion to the cube of the plate thickness, the plate thickness could be reduced by 6.5% ($=1.21^{1/3}$) to obtain the original stiffness of the 22" saw, but with a kerf savings.

Other options are thin rim saws where the thickness of the saw body, which determines the saw stiffness, is kept, but the rim thickness and kerf are reduced.

Log Sorting for Canter Lines

For some canter lines production is slowed by having to wait for the setworks to finish positioning, which requires larger gaps between logs. Mills with this problem can increase production by sorting the logs by diameter so that the saws and chipping heads do not have to be moved, or at least, moved smaller distances. This does require some changes in log handling, but the logs can be feed almost butt-to-butt.

There still needs to be a mix of log sizes brought into the mill. If too many large logs are brought in, this floods the edgers and trimmer. If too many small logs, then the back end of the mill is starved. If the canter operator has log bins to choose from, then log mix can be decided by the operator. If the logs come directly off the log deck then a solution is to have the edger operator in radio contact with the yarder operator.

Maintenance & Alignment

Automation has resulted in fewer operators on the mill floor, but maintenance becomes more critical for consistent production. Also, someone needs to continually look at the computer settings: it is surprising, for example, how often that the feed speeds are not only not optimized, but has the same values that were loaded during installation.

In previous articles, the author has stated that incorrect alignment typically accounts for 2/3 of all sawing problems, but feedback from mills indicates that this ratio should increase to about 80%.

The benefits from accurate alignment and well maintained equipment are numerous and significant:

a) Less jamming or loss of control of wood. Ensuring control of the wood has to be the first objective of maintenance. Thick saws can hide alignment or wood control problems
b) Fewer unscheduled stops due to damage to the saws.
c) Better sawing accuracy
d) Higher feed speeds and thinner saws are sometimes possible.

The key to productivity is consistency. It only takes one mistake or mis-adjustment to interfere with machine efficiency. The standards of alignment work or saw maintenance need to be documented and communicated to all people involved to ensure everyone working to the same assumptions, procedures and measurements. In other manufacturing industries this is done through Standard Operating Procedures (SOP's), which document a procedure or process. Usually the SOP's are kept next to the machine for quick reference. Furthermore, these documents will change over time as improvements are discovered.

Visual Grade Improvements

Improvements in visual grade can improve income, or at the least, help to keep customers happy. With high value raw material and product, recovery and surface finish take precedence over production. Sawing affects visual grade in three ways: elimination of planner skip, reduction of mismatch or less fibre tearing for unplanned lumber.

Mismatch in double-arbour edgers can be the result of problems with guide or saw preparation. With saw teeth, their geometry and sharpness must be symmetric. The use of stainless steel saw plate has also shown to reduce mismatch.

Tear-out is mostly related to tooth bite and, to a lesser extent, kerf. The controlling factor is the forces on the sawdust chip just as it breaks away from the wood. Larger forces increase the likelihood that the chip will break along the grain rather than be sheared by the cutting edge of the tooth. The cutting forces can be reduced in two ways: reduce the bite and reduce the kerf.

An example of reducing kerf on trim saws reduced fibre blow-out on the exiting edge because the force on the chips was reduced. In one case a thin-rim plate was used to reduce kerf but maintain the plate stiffness.

Real-Time Monitoring of Saws and Wood

Implicit in the idea of continuous improvement is the need to measure the product and the process in order to know whether a change has been beneficial. This goes beyond the common task assigned to quality control personnel. The issue is not just whether the product is acceptable, but has there been an improvement that can be quantified and documented.

Most quality control programs are based on manual caliper measurements of board size. While this method does give an indication that the process is in or out of control (that is, something has changed), too few measurements are available because of the time needed to

measure boards. More measurements are needed to identify patterns and to feel confident in the statistical conclusions.

Some of the benefits of real-time monitoring are:

1) Ability to see issues or the effect of changes right away.
2) The results can be displayed in many places in the mill – quality control, production manager, machine operator, filing room - there are more eyes looking for problems, and more importantly, more solutions suggested.
3) Can see when machine problems happen (ex. Hitting bandsaw guides, trapped shims)
4) Decisions can be made quickly. For instance, schedule lunch or graveyard shift alignment check, or what ever is suspected.
5) Can see patterns in board shapes that are lost in statistics, but point directly to the cause.

Conclusions

Improvements in machinery and computer controls will continue to be developed. These new features will be the baseline of technology, but should not define the limits. The need is to manage technology to obtain consistent and sustainable production, not just use technology and be in its control. Part of the process of continuous improvement is a thorough understanding of the technology so that the little details, which have such a major effect on profits, are examined and improved. The main point is that these small changes are often done for little cost or risk.

Although the traditional approach of increasing feed speeds can sometimes improve profits, there are also demonstrated benefits to slowing down and doing a better, more consistent job. It is the whole process that needs to be optimized, wherever possible, to increase profits.