# Hardwood Sawmill Downtime Costs

## Studies of downtime in band mills and circle mills reveal differences.

By Jan Wiedenbeck and Kyle Blackwell

How time flies when you don't pay attention to it. With hardwood sawmill operating costs ranging from $4 to $25 per operating minute ($95/MBF to $335/MBF) and gross profit margins ranging from $0.10/BF to $0.35/BF, five extra minutes of downtime per day will cost a sawmill that produces an average of 20,000 BF per day (5 MMBF annually) between $21 and $73 per day in profit. The average is $47, which represents the opportunity cost for the lumber that could have been produced during those 5 minutes.

In addition, even though the mill is not operating, the lion's share of operating expenses continue to accrue during the time the sawmill is down (that is, fixed costs and even labor during short downtimes). If we assume that 85 percent of regular operating expenses are incurred and the average operating cost per minute is $10.50, approximately $45 dollars in costs are accrued and $47 in profits are lost (for a total of $92) for every 5 minutes of downtime in our example of a 20,000 BF/day mill.

Given the high price of logs, $92 doesn't seem very alarming until you consider the total annual cost and other ways that this money or time might be spent. Five minutes per day of unnecessary sawmill downtime multiplied by an estimated 250 operating days per year adds up to a cost of $23,000 per year for those 5 unproductive minutes per day. And, unfortunately, rare is the sawmill that squanders a mere 5 minutes per day.

### Downtime Benchmark

Downtime data was collected at 22 sawmills in a study conducted by the U.S. Department of Agriculture Forest Service and the University of Kentucky in 1999 and 2000[1]. All operating delays on the headsaw of 10 seconds or longer duration were recorded in these studies. Overall, these 22 mills had an average of 16.7 percent downtime (the study collected downtime data for 100.74 hours and recorded 16.79 hours of downtime). While the duration of these studies was relatively short (averaging 4.5 hours), the large number of studies conducted allowed us to capture a range of downtime performance that supports the use of these downtime results as overall benchmarks. Figure 1 shows the downtime recorded for each of the 22 sawmills and indicates the average (mean) downtime for the circle and band sawmills.

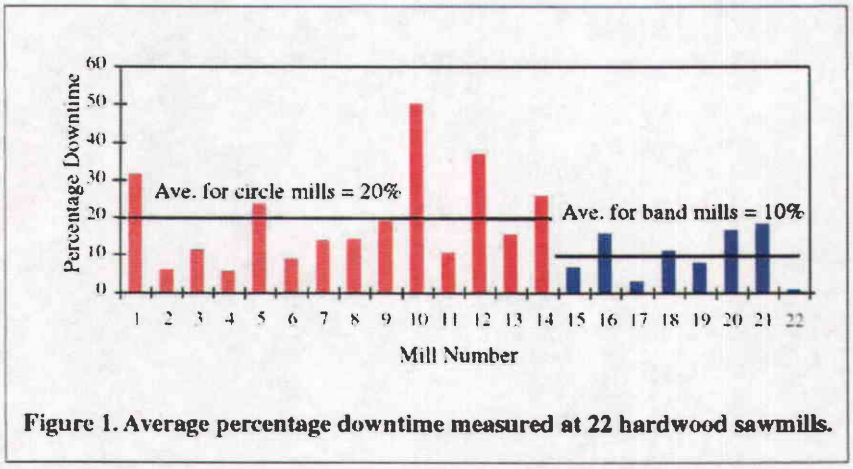


**Figure 1. Average percentage downtime measured at 22 hardwood sawmills.**

Of the major causes of downtime recorded, the only consistent cause from one mill to the next was employee breaks. This is not to say that other important downtime causes do not plague these 22 mills on a regular basis, but rather the other causes of downtime were more diverse between mills.

Federal labor law does not mandate that breaks be granted to employees, but some state labor laws do. Breaks are necessary and valuable, regardless of statutory requirements—they can recharge an employee both mentally and physically so they work more safely and efficiently when they return to the job. However, while conducting this downtime study, we observed time and again that scheduled 10- or 15-minute breaks were stretched by two or three minutes, and sometimes longer. Sometimes this break extension was due to equipment maintenance activities that were not quite completed in the allotted time. More frequently however, the extended break appeared to be due only to the slow return of employees to their workstations.

Two 15-minute scheduled breaks in an 8-hour work shift lead to a maximum possible uptime for the sawmill of 93.75 percent (6.25 percent downtime). For mills running longer daily work shifts, the baseline uptime percentage will be slightly higher (that is,

for a 9-hour work shift the maximum possible uptime after subtracting break time is 94.5 percent). At the majority of sawmills, an additional reduction in uptime of 1 to 2 percent can be attributed to protracted breaks. This estimate is probably conservative since our presence in the sawmills with stopwatches in hand during these studies likely caused the sawmill employees to be more punctual than would normally be the case.

| | Typical band sawmill | Typical circle sawmill |
|---|---|---|
| Average production cost per hour | $600 ($10/Min) | $300 ($5/Min) |
| Gross margin per MBF lumber | $100 ($0.10/BF) | $100 ($0.10/BF) |
| MBF lumber per hour | 8 | 8 |
| Average downtime per day | 0.8 Hours (48 Min) | 0.8 Hours (48 Min) |
| Downtime cost per day | $1,120 | $910 |
| Operating days per year | 250 | 250 |
| **Yearly cost of downtime** | **$280,000** | **$227,500** |

**Table 1. Downtime cost example comparing "typical" band and circle sawmills**

## Band, Circle Differences

A difference in downtime was observed between band mills and circle mills (Figure 1). The average for the eight band mills in this study was 10.3 percent (0.82 hours/8 hour shift). The major cause of this downtime was due to coffee and lunch breaks. The second most important cause of downtime in these band mills was due to log handling speed at the carriage. This includes log turning, log loading, and setting the log for the next saw set.

For circle mills, the average downtime was 19.6 percent (1.6 hours/8 hour shift). However, the adjusted average downtime for circle mills of 17.2 percent is probably a better downtime figure. In the adjusted average, the influence of Mill No. 10, which had more than 50 percent downtime on the day of our study, is removed from the calculation. This adjusted average downtime is relatively close to the median downtime for these 14 circle sawmills—14.8 percent.

While the percentage downtime for circle sawmills tends to be higher than for band sawmills, the cost per year of downtime is often higher for the band headrig sawmills. This is due to a combination of factors. A sawmill with a band headrig typically has higher production per hour and thus stands to lose more profit per hour when not producing lumber (an opportunity cost). These sawmills also tend to have higher operating costs per minute, thus the real costs incurred during downtime are higher. Table 1 gives examples of the total annual cost of downtime for typical hardwood band and circle sawmills. If a sawmill's downtime can be reduced by 50 percent, 25 percent, or just 5 percent (i.e., 4 minutes per day for the circle mill in this example), the annual downtime cost savings will be significant ($11,375 per year given four minutes per day of added productivity).

## Downtime Per Log

The average downtime per log processed was 0.33 minutes per log for 19 of the study sawmills (log counts were missing for the other 3 mills). The adjusted average downtime per

# Sawmill Manufacturers Respond To Study Results

Manufacturers of band mills are quick to point out the advantages of bands versus circle mill headrigs. "We believe the greatest benefit in operating a band headrig over a circle headrig is the increased yield," says Butch Wilson of Ligna Machinery (336/ 584-0030). "A 6-ft. bandmill typically has a kerf of 0.125-in. as compared to a 0.31250-in. kerf for a typical circle mill." He adds that grade uplift and reduced downtime indicate that progressive sawmills will be installing bandmills in the future.

USNR's Don Bingham (360/ 225-8267) says that combined with thinner kerf and higher recovery is smoother, more accurate lumber and a larger depth of cut with a bandmill headrig.

A Coe Newnes/McGehee spokesperson (250/ 833-3028) adds that more teeth per saw for a bandmill means the wear is distributed over a greater number of teeth. Additionally, the bandmill headrig usually offers no step or mis-match as with double circular headrigs.

Terry Oliver of T.S. Manufacturing (705/ 324-6482) reports that, in addition to offering thinner kerf, a bandsaw can run faster that a circular saw and a bandsaw can provide a cut on the return pass (with a double cut bandsaw), increasing overall productivity. "With a bandsaw there is a saw guide above the surface being sawn," he says. "With a hydraulically adjustable guide, you can control the quality of the cut better than on a circular headsaw."

Pointing out the advantages of the circle mill headrig is Robert Hege of Meadows Mills (336/ 838-2282). He says, "Bandsaw mills have more downtime due to the fragile nature of the band. There are many more circle sawmills than there are band sawmills and some of the circle units are old and not properly maintained. Therefore it is probably possible to show that circle sawmills as a whole group have more downtime; but, when well maintained circle sawmills are surveyed against well maintained bandmills, the bandmills will have far more downtime."

He adds, "Circle sawmills have long been the standard of the American sawmill industry," he says. "They are the most productive primary breakdown equipment and are commonly accepted as the least initial cost unit and the lowest cost unit to maintain."

Hege says band sawmills have thinner kerf and must be used in very expensive high grade lumber to prove as economical as a circle sawmill. "Considering all cost-of-kerf savings a circle sawmill used as a primary breakdown and a thin kerf resaw is the best combination of high production and kerf saving," Hege reports. "The most important factor is the much lower cost of initial purchase, lower maintenance cost and higher productivity of the circle sawmill puts more money into the owner's pocket." **SL**

***Downtime when the sawyer is away from his station is more expensive for a bandmill headrig operation than for a circle mill headrig operation.***

| State, year, and type of mill | Downtime (%) | Downtime per 8-hr shift (hr) |
|---|---|---|
| **New York, 1976** | **20.9** | 1.67 |
| Band | 21.2 | |
| Circle | 20.7 | |
| **New York, 1977** | **20.3** | 1.62 |
| Band | 16.1 | |
| Circle | 21.4 | |
| **Vermont, 1984** | **11.3** | 0.90 |
| Small (1-2.5 mmbf/year) | 13.7 | |
| Medium (2.5-5 mmbf/year) | 12.4 | |
| Large (>5 mmbf/year) | 7.9 | |
| **FS-KY, 2000** | **16.7** | 1.34 |
| Band | 10.3 | |
| Circle | 19.6 (17.2*) | |

** This is an adjusted downtime figure in which the extreme downtime recorded at one mill was removed from the calculation.*

**Table 2. Comparison between studies of average percentage downtime**

log for circle sawmills (with the extreme outlier removed) was 0.40 minutes (24 seconds) while the average downtime for band sawmills was 0.18 minutes (11 seconds) per log. Note that the downtime per log for circle sawmills is 220 percent of the downtime per log for band mills, while the average downtime per shift for circle sawmills is only 190 percent of the downtime per shift for band sawmills. Thus, on a per-log-processed basis, the downtime difficulties in circle sawmills are intensified due to the fact that band sawmills typically process logs at a faster rate.

## Earlier Studies

Table 2 compares the average downtime recorded in this 22-mill study with downtime figures from studies conducted in New York [2, 3] and Vermont[4] in the 1970s and 1980s. Of the earlier studies, the Vermont study is the only one that gave downtime causes[4]. The Vermont study reported the same result found in this study: more than 30 percent of the downtime was due to coffee and lunch breaks for the workers (including both scheduled and extended break times).

Why do band mills and higher production sawmills have less downtime, on average (refer to the Vermont data in Table 2)? Keep in mind that downtime was only recorded in these studies whenever the head saw was not processing logs. Since many band mills and higher production sawmills have more than one piece of equipment and flow path for processing lumber downstream from the head saw (that is, a resaw and edger or a resaw and gang saw and edger), the head saw can continue to process logs when one of these other production lines goes down.

Another contributing factor to the circle mill/band mill downtime difference may be that the average age of the headrigs in the circle sawmills is considerably older than the average age of the band headrigs; thus more breakdowns would be expected. Also,

these updated headrigs are more frequently equipped with log and slab handling systems that run faster and (hopefully) smoother.

## Conclusions

Any downtime for a sawmill is an unwanted expense, and a decrease in the downtime that is attributable to extended breaks may have the potential to increase the profits of the sawmill. A mill that has the majority of its downtime in breaks should look at alternatives that will reduce this downtime. One of the most common ways to address this is to stagger breaks so the mill can continue to operate while the employees still receive their breaks. This system not only increases mill throughput for the shift, but also enables mill employees to obtain a higher skill level in alternate jobs so that absences of key personnel are less disruptive to the operation.

Higher headrig downtimes in circle sawmills than in band sawmills may be due to the age of the equipment or the design of the sawmills. Managers of sawmills that are experiencing higher than average downtime percentages on a regular basis should quickly but carefully identify the major causes of downtime and the associated costs. These costs (considering both lost profit and incurred expenses) will lead to a conservative estimate of the amount of money that can be spent to remedy persistent problems. **SL**

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