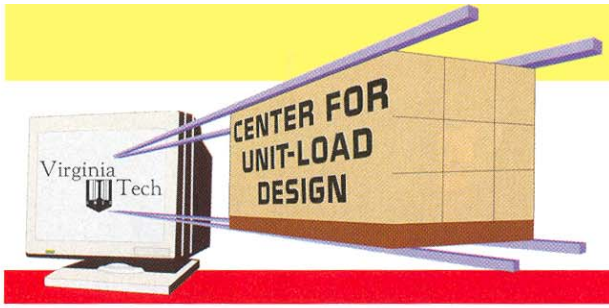

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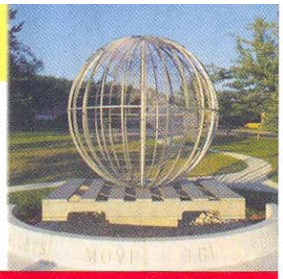

Cant, Part Volume Little Affected By Sawing Method, Study Shows

Analysis Shows Curved Sawing Small Hardwood Logs Increases Yield of Side Boards

This is the first in a series of technical articles from the Virginia Tech Center for Unit Load Design, the leading pallet and transport packaging testing lab in the country. The Center is dedicated to helping the packaging, pallet, and materials handling industries save money, resources, and lives. To contact the center call 540/231-5370 or visit www.unitload.vt.edu

Overview

Curve sawing is a primary log breakdown process that incorporates gang-saw technology to allow two-sided cants from logs with sweep to be cut parallel to the log surface or log axis. There are two basic curve sawing techniques. One method manipulates a curved cant through stationary saws, while the other method uses articulating saws that follow the contour of the log.

Since curve sawn logs with sweep are cut along the grain, the potential for producing high quality straight grain lumber and cants increases, and strength, stiffness, and dimensional stability are maximized.

Curve sawing methods have been employed since the early 1900s. Today they are widely incorporated in high production softwood lumber manufacturing facilities. However, with a few exceptions, the practice of curve sawing is virtually nonexistent in hardwood sawmills.

As hardwood lumber and stumpage prices rise, lumber manufacturers are forced to produce consistently high quality, high value products from existing stocks of low-grade logs. Wooden pallets are no exception. Raw material purchases represent the greatest per unit cost of operating a pallet manufacturing facility. While it's no secret that hardwood sawmills continually strive to maximize yield and grade recovery, the presence of sweep in logs limits traditional hardwood sawmilling efficiency. Because of this common log defect, curve sawing is a viable solution that is gaining attention in the hardwood lumber industry.

Since pallet manufacturers typically purchase cants as raw material for pallet parts, it is important to explore the relationship between cants processed by curve sawing techniques and the pallet parts that will be processed from them.

Sweep is a log defect traditionally characterized as uniform curvature along an entire log length. The measure of sweep is the maximum deviation of the curved surface of a log. Because hardwood sawmills traditionally straight saw all logs, logs with sweep yield less lumber.

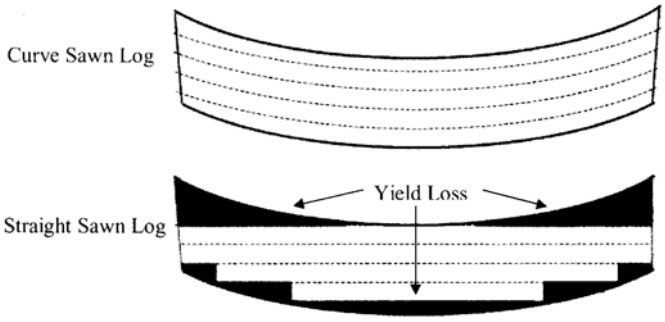

Figure 1. *Diagram that compares the impact of sawing method on lumber yield from logs with sweep.*

At a sawmill, the effect of sweep on lumber recovery is dependent on a combination of three log characteristics: the degree of log curvature, log length, and log diameter. When straight sawing a curved log, yield loss increases as the level of sweep increases. This is shown schematically in **Figure 1.** Yield loss from sweep is inversely related to log diameter: yield losses increase as diameter decreases. Finally, straight sawing curved logs results in shorter boards as well as cants.

But more important to pallet manufactures is the fact that straight sawn cants from curved logs have sloped grain. Wood with sloped grain is weaker than straight grain wood, and is also more prone to warp. The National Wooden Pallet and Container Association's Uniform Standards for Wood Pallets limits the severity of sloped grain allowed in pallet components.

Frequency, Degree of Sweep

To the extent that curve sawing could become established in hardwood sawmills, it was necessary to first understand the extent of sweep in hardwood timber. How big is this problem? How significant is this log defect?

A recent study performed by the Pallet and Container Research Laboratory at Virginia Tech investigated the frequency and severity of sweep in logs at Eastern hardwood sawmills. The results from this study indicate that approximately one third (32%) have measurable sweep of 1 inch or more in 12 feet of log length. Within this group of logs, average sweep was 4.1 inches, and the average scale deduction due to the presence of sweep was

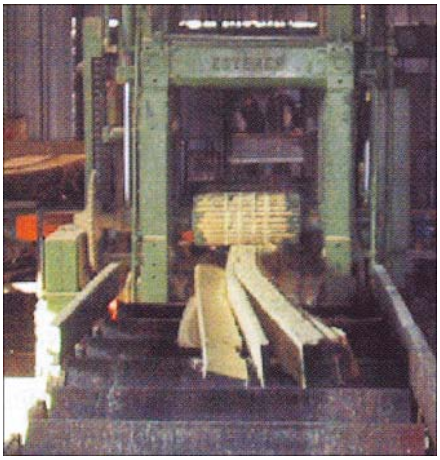

Figure 2. *Picture of Esterer sash gang curve saw in operation curve sawing.*

13%. Log scale deductions that result from sweep were calculated by methods prescribed by Everette Rast in the 1973 USDA Forest Service publication: *A Guide to Hardwood Log Grades.* The level and frequency of sweep in hardwood logs is significant.

The majority of pallet cants comes from small diameter logs. The effect of sweep on yield is greater for small diameter logs. Thus, the potential for curve sawing to improve pallet part quality and yield seems possible. It is likely that curve sawing of hardwood logs will increase in the future.

Effect of Curve Sawing Logs with Sweep

The Pallet and Container Research Laboratory at Virginia Tech conducted a second study to investigate the impact of sawing pattern (straight vs. curve sawing) on lumber, cant, and pallet part yield from logs with varying degrees of sweep. Lumber yield and pallet part yield studies were conducted at a local sawmill equipped with an Esterer sash gang curve saw (saw kerf = 0.130 – 0.135 inches) **(Figure 2),** and a local pallet mill.

For this study, a total of 134 small diameter hardwood logs (1,250 cubic feet: Smalian) were sawn. Logs were sorted into three categories based on the severity of sweep. Half from each category were randomly selected for straight sawing and half for curve sawing. These logs were relatively low grade and would be considered more typical for pallet part production than for normal grade lumber. The sawing pattern included 4/4 side boards with a random width full 4-inch thick cant sawn from the center of the log. With sweep up or down, twin band saws were used to saw two faces.

Two sided cants were then sent to the Esterer sash gang saw to be straight sawn or curve sawn. For curve sawing, the sash gang was allowed to cut on the curve using manual controls. The operator visually followed the log contour. Lumber and cant yields were determined for each group, and the cants were further processed into pallet parts.

The results of this study indicated that cant and pallet part yields are not affected by sweep. A cant is cut from the center of a log, and except for the most severe cases, the cant volume within the center of a log is not affected by the curvature caused by sweep-whether straight sawing or curve sawing. Pallet part yield is directly related to cant yield. For logs with severe sweep, 6.5 inches or more per 12-foot length, pallet part yields from curve sawing can increase somewhat as a result of longer pallet cants that can be processed. However, such extreme sweep renders these logs very difficult to handle and they are not often sawn. The discovery that pallet part

yields are similar regardless of the sawing method employed is not surprising since only one pallet cant was sawn from each log, and the length of the cant will most often correspond to the length of the log. Pallet cant and part volume from curved logs are little affected as a result of sawing method.

An important finding from this research was that when curve sawing small diameter hardwood logs with sweep, the yield of lumber from the outside of the log increases significantly. These boards are often called 'side' or 'jacket' boards. The results indicate that jacket board yield can be as much as 10% to 12% higher when curve sawing hardwood logs with an average sweep of 3.3 inches and greater (12 foot basis). Since approximately one-third of hardwood logs are not considered straight, significant lumber yield improvements can occur when curve sawing cants from these logs.

Other results from this study reveal that there is no significant difference in lumber length due to curve sawing cants from logs with an average sweep ranging from 0 to 3.3 inches (12-foot basis). For logs with sweep above this range, curve sawn lumber can be up to 1 foot longer than straight sawn lumber.

The Esterer sash gang curve saw produced curved cants and lumber processed from sweepy logs. It is important to note that the curve sawn pallet cants did not straighten out completely when stacked. However, curved cants did not cause handling problems during the pallet part manufacturing process. Cants were sawn into pallet parts using a Pendu chop saw and a circle gang saw. Should the hardwood lumber industry adopt curve sawing practices, the purchase of curve sawn cants will not hinder pallet parts production. The pallet parts will likely be straighter grained and will warp less than parts sawn from straight sawn cants produced from curved logs.

Pallet parts from curve sawing and pallet parts from straight sawing logs with sweep were separately assembled into 48x40, partial 4-way, three-stringer pallets on a Viking Duomatic assembly machine. The pallets were allowed to slowly dry to study the effect of sawing on pallet quality by observing the presence or absence of warp and splits in the stringers and deck boards. There was no obvious difference in quality between the pallets assembled with curve sawn parts and those from straight sawn parts.

It is clear from the study should the hardwood lumber manufacturing industry adopt curve sawing of sweepy logs, the impact on pallet production will be minimal. Curve sawing sweepy logs will improve lumber yields and may improve hardwood lumber quality. Therefore, integrated pallet mills and hardwood grade mills should consider the benefits of curve sawing.

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(Editor's Note: Peter Hamner is a Research Associate and Marshall White is a Professor at Virginia Tech; Phil Araman is Research Project Leader for the U.S. Forest Service at its Southern Research Station in Blacksburg, Va.)