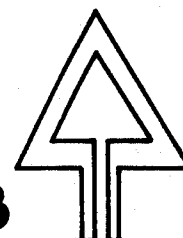
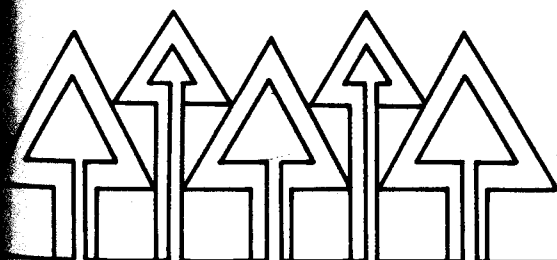
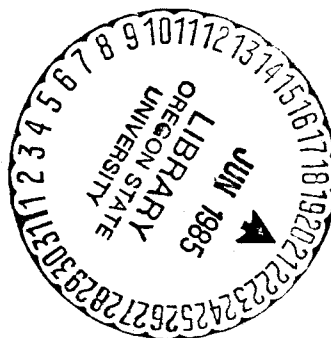


CLPLOSS: Analyzing Green-end Veneer Recovery and Loss

Thomas H. Sheffield
James W. Funck



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*Oregon State University Forest Research Laboratory
(Research bulletin)*

Foreword

At the request of industry and under the sponsorship of clipper manufacturers and the Plywood Research Foundation, the Department of Forest Products at Oregon State University undertook the task in 1979 of examining the potential for improving green-end veneer recovery, up to and including the clipper. A comprehensive assessment technique was successfully developed that uses motion picture photography and digitizing methods. Reported in this publication are the basic procedures employed by the authors in their original study of five mills; also discussed are possible system modifications and alternate applications in veneer and lumber production. Further information concerning this technique or microcomputer program listings may be obtained by contacting:

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Executive Summary

PURPOSE

This paper is a detailed description of a method for calculating and analyzing losses and recoveries in a veneer peeling/clipping operation. The method involves filming veneer sheets as they exit the clipper, digitizing this film, and using the digitized information in a computer analysis.

USES

- For making "before and after" comparisons during a period of green-end capital improvement.
- For comparing recoveries of two similar operations (e.g., with X-Y charger vs. without X-Y charger).
- For ongoing green-end quality control.
- For analyzing edger or trimmer operations in lumber manufacturing.

ADVANTAGES

- The technique is non-contact, so it does not interrupt production.
- It is a direct measurement system.
- It provides recovery and loss data, some of which were previously unmeasurable, up to and including the clipper (i.e., block, core, spur, trash-gate round-up, clipped round-up, clipped reject, accurately clipped recoverable, full sheet, half sheet, random strip, untrimmed fishtail, trimmed fishtail, cubic recovery, and scribner recovery data).

DISADVANTAGES

- The digitizing process is very labor intensive.
- There can be a significant initial equipment investment required.

Introduction

The forest products industry is being challenged today more than ever before in its history to efficiently utilize the nation's limited timber resources. The present shortages and those expected in the near future will constitute not only losses in total volumes harvested but also losses in log quality and mix (Tedder 1979; USDA 1973). Concurrently, stumpage prices are increasing at rates substantially faster than the revenues received from the veneer produced. The most immediate solution available for this restrictive economic situation is improved utilization of the timber presently harvested. Substantial profit improvements can be achieved by reducing the "effective" material costs through better processing techniques. Maximizing efforts at this particular leverage point can move a facility out of an average or marginal operating climate into a more profitable market position. Therefore, recovery is a critical parameter that a mill manager can control in adjusting to the high cost of raw materials.

Although methods of digitizing data have been applied previously to various aspects of the forest products industry (McMillin 1982; Murdock 1982;

Tobin and Bethel 1969), our work with a digitizer reported herein and in the thesis by Sheffield (1983) represents the first comprehensive and detailed examination of the veneer-making process at the green end. With the cooperation of industry, we have developed a technique for calculating and analyzing losses and recoveries in a veneer/peeling operation, up to and including the clipper. Figure 1 illustrates this method that involves (1) measuring a desired sample of selected blocks and cores, (2) coding the veneer ribbon with spray dye, (3) filming veneer sheets as they exit the clipper, (4) digitizing each veneer image, and (5) using this digitized data in a computer program called CLPLOSS ("clip-loss") that analyzes veneer recovery and loss.

The sections following in this report provide the detailed instructions, discuss the optional materials, and suggest the minor modifications that can tailor this technique to a particular mill and production situation. This report does not address grade considerations; hence, the recovery values discussed are in terms of a strategy to maximize wood volume only.

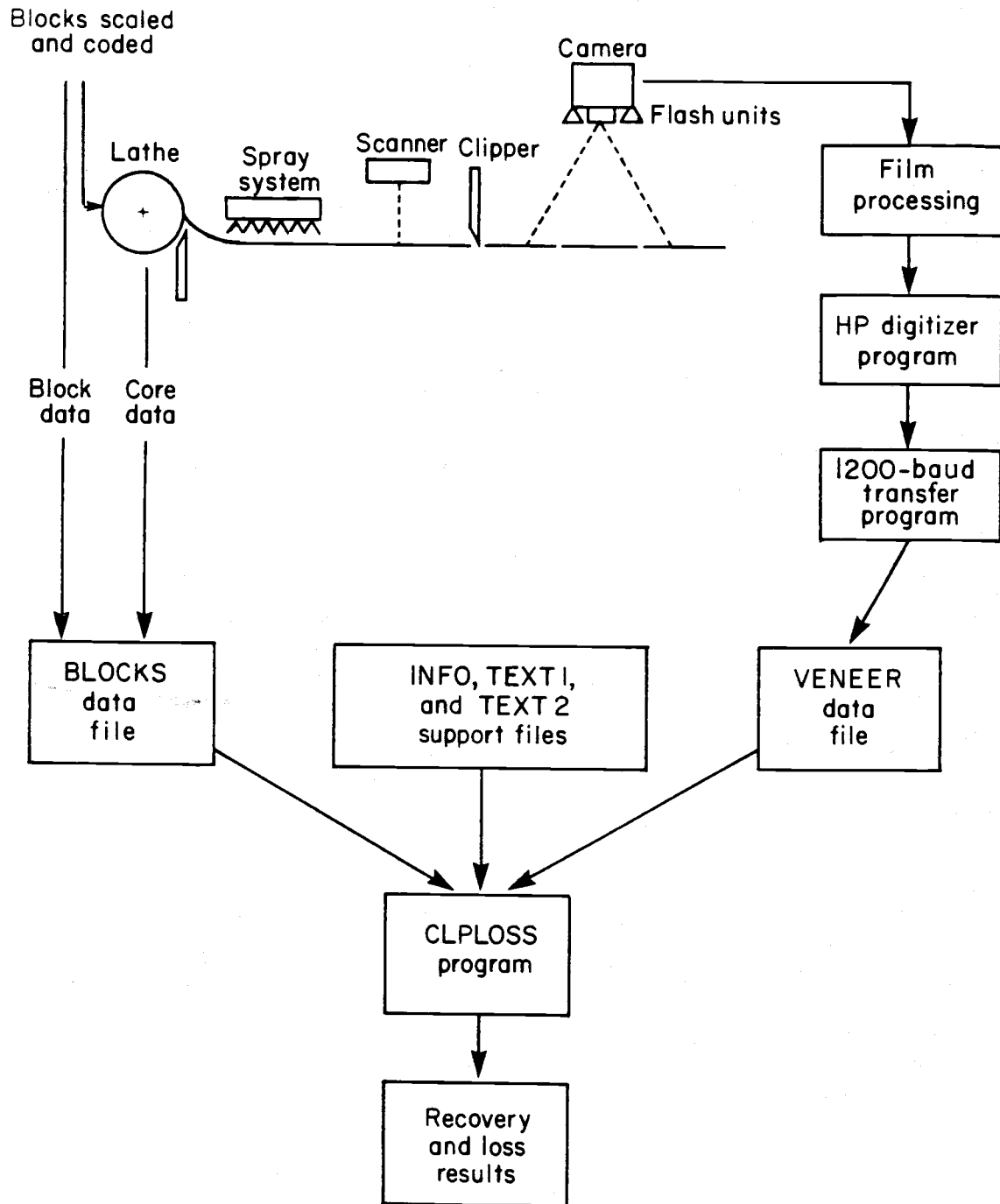


FIGURE 1.

OVERVIEW OF THE CLPLOSS ANALYSIS TECHNIQUE FOR VENEER RECOVERY AND LOSS.

Research Materials

Our original research project examined five separate mills. At each mill, 30 blocks in four diameter classes were examined, resulting in a total of 120 test blocks peeled per mill. This allowed the data to be analyzed statistically for differences between mills and diameters; however, other data could have been compared, such as between machine centers, grades, species, or facilities. Because we were investigating the potential to increase recovery at five mills with five different clippers, it was important that the logs chosen be as homogeneous as possible between the mills and diameters. The blocks in our study were scaled in accordance with the Scribner Decimal C system and coded according to diameter with paint on their ends. The veneer ribbon peeled from the blocks was coded-to-match using dye in a six-head spray system, first employed by Lane (1971).

Filming of the clipped veneer pieces employed a stroboscopic flash that was synchronized to an 8 mm Nizo 56 movie camera so that the image of the moving veneer would not be blurred. Because we had to film the veneer at line speeds running at 250 feet per minute, the camera had a frame rate of about 70 frames per minute or 0.86 seconds per frame; this ensured that each veneer piece appeared completely in one frame with some overlap. However, the frame rate was so fast that a single flash unit could not reliably handle the load. Therefore, a dual flash system was employed using two LH4 lampheads driven by two P500-ALM power units, both manufactured by Norman Enterprises, Inc. They were fired

alternately using an electronic, bistable, flip-flop circuit. The film used was 32 ASA Kodak Super 8 Plus X, reversal black and white movie film (#7276), in 50 ft. cartridges. The f-stop settings depended on the ambient light within the mill and usually varied from f/2.8 to f/5.0. The camera and flash system were mounted on scaffolding above the conveyor. A sighting device was constructed for aligning the camera's film image perpendicular to the flat conveyor plane, because misalignment would yield erroneous sheet area information during the digitizing operation.

Shown also in Figure 1 is the data file development process for the CLPLOSS computer program. A Hewlett-Packard (HP) 9825A microcomputer with an HP 9864A digitizer and Centronics printer were used for digitizing the film images. A 1200-baud transfer program was also used. All microcomputer programs are written in HP BASIC. VENEER, INFO, and BLOCKS are three data files required for CLPLOSS analysis. In addition, there are two optional but recommended text files (TEXT 1 and 2) useful in arranging CLPLOSS output. These programs operate in a self-explanatory manner and may serve as examples for adaptation to other hardware brands. The CLPLOSS program is written in FORTRAN V. It was compiled on Oregon State University's CYBER 170/720 mainframe computer under the NOS operating system. With the exception of the initial system sort, CLPLOSS should be quite adaptable to other computer systems.

Data Acquisition at the Mill

Table 1 shows many of the tasks that must be performed in the collection of veneer data. The time and personnel needed will depend on the

complexity of the particular investigation and the number of peeler blocks required.

TABLE 1.

A TYPICAL WORK SCHEDULE FOR DATA ACQUISITION AT THE MILL.

Day 1

Select the blocks required for the study.
Take all required measurements of block diameter, length, and defects.
Tag, paint, or otherwise mark all blocks as required by the study.

Day 2

Erect the camera support system.
Set-up the spray system.
Film the peeling/clipping operation.
Measure and photograph the control sheet.
Determine average veneer thickness.
Obtain specific information regarding equipment and production settings.
Obtain core measurements.

Coding of Blocks and Veneer

The block selection process is dependent on the type of study. In a mill-run study, no pre-sorting of the blocks is done; the blocks are simply taken as they come from the yard. If mills are being compared, it is important that the logs chosen for the study be as homogeneous as possible between the various mills and diameters. This is best done by selecting one large set of blocks and randomly distributing them between the mills. If this is not practical, the blocks should be carefully selected to minimize the number of spin-outs and reduce the log quality variations. If a specific number of blocks is needed, such as in a statistical analysis, a few extra blocks should be chosen to replace any that become lost, unidentifiable, or spin-out prematurely.

Grading and scaling should be carried out according to the standards established by the appropriate regional scaling agency. From a computational standpoint, the various recovery values calculated will be correct regardless of the board-foot scaling system employed. Both gross and net scale are required. Maximum and minimum diameter measurement for both the large and the small end of the block, as well as scaling length, are also required. After scaling, each block must be identified uniquely on both ends in the chuckable area as to its specific grade, diameter class, or sample number as required by the experimental design. Brightly colored aerosol spray paints, such as tree marking paints, or aluminum or plastic tags serve well as block identifiers. If the blocks are to be conditioned in a water bath system, spray paint may not be adequate because of darkening problems. Any extra blocks should be marked with a different set of identifiers to indicate that they are extra blocks.

The veneer also must be marked in order to identify during the digitizing operation the specific block of its origin. Depending on the complexity of the experimental design, several veneer identifying schemes are possible. When relatively few codes are necessary, the simplest method requires only a single dye color and a general purpose garden sprayer. For example, the veneer originating from blocks with Code #1 may be marked on the leading edges with a wavy line, Code #2 veneer perhaps with a dashed line, Code #3 with a left straight line, Code #4 with a right straight line, and so on. Another possibility is to use different colors in a multi-head dye spray system, as in our study and Lane (1971). No matter what system is used, the main objective

should be unique and reliable identification of the veneer on film.

Because the veneer sometimes buckles during production, the spray head assembly should be suspended about twelve inches over the conveyor on the downstream side of the lathe just beyond the trashgate tipple. If mounted too high, an adequately dense spray line may not result. Water soluble acid dyes, such as those in automatic moisture detector systems, can be used and obtained from companies such as the Keystone Ingham Corporation. However, the colors used should be different from those in the moisture detectors, so the pullers do not become confused. Previous experience with red and green dyes indicates an appropriate mixture rate of about 9 and 29 grams per gallon, respectively. A total of approximately twenty gallons of dye solution should be adequate to mark 120 blocks in this manner.

Filming Procedures

The purpose of the filming procedure is to provide a permanent record of the clipped veneer that can then be digitized to obtain the area of each individual piece generated by the clipping operation. There are many advantages to this method: precise area information is provided for both rectangular and very irregular pieces; there is no production interference; a visible record is provided of occurrences before and after each clip; and the veneer data are provided in computer-usable format and code.

The choice of the appropriate filming equipment is crucial to the overall capabilities of the filming process. Table 2 summarizes the advantages and disadvantages of many of the equipment options available. The equipment should be able to provide good quality images with minimum distortion. In addition, it should be capable of maintaining a frame rate fast enough to keep up with the production line speed. In order to be digitized properly, each piece of veneer must appear completely in one frame of film.

Considering the large number of film frames generated for even small studies, the choice of film format and medium are very important. The least expensive format is in 8 mm cameras, but they generally offer less versatility. Employing the 16 mm format increases initial costs but also increases the availability of functions. With either the digitizing camera or image analyzer mentioned in Table 2, the labor intensive, manual

TABLE 2.

THE ADVANTAGES AND DISADVANTAGES OF VARIOUS FILMING AND DIGITIZING EQUIPMENT.

Equipment options	Advantages	Disadvantages
8 mm movie camera with flash synchronization and variable frame rate.	<ul style="list-style-type: none"> --Very readily available. --Low film purchase and developing costs. 	<ul style="list-style-type: none"> --Moderate initial system cost. --Shutter speed fixed and usually too slow to "stop" the moving veneer. --Requires a high speed, quick re-charging flash system. --Bulk loaded film magazines not available, requiring film cartridge changes during long photographic sessions. --Relatively few film types available. --Requires digitizer and manual digitizing.
8 mm movie camera with variable frame rate and variable shutter speed (variable shutter width).	<ul style="list-style-type: none"> --Usually available. --Low film purchase and developing costs. --Low initial system costs. --Variable shutter speed eliminates need for flash system. 	<ul style="list-style-type: none"> --Few high speed (ASA) film types available. --Bulk magazines often not available. --Requires digitizer and manual digitizing.
16 mm movie camera with variable frame rate and variable shutter speed.	<ul style="list-style-type: none"> --Commercially available. --Low film purchase and developing costs. --Bulk magazines available. --Very versatile with many functions available. 	<ul style="list-style-type: none"> --Moderate initial costs. --Large selection of film types available. --Requires digitizer and manual digitizing.
35 mm single lens reflex with bulk magazine and motorized film advance.	<ul style="list-style-type: none"> --Readily available. --Low initial system costs. --Wide range of film types available. --Large film format enhances resolution and interpretive capabilities. 	<ul style="list-style-type: none"> --High film purchase and developing costs. --Bulk magazine required. --Motorized film advance required. --Large film format becomes very bulky with small peeler block samples. --Camera is slow to reload and requires much reloading, thus requiring production line interruption. --Requires digitizer and manual digitizing.
Video camera.	<ul style="list-style-type: none"> --Readily available. --Low film medium costs and no developing costs. --High frame rates available. --Video tape may be reused. --Functional under relatively low ambient light and conditions. --Instant replay capability and stop action modes. 	<ul style="list-style-type: none"> --High initial system cost. --Frame rates often fixed. --Variable or slow frame rates not available. --Less resolution and dynamic range than photographic media. --Video display must be coupled with a transparent digitizer platen. --Requires a large flat plate video display. --Requires manual digitizing.
Digitizing camera.	<ul style="list-style-type: none"> --No photographic or video intermediary required. --Digitizes directly allowing digital data to be immediately recorded and/or processed. --Fast digitizing frame rate. --Eliminates need for manual digitizing. 	<ul style="list-style-type: none"> --High initial system costs. --Very few camera vendors available. --Image processing software must be developed by user. --Subject must remain stationary during digitizing period.
Image analyzer.	<ul style="list-style-type: none"> --Fast digitizing frame rate. --Eliminates need for manual digitizing. 	<ul style="list-style-type: none"> --Very high initial system costs. --Few vendors available. --Image processing software must be developed by user. --Subject must remain stationary during digitizing period. --Film intermediary required.

digitizing used in our study may be eliminated. However, a substantial investment in image analysis software would be required. While saving labor, the image analyzer still requires that the veneer be filmed. On the other hand, the digitizing camera should offer great potential for accelerated recovery analysis. The use of video tape requires a CRT (cathode ray tube). Digitizing off a CRT requires a large diagonal measurement screen, a high resolution display matrix, an optically flat display screen, and a transparent digitizing platen. Although transparent platens are currently available, it appears that large, flat screen, high resolution CRT's are just starting to become commercially available.

In situations where our technique will be used very infrequently and on a small number of blocks, or where there is a severely restricted budget, the 8 mm movie camera with variable frame rate and shutter speed and manual digitizing option (Table 2) is recommended. The equipment for this option ranges in cost: micro-computer, \$1500-\$10,000; camera, \$350-\$1000; projector, \$500-\$3000; and digitizer, \$500-\$5000. On the other hand, if this technique will be used frequently and there is a sufficient budget, an image analyzer or digitizing camera (\$1,000-\$150,000 cost) may be substituted for the projector and digitizer, and perhaps the micro-computer, in the preceding option. It must be remembered that software will need to be written for the image analyzer or digitizing camera, which could add significantly to the cost of the system. Equipment and settings used in our original study have been described in the Research Materials section.

Because it is essential to be able to view the actual clipping sequence, the veneer must be filmed before the first green chain puller's cart or vacuum diverters. It is further suggested that, if possible, the film subject area should be on the green chain conveyor rather than the clipper exit conveyor, because the individual pieces are better separated from one another. There are three ways the camera must be positioned in order to minimize distortion of the filmed image: (1) centered on the conveyor; (2) elevated to a height allowing the veneer images to be well away from the edges of the film frames; and (3) exactly parallel to the green chain.

In order to locate and align the camera equipment above the conveyor, it must be properly supported; possible options are using scaffolding, an overhead crane, or a boom truck (i.e., cherry picker). If scaffolding is used, approximately

6-by-8 ft of free floor area is required on both sides of the conveyor near the clipper outfeed. The first pullers and pull carts may have to be moved farther downstream if they normally are in these areas. Two scaffolding towers need to be erected, one on each side of the conveyor up to the height required for the camera. Adequate planking is necessary at the top levels for a work area and equipment placement. The twin towers are connected to one another by a 16 ft plank. This plank provides a walkway for the camera operator during the camera set-up period and for making additional adjustments and film changes during the filming operation. Excessive movement on the scaffolding during the actual filming should be kept to a minimum if sharp and accurate pictures are to be made.

The actual height of the camera, frame speed, shutter speed, and f-stop setting will vary from mill to mill. Mill specifics, such as ceiling height and single versus double clippers, may affect the set-up. Information provided with the movie camera should help determine the correct shutter speed and f-stop setting. Very low ceiling heights or attempting to film the bottom clipper in a double clipper installation will require a wider angle lens. At least one test run should be made to become familiar with the system and to check such settings as shutter speed, film speed, and f-stop.

A final and important requirement of the filming procedure is that the entire portion of the conveyor area to be filmed should lie in a common plane. That is, the entire length of conveyor in the camera viewing area should lie flat but not necessarily horizontal. Filming on a curved conveyor will provide erroneous sheet area information during the digitizing operation. Regardless of whether the conveyor is flat and horizontal, or flat and inclined, the camera line of sight must be perpendicular to the conveyor plane.

For the purpose of aligning the camera, a simple camera sighting device should be constructed (Figure 2). This device can be made from 3/4" plywood and consists of two triangles rigidly supported and mounted perpendicular to a 2-by-2 ft plywood base. On the vertical edge, two highly visible sighting targets are mounted. The top sighting target consists of a red circle and the bottom target a white cross. The mill sighting device is centered on top of a full sheet of veneer placed on the conveyor which is centered in the camera's field of view. Looking through the camera, the operator should align the camera until the white cross is visible perfectly centered

in the red circle. Thus, with the completion of this procedure, the camera is correctly positioned directly over and aligned with the plane of the moving veneer. Make certain that the camera's field of view allows adequate room on either side of the sheet to allow for any side to side movement of the veneer as it is conveyed during production.

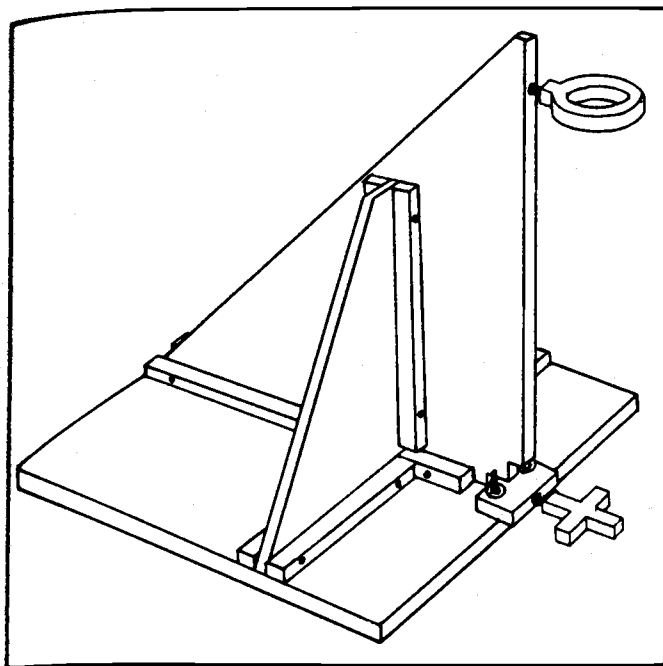


FIGURE 2.

CAMERA SIGHTING DEVICE USED TO INSURE CAMERA ALIGNMENT WITH GEOMETRIC PLANE OF THE VENEER.

Peeling/Filming Operation

Once the scaffolding, the camera, and the spray unit are in place, the actual peeling/filming operation can begin. During peeling, several production considerations must be addressed. The lathe operator should be instructed to keep the knife head in the closed position except, for example, when absolutely necessary to clear a jammed knife. This practice insures that all the veneer photographed is as uniform in thickness as possible within standard production capabilities. Because the spray unit is placed only about a foot above the moving veneer ribbon, the ribbon must be kept flat to prevent excessive and abnormal veneer breakage. All other aspects of the peeling operation can be carried out as per standard operating procedures. In a tray system, the clipper operator must unload the trays in the same sequence in which they are loaded. In a

double clipper installation, each full block must be loaded on only those trays feeding a particular clipper if comparisons between each clipper are desired. This should only present problems for mills peeling blocks larger than 40 inches in diameter. One option for those mills is to run each clipper separately on off-shift hours.

With the peeling/filming operation under way, several specific tasks need to be performed. One worker should be responsible for spraying the correct mark or color on the veneer. A second worker should be positioned between the lathe charger and the peeler core drag chain. This second worker reads the code on the block being charged into the lathe and verbally relays that information to the worker at the sprayer. In addition, when the block has been peeled and its core ejected onto the drag chain, the second worker may also need to re-mark the core appropriately. A third individual is needed on the scaffolding to monitor film use and remove and replace film cartridges as necessary.

At the conclusion of the peeling/filming operation, a control sheet is marked, measured, and photographed. The purpose of the control sheet is to relate actual sheet dimensions to the dimensions of the image projected on the digitizer. A full sheet is randomly selected from those just peeled and marked in a pairwise fashion at five extreme locations, as indicated in Figure 3.

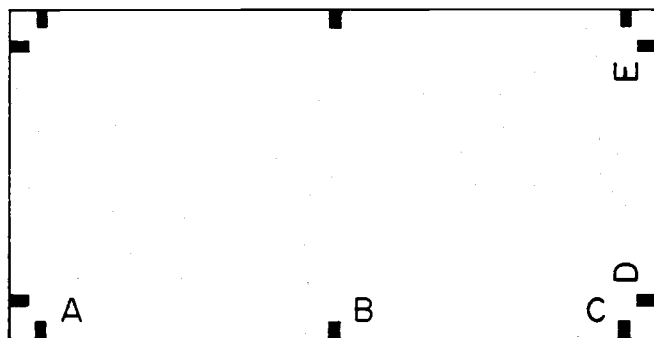


FIGURE 3.

EXAMPLE OF PAIRWISE MARKING ON A CONTROL SHEET.

Each of the five dimensions must be accurately measured and recorded. During a break or between shifts, this sheet can be placed on the non-moving conveyor and filmed with the camera exactly as one would film the moving veneer.

Upon completion of the entire filming operation, an average thickness must be determined for the

veneer just peeled so that veneer areas can be converted into veneer volumes. With a micrometer, one hundred veneer thickness measurements need to be taken from a random group of full sheets, half sheets, and randoms in order to determine the mean thickness of peeled veneer within ± 0.001 inch at a 95% confidence level (Sheffield 1983).

The cores from the test run should be spread only one layer deep so that individual diameter measurements may be taken at both ends and the middle. Where cores are excessively split or mushroomed on the ends, the measurement location should be moved to where the core begins to appear cylindrical. The use of calipers instead of tapes facilitates this task. The coding on the end of the core should match the original block. However taken, all measurements must be converted to their decimal equivalents for CLPLOSS analysis.

After measuring the cores, appropriate clipper/scanner data must be obtained. The specific data required will depend mainly on the objectives of the study. Table 3 indicates the clipper/scanner data required for an indepth green-end analysis. These measurements are needed during the digitizing operation to determine why clips occurred and their accuracy. The terminology employed in Table 3 is that used by the Morvue

systems and all measurements are in inches. Comparable terms exist with Black-Clawson systems.

TABLE 3.

CLIPPER/SCANNER DATA REQUIRED (INCHES).

<u>Veneer Size</u>	
Sheet Length	
Full Sheets _____	Fish-tails _____
Sheet Width	
Full Sheets _____	Half Sheets _____
<u>Flaw Limits</u>	
Normal Grade	
Crack _____	With Grain _____
Against Grain _____	Edge _____
Low Grade	
Crack _____	With Grain _____
Against Grain _____	Edge _____
Normal Grade	
Margin _____	Minimum Strip _____
Flaw Centering _____	
Alternate Grade	
Margin _____	Minimum Strip _____
<u>Spur-knife setting</u> _____	

Data Acquisition at the Lab

The laboratory digitizing procedures provide a means for accurately quantifying and classifying each individual piece of veneer produced at the clipper, no matter how irregular its shape. Basically, this procedure requires that the movie film frames be projected onto a digitizing surface (digitizing platen) where a hand held cursor is traced over the outline of the image. Through a series of READ statements in the software, the cursor's position is translated into a series of X-Y coordinates as it follows the image outline. The digitizing program uses these values to calculate the actual veneer areas. The CLPLOSS program then converts the areas into veneer yield and loss information.

Digitizing Operations

The components in the laboratory digitizing operations are the microcomputer, digitizer platen and stand, and projector and stand (Figure 4). The platen stand should be held at a



FIGURE 4.

LABORATORY ARRANGEMENT FOR DIGITIZING OPERATION.

constant position by either mounting or securing it against a fixed object. The platen itself can be maintained at any comfortable incline.

To insure that the filmed veneer images are accurately digitized, it is essential that the projector be aligned precisely perpendicular in two planes to the platen. A plexiglass platen sighting device can be constructed to aid in the alignment (Figure 5). The device is similar to but smaller than the camera sighting device described earlier. It consists of a pair of right triangles glued to a plexiglass base. Mounted on the triangles' plane of intersection are two very small spheres (1/8 inch office push pins work very well) approximately eight inches apart that act as alignment targets.

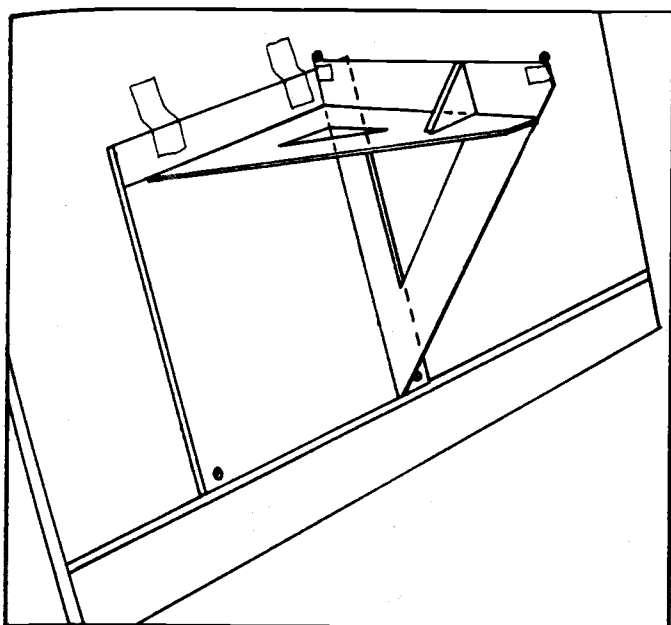


FIGURE 5.

PLATEN SIGHTING DEVICE USED TO INSURE PERPENDICULARITY OF THE PLATEN TO THE PROJECTOR.

The projector stand should be positioned far enough away from the digitizer so that the projected image utilizes the greater part of the active platen surface. The projector is turned on without film in it to create a rectangle of white light in the center of the digitizer platen. The platen sighting device is then placed on the platen, and the two spheres centered in the lighted rectangle. The two small target spheres will create shadows on the platen. The projector is properly aligned when the two spheres produce a single shadow rather than two spherical shadows in the center of the rectangle. Rotating the device 90 degrees from its original placement on

the platen facilitates its alignment in two axes. The adjustments to correct any horizontal disparity between the two shadows are made by slightly moving to the left or right the position of the projector stand relative to the floor. Any vertical adjustments are made by slightly changing the angle of the projector stand or the digitizer platen. Once properly aligned, the projector stand should be firmly located to prevent any movement and misalignment; nevertheless, alignment should be checked periodically.

The digitizer is a device capable of generating X-Y coordinates only. The user must develop software that will transfer the coordinates to a computer and analyze them properly. In this case, the coordinates are required to calculate veneer areas. For rectangular pieces, the coordinates representing each corner point of the sheet provide length and width information required to calculate areas. A method of trapezoidal approximation is used for all irregularly shaped pieces. As the cursor is traced over the curved or irregularly shaped piece, a close-interval continuous summation of trapezoids takes place to provide the area of the piece.

Each digitizing operation can be coded as to the mill, diameter class, and block number to which the piece of veneer belongs. In addition, the piece can be classified into one or more of the veneer types listed in Table 4 and digitized to determine its area. If the potential for improving scanner/clipper operations is to be examined by this technique, then a full knowledge of the scanner logic is obviously required. However, scanner logic can be ignored if the study's objective is to simply quantify merchantable veneer, examine standard sheet sizes, or determine sheet population statistics.

Codes 1 through 5 designate standard veneer classifications, although the real advantage of using this technique for veneer recovery studies is apparent in Codes 6, 7, 8, and 9. Codes 6 and 9 designate the specific sources within the veneer peel where standard clipper trash was generated. Clipped round-up is trash clipped out of that portion of the veneer ribbon (Region A in Figure 6) generated before the block is completely rounded up. Reject is defined as trash clipped out after round-up is complete (Region B of Figure 6). Only the trash-gate round-up portion of the peel (not shown in Figure 6—occurs prior to ribbon development) is calculated rather than directly measured with the digitizer, because it is sent directly down the trashgate to the chipper, and as a result, is never filmed.

TABLE 4.

NINE VENEER CLASSIFICATIONS AND CODES.

Veneer code	Veneer classification
1	Full sheet
2	Half sheet
3	Random strip
4	Untrimmed fish-tail
5	Trimmed fish-tail
6	Reject
7	Inaccurately clipped recoverable
8	Accurately clipped recoverable
9	Clipped round-up

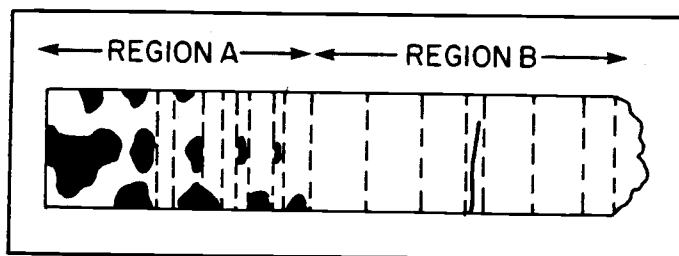


FIGURE 6.

EXAMPLE OF A TYPICAL VENEER PEEL SHOWING PORTIONS OF THE ENTIRE RIBBON.

Codes 7 and 8 provide information about the trash presently being lost and whether it has any potential for being recovered. Inaccurately clipped recoverable material is defined as trash resulting from some system error, such as belt or veneer slippage, timing wheel problems, or varying response times in valves or relays. In other words, this material should have ended up in one of the merchantable classes (Codes 1 through 5) instead of trash. In contrast, accurately clipped recoverable trash is produced when nothing goes wrong in the clipping process: the clipper/scanner system performs exactly as it is supposed to perform, but good wood is lost to trash because of faulty clipper logic or poor management.

The average times required for digitizing various block diameters in the original project are listed in Table 5. The manual digitizing process is the most labor intensive aspect of this technique; however, substantial time could be saved over

that shown in Table 5 when less complex investigations, a digitizing camera, or an image analyzer are involved.

TABLE 5.

APPROXIMATE TIMES REQUIRED FOR DIGITIZING VARIOUS BLOCK DIAMETERS UNDER THE ORIGINAL STUDY.

Diameter class (inches)	Average digitizing time required (hours/block)
10.00-14.99	0.63
15.00-19.99	0.95
20.00-24.99	1.38
25.00-29.99	1.93

Microcomputer Programs

Control Sheet Program

The purpose of the control sheet program (available upon request) is to obtain a scalar value that represents the relationship between the dimensions of a full sheet's projected image and its actual dimensions as measured in the mill (Figure 3). The scalar value should be determined separately for each mill. This computer program determines the distance between two points (the pairwise marks on the control sheet) and displays the value in inches. Then this value is used to calculate the overall scalar value that is used in the digitizing program to calculate sheet areas. After the film has been developed, the single frame containing the control sheet is projected onto the digitizer platen. With the control sheet program loaded, the operator makes repetitive measurements at each pair of marked positions and then obtains a single, average scalar value that represents the overall ratio of the down-sized film image. The scalar factor is calculated as follows:

$$\text{Scalar factor} = \frac{\text{Actual measured length, inches}}{\text{Average digitized length, inches}} \times \frac{1}{12} \frac{\text{inches}}{\text{foot}}$$

Digitizing Program

The digitizing program (Appendix A) has many prompts and is designed to be self-explanatory.

Because the HP 9825A microcomputer employs internal cassette tapes for mass storage, the tapes must be initialized ("marked") in order to allocate space for recording the data. The program uses an array of 100-by-5 data elements; thus, each file requires about 4500 bytes. Each HP cassette can contain 30 files of this size per track. To facilitate data management procedures, each file should be sequentially numbered with both a file and a serial number. Within the program, a series of questions will request the file and serial numbers and specific code values, such as the mill number (1 through 5), the code number for the block diameter class (1 through 4), the block or replicate number (1 through 30), and the type of veneer being digitized (1 through 9). As the digitizing session proceeds, the information is continuously stored on cassette tape as well as outputted via the printer. A nested series of DO loops aids in keeping the total number of operator keystrokes to a minimum. Through the use of immediate execute keys or special function keys, the program will allow the operator to enter or exit the process at any time.

Data File Print Program

Unlike program files, data files cannot simply be loaded into the HP computer and printed directly; therefore, a short program, Data File Print, is

required (available upon request). Once this program is loaded into memory, the operator designates the first and last files to be printed. Through a series of DO loops, the data is read off the HP cassette, directed to an allocated array, and sequentially sent to the output device. With this program, the data file contents can be easily checked against the output generated by the actual digitizing operation.

1200-baud Transfer Program

The 1200-baud transfer program (available upon request) transfers the cassette data to the Oregon State University mainframe computer (CDC CYBER 170/720). The transfer takes place on a line-by-line, file-by-file basis. Once the computer is connected to the modem, the program operates very simply, and instructions for the proper set-up are provided in the program display. After the program is loaded into the microcomputer and prior to running the program, Line 50 must be edited with a file name for storing the data file on the mainframe computer. Then the program initiates the actual log-on procedures, enters the mainframe's text entry mode, reads the data into an array, transfers the data, exits the text mode, saves the file, and performs the log-off sequence.

CLPLOSS Computer Program

The CLPLOSS program for analyzing veneer recovery (Appendix B) consists of two sections. The first section processes the veneer raw data. It employs a CDC CYBER 170/720 sort/merge routine and a summation routine, which reduces the coded raw data originating from the HP digitizing operation. Once summed, an intermediate file is created containing the summary veneer data on a block-by-block basis. The second section uses this summarized data plus the spur knife setting and average veneer thickness information to create a listing of loss and recovery data by mill, block diameter, and mill-by-block diameter.

The CLPLOSS program is designed to operate from five input files: three data files called VENEER, BLOCKS, and INFO, and two support files called TEXT1 and TEXT2. The file called VENEER originates directly from the laboratory digitizing operation and contains coded veneer data. As each piece of veneer is digitized, the

data file is automatically recorded in a (4(16,4X),F10.3) format. Included in this data file are the mill code, diameter code, block or replicate number, veneer type code (Table 4), and veneer area (sq. ft.). The data used to create the file called BLOCKS originates from the field data sheets containing both block and core data that are manually entered in a (211,12,1X,4(F7.4,2X),F9.5,3F8.5,F4.0,F5.0) format. The first elements include a one digit mill number, diameter number, and a two digit block number. The remaining data in this field are the values for the major and minor large-end diameters, the major and minor small-end diameters, block length, the core diameter on the lathe operator end, the middle of the core, the opposite end of the core, and the gross and net Scribner Scale of the block volume. The file called INFO consists of two lines of data: one line contains the spur knife settings in inches; the other line has the average veneer thicknesses in inches for each mill being examined. Each line is entered in a 5F13.9 format. The number of

columns on each line must be equal to the number of mills (HIGHM), which was five in the original study.

The three data files are essential for the CLP-LOSS program to operate, whereas it will function without the two TEXT files. TEXT1 and TEXT2 are a part of the output documentation process. CLPLOSS also performs range checking of the veneer codes in the VENEER data file and provides a listing of line numbers when veneer codes are out of the user-provided bounds. This listing, however, does not provide information regarding the overall correctness of the data.

There are at least seven noteworthy problems regarding CLPLOSS operation. First, the CLP-LOSS program was written employing a sort/

merge utility specifically supported by CYBER that may not be compatible with other systems. Similar sort/merge routines are available on other computer systems. Second, all peeler blocks must produce at least two full sheets and at least two half sheets. If not, a logical error during execution will result. This can be circumvented by inserting a test in the standard deviation equations for both the full and the half sheets to check that the divisor of $n-1$ is not zero. Third, the output requires a 132 character device. Fourth, the integer variables HIGHM, HIGHD, and HIGHB must be initialized to their appropriate integer values before attempting to run the program. These values correspond to the maximum number of mills, diameter classes, and blocks under consideration. This is done immediately after the sorting routine in CLPLOSS. Fifth, the three data

TABLE 6.

TYPES OF CLPLOSS OUTPUT DATA.

<u>Totals for number of:</u>		
Digitizing operations processed		
Blocks processed		
Mills examined		
Diameters examined		
Blocks in each diameter class		
<u>Section 1 - Data presented on a block-by-block basis, if requested.</u>		
Block number		
Total full sheet area (Code 1)		
Total number of full sheets		
Percent of block volume		
Total half sheet area (Code 2)		
Total number of half sheets		
Percent of block volume		
Total random strip area (Code 3)		
Percent of block volume		
Total untrimmed fish-tail area (Code 4)		
Percent of block volume		
Total trimmed fish-tail area (Code 5)		
Percent of block volume		
Total reject area (Code 6)		
Percent of block volume		
Total accurately clipped recoverable area (Code 7)		
Percent of block volume		
Total inaccurately clipped recoverable area (Code 8)		
Percent of block volume		
Total clipped round-up area (Code 9)		
Percent of block volume		
<u>Section 2 - Data presented on a summarized basis.</u>		
Block data		
Average block length (inches)		
Average veneer thickness (inches)		
Average large-end diameter (inches)		
Average small-end diameter (inches)		
Gross Scribner scale (bd. ft.)		
Net Scribner scale (bd. ft.)		
Block cubic volume (cu. ft.)		
Core and spur data		
Average core diameters (inches)		
Operator end, center, and opposite end		
Total core volume (cu. ft.)		
Percent of total block volume		
Total spur volume (cu. ft.)		
Percent of total block volume		
Round-up data		
Total round-up volume (cu. ft.)		
Percent of total block volume		
Trash-gate round-up volume (cu. ft.)		
Percent of total block volume		
Clipped round-up volume (cu. ft.)		
Percent of total block volume		
Veneer volume data		
Total merchantable veneer volume produced (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Theoretical merchantable veneer volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Cubic recovery ratio (CRR)*		
Veneer recovery factor (VRF)**		
Clipping loss data		
Total clipping loss volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Total reject volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Accurately clipped recoverable veneer (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Inaccurately clipped recoverable veneer (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Full sheet size and volume data		
Individual full sheet area (sq. ft. actual thickness)		
Average area		
Standard deviation		
Total full sheet volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Half sheet size and volume data		
Individual half sheet area (sq. ft. actual thickness)		
Average area		
Standard deviation		
Total half sheet volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Random strip data		
Total random strip volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Fish-tail data		
Total untrimmed fish-tail volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Total trimmed fish-tail volume (cu. ft. and sq. ft. 3/8 in.)		
Percent of total block volume		
Data on a percent merchantable basis		
Full sheets		
Half sheets		
Random strip		
Trimmed fish-tail		

* CRR is the cubic foot volume of merchantable veneer produced per cubic foot of block volume.

** VRF is the square feet of veneer produced (3/8 inch) per net Scribner board foot volume.

files (VENEER, BLOCKS, and INFO) are required and must be available for processing by CLPLOSS. The two text files (TEXT1 and TEXT2) are optional. However, for reasons of clarity, it is recommended that they be made available for processing. Sixth, the input format is a fixed format and, therefore, must be provided as requested. And seventh, the program will not

accept more than two main parameters (in this case, mill and diameter).

An example of CLPLOSS output is too lengthy to be included in this report, but is available upon request. The data potentially available from the CLPLOSS program are listed in Table 6.

Alternate Applications

The technique we have developed is very adaptable. Even though it was developed specifically for veneer clipping applications, it may be employed equally well to other aspects of veneer production and also to lumber processing systems. In many of these alternate applications, remember that the digitizing operations may be substantially streamlined simply by digitizing only the veneer or lumber of interest. Also, several of the adaptations need only a minimum of set-up and laboratory digitizing time.

Veneer Production

During a period of green-end capital improvement, very exact "before and after" comparisons can be undertaken to justify the capital expenditure or to check the performance standard after installation. For example, an investigation might be used to accurately quantify the increased recovery resulting from the installation of a new clipper, an X-Y charger, or a lathe follower system.

Comprehensive recovery comparisons between two or more very similar peeling operations can be conducted. For instance, one line with an X-Y charger could be directly compared with one not having an X-Y charger, or the charger could be turned on and off.

An estimate of trash-gate losses can be made on the basis of species, grade, shift, or lathe operator. Such information might show a need for an automatic round-up feature and additional lathe operator awareness or training.

Conclusion

Our original study showed that the average total loss at the clipper ranged from 5 to 10 percent of

The effectiveness of the green chain puller can be checked by using the film and digitizer information to analyze which pieces should have been pulled compared to those actually pulled.

An on-going system of green-end quality control is possible, whereby a digitizing camera is utilized in conjunction with the appropriate recovery software.

A detailed analysis can be conducted on the effects of changing various scanner settings.

Lumber Production

Because there is the benefit of adequate time during the digitizing process to determine optimum cut placement, baseline information on the various machine centers being examined can be provided.

Direct quantification of excessive raw material loss at the trimmer is possible by filming a sample of dimension lumber prior to trimming. Comparisons of the digitized volumes with those volumes obtained from the green chain tally can be made. The investment in time and effort on this simple system would be quite minimal. Such comparisons might indicate a need for increased operator training and aid in justifying a trimmer optimizer or in checking its accuracy.

The raw material losses from improper board edging practices can be assessed. The wane and knots are easily detectable. This data can aid in justifying an edger optimizer or in checking its accuracy.

the total block volume, and that merchantable veneer volumes could potentially be improved

anywhere from 1.5 to 4.0 percent at the clipper. Figure 7 illustrates the impact of an increase of only a few percent on profit potential. For instance, for a mill producing 70 million square feet of veneer (3/8-inch basis) per year, increasing its recovery factor by only one percent, and selling that increase in veneer at \$30/M, would realize an increase in profit of nearly \$70,000 annually.

With the rising cost of raw material, labor and capital, it is imperative that the forest products industry find methods to improve recovery, productivity, and product value. The initial step in meeting this challenge is to accurately determine processing recovery values and existing raw material recovery potential. A technique has been described that allows mill management to quantify the amount of potentially recoverable veneer presently being lost at the green-end clipper.

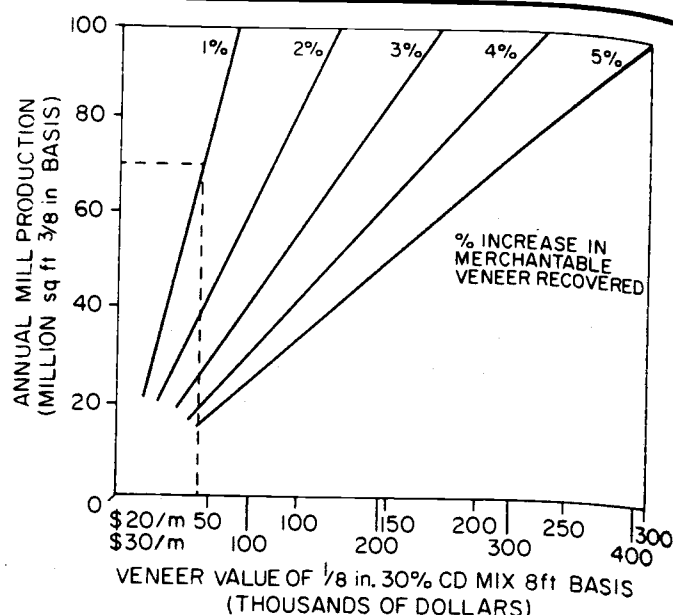


FIGURE 7.
ANNUAL POTENTIAL INCREASE IN REVENUE
AT VENEER VALUES OF \$20/M AND \$30/M.

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Appendix A: Digitizing Program Listing

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0: "PROGRAM #1          DIGITIZING PROGRAM          ":
1: "TRK1,FILE0":
2: "THIS DIGITIZING PORTION OF THE VENEER RECOVERY STUDY PROGRAM,":
3: " COMPUTES THE AREA, IN SQ. IN., OF INDIVIDUAL PIECES OF VENEER.":
4: " X&Y COORDINATES ARE OBTAINED WHEN MOVIE FILM OF DOUGLAS-FIR VENEER":
5: " IS PROJECTED ONTO A DIGITIZER SURFACE AND THE IMAGE IS DIGITIZED.":
6: " THE AREA IS THEN CONVERTED TO ACTUAL SQ. FT. DIMENSIONS. THIS":
7: " PROGRAM PROVIDES RAW DATA ON INDIVIDUAL SHEET AREAS.":
8:
9:
10: PRT "DIGITIZING"

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11: PRT "PROGRAM";SPC
12: PRT "SPECIAL"
13: PRT "FUNCTIONS";SPC
14: PRT "DIRECTIONS...";SPC
15: PRT "1.  PRESS 'FETCH'"
16: PRT "2.  PRESS 'FO'"
17: PRT "3.  TYPE IN"
18: PRT "  INSTRUCTIONS"
19: PRT "4.  PRESS 'STORE'"
20: PRT "5.  REPEAT FOR"
21: PRT "  EACH SPECIAL"
22: PRT "  FUNCTIONS";SPC ;SPC ;BEEP
23: BEEP
24: PRT "ENTER.....";SPC ;SPC
25: PRT "FO= *CONT 106"
26: PRT "F1= *CONT 101"
27: PRT "F2= *CONT 95"
28: PRT "F3= *CONT 192"
29: PRT "F4= *CONT 35"
30: SPC ;SPC
31: PRT "WHEN FINISHED...";SPC ;SPC
32: PRT "  PRESS F4";SPC ;SPC
33: DSP "ENTER SPECIAL FUNCTIONS NOW!";BEEP;STP
34:
35: PRT "START A NEW"
36: PRT "  FILE FOR EACH"
37: PRT "  NEW BLOCK";SPC
38: PRT "TO DO SO....."
39: PRT "PRESS 'FULL' AFTER"
40: PRT "COMPLETING"
41: PRT "EACH BLOCK";SPC ;SPC
42: DSP "TURN DIGITIZER ON";BEEP;STP
43: DSP "TURN LINE PRINTER ON";BEEP;STP
44: DSP "LINE PRINTER SW IN 'N' POSITION";BEEP;STP
45:
46: "ARRAY W RECORDS BLOCK CODES AND AREA DATA":
47: "ARRAY Q RECORDS COORDINATE DATA FOR AREA CALCULATIONS":
48: DIM W[100,5],Q[4,2]
49:
50: BEEP
51: ENT "ENTER NEXT SERIAL NUMBER",S;BEEP
52: ENT "ENTER NEXT DATA FILE NUMBER",RO;BEEP
53:
54:
55:
56:
57: "THE X-Y SCALAR FACTOR AND MILL NUMBER MUST BE ENTERED HERE":
58: .582]R
59:
60: "MILL":
61: 4]A
62:
63: "BLOCK":
64: DSP "MARK YOUR TALLY SHEET";BEEP;WAIT 300;BEEP;STP
65: ENT "BLOCK#=?",B;BEEP
66: IF B<1;CLL 'INPUT ERROR';GTO -1
67: IF B>32;CLL 'INPUT ERROR';GTO -2
68:

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69: "DIAMETER":
70: ENT "DIAMETER CLASS#=?",C;BEEP
71: IF C<1;CLL 'INPUT ERROR';GTO -1
72: IF C>4;CLL 'INPUT ERROR';GTO -2
73: "CORRECT":
74: BEEP
75: ENT "ALL INPUTS CORRECT? 1=YES,0=NO",R2
76: IF R2>1;CLL 'INPUT ERROR';GTO -1
77: IF R2=0;GTO +2
78: IF R2=1;GTO +7
79: BEEP
80: ENT "WANT TO TRY AGAIN?,1=YES,0=NO",R3;BEEP
81: IF R3>1;CLL 'INPUT ERROR';GTO -1
82: IF R3=1;GTO "MILL"
83: IF R3=0;GTO "END"
84:
85: "NEW FILE":
86: DSP "DATA TRACK COMING UP";BEEP;WAIT 1000
87: INA W
88: TRK O
89: FDF RO;WAIT 1000
90: 1]I
91: "THE FIRST LINE OF EACH FILE IS MARKED WITH A SERIAL NUMBER (S)":
92: S]W[I,5]
93: I+1]I
94:
95: "VENEER":
96: BEEP
97: ENT "VENEER CODE#=?",D;BEEP
98: IF D<1;CLL 'INPUT ERROR';GTO -1
99: IF D>9;CLL 'INPUT ERROR';GTO -2
100:
101: "TYPE":
102: ENT "DIGITIZING TYPE#=?",R1;BEEP
103: IF R1<1;CLL 'INPUT ERROR';GTO -1
104: IF R1>2;CLL 'INPUT ERROR';GTO -2
105:
106: "SKEW":
107: GSB "SKEW CORRECTION"
108: IF R1=1;GTO "QUADRALATERAL"
109: IF R1=2;GTO "TRAPAZOIDAL OR CONVOLUTED"
110:
111: "QUADRALATERAL":
112: BEEP
113: DSP "READ TOP LEFT CORNER";BEEP
114: RED 4,X,Y;BEEP
115: DSP "READ TOP RIGHT CORNER"
116: RED 4,W,Z;BEEP
117: GSB "COORDINATE 3&4 CORRECTION"
118:
119: "THE TRUE LENGTH CALCULATIONS CORRECT THE QUADRALATERAL SHAPED ":
120: " PIECES (MEASUREMENTS) FOR BEING OUT OF SQUARE":
121: "8 FOOT TRUE LENGTH"
122: \((Q[2,1]-Q[1,1])^2+(Q[2,2]-Q[1,2])^2)E
123: \((Q[4,1]-Q[3,1])^2+(Q[4,2]-Q[3,2])^2)O
124: "4 FOOT TRUE LENGTH"
125: \((Q[3,1]-Q[1,1])^2+(Q[3,2]-Q[1,2])^2)T
126: \((Q[4,1]-Q[2,1])^2+(Q[4,2]-Q[2,2])^2)U

```

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127: "AVERAGE OF SIDES":
128: (E+O)/2]M
129: (T+U)/2]N
130: M*R*N*R]P
131: GTO "CHECK"
132:
133: "TRAPAZOIDAL OR CONVOLUTED":
134: O]V]T
135: DSP "BEGIN CONTINUOUS DIGITIZING";BEEP
136: RED 4,X,Y;BEEP
137: "READ":
138: RED 4,W,Z;BEEP
139: GSB "COORDINATE 3&4 CORRECTION"
140: ABS(Q[3,1]-Q[4,1])M
141: IF Q[3,2]>Q[4,2];GTO +3
142: ABS(Q[3,2]-Q[4,2])/2+Q[3,2]]N
143: GTO +2
144: ABS(Q[3,2]-Q[4,2])/2+Q[4,2]]N
145: M*R*N*R]P
146: IF Q[3,1]<Q[4,1];P+V]V;GTO +4
147: "POSITIVE AREA NOW SUMMED":
148: P+T]T
149: "NEGATIVE AREA NOW SUMMED":
150: W]X
151: Z]Y
152:
153: "CONTINUOUS CUT-OFF":
154: IF Q[4,2]<0;GTO "SHEET AREA"
155: GTO "READ"
156:
157: "SHEET AREA":
158: IF V>T;V-T]P;GTO "CHECK"
159: DSP "THIS AREA IS INCORRECT";BEEP;WAIT 200;BEEP;WAIT 200;BEEP;WAIT 1500
160: DSP "DO IT OVER";BEEP;WAIT 1500;BEEP;GTO "SKEW"
161:
162: "CHECK":
163: "THE AREA IS PRINTED ON THE INTERNAL PRINTER":
164: "FOR A PRELIMINARY VISUAL CHECK":
165: FXD 1;PRT D
166: FXD 3;PRT P;SPC;SPC
167: ENT "CORRECTLY DIGITIZED? 1=YES,0=NO",R4;BEEP
168: IF R4>1;CLL 'INPUT ERROR';GTO -1
169: IF R4=1;GTO +6
170: IF R4=0;DSP "THEN LETS DO IT OVER!";BEEP;WAIT 2000;BEEP
171: GTO "SKEW"
172: "IF THE AREA IS VISUALLY CHECKED TO BE CORRECT, ALL INPUTS ARE":
173: "SENT TO THE LINE PRINTER AND ARE THEN RECORDED ON TAPE":
174:
175: "STORE":
176: IF I>2;GTO +5
177: FMT 1,40X,"FILE#=",F4.0,5X,"SERIAL#=",F4.0
178: WRT 10.1,R0,S
179: FMT 2,1X,"MILL",2X,"BLOCK",2X,"DIAMETER",2X,"VENEER",3X,"AREA"
180: WRT 10.2
181: FMT 3,2X,F1.0,5X,F2.0,7X,F1.0,9X,F1.0,3X,F7.3
182: WRT 10.3,A,B,C,D,P
183: A]W[I,1]
184: B]W[I,2]

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185: C]W[I,3]
186: D]W[I,4]
187: P]W[I,5]
188: I+1]I
189:
190: "FILE CHECK":
191: IF I<100;GTO "VENEER"
192: GSB "FILE FULL"
193:
194: "END":
195: GSB "FILE STORE"
196: GSB "FILE CHANGE"
197: DSP "ADVANCE LINE PRINTER PAPER";BEEP;STP
198: ENT "CONTINUE THIS BLOCK? 1=YES,0=NO",R10;BEEP
199: IF R10>1;CLL 'INPUT ERROR';GTO -1
200: IF R10=1;GTO "NEW FILE"
201: ENT "ANOTHER BLOCK TODAY? 1=YES,0=NO",R9;BEEP
202: IF R9>1; CLL 'INPUT ERROR';GTO -1
203: IF R9=1;GTO "BLOCK"
204:
205: "FINISHED":
206: ENT "FINISHED FOR TODAY? 1=YES,0=NO",R7;BEEP
207: IF R7>1;CLL 'INPUT ERROR';GTO -1
208: IF R7=0;GTO "VENEER"
209:
210: BEEP;WAIT 500;BEEP;WAIT 500;BEEP
211: DSP "TURN OFF DIGITIZER!!!";BEEP;STP
212: END
213:
214: "*****":
215: "*****SUBROUTINES*****":
216: "*****":
217:
218:
219: "SKEW CORRECTION TRIGONOMETRICALLY ALIGNS THE USER DESIGNATED":
220: "      X-Y AXIS WITH THE TRUE PLATEN X-Y AXIS":
221:
222: "SKEW CORRECTION":
223: INA Q
224: FXD 8
225: DSP "MARK ORIGIN & BOTTOM LEFT CORNER";BEEP
226: RED 4,F,G;BEEP
227: DSP "MARK BOTTOM RIGHT CORNER";BEEP
228: RED 4,H,J;BEEP
229: IF H=F;DSP "HIT 'C' BUTTON PLEASE";STP;GTO +2
230: GTO +2
231: DSP "TURN IT OFF THIS TIME";BEEP;WAIT 1500;GTO "SKEW CORRECTION"
232: ATN((J-G)/(H-F))R8
233: COS(R8)K
234: SIN(R8)L
235: "COORDINATES 1&2 CORRECTION":
236: "K&L ARE SKEW CORRECTION FACTORS":
237: F*K+G*L]Q[1,1]
238: G*K-F*L]Q[1,2]
239: H*K+J*L]Q[2,1]
240: J*K-H*L]Q[2,2]
241: "FIRST TWO COORDINATES NOW SKEW CORRECTED":
242: RET

```

```

243:
244:
245: "COORDINATES 3&4 CORRECTION":
246: X*K+Y*L]Q[3,1]
247: Y*K-X*L]Q[3,2]
248: W*K+Z*L]Q[4,1]
249: Z*K-W*L]Q[4,2]
250: "SECOND TWO COORDINATES NOW SKEW CORRECTED":
251: RET
252:
253:
254:
255: "FILE FULL":
256: BEEP;WAIT 150;BEEP;WAIT 150;BEEP;WAIT 150;BEEP;WAIT 150;BEEP
257: DSP "FILE FULL!!!!";BEEP;WAIT 3000
258: RET
259:
260:
261:
262: "FILE STORE":
263: RCF RO,W[*]
264: PRT "FILE #",RO
265: PRT "RECORDED";SPC ;SPC
266: PRT "SERIAL #",S
267: PRT "RECORDED";BEEP;SPC ;SPC ;WAIT2000
268: RET
269:
270:
271:
272: "FILE CHANGE":
273: RO+1]RO
274: S+1]S
275: FDF RO
276: WAIT 1000
277: BEEP;WAIT 150;BEEP;WAIT 150;BEEP
278: DSP "NEW DATA FILE=",RO;WAIT 4000
279: RET
280:
281:
282:
283: "INPUT ERROR":
284: DSP "INPUT ERROR-----DO IT OVER!!!!";BEEP;WAIT 3000;BEEP
285: RET

```

Appendix B: CLPLOSS Program

PROGRAM CLPLOSS

```

C
C THIS VENEER RECOVERY PROGRAM, DEVELOPED AT
C THE OSU DEPT. OF FOREST PRODUCTS, ASSESSES GREEN
C VENEER RECOVERY AND LOSSES UP TO AND INCLUDING THE
C GREEN-END CLIPPER. THE PROGRAM WILL DO THIS
C ANALYSIS FOR UP TO FIVE MILLS AND FOUR DIAMETER
C CLASSES. RESULTS OBTAINED USING THIS PROGRAM
C COULD POTENTIALLY BE USED TO PROVIDE:
C
C

```


1. CLIPPER AND SCANNER MANUFACTURERS WITH DATA POTENTIALLY NECESSARY FOR IMPROVING EXISTING RECOVERY STRATEGY.
2. MILL MANAGEMENT WITH BETTER INFORMATION FOR FUTURE CAPITAL EXPENDITURES. AND
3. STANDARDIZED PROCEDURES AND DATABASES NECESSARY TO CONDUCT SIMILAR IN-HOUSE ANALYSES.

THIS PROGRAM BASICALLY CONSISTS OF TWO SECTIONS...

SECTION 1 - EMPLOYS A CYBER SORT/MERGE ROUTINE AS WELL AS A SUMMATION ROUTINE TO REDUCE THE CODED RAW DATA FROM THE H/P DIGITIZING OPERATION. CYBER READS OFF THE DATA FILE CALLED 'VENEER'. THIS RAW DATA FILE IS COMPRISED OF NINE VENEER TYPES AND AREA, WHICH WHEN SORTED, CREATES A TEMPORARY FILE CALLED 'SORTOUT'. THE AREAS IN THIS INTERMEDIATE FILE ARE THEN SUMMED ACCORDING TO THE NINE SPECIFIC VENEER TYPES. ONCE SUMMED, THE INFORMATION IS USED TO CREATE A FILE CALLED 'VENOUT' WHICH PROVIDES SPECIFIC VENEER DATA ON A BLOCK BY BLOCK BASIS.

SECTION 2 - IS A SPLIT PLOT ANALYSIS OPERATING OFF THE ABOVE REDUCED BLOCK DATA IN THE 'TBLOCK' ARRAY. THIS ANALYSIS CREATES A LISTING OF BLOCK DATA AS CLASSIFIED BY PERMUTATIONS OF THE TWO KEY PARAMETERS, MILL AND DIAMETER. THIS SECTION OPERATES OFF THE PERMANENT FILE 'BLOCKS' AND THE NEWLY CREATED TEMPORARY FILE CALLED 'SORTOUT'.

```

INTEGER DIA,BLK,CODE,HIBLK,HIGHT,REP,ERROR,HIVEN,HIGHM,HIGHB,HIGHD
REAL IACRT,IACRTA,IACRTB,IACRTP
CHARACTER*13 LABS(29), LINE*130
DIMENSION TEMP(29,64),TBLOCK(5,4,30,28),VENTHK(5),VENLEN(5)
COMMON/FIRST/ FULLT,FULLS,FULLK,HALFT,HALFS,HALFK,RANT,
1 UTFTT,TFTT,REJT,ACRT,IACRT,CLPRUP,FULLC,HALFC
COMMON/SECOND/ TBLOCK,BLKS,STHK,SBLN,SDMAJ,SDMIN,SSCBVG,SSCBVN,
1 SCOR1,SCOR3,SCOR5,SCORVO,SSPRVO,STHVOL,SFULLT,SFULLS,
2 SFULLK,SHALFT,SHALFS,SHALFK,SRANT, SUTFTT,STFTT,SREJT,
3 SACRT,SABCVO,SCORVP,SSPRVOP,SIACRT,SCLPRU,
4 BLENV,DMAJAV,DMINAV,COR1AV,COR3AV,COR5AV,
5 TOVOLA,TOVOLB,TOVOLP,THVOLA,THVOLB,THVOLP,CRR,
6 VRF,CLLOSA,CLLOSB,CLLOSP,ACRTA,ACRTB,ACRTP,REJA,REJB,
7 REJP,IACRTA,IACRTB,IACRTP,FULLAV,FULLSD,FULLA,FULLB,
8 FULLP,HALFAV,HALFSD,HALFA,HALFB,HALFP, RANA,
9 RANB,RANP,UTFTA,UTFTB,UTFTP,

```

```

A TFTA,TFTB,TFTP,TGRUP,TGRUPP,CLRUPP,RUPVOL,RUVPLP,
B FULLM,HALFM,RANM,TFTM,SFULLC,SHALFC
COMMON /THIRD/ TEMP

```

```

*****
***** SECTION 1 *****
*****

```

PROCEDURES WILL NOW BE ESTABLISHED TO DIRECT CYBER TO CONVERT THE RANDOM H/P RAW DATA INPUT INTO AN ASCENDING AND SEQUENTIALLY ORDERED FILE CALLED 'SORTOUT'. IN THAT FILE, THE THREE INDICATOR VARIABLES (MIL,DIA,BLK) ARE ORDERED TO PRODUCE CELLS OF THE FIFTH DEPENDENT VARIABLE (AREA).

```

DATA TBLOCK/16800*0.0/,TEMP/1856*0.0/
OPEN(5,FILE='INFO')
READ (5,134) VENLEN

```

```

READ (5,134) VENTHK
OPEN(1,FILE='SORTOUT')
OPEN(3,FILE='VENEER')
CALL SMSORT (80)
CALL SMFILE (4HSORT,5HCODED,3,6HREWIND)
CALL SMFILE (6HOUTPUT,5HCODED,1,6HREWIND)
CALL SMKEY (1,1,10,0,7HDISPLAY,6HASCII6,1HA)
CALL SMKEY (21,1,10,0,7HDISPLAY,6HASCII6,1HA)
CALL SMKEY (11,1,10,0,7HDISPLAY,6HASCII6,1HA)
CALL SMEND
CLOSE(3)
PRINT*, 'SORT/MERGE ON RAW VENEER DATA COMPLETE'
PRINT*, 'THE SORTED VENEER DATA WILL NOW BE SUMMED'
PRINT*, '      ON A BLOCK BY BLOCK BASIS'
OPEN(2,FILE='VENOUT')
CALL ZEROA

```

```

C THE ORDERED RAW DATA FROM THE TEMPORARY FILE 'SORTOUT'
C WILL NOW BE CLASSIFIED BY MILL, DIAMETER, AND
C BLOCK. PIECE AREAS, SUM OF AREAS SQUARED, AND
C PIECE COUNT ARE SUMMED FOR EACH BLOCK. THE
C SUMMATION OPERATION TAKES PLACE WHEN THE INDICATOR
C VARIABLES OF THE LINE READ DIFFER FROM THE LAST
C LINE READ.

```

```

HIGHM = 5
HIGHD = 4
HIGHB = 30
ERROR = 0
I = 0
HIVEN = 0
HIBLK = 0
PI = 3.1415927
HIGHT = 0

```

```

OPEN(4,FILE='TEXT1')
101 READ(4,'(A)',END=102)LINE
WRITE(2,'(A)')LINE
GO TO 101
102 MIL = 9999
READ(1, 135,END=109)MIL,BLK,DIA,CODE,AREA
HIVEN = HIVEN+1
IF (HIVEN.EQ.1) THEN
  J = MIL
  K = DIA
  L = BLK
ENDIF

```

```

C THE CONTROL VARIABLES OF THE INPUT VENEER DATA FILE
C ARE EXAMINED TO DETERMINE WHETHER OR NOT THEY
C ARE WITHIN THE USER SPECIFIED LIMITS. IF
C FOUND TO BE INCORRECT, AN ERROR MESSAGE AND A
C NUMBER ARE PRINTED, AND THE RUN CONTINUES.

```

```

C IF (MIL.LT.1.OR.MIL.GT.HIGHM.OR.DIA.LT.1.OR.DIA.GT.HIGHD.OR.BLK.LT
C 1.1.OR.BLK.GT.HIGHB) GO TO 103
C IF (MIL.EQ.0.OR.DIA.EQ.0.OR.BLK.EQ.0.OR.CODE.EQ.0.OR.AREA.EQ.0)
C 1 GO TO 105
C GO TO 107
103 IF (ERROR.GT.0) GO TO 104
WRITE (2,137)
WRITE (2,138)
ERROR = 1
WRITE (2,139) HIVEN
GO TO 102
104 WRITE (2,139) HIVEN
GO TO 102
105 IF (ERROR.GT.0) GO TO 106
WRITE (2,137)
WRITE (2,138)
ERROR = 1
106 WRITE (2,140) HIVEN
GO TO 102

```

```

C THE SUMMATION WITHIN EACH SPECIFIC VENEER CLASSIFICATION
C NOW TAKES PLACE WITH THE AREAS BEING CONVERTED FROM
C A COMMON SQ.FT. TO A COMMON CUBIC BASIS. THIS DATA
C IS USED TO CREATE A LOCAL FILE CALLED 'VENOUT'.

```

107 IF (MIL.NE.J.OR.DIA.NE.K.OR.BLK.NE.L) GO TO 109

108 IF (CODE.EQ.1.) THEN
FULLT = FULLT + AREA
FULLC = FULLC+AREA*VENTHK(MIL)/12.0
FULLS = FULLS+AREA**2
FULLK = FULLK+1
GO TO 102
ELSE IF(CODE.EQ.2.)THEN
HALFT = HALFT + AREA
HALFC = HALFC+AREA*VENTHK(MIL)/12.0
HALFS = HALFS+AREA**2
HALFK = HALFK+1
GO TO 102
ELSE IF(CODE.EQ.3.)THEN
RANT = RANT+AREA*VENTHK(MIL)/12.0
GO TO 102
ELSE IF(CODE.EQ.4.)THEN
UTFTT = UTFTT+AREA*VENTHK(MIL)/12.0
GO TO 102
ELSE IF(CODE.EQ.5.)THEN
TFTT = TFTT+AREA*VENTHK(MIL)/12.0
GO TO 102
ELSE IF(CODE.EQ.6.)THEN
REJT = REJT+AREA*VENTHK(MIL)/12.0
GO TO 102
ELSE IF(CODE.EQ.7.)THEN
IACRT = IACRT+AREA*VENTHK(MIL)/12.0
GO TO 102
ELSE IF(CODE.EQ.8.)THEN
ACRT = ACRT+AREA*VENTHK(MIL)/12.0
GO TO 102
ELSE IF(CODE.EQ.9.)THEN
CLPRUP = CLPRUP+AREA*VENTHK(MIL)/12.0
END IF
GO TO 102

C
C FOR A SPECIFIC FACTOR CLASSIFICATION,THE SUMMED CUBIC
C VOLUMES ARE LOADED INTO ARRAY 'TBLOCK'. A
C PRELIMINARY OUTPUT OF THIS VENEER DATA WILL BE
C PROVIDED IF DESIRED.
C

109 TBLOCK(J,K,L,14) = FULLT
TBLOCK(J,K,L,15) = FULLS
TBLOCK(J,K,L,16) = FULLK
TBLOCK(J,K,L,17) = HALFT
TBLOCK(J,K,L,18) = HALFS
TBLOCK(J,K,L,19) = HALFK
TBLOCK(J,K,L,20) = RANT
TBLOCK(J,K,L,21) = UTFTT
TBLOCK(J,K,L,22) = TFTT
TBLOCK(J,K,L,23) = REJT
TBLOCK(J,K,L,24) = IACRT
TBLOCK(J,K,L,25) = ACRT
TBLOCK(J,K,L,26) = CLPRUP
TBLOCK(J,K,L,27) = FULLC
TBLOCK(J,K,L,28) = HALFC
J = MIL
K = DIA
L = BLK
HIBLK = HIBLK+1

C
C THE ACCUMULATION VARIABLES ARE NOW REINITIALIZED TO
C ZERO AND THE PROGRAM CONTINUES TO THE NEXT BLOCK
C OF VENEER DATA.
C

CALL ZEROA
IF (MIL.NE.9999) GO TO 108
PRINT *, 'THE VENEER SUMMATION IS NOW COMPLETE'
IF (ERROR.EQ.0) WRITE (2,141)
WRITE (2,142) HIVEN
WRITE (2,143) HIBLK
WRITE (2,144) HIGHM,HIGHD,HIGHB

C
C IT IS DETERMINED WHETHER OR NOT THE USER
C DESIRES A VENEER VOLUME OUTPUT ON A
C BLOCK BY BLOCK BASIS.
C

PRINT*, 'DO YOU WANT A COPY OF THE VENEER VOLUMES'

```

PRINT*, 'ON A BLOCK BY BLOCK BASIS ?'
PRINT*, ' (ENTER 1 FOR YES, 0 FOR NO)'
READ(*, '(I1)') I
IF (I.NE.1) GO TO 240
WRITE (2, 145)
WRITE (2, 146)
WRITE (2, 147)
I = 0
DO 110 J=1, HIGHM
  DO 110 K=1, HIGHD
    DO 110 L=1, HIGHB
      I = I+1
      WRITE (2, 148) I, (TBLOCK(J, K, L, M), M=14, 19)
110 CONTINUE
  WRITE (2, 149)
  WRITE (2, 150)
  WRITE (2, 151)
  WRITE (2, 152)
  WRITE (2, 153)
  WRITE (2, 154)
  I = 0
  DO 111 J=1, HIGHM
    DO 111 K=1, HIGHD
      DO 111 L=1, HIGHB
        I = I+1
        WRITE (2, 155) I, (TBLOCK(J, K, L, M), M=20, 26)
111 CONTINUE
C
C *****
C ***** SECTION 2 *****
C *****
C
C THE FOLLOWING CALCULATIONS EMPLOY THE TWO END CONIC
C FORMULA AND ARE NECESSARY PRIOR TO LOADING THE
C INPUT DATA INTO ARRAY 'TBLOCK'. THIS FIRST
C READ SECTION READS THE SCALED BLOCK DATA FROM
C THE INPUT FILE 'BLOCKS' TO MAKE THE NECESSARY
C CALCULATIONS.
C
240 CLOSE(1)
  OPEN(1, FILE='BLOCKS')
  HIBLK = 0
C
C
C THE FOLLOWING READ STATEMENT READS ONLY THE VENEER
C DATA FROM THE INPUT FILE CALLED 'BLOCKS'. THE
C DATA IS THEN LOADED INTO THE ARRAY 'TBLOCK'.
C
C
112 READ(1, 136, END=218) MIL, DIA, REP, DMAJA, DMAJB, DMINA, DMINB,
1  BLEN, COR1, COR3, COR5, SCBVG, SCBVN
  HIBLK = HIBLK+1
  IF (MIL.EQ.0) GO TO 218
  DMAJ = (DMAJA+DMAJB)/2.0
  DMIN = (DMINA+DMINB)/2.0
  ABCVOL = (PI*BLEN/20736.0)*(DMAJ**2+DMIN**2+DMAJ*DMIN)
  CORVOL = (PI*BLEN/41472.0)*(COR1**2+2.0*COR3**2+COR5**2.0+COR1*
1COR3+COR3*COR5)
  COR2 = COR1+(COR3-COR1)*(1.0-VENLEN(MIL)/BLEN)
  COR4 = COR5+(COR3-COR5)*(1.0-VENLEN(MIL)/BLEN)
  SPRVOL = (PI*(BLEN-VENLEN(MIL))/6912.0)*(DMIN**2-((COR1**2+COR2**2
1+COR4**2+COR5**2+COR1*COR2+COR4*COR5)/6.0))
  THVOL = ((PI*VENLEN(MIL))/6912.0)*(DMIN**2-((COR2**2.0+2.0*COR3**2
1+COR4**2+COR2*COR3+COR3*COR4)/(6.0)))
  TBLOCK(MIL, DIA, REP, 1) = BLEN
  TBLOCK(MIL, DIA, REP, 2) = VENTHK(MIL)
  TBLOCK(MIL, DIA, REP, 3) = DMAJ
  TBLOCK(MIL, DIA, REP, 4) = DMIN
  TBLOCK(MIL, DIA, REP, 5) = ABCVOL
  TBLOCK(MIL, DIA, REP, 6) = SCBVG
  TBLOCK(MIL, DIA, REP, 7) = SCBVN
  TBLOCK(MIL, DIA, REP, 8) = COR1
  TBLOCK(MIL, DIA, REP, 9) = COR3
  TBLOCK(MIL, DIA, REP, 10) = COR5
  TBLOCK(MIL, DIA, REP, 11) = CORVOL
  TBLOCK(MIL, DIA, REP, 12) = SPRVOL
  TBLOCK(MIL, DIA, REP, 13) = THVOL
  GO TO 112
218 PRINT *, 'ALL BLOCK DATA HAS NOW BEEN CALCULATED'

```

```

PRINT *, 'THE SPLIT PLOT SORTING WILL NOW TAKE PLACE'
C
C *****CLASSIFICATION BY MILL*****
C
DO 114 J=1,HIGHM
  CALL ZEROB
  DO 113 K=1,HIGHD
    DO 113 L=1,HIGHB
      CALL SUM (J,K,L)
113   CONTINUE
      CALL CALC (J)
      TEMP(J,3) = VENTHK(J)
114   CONTINUE
C
C *****CLASSIFICATION BY DIAMETER*****
C
DO 116 K=1,HIGHD
  CALL ZEROB
  DO 115 J=1,HIGHM
    DO 115 L=1,HIGHB
      CALL SUM (J,K,L)
115   CONTINUE
      I = K+HIGHM
      CALL CALC (I)
      TEMP(I,3) = 0
116   CONTINUE
C
C *****CLASSIFICATION BY MILL AND DIAMETER*****
C
DO 119 J=1,HIGHM
  DO 118 K=1,HIGHD
    CALL ZEROB
    DO 117 L=1,HIGHB
      CALL SUM (J,K,L)
117   CONTINUE
      I = HIGHM+HIGHD*J+K
      CALL CALC (I)
      TEMP(I,3) = VENTHK(J)
118   CONTINUE
119   CONTINUE
C
C PRINT SPECIAL 'ALL' LABELS
C
DO 120 J=1,HIGHM
  WRITE (LABS(J) , '(I2,8X,'''ALL''')')J
120   CONTINUE
  I = HIGHM+1
  DO 121 J=1,HIGHD
    WRITE (LABS(J+HIGHM) , '('''ALL''',8X,I1,1X)')J
121   CONTINUE
  DO 122 I=1,HIGHM
    DO 122 J=1,HIGHD
      WRITE (LABS(HIGHM+HIGHD*I+J) , '(I2,8X,I2,1X)')I,~
122   CONTINUE
  J = HIGHM+HIGHD+(HIGHM*HIGHD)
  OPEN(6,FILE='TEXT2')
250  READ(6,'(A)',END=251)LINE
  WRITE(2,'(A)')LINE
  GO TO 250
251  WRITE (2,156)
  WRITE (2,157)
  WRITE (2,158)
  WRITE (2,159)
  WRITE (2,160)
  DO 123 I=1,J
    WRITE (2,161) LABS(I),TEMP(I,1),TEMP(I,2),TEMP(I,3),TEMP(I,4),
1    TEMP(I,5),TEMP(I,6),TEMP(I,7),TEMP(I,8)
123   CONTINUE
    WRITE (2,162)
    WRITE (2,163)
    WRITE (2,164)
    WRITE (2,165)
    WRITE (2,166)
    WRITE (2,167)
    DO 124 I=1,J
      WRITE (2,168) LABS(I),TEMP(I,1),TEMP(I,9),TEMP(I,10),TEMP(I,11)
1    TEMP(I,12),TEMP(I,13),TEMP(I,14),TEMP(I,15)
124   CONTINUE
    WRITE (2,169)

```

```

WRITE (2,170)
WRITE (2,171)
WRITE (2,172)
WRITE (2,173)
DO 125 I=1,J
  WRITE (2,174) LABS(I),TEMP(I,1),TEMP(I,16),TEMP(I,17),TEMP(I,18
1  ),TEMP(I,19),TEMP(I,20),TEMP(I,21)
125 CONTINUE
WRITE (2,175)
WRITE (2,176)
WRITE (2,177)
WRITE (2,178)
DO 126 I=1,J
  WRITE (2,179) LABS(I),TEMP(I,1),TEMP(I,22),TEMP(I,23),TEMP(I,24
1  ),TEMP(I,25),TEMP(I,26),TEMP(I,27),TEMP(I,28),TEMP(I,29)
126 CONTINUE
WRITE (2,180)
WRITE (2,181)
WRITE (2,182)
WRITE (2,183)
DO 127 I=1,J
  WRITE (2,184) LABS(I),TEMP(I,1),TEMP(I,30),TEMP(I,31),TEMP(I,32
1  ),TEMP(I,33),TEMP(I,34),TEMP(I,35)
127 CONTINUE
WRITE (2,185)
WRITE (2,186)
WRITE (2,187)
WRITE (2,188)
DO 128 I=1,J
  WRITE (2,189) LABS(I),TEMP(I,1),TEMP(I,36),TEMP(I,37),TEMP(I,38
1  ),TEMP(I,39),TEMP(I,40),TEMP(I,41)
128 CONTINUE
WRITE (2,190)
WRITE (2,191)
WRITE (2,192)
WRITE (2,193)
WRITE (2,194)
DO 129 I=1,J
  WRITE (2,195) LABS(I),TEMP(I,1),TEMP(I,42),TEMP(I,43),TEMP(I,44
1  ),TEMP(I,45),TEMP(I,46)
129 CONTINUE
WRITE (2,196)
WRITE (2,197)
WRITE (2,198)
WRITE (2,199)
WRITE (2,200)
DO 130 I=1,J
  WRITE (2,201) LABS(I),TEMP(I,1),TEMP(I,47),TEMP(I,48),TEMP(I,49
1  ),TEMP(I,50),TEMP(I,51)
130 CONTINUE
WRITE (2,202)
WRITE (2,203)
WRITE (2,204)
WRITE (2,205)
DO 131 I=1,J
  WRITE (2,206) LABS(I),TEMP(I,1),TEMP(I,52),TEMP(I,53),TEMP(I,54
1  )
131 CONTINUE
WRITE (2,207)
WRITE (2,208)
WRITE (2,209)
WRITE (2,210)
DO 132 I=1,J
  WRITE (2,211) LABS(I),TEMP(I,1),TEMP(I,55),TEMP(I,56),TEMP(I,57
1  ),TEMP(I,58),TEMP(I,59),TEMP(I,60)
132 CONTINUE
WRITE (2,212)
WRITE (2,213)
WRITE (2,214)
WRITE (2,215)
DO 133 I=1,J
  WRITE (2,216) LABS(I),TEMP(I,1),TEMP(I,61),TEMP(I,62),TEMP(I,63
1  ),TEMP(I,64)
133 CONTINUE
STOP

```

```

C
C
C
C
SECTION 1 AND 2 INPUT FORMAT STATEMENTS

```

```

134 FORMAT(5F13.9)
135 FORMAT(4(I6,4X),F10.3)
136 FORMAT(I1,I1,I2,1X,4(F7.4,2X),F9.5,3(F8.5),F4.0,F5.0)

```

SECTION 1 OUTPUT FORMAT STATEMENTS

```

137 FORMAT(3(/),T53,'***** VENEER FILE CODE ERROR LISTING *****')
138 FORMAT('-',T 10,'CODING ERRORS HAVE BEEN DETECTED ',
* 'IN THE FOLLOWING LINES OF YOUR VENEER DATA FILE:')
139 FORMAT('O',T20,'***** CODE ERROR IN LINE ',I8)
140 FORMAT('O',T20,'***** ZERO ERROR IN LINE ',I8)
141 FORMAT(3(/),T20,'NO CODING ERRORS HAVE BEEN DETECTED IN YOUR ',
* 'RAW DATA FILE')
142 FORMAT(3(/),T10,'THE TOTAL NUMBER OF DIGITIZING ',
* 'OPERATIONS BEING CONSIDERED HERE ARE =',T80,I8)
143 FORMAT(3(/),T10,'THE TOTAL NUMBER OF PEELER BLOCKS ',
* 'BEING CONSIDERED HERE ARE =',T73,I8)
144 FORMAT(3(/),T10,'CONSISTING OF ',I4,' FACILITIES ',
* 'I4,' DIAMETERS, AND ',I4,' BLOCKS IN EACH')
145 FORMAT('I',T4,'BLOCK',T17,'TOTAL FULL SHEET AREA',T47,
* 'TOTAL COUNT',T77,'TOTAL HALF SHEET AREA',T107,
* 'TOTAL COUNT')
146 FORMAT(T3,'NUMBER',T15,'(CUBIC FEET) (SUM OF',T48,
* 'OF FULLS',T75,'(CUBIC FEET) (SUM OF',T108,'OF HALVES')
147 FORMAT(T33,'SQUARES',T93,'SQUARES')
148 FORMAT(T4,I4,T14,F12.3,T31,F12.3,T50,F6.0,T74,
* F12.3,T91,F12.3,T110,F6.0)

```

```

149 FORMAT('I',T4,'BLOCK',T12,'TOTAL RANDOM TOTAL UNTRIMMED',
* T45,'TOTAL TRIMMED TOTAL REJECT TOTAL ACCURATELY',
* T98,'TOTAL INACCURATELY TOTAL')
150 FORMAT(T3,'NUMBER STRIP AREA FISH-TAIL AREA',T45,
* 'FISH-TAIL AREA',T66,'AREA',T81,'CLIPPED',T102,
* 'CLIPPED',T121,'CLIPPED')
151 FORMAT(T14,'SQ.FT.',T30,'(SQ.FT.',T48,'(SQ.FT.',T65,'(SQ.FT.',
* T79,'RECOVERABLE AREA RECOVERABLE AREA',T120,'ROUND-UP')
152 FORMAT(T12,'ACTUAL THICK.) ACTUAL THICK.) ACTUAL THICK.)),
* T63,'ACTUAL THICK.)),T81,'(SQ.FT.',T103,'(SQ.FT.',T120,
* '(SQ.FT.))
153 FORMAT(T80,'ACTUAL THICK.)),T101,'ACTUAL THICK.)),
* T121,'ACTUAL')
154 FORMAT(T121,'THICK.))')
155 FORMAT(T4,I4,T13,F9.3,T30,F9.3,T47,F9.3,T63,F9.3,T81,F9.3,
* T103,F9.3,T119,F9.3)

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SECTION 2 OUTPUT FORMAT STATEMENTS

```

156 FORMAT('I',T54,'***** BLOCK DATA *****')
157 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T38,
* 'AVERAGE',T50,'AVERAGE',T62,'AVERAGE',T75,'AVERAGE',
* T91,'GROSS',T107,'NET',T120,'CUBIC BLOCK')
158 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T39,'BLOCK',T50,
* 'VENEER',T61,'LARGE END',T74,'SMALL END',T90,
* 'SCRIBNER',T105,'SCRIBNER',T123,'VOLUME')
159 FORMAT(T28,'BLOCKS',T38,'LENGTH',T49,'THICKNESS',T62,
* 'DIAMETER',T75,'DIAMETER',T91,'SCALE',T106,
* 'SCALE',T122,'(CU.FT.))')
160 FORMAT(T39,'(IN.))',T51,'(IN.))',T63,'(IN.))',
* T76,'(IN.))',T89,'(BD.FT.))',T104,
* '(BD.FT.))')
161 FORMAT('O',T7,A13,T29,F5.0,T39,F5.1,T51,F6.4,
* T63,F5.1,T76,F5.1,T90,F8.1,T105,F8.1,
* T121,F8.1)
162 FORMAT('-', 'INVALID THICKNESSES ARE INDICATED BY ZEROS')

```

```

C
C
163 FORMAT('1',T50,'***** CORE AND SPUR DATA *****')
164 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T38,
* 'AVERAGE CORE DIAMETERS (IN.)',T70,'TOTAL CORE',T84,
* '% OF TOTAL',T98,'TOTAL SPUR',T112,'% OF TOTAL')
165 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T72,'VOLUME',T86,
* T85,'BLOCK',T100,'VOLUME',T114,'BLOCK')
166 FORMAT(T28,'BLOCKS',T39,'OPERATOR',T71,
* '(CU.FT.)',T84,'VOLUME',T99,'(CU.FT.)',
* T113,'VOLUME')
167 FORMAT(T41,'END',T50,'CENTER',T61,'END')
168 FORMAT('0',T8,A13,T29,F5.0,T40,F5.2,T51,F5.2,T60,F5.2,
* T72,F6.1,T86,F4.1,T99,F6.1,T114,F4.1)

C
C
169 FORMAT('1',T51,'***** ROUND-UP DATA *****')
170 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T38,
* 'TOTAL ROUND-UP',T55,'% OF TOTAL',T69,'TRASH-GATE',
* T83,'% OF TOTAL',T97,'CLIPPED',T108,'% OF TOTAL')
171 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T41,'VOLUME',T57,
* 'BLOCK',T70,'ROUND-UP',T85,'BLOCK',T97,'ROUND-UP',
* T109,'BLOCK')
172 FORMAT(T28,'BLOCKS',T40,'(CU.FT.)',T56,'VOLUME',T71,
* 'VOLUME',T98,'VOLUME',T109,'VOLUME')
173 FORMAT(T70,'(CU.FT.)',T97,'(CU.FT.)')
174 FORMAT('0',T8,A13,T29,F5.0,T40,F8.1,T57,F4.1,T70,F8.1,
* T85,F4.1,T97,F8.1,T110,F4.1)

C
C
175 FORMAT('1',T50,'***** VENEER VOLUME DATA *****')
176 FORMAT('-',T7,'MILL',T14,'DIAMETER',T26,'NUMBER',T36,
* 'TOTAL VENEER VOLUME',T58,'% OF TOTAL',T72,
* 'THEORETICAL VENEER VOLUME',T99,'% OF TOTAL',T113,
* 'CUBIC',T122,'VENEER')
177 FORMAT(T7,'CLASS',T16,'CLASS',T28,'OF',T40,'PRODUCED',
* T61,'BLOCK',T101,'BLOCK',T111,'RECOVERY',T121,'RECOVERY')
178 FORMAT(T26,'BLOCKS',T34,'(CU.FT.)',T44,'(SQ.FT.3/8 IN.)',
* T61,'VOLUME',T72,'(CU.FT.)',T83,'(SQ.FT.3/8 IN.)',
* T100,'VOLUME',T113,'RATIO',T122,'FACTOR')
179 FORMAT('0',T7,A13,T25,F5.0,T33,F8.1,T45,F12.1,T63,F4.1,
* T72,F8.1,T85,F12.1,T103,F4.1,T112,F5.3,T122,F5.3)

C
C
180 FORMAT('1',T50,'***** CLIPPING LOSS DATA *****')
181 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T40,
* 'TOTAL CLIPPING LOSS',T65,'% OF TOTAL',T79,
* 'TOTAL REJECT VOLUME',T104,'% OF TOTAL')
182 FORMAT(T7,'CLASS',T18,'CLASS',T30,'OF',T67,'BLOCK',
* T106,'BLOCK')
183 FORMAT(T28,'BLOCKS',T38,'(CU.FT.)',T49,'(SQ.FT.3/8 IN.)',
* T67,'VOLUME',T77,'(CU.FT.)',T88,'(SQ.FT.3/8 IN.)',
* T105,'VOLUME')
184 FORMAT('0',T7,A13,T29,F5.0,T38,F8.1,T51,F8.1,T67,F4.1,
* T77,F8.1,T90,F8.1,T106,F4.1)

C
C
185 FORMAT('1',T47,'***** CLIPPING LOSS DATA *****')
186 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T39,
* 'ACCURATELY CLIPPED',T63,'% OF TOTAL',T78,
* 'INACCURATELY CLIPPED',T104,'% OF TOTAL')
187 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T39,
* 'RECOVERABLE VENEER',T65,'BLOCK',T79,
* 'RECOVERABLE VENEER',T106,'BLOCK')
188 FORMAT(T28,'BLOCKS',T37,'(CU.FT.)',T47,'(SQ.FT.3/8 IN.)',
* T64,'VOLUME',T76,'(CU.FT.)',T87,'(SQ.FT.3/8 IN.)',
* T105,'VOLUME')
189 FORMAT('0',T7,A13,T29,F5.0,T37,F8.1,T50,F8.1,T65,F4.1,
* T76,F8.1,T90,F8.1,T106,F4.1)

C
C
190 FORMAT('1',T48,'***** FULL SHEET SIZE AND VOLUME DATA *****')
191 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T38,
* 'INDIVIDUAL FULL SHEET AREA',T72,'TOTAL SHEET VOLUME',
* T97,'% OF TOTAL')
192 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T41,'(ACTUAL THICKNESS)',
* T99,'BLOCK')
193 FORMAT(T28,'BLOCKS',T39,'AVERAGE',T55,'STANDARD',T68,
* '(CU.FT.)',T80,'(SQ.FT.3/8 IN.)',T98,'VOLUME')

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194 FORMAT(T55,'DEVIATION')
195 FORMAT('O',T7,A13,T29,F5.0,T39,F7.3,T54,F7.3,T68,F8.1,
*      T83,F8.1,T99,F4.1)
C
C
196 FORMAT('1',T44,'***** HALF SHEET SIZE AND VOLUME DATA *****')
197 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',
*      T38,'INDIVIDUAL HALF SHEET AREA',T72,
*      'TOTAL SHEET VOLUME',T96,'% OF TOTAL')
198 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T43,'(ACTUAL THICKNESS)',
*      T99,'BLOCK')
199 FORMAT(T28,'BLOCKS',T39,'AVERAGE',T55,'STANDARD',T67,
*      '(CU.FT.)',T80,'(SQ.FT.3/8 IN.)',T98,'VOLUME')
200 FORMAT(T55,'DEVIATION')
201 FORMAT('O',T7,A13,T29,F5.0,T39,F7.3,T55,F7.3,T67,F8.1,
*      T82,F8.1,T98,F4.1)
C
C
202 FORMAT('1',T49,'***** RANDOM STRIP DATA *****')
203 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T42,
*      'TOTAL RANDOM STRIP',T67,'% OF TOTAL')
204 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T48,'VOLUME',
*      T69,'BLOCK')
205 FORMAT(T28,'BLOCKS',T39,'(CU.FT.)',T50,'(SQ.FT.3/8 IN.)',
*      T69,'VOLUME')
206 FORMAT('O',T7,A13,T29,F5.0,T38,F8.1,T53,F8.1,T70,F4.1)
C
C
207 FORMAT('1',T50,'***** FISH-TAIL DATA *****')
208 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T41,
*      'TOTAL UNTRIMMED F/T',T67,'% OF TOTAL',T84,
*      'TOTAL TRIMMED F/T',T107,'% OF TOTAL')
209 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T46,'VOLUME',T69,
*      'BLOCK',T88,'VOLUME',T109,'BLOCK')
210 FORMAT(T28,'BLOCKS',T39,'(CU.FT.)',T51,'(SQ.FT.3/8 IN.)',
*      T69,'VOLUME',T81,'(CU.FT.)',T92,'(SQ.FT.3/8 IN.)',
*      T109,'VOLUME')
211 FORMAT('O',T7,A13,T29,F5.0,T37,F9.1,T52,F9.1,T70,
*      F4.1,T79,F9.1,T94,F9.1,T110,F4.1)
C
C
212 FORMAT('1',T42,'***** DATA ON A % MERCHANTABLE BASIS *****')
213 FORMAT('-',T7,'MILL',T16,'DIAMETER',T28,'NUMBER',T38,
*      'FULLS',T47,'HALVES',T57,'RANDOMS',T68,'TRIMMED')
214 FORMAT(T7,'CLASS',T17,'CLASS',T30,'OF',T67,'FISH-TAILS')
215 FORMAT(T28,'BLOCKS')
216 FORMAT('O',T7,A13,T29,F5.0,T38,F5.1,T47,F5.1,
*      T58,F5.1,T68,F5.1)
END
C
C
*****
***** SUBROUTINES *****
*****
C
C
THIS SHORT ROUTINE REINITIALIZES ALL VARIABLES
FOR THE SUMMATION BY VENEER CODE ROUTINE.
C
C
SUBROUTINE ZEROA
COMMON/FIRST/A(15)
DO 1 I=1,15
  A(I) = 0.0
1 CONTINUE
RETURN
END
C
C
THIS ROUTINE REINITIALIZES ALL SUMMING VARIABLES
IN THE SPLIT-PLOT CLASSIFICATION PROCEDURE.
C
C
SUBROUTINE ZEROB
DIMENSION TBLOCK(5,4,30,28)
COMMON/SECOND/TBLOCK,B(85)
DO 1 I=1,85
  B(I) = 0.0
1 CONTINUE
RETURN
END

```

THIS SUMMATION ROUTINE TOTALS ALL NECESSARY VARIABLES
FOR EACH FACTOR CLASSIFICATION.

SUBROUTINE SUM (J,K,L)
DIMENSION TBLOCK(5,4,30,28)
COMMON/SECOND/ TBLOCK,BLKS,STHK,SBLEN,SDMAJ,SDMIN,SSCBVG,SSCBVN,

1 SCOR1,SCOR3,SCOR5,SCORVO,SSPRVO,STHVOL,SFULLT,SFULLS,
2 SFULLK,SHALFT,SHALFS,SHALFK,SRANT, SUTFTT,STFTT,SREJT,
3 SACRT,SABCVO,SCORVP,SSPRVOP,SIACRT,SCLPRU,
4 BLENV,DMAJAV,DMINAV,COR1AV,COR3AV,COR5AV,
5 TOVOLA,TOVOLB,TOVOLP,THVOLA,THVOLB,THVOLP,CRR,
6 VRF,CLLOSA,CLLOSB,CLLOSP,ACRTA,ACRTB,ACRTP,REJA,REJB,
7 REJP,IACRTA,IACRTB,IACRTP,FULLAV,FULLSD,FULLA,FULLB,
8 FULLP,HALFAV,HALFSD,HALFA,HALFB,HALFP, RANA,
9 RANB,RANP,UTFTA,UTFTB,UTFTP,
A TFTA,TFTB,TFTP,TGRUP,TGRUPP,CLRUPP,RUPVOL,RUVOLP,
B FULLM,HALFM,RANM,TFTM,SFULLC,SHALFC

BLKS = BLKS+1
SBLEN = SBLEN+TBLOCK(J,K,L,1)
STHK = STHK+TBLOCK(J,K,L,2)
SDMAJ = SDMAJ+TBLOCK(J,K,L,3)
SDMIN = SDMIN+TBLOCK(J,K,L,4)
SABCVO = SABCVO+TBLOCK(J,K,L,5)
SSCBVG = SSCBVG+TBLOCK(J,K,L,6)
SSCBVN = SSCBVN+TBLOCK(J,K,L,7)
SCOR1 = SCOR1+TBLOCK(J,K,L,8)
SCOR3 = SCOR3+TBLOCK(J,K,L,9)
SCOR5 = SCOR5+TBLOCK(J,K,L,10)
SCORVO = SCORVO+TBLOCK(J,K,L,11)
SSPRVO = SSPRVO+TBLOCK(J,K,L,12)
STHVOL = STHVOL+TBLOCK(J,K,L,13)
SFULLT = SFULLT+TBLOCK(J,K,L,14)
SFULLS = SFULLS+TBLOCK(J,K,L,15)
SFULLK = SFULLK+TBLOCK(J,K,L,16)
SHALFT = SHALFT+TBLOCK(J,K,L,17)
SHALFS = SHALFS+TBLOCK(J,K,L,18)
SHALFK = SHALFK+TBLOCK(J,K,L,19)
SRANT = SRANT+TBLOCK(J,K,L,20)
SUTFTT = SUTFTT+TBLOCK(J,K,L,21)
STFTT = STFTT+TBLOCK(J,K,L,22)
SREJT = SREJT+TBLOCK(J,K,L,23)
SACRT = SACRT+TBLOCK(J,K,L,24)
SIACRT = SIACRT+TBLOCK(J,K,L,25)
SCLPRU = SCLPRU+TBLOCK(J,K,L,26)
SFULLC = SFULLC + TBLOCK(J,K,L,27)
SHALFC = SHALFC + TBLOCK(J,K,L,28)
RETURN
END

THIS ROUTINE TAKES ALL ACCUMULATED VALUES FOR A
PARTICULAR FACTOR CLASSIFICATION AND CALCULATES
AVERAGES, STANDARD DEVIATIONS, CUBIC VOLUMES,
BOARD FEET VOLUMES, AND PERCENTAGE VOLUMES FOR
FULL AND HALF SHEET CATEGORIES. FOR THE REMAINING
SEVEN VENEER CATEGORIES, ONLY AREAS AND PERCENT
VOLUMES ARE CALCULATED. THESE CALCULATED VALUES
ARE THEN STORED IN A TEMPORARY ARRAY CALLED
'TEMP' TO AWAIT FINAL OUTPUT.

SUBROUTINE CALC (I)
REAL IACRTA,IACRTB,IACRTP,MERCH
DIMENSION TBLOCK(5,4,30,28)
COMMON/FIRST/ FULLT,FULLS,FULLK,HALFT,HALFS,HALFK,RANT,
1 UTFTT,TFTT,REJT,ACRT,IACRT,CLPRUP
COMMON/SECOND/ TBLOCK,BLKS,STHK,SBLEN,SDMAJ,SDMIN,SSCBVG,SSCBVN,
1 SCOR1,SCOR3,SCOR5,SCORVO,SSPRVO,STHVOL,SFULLT,SFULLS,
2 SFULLK,SHALFT,SHALFS,SHALFK,SRANT, SUTFTT,STFTT,SREJT,
3 SACRT,SABCVO,SCORVP,SSPRVOP,SIACRT,SCLPRU,
4 BLENV,DMAJAV,DMINAV,COR1AV,COR3AV,COR5AV,
5 TOVOLA,TOVOLB,TOVOLP,THVOLA,THVOLB,THVOLP,CRR,
6 VRF,CLLOSA,CLLOSB,CLLOSP,ACRTA,ACRTB,ACRTP,REJA,REJB,
7 REJP,IACRTA,IACRTB,IACRTP,FULLAV,FULLSD,FULLA,FULLB,
8 FULLP,HALFAV,HALFSD,HALFA,HALFB,HALFP, RANA,
9 RANB,RANP,UTFTA,UTFTB,UTFTP,
A TFTA,TFTB,TFTP,TGRUP,TGRUPP,CLRUPP,RUPVOL,RUVOLP,
B FULLM,HALFM,RANM,TFTM,SFULLC,SHALFC
COMMON /THIRD/ TEMP(29,64)
BLENV = SBLEN/BLKS

DMAJAV = SDMAJ/BLKS
 DMINAV = SDMIN/BLKS
 COR1AV = SCOR1/BLKS
 COR3AV = SCOR3/BLKS
 COR5AV = SCOR5/BLKS
 SCORVP = SCORVO/SABCVO*100.0
 SSPRVOP = SSPRVO/SABCVO*100.0
 TOVOLA = SFULLC+SHALFC+SRANT+STFTT
 TOVOLB = TOVOLA*32.
 TOVOLP = TOVOLA/SABCVO*100.0
 THVOLA = STHVOL
 THVOLB = THVOLA*32.
 THVOLP = THVOLA/SABCVO*100.0
 CRR = TOVOLA/SABCVO
 VRF = TOVOLB/SSCBVN
 CLLOSA = SREJT+SCLPRU
 CLLOSB = CLLOSA*32.
 CLLOSP = CLLOSA/SABCVO*100.0
 ACRTA = SACRT
 ACRTB = ACRTA*32.
 AC RTP = ACRTA/SABCVO*100.0
 REJA = SREJT
 REJB = REJA*32.
 REJP = REJA/SABCVO*100.0
 IACRTA = SIACRT
 IACRTB = IACRTA*32.
 IAC RTP = IACRTA/SABCVO*100.0
 FULLAV = SFULLT/SFULLK
 FULLSD = ((SFULLS-(SFULLT**2)/SFULLK)/(SFULLK-1.0))*0.5
 FULLA = SFULLC
 FULLB = FULLA*32.
 FULLP = FULLA/SABCVO*100.0
 HALFAV = SHALFT/SHALFK
 HALFSD = ((SHALFS-(SHALFT**2)/SHALFK)/(SHALFK-1.0))*0.5
 HALFA = SHALFC
 HALFB = HALFA*32.
 HALFP = HALFA/SABCVO*100.0
 RANA = SRANT
 RANB = RANA*32.
 RANP = RANA/SABCVO*100.0
 UTFTA = SUTFTT
 UTFTB = UTFTA*32.
 UTFTP = UTFTA/SABCVO*100.0
 TFTA = STFTT
 TFTB = TFTA*32.
 TFTP = TFTA/SABCVO*100.0
 TGRUP = SABCVO-(SSPRVO+SCORVO+SFULLC+SHALFC+SRANT+SUTFTT+SCLPRU+
 1SREJT)
 TGRUPP = TGRUP/SABCVO*100.0
 CLPRUP = SCLPRU
 CLRUPP = CLPRUP/SABCVO*100.0
 RUPVOL = TGRUP+CLPRUP
 RUVOLP = RUPVOL/SABCVO*100.0
 MERCH = FULLB+HALFB+RANB+TFTB
 FULLM = FULLB/MERCH*100.0
 HALFM = HALFB/MERCH*100.0
 RANM = RANB/MERCH*100.0
 TFTM = TFTB/MERCH*100.0
 TEMP(I,1) = BLKS
 TEMP(I,2) = BLENV
 TEMP(I,4) = DMAJAV
 TEMP(I,5) = DMINAV
 TEMP(I,6) = SSCBVG
 TEMP(I,7) = SSCBVN
 TEMP(I,8) = SABCVO
 TEMP(I,9) = COR1AV
 TEMP(I,10) = COR3AV
 TEMP(I,11) = COR5AV
 TEMP(I,12) = SCORVO
 TEMP(I,13) = SCORVP
 TEMP(I,14) = SSPRVO
 TEMP(I,15) = SSPRVOP
 TEMP(I,16) = RUPVOL
 TEMP(I,17) = RUVOLP
 TEMP(I,18) = TGRUP
 TEMP(I,19) = TGRUPP
 TEMP(I,20) = CLPRUP
 TEMP(I,21) = CLRUPP
 TEMP(I,22) = TOVOLA

```
TEMP(I,23) = TOVOLB
TEMP(I,24) = TOVOLP
TEMP(I,25) = THVOLA
TEMP(I,26) = THVOLB
TEMP(I,27) = THVOLP
TEMP(I,28) = CRR
TEMP(I,29) = VRF
TEMP(I,30) = CLLOSA
TEMP(I,31) = CLLOSB
TEMP(I,32) = CLLOSP
TEMP(I,33) = REJA
TEMP(I,34) = REJB
TEMP(I,35) = REJP
TEMP(I,36) = IACRTA
TEMP(I,37) = IACRTB
TEMP(I,38) = IACRTP
TEMP(I,39) = ACRTA
TEMP(I,40) = ACRTB
TEMP(I,41) = ACRTP
TEMP(I,42) = FULLAV
TEMP(I,43) = FULLSD
TEMP(I,44) = FULLA
TEMP(I,45) = FULLB
TEMP(I,46) = FULLP
TEMP(I,47) = HALFAV
TEMP(I,48) = HALFSD
TEMP(I,49) = HALFA
TEMP(I,50) = HALFB
TEMP(I,51) = HALFP
TEMP(I,52) = RANA
TEMP(I,53) = RANB
TEMP(I,54) = RANP
TEMP(I,55) = UTFTA
TEMP(I,56) = UTFTB
TEMP(I,57) = UTFTP
TEMP(I,58) = TFTA
TEMP(I,59) = TFTB
TEMP(I,60) = TFTP
TEMP(I,61) = FULLM
TEMP(I,62) = HALFM
TEMP(I,63) = RANM
TEMP(I,64) = TFTM
RETURN
END
```

SHEFFIELD, THOMAS W., and JAMES W. FUNCK. 1985. CLPLOSS: ANALYZING GREEN-END VENEER RECOVERY AND LOSS. Forest Research Laboratory, Oregon State University, Corvallis. Research Bulletin 49. 31 p.

This paper is a detailed description of a method for calculating and analyzing losses and recoveries in a veneer peeling/clipping operation. The method involves filming veneer sheets as they exit the clipper, digitizing this film, and using the digitized information in a computer analysis.

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