HaLT: a computerized training program for hardwood lumber graders

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Abstract

A computer program for training both novice and experienced hardwood lumber graders in accordance with the National Hardwood Lumber Association (NHLA) rules is presented. It is anticipated that this program will help alleviate the problems of improper grading by improved and continued training and make lumber manufacturers and purchasers more knowledgeable of the rules. This additional knowledge should help to resolve disputes that can occur due to varied interpretation of the NHLA rules. The program will have practical value both in the areas of testing and training lumber graders.

Every year, millions of dollars are lost in the hardwood lumber industry because of the inaccurate grading of lumber. In some hardwood sawmills, the lumber is graded not once, but several times. Additionally, disputes arise between the manufacturer and the consumer concerning the grade of lumber and the National Hardwood Lumber Association (NHLA) may be called to arbitrate. There are several reasons these difficulties occur. One primary reason is that grading rules are complex and it is difficult for trainees to learn this skill. Many years of experience are required to meet the speed and accuracy requirements of today's mills.

Training in the area of lumber grading is not easy to obtain. Training is available in a 14-week course offered by the NHLA in Memphis, Tenn. Short courses (3 or 4 days) are also offered but these are generally insufficient to develop the speed and accuracy required for production conditions. The goal of this research report is to assist in the training of graders by the use of a Hardwood Lumber Training (HaLT) computer program developed at Louisiana State University in cooperation with others. The program allows novice or inexperienced graders to obtain much needed practice so that the decisions these graders make will be proper and accurate.

It is the intent of this program to fill the void in the training of lumber graders. The HaLT computer program differs in a number of respects from those currently under development elsewhere and will act as an expert system to guide the user throughout the training session. The program will be economical, requiring only an IBM compatible computer with Enhanced Graphics Adapter (EGA).
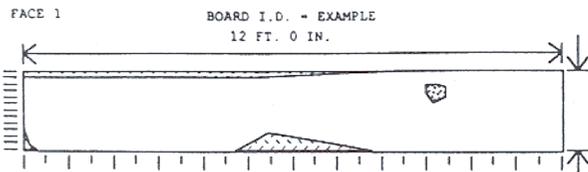
Program features

The HaLT program has several unique and important features:

1. The HaLT program has full high-resolution color graphics that allow the user to examine each board and easily see defects because different colors can be used for each defect type.

2. The HaLT program provides a normal view of the entire board; however, because most lumber is up to 16 times as long as it is wide, it is not possible to fit a scaled version of the entire board on a computer screen and still show sufficient detail. This program provides an expanded view of the board if the user wishes. The expanded view shows a 4-foot section of the board at one time. The user can scan from one end of the board to the other using this expanded view in order to get a more detailed view of the board.

Figure 1. — Introductory view of the board.
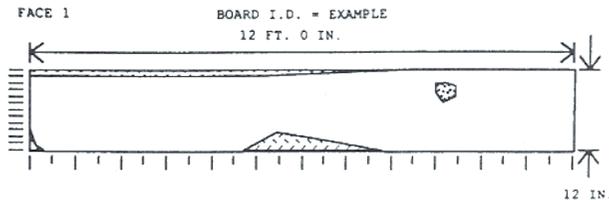
Figure 2. — Menu selection options.

3. On-screen rulers are provided so that users can easily measure defect sizes, cutting sizes, etc. These rulers are available in both the normal view of the board and in the expanded view.

4. This program incorporates the grading program developed by Klinkhachorn et al.[1], which asks users to provide only a minimal amount of information about each board to the program. This means that the operator need only specify board size and information about each defect. The defect information required is the coordinates of each defect, the type of defect, and the face on which each defect occurs. The user does not have to predetermine the grade of each board as the program will do this automatically.

5. Another valuable feature of HaLT is that both faces of each board can be shown and are considered in the grading process. This is a great advance over training programs written previously. Grading both sides of a board is an absolute requirement if the grading procedure is to be properly performed. In some grades, the board must be graded from the good face, and in other grades, the board must be graded from the poor face. This feature allows the user to make decisions about which face is which, so that the grading rules can be properly followed.

6. When the program asks the user questions about the board, if an incorrect answer is given, reasons explaining how the correct answer is derived are presented. For example, if the wrong surface measure is given, the program shows the user the correct surface measure and how it is calculated. Also, if an incorrect grade is given, the program provides the correct grade and demonstrates how the correct grade is determined. The program states which defect rules were violated, tells how many cutting units are required to meet the grade, and shows one example of how these units can be obtained.

7. The program allows species-dependent rules to be included in the grading of boards so that users can familiarize themselves with exceptions that occur within different species groups.

Program description

The HaLT program contains two parts. The first part consists of graphics routines and user interface subroutines. These routines provide all graphic views of the board, ask questions of the user, compare answers, provide reasons, etc. The second part of HaLT is the grading program previously mentioned. This part of the program grades the lumber and provides the correct information about each board. No database that describes the boards is required because the grade is computed from the grading rules.

The training procedure begins by showing the user a view of the entire board (Fig. 1). The defects on each side are shown one face at a time. Each defect is flashed for several seconds and the type of each defect is written on the screen. The user is then asked to calculate the surface measure of the board with the option of either examining the other face, examining an expanded view of the board, answering the question, or exiting the program (Fig. 2).

If the user chooses to examine the other face, the defects on the other face of the board are shown. If the user prefers to see an expanded view of the board, this view is shown at the bottom of the screen. Figure 3 shows the computer screen with the expanded view. The user may also scan back-and-forth along the length of the board or flip the board to obtain any additional information. When finished, the program returns the user to the original four options. If the user chooses to exit, the program is terminated. If the user chooses to answer

[1] Klinkhachorn, P., J.P. Franklin, C.W. McMillin, R.W. Conners, and H.A. Huber. 1988. Automated computer grading of hardwood lumber. Forest Prod. J. 38(3):67-69.
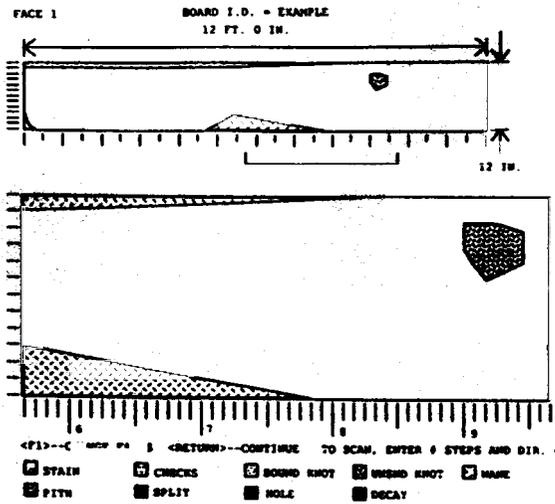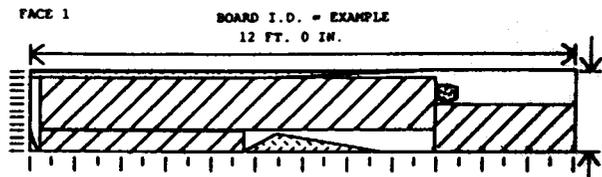
Figure 3. — Expanded view of the board.

Figure 4. — Example of cuttings suggested by the grading program.

the question, he is prompted for the answer. If the answer is correct, a message to that effect will appear. If the answer is incorrect, the correct answer will be given, as well as a demonstration as to how the correct answer was calculated.

The user is next asked for the correct grade. Possible choices for grades are FAS, Select, No. 1 Common, No. 2 Common, No. 3 Common, and Below Grade. Here again, the user is presented with the four original options. Everything occurs in the same fashion except that in this case, if the user incorrectly specifies the grade, a more complete explanation is given. For example, the computer will indicate if the board is too short to meet a particular grade or if a knot on the board is too large. Any rule violations, such as those which pertain to board size or defect size as defined in the *Rules for the Measurement and Inspection of Hardwood and Cypress Lumber*,[2] are explained at this point. After all such explanations, the program shows how many cutting units are required and how many cuttings are allowed for the particular grade. If these cuttings can be found, the program shows one possible example of the cuttings on the small version of the board. The user is then allowed to flip the board to see that none of these cuttings overlap any defects. Figure 4 shows the cuttings suggested by the grading program for the original board shown in Figure 1.

This process is repeated for each board in the file. Additional board files can be added without predetermining the grade of lumber, therefore, even novices can set up the boards since the program will automatically determine the grade.

Conclusion

A computer program has been developed to provide training for hardwood lumber graders. The program offers an alternative learning tool that can be used by the lumber industry to educate and train their graders on-site, at low expense, through an interactive computer expert system. The program is also a valuable tool for testing and maintaining the skill level of existing hardwood lumber graders. The program has been designed so that it provides information and instructions and can be easily operated by nontechnical users.

The software runs on IBM PC or compatible machines with a color monitor and Enhanced Graphic Adapter (EGA) card. Requests related to evaluation or use of the program for research and developmental purposes should be directed to C.W. McMillin, Southern Forest Experiment Station, 2500 Shreveport Highway, Pineville, LA 71360.

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[2] National Hardwood Lumber Association. 1986. Rules for the Measurement and Inspection of Hardwood and Cypress Lumber. Memphis, Tenn.