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Forest Development Research

P R O G R A M

**Manning Diversified Forest Products
Research Trust Fund
MDFP 17/95**

The Evaluator© Software Designed to
Evaluate Optimum Log Cutting Patterns

Alberta

ENVIRONMENTAL PROTECTION



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Research Trust Fund
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**The Evaluator© Software Designed to
Evaluate Optimum Log Cutting Patterns**

Final Report

June 1998

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**Pub. No. T/423
ISBN: 0-7785-0248-1**

- Disclaimer -

The study on which this report is based was funded by the Manning Diversified Forest Products Research Trust Fund (MDFP) which is a component of Alberta's Environmental Protection and Enhancement Fund (EPEF). The views, statements and conclusions expressed, and the recommendations made in this report are entirely those of the author(s) and should not be construed as the statements conclusions, or opinions of members of the Manning Diversified Forest Products Research Trust Fund or of the Government of Alberta and its EPE Fund.

ABSTRACT

The Evaluator program has been designed to assist a sawmill manager in making decisions on how to maximize output value and recovery from logs. The program identifies the optimum cutting patterns for a given log class and aids in dividing logs into classes for economical batch processing.

Different cutting programs are compared to maximize profitability by analyzing lumber market prices compared to the given log profiles. The program is also capable of evaluating new products for the sawmill, by comparing them to a standard log batch.

The Evaluator provides an efficient means of calculating the optimum cutting patterns for logs, speeds up the decision making process and reduces the risk of waste.

TABLE OF CONTENTS

Introduction	1
Log Conversion Method	1
Evaluation Process	1
Simulation Process	1
The Process of Evaluating a Log Class	2
Installation	3
About this Application.....	3
Program Flowchart	4
1. Starting Up	5
To Start the Evaluator	5
How to Create a New Program	5
2. Log Profile	6
To Input New Log Classes to the Profile	6
3. Product Profile.....	10
To Input New Products to the Profile.....	10
How to Use the Product Profile Library	11
How to Enter A New Product/Edit Using the Record Viewer	13
4. Evaluate Program.....	14
5. Program Result	15
6. Compare Programs	16
7. Detailed Board Result.....	17
Appendix A Glossary	18
Appendix B Diagrams.....	22
Appendix C Printed Reports	27
Index	27

LIST OF FIGURES AND TABLES

List of Diagrams (Appendix B)

Diagram 1: Stack Combination with 4 Centerboards

Diagram 2: A Stack with Sideboards Added

Diagram 3: Cutting Modes

Diagram 4: Number of Sideboards Produced During the Primary and Secondary Cut

Diagram 5: Example of Cutting Pattern with a High Cant Height and Narrow Width

Diagram 6: Cutting Pattern Enhanced by Using the Square Percentage Parameter

Diagram 7: Setting the Maximum Allowable Wane

Diagram 8: The Effects of Increasing the Wane Parameter

List of Reports (Appendix C)

Report 1: Program Result 28

Report 2: Compare Programs 29

Report 3: Board Result 30

Introduction

The Evaluator program enables a sawmill manager to make decisions about how to maximize recovery and value in specific log diameter classes or groups of log classes. The program identifies the optimum cutting patterns for a given log class or conversely the optimum log class for a given cutting pattern or target lumber sizes. The program also helps make decisions on how to divide logs into classes for batch processing

Log Conversion Method

The log conversion in the model is done according to the split taper method, parallel to the pith and equidistant from both sides of the log. This is the method used at Manning Diversified Forest Products Ltd. in Manning, Alberta. The cutting patterns suggested by the Evaluator will be both symmetrical and asymmetrical. It is possible, however, to force a solution which is either symmetrical or asymmetrical, if so desired.

Log conversion can be done with band saws or circular saws close coupled to a chipper canter. The log is positioned with the "horns down" on the infeed and two equal faces are opened on each side of the log. The wood fiber removed is in the form of chips and side cut lumber. The side cut lumber is then further processed on a board edger. The centre cant then proceeds to the second breakdown machine where it is turned 90 degrees and passed through a combination of chipper canters and a multisaw gang edger where centreboards and sideboards are produced.

Evaluation process

It is necessary to first establish:

- 1) Machine settings
- 2) Log profile to be used
- 3) Desired range of lumber products with prices and relevant wane considerations

The Evaluator then simulates a range of cutting pattern solutions for each log class. The Evaluator compares the various solutions in terms of value to determine the optimum cutting solution(s).

Simulation process

To determine the best cutting pattern based on value for a given log class, the simulation process uses all boards in the current program to build a number of possible cutting pattern solutions. Possible solutions are limited by the machine settings such as: maximum number of sideboards as primary cut, the thickness of the first board in stack, minimum stack width and cutting mode.

Other determining factors are the price and the allowable wane on the boards. The taper and length of the log are also determining factors for the simulation process.

The process of evaluating a log class

1) Adding Centerboards

The buildup of the stack combinations are limited by: the diameter, length and taper of the log, the centerboards available, the wane parameters of the centerboards, and the machine settings. Refer to Diagram 1: Stack Combination with 4 Centerboards.

Each centerboard added to the stack is evaluated starting with the longest possible board length first. If the board fails due to excessive wane, the next longest board length is evaluated, until a compatible board length is found. It is important to simulate the next board length if the first fails, since the log has a larger diameter closer to the end (due to the taper factor). In addition, the next board length might have different wane parameters associated with it, which affects the simulation. The only reason a board will fail (not be added to a stack) is if it is longer than the log length or has excessive wane.

2) Adding Sideboards

For each stack, the simulator tries to add sideboards. The adding of the sideboards to a stack is limited by the height and width of the stack, the diameter, length and taper of the log, the sideboards available, the wane parameters of the sideboards and the machine settings.

As with the centerboards, each sideboard is evaluated using the same algorithm. Refer to Diagram 2: A Stack with Sideboards Added.

The combinations of centerboards and sideboards calculated are stored in a temporary list.

3) Calculating the values of combinations

To calculate the value of each combination, the board values are summarized and added to the value of chips and sawdust.

Board value + Chip value + Sawdust value = Value of the combination

Finally, the combinations are sorted by value, highest value first.

Note: The cutting pattern solutions for a log class can be viewed in the *Evaluate Program* page by double clicking on the desired log class in the current log profile grid. The Prev. Pattern and Next Pattern buttons can be used to navigate up and down in the list of cutting pattern solutions.

Installation

The installation is a two step process.

Step 1:

The first step is to install the MS Access database engine ver. 3.5. If MS Access version 3.5 is already installed on your computer, move to Step 2. If you are unsure, then go to step 2, install the application and then try to run it. If it doesn't run properly (many error messages), then install the MS Access database engine.

The MS Access database engine consists of 5 disks. To install, insert MS Access Disk 1 (of 5). From the Windows Start Menu (Click on the "Start" button), choose "Run..." from the file menu. In the "Run" dialog box, type "a:\setup.exe" and click "OK." This will start the setup program, which will guide you through the setup process. Follow the instructions in the setup program.

Step 2 (Required):

This setup installs the Evaluator application and the associated database files. Insert Evaluator Disk 1 (of 2). From the Windows Start Menu, choose "Run..." from the file menu. In the "Run" dialog box, type "a:\setup.exe" and click "OK." This will start the setup program, which will guide you through the setup process. Follow the default instructions in the setup program to install properly. (Use the default settings. The program may not function properly if it is installed to a different directory).

Once the setup procedure is completed, the program is ready to run. Refer to the contents of this manual on how to run the application.

Requirements

Windows95 is required. This application does not work with previous versions of Windows, such as Windows 3.1, etc.

About this application

The application's main form consists of several tabbed pages with a drop-down list located at the top. The drop-down list consists of all programs stored in the database and is always visible on the main form for easy access no matter which tabbed page is opened. The program selected from the drop-down list is the program the application is currently working on; all log classes and products entered will be for this program. To select a program from the list, click on the drop-down button and the list will expand allowing you to select a program.

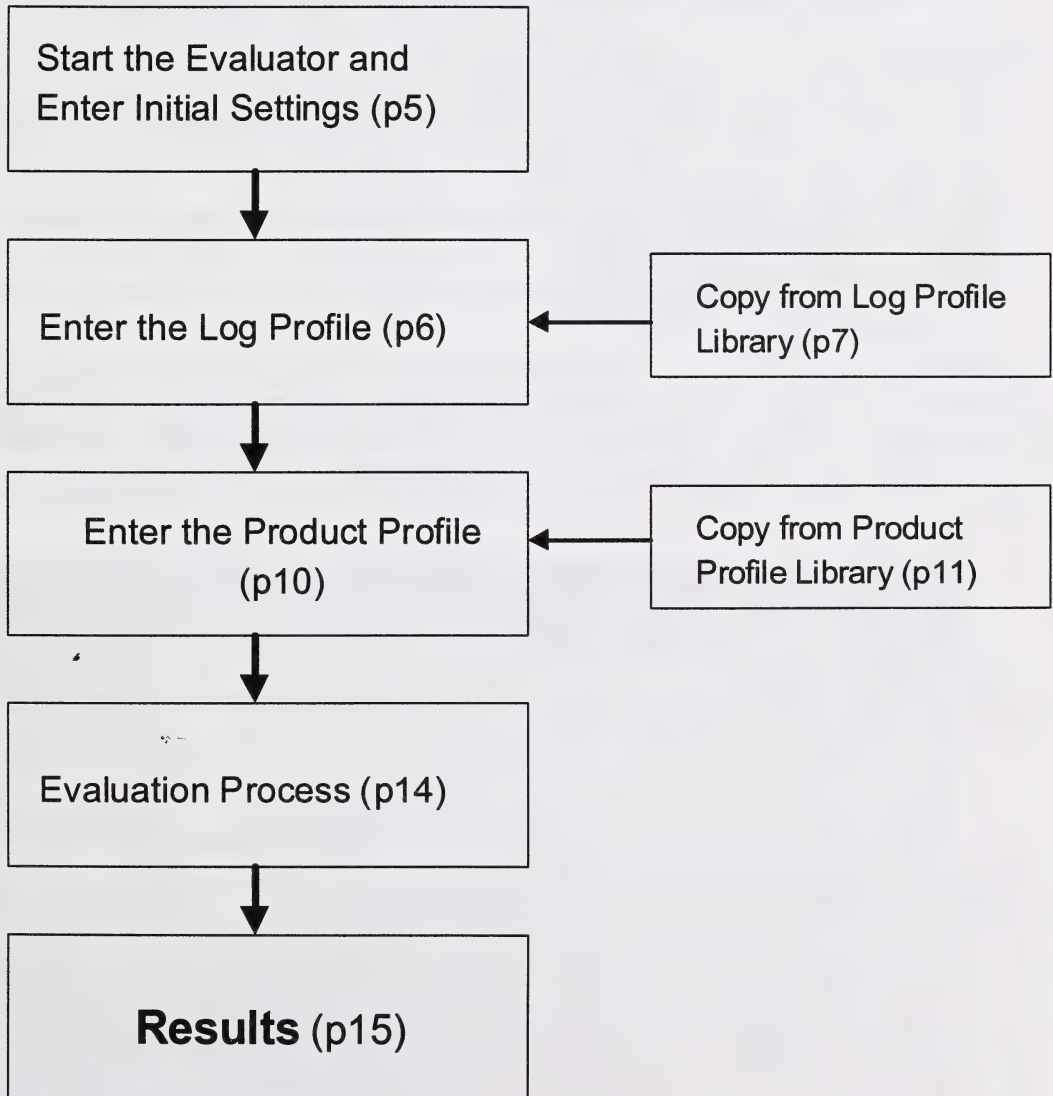
The tabs are located at the bottom of the application. When you click on a tab, the corresponding page is opened. Each page has a button bar at the bottom of the page for accessing various functions. The functions and number of buttons will vary from page to page. There are also a number of other forms that can be accessed, which will be explained in the following sections.

Development tools used

This application was developed using Delphi, a visual development toolkit from Borland. The database used by the application was created using Microsoft Access.

Program Flowchart

This flowchart gives an overview on how to use this program.



1. Starting up

To Start the Evaluator

1. From the desktop menu, select the Evaluator System icon.
2. The following Evaluator (main form) screen will come up.

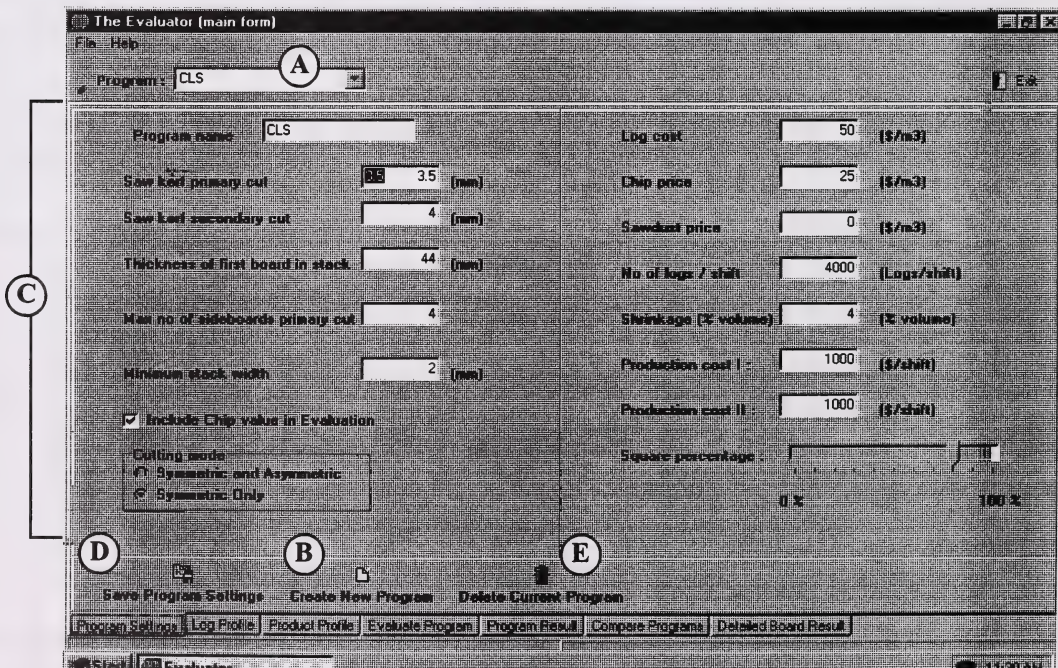


How to Create a New Program

3. From the **Program** box(A), select an existing program, or press the **New Program** button(B). A dialog box will come up where you can type in a new name for the program. Enter a name, and Click **OK**.
4. Enter the necessary information in section **C**. (Refer to Appendix A&B for the terms)
5. Click on **Save Settings**(D). This ensures the changes are present the next time the program is used.

Note

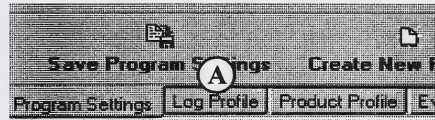
To delete a program: Click on **Delete Program**(E) to remove a program from the database. A confirmation dialog will come up in case the delete button was clicked accidentally. Click **Yes** to go ahead with the deletion.



2. Log Profile

This screen consists of a table and a graph. The table shows the log classes for the current program, and the graph shows the distribution of the number of logs and the volume per log class. The graph only shows the totals per diameter class, not length class. If there are two or more similar diameter classes but different lengths, the values are combined in the graph. The table sorts the log classes by diameter and length in ascending order. The log class is defined as a minimum and maximum diameter and a length, this combination is the unique key in the database for this information and therefore there cannot be two identical log classes in one program. The same log class, however, can be represented in a different program.

To open the Log profile screen, click on the **Log Profile** tab(A) at the bottom left corner of the screen.



To input new log classes to the profile

There are two options for inputting log classes to the profile:

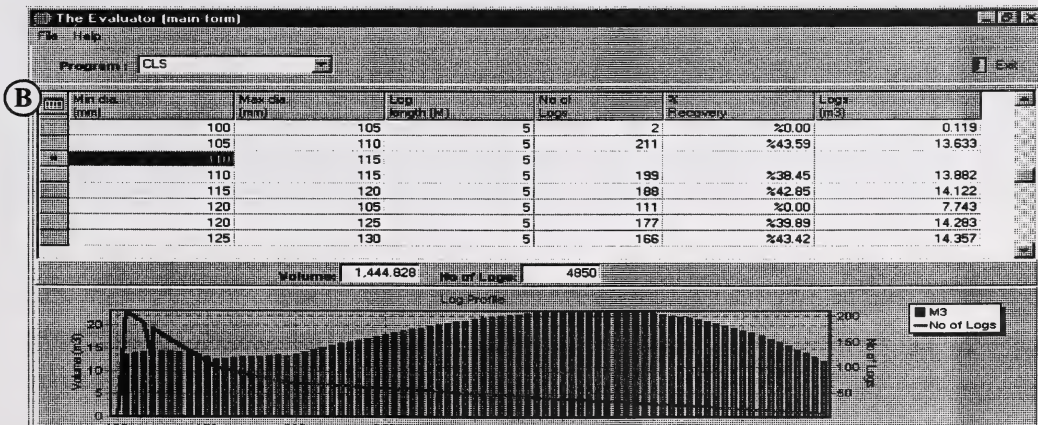
Method 1) Edit/make changes directly to existing profiles

Method 2) Generate a new profile or copy an existing profile from the log profile library

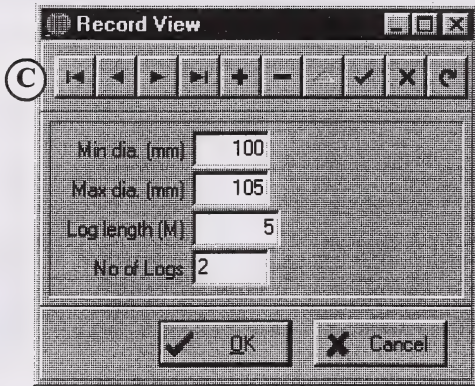
Method 1)

1. Changes can be made to existing profiles by directly typing in the new values. To cancel the change, press "Esc" on your keyboard (before you move to the next line or press "Enter" on your keyboard). To insert a new line, select a line and press the "Insert" button on your keyboard. The new line will be entered above the selected line (indicated by a *), with some values copied from the selected line. To cancel the insert, press "Esc" on your keyboard. To delete a line, press "Ctrl" and "Delete" (at the same time) on your keyboard.

2. You can also add or edit a log class by clicking on the table icon (B).



2. The record viewer window will come up, where log classes can be inserted, deleted or edited. To insert a new log class, click on the + button, then enter the minimum and maximum diameters, log length and number of logs. Click on the check mark button(✓) to save the entry.



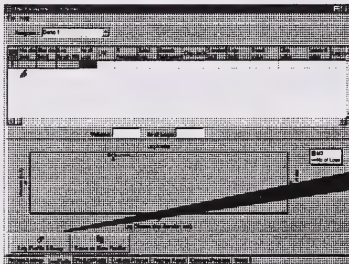
Note

The first four buttons are navigation buttons(C), to go to the first, previous, next or last log class. To cancel an entry (before clicking on Save), click on X.

Method 2)

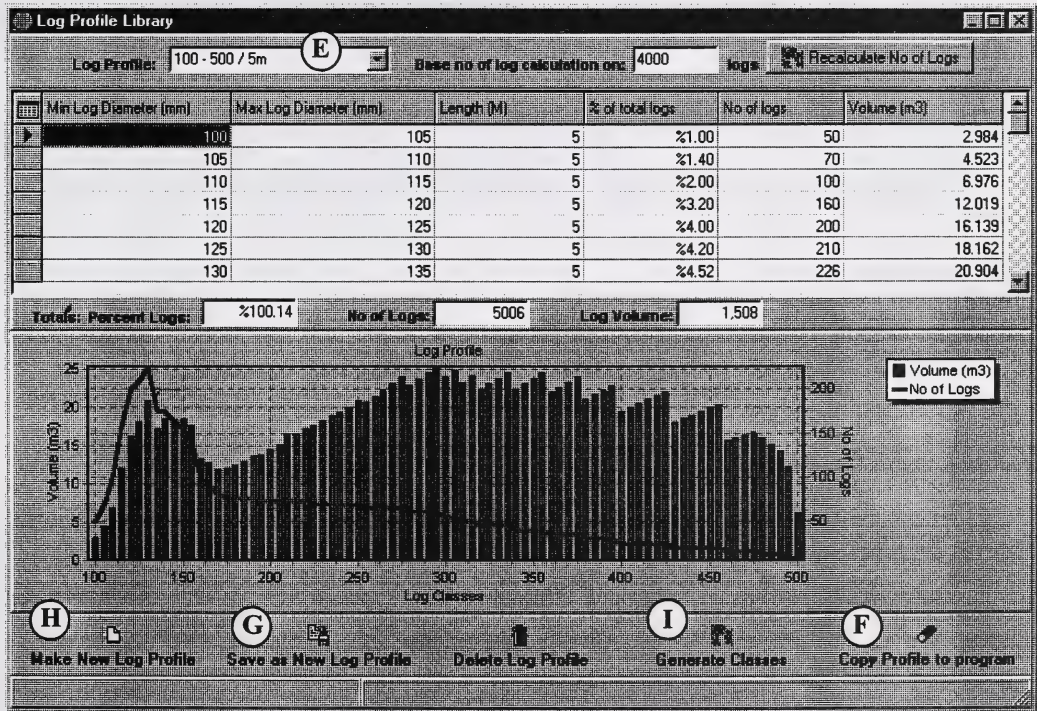
The advantage of this option is that you can reuse profiles made previously and thus minimise keyboard entry operations.

1. Click on **Open Log Profile Library(D)**.



The Log profile library form is of similar layout as the previous form. At the top there is a drop-down list where all stored log profiles are accessible. The table and graph show the log classes for the current profile.

2. If a profile has been previously created, select the log profile to use from the drop-down list(E) and then click on **Copy Profile to Program(F)**. This closes the library and copies the library's log classes into the current program's log profile. If log classes were already present in the current program's profile, they will be deleted.
3. If you want to make changes to a profile in the library and save it as a new profile, click on **Save as New Log Profile(G)**, enter a name for the profile, and press **OK**. Proceed to step 6.
4. If you don't find a profile close to yours, click on **Make New Log Profile(H)**, enter a name for the new profile, and press **OK**. Then, click on **Generate Classes(I)**.



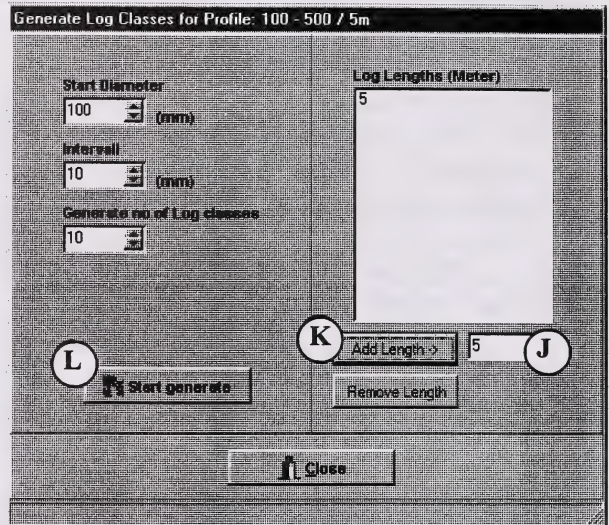
(Continues on next page)

5. The following screen will show up. Enter the **Start Diameter**(smallest diameter in the batch), the **interval** between classes, and the **number of log classes** to be generated.

Then, enter the length of the logs in box **J**, and press **Add length(K)**. Repeat if there is more than one length. Press **Start generate(L)**. **Close** when finished. You will return to the screen shown below.

Note: You can also remove a length from the list by highlighting a length on the list and clicking on **Remove length**.

6. Enter the percentage (number of logs in the class/total number of logs) of the logs in each class (**M**). Follow step 7 to edit any other item on the log profile.



Log Profile Library

Log Profile: 115 - 400 / 3.1m Base no of log calculation on: 5006 logs Recalculate No of Logs

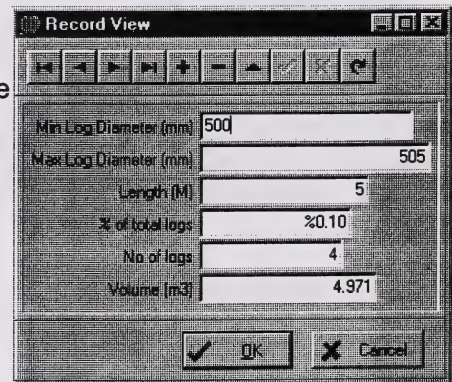
Min Log Diameter (mm)	Max Log Diameter (mm)	Length (M)	% of total logs	No of logs	Volume (m3)
115	125	3	%2.50	125	5.147
125	135	3	%4.00	200	9.540
135	145	3	%5.00	250	13.680
145	155	3			
145	155	3	%6.00	300	18.673
155	165	3	%7.00	350	24.598
165	175	3	%8.60	430	33.896

Totals: Percent Logs: %100 No of Logs: 5000 Log Volume: 569

7. Changes can be made directly by typing in the new values. To cancel the change, press “Esc” on your keyboard. To insert a new line, select a line and press the “Insert” button on your keyboard. The new line will be entered above the selected line indicated by a * (**N**). To cancel the insert, press “Esc” on your keyboard. To delete a line, press “Ctrl” and “Delete.”

8. You can also click on the table mark (**O**) to add/delete or edit a log class. Refer to the **Note** and **step 2** on page 7 for instructions

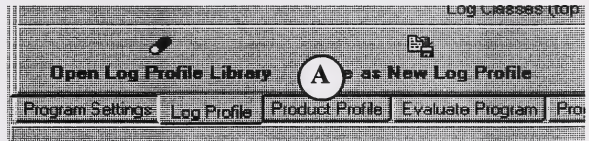
9. Click on **Copy Profile to Program(F**, previous page).



3. Product Profile

This page consists of a table listing the products for the current program. The products are sorted in order of whether they are a sideboard, the green thickness, width and metric length. Each product on the list is unique, which means there cannot be two products where the field's sideboard, green thickness and width and metric length are the same in a single program. The same product, however, can appear in a different program.

To open the Product profile screen, click on the **Product Profile** tab(A) at the bottom left corner of the screen.



To input new Products to the profile

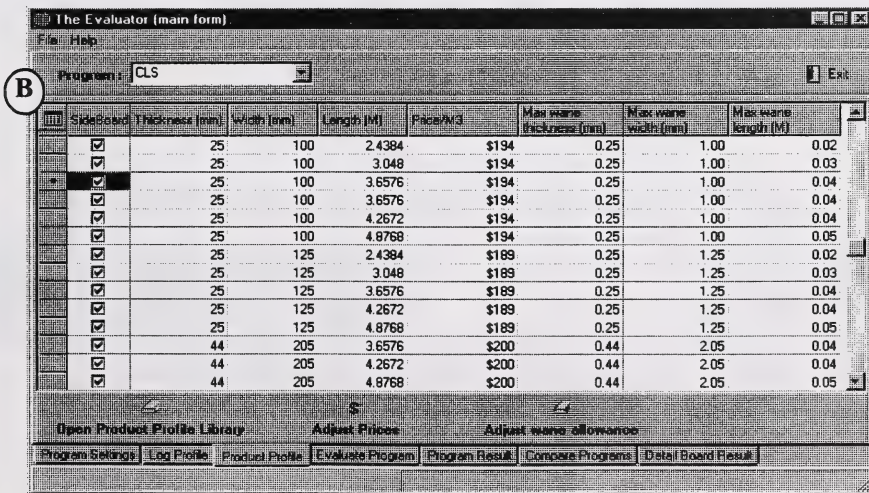
There are two options for inputting new products to the profile.

Method 1) Edit/make changes directly to existing profiles

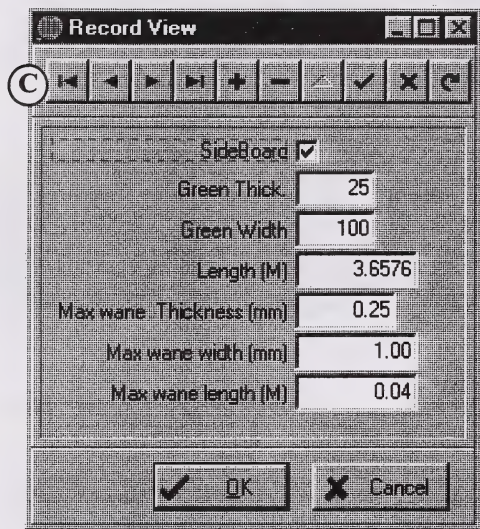
Method 2) Generate a new profile or copy an existing profile from the product profile library

Method 1)

- Changes can be made to existing profiles by directly typing in the new values. To cancel the change, press "Esc" on your keyboard. To insert a new line, select a line and press "Insert" on your keyboard. The new line will be entered above the selected line(indicated by a *). To cancel the insert, press "Esc" on your keyboard. To delete a line, press "Ctrl" and "Delete"(at the same time) on your keyboard.
- You can also add/delete or edit a product class by clicking on the table icon (B).



2. The record viewer window will come up. To insert a new log class, click on the + button, and enter the green thickness and width, length(in meters), nominal thickness and width, allowed wane on the thickness, width and length. Click on the check mark button(✓) to save the entry.



Note
 The first four buttons are navigation buttons(C), to go to the first, previous, next or last product. To cancel an entry (before clicking on Save), click on the X button.

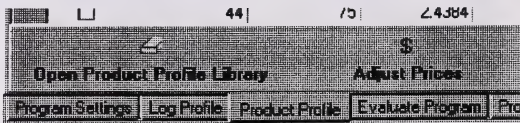
Method 2)

The advantage of this option is that you can reuse profiles made previously and thus minimise keyboard entry operations. The top table lists the products for the product profile selected. These products will get copied to the current program's profile when the **Use This Profile** button is clicked. The bottom form is a price calculation helper table (refer to p20 for details).

Background: When a product is produced in the sawmill, its value is unknown until it is dried, planed, trimmed and graded. The value after these processes is applied to the unfinished product to evaluate the logs. This value depends on what the price and grade recovery for each grade was / is for the finished product.

How to Use the Product Profile Library

1. Click on **Open Product Profile Library** (right). The Log product library form is of similar layout to the previous form. At the top there is a drop-down list where all stored product profiles are accessible.



2. Select the product profile from the drop-down list (D). If you don't need to make changes, click on **Copy Board Profile to Program (E)**. This closes the library and copies all boards into the current program's board profile. If there were products already present in the current program's profile, they will be deleted. (Go to Section 4, Evaluate Program)

3. The Price/m3 can be edited directly, or by using the helper below (F). The helper is designed to convert market prices (m3 or Mfbm) into the sawmill's Price/m3. To use this function, first highlight the product price you want to calculate from the top screen. Then, on the helper screen below, select the grade from drop-down list G, and enter the Thickness and Width in mm or inches. Note that if you enter mm, the market price is assumed to be Price/m3, and if entered in inches, the price is assumed to be Price/Mfbm Nom. Enter the % recovery for each grade in the **Recovery** column, and the market price in the **Price** column. Enter all the grades, and press **Update Price (H)**. Repeat for all the prices you want to calculate.

4. To adjust the wane parameters in the current profile for the sideboards and/or centre-boards, click on I, specify a percent wane allowance for thickness, width and length, and click on **Apply changes**.

5. If you want to make changes to a profile in the library and save it as a new profile, click on **Copy Board Profile to Program (E)**, enter a name for the profile, and press **OK**. You can also add, delete or edit a product by entering it directly (refer to p.9 Step 7 for instructions), or click on J and use the record viewer.

6. If you don't find a profile close to yours, click on **Create New Board Profile (K)**, enter a name for the new profile, and press **OK**. Click on J and use the form to add products.

(Continued on next page)

Product Profile Library

Product Profile: 44 mm (D)

Un-Finished Products

Sideboard	Green Thick(mm)	Green width(mm)	Length (M)	Price/m3 (green)	Max wane Thickness (mm)	Max wane width (mm)	Max wane Length (M)
<input checked="" type="checkbox"/>	25	100	2.4384	\$41	5	20	0
<input checked="" type="checkbox"/>	25	100	3.048	\$41	5	20	1
<input checked="" type="checkbox"/>	25	100	3.6576	\$41	5	20	1
<input checked="" type="checkbox"/>	25	100	4.2672	\$41	5	20	1
<input checked="" type="checkbox"/>	25	100	4.8768	\$172	5	20	1
<input checked="" type="checkbox"/>	25	123	2.4384	\$172	5	25	0
<input checked="" type="checkbox"/>	25	125	2.4384	\$167	5	25	0
<input checked="" type="checkbox"/>	25	125	3.048	\$167	5	25	1
<input checked="" type="checkbox"/>	25	125	3.6576	\$162	5	25	1
<input checked="" type="checkbox"/>	25	125	4.2672	\$162	5	25	1
<input checked="" type="checkbox"/>	25	125	4.8768	\$162	5	25	1
<input checked="" type="checkbox"/>	44	75	2.4384	\$180	9	15	0

Grade	Thickness	Width	Recovery	Price
J-Grade (G)	1	4	50	100
#3	1	4	25	100
Economy	1	4	25	100

Update Price (H)

Adjust Wane Allowance (I)

Create New Board Profile (K) Remove Current Board Profile Copy Board Profile to Program (E)

How to enter a new product/edit using the Record Viewer

(Refer to appendix A for terminology)

7. Click on the '+' button(L) to enter a new product.
8. If sideboards are being cut, check the sideboard field by clicking on it.
9. Enter the **green thickness** and **green width**.
10. Enter the **Metric length(m)**.
11. In the **Wane allowance** section, enter the **Max on thickness**, **Max on width** and **Max on Length**.
12. Click on the check mark button(M) to save this product.
13. Repeat steps 6 to 13 to enter more products. Click **OK(N)** to return to previous form.

The screenshot shows a 'Product Entry Form' window. At the top, there is a menu bar with buttons: First, Prev., Next, Last, New, Delete, Edit, Save, Cancel, and Refresh. Below the menu bar is a row of navigation buttons: a left arrow (circled O), a left arrow, a right arrow, a right arrow, a plus sign (circled L), a minus sign, a left arrow, a checkmark (circled M), an X (circled P), and a refresh symbol. The main area contains several input fields: a checked 'Sideboard' checkbox, 'Green thickness (mm)' (100), 'Green width (mm)' (100), 'Metric length (meter)' (4.8768), and 'Price / m3 (green)' (\$100). Below this is a 'Wane allowance' section with 'Max on thickness (mm)' (5), 'Max on width (mm)' (20), and 'Max on Length (meter)' (1). To the right of this section is a 'ReferenceNo' field with the value 180. At the bottom, there are two buttons: 'OK' with a checkmark (circled N) and 'Cancel' with an X.

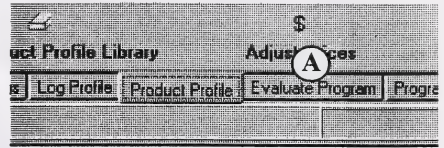
Note

The first four buttons are navigation buttons(O), to go to the first, previous, next or last product. To cancel an entry (before clicking on Save), click on the X button(P).

4. Evaluate Program

Once the program settings, log profile and product profile have been entered the program is ready to be evaluated.

To open the Evaluate Program screen, click on the Evaluate Program tab(A) at the bottom left corner of the screen.



1. To start the evaluation, click on the **Evaluate program(B)** button. The application will load up and start evaluating each log class. As the evaluation process progresses, the resulting sawing pattern is updated on the form for each log class.
2. When the evaluation process is completed, a dialog box comes up to notify you that the process is complete. Click the **OK** button to close the dialog.
3. You can now examine the resulting sawing pattern and other values for each log class. To do this, double click on a **log class(C)** in the table **Current log profile**. The optimum sawing pattern for this log class will be displayed in the log diagram (**D**) to the left.
4. In the **Sawing pattern details**, the size, length, price, volume and value for each board in the current log class is displayed. To the right is a **Total Log table(F)** that shows the total board, chip and sawdust volumes and values for a log in the selected log class.
5. It is also possible to examine the other sawing patterns that were evaluated for the log class. These patterns were rejected because they represented a lower value. To see the next best-ranked pattern, click on the **Next pattern** button(**G**). To go back click on the **Prev. pattern** button.

Current Log Profile

Min (in)	Max (in)	Log length (ft)	No of Logs	LFV	% Recovery	\$/mc3	Boards (in3 green)	Chips (in3)	\$/mc3
50	100	3	1	151.88	%31.94	\$29.40	1.87	3.78	
105	110	3	211	216.68	%43.59	\$50.77	5.94	7.41	
115	115	3	199	200.70	%40.37	\$45.18	5.60	8.02	
115	120	3	188	213.00	%42.85	\$49.55	6.05	7.82	
120	125	3	177	198.28	%41.70	\$46.56	5.96	8.02	
125	130	3	166	215.83	%44.26	\$51.05	6.35	7.42	
130	135	3	155	230.64	%46.40	\$53.72	6.65	7.41	

Sawing pattern details

#	Size	Length	Price	M3	Value
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
79	44.0x250.0	4.88	200.00	0.054	10.72
84	44.0x205.0	3.95	200.00	0.033	6.59
Total:					0.615 22.95

Total Log

	Vol. (m3)	Value
Board:	0.615	122.95
Chip:	0.518	12.90
Sawdust:	0.086	0.00
Total:	1.219	135.85

5. Program Result

This page displays a summary of the program result, as well as a graph that shows the dollar value per m3 and recovery per each log class (grouped by diameter only).

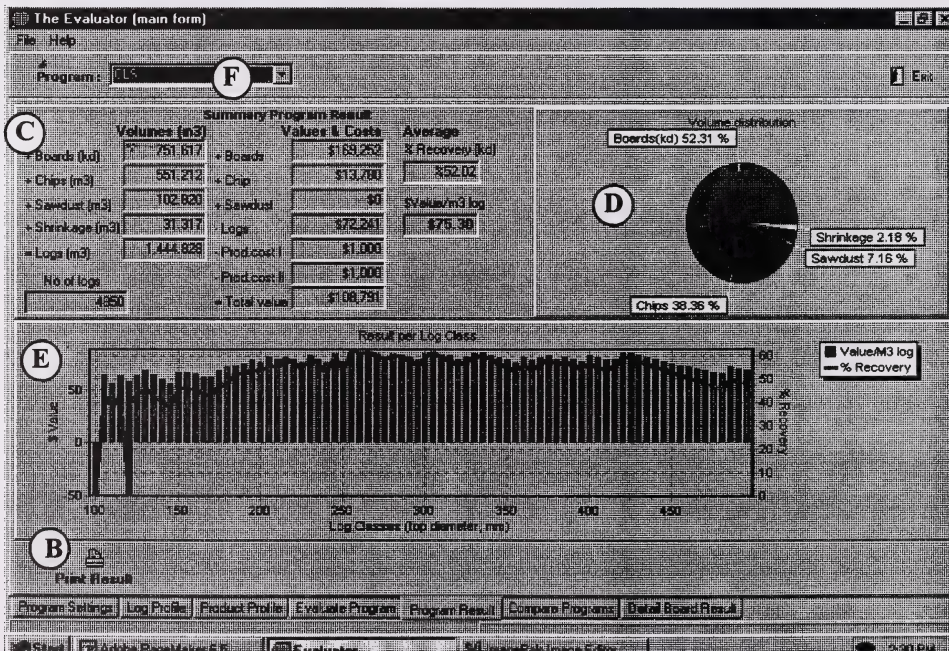
To open the Program Result screen, click on the **Program Result** tab(A) at the bottom left corner of the screen.



1. To print the results, click on the **Print Result(B)** button.

2. The summary of the program results are presented in section **C**. The pie chart(D) shows the distribution of the total board, chip and sawdust volume as well as the shrinkage for the logs in this program. The **Value per m3 of log**(bar graph) and the **% recovery**(line graph) is plotted for each log class on the Result per Log Class graph(E).

3. To view the program result for other programs (created previously), select the program from the **Program** drop-down menu(F).



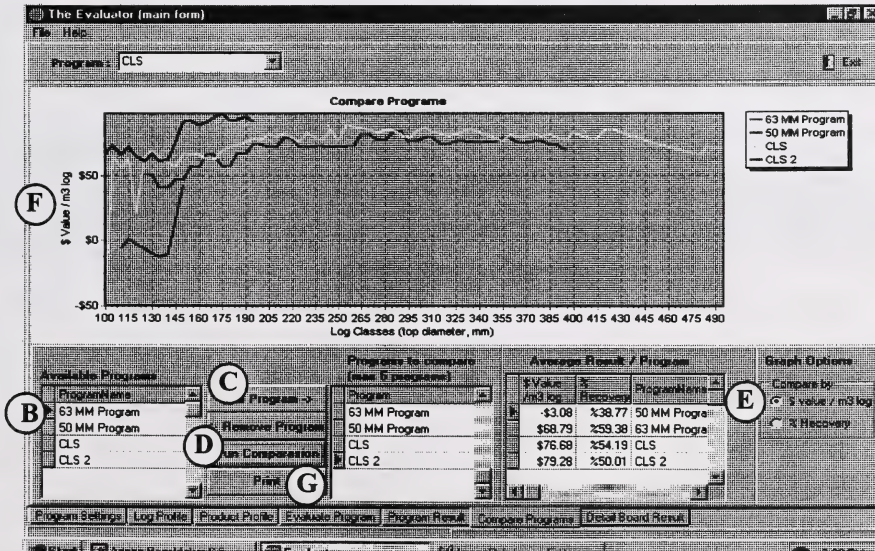
6. Compare Programs

This page is used for comparing different programs. A maximum of 5 programs can be compared at a time. The top graph shows each log class result. Below are 3 tables: The leftmost table shows all programs available for comparison, the middle table shows the programs being compared, and the right most table shows the average result for each program being compared.

To open the Program Result screen, click on the Program Result tab(A) at the bottom left corner of the screen.



1. To add a program to the compare table, select the program in the **Available Programs** table(B) and then click the **Add program->(C)** button. To remove a program, select the program and click the **<- Remove program** button.
2. Once the programs to be compared are added, click the **Run comparison** button(D). The result appears on the **Compare Programs** graph(top), with the value chosen for each log class (grouped by diameter only).
3. On the **Graph options** panel(E), select either **Dollar value / m³ log** or **% Recovery** (which is based on an actual volume) as the mode of comparison for the **Value(F)** in the graph. Click on **Print(G)** to print the graph.



7. Detailed Board Result

This page gives a detailed summary of the products (boards) yielded from the program evaluated.

To open the Detail Board Result screen, click on the **Detailed Board Result(A)** at the bottom left corner of the screen.



1. Select the program from the **Program** drop down list(B).
2. To print the Detail Board Result chart, click on **Print Result(G)**.

SideBoard	Thickness	Width	Length	Price/M3	Pieces	Volume (M3)	Value
<input checked="" type="checkbox"/>	25	100	2.4384	\$194	6	0.183	\$0
<input checked="" type="checkbox"/>	25	100	3.048	\$194	8	0.427	\$0
<input checked="" type="checkbox"/>	25	100	3.6576	\$194	6	0.274	\$0
<input checked="" type="checkbox"/>	25	100	4.2672	\$194	6	0.320	\$0
<input checked="" type="checkbox"/>	25	100	4.8768	\$194	28	9.217	\$0
<input checked="" type="checkbox"/>	25	125	3.048	\$189	2	0.019	\$0
<input checked="" type="checkbox"/>	25	125	3.6576	\$189	2	0.023	\$0
<input checked="" type="checkbox"/>	25	125	4.2672	\$189	10	1.200	\$0
<input checked="" type="checkbox"/>	25	125	4.8768	\$189	118	210.403	\$0
<input checked="" type="checkbox"/>	44	205	4.2672	\$200	6	1.155	\$0
<input checked="" type="checkbox"/>	44	205	4.8768	\$200	102	453.172	\$0
<input type="checkbox"/>	44	75	3.6576	\$200	2	0.024	\$0
<input type="checkbox"/>	44	75	4.2672	\$200	2	0.028	\$0
<input type="checkbox"/>	44	75	4.8768	\$200	2	0.032	\$0
<input type="checkbox"/>	44	100	3.048	\$200	2	0.027	\$0

Appendix A Glossary

(Diagrams in Appendix B)

Centreboards: These boards are extracted from the wane free square or rectangle of the log and are normally the same thickness and width.

Chip price: Approximate market value of the chips, entered as price(\$) per m³

Chip value: Total value of the chips produced by the log.

Cutting mode (Diagram 3): - In the *Symmetric and Asymmetric* mode, the log patterns are using a fixed thickness of the first board in the stack (see parameter 'Thickness of first board in stack') and the resulting log pattern can be either symmetric or asymmetric. The thickness of the first board must have a value in the product profile in order to use this mode. The *Symmetric only* mode always results in a symmetric cutting pattern.

Dollar Value (Price) per m3 log: The term 'Dollar Value per m3 log' is used to compare and evaluate different programs, as well as individual log classes. Since the raw material (logs) is of limited volume, the sawmill's goal is to extract as much value as possible from each log. The term 'Dollar Value per m3 log' shows this value per m3 unit.

Finished products: Products that have been graded, trimmed, and are ready to ship.

Log class: A minimum and maximum top diameter combined with a length makes up the log class definition.

Log Conversion: The process where the log is broken down into boards.

Log cost: Cost of the log (raw material cost), entered as price per m³

Log profile library: Log profiles can be stored and made in a library to make it easy to use the same profile in many programs. This is a convenience to avoid entering all log data for each new program; instead a profile can be brought in from the profile library.

Log profile: Each program has a range of logs in various diameters and lengths attached, this is referred to as the log profile. These are the logs used in the evaluation of the program.

Log volume calculation: Log volume is calculated according to the Alberta Forestry Scale method.

Minimum stack width: The minimum width a stack can be cut to by the machine. For example, if the secondary log processing is using a chipper canter, then this value corresponds to the smallest distance between the chipper canter heads. If no restriction applies then set this value to zero.

No. of sideboards primary cut (Diagram 4): The number of sideboards cut during the primary cut. This value depends on the machine setup. If the primary machine is a quad band saw coupled with a chipper canter, a maximum of four sideboards can be processed (if all bands are in use). If the primary machine is a chipper canter only then zero sideboards can be processed.

Nominal thickness and width: The North American standard for describing dimensional products is to use a nominal size instead of the actual. Consequently the volume calculated is also of a nominal unit usually expressed as “Mfbm nominal.” As the lumber recovery factor (LRF) is expressed as ‘number of fbm per m³ log,’ it does not represent an actual fiber recovery from the log. This is not a problem as long as the sawmill is only producing dimensional lumber but as other products are introduced in the production it becomes an uncertainty of which products are generating the best recovery. It is therefore always best to use the actual lumber volume produced to compare recoveries.

In reality, comparing recoveries does not tell us which product is the best to produce. You can only achieve this by comparing value, although it is true in most cases that good recovery equals good value. This application shows all results in m³, although it is possible to enter lumber prices in a Mfbm Nominal unit.

No. of logs/shift: The number of logs that can be processed during one shift

Percent board recovery: Percent board recovery is calculated as Board volume m³ / Log volume m³ x 100. It is pointed out in the programs if the recovery reflects a green board volume or a kiln dried board volume.

Price calculation helper table grid: Refer to following page.

Product profile library: Product profiles can be made and stored in a library to make it easy to use the same profile in many programs. This is more of a convenience to avoid entering all product data for each new program; instead a profile can be brought in from the profile library.

Product profile: Each program has a range of products in various sizes and lengths attached, this is referred to as the product profile. These are the products used in the evaluation of the program.

Program name: This field allows you to change the name of the program. To change the name, first type the new name and then press the save button.

Program: Refers to a specific set of logs, products and other unique settings evaluated in the application. Each program has a unique name for identification.

Price calculation helper table grid: This table grid is only used as an aid to calculate the price back to a m3 price for the green rough product produced in the mill from the market price and the grade out-turns. It also possible to enter a price direct to the un-finished product table grid.

Example:

A price for a green rough 44 x 100 needs to be calculated from the market back to the sawmill and the finished product is a 2 x 4 nominal size with a nominal price per MFBM. If the size entered is an imperial size the application assumes that the size is a nominal value and that the price entered is the nominal price per MFBM.

Three grades are extracted from the un-finished product during planing and sorting operations: 2 & Btr, #3 and Economy, with the following price and grade recoveries.

Grade	Thickness	Width	% Recovery	\$Price
2 & Btr	2	4	55	400
#3	2	4	30	250
Economy	2	4	10	100

First we need to establish the difference between the finished size and the un-finished size which we call the conversion factor.

In this case the factor is calculated as:

$$(44 \times 100) / ((2 \times 25.4) \times (4 \times 25.4)) = 85.2\%$$

The weighted price is calculated using the recovery and the price

$$(0.55 \times 400) + (0.3 \times 250) + (0.1 \times 100) = \$305 / \text{MFBM NOM}$$

Then, the price is converted from a per MFBM to a m3 nominal price using the constant 2.36 on a net count. ($2.36\text{m}^3 = 1000 \text{Fbm}$)

$$\$305 \text{ per MFBM NOM divided by } 2.36 = \$129 \text{ per m3 nominal}$$

Finally, to get the price into a net green count, it is converted using the original conversion factor.

$$\$129 \text{ per m3 nominal} \times 85.2\% = \$110 \text{ per m3 net green}$$

Saw kerf primary cut (Diagram 4): The thickness of the saw kerf in the primary process. It is 0 if no sideboards are being cut during the primary process.

Saw kerf secondary cut (Diagram 4): The thickness of the saw kerf in the secondary process.

Sawdust price: Approximate market value of the sawdust, entered as price per m³ (usually 0)

Shrinkage (% volume): How much the boards will shrink (in terms of volume) during the drying process. This is used to calculate the volume loss due to shrinkage.

Sideboards: The boards extracted from the outer parts of the log. These boards usually have more wane than centreboards.

Square percentage: This parameter may be used to avoid cutting patterns that are not practical to cut, e.g. patterns with a high cant height and narrow width (refer to **Diagram 5**). Although a certain cutting pattern may have the highest value, it may not be the most practical solution to cut in the mill. By using the square percentage parameter, it is possible to direct the simulation engine to try to make the cutting pattern more square (refer to **Diagram 6**) and therefore a more practical solution for the mill. If a resulting pattern contains a high cant height and narrow width, then increase the square percentage value a few steps and evaluate again.

Stack: The boards processed from a log in the secondary log conversion process.

Taper: To set the taper, open the taper table from the main menu under menu item File – Taper table. The evaluation process for each log is simulated deriving the taper factor from this table.

Thickness of first board in stack (Diagram 4): If the cutting mode is set to ‘Symmetric and Asymmetric’ it is assumed that the first board in the stack has fixed thickness. This thickness must correspond to a sideboard thickness in the product profile. If cutting mode ‘Symmetric only’ is used, then this parameter has no effect.

Un-Finished product: Products before grading and trimming.

Wane: Missing fibre on boards. Wane on the boards normally represents a lower value.

Wane parameter: The maximum allowable wane can be set in three directions on the boards: thickness, width and length (refer to **Diagram 7**).

By setting the wane parameter on a board it makes it possible for the simulator to allow for loss of wood on a board.

Increasing the wane allowance results in a larger lumber volume recovery, but many boards are usually of lesser value. The effect of increasing the wane parameters is illustrated in **Diagram 8**. A log with many sideboards still utilizes full-length sideboards if the allowable wane is within the limits.

Appendix B **Diagrams**

List of Diagrams

Diagram 1: Stack Combination with 4 Centerboards

Diagram 2: A Stack with Sideboards Added

Diagram 3: Cutting Modes

Diagram 4: Number of Sideboards Produced During the Primary and Secondary Cut

Diagram 5: Example of Cutting Pattern with a High Cant Height and Narrow Width

Diagram 6: Cutting Pattern Enhanced by Using the Square Percentage Parameter

Diagram 7: Setting the Maximum Allowable Wane

Diagram 8: The Effects of Increasing the Wane Parameter

Diagram 1
Stack Combination with 4 Centerboards

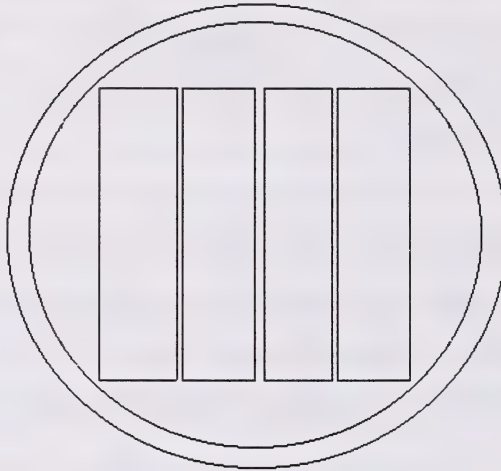


Diagram 2
A Stack with Sideboards Added

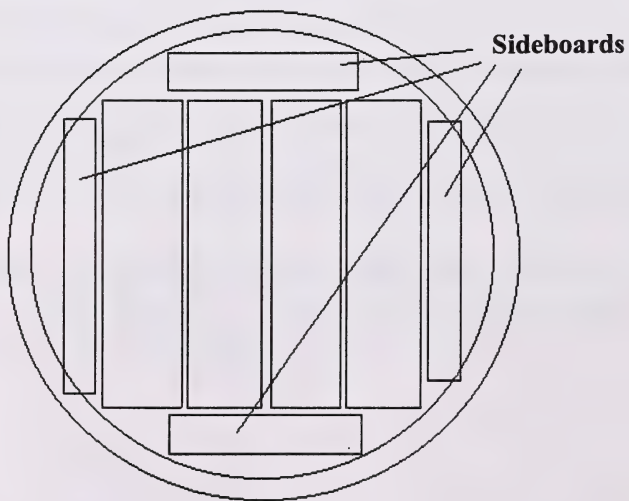
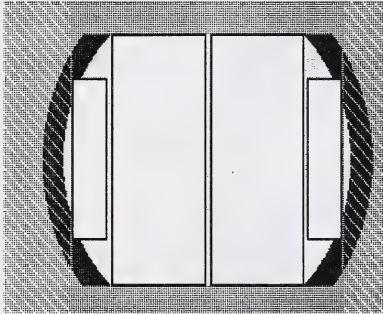


Diagram 3
Cutting Modes

Symmetric Cut



Asymmetric Cut

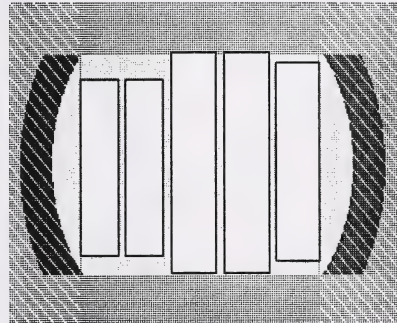
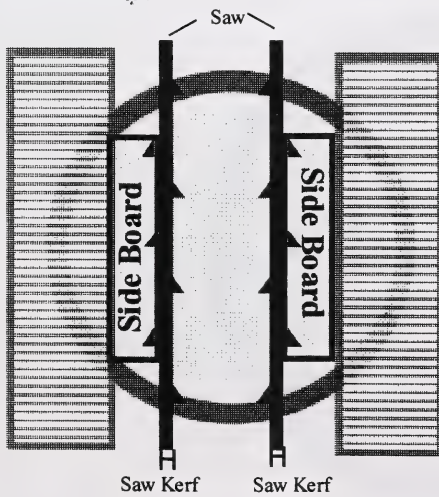


Diagram 4

Number of Sideboards Produced During the Primary and Secondary Cut

Primary Cut



Secondary Cut

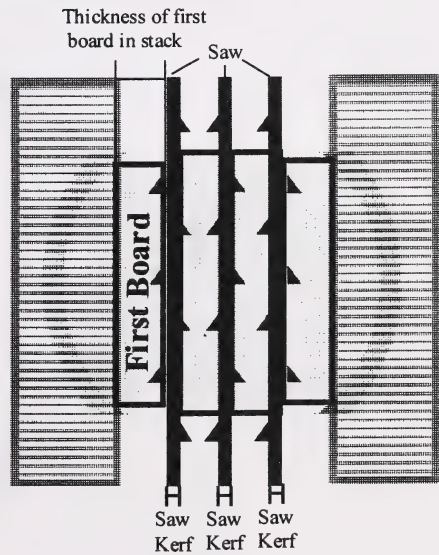


Diagram 5

Sample Cutting Patterns with a High Cant Height and Narrow Width

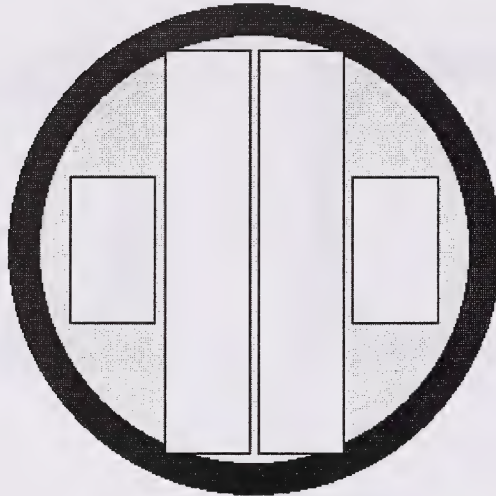


Diagram 6

Cutting Pattern Enhanced by Using the Square Percentage Parameter

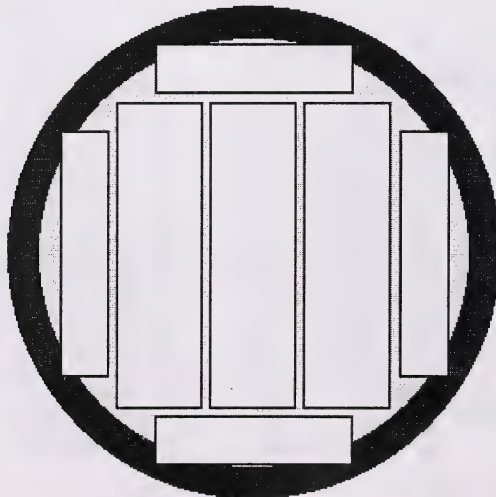


Diagram 7
Setting the Maximum Allowable Wane

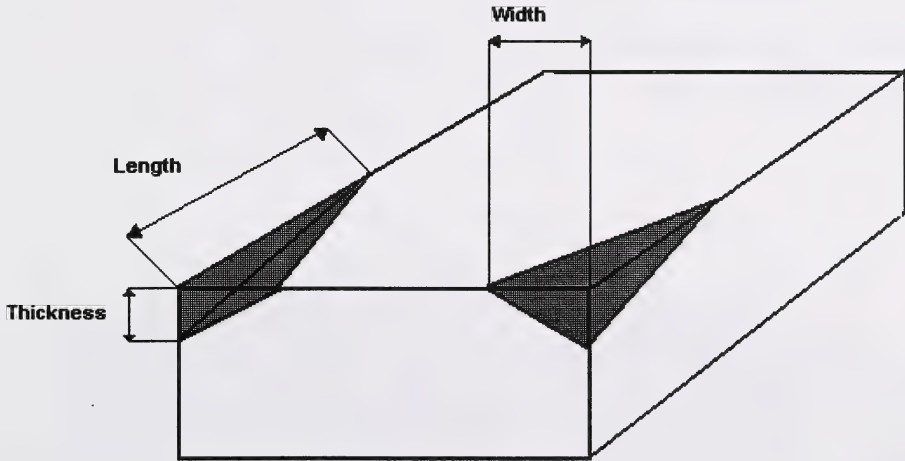
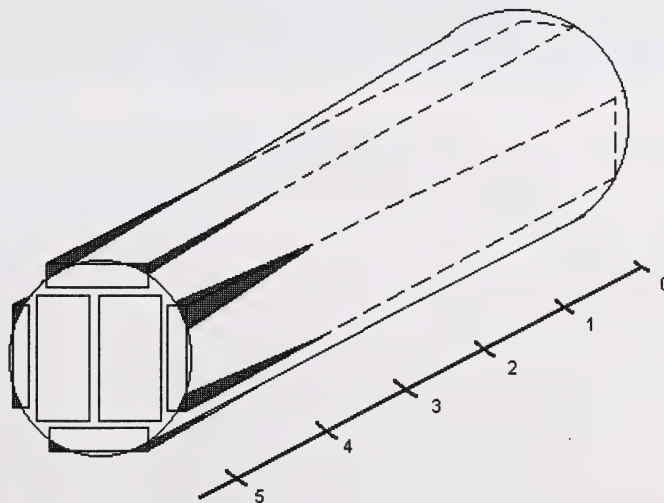


Diagram 8
The Effects of Increasing the Wane Parameter



Appendix C Printed Reports

List of Reports

Report 1: Program Result	28
Report 2: Compare Programs	29
Report 3: Board Result	30

Program Result

Program : CLS

Volumes, M3

Boards (kd) :	819.292
Chips :	410.679
Sawdust :	151.478
Shrinkage :	34.137
= Logs :	1,442.873

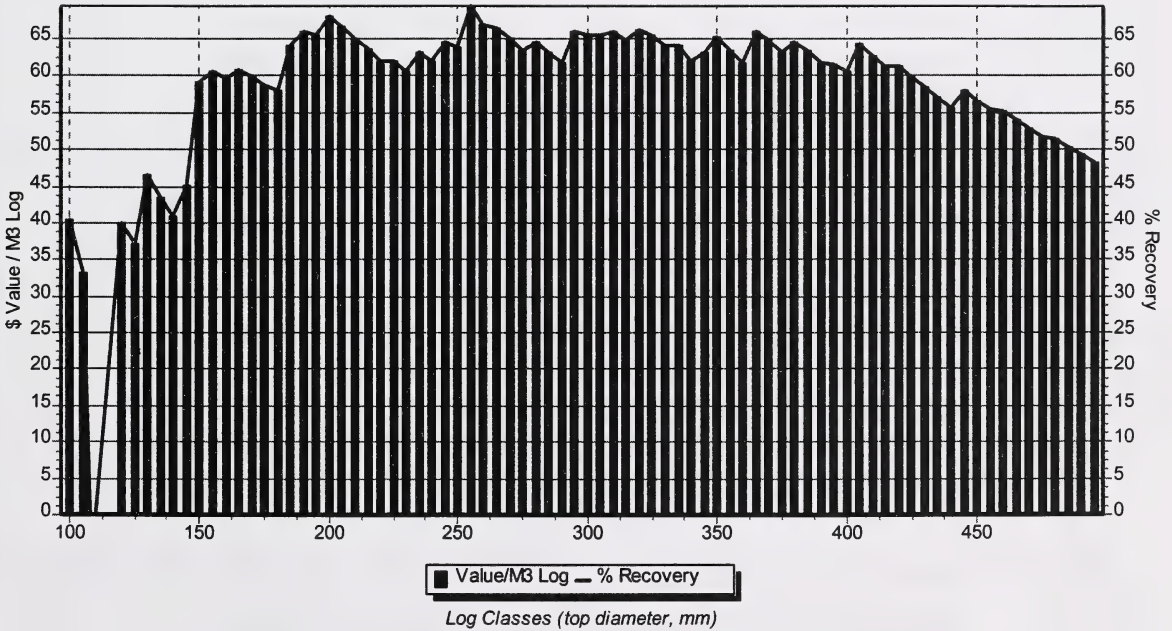
Values & Costs

+ Board value :	\$169,499
+ Chip value :	\$10,267
+ Sawdust value :	\$0
- Log Cost :	\$72,144
- Production cost I :	\$1,000
- Production cost II :	\$1,000
= Total Value :	\$105,623

Average

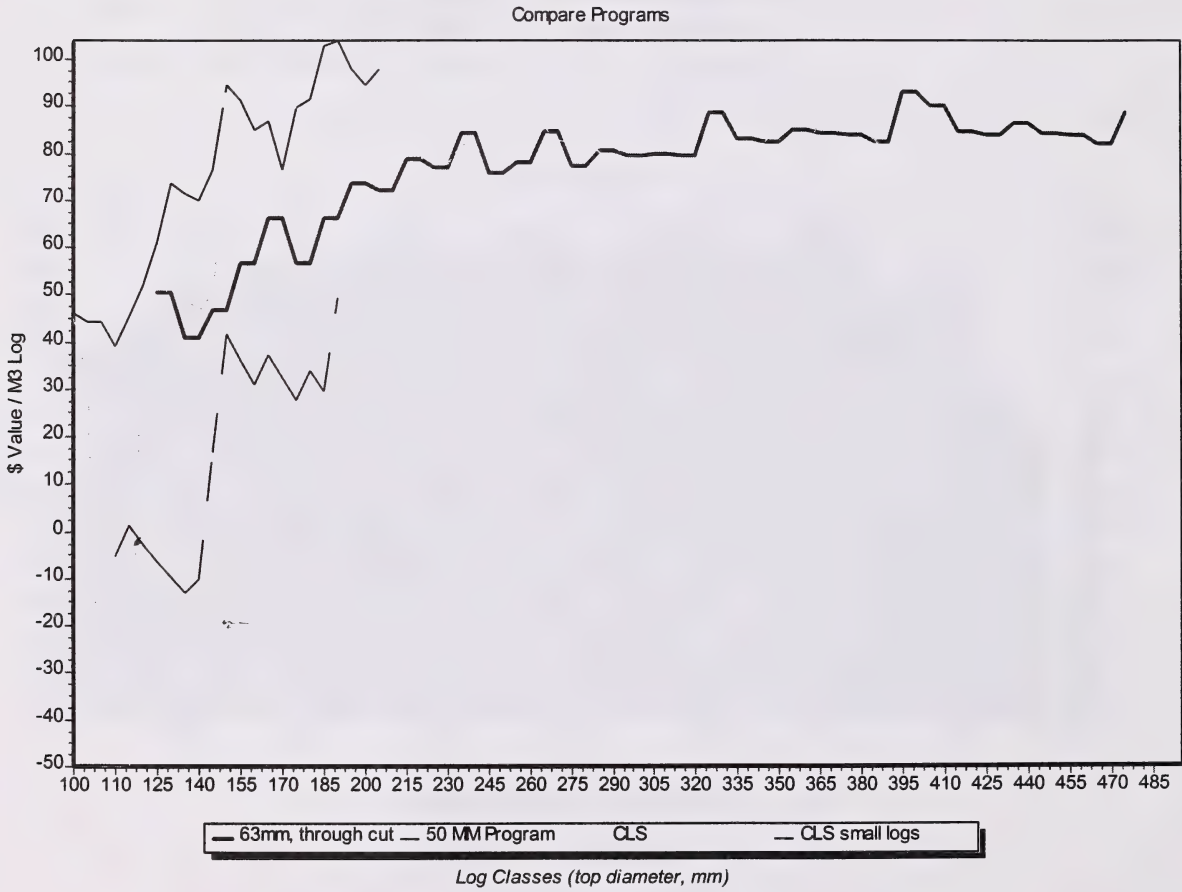
Board recovery :	%56.78
Value / M3 Log :	\$73.20

Result per Log Class



Compare Programs

Program	% Recovery	Value/M3 Log
50 MM Program	%42.28	\$5.28
63mm, through cut	%56.39	\$72.45
CLS	%59.15	\$74.59
CLS small logs	%52.08	\$75.44



Board Result

Program : CLS

Sideboard Thickness	Width	Length	Pieces	Price	Vol. (M3 green)	Value
X	25 x 100	2.44	1002	\$194	6.112	\$1,187
X	25 x 100	3	2018	\$194	15.135	\$2,940
X	25 x 100	3.65	2080	\$194	18.980	\$3,687
X	25 x 100	4.3	1294	\$194	13.910	\$2,702
X	25 x 100	4.88	962	\$194	11.736	\$2,280
X	25 x 125	2.44	90	\$189	0.686	\$130
X	25 x 125	3	406	\$189	3.806	\$719
X	25 x 125	3.65	926	\$189	10.562	\$1,995
X	25 x 125	4.3	1630	\$189	21.903	\$4,136
X	25 x 125	4.88	2318	\$189	35.349	\$6,675
X	44 x 205	3.65	726	\$200	23.902	\$4,780
X	44 x 205	4.3	942	\$200	36.536	\$7,307
X	44 x 205	4.88	1882	\$200	82.841	\$16,568
	44 x 75	3.65	222	\$200	2.674	\$535
	44 x 75	4.3	398	\$200	5.648	\$1,130
	44 x 75	4.88	974	\$200	15.685	\$3,137
	44 x 100	2.44	422	\$200	4.531	\$906
	44 x 100	3.65	332	\$200	5.332	\$1,066
	44 x 100	4.88	2006	\$200	43.073	\$8,615
	44 x 125	4.88	693	\$200	18.600	\$3,720
	44 x 155	4.3	140	\$200	4.106	\$821
	44 x 155	4.88	1075	\$200	35.778	\$7,156
	44 x 180	3	254	\$200	6.035	\$1,207
	44 x 180	3.65	246	\$200	7.111	\$1,422
	44 x 180	4.3	238	\$200	8.105	\$1,621
	44 x 180	4.88	1642	\$200	63.463	\$12,693
	44 x 205	4.3	198	\$200	7.680	\$1,536
	44 x 205	4.88	1885	\$200	82.973	\$16,595
	44 x 250	3.65	186	\$200	7.468	\$1,494
	44 x 250	4.3	90	\$200	4.257	\$851
	44 x 250	4.88	4865	\$200	261.153	\$52,231
			32142		865.132	\$171,840

Index

A

Asymmetric cut 24

B

Board Result(Report) 30

C

Centreboards 18

Chip price 18

Chip value 18

Class interval 9

Compare Programs 16

Compare Programs(Report) 29

Creating a New Program 5

Current log profile 14

Cutting diagrams 22, 27

D

Detail Board Result 17

Dollar Value(Price) per m3 log 18

F

Finished products 18

G

Graph options 16

Green thickness/width 13

I

Imperial length 18

L

Log class 9, 14, 18

Log conversion 18

Log cost 18

Log profile 6, 18

Log profile library 7, 18

Log volume calculation 18

M

Minimum stack width 18

N

No. of logs/shift 19

No. of sideboards primary cut 19

Nominal thickness and width 19

P

Percent board recovery: 19

Price calculation helper table grid 19, 20

Product profile 10, 19

Product profile library 11, 19

Program 19

Program Flowchart 4

Program name 19

Program Result 15

Program Result screen 16, 17

Program Result(Report) 28

R

Record Viewer 13

S

Saw kerf primary cut 21

Saw kerf secondary cut 21

Sawdust price 21

Sawing pattern details 14

Shrinkage (% volume) 21

Sideboards 21

Split taper method 1

Square percentage 21

Stack 21

Start Diameter 9

Starting the Evaluator 5

Symmetric cut 24

T

Taper 21

Thickness of first board in stack 21

Total Log table 14

U

Un-Finished product 21

V

Value after processing 11

Value per m3 of log 15

W

Wane 21

Wane allowance 13

Wane parameter 21

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