CTI Analysis and Consulting Services

Roll Stock Analysis™

Report of Summary and Recommendations

Imperial Test Case

Corrugated Technologies
Roll Stock Analysis® Test Case
Imperial

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1. Introduction

This document presents test case results of roll stock width analysis for an actual Corrugated Plant, performed by Corrugated Technologies, Inc. The Plant name has been changed to "Your Plant" for discretion purposes.

The purpose of this test case was to demonstrate the evaluations of various simulations of the order combining process for the plant's order pool using user-selected roll stock widths to determine the best widths of roll stock to inventory. The order pool consisted of orders in the period from April 1, 1998 to March 31, 1999.

The description of the analysis process, the steps executed and the test process results follow.

2. Roll Stock Width Analysis Overview

An important decision all box plant managers have to deal with is deciding which roll stock sizes to carry in inventory. The primary tradeoff is between side trim, production costs and inventory carrying costs. If a planner has more roll stock sizes to work with, trim loss will go down, but inventory will increase. For many plants, this increase in inventory could mean the difference between losing money and profitability.

CTI's Roll Stock Analysis (RSA) service can help you determine the appropriate mix of roll stock sizes to carry in inventory. The RSA performs an analysis using the plant's recent order history to estimate the impact of different sets of roll stock sizes on plant production costs. If the plant's goal is to reduce the number of roll stock sizes, then any production cost increase will be balanced against the value of the reduction in inventory. If the RSA suggests that more sizes should be carried, then the operating cost savings must be weighed against the carrying cost of increased inventory.

2.1 Preparation

In order to analyze the appropriateness of the roll stock sizes being carried, the user must first obtain a database of production history orders. This database could come from your host computer, or CTI's Corr-Trim® could collect a database of orders over time. Then subsets of the orders are selected according to a specific date range, such as a single quarter (if order pool is seasonal) or an entire year of orders. This set of orders must then be scrutinized to exclude orders with preprint stock, special processes, (these orders can't be combined with other orders and the roll stock for these orders can't be eliminated), and various other reasons. The resulting pool of orders is used in the analysis of existing roll stock inventory and simulations involving other sets of roll stock sizes.

Next, the user determines what roll stock widths are currently maintained in inventory and the associated roll stock costs such as inventory value, production costs, operating costs, etc. This information can typically be obtained from the planning department and the accounting department. Then, using the pool of orders, a Specific Grade Analysis is run using the currently stocked widths to get a baseline from which to evaluate all the alternatives to be generated. The results of this initial analysis are placed in a spreadsheet and used as a baseline to compare alternative sets of roll stock sizes.

The test pool of orders is also run through a Width Optimization Analysis by combining orders for all grades. The Width Optimization Analysis is based on the assumption that you have unlimited roll stock available in all possible sizes (in one inch increments). By running the pool of orders through a combining algorithm, the orders will group to certain sizes. The main considerations of the algorithm are minimum side trim, maximum width of the corrugator and maximum out. The output is a table, which shows the MSF required of each roll stock component by size to the nearest one-inch increment, after allowing for edge trim. If, for example, the order pool for some specialty grade consists of 36 and 1/2 inch wide orders and one inch minimum side trim is selected, the table will show the MSF of 74 inch roll stock required for each component of that grade.

The purpose of this data is to provide a summary of the roll stock required by size for all grades. This data is then placed in a spreadsheet and analyzed to provide an initial master list of sizes (or range of sizes) for all grades. The spreadsheet arranges the data in a way

to easily see the most used grades, percent of total roll stock for each grade and MSF per grade. It also shows the total MSF for each width of roll stock and the amount of that width used by the algorithm for each grade. For a high volume grade, the majority of usage will probably be near the maximum corrugator width.

The purpose of the Width Optimization Analysis is to provide an overview of the roll stock required by size for all grades. This data can be analyzed to provide an initial (first trial) set of sizes that will be needed to meet the requirements of all the grades. This initial set of sizes, derived from the results of the Width Optimization Analysis, is compared against the set of widths currently carried by the plant in order to generate ideas for change. Width Optimization Analysis will show that for high volume grades the majority of usage will probably be near the maximum corrugator width. As such, Width Optimization Analysis provides information about the range of sizes to be carried rather than the individual sizes which will be most economical considering production costs. For example, Width Optimization Analysis might show a high volume with usage in the 79 to 87 inch ranges that may be satisfied with 87,85,83,79 inch sizes or by 87,84,81 inch sizes. The best set of sizes considering production costs will be determined in a Specific Grade Analysis later.

A side benefit of Width Optimization Analysis is that it allows you to raise the question as to whether or not the volume of a particular order warrants carrying roll stock which is used only for that order. In some cases it may even make sense to purchase low volume board grades rather than producing them.

2.2 Analysis

From the results of the Width Optimization Analysis, the user can determine the most-used paper grades. A Specific Grade Analysis is then performed on each grade starting with the most-used grades and working down to the least-used grades. This is done by simulating the order combining process for appropriate order pools using user-selected roll stock widths, which were suggested from the Width Optimization Analysis. The user runs the Specific Grade Analysis as an iterative process, selecting different solutions with different paper widths for comparison. The resulting production and inventory costs are placed in a spreadsheet for comparison against the baseline developed earlier. Net savings and net costs are displayed for easy comparison.

Specialty liners may not need to be analyzed because the Width Optimization Analysis may indicate that only 1 or 2 sizes are required. Low volume grades may also be omitted from analysis since attempts at reducing stock may not result in any appreciable savings. In general, once approximately 90% of the stock are analyzed, sufficient savings have been realized and further analysis on the remainder of the stock may not be necessary.

Once all the targeted grades have been analyzed and acceptable solutions have been selected for each grade, the user may wish to review his selections in a result summary. This summary presents each grade analyzed, the proposed savings in number of rolls and the impact on inventory and production costs, both per grade and in summary totals.

The RSA production and inventory cost estimates are based on a series of inputs that may not be entirely accurate for the plant’s upcoming period. Fluctuations in business, changing operational and inventory costs, as well as the fact that last year’s order pool is not exactly the same as next year’s order pool have an impact on the actual costs you will see.

Even so, RSA should give you a good indication of your production costs comparing different sets of roll stock sizes. Also, you get an idea of the "relative costs" of carrying inventory in different sets of widths. It seems pretty logical that if you reduce the number of widths you carry in a grade from 14 to 8 there will be an inventory carrying cost savings. It is up to you to weigh the inventory cost savings projected by the RSA module and adjust them by some factor to more accurately reflect the situation at your plant.

If more accurate cost projections are required, using the Corr-Trim Combiner to validate the results can further test the results of the RSA process. Using the Corr-Trim analysis mode, the planner could trim current orders using only the roll sizes selected in the RSA module over some period of time. This would give a better idea of the actual savings that could result by only using the set of roll sizes selected in RSA.

The RSA allows you to simulate combining a large set of orders varying the inputs to the combining process. This simulation is essentially a trial and error process for determining the best set of roll stock sizes. The heart of this analysis generates solutions for very large order pools and accumulates statistics on:

- slitter changes
- roll stock changes
- edge trim
- cost per MSF
- number of incomplete orders
- lineal footage and MSF required by sizes

2.3 Summary

The determination of the best roll stock sizes is a difficult problem and there is no direct prescriptive method that will answer the question. The purpose of this service is to provide a mechanism to carry out a series of simulation experiments in an efficient and timely manner so that a thorough analysis can be performed. With this information, plant management can make an informed decision as to what roll stock sizes to carry.

3. Order Preparation

This section describes the preparation of the order data to be used in the roll stock analysis.

3.1 Orders Imported

Number of Orders Imported	5906
Order Period	4/1/98 – 3/31/99

The following steps were taken to clean up the order database:

1. Extracted grades that the plant no longer wants to use.
2. Combined seldom-used grades into more frequently used grades.
3. Extracted all pre-print and other "specialty" orders.
4. Extracted all special self-trimming items from database.
5. Extracted orders for certain customers the plant did not want to include.
6. Consolidated current 86 board grade combinations to 41 board combinations.

3.2 Order Set for Analysis

Number of Orders	5906
Analysis Period	4/1/98 – 3/31/99
Board Grades	41
Paper grades	12

4. Board Grade Consumption for Order Set

This section includes some sample reports used to illustrate board grade consumption for the particular order set being analyzed. These reports aid in the *Roll Stock Analysis*. The reports frequently prepared are:

1. Board Grade Consumption,
2. Board Grade Consolidation report
3. Grade Consumption report by Percentage (pie chart)
4. Grades With less Than 50 Orders.

BOARD GRADE CONSUMPTION

Total Number of Orders : 5,906 Sq. Feet Of All Orders 472,546,811

Board Grade Consumption - Sorted by Usage

Analysis Group : Corrugated Technologies Plant : Your Plant

Period From : 4/1/1998 To : 3/31/1999

Line	Grade ID	Liner 1	Medium 1	Liner 2	Medium 2	Liner 3	Medium 3	Liner 4	# Orders	Sq Area	Total %	Cmul %
1	KM45KC	K	M45	K					587	61,325,022	12.98	12.98
2	L70M28L70C	L70	M28	L70					639	39,101,890	8.27	21.25
3	L120M28L120C	L120	M28	L120					366	33,148,264	7.01	28.27
4	KM28KC	K	M28	K					477	28,451,383	6.02	34.29
5	CWKM65KC	CWK	M65	K					240	27,998,691	5.93	40.21
6	9	CWK	M45	K	M45	K			327	25,421,126	5.38	45.59
7	L120M65L120C	L120	M65	L120					534	23,635,403	5.00	50.59
8	30#M2830#B	30#	M28	30#					434	23,407,514	4.95	55.55
9	J2M45J2C	J2	M45	J2					171	22,955,781	4.86	60.41
10	J2M45KC	J2	M45	K					183	19,764,016	4.18	64.59
11	L90M65L90C	L90	M65	L90					120	14,785,750	3.13	67.72
12	KWTM45KC	KWT	M45	K					158	14,074,090	2.98	70.70
13	J2M65J2C	J2	M65	J2					91	13,979,043	2.96	73.65
14	L120M45L70C	L120	M45	L70					165	13,450,226	2.85	76.50
15	CWKM28KB	CWK	M28	K					63	11,756,314	2.49	78.99
16	39	L70	M65	L70	M65	L70			168	11,088,901	2.35	81.33
17	KM28KB	K	M28	K					63	10,465,313	2.21	83.55
18	L70M28L70M28L70BC	L70	M28	L70	M28	L70			199	8,552,069	1.81	85.36
19	CWKM28KC	CWK	M28	K					110	8,165,882	1.73	87.09
20	KWTM65J2B	KWT	M65	J2					34	7,678,247	1.62	88.71
21	J2M28J2C	J2	M28	J2					144	7,552,186	1.60	90.31
22	L120M45L120C	L120	M45	L120					82	7,511,350	1.59	91.90
23	H2M45H2C	H2	M45	H2					28	5,104,587	1.08	92.98
24	18	KWT	M45	K	M45	K			49	4,457,095	.94	93.92
25	KWTM45J2C	KWT	M45	J2					43	3,239,087	.69	94.61

Board Grade Consolidation Report

Analysis Group: Corrugated Technologies Plant : Your Plant

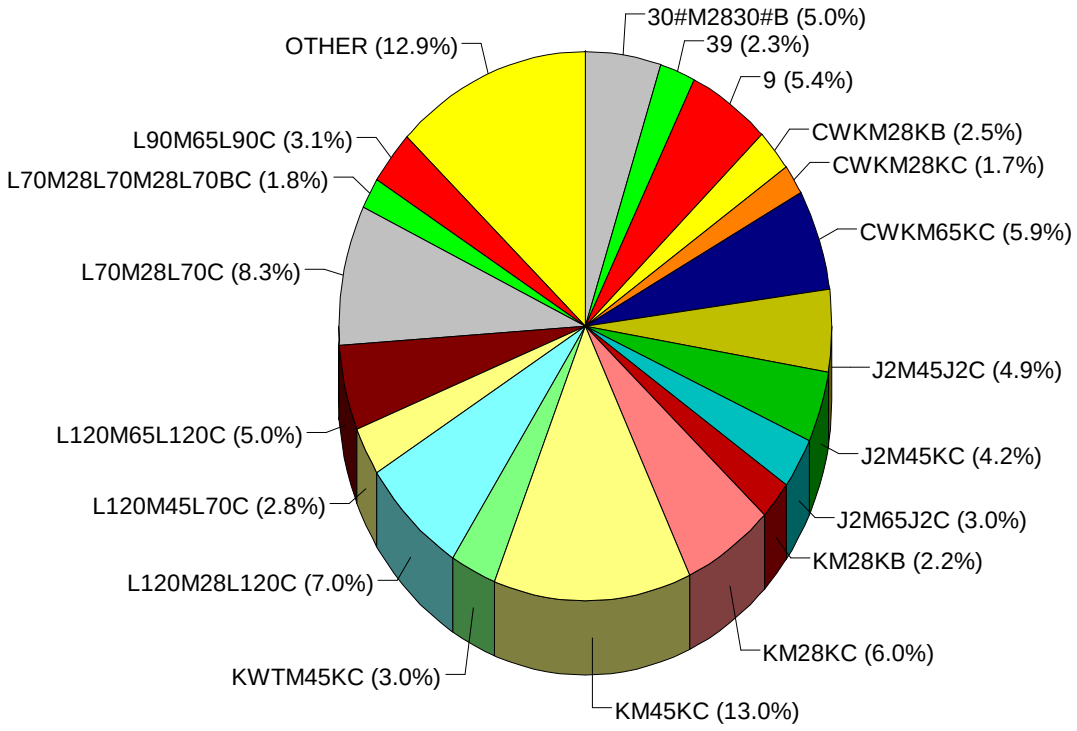
Current Grade			Area		Orders	Recommended Grade	
KM45KC	K-M45-K		5,697,234	12.9 %	587		
		Totals:	5,697,234	12.9 %	587	KM45KC	K-M45-K
KM28MC	K-M28-M		98,040	0.2 %	26		
L70M28L70C	L70-M28-L70		1,865,157	4.2 %	266		
L70M28MC	L70-M28-M		56,536	0.1 %	19		
MM28KB	M-M28-K		278,781	0.6 %	65		
MM28MC	M-M28-M		1,207,338	2.7 %	210		
MM45MC	M-M45-M		126,801	0.3 %	53		
		Totals:	3,632,654	8.3 %	639	L70M28L70C	L70-M28-L70
L120M28L120C	L120-M28-L120		3,079,549	7.0 %	366		
		Totals:	3,079,549	7.0 %	366	L120M28L120C	L120-M28-L120
KM28KC	K-M28-K		2,643,198	6.0 %	477		
		Totals:	2,643,198	6.0 %	477	KM28KC	K-M28-K
CWKM65KC	CWK-M65-K		2,601,142	5.9 %	240		
		Totals:	2,601,142	5.9 %	240	CWKM65KC	CWK-M65-K
31	CWK-M45-K-M45-J2		43,188	0.1 %	8		
9	CWK-M45-K-M45-K		2,318,492	5.3 %	319		
		Totals:	2,361,680	5.4 %	327	9	CWK-M45-K-M45-K
L120M65L120C	L120-M65-L120		2,195,782	5.0 %	534		
		Totals:	2,195,782	5.0 %	534	L120M65L120C	L120-M65-L120
MM28MB	M-M28-M		2,174,611	4.9 %	434		
		Totals:	2,174,611	4.9 %	434	30#M2830#B	30#-M28-30#
J2M45J2C	J2-M45-J2		2,132,644	4.8 %	171		
		Totals:	2,132,644	4.8 %	171	J2M45J2C	J2-M45-J2
J2M28KC	J2-M28-K		4,777	0.0 %	3		
J2M45KC	J2-M45-K		1,569,716	3.6 %	155		
KM45J2C	K-M45-J2		261,629	0.6 %	25		
		Totals:	1,836,122	4.2 %	183	J2M45KC	J2-M45-K
L90M65L90C	L90-M65-L90		1,373,630	3.1 %	120		
		Totals:	1,373,630	3.1 %	120	L90M65L90C	L90-M65-L90
CWKM28L70C	CWK-M28-L70		16,836	0.0 %	5		
CWKM45L70C	CWK-M45-L70		14,242	0.0 %	3		
KWTM45KC	KWT-M45-K		1,276,437	2.9 %	150		
		Totals:	1,307,515	3.0 %	158	KWTM45KC	KWT-M45-K
J2M65J2C	J2-M65-J2		1,298,685	2.9 %	91		
		Totals:	1,298,685	2.9 %	91	J2M65J2C	J2-M65-J2
KM65KC	K-M65-K		113,283	0.3 %	9		
L120M45KC	L120-M45-K		14,060	0.0 %	2		
L120M45L70C	L120-M45-L70		1,122,214	2.5 %	154		

Analysis Name : Corrugated Technologies

Plant Name : Your Plant

From : 4/1/1998 **To** 3/31/1999

GRADE CONSUMPTION BY PERCENTAGE



5. Paper Grade Consumption for Order Set

This section includes a sample report used to illustrate paper grade consumption for the particular order set being analyzed. These reports aid in the *Roll Stock Analysis*. The report frequently prepared is:

1. Paper Grade Consumption.

PAPER GRADE CONSUMPTION

Sq. Feet Of All Orders 1,748,947,282

Analysis Group : Corrugated Technologies Plant : Your Plant

Period From : 4/1/1998 To : 3/31/1999

Line	Paper Grade	Total Orders	Sq. Feet	TotalPct	Pct of Inv	Cost Per Ton	Cost Per MSF	Weight Per MSF
1	30#	434	46,815,028	2.68		$416.08	$6.24	30.00
2	CWK	935	86,011,748	4.92		$534.86	$11.23	42.00
3	H2	122	17,119,838	.98		$381.40	$17.16	90.00
4	J2	780	130,898,826	7.48		$371.37	$12.81	69.00
5	K	2,398	349,528,882	19.99		$371.50	$7.80	42.00
6	KWT	326	31,056,482	1.78		$619.17	$13.00	42.00
7	L120	1,208	148,067,348	8.47		$391.30	$11.15	57.00
8	L70	1,228	158,410,020	9.06		$399.52	$7.19	36.00
9	L90	120	29,571,500	1.69		$391.19	$8.80	45.00
10	M28	2,573	260,703,822	14.91		$346.22	$4.50	26.00
11	M45	2,014	323,695,305	18.51		$331.58	$5.47	33.00
12	M65	1,319	167,068,483	9.55		$342.57	$6.85	40.00

6. Width Optimization

A hybrid of Corr-Trim accepts your orders as input and trims them with the main purpose of minimizing side trim. It assumes paper widths of whatever the corrugator max is, down to one-half the corrugator size in one-inch decrements. This step should answer the question: " If I were to trim my entire order set, how can these orders be best combined to minimize waste?"

For this Corrugated Company, the orders were "combined" using a 3-day "pull ahead" and the maximum out on the corrugator was set to 7. The results of the analysis are on the following pages. It shows paper widths down the left side of the page. Across the top of each column are the paper grade names. The numbers given show the MSF per grade width.

The results of this step show, for each paper grade, which paper widths minimize side trim. For your needs, rather than looking at the specific MSF values, it may be more useful to step back and view the pattern of use at the higher widths.

7. Specific Grade Analysis

This phase of the analysis process simulates the combining of orders with the purpose of estimating production costs for the paper grades and paper widths selected by the user. This data is then used to compare the cost of production for several user-selected sets of paper widths. In this process, a modified version of CTI's powerful scheduling algorithm evaluates the economic tradeoffs considering the following parameters:

- Corrugator Cost
- Average Board Cost
- Average Paper Change Cost
- Average Slitter Change Cost
- Scrap Value
- Average Corrugator Speed
- Average Board Weight
- Minimum Run Lineal
- Minimum Trim
- Maximum Trim
- Maximum Out

The data provided in this section is presented in two groups. The first group of results, for each paper grade analyzed, gives the following:

1. The production cost information of the "best" width set selected by the Corrugated Company.
2. The production cost information related to the present set of widths carried by the plant. This is noted as "Trial 1" or "PRESENT".
3. Other "trials" (width sets) whose analysis was of interest.
4. Trials that were deemed not as good are not presented.

The second set of data presented, titled *Detail Analysis Trial Comparison*, shows the summary costs associated with various trials of width sets for each paper grade. The *Detail Analysis Trial Comparison* reports show a column for the present widths stocked for each grade under the column titled " PRESENT." The "best" sets of widths are given in the box labeled "Selected Trial". Samples for paper grades K and L70 follow.

Analysis Name : Corrugated Technologies

Plant Name : Your Plant

From : 4/1/1998 **To** 3/31/1999

No. of Orders : 6099

Paper Grade : K

Trial : 1

Trim Parameters:	MinTrim :	1.13	MinLineal :	3000
	MaxTrim :	4.00	PullAhead :	3 days

MDetailText :

```
VALUES IN BRACKETS SHOW % OF SELF TRIM   **=100
TOTAL SIDE TRIM MSF  6221.83    $ 123621.50
TOTAL STOCK CHANGES     1340    $ 134000.00
TOTAL SLITTER CHANGES   1619    $  32380.00(74)
TOTAL CORR. HOURS     1641.6    $1149116.00
             TOTAL COST         $1439118.00
               COST/1000        $    690.97

SIZE   87.00   TLF=   5793712(64)
SIZE   84.50   TLF=   2197660(35)
SIZE   83.00   TLF=   4599891(58)
SIZE   81.00   TLF=   1271310(48)
SIZE   79.00   TLF=   2440324(62)
SIZE   77.00   TLF=   4030390(77)
SIZE   75.00   TLF=   4995185(79)
SIZE   73.00   TLF=   2900289(90)
SIZE   71.00   TLF=   1493892(90)
SIZE   69.00   TLF=   1316240(50)
SIZE   67.00   TLF=   4218971(97)
SIZE   65.00   TLF=    803914(72)
SIZE   63.00   TLF=    539534(58)
SIZE   61.00   TLF=    291676(43)
SIZE   53.00   TLF=     38562(**)
SIZE   52.00   TLF=    272096(94)
SIZE   47.13   TLF=   2219963(99)
       TOTAL LINEAL= 39423616(72)
   MSF= 241309.8
MSF/HR=    147.0
AVG WID=    73.45

*** SLITTER AND STOCK STATISTICS ***

Average Lineal SL/CH =    6825.34
Minimum Lineal SL/CH =    1017.00
Maximum Lineal SL/CH =   44230.00
Average Lineal ST/CH =    8370.36
Minimum Lineal ST/CH =    1017.00
Maximum Lineal ST/CH =   52414.00

% SIDE TRIM= 2.51

% OF REQUIRED MSF MADE IS   99.2
```

Analysis Name : Corrugated Technologies

Plant Name : Your Plant

From : 4/1/1998 **To** 3/31/1999

No. of Orders : 5947

Paper Grade : K

Trial : 125

Trim Parameters:				
	MinTrim :	1.00	**MinLineal :**	1000
	MaxTrim :	4.50	**PullAhead :**	4 **days**

MDetailText :

```
VALUES IN BRACKETS SHOW % OF SELF TRIM   **=100
TOTAL SIDE TRIM MSF  6907.99    $ 137254.60
TOTAL STOCK CHANGES     1095    $ 109500.00
TOTAL SLITTER CHANGES   1476    $  29520.00(65)
TOTAL CORR. HOURS     1552.7    $1048088.00
             TOTAL COST         $1324363.00
               COST/1000        $    649.63

SIZE   87.00   TLF=   5275228(57)
SIZE   85.00   TLF=   3196558(17)
SIZE   83.00   TLF=   4341118(58)
SIZE   80.00   TLF=   5465954(32)
SIZE   77.00   TLF=   8368822(75)
SIZE   73.00   TLF=   3424679(79)
SIZE   71.00   TLF=   2306323(71)
SIZE   67.00   TLF=   4910655(93)
       TOTAL LINEAL= 37289341(62)
   MSF= 236198.4
MSF/HR=    152.1
AVG WID=    76.01

*** SLITTER AND STOCK STATISTICS ***

Average Lineal SL/CH =    7356.31
Minimum Lineal SL/CH =     587.00
Maximum Lineal SL/CH =   50548.00
Average Lineal ST/CH =   10041.72
Minimum Lineal ST/CH =     587.00
Maximum Lineal ST/CH =   84596.00

% SIDE TRIM= 2.84

% OF REQUIRED MSF MADE IS   99.1
```

DETAIL ANALYSIS TRIAL COMPARISON

Analysis Group : Corrugated Technologies Plant : Your Plant

Period From : 4/1/1998 To : 3/31/1999 Paper Grade : K Selected Trial : 125

Line	Description	PRESENT	TRIAL 46	TRIAL 57	TRIAL 58	TRIAL 66	TRIAL 70
1	Width 1	87.00	87.00	87.00	87.00	87.00	87.00
2	Width 2	84.50	85.00	85.00	85.00	85.00	85.00
3	Width 3	83.00	83.00	83.00	83.00	83.00	83.00
4	Width 4	81.00	80.00	80.00	80.00	80.00	80.00
5	Width 5	79.00	76.50	76.50	77.00	77.00	77.00
6	Width 6	77.00	73.00	73.00	73.00	73.00	73.00
7	Width 7	75.00	71.00	71.00	71.00	71.00	71.00
8	Width 8	73.00	67.00	67.00	67.00	67.00	67.00
9	Width 9	71.00					
10	Width 10	69.00					
11	Width 11	67.00					
12	Width 12	65.00					
13	Width 13	63.00					
14	Width 14	61.00					
15	Width 15	53.00					
16	Width 16	52.00					
17	Width 17	47.13					
18	Number of Widths	17	8	8	8	8	8
19							
20	Inventory (tons)	0.0	0.0	0.0	0.0	0.0	0.0
21	Inv Related Costs	$0	$0	$0	$0	$0	$0
22	Change	N/A	$0	$0	$0	$0	$0
23							
24	Prod. cost (MSF)	$2.53	$2.41	$2.40	$2.39	$2.37	$2.38
25	Prod. cost total	$884,442	$841,886	$838,874	$834,112	$827,734	$831,530
26	Change	N/A	($42,556)	($45,568)	($50,331)	($56,708)	($52,912)
27							
28	Net $ Change	N/A	($42,556)	($45,568)	($50,331)	($56,708)	($52,912)
29							
30	MSF/Hour	147.0	152.3	152.4	152.4	152.8	152.1
31	AVG Width	73.45	76.09	76.16	76.16	76.37	76.01
32	% Side Trim	2.51	3.10	3.04	2.87	2.92	2.84
33	% MSF Made	99.2	99.2	99.2	99.2	98.9	99.1

Analysis Name : **Corrugated Technologies**

Plant Name : **Your Plant**

From : **4/1/1998** **To** **3/31/1999**

No. of Orders : 955

Paper Grade : L70

Trial : 1

Trim Parameters:	**MinTrim :**	1.13	**MinLineal :**	3000
	MaxTrim :	4.00	**PullAhead :**	3 **days**

MDetailText :

```
VALUES IN BRACKETS SHOW % OF SELF TRIM   **=100
TOTAL SIDE TRIM MSF  2054.42    $  40819.19
TOTAL STOCK CHANGES      567    $  56700.00
TOTAL SLITTER CHANGES    700    $  14000.00(73)
TOTAL CORR. HOURS      544.8    $ 381343.20
             TOTAL COST         $ 492862.30
               COST/1000        $    768.96

SIZE   87.00   TLF=    759160(18)
SIZE   84.50   TLF=    994308(42)
SIZE   83.00   TLF=   1040243(70)
SIZE   81.00   TLF=    260505(27)
SIZE   79.00   TLF=   2300214(85)
SIZE   77.00   TLF=   1534056(75)
SIZE   75.00   TLF=     48014(**)
SIZE   74.00   TLF=    452238(19)
SIZE   73.00   TLF=    264783(81)
SIZE   71.00   TLF=    253550(96)
SIZE   69.00   TLF=    416960(85)
SIZE   67.00   TLF=    224889(81)
SIZE   65.00   TLF=    262089(96)
SIZE   60.00   TLF=    315107(**)
SIZE   58.00   TLF=    753065(96)
SIZE   52.00   TLF=    417498(98)
SIZE   50.25   TLF=   1303793(99)
SIZE   49.50   TLF=   1356095(97)
SIZE   45.75   TLF=    104326(**)
SIZE   44.50   TLF=     22145(**)
       TOTAL LINEAL= 13083046(77)
   MSF=  74260.9
MSF/HR=    136.3
AVG WID=    68.11

*** SLITTER AND STOCK STATISTICS ***

Average Lineal SL/CH =    5739.90
Minimum Lineal SL/CH =    1021.00
Maximum Lineal SL/CH =   26893.00
Average Lineal ST/CH =    6950.81
Minimum Lineal ST/CH =    1021.00
Maximum Lineal ST/CH =   26893.00

% SIDE TRIM= 2.69

% OF REQUIRED MSF MADE IS   99.6
```

Analysis Name : Corrugated Technologies

Plant Name : Your Plant

From : 4/1/1998 **To** 3/31/1999

No. of Orders : 5947

Paper Grade : L70

Trial : 70

Trim Parameters:				
	MinTrim :	1.00	**MinLineal :**	2000
	MaxTrim :	4.75	**PullAhead :**	3 **days**

MDetailText :

```
VALUES IN BRACKETS SHOW % OF SELF TRIM   **=100
TOTAL SIDE TRIM MSF  3082.71    $  61250.20
TOTAL STOCK CHANGES      602    $  60200.00
TOTAL SLITTER CHANGES    887    $  17740.00(67)
TOTAL CORR. HOURS      577.5    $ 389830.30
             TOTAL COST         $ 529020.50
               COST/1000        $    739.77

SIZE   87.00   TLF=   2642507(34)
SIZE   83.00   TLF=   1687492(56)
SIZE   80.00   TLF=   2361913(85)
SIZE   77.00   TLF=   2175925(75)
SIZE   73.00   TLF=    407157(63)
SIZE   71.00   TLF=   1009672(56)
SIZE   67.00   TLF=    576108(72)
SIZE   60.00   TLF=    969650(96)
SIZE   52.00   TLF=   2039132(96)
       TOTAL LINEAL= 13869559(69)
   MSF=  82854.7
MSF/HR=    143.5
AVG WID=    71.69

*** SLITTER AND STOCK STATISTICS ***

Average Lineal SL/CH =    4954.59
Minimum Lineal SL/CH =     636.00
Maximum Lineal SL/CH =   26893.00
Average Lineal ST/CH =    7222.43
Minimum Lineal ST/CH =     636.00
Maximum Lineal ST/CH =   36520.00

% SIDE TRIM= 3.59

% OF REQUIRED MSF MADE IS   99.5
```

DETAIL ANALYSIS TRIAL COMPARISON

Analysis Group : Corrugated Technologies Plant : Your Plant

Period From : 4/1/1998 To : 3/31/1999 Paper Grade : L70 Selected Trial : 70

Line	Description	PRESENT	TRIAL 46	TRIAL 57	TRIAL 58	TRIAL 66	TRIAL 70
1	Width 1	87.00	87.00	87.00	87.00	87.00	87.00
2	Width 2	84.50	83.00	83.00	83.00	83.00	83.00
3	Width 3	83.00	80.00	80.00	80.00	80.00	80.00
4	Width 4	81.00	76.50	76.50	77.00	77.00	77.00
5	Width 5	79.00	67.00	73.00	73.00	73.00	73.00
6	Width 6	77.00	60.00	71.00	71.00	71.00	71.00
7	Width 7	75.00	52.00	67.00	67.00	67.00	67.00
8	Width 8	74.00	49.50	60.00	60.00	60.00	60.00
9	Width 9	73.00		52.00	52.00	52.00	52.00
10	Width 10	71.00		49.50	49.50		
11	Width 11	69.00					
12	Width 12	67.00					
13	Width 13	65.00					
14	Width 14	60.00					
15	Width 15	58.00					
16	Width 16	52.00					
17	Width 17	50.25					
18	Width 18	49.50					
19	Width 19	45.75					
20	Width 20	44.50					
21	Number of Widths	20	8	10	10	9	9
22							
23	Inventory (tons)	0.0	0.0	0.0	0.0	0.0	0.0
24	Inv Related Costs	$0	$0	$0	$0	$0	$0
25	Change	N/A	$0	$0	$0	$0	$0
26							
27	Prod. cost (MSF)	$3.73	$3.79	$3.70	$3.69	$3.65	$3.59
28	Prod. cost total	$591,163	$600,678	$586,314	$585,013	$577,537	$568,719
29	Change	N/A	$9,515	($4,850)	($6,151)	($13,626)	($22,445)
30							
31	Net $ Change	N/A	$9,515	($4,850)	($6,151)	($13,626)	($22,445)
32							
33	MSF/Hour	136.3	135.6	138.1	138.0	141.2	143.5
34	AVG Width	68.11	67.78	69.01	68.95	70.58	71.69
35	% Side Trim	2.69	4.20	3.73	3.63	3.84	3.59
36	% MSF Made	99.6	99.6	99.5	99.5	99.2	99.5

8. Analysis Summary

The following *Plant Summary* report shows the summary of number of sizes and costs associated with each set of widths selected for each paper grade.

The matrix of widths report represents the current number of widths and the recommended number of widths.

8.1 Production Cost

Analysis was performed using a figure of $675/hr for corrugator cost.

8.2 Projected Savings

The projected savings from this analysis were $394,731. From consolidation alone was $97,746. Consolidation resulted in changes from 86 Board grade combinations to 41 board combinations. The plant would move from 182 sizes to 88.

PLANT SUMMARY

Analysis Group : Corrugated Technologies Plant : Your Plant

Period From : 4/1/1998 To : 3/31/1999

GradeID	Selected Trial	Present Widths	New Widths	Widths Diff	Present Inv Cost	New Inv Cost	Inv Cost Diff	Present Prod Cost	New Prod Cost	Prod Cost Diff	Total Cost Diff	Old Pct	New Pct	Pct Diff
30#	17	4	4	0	0	0	0	71,337	69,707	-1,629	-1,629	97.4	98.1	.7
CWK	40	12	8	-4	0	0	0	119,548	116,015	-3,533	-3,533	99.1	99.1	0.0
H2	12	5	4	-1	0	0	0	52,082	53,537	1,455	1,455	100.1	100.1	0.0
J2	12	16	9	-7	0	0	0	334,615	333,088	-1,527	-1,527	99.7	99.6	-.1
K	125	17	8	-9	0	0	0	884,442	831,530	-52,912	-52,912	99.2	99.1	-.1
KWT	31	11	8	-3	0	0	0	50,576	50,263	-313	-313	99.9	100.0	.1
L120	37	15	7	-8	0	0	0	544,776	534,181	-10,596	-10,596	87.0	87.1	.1
L70	70	20	9	-11	0	0	0	591,163	568,719	-22,445	-22,445	99.6	99.5	-.1
L90	19	2	2	0	0	0	0	91,994	91,994	0	0	83.0	83.0	0.0
M		16		-16	0		0	79,235		-79,235	-79,235	95.9		-95.9
M28	43	26	10	-16	0	0	0	777,390	714,893	-62,497	-62,497	99.6	99.7	.1
M45	20	17	9	-8	0	0	0	817,978	797,946	-20,031	-20,031	99.7	99.7	0.0
M65	18	21	10	-11	0	0	0	474,521	461,588	-12,933	-12,933	99.9	99.9	0.0

	Widths	Inventory Cost	Production Cost	Total Cost
Present	182	0	4,889,658	4,889,658
New	88	0	4,623,461	4,623,461
Difference	-94	0	-266,197	-266,197

Your Plant

RSA™ Summary of Results

From : 4/1/1998

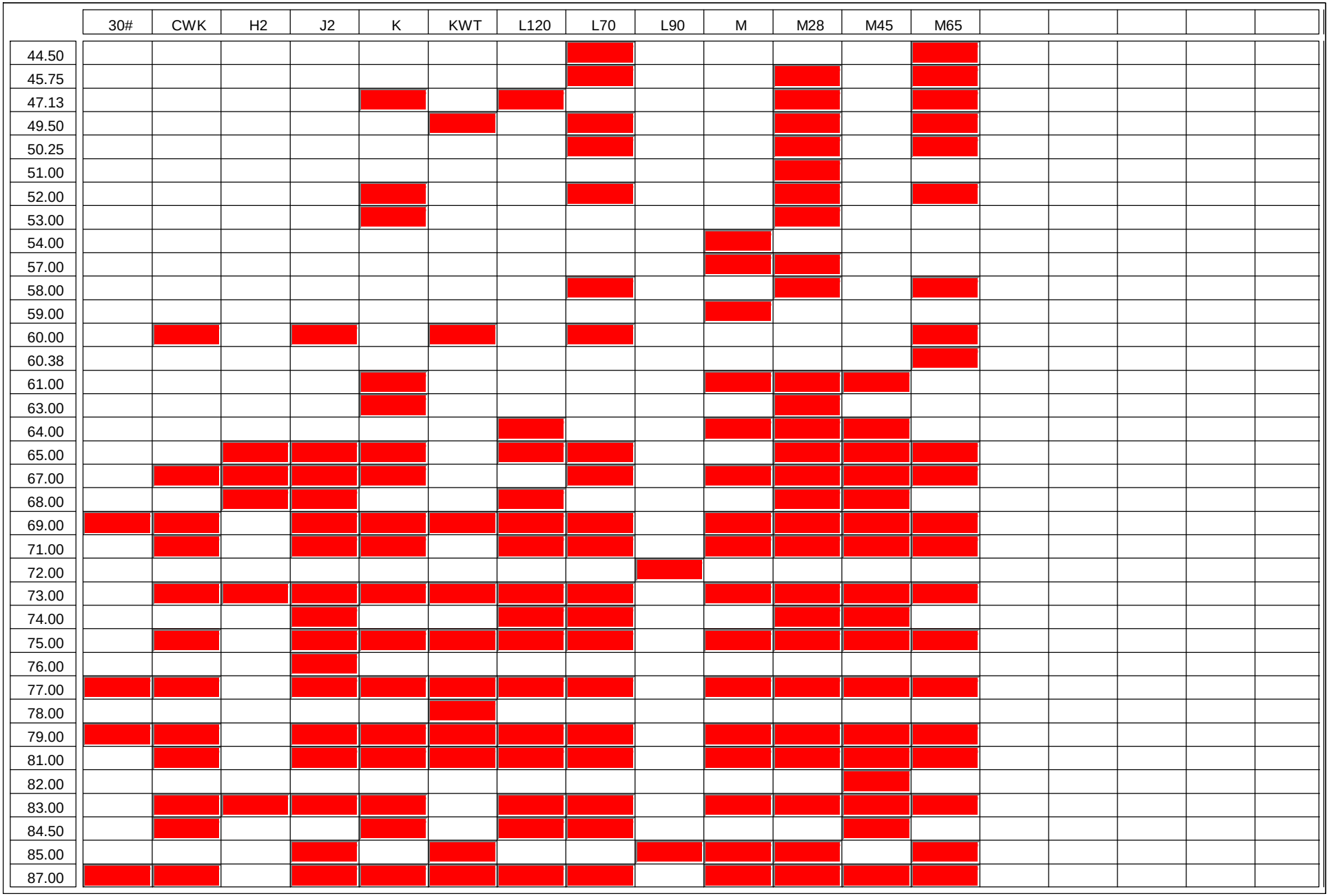
To : 3/31/1999

	Present	New	Difference	Percent
Roll Stock Sizes	182	88	-94	-51.6 %
Paper Changes	7583	6690	-893	-11.8 %
Slitter Changes	9024	8862	-162	-1.8 %
Lineal per Paper Change	26,467.69	28,875.73	2,408.04	9.1 %
Lineal per Slitter Change	22,241.19	21,798.53	-442.65	-2.0 %
Corrugator Hours	8,357.20	8,043.80	-313.40	-3.8 %
Area per Hour	144.64	148.26	3.61	2.5 %
Side Trim Percentage	2.5 %	3.0 %	0.5 %	21.0 %
Average Width	72.27	74.08	1.81	2.5 %
Production Cost	$4,889,657.98	$4,623,460.93	($266,197.05)	-5.4 %
Inventory Cost	$0.00	$0.00	$0.00	
Total Cost & Savings	$4,889,657.98	$4,623,460.93	($266,197.05)	-5.4 %

Current Widths - by Grade

7/21/00

Analysis Group : Corrugated Technologies **Total Widths:** **182** Plant : Your Plant



Recommended Widths - by Grade

7/21/00

Analysis Group : Corrugated Technologies **Total Widths:** **88** Plant : Your Plant

	30#	CWK	H2	J2	K	KWT	L120	L70	L90	M28	M45	M65						
52.00																		
60.00																		
67.00																		
71.00																		
72.00																		
73.00																		
77.00																		
80.00																		
83.00																		
85.00																		
87.00																		

Appendix A: Preparation Information and The Analysis Process

The Roll Stock Analysis Test Case document provides an overview and a sample of the Roll stock Analysis process. For additional information on how to prepare for the Roll stock Analysis Service, consult the "Service Initiation Information" document, available in metric and imperial. This document covers in more detail:

1. Data Preparation,
2. User Input Parameters,
3. Order Set Preparation,
4. Importing Orders,
5. Width Analysis,
6. Results Generation.

The "Service Initiation Information" document can be obtained with permission from Corrugated Technologies, Inc.

Appendix B: Developing Corrugator Costs

The Roll Stock Analysis Test Case document provides an overview and a sample of the Roll stock Analysis process. For additional information on how to develop corrugator costs for the Roll stock Analysis Service, consult the "Developing Corrugator Costs" document, available in metric and imperial. This document covers in more detail:

1. Corrugator Cost per Hour,
2. Cost of a Stock Change,
3. Cost of a Slitter Change,
4. Corrugator Single Facer Speed Averages,
5. Cost of Stock combined at the Corrugator,
6. Adhesive and other Enhancement Material Costs,
7. Examples of developing Corrugator Costs.

The "Developing Corrugator Costs" document can be obtained with permission from Corrugated Technologies, Inc.