OPPORTUNITIES THROUGH QUALITY CONTROL

W.C. "Bill" Beach
Council of Forest Industries of B.C.
Vancouver, British Columbia

Over the past ten years there have been tremendous gains in productivity in our lumber industry. Increased automation and selective downsizing of the workforce have provided record level of per man day productivity. These gains have served to increase profitability through an effective decrease in per unit operating costs. Unfortunately, in many large log mills such as those found along the west coast of North America, too often these gains in productivity have been made without sufficient attention to equivalent or even greater gains that could be made through more effective quality control. This paper examines some of the opportunities that exist in our mills today through greater adherence to systematic quality control.

The current practice of quality control in the lumber industry falls into one of the following categories:

1) virtually nonexistent
2) superficial
3) traditional
4) comprehensive

Let's examine each level.

Virtually Nonexistent Quality Control

There are mills where no systematic approach to quality control exists. In these operations there is no individual person responsible for quality control because it is felt that quality control is the responsibility of all. What in fact happens, if no one is given the responsibility for quality control, then effective quality control is virtually nonexistent.

Superficial Quality Control

Some mills have an individual who is designated as a quality control supervisor. Unfortunately this individual is often a junior man with little experience, reporting to the mill superintendent. In addition, he finds that he works on quality control when he has time. Quality control activities (usually confined to grade checks) are second priority to supervising weekend cleanup, relief production supervision, helping with tallying or log inventory, and other such related jobs. By assigning a low level of priority to the practice of quality control the result becomes nothing better than superficial.

Traditional Quality Control

What can be referred to as traditional quality control is practiced in most mills today. Activities normally included in traditional quality control are grade supervision, monitoring of product condition, monitoring product recovery at the planer, and

assessing package quality. Such traditional practices have been successful in improving grade consistency, manufacturing consistency, and product appearance. However, as an industry we still often encounter problems in these areas so there is undoubtedly a need for greater vigilance. Some of the following points given evidence to this concern:

Grade Supervision

In the five-year period 1981-1986, 130 reinspections were undertaken on coastal production. Of these 130 reinspections over 80% were initiated due to off-grade or off-grade and stain in the shipment. The expense in servicing these claims alone exceeded $500,000 and the settlement losses incurred totalled several million dollars.

Over the past three years sample grade surveys have been undertaken. The following chart is a summary of some of the findings.

SAMPLE GRADE SURVEYS CONDUCTED BY COFI

Item	Mills Surveyed	Total FBM Inspected	On Grade	Above Grade	Below Grade
#3 Clear & Btr.	12	74844	81.1%	--	18.9%
#4 Clear	8	22578	66.2%	26.0%	7.8%
#2 Merch & Btr.	7	49965	89.5%	4.5%	6.0%
Stand/#2 Struct	3	12915	91.3%	0.7%	8.0%
Util/#3 Struct	6	46072	77.8%	19.0%	3.2%

Given the below grade found in 85/15 R List Clear, it's not surprising that a large number of reinspections have occurred on this item. It is also interesting to note the above grade content in the sample. If one were to apply 1986 values to the lost sales realization, the dollars involved are rather staggering. An example of two items done are shown below:

EXAMPLE #1 -- LOSSES DUE TO OFF-GRADE

GRADING ACCURACY FOR #4 CLEAR

BEST MILL			WORST MILL			AVERAGE		
On	Above	Below	On	Above	Below	On	Above	Below
91.4%	8.6%	0.0%	43.0%	50.3%	6.7%	66.2%	26.0%	7.8%

ACTUAL LOSSES FROM OVERGRADE

$17/MBM	$100/MBM	$52/MBM

POTENTIAL IMPROVEMENT

$ 1/MBM	$ 85/MBM	$36/MBM

ASSUMING AN ANNUAL MILL PRODUCTION OF 100 MMBM
AND ASSUMING APPROXIMATELY 4 MMBM IS #4 CLEAR

$ 4,000	$340,000	$144,000

EXAMPLE #2 -- LOSSES DUE TO OFF-GRADE

GRADING ACCURACY FOR UTIL/#3 STRUCT

BEST MILL			WORST MILL			AVERAGE		
ON	ABOVE	BELOW	ON	ABOVE	BELOW	ON	ABOVE	BELOW
86.2%	10.0%	3.8%	64.6%	31.0%	4.4%	77.8%	19.0%	3.2%

ACTUAL LOSSES FROM OVERGRADE

$8/MBM	$25/MBM	$15/MBM

POTENTIAL IMPROVEMENT

$2/MBM	$18/MBM	$ 9/MBM

ASSUMING AN ANNUAL MILL PRODUCTION OF 100 MMBM
AND ASSUMING APPROXIMATELY 8.8 MMBM IS UTIL/#3 STRUCT

$17,600	$158,400	$79,200

If we consider that an above grade content averaging 8% is within acceptable limits, then anything in excess of that is our potential for improving sales realization in our grade mix. Based on the sample above, an opportunity to improve on average per 100 million production, was found to be $144,000 for R List 4 Clear and $79,200 for S4S #3 Structural. If other items were considered, the average opportunity per major producer within current grade mixes amounts to several hundred thousand dollars each! This exists despite current levels of grade supervision.

MONITORING PRODUCT CONDITION

Maintaining good product condition means getting your product into the market free from mould, stains, checking, warp, or other such damaging defects. Anti-stain chemicals and protective coatings are used extensively to maintain product condition. However concerns must be expressed about the effectiveness of our quality control system given recent difficulties faced by our industry.

In 1985 we had the worst record for claims against mould and stain that the industry had faced for several years. By coincidence, at that same time the industry was forced to change suppliers for their chlorophenols due to product discontinuation by their normal source. Immediately everyone suspected that the chemical formulation from the new supplier was at the root of the increased stain and mould. After extensive field surveillance by Forintek and COFI, it was found that in all cases the cause of the severe mould and stain problems were inadequate application of anti-stain chemical! The quality surveillance system had simply not ensured adequate treatment was taking place.

In addition to the stain and mould problems encountered, the industry is constantly struggling with checking in clear grades, timbers and cut stock. Burlap, end paint, and a few other protective methods used in the past are now being recognized as inadequate. New products are available to deal more effectively with these problems but a vigilant system of quality surveillance will be needed to ensure ongoing effectiveness.

ACTIVITIES AT PLANER AND PACKAGE QUALITY

Quality control activities in and around the planer remain an important area of focus. Issues such as surface quality, grade accuracy, trim loss, grade stamping, product recovery, moisture problems, and general manufacturing quality all can be examined at this point. Normally the last convenient area to get a good look at your product, the planer should be an important check point in the lumber manufacturing process.

Package presentation is really a company's signature on its product. The way a package of lumber appears including the merchandising techniques and care of presentation give a strong message to customers of how you regard your product. Items such as end and side squeezing, strapping, sticker and dunnage placement, stencilling, end painting, brightness, and protective coverings all should be considered in a systematic quality control program.

COMPREHENSIVE QUALITY CONTROL

Activities associated with traditional quality control although all very important, have tended to focus on areas outside of the sawmill. Usually one would find a quality control supervisor examining and analyzing the product once it had departed from the sawmill. However, there are many gains to be made through systematic and comprehensive quality control which guides the entire manufacturing process beginning at the log pond or log yard. These gains can be generally categorized under three headings: Grade recovery, lumber recovery through improved conversion techniques, and lumber recovery through size control.

GRADE RECOVERY

In the coast region of British Columbia prior to 1980, approximately 12% of total Hemlock production was extracted as Shop and Better. Given a concerted effort to improve this percentage over the last six years, the level has been increased to 19-21% of total production. A future target of 30% has been set and it is believed that a true potential of 35% exists.

The key ingredient in clear fiber extraction in the sawmill is proper attention to lumber conversion practices. Let us examine some of the principal areas of the mill where opportunities are missed.

1) Headrig: Obviously the headrig is one of the pivotal machine centers in terms of clear recovery. Proper conversion techniques applied here will ensure a maximum potential for downstream recovery of high grade lumber.

Probably the greatest source of missed opportunities at this center is insufficient use of full taper settings. If no taper or insufficient taper is used in sawing larger clear logs there is little likelihood of extracting these products downstream. The sawyer must saw round and round the log using full taper settings thereby removing clear fiber in the longest lengths and widest widths possible. The natural taper in the log can be removed in the lower grade position at the center of the log.

The greatest opportunity for clear recovery when sawing round and round, is on the fourth face of the log. Both thin and heavy clears removed at this point will contain two sawn edges and will require little if any further manufacturing to be placed on order. Any clear extracted prior to this face will require at least one further machine center in order to extract a final product. As well, one would normally expect the further processing required would be at a machine less likely to provide the optimum taper capability of the headrig.

A common error among sawyers is to discontinue use of full taper settings before sawing all four faces of the log. This practice is exactly the same as not applying any taper settings at all. What happens is that the taper instead of being removed on the first two faces, is simply removed on the last two faces. Although his intentions are good, the sawyers results in this case, are poor.

Another common source of loss at the headrig is heavy slabbing. Removing inordinately heavy slabs guarantees downstream losses. A heavy slab is very difficult for any downstream operator to process accurately. In addition one must acknowledge that slabs are not lumber. Any operator at a work station in a sawmill has a lower regard for slabs than he does for fully sawn lumber. For that reason a slab is more likely to be treated casually and processed poorly (or even chipped) in spite of the fact that this item has the highest potential for clear fiber recovery of any lumber circulating in the mill.

Another source of missed opportunity at the headrig is the failure to saw deep enough for all the clear. The impatience to drop a backstand too early will often show up in the number of clear faces one can find when inspecting the timbers piled in a producer's yard. This common practice is not defendable and results in a much lower sales realization in many large log mills.

2) Edger/Trimmer: A further opportunity exists for grade separation at downstream machine centers such as the edger or trimmer. However, it is initially important that the operator can recognize each piece that will yield an increased value through further processing. Proper operator training and smooth machine center flow will greatly facilitate these gains.

In addition to grade separation, a conscientious effort to reduce overedging, overtrimming, etc., will provide optimum value. Again this requires operator training and close supervision.

3) Sawmill Grading: Losses associated with poor sawmill grading have already been alluded to earlier. This factor can contribute to huge losses each year in our industry. Extensive training on an ongoing basis is required for people in this area and the potential payback is very short and very large.

LUMBER RECOVERY: SAWMILL PRACTICES

Exclusive of grade recovery there are enormous gains to be made in increasing lumber recovery simply through better sawmill practices. What follows are several summary findings of losses surveyed at machine centers in our coast sawmills.

Number of machine centers surveyed in brackets.

LOG BUCKING LOSSES

	Water (5)	Mill (6)
Bucked wrong	36%	20%
FBM loss per year	8,064,657	5,671,250
$ loss per year	$ 2,419,397	$ 1,701,300
Avg. loss per mill	$ 483,879	$ 283,550
Worst mill	$ 725,819	$ 921,538

EDGING LOSSES

	Edger (24)	Pony (5)
FBM loss per year	16,246,000	1,838,000
$ loss per year	$ 4,873,800	$ 551,400
Avg. loss per mill	$ 203,075	$ 110,280
Worst mill	$ 662,024	$ 135,644

2.4% loss of production

AUTO TRIM LOSSES (12)

FBM loss per year	9,531,250
$ loss per year	$ 2,859,375
Avg. loss per mill	$ 238,281
Worst mill	$ 416,992

1.8% loss of production

These few examples serve to demonstrate the magnitude of losses in our mills even without consideration for increasing grade recovery. A concerted effort to improve lumber recovery through better sawmill practices will definitely yield improved returns.

PRODUCTION VERSUS VALUE

One could hardly argue that production is not important in the sawmill. Production is the foundation for profit and is essential for survival. However, of all the outputs from a sawmill, production is the easiest to measure and invariably becomes the focus when measuring performance. What one must prevent is such an overemphasis on production that grade and lumber recovery are continually sacrificed to meet production goals. In sum, there is always a need to balance production, grade, and lumber recovery in a mix that provides the greatest profit.

To illustrate the above point the following model is provided showing the potential for gain through a better balance.

CASE 1

SAWMILL IMPROVEMENT OPPORTUNITIES (1986)

Sawmill Production Per Shift.....:	200 MBM
Sawmill Lumber Recovery Factor....:	230 FBM/Cubic Meter
Total Log Usage.....:	870 Cubic Meters

PRODUCTS PRODUCED (BY PERCENTAGE)

3" & Thicker		Timbers.....	15%
- #3 Clear & Btr....:	5%		
- #4 Clear.....:	2%	Export #2 Merch...:	20%
- Factory.....:	1%	Export #3 Common..:	8%
Under 3" Thick		S4S #2 Struct.....:	23%
- #3 Clear & Btr....:	4%	S4S #3 Struct.....:	11%
- #4 Clear.....:	2%		
- Shop.....:	1%	Other Products....:	8%

BASE CASE

Total log cost.....:	$ 34,800
Total Operating Costs.....:	$ 18,000
Total costs.....:	$ 52,800
Gross product value.....:	$ 56,460
VARIANCE.....:	$ 3,660

This base case provides $3,660 available for profit given the level of production, L.R.F., and grade mix shown. Case 2 demonstrates the opportunity by increasing production by 10%, from 200 MFBM per shift to 220 MFBM. As you can see below, there is an increased profit potential of 59% over the base case.

CASE 2

SAWMILL IMPROVEMENT OPPORTUNITIES (1986)

Sawmill Production Per Shift.....:	220 MBM
Sawmill Lumber Recovery Factor....:	230 FBM/Cubic Meter
Total Log Usage.....:	957 Cubic Meters

PRODUCTS PRODUCED (BY PERCENTAGE)

3" & Thicker		Timbers.....	15%
- #3 Clear & Btr...:	5%		
- #4 Clear.....:	2%	Export #2 Merch...:	20%
- Factory.....:	1%	Export #3 Common..:	8%
Under 3" Thick		S4S #2 Struct.....:	23%
- #3 Clear & Btr...:	4%	S4S #3 Struct.....:	11%
- #4 Clear.....:	2%		
- Shop.....:	1%	Other Products....:	8%

	Base Case	Case 2
Total log cost.....:	$ 34,800	$ 38,280
Total Operating Costs..:	$ 18,000	$ 18,000
Total costs.....:	$ 52,800	$ 56,280
Gross product value....:	$ 56,460	$ 62,106
VARIANCE.....:	$ 3,660	$ 5,826 (59%)

In Case 3 we have chosen to reduce our production by 5% from 200 MFBM per shift to 190 MFBM, but have succeeded in improving our grade mix. In this case the margin available for profit improves by 80%.

CASE 3

SAWMILL IMPROVEMENT OPPORTUNITIES (1986)

Sawmill Production Per Shift.....:	190 MBM
Sawmill Lumber Recovery Factor....:	230 FBM/Cubic Meter
Total Log Usage.....:	826 Cubic Meters

PRODUCTS PRODUCED (BY PERCENTAGE)

3" & Thicker		Timbers.....:	12%
- #3 Clear & Btr..:	7%		
- #4 Clear.....:	4%	Export #2 Merch...:	17%
- Factory.....:	2%	Export #3 Common..:	8%
Under 3" Thick		S4S #2 Struct.....:	19%
- #3 Clear & Btr..:	6%	S4S #3 Struct.....:	11%
- #4 Clear.....:	3%		
- Shop.....:	3%	Other Products....:	8%

	Base Case	Case 3	
Total log cost.....:	$ 34,800	$ 33,040	
Total Operating Costs..:	$ 18,000	$ 18,000	
Total costs.....:	$ 52,800	$ 51,040	
Gross product value....:	$ 56,460	$ 57,590	
VARIANCE.....:	$ 3,660	$ 6,550	(80%)

If a mill is running up to capacity, it is unlikely that a 10% increase in production can be achieved without sacrifice. Likely what will occur will be a reduction in LRF even if grade outturns can be maintained. It is therefore prudent to adjust the recovery stated in Case 2 to reflect this. If we reduce the LRF to 225 from 230 our increased margin for profit then reduces to 36%.

CASE 4

SAWMILL IMPROVEMENT OPPORTUNITIES (1986)

Sawmill Production Per Shift.....:	220 MBM
Sawmill Lumber Recovery Factor....:	225 FBM/Cubic Meter
Total Log Usage.....:	978 Cubic Meters

PRODUCTS PRODUCED (BY PERCENTAGE)

3" & Thicker		Timbers.....:	15%
- #3 Clear & Btr.....:	5%		
- #4 Clear.....:	2%	Export #2 Merch...:	20%
- Factory.....:	1%	Export #3 Common..:	8%

Under 3" Thick		CLS #2 Struct.....:	23%
- #3 Clear & Btr.....:	4%	CLS #3 Struct.....:	11%
- #4 Clear.....:	2%		
- Shop.....:	1%	Other Products....:	8%

	Base Case	Case 4
Total log cost.....:	$ 34,800	$ 39,120
Total Operating Costs..:	$ 18,000	$ 18,000
Total costs.....:	$ 52,800	$ 57,120
Gross product value....:	$ 56,460	$ 62,106
VARIANCE.....:	$ 3,660	$ 4,986 (36%)

By slowing our mills down a little it is also likely that we will increase out LRF. If more time is spent in processing each log there will be not only a greater opportunity to increase grade but also to increase volume recovery. For argument sake, then, let us examine the effect of increasing the recovery from 230 FBM/m^3 to 235 FBM/m^3 along with the improved grade outturn. The improvement potential now becomes 98% over the base case!

CASE 5

SAWMILL IMPROVEMENT OPPORTUNITIES (1986)

Sawmill Production Per Shift.....:	190 MBM
Sawmill Lumber Recovery Factor....:	235 FBM/Cubic Meter
Total Log Usage.....:	809 Cubic Meters

PRODUCTS PRODUCED (BY PERCENTAGE)

3" Thicker		Timbers.....:	12%
- #3 Clear & Btr...:	7%		
- #4 Clear.....:	4%	Export #2 Merch...:	17%
- Factory.....:	2%	Export #3 Common..:	8%
Under 3" Thick		CLS #2 Struct.....:	19%
- #3 Clear & Btr...:	6%	CLS #3 Struct.....:	11%
- #4 Clear.....:	3%		
- Shop.....:	3%	Other Products....:	8%

	Base Case	Case 5
Total log cost.....:	$ 34,800	$ 32,360
Total Operating Costs..:	$ 18,000	$ 18,000
Total costs.....:	$ 52,800	$ 50,360
Gross product value....:	$ 56,460	$ 57,589
VARIANCE.....:	$ 3,660	$ 7,229 (98%)

This sample model serves to make an important point. When our mills are operating at maximum capacity, is enough attention being paid to balancing production, grade, and volume recovery?

THE VALUE OF SIZE CONTROL

No discussion of sawmill improvement would be complete without mentioning size control. The systematic monitoring of lumber sizes can provide good returns both in terms of trouble shooting processing problems and in reducing mill target sizes. The following points illustrate some of the benefits:

1) Prevents operating "out of control"
2) Improves awareness of all sawmill personnel
3) Improves sawmill maintenance programs
4) Provides valuable feedback to filing room
5) Reduces lumber processing costs
6) Improves LRF through reduced target sizes

The value of improved LRF cannot be overstated. Using a sawsim analysis of an interior sawmill producing SPF dimension the following data was gathered:

SAWSIM - LOG BREAKDOWN SIMULATION

VALUE OF TARGET SIZE REDUCTION

	Base Case	1/16"Red Width	1/16"Red W & T
Total logs/shift.....:	2,000	2,000	2,000
Total cubic feet/shift.....:	22,520	22,520	22,520
Lumber pieces/shift.....:	10,240	10,320	10,480
Total FBM/shift.....:	165,440	166,780	170,260
Total MBM/year (450 shifts)..:	74,448	75,051	76,617
Total dollar value (x 1000)..:	$ 14,890	$ 15,051	$ 15,323
Dollar improvement.....:		$ 120,000	$ 433,000

In a mill producing above 75 MMFBM per year, a reduction in target size of 1/16" provided an increased opportunity of almost a half a million dollars!

PRODUCTION AND PROFIT

We must provide sufficient volume of production in order to balance fixed operating costs. However, at that point further gains in production must be tempered with a focus on both grade recovery and LRF. Such a focus requires a commitment to systematic and comprehensive quality control.

This means going beyond traditional practices and instilling the knowledge in our workforce of what it takes to optimize value. Production is not the key to our success, quite simply it is PROFIT.