LUMBER DRYING: AN OPPORTUNITY FOR IMPROVING PROFITABILITY

James A. Hallstrom
Decision Dynamics, Inc.
Portland, Oregon

Introduction

The lumber drying area is a very profit sensitive part of a total sawmill operation. With effective monitoring and management control of this area, opportunities for profit improvement can be readily identified and captured.

However, historically, management has not spent much time analyzing and improving the lumber drying area. Rather, management time and capital have gone into analyzing and improving the sawmill operation from log processing to the green chain. There are many good reasons for management to spend time and capital in these areas. Recovery and production improvements are substantial from the use of new technology and modern equipment. More accurate machinery, thinner sawkerfs, and machinery with process control to fully automate or assist operators in the decision making process have an excellent payback from the investment standpoint. And further, management has an easy time justifying capital expenditures for new equipment in the mill because the numbers are readily available.

Management's lack of attention to the lumber drying segment of the sawmill operation has resulted from many factors. First, the dry kiln suffers from the "Black Box" syndrome. Management has difficulty relating to the lumber drying process because of a lack of experience and typically, managers feel they have little or no control over this operation. Secondly, there have been few technological improvements in the last 20 years to justify capital expenditures in the lumber drying area. Thirdly, figures to justify new equipment purchases or changes in drying procedures are difficult to accumulate and analyze.

Typically, lumber drying is a process that degrades its raw material. The goal of the drying process is, therefore, to minimize the degrading or maintain the value of the raw material at its highest levels and meet the moisture content specifications. Through systematic monitoring and reporting of critical information, improved procedures can result in increased profitability. Also, the analysis of this critical information will help management justify expenditures on new equipment that will improve profitability.

Opportunities in Lumber Drying

Three opportunities for increased profitability from improvements in the lumber drying process are:

1. Degrade losses--Degrade losses that occur between the rough green form and the surfaced dry form of lumber can have a significant effect on the value of the end product.

The value difference associated with degrade losses between rough green and dry surfaced is illustrated in Table I and II. Table I is an example of Rocky Mountain Pine 2X6 COMMON material and Table II is an example of Rocky Mountain Pine SHOP material.

TABLE I

Rocky Mountain Pine 2X6 Grade Development

	Rough, Green Gradeout		Surfaced, Dry Gradeout	
	%	Price*	%	Price*
No.2+Btr Dim.	86	$255	60	$255
3 Common	6	160	19	160
4 Common	6	135	19	135
5 Common	2	100	2	100
Average		$239		$211
Difference			$28	

*September 1979 Prices

TABLE II

Rocky Mountain Pine Grade Development
Upper Grade Lumber

	Rough, Green Gradeout		Surfaced, Dry Gradeout	
	%	Price*	%	Price*
Moulding + Btr	36	$750	15	$750
No.1 Shop	15	540	4	540
No.2 Shop	28	475	40	475
No.3 Shop	18	270	33	270
Shop Outs	3	160	8	160
Average		$537		$426
Difference			$111	

*September 1979 Prices

The lower grade distribution in the surfaced dry form for both the COMMON and SHOP material was primarily the result of three factors:

1. Drying defects
2. Machining defects
3. Grader errors

It is important for every mill to identify and analyze degrade losses occurring between the rough green and surfaced dry form. The opportunities may not be as large as the $111/MBM difference indicated in Table II, but the potential for improvement will likely be worth pursuing. Mill management should not expect to eliminate degrade losses completely, but if degrade losses could be reduced an average $5/MBM on a total mill production of 50 MMBM, a $250,000 annual profit improvement would result.

2. Sticker Stacking--Sticker stacking quality can have a significant impact on the value of the end product. The value of lumber degrade losses associated with poor sticker stacking and other causes at a coast hemlock mill are included in Table III. The lumber was stacked and stickered from a hand pull green chain.

TABLE III

Lumber Degrade Caused by Seasoning Defects
Coastal Hemlock Sawmill

Before Sticker - Stacker Installation

Item	Actual Grade	Potential Grade	Percent Degraded	Degrade Cost ($/MBM)
2X4	Utility	Std+Btr.	19.7	$19.70
2X4	Economy	Std+Btr.	24.7	49.40
2X6	Economy	No.2+Btr.	35.3	43.24
2X8	No. 3	No.2+Btr.	24.5	22.05
2X8	Economy	No.2+Btr.	39.7	55.38

The figures indicate a significant percentage of NO.2 (STD) & BTR material (19.7 to 35.3 percent) was degraded to NO.3 (Utility) or ECONOMY. The cost of the degrade ranged from $19.70/MBM to $55.38/MBM for the items graded. After an automatic sticker-stacker system was installed the degrade cost was reduced to $8.94/MBM (see Table IV).

TABLE IV

Lumber Degrade Caused by Seasoning Defects
Coastal Hemlock Sawmill

After Sticker - Stacker Installation

Item	Actual Grade	Potential Grade	Percent Degraded	Degrade Cost ($/MBM)
2X6	Economy	No.2+Btr.	7.3	$8.94

If we assume degrade and trim losses associated with poor stickering could be reduced by $3/MBM, the annual profit improvement potential on a 50 MMBM operation would be $150,000.

3. Moisture Content Control--The average moisture content (MC) and moisture content distribution has a significant effect on the value of the end product and the recovery level of a mill. First, MC distribution and average MC directly affect the size distribution of the material from the dry kiln. This is illustrated in Chart I. The lower the moisture content the higher the total shrinkage. The following example shows the impact of a 5 percent change in MC on the green target size, if other factors determining size remain constant.

	Average MC 15%	Average MC 10%	Difference
Dry & Surfaced Size	1.500	1.500	
Shrinkage	.082	.109	.027
Sawing Variation	.028	.028	
Planing Allowance	.080	.080	
	1.690	1.717	.027

This .027 inch amounts to approximately a 1.5 percent improvement in recovery on this size of material. If a mill processed 40 MMBM logs annually with an average log cost of $250/MBF the 1.5 percent improvement would translate to a $150,000 log cost savings per year. Secondly, raising the average MC will also reduce degrade and trim losses caused from splits, twist, warp and other drying defects. This has been documented by Mr. Ed Williston in studies at the Weyerhaeuser Company. Thirdly, as indicated in Chart II, the MC distribution will become narrower when the average MC is increased. This will reduce the variation in size due to shrinkage, therefore, reduce skip and trim degrade losses. Moisture content in the dry kiln is analogous to sawing variation in the mill, as it relates to controlling lumber sizes.

Changing Economics

The changing economics in the forest products industry over the past ten years requires each mill manager to reevaluate his policies and procedures on an ongoing basis. Log costs have doubled and/or tripled in the last ten years in some areas. Log costs are becoming a higher percentage of the total cost of goods sold every year. This means it is becoming increasingly more important to maximize volume and grade recovery and minimize degrade losses.

Another aspect of the changing economics is the relative value difference between common and upper grade material. Chart III illustrates this fact very well. Question--Can you afford to have the same drying degrade percentage associated with your upper grade material, today, that you had three years ago? The answer, in most cases, should be, NO.

The current price relationship between commons and upper grade material indicate lowering the degrade percentage on upper grade material would be more profitable. More emphasis should be made to control defects (excessive skip, warp, etc.) that degrade upper grade material into commons.

Another important part of management control over any aspect of the operation is staying abreast of new technology. New technology needs to be evaluated as soon as it can be economically justified.

Significant advances in kiln monitoring devices have been made in the last few years. The use of in-kiln probes has helped operators better control the drying process. The new kiln controllers with microprocessor technology coupled with in-kiln probes has further helped the kiln operator do a better job.

It is also important to stay aware of research in alternative drying method. Methods such as dehumidification, radio-frequency, vacuum, and solar drying may not be economical now, but one of them could be in the near future.

How to Identify and Capture Opportunities

First, I would like to relate the experience a mill had while working to improve the lumber drying area of their operation over a three-year period. They did all of the following:

- Hired drying consultants
- Had kilns inspected and reinspected
- Monitored air flow
- Monitored moisture contents by kiln and charge
- Made some mechanical improvements
- Implemented revised drying schedules

Although this mill did all of the above, management did not feel they had made any significant progress. They made some improvements, but were unable to measure the results for two main reasons. First, they failed to specifically define the objectives of their improvement program (i.e. - 1. Reduce steam consumption, 2. Reduce drying schedules, 3. Reduce drying degrade). Secondly, they failed to well document their base case situation. This in itself made it impossible to measure how much improvement had been made.

The following are procedures that will help obtain desired results from a lumber drying improvement program. This should not be considered the only way to design an improvement program, but it will give better results than those described previously.

1. Identify specific problems or opportunities.
   Examples:
   - Mechanical - fans, vents
   - Structure - doors, walls, baffles
   - Steam supply - adequate, consistent
   - Stacking quality - sticker alignment
   - Piling quality - load position
   - Degrade or falldown percentage
2. Quantify opportunities.
3. Set priorities - Establish order to pursue opportunities.
4. Establish Action Plan with objectives and method to capture a specific opportunity.

5. Perform sufficient testing and analysis to describe the base case situation as the first step in the action plan.
6. Establish a monitoring system to document improvement during and at the end of a particular improvement project.

Conclusion

There are significant opportunities in the lumber drying area for improving overall mill profitability. The changing economics of the forest products business indicate improved management control in the lumber drying area will pay big dividends. Specific opportunities to reduce degrade losses, which result in improved volume and grade recovery, can potentially amount to $100,000 or more a year. A systematic approach should be used to identify and evaluate each drying opportunity. This will help insure that a lumber drying improvement project design to capture a specific opportunity will result in bottom-line improvement.

CHART I

LUMBER SHRINKAGE

MILL TARGET SIZE 1.69 IN.

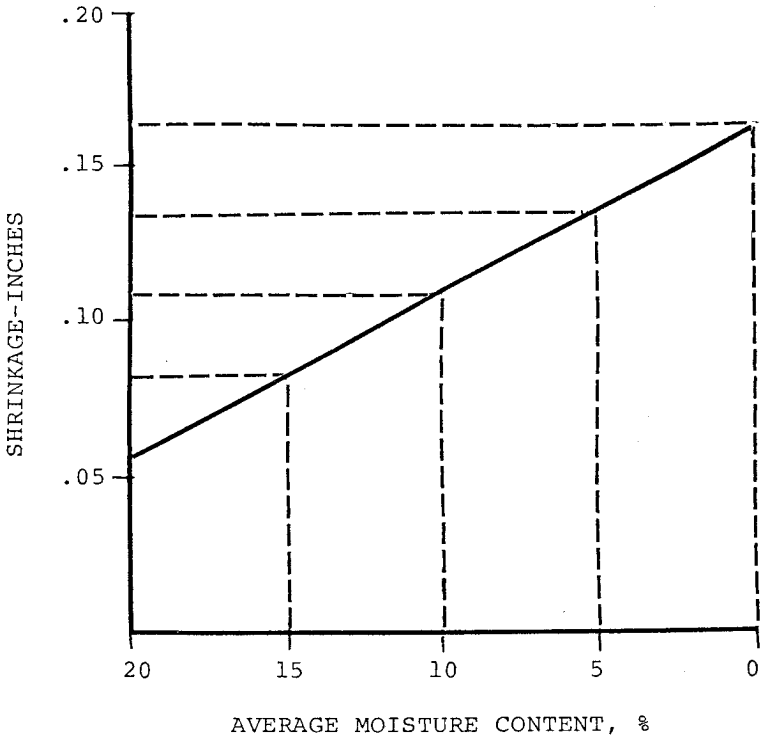

CHART II

DISTRIBUTION OF BOARDS
BY MOISTURE CONTENT.

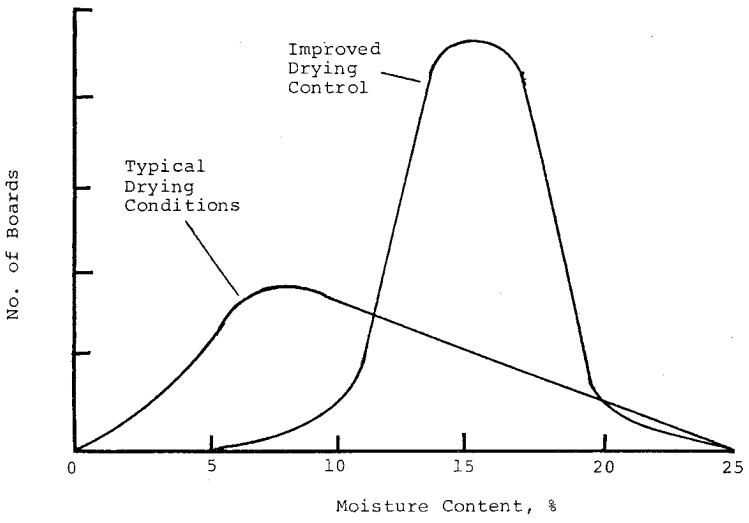

CHART III

HISTORIC PRICES
1970-1979
PONDEROSA PINE