

A COMPUTERIZED LUMBER MOISTURE CONTENT DATA GATHERING AND ANALYSIS SYSTEM

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1. Why we needed something

As labor and equipment costs have increased, the lumber industry has modified its log breakdown and lumber sorting systems to gain offsetting economies. We have eliminated our green chains, proceeded to live log sawing, decreased our green lumber inventories, and increased our production volumes and the number of species produced until we no longer have the ability to segregate our lumber into sorts of similar drying characteristics.

This trend toward automation has greatly increased the variability of our green lumber moisture content and given us sorts of widely variable drying rates. We have now added to the inherent moisture content variability in our lumber.

1. Boards with combinations of heart, sap, sinker, and/or water core.
2. The inability to separate even the fewer number of sorts that we still develop.
3. The inability to compose full kiln charges of any one drying characteristic even if we could sort it.
4. Pressure to decrease drying times to meet increased production.
5. Non-uniform drying conditions between and within kilns.

The enormous variability of the lumber that any seasoning department is expected to dry uniformly has increased the number of samples and the frequency of sampling necessary to get reliable data to such an extent that accurate measurements by a conventional method has become impractical. Two choices then remain; lower the reliability of the measurements or develop an unconventional system. We have chosen to develop the latter.

By assembling available electronic components, we have coupled an inline "power loss" moisture meter with a mini-computer. The resulting output can give us an instantaneous description of the lumber we have dried. With this type of information, we can modify our schedules, make recommendations for process improvements, detect malfunctioning equipment, improve our drying techniques, improve our drying uniformity, and monitor our product quality.

We have just put this system "on-line" at our Rutledge unit in Coeur d'Alene, Idaho, where we are using it in conjunction with a general drying improvement program covering all of Potlatch's Idaho mills. The unit is currently installed on the dry chain following the unstacker. The lumber progresses sideways, and we are able to measure a section 18 inches long by the width of the board. Future

plans include installation of the computer on the surfacers where we will be able to measure the full width every 6 inches along the length of the board.

II. What was needed

We began sampling data with a hand-held resistance moisture meter, rapidly progressed to a strip chart recorder coupled to an in-line power loss meter, and just as rapidly became swamped with data. It became obvious that an automated system was necessary.

When selecting this system, we realized that we would need something capable of handling very large volumes of data easily and accurately. The system would also have to be capable of taking multiple readings on each board traveling in excess of 400 fpm. We realized that in order to use the system efficiently, we must understand what the meter is actually measuring and what part of this data the computer was working with. The system would have to be capable of providing a permanent record of the data and of analyzing and printing it upon request.

The system selected would also have to be versatile enough to be adaptable to other electronic measuring instrumentation. It would have to be portable enough to install at any location equipped with a meter within any mill and be transportable enough to install at any of our mills in a short hook-up and debugging time.

III. What we have

During a visit to the Oregon State University lab we became aware of a system using a computer, similar to the one we eventually purchased, to monitor and record air velocities and temperature from thermocouples.

We began examining moisture monitoring systems in detail and we settled upon a Wagner inline "power loss" moisture meter coupled with a Hewlett Packard 9825-A calculator based computer. All interface gear and adaptors were also produced by Hewlett Packard.

The system we chose lends itself well to research applications. The computer is desk mounted, and is easily moved and used at any of our mills that is equipped with the Wagner moisture meter. We calibrate the program to the meter and can monitor and analyze the moisture contents of the dry lumber loads as fast as they can be unstacked without disturbing the production system.

IV. What it will do

We presently have a program that will allow us to analyze each kiln cart in cross section. We are perfecting a program that will allow us to look at a complete kiln charge lengthwise.

To provide additional storage capacity, we have a "floppy disc" recorder that will store the data from 120 kiln carts of 1800 boards per cart.

The system presently records the highest 3" wide average moisture content on the board cross-section as seen by the moisture

meter. We currently take a reading every 1/2 inch, but we have the capability of recording as often as every 1/16 inch. When we switch to the planer installation, we plan to record a measurement taken every 6 inches along a board moving at 350 fpm. The data will be available almost immediately upon completion of the load.

The reliability of the system is dependent upon the calibration of the meter. We initially correlated the meter readings with oven dry samples to check its potential. The meter is calibrated in the field with a hand-held resistance moisture meter.

We can obtain almost any type of data analysis and printout desired. The present printout, as shown in Figure 1, contains the following:

1. bar graph of distribution
2. average MC of boards in range
3. standard deviation of boards in range
4. number of boards in range
5. number of boards over range
6. printout of MC class of each board in the location in which it was dried. The printout uses a (-) for boards less than 10% MC, and (=) for boards between 10 and 19% MC, and a (xx) for boards greater than 19% MC.

We also have a program that can print the MC in the location of the board.

V. How it works and how we will use it

Data collection in the lumber handling system is illustrated in Figure 2. Dry lumber comes from the kiln, still on stickers, to the unstacker where it is marked with a reflective chalk. It is unstacked and travels down the incline belt. Boards pass through the moisture meter on the sorting table at about 54 feet/minute where its moisture content is recorded by the computer.

An alternative use is also illustrated. The lumber is transported in close piles to the surfacer infeed and is monitored as it travels out of the surfacer at about 400 fpm. At our other mills not equipped with a dry chain, the kiln carts are unstacked and surfaced in one step. We are monitoring the MC of the boards and marking boards of the moisture content desired for our specialties operation.

Figure 3 diagrams the components of our computerized system, which operates as described in the following paragraphs.

Electric eye #1 looks for the reflective marks on the end of the board. When the light is returned, a signal is put out by the "Event Sense Card" in the multiprogrammer. When the electric signal is returned, an event is signalled telling the calculator that a new course has started.

Electric eye #2 looks for the board. When the light is not reflected by the mirror, an event is signalled telling the computer that a board is in the meter. The computer then accepts the voltage from the electronic (power-loss) Moisture Meter. When a board enters the meter's radio frequency field, the field is interrupted and some of the

power is absorbed. The internal meter circuitry converts the power "lost" to a voltage. The meter itself then measures the voltage.

The Hewlett Packard "calculator-based computer" records and analyzes the data.

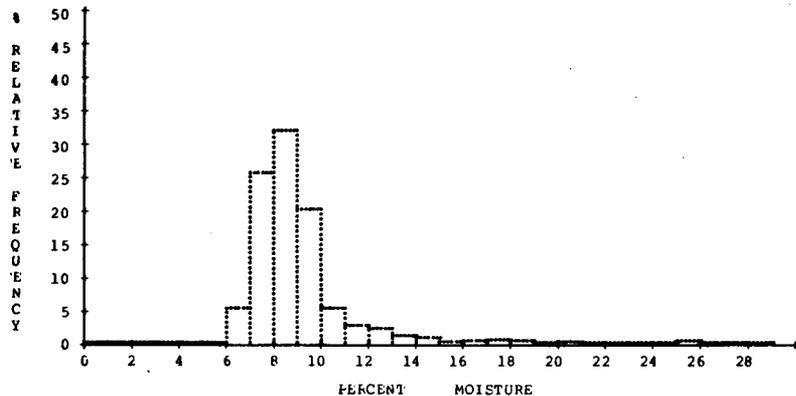
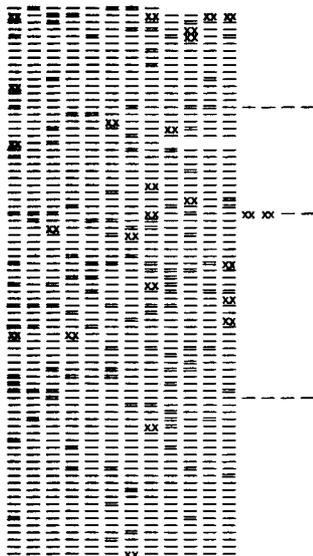
The interface gear converts the voltage from the meter to a digital number that the computer can work with. The interface cards act as interpreters between the computer and its peripherals.

When the program demands either the data or the analyzed results, it may be printed and plotted by the printer.

The data is stored on a floppy disc until an opportunity to analyze and print it arises. A single disc can store up to 216,000 measurements - the number of boards for the unstacker application. The computer can call up any data point in any load for examination.

Figure 1

SAMPLE DATA PRINTOUT



CELL	R. FREQ.	FREQ.	CELL	P. FREQ.	FREQ.	CELL	R. FREQ.	FREQ.
1	0.00	0	11	5.32	50	21	0.21	2
2	0.00	0	12	2.66	25	22	0.11	1
3	0.00	0	13	2.13	20	23	0.11	1
4	0.00	0	14	1.17	11	24	0.11	1
5	0.11	1	15	0.85	8	25	0.11	1
6	0.11	1	16	0.21	2	26	0.32	3
7	5.32	50	17	0.32	3	27	0.00	0
8	25.65	243	18	0.53	5	28	0.00	0
9	32.23	303	19	0.32	3	29	0.00	0
10	20.21	190	20	0.00	0	30	0.11	1

MEAN	(<30)	8.97	UNDEF 10%	83.8%	788	FUTLEDGE
S	(<30)	2.34	CVLF 19%	2.7%	25	5/19/77
N	--	940	CVLF 30%	1.6%	15	LOAD 1E

CDR B" 11/16
 KB-L6
 2-34615-A

Figure 2

UTILIZATION OF OUR COMPUTERIZED LUMBER
MOISTURE CONTENT DATA ANALYSIS SYSTEM

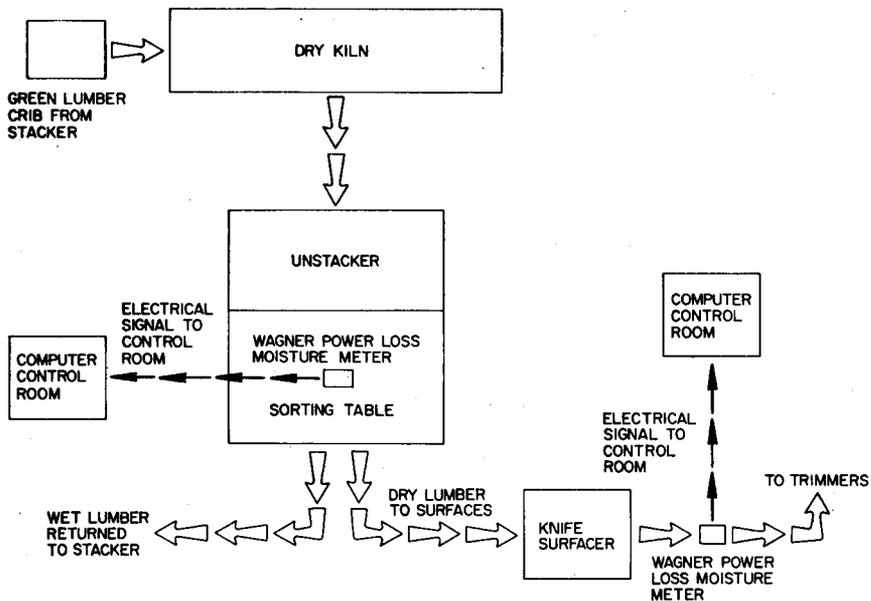


Figure 3

COMPONENTS OF OUR COMPUTERIZED LUMBER MOISTURE
CONTENT DATA GATHERING AND ANALYSES SYSTEM

