PRELIMINARY EVAULATION OF ELECTRONIC MEASUREMENTS FOR PRESORTING HEM-FIR DIMENSION LUMBER

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Optimum kiln drying of hem-fir dimension lumber requires segregation of green boards into three sorts: Sapwood, normal heartwood, and sinker heartwood. Each board sort must then be dried separately because kiln charges with mixed wood types will have an unacceptable range of board moisture contents at the end of a conventional drying cycle. When sapwood boards have reached an average MC of 15%, most sinker boards will still be above the allowable maximum MC of 19% while normal heartwood boards will be overdried and subject to planer breakage. Presorting green hem-fir dimension lumber is desirable but not currently feasible at high-production mills because it must be done visually by experienced lumber handlers who need to turn each board on the green chain.

A laboratory study was initiated to evaluate the accuracy of electronic techniques for use in the commercial presorting of green hem-fir dimension lumber. Seven different types of electronic instruments were tested on green sapwood, heartwood, and sinker heartwood in short-length board samples from western hemlock (Tsuga heterophylla) and white fir (Abies concolor). The electronic tests are divided into three groups: conductance tests, dielectric tests, and longitudinal stress-wave tests.

Conductance Tests

These tests were made with a battery-powered ohmmeter which measures resistance to a pulsed-electric current provided by an FET transistor (Shigometer Model No. 7950). Resistances were measured with needle electrodes driven into the surface of the boards. All resistance measurements in sapwood were greater than 60 Kohms while 99% of sinker heart resistances were less than 50 Kohms. Heartwood resistances were generally in the sapwood range but there was some overlap with sinker heart and 29% of heartwood resistances ranged from 20 Kohm to 60 Kohm. Pulsed-current resistance measurements are capable of distinguishing sapwood from sinker heart in most boards of green hem-fir lumber.

Dielectric Tests

Four different dielectric moisture meters were used for these tests. All meters were portable and used surface contact electrodes that did not penetrate the wood. Two meters are of the power-loss type, one is the capacitance type and the fourth meter is the capacitance admittance type. Green moisture contents ranged from 35 to 80% for heartwood samples and were greater than 90% for both sapwood and sinker samples; yet neither the power-loss nor the capacitance meters could measure significant

differences among the three wood types. The capacitance admittance meter readings were similar for sapwood and sinker heart and averaged four units lower for heartwood. The four dielectric moisture meters used in this study are not capable of presorting green hem-fir lumber on a commercial scale, but the capacitance admittance type can probably be redesigned to accurately distinguish heartwood boards from sapwood and sinker boards.

Longitudinal Stress-wave Tests

Electronic timers were used to measure the velocity of stress waves that were generated along the grain by two different methods, namely: ultrasonic pulses and mechanical impact. It took significantly shorter times for both ultrasonic and impact stress waves to travel through heartwood than through sapwood and sinker heart. Stress-wave transit times were similar for sapwood and sinker heart. Measurements of longitudinal stress waves should be applicable for commercial presorting of green hem-fir heartwood boards from sapwood and sinker boards.

These laboratory tests indicate that it may be feasible to use conductance and stress-wave measuring devices for commercial segregation of green hem-fir dimension lumber into three separate drying sorts. Additional tests will be conducted in the field on standard length lumber to verify results from these tests. The experimental procedure will be to separate heartwood boards from sapwood and sinker heart boards on the basis of longitudinal stress-wave measurements. Sapwood boards will then be separated from the sinker heart boards using measurements of pulsed-current resistances. All sample boards will be kiln dried to evaluate the effectiveness of the electronic measuring techniques.