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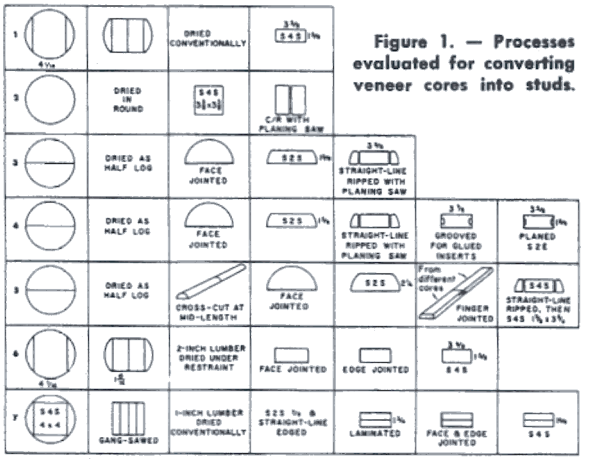

Figure 1. — Processes evaluated for converting veneer cores into studs.

Straight Studs from Southern Pine Veneer Cores and Cordwood

AN ECONOMICALLY feasible system has been developed for converting southern pine veneer cores into straight 8-foot studs (2). Prototype studs — two per core — were 100 percent SPIB Stud grade and better.

The developmental research, performed at Alexandria, La., evaluated seven alternative processes for converting the cores, which typically are low in specific gravity and contain large amounts of juvenile and compression wood. The distortions occurring in the finished studs with changes in relative humidity were measured, and several post-machining brush or dip treatments were tested for effectiveness in preventing crook.

Studs from all seven processes were evaluated for strength and elastic modulus in flatwise bending, edgewise bending, full-length compression, and full-length tension; regression relationships were calculated. Strengths proved more than adequate for loads normally imposed on studs.

The process that appears to have the greatest commercial applicability consists of center-ripping the green core, blanking out a stud from each half-core on a chipping surfacer-edger (3), kiln-drying the oversize blanks, and then removing all drying distortions by facejointing followed by thicknessing and straightline ripping.

The process is also applicable to the conversion of 8-foot bolts of southern pine (and perhaps lodgepole pine) in diameters ranging from 5-1/4 to 6-3/4 inches inside bark (4).

With slight modification, that is, fabrication of a fingerjoint at midlength of each stud blank, the conversion system can be applied to 4-foot-long southern pine cordwood in diameters ranging from 4-1/4 to 6-3/4 inches inside bark (1).

This paper reviews the developmental phases of the research on cores and the projected applications of the results.

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Conversion by Skrag Mill

A total of 248 southern pine veneer cores averaging 5.3 inches in diameter were processed through an end-dogging skrag mill, cross-circulation kiln, and crook-reducing planer into pairs of S4S 2 by 4's eight feet long (Fig. 1, Process 1). Ninety-one percent of the studs were SPIB Stud grade or better. The cores averaged 5.7 rings per inch; if they had been a more representative 3.5 rings per inch the yield of Stud grade and better would have been about

84 percent. Crook was minimized if specific gravity was low and if the pith was centered in the stud or located adjacent to a 3-5/8-inch face.

Comparison of Other Methods

Of six alternatives to skrag mill conversion, three produced studs that graded 100 percent SPIB Stud or better and suffered little distortion with changes in relative humidity (Fig. 1, Processes 3, 4, and 5). In the most simple method (proposed, with modifications, for commercial practice) the veneer cores were center-ripped, dried, fully jointed on the flat face, thicknessed, and finally straight-line ripped to finished width (Fig. 2). In a second method, the two edges of the studs thus made were grooved to receive 8-foot glued inserts. In a third, the dry, rough half-core was crosscut at midlength, and each 4-foot section was facejointed and fingerjointed to a similar section from a different core; the 8-foot piece was then facejointed, thicknessed, and ripped to width.

Post-machining Treatments

In suppressing crook, seven brush or dip treatments were equally ineffective. Although two brush coats of aluminum paint or shellac somewhat diminished rate of water pickup, even these treatments permitted major changes in moisture content during 8 weeks of exposure. Change in moisture content was positively related to change in crook. Rate of moisture content change in studs exposed under a water shower was inversely proportional to specific gravity and rings per inch. Studs with either high specific gravity or many rings per inch were prone to crook.

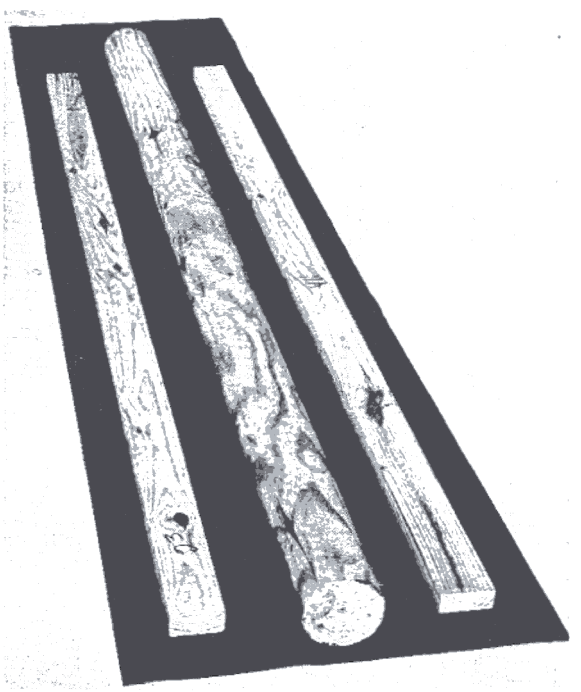

Figure 2. — Prototype studs made by center-ripping a green veneer core, drying the half-cores, and then extracting a warp-free stud from each half-core by facejointing, thicknessing, and straight-line ripping.

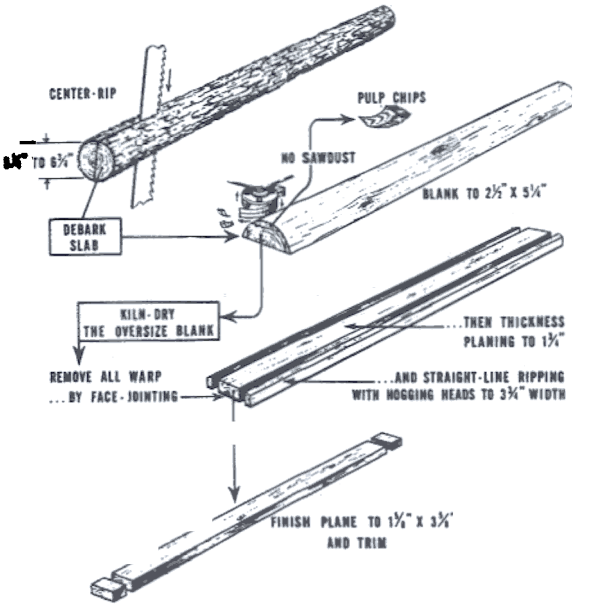

Figure 3. — Studs can be made from 8-foot bolts by center-ripping the bolts, debarking the half-bolts, blanking out a stud from each half-core on a chipping surfacer-edger, kiln-drying the oversize blanks, and then machining the blanks to warp-free size.

Strength Properties

A total of 105 studs manufactured from the veneer cores had lower specific gravity (0.50 based on oven-dry volume and weight), fewer rings per inch (3.6), and lower moduli of rupture and elasticity than did studs from the normal run of southern pine logs.

Ultimate strengths averaged 5,200 pounds per square inch in edgewise bending, 4,830 pounds per square inch in full-length compression, and 2,860 pounds per square inch in full-length tension. Corresponding values for modulus of elasticity (MOE) were 1,310,000, 1,170,000, and 1,320,000 pounds per square inch. Yield strength was 72 percent of ultimate strength in bending and in tension but only 56 percent in compression.

Stiffness and strength of the 2 by 4's declined as SPIB grade decreased. MOE was positively correlated with full-length strength, but in no case accounted for more than 39 percent of the variation in ultimate strength. The studs were, of course, extremely vari-

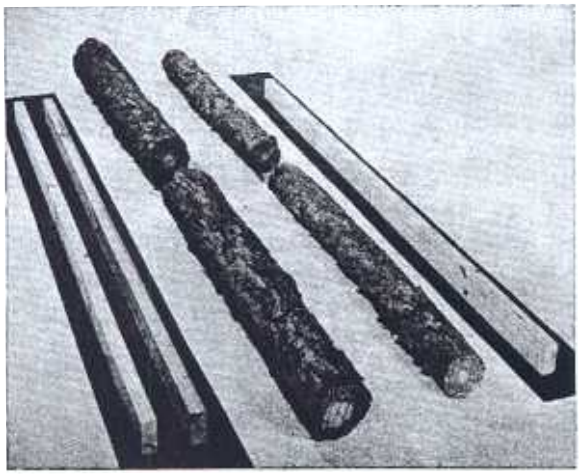

Figure 4. — Two 6-inch bolts like those on the left will yield two 8-foot fingerjointed studs. A single fingerjointed stud can be manufactured from two 4-½-inch bolts.

able because they had been manufactured by seven processes.

For reasons not clear, no test mode showed significant correlation between specific gravity and MOE. Simple regression analysis disclosed that MOE (measured by any test mode) was positively correlated with rings per inch (r^2 values from 0.27 to 0.37).

Projected Applications

Veneer Cores

For an estimated $300,000 an existing plywood plant could be equipped to manufacture kiln-dry studs from cores. Annual production would be 10,752,000 board feet of studs if the lathe produces two 8-foot cores per minute and operates three shifts per day, 7 days per week, 50 weeks per year. Two man-hours of labor would be required per thousand board feet of studs. Total investment, including working capital, is estimated at $400,000. Annual sales would be $864,000, and annual profit before income taxes is estimated at $454,000. These figures are based on a purchase price of $0.212 per core (that is, the alternative value of the core converted to chips at $6.30 per ton), a net sale price of $5 per ton FOB plant for dry wood waste, and an average net selling price of $75 FOB mill per thousand board feet of kiln-dry S4S studs.

The investment would still be attractive if the plywood plant operated two shifts daily, or if cores were valued at $0.50 each.

8-Foot Bolts

A total investment of $425,000, including $100,000 of working capital, will finance an operation to convert 8-foot southern pine cordwood into straight, kiln-dry studs (Fig. 3). Only bolts with inside-bark diameters from 5-1/4 to 6-3/4 inches are converted. Bolts less than 4-1/4 inches in diameter and those 7 inches and larger are resold for conventional conversion into pulp chips, lumber, or veneer.

On a one-shift basis, 2,880 bolts would be consumed daily. Output would be approximately 5,760 studs (30,720 board feet) plus 12 tons of pulp chips and 29 tons of dry shavings. The plant would employ 10 men in the mill plus office staff. Annual sales would be $614,000. Annual profit before income taxes is estimated at $82,000, a 19-percent return on total investment. These figures are based on a purchase price of $0.50 per bolt FOB plant, a pulp chip selling price of $6.30 per ton FOB plant (green basis), a selling price for dry shavings of $5 per ton FOB plant, and a net average sale price of $75 per thousand board feet of S4S kiln-dry studs FOB mill. Very nearly all studs would be SPIB Stud grade and better.

4-Foot Bolts

For an estimated total investment of $4,000,000, including $1,000,000 working capital, a plant can be built to convert 4-foot southern pine cordwood into fingerjointed, straight, kiln-dry studs (Fig. 4) at the rate of one stud per second. The plant is designed to utilize wood from large acreages of young plantations.

Only bolts with inside-bark diameters between 4-1/4 and 6-3/4 inches are converted to studs. Bolts of less than 4-1/4 inches would be chipped, and bolts 7 inches and larger would be debarked and resold for conversion into veneer.

On a two-shift basis, approximately 715 cords of rough bolts would be consumed daily; output would be approximately 43,200 studs (230,400 board feet) plus 207 tons of green pulp chips, 266 tons of dry shavings, and 87 cords of peeler bolts 4 feet long. The plant would employ 126 men in the mill plus office staff. Annual sales would be $5,363,000, and annual profit before income taxes is estimated at $663,000 — a 16.6-percent return on total investment. These figures are based on a price of $17.50 per standard rough cord FOB plant, a pulp chip selling price of $6.30 per ton FOB plant (green basis), a selling price for dry shavings of $5 per ton FOB plant, and a net average sale price of $75 per thousand board feet of S4S kiln-dry studs FOB mill. Very nearly all studs would be SPIB Stud grade and better.

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