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# ST PRODUCTS LABORATORY

In cooperation with the University of Wisconsin

MADISON, WISCONSIN

## CALIFORNIA REDWOOD ITS PROPERTIES AND USES

### SUMMARY OF PREVIOUS REPORTS

Compiled by

ROBERT M. VOLKERT

Assistant Wood Technologist

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# C A L I F O R N I A   R E D W O O D

## ITS PROPERTIES AND USES

### Properties

#### Mechanical

The outstanding feature developed by the few tests that have been made on redwood is the variability of the wood with regard to strength properties. The seat of the difficulty in obtaining reliable data lies in variation in density or specific gravity found in the species. In order to secure data on mechanical properties which would be representative of the species it would first be necessary to have a thorough knowledge of the density variation. Then by the selection of material of typical densities it would be possible to make strength tests which would be conclusive with respect to the density-strength relation and hence truly representative of the species in its whole range of strength values.

Information as to the strength of redwood of various densities would unquestionably be of more value to the user than strength data based on "average" density. Also, it would enable the producer to select material adequate for certain purposes and thereby eliminate, to a large extent, an important source of complaint on the part of the consumer. Without such a selection of material it is difficult for the consumer interested primarily in the strength of the wood to place proper reliance upon any given lot of it.

Tests have shown that some specimens of redwood are very hard, with a strength about equal to that of oak or long-leaf pine, while others are light, soft, and brash. Consequently the information now available on redwood, is, in general, quite erratic, which makes it difficult to draw a fair comparison with certain other important species and to derive values truly representative of the species.

On account of the variability in density of the material tested at the Laboratory nothing more than a general indication of the strength of redwood as compared with other species can be given. Judged by the average density of the material tested, redwood compares favorably with the following species:

1. Strength as a beam or post

Port Orford cedar  
Douglas fir of the coast type  
Western larch  
Loblolly and shortleaf pine  
Red maple

2. Hardness

Port Orford cedar  
Douglas fir of the coast type  
Western larch  
Loblolly pine  
Shortleaf pine  
Tamarack  
Black ash  
Cucumber tree  
White elm  
Red gum  
Oregon maple  
Silver maple  
Sycamore



### 3. Shock resisting ability

Southern cypress  
Douglas fir of the mountain type  
Grand fir  
Noble fir  
Western white pine  
Red spruce  
White spruce  
Red alder  
Chestnut  
Cottonwood

### 4. Stiffness

Southern cypress  
White fir  
Lodgepole pine  
Pitch pine  
Red spruce  
White spruce  
Red alder  
Aspen  
Slippery elm  
Red gum  
Oregon maple  
Magnolia  
Sycamore

Another series of tests on redwood of different average density might lead to entirely different species-comparisons.

The shrinkage of redwood should be given special mention on account of its peculiar variability. Indications from the most recent tests are that the average shrinkage of the wood in both radial and tangential directions is relatively low as compared with most species. Redwood is generally reputed to have a pronounced longitudinal shrinkage, and several instances of abnormal shrinkage in the lengthwise direction have come to the attention of the Forest Products Laboratory. This characteristic probably applies to

occasional boards, but it can not be said to hold for the species as a whole. However, a lot of lumber carefully seasoned to the moisture content at which it is to be used, should give no trouble as the shrinkage has taken place before the lumber is put into use.

### Physical Properties

Seasoning - As in the case of its other properties, some variability exists in the ease of kiln drying of redwood. The variation is due in a very large measure to differences in moisture content, the heavier wood in the butt logs containing a much greater percentage of moisture than the wood from logs higher up in the tree. Redwood, as a rule, requires more time in the kiln than the pines, fir, and many other coniferous species, but if reasonable care be exercised it can be dried with a very low degrado. It is advantageous to segregate the lumber according to moisture content and charge into separate kilns.

Ability to stay in place - Investigations and observations by the Forest Service indicate that in ability to stay in place redwood is comparable to Douglas fir, western hemlock, southern yellow pine, western white pine, Sitka spruce, basswood, and others. Redwood stays in place better than eastern hemlock, western larch, black cottonwood, California black oak, and sycamore, but not so well as white pine, probably the premier wood in this respect.

Workability - No exhaustive studies to determine the workability of our native woods have been conducted by the Forest Service, but a considerable amount of information has been collected from observations in woodworking shops and from the experience of others. Workability is a composite property of wood texture, hardness, density, composition, and other qualities. Although redwood falls in the same general class with eastern white pine, yellow poplar, sugar pine, the cedars, western white pine, western yellow pine, basswood, and chestnut, as regards workability, it ranks slightly below the first three and slightly higher than the others. It is better in this property than most of the other commercial woods.

Nail-holding ability - The ability of wood to resist the withdrawal of nails or screws depends to a large extent on its specific gravity (density), its hardness, strength in fibre, texture, greater or less tendency to split, and other properties. Because redwood is lower in density and certain other properties than many other woods, naturally its ability to hold nails is considerably less. Redwood is therefore grouped with those woods having the least nail-holding ability, such as the cedars, southern cypress, the firs, certain of the pines (jack, lodgepole, Norway, sugar, western white, western yellow, eastern white), the spruces, and also such hardwoods as basswood, aspen, chestnut, cottonwood, and yellow poplar.

Ease of Gluing - Although no actual experiments concerned with gluing properties of redwood have been carried on at the Forest Products Laboratory, much information has been obtained through observations and experience. Redwood may be classed with woods which can be glued without difficulty. Such woods are: Douglas fir, a number of the pines (sugar, southern yellow, western white, western yellow, eastern white), spruce (red, white, Sitka), basswood, chestnut, cottonwood, red gum, white oak, yellow poplar, and black walnut.

Durability - The durability, or power of resistance to decay, of untreated wood is usually affected by such factors as climatic conditions, proximity to soil, amount of heart and sapwood, and the composition of the wood. Black locust and osage orange are among the most durable of the native woods. Southern cypress, redwood, catalpa, and most of the cedars are also highly durable. The durability of the heartwood of redwood is one of its most important characteristics, comparing favorably with certain of the cedars (Alaska, incense, Port Orford, western red, white), southern cypress, and catalpa.

Chemical properties - Chemical analysis of redwood thus far indicates that it contains less cellulose than western yellow pine, western red cedar, western white pine, long-leaf pine, Douglas fir, western larch, white spruce, tanbark oak, balsa, hickory, eucalyptus, basswood, yellow birch, and sugar maple, and slightly more than incense cedar. It is also



low in resinous content. Redwood shows practically the same resistance to dilute acids as the other coniferous woods. The destructive distillation of the wood is said to yield phenol and cresol in large enough quantities and pure enough form for the market.

Experiments with redwood for pulp and paper indicate that it is unsatisfactory because the yield is low and the strength, quality, and color of the resulting paper quite inferior. If used at all the production of kraft paper offers the greatest possibility.

### Uses

#### Established uses

Tanks, silos, and cooling towers - Redwood, because of its durability and its tendency not to shrink or swell excessively, is particularly suited for these uses. If leaching of color is objectionable redwood is unsuitable under certain conditions.

Burial caskets and coffins - Redwood is used to only a slight extent for natural finish caskets, on account of its softness. The species is not used much for outside shipping boxes. Redwood is, however, used in fairly large quantities for cloth covered caskets and is entirely suitable.

Incubators and brooders - Redwood is being used satisfactorily for incubators and brooders because of its durability, ease of working and ability to stay in place. It



also possesses sufficient hardness and strength for outside finish in such constructions. It is claimed that redwood is a good insulating material and therefore of high value for interior work and shelving in incubators and brooders.

Cigar boxes - Redwood, in varying quantities, has been and is being used for cigar boxes because of its color, absence of odor and taste, and small shrinkage and swelling.

Flasks - Redwood is being used for foundry flasks with good results. It has all the required properties and ranks approximately with white pine in adaptability to the purpose. Ability to stay in place, durability, and relative freedom from resinous material are the important properties required.

Patterns - The use of redwood for temporary patterns has not been as satisfactory as it might have been because slash-grain material has been used. Vertical-grain redwood should give better results because it shrinks and swells less, is more easily worked, and there is less danger of raised grain than in slash grain.

Battery separators - Woods used for battery separators must be somewhat acid resistant, porous enough to allow passage of the battery solution or electrolyte, and easy to work. Redwood has these properties sufficiently for use in battery separators.

General millwork - The use of redwood is reported as satisfactory for exterior finish, balusters, and newel posts, as well as gutters, fixtures, ceiling, and some parts of interior finish.

Uses recently introduced

Refrigerator parts such as inside lining, cores for metal lining, outside backing, bottoms, and outside finish.  
Beehives  
Core stock  
Greenhouses and hothouse beds  
Ice cream tubs and freezers  
Ice cream cabinets  
Interior lining and shelving of case goods, fixtures, and closets; sides, backs, and bottoms of drawers  
Feather boards and winding shells or drums (winding bolts of cloth, etc.)  
Action rails, motor valves and boards, key bottoms, key bottom rails, and backing of pianos  
Organs; (groove or socket boards, swell boxes and pipe chests, bellows, pipes, outside backing, inside shelving)  
Wooden and canvas signs and canvas stretchers  
Shade rollers and slats, map rollers, rug poles, and curtain rods and poles  
Molding  
Ceiling and paneling for automobile bus and stage bodies  
Venetian blinds  
Screens and lattices  
Toilet tanks  
Running boards for freight cars  
Hoppers and boxes for grain drills  
Smoked fish pails and boxes  
Candy and cooky pails and boxes  
Fruit and vegetable boxes  
Shirtwaist, jewelry, and novelty boxes  
Salt, pepper and spice boxes, and boxes for coffee mills or grinders  
Advertising thermometers  
Cigar molds  
Humidors  
Toys  
Manual training supplies  
Wood pipe

Mine equipment - doors, mine timbers  
Garage and fireproof doors  
Lath  
Railroad ties  
Shingles  
Well-covering and curbing  
Water troughs  
Chicken coops - roosts, nests  
Irrigation flumes  
Hog feeders  
Fencing  
Grade stakes  
Mud sills  
Porch stair risers  
Lead Pencils  
Sliced veneer  
Sawdust for packing grapes  
Cess pool lining  
Trunking and capping  
Manure boxes  
Souvenirs - ash trays, pin trays, jewel trays,  
candle sticks, bowls

Possible uses for redwood

Freight car construction  
Laundry appliances - washing machine tubs, ironing  
boards, curtain stretchers, and clothes driers  
Athletic and sporting goods - billiard tables, target  
frames, decoy ducks, artificial bait.  
Butter, lard and jelly tubs  
Battery boxes  
Kiddie coops and cribs  
Safety gates  
Rolling partitions  
Musical instruments - guitars and ukeleles  
Sand boxes for golf courses  
Blackboard frames  
Stove boards  
Fruit graders  
Boxes and crates  
Leather stretchers  
Flower boxes  
Drain boards for sinks  
Calendar mounts  
Floats and lobster pots  
Shields - backing for escutcheons  
Feed bag bottoms  
Drawing boards  
Mirror backing