The Use of Redwood for Home Construction

by

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of the Requirements for the Degree
Bachelor of Science
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Approved:

Professor of Forestry
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I. Introduction

Millions of years ago when the dinosaurs and other prehistoric monsters roamed the earth they lived in an environment of flourishing vegetation, which included the redwood tree. Fossil discoveries verify that the redwood was once quite commonplace throughout the world. Only in California and a small spot in southwestern Oregon did this tree escape extinction by the ravages of the Glacial period. Today, in a belt averaging twenty miles wide and four hundred and fifty miles long, parallel to the northern coast of California, we have a forest empire in itself, made up of the tallest, the largest, and the oldest trees to be found in the world. Some of these trees attain a height of 350 feet, with a diameter of 20 feet, containing enough lumber in one tree to build twenty-two average-sized homes. Authentic records indicate that some of the trees now living were saplings before Christ was born, dating back 50 to 100 years B.C. In fact the Latin name, "sempervirens", given to the tree, means "always living". The redwoods have been subject to attack by insects, fungi, and fire as other trees during these hundreds of years, but with the exception of superficial fire damage they have resisted the principal enemies of wood down through the ages. Fallen trees have lain on the ground for hundreds of years, yet are so sound today that when taken to the sawmill they produce perfect, sound lumber. Scientific investigations have shown that redwood lumber possesses many peculiar properties which make it very
Figure 1
Note the end of the log—over which has grown a giant redwood tree 2,500 years old. The log is still sound and durable after laying on the ground for thousands of years.
durable--virtually an everlasting wood.

This very durable quality of redwood, along with the beautiful finish that it takes, makes it an ideal wood to use in the construction and finishing of your home. But these are not the only qualities of redwood. In the following chapters, I shall endeavor to explain the many qualities and uses of redwood and their importance in the construction of your home to make it (1) "longer lived" (2) more comfortable to live in (3) cost less to maintain (4) safer to live in than other types of construction and (5) that the cost of a home built of Redwood will be less as realized over a period of years.

I shall include pictures and sketches of homes built and finished of Redwood to show the possibilities that may be included in construction of or adding to your home to make it a structure of greater durability and beauty.
CHAPTER I
Shrinkage

Wood is composed of minute hollow cells, most of which are greatly elongated. These are fastened together like the cells of a honey comb. Water exists in green wood in two conditions; namely, as free water in the cell cavities, and as water absorbed in the cell walls. When wood contains just enough water to saturate the cell walls, it is said to be at the fiber saturation point. Water in excess of this amount cannot be absorbed by the cell walls and therefore is free water in the cell cavities. Removal of the free water from the cell cavities has no apparent effect upon the properties of wood except to reduce its weight, but as soon as any of the water in the cell walls is removed, wood begins to shrink. Since the free water is removed first, shrinkage does not begin until the fiber saturation point is reached.

The fiber saturation point for woods varies from about 23 per cent to 30 per cent moisture content, but for all practical purpose can be taken as approximately 28 per cent for Redwood and its competing species. Reductions in moisture from natural or green condition down to approximately 28 per cent, therefore, do not result in any shrinkage. The real shrinkage range for Redwood is from about 23 per cent moisture content to about 6 per cent. The greatest shrinkage takes place from 20 per cent to 10 per cent.

After the fiber-saturation point has been reached and the cell walls begin to give up their moisture they shrink
in all directions although not uniformly. The cause of this shrinkage is the contraction of the cell walls due to drying out, thus reducing the diameter of the cells so that they are drawn closer together.

This reduction in the size of the cells causes a certain amount of shrinkage in wood cut vertical to the grain and a greater amount in wood cut plain or flat grain. Generally speaking, the shrinkage is about twice as great across a plain or flat grain face as it is across a vertical grain face. This is a factor that should be considered in house construction where the boards come in direct contact with the weather.

Longitudinal or end shrinkage in the length of a piece of lumber is normally so small that it is generally not considered, and for all practical purposes is neglected in almost all species.

The U. S. Forest Products Laboratory has made a great many tests on Redwood to develop shrinkage factors. They show by hundreds of measurements of longitudinal shrinkage that it is not important in normal wood. (1)

Another factor which may influence the extent to which wood shrinks is its density, that is, the actual amount of wood substance present in a unit of volume, as indicated by the dry weight of the wood. Heavier woods shrink and swell more than the lighter woods with a given change in moisture content. Redwood is generally considered as one of the lighter woods, hence shrinks less under a given moisture content change.
Redwood has the least volumetric shrinkage of any commercial American wood, and therefore it can be subjected to considerably more change in moisture before it has the same change in dimensions as other commercial species.

All woods contain certain infiltrated substances which are generally defined as that portion of the wood which would be soluble in an inert solvent. Redwood is rich in these substances and they are apparently the cause of low shrinkage of the heart wood of Redwood. Certain sugars injected into woods will materially reduce the shrinkage, and these substances of Redwood apparently act in a similar manner.

In the following table, taking Redwood as 100% as a datum, comparative values of other common woods used for house construction are indicated as to their shrinkage factors.

Figure 2
Applications of Redwood where minimum shrinkage is important.
<table>
<thead>
<tr>
<th>Commercial and botanical name of species</th>
<th>Trees tested</th>
<th>Shrinkage from green to oven-dry condition based on dimensions when green</th>
<th>Radial</th>
<th>Longtential</th>
<th>Volumetric (composite value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redwood (Sequoia sempervirens)</td>
<td>16</td>
<td>100 100 100 100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Douglas-fir (Pseudotsuga taxifolia)</td>
<td>34</td>
<td>208 195 181</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ponderosa pine (Pinus ponderosa)</td>
<td>31</td>
<td>162 158 145</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sitka spruce (Picea sitchensis)</td>
<td>25</td>
<td>179 188 173</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Red Cedar (Thuja plicata)</td>
<td>15</td>
<td>100 125 113</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Hemlock (Tsuga heterophylla)</td>
<td>18</td>
<td>179 198 179</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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CHAPTER II
Density, Specific Gravity, Weight

The related properties of density, specific gravity and weight of wood are important not only because of their individual application, but because of their effect on certain other properties of wood, principally its strength and shrinkage.

Density, referring to wood, is the mass of wood substance in a definite volume. Density of wood in its dry state is shown by its specific gravity.

Specific gravity is the weight of any given substance divided by the weight of an equal volume of pure water at its greatest density. The specific gravity of water is 1.0.

Various strength properties are affected by difference in density, or specific gravity, some varying in a direct ratio and others at a more rapid rate. Generally speaking, one piece of wood which has twice the density of a second would be expected to have twice the stiffness and endwise crushing strength; about two and one half times the bending strength; approximately three and one half times the toughness; and about four and three quarters the hardness. These relations, however, will apply more precisely within a single kind of wood than between different species.

Density, or the amount of wood substance, also has an effect on shrinkage. Woods containing a higher amount of wood substance per volume shrink and swell more than woods containing a lesser amount of wood substance.
Redwood is classified as a wood "moderately light in weight".

In bending strength, crushing strength, and hardness, the values for virgin-growth redwood are somewhat higher for its specific gravity than would be expected from the average behavior of other species, while the values for shock resistance are somewhat lower.

Though Redwood increases in many strength properties during seasoning, the increase is less than for most species. A few properties, particularly those of shock resistance show for Redwood, as for numerous other species, an actual decrease due to seasoning.

The standard specifications for grades of California Redwood lumber as adopted by the California Redwood Association take into consideration the properties of density, specific gravity, and weight, Redwood being graded with special reference to its suitability for the use intended. For example, the grading rules for structural Redwood reject pieces of light weight, as these are not representative of true strength values. On the other hand such pieces conform, for example, to such uses as siding.

In the following table, Redwood may be compared to other common woods used for house construction as to their specific gravities and weights.
### Table 2. Specific Gravity and Weight

<table>
<thead>
<tr>
<th>Commercial and botanical name of species</th>
<th>Trees tested</th>
<th>Specific gravity, oven dry based on volume when green</th>
<th>Weight/cu.ft. Green At 12% M.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redwood (Sequoia sempervirens)</td>
<td>16</td>
<td>0.39</td>
<td>52 Pounds 28 Pounds</td>
</tr>
<tr>
<td>Douglas-fir (Pseudotsuga Taxifolia)</td>
<td>34</td>
<td>0.45</td>
<td>38 Pounds 34 Pounds</td>
</tr>
<tr>
<td>Ponderosa pine (Pinus ponderosa)</td>
<td>31</td>
<td>0.38</td>
<td>45 Pounds 28 Pounds</td>
</tr>
<tr>
<td>Sitka spruce (Picea sitchensis)</td>
<td>25</td>
<td>0.37</td>
<td>33 Pounds 28 Pounds</td>
</tr>
<tr>
<td>Western Red Cedar (Thuja plicata)</td>
<td>15</td>
<td>0.31</td>
<td>27 Pounds 23 Pounds</td>
</tr>
<tr>
<td>Western Hemlock (Tsuga heterophylla)</td>
<td>18</td>
<td>0.38</td>
<td>41 Pounds 29 Pounds</td>
</tr>
</tbody>
</table>

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CHAPTER III

Stiffness, Hardness, and Shock Resistance

The properties of stiffness, hardness, and shock resistance in wood are generally associated with the application of a hardwood, nevertheless their construction is often important to the prospective home builder in analyzing the utilization of a softwood or conifer species for a particular purpose.

Stiffness may be associated with the framework of a structure, sash, mill roofs; and similar applications. Lack of stiffness or ease of bending is also important in many usages of wood.

Shock resistance may be associated with laminated floor construction; boat construction; parts of equipment; grand stand construction, and similar points of utility.

Hardness may be associated with the usage of flooring, and railroad ties, but correctly stated it is a measure of indentation of wood. Lack of hardness, or a degree of softness, is necessary in other uses as in millwork, and in wood that is worked for the manufacture of wooden articles.

When any weight or load is placed on a wooden member, a deflection or bending of this member is produced. Stiffness is a measure of the resistance to this deflection. While the strength of a beam varies as its width and as the square of the depth, the stiffness, or the resistance which a beam offers to flexure, will vary as its width and as the cube of the depth. It is therefore more desirable to have
beams, or joists deep rather than broad.

The deflection or bending of a beam is in direct proportion to the applied load up to a certain limit. For example, if a stick of a certain size and length will bend and show a deflection of one-eighth of an inch under a load of five pounds, it would be expected to show a deflection of one-quarter of an inch under a load of ten pounds. Beyond a certain limit, however, the bending will increase faster than the load, and ultimately as more load is applied the stick will break. The point at which the deflection increases faster than the rate of the load is the elastic limit. A stick bent beyond the elastic limit will not regain its original shape when the load is removed, in other words, it is permanently deformed.

In computations of design of wooden members, their stiffness is expressed by the factor known as modulus of elasticity, which is the ratio of stress per unit area to corresponding strain per unit length, the strain being within the elastic limit. Deflection under a given load varies inversely as the modulus of elasticity or in other words, a material with a high modulus of elasticity deflects but little. For example, steel has a high modulus of elasticity while that of rubber, which bends and deflects easily, is very low.

Stiffness enters into the design of beams in various applications. For instance, the deflection or bending of beams must often be kept within a prescribed fraction of
the length of the span. For plastered ceilings, the deflection of the floor beams above is usually limited to one three hundred-sixtieth of the span. A deflection of one two-hundredth of the span is often used for wooden bridge construction, although in certain bridge applications more severe limitations are advocated.

In posts or columns, stiffness plays a part in the utilization of lumber after a certain height of post is reached. It should be realized that in a short column its supporting strength is entirely dependent on the endwise compressive strength of the wood. In fact this endwise compressive strength is the controlling element of design in a column up to a point where its height is about eleven times its least cross-sectional dimension. As this ratio of height to least cross-sectional dimension of a column increases, stiffness becomes more of a factor and endwise compressive strength less, until a limit is reached where the stiffness of the material is the one controlling feature of the usage.

Hardness, as associated with wood usage, is most commonly thought of as the ability of wood to resist abrasion or scratching, although it is a measure of its resistance to indentation. While resistance to indentation is dependent mostly on the density of the wood, or the amount of wood substance present, wearing qualities or resistance to abrasion may be governed by other factors, such as toughness and size and arrangement of fibers. Abrasion or wearing qualities may also be affected to some extent by the way in which wood is
Figure 3
A huge highway construction project built entirely of Redwood.

Figure 4
Laminated Redwood floor, in process of construction on main highway steel suspension bridge with wide stringer spacing, visualizing an application of wood where stiffness and shock resistance are important.
sawed, and not directly by the hardness, as vertical grain softwood flooring is better than slash grain because of greater uniformity of wear.

In laboratory tests made for hardness of wood, the measure of hardness is the load required to embed a steel ball, having a diameter of 0.444 inches and giving a projected area of one square centimeter, to one half of its diameter. By these tests it has been proved that end hardness usually is greater than the hardness of the sides of a piece.

Shock resistance is the capacity to withstand suddenly applied loads, therefore, wood high in shock resistance withstands repeated shocks, blows and jolts. In order to rank high in this respect a wood must be strong in cross breaking and at the same time must be able to bend considerably before it breaks. The conifer woods as a group will not, as a rule, bend so far as hardwoods before failure occurs and therefore, generally will not have the shock resisting abilities of the hardwoods.

The common method of making tests upon the resistance of wood to shock is to support a small beam at the ends and drop a heavy weight upon it at the center. The height of the weight is increased after each drop, and records of deflection are taken until failure.

Where a load is applied instantaneously as in impact or shock, a stick of wood will resist without apparent injury a force more than double a constant steady load that would ultimately cause failure.
Redwood in general follows the characteristics of other conifers, although the hardness of virgin growth Redwood is somewhat higher for its specific gravity than would be expected from the average behavior of other conifers, and shock resistance somewhat lower.

There is, however, more uniformity in Redwood than in the average of other conifers. Individual pieces of Redwood vary less from average values in stiffness, hardness, and other shock resistance than the average of other conifers shows.

In certain conifers there is a pronounced difference between the hardness of spring and summer wood which permits marked variation in surface hardness at close intervals. There is not this marked difference in Redwood and which gives it more of a uniform character.

In the following table the comparative values of stiffness, hardness, and shock resistance are shown for Redwood and other woods used in house construction. These values are shown on a comparative basis taking the values of Redwood as 100 per cent as a datum. Comparative values of the other species are shown above or below this datum, accordingly as these values are greater or less than Redwood.
### Table 3. Stiffness, Hardness, and Shock Resistance

<table>
<thead>
<tr>
<th>Commercial and botanical name of species</th>
<th>Number</th>
<th>Trees tested</th>
<th>Bending strength</th>
<th>Compressive strength (endwise)</th>
<th>Stiffness</th>
<th>Hardness</th>
<th>Shock resistance</th>
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<tr>
<td>Redwood (Sequoia sempervirens)</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Douglas-fir (Pseudotsuga taxifolia)</td>
<td>34</td>
<td>108</td>
<td>104</td>
<td>132</td>
<td>109</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>Ponderosa pine (Pinus ponderosa)</td>
<td>31</td>
<td>78</td>
<td>67</td>
<td>82</td>
<td>76</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>Sitka spruce (Picea sitchensis)</td>
<td>25</td>
<td>87</td>
<td>73</td>
<td>105</td>
<td>81</td>
<td>117</td>
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<tr>
<td>Western Red Cedar (Thuja plicata)</td>
<td>15</td>
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<td>72</td>
<td>79</td>
<td>70</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Western Hemlock (Tsuga heterophylla)</td>
<td>18</td>
<td>89</td>
<td>82</td>
<td>105</td>
<td>93</td>
<td>112</td>
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</table>

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CHAPTER IV
Nailing

Man's attempt to construct a shelter for himself and for those dependent upon him, led him to various methods of fastening things together. At first he contented himself with lashings made from vines and thongs. Soon he found that these methods lacked durability, and hence we find the wooden peg making its appearance. Again the question of endurance prompted him to seek further, and the first crude metal nail was fashioned. These nails were made of various metals including iron, bronze and copper.

Today, expert engineering knowledge, combined with the research work of metallurgists, has developed nails specifically adapted to every purpose and need. Nails are available made from bright steel, solid copper, bronze, alloyed metals and rustless steel. Bright steel nails are available covered with zinc or other coatings which add many years to their life and value.

Besides moisture changes in wood and direction of driving, the nature of the surface of the nail, type of point and form of shank are contributing influences to nail-holding ability.

Good qualities of zinc or cement coating on nails tend to increase original resistance to withdrawal, as compared to plain nails. A chemically etched nail developed at the U. S. Forest Products Laboratory has from 180-200 per cent higher holding power in soft wood than a plain nail.
Generally speaking, a nail with a long sharp point may have a higher holding power than one with a common point, but it will increase the tendency to split. A blunt point with no taper will reduce splitting somewhat but its holding power may be below that of a common nail. A nail with a taper at the end terminating in a blunt point will not split wood as badly as a common nail and on the average will have a somewhat higher resistance to withdrawal than a nail with a blunt point and no taper.

Redwood bevel siding should be nailed at every bearing but only near the butt edge so the nail penetrates at the tip edge of the under course. This method holds it securely in position and allows for any subsequent working of material such as movement of wood due to climatic changes.

Shiplap and rustic siding should be nailed with two nails at every bearing.

Where ends of wide siding abut at bearings it may be advisable, in order to secure and maintain flush surfaces, to face or sew the nails. Sew nailing is performed by slightly bending the nail with the claw of the hammer and then driving the nail at an angle near the end of one piece of siding so that it will penetrate the end of the abutting piece and tend to turn toward the surface of the latter, thereby drawing the pieces flush.

The first consideration to prevent splitting of wood in nailing is to use the correct size of nail. Do not use a nail with a long sharp point where splitting might occur.
There are no difficult problems involved in the nailing of Redwood to prevent splitting, and its nailing properties are about the same as those of other woods of like texture and density. Millions of feet of Redwood 3/8 inches and less in thickness are used in nailed articles. Satisfactory nailing is secured by simple consideration of the usage involved.

The use of nails protected from corrosion is a very wise provision. Durable Redwood resists decay for a long time and it should be fastened with a material that resists disintegration. For general application in exposed material the use of hot dipped galvanized nails is recommended. Copper nails are justifiable in applications where corrosion is a factor.

In problems of nailing where corrosive action is particularly severe as in types of construction where acids or alkalies or their compounds are present, nails made from stainless steel are recommended.

Discoloration extending in a small area around nail heads, and appearing after exposure to moisture and storms is not indicative of any decay of wood. Redwood contains no ingredient that may be termed as active on steel creating an acid that destroys wood fiber. Like many other woods, Redwood contains tannin. The action of tannin on unprotected steel creates an iron tannin compound which causes a discoloration around the nail. This condition is purely local and is simply a discoloration and does not indicate a disintegration of the fibers of Redwood and they remain sound.
As an unprotected nail oxidizes and rusts it tends to enlarge somewhat in cross-section, and as the layers of rust break off it naturally leaves the nail hole larger than the nail, decreasing the holding power. This condition of discoloration can be combated by the use of hot dipped galvanized nail, or by nails otherwise amply protected against corrosion.

In puttying nail holes in Redwood that is to be painted, best results are obtained by using only the highest grade of lead and oil putty that will not shrink or lose its adhesion.

In puttying nail holes in Redwood which is to have a natural finish, do not use putty with an oil base as it will show through the natural finish. Use Redwood flour, or very fine sawdust, with barely enough glue added to make it stick and apply like putty, or else use one of the commercial forms of putty specially prepared for this purpose.

It should be kept in mind, that when you are building a home of Redwood which is a thing of beauty and durability, it is important to use the proper nails in fastening that home together.
CHAPTER V
Paintability

Redwood is naturally a very durable wood, suitable for outdoor use in an unpainted condition. However, there are many occasions when painting is desirable from the aesthetic sense as well as protection from the elements. Nothing is more beautiful than a neatly painted home with a picket fence and a garden with trellises and comfortable outdoor wooden furniture.

Redwood has outstanding ability to take and hold paint coatings. All painting authorities agree that if the quality of paint is the same, the life of the coating depends upon the material on which it is applied.

The U. S. Forest Products Laboratory divides commercially important softwoods into four classifications for painting. Redwood is placed in the group which contains those woods "That hold paint longest and suffer least when protection against weathering becomes inadequate". (5)

Reliable experiments using the same paints on many woods and subjecting all to the same weather conditions show that Redwood requires repainting less often than any of the woods tested. These experiments mean that the integrity of paint coating on Redwood last as much as 40 per cent longer than one some other commercial species.

To secure the most durable and satisfactory paint job, use pure white lead in, oil, or the highest grade mixed paint, selecting a brand of highest quality sold by a re-
liable dealer, and applied according to the manufacturer's instructions.

A chapter on recommended paints and painting instructions will go more thoroughly into this detail later in this paper.

Figure 5
A painted Redwood home set off by a picket fence.
CHAPTER VI

Insulating Quality

The heating bill in your home is one of the major month-to-month expenses. Our natural objective, therefore, is to keep this charge as low as possible consistent with comfort.

Wood, because of its cellular structure, is a better insulator than non-cellular materials. Most figures for the insulating values of complete house walls place wood at the top of the list. The heat loss in winter through 100 square feet of wood wall consisting of 2x4 studding, 3/4" sheathing, building paper, 7/16" clapboards, lath and plaster is only 25 British Thermal Units per hour per degree of temperature difference between the inside and outside temperatures.

The corresponding figure for an 8 inch brick wall with plaster directly attached is 46 Thermal Units or 34 for a 12-inch brick wall. When the 8-inch brick wall is furred on the inside, then lathed and plastered the heat loss is 30 Thermal Units, which is 5 units more loss than that of standard wood construction with no added insulation. This is a heat loss difference of 20 per cent in favor of the wood construction. (6)

Experiments made on thermal properties of woods as a cooperative research project between the American Society of Heating and Ventilating Engineers, the National Lumber Manufacturers Association, and the University of Minnesota, showed that "Redwood has a low thermal conductivity". The insulating value of Redwood was above the average of the species tested.
Redwood's high insulating value makes homes like this easy to heat or cool.
CHAPTER VII

Description of Grades

The grades of Redwood have been set up by the California Redwood Association, which is made up of the members of all the important redwood sawmills. The association maintains experienced certified lumber inspectors who impartially inspect each shipment of lumber from the mills. Certificates of inspection are issued by the association verifying the grades and specifications of each shipment. This is true for both the domestic and export trade.

The grades of Redwood are as follows:

CLEAR ALL HEART GRADE--

The highest grade of lumber manufactured in California Redwood; a super grade, higher than any called for by American Lumber Standards. It is well manufactured from sound, live, all heartwood, and is selected for texture, appearance, milling and working qualities, as well as for freedom from sapwood and knots. It may be used with confidence for the most exacting purposes. It is perfectly adapted to natural finishes and is used for the highest quality exterior and interior trim, sidings, paneling, ceiling, partitions, moldings, and millwork. The natural preservatives contained in California Redwood insure maximum resistance to decay and insect attack. Its freedom from pitch and resinous substances insures long life to any decorative coating. Clear All Heart Vertical Grain is a special selection from Clear All Heart.
Figure 7
Clear All Heart or "A" grade suitable for paneling and trim.

Figure 8
The natural beauty of Redwood is used in this timbered ceiling.
"A" GRADE--

Practically free from knots and other defects. It may contain a small amount of sapwood and individual boards may vary in texture, grain and appearance. It is suitable for natural finish where variations in color and appearance are desired, and for high quality painted exterior and interior trim, including sidings, rustic, ceiling, partitions and moldings.

"B" GRADE--

Admits sapwood, discoloration, birdseye and occasional small tight sound knots. It is entirely suitable and practical for paint finishes, and natural finishes where variations in color and pattern are desired.

FOUNDATION GRADE--

Grade marked lumber selected from No. 1 Heart Common for characteristics which insure high resistance to decay and termite attack, and durability under severe service conditions.

NO. 1 HEART COMMON BOARDS AND DIMENSION--

Well manufactured from sound live heartwood, and are recommended for use where strength and lasting qualities, rather than appearance, are important. This grade is also recommended for purposes where durable utility lumber is desired and for applications such as use in contact with soil or exposed to the elements where high resistance to decay and insect attack is essential.

It admits sound, tight knots up to the maximum of 1½
inches in 12-inch widths. Sapwood is not permitted in this grade.

For Dimension in this grade, strength and durability are the primary considerations rather than appearance. Heart Common is manufactured in timber sizes and is widely used for heavy construction where the higher strength values assigned to Structural Redwood grades are not essential.

NO. 2 COMMON--

Suitable for use in ordinary construction and is available in the same sizes and workings as No. 1 Heart Common up to 6 x 8 inches. Occasional knotholes, shakes, checks and sapwood are permitted. Maximum knot sizes are limited to 2 inches in the narrow widths and 3½ inches in the 12-inch boards.

NO. 3 COMMON--

The lowest grade manufactured in Redwood and is practically all marketed in local territory. It is suitable for temporary construction and for many uses which are not exacting. (7)
CHAPTER VIII
Uses of Redwood

Redwood has hundreds of commercial uses as do most of the other commercially important softwoods. However, Redwood due to its very durable qualities, ease with which it is worked, extremely low volumetric shrinkage, and beautiful color and grain is highly recommended for the following standard patterns for house construction:

- Foundation Stock
- Mud Sills
- Underpinning
- Siding
- Interior and Exterior Trim
- Window Sills and Casings
- Gutters
- Picket Pack Fencing
- Log Cabin Siding
- Mouldings
- Paneling
- Shingles
- Shakes

Redwood siding is manufactured in ten basic patterns. Each pattern is designed to enhance the beauty and style of architecture desired in your home.

The ten basic patterns are as follows:
1. Anzac Siding
   - Surfaced four sides
Figure 9
Five basic patterns of Redwood siding.
Widths: 8, 10, and 12 inches
Thickness: 25/32 inches
Laid with 1\(\frac{1}{4}\) inch lap. Weather groove and spacing line.

2. Plain Bevel and Bungalow Sidings
Rough or surfaced face
Net width \(\frac{1}{8}\) inch less than nominal
Thickness: 15/32, 9/16 butt - 3/16 tip
Widths: 4, 5, 6, 8, and 10 inches
Lap: as desired

3. Round Edge Bevel and Bungalow Sidings
Surfaced face
Widths: 4, 6, 8, 10, and 12 inches
Thickness: \(\frac{1}{2}\), 11/16 butt - 3/16, 9/32 tip
Exposed width 1 inch less than nominal

4. "Economy" Bevel and Bungalow Sidings
Widths: 5 and 7 inches
Butt Thickness: 5 in., 41/64 inches; 7 inches,
39/64 inches; Tip 5/32 inches
Available in square, bevel, and round edges
Exposed width 1 inch less than nominal

5. Rabbeted Bevel and Bungalow Sidings
Rough or Surfaced Face
Widths: 4, 6, 8, 10 and 12 inches
Butt Thickness: \(\frac{1}{4}\), 11/16, 27/32 inches - tip
3/16, 9/32, 3/8 inches
Exposed width 1 inch less than nominal
Figure 10
Five basic patterns of Redwood siding.
6. Channel Rustic Sidings
   S4S
   Width: 10 inches
   Thickness: 25/32 inches
   Exposed width 1 inch less than nominal

7. V Rustic Sidings
   S4S shiplap
   Widths: 4, 6, 8, 10, and 12 inches
   Thickness: 9/16, 25/32 inches
   Exposed widths 1 inch less than nominal

8. Cove Rustic Sidings
   S4S
   Widths: 4, 6, 8, and 10 inches
   Thickness: 25/32 inches
   Exposed width 1 inch less than nominal

9. Wall Boarding (Board and Flush Batten)
   Tongue and Groove, S4S (for vertical or horizontal application)
   Board widths: 6, 8, 10, and 12 inches
   Batten Widths: 2 and 3 inches
   Thickness: 25/32 inches
   Exposed Width for one board and one baten 1\(\frac{1}{8}\) in.
   less than nominal

10. Wall Boarding
    Shiplap, S4S (for vertical or horizontal application)
    Widths: 8, 10, and 12 inches
This neatly painted picket fence of "Colonial" style, enhances the architecture of this California home.
Thickness: 25/32 inches
Exposed Width 1 inch less than nominal (8)

Have you ever walked down the street of a residential area and noticed a home with a neatly painted picket fence around the yard? It seems to set off the house to a better advantage like a gold frame enhances the beauty of a beautiful girl's picture.

Redwood picket fences are ideally suited to serve you best. They are sold already packaged in the size and style that you desire. One "Picket Pack" has enough pickets to build from six to eighteen feet of fence, depending on widths and spacing. All pickets are cut to exact size and lengths and are smooth-finishes, ready to use.

Eight styles are available as shown on the accompanying page. Two grades are manufactured. Standard Picket Pack, for use when the fence is to be painted, and Perfection Picket Pack for unpainted or clear-finished use. They will withstand constant exposure to dampness without decay. Both types of Picket Pack are free of knots and other defects.

All pickets are 3/4 inches thick and surfaced four sides. There are five heights: 23, 35, 41, 47, and 59 inches. Four widths: 1 3/4, 2 1/2, 3 1/2, and 5 1/2 inches. There are two 1 5/16 inches square pickets (Westchester).

The natural characteristics of Redwood qualify it for shingle use. It is slow to burn, its beauty improves with age, it is good for insulation, and above all, it is durable.

The label "Certified Shingles" is affixed to every bundle of Redwood shingles produced by members of the California
Figure 12
Redwood fence, gates, shake siding, doors, and trim are utilized in this home.

Figure 13
This Redwood gate and arbor form an attractive corner of this yard.
Redwood Association, and is your assurance that the product meets the high standards specified by the U. S. Department of Commerce. Certified Shingles of the Association are 100 per cent heartwood and 100 per cent vertical grain, which does not curl.

Redwood paneling will add unusual beauty and distinction to your home. Its velvety appearance and matchless grain seems to give a certain warmth that makes your home more comfortable to live in.

Clear Redwood for paneling may be obtained in widths up to 24 inches from standard stock and up to 40 inches on special orders. Panels may be laid either vertically or horizontally. Using Redwood paneling horizontally gives a more modern streamlined appearance.

Paneling may be finished by waxing to bring out the grain more or it may be stained with a variety of stains that have been developed to enhance the beauty of Redwood.
Figure 14
This is another view of the room shown in the frontispiece.

Figure 15
The paneling and fireplace mantel are built of Redwood in this home.
CHAPTER IX
Recommended Paints for Redwood

A satisfactory paint job is created from the combination of good paint properly applied to a satisfactory surface. Redwood has high ability to take and hold paint coatings. It is free from pitch or resin and there is no trouble with raised grain.

Painting is a simple process. It consists of three agencies: (1) a vehicle to secure penetration (usually turpentine), (2) an oil to hold the color, and form a protective film on the surface, and (3) the pigment or color itself. Good paint will last until the oil film wears out and permits the finely ground particles of pigment to fall away as dust. The heavier the coat of oil and the deeper the penetration the better the job. Redwood's porosity or absorbing power is therefore a perfect surface to paint, enamel, or stain.

To insure best results Redwood should be thoroughly dry when painted, enameled, or stained. Unless absolutely necessary it should not be painted on a rainy day. The wood absorbs moisture from the air, which partially fills the pores that should be filled with paint.

Most of the leading paint companies manufacture preparations which they recommend for natural finishes on Redwood exteriors. In general, these are intended to afford weather protection, maintain color, and to retard the oxidation and darkening which often comes from straight oil applications.
Figure 16
Horizontal panels, venetian blind slats, and block flooring are all Redwood, stained and waxed.

Figure 17
Redwood Room, Clift Hotel, San Francisco, shows suitability of Redwood for smart, modern interiors.
These types of finishes are usually of three classifications: (1) transparent colorless stains; (2) combinations of different oils; and (3) varnishes.

Many of these stains can be varied from the natural either lightening or darkening the appearance. They can also be produced in tints, which give various color effects, but which reveal the figure and grain of the wood.


Bleaching oils which give a weathered effect are manufactured by Samuel Cabot Company, San Francisco, and W. P. Fuller and Company, San Francisco.

The varnishes used for natural exteriors should be spar varnishes and all leading paint companies manufacture them. They are usually very durable and give good protection against weathering. They do, however, give a very glossy appearance. (9)

The California Redwood Association has prepared a list of recommended interior finishes of stains and waxes to suit the tastes of Redwood users. These finishes have proven popular and are easily procured.

These finishes have been developed from commercial stains and fillers. The materials can be had at any first-class paint store, and the finishes can be produced by any first class finisher who understands his trade.
The following description of finishes gives a fair idea of the versatility of Redwood for interior use. (10)

DESCRIPTION OF FINISHES

No. 1 Natural Redwood

Three coats of Old English Wax, let each coat dry 24 hours and then polish.

No. 2 Natural Redwood

Apply one coat of pure white shellac, thinned by adding one quart of alcohol to one gallon of the shellac. After drying, sand lightly. Then apply three coats of paste polishing wax. Allow each coat of the wax to stand for twenty minutes, then rub.

No. 3 Natural Redwood

Thoroughly mix two pounds of beeswax in one gallon of hot turpentine until the beeswax is entirely dissolved. (As turpentine is extremely inflammable, extreme care should be taken to prevent conflagration.) This preparation should be kept at a uniform heat during application. Apply liquid with soft cloth, rubbing with the grain, allow to dry 48 hours, then apply a coat of any white prepared wax and when dry polish with a soft cloth.

No. 4 Walnut Stain

Walnut stain made with Asphaltum varnish, Raw Umber and Van Dyke Brown with a little Burnt Sienna, made up with painter's thinner, boiled oil and Japen Dryer. After the stain coat has dried 24 hours it is given three coats of white shellac, each coat is rubbed down. Then given a coat of rotten stone and wax. Let stand for 24 hours, then polish.

No. 5 Light Walnut

For light walnut finish, add Lockwood's No. 65 Walnut Spirit stain to white shellac, and give three coats, each coat rubbed down. Then a coat of rotten stone and wax, let stand for 24 hours and polish. This produces an antique handworked surface.

No. 6 Black Walnut

The wood is first given a coat of acid stain. Then an oil stain coat for color. Then given two coats of pure
In this comfortable home, 10 inch Rabbeted Bevel Redwood siding was used.
white shellac. Each coat is rubbed down with steel wool. Then given a coat of rotten stone and wax, let stand for 24 hours and polish.

No. 7 Natural Grey

First coat is acid stain, let dry. Second coat is oil stain for color. Then two coats of pure white shellac, each coat rubbed down with steel wool. Then given a coat of rotten stone and wax, let stand for 24 hours and polish.

No. 8 Hand Hewn

An old antique finish on hand-hewn wood. Three coats of air darkened shellac rubbed down, rotten stone and wax.

No. 9 Rotten Stone - A simple two-coat finish

First treat the wood with the acid stain. Let dry. Then apply a coat of dry color wax stain, made with flat white under coat and thinner with a little oil and Japan added, also some rotten stone and dry green seal zinc, tone with dry color to the shade desired. Work into the mixture quite a lot of Old English Wax, about 21/2 pounds to the gallon. Put on the woodwork, let set a while and wipe up with rags. Let dry for 24 hours to 48 hours, and then polish with fine double O steel wool. Many architects prefer the dull tones for their interiors to the higher polishes.

No. 10 Orange Shellac

Apply three coats of pure, air-darkened orange shellac, rub down each coat with steel wool. Then wax and polish.

No. 11 Two-Tone Enamel

Apply three coats of flat enamel. Let dry four or five days, so as to harden. Then give a glaze coat of Raw Umber and Van Dyke Brown in thinner and Japan, wipe for the desired antique effect. Let dry 48 hours. Then give a coat of rotten stone and waxo wipe with soft cloths to produce the desired finish, let dry for 24 hours, then polish. This is a fine finish for old doors, paneling, screens and cabinets.

No. 12 Early American (Old Pine Finish)

First coat is a thin white shellac, second coat is flat white in oil and thinner, let soak in and then wipe clean with rags, third coat colored wax, glaze with dry
color and rotten stone, wiped for desired tone, let stand for 24 hours, then polish.

No. 13 Aged Effect

2 cans lye (size as per used in kitchen by housewife)
1 quart lime
1 gallon of hot water

Add lime to boiling water, then stir in lye slowly. Apply with fiber brush as it destroys a hair brush. Be careful of eyes and face.

No. 14 Mossy Effect

First apply a thin coat of clear creosote, swabbed on. Leave this exposed for a day or two, dependent upon the heat of the sun. After it is dry give it a coat of ordinary lime whitewash.
For this home at Lake Tahoe, Nevada, the architect specified rough-sawed bevel siding and vertical boards and battens.
CHAPTER X

Price of Redwood Home

Cost will, of course, be always a major factor influencing selection of materials for a home. The inexpensive will frequently be used rather than the expensive. Shrewd buying will obtain lower costs, but buying is no longer shrewd when value is sacrificed to price.

When you are building a home, you are putting your money into something that you want to have last for many years, maybe your lifetime. A durable wood, such as Redwood, often costs slightly more than ordinary woods. Yet, how little more is shown by this typical case study.

"A typical five room house, costing (complete in the New York area) $5,000 was selected from a prominent building publication. Complete lumber lists were obtained from the builder. Total lumber costs were then computed in two ways: first, using ordinary lumber of average grade; second, making appropriate changes to a durable wood of recommended grade. In both cases current retail prices were used in computations. The total difference in price between the two lists was $54.31. Yet that slight increase in cost gives the owner the assurance of a longer-lived, trouble-free home. It gives the mortgage holder the assurance that the house will outlive the period of amortization, with a minimum of repairs and maintenance."(11)

By this typical case study, it may be seen that while the initial cost may be a little higher when your home is built of Redwood, it will really cost you less when figured over a period of years.
Simplicity and dignity can characterize small houses as well as large ones. A home like this of Redwood, will cost you but little more, but will last many times as long.
CHAPTER XI

Summary

Redwood, though it had its infancy back in the earliest days of our civilization and has lived down through the ages, is a modern wood. Through the work of the California Redwood Association and the individual work and research of the companies that compose it, new ideas and uses of Redwood are constantly being tried out and put into use.

The Pacific Lumber Company of Scotia, California is now manufacturing Redwood fiber wool insulation made from shredding the long fibrous bark of Redwood. This Palco Wool, as it is called, gives extra insulating qualities as well as increased soundproofing. In the few years that it has been on the market, it has sold well and met with great success. Canada has been one of the first of the foreign markets to realize the extra values of this product, and thousands of tons of Palco Wool are shipped annually to this country.

More recently, The Pacific Lumber Company has been experimenting in using Redwood fiber mixed with wool for blankets and clothing. Some of these products are already making their appearance on the market at this time.

Keeping abreast of the times in home construction, Redwood was selected for the exterior finishing in Collier's "House of Ideas", built on the terrace of the Rockefeller Home Center. This strictly modern home designed by Edward D. Stone, utilized natural redwood siding, oiled to maintain its color, and accentuated only by the white doors and trim.
In this Colonial type home the strong horizontal feeling of the shadowline is obtained by using 12 inch Rabbeted Bevel Redwood siding.
Your home, too, may be kept abreast of the times by using Redwood. No matter what style of architecture you may desire, whether it be "Modern", French Provincial", "English", or "Colonial", Redwood is the perfect medium for making it the ideal home. For Redwood will make it (1) "longer lifed" by its durability, (2) more comfortable to live in by its extra insulating qualities, (3) cost less to maintain, (4) safer to live in than other types of construction because of its rigidity on resisting earthquakes, tornadoes, and hurricanes, and (5) that the cost of a home built of Redwood will be less as realized over a period of years because it will outlive the period of amortization.

Your home is your castle; it is one of your most prized possessions. Make it one of greater durability and beauty. Use Redwood.
Figure 22
Redwood flush joint shiplap was used in this home with a natural paint finish.
QUOTATIONS AND REFERENCES

(1) U. S. Forest Products Laboratory Progress Record - August, 1930.


(6) "We are going to Build our Home of Wood", West Coast Lumberman's Association.

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