

# Redwood

## Deck Construction

Redwood is a wood like no other and decks built of redwood are unique in their beauty and long-lasting service. There's a grade of redwood lumber for any part of any deck—luxury decks, economical decks, simple decks and decks that push the limits of definition.

Deck building isn't difficult. In fact, it's a perfect project for learning basic construction skills. Your deck can be as simple or complex as you wish to make it. The care taken in planning, choosing materials, double-checking measurements and adding personal finishing touches will go a long way in making your deck project look professional.

This booklet contains deck construction techniques and specifications based on decades of cumulative deck-building experience. It does not provide plans for building a specific deck, but it has valuable information that will help with any deck project.

### Planning A Deck

The first step in building a deck is to survey your yard and decide what problems the deck can solve.

Do you want to level a sloping yard? Create a central activity area? Upgrade a side yard? Minimize landscape maintenance? Make a barbecue or picnic area? Whatever problems you solve, you'll find your deck is a clean, dry place to enjoy one of the best sides of your home—the outside.

In selecting a site for a deck, it is important to think about privacy, safety, access to the house and protection from wind, noise and weather. Landscaping features must also be considered.

Think about the seasons when the deck will be used and the sun's path during the year. Often a southwestern or southeastern exposure is a good choice to take advantage of the morning or afternoon sun.

Don't forget to locate underground utility lines! In some cases, it may be wise to reposition the deck slightly to avoid interfering with utilities. In all cases, it is important to be aware of their placement.

### The Secret of Redwood's Long-Lasting Beauty

Redwood decks look better than decks made of other woods and keep their handsome appearance longer because redwood is naturally stable. This means redwood deckboards nail down flat and stay in place resisting warping, cupping, splitting and checking.

You'll find that redwood lumber has two predominant colors: cinnamon-red and creamy yellow. The cinnamon-red wood is heartwood and comes from the center of the tree. The creamy yellow wood is sapwood and comes from the portion of the tree near the bark. Some redwood grades are all heartwood while others permit both heartwood and sapwood.



**Garden Grades**

Garden grades of redwood are tailor-made for decks and they are not expensive! They have knots which give them a rustic look that blends well with landscaping and other natural materials. Redwood garden grades are available in dimensions from heavy timbers 20 feet in length to light-weight benderboard often used for edging garden walkways. Grades that have the word "heart" in the name are entirely decay-resistant heartwood.

**Construction Heart/Deck Heart**

All-heartwood grade containing knots; recommended for work on or near the ground and for posts, beams, joists and deckboards. Deck Heart is graded for strength characteristics and is available in 2x4 and 2x6 only.

**Construction Common/Deck Common**

Similar to Construction Heart and Deck Heart except containing sapwood; recommended for most above-ground applications such as railings, fences, deckboards and trellises. Deck Common is graded for strength characteristics and is available in 2x4 and 2x6 only.

**Merchantable Heart** Most economical all-heartwood grade, allowing larger knots and some knotholes; used for retaining walls and garden or utility structures on or near the ground.

**Merchantable** Same characteristics as Merchantable Heart but containing sapwood; suitable for fenceboards, trellises and above-ground utility applications.

**Architectural Grades**

Architectural grades of redwood are virtually knot-free or in the case of B Grade, contain knots of limited number and size. Architectural grades are the top of the redwood line. These grades are usually kiln dried to pre-shrink the lumber, but they are also available unseasoned. Often used for quality siding and interior paneling, architectural grades can be used for highly-visible landscape architecture where maximum stability is necessary.

**Clear All Heart** All-heartwood, free of knots; recommended for highly-visible applications like deckboards, railings, overhead shade structures.

**Clear** Similar quality to Clear All Heart except containing sapwood; uses include railings, fences, deckboards, benches and trellises.

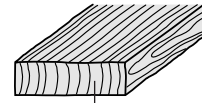
**Heart B** All heartwood grade containing limited knots and other characteristics not permitted in clear grades; uses same as Clear All Heart.

**B Grade** Similar quality to Heart B except containing sapwood; uses same as Clear.

**Grains**

Lumber has either flat or vertical grain depending on how it was cut from the log. Garden grades are sold with mixed grain patterns. To minimize cupping and grain raising, flat grain lumber should be used with the "bark side" up or facing out. Vertical grain lumber provides the smoothest surfaces for railings and benches.

**Vertical Grain**



Annual Rings

**Flat Grain**



Bark Side Pith Side

**Seasoning**

Seasoned or unseasoned garden grade lumber is suitable and most economical for decks and other outdoor projects. Architectural grades marked "Certified Kiln Dried" are pre-shrunk and have superior stability. They are good for areas requiring tight joints, such as outdoor shelves, cabinets and detail work.

**Textures**

Redwood is generally available with a smooth, planed surface on all four sides, known as S4S. Larger dimension timbers (4x4 and greater) are often available rough. Surfaced lumber is best for sitting and walking surfaces or areas to be painted.

**Sizes of Garden Grade Lumber**

Surfacing and seasoning reduce the dimensions of lumber. As a result, the actual dimensions of all lumber are different from the nominal dimensions. The chart below lists the actual and nominal dimensions of redwood garden grades.

**S4S Dry Sizes (Inches)**

Thickness		Width	
Nominal	Actual	Nominal	Actual
1	11/16	2	1 1/2
1 1/4	1	4	3 1/2
2	1 1/2	6	5 1/2
		8	7 1/4
		10	9 1/4

**S4S Green Sizes (Inches)**

Thickness and Width	
Nominal	Actual
4	3 9/16
6	5 1/2
8	7 1/2
10	9 1/2

**Specifying Redwood**

When you order or specify redwood lumber, it is important to list the following: *intended use, grade, seasoning, size and texture.*

**For Example:** Redwood lumber for (use) decking shall bear the Redwood Inspection Service grademark and shall be (grade) Construction Common, (seasoning) unseasoned, (size) 2x6, (texture) S4S.

**Redwood Grades and Uses**

	Construction Heart/Deck Heart	Construction Common/Deck Common	Merchantable Heart	Merchantable	Clear All Heart	Clear	B Heart	B Grade
Architectural	—	—	—	—	■	■	■	■
Garden	■	■	■	■	—	—	—	—
Knots	■	■	■	■	—	—	■	■
Sapwood	—	■	—	■	—	■	—	■
Posts	■□	—	—	—	■	—	■	—
Beams	■□	—	—	—	■	—	■	—
Joists	■□	—	—	—	■	—	■	—
Decking	■	■□	—	—	■	■	■	■
Rails	■	■□	—	—	■	■	■	■
Fenceboards	■	■	■	■□	■	■	■	■
Benches	■	■	■	■□	■	■	■	■
Planters	■	—	■□	—	■	—	■	—
Trellises	■	■	■	■□	■	■	■	■
Furniture	■	■	■	■□	■	■	■	■

- Suitable grade for use
- Most economical grade for use

With the preliminary planning done and the business of redwood grade, sizes, seasoning and textures taken care of, you can start thinking about the actual structure of the deck. Decks are walking surfaces held up off the ground by an understructure. The deck must be strong enough to support the weight of people, planters, benches, snow or anything else that might be placed on the deck. The understructure of a deck can have some or all of the following members: *footings, posts, beams, joists.*

The *footings* sit on or are partially buried in the ground. *Posts* are vertical members that rest on the footings and support the beams. *Beams* support *joists*, which are usually spaced about two feet apart and support the decking. The *decking* is the surface of the deck.

Each member of the deck is important in carrying the load and distributing the weight evenly. Proper spans—the distance between two supporting members—make for a safe deck and one that feels solid when you walk on it.

The following pages contain detailed descriptions of each part of a deck and techniques for putting them together.

### Laying Out the Deck

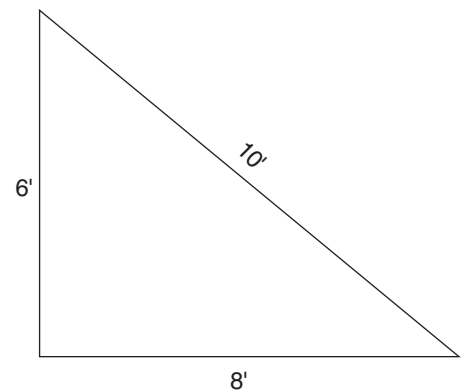
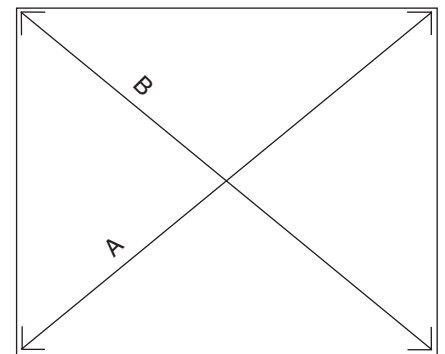
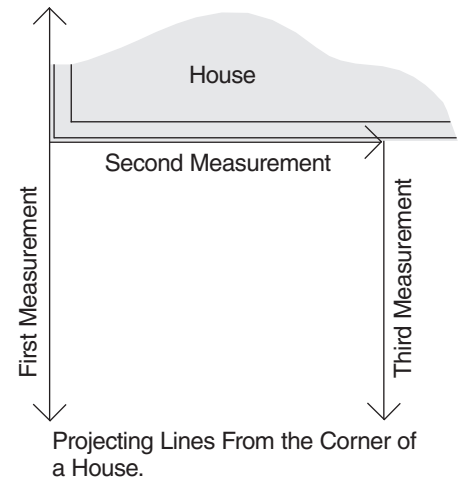
Mark the area for your deck with stakes and string. Consider all the points mentioned under “Planning” on the first page.

The deck perimeter can be laid out and squared in any number of ways. For example, if the deck is to extend from the corner of a house, it is easy to project a string line from the non-deck side of the house. This line and the wall where the deck will join the house form two sides of the deck perimeter. Next, measure the length of the deck from the corner along the wall of the house. With the third corner marked, the location of the last corner can be determined by measuring from these other established points.

The accuracy of any rectangle can be proven by diagonal measurements between the farthest corners. When the diagonals are equal, the rectangle is true. In some cases, the house or structure a deck is attached to will be out of line. It is usually best to make the deck conform to the structure.

Another method for determining the accuracy of a right angle is to create a right-angled triangle with sides 6 feet by 8 feet by 10 feet (or proportionate measurements). Using string, run two lines from a proposed 90 degree corner. Measure and mark points 6 feet from the corner in one direction and 8 feet in the other. A line connecting these two points and completing the triangle should be 10 feet in length. If it isn't, adjust the perimeter lines to square the corner.

Once the perimeter is staked out, it is time to place the footings.



## Footings

Deck footings rest on the ground and support the deck posts. Footings may be either concrete blocks, pre-cast pier blocks or poured concrete pads. As a rule of thumb, a footing should be about twice the size of the post it supports. For example, 4x4 posts should rest on 8x8 concrete footings.

Building codes are usually specific about the form and placement of footings. In general, they are required to extend below the frost line and they should extend above the ground to keep wood posts away from ground moisture.

Mixing and pouring concrete footings is a simple job. Cement, sand, gravel and water mixed in a wheelbarrow can be poured into a mold without much difficulty. Builders can make their own molds or buy forms, such as Sona Tubes, at building supply stores.

Placing the footings is key to the deck's stability. The number of footings and posts needed depends on the size of beams. In general, deck builders like to use heavier beams to minimize the number of footings. The placement of footings can be calculated from the suggested beam and joist spans.

## Posts

Posts are vertical members which rest on the footings and support the beams. The length of the posts is critical in establishing the height of the deck. Plan ahead—extended posts serve as a support for railings, benches and overhead trellises.

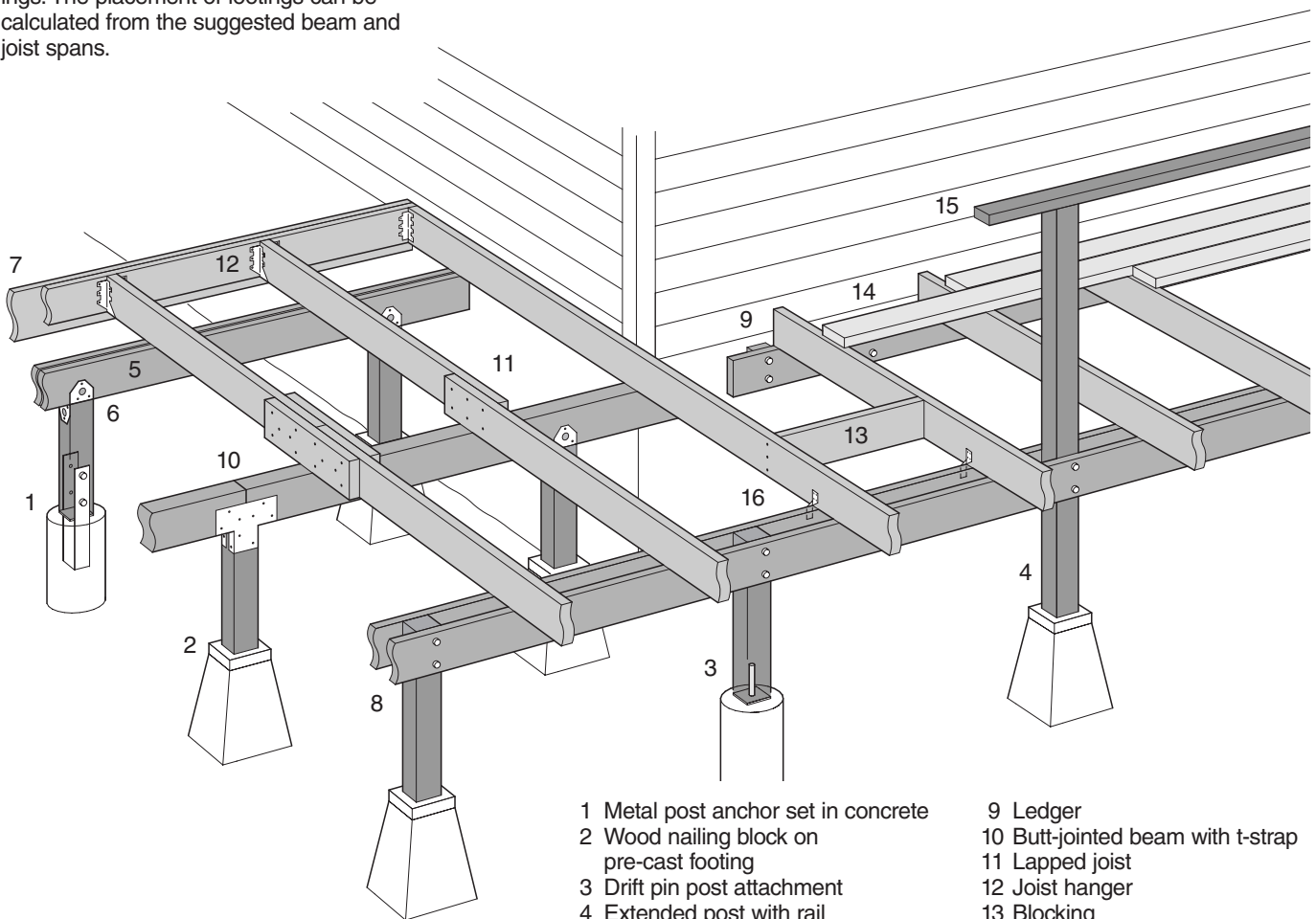
Timbers 4x4 and larger are most often used for posts. If large crowds, deep snow or other heavy loads are expected, or if the deck is elevated, larger posts may be needed and cross bracing may be necessary to prevent lateral movement. Local building codes will answer these questions.

There are several methods for attaching posts to the footings. Metal post anchors, wood nailing blocks, steel straps and drift pins are common methods. Metal anchors are recommended for high decks while wood nailing blocks are suitable for low decks.

Beams can rest on top of posts or double beams can straddle the post. The double beam method uses two pieces of thinner dimension lumber. Sometimes this can mean a savings. Naturally, if the double beam method is used, the posts need to be taller.

If a single beam is going to rest on top of the post, the post top must be trimmed carefully to make a solid seat for the beam. Double-check measurements before sawing. Measure and level the post from a stable reference position.

Make sure the posts are plumb when they are measured, installed and trimmed.



- |                                          |                                   |
|------------------------------------------|-----------------------------------|
| 1 Metal post anchor set in concrete      | 9 Ledger                          |
| 2 Wood nailing block on pre-cast footing | 10 Butt-jointed beam with t-strap |
| 3 Drift pin post attachment              | 11 Lapped joist                   |
| 4 Extended post with rail                | 12 Joist hanger                   |
| 5 Built-up beam with 1/2-inch spacers    | 13 Blocking                       |
| 6 Metal post/beam connector              | 14 Random length decking          |
| 7 Rim joist and fascia                   | 15 Rail cap                       |
| 8 Paired beams bolted to posts           | 16 Toe clip                       |
|                                          | 17 Joist spliced with wood cleats |

## Beams

Beams rest on the posts and support the joists. They are installed "on edge" with the narrow side resting on the post. For some low decks, beams may rest directly on the footings. Beams of 4x6 and greater are common. Often beams are "built-up" from thinner dimension lumber by fastening them together with bolts or lag screws.

The dimensions of beams depend upon their spacing and the distances they need to span. Larger beams require fewer posts and footings. Sometimes it may be necessary to butt-join beams over a post. They can be spliced together using cleats made of smaller lumber or by using a metal t-strap.

Beams fasten to the tops of posts by metal post connectors. Another method uses double beams which straddle the posts and are attached with heavy lag screws or carriage bolts. This method is ideal where posts rise above the deck to support a railing, seat or overhead structure.

In cases where beams rest directly on footings, they are held in place by anchor bolts or by toenailing into nail blocks.

Ledgers do the work of beams where the deck joins the house. The ledger should be bolted into the house framing or into the concrete foundation. Fasteners should penetrate at least 1½ inches into the framing or foundation. Use metal flashing to protect the ledger from moisture or use spacers between the house and the ledger to allow for water drainage.

### Suggested Beam Spans

For non stress-graded redwood lumber (Construction Heart), with a live load of 40 lbs. per sq. ft. and dead load of 10 lbs per sq. ft.

#### Beam Spacing

	Beam Sizes		
	4x6	4x8	4x10
6 feet	Span 4'0"	Span 5'0"	Span 7'3"
8 feet	3'3"	4'3"	6'3"
10 feet	3'0"	3'9"	5'6"
12 feet	2'9"	3'6"	5'0"

Beam span is the distance a beam extends from one post to the next. Beam spacing is the distance between beams. Deflection limited to L/240.

## Joists

Joists rest on the beams and support the decking. They are installed "on edge" with the narrow sides resting on the beams. At the side of the house, joists may be supported with a ledger. The distance that joists may span is determined by their dimension and the spacing between the joists.

Joists are often nailed to the top of beams and ledgers. With this design, the joists can overhang the beam for a cantilevered appearance and added space, but the overhang should never exceed one-quarter the joist span. A popular alternative is to hang joists from beams with metal joist hangers. This permits joists to be hung level with or below the top of beams.

For standard decking, joists should be spaced 24 inches on center (from the center of one joist to the center of the next). For diagonal decking, joists should be 16 inches on center. When installing 5/4-inch decking, joists should be spaced 16 inches on center and for diagonal decking, the spacing should be 12 inches on center.

Blocking nailed between the joists will increase the stability of the deck.

### Suggested joist spans

For non-stress graded redwood lumber (Construction Heart) with live load of 40 lbs. per sq. ft.

Joist Size	Joist Spacing	Joist Span
2x6	16" on center	7'3"
	24" on center	6'0"
2x8	16" on center	10'9"
	24" on center	8'9"
2x10	16" on center	13'6"
	24" on center	11'0"

Deflection limited to L/240.

## Decking

Decking provides the surface and walking area of the deck.

Redwood 2x4 or 2x6 dimension lumber is ideal for deck surfaces. Decking spans are described below. Extra weight, such as a large permanent planter, a hot tub or spa will need extra support. In some cases, it may be necessary to get assistance from a contractor, architect or engineer.

With random length decking make sure the ends meet over joists. Decking should be fastened with only one nail or screw per bearing. This permits some dimensional change in the decking yet provides enough holding power. Extra nails may be added later if necessary. Predrill nail holes at the end of decking to avoid splitting while nailing. For a cleaner look, use a hidden deck fastening system.

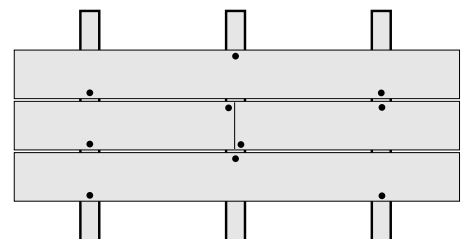
Since it is the most visible part of the structure, it is often desirable to add a design element to the decking. Decking can be applied in a variety of patterns including: diagonal, herringbone and parquet.

### Suggested Decking Spans

The suggested span for 2x4 or 2x6 decking is 24 inches. If the decking is to be installed diagonally, joists should be spaced 16 inches on center. Spans for 5/4-inch decking are 16 inches on center, and 12 inches on center when installed diagonally.

### Decking to Cover 100 Square Feet

Materials	Standard Linear Ft.	Diagonal Linear Ft.
2x6 Decking	210	242
2x4	326	375



A staggered nailing pattern permits slight "movement" during the wood's natural seasoning process while holding the decking in place.

### Construction Tips

Sometimes, enthusiasm can get builders into trouble if they don't think about the consequences. Overnailing, for example, is a common mistake. One deck nail or screw per bearing is fine for redwood 2x4 and 2x6 decking. Drive deck nail or screw flush with deck surface; do not countersink. Redwood shrinks less than most wood, but unseasoned redwood will shrink as the internal moisture evaporates. If it is held down with too many nails, decking may split when it shrinks.

Trapped moisture is another potential troublemaker to consider. Wood decay is caused by alternate moist and dry conditions. Consequently, the areas that trap moisture are the most critical. For example, the place where posts meet footings, or ledgers are attached to the house are moisture-problem areas. These members should be all-heartwood redwood and they should be pre-finished with a water repellent preservative solution. Decking, because it is quick draining, will not be as critical, but remember to leave about a 1/8-inch space between deckboards for drainage. You can use 16-penny nails as spacers and they are usually the handiest measuring tool when you are applying the decking.

### The Finishing Touch

There are many details that can help turn a plain deck into an "aaaahh" deck. Some finishing touches, like stairs and railings, may be absolutely necessary while others, like benches and planters, are simply a matter of taste and style.

As you are working, you'll notice other little things you can do that will make the deck "just right." For example, a fascia trim around the edge of the decking will give it a more finished look. Chamfered or roundover edges can soften the appearance of the deck board ends and edges. Or maybe you'd like to use mitered corners for your railing. Or add built-in shelves or cabinets.



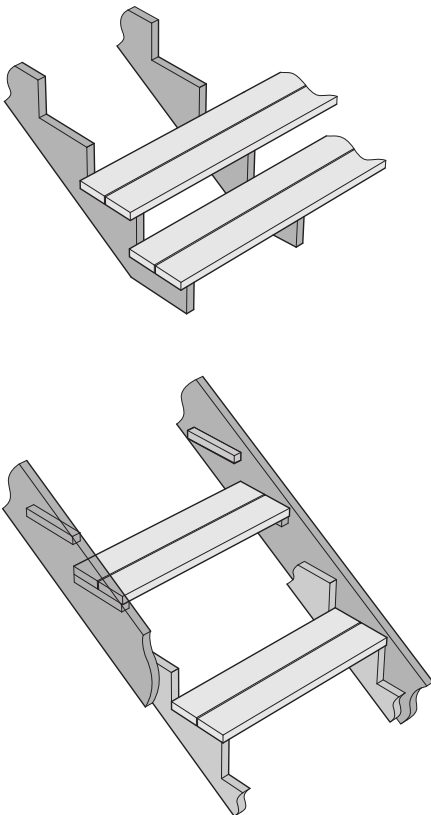
## Stairs

If the deck is over a foot off the ground, you'll need to build stairs. Stairs require precision carpentry and quality materials. Decay resistance is important, so an all-heartwood grade should be used.

Stairs are made with treads and stringers, sometimes called risers. The treads are the stepping surface and are supported by the stringers. Stair treads should be a minimum of 11 inches deep and between 6 and 7 inches apart. For wide stairs, notched stringers placed 24 inches apart provide proper support. If only two steps are planned, a 2x12 can be laid on edge or notched as a stringer. If more steps are needed, a sloping stringer should be used. According to most building codes, notched stringers must have a minimum of 3½ inches of width below the notch.

As an alternative, stair treads can be set inside a pair of stringers, so that the stringers enclose them on both sides. This is referred to as "boxed stringers." The tread can then be supported by cleats nailed to the stringers or by a separate notched stringer. Stringers should be 24 inches on center to provide proper support for the treads.

At the top, anchor the stringers to the deck framing. At the bottom, anchor them to the deck at the lower level or rest them on a concrete pad or footings.



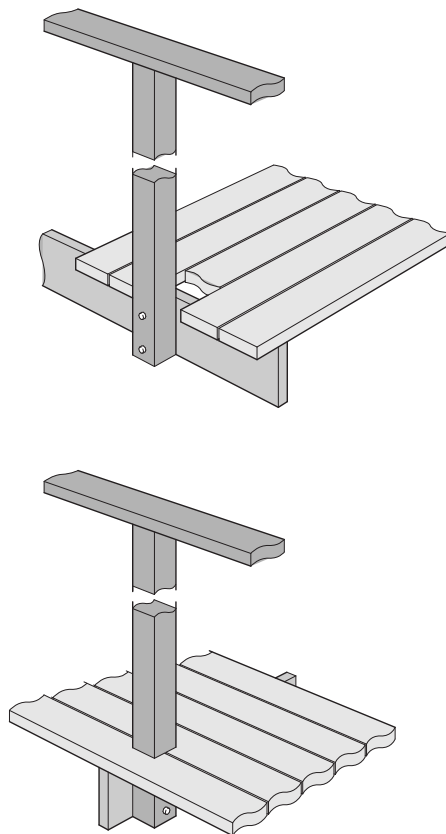
## Railings

Although the railings are often the last of the finishing touches, they need to be planned in advance. Consult local building codes for railing requirements. Railings are necessary for any deck over 1½ feet off the ground. In many areas a railing is required by law. For the most part, form should follow function.

Remember to design a railing that doesn't encourage sitting unless it is intended for that purpose. Railings should be sturdy barriers erected at the deck's edge without completely obscuring the view.

Railing supports should be securely fastened to the framing of the deck. Toenailing to the surface of the deck is not adequate. Railing supports should be bolted to joists or beams, or they may be an extension of the post.

Vertical grain redwood is suggested for the cap of a deck rail because it best resists weathering and splintering.



## Benches

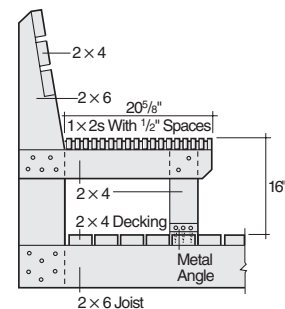
Benches aren't hard to build if a few basic rules are kept in mind. The best height is between 15 and 18 inches. Cushions change the measurement, so keep a ruler handy. Garden grades are economical and work well for benches.

Here are plans for two different types of benches. The first is built-in and is an extension of the deck railing. The second is a simple movable bench which can be built in a matter of minutes.

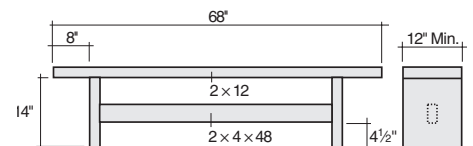
**Bench #1** This built-in bench is part of the railing. The length of the back and seat boards can vary according to your plan. The seat supports shown in the cross section below should be repeated every two feet. Many variations are possible since railings double as bench backs. The seat slats are 1x2 boards set on edge and spaced ½ inch apart. Bench supports extend from the railings' 2x6 posts which are, in turn, bolted to deck joists and beams. The horizontal bench supports are pairs of 4-foot 2x4's between which posts and legs are sandwiched. Each leg is attached to the decking with a metal angle bracket. Be sure the railing is strong enough to support the bench and the weight of people leaning against the back of the bench.

**Bench #2** This simple bench takes three saw cuts and a short time to build. It is made from an 8-foot 2x12 and is braced with a 2x4. Cut two 14-inch pieces from the plank's ends for legs, leaving a seating area 68 inches long. Center the 2x4 brace between legs and attach with 16-penny nails. Attach legs to the top by toenailing from below. If unseasoned lumber is used, assemble brace and top with deck screws.

### Bench #1



### Bench #2



## Finishes

Finishes will enhance the performance of any exterior wood project, so it is important to coat all surfaces with a water repellent wood preservative before installation. For example, it is necessary to coat sawn ends of posts and the back sides of ledgers before they are put into place and hidden by other parts of the deck.

**Clear Water Repellents** Clear water repellents with mildewcide can stabilize redwood's color at a buckskin tan if applied regularly.

**Bleaching Oils** Unfinished redwood tends to darken, then ultimately weathers to a soft driftwood gray. To achieve an immediate weathered appearance, a bleaching oil can be applied.

**Decking Stains** To achieve a lasting redwood color or any other hue, a water repelling, oil-based deck stain may be used. Be sure that the stain is recommended for walking surfaces.

**Naturally Weathered** Left unfinished, redwood will first darken and then will weather-bleach to a soft driftwood gray. Over time, this no-maintenance option results in a look that is preferred for a rustic appearance.

### Do

Use water repellents, stains and bleaching oils which contain mildewcide. Make sure all surfaces are clean and dry. Use a brush or roller for application.

### Don't

Don't use varnishes or lacquers on exterior redwood.  
Don't mix incompatible finishes—always follow manufacturer's directions.  
Don't use linseed oil alone as it will attract dirt and mildew.

Redwood Finishes Uses	Water Repellents w/ Mildewcides	Bleaching Oils and Weathering Stains	Semi-Transparent Stains	Solid-Color Stains	Latex Paints	Lacquers/Varnishes
Decks/Walkways	■	■	■○	■○	——	——
Fences	■	■	■	■	——	——
Planters/Retaining Walls	■	■	■	■	——	——
Seating	■□	■□	■□○	■□○	——	——
Tables	■□	■□	■□	■□	■□△	——
Garden Shelters	■	■	■	■	■△	——
<b>Effect</b>						
Color	Natural	Driftwood	Selected	Selected	Selected	——
Grain Visibility	High	Medium	Medium	None	None	——
<b>Application</b>						
Recommended Coats*	2	1-2	2	2	2	——
Primer Required	None	None	None	None	Oil/Alkyd	——
Refinish—Years	1-2	——	2-5	2-5	5-10	——

□ Non-toxic formulations   ○ Traffic bearing formulations   △ Certified Kiln Dried lumber only  
\*Follow manufacturer's recommendations.

## Fasteners

All nails, fasteners and hardware must be stainless steel, aluminum or top-quality, *hot-dipped* galvanized (electroplated galvanizing is not acceptable). Poor quality fasteners will react with redwood's natural, decay resisting extractives causing unsightly stains.

