Decks *Part 1 of 2*

By **BRUCE BARKER, ACI**

ONCE AGAIN, The Word invites you to travel into the dark realm of issues that sometimes are misunderstood by home inspectors. The Word hopes you will find this trip informative and maybe a little entertaining.

The Word's term this month is **decks**. The Word finds this term interesting because deck construction has become a lot more complex since he built his first deck some 25 years ago. When construction gets more complex, inspecting that construction also gets more complex.

Deck construction is far too complex for one column. We'll begin this month with basics including flashing, deck ledgers and hardware. We'll continue next month with more advanced issues.

We'll discuss single-level decks designed for the standard 40 psf uniform live load. Multi-level decks and decks supporting concentrated loads such as spas should be designed by a qualified engineer.

What's the fuss?

Let's first review two of the most significant problems with decks. The headline grabbers are the deaths and injuries caused when decks collapse and when guards fail. Decks collapse and guards fail for many reasons, but two of the most common reasons are improper fastening of decks and guards, and deterioration of deck fastening to the home due to water infiltration. Water infiltration is usually caused by improper drainage where the deck is attached to the home. Because water infiltration causes many other problems, let's look at deck drainage first.

When construction gets more complex, inspecting that construction also gets more complex.

Control that water!

The area where the deck ledger board is attached to the home is one long, potential water infiltration area and one of the longest such areas around the home. A properly installed drainage plane to control water is essential. Figure 1 shows the ideal arrangement of multiple materials that constitute the drainage plane. You won't be able to see most of the details shown in Figure 1 during a home inspection, but here are a few things that you might be able to see.

The deck ledger board shouldn't be attached directly to any wall cladding material, including

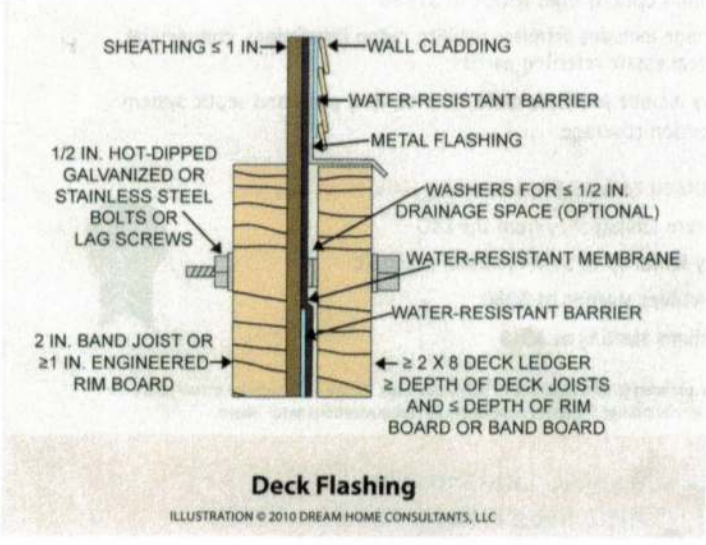

Figure 1

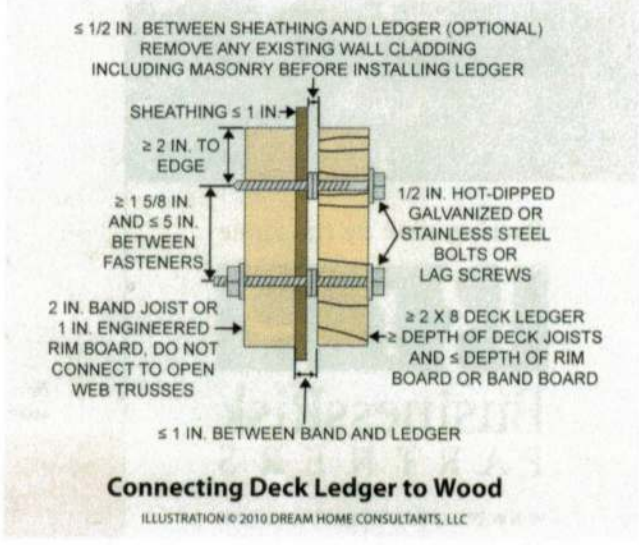

Figure 2

brick and stucco. This is both for structural and for water infiltration reasons. The wall cladding material should be removed and the deck ledger should be attached directly through the sheathing into an appropriate band or rim board. The sheathing shouldn't be more than 1 inch thick, and the distance between the band or rim board and the deck ledger shouldn't be more than 1 inch.

You may see a gap of ½ inch or less between the deck ledger board and the sheathing. This gap allows the deck ledger to dry and allows any water that gets behind the deck ledger to drain off. This gap isn't required and some controversy exists about whether a gap between the ledger and the sheathing is wise. The controversy involves whether the benefits of the gap are offset by the reduction in structural integrity caused by loss of contact between the deck ledger and the sheathing.

You should see some type of drip-edge flashing, usually galvanized steel, lapping over the deck ledger board and under the deck flooring. You probably won't see how the drip-edge flashing is installed under the wall cladding and how it's integrated with the other drainage materials, but drip-edge flashing installed on top of the wall cladding is a reportable deficiency.

Deck ledger boards

The deck ledger board should be treated or decay resistant dimension lumber that often is treated #2 southern pine or redwood. The deck ledger should be at least a 2x8 and at least as deep as the deck joists, so 2x10 deck joists should be attached to at least a 2x10 deck ledger. The deck ledger should not be deeper than the home's band or the rim board, so a 2x12 deck ledger shouldn't be attached to a 2x10 band board.

The deck ledger board should be attached to either a nominal 2x dimension lumber band board or to an engineered 1-inch or thicker rim board. The deck ledger should not be attached to I-joist type trusses or to open web (metal-plate connected) trusses without written engineer-approved plans. Figure 2 shows a summary of these typical requirements.

The type and location of fasteners are essential to ensure sound structural attachment of the deck to the home. Bolts or lag screws of ½-inch diameter are the usual minimum size. Hot-dipped galvanized is the usual minimum coating material for all hardware including nails, screws and joist hangers. Stainless steel may be required in severe-exposure areas such as near salt water.

Figure 3 shows the typical location of deck ledger board fasteners. The spacing of fasteners depends on the length of the deck joists, whether attachment is to a dimension-lumber band or to a rim board, and on the fastener type (bolt or lag screw). Typical fastener spacing for deck ledgers attached to engineered-rim boards is between 9-12 inches on center and between 11-24 inches for deck ledgers attached to dimension-lumber band boards. The more distant spacing applies to shorter deck joists and the closer spacing to longer deck joists. Lag screws need closer spacing than bolts. Refer to your local codes and to the references cited at the end of this column for more information about ledger fastener spacing.

Attachment of the deck ledger board is intended to accommodate vertical loads and lateral loads. Vertical loads are the weight of the deck materials (dead load) and the weight of occupants and belongings (live load). Lateral load is the force that wants to rip the deck out of the wall in the horizontal direction. You may see hardware such as that shown in Figure 4 as an alternate method of accommodating lateral loads. There should be at least two of these brackets per deck. Note that these brackets do not replace lag screws or bolts unless allowed by an engineer or by the bracket manufacturer's instructions.

Hardware corrosion

Almost all decks built before 2004 used wood treated with an arsenic-based compound known as CCA. The Federal government outlawed CCA as of December 31, 2003. CCA is somewhat corrosive to deck hardware, although hardware corrosion due to CCA isn't widespread. Hardware corrosion in CCA-treated decks is more likely due to severe environments and due to substandard hardware. ▸▸

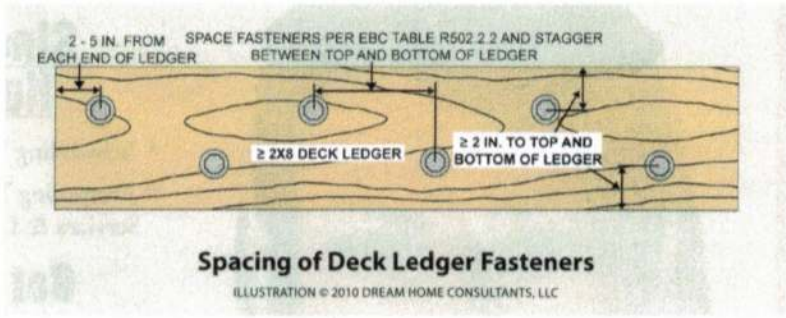

Figure 3

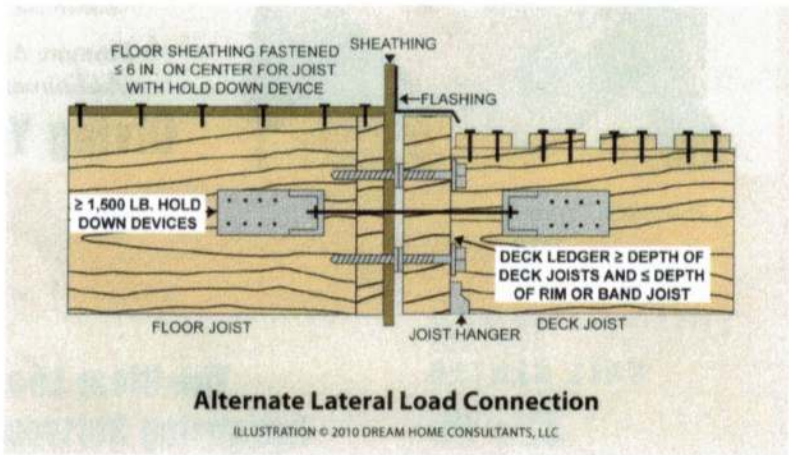

Figure 4

Most decks built beginning sometime in 2004 use wood treated with compounds such as ACQ and CBA. These compounds are more corrosive to deck hardware and hardware failure has occurred, particularly in decks built from 2004 to around 2007, or so when the corrosion problem became more widely known. You should look extra carefully at hardware on decks built since 2004, and especially at decks built in the early years of the conversion from CCA-treated wood.

It's pretty easy to tell the difference between galvanized and non-galvanized hardware. Galvanized hardware usually has a dull gray appearance. Non-galvanized hardware usually has a bright metallic appearance. It's more difficult to tell the difference between the different types of galvanized hardware unless you look at the box.

Hot-dipped galvanized hardware has a thicker corrosion-resistant zinc coating compared to other galvanized hardware such as electrogalvanized (EG) and mechanical-plated. The thinner coating of other galvanized hardware does not provide the necessary protection from corrosion caused by the new wood-treatment compounds. Some deck builders are using membranes to isolate hardware such as joist hangers from deck lumber. This is a good idea, although it's not required.

Here are some other hardware warnings. Never use aluminum hardware with the new wood-treatment compounds. Never use stainless steel and galvanized hardware together. For example, never use galvanized nails with a stainless steel hanger. The galvanic reaction will increase the corrosion rate. Never use copper flashing with the new treated wood unless the copper flashing is made with an isolation membrane.

The bottom line

For many years, deck building was lightly regulated and decks often were not carefully inspected. The 2009 IRC has a prescriptive section on decks and the new 2012 IRC expands on the 2009 code coverage of decks. Two other excellent guides to deck construction are DCA 6 Prescriptive Residential Deck Construction Guide 2009 IRC Version, available at **awc.org/codes/dcaindex.html**, and the Deck Framing Connection Guide by Simpson Strong-Tie, available at **www.strongtie.com/ftp/fliers/F-DECKCODE09.pdf**.

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Decks *Part 2*

By **BRUCE BARKER,** ACI

The good thing about deck stairs, landings and guards is that the rules are the same as for interior stairs, landings and guards.

ONCE AGAIN, The Word invites you to travel into the dark realm of issues that are sometimes misunderstood by home inspectors. The Word hopes you will find this trip informative and maybe a little entertaining.

The Word's term again this month is **decks**. The Word finds this term interesting because deck construction has become a lot more complex since he built his first deck some 25 years ago. When construction gets more complex, inspecting that construction also gets more complex.

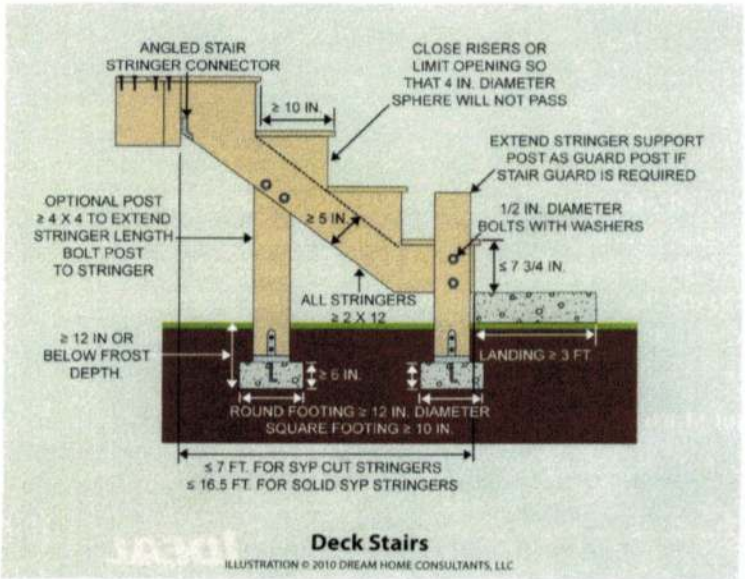
Last time, we discussed deck flashing, ledger boards and hardware. This time, we'll discuss deck stairs, guards and handrails. There are numerous ways to build decks (and many other things we inspect) that will work. We will discuss decks built using #2 Southern Pine. Decks using other materials and decks designed using other approved methods may work just fine. Just because something doesn't look quite like we discuss here doesn't necessarily mean it's wrong.

A brief review

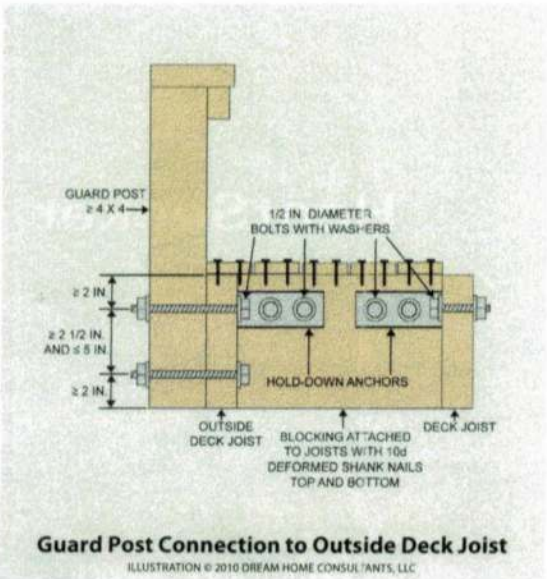
Let's briefly review what we discussed last time. One of the prime reasons for deck failure is water infiltration between the deck ledger board and the home. Water deteriorates the wood and the deteriorated wood allows the fasteners to pull loose. Proper flashing between an attached deck and the home is essential, and this flashing often is poorly installed. Look closely at this flashing.

Deck ledger boards should be attached to a nominal 2-inch-thick band joist or to an engineered rim board that is at least 1 inch thick using ½-inch bolts with nuts and washers or using ½-inch lag screws. You should not see ledger boards attached using nails or attached directly to floor trusses. You can make the deck self-supporting and eliminate both the flashing and ledger board issues.

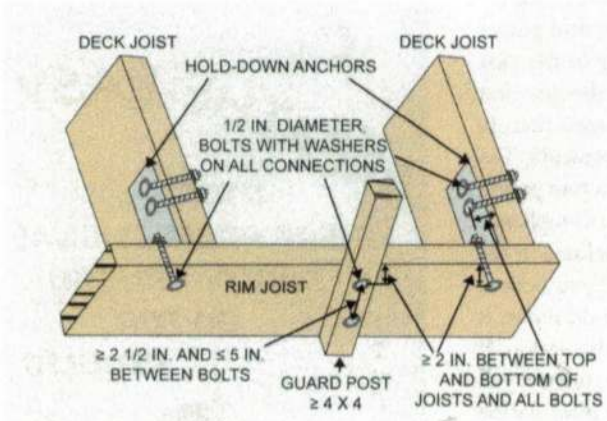
Corrosion of deck fasteners and hardware is a more common problem than it used to be. Wood preservative chemicals used beginning in 2004 are more corrosive than previous



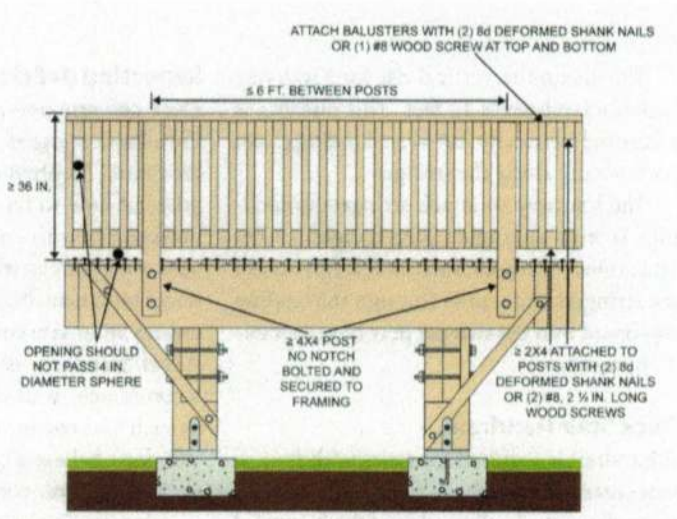
Deck Stairs



Guard Post Connection to Outside Deck Joist



Guard Post Connection at Rim Joist Between Deck Joists



Deck Guards

chemicals. This requires deck fasteners and hardware to be more corrosion-resistant. Deck fasteners and hardware should be hot-dipped galvanized or stainless steel, not electrogalvanized. Never mix incompatible fastener and hardware types together, such as galvanized joist hangers with stainless steel fasteners.

Deck stairs, landings and guards

The good thing about deck stairs, landings and guards is that the rules are the same as for interior stairs, landings and guards. Stairs should be at least 36 inches wide. Interior stair width mainly is for egress during a fire. Fire egress isn't usually an issue for deck stairs, but stairs that are too narrow are not safe to use no matter where they are. Besides, it's easier to keep interior and exterior stair rules consistent.

Interior stair width is measured above the handrail, but because a deck stair handrail usually is at the top of the stair, deck stair width often is measured along the tread. Any handrail should project into the stairs at least 1-½ inches (to help make it graspable) and should not project more than 4-½ inches into the stairs.

Deck landings should be at least as wide as the stairs and at least 36 inches deep in the direction of travel. Landing size also is a fire egress issue. Intermediate landings should be built as independent self-supporting decks, complete with support posts, footings and diagonal bracing.

Guards are required when the deck's finished surface is more than 30 inches above grade. Guard height should be at least 36 inches above the deck. Occasionally, you'll see a bench or other fixed horizontal surface at a guard. Measure the guard height from the fixed surface, not from the deck floor.

Vertical guard members (pickets or balusters depending on where you live) should not allow a 4-inch-diameter sphere to pass between them. Don't forget to check the space under the guard and at risers. A 4-inch sphere shouldn't pass under any bottom rail of a guard and shouldn't pass between treads with open risers. A 6-inch sphere shouldn't pass between the triangle formed by a stair riser, tread and any bottom rail of a guard on the open side of stairs.

By the way, guards often are called guardrails, particularly when they protect the open sides of stairs. Guard and handrails are the IRC-approved terms for these different components, but if you like the term guardrail, that's no problem.

Deck stairs risers and treads

The deck stair maximum riser height is 7-¾ inches and the maximum riser height difference between landings is ⅜ inch. The most common places to find stair riser problems are at the top, bottom and any intermediate landings. The framers sometimes don't position the stringer in the right place at landings or don't cut the stringer to allow for thickness differences if different materials are used on the treads and on the landing.

The minimum tread depth is 10 inches and the maximum tread depth difference between landings is ⅜ inch. Measure the tread depth between the leading edge of adjacent treads. This is where your feet will land when you walk the stairs.

Most stairs will have a nosing that projects beyond the riser over the next tread. The nosing should project beyond the riser between ¾-inch and ¼-inch riser and this projection should not vary more than ⅜ inch in a stairway.

Why do riser height and tread depth differences matter? You get used to the risers and treads when you walk a flight of stairs and you expect them to be uniform. If they're not uniform, you could stumble and fall. Minor riser and tread differences aren't a big deal for most people, but for small children, the elderly and people with reduced mobility, they could be a very big deal and cause a very bad fall.

Check the condition of the stair treads when you're walking the stairs. Wide tread material (2x8 and 2x10) is recommended for solid stringers, but in The Word's experience, treads (and other horizontal wood deck materials, for that matter) wider than the nominal 6 inches have a nasty tendency to cup over time. Severely distorted treads can be a safety issue, so watch for this.

Deck stair stringers

Specific guidelines exist for stair stringers. Stringers should be at least 2x12. The maximum unsupported horizontal run for a cut 2x12 stringer is 7 feet. Solid stringers may run horizontally for 16 feet, 6 inches. A 4x4 post may support stringers that exceed the maximum horizontal run. The post should be supported by a footing and bolted to the stringer. Cut stringers should have at least 5 inches of solid wood between the cut and the stringer edge. ▸▸

The maximum vertical rise for a stairway between landings is 12 feet. This distance is measured vertically between landings, not horizontally along the stringer.

The best way to attach stringers to landings is with an angled joist hanger. Other attachment methods such as a ledger under the stringers and screws through the landing rim board into the stringer may be acceptable if approved.

Deck Stair Handrails

A handrail is required for stairs with four or more risers. The handrail should be continuous from above the leading edge of the first tread to the trailing edge of the last tread. The top of the handrail should be between 34 and 38 inches above the leading edge of each tread. The problem with handrails for older decks, including those built by The Word in the 80s and 90s, is that 2x4 handrails were typical. Such handrails are not allowed because they are not graspable. Adding a 2x2 handrail will easily correct the problem, as will adding a circular handrail with a diameter between 1-¼ and 2 inches. Cutting in an appropriate finger recess will work for some handrail configurations.

When the stair handrail also serves as a guard, the vertical members should not allow a 4-⅜-inch-diameter sphere to pass. This is different from the 4-inch-diameter requirement for a guard.

Here's another problem with older decks. In the old days, we'd notch posts for deck guards and handrails and attach everything with nails. This works fine for a while, but over time, the nails tended to pull out, causing catastrophic failure of the guards and handrails. We improved this method by attaching the posts with bolts or lag screws to the deck rim joist. The problem with this method is that you're still relying on the nails that attach the rim joist for a significant amount of the holding power.

Now, deck guard and handrail posts may not be notched, and they must be secured to something substantial such as a deck floor joist or a rim board that is, in turn, secured to a floor joist. Hold-down anchor hardware has been developed to secure these connections. There should be not more than 6 feet measured horizontally between most wood posts for guards and stair guards. Other approved designs are acceptable.

Reporting deficiencies in older decks

Deck construction requirements and guidelines have changed significantly in the past few years. As often is the case, the question arises of how to report components that do not comply with current requirements. The answer depends on whether you, in your professional judgment, believe that non-compliance creates an unsafe condition as defined in the ASHI Standards of Practice. If you believe a component is unsafe, you should report it as such and recommend corrective action. If you don't believe a component is unsafe, you may report non-compliance as information or you may chose to ignore the situation. It's your choice, but choose wisely.

The bottom line

In case you missed these references last month, the 2009 IRC has a prescriptive section on decks and the new 2012 IRC expands on the 2009 code coverage of decks. Two other excellent guides to deck construction are DCA 6 Prescriptive Residential Deck Construction Guide 2009 IRC Version available at **awc.org/codes/dcaindex.html** and the Deck Framing Connection Guide by Simpson Strong-Tie available at **www.strongtie.com/ftp/fliers/F-DECKCODE09.pdf**. Remember, alternative methods and materials may be acceptable.

Decks frequently are built by weekend handymen, often with little more than a "how to" book, if they even have that. Given the risk of poor construction and the risk of personal injury and property damage, decks deserve special attention during our inspections.

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Decks *Part 3*

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Previously we discussed issues including deck flashing, ledgers, hardware, stairs, guards and handrails. This time we'll discuss deck framing issues such as joist-to-beam attachment, rim-joist attachment, footings, and support posts.

Remember when reading all The Word columns that we're discussing general principles. Just because something you see in the field doesn't comply with a general principle doesn't mean that what you see is wrong. Local building codes, manufacturer's instructions and engineered designs trump general principles.

A Brief Review

Let's briefly review what we discussed last time. A deck stairway is no different from any other stairway in terms of riser height, tread depth, landings, handrails and guards. This makes basic deck stairway inspection easier.

The guidelines for deck stair stringers depend on whether you're using cut stringers or solid stringers and on the lumber species. Cut stringers may only span 6 or 7 feet horizontally depending on the lumber species. Solid stringers may span about 13 or 16 feet depending on the lumber species. You may extend the stringer span using a 4x4 post.

Support posts for deck guards and stair guards should be attached to the deck using attachment devices that are attached to deck joists using bolts and washers.

Attaching Deck Joists to Framing

Attach deck joists to deck ledgers using approved joist hangers installed according to manufacturer's instructions. The joist hanger should be the right size for the joist. For example, a 2x6 joist hanger usually should not support a 2x8 joist, although this may be allowed under some conditions. Manufacturer supplied joist hanger holes should be filled with an appropriate fastener as specified by the manufacturer. Some holes are used for specific purposes and may not need a fastener in some situations. Joist hanger manufacturers have specific recommendations about appropriate fasteners, and these recommendations may not include some gun nails. Don't forget to look for incompatible fastener and hanger materials such as galvanized fasteners and stainless steel hangers.

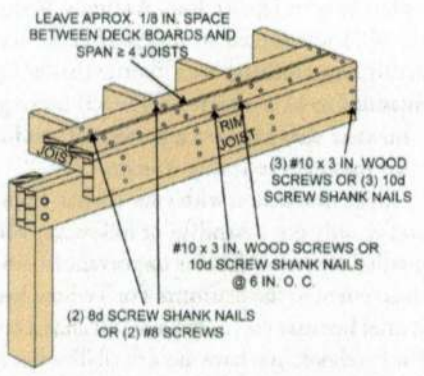
Attach deck joists to beams using three 8d-deformed-shank nails toe nailed, an approved attachment device or a joist hanger. The nailing method is recommended only when the deck ledger is attached to the home.

Attaching Rim Joists to Deck Joists

The rim-joist-to-deck-joist attachment used to be just another attachment; no longer. The outside deck floor board should be attached to the rim joist using either 10d-deformed-shank nails or #10 wood screws at 6 inches on center. The outside rim joist should be attached to the deck joists using three of the same fasteners per joist *(see Figure 1)*.

Deck Beams and Support Posts

In the old days we used wood 4x4 posts to support decks. This is still allowed by the IRC, but 4x4 posts are not recommended, particularly for tall decks. Three inch or larger steel columns are allowed if they have a shop-applied, rust-resistant coating on both the inside and outside. Remember to check that all posts are adequately anchored at both the top and the bottom. A manufactured-post base attached to or embedded in the footing is the typical bottom anchor and straps are the typical top anchor.



Deck Board and Rim Joist Construction

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Figure 1

Wood deck support posts should be at least 6x6 and should be not more than 14 feet tall measured from the footing to the bottom of the beam unless the deck is designed using accepted engineering practices. Six-by-six posts supporting a 2-member beam or equivalent may be notched with the beam attached to the post using two bolts with nuts and washers. A post-cap device may also be used. Six by six posts supporting larger beams may not be notched and should use a post-cap device to attach the beam to the post *(see Figure 2)*. Occasionally, you may see a beam attached to the side of the post with bolts or lag screws. This beam is supported only by the hardware, and this is not acceptable.

Built-up beams may no longer be constructed using smooth shank nails. Number 10 wood screws at least 3 inches long or 10d-deformed-shank nails should be used and should be staggered in two rows. In addition, two fasteners

should be installed at each beam end and at any splices. Any splices should be supported by a post.

Deck Joists

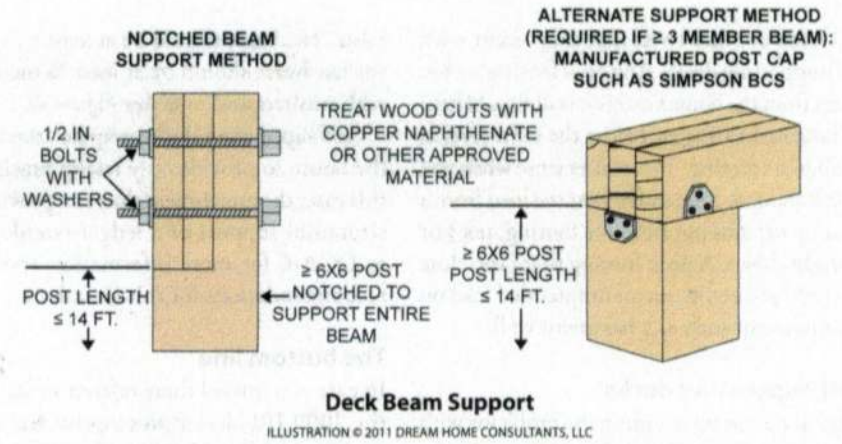
The maximum clear span for deck joists is less than the span for interior floor joists because joists exposed to wet conditions can't carry the same load. There are also different span tables for cantilevered deck joists than for joists that end at supports. You shouldn't use the regular code span tables for decks. DCA-6 has a deck joist span table.

A cantilevered deck is one where the joists project beyond the support beam. This is a popular deck construction method. The standard rule for the cantilever backspan ratio in residential framing is 1 foot of cantilever projection to 3 feet of joist inside the beam. Decks may be constructed using a 1 to 4 ratio instead of a 1 to 3 ratio *(see Figure 3)*.

Deck Footings

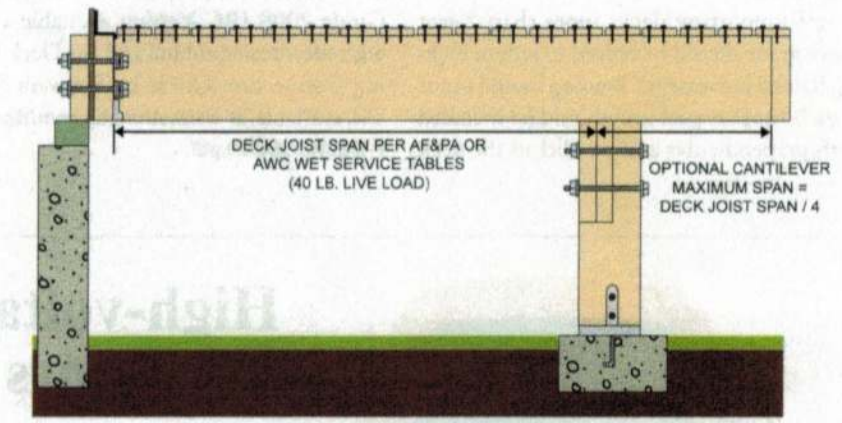
The Word remembers pouring deck footings using a few bags of concrete. These footings were rarely the size now recommended. The minimum round footing diameter is 15 inches and the minimum square footing dimension is 13 inches. Footing size increases significantly based on support post spacing and joist span.

The minimum footing depth is 6 inches. Like other footings, deck footings should be placed on undisturbed ground or ground that has been properly compacted to have a bearing capacity of at least 1,500 psi. The footing bottom of a deck attached to the home should be at least 12 inches deep or below the frost line, whichever is deeper. That's not hard in Phoenix where we don't worry about such things as frost lines. Footings for decks not attached to the home are not required to be below the frost line, but it is good practice to place them there. ▸▸



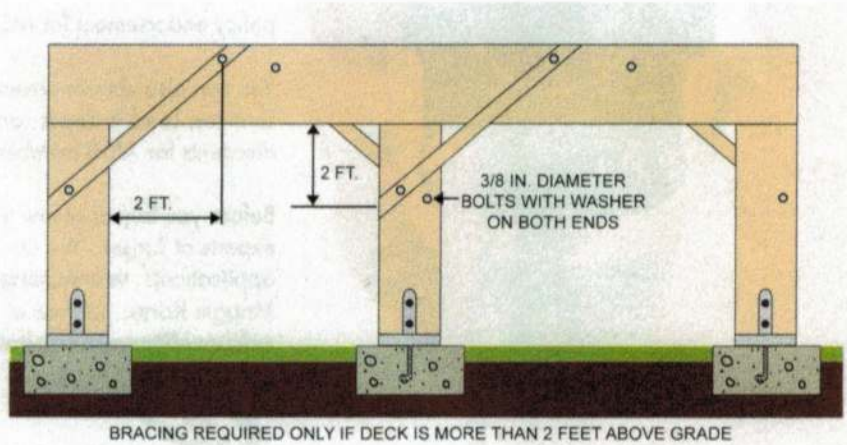
Deck Beam Support

Figure 2



Deck Joist and Cantilever Span

Figure 3



Deck Bracing Parallel to Beam

Figure 4

Here's another twist that may occur with self-supporting decks. Any deck footing within 5 feet from the home's exterior wall should have its bottom bearing surface at the same level as the home's footing. This makes sense when you think about it. Remember that the load from a footing extends out from the footing, not just straight down. A deck footing that's too close to the house could put an unintended load on a component such as a basement wall.

Self-supporting decks

A good option for avoiding the problems with flashing and with deck ledgers is to make the deck self-supporting. It's usually a more costly option because it means more footings, posts, and beams.

Self-supporting decks more than 2 feet above grade should be braced to reduce racking (lateral movement). Bracing should occur at each support post and should be installed both perpendicular and parallel to the deck joists. The brace should be at least a 2x4 and the hardware should be at least ⅜ inch bolts with washers and nuts *(see Figure 4)*.

Self-supporting decks may be attached to the house to provide only lateral bracing. In this case, the attachment does not provide the structural support of a ledger board. Refer to DCA-6 for more information about the recommendations for this situation.

The bottom line

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