Decks

By Bruce Barker, ACI


Photo 1

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

Our subject this month is **decks.** Readers with a long memory may recall The Word's rants on this subject more than four years ago. There have been several changes to recommended deck construction practices since that time, a good enough reason to revisit the subject. Another reason is that after 65 columns (including the July issue's column on the related topic of deck stairs), it is getting hard to think of completely new subjects to discuss. Please send new subject ideas to The Word.

Scary Stuff

Decks are not the most frequent source of claims against home inspectors. That dubious distinction belongs to structural problems inside the house. Does this tell you anything about a good place to focus your inspection? The good news about structural problems is that they usually can be repaired, given enough money. Structural problems rarely result in personal injury.

Deck structural failures, however, can result in personal injury and even death. Some of the injuries can be life-altering, and death is the ultimate life-altering event. No amount of money can fully compensate for a catastrophic injury or death. This is one reason why decks are scary.

Another reason why decks are scary is that decks, especially older decks, are often improperly built. There are several reasons for this. One reason is that decks are a popular do-it-yourself project; home inspectors know what that means. Another reason is that residential building codes have not had meaningful rules about deck construction until about the last 10 years. Even with these rules, misunderstandings about proper deck construction practices and inconsistent enforcement of minimum requirements have created a situation in which every deck you see has a high probability of having at least one significant defect.

Remember the Duck

Decks are like ducks. If it looks like a duck and quacks like a duck, it's probably a duck. Similarly, if it looks like a deck and is built like a deck, then it's probably a deck.

Decks are, therefore, more than just the structure at the back of the house. A deck could be a front porch, a landing and stairs to a door, a balcony or any number of similar structures. Make sure you look for deck-like structures anywhere around the house. If it's built like a deck, then you should probably inspect it like a deck. There is one caveat to the previous statement: If the deck carries more than its own dead load, then deck construction rules may not apply. An example of this is a screen porch that is built on a deck. The loads, including vertical and lateral loads, imposed by the roof and supporting components are not in the scope of the deck construction rules. Structures such as screen porches deserve additional attention, and possibly further evaluation by an engineer.

Deck Demons

There are lots of demons lurking around decks just waiting for an opportunity to cause a deck failure. We could spend an entire inspection evaluating only the deck. We may have a standard of practice within the next year to do just that, for a separate fee, of course. For now, however, we have a limited amount of time to inspect a deck. We need to focus our efforts on identifying the scariest deck demons.

If you look at deck failures, some patterns emerge. It's uncommon for components like posts, footings, floor joists and beams to be the primary cause of deck failures. These components can be secondary failure causes. They are important and should not be ignored, but there are other components that are scarier.

Stairs, guards and handrails are frequent primary causes of deck failures. Falls caused by improper construction and maintenance of these components can result in injuries ranging from minor to catastrophic. These components are scary and deserve careful inspection. The Word discussed these components in last month's column **(http://www.ashireporter.org/HomeInspection/Articles/Deck-Stairs/14890).**

The big gun in the deck demon world is detachment of the deck ledger from the house. This big gun has two scary relatives that enable the evil work of this demon. Ledger detachment is one of the most likely causes of a deck collapse.

Improper deck flashing enables the ledger detachment demon by letting water into the building. Water deteriorates the band board/rim joist to which the deck ledger is usually attached. If the band board/rim joist fails, it does not matter how many fasteners are used; the ledger connection may fail, causing a deck collapse **(Photo 1).**

Figure 1

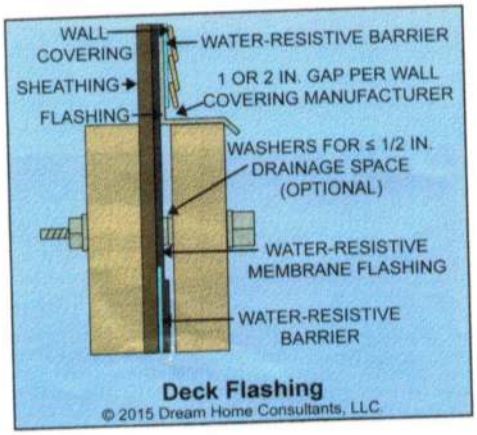
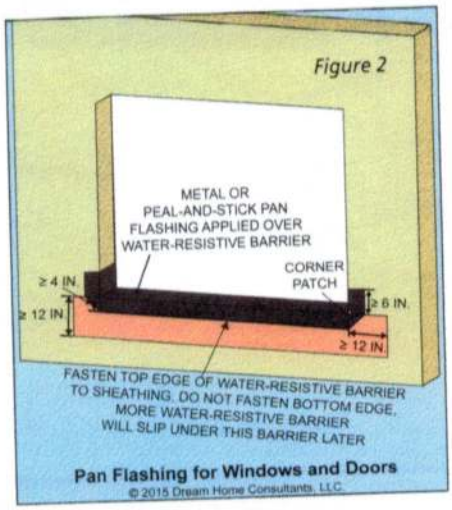


Figure 2



Lack of proper bracing enables the ledger detachment demon by allowing the deck to move. This movement stresses the ledger attachment connectors, which can, over time, cause fastener withdrawal, including detachment of the band board/rim joist itself. This bears repeating: Deck collapse can occur when the band board/rim joist and the deck ledger detach from the house as a unit. The Word will discuss bracing in a future column.

A False Demon

Deck failures, especially deck collapses, are sometimes blamed on too many people being on the deck. This might sound like a real demon, but it is, in almost all cases, a false demon. Studies have demonstrated that when people stand at a normal comfortable distance apart, it is nearly impossible that their combined weight will be more than the design live load of a deck (40 pounds per square foot). This does not mean that people's actions are never the cause of deck failures. Lateral loads created by side-to-side motion, such as dancing in unison, can loosen important deck connections. Deck collapse caused by people overloading a deck is an exceptionally uncommon event. Deck collapses caused by people's actions are far more likely to involve neglect of good construction and maintenance practices than they are to involve wild parties.

Flashing

Good deck flashing is very simple. **Figure 1** shows how it should be done. Even if the L flashing is omitted, the flashing will usually work.

Installing washers to provide a drainage space between the ledger and the sheathing is controversial. The Word sides with the camp that believes that flashing is often imperfect and that providing a draining space gives water a place to go other than around imperfect flashing. The Word also appreciates the camp that believes in direct contact between the ledger and the sheathing.

Most decks have a door that provides access to the deck. Flashing around this door is often improperly installed. **Figure 2** shows how it should be done. Even if the door flashing is improperly installed, the deck will probably not collapse for that reason alone. When combined with other improper flashing, improper door flashing can create a significant risk factor for a deck collapse.

The problem encountered when trying to inspect deck and door flashing is that important components are usually concealed. Look again at **Figures 1 - 2.** Note how the components are lapped shingle fashion to create a drainage plane. None of these flashing details are usually visible.

If the water damage is significant enough, and if there is access to the band joist/rim board area, the results of improper flashing can sometimes be detected. Even if access is possible, the results of improper flashing can take a long time to be detected. For this reason, it may be prudent to include a concealed flashing disclaimer in the deck inspection report.

Deck Ledger Attachment

Most decks rely on the attachment of a deck ledger to the house to provide support. Many, if not most, deck collapses occur when this support fails. Inspectors should understand how this attachment connection should be installed and they should carefully inspect this connection during a home inspection.

The first concept to understand about a deck ledger attachment is that there are two primary forces acting on a deck: Gravity (vertical) loads exert a downward force, and lateral loads move the deck from side to side and from front to back. Each load needs a separate connection system to help the deck ledger remain attached to the building. Bolts or screws help the deck ledger withstand vertical loads. Lateral load connectors help the deck ledger withstand lateral loads. Both connection systems should be installed. This fact is, unfortunately, not well communicated in deck construction standards.

The second concept to understand is that proper deck ledger attachment is more complicated than just installing some bolts or screws. Factors such as the type of house floor joists, the type of house band joist or rim board, and the orientation of the house floor joists are a few of the factors that determine how the vertical and lateral load fasteners and connectors should be installed. Discussing all of these factors is beyond the scope of this article, but we will cover the basics.

Figures 3 and 4 show how screws or bolts should be installed to connect the deck ledger to a band joist or rim board. These figures assume at least a 2x8 dimension lumber band board, or at least a 1-inch thick engineered rim joist, with dimension lumber floor joists or I-joists that are perpendicular to the band board or rim joist.

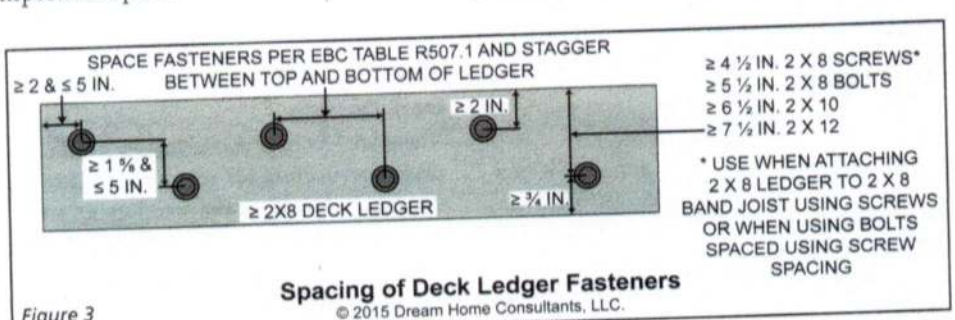


Figure 3

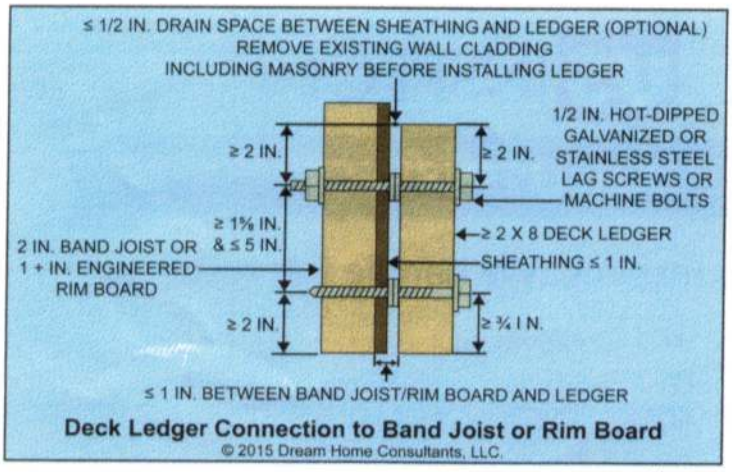


Figure 4

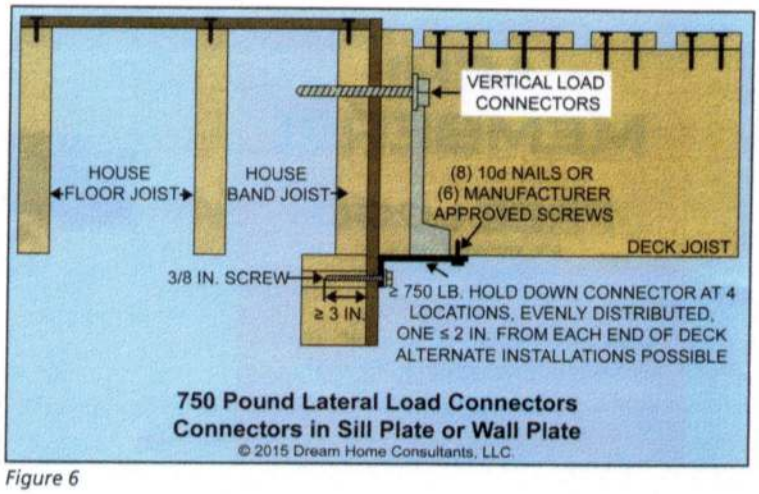


Figure 6

Note the distances between the screws or bolts and the edges of the band board and rim joists. Also note that the screws or bolts are staggered vertically along the deck ledger. These details are important to help ensure that the deck ledger and the band board/rim joist do not split under load.

Fastener spacing depends on factors such as deck floor joist length and spacing. Proper spacing distance can be found in DCA6-12 and in the International Residential Code (IRC). DCA6-12 is a free PDF download that may be found at www.awc.org. Every inspector who inspects decks should have this document.

Are home inspectors required to determine if the bolt/screw spacing is installed according to tables in the IRC or DCA6-12? The Word's opinion is no. We are not required to determine code compliance and we are not required to determine if a component is adequate to perform its intended function. If it appears that a reasonable effort was made to properly install bolts/screws, the home inspector can move on.

Figures 5 and 6 show two methods of installing lateral load connectors. **Figure 5** shows a connection for which the building floor joist is aligned with the deck joist. **Figure 6** shows a connection for which the building floor joist is either parallel with the band joist/rim board or when the building floor joist is not aligned with the band joist/rim board. **Figure 5** represents a connector such as the Simpson DTT2, and **Figure 6** represents a connector such as the Simpson DTT1. Both connectors, like all manufactured products, should be installed according to the manufacturer's instructions. This means, among other things, using manufacturer-supplied or -approved fasteners to install the connectors.

The Bottom Line

The Word wrote this column while traveling to and from the October 2015 Keystone ASHI seminar (a very well-run seminar presented by this ASHI chapter that is located in east-central Pennsylvania). A participant told The Word a story about how a client had fallen several feet after a deck guard failed. This inspector had, fortunately, reported a deficient guard and had recommended repair. As a result, this inspector heard about this unfortunate incident only when the client called to book another inspection.

There are several good lessons in this story, but the most important lesson for this column is this: Do not be the inspector who fails to report deck defects. The deck demons may haunt you if you do not find them and report them.

Memo to Hestia (goddess of the home and hearth): The Word does not reside on Mt. Olympus (just at its base) and welcomes other viewpoints. Send your lightning bolts or emails to Bruce@DreamHomeConsultants.com. The thoughts contained herein are those of The Word; they are not ASHI standards or policies.

Bruce Barker is the founder and president of Dream Home Consultants, and the author of *Everybody's Building Code*, written to help home inspectors understand the International Residential Code. Bruce has been building and inspecting homes since 1987. He currently serves on the ASHI Board of Directors. He is a certified Residential Combination Inspector and a licensed contractor in Arizona, Florida and North Carolina. To read more of Bruce's articles or if you need a presenter at your next chapter event, go to **www.dreamhomeconsultants.com.**

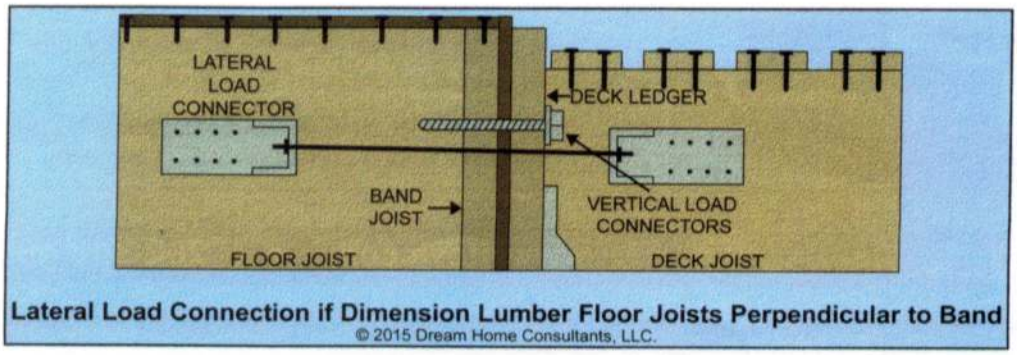
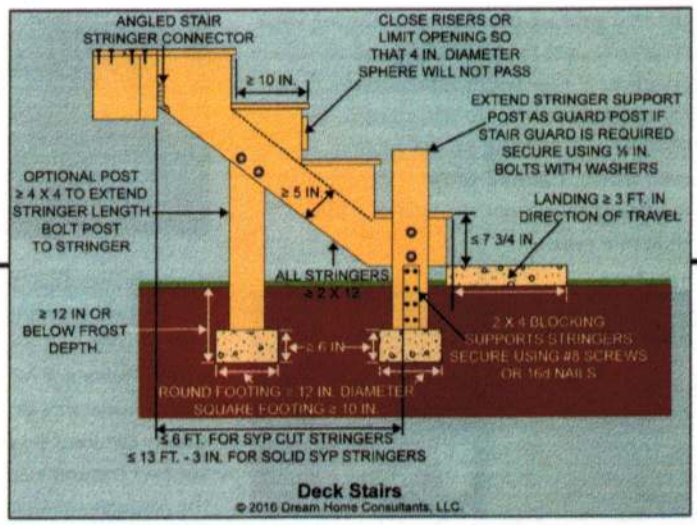


Figure 5

Deck Stairs

By Bruce Barker, ACI

Figure 1



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

Our subject this month is **decks.** The scariest deck demons are deck flashing and deck ledger attachments, which The Word will discuss in an upcoming column about decks. Meanwhile, there are other deck demons that are almost as scary; one of them is stairs.

Stair Safety

Inspectors should remember two important facts about stairs. The first fact is that stairs are one of the most dangerous systems we inspect. Falls involving stairs can result in serious personal injury; that is where the big money lies for attorneys. The second fact is that interior and exterior stairs share almost all of the same requirements. If anything, we should be more careful about applying current safety and structural requirements to exterior stairs because exterior stairs are subject to harsh environmental conditions that may exacerbate safety and structural problems. We should spend time inspecting all stairs, especially exterior stairs.

Inspection of stairs begins by determining if the stairs are safe for you and your client to use. Perform a quick visual check of the stringers, including their condition, length and attachment to the deck. Check the condition of the treads. You do not want anyone on the stairs if they collapse, and you do not want anyone to trip on deteriorated treads. "Failed under test" is not a good explanation for stair-related injuries during an inspection.

Stringer Bearing on Support

Stringers usually have two bearing points. The plumb (vertical) cut usually bears on a rim joist or on a beam. The seat (horizontal) cut should, **at a minimum,** bear on a solid landing. The stringers should be supported at grade level by posts that bear on footings, but The Word does not recall ever seeing this installation detail. If there is good stringer bearing on a solid landing, The Word declares victory and moves on. Those who live in cold climates might consider being stricter about stringer footings because frost heave could move the stringers and loosen the connection at the plumb cut. Refer to **Figure 1** for a summary of stringer installation recommendations.

Stringer attachment at bearing points must help the stringer resist both vertical and lateral loads. The vertical load (gravity) pulls the stringer down from the bearing point. This is the load inspectors think about more often. The lateral (horizontal) load pulls the stringer away from the bearing point. The lateral load is often the cause of the stair collapse; the nails withdraw from the bearing point, then gravity takes over.

There are three ways to attach stringers to the rim joist or beam to resist both vertical and lateral loads: the right way, the wrong way and the wrong way that might work. The right way is uncommon. The wrong way is the norm. The wrong way that might work is the scariest because it might work or it might not.

The right way to attach the stringer plumb cut to the rim joist or beam is by using a connector, such as a Simpson LSC or LSSU, installed according to manufacturer's instructions, including using the recommended fasteners. Connectors provide both the vertical and lateral support for the stringer. **Photo 1** shows an attempt to attach a stringer using a connector. Good try, but there are still problems. The stringer should fully bear on the connector seat. Screws are not allowed unless specifically allowed by manufacturer's instructions, and then, only manufacturer-supplied screws may be used. Deck screws and drywall screws are not allowed.

Photo 1

The wrong way to attach the stringer plumb cut to the rim joist or beam is using nails that are subject to withdrawal.

This is always wrong. Nails are subject to withdrawal unless the stringer is secured somewhere against lateral movement. If the stringers are bearing on a landing with no attachment to the landing and no other attachment that resists lateral loads, then the nails are subject to withdrawal. If the stringers are bearing on the ground, that is even worse. **Photo 2** shows a stringer that is pulling away from the rim joist after less than one year.

Photo 2

The wrong way that might work is when stringers are attached using nails that may not be subject to withdrawal. This method usually involves installing the nails at an angle through the stringer into the rim joist, a method called toe-nailing in some areas. This method sometimes involves installing the nails through the rim joist into the stringer plumb cut, a method called end-nailing in some areas. Stringer attachment using nails that are not subject to withdrawal might work if an adequate quantity of the correct nails is installed, if the nails are properly installed (there are rules about how to correctly install toe-nails), and if the wood and the nails maintain their integrity over the life of the deck. That is a lot of ifs—more than The Word is comfortable with. The Word recommends installing stringer connectors on all stringers that are nailed at the rim joist, beam or a drop header.

As we have discussed, the right way to attach a stringer is to use a connector. A properly installed connector makes stringer installation easy and can eliminate complications such as a drop header. Perhaps carpenters have not received the memo about these connectors or perhaps they like to do things the hard way. In either case, there are two common methods of positioning the stringer relative to deck flooring.

Photo 3

The best place to position a stringer, from a stringer attachment perspective, is to place the top tread even with the deck flooring. This allows the stringer plumb cut to fully bear on the rim joist or beam, and it provides the maximum fastening area. Carpenters do not like this method because they claim it makes installing the stair guards and handrails more difficult. A common stringer placement, therefore, is to place the top tread one riser below the deck flooring. There are two common ways to accomplish this. **Photo 3** shows one method, which is clearly a job for Obviousman. The other method is to use a drop header.

Photo 4

A drop header is a piece of lumber installed below the rim joist or beam. The stringer plumb cut bears partly on the drop header and partly on the rim joist or beam. If a drop header is used, the attachment of the drop header to the rim joist or beam is important. Attachment using nails is always wrong because the nails are subject to withdrawal over time. **Photo 4** shows a drop header secured using only nails. Proper attachment of the drop header to the rim joist or beam involves installing bolts through lumber to connect the drop header and rim joist or beam.

The Word is not aware of a prescriptive detail for connecting a drop header to a rim joist or beam. The following is a common detail that is accepted in some areas. Use at least two 2x4s. Install at least a ⅜-inch diameter bolt through the drop header and through the rim joist or beam. The bolts should be located as close as possible to the center of the 2x4, horizontally, so there is enough wood between the bolt and edge of the wood to resist wood splitting and shearing. 2 inches is a safe distance in this case.

Photo 5

Photo 5 shows a bolted drop header. The top bolt is too close to the right edge of the 2x4; if you look closely, the 2x4 is split. Otherwise, it is a decent effort at a drop header installation.

Assuming that the stringers are not supported at the bottom by posts and footings, the next best stringer seat cut bearing on support is to have the entire area of the seat cut below the bottom tread bearing on support. The stringer is better able to support the imposed loads with more wood on a

bearing surface. At a minimum, 1½ inches of the seat cut heel should bear on support. The seat cut toe should not be the only part of the stringer bearing on support. We should report configurations such as shown in **Photo 6** as significant deficiencies requiring correction. These configurations can allow the stringer to shear along the wood grain, resulting in stair collapse.

Photo 6

Stringer Construction

There are two styles of stringers. The cut stringer is by far the most common style. A cut stringer is made by cutting triangles into the stringer to obtain the risers and treads. The other, less common style is the solid stringer. Solid stringer treads bear on manufactured brackets or on lumber fastened to the stringer. A solid stringer is stronger than a cut stringer; thus, a solid stringer may span farther without support. A cut stringer made from Southern pine may only span six feet between supports. A solid stringer may span 13 feet, 3 inches. A stringer should be made using at least a 2x12 and the spans noted in the previous paragraph assume this. A stringer made using a 2x10 may work, but it is difficult to obtain the recommended stringer throat depth when cutting a 2x10. The throat is the area of uncut wood at the smallest point. The throat should be at least 5 inches deep. If a saw kerf extends past the riser/tread triangle, the measurement is to the saw kerf. **Photo 7** shows a stringer throat that is way too small. Refer to **Figure 1.**

Risers and Treads

As we discussed earlier, deck stairs share the same requirements as interior stairs. The maximum riser height depends on local rules and on when the stairs were built. The current maximum riser height in most areas is 7¾ inches. The Word does not get concerned unless the riser height is more than about 8 inches. Riser height difference is more of a concern because having different heights between risers is a trip hazard. The maximum riser height difference between any two risers in a flight of stairs is ⅜ inch. The Word is strict about reporting riser height differences.

Deck stairs are more likely to have open risers than are interior stairs. Open risers that are more than 30 inches above grade should not allow a 4-inch diameter sphere to pass.

The most common deck stair tread problem that The Word sees is loose and deteriorated treads. Loose and deteriorated treads should not surprise anyone. If there is any surprise, it is that treads last as long as they do. Treads are usually nailed and even deformed shank-type nails will withdraw eventually when the cut part of the stringer deteriorates because of weather exposure (the cut is almost always not preservative-treated). Treads are installed horizontally and may be subjected to prolonged exposure to moisture. Exposure to moisture can cause wood deterioration and distortion such as cupping. Southern pine sizes 2x6 and larger can be especially prone to deterioration and cupping.

The minimum tread depth is 10 inches in most parts of the country. The easy way to achieve the 10-inch depth with deck stairs is to use two 2x6s or two 5/4x6s, which produce a tread depth of a little over 11 inches (assuming the recommended ⅛-inch space is left between the two boards). Treads that are 6 inches or less nominal depth should not span more than 18 inches between supports. Tread span is usually not an issue for the common 36-inch wide stairway with cut stringers and lumber treads.

The Bottom Line

The lesson for this column is this: Do not be the inspector who fails to report deck defects. The deck demons may haunt you if you do not find them and report them. Memo to Hestia (goddess of the home and hearth): The Word does not reside on Mt. Olympus (just at its base) and welcomes other viewpoints. Send your lightning bolts or emails to Bruce@DreamHome-Consultants.com. The thoughts contained herein are those of The Word; they are not ASHI standards or policies.

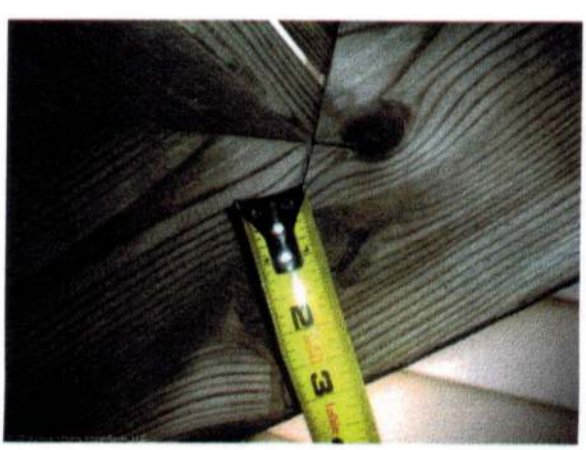


Photo 7

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