SPOTLIGHT ON DECKS

Pillar To Post Continuing Education Program

PILLARTOPOST
HOME INSPECTORS

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Chapter 1

CHAPTER 1
Overview and Objectives

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Chapter 1

Overview and Objectives

A deck is fundamental to the North American backyard experience. Decks are used as an extension of the indoor living space for relaxing, entertaining and dining. A beautiful deck is a real asset to the home.

Deck construction is usually fairly simple. In most cases, it is simple enough for a home owner to tackle as a weekend project. The construction skills and knowledge of the average home owner varies. As a result, the quality, structural integrity and safety of the deck may vary.

Over the past few years, there have been a number of high profile upper level deck collapses. For example, recently in Atlanta a high deck collapsed during a party where 63 people were on a 300 square foot deck. 63 people on a 300 square foot deck may seem excessive but if it had been built properly, it would have supported the entire party without any problem at all.

The objective of this session is to educate real estate professionals about deck construction, deck safety and new deck products.

Learning Outcomes

By the end of this course you will -

- become familiar with the components of a typical deck.
- know how to recognize a good deck.
- know how building permits and codes pertain to backyard decks.
- recognize the difference between a safe deck and an unsafe deck.

- know when a guard rail is required and recognize the difference between a good guardrail and an unsafe guardrail.
- know the various materials available for decks and the properties.
- know what's required to maintain a deck and make it last a long time.

This knowledge will –

- provide valuable information that can be passed on to your contacts and clients.
- help you answer your client's questions about decks.
- help you demonstrate to your clients that you are a knowledgeable and caring professional.
- Help us all improve the quality and safety of backyard decks.

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Chapter 2

CHAPTER 2

Decks

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Chapter 2

Decks

A **skilled** home-owner can build a deck that surpasses the quality of a contractor built deck. A skilled home owner can spend the time to select top quality materials and build the components with care. The money saved on labor can be invested in quality. Of course the key is the "skilled home-owner" part.

On the other end of the spectrum is the "weekend warrior", tackling projects well beyond skill level. You can usually recognize decks built by the weekend warrior. They sag, they aren't level, the proportions are not quite right. What's worse is that often safety and structural integrity suffer and some of the problems may not be easy to spot!

For example, the deck in this photograph is very poor. The main beam is structurally inadequate, the joist configuration is structurally inadequate and the guard rail is not built properly. These irregularities boil down to a deck that is unsafe and likely to sag so badly over the years that it will require a complete re-build. We will cover some of these items later in this session.

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Many weekend warriors build decks without a permit. This means nobody is checking if the deck is built to code. What is a permit and what is it for? What's a building code?

Building permit versus building code.
Some people are confused about the difference between a building permit and a building code. For example, in some areas, a building permit is not required for a small deck that is fairly close to the ground. Does this mean the deck does not have to be built to code?

Building Code: A building code is a document that defines how things should be built in order to perform the intended function and to do it safely.

Building Permit: A building permit is the city's permission to build. This takes into account zoning, property lines, views etc. In addition, part of the permit process is to make sure the proposed project complies with building codes. In most municipalities, obtaining a building permit also means that the project will be inspected by the municipality to verify that the project was built as described in the permit and that all building codes have been adhered to. Permits and codes mean better and safer deck.

Is a permit required for a deck? In most areas, a building permit is required for a deck of any kind, even a small deck. This makes sense because fundamental mistakes can happen even with a small deck. For example, the deck can overstep a set-back or cover over a septic system. If the deck is attached to the house, it can create a leakage problem if it is not flashed and sealed properly.

In some areas, a small deck that's close to the ground does not require a permit. Why would a small, low deck be exempt from a permit? If the deck is small, it is unlikely to create an issue for a neighbor. If the deck is low, a guard rail is not required for safety. Furthermore, a collapsing low deck is not as dangerous as a collapsing high deck!

Whether required or not, many backyard decks get built without a permit. Some of the defects are easy to spot and some are not. The bottom line is, in North America, deck collapse is the most common structural collapse in homes. Further, a very high percentage of decks pose a fall hazard because of inadequate guard rails.

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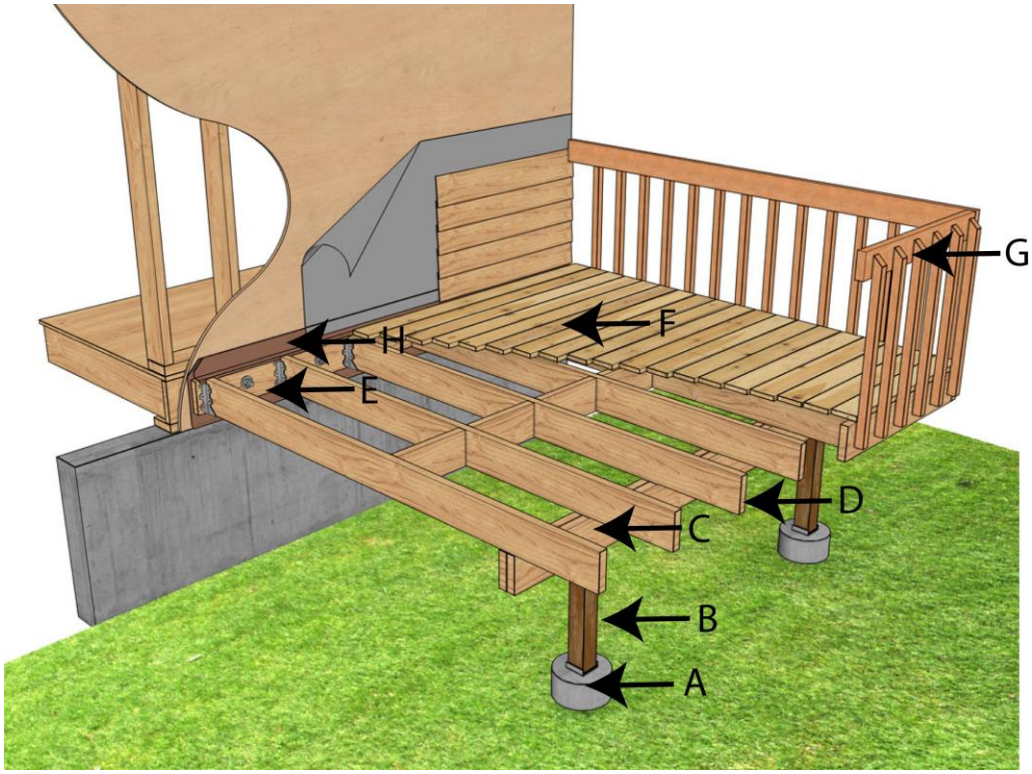
Anatomy of a Deck

Let's have a look at the various components of a deck.



A) Pier / footing
B) Post
C) Main beam
D) Joist
E) Ledger board
F) Decking
G) Guard rail
H) Flashing

A) For our purposes, a footing is a large piece of concrete in the ground for the weight of the deck to bear down on. If the deck posts were to rest directly on the ground, the weight of the deck above would cause the posts to sink into the ground. The footing spreads the weight of deck over a larger area so the **pressure** on the soil is reduced. The post won't sink into the ground. Usually, a footing is a large square of concrete located a few feet underground. The concrete piers then sit on top of the footing and extend above grade a few inches. From here, you can use wood posts. This

is a very inconvenient configuration for a simple deck because a large excavation is required to pour the concrete footings. ***For residential decks, the simple solution is to make the concrete piers wide enough to function as the footing as well.*** For example, if the pier is 12 or 15 inches in diameter, it may have enough cross-sectional area to function as a footing as well as a pier. This makes the construction much easier. Instead of an excavation, all that's needed is a cylindrical hole that can be drilled from above. The actual size of the pier depends on a number of factors that are dictated in the building code.

B) A post for a deck is usually just a 4X4 or 6X6 wood post. The post must be attached solidly to the top of the pier and to the main beam.

C) The main beam is usually two 2X8's nailed together. Instead of 2X8's you may see 2X10's or maybe three 2X6's. It all depends on the size of the deck and the spacing of the posts.

D) The joists for a deck are like the floor joists in your house. Under-sizing the joists is a common *weekend warrior* mistake. The joists should be as stiff and strong as the joists in your house.

E) The ledger board is perhaps the most important structural detail. If done properly, you end up with a structurally sound deck that will last for years. If it is not done properly, the entire deck could collapse.

F) The decking is what you see when the deck is all built. The most common decking is pressure treated lumber. Cedar is a higher end alternative. Finally, synthetic lumber is becoming more and more popular as the prices come down. We will look at these options later.

G) The guard rail is the key safety element on the deck. This is another detail that the weekend warrior gets wrong. A guard rail is required for a deck that is more than 30 inches high, measured from the ground to the surface of the deck. In some areas, a guard rail is required for decks of 24 inches and higher. The guard rail itself should have the following properties
    a. Solid – can withstand the force of a person slamming into it
    b. Not easily climbable
    c. Contains children - no space larger than 4 inches for a child to fall out.
    d. Must be 36 inches high. For high decks, a 42 inch guard rail is required.

H) Flashing sheds water. Flashing is usually made of metal. The flashing is layered is such a way that water will shed over and away from the ledger rather than seeping in behind. This prevents the ledger from rotting away and the deck from collapsing.

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Chapter
3

CHAPTER 3
Structure

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Chapter 3

Structure

Deck structures are, for the most part, very simple. We have already had an introduction to the components in the last section. In this section, we will look at the components in more detail showing a few examples of good and bad structures.

A strong deck: First of all, how ***strong*** should a deck be? Building codes specify this but in general a deck should be as strong and stiff as the floor inside a house. That means the footings, beams and joists should be able to support a load of 40 pounds per square foot plus the weight of the deck itself. As a first guess, it is common to use a design load of 55 pounds per square foot. This includes the required 40 plus the weight of a typical deck.

Just for fun, let's pretend we are engineers and try to figure out if that deck in Atlanta should have collapsed. 63 people on a 300 square foot deck!

First the deck: For a first guess, the deck should have been designed to support a live load of 40 pounds per square foot plus another 15 pounds per square foot for the "dead load" of the deck lumber itself. This gives 55 lbs/ft^2 X 300 ft^2 = 16,500 lbs.

Now the actual weight of the people and the deck: The deck itself weighs approximately 4,500 pounds. How much does a person weigh? Unless this party was a football team, we could choose a conservative average of 180 lbs (this is very high for an average weight considering men and women of all heights). 63 people X 180 lbs per person = 11, 340 lbs. The total weight is 11,340 + 4500 = 15,840 lbs!

The deck should have been strong enough to hold 63 people. I suppose if they were all dancing in unison, we would have a problem but we did use a very high average weight for our calculation. There is no question that if the party was a football team the deck

would collapse. At an average weight of 220 lbs we get a total load of 18,360 lbs! Say nothing of what would happen if the entire football team started dancing in unison. 63 football players would not actually physically fit on 300 square feet because each would have only a little more than 2 feet by 2 feet to stand!

Decks do collapse and it's usually because the deck was not designed and built to code.

Footings & Piers: In the last section we discovered that the footing is where the weight of the deck bears down on the soil. The footing spreads the weight of the deck out over a larger area to reduce the pressure on the soil. The end result is that the footing keeps the deck from sinking into the ground.

For most decks, the deck posts rest on concrete piers. The piers are chosen to have a large enough cross sectional area to be an acceptable footing as well. This arrangement is ideal for decks for the following reasons –

- It keeps the wood posts out of the dirt to prevent wood rot
- The hole for the pier can be drilled with an auger. A standard footing is square. Setting a standard footing would require digging a large hole by hand, pouring the concrete footing and then setting the piers and posts.

Footing / pier depth: To set the piers, a hole is augured into the ground. But how far should the piers go? The local building code will dictate this but in general, there are three requirements:

- The piers should be set below any loose organic soil and set on solid soil.
- The piers should be set on undisturbed soil.
- The piers should be at least 12 inches below the undisturbed ground surface.
- The piers and should be set below the frost line. The frost line is the maximum depth you would expect the soil to freeze on a very long cold winter. In cold climates, the frost line is the dictating factor.

This photograph shows the underside of a second story deck, with deck posts set on piers.

Posts: The posts that sit on top of the pier are usually 4X4 or 6X6 posts. High decks will have 6X6 posts. Here are a couple of notes with respect to posts:

Lateral support: the main loads on the post are strictly vertical, the weight of the deck pushing straight down through the posts to the footings. The posts also have to be able to accommodate a load applied to the side, even though this does not happen very often. The posts have to be attached at the top and the bottom. They can't just rest on the piers with the beam just resting on the post. This is a common defect found with decks.

Slenderness: The higher the deck, the longer the posts. The longer the posts, the larger the post cross-section required. If you look at extremes, this will make perfect sense. If you have a deck that is 15 feet off the ground, you would not be able to use 2X4's for posts. They would buckle.

For most small decks, the most common post size is 4X4. This fits nicely under a beam and on a pier. Because this is so common, a weekend warrior may not know that for a high deck, something larger will likely be required. For example, in most cases, a 4X4 post can be used for decks up to 8 feet high. In this photograph, the deck is quite high. We would want to verify the height and size of the posts. already

Some modern codes require a minimum 6X6 post for decks.

The Main Beam: For most decks, the beam is built up with two or three pieces of two inch lumber. For example, two two-by-eights nailed together. The size of the beam (two or three pieces, two-by-eights or two-by-tens) depends on the distance between the posts and the size of the deck.

The beam also has to be secured so it does not just tip over. This is usually done when attaching the beam to the posts. There are a number of ways to do this such as notching the beam into the post or using a special bracket.

Have a look at this photograph:

The beam rests on the posts and the deck joists rest on the beam. So what's the problem?

Problem #1, the posts are not secured to the beam. This means that if you bump into a post, it could slip out at the top and the deck come down on top of you!

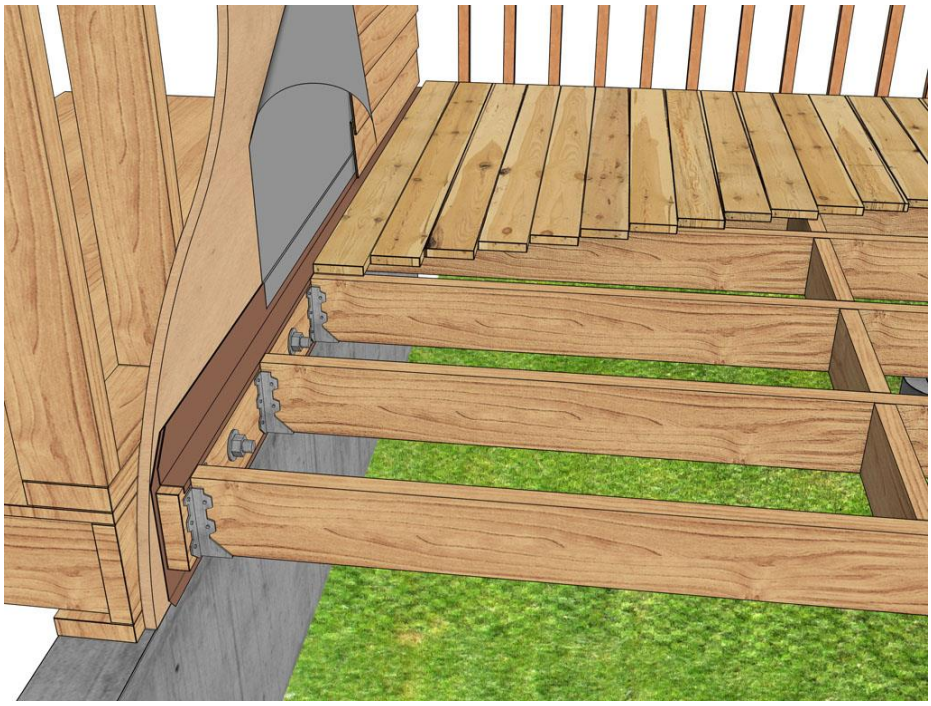
Problem #2, the beam itself could rotate and tip over from a side impact. Again the deck would collapse!

The entire configuration is unstable and could collapse from a fairly minor side impact or maybe a heavy wind.

House Attachment: This is the most critical detail. When you hear about a deck collapse, it is usually the result of improper attachment at the house.

First let's point out that you don't have to attach the deck to the house. The deck can be designed to be free standing. This means you would have posts and a beam at the house end of the deck as well as at the far end. This is not as elegant a solution as attaching to the house.

Most decks are attached to the house and the house makes up the support structure for the one end. The problem is, you need to find something secure to attach the deck to. Ideally the deck would be bolted directly to the house framing.



This shows the ideal attachment to the house. Here are some of the key features

- The deck ledger is bolted directly to the house structure.
- The bolts have sufficient strength (pullout strength and shear strength) to hold the deck securely
- There is flashing to keep rain water from leaking into the wall of the house. Flashing directs water over the ledger and drips water away from the wall.
- The joists are attached to the ledger with metal joist hangers.

This ideal situation is easy to achieve if the deck was built when the house was built. Otherwise, you have to remove siding material to get at the house structure, bolt the ledger in place and then seal and flash the wall so it does not leak. Now you can imagine why it's often done improperly!

Some house siding materials are fairly easy to deal with, others are not. Brick veneer is difficult because the brick veneer is not supposed to carry any of the load of the deck. You have to access the framing in behind. Even accessing the framing behind is problematic because of the one inch air gap behind the brick. Attaching a deck to a home with brick veneer is so difficult to do properly that some codes don't allow it at all in their prescriptive requirements. This means a structural engineer would have to design it.

In the first picture on the right, the home owner was able to access the framing by removing some bricks and attaching the joists directly to the house framing. One of the defects here is that water is going to get into the wall of the house. There is no flashing at all!

In the next picture, it looks like the home owner attached the ledger directly to the brick veneer! There are many problems with this scenario including; brick veneer should not support the load of the deck; there are no fasteners visible other than standard nails; there are no joist hangers for the joists. This looks like a problem! Will we be reading about this one in the newspapers?

Remember the deck with 63 people on it. Which configuration do you think will hold, the ledger attached to brick veneer with standard nails or a ledger bolted to the framing of the house like in this diagram?

Other structural issues:

There is more to know about deck construction but we can't cover it all here. A deck that is built with care, following the building code, will be a successful deck.

The building code is an evolving document. Details that may have been allowed years ago may not be allowed today. Furthermore, there are local code requirements and local building inspectors that may turn a blind eye to certain details. Attaching a deck to brick veneer is a good example. Some municipal inspectors may allow brick veneer to carry the load of the deck as long as the deck is bolted through to the framing behind. This variability makes it difficult to inspect a deck in retrospect.

Check Your Knowledge

Answer the questions below in the spaces provided

1. **True or false? To build a deck off the second story of a home, a permit is not needed as long as you build the deck to code.**

2. **True or false? Deck collapse is the most common structural collapse in homes.**

3. **True or false? Decks lower than 42 inches do not require a guard rail.**

4. **True or false? Decks do not have to be built as stiff or as strong as floors inside the house because decks are an add-on and not part of the main house structure.**

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Chapter 4

CHAPTER 4
Safety

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Chapter 4

Safety

The weekend warrior's most common mistake is to make a deck that is not up to modern safety standards. In this section we will look at a few safety elements including –

- The requirement for guardrails
- Guardrail height
- Guardrail strength
- Guardrail openings
- Guardrail climb-ability

Guardrail requirements: Guardrails prevent people from falling off the deck and injuring themselves. While it is possible to fall off almost any deck of any height and get hurt, guardrails are not required for low decks. The threshold deck height that requires a guardrail varies depending on where you live. In some areas, a guardrail is required for all decks greater than 30 inches. In other areas a guardrail is required for decks 24 inches in height and greater. The height is measured from the adjacent grade level to the deck surface. In this picture, the upper deck has a proper guardrail but how about the edge of the lower deck? It's close but it looks like more than 30 inches. If it is, it will need a guardrail.

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This picture shows a guardrail that is made up of trellis material. It is not an acceptable guardrail material. It's just not strong enough.

Guardrail height: How high does the guardrail have to be? The standard guardrail height is 36 inches high but it depends –

- The most common requirement is that 36 inch guardrails are required unless the deck is more than six feet high in which case 42 inch guardrails are required.
- In some areas, 42 inches is the standard height for all guardrails.

Guardrail strength: A guardrail has to be strong enough to withstand the strength of someone falling heavily against it. There are codes that actually specify the amount of impact force the guardrail must withstand but for our purposes, just imagine someone falling heavily into the guardrail or into the balusters. Many guardrails don't pass the test.

Guardrail openings: Any openings in the guardrail should not be larger than 4 inches. The guardrail should contain young children without the risk of a child falling through. For example, the balusters should not have more than 4 inches of space between them. In the photograph on the right, a person could easily fall through the openings in this guard.

Guardrail climb-ability: The guardrail should not be climbable. For example, horizontal members in the design of the

guardrail that could act as footholds for climbing are not allowed. A common mistake is building a bench into the guardrail. The bench makes the guardrail climb-able and is not allowed in most areas.

Chapter 5

CHAPTER 5
Materials

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Chapter 5

Materials

Today there are many choices for deck building materials. The three most common are pressure treated lumber, cedar and synthetic lumber. Each has its benefits.

Pressure treated lumber: Pressure treated lumber is the most common of the three deck building materials that we will look at here. Its main two benefits are; it is inexpensive and it lasts a long time. You can expect to get 20 years out of a pressure treated deck.

The main problem with pressure treated lumber is that it tends to warp, crack and split as it dries out. One solution to this problem is to buy premium treated decking. The premium product can cost up to fifty percent more but it makes a much nicer looking deck.

Cedar: For a rich and warm looking deck, cedar is the answer. Cedar has many benefits. It is very easy to work with and it's dimensionally stable. It doesn't warp and crack as much as the standard pressure treated products.

A cedar deck should easily last 20 years or more but the life cycle is variable depending on exposure. If it is located in a shaded damp area, cedar will not last as long.

Cedar that you buy today is not the same as cedar from years ago. Most of the high quality, first growth cedar is now gone. The cedar of today is a notch down in quality and it does not last as long.

Cedar is also a very soft wood. It will scuff and wear in high traffic areas.

Synthetic decking: The latest and most expensive option is to use synthetic decking. Synthetic decking is made of recycled plastics. Some are made of recycled plastics and wood. For example, the Weyerheuser product, called **ChoiceDeck®**, is made from recovered wood fibers and recycled polyethylene plastic. The wood fibers are encapsulated in polyethelene.

The main benefit of synthetic decking is that it is maintenance free. No staining, sealing or painting is required. Another benefit is that the decking can be formed much easier than wood. You can curve the pieces of decking if needed.

Some of the products feel cold to the touch when compared to real wood. Some people like this and some don't.

Some deck products are quite slippery when wet while others are not. Check for ADA approval for slip resistance. Keep in mind that weathered cedar is also quite slippery when wet.

There are many different styles of synthetic decking. Research it carefully before choosing a product. The common theme is that these products are more expensive than wood. For a big investment like this, it's important to make sure you are going to like the finished look and feel.

When you are picking a color, don't forget that synthetic decking weathers and changes color just as real wood does. Most manufacturers can show you color pallets of before and after weathering color.

The deck shown in this picture is the Weyerheuser product – ChoiceDeck®.

Chapter 6

CHAPTER 6

Maintenance

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Chapter 6

Maintenance

In the last section we looked at the three most common materials for deck construction. Life cycles of the various products are variable and depend on how well the wood is maintained.

The main point of deck maintenance is to prevent wood rot. A secondary goal of deck maintenance is to prevent splitting and drying of the wood.

Rot: Wood decks will rot if –

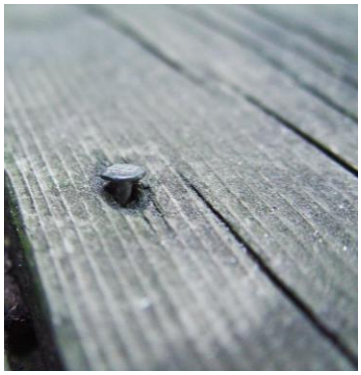
- There is standing water on the deck (the deck does not drain).
- Exposed end-grain in a vertical position.
- The deck is located in complete shade and sheltered from wind, where it takes a long time to dry.
- There is wood soil contact

In this picture, the deck posts are rotting through because the end grain of the posts was facing up and completely unprotected.

Wood drying and splitting: As wood dries it shrinks. The biggest

change in dimension is across the grain. In other words, the width of the deck boards shrinks after installation. High quality lumber does not shrink much while low quality lumber does. For example, low quality pressure treated lumber is not dried as well as premium grade. If you build your deck with premium grade pressure treated lumber, you will have decking that is more dimensionally stable and it will look great for many years.
Cedar is more dimensionally stable that pressure treated wood. The lumber is nice to work with because the pieces are nice and straight to start with and it does not shrink much after installation.

Expansion and contraction: The other reason that wood splits is that water soaks into the wood and then dries out again. The wood expands and contracts. Over time, the expansion and contraction causes the wood to split and deteriorate. People often describe this as wood that has "dried out" where in fact what you see is from repeated expansion and contraction. This picture shows a deck surface that has expanded and contracted over the years. There are nasty nail pops all over the deck and the wood surface is split. This could have been prevented by sealing the wood.



Sealing the wood: Wood sealer will improve the look and longevity of your deck. Here's why. First, it prevents water from soaking into the wood. If you splash water on the wood, it will bead up and run off. This solves two problems, it eliminates the standing water problem and it stops splitting due to expansion and contraction because water can't soak into the wood.

Here is how to test the deck to determine if it is time to seal the wood. Splash some water on the wood. If the water beads up, the wood sealer is still doing its job. If the water soaks in, it's time to re-seal.

Life cycle: The life cycles that were quoted in the last section depend heavily on how well the deck is maintained. A deck that is cared for and sealed will last much longer than a neglected deck.

Check Your Knowledge

Answer the questions below in the spaces provided

1. **True or false? A guard rail is required for a deck that is 40 inches from the ground.**

2. **In most areas, a high deck requires a higher guard rail than for a low deck. The deck height where this is required is usually six feet) depends on your areas. For a six food high deck, what guard rail height is required? _____**

3. **List the three decking materials in order from the least expensive to the most expensive. Cedar, standard pressure treated, synthetic decking.**

_____
_____
_____

4. **List two conditions that can cause wood rot (there are more than two to choose from)**

_____
_____

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Chapter 7

CHAPTER 7
CEP Quiz

CEP Quiz – Decks

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Name_____

1. List any two design requirements for a guardrail that keep people from falling from a deck.

_____

_____

2. True of false? Many decks get built without a permit.

3. The cylindrical concrete base that the deck posts rest on is called a -

    a. ledger

    b. girder

    c. pier

    d. post

4. Which of the following is a benefit of synthetic decking?

    a. it is less expensive

    b. very little maintenance required

    c. it is warm to the touch

    d. it stays the same color over the years

5. List two benefits of sealing a deck with wood sealer?

_____

_____

6. List two things that cause wood rot?

_____

_____

7. True or false? A deck post must be attached at the bottom but it does not have to be attached at the top. The deck structure simply rests on the posts. This allows for expansion and contraction and prevents wood splitting.

8. True or false? Cedar today is not the same quality as cedar from years ago.

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Chapter 8

CHAPTER 8

Presentation Evaluation

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Presentation Evaluation – Decks

TECHNICAL CONTENT	Excellent	Average	Poor	No Opinion
Presenter's knowledge of subject matter	○	○	○	○
Ability to keep you interested	○	○	○	○
Discussion / overview / recap	○	○	○	○
How well did this course meet your expectations?	○	○	○	○

Comments:_____

_____

ORAL PRESENTATION	Excellent	Average	Poor	No Opinion
Explanation of objectives	○	○	○	○
Voice (volume, clarity, speed)	○	○	○	○
Answers question clearly	○	○	○	○

Comments:_____

_____

VISUAL PRESENTATION	Excellent	Average	Poor	No Opinion
Voice (volume, clarity, speed)	○	○	○	○
Answers question clearly	○	○	○	○
Effectiveness of visual aids	○	○	○	○
Presenter's eye contact	○	○	○	○

Comments:_____

_____

MATERIAL HANDOUTS	Excellent	Average	Poor	No Opinion
Effectiveness of handouts	○	○	○	○

Comments:_____

_____

Please complete this portion:

Location: _____ Date: _____

Name (optional): _____ License# (optional): _____

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