This is an excerpt from the book

Inspecting a House

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Chapter 5

FOUNDATIONS, STRUCTURAL SUPPORTS, AND DECKS

A foundation can be loosely defined as whatever the house box sits on to support the weight of the structure. The foundation or supporting structure can be anything from solid block or concrete to posts and columns, wrought iron, or rock taken from the property. It has been said that as long as the foundation is in good shape, almost anything in the house can be fixed. That may be an exaggeration, but it does stress the importance of making sure the foundation is sound.

Vertical columns that support overhangs from porches to living areas can be considered to be the foundation of the overhead structure, and I normally inspect these at the same time as the rest of the foundation. I also inspect any wrought-iron railings around the front steps or porch, as well as the deck (if the house has one).

The Foundation

The bottom line in foundation inspections is that prospective buyers want to be assured that the house will not fall down once they move in. And I've inspected more than a few houses that looked as though they could. I recall one inspection

The brick foundation of this house is tilting forward. In an attempt to prevent its collapse, the owner drove metal pipes into the ground next to the foundation and patched up the Z-crack at the corner. In the close-up photo you can see that the house has separated from the foundation so much that someone has been able to run an extension cord between the two.

where the top of the brick foundation wall had tilted so far out that it looked as though the entire front of the house would come crashing down at any moment. In a futile attempt to stop the inevitable, the seller had driven a couple of 1-in. metal pipes into the ground in front of the foundation (see the photos above).

To keep a foundation from tipping over or to keep posts from sinking into the ground like spears, a footer is required. This is a flat base at least twice the width of the foundation that is normally installed deep in the ground below the frost line. If the foundation is continuous, the footer must be continuous too. The footer has to be wider than the foundation above it so it can spread the building's weight out onto the supporting earth below. In the old days, large buried rocks served as footers; today we use concrete pads. Because you cannot see into the earth to verify that the footer is both deep enough and wide enough, the only way to check for possible footer problems is to observe what is happening to the foundation.

Solid foundations

A solid foundation forms a continuous skirt around the building that supports the structure above it. There are many types of solid foundations, but you'll be checking for the same things regardless of type: namely, cracks or breaks in the foundation, bowing or tilting, and signs of disintegration. There's a good deal of overlap between inspecting a foundation and a basement wall, and the main causes of failure are the same for both. These include poor construction, frost-

Foundation problems aren't always evident until you go into the basement. This block foundation wall is caving in from the constant pressure of the earth pushing against it. You can see moisture coming through the lower blocks.

Over time, the constant pressure of earth against a block foundation can cause the wall to bow in and the mortar joint to fail.

related damage, settling or shifting of the ground under the footer, and a high water table or water infiltration caused by improper grading and guttering.

As you do your exterior inspection, make note of any conditions that may allow water to accumulate around the foundation, such as improper grading, missing or damaged gutters, cracked driveways and walkways, and so on. Then when you go into the basement, you can verify whether these problems are causing problems inside. Also note any significant cracks in the foundation and check to see if these cracks run all the way through the wall when you're inside. (For more on basements, see chapter 7.)

A solid, continuous foundation that extends from the footer to the framing can be of almost any material: rock, block, poured concrete, brick, or wood. Many old country houses sit on a continuous footer of rock taken from the planting fields. The rock itself lasts forever, but the mortar used to seal the openings between the rocks disintegrates over time. Use an awl to check for disintegration, and look for any long gaps between the rock and the foundation beams it is supposed to be supporting.

Block foundations are rarely problematic unless the footer is inadequate. If the footer moves or sinks, a typical structural defect is a Z-pattern crack through the block or the mortar joints. Ignore minor "old-age" cracks, but be on the lookout for long vertical or horizontal breaks that form a continuous pattern. As with other solid foundations, the constant pressure of the earth against a block foundation, along with excess water, can cause the foundation to bow in and the mortar joints to fail.

Brick foundations are subject to the same problems as block, but an additional check is for disintegration of the brick itself. New brick should be sound, but watch for old brick foundations or new foundations built with recycled brick, which usually isn't as hard as new brick. Use an awl to probe for signs of disintegration in the brick and the mortar. Be sure to check the foundation on all

Foundation Checklist

- ☐ Bowed or leaning foundations
- ☐ Excessive water around perimeter of foundation
- ☐ Gaps and major cracks in the foundation
- ☐ Crumbling or missing mortar joints
- ☐ Disintegrating brick
- ☐ Peeling stucco

sides of the house; as with siding, the foundation may be sound on all sides except one—the side that gets the heavy weathering.

Many solid foundations have a surface covering such as stucco. In cold climates, repeated freezing and thawing can peel off this covering (which is good, in a way, because now you can get a good look at the real foundation). Whenever I inspect a foundation that has a stucco covering I always make a note to check in the basement to see if there are problems on the inside of the foundation wall. Many times, the stucco is applied over the exterior of the foundation to conceal cracks and other defects.

Piers and columns

Not all houses are supported by a solid, continuous foundation. Many are held up by a system of piers or columns placed strategically around and within the house perimeter. These individual structural supports may be of rock, brick, block, concrete, wood, or steel. Rock piers are the oldest of these, and they should be in just as good a condition as they were the day they were installed. Most of these foundations were not constructed with mortar, so there was nothing to disintegrate. For those that have it, probe into the mortar to verify that it isn't crumbling or breaking apart. One common

If part of a footer settles and part does not, a stairstep Z-crack will work its way down the foundation wall. Write it up.

Settlement or shifting of the ground under the footing is one of the major causes of foundation failure. This crawl-space foundation, which used to be continuous, is breaking apart (as is the sidewalk next to it).

When stucco is applied directly to the foundation without wire, scratch coat, or brown coat, it doesn't stay on long in areas that undergo extremes of climate. Peeling stucco shouldn't have any structural effect on the building, although it may be concealing problems in the foundation itself.

Rock piers are the traditional standby for foundation support in old houses. Be on the lookout for shims that have fallen out from the top of the pier, allowing the floor beams to sag or break. This wood shim is still in position.

Brick support columns are prone to disintegrate—especially if the builder used old brick to begin with.

problem with rock support structures is that a wooden shim may have been wedged in at the top of the pier between the last rock and the horizontal support beam. This wedge may have slid out and the pier is no longer supporting the house. Therefore, when inspecting rock piers always shine your light to the very top to verify that something is making contact with the building.

Piers made of brick are fairly common on old houses, and sometimes the bricks are disintegrating. Old bricks were often made locally, and they are not always up to today's standards. In some cases, the bricks used in the piers were recycled from other buildings, and these are particularly prone to decay. Most of the time the disintegration will be obvious; if in doubt, probe the bricks or mortar with an awl.

Whenever wood comes in contact with concrete or dirt, it is a simple matter of time until it rots. Treated foundation posts last longer than untreated posts, but all will eventually succumb. Below ground, wooden posts will probably stay intact for quite a few years, but at the earth's surface they will rot and fall apart. We have finally learned our lesson and now break post contact with the earth or concrete by placing the column on a small raised, platform. But not all localities require this platform, and in many places you'll still find the posts sitting right on the moist concrete or, worse still, on the dirt.

Check for obvious problems in the posts such as rot, cracks, or excessive mildew; and use your awl to verify that the wood is sound. Be especially wary of hard-to-see posts within brushy areas that rarely see sunlight, posts that are in areas that flood (look for mud rings around the post), or

Pier and Column Checklist

- ☐ Rock or brick piers that have begun to disintegrate
- ☐ Wood columns that are rotted at ground level
- ☐ Concrete piers that have major cracks

posts sitting on concrete pads that are level with the ground. These will rot quickly.

On the coast, on steep hillsides, and in areas where houses are built over loose soil, you'll often see giant pole and circular concrete piers holding up the buildings. Disintegration of the wood columns will be obvious (make sure you check a few inches below ground level for rot), but problems with the concrete piers will be harder to detect. Check for a shear crack that goes all the way around or through the pier. If the concrete has broken or cracked all the way through, the only thing that is keeping it from shearing in two is the rebar within.

Low foundations

All houses have some kind of foundation, but on some buildings the foundation is so low to the ground that the floor joists are literally sitting in the dirt. In some parts of the country in the early 20th century, it was common to build the floor right into the ground. As illogical as this seems to us today, it was considered a viable option back then when wood was denser and less prone to rot. (Pine, considered a soft wood today, was so dense that it was difficult to drive a nail into.) The wood would rot, but not in the homeowner's lifetime. Unfortunately, it is rotting in ours, and the inspector needs to take a close look when the floor is at or close to ground level.

As you do your walk-around inspection of the exterior, observe how high the foundation is above ground level. If it is level with or below the ground, there's a good chance that the floor joists

Top: Whether treated or untreated, a wooden support post that's in contact with concrete (or the ground) will eventually rot. The inspector should probe into the post to see how far along the rot has progressed. Bottom: This post has been extended off the concrete by a raised platform—it shouldn't rot.

Porch Columns

Wooden columns and posts that support porch roofs are prone to rot, especially around the base where water runs off the roof and splashes back against the supports. Sometimes you'll see simple 4x4 posts holding up a structure, other times you'll see giant vertical columns reminiscent of old plantation homes of the South. Simple or grand, all columns will rot if they are in contact with the ground or concrete.

Plantation-style porch columns are particularly prone to rot where the base is in contact with concrete.

More common than giant columns, this simple home-made post is being eaten away by rot, mold, and mildew.

For a physical check of the support columns, you'll need an awl to probe the wood to see if it is solid or spongy. Check first at the base (where it rots the easiest) and then overhead to make sure the column is securely attached to the building. I usually give the column a gentle push to verify that it is tight to the building, but go easy here—you don't want the porch roof to come crashing down if there's a problem.

Some porch columns are a combination of brick and wood. The problem with these is that the two materials react differently to settling or shifting of the house structure. The upper wooden part can move and bend slightly if the footer or house shifts; but the rectangular brick section is "set in concrete" so to speak, and it cannot move. Instead, it starts to break up and come apart with the stress.

For a combination brick-and-wood column, it's always a race to see which is going to come apart first: the wood column or the brick base. This race was won by the brick.

You'll see this quite often in rural areas: a low foundation over a crawl space too small for a person to get through. This means that the floor joists are either in the dirt or an inch or two above it.

The upper end of this house has the full width of the floor joists in the dirt. The bottom skirtboard has fallen away, exposing rotted wood behind, which extends through the bottom plate and into the studs.

If you see a newly installed and freshly painted skirtboard, be aware that it might be hiding some major problems.

and other support beams are sitting in the dirt and rotting. Make a note of it and, when you go inside, look for major dips in the floor, indicating that the beams may be rotting and are no longer able to support the weight of the floor. If the foundation is a crawl space, note if there are any vents. If there are no vents, the joists are probably rotting. Although this is normally a problem only in older houses, I've also seen new homes with large crawl spaces rotting out for lack of venting. (For more on crawl-space inspections, see chapter 7.)

On the outside, look for rotting skirtboards at ground level, which likely indicate that there's a problem with the support beams behind. I'm also suspicious if I'm inspecting a house on which the skirtboard has recently been replaced. More often

Wrought-Iron Supports and Railings

Wrought iron is used as a support structure on some houses and more commonly as a hand railing around front steps and other parts of the building. The major problem with wrought iron is that it will eventually rust. One of the worst spots for rusting is where the iron is in contact with a porous concrete floor, as, for example, on the front steps of a house. Also check for rust through at the weld joints between railings.

Although major rust through will be obvious, it's important to check more than just the metal of the railing. You also need to look at the screws and/or bolts that hold the brackets to the walls, ceiling, and floor. If these rust through—and sometimes they are the first things to go—the railing is an accident waiting to happen.

Pay particular attention to stair and balcony railings, which people are likely to lean on. Look closely at the attachment brackets. Put your weight against them to verify that they are securely attached to the building and floor. Also be on the lookout for temporary fixes to rusted railings. I've seen hand railings attached to wrought-iron posts with everything from belts to metal ties. None of these will hold for long. Observe and report.

Wrought-iron stair railings have short life spans in cold climates, where salt, thrown down on the steps to melt the ice, also eats through the metal.

Wrought iron used as a support structure or railing is both decorative and functional, but it has one drawback—it rusts. Carefully check where the wrought iron attaches to the building and to the floor.

The screws used to attach this railing to the house have rusted through, causing the railing to the right of the door to come loose—a dangerous situation.

than not, the owner will repair obvious problems in an attempt to sell the house, while ignoring the major structural problems that the new boards conceal—such as rotting sills and floor joists.

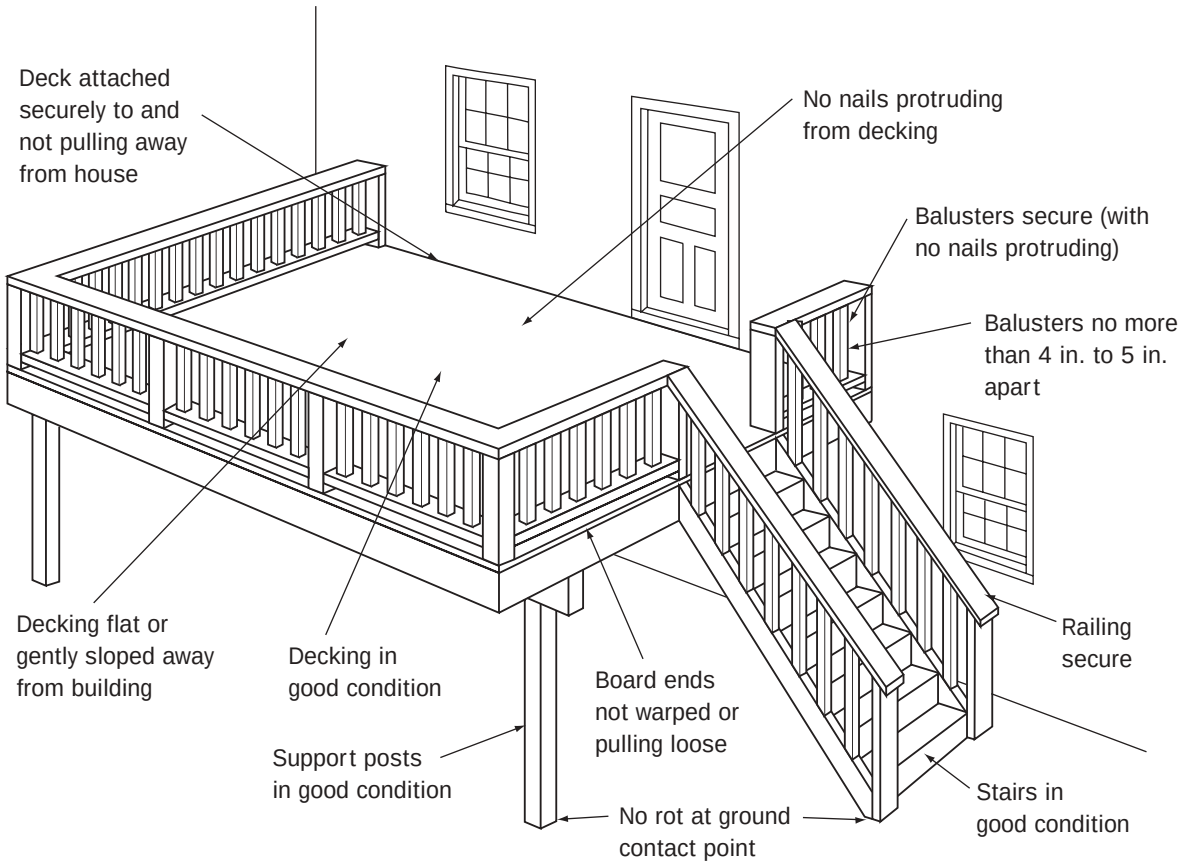
Decks

Building a deck is one of the most popular projects undertaken by do-it-yourselfers; but unfortunately, not all decks are constructed soundly. Although many are built to high standards, I've seen more than a few that are constructed contrary to both code and common sense. Typical problems fall into three main categories: the support posts and attachments, the railing, and the decking boards. In addition, you need to watch out for decks that are built in unsafe or illogical locations: I've inspected decks that were built just a couple of feet below the utility service drop and several that had the decking boards butting directly against the utility meter. And if a deck is installed immediately over an air-conditioning/heat pump unit, there will need to be 5 ft. minimum between the grill and the decking.

Support posts and attachments

The deck inspection should begin at the support posts. Treated wood posts and masonry posts are the most common. Verify that wood posts are in

Deck Inspection Checkpoints



The support structure and decking boards of this deck are in good condition, but the deck has been secured to the house with nails, which do not provide as strong an attachment as lag bolts. The entire weight of the deck and people on it are supported solely by the shear strength of just a few nails, which have a habit of working themselves back out.

These two threaded bolt ends are protruding from the deck support just a few feet off the ground on the yard side of the house (instead of toward the house). Be sure not to let something this dangerous get by you.

good condition without warp or major fracture and that they are securely attached to the structure, preferably with bolts. Masonry posts need to be checked for broken block or brick and deteriorating mortar joints. Don't overlook the obvious, such as one or more missing support posts; believe me, if it can be built wrong, you'll see it.

The support posts need a footer or concrete pad underneath to prevent them (and the deck) from sinking into the ground. You won't always be able to see the pad because it may be underground, but a clue that there's a problem is if the deck slopes noticeably toward the house (the support posts closest to the door usually take the most downward pressure). You can also use a long awl to check for the presence of an underground pad or footer. It's normal to build a slight slope into the surface of the deck so that rain and snow will drain away from the house. But be aware of severe slopes, especially at the corners, where a support post may be sinking or the dirt under the post may be eroding.

Codes normally require decks to be either independent of the main building or securely bolted to the structure. If the deck is attached to the structure, it should be with threaded bolts or

lag bolts, not nails. Although local codes may not require a bolted deck-to-house attachment, I always write it up as an area of concern if the deck support structure is simply nailed to the house. Problems associated with nailed attachments include shear weight limitations, the risk of the deck pulling away from the building, and nails working themselves loose over time. When bolts are used on the deck support structure, they should be installed with the threads toward the inside of the deck. If the threaded ends protrude from the supports, there's the danger that someone will catch his or her clothing or legs on them.

Railings

Most codes require that decks higher than 3 ft. off the ground have a railing around them to keep people on the deck from falling off. Just as important is the spacing between the vertical supports (or balusters) on the railing. If the balusters are too far apart, children might fall through or get their heads stuck. Most codes require the balusters to be placed no farther apart than 4 in. The same requirements apply to the stair railings leading to the deck.

Also check that railings are sound (not rotting) and are securely attached to the deck, stairs, and

Check to make sure that the gap between balusters complies to the local code (typically the gap should be no greater than 4 in. to 5 in.). If in doubt, measure, don't guess.

Decks such as these are a death trap for small children and the elderly. All decks over 36 in. high need railings and balusters to keep people from falling off.

This 2x4, the main support for the stair railing, was poorly installed and the railing wobbles when any one leans against it.

house. Make sure that the railing doesn't wobble back and forth and that there are no exposed nails.

Decking

On the earliest decks, decking boards were typically made from trees cut right on the property. Although some of the boards, like hard oak and locust, last a long time, eventually weather and insects take their toll. Newer decks are made of treated wood or a composite material, which is supposed to be a step in the right direction, although I've seen treated decks last less than a decade. Regardless of the material used, first check that the decking boards are sound and not rotted or broken (don't forget to check the treads on the stairs leading to the deck as well). Pay particular attention to boards that are under trees or in continual shade from the house. Such shady locations are a haven for the growth of algae, which the not only shortens the life of the deck but also poses a safety risk because it makes the deck slippery.

Mold and algae can make a deck as slick as ice as well as shorten the life of the deck.

Safety also comes into consideration when decks, especially wrap-around decks, are installed below steep roofs in cold climates. Nobody thinks about this until the first heavy snow fall. The snow accumulates on the roof and then slides down onto the deck, with the risk of seriously injuring anyone caught in the avalanche.

Most deck surfaces, even pressure-treated decks, need some type of treatment to prevent water from penetrating the grain. Decks of treated wood

This deck looks sound enough, but there's a hidden design problem here. The deck extends beyond the roofline, so any snow that accumulates on the steep roof will eventually slide down and bury anything (or anyone) that happens to be on the deck. An additional problem is the rain runoff from the roof, which will speed the deterioration of the deck.

Check for warp at the ends of decking boards. If they are not securely fastened, the ends have a tendency to buckle.

Deck Checklist

- ☐ Deck built immediately below electrical wires or over an air-conditioning/heat pump unit
- ☐ Warped or fractured wood support posts
- ☐ Deteriorated masonry posts
- ☐ Missing support posts
- ☐ Support posts that are sinking into the ground
- ☐ Deck securely attached to house or independently supported
- ☐ Bolts mounted head out and thread end in
- ☐ Railings and steps installed, if required, and secure and sound
- ☐ Maximum gap between balusters not exceeded (typically 4 in. to 5 in.)
- ☐ Decking in good condition and securely attached

that have been ignored and left to absorb whatever the weather throws at them will turn gray and have their grain pulling out of the wood; nontreated boards may be dark and look permanently wet in shady areas. Pay particular attention to the ends of the boards, which are prone to severe warping.

Look for deck nails that have worked their way back out of the decking as a result of extreme fluctuations in temperature.

Decking boards can be fastened down in a number of different ways, but the best way is to use stainless-steel screws attached from the top or bottom. I learned this the hard way on my own deck: I used coated spiral decking nails, and they are coming right back out of the decking boards. The temperature extremes in the mountains of Virginia where I live force the nails out of the wood. When it is very cold outside, I can hear the nails popping up from the surface—it sounds like a rifle going off. The nail heads are raised only about ¼ in. from the surface of the deck, but it's high enough to trip someone or to snag a bare foot.