Unreinforced Concrete Foundations and Some Modifications

By Keith Tarkington

All illustrations are based on foundations observed during home inspections and information provided by professionals. These illustrations are informational only and not plans for how to waterproof, repair or modify a foundation. A qualified engineer should evaluate any old foundation with issues to determine whether repair or replacement is necessary. The accuracy of the illustrations is not guaranteed. Actual foundations, framing, and presence of reinforcing steel will vary.

Original Foundation

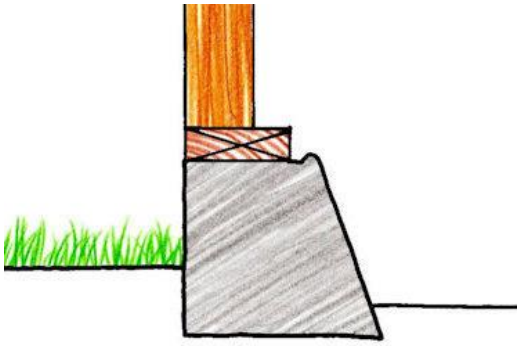

Figure 1 Unreinforced Concrete Foundation

Residential concrete foundations built between the 1900s and 1940s were often trapezoidal in shape (see Figure 1), smaller and did not have footings that extended deep into the soil. The older the foundation, the less likely it was steel-reinforced. Even if it had steel-reinforcing, the reinforcing would not be as substantial as in new foundations.

Concrete is a mixture of sand, aggregate (rocks), and portland cement. Salty, round beach sand was often used instead of sharp quarry sand. The aggregate could consist of dirty rocks from the construction site or large gravel. Sometimes insufficient portland cement, or too much aggregate, was used, making the concrete porous and weak. The water used to mix the concrete may have been salty bay water, rather than clean water. The concrete for the foundation was also usually mixed on site, leading to more inconsistency in the concrete. Many of these factors contributed to poor-quality concrete.

Poor-quality concrete is more susceptible to moisture entry, deterioration, and spalling, or surface flaking. Minor surface deterioration is common in older foundations. Over many years, the moisture penetration can deteriorate the concrete to the point where replacement becomes necessary. Some building departments will not permit seismic retrofitting in poor quality concrete. In order to adequately seismically reinforce the house, it may be necessary to install a new concrete foundation perimeter.

Older foundations may also exhibit cracking, which is common in concrete walls. Minor cracks can be caused by shrinkage or settling. Moderate or larger cracks may indicate ongoing settling or movement and the need for a qualified soils engineer report before and foundation repair or replacement.

Pre-1930 foundations with issues will usually need to be replaced.

Drainage Concerns – Curb Walls

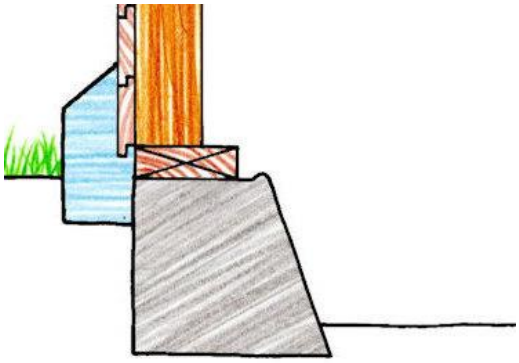

Figure 2 Concrete Curb Wall

Downspouts terminating near the foundation, soils sloping towards the house, or years of settling often lead to area drainage problems or water flowing into the crawlspace or below grade rooms. In new construction, downspouts are typically directed into subsurface pipes and the soil is sloped away from the house to direct water away from the foundation.

On older foundations, concrete curbs (see Figure 2), sometimes called "flashing curbs," were commonly installed along the outside of a foundation wall to prevent wood to soil contact or moisture entry caused by faulty grade (see Faulty Grade Concerns below), or soils and hardscaping sloped to the house. The curbs were installed to direct surface water away from or around the foundation, reducing water entry into the crawlspace. With time, the curbs can separate from the building, or deteriorate, necessitating caulking, replacement with new curbs, other more effective drainage solutions, lowering the exterior grade, or foundation replacement.

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

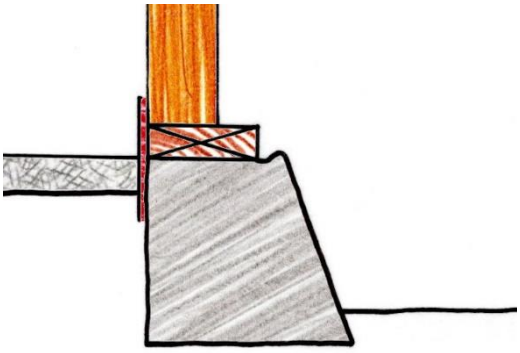

Figure 3 Metal Flash Wall

When modern curb walls are installed, the curb top will be canted or sloped away from the house. Metal flashing will also be integrated into the siding to drain water away from the house. (This detail is missing in Figure 2.)

Occasionally, concrete walkways were added later alongside a house and created a faulty grade condition or directed water toward the house. Metal flashing is often seen between the concrete and foundation, or siding, to minimize water entry (See Figure 3). Over time the metal flashing will corrode, which appeared to happen quicker when aluminum flashing was used, rather than galvanized steel.

Faulty Grade Concerns – Foundation Caps

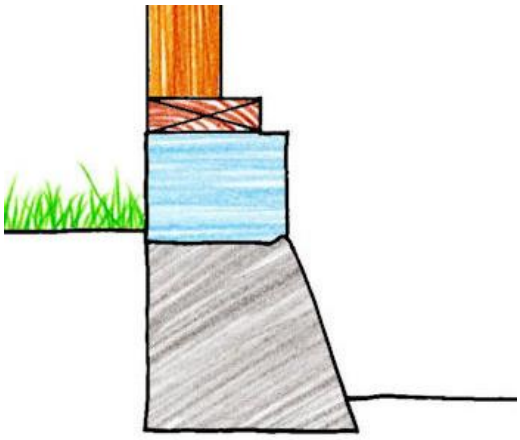

Figure 4 Concrete Cap

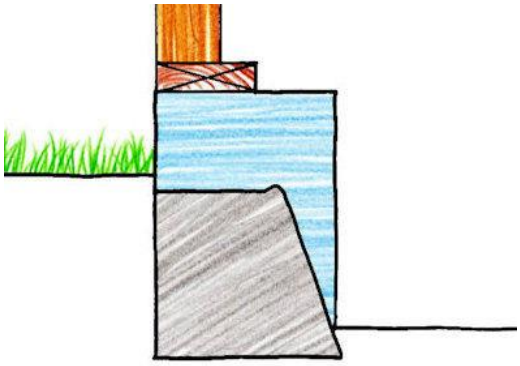

Figure 5 Concrete Cap

A faulty grade (where the exterior soil level is above the top of the concrete or masonry foundation) can allow moisture penetration, leading to decay or termite infestation. The standard in new construction is for the top of the foundation to be at least six inches above the soil level. Removal of soil adjacent to the foundation can eliminate a faulty grade condition, but it may also direct surface water toward the foundation. Previous repair methods included concrete caps (see Figures 4, 5, and 6) on top of the foundation to raise it above the exterior soil level, concrete curbs (see Figure 2) outside the foundation to act as a moisture barrier, or low concrete or wooden retaining walls to hold soil away from the foundation.

There was a period of time when concrete foundation caps (see Figures 4, 5, and 6) were installed on top of existing foundation walls by pest control companies to minimize moisture entry and damage to the wood framing, or Earth to Wood contact. Foundation caps were often steel reinforced and could improve the strength of the foundation system. They should not, however, be considered as strong as a new foundation. There are times when the home inspector will observe caps on deteriorated foundations that should probably have been replaced, rather than capped. Many building departments now prohibit the installation of caps over deteriorated concrete and complete replacement of poor-quality perimeter foundation walls is recommended.

When installed, metal pins were inserted into the old foundation to tie the two concrete pours together. (The metal pins are not shown in Figures 4, 5, and 6.) It is not uncommon to see the metal pins protruding from the sill plate.

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

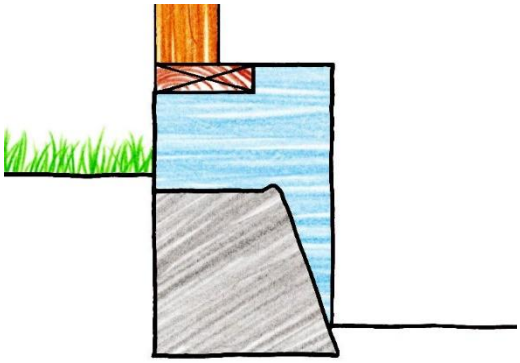

Figure 6 Concrete Cap with the Sill Plate Buried in Concrete

The installation of concrete caps can make seismic retrofits difficult when the new sill plate was embedded in the concrete, leaving only the top exposed (see figure 6). Depending upon the depth of the cap, the installation of foundation plates may not be possible.

Sometimes newspaper can be seen between the side edges of the cap and the original foundation. The paper was sometimes used to seal the bottom of the form to prevent the concrete from flowing out when the concrete was poured.

Faulty Grade Concerns – Foundation Cap and Saddle

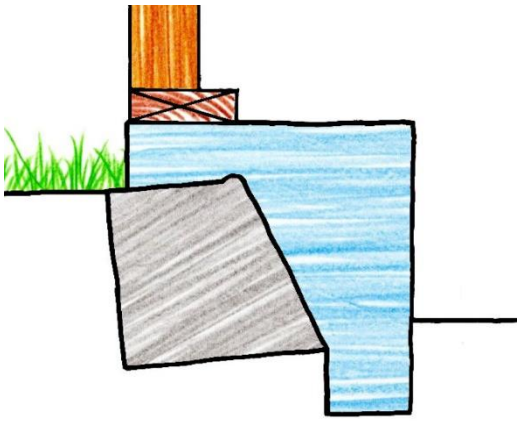

Figure 7 Cap and Partial Saddle on Rotated Foundation with Faulty Grade

Cap-saddles were typically poured on the top of and over one or both sides of an existing foundation that is either made of brick or poor-quality concrete (see Figures 7 and 8). Cap-saddles were usually steel-reinforced and could significantly strengthen the older building support system. They should not be considered equivalent to a new foundation (unless designed by a qualified engineer to modern standards). In some installations, the additional weight of a cap-saddle can cause settling, especially if the footings are inadequate and the soil is too weak to support the added weight. When an old foundation has a cap and saddle it may be difficult for a home inspector to determine the condition of the foundation. It is sometimes possible to dig along the bottom edge of the saddle and examine a portion of the foundation concrete.

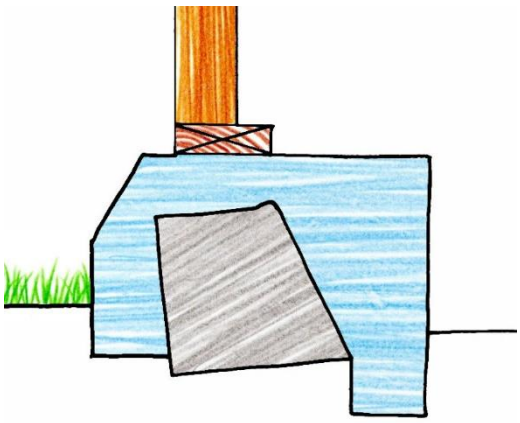

Figure 8 Cap and Saddle on Rotated Foundation

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

Foundation Rotation

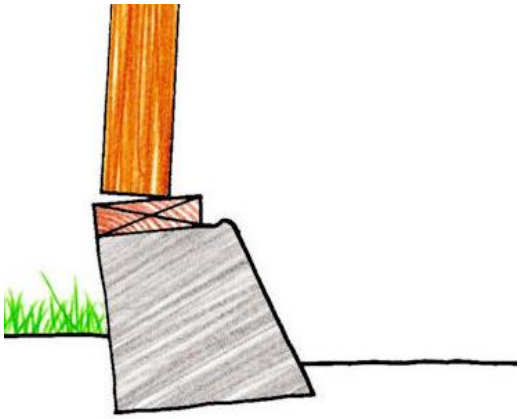

Figure 9 Foundation Rotation

Rotation, or foundation leaning, is not uncommon in older foundations. The weight of the exterior walls and roof can cause the foundation to lean or rotate outwards (see Figure 9). The amount of movement is influenced by the soil type; expansive soils or poor drainage can allow the foundation to settle. The foundation movement can continue until site drainage problems are addressed, or until repair, reinforcement, or replacement of the foundation occurs. Sometimes rotation slows or stops when load equilibrium on the foundation is reached.

Foundation rotation often causes cracking in the foundation concrete. Large cracks can often be found in the corners of the side with movement. Sometimes, large cracks are seen in other areas when the rotation is localized.

Occasionally, older foundations appear to be rotating because the top of the foundation was not poured level (see Figure 10). When a level is placed against the cripple wall studs, the walls are plumb. The cracks typically seen when a foundation has rotated, are not present.

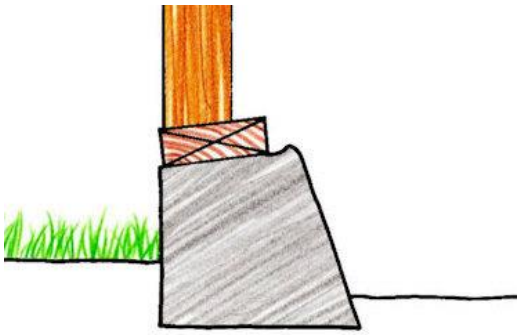

Figure 10 Foundation Top Not Level, but the Studs Are Plumb

Foundation Parge Coating

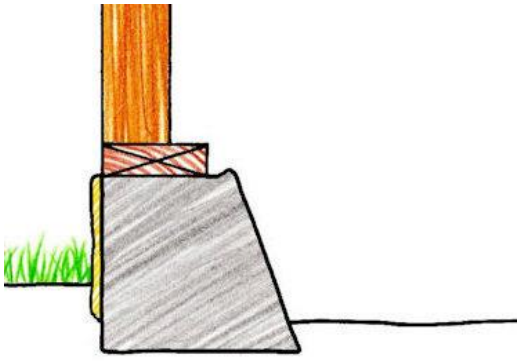

Figure 11 Parge Coating on Exterior of Foundation

A parge coating (see Figure 11) is a cement coating that is installed over an existing concrete or masonry surface. It may be installed for a few reasons, to improve the appearance by covering imperfections in the concrete surface, protect a deteriorating surface, or seal exterior cracks and gaps that may leak. When the foundation concrete is deteriorating, the parge coating is applied to reduce weather and environmental conditions that may further the deterioration. Parge coating will not improve concrete strength and may hide a significantly deteriorated foundation. The parge coating may obscure concrete defects from the inspector's view.

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

Foundation Support – Cuts in Grade

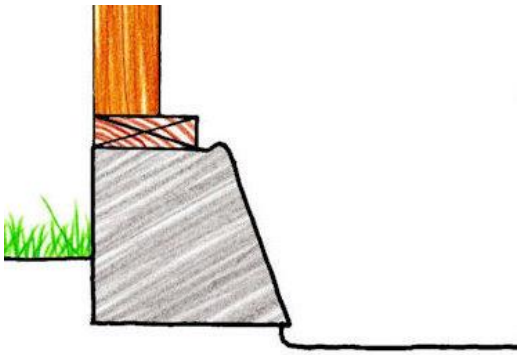

Figure 12 Foundation Undermined

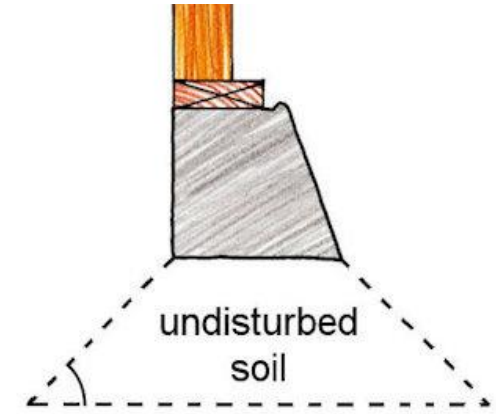

Figure 13 Undisturbed Soil Zone Below Foundation

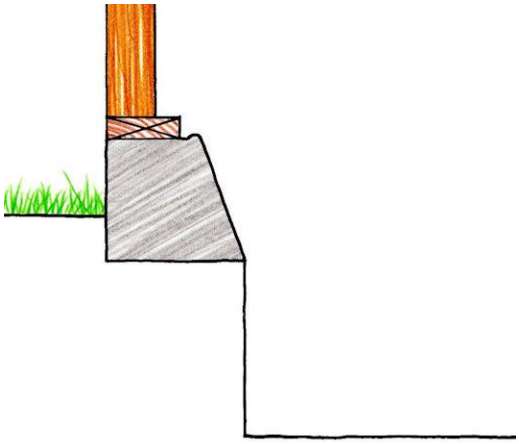

Figure 14 Cut in Grade Below Foundation

Over time, the soils may settle or shift away from beneath a foundation, and undermine it. A small amount of soil having shifted away from the bottom edge of the foundation (see Figure 12) may not cause problems, but current code requires foundations to be supported on undisturbed soil.

Sometimes the soil in a crawlspace is dug away, forming a "cut" in the soil surface that is steeper than the original slope (see Figures 14 and 15). For many soil types, it is necessary to support these cuts with a retaining wall. Concrete foundation walls or piers, above cuts-in-grade, and the soil in the cut-in-grade, may not be adequately supported. When not properly supported, rotation of the foundation may occur.

In new construction, the local building department will often specify which cuts require retaining wall support or they will require a qualified engineer to make the decision. Older cuts should be monitored for indications of erosion or soil slippage. Any steep cuts-in-soil should be reviewed by a qualified contractor or engineer, and repaired as needed.

To prevent problems from undermined foundations, the building code requires the soil under the foundation to remain undisturbed (see Figure 13). The slope required to properly maintain stability depends on the soil type. The slope is called the angle of repose (represented by the dotted lines in Figure 13.) Any cut steeper than the angle of repose risks foundation stability and should be repaired.

When older basements were excavated (see Figure 14), the resulting cuts in grade needed protection to prevent crumbling or failure. Sometimes the cuts-in-grade were covered with concrete (see Figures 16, 17, and 18), either to act like a retaining wall or to support the soil and foundation. There were times when the concrete was insufficient, not very thick, and subject to possible failure during large earthquakes. If the concrete layer is not thick, it should be evaluated by a qualified engineer or contractor and modified or replaced as needed.

Sometimes concrete, concrete block, or wood retaining walls (see Figure 19) were added to support the soil and structure. It is not unusual to find unreinforced concrete block walls or unreinforced solid concrete retaining walls. A determination of the thickness of the concrete or the presence of steel reinforcement is not easy. Unreinforced masonry walls may not perform well in an earthquake and failure in these walls would likely affect the foundation's ability to support the structure. Any unreinforced retaining walls should be evaluated by a qualified contractor and replaced if needed.

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

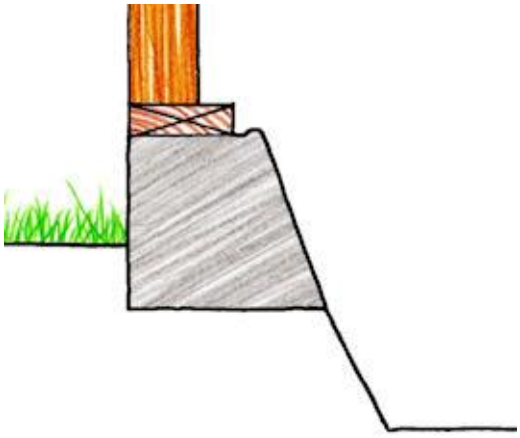

Figure 15 Cut in Grade Below Foundation Where the Angle of the Cut is Steeper Than Angle of Repose

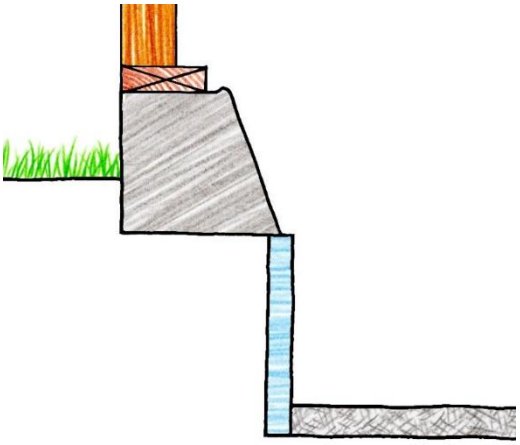

Figure 16 Concrete Layer Over Cut in Grade

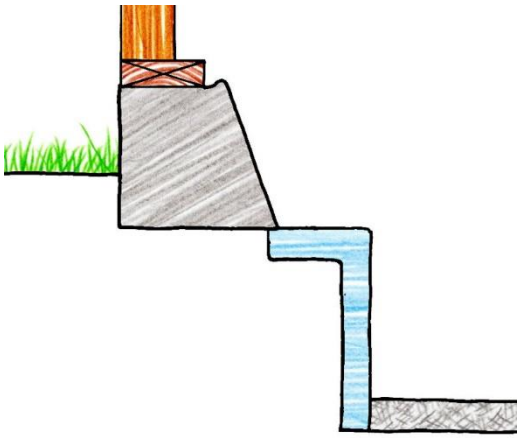

Figure 17 Concrete Layer Over Cut in Grade

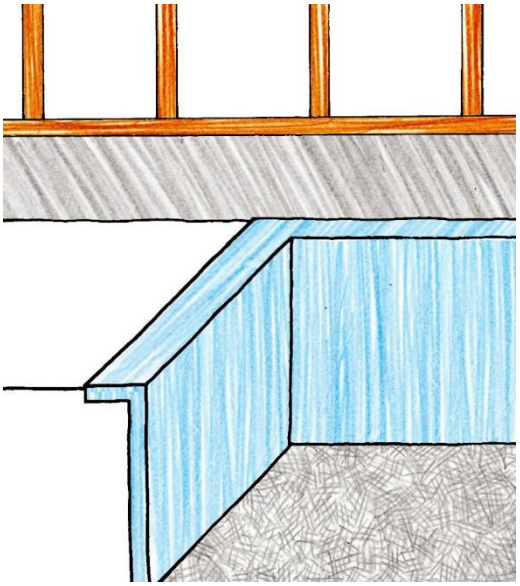

Figure 18 Concrete Layer Over Cut in Grade

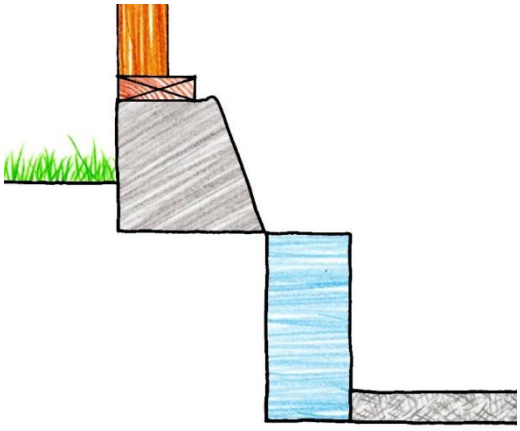

Figure 19 Concrete Retaining Wall

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

Foundation Assisting Walls

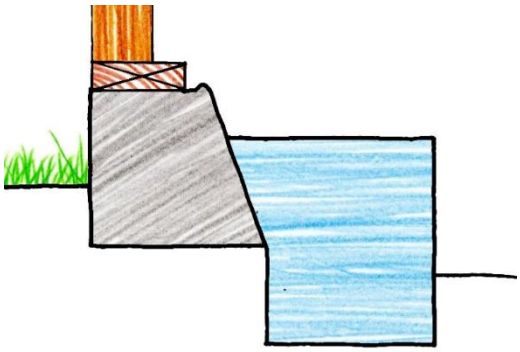

Figure 20 Pony Wall

Pony walls (see Figure 20), also called knee walls, are new, likely reinforced with steel, concrete walls installed beside an existing damaged foundation to provide additional support. The original foundation may be cracked or bowing from water entry or soils movement. When properly installed, the pony wall should improve the original foundation's resistance to movement. When not properly installed, the pony wall or other assisting walls will likely not provide the expected support or stability.

There may be instances where a new foundation wall was installed alongside an original wall, (see Figure 21) likely to reduce the cost of removing the original foundation. New cripple wall framing is installed on the sister foundation to support the house. This is not a common repair and may be seen on historical buildings with exposed exterior or brick foundations.

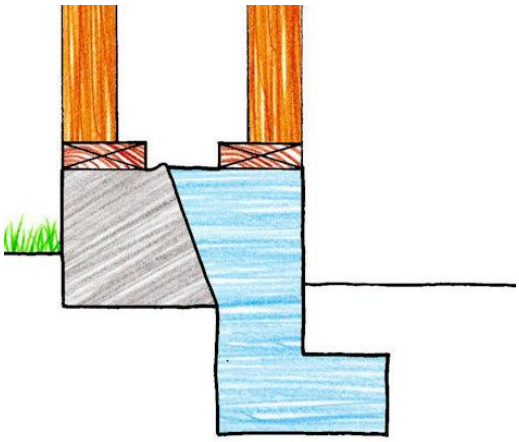

Figure 21 Sistered Foundation

Sometimes to achieve a conforming ceiling height in a below grade room or space, soil will be excavated. To prevent undermining the foundation, a bench foundation (see Figure 22) may be installed at the footing or base of the old foundation to support it and protect the soil from movement.

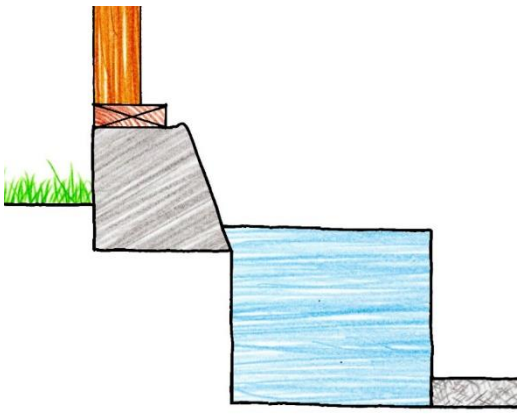

Figure 22 Bench Foundation

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

Foundation Additions

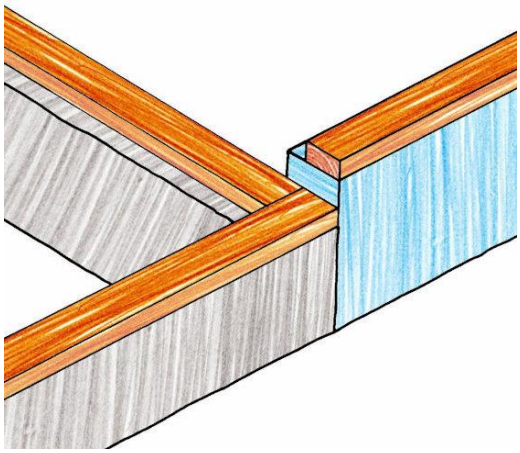

Figure 23 Older Foundation Addition

During the lifetimes of older houses, it is not uncommon to find one or more additions. The addition foundation walls are often more modern in design and typically have some amount of internal steel reinforcing. A determination as to the presence or extent of steel reinforcing is beyond the scope of the home inspector.

When properly installed, pins are drilled into the existing foundation to create a positive connection with the new addition foundation. Without destructive testing or special tools, the presence of the pins or reinforcing metal in the new foundation cannot be determined.

Older additions (see Figure 23) are frequently installed over old concrete patios. Other times, the patios are carefully cut to allow the foundation walls and piers to be installed into the soil. Even when installed into the soil, older addition foundations have outdated footings. When not properly installed, soil movement may create large cracks in the siding between the original house and the addition.

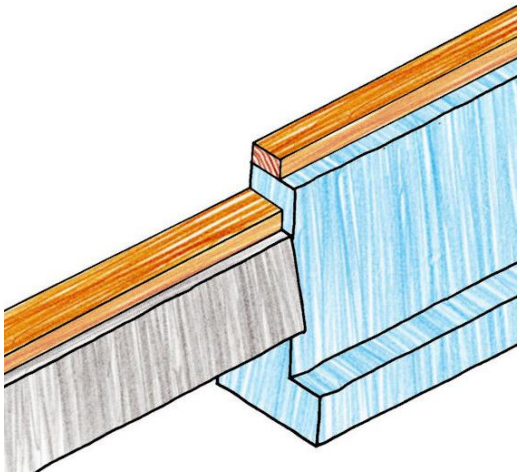

Figure 24 Newer Foundation Addition

Modern foundation wall additions (see Figure 24) will often be taller, with larger footings and reinforcing steel. When done with permits, there should be plans at the local building authority specifying the concrete strength and reinforcing steel placement.

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com

Foundations in Interior Living Spaces

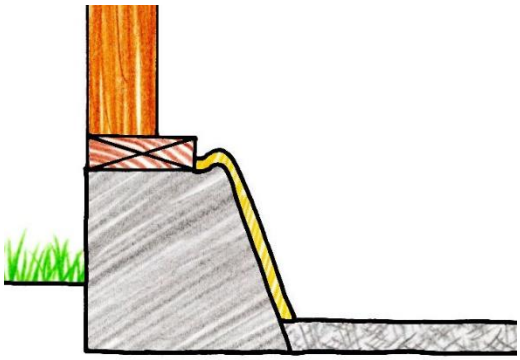

Figure 25 Parge Coating on Interior Wall

When the original foundation is exposed in living spaces, it is not uncommon for people to cover or hide the foundation to improve the living space appearance. Some common methods of covering the foundation include painting, parge coating, wood framed chases, or installing new walls in front of the foundation. Painting and parge coating (see Figure 25) leave the foundation exposed but improve its appearance by covering imperfections, water stains, efflorescence, spalling, or deterioration. A chase is a wood framed enclosure built over the exposed foundation (see Figure 26). The chase may be small, only large enough to cover the original foundation, or large enough to hide a bench foundation (see Figure 22) or retaining wall (see Figure 19). Sometimes, the living area is reduced with the installation of new walls (see Figure 27).

The home inspector may be able to see indications of the foundation condition through paint or parge coatings; efflorescence, spalling, deterioration, or cracks can sometimes telegraph through the coating. When chases or new walls are installed, the foundation condition will be largely unknown without causing damage to interior wall surfaces.

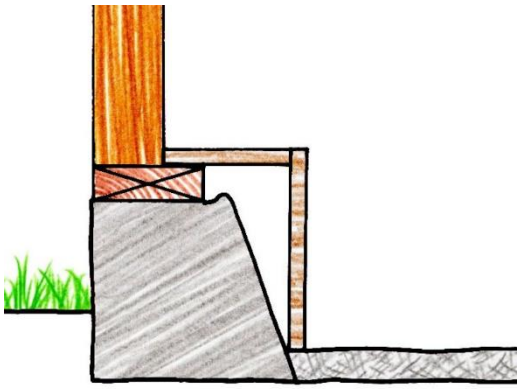

Figure 26 Chase Over Exposed Foundation

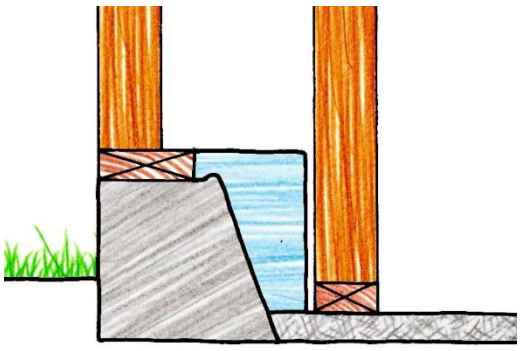

Figure 27 Foundation Saddle Between Original Wall and Framed Basement Wall

All illustrations are based on foundations observed during home inspections and information provided by professionals. These illustrations are informational only and not plans for how to waterproof, repair or modify a foundation. A qualified engineer should evaluate any old foundation with issues to determine whether repair or replacement is necessary. The accuracy of the illustrations is not guaranteed. Actual foundations, framing, and presence of reinforcing steel will vary.

Old Foundation	Stud or Sill Plate	Metal Sheet
New Foundation or Concrete	Lumber Cut End	Parge Coating
Walkway or Slab Floor	Exterior Grade Level	Chase Framing

© 2022 InspectionHelper.com