

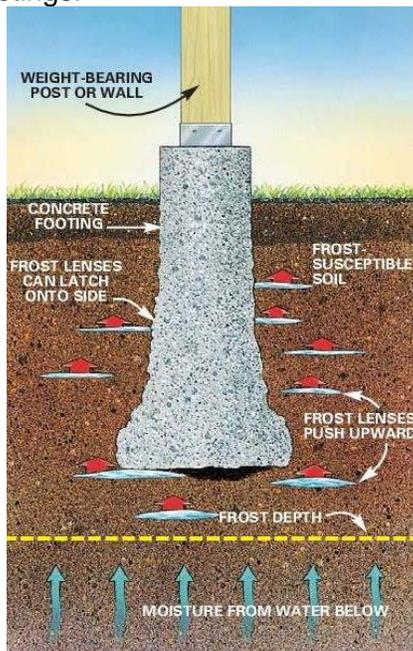
FROST HEAVE DECK and PORCH FOOTINGS

Decks and porches constructed on concrete pier footings can experience movement when certain conditions exist even though the footings were installed in accordance with the Minnesota State Building Code.

Pier footings will heave if soil moisture conditions and freezing temperatures occur in the right combination to exert force on either the bottom or sides of a concrete pier.

Homeowners should be aware that pier foundations are a compromise from the traditional continuous spread foundation used as the primary support for the dwelling.

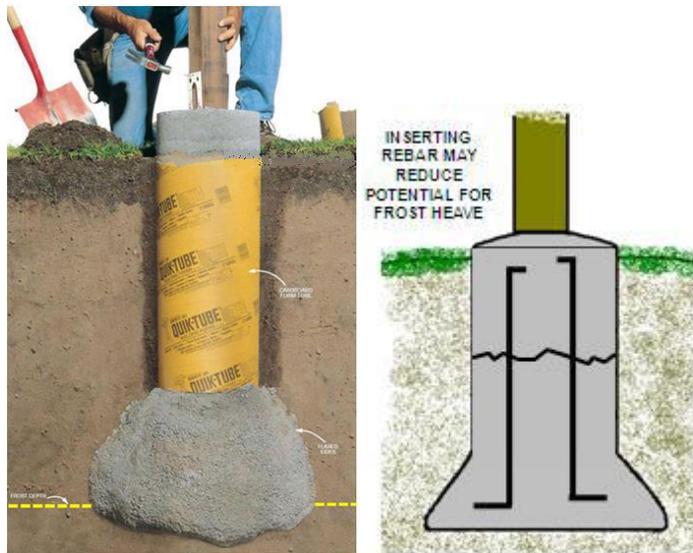
Pier footings:



- Are typically loaded to their design maximum leaving little room for error if soil bearing conditions are not carefully considered.
- Allow independent movement of individual footings since they have no structural connection between them.
- Are susceptible to “soft spots” in the soils that may be bridged by continuous strip foundations.
- Are isolated far from the dwelling which permits frost to surround the pier and deeply penetrate adjacent soils increasing the likelihood of frost heave.
- Place tension loads on the concrete in the pier when certain frost actions occur, a condition that exploits an inherent weakness in concrete.

Footings that heave can create significant damage ranging from jammed doors, broken windows, cracked gypsum board, roof leaks, disconnections of plumbing or electrical work, and aesthetic implications.

A code change that requires all footings to be poured with concrete having a 5000 psi compressive strength may provide some benefits from shearing of piers but it is too early to tell at this time.



The Minnesota State Building Code requires dwelling additions to be constructed on foundations that extend at least 42 inches below finished grade as protection against frost action. The code is by definition a *minimum* standard. As such, it should be expected that certain extreme conditions may occur from time to time that will negatively impact certain building components.

While frost penetrating below the footing could occur, it may not be the most likely reason why piers heave. It is possible that freezing ground places pressure on the upper portion of the pier lifting it out of the ground. Water expands about 9% in volume when it freezes. If the soils around the pier retain water late into the fall, freezing temperatures can wreak havoc with the pier. Water channeled to the location of deck and porch piers via sump pump hoses, downspouts, or poor drainage are often the reason for the saturated conditions. Overwatering lawns or adjacent plantings in late fall can also be the cause. Obviously, the homeowner has some control over these conditions. But in some cases, nature takes its course and things occur beyond the control of the homeowner.

What can you do to control this problem? If you are building a new deck or porch, you may wish to consider the following:

- Consider digging the footing deeper than the 42 inch minimum requirement.
- Use a cardboard form for the upper three feet of the pier.
- Wrap cardboard forms with several layers of heavy plastic to reduce adherence of soils to the form.
- Over-excavate the lower portion of the pier creating a “bell” to resist the pier from being lifted. Rebar should be installed to resist a fracture of the pier.

- Overbore piers and backfill the space between the form and the soil with a coarse granular material such as pea rock
- Take special precautions if you are near a wetland where problems predominate (consult a soils engineer).

Precautions to take or steps that may reduce current problems include:

- Do not allow downspouts and sump pump hoses to drain near piers.
- Avoid heavy fall watering of surrounding soils.
- Consider installation of drain tile where soil moisture content is always high.
- Install subsoil insulation to trap heat around the pier.

There are no guaranteed methods to prevent piers from heaving. Problems can show up 5, 10, or even 20 years after the structure was built. But you can take steps to minimize the potential for problems by taking certain precautions. And remember, the Minnesota State Building Code is only a *minimum* code.