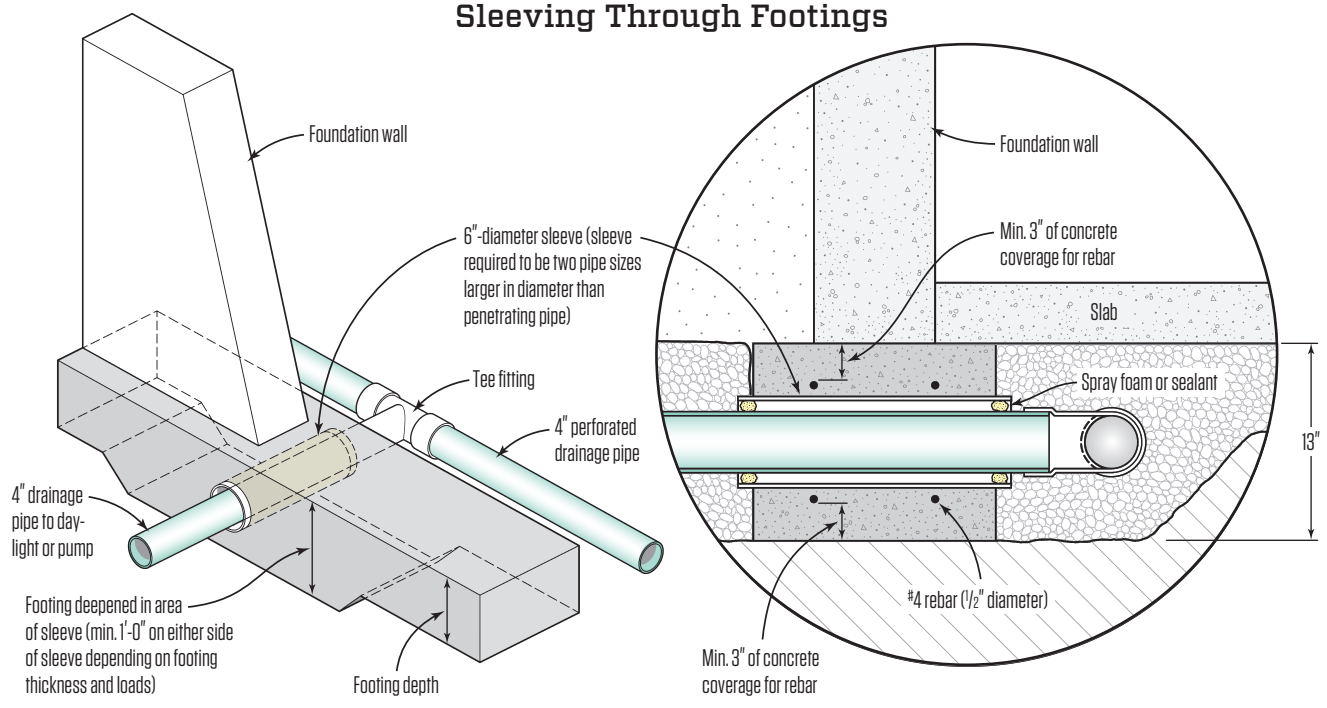
Q We plan to install underslab piping on an upcoming project for drainage. Rather than installing a sump pit inside the basement, we're hoping to install sleeves in the footing so that the underslab piping can drain to daylight, since the building site is sloped. Does a sleeve cast into a footing weaken the footing?

A *Darren Tracy, P.E., owner of West Branch Engineering in Saratoga Springs, N.Y., responds:* Generally, it is not a good idea to sleeve through a footing when it can be avoided. If you must do it, the sleeve is required to be two pipe sizes larger in diameter than the penetrating pipe, per P2603.4 of the 2021 International Residential Code. Presumably, this is to allow for movement in the pipe or the foundation and compensate for imperfect field installations to ensure that the foundation never comes in contact with the pipe and damages it. In this case, for typical 4-inch-diameter drainage pipe, the sleeve would need to be 6 inches in diameter.

That's a problem with footings formed with 2x10s. Any rebar in concrete that is permanently in contact with the ground requires 3 inches of concrete coverage, per ACI 318-19 table 20.5.1.3.1. The reason for this coverage is that even though the high pH of the concrete provides some protection against corrosion, it needs to be an adequate thickness. Above grade, only 1 1/2 inches to 2 inches of concrete cover is required, depending on the size of the rebar. Assuming 1/2-inch-diameter #4 rebar is used both above and below the sleeve adds another inch that must be accounted for in determining clearances.

Without consideration of the specific loads, but based upon the requirements noted, the minimum thickness of the footing would need to be 13 inches: 3 inches of concrete coverage for the rebar

Sleeving Through Footings



A protective sleeve that is two sizes larger than the pipe is required for any pipe that passes through a concrete foundation wall or footing. Depending on the size of the sleeve and the size of the footing, the footing may need to be deepened as shown to provide the required minimum 3 inches of concrete coverage for the rebar above and below the sleeve. The gap between the pipe and the sleeve should be sealed with spray foam or sealant.

Illustration by Tim Healey

underneath the sleeve; the 6-inch-diameter pipe sleeve; 3 inches of concrete coverage for the rebar on top of the sleeve; and another inch for the two lengths of 1/2-inch-diameter #4 rebar. That is a tight dimension with exact placement of the sleeve and rebar. To achieve the added depth, the footing could be deepened in the area of the sleeve, typically a minimum of one foot on either side of the sleeve, depending on footing thickness and loads. As with any penetration through a foundation wall, the gap between the pipe and the sleeve should be filled at both ends with spray foam or sealant to keep stones from working their way into the end annular space between the pipe and the sleeve.

When a pipe penetration in the foundation system is required, it's better to sleeve the foundation wall instead of the footing, though that solution won't work in this example because the drainage flow is relying upon gravity and a pitch. Another option is to install a sleeve under the footing. The same two-pipe size increase would apply, and the sleeve would need to be made with a robust material, such as schedule 80 PVC or ductile iron.

A better approach is to not use any underslab drainage piping at all, and instead install a minimum 4-inch-thick layer of #2 stone under the slab and footing to act as a drainage conduit. This subbase layer should be separated from the undisturbed subgrade by a geotextile fabric so that earth fines do not migrate into the stone subbase and clog the drainage system.

I used this method when constructing my home 20 years ago and have never had a water problem in the basement, even though there were springs spewing when we excavated for the footings. Because of those springs (I do live in a town called Saratoga Springs), I almost always have water in the stone layer under my slab and footings (verified by the sump pit I installed in my basement), but it has never risen to the slab level because the perimeter foundation drain is lower than the slab, and drains by gravity to daylight. The same result could be achieved with a pump if the site does not have the grades for gravity drainage.

Finally, to help keep water away from the foundation, consider installing an impenetrable layer adjacent to it at grade level. The layer—which could consist of a high-clay-content topsoil or polyethylene sheet covered with pea stone—should extend away from the foundation for several feet. And if the house is in a wet area with a high water table, consider raising the proposed elevation of the house.