TECH NOTES

# Waterproofing, Drainage, and Maintenance

A product of
**Concrete Foundations Association of North America**

# TECH NOTES

Practices for the treatment of water around the foundation including drainage, waterproofing and maintenance.

## DRAINAGE

In residential construction the foundation walls are designed for specific pressure, which depends on the properties of the soil and its water content. Changes in the water content due to weather conditions, changes to the building systems" or rising water table can result in significant increases in the pressure and thus the loading on the wall. Proper drainage can ensure that the design pressure is consistent with the actual pressure on the walls.

The goal or design theory behind proper drainage is the placement of materials with a high coefficient of permeability near the bottom part of the foundation. A medium size aggregate and sand is most commonly used, permitting water to easily collect from the soil above. Then by using drain tiles the water can be taken either away from the walls or stored in a tank. It can also be drawn away with a pump. Figure 1 below shows drainage configurations with outside and inside drain tiles.

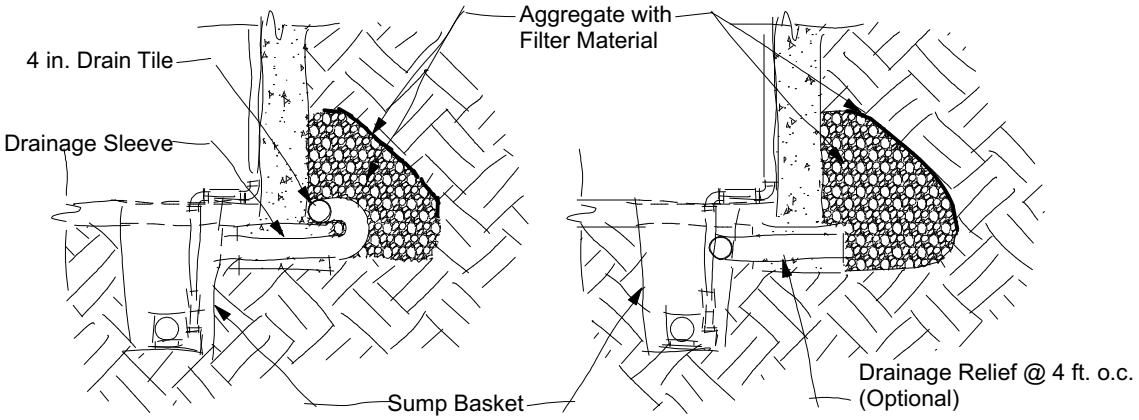


**FIGURE 1**

Proper drainage can be provided by using gravel drains, drainage tiles, perforated tiles or other proprietary commercially available systems. If a proprietary system is used it should be installed as per manufacturers recommendations. When using gravel or crushed stone for filler material it should be placed at least 1 foot beyond the outside edge of the footing and should be at least 6 inches above it. The gravel around the drainage system might have to be covered with a filter fabric depending on soil type.

## High Water Table

In cases where a high water table is present both interior and exterior drain tiles should be installed. A minimum of four inches of gravel or crushed stone are typically placed underneath the floor slab to drive water to the drain tiles. It is also recommended to install a vapor barrier between the porous layer and the slab, shown in Figure 2.

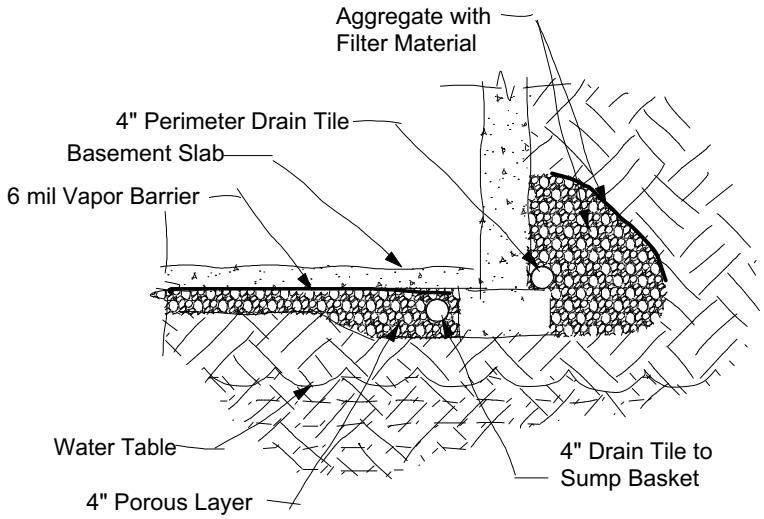


**FIGURE 2**

# COATINGS & MEMBRANES

The treatment of the foundation wall prior to backfill must include a coating or membrane applied to the surface of the concrete wall. Depending on the applicable code, project requirements or homeowner preference, systems are selected as either dampppprofing or waterproofing.

The International Residential Code (IRC) in section R406.1 (2012) prescribes that dampproofing is always required when the foundation walls enclose a habitable or other usable space except in cases where water-proofing is required.

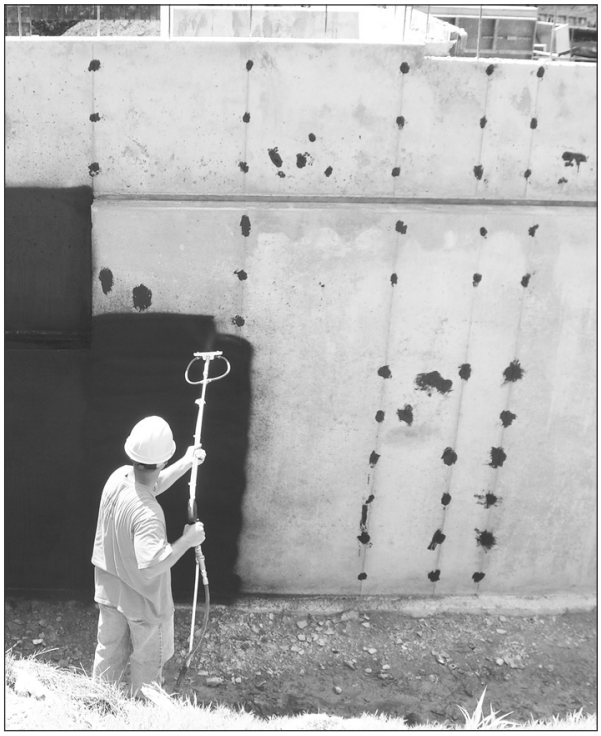

**FIGURE 3 - SPRAY-APPLIED DAMPPROOFING TO FOUNDATION WALL**

NOTES:

The application must extend from the top of the footing to the finished grade.

A common material for dampproofing is an asphalt or bituminous coating, which is applied to the surface of the concrete wall (see Figure 3). As a general rule, dampproofing coatings have poor elongation characteristics. This means they are not generally capable of stretching due to movement in the wall, especially when cracks develop from shrinkage taking place after the coating is applied or from poor maintenance to the structure.

## Waterproofing

Systems that can expand or stretch as the concrete surface changes are classified as waterproofing. They are capable of protecting the interior space over greater lengths of time and under more significant pressures.

Waterproofing is required when the foundation walls enclose a habitable or other usable space and the area is subject to a high water table or other ground-water conditions. It should completely cover the walls that are below grade and extend from the top of the footing to the finished grade (see Figure 4).

Materials that can be used for waterproofing include: 3 ply hot mopped systems, polymer-enhanced, asphalt, and rubber sheets, or other commercially available waterproofing systems.

When using propriety systems the Concrete Foundations Association recommends the use of ones with more than 5 years of labor and material replacement warranties.

## Membranes

Plastic sheet systems offer the optimum solution for waterproofing a foundation and reducing the hydrostatic pressure applied over time to the foundation wall. These systems consist of air-gap dimpled plastic membranes that are impermeable to water and water vapor, mechanically fastened to the concrete. The mechanically fastened sheet systems are capable of spanning large cracks and imperfections making them perfectly suited for water remediation systems as well as first construction prevention solutions. Figure 5 demonstrates a common dimple membrane system implemented for a complete exterior perimeter drainage solution

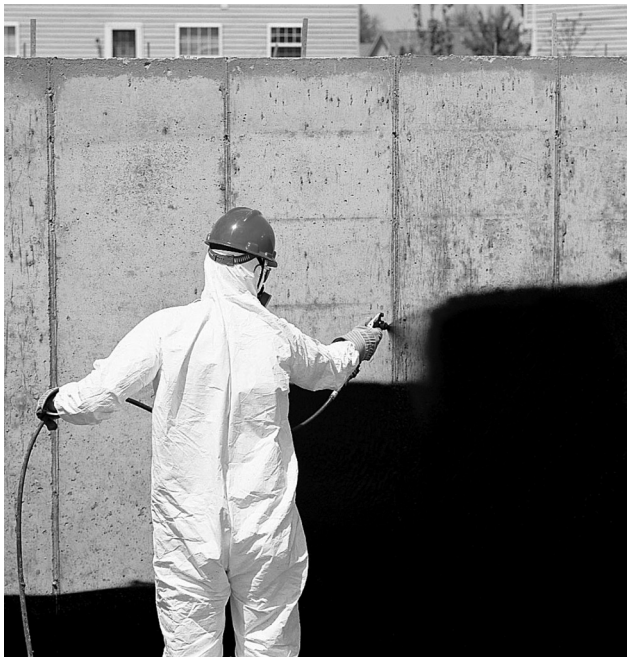

**FIGURE 4 - SPRAY-EMULSION WATERPROOF COATING APPLIED TO A CONCRETE FOUNDATION WALL**

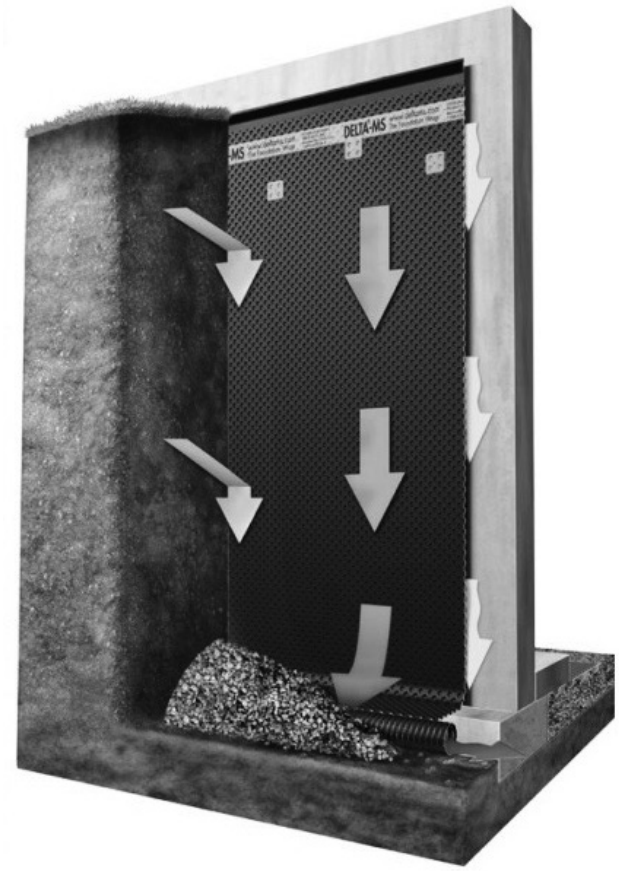


**FIGURE 5 - DIMPLE MEMBRANE SYSTEM**

# TROUBLESHOOTING

Water can appear on the foundation walls due to several reasons (by the IRC in section R406.2):

- Free flowing surface or ground water penetrating through cracks or openings both on the walls and the slab.
- Moisture traveling through the soil and concrete capillaries.
- Condensation of water on cold foundation walls.
- Vapor migration from cold damp soil to a warmer basement.

Water appearing on the inside surface of the foundation, whether on the wall or on the slab should be investigated. While concrete foundation walls do not have organic material to support the growth of mold or mildew, the persistent presence of moisture coupled with the natural dusts and finish materials of the interior space can encourage mold to grow, using the wall as a supporting structure. More on the topic of mold and foundations from can be obtained from the CFA website, www.cfawalls.org.

Troubleshooting these conditions is based on the type of drainage and coating system installed as well as the deficiencies in the maintenance of the structure. The first step should be to determine why there is water building up and passing through the wall. As seen in Figures 1 and 2, proper drainage and aggregate fill will keep the natural amounts of water in the soils from becoming problematic meaning that either more water exists or a failure has occurred. Below is a list of common problems associated with water infiltration sources:

- Inspect the gutters and downspouts. Homeowners frequently knock downspouts off or remove them to mow and fail to restore them to their installed position. Gutters become clogged with plant material forcing water to build up and flow over a low point in the run rather than dropping through the downspout.
- Look for water ponds along the foundation. This is an indication that the grade has settled over time or changes to the landscaping have resulted in a negative slope rather than the IRC requirement for a 10% slope (see CFA-TN-002 for more information).
- Determine if water is draining from the foundation. By looking into the sump pit (if it exists) or observing water actively draining to daylight from the foundation (common on sites with steep slopes), this is likely to be determined. If water cannot be seen draining from the system installed for the home, it is likely drainage tiles have been crushed or become clogged with roots or silt.

Once the probably cause(s) for water building has been determined, the remedies for the water condition range from simple to extensive. Putting back downspouts and cleaning out gutters, as well as perhaps installing gutter screens are quick and relatively inexpensive solutions. Restoring a minimum grade away from the foundation of 10% may be much harder or impossible, depending on lot and access. Both of these are demonstrated in figure 6. Repairing drainage tile is the most invasive requiring the soil around the foundation to be dug away to expose the point where the drainage tile exists. This may not be warranted.

If water has been determined or confirmed to be actively passing through the wall, it is likely that a dampprooing coating was used or no coating at all. There are two primary options for controlling water through the wall without digging away the soil from the foundation; filling the cracks and installing an interior water remediation barrier.

NOTES:

Crack remediation is a common solution for leaking cracks. The use of an epoxy-injection system will seal the crack, preventing moisture from leaking through to the interior, and it will strengthen the wall by bridging across the crack. It is recommended that a wall repair specialist be contracted with to provide this solution.

Water remediation barriers are systems designed to continue permitting water to move through the wall, capturing it and diverting it to a method of removal, such as a sump pit. These systems are often advantageous where interior finishes on the exterior of the wall exist and have to be removed to repair the condition.

The most aggressive method for fixing a water problem remains the excavation of the foundation perimeter and applying a waterproofing membrane or sheet, such as is recommended during new construction.

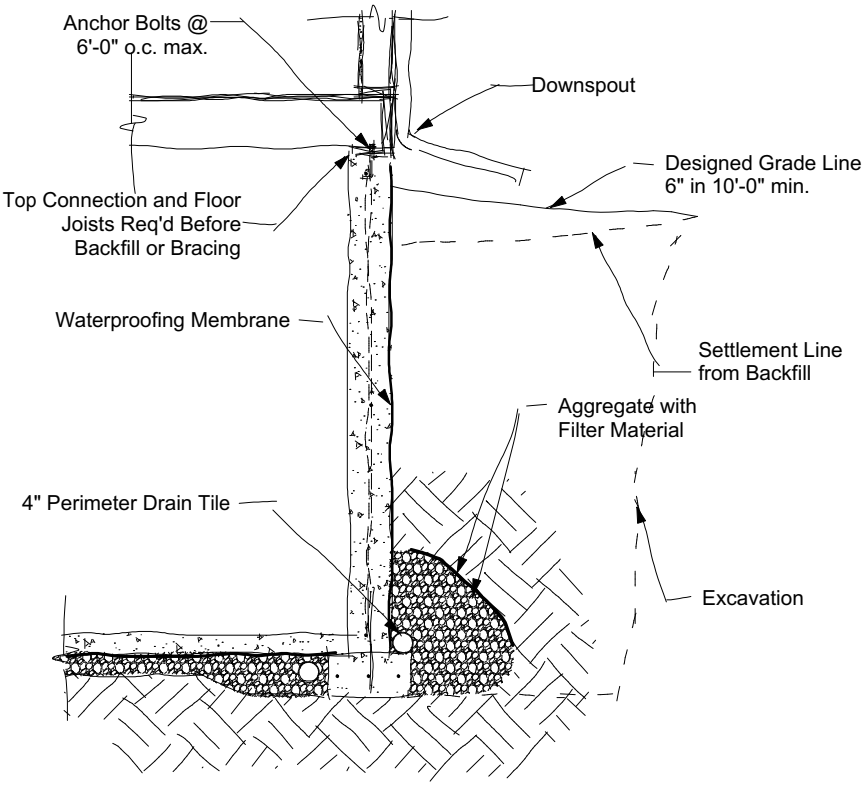


**FIGURE 6**