TCE & Associates, Inc. Consulting Structural Engineers
Preserving Your Past, Building Your Future®

# SELECTION OF A BELOW GRADE WATERPROOFING SYSTEM

The primary objective of a below grade waterproofing system is to protect the below grade space and structure from the adverse effects caused by liquid and gas intrusion. The below grade waterproofing also protects against soil contaminants.

The first step in determining the type of waterproofing system is reviewing the geotechnical report for the site or commissioning a geotechnical study for the project site to determine the below grade conditions including:

- Water table location
- Soil contaminants
- The type of soil including bearing capacity, presence of bedrock to determine the type of foundation system will be used.
- Site history

Often the Geotech report will include recommendations for the type of foundation for the building and provide recommendations for the dewatering required for the construction site.

After review of the Geotech report it is recommended to determine the type of foundation and method for construction used. When feasible, it is recommended to pour the concrete foundation walls and post apply the waterproofing membrane to the exterior of the foundation wall. This is often performed in open areas with shallower foundation walls. When post applied waterproofing is not feasible due to tight project site lines or large cost of excavation, pre-applied waterproofing will be required. Pre-applied waterproofing is typical in urban settings where the project site is confined by surrounding buildings, utilities, or roads thereby limiting the area of excavation. Pre-applied waterproofing is typically applied to wood lagging, neighboring foundation walls, or other site shoring material prior to placement of the cast in place concrete. Shotcrete is sometimes used to place the concrete which requires special detailing with additional inspections recommended. Shotcrete is rarely used on the east coast for foundation walls unless there are special conditions.

The location of the water table in relation to the lowest level slab will dictate whether the below grade water can be managed with dewatering to relieve the hydrostatic pressure or a “bath tub” design will be required. A “bath tub” design is commonly referred to when deep foundations are used to resist the water pressure and the waterproofing fully encapsulates the exterior of the foundation including below the foundation and mat slabs. Where the water table is lower than the lowest level, typically only the exterior perimeter foundation walls are waterproofed with a combination of a drainage layer directed to a underslab drainage system to relieve the hydrostatic pressure with a vapor barrier below the slab on grade. When a underslab drainage system is not feasible a more robust waterproofing membrane should be considered to resist the hydrostatic pressure. Some manufacturer’s will require an upgraded system in order to obtain a warranty in a “bathtub” design.

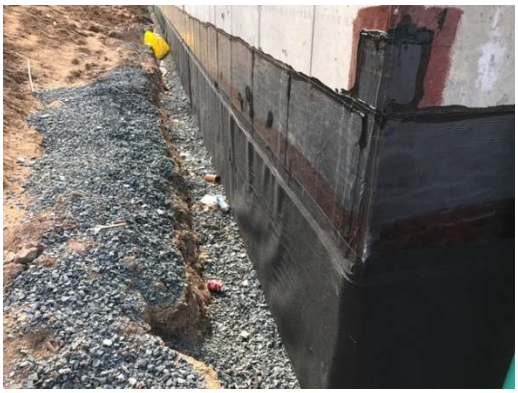

Photo 1. Example of post-applied waterproofing on the foundation wall at an open site

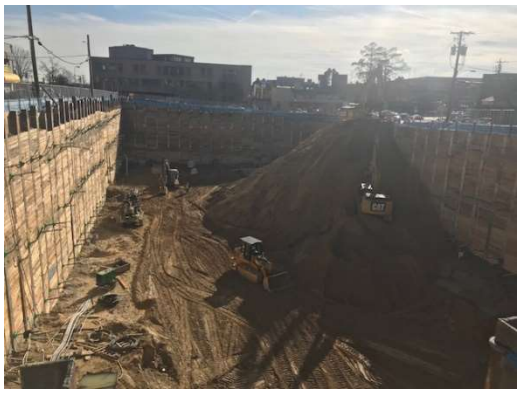

Photo 2. Example of project site with wood lagging

In most buildings the below grade space is used for garage parking and storage with the interior concrete foundation walls exposed. This allows for easy access to repair leaks through grout injection or the application of interior side waterproofing if required post construction. In some locations the below grade space has interior finishes for offices, gyms, or storage of sensitive equipment. An upgrade in the waterproofing material should be considered for buildings with occupied below grade space.

When selecting a waterproofing system, the material is recommended to be readily available locally and the local contractors familiar with product. Waterproofing material manufacturer's often require that the material is installed by contractors who have been certified in order to obtain a warranty. If the work force is familiar with the product, it will most likely result in less installation errors. The majority of waterproofing failures do not occur through the material but due to improperly detailed and installed penetrations or terminations.

Below is a description of the some common below grade waterproofing systems:

- Bentonite Systems
  Bentonite is a natural clay system that swells when exposed to water having the ability to expel water when properly confined and under pressure. The clay can bond to the newly poured concrete providing a barrier against water. Bentonite is recommended to be used in conjunction with a vapor barrier liner if a vapor barrier is required. Bentonite waterproofing is not recommended to be exposed for long periods of time because the bentonite can hydrate prematurely requiring replacement. Thermoplastic laminated products are available which help reduce the potential for bentonite clay erosion caused by excess water migration when in contact with flowing water. Geotextile faced bentonite membranes are available that sandwich the bentonite to further reduce the chance of failure due to loss of pressure due to void spaces. Void spaces can be caused by soil erosion or deterioration of wood lagging. A dual component waterproofing membrane system is available that combines a modified PVC reinforced thermoplastic membrane with a bentonite layer. The composite membrane provides both a fully welded thermoplastic membrane with an integrally bonded bentonite layer.

Photo 3. Example of pre-applied bentonite waterproofing onto drainage panel and wood lagging.

- Adhesive Surfaced Membranes
  "HDPE" systems, or high density polyethylene systems, are a polyethylene thermoplastic lined with an adhesive that bonds to the concrete when poured against the membrane. Newer "TPO" or thermoplastic polyolefin membranes have been introduced relatively recently with a butyl adhesive. Both the HDPE and TPO systems do not rely on confinement and can perform when not under pressure after construction. The membranes prevent water migration by the chemical bond between the concrete and the membrane through their adhesive. Both membranes require special detailing and rely on pressure sensitive tape for transitions.

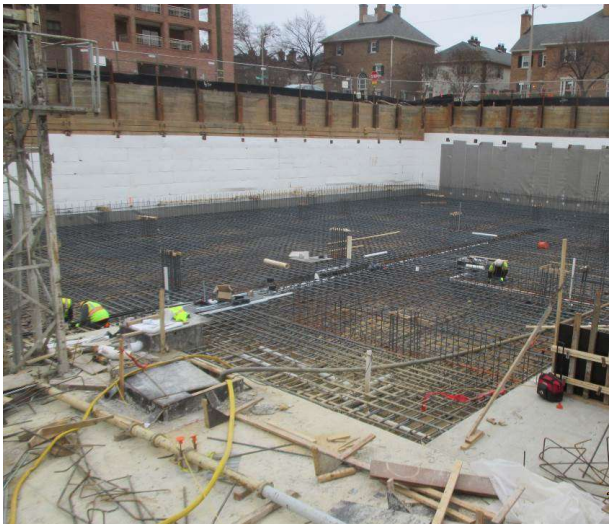

Photo 4. Example of pre-applied TPO system waterproofing in a "Bath tub" design.

The following additional items should be considered when selecting a below grade waterproofing:

- Support by manufacturer including response to site specific details
- Warranty offered. What does the warranty cover and what has been the history of the manufacturer honoring their warranty?
- Inspection requirements.
- Concrete water stops are often required as part of the waterproof system and should be coordinated with the concrete installer.
- Compatibility or availability to tie into above grade waterproofing to provide a watertight and warrantable transition.
- Amount of penetrations and how they will be detailed.

Prior to the selection of the below grade waterproofing material it is important to understand the site conditions and select the appropriate membrane for the building performance expected. It is important that site specific details are developed and that the installation is inspected by a third party. TCE has extensive experience in with below grade waterproofing systems and can provide consulting services during the design phase and inspection services during installation.

For more information, please Contact:

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