

White Paper

For the Engineer: How to Solve a Wet Basement

The origination of the water entering the basement with a poured foundation is usually where the floor meets the wall or at a visible floor crack or wall crack. Exceptions to water infiltration from the structure are when it enters from a window, bulkhead door or bulkhead area or over the sill plate where the foundation meets the framing structure.

Identifying the source of water entry is the most important piece of information to solve the wet basement problem. Where the water originates is less important. However, it has been proven that the majority of the water comes from the loose back-fill created during the construction of the foundation walls. The ‘virgin soil’, that is approximately 10 to 15 feet away from the foundation walls when the foundation is dug; is back-filled on the exterior. Due to the mechanics of a lesser amount of compaction in the back-fill area, rain water tends to build up pressure in this area on the exterior of the foundation. The ‘virgin soil’ that is approximately 10 to 15 feet away from the foundation walls is less likely to allow water to infiltrate.

A basement is built with a foundation footing, a foundation wall and a floor. Whenever three concrete structures are poured at separate times (as in the case of most basements), there is a seam in between each structure (i.e. the foundation footing and the foundation wall and where the foundation floor meets the footing and the wall). Due to this inherent “seam”, the built up pressure from the exterior over-dig comes in over and under the footing and builds up pressure where the floor meets the wall on the interior. The water will then come into the lower pressure area of the inside of the basement.

Another concern is a floor crack. Due to this described inherent pressure build-up, the water can enter through a visible crack in the floor as well as where the floor meets the wall. The key here is - “*a visible crack*”. Water will not typically enter the basement unless there is a “visible crack” in the floor or the wall. Of less concern is a wall crack where water can easily flow into the basement

Possible Solutions - while there are many theoretical solutions to a wet basement problem, most can be dismissed by a simple outline of the facts. There are two types of waterproofing – Pre-Construction and Post-Construction Basement Waterproofing. This article will deal more predominantly with Post Construction Basement Waterproofing (after the home is built).

Can we stop water from entering after the house is built by sealing it from the exterior?

The answer is usually “no”.

#1 - Digging out on the exterior, down 8 to 10 feet, in order to put a membrane around the foundation footing and the wall is unrealistic in most cases. Another fact is that water can and will seep underneath where the foundation footing meets the virgin soil. This is designated also as a crack or seam where water can easily filter under the footing – coming to the inside of the footing and then producing pressure at the floor/wall joint and then entering the basement itself.

#2 - Installing a sealant method on the exterior or membrane with a drainage pipe located at the footing is a proven method which will work for a short period of time. Unfortunately, the soil that is packed back around the house will settle into the pipe and clog it. This method can be used in new construction basement waterproofing but is usually inappropriate in a post-construction setting. These pipes also must be pitched away to an area that is lower than the foundation footing – either a storm drain or a drain-off area. Even with the use of felt fabric or stone, these drains will eventually clog.

#3 – Sodium Bentonite: Sodium Bentonite was produced in Pittsburgh, PA. to prevent rain water from getting onto iron and steel. The sheets would “melt” upon impact from the rain water and would stop the rain from getting onto the hard surfaces. Realistically, Sodium Bentonite (in sheet form) will stop water from getting into the foundation wall, but will not stop water from getting underneath the foundation footing and entering into the basement area. In the 1970’s, basement waterproofers converted Sodium Bentonite into a powder form and injected it around the exterior perimeter. This method worked in some cases, for certain situations, but definitely did not work consistently. It is an unrealistic and unfeasible method of basement waterproofing.

#4 – Pouring a Curtain of Concrete Around the Perimeter of the Home: Theorists reason that if the over-dig area was filled with concrete (not allowing water to penetrate into that area), this would stop water from building up pressure in the over-dig area and therefore, from entering the basement. The fact is that water will find the low pressure area of the over-dig, even from the lawn in the virgin soil area. Also, considering the inherent nature of pouring concrete, seams will be created and water will find its way into the over-dig area and will eventually come back into the basement.

#5 – Extending Downspouts: this method has proven reliable in many cases. However, due to the nature of rain and wind patterns, water will still build up in the over-dig area and enter into the basement at some point.

Potential Interior Solutions

#1 – Some people have poured entire floors over their existing floor theorizing that more concrete will help to stop the water from coming up into their basement. Due to the nature of concrete (as previously described) and the inherent seams that are created when two concrete structures are poured at separate times, water will still enter the basement area (regardless of the amount of concrete that has been poured)

#2 - Paints and Sealants on the Interior of the Wall and Floor: these methods have proven unreliable with high water pressure emanating from the floor/wall joint and floor cracks. There is no reliable sealant method from the interior to stop the water from entering the basement permanently. Hydraulic cements, although they may work for a few years, will eventually crack and form a seam where the hydraulic cement meets the new cement.

#3 - Polyurethane Injections/Epoxy Injections: these methods work very well for poured concrete foundation wall cracks, but will not work with block foundations unless there is an extreme amount of grout installed on the exterior and inside the block walls. These methods usually are not successful for floor wall joint seepage or for floor cracks.

Types of Foundations:

Poured Foundation Walls, Stone Walls and Block Walls are the predominant wall types used in typical residential or commercial foundations. The mechanics are all the same for water infiltration where the floor meets the wall or with floor cracks. There can be slight variances on the wall cracks for stone foundations and block wall foundations.

The Solution

The most effective proven solution for basement waterproofing is an interior drainage system. There are several types of drainage systems that are available on the market. The most common is the French Drain System – utilizing a 3” or 4” pipe that is drained into a sump. Most building inspectors (coming from a plumbing background) will argue that the pipe will need to be pitched toward the sump. This is simply not true. Water coming in from the foundation wall/floor area will seek entry into the perforated pipes and will move laterally until finding a drop off (i.e the sump). The drainage system will work well without a pitch. Relating to the necessity of the drainage systems with no pitch – the key is to be sure there is a drop off every 100’ to 125’ of lateral run. This will keep the water clear of the pipes and usually stop overflow. The fact is that water from the exterior comes in very slowly and is able to run along the perforated pipe until the drop-off.

The issue with French Drains on the interior is the depth of the French Drains as they are installed. It is possible for these systems to undermine the foundation wall and cause collapse. The risks of the depth and width of these trenches causing possible structural damage to the foundation wall and footing are very real. If there is further ground water coming from below, these deep drainage systems will also attract that water – keeping the pump working excessively

Shallow Systems:

There are several systems on the market today that address the water that only threatens the basement floor. The Water Trek System, by Basement Technologies, Inc, is an excellent example of an adaptable system that can be installed on the footing or in front of the footing. This unique system can be utilized in a manner unlike any other system. In the installation of this product, the possible footing configurations are identified and all solutions are provided along with each particular construction aspect of the existing foundation floor relation. The water that is brought to the pump is only the water that is threatening to come onto the floor. These systems do not undermine the foundation footing or wall and in this author's opinion are the best possible solution.

A “break” where the foundation wall meets the floor after concrete is put back in is necessary. This system has the unique feature of capturing the water coming down off of any wall cracks and also keeps the low pressure system over the foundation footing. This system is adaptable in that it can be installed on the footing or in front of the footing dependent upon each sub-floor situation.

Baseboard Systems:

Baseboard Systems are similar to a gutter-type preventative measure. If there is a monolithic pour when the foundation footing and the floor are poured at once, removing the floor can be devastating to the structure. Shearing cracks through the footing can cause destabilization of the foundation wall and may promote failure. Therefore, in these types of foundation footing situations, it is of paramount importance to not open up the floor for extended footages. The baseboard system is usually 8 feet in length and uses a 2-part epoxy that is attached directly to the floor after a preparation of the floor surface. The pump needs to be located in the low spot where the water comes in (where the floor meets the wall) and channels into the sump pump area and is then pumped out. The sump must be located in front of the footing in order to be sure not to “shear” or “crack” the footing structure. Special holes are installed at the floor/wall joint. In a poured foundation, a 45 degree angle is drilled down until the hole meets the foundation footing. In a block wall, CMU blocks are drilled so that water does not build up on the interior of the blocks. Tests have shown that this will not jeopardize the structure. Usually, in fieldstone walls, the floors would not be thick enough to call for a baseboard system. The baseboard system can also be utilized for steel reinforced/fiber mesh floors that are difficult to open.

Windows:

Windows that are underneath the grade of the lawn are also potential areas for water to enter into a basement. The most reliable way to handle a window well water penetration problem is to try these possible cures:

- A. Install an exterior Curtain Drain - low-pressure with stone and pipe - and run the water that is threatening the area away from the Window Well.
- B. If the Curtain Drain on the exterior does not work and water is overwhelming, an interior system can be installed by installing a 2" hole through the foundation wall (approximately 8" to 12" under the window) and installing a pipe with a membrane on the interior of the foundation wall and routing the water down into a French Drain or shallow system and then exiting via a pump.
- C. Window Well covers can easily be installed over the top of the subterranean windows to stop rain from getting into the Window Well area.
- D. Source of entry over the foundation wall and the sill plate – in certain situations, where foundations are low to the ground or are located at the base of a hill, water entry may easily emanate from the intersection of the sill plate and foundation wall.

Solution 1: Exterior Curtain Drains dug down to a depth of approximately 8", back filled with stone and pipe on the bottom of the trench – pitched away to a drop off area. A membrane installed on the foundation wall will also help this situation.

Solution 2: If the amount of water is overwhelming, an interior system using membrane on the inside of the wall enveloping the area where the foundation wall meets the sill plate – directing the wall into an interior sub-floor system. These types of systems are usually utilized in emergency situations only if the source of the water entry is where the sill plate meets the foundation wall. The exterior Curtain Drain should be a primary solution with a back-up of the interior membrane going down to a sub-floor or baseboard system on the interior.

Other Sources of Entry:

Bulkheads: Any area where this is a break in the wall and a stairway is installed to the outside is a possible source of water entry into the basement. The most effective solution, in most cases, is to install a grate on the inside of the foundation wall to catch any water that comes in. Treating the bulkhead area as an exterior area of the basement is very realistic in most cases. The goal is to keep water off the basement floor and a grate on the inside will certainly stop the water from getting onto the floor. Other methods of sealing bulkheads are numerous. Exterior grouting methods - exterior curtain drains take run-off

away - exterior foundation drains – poured concrete sealants etc. – are all trial methods that can be utilized in a bulkhead area.

Fieldstone/Brick Walls:

In a post construction setting, if the fieldstone wall is leaking, a trial effort of re-pointing the basement wall can be attempted. However, re-pointing the wall on the interior will not solve the problem permanently. A membrane over the foundation wall and into a sub-floor system on the interior is usually the fail-safe method. Excavating on the exterior, in a post construction setting, is not realistic due to possible stone settling or foundation falling.