

# Retaining Walls and Frost

Last Updated: Thursday, October 13th, 2016, Created: Thursday, May 20th, 2010

Hi Jon,

I have a driveway retaining wall that continues to be pushed by the ground, even though it is backed by gravel and drained to "nothing under the driveway" except crushed gravel. I realize proper drainage affects this somewhat, however would prefer not to cut open my driveway, sidewalk and dig all the way up to the French drain. Could it be an option to simply dig about 48" square and 45" deep and drop the drain from the bottom of the retaining wall there?. If in doubt, do you have the name of an engineer that could prepare an acceptable plan for the contractor to follow so as to avoid this recurring event. Wall is 40 feet long, 3" at the rod end and about 4 feet 8 inches where it meets the house. Best regards, Brian

Reply:

From your photos, the wall appears to have a smooth curve in it and I don't see broken mortar -- yet I assume it was originally built straight. Perhaps you have been patching it (which could actually make it worse because of retaining more water behind the wall).

Along the same lines, if I see the grass properly, there is a general run all the way from the back yard towards the front as well as that whole strip sloping into your retaining wall. In addition your neighbour's roof appears to drain into this area, and I assume one of your own downspouts probably drain here as well. And all of that appears to cut across the grass right towards your retaining wall. On the small back wall the bricks appear to be open, no mortar. On the long sloped side they appear to be sealed tight with mortar. So we have a number of questions: where does the water come from, and can we reduce that? How does the water travel behind the wall? Where does it drain to?

You say that you are sending water down into gravel under the driveway -- but where does it go from there? and if it drains out too slowly then it may just back up. Does the bottom of your driveway have a drain that actually goes someplace, like to a sump-pump or gravity drain?

As to your idea of digging a hole and dumping the water there, you need to understand the functioning of such a "dry well". It is considered a temporary holding tank and the size is made based on the anticipated influx v.s. the capacity of the soil to let it drain away. Properly built it will fill up during a terrible storm, and slowly dry out between storms. So on the drainage side the considerations are: how well does your soil drain? Heavy clay, almost not at all. High water table, it could fill from the bottom during heavy rains. Shallow rock, there may be no place to drain to. Digging a test hole of about any size and filling it with a garden hose can tell you a lot. An 8" post hole 4 feet deep that holds water is not a good sign for a dry well. Of course a soils expert could tell you a lot more -- and maybe size the well according your percolation capacity. Another thing to realize is that the large hole you want do dig is not all available for water -- you need to fill that hole with 3/4" clean gravel to give it strength and the only water storage you have is the space between the pieces of gravel.

Before we try to control the water, let's look at just how water and clay combine in our climate to attack retaining walls -- it is not simply water pressure but has more to do with "ice lenses". Click [HERE](#) for details but the essence is that ice lenses form in water saturated clay soils subject to freezing temperatures, and they form and expand perpendicular to the direction of heat loss. In an unheated basement, as in your "unheated" sunken driveway, heat comes from the centre of the earth and goes up toward the sky but also turns and goes horizontally through that retaining wall to the cold air on the other side. That means that Ice Lenses will be forming just behind the wall in vertical disks that will be pushing the wall into the open space. If we remove the clay, the pushing stops, or at least doesn't happen directly against the wall. If we remove the water, there are no ice lenses. If we remove the cold -- there is no force pushing out in the summer. So you need to see which part of all of this you can, and cannot control.

For a retaining wall we cannot control the temperature, nor the direction of heat loss. So we need to work on the water and the clay. With a finished wall that we are not rebuilding, we will try to not have to remove the clay. But before I go to controlling the water, let's take a quick look at how retaining walls should be build.

The sturdiest are in fact wooden retaining walls because when properly built they will not only deal with drainage but they have "anchors" deep back in the soil called "deadman tie backs" as you can see in the drawing above.

When ice lenses do form near the wall they will push both against the wall and the deadman -- equalizing forces and not pushing the wall forward.

Notice that there is also gravel backfill just behind the wall and no sealing between the boards, hence water can drain out of the clay and away.

Now for a masonry or stone retaining wall there are a number of important elements because we rarely have deadmen and tiebacks -- look at the last graphic above.

A footing that holds everything in place. A sloped construction that aids to resist tipping forces. A tight topsoil to slow down water penetration followed by a better drainage medium and weep holes, followed by a total drainage medium with a piped runoff. This will last a long time because there is never any serious accumulation of water near the masonry.

Your wall is relatively thin, very vertical, appears to be sealed on the face with mortar and has tremendous water input. I don't know if the clay is right behind the bricks or not. I doubt at that height that there was any attempt to use deadmen.

What to do?

If you have someplace for water to drain away at the bottom of the driveway, I would immediately drill some weep holes in the mortar near the bottom of the wall, especially in the problem areas, to relieve excess water pressure from the other side. Actually what I want to do has less to do with water pushing against the masonry and more to do with draining the clay in the area.

I assume you do not want to dig up the grass side of the wall - so let us see if we can reduce the water input to levels that the weep holes might keep this area dry enough that the ice lensing will be reduced if not stopped.

First of all those roof downspouts. I would channel them into underground pipes that exit at the curb beyond your retaining wall -- both yours and your neighbours.

Second I would install a surface trench drain just behind the retaining wall, that would catch and channel most of the grass run-off to the curb, again taking it totally beyond your retaining wall. This can be done with geo-textiles and gravel or with grated drainage channels.

If you have removed all the flowing water sources and only have water going in that is actually percolating through the grass, you may have no more problem. If this slows down but does not eliminate the problem, then you will probably have to eventually rebuild the retaining wall and this time be sure to provide a good gravel buffer between the clay and the wall as well a total drainage, probably to a sump pump to avoid saturating the clay with water.

**Keywords:**

Anchor, Stone, Garden, Landscaping, Drainage, Downspouts, Brick, Clay, Soil, Ice Lenses, Masonry, Mortar, Walls, Driveway, Sidewalk, Curb, Ground, Water Pressure, Frost Heaving, Temperature, Water Penetration, Footings, Rock, Gravel, Drains, Ice, Sump Pump, Water, Freezing, Frost, Problems