Some thoughts on calculating thermal bridges for PHPP
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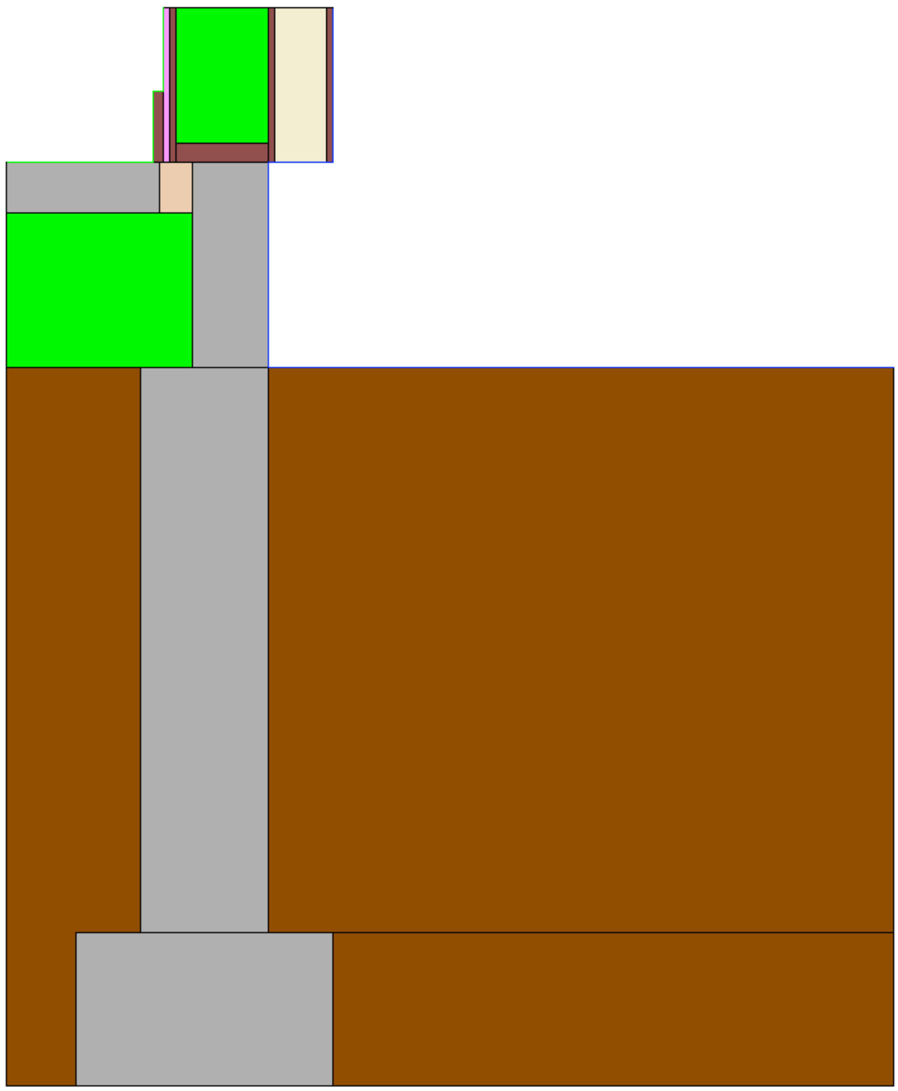
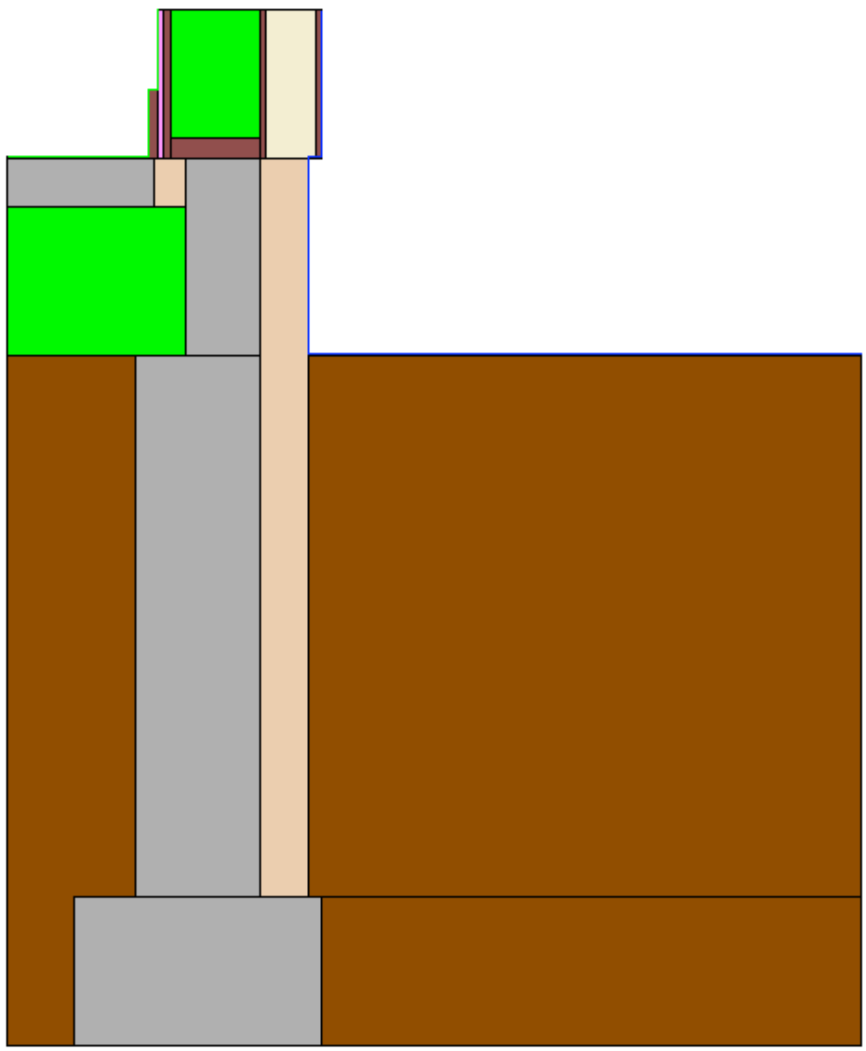
In my short exposure to thermal bridges in PHPP, it seems as though the most tricky are the slab edge TBs, because they lose heat to the ambient air (temperature zone A) and to the ground (temperature zone B). This seems even more tricky if the slab is on a frostwall rather than totally floating within foam, which may not be uncommon. This is the condition I have in the house I am analyzing. IN PHPP, the TBs to the ambient are entered separately from the TBs to the ground (in the Areas sheet.)

Here's the detail as the architect drew it (except I thickened both exterior foam and underslab foam):



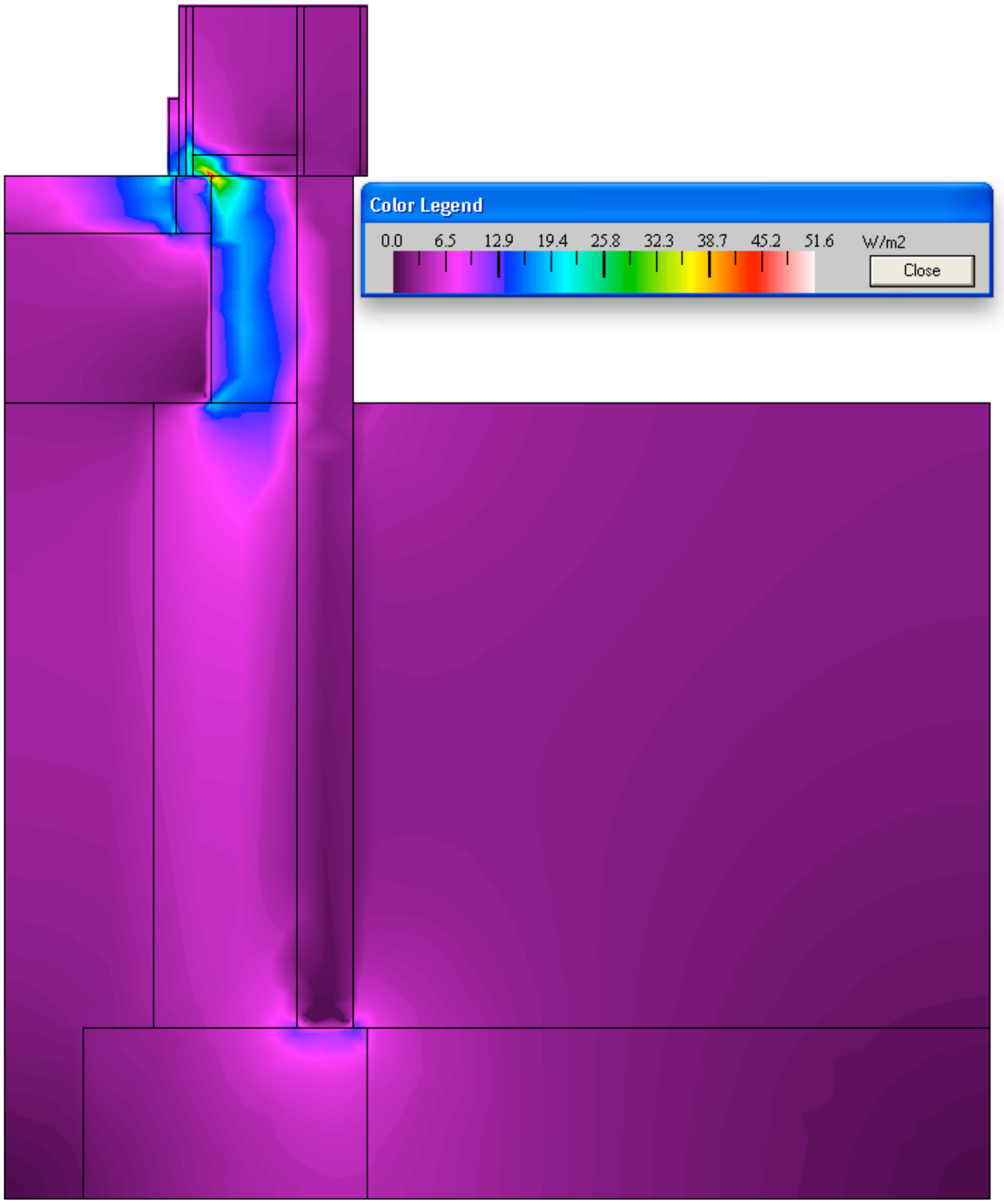
My feeling is that the primary direction of heat loss due to this thermal bridge is to the ambient rather than the ground, through that exposed concrete upstand. So I wanted to express the thermal bridge to ambient. By including the frostwall and footing and earth, I'm acknowledging that there is heat conducted down through the concrete that makes its way to the ambient air. I think this way of drawing the condition takes care of the thermal bridge that occurs both to the ground and the ambient air and should be entered as a TB to ambient. Note that I set the bottom of the earth and footing to adiabatic (no heat flow), which is a conservative condition – if that boundary condition is set at 50F instead the thermal bridge goes down rather than up.

The way I calculated the TB here is to take the wall dimension down to the bottom of the subslab insulation – it's 0.71 m. Wall U value is 0.102 W/m2K, so without a thermal bridge the wall conduction per linear meter of perimeter is 0.0725 W/mK. Then I use THERM to calculate the TB of the assembly as drawn. (I use the projected Y value, which I drew as 1 ft, or 0.3048 m). THERM gives a value of 0.5695 W/m2K for the assembly to ambient, I multiply that by the 0.3048 m dimension to yield 0.1736 W/mK conduction per linear meter of perimeter. The TB is (0.1736 – 0.0725), or 0.1011 W/mK. This is 10 times the allowable level that doesn't need to be calculated (0.01 W/mK). Next, I added four inches of XPS to the exterior of the frostwall.

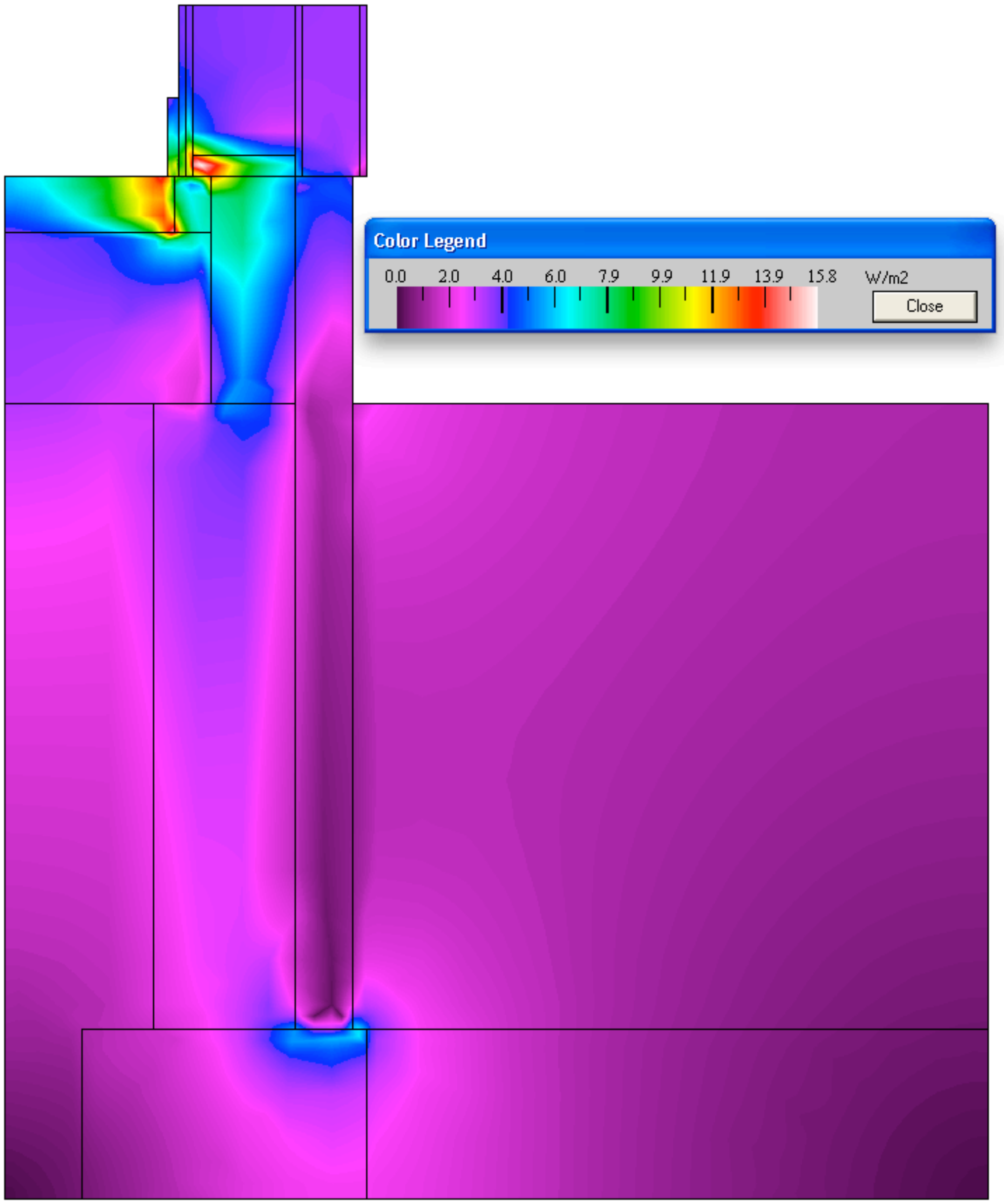


The TB drops to 0.062 W/mK. Next, I changed the concrete upstand to autoclaved aerated concrete (AAC), which has about the same conductivity as softwood. The TB drops to 0.031, or in half. I enter the TB number in cell V93 in the Areas sheet.

Here is a plot of heat flux intensity with the concrete upstand. Note the bleed around the bottom of the frostwall insulation! Peak heat flux is just over 50 W/m2.



The same assembly with the AAC upstand. Peak flux drops to less than 1/3 of the previous case – the material of the upstand matters. NOTE that the scales and therefore colors are different in each of the two images!!!


Color Legend
0.0
2.0
4.0
6.0
7.9
9.9
11.9
13.9
15.8
W/m2
Close