ESP-r Notes

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# General items

* The vertex point locations which describe the geometry of the surfaces are on the basis of the heat transfer area. Thus, they do not represent either the interior or exterior dimensions of a zone, but rather that which heat transfer is calculated across. It is prudent to select vertex locations within a realistic multilayer construction, preferably at the center of the insulation layer. For example: for an interior dimension 10 m x 10 m house with 10 mm of drywall and 15 cm of insulation, the vertices dimension should be 10.17 m x 10.17 m (10 m + 0.02 m [two drywall thicknesses] + 0.15 m [two half insulation thicknesses]). Unfortunately, the extra volume due to this increase will appear as additional air mass, although this is negligible. Due to corner effects, I would be inclined to reduce the dimensions, although corners tend to filled with framing and not insulation.
* The building simulator operates on the basis of calculated flux per unit area, and only multiplying by surface area at the end. Careful consideration must be given when attempting to distinguish is a variable is actually W or W/m2.

# Multilayer constructions

* Multilayer constructions are modeled as a series of materials and gaps. This makes it especially difficult to account for thermal bridging due to framing. Options exist to solve this issue:
  + Create a surface within the surface (similar to a window) and place all of the framing at this location. This option relies on thoroughly mixed air within the zone. It also may result in dewpoint temperatures at the framing surface when in fact these framing members are spread out and the dewpoint issue is mitigated by the surrounding insulation.
  + The insulation layer may be modified to represent the thermal properties of the framing.
    - It is recommended to make the insulation thickness equal to the framing, to avoid any large densities (NOTE: CHREM DOES NOT DO THIS).
    - The thermal conductivity should be modified to account for the parallel paths with consideration to the increased surface area of the insulation in absence of the framing.
    - The density and specific heat should be modified to be cross sectional area representative of the both the insulation and framing.

# BASESIMP

* Source code
  + src/esrubld/basesimp.F – the BASESIMP file readin and calculations.
  + src/esrubld/adjb.F – the attribution of the heat loss as a radiant loss from the outermost surface layer in accordance with the percentage specified in the \*.cnn file.
  + src/esrubld/input.F – calls the readin of the BASESIMP information
  + src/esrubld/simcon.F – calls the setup of the BASESIMP coefficients
  + src/esrubld/convect1.F – calls the BASESIMP convection coefficients each timestep
* Building files
  + zone.bsm – holds the BASESIMP information such as layout, height, insulation placement type.
  + zone.geo – list BASESIMP as the outside condition.
  + building.cnn – describes the BASESIMP attribution by connection type 6 and is followed by a percentage (whole %) of attributing the total heat loss to that surface.
* Documentation files
  + /NRCan\_docs/CANMET\_ESP-r…/BASESIMP\_configurations.pdf – describes the different foundation and insulation types (coded).
  + /NRCan\_docs/CANMET\_ESP-r…/BASESIMP-Description\_IBPSA-1997.pdf – describes the methodology.
* Simulation process
  + Prior to timestep simulation
    - The BASESIMP information is read in from the zone.bsm and the coefficients are determined before timestep begins.
  + At each simulation timestep
    - The convection coefficients are set.
    - The average foundation zone temperature is determined based on a weighted history to avoid peaking due to HVAC actuation.
    - The total heat loss of the foundation (all sides) is determined based on the correlations and coefficients. Note that this heat loss is in units of watts.
    - Finally, the portion of the heat loss as described in the building.cnn is applied as radiation to the outermost surface layer. Note that it is then divided by the surface area to be suitable for the ESP-r simulator.