Thermal Analyzer for Concrete Blocks

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Research Purpose and Goal:

A web application or Excel-based tool will be developed for contractors to more easily assess energy code compliance based on a variety of possible concrete blocks. The tool will allow the inputs of the concrete characteristics (density, thermal conductivity and specific heat), geometry (various web designs are on the market), filling material for cores, and spacing of reinforced concrete cores, to calculate an overall U and R value. Goal is to make construct outputs that can be read by typical code compliant software.

Definition of the Problem:

The Florida Building Code compliance simulation tools assume 1-D heat transfer for building envelope, so that any material property inputs should meet 1-D simulation requirement. It is OK for any wall assemblies composed of same material at each layer. However, concrete block, commonly used in building envelope assemblies in Florida, contains a layer composed of dissimilar materials as a two-dimensional component. It is essential to generate equivalent thermal properties to be used in 1-D simulations. Therefore, users can not input concrete block data directly without using equivalent thermal properties. The building code allows the isothermal method to calculate equivalent thermal properties. But, it requires users' more work to generate equivalent thermal properties and many users may not fully understand the various heat flow paths as typical concrete block walls have concrete web components, cores of air or insulation, and cores that are reinforced with concrete. In addition, it is easy to make mistakes during conversion. An app or Excel-based tool is needed to help users to generate required equivalent thermal properties.

Expected Outcome and Impact on The Code:

The tool developed in the proposed project will allow users to input concrete block properties and geometry directly and reduce users' effort to calculate equivalent material properties.

Budget:

$20,000