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## **Should historic solid mass masonry wall buildings be insulated during renovation?**

February 16, 2012 - Construction Design & Engineering

During the winter heating season, the thermal dynamic effect of heat passing from the interior heated spaces causes the temperature of the masonry wall to increase, which induces the drying of moisture within the wall assembly. Adding insulation to the interior surfaces of exterior masonry walls will reduce the thermal dynamic effect of heat migration from the warm heated spaces to the exterior unheated environment. This lack of heat migration will decrease the overall temperature of the wall during the heating season, potentially resulting in condensation and frost within the wall assembly.

The combination of colder wall temperatures, longer drying time of the wall, and higher indoor relative humidity can potentially result in freeze-thaw cycling within the wall assembly during the colder winter months. Freeze-thaw cycling decreases the durability of the masonry wall resulting in a reasonably high probability of structural damage.

During major renovations, there is, however, a general inclination to add thermal insulation to the interior surfaces of the brick masonry wall assembly to increase energy efficiency and occupant comfort in cold climate regions, like New England. Therefore, the challenge is to increase the energy efficiency of the wall assembly without decreasing its durability.

### Recommendations

The first but perhaps least obvious way to increase the thermal efficiency of an exterior masonry solid mass wall assembly is to minimize the amount of moisture which penetrates the wall from the exterior environment. One of the primary sources of water infiltration into the wall assembly is from wind-driven rain and snow. The amount of water penetration from the exterior environment is directly related to the condition of the masonry units, mortar joints and wall penetrations. A close inspection of the exterior structure, and subsequent implementation of repairs to any defects found in these areas, is the first line of defense in promoting energy efficiency and durability in any type of wall assembly.

The next step to prevent the introduction of moisture into the wall assembly, which decreases its energy efficiency, is to prevent indoor humidity from defusing into the wall. This is accomplished by installing a vapor barrier on the heated side of the exterior walls. There are both sheet and liquid applied systems that are commercially available for this purpose. An efficient vapor barrier will also incorporate an effective air barrier as well. When installing an air barrier system, emphasis should be given to including continuity at all wall component interfaces, such as window and door penetrations. Reduced air leakage will drastically increase the occupants' comfort as well as promote the overall energy efficiency of the wall assembly.

Lastly, the wall-to-window ratio should be noted when considering the introduction of thermal insulation into a previously uninsulated wall assembly. The key question to ask is, "Will adding

insulation to the masonry surfaces significantly improve the overall energy efficiency of the wall sufficiently enough to justify the potential risk to the durability of the wall assembly?" In most historic buildings, the window surface area accounts for a significant percentage of the total wall surface area. It is my opinion, based on thermal dynamic engineering principles, that adding insulation to high window-to-wall ratio assemblies will often not increase the overall energy efficiency of the wall sufficiently enough to justify the risk to its durability.

In addition, considering that air leakage is often the most significant source of heat loss and potential occupant discomfort, and that air leakage can be addressed through sound masonry restoration and the installation of an air barrier system, the addition of thermal insulation into the exterior wall assembly of historic structures is not typically warranted.

#### Conclusion

Insulating historic, solid mass masonry structures provides owners no insulation from major potential structural problems. True energy efficiency in the restoration of historic masonry buildings begins and ends with good old-fashioned maintenance and restoration of the masonry structure itself. It is an important factor leading to energy cost savings, as well as a cleaner, more comfortable environment and a healthier building.

Dennis Kulesza is the president of Metropolitan Restoration and Waterproofing Corp., Boston.

New England Real Estate Journal - 17 Accord Park Drive #207, Norwell MA 02061 - (781) 878-4540