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CAN "EQUIVALENT R-VALUE" BE USED TO DETERMINE COMPLIANCE WITH MASS WALL ENERGY CODE REQUIREMENTS?

No. The Equivalent R-Value of concrete masonry assemblies (or any mass wall system) cannot be used to determine compliance with energy code requirements. The Equivalent R-Value – also referred to as the Effective R-Value, Mass-Enhanced R-Value, Dynamic R-Value, as well as other names – is essentially a means of capturing and combining the effectiveness of thermal mass with the commonly understood steady-state R-value property of a system or material.

Despite the prevalent use of the term Equivalent R-Value, there is no single, standardized method of determining such a property for a material or assembly. Further, because some published Equivalent R-Values take into account not only conventional steady-state R-Value and thermal mass, but other intrinsic properties such as relative air leakage potential, local climate, and even building orientation, users are often left confused as to how to compare different materials or understand the context in which they were developed.

While Equivalent R-Values can help to illustrate that concrete masonry mass wall assemblies do not require the same level of insulation as non-mass wall assemblies when provided the same or better level of thermal efficiency, they cannot be used to determine compliance with energy codes. Building codes and standards only use steady-state R-Values and inherently take into account the thermal mass benefits of mass wall construction by requiring smaller steady-state R-Values for mass walls than corresponding light frame construction. Using Equivalent R-Values for demonstrating code compliance would be the same as taking credit for the same thermal property more than once.

Current building code requirements for energy efficiency stipulate minimum steady-state R-Values, which for concrete masonry construction are determined through physical testing (using procedures such as ASTM C1363 [1]) or by calculation using the code-defined series parallel (also called isothermal planes) method. Since the steady-state R-Values does not factor any time-dependent heat transfer characteristics, such as heat capacity (thermal mass) of a material, or the effect of climate conditions, building orientation, or other dynamic factors that influence thermal performance, for application to the minimum energy efficiency requirements in the International Energy Conservation Code (IECC) [2] Equivalent R-Values of mass wall construction are meaningless.

It is important to note that building codes and standards use the term equivalent R-value in the context of steel frame construction. In this context the term effective R-value is accounting for the extremely high level of thermal bridging that occurs in steel stud construction. For example, a metal framed wall insulated with R-13 batt insulation between the studs may only have an effective R-Value of about R-8 when considering the assembly as a whole. While this use of effective R-value is appropriate for these steel structures, it does not have relevance to concrete masonry wall assemblies.

REFERENCES

More details and information on thermal calculations and performance of concrete masonry construction can be found in the references:

1. *Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus,* ASTM C1363-11. ASTM International, 2011.

2. *International Energy Conservation Code* 2021. International Code Council, 2021

3. *Thermal Catalog of Concrete Masonry Wall Assemblies,*

Last Revised April 29, 2014

Second Edition. National Concrete Masonry Association, 2012.

4. *R-Values and U-Factors for Single Wythe Concrete Masonry Walls,* CMHA TEK 06-01C, Concrete Masonry & Hardscapes Association

5. Bradfield, Maribeth, *The Effectiveness of Effective R Value,* Masonry Edge/The Story Pole Magazine Vol. 6, No. 3. Masonry Advisory Council and Masonry Institute of Michigan, 2011.

ABOUT CMHA

The Concrete Masonry & Hardscapes Association (CMHA) represents a unification of the Interlocking Concrete Pavement Institute (ICPI) and National Concrete Masonry Association (NCMA). CMHA is a trade association representing US and Canadian producers and suppliers in the concrete masonry and hardscape industry, as well as contractors of interlocking concrete pavement and segmental retaining walls. CMHA is the authority for segmental concrete products and systems, which are the best value and preferred choice for resilient pavement, structures, and living spaces. CMHA is dedicated to the advancement of these building systems through research, promotion, education, and the development of manufacturing guides, design codes and resources, testing standards, and construction practices.

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