Report for Kings Material Inc.

Calculated OneStep R-Value and Thermo-Mass using EPS Type IX (1.80 #) (25psi)

R-Value and Thermo Mass have been formulated by using studies and test results conducted by reputable institutes such as Colorado Energy.org R-Value Table and Allwallsystem.com R-Value Table. For Thermal Mass we referenced studies on full scale massive walls conducted by ICMW and Oak Ridge National Laboratory.

R-Values for OneStep wall should be:

= 4" of block = R /thickness .80 + 5 5/8" of poured concrete times .20 =
R-Value per inch + EPS Type IX (1.80#)(25psi) @ R-Value 13.2 + 1" of air space = R-Value = 1

According to these figures, total R-Value for the OneStep Building System wall = R-Value estimated at R 18.575

Thermal Mass Effect for the OneStep Building System wall should be the strength of this wall system because of Thermal bridging as follows:

- The Mass of these wall affects the heat flow through them, especially in sunny climates with large temperature swings when massive building assemblies absorb energy surpluses from both the indoors and outdoors, slowing heat transmission.
- Thermal Mass factor varies depending on the calculated R-Value of the massive wall. The higher the massive wall's R-Value, the greater the mass factor. The mass factor varies from around 1 to 2.6 according to tests performed at Oak Ridge National Laboratory on full scale massive walls. The mass factor is multiplied by the calculated R-Value to estimate a *higher* R-Value that accounts for the Thermal Mass Effect.
- Wall systems insulated on the exterior perform better than walls insulated on the interior. **Walls insulated on the exterior have mass factors as high as 2.6.**
- Thermal Mass is effective in improving building comfort in any place that experiences these types of daily temperature fluctuations, both in winter as well as summer. When used well and combined with passive solar design, Thermal Mass can play an important role in major reductions to energy use in active heating and cooling systems.
- Materials such as concrete are commonly used for Thermo Mass**;** the thermal conductivity of concrete depends on its composition and curing technique. Concrete with aggregate is more thermally conductive.
- **Rigid foam used closer to the exterior side of this wall system (rather than the interior) gives this product a higher Thermo Mass.**

For example, if this project was in **Kansas City, MO** where the average winter temperature is 43.9° and the summer temperature 96°/74° with the number of heating degree days at 4,711 days, the summer mean daily range at 20 tells us that this wall should perform very well in this region. Because the solar radiation properties of concrete are = a* 0.60 and e* 0.88 and because we know that heat seeks out cold if the sun is shining, a good portion of the time this wall system could very well have an average R-Value of 30 under the proper conditions (meaning with very thick walls to achieve a high R-Value, possibly 1.2 to 2.6 times as high as expected due to the Thermal Mass Factor depending on climate).

Concrete rated at per inch thickness = hr *sf*. F/Btu = R-Value 0.10-0.20 times

Starting from interior to exterior with 2" block, 5 5/8" poured concrete, ASTM C-578 Type IX 2.75" Average/R-value – 13.2, 1" air space and 2" block, the R-Value would be R-18.575 X 2.6 =

<u>*R-48.295</u> under proper conditions.

<u>Note</u>: *This calculation for R-Value and Thermo Mass are exactly that, a calculation from R-Value tables and studies. This is an educational estimate. No one can give an exact R-Value or Thermo Mass under real life settings because of many reasons, for example: weather, craftsmanship of installment, plan design and so on.

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