Arranging Insulation for Better Thermal Resistance in Concrete and Masonry Wall Systems

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Three Walls

- **pre-cast panels**: $$$
- **cast in place**: $$$
- **concrete block**: $
1 billion/yr
80 million m²
1 of these...
Sources of Thermal Bridging

Thermal Resistivity (m·K/W)

Concrete Density (kg/m³)

- Insulation
- Light concrete
- Concrete
- Mortar
1 – Uninsulated two Core CMU
2 – Insulated two Core CMU
3 – Uninsulated Cut-Web CMU
4 – Insulation insert for Cut-Web CMU
5 – Insulated Multicore CMU
6 – Insulated solid block with interlocking insert
7 – Insulated solid block shape serpentine insert
Point #1: How much does insulation improve R-Value?

CMU R-value [m²·K/W]

Concrete resistivity [m·K/W]

solid block  two-core  multicore
Point #1:
How much does insulation improve R-Value?

CMU R-value [m²·K/W]

Concrete resistivity [m·K/W]
Point #1:
How much does insulation improve R-Value?

CMU R-value \([\text{m}^2 \cdot \text{K/W}]\)

Concrete resistivity \([\text{m} \cdot \text{K/W}]\)

cut-web
insert
two-core
Point #1:
How much does insulation improve R-Value?

Concrete resistivity [m·K/W]

CMU R-value [m²·K/W]  

multicore

inserts
Point #1:
How much does insulation improve R-Value?

CMU R-value [m²·K/W]

Concrete resistivity [m·K/W]

- solid block
- two-core
- multicore
- serpentine
- interlocking
- cut-web
- insert

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Point #2: How effective is the insulation?

Thermal Efficiency = \frac{R_i - R_u}{R_e}

- $R_u$: uninsulated CMU
- $R_i$: insulated CMU
- $R_e$: continuous insulation (equivalent volume)
Point #2: How effective is the insulation?
Point #3: How does mortar affect R-value?
Lightweight Concrete

Mortar Joint

Insulated Joint
Point #1:
How does mortar affect R-value?

Mortar Effect [%]

Concrete resistivity [m·K/W]

- two-core
- insert
Conclusions

- Insulation Potential
  - R-3.5 is possible

- Insulation Effectiveness
  - 80% is possible

- Mortar Effect
  - 12% reduction possible

- In All Cases:
  - concrete weight matters
  - configuration matters
Thank You!

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