# Navigating Energy Code Compliance
## Tools, Resources, and Confusion Avoidance

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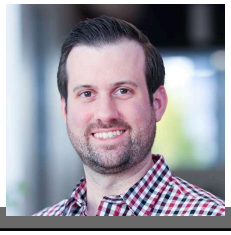
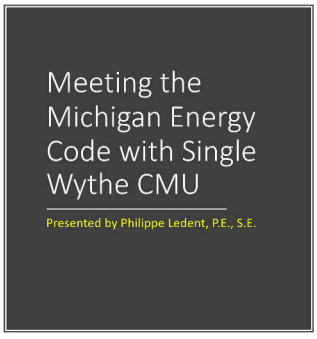
## Course Description

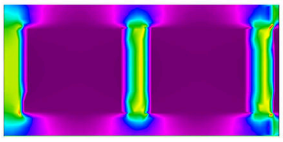
Efforts to increase the energy efficiency of new buildings has resulted in a storm of confusion and misinformation. We'll cut through the confusion and review some of the tools and resources available.

PS – I'm not Phil…






MASONRY
Institute of Michigan



# Learning Objectives

- Review of Energy Codes: IECC and ASHRAE 90.1 and Compliance Paths
- The Role of Thermal Mass and Impacts of Thermal Bridging
- Review of Masonry Design Guides and Handbooks
- Review of New Software

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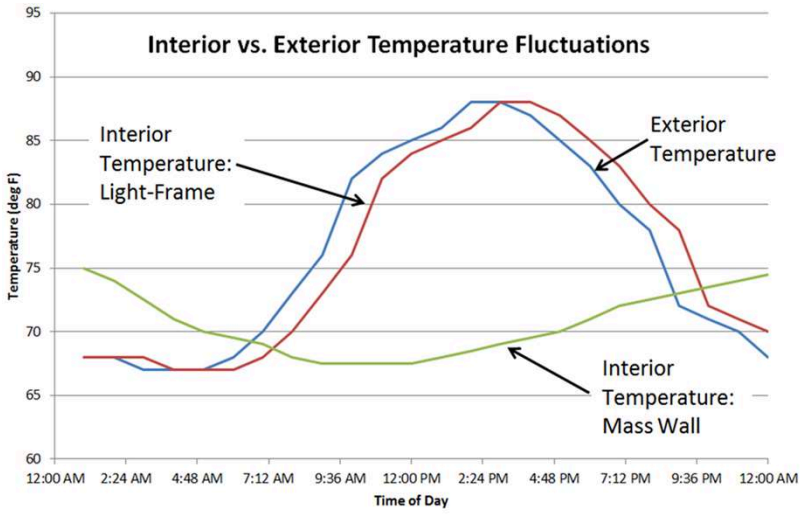
# Thermal Mass

Masonry's Strength

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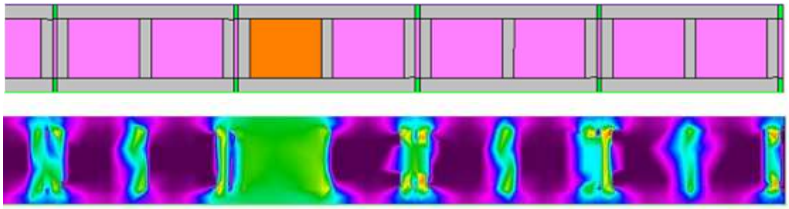
# Thermal Bridging

Masonry's Weakness



Unfortunately, the design community specifically and society in general, equate energy efficiency to R-values.

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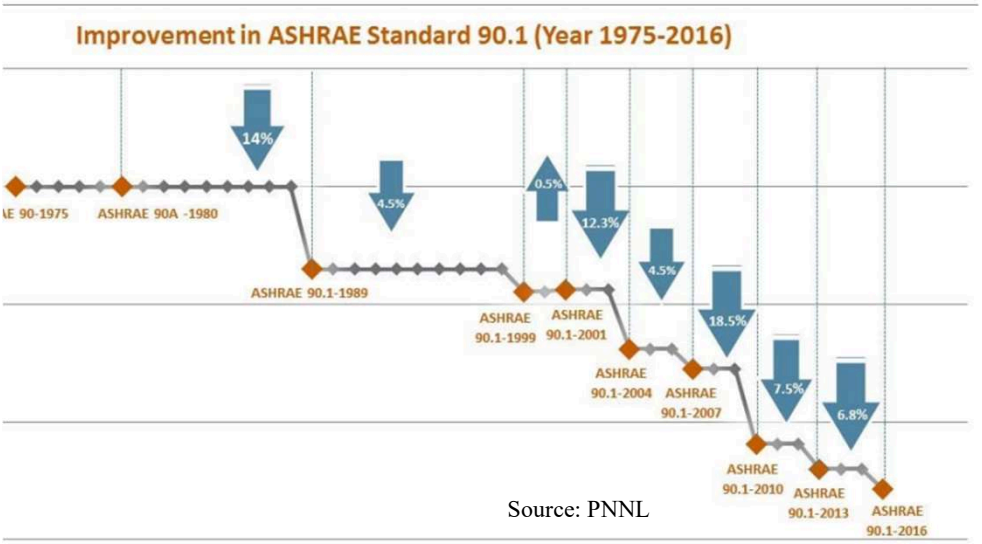
# Changes in Energy Efficiency




Source: PNNL

## Industry Evolution

Market drivers can spur (much needed) innovation…

Circa 1920

Circa 2010

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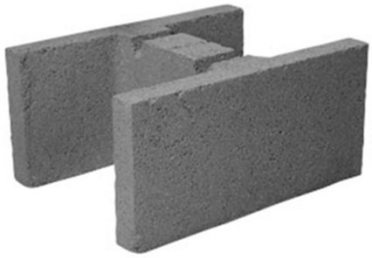
## Constraints

There were options in the marketplace, but established code requirements were limiting:

- Reducing the size/number of webs reduced thermal bridging, but triggered solid grouting of the assembly.



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# Constraints

There were options in the marketplace, but established code requirements were limiting:

- Reducing the size/number of webs reduces thermal bridging, but triggers solid grouting of the assembly.
  - Solution: Do some testing and update the codes.

**TABLE 1 Minimum Thickness of Face Shells and Webs[A]**

| Nominal Width (W) of Units, in. (mm) | Face Shell Thickness ($t_{fs}$), min, in. (mm)[B,C] | Web Thickness ($t_w$) | |
|---|---|---|---|
| | | Webs[B,D,C] min, in. (mm) | Equivalent Web Thickness, min, in./linear ft[E] (mm/linear m) |
| 3 (76.2) and 4 (102) | ¾ (19) | ¾ (19) | 1⅝ (136) |
| 6 (152) | 1 (25) | 1 (25) | 2¼ (188) |
| 8 (203) | 1¼ (32) | 1 (25) | 2¼ (188) |
| 10 (254) and greater | 1¼ (32) | 1⅛ (29) | 2½ (209) |

**…lls and Web Requirements[A]**

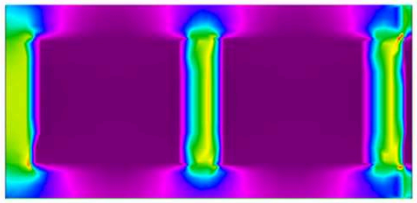
| Webs | |
|---|---|
| Web Thickness[C] ($t_w$), min, in. (mm) | Normalized Web Area ($A_{nw}$), min, in.²/ft² (mm²/m²)[D] |
| ¾ (19) | 6.5 (45, 140) |
| ¾ (19) | 6.5 (45, 140) |
| ¾ (19) | 6.5 (45, 140) |

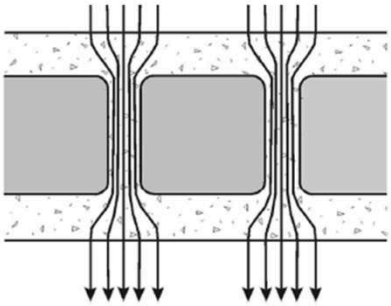
…ed in Test Methods C140.
…f the split surface is permitted to have thickness less than those shown, but not less …t apply and Footnote C establishes a thickness requirement for the entire faceshell. … shall be not less than ⅝ in. (16 mm).
…ed with grout. The length of that portion shall be deducted from the overall length of

# Constraints

There were options in the marketplace, but established code requirements were limiting:

- Current methods of modeling thermal performance of masonry were based on 1970s assumptions of unit shapes.





Series-Parallel Model

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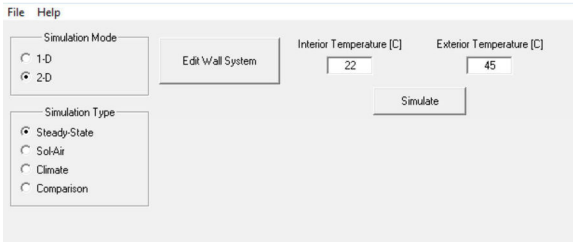
# Constraints

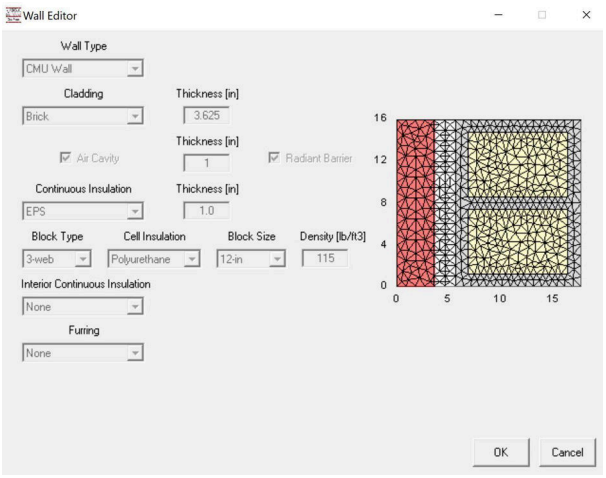
There were options in the marketplace, but established code requirements were limiting:

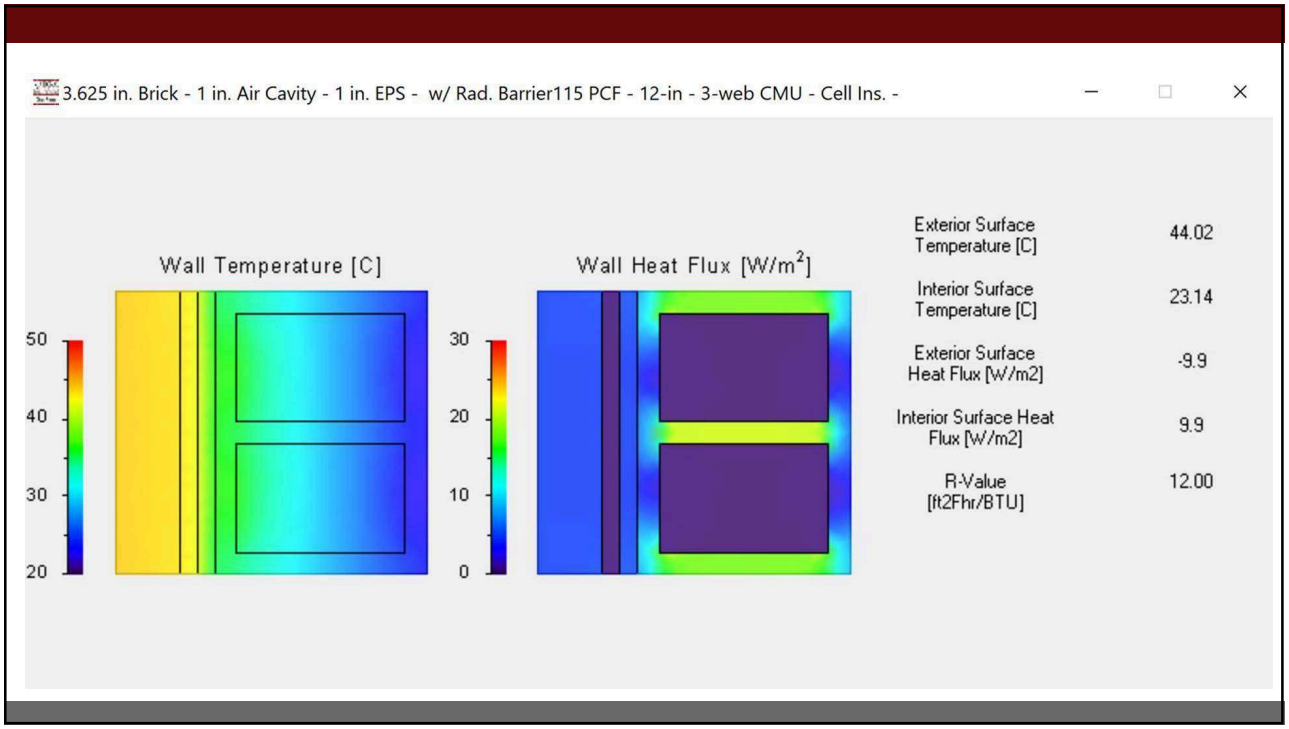
- Current methods of modeling thermal performance of masonry were based on 1970s assumptions of unit shapes.
  - Solution: Come up with better modeling methods.

# New Resources

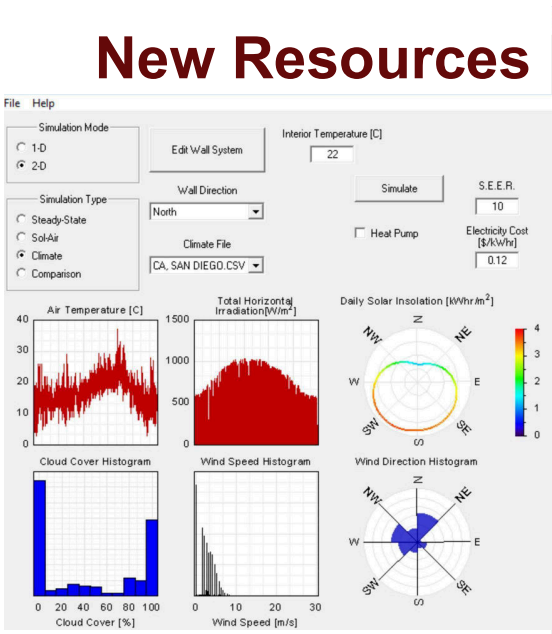
The crew at the National Brick Research Center have been hard at work.

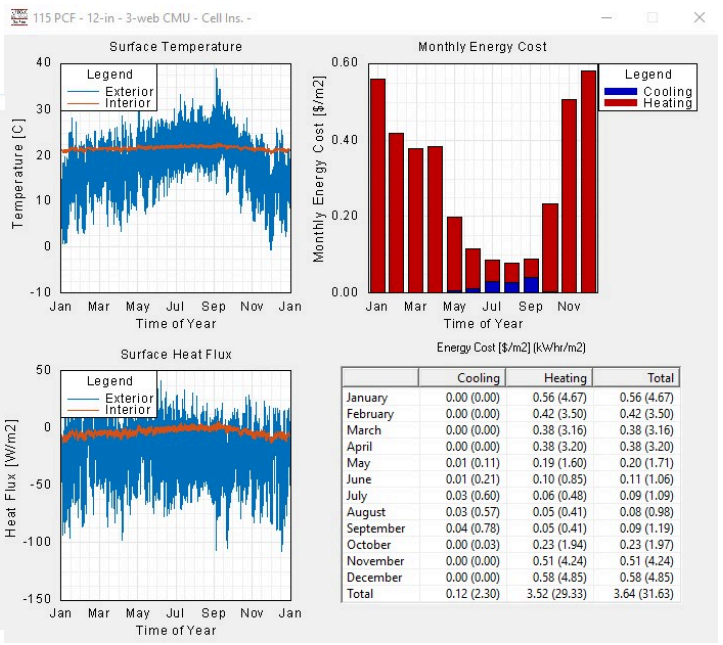




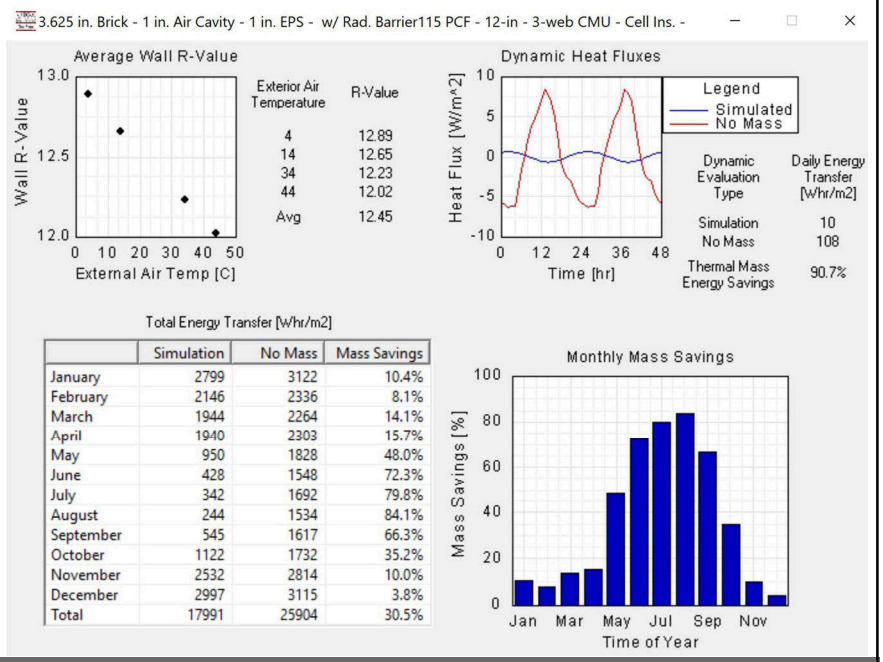

# New Resources




| | Cooling | Heating | Total |
|---|---|---|---|
| January | 0.00 (0.00) | 0.56 (4.67) | 0.56 (4.67) |
| February | 0.00 (0.00) | 0.42 (3.50) | 0.42 (3.50) |
| March | 0.00 (0.00) | 0.38 (3.16) | 0.38 (3.16) |
| April | 0.00 (0.00) | 0.38 (3.20) | 0.38 (3.20) |
| May | 0.01 (0.11) | 0.19 (1.60) | 0.20 (1.71) |
| June | 0.01 (0.21) | 0.10 (0.85) | 0.11 (1.06) |
| July | 0.03 (0.60) | 0.06 (0.48) | 0.09 (1.09) |
| August | 0.03 (0.57) | 0.05 (0.41) | 0.08 (0.98) |
| September | 0.04 (0.78) | 0.05 (0.41) | 0.09 (1.19) |
| October | 0.00 (0.03) | 0.23 (1.94) | 0.23 (1.97) |
| November | 0.00 (0.00) | 0.51 (4.24) | 0.51 (4.24) |
| December | 0.00 (0.00) | 0.58 (4.85) | 0.58 (4.85) |
| Total | 0.12 (2.30) | 3.52 (29.33) | 3.64 (31.63) |

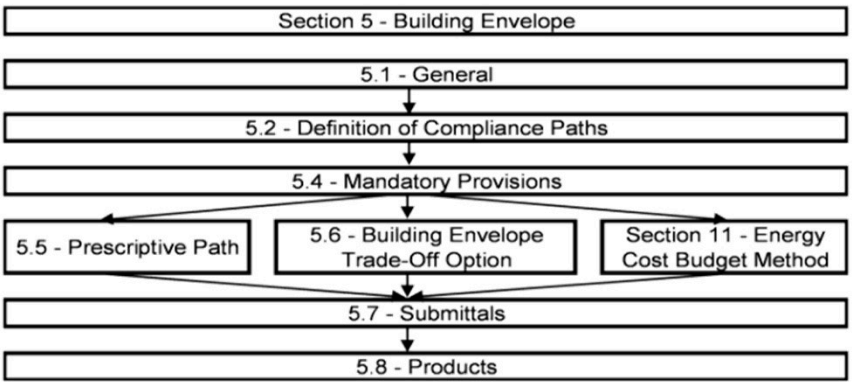
And quantify the benefits of thermal mass…$$$

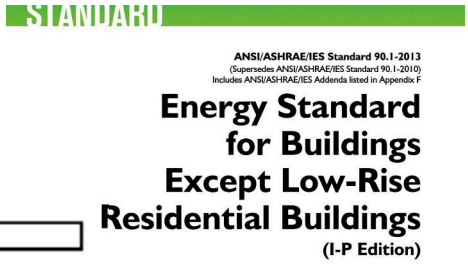



| | Simulation | No Mass | Mass Savings |
|---|---|---|---|
| January | 2799 | 3122 | 10.4% |
| February | 2146 | 2336 | 8.1% |
| March | 1944 | 2264 | 14.1% |
| April | 1940 | 2303 | 15.7% |
| May | 950 | 1828 | 48.0% |
| June | 428 | 1548 | 72.3% |
| July | 342 | 1692 | 79.8% |
| August | 244 | 1534 | 84.1% |
| September | 545 | 1617 | 66.3% |
| October | 1122 | 1732 | 35.2% |
| November | 2532 | 2814 | 10.0% |
| December | 2997 | 3115 | 3.8% |
| Total | 17991 | 25904 | 30.5% |

# Code Compliance

Three options:

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# Code Compliance

The prescriptive path is commonly used for relatively simple projects…but with a catch.

| CLIMATE ZONE | 1 | | 2 | | 3 | | 4 EXCEPT MARINE | |
|---|---|---|---|---|---|---|---|---|
| | All other | Group R | All other | Group R | All other | Group R | All other | Group R |
| **Walls, above grade** | | | | | | | | |
| Mass[g] | R-5.7ci[c] | R-5.7ci[c] | R-5.7ci[c] | R-7.6ci | R-7.6ci | R-9.5ci | R-9.5ci | R-11.4ci |
| Metal building | R-13+ R-6.5ci | R-13 + R-6.5ci | R13 + R-6.5ci | R-13 + R-13ci | R-13 + R-6.5ci | R-13 + R-13ci | R-13 + R-13ci | R-13 + R-13ci |

| CLIMATE ZONE | 1 | | 2 | | 3 | | 4 EXCEPT MARINE | |
|---|---|---|---|---|---|---|---|---|
| | All other | Group R | All other | Group R | All other | Group R | All other | Group R |
| **Walls, above grade** | | | | | | | | |
| Mass[g] | U-0.151 | U-0.151 | U-0.151 | U-0.123 | U-0.123 | U-0.104 | U-0.104 | U-0.090 |
| Metal building | U-0.079 | U-0.079 | U-0.079 | U-0.079 | U-0.079 | U-0.052 | U-0.052 | U-0.052 |
| Metal framed | U-0.077 | U-0.077 | U-0.077 | U-0.064 | U-0.064 | U-0.064 | U-0.064 | U-0.064 |
| Wood framed and other[c] | U-0.064 | U-0.064 | U-0.064 | U-0.064 | U-0.064 | U-0.064 | U-0.064 | U-0.064 |

# Code Compliance

And reputable sources aren't helping to clarify things…

DOW Building Solutions

**Continuous insulation (ci)** is the cornerstone to meeting a code's energy requirements, which can easily be met by varying the thickness of the insulation in commercial buildings. **Continuous insulation (ci)** is an uninterrupted blanket of insulation that spans over structural members without thermal bridges other than from fasteners and service openings. For those states following ASHRAE 90.1-2007 and IECC 2009, **continuous insulation** is no longer simply a value-added option – it is a requirement.

BIALOSKY + PARTNERS **ARCHITECTS**
CLEVELAND DESIGN BLOG

Continuous insulation (CI) has been an energy code requirement since the release of ASHRAE 90.1-2004, but unfortunately is still a bit of a mystery to many designers, contractors, and building officials. So, besides complying with the building code, why do we need continuous insulation? Thermal bridging through framing components reduces envelope insulation

# Solutions

Complying with energy codes has become more complicated than needed…but there are solutions.

# Solutions

They aren't difficult…

Where it's cold…




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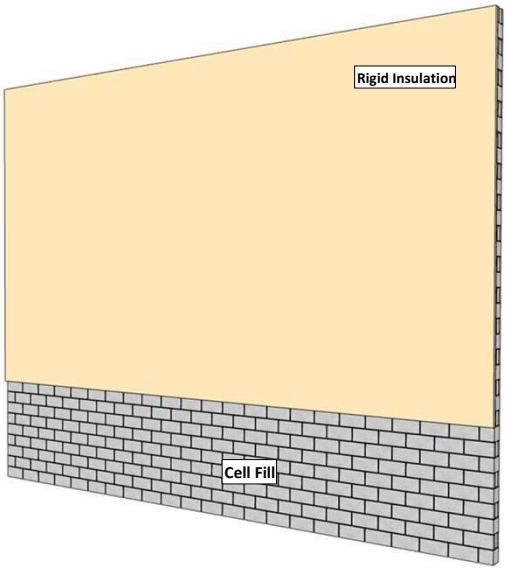
# Solutions

They aren't difficult…

Conventional
CMU Construction

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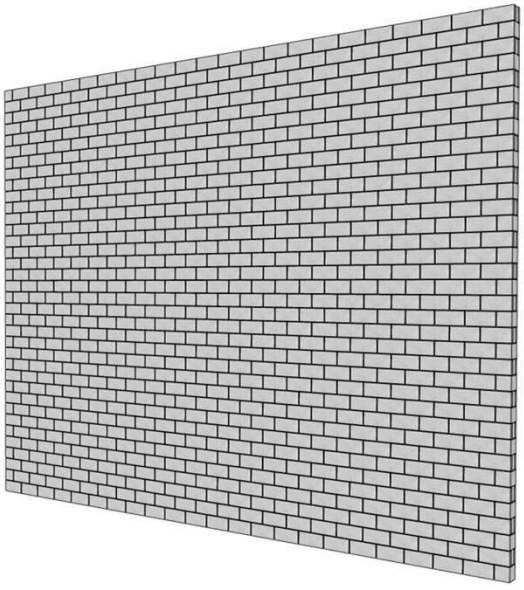
# Solutions

They aren't difficult…

Hi-Performance CMU
(reduced webs and
insulation inserts)



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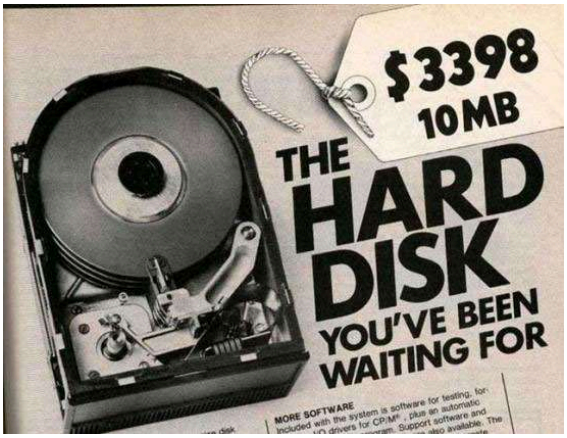
# Solutions

Just a little different…

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This concludes The American Institute of Architects Continuing Education Systems Course

THE MASONRY SOCIETY

**The Masonry Society**

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