Thank You!

Topics

- Masonry Foam Insulation
- Next Generation CMU
- f’m
- Foam Spec 07 21 19
Questions – Please Ask

- Interrupt
- Please Ask

Insulated “Next Generation” Concrete Masonry: Better & Faster For Less Money

(Section 07214 / 07 21 19)

CFIFOAM, Inc.
AIA/CES Provider ID: 40107238
AIA/CES Course: CFI3
CEU: 1.0 Hour H/S/W LU Credit
By the end of this session, attendees will understand that:

1. Energy code compliance does not require continuous insulation.

2. Web configurations are not regulated by web thickness, but rather by the cross-sectional area of the webs connecting the face walls.

3. Increasing $f'_{\text{min}}$ from 1500 psi to 2000 psi lets structural engineers spread vertical rebar to achieve significant savings.

4. Experience confirms that open-end CMU can be laid twice as fast as closed-end CMU to shorten construction schedules.
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Kevin Cavanaugh

Consultant & Independent Rep

• Arcosa Lightweight
• cfiFOAM Inc.
• Concrete Chemicals
• TempGuard Insulated Test Cylinders
Big 10 Convert!

Fear the Turtle?
Kevin Cavanaugh

BSME – U of Maryland
COOP at National Bureau of Standards
Hot Box & Thermal Mass

Kevin Cavanaugh

• Appointed by WI Governor Thompson to Multi-Family Dwelling Code Council
• AIA, ALA, CSI, NCMA, ACI, ASTM, WMA, ICPA, ESCSI
Kevin Cavanaugh

• ACI 122 Chairman –
  *Energy Efficiency of Concrete & Masonry Systems (Joint w/ TMS)*

• NCMA TG Chair –
  *Masonry Communications*
Balanced Fire Safety Design
& Concrete Masonry Fire Walls

Course No. WMAMASSYM2019
1 HSW LU
Provider No. T151
WMA Symposium Feb. 20 & 21, 2019
Project Fail Safe

- Fire Safety Score: -23.5%
- Means of Egress: -18.4%
- Total General Score: -13.2%
- Legacy vs. IBC

Project FAILSAFE Finds Sprinkler "Trade-Offs" Lead to Drop in Overall Fire Safety Scores

From: National Association of State Fire Marshals / Project FAILSAFE

Fire Protection News

Media Contact: Dave Weiks, 212-865-3337, dave.weiks@discovery.com

Project FAILSAFE Finds Sprinkler "Trade-Offs" Lead to Drop in Overall Fire Safety Scores

"Initial data from proprietary NAVITEK™ tool shows decrease in building safety..."
Fire Safety & Cost Study

Des Moines, IA
October 2017

Why Masonry?

- Past
- Present
- Future ...

- AIA 2030 Challenge & Changing Energy Codes
  - Higher & Higher Wall R-Values
  - Continuous Insulation
Masonry is a Great Value & offers....

- **AESTHETICS**
  - Looks good
  - Human scale

- **FUNCTION & PERFORMANCE**
  - Durability
  - Fire safety
  - Structural
  - Acoustics
  - Thermal
  - Moisture

- **VERSATILE**

  - Equals GREAT VALUE
Permanence and Quality – “Low Maintenance”

Design Flexibility
Creativity

Renovation
Concrete Masonry Unit (CMU)
Single-Wythe Half High CMU
Consider Decorative Half High CMU?

The Future – HOW Masonry?

- Past
- Present
- Future ...?
  - AIA 2030 Challenge & Changing Energy Codes
    - Higher & Higher Wall R-Values
    - Continuous Insulation
AIA 2030 Challenge

The 2030 Challenge allows up to 30 percent of the overall energy reduction to come from off-site renewable energy.
The Future – HOW Masonry?

- Past
- Present
- Future …?
  - AIA 2030 Challenge & Changing Energy Codes
    - Higher & Higher Wall R-Values
    - Continuous Insulation

How will CMU Wall Systems Survive?

Innovation

- Next Gen CMU
- Injection Foam
Smaller Webs = Higher R-Value

Smaller Webs = Higher R-Value

Reference Docs
ComCheck Ready Tables

2-Web & 3-Web Block

R, U & HC Values for Single-Wythe 8-Inch 3-Web Concrete Masonry Wall Assemblies

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<th>85pcf</th>
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<th>72V</th>
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<td>HC</td>
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<td>8.67</td>
<td>0.10</td>
<td>6.10</td>
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<td>0.10</td>
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<td>0.10</td>
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Insulated “Next Generation” Concrete Masonry: Better & Faster For Less Money

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CFIFOAM, Inc.
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3. Increasing \( f' \) from 1500 psi to 2000 psi lets structural engineers spread vertical rebar to achieve significant savings.
4. Experience confirms that open-end CMU can be laid twice as fast as closed-end CMU to shorten construction schedules.

• Learn what Aminoplast Injection Masonry Foam is.
  • Understand what Next Generation CMU are.
  • Appreciate the Masonry Foam is a very cost effective & greatly enhances CMU Wall performance.
  • Develop awareness that Masonry Foam does not increase Fire Ratings.
  • Understand that liabilities may accrue when using false performance claims.
Learning Objectives

- Learn what Aminoplast Injection Masonry Foam is.
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Aminoplast Masonry Foam Insulation
Next Generation CMU

Next Generation CMU – Cross Web Area %

13.4%  
1α = Traditional

4.5%  
1α = Open end and flat

4.5%  
1α = Double open end and flat block

4.7%  
1α = One reduced height web

8.9%  
1α = Three reduced height webs'

Next Gen CMU – Foamed on Site

Old CMU - Cross Web Area %

Traditional 8” CMU

Traditional 8 “A” Block

21%  
13.8%
AIA Bookkeeping

- Attendance Sign In – Form B
- Evaluation
- 1 HSW CEU
- Sources & References Materials

Course Evaluation – Online or Handout

In order to maintain high-quality learning experiences, please access the evaluation for this course by logging into CES Discovery and clicking on the Course Evaluation link on the left side of the page.
Let’s Review Injection Foam

- What it is
- How it is used
- FAQs
- Energy Code Impact
- Fire Myths
What is Aminoplast Foam?

Aminoplast Foam is...

- Waterborne
- 2-Component
- Job-Site Produced
- “Plastic Foam Insulation” per IBC 2603
- R-Value of 4.6 per inch
- Pre-Expanded & Injected (not sprayed)
What is Aminoplast foam insulation used for?

Thermal & Acoustical Insulation in Enclosed Cavities

- Not for roofs or under slabs
- Not for spraying over substrates
- Not for exposed applications

Foam Insulation is either...

Factory-Made (Rigid Board)

...or...

Job-Site Produced (Sprayed or Injected)
Job-Site Produced Foams are...

Spray-Applied as a liquid onto an open substrate (& then begin to expand)

...or...

Injected as a fully-expanded foam into an existing wall cavity

Foam Chemistry is either...

Petroleum-Based (Most Foams)
- Rigid Board (polystyrene or polyisocyanurate)
- Spray-Applied (polyurethane)

Or Nitrogen-Based (Injection Foam)
- “Aminoplast” foams...
  - Phenol, Melamine or Urea Polymers
“AminoPlast” Foam Insulation is Green and Sustainable

Waterborne
2-Component
Job-Site Produced
“Plastic Foam Insulation” per IBC 2603
R-Value of 4.6 per inch
Pre-Expanded & Injected (not sprayed)
**No Off-Gasing - Aminoplast Foam**

R-Value of 4.6 per inch

No Off-Gasing

---

**Repeat - Aminoplast Foam**

R-Value of 4.6 per inch

No Off-Gasing

Higher at Lower Temps
How is Foam Installed...
Aminoplast Foam is Injected...

Using Specialized Equipment

By Trained, Certified Installers

Into Vertical Walls

In CMU Walls via Drill-n-Fill Method

ALL Manufacturers Offer Material, Equipment, Training & Tech Support
The Drill-n-Fill Technique is most common...

First you Drill...
First you Drill...

Then you Fill...
Foam Flows Filling ALL Cores and Head Joints

A sample video from one supplier...
What is Aminoplast foam insulation used for?

- Thermal & Acoustical Insulation in Enclosed Cavities

- Not for roofs or under slabs
- Not for spraying over substrates
- Not for exposed applications
Common Questions...

1. How do you know the wall is full of foam?
2. What if the foam gets wet?
3. What’s the Whole-Wall R-value?
4. Does it comply with Energy Codes?
5. Can foam Increase Fire Resistance Rating?

Visual Verification is one QC Technique...
Infrared Scan is another QA Method...

FAQ - What If The Foam Gets Wet?
FAQ - What If The Foam Gets Wet?

After 48 hours ...
Very little wicks,
Very little absorbed,
Zero mold is sustained.
Dries to full functionality.

Are Single Wythe Walls Energy Code Compliant?
Yes, if the whole building envelope is evaluated...using ComCheck
Chars into **Useless Gunk** in 54 Minutes @ 400°F

Does Foam increase Fire Resistance Rating?
Claim Withdrawn – Sept. 2014

Update your Foam Specification

Sole Source
Fire Rating
Claim
Andover HS
Foam Take Aways

- Learn what Aminoplast Injection Masonry Foam is.
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Let's Review Next Gen CMU

- What it is
- Benefits
- Local Availability
- Energy Code Impact
- Other Properties

NEXT GENERATION CONCRETE MASONRY SHAPES AND THEIR IMPACT ON WALL DESIGN & PERFORMANCE
Extra Credit LO – Next Gen CMU

- Be familiar with the new ASTM C-90 and Next Generation CMU shapes
  - Understand that Next Gen. CMU enhance wall assembly performance.
  - Realize that Next Gen. CMU make it easier to meet Energy Codes.
  - Understand the positive impacts that Next Gen CMU provide to Sustainability & Wall Costs.
  - Learn that Next Generation CMU comply with Fire Safety, Structural & Acoustical requirements

An original block machine
C90 History – Early 1920s

“...the concrete block industry was in a chaotic state with respect to the sizes of block....Block were manufactured in 30 different lengths, 20 different widths and 26 different heights. Architects were severely handicapped because they had no way of knowing what sizes would be delivered ... until they arrived...Therefore, they were unable to dimension their bldgs. w/ any assurance...”

C90 History – Mid to Late 1920s

1924 – Standardization sets in
1927 – 95% of all block meet Stds.

1931 – C90 first Published
C90 – Changes Made in 2011

1. Equivalent Web Thickness Removed
2. Minimum Web $\geq \frac{3}{4}"$
3. Minimum Cross-Sectional Web Area $\geq 6.5 \text{ in}^2 / \text{ft}^2$
   a) Translates to 5.8 in$^2$ per 8 x 16 CMU.
   b) Or 4.5%

Permissible New CMU - 4.5%!
Old CMU ~ 21% Web Area

What is Next Gen CMU? & Benefits?

Next Generation CMU - Cross Web Area %
- 13.4%
- 4.5%
- 4.5%
- 4.7%
- 8.9%
- 8.9%
- 4.5%
Permissible New CMU - 4.5%!

Next Generation CMU – Cross Web Area %

Old CMU ~ 21% Web Area
Benefits of Next Gen CMU?

- Faster Install
- Complete More Jobs
- Fewer Injuries
- Healthier Masons
- More Profits
- Higher R-Values
- Easier to Meet Energy Code
- Green (Less Matl)

Faster Install

- 40-50% Lighter Block
  - 33 – 66% Productivity Increase Above Est.
  - 66 – 110% Increase Above NCMA Tek Note
- “A” Shape
  - Easier to Manuever

Ref. The ProBlock.com
**Typical Next Gen CMU Spec’d by Walmart Used Regionally**

**Enhanced Wall Assembly Performance**

- **Units**
  - Less Raw Material (10 – 28%)
  - Less Energy to Mnfr
  - Less CO2
  - Fewer Truck Loads = Less Gas = Less CO2

- **Installation**
  - Faster Install (33-66% faster in NC study)
  - Less Injuries
  - **Fewer trips to Jobsite** = Less Gas = Less CO2
  - Fewer trips to Jobsite = Complete More Jobs
NC Job Example – 5 Man Crew

• 10,000 Units
• Next Gen Units = 7.2 Days …8
• Old Regular CMU = 11.8 Days ….12

• What does 4 days of Labor cost?
• Fuel… Overhead… etc?

Smaller Webs = Higher R-Value
Higher R-Values

- 2.7 to 3.2 X greater than old CMU insulated w/ Foam
  - 8” Lwt CMU = R5.6 vs. R14.7
  - 12” Lwt CMU = R8.2 vs. R25.1

Ref. Jason Thompson Article - MasonryEdge / The Story Pole Vol. 7 No 2

2-3 x Higher R-Values w/ ESCS LWA CMU
Enhanced Wall Assembly Performance

- Units
  - Less Raw Material (10 – 28%)
  - Less Energy to Mnfr
  - Less CO2
  - Fewer Truck Loads = Less Gas = Less CO2

- Installation
  - Faster Install (33-66% faster in NC study)
  - Less Injuries
  - Fewer trips to Jobsite = Less Gas = Less CO2
  - Fewer trips to Jobsite = Complete More Jobs

More Sustainable

- Fewer Raw Materials
- Less Energy to Make CMU
- Improved Delivery Efficiency
- Lower CO₂ Emissions
Other Properties

- **Structural** - Unchanged
- **Fire Resistance** – Use NCMA Tek Note ET
- **& Acoustical** - Use NCMA Tek Note Wall Wt.
Proprietary Insert Systems

- Many
- R-Value Claims
  Test vs. Calculated?
- Thermal Mass Credit 2X
- Expensive

Single Wythe CMU Insulation Options – Inserts or Foam
HYBRID Next Gen CMU System Fully Insulated Foamed & Insert

Next Generation 3-Web Block Walls

Have Less Thermal Bridging
CMU Webs are thinner...

...Less Thermal Bridging means Improved Energy Efficiency...

2-Web and 1-Web Block are even more energy efficient...
2-Web and 1-Web Block are even more energy efficient...

“A” Block  “H” Block

CMU Webs Change On The Inside, Nothing Changes On The Outside.

Concrete Masonry still looks the same...!
Next Generation 3-Web Block Walls

Have Less Thermal Bridging

Cross-Sectional View Shows...

Less Thermal Bridging (meaning Higher R-Values)
Available Foamed "A Block"

2½" XPS Cavity Insulation plus 8” Next Generation 2-Web CMU insulating with Core Foam Masonry Foam Insulation®

[Non-Loadbearing]

R-19 x 13¼"

1½” Closed-cell SPF Cavity Insulation plus 8” Next Generation 2-Web CMU insulated with Core Foam Masonry Foam Insulation®

[Non-Loadbearing]

R-21 x 13¼"

Available Pre-Insulated 2 webs
Available Pre-Insulated 1 web

- **One web**
  - Reduced overall cross sectional area
- **EPS insert Thicker**
- **Open ended “H” configuration**
  - Great for fully grouted structures
  - May be adapted for partial grouted structures.
  - H style or Double Open ended CMU is the standard in markets where full grout is the norm.
Thermally Broken CMU
Local Mfgr - Next Gen CMU
### Bonus Question...

What is wrong in this drawing?

![Bonus Question Image]

---

### “A” & “H” Block Comparison

<table>
<thead>
<tr>
<th>A - Foamed</th>
<th>H – Pre-insulated</th>
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<tr>
<td>Meets C90</td>
<td>Meets C90</td>
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<tr>
<td>Field Insulated</td>
<td>Factory Insulated</td>
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<tr>
<td>Wall &lt; 100% Ins.</td>
<td>Wall 100% Insulated</td>
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<tr>
<td>Less $ per Unit</td>
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<td>Standard Fittings</td>
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<td>Long Time Use</td>
<td>ICC ES Rpt</td>
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<tr>
<td>Very Easy to Install</td>
<td>Easy to Install</td>
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<tr>
<td>Comcheck Data Sheets</td>
<td>Comcheck Data Sheets</td>
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</table>
Learning Objectives

• Be familiar with the new ASTM C-90 and Next Generation CMU shapes
• Understand that Next Gen. CMU enhance wall assembly performance.
• Realize that Next Gen. CMU make it easier to meet Energy Codes.
• Understand the positive impacts that Next Gen CMU provide to Sustainability & Wall Costs.
• Learn that Next Generation CMU comply with Fire Safety, Structural & Acoustical requirements

Commercial Table – R-Values
## Commercial Table Summary

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</tr>
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</table>

### Types

- **Roofs**: 3 Types
- **Walls Above-Grade**: 4 Types
- **Walls Below-Grade**: 1 Type
- **Floors**: 2 Types
- **Slab-On-Grade**: 2 Types
- **Opaque Doors**: 2 Types
### 2012 IECC R-Value Summary

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<td>13+3.8ci or 20</td>
<td>13+3.8ci or 20</td>
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<td>2</td>
<td>0</td>
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<td>20 or 13+5</td>
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<td>13+15.6ci or 20+10ci</td>
<td>13+15.6ci or 20+10ci</td>
<td></td>
</tr>
</tbody>
</table>

### Footnotes

Commercial Table

For SI: 1 inch = 25.4 mm. ci = **Continuous insulation**. NR = No requirement

**a.** Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

**b.** Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.2.

**c.** R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h·f2 °F.

**d.** Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

**e.** Steel floor joist systems shall be insulated to R-38.
Continuous Insulation (ci): Insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings.

**IS NOT MANDATORY**!
Compliance Paths

1. Prescriptive = R-Value Tables
2. Performance = Basic Software
   1. Use COMcheck & REScheck
      • U & Heat Capacity (HC)
   2. Use U-Value Prescriptive Table
      • CI is not required
3. Whole Building Analysis = Complex Software

Extra Credit - Mass Wall Definition

• Walls weighing at least 35 lbs/ft$^2$ of wall surface area, or
• 25 lbs/ft$^2$ of wall surface area if material weight is ≤ 120 lb/ft$^3$
<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Comm. Mass</th>
<th>Comm. Wood All Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.7ci</td>
<td>13+3.8ci or 20</td>
</tr>
<tr>
<td>2</td>
<td>5.7ci</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7.6ci</td>
<td></td>
</tr>
<tr>
<td>4 Ex. Mar.</td>
<td>9.5ci</td>
<td></td>
</tr>
<tr>
<td>5 &amp; Mar. 4</td>
<td>11.4ci</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>13.3ci</td>
<td>13+7.5ci or 20+3.8ci</td>
</tr>
<tr>
<td>7</td>
<td>15.2ci</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>25ci</td>
<td>13+15.6ci or 20+10ci</td>
</tr>
</tbody>
</table>

Nicholas Lang, P.E.
National Concrete Masonry Association
AIA/CES Course: ENERGY10
Evolution of CMU

Same system…more strength.

- 18 ft wall, 8 in. CMU
- 40 psf wind pressure
- 3,000 lb/ft axial

<table>
<thead>
<tr>
<th>Table 2 – Design Impact of TMS 402/602 Revisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Edition</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>2009 IBC1</td>
</tr>
<tr>
<td>2012 IBC2</td>
</tr>
<tr>
<td>2015 IBC3</td>
</tr>
</tbody>
</table>


*f'c = 3,500 psi

*f'c = 2,000 psi

*Incorporating 9 gage bed joint reinforcement at 16 inches.
### Vertical Rebar Spacing Increases

- **2009 = 40”**
- **2012 = 48”**
- **2015 = 96”**

---

#### Evolution of CMU – More Strength

[Image of CMU block evolution]

---

#### Table 1A: Vertical Rebar Spacing (in.)

<table>
<thead>
<tr>
<th>Descriptive</th>
<th>Shape</th>
<th>Material</th>
<th>Core</th>
<th>Outer</th>
<th>Face</th>
<th>Overlap</th>
<th>Rebar Spacing (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>2</td>
<td>EPS</td>
<td>0.20</td>
<td>0.40</td>
<td>0.80</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>106</td>
<td>2</td>
<td>Core Foam</td>
<td>0.20</td>
<td>0.40</td>
<td>0.80</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>115</td>
<td>2</td>
<td>CWA</td>
<td>0.20</td>
<td>0.40</td>
<td>0.80</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>125</td>
<td>2</td>
<td>Rebar</td>
<td>0.20</td>
<td>0.40</td>
<td>0.80</td>
<td>0.12</td>
<td>0.12</td>
</tr>
</tbody>
</table>

#### Notes:

- CMU “E” (Shipping) 4.0” grouted 15/16”-thick; CF = Core Foam
- CMU “F” (Shipping) 4.0” grouted 15/16”-thick; CF = Core Foam
- CMU “H” (Shipping) 4.0” grouted 15/16”-thick; CF = Core Foam
- CMU “HyG” (Shipping) 4.0” grouted 15/16”-thick; CF = Core Foam
- Geometry is subject to change (minimum of 98 cm)
- EPS / Core Foam Masonry Foam = 1.25”
- CWA = Core Masonry Foam
- Rebar = 3/8”
- Core Foam Masonry Foam = 1.25”
- EPS = Expanded Polystyrene
- Core Foam Masonry Foam = 1.25”
- CWA = Core Masonry Foam
- Rebar = 3/8”

---

#### Example:

- Insert insulation, calculated according to C90. NCMA’s R = 0.12 and ASHRAE’s R = 0.10.
- 15/16” thick, occupy the grouted cores located adjacent to face shells.
Prescriptive: R-Value

Prescriptive R-Value requires continuous insulation...
Prescriptive: U-Factor

Prescriptive U-Factor does NOT require continuous insulation…

Design Example: C2 Warehouse
Design Example: C2 Warehouse

Design Example
Baseline Building

Envelope Assemblies

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area or Perimeter</th>
<th>$U$-Value</th>
<th>Cond. $R$-Value</th>
<th>Proposed $U$-Factor</th>
<th>Budget $U$-Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof 1: Insulation Eaves Above Deck, [Bldg. Use 1: Warehouse]</td>
<td>8107</td>
<td>55.0</td>
<td>0.032</td>
<td>0.032</td>
<td></td>
</tr>
<tr>
<td>Floor 1: Stg/Clr/Sheets/Heated, Vertical 4 R</td>
<td>403</td>
<td>60.0</td>
<td>0.490</td>
<td>0.440</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- Exterior Wall: Other Wall, Heat capacity 0.0, [Bldg. Use 1: Warehouse]
- Window 1: Metal Frame/90, Perf 5-ply, Product ID Window, SxGC 2.21, VT 0.39, [Bldg. Use 1: Warehouse]
- Door 1: Insulated Metal, Non-Swinging, [Bldg. Use 1: Warehouse]
- Door 2: Insulated Metal, Swinging, [Bldg. Use 1: Warehouse]

East
- Exterior Wall: Other Wall, Heat capacity 0.0, [Bldg. Use 1: Warehouse]
- Window 1: Metal Frame/90, Perf 5-ply, Product ID Window, SxGC 2.59, VT 0.39, [Bldg. Use 1: Warehouse]
- Door 1: Insulated Metal, Swinging, [Bldg. Use 1: Warehouse]

South
- Exterior Wall: Other Wall, Heat capacity 0.0, [Bldg. Use 1: Warehouse]

Envelope PASSED: Design 0.0% better than code
Design Example

Basic Assembly Properties:
• Unit Density = 115 pcf
• Foam-in-Place Insulation in Non-Grouted Cells. R = 4.6/inch
• Vertically Grouted Cell: 120 in. o.c. (86 in. o.c. averaged trim steel)
• Horizontal Bond Beam at Roof Line

Option 1A:
12 in. CMU; exposed both sides

We need: \( U = 0.090 \) (R = 11.1)

Conventional three web unit…
\( U = 0.139 \) (R = 7.19)
Design Example

Option 1B: 12 in. CMU; exposed both sides

We need: $U = 0.090$ ($R = 11.1$)

New ASTM C90 two web unit...
$U = 0.098$ ($R = 10.14$)
Design Example

Option 1C:
12 in. CMU; lightweight exposed both sides

We need: $U = 0.090$ (R = 11.1)

New ASTM C90 lightweight two web unit...
$U = 0.089$ (R = 11.23)

Design Example

Option 1C: 12 in. lightweight CMU; exposed both sides; 2 web unit
Design Example – 8 in CMU

Option 2A:
8 in. CMU; exposed both sides

We need: \( U = 0.090 \) (\( R = 11.1 \))

Conventional three web unit...
\( U = 0.211 \) (\( R = 4.73 \))
Design Example

Option 2B: 8 in. CMU; exposed both sides

We need: $U = 0.090 \ (R = 11.1)$

New ASTM C90 two web unit…
$U = 0.151 \ (R = 6.63)$

Design Example

Option 2C: 8 in. CMU; Inside Finished; 1.5 inch polyisocyanurate, metal furring, ½ inch gypsum

We need: $U = 0.090 \ (R = 11.1)$

Two web unit…
$U = 0.055 \ (R = 18.2)$
Design Example

We don’t need to finish all interior surfaces…only those that need it.

Design Example

Option 2C – Interior finish on 3 of 4 walls.

Envelope Assemblies

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area of Perimeter</th>
<th>U-Value</th>
<th>Cont. U-Value</th>
<th>Proposed U-Factor</th>
<th>Budget U-Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof 1: Insulation-Free, Home Deck (Bldg. Use 1: Warehouse)</td>
<td>6187</td>
<td>0.032</td>
<td>0.032</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Roof 1: Insulation-Free, Home Deck (Bldg. Use 1: Warehouse)</td>
<td>453</td>
<td>0.040</td>
<td>0.040</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Outside Wall 1: Other Mass Wall, Heat Capacity 10.0 (Bldg. Use 1: Warehouse)</td>
<td>3314</td>
<td>0.025</td>
<td>0.025</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Outside Wall 2: Other Mass Wall, Heat Capacity 10.0 (Bldg. Use 1: Warehouse)</td>
<td>3314</td>
<td>0.025</td>
<td>0.025</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Window 1: Metal Framed, Fixed, Insulated (Bldg. Use 1: Warehouse)</td>
<td>24</td>
<td>0.030</td>
<td>0.030</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Window 1: Insulated Metal, Sliding (Bldg. Use 1: Warehouse)</td>
<td>554</td>
<td>0.025</td>
<td>0.025</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Envelope PASSES: Design 4%, better than code
Design Example
We don’t need to finish all interior surfaces…only those that need it.

Design Example
Option 2D: Interior finish on upper portion of walls.

<table>
<thead>
<tr>
<th>Envelope Assemblies</th>
<th>Gross Area</th>
<th>Cavity R-Value</th>
<th>Cont. R-Value</th>
<th>Proposed U/Factor</th>
<th>Budget U/Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof 1: Insulation/Ceiling Above Deck, [Bldg. Use 1 - Warehouse]</td>
<td>9187</td>
<td>5.00</td>
<td>0.052</td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td>Floor 1: Slab-On-Grade Unheated, Vertical 4 ft. [Bldg. Use 1 - Warehouse]</td>
<td>483</td>
<td>10.0</td>
<td>0.463</td>
<td>0.540</td>
<td></td>
</tr>
</tbody>
</table>

**NORTH**
- Exterior Wall 1: Other Mass Wall, Heat capacity 15.0 [Bldg. Use 1 - Warehouse]
- Wall 1: Metal Frame, Perf. Spec., Product ID: [Bldg. Use 1 - Warehouse]
- Door 1: Insulated Metal, Swinging [Bldg. Use 1 - Warehouse]
- Door 2: Insulated Metal, Swinging [Bldg. Use 1 - Warehouse]
- Exterior Wall 2: Other Mass Wall, Heat capacity 15.0 [Bldg. Use 1 - Warehouse]

**EAST**
- Exterior Wall 3: Other Mass Wall, Heat capacity 15.0 [Bldg. Use 1 - Warehouse]
- Window 1: Metal Frame, Perf. Spec., Product ID: [Bldg. Use 1 - Warehouse]
- Door 3: Insulated Metal, Swinging [Bldg. Use 1 - Warehouse]

Envelopes PASSsed: Design 2% better than code
Design Example

Option 3:
CMU with insulation insert; exposed both sides

We need: $U = 0.090 \ (R = 11.1)$

Insulated CMU with Insert, 10 inch wide…
$U = 0.077 \ (R = 12.99)$
Single Wythe CMU – Viable Solution for all Climates

SUMMARY - Learning Objectives

• Learn what Aminoplast Injection Masonry Foam is.
  • Understand what Next Generation CMU are.
  • Appreciate the Masonry Foam is a very cost effective & greatly enhances CMU Wall performance.
  • Develop awareness that Masonry Foam does not increase Fire Ratings.
  • Understand that liabilities may accrue when using false performance claims.
Learning Objectives

- Learn what Aminoplast Injection Masonry Foam is.
- **Understand what Next Generation CMU are.**
  - Appreciate the Masonry Foam is a very cost effective & greatly enhances CMU Wall performance.
  - Develop awareness that Masonry Foam does not increase Fire Ratings.
  - Understand that liabilities may accrue when using false performance claims.

By the end of this session, attendees will understand that:

1. **Energy code compliance does not require continuous insulation.**
2. Web configurations are not regulated by web thickness, but rather by the cross-sectional area of the webs connecting the face walls.
3. Increasing $f'_{m}$ from 1500 psi to 2000 psi lets structural engineers spread vertical rebar to achieve significant savings.
4. Experience confirms that open-end CMU can be laid twice as fast as closed-end CMU to shorten construction schedules.
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Bonus Question... Answer?

What is wrong in this drawing?
Final Questions ...

Any Foam or Next Gen Jobs?

Thank You!