There is a story of a young architect today analyzing a building constructed in the 1950s with solid masonry walls and single paned glass used on the exterior of the structure. That young architect referred to the building as an "old, masonry, energy inefficient building." In the present context of the 21st century, it is not energy efficient using today's standards. But, when it was built, as with most other buildings at that time, very little insulation was used because energy was a cheap commodity and architects and owners did not require use of insulation in their building envelopes.

Insulation and other techniques for energy conservation are coming to the fore today. Therefore, masonry buildings and other building types have been upgraded with different types of insulations. The use (in the 1950s and 1960s) of zonolite, vermiculite and perlite was used initially in the cores of concrete masonry units and wall cavity's to increase the masonry's marginal thermal performance. This satisfied the increased energy demands. In the earlier part of the 20th century, some insulation materials utilized on the inside of ice houses built in Chicago were horse hair and cork.

CAVITY WALL HISTORY: 200 YEARS

Cavity walls are not new, they have been observed in ancient Greek and Roman structures. At the Greco-Roman town of Pergamum, on the hills overlooking the Turkish town of Bergama, a stone wall of cavity type construction still exists.

Sometime in the early part of the 19th century, the cavity wall was rediscovered by the British. Plans dating as early as 1805 suggest a type of cavity wall construction. It featured two leaves (wythes) of brick, bonded by brick headers, spanning across a 6" cavity. An early British publication (dated 1821) suggests the use of cavity walls as a means of protection against moisture penetration. The use of metal ties was introduced in Southern England sometime after 1850. These original ties were made of wrought iron.

Cavity walls were first built in the United States late in the 19th century. Figure 1 illustrates an alternate type of cavity wall system originally featured in an 1899 text book assembled for people engaged in the engineering professions and construction trades. However, it was not until 1937 that this type of construction gained official acceptance by any building or construction agency in the United States. Since then, interest in and use of cavity walls in this country has rapidly increased. This has resulted in extensive testing to determine cavity wall properties and performance.

IN THE EARLIER PART OF THE 20TH CENTURY, SOME INSULATION MATERIALS UTILIZED ON THE INSIDE OF ICE HOUSES BUILT IN CHICAGO WERE HORSE HAIR AND CORK.
The early use of cavity walls in this country was limited primarily to exterior load-bearing walls in low rise construction. In the 1940s, designers began to recognize the advantages of cavity walls in high-rise buildings. Today, masonry cavity walls are the preferred wall system and are used extensively throughout the United States in all types of buildings. The primary reasons for their popularity are: superior resistance to rain penetration, excellent thermal properties, excellent resistance to sound transmission and high resistance to fire.

At the first North American Masonry Conference (1978), at the University of Colorado Boulder, masonry design professionals and research professors gathered from around the world for paper presentations and discussion. Water penetration and solid masonry walls were being discussed along with the now more accepted insulated cavity wall currently being designed and constructed in America.

Timber West, an elder scholar from England, who had an Albert Einstein white head of hair and a white handle bar mustache, addressed the crowd. He cleared his throat and said, “When are you bloody Colonialists going to learn that if you want to build brick masonry walls that won’t leak, you have to build a cavity wall. We (British) have been doing it for the last 200 years…” He silenced the audience.

MODERN ERA OF INSULATED MASONRY WALLS

The insulation used in masonry buildings changed drastically in the mid 70s due to the Arab oil embargo. Long lines of cars waiting to get gas along with increased energy demands promulgated new energy codes – this phenomenon changed the design world. Requirements for minimum R-values for various types of construction came into being. Masonry, concrete and precast industries were given credit for their mass in tempering the exterior temperature fluctuation. To meet these needs, a variety of insulations were used.

- BATT INSULATION
- EXPANDED POLYSTYRENE
- EXTRUDED POLYSTYRENE
- PHENOLIC FOAM
- POLYISOCYANURATE INSULATION
DESIGN CHALLENGES

The need for higher R-valued walls presented a design problem for architects. Traditionally, architects designed buildings for commercial, industrial, and residential applications. The most economical wall system in the past was solid masonry walls composed of three wythes (or layers) of brick and/or one wythe of brick tied into an 8" concrete masonry back up. The only place you could put rigid insulation in solid walls was on the inside of the building. This gave rise to the use of cavity walls composed of an exterior 4" brick wythe of masonry, a cavity consisting of an air space and closed cell rigid insulation and an interior wythe of the 8" concrete masonry. (Figure 2)

The history of cavity walls goes back many hundreds of years, but the greatest

<table>
<thead>
<tr>
<th>TYPE</th>
<th>XI</th>
<th>I</th>
<th>VIII</th>
<th>II</th>
<th>IX</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-VALUE / IN @ 75° F</td>
<td>3.1</td>
<td>3.6</td>
<td>3.8</td>
<td>4.0</td>
<td>4.2</td>
</tr>
<tr>
<td>DENSITY, MIN PCF</td>
<td>0.7</td>
<td>0.9</td>
<td>1.15</td>
<td>1.35</td>
<td>1.8</td>
</tr>
<tr>
<td>WATER ABSORPTION MAX, % BY VOL.</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>COMRESSIVE STRENGTH MIN, PSI</td>
<td>5</td>
<td>10</td>
<td>13</td>
<td>15</td>
<td>25</td>
</tr>
</tbody>
</table>

Must be protected with 1/2" drywall. (15 minutes of fire protection or greater.)
Extruded Polystyrene (XPS)

<table>
<thead>
<tr>
<th>TYPE</th>
<th>X</th>
<th>IV</th>
<th>VI</th>
<th>VII</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENSITY, MIN., PCF</td>
<td>1.35</td>
<td>1.60</td>
<td>1.80</td>
<td>2.20</td>
<td>3.00</td>
</tr>
<tr>
<td>R-VALUE/INCH @75ºF MIN.</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>COMPRESSIVE STRENGTH, MIN., PSI</td>
<td>15</td>
<td>25</td>
<td>40</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>WVP, MAX. PERM FOR 1”</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>WATER ABSORPTION, MAX., %/VOL.</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Most cavity applications use Type X or Type IV. All roof and interior wall systems incorporating extruded polystyrene insulation must consider adequate fire protection. Coverings such as 15 minute thermal barriers (1/2” drywall) or other alternatives based on building code diversified tests are regarded as acceptable in most applications.

Must be protected with 1/2” drywall. (15 minutes of fire protection or greater.)

HISTORY OF INSULATION

Extruded Polystyrene (XPS)

<table>
<thead>
<tr>
<th>TYPE</th>
<th>X</th>
<th>IV</th>
<th>VI</th>
<th>VII</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENSITY, MIN., PCF</td>
<td>1.35</td>
<td>1.60</td>
<td>1.80</td>
<td>2.20</td>
<td>3.00</td>
</tr>
<tr>
<td>R-VALUE/INCH @75ºF MIN.</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>COMPRESSIVE STRENGTH, MIN., PSI</td>
<td>15</td>
<td>25</td>
<td>40</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>WVP, MAX. PERM FOR 1”</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>WATER ABSORPTION, MAX., %/VOL.</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

The NEW Grout System

The NEW BMI Grout System consists of the silo that is pneumatically filled (no bags) with an attached fully automatic Grout Pump. BMI transports the silo with the pump to the jobsite. All the contractor has to do is hook up the hoses and pump. This allows the contractor to do the job more efficiently.

Pump on Silo

The Grout System is fully automatic. Water is injected into the drymix and the grout is pumped up to 500 ft. This system only requires three men to operate it, allowing the rest of the crew to lay block without interruption. BMI returns to the job site to refill the silo per the contractors request. This eliminates dealing with messy bags and helps increase production!

BMI Products produces several different products. We manufacture Gray or Colored Mortars, Adhesives, Plaster, Stucco, Self Leveling Floor and can customize products to suit your every need. Give us a call today!

BMI Products of Northern Illinois, Inc.
28919 W. Rt. 173
Antioch, IL 60002
P: (847) 395-7110 F: (847) 395-7105
www.bmi-products.com

Fax your wall cross section and questions to Chuck Ostrander at 847-297-8373.

Insulation Myths & Deceptive Truths:

Several years ago, a large manufacturer of batt insulation produced television commercials comparing the insulative R-value of 6” of batt insulation to 15” of wood and to 84” of brick masonry. This was a deceptive-ly true statement. However, neither wood nor masonry is marketed as an insulation material. The comparison of R-values of batt insulation to other types of insulation materials (2½” of polyisocyanurate, or 3½” of extruded polystyrene, or 4½” of expanded polystyrene) was not made because the comparison would not favor the batt insulation manufacturer in the general public’s perception. If the masonry industry had responded using the same illogic, you would have seen commercials on TV with the three little pigs building a brick house, and one little pig would be saying to his brother, “Do you realize it takes one half square mile of 6” batt insulation to have the same compres-sive strength of one square inch of brick masonry?”... After a five second pause, the other brother, with a questioning look on his face, would say “Did you have some bad beer last night?”...

Masonry is a structural and/or architec-tural material. You don’t build buildings with just insulation. In the Midwest climate, the Masonry Advisory Council encourages the use of insulation with masonry. The masonry industry needs insulation with its product, with the exception of masonry used as a passive solar heat storage medium.

Fax your wall cross section and ques-tions to Chuck Ostrander at 847-297-8373.
impetus for its use is for a more rain resistant type of wall system compared to solid masonry. In addition, it was more energy efficient as a corollary. Below are various wall cross sections and the R-value of the total wall system including the insulation selected. It is hoped this is of assistance to you in designing energy efficient walls in the future.

Jonathan Satko joined The Dow Chemical Company in 2001 after serving as architectural systems manager for polyisocyanurate insulation products with the Celotex Corporation. He has been involved in the construction products industry since graduating from Western Illinois University with a BA in mass communications in 1989. Satko has been an associate member of the Construction Specifications Institute (CSI) and Association of Licensed Architects (ALA), and is currently associated with the Bloomington-Normal Illinois Chapter of the National Association of Home Builders (NAHB).

jsatko@dow.com, 630-882-8164
R-VALUE OF VARIOUS WALL CROSS SECTIONS OF

**BRICK VENEER OVER 4” WOOD FRAME CONSTRUCTION**

<table>
<thead>
<tr>
<th>WALL COMPONENT</th>
<th>R-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Air Film</td>
<td>0.17</td>
</tr>
<tr>
<td>3⅜” Clay Brick</td>
<td>0.44</td>
</tr>
<tr>
<td>1” Air Space</td>
<td>0.97</td>
</tr>
<tr>
<td>1” Thermax Insulation</td>
<td>6.50</td>
</tr>
<tr>
<td>R-11 Batt Insulation</td>
<td>11.00</td>
</tr>
<tr>
<td>⅛” Drywall</td>
<td>0.45</td>
</tr>
<tr>
<td>Inside Air Film</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>TOTAL WALL R-VALUE</strong></td>
<td><strong>20.21</strong></td>
</tr>
</tbody>
</table>

**BRICK VENEER OVER 6” WOOD FRAME CONSTRUCTION**

<table>
<thead>
<tr>
<th>WALL COMPONENT</th>
<th>R-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Air Film</td>
<td>0.17</td>
</tr>
<tr>
<td>3⅜” Clay Brick</td>
<td>0.44</td>
</tr>
<tr>
<td>1” Air Space</td>
<td>0.97</td>
</tr>
<tr>
<td>1” Thermax Insulation</td>
<td>6.50</td>
</tr>
<tr>
<td>R-19 Batt Insulation</td>
<td>19.00</td>
</tr>
<tr>
<td>⅛” Drywall</td>
<td>0.45</td>
</tr>
<tr>
<td>Inside Air Film</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Total Wall R-Value</strong></td>
<td><strong>28.21</strong></td>
</tr>
</tbody>
</table>

**HISTORY OF INSULATION**

- Brick Veneer over 4” wood frame construction
- Brick Veneer over 6” wood frame construction

**OFFERING**

- Product knowledge
- Personalized services
- Extensive network of top-rated suppliers
- Color and style matching for brick & stone of any age
- Products spotted for efficient mason use
- Impressive on-time delivery performance

**INSPIRING VARIETY OF BRICK & STONE FOR YOUR DISTINCTIVE PROJECTS**

*from the little guy you like to deal with...*

NIBS
NORTHERN ILLINOIS BRICK & SUPPLY

Bowerston Shale • Cloud Ceramics • Cultured Stone • Dufferin Stone • Eldorado Stone • Glen Gery Brick • Jenkins Brick • Kansas Brick & Tile • Lakewood Brick & Tile • Mutual Materials • Natural Stone Veneers • Pine Hall Brick & Pavers • Rademann Stone • Redland Brick • Richards Brick • Robinson Brick • Rockwood • Sioux City Brick • Streator Brick • Summit Brick & Tile

Brick • Split Face Block • Custom Cast Limestone • Stone Veneer • Paving & Retaining Wall Materials • Masonry Supplies

**ELGIN**
39W180 Highland Ave.
847-468-0091
847-468-0116 fax

**MOKENA**
18911 S. Wolf Rd
708-479-5858
708-479-5826 fax
www.northernillinoisbrick.com
THE TOTAL WALL SYSTEM INCLUDING INSULATION

**BRICK VENEER OVER STEEL STUDS WITH BATT INSULATION**

*TAKING INTO ACCOUNT STEEL STUD THERMAL SHORTING AND ASHRAE 90.1 CORRECTION FACTORS*

<table>
<thead>
<tr>
<th>WALL COMPONENT</th>
<th>R-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Air Film</td>
<td>0.68</td>
</tr>
<tr>
<td>1/2&quot; Drywall</td>
<td>0.45</td>
</tr>
<tr>
<td>R-19 Batt Insulation</td>
<td>19.00</td>
</tr>
<tr>
<td>1/2&quot; Dens-Glass Gold</td>
<td>0.56</td>
</tr>
<tr>
<td>15# Felt</td>
<td>0.01</td>
</tr>
<tr>
<td>2&quot; Airspace</td>
<td>1.36</td>
</tr>
<tr>
<td>3 3/8&quot; Clay Brick</td>
<td>0.44</td>
</tr>
<tr>
<td>Outside Air Film</td>
<td>0.17</td>
</tr>
<tr>
<td>Apparent R-Value</td>
<td>22.67</td>
</tr>
<tr>
<td><strong>ACTUAL R-VALUE</strong></td>
<td><strong>11.27</strong></td>
</tr>
</tbody>
</table>

**BRICK VENEER OVER STEEL STUDS WITH EXTERIOR RIGID INSULATION**

*TAKING INTO ACCOUNT STEEL STUD THERMAL SHORTING AND ASHRAE 90.1 CORRECTION FACTORS*

<table>
<thead>
<tr>
<th>WALL COMPONENT</th>
<th>R-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Air Film</td>
<td>0.68</td>
</tr>
<tr>
<td>1/2&quot; Drywall</td>
<td>0.45</td>
</tr>
<tr>
<td>Wall Air Space</td>
<td>1.62</td>
</tr>
<tr>
<td>1/2&quot; Dens-Glass Gold</td>
<td>0.56</td>
</tr>
<tr>
<td>Air Infiltration Barrier</td>
<td>-</td>
</tr>
<tr>
<td>2&quot; Thermax Insulation</td>
<td>13.00</td>
</tr>
<tr>
<td>Air Space</td>
<td>.97</td>
</tr>
<tr>
<td>3 5/8&quot; Clay Brick</td>
<td>0.44</td>
</tr>
<tr>
<td>Exterior Air Film</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>TOTAL WALL R-VALUE</strong></td>
<td><strong>17.89</strong></td>
</tr>
</tbody>
</table>

**EFFICIENT SAFE ERGONOMIC**

New P-Series Machine

- Single Mast Set-up
- 10 ft Per Minute Speed
- Quick & Easy Assembly

**TNT EQUIPMENT CO.**

*We Make It Happen!*

**HYDRO MOBILE**

Rising with you

- Indiana’s #1 Choice of hydraulic scaffolding
- Offering efficiency to increase productivity

**EZ Grout Corporation**

Indiana’s Authorized Distributor

RENTAL | SALES | SERVICE  800-827-6846

6677 Broughton Ave.
Columbus, OH 43213
Fax 614-882-0751
HISTORY OF INSULATION

1980s TRADITIONAL CAVITY WALL

- 3 5⁄8˝ BRICK
- 7 5⁄8˝ CMU
- 2˝ THERMADRAIN WITH POLYISOCYANURATE (DOW SUPER TUFF R-C)
- 1.5˝ INSULATION
- 3⁄8˝ DRAINAGE MATERIAL
- 23⁄8˝ TOTAL THICKNESS
- 5⁄8˝ TOLERANCE/ANCHOR SPACE
- 1⁄4˝ OVERHANG

R-Value of Wall Using Polyisocyanurate

- 1 1⁄2˝ 15.93
- 2˝ 19.13
- 2 1⁄2˝ 21.93

R-Value of Wall Using Extruded Polystyrene

- 1 1⁄2˝ 11.81
- 2˝ 14.31
- 2 1⁄2˝ 16.81
- 3˝ 19.31

SOLID COMPOSITE MASONRY WALL

- 3 1/2˝ brick
- 1 1/4˝ overhang

CAVITY WALL R-VALUES WITH VARIOUS INSULATION CONFIGURATIONS

- 3 5⁄8˝ BRICK
- 7 5⁄8˝ CMU
- 2˝ THERMADRAIN WITH POLYISOCYANURATE (DOW SUPER TUFF R-C)
- 1.5˝ INSULATION
- 3⁄8˝ DRAINAGE MATERIAL
- 2 1⁄2˝ TOTAL THICKNESS
- 1⁄4˝ OVERHANG

R-Value of Wall Using Polyisocyanurate

- 1 1⁄2˝ 14.52
- 2˝ 17.73
- 2 1⁄2˝ 20.53

R-Value of Wall Using Extruded Polystyrene

- 1 1⁄2˝ 11.77
- 2˝ 14.27
- 2 1⁄2˝ 16.77

R-Value of Wall Using Expanded Polystyrene

- 1 1⁄2˝ 10.31
- 2˝ 12.31
- 2 1⁄2˝ 14.31
- 3˝ 16.31

SINGLE WYTHE CONCRETE UNITS HARVARD BRICK / HERITAGE BRICK

R-Value of Wall Using Polyisocyanurate

- 2˝ 18.7
- 2 1⁄2˝ 21.5

R-Value of Wall Using Extruded Polystyrene

- 2˝ 13.87
- 2 1⁄2˝ 16.37
- 3˝ 18.87

* INTEGRAL WATER REPELLENT IN CMU AND MORTAR
THERMAX
RIGID INSULATION
EXPOSED

3 1/8 HOLLOW BRICK
REINFORCED
#4 @30” O.C.

1/2” DRYWALL

R-Value of Wall
Using Thermax

2” 14.52
2 1/2” 17.32

13’ 0”

4” SINGLE WYTHE
HOLLOW REINFORCED BRICK

For nearly 80 years, the name Halquist has been
synonymous with stone. Quarrying throughout
Wisconsin and the Upper Peninsula, we make it
easy to select the right stone for your building,
remodeling and landscaping projects.
Halquist Stone...your #1 source for stone!

ROCKING AMERICA SINCE 1929

HALQUIST
STONE

800.255.8811
halquiststone.com

-commercial, industrial, institutional,
multi-family and retail construction.

J. and E. DUFF
mason Contractors

providing quality masonry construction since 1956

Mail: P.O. Box 368, West Chicago, IL 60186
Ship: 909 W. Washington St., West Chicago, IL 60185
Phone: (630) 562-3800 Fax: (630) 562-3801
Email: info@jeduff.com

Building America’s dream retreat...
...one stone at a time.