A brand of

BRICKWORKS
BUILDING PRODUCTS
Brickworks & Glen-Gery Facts

Brickworks was formed in 1934
Headquartered in Sydney, Australia
Australia’s largest brick manufacturer, with operations in all major states
Acquired Glen-Gery Corporation in 2018

Glen-Gery was founded in 1890
Glen-Gery Corporation is one of the nation’s largest brick manufacturers and operates nine brick manufacturing facilities and one manufactured stone facility
Glen-Gery products are sold nationally through a network of over 500 distributors as well as in Canada
Manufacturing Locations
Klaycoats & Engobes
York Handmade Brick
Creative Mines
Black, White & Grey Brick
OUR VALUES:

CARE
COLLABORATE
EXCEED
INNOVATE
INTEGRITY
LEAD

Thank You
Glen-Gery provides design professionals:

**Products**

- Face Brick
- Thin Brick
- Structural Brick
- Manufactured and Natural Stone
- Pavers
- Glazed Brick
- Colored and Preblended Mortar

**Support**

- Product and Technical Profiles
- Case Studies
- AIA Presentations
- Wall System Guidance/Suggestions
- Detail Review
- Specification Review
- Guide Specifications
The Basics of Brickwork Detailing

Leroy Danforth, Architectural Engineer
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Course Description

This program will address proper design of a brick veneer / cavity wall system. We will also see how to flash properly, proper workmanship practices, and recommended types of mortar as well as proper spacing and sizing of soft movement/expansion joints.
Learning Objectives

- Review location, spacing and detailing recommendations for movement joints
- Identify installation best practices that promote quality brickwork
- Design and select materials for optimum water penetrations resistance.
- Discuss efflorescence, cleaning and the use of clear coatings on masonry walls.
Resources

Technical Notes

7 Series – Water Penetration Resistance

8 Series – Mortars for Brick Masonry

18 Series – Expansion of Brickwork

28 Series – Brick Veneer Systems

www.gobrick.com
Introduction
Managing Masonry Movement

1. Accommodate (allow) movement
   - Expansion joints
   - Control joints
   - Bond breaks/Slip planes

2. Resist (restrain) movement
   - Joint reinforcement

3. Reduce differential movement
   - Use like materials
Movement Joints

CJ?

MJs?

EJ?
Expansion and Control Joints

Control Joints are for shrinking materials.

Expansion Joints are for expanding materials.
Estimating Movement and Expansion Joint Spacing
Driving Forces

| Changes in Temperature | ↑ = expansion  
|                       | ↓ = shrinkage  
| Changes in Moisture content | ↑ = expansion  
|                          | ↓ = shrinkage  
| Loading                 | Creep  
|                          | Deflection  

Type and extent of movement depends on material
Calculations for Movement*

Estimated Expansion

\[ m = \left[ 5 \times 10^{-4} + 6 \times 10^{-6} (T_m - T_c) \right] L \]

- moisture expansion
- thermal expansion

- \( m \) = total expansion, in.
- \( T_m \) = max. wall temperature
- \( T_c \) = installation temperature
- \( L \) = length of wall element, in.

Movement Joint Spacing

\[ s = \frac{(w \times c)}{\left[ 5 \times 10^{-4} + 6 \times 10^{-6} (T_m - T_c) \right]} \]

- \( s \) = spacing of movement joints
- \( w \) = width of movement joint
- \( c \) = compressibility of sealant

*From BIA Technical Note 18A*
Coefficients of Thermal Expansion

<table>
<thead>
<tr>
<th>Material</th>
<th>Coefficient</th>
<th>Movement (in/100 ft./100°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick Masonry</td>
<td>3.6</td>
<td>7/16&quot; (11 mm)</td>
</tr>
<tr>
<td>Lightweight CMU</td>
<td>4.3</td>
<td>1/2&quot; (13 mm)</td>
</tr>
<tr>
<td>Dense CMU</td>
<td>5.2</td>
<td>5/8&quot; (16 mm)</td>
</tr>
<tr>
<td>Structural Concrete</td>
<td>6.0</td>
<td>3/4&quot; (19 mm)</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>6.7</td>
<td>13/16&quot; (20 mm)</td>
</tr>
<tr>
<td>Aluminum</td>
<td>12.8</td>
<td>1-9/16&quot; (39 mm)</td>
</tr>
</tbody>
</table>
Simple Expansion Joint Spacing

- Joint width of 3/8 to 1/2 inch
- 20-25 ft spacing for vertical joints
- 2 ft. to 10 ft. from corners

Expelled joint material indicates inadequate joint size or spacing
Expansion Joint Detailing/Construction

Premolded Foam Pad

Neoprene Pad

Sealant & Backer Rod
Suggested Expansion Joint Locations

The Brickyard
Playa Vista, CA
corner MJ rule-of-thumb (1)

\[ L_1 + L_2 < \text{Typ. Spacing Between Expansion Jts.} \]

Either \( L_1 \) or \( L_2 \) \( \leq 10 \text{ ft.} \)

note from International Masonry Institute (IMI) (2010)

consider \( L_1 \) or \( L_2 \) 4-feet +/- when bricks are: new, dark colored, large sized, exposed to abundant heat gain, used in facades multiple openings.

inadequate MJ locations

vague specification language:
"Install expansion joints 20'-0" on-center."

miscellaneous building plan

crack
EXPANSION JOINTS

(a) EXPANSION JOINTS

(b)
Expansion Joints at Openings

Loose Lintel
- End of lintel
- Aligned with jamb
- Between openings

Fixed lintel
- Both ends of lintel

Shelf angle
- Designer’s choice
Different Wall Thickness or Height

Flexible joint filler

Flexible pointing sealant
Different Support Conditions
Horizontal EJ @ Shelf Angle

- Creep
- Rotation
- Deflection
- Tolerances
- Dimensional Variation

- Flashing to exterior of wall
- Shelf angle
- Sealant
- Backer rod
- Compressible Filler
Horizontal Expansion Joint

- No mortar at toe of shelf angle
- Flashing one course up does not work as well
Lipped Brick
Fixed Elements
Resisting Water Penetration
Durability of Masonry

Dependent upon

• Quality Product
• Proper Installation
  • Good Workmanship
• Proper design / detailing
• Maintenance
Drainage Wall Concept

- Water travels down the back face of the brickwork
- Collected by Flashing
- Led to the exterior through weepholes
Drainage Wall Elements
Air Space
Air Space

- Prevents moisture absorbed by veneer from wetting the rest of the wall
- Allows water to drain before wetting the rest of the wall.

Minimum 1” wide (residential)
2” recommended (commercial)
Air Space Recommendations

Insulation in cavity

2 inch cavity, but....

1 inch “clearance” minimum between insulation and brick
Mortar has fallen into the cavity between the outer brick veneer and the inner concrete block walls, creating a "bridge" for moisture.

Narrow air spaces are more easily blocked with mortar.
Mortar Collection Devices

Prevent blockage of weeps or mortar bridges
Water-Resistive Barrier
Water-Resistive Barrier

- Protects sheathing from liquid water.
- Maybe air permeable or impermeable (air barrier)

Materials:
- Polymeric membranes (e.g. Tyvek)
- Self-adhered membranes (e.g. Blueskin)
- Spray/Fluid membranes (e.g. Laticrete)
Water-Resistive Barrier

Sheet

• Must be lapped shingle style

Spray/Fluid applied

• Need transition materials to cover gaps in substrate

Board materials

• Must have joints between boards taped/sealed
Flashing

Collects water and directs it out of wall through weeps
Flashing Materials

Detailed recommendations in BIA TN 7A
Sheet and Pre-Formed Metal Flashing

• Copper
• Stainless Steel
• Galvanized Steel

• Excellent Durability
• Copper & Stainless Steel last the life of the wall
• Self adhered now available
• May be damaged during shipping
Composite/Laminated Flashings

Advantages:

• Life of the wall

• Less expensive than sheet metal flashing

• Easily formed by hand for irregular surfaces.

• Available with pre-formed corners & end dams

• Asphalt free materials recommended
Flashing / Air Barrier / Insulation Compatibility

<table>
<thead>
<tr>
<th></th>
<th>Spray Polyurethane Foam</th>
<th>Liquid Applied Asphalitic Air Barrier</th>
<th>Liquid Applied Acrylic Air Barrier</th>
<th>Membrane Applied Asphalitic Air Barrier</th>
<th>Polystyrene Foam Insulation</th>
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</thead>
<tbody>
<tr>
<td>Asphaltic copper fabric</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>Multi-Flash copper fabric</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
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<tr>
<td>Flash-Vent Copper Drainage</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
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<tr>
<td>EPDM</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>PVC</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>PVC Elvaloy® Self Adhered</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Peel &amp; Stick</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

- **Red**: NOT COMPATIBLE
- **Green**: COMPATIBLE
- **Yellow**: CAUTION
Plastic/Rubber Flashings

- Polyethylene
- PVC
- EPDM
- Self-adhesive

- Minimum 40 mil thickness recommended
Extend UV Sensitive Flashing with a Drip Edge
Slope Sills (and caps)
Min. 15 degrees, (approx. ¼” per inch)
Weepholes

- Place immediately above through wall flashing
- Include vents at top of wall/floor for glazed brick

Open/Vents: 24-32” o.c.
Wicks/Tubes: 16” o.c.
Weeps as Vents

Airflow through vents promote drying and reduce the potential for water related problems
Corrugated Anchors

Only compatible with

- Wood studs
- 1” cavity

Insufficient stiffness for other applications
Adjustable Anchors

Adjustable anchors required for steel studs
Joint Reinforcement

Suitable for masonry backings

Truss/triangular wire should not extend into brick wythe
Joint Reinforcement

Bed joints in veneer and backing wythes should align when joint reinforcement is used.
Joint Reinforcement

Alignment of bed joints between wythes is necessary when masonry is connected by:

a) Adjustable joint reinforcement
b) Truss type joint reinforcement
c) Ladder type joint reinforcement
d) All of the above
Workmanship
Full Head Joints
Properly Struck Joints

Moisture resistant joints

- Concave
- Vee
- Grapevine
Consider impact of raked joints, especially where exposure is more severe.

Roseland Condos
North Bergen, NJ
Weathered joints can create the desired shadow lines, while providing better water penetration resistance than raked joints.
Full Head Joints
WIRE
WOOD STRIP
BEVELED BED JOINTS
Protect from Cold Weather
Cover Unfinished Work
### Types of Mortar – ASTM C270

#### Proportion Requirements

<table>
<thead>
<tr>
<th>Type</th>
<th>Cement</th>
<th>Lime</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>1</td>
<td>¼</td>
<td>3 ¾</td>
</tr>
<tr>
<td>S</td>
<td>1</td>
<td>½</td>
<td>4 ½</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>O</td>
<td>1</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

Use the weakest compressive strength required

Lime adds workability – so does air *(What's Cheaper?)*

Type N PCL by proportion meets Type S properties
Flashing - Properly lapped & sealed
A Recipe for Efflorescence

Soluble compounds + Water or other solvent + Path to exterior surface
Houston, We Have a Problem
Efflorescence Prevention Strategies

Minimize sources of soluble compounds

Prevent water penetration and quickly direct water out of masonry

Disrupt potential pathways between soluble compounds and brick
Water Repellent Coatings

Not typically recommended for new brickwork

When appropriate, compatible types include breathable, penetrating products like silanes and siloxanes (breathable)
Questions?

This concludes The American Institute of Architects Continuing Education Systems Program

Dr. Nettie Stevens Science Center, Westfield State University Westfield, MA

www.glengery.com