Concrete Masonry Sustainable Construction

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National Concrete Masonry Association

Definition of Sustainability

1987 UN World Commission on Environment and Development

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.

U.S. Building Impacts:

- 12% Water Use
- 30% Greenhouse Gas Emissions
- 65% Waste Output
- 70% Electricity Consumption

Can you recognize “green” construction when you see it?

Consider the extremes:

Straw bale construction
- Very ‘green’
- Inexpensive
- Good thermal characteristics
- Limited durability.

Titanium construction
- Very durable
- Expensive

What is the size of your footprint?

- Accountability
- Set Expectations clearly
- Can not stick

Average Savings of Green Buildings

- ENERGY SAVINGS 30%
- CARBON SAVINGS 35%
- WATER USE SAVINGS 30-50%
- WASTE COST SAVINGS 50-90%

Source: Capital E

Sustainable Construction

National Concrete Masonry Association
Masonry Construction

Roman aqueducts – 150 AD

Modern Concrete Masonry Construction

Balance of extremes:
Provides the ease of maintenance and long-term durability at an affordable price.
But, may not be enough to convince the “build-and-unload” owner looking to maximum profit with straw bale construction.

“Green” Construction

Advantages of Concrete Masonry:
• Lower maintenance costs
• Use of recycled materials
• Reduced operating costs
• Flexibility in design
• Lower life cycle assessment costs (cradle to grave)
• Security (fire, hurricanes, tornadoes, etc)

Does this make it “green”?

Points Required for the Three Different Levels of Green Building

<table>
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<tr>
<th>Level</th>
<th>Silver</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot Design, Preparation, and Development</td>
<td>8</td>
<td>12</td>
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<tr>
<td>Resource Efficiency</td>
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<tr>
<td>Energy Efficiency</td>
<td>57</td>
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<td>Water Efficiency</td>
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<td>Indoor Environmental Quality</td>
<td>32</td>
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<td>Operation, Maintenance, and Hazardous Substances</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Global Impact</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Additional Points From Other Sections of Your Choice</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Lot Design, Preparation, and Development
- Erosion and Sedimentation Control
- Site Selection
- Development Density
- Brownfield Redevelopment
- Alternative Transportation
- Reduced Site Disturbance
- Stormwater Management
- Heat Island Effect
- Light Pollution

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Resource Efficiency
Objectives: to extend the life of existing building stock, conserve resources, reduce waste and reduce environmental impact of new buildings as they relate to materials manufacturing and transport.

Resource Efficiency
- Reduce Quantity of Materials and Waste
  - Utilizing modular construction (increments of 8 inches minimizes cutting and waste.
  - Units not used on a project can be utilized on another project or recycled.
Resource Efficiency

- **Enhance Durability and Reduce Maintenance**
  - Architectural units do not need repainting and are very aesthetically pleasing.
  - Life of concrete masonry is 100+ years.

- **Reuse Materials**
  - Consider reuse of existing building rather than new construction.
  ⇒ Masonry buildings are likely candidates for reuse because of their durability.

- **Use Recycled Content Materials**

Examples of “green” materials for concrete masonry production

**Cement Replacements**
- Fly ash
- Granulated blast furnace slag cement
- Other pozzolans

**Aggregate Replacements**
- Bottom ash
- Plastics
- Glass
- Rubber
- Other

- Fly ash: waste product from coal burning plants

Resource Efficiency

- **Recycle Waste Materials During Construction**
  - Consider reuse of existing building rather than new construction.
  ⇒ Masonry buildings are likely candidates for reuse because of their durability.

- **Construction Waste Mgmt.**

  - **New construction:**
    - Saw-cut or scrap masonry materials can be crushed and recycled into new masonry materials.
    - Intact, unused masonry materials can be used on another project or donated to a charity.
Construction Waste Mgmt.

- **Demolition:**
  - Masonry materials can be crushed and recycled into new masonry materials.
  - CMU can be crushed and used as aggregate for road beds or construction fill.
  - Crushed clay brick can be recycled as brick chips for landscaping.

Resource Reuse

- **Use salvaged, refurbished or reused materials, products and furnishings**
- **Strategies:** Reuse clay brick and masonry paving units.
  - Concerns associated with reusing mortared brick include bond and unit specifications.
  - Sand set pavers can easily be reused.

Regional Materials

- **Intent:** Increase demand for building materials that are manufactured locally.
- **Strategies:** Choose materials manufactured locally.
  - Most masonry materials are manufactured locally.

Regional Materials

- **Intent:** Increase demand for building materials that are extracted and manufactured locally.
- Most masonry materials are made from locally extracted materials.

Resource Efficiency

- **Recycle Waste Materials During Construction**
  - Consider reuse of existing building rather than new construction.
  - Masonry buildings are likely candidates for reuse because of their durability.

Energy Efficiency

Use masonry to:

- Reduce peak heating and cooling loads.
- Shift peak heating and cooling loads to non-peak hours.

- Reduce the size of HVAC systems.
- Reduce energy requirements for parking lot lighting. (ID credit)

Benefits of Thermal Mass

- Moderate indoor temperature swings.
- Greater comfort for occupants.
Insulation strategies

Taking advantage of thermal mass properties / equivalent R-value

Resource Efficiency

- Innovative Options
  - Life cycle considerations

Innovation in Design

- Fire protection through balanced design

1. Automatic Detection Systems (Alarms)
2. Automatic Suppression Systems (Sprinkler Systems)
3. Compartmentation - using non-combustible materials (Masonry)

Innovation in Design

- Fire protection through balanced design

ASTM E 119 - Would you believe that these are both 2-hour rated walls?

Robustness in Fires

Egress Protection

Hardened walls

Stair and Elevator Shafts
How Much Does Fire Safe Construction Cost

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Cost</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry &amp; Precast Single Bedroom Scheme</td>
<td>$14,316,223</td>
<td>105%</td>
</tr>
<tr>
<td>Masonry &amp; Precast Multiple Bedroom Scheme</td>
<td>$14,440,514</td>
<td>101%</td>
</tr>
<tr>
<td>Conventional Wood Framing Single Bedroom Scheme</td>
<td>$13,636,238</td>
<td>100%</td>
</tr>
<tr>
<td>Conventional Wood Framing Multiple Bedroom Scheme</td>
<td>$14,262,504</td>
<td>100%</td>
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Next Steps

- Additional cities (more than 25)
- Executive summary
- Insurance savings study
- Life cycle / energy study
Innovation in Design

- Acoustics

Performance measured by sound transmission classification (STC)

Performance measured by noise reduction coefficient (NRC)

Innovation in design

- Indoor air quality

Eliminating or reducing VOC emitting walls and floorings. Specify durable exposed materials that require no surface treatment.

Reducing or eliminating use of mold susceptible materials

Life Cycle Assessment

ASTM E 2432
Guide for General Principles of Sustainability Relative to Buildings

Why choose masonry?

- Form and function
- Versatile designs
- Long-term durability
- Fire-resistant
- Energy efficient
- Sound insulation
- Strength

Sustainable

Questions?

703-713-1900