

Innovations Position Masonry for the Future

By Phillip Samblanet, P.E.

While masonry is arguably man's oldest construction material and examples can be found from 10,000 years ago, innovation continues through the development of new masonry materials, construction methods and design methods. A few exciting innovations that structural engineers should be aware of include:

Autoclaved Aerated Concrete Masonry

While stone, brick and concrete masonry continue to be the most widely used materials, Autoclaved Aerated Concrete (AAC), which was developed in Europe, is gaining popularity because of its light weight, fire resistance, sound dampening characteristics, thermal resistance, and ease of construction. To provide designers with technical information, the US industry recently conducted extensive research that has led to design provisions; these are now included in the 2005 edition of the Masonry Standards Joint Committee's (MSJC) *Building Code Requirements for Masonry Structures* (ACI 530/ASCE 5/TMS 402). With the adoption by model building codes, designers will have another option for the design of buildings. (www.aacpa.org)



AAC Masonry building under construction

Self-Consolidating Grout

This material is gaining popularity quickly, as these grouts have extremely high fluidity allowing them to flow in confined spaces of reinforced masonry walls. Some industry leaders believe that self consolidating grout will become the grout of choice because of the ease of use, excellent fluidity leading to thorough filling of grout spaces, and high strength. (www.masonrysystems.org/whymasonry/10212004846.php)

FRP Reinforcement

Composite materials are increasingly being used with masonry materials, especially to strengthen and repair existing structures. However, the potential to use composites on new masonry buildings is also attractive. The Masonry Society is working with the American Concrete Institute on drafting guidelines for the use of composite materials on masonry. (www.acmanet.org) (www.mdacomposites.org)

New methods

Masonry design and analysis methods are also advancing. (www.masonrystandards.org)

- Strength design procedures continue to evolve and become more popular. They parallel, in many ways, strength design procedures for reinforced concrete. Thus, new designers find using masonry strength design procedures familiar, even when they have not been formally trained in masonry design.

- The MSJC is considering performance-based design procedures.
- To assist with more common types of masonry structures, the MSJC and The Masonry Society are also working on prescriptive design approaches. For example, The Masonry Society's High Winds Task Group is developing criteria for residential and low-rise masonry structures in hurricane-prone regions.

High Tech Advancements

Unique materials are being advanced to allow condition assessment of new and existing masonry structures.

- **Smart-brick.** The University of Illinois at Urbana-Champaign has developed a "smart brick" which monitors the condition of masonry through a multi-modal sensor package and wireless technology. The prototype sensors monitor the building's temperature, vibration, and movement. Advances could also sense moisture conditions and corrosion exposure of embedded items such as veneer ties. Benefits of "smart bricks" include monitoring existing structures for climatic exposure and post-disaster condition assessment.
- **Nanotechnology.** Penstar Corporation, in partnership with Advanced Design Consulting (ADC), is working to embed sensors in a masonry wall to provide data feedback on moisture content, movement, temperature, pH, as well as the concentration of chloride, sodium and potassium ions within concrete masonry units. Embedded in the masonry, these devices will provide data for evaluating concrete performance from its freshly mixed stage to its casting. In the completed structure, it would monitor performance during service, deterioration and repair. Real time data on the condition of the wall would then be available to the owners or occupants. Data could be downloaded into a facilities management software.

Quality Assurance, Inspection & Evaluation Tools

New technologies are also being increasingly used in assuring quality construction in the field. A variety of non-destructive tests include:

- Ultrasonic Pulse Velocity,
- Impact Echo
- Vibration Monitoring
- Spectral Analysis of Surface Waves
- Ground Penetrating Radar
- Infrared Imaging seems especially popular recently in verifying appropriate grout placement in reinforced masonry.

These innovations represent a small sampling of new and emerging trends in masonry. Innovations such as these assure that masonry construction will meet the needs of society both today and far into the future. ■



Phillip Samblanet is the Executive Director of The Masonry Society. TMS is the professional, technical and educational society for structural engineers, architects and contractors interested in masonry. For more masonry information, publications or membership contact The Masonry Society (303-939-9700 or www.masonrysociety.org).