ASTM Construction Standards: Supporting the Building Industry

ASTM International and the global construction industry have enjoyed a long and enduring partnership marked by progress and innovation in the building of homes, offices and other facilities worldwide. This relationship dates back to the founding of ASTM, as many of the Society's earliest technical committees and standards were driven by construction-related needs.

Today, more than 1,300 ASTM standards support the safe and economic construction of buildings, with the underlying quality and performance that will stand the test of time. These standards are the work of numerous ASTM technical committees that span a wide range of areas. The collective expertise of many of these committees is contained in the 45th edition of *ASTM Standards in Building Codes*, which contains specifications, practices and test methods that aid in the design of buildings that meet international code requirements.

ASTM INTERNATIONAL
Standards Worldwide

LAYING THE FOUNDATION: COMMITTEES C01 AND C09

Standards from ASTM Committees **C01 on Cement** and **C09 on Concrete and Concrete Aggregates** have long played a significant role in the worldwide construction industry.

Committee C01 on Cement was organized in 1902 to address the need to standardize the many cement specifications that existed at the time. From the start, Committee C01 has been a model of stakeholder collaboration and consensus standards development that is the hallmark of the ASTM International process. With a number of government and industry organizations, including the influential American Association of Portland Cement Manufacturers (later called the Portland Cement Association), all involved in the emerging cement industry in the early 1900s, ASTM offered the opportunity for balanced participation in creating uniform national specifications.

Working together, Committee C01 released its first standard in 1904: ASTM C9, Standard Specification for Cement. The standard was embraced by stakeholders, including manufacturers, engineers, architects and government agencies. Moreover, the release of the ASTM C9 standard turned out to be a watershed event for the young U.S. construction industry. With a single specification covering all general construction cement used in the United States, cement shipments and consumption nearly tripled in the next ten years, driving dramatic industry growth.

C150: THE GLOBAL STANDARD IN CEMENT

Specification C9 was the forerunner to another standard that today is the bellwether specification for cement in the worldwide construction industry — ASTM **C150, Specification for Portland Cement**, which covers the physical and chemical requirements for manufacturing eight types of portland cement, the basic ingredient of concrete. C150 is universally adopted and utilized in the construction industry by cement manufacturers and purchasers as well as concrete producers, specifiers and users.

Over the years, C150 has been revised to address changing industry needs, ensuring the standard's ongoing vitality in building quality and performance. Recent revisions have focused on base cement technology improvements to achieve environmental-related benefits and to support sustainable construction goals. For example, C150 has been revised to include the inter-grinding of limestone, which helps reduce the energy-intensive process of grinding clinker to create cement. In addition, C150 specifies the technically sound inclusion of slag (a steel processing byproduct) and fly ash (a coal processing byproduct) in cement, allowing for the productive re-use of these industrial waste materials.

C01 PERFORMANCE STANDARDS: ADVANCING THE DURABILITY OF CEMENT

ASTM Committee C01 is also investing in the ongoing enhancement of cement performance standards. While standards such as C150 and **C595, Specification for Blended Hydraulic Cements**, address both prescriptive and performance requirements, others, such as **C1157, Performance Specification for Hydraulic Cement**, are principally focused on durability and performance. C1157 specifies cements based on requirements for general use, high early strength, resistance to sulfates attack and heat of hydration.

COMMITTEE C09: THE AUTHORITATIVE SOURCE FOR CONCRETE STANDARDS

A dozen years following the Committee C01 startup, Committee C09 was formed in 1914 to address standardization requirements for concrete. Today, Committee C09 has a membership of approximately 1,100, including more than 100 participants from outside the United States. Thirty-six technical subcommittees have jurisdiction over 160 standards pertaining to concrete and related materials. Like those from Committee C01, the standards created by Committee C09 are woven into the day-to-day workings of the construction industry. For example, C09 standards such as **C94/C94M, Specification for Ready-Mixed Concrete**, cover fresh, unhardened ready-mixed concrete.

ADDRESSING NEW TECHNOLOGIES IN CONCRETE

Recently, Committee C09 has applied its expertise in developing test methods that support the advancement of new concrete technologies. One area of focus is pervious concrete, an environmentally friendly technology that provides communities with a better solution for stormwater management. Pervious concrete captures stormwater and allows it to seep into the ground, reducing runoff and helping to meet U.S. Environmental Protection Agency stormwater regulations. Because of its porous nature, pervious concrete cannot be tested using traditional concrete standards.

In 2008, the new Subcommittee C09.49 on Pervious Concrete filled the standards void by releasing its first method specific to pervious concrete. **C1688/C1688M, Test Method for Density and Void Content of Freshly Mixed Pervious Concrete**, is used as a means to verify that the pervious concrete delivered to a project corresponds to the producer's mix proportions.

Another recent technology that Committee C09 is addressing is self-consolidating concrete/high-performance concrete, which can flow easily into tight and constricted spaces without segregating and without requiring vibration. The committee has released new tests to measure the stability and consistency of self-consolidating concrete. These include **C1621/C1621M, Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring**, which is used in the mix design phase of self-consolidating concrete to assure proper mix optimization. It can also be used for production consistency quality control. Serving a similar purpose is another new C09 standard, **C1610/C1610M, Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique**. Cohesive self-consolidating concrete is especially important for deep-section applications such as walls or columns. As a result, the degree of segregation, as measured by the C1610 test, can indicate the suitability of a concrete mixture for its purpose.

C01 AND C09: COLLABORATION FOR INDUSTRY PROGRESS

Owing to their synergistic missions, ASTM International Committees C01 and C09 often work closely together to achieve common goals. One notable area of collaboration is a joint subcom-

mittee, C09.48/C01.48 on Performance of Cementitious Materials and Admixture Combinations. The group's aim is to develop standards for investigating interactions and evaluating changes in early-age properties when various combinations of hydraulic cements, supplementary cementitious materials, other finely divided materials, water and chemical admixtures are used in cementitious mixtures. In 2008, the subcommittee completed its first standard, ASTM **C1679, Practice for Measuring Hydration Kinetics of Hydraulic Cementitious Mixtures Using Isothermal Calorimetry**, which guides the investigation of the interactions and compatibility of various materials used to produce concrete.

Another important, longstanding area of collaboration between Committees C01 and C09 is the joint sponsorship and management of the **Cement and Concrete Reference Laboratory** (CCRL). Through its laboratory inspection and proficiency sample programs, CCRL collects data useful in developing cement and concrete standards. Materials included in these programs are portland, blended and masonry cements; portland cement concrete, pozzolans, masonry mortar and concrete masonry units. At the beginning of 2009, 1883 laboratories in 40 countries, including the U.S., participate in these programs.

COMMITTEE D08: KEEPING BUILDINGS SAFE AND DRY

Another longstanding ASTM committee that has had an enduring impact on building construction is **Committee D08 on Roofing and Waterproofing**. Formed in 1905, Committee D08 has grown to more than 450 members who continue to deliver innovative standards solutions that protect consumers and provide a common language in the marketplace. With 10 technical subcommittees, D08 is responsible for more than 150 standards for roofing and waterproofing materials, products and systems largely composed of organic materials such as asphalt, coal-tar, polymer modifiers, rubbers and plastics. Considering that most buildings require some form of roofing and waterproofing, the importance of D08 standards can be felt virtually everywhere.

While part of D08's early years were spent addressing the need for core specifications used by roofing and waterproofing product manufacturers, the group's activities have evolved to deliver standards that better define the expected reliability of finished products. D08 standards such as **D7158, Test Method for Wind Resistance of Asphalt Shingles**, meet the performance and safety expectations of consumers. In recent years, D08 has also offered standards that better define the use of roofing and waterproofing products and systems. Standards such as **D5082, Practice for Application of Mechanically Attached Poly(Vinyl Chloride) Sheet Roofing**, guide users on the proper installation of such systems.

New roofing and waterproofing innovations during the last two decades, as well as changes to traditional bituminous roofing technologies, have brought forward Committee D08's continued responsiveness. This was evident with the 2008 release of new standards, including ASTM **D7349, Test Method for Determining the Capability of Roofing and Waterproofing Materials to Seal Around Fasteners**. D7349 measures water migration resistance at the point of penetration. Another new standard, **D7379, Test Methods for Strength of Modified Bitumen Sheet Material Laps Using Cold Process Adhesive**, addresses the use of cold process adhesives in modified bitumen roofing systems.

COMMITTEE E06: PROTECTING BUILDING OWNERS AND OCCUPANTS

While numerous ASTM committees contribute to the construction industry through material- and product-related standards, another committee helps to ensure better building performance and management: ASTM **Committee E06 on Performance of Buildings**. Formed in 1946 during the post-war building boom, Committee E06 addresses topics related to the overall performance, improvement and management of buildings and related facilities. Working on one or more of 18 technical subcommittees, E06's broad global membership of 1,050 experts creates standards that assist building developers, owners and occupants in a number of areas pertaining to building health and safety.

One important role that Committee E06 fills is with standards pertaining to radon testing, lead contamination and asbestos control. The latter issue is the focus of Subcommittee E06.24 on Building Preservation and Rehabilitation Technology, which has published a series of standards that guides building owners in better managing asbestos. Notable among these standards is **E1368, Practice for Visual Inspection of Asbestos Abatement Projects**.

Subcommittee E06.23 on Lead Hazards Associated with Buildings has an extensive portfolio of standards dealing with lead-related issues, including **E1729, Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination**. Radon testing is one of the many topics covered by the standards developed by Subcommittee E06.41 on Air Leakage and Ventilation Performance. Standards such as **E2121, Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings**, provide contractors with a uniform set of practices that ensure a high degree of safety and success in retrofitting low-rise residential buildings with radon mitigation systems.

To help rate the performance of building windows, doors, skylights and curtain walls, Committee E06 has developed a series of standards that test these components in a variety of environmental conditions such as wind and airborne debris. Among the notable test methods in this area is **E1996, Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes**.

Among the recent focus areas by Committee E06 is high-rise building external evacuation devices. Here, Subcommittee E06.77 on High-Rise Building External Evacuation Devices currently offers two standards for equipment to be used in emergencies where primary routes to safety are not accessible: ASTM **E2484, Specification for Multi-Story Building External Evacuation Controlled Descent Devices**, and **E2513, Specification for Multi-Story Building External Evacuation Platform Rescue Systems**.

A new standard in the Committee E06 portfolio focuses on the use of insulating concrete form systems as energy efficient building envelopes for both residential and commercial construction. **E2634, Specification for Flat Wall Insulating Concrete Form (ICF) Systems**, issued at the end of 2008, is used by building officials as an enforcement tool and by architects to ensure that specified ICF products conform to minimum standards.

FACILITATING A SUSTAINABLE FUTURE IN BUILDINGS

Committee E06 activities have also been instrumental in the formation of a new ASTM standards writing committee that is working on sustainability in the building and meetings industries. The new ASTM **Committee E60 on Sustainability** will develop standards to advance the goals of sustainable development. E60 will expand on the work of the former Subcommittee E06.71 on Sustainability, which completed such standards as **E2432, Guide for General Principles of Sustainability Relative to Buildings**.

To further support environmentally friendly buildings and facilities, Committee E60 is working on a series of new standards that addresses such topics as marketing and product claims related to sustainable buildings, water stewardship and other issues.

MORE BUILDING BLOCKS

The ASTM technical committees already mentioned serve the worldwide construction industry, and many others also have long impacted the field of building construction.

ASTM **Committee C24 on Building Seals and Sealants** develops standards for the sealing of building joints that are considered to be part of the building complex. Examples of these include aerosol foam sealants, caulking compounds, elastomeric sealants, glazing compounds, preformed sealing tapes and preformed gaskets. The committee, with a membership of approximately 250, currently has jurisdiction over more than 90 standards. Significant among these is C920, Specification for Elastomeric Joint Sealants, which covers the properties of a cured single-or multi-component cold-applied elastomeric joint sealant for sealing, caulking or glazing operations on buildings, plazas and decks for vehicular or pedestrian use. C920 is widely cited in building codes and is used by numerous U.S. government agencies.

ASTM **Committee D07 on Wood** is responsible for more than 100 standards and test methods related to timber, wood, modified wood, veneer, wood-based structural panels and wood-based building products. Over the years the committee has kept pace with dynamic changes and expansion in the wood marketplace. From its early origins in simple wood standards, the committee today is engaged in the development of standards for such growth areas as natural fiber-polymer composites and structural wood adhesives. One example of the progressive activities within Committee D07 is the release of a new standard that recognizes the latest glued laminated timber technology. ASTM standard **D7199, Practice for Establishing Characteristic Values for Reinforced Glued Laminated Timber (Glulam) Beams Using Mechanics-Based Models**, will assist manufacturers in the introduction of new reinforced glulam products to the marketplace.

The area of building masonry and use of natural stone is the focus of several ASTM committees, including **C12 on Mortars and Grout for Unit Masonry**, **C15 on Manufactured Masonry Units** and **C18 on Dimension Stone**. C12 standards such as **C270, Specification for Mortar for Unit Masonry**, cover the use of mortars in the construction of nonreinforced and reinforced unit masonry structures. Similarly, **C216, Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)**, is focused on the use of concrete brick and similar solid units intended for use in structural masonry or facing for buildings and other structures. In addition, C18 standards like **C1242, Guide for Selection, Design and Installation of Dimension Stone Anchoring Systems**, are utilized by architects, engineers, contractors and material suppliers to design, select, specify and install natural stone products.

Standards from ASTM **Committee C11 on Gypsum and Related Building Materials and Systems** and **Committee C17 on Fiber-Reinforced Cement Products** address a variety of materials and products for cement roofing, siding, ceilings, walls and other building components. Cooperation between the two committees is evident in **C1629/C1629M, Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels**. The standard fills a gap in the marketplace by providing methods with which specifiers can compare specific abuse-resistant properties of products.

Standards developed by ASTM **Committee C14 on Glass and Glass Products** are used extensively in building construction to help specify glass for mirrors, coatings, glazing and general architectural uses. Two of the more popular C14 standards are **C1036, Specification for Flat Glass**, which addresses the quality requirements of flat, transparent, clear and tinted glass; and **C1048, Specification for Heat-Treated Flat Glass — Kind HS, Kind FT Coated and Uncoated Glass**, which covers the requirements for heat-strengthened and fully tempered coated and uncoated flat glass used in general building construction.

And, ASTM's Committee E60 has numerous new standards under way that focus on such issues as building attributes that promote sustainability; environmentally preferable products; and practices for environmentally friendly meetings.

As new buildings are constructed and existing ones are enhanced and improved, ASTM will continue to be a dedicated partner to the needs of construction industry stakeholders around the world.

ASTM INTERNATIONAL TECHNICAL COMMITTEES ON CONSTRUCTION

The ASTM technical committees highlighted in this piece include:

- C01 on Cement
- C09 on Concrete and Concrete Aggregates
- C11 on Gypsum and Related Building Materials and Systems
- C12 on Mortars and Grout for Unit Masonry
- C14 on Glass and Glass Products
- C15 on Manufactured Masonry Units
- C17 on Fiber-Reinforced Cement Products
- C18 on Dimension Stone
- C24 on Building Seals and Sealants
- D07 on Wood
- D08 on Roofing and Waterproofing
- E06 on Performance of Buildings
- E60 on Sustainability