PCA Portland Cement Association

CONCRETE TECHNOLOGY *Today*

25th CONCRETE TECHNOLOGY TODAY Anniversary

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Contents

Concrete Technology Today is available on the Internet at www.cement.org/ctt

Celebrating Twenty-five Years of *CTT*

by William C. Panarese, former Manager, Construction Information Services and Editor of *Concrete Technology Today* from 1981 to 1994.

In the year 2004, *Concrete Technology Today (CTT)*, completed 25 years of publication. With this Anniversary Issue, we celebrate this valuable resource for anyone using portland cement concrete in its myriad of applications.

Including this newsletter, 85 issues of *CTT* have been published over the years. *CTT* has helped thousands of readers including engineers, architects, specifiers, contractors, ready-mixed concrete producers, concrete products producers (precast and/or prestressed), construction materials and equipment suppliers and manufacturers, building and transportation officials, facilities owners, educators, students, and many others. All back issues of *CTT* are available on the Internet at *www.cement.org/ctt* fully searchable and downloadable as PDF files.

Over the years, many industry experts have served as editor of *Concrete Technology Today*. Ralph Spears was the first and is credited with the idea of publishing a quarterly 4-page newsletter in 1980. After Spears came William Panarese, who took over in March 1981 and was editor for 14 years, followed by Ward Malisch in July 1994, Steve Kosmatka in March 1996, Jamie Farny in March 2000, Martin McGovern in April 2001, and finally, Beatrix Kerkhoff in December 2003.

Portland cement concrete's versatility, durability, and economy have made it the world's most widely used construction material. *CTT* is all about concrete technology. It is intended for decisionmakers associated with design, management, and construction of projects using concrete. Its purpose 25 years ago—and still today—is to show various ways of using concrete technology to advantage and to avoid potential problems. On to the next 25 years! As always, please let us know if there are topics you would like discussed in future issues of *CTT*.

Concrete Technology Today–1980 to 2005

Many concrete events have taken place over the past 25 years and CTT has covered a lot of them. The timeline shows our picks of important innovations, projects, and standard developments from 1980 through 2005. Our online version of this timeline at www.cement.org/ctt has direct links to articles on the topics. Code numbers in parentheses indicate past CTT issues with in-depth information.

1982

Slag Specification

ASTM C 989 - Specification for Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars adopted.

1980

Eden's Expressway

Eden's Expressway completed, utilizing highway concrete recycling for subbase.

1983

High Strength Masonry Cements/Acceptance in Standards

The use of masonry cements simplifies the site mixing of mortar by eliminating the need to mix cement and lime when batching mortars, but the specification for these products only recognized Type N masonry cements prior to the 1980s. In 1983, the development and acceptance of requirements for M and S masonry cements in ASTM C 91 and their inclusion in ASTM C 270, Specification for Mortar for Unit Masonry in 1986, led to a wider range of options, improved the quality of higher strength mortars, and ultimately, increased the quality of masonry construction. (PL864)

1980 1985 1990 1995 2000 2005

25 Years — Concrete Technology Today — Interactive Timeline at www.cement.org/ctt

1981

Concrete Pumping Record

Concrete pumped 314 m (1034 ft) for Texas Commerce Tower, Houston. In 1998, Petronas Towers achieved a new pumping record with 380 m (1246 ft) in a single lift.

1982

First Roller-Compacted Concrete Dam Completed

Willow Creek Dam, Heppner, OR, was originally planned as a flood control rockfill dam with an impervious earthfill central core and side-channel spillway. However, the initial cost estimate for the dam, particularly with the side-channel spillway, appeared excessive. The solution was an RCC dam with an ungated overflow spillway through the center of the dam. RCC placement began in the spring of 1982 and took only five months to complete. A total of 331,000 cubic meters (433,000 cubic yards) of RCC was used to build the 51.5-m (169-ft) high, 543-m (1,780-ft) long dam. Average in-place cost of RCC was less than $19.00 per cubic yard. Since this first RCC dam, at least 70 other RCC dams have been built in the U.S.

1985

Superplasticizer Standard

ASTM C 1017 - Specification for Chemical Admixtures for Use in Flowing Concrete finalized.

1988

Early-Entry, Dry-Cut Saws

Weighing only about 11 kg (25 lb), the saw permitted joint cutting as soon as the slab could support the weight of the operator and saw without disturbing the finish—usually within two hours after final finishing. Early-entry saws are dry-cut saws, so their blades are designed for use without water for cooling. (CT023)

1988

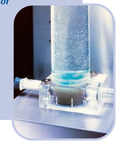
Two Union Square Building

The Two Union Square building in Seattle used concrete with a designed compressive strength of 131 MPa (19,000 psi) in its steel tube and concrete composite columns. High strength concrete was used to meet a design criterion of 41 GPa (6 million psi) modulus of elasticity. (PL933)

1990

Air-Void Analyzer

Developed in Denmark to determine air-void parameters in fresh concrete. The test apparatus measures volume and size distribution of entrained air voids and thus allows an estimation of the spacing factor, the specific surface, and the total amount of entrained air in concrete. (PL981)



1988

First Unified Masonry Design Standard Available

First unified design standard for masonry, Building Code Requirements for Masonry Structures (ACI 530-88/ASCE 5-88), brought together brick, concrete masonry, and composites of the two.

1990

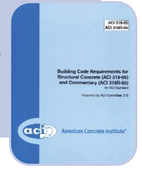
Concrete Highrise

311 S Wacker Drive building completed; at 292 m (959 ft) world's tallest concrete building. (PL941)

1989

ACI 318 Emphasizes Durability Requirements

To emphasize the importance of durability at the design stage, all durability requirements were assembled in one separate chapter in a revised ACI 318. In subsequent code editions, the durability requirements were expanded. Since 1989, and through the most recent edition (ACI 318-05), the code alerts the concrete designer that the durability requirements of Chapter 4 must be considered before designing a concrete mix. (PL903)



1992

Performance Standard for Cement

ASTM C 1157 - Performance Specification for Blended Hydraulic Cements adopted.

1993

Silica Fume Standard

ASTM C 1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures adopted.

1994

Insulated Concrete Forms (ICF)

The New American Home, the official show home of the National Association of Home Builders (NAHB), featured exterior walls built with insulating concrete forms (ICFs), a relatively new concrete forming system that was seldom used in the United States. At that time, the market share of homes built with all types of concrete wall systems (masonry, ICF, precast, AAC and removable forms) was a mere 3.5%. In 2004, The New American Home once again featured ICF exterior walls. However, during that 10 year span, the market share for concrete homes had grown to an estimated 16.1% of all single-family homes, with ICFs alone commanding a 4% share. (PL982)

1996

Autoclaved Aerated Concrete (AAC)

Autoclaved Aerated Concrete makes significant inroads in the commercial and residential markets in the U.S. (PL912, PL921)

1997

Confederation Bridge Completed

Concrete used for the Confederation Bridge across the Northumberland Strait between Prince Edward Island and New Brunswick was specifically designed for high durability in a severe environment. The bridge has to resist freezing and thawing, seawater exposure, and abrasion from floating ice. With a design life of 100 years, the use of high performance concrete and careful attention to production and construction practices were imperative. Over 400,000 cubic meters (520,000 cubic yards) of concrete was used for the structure. http://www.cement.org/bridges/br_100yr.asp

1998

1998 - Ultra-High Performance Concrete

First use of ultra-high performance concrete for Sherbrooke pedestrian bridge in Quebec. Since then many projects have been built with ultra-high performance concrete, also called reactive powder concrete, including a train station canopy in Calgary, Canada. (CT042)

2000

Sustainability

LEED for New Construction launched by U.S. Green Building Counsel. (CT041)

2000

Self-Consolidating Concrete (SCC)

Developed in Japan in the 1980s, self-consolidating concrete (SCC) gains importance in U.S. (CT022)

2001

VCCTL

Virtual Cement and Concrete Testing Laboratory (VCCTL) unveiled a Web-based virtual laboratory for evaluating and optimizing cement-based materials. www.vcctl.cbt.nist.gov (CT003)

2002

Conductive Concrete

First conductive concrete used for deicing operation at Roca Spur Bridge in Nebraska. (CT041)

2003

Chicago Wacker Drive

Chicago Wacker Drive reconstructed with High Performance Concrete. (CT013)

2004

Mixing Water Standard

ASTM C 1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete. First stand-alone mixing water standard in the U.S.—regulates use of potable and non-potable water as well as recycled water from concrete production operations. (CT033)

2004

Translucent Concrete Patented

Optical glass fibers running parallel to each other in the concrete make shadows on the lighter side appear with distinct outlines on the darker side.

Cement Mixer

Compilation of 25 Songs about Cement and/or Concrete
Mixed by: M. Wilson

1. ***Cement Mixer*** Alvino Rey
2. ***Concrete Sky*** Beth Orton
3. ***Concrete Girl*** Switchfoot
4. ***Concrete Jungle*** Bob Marley
5. ***Wet Cement*** Convoy
6. ***A Daisy Through Concrete*** Eels
7. ***Cement Shoes*** Neptunes
8. ***Concrete & Steel*** ZZ Top
9. ***The Cement Lament*** Michelle Shocked
10. ***Cement, Clay & Glass*** New Riders of the Purple Sage
11. ***Concrete & Barbed Wire*** Lucinda Williams
12. ***Cursing Concrete*** Rumbleseat
13. ***Wet Cement*** Citizen Fish
14. ***Cement Prairie*** XIT
15. ***Concrete Angel*** Martina McBride
16. ***Concrete & Clay*** Rushmore
17. ***Concrete Love*** Julia Fordham
18. ***Muffled by Concrete*** The Honor System
19. ***Tar & Cement*** Verdelle Smith
20. ***Lady in Cement*** Paul Desmond
21. ***Flowers in the Concrete*** Annet
22. ***Concrete Kingdom*** Billy Idol
23. ***Concrete Animals*** Shonen Knife
24. ***Concrete*** Midnight Oil
25. ***Concrete (Broadway)*** Lux Courageous

PCA Newsletters Go Electronic

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Register online at **www.cement.org/signup** and complete your personal interest profile. Select the electronic newsletters you would like to receive and your interest areas.

FREE

Register online and download *Portland, Blended, and Other Hydraulic Cements*, IS004, **a $21 value.***

* Free download is available only to those who register online.

New Information Products

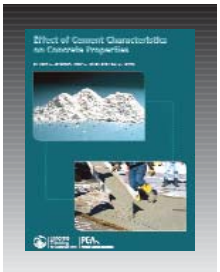
Save 30% to 90% on bulk orders. Contact Pat Schardt at 800.868.6733 or pschardt@cement.org.

The following information products are now available. To purchase them in the United States, contact the Portland Cement Association, Customer Service, 5420 Old Orchard Road, Skokie, IL 60077-1083, telephone 800.868.6733, fax 847.966.9666, or Web site ***www.cement.org***. In Canada, please direct requests to the nearest regional office of the Cement Association of Canada (Halifax, Montreal, Toronto, and Vancouver—***www.cement.ca***).

Concrete Floors and Moisture, EB119

See article "Understanding Concrete Floors and Moisture" on page 7.

Effect of Cement Characteristics on Concrete Properties, EB226



Discusses how different cement characteristics affect properties of fresh and hardened concrete.

Cement characteristics include chemical composition and physical properties. Concrete properties cover fresh concrete and hardened concrete including durability. Summary tables compare the changes in characteristics of cement with predicted or observed concrete behavior.

Performance of Architectural Concrete Panels in the PCA Outdoor Display, RD133–Now available in print!

This report looks at architectural concrete for buildings. It preserves the past with a detailed description of the construction of the PCA Outdoor Display, dismantled in 2001. Color photos and detailed descriptions of mix designs and construction techniques serve as an idea book for architects and building owners and a time-saving teaching guide for concrete producers and contractors. See http://www.cement.org/decorative/arch_panels.asp for a summary of the report.

Canadian Design and Control of Concrete Mixtures/Dosage et Contrôle de Mélanges de Béton on CDROM, CD101

The Canadian edition of the concrete industry's premier publication is now available in English and French on one fully searchable CD. In addition to having access to the book's entire text, photos, and graphics, users can click on selected references and be immediately linked to informative Websites, as well as 170 PCA research reports. Each of the book's 18 chapters has also been converted to PowerPoint® (English only).

Fellowship Grants Bear Fruit

Three student recipients of PCA Education Foundation Fellowships have completed their projects and recently published the results as PCA reports. All reports are available as PDFs at www.cement.org/bookstore.

Zach Grasley, University of Illinois at Urbana/ Champaign, 2002 fellowship recipient, completed a thesis on ***Internal Relative Humidity, Drying Stress Gradients, and Hygrothermal Dilation of Concrete***, SN2625. A system was developed that measures the internal RH and temperature in concrete and has a variety of potential applications including structural monitoring for durability risks, shrinkage prediction, and permeability-diffusivity measurements.

Hoa Lam, University of Toronto, completed ***Effects of Internal Curing Methods on Restrained Shrinkage and Permeability***, SN2620. Funded by a fellowship grant in 2002, the thesis investigates the ability of internal curing methods including superabsorbent polymers and saturated lightweight aggregate to mitigate autogenous shrinkage and restrained shrinkage.

Michelle Nokken, University of Toronto, received a 2001 fellowship for ***Development of Discontinuous Capillary Porosity in Concrete and Its Influence on Durability***, SN2861. This doctoral thesis documents development of an electrical conductivity test method for determining permeability of concrete.

25th Anniversary Special

FREE Back Issues from 1991 to 2004 of *Concrete Technology Today*:

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Understanding Concrete Floors and Moisture

Unwanted moisture in concrete floors causes millions of dollars in damage annually in the United States. Problems from excessive moisture include deterioration and debonding of floor coverings and resulting trip-and-fall hazards, microbial growth leading to reduced indoor air quality, and staining and deterioration of building finishes. Understanding moisture in concrete can help a builder design a flooring system ready to provide years of excellent service.

Construction Practices That Cause Moisture Problems

Many buildings and homes are constructed on phased, fast-track schedules. In some cases, floor coverings are placed on concrete that is only a few weeks old and has not had sufficient time to dry. Also, buildings that are being adapted for reuse or remodeled might receive new floor coverings with a more moisture-sensitive adhesive. Previously acceptable vapor transmission rates may no longer be suitable with the new adhesive, causing damage to flooring.

Vapor retarders are another factor in floor moisture problems. Vapor retarder sheets installed directly below interior concrete slabs are an essential component in a moisture resistant floor system. However, value engineering studies during building design may eliminate the vapor retarder, leaving a floor covering susceptible to moisture vapor infiltration from below. A quality vapor retarder, resistant to punctures, tears, and vapor permeability, can prevent many floor moisture problems, saving time, money, and aggravation for architects, owners, contractors, and engineers.

Moisture Vapor Emission Rate (Calcium Chloride Kit Test). Most flooring and adhesive manufacturers specify maximum limits for moisture vapor emission from concrete floors based on the Moisture Vapor Emission Rate (MVER) test (ASTM F 1869) expressed as pounds of moisture emitted from 1000 ft^2 in 24 hours. Specification limits vary by flooring manufacturer and material type. Typical limits are given in Table 1.

Moisture vapor emission rate is determined according to ASTM F 1869 using commercially available calcium chloride kits that absorb moisture from a specific test area over a known length of time. (IMG15989)

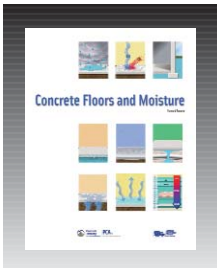
Table 1. Typical Limits for MVER Test*

MVER	Materials
5 lb/1000 ft^2 / 24 hr	Vinyl composition tile, felt-backed resilient sheet flooring, porous-backed carpet, and linoleum
3 lb/1000 ft^2 / 24 hr	Solid vinyl sheet flooring, vinyl-backed carpet nonporous-backed carpet, cork, and direct glue-down wood flooring

* *Addressing Moisture Related Problems Relevant to Resilient Floor Coverings Installed Over Concrete,* Resilient Floor Covering Institute, Rockville, Maryland, 1995.
Note: To convert to SI (μg/sec ·m^2), multiply by 56.51

CAUTION: For most concretes (w/c < 0.6) the MVER test determines moisture emitted from the upper two centimeters (less than an inch) of a concrete slab and is not a good indicator of moisture deep in the slab. A high MVER result indicates a floor is not ready to receive flooring, but a low MVER result only indicates that the moisture level in the upper portion of the concrete may be acceptable. To measure moisture over the full depth of the slab, devices such as the relative humidity probe should be used.

For more information on how to prevent moisture problems in concrete floors, ***Concrete Floors and Moisture, EB119,*** is available at www.cement.org/bookstore.



The book discusses the sources of moisture, drying of concrete, methods of measuring moisture, construction practices, specifications, and responsibilities for successful floor projects. For further information on concrete floors, including moisture tests, vapor retarders, avoiding delaminations, and how to protect floors from chemical attack, go to: *http://www.cement.org/tech/cct_con_design_floors.asp.*

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June 26–29, 2005 at PCA in Skokie, Illinois

Teaching the Materials Science, Engineering, and Field Aspects of Concrete

Sponsored by:

CENTER FOR ADVANCED CEMENT-BASED MATERIALS

Portland Cement Association

The Center for Advanced Cement-Based Materials (ACBM) and the Portland Cement Association are pleased to announce that the next Undergraduate Faculty Enhancement Workshop will be held **June 26–29, 2005,** at PCA headquarters in Skokie, Illinois. The Faculty Workshop will address the issues of adding and expanding coverage of concrete materials properties in undergraduate and graduate courses.

Participants will learn how to effectively facilitate teaching about concrete, see demonstrations and hear explanations on student laboratory experiments, and exchange information on successful implementation of concrete-related subject matter into curricula.

For more information see
http://www.cement.org/learn/acbm_05workshop.asp

Mark Your Calendars!

October **6, 2005** Regional course on Supplementary Cementitious Materials in Seattle, WA

Contact mwilson@cement.org for details.

CT051

CONCRETE TECHNOLOGY *Today*

PUBLISHER'S NOTE:
Intended for decisionmakers associated with the design, construction, and maintenance of concrete structures, *Concrete Technology Today* is published triannually by the Product Standards and Technology department and Construction Technology Center of the Portland Cement Association.

Our purpose is to highlight practical uses of concrete technology. If there are topics readers would like discussed in future issues, please let us know. Items from this newsletter may be reprinted in other publications subject to prior permission from the Association. PCA grants permission to electronically share this document with other professionals on the condition that no part of the file or document is changed. For the benefit of our readers, we occasionally publish articles on products. This does not imply PCA endorsement.

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