


American Concrete Institute®
Advancing concrete knowledge

History of Concrete

ACI Spring 2011 Convention
April 3 - 7, Tampa, FL

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ACI Web Sessions

The audio for this web session will begin momentarily and will play in its entirety along with the slides.

However, if you wish to skip to the next speaker, use the scroll bar at left to locate the speaker's first slide (indicated by the icon in the bottom right corner of slides 10, 44, 65, and 85). Click on the thumbnail for the slide to begin the audio for that portion of the presentation.

Note: If the slides begin to lag behind the audio, back up one slide to re-sync.


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ACI is bringing you this Web Session in keeping with its motto of "Advancing Concrete Knowledge." The ideas expressed, however, are those of the speakers and do not necessarily reflect the views of ACI or its committees.

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ACI Web Sessions

ACI Web Sessions are recorded at ACI conventions and other concrete industry events. At regular intervals, a new set of presentations can be viewed on ACI's website free of charge.

After one week, the presentations will be temporarily archived on the ACI website or made part of ACI's Online CEU Program, depending on their content.




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ACI Online CEU Program

ACI offers an easy-to-use Online CEU Program for anyone who needs to earn Continuing Education credits.


Once registered, you can download and study reference material. After passing a 10-question exam on the material, you will receive a certificate of completion that you can present to local licensing agencies.



Visit www.concrete.org/education/edu_online_CEU.htm for more information.




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ACI Conventions

ACI conventions provide a forum for networking, learning the latest in concrete technology and practices, renewing old friendships, and making new ones. At each of ACI's two annual conventions, technical and educational committees meet to develop the standards, reports, and other documents necessary to keep abreast of the ever-changing world of concrete technology.

With over 1,300 delegates attending each convention, there is ample opportunity to meet and talk individually with some of the most prominent persons in the field of concrete technology. For more information about ACI conventions, visit www.aciconvention.org.



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Fall 2011 Seminars

These seminars, cosponsored by ACI and the Portland Cement Association (PCA), will cover all the major changes in the new edition of the **318-11 Building Code**.

DATE	LOCATION	DATE	LOCATION
September 13	Chicago, IL	November 3	Charlotte, NC
September 27	Philadelphia, PA	November 8	Boston, MA
September 29	Houston, TX	November 10	Detroit, MI
October 4	Seattle, WA	November 15	Des Moines, IA
October 6	Los Angeles, CA	November 17	Portland, OR
October 11	New York, NY	November 29	Denver, CO
October 13	Minneapolis, MN	December 1	Phoenix, AZ
October 20	Cincinnati, OH	December 6	Atlanta, GA
October 25	New Brunswick, NJ	December 8	Washington, DC
October 27	St. Louis, MO	December 13	Dallas, TX
November 1	Orlando, FL	December 15	San Francisco, CA

For more information, visit [ACI seminars](#).

ACI Web Sessions

This ACI Web Session includes 4 speakers presenting at the ACI spring convention held in Tampa, FL April 3 – 7, 2011. Additional presentations will be made available in future ACI Web Sessions.

Please enjoy the presentations.



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Billie (Wilma) Snell, has been a teacher since 1988. She and her husband have a program using Floating Concrete kits and Paper Bridge kits to encourage all students to consider science, math and technology areas for their future. She is a member of ACI Committee 120, History of Concrete.

The Garden of Eden

by
Luke Snell, Mike Murray, & Billie Snell

The Garden of Eden

- Location – Lucas, Kansas
- Kansas Art – 1 of 8 Wonders
- Constructed – Stone & Concrete
- Builder/Artist – S.P. Dinsmoor

Welcome to the Garden of Eden,
A World of Concrete



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Samuel Perry Dinsmoor's home and his artwork!



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Dinsmoor's artwork is of both
Limestone and of Concrete!

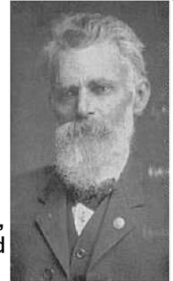


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Samuel Perry Dinsmoor was born in
1843; he served 3 years in the Civil
War.

He taught school in Illinois and
married his first wife (Mrs. Frances A.
(Barlow) Journey, in August 1870).

They moved to Lucas, Kansas in 1905,
where he began to build his home and
the various artwork.



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S.P. Dinsmoor with one of his 2 children and his
2nd wife, who was 20 years old and he was 81
in 1924. S.P. died in 1932.



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The basement and the 2nd story of his home,
built by S.P., was made of limestone and concrete.



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The 3rd story (the gables), floors, baseboards & the window stools were all made of concrete.



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Notice the lights in the window - they were put in long after Dinsmoor died.



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Another view of Dinsmoor's home of limestone and concrete.



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Various concrete art work as well as the concrete and stone home.



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The arbor is made of concrete.



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The arches of the arbor become the bodies of snakes.



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The concrete building where S.P. stored his tools: notice the stove pipe on the roof – also made of concrete.



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S. P. Dinsmoor's tools for building with the concrete.



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The entry way into the Garden of Eden: notice Adam apparently holding Eve's hand and Eve accepts the apple from the serpent.



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Abel's body is discovered by his wife and dog.



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Cain and his wife fleeing to the land of Nod.




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Not only did Dinsmoor construct many Biblical characters but he also constructed many whimsical structures.




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Notice the globe and the creature beside it is a Hydra. Even his trees were concrete.




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An Indian aiming towards something or someone




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This particular structure was named: Labor Crucified. Notice the doctor, lawyer, preacher and banker.




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Notice the fox at the bottom trying to catch the cat, who is attempting to catch the bird.



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Cages can be found on this property.



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Even an occasional concrete basket.



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There is even a concrete flag, with an "eagle" near by.



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Even picnic tables and a shelter are part of Dinsmoor's concrete structures.



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Concrete fences can be found throughout the Dinsmoor property.



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A concrete soldier, a concrete woman, and the concrete American flag.



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Dinsmoor's concrete mausoleum top



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S.P. Dinsmoor and his first wife's concrete mausoleum




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**That's All, Folks!
Any questions?**

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Lawrence Taber, P.E., is a Structural Engineer with the Black & Veatch Corporation in Kansas City, MO. He has been with Black & Veatch since 2001, designing numerous concrete, masonry and steel structures and buildings. He is also involved with various studies, construction resident services, and structural inspections.

As an ACI Member, Mr. Taber is Chair of two committees, and an active member of several additional committees. In 2007, he won the ACI Young Member Award for Professional Achievement and was voted the ACI-Missouri Chapter's Concrete Person of the Year. Mr. Taber received a B.S. in civil engineering and an M.S. in civil engineering with an emphasis in structural engineering from the University of Missouri-Rolla, Rolla, MO.

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**Rocky Home Construction
in the Ozarks**

A Look at Quigley's Castle

Larry Taber, PE
Black & Veatch

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Agenda

- The Quigley Family
- History of the Castle
- The Finished Castle
- Castle Exterior
- Inside the Castle
- Yard Art and the Castle Grounds
- Sustainable Aspects


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The Quigley Family

- Albert & Elise Quigley married during the depression and had five children
- Elise had moved to Ozarks when she was 9
- Elise loved the outdoors and collected rocks
- Albert operated a lumber mill near Eureka Springs, Arkansas
- The family lived in a lumber shack on a farm

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The Quigley Family



Elise Quigley



Original Lumber Shack

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History of the Castle

- Albert promised Elise he would build her a dream house with the lumber from their land
- Elise designed her house that would bring nature indoors in 1943 and the wood was cut
- With the outbreak of World War II, materials were rationed and Albert wanted to wait
- The design called for 32 large windows, which were not available

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History of the Castle

- One day when Albert was at the mill, Elise and her sons tore down the lumber shack
- Moved temporarily into a chicken house
- Construction on dream house started and the wood portion was soon finished
- Took three years to get the glass, meanwhile Elise covered the outside with her rocks
- Elise spent the rest of her life adding to it

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The Finished Castle

- Two-story house
- Interior completed in 1943; finished in 1946
- Contains 32 windows, several very large
- Exterior covered with rocks, fossils, petrified wood and crystals all mortared together
- Two separate foundations with 4 feet between for plants (which are now two-stories high)
- Only spent \$2000 cash to build home

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Castle Exterior




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Castle Exterior



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Inside the Castle



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Inside the Castle



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Inside the Castle



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Inside the Castle



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Inside the Castle

The house has two foundations. An outside footing goes down to bedrock. The inside foundation/floor is simply cement slab. There is no floor in between the two foundations and the plants grow right out of the natural soil up to the second floor ceiling. These are her original plants and are over 60 years old. There are Chinese Hibiscus, a Night Blooming Cyrus, a Bougainvillea, Asparagus Plumose, and a Brazilian Plume Plant planted in the soil.

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Yard Art and the Castle Grounds



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Yard Art and the Castle Grounds



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Yard Art and the Castle Grounds



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Sustainable Aspects

- Natural lighting
- Material reuse
- Durable construction
- Thermal mass
- Local material
- Rain water collection



Elise was sustainable in the 1940's!

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Closing Thoughts

- Elise Quigley was a strong lady with a vision
- Quigley's Castle is one of the most unique homes I have ever seen
- Design used large amounts of mortar which has held up very well for over 60 years
- Quigley's Castle truly brings the outdoors in
- Quigley's Castle is a good example of sustainability

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Thanks!



Elise Quigley's View

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William Ciggelakis, P.E. FACI, Chief Engineer, Professional Service Industries, Dallas, TX. William is a graduate of Rutgers University, College of Engineering, a registered Professional Engineer in Texas and Arizona, and has approximately 30 years experience in the Construction Management and Materials Engineering Fields. He is Past President of both the San Antonio and Houston Chapters of ACI and serves on several ACI committees.

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A Place in History



By:
William Ciggelakis, PE FACI
Sean Van Delist, LEED A.P.
Donald H Taubert


Historic District of San Antonio, TX

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An Ordinance (This was no Bomb)

- State of Texas
County of Bexar
City of San Antonio
- July 1, 1914
- Awarded: Texas Granitoid Company
- \$14,900.00
- \$0.80 / Square Yard



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Information To Build On

Limits of Construction

- **Belknap Place**
- From Dewey Place to Kings Highway
- 4,200 Linear Feet
- 40 Feet in Width
- 18,700 Square Yards




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Information To Build On

Patterned Stamped Concrete

- 1910 Stamping was not an aesthetic feature but a requirement for the sure footing of horses that pulled wagons
- Acute Angles at joints were avoided



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Information To Build On

First Imprinted Architectural Paving

- Forty years later, 1950
- Brad Bowman obtained the Bomanite Patent for patterned stamped concrete



ACI WEB SESSIONS
Information To Build On

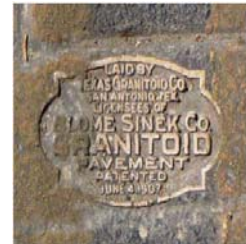
Joint Spacing was Not Fully Understood



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Patented Process (Profile)


- Two Course Placement
 - Large coarse aggregate in the lower lift
 - Denser graded, harder aggregate in the surface course
- Precursor to ACI 302
 - Guidelines for Slab and Floor Construction



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State of the Art Grading Equipment

- 1910 circa
- Aultman Taylor Steam Powered Motor Grader



millercountymuseum.org

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Supplemental Impact Echo Information



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Information To Build On

No Laser Screeds


- The full pavement profile varied from approximately 5-3/4 inches to 7-3/4 inches
- Constructed on FAT Clay
 - CBR of 2 to 4



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Information To Build On

Quarrying of Aggregate

- Knippa, TX
- 110 Miles West of San Antonio
- Concrete aggregate likely arrived via steam powered train



Circa 1883, Marion Steam Shovel archives.hcea.net

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Delivery of Concrete

- The first documented report of Ready Mix Concrete delivered by truck to a jobsite was in 1913 in Baltimore, Maryland
- 1914 Concrete for Belknap Place (3,100 c.y.) was either:
 - Delivered similar to above
 - Delivered by horse or mule drawn carts
 - Mixed On Site



Circa 1913
concretenetwork .com

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Site Ready Mix Concrete for Era 1914

- Steam Powered
 - Horse Drawn
 - Possibly Crawler Driven
- Manual Charging
- Limited Capacity





Circa 1903
dorner.at

chestofbooks.com

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Information To Build On

The Bottom Layer

- **Coarse Aggregate**
 - Gap Graded Pit Run Gravel (predominantly 3/4 to 1-1/2 inches)
- **Fine Aggregate**
 - Field Sand (low Fineness Modulus)
- **Apparent Estimated Concrete Mix Design**
 - 3-2-1 (gravel, sand, cement)

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Top Layer (1-1/2 to 3 inches thick)

- **Poorly Graded Coarse Aggregate**
 - Very hard and dense black colored stone (3/8 to 1/2 inch)
 - Visual Identification as Trap Rock from Knippa, TX approximately 100 miles West of San Antonio
- **Fine Aggregate**
 - Field Sand (low Fineness Modulus)
- **Apparent Estimated Concrete Mix Design**
 - 3-3-2 (gravel, sand, cement)

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Achievements

- **Surface Well Bonded**
 - No Curing Agents
 - No Bonding Compounds
 - No Set Retarders
 - No Water Reducers
- **Hot Weather Concreting**
 - 1st Published, 1991
 - *111 days per year-average Ambient Temperature in San Antonio, TX is 90° +F
 - No Chilled Water



Note: Cores are upside down

* CityData.com


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Performance

- **Current City Thoroughfare Requirements**
 - for VIA Metropolitan (City Bus Service)
 - 4,500,000 18kip ESAL's /30 years (current design)
 - Minimum of 9 inches of Portland Cement Concrete
- **Nearly 100 Years of Service**
 - Surpassed the current 30 year traffic design expectations
 - Varying pavement thickness 5-3/4 to 7-3/4 inches < 9 inches

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- **Donald H. Taubert, Retired QC Director of Capitol Cement**
 - Identified and located this Place
 - Researched the Original Contract
 - Funded & participated in the concrete coring and investigation of the investigation



Belknap Place
ACPA Lifetime Performance
Achievement Award

Closing

- Despite the durability and success of Belknap Place, PSI advocates that current procedures and available technologies for designing concrete and constructing concrete pavements should not be ignored.
- Moreover the concept of this pavement and the incorporation of available current technologies may be considered to further enhance the durability of concrete pavements.


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Ibrahim Erdem, Ph.D., P.E. specializes in structural analysis and performance of structures. He has experience in behavior of reinforced concrete and has investigated and developed repair/strengthening techniques, including masonry infilled structures. Dr. Erdem's structural investigations have included evaluation of the capacities of various timber members, structural and light gage steel components and connections, reinforced concrete beams and slabs, and analysis of composite steel girders that are common in bridge decks and other long span structures.

Dr. Erdem was a research assistant at Cornell University, where he conducted nondestructive testing (impact echo) on graphite rods and developed a new finite element of the human thoracolumbar spine. Besides being a teaching assistant for several classes, he was the instructor for a graduate level course on concrete structures for two semesters.

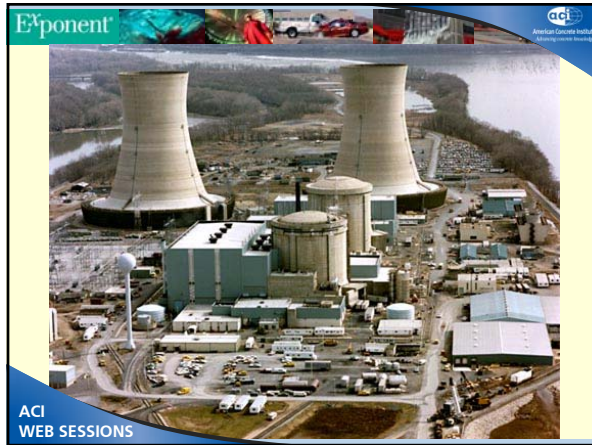
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Magnetite Concrete in the Nuclear Industry
 ACI 2011 Spring Convention,
 4/6/2011
 Tampa, FL


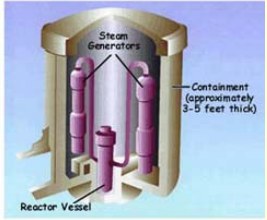


Ibrahim Erdem, Ph.D.
 Anthony M. Dolhon, PE

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Reactor Vessel

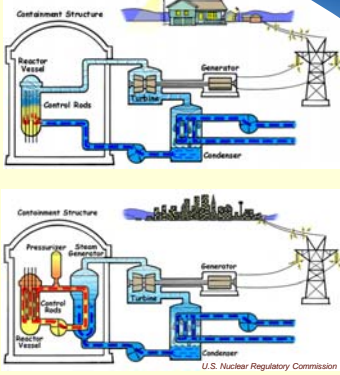
Inside a reactor vessel, enclosed in a concrete and steel containment building, with walls 3-5 feet thick

U.S. Nuclear Regulatory Commission

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Reactor Types

1. Boiling Water Reactor (BWR)
2. Pressurized Water Reactor (PWR)



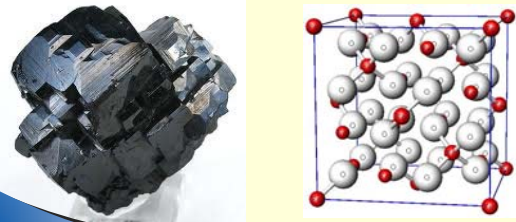
U.S. Nuclear Regulatory Commission

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Properties:

- Iron mineral (iron oxide), Fe_3O_4
- Ferrimagnetic
- Black



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Properties:

- Dense (Specific Gravity = 4.7-5.1)
- Hard (Hardness = 5.5-6.5 on Moh's scale)



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Properties:

- Water absorption capacity < 0.3%
- Abrasion value = 5.8



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Properties:


- Aggregate size = 1-1/8 inches and smaller



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History of Magnetite in Concrete Industry:

- 1900: in construction of concrete blocks for underwater construction
- 1950: in nuclear industry
- 1950-1970: radiation shielding, heavy concrete research
- 1984: ASTM C 637 and 638



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Magnetite Deposits

- United States (NY, NJ, PA, UT, CO, etc)
- Sweden
- Australia
- Chile
- South Africa
- Norway
- Switzerland
- India

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Magnetite Concrete Today:
 Nuclear power plants X-ray (Medical) facilities




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Magnetite Concrete Today:
 Coastal protection Offshore structures




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Magnetite Concrete Today:
 Counter weight



Oresund bridge

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Cautions:
 Conventional methods for design and installation. However, special attention is required in

- Mix design
- Transportation
- Pumping
- Placement
- Compaction



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Advantages:



- Radiation shielding
- Reduced volume
- Less heat of hydration
- More ballast
- Noise and vibration dampening

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Future study:

- Effect of elevated temperature
- Effects of chemical attack
- Long term performance
- Creep and shrinkage behavior


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Thanks!



Anthony M. Dolhon, PE
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Eric Bosler & Mats Drugge

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