

A Concrete Advantage: Production of Portland cement

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Revolutions in Science and Technology Paradigms
Monday, October 28, 2013

Discussion Topics

- History of Concrete Construction
- Development of Portland Cement
- Cement Applications
- Questions?

Egyptian Pyramid Construction



<http://famouswonders.com/great-pyramids-of-giza/>, accessed 10/24/13

Ancient Concrete Construction?

Used by the Egyptians (2000 BC)?

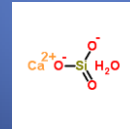
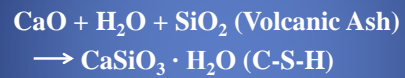
- [Hypothesis proposed by Joseph Davidovits](#)
 - Soft limestone with high kaolinite content mined and mixed with water
 - Combined with lime and natron
- Supported by Michel Barsoum (Journal of the American Ceramic Society, 2006)
- Disputed by Dipayan Jana (International Cement Microscopy Association, 2007)

Early Concrete Construction Methods

Developed by the Romans (27 BC)

- Limestone burned to produce quicklime
- Water added to create paste
- Volcanic ash mixed with paste to create mortar (Pozzuoli, Italy - "pozzolan")
- Mortar combined with fist-sized rocks and packed into shape

Chemically



Early Concrete Construction



Roman Colosseum

www.smithsonianmag.com, accessed 10/24/12

Early Concrete Construction



Roman Aqueducts

www.wikipedia.com, accessed 10/24/12

Early Concrete Construction



Roman Pantheon

www.wikipedia.com, accessed 10/24/12

Early Concrete Construction



Roman Pantheon Dome

www.walksofitaly.com, accessed 10/24/12

Early Concrete Construction



Baths of Caracalla

www.romecabs.com, accessed 10/24/12

Portland Cement

- [Joseph Aspdin \(1824\)](#)
- English Bricklayer from Leeds, England
- Resembled Natural Stone on Isle of Portland, England

Cement Production Ingredients



- Materials Crushed, Ground, and Proportioned
- Preheater used to increase temperature
- Rotating kiln raised temperature to 3000°F
- Transformation to cement clinker

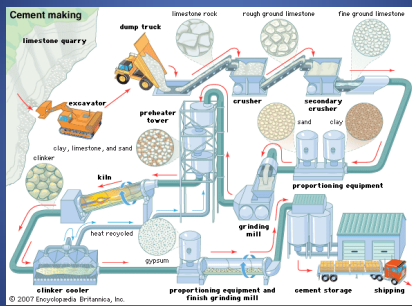
Cement from Clinker



- Clinker ground and combined with 5% gypsum
- Stored in silos to cool



Modern Cement Production



www.civildigital.com, accessed 10/24/12

Mineral (Pozzolan) Admixtures



<http://www.slacement.org>, accessed 10/24/13

Strength



Al Hamra Firdous Tower, Kuwait City

www.architizer.com, accessed 10/24/12

Foundation and Septic



www.michaelstrofconstruction.com, accessed 10/24/12



www.alliedseptic.com, accessed 10/24/12

Pipe and Culverts



www.lcpipe.com, accessed 10/24/12



www.precast.org, accessed 10/24/12

Pre-stressed and Post-Tensioned



www.bancrete.com, accessed 10/24/12



www.precast.org, accessed 10/24/12

Bridges



www.123f.com, accessed 10/24/12



www.jotun.com, accessed 10/24/12

Tiles and Siding



www.todayshomeowner.com, accessed 10/24/12



www.certainteed.com, accessed 10/24/12

Termite Resistance



Disaster Resistance



Versatility



Versatility



Falkirk Wheel

http://en.wikipedia.org/wiki/File:FalkirkWheelSide_2004_SeanMcClean.jpg, accessed 10/24/12

Interesting Shapes



www.ironic.com, accessed 10/24/12

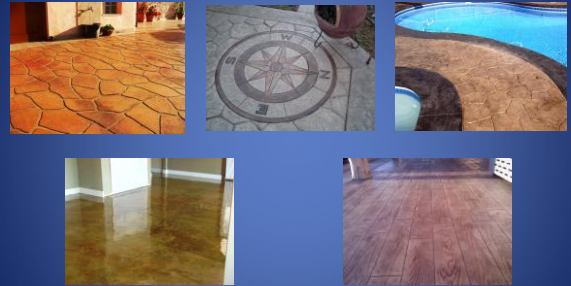
Concrete Pumping



Tilt-Up Concrete



Decorative Concrete



Concrete Countertops



Reflectivity



Sustainability



Main Concrete Advantages

- Strength
- Durability
- Versatility
- Thermal Mass
- Reflectivity
- Sustainability

QUESTIONS