In response to growing environmental and economic forces, architects, engineers, developers and owners are seeking efficient and innovative building solutions that conserve non-renewable resources. Increasingly, concrete is being recognized for its strong environmental benefits in support of creative and effective sustainable development. When considering the lifetime environmental impact of a building material – extraction, production, construction, operation, demolition and recycling – concrete is an excellent choice to meet these goals.

Concrete is Produced Locally from Abundant Natural Resources

The primary ingredients of concrete – crushed stone or gravel, sand and water – account for approximately 90% of the volume of the mixture and are plentiful in most locations. Cement, which accounts for most of the rest of the mixture, is usually produced and available regionally as well. As the one building material that is always produced in proximity to its use in buildings and infrastructure, ready mixed concrete greatly reduces the environmental impact of material transport by minimizing fuel requirements, energy consumption and emissions for transportation and handling. In addition, as a made-to-order material, concrete construction results in less building waste.

Recycled Materials in Concrete Reduce Emissions and Landfill Use

Like any manufacturing process, the production of cement used in concrete results in the creation of greenhouse gases, including CO_2. The U.S. cement industry has reduced CO_2 emissions by 30% since 1972 and now accounts for approximately 1.5% of U.S. emissions, well below other sources such as heating and cooling homes and buildings (33%), truck and auto use (27%) and industrial operations (19%). The CO_2 embodied in concrete as a finished building product is a very small quantity considering that cement accounts for a small proportion of the finished product.

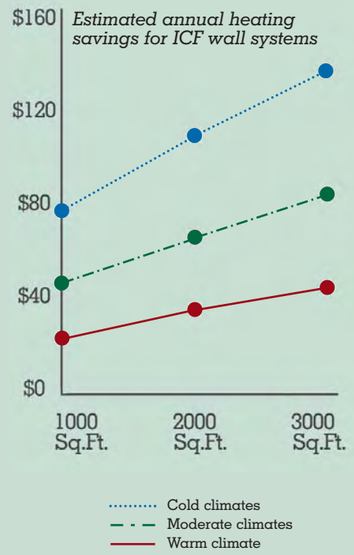
The concrete industry also uses industrial byproducts such as fly ash (from coal combustion) and blast furnace slag (created in iron manufacture) to constitute a portion of the cement used in producing concrete. Use of such waste byproducts in concrete prevents15 million metric tons a year of these waste materials from entering landfills. Utilizing these "supplemental cementitious materials" as a replacement for cement improves the strength and durability of concrete and also further reduces the CO_2 embodied in concrete by as much as 70% with typical values ranging from 15% to 40%.

Recycled concrete aggregate can substitute for conventional aggregate in most applications.

Finally, when a concrete structure has served its purpose, it can be crushed for use as aggregate in new concrete or as fill or base materials for roads, sidewalks and concrete slabs. Even the reinforcing steel in concrete (which often is made from recycled materials) can be recycled and reused.

Concrete Buildings Reduce Energy Use

Studies indicate that 80% or more of the greenhouse gases generated from structures are released through energy produced for their ongoing heating and cooling. Insulated concrete wall systems provide high R-value and thermal mass with low air infiltration to provide superior thermal efficiency and optimal energy performance over the long life of the building. Since homes and buildings constructed with insulated concrete walls are not subject to large daily temperature fluctuations, owners can lower heating and cooling bills by up to 25 percent. Heating, ventilating and air-conditioning can also be designed with smaller-capacity equipment for additional savings. Concrete interior and exterior finishes frequently require no additional treatments as well, reducing costs and energy consumption during construction and for ongoing maintenance.



Estimated annual heating savings for ICF wall systems

This chart illustrates the estimated annual heating savings produced by Insulating Concrete Form (ICF) wall systems for three different building sizes in cold climates, moderate climates, and warm climates. ICF construction produces comparable savings in cooling expenses.

Concrete isn't just durable and energy efficient, it's iconographically beautiful too.

Concrete Structures are Durable

Buildings and pavements that "stand the test of time" through their extreme durability and low maintenance requirements have a significant sustainable advantage over other structures. The water and cement in concrete chemically combine to form a paste that binds the sand and stone, together producing the necessary strength and durability to provide serviceability in a wide range of environmental conditions. Moisture, which can undermine other building materials through rust or rot, has no weakening effect on concrete. Neither termites nor mold take any toll on concrete either. In fact, concrete continues to strengthen over time, which is why concrete structures built thousands of years ago are still intact, such as the Roman aqueducts, Coliseum and Pantheon.

Concrete's legendary strength also enables it to withstand most man-made and natural disasters, including fires, hurricanes, earthquakes, tornados, explosions and even tidal waves. There is no stronger testament to the sustainability of concrete buildings than when they are the only ones still standing.

No other building material surpasses concrete's ability to withstand cataclysmic forces such as hurricanes, tornadoes and explosions.

Pervious Pavements Reduce Stormwater Runoff

Pervious concrete is made with little or no sand, producing a strong and durable pavement with voids that allow rain water to pass through. Pervious concrete pavements reduce or eliminate runoff and support pollution mitigation by capturing the first flush of rainfall and allowing it to percolate into the ground. Soil chemistry and biology can then "treat" the polluted water naturally. Pervious pavements reduce runoff that would otherwise burden streams with warm polluted water and instead help replenish aquifers. This approach also reduces or eliminates the need for stormwater detention ponds with corresponding energy reductions and cost savings for the developer as well as the opportunity to make use of that otherwise unproductive land.

Pervious concrete filters water though a permeable subbase and the soil below, preventing contaminated water from entering waterways or stormwater management systems.

Pervious concrete pavement systems are recognized as a valuable stormwater management tool under the requirements of the EPA Storm Water Phase II Final Rule. These regulations provide programs and practices to help control the amount of contaminants in waterways. Pervious concrete is a well-understood engineered product, with tested characteristics for compressive, tensile, flexural strength and freeze-thaw durability. Additional information regarding pervious concrete's applications, engineering properties, environmental benefits, structural and hydrological design characteristics, mix designs and construction techniques can be found at www.PerviousPavement.org.

Concrete's Light Color Reduces Urban "Heat Island" Effects

Concrete's high albedo means more light is reflected and less heat is absorbed, resulting in cooler communities. This concrete characteristic is particularly noteworthy in comparison to alternatives for paving and roofing. Concrete pavements also reduce energy usage and costs by requiring fewer lighting fixtures to provide the same illumination level.

Simply by choosing concrete pavement and reducing the heat island effect, air conditioning costs can be lowered by as much as 18%, the intensity of air pollution lessened, and the risk of heat-related health problems reduced.

Concrete Delivers™

Engineered concrete solutions for sustainability, durability and value.

Support sustainable development - specify concrete solutions.
For more information, visit www.GreenConcrete.info

LEED™ v2.2 Project Checklist: Concrete Points

Using concrete in various applications can help a project earn from 19-28 LEED™ points

Credit Categories		Points
Sustainable Sites		
Credit 3	Brownfield Redevelopment	1
Credit 5.1	Site Development, Protect or Restore Habitat	1
Credit 5.2	Site Development, Maximize Open Space	1
Credit 6.1	Stormwater Design, Quantity Control	1
Credit 6.2	Stormwater Design, Quality Control	1
Credit 7.1	Heat Island, Non-roof	1
Credit 7.2	Heat Island, Roof	1
Energy and Atmosphere		
Prerequisite 2	Minimum Energy Performance	Required
Credit 1	Optimize Energy Performance	1 - 10
Materials and Resources		
Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floors and Roof	1
Credit 1.2	Building Reuse, Maintain 95% of Existing Walls, Floors and Roof	1
Credit 2.1	Construction Waste Management, Divert 50%	1
Credit 2.2	Construction Waste Management, Divert 75%	1
Credit 4.1	Recycled Content, 10% (post-consumer plus ½ pre-consumer)	1
Credit 4.2	Recycled Content, 20% (post-consumer plus ½ pre-consumer)	1
Credit 5.1	Regional Materials. 10%	1
Credit 5.2	Regional Materials, 20%	1
Innovation and Design Process		
Credit 1.1	Durability	1
Credit 1.2	Concrete walls and ceiling with no coating	1
Credit 1.3 – 1.4	Apply for other credits demonstrating exceptional performance	2+
Credit 2	LEED™ Accredited Professional	1
Project Totals		19 - 28

From Leed NC 2.2

Concrete Helps Achieve LEED Certification

Leadership in Energy and Environmental Design (LEED) is a rating system devised by the United States Green Building Council (USGBC) to evaluate the environmental performance of a building and encourage market transformation toward sustainable design. Governments at all levels are endorsing LEED, through mandates, tax credits or grants. The system is credit-based, allowing projects to earn points for environmentally-friendly actions taken during construction and use of a building. Using concrete in various applications can help a project earn from 19-28 LEED® points.

LEED™ LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Concrete...

Meeting today's needs without compromising the future.

- Concrete is produced locally from abundant natural resources.
- Recycled materials in concrete reduce embodied CO_2 and landfill use.
- Pervious Concrete percolates stormwater into soil, recharging aquifers and preventing polluted runoff from overwhelming streams and lakes.
- Use of Insulating Concrete Forms (ICFs) for above-grade wall systems provides for increased R values, reducing heating, cooling and infrastructure costs.
- Concrete's thermal mass reduces temperature swings in buildings and conserves energy.
- Concrete's light color reduces the heat island effect, lowering urban energy use.
- Concrete's light color reflects more light at night, reducing lighting infrastructure and energy costs.
- Concrete can be made with reclaimed industrial materials that would otherwise burden landfills.
- At the end of a concrete building or pavement's usable life, concrete can be recycled.
- Impervious concrete roofs support green landscaping, reducing water runoff and reducing heat island effect.

Concrete Delivers™

Engineered concrete solutions for sustainability, durability and value.

www.GreenConcrete.info • www.NRMCA.org • www.ConcreteThinker.com
www.PerviousPavement.org • www.ConcreteAnswers.org

NRMCA

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