Building Green
WITH REINFORCED CONCRETE

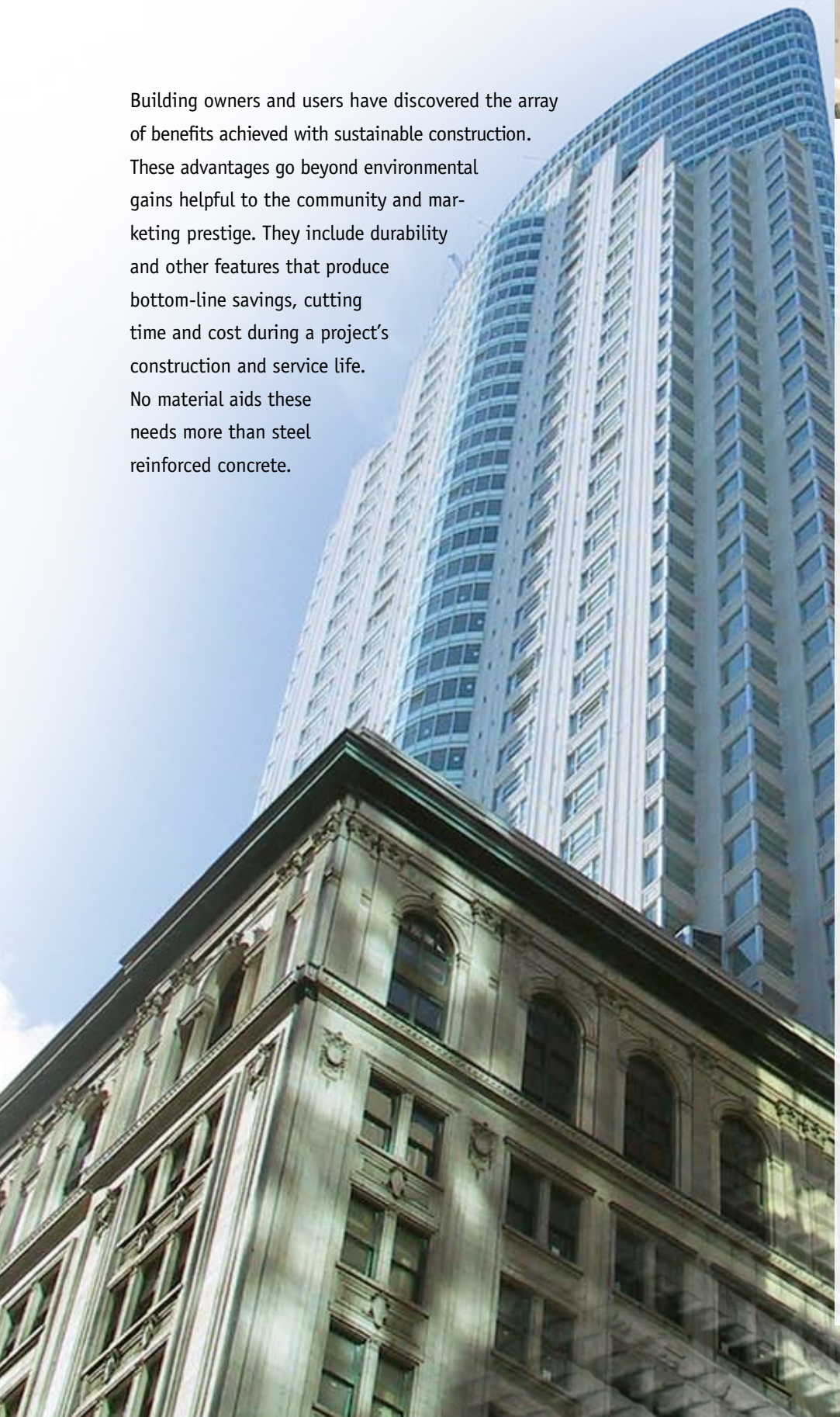
virtually 100% recyclable product, provides cradle-to-cradle construction.

Concrete Reinforcing Steel Institute

"Human design can learn from nature to be effective, safe, enriching, and delightful. Industry must create products for cradle-to-cradle cycles, whose materials are perpetually circulated in closed loops. Closed loops maximize material value without damaging ecosystems."

— McDonough Braungart Design Chemistry LLC

STEEL REINFORCED CONCRETE:
The Sustainable Solution



Building owners and users have discovered the array of benefits achieved with sustainable construction. These advantages go beyond environmental gains helpful to the community and marketing prestige. They include durability and other features that produce bottom-line savings, cutting time and cost during a project's construction and service life. No material aids these needs more than steel reinforced concrete.

Long Service Life

Reinforced concrete's durability ensures that the building will retain its structural and aesthetic capabilities for many years, eliminating the need to supplement or replace the structure. A carbon footprint is minimized when the need to build a new structure is eliminated.

Safety

Reinforced concrete buildings can withstand natural disasters, including hurricanes, tornadoes, earthquakes, and floods. This resistance minimizes the need for replacement or renovation in the wake of such cataclysms.

Fire Resistance

Inherent fire resistance is a valued benefit of reinforced concrete construction. The simplest concrete structural frame can easily achieve fire code compliance. Concrete acts as a natural barrier to fire with no need for additional fireproofing applications.

Energy Efficiency

Reinforced concrete's inherent thermal mass absorbs heat during the day and releases it at night, reducing HVAC costs and enhancing energy efficiency. This is especially important in buildings containing heat-generating equipment.

Improved Indoor Air Quality

Concrete contains no volatile organic compounds (VOCs), improving indoor air quality. Because it is inorganic, it also does not promote mold growth.

Low Maintenance

Reinforced concrete's durability also requires little patching or cleaning, eliminating the need for harsh chemical cleaners or other materials, lowering overall maintenance cost.

Concrete's Energy Use

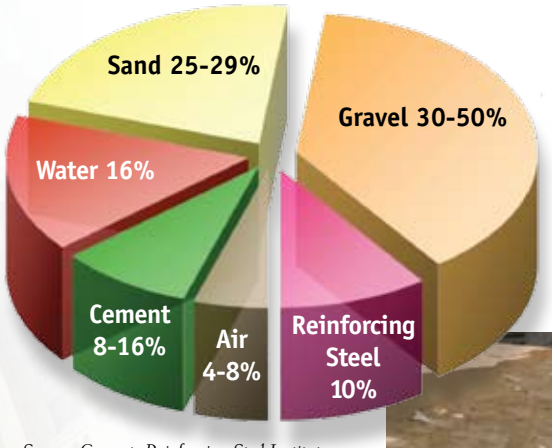
As with any material, manufacturing and transporting steel reinforced concrete to the site involves costs. But reinforced concrete is resource efficient, requiring little manufacturing for its creation, according to the National Ready Mixed Concrete Association.

Cement is the key energy-intensive material in concrete. Its ingredients comprise calcium (60% by weight), silicon (20%), aluminum (15%), iron (10%), and small amounts of other ingredients, according to the Portland Cement Association (PCA). The mixture of primarily limestone, iron, silica and alumina is heated to 2700° F to create the basis for cement. However, cement makes up only about 10% of concrete's composition. Likewise, the steel reinforcement used in steel reinforced concrete makes up only about 10% of the total material in the concrete components. This addition adds little costs or weight, yet increases strength dramatically.

Concrete manufacturers and steel mills also have worked to minimize the energy intensiveness of concrete manufacturing and steel production, respectively. Many of its attributes have been recognized by green-building programs, especially the Leadership in Energy & Environmental Design (LEED) program operated by the U.S. Green Building Council. As a result, reinforced concrete provides a variety of ways for owners and architects to increase their building's sustainable design.

Each year, producing reinforcing bars through steel recycling saves the energy equivalent to electrically powering about one-fifth of America's households (18 million) for one year.

Typical Composition of Steel Reinforced Hydraulic-Cement Concrete (by volume)



Source: Concrete Reinforcing Steel Institute April 2008

Minimized Harvesting Impact

Concrete is made primarily from naturally occurring and readily available materials: water, sand, and gravel. Suppliers of concrete products also are replacing significant amounts of cement in their mixtures with industrial by-products such as fly ash, silica fume, and blast-furnace slag. Use of these by-products in concrete removes them from landfills and reduces cement use, while in many cases producing an even more durable concrete.

Minimized Transportation Cost

Concrete manufacturers, steel mills and reinforcing bar fabricators are located throughout the country, and they typically use locally available materials. Thus, cost to transport ingredients or finished products to the site are minimized. Virtually all of reinforced concrete components can be made within 500 miles of the construction site, a key element in achieving LEED points.

Recycled Materials

The reinforcing steel used in concrete is virtually 100% recycled from other metal products. Likewise, cement often is replaced by supplemental cementitious materials that otherwise would enter the waste stream. This contribution by reinforced concrete in providing recycled materials is recognized by LEED.

More than 7 million tons of scrap steel is recycled into reinforcing bars every year, virtually the entire feedstock. This recycling avoids a massive energy expenditure—one ton of steel reinforcing bars would otherwise require about 2,500 pounds of ore, 1,400 pounds of coal, and 120 pounds of limestone.

Reinforcing bar is typically made in electric arc furnaces, which produce about 45% of the steel products made in America. Nearly 100% of the feedstock used for producing reinforcing bars is provided by recycled ferrous scrap.

Recyclable

Steel reinforcement is infinitely recyclable, meaning it typically is recycled by demolition contractors, who sell the bars as ferrous scrap. The steel is reclaimed by crushing the concrete and retrieving the bars with hammers, breakers, and grappling hooks mounted onto heavy equipment. The steel is then cut into pieces, using torches and cutting tools. The steel is sold to plants and reused as new quality steel products. More than 65% of all reinforcing bars are recycled, according to The Steel Recycling Institute.

Likewise, the concrete can be crushed and reused as aggregates in new concrete structures, in roadbeds, and for breakwaters as larger pieces. The combination of recycling activities for reinforcing steel and concrete make it a totally cradle-to-cradle building material that is recognized by sustainable-design organizations worldwide.

Reduced Waste

Concrete components typically are cast as specified, with little excess produced. What waste accrues through cutouts, etc., can be recycled. Many steel and concrete plants have instituted water-recycling programs and other environmental processes to further reduce the manufacturing impact.

Design Flexibility

Reinforced concrete offers flexibility to design dramatic architectural shapes with long-span capability. This can deliver open interior layouts, creating flexibility in design spaces and providing the ability to install equipment quickly. As usage changes, steel reinforced concrete elements can be modified to allow buildings to expand, cutting costs and reusing material.

Reduced Floor Heights

Reinforced concrete framing systems offer substantially lower floor-to-floor heights, creating energy-efficient designs that may be able to add revenue-generating floors to the building while meeting zoning restrictions on height.

Aesthetic Variety

Reinforced concrete can replicate the look of many types of stone that would be costly to quarry and transport. Thin bricks can be embedded in concrete walls to resemble masonry, significantly reducing material use and cost. Logos, names, and other decorations can be cast into the concrete, eliminating material costs and maintenance for these added elements.

Significant Social Benefits

Reinforced concrete provides high fire resistance, lower noise transmission, and vibration dampening—creating safe, secure, comfortable designs. Combined with its ability to build taller and closer to city centers, improved indoor air quality, wind resistance, indoor comfort and other amenities, reinforced concrete can help boost productivity, worker satisfaction and offer a higher quality "greener" way of life.

STEEL REINFORCED CONCRETE helps architects and engineers meet owners' goals for achieving sustainable design

For more information on these benefits and how reinforced concrete can help achieve sustainable design goals, contact:

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