

Precast Helps Attain LEED Certification



Total-precast structure aids office design by offering 'green' qualities, including close proximity, energy efficiency, recyclability and minimal construction waste

It's only natural that officials at CH2M Hill would give "green" building factors a high priority when planning their new world headquarters in Englewood, Colo. The firm provides a wide range of infrastructure engineering and construction services — including environmental services — to public and private clients on six continents. The green attributes designed into the building included a total-precast concrete structural system.

In creating the three-building campus, designers at Barber Architecture in Denver followed the Leadership in Energy & Environmental Design (LEED) standards created by the U.S. Green Building Council (USGBC). During the design process, CH2M Hill designated Andrea Kamage, a LEED-accredited professional, to champion

their environmental and sustainability concerns, says Michael Barber, the firm's president and director of design.

In fact, all three buildings in the new campus are LEED-certified, and they represent some of the nation's first total-precast office buildings to be so designated. Moreover, precast concrete

achievement of LEED certification, says Paul Todd, who at the time was associate principal at Barber Architecture. The campus consists of the five-story world headquarters building flanked by two four-story buildings. The corporate headquarters contains 165,000 square feet, while the other two buildings — a regional headquarters and support building — each have 113,000 square feet.

In all likelihood, the architect would have designed the buildings with precast concrete components regardless of the LEED influence. "I've come to realize that a total-precast building is something of a novel thing nationally," says Todd, "But here in Denver, precast is used extensively for two reasons: cost and schedule."

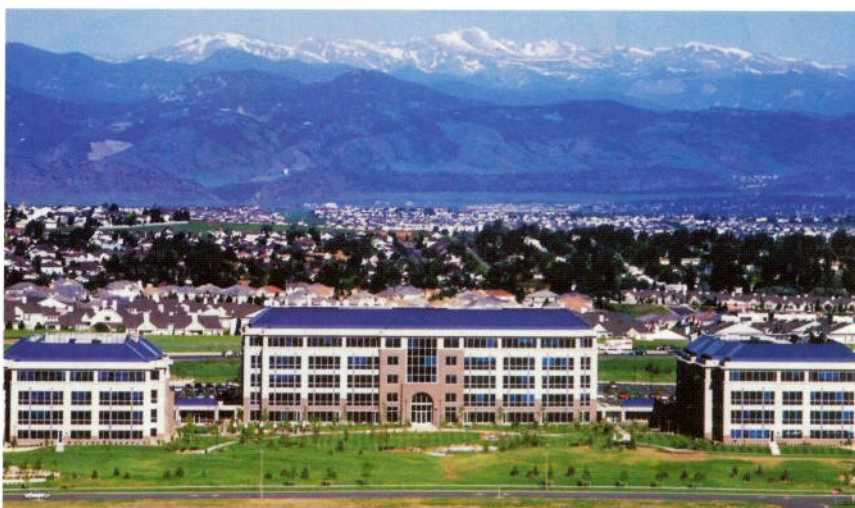
'Here in Denver, precast is used extensively for two reasons: cost and schedule.'

contributed significantly toward the

The designers typically create a trial steel schematic with cladding, as well as a total-precast building, to determine costs and other factors, he explains. "Nine times out of 10, precast turns out to be more economical — and that was before steel experienced its recent price increases." All three structures were framed with total-precast systems that include precast shear walls, 10-foot-wide double tees, rectangular spandrel beams, inverted tee beams and load-bearing exterior wall panels. Bay sizes are about 30 feet wide and vary in depth from 40 to 50 feet.

LEED Points Achieved

LEED certification is awarded according to points achieved in six broad categories: Sustainable Sites; Water Efficiency; Energy &



Mabogany-colored precast accentuates the buildings' bases and entries. Both the mabogany panels and the limestone field panels were acid etched. The three buildings are joined by an enclosed ground-floor passage.



Fact Sheet

Project: CH2M Hill World Headquarters
Type: Commercial office building – corporate headquarters
Location: Englewood, Colo.
Designer: Barber Architecture, Denver
Engineer: S.A. Miro, Denver
Contractor: The Weitz Co., Denver
Owner: CH2M Hill Inc., Englewood, Colo.
Precaster: Rocky Mountain Prestress, Denver
Size: 391,000 square feet
Precast components: 2,590 components
Project cost: \$52.38 million
Precast concrete: \$8.4 million

CH2M Hill's three buildings frame a courtyard, with the world headquarters building at the right. Three doors on the lower level, at right, provide access to the terraces from common meeting rooms on the ground floor.

Atmosphere; Materials & Resources; Indoor Environmental Quality; and Innovation & Design Process (see sidebar). Each of the six categories has a number of specific criteria to measure a building's environmental friendliness. It takes 26 points to gain certification, which is the number of points attained at CH2M Hill.

"The category in which I believe precast made the most impact at CH2M Hill is in Materials & Resources," Todd explains. Under that category, one point was awarded for construction waste management. If the project can divert 50 percent of its construction waste from a landfill, it earns a point. Precast aids that total, as it provides no on-site waste, he points out.

The building also earned two points for recycled content, and here again,

precast concrete contributed to the LEED certification. The concrete contains fly ash, a recycled material that replaces some of the cement, a material that takes the most energy to produce in concrete. The precast also contains rebar, which uses recycled steel. A project receives one point if 5 percent of its content uses recycled material

and two points if 10 percent is recycled. CH2M Hill's headquarters garnered both points.

Precast also contributed to the buildings' use of local/regional materials, another LEED criterion. If a minimum of 20 percent of materials are manufactured within 500 miles of the building, one point is earned —

"The buildings have a very strong base, shaft and top," says architect Paul Todd.





All three buildings feature total-precast structural systems. The third building, in the foreground, is a support structure that houses the data center. It was designed, fabricated and erected in just 11 months. Rocky Mountain Prestress was both the precaster and the erector.



LEED Points For CH2M (26 points achieved)

SUSTAINABLE SITES:	4	MATERIALS & RESOURCES:	5
Site Selection	1	Divert 50% of Construction Waste	1*
Bicycle Storage & Changing Rooms	1	Recycled Content	2*
Development Footprint	1	20% of Material Made Locally	1*
Stormwater Management	1	50% of Recycled Material	
		Harvested Locally	1*
WATER EFFICIENCY:	3	INDOOR ENVIRONMENTAL QUALITY:	5
Landscaping Water Reduced 50%	1	Construction IAW Management Plan	1
No Potable Use/No Irrigation	1	Low-Emitting Adhesives & Sealants	1
Water Use Reduction of 20%	1	Low-Emitting Paints	1
		Low-Emitting Carpets	1
ENERGY & ATMOSPHERE:	5	Indoor Chemical & Pollutant Source Control	1
20% Energy Savings	2*	INNOVATION & DESIGN PROCESS:	4
30% Energy Savings	1*	Innovation in Design-Green Housekeeping	1
Additional Commissioning	1	Innovation in Design-Sustainable Furniture Systems	1
Measurement & Verification	1	Innovation in Design-Exemplary Performance	1*
		LEED Accredited Professional	1

** Indicates points where precast concrete components helped obtain certification.*

TOTAL 26

and if 50 percent of that 20 percent of materials are “harvested locally,” as LEED puts it, then the building gains another point. CH2M Hill again picked up both points, because the plant for precaster Rocky Mountain Prestress is less than 20 miles from the building site.

Precast concrete helped earn another point, in “Innovation in Design: Exemplary Performance of Materials and Resources.” Fully 59 percent of the project’s materials were produced locally, more than double the 20 percent required for the first credit. In

The buildings are among the first LEED-certified facilities to feature total-precast structures.

fact, structural and architectural precast components used in the CH2M Hill project accounted for 39 percent of the materials used to calculate the local/regional content of the buildings.

Benefits Of Thermal Mass

The buildings’ total-precast structural systems also contributed to their energy efficiency — and the buildings earned five LEED points in the category of Energy & Atmosphere. To win LEED’s Minimum Energy Performance prerequisite, the building must meet ASHRAE 90.1-1999 energy efficiency and performance requirements, or those of a more restrictive local code if one exists. The builders also received three LEED points under the category of “Optimize Energy Performance.”

Two of the LEED points resulted from a 20 percent savings, compared to a base building — and another point was gained because the buildings achieved a 30 percent reduction in energy cost. Precast was among several materials used on the buildings’ exterior that aided this efficiency.

Precast’s aid derived from the thermal mass of the load-bearing architectural precast panels on the façade. The material is so dense that it helps to absorb heat during the day and moderate daily temperature swings. Recent studies have demonstrated that

thermal mass creates more efficiency than designers tend to realize, according to the Environmental Council of Concrete Organizations (ECCO), of which PCI is a member. Actual energy performance has guided the

‘We designed the buildings to maximize the positive and environmentally friendly attributes of precast.’

development of thermal-mass standards, according to a report from ECCO. “These standards have successfully translated the behavior of thermal mass into understandable and easy-to-use terms,” the report states. “The result is that thermal mass has become a feasible element of building design.”

LEED Essentials

The Leadership in Energy & Environmental Design (LEED) standards form a comprehensive system by which buildings are awarded points based on their sustainability and environmental friendliness in several categories. To attain basic LEED certification, between 26 and 32 points are required, and the CH2M Hill buildings achieved 26 points.

The LEED system also designates a “Silver” level, which requires 33 to 38 points; a “Gold” level requires 39 to 51 points; and a “Platinum” level takes 52 or more points.

While precast concrete helps attain LEED certification, some of the criteria do not relate directly to the material — and the CH2M Hill campus achieved a number of points in those categories as well. They include Sustainable Sites, Water Efficiency, and Indoor Environmental Quality.

Under the Sustainable Sites category, for example, the CH2M Hill buildings received one point for site selection, one point for having bicycle storage and changing rooms, one point for reduced site disturbance and one point for stormwater management/treatment. To obtain the site-selection point, the building could not use prime farmland, land on a floodplain, wetlands, or land inhabited by any endangered species. Each criterion has detailed definitions.

The CH2M Hill buildings also received three LEED points for water efficiency. To gain one point, the buildings must limit the use of potable water for landscape irrigation. Another point was gained for using no potable water for irrigation. And the campus buildings received a point for reducing water use in the building by 20 percent compared to an existing standard.

Indoor Air Quality is a major LEED category. Here, the buildings attained five points. Credits were given for having an air-quality management plan during construction, for the use of low-emitting adhesives and sealants, for low-emitting paints, for low-emitting carpets and for the control of indoor chemicals and pollutants.

The LEED standards are sure to gain momentum across the country, and as they do, the country’s built environment will harmonize more with the natural environment.

Rocky Mountain Prestress helped plan the design to obtain as many LEED points as possible, says Jim Albertson, who at the time was vice president of sales for the firm. “It was always totally a precast building,” says Albertson. “So we didn’t have to divert components from one material to another to gain LEED certification. We designed the buildings to maximize the positive and environmentally friendly attributes of precast.”

Precast also was the fastest structural system to build, he says. “All the architects and contractors in the Denver area understand how precast can accelerate a schedule. It’s faster than any other system by at least two months.”

At the CH2M Hill campus, the firm moved into the finished building just one year after final design plans were completed. Several months later, the client decided to add the third building, a four-story support structure, again using a total-precast concrete structure. Portions of the third building repeated the design of the first four-story



The buildings are designed to provide a corporate identity — and to be marketable in case CH2M Hill ever moves or downsizes.

building, but the precast components could be completed so quickly that the client moved into the third structure just one month after occupancy of the other two buildings.

“From complete design to occupancy took just 11 months,” says Todd. “Although it was a twin to the regional

‘From complete design to occupancy took just 11 months.’

headquarters building, the interior space planning was different. And it has a data center, which is different. So it required some tweaking of the original design to ensure it met the needs effectively.”

Market-Conforming Structures

Besides the LEED standards, Barber says two other influences guided the design at the CH2M Hill campus. One was the desire to give the company an identity in a prominent location along a freeway in the Denver area. That influence was balanced by

the client’s desire to build market-conforming buildings that would be desirable properties for other office tenants if CH2M Hill were to move its headquarters or downsize the firm. Any of the three buildings could be converted to stand-alone, multitenant office buildings.

“We needed to be cost-competitive in the marketplace, so we balanced first cost with maintenance cost and the sustainability/environmental issues,” says Barber. “Every LEED strategy that we considered was balanced with the influences of first cost and maintained cost. The building is close to the first cost of an investment-grade office building.

Precast concrete also helped hold down the buildings’ cost, Barber says. “The precast walls not only support the

floor loads, they also form the exterior finish of the buildings,” he explains. “By casting structural components with an architectural finish, the pieces eliminate the redundancy between the exterior finish and structural components.”

Choice Of Colors

CH2M Hill, which is basically an infrastructure design firm, “was very interested in participating in the campus design, including the precast color selections,” said Todd. The designer created a series of color studies, which CH2M officials narrowed down to two schemes. One featured a green accent color in the precast, with a gray field color and a green-gray roof. The


‘We needed to be cost-competitive in the marketplace.’

second scheme had a mahogany accent color for the precast, with a limestone field and a blue roof.

The team decided to prepare precast samples of both color schemes. They then put those samples together with the glass color, the mullion color and the two different roof colors. The client chose the blue roof color with the mahogany accent and limestone field color. Both colors have an acid-etched finish.

The potential for growth was another influence on design. “It’s a multiple-building campus, and it’s going to grow over time,” says Barber. “CH2M Hill wanted it to feel complete at any given time, so that it can grow in a logical way, but always be complete at each stage.” ■

— Daniel C. Brown

 **pci.org** Click For More...

For additional information on this story, visit www.pci.org/pdf/knowledgebank/ch2m_05.pdf. (Adobe Acrobat version 5 or greater required.)

To learn more about **total-precast structures**, visit the Designer’s Knowledge Bank by clicking on the DKB icon at www.pci.org or at your local precaster’s Web site.