



case history

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Concrete Builds Environmental Showcase

In 1994, a 2,640-sq.-ft. Environmental Showcase Home (ESH) built in northeast Phoenix, Ariz., proved that currently existing designs and technologies could result in a home that uses 60% less energy and 60% less water than a typical energy-efficient home. Concrete played a key role in its inception.

The design is applicable to any new home because the ESH uses only readily available commercial products. Before 1990, many of the materials and technologies used in the ESH did not exist. However, these innovative and environment-friendly products are now available to designers and the public, who are

just becoming aware of their possibilities.

Long a mainstay of construction, even concrete block has evolved into a “greener” product. For the envelope wall, the ESH designers, Jones Studio, Inc., Phoenix, chose an 8-inch-thick H-shaped concrete masonry unit (CMU) produced locally to create a thermal envelope that saves more than 30% of the energy used in a typical new home.

The Grade N, Type 1 hollow CMUs contain 25% fly ash replacement for the cement. Replacing a portion of the cement with this electric industry byproduct significantly reduces the embodied energy of the concrete and reduces the amount of fly ash sent to landfills.

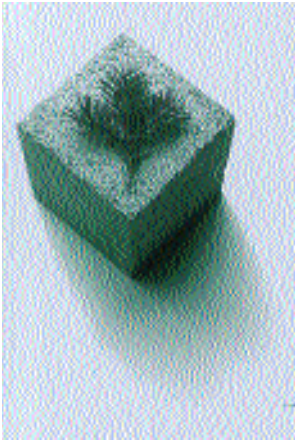
This block also provides only a small thermal bridge at the center of the H-shape. By filling the hollow spaces of the block with a polyurethane foam, the contractor, Homes & Son, Phoenix, produced a wall with an R-value of 24, far greater than the typical R-value of 19 for walls. Better yet, the foam did not require a blowing agent with CFCs (chlorofluorocarbons) or HCFCs (hydrochlorofluorocarbons), which deplete the ozone layer.

The CMU wall has a system of post-tensioning rods that eliminates the need for grouting and makes more space available



Maintenance-free sealed concrete exterior saves finishing energy.





for insulation. Like most reinforcing, the steel rods have a high recycled content—mostly from discarded automobiles.

Often CMUs are given another finish such as paint or siding on the inside and outside. To avoid the embodied energy costs of other finishes and their maintenance, the block surface was sandblasted, removing its thin gray outer layer to expose a colorful, textured aggregate inside. Applying a penetrating sealer to the surface makes the finish maintenance-free for the life of the home.

“One of the most durable materials to use in the desert is concrete because its stone-like properties allow it to fend off the climatic changes,” write the authors of *The Environment Comes Home*, a book about the Environmental Showcase Home. “In addition, it is essentially chemically inert and will eventually erode into materials similar to stone and gravel.”

In addition to concrete walls, the foundation and floor slabs are cast-in-place concrete with 25% fly ash replacement for cement. By finishing the slabs with colors, sandy stone-like textures, or highly polished smooth surfaces, the designers avoided the need for additional floor covering in most rooms, and again reduced the embodied energy costs of the home.

Whenever large areas of concrete come into contact with one another or with fixed objects, jointing is required. In this case, a 100% recycled newsprint product was used to fill expansion and control joints.

Paving surfaces are reduced as much as possible around the home and sited to the north and east for less heat absorption. Walkway paving consists of precast concrete stepping stones surrounded by stabilized granite to create a smooth path that allows water to penetrate. If necessary, these stepping stones can be easily relocated or replaced, reducing the energy that would be necessary to replace the walkways.

About 95% of all materials used in the Environmental Showcase Home have at least some recycled material content. Concrete helped the designers meet this goal by containing the waste product fly ash, and was beneficial to the house overall by providing the thermal mass to conserve a maximum amount of energy.

To create this new standard for sustainable building in the Southwest desert, the builders and designers underwent a continual learning process, because so many new products and materials became available during the design and construction of the EHS.

The Arizona Public Service Co., the state’s largest electric utility company, sponsored the ESH, which has four bedrooms, three baths, a triple garage, and a swimming pool. The home’s average energy bill is estimated at \$85 per month without using solar energy and \$30 per month using it. Over its 30-year life, the ESH is estimated to prevent 540,000 pounds of air pollution and save 2.3 million gallons of water (27,000 gallons per year).

In September 1995, the ESH won the top honor for its environmental design from the Valley Forward/Honeywell Annual Environmental Excellence competition.



Attractive cast-in-place flooring can be colored and textured in a variety of ways.

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promoting the environmental
benefits of concrete and its role
in safe and sustainable
construction.

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