Precast on the Rocks

Insulated precast concrete panels enable an architect to design an award-winning home at a unique location in Australia.

By Shari Held

Photo courtesy of Trevor Mein

Thermal insulated concrete sandwich panels keep the home's temperature consistent despite extreme fluctuations in the area.

Hanging Rock, located in the Macedon Ranges of scenic Victoria near the southern tip of Australia, has a rather checkered past. The massive volcanic boulder, suspended between two other rocks, was once the site of Aboriginal tribal gatherings. But the Aborigines refused to climb the 350-foot lava blister because they feared malevolent spirits inhabited the area. In the '70s, Hanging Rock was immortalized by Picnic at Hanging Rock, a haunting movie in which several schoolgirls and a teacher mysteriously disappear. The eerily beautiful landscape seems to inspire that kind of mystique.

But recently, the picturesque location served as an inspiration for something different – the award-winning House at Hanging Rock. The home, in which precast concrete played a starring role, earned Australia's most prestigious residential architectural prize, the 2014 Robin Boyd Award, and the 2015 Australian Institute of Architects Victorian State Harold Desbrowe-Annear Award for Residential Architecture.

Kerstin Thompson Architects designed the House at Hanging Rock for European artist Tatiana Henderson and her husband. The couple, who were actively involved in the design process from the beginning, had several criteria for their new abode. The exterior had to merge into the landscape while providing them with shelter and protection from the elements, including extreme fluctuations of temperatures and dangerous brushfires. And the interior needed to convey a feeling of intimacy in contrast with the spectacular, vast expanses of the surrounding area.

A CONCRETE SOLUTION

The owners requested a "brutalist use of materials" and felt constructing the home from concrete would mesh well with their concept. In addition to its aesthetically pleasing qualities, concrete is known for its adaptability, low maintenance and durability.

That fit right in with Thompson's philosophy of designing buildings that enhance the natural surroundings rather than alter the site to accommodate construction. The House at Hanging Rock, set amidst a stark and dramatic landscape, holds its own without being obtrusive and taking away from the natural beauty of the area.

Kerstin Thompson Architects specified precast concrete for the House at Hanging Rock due to its cost-effectiveness, durability and thermal efficiencies.

"The House at Hanging Rock epitomizes the clarity of KTA's planning and interest in a direct and reduced material palette in which the structure actually forms the finished surface," said architect Kerstin Thompson. "Much of the house's intriguing character comes from the use of concrete thermapanels for the primary wall expressed inside and out. More broadly, the project demonstrates the intrinsic relationship between construction, material, parti and landscape in the making of this distinctive dwelling."

PRACTICAL AND COST-EFFECTIVE PRECAST

Thermomass insulated concrete sandwich panels from Composite Global Solutions were used for the walls of the home. Thompson had used Thermomass panels in an earlier industrial project for the Templestowe Fire Station, but this was her first foray into using them for the residential market. The precast panels met the design specifications for a concrete finish on both the exterior and interior walls. Using precast also helped keep the cost of constructing a concrete home in check.

"It was a more cost-effective way to achieve a concrete building than in-situ," Thompson said. "And precast offered more quality control than in-situ, since it was produced within a controlled factory setting. This helped with managing client expectations around the finish."

Another advantage Thermomass precast concrete sandwich panels brought to the project was excellent thermal efficiencies. Thermomass panels can handle extreme temperature fluctuations over a 24-hour period, something common in that part of Australia.

During the daylight hours, the insulation protects the home against sharp rises in external temperatures. Any heat entering the home through the windows and doors is cooled by the interior layer, which acts as a heat sink for the building, lowering ambient temperatures.

"As the external temperature drops towards evening and throughout the night, the interior leaf of the concrete panel, that has gradually risen in temperature during sunlight hours, keeps the internal temperature pleasant," said Fredrik Carlstrom,

Construction of the home was completed in just under two years.

marketing manager for Composite Global Solutions in Toorak, Victoria. "As such, the peaks and troughs of diurnal temperature fluctuations have been vastly diminished, resulting in a much smoother temperature variation."

By placing the insulation toward the outside of the sandwich panel and having the bulk of the internal mass on the inside of the structure, diurnal swings are reduced without the need for additional non-passive cooling.

FIVE STEPS TO SUCCESS

Manufacturing the insulated precast concrete sandwich panels is a five-step process, and timing is critical. First, the exterior layer of concrete is poured into a form with reinforcement that's been treated with a bond-release agent. Immediately after the exterior layer is set – within 15 to 20 minutes to ensure the concrete mix is still plastic – pre-drilled, extruded polystyrene insulation is placed over the concrete. Next, special concrete-compatible, fiber-composite connectors are inserted through the pre-drilled holes in the insulation. A single connector is strong enough to carry up to 2,500 pounds of concrete. Then, the form is vibrated to create a 5-to-7-inch slump around the notches in each connector. For the finishing touch, another layer of reinforcement is laid and the interior layer is poured on top.

Sandwiching the insulation between the two layers of concrete doesn't just help moderate indoor temperature fluctuations – it greatly reduces energy consumption as well. R-values range from R-10 to R-50, which is significantly better than concrete alone.

Thermomass concrete panels also meet the strict bushfire attack level requirement for the area. No one in Victoria has forgotten 2009's "Black Saturday," during which 400 individual bushfires broke out, leaving 173 dead and 414 injured. Global warming is making the area hotter and drier and the threat of bushfires is an ever-present challenge to builders.

"By its very nature, concrete is non-combustible," Carlstrom said. "And since the insulation is never exposed to naked flame, being sandwiched between two layers of concrete, the whole system is deemed to satisfy the fire ratings of the area."

On-site construction on the 2,583-square-foot home, built by Project Precast Panels, took place from July 2011 to April 2013.

CONCRETE WALLS LET THE SCENERY TAKE TOP BILLING

Thompson's design called for three parallel levels or terraces, each in an east-west orientation that followed the slope of the hill they're nestled against. The generous overhang on the tapered roof, which creates a shadow serving as a buffer between the home and the outdoors, helps the home blend seamlessly with the rugged terrain.

According to Thompson, the multiple levels help define the interior space, creating distinct areas within the home. Each level has its own function: the lower level houses the guest room and studio, the upper level contains the master suite and study, and the middle level accommodates the main living areas.

"The widest of the three terraces houses the central living

The House at Hanging Rock has won several awards, including Australia's most prestigious residential architectural prize, the Robin Boyd Award.

zone and overlaps with the outer two terraces, creating a series of interconnected living spaces that are experienced as one larger space," Thompson said.

The middle level is also where the three terraces flow together, providing spectacular views. Incorporating that rugged scenery into the interior of the home was crucial to the owners. Its rough-textured precast walls and concrete floors provide a rustic backdrop that puts the spotlight on the scenery. The parallel concrete walls also create natural longitudinal "viewing corridors." But Thompson expanded upon that concept by "pulling apart" selected panels to create lateral views that capture the scenes from all three levels in the main living space.

"The formal arrangement of the house frames the desirable views – distant ones of Hanging Rock and closer ones of bushland," Thompson said. "There are also incidental diagonal views across the various levels and spaces. Although a 2.4 module is used for all wall panels without windows, the spatial outcome is decidedly un-modular and dynamic."

A FITTING ABODE

The House at Hanging Rock has been described as everything from "sophisticated and elegant" to "tough," but architects and those in the industry appear to be fascinated by it. A big part of its allure is the innovative use of precast concrete panels that form the interior and exterior of the home.

"We have been delighted by the success of the project, particularly the peer recognition we have received for the quality of the architecture," Thompson said. "It is appreciated when what we, in our office, have judged to be a good building is endorsed as such by others. But most rewarding is the clients' enjoyment of it: the rightness of the fit between their lives and the flow and feel of the house." **PS**

Shari Held is an Indianapolis, Ind.-based freelance writer who has covered the construction industry for more than 10 years.