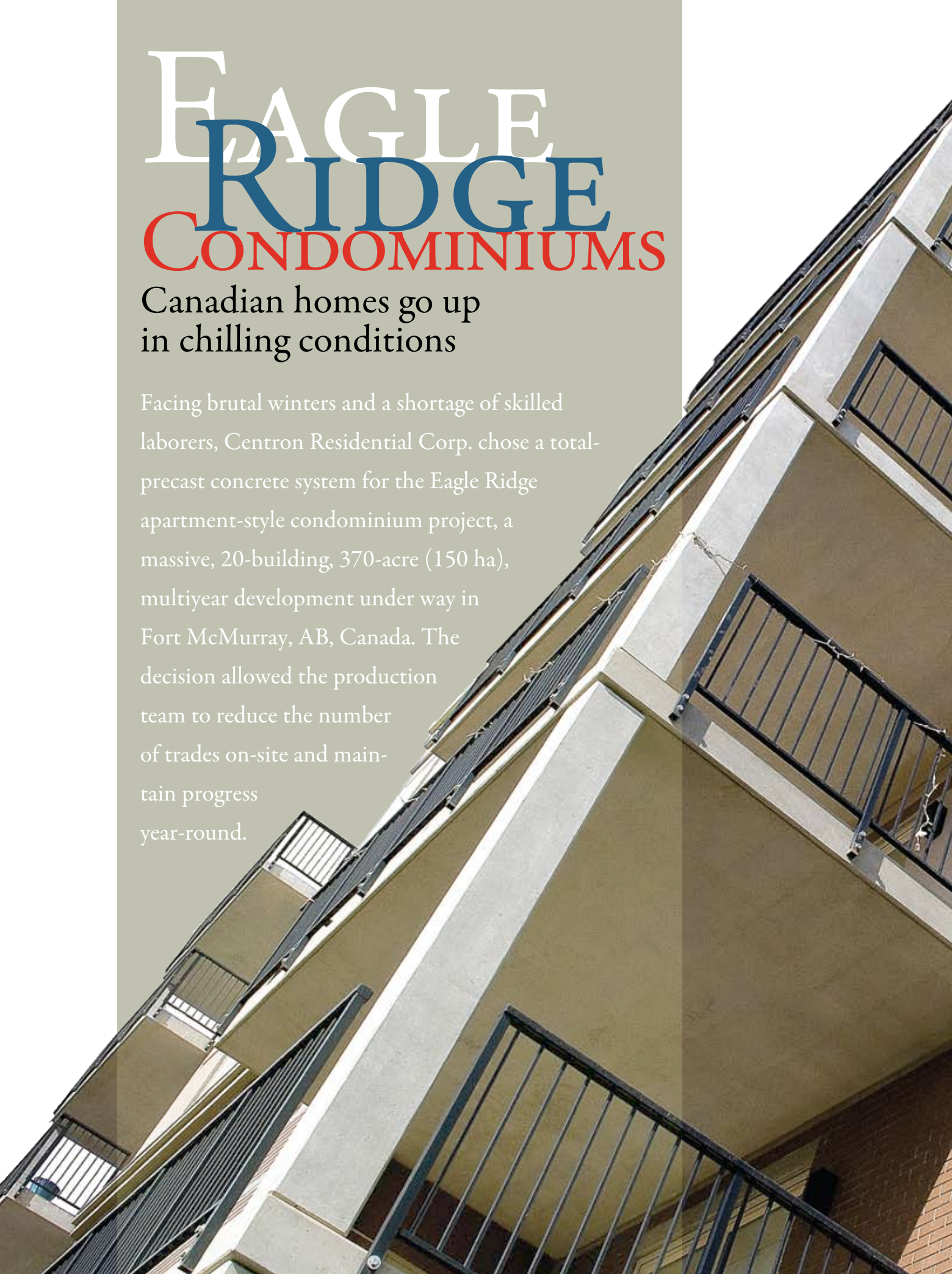
Eagle Ridge Condominiums

Canadian homes go up in chilling conditions

Facing brutal winters and a shortage of skilled laborers, Centron Residential Corp. chose a total-precast concrete system for the Eagle Ridge apartment-style condominium project, a massive, 20-building, 370-acre (150 ha), multiyear development under way in Fort McMurray, AB, Canada. The decision allowed the production team to reduce the number of trades on-site and maintain progress year-round.



Sarah Fister Gale

Above The average low temperature in winter at the site of the Eagle Ridge condominiums in Fort McMurray, AB, Canada, is -23 °C (-10 °F). Courtesy of Lafarge.

Previous page The team working on the Eagle Ridge apartment-style condominiums in Fort McMurray overcame challenges such as frigid working conditions and the lack of a skilled workforce. Courtesy of Lafarge.

Fort McMurray is a burgeoning town of fewer than 100,000 people in the northern corner of Alberta, Canada, where the average low temperature in the winter is -23 °C (-10 °F), and it always drops to -40 °C (-40 °F) for at least a few days out of the year.

The city has seen rapid growth in recent years due to investment in oil sands and oil pipeline projects, leaving the city scrambling to accommodate the surge in population.

"There has been so much growth in Fort McMurray that there is not an adequate supply of housing," says Wayne Benz, president of Centron Construction Group in Calgary, AB, Canada.

To ease the housing crunch, Centron is building the Eagle Ridge apartment-style condominiums on

Team members

Owner:
Centron Residential Corp., Calgary, AB, Canada

Architect:
Gibbs Gage Architects, Calgary

Engineer of record:
TRL & Associates, Calgary

Specialty engineer:
Kassian Dyck Associates, Calgary

Contractor:
Centron Residential Corp.

Precaster:
Lafarge, Edmonton, AB

Within two years of the start of construction, seven of the twenty Eagle Ridge condominium buildings in Fort McMurray, AB, Canada, were completed and two more were under way. The acoustic benefits that concrete offers reduce construction noise for the current residents. Courtesy of Tucker Photography.

a bluff overlooking the Athabasca River using a total-precast concrete system, which helped the company overcome many of the obstacles that this project presented. When complete, the community will feature 3700 residential units that will house 10,000 people.

The construction site was cleared in May 2006, and work on the first building began in August that year. Within two years, seven of the twenty buildings were completed, and two more were under way.

Each of the six-story condo buildings features a total of 3200 m^3 (4150 yd^3) of precast concrete, comprising about 1850 pieces.

"Putting up that many buildings is difficult in a place like Fort McMurray," Benz says. "The remoteness of the site, the lack of an available and skilled workforce, and the harsh climate all added challenges to the project."

Benz, whose company has worked with precast concrete for years, recognized the value that the material could bring to such a project. From reducing the number of tradespeople needed on-site to minimizing the time workers would be required to work outdoors, precast concrete met the needs of the project team without compromising the quality or deadline, and it helped keep costs in line.

"You've got to build economically because if the end product is too expensive, you can't sell them to people," Benz says. "When we went through the price scenario and factored in the time reductions and the ability to reduce the number of trades on-site, we found that precast was a lot less expensive than cast-in-place. In fact, it's not much more expensive than wood-frame construction, but the quality is a whole lot better."

Virtual design

With the decision in place to use an all-precast concrete system, Centron assembled the team of precasters, engineers, architects, and builders to identify potential problems and mitigate risks before construction began.

"We took a team approach to developing this project," says Don Zakariasen, director of marketing, concrete products, for project precaster Lafarge. "We all came together in a board room to design it together."

To avoid mistakes and to fast-track production, Kassian Dyck Associates in Calgary, the precast concrete engineer for the project, used three-dimensional (3-D) modeling software to prototype the project and create all of the precast concrete shop drawings.

"It's a huge-scale project, and Lafarge needed drawings for every piece of precast," says Wayne Kassian, president of Kassian Dyck Associates. "We didn't have the time or resources to produce them using conventional methods."

With an extremely short time frame from design to construction, the software enabled his team to design the project in much less time than it would have taken for hand drawings. The 3-D simulation also enabled the entire team to explore potential problems and find

The casting yard for the components of the Eagle Ridge condominiums in Fort McMurray, AB, Canada, is five hours away in Edmonton, AB. Three-dimensional simulation helps avoid construction delays by catching potential problems early. Courtesy of Tucker Photography.

The extremely cold winter climate in Fort McMurray, AB, Canada, was taken into consideration when choosing precast concrete for the Eagle Ridge condominiums. Precast concrete allows year-round, all-weather construction. Courtesy of Lafarge.

fixes prior to construction. This was especially important because the casting yard was a five-hour drive from the jobsite, which meant any problems with the precast concrete components during construction would cause days of delay if new pieces had to be recast in Edmonton then trucked back to Fort McMurray.

"We built the entire precast structure in 3-D with every nut and bolt and lifting device in place so we could see any problems up front and make modifications," Kassian says, noting that the design evolved over several meetings with the precaster, engineers, and architects. "They brought their expertise to our design concept and gave us input on the model and connectivity issues that ultimately made it easier for the whole team."

Using the software, the team was able to identify issues such as corners not lining up and headroom problems in doorways. The model also alerted the design team to an opportunity to expand the size of some of the condos.

"Looking at the model on the screen one day, the architect and developer noticed there was a huge void of space in the stairwells," says Kassian. "We realized we could put a doorway into those stairwells and add that livable space to the adjoining apartment as an extra room or bathroom."

That discovery allowed designers to increase the number of square feet—and thus the price—of those corner units.

"It added value to the project," he says.

Cold-weather construction

Looking ahead to the construction phase of the project, the extremely cold climate in the area was factored into many of the project decisions, Zakariasen says. The project would last several years, and construction needed to continue year-round, which meant that the climate would affect working conditions, schedules, energy costs to heat and enclose unfinished buildings for grouting and finish work, and ultimately the finished envelope of the building.

"We needed a solution that allowed for all-weather construction with minimal crews so the long winters wouldn't affect our schedule," Zakariasen says. "A major contributing factor to

Facts and Figures

- **Project:** Construction of 20 total-precast concrete condominium buildings with brick-patterned and stucco facing to house 10,000 people
- **Design began:** April 6, 2006
- **Precasting began:** July 12, 2006
- **First building completed:** December 5, 2006
- **Number of precast concrete pieces:** 36,000
- **Total cubic meters of concrete:** 67,000 (88,000 yd^3)
- **Building dimensions:** 90 m × 22 m (300 ft × 75 ft)
- **Building components:** 18 units per floor average with 151 hollow-core slabs, 21 interior shear walls, 22 balconies, and 48 exterior insulated panels
- **Precast concrete contract cost for phases 1 and 2:** About $120 million

the decision to do total precast was the ability to reduce workers on the project site."

"The beauty of these buildings is we can work in any weather," says Kelly Zaharia, Centron's project manager for Eagle Ridge. "Using precast has been a benefit to scheduling, costs, and resources."

From the beginning, the project team knew that attracting laborers in the small city would be a challenge. Most of the workers in town are employed by the oil companies, and there aren't enough nearby cities to fill the lack of skilled tradespeople.

Instead, Lafarge was able to tap into the much larger labor pool in Edmonton, the city in which all of the 36,000 pieces of precast concrete for the project are being cast and then trucked to the site. Lafarge also benefited from the climate-controlled conditions of the precasting plant, where most of the construction can be performed indoors.

The factory conditions also allow workers to forego heavy winter gear and gloves during critical production steps and to perform tasks standing on the floor, rather than hanging off scaffolding.

"They can build a better-quality product in these conditions," Kassian says. That is critical in a town where winter can last seven months, slowing and even stopping outdoor construction when conditions prevent safe progress.

"Because the entire structure of each building is built in a different city under indoor conditions, we aren't as reliant on the weather," he says.

Using a total-precast concrete design also means that no other trades need to be on-site during the erection process, further reducing the need for workers and lessening the impact of the weather.

However, casting the precast concrete elements off-site only addressed some of the weather- and labor-related challenges that the project team faced. How the components would be erected on-site, even in frigid weather conditions, was also a concern.

Once the precast concrete pieces are at the site, the buildings are assembled like a jigsaw puzzle, and can be completed from the parking level to the sixth-story roof in 62 days.

To secure enough workers for the construction crews, Centron provides accommodations for all crew members, which is a big perk, Zaharia says, but also a logistical challenge in a town already short on housing.

"It's a little scary figuring out where you are going to find and house 200 people," he says.

It took a while, but over the past year and a half, Zaharia has built up a talented and reliable crew of tradespeople and Centron's own employees who work seamlessly together.

The buildings of the Eagle Ridge condominiums in Fort McMurray, AB, Canada, are assembled like a jigsaw puzzle and can be completed in 62 days. Courtesy of Tucker Photography.

"We've got it down to a science now," Zaharia says, noting that his team can complete all of the exterior painting and roofing on a six-story building and have it watertight and ready to occupy within four to six weeks of erection.

"The time savings is immense. Compared to a traditional wood-frame building, we can shave five to six months off just on exteriors," he says. "That's substantial."

The crews are still faced with the challenge of putting up buildings year-round, even during the bitter cold of winter. The biggest challenge was warming the structures enough to complete the temperature-sensitive grouting on each floor.

"Typically, with precast you go up one floor at a time, do the grout, then move to the next floor," Zakariasen says.

However, grouting cannot be done under extremely cold conditions. That left the erection crews to use the conventional method of heating and hoarding, in which crews put up insulated tarp shelters around the open construction site and blow in hot air to increase the temperature for grout work. Zakariasen didn't think that was a feasible or economical choice.

"If you try to contain heat with tarps in those conditions, the wind blows through every crack and open window. It's difficult to maintain a high enough temperature to grout effectively, and it's a huge expense," he says.

Instead, the Lafarge team came up with an innovative solution that eliminated the immediate need to heat the structures and allowed them to build three to four floors at a time.

Precision casting is used in localized areas to develop a controlled and predetermined load path in the ungrouted precast concrete structure. This allows multiple levels of the building to be erected, including an insulated precast concrete sandwich wall panel exterior cladding complete with glazing. Bolted connections were used to eliminate the need for welding and the associated preheating requirements.

This process, which has never been used before, enabled the construction crews to erect the entire structure to the roof before returning to do the finish work.

"There is no need for cranes to hold the assembly together while waiting to weld connections," Zakariasen says. "When the guys go back to do the grouting, they have proper walls and nice environment to work in."

The window contractor installed the windows in the panels at the Edmonton, AB, Canada, plant prior to shipping the panels to the construction site for the Eagle Ridge condominiums in Fort McMurray, AB. Courtesy of Lafarge.

Not only did this design strategy keep the crews warm, it kept the project on schedule, winter and summer, enabling them to meet tight deadlines. It also cut huge energy costs from the project.

To further insulate the structures during erection and to shorten timelines, the window contractor installed the windows in the panels at the Edmonton plant prior to shipping the panels to the construction site, rather than installing them once the buildings are erected.

"That way, the buildings are totally enclosed when they go up," Kassian says.

Initially, the design team was a little nervous about shipping the panels with the windows installed for fear they would crack or break due to flying road debris and jostling. To minimize this risk, they covered both sides of the windows with plywood before shipping them. After the first several panels arrived with the windows completely intact, they decided the extra plywood step might be unnecessary and shipped the next batch without them.

"We discovered that there was minor window damage, but it was site created, not from shipping," Zakariasen says.

The decision to install widows off-site also enables the window installers to work in controlled conditions and reduces the number of workers needed at the Fort McMurray site. "Virtually every trade benefited from this decision," he says.

Insulation importance

Other weather-related choices were made with the condo occupants in mind. All of the building exteriors are made from insulated wall panels that sandwich a layer of insulation between two layers of concrete.

The balconies also required a unique design method to prevent the cold from sneaking inside the buildings.

"Typically, a balcony is an extension of the structure cantilevered outside," Kassian says.

Because of the brutally cold winters in that region, such a design would allow the cold to conduct inside via the continuous concrete slab. This would require more heat to maintain a comfortable environment and could cause thermal movement in the structure.

"The design team wanted a solution that would allow the exterior balcony to be a separate piece of concrete with a thermal break," Kassian says.

Through collaboration among Lafarge, Kassian, and Gibbs Gage Architects, the architect for the project, they came up with a fix.

"We had a Eureka moment," Kassian says.

They staggered the 75-mm-thick (3 in.) exterior wall panels in a stepped pattern and attached the balconies to the exterior stepped panels with steel connectors threaded through the insulation to the interior walls.

"It eliminates a thermal bridge between the interior and exterior that doesn't break the insulation," Zakariasen says.

The resulting structures have excellent thermal properties that translate to comfort and cost savings for residents, Zaharia says. "Because of the thermal mass of concrete, it stays warm in the winter and cool in the summer. That means lower energy bills."

Residents also benefit from the amazing acoustics that concrete structures offer.

"These buildings are so quiet. The owners who are currently in buildings can hardly hear what's going on outside, even though we are in the middle of phase two construction," says Zaharia who experienced the sound quality firsthand when the entire project team had an on-site meeting in one of the buildings.

The meeting took place during a sudden severe rain storm that dropped 100 mm (4 in.) of rain in 45 minutes.

"There were 50 people in that room, and we didn't hear a thing," he says. "There could have been gale-force winds and we wouldn't have known it was happening."

Brick-style concrete

The designers faced one last challenge with the Eagle Ridge project. As the erection crews put up the first of the 20 precast concrete buildings, some in the community were skeptical about how they would appear. There was some concern that the concrete buildings, which feature brick patterns, staining, and stucco cap, would look boxy, industrial, or fake.

"I knew it would look good, but there were doubters," Benz says, but he was able to quickly prove them wrong. "The buildings look better than anyone even expected."

The Eagle Ridge condominiums in Fort McMurray, AB, Canada, satisfied skeptics of precast concrete's aesthetics with its brick patterns, staining, and stucco design. Courtesy of Tucker Photography.

The brick texture is created using formliners in the casting beds to create a brick-like surface. Once erected, different-colored stains are applied to the exteriors, leaving the mortar joints gray to replicate a typical brick wall.

Rick Lewis, partner at Gibbs Gage Architects, says, "The brick finish is very unique. It has rich colors and textures, and people think these buildings are made from brick."

That is a rare occurrence in a town filled with vinyl-sided houses. "There is no other brick in Fort McMurray because you can't get the trades to come in and lay it," Zakariasen says. "There is not a single person up there who's not aware of these buildings."

While the project will continue for many more months, it remains on schedule and within its budget.

"Initially we were a bit behind as we worked through the process of how to erect these buildings, but now we are well ahead of schedule," Zaharia says.

"I kept expecting phone calls saying the panels don't fit or something hasn't arrived, but they never came. Once we figured out the timeline and worked the bugs out, the project has gone smoothly ever since," Lewis says. "We are really happy with the way it turned out."

About the author

Sarah Fister Gale is a freelance writer based in Chicago, Ill.

Synopsis

Choosing a total-precast concrete system for the 20-building Eagle Ridge condominium development project in northern Canada allowed developers to reduce the number of workers it needed on-site and minimize the impact of cold-weather construction. Using a team-based approach and innovative three-dimensional modeling tools to plan the project down to the final detail has ensured that the buildings go up on schedule with minimal disruptions, producing a cost-effective, brick-style community that has impressed the government and residents alike.

Keywords

Balcony, brick, cold weather, formliner, hollow-core, heat and hoard, residential, sandwich panel, thermal break, thermal mass, three-dimensional modeling, total-precast concrete.

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