Extreme Precast: Freezing Out the

Five frigid project stories chosen by proud precast concrete producers

BY SUE McCRAVEN

Precast concrete is not just a fair-weather friend. When the mercury drops below 50 F, cast-in-place (CIP) concrete is not a viable option as a construction material. Precast concrete, however, offers rapid on-site installation and cost effectiveness even in frigid weather. Here are the stories of five producers who supply clients with precast products in cold-weather states from Alaska to Wisconsin. These precasters proudly explain how precast concrete provides a better, more economical solution than CIP concrete construction, especially for extreme site and weather conditions. For really challenging jobs, precast concrete not only installs rapidly, but project engineers consider precast applications to be the best solution.

Mountain pass demands a rapid installation

Glacier Precast Concrete Inc., Kalispell, Mont.

No place to be caught in a snowstorm, Logan Pass is located on the Continental Divide in Glacier National Park in northwest Montana. At an elevation of 6,646 ft, the summit of the Going-to-the-Sun Highway was the unlikely construction site for Glacier Precast Concrete. Weather conditions at this elevation offer scant time for building during the off-season, and truck and equipment access on this historic highway is very restrictive.

"Glacier's challenge on Logan Pass was to construct a public vault toilet facility next to a historic visitor center during the "shoulder season[1]" when plumbing is not available at the site," said Tom Anderson, owner of Glacier Precast Concrete. "The Visitor Center closes in late September. Our other challenge was to match the architectural design of the existing Visitor Center."

[1] Shoulder season is a travel period between peak and off-peak seasons.

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At 6,650 ft, Logan Pass in Glacier National Park is no place for the timid. "It starts snowing in September and road access becomes very challenging," said Tom Anderson of Glacier Precast of Kalispell, Mont.
Photo courtesy of Glacier Precast (www.glacierprecast.com)

"Our precast quality and strength will be far superior to anything poured outside ..." said Ryan Johnson of Fairbanks Precast and Rebar, North Pole, Alaska.

Photo Courtesy: Fairbanks Precast & Rebar (www.fairbanksmaterials.com)

The Visitor Center on Logan Pass was completed in the 1960s and is listed in the National Register of Historic Places. The exterior walls were poured in place in 2-ft lifts that incorporated hand-picked stones from the area. A fairly dry concrete mix was placed and packed by hand in the forms. Crumpled newspapers were used to hold the stones away from the formwork so that the concrete would wrap partially around the stones and make them visible after stripping.

Fifty years later, Glacier Precast Concrete's project was to build a five-stall vault toilet facility with a maintenance room over an old existing septic tank. To match the 1960s architecture of the Visitor Center, the visible walls were poured face-down on a rough-cut lumber form liner using dry-cast concrete, and Glacier National Park employees hand-picked the stones at the site. Precast concrete was chosen because of the durability of concrete in a harsh environment, the ability of the precaster to match the architectural design, and the speed of installation in a very short building season. Because the U.S. National Park Service wanted to keep the Visitor Center open without disruption, park administrators did not want construction to begin on Logan Pass until after Labor Day. "This made the building season really short," says Anderson, "as it starts snowing in September and the road access becomes very challenging."

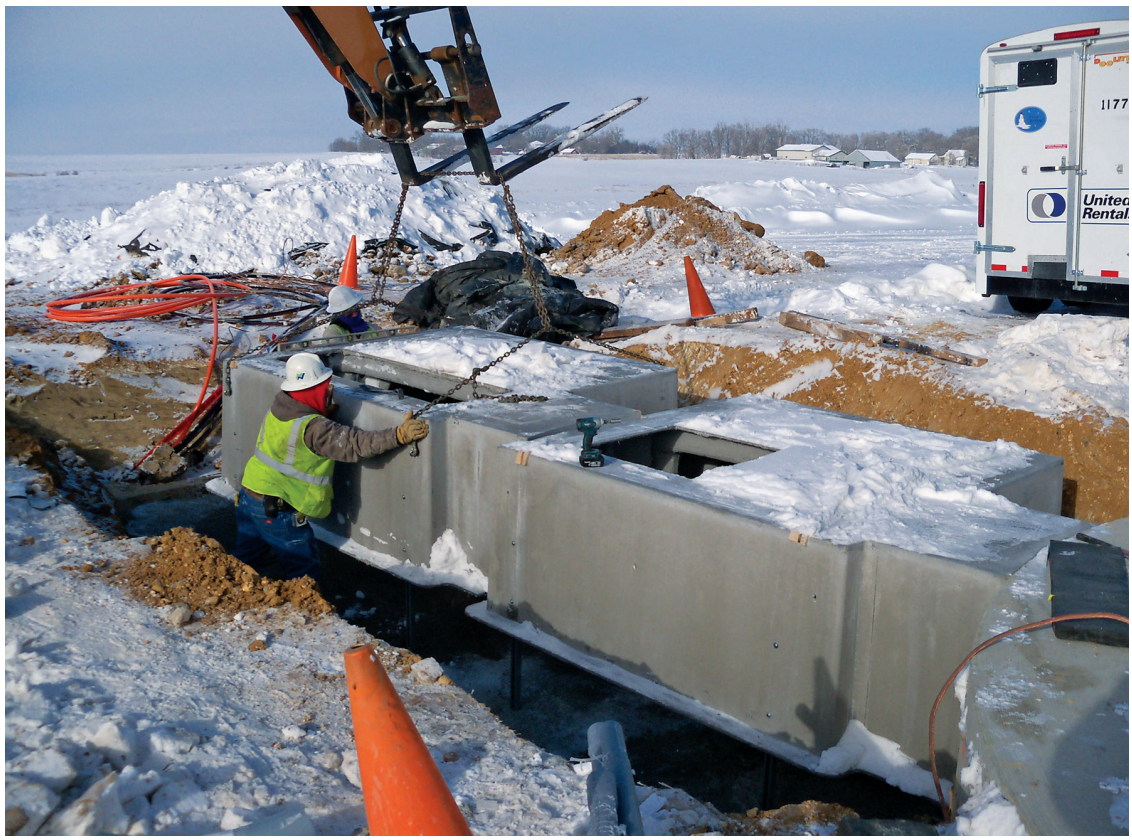
Glacier Precast manufactured the 16 panels needed for the project in about three weeks and the panels were erected in mid-September of 2010. "A rapid installation was critical, because the NPS carpenters needed all the time they could get to install the roof and porch before snow shut the road off completely in October," says Anderson. "By using a precast concrete assembly, the walls and floor panels were installed in just two days compared with a cast-in-place system, which would have required weeks of construction."

Luminous precast in the Land of the Midnight Sun

Fairbanks Precast & Rebar, North Pole, Alaska

"When the weather turns colder, precast has some big advantages," says Ryan Johnson, precast manager at Fairbanks Precast & Rebar in North Pole, Alaska. "Fairbanks supplies many small projects for Alaskan contractors who don't want to deal with pouring fresh concrete in the harsh elements or where the job site is located in a remote part of the state where ready-mix concrete delivery is not an option."

Examples of precast products manufactured by Fairbanks Precast & Rebar include orange security barriers for British Petroleum, and generator module foundations and pump station structures for the Trans Alaskan Pipeline. "We have the critical advantage of pouring concrete in a temperature-controlled environment where freezing concrete, adequate cure



"Concast's precast box pads...make installation of wind turbine trasformers pretty painless even in extreme conditions," says Rob Duncan of Consulting Engineers Group (CEG), Farmington, Minn.
Photo Courtesy of CEG (www.ceg-engineers.com) and Concast Inc. (www.concastinc.com)

time and extreme working conditions are not an issue," says Johnson. "Our precast quality and strength will be far superior to anything poured outside where the cold ground can prevent concrete from setting up properly or the wind can come up and destroy your enclosure, leaving you with a mess."

During the winter months in Alaska, Fairbanks Precast & Rebar uses extra measures in precast production, including a concrete accelerator, hot water, heated aggregates, and extra heating fuel to keep the shop warm. In the past, Fairbanks Precast & Rebar did not produce from November to mid March, because ready-mix suppliers in this region of Alaska are not typically open. In the summer of 2011, Johnson explains, "We were able to install and enclose a small batch plant from Mixer Systems. I'm not saying we will be pouring concrete inside at -50 F, but we should be able to extend our season on both ends and remain flexible throughout the winter."

Replacing CIP at snowy substations and remote wind farms

Concast/Fibercrete Inc., Zumbrota, Minn.

During Minnesota's harsh winters on the windswept plains, utility contractors are installing precast concrete trench systems and wind-turbine transformer box pads from Concast Inc.'s Zumbrota facility. For the trenches, U-shaped precast channels with removable covers are set in the ground at utility substations while the snow flies.

For the wind farm application, the 1,500-to-1,800-lb box pads have an integrated tunnel with custom conduit openings that connects with a specific wind turbine foundation. The 8-ft-square, 3-ft-deep pads support the turbine's three-phase transformer. The walls of the box pads are only ½-in-thick but very strong, as the internal ribs are made with glass fiber reinforcement. Wind turbine bases can be 16 ft in diameter and the transition duct tunnel from the precast box pad is designed to fit flush to the curved base.

The box pads are not standard designs. Concast receives a footprint drawing of the transformer, and from this a custom box pad with the required reinforcing is designed and produced. The transformers weigh up to 20,000 lbs, so the reinforcing must be adequate for structural support and for the openings that lead to the turbine base. The cable openings are usually specific to the transformer design. Precast shipments typically begin six weeks after receipt of the customer-approved drawing, and depending upon the size of the wind farm, final shipment is usually complete in 12 weeks. Concast's plant in Zumbrota can produce 10 to 12 box pads for delivery each week (per project), compared to about 50 precast units per week during the summer at peak season.

Concast uses a proprietary blend of glass fiber-reinforced concrete made with portland cement called Fibercrete®. According to Ben Olson, vice president at Concast, the slurry mixture, with chopped alkali-resistant Zircon (glass) fibers, is sprayed on the trench or box pad forms. A hand-held roller is used to compact and consolidate the material against the form, allowing for thinner sections and a high strength-to-weight ratio. After an overnight cure, the trenches or box pads are removed from the steel forms and the edges are tooled for a smooth finish. Field modifications are easily done with any masonry tool. Precast plant fabrication of the trenches and the box pads means that these systems

David Rasmussen and Aaron J. Ausen of Dalmaray Concrete Products of Janesville, Wis., said, "In Wisconsin winters...with highs of 0 F and snow...we turn products around alot faster than CIP."

Photo Courtesy of Dalmaray Concrete Products (www.dalmarayconcreteproducts.com)

can be installed in cold weather that would preclude on-site forms and CIP concrete placement. Precast systems are also less expensive.

"Concast's precast box pads with their unistrut leveling system make installation of wind turbine step-up transformers pretty painless even in extreme conditions," says Rob Duncan of Consulting Engineers Group (CEG) in Farmington, Minn. "A poured foundation would require us to frame and pour a foundation slab, pour a duct bank, and then dig out the dirt underneath the slab to install a ground sleeve. This would be a tough task in these extreme conditions, and we still wouldn't have the space for cable handling that we get with the Concast pad."

Cold-weather construction calls for precast solutions

Dalmaray Concrete Products Inc., Janesville, Wis.

For precast producers in the northern regions, winter winds can blow in opportunity. "When a project originally specifying 12 CIP utility vaults needed to begin construction in the fall," says Aaron Ausen, plant manager at Dalmaray Precast Concrete Products, "a good customer contacted us about doing the vaults with precast. Due mainly to quality and cost savings, this customer prefers precast over cast-in-place, and for this particular project, he was looking at a Midwest winter that would make construction of the project difficult with CIP."

The walls, floors and covers were originally specified with 8-in. and 10-in. wall thicknesses. "With precast, however," said Ausen, "we were able to redesign the vaults to have 6-in.-thick walls and satisfy the required loadings. This meant big cost savings to our client." After getting engineering approval, production time was two weeks with continuous delivery throughout the project. A short installation time was critical for the customer to meet the project deadlines, and they were able to complete the project at the beginning of week three.

Dalmaray cast everything in-house with controlled shop temperatures. "We used a small dose of accelerator along with an SCC admixture in order to create a beautiful, strong finish for the customer," says Ausen. "We also tested every batch to make sure each vault was shipped with a minimum 5,000 psi compressive strength. In Wisconsin winters, you cannot afford to ship product without adequate strength gain." The project was completed in February and March of 2011 under typical Midwest winter conditions. "(It was) very, very cold with highs of 0 F and snow," says Ausen. During most of the project, Dalmaray delivered the pieces to the job site so they would be ready for installation after the severe weather subsided.

Using temperature-controlled, in-plant production, precasters can use advanced mix designs and curing techniques to meet the needs of clients during severe weather months. "Precasters do not have to deal with elements as much as CIP construction does," says Ausen. "We can usually turn products around a lot faster than CIP, and for many projects, time is the deciding factor in winning a bid. Precast also achieves a much higher-quality product with controlled conditions. Pieces will come out better looking, stronger and faster than CIP."

In addition to moving a project along during winter months, minimizing worker exposure to the elements during extreme weather conditions is important to contractors. General contractors understand the limitations cold conditions pose for CIP construction and for on-site workers. Precast concrete solutions allow contractors to minimize worker exposure to the elements and thereby increase job-site safety.

"Dalmaray was able to take the complexity of our install and minimize our on-site labor in order to provide not only a quality product, but also assist in reducing exposure to the harsh environment," says Chris McGuire, Faith Technologies Purchasing Agent for the utility vault project.

"We continually pursue winter construction jobs and drive home the point to contractors that using precast has many advantages, making it the construction method of choice no matter what season," says Ausen.

"Sub-zero temperatures did not prevent a rapid 10-day installation," says Brian Seubert of County Materials Corp., Roberts, Wis. "If built as a CIP structure, the extremely cold weather would have not only delayed construction, but the project would have come to a standstill."
Photo courtesy of County Materials Corp. (www.countymaterials.com)

Sub-zero site conditions in Minneapolis

County Materials, Roberts, Wis.

Construction of the Solhaus Apartment[2] project in a triangular footprint on the University of Minnesota campus presented County Materials with a number of site-specific challenges during the fall and winter of 2010-2011.

County Materials supplied more than 18,550 sq ft of 8-in. and 12-in. hollowcore planks, 685 ft of beams (inverted-T, rectangular and L-shaped) and 170 ft of columns. The bottom story and parking structure of the 75-unit building is precast concrete and supports five floors of wood framing above. Erection of the precast took place in February 2011 with adverse weather conditions that kept the job site below freezing temperatures for much of the construction.

"There is a strong rationale to using precast over CIP concrete for the cold-weather construction season in the Midwest," says Brian Seubert, general manager at County Materials Corp., "because of precast's advantages, including cost, quality and accelerated construction." Seubert listed the following specific advantages of precast concrete solutions over CIP work:

- Product quality is controlled and monitored more easily at a precast production facility (with in-house testing labs) than in the field.
- In a precast plant environment, it is easier to control the concrete mix and ambient conditions for placement and curing.
- Precast plant process controls guarantee concrete strength and durability of the final product.
- Precasters offer clients cost savings, because plants order materials for multiple projects and one-time bulk-purchase costs are minimized.
- Severe weather is eliminated as a controlling factor for concrete quality, because precasters can cast product indoors for consistently high material quality.
- On-site, modular precast components can be installed rapidly without the delay required for CIP concrete to cure and gain adequate strength.
- Accelerated curing techniques in the precast facility mean a shorter project timetable between manufacturing and building erection.

"If the Solhaus Apartments were built as a CIP structure, the extremely cold weather would have not only delayed construction," says Seubert, "but the project would have come to a standstill."

Once production started, it took County Materials 10 working days to manufacture the required product and only one week to erect the entire lower level. The building's unusual triangular geometry presented many intricate angles for construction. "Complex geometry can substantially increase completion time and cost on any project," explains Seubert, "but because the precast pieces are made to specific dimensions in a controlled environment, they fit together like a complicated puzzle. On-site costs are reduced, and the structure can be erected rapidly in one seamless result."

County Materials Corp. has worked with several contractors on a number of projects where precast concrete systems (including prestressed hollowcore, and precast box culverts and pipe) have been preferred over CIP construction, because adverse weather conditions made on-site concrete placement impractical, uneconomical and time consuming. For the clients, precast concrete means a faster-moving job site, reduced cost, and higher quality as an end result.

When the going gets tough, the tough get going

These five chilly narratives say much about the advantages of precast concrete solutions in extreme weather conditions and remote locations. Precast concrete offers customers and contractors a more rapid installation than CIP construction, and for cold, icy job sites, less worker exposure to the elements means a safer project. When product quality and cost savings are added to the mix, not only is precast a smarter and more economical solution – but it doesn't leave you standing out in the cold. ps

Sue McCraven, NPCA technical consultant and Precast Solutions editor, is a civil and environmental engineer.

[2] Architect: Tushie Montgomery Architects, Minneapolis, MN; Project engineer: Hanuschak Consultants Inc., Winnepeg, MB, Canada; General contractor: Greiner Construction, LLC, Minneapolis, MN.