ALTERNATIVE Delivery Formats GROWING IN POPULARITY

Precast concrete often aids owners considering alternative delivery methods to encourage dramatic aesthetics, maximized energy efficiency, and expedited occupancy with controlled costs

— Craig A. Shutt

Owners today are looking for the best balance of design quality, fast construction, energy efficiency, controlled costs, and other key needs. Often, they realize that alternative-delivery methods beyond the traditional design-bid-build approach offer better ways to accomplish their goals. They can require new approaches to design and construction relationships, but they typically pay off in dramatic ways.

Design-build methodology has been used in some form for many years, often leading to a reconsideration of collaboration methods. That has led to such approaches as Construction Manager/General Contractor (CM/GC), Public-Private Partnerships (P3), Integrated Project Delivery, and combinations that use elements that best fit the participants and project.

This evolution happens as developers see benefits from having construction partners bring their expertise on any issues as early as possible. That has fostered conversations on multiple paths to accomplish goals with subcontractors, such as bringing them in on a design-assist basis to avoid duplications in design and requests for information. Precast concrete fabricators have become adept at joining projects early on a consultation, design-assist, or value-engineering basis, to help maximize efficiency of components throughout the design and construction process.

The best delivery method for each project will depend on a number of variables, but most can be used with virtually any type of project. The following examples show how alternative delivery methods benefited a range of building types and used precast concrete components to help achieve their goals.

DESIGN-BUILD LABS
A total-precast concrete structural system and architectural panels help meet the needs of the DOE's Energy System Integration Facility. Photo: JE Dunn Construction.

Photo: Bill Timmerman, SmithGroupJJR.

ENERGY SYSTEMS INTEGRATION FACILITY

LOCATION
Golden, Colo.

PROJECT TYPE
Experimental laboratory, data center, and offices

SIZE
180,000 square feet (80,000 square feet for precast concrete laboratory)

COST
$135 million

DESIGNER
SmithGroupJJR, Phoenix, Ariz.

OWNER
Department of Energy's National Renewable Energy Laboratory, Golden, Colo.

STRUCTURAL ENGINEER
Martin/Martin Inc., Lakewood, Colo.

CONTRACTOR
JE Dunn Construction, Denver, Colo.

PCI-CERTIFIED PRECASTER
Stresscon, Colorado Springs, Colo.

PRECAST COMPONENTS
991 pieces, including double tees; inverted T-beams; L-beams; rectangular beams; Thermomass walls with 3 inches of insulation, an exterior 3-inch architectural wythe and an interior structural wythe of 8 or 10 inches; columns; shear walls; spandrels; shaft lids; and site walls

THREE FUNCTIONS
The lab contains offices, a data center, and high-bay labs, which precast concrete helped make into flexible open spaces for research of all types. Photo: Bill Timmerman, SmithGroupJJR.

ENERGY SYSTEMS FACILITY

High-tech laboratories have special needs beyond those of more traditional buildings. In the case of the Department of Energy's (DOE's) Energy Systems Integration Facility in Golden, Colo., a design-build delivery method led to an innovative design in which the building's three core functions were divided into separate but connected structures. To meet the high-tech needs of the center's research laboratories, the team specified a total-precast concrete structural system and architectural panels.

The 182,500-square-foot facility is the first in the country to conduct integrated megawatt-scale research and development on the components and strategies needed to safely move clean-energy technologies onto the electrical grid at the speed and scale required to meet the nation's long-term goals. As such, DOE officials wanted to ensure they created a highly functional design that could be adapted to meet current and future research needs, while also providing a dramatic appearance. It also had to provide an ultra-green workplace, both to make a statement and to provide long-term efficiency.

The facility provides three functions: office space for employees, a data center, and the high-bay laboratories, which contain approximately 80,000 square feet. The laboratory spaces, ranging in size from 5,000 square feet to 10,000 square feet with 32-foot-tall ceilings, had to be versatile to adapt as new technologies were tested and also offer easy access for large equipment. They required large, unobstructed space as well as robust loading capabilities. The building also had to provide a 50-year service life, in addition to respecting stringent energy requirements.

The project was let on a design-build basis, as a key part of planning included the high-tech laboratory space which drove the schedule. It needed to be completed early to allow time for the specialized equipment to be installed. It also was the segment placed highest on the site, which had a 45-foot slope from one end to the other.

> 'The building was unique from the very beginning at its bid stage.'

DESIGN-BUILD COMPETITION

"The building was unique from the very beginning at its bid stage," says Brad Gildea, an associate at SmithGroupJJR, the architectural firm on the project, which worked with JE Dunn Construction. The project was let with a design-build delivery method, but it was awarded through on a competition among teams based on each group's qualifications, pricing, and proposal. The three participating teams were given a stipend to produce their proposal and present it. "It was pretty intense even before we got the project."

The design-build format was seen as a way to encourage innovation and fast-track the project, he explains. In creating their plans, the teams followed performance-based characteristics laid out in the Request for Proposal. Each team was given a 900-page set of parameters without a conceptual outline or bridging documents. It features programming needs, specifications, and performance needs. "We had to digest all of that, come up with a design, verify its constructability with our partners, and then present it," Gildea explains.

Although the firm had never worked directly with JE Dunn, a relationship had been established between SmithGroup's

Laboratory Group in Phoenix and JE Dunn's office in Denver. "We both knew the project was looking for participants, and we got together."

Their preliminary design was selected, and then the team value-engineered it to align with the final budget parameters. "We went through design/schematic development to 100% of the design-development stage to provide a Fixed Firm Price." Once they had the elements worked out, their construction plan had to be approved by DOE.

The team then solicited input from precasters to help work out a final plan for the structure. "In the initial phase, we considered a steel-frame building," Gildea says. "But it became apparent that a precast concrete structure would provide more efficiency."

'We wanted a precast partner early on to help tailor the design to our needs.'

PRECASTER PROPOSALS

The design-build team went through an "intense" schematic-planning phase after winning the project and presented the proposal to two precasters, who did rough drawings and analyzed their plan based on efficiency and cost. "We wanted a precast partner early on to help tailor the design to our needs and to ensure the plan was efficient for the interior design as well as for the exterior skin," Gildea says.

Mike Tilbury, vice president at JE Dunn Construction, agrees the format aided the project and led them to the precast concrete structure. "Design-build was definitely a key part of the success. We could work collectively as a team and analyze costs and performance requirements to determine that precast concrete provided the best approach to reach all of our requirements."

Stresscon won the project and joined the team. "Stresscon proved to be most flexible in meeting our needs and providing a good solution," Gildea says. The team used Building Information Modeling (BIM) to model the design and create the most efficient precast structure.

The precast concrete components provided multiple benefits, explains Mark Kranz, vice president and design director at SmithGroup. "The precast concrete columns and double tees provided the structural capabilities and open spaces on the interior, while structural load-bearing, insulated sandwich wall panels using a custom aggregate with an acid-etch finish on the exterior architectural layer provided a durable, energy-efficient, and aesthetically intriguing building envelope."

"Manufacturing the panels was challenging," says Michael Benedict, the project manager for Stresscon and now a consultant for the firm. "They had to be well insulated, load-bearing and 32 feet tall. They also had a lot of deep reveals that needed to be defined well." The panels feature 3 inches of insulation with a 3-inch exterior architectural wythe of concrete and either an 8- or 10-inch interior structural wythe, depending on its location and structural requirements. A few panels with a 3-inch interior wythe also were used for the building's base. In all, 919 components were produced.

The precast framing allowed for quick erection of the shell along with other benefits. The double tees provided long spans for the required open spaces as well as creating a four-hour fire wall between the lab and the adjoining data center. "The inherent fire protection offered by precast concrete eliminated the site activity, time and costs that would have been required to fireproof the walls to the level that was needed for the laboratories," says Tilbury.

HIGH-TECH PANELS
The precast concrete panels are well insulated, load-bearing and 32 feet tall, and feature deep reveals with strong definition. Photo: Bill Timmerman, SmithGroupJJR.

HIGH BAYS
The high-bay laboratories required large openings for roll-up doors, which were provided by the precast structure with no difficulty. Photo: Stresscon.

Photo: Bill Timmerman, SmithGroupJJR.

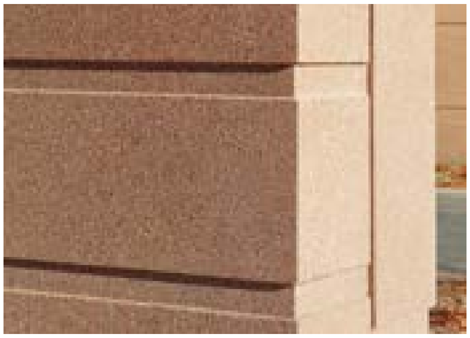
Block-outs for rollup doors were provided in the panels on one façade to provide easy access for trucks to deliver large payloads. "These could be provided in the panels without a problem," says Benedict. "We do it on a regular basis and these weren't out of the ordinary, except for the height of the panels."

CRAWL SPACE CREATED

The sloping site presented challenges, but also provided an opportunity for the creation of a crawl space beneath the laboratory that becomes taller, varying between 4 and 16 feet, as it extends to the other sections further down the slope. Once building pads were established for the building segments, four separate concrete crews could work concurrently on foundations.

The crawl space was added after the design had been completed, as the building originally was planned to have a slab-on-grade base. "There was a tremendous amount of mechanical and electrical infrastructure, and the owners asked if we could add a crawl space to handle it," Gildea explains. "As we were using double tees for the rest of the structure, we were able to add them in this area to provide desired the access and meet necessary loading requirements."

"The Research Electrical Distribution Bus is a one-of-a-kind electrical distribution system that had never been designed or built before," Tilbury notes. "The precast concrete crawl-space design allowed us to have crews inside working to install what would have been underground conduit while allowing other crews to work simultaneously on the upper floors. That provided a huge savings in time. Without that approach, to get all of the underground systems into place and then try to build over it afterward, would have crushed our schedule."



CUSTOM FINISH
The panels feature a custom-aggregate outer architectural layer, with an acid-etch finish to provide a durable, energy-efficient and aesthetically intriguing appearance. Photo: Bill Timmerman, SmithGroupJJR.

The exterior panels feature a gray finish with a textural coating applied after the panels were erected. "We tried a value-engineered approach of applying paint rather than using integral color, but it didn't provide the same aesthetic," Gildea says. Three passes with the textured coating were performed to create base, light splatter, and dark splatter areas.

The office and data center, which feature metal panels, are separated from each other and the high-bay labs by "knuckles" in the envelope that keep them distinct. The two sections cantilever off of a precast concrete, structurally framed base that was clad with 9-inch-thick precast concrete panels with an appearance created with a custom aggregate and an acid-etched finish. Fifteen mockups were completed to ensure a precise match between the textured lab panels and the finished base panels.

"There are very complementary looks among all the sections," Tilbury says. The textures fit with the energy campus's overall aesthetic language, which includes metal panels, glass curtain wall, aluminum accents, and precast concrete panels.

TEES OFFER VERSATILITY

The double tees provided an additional benefit, as they had Unistrut assemblies cast into the lengths used for roofing components. This offers the opportunity for scientists to attach any riggings or harnesses they need to hang devices and not worry about loading requirements. "It gives them flexibility to perform any experiment necessary in the most efficient layout," says Gildea. The embedded Unistrut also offers a safety benefit, as future installations will not require overhead drilling.

The wall panels' R-20 insulation, coupled with the roof's R-40 insulation, helps the building achieve its "aggressive" energy goals, Gildea says. "Stresscon really rose to the top in suggesting ways that we could achieve the R-values we needed." This was aided by the non conductive connectors that hold the insulation in place, eliminating any thermal bridging. "The 16-inch-thick insulated wall panels provided the R-20 level we needed without any need to fur out the inside and add insulation. It also helped the electrical and mechanical contractors to have finished concrete walls on the inside to work with."

> 'The 16-inch-thick insulated wall provided the R-20 level we needed.'

The project was planned to meet LEED Gold certification, but ultimately it achieved LEED Platinum certification, the highest available, generating 56 of a possible 62 points. Precast concrete aided this in a variety of ways, including high energy efficiency, local manufacture of materials, using local materials, use of recycled and recyclable materials, minimization of construction waste, and more.

The precast erection moved smoothly and was completed in approximately 60 days. Construction started at the bottom of the hill and moved up, with the crane repositioned on the slope as needed. As the work was done on federal property, everyone on the site had to be vetted and identified, so the contractor created a fenced-off site to control access away from the rest of the campus.

"The precast concrete box went up fast, well before the cold weather set in, and we framed in the windows until they could be installed in the spring," Gildea says. Gas-fired heaters were installed while trades fitted out the laboratory spaces. "On sections where they were putting up the steel framing, they were working through cold weather while those working on the precast sections were inside, toasty and warm."

Because the high-bay lab building was on the high side of the slope and had such complex systems, the critical path for the project ran through it, Tilbury says. "Getting it up quickly was huge. It was absolutely critical to the schedule."

Today the facility is home to 200 scientists and engineers who are working to find efficient ways to solve energy concerns. They are doing it in a building that is versatile, contemporary, highly functional, and highly energy efficient, while being respectful of its surrounding environment.

"It was a creative approach that turned out very well," says Gildea. "The precast concrete structure came together efficiently and provided the aesthetic, functional, and structural needs we required."

ADDED VERSATILITY
Unistrut assemblies were cast into the roofing components to allow equipment to be hung without worry about loading restrictions. Photo: Bill Timmerman, SmithGroupJJR.

Photo: Coreslab.

THE UNIVERSITY OF TAMPA FACILITY

As The University of Tampa expanded, it needed new classroom and administrative space as well as parking for its staff and students. In 1997, The Beck Group constructed a 212,465-square-foot, five-level precast concrete parking structure for 583 cars. In 2000, the university awarded phase two of the garage, an addition of a five-level, 49,540-square-foot single bay with brick/sealed precast concrete exterior to the existing three-bay parking garage, adding 235 parking spaces. In 2013, university officials challenged the firm to create an addition to that structure, this time featuring eight levels, including additional parking spaces plus three floors of classroom and community space.

The University of Tampa's new Maureen A. Daly Innovation and Collaboration Center adds 511 classroom seats for students and 31 faculty offices on floors one and two, the John P. Lowth Entrepreneurship Center on the eighth floor, and 386 parking spaces on the intervening levels. To achieve these diverse needs in a tight space, while connecting the new and existing structures together both through an access bridge and through aesthetic design, the university used an Integrated Project Delivery team that featured Beck as both architect and construction manager.

> The university used an Integrated Project Delivery team to achieve its diverse needs on a tight space.

Others were brought onto the team as well, including structural engineer Master Consulting Engineers Inc. (MCE). They decided the best way to meet these needs was to create a total-precast concrete structural system that essentially isolated the first two floors of classrooms inside a building-within-a-building, and then build the parking levels above that in an encompassing structure. Coreslab Structures (TAMPA) Inc. fabricated the precast concrete components to achieve this goal.

The use of the Integrated Project Delivery team, in which the architectural and construction services are provided by the same firm, offered significant benefits to the project, says Armando Castellón, principal at MCE. "It helped generate important input in the early days before the design was finalized," he said. This proved especially beneficial when the top-floor community spaces were added after design had started. "We had to coordinate the work and modify the existing plans, and that was much easier to do with the Integrated Project Delivery format."

Construction could start almost as soon as the plans were finished, he explains, as the precaster was fabricating components while drawings were completed and the site was prepared. "We worked closely from day one with the precast manufacturer, so we had the drawings completed of a complicated structure where two fully independent buildings were occupying the same footprint. We were able to develop the separation between the two buildings of classrooms and parking to avoid any sound or vibration transfer between the buildings. It helps a lot due to the complications with all of the loading we had going on for the two buildings, as well as for the connections to the existing garage."

In essence, a precast concrete structural frame was created for the first two levels of classroom and office space; then a second frame, with different columns and shear walls, was built within it. "The University was extremely worried that noise and vibration from automobile traffic would disrupt classroom activities, so we had to isolate those levels completely from the upper floors," he says. "Precast concrete helped ensure they were entirely separate."

The first two floors feature hollow-core slabs for flooring, while those above use double tees. The top level's flooring features bridge tees covered with 6 inches of insulation with a concrete topping over it to create isolation. "The top floor of conference rooms offers a high-profile location with beautiful views of the campus," says Castellón.

TOP OF THE CLASS
The University of Tampa's Maureen A. Daly Innovation and Collaboration Center combines classrooms, faculty offices, and parking. Photo: Coreslab.

THE UNIVERSITY OF TAMPA MAUREEN A. DALY INNOVATION AND COLLABORATION BUILDING

LOCATION
Tampa, Fla.

PROJECT TYPE
Higher education, retail, and parking structure

SIZE
213,000 square feet

DESIGNER/CONTRACTOR
The Beck Group, Tampa, Fla.

STRUCTURAL ENGINEER
Master Consulting Engineers, Tampa, Fla.

OWNER
The University of Tampa, Tampa, Fla.

PCI-CERTIFIED PRECASTER
Coreslab Structures (TAMPA) Inc., Tampa, Fla.

PRECAST COMPONENTS
1,128 individual pieces from 38 product types, including columns, beams, shear walls, double tees, bridge bulb tees, fascia panels, and architectural panels

The exterior columns were erected 2 inches apart in some locations, says Mark McKeny, sales manager at Coreslab Structures (TAMPA) Inc. "We had to be sure the vibrations couldn't transfer." Each level was erected simultaneously with the interior structure followed by the exterior one next to it.

CANTILEVERED PARKING

The existing building's foundation had not been planned for any expansion, McKeny notes, so it could not support additional load, requiring an innovative approach to connect the garages and provide the amount of parking required. By cantilevering the parking levels, new foundations could be placed 8 feet 8 inches away from the existing garage, eliminating the need to retrofit the existing foundations. The cantilever on the south elevation extended the structure 10 feet to allow for a more efficient parking layout along with creating a unique façade. Large tie-backs were used to secure the cantilevered levels' double tees.

> The two structures were connected via a bridge constructed of 18-inch-deep precast concrete bridge tees spanning the 60-foot space.

The two structures were connected via a bridge constructed of 18-inch-deep precast concrete bulb tees spanning the 60-foot space. The bridge spans from the second floor of the existing facility to the first double-tee level, on the third floor, of the new structure. The bulb tees were fabricated with lightweight concrete and 61-foot-wide horizontal load-bearing wall panels that supported six bridge tees per level.

"The bridge connection from the existing garage was necessitated by a lack of space in the new footprint to include sufficient ramping past the classroom level to reach the parking levels," explains McKeny. This bridge had to be high enough to

BRIDGING THE GAP
An access bridge created with precast concrete double tees spans the roadway connecting the existing building with the new. Photo: Coreslab.

provide sufficient clearance for the City of Tampa's 20-by 60-foot air-right requirement for the road below.

HIGH MARKS
The conference room on the top floor provides expansive views of the university's campus. Photo: Coreslab.

The façade on the cantilevered portion features a buff-colored frame around long, thin, columns finished with embedded thin brick. The columns actually consist of two panels, a top and a bottom piece, with part of the framing holding four brick-covered "fingers" of concrete. The concrete in these fingers was mixed with gray concrete to replicate the look of mortar, while an architectural mix design was used to achieve the buff frame.

Inlaid thin brick also was used on other sides of the building in more traditional panelized forms, with ribbon-window cutouts provided to replicate the look of a more conventional office or classroom. The featured brick is a special brick used throughout the University of Tampa campus, for which typical bricks were cut to be embedded. A special formliner supplied by Innovative Brick Systems was used to secure the brick in place due to the high level of tolerances needed to cast it.

The base of the bridge features arched precast concrete fascia pieces with the university's name embossed into the side.

A mezzanine created in the top floor also posed challenges, as it couldn't be supported from the floor because those components were already loaded to the maximum, Castellón says. So the mezzanine loads were supported off the roof-bridge tees.

The tight site and small footprint, located at the center of an active campus along a busy street, complicated delivery and erection of components, McKeny notes. "We could have only two or three trucks on the site at once, so we had to coordinate deliveries quickly and keep things moving. Adds Castellón, "The site was open, but it was not very large, so it required careful maneuvering."

CUSTOM TOUCHES
Thin brick corner pieces were used to provide returns that eliminated joints at the corners. Photo: Coreslab.

The project has proven a great success, with a dramatic look and each function working smoothly. A coffee shop on the first floor adds even more activity and color to the facility. "The building is very active and achieved the goal of being two buildings in one," Castellón says. "The two spaces are completely independent. Anyone in the classroom spaces can feel comfortable, because there is no vibration felt."

The use of the Integrated Project Delivery services helped ensure all of the challenges were met and aided the project's efficiency. "This approach takes design-build to the next level," says McKeny. "The challenges we faced really were aided by early consideration and coordination. It was a true integration of subcontractors with the owner, designers, and contractor sitting in the same room to work through the steps needed to resolve conflicts."

Photo: © Steve Maylone.

RALPH L. CARR JUDICIAL CENTER

LOCATION
Denver, Colo.

PROJECT TYPE
Courthouse and judicial offices

SIZE
695,707 square feet

COST
$258 million

DESIGNER
Fentress Architects, Denver, Colo.

OWNER
Trammell Crow Co., Denver, Colo.

STRUCTURAL ENGINEER
Martin/Martin, Lakewood, Colo.

CONTRACTOR
Mortenson Construction, Denver, Colo.

PCI-CERTIFIED PRECASTER
Gage Brothers Concrete Products, Sioux Falls, S.Dak.

PRECAST SPECIALTY ENGINEER
InfraStructure LLC, Omaha, Neb.

PRECAST COMPONENTS
1,191 architectural pieces (863 office building, 328 courthouse)

CARR JUDICIAL CENTER

A Construction Manager at Risk (CMR, also called CM/GC) format for delivery aided the design efficiency for the Ralph L. Carr Judicial Center in Denver, Colo., which features precast concrete architectural panels on its façade. The panels combine classic architectural touches with a contemporary feel to help blend three structures: a 12-story office tower that houses judicial and legal agencies, an adjacent four-story courthouse building with space for a variety of jurisdictions (including the state's Supreme Court), and a two-story linking building.

The 694,707-square-foot complex provides more efficient space for the state, consolidating seven judicial and legal agencies that had been leasing space in 10 locations. The new facility will serve as the center for legal proceedings in the state for some time, as the buildings were designed for a 100-year service life.

"We had a variety of goals we wanted to meet with this aesthetic design," says Julian Fentress, business development director for Fentress Architects, the architectural firm on the project. "We wanted to keep the buildings in the 'color family' of the state capitol design and keep it expressive of the courts overall. We wanted to balance a sense of openness and transparency and accessibility with a dignified quality that showed the strength of the judicial system."

Fentress was hired by the owner, along with the general contractor, Mortenson Construction, who was brought on 2 weeks later to help create the plan. "It was a Construction Manager at Risk delivery method, but it felt very much like a design-build project," says Fentress. "We were able to leverage the advantages of the contractor's expertise early in the process and bring that knowledge to bear as we brought in major subcontractors on a design-assist basis."

PRECASTER OFFERS DESIGN-ASSIST

The aesthetic needs led the team to look for a malleable, solid appearance, which led them to precast concrete. "Precast was a cost-efficient solution due to the repetitions of shapes within the panels," says Charles Cannon, project architect. "It allows us to create the articulation and fenestrations needed to succeed within the design goals." Gage Brothers was chosen to provide the architectural panels and consult on the design specifics.

"The precaster was selected to join the project team very early in the design process," says Fentress. "It was highly valuable to have the precaster involved so early, as they could bring a high level of experience that helped the design team avoid pitfalls and quickly reach project solutions as they worked to achieve the high design goals. The involvement of the precaster was instrumental in giving us the ability to quickly turn drawings and calculations around."

One of the specific details this early collaboration aided involved detailing the skin. "There are always multiple ways to attach the panels, and some will work more effectively than others in each design," explains Bob Louden, a principal at Fentress. "Bringing Gage on early allowed us to understand the best methods for attaching the precast to the steel and detailing the steel into the structure."

Since Gage joined the team early, they were able....., says Brett Sisco, construction executive for Mortenson. "They were able to work closely with the architect to ensure the design vision was met and that the ornamentation planned for the cladding was possible to achieve in the way it was drawn."

The team held regular meetings and teleconferenced as needed, walking through the details, says Joe Bunkers, vice president of preconstruction at Gage. "We looked carefully at every aspect, especially insulation and waterproofing," he says. "On every detail, we asked if this approach would extend the building's life."

LONG-TERM DURABILITY AND LOW MAINTENANCE COSTS

That was a critical consideration to meet the 100-year design life. "Precast was selected not only because it provided lower initial costs, but it also reduces the long-term maintenance costs for the owner," says Cannon. The large, panelized design reduced joints and ensured few points for moisture penetration that need to be inspected or updated every 15 years.

To enhance that, a two-layer waterproof joint-sealer system was devised, featuring a water-tight bead applied behind the grout layer. "It creates a system that is accessible and easy to replace in the future," Sisco says. "Precast's durability and low maintenance needs were very appealing to the state."

The courthouse structure features stone embedded in the precast panels, while the office building is clad with architectural panels with a finish that replicates the appearance of stone above the second level, with granite cladding embedded in panels on the first two levels. The only solid stone on the project was used for the stone pillars across the front of the courthouse.

Precast concrete also helped meet the "aggressive" schedule set for both design and construction phases, Sisco notes. "Precast was instrumental in getting the building enclosed quickly and watertight in an efficient way. We were really happy with how the precast concrete worked on the façade."

> 'The integration of steel with the precast concrete was accomplished using BIM to design the pieces and then following that design to fabricate the steel framing.'

The panelization was aided by the use of Building Information Modeling (BIM). "The integration of steel with precast concrete was accomplished using BIM to design the pieces and then following that design to fabricate the steel framing," says Louden. "The subcontractor created a model of the steel with haunches applied for the precaster, and the precaster could then take that model and align his connections in the right spots before casting. It was a dream come true to be able to integrate systems so thoroughly."

"We worked out everything in the BIM before fabrication began, so clashes in the field were minimal," says Sisco. "Gage was able to design to the shop-drawing level, so they knew exactly what was needed for the connections and panels." The BIM processes worked so smoothly that the project received a national award from the American Institute of Architects for BIM Technology in Integrated Design.

CUSTOM THICKNESS CREATED

The panels required 4-inch offsets in the face to allow for the desired articulation, but adding these made the panels too heavy for the tower crane. To resolve this, the precaster designed a custom panel that was 6 inches deep. This depth provided the desired look of the panel stepping in and out while maintaining the same depth to control the weight of the panel.

"We took special care on the coursing of the stone and the way it wrapped around corners," says Fentress. "We worked it out well in advance to ensure it would be done efficiently." Adds Louden, "Aesthetic efficiency was a key aim for our design. We wanted the stone to turn

CONSOLIDATED SPACE
The complex consolidates seven judicial and legal agencies that had been leasing space in 10 locations. Photo: © 2013 Jackie Shumaker.

the corner, and that took more work in detailing than we had anticipated, because that detailing can be difficult. By having the precaster on board early, we could work it out to the extent that it's difficult to tell that it is precast and not stone."

In some cases, the panels were delivered to a staging area on the way to the site where the spray foam insulation could be applied in advance, as it would have been too difficult to reach some portions once the panels were erected. The insulation, along with precast concrete's inherently efficient mass and other attributes, helped the project achieve LEED Gold certification.

The precast façade also aids with blast deterrence, Cannon says. "Although the building was not designed for actual blast events, the owner is relying on the visual durability and solid natural presence of the precast concrete as a deterrent to threats."

STONE LOOK
Granite was embedded in to panels on the first two levels, with finishes replicating stone used on upper levels. Photo: © Steve Maylone.

The erection moved smoothly, with 1,200 pieces erected in 4 months. As many as four crews worked simultaneously on the site. A nearby staging area was used to deliver the appropriate panels as needed. "Any project downtown will have challenges maneuvering material," says Louden. "The contractor worked closely with the city and traffic engineers to close lanes as needed for the shortest time possible."

The prefabricated nature of precast concrete helped minimize site congestion. "The more work you can prefabricate on downtown jobs, the better it is," Louden says. "It can be hard to get labor onto the site and have room to do their jobs. Precast lent itself well to alleviating site activity."

A separate mobile crane was used for heavier pieces that could not be set with the tower crane. "The heavier pieces were more challenging, but they were definitely worth it due to their overall speed of erection and efficiency." Adds Sisco, "There were some heavy picks in congested areas, but it was a much better way to get it done quickly at a lower cost than any other proposal."

The panels were erected floor to floor, but also were supported column to column to provide sufficient load transfers. The office building was erected first, followed by the courthouse.

The CMR format aided the project's efficiency, and Louden expects they will see more of it in the future. "Public entities are using more types of approaches to project delivery today," he says. "The best one depends on the owner's appetite for risk. But the federal government really embraces design-build and sees the benefits. Colorado is now using it, and other states are coming around."

Adds Sisco, "This project could not have been done so efficiently without bringing Gage in at an early stage to work out the details. It worked really well. It turned out beautifully."