Market Diversity Keeps Benesch Flourishing

A range of projects, including railroad and pedestrian bridges, deepens firm's expertise

by Craig A. Shutt

Ever since Alfred Benesch & Company opened its doors in 1946, the firm has looked to grow its structural and civil engineering services. Its first major expansion in the early 1950s added bridge design projects as well as construction management. That work has led the firm to design a wide spectrum of bridges, including railroad and pedestrian bridges, as well as those with spans ranging from stream crossings to high-profile arch bridges. It has now embarked on a planned program of growth that will expand its client list and expertise in new directions.

"We've been designing bridges for nearly 65 years, and we've done pretty much every type there is," says John Carrato, president and CEO of the Chicago-based firm. "Our engineers are proficient in the study and design of continuous, complex structures, including tied-arch, segmental box girder, and cable-stayed bridges."

The firm also specializes in high-order, finite-element analysis associated with nonlinear and buckling behavior. "We are relentless in the pursuit of industry advancements, and we pride ourselves on implementing innovative solutions," he says. That pursuit led Benesch to design one of the first segmental concrete box girder bridges in the United States and the first in Illinois. The Kishwaukee River Bridge near Rockford was bid in 1976.

Value Engineering Techniques

The company emphasizes the importance of its study and evaluation of bridge conditions prior to design. For each project, it performs a type-size-location study to determine the best solution, bringing in a variety of perspectives to consider for every concept. "Our design philosophy is to marry conventional engineering with value engineering," he says. "We often use value engineering techniques to plan and design our projects."

Workshops for each project aid that approach. They bring together the project's senior people, including the owner when possible. The meetings last one to five days, depending on the complexity of the project. "It's a short but formal way to ensure we look at all of the needs, desires, and constraints of the owners, users, and stakeholders," Carrato explains. "It allows us to look at the challenges through their eyes." The workshops, held for more than 30 years, "are ingrained in our culture now."

The firm also uses an online technical blog to keep employees abreast of new ideas and to facilitate communication. Ongoing communication and planning has created such close relationships

The Paducah & Louisville Railway Bridge J23.3 near Fort Knox, Ky., features 95-ft-long precast concrete AASHTO girders with a cast-in-place concrete deck. The bridge was built offline and the alignment was switched once the bridge was completed.
All photos: Alfred Benesch & Co.

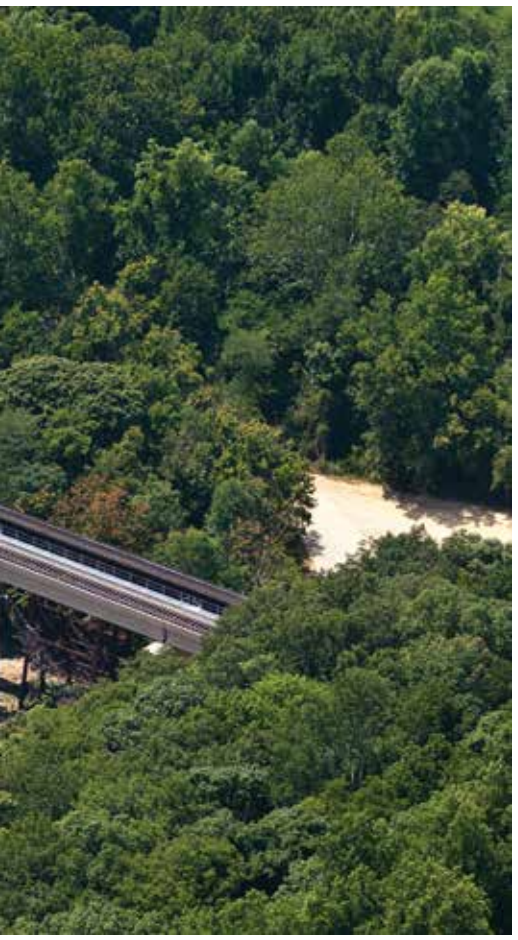
that about 95% of the firm's business comes from repeat customers, including departments of transportation, toll authorities, cities, counties, and other types of municipalities.

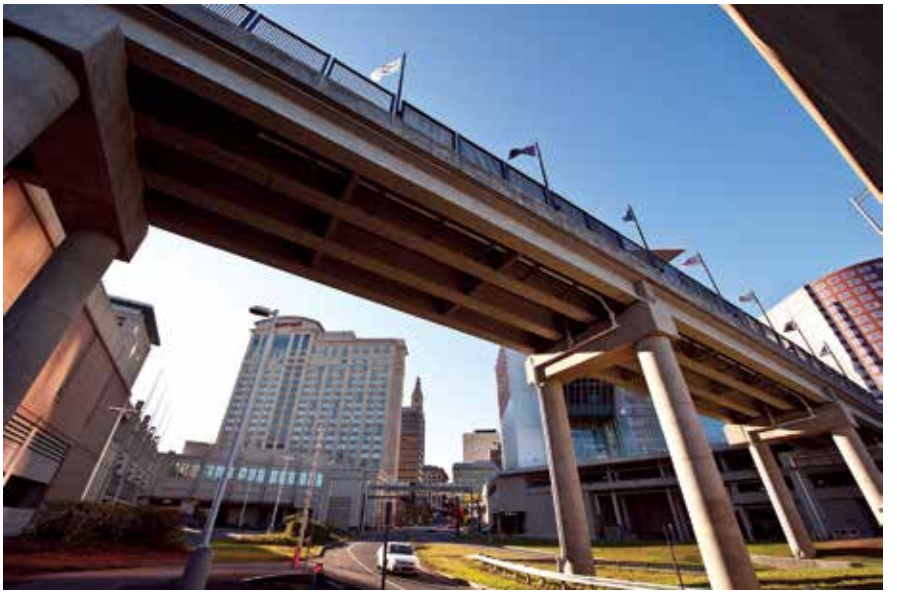
Value engineering also plays into providing tighter estimates, which owners are demanding, Carrato notes. "They want to know how every change impacts the budget and how it will affect user costs, for which they've gained a great appreciation. It's not only about the lowest cost but also the most value for the money spent."

Railroad Designs Thrive

Benesch offers particular expertise in railroad bridges. "Railroad bridges are unique because we can't stage traffic or create detours," Carrato explains. "They have to be constructed quickly with small work windows, typically a few hours."

In many cases, the railroad bridges are constructed of concrete, regardless of the original bridge's construction, adds David Morrill, senior vice president and structural group manager for Illinois. "The use of concrete has been increasing dramatically in railroad bridges," he says. "Where we used to design with steel, we're now using concrete for more superstructures." That's especially true for replacement of shorter timber-trestle bridges in the 20- to 40-ft range.





The three-span, 268-ft-long Mayor Mike Peters Pedestrian Bridge in Hartford, Conn., has prestressed bulb-tee girders with a composite precast concrete deck slab. It features two colors of stamped concrete to create a brick-like pattern.

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Typically, the designs prove more economical in the short and long term. "Concrete segments can be heavier, so bigger cranes and a larger substructure may be needed," says Morrill. "But those costs are more than offset by precasting pieces and moving them into place quickly and by reducing long-term maintenance needs."

A recent railroad project involved the Paducah & Louisville Railway Bridge J23.3 near the Fort Knox Army Base in Kentucky. Designers used 95-ft-long precast concrete AASHTO girders with a cast-in-place concrete deck for the project, which replaced a steel-tower viaduct bridge from the late 1800s. The bridge was built off line and the alignment was changed to connect to it rather than replacing the steel bridge in line. "Constructing the bridge in line would have been a tremendous challenge," Carrato says. "We often build off line and slide the bridge into place, but this project proved most effective by changing the alignment."

Pedestrian Bridges Growing

Benesch also has become proficient at designing pedestrian bridges, which are becoming more popular. "The new urbanism and focus on transit options are leading to a desire for better pedestrian access while minimizing vehicle use," says Jim Fuda, Connecticut division manager. "Cities want to connect neighborhoods in better ways."

Those projects feature different, but no fewer, challenges, he notes. "With pedestrian bridges, owners are more sensitive to aesthetics and function. Since pedestrians' perspectives are at a walking pace, they experience more details, ornamentation, and the bridge's walking surface." That can often lead designers to use concrete. "From a pedestrian's perspective, concrete offers a more integrated appearance, from deck to railings to substructure," he says. "It can create nice lines that allow pedestrians to see the aesthetic elements working together."

The Mayor Mike Peters Pedestrian Bridge in Hartford, Conn., is an example. The 268-ft-long bridge, connecting the Connecticut Convention

Center with the Connecticut Science Center, is a three-span, precast concrete bridge consisting of prestressed bulb-tee girders with a composite precast concrete deck slab. The design provided the best overall economy, durability, and maintenance costs while offering accelerated bridge construction (ABC), minimizing disruptions to the highway ramps below. More details about this bridge are provided in the Winter 2012 issue of *ASPIRE*.™

The speed with which precast concrete allowed the bridge to be constructed, by fabricating components off site and bringing them together with minimal disruptions, was a key attribute. "We are seeing much more emphasis on doing work quicker, with less impact on traffic, and more searching for accelerated bridge concepts," says Morrill. "Accelerated bridge concepts are more prevalent and desirable today."

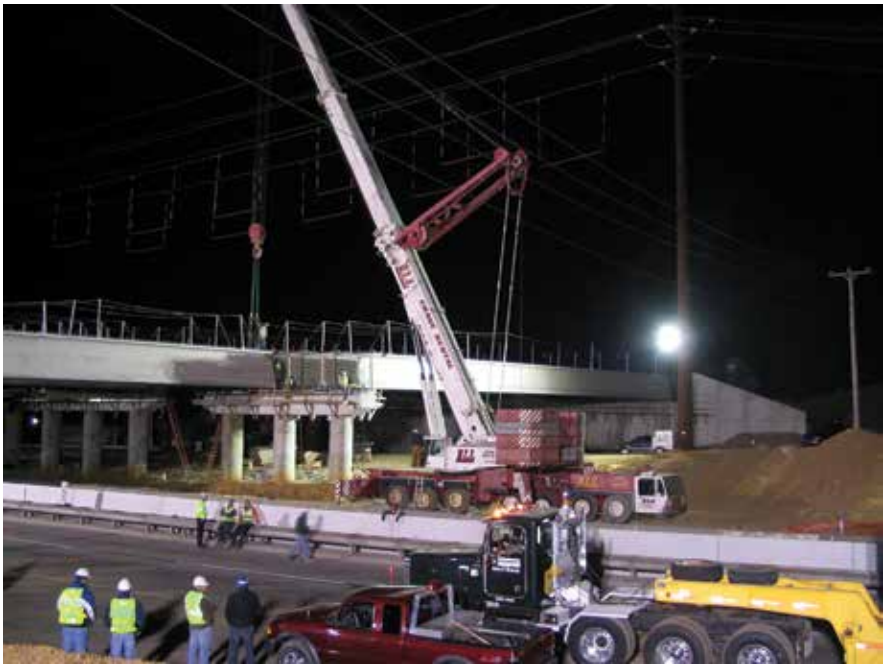
Expanding ABC Techniques

The firm is well versed in ABC techniques from its railroad work, says Carrato. "We've had no choice there, and many of those concepts can transfer to highway bridges." The firm has used sliding techniques on many railroad bridges as well as on several highway bridges recently. It also has experience with self-propelled modular transporters (SPMTs). "SPMTs show that even with massive components, these bridges can be moved readily."

Precast concrete helps speed up projects, especially with its ability to integrate its components. "In the past, precast concrete was used mostly for beams, but now it's expanding its uses to include pier caps, columns, and combinations of pieces that can be put together like an erector set," Morrill says. "We're seeing more of a drive in that direction now."

Benesch has even patented a precast concrete retaining wall to aid in simplifying designs. "Our goal with precast concrete projects is to simplify details and repeat them to reduce fabrication efforts, creating more efficiencies of every kind," Morrill explains. More details about this retaining wall system are provided in the Spring 2013 issue of *ASPIRE*.

An example of the speed that concrete designs can provide is the State Route 222 Bridge in Lehigh County, Pa. A 5.5-mile-long, boulevard-style bypass, required to alleviate congestion, included a new three-span bridge over the Pennsylvania Turnpike. This 358-ft-long bridge features precast, prestressed concrete AASHTO I-beams and spread box beams in a splayed arrangement to accommodate the loop-ramp geometry, with span lengths up to 158 ft. Estimates showed that the precast concrete design saved about 20% compared to the steel design.



Nighttime turnpike closures of no more than 15 minutes each were allowed to set the center-span beams, which had pick weights in excess of 110 tons, explains John Eagan, vice president and assistant division manager in the Pottsville, Pa., office. "We coordinated with the Turnpike Commission to swing the beams into place quickly and get the turnpike open again as fast as possible each night," Eagan says.

Aesthetics Gain Attention

As owners become more concerned about aesthetics, designers are incorporating ornamentation using formliners, curving forms, and interesting geometries. "We're doing shapes and amenities that we previously would not have done," says Fuda. "It's great, because we can create a nice ambience. Bridges are very visible structures, so attention to aesthetics pays off."

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An example of functional aesthetics can be seen in the firm's work on the University Avenue Bridge over I-74 in Peoria, Ill. The central supporting pier on the bridge, made with precast concrete, came down alongside the Dry Run Creek Flume. To avoid disrupting this waterway, designers created a concrete tied-arch pier that straddles the flume. This design was repeated on another bridge further down the highway.

As that project shows, sites are becoming more challenging. "It can be difficult to shoehorn a new bridge into the existing space," says Fuda. More projects replace existing bridges, where restrictions have increased since the original construction. For that reason, many bridges are being rehabilitated, and include the reuse of piers and foundations.

A type-size-location study for the State Route 222 Bridge in Lehigh County, Pa., led to a precast concrete design using AASHTO I-beams and spread box beams for the 358-ft-long, three-span bridge over the Pennsylvania Turnpike.

University Bridge on I-74 in Peoria, Ill., features a concrete tied-arch support pier that straddles the Dry Run Creek Flume. The design for the project, which features precast concrete girders, creates an aesthetically pleasing, functional support design.

The rebuilt two-level Wacker Drive viaduct in Chicago replaced the existing 1400-ft-long structure but retained many of the existing caissons. To help attain a 100-year service life, the deck slab was post-tensioned in both directions and included epoxy-coated reinforcement.

Retaining caissons on the Wacker Drive upgrade in Chicago, Ill., for instance, saved considerable time and money, but it created challenges, says Morrill. Benesch's portion of the project required replacing the 1400-ft-long, two-level viaduct and repairing fixed spans of the adjacent bascule bridge. The design, covering 44 spans that were five bays wide, featured a cast-in-place, post-tensioned concrete slab. Existing caissons were kept, but grade beams had to be placed over some of the existing caissons to support new columns placed in different locations. See *ASPIRE* Fall 2012 for more details about the Wacker Drive project.

Durability has become more prominent in the owner's concerns, says Eagan. "Owners always want longer life and less maintenance," he says. Key ways to achieve that are to minimize deck joints and stretch precast concrete beams to eliminate piers. That's being helped by higher concrete strengths, he notes. "We used to work with 5 ksi concrete, but today we get 10 ksi routinely." More seismic control is being added to designs both as zones become more stringent and to add overall resilience, adds Morrill.

Sustainable Designs Sought

Longer life, more durable structures, and reuse of existing materials are key sustainable-design concepts that owners appreciate, Morrill notes. "Owners want more green structures, both to be sustainable and because reuse saves funds," he says. "Based just on environmental and economic factors, rehabilitation is definitely a higher priority today. The luxury of simply replacing a deficient bridge is over. We get more questions today about what can be reused."

Benesch has positioned itself to meet the demands of both new and existing bridges by expanding its business in recent years. In the past three years, it has made four acquisitions.

Its expansion isn't finished, says Carrato. "We have a long-term plan to grow and diversify geographically." Acquisitions now are focused on bolstering Midwest offices and expanding in the Southeast, where Benesch gained a foothold with its 2011 merger (see sidebar for more information).

"We don't want to become a mega-company, but we do want to have diversity, because not all markets are in the same shape at the same time," he explains. "We also know that more offices create more opportunities for our employees to grow."

The acquisitions add expertise and diversity as the firm deals with evolving needs, such as an emphasis by states on design-build and public-private partnerships (P3). "P3 projects are one reason we want to grow," he says. "We want to compete in that arena. We see where owners are going with their projects, and we want to be part of that activity and be a leader in that market with innovative, cost-effective designs."

For additional photographs or information on this or other projects, visit www.aspirebridge.org and open Current Issue.

Benesch's Beginnings

Alfred Benesch founded his structural and civil engineering firm in Chicago in 1946. The next year, he hired his first employee, Harold R. Sandberg. Today, the firm has approximately 460 employees operating in 19 offices.

In the early 1950s, the firm expanded its expertise to include railroad and highway bridges and construction management. It also evolved from a partnership into a corporation and did work especially on the Illinois and Indiana toll-road system. It added value engineering in 1975, first internally and then expanding it into a separate service.

In recent years, it has experienced significant growth through mergers and acquisitions. In 2010, it merged with HWS Consulting Group in Lincoln, Neb., adding offices in three Midwestern states. In 2011, it merged with Clinard Engineering Associates LLC in Brentwood, Tenn., opening its first Southeast office.

In 2012, it added to its Colorado and Illinois offices by merging with LONCO. It also added offices in Connecticut and Massachusetts by merging with Purcell Associates Inc.

Benesch consistently ranks among the Top 500 Design Firms in the country as ranked by *Engineering News Record*. It recently received recognition for the fifth year in a row as one of the nation's Top 50 "Go-To" bridge-design firms by *Roads & Bridges* magazine.