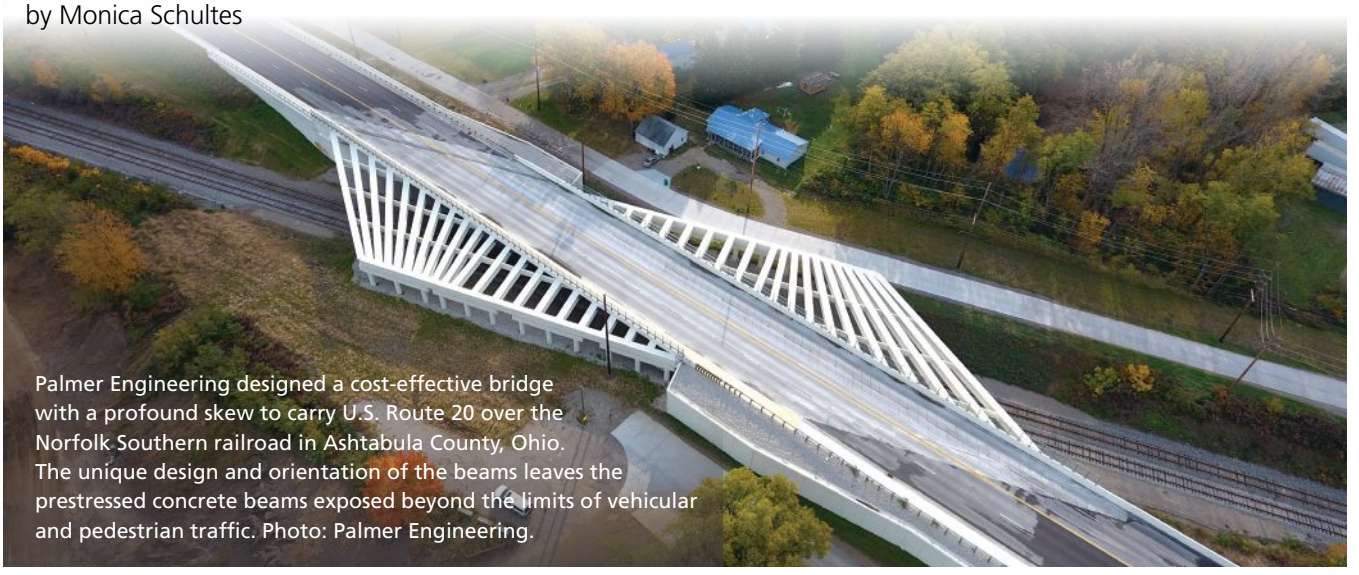
Palmer Engineering

Palmer Engineering has provided civil engineering services across the Appalachian region for 55 years

by Monica Schultes



Palmer Engineering designed a cost-effective bridge with a profound skew to carry U.S. Route 20 over the Norfolk Southern railroad in Ashtabula County, Ohio. The unique design and orientation of the beams leaves the prestressed concrete beams exposed beyond the limits of vehicular and pedestrian traffic. Photo: Palmer Engineering.

Palmer Engineering Company, incorporated in 1969, is a consulting engineering firm specializing in transportation, structures, surveying, land development, and water resources. Headquartered in Winchester, Ky., Palmer Engineering employs more than 120 professionals across five states. The firm maintains four offices in Kentucky, three in Ohio, two in Florida, and one each in West Virginia and Tennessee. Some offices specialize in a particular subfield, but all offer a wide range of services, including civil engineering, surveying, environmental, infrastructure design, water resources, bridge design, bridge inspection, roadway design, traffic engineering, and utility engineering.

The Palmer Way

Palmer Engineering offers comprehensive bridge engineering services, including design of new structures, in-service bridge inspection, load rating, and maintenance. Everyone on their team of structural engineers is experienced in both new design and bridge inspection. "That is the Palmer way. We want our people in the field and involved in designing and maintaining our infrastructure. There is a great reward in that connection," says Dr. David Deitz, vice president at Palmer Engineering.

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Deitz credits the company's longevity and success in the region to their unique understanding of the critical facets of resilient structures. While many engineering firms specialize, Palmer Engineering is well rounded, which complements the needs of their region's, and the country's, aging infrastructure. Their bridge work is primarily with departments of transportation, often in conjunction with highway projects.

Bridge Inspection

In addition to designing new structures, Palmer Engineering works with transportation agencies to maintain their inventory of bridges. The firm performs inspections and load ratings of existing structures and will develop repair plans, if necessary. Much of that work involves visual inspection of every type of bridge, from small culverts to major river crossings. For example, in Palmer Engineering's work with the Kentucky Transportation Cabinet (KYTC), some projects start with a detailed bridge inspection to document deterioration, cracks, or excessive corrosion. In some cases, these findings lead to the development of a set of plans to repair the structure. Those plans might include a deck overlay, component retrofits, or crack repair. The inspection findings are also sometimes used to refine bridge load ratings, which are needed to document a structure's load-carrying capacity.

Many Palmer Engineering inspectors are certified by the Society of Professional Rope Access Technicians, which means they can safely perform rope-access inspections from heights. All primary Palmer bridge inspectors also maintain Remote Pilot Certificates from the Federal Aviation Administration. Deitz notes the value of drones in their inspection work. "This month, our crews inspected 30 small-to-medium bridges, and because our inspectors always have a drone with them, the drones supplement their efforts on the ground. Drones provide a better look at site conditions because even the smallest inspections often require a

The Kennedy Interchange—also known as "Spaghetti junction"—is the confluence of three interstates and intertwines with local access roads between downtown Louisville, Ky., and the Ohio River. Palmer Engineering was part of the project team that designed the reconstruction of the interchange. Photo: Palmer Engineering.

better view. Our drones are just another tool in the toolbox."

In 2024, Palmer Engineering inspected twin bridges carrying State Route 2 over the Huron River and an adjacent estuary in Erie County, Ohio. Each of the bridges is composed of 27 spans, with a total length of approximately ½ mile. To enhance the inspection, Palmer performed a scan of the bridge decks with a drone-mounted infrared camera operated by Palmer's experienced drone pilots. The inspection is the first phase of a bridge rehabilitation that will evaluate deterioration of the concrete decks, piers, and girders.

Emergency Work

Palmer Engineering's breadth of experience in design and inspection is called upon in emergency situations. In November 2024, the firm provided immediate support to the Ohio Department of Transportation after a large outdoor fire under the Ohio approach to the Daniel Carter Beard Bridge on Interstate 471, which connects Cincinnati to Newport, Ky. This fire led to the closing of the southbound lanes of the interstate, and the firm was part of the project team that designed shoring towers to stabilize the approach spans until more permanent repairs could be installed.

In 2022, localized flooding in eastern Kentucky prompted KYTC to engage Palmer Engineering for emergency bridge inspections. "These bridges were rarely, if ever, overtopped in the past, but after the storm, some were under several feet of water," says Deitz. "Some structures had been completely washed away." Immediately after the event, Palmer inspected more than 60 bridges in support of KYTC's efforts to document the condition of every structure in the area. The firm then worked with KYTC to design 11 replacement bridges in three months. "We were called out after the storm event to support inspection efforts and then to design and replace some of these critical bridges immediately," explains Deitz. "We designed one bridge within a week to get it reopened. Our firm is local, so we were committed to helping."

In November 2020, a truck hauling potassium hydroxide and diesel fuel crashed into a jackknifed truck and caught fire on the northbound deck of the Brent Spence Bridge. The structure is a vital crossing of Interstate 71 and Interstate 75 over the Ohio River between Covington, Ky. and Cincinnati, Ohio. Palmer Engineering and three other consulting firms joined KYTC inspectors to assist in the immediate inspection of the bridge. Because chemical fire temperatures exceeded 1500°F, traditional inspection methods were not initially feasible; under these conditions, drones were an important inspection tool.

Workforce Development

Like most firms in the industry, Palmer Engineering is seeking innovative ways to find and retain highly skilled employees. Hiring and keeping a highly skilled workforce is challenging, says Deitz. "There is a real shortage of engineers, so we work with the University of Kentucky and other universities to find young talent." This outreach program feeds into the Palmer Engineering intern program. "We look ahead to future graduates who will make a good fit with our team," says Deitz. For example, to prepare engineering students to enter the workforce, the University of Cincinnati has a mandatory co-op program in which students alternate semesters in the classroom with semesters working full time. Palmer Engineering maintains a relationship with the program and employs a few students each semester.

"We take an active role in hiring interns and making sure they're a good fit for us and we are a good fit for them before they graduate," says Deitz. Palmer Engineering supports young engineers as an investment in

Precast concrete deck panels that are full-depth and full-width are placed on box beams spanning Harrods Creek. The deck panels cantilever beyond the existing spandrel walls on each side to widen the existing crossing while maintaining its historic profile. Photo: Stantec.

Part of the Corridor Q project, this bridge carrying U.S. Route 460 over Marrowbone Creek and Kentucky Route 195 features twin nine-span precast concrete I-beam structures with 180-ft-tall piers. The structure is supported on tapered, hollow piers. Photo: Palmer Engineering.

their future. Their support of intern and co-op programs helps strengthen the firm's structural engineering pipeline while also helping young engineers innovate and grow in their careers.

The firm also fosters a mentoring culture among its employees. More-seasoned engineers make a concerted effort to mentor younger professionals during projects, giving them opportunities to gain experience in each phase of the work. "I think our other principals would agree that we are sharing our philosophies and experiences," says Deitz. It comes down to making an investment to teach innovative approaches and provide a variety of experiences. "If the young engineers have not yet designed a side-by-side concrete box-beam bridge or are unfamiliar with tall concrete piers, then we include them and provide that opportunity, so everyone is well rounded."

Project Highlights

Ashtabula County, Ohio, Bridge Replacement

When a 1940s-era, 23-span reinforced concrete slab bridge in Ashtabula County, Ohio, needed to be replaced due to age and deterioration, Palmer Engineering prepared the design plans. The bridge carries U.S. Route 20 over the Norfolk Southern rail line, where the skew between the road and railroad is approximately 72 degrees.

For this project, the owner sought a cost-effective bridge that would increase vertical clearance while also accommodating two future tracks adjacent to the existing rail lines. To address the challenges, the project team designed and constructed an innovative single-span bridge with prestressed concrete I-beams oriented perpendicular to the centerline of the railroad tracks rather than parallel to the roadway centerline. The parts of the superstructure within the roadway limits are supported on stub abutments behind mechanically stabilized earth walls; beyond those limits, the bridge is supported on piers.

To reduce construction costs, a splayed framing plan with relatively wide beam spacing was used at the acute corners. This strategy eliminated beam lines and minimized substructure lengths. For additional cost savings, the bridge deck extends only in the footprint of the roadway and sidewalks, leaving significant portions of the beams exposed. The final layout uses 33 beams, with the 100-ft interior beams perpendicular to the abutments and spaced at a constant 13 ft. The 10 beams on each side of these central beams are splayed, with spacings ranging from 6 to 16 ft, and spans ranging from 100 to 141 ft.

Tall Piers and Seismic Challenges in Kentucky

Eastern Kentucky has some of the tallest bridges in the eastern United States due to its rugged mountainous terrain and steep slopes. Many project sites in the region pose unusual challenges for designers. Mobility difficulties were acknowledged in the Appalachian Regional Development Act of 1965, which designated highway corridors in the region for specific infrastructure funding. Over the past 25 years, Palmer Engineering has been responsible for the design of more than 25 miles of highway in eastern Kentucky. This part of the Appalachian regional highway system has more than 30 major bridges, several with concrete pier heights in excess of 200 ft.

Recently, Palmer Engineering was responsible for designing the entire 16-mile Kentucky portion of the Appalachian Development Highway System's Corridor Q (U.S. Route 460). That corridor runs from U.S. Route 23 in Kentucky to Interstate 81 in Virginia. The firm's experience designing bridges in mountainous areas helped them work around constraints such as the potential for subsidence associated with an abandoned coal mine. Construction is ongoing, and the project should be complete in 2025.

Tall concrete piers in the mountains can be a very impressive feature. A representative design on the Corridor Q project consists of hollow cast-in-place concrete columns with 1-ft 6-in.-thick walls that are a consistent 16 ft wide transversely and begin at 6 ft thick longitudinally just below the pier cap, widening at a tapered ratio of 40 to 1 in the longitudinal direction as the column approaches the ground elevation. Palmer Engineering has designed similar piers for other projects in the region. Rock is typically close to the surface, so many of the piers are supported on spread footings.

History of Palmer Engineering

Ralph Palmer and Dick Nunan founded Palmer Engineering in 1969 in Winchester, Ky., as a surveying enterprise. The firm later moved into highway design and grew from there, expanding into structural and environmental engineering services. Palmer's vision to add more in-house services led the business to become what it is today. Today, the firm has more than 120 employees, including 60 professional engineers, engineers-in-training, and professional land surveyors.

Ralph Palmer graduated from the University of Kentucky with a degree in civil engineering. He retired in 2006, but his fundamental belief that business should be based on honesty and integrity is still part of the culture of Palmer Engineering. The firm has registered professionals specializing in transportation engineering, traffic engineering, structural engineering and inspection, surveying, and environmental design. The firm intends to continue to be a small firm and operate like the family business that Palmer envisioned. His son currently works in the survey division.

However, in situations where there is significant overburden, end bearing piles or large-diameter drilled shafts are used for the foundations. Given the height of the piers required, Palmer Engineering made special considerations for creep, slenderness, and shrinkage of the concrete, which are not specifically considered in conventional pier design.

Palmer Engineering also works in western Kentucky, which, in contrast to eastern Kentucky, is mostly flat. For example, the firm partnered with Michael Baker International for the replacement of the western Kentucky bridges carrying U.S. Route 68/Kentucky Route 80 over Kentucky Lake and Lake Barkley. A concern on this project was seismic activity, as western Kentucky is located in the New Madrid seismic zone. "As part of our work," Deitz says, "we performed rigorous time-history analysis of the approach structures across the two large lakes."

Deitz notes that the firm has the expertise to address the engineering challenges it has encountered in Kentucky and elsewhere. "Palmer Engineering has performed detailed seismic analysis and has designed some of the tallest piers in the Eastern United States," explains Deitz. "We can manage large and challenging projects despite our small size. We pride ourselves in our technical capabilities and ability to undertake complex projects."

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Kennedy Interchange, Louisville, Ky.

The Kennedy Interchange in downtown Louisville, Ky., is the junction of Interstates 64, 65, and 71. Because of the interchange's complicated geometry and required diverging, weaving, and merging movements, it has been called "Spaghetti Junction." Reconstruction of Kennedy Interchange was part of a larger project that included construction of 41 permanent bridges and aimed to improve mobility across the Ohio River downtown and on the east side of Louisville. Palmer Engineering was part of the design-build team, led by Walsh Construction, for the project.

As part of the inspection of the twin bridges carrying State Route 2 over the Huron River and an adjacent estuary in Erie County, Ohio, Palmer Engineering performed a scan of the bridge decks with a drone-mounted infrared camera operated by experienced drone pilots. The scan helped to document the condition of the 27-span precast, prestressed concrete girder bridges. Photo: Palmer Engineering.

Palmer Engineering's responsibilities included the final design of 15 bridges, including flyovers, interstate-to-interstate ramps, and local access ramps. The superstructures vary depending on the site constraints and include prestressed concrete I-girders and box beams, among others. Substructures include integral end bents, semi-integral breast wall abutments, expansion abutments with backwalls, and expansion joints. Palmer Engineering also provided surveying services. "All of the structures had challenging geometry, including severe skews, wedge-shaped spans, horizontal curves, and sharp vertical curves," recalls Deitz. "This was a good example of the use of conventional simple-span precast concrete girders made continuous for live load despite unique shapes, layout, and skews."

Widening the Historic Harrods Creek Bridge

In Louisville, Ky., Palmer Engineering served as the specialty engineer for a challenging project to widen an existing one-lane bridge to two lanes while preserving the historic character of the original span across Harrods Creek. The structure, which was deteriorating rapidly, was eligible for the National Historic Register. Facing a mandate to keep the original concrete arch, the project team pursued a unique solution to conceal a new structure inside the arched spandrels of the existing bridge. The concept would not transfer any new loads onto the existing arch. Precast, prestressed concrete box beams were selected to maintain the structure's narrow profile while adding the necessary deck width to meet current design standards. Palmer Engineering worked with the precast concrete manufacturer to design specially fabricated full-width, full-depth precast concrete bridge deck panels. The existing bridge deck had to be widened by more than 10 ft, so the new deck cantilevers outside the existing spandrel walls on each side. The prestressed concrete box beams had to be shallow in depth to meet the geometric constraints of the project, and it was important to install them quickly so that the structure could reopen in time for the beginning of the new school year.

Stewardship

Deitz emphasizes that Palmer Engineering intends to continue to grow as a firm and maintain their multifaceted team of professionals. "We are vested in the benefits of prolonging the life of our infrastructure," says Deitz. In addition to performing inspections, the firm helps owners implement maintenance programs, which are an important part of extending the service lives of bridges. Their work on transportation projects puts Palmer Engineering on the frontline as stewards of these important assets.