

ACEC Missouri 2021 Engineering Excellence Awards

Grand Conceptor Award



HNTB Corporation, Kansas City

PROJECT TITLE:

Champ Clark Bridge

CLIENT/OWNER:

**Missouri Department of Transportation;
& Illinois Department of Transportation**

Initially built in 1928, HNTB's predecessor company designed the original Champ Clark Bridge in Louisiana, Missouri; therefore, it was

fitting for HNTB to return nearly 100 years later and be tasked with the bridge's replacement. The original bridge linked farming areas in Missouri and Illinois, encouraging agricultural communities to sprout up on both sides of the Mississippi River. As transportation and technology evolved over time, the bridge grew functionally obsolete and structurally deficient.

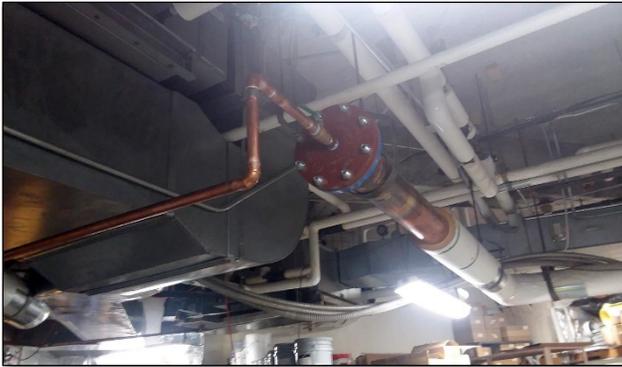
The initial two narrow, 10-foot-wide, shoulderless lanes meant oversized trucks and farm equipment had limited clearance when crossing the bridge. Drivers of those vehicles would have to pull off the road until law enforcement could shut down one lane of the bridge, escort the trucker or farmer across, and then reopen the bridge to normal traffic. Lack of clearance contributed to other issues like side mirrors constantly striking the truss, breaking off, and falling into the river, as well as major public safety traveling concerns. The bridge was a lifeline to the nearest hospital and traveling to the next closest bridge, 45 minutes away, could present a life-threatening delay. Routine shutdowns such as these were a drain on public safety resources, supply chain productivity, the farmers and the residents.

A recipient of a federal TIGER grant in recognition of its critical importance to the region, the project was a joint undertaking between the Missouri DOT and Illinois DOT to connect and enhance communities with the potential to provide transformative opportunities, particularly for struggling small towns like Louisiana.

The team's low-maintenance, straightforward design provided the perfect solution. The project's primary elements are a five-span, continuous steel plate girder bridge founded on 11'6" diameter drilled shafts and a three-span prestressed concrete girder unit. The new bridge carries 12-foot-wide lanes with 10-foot shoulders in each direction. Along with the river bridge, the project included significant approach work on each side of the river. On the Illinois side, reconstruction of the approach roadway to above the 500-year flood elevation and passing over a critical levee were needed. The Missouri side required the rehabilitation and expansion of the adjacent intersection that included drainage improvements and enhanced lighting. When the new replacement bridge opened to traffic in the summer of 2019, the new structure more than doubled the existing bridge's width. The project is the first time the design/build delivery method has been used to cross the Mississippi River in an eight-state region and the first design-build project for IDOT.



Grand Awards



Bartlett & West, Inc., Jefferson City

PROJECT TITLE:

Providing Clean, Safe and Connected Water: The Missouri Capitol Complex

CLIENT/OWNER:

State of Missouri Office of Administration – Division of Facilities Management, Design & Construction

The goal of the project was to successfully decommission the Missouri Capitol Complex Water System by connecting any remaining buildings or facilities in the Complex to the neighboring Missouri American Water Company system.

The nature of the Complex's buildings and the intricacies of the system presented unique challenges for the overall project—we had to connect and disconnect pipes with little-to-no interruption in water service. To solve this issue, Bartlett & West developed and implemented a sophisticated tie-over plan that included an innovative system of temporary water taps and service lines. The tie-over plan, developed by fully analyzing and interpreting the Capitol water system, allowed all key participants to work from the same plan and minimized the water service downtime.

Bartlett & West also prepared a present-worth analysis during the initial design for project justification, and hydraulic analyses and field tests during design to ensure proper continuity of water service after project completion.

The project was unique because of its location, complexity and operational challenges. Bartlett & West used its engineering skills—critical thinking, problem solving and innovative solutions—to coordinate, plan and manage this essential project.

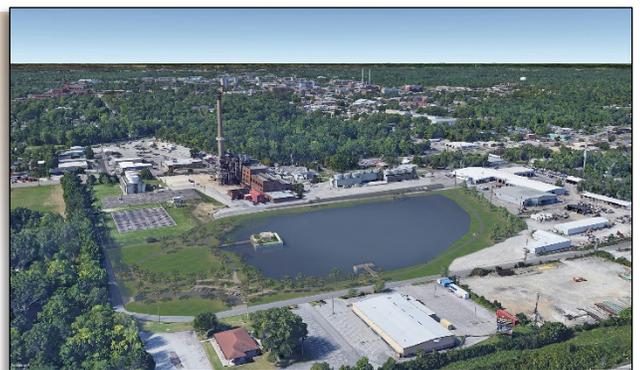
Burns & McDonnell, Kansas City

PROJECT TITLE:

More's Lake Coal Combustion Residuals Impoundment Closure and Restoration Project

CLIENT/OWNER:

City of Columbia, MO



The More's Lake Coal Combustion Residuals Impoundment Closure and Restoration Project began in 2015, when the U.S. Environmental Protection Agency (EPA) published the final rule on the requirements for the disposal of coal combustion residuals (CCR) in landfills and surface impoundments. More's Lake had become part of the Columbia Municipal Power Plant over 100 years prior. By 2015, it had accumulated over 90,000 cubic yards of coal ash without an engineered liner.

In 2015, the City of Columbia elected to close the CCR unit by removing and decontaminating all areas affected by coal ash to meet the new EPA regulations. Burns & McDonnell partnered with the City to provide planning, environmental remediation, regulatory consulting and engineering services. Burns & McDonnell developed closure plans, designed and constructed the site groundwater monitoring well network, performed groundwater monitoring and reporting, provided regulatory submittals and certified the closure of the facility. Our team also performed the engineering design and completed the construction plans and specifications so the City could beneficially utilize the coal ash as an embankment fill to create a new landfill access road. This unique approach saved the City 13,000 cubic yards of landfill airspace and approximately \$600,000 in saved tipping fee revenue while also conserving valuable landfill cover soil.

Upon closure, the City retained Burns & McDonnell to continue restoration of the site by designing a public park to be completed with walking trails with benches, a picnic shelter, a fishing pier and green spaces. It will also include a bioretention cell to manage stormwater drainage from the roadway and parking area.

The More's Lake Coal Combustion Residuals Impoundment Closure and Restoration Project was completed in February 2020, ahead of the City of Columbia's original deadline and \$750,000 under budget. This closure signified another step in the transformation of More's Lake from a family fishing pond to a coal ash impoundment to what will soon be a landscaped park preserving a piece of the city's history.



Burns & McDonnell, Kansas City

PROJECT TITLE:

Portneuf Culvert Replacement

CLIENT/OWNER:

Idaho Transportation Department

Problem: This culvert replacement project in Idaho used partial tunneling with tunnel liner plate to replace a severely deflected corrugated metal pipe (CMP) in the Portneuf River under US-30. This trenchless replacement method was the first of its kind for the Idaho Transportation Department (ITD) and was selected to replace the 262-foot-long, 10-foot-diameter culvert because of multiple project constraints, including tall MSE retaining walls with 45 feet of fill and geofoam above the culvert.

The project is located near Lava Hot Springs, Idaho, where a 1962 flood washed out the main channel culvert and caused the roadway embankment to fail. At that time, ITD replaced the culvert and added two overflow culverts to handle future floods. Over time, the overflow culverts' inverts became corroded, and a portion of the main channel culvert crown became significantly deflected into a kidney-bean shape. In 2011, the Topaz Bridge and US-30 widening project, which replaced the bridge over the Union Pacific Railroad and the Marsh Valley Canal, created additional challenges for the culvert replacement because it utilized geofoam fill and MSE walls. Environmental constraints included wetland impacts and mitigation, aquatic organism passage, presence of migratory birds and bats, protection of vegetation, and turbidity. Hydraulics challenges included demonstrating a no-rise, obtaining acceptable velocities, and avoiding a decrease in the hydraulic opening. In addition, the Portneuf-Marsh Valley Canal Company limits the timeframe for reducing river flows with an upstream flow control structure to October through March, when low flows are anticipated.

Solution: ITD partnered with Burns & McDonnell to solve this complex problem. Early in the project, it became clear that a simple slip liner solution would not produce the desired results, and an alternate solution was necessary. The team studied other trenchless alternatives, including liners and jack & bore, but the deflected shape of the existing culvert limited the size of liner that could fit in the available opening, and the resulting changes to flow lines and velocities were unacceptable. The team identified three possible alternatives: traditional jack & bore, jacking a larger pipe around the existing one, and partial tunneling. Both jacking alternatives would require construction of a substantial and expensive bulkhead in the river channel and would impact the surrounding MSE walls, potentially conflict with the geofoam fill, and increase the construction schedule. Ultimately the partial tunneling alternative was selected because it could be constructed in place and would produce acceptable hydraulic results, limit environmental impacts, and avoid conflicts with the MSE walls and geofoam fill. The partial tunneling alternative included shoring of the existing culvert, sequentially removing sections of the existing CMP, constructing a new pipe inside the existing one using galvanized steel tunnel liner plate, and timely pressure grouting of the new culvert sections. All culverts were retrofitted with a beveled headwall to improve hydraulics, and the overflow culverts' inverts were repaired with concrete as preventative maintenance.

HNTB Corporation, Kansas City

PROJECT TITLE:

Allegiant Stadium

CLIENT/OWNER:

StadCo/The Las Vegas Raiders



As architect of record for the Las Vegas Raider's Allegiant Stadium, HNTB Corporation led a design team that helped the team overcome six significant challenges and open an ultramodern sports facility on time and within the \$1.6 billion budget. In doing so, the design team, led by HNTB's Kansas City, Missouri, office, pushed the limits of architecture, innovation and engineering.

Melding brands. The Raiders envisioned a stadium design that would meld their iconic brand with the glitz and glamor of the famous Las Vegas strip. Using the inspiration of a luxury sports car's curves and lines, the HNTB-led design team

created a sleek façade of black glass wrapped with flowing black ribbonry and highlighted by bold white stripping. The interior features contemporary, vibrant spaces and a high-energy Vegas-style nightclub.

Developing a retractable field. The team's owner wanted football played on a natural grass field. Given Las Vegas' desert climate, a fully enclosed stadium was the only option, but an enclosed structure was not conducive to growing grass. Building on industry best practices and lessons learned, the design team developed a self-contained playing field that can slide into the stadium on game days and outside of the stadium for optimal growing conditions.

Designing a first-of-its-kind ETFE roof system. A truss-built steel roof forms the outer ring of Allegiant's dome and then gives way to a large oculus. Because the stadium was relocated to Las Vegas, the oculus had to be enclosed to protect occupants from the desert's heat and glaring sun. HNTB led a team that designed the first cable-net-supported ETFE roof system in the U.S. It covers the oculus while retaining the light, airy, daylit feeling of an open stadium.

Creating the world's most technologically advanced stadium. Because fans want instant connection to statistics, each other and to family and friends through social media, the stadium has a substantial fiber optic backbone that can support current needs and facilitate next-generation technologies as they roll out.

Using the brand color palette. HNTB adhered to a strict color palette of black, white and silver to design the Raiders' locker room and Raiderette's lounge. Creating punch and accent using only the brand color palette was a challenge, but HNTB overcame it with texture, glass, matte and glossy finishes, reflectivity and architectural lighting.

Meeting a 42-month schedule. The NFL approved the Raiders' move to Las Vegas under the condition that the new stadium be open for the 2020 season, one year earlier than planned. HNTB's design time was cut by one year to accommodate the new and extremely aggressive 42-month schedule. A hybrid design-build delivery method delivered the stadium on time.

Other features of Allegiant Stadium include 90-foot-tall lanai doors that open to a panoramic view of the North Las Vegas skyline and an Al Davis memorial torch, the world's largest 3D-printed structure.



Horner & Shifrin, Inc., St. Louis

PROJECT TITLE:

Emerson Zooline Railroad Tunnel Repairs

CLIENT/OWNER:

Saint Louis Zoo

The two-foot (610 mm) narrow gauge Emerson Zooline Railroad is the Saint Louis Zoo's most popular paid attraction, critical to the overall operating budget of the Zoo. The Zoo's two

longest 60-year-old corrugated metal pipe (CMP) train tunnels experienced ovaling and flooding of the tracks from groundwater. Horner & Shifrin was responsible for the design of repairs to the CMP and a solution to prevent future flooding within the tunnels. Our unique approach avoided disruptions to ground operations by performing repairs wholly within the tunnel, without breaking through to the surface, and adding a new sump pit, pump and drainage system for dewatering the tracks.

Horner & Shifrin's repairs of the Emerson Zooline Railroad Tunnel required the use of innovation, ingenuity, and extensive forethought to achieve the client's objectives for an accelerated engineering and construction project. Unique design elements were to replace a structural member under at the location of its highest stress without unloading the structure. This had an inherent amount of risk, not only for the engineer, but the bidding contractors as well. Higher risk construction projects would not only limit the number of bidders, but the bids would be higher than normal projects with lower risk.

Normal projects don't really require the engineer to consider a contractor's means and methods of construction, however, if what we put on our plans was not constructible, it won't get built. To help mitigate the risk and get the maximum number of bidders to keep the cost in check, H&S carefully considered and presented multiple repairs we thought were possible. In addition we presented a shoring concept that could allow the repairs we presented to be made. We included a special provision that allowed contractors to present an alternate repair not on the plans, to which one bidder did make a proposal. There were 12 contractors at the mandatory pre-bid meeting and 7 contractors placed bids. The selected bidder was able to meet all the major bidding requirements and substantially complete with the major repairs and railroad installation for use by the owner within the planned shutdown.

In large part, unless you know what you are looking for when you ride on the passenger car, you are unaware that these repairs took place. The project will greatly reduce or eliminate the maintenance and operation issues the Zoo regularly needed to do keep this structure operational and safe. This was a great project that exemplifies what can and should be done to achieve a tunnel repair elsewhere, where site conditions allow.

Horner & Shifrin, Inc., St. Louis

PROJECT TITLE:

Industrial Wastewater Pretreatment Facility

CLIENT/OWNER:

Kerry Ingredients & Flavours



The Kerry Flavours and Ingredients facility in Affton, MO had outgrown its existing gravity separator for the treatment of its industrial wastewater. Wastes generated during food production line washdowns typically contain high amounts of Fats, Oils, and Greases (FOG), and the cleaning agents utilized create an emulsified liquid that can be very difficult to separate. After receiving multiple Notices of Violation from the Metropolitan St Louis Sewer District, the facility was facing the possibility of being shut down if they were unable to bring their waste generation under compliance for discharge to MSD's sewers.

Horner & Shifrin, Inc., was hired initially to perform a study to characterize the industrial waste and evaluate various options for treatment and/or disposal. The final project then consisted of the construction of a pretreatment plant including waste equalization, chemical pretreatment, Dissolved Air Flootation for FOG removal, and a screw press to minimize the final waste stream. The process was designed to allow for the final generated waste to be suitable for compost or even lowgrade livestock feed given the proper chemical usage.



IMEG Corp., St. Louis

PROJECT TITLE:

January Hall Renovation

CLIENT/OWNER:

Washington University in St. Louis

Louis. This 30,000-sf renovation is the first major construction project in the historic building and was completed in a compressed eight-month time frame while exceeding the university's goal for energy efficiency and achieving LEED Platinum certification.

Originally constructed in the 1920s, the historic January Hall is the three-story home of University College, the professional and continuing education division at Washington University in St.

The renovation of the two lower floors (which house classrooms, offices, and active learning labs) included completely replacing the mechanical, electrical, and technology systems throughout the building and adding fire protection sprinklers to the two lower floors with accommodations to be extended to the top floor in a future project. The top floor houses the campus' East Asian Library, which includes rare books that remained in place during construction.

The nearly 100-year-old building made coordinating new building systems within the historic structure challenging. Engineers surveyed the site, selected systems that required limited space, and actively coordinated with the architect and university to ensure the systems were appropriate. The new mechanical systems provide an energy-efficient solution with a high level of control for the building occupants and provided the necessary flexibility to install modern systems in the existing historic building.

Initially the university set sustainability goals for LEED Silver certification and energy savings of at least 20% compared to a baseline building. But as the project evolved it became apparent it could exceed those goals and actually became the first building on campus to be LEED v4 Platinum certified.

January Hall now serves as an example of how to sustainably renovate a historic building and highlights the university's commitment to the health, safety, and wellbeing of their staff and students, as well as the local and global environment.

Wilson & Company, Inc., Engineers & Architects; & Radmacher Brothers Excavating Co., Inc., Kansas City

PROJECT TITLE:

I-435 South Loop Link Design-Build Project

CLIENT/OWNER:

Missouri Department of Transportation



Bracing for a dreadful encounter with a sea of traffic and impacts of a mid-project surprise feels paltry when it whispers by without notice. Halfway through reconstructing six bridges and Missouri's highest crash-rate corridor, hearts skipped a beat when a routine inspection revealed the end of one of the bridges was on the verge of failure. Instead of the costly six-month delay normally needed for a change order of this size, MoDOT and the Radmacher-Wilson team used the design-build approach to pull off a customized design in one week.

The 12-hour repair went so smoothly that Operation Green Light, Kansas City's traffic signals and incident response coordinators, contacted the team to confirm the rehabilitation had actually happened. It had no noticeable impacts on traffic flow. This was a representation of the design-build team that completed work on the second-heaviest-traveled corridor in Kansas City while minimizing peak-hour lane closures.

Safety was paramount in a city with a 10-year-history of traffic delays and challenges surrounding other efforts taken to update the 54-year-old I-435 South Loop. Locally dubbed the "I-435 parking lot," this stretch serves as the only East-West interstate connection on the south side of the Kansas City metro area. With an "F" level of service rating, the road needed capacity improvements to relieve congestion and improve the reliability and safety of the connection. Most of the bridges in the corridor were in poor condition and required rehabilitation or replacement.

MoDOT, the project owner, set the ambitious challenge of completing a major rehabilitation to the pavement and bridges while improving capacity within a fixed \$64.5 million budget and a two-season construction timeframe. MoDOT selected the Radmacher-Wilson team after their concept met every project need while increasing the pavement's lifespan to nearly 40 years.

The Radmacher-Wilson team's innovative pavement design used the existing pavement structure as the base for the new pavement structure. By building on the existing structure, the pavement is more durable, with a longer life expectancy than new pavement, at a reduced cost and shorter construction duration. Original concepts restricted new pavement to the additional lanes. However, this solution enabled the team to pave the project corridor in new concrete, while adding a new, fifth lane in each direction.

Cost reductions continued as the pavement design eliminated the need for old pavement removal, which provided flexibility in construction phasing and traffic control. Combined with a unique approach to separate interchange bridges with a wide median, the team proposed constructing the new pavement and bridges while maintaining four lanes of traffic in both directions. The team pushed traditional concepts to achieve all of the project goals creatively, resulting in the most new infrastructure possible within budget while offering the least impacts to the public.

The project team, including the owner, contractor, and design team, took a partnered and collaborative approach to deliver the project from the start. Colocation and partnering efforts led to a group that shared a common goal of providing a successful project from all perspectives. They faced challenges and issues as a team, striving towards a shared vision. This project and its success have demonstrated the value of innovative engineering for the community and MoDOT, state-wide. The I-435 South Loop Link project stands as an example of success beyond its initial expectations. The project team demonstrated how this partnered method can lead to public praise during and after construction.

Honor Awards

ABNA Engineering, Inc., St. Louis

PROJECT TITLE:

IKE Smart City Kiosks – Downtown St. Louis

CLIENT/OWNER:

IKE Smart City, LLC



The City of St. Louis' wish to provide smart technologies and propel the City forward as innovative, connected and future-focused was granted with the implementation of the IKE Smart City Kiosk – Downtown St. Louis Project. Twenty (20) 5'5" tall interactive kiosk screens were strategically located throughout the City for each traveler to experience a live digital concierge of information discovery. Each kiosk provides smart information for wayfinding, transit access, events, service resources and interactive communications.

The problem, however, was how to best implement this smart initiative throughout the corridors of an urban city where right-of-way land use was already filled with physical structures and constraints. To execute a successful project, it was imperative to equally balance the following design concerns:

- Select kiosk locations with the highest visibility to attract on foot traffic and the attention of passing motorists.
- Select kiosk locations near existing 24-hour electric power sources.
- Select kiosk locations at surface areas which were ADA (American Disabilities Act) compliant and provided proper drainage.
- Finalize locations that generated cost-effective measures for construction.

Additionally, it was critical to be able to effectively communicate these key and other design elements with the Client, who was not familiar with or local to the St. Louis area.

ABNA welcomed each challenge with the following solutions. ABNA performed a thorough analysis of several potential locations based on the key design concerns, then recommended the final locations. Data for volume of foot and vehicular traffic was evaluated to determine the highest visibility. Coordination with multiple utility companies and agencies was conducted including the City of St. Louis Traffic Department to identify potential traffic signal boxes and Ameren Missouri to identify potential power poles that could both be utilized as a stable and consistent power source.

Also, in evaluating the site locations, numerous measurements were taken. The sidewalk slope accessing each kiosk required a grade between 1% and 2% to allow wheelchairs to maneuver safely, and to provide proper drainage. During the design phase, ABNA's team identified cost-saving opportunities to minimize construction costs for the Client.

Much like the innovative spirit this kiosk initiative generated, ABNA's dedicated staff initiated several project processes that have become the Client's standards. To effectively communicate with the Client, ABNA created a physical "template," which was used to photograph a visual kiosk construction representation at each site location; employed interactive mapping to convey large amounts of detailed information without burdening valuable storage space; and utilized AutoCAD Civil 3D to develop a format to clearly display significant details.



Affinis Corp, Kansas City

PROJECT TITLE:

Ward Road Improvements, County Line Road to 163rd Street

CLIENT/OWNER:

City of Lee's Summit, MO

The City of Lee's Summit wanted to improve Ward Road, an arterial on the southwest side of the city, to increase the safety for all users. Pedestrian access was incomplete, and it didn't easily accommodate cyclists alongside vehicles. This project would form the final connection in their long-term plan for this busy corridor.

Before beginning design, Affinis reviewed traffic counts. That data collected helped the design team determine the 3- to 4-lane section would handle traffic now, as well as for the next 30 years. They added left and right-turn lanes in the areas where volume warranted it. By applying value engineering strategies, they ensured Ward Road wasn't over built.

Throughout the design and construction phases, erosion control was an important consideration to not only the city, but also local residents. Ward Road is adjacent to Raintree Lake, and a nearby creek that feeds into it. In addition to implementing control measures prior to and during construction, Affinis installed turbidity curtains at the lake's entrance to help keep sediment out. Outlet drainage structures were placed on the west side of the road, so collected runoff could daylight into the upstream basins, preventing sediment from entering the lake.

The project site was multi-jurisdictional. To make the improvements, coordination was required with the city, as well as unincorporated Cass County. Affinis also worked closely with city owned utilities, a rural water district, and public utilities. Based on the timing of the project, they were able to coordinate a line upgrade with Cass County Rural Water District 7. Consolidating the work into one project meant residents gained improved infrastructure with minimal disruption.

When making these improvements, the city chose to use all concrete pavement, because it requires less long-term maintenance. They added LED street lights to improve visibility and integrated a 10-foot walking trail within the city limits. The roadway is part of a larger bike trail, so creating a safe environment for bicyclists, pedestrians, and vehicles was a top priority. Adding an enclosed storm sewer system was another integral part of the scope. The new design makes maintenance easier for residents. Overall, the project incorporated design elements that will save city dollars with fewer maintenance calls.

The improvements on Ward Road met all of the city's goals. The new design provides safer access for the entire community, connecting it in new ways. Now, there is a smooth riding surface to the north and south for cyclists. Pedestrian access is complete for the area, and vehicles can reach adjacent roads more safely and efficiently. It also completes the final leg of the city's planned improvements to this busy corridor.

Alfred Benesch & Company, Joplin

PROJECT TITLE:

Bridge Asset Management Program

CLIENT/OWNER:

KCMO Public Works Department



Overview: The City of Kansas City, Missouri (KCMO) in partnership with Alfred Benesch & Company (Benesch) developed and implemented innovative strategies and electronic tools to establish a Bridge Asset Management Program. Development and implementation of the Program allows the City to maintain and improve its infrastructure network, all while in the midst of budget, schedule and public constraints. The program partnership between KCMO and Benesch provided tools and strategies to address immediate needs without sacrificing the long-term sustainability of the City's network.

Problem: Like communities nationwide, KCMO faces the confluence of multiple physical, financial, social and organizational challenges manifesting themselves in the overarching problem of how to maintain existing infrastructure assets. While all City assets are aging, the bridge network in particular is experiencing assets nearing the end of original design life. Inadequate preventative care investment has limited the ability to salvage many structures. Increased competition for limited City funds has resulted in Public Works being challenged to "do more with less". Public demand for increased safety, accessibility, mobility and multi-modal alternatives, combined with growing traffic volumes and heavier loadings further stress deteriorating infrastructure. Finally, internal organizational structures, retiring staff and insufficient means of staff replacement result in loss of institutional knowledge and trained employees.

Solution: Efficient and effective integration of asset management strategies endorsed by APWA, FHWA and ISI into municipal maintenance, operation and planning efforts is the solution. Thousands of manhours have been saved through the use of nationwide best practices and utilization of available technologies. Integration of data collection, storage and application tools have enhanced consistency of inspections, estimating, prioritization and planning, while making quality control and data validation a systemic application throughout the process. Automation and reference database tools eliminate the primary source of errors – repeated data input. GIS applications, deterioration forecasting, logic-based triggering of "work actions" and consistent evaluation criteria provide faster, more accurate, decision matrices. Incorporation of ROI evaluations, risk assessments and financial strategies result in data-driven decision making. The 10-Year CIP Tool applies live data updated by on-going inspections and maintenance activities for a defensible, repeatable process. An annual bridge maintenance program implementing "planned activities" was initiated. Screening, ranking and prioritization was achieved. New maintenance details and specifications were created to simplify plan production and facilitate opportunities for economies of scale pertaining to bridge actions needed across multiple structures.

Results & Moving Forward: This program exemplifies the application of data-driven, value-based, innovative solutions to the overarching challenge facing all asset owners: How to maintain, preserve, and extend the functional/operational lives of aging infrastructure while confronting increasing financial competition for finite resources. Results have shown that integrating preventative care and maintenance activities into a planned life-cycle program does provide positive ROI, demonstrating that sustainable and practical strategies are not mutually exclusive. As one of the first applications of these asset management tools in the KC Metro Area and across Missouri, the success and expanding application of these strategies within KCMO will substantiate their effectiveness and encourage application across other communities.



Bartlett & West, Inc., Jefferson City

PROJECT TITLE:

Forum Boulevard and Green Meadows Roundabout: Increasing Safety and Capacity

CLIENT/OWNER:

City of Columbia, MO

The Forum Boulevard and Green Meadows Road intersection improvement project in Columbia focused on upgrading an existing stop-controlled intersection to better accommodate growing traffic in the southwestern portion of the city.

Forum Boulevard is a four-lane road, which is divided by a median starting just before its intersection with Green Meadows Road. The stop-controlled intersection at that location left long delays at peak traffic hours, fueled somewhat by the confusion caused by up to six vehicles being at stop bars at one time trying to determine who had the right-of-way to proceed first.

The Columbia Public Works Department determined that a partial two-lane roundabout would be a good solution to the traffic congestion problem and engaged Bartlett & West to help design the solution. During the initial design process, the public involvement showed that while commuters supported the plan, residents had concerns with the construction of a roundabout at this location. The City and Bartlett & West then began a lengthy public engagement effort that involved a conceptual study to review alternate intersection layouts such as signalized and urban J-turn options. These alternates were then taken to the public, as well as City Council and various pedestrian and bicycle groups, to review the impacts and benefits each could provide.

The final intersection improvement, a partial dual-lane roundabout, provides for the peak hour traffic volumes with minimal delay while also allowing for low-volume traffic hours to see a similar low delay as they previously had. Additionally, the roundabout allows for this route to be utilized as a detour route during subsequent construction projects in this portion of town by better allowing various through and turning movements without the need to change the lane assignments or signage.

Construction was delayed from the original timeframe, but was completed ahead of its need as a detour route for other projects. Additionally, the roundabout was always designed such that at least three of the four legs of the intersection remained open to two directional through traffic during construction with no shut down of traffic on Forum Boulevard.

Crawford, Murphy & Tilly, Inc., St. Louis

PROJECT TITLE:

Taxiway K Reconstruction

CLIENT/OWNER:

St. Louis Lambert International Airport



Engineers are constantly moving their profession forward by following best practices and building upon the good work of others. Yet there will always be times when an engineer is asked to accomplish something that has rarely been attempted before, if ever. Without standards and guidelines providing a framework for moving forward, the engineer must rely more fully on their ingenuity, along with their determination to fulfill the client's wishes.

This was the situation on the St. Louis Lambert Taxiway K Reconstruction project. When a taxiway requires full reconstruction, it is almost always the case that the pavement will be taken out of operation while construction is

completed. Because Taxiway K provides access to the airport's Air Cargo Apron, which serves FedEx, UPS and Amazon, the airport wanted to take every measure to avoid disrupting these high-traffic tenants, whose presence provides a significant economic benefit. Over one billion pounds of cargo passed through the facility in 2019, a figure expected to rise 15% this year.

As the airport's long-time consultant, CMT was asked to lead a team in developing a phasing plan that would allow the tenants' aircraft, some of the largest in the industry, to safely navigate the taxiway while it was being reconstructed. It is rare for an aviation consultant to be asked to accomplish a task for which the FAA has not issued guidelines and standards, but that was the challenge the project team faced.

The construction phasing on this project allowed passage of aircraft down one side of the taxiway while the other side was rebuilt. At any given time, there was an up to 3.75' drop off as close as 15' from the aircraft wheels while being tugged from the apron to the movement area of the airfield. Continuous barricades lining the work zone, along with temporary markings, temporary lights, and wing walkers, helped keep the tugs on track.

Because a full safety area could not be provided during construction, it was determined that the best alternative for providing safe passage for aircraft as they passed through the construction zone was the use of aircraft tugs, with wing walkers to guide them along the way. This required that operational staff be provided special training, as they typically only work on the apron. Safety and security issues and precautions were addressed as the workers would be asked to move from a non-movement area to a movement area, where different procedures and restrictions are in place.

Since aircraft tugs are not usually asked to leave the cargo apron, the project team also developed a series of temporary/bypass service roads so that the tugs could safely make their way back to the apron after pulling the aircraft through the construction zone.

In addition, the measures taken to keep the airport's tenants fully operational, the Taxiway K project features a unique drainage solution that CMT developed and refined on pavement projects at Lambert for over 20 years. Deliberate subsurface drainage design is based on the use of open-graded aggregates that provide improved drainage, resulting in longer pavement life. This innovative solution was recently accepted as an FAA standard.

Finally, it was critical that the project be completed before November, so that normal operations could be restored before the busy holiday season for the three tenants. Despite the many challenges at hand, the project was completed two weeks ahead of schedule and within budget.



HDR Engineering, Inc., Kansas City

PROJECT TITLE:

Route 47 Missouri River Bridge

CLIENT/OWNER:

Missouri Department of Transportation

The original Route 47 Bridge, completed in 1936, consisted of nine spans: (50') deck girder; (100') deck truss; (415'-475'-475'-415') cantilevered through-truss; (100') deck truss and (50')

deck girder totaling 2562' long. The structure spans the Missouri River and multiple Union Pacific Railroad tracks connecting Franklin and Warren Counties in Washington, MO. The roadway width on the bridge was limited at 22'-0".

The Missouri Department of Transportation hired HDR to investigate alternatives to replace the Route 47 Missouri River Bridge. Numerous structure types from steel plate girders, haunched plate girder, prestressed concrete NU girders, tied arch and through truss were considered. A mixture of prestressed concrete NU girder approaches and plate girder main span units was determined to be the most cost effective.

The new nine span structure is a 2,500-foot-long. HDR provided preliminary design, right-of-way, and final design services. The new bridge was constructed immediately upstream of the existing structure. The bridge accommodates 12-foot traffic lanes with 10-foot shoulders in each direction with a protected 10-foot-wide pedestrian/bicycle dual use path along the west side. The design included extensive hydraulic analyses due to the nature of the major river crossing. A two-dimensional hydraulic model was used to determine roadway overtopping discharges as well as scour analysis. The south end of the bridge was shortened through the use of an MSE wall abutment with foundation improvements to address sloping rock conditions.

Throughout the design process there was a strong apprehension in the community to losing the existing truss structure, which had served as an icon and a historic symbol for the region. The local communities put up \$800,000 of their own funds to stress the importance of the aesthetic enhancements. HDR worked closely with MoDOT and the local Bridge Enhancement Committee to educate the local community on the design process and develop the visual enhancements to include variable depth girders, structural shape of substructure elements, pedestrian railing and aesthetic lighting.

Through active participation in these meetings, the design team was able to alleviate the concerns of the committee members, these members then became advocates for the new design.

HDR's design effort extended into construction working with MoDOT construction staff to address contractor value engineering proposals, requests for information (RFIs), partnering meetings and construction submittal reviews. HDR is extremely proud of this one-of-a-kind structure over the Missouri River and feel that it deserving of the ACEC Award for Engineering Excellence.

HNTB Corporation, Kansas City

PROJECT TITLE:

U.S. 24 Bridge Over Delaware Street

CLIENT/OWNER:

Missouri Department of Transportation



In 2019, the 70-year-old U.S. 24 Bridge over Delaware St. that served as the entrance to the Truman Library and Museum was outdated and reaching the end of its usable life for the Missouri Department of Transportation (MoDOT) and City of Independence, Missouri. Since the library and museum was planning a renovation, they wanted to update the iconic entrance to a more appropriate presidential aesthetic. To coincide with the nearby renovations, the project required careful coordination with all stakeholders and was completed within a restricted timeframe. The final project cost \$2.7 million, \$400,000 below the estimated cost of \$3.1 million, and opened four days ahead of schedule on May 26, 2020.

The U.S. 24 bridge was the first of 27 Kansas City District bridges replaced as part of Missouri Gov. Parson's \$351 million Focus on Bridges program, which seeks to replace 250 bridges across the state. As such, the project team carried a great responsibility to ensure the project's success. Key to that success was achieving a quick consensus among project stakeholders, which included individuals from MoDOT, City Council, the Parks Department and Truman Library. The project goals – all of which were met – were to replace the existing structure economically, minimize traffic impacts along U.S. 24, and provide context-sensitive aesthetic enhancements while staying within the existing right-of-way footprint. In addition to those project goals, the stakeholders wanted the project to meet goals that would draw attention and additional visitors to the area.

Aesthetically, the resulting bridge complements the presidential and stately appeal of the library and museum. The City said it wanted artwork panels to have "drive-by" and "selfie" appeal to further its goal as a destination for national visitors. Additionally, this site provides a connection between Mill Creek Park to the north and McCoy Park to the south. Improvements to the street crossings using inlaid, high-contrast patterned pavement markings, adding a bicycle and pedestrian path, in addition to widening the existing sidewalks, improved the safety and experience of all non-motorized transportation users.

The complexities of the bridge replacement revolved around the project's budget and schedule. To keep the project within budget, the design team, led by HNTB Corporation, reduced the initial construction and long-term maintenance costs of the bridge by shortening the bridge to one span through use of lightweight fill so as not to compromise the integrity of the existing box culvert below ground. The design team was also tasked with gathering stakeholder input and achieving consensus in the first two months of design on the contextually sensitive aesthetic enhancements for the project, while simultaneously completing preliminary and final design in less than six months to coincide with the library renovations. To shorten the construction schedule, the team was required to over-excavate and replace soils at the west abutment due to conditions that otherwise would require extensive settlement wait times during construction. Eliminating the expected 3 inches of settlement took an anticipated 3 months off the construction schedule. In addition, the team utilized a thorough maintenance of traffic plan, minimizing traffic impacts to the site during construction. Due to the library's temporary closure, the team was able to close Delaware St. under U.S. 24 to traffic, allowing this main artery through Independence to continue to carry traffic down and back up the ramps while the bridge was removed and reconstructed.

The team's design achieved each of the project goals, as well as those set by the project stakeholders that aimed to support Independence as a destination and gateway, all while remaining within budget and schedule restraints. Residents and visitors to the area can enjoy the new aesthetic bridge and interchange for years to come.



HR Green, Inc., Chesterfield

PROJECT TITLE:

Route 109 Improvements Phase 2

CLIENT/OWNER:

City of Wildwood, MO

The City of Wildwood's Vision Statement states that its community is "about a quality of life based upon careful stewardship of the magnificent natural environment, and

ensuring that this legacy is passed on to future generations as a result of planned, responsible, sustainable growth through citizen and business partnerships that respect the natural qualities of the land." This vision is manifested in the characteristically rural two-lane roads and large-acre lots on the outskirts of the community, contrasted by a carefully planned town-square development with targeted commercial uses in the heart of the City. Missouri Route 109, the westernmost connector between Interstates I-44 and I-64, is generally seen as the north-south divide between the densely developed and the more rural areas.

The Route 109 Widening project is a continuation of previous work on the corridor where the City championed the vision, developed the funding strategies, and executed the design and construction of infrastructure improvements to improve safety, increase capacity, and reduce congestion on MoDOT routes. Mindful of their vision statement, the City has charted a course to reduce congestion in the community by adding capacity to handle increases in traffic demands, and improve safety and levels of service at intersections without negatively impacting the beauty of the natural surroundings which make the community so unique.

In 2015, the City completed the widening of Route 109 between Clayton Road and Route 100 from two to four lanes. The construction included roundabouts at Pond Grover Loop Road and the westbound Route 100 ramps, as well as two grade-separated pedestrian crossings. This project left the Route 109 bridge over Route 100 to carry one lane in each direction, with signal control on the eastbound ramp intersection. Recognizing a need to continue widening to the south and the desire to improve the safety and performance of the eastbound Route 100 ramp intersection, the City acquired a Cost Share funding package through MoDOT. This funding would widen Route 109 from the Route 100 bridge to just north of Old Manchester Road to four lanes and would construct two additional roundabouts along the corridor: one at the eastbound ramps, and one at Main Street, as well as the modification of the existing roundabout at the westbound ramps.

Around the same time, the City was looking for ways to connect their expanding trail network to the west, which meant crossing Route 109. Currently trail users could access the northeast, northwest, and southeast quadrants of the project through grade-separated facilities, but venturing into the southwest quadrant meant crossing Route 109 either at the eastbound Route 100 or the Old Manchester Road signals. Seizing an opportunity for Transportation Alternative Project Funding (TAP), the City acquired federal funding to construct a grade separated crossing of Route 109 near the Route 100 eastbound ramps intersection.

The final piece of the project came in 2016 when MoDOT programmed the rehabilitation of the existing Route 109 bridge over Route 100 and included it with this project. The bridge deck and approach slabs had reached the end of their service life, presenting the ideal opportunity to eliminate the expansion joints at each end of the bridge by converting the stub end bents to a semi-integral end bents. Additional rehabilitation effort would include substructure repairs, bearing replacements, and cleaning and recoating the steel superstructure.

The City of Wildwood, working in partnership with HR Green, was able to successfully implement their vision for the Route 109 Corridor using creative funding mechanisms, and overcoming several design challenges and other site-related obstacles along the way.

TranSystems, Kansas City

PROJECT TITLE:

I-35 / 152 Interchange Improvement Project

CLIENT/OWNER:

**Missouri Department of Transportation –
Kansas City District**



The I-35/152 Interchange is located in the northeast part of the Kansas City metro area in Liberty, Mo. The project includes the interchange at I-35 and Route 152, the intersection at Route 291 and Kansas Street and the section of Kansas Street

between these two locations, all of which are critical junctions for the City of Liberty. The cities of Liberty and Kansas City, Mo. have experienced significant development and growth in recent years. The Route 152/Kansas Street corridor has been directly affected by this growth, and has caused significant traffic congestion and safety concerns.

With traffic volumes on Route 152 at the interchange continuing to grow from around 30,000 in 2006 to nearly 50,000 in 2016, congestion as well as safety needed to be addressed sooner rather than later.

In response, the Missouri Department of Transportation (MoDOT) and the cities of Liberty and Kansas City, Mo., jointly funded the I-35/152 Interchange Improvements project. Due to this funding agreement, the project was broken into three parts and included the I-35 interchange, the Route 291 intersection on the east end, and the Route 152/Kansas Street corridor in the middle.

The work included improvements to the interchange at I-35/Route 152, including bridge replacement and ramp extensions, corridor improvements to Kansas Street from the interchange to Route 291 and intersection improvements to Route 291 and Kansas Street, as well as intersections for Connister, Blue Jay and Forrest. Additionally, a multiple-use path along the south side of Route 152 and Kansas Street extend across the I-35 bridge to address bicycle and pedestrian access along the corridor.

MoDOT selected TranSystems for both Phases 1 and 2 of the interchange improvement project which included traffic analysis and design of the corridor improvements as well as bridge replacement work, retaining walls, traffic signals, storm sewer, signing, pavement markings, street widening and adding turn lanes. The project also addressed bicycle and pedestrian needs along the corridor with the addition of a multiple-use path along the south side of Route 152 and Kansas Street and a five-foot-wide sidewalk along the north side, of which both extend across the I-35 bridge.

The completed project will accommodate future development, and most importantly, improve traffic safety. It also creates a safe, efficient, environmentally sound, and economical transportation facility that meets the growing needs of the area.



TREKK Design Group, LLC, Kansas City

PROJECT TITLE:

North Oak Trafficway Reconstruction

CLIENT/OWNER:

City of Kansas City, Missouri Public Works

The North Oak Trafficway corridor is a major north-south transportation link connecting more than 12,000 Kansas City residents to the Northland daily. This corridor serves as an economic engine for the City and the region, as well as a home to hundreds of businesses and several neighborhoods.

The project limits extend over 1 mile from 32nd Street at the south end to NE Evansdale Road on the north end. Within this segment of North Oak Trafficway, there are primarily businesses on the east side of the road, and parks and neighborhoods on the west side. The existing roadway was badly deteriorated due to poor subgrade conditions and lacked pedestrian or bicycle facilities to connect residents to nearby parks and amenities.

The proposed improvements to North Oak Trafficway included reconstruction of the existing four-lane facility and the addition of sidewalks, curb and gutter, shared use bicycle/pedestrian paths, bus stop pads, retaining walls, LED lighting, and two sections of water main replacement. This project is a critical link connecting businesses, residents, and other amenities with multi-modal access. The North Oak Trafficway Design-Build Reconstruction provided roadway and streetscape improvements, which will pave the way for future connectivity and prosperity along this vital corridor.

The City of Kansas City, Missouri selected the Radmacher Brother Excavating/TREKK Design Group (RBE/TREKK) team in 2018 after an in-depth procurement process to select the most qualified team to deliver this design-build project. They selected the RBE/TREKK team based on their qualifications, design approach and innovation, ability to maintain traffic during construction, aggressive completion schedule and overall cost. The team began design and construction work in late 2018. The design-build team collaborated closely to find creative and innovative solutions to the unique conditions on North Oak Trafficway and deliver a constructed project by late 2019—just over a year from selection.

The completed roadway includes four reconstructed lanes of traffic, added sidewalk and shared use path for pedestrians and bicyclists, upgraded transit stops, and new connections to the existing pedestrian network and area attractions. The team also optimized the design footprint by using retaining walls and offsetting the proposed centerline from its existing location. In addition, the enclosed stormwater drainage system along North Oak Trafficway was improved as a part of this project. Trees and lights were also included in the design to improve the corridor's streetscape.