A Massive Modernization Initiative

Foth Uses Digital Engineering to Deliver Innovative Infrastructure Project

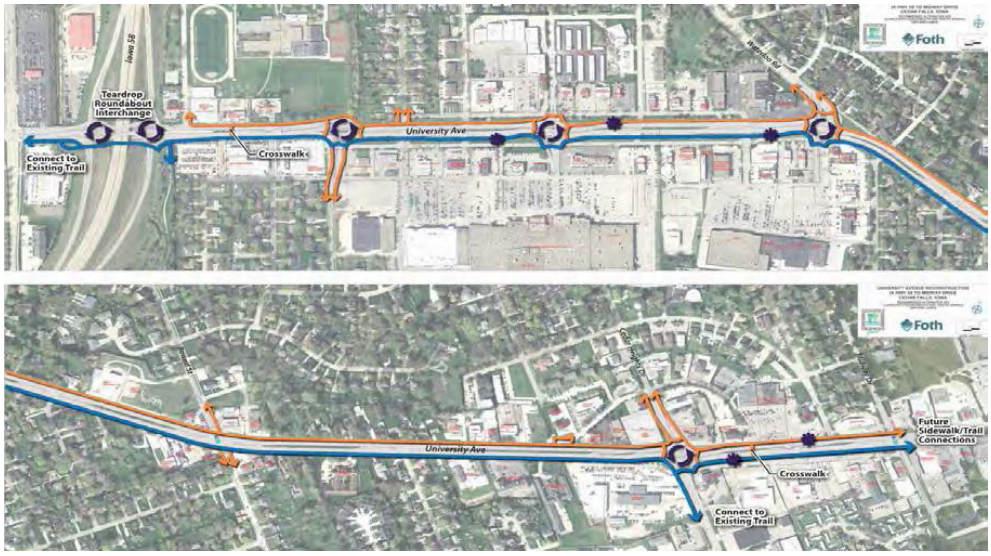
Located in the busy community of Cedar Falls, Iowa, University Avenue is a critical two-mile, six-lane divided highway that supports more than 20,000 vehicles per day. The 60-year-old corridor had deteriorating pavement and was experiencing a crash rate 20% higher than the state average. The thoroughfare lacked pedestrian and bicycle accommodations and had exceeded its expected lifespan. With increasing public pressure to improve roadway conditions, the city of Cedar Falls initiated a USD 38.9 million modernization initiative to transform and revitalize the corridor.

Foth was retained to develop a comprehensive transportation plan from preliminary engineering through final design and construction. They introduced innovative design elements, including roundabouts, a lane reduction, and a Complete Streets approach to accommodate multimodal travelers, all of which were met with strong public scrutiny.

"Our concept development and design processes had to be accurate, defendable, and stand up to public scrutiny," explained Aaron Moniza, senior client manager at Foth. Faced with intense public involvement and aggressive timelines, compounded by technical and engineering challenges, the organization required integrated digital applications to meet city and stakeholder demands.

Coordinated Digital Workflows

With 100 members in seven offices working together for over five years, it was important that Foth have the right communication and design applications. Working closely with the city, Foth set out to help it realize its goals using Bentley's open BIM and reality modeling applications. The



team used multiple data acquisition capabilities, including drone and mobile scanning for fast and accurate data collection. Bentley's civil, utility, and structural applications were used for traffic modeling, corridor simulations, utility coordination, and comparison of signaled intersections vs. roundabouts, which facilitated collaborative engineering processes. These processes enabled quick analysis of numerous design alternatives to determine an optimal roadway solution.

Collaboration and effective sharing of the models and engineering data were critical to meeting the aggressive schedule and developing a cost-effective design. Bentley's open applications streamlined workflows and facilitated coordinated design to meet these timelines. The integrated digital platform helped teams remotely manage data and bring consistency in document management and engineering processes, while also providing traceability for design change management to diagnose and remediate issues within hours instead of weeks. Access to project data and models onsite through mobile devices enabled field personnel to quickly answer questions and remotely develop solutions.

Maximizing Model Potential

Having a single 3D model improved the accuracy and efficiency of the design process, seamlessly integrating designers and consultants from a global network. The intelligent reference model facilitated virtual measurements and clash detection, including addressing more than 200 utility conflicts. The model helped the team coordinate with 11 public and private utilities to relocate underground and overhead infrastructure in advance of construction, including adjustments for more than 2 miles of major communication facilities. Using the 3D model helped align all parties to identify and visualize clashes while also reducing risk of delays during construction. Allowing contractors access to the 3D model, along with the high-quality construction documents, resulted in the winning bids coming in under original estimates.

Ultimately, the total construction costs were 3% below the contract bid amounts, saving the city more than USD 500,000. Finally, the 3D model also helped improve the construction phase. Foth established the 3D model as a digital twin, with data flowing to and from the model as field personnel identified and resolved potential issues onsite. Beyond construction, the engineering information contained in the digital twin will provide significant value to future operations and asset management as these digital assets can intelligently convey critical information for performance improvements to the city.

Integrated Applications Deliver Benefits

Saving time in the design phase dramatically reduced the overall project schedule, allowing Foth to meet construction and city schedules while delivering a high-quality project. Despite the aggressive schedule, construction started a full year earlier, with an estimated total return on investment of USD 650,000. The new design improved safety and reduced injury accidents by 89%, resulting in USD 1.9 million in savings and a decrease in travel time equivalent to more than USD 1 million in savings annually.

"We talked about the technology, but at the end of the day, it's about the people," stated Molly Long, lead civil engineer at Foth.

The transformative design incorporated sidewalks and bike lanes as well as benches and landscaping to achieve higher safety levels for drivers, bicyclists, and pedestrians. The new multimodal network will increase connectivity to employment and services, support workforce development, and contribute to community revitalization. Foth's safe and economical modern design delivered a return on investment estimated at USD 32 million to the public of Cedar Falls to be realized during the next 25 years. The improvements made to University Avenue have revitalized economic growth and transformed the community.

To learn more about the project, visit *www.bentley.com/en/goingdigital/foth*.