

TRANSFORMING TRAVEL

How a design-build approach has improved a vital roadway and the quality of life in Salt Lake County, Utah



Maintenance of traffic flow and rapid construction completion were important criteria for the project's success.

The Bangerter Highway is a major north-south artery that serves the rapidly expanding population of Utah's Salt Lake County and connects motorists with Salt Lake City International Airport. Although it carries about 60,000 vehicles daily, it is considered a "partial expressway" because of a number of at-grade, signalized intersections. In fact, the highway features six of Utah's 10 busiest intersections, including 5400 South, which handles nearly 54,000 vehicles daily. Traffic signals and heavy vehicular volume combine for bottlenecks that cost motorists time and money while impeding access to businesses in the Bangerter footprint.

In 2017, the Utah Department of Transportation (UDOT) sought to address these issues by replacing four of the most heavily trafficked signalized intersections — 7000 South, 9000 South, 11400 South and the busy 5400 South — with grade-separated interchanges. For this important project — Bangerter 4, as it became known — UDOT engaged a design-build team

that included Michael Baker International as designer and a joint venture of Ralph L. Wadsworth Construction Company and W.W. Clyde JV as primary contractor.

UDOT outlined several important criteria for the \$140 million project, including maintenance of traffic flow and rapid construction completion. While three of the intersections were planned for and took two construction seasons, major construction at the 7000 South intersection needed to be finalized before the start of the next holiday shopping season, a vital concern for venues such as the popular Jordan Landing Shopping Center.

Design-Build: A Growing Force in Highway Construction

Because of the complexity and compressed schedule for Bangerter 4, UDOT opted for a design-build approach, in which the owner/client contracts with the designer and contractor as a team rather than through separate agreements.

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— Marwan Farah, Project Director UDOT

With a more conventional design-bid-build mechanism, the designer must finish its work before the contractor can begin — even before the construction requests for proposals can be released. Notes Marwan Farah, UDOT's Bangerter Highway Project Director:

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Design-build is a growing force in the construction industry because of its consistent results. According to the Design-Build Institute of America (DBIA), design-build provides 36 percent faster construction than design-bid-build, 3.7 percent less cost growth, and faster delivery speed by a whopping 102 percent. DBIA projects that, by 2021, design-build will be utilized on 44 percent of all construction projects. For the period 2018-2021, design-build will account for \$1.2 trillion in spending.

Michael Baker and UDOT have been leaders in design-build, and UDOT has pioneered an innovation in the discipline, mandating that for initiatives as intricate and multifaceted as Bangerter 4, the designer, primary contractor and UDOT itself must colocate on-site. This arrangement provides many benefits.

"The most important thing is that you improve the line of communications," Farah says. "Whenever — and whatever kind of — issues arise, instead of exchanging phone calls or e-mails, we have the full team right there. For a project as complex as this, that was huge. Moreover, representatives from all the adjacent entities and municipalities were able to come over to our office on-site and have face-to-face interaction. Putting names and faces together was vital for this project. I do not know if you could put a price tag on the value."

Dayle Coburn, P.E., Transportation Design-Build Manager in Michael Baker's Salt Lake City office and Project Design Manager for Bangerter 4, notes that colocation of the three principals "helped us decide which pieces to prioritize so we could meet UDOT's schedule."

Accelerating the Ramps Package

One of the major objectives of the design-build team was maintaining existing Bangerter Highway traffic flow — three lanes in each direction — throughout the project.

"That was our biggest challenge," confirms Mike Arens, P.E., Office Executive for Michael Baker in Salt Lake City. "The big push was to improve the corridor without harming businesses or upsetting residents. That has been an overall theme of UDOT. They are really focused on serving the public during construction."

Rerouting 60,000 vehicles to the already overburdened cross streets was unthinkable. To solve the problem, the team first subdivided into four subunits — one for each interchange — that would work simultaneously. Then, each subunit accelerated design and construction of the new ramps, where main-line Bangerter Highway traffic would be rerouted.

"Once we got the ramps package together," Coburn says, "everything else kind of fell into place."

That strategy was so effective that the team was able to reduce full closures of the highway from a

projected 24 closures to just six, a major benefit for motorists and businesses.

Yet another challenge, this one just as sensitive, was developing a plan to design around the Jordan Aqueduct, which traverses three of the four interchanges. Owned by the United States Bureau of Reclamation (BOR) and operated by the Jordan Valley Water Conservancy District, the aqueduct features 78-inch pipe at two interchanges and 66-inch pipe at the other two. Because the aqueduct was constructed in the 1970s and lacks joint restraint, the team had to limit excessive vibration, loading and settlement along the BOR right-of-way during construction and thereafter.

Working as a unit from their colocated field headquarters, Michael Baker and the JV developed and implemented a plan that included coordination of more than 20 permits for encroachment in the easement, early permitting to facilitate rapid onset of rough grading, a custom foundation for sign and signal equipment in the easement, and innovative drainage systems to limit catch basins and pipe in the easement.

An issue nearly as complex was minimizing project impact at the 5400 South interchange, where a gravel pit that had been excavated just east of the highway stopped at an apartment complex at the bottom.

Here, the team lowered the ramp profile seven feet below the existing pavement and graded a slope from the easement line to the bottom of a wall bench to reduce the exposed wall height to 44 feet. Working with a subcontractor, RECo, the team developed the mechanically stabilized earth wall that, from leveling pad (embedment) to top of capping, measures 48 feet and uses a 53-foot-wide stabilized earth section.

The team also raised Bangerter Highway to pass over 5400 South, thereby grade-separating the interchange. The highway now rises 27 feet above the east ramp. From the back fence of the apartment complex to the top of Bangerter pavement, the elevation difference is 72 feet in height. These tall walls were required to provide the least impactful approach to businesses and residents at this location.



A major focus of the project was to improve the travel corridor without harming businesses or upsetting residents.

Based on the success of the project, UDOT has identified three more Bangarter Highway intersections to be converted.

As work at 7000 South neared completion, the team faced another challenge — maintaining access to Oquirrh Elementary School during reconstruction of the pedestrian overpass, which is adjacent to the highway. While much of the construction was accomplished during the summer, that left the period from late August through early November, when class would be in session. For those months, the team devised an innovative workaround: it coordinated with the school to hire four additional buses to safely transport Oquirrh students.

“We have had to come up with alternate ways of accommodating pedestrians on previous projects, but normally that has been covered by a dedicated crosswalk with an attendant. This was the first time we hired buses to move people around while the pedestrian bridge was out,” notes Arens.

We Have Improved the Quality of Life

By December 2018, construction was substantially completed, with only such tasks as landscaping

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— Mike Arens, Office Executive –
Salt Lake City, Michael Baker

and minor lane striping remaining. Bangarter 4 statistics are impressive, indeed, as the team worked nearly 290,000 man-hours, placed 16 miles of concrete safety barrier and 10 miles of drainage pipe, excavated or placed 2.2 million tons of dirt, and replaced a pedestrian span to enhance convenience and safety.

Moreover, by accomplishing the first phase of this in a single construction season, the team saved the holiday shopping season for local merchants, enabling them to enjoy a healthy Black Friday.



Michael Baker’s Bryan Mouser, P.E., (left), Director of Transportation; Logan Julander, P.E., Engineer – Bridge; Mike Arens, Office Executive – Salt Lake City; and Dayle Coburn, Transportation Design-Build Manager, collaborate on solutions.

Perhaps the most enduring benefit has been improving the traffic flow along Bangerter Highway. Farah estimates that the grade-separated interchanges are saving motorists approximately two minutes at each interchange.

"That is eight minutes of time savings," he says. "On the main line, 60,000 vehicles no longer have to stop for traffic lights. On the cross streets, cars do not have to wait for main-line traffic."

"Removing signalized intersections has tremendously improved safety; we have eliminated the potential for running a red light. We also have improved the environment, as 60,000 vehicles are not idling at every intersection. Motorists get home quicker and safer, and we have improved the quality of life."

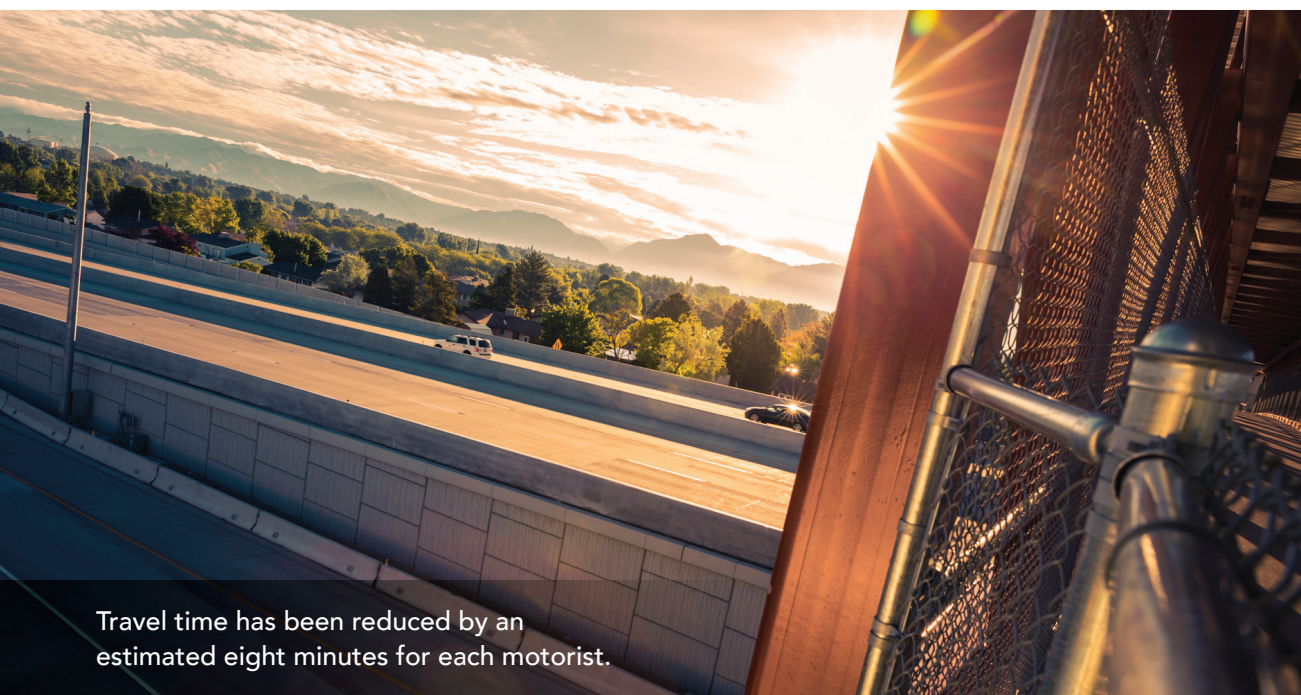
All this, in turn, has made the valley a more attractive site for business locations. Says Darren Burton, P.E., Michael Baker's Deputy Design Manager and Roadway Lead in Salt Lake City:

"More people are apt to travel now. We are starting to see more economic development around those interchanges."

Professional and civic organizations have recognized Bangerter 4 with a number of awards, including the following:

- Keep Utah Moving Award (2018 UDOT Conference Award for innovation and excellence in project delivery)
- Excellence in Paving, Best Urban Divided Highway Project Completed in the State of Utah in 2018 (American Concrete Pavement Association, Utah Chapter)
- 2018 *Utah Construction and Design Magazine* – Design-Build Project of the Year Award
- 2019 Utah Association of General Contractors (AGC) Highway Project of the Year.

The most significant tribute came from UDOT itself. Based on the successes of the project — and the design-build approach — UDOT has identified the conversion of three more Bangerter Highway interchanges, the next step in the transformation of the road to a full-fledged expressway. 🦋



Travel time has been reduced by an estimated eight minutes for each motorist.

The Bangerter 4 project has earned recognition from professional and civic organizations.

