

Work crews had to deal with challenging terrain in addition to the traffic.



ARIZONA Arizona's SR-68 Rural Design-Build Success

WORK ZONE INNOVATIONS KEEP TRAFFIC MOVING

Sitting in traffic delays can be distressing no matter where you live, but imagine being stuck in a construction-related traffic delay in the hot Arizona desert sun. When it came time to reconstruct 13.5 miles of highway in Arizona, the Arizona Department of Transportation (ADOT) knew they had to develop innovative ways to keep traffic moving while completing the construction on State Route 68 (SR-68) safely and efficiently. Thanks to creative thinking, motorists reported that construction delays were minimized and the project was a great success.

Located in northwest Arizona, SR-68 runs between Kingman and Bullhead City, Arizona, which is located directly across the Colorado River from Laughlin, Nevada. Even though SR-68 is a rural corridor, it serves as a major commuter route for Arizona residents who work at the many casinos in Laughlin. Trucks also comprise 10 percent of the vehicles on SR-68 and a large number of recreational vehicles use the corridor as well. The narrow, two-lane highway winds its way between the desert landscape and the Black Mountains with a 6 percent grade, steep curves and little opportunity for vehicles to pass safely. ADOT's construction decision was based on making SR-68 safer for the ever-increasing volume of traffic.

ADOT took a number of innovative steps during the project to enhance the Design-Build (D-B) process, make the road better and safer, address important environmental concerns, and minimize construction traffic delays. The project is now featured as a best practice by Highways for LIFE, a Federal Highway Administration Program that advances Long lasting highways using Innovative technologies and practices to accomplish Fast construction of Efficient and safe pavements and bridges.

Challenges in the Desert: SR-68

The \$42 million SR-68 project, the third of three D-B pilot projects initiated by ADOT, covers 13.5 miles. The project involved reconstructing the existing 2-lane highway to a 4-lane divided highway, 2 miles of which included new alignment. Also included were drainage work, rock work, and improvement of an existing truck escape ramp along with the addition of a second escape ramp.

Six structures at two locations were built, including two for Big Horn Sheep to cross underneath the highway.

This project had three sets of significant challenges. First were the challenges of completing a D-B project in a rural area. ADOT had completed two previous D-B projects, but both were located in metropolitan areas, much easier propositions. Next, innovative traffic control would be critical to minimizing delays in this rural area where the only possible alternative routes would take commuters nearly 100 miles out of their way. Finally, completing a D-B project in a location where the Bureau of Land Management (BLM) owned 60% of the land in the construction area presented the need for unprecedented agency coordination in order to adequately address environmental requirements and concerns.

Design-Build Challenges

The very nature of a D-B project requires the designers and contractors, in this case Parsons Transportation Company and CH2M Hill (designers) and Kiewit Western Company (prime contractor), to be located in close proximity so they can work simultaneously on the project. At the beginning of the SR-68 project, ADOT, the designers, and the contractor were located together in Phoenix, Arizona. Early in the process the plan was for the team to relocate to the rural project site. However, because there was no T-1 line available in the remote location and managing design data via dial-up would have meant hours of wasted time, a critical decision was made for the designers to remain in Phoenix.

Former ADOT Senior Resident Engineer Jennifer Livingston explains, “Weekly meetings were held during which the designers traveled to the construction site to spend as much time as was needed to address issues on site once construction was underway.” The arrangement worked well and the project progressed quickly and efficiently, despite the separation.

Keeping Motorists Moving

The second major challenge to the SR-68 project was the most challenging. SR-68 served as a major commuter route and with no alternative routes available ADOT was tasked to devise innovative and effective methods of keeping traffic delays to a minimum during construction. Innovations included a travel time system camera, Motorist Assist Patrols (MAPs), and other enhancements such as lane rentals, variable message signs, a highway conditions reporting system and an unprecedented public outreach and education campaign.

Travel Time System Camera

To measure travel time through the construction area, four cameras, mounted on construction signs to keep from distracting motorists, took photos of license plates at the beginning and end of the construction zone. The license plates were encrypted, then matched to determine the length of time it took to travel through the construction area.

The cameras caused controversy early when some motorists complained that the lights from the cameras were distracting. In response, the contractor redirected the lights. As construction continued and travel lanes moved, cameras were continually adjusted to maintain clear shots of the license plates. At one point in the project, a camera was stolen causing the cameras to be welded to construction signs as a security measure.

Privacy was also a concern. Some motorists were uncomfortable with cameras photographing their license plates. However, ADOT's public outreach and education campaign ensured commuters that the images were encrypted and only saved for 15-30 minutes at a time (or the time it took for the vehicle to pass through the construction area). In addition, motorists were reminded often that the purpose of the camera system was to keep them moving. As public understanding increased and traffic kept moving, they were more than happy to let the cameras do their job.

ADOT added a provision to the contract which directed that during construction, travel time for motorists would not exceed 27 minutes. This included a \$400,000 travel-time incentive budget, which was reduced every time the travel-time goals were exceeded. The contractor was responsible for measuring travel times which were taken 24 hours a day, 7 days a week and were averaged over 10 minute periods. If three consecutive 10 minute periods exceeded the goal, the contractor was charged per minute per lane. At the end of the project, any funds left over were to be paid to the contractor. If the contractor depleted the entire \$400,000 budget, the contractor was responsible for paying for the additional time-travel delay. Prior to construction, ADOT determined that it took motorists 17 minutes on average to travel through the area. Once construction began, traffic control measures and reduced speed limits increased this time to 21 minutes. In the end, Kiewit Western Company earned 94 percent of the incentive.

Motorist Assist Patrol (MAP)

Because of extreme heat and the high usage of the construction route, breakdowns were common and the MAP was put into place to help stranded motorists, when needed. Each vehicle was equipped with traffic control devices, water, gasoline, flares, jacks and lighted arrow signs. Because they sometimes encountered drivers acting suspiciously, the contractor, who operated MAP during the off-peak hours of 4:00 p.m. - 6:00 a.m. and around the clock on weekends, hired a private security agency to furnish the MAP drivers. MAP drivers also dressed in typical construction-type clothing in an attempt to put drivers at ease.

MAP drivers assisted 963 stranded motorists during the course of the project with 68 percent able to get back on the road with the assistance of the MAP driver alone. Each stranded motorist was given a satisfaction survey. Motorists reported an average wait time of 14 minutes for help and rated their satisfaction with the MAP program a 4.8 on a scale of 1-5. The MAP program was such a success it has now been used on other projects in Arizona.

Other Work Zone Enhancement Innovations

ADOT utilized additional work zone enhancements to keep traffic moving during the SR-68 project. Lane rentals, variable message signs, a Highway Conditions Reporting System (HCRS) and a significant public outreach campaign were all effective in keeping traffic moving.

The lane rental program was an especially efficient tool. The SR-68 contract included a \$1 million incentive that directed the contractor be charged against the incentive if any lane was closed for more than 5 minutes. The amount charged varied depending on the time of day with peak hours significantly higher than off-peak.

FHWA Transportation Engineer Alan Hansen explains the lane rental this way,

“Lane rentals changed the way the contractor worked. He was motivated to stage his work so he wasn’t creating unnecessary delays. The contractor planned ahead and pre-positioned equipment based on how much money he would be charged for closing the lane. The lane rental program encouraged the contractor to operate during off-peak hours whenever possible.” In the end, the Kiewit Western Company earned nearly half of the \$1 million lane rental incentive.

Variable Message Signs (VMS) were used throughout the area to keep motorists up-to-date on traffic information along the construction route. They were also an immediate and accurate means of providing drivers with options as they approached the work zone.

The HCRS was another communication tool used to provide motorists with information on the construction zone. This webpage allowed motorists to access accurate and timely information on roadway conditions throughout the State. It was updated daily and included information such as the status of construction projects, weather and even upcoming events that could affect traffic patterns. The system was particularly effective in passing information from the SR-68 project, especially during blasting operations.

An extensive public information campaign was conducted by ADOT to keep motorists on top of what was happening along SR-68 during construction. Efforts included a project web page; a hotline where commuters could get latest information and construction alerts; a speaker’s bureau where project officials discussed the project and addressed questions or concerns; and brochures and newsletters.

BLM Environmental Concerns: Unprecedented Teamwork

The third set of significant challenges was wrapped around the need for unprecedented agency coordination in order to adequately address environmental requirements and concerns of BLM. In fact, at one point in the planning for the SR-68 project, ADOT questioned whether attempting a D-B process would be feasible in this rural desert setting because of the significant coordination that would be required.

The mission of BLM is to protect the natural resources of the land areas it manages and in the SR-68 project, BLM owned more than 60 percent of the land. This meant that BLM would need to be deeply involved with every aspect of design and construction to ensure environmental concerns were met, concerns which included the safety of Big Horn Sheep, the protection of cacti and other plants native to the area, and maintaining the natural look of the environment after construction was completed. In a fast moving project, delays in coordination could escalate costs and delay completion. So, in an attempt to ensure all concerns were addressed throughout the D-B process, BLM assigned a full-time liaison to the SR-68 project, a move that proved critical to success.

As part of the project, two wildlife crossings for Big Horn Sheep were constructed, allowing sheep to pass safely below the highway while motorists remained safe on the highway above. Locations for the crossings were chosen by studying data compiled by the Arizona Game and Fish Department, BLM, and ADOT. The team studied known travel patterns of the sheep and also examined “kill data” to determine where there was a concentration of accidents involving sheep. The resulting two crossings allow sheep and motorists to co-exist in harmony.

During reconstruction of the highway, one and one half million cubic yards of excavation took place. Normally, any plants included in that excavation would have been lost, but BLM worked with the team to find a way to save cacti and other plants native to the area. In fact, more than 8,000 cacti and plants were relocated to a local nursery and replanted after construction to maintain the local habitat. ADOT used GPS to determine the location and orientation of the cacti so when they were returned, they could be replanted correctly. The careful, detailed inventory of the cacti and plants kept the mortality rate within an acceptable range.

Finally, nearly one million cubic yards of rock were excavated by blasting during the SR-68 project. To restore the natural look of the area afterwards, the team used a spray stain on the blasted slopes. Photographs taken prior to the excavation were used in an attempt to replace rocks and boulders in strategic locations. They were also used to recreate the density of the area to make the excavation cuts look as if they had been present for a long time.

In the end, the challenges to the D-B process in a rural environment on publicly owned land were met with resounding success. In fact, FHWA Area Engineer Tom Deitering estimates that thanks to the D-B process, “a project which would have taken four to five years to complete was finished in just 2.5 years.” Not only did this save time for motorists and the construction team, it also saved precious highway dollars.

Lessons Learned

In the end, the SR-68 reconstruction project was completed in nearly half the time it would have taken if a Design-Bid-Build contract had been used. More importantly, traffic delays were kept to a minimum thanks to work zone enhancements that focused on keeping drivers moving.

When the terrorist attacks of September 11, 2001 occurred, authorities closed US-93, which crosses the Hoover Dam, to truck traffic, redirecting them through the SR-68 work zone. Thanks to the innovative work zone enhancements, the area was able to handle the extra traffic through the work zone efficiently.

Including BLM in the D-B process was valuable and essential given that BLM had specific environmental concerns that needed to be addressed. Team members learned that this enhanced the D-B process and would have no hesitation in using the same model to work closely with a third party on environmental concerns in future projects. Deitering explained, “Close coordination on the SR-68 project earned trust with the Bureau of Land Management. This working relationship benefited future ADOT projects on other highways crossing BLM lands.”

While the travel time system camera was an effective means of keeping traffic moving on this particular project, it might not be effective in every setting. One of the things that made it work so well on the SR-68 project was the fact that once motorists entered the work zone, there was nowhere else to go except through the work zone. Hansen explains, “If the system were used in an area where motorists could get on and off at various points, it would not be an effective means of measuring travel time.”

Another lesson learned with regard to the travel time system camera was that travel intervals should not be longer than the average travel time through the construction area. The SR-68 project allowed for the averaging of 30-minute intervals. Livingston explains that “Ten-minute intervals would allow a more realistic and accurate calculation of travel time through a project location and

the impacts that construction could have on travel time. For example, if the contractor saw in the first 10-minute interval that traffic was being delayed, he or she would have 20-minutes to make up for that delay. Tighter intervals would have forced the contractor to plan even better.”

Contractual incentives were also an effective means of keeping traffic moving and lanes open. By placing the burden of responsibility on the contractor and using contractual incentives, the contractor was motivated to plan work well ahead of time in an effort to keep lanes open and traffic moving. Equipment was moved into place ahead of time, blasting and other work that would require a traffic stoppage was planned for off-peak hours and crews were constantly aware of how long it was taking motorists to travel through the work-zone area thanks to the travel time system camera which was monitored at the construction site. Adjustments were made immediately and in the end, everyone was pleased with the outcome. Motorists were able to keep moving and the contractor was able to earn a large majority of the incentive.

Finally, ADOT learned that by conducting an extensive public outreach and education campaign, they were able to constantly keep in touch with customers. By letting constituents know they were looking for ways to keep delays to a minimum, they also won the public trust and support.

Conclusion

The SR-68 project challenged ADOT to complete its first rural D-B project while working closely with a third party, the Bureau of Land Management. The team addressed significant environmental concerns, served customers by keeping them informed, kept traffic moving through the work zone through a number of innovative methods, and successfully completed a highway that is better, safer, and longer lasting. It achieved these many successes under the most difficult circumstances, making a significant difference in the lives of travelers on SR-68.