2016 AGC ACE Awards

Category 5: Best Building Project – Specialty Contractor (\$2-\$6 Million)
Specialty Contractor: Sturgeon Electric Company, Inc.
Project Name: Eisenhower/Johnson Memorial Tunnels - Fixed Fire Suppression System

Colorado is home to the Eisenhower/Johnson Memorial Tunnels (EJMT), the highest vehicle tunnel system in the world at more than 11,000 feet. Accommodating over 12 million commuters annually, the twin tunnels are the primary arteries connecting the heart of Colorado to the west, and bear historical social and economic significance to the United States. Considered an engineering marvel upon completion in the late 1970's, the tunnels catalyzed the biggest boom in mountain towns since Colorado's gold rush, allowing formerly meager towns such as Breckenridge to flourish rather than fade away, as was the fate of many former mining towns.

Nearly 40 years after their construction revolutionized transportation across the Continental Divide, a 2012 study by the Colorado Department of Transportation (CDOT) revealed that the tunnels were in perilous condition - potentially one catastrophic fire away from inflicting billions of dollars of economic damage to Colorado and neighboring western states. Regarding such condition as a looming threat to public safety and regional economic health, CDOT sought to follow the example of new tunnel firefighting innovations fostered in Europe, Japan, and Australia, where highly flexible suppression systems are engineered to combat different types of fires while protecting the traveling public. In this quest, CDOT found themselves at the helm of implementing the most complex and innovative tunnel fire mitigation project America had ever seen: the EJMT Fixed Fire Suppression System project.

The **first of its kind** in the United States, this project was closely observed through the eyes of tunnel and transportation authorities and engineering firms across the world. Colorado Congressman Jared Polis recognized the paramount significance of this project:

"I-70 is an essential economic artery for Eagle and Summit County, Colorado and the region, and the Eisenhower tunnel is critical to its safe operation. If this tunnel were to be shuttered by a catastrophic fire it would cost untold damage to jobs and businesses.

With this much on the line, and the cost of a fire so high, a fire suppression system is a smart investment in our transportation infrastructure and our economy."

Spanning nearly two miles across the Continental Divide, EJMT requires an operations team of more than 50 full-time employees dedicated to a wide range of responsibilities, including tunnel and ventilation maintenance, snow removal, equipment service, end-to-end camera video surveillance, and emergency fire/medical response. The addition of the Fixed Fire Suppression System provided significant improvements for the surveillance and emergency response teams, roles which had largely remained unchanged for forty years. Despite the high-tech nature of the system, the operability of the impressive new response mechanisms and support features is straightforward and simple to use:

- A Fiber-Optic Linear Heat Detection system spans the length of each tunnel. Detecting a fire within accuracy of five feet, the system notifies the operations team, who can rapidly trigger rescue teams and apply suppression immediately.
- A water-only deluge system which is capable of suppressing a large fire within the first two minutes of the event.
- A new drainage system accommodates the deluge discharge of 500 gallons of water per minute.
- A 350kW emergency generator added to the west entrance for backup support of critical systems.

CDOT brought on Barnard Construction Company, Inc. to manage the project, who then awarded the \$2.2 Million electrical contract to Sturgeon Electric. The electrical scope of work on the project included power and control for the Fixed Fire Suppression System's detection, notification, and CCTV system, mechanical systems power and control, and new 350kW generator.

Solutions of Special Projects:

The remote and high elevation location, consistent adverse weather and concerns about economic impact to tourism along I-70 as a result of closures posed constant challenges to CDOT and the project team. In addition, the project's original estimate of 24 months duration was narrowed to 15 months (nearly 63% faster). In response to these challenges, CDOT, Barnard Construction, Sturgeon Electric and all trade partners worked together to form a truly integrated, cohesive and motivated team, aligned to common goals. This successful working relationship helped prevent disputes and improved effectiveness of weekly coordination meetings/collaboration. It was also the catalyst that led to the development of the following solutions that were instrumental in negating the project's unique challenges:

- Installed the majority of the new system in existing overhead plenum space, granting flexibility to perform work with minimal disruption to traffic.
- Concurrent Electrical and Mechanical activities in plenum spaces allowed multiple trades to share conduit and equipment support structures, saving time and material.
- Surface installations exposed to traffic were performed at night. East and west traffic was re-routed through one tunnel while the other remained closed. Both tunnels opened up as morning traffic increased.
- Centered on the Continental Divide, average yearly snowfall exceeds 26 feet. To battle accessibility issues caused by adverse weather, CDOT and the project team worked together to improve materials management and staging. Sturgeon Electric executed a bulk purchase of all necessary conduit and wire at the beginning of the project, relieving materials procurement issues.
- Structural limitations prevented material staging in the plenum above; crews had to bring in and take out all of their material and equipment daily. As a resolution, Sturgeon Electric's in-house fabrication shop developed custom dual-ended material carts which were instrumental in maximizing efficiency.

Excellence in Project Execution and Management/Team Approach:

Sturgeon Electric faced a major challenge with installing each of the fiber cables at the peak of each tunnel - the cables could not be spliced, and daytime material staging was prohibited. This meant Sturgeon Electric would have to install each two-mile cable within an 8-hour closure. In addition, the weight of new equipment was cause for concern due to structural restrictions. Sturgeon Electric rose to both challenges:

- Multiple scissor-lifts were affixed to a 50-foot trailer, allowing crews of eight to install the cable and support tray at whirlwind speeds; the teams were able to execute this fourmile installation in both tunnels within a single work shift!
- Used Intermediate Metal Conduit (IMC) in lieu of Galvanized Rigid Conduit (GRC) traditional to such Industrial applications. Use of IMC simultaneously provided structural weight relief and cost savings.

Construction Innovations/State-of-the-Art Advancement:

The Fiber-Optic Linear Heat Detection system can detect a fire with high accuracy, which provides unprecedented readiness improvements to the tunnels' first-responders team:

- > Notification instantly provides accurate locations and data regarding the fire's intensity.
- Triggers high-resolution cameras so that EMJT onsite staff can view, assess, and make informed decisions when responding to a fire event.
- Operators in the control room can trigger fire suppression via the water deluge system at the exact location of the fire, buying precious time for first-responders, or potentially extinguishing the fire altogether.
- A system capable of providing water for 60 minutes with two deluge sprinkler zones as well as 500 gallons per minute from the existing standpipe system.

Environmental and Safety:

Executing work safely within the tunnels required a commitment to disciplined planning and communication for Sturgeon Electric's crews. Working at elevations of over 11,000 feet, facing extreme weather conditions, and mitigating traffic concerns within the tunnels (speeding vehicles, exhaust fumes, traffic control) were a daily concern. In addition, the plenums are void of natural light, and temperature often lingered at near-freezing, in extreme cases with a windchill of -20 degrees. Crews would regularly trek over a mile within the plenum just to get to their work site. Despite all of this, Sturgeon completed the project ahead of schedule with zero injuries.

Excellence in Client Service and/or Contribution to Community:

Previous to the Fixed Fire Suppression system, average emergency response times were 8-10 minutes, and the nearest fire stations were more than 15 minutes away. As a result, an average vehicle fire was often unable to be kept from becoming unstoppable and often caused serious structural damage inside the tunnel. With the cost of replacing each bore of the tunnel estimated at approximately \$1.5 billion, the \$20 million price-tag of the new system was considered a bargain.

Most Importantly, the EJMT Fixed Fire Suppression system improves life safety and protects an essential transportation asset that connects Colorado's Front Range with the Western Slope, while facilitating commerce.

Colorado Governor John Hickenlooper said of the project, "The fire suppression system will help protect the traveling public as well as this critical asset to our highway system....closure or long-term damage to one of these tunnels could cost Colorado billions of dollars and impact tourism along the I-70 mountain corridor."

Sturgeon Electric is proud to have partaken in this project with CDOT, Barnard Construction, and other trade partners to safely and successfully deliver one of Colorado's most noteworthy construction achievements in 2015. As such, we contest that the story and significance of it bear worthiness of Colorado AGC's award for *"Best Building Project - Subcontractor, \$2-\$6 Million"*.



















