High Over Hoover Dam

Rising 880 ft above the Colorado River, the majestic Hoover Dam Bypass poses formidable challenges to bridge inspectors. And that is why the rope access technicians who performed a thorough inspection of the bridge in January are invaluable.

By Ryan Nataluk, P.E.

THE MIKE O’CALLAGHAN–PAT TILLMAN Memorial Bridge, often referred to as the Hoover Dam Bypass, is a very large, complex, and strategically important structure that carries U.S. Route 93 between Nevada and Arizona over the Colorado River. (See “Engineering’s Newest Marvel,” by Dave Zanetell, P.E., M.ASCE, David Goodyear, P.E., S.E., PF.Ng, M.ASCE, Jeff St. John, P.E., M.ASCE, Brian Lomax, and Danny Sullivan, Civil Engineering, October 2011, pages 56–65, 86–87.) I can vividly remember the awe and inspiration I felt the first time I viewed this structure. I was at the Hoover Dam observation area, and it was shortly after Stantec had been selected by the Nevada Department of Transportation (NDOT) to perform statewide inspections that would include this marvel. While looking at the bridge with a dropped jaw that day, I thought about my bridge inspection career and realized that this is why we specialize in condition assessments—so that you’re safe that it can take a while to stop long enough to absorb the exposure of it all. It’s not often you get to hang devoid of contact with any structure while looking down on the Hoover Dam.

As Nicholas Cioffredi, P.E., a senior bridge inspection engineer for Stantec, notes, “You’re so focused on the task at hand, inspecting this engineering marvel, doing your job, and making sure that you’re safe that it can take a while to stop long enough to absorb the exposure of it all. It’s not often you get to hang devoid of contact with any structure while looking down on the Hoover Dam.”

downstream of Hoover Dam, this structure is eloquently anchored into the sheer rock faces of the historic Black Canyon. The main segment of the bridge, which is a twin-rib concrete arch and steel composite structure, spans approximately 1,060 ft from wall to wall. Over the course of two weeks in the middle of January 2013, three professional engineers and three engineers in training—all professional rope access technicians—from Stantec rappelled, climbed, ascended, traversed, and crawled over, under, inside, and around every inch of this structure to thoroughly document the bridge’s structural condition.

The National Bridge Inspection Standards were established in 1968 by Congress following the tragic collapse on December 15, 1967, of the Silver Bridge, which connected Point Pleasant, West Virginia, with Gallipolis, Ohio. Since then every bridge structure, whether of the size of the Golden Gate Bridge or as small as a 20 ft clear span culvert in a rural locale, must be inspected at intervals not to exceed 24 months unless the Federal Highway Administration rules otherwise. The Hoover Dam Bypass is considered one of the newest national monuments (al-
The personnel and engineering teams who inspect and evaluate our nation’s infrastructure are very specialized civil and structural engineers and technicians who sometimes receive little recognition for the important tasks they perform.

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als work is very handy to utilize in the inspection of truss bridges, arches, and other structures that require both vertical and horizontal movement to complete the job.

One full rebelay between spanned columns took upward of four hours. Therefore, once an inspector left the deck of the bridge, he was going to be “on rope” for quite a while. A Klein support of four hours, and this was my greatest concern for the team. The temperature can rise, the wind can pick up, a thunderstorm can roll through, or a person can overexert himself. Each team member had to be prepared for just about anything, including carrying all of the water and food required. Escape and rescue plans needed to be ready for execution at any moment. I am glad to report that there was not even one incident on this project, and the team performed flawlessly over the two-week inspection.

No project can proceed and end smoothly without the teamwork and trust among all members and stakeholders. Each project requires the collaborative, dedicated effort of several agencies and teams. This project benefited from exceptional commitment from the NDOT and their partners and stakeholders. The team worked well together, and the inspection was successful. I am glad to report that there was not even one single incident on this project, and the team performed flawlessly over the two-week inspection.

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We were fortunate to have inspected and evaluated some of the largest and most iconic bridges in America. Our team, composed of professional engineers and engineers in training, has evaluated structures ranging from the Great Wall of China to the Hoover Dam. Our collective experience allows us to evaluate and maintain inventories in the country. Additionally, public safety and preserve Nevada’s state’s past and the Galena Creek Bridge, which requires more advanced knowledge and inspection methods ranging from New York City’s George Washington, Queensboro, and Brooklyn bridges to smaller timber bridges in rural locales. This was my first opportunity to inspect the Mike O’Callaghan–Pat Tillman Memorial Bridge, which is the team that inspected the structure that replaced the Silver Bridge. Our collective experience gives us insight into several key areas of bridge inspection, including perspectives on the nation’s structural history and future through our detailed involvement in design, fatigue, retrofit, and failure. This, combined with our experience in evaluation, access planning, and assessment of material defects and properties, qualified our team for this momentous inspection. Just as important, all members of our team of engineers and technicians held certifications in specialized access and inspection methods ranging from rope access to underwater diving to nondestructive testing.

Frank Block’s account:

The opportunity to inspect the Mike O’Callaghan–Pat Tillman Memorial Bridge was a once-in-a-lifetime experience (although I’m hopeful for a return trip in 2013). I can remember first hearing that we were awarded the contract for statewide bridge inspections. I was very interested in travelling around a state in which I had spent little time. I then came to realize the scope of the project and that our inspections would include the recently completed Mike O’Callaghan Bypass structure. My interest quickly turned into a mild obsession. I began to pore over Internet photographs and articles on the bridge while thoroughly conveying my interest in this inspection to the decision makers assembling the inspection team. It is not only the most iconic and nationally recognized structure since the Golden Gate Bridge, but it is also composed of professional engineers and technicians who hold certifications in specialized access requirements. As the team member in charge of planning the rope allocations and inspection sequencing, this was my primary concern. I was also a little apprehensive about performing a complete interior inspection of the bridge and the Hoover Dam spread out before me. This, coupled with the adrenaline from the incredible height at which I was suspended and with the unsettling, somewhat frightening sensations of the hydraulic platform, made for a nervously euphoric experience. The best was far by each other and the UBIV bucket and rode out over the bridge rail of this iconic structure, I couldn’t help but be overcome by a state of pure wonderment at the beauty and grandeur of the Black Canyon and the Hoover Dam spread out before me. This, coupled with the adrenaline from the incredible height at which I was suspended and with the unsettling, somewhat frightening sensations of the hydraulic platform, made for a nervously euphoric experience. The best was far by each other and the UBIV bucket and rode out over the bridge rail of this iconic structure, I couldn’t help but be overcome by a state of pure wonderment at the beauty and grandeur of the Black Canyon and the Hoover Dam spread out before me. This, coupled with the adrenaline from the incredible height at which I was suspended and with the unsettling, somewhat frightening sensations of the hydraulic platform, made for a nervously euphoric experience.

Frank Block, P.E., A.M.ASCE, is a project engineer for Stantec Consulting in Denver.
were injury crashes, and 69 percent were property damage-only crashes.” If you compare these statistics with the 0.0 percent of fatalities connected and associated with the use of technical rope access work, you can clearly deduce that rope access work is very safe. That safety is also enjoyed by the traveling public. Not only is our work keeping the structures safe for travel, but rope access also enables us to work unnoticed. More often than not, motorists do not see us and therefore are not distracted by us.

In addition to safety, rope access provides an economical way for owners to evaluate such assets as bridges, buildings, dams, tanks, and towers. In most situations there is no need for the costly endeavor of shutting down traffic lanes for a full-blown traffic control setup. Additionally, there is little need for expensive mechanical equipment and specialized staff to lift or suspend the engineers or workers. A growing proportion of the rope access technicians in the United States and Canada—whether they perform inspections, maintenance, window washing, or other vertical work—are members of and certified by the Society of Professional Rope Access Technicians. The organization’s mission, according to its website, is to “advance the safe use of rope access through education, developing standards, and administering certifications.” Stantec has nearly 20 professional engineers and engineers in

NICHOLAS CIOFFREDI’S ACCOUNT:

The anchors were set. We tugged and pulled our anchor slings every which way from the safety of the underbridge inspection vehicle bucket and then checked to make sure there was no chance of movement. There wasn’t. Still, I’d be lying if I said there wasn’t a moment of relief that first time the bucket dropped out from underneath me and I was floating, the Colorado River 880 ft below.

The first time I was “on rope” on this structure I was out for four hours. And once you’re on rope, you’re on rope. Nobody’s going to come get you. Nobody’s going to come and hang out.

On Hoover, we were actually on four ropes most of the time. You have to have ropes attached to both ends of the span so you can maneuver along the bridge length. You pull on one and release the other so you can position yourself where you want. It takes a little bit of acrobatics, I guess.

It might have been the morning of the third day on rope before I stopped and turned around to face the chasm below and realized where I was. Everything was very slow and surreal for a moment. I couldn’t help thinking, “What an amazing privilege!” That’s when I realized that our job has its perks.

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We always say, “There’s no glory in bridge inspection,” but Hoover was a glory job.

Nicholas Cioffredi, P.E., is a structural engineer and senior inspector for Stantec Consulting in Denver.
sections transfer stress uniformly, allowing for less bending, twisting, or elongation of an element. These conditions must be understood by modern designers and builders alike. Smooth, rounded details transfer stress uniformly, allowing for less concentration of stress.

Concrete members of our rope access team were initially concerned about the required mechanical equipment. The inspection would have to be performed by two separate dual-rope systems. The arch ribs of the bridge are hollow and had to be inspected from the interior for indications of internal defects. Once inside, inspectors required a set of 700 ft long ropes to descend and ascend the steep interiors of the arches. Confined-space rope access requires another air inside the arch ribs requires continuous monitoring via four gas-air monitors. Each inspector is equipped with a monitor, and the readings are radiated to the control room via radio frequency intervals.

When using rope access, one of the most important aspects of the plan is to know how much rope will be needed. You need the required length of rope below you as you descend through the inspection; otherwise, it would be like trying to rig a tent on a quarter of a tank of fuel. You simply won’t make the full journey. There aren’t going to be any rope stations along the way. Again, careful study of the bridge plans was necessary to complete the detailed approach.

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