

## **Final Report**

# **Dedication Ceremony for the Kaibab Trail Suspension Bridge as a National Historic Civil Engineering Landmark**

**February 23, 2019**



**Prepared by: Jonathan Upchurch, P.E., PTOE, F. ASCE**

**December, 2019**

**Submitted by Arizona Section, ASCE**

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

**This report documents the dedication ceremony held on February 23, 2019.**

### **Date and Location of Ceremony:**

February 23, 2019

Adjacent to Yavapai Geology Museum, South Rim, Grand Canyon National Park

### **Names of attending dignitaries:**

Robin Kemper – President, ASCE

Lisa Carrico – Deputy Superintendent, Grand Canyon National Park

Dave Mortenson, President, Grand Canyon Historical Society

Jonathan Upchurch – Master of Ceremonies, Corresponding Member of ASCE History and Heritage Committee

Fred Nelson - ASCE Region 8 Governor

Larry Magura - ASCE Region 8 Governor

Brent Borchers - ASCE Region 8 Governor

Ted Smithwick - ASCE AZ Section President

Breanna Connolly - ASCE AZ Section President Elect

Gary Miller - ASCE AZ Section Vice President

Jeff Swan - ASCE AZ Section Secretary

Mark Lamer - ASCE AZ Section Past Past President

Fausto Burruel - ASCE AZ Section Past President

Julian Dresang - ASCE AZ Section History and Heritage Chair

Karl Rockwell - ASCE AZ Section Treasurer

Ryan Mahar - ASCE Northern AZ Branch Vice President

### **Other ASCE members attending**

Yugantha Yasanayake, Craig Schellbach

### **Other Guests**

Angela Borchers, Sarah Somers, Betty Upchurch

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### Approximate number of attendees:

Two events were held on February 23 and both events were attended by the list of dignitaries above. As a part of the Fifth Grand Canyon History Symposium, a 45 minute presentation entitled “Kaibab Trail Suspension Bridge: A National Historic Civil Engineering Landmark” was given at 1:30 p.m. at the Shrine of the Ages. The presentation was given by Jonathan Upchurch.

The Landmark plaque unveiling and Dedication Ceremony was held at 3:00 p.m. on the rim of the Grand Canyon, adjacent to the Yavapai Geology Museum.

170 attendees at 1:30 p.m. presentation

50 attendees at 3:00 p.m. dedication ceremony



Left to right: Dave Swan, Jonathan Upchurch, Ryan Mahar, Larry Magura, Kayla Fleishman, Gary Miller, Fred Nelson (kneeling), Robin Kemper, Ted Smithwick, Mark Lamer, Brent Borchers, Fausto Burruel (kneeling in red), Julian Dresang

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### **Press releases:**

Two media advisories were prepared by ASCE Media Relations staff (in Washington, DC) to promote advance media interest in the event. One was issued on February 19 and a follow up was issued on February 22. A copy of the February 22 media advisory is included on pages 8-9.

ASCE Media Relations staff issued a news release on February 23, in conjunction with the Dedication Ceremony. A copy is included on pages 10-12.

### **Media coverage:**

The Kaibab Trail Suspension Bridge and the Dedication Ceremony received significant media coverage.

Very notably, the History Lesson story in the March 2019 issue of Civil Engineering magazine was about the bridge. This may have been the first time that a History Lesson story on a Landmark was published in conjunction with a Landmark dedication. Pages 13-16.

The bridge and ASCE received great visibility in an Arizona Highways story in the February issue. Arizona Highways' monthly circulation surpasses 200,000 copies, with readers in 50 U.S. states and in two-thirds of the world's countries. The story on the Kaibab Trail Suspension Bridge noted that, in conjunction with Grand Canyon National Park's Centennial in February, the bridge was "being honored as a National Historic Civil Engineering Landmark". Pages 17-18.



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The Landmark dedication was also covered by stories in

Arizona Republic / azcentral.com    pages 19-20

Williams-Grand Canyon News    pages 21-22

Engineering.com    pages 23-24

Civil + Structural Engineer    pages 25-26

Infrastructurepreservation.com    pages 27-28

Flagstaff Business News    page 29

Internal to ASCE, the Landmark dedication was covered in ASCE SmartBrief and other outlets. The Special July 5 edition of ASCE SmartBrief reported that one of the most-clicked stories in SmartBrief during the previous six months was the February 25 story on the Kaibab Trail Suspension Bridge.

### **Materials created for the dedication, such as brochures and invitations:**

Printed program    page 7

Transcript of remarks at Dedication Ceremony    pages 30-38



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### **The exact location of the plaques:**

There are two identical Landmark plaques. GPS coordinates and instructions to locate are given here.

1) One Landmark plaque is located on the South Rim of the Grand Canyon in the Grand Canyon Village area. 36 03 57.71 N 112 07 01.60 W From the gateway community of Tusayan, proceed north 1.9 miles to the Grand Canyon South Entrance Station. There is an entrance fee to Grand Canyon National Park. From the Entrance Station, proceed north an additional 7.7 miles on the South Entrance Road, making no turns and passing Grand Canyon Visitor Center and Mather Point. At 7.7 miles turn right to the Yavapai Geology Museum and park in the parking lot. Walk north to the Geology Museum on the Canyon Rim. The Landmark plaque is located 100 feet east of the Museum, on the Canyon Rim. The Kaibab Trail Suspension Bridge is visible from this point.

2) The second Landmark plaque is located near the Kaibab Trail Suspension Bridge at the bottom of the Grand Canyon. 36 06 05.27 N 112 05 26.92 W Viewing the plaque and going to the Landmark itself requires a hike of either about 7 miles (one-way) on the South Kaibab Trail, or about 10 miles (one-way) on the Bright Angel Trail, and a descent of about 4,400 feet from the South Rim trailheads. No one should attempt to hike from the South Rim to the bridge and return in one day. Anyone interested in hiking to the bridge should visit <https://www.nps.gov/grca/planyourvisit/backcountry.htm> and read trail descriptions for the South Kaibab Trail and Bright Angel Trail. The Landmark plaque is located next to the trail, about 350 feet west of the north end of the Kaibab Trail Suspension Bridge.

### **Archival Video**

A video of the 1:30 p.m. presentation on the history of the bridge is available on Vimeo at:

<https://vimeo.com/322458566>

A video of the 3:00 p.m. Dedication Ceremony is available on YouTube at:

<https://youtu.be/Od7JMdHhmLU>

A DVD which includes both of the above presentations was created by Fred Nelson and a copy was provided to the ASCE History and Heritage Committee (provided to Jennifer Lawrence on the ASCE staff).

## DEDICATION CEREMONY PROGRAM



Program Design and Printing Donated By:



### KAIBAB TRAIL SUSPENSION BRIDGE

Dedication as a National Historic  
Civil Engineering Landmark

Grand Canyon National Park  
February 23, 2019 at 3:00 p.m.



#### PROGRAM

##### Welcome and Introduction of Honored Guests

Jonathan Upchurch, P.E., PTOE, FASCE,  
Corresponding Member, ASCE History and Heritage Committee

##### Brief History of the Kaibab Trail Suspension Bridge

Jonathan Upchurch

##### Remarks and Presentation of Landmark Plaque to Grand Canyon National Park

ASCE President Robin Kemper, P.E., LEED AP, F.SEI, F.ASCE

##### Acceptance of Landmark Plaque by Grand Canyon National Park, and Remarks

Lisa Carrico, Deputy Superintendent

##### Remarks by ASCE Arizona Section President

Ted Smithwick, PE, President, Arizona Section,  
American Society of Civil Engineers

##### Remarks on behalf of Grand Canyon Historical Society

Dave Mortenson, President

##### Thank You and Closing

Jonathan Upchurch

As civil engineers, we take great pride in designing and constructing structures and sites that become legacies of our communities. The Kaibab Trail Suspension Bridge is a prime example of engineering innovation. Engineering the bridge under such unfavorable conditions reflects on the resourcefulness and innovation of the civil engineers responsible for this project.

- Robin A. Kemper, PE, President, ASCE

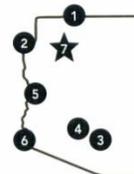
#### NATIONAL HISTORIC CIVIL ENGINEERING LANDMARK PROGRAM

The objectives of the program are to:

- Encourage all civil engineers to become more aware of the history and heritage of their own profession.
- Increase appreciation by the public of civil engineering contributions to the progress and development of the United States and the world.
- Identify and designate national historic civil engineering works that have made a significant contribution to the development of the United States and other countries and to the profession of civil engineering in particular.
- Encourage, where appropriate and feasible, the preservation of significant historic civil engineering works.
- Provide a documented archive of Civil Engineering Historic Landmarks for the use of engineering students, professional writers, researchers, and historians.

#### NATIONAL HISTORIC CIVIL ENGINEERING LANDMARKS IN ARIZONA

1. Navajo Bridge (*The original bridge, completed in about 1929*)
2. Hoover Dam
3. Theodore Roosevelt Dam and Salt River Project
4. Hohokam Canal System
5. Colorado River Aqueduct (*Begins on the Arizona / California border, above Parker Dam and extends to the Los Angeles area*)
6. All-American Canal (*Begins on the Arizona / California border at Yuma and extends to the Imperial Valley in California*)
7. Kaibab Trail Suspension Bridge



**MEDIA ADVISORY**

## Media Advisory

*February 22, 2019*

Contact: Alexa Lopez (202)202-7853 | [alopez@asce.org](mailto:alopez@asce.org)

### **American Society of Civil Engineers to Dedicate Kaibab Trail Suspension Bridge as National Historic Civil Engineering Landmark Tomorrow**

**Grand Canyon, Ariz.** — The American Society of Civil Engineers (ASCE) will recognize the Kaibab Trail Suspension Bridge as a National Historic Civil Engineering Landmark on Saturday, February 23, 2019. Built in 1928, the bridge carries foot and mule traffic over the Colorado River at the bottom of the Grand Canyon. The Kaibab Trail Suspension Bridge was nominated by the ASCE Arizona Section to the ASCE History and Heritage Committee in 2016.

A dedication ceremony will take place at **3:00 p.m.**, which will include the unveiling of the landmark plaque and remarks. The ceremony will be held in conjunction with the Fifth Grand Canyon History Symposium. Media are encouraged to attend.

**WHAT:** Dedication Ceremony of the Kaibab Trail Suspension Bridge in Grand Canyon National Park as a National Historic Civil Engineering Landmark  
*\*Media availability for interviews immediately following dedication ceremony*

**WHO:** American Society of Civil Engineers  
**Robin A. Kemper, PE, President, American Society of Civil Engineers**  
Ted Smithwick, PE, President, Arizona Section, American Society of Civil Engineers

*Featuring remarks from:*

Lisa Carrico, Deputy Superintendent, Grand Canyon National Park  
Dave Mortenson, President, Grand Canyon Historical Society

*\*This event is open to the public.*

**WHEN:** **Tomorrow**, Saturday, February 23, 2019, 3:00 p.m.

**WHERE:** Yavapai Geology Museum (located on the South Rim in Grand Canyon National Park)

Grand Canyon [National Park - South Rim](#)  
[Grand Canyon Village, AZ 86023](#)

A presentation by ASCE Fellow Jonathan Upchurch, PE entitled, “Kaibab Trail Suspension Bridge: A National Historic Civil Engineering Landmark” will be held at 1:30 p.m., prior to the dedication ceremony. The presentation will take place at the Shrine of the Ages, 30 South Entrance Road, Grand Canyon National Park - South Rim. This event is not open to the public, but media are welcome to attend to learn about the history and significance of the bridge. **Photography and video cameras are not allowed.**

***In the event of inclement weather, the dedication ceremony will be held during the 1:30 presentation at the Shrine of the Ages.***

Media interested in attending should contact Alexa Lopez at (202) 789-7853 or [alopez@asce.org](mailto:alopez@asce.org).

**ABOUT THE AMERICAN SOCIETY OF CIVIL ENGINEERS**

*Founded in 1852, the American Society of Civil Engineers represents more than 150,000 civil engineers worldwide and is America's oldest national engineering society. ASCE works to raise awareness of the need to maintain and modernize the nation's infrastructure using sustainable and resilient practices, advocates for increasing and optimizing investment in infrastructure, and improve engineering knowledge and competency. For more information, visit [www.asce.org](http://www.asce.org) and follow us on Twitter, @ASCETweets and @ASCEGovRel.*

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NEWS RELEASE



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(703) 295.6333 fax ■ www.ASCE.org

## News Release

*February 23, 2019*

Contact: Alexa Lopez (202) 789-7853 | alopez@asce.org

### **Kaibab Trail Suspension Bridge Recognized as National Historic Civil Engineering Landmark**

**Grand Canyon, Ariz.** — The 91-year-old Kaibab Trail Suspension Bridge, otherwise known as the “Black Bridge,” in the Grand Canyon was recognized today as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers (ASCE), at a ceremony onsite attended by civil engineering leaders, Grand Canyon National Park leaders and representatives from the Grand Canyon Historical Society.

ASCE represents more than 150,000 members of the civil engineering profession worldwide. It is the oldest national engineering society in the United States. ASCE recognizes historically significant civil engineering projects, structures, and sites all over the world. More than 200 projects have earned the prestigious title for creativity and innovation, and almost all are executed under challenging conditions.

At the time of its completion, the Kaibab Trail Suspension Bridge was the only crossing of the Colorado River in a distance of 754 miles from Moab, Utah to Needles, California. Due to the travel barrier of the Colorado River and its canyons, the bridge is still one of the few Colorado River crossings in the region. Except for a suspension bridge only one-half mile downstream, the Kaibab Trail Suspension Bridge is the only physical crossing of the Colorado River in 340 miles, between Navajo Bridge upstream and Hoover Dam downstream – both of which have previously been designated as National Historic Civil Engineering Landmarks.

“As civil engineers, we take great pride in designing and constructing structures and

## Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge

sites that become legacies of our communities,” said Robin A. Kemper, PE, President, ASCE. “The Kaibab Trail Suspension Bridge is a prime example of engineering innovation. Engineering this bridge at the base of one of the world’s greatest wonders – the Grand Canyon – illustrates the resourcefulness and innovative spirit of the civil engineers responsible for this project.”

Built in 1928 and located within one of the seven natural wonders of the world—the Grand Canyon, the 440-foot single span suspension bridge crossing the Colorado River has fostered backcountry recreation and provides a connection between the North and South Rims of the Grand Canyon. Since its completion, the bridge has served mule-riding tourists, pack trains hauling supplies to Phantom Ranch, hikers, backpackers, Park Service and concessionaire employees. The bridge also provides a pathway that is five feet wide. The structure is suspended from four 550-foot-long suspension cables and stabilized by two wind cables. Unmodified since its original construction, the bridge remains in service today and has an estimated 100,000 crossings a year.

“The ASCE Arizona Section is incredibly grateful for this prestigious landmark designation,” said Ted Smithwick, PE, President, Arizona Section, ASCE. “The Suspension Bridge is a unique part of Arizona history and joins the ranks of iconic projects, such as the Golden Gate Bridge and the Hoover Dam.”

“The Kaibab Trail Suspension Bridge is exemplary of the park’s history and reminds us of the challenges that were required to build the bridge across the Colorado River in such an isolated location, without the benefit of modern transportation methods or technologies that we have today,” said Christine Lehnertz, Superintendent, Grand Canyon National Park. “I am proud to see this bridge recognized today as a National Historic Civil Engineering Landmark.”

The Kaibab Trail Suspension Bridge was nominated by the ASCE Arizona Section to the ASCE History and Heritage Committee in 2016. Other Historic Civil Engineering Landmarks in Arizona include the Navajo Bridge, the Theodore Roosevelt Dam and Salt River Project and the Hohokam Canal System.

For more information about ASCE’s Historic Civil Engineering Landmark Program, go to [ASCE.org/landmark-program](https://www.asce.org/landmark-program).

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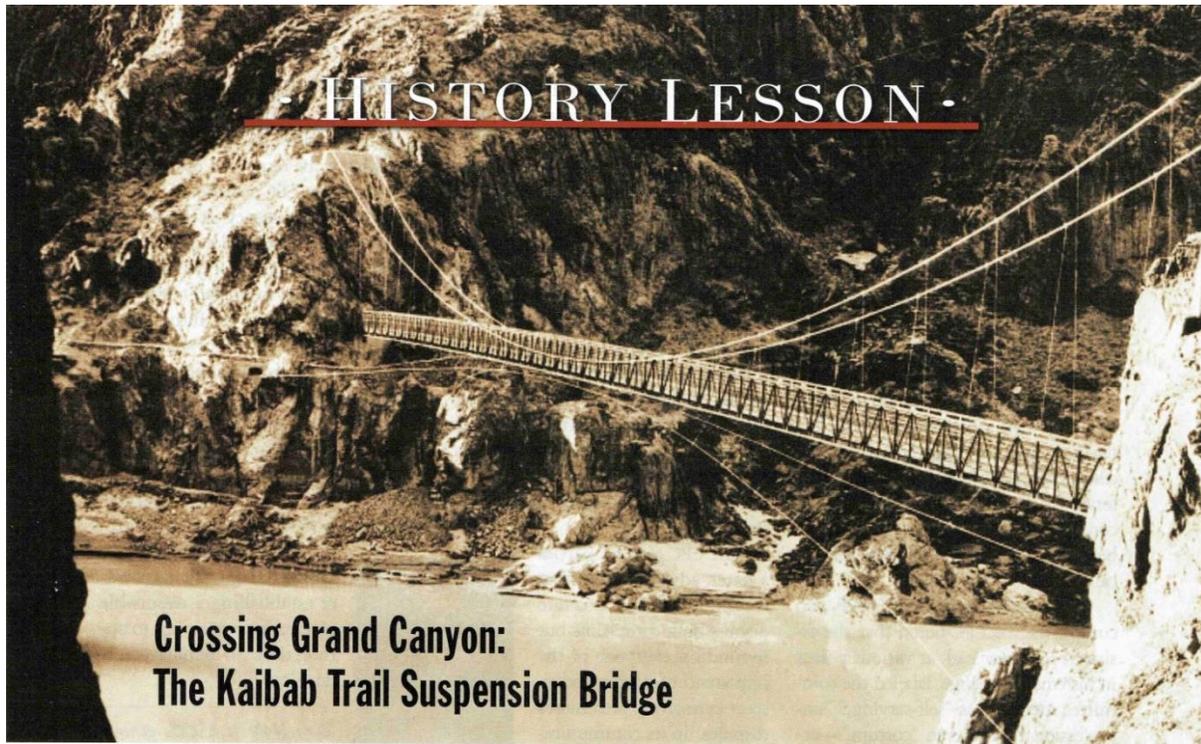
### **ABOUT THE HISTORIC CIVIL ENGINEERING LANDMARK PROGRAM**

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*The American Society of Civil Engineers Historic Civil Engineering Landmark Program recognizes historically significant local, national, and international civil engineering projects, structures, and sites. Through dedications, a physical plaque on site, and an online historical record open to all, the landmark program increases public appreciation of civil engineering contributions to the progress and development of society; provides civil engineers with an historical awareness of their own profession for both practical insights and pride; encourages the preservation of significant historic civil engineering works; and fosters the inclusion of civil engineering landmark information in encyclopedias, guidebooks and maps.*

American Society of Civil Engineers, 101 Constitution Avenue, NW, Suite 375 East, Washington,  
DC 20001, USA

HISTORY LESSON STORY: CIVIL ENGINEERING MAGAZINE



**Crossing Grand Canyon:  
The Kaibab Trail Suspension Bridge**

**J**ONATHAN UPCHURCH, P.E., Ph.D., P.T.O.E., F.ASCE, made his first visit to the Grand Canyon in 1961 when he was in middle school. He and his parents attempted to hike to the bottom and back to the rim on a hot day in June. “My mother and I didn’t make it all the way to the bottom,” he says. “Dad made it. We were naive flatlanders from Illinois who didn’t understand what we were getting into.”

Despite that inauspicious start, Upchurch remained closely connected to the canyon throughout his life. He took frequent hikes on subsequent vacations and while living in the Phoenix area. From 2006 to 2012 he lived on

the South Rim, part of the time working as a National Park Service (NPS) Transportation Scholar. He estimates he has hiked roughly 2,400 mi in the canyon.

Of course, most visitors see only

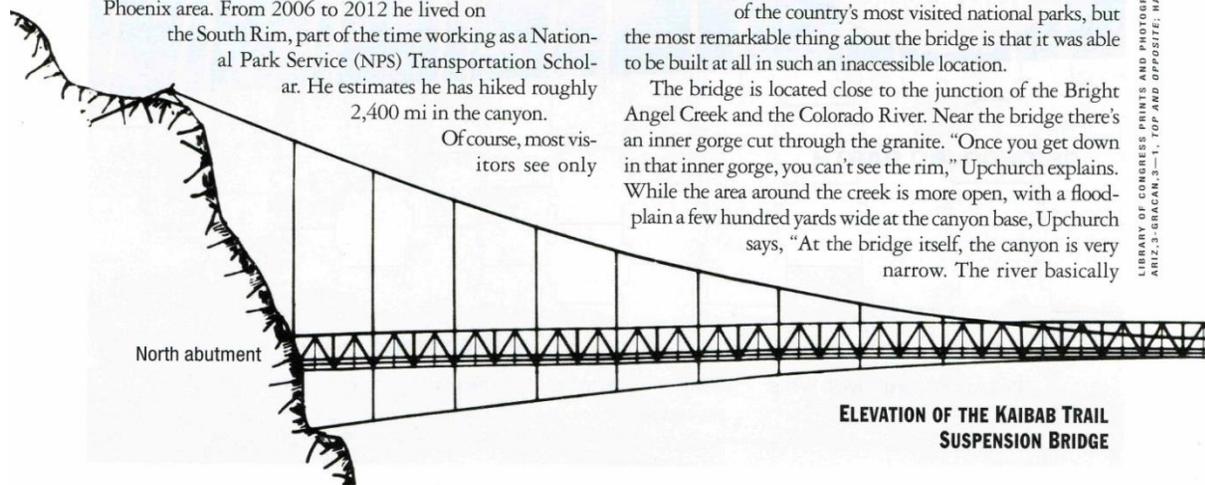
**The 1928 Kaibab Trail Suspension Bridge, with minor maintenance, has continued to allow tourists to descend one side of the Grand Canyon and ascend the other.**

the sprawling view from the top. Down below, where trees give way after the first 1,000 ft and are replaced by cacti and yuccas, it’s “also awesome,” he says. “Awesome in terms of the scenery, the scale, the environment, all the things you are sensing. I think it’s absolutely more impressive (than the rim).”

And at the bottom of the canyon lies one of few projects within a national park to be named a national historic civil engineering landmark in ASCE’s Historic Civil Engineering Landmark Program. The 440 ft, single-span Kaibab Trail Suspension Bridge, completed in 1928, crossed the Colorado River using four 550 ft long suspension cables. It helped launch tourism in one of the country’s most visited national parks, but

the most remarkable thing about the bridge is that it was able to be built at all in such an inaccessible location.

The bridge is located close to the junction of the Bright Angel Creek and the Colorado River. Near the bridge there’s an inner gorge cut through the granite. “Once you get down in that inner gorge, you can’t see the rim,” Upchurch explains. While the area around the creek is more open, with a floodplain a few hundred yards wide at the canyon base, Upchurch says, “At the bridge itself, the canyon is very narrow. The river basically



LIBRARY OF CONGRESS PRINTS AND PHOTOGRAPHS DIVISION, EDITH: HAER ARIZ.3:GRACAN.3-1, TOP AND OPPOSITE; HAER ARIZ.3:GRACAN.3-27, BELOW

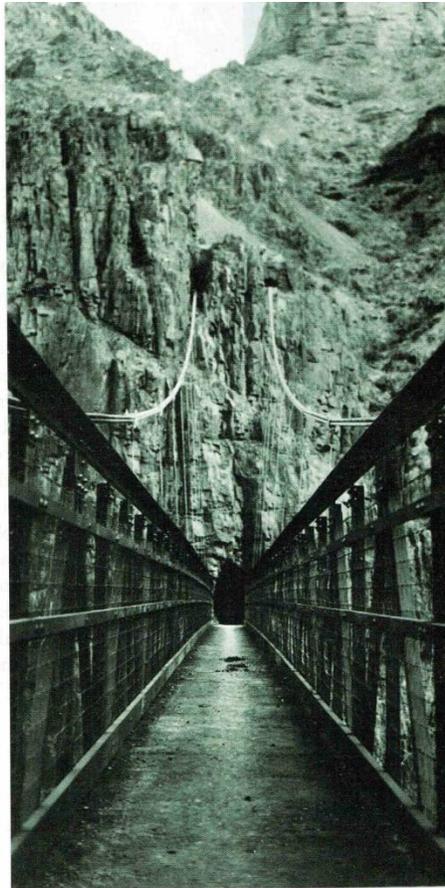
extends from the cliffs on one side to the cliffs on the other.”

Before 1907, the only way to cross the river in this part of the 277 mi long Grand Canyon was on a boat, according to *Historic Civil Engineering Landmark Nomination for the Kaibab Trail Suspension Bridge Grand Canyon National Park*, a paper written by Upchurch for ASCE’s Arizona Section in 2016. It was a dangerous crossing that cost many travelers their lives. In 1907, outdoorsman David Rust built a cableway across the river at the location of the current bridge, according to Upchurch. (Rust also built the first trail from the North Rim to the canyon floor.)

The cableway “consisted of one main cable with a six-foot by ten-foot by six-and-a-half-foot-high steel cage suspended beneath,” Upchurch says. The first two passengers were women, Rose Evans and Lida Bilveal, who had hiked down from the South Rim. In 1913, former U.S. president Theodore Roosevelt used the cableway to cross the river.

Rust’s work helped tourism at the canyon boom in the 1910s. The cableway joined two trails that allowed tourists to descend and ascend the canyon on opposite sides. Rust also opened a camp for travelers, now known as Phantom Ranch. The cableway, Upchurch wrote, “lasted until 1917 when the cable cage was damaged in a Colorado River flood.” Grand Canyon National Park was established in 1919, and soon after, engineers with the NPS began planning a replacement for Rust’s cableway.

The first bridge to cross the river was completed in 1920, according to a Historic American Engineering Record (HAER) report on the bridge prepared and submitted by Donald C. Jackson and Jean P. Yearby in 1984, which included papers written in 1929 by, respectively, Ward P. Webber, the bridge’s design engineer, and John H. Lawrence, its construction supervisor. This early bridge “afforded the only safe means of crossing the river in a stretch of several hundred miles,” Webber wrote. “The completion of this bridge made it



**At the south approach, the bridge enters a tunnel and its suspension cables extend through their own smaller tunnels above.**

it would have to be strong enough to support the weight of a mule train, end to end. It would also have to be able to withstand fierce winds.

But first engineers had to contend with how to access the site. Access was as difficult as any project ever considered for ASCE’s landmark

program. “Transporting materials to the construction site via the Colorado River was completely impractical,” Upchurch wrote. “The nearest upstream point where the river could be accessed was 87 miles away and there were several world-class rapids between that access point and the bridge site.”

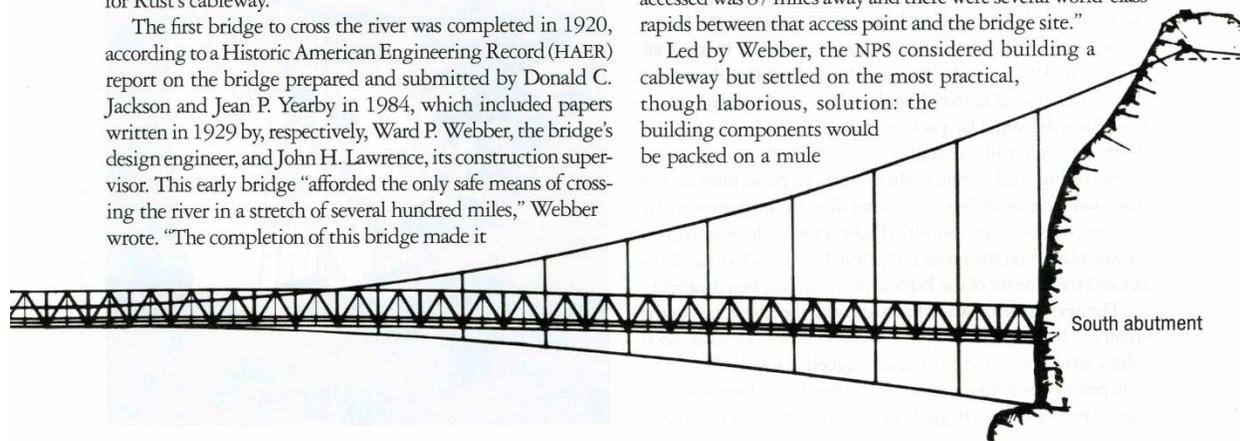
Led by Webber, the NPS considered building a cableway but settled on the most practical, though laborious, solution: the building components would be packed on a mule

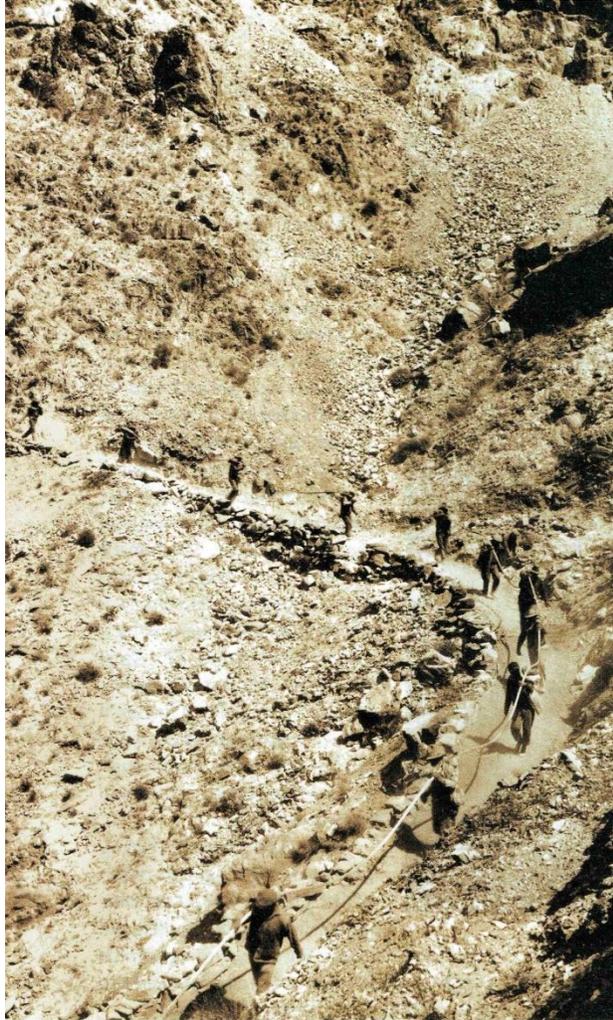
possible to travel by saddle horse from the South Rim to the North Rim for the first time in the history of the park.”

During the 1920s, according to Webber, the NPS constructed the Kaibab Trail “to provide a more direct route across the canyon. The site of the original river crossing was retained as it was admirably situated but the first bridge was too light and elastic to accommodate the increased traffic safely and a stronger and more rigid structure became necessary.”

Additionally, the bridge could only support the weight of one mule at a time, which made crossing with larger groups time-consuming. And its lack of wind bracing made it vulnerable to heavy gusts. On April 30, 1923, a wind storm heavily damaged the bridge, Upchurch wrote, breaking an anchor cable and 33 hanger rods. Additionally, the bridge floor buckled and broke in two places.

With more tourists visiting the canyon, NPS engineers decided that a new bridge on the same alignment would be required, and





train that would be sent down the canyon path, which drops approximately 4,700 ft over 7 mi “of tortuous trail with dozens of switchbacks,” wrote Upchurch. The challenging terrain put key constraints on the bridge itself: “The length and weight of individual rigid members was limited to 10 feet and 200 pounds. About 122 tons of materials and supplies were delivered by pack animals down the seven miles of trail.”

According to Lawrence, there were 42 pack animals and seven saddle animals bringing material to the bridge every day over the course of three months. (Eight of the mules were named for key players on the project, Upchurch says, including Webber and the director of the NPS at the time, Stephen Mather.)

The next question was what to do with the exceptions to the small and lightweight components, namely the four suspension cables, which extended 550 ft and weighed 2,300 lb apiece. The only practical way to transport the cables down the trail was to carry them by hand. The park service enlisted 42 men from the

**Bringing down the long and heavy suspension cables, above, required a team of 42 men from the Havasupai tribe to carry the load across a twisty 7 mi trail that descended nearly 1 mi.**

Havasupai tribe, whose members had lived in a remote village at the base of the canyon for more than 1,000 years, to bring down the suspension cables from the South Rim.

“Each man’s share of the load was approximately 50 pounds,” wrote Lawrence. “The round trip was made in two days.” Upchurch describes the line of men as winding down the trail like a centipede, hoisting the cables the whole way.

Engineers selected a Warren truss for the bridge’s design because it contains few main components and could be “interchanged between panels,” Webber wrote. This made storing the steel easier on such a tight site.

To guard against the heavy winds like those that debilitated the 1920 bridge, engineers took special care to provide sufficient wind bracing, Webber wrote. “Although the stiffening truss is constructed as a continuous structure rigidly riveted together, the narrow width in comparison to its length tends toward elasticity,” he wrote. “The necessary lateral strength is provided by two wind cables, one on each side, which are connected to the truss by wind guys similar to vertical hangers.” The wind cables were positioned at a 26-degree angle downward from the bridge deck to protect against excess uplift.

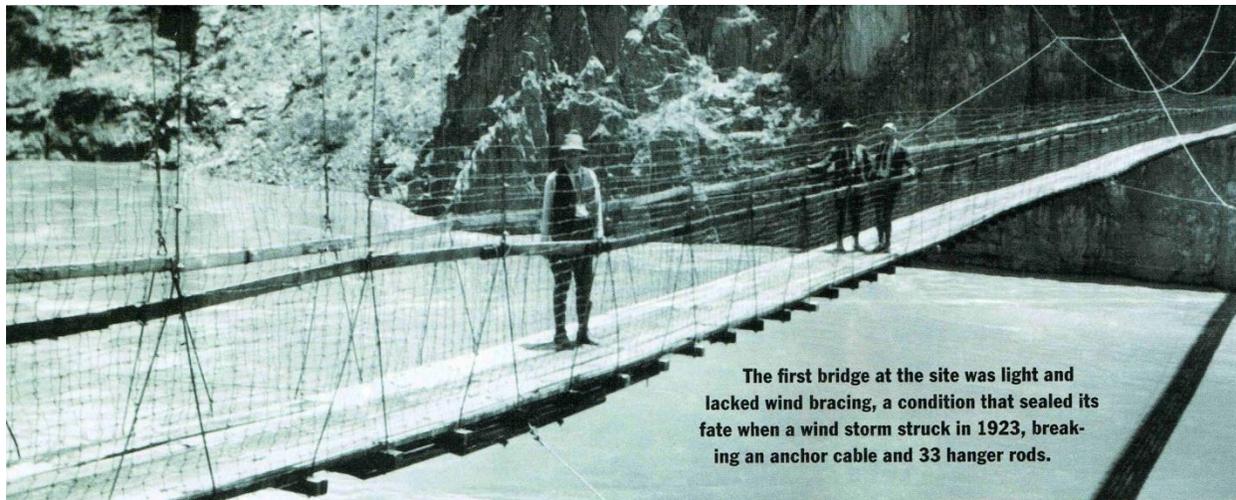
The wind cables, like the suspension cables, also had to be transported in long lengths. The initial cable was about 900 ft long and was cut in half at Yaki Point on the South Rim. Then

**The original crossing over the Colorado River in the Grand Canyon was a cableway that suspended a single steel cage.**

the two cables were sledged to the bridge site on a “go-devil” sled (a simple, horse-drawn carrier) that Lawrence designed. “This method showed considerable saving in cost over the method used in transporting the main cables,” Lawrence



GRAND CANYON MUSEUM COLLECTION, ALL THREE



**The first bridge at the site was light and lacked wind bracing, a condition that sealed its fate when a wind storm struck in 1923, breaking an anchor cable and 33 hanger rods.**

wrote. But the method couldn't be used for the main cables because it would have taken more than twice as long.

"The south upstream wind cable anchorage was quite difficult to place," he continued. "It was necessary for the jackhammer operator to hang in a sling from two ropes one hundred and twenty five feet below where the rope was secured and with a seventy foot sheer wall to the river below him."

The new bridge was built roughly 16 ft higher than the old one, which "required the construction of new bridge approaches in the sheer canyon walls for the trail," Upchurch wrote. "A 105-ft long tunnel was built on the south end, which avoided rock overhanging the trail and the danger of falling rock, allowed for a straight approach,... and eliminated the danger of undermining the bridge cable [anchorages]."

Construction equipment, including two Ingersoll Rand air compressors, were brought in from a U.S. Forest Service warehouse in San Francisco. "The compressors were so ineffective that it was found necessary while drilling in the tunnel approach to hook both compressors on to one small jackhammer," wrote Lawrence. "This slowed up the work considerably, there being at times hardly enough air to run even the one drill."

In all, the bridge weighed 108 tons—each cable weighed 1.16 tons, according to Webber. The length of the bridge stiffening truss was 440 ft, and the loading was 380 lb per linear ft of bridge per cable, giving the bridge a maximum tensile stress of 103.8 tons per cable. "The entire weight of the bridge together with the live load is supported by the main cables and anchorages," Webber wrote. The weight of the stiffening truss is supported "by the cable and is called upon only to resist deformation caused by an unbalanced live loading. The maximum stress from this condition arises when only one half of the truss is covered with the full load."

"I think the other thing that's remarkable is how quickly this bridge was authorized and built," says Upchurch. He explains that the superintendent of Grand Canyon National Park at the time, Miner R. Tillotson, wrote to the chief engineer of the NPS, Frank Kittredge, in early December 1927, proposing the bridge. By early January 1928 the NPS had allocated \$50,000. By mid-February, the NPS had requested bids, and construction began in early March. No fewer than

six civil engineers were involved with designing and building the bridge.

The work was completed by early August, despite treacherous heat in the summer months that contributed to a 300 percent rate of turnover in the labor force. (Getting workers who needed medical attention out of the canyon was difficult; they had to be put on a mule.)

Upchurch's ASCE nomination quotes Kittredge from 1929 observing that while the Forest Service had designed a great many trail bridges, none of them approached 500 ft in length; most were between 100 and 300 ft.

According to Upchurch, the bridge remains in good condition. It has been repainted a number of times, including in the late 1940s and again in the early 2000s. About a decade ago, the hanger cables were replaced. The tread on the bridge deck has been replaced.

The Kaibab Trail Suspension Bridge remains a fundamental link in the only cross-canyon trail connecting the North and South Rims and is crossed more than 100,000 times each year, Upchurch wrote. It also influenced the design of the Verde River Sheep Bridge, which was built across the Verde River in Arizona primarily to allow sheep to be driven between grazing sites and was completed in 1944.

The Kaibab Trail Suspension Bridge, which cost all of \$39,473.52, was named to ASCE's Historic Civil Engineering Landmark Program in 2017, and at press time, the bridge was scheduled to be dedicated on February 23. "The dedication of the Kaibab Trail Suspension Bridge includes many stories—stories of history, civil engineering ingenuity, the development of Grand Canyon National Park, and park visitors who have, for over 90 years, used the bridge to explore and experience the Grand Canyon," Upchurch says. "I've now successfully hiked to the canyon bottom many times. Knowing that the bridge has been designated as a national Historic Civil Engineering Landmark brings all those stories together for me." —T.R. WITCHER



**Witcher**

T.R. Witcher is a contributing editor to Civil Engineering.

ARIZONA HIGHWAYS MAGAZINE STORY

# LOW BRIDGE

In 1928, construction workers put the final touches on what's commonly known as the Black Bridge. As bridges go, it's not the most beautiful, but considering it was built by hand a mile below the South Rim, it's very impressive. That's why, this month, it's being designated a National Historic Civil Engineering Landmark.

| BY NOAH AUSTIN | PHOTOGRAPHS BY TOM BROWNOLD |



**E**VERY BRIDGE DESIGNER FACES CHALLENGES. But the Kaibab Trail Suspension Bridge added a new level of difficulty. Completed in 1928, the 440-foot bridge spans the Colorado River at the bottom of the Grand Canyon. To reach it, workers had to hike 7 miles down the steep South Kaibab Trail, losing nearly a mile of elevation along the way. Because the trail was the only way to reach the site, every piece of the bridge had to be carried by a worker or a pack animal — meaning no piece could be longer than 10 feet or weigh more than 200 pounds. (Except the 550-foot suspension cables, that is. Those 2,300-pounders were carried down the twisting trail by teams of 42 men, mostly Havasupais.)

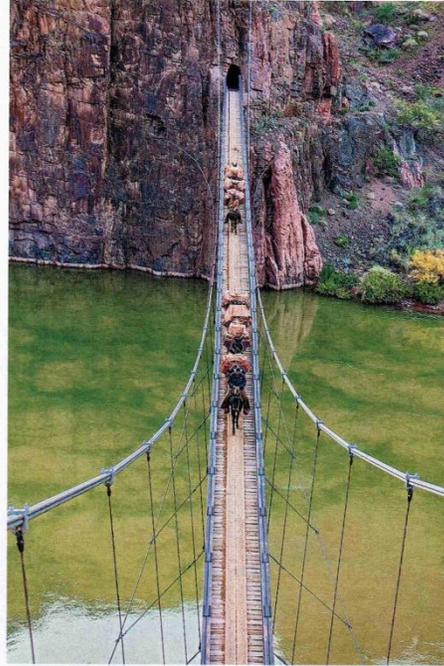
Despite the obstacles, the Kaibab Trail Suspension Bridge, more commonly known as the Black Bridge, became a Grand Canyon institution. And in conjunction with the park's centennial this month, it's being honored as a National Historic Civil Engineering Landmark — one of only a handful in Arizona.

The designation is a marriage of passions for Jonathan Upchurch, who authored the landmark nomination. A member of the American Society of Civil Engineers, Upchurch has hiked some 2,400 miles in the Canyon since he first visited in 1961. He also lived at the South Rim for six years and became familiar with Grand Canyon National Park's history and culture.

Upchurch notes that when the Black Bridge was completed, it was the only Colorado River crossing in the 754-mile stretch between Moab, Utah, and Needles, California. Even today, it and the nearby Bright Angel Bridge, also known as the Silver Bridge, are the only crossings in the 340 miles between Navajo Bridge and Hoover Dam. But the Silver Bridge, built in the 1960s to carry the Trans-Canyon Pipeline across the river, had the benefit of more modern technology — namely, helicopters to get equipment and bridge pieces to the bottom of the Canyon. (Additionally, that bridge, unlike the Black Bridge, wasn't designed to support mule traffic.)

The Black Bridge “is very remote, and the topography is extreme,” Upchurch says. “In the 1920s, those two factors very strongly influenced the design and the construction. It had to be designed in pieces that were small in size and not too heavy.” It also needed to be more durable than its predecessor, which was completed in 1921 and was prone to wind damage. In all, workers and pack animals took 122 tons of materials and supplies down the trail. And once they had the pieces, workers had to build a bridge that was the first of its kind: As Upchurch notes in the landmark nomination, at the time of construction, the National Park Service could find no record of another trail bridge this long.

The bridge furthered the growth of Phantom Ranch and allowed hikers to safely reach the North Rim from the South Rim, and today, it's estimated that some 100,000 people cross it annually. It also influenced the design of the Verde River Sheep Bridge, a similar structure north of the Phoenix area. These and other factors, Upchurch says, make the Black Bridge wor-



OPPOSITE PAGE: A tunnel on the Grand Canyon's South Kaibab Trail leads to the Kaibab Trail Suspension Bridge, which was completed in 1928 and spans the Colorado River.

ABOVE: Of the two river bridges in the Canyon, the Black Bridge is the only one designed for mule traffic.

thy of National Historic Civil Engineering Landmark designation. In Arizona, Hoover Dam and Navajo Bridge already have that honor, as do Theodore Roosevelt Dam, the prehistoric Hohokam canal system in the Salt River Valley, and two aqueducts that carry water from the Colorado River into California.

On February 23, during the Grand Canyon History Symposium, Upchurch plans to give a presentation at the South Rim's Shrine of the Ages on the Black Bridge's history and construction. If the Canyon's unpredictable weather cooperates, there also will be an outdoor dedication: A landmark plaque with a 99-word citation will be installed near the Yavapai Geology Museum, at a spot where the bridge is visible.

“It serves as another interpretive wayside for visitors to the park, to help them understand the history of the park,” Upchurch says. “In a more general sense, it helps the public to understand the field of civil engineering and what it's all about.”

Another plaque will go near the bridge, but fewer people are likely to see that one. As the bridge's builders would tell you, it's a long way down. 🏞️

## ARIZONA REPUBLIC STORY

<https://www.azcentral.com/story/news/local/arizona/2019/02/23/kaibab-trial-bridge-grand-canyon-named-engineering-landmark/2966020002/>

and

<https://www.msn.com/en-us/travel/article/91-year-old-grand-canyon-bridge-named-an-engineering-landmark/ar-BBTZzA2>

## 91-year-old Grand Canyon bridge named an engineering landmark

Perry Vandell, Arizona Republic Published 5:50 p.m. MT Feb. 23, 2019



American Society of Civil Engineers President Robin Kemper reaches for a handshake as Jonathan Upchurch, an ASCE Fellow, unveils a plaque commemorating the South Kaibab Suspension Bridge's designation as a National Historic Civil Engineering Landmark. (Photo11: American Society of Civil Engineers)

A 91-year-old bridge connecting the northern and southern rims of the Grand Canyon was recognized Saturday afternoon as a National Historic Engineering Landmark.

The American Society of Civil Engineers celebrated the Kaibab Trail Suspension Bridge's designation with Grand Canyon National Park leaders and Grand Canyon Historical Society members at a physical landmark commemorating the achievement.

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

The bridge, also called the "Black Bridge," is one of two suspension bridges over the Colorado River in the span of 340 miles. It lies between the Navajo Bridge to the east and the Hoover Dam to the west.

“The Kaibab Trail Suspension Bridge is a prime example of engineering innovation," ASCE President Robin Kemper said in a written statement. "Engineering this bridge at the base of one of the world’s greatest wonders – the Grand Canyon – illustrates the resourcefulness and innovative spirit of the civil engineers responsible for this project.”

ASCE says the 440-foot bridge has allowed hikers to cross the canyon since it was completed in 1928 and remains unaltered to this day.

## WILLIAMS – GRAND CANYON NEWS STORY

<https://www.grandcanyonnews.com/news/2019/feb/26/kaibab-trails-black-bridge-named-national-historic/>

### **Kaibab Trail’s Black Bridge named National Historic Civil Engineering Landmark**



The American Society of Civil Engineers recognized the Kaibab Trail Suspension Bridge in a ceremony Feb. 23 at Yavapai Geology Museum on the South Rim. (Terri Attridge/NPS)

#### **By Williams-Grand Canyon News**

- Originally Published: February 26, 2019 9:53 a.m.
- GRAND CANYON, Ariz. — Built in 1928, the Kaibab Trail Suspension Bridge, or Black Bridge, was so remote that the site could not be reached by motor vehicles.

According to the National Park Service, the 122 tons of materials for the structure was hauled by mules and manpower down nine miles of the south Kaibab Trail. Around 40 members of the neighboring Havasupai Tribe also joined the effort, carrying the one-ton, 550-foot suspension cables single-file to the construction site.

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

A marvel of its time, the Black Bridge was recently named a National Historic Civil Engineering Landmark by the American Society of Civil Engineers (ASCE).

According to ASCE, more than 200 projects worldwide have earned the designation of ASCE Historical Civil Engineering Landmark, one that illustrates the creativity and innovative spirit of civil engineers. Almost always performed under challenging conditions, each of these engineering feats represents the achievement of what was considered an impossible dream.

The Kaibab Trail Suspension Bridge was nominated by the ASCE Arizona Section to the ASCE History and Heritage Committee in 2016. The dedication ceremony was held Feb. 23 in conjunction with the 5th annual Grand Canyon History Symposium.

### **About ASCE**

Founded in 1852, the American Society of Civil Engineers represents more than 150,000 civil engineers worldwide and is America's oldest national engineering society. ASCE works to raise awareness of the need to maintain and modernize the nation's infrastructure using sustainable and resilient practices, advocates for increasing and optimizing investment in infrastructure, and improve engineering knowledge and competency.

## ENGINEERING.COM STORY

<https://www.engineering.com/BIM/ArticleID/18642/Pioneering-Grand-Canyon-Bridge-Nabs-ASCE-Award.aspx>

### Pioneering Grand Canyon Bridge Nabs ASCE Award

Emily Pollock posted on March 01, 2019



*Don't let its delicate appearance fool you: the Kaibab Bridge has been standing since 1928, and still welcomes tens of thousands of visitors every year. (Image courtesy of Grand Canyon Explorer.)*

The Grand Canyon's Kaibab Trail Suspension Bridge has been recognized as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers (ASCE).

Built in 1928, the Kaibab is a single span suspension bridge connecting the north and south ridges of the Grand Canyon. It's suspended from four 550-foot-long suspension cables and stabilized by two wind cables. The enormous cables presented a challenge when the bridge was built because motor traffic couldn't access the remote site location. Instead, the 122 tons of

## Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge

material that were needed to build the bridge were carried on foot and by mule, each suspension cable carried by a line of workers.

Since 1928, the bridge has not been modified, and still carries about 100,000 visitors by foot or by mule every year. The difficult terrain means it's the only connection between the two sides for 340 miles—between the Navajo Bridge and the Hoover Dam.

“The Kaibab Trail Suspension Bridge is exemplary of the park’s history and reminds us of the challenges that were required to build the bridge across the Colorado River in such an isolated location, without the benefit of modern transportation methods or technologies that we have today,” said Christine Lehnertz, Superintendent of the Grand Canyon National Park, in the ASCE’s press release. “I am proud to see this bridge recognized today as a National Historic Civil Engineering Landmark.”

Today, the National Historic Civil Engineering Landmark designation has been given to over 200 structures across the world. According to the ASCE, it's given out to “historically significant local, national, and international civil engineering projects, structures, and sites” for creativity, innovation, and work under challenging conditions. Despite the “National” in its name, the award recognizes landmarks across the world. The newest is the Snowy Mountains Hydro-Electric Scheme, an Australian hydroelectric project that redirected the flow of the Snowy River for hydroelectricity and irrigation (completed in 1972).

To the ASCE, the awards are important because they serve as a reminder of the importance of civil engineering—to both members of the general public and civil engineers. “As civil engineers, we take great pride in designing and constructing structures and sites that become legacies of our communities,” said Robin A. Kemper, President of the ASCE. “The Kaibab Trail Suspension Bridge is a prime example of engineering innovation. Engineering this bridge at the base of one of the world’s greatest wonders—the Grand Canyon—illustrates the resourcefulness and innovative spirit of the civil engineers responsible for this project.”

To learn more about the landmarks recognized by the ASCE, visit their [website](#).

## **CIVIL + STRUCTURAL ENGINEER STORY**

<https://www.cseengineermag.com/kaibab-trail-suspension-bridge-recognized-as-national-historic-civil-engineering-landmark/>

**civil + structural  
ENGINEER**



### **Kaibab Trail Suspension Bridge Recognized as National Historic Civil Engineering Landmark**

FEBRUARY 25, 2019

STRUCTURES + BUILDINGS TRANSPORTATION WEST

Grand Canyon, Ariz. — The 91-year-old Kaibab Trail Suspension Bridge, otherwise known as the “Black Bridge,” in the Grand Canyon was recognized as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers (ASCE), at a ceremony onsite attended by civil engineering leaders, Grand Canyon National Park leaders and representatives from the Grand Canyon Historical Society.

ASCE represents more than 150,000 members of the civil engineering profession worldwide. It is the oldest national engineering society in the United States. ASCE recognizes historically significant civil engineering projects, structures, and sites all over the world. More than 200

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

projects have earned the prestigious title for creativity and innovation, and almost all are executed under challenging conditions.

At the time of its completion, the Kaibab Trail Suspension Bridge was the only crossing of the Colorado River in a distance of 754 miles from Moab, Utah to Needles, California. Due to the travel barrier of the Colorado River and its canyons, the bridge is still one of the few Colorado River crossings in the region. Except for a suspension bridge only one-half mile downstream, the Kaibab Trail Suspension Bridge is the only physical crossing of the Colorado River in 340 miles, between Navajo Bridge upstream and Hoover Dam downstream – both of which have previously been designated as National Historic Civil Engineering Landmarks.

“As civil engineers, we take great pride in designing and constructing structures and sites that become legacies of our communities,” said Robin A. Kemper, PE, President, ASCE. “The Kaibab Trail Suspension Bridge is a prime example of engineering innovation. Engineering this bridge at the base of one of the world’s greatest wonders – the Grand Canyon – illustrates the resourcefulness and innovative spirit of the civil engineers responsible for this project.”

Built in 1928 and located within one of the seven natural wonders of the world—the Grand Canyon, the 440-foot single span suspension bridge crossing the Colorado River has fostered backcountry recreation and provides a connection between the North and South Rims of the Grand Canyon. Since its completion, the bridge has served mule-riding tourists, pack trains hauling supplies to Phantom Ranch, hikers, backpackers, Park Service and concessionaire employees. The bridge also provides a pathway that is five feet wide. The structure is suspended from four 550-foot-long suspension cables and stabilized by two wind cables. Unmodified since its original construction, the bridge remains in service today and has an estimated 100,000 crossings a year.

“The ASCE Arizona Section is incredibly grateful for this prestigious landmark designation,” said Ted Smithwick, PE, President, Arizona Section, ASCE. “The Suspension Bridge is a unique part of Arizona history and joins the ranks of iconic projects, such as the Golden Gate Bridge and the Hoover Dam.”

“The Kaibab Trail Suspension Bridge is exemplary of the park’s history and reminds us of the challenges that were required to build the bridge across the Colorado River in such an isolated location, without the benefit of modern transportation methods or technologies that we have today,” said Christine Lehnertz, Superintendent, Grand Canyon National Park. “I am proud to see this bridge recognized today as a National Historic Civil Engineering Landmark.”

The Kaibab Trail Suspension Bridge was nominated by the ASCE Arizona Section to the ASCE History and Heritage Committee in 2016. Other Historic Civil Engineering Landmarks in Arizona include the Navajo Bridge, the Theodore Roosevelt Dam and Salt River Project and the Hohokam Canal System.

For more information about ASCE’s Historic Civil Engineering Landmark Program, visit <https://www.asce.org/landmark-program>.

## INFRASTRUCTURE PRESERVATION.COM STORY

<https://infrastructurepreservation.com>

<https://infrastructurepreservation.com/the-south-kaibab-suspension-bridge-wins-engineering-landmark-award/>

### **The South Kaibab Suspension Bridge Wins Engineering Landmark Award**

Published February 24, 2019

By **Irfan Nugroho**



*ARIZONA* – The American Society of Civil Engineers (ASCE) has presented a National Historic Engineering Landmark award to the South Kaibab suspension bridge on Saturday, February 23, 2019.

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

The designation of the 91-year-old bridge, according to an official statement by the ASCE, was mainly due to its ‘resourcefulness and innovative spirit’.

“The Kaibab Trail Suspension Bridge is a prime example of engineering innovation,” said ASCE President Robin Kemper.

“Engineering this bridge at the base of one of the world’s greatest wonders – the Grand Canyon – illustrates the resourcefulness and innovative spirit of the civil engineers responsible for this project.”

Present at the award giving ceremony were members of the ASCE and the Grand Canyon Historical Society, and leaders of the Grand Canyon National Park.

Located in the Grand Canyon National Park over the Colorado River, the South Kaibab Trail Suspension Bridge connects the Hoover Dam to the west and the Navajo Bridge to the east.

Since first opened in 1928, the “Black Bridge” – another name of the bridge – has served many hikers to cross the Grand Canyon.

The bridge’s architecture remains unchanged for nearly 91 years, despite once closed to foot traffic in October 2017 due to the replacement of wood decking and tread boards.

FLAGSTAFF BUSINESS NEWS STORY

www.flagstaffbusinessnews.com



American Society of Civil Engineers President Robin Kemper leads the ceremony to acknowledge the 1928 engineering feat.

Courtesy photo

## Kaibab Trail Suspension Bridge Recognized as Engineering Landmark

**T**he 91-year-old Kaibab Trail Suspension Bridge, also known as the “Black Bridge” in the Grand Canyon, has been recognized as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers (ASCE).

At the time of its completion, the Kaibab Trail Suspension Bridge was the only crossing of the Colorado River, with a distance of 754 miles from Moab, Utah to Needles, California. Because of the travel barrier of the Colorado River and its canyons, the bridge is still one of the few Colorado River crossings in the region.

“As civil engineers, we take great pride in designing and constructing structures and sites that become legacies of our communities,” said ASCE President Robin A. Kemper, PE. “The Kaibab Trail Suspension Bridge is a prime example of engineering innovation. Engineering this bridge at the base of one of the world’s greatest wonders – the Grand Canyon – illustrates the resourcefulness and innovative spirit of the civil engineers responsible for this project.”

Built in 1928, the 440-foot single span suspension bridge has provided a connection between the North and South Rims. It has served mule-riding tourists, pack trains hauling supplies to Phantom Ranch, hikers, backpackers, National Park Service and concessionaire employees. The bridge also provides a pathway that is five feet wide. The structure is suspended from four 550-foot-long cables and stabilized by two wind cables. Unmodified since its original construction, the bridge remains in service today and has an estimated 100,000 crossings a year. **FBN**

## Transcript

### Dedication Ceremony for the Kaibab Trail Suspension Bridge as a National Historic Civil Engineering Landmark

#### Grand Canyon National Park

February 23, 2019

#### Jonathan Upchurch, P.E., PTOE, F. ASCE - Master of Ceremonies

Good afternoon. I know we have some members of the general public here - visitors to Grand Canyon National Park. Thank you for joining us. This is an event sponsored primarily by the American Society of Civil Engineers but with a tremendous amount of help and cooperation from the National Park Service and Grand Canyon National Park.

My name is Jonathan Upchurch. I'm a Corresponding Member of the American Society of Civil Engineers History and Heritage Committee. The American Society of Civil Engineers is a 150,000 member organization of civil engineers, many of them in the United States but also members in about 100 other countries around the world. The American Society of Civil Engineers – we are the folks who plan, design, build, operate, maintain, and manage all kinds of infrastructure – infrastructure that everyone in the public relies on every single day. We believe we are a “people-serving profession” through the work that we do.



## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

We are here today to dedicate the Kaibab Trail Suspension Bridge as a National Historic Civil Engineering Landmark. If you are new to the Park, or unfamiliar with the Park, it is possible to see the bridge from this vantage point – if you are over here closer to the wall. Maybe you can't see it if you are back on that side of the path. But you will have an opportunity to take a look when we finish up here, a little bit later.

This bridge was built across the Colorado River at the bottom of the Canyon in 1928. It was a tremendous challenge to design and construct this bridge because of its location. It is not easy to get to the bottom of the Grand Canyon. The bridge was designed so that all of the material – almost all of the material used in the bridge - could be carried down the South Kaibab Trail on mules. With the exception of some very long cables, everything else on the bridge is 10 or fewer feet long and weighs less than 200 pounds, so that it could be carried down by mule. There was a lot of innovation in terms of design and in terms of construction and that is what makes this bridge quite remarkable.

We have a cast of special guests here. There are some programs available. We have some programs available back here. Raise your hand if you would like a program, we will try to get one in your hands. We have a group of very special people who are here today to make remarks at our dedication ceremony. I will introduce the first two speakers because they are going to follow very quickly, one right after the other.

Robin Kemper is the elected President of the American Society of Civil Engineers. She lives in New Jersey. Thank you for coming here. We are delighted to have you with us representing ASCE at the national and international level. And, Lisa Carrico, the Deputy Superintendent of Grand Canyon National Park, here on behalf of the Park, representing the Park as part of this dedication ceremony. So, I would like to turn this over to ASCE President Robin Kemper.

### **Robin A. Kemper, P.E., LEED AP, F.SEI, F.ASCE – ASCE President**

Thank you, Jonathan.

Thank you so much for that warm welcome, and this beautiful warm day – right ? It's wonderful to be here and I am truly honored. I'm going to give a bit of history about our program and also the bridge and you will understand why it is such an honor to be here today and why this is an extremely special event.

For more than thirty years, ASCE has recognized civil engineering achievements that have played a unique role in the development of the world as Historic Civil Engineering Landmarks. To date, more than 200 projects worldwide have earned this prominent designation. That may sound like a lot, but 200 around the world? Here comes two hundred and one, give or take.

## Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge

As Jonathan said, we have 150,000 members worldwide, we are in 177 countries, or 90 percent of the countries in the world. So we have a very large reach in being that people-serving profession. As Jonathan said, we touch every single person, like every single day around the world with all that civil engineers do.

This Landmark program is a very elite group includes famous Arizona landmarks like the Navajo Bridge, the Theodore Roosevelt Dam & Salt River Project, and the Hohokam Canal System. So today's dedication is joining that illustrious and elite group in the state of Arizona.



In this ongoing program, ASCE's History and Heritage Committee nominates historically significant civil engineering projects and programs for recognition. I had the honor of just being in England in October. And there, the Institute of Civil Engineers – similar, our counterparts in England for the American Society of Civil Engineers – were celebrating their 200th anniversary. So we recognized them as a Historic Landmark – their program.

The Committee carefully reviews each nomination package and, when a project is determined to be deemed acceptable, they recommend it to the ASCE Board of Direction that that project be named by the Society as a Historic Civil Engineering Landmark. And those who have actively been involved with that process – and I believe that there a few of you here today - can tell you that it is not an easy task. You can go through this process and be turned down.

ASCE is proud to recognize the Kaibab Trail Suspension Bridge as a Historic Civil Engineering Landmark. Completed in 1928 and located within one of the seven natural wonders of the world,

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

the bridge was instrumental in developing backcountry recreation and providing a connection between the North and South Rims of the Grand Canyon. For the past 91 years, it has served mule-riding tourists, pack trains hauling supplies to Phantom Ranch, hikers, backpackers, and Park Service and concessionaire employees. It remains in service today, unmodified from its original 1928 construction.

As civil engineers, we take great pride in designing and constructing structures and sites that become legacies of our communities. The Kaibab Trail Suspension Bridge is a prime example of engineering innovation. The bridge is a 440-foot single-span suspension bridge crossing the Colorado River. Designed to carry mules and foot traffic, it provides a pathway five-feet wide. And for those who heard Jonathan's presentation just about an hour ago, the reason it was only five feet wide was to make sure those mules could not turn around and cause havoc. Four 550-foot-long suspension cables and two wind cables support and stabilize the structure.

Due to its remote location and incredibly difficult access through rugged terrain, constructing the bridge had a set of challenges unlike any of those other National Historic Civil Engineering Landmarks. Humans and mules transported the 122 tons – that's 122 times 2,000 pounds - in materials and supplies down the seven miles of trail because you could not access the bottom via any vehicular traffic – any vehicles.

Walking single file, 42 men, mostly Havasupai tribesmen, carried the one-ton – that's 2,000 pounds each, 550-foot-long suspension cables. Imagine that; 42 people carrying 2,000 pounds down seven miles. That's amazing. Engineering the bridge under such unfavorable conditions reflects on the resourcefulness and innovation of the civil engineers responsible for the project. To this day, the Kaibab Trail Suspension Bridge continues to be one of the few Colorado River crossings in this region. Except for a suspension bridge only one-half mile west [downstream], the Kaibab Trail is the only physical crossing of the Colorado River in 340 miles. It shows you how important this crossing is.

We would like to thank the Arizona Section of ASCE for nominating this structure as a Civil Engineering Landmark and for hosting this wonderful event. Civil engineers are not always in the spotlight, but the Kaibab Trail Suspension Bridge is an exception. With about one hundred thousand crossings each year, this landmark stands as a testament to the wisdom of civil engineers and the meticulous principles of engineering for many generations to recognize.

Let me also thank Grand Canyon National Park and the National Park Service and the Grand Canyon Historical Society. They have worked together, with ASCE, to recognize the importance of this bridge and to interpret the bridge's history for Park visitors.

Now, please join me in celebrating the dedication of the Kaibab Trail Suspension Bridge as an Historic Civil Engineering Landmark. I present this plaque on behalf of ASCE to the Grand Canyon National Park, which serves as steward of this remarkable civil engineering

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

achievement. Deputy Superintendent Lisa Carrico, please accept this plaque with our appreciation and gratitude.

[Landmark plaque is unveiled, applause]

Thank you very much.

### **Lisa Carrico, Deputy Superintendent, Grand Canyon National Park**

Good afternoon. It is so wonderful to be here in the sunlight in this gorgeous setting. I can't imagine a better place – maybe if the temperature was a little bit higher.

I am Lisa Carrico. I am the Deputy Superintendent for Operations here at Grand Canyon National Park. And it is my honor and a privilege to say on behalf of the Superintendent and staff at Grand Canyon, welcome.

I want to thank all of you who had a hand in making today possible. I would like to start, if you don't mind, with members of my staff. Thank you all so much for the work you do each and every day and for the work you did today to make sure that this went well.

I don't know for certain how many people, but I would say hundreds of people, were involved in the efforts to formally recognize the Kaibab Suspension Bridge and I want to recognize those efforts and to thank you. They will assure that all who come to Grand Canyon have an opportunity to learn more about the importance of a bridge as significant as this in terms of



## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

American engineering history. Last year we had almost 6.4 million visitors come to the National Park. Think how many of those people will come here, will see this plaque, and will be able to take a peek over the edge and see that little black “toothpick” lying across the River down there. Know that the efforts that you made to make sure that we memorialized this bridge will serve for years and years to come.

As has already been mentioned, but I think it’s important, because we in the National Park Service take very seriously service to our visitors. The 1928 completion of the Kaibab Bridge changed the tourism scene in the Inner Canyon by connecting the trails between the North and South Rims and making safe passage across the Colorado possible for both mules and people. For forty years, until the Silver Bridge was constructed just a little ways downriver in the late 1960’s the Kaibab Bridge was the only access for hundreds of miles. To this day it remains critical in terms of allowing people, supplies and materials for those who traverse the Bright Angel and North and South Kaibab Trails.

I want to close by saying on behalf of the National Park Service and Grand Canyon we gratefully accept this plaque commemorating the Kaibab Suspension Bridge as a Civil Engineering Landmark and we look forward to the placement of the plaque down in the Canyon by the bridge in the very near future.

Thank you very much. (Applause)

### **Jonathan Upchurch**

Thank you, Deputy Superintendent Lisa Carrico.

Next, I would like to introduce the President of the Arizona Section of the American Society of Civil Engineers for some brief remarks – Ted Smithwick.

### **Ted Smithwick, P.E., President, Arizona Section ASCE**

Thank you, Jonathan, much appreciated. And, again, I am the President of the Arizona Section of ASCE. We’re incredibly grateful for this prestigious Landmark designation, and as discussed today, the design and construction of this bridge was done by civil engineers under Park and National Park Service’s civil engineers at both the Park and national level.

We would not be here today if it was not for the commitment of these civil engineers. Thank you again to Jonathan Upchurch for your ongoing dedication to this event. I admire you for your service and devotion to your community.

## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

Thank you to Robin Kemper for travelling here to this event. We tried to give you warm weather. It didn't quite work out.

Lastly, a call to action for everyone here today while we are celebrating the hard work and dedication of engineers who worked on this project, I would like to remind everyone of a daily and long-term goal we all have, and that is to inspire and encourage the youth of today to build a better world for the youth of tomorrow. It's amazing how listening to others and just a few words of encouragement can inspire a lifetime of learning and accomplishment.

Thank you again from the ASCE Arizona Section. (applause)

### **Jonathan Upchurch**

Thank you, Ted. And I would now like to introduce Dave Mortenson. He is President of the Grand Canyon Historical Society. For those of you who may be here visiting the Park – the general public – the Grand Canyon Historical Society has had, for the past three days, a Grand Canyon History Symposium, sponsored by the Historical Society. Dave.

### **Dave Mortenson, President, Grand Canyon Historical Society**

You know, I am going to represent the users of that bridge. These [the civil engineers assembled here today] are the builders, the designers. But before I do that I want to share a story. That bridge has caused my only granddaughter, who lives in Tokyo, in 2011 we did a river trip [through the Grand Canyon]. She got on that bridge and was asking all these questions about it. And I visited her over Christmas. She is a senior in high school and I said, "What are you going to do?" She said, "I'm going to college and I'm going to become a civil engineer." (applause)



## **Final Report      Dedication Ceremony for the Kaibab Trail Suspension Bridge**

I didn't plan that, that's just serendipity, but that bridge caused it. And she was so mesmerized by that bridge. We had a river trip, and that's one thing Robin didn't mention. River runners use that bridge a lot. First of all, it's a spiritual thing, because, when you come down the river, there's only one other thing you see that's manmade and that's the Desert [View] Watchtower. You get to that bridge and you know there's some nice lemonade right up that canyon. (laughter)

A lot of river trips do exchanges there. So people hike in and hike out, and that bridge is the vehicle by which you can do that, and it's just wonderful. I experienced that when I was 13, before the [Glen Canyon] Dam. This was a wild river. When we hit that spot, it was like there are people in the world still left.

But it's an honor for our organization to be really pleased to help with this project because it's not easy to get something designated, as Robin said. And I know the people in Arizona have worked really hard, and I appreciate that. The point is, this bridge represents so much history, and so much future history because so many people are going to be using this bridge in many ways, and we have mules who will use it too. I'm really honored to be part of this celebration. Thank you. (applause)

### **Upchurch**

Thank you, Dave. And I want to thank you individually because of your agreement that we would do this as a joint event - that we would do the dedication ceremony in concert with the Fifth Grand Canyon History Symposium. Thank you very much.

I want to ask again, just briefly, as I did earlier this afternoon, are there any members of the Havasupai Tribe who are with us this afternoon? Okay, thank you. [there were none present] As I mentioned earlier this afternoon in a different presentation, the Havasupai Tribe did play a role in the construction of this bridge. I mentioned that almost everything on this bridge was carried down on the backs of mules. The exception was the four very heavy suspension cables, each 550 feet long and, as Robin said, each one weighing more than a ton. They were carried down by 42 men, mostly members of the Havasupai Tribe. It was like a giant centipede. They spread themselves out along 550 feet of cable, evenly spaced, and they wound their way down the South Kaibab Trail to deliver that part of the bridge down to the bottom of the Canyon. The Havasupai Tribe, the native Americans, they are very connected with this region. This is their original home. They did play a role in building the Kaibab Trail Suspension Bridge.

Is there anyone else here who would like to add any particular remarks to our ceremony this afternoon?

Please introduce yourself.

**Fred Nelson**

I'm Fred Nelson. I'm a [ASCE] Region Governor from Arizona, assigned to Alaska. We have Larry Magura here from Oregon, who is assigned to Arizona. We love Larry. He is a native Arizonan now. We have Brent Borchers – where's Brent? – Brent's another Arizona Governor. He's assigned to Hawaii. He's got some seniority.

I just wanted to say that if you look at the map here [in the printed program] all seven of these monuments [ASCE Historic Landmarks in Arizona] have something to do with the Colorado River system. Five of them are on the Colorado River and two are on the Salt River. Isn't that something? I was the [Arizona Section] Historian when we did the Hohokam Canal System, and that was a marvelous thing – we did that in the early 90's. 700 miles of canals built by the Hohokams.

And then the other two monuments that we tried to get were the Grand Canyon Railroad which some of you have ridden on, and the Ash Fork – Bainbridge Steel Dam. So those are two state monuments. They weren't successful in becoming national ones (ASCE Historic Landmarks), so we made them state ones. Thank you. (applause)

**Mark Lamer**

Hi everyone, I'm Mark Lamer, I'm a Past President of the Arizona Section. I was part of a group of four that originally filled out the paperwork to start this process four or five years ago – I can't remember exactly how long. But the one thing I just wanted to say is this would not have happened without Jonathan Upchurch. So, I want to give really big a round of applause for Jonathan and thanks for doing this. (applause)

**Jonathan Upchurch**

Thank you all for joining us. You are welcome to do photo ops - photos of the plaque, all of our dignitaries who are here today. Again, thank you. Enjoy the day.