American Segmental Bridge Institute
ASBI
Segments
advancing the industry

volume 64
Spring 2021

A Message from the President

Editorial by
Elie Homsi
ASBI President
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past.
present.
future.

LIGHT AT THE END OF THE COVID TUNNEL.

As 2020 has come to a close, a very unusual year to say the least, there is hope the COVID-19 pandemic is headed in the right direction—fewer people being infected and death rates going down. Now that vaccines are approved, being produced in large quantities, and vaccination centers being established to get as many people vaccinated as possible, there is a brighter outlook for 2021 though will most likely be the end of summer, early fall before we know if we're truly going to beat the virus and its various mutations.

We are feeling positive about the outcome and are planning accordingly.

I will be serving as ASBI's President for the next two years and believe there will some new challenges before us as the country begins to reopen and businesses begin to recover. The economy is refocusing its priorities, ~~this will be~~ an opportunity for ASBI to grow into some new areas of the concrete segmental bridge industry with some focus on operations and maintenance of segmental structures. With the current trends to funding sustainable and environmentally friendly initiatives, we should also explore promoting segmental bridges as a Green solution and exploring new applications for the segmental industry in the renewable energy sectors.

In 2020 we held our first and hopefully last virtual conference. It was a success. The presentations, the attendance and the engagement were beyond our expectations. Our preferred plans would have been to meet in person in beautiful Austin, enjoy some great barbeque, and be able to network and visit with friends and colleagues like we had done for the past 31 years. However, 2020 had different plans for us, and COVID forced us to explore new technologies to hold the conference while respecting local ordinances and keeping everybody safe. Lots of credits go to Gregg and Ingrid for being trailblazers and adapting to the 2020 reality and figuring out how to migrate the conference, as well as our various seminars and activities, to a virtual platform. Special thanks go to Steven Byars as well for chairing the conference and lining up great speakers.

The only missing component of the conference was the in-person interaction that no virtual setting can replace. We are exploring venues to improve on this experience should we be forced to hold another virtual conference in the future.

The 33rd Annual Convention will be held November 8-10 at the Westin La Paloma Resort and Spa in Tucson, Arizona. It will be an in-person event and all CDC guidelines for hosting events will be in place for all attendees. The committee meetings will be held virtually the week before the start of convention in order to allow for more attendance as well as scheduling with no overlap of meetings. The general session will begin at 1:00 p.m. on Monday, November 8, which is a change from previous convention schedules. This will allow for two full days of presentations over three days, with a Tuesday luncheon for presentation of the Bridge Award of Excellence to

Continued on page 3

Due to the ongoing Coronavirus (COVID-19) situation, ASBI events ~~are on hold until further information is provided regarding reopening of businesses and updates on travel restrictions by Federal and State governments.~~ Please check the Events website for further information.

April 2021

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	**12**	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

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Grouting Certification Training Webinar

Training necessary to understand and successfully implement grouting specifications for post-tensioned structures.

June 2021

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20	21	22	23	24	25	26
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7

Construction Practices Seminar

The 2021 Construction Practices Seminar will be held at the Marriott Seattle Airport.

November 2021

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	**8**	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

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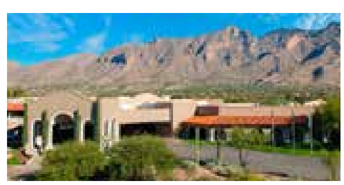
ASBI 33nd Annual Convention (Tucson, AZ)

Join us at the Westin La Paloma Resort and Spa for the 33nd Annual ASBI Convention.



ASBI 33rd Annual Convention and Committee Meetings

MARK YOUR CALENDAR

ASBI 33rd Annual Convention and Committee Meetings to be held at the The Westin La Paloma Resort & Spa November 8-10, 2021

Please see Events at *www.asbi-assoc.org* for further information.

At this time, ASBI is planning on a live event. If the COVID-19 pandemic continues to require travel limits and social distancing, we will again host a virtual event.

Follow us on

Photo Courtesy of Jim Henson.

Photo Courtesy of Caught in the Moment Photography.

Photo Courtesy of Shutterstock.

Continued from page 1

recipients as well as a keynote address. There will be an exhibit hall for vendors who would like to showcase their products and services. You may check the ASBI website for more information as it becomes available. Stay tuned for updates.

ASBI continues to offer grouting training webinars, with two classes completed this year – one in February for Bridging North America, and one in March for the City of Los Angeles. The next webinar will be held on April 12, with instructors available throughout the presentations for live Q&A. Registration is open and you can go to https://www.asbi-assoc.org/index.cfm/grouting/training for more information and online registration.

The Seminar for Construction Practices of Segmental Concrete Bridges is scheduled for June 7-8 in Seattle, Washington. For more information and to register online, please go to: *www.asbi-assoc.org/index.cfm/events/seminar*. Please note that this seminar may be rescheduled if the CDC is still recommending limited travel as well as postponing in-person events.

There are three new manuals being developed by the Education Committee: Concrete Segmental Bridge Design, Operations and Maintenance, and Guidelines for Design and Construction of Segmental Bridges for Rail. The Concrete Segmental Bridge Design Manual is in the editing phase and the committee is planning on manual completion by the end of this year.

I look forward to working with all of you over the next two years and hope to see you in person at one of our events.

Stay safe and prosper

Elie Homsi
ASBI President

communication news

Grouting Certification Training

2020

There were 4 webinars held in 2020:

APRIL: 109 Attendees and 8 Certified as Technicians

JUNE: 11 Attendees

~~**July:**~~ 22 Attendees with 1 Certified as Technician

DECEMBER: 24 Attendees

2021

The next webinar will be held April 12. For information and registration, go to the ASBI website, Grouting Certification tab and 2021 Certification Training.

Moved and Have a New Address?

Please let us know if you have had an address change so we may update the information on the ASBI website as well as the mailing list. Don't forget to include new telephone, as well as e-mail address. You may send any updates to *info@asbi-assoc.org*.

New 2020-2021 ASBI Organizational Members

WE ARE PLEASED TO WELCOME THE FOLLOWING NEW MEMBERS TO ASBI:

New Academic Members

Fatmir Menkulasi
Wayne State University

Julian Yamaura
University of Washington

New Professional Members

Doug Dixon
Doug Dixon & Associates, Inc.

Paul Nehme
FSA

Ahmed Eraky
RTA

Victor Sanchez
WSP USA, Inc.

Su Hao
ACII, Inc.

Brett Sauter
Ciorba Group, Inc.

New Student Members

Alvaro Mendoza Grisales
University of Florida

Santosh Humagain
University of Toledo

Nicolous Halverson
University of Florida

Jonathan Jiannuzzi
University of Florida

New Transportation Official Members

Krishnakant Andurlekar
Caltrans

Xiangyang Fu
Caltrans

Sebastian Barajas
Caltrans

Monthly Webinars

ASBI will be offering monthly webinars beginning in March:

MARCH 31, 12:00 – 1:00 P.M. CST
What Have We Learned from 10 Years of Data on the New I-35 Saint Anthony Falls Bridge in Minnesota?

APRIL 28, 12:00 – 1:00 P.M. CST
How is the First Segmental Bridge in the U.S. Performing? An Update on the JFK Causeway.

All webinars are free of charge, but you must register to attend.

Go to the ASBI Events page and follow the link to the Monthly Webinars for more information and to register.

In his 41st year of service with Watson Bowman Acme, Steve Pabst has announced his retirement at the close of 2020.

In 1979, Steve began his career with the founding business, Watson Bowman Associates, then located in the heart of Buffalo, NY. He was hired by industry pioneers Stewart C. Watson and Thomas C. Bowman.

His first major assignment was Product Manager for the recently developed Wabo®Crete, Elastomeric Concrete product line. Experiencing successful trial installations with the New York Thruway Authority and Port Authority of NY&NJ, product acceptance and market utilization rapidly hit the mainstream throughout the US and Canadian bridge markets.

Across decades of company mergers and acquisitions, Steve accepted a variety of national product and sales management roles, with an eventual appointment in 2003 as Watson Bowman Acme Sales Department Manager for North America. Within this role, he became responsible for oversight of sales growth and sales organization expansion across WBA's three key Business Sectors of Bridge, Architectural, Parking and Stadium.

His product application, technical knowledge and market influence are evidenced on some of the largest bridge infrastructure projects throughout North America.

Steve is a co-patent holder, published author, and active ASBI organization Board of Directors and Committee Member. A longstanding supporter of ASBI, he has capably served the organization and Watson Bowman Acme, which is best illustrated by his many longstanding and trusted business relationships across the sprawling infrastructure construction marketplace.

On behalf of the entire Watson Bowman Acme organization, we wish Steve all the best as he moves on to the next chapter of his life.

Have news to share?
THEN TELL US!
Whether you have moved and need to update your information or have a story idea for an upcoming newsletter email us at info@asbi-assoc.org.

ASBI Construction Practices Handbook

Interested in learning about the construction of segmental concrete bridges? The 3rd Edition of the Construction Practices Handbook is available for FREE download at *www.asbi-assoc.org/index.cfm/publications/publications.* There have been ~~420+~~ downloads of this publication since it became available in July 2019.

This "How-To Handbook" was developed to provide guidance for construction of concrete segmental bridges. Although the segmental construction concept is generally very simple, the construction technology involved is, in numerous ways, more demanding than that required for other types of technology used in the industry. The use of concrete segmental bridge construction continues to grow throughout the United States and Canada. Increased use of this technology has led to a need to provide industry standard information for use by contractors, inspectors, quality control staff, and owners. In the interest of educating the industry, sharing best practices, and standardizing methods, this handbook is intended to provide a basic understanding of segmental construction technology. The overall goal is to facilitate the construction process, avoid common difficulties previously encountered, and reduce impacts to projects. This handbook is intended to be an industry guide aimed at focusing on specific aspects of the technology based on past experience.

convention news

2020 ASBI Virtual Convention

The 2020 ASBI Virtual Convention was held on October 27-28. Due to COVID-19 we had to shift from a face-to-face event in Austin to a live virtual event. There were 186 attendees with 114 DOT attendees of which 87 were first-time attendees.

The focus was on Technology & Innovation with Joseph Kopser serving as MC for the event. Thank you to all the presenters who made this event possible.

THE 2020 BIENNIAL LEADERSHIP AWARDS WERE PRESENTED TO:

– **Timothy Barry** – *RS&H, Inc.*
Outstanding Career Contributions Providing Leadership in Design and Construction Support for Concrete Segmental Bridges

– **Matthew Chynoweth** – *Michigan Department of Transportation*
Outstanding Career Contributions Providing Leadership in Advocating the Benefits of Concrete Segmental Bridges

– **Gowen Dishman** – ~~HNTB Corporation~~
Outstanding Career Contributions Providing Design, Construction, and Advancement of Concrete Segmental Bridges

– **Shahid Islam** – *DYWIDAG-Systems International USA, Inc.*
Outstanding Career Contributions for the Advancement of Successful Concrete Segmental Bridges

– **William J. "Jay" Rohleder, Jr.** – *FIGG*
Outstanding Career Contributions Providing Construction Engineering Services for Concrete Segmental Bridges

– **Patrick Malone** – *PCL Construction Enterprises, Inc.*
Outstanding Service and Leadership as ASBI President for 2019 and 2020

Pictured (left to right): Timothy Barry, Matthew Chynoweth, Shahid Islam, William J. "Jay" Rohleder, Jr., Patrick Malone. ~~Photo courtesy of ?????????~~.

2020 Virtual Convention Sponsors

ASBI Would Like to Thank the Following Organizational Members for Their Sponsorship of the 2020 Virtual Convention

GOLD

ALLPLAN FINLEY Engineering Group wsp

Thank You for Your Continued Support of ASBI During the 2020 Pandemic.

2020 ASBI Virtual Convention Vendor Webinars

We would like to acknowledge the following ASBI members who provided Vendor Webinars leading up to the start of the 2020 Virtual Convention:

- Allplan, Inc.
- R.J. Watson, Inc.
- RS&H, Inc.
- Structural Technologies VSL
- Watson Bowman Acme

We would like to thank these members for supporting ASBI during the 2020 pandemic.

Director's Corner

Gregg Freeby
Executive Director, ASBI
gfreeby@asbi-assoc.org

Greetings all! With 2021 well underway it's perhaps a great time to not only look back over our shoulder a bit but also look forward to the coming months.

Last year was unique for all of us. As an organization, ASBI was able to flex to deliver our content entirely online. This included grouting training, flexible filler training, a segmental bridge construction webinar series, committee meetings and our first ever Virtual Convention. All of our online events had strong participation from our members and partners. For me, the most significant was participation we had at our Virtual Convention by DOT staff and academia. We had 42% of our attendees from DOT staff and 5% from academia. This was nearly half of all attendees and represents our owners and decision makers as well as our future workforce. With a virtual event we were able to reach a much more diverse audience than with our traditional in-person event. This will give us new ideas as we imagine what the 2021 Convention will look like.

Coming off the momentum from last year, we are ready to begin hosting monthly webinars relevant to segmental bridging technology. Each webinar will be held the last Wednesday of each month from 12:00 – 1:00 p.m. Central Time.

We will start on March 31st with "What Have We Learned from 10 Years of Data on the New I-35 Saint Anthony Falls Bridge in Minnesota?" The presenters will be Kent Montgomery, FIGG, and Chris Burgess, FIGG. Then on April 28th, Brian Merrill with WJE will make a presentation titled "How is the First Segmental Bridge in the U.S. Performing? An Update on the JFK Causeway." Our May offering is in the planning stages but will likely be a lesson learned project feature on the Canadian River Bridge in Logan, New Mexico.

We are working on a way for folks to subscribe to our webinar announcements, but in the meantime you can check for the Monthly Webinars under the Events Tab on the ASBI Website for registration and more information: *www.asbi-assoc.org/index.cfm/events/MonthlyWebinars*.

The ASBI office came through Winter Storm Uri in Texas unscathed. A week of temperatures well below freezing, including several nights in single digits, five inches of snow followed by an ice storm is something we were just not ready for in Texas. Despite the intermittent power and water outages we were able to successfully deliver an online session of our grouting certification training for the Bridging North America team. Definitely a week that won't soon be forgotten by many of us.

In closing, I hope this message finds you, and those close to you, staying healthy and perhaps at least a little optimistic about what the rest of 2021 has in store for us.

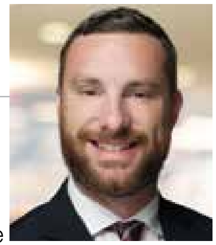
Stay safe,

Gregg Freeby

Follow us on

committee news

COMMUNICATIONS & MEMBERSHIP



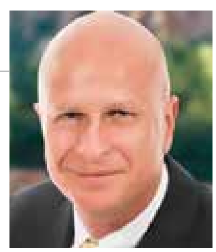
Cory Rogers, Chair
RS&H

~~Mr.~~ Corey Rogers with RS&H has agreed to serve as the new Chair of the combined committee. A special thanks to ~~Mr.~~ Mark McRobie for his leadership of this group over the past few years is in order. Thank you, Mark.

The committee is working with the ASBI staff to further our Social Media Campaign efforts. To that end, ASBI has contracted with a Social Media Manager to augment our staff in this area and to gain additional expertise.

The work by Dr. Andrea Schokker and her staff at the University of Minnesota Duluth to take over the creation of the ASBI Segmental Database and Durability Report continues to advance. A 'members only' version of the database will be released in the coming weeks to allow our membership to ~~make a~~ critical review and provide comments on the work done to date.

EDUCATION



Patrick Malone, Chair
PCL Civil Constructors, Inc.

Ken Price serves as the Design Subcommittee Chair and has been working with great dedication towards the goal of completing the new ASBI Planning and Design Manual. This manual is in a final first draft phase and is going through an integrated review of the entire document by a number of experts within the committee as well as contracted resources. The group is always open to a fresh set of eyes on this draft. Please contact Ken Price (Kenneth.Price@wsp.com) or the ASBI office (info@asbi-assoc.org) if you, or someone you know is interested in this opportunity.

The Operations and Maintenance Subcommittee under the leadership of Brett Pielstick continues to advance the first draft of an Operations and Maintenance Manual. A first draft of this document is expected later this year.

Tim Barry continues his leadership of the Construction Practices Work Group. As a reminder, this group authored the 3rd Edition of the Construction Practices Handbook which has been published and is available for electronic download directly from the ASBI website at: *www.asbi-assoc.org/index.cfm/publications/handbook-download*

This work group is also planning a Construction Practices Seminar to be held in person in Seattle, Washington, on June 7-8. Details including registration can be found under the Events tab on the ASBI website: *www.asbi-assoc.org/index.cfm/events/seminar*

Greg Hunsicker is the Chair of the Grouting Work Group. This group will be hosting a session of the Grouting Certification Training via webinar on April 12. Details for this event can also be found on the ASBI website.

TECHNOLOGY & INNOVATION

Greg Shafer, Chair
Parsons

This committee and its associated subcommittees continue to be very active with regular meetings. The Construction Subcommittee, under the leadership of John Dunham, continues to work with the latest advancements in flexible fillers, joints, and the use of CRFR.

Kent Montgomery's Design Subcommittee is active in several topics. A working group of the committee drafted a Working Agenda Item regarding creep and shrinkage formulations for segmental bridges for the AASHTO T-10 Committee. The T-10 Committee used this draft as a starting point for WAI 216A, which will be balloted in 2021. Another working group is investigating the advantages of UHPC for segmental bridges. The subcommittee is beginning to look at the effect of NCHRP Report 906 on minimum reinforcing requirements.

Jeff Pouliotte's M&O Subcommittee authored a segmental load rating problem statement that was recently approved by AASHTO for funding. The NCHRP is working on awarding a contract to a research agency to be announced soon. The committee is also monitoring developments with electrically isolated tendons and corrosion inhibiting materials.

2021 – 2022
ASBI EXECUTIVE COMMITTEE

The following ASBI members were approved by the Board of Directors to serve on the Executive Committee for 2021-2022:

- Elie H. Homsi, *President*
- John A. Corven, *Vice President*
- Steven Byars, *Secretary/Treasurer*

Members:

- Matthew Chynoweth
- Sam Fallaha
- Gregory Hunsicker
- Mike Kiggins
- Patrick L. Malone
- Andrea Schokker

Sam Fallaha, Gregory Hunsicker, and Andrea Schokker are serving as new members on the Board.

ASBI would like to thank Mike Keever, Barton Newton, and Guido Schwager for their many years of service on the Executive Committee as they step down.

ASBI 33rd Annual Convention and Committee Meetings

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project news

~~Caption (~~Photo courtesy of FINLEY Engineering~~)~~

OWNER
City of Edmonton

DESIGNER
Arup

CONTRACTOR
American Bridge

CONSTRUCTION ENGINEERING SERVICES
FINLEY Engineering Group, Inc.

CONSTRUCTABILITY REVIEW/ ESTIMATING SERVICES AND PREBID/PRELIMINARY DESIGNER
American Bridge

CONSTRUCTION ENGINEERING INSPECTION
American Bridge/TransEd / Arup / City of Edmonton

FORM TRAVELERS FOR CAST-IN-PLACE SEGMENTS
Aluma Systems

ERECTION EQUIPMENT
Aluma Systems

POST-TENSIONING MATERIALS
VSL International

STAY CABLE MATERIALS
VSL International

BEARINGS
Watson Bowman Acme

EXPANSION JOINTS
Watson Bowman Acme

PREPACKAGED GROUT
SIKA

The Tawatinâ Bridge

THE SIGNATURE EXTRADOSED BRIDGE OF THE EDMONTON VALLEY LIGHT RAIL EXTENSION

The new Tawatinâ Bridge spans the North Saskatchewan River and is a part of the new multi-phased Edmonton Valley Line extension. The 27-km rail Valley Line route will ultimately run southeast to west, from Mill Woods to Lewis Farms crossing, through Edmonton's downtown core and will carry an estimated 100,000 daily commuters.

The new light rail transit (LRT) bridge is a three-span (100-m, 110-m, 50-m) asymmetrical, extradosed bridge consisting of two lines of light rail transit. An 8-m wide x 208-m long shared-used path (SUP) is suspended below the concrete superstructure. The substructure consists of an abutment on the north end, two piers of 25-m (Pier 2) and 9-m height (Pier 3), and a 58-m tall pylon (Pier 1) with two 30-m pylon legs. The superstructure is a 11.7-m wide x 3.4-m tall multi-web box girder with 39 total segments cast, two closure segments, one abutment segment, and a 58-m long cast-in-place (CIP) portion (Span 3). There are 7 pairs of stay cables, each with 40 strands, that go through a saddle system within each leg of the pylon. Over 12,400 tonnes of concrete is used for the construction of the bridge.

The superstructure is a 11.7-m wide x 3.4-m tall multi-web box girder with 39 total segments cast, two closure segments, one abutment segment, and a 58-m long cast-in-place (CIP) portion.

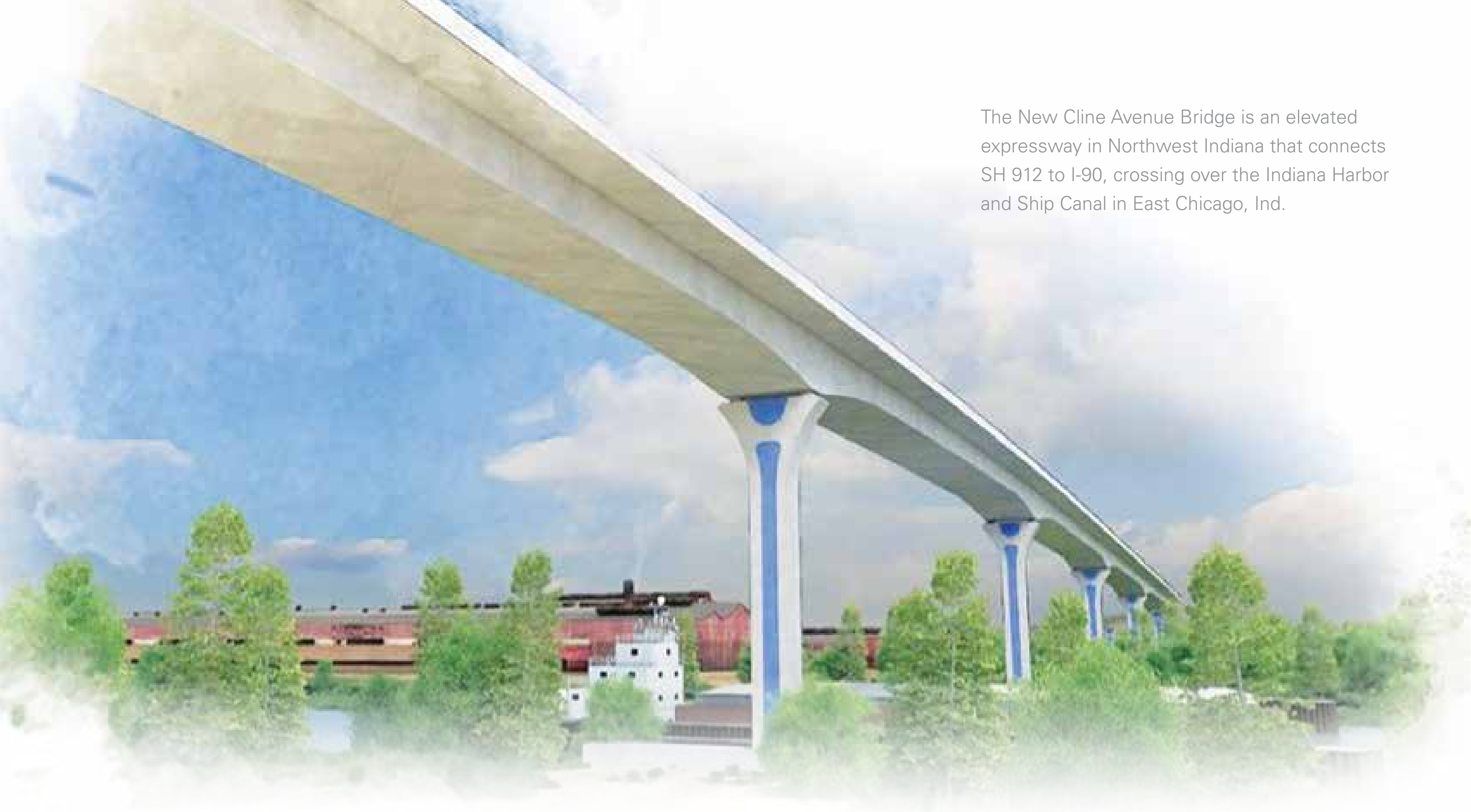
Spans 1 and 2 of the Tawatinâ bridge was constructed using a cast-in-place balanced cantilever method with moveable form travelers (MFT) from the Pier 1 Pylon. Beyond the first 6 pairs of cantilever segments, the casting cycle for each segment is as follows: launch MFT forward, cast leading segment with stay anchorage system, perform 1st stage stressing of stay cable, 2nd MFT launch, cast next segment, perform 2nd stage stressing of stay cable, 3rd MFT launch, and repeat cycle. The Span 3 CIP portion was cast on temporary falsework.

In mid-September 2020, the final closure segment between Spans 2 and 3 were cast by American Bridge with great success, achieving within 3-mm of the target theoretical setup elevations. Following the closure, both moveable form travelers were removed from the superstructure and all continuity post-tensioning was stressed and grouted. In addition, portions of the rail track system and rail plinths have been installed along with the permanent collision barriers by both American Bridge and TransEd. Currently, American Bridge is erecting the SUP structure using a rolling trolley system, designed with **FINLEY**, that is underslung from the superstructure. The future construction tasks include the installation of the trackwork for the light rail system, remaining deck barrier systems, and concrete finishing. The construction of the Tawatinâ Bridge is expected to be completed by the summer of 2021.

American Bridge is the Contractor of TransEd Partners for the construction of the Tawatinâ Bridge with **FINLEY** Engineering Group as their Specialty Engineer. The owner of the Tawatinâ Bridge is the City of Edmonton. All photos are credited to American Bridge.

~~Caption~~

~~Caption (Photo courtesy.)~~



The New Cline Avenue Bridge is an elevated expressway in Northwest Indiana that connects SH 912 to I-90, crossing over the Indiana Harbor and Ship Canal in East Chicago, Ind.

OWNER
United Bridge Partners

OWNER'S ENGINEERS
TransSystems

DESIGNER (SUPERSTRUCTURE)
FIGG

DESIGNER (SUBSTRUCTURE)
FIGG

DESIGN-BUILD TEAM
FIGG Bridge Builders

CONTRACTOR
FIGG Bridge Builders

CONSTRUCTION ENGINEERING SERVICES
FIGG

CONSTRUCTABILITY REVIEW/ ESTIMATING SERVICES
Armeni Consulting Services

CONSTRUCTION ENGINEERING INSPECTION
FIGG Bridge Inspection

PRECAST PRODUCER
Cline Precast, LLC (A FIGG Company)

FORMWORK FOR PRECAST SEGMENTS
Ninive

ERECTION EQUIPMENT
FIGG Bridge Builders

POST-TENSIONING MATERIALS
Structural Technologies VSL

BEARINGS
Cosmec

PREPACKAGED GROUT
Euclid Chemical Company

Cline Avenue Bridge

CONSTRUCTION OF THE NEW CLINE AVENUE BRIDGE OVER INDIANA HARBOR AND SHIP CANAL, EAST CHICAGO, IND.

W. Jay Rohleder Jr., P.E., S.E., Project Manager, FIGG Bridge Builders

This connection on the eastern side of the Chicago metropolitan region accommodates significant interstate truck traffic and provides a vital link to important commercial industries and employment centers along the Lake Michigan shoreline. The new bridge replaces a structurally deficient bridge that was closed in November 2009 and then demolished by the Indiana DOT. At the time, approximately 35,000 vehicles per day were using the bridge.

Since traditional state funding was not available to replace the bridge, the design, construction, operation and maintenance of this new bridge is privately funded without using any federal, state or local tax dollars. The replacement bridge will be supported by user fees (tolls) and is configured to accommodate current and future traffic. The bridge is positioned in the existing right-of-way with room to build a future twin bridge when warranted by traffic growth. A modern all-electronic open-road tolling system will create a user-friendly experience for bridge travelers.

The segment reinforcement cages are pre-tied in temporary jigs outside the precast building and pushed on carts inside along an innovative rail system. (Photo courtesy of FIGG.)

The New Cline Avenue Bridge construction uses local materials and local union labor which enhances economic opportunities in the area. The construction provides over 300 local jobs. Transportation will be improved in Northwest Indiana while achieving environmental stewardship with features such as sustainable concrete materials, long open spans and low energy LED lighting.

Construction of the bridge started on July 10, 2017, and opened to the public in December 2020. The bridge is 6,236 ft long with a 316 ft main span over the Indiana Harbor and Ship Canal, providing 100 ft of vertical and 200 ft of horizontal navigational clearance. The superstructure is composed of sustainable post-tensioned concrete single-cell box girders designed with low-maintenance features for a 150-year service life. The overall project is 9,850 ft long, which includes connecting the new concrete segmental bridge with a 2,400-ft-long adjacent existing steel beam bridge with construction rehabilitation being achieved concurrently.

The New Cline Avenue Bridge is comprised of 29 spans and 28 piers, with typical spans that vary between 170 ft to 290 ft. The piers vary in height from 24 ft to 86 ft. The substructure is founded on 16-in.-diam. open-end steel pipe piles. The top 20 ft of the pipe piles are filled with cast-in-place concrete and doweled into the footings. As an environmentally sensitive feature, the footings were placed mostly above ground with an attractive shape in order to avoid dewatering with a high-water table over land and not disturb the underlying soils. The webs of the trapezoidal superstructure cross-section taper down to a narrow width at the top of the pier cap to allow an elegant aesthetically shaped pier. The tapering pier shapes also include an inset reveal that will be stained with blue to enhance the overall attractive draw of development and users to the bridge.

The superstructure is 46 ft wide at deck level to accommodate two 12-ft lanes with 9-ft shoulders. The precast box girder varies in depth from 9 ft to 14 ft with 16 constant-depth spans and 13 variable-depth spans. Because the pier locations and spans were designed to coincide with the previous bridge piers, the end span lengths of the resulting units require mid-span expansion joints. There are three mid-span expansion joint locations along the bridge that include large structural steel expansion beams that slide on elastomeric bearings within the core of the adjacent cantilever ends of the box girders.

The precast box girder segments are cast with a custom-designed concrete mix that provides a high-strength, low-permeability (< 1,000 coulombs) superstructure. The superstructure is biaxially compressed with transverse and longitudinal tendons along the span to provide redundancy and durability. The deck includes extra thickness that is precast with the segments to provide an integral wearing surface that uses high-strength concrete cured in a factory-quality setting.

WORKING TOGETHER

The bridge design and construction has progressed through significant stakeholder coordination for local CN and IHB Railroads, City of East Chicago building permits, Indiana DOT adjacent roadway connections, Federal Aviation Administration (given close proximity to the Gary, Ind., airport), Indiana Department of Natural Resources, Indiana Department of Environmental Management, State Historic Preservation Office, U.S. Coast Guard and U.S. Army Corps of Engineers, and local electric and gas service utilities.

The precast superstructure segments are cast in a yard located on the Cline Avenue Bridge property. There are four total casting cells on the project. Three cells are used to cast typical box girder segments inside an 82-ft-wide by 300-ft-long by 58-ft-high casting building that was erected for the project. This has allowed segment casting to continue throughout the winter in Northwest Indiana. A fourth cell is located outside the building for casting the heavier pier segments, which are not affected by the

The precast box girder segments are cast with a custom-designed concrete mix that provides a high-strength, low-permeability superstructure.

There are four total casting cells on the Cline Avenue Bridge project. Three cells are used to cast typical box girder segments inside a casting building that was erected for the project. (Photo courtesy of FIGG.)

schedule. The segment reinforcement cages are pre-tied in temporary jigs outside the building and pushed on carts into the building along an innovative rail system. Overhead cranes inside the building lift and set the cages into the forms in the casting beds. The segments are match-cast to each other, and then individually rolled out of the building and transported into storage with a yard straddle crane until needed for span erection. The segment production goal is to precast one segment in each bed every day, and this rate of erection has been regularly achieved. There is a total of 685 segments for the project that weigh between 65-90 tons each. As of February 2019, 60% of the segments had been precast and placed into storage. Superstructure segment erection started in March 2019.

The segment production goal is to precast one segment in each bed every day.

Assembly of the bridge superstructure represents the final major step in the construction schedule and is performed using the balanced cantilever method of precast segment erection. For this method, **FIGG** Bridge Builders (**FIGG**) designed, fabricated and assembled temporary structural steel towers around the permanent piers to support the superstructure pier segments and typical segments during cantilever construction. Adjacent cantilevers are erected outward from the piers until they are within approximately 4 ft of each other at mid-span where a cast-in-place closure is placed and continuity tendons stressed across the joint to complete the spans. There are 28 cantilevers and 28 closure joint pours between cantilevers to complete the entire bridge. The spans are easily accessed for erecting segments with ground-based cranes. Erection is being performed at two headings using two separate large-capacity cranes to lift and set the cantilever segments. Only one 316-ft span will need to be erected with marine operations over the Indiana Harbor and Ship Canal. Approximately one-half of the segments are delivered to the cranes by the straddle lift on the west side of the project. Once erection progresses across the canal, the remaining precast segments will be transported to the other side of the canal to complete erection of eastside spans and connect the New Cline Avenue Bridge to the adjacent existing steel-beam bridge.

INNOVATION

One advanced technique being used for quality control by the project team is concrete maturity sensors to monitor the curing of cast-in-place footings and precast superstructure segments. The maturity sensors

A casting bed inside the precast building is used for constant-depth segment casting. (Photo courtesy of FIGG.)

Crews rolling a typical reinforcement cage into building for precast superstructure segments. (Photo courtesy of FIGG

were initially calibrated with concrete test cylinders until the sensors then became the mechanism for determining when forms could be stripped, segments moved in the beds and transverse post-tensioning stressed. They also provide a record of temperature gains while the concrete is hydrating. These sensors offer added value with an opportunity to evaluate long-term strength gain of the bridge as a reference for future load-rating and transporting special overload trucks.

FIGG serves as the engineer-procure-construct (EPC) general contractor and performed project design. **FIGG** services include performing quality control of the constructed bridge, while quality assurance is provided with independent testing facilities. Local engineering subconsultants have been engaged for roadway design, material testing and construction survey services. Superstructure precasting is performed by Cline Precast LLC, a **FIGG** subsidiary. Substructure construction has been performed by Kenny Construction. Superstructure erection is performed by McLean Contracting Company. All the principal contractors and subcontractors are using local union subcontractors to provide specialty labor resources. The bridge concrete, reinforcement and supporting materials are provided by local suppliers.

The bridge has continued to generate an increasing level of public interest and excitement. The community of future bridge users and neighbors have been engaged by the construction team through site tours, presentations and a planned series of "Saturday Talks" at the project office. This is an opportunity to share bridge construction progress with the interested public in a safe, protected viewing area where substructure, segment precasting and superstructure erection can all be seen from one convenient location. The community visitors and other site guests enjoy signing their names and messages inside the box girder segments while they are stored on the grounds near the project office. This personalizes their presence in the historical moment of this important transportation connection. The opening of this major state highway provides better transportation to work, recreation, movement of goods and services, and time savings, advancing the quality of life throughout the region.

Postscript to Opening from United Bridge Partners Press Release, December 23, 2020

CLINE AVENUE BRIDGE CELEBRATES RETURN TO COMMUNITY

Cline Avenue Bridge, LLC, owned and operated by United Bridge Partners (UBP), proudly announces the opening of the new Cline Avenue Bridge located in East Chicago, Ind. The bridge's completion is the culmination of over five years of planning and construction, tens of thousands of tons of concrete and steel, and countless hours of skilled labor. On December 23, the company commemorated the occasion with a ribbon cutting and ceremonial first drive attended by dignitaries, stakeholders, members of the public. The event doubled as a fundraiser benefitting Boys & Girls Club of East Chicago and Lake Area United Way.

Serving as the "Gateway of Lake County," the new Cline Avenue Bridge will spur economic growth, reestablish transport connectivity, and alleviate congestion while serving as an elegant landmark in which the people of Lake County can take pride. The company will further elevate the community by providing ten cents of every collected toll to the city of East Chicago and by partnering with and supporting local non-profit organizations.

"As an East Chicago native, it's particularly meaningful to be part of this project," shared Terry Velligan, general manager of operations at Cline Avenue Bridge. "Its sheer magnitude and far-reaching benefits set it apart from other infrastructure projects in the nation. We are truly grateful to Mayor Copeland and the skilled tradespeople for their diligence and perseverance that made our dream of a more connected community become reality."

~~Caption (~~Photo courtesy of FINLEY Engineering~~)~~

Redesign of the American Road Bridge

OWNER
Moriah Jerusalem Development Corporation

DESIGNER
Finley Engineering Group, Inc.
VIA Bridges, Ltd.

CONTRACTOR
Denya Group Ltd

CONSTRUCTION ENGINEERING SERVICES
Finley Engineering Group, Inc.

FORM TRAVELERS FOR CAST-IN-PLACE SEGMENTS
NRS

POST-TENSIONING MATERIALS
CLL

BEARINGS
Maurer-Sohne

EXPANSION JOINTS
Maurer-Sohne

Jindrich Potucek, P.E., Finley Engineering Group

The new bridge is located on American Road, in the south of Jerusalem, spanning over the olive orchards of the deep Darga Wadi valley. The superstructure consists of a prestressed concrete box girder, with 52'-6" wide deck and spans of 220'-315'-220'. The variable depth box with a smooth parabolic curve integrated into twin wall piers, mimics the shape of the valley and the two together form an elegant couple.

The key feature of the redesign efforts consisted of an introduction of transverse post-tensioning in the top deck

The bridge is currently under construction and being built by the balanced cantilever method with form travelers. The team of Danya-Cebus and **FINLEY** were awarded the contract in 2019 and proposed a Value Engineering design optimization including both superstructure and substructure. The key feature of the redesign efforts consisted of an introduction of transverse post-tensioning in the top deck, widely used in the USA but still quite uncommon in Israel. This design improvement started a positive domino effect from top to bottom as it improved the durability of the deck, due to the enhanced

Caption (Photo courtesy of FINLEY Engineering.)

Caption (Photo courtesy of FINLEY Engineering.)

crack control, and therefore the thickness of the top slab was significantly reduced. Thanks to a lighter top deck, the web thickness could be optimized, and less longitudinal post-tensioning was required. With less PT ducts in the bottom slab, the thickness could be decreased, which further boosted the efficiency of post-tensioning. The reduced weight of superstructure resulted in savings of substructure concrete, reinforcement quantities and improved the dynamic behavior during a seismic event. The overall savings on both superstructure and substructure material quantities varied from 12% of reinforcing steel to 18% of post-tensioning steel.

The initial construction sequence was rethought and a new segment layout was proposed. Thanks to the smaller superstructure weight, the segment length was unified to 15'-5", which standardized the segment production and reduced the number of casting cycles by 18%. The asymmetrical pier table helped to reduce the out-of-balance moments on the pier during construction controlling load the condition for the design of pier longitudinal reinforcement.

Currently, the construction is nearing the completion stage, with the last two closure pours remaining, and so far has proven to be a great success for the Client and the Contractor.

(Rendering courtesy of FINLEY Engineering.)

~~Bridge~~ Blue Ridge Parkway Bridge Over I-26

Jan Zitny, P.E., Finley Engineering Group

The Blue Ridge Parkway is one of the most scenic roads in the United States which runs through Virginia and North Carolina connecting Shenandoah National Park with Great Smoky Mountains National Park. The project site is located South of Asheville, NC and intersects the I-26 interstate highway. Due to the heavy traffic, the NCDOT is widening I-26 from two lanes to four lanes in each direction. It will require the new construction of the Blue Ridge Parkway Bridge over I-26, as the pier layout of the existing bridge was not able to accommodate the new highway configuration beneath, which requires an overall widening width to 182 ft.

The new bridge consists of a 3 span precast concrete box girder superstructure with span lengths of 165 ft - 275 ft - 165 ft and a precast segmental concrete substructure. The bridge is horizontally curved with a constant radius and superelevation of 1,500 ft and 6%, respectively. The bridge deck width accommodates two traffic lanes and a pedestrian sidewalk. The precast superstructure segments have an overall width of 36.5 ft and variable depth ranging from 16 ft to 8 ft.

FINLEY, as the specialty engineer for **Structural Technologies**, is responsible for the construction engineering of the precast substructure and superstructure elements of the new bridge. **Structural Technologies** is the subcontractor for erecting the precast substructure and superstructure elements of the new bridge. Fluor-United Infrastructure Group is responsible for the widening of I-26 and related objects including the construction of abutments and foundations of the Blue Ridge Parkway Bridge. **FINLEY's** parametric modeling and 3D BRIM method is used to produce shop drawings for all superstructure and substructure elements, which brings overall efficiency to the fabrication process.

One of the major challenges for construction will be the erection of the precast superstructure, which is restricted to cause minimum disruption to the I-26 traffic below. One of the issues for erection is the difficult access to the abutments, which prevents the use of heavy cranes for end span segment erection. **FINLEY** and **Structural Technologies** developed a scheme to utilize a single precast segment delivery location at each of the bridge pier tables for superstructure erection. This single delivery location is a key point for the tandem segment erection on the balanced cantilever using two different sets of construction equipment. In the main span, segments are erected using a ground-based crane. In the side spans, segments are transported on rails from the pier table to the segment lifter on the superstructure and erected using a balanced cantilever method or placed on end span falsework. During erection of the segments, ground anchors had to be designed and incorporated into the spread footing foundation system to pre-compress the footing to the gneiss rock bed and enhance the stability during balanced segment erection at both pier locations. Casting for both substructure and superstructure is expected to begin in Spring 2021.

One of the major construction challenges is the erection of the precast superstructure, which is restricted to cause minimum disruption to the I-26 traffic below.

OWNER
North Carolina DOT (NCDOT)

DESIGNER
Federal Highway Administration (FHWA)

CONTRACTOR
Fluor-United Infrastructure Group (I-26 Widening)
Structural Technologies (Bridge Erection)

CONSTRUCTION ENGINEERING SERVICES
Finley Engineering Group

CONSTRUCTABILITY REVIEW/ ESTIMATING SERVICES
AECOM

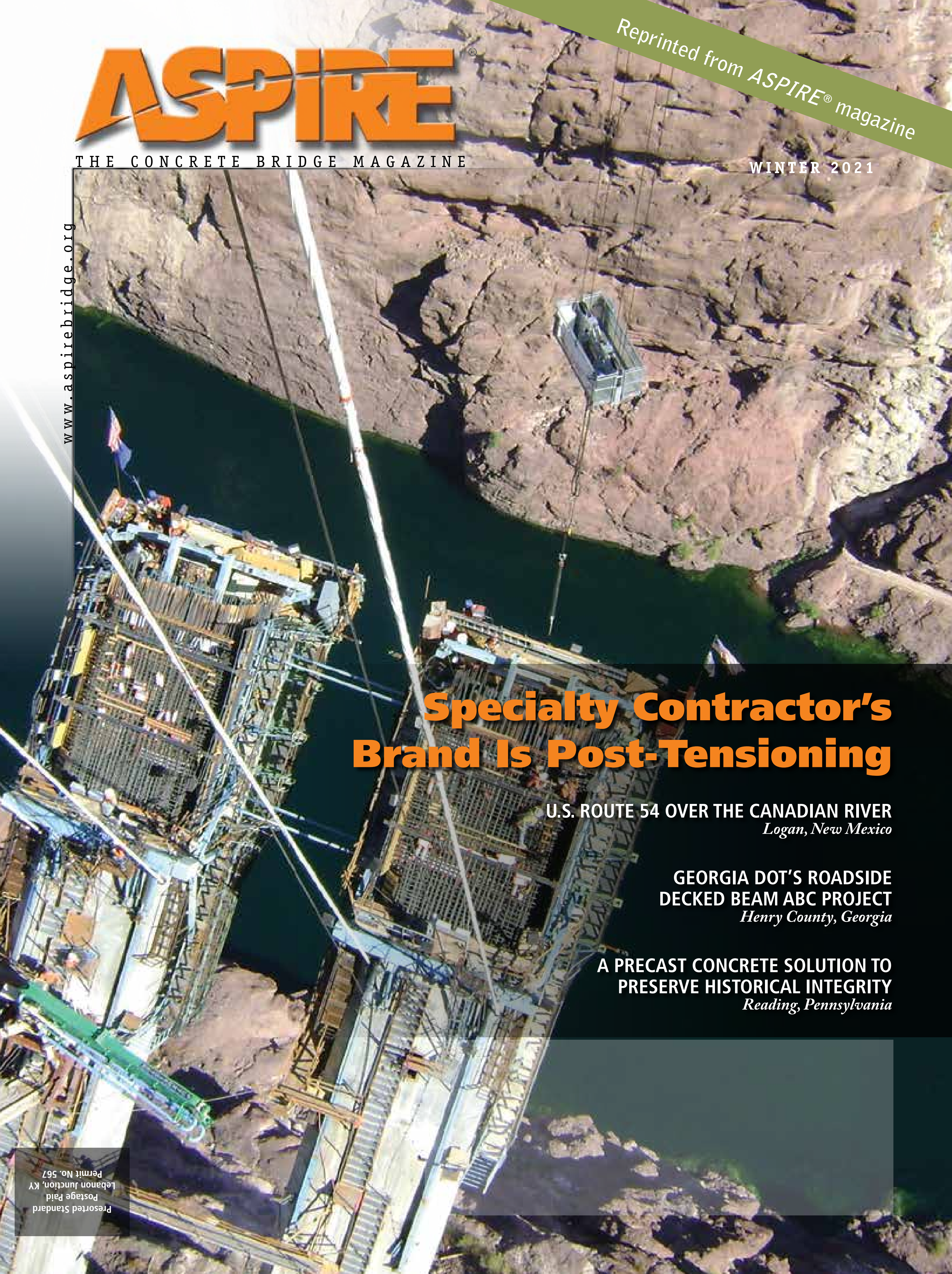
PRECAST PRODUCER
Coastal Precast Systems

FORMWORK FOR PRECAST SEGMENTS
EFCO

ERECTION EQUIPMENT
Structural Technologies

POST-TENSIONING MATERIALS
Structural Technologies

BEARINGS
RJ Watson



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U.S. ROUTE 54 OVER THE CANADIAN RIVER
Logan, New Mexico

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Henry County, Georgia

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PROJECT

U.S. Route 54 over the Canadian River

New Mexico's First Cast-in-Place Concrete Segmental Box-Girder Bridge

by Nyssa Beach, Jacobs Engineering, and
Jeff Mehle, McNary Bergeron & Associates

The new alignment of U.S. Route 54, with the nearly completed concrete segmental box-girder bridge, is offset just east of the existing alignment with its aging deck truss bridge. Photo: Malcolm International.

Amid the expanse of rural desert in northeastern New Mexico is the small, agriculture-centered village of Logan. In Logan, the Canadian River, which cuts deeply through the desert landscape, is crossed by a steel deck truss bridge carrying U.S. Route 54 (U.S. 54). This bridge is steeped in the rich history that brought commerce trails, rails, and roads to the area. Currently, the U.S. 54 corridor is the main trucking route from Chicago, Ill., to El Paso, Tex., with over 50% truck traffic. Additionally, it provides access to Ute Lake State Park—Ute Lake is the second largest lake in New Mexico and is popular with water and fishing enthusiasts.

The new U.S. 54 Canadian River Bridge is an exciting first for the state of New Mexico and a new chapter for the area's transportation future: a cast-in-place segmental box-girder bridge. This bridge, built with the balanced-cantilever method, was designed to replace a 1954 steel truss structure while also minimizing impacts to the Canadian River, the river's protected inhabitants, and the surrounding wetlands, as well as to adjacent historic and prehistoric archaeological sites. The new structure addresses the deficiencies and poor condition of the load-restricted steel deck truss bridge, thus improving safety and ensuring the future viability of the U.S. 54 corridor.

The New Mexico Department of Transportation (NMDOT) and the design team met the challenges of this unique location by conducting a comprehensive alignment and structure selection study while engaging public input. The result is a three-span segmental structure with a sweeping alignment that is offset just east of the existing river crossing.

Designing a Bridge for a Unique Location

The design of the Canadian River Bridge balances both the structural and functional requirements of the project. The new 43-ft-wide cross section includes two 12-ft-wide lanes, 8-ft-wide shoulders on each side, and barriers. The pier locations were carefully considered during design to minimize environmental impacts and avoid the river's floodplain. The three-span configuration was optimally set at 200, 325, and 210 ft. The box-girder depth varies from 18 ft at the piers to 8 ft at midspan and at the abutments. This segmental box-girder structure is on a 3000-ft-radius horizontal curve with a constant 4% cross slope.

During the balanced-cantilever construction, the superstructure was consistently built a half segment out of balance on either side. Each pier table was built out to be half a segment longer on one side such that when the 15-ft-long segments were cast on either side of the cantilever, the superstructure was only ever half a segment out of balance at any time. The design of the twin-wall columns efficiently handled the large out-of-balance moment during construction and carried it as a couple to the foundation. The piers and abutments are founded on deep concrete drilled shafts.

Project Challenges

Constructing a bridge in rural northeastern New Mexico presented several unique challenges to the U.S. 54 Canadian River Bridge project team.

profile

U.S. ROUTE 54 CANADIAN RIVER BRIDGE / LOGAN, NEW MEXICO

BRIDGE DESIGN ENGINEER AND OWNER'S ENGINEER: Jacobs Engineering, Denver Colo.

PRIME CONTRACTOR: Fisher Sand & Gravel New Mexico Inc., Placitas, N.Mex.

SEGMENTAL CONTRACTOR: Malcolm International, Rancho Cordova, Calif.

CONSTRUCTION ENGINEERING: McNary Bergeron & Associates, Broomfield, Colo.

POST-TENSIONING SYSTEM AND FORM TRAVELER SUPPLIER: Schwager Davis Inc., San Jose, Calif.

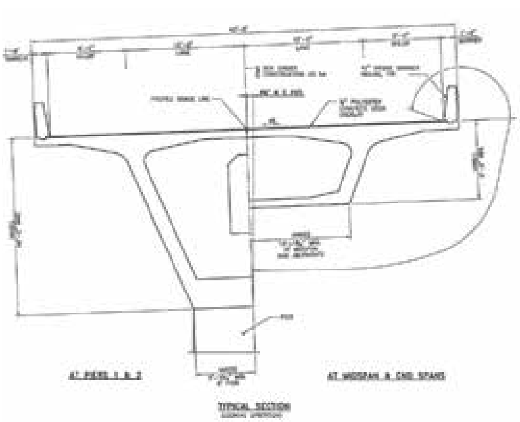
With the bridge about half complete, multiple construction operations were underway concurrently, including the nearly completed balanced-cantilever construction of cantilever 1, construction of pier table 2, and construction of both end spans on falsework. Photo: Malcolm International.

The new U.S. 54 alignment is on a sweeping 3000-ft-radius horizontal curve. Photo: New Mexico Department of Transportation.

Remote Location

Logan is approximately 200 miles east of both Albuquerque, N.Mex., and Santa Fe, N.Mex., and 100 miles west of Amarillo, Tex. It has a population of just over 1000 and is home to ranching and agriculture, as well as recreation at Ute Lake State Park.

The availability of workers with bridge construction experience was limited in Logan. Most of the workers were from out of town or out of state. Scheduling of major construction tasks needed to take workers' holidays and trips home into account. The remote site also led to a high turnover of laborers, which extended the learning curve associated with constructing a segmental bridge. To minimize the impact of the high turnover rate, a core group of key field staff members was relocated to New Mexico and remained consistent throughout the project. This helped keep consistency in key roles despite turnover challenges with construction staff in the remote project location. The segmental contractor also used three-dimensional sketchup models for workforce training to efficiently bring on new workers, as needed, and get them up to speed on the segmental construction and, in particular, the procedures, quality control, and terminology associated with each part of segmental construction. Scheduling, training, and coordination between tasks and operations was imperative for meeting the construction schedule.



Typical bridge section showing the box-girder depths, which vary from 18 ft at the piers to 8 ft at midspan and at the abutments. Figure: New Mexico Department of Transportation.

Brine Aquifer

During the final design phase, a specific challenge for the design team was the presence of a brine aquifer deep below the project site. If the aquifer were disturbed during construction, the high chloride concentration from the aquifer would contaminate the water supply downstream. Due to the aquifer's varying depth amid thin mudstone or siltstone layers, the greatest risk for penetration was around pier 2. The design team worked closely with the Canadian River Municipal Water Authority to weigh the risks and determine the best path forward. The final design mitigated risk by increasing the size of the pier footing and drilled shafts, which in turn allowed the shafts' lengths to be shortened.

The project's special provisions required the contractor to have a containment plan and system in place in the unlikely event that the drilling operations penetrated the aquifer. This containment plan included testing water samples from the Canadian River before drilling for a baseline and again after installing the drilled shafts. Provisions for capture and disposal of brine water were identified in case the testing showed elevated levels of saline. Although this phase of construction had uncertainty and potential risk, the drilling and shaft installation did not ultimately impact the brine aquifer and no additional mitigation measures during construction were required.

NEW MEXICO DEPARTMENT OF TRANSPORTATION, OWNER

OTHER MATERIAL SUPPLIERS: Reinforcement: CMC Rebar, Albuquerque, N.Mex.; bearings: D.S. Brown Company, North Baltimore, Ohio; expansion joints: Watson Bowman Acme, Buffalo, N.Y.; prepackaged grout: US SPEC, Denver, Colo.

BRIDGE DESCRIPTION: Three-span, 735-ft-long, post-tensioned, cast-in-place concrete segmental box-girder bridge

STRUCTURAL COMPONENTS: 38 variable-depth cast-in-place concrete segmental box-girder segments and three closure segments, end spans cast on falsework, monolithic twin-wall columns, pier footings, and drilled-shaft foundations

BRIDGE CONSTRUCTION COST: $22 million

Form travelers at either end of cantilever 1. Geometry control and monitoring during segment casting ensured accurate vertical and horizontal alignments. Photo: Malcolm International.

Concrete

For segmental construction, a high-performance concrete is required. This bridge's design specifically required concrete with a 28-day compressive strength of 6000 psi, and a 3500-psi minimum strength was required prior to tensioning the post-tensioned tendons. To meet the fast-paced construction schedule of the desired seven-day casting cycle, a high-early-strength concrete mixture was ideal.

To achieve a concrete mixture that met these requirements, more than 20 trial batches using local materials and admixtures were tested. A concrete mixture with an 8 to 9 in. slump to facilitate placement among congested reinforcement and a strength of 3500 psi within 12 hours was achieved.

The project's concrete supplier was located in Tucumcari, N.Mex., 25 miles south of the project site. To address the challenges of producing a special concrete mixture and transporting it over 30 minutes by truck, the contractor opted to set up a temporary batch plant at the project site. The on-site facility enabled easier communication and immediate response times, and provided concrete production that met the project specifications and demands.

Weather

Logan is located at an elevation of approximately 3800 ft above sea level, with a relatively dry climate. However, this region also sees a wide range of temperatures—with high temperatures above 100°F during the summer, and lows below freezing with periodic snow in the winter—and experiences extreme weather swings throughout the year. These drastic weather swings can occur within the same week or even within a 24-hour period.

Another weather obstacle for construction operations and schedule are high, gusty winds, which are common in this area. In March 2019, wind gusts of over 60 miles per hour derailed two dozen train cars on a rail bridge downstream from the project.

Design Support During Construction

Throughout the segmental construction, the project team—NMDOT, the design team, and the contractor—worked together to collaborate on the successful execution of vital construction operations.

Comprehensive Concrete Repair Plan

The design engineer and NMDOT coordinated with the segmental contractor to develop a comprehensive concrete repair plan that could be used as necessary throughout the construction to address repairs efficiently and effectively. In the early development of the optimal concrete mixture, concerns arose about slump, the effect of the dry desert climate on the mixture, and consolidation issues. Nondestructive testing, including the impact-echo method, was conducted in areas of significant repair to provide assurance and confidence regarding the quality of the final product.

Post-Tensioning and Grouting

During segmental post-tensioning operations, the design team and the contractor's engineer worked to fine-tune the design parameters based on field-verified values. The theoretical design prestressing parameters for

AESTHETICS **COMMENTARY**

by Frederick Gottemoeller

The challenge of inserting a new bridge into a spectacular natural scene is to design the bridge so that it complements, not clutters, the landscape. A new bridge will unavoidably become the center of attention, but it shouldn't fight for that attention. It should look like it has always been there. One way of accomplishing this is to fit the features of the bridge into the physical features of the site in an obvious and natural way. Here, the piers of the U.S. Route 54 bridge rest on the valley's slopes, out of the floodplain. Plus, the blocky, unadorned pier shafts give the piers an appearance similar to the blocky boulders of the nearby bluffs.

Simplicity itself usually helps fit a new bridge into a spectacular scene. That characteristic should extend to the basic geometry. Here the geometry consists of three horizontal curves: two at each end of the project to create the departure from U.S. 54, and a single, long curve in the middle. Its overall length matches the bridge to the scale of the desert landscape. Imagine how different the bridge would have looked if the designers had decided, for reasons of construction simplicity, to make the bridge straight. There would have been two short curves at each end of the bridge with a straight section in the middle, creating the "broken back curve" dreaded by highway engineers. The bridge would have had a choppy, cut-up appearance, completely out of place in this sweeping landscape.

Sloping the webs of the box girder is another direct, natural way of increasing the sculptural interest of the bridge. Simply by their geometric interplay with the haunches of the girders, the sloped sides create curved edges and varying widths for the girder soffits. Finally, deepening the haunches over the piers visually demonstrates the natural distribution of forces in the bridge, something I imagine the school kids in Logan grasped intuitively when they were given a chance to learn about the structure.

Closure beams were used to align and grade the cantilever tips and end spans for casting the closure sections. Photo: Malcolm International.

Formwork being set in preparation for casting the next box-girder segment. Photo: Malcolm International.

friction and wobble were compared with the actual observed coefficients measured in the field, with field friction tests and elongation compared with force results for each length of tendon. Additionally, post-tensioned tendon tensioning results were tracked to identify elongation trends during the progression of the cantilever segments. The cantilever tendon elongations during construction were compared to an allowable ±7% tolerance on the elongation difference between actual and theoretical values. This was valuable in recognizing trends to anticipate and understand the results and quickly address any anomalies.

The 38 top slab cantilever-construction tendons at each pier were composed of fifteen 0.6-in.-diameter strands. After the closure segments were cast, bottom slab continuity tendons—10 tendons with fifteen 0.6-in.-diameter strands in the end spans and 14 tendons with eighteen 0.6-in.-diameter strands in the center span—were tensioned. All continuity tendon ducts were sized for 19 strands as a provisional allowance. Six high-strength $1\frac{3}{8}$-in.-diameter post-tensioning bars were also used in each end span.

In December 2019, the U.S. Route 54 project team gave presentations on the cast-in-place segmental concrete box-girder bridge to students of the Logan Municipal Schools. The students also participated in hands-on activities related to bridge construction. Photo: Logan Municipal Schools.

Before post-tensioned tendon grouting operations began, the U.S. 54 project team worked together with the American Segmental Bridge Institute (ASBI) to host ASBI Grouting Certification Training on site. This training provided valuable support and guidance ahead of the grouting operations, which were crucial to the long-term protection and durability of the structure.

Geometry Control

An essential aspect of cast-in-place segmental construction is geometry control. As box-girder segments are cast at either end of the cantilever, the geometry of the bridge is monitored with the ever-changing conditions, and adjustments are made with each casting. The geometry is constantly checked for agreement with the theoretical geometry, while also taking into account and correcting for the as-built conditions.

On the U.S. 54 project, geometry control was led by the contractor's construction engineer and survey team. Geometry-control quality assurance was performed independently by the design team and verified in survey checks. At the closure segments, the tips of the segments were aligned to within $\frac{1}{2}$ in. of each other in both the vertical and horizontal geometry. This accuracy demonstrated the success of the geometry-control coordination and minimized cast-in correction forces.

"This Is *Your* Bridge"

During segmental construction, representatives from NMDOT, the design engineer, and the segmental contractor came together to give two interactive presentations for students in the Logan Municipal School District. At the time of the presentations, the residents of Logan had been observing the progress of the segmental structure for over a year. The students and school staff were therefore brimming with questions and eager to learn about the project. These educational presentations provided an opportunity to share project information and technical design facts, demonstrate career paths in engineering and skilled trades, and help the students develop a sense of ownership of their community's exciting new bridge. After the presentations, the students participated in hands-on activities to learn more about different bridge construction elements, including a tendon anchorage assembly, a reinforcement cage, concrete cylinders, personal protective equipment, and design drawings.

Conclusion

The U.S. 54 Canadian River Bridge project team worked in harmony with the rural and sensitive environment at the site to develop a bridge that is well suited to its beautiful and unique location. Segmental construction was completed in July 2020. Following the completion of a polymer concrete overlay placement, approach roadway, and tie-in to the new river crossing, traffic will be moved to the new structure and the existing steel deck truss bridge will be removed.

Nyssa Beach is a structural engineer and project manager with Jacobs Engineering in Denver, Colo. Jeff Mehle is a partner and principal engineer for McNary Bergeron & Associates in Broomfield, Colo.

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