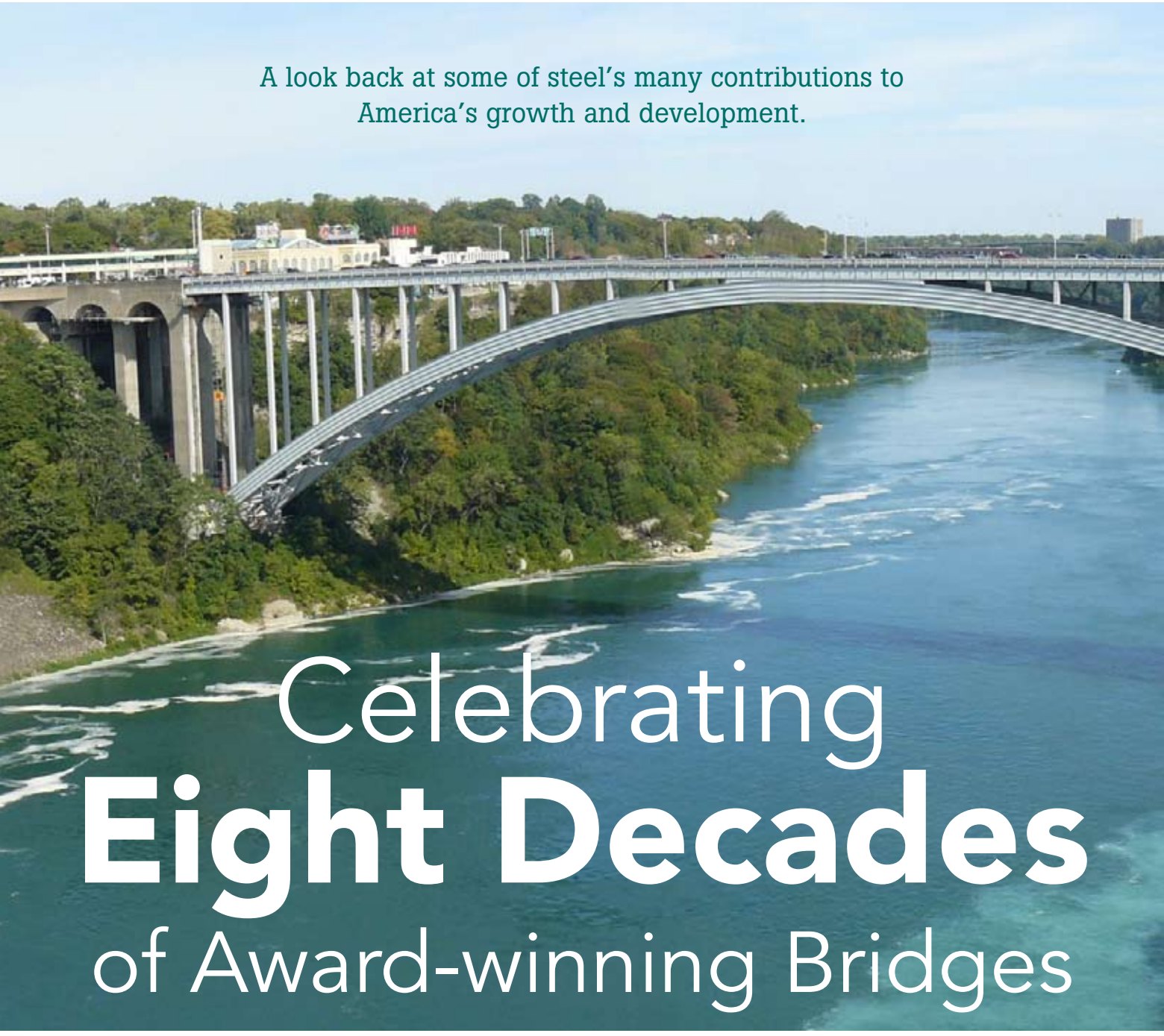
A look back at some of steel's many contributions to America's growth and development.



Celebrating Eight Decades of Award-winning Bridges

FOR MORE THAN 80 YEARS, the National Steel Bridge Alliance Prize Bridge Competition has honored significant and innovative steel bridges constructed in the United States. The competition began in 1928 with first place awarded to the Sixth Street Bridge in Pittsburgh, coincidentally just a few blocks down the river from where the NASCC: The Steel Conference took place in May 2011. Since 1928, more than 300 bridges have been so honored in a variety of categories, which today include long span, medium span, short span, movable span, major span, reconstructed, and special purpose.

Recently, the Prize Bridge Competition has taken place in alternate years and the winners have been announced at NSBA's World Steel Bridge Symposium. Because the next WSBS will be co-located with The Steel Conference in 2012, we are taking this opportunity to look back at the award-winning bridges that have gone before, seeking to find the most popular as well as the most notable among them.

The bridges we recognize here as all-time favorites were selected in two concurrent levels of competition, resulting in two levels of awards. The People's Choice award winners were selected through an online public vote. The Industry Choice awards were chosen by the panel of esteemed judges noted in the inset.

All first place winning bridges in the various categories used since the competition began in 1928 were eligible for the 2011 competition. NSBA announced the 2011 Top Prize Bridge Award winners at the 2011 AASHTO Subcommittee on Bridges and Structures Annual Meeting in May in Norfolk, Va.

Read on for an appreciation, and a little history, of some of the most truly iconic and beautiful steel bridges our nation has to offer.

2011 "Favorite Bridge" Judges

- Ben Beerman – Federal Highway Administration
- Hormoz Seradj – Oregon Department of Transportation
- Robert Healy – Rummel, Klepper & Kahl
- Doug Waltemath – Harrington & Cortelyou
- Ray McCabe – HNTB
- David Hohmann – Texas Department of Transportation

Vijaya Sanmukam

People's Choice Award Winners

The goal of the online public voting was to determine the three favorite Prize Bridge Award winners of all time. The turnout was extremely enthusiastic, with nearly 3,000 votes submitted.

Rainbow Bridge
Niagara Falls, N.Y. (17.5% of votes)
1941 Prize Bridge Award, First Place — Class A

Built in 1941, just 1,000 ft down the Niagara River from the American Falls, the Rainbow Bridge was the largest hingeless arch bridge in the world from the time of its construction until surpassed by the Lewiston-Queenston Bridge in 1962. The total cost of the bridge was $4 million. The engineers were Waddell & Hardesty and the Edward P. Lupfer Corporation. Fabrication and erection was by the Bethlehem Steel Company.

The deck of the Rainbow Bridge is approximately 202 ft above the Niagara River. It is 1,450-ft long with a main span of 960 ft. Its two 22-ft-wide roadways provide two lanes in each direction. A $72 million transformation, completed in 2000, entailed the rebuilding of both plazas as well as widening the approaches.

Today the Rainbow Bridge continues to be a major tourism gateway between Canada and the United States, generating tens of millions of dollars of activity on both sides of the border. It is open 24 hours a day to passenger vehicles and buses; no commercial vehicles are allowed. Eighteen traffic lanes in New York and 16 in Ontario facilitate flow of traffic for governmental inspections.

—Lew Holloway, General Manager, Niagara Falls Bridge Commission

Paper Mill Road Bridge
Baltimore County, Md. (13.3% of votes)
2001 Prize Bridge Award Winner, Long Span

A new Paper Mill Road (MD 145) Bridge crossing of Gunpowder Falls and Loch Raven Reservoir opened to traffic in December 2000. Adjacent to the original crossing of a much earlier vintage, this aesthetically pleasing bridge designed by Johnson, Mirmiran & Thompson, Baltimore, consists of a rust-colored steel box arch with a span of 495 ft and an overall length of 670 ft that rises to a height of 99 ft above Gunpowder Falls. Innovative construction techniques were utilized to erect this modern arch structure. One such technique was the use of a causeway across the reservoir as a staging platform, but also designed to protect any submerged Native American artifacts and paper mill ruins.

Travelers using the new bridge benefit from the safer curves in the approach roadways, wider lanes and unrestricted load carrying capacity. The appearance of this structure is consistent with the park-like environment of the Loch Raven Reservoir, maintaining the pristine nature of this vital water supply for the Baltimore area. The arch structure provides a long center span to avoid impacts to the waterway, and complements the existing historic bridge, which was undisturbed by the construction.

This project in northern Baltimore County, Md., is a model for balancing future transportation needs, environmental considerations within a waterway, and preservation of a historical structure, all of which required intergovernmental cooperation. Fostering a partnership that resulted in that intergovernmental cooperation was vital to the success of the Paper Mill Road bridge project.

The existing historic bridge was owned by the city of Baltimore, although it is located outside the city's jurisdictional boundaries, but still within Baltimore County. The structure served to connect sections of Paper Mill Road, which was owned and maintained by the Maryland State Highway Administration. Negotiations among the three jurisdictions resulted in the state accepting the new bridge into the state highway system, thereby unifying ownership and maintenance of this vital link in this major commuter route serving traffic between Baltimore and Harford Counties.

Baltimore County agreed to take over the ownership and maintenance of the original bridge to preserve the historic structure for possible continued use, and the city divested itself of the operation and maintenance costs, as well as responsibilities associated with the existing bridge located outside of the city limits.


Sheridan Vincent

Colonel Patrick O'Rorke Bridge
Rochester, N.Y. (13.2% of votes)
2005 Prize Bridge Award Winner
Movable Span


Bergmann Associates

The true measure of success for a project is how the community views the facility long after opening day. During the planning and design of the Colonel Patrick O'Rorke Memorial Bridge, the Bergmann Associates team, the New York State Department of Transportation and Monroe County listened to a fully engaged stakeholder group and designed a structure that was consistent with the context of the community and an enhancement to its surroundings. More than seven years after the first vehicles crossed the newly constructed bridge, the success of this project is evident by observing the vibrancy of the surrounding communities and listening to locals, neighbors and users alike.

Thomas Hack, P.E., senior structural engineer with the City of Rochester, N.Y. recently said, "The Colonel Patrick O'Rorke Memorial Bridge resurrected not just another river crossing but it revitalized an entire neighborhood. Rochester's Charlotte neighborhood could not be more proud of this iconic structure. It has instilled pride and helped solidify the community's 'Port of Rochester' as a major destination point with a sense of place and a sense of activity. No longer is this crossing considered a monotonous utilitarian structure simply straddling a lifeless waterway. Rochester's waterfront is now thriving with activity, life and purpose."

"In every community there is usually a landmark structure that captures the spirit and imagination of its people," said Monroe County bridge engineer Bo Mansouri, P.E., "a structure that people can relate to, affectionately identify with, and come home to. The Colonel Patrick O'Rorke Memorial Bridge is one such structure within the historic community of Charlotte, Rochester, N.Y. It brings an immense sense of pride to the people of this harbor town community. Its dedicated name-sake memorializes a hometown hero who fought in the Civil War for independence and freedom of the entire country."

— *Bergmann Associates, Rochester, N.Y.*

Industry Choice Winners

Sixth Street Bridge
Pittsburgh, Pa.
1928 Prize Bridge Award Winner, Most Beautiful Steel Bridge

The Sixth Street Bridge, or the Roberto Clemente Bridge as it is now known by most non-engineers, is as unique a bridge as Clemente was as a baseball player. This beautiful and magnificent bridge, the first of Pittsburgh's three sister bridges, was a part of the street system when it first was built and now connects the central business district with the sports and entertainment section across the Allegheny River. After 83 years of service, this bridge remains an important part of the fabric of Pittsburgh.

When constructed, the Sixth Street Bridge was the longest self-anchoring suspension bridge in this country and was quite a change from many previous slender-member bridges. It was designed by some of the Allegheny County Department of Public Works' 102 staff engineers. Rather than using cables, they used "links" of seven steel eyebars that alternate and mesh with eight-eyebar links to provide the suspension.

The reason for using the self-anchoring suspension was due to the lack of space. With a roadway on one side and railroad tracks on the other, there was no space for the massive anchoring rooms required. By connecting the eyebar suspension system to two large structural steel box girders that spanned the river, the engineers accomplished their mission. The two massive stiffening girders are tied down at the edge of the river piers by two long eye-bars placed deep into each pier. The heavy deck and the two structural stiffeners also are attached to the eyebar suspension by eyebars. As a testament to its design for strength, this bridge has never had a weight limit imposed on it.

The use of the eyebar suspension medium makes this bridge a most attractive and appealing structure to both the engineer and the public. With two more sister bridges next to it, the effect is even more beautiful. This style of bridge has been used in other places in the world, but not often and not as dramatically as in Pittsburgh. Steel was used because it was constructed in the Steel Capital of the world. By far the best and most recognized icon of the many beautiful and unique steel bridges in the Pittsburgh area, it can also be seen from inside PNC Park, the home of the Pittsburgh Pirates.

This engineering wonder is even more important to Pittsburgh today than when it first opened on October 19, 1928. I am especially thrilled that AISC has again selected this beautiful and unique bridge that shows to the nation that steel bridges are spectacular, even in the eyes of the public.

—John. F. Graham, Jr., P.E., Graham Consulting, Inc., Pittsburgh, Pa., and former director of engineering and construction, Allegheny County, Pa.

John F. Graham, Jr.

To submit a bridge project for the 2012 Prize Bridge Award competition, please visit **www.steelbridges.org**. All entries must be received by November 30, 2011. The 2012 Prize Bridge Award winners will be announced at the 2012 World Steel Bridge Symposium co-located with the NASCC: The Steel Conference in Dallas, Texas, April 18-21.

Bayonne Bridge
Bayonne, N.J.
1931 Prize Bridge Award Winner,
First Place — Class A

With rail traffic in mind, the bridge's chief designer, Othmar H. Ammann, began developing a scheme that spanned the Kill Van Kull with a single, innovative, arch-shaped truss. As with the suspension bridge scheme, Ammann worked on the arch design in partnership with architect Cass Gilbert. The arch bridge that emerged promised to be a remarkably efficient solution, well suited to the site from both an engineering and aesthetic standpoint.

Construction of the Bayonne Bridge began in September 1928. The projected date of completion was early 1932. Thanks to thoughtful planning, careful management, and ingenious construction technology, the $13-million bridge was completed in November 1931—several months ahead of schedule, and $3 million under budget.

Once constructed, the truss was the world's longest. To this day the truss stands as one of the world's most elegant arches, made of a sleek and modulated form of high-strength alloy steel.

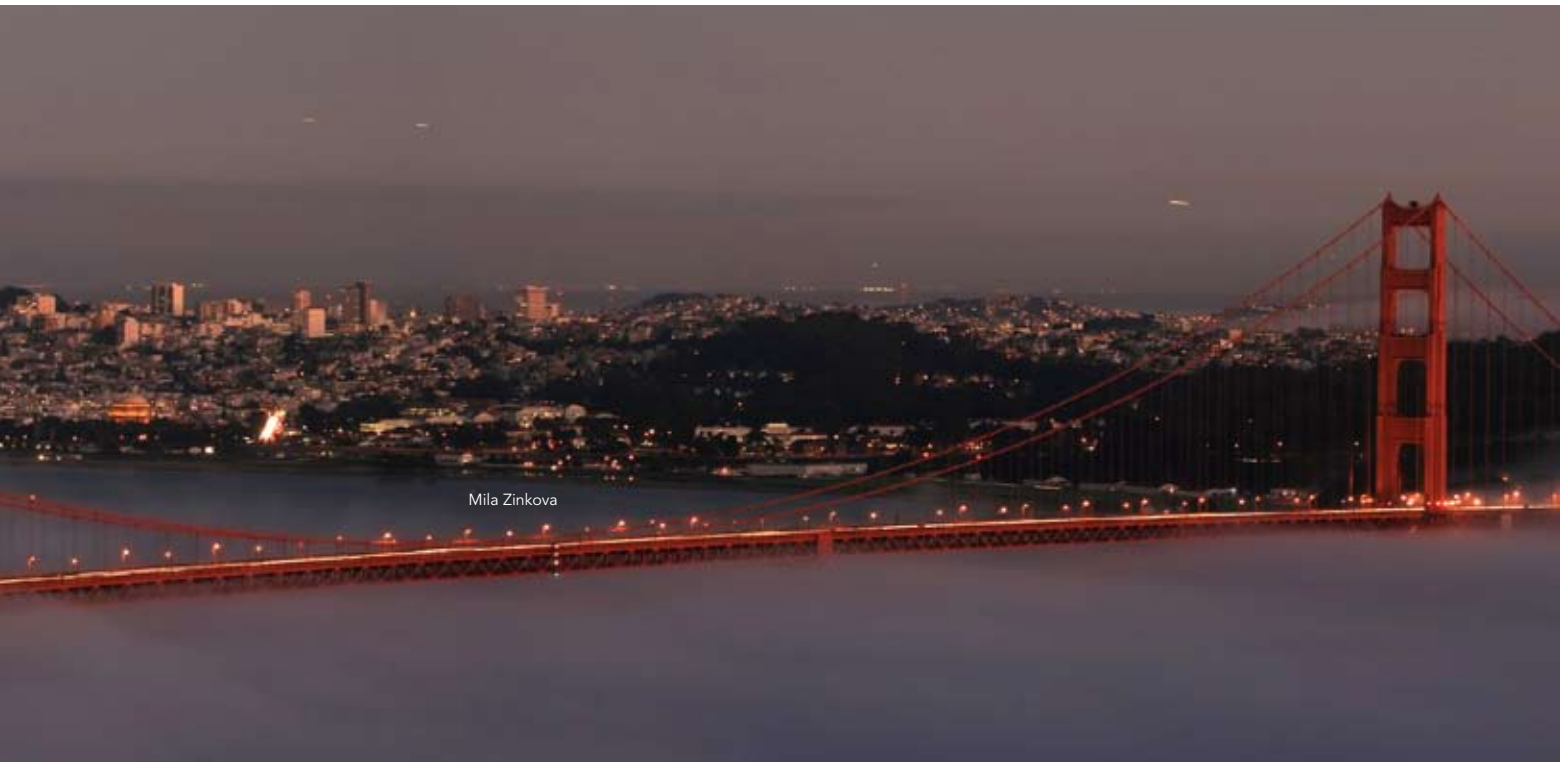
The American Institute of Steel Construction selected the Bayonne Bridge as the most beautiful steel bridge to open to traffic in 1931. As Ammann said at the opening ceremony, "The Port Authority recognized the fact that its structures must not only be useful, but they must also conform to the aesthetic sense. This was one of the motives for the selection of an arch spanning the entire river in one sweeping graceful curve."

From "Bayonne Bridge: A Landmark by Land, Sea, and Air," by Darl Rastorfer, commissioned by the Port Authority of New York and New Jersey.

Golden Gate Bridge
San Francisco
1937 Prize Bridge Award Winner
First Place — Class A

The Golden Gate strait is the entrance to the San Francisco Bay from the Pacific Ocean. Approximately three-miles long by one-mile wide, it was named "Chrysopylae," or Golden Gate, by John C. Frémont circa 1846. An officer in the U.S. Army Corps of Topographical Engineers, Frémont later wrote that the strait reminded him of the harbor in Byzantium, which is now Istanbul, named Chrysoceras or Golden Horn.

In August 1919, city officials formally requested that San Francisco city engineer Michael M. O'Shaughnessy explore the possibility of building a bridge that crossed the Golden Gate Strait. O'Shaughnessy consulted with a number of engineers across the country about feasibility and cost of building a bridge across the strait. Most speculated that a bridge would cost more than $100 million and that one could not be built. But it was Joseph Baermann Strauss that came forward and said such a bridge was not only feasible, but convinced civic leaders that the bridge could be built for $25 to $30 million and could be paid for by toll revenues alone.


Mila Zinkova

The bridge ultimately was built out of necessity as population centers were growing and traffic congestion at the existing ferry docks was becoming intolerable. Upon its completion in 1937, the Golden Gate Bridge provided passage across the bay, on average, for 9,073 automobiles per day. After almost 75 years of service, its average daily traffic has increased almost 12 times, to nearly 107,000 daily users.

At 4,200-ft long, and with a vertical clearance of 220-ft at mid-span, the Golden Gate Bridge suspension span was considered the longest span in the world for 27 years until New York City's Verrazano Narrows Bridge took that title in 1964. The Golden Gate Bridge's main towers, suspended structure, anchorages, and approaches accounted for the 83,000 tons of structural steel used on the project.

Consulting architect Irving F. Morrow championed the art deco styling of the bridge by simplifying the pedestrian railings to modest, uniform posts placed far enough apart to allow motorists an unobstructed view. The light posts took on a lean, angled form. Wide, vertical ribbing was added on the horizontal tower bracing to accent the sun's light on the structure. The rectangular tower portals themselves decrease on ascent, further emphasizing the tower height. These architectural enhancements define the Golden Gate Bridge's art deco form, which is known and admired the world over. The Golden Gate Bridge has always been painted orange vermilion, dubbed "International Orange." Rejecting carbon black and steel gray, Morrow selected the color to blend well with the span's natural setting and also stand out in contrast to its frequently foggy atmospheric conditions. If the U.S. Navy had its way, the bridge might have been painted black with yellow stripes to assure greater visibility for passing ships.

The University of California Berkeley Library eloquently states, "The Golden Gate Bridge continues to astound and inspire. Some believe its soaring grace and sublime elegance enhance the beauty of its site as few man-made structures do. Considered an Art Deco sculpture and a symphony in steel, the bridge has always inspired artists, poets, writers, and filmmakers. It has also become a symbol for communication, for the portal to the Pacific—uniting America and Asia—and for San Francisco, its magical city by the bay."

White Bird Canyon Bridge
White Bird, Idaho
1976 Prize Bridge Award Winner
Medium Span High Clearance

The graceful lines of the White Bird Canyon Bridge on Idaho's U.S. 95 belie the challenge presented in its construction. Begun in 1974, the bridge was the last link in a 10-year improvement effort to widen Idaho's primary north-south highway. When this section was opened, it eliminated 23 switchbacks in a seven-mile stretch that previously dropped the highway 3,000 ft from Camas Prairie into the Salmon River canyon.

Passing 205 ft above White Bird Creek, the bridge is 810-ft long and includes an imperceptible arch that is included more to compensate for thermal expansion than to impart strength. The steel structure consists of two parallel sets of 11 girder sections. The knee braces are fully boxed while the horizontal sections are open topped "bathtub" girders.

The steel was shipped cross country by rail, then trucked to the southern end of the project, which provided more working space than the canyon-enveloped north end.

—Will Hawkins and Mike Huntington. Huntington worked on the bridge and has documented its construction online at ***http://bit.ly/qRQX5n****.*


William Vann/EduPic

Roosevelt Lake Bridge
Roosevelt Lake, Ariz.
1991 Prize Bridge Award Winner, Long Span

The $21.3 million Roosevelt Lake Bridge was built to take traffic off the top of Roosevelt Dam. The longest two-lane, single-span, steel-arch bridge in North America, it spans 1,080 ft across Roosevelt Lake.

Prior to completion of the bridge in October 1990, traffic drove over the top of the dam on a roadway designed to allow two Model-T Fords to pass abreast. Today's recreational vehicles and full-size automobiles are too wide to permit two-way traffic on the dam, but the bridge provides that capability.

The Roosevelt Lake Bridge earned rare distinction when in November 1995 it was named one of the top 12 bridges in the nation. The American Consulting Engineers Council cited the bridge for overall design, size, eye-appeal and design challenge. Other bridges cited were the Golden Gate Bridge and Brooklyn Bridge.

Source: U.S. Department of the Interior, Bureau of Reclamation.


MSC Archives

Andrew Bossi

Woodrow Wilson Memorial Bridge
Washington, D.C.
2009 Prize Bridge Award Winner,
Special Award

The Woodrow Wilson Bridge is a project of national importance, located at a critical point on I-95 over the Potomac River connecting Maryland and Virginia just south of the nation's capital. The bridge is an integral part of a $2.6 billion corridor project that has eased congestion and shortened travel times for the more than 70 million travelers who use it every year and has allowed hundreds of billions in commerce to travel economically throughout the region. The bridge itself is a 1.1-mile-long, $650-million structure capable of carrying 12 lanes of traffic plus a hiker/biker facility. The bridge is also capable of carrying rail traffic if needed. The centerpiece of the bridge is its unique movable span which allows unrestricted maritime commerce on the river.

The Woodrow Wilson Bridge is one of the most significant achievements in bridge engineering in this country. As co-owners of the bridge, Maryland and Virginia are very proud of the technical achievements that the bridge represents, especially regarding its modern, state-of-the-art use of structural steel. Many of the challenges that the project faced were solved through the thoughtful and innovative application of modern steel technology. MSC

—Robert Healy, Rummel, Klepper & Kahl, Baltimore, and former deputy director, Maryland State Highway Authority.

Potomac Crossing Consultants