VOLUME XII / NUMBER 3 / THIRD QUARTER 1972

MODERN STEEL CONSTRUCTION

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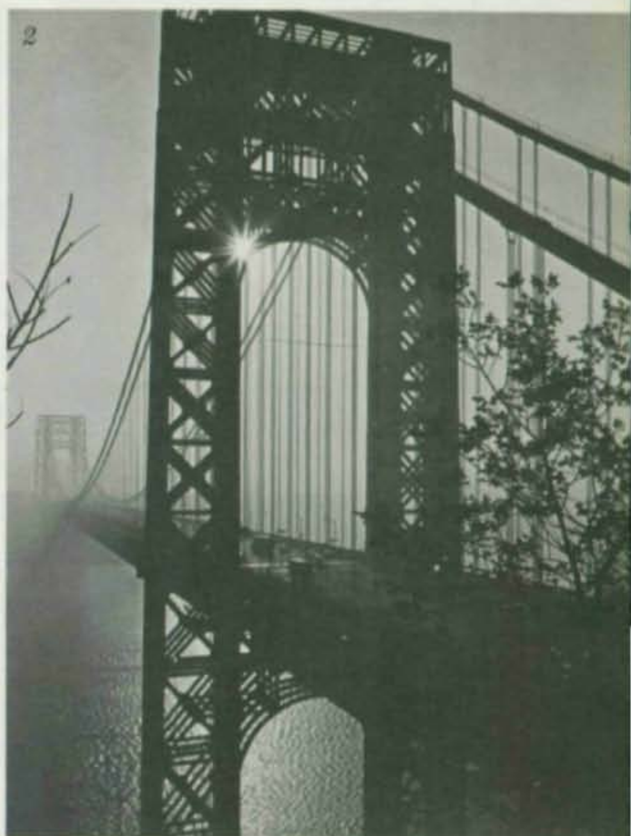

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MODERN STEEL CONSTRUCTION

Published by

American Institute of Steel Construction

101 Park Avenue, New York, N. Y. 10017

VOLUME XII / NUMBER 3 / THIRD QUARTER 1972

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THE THIRD ANNUAL T. R. HIGGINS LECTURESHIP AWARD

The 1973 T. R. Higgins Lectureship Award has been announced nationally to educators, engineers, and architects. Named in honor of the former AISC Director of Engineering and Research, the Award recognizes the author of the technical paper judged to have made the most significant contribution to engineering literature on fabricated structural steel.

The Award-winning paper will be selected by a jury of six eminent educators, designers, and industry representatives.

They are:

Theodore V. Galambos *Washington University-St. Louis*
William McGuire *Cornell University*
John E. Mueller *Whitehead & Kales Company*
Clarkson W. Pinkham *S. B. Barnes & Associates*
Leslie E. Robertson *Skilling Helle Christiansen & Robertson*
Robert S. Sherman *Carolina Steel Corporation*

The Award winner will be announced on February 5, 1973. Presentation of an engraved certificate and a $2,000 honorarium will be made at the 1973 AISC National Engineering Conference in Philadelphia, where an oral review of the prize-winning paper will be presented by the author.

THE ELEVENTH ANNUAL FELLOWSHIP AWARDS

The deadline for entries to AISC's 1973 Fellowship Awards Program is February 8, 1973. These awards serve to encourage expertise in the creative use of fabricated structural steel.

Four $2,500 fellowship awards will be granted to senior or graduate students enrolled in a structural engineering program at an accredited engineering institution. Additionally, the head of the department where each Fellow will undertake his study will receive a further grant of $500 for unrestricted general administrative use.

Students interested should contact the Education Committee, AISC, 101 Park Avenue, New York, N.Y. 10017 for the Rules and Instructions for Applicants.

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THE BRIDGES OF NEW YORK

One of the highlights of the AISC National Engineering Conference, held last May, was a boatride around Manhattan Island. The excursion emanated from the lower tip of Manhattan, went north on the Hudson to the George Washington Bridge, then south and on up the East River to the Triborough Bridge, and finally back down the East River and out to the Verrazano-Narrows Bridge. AISC Assistant Chief Engineer Andrew Lally, one of the tour guides, pointed out the various bridges along the way, giving historical background and specifics on these interesting structures.

Presented here is a summary of Mr. Lally's remarks.

The George Washington Bridge

As early as 1868, authorization to build a bridge across the Hudson had been granted by New Jersey. However, New York did not agree to the use of river piers. Arguments over clearances and locations led to a series of starts, halts and abandonments until 1927, when construction finally started on the George Washington Bridge.

Othmar H. Ammann designed the bridge. Ammann, a native of Switzerland, came to this country in 1904 and worked for Gustav Lindenthal, who had devoted years to the promotion of a Hudson River crossing. In 1925, Ammann became Chief Engineer for the Port of New York Authority. In this capacity, he directed the construction of the bridge that held the world's record span length until the Golden Gate Bridge was built a few years later.

The economy of keying into the tough, durable traprock of the Palisades for the western anchorage and the depth to rock on the east side, along with the high vertical clearance required for shipping, made a suspension bridge the logical solution.

The main span of the George Washington Bridge measures 3,500 ft. The center vertical clearance extends 213 ft above mean high water. Twin steel towers raise the cables 593 ft high on the cast steel saddles. Silicon steel, totaling 23,587 tons, and carbon steel, weighing 18,254 tons, were used in the towers. The towers are made up of four steel bents, rigid enough laterally and vertically to spread the cable loads from their interior columns at the top, to all the columns in the bent, at their bases. The longitudinal flexibility of the towers accommodates the cable deflection.

Cable saddles top the towers on a nest of rollers; these were used only for adjusting saddle position during initial construction and during the lower deck placement. During normal service, the saddles are blocked, which precludes roller motion. This forces the towers to deflect longitudinally to

The George Washington Bridge

The lower deck of the George Washington Bridge

accommodate the cable movements. Since the short end cables limit movement at the saddle, the slender towers flex easily without inducing high stresses within their deflection range.

The four cables transmit 248-million lbs of pull on each anchorage. The cable tension computation is comparatively simple. Taking the summation of moments about the cables' low point in the center of the span, and dividing by the cable sag, the horizontal component of the cable tension at the top of the tower is found. This component, divided by the cosine of the cable's maximum slope, gives the maximum pull. This force divided by the allowable stress gives the required size.

Cables stretch under live load and when temperatures rise. This increase in sag is significant and must be considered. By "cut and try," or by means of a direct but more complicated "deflection" solution, the sag and pull of the cable for any loading can be calculated. With a minimum temperature and live load on all spans, the cable sag is 2 ft greater than normal. Dividing the maximum tension of 6.53 million lbs in each cable by the allowable stress of 82,000 psi gives the required size of each cable – 800 sq in. Each cable has 26,474 galvanized steel wires. The cable wire is cold drawn steel with a prescribed yield of 150 ksi and an ultimate of 220 ksi. The averages provided were actually 184 ksi and 234 ksi.

The unexpected aesthetics of the exposed steel towers led to abandoning initial plans for a stone encasement.

Formal ceremonies marked the opening of the bridge on October 25, 1931.

Although designed to carry two levels of traffic, the initial construction only included the eight-lane upper deck; a six-lane lower deck was to be added when needed. Work began on the lower deck in 1958, and it was opened to traffic in 1962.

The design of the lower deck included the addition of deep stiffening trusses. Until then, other factors provided adequate stiffness. This is of particular interest in view of the 1941 Tacoma Narrows Bridge failure due to lack of stiffness. (Four months after the Tacoma bridge was opened to traffic, it collapsed in a 42 mph wind. As a result, stiffening trusses were added to other flexible bridges throughout the country.)

The original stiffness of the George Washington Bridge was due to the short end span cables, which limited the main span cable movements, and the massive deck which added to its stability. In addition, the aerodynamic configuration of the wide deck did not create the wind excitation problem experienced by other bridges.

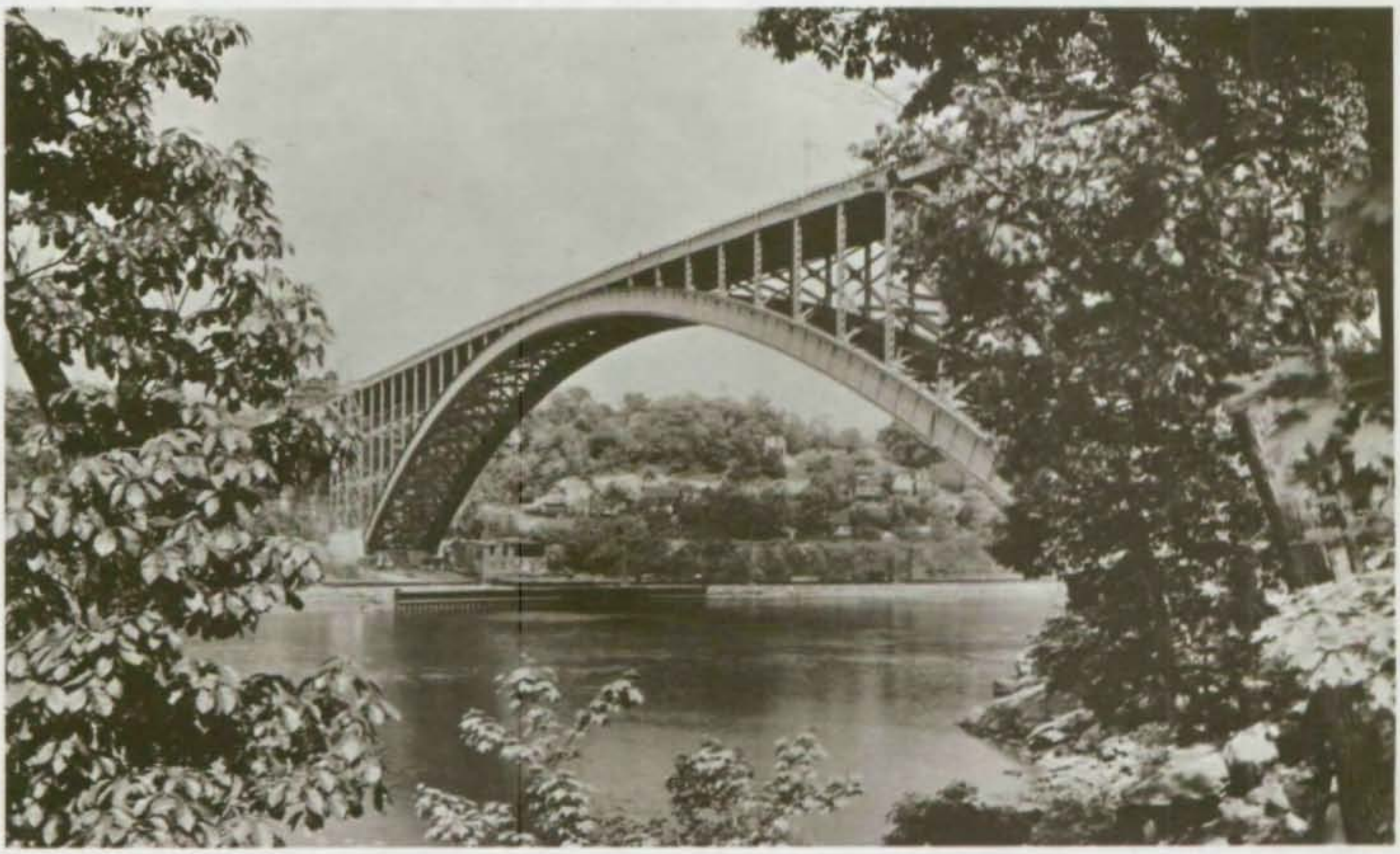
The Tacoma Narrows Bridge suffered an aerodynamic instability caused by the H cross-section of the deck, formed by the shallow stiffening plate girders. In the steady wind, the vortex shedding above the deck reduced the vertical load when the deck moved down. The opposite occurred when the deck rebounded. In harmony with the natural period of the structure and having practically no torsional stiffness, the deck tore apart when the torsional mode accompanied the grossly amplified longitudinal mode.

The Henry Hudson Bridge

An example of a spectacular arch bridge in this country is the Henry Hudson Bridge over the mouth of the Harlem River, from the northern end of Manhattan to Spuyten Duyvil in the Bronx. Opened to traffic in 1936, this 800-ft arch span bridge was designed by D. B. Steinman.

In 1908, Dr. Steinman, then a civil engineering student at Columbia University, outlined in his thesis, in addition to his design analysis, a thorough discussion of the artistic phase of the proposed Henry Hudson Bridge. The paper showed that a steel arch span could be built for half the cost of the proposed concrete span. Twenty-five years later, the plan by Steinman became a reality, when he received the commission for his firm to design the bridge at the location designated in his C. E. thesis.

Designed for two levels of roadway, the bridge opened with only one. An upper roadway would go up when the need became apparent. It did. One month after opening, construction started on the second level.



The Henry Hudson Bridge

The Brooklyn Bridge

When completed, the Henry Hudson Bridge was the longest fixed, plate girder arch in the world. The mid-span vertical clearance is 142.5 ft. In 1936, the bridge won honorable mention in the AISC Prize Bridge Competition.

The Brooklyn Bridge

The longest bridge in the world when it opened to traffic in 1883, the Brooklyn Bridge remains an engineering masterpiece among its more recently constructed neighbors.

The Brooklyn Bridge was, of course, far from the first of its kind; 142 years earlier, a primitive iron chain bridge 70 ft long spanned the River Tees in England.

In 1818, Thomas Telford built the prototype of all modern suspension bridges across the Menai Straits in Wales. The bridge spanned 550 ft and carried the roadway 100 ft above the water.

Earlier, in 1801, James Finley, a judge of the Court of Common Pleas in Pennsylvania, erected a 70-ft span. He applied for a patent on his suspension bridge design in 1810. One famous structure of the Finley type is the 244-ft main span suspension bridge over the Merrimack River in Massachusetts. This bridge lasted for about 100 years, and then was rebuilt in its original form in 1909, and still functions.

Steel was first used in a 312-ft chain suspension bridge in Vienna in 1828. Experimenting with stiffening the roadway of suspension bridges started in 1832 with James Dredge's Loch Lomond Bridge.

The Brooklyn Bridge designer, John Augustus Roebling, was born in Germany in 1806. After completing his studies at the Royal Polytechnic School in Berlin, he came to America in 1831. In 1844, he built his first suspension bridge, a seven span wooden aqueduct over the Allegheny River. The 162-ft spans were suspended by two 7-in. wire cables, which he had designed a few years earlier as a replacement for hemp rope.

Roebling's 1847 feasibility study of building a railroad suspension bridge across the gap at Niagara Falls resulted in construction of the 821-ft main span suspension bridge. After 42 years of service, increased railroad loading made the bridge obsolete.

Another suspension bridge that Roebling fought to build was the bridge over the Ohio River at Cincinnati. In 1867 the bridge was finally completed.

Talk of connecting Brooklyn with Manhattan had gone on since early in the 19th century, but authorities said it couldn't be done. In 1857, the New York Journal of Commerce published a letter by Roebling, which argued the feasibility of such a span. After the Civil War, the idea of the project was revived. In 1869, a board of eminent engineers reviewed Roebling's plans and unanimously confirmed the proposed design. The New York State Legislature then authorized the New York Bridge Co. to build a bridge over the East River, with Roebling as chief engineer.

Roebling was making surveys for the location of the main piers on the Brooklyn wharf, when a ferry struck the bulkhead. Roebling's right foot was crushed between the wooden pilings, resulting in his death three weeks later.

His son, Col. Washington A. Roebling, a Civil War Veteran and graduate engineer from Rensselaer Polytechnic Institute (the first U. S. engineering school), carried on the building of the bridge.

The first problem to be faced was the construction of firm foundations for the massive 271½-ft high towers. This was solved by using pneumatic caissons. Although this method had been used in Europe, the Brooklyn Bridge and the Eads Bridge, constructed concurrently, were the first to use pneumatic caissons for large deep foundations.

The huge timber caissons were built nearby, floated to the dredged pier location, and sunk within the cofferdam by the courses of foundation masonry placed upon them.

The Brooklyn caisson caught fire several times, culminating in the "great fire" of 1870. By flooding the caisson, the fire was finally extinguished. Two and a half days later, the water was expelled and damage repair began.

In 1872, Col. Roebling was carried out of the Manhattan caisson. A victim of the dreaded "Caisson Disease," he was paralyzed for life. Despite his severe handicap, he continued to direct operations from his home.

This was the first bridge to use wire cables; spinning of the cables took 26 months. The bridge was opened to traffic in 1883, 14 years after construction began.

The main span is 1595½ ft, with 930-ft end spans. The vertical clearance of 135 ft established a clearance standard. In each of the four cables, measuring 15¾-in. dia., there are more than 5,400 parallel galvanized wires.

John Roebling explained his use of diagonal stay cables in resisting destructive wind forces in his preliminary report on the bridge, "The supporting power of the stays alone will be 15,000 tons, ample to hold up the floor. If the cables were removed, the bridge would sink in the center but would not fail."

The Manhattan Bridge

The Manhattan Bridge has a main span of 1,470 ft with 725-ft side spans.

Designed by the New York City Department of Bridges, the bridge was completed in 1909. This bridge represents the first suspension bridge designed in accordance with Moisseiff's "Deflection Theory." This theory takes into account the change in geometry under live load deflection as opposed to a conventional "elastic" analysis in which the configuration of the system is taken as that under dead load only. Moisseiff developed Melan's "More Exact Theory" for this general application and named it the "Deflection Theory," recognizing that no theory would be exact. The tacit neglect of dead load on the deformation of the bridge under live load was a serious error for long span bridges. This situation existed because the Rankine-Ritter elastic theory was based on a rigid stiffening truss. Later, the theory was picked up and used without further scrutiny on other more flexible bridges.

D. B. Steinman's office was engaged in 1955 to investigate the bridge's condition from the standpoint of distress incurred since opening to rapid transit service, and recommend a solution. The report revealed that the bridge suffered severe distortion from full rail loading on one side only, causing a 3-ft mid-span live load deflection on the loaded side and an upward movement of 9 in. on the unloaded side. The accompanying longitudinal movement created racking in the floor panels, causing damage to the suspended floor beam flanges. Samples of the main cables tested showed good results.

Although the report recommended extensive work involving removal of the four rapid transit tracks, converting rail lanes to vehicular lanes, and building a tunnel for train traffic, only limited repairs were made.

The Manhattan Bridge

The Williamsburg Bridge

The Williamsburg Bridge

In 1903 when the Williamsburg Bridge opened to traffic, it broke the Brooklyn Bridge's record for the longest span by 4½ ft with a main span measuring 1,600 ft.

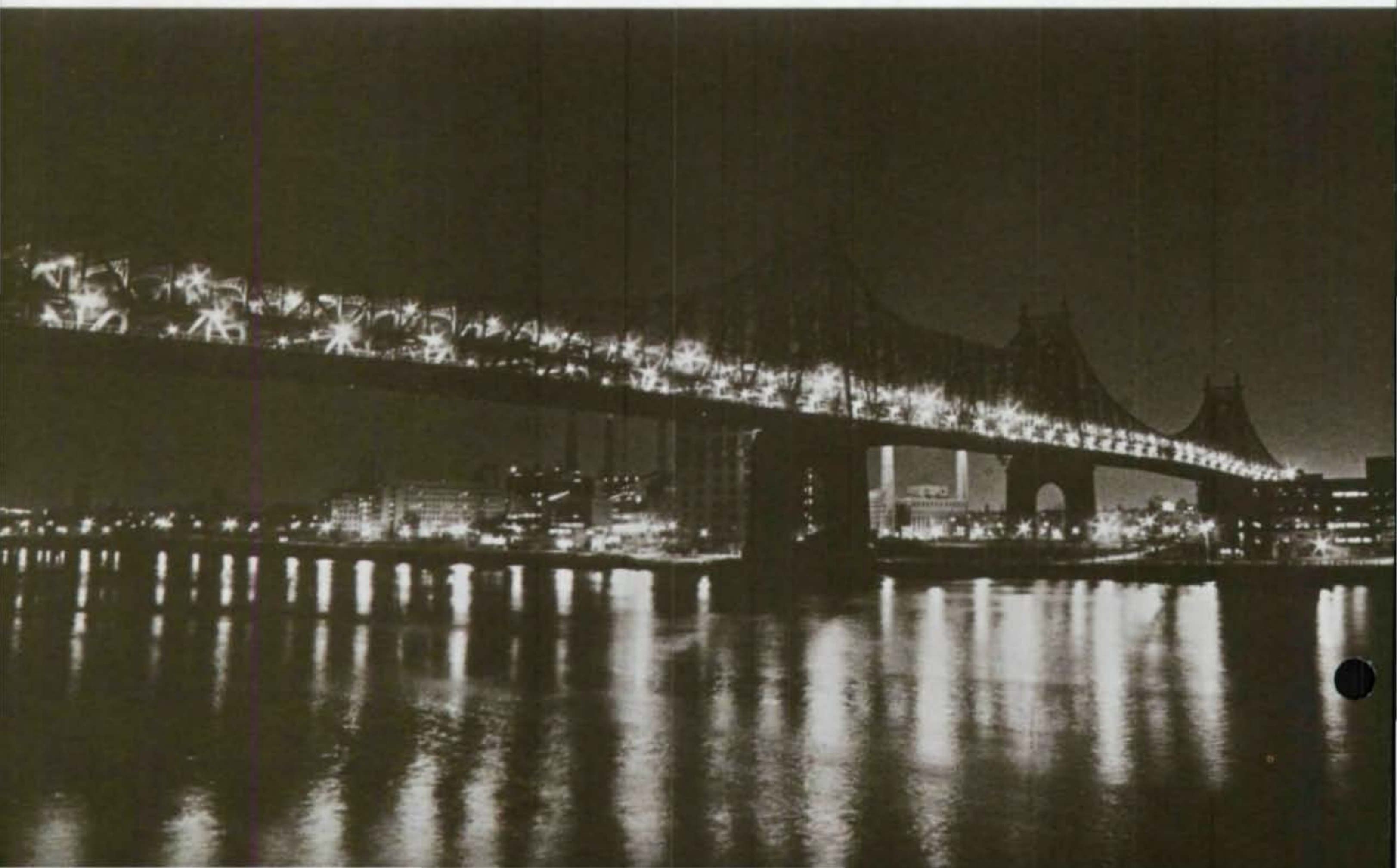
The straight unloaded cables of the end spans carry the main span loading direct to the anchorages. The end spans are carried on steel bents.

Designed by Leffert L. Buck, the Williamsburg was the first long span suspension bridge constructed with steel towers. The four 18⅝-in. dia. cables are made up of ungalvanized steel wires. The stiffening trusses are 40 ft deep. This depth-to-span ratio of 1/40 was the highest ever used. These ratios became lower with more slender stiffening trusses until the 1/350 of the ill-fated Tacoma Narrows Bridge set the lower limit. Now, aerodynamically stable box girder decks surpass this slenderness.

The Queensborough Bridge

The continuous cantilever trussed Queensborough Bridge connecting Manhattan and Queens, completed in 1909, was the first bridge in which nickel steel was employed.

The Queensborough Bridge



The channel spans are 1,182 ft and 984 ft. The middle anchor span is 630 ft. The anchor span on the Manhattan side of the bridge is 469 ft and on the Queens side is 459 ft. The channel cantilever arms connect at the center without a suspended span, making it statically indeterminate. The usual suspended center span may have been eliminated in an attempt to imitate the neighboring suspension bridges. The upper and lower decks were designed for four railway tracks each.

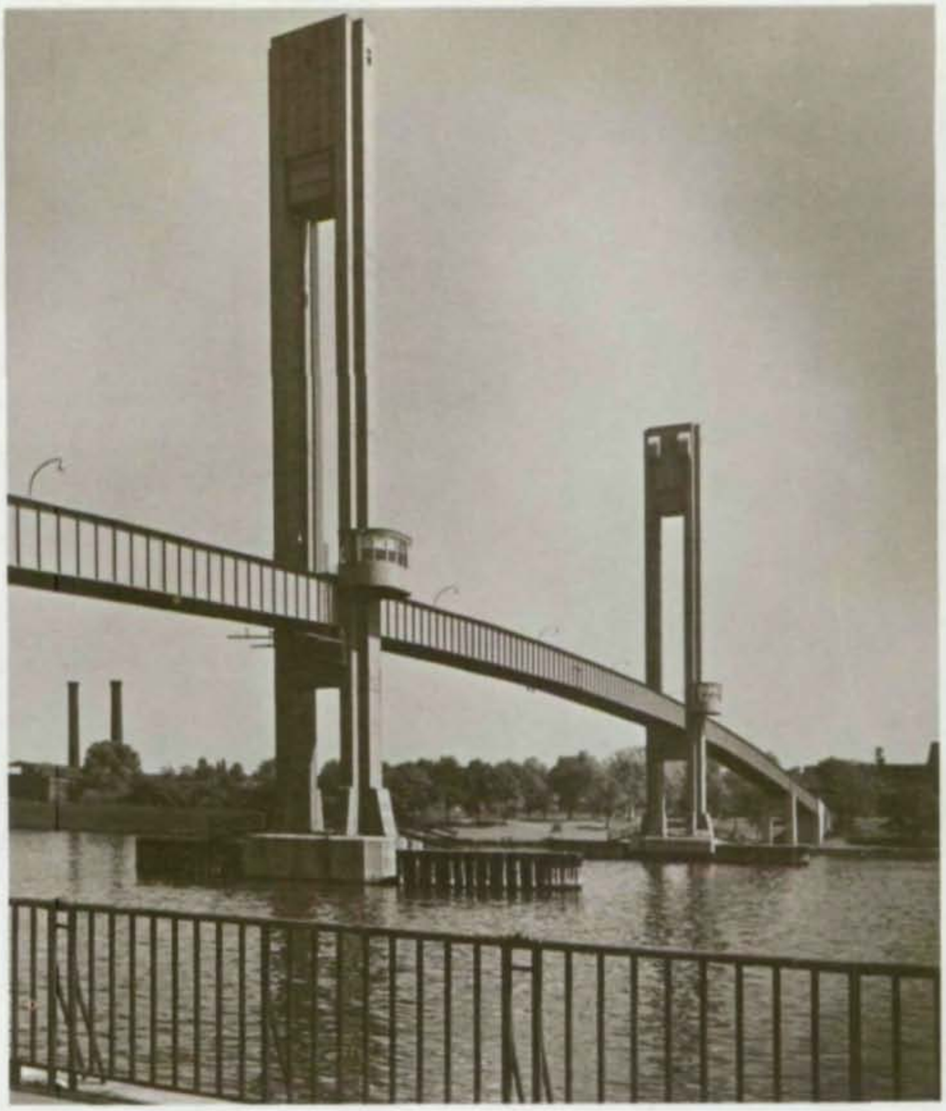
After the Quebec Bridge failed in 1907, concern was expressed about the safety of the Queensborough Bridge. Two independent groups were retained to review the design. Both reports agreed that the structure was inadequate to carry the intended loads. A gross error had been made in the computation of dead loads during an earlier change in the design. Two tracks had to be removed from the upper deck to diminish the train loading. Additionally, a subway tunnel was built a block away at 60th Street to accommodate the reduction of transit bridge capacity. The bridge, at best a clumsy looking structure, was disowned by the consulting architect, Henry F. Hornbostel, who remarked upon seeing the completed bridge, "My God, it's a blacksmith shop."

Other East River Bridges

The Welfare Island Bridge spans the East Channel of the East River, connecting Welfare Island and Queens. This vehicular bridge has a lift span of 418 ft. Designed by Tippets-Abbett-McCarthy & Stratton, the bridge opened to traffic in 1955. That same year, the bridge was cited by the AISC Prize Bridge Awards Jury.

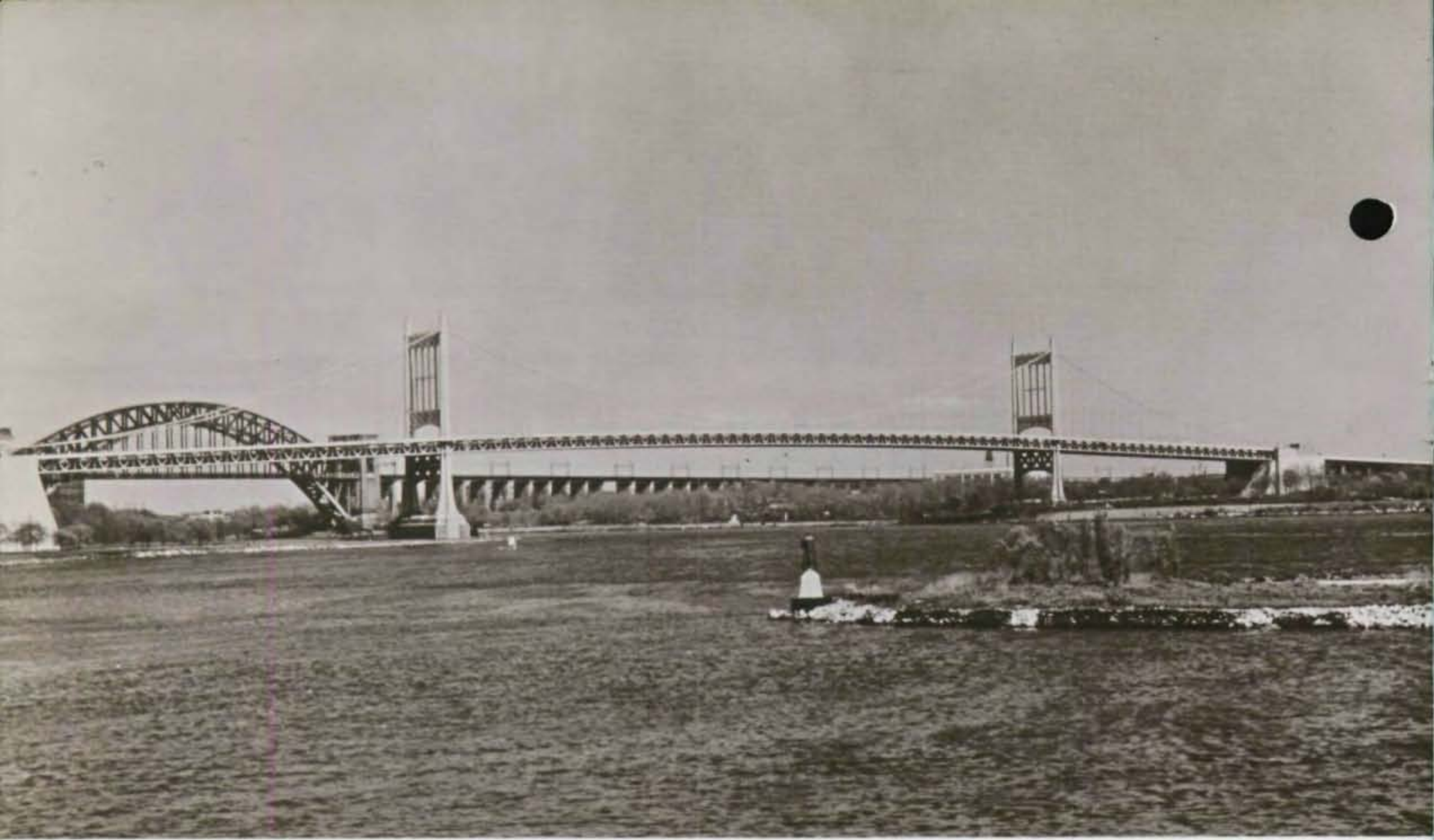
Just north of Welfare Island lies Ward's Island and another vertical lift span bridge completed in 1951. This pedestrian bridge connects the island to Manhattan at East 103rd Street. O. H. Ammann designed this 312-ft span bridge. This bridge also won an AISC Prize Bridge Award.

The East River Crossing of the Triborough Bridge has a main span of 1,380 ft. The Triborough Bridge Authority built this suspension bridge, under the direction of O. H. Ammann, Chief Engineer, with Allston Dana as Engineer of Design, and Leon S. Moisseiff as Consulting Engineer. The AISC Prize Bridge Award Jury honored this bridge in 1936.



The Harlem River Pedestrian Bridge

The Welfare Island Bridge



The East River Crossing of the Triborough Bridge

Behind the Triborough Bridge stands the Hell Gate Bridge. This colossal railroad arch bridge was designed by Gustav Lindenthal. The Hell Gate spans 997½ ft between steel bearings. It carries the heaviest railroad traffic on four tracks over a massive ballast floor. The foundations were placed with pneumatic caissons.

The condition of the river bottom and current dictated constructing the arch without falsework. The arch was cantilevered out from both abutments by use of massive steel back stays. The main arch ribs are the lower chords of the trusses. The upper trusswork serves as bracing.

The Hell Gate held the record for the world's longest arch span bridge from the time of its completion in 1916 until it was surpassed by the Bayonne Bridge over the Kill Van Kull in 1931.

The Verrazano-Narrows Bridge

The longest span bridge in the world, the Verrazano-Narrows Bridge, was opened to traffic in 1964, 15 years after the Triborough Bridge and Tunnel Authority was granted a federal permit to construct a bridge across the Narrows, connecting Staten Island and Brooklyn. Designed by Ammann and Whitney, the bridge has a main span of 4,260 ft, 60 ft longer than the second ranking Golden Gate, 460 ft more than the third longest Mackinack, and 760 ft longer than the fourth ranking George Washington.

The smooth, slender towers, 693 ft above the water, appear deceptively simple. The interior of these towers encase thousands of steel cells. The towers, weighing 27,000 tons, transmit a total load of 134,000 tons to their bases. Each tower has about as much steel as the Empire State Building. The tower foundation is 105 ft below mean high water on the Staten Island side. The foundation on the Brooklyn side of the bridge is 170 ft deep.

The foundations were built by the open well method because excavation by pneumatic caissons is impractical at depths below 120 ft. Since the open well method does not permit direct examination at the founding stratum, care must be taken to insure proper founding conditions.

The tower pier caissons were started by setting the steel cutting edges of the caisson bottom within the dewatered cofferdam. The steel enclosures of the 7-ft high cutting edges were filled with concrete, forming nine rectangular chambers. The chambers, filled with sand to the top of the cutting edges, acted as a base for the walls of the dredging wells through which the clamshell dredge excavated the material below, and sunk the caisson. The sinking of the caissons occured gradually and was usually not noticeable. When the caisson reached its founding stratum, the concrete was tremied to fill each well to approximately 9 ft above the top of the dredging chamber. The rest of the wells remain filled with water. The wells are capped by a concrete slab, which distributes the tower load through the cells to the foundation bottom.

The massive cable anchorages contain 375,000 cu yds of concrete. Their bases equal the size of two football fields. The large eye-bars, embedded in the heel, anchor the bridge's four 3-ft dia. cables.

Construction took only a little more than five years, from start to completion on November 21, 1964. In 1965, AISC honored the designers, owners, and builders with the First Special Bridge Award for "Outstanding Achievement in Technology and Aesthetics."

The Hell Gate Bridge

The Verrazano-Narrows Bridge

PRIZE BRIDGES OF 1972

PRIZE BRIDGE 1972 — LONG SPAN

Koocanusa Lake Bridge
Libby, Montana
Designer: Morrison-Maierle, Inc.
Owners: U.S. Army Corps of Engineers and U.S. Forest Service
General Contractors: R. A. Heintz Construction Co. *Williamette-Western Corp.*
Steel Fabricator: The Coeur d'Alenes Company

PRIZE BRIDGE 1972 — MEDIUM SPAN, HIGH CLEARANCE

Sacramento River Bridge at Bryte Bend
Sacramento, California
Designer: State of California
Owner: State of California
General Contractor: Murphy Pacific Corporation
Steel Fabricator: Murphy Pacific Corporation

PRIZE BRIDGE 1972 — MEDIUM SPAN, LOW CLEARANCE

Tuolumne River Bridge
Near Sonora, California
Designer: State of California
Owner: State of California
General Contractor: Peter Kiewit Sons' Co.
Steel Fabricator: San Jose Steel Company, Inc.

PRIZE BRIDGE 1972 — SHORT SPAN

Sand Island Bridge
West of Bluff, Utah
Designer: Utah State Department of Highways
Owner: San Juan County
General Contractor: W. W. Clyde & Company
Steel Fabricator: Mountain States Steel Company

PRIZE BRIDGE 1972 — HIGHWAY GRADE SEPARATION

Scott Hill Road Bridge
Lebanon, Connecticut
Designer: Storch Engineers
Owner: State of Connecticut
General Contractor: Savin Brothers, Inc.
Steel Fabricator: Bethlehem Steel Corporation

PRIZE BRIDGE 1972 — ELEVATED HIGHWAYS OR VIADUCTS

Roadways Bridge SW and WS of Interchange C
Washington, D.C.
Designer: Richardson, Gordon and Associates
Architectural Consultants: Harbeson Hough Livingston and Larson Architects/Planners
Owner: Government of the District of Columbia
General Contractor: Head Construction Company
Steel Fabricator: American Bridge Division, United States Steel

PRIZE BRIDGE 1972 — MOVABLE SPAN

Berwick Bay Bridge — No. 80.46
Berwick To Morgan City, Louisiana
Designer: Modjeski and Masters
Owner: Southern Pacific Transportation Company

General Contractors: Massman Construction Company
John F. Beasley Construction Company
Steel Fabricator: Vincennes Steel Corporation
Division of NOVO Corporation

PRIZE BRIDGE 1972 — SPECIAL PURPOSE

Tenney Park Pedestrian Bridge
Madison, Wisconsin
Designer: Arnold and O'Sheridan, Inc.
Owner: City of Madison
General Contractor: C & C/Bohrer Inc.
Steel Fabricator: Theo. Kupfer Iron Works, Inc.

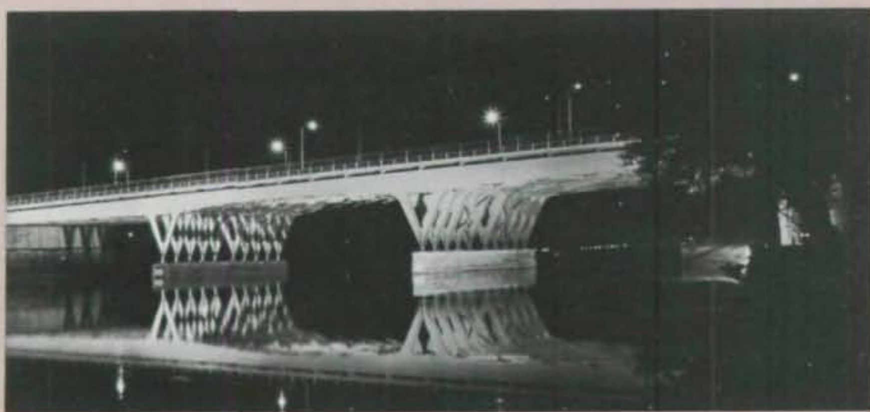
AWARD OF MERIT 1972 — LONG SPAN

Dent Bridge
Clearwater County, Idaho
Designer: Howard, Needles, Tammen & Bergendoff
Owner: U. S. Army Corps of Engineers
General Contractor: Hensel Phelps Construction Co.
Steel Fabricator: Fought & Company, A Division of Allied Equities Corporation

AWARD OF MERIT 1972 — MEDIUM SPAN, HIGH CLEARANCE

East Pearl River Bridge
St. Tammany Parish, Louisiana
and Hancock County, Mississippi

Designers: (A Joint Venture): Barnard and Burk and Howard, Needles, Tammen & Bergendoff
General Contractors: (A Joint Venture): W. R. Fairchild Construction Company and J.W. Snowden Construction Company
Steel Fabricator: Teledyne Irby Steel



AWARD OF MERIT 1972 — MEDIUM SPAN, HIGH CLEARANCE

Girard Avenue Bridge Over the Schuylkill River
Philadelphia, Pennsylvania

Designer: City of Philadelphia
Owner: Commonwealth of Pennsylvania
General Contractor: Conduit & Foundation Corporation
Steel Fabricator: Bethlehem Steel Corporation

AWARD OF MERIT — MEDIUM SPAN, HIGH CLEARANCE

Kansas City Southern RR Bridge A-307 Over Arkansas River
Redland, Sequoyah and LaFlore Counties, Oklahoma

Designers: Forrest and Cotton, Inc. and Wolchuk and Mayrbaurl
Owner: The Kansas City Southern Railway Company
General Contractors: Superstructure: Bethlehem Steel Corporation and Substructure: Peter Kiewit Sons' Co.
Steel Fabricator: Bethlehem Steel Corporation

AWARD OF MERIT 1972 — MEDIUM SPAN, LOW CLEARANCE

Blue River Bridges on I-70
Silverthorne, Colorado

Designer: State of Colorado
Owner: State of Colorado
General Contractor: A. S. Horner Construction Co.
Steel Fabricator: The Midwest Steel & Iron Works Co.

AWARD OF MERIT 1972 — MEDIUM SPAN, LOW CLEARANCE

Washburn Bridge
Washburn, North Dakota

Designer: North Dakota State Highway Department
Owner: State of North Dakota
General Contractor: Sletten Construction Company
Steel Fabricator: Capitol Steel & Iron Company

AWARD OF MERIT 1972 — SHORT SPAN

ewton Ford Bridge
ll Creek Falls State Park, Tennessee

Designer: Betts Engineering Co., Inc.
Architectural Consultant: James R. Franklin, Architect
Owner: Tennessee Department of Conservation
General Contractors: B. H. Phillips Construction Company
Sheco Construction Company
Steel Fabricators: Graham Structures, Inc.

AWARD OF MERIT 1972 — HIGHWAY GRADE SEPARATION

Frisco East Interchange Bridge on I-70
Frisco, Colorado

Designer: State of Colorado
Owner: State of Colorado
General Contractors: Colorado Constructors, Inc.
A. S. Horner Construction Co.
Steel Fabricator: The Midwest Steel & Iron Works Co.

AWARD OF MERIT 1972 — HIGHWAY GRADE SEPARATION

I-95 Southbound Bridge over John F. Kennedy orial Highway
more, Maryland

Designers: Knoerle, Bender, Stone & Associates, Inc.
Matz, Childs & Associates, Inc.
Architectural Consultant: Urban Design Concept Associates
Owner: City of Baltimore, Department of Public Works
General Contractor: Interstate Bridge Company of Maryland, Inc.
Steel Fabricator: Cumberland Bridge Company

AWARD OF MERIT 1972 — HIGHWAY GRADE SEPARATION

L⁵ Overcrossing Bridge of I-5, I-205 Interchange
Tualatin, Oregon

Designer: Oregon Department of Transportation
Owner: State of Oregon
General Contarctor: Guy F. Atkinson Company
Steel Fabricator: American Bridge Division,
United States Steel

AWARD OF MERIT 1972 — MOVABLE SPAN

Hoquiam River Bridge
Hoquiam, Washington

Designer: Washington State Highway Commission
Architectural Consultant: Edward J. Green
Owner: State of Washington
General Contractor: Williamette-Western Corp.
Steel Fabricator: Northwest Steel Fabricators, Inc.

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AWARD OF MERIT 1972 — MOVABLE SPAN
John's Pass Bridge
Treasure Island and Madeira Beach, Florida
Designer: W. K. Daugherty
Owner: State of Florida
General Contractor: Scott Construction Company
Steel Fabricator: Nashville Bridge Company

AWARD OF MERIT 1972 — SPECIAL PURPOSE
78th and Maple Street Pedestrian Bridge
Omaha, Nebraska
Designer: Richardson, Gordon and Associates
Owners: State of Nebraska and City of Omaha
General Contractor: Foster-Smetana Co.
Steel Fabricator: Paxton & Vierling Steel Co.