THE PORT OF NEW YORK AUTHORITY

CREATED BY COMPACT BETWEEN THE STATES OF NEW YORK AND
NEW JERSEY AND RATIFIED BY CONGRESS

SECOND PROGRESS REPORT

ON

KILL VAN KULL BRIDGE

BETWEEN

BAYONNE, NEW JERSEY

AND

PORT RICHMOND, STATEN ISLAND, NEW YORK

MARCH, 1931

---

80 - 90 EIGHTH AVENUE, NEW YORK CITY

THE PORT OF NEW YORK AUTHORITY

80-90 EIGHTH AVENUE, NEW YORK CITY

COMMISSIONERS

New York

JOHN F. GALVIN, *Chairman*
HOWARD S. CULLMAN
JOHN F. MURRAY
GEN. GEORGE R. DYER
JOHN J. PULLEYN
A. J. SHAMBERG

New Jersey

FRANK C. FERGUSON, *Vice-Chairman*
SCHUYLER N. RICE
GEN. WILLIAM C. HEPPENHEIMER
JOSEPH G. WRIGHT
GEORGE DEB. KEIM
IRA R. CROUSE

EXECUTIVE DEPARTMENT

JOHN E. RAMSEY, *General Manager*
JOHN J. MULCAHY, *Assistant General Manager*

L. J. KEEFE, *Secretary*
MORRIS M. FROHLICH, *Assistant Secretary*
H. S. QUIGEL, *Real Estate Agent*
E. TRACY LANTERMAN, *General Claim Agent*
WILLIAM LEARY, *Treasurer*
E. E. MENZER, *Assistant Treasurer*
MARION RODGERS, *Auditor*

LEGAL

JULIUS HENRY COHEN, *General Counsel*

PAUL WINDELS
Associate Counsel, New York

RUSSELL E. WATSON
Associate Counsel, New Jersey

LEANDER I. SHELLEY
Attorney

T. J. W. GERATY
Attorney

FRANK B. WETTIG
Attorney

A. J. TOBIN
Real Estate Attorney

DEVELOPMENT AND OPERATION

BILLINGS WILSON, *Assistant General Manager*

W. P. HEDDEN
Chief, Bureau of Commerce

E. MORGAN BARRADALE
Superintendent of Tunnel Operation

GLENN S. REEVES
Engineer, Port Development and Transit

SYDNEY CUMBERLEDGE
General Superintendent of Bridges

DEPARTMENT OF ENGINEERING

STAFF

O. H. AMMANN
Chief Engineer

J. C. EVANS
Terminal Engineer

EDW. W. STEARNS
Assistant Chief Engineer

W. E. THOMPSON
Tunnel Engineer

ALLSTON DANA
Engineer of Design

M. B. CASE
Engineer of Construction

H. J. BAKER
Engineer of Steel Inspection

JAMES H. DUGAN
Assistant Engineer of Design

A. ANDERSEN
Assistant Engineer of Design

W. E. CUENOT
Chief Draftsman

JOHN N. DODD
Electrical Engineer

CHAS. W. MURDOCK
Mechanical Engineer

ERLING OWRE
Architect

A. W. MUNSELL
Engineer of Masonry Inspection

E. W. BOWDEN
Assistant to Chief Engineer

CHAS. S. GLEIM
Assistant Engineer of Construction

R. T. ROBINSON
Resident Engineer
Kill van Kull Bridge

R. HOPPEN, JR.
Resident Engineer
Hudson River Bridge—New York Section

H. R. SEELY
Resident Engineer
Hudson River Bridge—Central and New Jersey Sections

A. H. MORRILL
Resident Engineer on Surveys—Midtown Hudson Tunnel

J. W. RICHARDSON
Engineer of Maintenance

CONSULTING ENGINEERS

WM. H. BURR
Consulting Engineer

JAMES F. FORGIE
Consulting Engineer

E. P. GOODRICH
Consulting Engineer

FREDERIC R. HARRIS
Consulting Engineer

LEON S. MOISSEIFF
Advisory Engineer of Design

DANIEL E. MORAN
Consulting Engineer on Foundations

ROBERT RIDGWAY
Consulting Engineer

LEWIS B. STILLWELL
Consulting Electrical Engineer

JOSEPH B. STRAUSS
Consulting Engineer

GEORGE L. WATSON
Consulting Engineer

OLE SINGSTAD
Chief Consulting Engineer on Tunnels

CONSULTING ARCHITECTS

CASS GILBERT
Hudson River Bridge and Kill van Kull Bridge

AYMAR EMBURY II
Inland Terminal No. 1

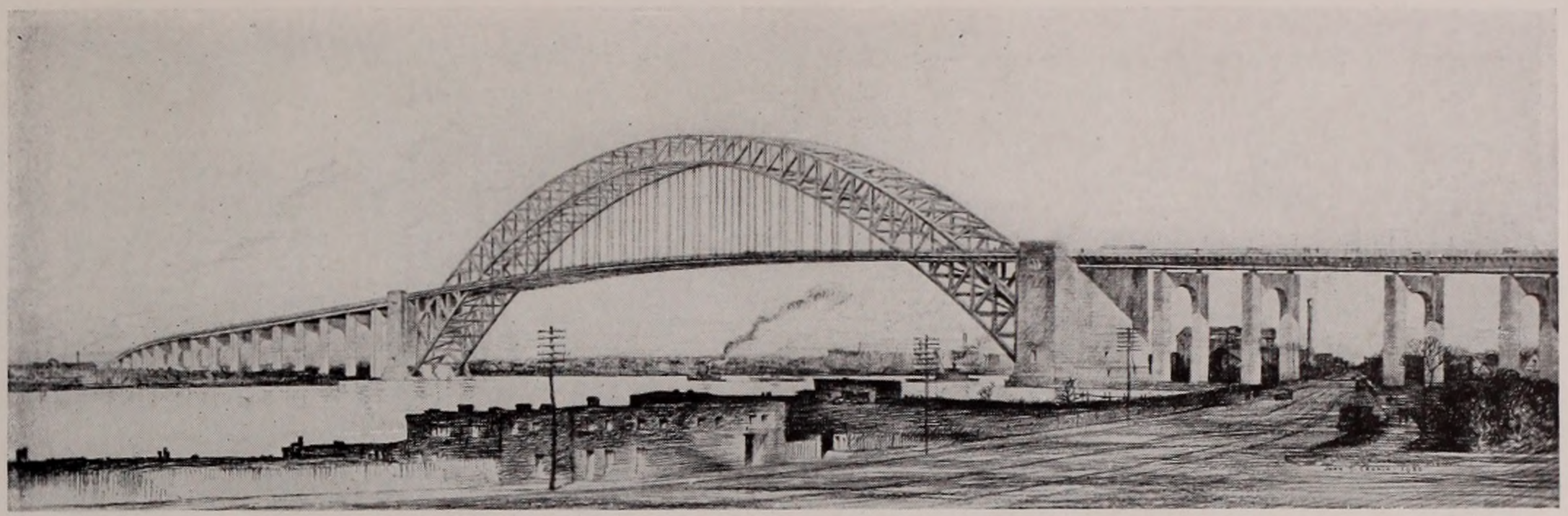
ENGINEER-ARCHITECTS FOR INLAND TERMINAL

ABBOTT, MERKT & CO.

CONSULTING GEOLOGIST

PROF. CHAS. P. BERKEY

AERIAL VIEW OF KILL VAN KULL BRIDGE AT TIME OF CLOSING OPERATIONS. OCTOBER 4, 1930



March 10, 1931

To the Commissioners of The Port of New York Authority

Gentlemen:

Less than a year ago, there was submitted to you the First Progress Report on the Kill van Kull Bridge. The Second Progress Report of the Chief Engineer, herein included, describes the successful completion of the erection of the largest arch span ever attempted. This arch involved placing of almost seventeen thousand tons of steel and necessitated unusual methods of construction inasmuch as the falsework supports were not allowed to encroach upon the shipping channel which is near the south shore of the Kill van Kull Bridge site. The difficulties encountered were overcome through the employment of unique methods as is explained by the Chief Engineer.

The major or more serious parts of the work have now been completed. What remains to be done is relatively simple and the work may be speedily concluded except for the street approach problem on the Staten Island side which still remains unsolved. This may eventually cause some traffic disorders, although it will not delay the opening of the bridge which is now confidently anticipated for the latter part of 1931.

J. E. Ramsey
General Manager.

THE KILL VAN KULL BRIDGE. ERECTING FLOOR STEEL. JANUARY 21, 1931

KILL VAN KULL BRIDGE

SECOND PROGRESS REPORT

Report
By the Chief Engineer

March 2, 1931

Mr. J. E. Ramsey, *General Manager*

Since rendering on April 1, 1930, the first report on the construction of the Kill van Kull Bridge, very satisfactory progress has been made. If construction contracts now in progress or shortly to be undertaken are carried out in accordance with schedule, opening of the bridge to traffic in the latter part of 1931 may be confidently expected.

The First Progress Report described the work of making borings and test pits, the construction of main bridge abutments and the construction of the Bayonne and Port Richmond approach piers, all of which had been completed. The erection of the steel arch had been started in 1929 and the south or Port Richmond section had been completed in March, 1930. On April 1, 1930, the greater portion of the Bayonne approach steel was in place.

Since that time the north or Bayonne section of the arch has been successfully erected and the arch closed, suspenders have been put in place and the floor steel has been completed. Erection of the Bayonne and Port Richmond approach steel work has also been completed.

The filling and grading of the Bayonne approach was undertaken in August and completed in October, 1930. A contract for the filling of the Port Richmond approach was awarded in November and at the present date is approximately ninety per cent completed. In January, 1931, a contract for the construction of the portion of the Bayonne approach lying between West Third Street and West Seventh Street was awarded and the work is in progress.

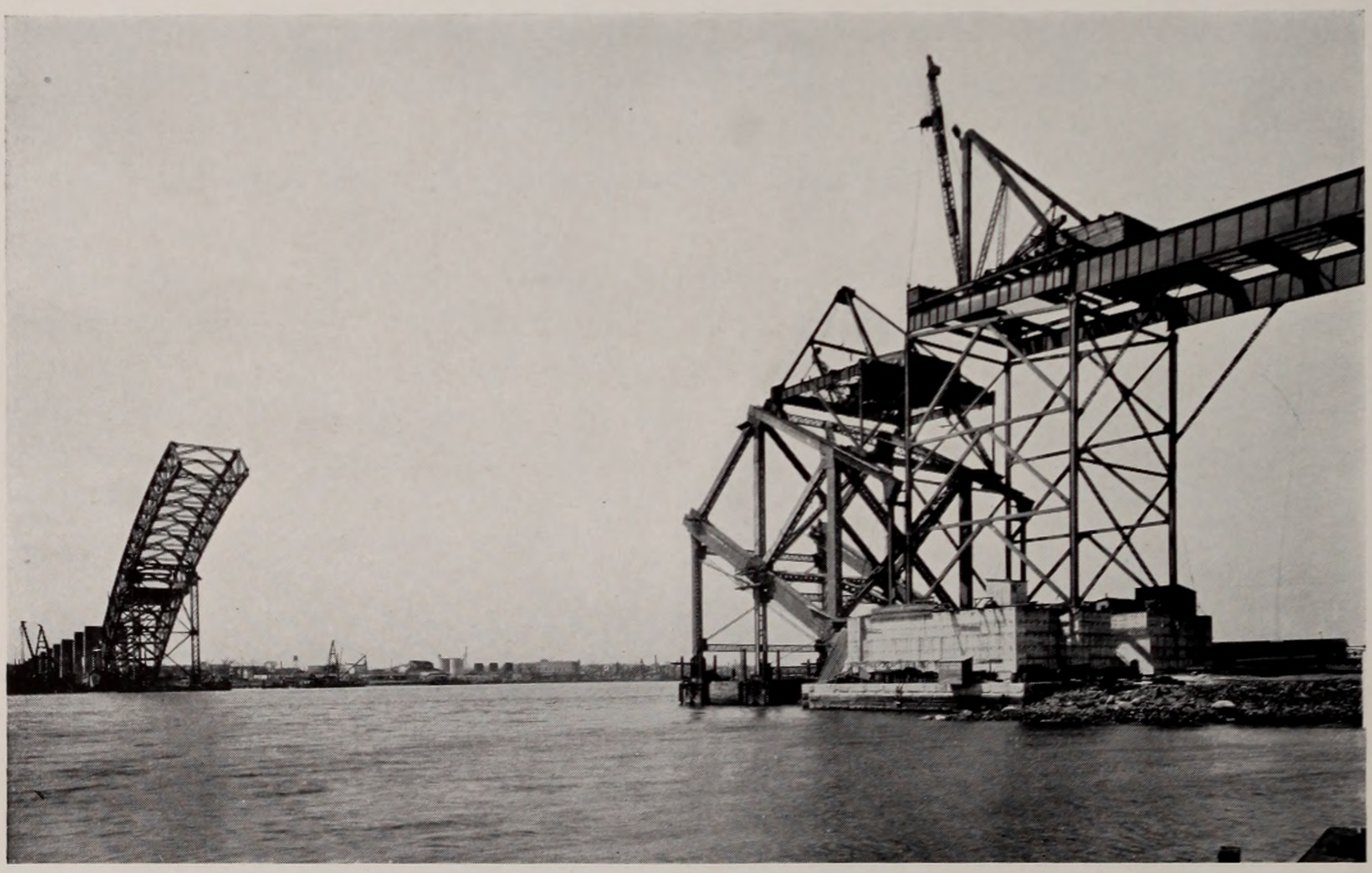
CONTRACTS

Construction contracts have been awarded to date as follows:

Contract BP-1—Borings and Test Pits
Contractor, Giles Drilling Company, Inc.

Contract BP-2—Main Bridge Abutments
Contractor, H. P. Converse

ASSEMBLING TRAVELER AT THE PORT RICHMOND ABUTMENT FOR ERECTION OF THE SOUTH SECTION OF THE ARCH. SEPTEMBER 25, 1929



ASSEMBLING TRAVELER AT THE BAYONNE ABUTMENT FOR ERECTION OF THE NORTH SECTION OF THE ARCH. APRIL 23, 1930

Contract BP-3—Steel Work of Bridge and Approaches
Contractor, American Bridge Company

Contract BP-4—Bayonne Approach Piers
Contractor, P. T. Cox Contracting Company, Inc.

Contract BP-5—Port Richmond Approach Piers
Contractor, Arthur McMullen Company

Contract BP-6—Bayonne Approach Fill
Contractor, S. & F. Konigsberg Company

Contract BP-7—Port Richmond Approach Fill
Contractor, John J. O'Rourke, Inc.

Contract BP-8—Bayonne Approach—Third Street to Seventh Street
Contractor, Charles T. Kavanagh

Contracts BP-1, 2, 4, 5 and 6 have been completed at a cost of $1,242,633.45. Contracts BP-3, 7 and 8 on which work is still in progress, will be completed at an approximate cost of $5,300,000, resulting in the approximate total of $6,542,000 for construction contracts awarded to date.

ERECTION OF ARCH AND FLOOR STEEL

The Kill van Kull is spanned by a two-hinged parabolic steel arch measuring 1675 feet between bearing points on the abutments. The arch, which is more fully described in the First Progress Report, is composed of two arch trusses, spaced 74 feet on centers, with a rise of 274 feet from the center of bearing to the crown of the lower chord. Each truss has a depth of 37 feet 6 inches at the crown and 67 feet 6 inches at the abutments.

The web members of the arch trusses are arranged in forty panels of equal length. The bottom chord is of carbon-manganese steel of a cross sectional area of 980 square inches at the abutment and 580 square inches at the crown. It is designed to carry the greater portion of the dead load of the span, and thrusts against hinges formed by pins 16 inches in diameter which bear upon heavy steel forgings through which the loads are transmitted to the structural shoes. The top chord is of silicon steel varying in cross section from 272 square inches to 421.5 square inches. The web members of the trusses, the bracing between trusses, and the floor beams and stringers, which support the deck slabs, are partly of silicon steel and partly of carbon steel. The central part of the floor system is suspended from the arch trusses by means of wire rope hangers.

The arch was erected in two sections from the abutments. The method of erection was unusual inasmuch as it involved cantilevering from both ends with the assistance of false-work bents placed successively as erection of the arch proceeded. The ideal procedure would have been to have the two sections meet at the crown of the arch. However, the

THE PORT OF NEW YORK AUTHORITY

KILL VAN KULL BRIDGE

TYPICAL ERECTION STAGES OF ARCH SPAN

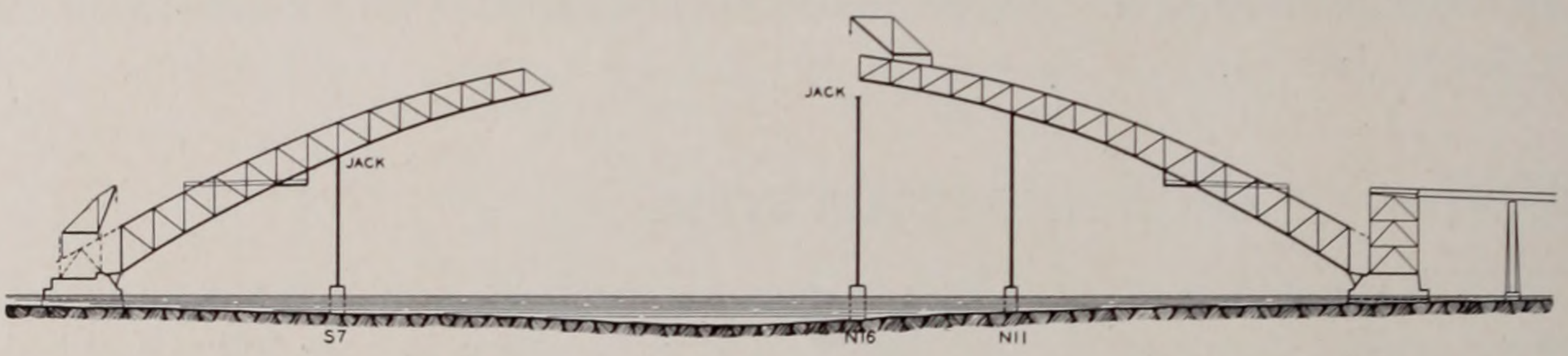
SCALE IN FEET

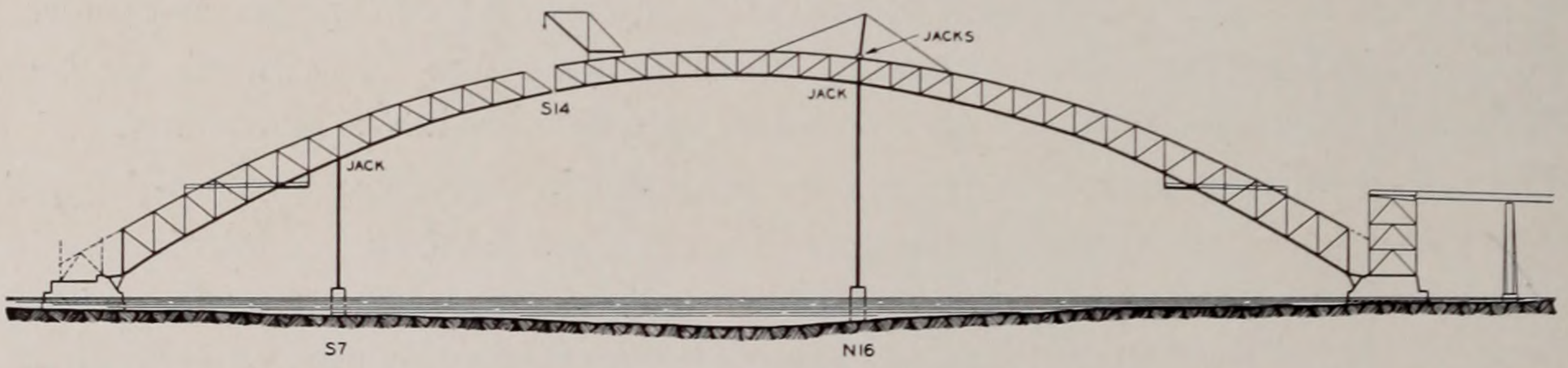
0 100 200

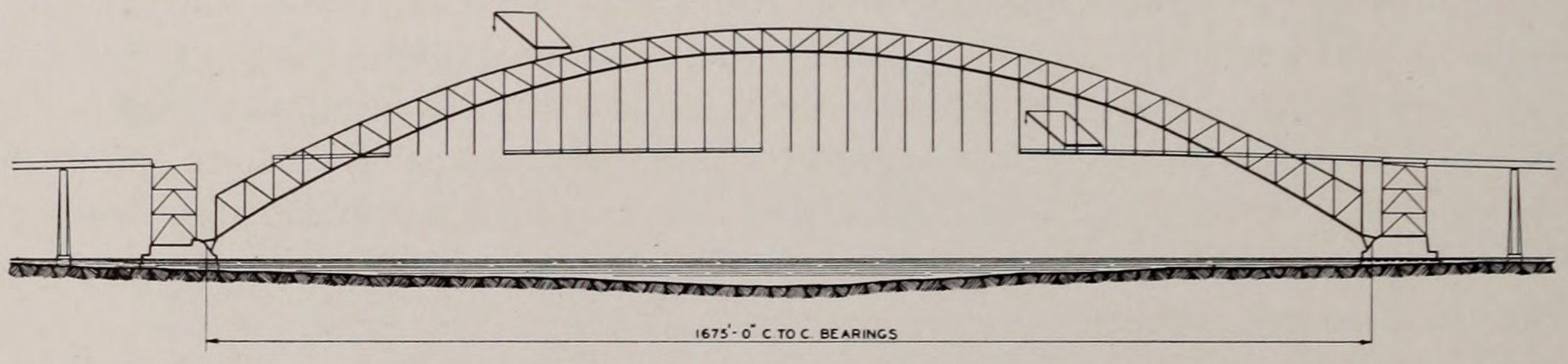
PORT RICHMOND
STATEN ISLAND N.Y

BAYONNE
NEW JERSEY

NOTE
ERECTION OF NORTH PORTION OF ARCH STARTS
AFTER COMPLETION OF SOUTH PORTION







REVISED FEB 20, 1931 FEBRUARY 1, 1930 BP-105

falsework supports were not allowed to encroach upon the shipping channel, which at the bridge site is near the south shore of the Kill van Kull and therefore involved unsymmetrical arrangement.

The steps followed in erection will be more readily understood by reference to the appended diagram of erection procedure. The most advanced falsework bent to support the Port Richmond or south section of the arch was located at panel point 7. The length of this section was thus limited to fourteen panels. The Bayonne section or north arm was construction of twenty-six panels or to a point 248 feet beyond the crown of the arch where closure was effected.

ERECTING FIRST PANEL BY DERRICK BOAT, BAYONNE SECTION OF THE ARCH. APRIL 9, 1930

The south arm was completed before undertaking work on the north arm. A single erection traveler which operated on rails along the top chords of the trusses erected both arms. Some of the falsework bents used in erecting the south arm were again used for the north arm and, in general, the same procedure was followed in the early stages of erection of the two arms, except that the first panel of steel in the south arm was erected by a traveler which had been assembled on the abutment, while for the north arm the first panel was erected by floating equipment.

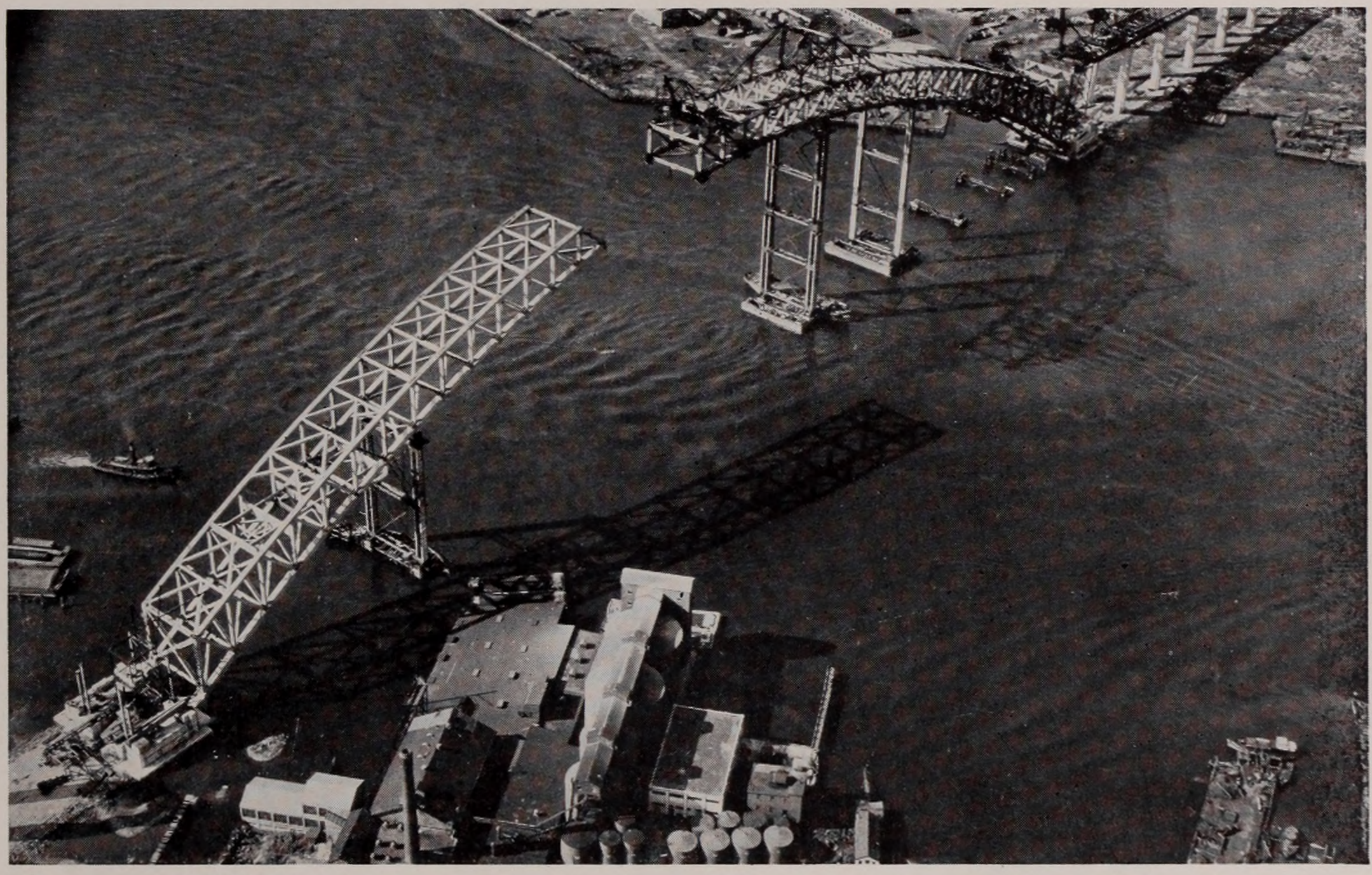
Erection of the south arm was completed during March, 1930, and the method was described in the last progress report. The procedure followed in erecting the longer north arm is described herein.

ERECTING NORTH SECTION OF THE ARCH. MAY 9, 1930

ERECTING NORTH SECTION OF ARCH, BAYONNE ABUTMENT IN FOREGROUND. JULY 15, 1930

Pier foundations for the falsework bents to support the north arm of the arch had been placed at panel points 1, 2, 4, 7, 11 and 16. The piers at points 1, 2 and 4 consisted of four groups of square timber piles tightly wedged in steel boxes braced together. The piers for the bents at panel points 7, 11 and 16 were steel boxes containing steel H-Section piles encased in concrete. All piers were founded upon rock.

The falsework bents were made up largely of members intended for later use in the permanent structure; the heavier members were built of girders of the Port Richmond approach viaduct. Alternate bents were equipped with jacks of three thousand five hundred tons capacity each for the purpose of adjusting the vertical position of the arch trusses.



ARCH ERECTION. SEPTEMBER 20, 1930

A floating derrick erected the falsework bent at panel point 1 and the arch members of the first panel. The Bayonne approach traveler had at this time completed erection of the abutment steel work and was in position to assemble the main span erection traveler on the top chord in the first panel. Steel work of the second panel was then erected as a cantilever arm, following which the falsework bent at panel point 2, equipped with jacks, assumed the load and freed bent 1. The third and fourth panels were next added as a cantilever arm followed by lowering the jacks at bent 2 which thus transferred the load of the arch section to falsework bent 4. As erection progressed this bent was later freed by jacking up at bent 7. Similar jacking operations were carried out as erection proceeded to and beyond the

ERECTING THE BAYONNE SECTION OF THE ARCH — SEPTEMBER 18, 1930

falsework bent at panel point 11 which assumed the load by lowering the jacks at bent 7 and was later relieved by jacking up at bent 16.

The stresses which occurred during erection were such as to require an increase in the section of certain web members by the addition of temporary material. In other cases the section of the member was increased permanently, while at some points both expedients were used. The highest stresses occurred in the vicinity of the support at panel point 16 north. To relieve these stresses a temporary toggle truss of steel posts and eyebars was assembled on the top chord at this point. The toggle was erected by a small traveler while the main traveler proceeded to erect the arch members between panel point 16 north and the crown of the arch.

With the toggle in place erection then proceeded to a point six panels beyond the crown to meet the south arch section previously completed. At this stage of erection, just prior to closing the two arch sections, the north section had a cantilever arm of ten panels and an anchor arm of sixteen panels.

Closure at panel point 14 south was effected by lowering both sections of the arch simultaneously to bear upon a sixteen inch diameter pin in the lower chord, a process which required particular care and close coordination. Guide castings were provided to insure horizontal alignment of the trusses upon closing. Possible errors in alignment of as much as six inches were anticipated. The precision in fabrication and erection had been such, however, as to result in an actual error in alignment of less than one inch.

When the lowering of the two arch sections was commenced, the opening at the pin at panel point 14 south was approximately twelve inches as compared with a theoretical opening of over eleven and one-half inches. The actual work of jacking was performed on October 3rd and 4th, 1930. On the latter date full contact was established and the arch was swung free of its falsework supports.

The arch was then in a three hinged condition. To convert the structure into a two hinged arch the insertion of a top chord member in each truss was required. The arch had been designed upon the assumption that under the initial condition after closing it would be three hinged with one hinge in the lower chord at the crown of the arch. A closing upper chord member at the crown would, under such condition, carry no stress. Under any condition of additional loading the arch would act as a two hinged structure.

Since the closing was effected at a point six panels south of the crown it was necessary to compute the compressive stress which would exist in a top chord member at that location to meet the assumed conditions. In order to insert the closing member a jacking force was applied to the arch at bent 7 south. The resulting distortion of the arch ring was such as would reduce the stress in the closing member to zero. Under this condition the chord member was fitted in position, the rivet holes drilled and the rivets driven. A set of strain gage measurements made on the closing member with the arch free of the falsework bents indicates that the actual stress in this member corresponds to the theoretical value within five per cent.

KILL VAN KULL ARCH. CLOSING TOP CHORD MEMBER IN POSITION. PORT RICHMOND ABUTMENT IN FOREGROUND. OCTOBER 18, 1930

FLOOR STEEL ERECTION. PORT RICHMOND ABUTMENT IN FOREGROUND. DECEMBER 17, 1930

Following the completion of arch truss erection the remaining falsework bents and piers were removed, wire rope suspenders were placed and erection of the floor system was started. Main transverse floor beams occur at each panel point. At points where the floor system is suspended below the lower chord of the arch ring four 3¼ inch wire ropes attach to each end of a floor beam. These beams are connected by four roadway stringers in each panel. Transverse secondary floor beams support bulb beams which will form part of the reinforcing for the roadway concrete slab. Wind chords, steel roadway curbs, lateral bracing and framing for a sidewalk on the west side of the bridge complete the floor structure. The design of the floor system is such as to provide for the later addition of two lines of rapid transit or for increasing the width of roadway from forty feet to sixty-five feet.

The floor system was erected in two principal sections. The traveler on the top chord of the arch began erection one panel south of the crown of the arch and continued south to a point within two panels of the Port Richmond abutment. At the same time the Bayonne approach traveler started at the north abutment and proceeded with the erection of the floor steel of the main span. This traveler was on the floor level and was unable to operate for a short distance within and beyond the portal of the arch. Accordingly auxiliary tackle attached to the truss was used for hoisting the floor steel in this area. Later the traveler "A" frame was lowered and moved through the portal, reassembled at panel point 10 and thence proceeded to join the floor steel with the other section near the center of the span. All main span floor steel except that required for two panels adjacent to the Port Richmond abutment is now in place.

STRESS OBSERVATIONS DURING ERECTION

In conjunction with the erection of the north arm of the arch an extensive series of stress measurements was planned and carried out to supplement and check the analytical computations of stresses in the structure and to serve, if necessary, as an additional field control for the erection. The measurement of stresses in bridge members is possible because of the definite relation which exists between the stress and the resulting elastic change in length of the member. The instrument used is merely a device for measuring the very small change in length caused by the load.

At definite stages of the erection the strains in the steel of certain critical members were measured and the corresponding stresses reported at once on regular forms prepared for the purpose. In addition, strain measurements were employed to test the behavior and adequacy of the highly stressed erection toggle at panel point 16 north. The closing members of the arch were inserted at point 14 south with the assistance of strain gage observations.

All strain gage observations, with the exception of those on the toggle and at the closing operation, were made at night in order to secure uniform and more accurately known temperature conditions, and to avoid the effect of changeable erection loads and vibrations. The strains were measured at both ends of all members from the inside, with specially devised 20 inch gages manually operated. The gage points at each section were arranged so

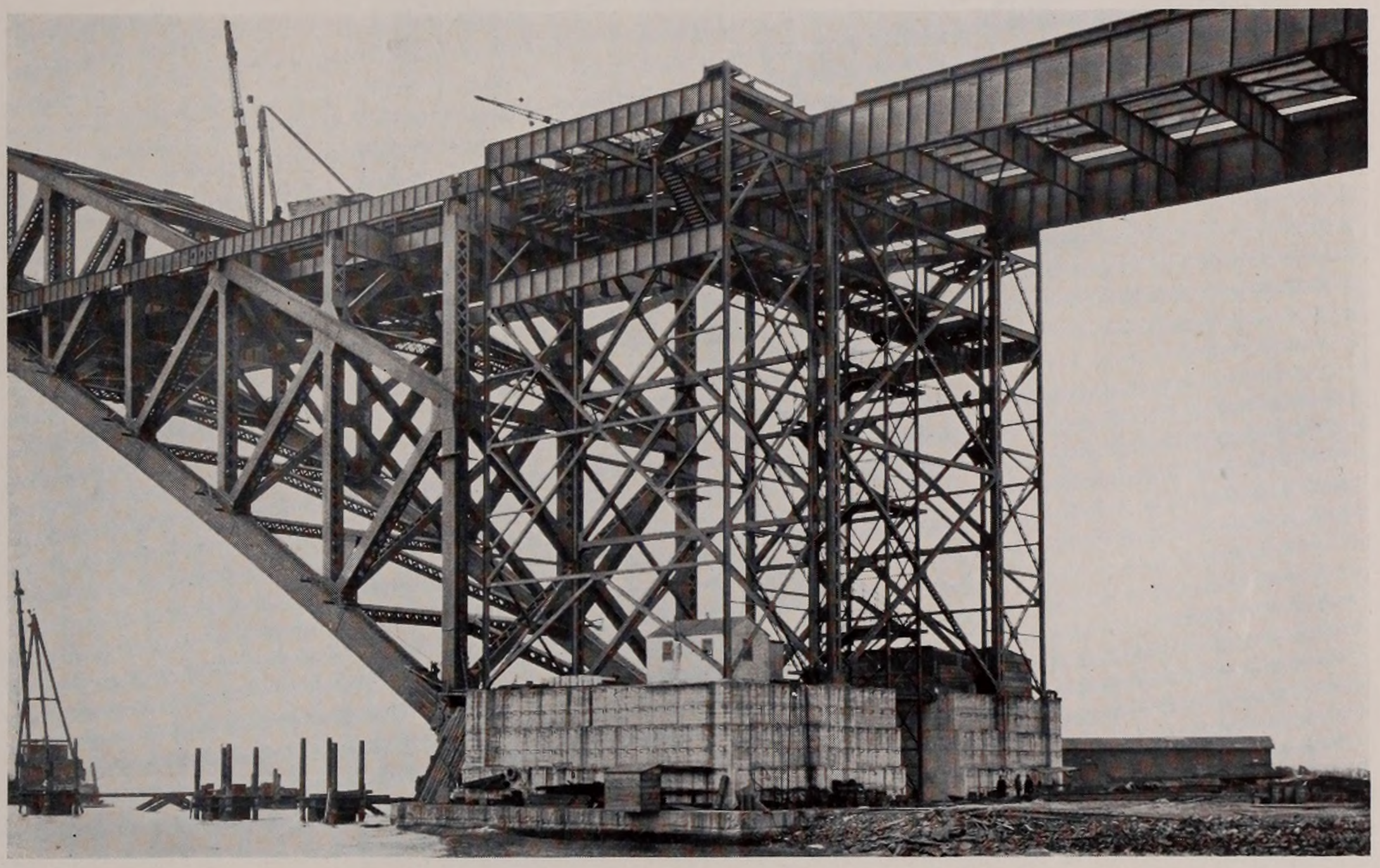
KILL VAN KULL ARCH READY FOR CLOSING OPERATION, BAYONNE ABUTMENT AT RIGHT. OCTOBER 2, 1930

ERECTING FLOOR STEEL IN TWO SECTIONS. DECEMBER 17, 1930

that the distribution of stress between the different parts of the member could be obtained. As many as eleven gage lines, in the bottom chord members, were used at a section.

The results obtained by these strain measurements show a close agreement with the computed values of stress throughout the erection, and demonstrate the reliability of modern stress analysis applied to such a structure.

These measurements are being continued on the completed arch ribs to show the distribution of the added floor loads between the various members of the arch. Various studies of secondary stresses are also being made.

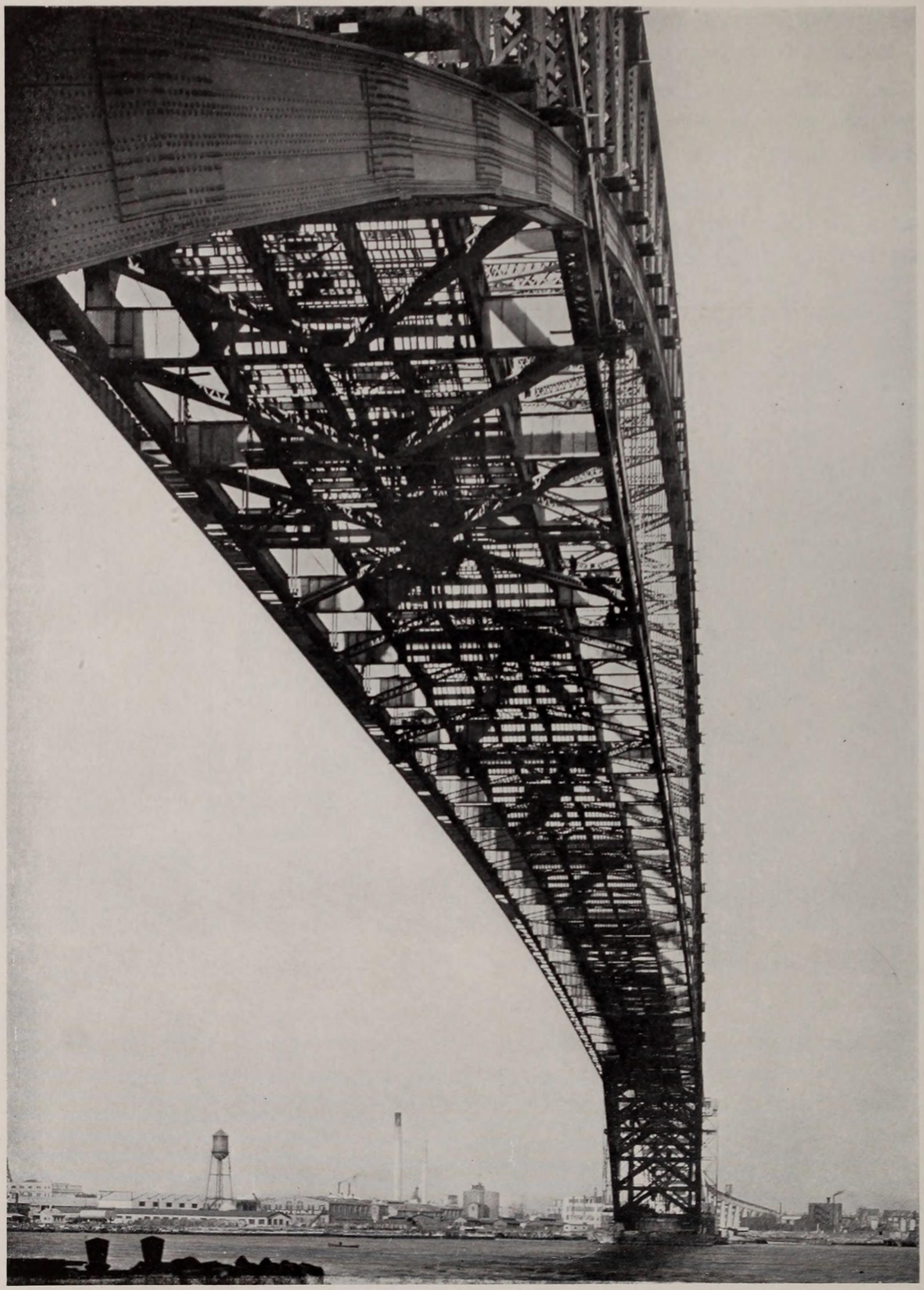


STEELWORK AT THE BAYONNE ABUTMENT. NOVEMBER 26, 1930

The final report on the tests of the four large carbon-manganese steel columns, made at the U. S. Bureau of Standards and described in the First Progress Report, is being prepared in conjunction with that on the tests of the columns for the Hudson River Bridge towers.

ABUTMENT STEEL

The actual mass of concrete required at each abutment to transmit the thrust of the arch to bed rock is comparatively small. The top of the abutment block is only slightly over twenty feet above river level. For architectural reasons the abutments will be carried as solid appearing pillars to a height somewhat above the roadway level. They will actually



VIEW FROM THE PORT RICHMOND ABUTMENT. FEBRUARY 1, 1931
BRIDGE ROADWAY

be built of curtain walls faced with granite after the bridge is opened to traffic. The roadway deck at this location is carried on a skeleton steelwork.

THE BAYONNE AND PORT RICHMOND APPROACH STEEL

With the exception of spans at West Fourth Street and at Juliette Street the steel work of the Bayonne approach was completed at the time of rendering the First Progress Report. Erection was started January 28, 1930, at West Third Street and was completed at the abutment just prior to April 1, 1930.

The Port Richmond approach construction is similar to that of the Bayonne approach. It consists in general of a series of plate girder spans of 126 feet maximum length on reinforced concrete piers. The transverse floor beams are spaced at approximately 20 foot intervals and carry stringers which will support the concrete slab. Special construction was necessary at Richmond Terrace which is crossed by a span of 183 feet 10 inches. At this location long girders continuous in three spans over four supports were provided. In all spans framing for a sidewalk 6 feet 6 inches wide is provided in temporary location on the west side of the approach only. As in the main span provisions are made for future changes in width of roadway or additions of rapid transit tracks and footwalks.

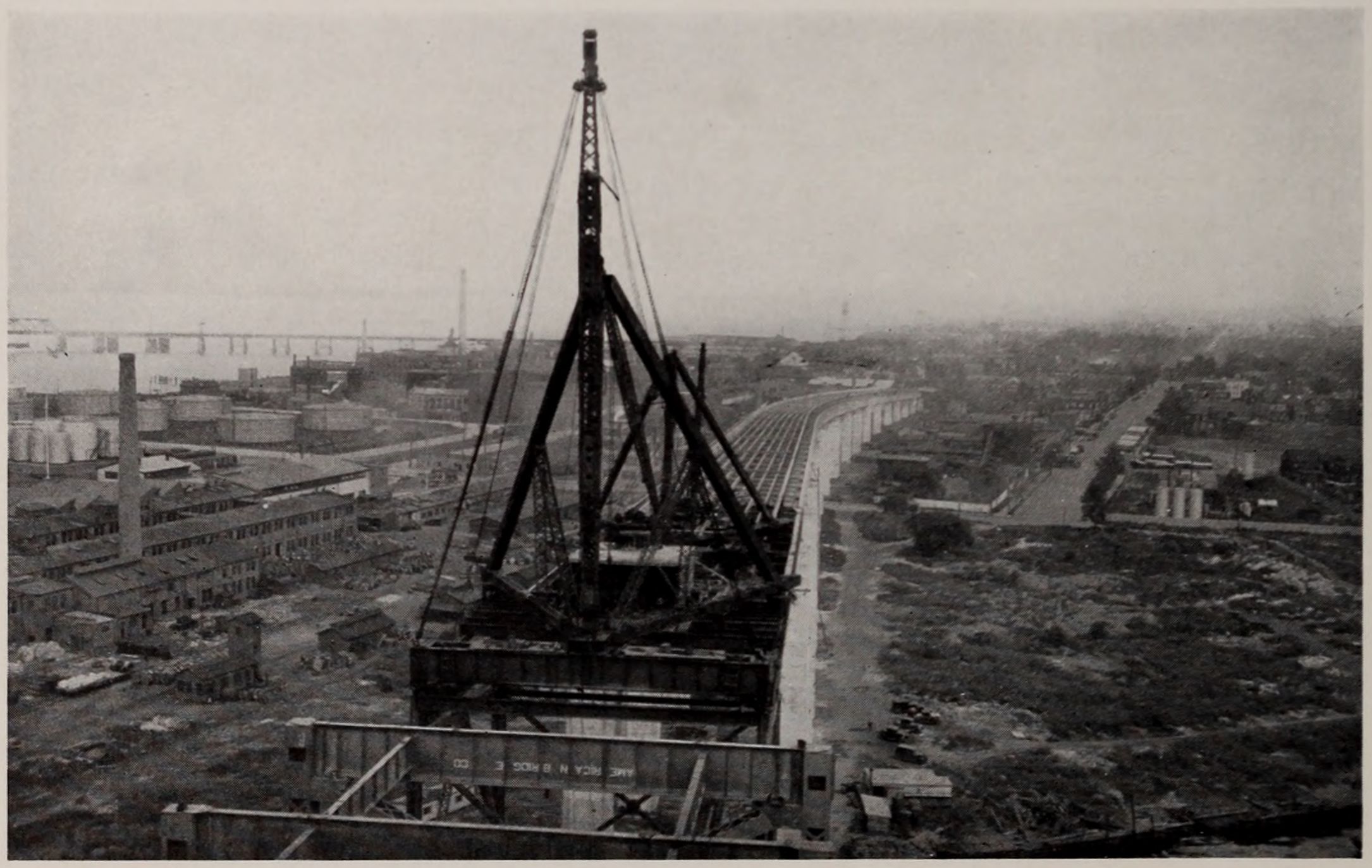
Steel erection on the Port Richmond approach was started October 14, 1930, at Innis Street. As in Bayonne, steel was delivered on flat cars which operated on tracks laid between the piers. A crane erected the first spans and assembled the approach traveler on the floor steel. The Port Richmond approach steel work is now in place with the exception of certain members required for the sidewalk.

THE BAYONNE APPROACH—WEST THIRD STREET TO WEST SEVENTH STREET

The main portion of the structural floor steel ends at piers located north of West Third Street. Northward from this point to the north side of Margaret Street, a distance of three blocks or approximately nine hundred feet, the approach consists of a reinforced concrete viaduct with abutments supporting steel spans at Juliette and West Fourth Streets. Continuing from Margaret Street to West Seventh Street, a distance of approximately seven hundred feet, the approach roadway is on embankment. At West Sixth Street the roadway branches, the east entrance connecting with Hudson County Boulevard and the west entrance with Avenue A at West Seventh Street. West Fifth Street is closed by the embankment and Margaret Street is closed by the concrete structure except for a pedestrian passageway on the north side. The sidewalk, which has been mentioned as located on the west side of the bridge structure, terminates in a stairway leading down to the south side of West Fourth Street.

A contract for the filling and grading of the approach from Margaret Street to West Seventh Street was awarded to the S. & F. Konigsberg Company on August 8, 1930. This work was completed on November 15, 1930.

BAYONNE APPROACH FROM ABUTMENT. SEPTEMBER 18, 1930



PORT RICHMOND APPROACH STEEL ERECTION. NOVEMBER 26, 1930

A contract for the completion of the approach from West Third Street to West Seventh Street was awarded to Charles T. Kavanagh on January 15, 1931. This work will include the reinforced concrete viaduct structure and concrete paving on the approach.

THE PORT RICHMOND APPROACH FILL

The steelwork of the Port Richmond approach terminates at Innis Street. In the plaza block south of this point the approach roadways are carried on an earth embankment. The roadway divides, the westerly branch leading directly to a connection with Morningstar Road south of Hooker Place. The other branch swings to the east side of the plaza block to provide a future connection with a highway on Trantor Place. As initially constructed, this roadway along the east side of the plaza block will be connected to Morningstar Road by means of a road paralleling Hooker Place along the southerly side of the plaza block.

The westerly branch roadway passes over the end of an old abandoned quarry located in the central portion of the plaza. Water and debris have accumulated in the quarry over a period of years. Before attempting to deposit the fill for the roadway at this point it was necessary to pump the water from the quarry and to remove a large volume of trash and rubbish. Rock and earth fill was then deposited on the quarry floor.

The contract for this work was awarded to John J. O'Rourke, Inc. on October 21, 1930. The removal of refuse at the roadway site is now completed and the Contractor is placing the roadway fill.

FUTURE CONTRACTS

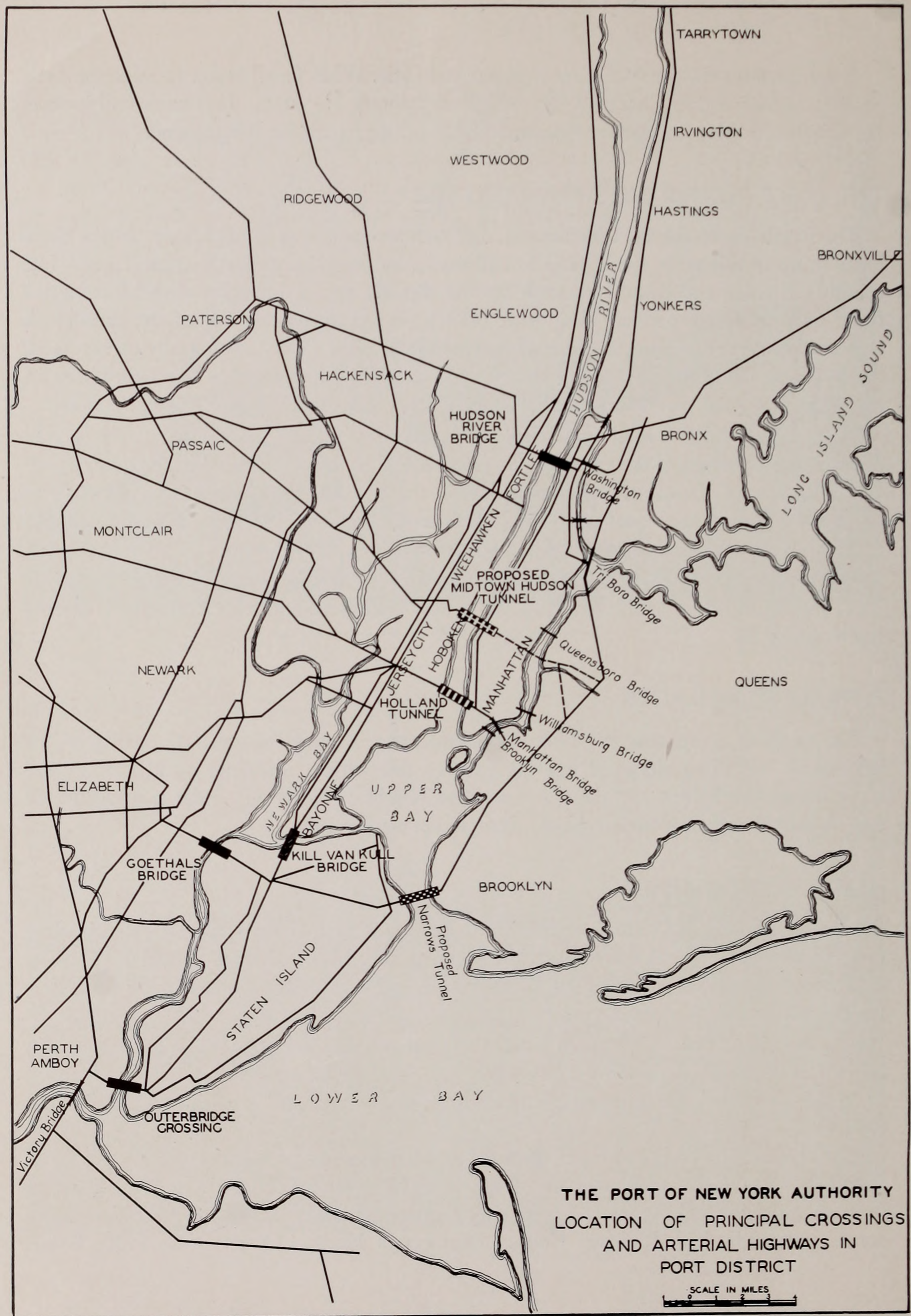
The work of completing the Port Richmond plaza, placing the concrete paving on the steel work, installing electrical lighting fixtures and wiring, installing metal railings and constructing toll booths and the administration building will be put under contract in the near future in sufficient time to permit completion during 1931.

ACKNOWLEDGMENTS

Numerous individuals and organizations have contributed materially to the development of the work by valuable advice and cooperation. Many of those to whom indebtedness was acknowledged in the First Progress Report have assisted further in the work during the past year.

To Lieutenant Colonel P. S. Bond, U. S. Engineer, Second New York District, credit is due for granting permits for temporary piers, and to Captain Randolph Ridgely, Jr., U. S. Coast Guard, for granting permission to operate tugs and car floats in the Kill van Kull.

The cooperation of the Hon. G. E. Keenan, Commissioner, City of Bayonne, the Hon. Joseph Minton, Commissioner, City of Bayonne, Mr. Walter L. Clarkson, City Engineer of Bayonne, Mr. T. J. Wasser, Supervising Engineer, Board of Chosen Freeholders, Hudson County, Mr. F. J. Radigan, County Engineer of Hudson County, Mr. Philip Guise,


TARRYTOWN
IRVINGTON
WESTWOOD
RIDGEWOOD
HASTINGS
BRONXVILLE
PATERSON
ENGLEWOOD
YONKERS
HACKENSACK
HUDSON RIVER BRIDGE
HUDSON RIVER
BRONX
PASSAIC
FORT LEE
Washington Bridge
LONG ISLAND SOUND
MONTCLAIR
WEEHAWKEN
PROPOSED MIDTOWN HUDSON TUNNEL
Tri Boro Bridge
JERSEY CITY
HOBOKEN
MANHATTAN
Queensboro Bridge
QUEENS
NEWARK
HOLLAND TUNNEL
Williamsburg Bridge
Manhattan Bridge
Brooklyn Bridge
NEWARK BAY
ELIZABETH
BAYONNE
UPPER BAY
KILL VAN KULL BRIDGE
GOETHALS BRIDGE
BROOKLYN
Proposed Narrows Tunnel
STATEN ISLAND
PERTH AMBOY
LOWER BAY
OUTERBRIDGE CROSSING
Victory Bridge
THE PORT OF NEW YORK AUTHORITY
LOCATION OF PRINCIPAL CROSSINGS AND ARTERIAL HIGHWAYS IN PORT DISTRICT
SCALE IN MILES
0 1 2 3 4

City Development Engineer of Jersey City and Colonel H. W. Hudson, representing the New Jersey State Highway Commission, in developing the plans and furthering the construction in Bayonne, is acknowledged.

Mr. Theodor S. Oxholm, Consulting Engineer to the Borough of Richmond, Mr. Thomas B. Oakley, Engineer of the Borough of Richmond, and Mr. Arthur S. Tuttle, Consulting Engineer of the Board of Estimate and Apportionment of the City of New York, have assisted in the development and construction of the Port Richmond approach.

The Contractors named elsewhere herein have carried on the work of construction in a highly satisfactory manner.

The continued valuable advice of the Consulting Engineers and the Consulting Architect and the cooperation of the members of the Port Authority Staff is appreciated and acknowledged.

Respectfully submitted,

(Signed) O. H. AMMANN,

Chief Engineer.

TABULATION OF BIDS FOR FILLING AND GRADING—BAYONNE APPROACH

CONTRACT BP-6

Received August 4, 1930

Item	Description	Quantities for Comparison	S. & F. Konigsberg		Samuel Konigsberg		Chas. T. Kavanagh		McCabe Bros. Co., Inc.		Davis & Davis Co.		International Excavating Co.	
			Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Fill, in place	24,500 cu. yds.	$0.58	$14,210.00	$0.745	$18,252.50	$0.95	$23,275.00	$0.95	$23,275.00	$0.95	$23,275.00	$1.00	$24,500.00
2	Concrete and brick masonry in place	70 cu. yds.	25.00	1,750.00	28.00	1,960.00	22.00	1,540.00	24.00	1,680.00	30.00	2,100.00	48.00	3,360.00
3	Reinforcing rods	5,100 lbs.	.07	357.00	.06	306.00	.08	408.00	.09	459.00	.12	612.00	.08	408.00
4	Cast iron, in place	3,200 lbs.	.06	192.00	.05	160.00	.04	128.00	.30	960.00	.08	256.00	.15	480.00
5	Twelve in. vitrified pipe in place	60 lin. ft.	1.00	60.00	1.50	90.00	2.00	120.00	2.00	120.00	5.00	300.00	2.00	120.00
	Total estimated contract price			16,569.00		20,768.50		25,471.00		26,494.00		26,543.00		28,868.00

TABULATION OF BIDS FOR FILLING PORT RICHMOND APPROACH

CONTRACT BP-7

Received October 20, 1930

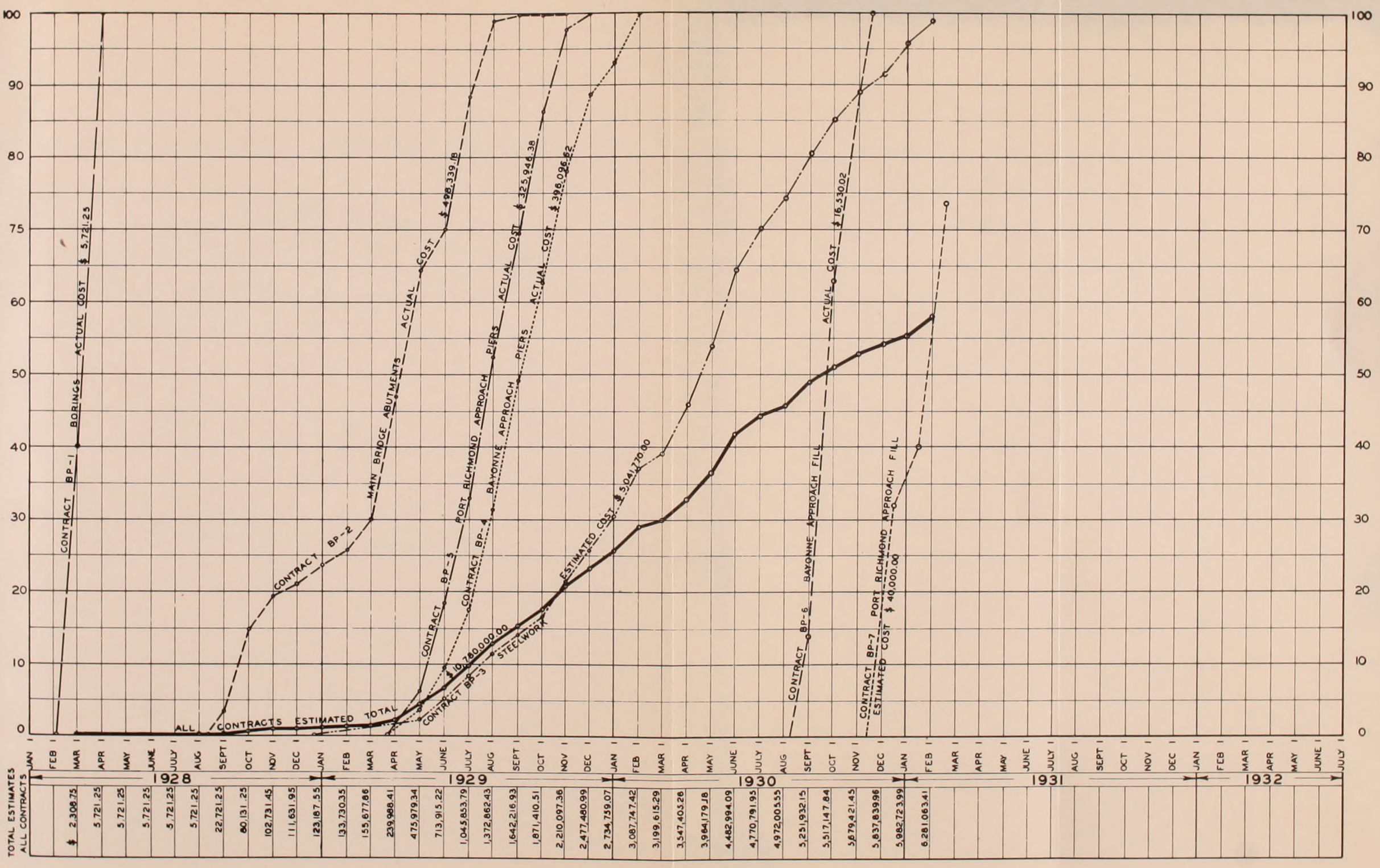
Item	Description	Quantities for Comparison	J. J. O'Rourke		C. J. Agrios		Chas. T. Kavanagh		Samuel Konigsberg	
			Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Fill	30,000 cu. yds.	$0.95	$28,500	$1.00	$30,000	$1.14	$34,200	$1.55	$46,500.00
2	18 in. vitrified clay pipe sewer, including concrete casing and manhole			745		600		500		13,500.00
3	Pumping out quarry, cleaning up debris and demolishing buildings			5,000		4,000		1,000		856.75
	Total estimated contract price			34,245		34,600		35,700		60,856.75

TABULATION OF BIDS FOR BAYONNE APPROACH—THIRD STREET TO SEVENTH STREET

CONTRACT BP-8

Received January 12, 1931

Item	Description	Quantities for Comparison	Chas. T. Kavanagh		International Engr. Co.		Frederick Snare Corp.		W. H. Gahagen, Inc.		P. T. Cox Contr. Co.		Johnson Drake & Piper		Arthur McMullen Co.		Jos. Mitchell, Inc.		Merrit Chapman & Scott Corp., N. Y.	
			Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1	Excavation	8,000 cu. yds.	$ 1.25	$ 10,000.00	$ 2.25	$ 18,000.00	$ 1.90	$ 15,200.00	$ 1.80	$ 14,400.00	$ 2.55	$ 20,400.00	$ 1.50	$ 12,000.00	$ 3.50	$ 28,000.00	$ 2.20	$ 17,600.00	$ 2.40	$ 19,200.00
2	Concrete, except that specified in Items 6, 7, 8, 9	5,700 cu. yds.	14.00	79,800.00	20.00	114,000.00	16.20	92,340.00	26.00	148,200.00	23.50	133,950.00	26.00	148,200.00	22.00	125,400.00	30.54	174,078.00	25.70	146,490.00
3	Cement, mixed in concrete, mortar, or sand-cement cushion	12,000 bbls.	2.55	30,600.00	3.25	39,000.00	2.83	33,960.00	3.00	36,000.00	2.75	33,000.00	2.80	33,600.00	3.00	36,000.00	2.71	32,520.00	3.25	39,000.00
4	Granite masonry	20 cu. yds.	200.00	4,000.00	180.00	3,600.00	100.00	2,000.00	135.00	2,700.00	240.00	4,800.00	175.00	3,500.00	240.00	4,800.00	150.00	3,000.00	250.00	5,000.00
5	Granite curbing	3,850 lin. ft.	2.75	10,587.50	3.00	11,550.00	3.10	11,935.00	2.95	11,357.50	2.70	10,395.00	2.50	9,625.00	3.25	12,512.50	2.90	11,165.00	5.50	21,175.00
6	Concrete curbing	1,020 lin. ft.	.85	867.00	1.50	1,530.00	1.10	1,122.00	1.63	1,662.60	1.50	1,530.00	1.10	1,122.00	1.70	1,734.00	1.10	1,122.00	1.80	1,836.00
7	Concrete sidewalks on sub-grade	1,350 sq. yds.	1.80	2,430.00	2.00	2,700.00	2.50	3,375.00	2.16	2,916.00	3.25	4,387.50	2.30	3,105.00	2.30	3,105.00	2.00	2,700.00	2.20	2,970.00
8	Concrete roadway pavement on sub-grade	4,600 sq. yds.	1.85	8,510.00	2.40	11,040.00	3.75	17,250.00	2.50	11,500.00	2.80	12,880.00	2.85	13,110.00	2.50	11,500.00	2.50	11,500.00	3.25	14,950.00
9	Concrete pavement base on sub-grade	4,400 sq. yds.	1.40	6,160.60	1.25	5,500.00	3.10	13,640.00	1.80	7,920.00	1.90	8,360.00	2.60	11,440.00	1.85	8,140.00	2.20	9,680.00	2.30	10,120.00
10	Granite block pavement, with sand-cement cushion	1,400 sq. yds.	6.50	9,100.00	5.80	8,120.00	6.35	8,890.00	6.00	8,400.00	6.35	8,890.00	5.50	7,700.00	5.75	8,050.00	6.80	9,520.00	7.25	10,150.00
11	Sheet asphalt pavement	3,000 sq. yds.	1.50	4,500.00	1.70	5,100.00	1.90	5,700.00	1.75	5,250.00	2.40	7,200.00	2.00	6,000.00	1.90	5,700.00	1.75	5,250.00	3.40	10,200.00
12	Reinforcing rods	1,100,000 lbs.	.05	55,000.00	.044	48,400.00	.05	55,000.00	.0626	68,860.00	.065	71,500.00	.065	71,500.00	.08	88,000.00	.0598	65,780.00	.065	71,500.00
13	Reinforcing trusses	12,500 lin. ft.	.36	4,500.00	.30	3,750.00	.55	6,875.00	.40	5,000.00	.29	3,625.00	.35	4,375.00	.35	4,375.00	.373	4,662.50	.40	5,000.00
14	Wrought Iron pipe	1,150 lbs.	.45	517.50	.20	230.00	.18	207.00	.10	115.00	.25	287.50	.20	230.00	.35	402.50	.453	520.95	.30	345.00
15	Castings for manhole covers and frames, inlet gratings and frames, and scuppers	26,000 lbs.	.04	1,040.00	.07	1,820.00	.084	2,184.00	.05	1,300.00	.07	1,820.00	.05	1,300.00	.06	1,560.00	.05	1,300.00	.06	1,560.00
16	Twelve (12) inch diam. vitrified clay pipe	700 lin. ft.	.65	455.00	1.00	700.00	1.50	1,050.00	1.00	700.00	1.35	945.00	1.75	1,225.00	2.50	1,750.00	1.40	980.00	1.00	700.00
17	Eighteen (18) inch diam. vitrified clay pipe	105 lin. ft.	1.30	136.50	2.00	210.00	2.50	262.50	2.00	210.00	2.10	220.50	3.00	315.00	3.50	367.50	3.33	349.65	2.00	210.00
18	One (1) inch steel conduits	1,300 lin. ft.	.39	507.00	.30	390.00	.40	520.00	.50	650.00	.50	650.00	.30	390.00	.45	585.00	.406	527.80	.30	390.00
19	Two (2) inch steel conduits	12,000 lin. ft.	.56	6,720.00	.40	4,800.00	.78	9,360.00	.80	9,600.00	.70	8,400.00	.55	6,600.00	.60	7,200.00	.557	6,684.00	.60	7,200.00
20	Three (3) inch steel conduits	600 lin. ft.	1.11	666.00	.70	420.00	1.60	960.00	1.85	1,110.00	1.20	720.00	1.10	660.00	1.10	660.00	.99	594.00	1.25	750.00
21	Galvanized steel boxes and covers	5,500 lbs.	.25	1,375.00	.30	1,650.00	.29	1,595.00	.50	2,750.00	.35	1,925.00	.15	825.00	.36	1,980.00	.34	1,870.00	.25	1,375.00
22	Top soil and seeding	19,000 sq. yds.	.40	7,600.00	.25	4,750.00	1.18	22,420.00	.15	2,850.00	.55	10,450.00	.65	12,350.00	.50	9,500.00	.35	6,650.00	.30	5,700.00
23	Demolition and removal of buildings	.....		3,000.00		2,000.00		3,400.00		4,900.00		2,150.00		8,500.00		5,000.00		3,218.10		13,500.00
	Total estimated contract price			248,072.10		289,260.00		309,245.50		348,351.10		348,485.50		357,672.00		366,321.50		371,272.00		389,321.00



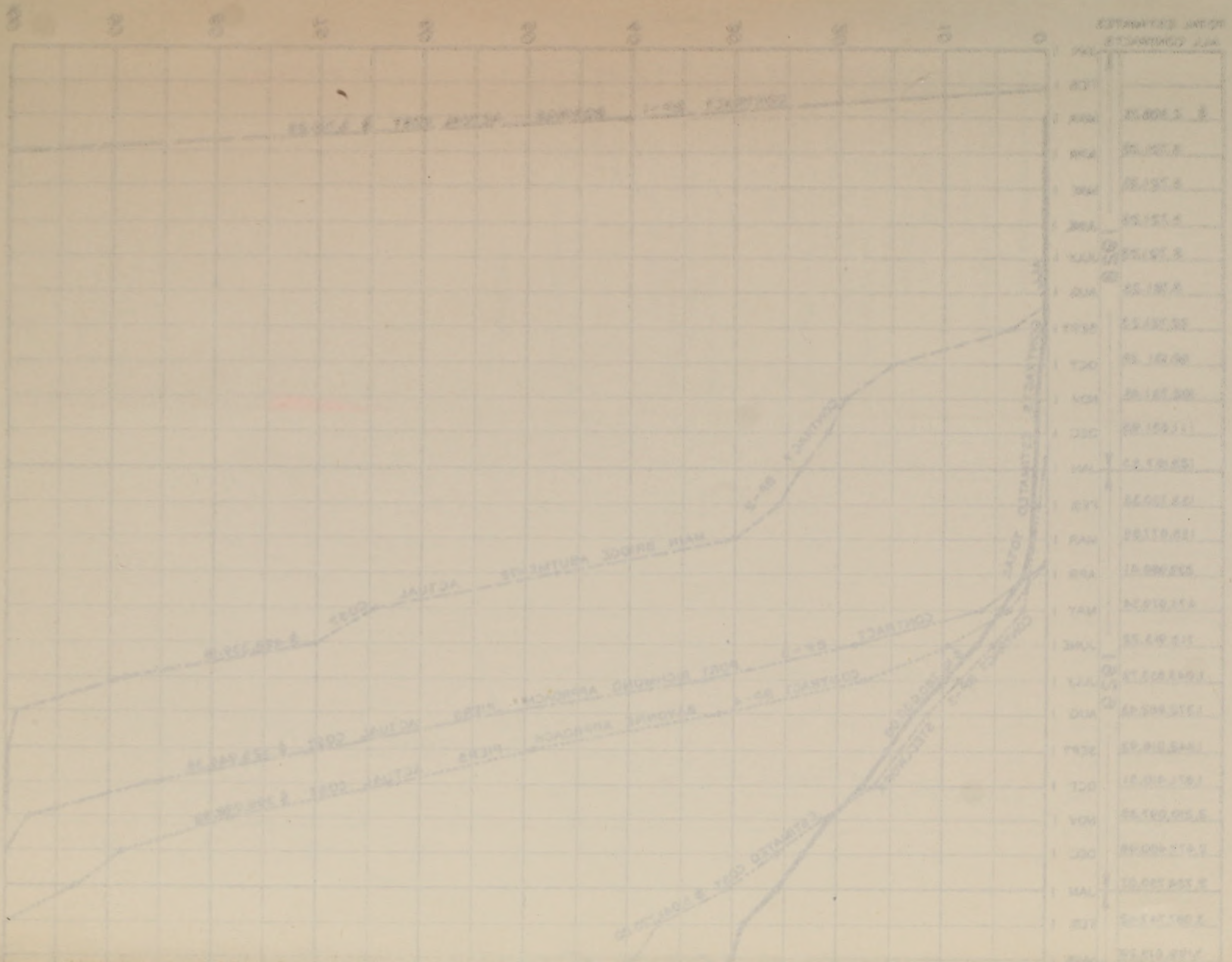
KILL VAN KULL BRIDGE

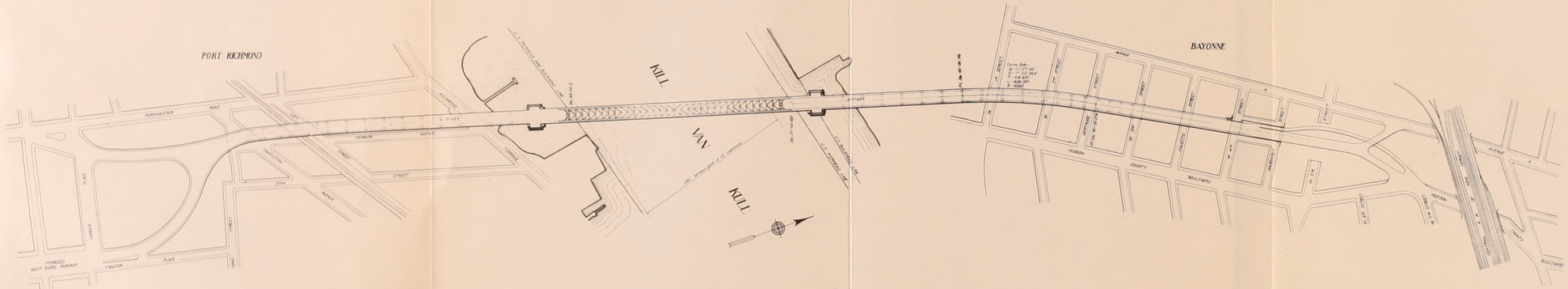
CONSTRUCTION PROGRESS

AS SHOWN BY

MONTHLY ESTIMATES ON CONTRACTS

PER CENT OF CONSTRUCTION WORK COMPLETED





SECTION AT ARCH ABUTMENT

SECTION AT CENTER OF ARCH

SECTION OF APPROACH

THE PORT OF NEW YORK AUTHORITY

KILL VAN KULL BRIDGE

BAYONNE - PORT RICHMOND

GENERAL PLAN AND ELEVATION

MARCH 13, 1929

BP-100