68TH CONGRESS, 1ST SESSION
Senate Document No. 95

REPORT OF THE ARLINGTON MEMORIAL BRIDGE COMMISSION

THE ARLINGTON MEMORIAL BRIDGE

MESSAGE FROM THE PRESIDENT
OF THE UNITED STATES

TRANSMITTING PURSUANT TO LAW THE REPORT OF THE ARLINGTON MEMORIAL BRIDGE COMMISSION ON THE PROJECT TO CONSTRUCT A MEMORIAL BRIDGE ACROSS THE POTOMAC FROM THE VICINITY OF THE LINCOLN MEMORIAL TO THE ARLINGTON ESTATE

APRIL 21 (calendar day, APRIL 23), 1924.—Read, referred to the Committee on Commerce, and ordered to be printed

APRIL 24 (calendar day, APRIL 25), 1924.—The Committee on Commerce discharged, and referred to the Committee on Public Buildings and Grounds and ordered to be printed, with illustrations

GOVERNMENT PRINTING OFFICE
WASHINGTON
1924

SUBMITTED BY MR. FERNALD

IN THE SENATE OF THE UNITED STATES,
April 24 (calendar day, April 25), 1924.

Ordered, That the Committee on Commerce be discharged from the further consideration of the report of the Arlington Memorial Bridge Commission (S. Doc. No. 95) heretofore transmitted to the Senate and that it be referred to the Committee on Public Buildings and Grounds and be printed, with illustrations.

Attest:

GEORGE A. SANDERSON,
Secretary.

CONTENTS

	Page
Report of Arlington Memorial Bridge Commission	1
General description	6
Bridge plaza and the water gate	6
Bridge	7
Columbia Island and the Lee Highway	9
Cemetery entrance and approach	11
Cemetery grounds	12
Widening and extension of B Street	12
Widening of Twenty-third Street	13
Recommendations	13
A bill to provide for the construction of a Memorial Bridge	15
Appendix	19
Report of the executive and disbursing officer	21
Former steps to secure a Memorial Bridge	21
The competition of 1901	27
Recommendations of the Park Commission of 1901	28
Present Commission and the present project	30
Work under the present Commission	30
Engineering and architecture	34
Borings and surveys	34
Draw span	34
Channel of river	35
Selection of architects	35
Outlines of structure	36
Main structure	37
Loadings	37
Foundations	37
General description	38
The bridge plaza and the water gate	38
The bridge	39
Columbia Island and the Lee Highway	40
The Cemetery entrance and approach	42
The Cemetery grounds	43
Estimates of cost—Summaries for entire period	44
Ten-year program of expenditures and construction	45
Detailed estimates	46
Memorial Bridge	46
Bridge plaza and water gate	46
Formal treatment of Columbia Island	47
Alternate for Columbia Island without formal treatment	48
Parkway and memorial entrance to Cemetery	49
Alternate for parkway to Cemetery, omitting the memorial entrance	50
Straightening and widening B Street	51
Widening of Twenty-third Street	51

ILLUSTRATIONS

	Facing page
General plan	2
Map of a portion of Washington showing relation of the bridge thereto	6
Retouched photograph showing new bridge as it will appear from south end of Highway Bridge	14
Perspective	15
Widths of roadways of well-known bridges	22
Elevation and plan of bridge proper	26
Elevation of bascule	28
Elevation of typical arch	28
Elevation of east end and water gate	28
Elevation of water gate	28
Elevation of entrance to bridge	32
Elevation of Arlington Heights and profile of bridge	34
Model of entrance to bridge and one arch	38
Engineering plan of bridge and vicinity	52
Outline elevation with dimensions	52
Deck and arch construction	52
Detail of arch ring	52
Borings for bed rock	52
Typical cofferdam crib for intermediate pier	52

Arlington Memorial Bridge Commission

WASHINGTON, D. C., *April 22, 1924.*

SIRS: In compliance with section 23, public buildings act approved March 4, 1913, the Arlington Memorial Bridge Commission have the honor to submit the following report and recommendations upon the project for a Memorial Bridge across the Potomac River in the vicinity of the Lincoln Memorial, with estimate of cost.

The project for the construction of a Memorial Bridge across the Potomac River from Washington to the Arlington Cemetery has been considered from time to time for more than seventy-five years, apparently being first suggested by President Andrew Jackson. Reference to this suggestion of President Jackson was made by Daniel Webster in an address on the Fourth of July, 1851, as follows:

> Before us is the broad and beautiful river, separating two of the original thirteen States, which a late President, a man of determined purpose and inflexible will, but patriotic heart, desired to span with arches of ever-enduring granite, symbolical of the firmly established union of the North and the South. That President was General Jackson.

This quotation states in forceful language the object of the proposed Memorial Bridge across the Potomac, and it would be difficult to conceive of a Memorial Bridge for a more deserving cause and of a more carefully studied design to express such a sentiment. Since this suggestion was first made by President Jackson frequent efforts have been made to carry through the

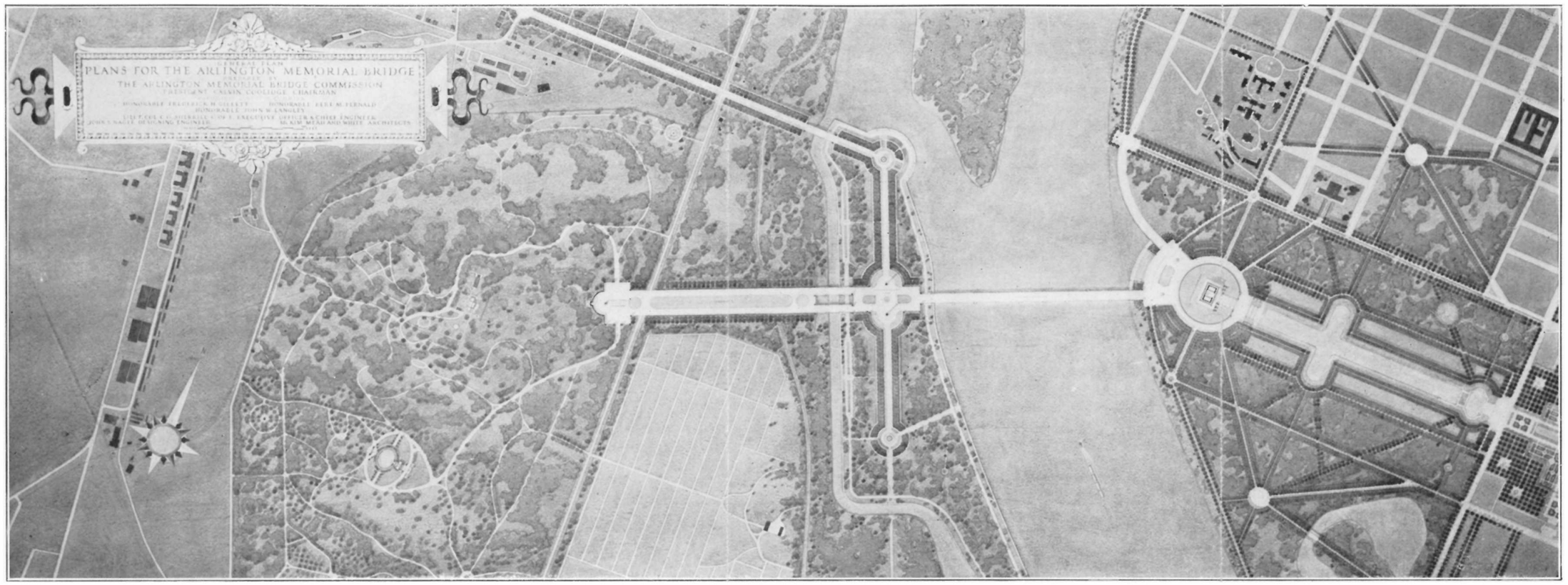
project, but none of these efforts have ever gone further than preliminary studies and the preparation of different designs, the most notable of which were prepared in 1901 under authority of the sundry civil act approved March 2, 1899. These plans were submitted to Congress by the Secretary of War on April 9, 1900, but no authorization for the initiation of work was ever granted.

When in 1901 the Senate Park Commission reported on the development of the park system of the District of Columbia, it suggested for the first time the desirability of placing a Memorial Bridge at the Lincoln Memorial instead of at the site farther upstream, which had been contemplated in all previous plans for this project.

No further active steps upon the prosecution of this Memorial were taken until the passage of the public buildings act of March 4, 1913, providing, among other things, as follows:

> SEC. 23. That a commission is hereby created, to consist of the President of the United States, the President of the Senate, the Speaker of the House of Representatives, and the chairmen of the Committees on Public Buildings and Grounds of the Senate and House of Representatives, for the purpose of investigating and reporting to Congress a suitable design for a Memorial Bridge across the Potomac River from the city of Washington to a point at or near the Arlington estate in the State of Virginia, and the said commission is hereby authorized to expend the sum of $25,000 in procuring such designs and for making such surveys and estimates of cost as they may deem advisable, and report as early as may be to Congress.

Although the above mentioned act of 1913, creating the Arlington Memorial Bridge Commission, authorized the expenditure of $25,000 for the purpose of investigating and reporting to Congress a suitable design for a Memorial Bridge across the Potomac River, it was not until nine years later that an appropriation was made in the executive and independent offices appropriation act, approved June 12, 1922, reading as follows:



GENERAL PLAN

To enable the commission created by section 23 of the public buildings act approved March 4, 1913, to investigate and report to Congress a suitable design for a Memorial Bridge across the Potomac River from the city of Washington to a point at or near the Arlington estate, in the State of Virginia, together with such surveys and estimates of cost as they may deem advisable, to be expended under the direction of the commission and to remain available until expended, $25,000.

Immediately after the passage of this act, work was actively commenced upon the preparation of general plans and estimates for the proposed bridge, under the immediate charge of the executive and disbursing officer of the Commission, with the assistance of a force of engineers and architects. The details of the work accomplished under this Commission, a historical summary of the progress previously made in connection with this general project, and detailed estimates of cost are given in full in the attached report of the executive and disbursing officer. (See Appendix, p. 19.)

A careful examination was made by the Commission into the relative merits of the various locations that had been suggested for the proposed bridge, advocates of different views being given an opportunity to present pertinent facts. As a result of the evidence submitted and a personal inspection by the Commission, it was unanimously decided at a meeting of the Commission on December 18, 1922, that a low-level bridge with a draw span should be constructed on a line joining the Lincoln Memorial with the Lee Mansion. It was further decided by the Commission that the general treatment on Columbia Island and the Virginia shore should include a roadway in the axis of the bridge leading directly toward the Lee Mansion with a suitable memorial gate or other appropriate treatment at the entrance to the Cemetery, and suitable connecting roadways located with due regard to grades and curvatures from this gateway to the Lee Mansion. From the Virginia terminus there is also contemplated a main roadway leading along

the north end of the Cemetery between Arlington and Fort Myer, and ultimately a second roadway toward the south end of the Cemetery for traffic in the direction of Richmond. The plans and estimates have been made to carry out the decisions.

The essential general features of both the engineering and architectural aspects of the bridge have been delineated on suitable drawings and a plaster of Paris model of large scale, copies of which are transmitted with this report for the consideration of the Congress. The originals are on file in the office of the executive officer of the Commission.

Notwithstanding the differences of opinion which previously existed as to the relative merits of the different types of structure and the different feasible locations, the Commission feel safe in stating that at the present time there appears to be unanimity on the part of all interested parties as to the excellence of the plans as prepared, and the desirability of the early completion of the project in general accordance with these plans subject to such modifications as may appear advisable after authorization and before actual construction begins.

The bridge as planned consists of nine spans—a draw span at the center, flanked on each side by four masonry spans—of graceful profile, having a total length between terminal pylons of 2,138 feet, a total width of 90 feet in the clear, and a roadway 60 feet wide between curbs, bordered on each side by sidewalks of 15 feet in width. The 40-foot width of roadway contemplated for the bridge under the 1901 plan was based on the slow horse-drawn vehicular traffic of limited volume used in that day and would be entirely inadequate for the rapid-moving motor traffic of tremendous volume found in Washington at the present day. In 1912 there were

only 1,200 motor vehicles registered in Washington, whereas to-day there are more than 100,000. As planned, the structure will be faced with granite harmonizing well with the Colorado Yule marble of the Lincoln Memorial.

This project has many important features which, taken together, will make it the greatest single memorial project undertaken by any Nation in recent times. Following immediately after the Lincoln Memorial in time of construction, it fortunately supplements and completes that great Memorial in finishing the landscape in its vicinity and carries the Mall treatment of Washington and L'Enfant across the Potomac to Arlington and up to the last resting place of the designer of the original plan of the Capital at the portico of the Lee Mansion. In addition to this relationship, there is the compelling patriotic motive in the project of a direct broad boulevard from the Capitol through B Street extended and widened, by way of the Lincoln Memorial and on across the broad and dignified bridge, as a route for the Nation's fallen heroes to their last resting place in the Arlington National Cemetery. There is a third great motive in the complete plan and that is the provision of a magnificent entrance to Washington from Virginia for the Lee Highway coming across the entire country from Los Angeles, California.

The fourth and perhaps the greatest of all is the symbol of the binding together of the North and South in one indivisible Union, knowing no sectional lines.

As the traveler approaches Washington over the brow of Arlington Heights in Fort Myer there will burst on his view a panorama that has few equals in the world; once seen it will never be forgotten, and will live in the memory of the beholder forever as a perpetual inspiration to loyalty, patriotism, and devotion to country.

GENERAL DESCRIPTION

The essential parts of the project are as follows:

1. The plaza and roads between the Lincoln Memorial and the bridge, including the water gate fronting the Lincoln Memorial.

2. The bridge proper.

3. The treatment of Columbia Island, the bridge to the mainland forming the terminus of the Lee Highway.

4. The parkway extending from Columbia Island to and including the main entrance to the Arlington National Cemetery.

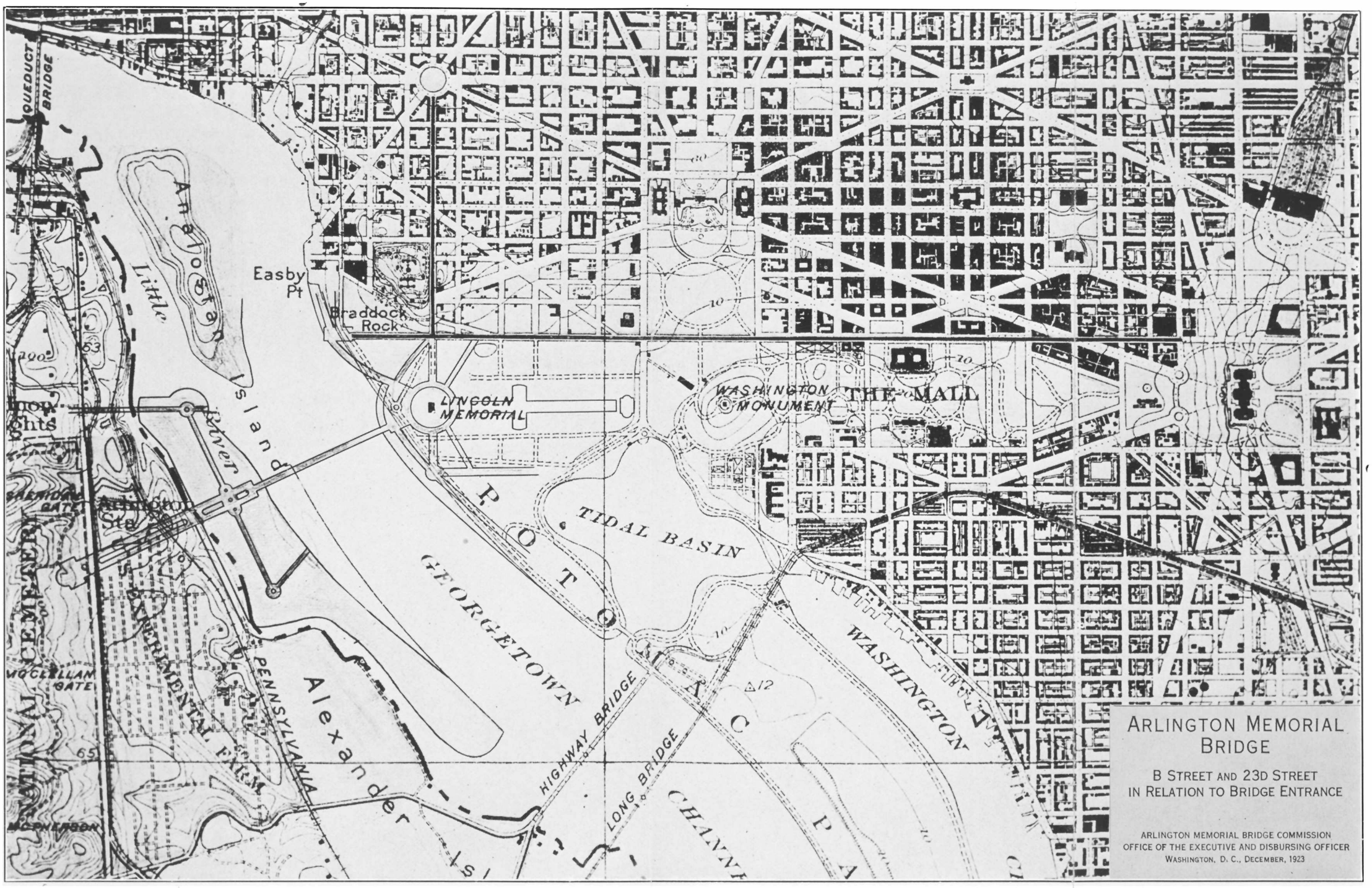
5. The treatment of the Cemetery.

6. The widening of B Street NW., and its extension straight through to the Capitol as an east-west boulevard of approach from the Capitol to the Memorial Bridge and Arlington Cemetery.

7. The widening of Twenty-third Street into a similar north-south boulevard from Washington Circle to B Street.

BRIDGE PLAZA AND THE WATER GATE

The area of the Mall axis at its junction with the Potomac has been treated so as to recognize the importance both of the final feature of a parkway extending from the Capitol to the Potomac and that of a plaza whence radiate the bridge and important park roads, including access to the Lincoln Memorial and to the river bank. The bridge and the shore road are symmetrically arranged with respect to the continuation of the Mall axis, both the road and the bridge being provided with entrance pylons. A monumental flight of steps between the bridge and the road leads to the river, the whole composition thus forming a water gate giving access through the Mall with its important monu-



MAP OF A PORTION OF WASHINGTON

Showing relation of the bridge thereto

ments to the Capitol. The steps leading down to the river bank form landing places for small boats, the piers at either end of the steps forming landing places for larger ones. The parking on B Street north has been shown extending to the river bank, and B Street south has been straightened so as to be parallel to the Mall axis, terminating with a rond point at its intersection with Twenty-third Street extended to the southward of the Lincoln Memorial. This rond point is the site of the proposed Ericsson Memorial, for which funds are in hand and work can be commenced as soon as its site is definitely determined in accordance with this project.

BRIDGE

It is proposed to use granite for the facing of the bridge, the material not only being of great beauty but also of most enduring quality, especially when in contact with or in the vicinity of water.

In order not to interfere with the view of the Lincoln Memorial as seen from Columbia Island, the bridge has been kept as low as possible consistent with sound engineering and economy. It has nine segmental arches, the center span being 184 feet long, and the length of the spans decreasing gradually each way toward the shore, so that the end spans are 166 feet. The bridge is 2,138 feet long between the terminal pylons. The roadway is 60 feet and each of the two sidewalks 15 feet wide, making a total width of 90 feet.

The architecture has been kept as simple and severe as possible, the structure mainly depending for its beauty upon the perfection of its general proportions and its adornment with significant sculpture pieces of the highest quality of design. The Washington entrance to the bridge is marked with two pylons, located about

500 feet from the Lincoln Memorial. Similar pylons are placed at the entrance to the shore road and are repeated at the Virginia entrance to the bridge. They are 40 feet high and are adorned on the sides with sculptured groups and appropriate inscriptions and surmounted by eagles symbolic of the United States of America. These symbols appear also as the only sculptured ornaments on the sides of the bridge, where they are shown in the large disks on both ends of each of the river piers. The sculpture on the sides of the four pylons represents in different ways the recognition of the common bonds and aspirations of the Nation and the final triumph of the idea of a permanent and complete Union.

The pairs of figures on each end of the piers of the bridge represent symbolically the outcome of that harmonious Union, the result of the energies of the entire country in the arts of peace—that is, those inventions and accomplishments in science and art particularly connected with the history of this country. Thus would be symbolized the agricultural, engineering, religious, and educational progress, to mention but a few categories of action. In the opinion of the architect, this sculpture vitalizes the entire conception of the design of the bridge, differentiating this Memorial from all others, and making the reason for its existence intelligible at a glance.

The center arch of the bridge is required to be a draw opening. The double-leaf bascule form has been adopted as interrupting to the least possible degree the unity of the bridge. However, this introduction of a steel arch in a construction designed to be in the highest degree monumental is to be regretted; and as very few ships go above the site up the Potomac, it is to be hoped that the permission of Congress will be granted in

the not distant future to replace the draw with a masonry arch like the others in the bridge.

COLUMBIA ISLAND AND THE LEE HIGHWAY

Even before the reclamation of Columbia Island by the dredging operations of the Corps of Engineers had advanced materially it was always considered as a suitable site for formal park treatment, a fitting end for the Memorial Bridge, as well as an important feature in itself. Being so intimately related to the bridge, it was thought proper that the plans for the ultimate development of Columbia Island as a park should be included as part of the project for the Memorial Bridge. Accordingly, the lines of the shore of the island have been somewhat rectified to permit a cross axis almost perpendicular to the main axis of the bridge and extending the full length of the island. The intersection of these two axes has suggested a plaza with fitting architectural adornment in a measure supplemental to the Lincoln Memorial across the river, and for this purpose two stately columns are proposed to be erected here, framing in but not interfering with the view of the Lincoln Memorial from the direction of the Lee Mansion. These columns symbolize the one the North and the other the South. They are surmounted by statues of Victory, the stylobates whence they rise offering surfaces suitable for decorations, bas-relief, and inscriptions. The columns are 166 feet high, or practically of the same height as the Colonne de Juillet in Paris.

The axis of Columbia Island affords an opportunity to recognize the great Lee Highway undertaking and to make it an integral part of the whole composition. This highway, which at present passes over the Francis Scott Key Bridge into Washington by a circuitous and highly

congested route, can be given a splendid direct approach over the brow of the imposing Arlington Heights, exactly on the prolongation of the axis of the Mall. From this point a superb view of the bridge, the Lincoln Memorial, the Washington Monument, and the Capitol will be enjoyed by the traveler entering the Nation's Capital over this route. From the Arlington Heights the Lee Highway would descend toward Washington, keeping on the axis of the Mall, passing over the stream between the mainland and Columbia Island by a single-arch bridge, and cross the axis of the island, continuing its course to the water's edge of the main channel, where it is planned to construct a water gate facing and corresponding to that at the Lincoln Memorial previously described. Rome had its five great avenues of approach: The Flaminia, Praenestina, Aurelia, Ostiensis, and Appian Ways. Washington has none worthy of the name, but in this proposed terminus of the Lee Highway will be created the first and most magnificent of all possible entrances to the National Capital.

The intersection of the axis of the Mall with the axis of Columbia Island, alluded to above, affords an appropriate spot for a memorial in the shape of a circular or polygonal temple marking the north end of the important Lee Highway. This treatment would be echoed at the lower end of the island and at an equal distance below the main plaza by a memorial or a rest pavilion.

The narrow waterway separating the island from the Virginia shore will be peculiarly adapted for boating parties and is destined to grow in popularity as time goes on. A number of landing places have been provided along this channel. Apart from the formal roads shown and a certain number of footpaths, it is recommended that the island be rather densely planted in

trees so as to correspond in appearance, as nearly as possible, with Analostan Island. In this connection the acquisition of Analostan Island by the United States Government would not only prevent its possible and even probable use for purposes which would render it objectionable in its close proximity to the dignified treatment herein described but would also be highly desirable on account of its natural beauty and suitability for park purposes.

CEMETERY ENTRANCE AND APPROACH

Continuing along the main avenue on the axis of the bridge, and after crossing over the waterway separating Columbia Island from the Virginia shore on a small twin bridge harmonizing with the main structure, extends a formal parkway within an extensive park area with two roadways and a "tapis vert" between, bounded by hedges and elms, and rising on a slight but uniform grade, leads to the foot of the steep slope rising up to the Lee Mansion. This abrupt change of grade suggests the placing of the chief memorial entrance to the Arlington National Cemetery at this point. Accordingly a plaza is shown on the drawings in part excavated into the side of the hill, whence radiate the roads to the Mansion, to the Memorial Amphitheater, and other parts of the Cemetery. The west end of the plaza is in the form of a semicircle, the diameter of which is 226 feet and is in structure a retaining wall 30 feet high. The visible face of this retaining wall will be decorated with niches, pilasters, and tablets bearing appropriate inscriptions. Access is provided to the terrace surmounting the retaining wall, whence an all-embracing view of the parkway may be obtained—the columns of Columbia Island, the Memorial Bridge, the Potomac,

the Lincoln Memorial, 5,808 feet distant, the Washington Monument, and far in the distance the glistening white dome of the Capitol. Through the trees up to the westward a glimpse of the simple and dignified Arlington Mansion may also be obtained on the top of the heights.

CEMETERY GROUNDS

It is proposed to leave that portion of the Cemetery grounds intervening directly between the main entrance just described and the Lee Mansion in practically its present informal condition, eliminating but two or three trees to enable the visitor to see the Lee Mansion from below and to view the Lincoln Memorial and at least a portion of the bridge from above. The new roads leading up the hill are so located as to have easy grades and can be connected at no great distance from the entrance with roads which now exist. These old roads, however, should be widened. The same may be said in regard to connecting the present footpaths with the entrance terrace, but another footpath should be added leading to the southward. A new road is also indicated leading from the proposed main entrance to the Amphitheater, thus providing more direct access thereto than is at present afforded.

WIDENING AND EXTENSION OF B STREET

An important feature and one closely related to the Arlington Memorial Bridge is the extension of B Street eastward to the Capitol Grounds, and the widening of this street throughout its entire length and its paving with asphalt. This improvement is essential to allow for the fullest use to be made of the route over the proposed bridge to the Arlington National Cemetery, as it would be the natural boulevard of approach to the

Cemetery from the Capitol. Not only would this be of much value in conjunction with this project, but it would be of great value in diverting a large portion of traffic now congesting Pennsylvania Avenue in the vicinity of the Treasury Building westward beyond the White House to streets leading north and northwest. B Street under this proposal would become throughout its entire extent a splendid boulevard bordering the park system.

WIDENING OF TWENTY-THIRD STREET

Another important and closely related project to the bridge is the suitable widening of Twenty-third Street from Washington Circle southward to B Street immediately north of the Lincoln Memorial. On all important memorial occasions occurring in Potomac Park or in the Arlington Cemetery Twenty-third Street would thus become the most important north and south route for all of the northwest section of the city and would become the popular means of approach to the Lincoln Memorial and the Arlington Memorial Bridge. At the present time this important approach to the Lincoln Memorial and the Arlington Memorial Bridge is too narrow to meet the reasonable demands of traffic.

RECOMMENDATIONS

The Commission, having carefully analyzed the various features of the bridge and having given due consideration to the requirements of economy, now recommend that the Arlington Memorial Bridge project be authorized for immediate execution at a total cost not exceeding $14,750,000 in detail as follows:

97501—24——2

Memorial Bridge proper	$7,250,000
Bridge plaza and water gate	1,000,000
Columbia Island	2,880,000
Parkway and memorial entrance to Cemetery	1,390,000
Extension of B Street eastward to the Capitol and widening to 120 feet	2,070,000
Widening Twenty-third Street from Washington Circle to B Street	160,000
Total	14,750,000

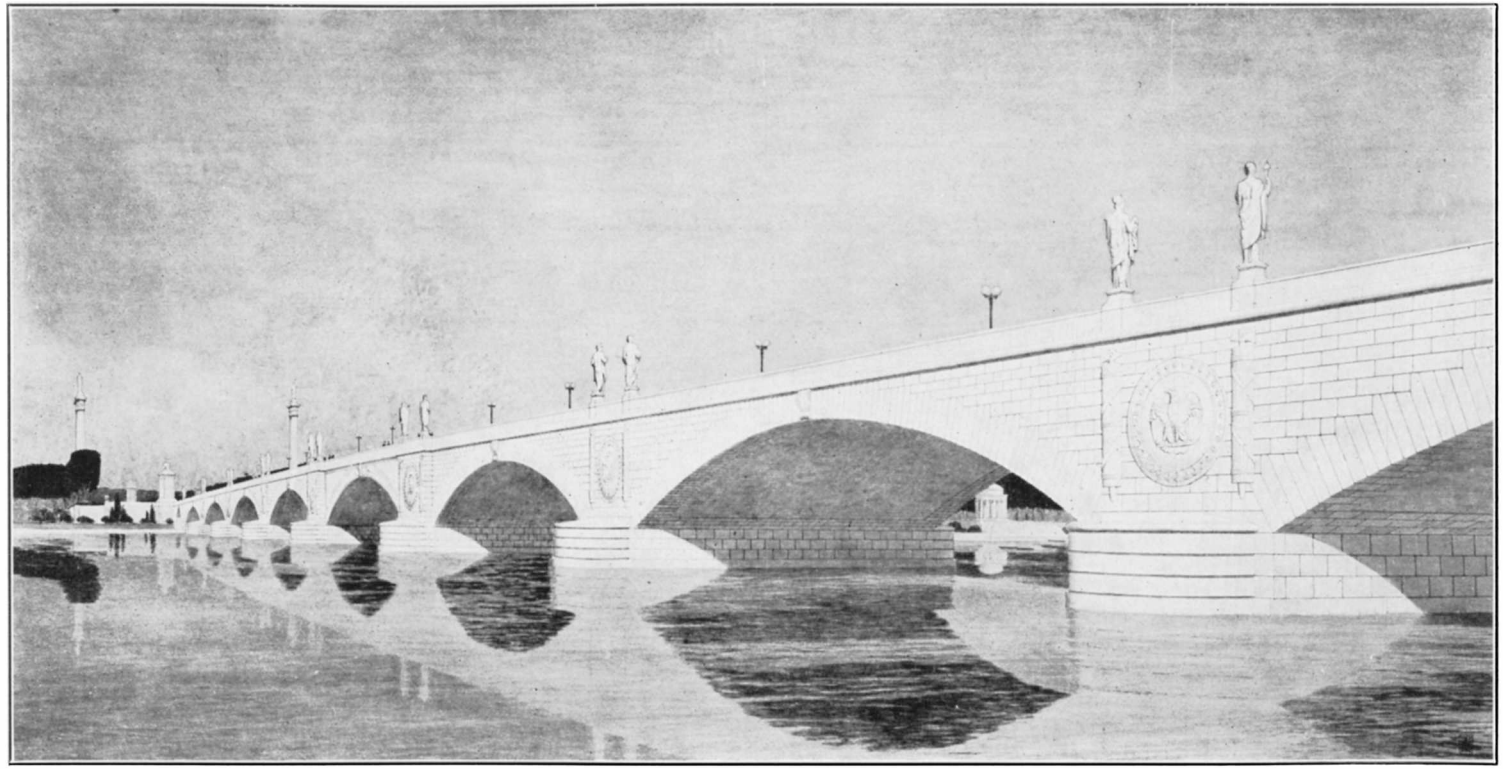
It is the opinion of the Commission that this proposal is the most economical and advantageous one of those suggested and that the expenditures of the sums involved are justified by the important results to be secured.

The Arlington Memorial Bridge Commission recommends the above program to be carried out in accordance with the following ten-year program of expenditures and construction:

End of—	Expended during year	Work to be completed during year
First year	$500,000	Engineering forces organized; equipment, plant, instruments, and furniture purchased; working drawings prepared, grading and dredging finished, consultants retained, and contracts let for actual construction work on bridge.
Second year	2,500,000	Work on river piers half completed.
Third year	2,500,000	Work on piers completed and construction of arches and superstructure begun.
Fourth year	2,500,000	Arches and superstructure finished; draw span installed; plaza and water gate at Lincoln Memorial, avenue across Columbia Island, twin bridge over boundary channel, parkway to Cemetery and driveways in Cemetery half finished.
Fifth year	2,000,000	Ornamentation of main bridge and twin bridge over boundary channel and all work started in fourth year finished, thus providing access across bridge into Cemetery over completed avenue.
Sixth year	1,000,000	In the last five years the formal treatment on Columbia Island will go forward with the filling of the island by the dredging in Virginia Channel and by dumping from trucks. The memorial entrance to the Cemetery and all landscape work will be finished at the end of this period, including the improvement of B Street and Twenty-third Street.
Seventh year	1,000,000	
Eighth year	1,000,000	
Ninth year	1,000,000	
Tenth year	1,000,000	



RETOUCHED PHOTOGRAPH SHOWING NEW BRIDGE AS IT WILL APPEAR FROM SOUTH END OF HIGHWAY BRIDGE



PERSPECTIVE

There is transmitted herewith a draft of a bill, which it is recommended be enacted into law to carry out the project set forth in this report and the appendix attached hereto.

Very respectfully submitted.

CALVIN COOLIDGE,
The President of the United States.
ALBERT B. CUMMINS,
The President pro tempore of the Senate.
FREDERICK H. GILLETT,
The Speaker of the House of Representatives.
BERT M. FERNALD,
Chairman Senate Committee on Public Buildings and Grounds.
JOHN W. LANGLEY,
Chairman House Committee on Public Buildings and Grounds.

The CONGRESS OF THE UNITED STATES.

A bill to provide for the construction of a Memorial Bridge across the Potomac River from a point near the Lincoln Memorial in the city of Washington to an appropriate point in the State of Virginia, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Commission created by section twenty-three of the Act approved March fourth, nineteen hundred and thirteen (Thirty-seventh Statutes, page 885), is hereby authorized and directed to proceed at once with the construction of a Memorial Bridge across the Potomac River from the vicinity of the Lincoln Memorial in the city of Washington to an appropriate point in the State of Virginia, including appropriate approaches, roads, streets, boulevards, avenues, and walks leading thereto on both sides of said river, together with the landscape features appertaining thereto, all in accordance with the design, surveys, and estimates of cost transmitted by said Commission to Congress under date of April 22, 1924: *Provided,* That

said Commission may make such changes in design and location of said bridge without increasing the total cost of the project as in its discretion may be found to be necessary or advisable.

SEC. 2. That the execution of the project herein and hereby authorized shall be carried out under the general supervision of the Arlington Memorial Bridge Commission in the immediate charge of the executive officer of the said Commission, and that said construction shall be entered upon as speedily as practicable in accordance with the plans submitted by the said Commission and shall be prosecuted to completion by contracts or otherwise, as may be most economical and advantageous to the Government and approved and ordered by the said Commission in a total sum not to exceed fourteen million seven hundred and fifty thousand dollars, which sum is authorized to be appropriated from any moneys available or that may become available in the Treasury of the United States.

SEC. 3. That the said executive officer of the said Arlington Memorial Bridge Commission is hereby authorized, with the approval of the said Commission, to employ the services of such engineers, architects, sculptors, artists, and other personnel as shall be determined to be necessary without reference to Civil Service requirements, and at rates of pay authoried by said Commission: *Provided,* That such officers of the United States Corps of Engineers as may be considered necessary by said Commission may be detailed by the President on this work for such periods as the Commission may require.

SEC. 4. That the said Arlington Memorial Bridge Commission is hereby authorized to occupy such Government-owned lands as may be necessary for the bridge project authorized herein and on completion of the project to transfer to the park system under the Chief of Engineers, United States Army, all or such portions of such lands as the said Commission may in its discretion decide to be necessary.

SEC. 5. That the said Arlington Memorial Bridge Commission is hereby authorized to procure by purchase

in the open market, or otherwise, as may be most advisable, or by condemnation, such privately owned lands as may be necessary for approaches on the Virginia shore, and to allow B Street northwest, Washington, D. C., to be opened up from the Capitol to the Potomac River in accordance with the said plans of the said Commission: *Provided,* That any condemnation carried out under this Act shall be in accordance with the provisions of the Act of Congress, approved August thirtieth, eighteen hundred and ninety, providing for a site for the enlargement of the Government Printing Office.

SEC. 6. That the project herein authorized may be prosecuted by direct appropriations or by continuing contracts or by both direct appropriations and continuing contracts: *Provided,* That the expenditures in any year shall not exceed the amounts for the corresponding year as shown in the ten-year program of expenditures and construction contained in the report of the said Commission.

SEC. 7. That said Commission shall annually submit to Congress, through the Bureau of the Budget, a statement of sums of money previously expended and an estimate of the total sum of money necessary to be expended in the next succeeding year to carry on the work authoried by this Act.

APPENDIX

Report of the Executive and Disbursing Officer Arlington Memorial Bridge Commission

NOVEMBER 30, 1923.

SIR: In conformity with the decision of the Arlington Memorial Bridge Commission at the meeting held June 29, 1922, "That the plans for the bridge should be prepared by the executive and disbursing officer with the assistance of the necessary technical personnel, including consulting engineers, architects, and landscape architects," I have the honor to report that the essential general features both of the engineering and architectural plans of the bridge have been delineated on suitable drawings and that the project outlined herein is now in readiness for presentation to Congress with such recommendations as the Commission may desire to make.

To render easily understood the following detailed account of the various phases and developments of the work, the difficulties encountered, and the final solutions reached, it seems appropriate that a brief outline of the history of former steps taken to secure a Memorial Bridge be here given in this report.

FORMER STEPS TO SECURE A MEMORIAL BRIDGE

The question of a suitable bridge across the Potomac from Washington to Arlington has been discussed from time to time for the past seventy-five years, the first official action having been taken by the United States Senate on May 24, 1886, in the following resolution:

Resolved, That the Secretary of War be directed to examine and report upon the expediency of constructing a Government bridge, with a suitable draw and approaches, from a point at or near the foot of New York Avenue or New Hampshire Avenue, on the public grounds, across the Potomac River and Analostan Island to a point on the United States National Cemetery grounds at Arlington, so as to connect in the best manner the public grounds on the two sides of the Potomac, with estimates

of the cost of the kind of bridge deemed by the department most expedient, as well as the cost of alternative plans considered practicable, and which will not materially affect the navigation of the river.

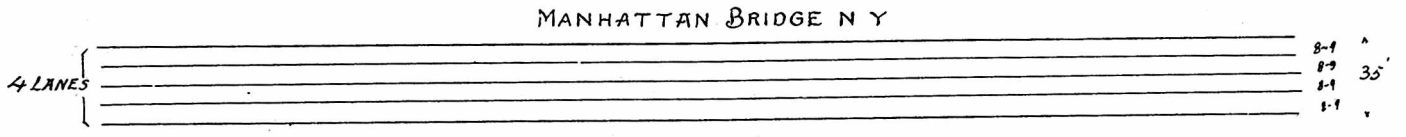
The resolution was referred by the Chief of Engineers, General Newton, to Major Hains, Corps of Engineers, for report.

Major Hains in his report proposed a bridge of four spans of about 300 feet length each, the second span from the Washington City side to be a pivot draw, the bridge to have carriageway 24 feet wide and two sidewalks each 8 feet wide; the main bridge structure to be about 1,200 feet long; the approach on the Washington side to be a wide roadway on an embankment, with a grade of about 3 feet in 100; Analostan Island and the bed of Little River to be crossed partly by embankment and partly by open trestle supporting the roadway; the lower chord of the bridge to be placed at about 28 feet above the level of low tide; the piers and abutments to be built of solid masonry; the truss to be capable of bearing a moving load of about 75 pounds to the square foot of roadway. The cost of such a structure, finished in the best manner and with some degree of ornamentation, was estimated at $609,543. An alternative plan for three spans of steel was also given, the cost estimated at about $650,000. The bridges contemplated were to be through spans.

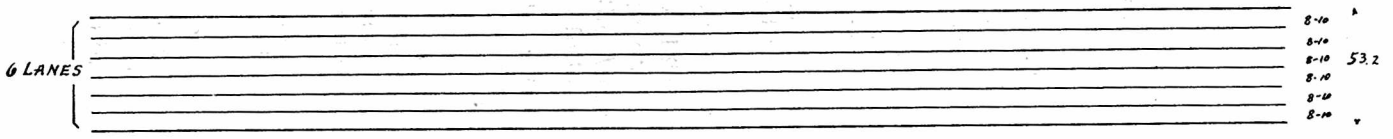
About the same time Captain Symons, Corps of Engineers, submitted a plan for a bridge from Observatory Hill to Arlington, across the Potomac River, the bridge designed to be a link in a wide travel way from the Capitol to the National Cemetery and Government estate at Arlington, to pass at a sufficient height above the river to incommode commerce in the least possible manner, and to be monumental in its character; the main spans to be 306 feet in the clear, with a clear height above high tide of 90 feet under two of them; the span arches to be of steel; the approaches and a portion of the bridge across the lowlands designed to be in embankment 50 feet wide on top, well paved, and with sidewalks and a substantial railing.

WIDTHS OF ROADWAY OF WELL KNOWN BRIDGES.

MANHATTAN BRIDGE N Y

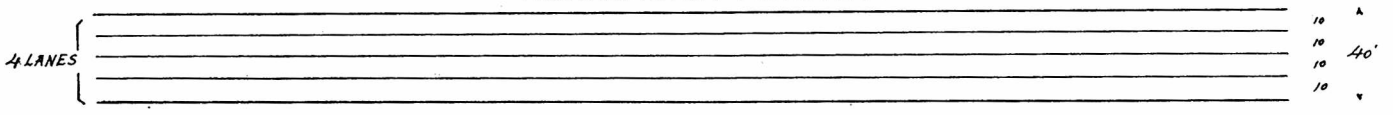


QUEENSBORO. BRIDGE. N.Y

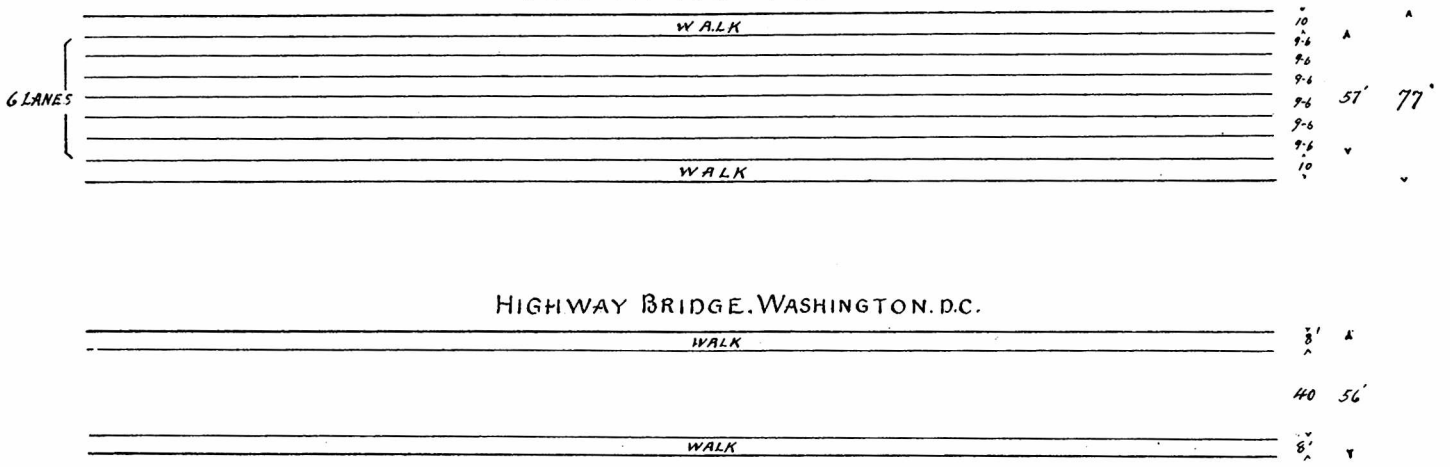


TWIN TUBES

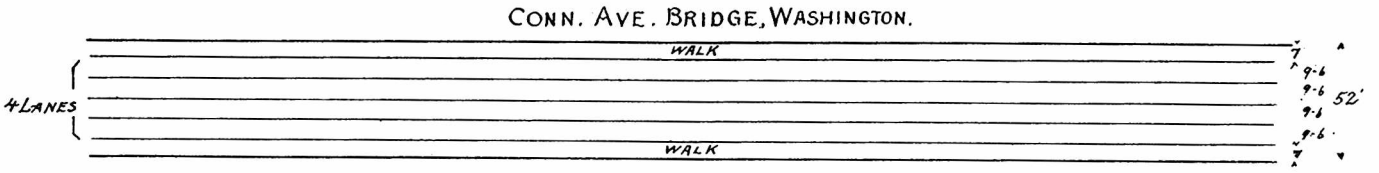
HUDSON RIVER TUNNELS, N.Y.



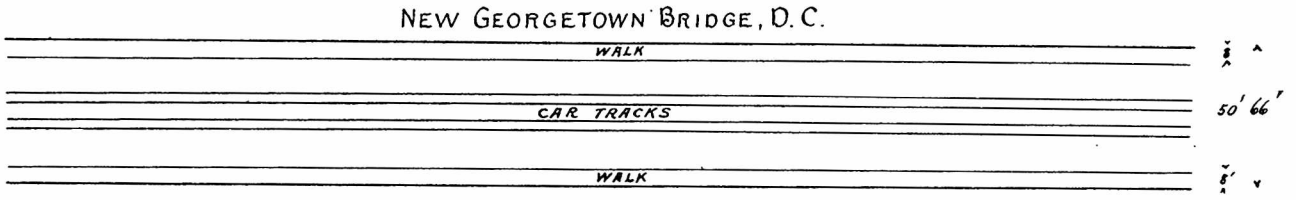
PHIL.A PA CAMDEN SUSPENSION.



CONN. AVE. BRIDGE, WASHINGTON.

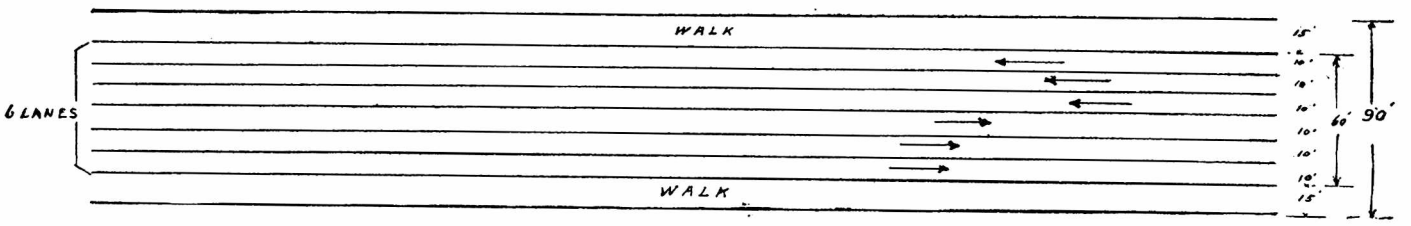


NEW GEORGETOWN BRIDGE, D.C.



PROPOSED

ARLINGTON MEMORIAL BRIDGE



WASHINGTON-VIRGINIA

HIGHWAY BRIDGE. WASHINGTON. D.C.

This proposed bridge was memorial in its conception and the cost estimated at from $1,000,000 to $1,500,000. It was to be "essentially a deck bridge with two partially through spans"; roadway 30 feet wide, with 8-foot sidewalks on each side; piers to be handsome in design, of solid masonry.

The full reports from which the foregoing brief summaries are taken are printed in pages 892–897, Appendix I, Part II, of the Annual Report of the Chief of Engineers for 1886.

On the 20th of February, 1890, the Senate adopted the following resolution:

Resolved, That the Secretary of War be, and he is hereby, directed to examine and report to the Senate on the most suitable kind of bridge, with approaches, from a point at or near the foot of New York Avenue across the Potomac River to a point on the United States National Cemetery grounds at Arlington, so as to connect in the best manner the public grounds on both sides of the Potomac River, with estimates of the kind of bridge deemed most expedient, and which will not interfere with the navigation of said river.

This was referred to Colonel Hains for report. From his report, dated April 17, 1890, and which, with drawings appertaining, is printed on pages 1045–1047, Appendix K, Part II, of the Annual Report of the Chief of Engineers for 1890, the following is taken:

With a view to meeting the objections to a drawbridge and at the same time to bring the cost of one without a draw within reasonable limits, I have designed a bridge on the suspension principle, the clear height above the water at midchannel to be 105 feet, the river span to be 1,100 feet, and two shore spans 652 feet each; the approaches at each end to be on masonry-arched viaducts and embankments of earth; approaches at each end to be of steel, passing over two granite towers, each 210 feet high. * * * The extreme width of bridge to be about 54 feet, with a roadway for vehicles 34 feet wide in the clear, and two sidewalks for pedestrians 8 feet wide.

The total length proposed for this bridge, including approaches, was 4,580 feet, and its estimated cost $3,591,000. Of this, Colonel Hains stated that by reducing the width to 40 feet, making the roadway 24 feet wide instead of 34, a reduction of $500,000 could be made in

the estimated cost, and that a still further reduction of about $400,000 could be made by building the approaches on iron trusses resting on masonry piers, but that these modifications would detract from the dignity of the structure and would not harmonize with the architectural features of other parts of the work.

This bridge was to cross the Potomac River at or near the Naval Observatory.

Senate bill 796, Fifty-second Congress, first session, introduced December 14, 1891, contained the following provisions:

* * * That the sum of fifty thousand dollars is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the purpose of laying off so much of the Arlington estate in Virginia, near Washington, District of Columbia, as may not be otherwise used, into a public park, to be known as "The Arlington Park," and making appropriate roads or avenues therein. The Secretary of War is hereby charged with the duty of expending the sum aforesaid for the purpose named.

SEC. 2. That the Secretary of War is authorized and directed to have constructed an iron bridge from the most convenient point of the Naval Observatory grounds across the Potomac River to the most convenient point of the Arlington estate property.

SEC. 3. That said bridge shall be constructed of iron, with a wagon way thirty feet wide and a passenger footway on each side eight feet wide, and shall be of such height as will permit the free passage of vessels; and if not practical to give said bridge sufficient height to permit the passage of vessels the Secretary of War is authorized to have a draw erected in said bridge of suitable dimensions for the accommodation of vessels. And the sum of five hundred thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the purpose of carrying out the foregoing.

The following resolution of the Senate Committee on Public Buildings and Grounds, Fifty-second Congress, April 18, 1892, was referred to the Secretary of War in connection with the bill (S. 796) just quoted:

Resolved by this committee, That the Secretary of War (in connection with S. 796) be requested to have an estimate made of the cost of the bridge proposed to connect the United States Naval Observatory grounds and Arlington estate property, and to suggest his views in reference to the plans and specifications,

and submit plan of the proposed bridge, and to state whether a more desirable point for the Washington end of the bridge than the Naval Observatory grounds can be secured.

Maj. C. E. L. B. Davis, Corps of Engineers, to whom this bill was referred by the Chief of Engineers, General Casey, reported under date of June 1, 1892, that, in his opinion, no more desirable point for the Washington end of the bridge than the Naval Observatory grounds could be secured. He recommended a bridge closely similar to the one proposed by Colonel Hains in 1886, the only change being in the width of wagon way proposed, which was 30 feet instead of 24 feet, the bridge to consist of four spans of about 300 feet each, the second one from the Washington side to be a pivot draw, the trusses to be of steel. The lower chord of the structure to be 25 feet above low tide.

The estimated cost of the bridge and approaches was $803,990.

Bill 9120, House of Representatives, June 6, 1892, Fifty-second Congress, first session, for the construction of a Memorial Bridge from the Naval Observatory grounds to the Arlington estate, contained the following:

* * * That the Secretary of War is authorized and directed to have constructed a Memorial Bridge from the most convenient point of the Naval Observatory grounds across the Potomac River to the most convenient point of the Arlington estate property.

SEC. 2. That said bridge shall be of such dimensions and capacity, and constructed of such material as in the judgment of the Secretary of War is most suitable; and if not practicable to give said bridge sufficient height to permit the passage of vessels, the Secretary of War is authorized to have suitable mechanical means or draw provided to allow the unobstructed passage of vessels in the channel part of the river; and the sum of one hundred thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the purpose of securing designs and to commence the construction of said bridge.

On the 29th of January, 1895, during the third session, Fifty-third Congress, a bill (No. 2673) was introduced in the Senate of the United States, and is as follows:

A bill to provide for the construction of a bridge across the Potomac River

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized and directed to have constructed a bridge from the most convenient point of the Naval Observatory grounds or adjacent thereto across the Potomac River to the most convenient point of the Arlington estate property, subject to such regulations as he shall prescribe.

SEC. 2. That the cost of said bridge shall not exceed the sum of six hundred thousand dollars, and the sum of one hundred thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the purpose of securing designs and of commencing the construction of said bridge, which shall be used exclusively for foot passengers and vehicles, and prohibited to all tramways, whether propelled by steam, electric, cable, horse, or other power.

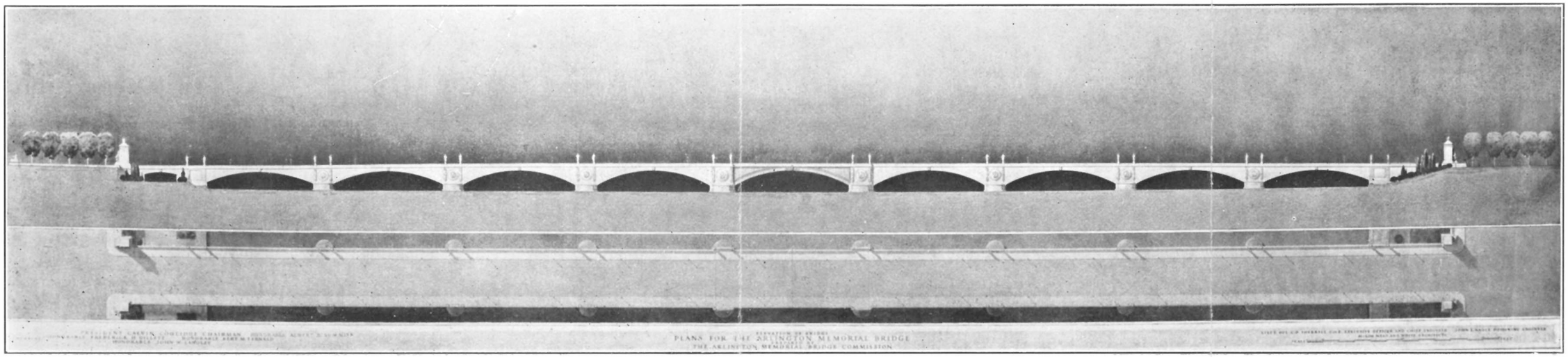
This bill was referred by the Chief of Engineers, General Casey, to Major Davis, Corps of Engineers, for report. Major Davis in his report, February 2, 1895, upon the bill wrote:

While the present bill says nothing specific as to the artistic or monumental character of the proposed bridge, the very liberal allotment of $100,000 for the purpose of securing designs, and the absolute prohibition of all tramways, whether propelled by steam, electric, cable, horse, or other power, would seem to imply a bridge of the character above specified.

This report in referring to the recommendation (in 1886) of General Newton for a mixed board of engineers to consider plans for such a bridge says:

If the expenses of such a board are deducted from the $600,000 mentioned in the bill as the extreme limit of the cost of the bridge, as well as the expense attending the competition—for it is doubtful if satisfactory plans could be submitted unless some pecuniary inducements are offered—there would not be enough money left to build even a commercial bridge, and any attempt at an artistic or memorial structure would be out of the question.

He therefore recommended that the words in section 2 of the bill, " the cost of said bridge shall not exceed the sum of six hundred thousand dollars; and," be stricken out.



ELEVATION AND PLAN OF BRIDGE PROPER

On December 3, 1895, a bill identical with the one just quoted, with the exception that it provided for the construction of a Memorial Bridge, was introduced in the Senate.

None of the foregoing bills became laws.

With two exceptions the designs considered prior to 1897 were for ordinary traffic bridges—that is, bridges not of a memorial character—the superstructures of all the bridges considered, however, to be of iron or steel, the proposed widths of roadways to range from 24 to 40 feet and the widths proposed for sidewalks each ranging from 8 to 10 feet. The acts or bills under which the designs were considered generally contained provisions in the interest of navigation of the river.

The cost of material and labor upon which the estimates were then based can hardly be satisfactorily compared with the high prices of to-day for most building material or with the cost of labor of to-day. The demands for bridge capacity of the large and growing city of Washington of to-day are far greater than would have been those of twenty to forty years ago.

THE COMPETITION OF 1901

The sundry civil act of Congress, approved March 2, 1899 (Public, No. 188), provided for securing designs for a Memorial Bridge at Washington, as follows:

> Memorial Bridge across the Potomac River: To enable the Chief of Engineers of the Army to continue the examination of the subject and to make or secure designs, calculations, and estimates for a Memorial Bridge from the most convenient point of the Naval Observatory grounds, or adjacent thereto, across the Potomac River to the most convenient point of the Arlington estate property, the sum of five thousand dollars.

It was early decided in the office of the Chief of Engineers, which was charged with the performance of this work—

> That the most expeditious and probably the most satisfactory method of carrying out the provisions of that act would be through competition of a limited number of prominent and experienced bridge engineers and designers, invited to present designs in accordance with general outline specifications to be drawn up under the supervision of the Engineer Department.

By the 31st of January the designs had been delivered. With each design was a memoir by the designer explanatory of his proposed structure.

Messrs. L. L. Buck, William R. Hutton, George S. Morison, and William H. Burr were invited to bid and submitted designs for the consideration of the board. After careful study the board, being assembled on February 19, 1900, at the call of the chairman, placed the comparative merits of the designs as follows:

No. 1. Design No. 2, of Mr. William H. Burr.

No. 2. Design No. 2, of Mr. William R. Hutton.

No. 3. Design No. 1, of Mr. L. L. Buck.

No. 4. Design No. 1, of Mr. George S. Morison.

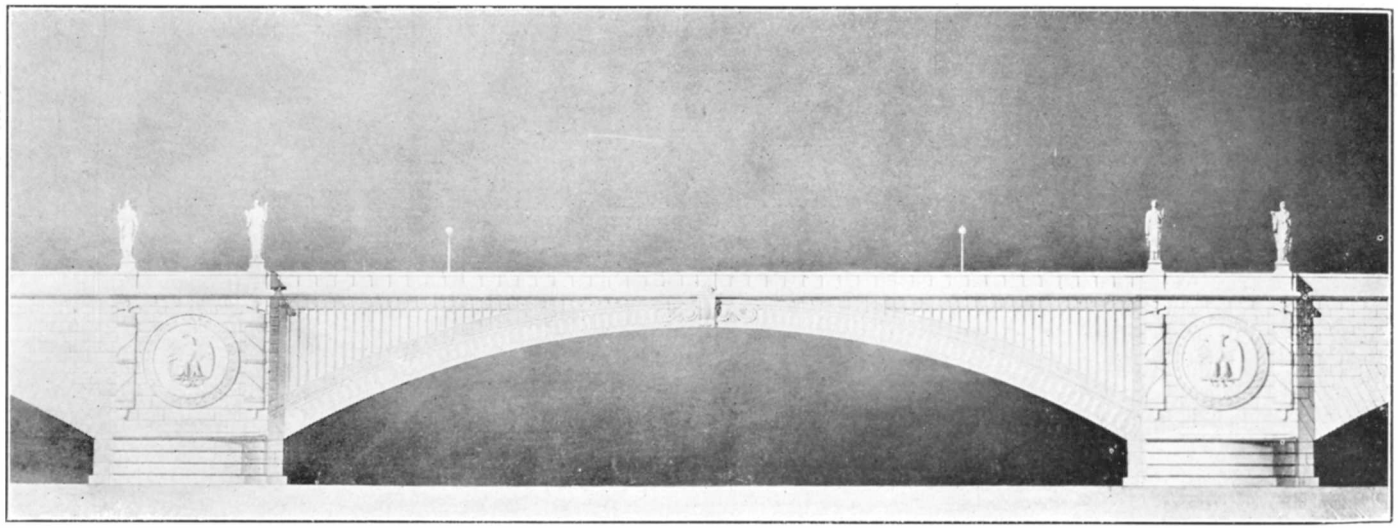
The board expressed the opinion that the general design of Mr. Burr's, designated as the first in the order of merit, meets the conditions of the problem and should be adopted, subject to certain recommendations and modifications set forth in their report, as to width, slope of roadway, curve of underside of draw, towers, provision for tramcars, elevation of initial point, etc., and such other minor modifications as experience may suggest upon the undertaking of the work or during its progress.

The estimated cost of Mr. Burr's structure, as designed originally, was $3,680,672; and the board estimated that the modifications recommended would add about 32 per cent, bringing the total cost up to $4,860,000. The complete report of this Board of Engineers is to be found in House Document No. 578, Fifty-sixth Congress, first session.

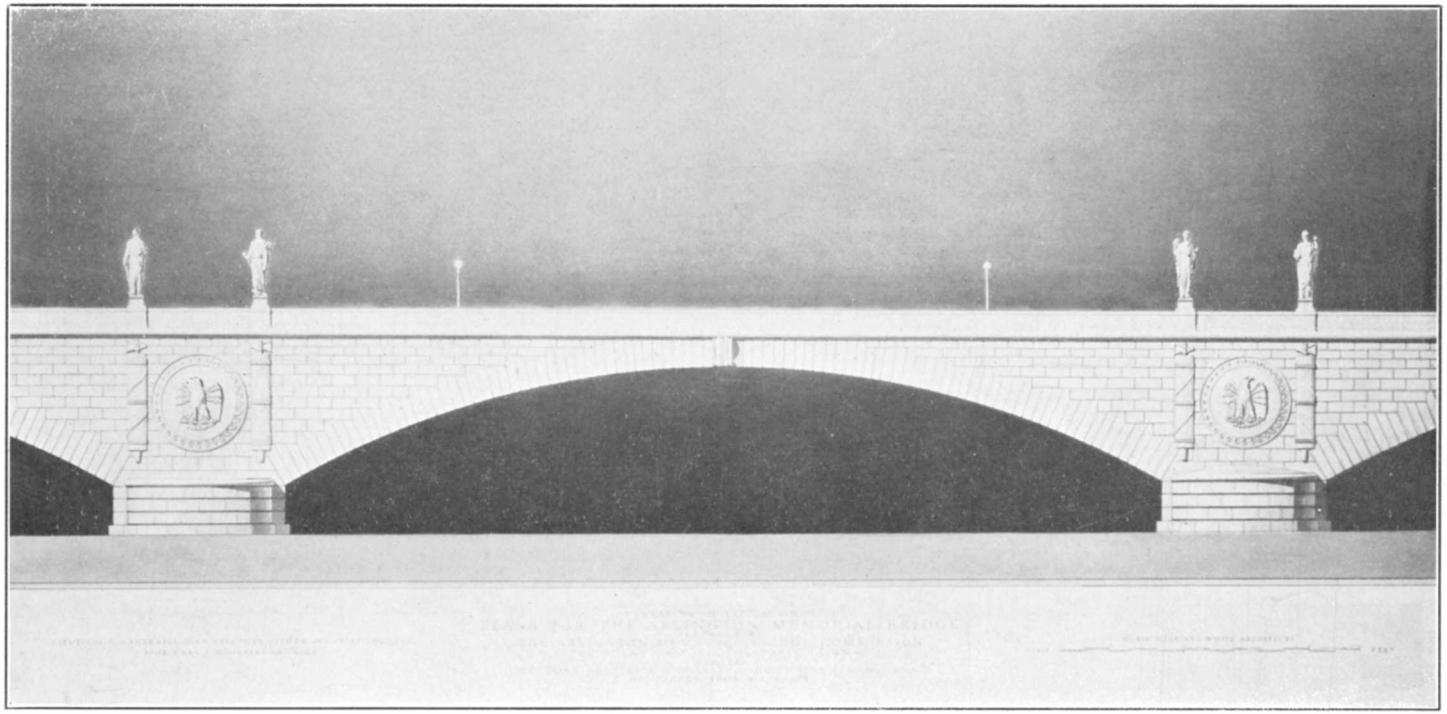
The plans were submitted to Congress by the Secretary of War April 9, 1900, but no authorization for the initiation of the work was ever granted. The drawings are now on file in the Office of Public Buildings and Grounds.

RECOMMENDATIONS OF THE PARK COMMISSION OF 1901

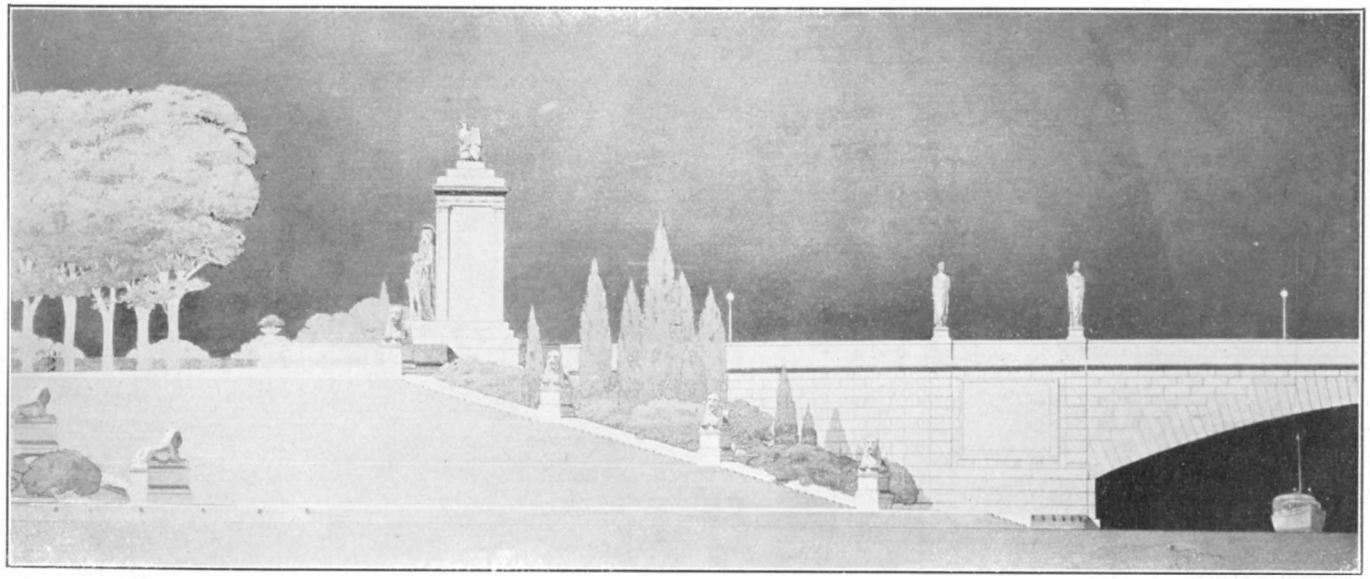
All the studies for bridges made up to this time were completed before study had been made for the development of Potomac Park and the carrying of the Mall



ELEVATION OF BASCULE



ELEVATION OF TYPICAL ARCH



ELEVATION OF EAST END AND WATER GATE



ELEVATION OF WATER GATE

(West front Lincoln Memorial)

system to the river. When in 1901 the Senate Park Commission was appointed to report on the development of the park system of Washington, this commission for the first time pointed out the desirability of placing the Memorial Bridge at the Lincoln Memorial instead of at the site farther upstream, which had been considered in all of the previous projects.

A recommendation for the site at the Lincoln Memorial was made by this commission of 1901, as follows:

> Up to the time this report was submitted no study had been made for the development of the Potomac Park, and for this reason, doubtless, favorable consideration was given to bridge plans which contained in themselves features unusually elaborate. The studies which the Park Commission has made for the improvement of Potomac Park and the introduction in the park proper of memorials of the largest type have led the commission to recommend certain modifications in both the location and the character of the Memorial Bridge.
>
> The proposed Lincoln Memorial, located on the bank of the Potomac, on the axis of the Capitol and the Washington Monument, and occupying an elevation of 40 feet above the level of the water, makes a starting point for a bridge that becomes especially convenient when this road point is considered as the point of divergence and reunion of the driveways leading to the Rock Creek Park system on the northwest and the Potomac system on the southeast. Moreover, the establishment of this concourse allows the bridge to cross the river at the angle most convenient, taking into consideration both the channel of the river and the main objective point—the Mansion House at Arlington.
>
> Inasmuch as the comparatively flat topography of the country makes undesirable a high bridge under which vessels could pass, the decreased length of bridge required under the new plans is in itself a weighty consideration. At the same time the necessity of placing a draw in the bridge calls for such a treatment of the spans as shall not result in an apparent weakening of the structure at its central and vital point.
>
> All these things considered, the commission recommends that the Memorial Bridge proper begin at the proposed Lincoln Memorial and extend to Analostan Island; that the supports be masonry piers of monumental character; that the spans be so arranged as to present a uniform appearance, the character of the draw used being such as to bring about this result. Also that a concourse suited to memorial treatment be established

on Analostan Island, and that the extension of the passageway from the island to the Virginia shore be distinctly subordinate to the bridge proper.

PRESENT COMMISSION AND THE PRESENT PROJECT

The public buildings act approved on March 4, 1913, provided among other things as follows:

SEC. 23. That a Commission is hereby created, to consist of the President of the United States, the President of the Senate, the Speaker of the House of Representatives, and the chairmen of the Committees on Public Buildings and Grounds of the Senate and House of Representatives, for the purpose of investigating and reporting to Congress a suitable design for a Memorial Bridge across the Potomac River from the city of Washington to a point at or near the Arlington estate, in the State of Virginia, and the said Commission is hereby authorized to expend the sum of $25,000 in procuring such designs and for making such surveys and estimates of cost as they may deem advisable, and report as early as may be to Congress.

The officer in charge of public buildings and grounds was designated as executive and disbursing officer of the Commission on December 13, 1915.

Although authorized by the terms of the act above quoted to expend $25,000, it was not until eight years later that funds became available under the terms of the executive and independent offices appropriation act approved June 12, 1922, as follows:

ARLINGTON MEMORIAL BRIDGE COMMISSION: To enable the Commission created by section 23 of the public buildings act approved March 4, 1913, to investigate and report to Congress a suitable design for a Memorial Bridge across the Potomac River from the city of Washington to a point at or near the Arlington estate, in the State of Virginia, together with such surveys and estimates of cost as they may deem advisable, to be expended under the direction of the Commission and to remain available until expended, $25,000.

WORK UNDER THE PRESENT COMMISSION

Immediately after funds became available active work on the design was initiated. The broad outlines of the design were first defined at a meeting of the Commission held June 29, 1922, in the office of the President

at the White House, a copy of the approved minutes of which follows:

That the bridge should be built in the extension of New York Avenue.

That it should consist of a series of arches, faced with masonry, without a draw or other opening.

That the height of the bridge should be sufficient to allow the passage of river traffic (between 80 and 90 feet above mean low water at the center of the channel span).

That the plans should be prepared by the executive officer of the Commission, with the assistance of the necessary technical personnel, including consulting engineers, architects, and landscape architects.

That the Commission of Fine Arts be called upon for advice relating to the various architectural and artistic matters connected with the design.

That the recommendations of the executive officer be submitted to the Commission for approval in advance of the making of definite arrangements for the employment of a consulting architect, engineer, and landscape architect.

Following these decisions of the Commission on July 24, 1922, Mr. John L. Nagle, assistant engineer in the office of the Chief of Engineers, was appointed designing engineer for the project and the technical work of the design was immediately begun.

Old surveys made in the vicinity of the bridge site were examined, but none having been found adequate for the purposes of this bridge it was decided that a new one be made. The limits for the newly surveyed area were taken approximately as 1,000 feet up and down stream from the center line of the bridge, beginning at Twenty-third Street on the District side and ending at the high ground westward of the Fort Myer Reservation on the Virginia side. The field work was begun in November, 1922, and finished in February, 1923.

It was found that borings to solid rock had been made upon this site by Col. Charles J. Allen, Corps of Engineers, United States Army, in 1897–98; and as the results of these borings, contained in House Document No. 388, Fifty-fifth Congress, second session, served admirably for the purposes of this project, no exploratory work of such nature was undertaken.

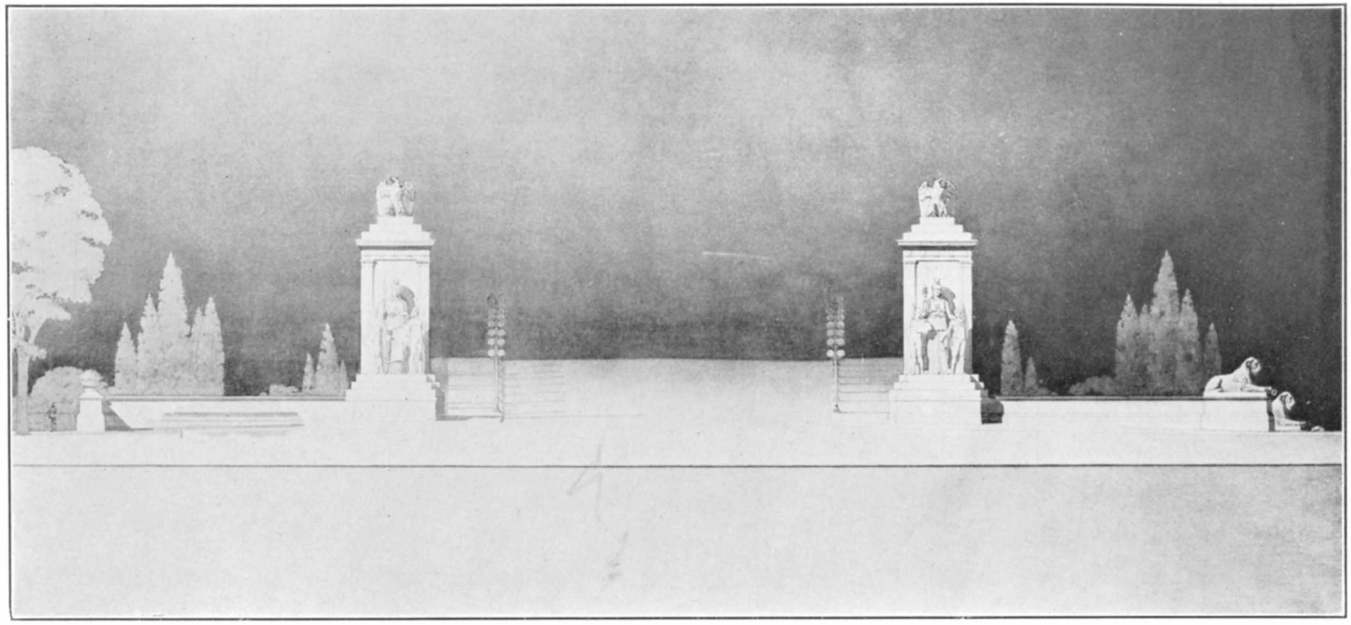
Meanwhile the preliminary work of design for a high-level bridge, permitting the passage of all river traffic under it, had gone forward, and by December, 1922, was in such state of completion that the more detailed design was about to be taken up.

The Commission of Fine Arts, which had from the time of its first being acquainted with the decision of the Bridge Commission to locate the bridge on the line of New York Avenue extended, actively opposed such location, recommended instead that the bridge should be located on the line from the Lincoln Memorial to the Lee Mansion in the Arlington National Cemetery in conformity with the suggestion of the Park Commission of 1901 previously quoted in this paper.

In order to secure the decision of the Bridge Commission on this and other matters relating to the bridge, the executive and disbursing officer received authority from President Harding to call a meeting of the Bridge Commission, which was held December 5, 1922, at the Executive Offices. The following decisions of the Commission were made at this meeting:

> After a detailed discussion of the question as to the preferable location of the bridge, it was decided by the Commission to hold a meeting at an early date, at which the members of the Commission of Fine Arts would be requested to be present and advise the Bridge Commission in reference to the matter of location and design of the proposed Arlington Memorial Bridge.
>
> The executive officer was authorized to proceed to make arrangements for a competition in general accordance with his proposal contained in a letter to the chairman of the Commission, dated November 29, 1922.
>
> The Commission decided that the width proposed by the executive officer in a letter to the chairman of the Commission, dated November 29, 1922, was satisfactory and would be followed in the design.
>
> The Commission further decided that the proposed Arlington Memorial Bridge would be described as a "memorial to those who have died in the military service of the country."

The meeting mentioned in the foregoing minutes at which the Commission of Fine Arts was to be invited to attend was held on December 18, 1922. The following



ELEVATION OF ENTRANCE TO BRIDGE

copy of the approved minutes of this meeting gives the decision of the Bridge Commission at the meeting:

Present, Hon. Warren G. Harding, President of the United States, chairman; Hon. Calvin Coolidge, Vice President of the United States; Hon. Frederick H. Gillett, Speaker of the House of Representatives; Hon. Bert M. Fernald, chairman Senate Committee on Public Buildings and Grounds; and Hon. John W. Langley, chairman House Committee on Public Buildings and Grounds. The executive officer, Lieut. Col. Clarence O. Sherrill, was also present.

The following members of the Commission of Fine Arts were present by request to advise the Bridge Commission on questions relating to the location and design of the proposed Memorial Bridge: Mr. Charles Moore (chairman), Mr. Henry Bacon, Mr. H. Siddons Mowbray, Mr. Louis Ayres, Mr. James E. Fraser, and Mr. Milton Medary.

The various proposals under consideration for the location of the proposed bridge were presented by the executive officer, and after a brief discussion all present proceeded by automobiles to visit on the ground the important localities connected with this bridge, going first to the naval hospital, thence to the Lincoln Memorial, thence to a point on Military Road on the line joining the Lincoln Memorial with the Lee Mansion, thence to the hill on Military Road just north of the Cemetery, thence to the new Key Bridge, which was crossed on foot. At all of these locations the members of the Commission discussed fully the various possibilities, finally returning to the White House, where, after a brief session, it was unanimously decided that a low-level bridge, with a draw, should be constructed on the line joining the Lincoln Memorial with the Lee Mansion.

It was further decided by the Commission that the general treatment on Columbia Island and the Virginia shore should include a roadway on the axis of the bridge leading directly toward the Lee Mansion, with suitable memorial gate or other treatment at the entrance to the Cemetery and suitable connecting roadways located with due regard to appropriate grades and curvatures from this gateway to the Lee Mansion. From the Virginia terminus there are also to be two main roadways, one leading around the north end of the Cemetery between Arlington and Fort Myer, the other leading around the south end of the Cemetery for traffic in the direction of Richmond.

In accordance with these decisions, the office of the executive and disbursing officer at once began work on the bridge at the Lincoln Memorial site. The actual

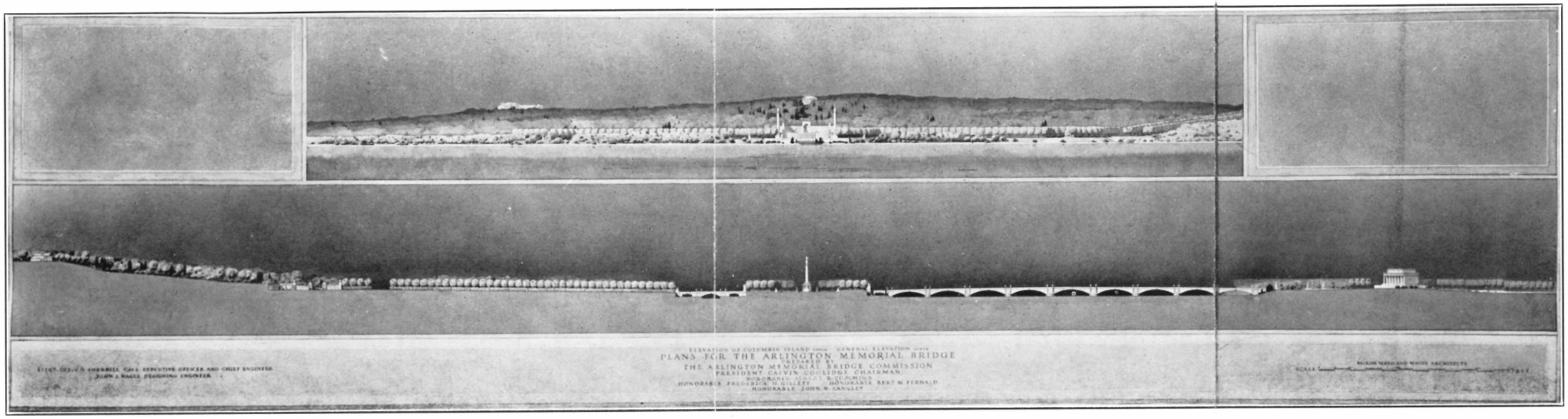
position of the center line of the bridge was taken as the line joining the center of mass of Lincoln Memorial and the center of the façade of the Lee Mansion in the Arlington National Cemetery.

ENGINEERING AND ARCHITECTURE

Borings and surveys.—As no previous borings had been made along the axis of the bridge in this location, it was necessary at the outset to determine the profile of the bedrock before any but the rudest of preliminary design work could be undertaken. The borings were made by the personnel of the office with equipment loaned for the purpose by the United States Engineer officer, Washington, D. C. The work was started immediately after January 1, 1923, and finished by the middle of February. In all, 113 holes were drilled to bedrock, the aggregate depth of the holes being about 2,000 linear feet. The survey work previously mapped out for the New York Avenue site was extended so as to cover the area on both sides of the new site and covered the area from east of the Lincoln Memorial to the west side of Arlington Cemetery. The surveys were under the immediate supervision of Mr. George E. Clark, junior engineer.

Draw span.—The next question to arise was that of a draw span in the bridge. It was thought that the inclusion of a steel draw span would be detrimental to the bridge as a great memorial. The views of the War Department, through the United States Engineer officer at Washington, were asked as to the possibility of building the bridge without a draw span, but with clearance enough to permit practically all of the river traffic.

A public hearing was held by the District Engineer officer and the proposal to build the bridge without a draw span met with considerable opposition not only from the various shipping interests but also from numerous civic organizations, and it then became evident that it would be inadvisable to insist on a bridge without a draw span. In a letter dated March 13, 1923, the Chief of Engineers advised this office that to eliminate



ELEVATION OF ARLINGTON HEIGHTS (UPPER)

Profile of bridge from Lincoln Memorial to Lee Mansion (lower)

the draw span in this bridge would injuriously affect the river traffic and would be in violation of established governmental policies regarding navigable waterways; but, on the contrary, a draw span affording a clear waterway of not less than 100 feet in width for vessels of all heights would be adequate in the plans of the bridge. These requirements have been followed in the design.

Channel of river.—The question of maintaining a sufficient area in the channel of the river for the passage of the water was given much consideration, for while the volume of flow of the Potomac at ordinary stages is small, the discharge in times of flood becomes so great as to present a serious problem. The question was somewhat complicated by the problem of disposing of the discharge of Little River (lying between the Virginia shore and Analostan Island), which at ordinary stages carries little water, but in times of high water acts as a valuable auxiliary channel to relieve conditions in the main channel of the stream between Analostan Island and the Washington shore. The discharge from Little River formerly overflowed the flats where Columbia Island is now located. With the elimination of this outlet, two courses were possible—either to leave sufficient area for this discharge on the Virginia side of Columbia Island or to divert the bulk of it into the main channel of the Potomac at the top of Columbia Island. The latter course was selected as the more expedient, although to provide increased carrying capacity for the main channel it will be necessary to dredge away a strip sufficiently wide from the eastern shore of Columbia Island so that the resulting channel will conform in carrying capacity to that recommended by the Board of Engineers in the report of February 18, 1882.

Selection of architects.—The controlling factors of the design having been determined, it became possible to proceed with the more detailed problems. However, before much progress could be made in these matters the question of architectural details had to be decided. Originally this office was authorized by the

Bridge Commission to conduct a competitive program for the purpose of securing the architectural designs, but with the loss of time incurred by the change of the bridge site and the added expense due to increased area to be surveyed and to the new borings to be made in the bed of the river, it was finally decided that this method would be impracticable. The Commission of Fine Arts was asked to recommend names for consideration as architects to collaborate with the engineer in the design of the bridge. In accordance with this request, the Commission of Fine Arts submitted the names of McKim, Mead & White, of New York; Charles A. Platt, of New York; and Paul Cret, of Philadelphia. The executive officer then requested the authority to enter into negotiations with the architectural firms; and after receipt of authority in a letter from President Harding, dated March 5, 1923, to employ McKim, Mead & White, of New York City, at once began negotiations with this widely known and responsible firm and one whose authority on architectural matters is unquestioned. As a result of these negotiations the executive officer on April 4, 1923, in behalf of the Arlington Memorial Bridge Commission, entered into a contract with the firm of McKim, Mead & White, under the terms of which the latter agreed in part as follows:

> To provide and furnish the architectural features of the design in collaboration with the engineering features of the design prepared by the said executive and disbursing officer for the said Arlington Memorial Bridge, and for such other professional architectural services as may be necessary in connection therewith.

From the moment of the signing of the contract with the architects the work went rapidly forward on both architectural and engineering designs, and with results believed to be highly creditable.

Outlines of structure.—After considerable preliminary investigation, in which all comparable outstanding bridges in the world of different numbers of spans were examined, it was agreed that a bridge of nine spans—a draw span flanked on both sides by four masonry

spans—most nearly fulfilled all engineering and architectural conditions. The roadway at the center of the draw span is at an elevation of 43 feet above mean low water, and from this height the roadway slopes downward in each direction to an elevation of 31 feet at the terminal pylons marking the entrances to the bridge, the profile of the roadway taking the form of an inverted parabolic curve. The segment of a circle was adopted as the curve for all the arch rings as being the simplest, most beautiful, and altogether most appropriate. The resulting arches are of graceful and pleasing proportions and provide fairly satisfactory working conditions for the materials of which the rings are to be constructed.

Main structure.—The main structure of the bridge is to be reinforced concrete and structural steel, faced with white granite. The draw span is to be of the double-leaf bascule type, appropriately faced with granite or metal painted white to harmonize with the masonry spans. All operating machinery, tenders' houses, lookout stations, etc., as far as possible are kept below the bridge deck and out of sight, so that, when closed, the draw span will appear as an integral portion of the bridge.

Loadings.—The arch rings are designed to carry, in addition to dead loads, temperature stresses, etc., a uniformly distributed live load of 110 pounds per square foot on the bridge deck so placed along the length of the bridge as to cause the maximum stresses. The deck and its supports are designed to carry a double row of 20-ton buses or a uniformly distributed live load of 125 pounds per square foot or any combination of the two systems of loading which gives maximum stresses, together with an impact allowance of 35 per cent of the maximum live-load stress.

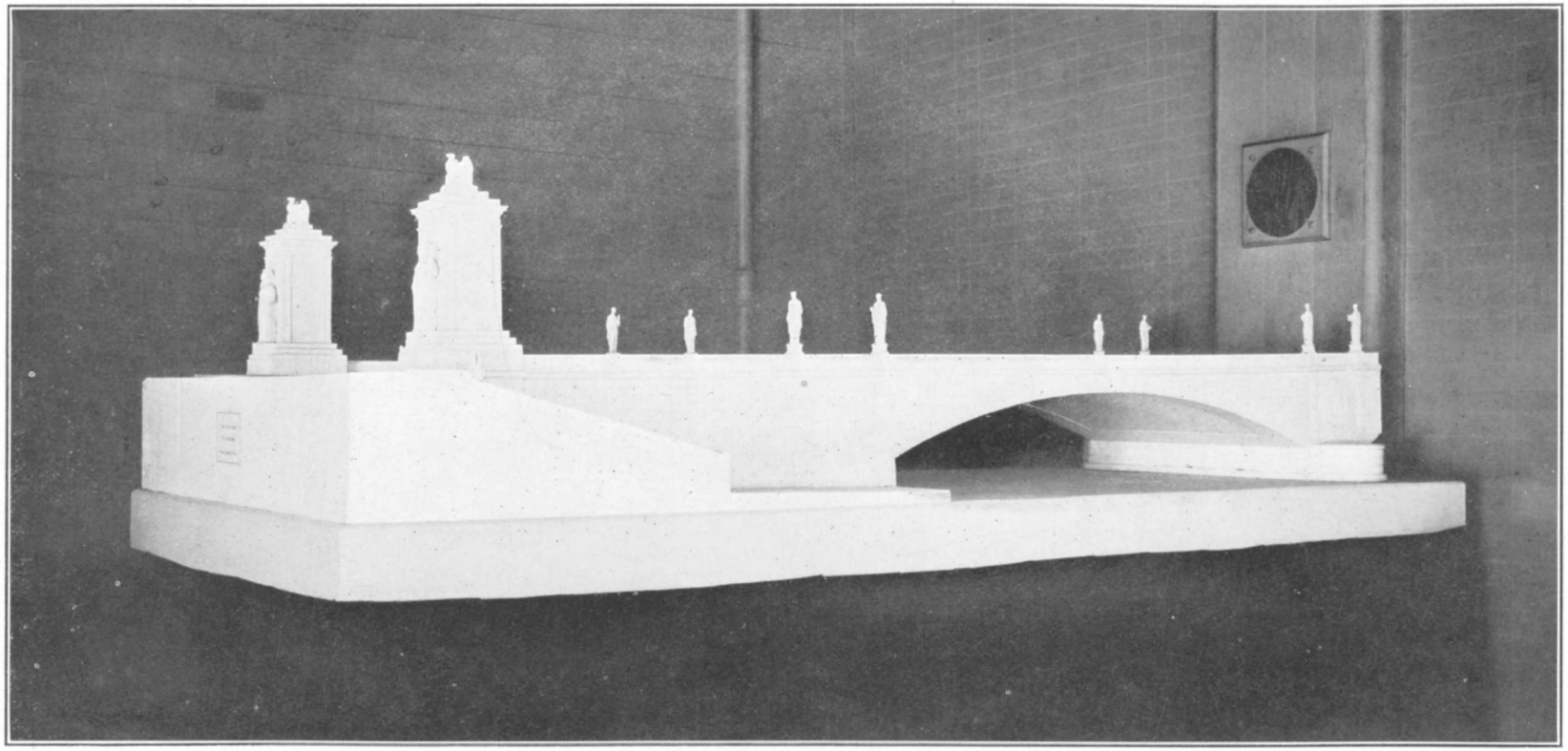
Foundations.—All foundations for the bridge and subsidiary structures will be carried down to bedrock. As the depth to the bedrock is not excessive, the open-caisson method for sinking the foundations will probably prove most economical and feasible.

GENERAL DESCRIPTION

The essential parts of the project are as follows:

1. The plaza and roads between the Lincoln Memorial and the bridge, including the water gate fronting the Lincoln Memorial.
2. The bridge proper.
3. The treatment of Columbia Island, the bridge to the mainland forming the terminus of the Lee Highway.
4. The parkway extending from Columbia Island to and including the main entrance to the Arlington National Cemetery.
5. The treatment of the Cemetery.
6. The widening of B Street NW., and its extension straight through to the Capitol as an east-west boulevard of approach from the Capitol to the Memorial Bridge and Arlington Cemetery.
7. The widening of Twenty-third Street into a similar north-south boulevard from Washington Circle to B Street north.

The bridge plaza and the water gate.—The area of the Mall axis at its junction with the Potomac has been treated so as to recognize the importance, both of the final feature of a parkway extending from the Capitol to the Potomac and that of a plaza whence radiate the bridge and important park roads, including access to the Lincoln Memorial and to the river bank. The bridge and the shore road are symmetrically arranged with respect to the continuation of the Mall axis, both the road and the bridge being provided with entrance pylons. A monumental flight of steps between the bridge and the road leads to the river, the whole composition thus forming a water gate giving access through the Mall, with its important monuments, to the Capitol. The steps leading down to the river bank form landing places for small boats, the piers at either end of the steps forming landing places for larger ones. The parking on B Street north has been shown extending to the river bank, and B Street south has been straightened so as to be parallel to the Mall axis, terminating with a rond point at its intersection with Twenty-third



MODEL OF ENTRANCE TO BRIDGE AND ONE ARCH.

Street extended to the southward of the Lincoln Memorial. This rond point is the site of the proposed Ericsson Memorial, for which funds are in hand an work can be commenced as soon as its site is definite determined in accordance with this project.

The bridge.—It is proposed to use granite for the facing of the bridge, that material not only being of great beauty, but also of most enduring quality, especially when in contact with or in the vicinity of water. This granite will be of pure white, as nearly as possible the color of the marble used in the Lincoln Memorial; in fact, at a little distance this material will be hardly distinguishable from the white Colorado Yule marble of the latter.

In order not to interfere with the view of the Lincoln Memorial as seen from Columbia Island the bridge has been kept as low as possible consistent with sound engineering and economy. It has nine segmental arches, the center span being 184 feet long and the length of the spans decreasing gradually each way toward the shore, so that the end spans are 166 feet. The bridge is 2,138 feet long between the terminal pylons. The roadway is 60 feet and each of the two sidewalks 15 feet wide, making a total width of 90 feet.

The architecture has been kept as simple and severe as possible, the structure mainly depending for its beauty upon the perfection of its general proportions and its adornment with significant sculptured pieces of the highest quality of design. The Washington entrance to the bridge is marked by two pylons, located about 500 feet from the Lincoln Memorial. Similar pylons are placed at the entrance to the shore road and are repeated at the Virginia entrance to the bridge. They are 40 feet high, and are adorned on the sides with sculptured groups and appropriate inscriptions and surmounted by eagles symbolic of the United States of America. These symbols appear also as the only sculptured ornaments on the sides of the bridge, where they are shown in the large disks on both ends of each of the river piers. The sculpture on the sides of the four pylons represent in different ways the recognition of the

common bonds and aspirations of the Nation and the final triumph of the idea of a permanent and complete Union.

The pairs of figures on each end of the piers of the bridge represent symbolically the outcome of that harmonious Union, the result of the energies of the entire country in the arts of peace—that is, those inventions and accomplishments in science and art particularly connected with the history of this country. Thus would be symbolized the agricultural, engineering, religious, and educational progress, to mention but a few categories of action. In the opinion of the architect this sculpture vitalizes the entire conception of the design of the bridge, differentiating this memorial from all others and making the reason for its existence intelligible at a glance.

The center arch of the bridge is required to be a draw opening. The double-leaf bascule form has been adopted as interrupting to the least possible degree the unity of the bridge. However, this introduction of a steel arch in a construction designed to be in the highest degree monumental is to be regretted; and as very few ships go above the site up the Potomac, it is to be hoped that the permission of Congress will be granted in the not distant future to replace the draw with a masonry arch like the others in the bridge.

Columbia Island and the Lee Highway.—Even before the reclamation of Columbia Island by the dredging operations of the Corps of Engineers had advanced materially, it was always considered as a suitable site for formal park treatment, a fitting end for the Memorial Bridge, as well as an important feature in itself. Being so intimately related to the bridge, it was thought proper that the plans for the ultimate development of Columbia Island as a park should be included as part of the project for the Memorial Bridge. Accordingly the lines of the shore of the island have been somewhat rectified to permit a cross axis almost perpendicular to the main axis of the bridge and extending the full length of the island. The intersection of these two axes has suggested a plaza with fitting architectural adornment in a

measure supplemental to the Lincoln Memorial across the river, and for this purpose two stately columns are proposed to be erected here, framing in but not interfering with the view of the Lincoln Memorial from the direction of the Lee Mansion. These columns symbolize the one the North and the other the South. They are surmounted by statues of Victory, the stylobates whence they rise offering surfaces suitable for decorations, bas-relief, and inscriptions. The columns are 166 feet high or practically of the same height as the Colonne de Juillet in Paris.

The axis of the Columbia Island affords an opportunity to recognize the great Lee Highway undertaking and to make it an integral part of the whole composition. This highway, which at present passes over the Francis Scott Key Bridge into Washington by a circuitous and highly congested route, can be given a splendid direct approach over the brow of the imposing Arlington Heights, exactly on the prolongation of the axis of the Mall. From this point a superb view of the bridge, the Lincoln Memorial, the Washington Monument, and the Capitol will be enjoyed by the traveler entering the Nation's Capital over this route. From the Arlington Heights the Lee Highway would descend toward Washington, keeping on the axis of the Mall, passing over the stream between the mainland and Columbia Island by a single-arch bridge, and cross the axis of the island, continuing its course to the water's edge of the main channel, where it is planned to construct a water gate facing and corresponding to that at the Lincoln Memorial, previously described. Rome had its five great avenues of approach: The Flaminia, Praenestina, Aurelia, Ostiensis, and Appian Ways. Washington has none worthy of the name, but in this proposed terminus of the Lee Highway will be created the first and most magnificent of all possible entrances to the National Capital.

The intersection of the axis of the Mall with the axis of Columbia Island, alluded to above, affords an appropriate spot for a memorial in the shape of a circular or polygonal temple marking the north end of the impor-

tant Lee Highway. This treatment would be echoed at the lower end of the island and at an equal distance below the main plaza by a memorial or a rest pavilion.

The narrow waterway separating the island from the Virginia shore will be peculiarly adapted for boating parties and is destined to grow in popularity as time goes on. A number of landing places have been provided along this channel. Apart from the formal roads shown and a certain number of footpaths, it is recommended that the island be rather densely planted in trees so as to correspond in appearance, as nearly as possible, with Analostan Island. In this connection the acquisition of Analostan Island by the United States Government would not only prevent its possible and even probable use for purposes which would render it objectionable in its close proximity to the dignified treatment herein described, but would also be highly desirable on account of its natural beauty and suitability for park purposes.

The Cemetery entrance and approach.—Continuing along the main avenue on the axis of the bridge, and after crossing over the waterway separating Columbia Island from the Virginia shore on a small twin bridge harmonizing with the main structure, extends a formal parkway with an extensive park area with two roadways and a " tapis vert " between, bounded by hedges and elms, and rising on a slight but uniform grade, leads to the foot of the steep slope rising up to the Lee Mansion. This abrupt change of grade suggests the placing of the chief memorial entrance to the Arlington National Cemetery at this point. Accordingly a plaza is shown on the drawings in part excavated into the side of the hill, whence radiate the roads to the Mansion, to the Memorial Amphitheater, and other parts of the Cemetery. The west end of the plaza is in the form of a semicircle, the diameter of which is 226 feet and is in structure a retaining wall 30 feet high. The visible face of this retaining wall will be decorated with niches, pilasters, and tablets bearing appropriate inscriptions. Access is provided to the terrace surmounting

the retaining wall, whence an all-embracing view of the parkway may be obtained—the columns of Columbia Island, the Memorial Bridge, the Potomac, the Lincoln Memorial 5,808 feet distant, the Washington Monument, and far in the distance the glistening white dome of the Capitol. Through the trees up to the westward a glimpse of the simple and dignified Arlington Mansion may also be obtained on the top of the heights.

The Cemetery grounds.—It is proposed to leave that portion of the Cemetery grounds intervening, directly between the main entrance just described and the Lee Mansion, in practically its present informal condition, eliminating but two or three trees to enable the visitor to see the Lee Mansion from below and to view the Lincoln Memorial and at least a portion of the bridge from above. The new roads leading up the hill are so located as to have easy grades and can be connected at no great distance from the entrance with roads which now exist. These old roads, however, should be widened. The same may be said in regard to connecting the present footpaths with the entrance terrace, but another footpath should be added leading to the southward. A new road is also indicated leading from the proposed main entrance to the Amphitheater, thus providing more direct access thereto than is at present afforded.

An important feature and one closely related to the Arlington Memorial Bridge project is the extension of B Street eastward to the Capitol Grounds and the widening of this street throughout its entire length and its paving with asphalt. This improvement is essential to allow for the fullest use to be made of the route over the proposed bridge to the Arlington National Cemetery, as it would be the natural boulevard of approach to the Cemetery from the Capitol. Not only would this be of much value in conjunction with this project, but it would be of great value in diverting a large portion of traffic now congesting Pennsylvania Avenue in the vicinity of the Treasury Building westward beyond the White House to streets leading north and northwest.

B Street under this proposal would become throughout its entire extent a splendid boulevard bordering the park system.

Another important and closely related project is the suitable widening of Twenty-third Street from Washington Circle southward to B Street, immediately north of the Lincoln Memorial. On all important memorial occasions occurring in Potomac Park or in the Arlington Cemetery Twenty-third Street would thus become the most important north and south route for all the northwest section of the city and would become the popular means of approach to the Lincoln Memorial and the Arlington Memorial Bridge. At the present time this important approach to the Lincoln Memorial and the Arlington Bridge is too narrow to meet the reasonable demands of traffic.

Estimates of cost—Summaries for entire period

	All granite construction as proposed by the architects	Substituting concrete for granite where feasible	
		Omitting formal treatment of Columbia Island and memorial entrance	As proposed by the executive officer
	Proposal I	Proposal II	Proposal III
Memorial Bridge proper	$9,250,000	$7,250,000	$7,250,000
Bridge plaza and water gate	2,300,000	1,000,000	1,000,000
Columbia Island	6,480,000	1,200,000	2,880,000
Parkway and memorial entrance to Cemetery	2,390,000	480,000	1,390,000
Extension of B Street eastward to Capitol and widening to 120 feet	2,070,000	2,070,000	2,070,000
Widening Twenty-third Street from Washington Circle to B Street	160,000	160,000	160,000
Grand total for project	22,650,000	12,160,000	14,750,000

Proposal I: Constitutes the ideal solution; it contemplates the completion of the entire project as indicated on the drawings, using white granite for all steps, walls, walks, soffits of arches, and all other visible faces excepting the pavement of the roadways.

Proposal II: Represents the most economical solution consistent with reasonable demands of appropriateness; it contemplates the completion of the project as indicated on the drawings, omitting the formal treatment of Columbia Island, the Lee Highway Bridge across the boundary channel, and

the memorial entrance to the Cemetery (but retaining the avenue across Columbia Island as indicated), substituting concrete for granite in all sidewalks, steps, and soffits of all arches excepting a return of suitable width in granite along the faces of the arches, using granite elsewhere as in Proposal I.

Proposal III: Is a mean between the two foregoing proposals and is a satisfactory solution having due regard to economy; it contemplates the completion of the entire project as indicated on the drawings, substituting concrete for granite as in Proposal II.

Ten-year program of expenditures and construction

End of—	Expended during year	Work to be completed during year
First year	$500,000	Engineering forces organized; equipment, plant, instruments, and furniture purchased; working drawings prepared, grading and dredging finished, consultants retained, and contracts let for actual construction work on bridge.
Second year	2,500,000	Work on river piers half completed.
Third year	2,500,000	Work on piers completed and construction of arches and superstructure begun.
Fourth year	2,500,000	Arches and superstructure finished; draw span installed; plaza and water gate at Lincoln Memorial, avenue across Columbia Island, twin bridge over boundary channel, parkway to Cemetery and driveways in Cemetery half finished.
Fifth year	2,000,000	Ornamentation of main bridge and twin bridge over boundary channel and all work started in fourth year finished, thus providing access across bridge into Cemetery over completed avenue.
Sixth year	1,000,000	In the last five years the formal treatment on Columbia Island will go forward with the filling of the island by the dredging in Virginia Channel and by dumping from trucks. The memorial entrance to the Cemetery and all landscape work will be finished at the end of this period, including the improvement of B Street and Twenty-third Street.
Seventh year	1,000,000	
Eighth year	1,000,000	
Ninth year	1,000,000	
Tenth year	1,000,000	

The above program is based on Proposal III, involving a total expenditure of $14,750,000.

If Proposal I is adopted, the yearly expenditure after the second year as indicated above will be increased about 67 per cent, the expenditures for the first two years remaining unchanged.

If Proposal II is adopted, the expenditures for the first five years will remain as above, those for the last five years will be reduced to about 50 per cent, making $500,000 per year for the period.

97501—24——4

Detailed estimates

MEMORIAL BRIDGE

Engineering:		
Piers, 100,000 cubic yards concrete, at $28	$2,800,000	
Arches and deck, 24,000 cubic yards reinforced concrete, at $30	720,000	
Structural steel, 1,800 tons, at $150	270,000	
Draw span, complete with lifting mechanism but not ornamented	450,000	
Protection for draw span	50,000	
Grading for approaches, 100,000 cubic yards earth, at $0.75	75,000	
Dredging, 800,000 cubic yards, at $0.12	96,000	
Engineering and contingencies	439,000	
Total		$4,900,000
Ornamentation and embellishment:		
Ornamentation of draw span	250,000	
Granite facing for piers, spandrel walls, and balustrades, 120,000 cubic feet, at $10	1,200,000	
Statues along balustrades, 40, at $9,800	392,000	
Entrance pylons—		
Groups, 4, at $28,000	112,000	
Bas-reliefs, 16, at $9,000	144,000	
Eagles, 4, at $3,000	12,000	
Ornamental lamp posts, 40, at $460	18,400	
Models	4,150	
Architecture and contingencies	217,450	
Total		2,350,000
Total for Memorial Bridge as recommended herein		7,250,000
For all-granite soffit, as proposed by architects, add 200,000 cubic feet granite, at $10		2,000,000
Total		9,250,000

BRIDGE PLAZA AND WATER GATE

Engineering:	
Dredging, 150,000 cubic yards, at $0.12	$18,000
Sea wall, 2,000 linear feet, at $75	150,000
Piling, 32,000 linear feet, at $1	32,000

Engineering—Continued		
Asphalt paving, 30,000 cubic yards, at $4.50	$135,000	
Curbing, 8,000 linear feet, at $2.25	18,000	
Sidewalks, concrete, 10,000 square yards, at $2.40	24,000	
Concrete for steps, back walls, etc., 5,000 cubic yards, at $30	150,000	
Engineering and contingencies	43,000	
Total		$570,000
Ornamentation and embellishment:		
Granite facing, copings, walls, etc., 30,000 cubic feet, at $10	300,000	
Sculpture—		
Groups, 2, at $28,000	56,000	
Lions, 8, at $3,000	24,000	
Eagles, 2, at $3,000	6,000	
Ornamental iron lamp standards, 20, at $460	9,200	
Models	1,800	
Architecture and contingencies	33,000	
Total		430,000
Total for bridge plaza and water gate, as recommended herein		1,000,000
For all-granite treatment as proposed by architects, add 130,000 cubic feet, at $10		1,300,000
Total		2,300,000

FORMAL TREATMENT OF COLUMBIA ISLAND

Engineering:	
Sea wall, 2,000 linear feet, at $75	$150,000
Piling, 30,000 linear feet, at $1	30,000
Asphalt paving, 75,000 square yards, at $4.50	337,500
Curbing, 12,000 linear feet, at $2.25	27,000
Sidewalks—	
Concrete, 20,000 square yards, at $2.40	48,000
Gravel, 10,000 square yards, at $1.25	12,500
Twin bridge over boundary channel, 10,000 cubic yards reinforced concrete, at $30, without ornamentation	300,000
Lee Highway Bridge, 6,500 cubic yards, at $30	195,000

Engineering—Continued		
Steps, boat landings, etc., concrete, 8,000 cubic yards, at $30	$240,000	
Sodding, trees, shrubbery, etc	100,000	
Engineering and contingencies	140,000	
Total		$1,580,000
Ornamentation and embellishment:		
Granite facing for twin bridge, 30,000 cubic feet, at $10	300,000	
Granite facing for Lee Highway Bridge, 15,000 cubic feet, at $10	150,000	
Granite facing, copings, walls, pavilions, etc., 37,000 cubic feet, at $10	370,000	
Sculpture:		
Seated figures, 6, at $10,000	60,000	
Groups, 2, at $28,000	56,000	
Figures at top of columns, 2, at $20,000	40,000	
Statues, 8, at $9,800	78,400	
Ornamental iron lamp standards, 40, at $460	18,400	
Bas-relief at base of column (14 feet by 48 feet 6 inches)	100,000	
Models	6,000	
Architecture and contingencies	121,200	
Total		1,300,000
Total for treatment of Columbia Island as recommended herein		2,880,000
For all-granite treatment, as proposed by architects, add 360,000 cubic feet granite, at $10		3,600,000
Total		6,480,000

ALTERNATE FOR COLUMBIA ISLAND WITHOUT FORMAL TREATMENT

Engineering:		
Asphalt pavement, 45,000 square yards, at $4.50	$202,500	
Curbing, 7,000 linear feet, at $2.25	15,750	
Sidewalks—		
Concrete, 10,000 square yards, at $2.40	24,000	
Gravel, 10,000 square yards, at $1.25	12,500	

Engineering—Continued		
Twin bridge over boundary channel, without ornamentation, 10,000 cubic yards reinforced concrete, at $30	$300,000	
Sodding, trees, shrubbery, etc	100,000	
Engineering and contingencies	65,250	
Total		$720,000
Ornamentation and embellishment:		
Granite facing for twin bridge, 30,000 cubic feet, at $10	300,000	
Ornamental lamp standards, 10, at $460	4,600	
Sculpture—		
Groups, 2, at $28,000	56,000	
Statues, 8, at $9,800	78,400	
Architecture and contingencies	41,000	
Total		480,000
Total for Columbia Island without formal treatment		1,200,000

This treatment contemplates the development of Columbia Island as indicated on the drawings, omitting the avenue perpendicular to the axis of the bridge, the two columns, the pavilions, the boat landings, and the Lee Highway Bridge over the boundary channel.

PARKWAY AND MEMORIAL ENTRANCE TO CEMETERY

Engineering:		
Asphalt paving, 32,000 square yards, at $4.50	$144,000	
Sidewalks, 8,000 square yards, at $2.40	19,200	
Curbing, 10,000 linear feet, at $2.25	22,500	
Crossing Pennsylvania Railway—		
Reinforced concrete, 3,000 cubic yards, at $30	90,000	
Back filling, 25,000 cubic yards, at $0.50	12,500	
Concrete back walls, steps, etc., 5,000 cubic yards, at $30	150,000	
Sodding, trees, shrubbery, etc	10,000	
Driveways through Cemetery, three-fourths mile, at $60,000	45,000	
Engineering and contingencies	46,800	
Total		$540,000

Ornamentation and embellishment:		
Granite facing, copings, walls, etc., 60,000 cubic feet, at $10	$600,000	
Sculpture—		
Statues in niches, 8, at $8,000	64,000	
Busts on columns, 34, at $500	17,000	
Equestrian in court	30,000	
Ornamental iron lamp-posts, 40, at $460	18,400	
Ornamental iron fence, 400 linear feet, at $115	46,000	
Models	2,600	
Architecture and contingencies	72,000	
Total		$850,000
Total for parkway and memorial entrance to Cemetery as recommended herein		1,390,000
For all-granite treatment, as proposed by architects, add 100,000 cubic feet granite, at $10		1,000,000
Total		2,390,000

ALTERNATE FOR PARKWAY TO CEMETERY, OMITTING THE MEMORIAL ENTRANCE

Engineering:		
Asphalt paving, 32,000 square yards, at $4.50	$144,000	
Sidewalks, 8,000 square yards, at $2.40	19,200	
Curbing, 10,000 linear feet, at $2.25	22,500	
Crossing Pennsylvania Railway—		
Reinforced concrete, 3,000 cubic yards, at $30	90,000	
Back filling, 25,000 cubic yards earth, at $0.50	12,500	
Concrete steps, etc., 1,000 cubic yards, at $30	30,000	
Sodding, trees, shrubbery, etc	10,000	
Driveways through Cemetery, three-fourths mile, at $60,000	45,000	
Engineering and contingencies	36,800	
Total		$410,000
Ornamentation and embellishment:		
Ornamental iron lamp standards, 40, at $460	18,400	

Ornamentation and embellishment—Continued		
Ornamental iron fence, 400 linear feet, at $115	$46,000	
Architecture and contingencies	5,600	
Total		$70,000
Total for parkway to Cemetery, omitting memorial entrance		480,000

This treatment contemplates the treatment of that part of the project on the Virginia shore as indicated on the drawings, omitting the memorial entrance to the Cemetery.

STRAIGHTENING AND WIDENING B STREET

Property and improvements to be acquired	$1,300,000
Asphalt paving, 96,000 square yards, at $4.50	432,000
Curbing, 28,220 linear feet, at $2.25	63,495
Sidewalks, 50,000 square yards, at $2.40	120,000
Engineering and contingencies	154,505
Total	2,070,000

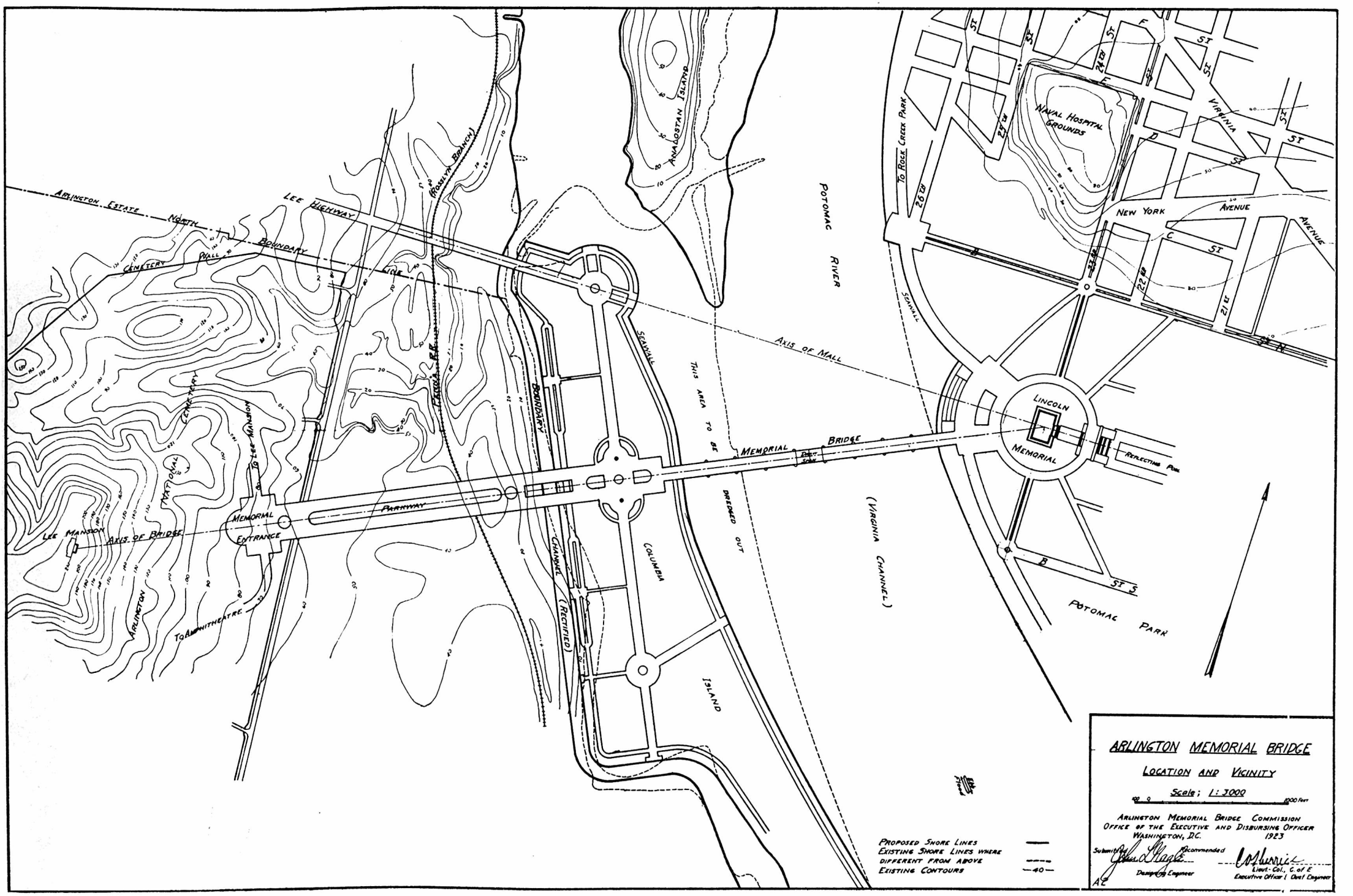
WIDENING OF TWENTY-THIRD STREET

Asphalt paving, 23,000 square yards, at $4.50	$103,500
Resetting curbs, 8,000 linear feet, at $1.50	12,000
Sidewalks, 13,500 square yards, at $2.40	32,400
Engineering and contingencies	12,100
Total	160,000

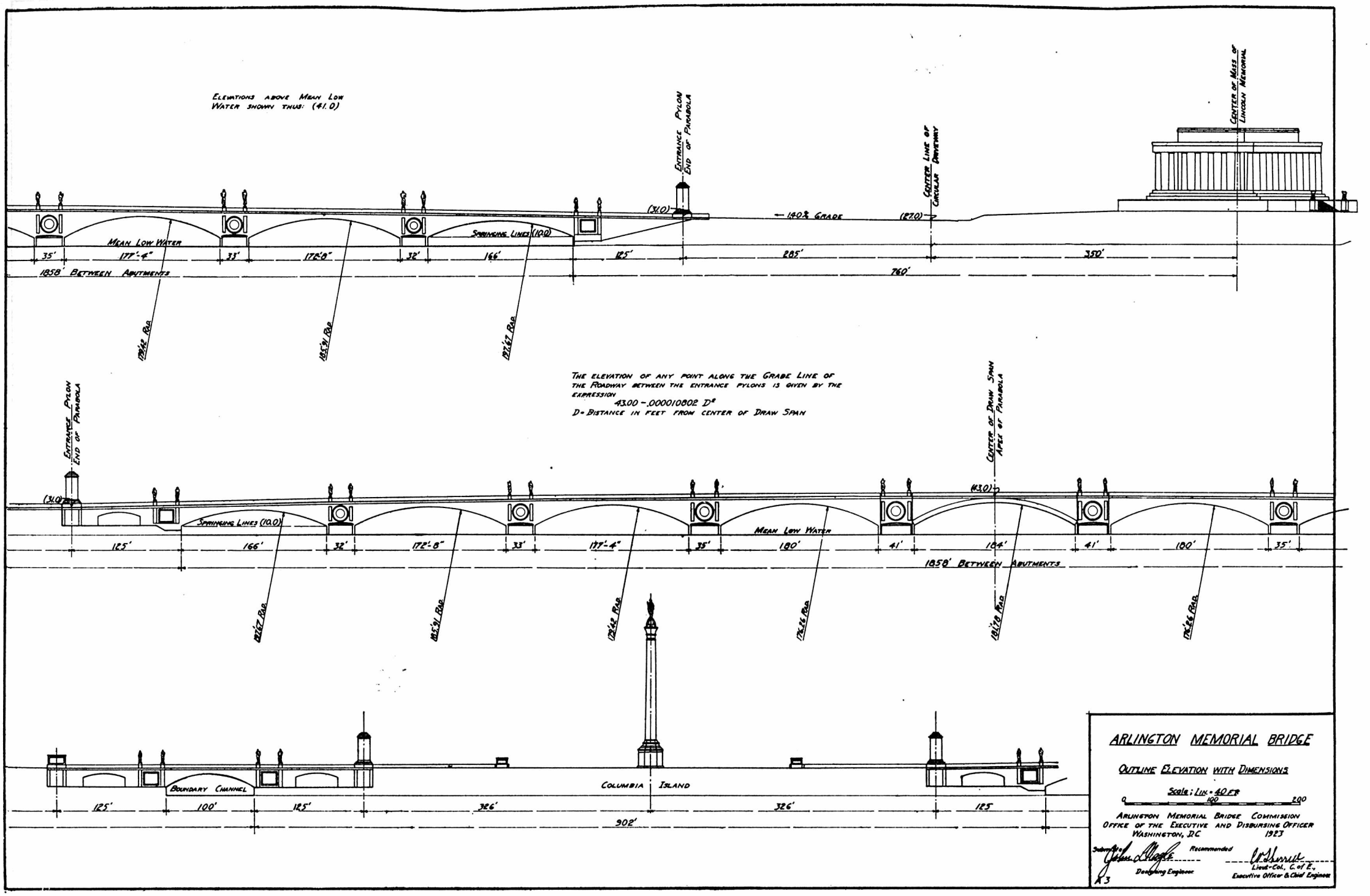
Respectfully submitted.

C. O. SHERRILL,
Lieutenant Colonel, Corps of Engineers,
Executive and Disbursing Officer.

The CHAIRMAN
ARLINGTON MEMORIAL BRIDGE COMMISSION.



ENGINEERING PLAN OF BRIDGE AND VICINITY



ARLINGTON MEMORIAL BRIDGE

Outline Elevation with Dimensions

Scale: 1 in. = 40 ft.

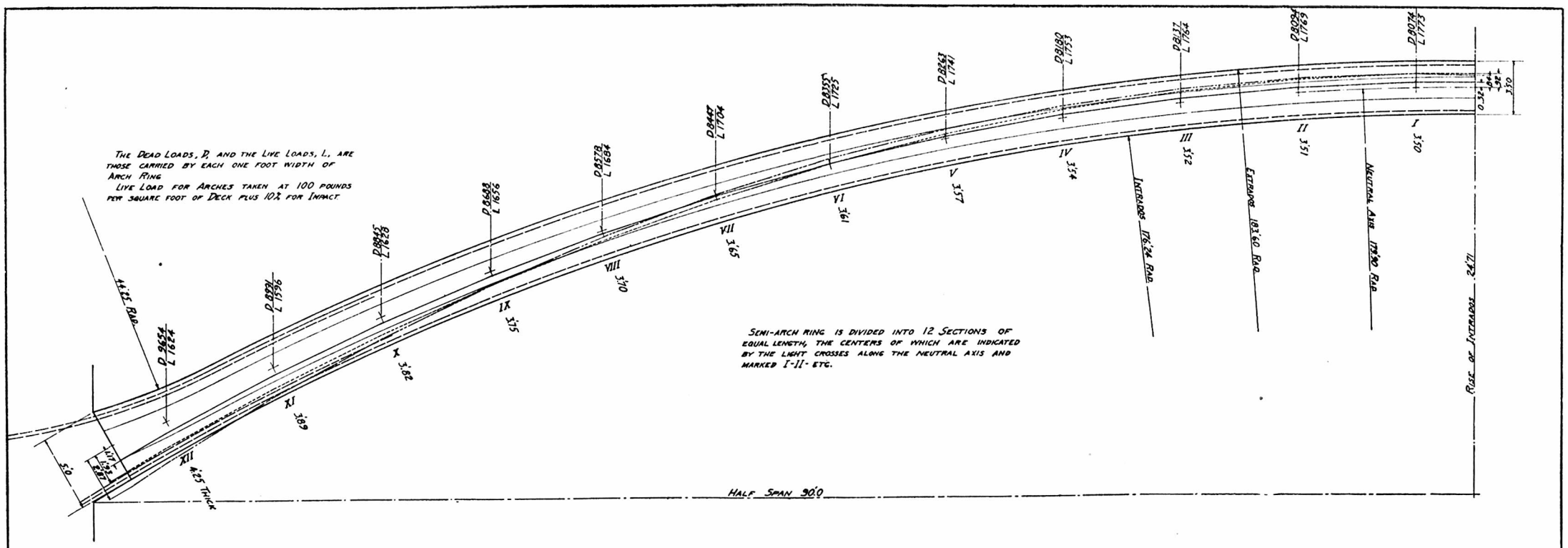
0 100 200

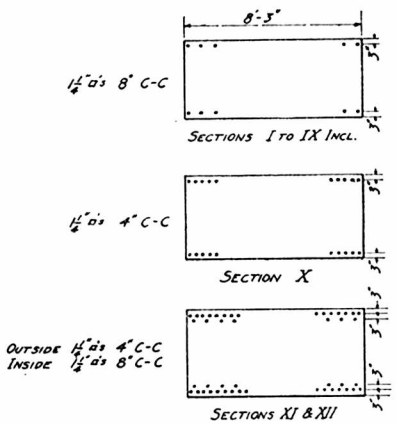
Arlington Memorial Bridge Commission
Office of the Executive and Disbursing Officer
Washington, D.C.
1923

Submitted: John C. Sprague, Designing Engineer
Recommended: U. S. Grant, Lieut.-Col., C. of E., Executive Officer & Chief Engineer

K3

OUTLINE ELEVATION WITH DIMENSIONS





Ends of all rods are to be carried far enough past their indicated sections to develope full strength by bond.

Dead Load plus Live Load	Line of Pressure Indicated	Temp. Change from normal	Hor. Thrust
On whole Span	———	+ 25°F	214302#
On Left Half	—·—·—·—	- 35°	180951
On middle Half	- - - - - - -	- 35°	193098
Dead Load only	Not shown	+ 25°	178010
" " "	" "	0°	171685
" " "	" "	- 35°	162830

The Hor. Thrusts shown above correspond to each one foot width of arch ring. In all of these thrusts, corrections have been made for the effects of Arch Shortening due to direct stress.
The Thrusts and the positions of the Lines of Pressure were computed by the method of Elastic Weights and Antipolars

ARLINGTON MEMORIAL BRIDGE

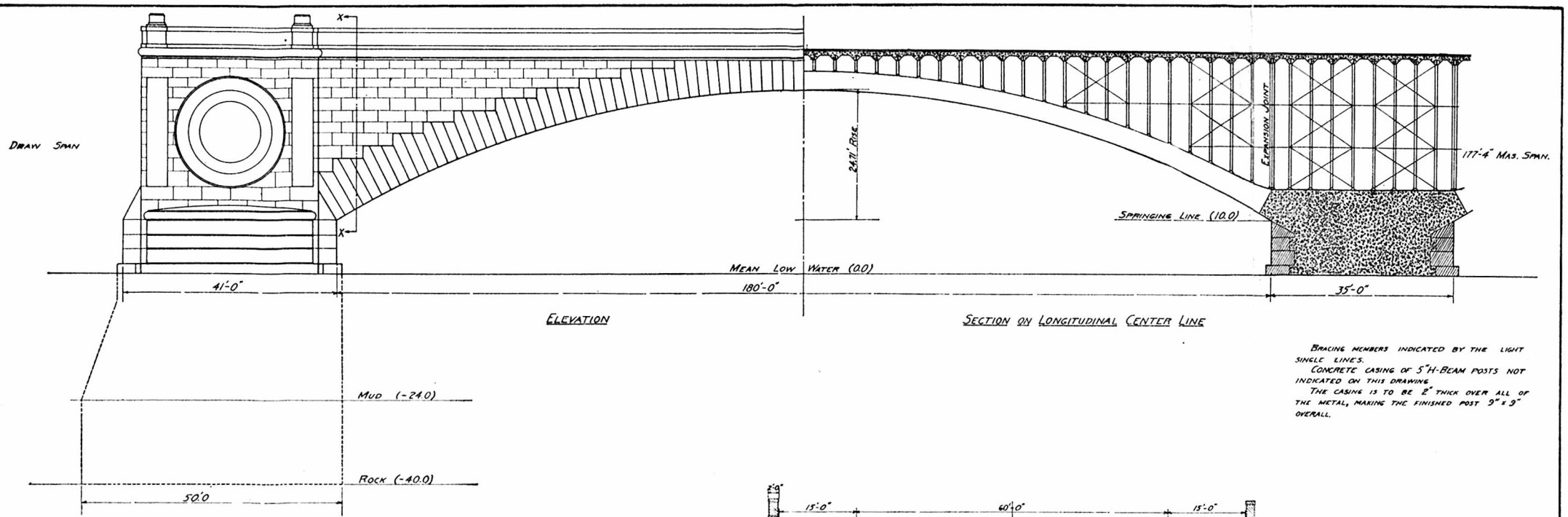
Detail of Arch Ring

Scale; ⅜ in = 1 ft

Arlington Memorial Bridge Commission
Office of the Executive and Disbursing Officer
Washington, D.C., December 1923.

Submitted: John L. Haycock, Designing Engineer
Recommended: W. D. Smith, Lieut.-Col., C. of E., Executive Officer & Chief Engineer

A5



ELEVATION

SECTION ON LONGITUDINAL CENTER LINE

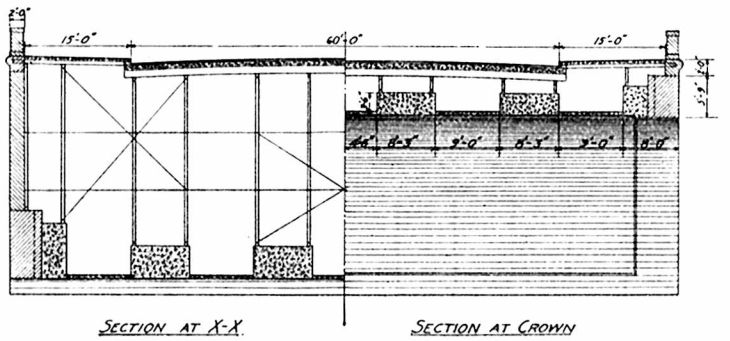
Bracing members indicated by the light single lines.

Concrete casing of 5" H-Beam posts not indicated on this drawing.

The casing is to be 2" thick over all of the metal, making the finished post 9" x 9" overall.

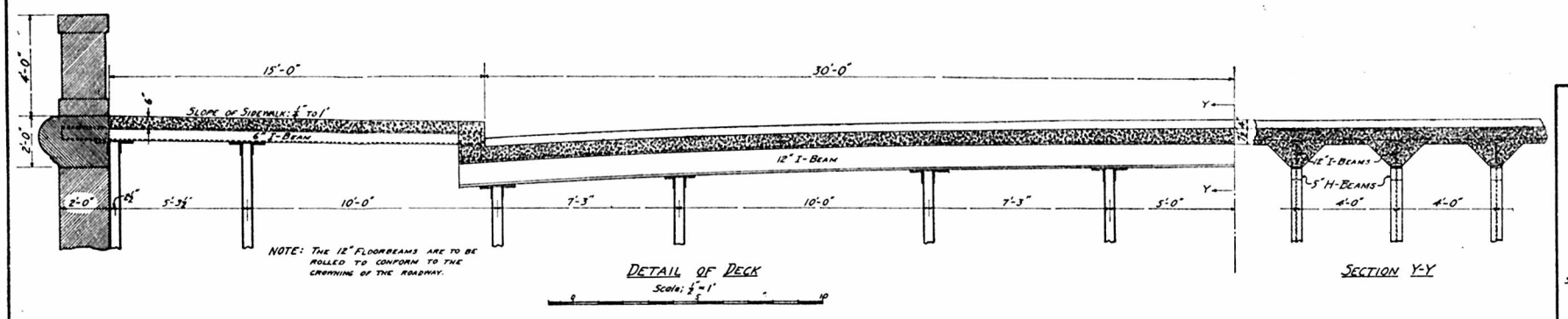
Facing stones to be of White Bethel Granite

Live Load for Deck: Double row of 20-Ton vehicles and a uniform load of 125 pounds per square foot plus a 35% allowance for Impact



SECTION AT X-X

SECTION AT CROWN



NOTE: The 12" floorbeams are to be rolled to conform to the crowning of the roadway.

DETAIL OF DECK
Scale; ½" = 1'

SECTION Y-Y

ARLINGTON MEMORIAL BRIDGE

DECK AND ARCH CONSTRUCTION

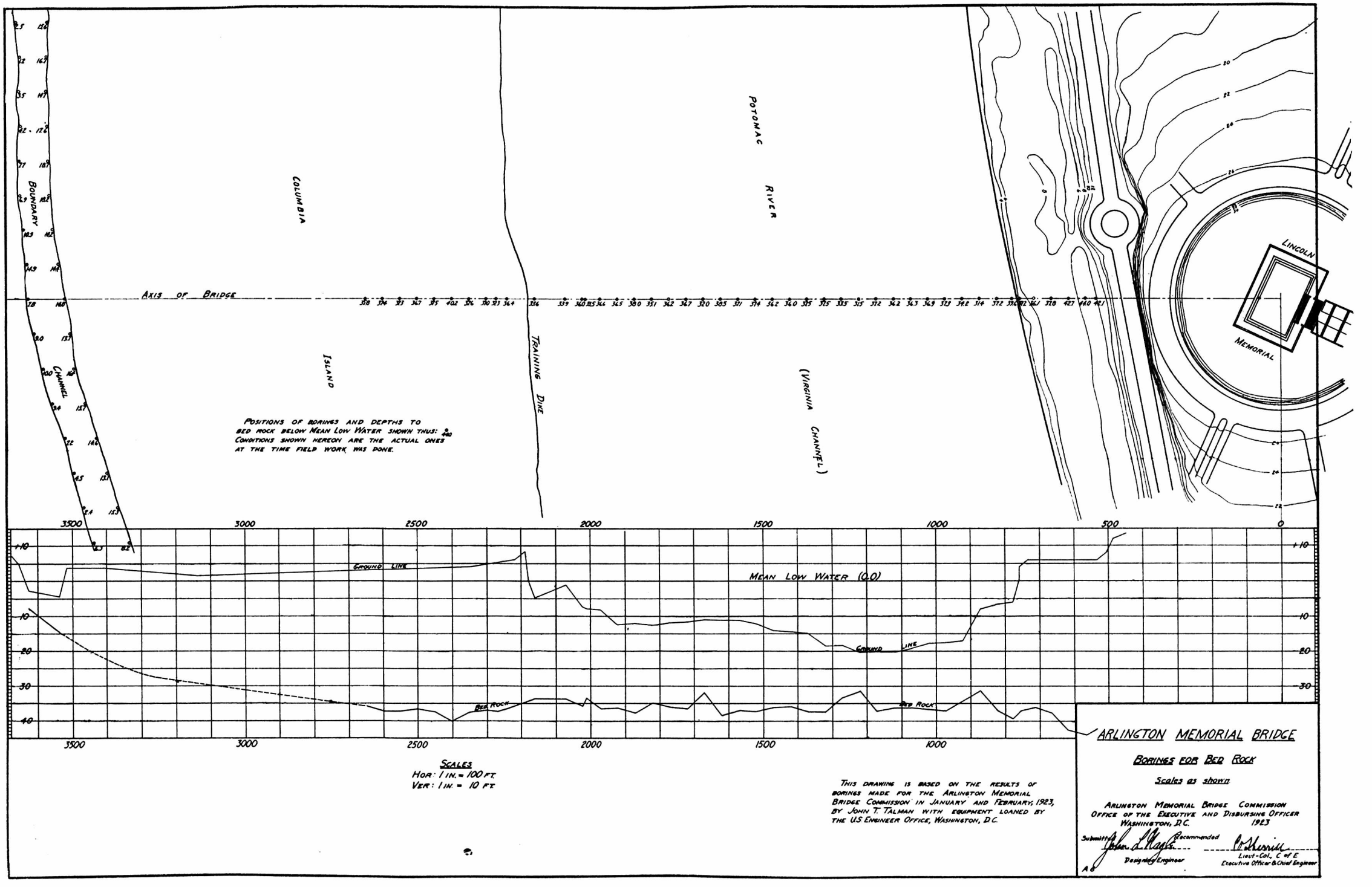
Scale; LIN. = 8 FT

ARLINGTON MEMORIAL BRIDGE COMMISSION
OFFICE OF THE EXECUTIVE AND DISBURSING OFFICER
WASHINGTON, D.C. 1923.

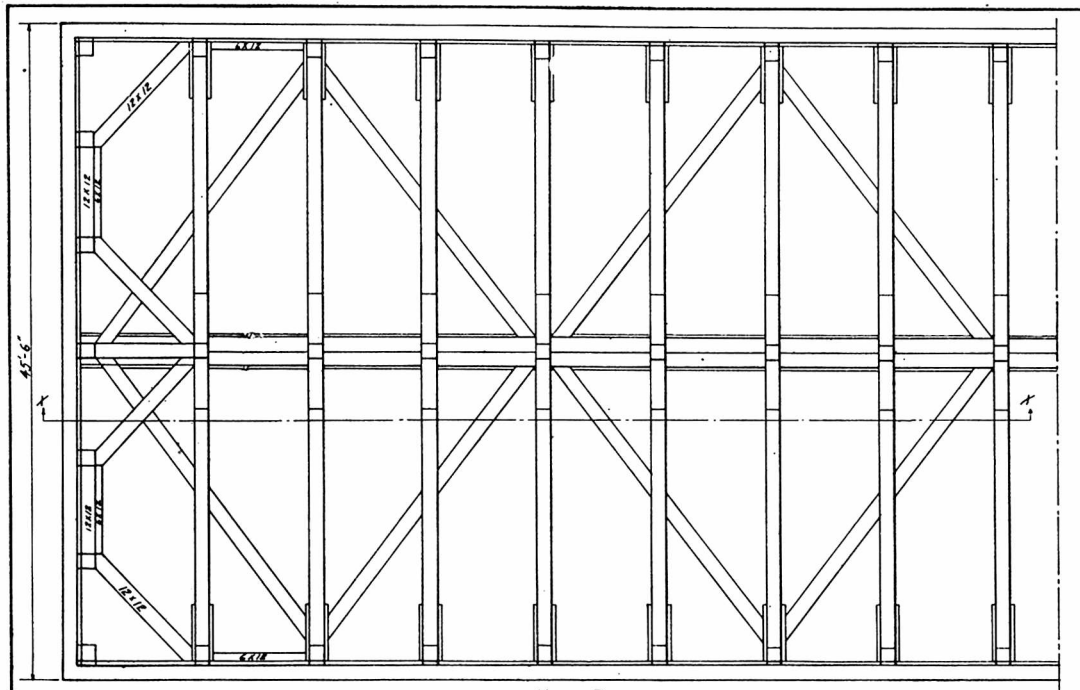
Submitted: John L. Slagle, Designing Engineer
Recommended: C. S. Sherrill, Lieut-Col, C of E., Executive Officer & Chief Engineer

A 4

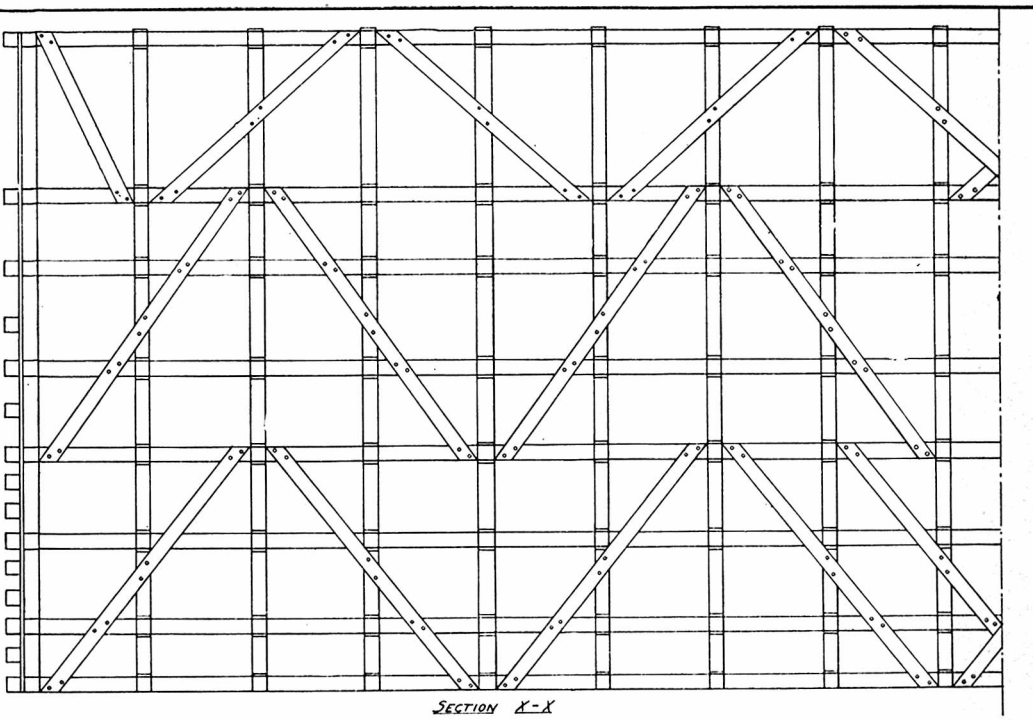
DETAIL OF ARCH RING



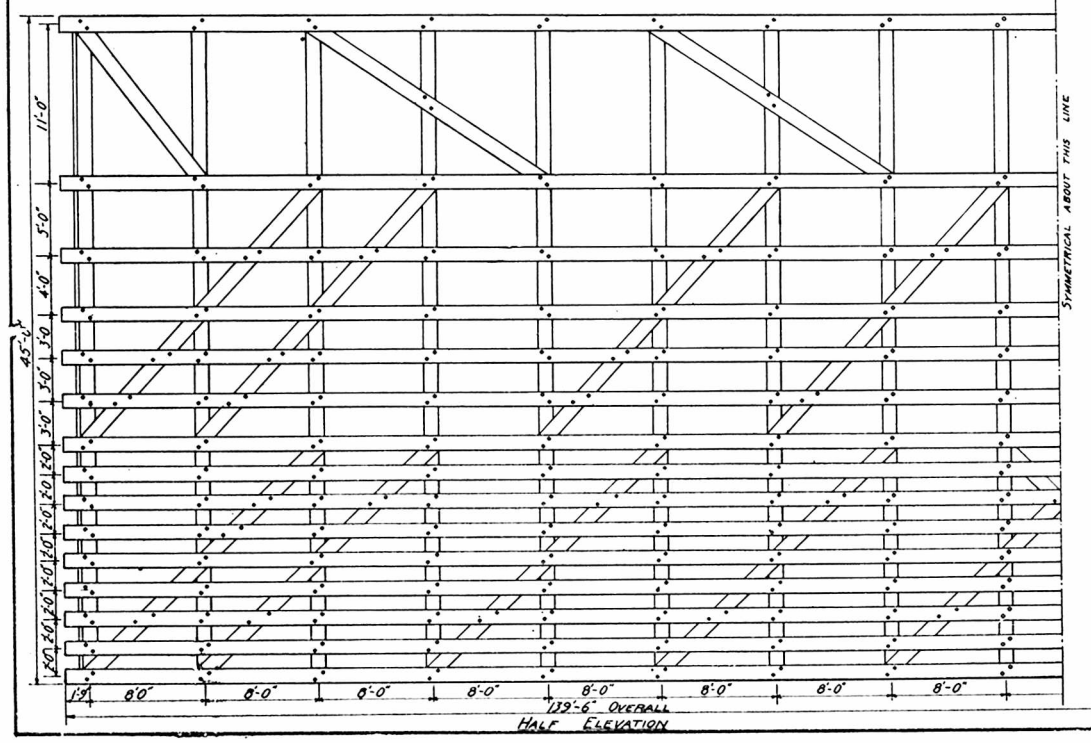
BORINGS FOR BED ROCK



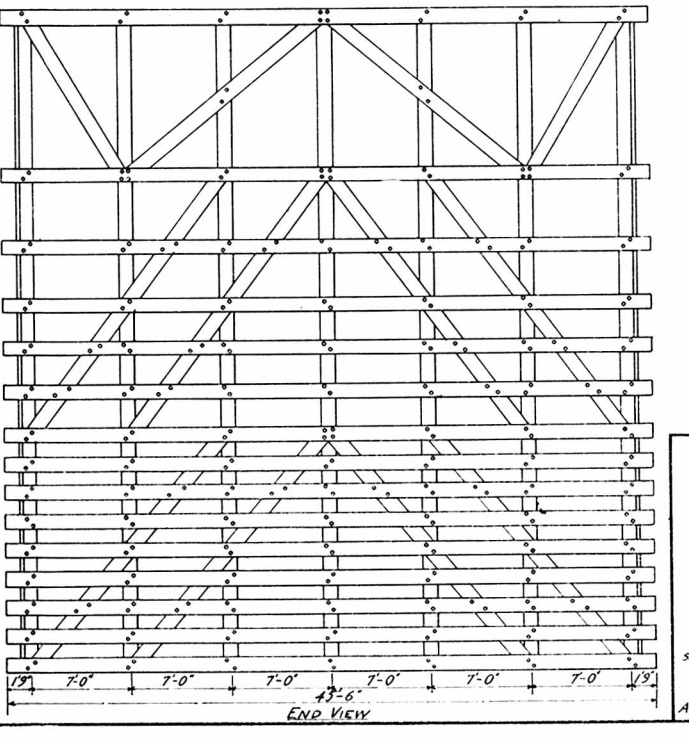
HALF PLAN



SECTION X-X



HALF ELEVATION



END VIEW

MAIN MEMBERS 12×12 PINE. BRACING MEMBERS 3×12 PINE EXCEPT WHERE OTHERWISE SHOWN.

COUNTERSINK ALL BOLT HEADS ON THE EXTERIOR FACES OF THE CRIB

WIDTH OF PIERS TO BE VARIED TO FIT THE DIFFERENT PIERS

CRIB TO BE BUILT UPON AND LAUNCHED FROM WAYS ON SHORE AND THEN TOWED TO POSITION AND SUNK

ARLINGTON MEMORIAL BRIDGE

TYPICAL COFFERDAM CRIB FOR INTERMEDIATE PIER

Scale: 1 IN = 4 FT

ARLINGTON MEMORIAL BRIDGE COMMISSION
OFFICE OF THE EXECUTIVE AND DISBURSING OFFICER
WASHINGTON, D.C. 1923.

Submitted — Designing Engineer

Recommended — Lieut-Col, C. of E., Executive Officer & Chief Engineer

A

TYPICAL COFFERDAM CRIB FOR INTERMEDIATE PIER