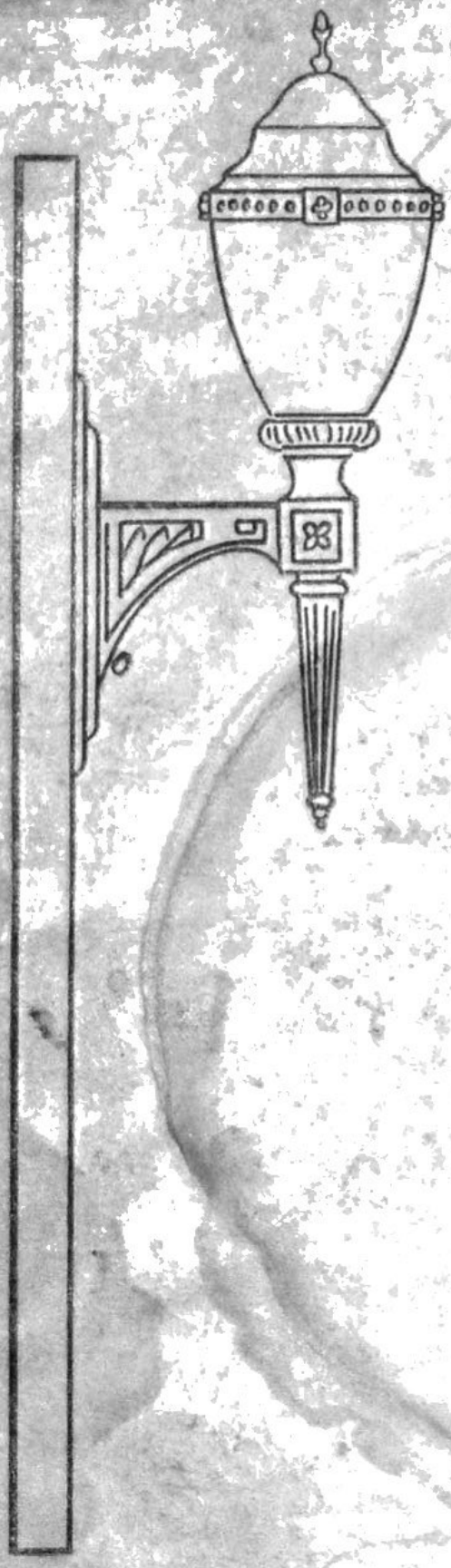
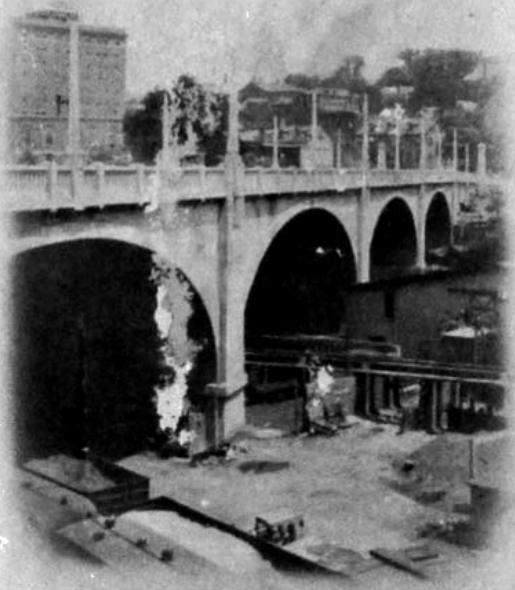


Hill-to-Hill Bridge

BETHLEHEM,
PENNSYLVANIA

HISTORICAL
AND
PICTORIAL



THE

Hill-to-Hill Bridge

BETHLEHEM, PENNSYLVANIA

ILLUSTRATED

INCLUDING HISTORICAL REVIEW
AND
ENGINEERING FEATURES

September, 1924

By R. R. KEIM

BIRD'S EYE VIEW OF THE ENTIRE HILL-TO-HILL BRIDGE, BETHLEHEM, PA. Photo by Conradi
Taken on July 27, 1924, from the roof of the Hotel Bethlehem. The Main Street Branch or Main Approach to the bridge, is located in the foreground.

Hill-to-Hill Bridge

FOREWORD

IT IS THE INTENTION of the writer to make a permanent, brief record for the Community of Bethlehem of the history and engineering features of the famous HILL–TO–HILL BRIDGE in the form of a Souvenir.

The project, now completed, and which has taken years to materialize into the beautiful concrete structure, is the greatest undertaking Bethlehem has ever accomplished.

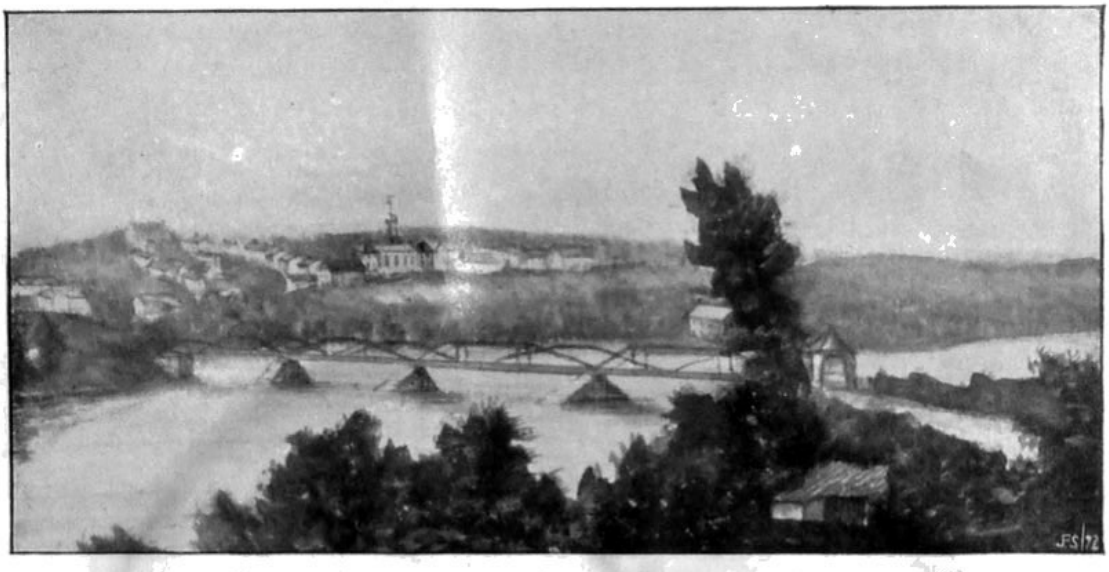
The Hill-to-Hill Bridge is well known in engineering circles throughout the United States. It is unique in that it has eight approaches, or entrances, and forms an overhead driveway, eliminating grade crossings over four railroads, namely, Philadelphia & Reading Railroad, Lehigh Valley Railroad, Central Railroad of New Jersey, and Lehigh and New England Railroad. It also spans the Lehigh River and the Lehigh Coal & Navigation Company's canal. Danger and delay will be obviated and easy communication may be enjoyed between the business centers of the City of Bethlehem and points east and west therefrom.

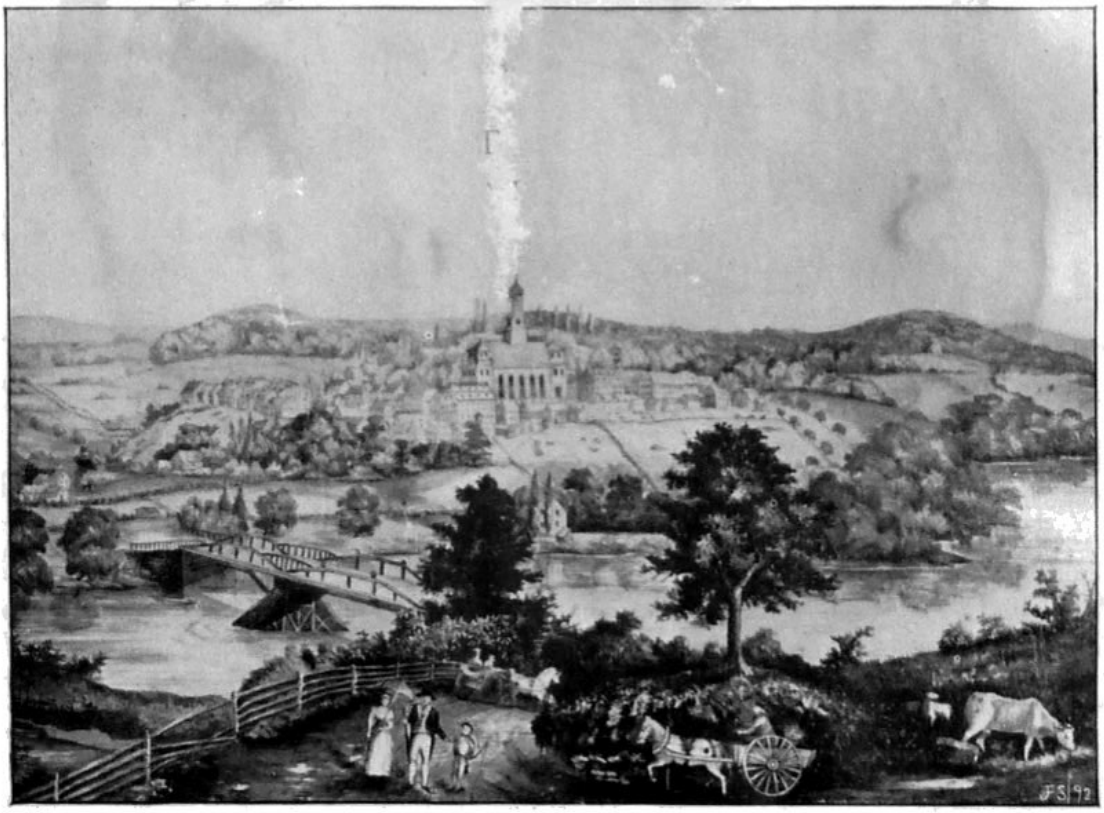
The writer acknowledges the aid given, in compiling this record, by A. H. Buck, Secretary of the Chamber of Commerce; The Bethlehem Times of November 16, 1921, for the historical data, and the very helpful aid given by A. N. Roberts in the criticism and additions to this historical record.

The writer is also greatly indebted to Rodgers & Hagerty, Inc., and to R. L. Beckel for information and criticism in the technical and engineering part of this record; to G. A. Conradi for the use of several of his photographs, and to the (Moravian) Congregation of United Brethren of the Borough of Bethlehem and its Vicinity for historical views of Bethlehem which appeared in "Levering's History of Bethlehem."

R. R. KEIM.

Bethlehem, Pa., 1924.





BETHLEHEM
1805
1810

Showing the first bridge across the Lehigh River.

THE FIRST BRIDGE built in Bethlehem dates back to 1792, when the Lehigh Bridge Company of Bethlehem was incorporated.

Towards the close of 1791, Warden Schropp and other men at Bethlehem, who were studying the external problems of the time, revived, with more vigor than before, the oft-mooted project of a bridge. The ferry across the Lehigh, used as the only means of crossing the stream up until this time, had become very inadequate and a better means of conveyance across the stream on a foundation more firm than the ferry was strongly agitated and very necessary.

The bridge then erected (in 1794) was an uncovered structure made of wood but built in the most substantial manner, resting on three stone piers, with a sidewalk, similar to the ones on the old covered bridge, familiar to many. The old rope ferry, the only way of crossing the river prior to 1792, was then abandoned. The site of this bridge was the same as the old covered bridge and as the river section of the Hill-to-Hill bridge.

A committee appointed January 2, 1792, to deliberate on the matter and report, declared, three days later, in favor of postponing it because of other proposed undertakings. The committee consisted of Bishop Ettwein, Paul Muenster, Francis Thomas, the carpenter; Frederick Beitel, the farmer and wagoner; Valentine Fuehrer, and Massa Warner, connected with the fortunes of the Crown Inn and the ferry. The last two opposed the building of a bridge at that time probably for their own interests, and Ettwein stoutly opposed it, for he favored first enlarging the hotel accommodations of the town, which seemed to him and some others to be the more pressing need.

How similar these conditions were to those that existed at the time when the Hill-to-Hill project was first proposed and agitated and the campaigning necessary to accomplish the successful completion of the same.

A secret meeting in the absence of Ettwein was called on January 23, 1792, and a unanimous vote was cast in favor of a bridge. All the voting men of the town were invited to this meeting. So the bridge was built, Ettwein still not being in favor of it but not actively opposing it.

The act of assembly authorizing it was passed April 3, 1792. Contracts for furnishing material and building the bridge were let in due time, and at last, fine hemlock timber, cut in the forests along the Panther Creek near Mauch Chunk, began to be floated down and drawn ashore near the ferry. In the spring of 1794, operations were properly started. On May 12 the wood-work was commenced, and on June 25 the first pier was completed. But between difficulties encountered because of inexperience in building a bridge across so wide a stream as the Lehigh, and a set-back through damage done by high water, the work was delayed, so that it was Saturday, September 27th, before the announcement could be made "the bridge is finished". The next day it was opened for free travel and on Monday the taking of toll commenced. The structure cost $7,800. The amount was distributed in shares of $100, all stock held by citizens of Bethlehem. This first bridge, like its

successor, built in 1816, and opened for travel October 19th, was an uncovered one. The old ferry was abandoned as soon as the bridge was finished.

The view from this old bridge is represented to have been impressively beautiful, but few buildings having been erected near the stream, so that nothing obstructed the vision of the beautiful Lehigh Valley scenery, then famous to travelers. The "Old Crown Inn" was situated on the South Side, at the present site of the Union Station.

Some idea as to the beautiful view, then to be had, can be obtained from the following record noted by Martin in his "Historical Sketch of Bethlehem," in 1872.

THE OLD COVERED BRIDGE

As it appeared from the south bank of the river.
Built in 1841 and partly rebuilt in 1862.

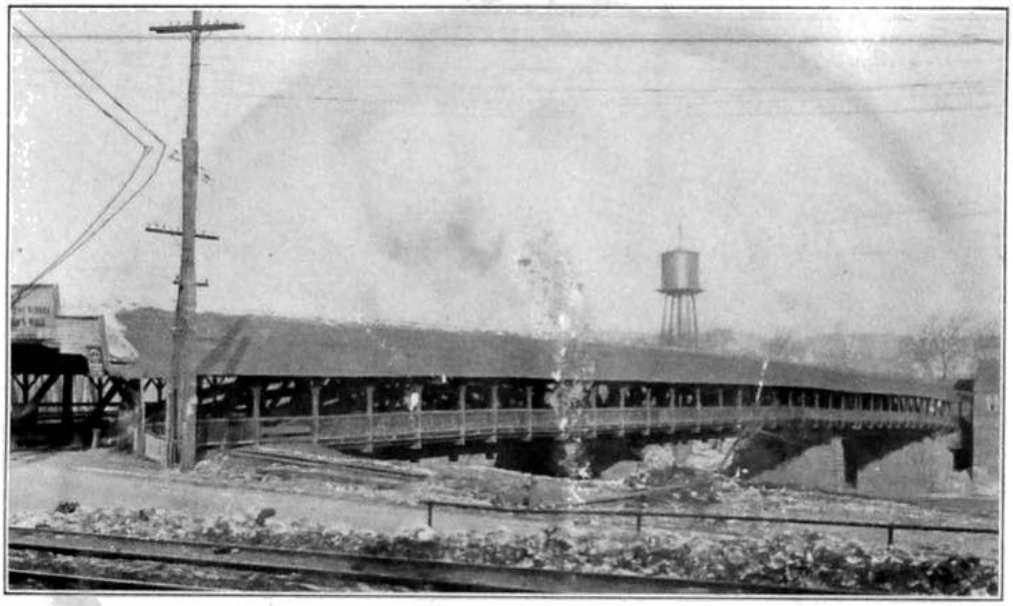
"The river, its banks covered with verdure; the surrounding hills and mountains covered with the forest trees; the islands so dear to every Bethlehemite, and Bartow's path winding along beside the rippling waters of the Lehigh, formed a picture of quiet repose and wild beauty, seldom if ever equaled."

Modern improvements have destroyed, but not entirely eradicated all traces of the former beauty of the scene.

The freshet of the 8th of January, 1841, washed away this old structure, the wood work of which had become gray with age and worn with travel.

The Bethlehem Bridge Company's bridge was built in 1841, at a cost of $7,258, to replace the old structure washed away, and was opened for travel on September 20th of that year. This bridge was twenty-three feet above low water mark and its floor was 400 feet long by actual measurement. It was the third bridge built within forty-seven years on the same site.

The above bridge, built in 1841, was the well-known covered bridge, the southern half of which was washed away by the freshet of June 5, 1862, caused by the breaking of the dams of the Lehigh Navigation Company above Mauch Chunk; heavy and continuous rains occurred on the 3rd of the month, in the mountains, and the splendid dams used to feed the Lehigh Canal gave way, one after another, before the great pressure of the water, the dam No. 4, at White Haven, being the first to break. The destruction of property was enormous and the loss of life very serious. The dams were never rebuilt. That portion of the bridge destroyed was soon rebuilt, and the new part roofed with slate.



OLD COVERED BRIDGE Photo by Conradi
An old landmark. Condemned for years.
As it appeared before tearing down to make way for the
Hill-to-Hill Bridge.

In 1887, a company was incorporated for the purpose of constructing a bridge across the canal and river east of Nisky Hill Cemetery. It was called "The Nisky Hill Bridge Company". Complications delayed this effort to secure a free bridge across the river. Some thought a more satisfactory solution of the problem of closer relations between the North and South Sides, of street car service and other "desiderata" lay in a new bridge to be constructed from a proposed extension of Main Street, Bethlehem, from its intersection with Church Street southward to the Monocacy, straight across the river. This large plan, starting with measures by the Bethlehem Town Council to open the street extension referred to, took precedence, for a season, of efforts to free one or the other existing bridges.

After its abandonment, these efforts resulted in the entire freeing of the old Main Street bridge (covered bridge) on which toll was still taken for vehicles. It was traveled free by teams, for the first time, on November 8, 1892.

The above account is interesting since it is the germ of the Hill-to-Hill Bridge idea in Bethlehem.

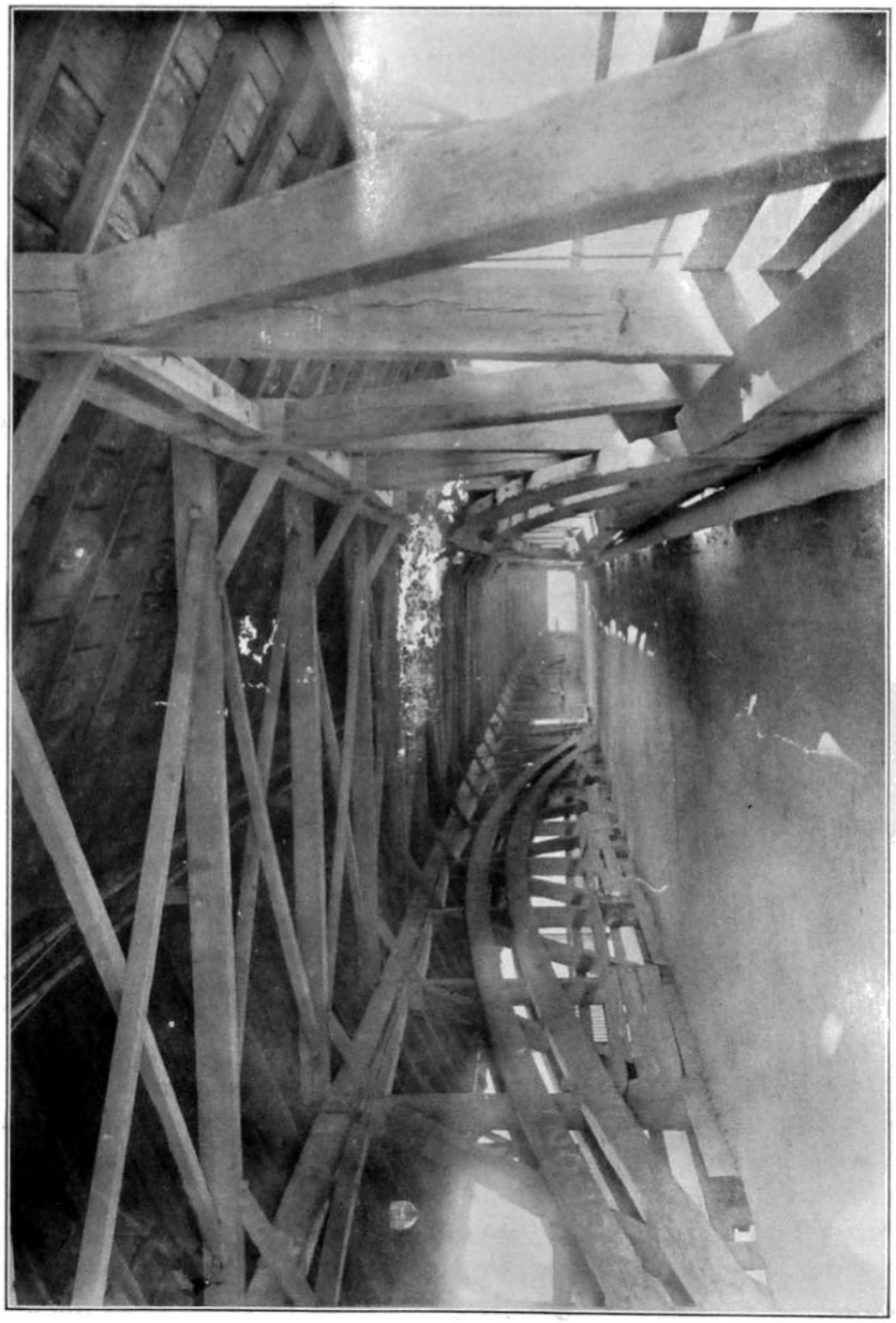


Photo by Conradi

A RELIC

Interior of the Old Covered Bridge.

Historical Sketch of Hill-to-Hill Bridge

THE STORY of Bethlehem's Hill-to-Hill Bridge is the story of the unwearying efforts of the eager, far-sighted citizens with a breadth of vision and an unselfish desire to promote the material progress of the City. Even though differences of opinion cropped out, the vital necessity of a free bridge across the Lehigh was always made the outstanding fact.

The Hill-to-Hill Bridge, now completed, will stand for years to come as a monument in the advancement of municipal progress, to those who have taken an active part in promoting the project but have since gone to their reward, and in honor of those who are still living.

For many years efforts were made to place a modern bridge across the Lehigh River and to eliminate the dangerous railroad crossings. One of the earliest free bridge movements was one of which Capt. Edwin Schortz was chairman; Archibald Johnston, Vice-Chairman; A. Gradwohl, Treasurer, and Edw. Welden, Secretary. Also, committees from the Bethlehem and South Bethlehem Councils in conjunction with the Boards of Trade, etc., were appointed and organized about 1890, or 1891, as a result of a citizens committee, as follows:

Bethlehem Council and Board of Trade
H. D. Yeager,
L. W. Snyder,
J. P. Wetherill.

South Bethlehem Council and Board of Trade
Paul Kempsmith,
James McMahon,
C. A. Worsley.

Law
Jas. H. Sheridan,
John H. Knisely,
Hartley C. Wolle.

Petitions
C. F. Brown,
E. H. Shipman,
J. W. Martenis,
Chas. Fenstermacher,
George Murray,
W. A. Wilbur.

Bethlehem Iron Co., and Lehigh Zinc & Iron Co.
Joseph Johnston,
George Jenkins,
Adam Brinker.

Many types of bridges and places for crossing between the two Boroughs were considered. A bridge was planned at what was known as Gas Alley, on the North Side, to Northampton Street, on the South Side, but this proved to be too close to the New Street Bridge, and it was claimed that three thousand feet or thereabouts must intervene between adjacent bridges.

The second meeting of the Committee was held December 9, 1892, and elected Archibald Johnston, Chairman; George Jenkins, and the Borough Engineer of South Bethlehem, Mr. Shipman, a committee of three to advance the bridge project generally. They consulted Prof. Merriman, of Lehigh University, Civil Engineer; the Moravian Congregation as to a northern approach through the Nisky Hill Cemetery, and with the Lehigh Zinc and Iron Company as to a southern approach on Augusta Street.

In April, 1893, petitions were prepared to be presented to the Board of Commissioners of Northampton County, setting forth the necessity for the construction of a free highway bridge, connecting the Bethlehems. The conclusions of this committee were that a bridge connecting Center Street with Augusta Street could be constructed with about a 4.3% grade. The project was temporarily dropped, however, due to opposition and lack of interest.

Later, Commissions were organized on both the North and South Sides of Bethlehem, and these were subsequently merged into one.

The North Side Commission was Composed of:
A. Johnston, President,
J. S. Krause, Vice-President,
Geo. W. Grube,
J. S. Moyer,
W. B. Myers,
H. A. Foering,
M. C. Fetter,
W. E. Martin,
I. H. Shimer.

The South Side Commission was Composed of:
J. M. Degnan, President,
James Rawle, Vice-President,
Jos. W. Adams,
A. C. Graham,
R. K. Berkemeyer,
L. D. Ritter,
Jos. T. Bird,
John Degnan,
C. C. Aldinger,
J. T. Hart,
Geo. D. Dobbins.

The Joint Bridge Commission organization consisted of Archibald Johnston, President; J. M. Degnan, Vice-President; Thos. Ganey, Secretary; R. E. Neumeyer, Consulting Engineer.

The same general procedure was followed as was pursued by the previous commissions. The railroads and all interested parties were requested to cooperate in the erection of a free bridge, and Engineers Mansfield Merriman and Clarence W. Hudson were retained in consultation. A bid was received from McClintic-Marshall Company, of Pittsburgh, dated January 31, 1907. The structure under consideration was a steel bridge and was estimated to cost slightly under five hundred thousand dollars. The result of the deliberations of this commission was similar to that of former committees. No plan could be devised which would meet the approval of all interested parties.

On March 26, 1911, a newly appointed committee, on a New Free Bridge between the Bethlehems, met for organization. This committee had been appointed by the Commercial League of the South Side (now the South Side Business Men's Association). Mr. H. A. R. Dietrich was elected Chairman; Mr. F. P. Martenis, Secretary, and Mr. H. M. Ueberroth, Treasurer. Others on this committee were Michael O'Reilly, Adam Brinker and Emil Droll. Upon request by the Secretary of the above Committee, the Industrial Commission (North Side) appointed a committee consisting of H. A. Foering, C. H. Riegel, Malcolm Metzger, R. S. Siegel and W. F. Schneller.

The two committees met on June 8, 1911, and a permanent organization was effected under the name of the Bethlehems' Joint Bridge Commission, electing H. A. R. Dietrich as permanent Chairman; R. S. Siegel, permanent Vice-Chairman; F. P. Martenis, permanent Secretary, and Malcolm Metzger, permanent Treasurer.

At this meeting C. M. Schwab was elected an honorary member of the Commission.

The Secretary was ordered to notify the Northampton County Commissioners of the organization of the Bethlehems' Joint Bridge Commission and to request them to fix a date when a joint meeting of County Commissioners and Joint Bridge Commission might be held relative to the erection of a Free New Bridge between the Bethlehems.

The Joint Bridge Commission met frequently and at the meeting held on June 29, 1911, more members were added, as follows: W. A. Wilbur, Archibald Johnston, O. L. Peysert, W. E. Martin, J. M. Degnan, W. B. Schaeffer and Paul Kempsmith.

The idea of a Hill-to-Hill Bridge must have been born at this time, for the records of the meeting show that the County Commissioners of Lehigh and Northampton Counties were invited to be the guests of the Bethlehems' Joint Bridge Commission at the Bethlehem Club, on July 5, 1911.

Bridge matters began to look very bright, for at this meeting of County Commissioners and Joint Bridge Commission resolutions passed both Boards of County Commissioners unanimously, the resolutions declaring in substance that the old covered bridge was not sufficient to accommodate public travel,

being too narrow, and in addition, "it was worn out." The resolutions further declared for a new structure which would eliminate the grade crossings on both sides of the approaches to the new bridge and recommended the submission of a petition for the favorable action of the respective Grand Juries of the two counties.

Several new members were present at the meeting held on July 26, 1911, namely, C. M. Schwab, W. A. Wilbur, E. G. Grace, and R. E. Neumeyer (Consulting Engineer). A committee consisting of Messrs. Martin, Schaeffer, Ueberroth, and W. A. Wilbur was appointed to study the plans (which had been submitted by R. E. Neumeyer) for a new bridge. At a meeting held on August 4, 1911, Mr. Wilbur reported for the Committee on Plans and Location, that in their judgment the original plan would damage and harm property owners and would result in engendering so much opposition from Lehigh County that no financial assistance could be expected from it. They submitted the following estimates for a concrete structure (estimated by F. P. McKibben), excepting that portion of the bridge over railroad tracks and canal, which was to be steel:

Ramp, Second Street, South Side	$ 28,000.00
Bridge over P. & R. and L. V. R. R. Tracks	65,500.00
Grading, South Side Approach	15,000.00
Bridge from L. V. R. R. to Canal	122,000.00
Bridge over Central R. R. of N. J. and Canal	41,000.00
Ramp to Main Street	57,000.00
Ramp to Sand Island	19,500.00
Rights of Way and Damages	50,000.00
Concrete Construction	84,000.00
Total Estimate	$482,000.00

The above report of the Committee on Plans and Location was approved and adopted. This plan was known as Neumeyer Plan No. 1. Committees were appointed to interview the railroad and canal companies and also one on legal requirements, as follows:

Railroad Committee	Law Committee
C. M. Schwab,	R. S. Siegel,
W. A. Wilbur,	C. H. Riegel,
E. G. Grace.	H. J. Hartzog.

Chairman Siegel of the Law Committee reported at the September meeting that the Grand Juries of Northampton and Lehigh Counties and Judges Scott and Stewart had approved the petitions which had been presented to the courts.

At a meeting on July 2, 1912, J. W. Adams, A. P. Miller and L. W. Strock were added to the Joint Commission.

One of the greatest difficulties met with and which threatened to bring matters to a halt, was the attitude of the Lehigh County Court, which, unlike the Northampton County Court, had refused to approve or confirm the find-

ings of its Grand Jury, said Grand Jury having been strongly in favor of the Hill-to-Hill Bridge.

Northampton County had agreed to give $100,000; Lehigh County, $95,000; Lehigh Coal and Navigation Company and the Railroads together, $275,000, and $50,000 had been guaranteed by Messrs. Schwab and Wilbur.

From December 9, 1912, and until November, 1914, no meetings of the Joint Bridge Commission were held, the bridge project being held up by legal entanglements and railroad difficulties. At a meeting held in November, 1914, the Railroad Committee, consisting of Messrs. C. M. Schwab, W. A. Wilbur and E. G. Grace, made a complete report, together with copies of correspondence with the railroads interested.

On June 18, 1915, the Industrial Commission decided to oppose the building of a bridge from shore to shore and appointed a committee to oppose approval of such a bridge by the Grand Juries of Northampton and Lehigh Counties. They also requested the Chamber of Commerce of South Bethlehem to cooperate with them in their attitude on the bridge matter. The above denoted lack of unanimity on the part of the public service organizations of the Bethlehems.

The demand of the Philadelphia and Reading Railroad for the closing of the Third Street crossing proved an obstacle at this time, since the Joint Bridge Commission opposed it. At a meeting held in July, 1915, a committee was appointed to confer with the South Bethlehem Council relative to the matter.

As far as the railroads were concerned, the bridge question was in statu quo. Besides, opposition was registered by every interest which thought it might suffer financially by the location of a new bridge.

Resolutions were adopted at a meeting in August, 1915, by the Commissioners of Northampton and Lehigh Counties relative to the erection of a new bridge over the Lehigh River, and extending an invitation to a joint meeting.

The Philadelphia and Reading Railroad Company now desired the closing of both the Third Street and Brodhead Avenue crossings, and the Lehigh Valley Railroad Company also desired to close the Front Street crossing. Council agreed that the Brodhead Avenue crossing might be closed, but deemed it unwise to close the Third Street crossing and the Front Street crossing.

About this time (July, 1915) a petition for a Hill-to-Hill Bridge to the Public Service Commission (a new organization instituted by the State) was circulated, with the idea of bringing the matter to a head and to endeavor to make the Hill-to-Hill Bridge a reality, and was signed by hundreds of the citizens, each signor pledging $5.00 to cover expenses of data, etc., connected therewith, the first organization to sign the petition being the Woman's Club of Bethlehem. It was Dallett H. Wilson who had taken hold of the situation at this point and who advised and circulated the above petition to the Public Service Commission, for the abolition of certain dangerous grade crossings as provided by Pennsylvania Statute.

This petition, signed by many citizens, was filed on August 3, 1915, before the Public Service Commission, after having received no satisfaction from the railroads in conjunction with the local Joint Bridge Commission. R. E. Neumeyer, Consulting Engineer, was selected to draw plans for the approval of the Public Service Commission.

In response to this petition, Chairman William D. B. Ainey, Secretary A. B. Millar, and Dr. Herbert F. Snow, Chief of the Bureau of Engineering of the Public Service Commission, came to Bethlehem on August 5, 1915, and conferred with representatives of the citizens committee and the counsel and engineers of the various interested railroads and the Lehigh Coal and Navigation Company. At that time, they examined what was known as Neumeyer Plan No. 1, which had received the approval, as stated before, of the Bethlehems' Joint Bridge Commission, which had been before the interested parties up to that time, and which put one of the termini of the bridge in the hollow on South Main Street. They also examined a revised plan (Neumeyer Plan No. 2) presented by Mr. Wilson, providing for a bridge from hill-to-hill and eliminating certain of the grade crossings which had been the unanimous feeling among all parties.

Considerable discussion took place the following months between the various interested parties and the public, as to the feasibility of repairing the Old Covered Bridge at a cost of $40,000; as to which grade crossings should be eliminated; as to the construction of a temporary bridge; all of which caused a great deal of friction and delay.

During August, more trouble and delay was experienced, due to protests on the part of the railroads asking for the dismissal of the petition of the citizens of the Bethlehems.

A hardship was being wrought on the community because, since June 15, 1915, the old bridge was closed to heavy trucks and teams. In the meantime plans were being prepared in conformity with the wisest and best means of eliminating the grade crossings and costs were being estimated.

On October 21, 1915, Attorney D. H. Wilson took the plans for a Hill-to-Hill Bridge to the Public Service Commission at Harrisburg.

A public hearing on the whole matter was announced by the Public Service Commission to be held in the Court House in Allentown, December 16, 17 and 18, 1915. During the course of this hearing a great triumph was scored which was made evident by a manifest change of attitude toward a Hill-to-Hill Bridge on the part of the railroad companies. A bridge eliminating grade crossings was now in sight. The hearing was very satisfactory to the petitioners.

The question had now resolved itself into the kind of a bridge to be built. Certain interests were in favor of the Neumeyer (1912) Plan No. 1, which dropped a terminus of the bridge just across the tracks of the Central Railroad of New Jersey in the hollow opposite the Brown-Borhek Company offices and left Seminary Hill, a nine and one-half per cent grade, still intact. It might be interesting to note that the River Street Ramp of the present Hill-

to-Hill Bridge, between the river and canal, as constructed, has a grade of 8.9%, which is the steepest grade in the entire bridge.

In the meantime the old covered bridge was repaired by the counties at a cost of $8,000. Traffic was allowed to cross at its own risk.

On January 31, 1916, the Bethlehem Town Council took action favoring a Hill-to-Hill Bridge reaching Main and Church Streets west of the Seminary. At a meeting held on April 6, 1916, Mr. W. A. Wilbur, Chairman of the Railroad Committee, reported that at a joint meeting of the various Railroad Committees, the railroads had agreed to contribute not more than $300,000 for a free bridge, provided that Bethlehem and South Bethlehem each contribute $25,000 in addition, and the plan to be the Neumeyer Plan No. 1. Also on the condition of closing the Brodhead Avenue crossing and the South Main Street crossing. The above was on the assumption that the bridge would cost $525,000, the railroads contributing $275,000, provided that in case the bridge should cost more than the above amount, the excess over that amount to be pro rated among the parties contributing, but in no case would the railroads contribute more than $300,000.

The joint Railroad and Legal Committee had successfully consummated on August 8, 1916, all the details as to the necessary understandings, and the legislation necessary to abandon certain grade crossings. This committee also informed the Public Service Commission that the two Boroughs had each pledged $25,000; the Railroad Companies had guaranteed $275,000, which might be increased to $300,000; the County of Lehigh would contribute $95,000 and the County of Northampton $100,000; the value of trolley franchises was not less than $50,000. The Neumeyer Plan No. 1, was submitted as the plan that had been agreed upon by the interested parties.

Both the Bethlehem and South Bethlehem Councils in June, 1916, pledged the amounts to be contributed. Burgess J. M. Yeakle decided to call a mass meeting of Bethlehem citizens to ascertain the public sentiment. This meeting was held on September 8, 1916. The sentiment was overwhelmingly in favor of a Hill-to-Hill Bridge, involving Neumeyer-McKibben Plan No. 3, which placed the Bethlehem terminus at Main and Church Streets, the main bridge way having a width of 60 feet, with a ramp to the West Side, the bridge southward from the north side of the Lehigh River remaining practically as shown in Neumeyer Plan No. 1, which already had the approval of the Public Service Commission's engineer and the engineers of the railroad companies and the two counties.

On September 12, 1916, the Public Service Commission again held a meeting, at which Attorney Wilson stated that Bethlehem would assume the difference in cost between Neumeyer Plans No. 1 and No. 3. The Public Service Commission visited the Bethlehems on September 15, 1916, for the purpose of making a survey of the grade crossings and the contemplated termini of the new bridge. During this visit, Chairman W. D. B. Ainey stated, on behalf of the Public Service Commission, that while he knew the Public Service Commission had the power to abolish dangerous grade crossings, it

did not have the power to authorize the Hill-to-Hill Bridge with the terminus on the North Side reaching the intersection of Main and Church Streets and stated that if the public could raise, as was suggested, a substantial sum, sufficient to defray a large part of the cost of this extension, the Commission would be inclined to favor it. It was stated that the amount ($200,000) then thought sufficient to cover the difference in cost between the Neumeyer Plan No. 1 and the Neumeyer-McKibben Plan No. 3, could be raised within thirty days. During this conversation a messenger appeared with a written message from Mr. J. E. Mathews, agreeing, on behalf of himself and associates, to contribute $25,000. This incident proved to be the turning point of the crisis of Bethlehem's Hill-to-Hill Bridge project, as Chairman Ainey was convinced of the possibility of raising the necessary $200,000 and allowed the thirty days extension of time.

On September 27, 1916, the Joint Bridge Commission met in the South Bethlehem Chamber of Commerce rooms, approved the Neumeyer-McKibben Plan No. 3, and effected an organization for the Hill-to-Hill Bridge Campaign to solicit subscriptions in an amount necessary to assure the Public Service Commission of this community's financial ability to complete a Hill-to-Hill Bridge, according to Neumeyer-McKibben Plan No. 3.

This newly appointed organization or committee consisted of the following:

Archibald Johnston, Chairman,
R. E. Wilbur, Vice-Chairman,
Paul DeSchweinitz, Vice-Chairman,
A. N. Roberts, Secretary,

Frank C. Stout,
W. B. Myers,
A. C. Dodson,
Adam Brinker,
Elmer F. Eberts,
A. P. Miller,
J. H. Sheridan,
H. S. Snyder,
H. J. Meyers,
J. S. Krause,
J. E. Mathews
A. C. Huff,
J. M. Yeakle,
H. A. Foering,
H. A. R. Dietrich.

Prior to the formation of this Campaign Committee, one of the leading advocates and supporters of the campaign method of raising the necessary amount for the Hill-to-Hill project, as suggested by the Public Service Commission, was the then Burgess, now Mayor, of Bethlehem, J. M. Yeakle.

With this meeting (September 27, 1916) closed the long period of splendid service of the Bethlehems' Joint Bridge Commission as a Commission. The results of their work, stretching over a period of years in the face of many discouragements, and often meeting seemingly unsurmountable opposition, can now be visualized in the completed beautiful concrete structure "from hill-to-hill".

The campaign was launched at a banquet held in the old Eagle Hotel on Monday evening, October 2, 1916, for $200,000, of which over $40,000 had been subscribed previous to this date. The campaign was to continue for one week, closing October 10, 1916. Archibald Johnston was Chairman and H.

F. Schmidt, of Harrisburg, acted as the director. Large clocks were placed on the Bethlehem Trust Company and the E. P. Wilbur Trust Company buildings, on which were recorded the amounts raised daily. When the amounts were reported daily at a noon-day luncheon, there were scenes of unusual enthusiasm and good natured rivalry, songs were sung, speeches were made and parades organized to turn the hands of the clocks to the new mark, led by the Bethlehem Steel Company Band. The campaign closed with a banquet, successfully, on Saturday, October 8, 1916, having gone "over the top", the total amount being $456,849.66, contributed by citizens, merchants and corporations. Many notables were present, including C. M. Schwab, E. G. Grace, W. D. Ainey and Judges of Court and Commissioners of Lehigh and Northampton Counties.

The campaign plan was divided into three divisions, with the following chairmen or majors and captains of teams:

DIVISION "A"

A. Newton Roberts, Major

Captains of Teams

W. R. Coyle,
G. Wm. Riegel,
R. S. Taylor,
Wm. J. Heller.

DIVISION "B"

Dallett H. Wilson, Major

Captains of Teams

Charles Kurtz,
Edward L. Myers,
Milton Lawfer,
D. W. Armistead.

DIVISION "C"

H. A. Foering, Major

Captains of Teams

George H. Grim,
R. B. Weand,
O. H. Best,
F. F. Speck.

These captains selected the personnel of their own teams.

At the close of the campaign, the following amounts were available for the building of the bridge:

Individual Contributions	$ 206,849.66
Personal contribution of Mr. C. M. Schwab	50,000.00
Bethlehem Steel Company	200,000.00
Northampton County	150,000.00
Lehigh County	125,000.00
Lehigh Valley Transit Co. (for franchise)	100,000.00
South Bethlehem Borough	25,000.00
Bethlehem Borough	25,000.00
Lehigh & New England R. R. Co. and allied interests	15,000.00
Phila. & Reading, Lehigh Valley, and Central Railroad Companies	300,000.00
Total	$ 1,196,849.66

Thus, a campaign which had been undertaken with some hesitancy, was brought to a successful conclusion and evidenced what can be accomplished by co-operation.

The success of the Hill-to-Hill Bridge Campaign in bringing the Bethlehems together resulted in a further effort to bring them closer together in a movement for a "GREATER BETHLEHEM" which ultimately united them as one city.

The Public Service Commission forwarded to Mr. Wilson on October 14, 1916, their decision that the grade crossings would be abolished, and that a public hearing would be held of that body on November 2, 1916, at Lehigh University to determine the costs of damages and apportionment of the expenses of the new bridge.

The question of handling the affairs connected with the construction of the bridge was the next issue to be settled. The Public Service Commission of the State, considering the great local interest shown in the project, finally decided to appoint a local committee to act as its agents. This was done in January, 1917, Mr. Archibald Johnston being appointed Chairman, and Mr. A. Geo. Shoffner, Secretary thereof, and the committee being designated as the Bethlehem's Bridge Commission. Other members of this committee were: A. C. Graham, Vice-Chairman; J. S. Krause, O. L. Henninger, representing Lehigh County, and Elmer P. Peifer, representing Northampton County. This latter commission secured the services of Mr. Clarence W. Hudson to design and supervise the construction of the bridge.

A complete design of the structure was prepared in 1917-1918, but the World War prevented its execution as the government ordered a halt on all work which was not of direct service to the government in prosecuting the war.

However, the cost of labor and of material had advanced so much that many of our citizens concluded that the bridge would not be built in their day. This belief was strengthened by the statement of Dallett H. Wilson to the Public Service Commission on January 16, 1919, that according to the estimates of the engineer the bridge at that date would cost $2,250,000 instead of $1,198,000 as was estimated in 1916. Engineer C. W. Hudson presented plans with a few changes suggested. Dallett H. Wilson stated that the property values involved amounted to $152,836 and that he had bought seventeen properties for $85,506 for the Bridge Commission. Engineer Hudson stated that it would take from two hundred to two hundred fifty men from one and one-half to one and three quarter years to build the bridge.

At a meeting held on April 30, 1919, Engineer Hudson said that forty-seven plans had been reviewed. The Lehigh Valley Railroad requested further changes in the plans at their expense—the change being the length of the steel span over their tracks. It was decided at a meeting on June 15, 1919, that the bridge would cost $2,125,000. The Lehigh Valley Transit Company declared at a meeting on July 2, 1919, that it did not want the privilege of using the bridge. Engineer Hudson estimated the total cost of the bridge, including land damages, at $2,278,412. Later the railroads agreed to pay $500,000 under the new conditions of higher values, etc.

On October 21, 1919, the Public Service Commission had taken definite action to build the bridge.

The rejoicing engendered by the announcement that the bridge would surely be built, and that operations would be begun in the Spring of 1920, was considerably checked, when, in response to the advertisement for bids by the Public Service Commission on December 29, 1919, terminating on February 25, 1920, only one bid was submitted, and that by T. L. Eyre, West Chester, at $4,871,437. This amount was staggering, and the railroads became lukewarm about building the bridge.

Action was taken by the Commission and Engineer Hudson to cut off $1,700,000 from the cost, according to revised plan prepared by the Engineer in 1920-21. It was evident that Chairman Ainey and the Public Service Commission were determined not to be baffled in granting this needed improvement to our community.

New bids were asked for upon the revised plans, and five were submitted. They were opened at Harrisburg by the Public Service Commission on June 30, 1921, and the contract was awarded on July 11, 1921, to Rodgers and Hagerty, Inc., of New York City, the lowest bidder at $2,568,000, which was $253,000 higher than the last allocation of the Public Service Commission on November 11, 1919. On July 25, 1921, the contract for building the Hill-to-Hill Bridge was signed at Harrisburg by the Public Service Commission and John J. Hagerty, President of his company.

Work was actually begun on Monday, August 1, 1921.

Thus ends an important chapter in this great enterprise, which now provides a great highway for our commerce and communication between the North and South sides, and is one of the greatest factors for unifying us as a city.

The story of the bridge has been a long one, but it is the story of magnificent achievement, to the glory of fraternal co-operation.

PUBLIC SERVICE COMMISSION OF THE COMMONWEALTH OF PENNSYLVANIA—1921

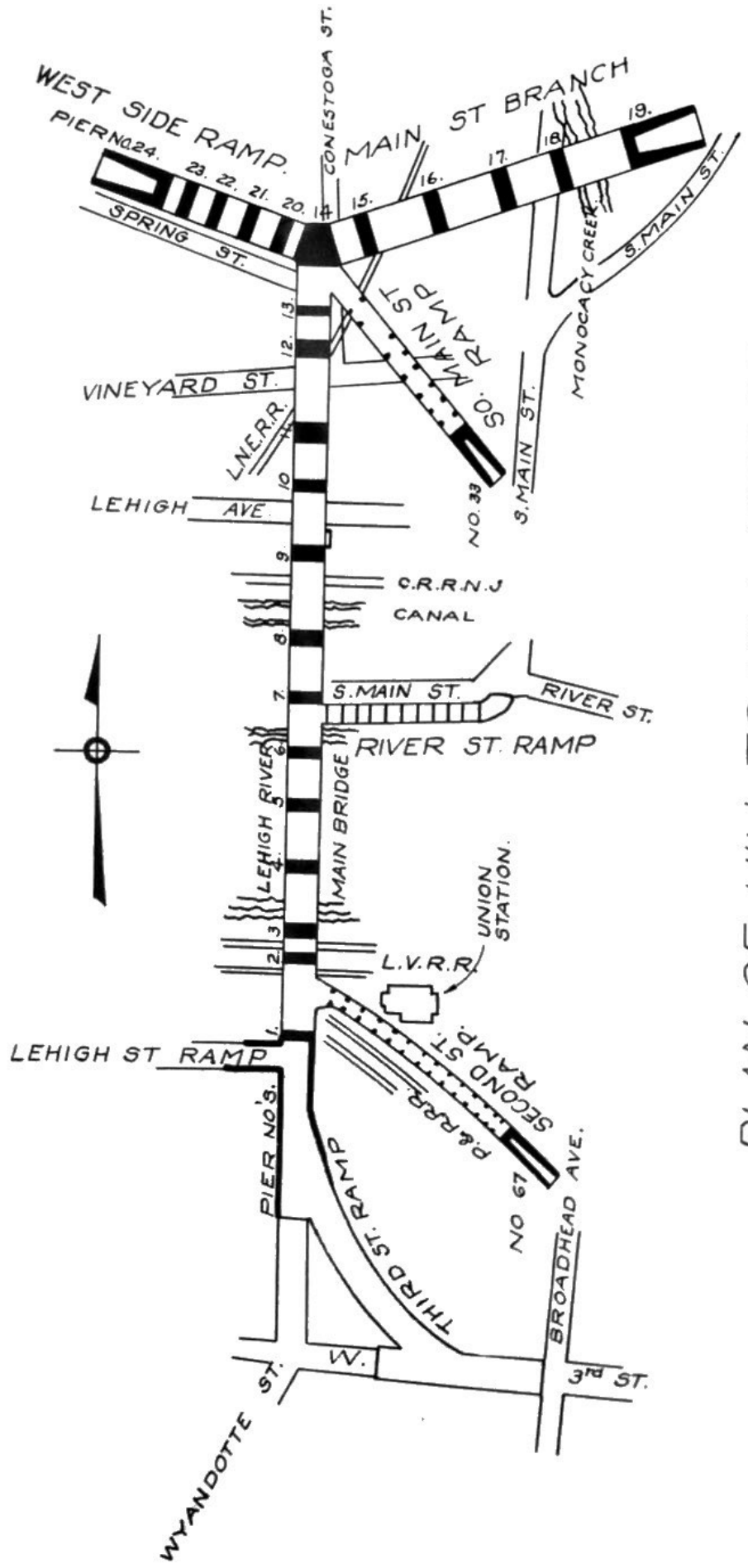
Wm. D. B. Ainey, Chairman,

James S. Benn, Samuel M. Clement, Jr.,
S. Ray Shelby, John W. Reed,
John S. Rilling, Milton J. Brecht,

John G. Hopwood, Secretary,
Dr. F. Herbert Snow, Chief, Bureau of Engineering.

BETHLEHEM'S BRIDGE COMMISSION—1921

Archibald Johnston, Chairman,
J. S. Krause, Vice-Chairman, G. H. Blakeley,
O. L. Henninger, representing Lehigh County,
A. A. Woodring, representing Northampton County,
A. Geo. Shoffner, Secretary,
Dallett H. Wilson, Counsel,
C. W. Hudson, Engineer.



PLAN OF HILL-TO-HILL BRIDGE

Brief Resumé of Work on Hill-to-Hill Bridge During Construction

1921-1924

Actual work was started by Rodgers and Hagerty, Inc., on Monday, August 1, 1921, when an office was opened.

The initial shipment of contractor's equipment was started on August 15, 1921. The high steel towers for pouring concrete were then erected. All distributing apparatus was made by the Insley Mfg. Co., of Indianapolis. The two central concreting plants were also constructed. The one was located near pier 7 between the river and the canal, and the other at Spring Street, West Side. The concreting work was divided about equally between them. Excavation was started September 27, 1921, piers 9 and 11 being the first to be excavated. Concreting operations were started on December 14, 1921, at pier 14.

Due to a stipulation in a two-year agreement with the Bethlehem Bridge Commission that concrete could not be poured below a temperature of freezing (32° F.), work was shut down on January 11, 1922.

The actual work accomplished to the above date of shutdown can be summed up as follows:

Excavation	22,000 Cu. Yds.
Concrete	2,696 Cu. Yds.
Reinforcing Steel delivered	1,000,000 lbs.

Work was again resumed with the advance of favorable spring weather on March 15, 1922. Excavation and concreting operations were pushed on a large scale, the contractors employing about 350 men during the height of operations. The bridge construction made headway in all its seven ramps, working on a gigantic scale. During the Summer, as high as 1000 cubic yards of concrete were poured in a 24-hour day, on the entire job. This necessitated a continual inflow of stone, sand and cement. The average cement hauled from the mills at Bath (Pennsylvania Cement Company) was about 2000 bags per day, to the contractor's mixing plants and storehouse. The stone and sand were similarly hauled continuously, the stone being hauled from Groman's Quarry, north of the city, along the Monocacy Creek and the sand being hauled from the Central Railroad siding at the Bethlehem Junction to the two mixing plants. The sand was shipped from Kenvil, New Jersey, near Lake Hopatcong.

The construction of the bridge made great headway until operations were again shut down due to cold weather, about January 1, 1923.

The status of the work accomplished to the above date of shut-down can be summed up as follows:

Excavation, all classes.....56,000 Cu. Yds.
Concrete, all classes.....67,000 Cu. Yds.

At this time the bridge was about 57% completed, this percentage based on the ratio of work paid for to total contract sum.

Up to December, 1922, about 2,000,000 feet of lumber, mostly from Texas, had been used in the form work. About 900 tons of reinforcing rods from five-eighths to one and three-eighths inches in diameter, manufactured by the Bethlehem Steel Company, had been used. 8,200 square feet of water proofing had been placed and 8000 cubic yards of back-fill at various points along the bridge.

Operations were again resumed about March 15, 1923; concreting being resumed on March 23, at the South Main Street Ramp. During April and May, wooden piles were driven in the Lehigh River bed between piers 4, 5, 6 and 7, on which to rest the forms for the spans. The excavation of the River Street Ramp, the last of the "wings" of the big structure remaining to be excavated, was started early in May. The back-fill operations assumed an important role in the work during the Summer of 1923. The dirt, which had been deposited on Sand Island from pier excavations, was hauled back to the various parts of the bridge and used as the back-fill, up to the roadway level.

By June 30, 1923, the bridge had been about 75% completed. An average of 250 men were employed on the bridge during the Summer of 1923. The work progressed rapidly, the weather remaining ideal, until operations were shut down about January 10, 1924. By this date the bridge in general, except the River Street Ramp, assumed a finished appearance. Most of the water-proofing and back-fill had been placed.

Operations were again resumed on March 15, 1924. About 200 men were employed during the Summer of 1924. The railing construction was rapidly completed, as well as roadway and sidewalk construction. By August, the paving of the roadway with Belgian or granite blocks was well under construction, everything else being completed, except the River Street Ramp.

To describe the new structure as an "object of beauty" is expressing it inadequately. The bridge is of a very artistic, though simple, design and has a very graceful appearance.

A general view of the excavation necessary for a pier foundation. In the upper right hand corner, the men are operating a steam drill, preparatory to blasting. Some of the large, rough wooden beams (most of which were shipped to Bethlehem from Texas) used for bracing the walls of the excavation, can be seen in the background.

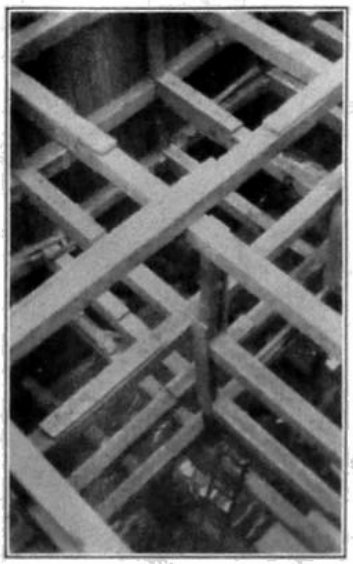
Considerable blasting was necessary in making the excavation of some of the piers, to remove the shale and limestone rock. Electric pumps were used to remove whatever water found its way into the excavation.

The material was removed in large, two-cubic yard buckets, and dumped into waiting trucks by means of a hoisting engine and derrick. By having four or five of these buckets, and two or three trucks, the operation was made very rapid and efficient, which accounts for the speed with which the contractors made these excavations. The maximum quantity of excavation performed in one month was 9,480 cubic yards over the entire job.

Excavating was done by means of open shafts. Steel sheeting protected the deeper holes; wood sheeting protecting the more shallow excavations. Excavation of the piers everywhere was carried down to solid rock.

The above excavation was in Pier 19, on the East side of Monocacy Creek, and reached a depth of 23 feet, below ground level. This was one of the last piers to be excavated.

The photograph was taken on July 20, 1922.



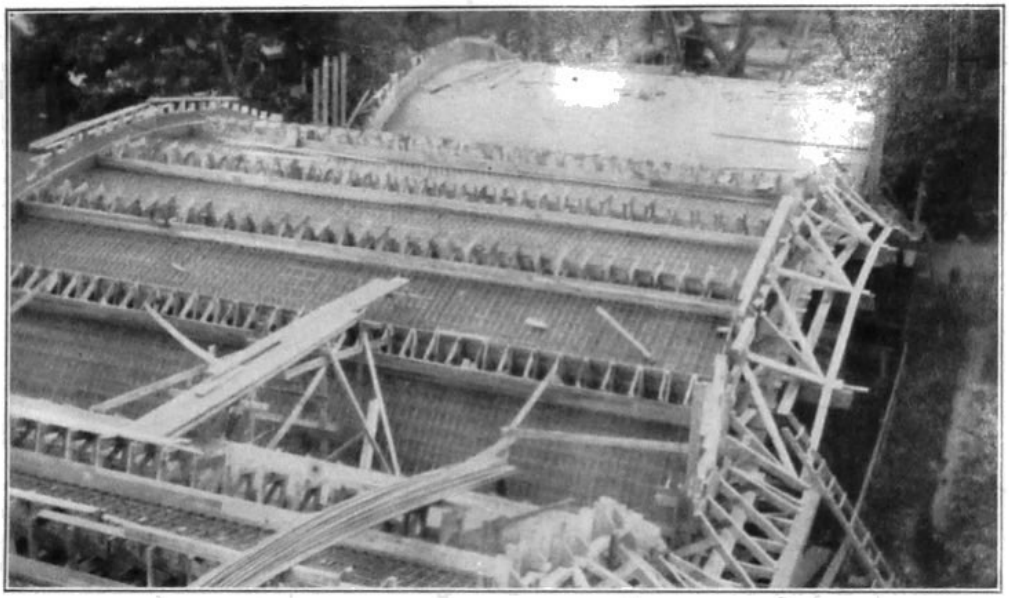
Looking down in the excavation for Pier No. 6, which had a depth of 30 feet. Pier No. 3 had the deepest excavation, of 52 feet.

Shows the heavy timber bracing for the steel sheeting walls. The piers were concreted in stages, each stage being up to the next horizontal series of timber braces, the vertical braces being removed after each pouring of concrete had set and then that space filled with concrete.

Lackawanna steel sheet piling, in lengths up to 45 feet, was used for all coffer-dam work. Both Vulcan and McKiernan Terry steam hammers were used to drive the sheeting. The interior bracing of the coffer dams, and other pier excavations, was made up of 10-inch by 10-inch and 12-inch by 12-inch timbers on 4-foot centers. Twenty-four inches clearance was allowed for the forms.

Three electrical pumps were required to pump the water out of the excavation for Pier No. 6.

Taken on June 25, 1922.



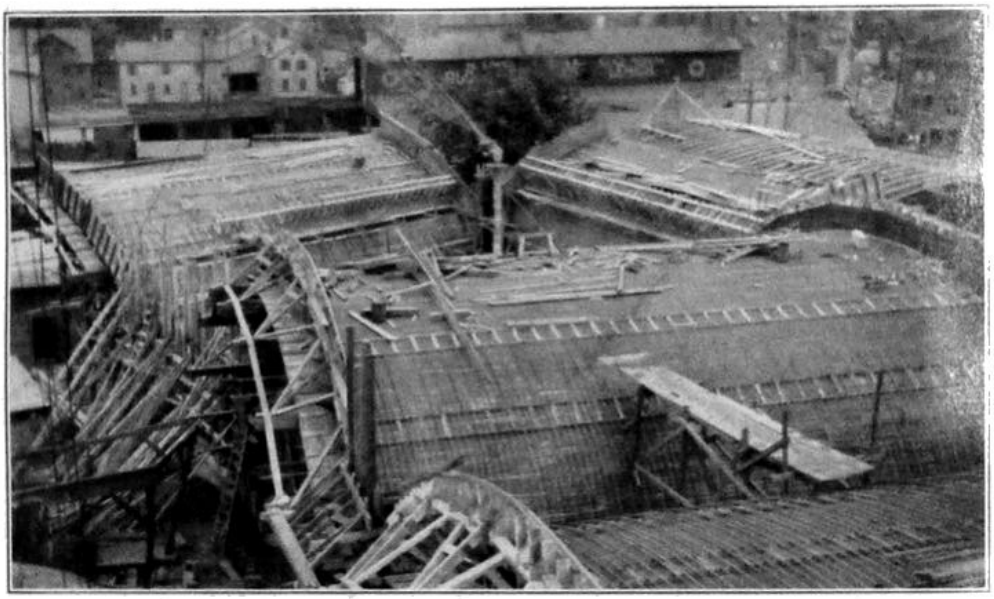
Spans 22-23 and 23-24 of the West Side Ramp. Gives a good idea of the construction of the bulk-heads for the keys between the various sections of the arch-ring.

The concrete was poured, first in the section nearest the pier drain basin, on each side of the arch-ring; then the top section was poured; and then the other sections were poured symmetrically each time. This was done to balance the heavy load on the false work below.

The keys or narrow sections, in above photograph, were not poured until the other sections had "set". Then the keys were poured after removing the bulk-heads, thus completing the arch-ring.

In the above illustration, only the lower layer of arch-ring reinforcing rods were in place. They were placed one inch above the bottom of the arch-ring along its entire curvature. The upper layer was placed in a similar manner, about one foot (at the crown) above the lower layer.

Above view was taken on July 8, 1922.



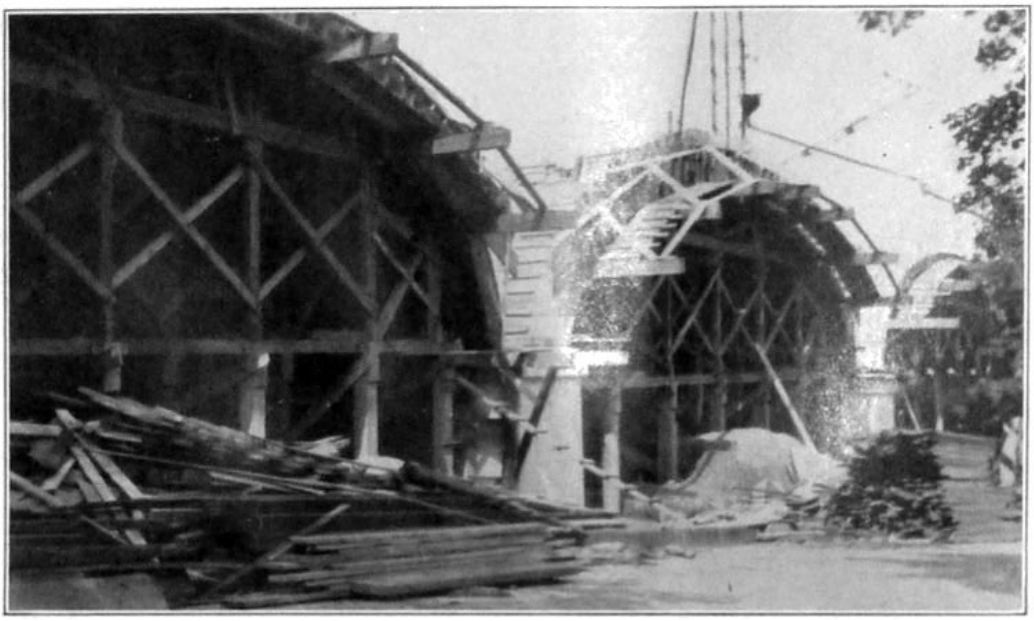
The intersection point of four parts of the bridge, namely: Main Street Branch to the left, in the background; the Main Bridge to the right, in the background; the West Side Ramp, in the foreground, and the South Main Street Ramp, not constructed at time photograph was taken.

This point, Pier 14, was the most complicated construction of the entire bridge.

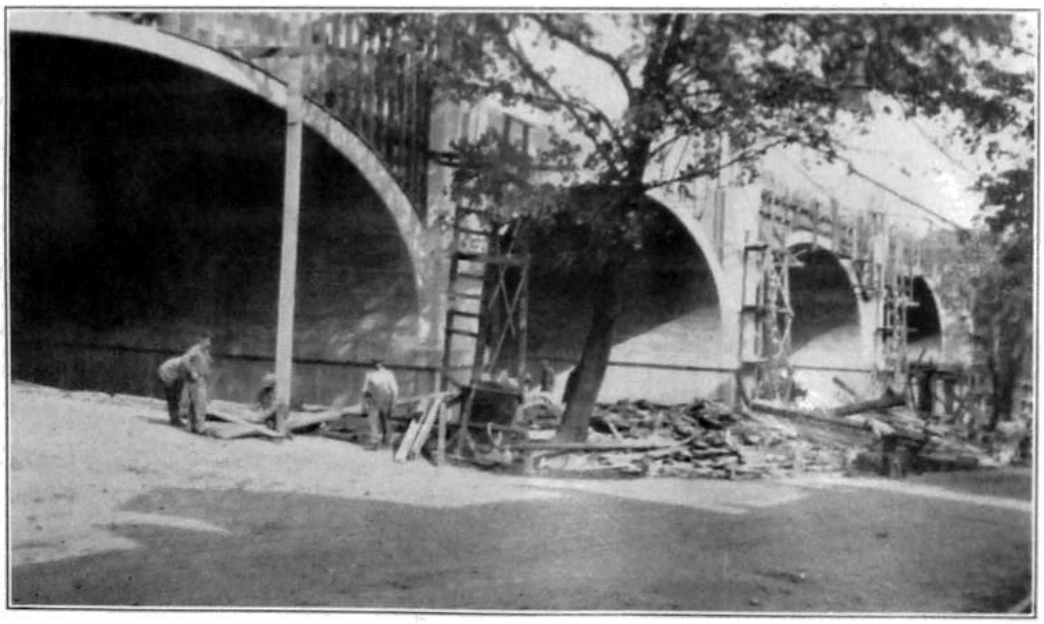
The arches shown are 14-13 (65-foot span) of the Main Bridge; 14-15 (88-foot span) of the Main Street Branch, and 14-20 (56-foot span) of the West Side Ramp.

Some of the arch-ring reinforcing rods have been placed as well as the lower part of the bulk-heads for the keys.

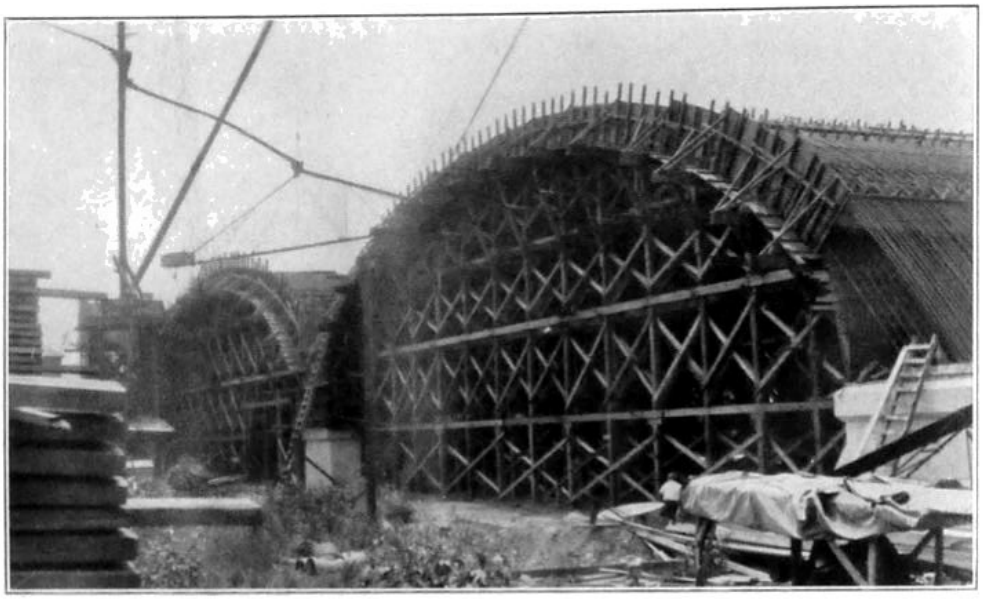
Photographed on July 8, 1922.



This photograph, taken on June 25, 1922, shows spans 20-21, 21-22, 22-23, all 56-foot spans of the West Side Ramp, along Spring Street. The height of these spans, to the top of the false-work, varies from 20-24 feet for the several arches. The false-work supporting the arch-ring forms, is shown in place. All of the false-work is bolted together. The piers in the photograph are completed up to the coping.



View of the West Side Ramp, four months later, showing the progress of construction, taken on October 17, 1922, opposite Pier No. 24. The false-work beneath the arch-rings has been removed. Note the relative thickness of the arch-rings, which is 1 foot 3 inches at the crown for these 56-foot spans. About 195 cubic yards of concrete was placed in each of these spans and about 30 tons of reinforcing steel (round rods, 1 inch in diameter). The spandrel wall forms have been partly erected. Piers 20, 21, 22 and 23 are shown.



False-work for 107-foot spans 9-10 and 10-11 of the Main Bridge Structure. The height of these arch-rings is about 40 feet above the ground level.

Pier 10, in the center, is 18 feet by 63 feet at the footing, and has a depth of 31 feet below ground. Pier 11, at the right, is 36 feet by 63 feet at the footing, and 28 feet below ground.

Some idea can be obtained of the tremendous amount of lumber used for the false-work to support the arches for the heavy load of concrete. Most of this lumber was shipped from Texas. Above photograph was taken on August 17, 1922.

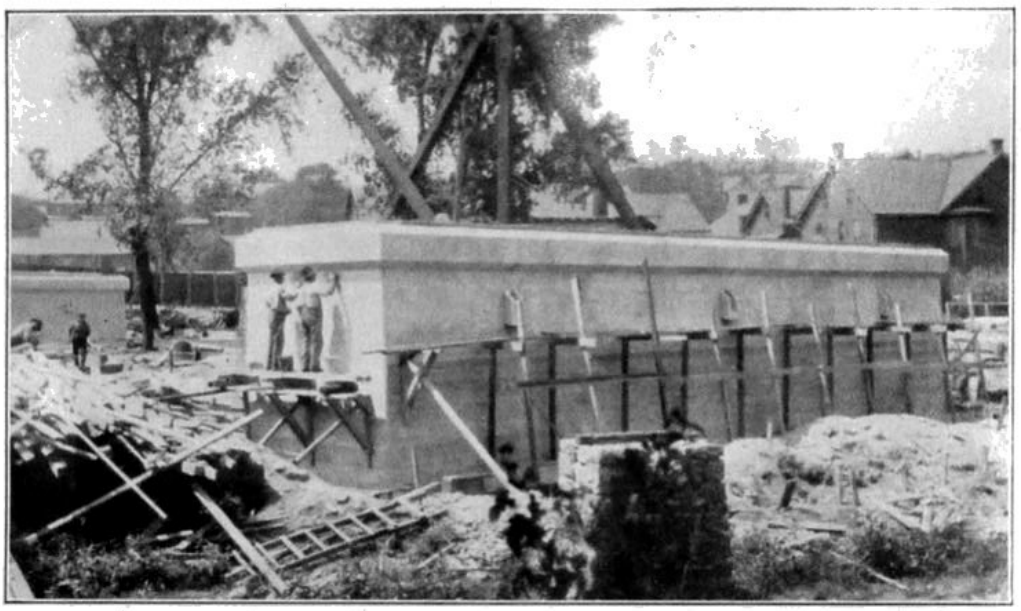
Forms for abutment Pier 19, finished up to the coping of the pier.

The illustration shows how the drain pipes are placed in the pier and the tie rods used to support the forms during concreting, which remain in the concreted pier.

The "step-up" in the concreting forms a backing for the part of the pier above and serves as a binder for the next pouring of concrete.

The dimensions of abutment Pier 19 are 36 ft. by 63 ft., at the footing.

The concreted foundation has been completed as shown, and the photograph indicates everything in readiness for the pouring up to the top of the forms or coping of the pier. It was poured four days after the picture was taken, on August 21, 1922.



View of Pier 18, of the Main Street Branch, completed up to the coping, taken on August 23, 1922.

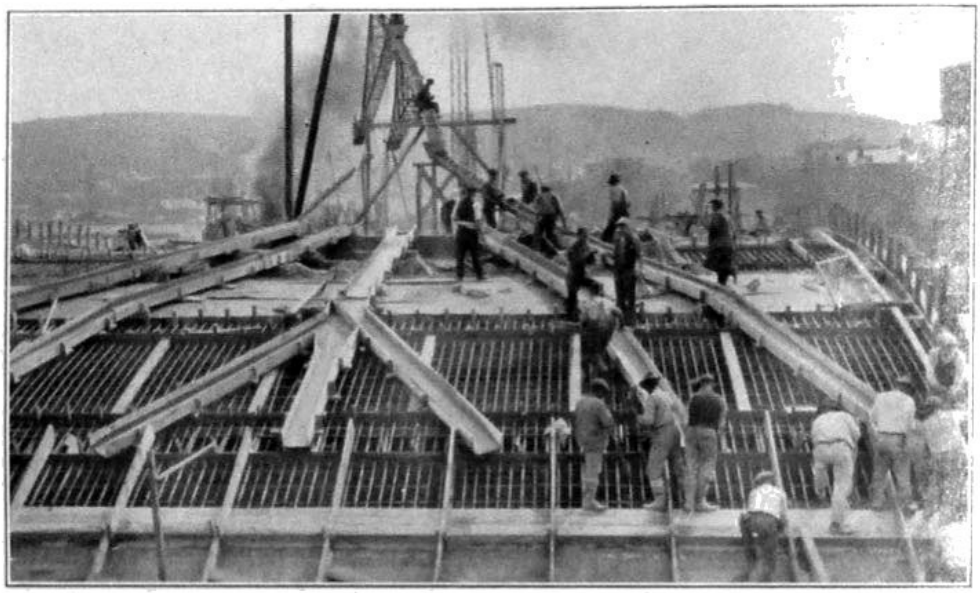
The men are "rubbing down" the sides of the pier with carborundum blocks, to give it a smooth, white finish.

The drain pipe outlets, three in number, are shown on the near side of the pier.

The drainage system in this bridge is a very complicated and wonderful piece of engineering, since every part of the structure is taken care of by it. Each pier has its series of drain outlets as above.

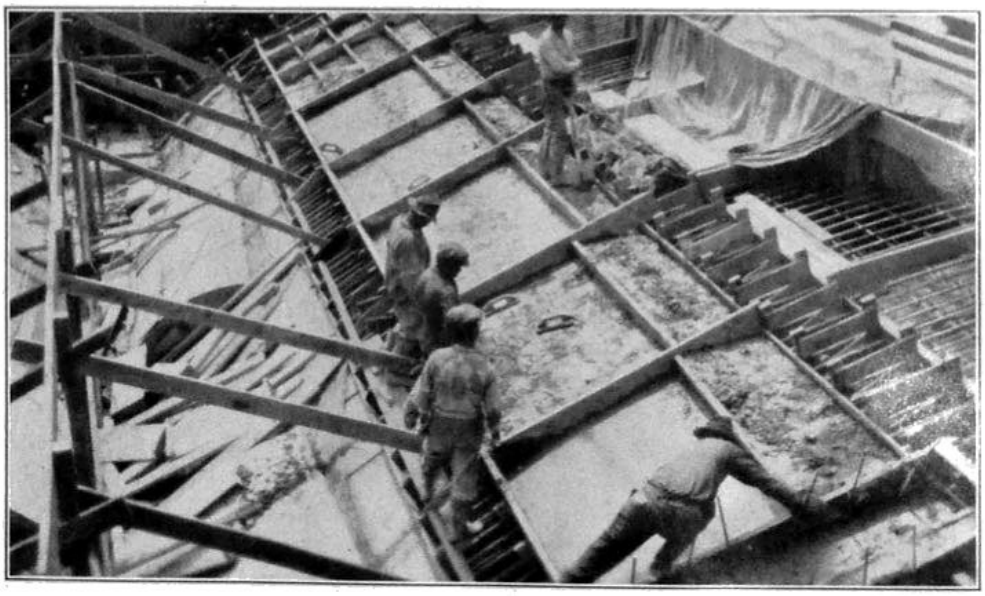
There are also two snow removal openings which will greatly aid in disposing of the snow quickly. One is located above the river in the center of arch 5-6, and the other, above the Monocacy Creek, between Piers 18 and 19. These snow removal openings are separately reinforced.

The dimensions of the above Pier 18 are 12 feet by 63 feet, at the footing.



Placing concrete in span 11-12 of the Main Bridge. The center voussoir is in place and the crew are starting on the quarter point voussoir sections.

Note the key-ways and the method of distributing the concrete by a system of chutes. Photographed on September 20, 1922.



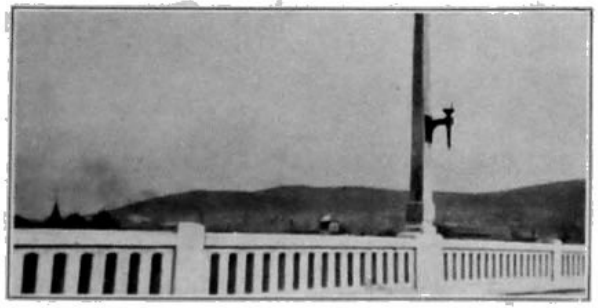
This view of the method of concreting an arch-ring was taken on August 17, 1922. The men were smoothing the concrete in the quarter point voussoir sections, located in arch-ring, 22-23, at Pier 22, of the West Side Ramp.

The key-ways and voussoir sections are easily distinguished. The arch-ring reinforcement rods (1 inch in diameter) are all encased in the concrete as shown.

Water-proofing was placed on the concrete surface before placing the back-fill on the arches.

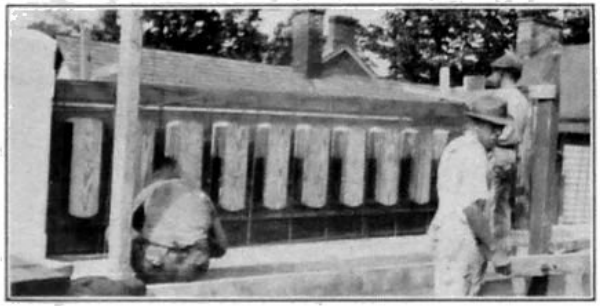
Canvas covers were used to keep the concrete from setting too quickly and to protect it from the hot sun.

The manner in which these arch-ring sections were concreted is well illustrated in the cut above.

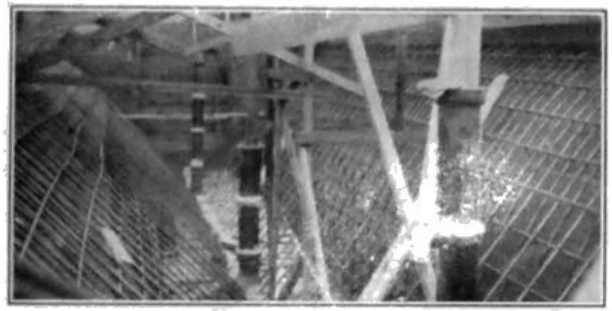


Balustrade and lamp-posts. All members, both vertical and horizontal, are reinforced. July 30, 1924.

Driving wooden piles in the Monocacy Creek for form work for arch 18-19. September 22, 1922.

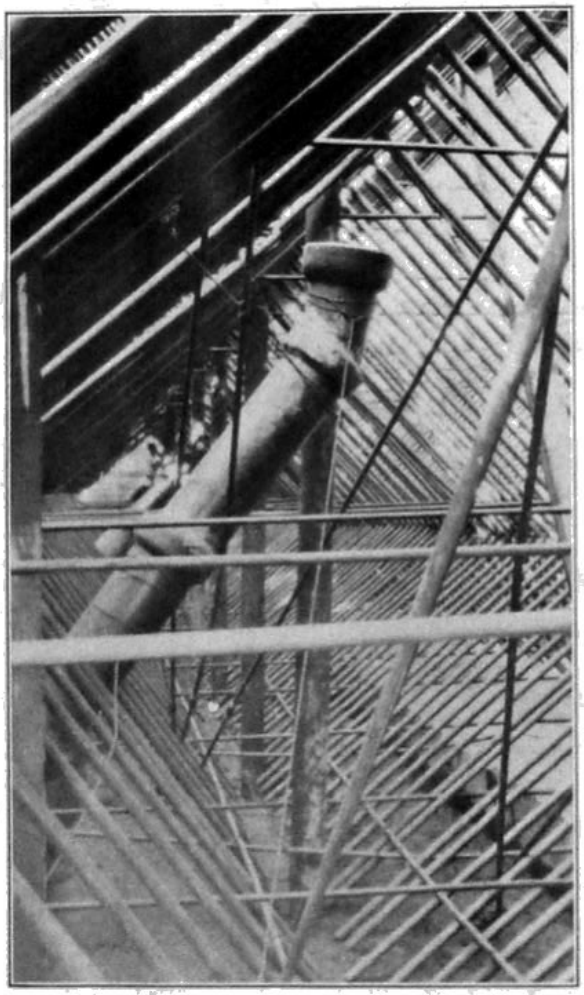


Forms and reinforcing for section of railing. July 29, 1923.



Lower layer of arch-ring rods and drainage pipes in Pier 23. July 8, 1922.

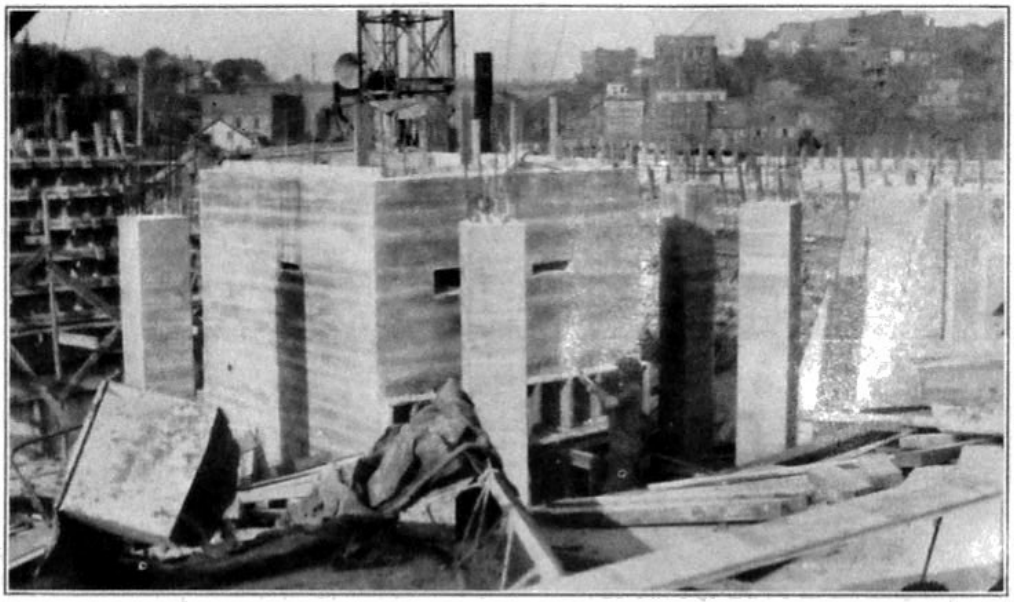
Lighting arrangement for pouring concrete at night, at abutment Pier 19. November 6, 1922.



Interior view of Pier 15, of the Main Street Branch, showing the reinforcing in place, complete and ready for pouring of concrete, which took place two days after the photograph was taken (October 28, 1922); everything shown being encased in the concrete.

Shows the large amount of steel necessary for the reinforcing of the arches of the bridge, all of which was made by the Bethlehem Steel Company.

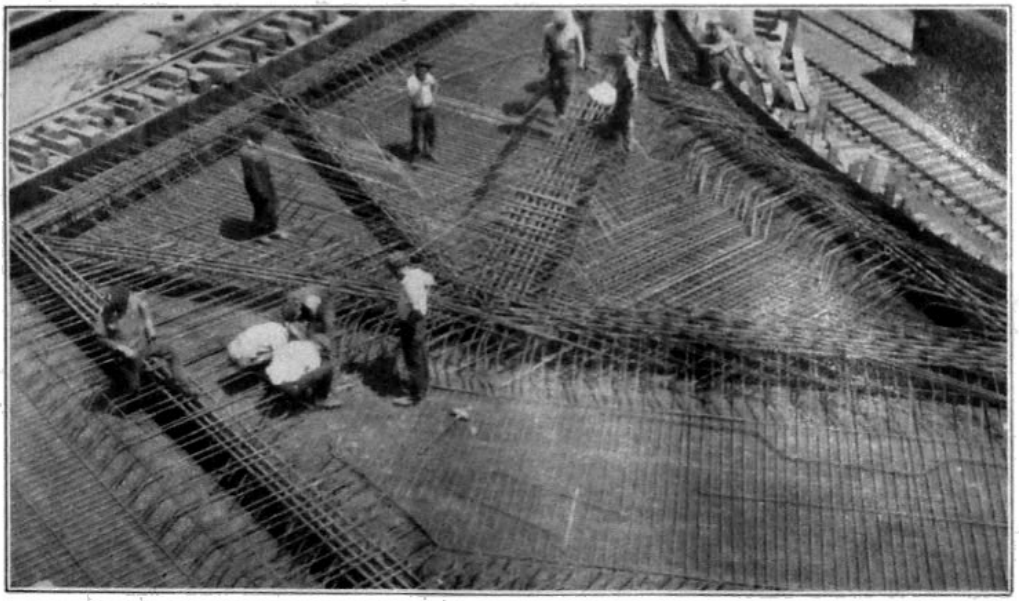
The drain pipes were placed as shown.



Large manhole and supporting columns at Pier 14. This is the central point for all the wiring of the bridge, the small openings on the sides of the manhole being for the ducts to pass through.

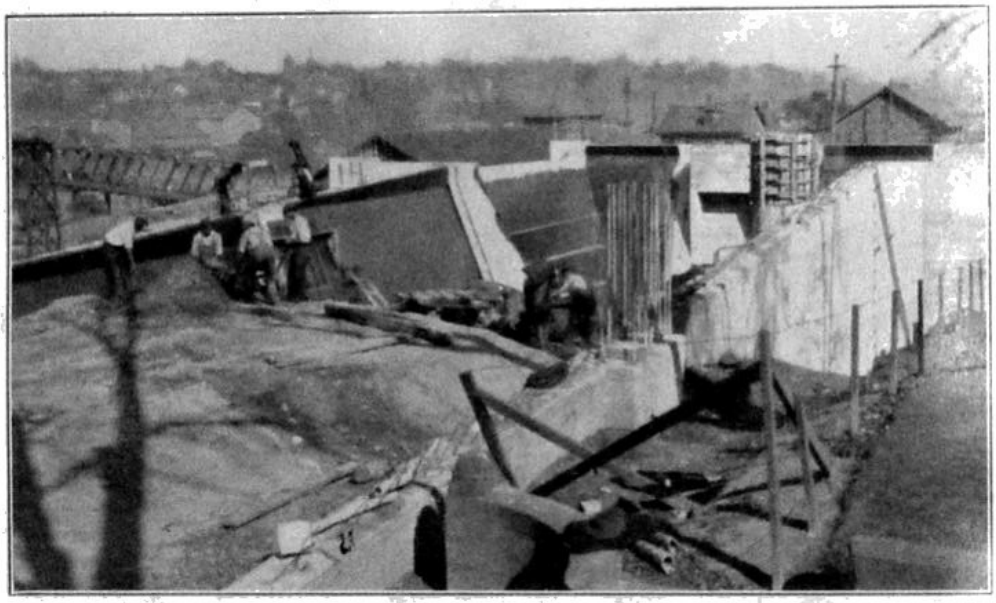
The remaining space was filled with earth up to the roadway. These columns and the manhole help support the tremendous weight of the island platform and roadway above it.

Photographed on October 22, 1922.



Reinforcing in the large floor slab at the intersection of the Main Street Branch with the South Main Street Ramp and the Main Bridge. Three-quarter inch rods were used. This is the most complicated reinforcing in any part of the bridge.

Photographed on August 9, 1923.

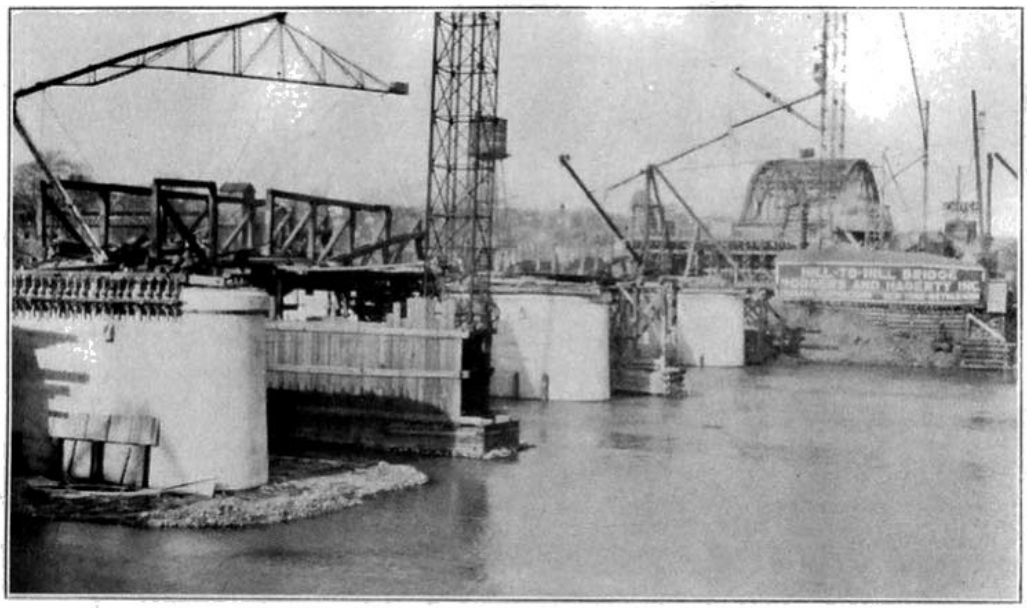


View of the Lehigh Street Ramp, ready for the earth-fill, located at the Lehigh Valley Railroad Office Building.

Shows the water-proofing on the retaining walls of the ramp. The black surface denotes the water-proofed coating.

In the distance the abutment Pier No. 1 can be noted, the inside surface of which is also coated with the water-proofing. The process of water-proofing consists of a coating of tar on the cement wall, a 3-ply coating of membrane water-proofing material and then a second coating of tar.

Photographed on October 11, 1922.



Pier No. 4 Pier No. 5 Pier No. 6

160-foot steel tower, center of Lehigh River.

240-foot steel tower, South Mixing Plant.

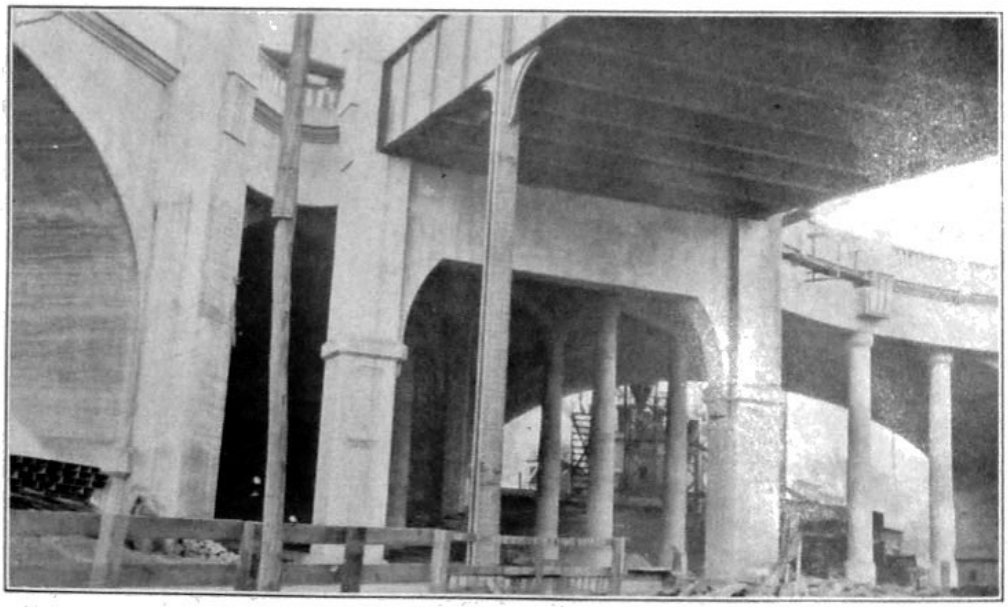
Showing the River Piers built up to the top of pier coping and the steel span 8-9, in the distance.

View from the south side of the Lehigh River, taken on December 13, 1922.

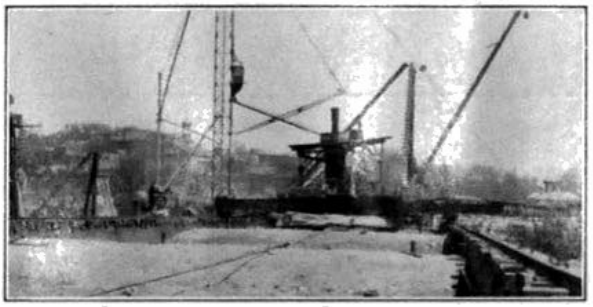
View of section of the Second Street Ramp finished up to the roadway, located at the Old Union Station. Shows the artistic construction, the concrete reinforced girders underneath the roadway, and the bridge seat on the two large columns, in the foreground, for the steel girders connecting with the steel span 1-2.

Above photograph taken on June 30, 1923.

Cement for the Hill-to-Hill Bridge was furnished by the Pennsylvania Cement Company, of Bath, Pa.



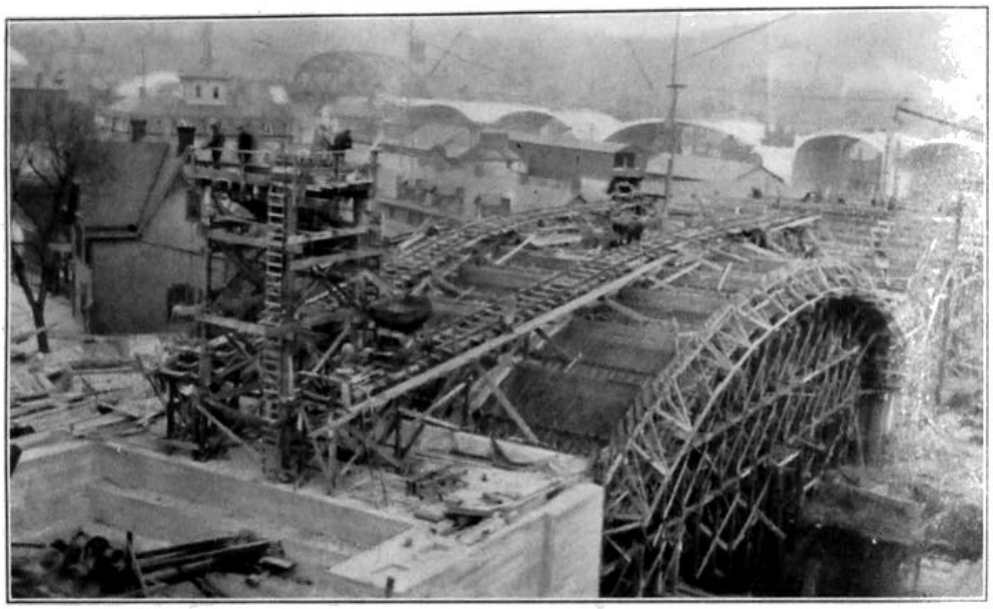
Supporting columns and girder construction, at the junction point, Pier 14, of the three ramps,—Main Street Branch, South Main Street Ramp, and West Side Ramp,—with the Main Bridge. Taken on November 10, 1923.



Traveler used to fill in the arches with earth. Hoists the earth from trucks below to the arch. West Side Ramp. Taken May 3, 1923.

About 10,000 cubic yards of back-fill (earth) above that furnished from the foundations were required to complete this operation, and this was obtained from other excavations in connection with the work.

View of Groman's Quarry along the Monocacy Creek, where Rodgers & Hagerty, Inc., obtained most of the stone for the concrete, and operated a crushing plant, thus insuring continuous delivery of crushed stone for the bridge. Taken on July 29, 1922.



View looking west along the Main Street Branch. Abutment Pier 19 is in the foreground and Arch 18-19 (129-foot span) across the Monocacy Creek. A snow removal opening is constructed in the center of this arch.

A novel method of handling concrete is illustrated. The concrete was first hoisted to the platform, then taken to the voussoir section of the arch-ring desired, by means of the small railroad and one-cubic yard capacity buckets on wheels.

The above method was installed because of its efficiency, both as to the number of men required, and the speed, and also, for the purpose of facilitating the placing of concrete during cold weather. The system was entirely satisfactory; as high as 650 cubic yards of concrete being poured in one day.

Note five concrete arch spans of the main bridge structure, in the background, between Piers 9 and 14 and steel span 8-9. (Taken on November 22, 1922.)

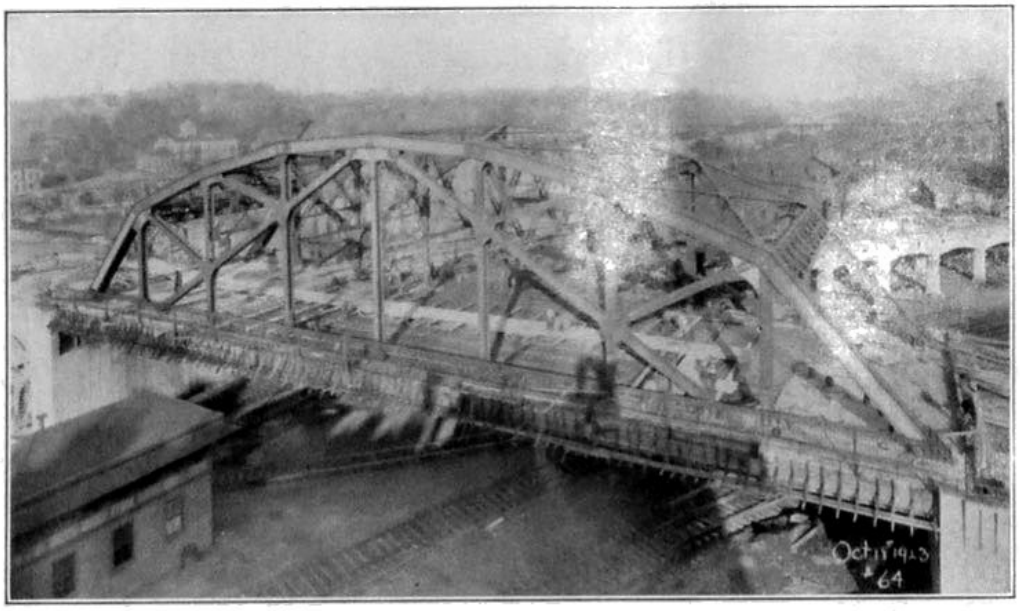


Photo by Conradi

View of the 171-foot structural steel span 1-2, across the Philadelphia and Reading Railroad tracks and two tracks of the Lehigh Valley Railroad, taken on October 18, 1923, from the Lehigh Valley Railroad Office Building.

This span has been termed the *Hudson* Span, since its construction is rather unique. Most of the load and stress is carried by the diagonal chords of the truss.

The reason for this peculiar design is that the Second Street Ramp joins the bridge at the span over the Lehigh Valley and the Philadelphia and Reading tracks. In order to permit the passage of vehicles between this ramp and the bridge, the diagonal members had to be eliminated. This made the use of the ordinary type of truss impossible, and Mr. Hudson developed the design as shown. The same design of span was duplicated over the Jersey Central and the Canal (span 8-9) in order to simplify the fabrication as much as possible.

The reason for constructing the two above spans of steel instead of concrete is that, in order to obtain the necessary clearance for the railroads beneath, a greater height would have been necessary for the entire structure, thus requiring the use of a far greater quantity of concrete, reinforcing steel and heavier foundations and therefore adding greatly to the cost of the viaduct.

The steel truss construction is completed, as well as the reinforcing of the roadway across the span.

The roadway slabs are being concreted from both ends toward the center.

The Second Street Ramp is shown in the right background, as well as the connection of this ramp with the steel span 1-2.

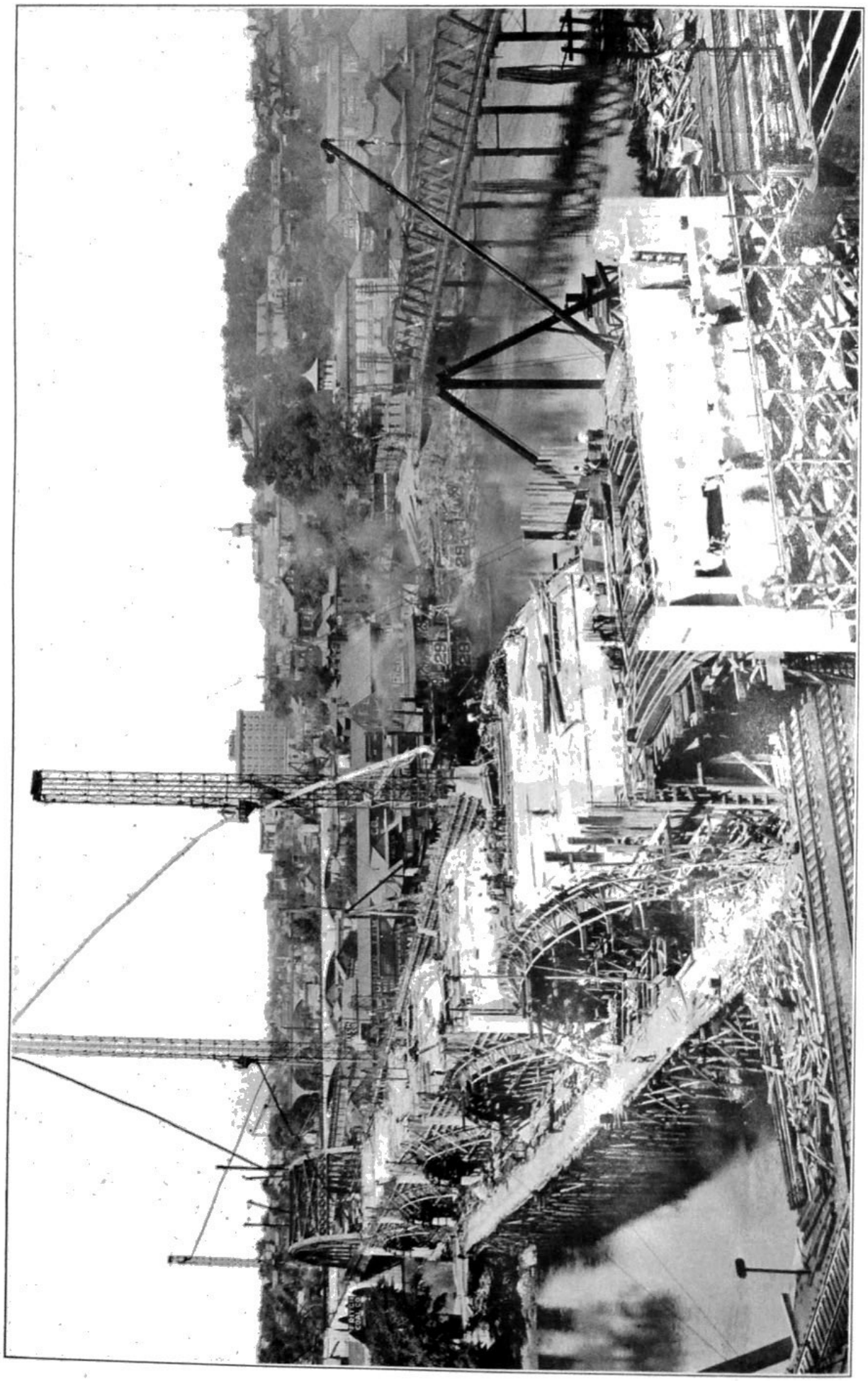


Photo by Conradi

A general view of the construction operations taken on July 26, 1923, from the Lehigh Valley Railroad Office Building.

The three distributing towers and the entire distributing system are well shown. The steel tower in the background is 200 feet high and is equipped with a 37-cubic foot hoisting bucket. At the top is a 3-way hopper serving three lines of chutes, which extend toward the West Side Ramp, the Main Street Branch and the Main Bridge. These lines all terminate in derrick mast hoppers located at the top of 80-foot derrick masts. Distribution is effected from the derricks by means of cantilever chutes suspended from the derrick booms.

The tower in the center is 240 feet high, and serves two lines of chutes. The one (northerly) chute crosses the canal; the other chute extends to the auxiliary steel tower, 160 feet high, in the middle of the Lehigh River, in the foreground, which tower supports the long line of chutes crossing the river. All the towers have quick shift sliding boom plants for placing concrete within a radius of 125 feet.

The arch-rings of the river spans have been concreted and the spandrel walls are in the process of construction, as can be noted.

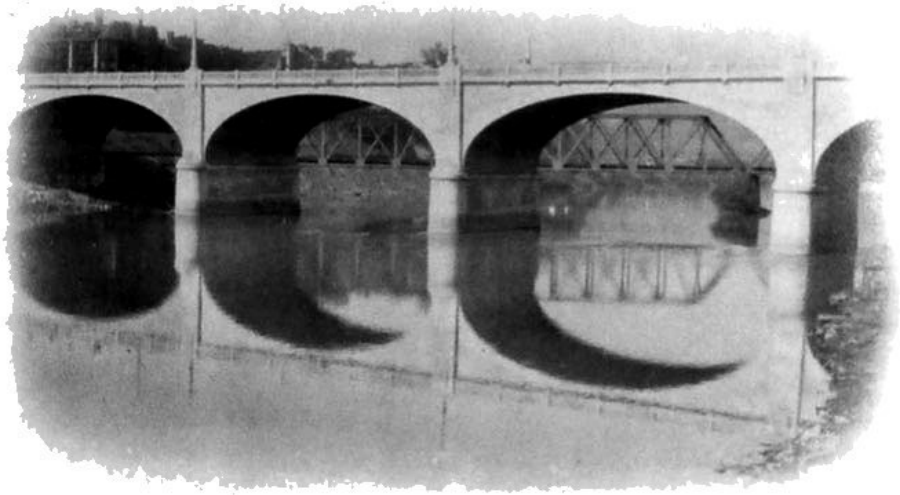
Pier 2, in the foreground, has a foundation of nearly 100 reinforced concrete piles, which were driven into the ground to a depth of about 20 feet by a steam hammer. The bridge seat for the steel span 1-2 is located near the top of this pier.

The forms for the reinforced concrete girder-span 2-3 are in the process of erection.

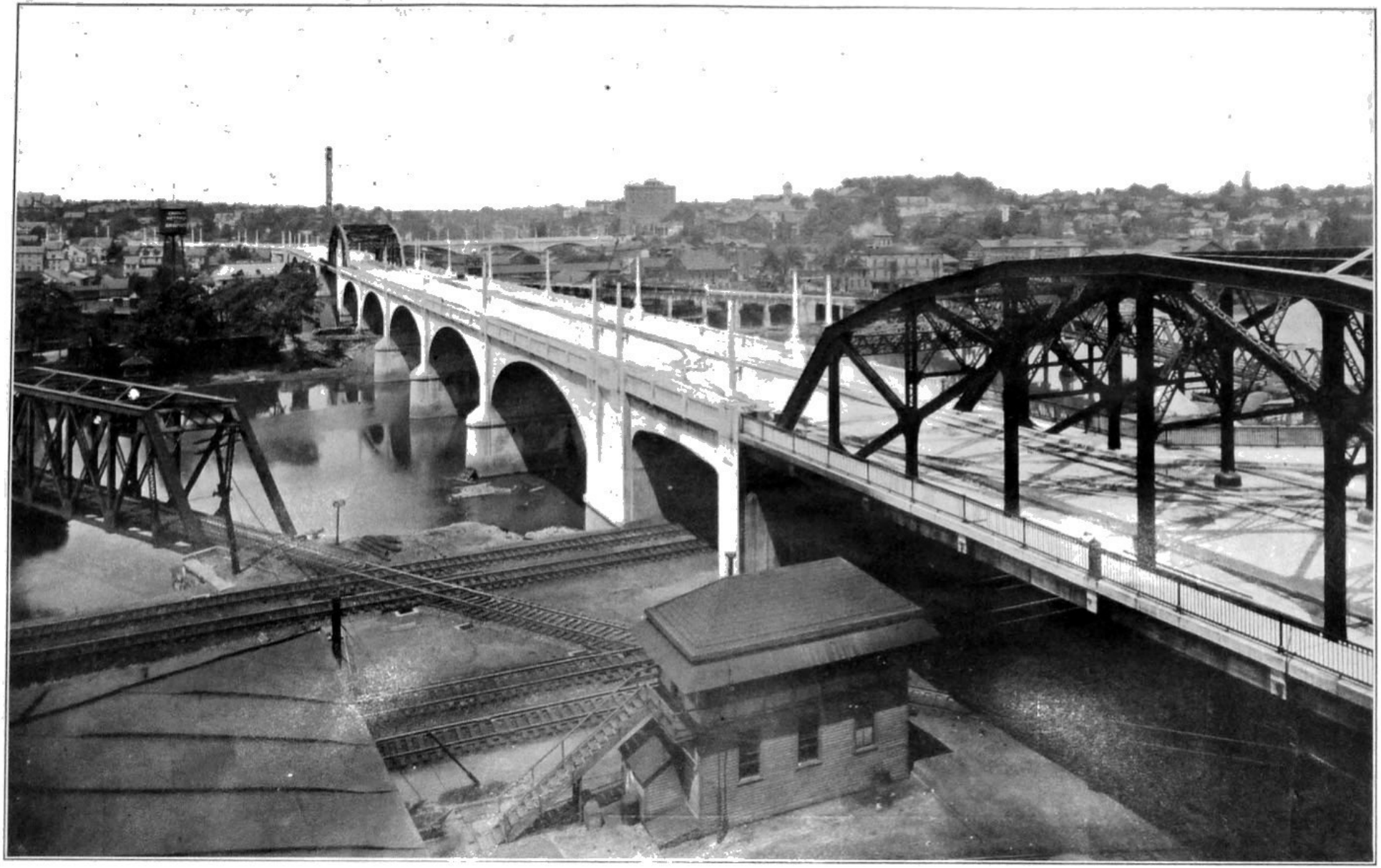
The platform, erected on wooden piles, along the left side of the bridge, was used by the contractors' trucks for the various operations.

Steel span 8-9 is in the background, completed.

Hotel Bethlehem and the Moravian Church are among the prominent buildings which stand out in the background.

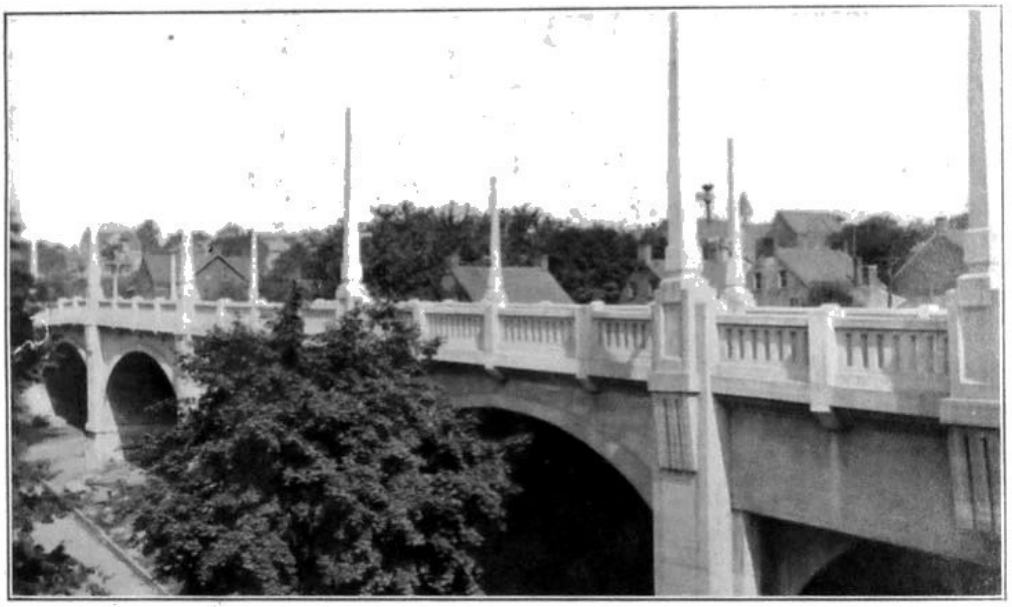


The arches of the Main Bridge across the Lehigh River show the artistic and graceful appearance of the viaduct. 107-foot spans. Photographed on July 27, 1924.



View of Hill-to-Hill Bridge, taken on July 25, 1924, looking north from the Lehigh Valley Railroad Office Building. The bridge is of the spandrel reinforced concrete arch type, with two large structural steel spans.

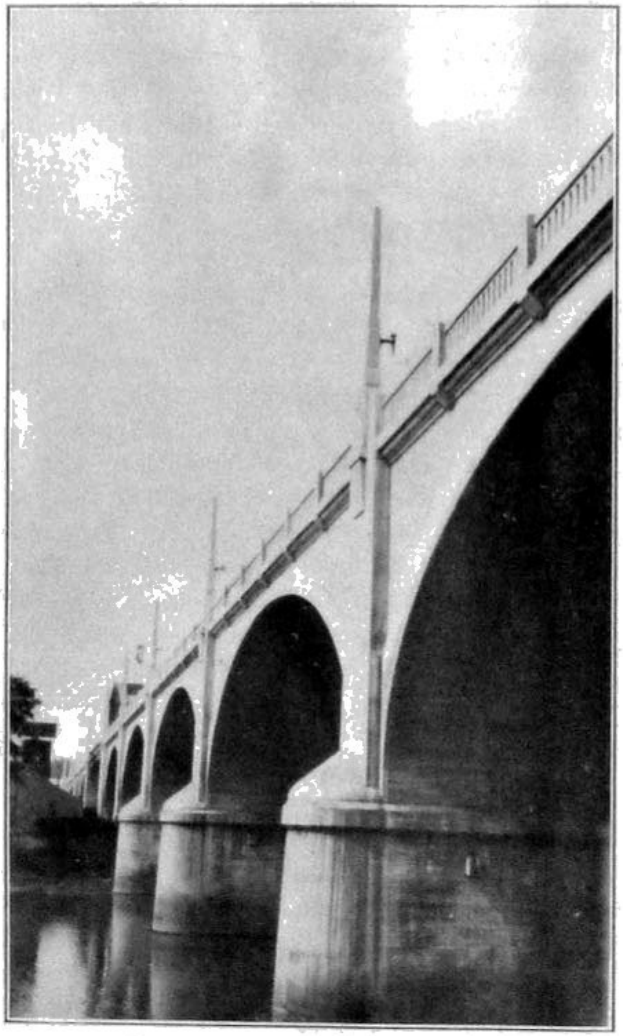
Photo by Conradi



West Side Ramp, completed.

The proportions and artistic design are entirely in conformity to the design and size of the viaduct. It gives an impression of solidity and at the same time the lines are plain but graceful.

Photographed on July 27, 1924.



Arch Spans across Lehigh River, showing massive concrete structure. Note: rounded "noses" of piers, so constructed to aid in breaking ice that may collect; and the drainage outlets at the piers.

Photographed on July 30, 1924.

SOME PERTINENT FACTS REGARDING THE CONSTRUCTION OF THE HILL-TO-HILL BRIDGE

Bids received by Public Service Commission, at Harrisburg, Pa., for construction of bridge	June 30, 1921
Contract awarded to Rodgers & Hagerty, Inc.	July 11, 1921
Rodgers & Hagerty, Inc., office opened in Bethlehem, Pa.	August 1, 1921
Total approximate cost of bridge	$ 3,000,000.00
Amount of Rodgers & Hagerty, Inc., bid	$ 2,568,000.00
Cost of extra construction items, estimated to August 1, 1924	3,000.00
Cost of land damages as per court judgment	282,972.42
Reimbursement of Bethlehem Bridge Commission for cost of temporary bridge construction	42,913.25
Reimbursement of Bethlehem Bridge Commission for engineering and legal service and purchases of property for bridge right of way	140,843.75
Rehabilitation of temporary bridge in 1923	15,252.45

Type of bridge	Spandrel, Reinforced Concrete Arch
Number of main piers and abutments	26
Number of independent foundations exclusive of main piers	153
Number of independent wall foundations and wall sections	68
Number of arch spans in entire bridge	26
Number of concrete lamp posts (2 sizes) on entire bridge	129
Number of iron lamp posts on South Main Street Ramp	10
Aggregate lineal feet of clear span	1910
Longest concrete arch span (11-12), lineal feet	146
Smallest concrete arch span, lineal feet	56
Longest structural span (steel trusses), lineal feet	171
Number of girder spans	38
Longest plate girder span, lineal feet	85
Entire length of Viaduct, lineal feet	6055
Length, Main Bridge Way (Piers 1-14), lineal feet	2085
Total length of all approaches, lineal feet	3995
Length of Main Street Branch, lineal feet	868
Length of West Side Ramp, lineal feet	491
Length of South Main Street Ramp, lineal feet	511
Length of River Street Ramp, lineal feet	403
Length of Second Street Ramp, lineal feet	680
Length of Third Street Ramp, lineal feet	880
Length of Lehigh Street Ramp, lineal feet	162
Length of retaining wall on Third Street Ramp, feet	360
Length of retaining wall on Lehigh Street Ramp, feet	193
Length of retaining wall on Main Street Branch, feet	325
Length of retaining wall on West Side Ramp, feet	300
Length of retaining wall on Second Street Ramp, feet	530
Length of retaining wall on South Main Street Ramp, feet	240
Height of bridge roadway above average water level, feet	48
Height of bridge roadway above average ground level, feet	25–35
Width of broadest section of bridge, feet	65
Width of narrowest section of bridge, feet	38
Width of driveway on Main Bridge, Main Street Branch and Third Street Ramp, ft.	44
Width of driveway on West Side Ramp, feet	36
Width of driveway on South Main Street Ramp, feet	27' 11"
Width of driveway on Second Street Ramp, feet	27' 7"
Width of driveway on River Street Ramp, feet	21

Width of driveway on Lehigh Street Ramp, feet	30
Width of sidewalk on Main Bridge, Main Street Branch, West Side Ramp, Lehigh Street Ramp and Third Street Ramp (2 sidewalks)	7′ 6″
Width of sidewalk on South Main Street Ramp (1 sidewalk)	7′ 6″
Width of sidewalk on Second Street Ramp (1 sidewalk)	4′ 5″
Width of sidewalk on River Street Ramp (1 sidewalk)	5′ 0″
Length of spans across the river, lineal feet	107
Length of West Side Ramp spans, lineal feet	56
Length of Main Street Branch spans, lineal feet	129
Length of concrete girder span 2-3, lineal feet	48
Thickness of arch-ring at crown in 107-foot span	2′ 0″
Thickness of arch-ring at crown in 56-foot span	1′ 3″
Thickness of arch-ring at crown in 129-foot span	2′ 3″
Thickness of arch-ring at crown in 146-foot span	2′ 6″
Total quantity of concrete in Pier 14, approximately, cubic yards	7000
Total quantity of concrete in 107-foot span, cubic yards	690
Total quantity of concrete in 146-foot span (11-12), cubic yards	1242
Total quantity of concrete in 129-foot span, cubic yards	883
Total quantity of concrete in 56-foot span (West Side), cubic yards	195
Total weight of steel in truss spans (estimated) 1-2 and 8-9, pounds	2,235,000
Total weight of steel in South Main Street Ramp (estimated), pounds	1,144,850
Total weight of reinforcing steel for entire bridge (estimated), pounds	3,338,210
Weight of reinforcing steel in 107-foot spans, tons, about	65
Weight of reinforcing steel in 146-foot span, tons, about	175
Weight of reinforcing steel in 56-foot span, tons, about	30
Weight of reinforcing steel in 129-foot span, tons, about	60
Weight of reinforcing steel in span 2-3, reinforced concrete girders, 48-foot span, tons, about	50
Class of concrete in pier tops, arch-rings and coping	1–2–4
Class of concrete in spandrel walls	1–2½–5
Class of concrete in pier foundations	1–3–5
Grade of Main Bridge and Main Street Branch	Level
Grade of South Main Street Ramp	6.75%
Grade of West Side Ramp	4%
Grade of Second Street Ramp	4.88%
Grade of River Street Ramp	8.90%
Grade of Third Street Ramp	6%
Grade of Lehigh Street Ramp	5%
Maximum quantity of excavation performed in one month, cubic yards	9,480
Maximum quantity of concrete placed in one month, cubic yards	8,723
Maximum quantity of concrete placed in one form continuous pour by bucket in 24 hours (both plants operating), cubic yards	958
Maximum quantity of concrete placed in one form continuous pour by chutes in 36 hours (one plant), cubic yards	944
Maximum quantity of concrete placed on entire job in 24 hours, cubic yards	1,050
Total excavation involved, cubic yards	68,500
Total concrete handled and placed in entire bridge (estimated), cubic yards	107,000
Total waterproofing used, square yards	230,000
Total paving surface (for granite blocks), square yards	23,500
Estimated number of granite blocks (concreted on foundation)	651,000
Deepest excavation for pier, below ground level (Pier No. 3), feet	52
Shallowest excavation for pier, below ground level (Pier 24), feet	10
Total conduit used on entire bridge, miles	34
Total sidewalk on Viaduct and approaches, miles	2
Automobile trucks in use daily, 5-ton capacity	18

Average run per truck per day, hauling cement, sand or stone, miles	80
Wire cable used on job, miles	14
Quantity of cement furnished by the Pennsylvania Cement Company, bags, over	425,000

CARLOADS OF EQUIPMENT, MATERIAL AND SUPPLIES USED ON ENTIRE JOB

Equipment	34
Coal	176
Lumber, ties and wood piles	216
Sand	1940
Stone (additional to Groman's Quarry product)	314
Steel sheet piling	11
Fibre conduit	9
Cast iron soil pipe	1
Cast iron water pipe	4
Wire mesh	3
Vitrified pipe	1
Bolts and nuts	1
Granite paving blocks	170
Total (cars of 40-ton average capacity)	2880

The above does not include the cement hauled direct from the mills by the contractor's own trucks or the crushed stone from his own quarry. Nor does it include any structural or reinforcing steel.

LIST OF SUB-CONTRACTORS ON HILL-TO-HILL BRIDGE

Bethlehem Steel Bridge Corporation—Fabrication and erection of all steel spans.

Minwax Waterproofing Company, New York City—Placed all the waterproofing.

J. Meehan & Son, Philadelphia, Pa.—Furnished and placed the granite blocks on roadway. Blocks from Georgia and Maine.

Tucker Electric Construction Company, New York City—Wiring of bridge.

PARTIAL LIST OF COMPANIES FURNISHING MATERIAL

Pennsylvania Cement Company (Plant at Bath, Pa.), New York City—Furnished cement for concrete construction to the extent of over 106,000 barrels.

Lehigh-Portland Cement Co., Allentown, Pa.—Furnished about 30,000 barrels of cement.

Johns-Manville, Inc. (Plant at Manville, N. J.), Philadelphia, Pa.—Furnished all the electrical conduits.

Bethlehem Foundry & Machine Company, Bethlehem, Pa.—Furnished all the castings, e.g., manhole covers, etc.

Construction Lumber Company, of Pittsburgh, Pa.—Furnished the major portion of the lumber.

Trexler Lumber Co., of Allentown, Pa.—Furnished about one-half million feet of lumber used in the false work.

Keystone Supply Company, Philadelphia and Bethlehem, Pa.—Furnished the drain fittings.

Bethlehem Steel Company, Bethlehem, Pa.—Furnished all of the reinforcing steel as well as the trolley tracks.

Reed Iron Works Company, New York City—Furnished the bronze brackets.

Wm. H. Taylor & Co., Allentown, Pa.; Krause Hardware Company, Bethlehem, Pa., and others—Furnished miscellaneous construction hardware.

Morris Black, Bethlehem, Pa.—Furnished the sand.

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