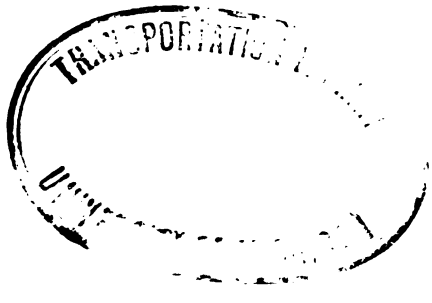
Engineering News-Record

A Consolidation of Engineering News and Engineering Record

A JOURNAL OF CIVIL ENGINEERING AND CONSTRUCTION

ISSUED WEEKLY



VOLUME LXXXVI

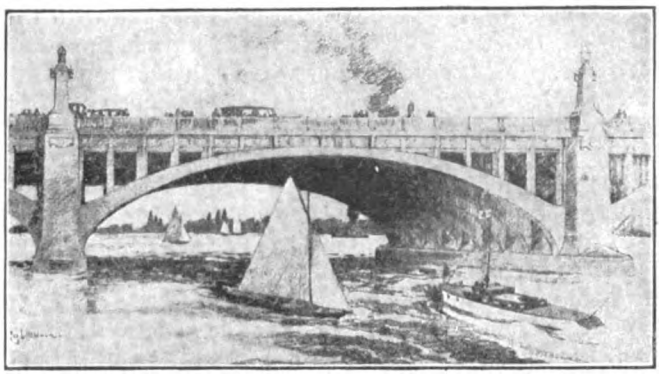
January 1 to June 30, 1921

McGRAW-HILL COMPANY, INC.
10TH AVENUE AT 36TH STREET
NEW YORK

Redesign of Belle Isle Bridge to Reduce Cost

Arch Structure Proposed Because Bids on Adopted Cantilever Design Exceed Available Funds—Arch Type Held Liable to Injury From Settlement of Pile Foundations in Clay—Revise Cantilever Plans

WITHIN the past four months two separate sets of bids for construction of the monumental Belle Isle bridge projected by the city of Detroit exceeded the bond issue voted by the people a few years ago, and the city council has in each instance rejected all bids. This condition has created a knotty problem as to how the city is to obtain the bridge without further postponement, and yet within the sum voted; at the same time a sharp engineering controversy has arisen over the matter through the events reported in our news pages Jan. 27, p. 190; Feb. 24, p. 359· March 3, p. 396, and March 10, p. 442.



CANTILEVER SPAN OF ARCH APPEARANCE. BELLE ISLE BRIDGE

Devised by the commission of 1917 because it considered a true arch not permissible in view of the risk of foundation settlement, this design has proved too costly to come within the funds voted for the bridge by the citizens of Detroit. As a result one of the major municipal projects of the year is in an impasse, and Detroit engineers are busy discussing what should be done, especially since Daniel B. Luten submitted a design for a reinforced-concrete arch bridge. Both designs propose to found the piers on piles at similar loading, and both involve eccentric footing pressure.

Because of the importance of both the administrative and the technical questions involved, and the desirability of placing them before the engineering profession with a view to aiding in their clarification, *Engineering News-Record* requested H. H. Esselstyn, of the firm appointed as supervising engineers for the bridge, L. M. Gram, who was engineer to the commission that decided upon the design three years ago, and William H. Adams, at whose instance an alternative design was presented a month ago, to state the essentials of the situation as regards the official design, the foundation conditions, and the alternative design. Statements by Mr. Esselstyn and Mr. Adams follow, together with a summary of the facts and conclusions concerning the foundation. This latter has been prepared from data supplied by Mr. Esselstyn and quotations from the original commission report, to which Prof. Gram referred our request.

Briefly reviewed, the case rests on these facts: That the commission concluded the subsoil to be not dependable enough to make it wise to bring arch thrusts to bear on it, and therefore adopted a steel-concrete cantilever design comprising steel frame "umbrellas" projecting both ways from the piers, and short I-beam connecting spans, all embedded in concrete; that this design, which necessarily involves a large tonnage of structural steel, proves to be excessively costly at present; that a concrete arch design was laid before the city council recently which, though the precise cost figures are in dispute, is very much cheaper than the official design; that the local engineering society protested to the city that a cheap or unsubstantial structure is not wanted, and asked that a board of engineers be appointed to pass on designs; and that the council has requested the supervising engineers for the bridge to prepare a modified—cheapened—cantilever design.

Development of Official Design and Its Revision

BY H. H. ESSELSTYN
of Esselstyn-Murphy, Detroit, Supervising Engineers for Belle Isle Bridge

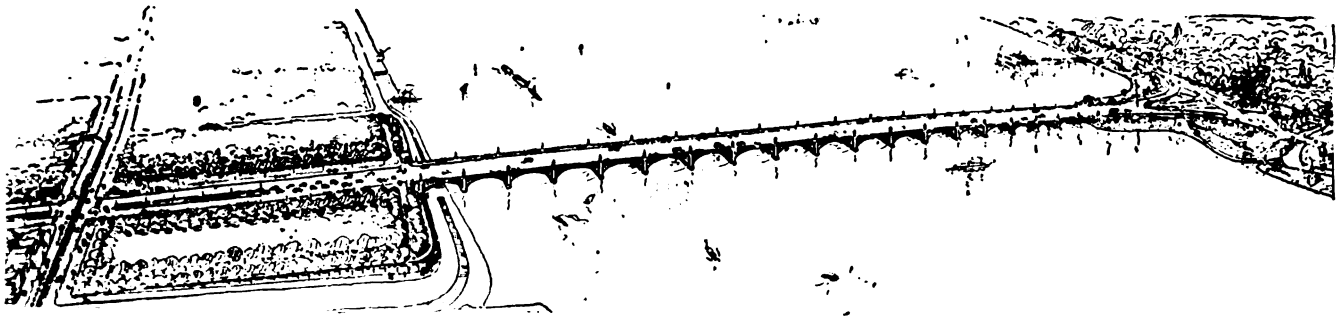
IN THE SITUATION that has been created by the failure to award contracts for the construction of the Belle Isle bridge, on two occasions during the past winter, and the more recent proposal of a substitute design totally at variance with the principles laid down by the commission of engineers that developed the present design, it is important to set down the fundamental reasons why the structure was designed as a concrete cantilever, and what is involved in the present situation.

Thorough investigation of the project for a bridge for the Belle Isle site was made by a commission of engineers appointed in 1916, which after a year and a half of study rendered its report in November, 1917. The commission was composed of Mortimer E. Cooley (ch.), Francis C. McMath, William R. Kales, Emil Lorch, and Henry R. Riggs. Lewis M. Gram was chosen as engineer. Mr. Lorch acted as architect to the commission. On May 1, 1918, George H. Fenkell, commissioner of public works, recommended the design developed by the commission to the city council, and it was subsequently adopted. Since that time no other project or design has been in question but that of the commission.

The foundation problem was of fundamental importance in the commission's study, and special investigation of soil conditions was made by borings, pile tests, and the like. (See preceding article.—EDITOR.) As a result of careful scrutiny of the data, the commission decided that the following requirements must be met by the structure: (1) It should be as light as possible; (2) the foundation reactions must be entirely vertical. A pile loading of 18 tons was recommended, though the detail design has been made on the basis of 14 tons dead load per pile, no live load considered.

Prior to this conclusion, the commission considered some ten different types of structure, including the reinforced-concrete arch type. They included: Plate girder with cantilever sidewalk, steel truss with alternate cantilever spans, steel truss simple spans, concrete arch, steel two-hinged arch, concrete two-hinged arch, steel three-hinged arch, concrete three-hinged arch, open steel cantilever, and finally concrete cantilevers, the latter type being ultimately adopted.

All the types were considered with and without cantilevered sidewalks, and the final choice was in favor of the design with the outer rib placed under the outer edge of the deck, so that the concrete work of the piers could be carried up through the structure in order to



BRIDGE AS PLANNED BY THE 1917 BOARD OF ENGINEERS—CANTILEVERS AND SUSPENDED SPANS

give a more effective architectural development than can be obtained with cantilever sidewalks, where the pier feature could not be carried above the balustrade.

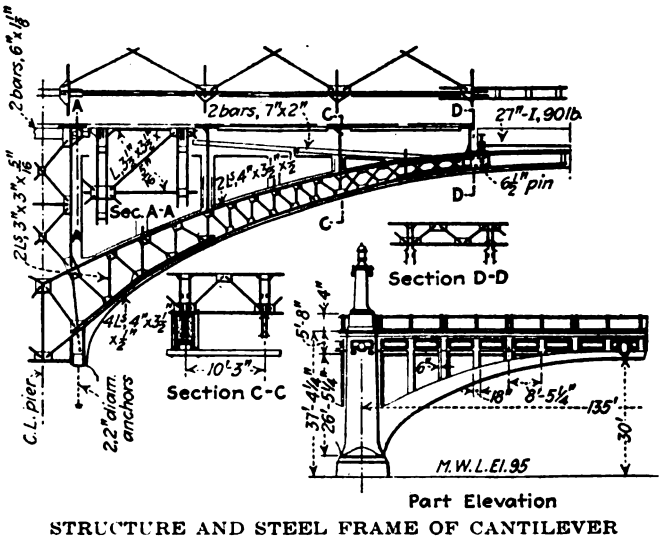
Upon the decision to base the choice of type on the two principles stated above, the arch designs were necessarily eliminated. That it is untenable from an engineering standpoint to consider for a moment a reinforced-concrete arch bridge for the site was moreover brought out very emphatically by the preponderance of evidence against the arch bridge proposal at the public hearing before the council three weeks ago, when a number of engineers presented their views.

As originally estimated by the commission, the cost of the bridge would have been less than $3,000,000, including the Jefferson Ave. subway in the north approach. A bond issue of $3,000,000 was subsequently voted by the people in a referendum election, and later the writer's firm was appointed as supervising engineers for the design and construction. In the preparation of contract plans the commission's general design drawings were closely followed, yet in bids received for parts of the work last November a total cost of $5,000,000 was indicated, and in bids received after readvertising the lowest bid was about $4,500,000, exclusive of the subway, as compared with a sum of $2,500,000 available after final payment for the subway approach contract already in process of construction. It was subsequent to the refusal of the city council to award contracts on these bids that the proposal of designs for a reinforced-concrete arch structure was made to the council by an outside engineer.

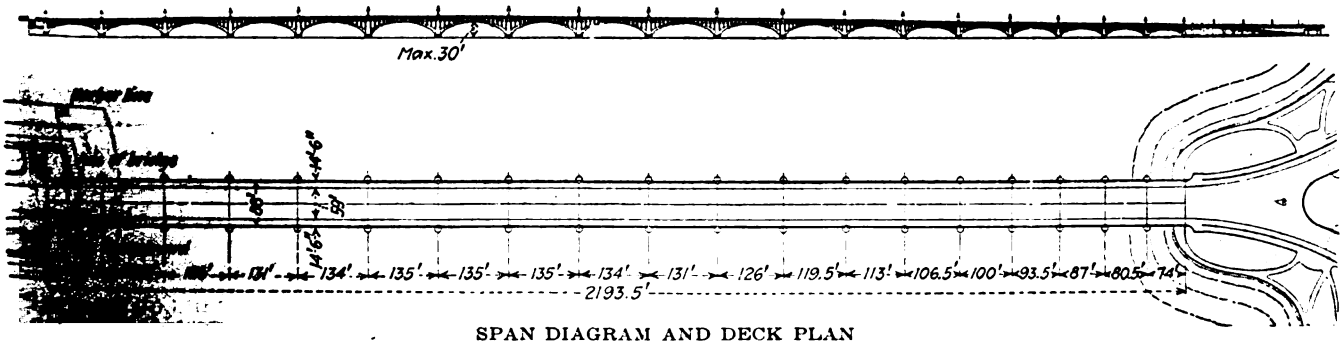
The latest official act of the council on the matter was the passing of a resolution on March 1 recommending "that Esselstyn-Murphy be authorized and directed to make such modifications of the original reinforced-concrete cantilever bridge recommended by the Belle Isle Bridge Commission as will bring the cost within the balance of approximately $2,500,000 remaining, such modifications to consist of the elimination of approaches and the substitution of dirt fill therefor and such other changes as may be deemed necessary." The resolution was subject to veto, but the time for such a veto has now passed, and work is already in progress on the modified design called for in it. The new design will be ready for presentation to the council in a month.

The commission had made a study of the structure with cantilevered sidewalk, as already stated, and it is this design we are now coming back to, because of its economy over the official design. In the modified design no sacrifice is being made as regards carrying capacity, stability, or the like.

However, it should be emphasized that the matter of changing the design of the bridge is a very delicate one, and we as engineers for the bridge have all along fought to have the original commission reappointed and kept in office until the structure is completed. This has not as yet been done and we have been instructed by the resolution just quoted to prepare a modified design. It is proper to say that we are treating with the most careful consideration the original accepted design, and we believe that by adopting one of the original designs considered by the commission we are acting in the spirit of those who carried out the fundamental engineering studies.



STRUCTURE AND STEEL FRAME OF CANTILEVER

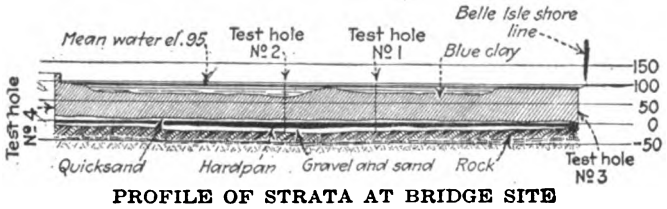


SPAN DIAGRAM AND DECK PLAN

Soil Conditions Back of Cantilever Design

AT THE site of the bridge, rock occurs 103 to 125 ft. below water level, and the main part of the overlying soil is blue Detroit clay, a material that often proves troublesome. The foundation problem being of first importance, whatever the type of bridge chosen, special investigation of the underlying soil conditions was made by the commission, by means of borings and test piles, the results being checked against data obtained from others who had made similar surveys in Detroit.

For a depth of 90 ft. below water, a light blue clay of nearly uniform hardness, containing fine sand in



PROFILE OF STRATA AT BRIDGE SITE
One hundred feet of clay, hardpan and sand overlie rock.

spots, was encountered; in one hole near the middle of the river a 7-ft. quicksand layer was found at 90 ft. depth. The pile-driving records for the temporary bridge nearby also indicated softer material near the middle of the river. At 100 to 110 ft. hardpan was encountered, and below this generally some 10 ft. of sand and gravel over rock. The profile developed is shown herewith.

It was considered impracticable to extend foundations through 30 ft. of water and 90 ft. of the more or less plastic clay to bedrock, especially in view of the great cost of caisson work in Detroit, where gas and quicksand pockets are often encountered in the clay, producing considerable trouble. Common practice in heavy work along the water front is to drive wooden piles into the clay and on top of these to cast a concrete mat. It was decided by the commission that this would be the only feasible type of foundation to be used.

Pile tests were made with piles of 15-in. butt diameter and 8-in. point, driven to 51 ft. penetration. Four test piles driven by steam hammer showed penetrations of 0.27 to 0.38 in. per blow at 40 ft. penetration; one of them, driven continuously to 50 ft., showed a final penetration of 0.18 in. per blow, and another, driven to 50 ft. after 20 hrs. wait, showed a final penetration of 0.05 in. per blow. This last-mentioned pile was placed under test load two weeks later; under 20 tons its settlement was 0.023 ft. in 14 days, increasing to 0.035 ft. after 32 days, while under 42 tons the settlement increased to 0.074 ft. the first 15 days and to 0.124 ft. in 58 days. None of these piles extended below the blue clay. These results led to the conclusion that piles "would carry 18 to 20 tons without serious progressive settlements." A loading of 18 tons was recommended for design.

As the result of its foundation studies the commission formulated the two principles quoted in the article of Mr. Esselstyn (p. 452), and shaped its decision of bridge type thereby. The commission said:

"Arches and cantilevers are types which economically follow pleasing lines, and therefore investigation of their relative adaptability was made by means of sketches and estimates of costs. Two-hinged, three-hinged and hingeless arches were considered, and while each has its advantages, all are dependent for stability upon lateral resistance of the soil. Furthermore, an intelligent analysis of stresses must be based upon assumed and uncertain displacements of the piers. For these reasons and in view of the soil conditions, as described above, a structure based upon the cantilever principle with vertical reactions is considered preferable."

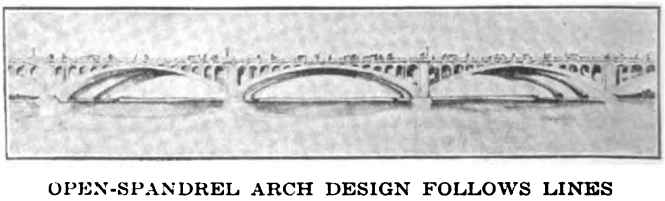
Summarizing its choice of design, the commission stated that its foundation studies "indicate that a structure designed upon cantilever principles would best fit the natural conditions. Other structural types were carefully considered but the great distance to rock and the plastic condition of the overlying soil were the most important eliminating factors. Moreover the curved arms of the cantilever construction give pleasing lines consistent with the character of the bridge as a civic and park structure. The water level is subject to slight changes, hence the curved arms can spring from the piers at a low point and an open-spandrel treatment is practicable, giving an effect of lightness without sacrificing that of strength and dignity. The advantages with respect to appearance as well as permanence were deciding factors in the selection of reinforced concrete as the most suitable material."

Data of Reinforced-Concrete Arch Design Recently Proposed

BY WILLIAM H. ADAMS
Consulting Engineer, Detroit

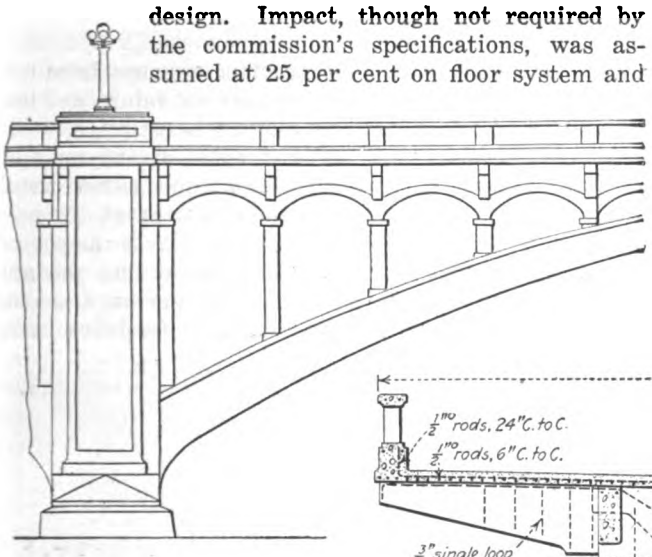
THE official design for the Belle Isle bridge, of structural-steel-and-concrete cantilever type, was twice advertised in the fall of 1920. The lowest bids ran nearly $2,000,000 over the funds available, and the city council rejected all bids. Matters stood thus when at the writer's suggestion the council granted a hearing on Jan. 14 to Daniel B. Luten on a proposed modification of the bridge program, and Mr. Luten presented preliminary sketches for an arch bridge which he stated should be built within the funds remaining from the $3,000,000 bond issue—about $2,500,000. By resolution the council thereupon permitted Mr. Luten to submit, within thirty days, detailed plans, specifications, and estimates, with the understanding that all general requirements of the bridge commission's report be met as to strength and capacity and that the bridge should have the same general appearance as that provided in the official plans.

Estimates of cost submitted in accordance herewith, accompanying a set of detail plans, ranged from $2,486,-360 for an earth-filled arch and the official approach design to $2,175,725 for an open-spandrel arch design with modified south approach. The open-spandrel design, described in the following, approaches closely in appearance the commission's design. The alternate design for the approach at Belle Isle saves about $140,000 by broadening out the fill and eliminating the ramps and retaining walls.



OPEN-SPANDREL ARCH DESIGN FOLLOWS LINES OF COMMISSION DESIGN

Sixteen spans of 95 to 160 ft. in the clear form the river crossing in the open-spandrel design, three channel arches having clear spans of 160 ft. and a clear rise of not less than 30 ft. The roadway width (85 ft. between railings) and the loading (100 lb. per sq.ft. with provision for concentrated loads of an 18-ton truck or two 50-ton street cars on each track) are as in the official design. Impact, though not required by the commission's specifications, was assumed at 25 per cent on floor system and



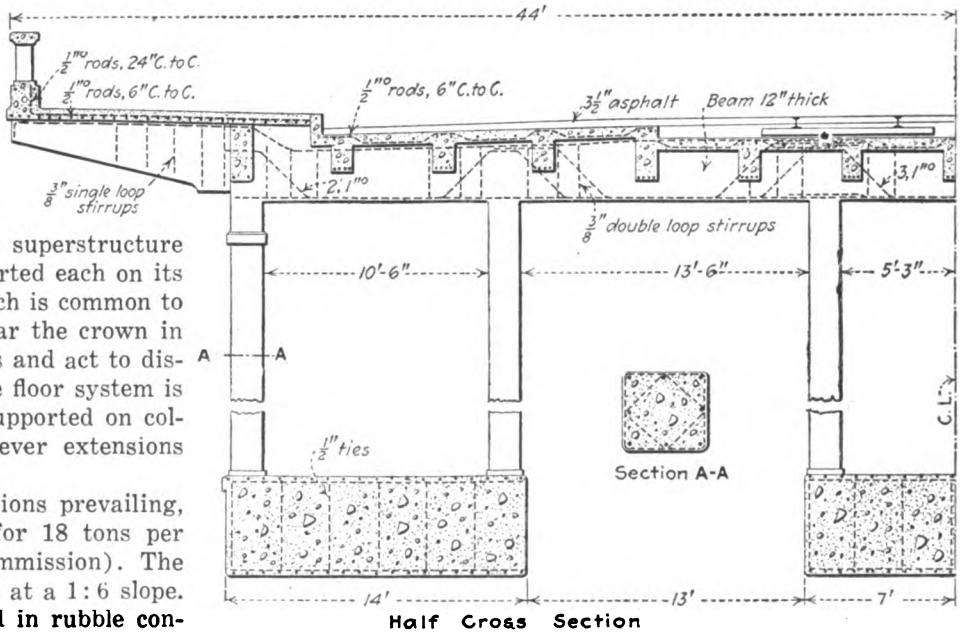
zero on arches and piers. The superstructure comprises three arch ribs supported each on its unitary pier down to a base which is common to all. Two transverse girders near the crown in each span connect the three ribs and act to distribute concentrated loads. The floor system is carried on transverse girders supported on columns from the arches; cantilever extensions support the sidewalk.

On account of the soil conditions prevailing, the foundations are designed for 18 tons per pile (as recommended by the commission). The outer rows of piles are battered at a 1:6 slope. The top 3 ft. is to be enveloped in rubble concrete, laid under water, the top of this mat being at the elevation of the bottom of the mat of the official design. Above this is a 6-ft. mat of reinforced concrete, 93 ft. long and of width varying with the span.

The piers are designed for one span fully loaded and the adjacent span unloaded, analyzing the piers by the elastic theory, considering arch and pier as one elastic system; or, one span half loaded, adjacent span unloaded, analyzing by the gravity method, arches as though unattached. The piers are located so as to avoid all the old piers of the earlier bridge, which are to be removed. There is no necessity for much provision against scour, as the current is sluggish and the river levels uniform.

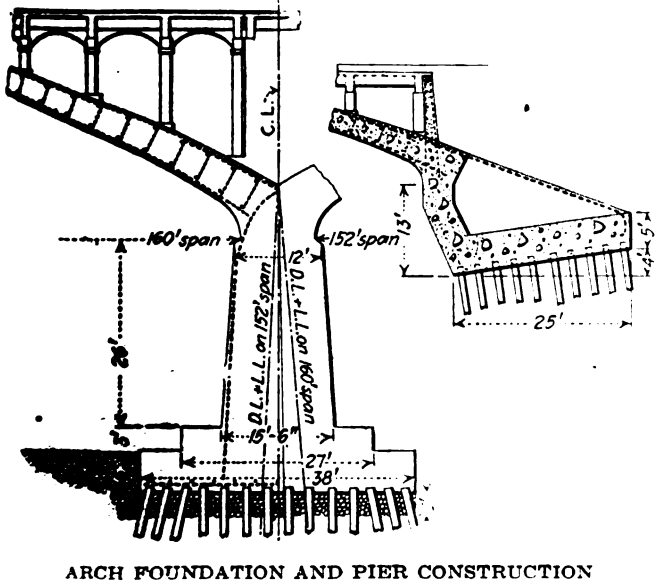
As the longer spans have the greater rise, the thrusts for uniform loads are approximately equal. Unbalanced thrusts are slight as compared with the total load; they are fully provided for by the battered piling. The deepest pier will extend 35 ft. below water line. As it is intended that the 9 ft. of base and sub-base concrete shall act as a seal for the cofferdam, this deepest pier will have 26 ft. of pumpage.

The economies of the design consist in the elimination of over 4,000 tons of structural steel trusses and bracing,



ELEVATION AND CROSS-SECTION OF 160-FT. ARCH SPAN

bolts and anchors, and 1,300 tons of steel sheetpiling; a reduction in concrete from about 63,000 cu.yd. to about 50,000 cu.yd., with a greater simplicity of construction and detail; the use of concrete railing throughout; simplified drainage, waterproofing and lighting, and a more economical system of centering.



ARCH FOUNDATION AND PIER CONSTRUCTION

Track Maintenance by Piece Work

Owing to the abnormal conditions under which maintenance of way work has been conducted during the past year, no considerable amount of maintenance of way work has been handled under contract or piece work schedules, according to the report of the Committeee on Track of the American Railway Engineering Association. The standard track work system which was in effect on the Baltimore & Ohio R.R. and the Pennsylvania R.R. had as one of its essentials the establishment of unit performance or piece work schedules, but this system was abandoned by the U. S. Railroad Administration and has not been re-established. Many roads resorted to the cost-plus form of contract in handling maintenance work during the past year, but in effect this plan was little more than the recognition of the contractor as a labor agent, the work being done as heretofore under the immediate direction and supervision of the regular railway officers.

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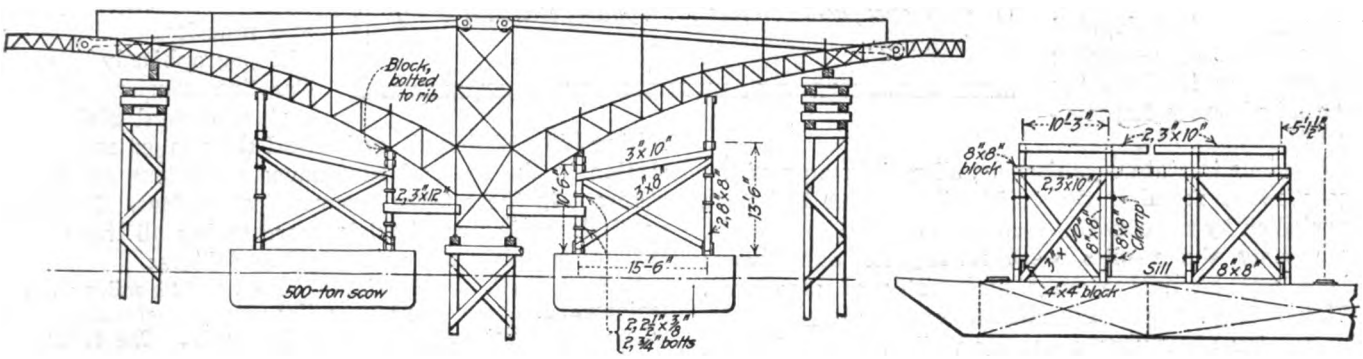
Belle Isle Bridge Steelwork Placed by Floating

Umbrellas for Concrete Cantilever Spans Assembled on Pile Bents Near Shore and Moved to Place on Scows

CONSTRUCTION work on the steel and concrete cantilever-arch bridge of the city of Detroit, connecting the mainland with the city park on Belle Isle, has been in progress since last fall, and a number of the concrete piers have been completed by the contractors, Greiling Bros. The Wisconsin Bridge & Iron Co., contractor for the steel ribs, has begun erection, and several of the umbrellas, consisting of the adjoining halves of two spans, have already been set in place. In this work the interesting expedient of assembling the umbrellas near shore, at some distance from the site, and floating them to the bridge by scows has been adopted, by which means all questions of falsework at the bridge site are eliminated.

As described in *Engineering News-Record* of March 17, 1921, p. 452, the bridge is about 2,200 ft. long over all and consists of arch-shaped spans of lengths 74 ft. to 135 ft. center to center of piers, with rise ranging up to about 25 ft. for the longest spans. Each span consists of two cantilever arms and a short suspended span in the middle. The steel framework, of the general arrangement shown in the sketch herewith, is proportioned to carry its own weight and that of the forms and concrete of the ribs, while the load of the deck structure, pavement, and traffic will be resisted by joint action of the concrete and the steel.



SUPPORTS FOR ASSEMBLY OF BELLE ISLE BRIDGE STEELWORK AND ARRANGEMENT FOR FLOATING

For assembly of the steelwork, the contractor secured the use of a small portion of the upper end of Belle Isle. The steel is received by rail at a gravel dock on the Detroit side of the river, where a self-propelling derrick running along the dock is available for transferring it to barges. A derrick set up at the assembly yard here unloads the barges and stores the steel.

A unit or umbrella comprising the steel tower over a pier and the two abutting half ribs is assembled on pile bents as indicated by the heavy lines in the sketch. The tower is first set in place on the central pile trestle, and is bolted up complete with its bracing. Next, the preassembled half ribs are swung to place individually, connected to the tower, and supported near their outer ends on the outer falsework tower. The latter was built low enough to take the smallest span, and blocking is used to make the proper height for the longer spans. The eyebar backstays are then connected by their pins on the tower end, and when all in place are connected pair by pair at the outer pins. Finally the deck framing and bracing are placed and bolted up and the unit is ready for floating to the site. All the work at this stage is bolted, no riveting being allowed at the assembly yard under the order of the engineers, Esselstyn-Murphy, of Detroit.

For floating to the bridge site, two 102-ft. scows are placed transversely under the haunches of the half arch ribs. Two sets of adjustable bents on each scow form a support for blocks bolted to the ribs. The scows are flooded sufficiently to give a lift of about 3 ft. When placed under the ribs they are fitted to bearing against the steelwork by raising the adjustable bents and clamping them in position, and then the scows are pumped out. As soon as the steelwork comes to bearing, small posts are put under the adjustable sections of the bents to take the load, and then the pumping is continued until the scows lift the steel clear of the falsework.

After a two-scow unit is floated to the bridge site, it is swung around above the pier on which it is to be set and permitted to float down slowly with the current under control of the tug and tag lines until the steel tower is directly over the anchor bolts. The unit is then settled slowly into place by flooding the scows, one end being allowed to go down somewhat ahead of the other to facilitate the entering of the anchor bolts. As soon as the steel is landed the scows are sunk clear, pulled out from under, and pumped out for return to the assembly yard for the next unit.

The scows are flooded by pumping water into the compartments with gas pumps, of which one is provided on each scow. Three-inch natural siphons assist in the early stages of the work. Unwatering is done by means of the gas pumps.

The units of steelwork range from about 100 to 230 tons in weight. It is found an easy matter to assemble, float, and land two units in ten days. For this rate of working four men are required on the assembly work and a small gang is taken from the work at the bridge to assist in landing the steelwork on the piers.

Italy to Spend Large Sum on Railroads

It has been recently announced that the Italian Government in the next four years will spend 1,750,000,000 lire for state railway renewals and replacements that were deferred by the war and by the difficulties encountered since. Of the sum to be expended, 450,000,000 to 500,000,000 lire have been allotted for shops, buildings, and repairs to the line. At the instigation of the Treasury Ministry, the government, in electrifying the railways or improving them extensively, is inclined to take much of the material and equipment needed from Germany by way of reparations.—*Commerce Reports.*

view that the engineer is necessary to a large construction job, and that his responsibility and supervision should attend upon the job throughout, until its completion, at which time he is capable then of certifying the safety and adequacy of the construction. Sound practice in this respect should be enforced by the society, and the society should also set up a sub-committee to deal with problems arising in construction relations and gradually build up a code of practice. Lewis D. Rights, contracting engineer of the Shoemaker-Satterthwait Bridge Co., reviewed the change in commercial conditions in the structural field, from design by fabricating companies to design principally by independent engineers, and pointed out that the manufacturers desire generally to eliminate engineering service from their work and confine themselves to construction. He opposed the French resolution, however, on the ground that the responsibility for the structural safety of a building should rest upon the owner, not upon the engineer. He moved that the resolution be referred to a sub-committee of three for report. This proposal was adopted by the meeting. Another suggestion made in the course of the discussion, to the effect that the owner of any building under construction should be required to give bond for its safety, so that bonding interests would undertake the determination of safety, was not acted upon.

At the same meeting an interesting sketch of the Alsatian Rhine navigation canal project was presented by M. Antoine, an engineer of the French Government. This project, which has been in existence in some form for twenty years or more, has recently acquired definitive status by an international agreement of the states bordering on the Rhine. In connection with the navigation improvements which this canal will bring about, nearly half a million horsepower will be developed.

Motion pictures illustrating the Catskill aqueduct were shown as an introduction to the meeting. The section has adopted the plan of opening each meeting with motion pictures, to bring about an early gathering and thereby make is possible to terminate the meetings earlier in the evening.

Roads Bureau College Planned

The establishment in Washington of a Bureau of Roads College, somewhat along the lines of the Army War College, is regarded by Thomas H. MacDonald, Chief of the Bureau of Public Roads, as a desirable step to keep practising highway engineers abreast with progress in the art. The college would be planned so as not to conflict with established educational institutions. It would not be a post-graduate school. The idea is to provide short courses largely for the benefit of experienced engineers. There is ample opportunity, Mr. MacDonald thinks, for more work on the scientific side of road building. The study of the physics of road building materials is not keeping pace with the science of their application. For that reason Mr. MacDonald attaches importance to the arrangements already made for a series of lectures by Dr. W. A. Patrick of Johns Hopkins University on the physical chemistry of the colloids. These lectures will constitute a part of a series arranged by the Secretary of Agriculture.

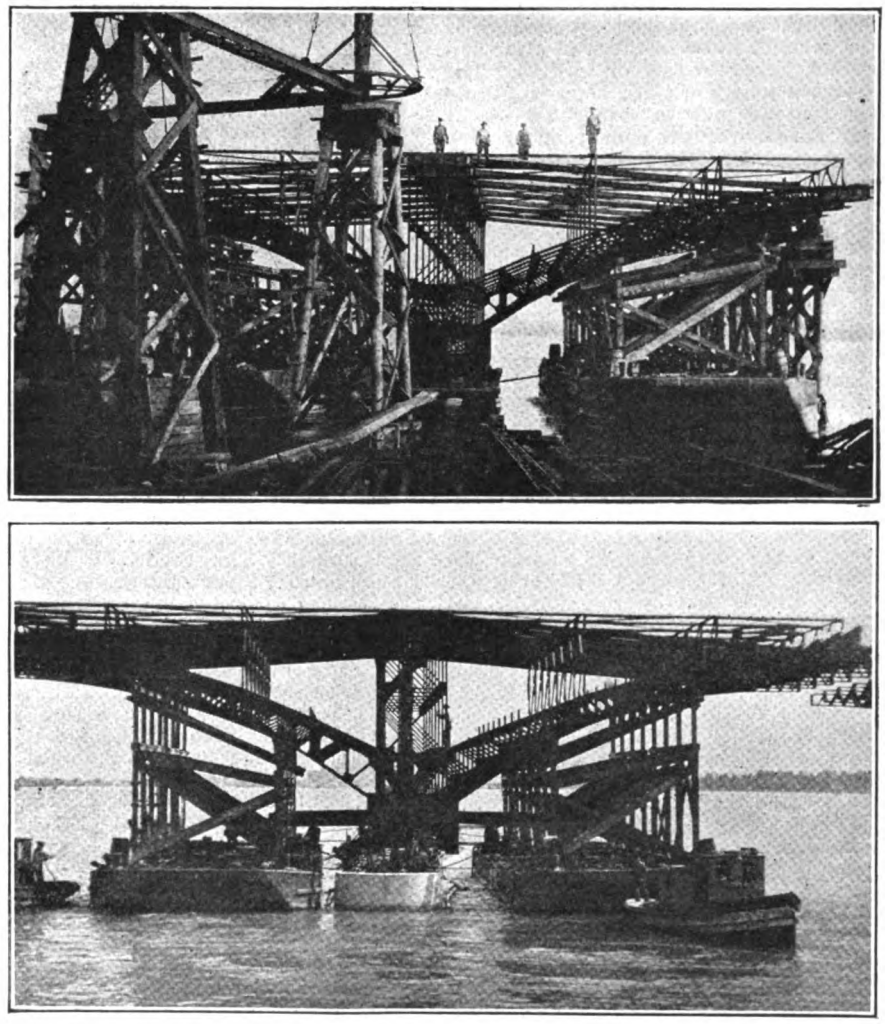
New Canadian National Board Appoints Executives

The first meeting of the new Canadian National Ry. board of directors was held Oct. 10, when Major Graham Bell, Deputy Minister of Railways, was appointed vice-president. S. J. Hungerford, who has been vice-president and operating general manager of the Canadian National lines (not including the Grand Trunk) was formally appointed vice-president and general manager of these lines. Both these appointments are temporary, pending the coming of Sir Henry Thornton from England.

W. D. Robb, vice-president and general manager of the Grand Trunk, has appointed D. E. Galloway as assistant vice-president of the Grand Trunk System; C. G. Bowker, operating manager on lines east of the Detroit and St. Clair Rivers; and C. Manning assistant manager on the same lines. Mr. Galloway was appointed assistant to the president in 1911 and occupied that position for several years.

Would Consolidate Colleges in Canadian Maritime Provinces

A proposal has been made to consolidate all the colleges in the three Canadian maritime provinces in one federated university. This would include the engineering schools conducted by the colleges. At present, the following maritime province educational institutions have engineering schools or departments: Dalhousie University, Halifax; University of New Brunswick, Fredericton; St. Francis Xavier University, Antigonia; Mount Allison University, Sackville; St. Dunstan's University, Charlottetown; Nova Scotia Technical College, Halifax; Acadia University, Wolfville; and King's College, Windsor. The proposal for one big engineering school has been received with favor by many of the graduate engineers of the maritime provinces although there has been exhibited a difference of opinion over the advisability of discontinuing such long established engineering schools as that of the University of New Brunswick.



NOVEL STEEL-ERECTION METHOD USED AT BELLE ISLE BRIDGE

As outlined in *Engineering News-Record* of July 27, p. 149, an interesting floating-in procedure is followed in placing the steel frames of the arch-shaped cantilever spans of Detroit's monumental concrete bridge which will cross the west arm of the Detroit River to connect with the public park on Belle Isle. Each unit comprising two half-cantilever frames and the pier tower from which they spring is erected on shore, some distance away from the bridge site, where falsework for supporting the arms is provided. Then two scows carrying adjustable timber bents are floated under the arms (upper view), are pumped out to raise the steel frame off the falsework, and are then towed to the bridge, where the steelwork is easily lowered to its seat on the pier by flooding the scows. In the lower view the frame is seen approximately over the pier, being pulled to correct position by mooring lines. The work is being done by the Wisconsin Bridge & Iron Co. under the direction of Esselstyn-Murphy, engineers.

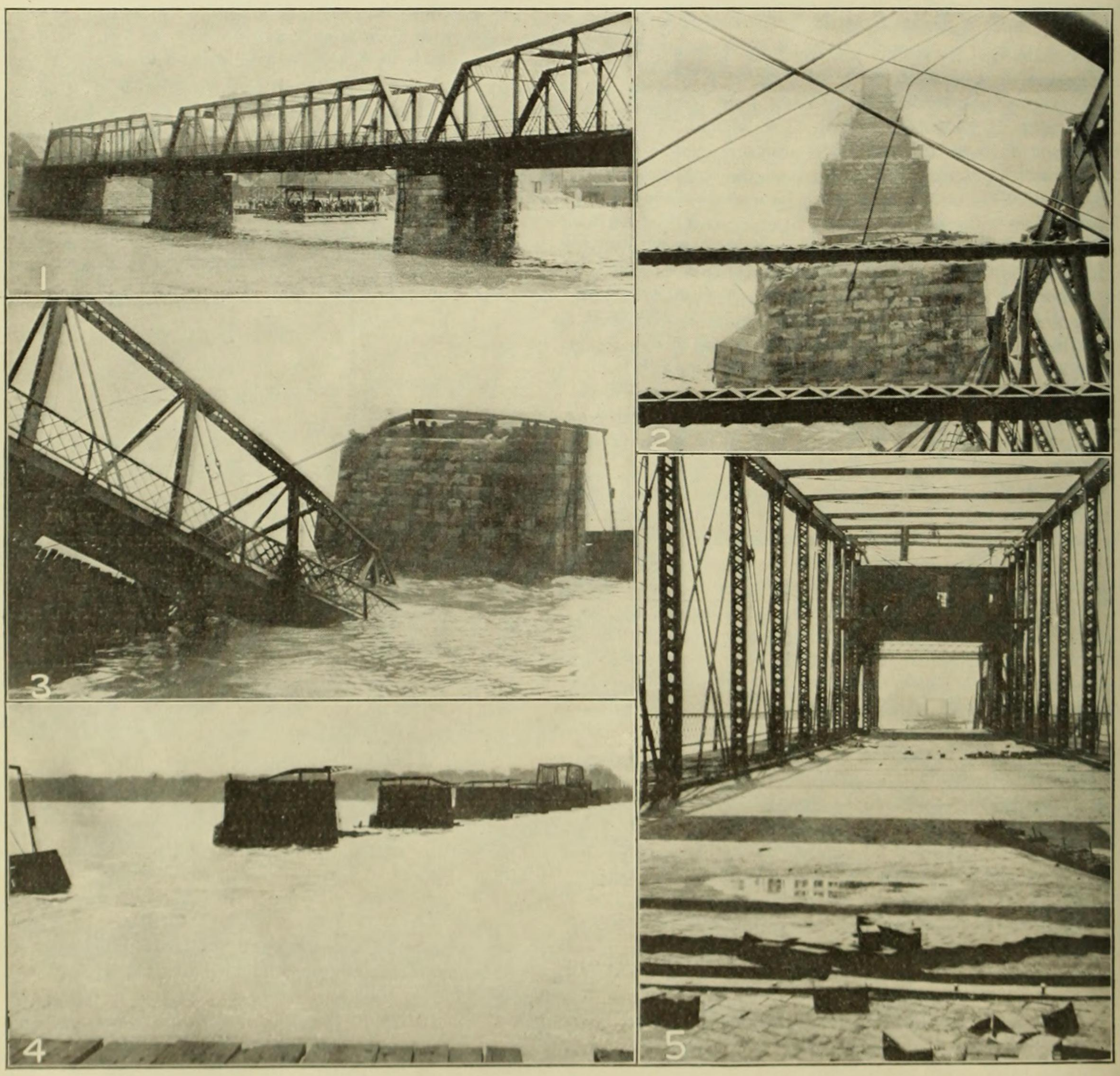
News of the Engineering World

Bridge-Floor Fire Destroys Detroit-Belle Isle Bridge

On Apr. 27 a fire in the creosoted-wood floor system of the iron truss bridge between the mainland at Detroit, Mich., and the city's park of Belle Isle completely wrecked ten spans and half of the drawspan. As shown in the accompanying views, most of these spans were so buckled and weakened as to cause their collapse into the river. The bridge, completed in 1889 at a cost of $325,000, was made up of 12 wrought-iron through-truss pin-connected spans, 156 ft. each, a 318-ft. swingspan and pony-truss approaches. Its total length was 2543.6 ft.

The floor system consisted originally of wooden stringers and plank flooring, but in 1906 this was changed to heavier stringers supporting 4-in. creosoted planks, on which were laid 3½-in. creosoted blocks across the 24-ft. roadway. Plank walks 9 ft. wide were supported on brackets outside the trusses.

During a stiff southerly wind, on the afternoon of Apr.



FIRE DESTROYS DETROIT-BELLE ISLE BRIDGE

(1, Two spans and part of drawbridge span at Detroit end still standing. 2, Looking over burned spans toward island. 3, Fallen south end of drawspan. 4, Bare piers, looking toward island; single remaining span in distance. 5, Looking through drawspan toward island, showing type of floor.)

27, a city tar-wagon passing from the island to the mainland probably dropped hot cinders from its ashpan, which must have landed in the cracks in the wooden curbing in several places, as the fire was first discovered under the drawspan and next under the island end of the main through spans. The floor burned very quickly. Attempts to extinguish the fire by bucket were futile. When the fire was first seen there were several motor cars and many pedestrians on the bridge. So rapid was the spread of the conflagration that a number of persons had narrow escapes from between the two evident fires. An effort was made to fight the fire from fireboats, but little progress was made, mainly on account of the difficulty of reaching it through the dense smoke from the creosoted wood. The shore apparatus managed to save the two spans nearest the mainland.

Trusses 1 and 2 at the Detroit end are still on their piers. The adjacent half of the drawspan is in position, but in very bad condition. The south half of the draw buckled at the center and fell into the river. The three short spans at the island are also in position, as is one of the 156-ft. trusses near that end.

Most of the steelwork is at present submerged, but the few broken ends of lower-chord members exposed show a reduced cross-section and considerable elongation, indicating that more heat was generated than one would expect to find in such a fire. The piers are built of good-grade limestone, and the amount of spalling and cracks near the top give further evidence of the heat generated.

The city is now making arrangements for the immediate building of a pile bridge at a temporary site, to be finished June 15, and at a special election the bond issue for a new bridge will doubtless be voted. At the April election a bond issue to replace the old bridge or to build a new one of greater capacity further up river failed to carry. A design for this new bridge, to be of reinforced-concrete arches, has been made by Barclay Parsons & Klapp, of New York City.

Waterproofing the Eden Park Reservoir, Cincinnati, Ohio

A contract for supplying waterproofing material for continuing the efforts to make the Eden Park reservoir at Cincinnati, Ohio, water-tight has been signed between the city and the Minwax Co., Inc., 18 E. 41st St., New York City. The reservoir is an old one. A few years ago leaks were disclosed and a lining was put in by contract. This did not prove to be tight and later repairs have not made the job satisfactory. The exact method of applying the new waterproofing material has not yet been made public. J. A. Hiller is General Superintendent of Water-Works at Cincinnati and J. B. Gardner is Secretary of the Minwax Co.

The Chicago Union Station

Preliminary work has been commenced for the construction of the new Union Station at Chicago, to take the place of the old station at Adams and Canal St., now used by five of the railways entering the city. The main passenger building, 300x400 ft., will occupy the block bounded by Adams, Jackson, Canal and Clinton St., a subway 100 ft. wide running east under Canal St. to a train concourse 175x250 ft. extending between two groups of stub tracks. There will probably be 10 tracks for lines at the north end and 15 for those at the south end of the station. A pair of through tracks will provide for interchange or transfer movements, and there will be extra tracks for baggage, mail and express service. The track level will be lowered slightly, being kept high enough above the water level of the river to insure sufficient drainage. The cost of the terminal, including land and construction, is estimated at about $60,000,000.

The new freight terminals will extend from Harrison St. south to 16th St., and will occupy most of the space between Canal St. and the river. The Chicago, Burlington & Quincy freight terminal will front on Canal St. (with a freight house between Harrison and Taylor St.), and the Pennsylvania Co.'s terminal will be between this and the river. The latter company will build a freight house fronting on Stewart Ave. and extending from Polk to Taylor St. The freight tracks will be about 4 ft. below the present level (which is approximately at street level). The streets will be raised to about the level of the bridges over the river, and Canal St. (forming the western boundary of the site) will be raised to the same level.

In planning its new terminal the Pennsylvania Co. originally proposed an independent freight terminal between Van Buren, Polk, Jefferson and DesPlaines St., west of the passenger station. This was to be approached by an elevated branch line, having inclines to reach surface tracks (as well as the upper tracks) in the terminal. This project was strongly opposed by the city as unnecessarily extending the already excessive area occupied by terminals and forming an additional barrier to the westward growth of the business district. The opposition was so strong that the railway company abandoned the project.

For the new passenger station and terminal the Union Station Co. has been organized, representing jointly the Pennsylvania Co. (in the majority), the Chicago, Burlington & Quincy R.R., and the Chicago, Milwaukee & St. Paul Ry. The Chicago & Alton Ry., which uses the present station and will be a tenant of the new one, is not included in the owning company.

The construction is in the hands of the Pennsylvania Co., under Thomas Rodd, Chief Engineer of the Pennsylvania Lines (Pittsburgh, Penn.) and also Chief Engineer of the Union Station Co. J. D'Esposito, Assistant Engineer, Pennsylvania Lines, is in general charge of the work. The architects are Graham & Burnham, of Chicago. The Pennsylvania Co. has let two contracts—one for clearing the site for its new freight house, to P. T. Clifford & Sons, of Valparaiso, Ind.; the other for the construction of the temporary freight house, to the Sumner Sollitt Co., of Chicago.

Fire Sweeps Colon, C. Z.

A fire on Apr. 30, starting in the telephone exchange of Colon, C. Z., was swept by a high wind toward the Cristobal section of the city. Here 12 buildings were dynamited in an effort to stay the flames. The conflagration cost the lives of 11 persons (no Americans) and 7000 persons were rendered homeless. The property damage is reported to exceed $3,500,000. The United States Commissary depot—the largest building on the Isthmus—was destroyed, as were also the buildings of the Panama Banking Co. and the International Banking Corporation.