Recommendations and General Plans

for a

Comprehensive Passenger Subway System

for the

City of Chicago

Made and Submitted to

Honorable Fred A. Busse, Mayor

and

Honorable Milton J. Foreman, Chairman

and the

Members of the Committee on Local Transportation

of the

City Council of the City of Chicago

By
BION J. ARNOLD
January, 1911

Members of the Committee on Local Transportation of the City Council of the City of Chicago

ALD. MILTON J. FOREMAN, *Chairman.*

ALD. JOHN P. STEWART,	ALD. JOHN A. RICHERT,
ALD. CHARLES M. FOELL,	ALD. JOHN S. DERPA,
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ALD. MATTHIAS A. MUELLER,	ALD. JAMES R. BUCKLEY,

H. H. EVANS, *Secretary.*

LETTER OF TRANSMITTAL.

CHICAGO, Jan. 31st, 1911.

Honorable Fred A. Busse, Mayor, Honorable Milton J. Foreman, Chairman, and the Members of the Committee on Local Transportation of the City Council of the City of Chicago.

GENTLEMEN:

Complying with the commission entrusted to me when appointed as Chief Subway Engineer for the City to formulate working plans and recommendations for a comprehensive subway system for the City of Chicago, I have the honor to transmit herewith plans and recommendations, which I trust will be found sufficiently comprehensive to meet with your approval and that of the citizens of Chicago in general.

No attempt has been made to show in this report the necessity for subways, for it is taken for granted that on account of the present congestion, at times, of the surface line cars and elevated trains in the business district, as well as the apparent demand for the removal of the elevated loop structure, that subways are desired regardless of whether they can be justified from a financial viewpoint or not.

My recommendations are for the adoption of a plan which will form the nucleus of a comprehensive subway system for the entire city, constantly tending to enlarge the present business district, capable of gradual development and of unlimited expansion, involving no grade crossings, no grades except where necessary to pass under the river and to avoid grade crossings and few, if any, intersecting switching points, and also to begin the construction of such a system with a reasonable investment at first, which initial investment need not exceed the amount now available by the city for subway construction.

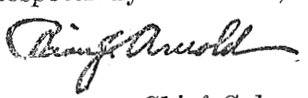
These recommendations are made by the writer after having studied the transportation problem of Chicago for nearly a decade, always keeping well in mind the city's probable future growth and the absolute necessity for the expansion of the business district.

Plan No. 1, as shown in its developed state on Map No. VII, seems to me to best fulfill these conditions and, if a subway is to be built, I recommend its construction in the steps, or stages, set forth in the report and as shown on Maps I, II, III, IV, V, VI, VII and VIII.

Full information regarding foundations, underground utilities, occupancy of sub-sidewalk space, character of soils, and other difficulties which would be encountered in the construction of subways in the present business district, has been compiled, but it has not been thought best to go to the expense of preparing full detailed construction plans for the various subways discussed until it has been definitely decided by the city just what part of the subway system will first be built. It has, however, been necessary to prepare many general and detailed plans in order to reach the conclusions submitted herewith and in preparing these plans the exhaustive information relating to the above subjects embodied in the report of your committee compiled under the direction of City Engineer John Ericson, by the late Thomas T. Johnston and his assistants, several of whom have been retained by me on this work, has been of value and has been freely used.

Plans are ready for the construction of the first step outlined, and specifications and detailed drawings can be prepared so that contracts could be let for this portion of the subway within sixty days from the date that authority is given to proceed with the work.

Respectfully submitted,



Chief Subway Engineer.

GENERAL STATMENT OF PROBLEM

AND

DESCRIPTION OF PLANS

FOR A

PASSENGER SUBWAY SYSTEM

FOR THE

CITY OF CHICAGO

The problem of preparing working plans at the present time for a subway system for the City of Chicago is especially difficult, not only because of the physical difficulties introduced by the existence of the present Illinois Tunnel, consisting of about 60 miles of freight tunnel, which, in general, is but 33 feet below the surface of the streets, thereby almost prohibiting the building of a comprehensive subway system between this tunnel and the surface of the streets without introducing the dangers incident to the use of grade crossings, but also from the further fact that the policy of the city is not yet settled as to the method of financing subways. Some of the citizens of Chicago advocate the construction of municipally owned subways, independent of the present traction companies, while others seem to be in favor of granting ordinances for the construction of privately owned subways, also independent of the present traction companies. A further complication is introduced by the traction settlement ordinances of February 11, 1907, under which the surface lines are operating, having a provision whereby the surface line companies are required, upon the de-

mand of the city, to furnish money toward the construction of subways, provided, however, that these companies have the full use of the subways so constructed, up to the capacity that they require, and the advocates of the municipally owned subways oppose the acceptance from the surface line companies of any money for the construction of subways.

Necessary to design two plans

With the above facts in mind, in order to produce plans which will meet all reasonable and fundamental objections likely to arise during the discussion and final determination of the city's subway policy, as well as the engineering and operating conditions which will be imposed upon a subway system when built, it has seemed necessary to prepare plans for two distinct systems but to recommend the one which seems the better on the theory that the policy of the city should be made to fit the better plan, although leaving the city free to adopt the other plan if this theory proves incorrect and the plan recommended cannot be put into practice.

Plan No. 1 for a Comprehensive Subway System for surface, Elevated and Subway Cars

Plan No. 1 is for a high speed, comprehensive system, designed to ultimately cover the entire city, in which could be operated high speed and local trains, independent of any of the present traction companies. This system could be built by the city or by private capital, without the use of any money from the present surface line companies, or by utilizing this money if the city decided to do so. Upon the tracks of this subway could at first be run the present surface line cars, later the trains of the present elevated roads, and finally, when extended, the trains of a high speed comprehensive subway system covering the entire city, thus making it possible to promptly relieve the present surface line congestion at moderate cost by constructing

only a portion of the system at first, and later to eliminate the entire present elevated loop structure, if conditions should come about so that this could be accomplished, and at the same time have the nucleus of a high speed subway system, which could be extended from time to time, as conditions warranted, until it covered the entire city, approximately as shown on Map VII. This plan, for convenience to the general public and from an investment and operating viewpoint, would be the most economical plan to adopt, and is shown in its progressive steps, or stages of construction, on Maps I, II, III, IV, V, VI, VII and VIII, which will be described more in detail hereafter.

Plan No. 2 for a Surface Car System

Plan No. 2, shown on Map VIII, is for a system designed to be used exclusively by the surface line cars for the relief of present congestion in the business district, utilizing the existing tunnels under the river, and so located that it would not interfere with the ultimate construction of the high speed subway of Plan No. 1. Under this plan the city could allow the surface line companies to construct a subway system, suitable for surface cars, with their own money, or call upon the present surface line companies for the money defined in the ordinances, and construct it jointly with them, or not as it saw fit. Since the system is located upon streets which would not be necessary in the construction of the system outlined in Plan No. 1, the city's interests would not be jeopardized for the ultimate construction of a future independent high speed subway. Should it be decided to construct at present under Plan No. 1 and the requirements of the future make it necessary to have additional terminal subways in the present business district, Plan No. 2 could then be utilized.

Basic Considerations

Fundamentally, no subway plan should be adopted involving any system of loops, or other methods of construction, which will prevent the building of a high speed subway system ultimately covering the entire city, through which high speed trains could be run, for no extensive subway system can be justified from an investment viewpoint unless it is so designed that ultimately high speed trains each having a capacity of not less than 10 of the present elevated cars could operate through it at times of maximum traffic, as it is only by this method that the cost of operation per car mile of such a system can be brought low enough to justify the heavy investment necessary for long distance subways, and take care of the high fixed charges necessitated in their construction. This does not mean that, aside from financial reasons, it is not advisable to construct at once enough subway in the business district to relieve the present congestion of surface and elevated cars, but it does mean that the ultimate plan to be kept in mind in analyzing the transportation problem of the City of Chicago should be one that will lead toward securing a transportation system that no matter how owned will eventually gather the passengers by means of surface line cars and deliver them to high speed subway or elevated trains which, in turn, will bring them to and through the business district, to whatever extent it may be expanded, in economically and safely operated heavy, high speed trains, stopping infrequently, in order that high average speed may be made, with the intermediate points between these stops served by the present surface line cars or local elevated or subway cars. In such a system the elevated lines would serve the same purpose as subways for such territory as they occupy, if operated into and through the present and future congested business district in subways.

Principles

The principles upon which such a subway system should be constructed are as follows:

First. Through operation from the southern termini to the northern termini, wherever they may be located, and vice versa, upon as straight tracks as practicable, on one or more of the following streets: Michigan avenue, Wabash avenue, State street, Clark street, Fifth avenue, Halsted street, Western avenue, etc., as the future may demand.

Second. Similar east and west subways, with the grades separated where they cross the north and south subways, located, to start with, say, on Madison street, and eventually upon such other east and west streets, north and south of Madison street, as future conditions may demand, utilizing, however, at once certain of these streets in the present business district for loop terminals for the present west side surface and elevated cars, but so arranged that the subways so used may finally be used for future subway cars.

Third. These north and south and east and west subways eventually to be supplemented by diagonal subways upon Milwaukee avenue, Blue Island avenue, Archer avenue and such other diagonal streets, as the future may determine best to locate subways upon.

Since the city extends in three directions only it is necessary to return to the west side some of the cars coming from that side, by reversing their direction, either by means of stub end or loop terminals. This is accomplished in the plan under consideration by loop terminals in preference to stub end terminals, for by the loop method continuous operation is permitted with the corresponding increased capacity and speed, and the elimination of danger in operation.*

(*Note: See Appendix "A"—Map No. VII, for suggested streets under this general plan.)

The east and west subways (with the exception of the one on Randolph street which must run at high level east of the south branch of the river in order to allow the north and south subways to pass under the river at grades not exceeding those of the west side subways) after once having descended to come under the river should remain down and pass under the north and south subways in the present business district, although west of the south branch of the river, the east and west subways could be constructed as high level subways, but dipping to allow the Halsted street and Western avenue subways, or such other north and south subways as may be constructed upon the west side prior to the construction of the east and west subways, to pass over them. In case the east and west subways on the west side of the river are constructed first, the north and south subways should dip at intersecting points.

In such a system no particular business district would be given any permanent advantage, or any advantage which the natural expansion of the system would not rectify, over any other business district, for the present business district, and ultimately the entire city, would be gridironed with subways located at approximately equal distances apart, north and south, and east and west, varying somewhat with the density of population, intersecting each other at right angles, except where the diagonal subways were constructed, and thus not only tend to extend the present business district north, south and west, by the elimination of loops, except for the terminals of the west side system, but also make it possible for passengers to go, upon high speed trains, operated upon

straight and practically level tracks, without grade crossings or switches, from any point in the city to almost any other point in the city with but one transfer, and in most cases without transferring at all. Such a system can be constructed and operated more economically and involves less risk in operation than any other subway system suitable for Chicago conditions, and it therefore possesses the elements, so far as a subway system can, by keeping the investment for good construction to a minimum, of enabling the city to retain its present One-City-One-Fare system, whatever that fare may be, and at the same time makes it possible to adopt the universal transfer system, without injustice to anyone, within the district between Twelfth street, Halsted street and the Chicago River, within which district the present surface companies are now exempt by ordinance from issuing universal transfers until the construction and operation of subways.

By this system all west side passengers can be carried, without transferring, directly to the lake front, if desired, or, by transferring once, to any north or south point of the city served by the subway system. Passengers from the north and south sides can be carried northward and southward throughout the entire length of the city, without transferring, and, by transferring once, to any western point served by the subway system. If this system were supplemented by the extension of future subways in 22d street, 12th street, Washington street and Chicago avenue to the light house docks shown in The Commercial Club's Plan of Chicago,* when it is carried into effect (See

*By Daniel H. Burnham and Edward H. Bennett.

Map VII) and also by the depression of the streets upon which are now located the present stub end surface car line tracks between Grant Park and Jackson Park, such as 18th street, 22d street, 31st street, 39th street, 43d street, 47th street, etc., the present surface line cars could be carried through under the Illinois Central tracks to the lake front, and thus not only remove from the surface of these streets, at these points, the objectionable terminal yard movement of cars now necessary, but also enable all passengers to be carried directly to the lake front, and thus aid in restoring to the citizens the use of the beaches of this part of the city.

Through Routing under Plan No. 1

Plan No. 1, as recommended, provides through routing from the northern part of the city to the southern part of the city and vice versa, as well as from some of the east and west streets and the diagonal subways, and some of the north and south subways, but makes no attempt at universal through routing, by means of too many "L"* routes which are possible and practicable upon the surface with cars operating at moderate speed, for to do so introduces expensive complications in construction and dangers in operation which do not seem necessary or wise. The plan does, however, as thus far outlined, make limited through routing possible, brings the west side citizens to the lake front without transferring, and gives to all passengers the advantage of the universal transfer in numerous sheltered stations, thus tending to relieve the congestion which would occur if this transferring took place at few stations, and eliminates not only the reduction of capacity of the system, but also the delays and dangers incident to the

*Meaning routes branched off at right angles.

use of curves, grades and switches which would be involved in an attempt at universal through routing. It should be clearly understood, however, that Plan No. 1, as recommended, does not prevent the necessary connections being made now or in the future for the establishment of many through routes, if during construction or after the subways are built it should prove desirable or necessary to have them, but the advantage of universal through routes, when the safety and extreme flexibility of the system without them are considered, do not seem sufficient to warrant the reduction in capacity of the system and the expenditure of money necessary to accomplish them underground.

General Design of Subway Structure

In order to make it possible to adopt such a system much consideration has been given to the question of a proper design for the subways to be constructed in the different streets of the city, and great difficulty has been encountered in adopting a design which would give capacity, safety and clearance sufficient to enable cars as large as the present elevated cars to pass through the subways without necessitating grade crossings or greatly interfering with the present structure of the Illinois Tunnel Company. It was deemed advisable that the passenger subways should be built to accommodate, at all points, the present elevated cars, so that if in the future it should seem best to change the routing of these cars from that at present contemplated, or to bring the cars of interurban railways in over the present elevated structures, or through future subways, the subway system could receive such cars and allow any method of operation that might at that time seem best. Since these elevated cars are but slightly larger than the present

standard surface cars which probably must be operated in the subways the increased cost of making the subways large enough to accommodate the elevated trains is small and this objection is more than balanced by the advantages gained by so building them.

After considerable planning and by adopting reinforced concrete steel construction and in some instances combination I-beam and concrete construction, designs have been developed which if followed will permit the construction of bores of sufficient size to allow such cars to pass through them, and not seriously interfere with the structure of the Illinois Tunnel Company, although at certain points this latter structure will have to be slightly changed. The general design adopted is one which permits a shallow construction for the high level subways, allows sufficient room for the low level subways to pass under the high level subways and over the Illinois Tunnel Company's structure, and also allows the low level passenger subways to be placed almost as close to the surface of the streets as the single-decked subways of other cities where mezzanine floors are used for the distribution of passengers to the trains.

Method of Procedure

If Plan No. 1 is adopted, and on the assumption that the first use of a subway system will be for the present surface line cars, keeping well in mind the necessity of utilizing the money already expended upon the present river tunnels, and of keeping the investment in subways as low as practicable on the start, in order not to unnecessarily over-capitalize the present surface line companies, in case they are required to furnish money toward the construction of subways, or burden the city with an unnecessary investment in case it constructs them, the following method of building the system is recommended:

This method of procedure contemplates the utilization of the present river tunnels until such time as the demands upon the subway system necessitate the construction of other tunnels to supplement them.

First Step—See Map I.

North and South Service

In order to accommodate the north and south bound surface cars, and relieve the congestion upon Clark street, which is the street most in need at present of such relief, and in which under the plan may eventually be placed four subway tracks, it would be advisable to construct at first a two-track subway, so located that two additional tracks could be added when needed, and connect the tracks now constructed with the south end of the La Salle street tunnel, already built for such a connection. From the south end of this tunnel the two tracks at first constructed could proceed southward in La Salle street, rising from the present tunnel terminal on a 5% grade, and reaching the high level grade at Washington street, in order to clear a low level east and west subway which the future may require in Washington street; thence south in La Salle street, at high level, to Madison street; thence east in Madison, at high level, to Clark; south in Clark, at high level, to Archer avenue, where its southern portal would be located at present. Inasmuch as this terminates in a railroad district now well served by the Clark street surface cars, this subway could turn east in Polk street, at high level, to Custom House Place or Plymouth Court; thence south at high level to Fourteenth street, thus opening up a new artery into the downtown district, if either of these streets could be made available.

The construction of the Clark street subway described would at once give an underground artery

through the business district, upon which the surface line cars could be operated at high speed, thus tending to cut down the running time of all the north bound and south bound surface cars that might be run through this subway at present and if Custom House Place or Plymouth Court is now utilized the subway placed in either of them would ultimately become a part of Plan No. 2 hereinafter described and at the same time leave Clark street free for the extension of the subway in this street north or south at any time to become a part of the comprehensive high speed system under Plan No. 1.

For estimates of cost see page 28.

East and West Service

In order ultimately to take care of the elevated lines from the west side, and eventually high speed subways from the central business district to the western division of the city, the plan calls for the construction of subways upon four of the east and west streets in the present business district, viz: Randolph street, Madison street, Jackson boulevard and Harrison street, and later, upon Chicago avenue and Twelfth street, and eventually upon other east and west streets, located to the north and south, as well as additional north and south streets, as suggested in the general list of streets in Appendix A which locations future conditions might modify, but would not affect the location of the first subways in the business district.

West Side Surface Cars Passing Through the Washington Street Tunnel

To facilitate the movement of west side surface cars at present and also to invest such money as is at first expended for subways and have them located so that they will ultimately become part of the permanent high speed subway system, and at the same time be placed in streets where the first high speed west side subways will most likely be needed, a single

track connection could be made (See Map I) at a suitable point, with the existing south track in the east end of the present Washington street tunnel, as this tunnel is now constructed in such a manner as to become part of the future subway system; thence ascending in Washington street with this track on a 5% grade to and curving into Franklin street, and proceeding in the east side of this street at low level to Madison street; thence curving into and continuing eastward in the south side of Madison street at low level to Wabash avenue; thence rising on a 2% grade to and curving into the west half of Michigan avenue to a grade suitable for the mezzanine floor stations hereinafter described; thence continuing south in Michigan avenue at this grade to Jackson boulevard; thence curving west and continuing in the north side of Jackson boulevard downward on a 2% grade to Wabash avenue; thence west in the north side of Jackson boulevard to Franklin street, thence curving north in the east half of Franklin street and rising on a 2% grade at Adams street to a level corresponding to the grade of the tracks at the mezzanine floor stations in Michigan avenue hereinafter described; thence continuing at this grade to Monroe street; thence descending a 2% grade to Madison street, where it swings into the west half of Madison street and descends a 5% grade to Washington street; thence crossing under the south track, curving and continuing at this level in Washington street to the proper elevation for connecting with the north track in the Washington street tunnel, thence downward at the present established 3% grade and through the tunnel to the west. Thus a complete loop is formed for all cars passing through the Washington street tunnel.

West side Surface Cars passing through present Van Buren Street Tunnel

Beginning with a suitable connection with the south track in the Van Buren street tunnel, which connection is not now provided, thence ascending a 5% grade to Franklin street; thence north in Franklin street, continuing the 5% grade upward to low level in Jackson boulevard; thence curving and continuing east, at low level, in the north half of Jackson boulevard to Wabash avenue; thence rising on a 2% grade and curving north into the west side of Michigan avenue; thence continuing north in Michigan avenue at a level suitable for the mezzanine floor stations, as hereinafter described, to Madison street; thence curving into Madison street and descending on a 2% grade to Wabash avenue; thence continuing west in the south half of Madison street to Fifth avenue; thence ascending a 5% grade to Franklin street; thence curving into Franklin street and descending on a 3% grade to Monroe street; thence continuing at a level in Franklin street corresponding to the grade of the tracks at the station in Michigan avenue to Adams street; thence descending on a 2% grade to Jackson boulevard; thence descending a 5% grade to and curving into the Van Buren street tunnel; thence continuing downward on a 5% grade west and joining by means of a suitable connection with the present north track in the Van Buren street tunnel, thus forming a complete loop for all cars operating through the Van Buren street tunnel.

For estimate of cost of these loops see page 29.

When the tracks thus described in Franklin street, Jackson boulevard, Michigan avenue and Madison street become a part of the permanent system, no reconstruction will be necessary except the removal of some temporary curves and inclines in Franklin street at the intersection of Jackson boulevard and Madison

street with Franklin street, and interconnecting the two tracks in Franklin street by means of short pieces of straight track at these locations.

Location of Stations

Stations should be provided at present under this plan as follows:

One at Madison street, extending from La Salle street to Clark street, with entrances at each end. (See Plate 1.)

One at Madison street and State street, with entrances on each side of State street, having platforms extending to Wabash avenue, where entrances will also be provided on each side of the street. (See Plate 2.)

One at State street and Jackson boulevard, with entrances on each side of State street, having platforms extending to Wabash avenue, where entrances will also be provided on each side of the street. (See Plate 3.)

One at Jackson boulevard between Clark and La Salle streets, with entrances at each end. (See Plate 4.)

One at Franklin street, extending from a point near Adams street to a point somewhat north of Monroe street, with entrances at the center. (See Plates 5, 6 and 7.)

Mezzanine floor stations in Michigan Ave. for convenience of passengers and pedestrians

One at Michigan avenue, extending from Monroe street to Adams street, with entrances at each end, and so constructed as to allow the building of a mezzanine floor extending over the present and future tracks for the distribution of passengers. The adoption of this plan for stations in Michigan avenue would make it possible to construct broad sub-surface passageways or mezzanine floors of ample width at streets where subway stations may be located, viz: Randolph, Washington, Monroe, Adams, Van Buren, Congress,

and ultimately other streets to the south and north, as future subways are built. Pedestrians could then safely and quickly cross Michigan avenue, at any of these streets, below the surface, and thus avoid the dangers which now exist from crossing on the surface, due to the width of the avenue and the innumerable automobiles and other vehicles that are almost constantly passing. (See Plates 8, 9 and 10.)

The figures show the stations as they would be when completed, but it would be necessary to construct now only such parts of them as would be required to serve the tracks described.

Second Step—See Map II.

Possible to Remove Present Elevated Loop

When conditions have been brought about so that the trains of the present elevated railways can be run in subways, and at the same time continue operating surface cars through the Washington, Van Buren and LaSalle street tunnels, then in order to accommodate the elevated trains and also to make it possible to take down the present loop structure, the next step would be to construct a north and south 4-track high level subway in State street, from 12th street to Chicago avenue; thence west in Chicago avenue with two tracks at high level, so located that two additional tracks could eventually be placed in this avenue, to Franklin street, where a connection by means of an incline would be made upon private property with the tracks of the Northwestern Elevated Railroad Company and the other two tracks of the State street subway connecting at Chicago avenue with the present surface car lines. An inclined connection with the tracks of the South Side Elevated Railroad Company would also be made near 13th street by descending on its own right of way, thence swinging westward, partly

State Street Subway from 12th Street to Chicago Avenue

through private right of way and partly through 13th street to State street, then into the portal of the subway, while the other two tracks of the State street subway would be connected to the present surface line tracks in State street at 12th street. Upon the two east tracks of the four through tracks in State street would be operated the through route trains of the South Side Elevated and Northwestern Elevated Railroad systems, and upon the two west tracks would be operated, at present, the cars of the present surface line companies. These local surface cars could ultimately be replaced with high speed subway cars when the subway is sufficiently extended, and the surface cars provided for in other subways.

Chicago and Oak Park Trains Placed in Subways

Simultaneously with the building of the State street subway, connections should be made with the west side elevated systems by constructing a suitable inclined connection with the Chicago & Oak Park Elevated Railroad on private property in the vicinity of Sangamon street between West Lake street and West Randolph street, and the construction of a 2-track high level subway (the tracks of which, for convenience, will be described jointly regardless of the direction of traffic which is indicated by arrowheads upon Map No. II and described in Appendix B) from Sangamon street in the south side of West Randolph street to Clinton street, where it would descend under the river, on a grade not exceeding 3%; thence ascending on a grade not exceeding 3% to LaSalle street, keeping sufficiently low at Franklin street to pass under two tracks hereinafter described, to be located in Franklin street, and continuing at high level to Wabash avenue, thence descending on a 3% grade to Michigan avenue; thence curving and continuing south in Michigan avenue, from

Randolph street to Madison street, at a level suitable for mezzanine floor stations hereinbefore described; thence curving into and descending on a 2% grade to Wabash avenue; thence west at low level in the north side of Madison street to Franklin street, keeping sufficiently low, with grades not exceeding 3%, to pass under the two tracks already located in Franklin street under Step 1; thence west under the river on grades not exceeding 3% to Clinton street, thence at high level in the north side of Madison street to the previously mentioned connection of the Chicago & Oak Park Elevated Railroad in the vicinity of Sangamon street, thus forming a complete loop upon which the trains running over the tracks of this company could be operated.

Metropolitan West Side Elevated Trains Placed in Subways

Also connecting with the Metropolitan Elevated structure in the vicinity of South Peoria street, thence south on private property, with a suitable inclined structure to Harrison street, thence east in Harrison street with a 2-track high level subway (the tracks of which, for convenience, will be described jointly regardless of the direction of traffic upon them, which is indicated by arrow-heads upon Map No. II and described in Appendix B) so located in the north half of the street that two additional tracks may ultimately be placed in this street, through and under the river on grades not exceeding 3%, to LaSalle street, thence east with two tracks at low level to Wabash avenue, where they will ascend on a 2% grade to Michigan avenue, thence curving and continuing north in the west side of Michigan avenue, on a level suitable for the mezzanine floor stations hereinbefore described, to Jackson boulevard, thence curving into Jackson boulevard, and descending a 2% grade to Wabash ave-

nue, thence extending west at low level in the south half of Jackson boulevard to Sherman street, thence descending on a grade not exceeding 3% to clear tracks referred to in Step 1 located in Franklin street, and continuing west under the river, on grades not exceeding 3%, thence to the high level at Clinton street, and continuing west in the south half of Jackson boulevard, at high level, so that two additional tracks could eventually be installed in the north half of the street, to the vicinity of South Peoria street, thence south to the inclined connection to the Metropolitan Elevated structure previously mentioned, thus forming a complete double track loop for the trains of the Metropolitan system.

For estimate of cost of these loops see page 30.

Steps 1 and 2 Combined

Map III shows the system when Steps 1 and 2 have been completed and used for the operation of both surface and elevated cars, routed as described on pages 15 to 23 of this report and in Appendices B and C.

Step No. 3—Map IV.

When the capacity of the west side loops is reached, additional subway capacity for elevated or subway trains, through which could be operated additional elevated or subway trains from the present west side systems or future subway trains, can be provided by constructing a double track loop, beginning at the inclined structure at Sangamon street, previously described, thence east in the north side of Randolph street to Michigan avenue; thence south in Michigan avenue to Harrison street, thence west in Harrison street to a junction with the inclined connection of the Metropolitan Elevated Railroad at South Peoria street, and following the same grades as the subways previously

described in these streets. By the use of these additional tracks the elevated trains of the Chicago & Oak Park and Metropolitan Elevated systems can be through routed with each other and used for express service when so routed, and the loops previously described under Step 2 used for local elevated or subway trains.

Through Routing of Elevated and Subway Trains

This third loop, as shown on Map IV, could also be connected with the diagonal subways in Milwaukee avenue and Blue Island and Ogden avenues when these subways are constructed, as well as additional north and south tracks in Michigan avenue, to be hereinafter described, and thus provide through routing from the west part of the city to both the north and south parts of the city and vice versa for all elevated and subway trains operating over these tracks. For estimate of cost of Step 3 see page 32.

Step No. 4—Map V.

Steam Railway Passenger Terminals all Served by Subway Cars

In order to still further extend the business district and to conform to the steam railway terminal plan now under contemplation for locating stations upon 12th street, should this be carried out, and at the same time better serve the north side manufacturing district, a 2-track subway in 12th street from Newberry avenue to Michigan avenue, thence north in Michigan avenue and Rush street, to Chicago avenue, thence west in Chicago avenue to Green street, could be constructed. Then all of the steam railway passenger terminals would be served by subway cars, as the plan thus far developed takes care of the new Chicago & Northwestern station through the Madison street subway, the Grand Central and La Salle street stations through the Harrison street subway, and the proposed Canal street station through either the Jackson boulevard or Harrison street subways.

Map VI shows the subway system after Steps 1, 2, 3 and 4 have been completed, but does not show the suggested storage tracks.

For estimate of cost of Step 4 see page 32.

Step No. 5—Map IX.

Outer Harbor or Light House Docks of the Commercial Club's "Chicago Plan" Connected with all Steam Railway Passenger Terminals

By constructing a short piece of subway between 12th street and Chicago avenue in Canal and Townsend streets, a subway loop connecting all of the steam railway stations in the city could then be completed. Since this loop intersects the north and south subways and passes through the mezzanine floor stations in Michigan avenue, it makes it possible for passengers to transfer to any other subway, and would be the first of a series of loops in the city which could ultimately be constructed, as suggested in the Commercial Club's "Chicago Plan." Thus the subway system as planned would have the advantages of the plan of through routed high speed trains combined with the terminal loop system, both or either of which could be extended in the future, as might seem best, and when the outer harbor becomes a reality the docks and outer piers could be connected with the railroad station loop. All of the steam railway terminals and two of the outer docks would then be interconnected by means of a subway, and if then thought advisable leads to storage tracks could be taken off from these extension tracks running to the docks and ample underground storage and switching yards provided.

Storage and Switching Yards Provided at Docks

For estimate of cost of Step 5 see page 33.

Possible future expansion of Subways.—See Map VII.

It is impossible at the present time to determine upon what streets future subways will be located, or how the next step in subway construction will be taken, although a suggested plan is shown on Map VII, and a list of routes outlined in Appendix A.

It is not improbable, however, that some of the trains of the Douglas Park branch of the Metropolitan Elevated Railroad will finally be brought eastward by means of a subway in 22nd street to a subway in Michigan avenue, State street or Clark street, and that the trains of the Humboldt Park and Logan Square branches of this road will eventually be brought eastward in North avenue to one or the other of these subways, or via Milwaukee avenue to the Randolph street subway and through-routed through the business district to the south or west side, and that some of the trains of the future subways in Ogden avenue and Blue Island avenue, will be run in the Harrison street or Jackson boulevard subways, and that the Madison street subway will be extended considerably westward as a 4-track high speed subway; also that the Michigan avenue, State street or Clark street subways eventually will be extended southward, and that the Michigan avenue or State street subway will be extended northward through Lincoln Park and Clark street, or Evanston avenue, to a considerable distance, thus giving service to a territory not now well served with high speed transportation; also that the Randolph street subway will be ultimately connected with the high speed subway in Milwaukee avenue to the extent that the entire capacity of the tracks outlined under Steps 1 and 2 may be ultimately necessary for the high speed and local elevated or subway trains to the exclusion of the present surface cars, and that other means for taking care of the surface cars will then have to be provided. When this time arrives the surface cars which have previously operated in the subways built under Step 1 of Plan 1, can be cared for by constructing a part of the system shown in Plan No. 2.

Plan 2 for Surface Cars. See Map VIII

The first step under this plan would probably be to extend the Washington street tunnel directly east with two tracks at low level to Michigan avenue, thence south in Michigan avenue at a suitable level to fit the mezzanine floor stations previously described to Van Buren street; thence west in Van Buren street, at low level, to Franklin; thence north in Franklin, at low level, to the east entrance of the Van Buren street tunnel, all as described in detail in Appendix E.

All Railroad Passenger Terminals and all Outer Docks Connected by Subways; Storage Yards for Subway Cars Provided

If now the subway in 22d street has been built and extended east to the southern of the two outside or light house docks of the Chicago Plan, and north and south connections made from the previously described subway lines in Chicago avenue and 12th street, connecting to the outer or light house docks of the Chicago Plan, a complete interconnecting subway between all of the passenger transportation terminals of the city will have been provided, and the transportation system made to completely harmonize with the Chicago Plan. From the tracks leading to the inner docks there could then be constructed storage yards under Grant Park for surplus west side and surface cars which would come into the city during the morning rush hours and return during the evening rush hours.

Expanded Business District

The system as it would then exist, exclusive of the storage yards, but embodying Steps 1, 2, 3, 4 and 5 of Plan 1 and that portion of Plan 2 just described, covering the portion of the city which would then probably constitute the business district, together with the necessary connections in Michigan avenue for the through-routing of subway cars, is shown on Map IX, and the system as it might at some future time exist for the area now constituting the entire city, is shown on Map VII previously described.

Additional Provision for North Side and South Side Surface Cars

If, when the time arrives for the elimination of the surface cars from the tracks in Madison street, Michigan avenue and Jackson boulevard, as shown on Map I, the Clark street subway has been extended northward through a new tunnel, and additional facilities have not been provided for the north bound and south bound surface cars by the construction of additional north and south subways in Michigan avenue, Wabash avenue or Fifth avenue, as outlined in Plan 1, these surface cars could then be taken care of by additional tracks in subways located in La Salle street and Dearborn street, also shown on Map VIII, which plan provides, by the construction of these tracks, for through routing the surface cars of the north and south divisions and looping the surface cars from the west division of the city and the surplus cars of the north and south divisions not required for through routing.

Universal Through Routing under Plan No. 2

Should it be decided to develope Plan No. 2 and extend it so as to provide universal through routing which is not recommended under this plan, on account of the excessive cost and the other reasons previously given, it could be done as outlined in Appendix E and as shown on Map X.

ESTIMATES.

The estimates of costs of the various steps hereinbefore described are as follows:

PLAN 1—STEP 1—MAP 1.

This subway from the southern portal of the La Salle street tunnel, via La Salle, Madison and Clark streets, to Archer avenue, including such portions of the station at Clark and Madison streets as it would be necessary to construct, and complete sta-

tions at Jackson boulevard, Harrison and 12th streets including care of abutting buildings, but exclusive of damages to property, if any, is estimated to cost..... $3,000,000

Or a 2-track subway having 4.128 miles of single track and 4 stations, complete ready for operation at $726,710 per mile.

OR AS AN ALTERNATIVE ROUTE.

The subway from the southern entrance of the La Salle street tunnel, via La Salle, Madison, Clark, Polk streets, Plymouth court or Custom House place to 14th street, including such portions of the stations at Clark and Madison streets and Clark street and Jackson boulevard, as it would be necessary to construct, but exclusive of damages to property, if any, is estimated to cost..... $2,500,000

Or a 2-track subway having 3.124 miles of single track and 4 stations, complete ready for operation at $800,250 per mile.

TERMINAL LOOP—PLAN 1—STEP 1—MAP 1.

This loop from the east entrance of the Washington street tunnel, via Franklin and Madison streets, Michigan avenue, Jackson boulevard and Franklin street, back to the east entrance of the Washington street tunnel, and the loop from the east entrance of the Van Buren street tunnel, via Franklin street, Jackson boulevard, Michigan avenue, Madison street and Franklin street to the east entrance of the Van Buren street tunnel, together with that portion of the stations

(including escalators) on Madison street and Jackson boulevard between La Salle and Clark streets, and between State street and Wabash avenue, also in Franklin street between Monroe and Adams streets, and in Michigan avenue between Monroe and Adams street, which it would be necessary to build at present in order to take care of the traffic on the tracks described, should be constructed simultaneously with the Clark street subway, and are estimated to cost, when so constructed, exclusive of damages to property, if any..... $5,000,000

Or a subway having 3.663 miles of single track and 6 stations, complete ready for operation at $1,364,950 per mile.

PLAN 1—STEP 2—MAP II.

North and South Subway.

A subway as shown on Map II having two tracks, beginning at an inclined connection with the Northwestern Elevated Railroad at or near Franklin street, via Chicago avenue, North State and State streets, extending to an inclined connection with the South Side Elevated Railroad system at 12th street; this subway also having two other tracks beginning at a portal in Chicago avenue near Dearborn avenue and extending via Chicago avenue, North State and State streets, to another portal near 13th street, including stations in Chicago avenue between Clark and La Salle streets, in North

State street between Ohio and Indiana streets, and in State street between Washington and Madison streets, between Jackson and Van Buren streets at Harrison and at 12th streets, including care of abutting buildings but exclusive of damages to property, if any ..... $ 7,750,000

Or a 4-track subway having 10.184 miles of single track and 5 stations complete ready for operation at $768,550 per mile.

East and West Loops.

A subway as shown on Map II beginning at an inclined connection with the Metropolitan Elevated Railroad system on South Peoria street and extending via Harrison street, Michigan avenue and Jackson boulevard to South Peoria street; also a subway beginning at an inclined connection wtih the Chicago & Oak Park Elevated Railroad structure on Sangamon street and extending via Madison street, Michigan avenue and Randolph street to Sangamon street, including stations (with escalators where necessary) on Randolph and Madison streets be tween State street and Wabash avenue, between La Salle and Clark streets and between Jefferson and Clinton streets; on Jackson boulevard and Harrison street between State street and Wabash avenue, between La Salle and Clark streets, and between Canal and Clinton streets; also on Michigan avenue between Congress and Van Buren streets, and between Madison and Randolph streets, including care of abutting buildings but exclusive of damages to property, if any $13,500,000

Or a 2-track subway having 9.5 miles of single track and 14 stations, complete ready for operation at $1,421,100 per mile.

PLAN 1—STEP 3—MAP IV.

East and West Loop.

A subway as shown on Map IV beginning at an inclined connection on South Peoria street with the Metropolitan Elevated Railroad structure and extending via Harrison street, Michigan avenue and Randolph street to Sangamon street and ending with an inclined connection with the Chicago & Oak Park Elevated Railroad, including stations on Harrison street between Clinton and Canal streets, at Clark street, and between State street and Wabash avenue, on Randolph street between Wabash avenue and State street, Clark and La Salle streets, and Clinton and Jefferson streets; also on Michigan avenue between Congress and Van Buren streets, between Adams and Monroe streets, and at Washington street between Madison and Randolph streets, including care of abutting buildings but exclusive of all damages to property, if any, is estimated to cost .....$ 6,250,000

Or a 2-track subway having 5.954 miles of single track and 9 stations, complete ready for operation at $1,049,710 per mile.

PLAN 1—STEP 4—MAP V.

East and West Loop.

A subway as shown on Map V beginning at Newberry avenue and extending via 12th street, Michigan avenue, Rush street and

Chicago avenue to Green street, including stations (with escalators where necessary) on Chicago avenue between Sedgwick and Orleans streets, and La Salle and Clark streets; on Michigan avenue between Monroe and Adams streets; and on 12th street between State street and Plymouth court, including care of abutting buildings but exclusive of damages to property, if any, is estimated to cost .....$ 9,700,000

Or a 2-track subway having 8.78 miles of single track and 4 stations, complete ready for operation at $1,104,780 per mile.

PLAN 1—STEP 5—MAP IX.

Complete Warehouse and Steam Railroad Passenger Terminal Loop.

A subway shown on Map IX extending in Canal and Townsend streets from 12th street to Chicago avenue, including stations in Canal street at Jackson boulevard and at Madison street with escalators, and including care of abutting buildings but exclusive of damages to property, if any, is estimated to cost.....$ 3,750,000

Or a 2-track subway having 3.976 miles of single track and two stations, complete ready for operation at $943,150 per mile.

PLAN 2—MAP VIII.

East and West Loop.

That portion of a subway as shown on Map VIII from the east entrance of the Washington street tunnel via Washington street, Michigan avenue, Van Buren street

and Franklin street to the east entrance of the Van Buren street tunnel, including stations with escalators (where necessary) on Washington street and Van Buren street between La Salle and Clark streets, and State street and Wabash avenue; and on Michigan avenue between Monroe and Adams streets, including care of abutting buildings but exclusive of damages to property, if any, is estimated to cost.....$ 4,500,000

Or a 2-track subway having 6.182 miles of single track and 5 stations, complete ready for operation at $768,360 per mile.

North and South Subway.

That portion of a subway as shown on Map VIII from the southern portal of the La Salle street tunnel via La Salle street, Polk street and Plymouth court (or Custom House place) to 14th street, together with the subway from La Salle and Lake streets via Lake and Dearborn streets to Polk street, including stations on La Salle street between Washington and Madison streets and Jackson boulevard and Van Buren street, and at Harrison street; on Dearborn street between Washington and Madison streets, and Jackson boulevard and Van Buren street, and at Harrison street; and one on Plymouth court at 12th street, including care of abutting buildings but exclusive of damages to property, if any, is estimated to cost .....$ 4,750,000

Or a 2-track subway having 3.608 miles of single track and 6 stations, complete ready for operation at $1,247,230 per mile.

PLAN 1—MAP IX.

The necessary connections in Michigan avenue for through routing of the subway cars as shown on Map IX is estimated to cost .....$ 1,000,000

PLAN 2—MAP X.

The necessary connections for universal through routing, as described in appendix "E" and shown on Map X for Plan No. 2, are estimated to cost .....$ 2,500,000

In case a two-track subway has not been previously built in Franklin street, together with a station in Franklin street, between Washington street and a connection with the Van Buren street tunnel, as outlined in Plan 1, Step 1, add to this last figure to accomplish universal through routing under Plan 2 .....$ 450,000

SUBWAY STATIONS.

In order to secure the advantage of shallow subways, thereby not only making them easily accessible to the street surface for passengers, by means of stairways of ample width, but also to greatly reduce their first cost it has been found necessary, in designing the subway system previously outlined, to somewhat increase the width of the sidewalks upon such streets as are occu-

pied by high level subways, with a corresponding decrease in the width of the roadway in these streets. The increase in the width of the sidewalks upon some of these streets seems desirable and almost necessary, on account of the present congestion of pedestrians upon these streets, while the advantages of maintaining the present width of the roadway do not seem as necessary as the advantages gained for pedestrians and subway users by the suggested changes. If the sidewalks are not widened, it will be necessary to locate the entrances upon the present sidewalks close to the buildings, and reach the station platforms through deep stairways or escalators, and underground passages, and other stairways rising to the station platforms, thus necessitating the passengers descending a considerable distance, thence horizontally under the tracks and walking up stairs to reach the train platforms, unless underground grade crossings are adopted, which as previously stated, are prohibitive.

The necessity of confronting this condition is due to the difficulty pointed out in the first paragraph of this report, wherein was stated that the problem of designing a subway system for the City of Chicago was made very difficult on account of the present location of the Illinois Tunnel, which is so near the surface that the general use of stations with mezzanine floors is impossible unless the entire passenger subway is lowered about eight (8) feet, thereby not only necessitating grade crossings, or the destruction of the Illinois Tunnel structure in the business district and greatly increasing the cost of the subway system, due to the extra amount of excavation necessary and the material required in the structure in order to resist the increased pressure on the sides of the subway, on account

of the extra depth, and for the construction of mezzanine floor stations throughout the entire system.

In order to avoid these excessive costs and depths—with the corresponding inconvenience to passengers—and to adopt the design which the plans call for, it will be necessary, in order to maintain stairways of sufficient width, to change the widths of sidewalks as follows:

	Increasing Sidewalks From	To	Increasing Sidewalk Space	Decreasing Street Width	Leaving between car and curb
66′ streets,	14′	16′	14.3%	10.52%	7′ 8″
80′ streets,	16′	20′	25.0%	16-2/3%	10′ 8″
100′ streets,	20′	25′	25.0%	16-2/3%	15′ 8″

It may be argued that the resulting decrease in the width of the roadways would interfere with the free movement of vehicles while passing each other on the space between the curb and the street car. A study of the existing conditions shows that on a 66-foot street with a two-track street railway, the space between the car and the curb is now sufficient for only one vehicle. The proposed change will still leave a free passage for a single vehicle.

In the case of 80-foot streets, two of the widest vehicles cannot at present pass each other between the car and the curb at the same time that a car is passing, and teams hauling narrower wagons at present rarely attempt to pass each other under these conditions. Thus, in such streets, the proposed changes will make no practical difference in the movement of the vehicle traffic, but will give great advantages to the subway and to pedestrians. The necessity for this additional sidewalk space is being emphasized as the number of tall buildings increases.

For 100-foot streets, such as State street, there is at present ample space for teams to pass one another between the curb and the car, and the space left if the suggested increase in the width of sidewalks were put into effect, would still be sufficient to allow two vehicles to pass each other between the curb and the car.

Description of Stations.

Plate 2 shows a station designed in accordance with this method of construction, and is recommended as the most desirable form to adopt, for by this design, the tracks are so located that the entrances to the stations can be made directly from the sidewalks without necessitating the use of mezzanine floor stations, except on Michigan avenue, where mezzanine floor stations have special advantages, as hereinbefore described, and can be adopted.

This plan of stations is accomplished without the general use of mezzanine floors by utilizing the sub-sidewalk space between the present curb line and the property line. The adoption of this design will make the cars of the high level subways easy of access from the streets by the descent of short flights of stairs, and when supplemented by escalators leading to the low level subways, will make the street surfaces easily accessible to all passengers, without excessive exertion, thus giving to this subway system advantages in the way of ready and easy access to the street surface and economy in first cost and operation, which no other 4-track system yet designed possesses. Should it be found impracticable to widen the sidewalks as suggested and thus make the adoption of the recommended type of station possible, the type of station shown on Plate 11 can be adopted, which in general is the same

as the recommended type shown on Plate 2, with the exception that access to the station platforms of the high level subways is obtained by means of stairways or escalators located contiguous to the buildings, and descending to a depth sufficient to enable passengers to pass under the tracks of the high level subway by means of suitable passageways, then ascending by means of stairways or escalators to the station platforms, while those desiring to pass to the low level station platforms would do so by means of other stairways or escalators.

This design of station, if adopted, would not necessitate a change in the general type of the subway, but would cause passengers greater inconvenience in getting to and from trains, as well as loss of time, both of which would be avoided by the adoption of the recommended design.

Traffic Congestion Avoided.

The general arrangement of the stations provides straight train or car platforms of sufficient width for all traffic, and to or from which passengers may pass expeditiously. Congestion will be avoided by providing that traffic in one direction will not be crossed by traffic in another direction, and at stairways to be used jointly by passengers entering and leaving, railings will be provided where practicable, to separate the traffic going in opposite directions.

In general, the island platform type of stations (Plate 12) will be used, which is one with its train or car platform between two tracks, so that passengers may be discharged from or loaded upon trains on either side of the platform.

At certain locations another type of station (Plates 6 and 7) will be used, which has a track on one side of the train or car platform only, and is known as the single track type.

Island Type Stations and Dimensions.

As the track can be generally tangent or parallel for any desired distance each side of stations, it will be possible to make the stations any length, to be determined by the amount of traffic at the stations in question, and whether it will be handled by trains or single cars. If the traffic is to be handled by trains, the platforms will be long enough for trains of ten cars, or 500 feet in the clear, which will permit passengers to enter or leave through the vestibules at the end of each car in the train, or through side or middle car entrances. The width of the island station platform is limited by the amount of space available for tracks and stations between the building lines of streets in which the subways will be located, thus limiting the width to 16 feet in most cases, yet giving sufficient capacity for the passenger traffic of trains on the two station tracks at the same time.

The stations for passengers using cars of the surface lines not running in trains, will have platforms not less than 250 feet long, to permit the operation of cars in strings of at least four cars, not coupled together but with sufficient space between for safe operation.

In addition to the length of train or car platforms required for passengers to enter and leave trains or cars, additional space will be required at each end to provide room for stairways from the street surface, ticket booths, newsstands, telephone booths and public comfort rooms.

Several Types of Island Stations.

There will be island stations of different dimensions as required, having stairways of different lengths and position which will be determined by the location of the stations, and whether they are for high or low level subways, or at the intersection of such subways.

Station Platforms.

The platforms at stations will vary in length as already stated, but will generally be 16 feet in width and where for use of elevated or subway trains, will be 3 feet 6 inches in height above the top of rails, so as to be about the height of the car floors and thus facilitate the movement of passengers by avoiding the necessity of their climbing up or down car steps. The platform for surface cars will be six inches above the top of rails.

Station platforms in subways to be used temporarily by surface cars but finally by elevated or subway trains, will be the length required for ten-car trains, but only the height adopted for surface cars. When trains are finally operated through the subway, the platforms may be elevated at minimum cost.

Stairways.

Stairways will be of fireproof material, provided with safety treads, and will be at least five feet in width on the inside, with two stairways at each end of each platform. The entrances to the stairways from the sidewalk will be of simple design, and may be enclosed by hoods or kiosks of cast iron and wire glass, which may be removed at the end of the winter season.

Ticket Booths.

The ticket booths will be constructed of fireproof material, ten feet by five feet inside measurement, which will give sufficient space for two ticket sellers.

They will be located so as to give a minimum obstruction to the flow of traffic. It is proposed to use but one ticket seller when the traffic is light, and during the night hours, when there is little traffic, to use an adjustable turnstile at the ticket booths for the collection of fares, instead of selling tickets for deposit at the chopper, thus reducing the number of station employes during these hours.

Gates.

The gates at the exits will be metal and during periods of light traffic opened and closed by mechanical means by the attendant at the chopper box. During the periods of heavy traffic, a porter or additional gateman will be in charge of the gates.

Public Comfort Conveniences.

Toilet rooms for men and women will be provided at each end of the station platforms, accessible to the general public. There will also be "rest rooms" for women provided with the usual comforts and conveniences.

Newsstands.

For the convenience of the subway patrons, newsstands of fireproof material will be provided at each end of the station, and so located that they will be convenient of access, without obstructing the flow of the traffic.

Station Finish.

The train platform and station floor is to be smooth troweled concrete, divided into squares to represent panels.

The finish of the walls and ceilings of the stations, including the platform, will be of simple design and at moderate cost, but selected principally for cleanliness and appearance.

The walls will have a sanitary cove of concrete joining the floors, to insure convenient cleaning and to avoid the usual corners that catch and hold the dust and dirt. Adjoining this sanitary cove will be a strip 12 inches high of smooth finished concrete, and above this several feet of white or opal glazed tile, with trimmings of colored tile. The walls above the tiling, and also the ceiling, to be finished with white cement or concrete.

The doors are to be of metal and glass, which, with the gates and railings, will be simple and pleasing in design, at moderate cost.

The toilet rooms will have slate walls and partitions, above which will be white tile to prevent disfigurement, and the vault light wells will be finished in white cement.

UTILITIES.

Reconstruction and renewal of utilities, including sewers and water mains, as well as gas mains, electric conduits, etc., have been postponed from year to year, as subway construction has been generally expected. Utility corporations will, it is believed, welcome a final determination of the location and type of subways and will co-operate in the solution of the problem of utility location.

Utilities are at present occupying more space in many of the streets than their future demands will require, which condition was brought about by the construction of capacious feeders or mains by independent corporations that have subsequently combined. Also by the addition of feeders or mains of small capacity as required from time to time, all of which might be replaced by one feeder of the same or greater capacity than the others combined, and located systematically with respect to the present and future needs.

During subway construction most of the utilities would necessarily have to be temporarily located in the alleys, with the possible exceptions of gas and water mains, which might be elevated above the surface of the street.

The types of high level subways suggested have sufficient space on each side of the subway structure for utilities. There are cases, however, when additional tracks are required for a distance of one or two blocks, to provide for through routing of cars and trains, which will require most of the utilities to be located in the alleys, from which all the buildings concerned may be reached.

The low level type of subways permits the location of the utilities overhead in galleries, either outside or inside the curb line, and except when the open cut method is under way at stations, the utilities need not be disturbed from their present position.

High and Low Pressure Water System.

Various designs of utility galleries have been prepared, both for construction in the alleys and as a part of the subway structure, which provide space for house drainage, high and low pressure water supply, fuel and illuminating gas, electric light and power conductors, telegraph and telephone cables, and compressed air or other tubes.

Plate 13 represents a typical cross-section in an 80-foot street and shows the utilities chambers, suggested arrangement of utilities, ventilating ducts, drains, etc.

DRAINAGE.

Gutters or drains are provided along the tracks to take care of any water which may find its way into the subway. These gutters will have sufficient grade

to cause water to run freely to the low points into sumps of suitable size. A system of automatic pumps or ejectors operated by electric power or compressed air, will then force the water from these sumps into the city sewers.

Waste water from wash bowls, sinks and toilets at stations will be conveyed to specially constructed sumps, and from there forced to the nearest sewers by similar means.

A drainage system has been designed to take care of only ordinary amounts of water, such as ground water or water from a broken water main, water from possible condensation on walls or ceilings, or that which may find entrance to the subway at times of heavy rains.

VENTILATION.

The design of subways adopted have the bores or passageways for each track enclosed except at stations, so that the movement of trains or cars through these enclosed passageways will act upon the air very much like a piston, and will push the air ahead and draw it in behind, giving a change of air continuously between stations, and to some extent change the air at the stations, where the train platforms are located.

In order to expel the vitiated and particularly the excessive heat from the stations and the subways, as well as any gases escaping into the utilities galleries, electrically operated fans or exhausters will be used in connection with large ducts under station platforms, communicating with the several vertical ducts between two contiguous columns along the center of the platforms, opening above the heads of the passengers.

The fans are located in chambers under the subway floors, which communicate with the outside by means of flues into and through the corner of the basement of abutting buildings, rising through the basement and first floor and discharging into alleys. Air may then be drawn in or blown out of this vent, giving positive mechanical ventilation.

By a similar arrangement of ducts in walls between tracks, the subways between stations will be ventilated. These wall ducts will communicate with the underplatform ducts by means of ducts beneath the tracks.

SEWERS.

Temporary connections will be made with existing sewers located in nearby or adjacent streets before the present connections are disturbed by the excavation in the streets where subways are to be constructed. These connections may be made through alleys, basements or sub-sidewalk spaces.

Conditions will vary in each block along the route of subways, and will require special arrangement, but from the study that has been given to this problem, it is safe to say that there will be no insurmountable difficulties in continuing sewer connections with all buildings during the construction of subways.

It will be possible to install permanent connections through alleys with some buildings, instead of making temporary connections through the basements or sidewalk spaces, which will avoid the cost of temporary connections.

Permanent Sewers.

As all north and south subways, except river approaches, will be the high level type, and all east and west subways, except those west of the river and adja-

cent to the main river, will be the low level type, the general arrangement of sewers should fit into any subway system designed with high and low level subways so arranged.

The topography of the business district east and south of the river and its branches and north of 14th street, the most important part of the district in which subways are desired, when considered in connection with the general arrangement of subways, suggests a separate system, of sewers north of Harrison street and west of State street, and north of Adams street and east of State street, and combined system sewer south of Harrison street west of State street and south of Adams street east of State street.

The area south of Adams street and east of State street may drain into the South Branch through an existing sewer in 14th street.

The area west of State street and between 12th and Harrison streets may drain into the South Branch through a main sewer to be constructed in Taylor street.

The area north of Adams street between State street and Fifth avenue may drain into the main river, or, as would possible be more desirable from a sanitary point of view, by means of an intercepting sewer, into the South Branch.

The area south of Adams street and north of Harrison street, west of State street, may drain directly into the South Branch.

The area north of Adams street south of Lake street and west of Fifth avenue may drain directly into the South Branch.

The small area north of Lake street and west of Fifth avenue may drain directly into the main river.

The area east of State street and north of Adams street may drain directly into the main river.

In the district where the combined sewers will be used, there will be either ample room for the combined sewers in the streets not wholly occupied by the high level subway structure, or in special galleries that will form a part of the high level structures. Lateral sewers in the east and west streets over the low level east and west subways, and storm drains in the roof of the high level subways, will connect with the combined sewers in the north and south streets.

In the districts where the separate system of sewers will be used, there will be ample room for the storm drains and sewers in the space allotted for utilities in the high level north and south subways, which, with lateral connections over the low level subways, will complete the sewerage of the districts where the separate systems will be used.

It is proposed to have all sewers discharge by gravity, and to avoid the use of syphons, but it is possible that both pumps and syphons may be necessary, to a limited extent.

With the general arrangement of sewers as outlined, any system of subways following the high and low level principle may be built which will permit the construction of an economical and capacious system of subways of modern and efficient design.

There will, of course, be exceptions to the general arrangement suggested at places where conditions may be unusual, but these will be cared for by special design and construction, which may require two sewers instead of one, syphons, slight changes in the proposed location of sewers, and possibly an unimportant change in the elevation of the subways.

LIGHTING.

At Stations.

The subway station, for lighting purposes, may be divided into three divisions:

1st.—The stairways from the street.

2nd.—The concourse, embracing passageways from the foot of the stairs to and through the ticket office to the train platform.

3rd.—The station platforms.

Incandescent lamps of varying candle power will be used, the size depending upon the exact finish of the wall and ceiling and the consequent loss of light by absorption therein.

The control of the light of each station will be had from a distributing cabinet, under control of the station agent or porter.

Separate light circuits direct from the primary source of power, and entirely separate from the power supply of the subway will be used, and for insurance to feeders, station transformers will be in duplicate or so subdivided as to give the greatest practicable insurance against failure to provide light.

In the sub-station or stations from which the converted power for the subway will be distributed, static transformers will be used, to which the conductors from the source of primary power will be carried, thus making the installation of power and light feeders separate and independent throughout the entire length of the subway.

The lighting of the sairways will be accomplished by means of strips of border lights, set at the foot and head of each flight of stairs, the angle of the border reflector being such as to distribute illumination as

uniformly over the flight of steps as can be accomplished, and at the same time giving intense light on the first steps at each end of the flight.

The lighting of the concourse and the rooms adjacent, such as the ticket booths, news stands, toilet rooms, porter's closets, etc., will be accomplished by the combination of wall and ceiling fixtures and cluster units, similar to those suggested for platform lighting, but of smaller size.

To light the train platforms, clusters located at the highest point of the ceiling arch and covered by opalescent hemispherical globes will be installed, the lights composing the clusters being in two circuits, and giving two degrees of intensity of illumination, so that one may be used during the hours of heavy travel and embracing all of the lights in the fixtures, and the other for the hours of light travel, using only a portion of the lights in each fixture.

Between Stations.

The passageways between stations through which trains or cars will be operated in one direction only, will be lighted by a system of moderate illumination with the lights so installed that they will be shaded from the eyes of a motorman on the train or car. The system of illumination will be divided into sections, which will be under the control of the proper employe, with the equipment consisting of incandescent lamps in clear glass globes and so arranged that a faint amount of illumination will be used under normal conditions, for the convenience of motorman in reading signals, but while the degree of illumination may be made greater in an emergency, such as a derailment or the loss of power causing the stopping of the trains and the darkening of the cars.

POWER.

The current necessary for the operation of the initial subways will be delivered at the bus-bars of the sub-station or stations, which will be economically located immediately along the line of the subway.

SUB-STATIONS.

Sub-stations will be constructed in the cross streets, immediately adjacent to the subway and on the same level with the subway, so that such stations shall form no greater barrier to the construction of future subways than the subway itself forms.

These sub-stations will be supplied with a three phase current through underground mains at a high tension voltage.

The sub-station equipment will consist of air cooled transformers, delivering an alternating current at reduced voltage to rotary transformers of a size approximating 2,000 to 4,000 k. w. each. The current from these rotary transformers will be distributed by a low tension power board, from which the current will be conveyed to the various sections into which the overhead trolley for surface cars and the third rail for elevated trains will be divided. The distribution of these secondary currents will be under the control of a load despatcher. The great importance of continuity of service and the known weakness of feeders will make advisable the installation of a distant control equipment, whereby the load despatcher may change the distant connections between feeders and the contacting trolley or third rail as easily as he may disconnect and rearrange the feeders on the sub-station switchboard.

Transmission.

It is proposed to supply power from the sub-station to the trolley for surface cars and third rail for ele-

vated trains through underground cables, laid in tile conduits, installed in the walls, floors or available space of the subway. The number of such feeders and their arrangement will, of course, depend upon the plan of operation which it is desired to follow. To obtain the maximum track capacity, however, it will be advisable to sectionalize the surface lines into one-half mile track sections and the elevated lines into one-quarter mile track sections.

Methods of Operation.

It is proposed to continue the trolley wire of the surface cars and the third rail of the elevated lines through the subway, so that no change may be required in thir equipments while operating through the subway. For emergency operation, it might be wise to install a trolley of standard surface car design over those tracks provided for elevated train operation, in order that surface cars may be run over elevated tracks if an emergency requiring such operation arises. It will not be necessary to provide a third rail in the subways devoted to surface car operation, because all elevated trains, except those of the South Side Elevated road, are now equipped with trolleys, and trolleys could easily be added to the cars of this system at much less expense than would be necessitated for installing third rails in the surface car subways.

Return Circuit.

It is proposed to make the largest possible use of the electrical conducting capacity of the track by bonding the rails at the joints to their full equivalent cross-section, and supplement the rails with return circuit conductors in order to reduce the liability of damages from electrolysis to a minimum.

SUMMARY

Summarized the advantages of Plan No. 1 are as follows:

(a) A comprehensive system starting with a nucleus involving a small investment but capable of gradual expansion until the system covers the entire city.

(b) No grade crossings.

(c) High speed straight line operation, with few switches or curves.

(d) Least practicable first cost.

(e) Great flexibility, and always tending to enlarge the business district in three directions.

(f) Ease of access to passengers owing to the shallowness of the high level subways which allows the platforms of the low level subways to be within 28 feet of the surface of the streets.

METHOD OF CONSTRUCTION

PLAN NO. 1.

If Plan No. 1 is adopted it is recommended that it be constructed in the following stages, in order to keep the initial investment as low as practicable, by utilizing the present river tunnels, properly distribute the passengers, relieve the present congestion of the surface line cars, and avoid the concentration of the construction upon one principal street:

Beginning at the south end of the present La Salle street tunnel, which is now constructed for joining to a subway; thence south on La Salle to Madison, east on Madison to Clark, south on Clark to Polk, where it could either continue southward on Clark to Archer avenue, if it were deemed advisable, or swing eastward on Polk to Plymouth Court, thence south on Plymouth Court to 14th street, thus opening up a new entrance to the business district.

Also beginning with the eastern end of the Washington street tunnel, which is also now constructed for joining to the subway, east on Washington to Franklin, south in Franklin to Madison, east in Madison to Michigan avenue, south in Michigan avenue to Jackson Boulevard, west in Jackson Boulevard to Franklin, south in Franklin to Van Buren; thence westward through the Van Buren street tunnel with suitable connection to this tunnel.

APPENDICES

APPENDIX A.

Showing Possible Expansion of Plan No. 1 into a Comprehensive Subway System.

See Map VII.

With the nucleus of the system constructed under Steps 1 and 2, of Plan No. 1, the system could be expanded as follows, although it is not to be assumed that any such universal expansion as herein outlined is practicable from a financial viewpoint until the density of population becomes much greater than it now is.

North and South Subways.

Michigan Avenue—Beginning at the Chicago River, thence south in Michigan avenue to Harrison street, thence diagonally through Grant Park, passing by the Illinois Central Station to a connection with Indiana avenue at 18th street; thence south in Indiana avenue to 22nd street, thence southeast and south in Cottage Grove avenue to South Chicago avenue, thence southeast in South Chicago avenue to the city limits, two tracks.

Also:

Connecting with these tracks at Rush street, thence northwest in Rush street to its intersection with State street at Elm street, thence north in State street to North avenue, thence diagonally through Lincoln Park to the intersection with Clark street at Center street; thence northwest and north in Clark street to Evanston avenue, thence

north in Evanston avenue to a connection with the Evanston Division of the Northwestern Elevated Railroad at Ainslie street just north of Lawrence avenue, two tracks.

State Street—From 22nd street north to Chicago avenue, four tracks.

(To be constructed from 12th street to Chicago avenue under Step 2, Plan 1; the Northwestern Elevated Railroad to be connected at Chicago avenue, owing to this company having four tracks as far south as this point, and the South Side Elevated Railroad to be connected at 12th street, owing to this company having three tracks as far north as this point.)

From Chicago avenue north in State street to North avenue, thence northwest in Clark to the city limits, two tracks.

From 22nd street south in State street to city limits, two tracks.

Clark Street—From Archer avenue north to North avenue, thence northwest via Lincoln avenue to the city limits, two tracks.

Also:

Connecting to these Clark street tracks at Archer avenue, forming a part of the Clark street system, thence southwest in Archer avenue to the city limits, two tracks.

Fifth Avenue and Wells Street—From Archer avenue north in 5th avenue, via 5th avenue and Wells street, to Division street, thence west in Division street to Clybourn avenue, thence northwest in Clybourn avenue to

Belmont avenue, thence west in Belmont avenue to Elston avenue, thence northwesterly in Elston avenue to the point of intersection with Milwaukee avenue near city limits, two tracks.

Also:

Connecting with these tracks in 5th avenue and Archer avenue and constituting part of the 5th avenue subway, thence southwest and west in Archer avenue, with two tracks to Ashland avenue, thence south in Ashland avenue, with two tracks to the city limits.

Halsted Street—From the southern city limits to Evanston avenue, four tracks.

This will give express service on two tracks and local service on the other two, and intersect the various east and west subways hereinafter described.

Western Avenue—From the south city limits to the north city limits, four tracks.

Upon two tracks of this subway could be operated high speed trains, and upon the other two tracks local trains.

North and south subways might be located upon other streets as ultimate developments require, but the streets named are merely suggested, as they are straight streets and especially adapted for the location of subways.

East and West Subways.

Taking Monroe street as the dividing point for the city, and naming east and west sub-

ways north and south from this street, the following subways might be built:

North of Monroe Street.

Madison Street—From Michigan avenue westward to Sangamon street, four tracks.

Two of these tracks would be constructed under Step 2 of Plan 1 and connected with the Chicago & Oak Park Elevated Railroad at Sangamon street, while the other two would extend westward to the city limits.

Also could be eventually supplemented by two additional tracks if needed.

Chicago Avenue—From the outer light house dock of the Commercial Club's Chicago Plan, west to the city limits, two tracks.

A part of these tracks extending from Rush street to Green street will constitute the north side of a loop which forms a part of Step 4 under Plan 1. With the two tracks already located in Chicago avenue, between State and Franklin streets, where they connect with the Northwestern Elevated tracks, there would be four tracks in Chicago avenue between State and Franklin streets.

North Avenue—From the lake front west to the city limits, two tracks.

Fullerton Avenue—From the lake west to the city limits, two tracks.

Belmont Avenue—From the lake west to the city limits, two tracks.

(These tracks with the two tracks already located in Belmont avenue as a part of the Fifth avenue and Wells street and Clybourn

avenue lines, under north and south subways, will make four tracks in Belmont avenue between Western and Elston avenues.)

Irving Park Boulevard—From the lake westward to the city limits, two tracks.

Subways South of Monroe Street.

Jackson Boulevard—From Michigan avenue west to South Peoria street four tracks, with suitable connection to the Metropolitan Elevated at this point, for two tracks, the other two tracks connecting with the Ogden avenue line as hereinafter described.

(Constructed under Step 2—Plan 1.)

Harrison Street—From Michigan avenue to South Halsted street, four tracks.

Two of these tracks will be extended westward and be constructed under Step 2 of Plan 1, while the other two will be continued from Halsted street southwest in Blue Island avenue to Western avenue, thence west in West 26th street to the City Limits.

Twelfth Street—From Michigan avenue west to the City Limits, two tracks.

(That portion of these tracks extending from Michigan avenue to Newberry avenue completed as a part of Step 4—Plan 1.)

Twenty-second Street—From the Light House Dock of the Chicago Plan, west to South Paulina street, thence north in South Paulina street to a point suitable for connection to the Douglas Park Branch of the Metropolitan Elevated Railway System, two tracks.

Thirty-ninth Street—From the lake west to the city limits, two tracks.

Fifty-first Street—From the lake west to the city limits, two tracks.

Sixtieth Street—From the lake west to city limits, two tracks.

Seventy-ninth Street—From the lake west to city limits, two tracks.

Additional Diagonal Subways.

Milwaukee Avenue—From Randolph and Canal streets, thence northwest in Milwaukee avenue to North avenue with four tracks, thence northwest from North avenue to a connection with the Metropolitan Elevated, just north of North avenue with two tracks, thence northwest in Milwaukee avenue to the city limits with two tracks.

Elston Avenue—See description under heading "Fifth avenue and Wells street."

Blue Island Avenue—Connecting with the Harrison street line previously described, at the intersection of Blue Island avenue and South Halsted street, thence running southwest in Blue Island avenue to 26th street, west in 26th street to the city limits, two tracks.

(Already described as a part of the Harrison street subway.)

Ogden Avenue—Beginning at Jackson Boulevard and thence southwest in Ogden avenue to the city limits, two tracks.

Grand Avenue—Connecting with the Milwaukee avenue line at Halsted street, thence west and northwest in Grand avenue to the city limits, two tracks.

APPENDIX B.

Describing the Movements of the Trains of the Chicago & Oak Park Elevated Railroad Company and the Metropolitan West Side Elevated Railway Company after Step 2 of Plan 1 has been completed. See Map II and Description of Plan—Pages 20 to 23.

By the completion of this Step 2 independent loop tracks extending from Sangamon street to Michigan avenue are provided for the trains of the Chicago & Oak Park Elevated Railway and also two independent loop tracks extending from South Peoria street to Michigan avenue are provided for the trains of the Metropolitan West Side Elevated Railroad Company, and the operation on these loops would be as follows:

Chicago & Oak Park Elevated Railroad Company:

On Map II the connection with this road is shown with the trains running left-handed on the elevated structure, as they now run, in order to operate properly on the present loop structure in the downtown business district, but if the loop should be taken down, the direction of operation could then be reversed upon the structure of the Chicago & Oak Park Elevated Railroad Company, and connections made correctly, as the plans will fit either right or left-hand running. Assuming, however, that they operate left-handed, the trains will run as follows:

From the elevated structure on Lake street, descending the incline to Sangamon street, thence in the subway via Sangamon to Madison, thence on the outside tracks of the loop via Madison street, Michigan avenue

and Randolph street back to Sangamon street, thence north in Sangamon to the incline leading to the elevated structure.

In the same manner trains could operate from the elevated structure east on the incline structure to Sangamon, thence in Sangamon in the subway to Randolph, thence on the inside track of the loop in Randolph street, Michigan avenue, and Madison street back to Sangamon street, thence north in Sangamon street to the incline connection with the elevated structure.

Metropolitan West Side Elevated Railroad Company:

The trains of this system now operate right-handed so that the plan shows this method of operation for this road. The trains would run as follows:

From the south track of the elevated structure the trains would descend the incline to South Peoria street, thence on the outside track of the subway, via South Peoria and Harrison streets, Michigan avenue and Jackson boulevard and South Peoria street, back to a connection with the inclined structure.

The elevated trains could also descend the incline to South Peoria street, thence proceed northward on the inside track of this loop via South Peoria street, Jackson boulevard, Michigan avenue, Harrison street and South Peoria street to a connection with the inclined structure.

APPENDIX C.

Describing the Movements of the Trains of the Chicago & Oak Park Elevated Railroad Company and the Metropolitan West Side Elevated Railroad Company after Step No. 3 of Plan 1 has been completed. See Map IV and Description of Plan 1, Pages 23 and 24.

By the completion of this step a complete supplemental loop is provided between the systems of the Chicago & Oak Park Elevated Railroad Company and the Metropolitan West Side Railroad Company, which could be used for high speed service, and over the tracks of which could be through-routed the trains of either system from one system to the other and vice versa. These tracks could also be utilized by surface cars, and by connecting these tracks with the subways in Michigan avenue, hereinafter described, through-routing is provided from the west side of the city, via Randolph street and Michigan avenue, southward or vice versa, and from the west side of the city, via Harrison street and Michigan avenue, northward or vice versa. In case future developments should provide this through-routing by means of other connections these tracks can be used for surface car operation by providing them with portals in Randolph and Harrison streets at Sangamon and South Peoria streets, or such other points as may be deemed best and connecting the tracks with the surface lines. The elevated train movements after the construction of these tracks would be as follows:

From the incline on the Chicago & Oak Park elevated structure south in Sangamon street to Randolph, thence on the inside track via Randolph, Michigan avenue, Harrison and South Peoria streets to the inclined

structure of the Metropolitan system, and from this incline on the outside track, via South Peoria and Harrison streets, Michigan avenue, Randolph and Sangamon streets to the inclined structure of the Chicago & Oak Park Elevated Railroad Company.

If the present elevated structure of the Metropolitan West Side Elevated Railroad Company, extending between the main trunk line of this system and Lake street, near to and parallel with Wood street, were connected with the structure of the Chicago & Oak Park Elevated Railroad at Lake street in such a manner that trains could be run from either system over the tracks of the other system through routing movements for either of these systems would be as follows:

To through route trains of the Metropolitan West Side Elevated Railroad Company to the south side, the train movement would be as follows:

From the inclined structure of the Chicago & Oak Park system, on the inside track, via Sangamon and Randolph streets to Michigan avenue, thence curving southward in Michigan avenue and connecting with the subway tracks in Michigan avenue hereinafter described, and shown on Map IX.

To through route these trains to the north side they would pass from the incline structure of the Metropolitan system on the outside track via South Peoria and Harrison streets to Michigan avenue, thence curving northward, keeping under and connecting with the subway tracks in Michigan avenue hereinafter described, and shown on Map IX.

To through route the trains of the Chicago & Oak Park Elevated Railroad Company from the west side

to the north side, the train movement would be as follows:

From the inclined structure of the Metropolitan West Side Elevated Railroad Company south in South Peoria street to Harrison street, thence on the outside track in Harrison street to Michigan avenue, thence on a diverting track passing under the Harrison street tracks and curving northward to a connection in Michigan avenue with the Michigan avenue subway hereinafter described and shown on Map IX.

To through route the trains of this system to the south side, they would pass from the incline structure of the Chicago & Oak Park Elevated structure via Randolph street to Michigan avenue, thence via the diverting track to a curve swinging southward under and connecting with the subway tracks in Michigan avenue, hereinafter described and shown on Map IX.

APPENDIX D.

Describing the Movements of Cars in Subway to be Constructed under Step 4, shown on Map V, and described on Pages 24 and 25 of the Description of Plans.

This subway, as shown, will be used for surface cars until it is extended considerably westward from the portals shown on the map, and cars entering the portal on Chicago avenue at Green street will pass eastward on the inside track to Rush street, thence south in Rush street and Michigan avenue to 12th street, thence west in 12th street and out of the 12th street portal at Newberry avenue.

In like manner cars entering the 12th street portal will pass eastward on the outside track to Michigan avenue, thence northward in Michigan avenue and Rush street to Chicago avenue, thence westward in Chicago avenue to and through the western portal at Green street. When the connection between 12th street and Chicago avenue is made, via Canal street, as shown on Map IX and referred to on page 25 of the description, cars could be operated over the loop thus formed in opposite directions, thus serving the railway stations and the extended business district.

APPENDIX E.

DETAILED DESCRIPTION OF PLAN NO. 2 FOR A SUBWAY TERMINAL SYSTEM FOR THE SURFACE RAILWAYS.

Plan No. 2 is for a surface terminal system and in its simplest and recommended form, if it is constructed, is shown upon Map No. VIII, and in its completed form, for universal through-routing, upon Map No. X.

In this plan all of the present river tunnels are utilized. The plan provides for installing through routing if required, and also for the looping of the cars of the three divisions of the city. The movement of cars in this subway, if built in its simplest form, as shown on Map No. VIII, would be as follows:

North to South via La Salle Street Tunnel.

From the north entrance of the La Salle street tunnel, south in La Salle to Polk street, east in Polk to Plymouth court, south in Plymouth court to 14th street.* Also from the north entrance of the La Salle street tunnel, south in La Salle to a diverting track "X" leading off from the west track in the La Salle street tunnel, thence descending on a 5% grade in La Salle street to Lake street, thence curving eastward under the tracks in La Salle street, ascending a 5% grade and connecting with the south track in Lake street, thence eastward in Lake street at low level to Dearborn, thence southward on a 5% grade in Dearborn street to track A, thence descending track

(*Note.—The plan shows a subway extending south in Plymouth Court to 14th Street, which if carried out would give an additional entrance to the business district not now available. Should Plymouth Court not be found available, the extension south should be made in La Salle Street instead of Plymouth Court, and extended to 16th Street, which could be done in case the plans now under contemplation are carried out and the Chicago River is straightened between 12th Street and 16th Street.)

A on a 3% grade to Polk street; thence east in Polk, and south in Plymouth court, rising on track "B" on a 3% grade to a point in or near Taylor street, where it intersects the south-bound track in Plymouth court; thence south in Plymouth court to 14th street.

South to North via La Salle Street Tunnel.

North-bound cars would enter the subway at 14th street, thence north in Plymouth court to Polk street, west in Polk to Dearborn, north in Dearborn to Lake, west in Lake to La Salle, thence north in La Salle, passing out of the north portal of the tunnel in La Salle street. Also from the portal at 14th street north in Plymouth court to Polk, west in Polk to La Salle, north in La Salle to the north side of Washington street, thence descending on a grade not exceeding 5% through the La Salle street tunnel.

To Loop Cars from the North Through La Salle Street Tunnel.

The cars entering the La Salle street tunnel from the north could be looped as follows:

From the northern portal of the La Salle street tunnel, south to track "X" previously described, thence east in Lake street to Dearborn, south in Dearborn to Polk, west in Polk to La Salle, north in La Salle to and through the La Salle street tunnel.

To Loop Cars from the South Through 14th Street Portal.

Cars coming from the south could be looped as follows:

From the 14th street portal north in Plymouth court to Polk, west in Polk to La Salle, north in La Salle to Lake, east in Lake to Dearborn, south in Dearborn

on track "A" to Polk street, east in Polk to Plymouth court, thence on track "B" to a junction point with the south-bound track in Plymouth court, thence south in Plymouth court through the 14th street portal.

Universal Through Routing.

If, in order to provide for universal through routing, additions to the system were made as represented in its completed form on Map No. X other car movements in addition to those already described as possible under the plan shown on Map No. VIII could be made as follows:

To Through Route From the North Side to the West Side via Washington Street Tunnel.

To through route from the north side to the west side, south-bound cars passing through the La Salle street tunnel would swing westward at Washington street on track "F," descending on a 6% grade, and passing over crossover "K" to track "G," which at the intersecting point is at the same grade as the west-bound track in Washington street, thence westward through and out of the Washington street portal.

To Through Route from the North Side to the West Side via Van Buren Street Tunnel.

To through route from the northern portal of the La Salle street tunnel to the west side through the Van Buren street tunnel, cars would pass south in La Salle to Washington street, thence over track "F" to track "H," thence ascending track "V" on a 6% grade to Franklin street, thence south in the high level subway in Franklin street to a point near Jackson boulevard, where it would descend on a 5% grade and join the west-bound track in the Van Buren

street tunnel, thence west through and out of the Van Buren street tunnel,—or south in La Salle to Van Buren, thence west in Van Buren on track "P" descending on a 4% grade to a point near Fifth avenue, thence west in Van Buren to Franklin, thence north in Franklin to the Van Buren street tunnel, thence west to and through the tunnel.

To Through Route from the South Side to the West Side, via Washington Street tunnel.

To through route from the south side to the west side through the Washington street tunnel, cars entering the portal at 14th street would pass north in Plymouth court to Polk street, west in Polk street to Dearborn, north in Dearborn street to track "Q," thence descending on a 5% grade on track "Q," then ascending track "R" on a 5% grade to Van Buren street to track "S"; thence descending on track "S" at a 6% grade in Van Buren street to La Salle street; thence north on track "T", ascending on a 5.5% grade to track "U"; thence on track "U" at high level to Washington street; thence west in Washington street on track "W", descending on a 6% grade to the west-bound main track in Washington street, thence through and out of the Washington street tunnel.

To Through Route from the South Side to the West Side, via Van Buren Street Tunnel.

To through route from the south side to the west side through the Van Buren street tunnel, cars entering the portal at 14th street would pass north in Plymouth court to Polk street, west in Polk street to Dearborn street, thence north in Dearborn to track "Q", then descending track "Q" on a 5% grade, thence ascending a 5% grade on track "R" to Van Buren

street, thence west in Van Buren street on track "S", descending on a 6% grade to the main west-bound track in Van Buren street, thence west in Van Buren street and north in Franklin street, thence west to and through the Van Buren street tunnel.

To Through Route from West Side to the South Side via Van Buren Street Tunnel.

Cars entering from the west and passing through the Van Buren street tunnel will swing south in Franklin street to Van Buren street; thence east in Van Buren street to track "O"; and ascend a 4% grade, swinging south to La Salle street, thence south in La Salle street on the main track to Polk street; thence east in Polk street to Plymouth court, thence south in Plymouth court through and out of the 14th street portal.

To Through Route from West Side to South Side via Washington Street Tunnel.

Cars entering the Washington street tunnel from the west would pass east in Washington street to track "N", ascending on a 6% grade to Dearborn street, thence south in Dearborn street to track "A" and descending on a 3% grade to Polk street, thence on track "B" in Plymouth court, ascending a 3% grade to the main south-bound track in Plymouth court to and through the 14th street portal.

To Through Route from the West Side to the North Side via the Van Buren Street Tunnel.

Cars entering the Van Buren street tunnel from the west would pass eastward to track "L" ascending on a 5% grade to Franklin street; thence northward in Franklin street and continuing upward on a 5% grade to Adams street, thence continuing at high level to

Madison street; thence descending on a 2% grade to Washington street; thence east in Washington street on track "J" to La Salle street; thence curving northward and continuing to and through the La Salle street tunnel.

To Through Route from the West Side to the North Side via the Washington Street Tunnel.

Cars entering the Washington street tunnel from the west would pass eastward to track "I", ascending track "I" on a 5% grade to Franklin street, thence crossing over to the north side of the street and continuing eastward to La Salle street on track "J", curving northward and conecting by means of track "Z", at low level, with the main north-bound track in the east side of the La Salle street tunnel, through and out of the portal of this tunnel.

Looping from the West.

Cars passing east through the Van Buren street tunnel to Franklin street, thence south in Franklin street to Van Buren street, thence east in Van Buren to Michigan avenue; thence north in Michigan avenue to Washington street; thence west in Washington street to and through the Washington street tunnel.

Cars entering the Washington street tunnel from the west could continue east in Washington street to Michigan avenue, thence south in Michigan avenue to Van Buren street, thence west in Van Buren street to Franklin street, thence north in Franklin street to Van Buren street tunnel, thence passing west to and through the Van Buren street tunnel.

Cars from the West Side Passing Through Van Buren Street Tunnel, Looping and Returning via Van Buren Street Tunnel.

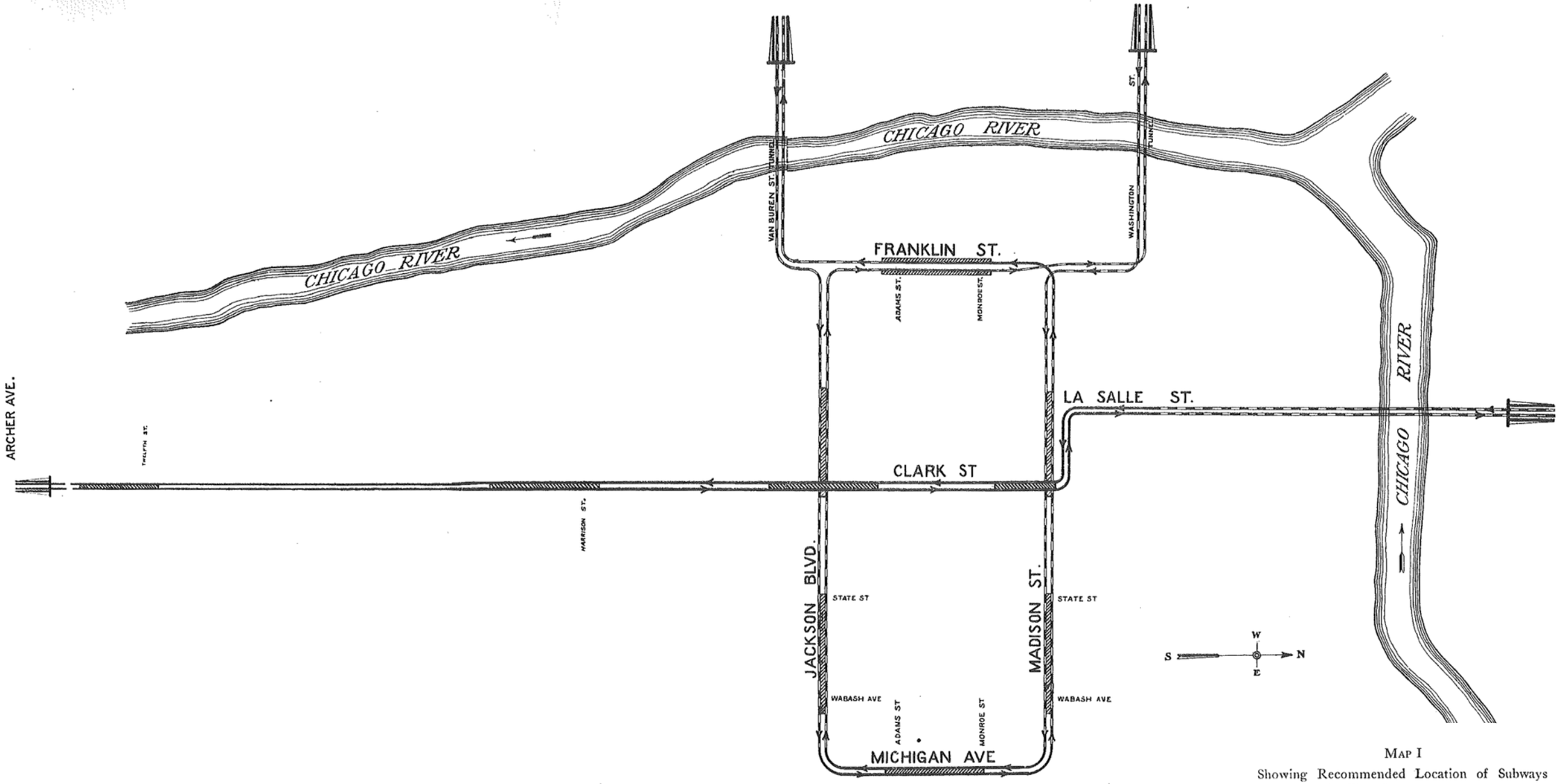
Cars entering Van Buren street tunnel could be looped as follows:

From the west portal of Van Buren street tunnel to Franklin street, thence south in Franklin street to Van Buren, thence east in Van Buren to Michigan; thence north in Michigan avenue to Washington street; thence west in Washington street to crossover "M", thence ascending track "V" on a 6% grade to Franklin street, thence south in Franklin street at high level to Adams, thence descending a 5% grade to the Van Buren street tunnel, thence continuing to and through this tunnel.

Cars from the West Side Passing Through Washington Street Tunnel, Looping and Returning via Washington Street Tunnel.

Cars entering the Washington street tunnel could be looped as follows:

From the west portal of the Washington street tunnel east in Washington street, ascending track "N" at 6% grade to Dearborn street, thence south in Dearborn street to Van Buren street; thence west in Van Buren street descending track "S" on a 6% grade to La Salle street; thence north in La Salle street, ascending track "T" on a 5.5% grade to Jackson boulevard, thence west in Jackson boulevard to La Salle street, thence north in La Salle street to Washington street, thence west in Washington street, descending track "W" on a 6% grade to Fifth avenue, connecting to the main west-bound track passing through and out of the Washington street tunnel.

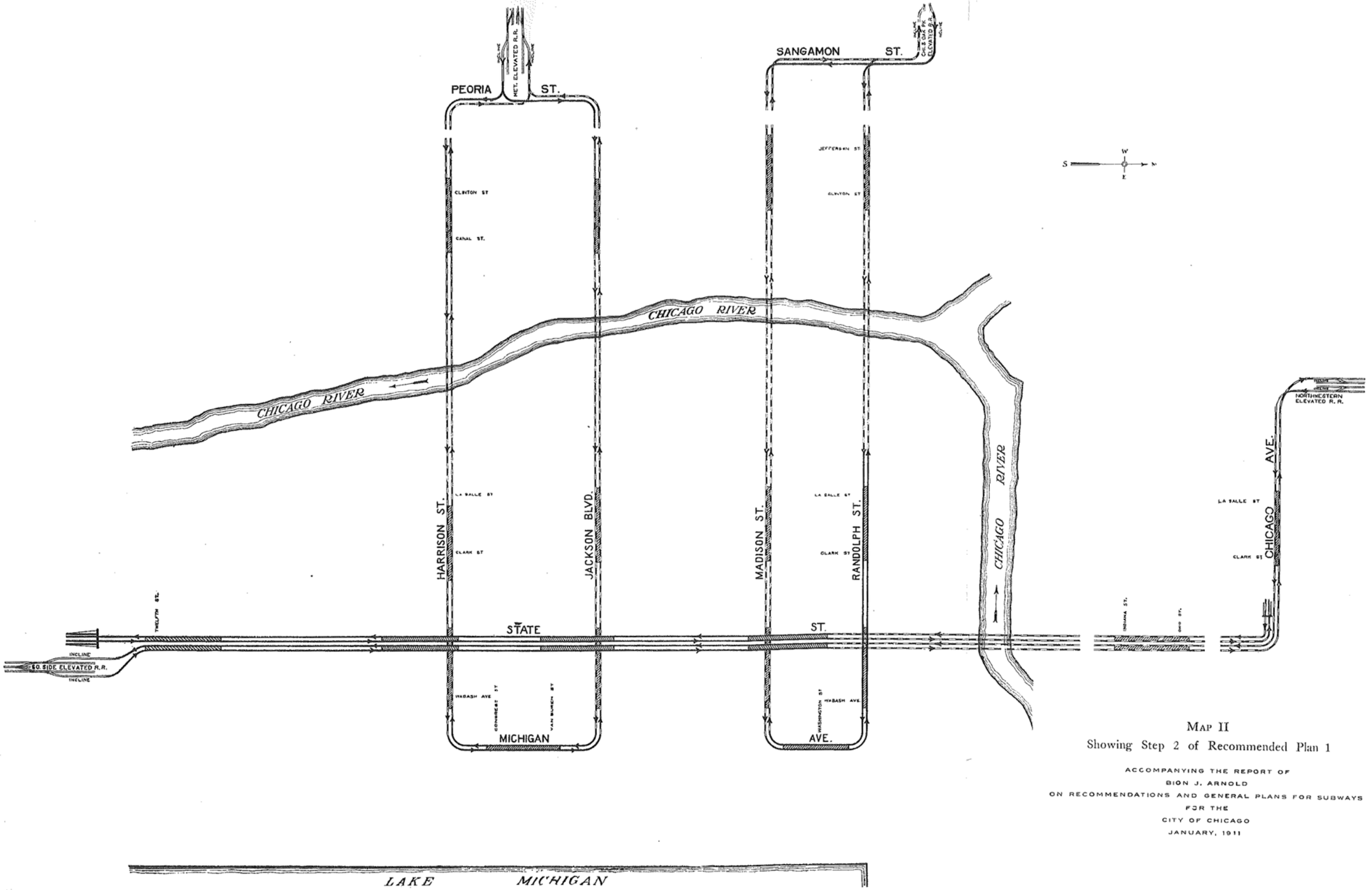


MAP I

Showing Recommended Location of Subways to be First Constructed, being Step 1 of Plan 1

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

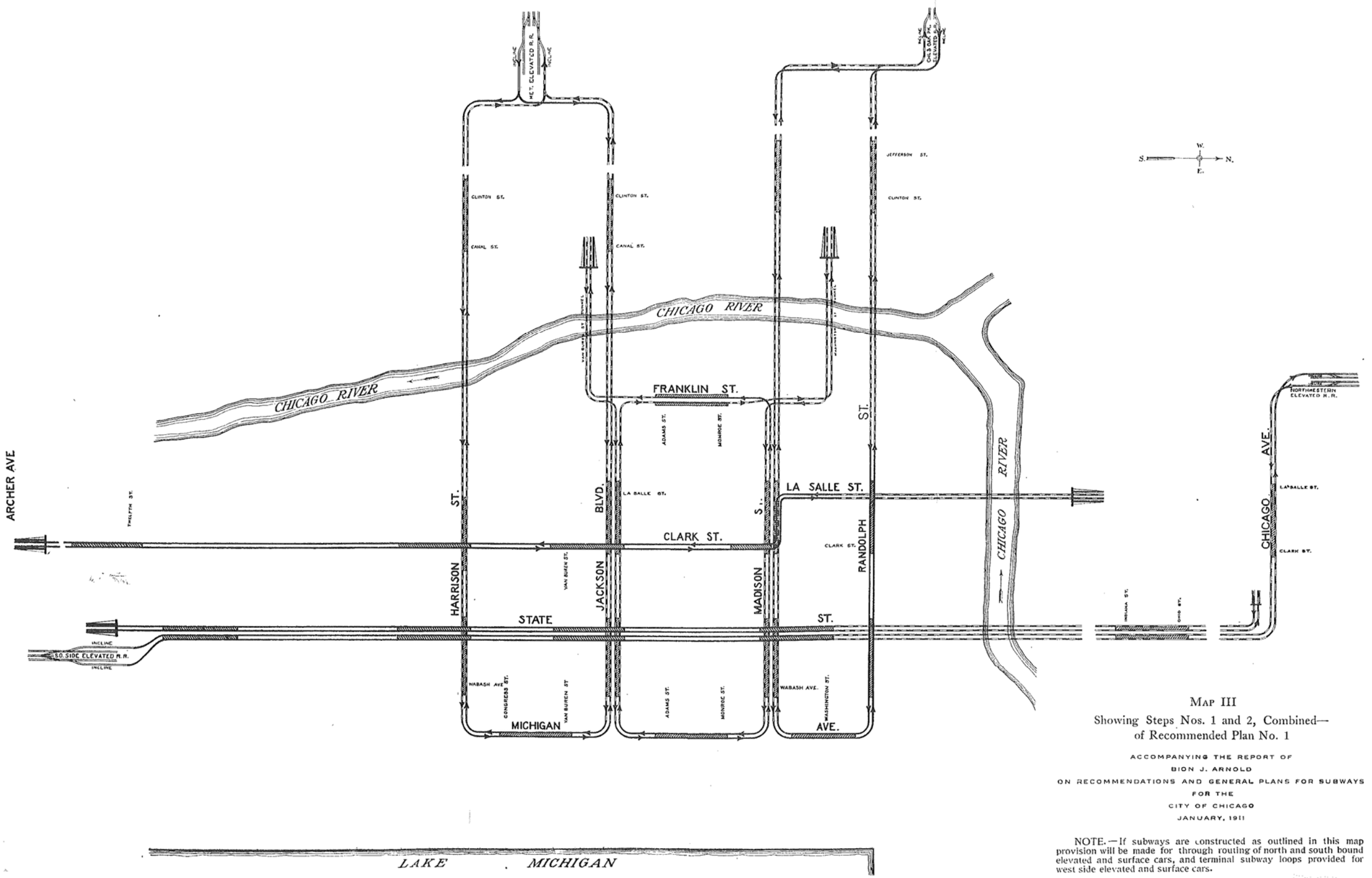
NOTE.—As soon as the subways shown hereon have been completed, transfer privileges now prohibited in the business district by the Feb. 11, 1907, ordinances must, under the terms of these ordinances, be given.



MAP II

Showing Step 2 of Recommended Plan 1

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

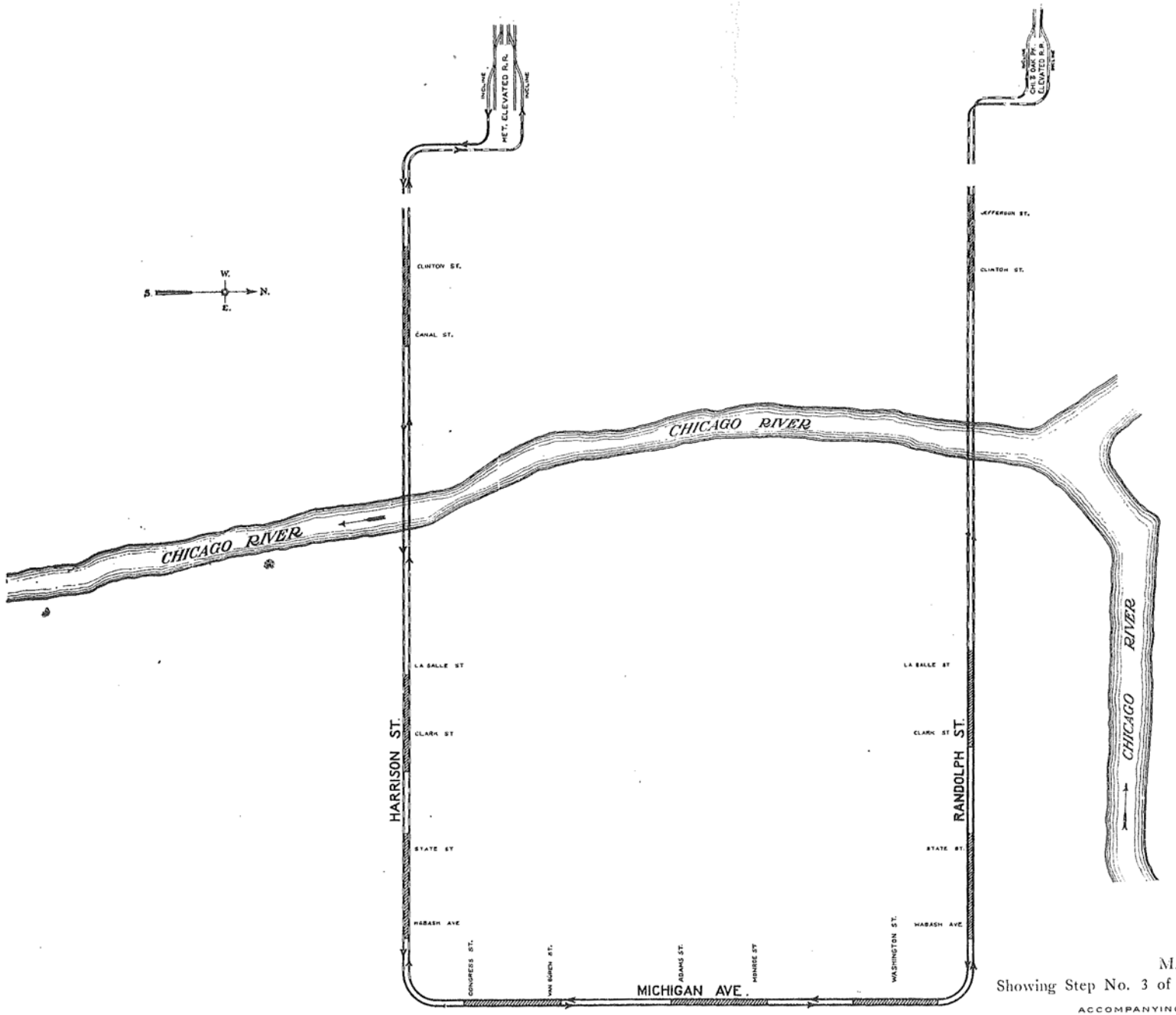


MAP III

Showing Steps Nos. 1 and 2, Combined—
of Recommended Plan No. 1

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

NOTE.—If subways are constructed as outlined in this map provision will be made for through routing of north and south bound elevated and surface cars, and terminal subway loops provided for west side elevated and surface cars.

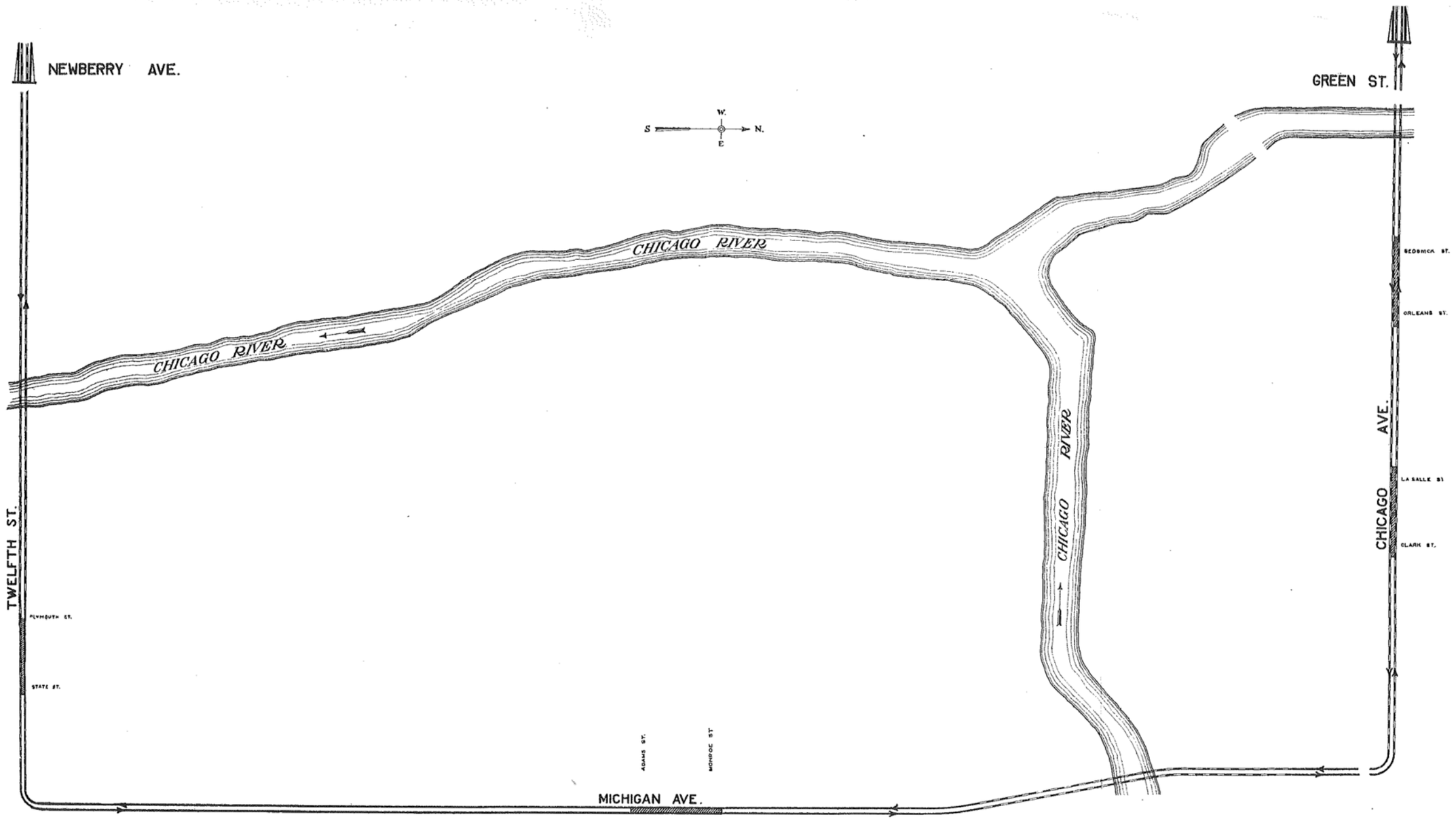


MAP IV

Showing Step No. 3 of Recommended Plan No. 1

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

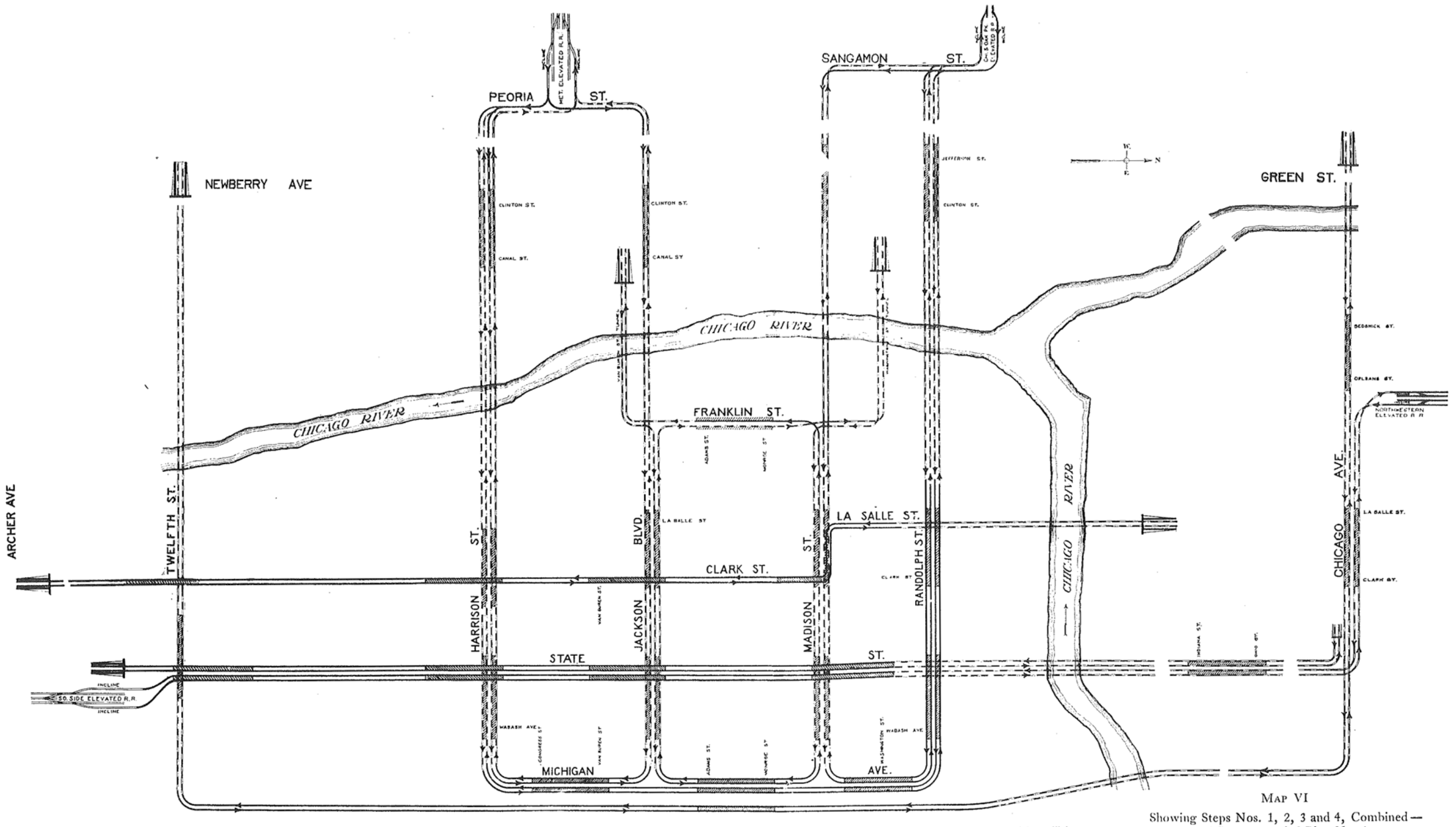
LAKE MICHIGAN



MAP V

Showing Step No. 4 of Recommended Plan No. 1

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



NOTE.—When these subways are constructed provision will have been made for through routing of north and south bound elevated and surface cars, and terminal loops provided for west side elevated and surface cars and for the through routing of the west side elevated railroad systems with each other.

MAP VI

Showing Steps Nos. 1, 2, 3 and 4, Combined — of Recommended Plan No. 1

ACCOMPANYING THE REPORT OF

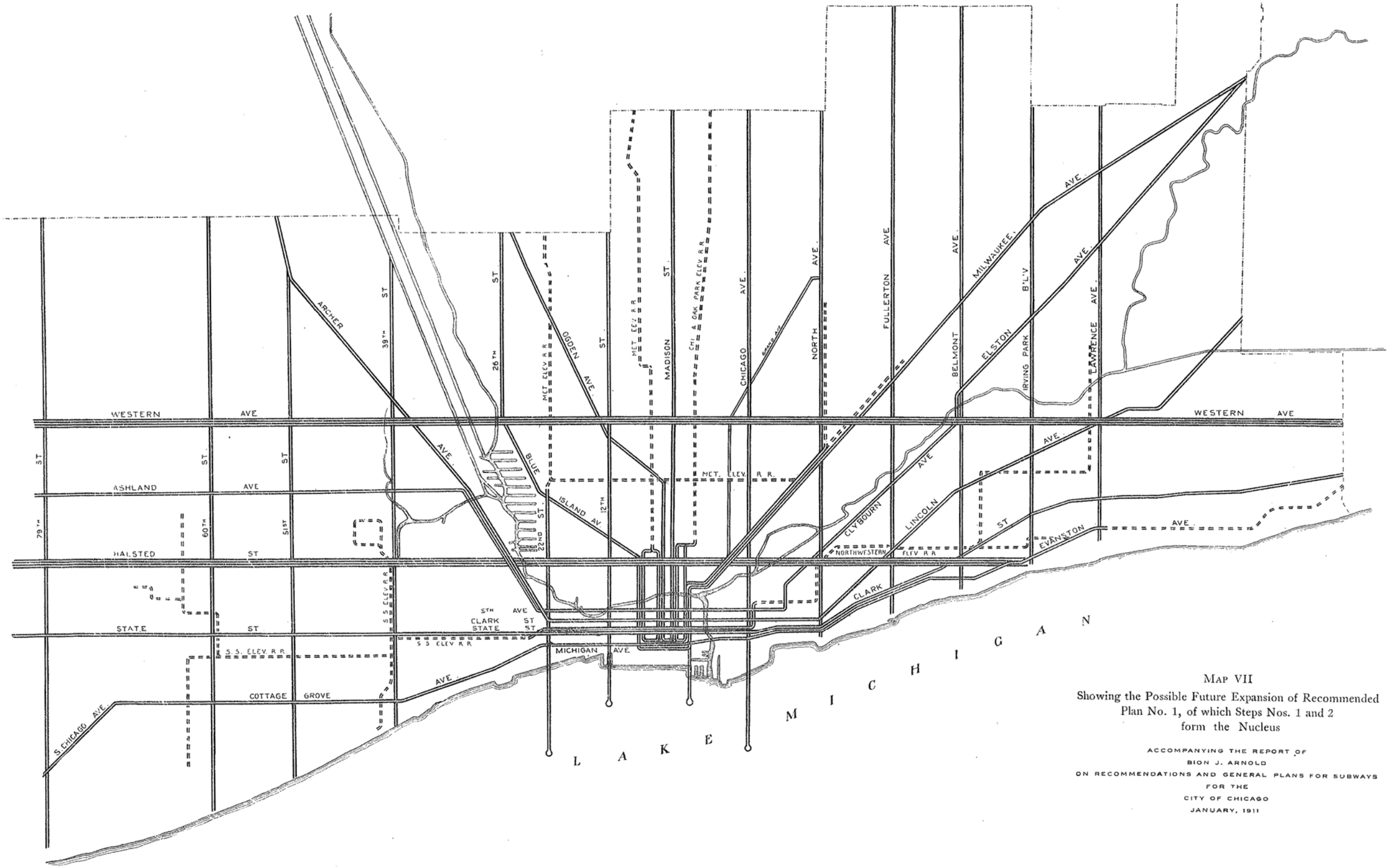
BION J. ARNOLD

ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS

FOR THE

CITY OF CHICAGO

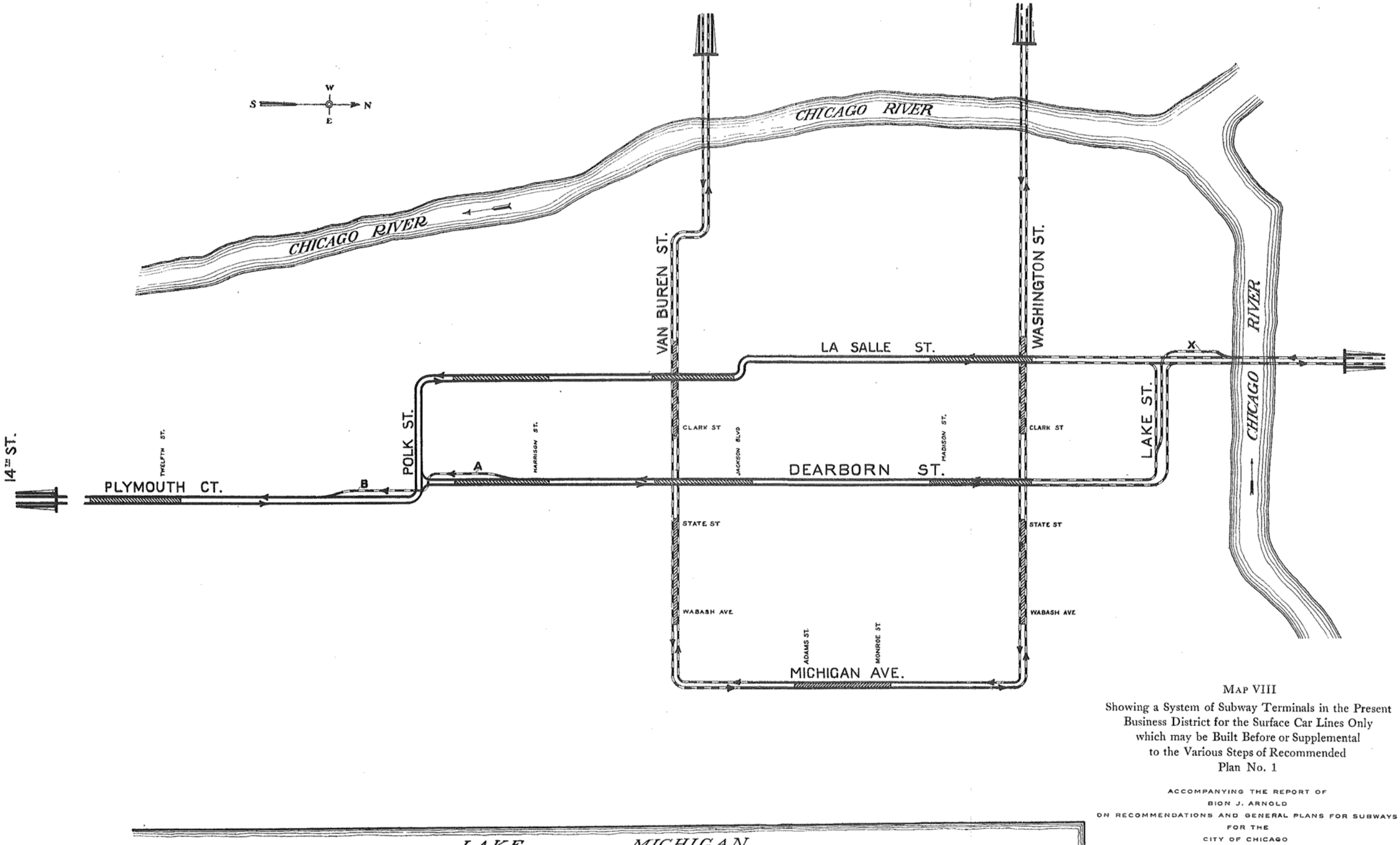
JANUARY, 1911



MAP VII

Showing the Possible Future Expansion of Recommended Plan No. 1, of which Steps Nos. 1 and 2 form the Nucleus

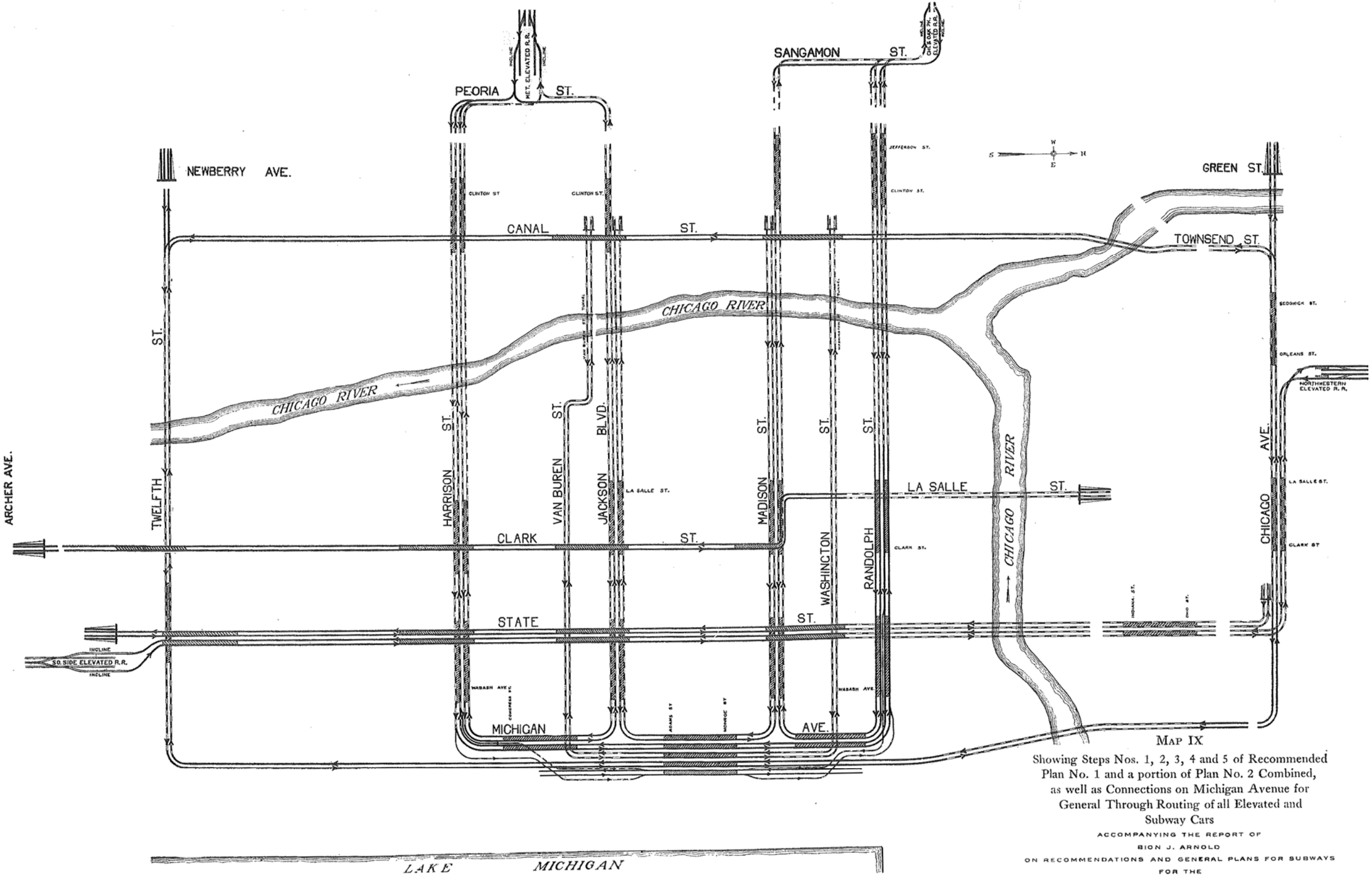
ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



MAP VIII

Showing a System of Subway Terminals in the Present Business District for the Surface Car Lines Only which may be Built Before or Supplemental to the Various Steps of Recommended Plan No. 1

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



MAP IX

Showing Steps Nos. 1, 2, 3, 4 and 5 of Recommended Plan No. 1 and a portion of Plan No. 2 Combined, as well as Connections on Michigan Avenue for General Through Routing of all Elevated and Subway Cars

ACCOMPANYING THE REPORT OF

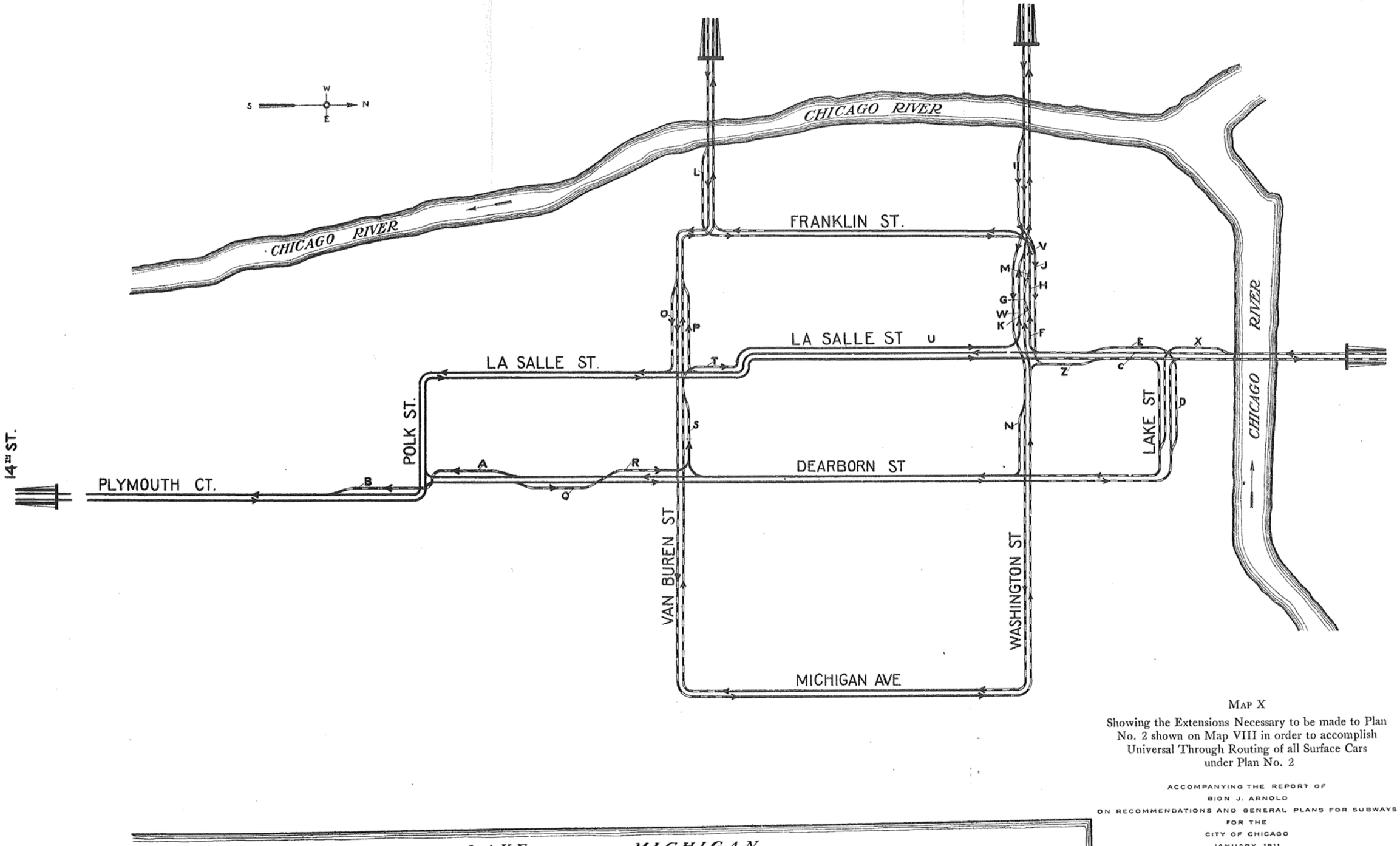
BION J. ARNOLD

ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS

FOR THE

CITY OF CHICAGO

JANUARY, 1911



MAP X

Showing the Extensions Necessary to be made to Plan No. 2 shown on Map VIII in order to accomplish Universal Through Routing of all Surface Cars under Plan No. 2

ACCOMPANYING THE REPORT OF
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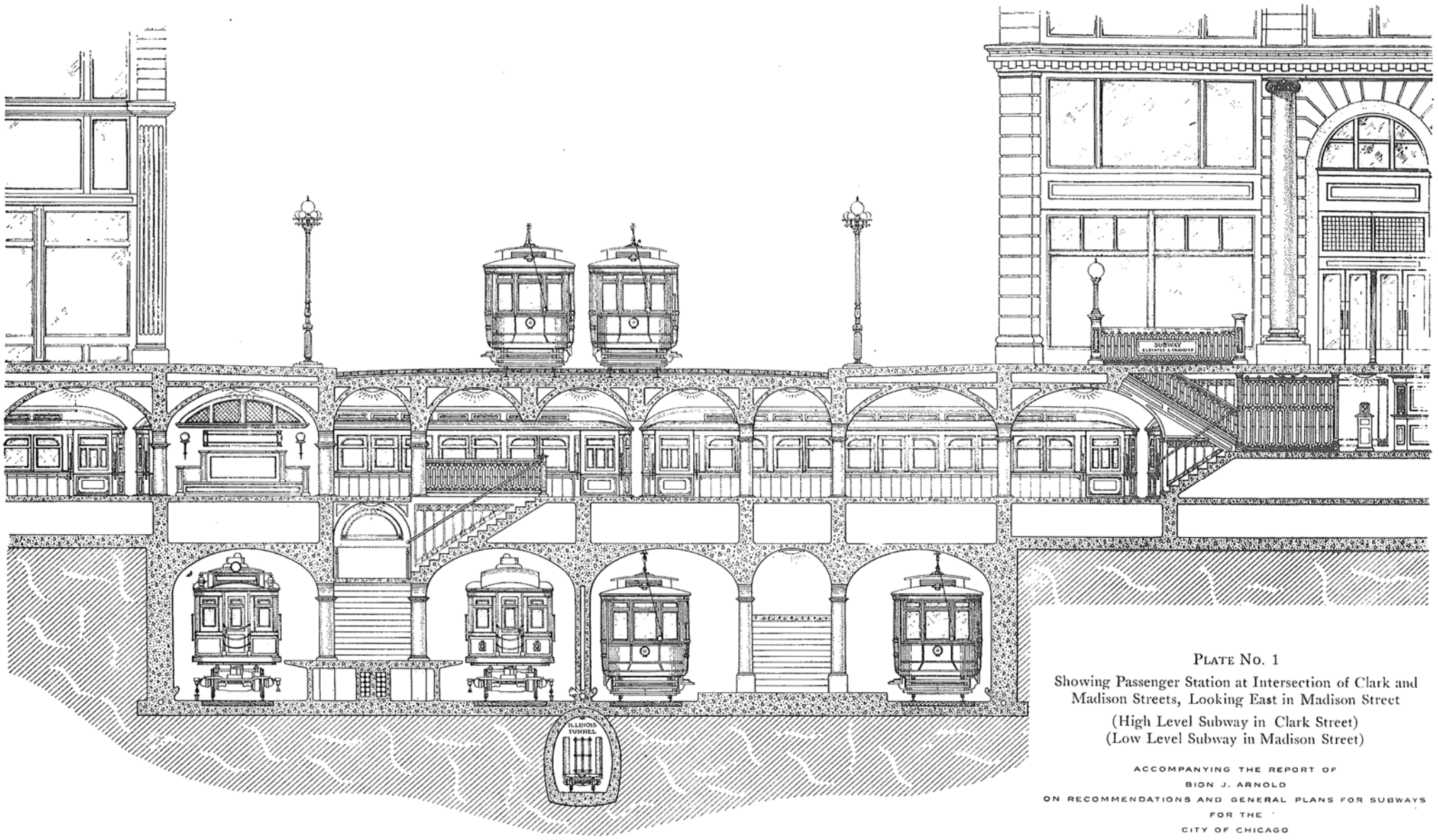
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



SCALE IN FEET.

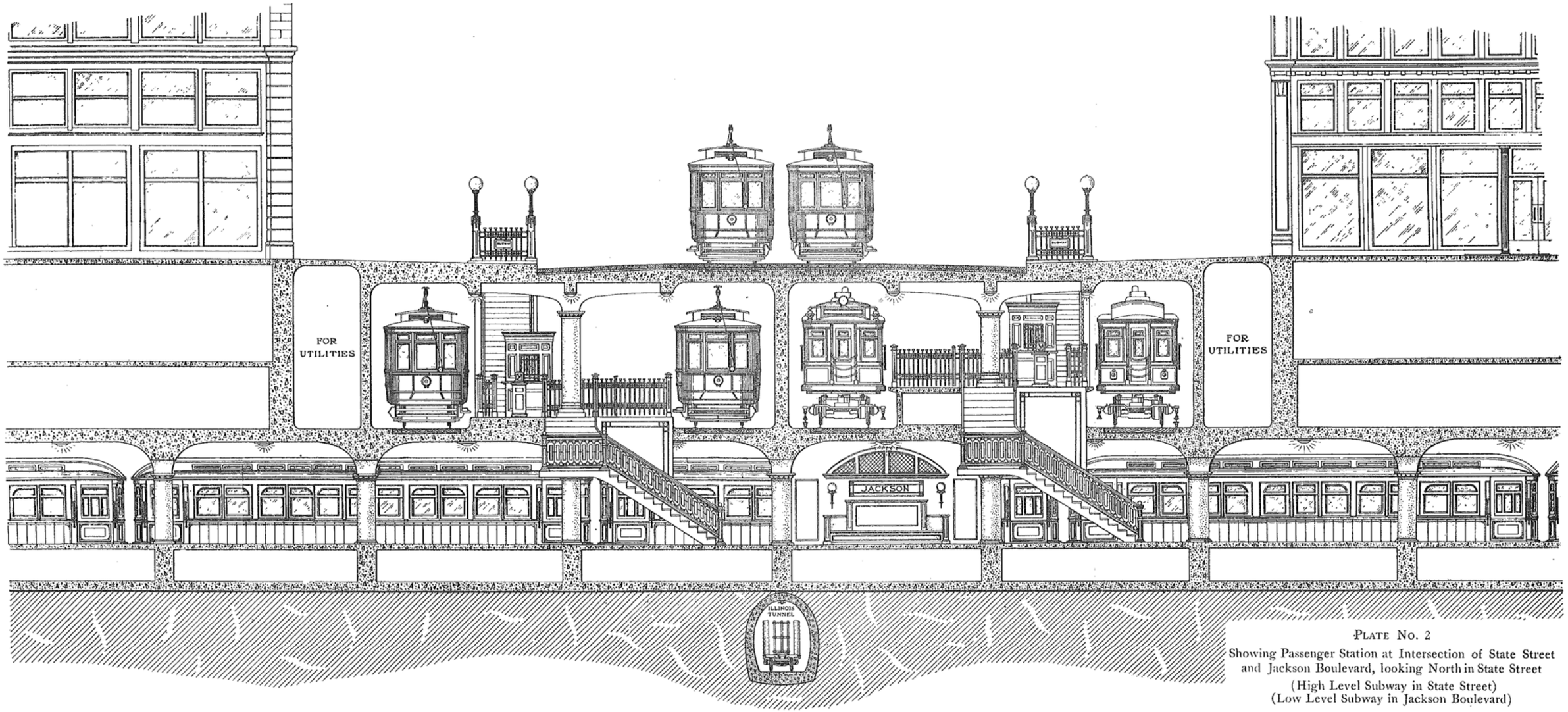
0 1 2 3 4 5 6 7 8 9 10

PLATE NO. 1

Showing Passenger Station at Intersection of Clark and Madison Streets, Looking East in Madison Street

(High Level Subway in Clark Street)
(Low Level Subway in Madison Street)

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



SCALE IN FEET.

1 0 1 2 3 4 5 6 7 8 9 10

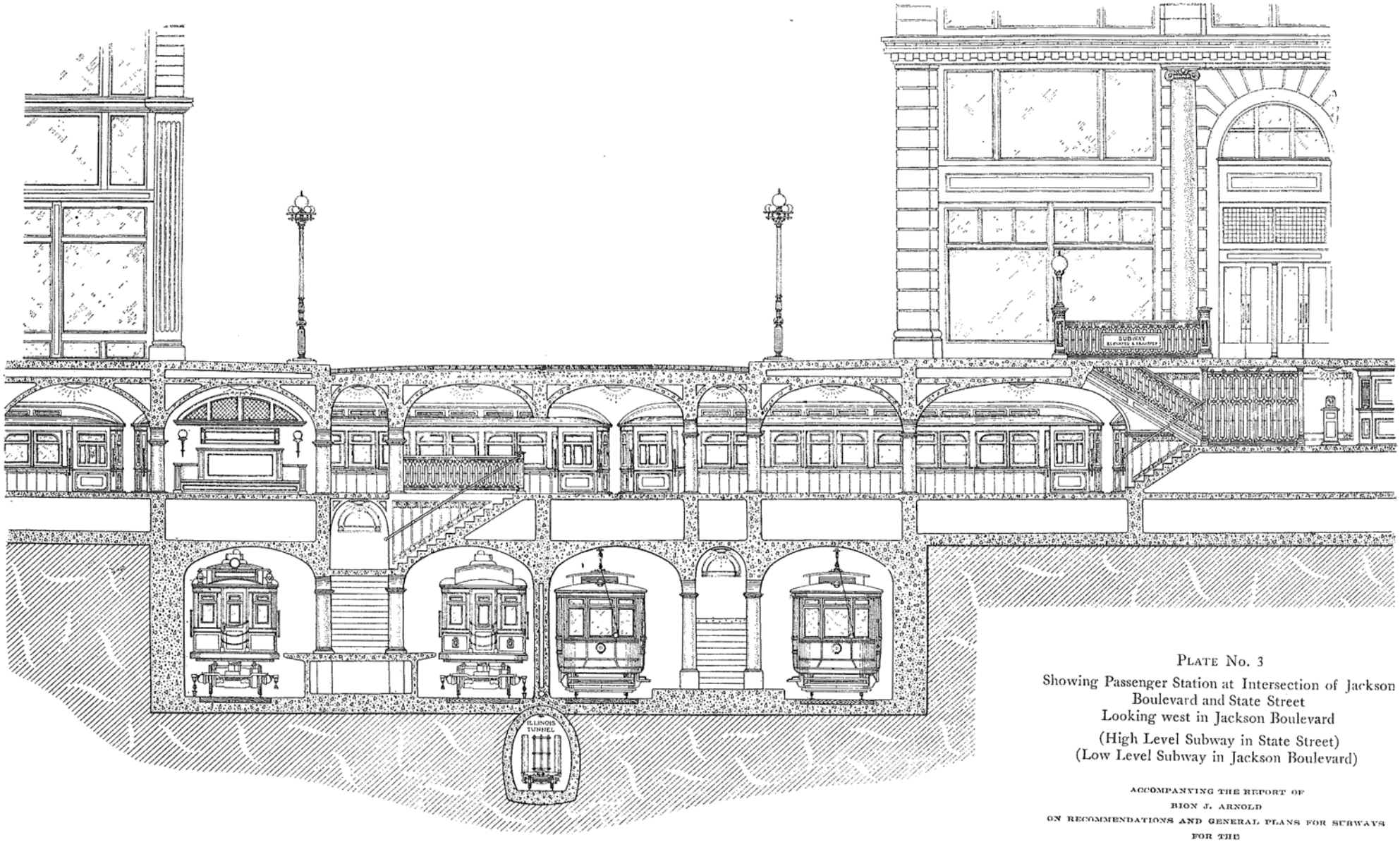
PLATE NO. 2

Showing Passenger Station at Intersection of State Street and Jackson Boulevard, looking North in State Street

(High Level Subway in State Street)
(Low Level Subway in Jackson Boulevard)

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

NOTE—This drawing represents the type of station which may be used at Madison and State Streets with slight modifications, and shows the sidewalks increased to 25 feet in width.



Scale in Feet

0 1 2 3 4 5 6 7 8 9 10

PLATE No. 3

Showing Passenger Station at Intersection of Jackson Boulevard and State Street
Looking west in Jackson Boulevard

(High Level Subway in State Street)
(Low Level Subway in Jackson Boulevard)

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

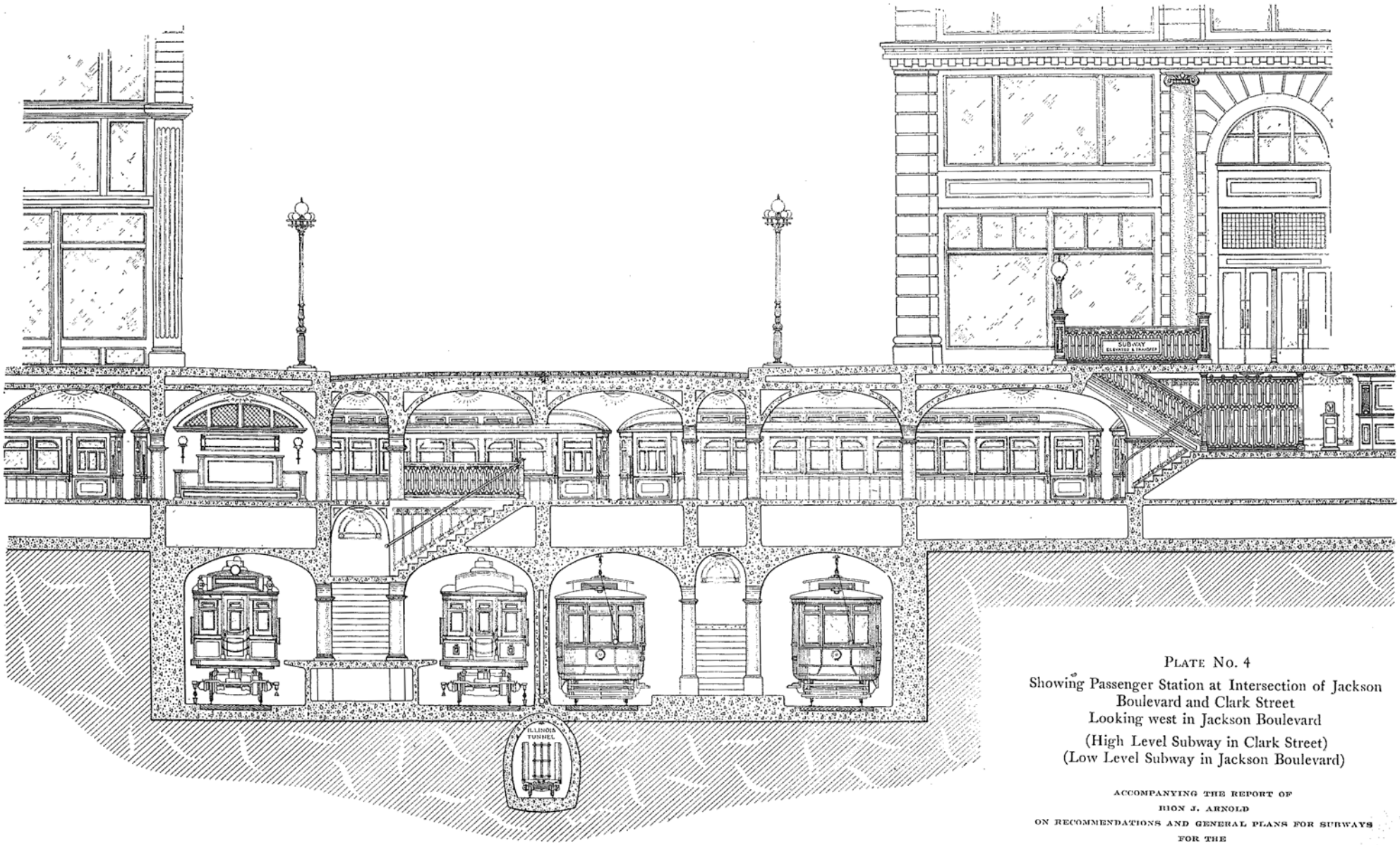


PLATE No. 4

Showing Passenger Station at Intersection of Jackson Boulevard and Clark Street
Looking west in Jackson Boulevard

(High Level Subway in Clark Street)
(Low Level Subway in Jackson Boulevard)

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

SCALE IN FEET

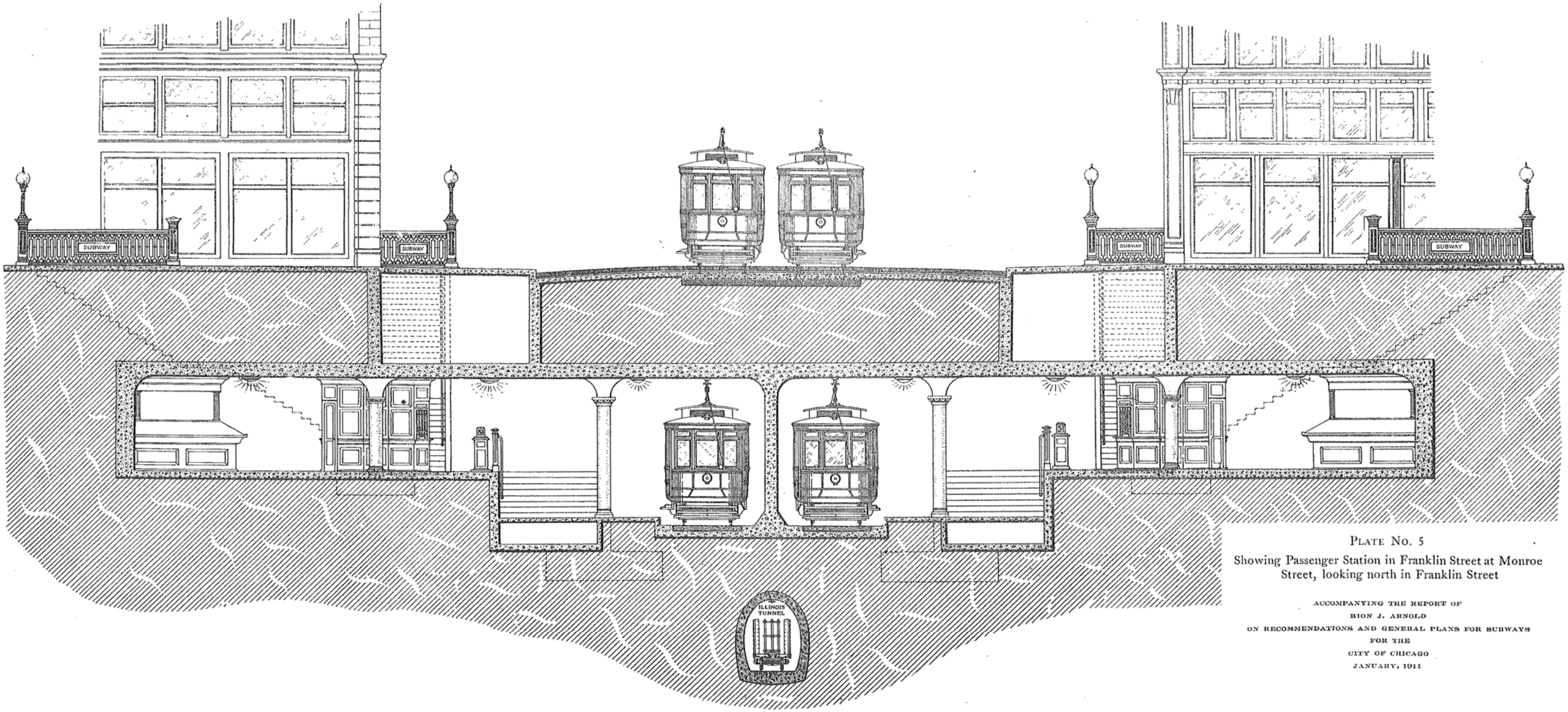


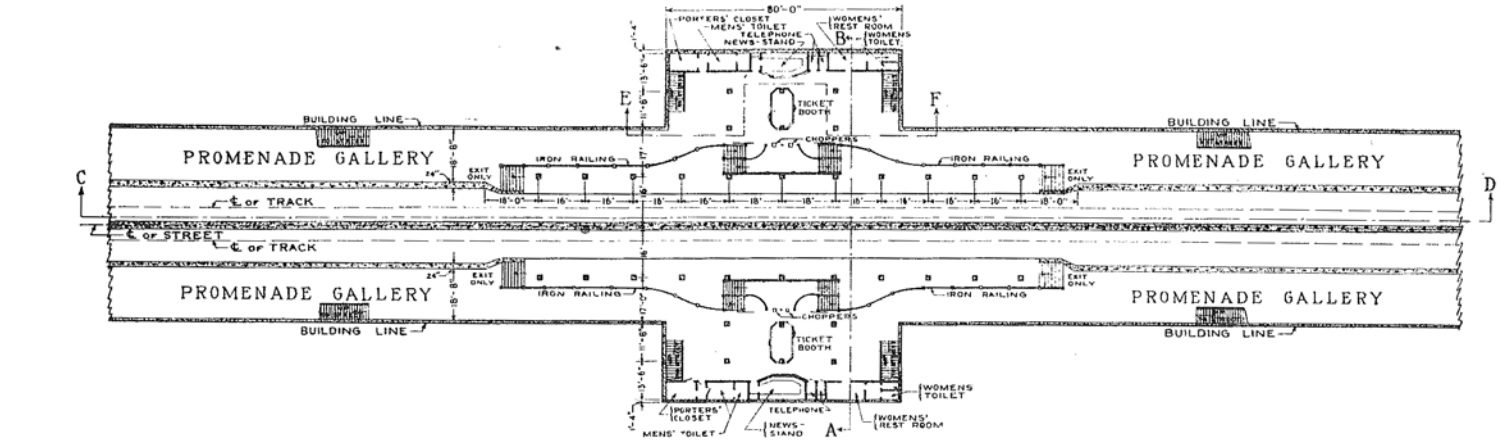
PLATE NO. 5

Showing Passenger Station in Franklin Street at Monroe Street, looking north in Franklin Street

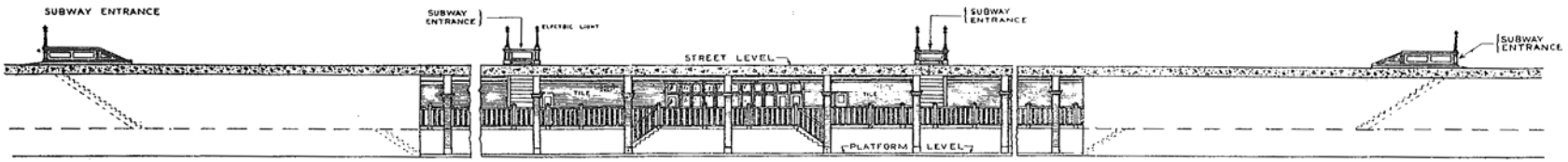
ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

SCALE IN FEET.

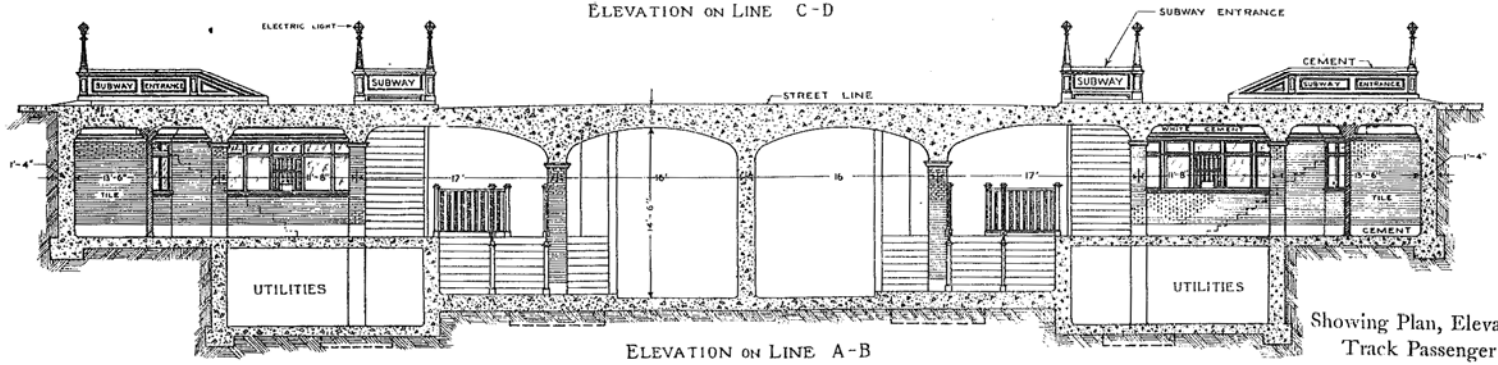
0 1 2 3 4 5 6 7 8 9 10



PLAN



ELEVATION ON LINE C-D

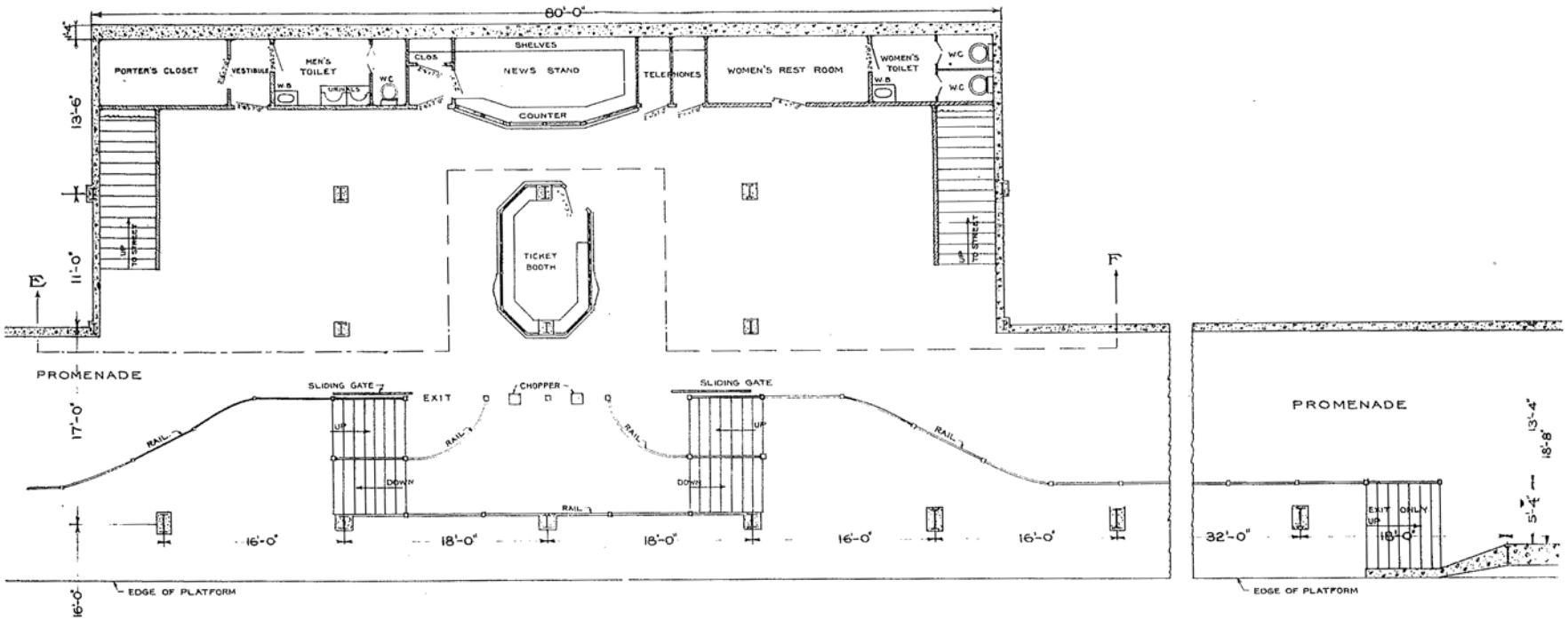


ELEVATION ON LINE A-B

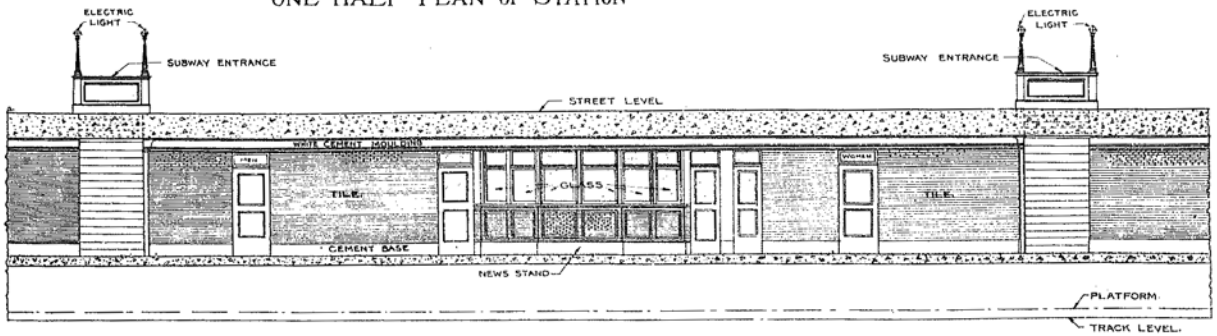
PLATE No. 6

Showing Plan, Elevation and Section of a Typical Single Track Passenger Station for High Level Subways

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



ONE HALF PLAN OF STATION

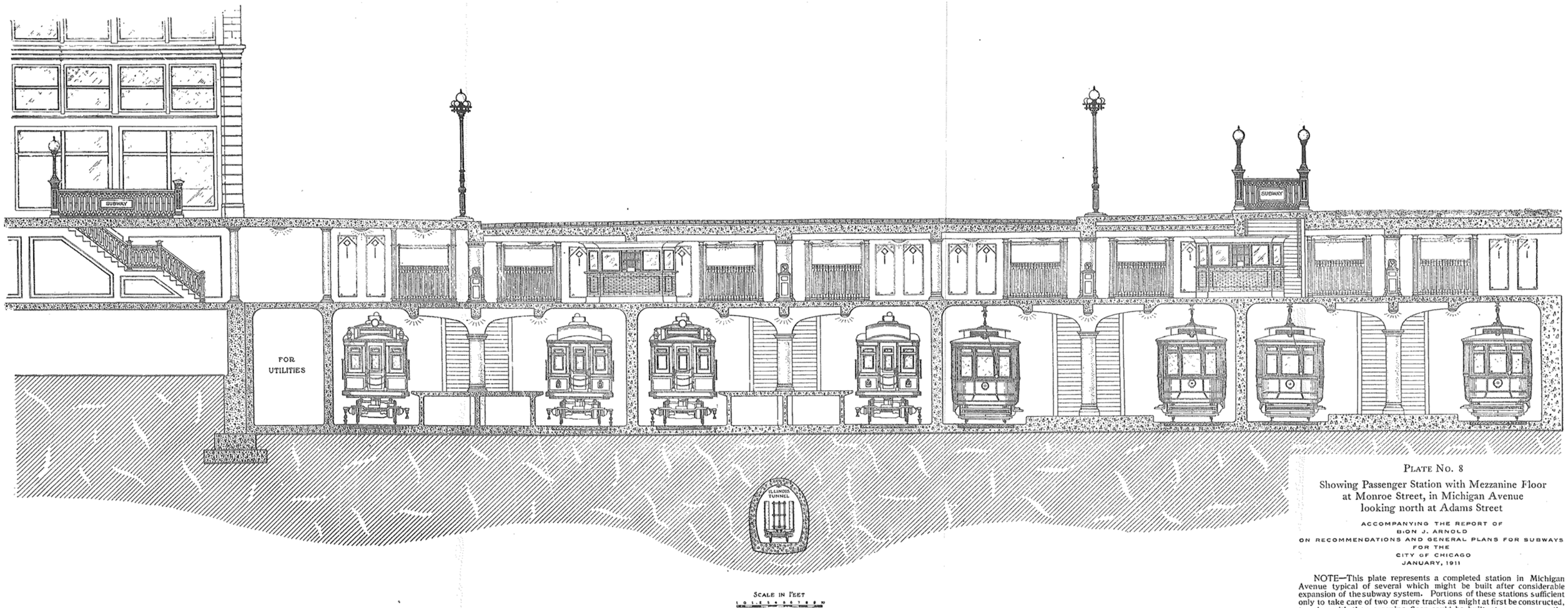


SECTIONAL ELEVATION OF STATION ON LINE E-F

PLATE NO. 7

Showing Plan and Elevation of a Portion of a Typical Single Track Passenger Station for High Level Subways

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



SCALE IN FEET

0 1 2 3 4 5 6 7 8 9 10

PLATE NO. 8

Showing Passenger Station with Mezzanine Floor at Monroe Street, in Michigan Avenue looking north at Adams Street

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

NOTE—This plate represents a completed station in Michigan Avenue typical of several which might be built after considerable expansion of the subway system. Portions of these stations sufficient only to take care of two or more tracks as might at first be constructed, together with the mezzanine floor could be built at once across the entire avenue and thus facilitate pedestrian traffic which is now difficult and dangerous on the surface on account of the width of the street and the constant vehicular traffic.

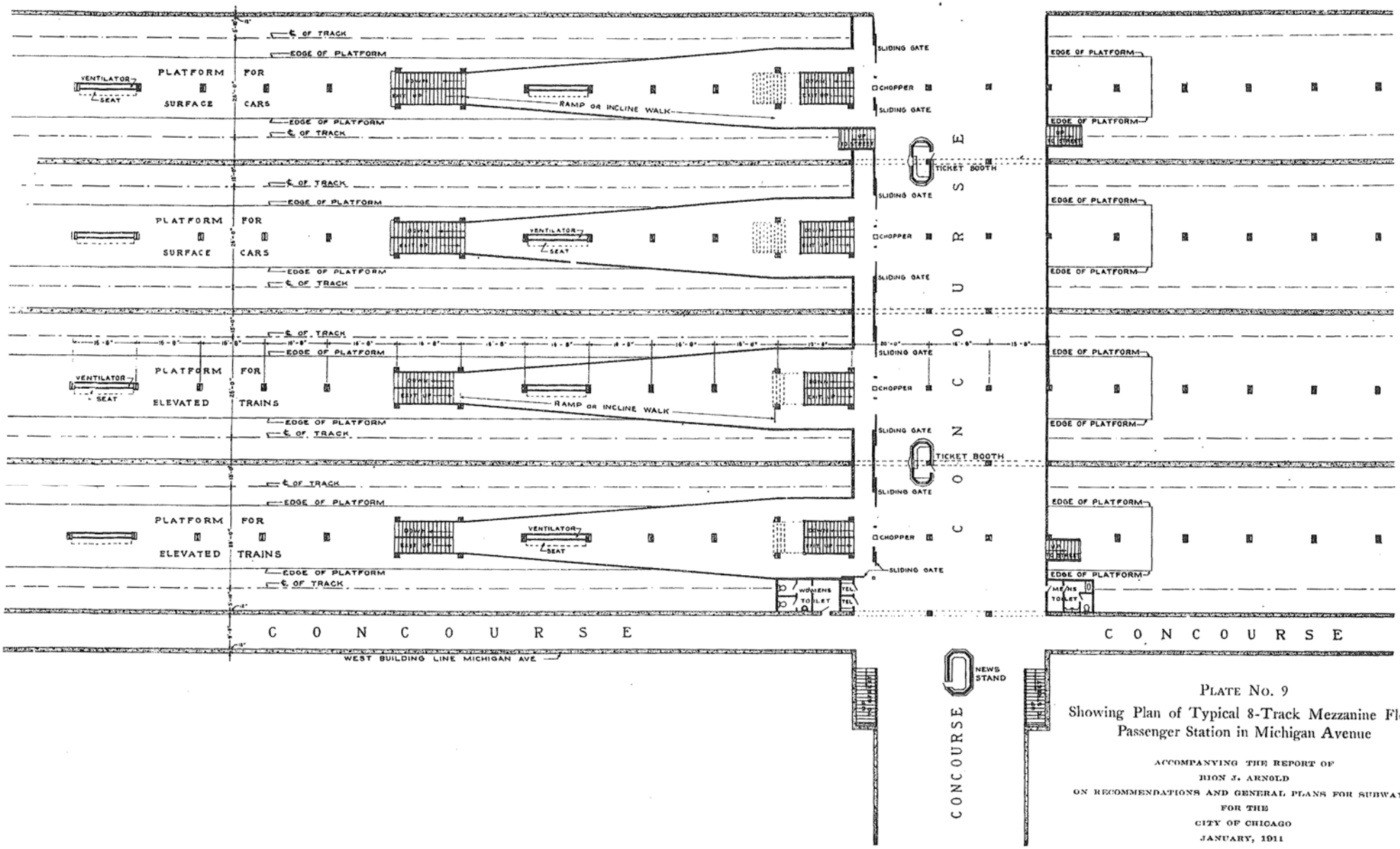
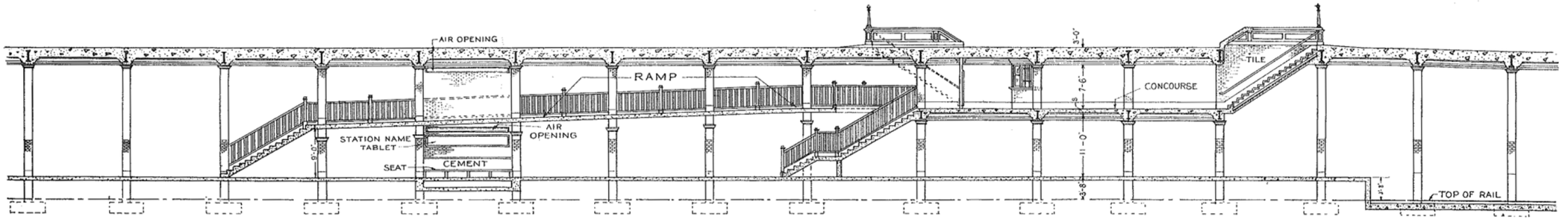


PLATE NO. 9

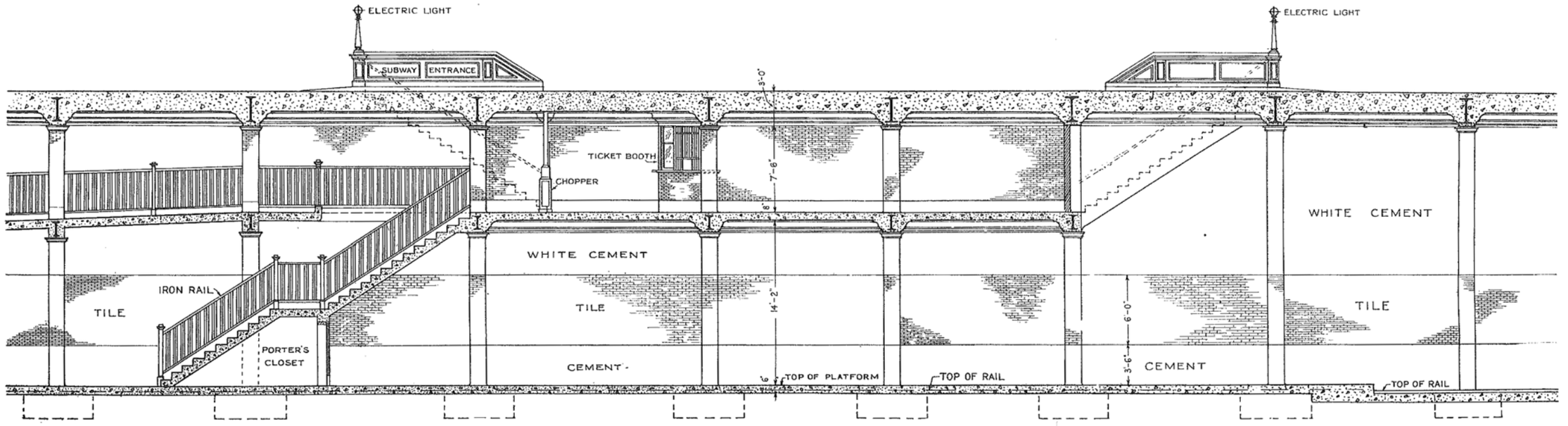
Showing Plan of Typical 8-Track Mezzanine Floor Passenger Station in Michigan Avenue

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911



Longitudinal Section of Eight Track Station

THROUGH TRAIN PLATFORM SHOWING RAMP AND CONCOURSE
AT ONE END ONLY



Longitudinal Section of Concourse of Eight Track Station

THROUGH SURFACE CAR STATION PLATFORM

PLATE NO. 10

Showing Longitudinal Section of Typical Mezzanine Floor Passenger Station in Michigan Avenue

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

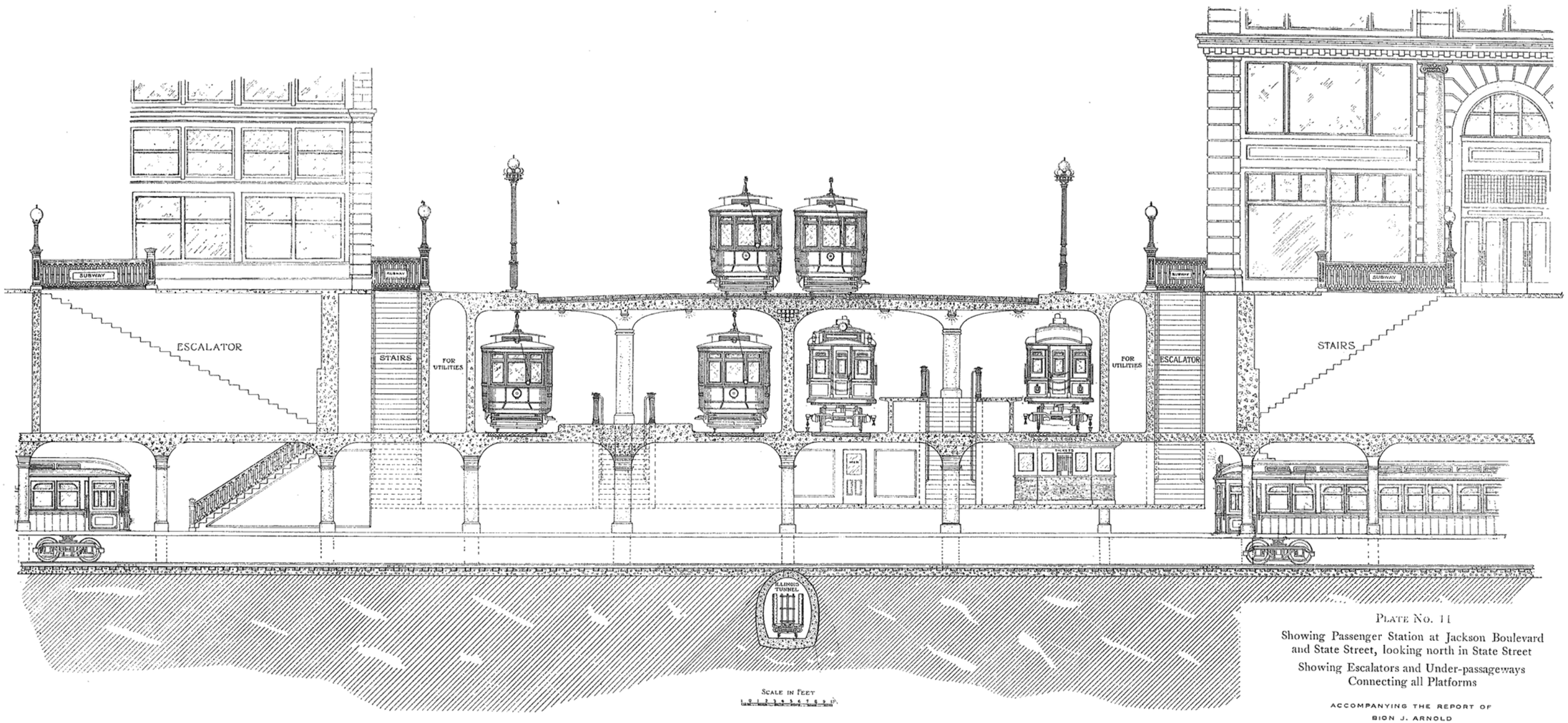


PLATE NO. 11

Showing Passenger Station at Jackson Boulevard and State Street, looking north in State Street

Showing Escalators and Under-passageways Connecting all Platforms

ACCOMPANYING THE REPORT OF
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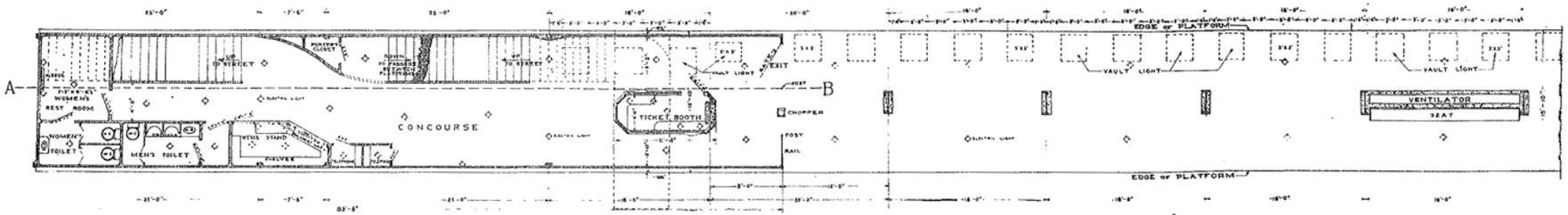
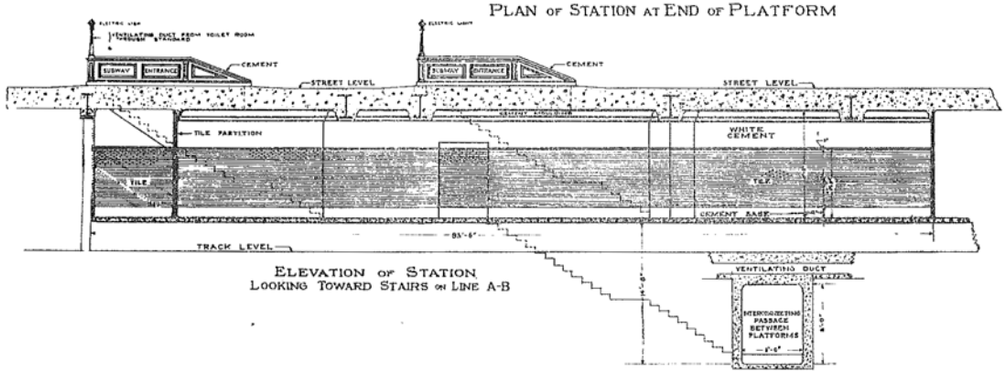
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
FOR THE
CITY OF CHICAGO
JANUARY, 1911

NOTE—This type of station would be necessary in case it is decided not to widen the sidewalks slightly, as required for the recommended typical station shown on Plate No. 2.

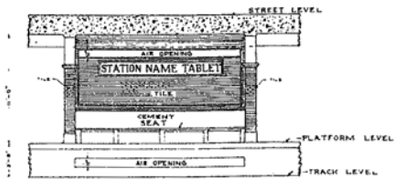
TYPICAL PLAN OF AN ISLAND STATION PLATFORM



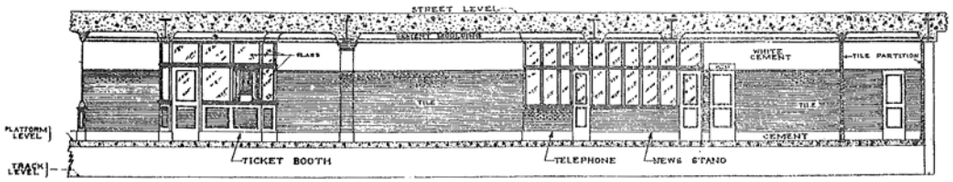
PLAN OF STATION AT END OF PLATFORM



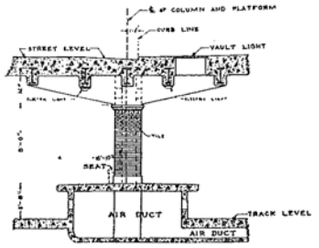
ELEVATION OF STATION
LOOKING TOWARD STAIRS ON LINE A-B



ELEVATION OF SEAT AND VENTILATING DUCT



ELEVATION OF STATION LOOKING TOWARD STREET ON LINE A-B



SECTION THROUGH VENTILATING DUCT AND SHAFT ON PLATFORM

PLATE No. 12

Showing Plan and Elevations for Typical Island Station for High Level Subway

ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
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CITY OF CHICAGO
JANUARY, 1911

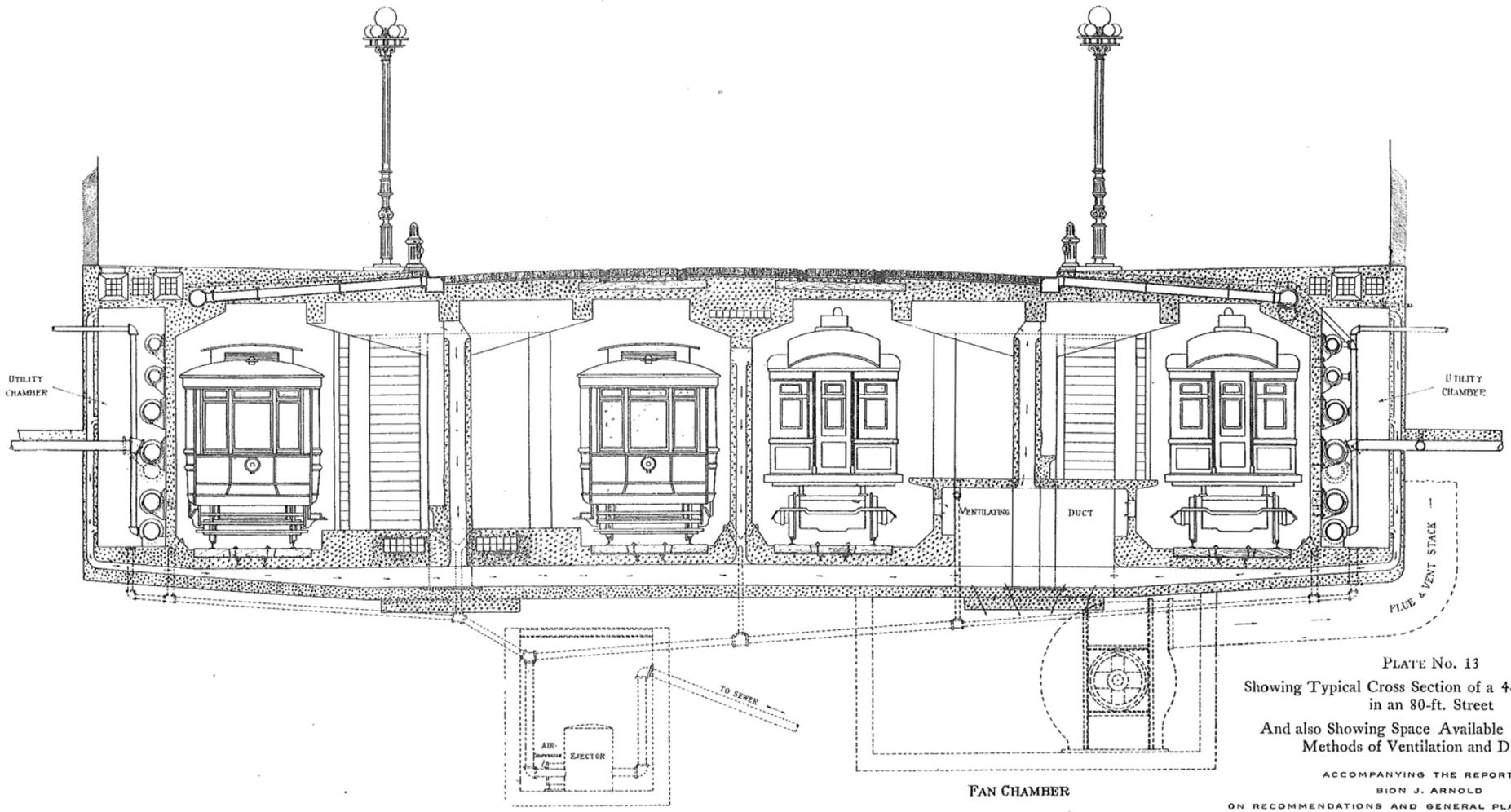

PLATE No. 13

Showing Typical Cross Section of a 4-Track Subway in an 80-ft. Street

And also Showing Space Available for Utilities, Methods of Ventilation and Drainage

ACCOMPANYING THE REPORT OF
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ON RECOMMENDATIONS AND GENERAL PLANS FOR SUBWAYS
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CITY OF CHICAGO
JANUARY, 1911

NOTE.—The space for utilities as shown is a minimum and widens between stations.