Boston Transit Commission.

Eleventh Annual Report.

June 30, 1905.

BOSTON TRANSIT COMMISSION

WASHINGTON ST. TUNNEL
EAST BOSTON TUNNEL & BOSTON SUBWAY.

Washington St. Tunnel is shown as located south of Cornhill and as proposed by one of many studies north of Cornhill.

Statutes 1902, C. 534; 1904, C. 167 and 1905, C. 460.

Scale

George G. Crocker, Chairman
Charles H. Dalton,
Thomas J. Garrity,
George R. Sweetser,
Horace G. Allen,
} Commissioners.

Howard A. Carson,
Chief Engineer.

CHARLES RIVER

BOSTON COMMON

PUBLIC GARDEN

STATE HOUSE

NORTH STATION

SOUTH STATON

SOUTH BAY

FORT POINT CHANNEL

SOUTH BOSTON

HARBOR

EAST BOSTON

WASHINGTON

TREMONT

SUBWAY

EAST BOSTON TUNNEL

Washington Street Tunnel	shown thus
East Boston Tunnel and the Boston Subway	"
Proposed Cambridge St. Subway	"
" Elevated Railway to Cambridge	"
Elevated Railway	"
Entrances or Exits for Washington St Tunnel.	"
Surface Lines	

HELIOTYPE CO., BOSTON.

FROM

THE BOSTON TRANSIT COMMISSION,

15 Beacon Street,

GEORGE G. CROCKER, *Chairman,*

CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,
Commissioners.

HOWARD A. CARSON,
Chief Engineer.

B. LEIGHTON BEAL,
Secretary.

ELEVENTH ANNUAL REPORT

OF THE

BOSTON TRANSIT COMMISSION,

FOR THE YEAR ENDING

JUNE 30, 1905.

BOSTON
E. W. DOYLE, PRINTER
1905

BOSTON TRANSIT COMMISSION.

15 Beacon Street, Boston, June 30, 1905.

To the City Council of the City of Boston:

In compliance with Statutes of 1894, chapter 548, section 24, the report of the Boston Transit Commission for the year ending June 30, 1905, is respectfully submitted.

Washington Street Tunnel.

The Washington street tunnel now in process of building is a two-track structure for the passage of trains of cars north and south through the congested portion of the city connecting with the elevated structure at either end. These trains of cars at present go through the original subway between Pleasant street and Causeway street but in the future they will run through the Washington street tunnel, and the old subway will be restored to its original use as a route for cars from the surface system.

The Boston Elevated Railway Company has the right under the law to request a hearing upon any important question arising in the course of the work except an award of or an agreement upon damages, and in case it disagrees with the Commission the question is to be determined by the Board of Railroad Commissioners. Under these conditions the progress in deciding upon the route, the location of stations, of entrances and exits and upon other important features of the plans has necessarily been slow. It is hoped that the precautions which have been taken to secure a right decision will in the end prove advantageous.

During the year work has been carried on in five sections of the Washington street tunnel, extending from the beginning of the southern incline at a point about opposite Nassau street to a point near Court avenue. As a result, traffic on Washington street from Kneeland street to the northern limit above mentioned has been interfered with somewhat, but the provisions of the act which require public streets and places, or a reasonable part thereof, to be left open for traffic between 8 A. M. and 6 P. M. on each secular day,

except public holidays, have been adhered to, and it is believed that the work has been prosecuted without unreasonable inconvenience to the public.

In conformity with the endeavor of the Commission to avoid interference with traffic, so far as possible, the contract for Section 4, which section covers the portion of the tunnel from Hayward place to near Franklin street, permitted the contractor to use, for the storage of his machinery, supplies, etc., about eight thousand square feet of the southerly extremity of the playground on the Common.

Subsequently the Commission deemed it advisable to increase this space by adding two thousand square feet so as to provide room for the erection and operation of a concrete mixing plant. The erection of this plant gave rise to fears on the part of some citizens that an unwarranted use of the Common was to be made. His Honor the Mayor was out of town at the time. The following correspondence ensued:

CITY OF BOSTON,
OFFICE OF THE MAYOR.

March 3, 1905.

HONORABLE GEORGE G. CROCKER, *Chairman, Boston Transit Commission.*

DEAR SIR:—It has been called to the attention of this office that a permanent, two-story structure, intended for the use of the contractors engaged in building the subway in Washington Street, is in process of erection on a portion of the parade ground on Boston Common.

A few days before Mayor Collins left for Virginia, Commissioner Allen called on him and stated that the contractors who were to submit bids for constructing the subway in Washington Street practically made it a condition before bidding that some convenient place be furnished them for storing during the day time the derricks which they found it necessary to use in connection with their work, and which they had to remove from Washington Street during the busier hours of the day. Mayor Collins finally agreed to their being allowed to place such derricks and other necessary machinery temporarily on a portion of the parade ground. I am quite convinced—and I was present at the interview—that the erection of a permanent structure or the storage of materials such as cobble-stones, etc.—or, in fact, anything other than the derricks and other machinery necessary in connection with their work—was not contemplated by Mayor Collins, and not assented to by him.

The occupation of the Common by such a structure as that now being erected has already caused much criticism and unfavorable comment, and will, I apprehend, be strongly objected to by our citizens as a whole. I therefore thought it proper to call the matter to your attention.

I am,

Very truly yours,

(Signed) M. P. CURRAN
Secretary.

BOSTON, March 4, 1905.

M. P. CURRAN, *Secretary, City Hall, Boston.*

DEAR SIR:—In answer to your letter of March 3 to the Chairman of the Commission I am directed to say that you are quite right in your conviction that the erection of a structure, (temporary, not permanent,) upon the Common was not spoken of by Commissioner Allen in his interview with the Mayor and yourself, as the necessity therefor had not been considered at that time.

Commissioner Allen was requested to see the Mayor upon the question of obtaining necessary space for the storage of materials, derricks and tools, and reported that he secured the Mayor's assent thereto.

The building mentioned in your letter is to cover a concrete mixer which necessarily has to be located near the work, and if not placed in the space designated by the Mayor will necessarily be located in the public streets on the line of the work or adjacent thereto. Any location on the streets would unavoidably obstruct traffic and the smoke and noise would be a nuisance to occupants of adjacent buildings, as was the case near the Custom House when so occupied in building the East Boston tunnel.

It seemed to the Commission that the convenience and comfort of the community require that it should not be located in the public streets.

Yours truly,

(Signed) B. LEIGHTON BEAL.
Secretary.

CITY OF BOSTON,
OFFICE OF THE MAYOR.

March 11, 1905.

HONORABLE GEORGE G. CROCKER, *Chairman, Boston Transit Commission, 15 Beacon Street, Boston, Massachusetts.*

DEAR SIR:—Through the public press and through official and private correspondence, Mayor Collins has been made aware of the unwarranted and illegal occupation of a portion of the playground on Boston Common by contractors engaged in constructing the Washington-Street subway. He has given the matter his earnest attention, and he instructs me to say to you that as soon as he returns to the city he will take steps to have the Common freed from the obstructions placed there without warrant or authority, and to restore it to its original use as a public ground.

I inform you at this time of the Mayor's intention, in order that your Board may, if it chooses, notify the contractors that they will be compelled to remove from the Common the unsightly pile of buildings and materials against the presence of which the public justly protest, and in order that your Board may have time to provide another location for the building and materials that now offend the eye and reduce the area allotted by general consent to the boys for a playground.

I am,

Very truly yours,

(Signed) M. P. CURRAN
Secretary.

BOSTON, March 13, 1905.

M. P. CURRAN, ESQ., *Secretary to His Honor the Mayor.*

DEAR SIR:—Your letter of March 11 addressed to the Chairman of the Commission has been received.

The acts of the Commonwealth providing for the construction of subways and tunnels, accepted by vote of the citizens, authorize the use of public ways and lands.

In prosecuting its work during the past ten years the Commission has used this authority by temporarily occupying parts of the Garden, the Common and other public ways and lands. Such occupancy was neither unwarranted nor illegal, but on the contrary was contemplated by the acts as definitely providing for the best interests of the city at large, and for minimizing the inconvenience of the community during the carrying out of important public works.

The building of the Washington street tunnel will subject citizens and merchants along the route to much unavoidable inconvenience, and the Commission is anxious not to aggravate the situation by still further increasing the congestion of the immediate neighborhood.

In order to limit the time of this inconvenience the work is being rapidly pushed forward. To accomplish this, however, machinery, tools and materials must be conveniently at hand. Pursuant to its policy the Commission has thought that the occupancy of a part of the Common would be far less inconvenient to the general public and merchants than to encumber the public ways and lands in and adjacent to Washington street already overcrowded.

The individual members of the Commission share with their fellow citizens the sentiment of respect for this priceless inheritance, the Common, and sympathize with all efforts for safeguarding it from wrong uses.

The area occupied for tools, derricks and material does not exceed the 8,000 square feet, suggested to and approved by Mayor Collins, and located by the Transit Commission engineers. Two thousand feet more were added by the Commission for the mixing plant, rather than to allow it to be placed in Washington street or adjacent thereto, where the smoke and noise would annoy the neighborhood, though the latter location was for the interest of the contractor. This is about one-half of one per cent. of the surface of the Common. The use of the playground is not materially interfered with, and the contractor, by the terms of his contract, is made subject to the regulation of the Superintendent of Public Grounds, and is required to restore the Common to as good condition as that in which he found it.

The Commission now, as heretofore, desires the advice of the Mayor of the city as representing the public interest in its broadest way, and on his return an inspection of the premises and a conference will undoubtedly lead to mutually satisfactory action.

By the order of the Commission,

(Signed) B. LEIGHTON BEAL.
Secretary.

Upon the return of His Honor a conference was held with him, and the Commission requested its Chief Engineer to investigate the whole matter once more. He reported thereon as follows:

BOSTON, March 25, 1905.

BOSTON TRANSIT COMMISSION,
GENTLEMEN:

Advisability of requiring the Contractor for Section 4 to vacate the Common.

In reply to your vote that

"The Chief Engineer be requested to make a written report regarding the advisability of requiring the Contractor for Section 4 to vacate the Common, especially with reference to the convenience of the public and the possibility of securing the best work."

I beg leave to report that, as is well known, the New Tunnel is to be built mainly of concrete and that the additional foundations for the numerous buildings which have to be supported in connection with the construction of this tunnel are to be of the same material. Many thousand cubic yards will be used on Washington street.

The contractors prefer to do their mixing by hand on the street close to their work, as that is more convenient for them and under present conditions costs them less money.

One objection to this practice is that it takes considerable space in the streets that, even under normal conditions, when no public work is there going on, are far too narrow for the use of vehicles and pedestrians. The controlling objection to hand mixing, however, is that concrete is decidedly better when mixed by machinery. Mixing by machinery takes even more space than mixing by hand. It not only requires space for storing cement, sand and broken stone but also space for the machinery itself and for teams going to and from the mixers. It is a dusty and dirty process and is more noisy than mixing by hand. The mixers must run by night as well as by day even though so noisy as to keep nervous people awake in neighboring hotels and lodgings.

If the Contractor vacates the Common where shall he go?

I do not know of any part of Washington street, Summer street or other place not too distant (except as noted later) where the necessary space could be found. If space in the neighboring streets *could* be found a moment's consideration will show that hundreds of people would be inconvenienced and offended to each one who could be annoyed by mixing in the present location. Where placed upon the Common the mixing and storing will not injure tree, grass or shrub. There is no near dwelling or lodging house, the passers-by are few, and there is no material interference with the use of the ball ground.

Phillips and Post Office squares, and possibly Fort Hill square, are suitable spaces, as far as distance is concerned, for mixing concrete and considerable space has already been taken in the first for Section 3, with so much opposition, however, that we have been searching for other places to move to. I certainly do not think that it would be wise to take any more space there.

Post Office square is farther away from Section 4 than from Section 5 and we may have to go to this square for mixing for the last named section. For reasons already indicated the location in this square should be deferred as long as is practicable.

Fort Hill square is about 12% more distant from the junction of Washington street with Temple place (the center of Section 4) than the place on the Common now occupied by the contractor for that Section. Moreover as Fort Hill square is adorned with flower beds, shrubs and young trees it is much more liable to injury for the

purpose in question than an equal space in the corner of the Common playground.

A word should be said here as to the effect of increased distance. Concrete begins to set, i.e., to harden as soon as it is mixed and I fear that if we should go to a point more distant than that selected on the Common the concrete would become so much hardened by the time it reached Section 4 as to require that it be re-mixed. If mixed over again valuable space on Washington street already alluded to would have to be taken and the advantages of mixing in an open distant space would be largely thrown away.

Space might be taken south of the Providence station and some spaces can be found in the Back Bay and in South Boston. The nearest of these spaces is 75% more distant from the center of Section 4 on Washington street and most of them are several times farther away than the selected locality on the Common. If either of these spaces should be used the objection on account of the hardening of the concrete would be much greater than that alluded to in the case of Fort Hill square.

At a later time we can perhaps make use of some portions of the completed tunnel for mixing concrete but for the present, having in view the convenience of the public and the possibility of securing the best work, it does not seem to me that the contractor for Section 4 should be required to vacate the Common.

Yours truly,

(Signed) H. A. CARSON
Chf. Engr.

After still further consideration, the following letter was sent to His Honor:

BOSTON, April 6, 1905.

To His Honor the Mayor PATRICK A. COLLINS.

DEAR SIR:—Since the conference between your Honor and the Chairman of this Commission soon after your return from the South, on March 22nd. this Commission has re-examined the question of its action in assigning a portion of the playground on the Common as a place for the storage of material and the mixing of concrete to be used in the construction of one of the sections of the Washington street tunnel.

The Commission is acting under the provisions of chapter 534 of the acts of the year 1902, which act was accepted by vote of the citizens of Boston. The desire that the work should be carried on with the least possible interruption to business is indicated by section five of the act which reads as follows:

"All work done under this act under or near public streets and places shall be conducted, so far as practicable, in such manner as to leave such streets and places, or a reasonable part thereof, open for traffic between the hours of eight in the forenoon and six in the afternoon of each secular day except public holidays."

The next section authorizes the Commission to use public ways and lands for the purposes of the act.

Positive as are these instructions as to avoiding interference with traffic and this permission to use public lands, the Commission, fully sympathizing with the feeling of great regard in which our citizens hold the Common, would not have felt justified in making use of any portion of it had it not been satisfied that such use was distinctly for the public benefit. Its decision has been

confirmed by the further examination which it has made, and by a special report in writing by its Chief Engineer, a copy of which is enclosed.

Any other plan which has been proposed would result in grave inconvenience to the public on account of interruption of traffic, dust and noise, or would be detrimental to the concrete in consequence of the mixer being too far distant from the place where the concrete is to be used.

The difficulties encountered in building a tunnel under a narrow way like Washington street and underpinning buildings along the route, without creating conditions almost unbearable, are very great. The more fully the nature and extent of these difficulties are realized the more general will be the approval of the action of the Commission.

The Commission assures your Honor that it will sedulously guard the Common against permanent injury, and at the end of its occupation will cause the portion occupied to be left in good and suitable condition.

THE BOSTON TRANSIT COMMISSION,
By (Signed) GEORGE G. CROCKER
Chairman.

Entrances and Exits.

In the Tenth Annual Report of this Commission, on page 35, occurs the following:

"Consideration of the volume of traffic on the sidewalks and streets in connection with the width of those sidewalks and streets has convinced the Commission that it would not be expedient to take any portion of the sidewalk or the roadway on either Washington street or the side streets for entrances to the stations. It was determined in all cases to make the entrances in private property, and so far as possible, on side streets."

In accordance with this determination the Commission studied many locations in private property on La Grange street, Boylston street, Essex street, Hayward place, Temple place, Winter street, Summer street, and Franklin street, and was in frequent conference with the officials of the Boston Elevated Railway Company in relation thereto. The property numbered 15 Essex street was taken November 12, 1904, for the southerly entrance to and exit from the platform for north bound trains at the Boylston street station, and on the same date the property numbered 11 and 13 La Grange street was taken for the entrance to and exit from the platform for south bound trains at the same station. Subsequently, in negotiating with the owners of this latter property it was found more desirable and economical to take the property on the opposite side of La Grange street, belonging to the same owners, and although the actual taking of this second prop-

erty has not been made, the details and the terms under which an exchange can be made have been agreed upon.

On October 18, 1904, the Boylston Market Association, learning that the Commission had in contemplation the location of an entrance to and exit from the platform for south bound trains at the Boylston street station in its building, on the south side of Boylston street, a short distance west of the corner of Boylston and Washington streets, filed a remonstrance and requested a hearing. At the hearing, which was held on November 3, 1904, the Association was represented by its President, William A. Gaston. Other owners and tenants of property on Boylston street were also present. Subsequently the officials of the Boston Elevated Railway Company asked for a further conference on this particular location, and at such conference and later ones indicated a strong preference for a location at the northwest corner of Boylston and Washington streets.

The following considerations, however, led the Commission to fix upon a location on the south side of Boylston street:

On the average the buildings on Washington street are now carried up only to about one-half the hight which the law permits. The additional and improved railway service which will result from the operation of trains in the tunnel is likely to hasten the erection of new buildings furnished with more general elevator service. An enormous department store is now being erected on Washington street between Essex street and Hayward place. Such new buildings, together with the tunnel railway service, must, in the near future, largely increase the number of people using the sidewalks on Washington and intersecting streets. The sidewalk on the south side of Boylston street is wider than that on the north side. It is not now congested by traffic, whereas the sidewalks on either side of the northwest corner of Washington and Boylston streets are congested with traffic to such a degree that people passing thereon are seriously incommoded. At points where there is now congestion the trouble will increase. If the entrance and exit is on the south side of the street the passengers coming from or going to the west, which the Commission believes would constitute a large proportion of those using the station, would neither use the narrow sidewalk on the north side of Boylston street nor increase the congestion at the corner. Passengers going to or coming from the east could readily avoid this congested corner. To place the entrance and exit on the south side of Boylston

street would enlarge to a certain extent the business area and would distribute real estate values rather than increase values already excessive. The expense of a location at the northwest corner of the two streets would be far in excess of the expense of a location on the south side of Boylston street and this expense would be still further increased if the sidewalks in the vicinity of the entrance and exit should be adequately widened by taking private property therefor.

On December 10 it was voted to locate the Boylston street entrance and exit in the Continental building, so-called, about 106 feet west from Washington street. On the same day the following communication was received from the Boston Elevated Railway Company:

SECRETARY'S OFFICE,
101 MILK ST.

BOSTON, MASS., Dec. 10th, 1904.

B. LEIGHTON BEAL, *Secretary, Boston Transit Commission, 15 Beacon St., Boston, Mass.*

DEAR SIR:—I beg to acknowledge receipt of your letter of even date, received this day, enclosing the following attested vote:

"VOTED: That the location of the Boylston street entrance, Boylston street station, Washington street tunnel, as shown on plan No. 6809, being about 106 feet west from Washington street, be adopted."

This company in pursuance of section 13 of chapter 534 of the Acts of 1902, has this day appealed to the Board of Railroad Commissioners for revision thereof, and I enclose herewith a copy of such appeal.

Yours very truly,

(Signed) JOHN T. BURNETT.
Secretary.

Enclosure.

COPY.

BOSTON, MASS., Dec. 10th, 1904.

To the Honorable Board of Railroad Commissioners:

The Boston Elevated Railway Company has this day received notice of the determination by the Boston Transit Commission of the important question of the location of the Boylston street entrance of the Boylston street station of the Washington street tunnel, upon which the Company had previously requested a hearing, by the following vote passed by the Commission December 10, 1904:—

"VOTED: That the location of the Boylston street entrance, Boylston street station, Washington street tunnel, as shown on plan No. 6809, being about 106 feet west from Washington street, be adopted."

The Company, regarding this determination of this question as inconsistent with the public interests, hereby applies to the Board, in pursuance of section 13 of chapter 534 of the Acts of

1902, for revision thereof, and that the Board may consider and finally determine the question.

Executive Committee of the Board of Directors,
BOSTON ELEVATED RAILWAY COMPANY,
By JOHN T. BURNETT,
Secretary.

The determination by the Board of Railroad Commissioners was as follows:

COMMONWEALTH OF MASSACHUSETTS,
IN BOARD OF RAILROAD COMMISSIONERS.

March 29, 1905.

Determination of the entrance and exit for the Boylston street station of the Washington street tunnel.

Such throngs of people now use the narrow sidewalks of Washington and Boylston streets that the location of an entrance and exit for the Boylston street station of the tunnel is a perplexing problem. It would seem strange if there were not a diversity of opinion as to the proper way of solving it. The governing thought must of course be the largest convenience of the public consistent with a reasonable economy in construction.

An examination of the sites which have been proposed convinces us that the ultimate difference in cost, in view of the character of the estates which would be invaded and the ways open for the use and disposition of the property taken, would be too small to weigh heavily in the balance against the comfort and convenience of so large a public as that here interested. This difference in cost, we think, ought not to be a controlling factor in the choice of location.

The question is, then, how to best accommodate and to quickly and safely distribute the people who use the station, with the least annoyance to those passing by.

The suggestion that the larger number of persons who will take the southbound trains will come from the district north of Boylston street is pertinent; but just what proportion of patrons will approach the station by way of Washington street and what proportion by way of Boylston street is not clear.

As the result, however, of careful consideration the Board is of the opinion that with a view to quickly relieving the sidewalks which will probably be most largely used there should be an entrance to the station from Washington street and an exit to Boylston street, and that these should be provided by way of the premises on the northwest corner of Washington and Boylston streets.

In so deciding the Board does not accept the plan submitted by the company but, without attempting to go into detail, suggests the very great advantage to be derived from taking enough of the street floor of the building upon the corner to provide room which the sidewalks are not wide enough to furnish. Such an arrangement would permit persons approaching from Boylston street to reach the station without entering upon Washington street and so prevent the congestion otherwise probable as the result of opposite streams of travel meeting on Washington street.

(Signed) JAMES F. JACKSON,
GEORGE W. BISHOP,
CLINTON WHITE,
Commissioners.

A true copy.
Attest: (Signed) CHARLES E. MANN,
Clerk.

In consequence of this decision the building at the northwest corner of Boylston and Washington streets was taken April 1, 1905. The decision is understood by the Commission as defining the policy of the Railway Company and Railroad Commissioners to be generally in favor of entrances and exits in corner estates.

Arrangements have been made, without material expense to the city, for returning the property taken on Essex street to the estate of the owner. In substitution therefor an easement for an entrance and exit has been taken in the building at the southeast corner of Washington and Essex streets. This taking is confined to a portion or section of the premises fixed by horizontal planes of division as permitted by the act (Statutes 1902, Chap. 534, Sec. 6.) A copy of the taking will be found in Appendix A.

The conditions on Temple place are such that the Railway Company admits that a corner entrance and exit are inexpedient, and although final action has not been taken, negotiations have been carried on with the owners and a lessee of the Blake estate on the southerly side of Temple place, and a satisfactory agreement has been reached. No other entrances and exits, up to the date of this report, have been definitely located.

Settlements for Property Taken.

All of the estates mentioned in the Tenth Annual Report as having been taken for the Ash street incline have been settled for, the total amount paid for this property being $555,300.

Private Entrances and Exits and Show Windows.

Several requests have been received for private entrances to and exits from the station platforms and for the construction of show windows in the sidewalls. Inasmuch as by the terms of the lease the Boston Elevated Railway Company has the exclusive use of the tunnel, all such requests have been referred to that Company. No communication requesting action on these matters by the Commission has yet been received from the Company, and the Commission has not yet determined upon what conditions, if at all, it would be willing to grant such privileges.

Route of the Tunnel from Adams Square North.

As stated in the last annual report, when this Commission selected for the tunnel, from its southern end to Hay-

market square, a route east of Washington street, the Boston Elevated Railway Company appealed from its decision to the Board of Railroad Commissioners, and that Board, under date of October 19, 1903, fixed upon Washington street as the best route but thought it

> "advisable to stop at the junction of Washington street and Adams square, for the reason that further legislation may be desirable to permit such changes in the present subway and approaches as may be requisite to properly connect the tunnel with the rest of the railway system."

At the following session of the Legislature the further legislation referred to was enacted at the instance of the Board. (Statutes 1904, Ch. 167. See Tenth Annual Report.)

The Commission being, however, unable to discover any satisfactory plan within the scope of the authority given by the acts of 1902 and 1904 so reported to the Board in February of the present year, and at the request of the Board submitted to it a draft of an act, which, meeting with its approval, was laid before the Legislature by it and duly enacted. (Statutes 1905, Ch. 460—see Appendix B.)

It is believed that this act gives to the Commission such latitude of powers as will enable the best possible method of treatment in connection with the Washington street route to be adopted.

To secure good alignment and grades for the tunnel from State street north without interfering seriously with the traffic capacity and convenience of the present subway is a problem very difficult of solution. Many studies have been considered by the Commission, but to each there are serious objections. Thus far no plan has been adopted.

EAST BOSTON TUNNEL.

At the date of the last report, it was stated that work on the connection of the East Boston tunnel with the subway had been suspended because of the request of the Boston Elevated Railway Company for a curve of larger radius than it had formerly approved, in order to permit the passage of longer and wider cars than those now in use by the Company, and because of the fact that compliance with this request would be impossible unless more funds were appropriated by the Legislature. For this and other reasons the following communication was addressed to the Legislature of 1905:

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts in General Court Assembled:

The Boston Transit Commission respectfully represents that the issue of bonds of the City of Boston for the purposes set forth in chapter 548 of the acts of the year 1894 was fixed at $7,000,000; that the subway has cost in round numbers $4,125,000; that this amount deducted from $7,000,000 left a balance of $2,875,000.

That under the provisions of chapter 347 of the acts of the year 1897 the $7,000,000 issue was reduced by the amount of $616,000, which was the value as approved by the Mayor of the city of certain land acquired by the Commission from the Boston & Maine Railroad which was necessary for the use of the Commission during construction of the subway, but which, upon its completion, was no longer needed for the purposes of the act, and which was transferred to the city for a market or other public purposes.

That this reduction in the appropriation was made by the act although this $616,000 did not represent a permanent expenditure by the Commission but a saving by the Commission in the net cost of its work.

That by a subsequent act of the same year (St. 1897, C. 500) a further issue of bonds to the amount of $500,000 was authorized for the construction of the East Boston tunnel, and it was provided that the Treasurer should apply the proceeds of said $500,000 and the proceeds of the said issue of $7,000,000 in bonds to the payment of the cost and expenses of constructing the subway and the tunnel or tunnels to East Boston and the stations, inclines and steps in connection therewith.

That it is doubtful whether the legal effect of these acts is to make available for the construction of the subway and the East Boston tunnel the whole issue of $7,500,000 in bonds or only that amount less said $616,000.

That to avoid possibility of question as to the legality of the issue about one-half of said reduction, namely, $300,000 by St. 1903, C. 190, was definitely restored to the Commission for the construction of said East Boston tunnel.

That it now appears that to make suitable provision for the payment of all cost and expenses incurred in connection with the construction of said tunnel, including an emergency exit from the Atlantic avenue station, requested by the lessee company after the Paris subway disaster; for the construction and equipment of elevators and of ventilating fans which the Commission is advised should be furnished under the act by the Boston Elevated Railway Company but which to avoid continued delay in the opening of the tunnel have been contracted for by the Commission under agreements with the company that it will reimburse the city if the court determines that such is its obligation; for interest on the cost of the tunnel arising out of the delay in opening it for use caused by protracted negotiations relating to such elevators and ventilating fans; for a connection with the present subway with a curvature and clearance adapted to the use of cars larger than those now in use by the Boston Elevated Railway Company, such connection being more expensive than that originally planned; and for defence against or settlement of claims for damages, many of which are believed by the Commission to be excessive, the balance of said reduction in said bond issue, such balance being $316,000, should be made available for the use of the Commission.

WHEREFORE said Boston Transit Commission petitions that legislation appropriate to that end may be passed.

THE BOSTON TRANSIT COMMISSION
By (Signed) GEORGE G. CROCKER
Chairman.

BOSTON, January 18, 1905.

Pursuant to this petition the Legislature passed an act restoring to the Commission the balance of $316,000 for which it asked. This act, Chapter 187, will be found in Appendix C.

Ventilating Apparatus.

With regard to the installation of ventilating apparatus a legal question arose similar to that which had been encountered in the installation of elevators. The Boston Elevated Railway Company took the position that this apparatus should be installed by the Commission as a part of the work of construction, while the Commission held that it should be installed by the Company as a part of the equipment. That there might be no delay in the opening and operation of the tunnel, the Commission has installed the apparatus under an agreement with the Company that the expense is to be reimbursed in the event of the decision of the courts that it is the Company's duty to pay for such installation. The agreement follows:

WHEREAS, by the acts of the year 1897, chapter 500, section 17, it is provided that the Boston Transit Commission shall construct a tunnel or tunnels of sufficient size for two railway tracks, with approaches, entrances, sidings, stations and connections therefor, and for the running of railway cars therein, from a point or points on or near Hanover street in the city of Boston, or such other point or points as said Commission may deem proper for a suitable connection with the subway or subways provided for by the acts of the year 1894, chapter 548, section 25, to a point or points at or near Maverick square in that part of Boston called East Boston, where a suitable connection with surface tracks may be made, and otherwise as therein provided, and that upon completion thereof the Commission shall execute a lease thereof in writing to the Boston Elevated Railway Company for a term and at a rental fixed by the act, and

WHEREAS, in certain places in said tunnel the Commission has constructed ducts, shafts and chambers for ventilating purposes, and the question has arisen which party is to provide and install ventilating fans to be used in connection therewith, to improve and insure the draft or circulation of air, and the Commission and the Company are unable to agree thereon, and

WHEREAS, public interests may suffer if the execution of the lease and the use of the tunnel by the Company should be delayed by such disagreement,

NOW, THEREFORE, it is agreed by the Boston Transit Commission and the Boston Elevated Railway Company, as follows:

The Commission agrees to contract for and install such ventilating fans as it deems desirable for the above purposes, and the Company agrees that such action shall be without prejudice to the rights of the Commission and of the city and that it will repay the cost thereof with interest at the rate of 3½ per cent. per annum thereon, upon final determination by the court or by an arbitrator agreed on by the parties that such fans should have been furnished and paid for by it. For the purposes of this decision it may be assumed that it is incumbent upon the Company to take a lease of the East Boston tunnel, in some proper form, as soon as it is completed under the statute, and that artificial ventilation by such means is so essential to the convenient use of the tunnel by passengers that either the Commission or the Boston Elevated Railway Company is bound to ensure the same by providing such fans. The statutes and all the circumstances are to be considered. The future execution of a lease of the tunnel shall not be deemed a waiver or modification of the rights of either party hereunder.

The Company also agrees to assent to and co-operate in such further action, if any, as may be necessary and proper to bring this question before the court or an arbitrator if one is agreed on, in such manner that it can be considered and determined, as justice may require.

IN WITNESS WHEREOF the Boston Transit Commission, acting in behalf of the city of Boston, has caused this instrument to be executed in its name by its Chairman, and the Boston Elevated Railway Company has executed the same by its President hereto duly authorized, this eleventh day of July, 1904.

BOSTON TRANSIT COMMISSION,
By (Signed) GEORGE G. CROCKER
Chairman.

BOSTON ELEVATED RAILWAY COMPANY,
By (Signed) WILLIAM A. BANCROFT
President.

Atlantic Avenue Station.

The contract for the construction of the building covering the easterly stairway and elevators for this station was awarded August 15, 1904, and it was to be finished by December 15, 1904. Owing to various causes, chief of which was a delay on the part of the steel manufacturers to furnish the material to the contractors, the work has progressed very slowly, and at the date of this report the surface structure is not finished. It is hoped, however, that it will be completed and the elevators ready to operate this autumn. In the meantime the tunnel has been operated without the use of this station.

In accordance with a request of the Boston Elevated Railway Company, a seven-foot stairway connecting with both platforms has been built at the westerly end of the station. This stairway is not connected with any elevator and is intended chiefly as an emergency exit.

Plans have been submitted by the Company, and approved by the Commission and the Board of Aldermen, for the connection of this station with the elevated structure of the State street station by an overhead foot bridge.

Interior Lining.

After that portion of the tunnel which is under the harbor had been completed according to the original plans, it was found that the leakage, while inconsiderable in amount, spread over the interior wall in such a way as to give an impression of dampness, and was not pleasing to the eye. This portion of the tunnel was therefore lined with ribbed tile of fireproof clay covered with cement, so that the face of the walls is now smooth and comparatively dry. The spaces between the ribs form channels which conduct the leakage to the invert, and thus to the pumps. As a matter of fact the total leakage in the tunnel is about seven gallons per minute, which is much less than in any other tunnel yet constructed under similar conditions.

Lease.

At the date of the Tenth Annual Report it was thought that the lease of the tunnel to the Boston Elevated Railway Company was very nearly ready for execution, but so many details came up for discussion and consideration that the lease was not executed and delivered until December 24, 1904. The term and rental had both been fixed by the Legislature, the former being for twenty-five years from June 10, 1897, and the latter being an amount equal to three-eighths of one per cent. of the gross receipts for each year, ending September 30, of all lines owned, leased or operated by the Company. The lease, in full, will be found in Appendix D.

Collection of Tolls.

By the provisions of chapter 500 of the acts of 1897, a toll of one cent is to be collected from each person passing through the tunnel in either direction and by the same act the Company is made the agent of the city to collect such tolls. On the same day that the lease was executed, the Company executed with the Mayor an agreement under which such collections are to be made, which agreement will be found in Appendix E. As to the manner of collection of tolls the Company submitted the following methods:

VICE-PRESIDENT'S OFFICE,
101 MILK ST.

BOSTON, MASS., Nov. 18th, 1904.

East Boston Tunnel — collection of tolls:

HON. GEORGE G. CROCKER, *Chairman, Boston Transit Commission, 15 Beacon Street, Boston, Mass.*

DEAR SIR:—The exact method of collecting tolls from persons passing into or through the East Boston Tunnel is yet to be determined.

The following two methods have occurred to us, viz.:

FIRST: All persons entering the tunnel from Scollay Square Subway Station to pay the toll of one cent at tolls' booth; all persons entering the tunnel at Court Street Station and Devonshire Street Station to pay six cents; all persons transferring to the East Boston Tunnel from the Elevated at Atlantic Avenue Station to pay the one cent toll at tolls' booth, all other persons entering this station to pay six cents. Tolls to be collected from passengers entering the tunnel at Maverick Square by a force of collectors on the cars which will require a considerable number of men. This will undoubtedly cause considerable delay and inconvenience to traffic and possibly trouble with passengers and complaint. The running of a considerable service is contemplated, and the holding of cars at this point for the collection of tolls is impossible.

SECOND: Persons entering at all stations to pay six cents for a ticket which will be deposited in ticket collector's box; all persons entering from Scollay Square to pay one cent at toll booth; all persons entering from Atlantic Avenue Elevated Station to pay one cent at toll booth. Persons entering on cars from East Boston to pay tolls on making exit: at Atlantic Avenue east platform before taking elevator or stairs, at Devonshire Street east platform before ascending stairs, at Court Street east platform before ascending stairs or passing Scollay Square. For the present no persons will make exit from the west platforms of the stations who have not already paid their toll. It remains, therefore, to provide for way passengers so that they need not pay toll twice. At Atlantic Avenue persons descending by elevator or stairs to east platform could be supplied with exit checks by platform-man; at Devonshire Street persons descending stairs to east platform could also be supplied with exit check by platform-man. At Court Street no persons will enter on east platform except by car. This method will probably not require nearly as many toll collectors as the first method.

We respectfully submit the matter for your consideration and advice as to which method you prefer. We should also be glad of any suggestion as to a better method.

Yours very truly,

(Signed) C. S. SERGEANT
Vice-President.

The Commission approved the second method, which was substantially put into operation by the Company.

Opening of the Tunnel.

On December 29, 1904, the tunnel was officially inspected by the Governor of the Commonwealth, a representative of the Mayor of the City, heads of State and City Departments, members of the City Government, and other invited guests, pursuant to a joint invitation issued by the Boston Elevated Railway Company and the Commission. On the next day, without further ceremony, the tunnel was opened for public traffic. Reports for the first three months of use indicate that the gross income to the City, from the tolls, will be at least $80,000 per annum.

Winthrop Statue.

The Art Commission has decided to locate the statue of John Winthrop, removed from Scollay square, on a plot adjacent to the First Church, which plot has been provided by the Church for the purpose. The statue has been removed to the yard of John Evans & Co. for alterations in the base, and will be set up in its new position during the coming summer.

SUBWAY.

The Commission has approved the application of the Boston Elevated Railway Company for changes in the platforms at the subway stations in order to accommodate five-car trains, these alterations being made at the expense of the Company.

Prevention of Fire.

In the fall of 1904 Prof. C. L. Norton of the Massachusetts Institute of Technology was asked to examine the present subway stations with reference to danger from fire. He submitted the following report:

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

BOSTON, MASS., Sept. 22, 1904.

Boston Transit Commissioners,
HOWARD A. CARSON, *Chief Engineer.*

DEAR SIR:—I have examined the existing temporary stations in the Subway with a view to possibly minimize the danger of fire and would submit to you the following notes and suggestions:—In the matter of the proposed extension of stations, I would suggest that the construction of heavy plank and large timbers now in use be followed throughout, since the danger to these platforms

is in large part the danger of their ignition from disordered car machinery. I should advise the fixing of all the platforms, new and old, with a light lath, expanded metal for instance, on which should be plastered a coating of Portland cement and sand of a mixture about one to three, and of the thickness of 1-4 inch.

A further danger to these platforms lies in the possible accumulation of dirt, papers and rubbish generally underneath them and the subsequent accidental ignition. The greatest care should be exercised to close every opening into these sub-platform spaces. Examination shows several traps and hinged doors in the tops and faces of these platforms and a number of rat-holes which show the possibility of an accumulation of rubbish by human or other agencies, which might readily start, not a serious fire but a smudge which would be sufficient to cause possibly a panic. Noticeably at Scollay Square station, preventive measures along this line should be at once applied. The wooden boxing around the steel posts which penetrate these platforms should, in my judgment, be entirely removed and the openings thereby left in the plank floor securely stopped, or else the tops of these wooden casings should be reinforced in a strong manner and in such fashion as not to permit of the lodgment of rubbish, cigar stumps etc.

The supply of pails of water and sand I believe to be adequate and the hand fire-extinguishers appear to be of sufficient number and well located. I believe there should be one, or better, two lines of small hose available at each platform, in view of the large amount of inflammable material that is present, viz:—the ticket-taker's box, news stands, turn-stiles and telephone booths. The piping for this water supply could be rendered easily accessible and the objection, which has led to the partial discontinuance of the hose system which was originally supplied, viz:—the freezing, can be guarded against either by allowing circulation of the water, or by covering the "dead ends" with a non-conducting pipe cover.

All the wooden rubbish bbls. should be discarded and metal ones substituted for them. That there is real danger in these is evidenced from an experience of last winter, when, during a few minutes delay at Boylston Street station, I noticed a fellow-traveler throw a lighted match into one of these barrels; in a moment smoke appeared at the top of the barrel and later flames which burned to a height of a foot or so about the top of the barrel. I called the attention of one of your employees to the situation and suggested that we turn the barrel over, however, he jumped promptly into the barrel and between the vigorous stamping and the fact that he had on a heavy overcoat he very promptly put the fire out; but it was strongly impressed upon me at the time that, had this occurred, say at Park Street when the station was crowded, the danger to the travelling public, not perhaps from fire but from its own effort to escape from fire would have been quite considerable.

The wooden platforms near which it is customary to put these barrels should be protected either with asbestos board, tin, or Portland cement upon metal lath, and it would be well if these barrels, like the half barrels now in use, should have some definite fixed location.

I need hardly to call attention to, what has already been emphasized in regard to the recent disaster, the absolute necessity of providing for a possible panic by training beforehand the employees of the road who are to be on duty at these stations. There is no one of the preventive measures which I have suggested which, to my mind, can compare in efficiency with the

proper training of the station men to protect the patrons of the road from panic in case of even a slight fire.

Respectfully submitted,

(Signed) C. L. NORTON

A copy of this report was transmitted to the Boston Elevated Railway Company. In the same connection the following letter was sent to that Company:

BOSTON, November 14, 1904.

Boston Elevated Railway Company,

WILLIAM A. BANCROFT, *President.*
CHARLES S. SERGEANT, *Vice President.*

GENTLEMEN:—The surface areas in the following subway stations now covered by newspapers, periodicals, and advertisements, are reported to be as follows:

Station.	Square Feet.
Boylston street	517
Park "	353
Scollay square	276
	1146

The larger part of this area is vertical boardings to which are attached magazines, etc. This combination of wood and paper is highly inflammable. The lighting of matches by smokers on the platforms, which has become a common custom, makes these combustible materials an extra hazardous fire risk. If a fire, of however short duration, should happen when the platforms are crowded, the peril to passengers, especially to women with their inflammable dresses, would be serious, and a panic might easily occur resulting in a calamity.

Enlargements of and additions to the news stands have been made since they were first installed, and, as now arranged, these stands are believed to be a menace to the safety of passengers.

The Commission therefore suggests that all vertical boardings be removed and the magazines, etc. be only displayed as originally provided for.

By order of the Commission,

(Signed) B. LEIGHTON BEAL.
Secretary.

Cost of Removing and Relocating Underground Structures.

During the construction of the subway an agreement was reached with various companies having franchises in the streets for underground structures, by which all expense caused by the removal or relocation of such of these structures as interfered with the construction of the subway was to be borne originally by the Commission, awaiting a deter-

mination by the courts as to legal liability therefor. In 1902 a decision was rendered in the Supreme Court pursuant to which the electric companies refunded the net amount of $11,919.88. (180 Mass. 516. See Eighth Annual Report, page 33.)

The claim of the Commission against the gas companies for expenses incurred in the removal and relocation of gas pipes was about $33,000, with interest from various dates in 1895, 1896, 1897, 1898 and 1899. In July, 1904, these companies made an offer to settle by paying $35,500 and $2,000 additional for counsel fees. This offer was accepted by the Commission with the approval of the Corporation Counsel. The net cost of the subway and alterations has therefore been further reduced by this sum.

Payment of Rental under the Toll System.

In accordance with that clause of the lease of the subway which provides that if in any one quarter the amount which the Company would pay for rental, reckoned on a stated toll for each car, should exceed the amount reckoned on the basis of four and seven-eighths per cent. of the cost, the Company shall pay such excess, the following was received:

AUDITOR'S OFFICE, 101 MILK ST.

BOSTON, MASS., Nov. 3rd, 1904.

Boston Transit Commission,
Boston, Mass.

B. LEIGHTON BEAL, *Secy.*,

DEAR SIR:—I neglected to notify you that for the three months ending with June, 1904, we owed the City of Boston $796.52 and for the three months ending with September, 1904, $3,154.29 as additional rent for the subway on account of our having run a greater number of trips, than would amount to the rental which you charged, at 5c. per single trip.

This $3,950.81 was paid to the City of Boston on October 28th and we hold their receipt dated October 31st for the same.

It gives me great pleasure to say that during the two previous quarters the number of trips were such that no additional compensation was due.

Yours truly,

(Signed) H. L. WILSON.
Auditor.

The payments previously made amounted to $10,169.40, making a total of $14,120.21 thus far paid on account of the operation of the toll clause.

Alterations.

Since May, 1903, there have been no expenditures for alterations in the subway under chapter 500 of the acts of 1897 to adapt the subway to the use of elevated trains. The amount of bonds issued under this act was $250,000. Of this amount, $242,873.93 was expended, leaving a balance of $7,126.07. This balance, under the law, could be made available for no other purpose than for these alterations or for the Sinking Fund for the same, and the account has been closed by transferring this amount to the Board of Commissioners of Sinking Funds.

CHARLESTOWN BRIDGE.

There was left from the land taken for the purposes of construction of the Charlestown Bridge about 6833 feet fronting on the bridge and on Chamber and Water streets. The Commission has endeavored from time to time to dispose of this land at private sale, and during the winter it was extensively advertised, but without result. Finally it was advertised to be sold at public auction, on May 23, 1905, and was bought by C. W. Howard, representing Charles F. Morrill, for three dollars per foot. This sale will net a little over nineteen thousand dollars for the Sinking Fund, and by this transaction the connection of the Commission with the Charlestown Bridge is closed.

LEWIS & CLARK EXPOSITION.

The exhibit of the work of the Commission which was made at Paris, Buffalo and St. Louis has been sent to the Lewis & Clark Exposition.

DEVELOPMENT OF SUBWAY SYSTEMS.

The Legislature of 1905 passed a resolve directing the Commission to inquire into the subject of the further development of the subway systems of the city of Boston, and to report to the next Legislature. This resolve will be found in Appendix F.

SINKING FUNDS.

The following sums have been received during the year by the Commission and deposited with the City Collector to the credit of the various sinking funds as shown below:

Rapid Transit, East Boston Tunnel loan:				
1904:				
Oct.	20.	Sale of plan	$25 00	
Dec.	29.	Rent of rails	13 87	
1905:				
May	9.	Portion of air compressing plant	5,800 00	
				$5,838 87
Boston Tunnel and Subway loan:				
1904:				
Dec.	29.	Settlement of Contract No. 214	$65 00	
				65 00
Total				$5,903 87

The following is the condition of the debt and of the sinking funds for the various divisions of the work of the Commission at the date of this report:

SUBWAY (INCLUDING ALTERATIONS.)

(*Debt, $4,416,000, outside debt limit.*)

Amount of fund, July 1, 1904		$665,189 89
Interest on bank deposits, July 1, 1904, to date	$2,052 06	
Interest on investments, July 1, 1904, to date	15,537 50	
Revenue, etc., July 1, 1904, to date	50,882 45	
		68,472 01
		$733,661 90

CHARLESTOWN BRIDGE, NO. 1.

(*Debt, $750,000, inside debt limit.*)

Amount of fund, July 1, 1904		$98,152 20
Interest on bank deposits, July 1, 1904, to date	$100 36	
Interest on investments, July 1, 1904, to date	1,934 50	
Requirement for debt	8,613 00	
		10,647 86
		$108,800 06

CHARLESTOWN BRIDGE, NO. 2.

(Debt, $805,000, outside debt limit.)

Amount of fund, July 1, 1904		$107,095 93
Interest on bank deposits, July 1, 1904, to date	$199 39	
Interest on investments, July 1, 1904, to date	2,653 00	
Revenue, etc., July 1, 1904, to date	728 01	
Requirement for debt	8,094 00	
		11,674 40
		$118,770 33

EAST BOSTON TUNNEL.

(Debt, $3,018,000, outside debt limit.)

Amount of fund, July 1, 1904		$25,314 11
Interest on bank deposits, July 1, 1904, to date	$83 67	
Interest on investments, July 1, 1904, to date	350 00	
Revenue, etc., July 1, 1904, to date	5,838 87	
		6,272 54
		$31,586 65

BOSTON TUNNEL AND SUBWAY.

(Debt, $1,556,700, outside debt limit.)

Amount of fund, July 1, 1904		$8,901 50
Interest on bank deposits, July 1, 1904, to date	$122 26	
Revenue, etc., July 1, 1904, to date	65 00	
		187 26
		$9,088 76

AMOUNTS PAID FOR RENTAL OF THE SUBWAY.

The following sums have been paid during the year by the Boston Elevated Railway Company for the use of the subway:

Sept. 30, 1904:		
Total cost of subway	$4,135,367 79	
Amount recovered from gas companies on account of subway for cost of changing pipes, conduits, etc.	34,930 21	
Net cost of subway	$4,100,437 58	

One quarter's rental		$49,974 08
Alterations: total cost	$243,238 77	
Amount recovered from gas companies on account of alterations for cost of changing pipes, conduits, etc.	569 79	
Net cost of alterations	$242,668 98	
One quarter's rental		2,957 53
Dec. 31, 1904:		
Net cost of subway	4,100,437 58	
One quarter's rental		49,974 08
Alterations: net cost	242,668 98	
One quarter's rental		2,957 53
March 31, 1905:		
Net cost of subway	4,100,482 63	
One quarter's rental		49,974 63
Alterations: net cost	242,673 93	
One quarter's rental		2,957 59
June 30, 1905:		
Net cost of subway	4,100,482 63	
One quarter's rental		49,974 63
Alterations: net cost	242,673 93	
One quarter's rental		2,957 59
		$211,727 66
Received on toll account		3,950 81

STATEMENT OF EXPENSES.

The following is a classified statement of the expenses of the Commission for the year ending June 30, 1905:

SUBWAY.

ENGINEERING DEPARTMENT.

Legal and expert advice		$50 00

SECTION FIVE.

Field supplies	$165 64	
Labor	401 84	
Teaming	16 01	
		583 49
Total		$633 49

Carried forward, $633 49

Brought forward, ...			$633 49

CREDIT.

During the year there has been recovered from the Boston Gas Light Company and the Bay State Gas Company, on account of work done in connection with removal and relocation of their underground structures, the net sum of $35,500.00 ; of this amount, $34,930.21 is credited to the subway account and $569.79 to the alterations account. Credit is shown below under the various sections in which the work was performed as follows :

Subway:			
General . . .	$18 58		
Sect. One . .	1,244 59		
Two . .	1,286 55		
Three . .	7,394 30		
Three and one-half	123 69		
Four . .	5,720 04		
Five . .	1 34		
Seven . .	3,379 15		
Eight . .	4,276 02		
Eight and one-half	762 52		
Nine . .	5,216 78		
Ten . .	5,506 65		
		$34,930 21	
Amount transferred to alterations account as per records of the Commission of January 28, 1905 . .		4 95	
Total credit			34,935 16
Net decrease			$34,301 67

ALTERATIONS.

(*Made upon request of Boston Elevated Railway Company, as authorized by Chapter 500, Acts of 1897.*)

GENERAL.

Amount transferred from subway account as per records of the Commission of January 28, 1905. .	$4 95	

CREDIT.

Amount recovered from gas companies on account of work done in connection with removal and relocation of their underground structures, Section 7, E. P. . . .	569 79	
Net decrease		564 84
Total decrease on subway and alterations . .		$34,866 51

Decrease in cost of various sections occasioned by amount recovered from gas companies :

Subway.	Expended.	Credit.	Net Decrease.
General	$50 00	$18 58	*$31 42
Section One		1,244 59	1,244 59
Two		1,286 55	1,286 55
Three		7,394 30	7,394 30
Three and one-half		123 69	123 69
Four		5,720 04	5,720 04
Five	583 49	1 34	*582 15
Seven		3,379 15	3,379 15
Eight		4,276 02	4,276 02
Eight and one-half		762 52	762 52
Nine		5,216 78	5,216 78
Ten		5,506 65	5,506 65
	$633 49	$34,930 21	$34,296 72
Alterations.			
Section Seven		$569 79	$569 79

* Increase.

EAST BOSTON TUNNEL.

General Expenses :			
Office—Fuel and light		$26 40	
Rental		1,350 00	
Stationery and printing		381 23	
Supplies		106 90	
Stenographers		736 32	
Messenger		288 00	
Clerks		288 00	
Salaries of Commissioners and Secretary		9,435 00	
		$12,611 85	
Transferred to Boston Tunnel and Subway	$9,710 23		
Transferred from Boston Tunnel and Subway	1,284 46		
Net transfer to Boston Tunnel and Subway		8,425 77	
		$4,186 08	
Proportion of salary of Chief Engineer		1,200 00	
			$5,386 08

ENGINEERING DEPARTMENT.

Rooms—Supplies	$253 20	
Stationery and printing	697 83	
Fuel and light	15 15	
Rental	387 50	
Carried forward,	$1,353 68	$5,386 08

Brought forward,	$1,353 68	$5,386 08
Messengers	124 40	
Stenographers	327 67	
Skilled service	3,147 66	
		4,953 41

MISCELLANEOUS.

Legal and expert advice	$150 00	
Insurance	36 00	
Teaming	5 70	
Field supplies	214 76	
Labor	225 69	
Water pipes	7 50	
		639 65

SECTION A.

(*In Maverick square and Lewis street, East Boston, to a point 100 feet southwest of Webster street.*)

Construction	$231 49	
Field supplies	58 78	
Labor	392 08	
Office supplies	3 32	
Teaming	15 87	
		701 54

SECTION B.

(*From a point in Lewis street 100 feet southwest of Webster street, East Boston, under harbor between South Ferry slip on the East Boston side and Long wharf on the Boston side, State street.*)

Boston Tunnel Construction Company	$51,156 55	
Wm. H. Smith (Contract No. 208)	12,504 82	
E. W. Everson & Co. (Contract No. 206)	1,796 72	
Woodbury & Leighton Co. (Contract No. 210)	18,398 00	
Charles Brigham, Architect	1,062 37	
American Blower Co.	5,007 75	
Whittier Machine Co.	22,125 00	
Advertising	29 40	
Construction	15,016 14	
Instruments	35	
Stationery and printing	215 40	
Office supplies	82 95	
Field supplies	1,826 93	
Inspection	289 03	
Labor	6,173 87	
Skilled service	307 37	
Teaming	88 06	
Water pipes	291 83	
		136,372 54
Carried forward,		$148,053 22

Brought forward, ...		$148,053 22

SECTION C.

(*Under State street from India street to near Atlantic avenue.*)

Patrick McGovern (Contract No. 188)	$10,489 38	
Coleman Bros. (Granolithic) . .	98 43	
E. W. Everson & Co. (Contract No. 206)	9,852 29	
Wm. H. Smith (Contract No. 208) .	3,341 93	
American Blower Co. . . .	2,727 25	
Advertising	61 25	
Construction	6,525 58	
Office supplies	13 01	
Field supplies	600 66	
Inspection	354 97	
Insurance	108 44	
Labor	2,551 26	
Teaming	142 98	
Water pipes	633 73	
		37,501 16

SECTION D.

(*In State street between India street and Congress street.*)

Patrick McGovern (Contract No. 188)	$1,609 75	
Wm. H. Smith (Contract No. 208) .	2,016 24	
Construction	844 60	
Field supplies	307 82	
Inspection	20 25	
Labor	47 32	
		4,845 98

SECTION E.

(*Station under the Old State House near the head of State street.*)

Coleman Bros. (Granolithic) . .	$181 73	
Construction	284 84	
Office supplies	13 02	
Field supplies	634 82	
Inspection	50 63	
Labor	436 64	
Teaming	8 53	
		1,610 21

SECTION F.

(*From the westerly end of the Old State House across Washington street and along Court street to near Tremont street.*)

Coleman Bros. (Contract No. 192) .	$5,715 64	
Patrick McGovern (Contract No. 188)	50 30	
Woodbury & Leighton Company (Contract No. 199) . . .	5,933 30	
Carried forward, . . .	$11,699 24	$192,010 57

Brought forward, . . .	$11,699 24	$192,010 57
H. P. Nawn (Contract No. 204) .	3,466 35	
Harrington, Robinson & Company (Contract No. 202) . . .	1,690 07	
Advertising	7 13	
Construction	1,590 14	
Eng. stationery	125 00	
Office supplies	88 25	
Field supplies	1,639 19	
Inspection	86 71	
Labor	3,529 92	
Legal and expert advice . . .	609 27	
Skilled service	56 00	
Teaming	62 45	
Water pipes	10 95	
		24,660 67

BOSTON TUNNEL AND SUBWAY.

General Expenses:			
Office—Furniture .	$45 48		
Lighting .	49 15		
New rooms .	14 00		
Printing .	1,209 97		
Rental . .	2,000 00		
Repairs . .	10 70		
Stationery supplies . .	362 04		
Telephone-Telegraph .	98 26		
Travel . .	56 00		
Stenographers . .	1,682 97		
Messenger . . .	648 00		
Clerks . . .	648 00		
Salaries of Commissioners and Secretary	18,865 00		
	$25,689 57		
Transferred to East Boston Tunnel . .	1,284 46		
		$24,405 11	
Amount transferred from East Boston, general expenses . . .		9,710 23	
General office expenses chargeable directly to Boston Tunnel and Subway:			
Furniture . .	$200 65		
New rooms . .	530 67		
Printing . .	125 80		
Repairs . . .	15 38		
Stationery supplies	198 36		
Telephone-Telegraph	40		
		1,071 26	
			35,186 60
Carried forward, ...			$251,857 84

Brought forward,		$251,857 84

ENGINEERING DEPARTMENT.

Rooms—Fuel	$46 18	
Furniture	533 60	
Lighting	426 77	
New rooms	478 80	
Printing	1,929 50	
Rental	2,962 50	
Repairs	38 63	
Stationery supplies	2,420 06	
Telephone-Telegraph	306 30	
Travel	9 50	
		9,151 84

MISCELLANEOUS.

Gow & Palmer (Contract No. 211)	$637 89	
Peter W. Hill (Contract No. 207)	36,473 03	
Patrick McGovern (Contract No. 205)	19,986 37	
Advertising	55 40	
Borings:		
Labor	134 37	
Chief Engineer	10,800 00	
Field supplies	832 78	
Inspection	24 78	
Instruments	205 64	
Insurance	200 00	
Labor	35,225 53	
Messengers	1,166 00	
Paving	139 27	
Legal and expert advice	288 00	
Skilled service	44,547 78	
Stenographers	2,112 37	
Stock	20,538 33	
Teaming	276 32	
Testing	376 41	
Test pits	321 05	
Tools	177 64	
Water pipes	337 78	
	$174,856 74	
Transferred to Section One account:		
Property damages:		
Repairs $7,795 81		
Takings 65,500 00		
	73,295 81	101,560 93

SECTION ONE.

(*From westerly side of Ash street opposite Nassau street to a point in Washington street near southerly side of Eliot and Kneeland streets.*)

Coleman Bros. (Contract No. 216)	$8,521 19	
Gow & Palmer (Contract 211)	634 84	
Patrick McGovern (Contract No. 220)	67,129 54	
Carried forward,	$76,285 57	$362,570 61

Brought forward,	$76,285 57	$362,570 61
H. P. Nawn (Contract No. 215)	5,878 19	
New England Structural Company (Contract No. 213)	18,023 15	
Advertising	105 24	
Alterations	3,498 41	
Change of grade	1,271 45	
Construction	16,471 94	
Damages	450 00	
Field supplies	2,086 50	
Fuel	96 30	
Inspection	133 70	
Instruments	4 55	
Labor	1,662 11	
Lighting	117 37	
Printing	225 95	
Protection of tenants	6 00	
Property damages:		
Repairs	7,928 31	
Takings	555,300 00	
Skilled service	3,091 59	
Stationery supplies	88 85	
Teaming	140 15	
Telephone-Telegraph	20 76	
Testing	17 19	
Tools	97 98	
Underpinning	76 18	
Water pipes	430 74	
Legal and expert advice	43 00	
		693,551 18

SECTION TWO.

(*From near the southerly side of Eliot and Kneeland streets to near the northerly side of Boylston street.*)

Boston Bridge Works (Contract No. 217)	$23,897 36	
Coleman Bros. (Contract No. 216)	11,454 87	
Gow & Palmer (Contract No. 211)	31,447 98	
Patrick McGovern (Contract No. 221)	65,996 44	
Advertising	62 15	
Alterations	532 83	
Construction	21,637 43	
Damages	325 76	
Field supplies	6,928 52	
Fuel	440 59	
Furniture	8 25	
Inspection	158 13	
Instruments	41 75	
Insurance	6 00	
Labor	847 99	
Legal and expert advice	275 00	
Lighting	447 10	
Printing	131 48	
Carried forward,	$164,639 63	$1,056,121 79

Brought forward,	$164,639 63	$1,056,121 79
Protection of tenants	39 85	
Skilled service	3,975 92	
Stationery supplies	69 62	
Teaming	24 45	
Telephone-Telegraph	18 00	
Testing	30 02	
Tools	475 28	
Underpinning	5,545 85	
Water pipes	3,953 19	
		178,771 81

SECTION THREE.

(*From near the northerly side of Boylston street to about 30 feet north of the northerly side of Hayward place.*)

Boston Bridge Works (Contract No. 223)	$23,248 82	
Jones & Meehan (Contract No. 226)	43,589 38	
Advertising	69 45	
Alterations	65 52	
Construction	10,821 38	
Field supplies	159 93	
Fuel	13 56	
Instruments	4 40	
Insurance	432 50	
Labor	751 93	
Legal and expert advice	112 50	
Printing	89 39	
Protection of tenants	53 78	
Skilled service	2,810 59	
Stationery supplies	15 15	
Teaming	50	
Telephone-Telegraph	18 00	
Testing	34 62	
Underpinning	1 02	
Water pipes	762 64	
		83,055 06

SECTION FOUR.

(*From about 30 feet north of Hayward place to about 50 feet south of Franklin street.*)

H. P. Converse & Company (Contract No. 231)	$412 45	
Hugh Nawn Contracting Company (Contract No. 234)	188,007 03	
Lewis F. Shoemaker & Company (Contract No. 228)	20,654 66	
Advertising	52 77	
Carried forward,	$209,126 91	$1,317,948 66

Brought forward,	$209,126 91	$1,317,948 66
Alterations	1,301 96	
Construction	19,441 45	
Damages	525 00	
Field supplies	139 81	
Inspection	284 26	
Instruments	35 58	
Insurance	1,950 24	
Labor	562 11	
Legal and expert advice	252 50	
Lighting	21 02	
Messenger	10 13	
Printing	178 29	
Protection of tenants	222 89	
Skilled service	2,837 26	
Stationery supplies	36 40	
Teaming	5 89	
Telephone-Telegraph	22 29	
Test pits	29 46	
Testing	13 45	
Tools	20 00	
Underpinning	309 11	
		237,326 01

SECTION FIVE.

(*From about 50 feet south of Franklin street to near Court avenue.*)

Coleman Bros. (Contract No. 240)	$14,739 00	
Advertising	63 13	
Borings	268 97	
Construction	1,789 95	
Field supplies	11 40	
Furniture	12 75	
Instruments	14 05	
Labor	115 30	
Legal and expert advice	50 00	
Printing	81 79	
Skilled service	287 03	
Stationery supplies	18 49	
Telephone-Telegraph	28 62	
Test pits	12 31	
Tools	8 40	
		17,501 19

SECTION SIX.

Test pits	$0 60	
		60
Carried forward,		$1,572,776 46

Brought forward, ...		$1,572,776 46
INTEREST.		
East Boston Tunnel . . .	$76,383 28	
Boston Tunnel and Subway . .	16,930 21	
		93,313 49
Total		$1,666,089 95
Less net decrease in subway and alterations accounts, as above . .		34,866 51
Grand Total . . .		$1,631,223 44

SUMMARY.

	From beginning of work to June 30, 1904.	June 30, 1904, to June 30, 1905.	Total.
Subway — Subway Commission .	$14,131 16		$14,131 16
Part of General Expenses . .	117,473 24		117,473 24
Engineering and Miscellaneous .	407,444 06	$31 42	407,475 48
Section One . .	240,651 71	*1,244 59	**239,407 12
Two. .	364,892 05	*1,286 55	**363,605 50
Three .	308,033 66	*7,394 30	**300,639 36
Three and one-half.	9,479 39	*123 69	**9,355 70
Four .	475,340 37	*5,720 04	**469,620 33
Five. .	388,312 54	582 15	388,894 69
Six . .	327,494 86		327,494 86
Seven .	234,883 42	*3,379 15	**231,504 27
Eight .	99,890 26	*4,276 02	** 95,614 24
Eight and one-half.	77,401 99	*762 52	** 76,639 47
Nine. .	304,668 85	*5,216 78	**299,452 07
Ten . .	260,004 53	*5,506 65	**254,497 88
Eleven .	270,310 57		270,310 57
Interest . .	258,575 60		258,575 60
Amount transferred to alterations account, as above .		*4 95	*4 95
Total . .	$4,158,988 26	*$34,301 67	**$4,124,686 59

	From beginning of work to June 30, 1904.	June 30, 1904, to June 30, 1905.	Total.
Alterations—Part of Gen'l Expenses.	$28,945 53		$28,945 53
Section Three	2,568 26		2,568 26
Four.	163 42		163 42
Five.	30,233 01		30,233 01
Seven	179,085 95	*$569 79	**178,516 16
Nine	3 00		3 00
Ten.	534 04		534 04
Interest	1,905 56		1,905 56
	$243,438 77	*$569 79	**242,868 98
Amount transferred from subway account, as above		4 95	4 95
Total	$243,438 77	*$564 84	**$242,873 93
Bridge—Part of Gen. Expenses.	$53,820 57		$53,820 57
Construction, etc.	1,516,377 41		1,516,377 41
Total	$1,570,197 98		$1,570,197 98
East Boston Tunnel — Part of General Expenses	$153,429 32	$5,386 08	$158,815 40
Engineering Expenses	169,066 24	5,593 06	174,659 30
Section A	98,061 33	701 54	98,762 87
B	1,075,663 33	136,372 54	1,212,035 87
C	444,525 97	37,501 16	482,027 13
D	238,896 72	4,845 98	243,742 70
E	186,341 26	1,610 21	187,951 47
F	206,330 24	24,660 67	230,990 91
Interest	171,773 60	76,383 28	248,156 88
Total	$2,744,088 01	$293,054 52	$3,037,142 53
Boston Tunnel and Subway — Part General Expenses	†$36,978 98	$35,186 60	$72,165 58
Engineering Expenses	†119,331 25	110,712 77	230,044 02
Section One		693,551 18	693,551 18
Two		178,771 81	178,771 81
Three		83,055 06	83,055 06
Four		237,326 01	237,326 01
Carried forward,	$156,310 23	$1,338,603 43	$1,494,913 66

	From beginning of work to June 30, 1904.	June 30, 1904, to June 30, 1905.	Total.
Brought forward,	$156,310 23	$1,338,603 43	$1,494,913 66
Five .		17,501 19	17,501 19
Six .		60	60
Interest . .		16,930 21	16,930 21
Total . .	$156,310 23	$1,338,603 43	$1,529,345 66
Grand Total .	$8,873,023 25	$1,631,223 44	$10,504,246 69

* Credit. ** Decrease.

† Details of these items:

Total general expenses, 10th Annual Report		$48,115 62
Proportion of salary of Chief Engineer transferred to engineering expenses . . .		11,819 50
		$36,296 12
Total general office expenses to June 30, 1904	$797 84	
Amount already charged	114 98	
Balance chargeable		682 86
		$36,978 98
Total engineering expenses, 10th Annual Report		$108,194 61
Transferred from general office expense account as above		11,136 64
		$119,331 25

It will be noted that the total cost of the subway as shown on page 37 is $4,124,686.59, while the cost charged to the Boston Elevated Railway Company as a basis for rental as shown on page 27 is $4,100,482.63, a difference of $24,203.96. Of this amount, $23,670.92 is accounted for on page 14 of the Fifth Annual Report. The balance, $533.04 while carried on the books of the Commission and of the City Auditor as part of the cost of the subway, has been expended for purposes which, according to law, are not chargeable to the Company in determining the cost upon which rental is based.

The report of the Chief Engineer is appended.

GEORGE G. CROCKER,
CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN.
Boston Transit Commission.

REPORT OF THE CHIEF ENGINEER.

Boston, June 30, 1905.

George G. Crocker, Charles H. Dalton, Thomas J. Gargan, George F. Swain, Horace G. Allen, *Boston Transit Commissioners.*

Gentlemen:—I submit herewith my report of work on the Washington-street Tunnel for the past year and on some matters of construction in connection with the East Boston Tunnel.

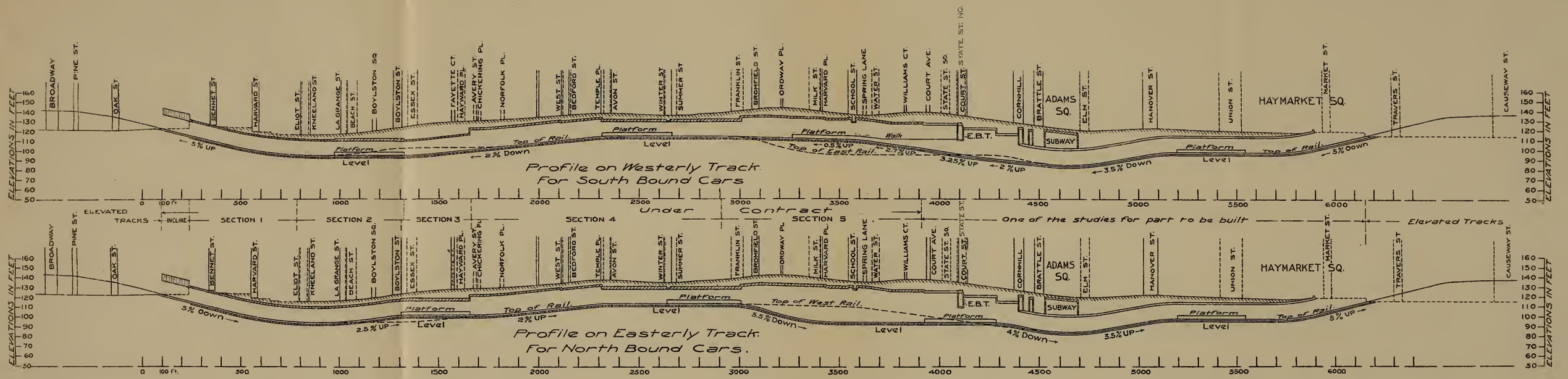
WASHINGTON-STREET TUNNEL.

Work has been in progress on the Washington-street Tunnel this season from near State street on the north to the southern limit, not far from Oak street. The details respecting this work are shown in the statistical tables on pages 44 to 47 and on the following pages.

The general layout of the Washington-street Tunnel is shown on plate 1, and the profile on plate 2. The plan and profile show not only that portion on which the lines have been definitely fixed, that is, to the south of Cornhill, but also indicate one of the studies for the portion of the tunnel to the north of Cornhill.

Of the whole length of the tunnel—according to the plan referred to—50 per cent. will be straight, 33 per cent. will have a curvature of about 5000 feet radius, 2 per cent. of about 1800 feet radius and 15 per cent. of about 500 feet radius. The grades are as follows:—Of the whole length of the tunnel 40 per cent. will be level, 7 per cent. will have a grade of less than one foot in one hundred, 22 per cent. a grade of about two feet in one hundred, 13 per cent. from three and one-fourth to four feet in one hundred and about 18 per cent. of about five feet in one hundred.

A train going north and descending into the Subway, will be about 48 feet lower at Eliot street than when on the



PROFILE OF WASHINGTON ST. TUNNEL

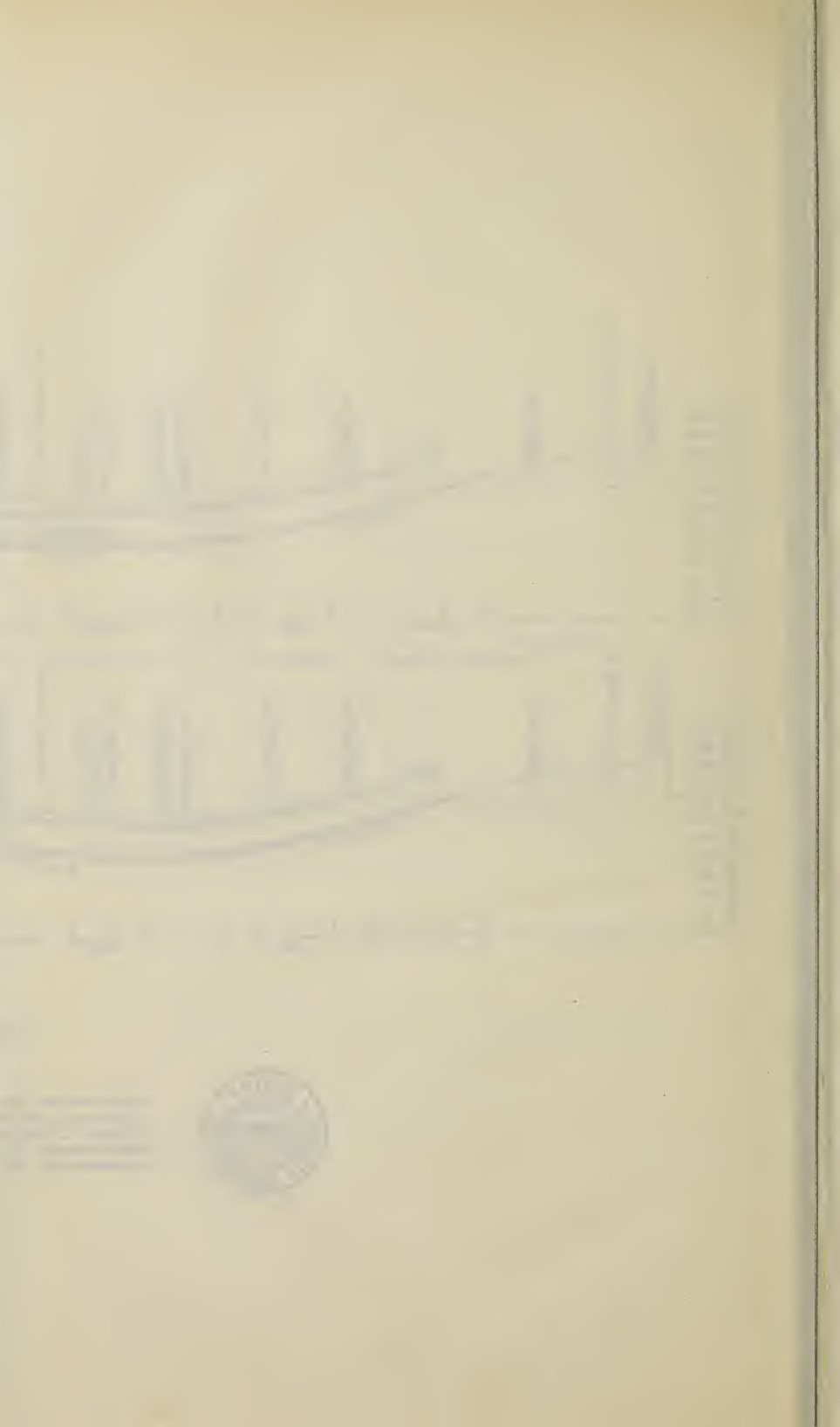
BOSTON TRANSIT COMMISSION

GEORGE G. CROCKER, Chairman.
CHARLES H. DALTON
THOS. J. GARGAN
GEORGE F. SWAIN
HORACE G. ALLEN
} COMMISSIONERS.

HOWARD A. CARSON, Chief Engineer.

Note:- Datum is about 100 $\frac{67}{100}$ feet below mean low water of the sea.

HELIOTYPE CO., BOSTON.



elevated structure at Broadway. At Eliot street the track is about 21 feet below the street surface and 6 feet lower than mean low water of the sea. Continuing north the train will climb 19 feet to Temple place. From Franklin street the tracks descend and pass beneath the East Boston Tunnel at State street at about the same level that they are under Eliot street. The lowest place in the Tunnel, according to the profile shown, will be nearly under the old Subway at Adams square, 28 feet lower than at Franklin street. Continuing north the train will climb 52 feet to the elevated structure at Causeway street.

Cross-sectional plans of some of the work under contract are shown on Plates 4, 5, 6, 7, 10, 13 and 15. The character of the cross-section of the tunnel varies greatly, determined by its situation and use. South of Kneeland street, where the tunnel is wholly to the east of Washington street and in private land, it was necessary not only to adequately support all of the existing buildings which are over the tunnel but also to provide for taller and heavier buildings which are permissible under the building laws. These conditions were best met by a heavy roof of steel beams and concrete supported by reinforced concrete side walls and by a line of steel posts between the tracks. North of Kneeland street, as will be seen from the map, "staggered" station platforms occur at frequent intervals as near the surface of the street as is practicable, and at these platforms the roof is made of steel beams and girders with concrete arches between. Where there are no platforms, and where a considerable depth exists, the tunnel is covered by an arch with tie-rods. In all parts of the work the contingency has been provided for that the pressure of the earth may be removed on either side of the tunnel while a heavy load is being carried on top and a pressure is exerted by the earth on the other side. This provision is not usually made in masonry subways in other cities, but the conditions of narrow streets and the frequent construction of buildings with deep cellars appear to demand it here.

Ventilation.

Little or no provision has been made for the positive ventilation of street subways constructed in other parts of the world. Adequate fans and ventilating chambers were placed in the original Boston Subway and in the East Boston

Tunnel, and will be provided in the Washington-street Tunnel. In accordance with our previous methods, fresh air will in general be admitted at the stations and drawn out of the tunnel at points between stations. In some parts of the original Boston Subway the air from the tunnel was discharged through gratings in the sidewalks, but this might be objectionable on the surface of the crowded sidewalks of Washington street. Tubes will, as a rule, be used to conduct the air from points where it leaves the tunnel to the points where it will be discharged, which will usually be above the subway entrances. These tubes will in some cases be below the tunnel (see Plate 5), and in other cases above, as illustrated on Plates 10 and 15.

METHOD OF DOING THE WORK, NON-INTERFERENCE WITH TRAFFIC IN THE STREET.

The Tunnel structure in Washington street is in no place far removed from and for most of the way comes close to the lines of the building. On account of the narrowness, crookedness and irregularity of the street and the frequency of the Tunnel station platforms, the cross-section of the Tunnel is very irregular and is rarely uniform for more than a few feet in length. Most of the sewer, water and gas pipes and other structures under the street, required to be moved to a new position and many service pipes are to be laid cross-wise to connect with the different buildings. For these reasons most of the earth from the pavement down to the bottom of the Tunnel is necessarily taken out. The work, however, has been carried on in such a way as to interfere but little with the traffic of the street. The method of doing the work has been similar to that employed on the streets when the original Subway was built. The paved surface of the street has been replaced little by little with heavy planking laid flush with the original surface of the paving and supported on timbers, and most of the work in the daytime has been done under this bridging. During the night much more of the surface of the street is occupied, but nevertheless enough space is left free so that fire engines and apparatus can pass through Washington street and in and out of any adjoining street, and this provision permits the passage of the comparatively few teams used in the night. On Sundays and holidays the street surface is occupied in places in putting down new bridging and in doing other work for which the time in a single night is

too short. The street-railway cars are not diverted from Washington street in the day time except in case of emergency, but either the north or the south bound line, or both, are often diverted at night and on Sundays.

The work has been necessarily irregular and of a piecemeal character, but the order of doing the parts has generally been somewhat as follows: underpinning is done where necessary; side walls are built in narrow trenches, one at a time; new sewers are built in or near them; interior posts, if any, are placed in a narrow trench; the roof is put on; the core is dug out; and finally the invert is completed. During this series of operations a large number of pipes of various kinds must be supported and changed and considerable rearranging of braces and props must be made.

Statistical Tables.

The tables on pages 44 to 47 give many of the facts in regard to work on Washington street, and in the following pages additional information is given which could not readily be tabulated. This is for the most part compiled from the reports of the assistant engineers.

No. 1. — CONSTRUCTION.

Designation of Section.	LOCATION OF SECTION.		Numbers given to Plates illustrating Section.	Assistant Engineer on Ground.	Contractor for Construction and Date of Contract.	Appendices Showing Bids.	Date of Completion named in Contract.
	South End.	North End.					
SOUTHERLY INCLINE	West side of Ash Street, opposite Nassau Street	98 feet south of Bennet Street	3	P. F. O'Brien	Harry P. Nawn Oct. 4, 1904	K–10	Oct. 29, 1904 [Certificate of completion, Nov. 5, 1904]
SECTION 1	98 feet south of Bennet Street	Washington Street near south side of Kneeland Street	4	P. F. O'Brien	Patrick McGovern Nov. 17, 1904	K–12	June 1, 1905
SECTION 2	Washington Street near south side of Kneeland Street	Washington Street near north side of Boylston St., including some work in Boylston Street	5 and 6	R. B. Farwell	Patrick McGovern Nov. 28, 1904	K–14	June 20, 1905
SECTION 3	Washington St. near north side of Boylston St., including some work in Essex St.	Washington Street, 28 feet north of Hayward Place, including some work in Hayward Place	7, 8 and 9	R. B. Farwell	Jones & Meehan Dec. 19, 1904	K–16	July 31, 1905
SECTION 4	Washington Street, 28 feet north of Hayward Place	Washington Street, 53.5 feet south of Franklin Street	10, 11, 12, 13 and 14	L. L. Street	Hugh Nawn Contracting Co. Feb. 18, 1905	K–20	Jan. 1, 1906
SECTION 5	Washington Street, 53.5 feet south of Franklin Street	Washington Street, 14.5 feet south of Court Avenue	15	P. F. O'Brien	Coleman Bros. May 19, 1905	K–23	July 1, 1906

No. 2.

Designation of Section.	CHARACTER OF EXCAVATED EARTH.	Surplus Earth, where dumped or disposed of.
SOUTHERLY INCLINE	Below level of basements a stiff blue clay with very little water.	Near junction of Dorchester Av. and Southampton St., So. Boston, a distance of 8000 ft.
SECTION 1	Upper portion mostly clay and gravel. About four feet from bottom a layer of sand was encountered with water. Below this a stiff blue clay mixture with little water.	9000 cu. yds. to near Dorchester Av. and Southampton St., a distance of 8000 ft.; 3000 cu. yds. to scow, a distance of 7000 ft., and dumped at sea outside of Boston Light.
SECTION 2	From surface to a depth of seven or eight feet, sand and gravel filling. Below that yellow or blue clay with some sand, the bottom being generally soft and wet.	Mostly to dump at Kemp St., South Boston, a distance of 8000 ft.
SECTION 3	In Essex St. for seven or eight feet below surface, sand and gravel filling; the next ten feet yellow clay; below that blue clay. In Washington St., opposite Essex St., down to about ten feet below surface, sand and gravel filling, below that yellow clay and sand. North of Essex St., for ten feet below surface, sand and gravel filling; for fourteen feet below this, clay and sand; below this, sharp brown sand. Below 30 ft. from surface, considerable water was encountered in Washington St.	Mostly to Commonwealth dump, vicinity of B and E Streets, South Boston, a distance of from 6000 to 7000 ft.
SECTION 4	Five or six feet below surface was filling, then to ten feet below surface hard blue clay. North of Temple Place, below the clay, hard coarse gravel and sand. South of Temple Place, fine brown sand. Very little water was found on Section 4.	Mostly to scow, a distance of 3500 ft., and dumped at sea outside of Boston Light.
SECTION 5	South of Milk St. a hard compact mixture of clay and gravel. About Elev. 110, near Bromfield St., a layer of coarse sand containing a large quantity of water was encountered.	Scow, a distance of 4000 ft., and dumped at sea outside of Boston Light.

No. 3.—PROGRESS ON CONSTRUCTION.

Designation of Section.	Dates of Beginning.		Amount of work done to and including June 30, 1905.		Estimated Total Quantities.		Number of Men ordinarily Employed by the Contractor.	
	Excavation.	Concrete.	Excavation in cu. yds.	Concrete in cu. yds.	Excavation in cu. yds.	Concrete in cu. yds.	Day.	Night.
SOUTHERLY INCLINE	Oct. 6, 1904	Oct. 11, 1904	665	480	665	480	42	27
SECTION 1	Nov. 21, 1904	Nov. 29, 1904	11,500	4,000	12,000	4,300	55	38
SECTION 2	Nov. 26, 1904	Dec. 1, 1904	17,500	3,500	20,000	4,500	74	61
SECTION 3	Dec. 20, 1904	Dec. 31, 1904	9,000	1,250	20,000	3,900	57	43
SECTION 4	Feb. 21, 1905	Feb. 28, 1905	27,000	5,387	49,000	10,000	150	227
SECTION 5	May 26, 1905	June 7, 1905	6,900	540	52,000	11,500	93	112

No. 4. — STEELWORK.

Designation of Section.	Contractor for Furnishing Steelwork and Date of Contract.	Appendices Showing Bids.	Date of Completion named in Contract.	Date of Certificate of Completion.
SOUTHERLY INCLINE	Harrington Robinson & Co. September 10, 1904		September 23, 1904	Delivered September 30, 1904
SECTION 1	New England Structural Co. September 9, 1904	K–9	November 12, 1904	December 12, 1904
SECTION 2	Boston Bridge Works October 12, 1904	K–11	January 12, 1905	March 18, 1905
SECTION 3	Boston Bridge Works November 23, 1904	K–15	March 3, 1905	April 14, 1905
SECTION 4	Lewis F. Shoemaker February 1, 1905	K–17	May 25, 1905	
SECTION 5	F. A. Houdlette & Son May 31, 1905	K–22	September 1, 1905	

Incline near Ash Street.

NOTE.—Considerable information in regard to this work will be found in the table on pages 44 to 47 and on plate 3.

The buildings where the incline is situated were taken down and their material removed by Thomas A. Elston & Co. between September 8 and October 6, 1904. They were mainly four-story brick structures about sixty years old.

The retaining walls and roof of the incline are composed of concrete reinforced with steel rods. Above the surface of the ground the sides are open, for light and ventilation. Steel posts encased in concrete support the roof, on which is a monitor, about 8 feet wide, open on the sides.

The side walls from the floor of the incline to copings above the surface of the ground, were built in monolithic sections of 20 feet in length with expansion joints between. The roof was made continuous with a sliding joint at the junction with Section 1.

Section 1 of the Washington-Street Tunnel.

NOTE.—Considerable information in regard to this contract section will be found in the table on pages 44 to 47 and on plate 4.

General Description of Structure.—As this portion of the tunnel structure is entirely covered by buildings (except at street crossings), and as taller and heavier buildings may sooner or later, replace the present ones, the walls, roof and foundations are strongly built. The walls and invert of Section 1 are of reinforced concrete. The roof consists of steel I-beams imbedded in concrete and supported on the side walls and a row of center columns. These beams vary from 12 inches to 24 inches in depth and are spaced from 1 foot to 4 feet apart according to the loading to which they are likely to be subjected.

Details of Construction.—The work was carried on from both ends and from shafts in Bennet and Harvard streets in sections from 12 to 20 feet in length. In excavating the sections to the required depth, the earth was filled into tubs which were carried on small cars to the shafts, where the tubs were hoisted and dumped into carts. After the excavation was completed, the floor or invert of the tunnel was built; the side walls were next erected; then the center columns and roof beams were placed in position and riveted, after which the roof was completed with concrete which surrounds the beams and fills the space between them. The

Incline of Section 1 of the Washington Street Tunnel, near Ash Street, looking northerly. Walls and covering are of reinforced concrete.

BOSTON TRANSIT COMMISSION

SECTION 1

WASHINGTON ST. TUNNEL

CROSS SECTION ABOUT 68 FT NORTH OF HARVARD ST.

STA. 6+52.5.

H. A. Risdon Chief Engineer.

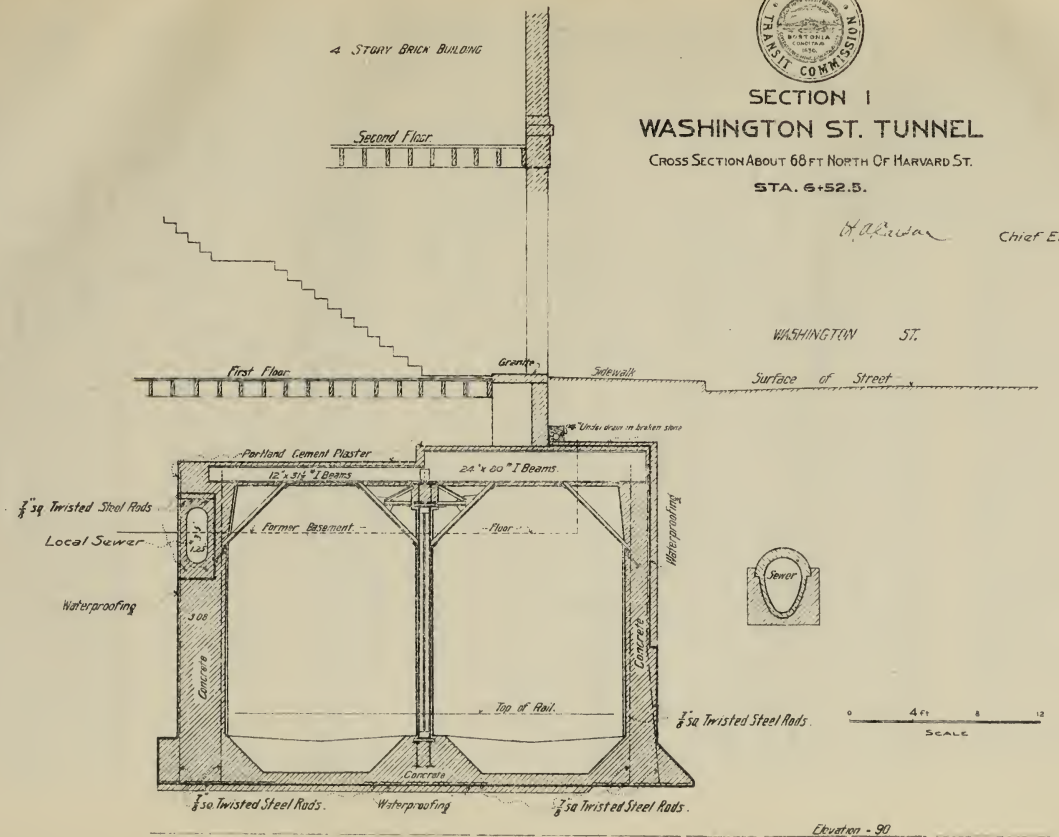


PLATE 4.

HELIOTYPE CO., BOSTON.

invert and side walls were made almost wholly of concrete. The concrete was mixed by a Smith rotary mixer and carried to the several openings in iron carts. The building foundations were supported on steel I-beams during construction, and then pinned up on the completed roof with brick masonry. During the excavation and construction of each short section of the tunnel, the I-beams just referred to were supported by blocking or posts resting on neighboring unexcavated earth or on the partially or wholly completed adjacent subway walls.

Generally the division walls and piers of the overhead and neighboring buildings were underpinned with brick masonry from the completed subway roof and on the sides of the subway down to an inclined plane, having an angle of 60° with a horizontal plane passing through the bottom of the side walls. Concrete sheeting was used outside the easterly wall underneath the premises No. 710-740 Washington St., occupied by Cobb, Aldrich & Co., which sheeting was left in place. Everywhere else wooden sheeting was used, which was removed as the work progressed. The roof of the tunnel is below the street floors of buildings, except in the Sherburne Building, where it is from 3 to 5 feet above the street floor. This story is now being remodelled. The work of supporting the buildings, constructing the tunnel, and pinning up the building foundations from the tunnel roof was necessarily slow, and took more time than was originally estimated.

About 125 linear feet of the westerly wall of the tunnel south of Kneeland street was built in advance of the main contract by Coleman Brothers, in connection with similar work on Section 2.

The grade of the tunnel required the raising of the grade of Bennet street about 2 feet. This new grade runs down to the former grade at Washington street and at 50 feet easterly of Ash street.

At 8.00 A. M., May 12, some of the bracing which supported the easterly bank of the tunnel excavation near 710 Washington street gave way, allowed about 30 cubic yards of earth to come into the trench, and left blocking that supported the underpinning beams of the building in a somewhat perilous situation. Some thirty men were employed during the day in putting the bracing and blocking in safe condition. The assistant engineer had examined the bracing the night

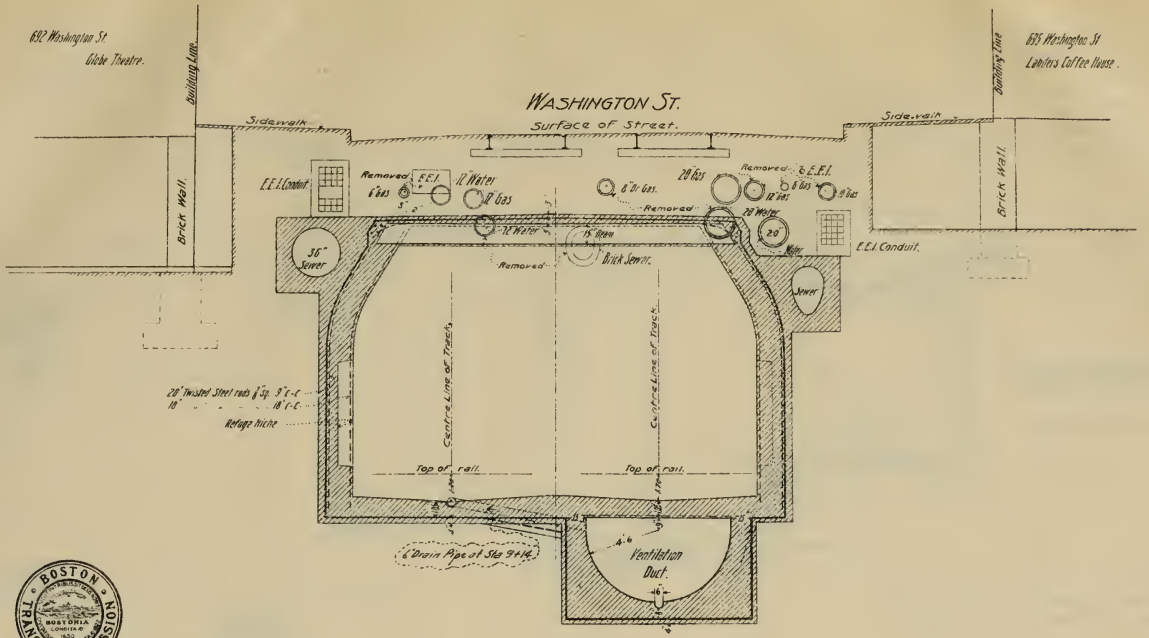
before and found it in good condition. It is his opinion that the cause of the cave-in was the taking out of supports for the bracing by the concrete gang in order to put in concrete. Four or five men were injured, but not seriously, and in a few days they returned to their work. The building (occupied in part by Cobb, Aldrich & Co.) did not settle at all.

Section 2 of the Washington-Street Tunnel.

NOTE.—Considerable information in regard to this contract section will be found in the table on pages 44 to 47 and on plates 5 and 6.

General Description of Structure.—Where Eliot and Kneeland street cross Washington street, for a length of 40 feet, the structure consists of a concrete invert with reinforced concrete side walls and the roof of 15 in. I-beams, 5 feet on centers, with concrete jack arches turned between the beams. For the next 120 feet going northerly the invert and walls are of similar construction, but the roof is of a flat arch type with 15 in. beams imbedded in the concrete every 18 inches. For the remainder of the Section the invert is of concrete and the easterly wall of reinforced concrete; the westerly wall consists of steel columns spaced 5 feet on centers surrounded with concrete; two lines of center columns carry girders extending longitudinally with the tunnel, the roof beams extending across the tunnel resting on the side walls and these girders, and between these beams, which are 5 feet apart, concrete jack arches are turned. Where this last type is used, there is a station platform from 11 to 17 feet in width on the westerly side of the tunnel for the accommodation of south-bound trains. Approaches to this platform extend into LaGrange and Boylston streets, distances of about 100 and 45 feet respectively from the westerly line of Washington street. These approaches occupy practically the width of the two streets named, and have walls of steel columns embedded in concrete, roofs of steel beams and concrete jack arches, a row of center columns and bottoms of concrete, eventually to be covered with a granolithic surface.

Details of Construction.—It was deemed prudent to have a portion of the side walls of the tunnel—especially where close to building foundations—done in advance of the main work of construction, and a contract was made with Gow & Palmer for doing a portion of this advance work. They began operations on the evening of September 6, 1904,



BOSTON TRANSIT COMMISSION

SECTION 2

WASHINGTON ST. TUNNEL

CROSS SECTION ABOUT 75 FT. SOUTH OF LA GRANGE ST.

STA. 9 + 25

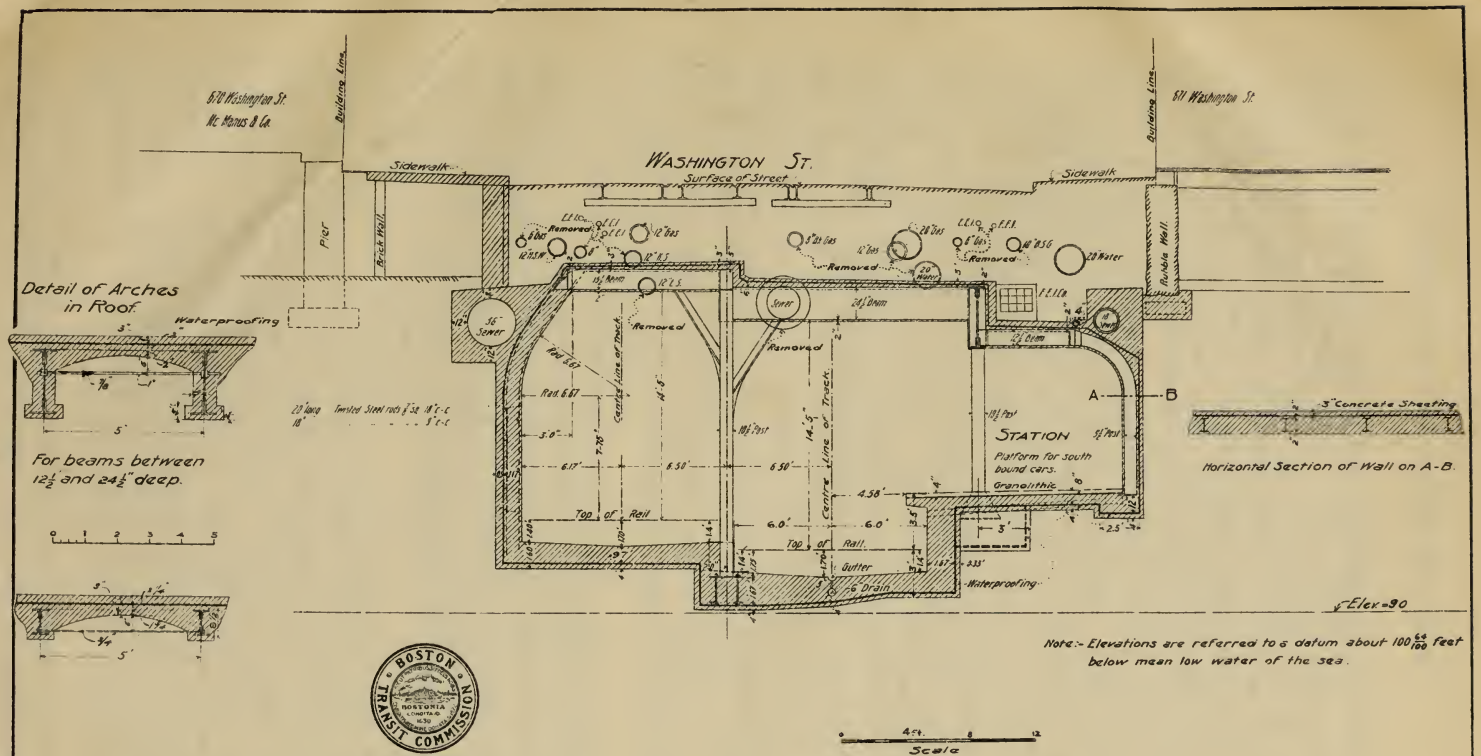
H. A. Carson Chief Engineer

Note - Elevations are referred to a datum about $106\frac{9}{10}$ feet below mean low water of the sea.

0 4ft. 6 12
Scale

PLATE 5.

HELIOTYPE CO., BOSTON.



Note:- Elevations are referred to a datum about 100 64/100 feet below mean low water of the sea.

BOSTON TRANSIT COMMISSION

SECTION 2

WASHINGTON ST. TUNNEL

CROSS SECTION ON NORTHERLY SIDE OF BEACH ST.

STA. 10+83

H.L. Eaton Chief Engineer

PLATE 6.

HELIOTYPE CO., BOSTON.

on the southerly side wall to the LaGrange street station, opposite No. 12 LaGrange street. Four days later, work in Washington street was begun on an opening for the pump-well at the intersection of Beach street. Work in LaGrange and Washington streets was prosecuted diligently by the contractors, although great care was required, particularly in the former street, where the tunnel walls were horizontally within a few inches and vertically about 10 feet deeper than the foundations of the adjoining buildings. After reaching the depth of these foundations, excavation was carried on generally in pockets 6 feet in length and the side wall erected therein before the intermediate pockets were excavated. In spite of the precautions taken, settlement took place on the LaGrange street side of the building situated at the northerly corner of Washington street. To obviate settlement on the Washington street front, the building was supported by spur-shores before operations were begun there. The foundation was then underrun in pockets about 2 feet in width, and strengthened by a wider concrete base about 18 inches in depth, containing 6 in. I-beams, this process being continued until the whole foundation had been strengthened. In that part of Washington street where the side walls did not come nearer than 8 feet to the buildings, the length of the pockets excavated was about 16 feet.

In order to push the side walls ahead as fast as possible, a contract was also made with Coleman Brothers, and most of the side walls of the section south of the station platform were built by them. Excavation and masonry were carried on in alternate 16-foot stretches, and new sewers at the same time built on each side of the street, the intermediate sections being built afterwards.

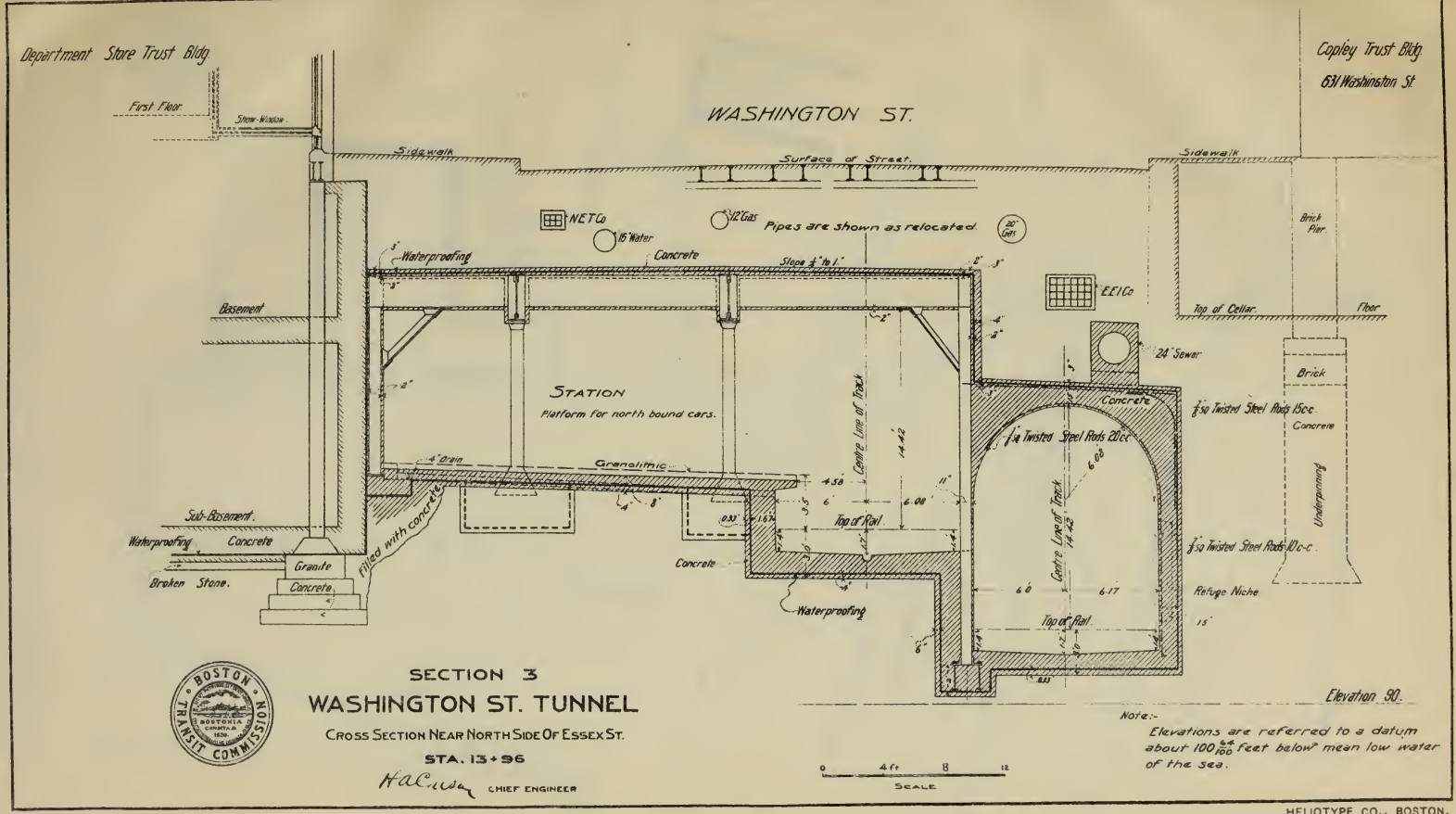
The Lyceum building and the Washington street front of the building at the southerly corner of LaGrange street were underpinned to the depth of the tunnel wall before excavation for the wall was begun. Contracts for this work were made with Isaac Blair & Co. The buildings were spur-shored and the foundations carried on steel beams. Excavation was made to the required depth, and concrete walls and piers brought up to within 18 inches of the old foundations, the final pinning being done with brick masonry.

Work by Gow & Palmer and Coleman Brothers continued until after Patrick McGovern had started on the main

contract for the section, the first-named firm finishing the work they were doing on December 6 and the second on December 8. Gow & Palmer had constructed about 430 feet of side wall and sewer in Washington street and about 180 feet in LaGrange street, all in Section 2. Coleman Brothers had built about 170 feet in Washington street in Section 2 and also an adjoining strip of about 125 feet of the westerly wall and sewer in Section 1. Contractor McGovern proceeded with the construction of the side walls and sewers where the other contractors had left off, and soon had the westerly side finished south of Boylston square, while the easterly side was practically completed to the southerly line of Boylston street. The house connections were then connected into the new sewers, and the old sewers abandoned. The work of excavating the core was then pushed ahead in LaGrange street and that part of Washington street where the station was located; in the former case the full width of the structure being taken, while in the latter a trench was dug first and the platform posts and roof placed, after which the remaining width of the street was excavated in stretches about 40 feet in length, the bottom concreted and the steel then erected and the roof finished.

In that part of Section 2 south of the station a different method was adopted. The street was excavated to a depth sufficient to allow the roof-beams to be set in position from side wall to side wall and the roof was finished first. The core was then excavated underneath and the earth taken in cars to near Kneeland street, where it was hoisted through a hatch and dumped into carts. As the excavation was completed, the ventilation duct and invert were concreted in short sections.

Patrick McGovern's contract included the underpinning of the buildings at the corners of Washington and Boylston streets,—the Boylston and Shuman Buildings. The Boylston Building was underpinned by partitioning off a space about twelve feet square about each one of the main piers, successively, cutting through the piers, and supporting them by heavy steel beams put through and under them. A hole underneath was then dug of the required size and depth and heavy brick piers built up to the old piers. These brick piers were connected by a concrete wall which supported the lighter piers of the building. In the case of the Shuman Building small cross-drifts were driven under the



SECTION 3

WASHINGTON ST. TUNNEL

CROSS SECTION NEAR NORTH SIDE OF ESSEX ST.

STA. 13+96

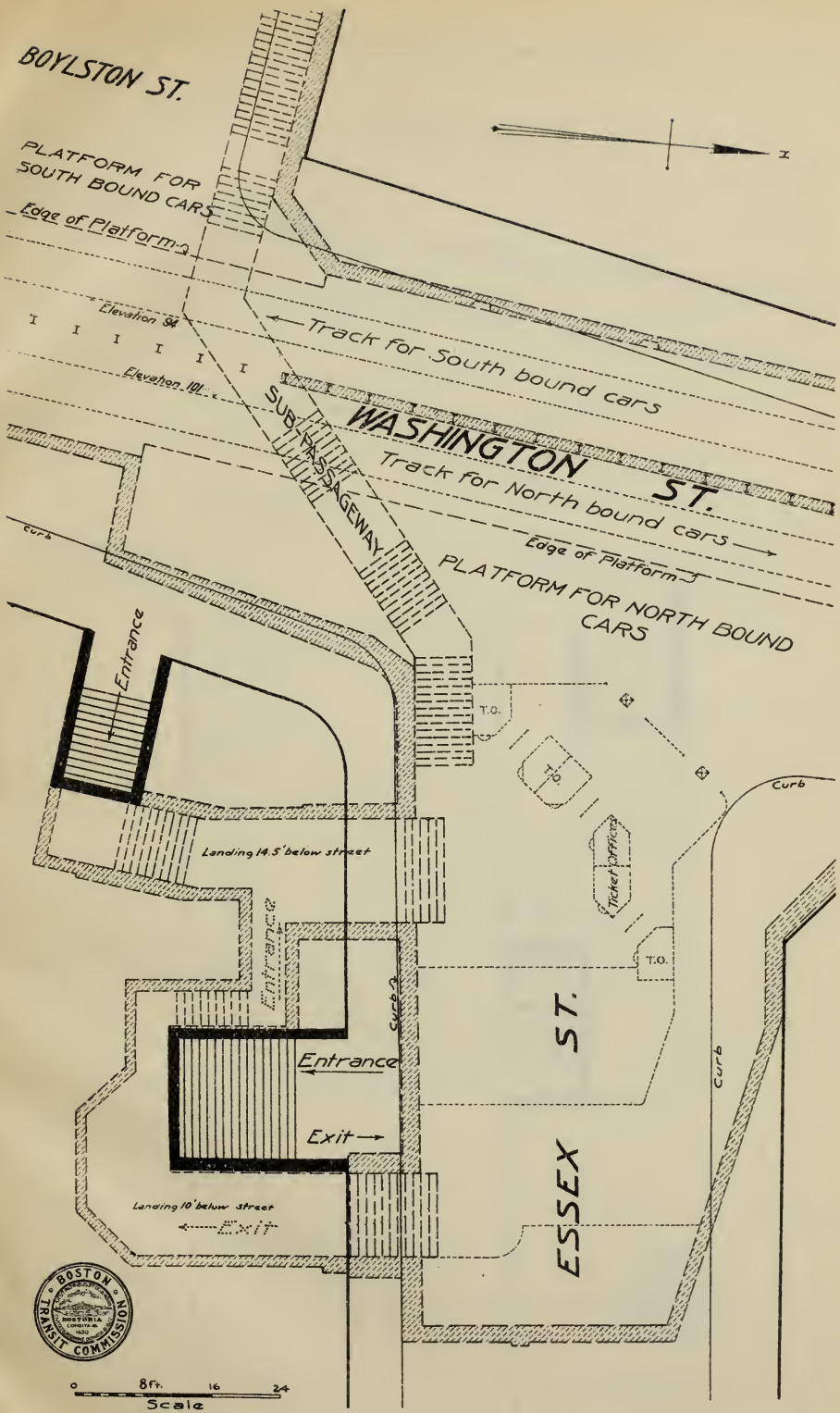
H. A. Cruse CHIEF ENGINEER

SCALE 0 4 ft 8 12

Note:- Elevations are referred to a datum about 100 64/100 feet below mean low water of the sea.

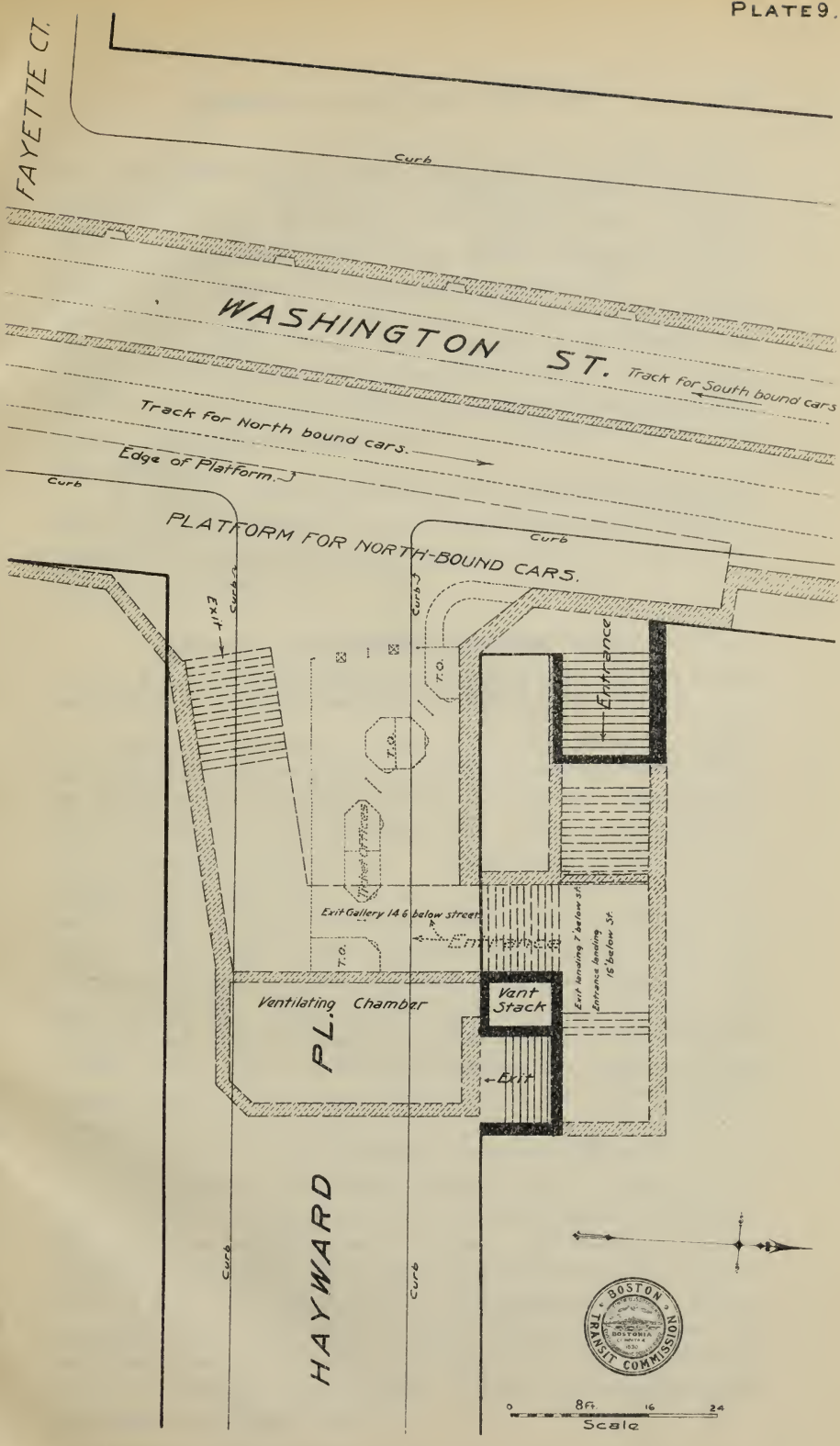
PLATE 7.

HELIOTYPE CO., BOSTON.



ESSEX STREET ENTRANCE AND EXIT TO PLATFORM FOR NORTH-BOUND CARS, AND SUB-PASSAGEWAY TO PLATFORM FOR SOUTH-BOUND CARS AT BOYLSTON STREET.

HELIOTYPE CO., BOSTON.



HAYWARD PLACE ENTRANCE AND EXIT TO PLATFORM FOR NORTH-BOUND CARS.

HELIOTYPE CO., BOSTON.

piers, and I-beams about twenty feet long were inserted under the foundation. Another set of I-beams parallel with and close to the front of the piers were placed above the first beams and supported at the end on timber blocking, the first beams being supported from these by iron bolts. A large box was built upon the outer ends of the lower beams and filled with paving stones, thus forming a cantilever, the weight of the building being upon the short arm. The excavation and masonry work then proceeded as usual in similar cases. The work of supporting the buildings was done by Isaac Blair & Co.

At this date (June 30) Section 2 is practically completed from the end of Section 1 to the southerly line of Boylston street, but considerable work remains to be done in the vicinity of Boylston street.

Section 3 of the Washington-Street Tunnel.

Note.—Considerable information in regard to this contract section will be found in the table on pages 44 to 47 and on plates 7, 8 and 9.

General Description of Structure.—The structure varies in width from 53 feet at the northerly corner of Essex street to 35 feet at the northerly end of the section. The inverts are of concrete. The westerly side wall is of concrete with imbedded steel rods. A reinforced concrete arch springs from this wall over the westerly track to a center wall of steel columns 5 feet on centers surrounded by concrete. From these center columns steel I-beams cross over the easterly track to a line of girders resting on columns in the station platform. The platform girders are connected to the easterly side wall by I-beams, the easterly wall consisting of I-beam posts every 5 feet surrounded by concrete. The spaces between the beams are spanned by concrete jack-arches, the concrete being carried high enough to cover the whole structure. A cross section is shown on Plate 7.

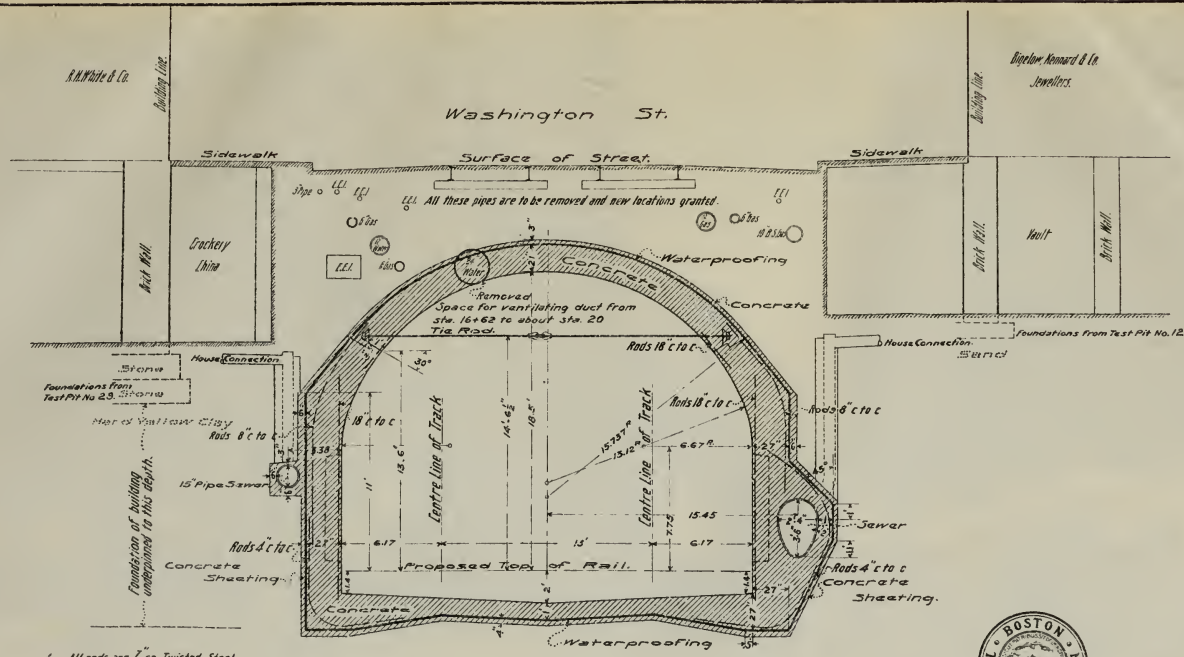
The platform mentioned above is from 8 feet to 26.5 feet in width on the easterly side of the structure and is for the use of the northerly bound trains. Approaches to these platforms extend into Essex street and Hayward place about 60 feet from the easterly line of Washington street. These approaches have side walls of steel columns surrounded by concrete, steel center columns, and roofs of I-beams spanned between by small concrete arches. Plans of these approaches are shown on Plates 8 and 9.

Details of Construction.—The contract for this section included in addition to the construction of the tunnel, the tunnelling for and laying of about 600 feet of 18 inch and 24 inch pipe sewers in Hayward place, Harrison avenue and Essex street as part of the necessary sewer changes in connection with the work. The contractors began on this sewer work on December 20, 1904, at the intersection of Hayward place and Harrison avenue. Two days later, operations in Washington street were begun in front of the store of the Pitts-Kimball Company. During the first month the work was confined to these sewers and to excavating and building the westerly wall of the tunnel where it was not very near to building foundations.

Because of the depth and proximity of the tunnel, it was deemed necessary to underpin the walls of the buildings on the westerly side of Washington street from the northerly end of Section 2 to and including the southerly corner of the Bumstead Building, a distance of about 140 feet, and also the walls of the Arioch Wentworth Building fronting on Washington street and Hayward place. Excavation for this underpinning was begun in the Hotel Cecil on January 20, 1905. The work of supporting the buildings was done by John Soley & Sons. The general method was to partition off a portion of the basement and to cut through the walls and piers and support the building on heavy steel beams. At the date of this report the Washington street fronts of the buildings named have been underpinned, but work is going on under the Hayward place front of the Arioch Wentworth Building.

The general method in Washington street after the building foundations have been underpinned has been to build the westerly wall of the tunnel to the height of the springing line of the arch, and then to excavate for and build the center wall to the springing line, after which the arch is turned. At this writing the westerly wall is practically all built to the springing line, but only 85 feet of the center wall and arch have been built. On the easterly side of the street the columns have been set in position, but the concreting is not yet completed.

In Essex street the first work consisted in connecting the 24 inch sewer already referred to by a new 24 inch sewer on the southerly side of Essex street to the new 3 ft. concrete sewer on the easterly side of Washington street. After this



BOSTON TRANSIT COMMISSION

SECTION 4
WASHINGTON ST. TUNNEL

CROSS SECTION ABOUT 10 FT. SOUTH OF WEST ST.

STA. 21+00

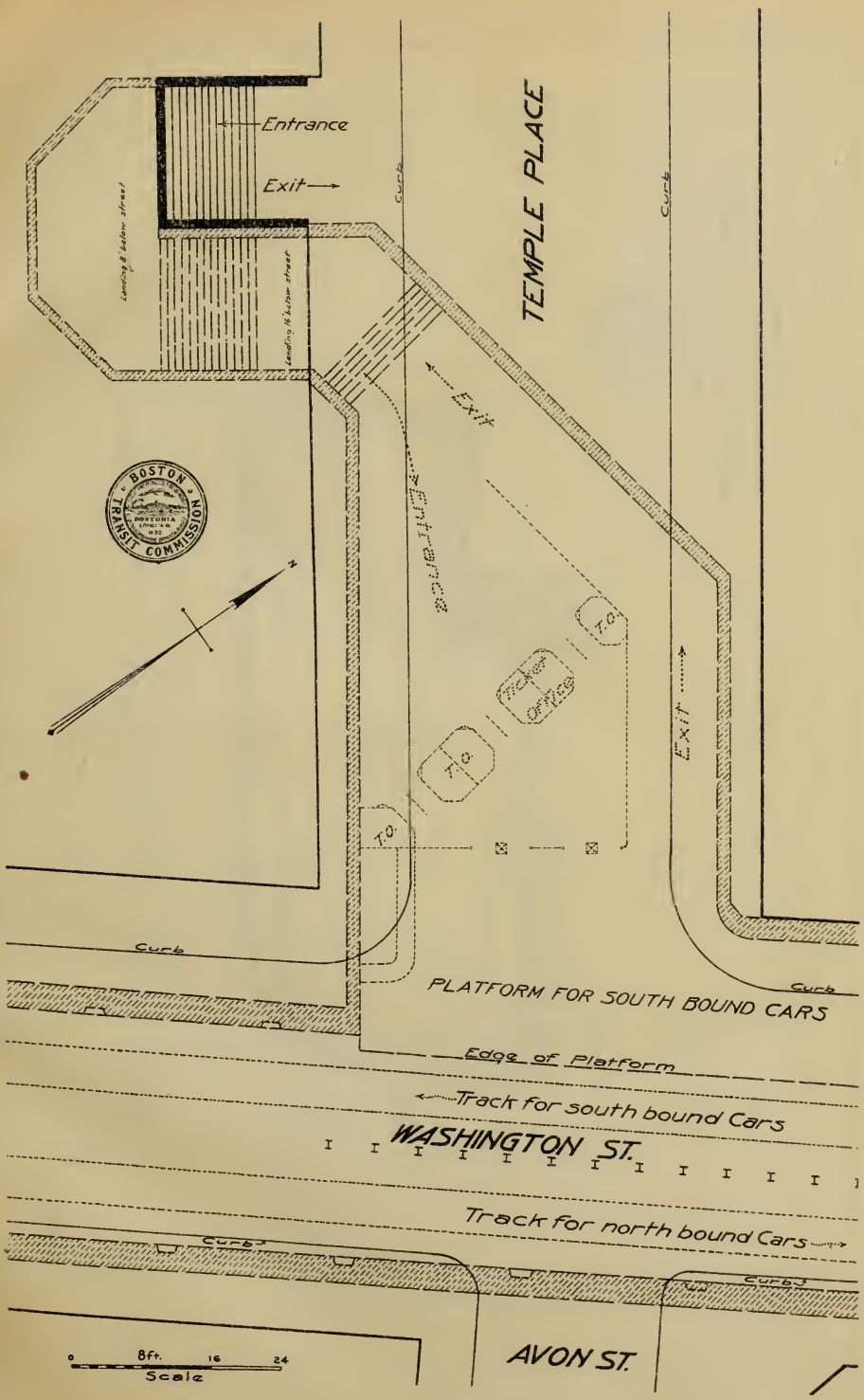
H.A. Carson Chief Engineer

PLATE 10.

HELIOTYPE CO., BOSTON.

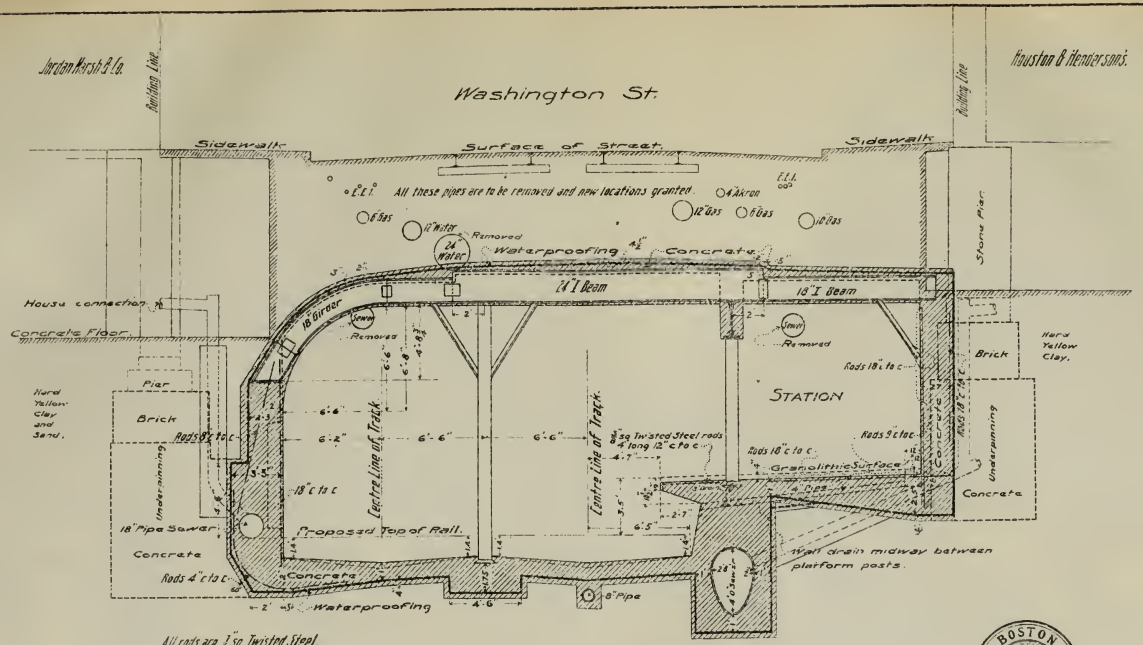
Looking northerly on Washington Street from West Street (Section 4, Washington Street Tunnel). The photograph shows the planking which forms the top of the temporary street bridging. On the right can be seen a ventilating hole through the bridging, guarded by vertical and inclined posts. The crowded condition of the sidewalks is shown. June 26, 1905.

PLATE 11



TEMPLE PLACE ENTRANCE AND EXIT TO PLATFORM FOR SOUTH-BOUND CARS.

HELIOTYPE CO., BOSTON



BOSTON TRANSIT COMMISSION

SECTION 4

WASHINGTON ST. TUNNEL

CROSS SECTION ABOUT 29 FT. NORTH OF TEMPLE PL.

STA. 23+85

Note:- Elevations are referred to a datum about 100 Ed 00 feet below mean low water of the sea.

0 4 Ft. 8 12
Scale

P. M. Carson Chief Engineer

PLATE 13.

HELIOTYPE CO., BOSTON.

Looking northerly on Washington Street from Winter Street (Section 4, Washington Street Tunnel). The photograph shows the planking which forms the top of the temporary street bridging. June 26, 1905.

had been completed, the side-wall columns were placed and concreted in. Excavation in the center of the street is now going on.

Work on Washington street has been simplified by the diversion of the old sewer by a temporary wooden box sewer into the new sewer in Hayward place so that there is now not much sewage to contend with in Section 3.

Section 4 of the Washington-Street Tunnel.

Note.—Considerable information in regard to this contract section will be found in the table on pages 44 to 47 and on plates 10, 11, 12, 13 and 14.

General Description of Structure. — From the southerly end of the section to Temple place the structure consists of a concrete invert, reinforced concrete side walls and a concrete arch with steel tie rods of 2.25 inches diameter spaced about 2.5 feet apart. A cross section is shown on plate 10. Between Temple place and Winter street there is a platform on the westerly side of the street for south-bound cars, which is about 350 feet long and from 16 to 17 feet wide. The cross section of this platform is shown on plate 13. From Winter street north there is a platform on the easterly side of the street for north-bound trains. This platform has about the same length and width as the other. A cross section of this platform is shown on plate 15 relating to Section 5.

North of Temple place the roof of the structure is composed of steel roof beams placed 5 feet on centers, with concrete arches between them. A cross section of these arches is shown on plate 15. Between Temple place and Winter street the roof beams are supported by reinforced concrete walls and two lines of steel columns. North of Winter street the structure differs from the above in that steel columns are placed in the easterly concrete wall and the roof beams are riveted to them.

Underpinning of Buildings.—Owing to the proximity of the subway walls to the buildings, it was decided to underpin about three-fourths of all the buildings along the line of this section. The foundations of these buildings were carried down to the same depth as the bottom of the subway. The work of supporting the buildings while this underpinning was going on was sub-let by the general contractor mainly to the John Cavanaugh & Son Building Moving Company, and in part to Gow & Palmer. The work was commenced about March 1, and has been finished at the date of

this report, June 30. The careful levels taken on these buildings showed no settlement greater than one-eighth of an inch, and that in two cases only.

Details of Construction.—As the new tunnel displaces the old sewer, it was necessary to build the side walls and the new sewers and to turn the flow of the sewage into these sewers in advance of much of the work in the center of the street. These walls have been completed north of Norfolk place, and the new sewers are (June 30th) about ready to be used. About 250 feet of arch has been built south of Temple place where the old sewers did not interfere. One-fourth of the steel on the section has been placed in position.

Work on this section was commenced on February 21, and has been pushed vigorously. Under the provisions of the contract, the contractor was not allowed to remove excavated material south of Winter street between 7.45 A. M. and 6.15 P. M. except on Sundays and holidays. This required the greater part of the excavation to be done at night. The progress of the work indicates that the completion of the section may be expected somewhat in advance of the time set in the contract.

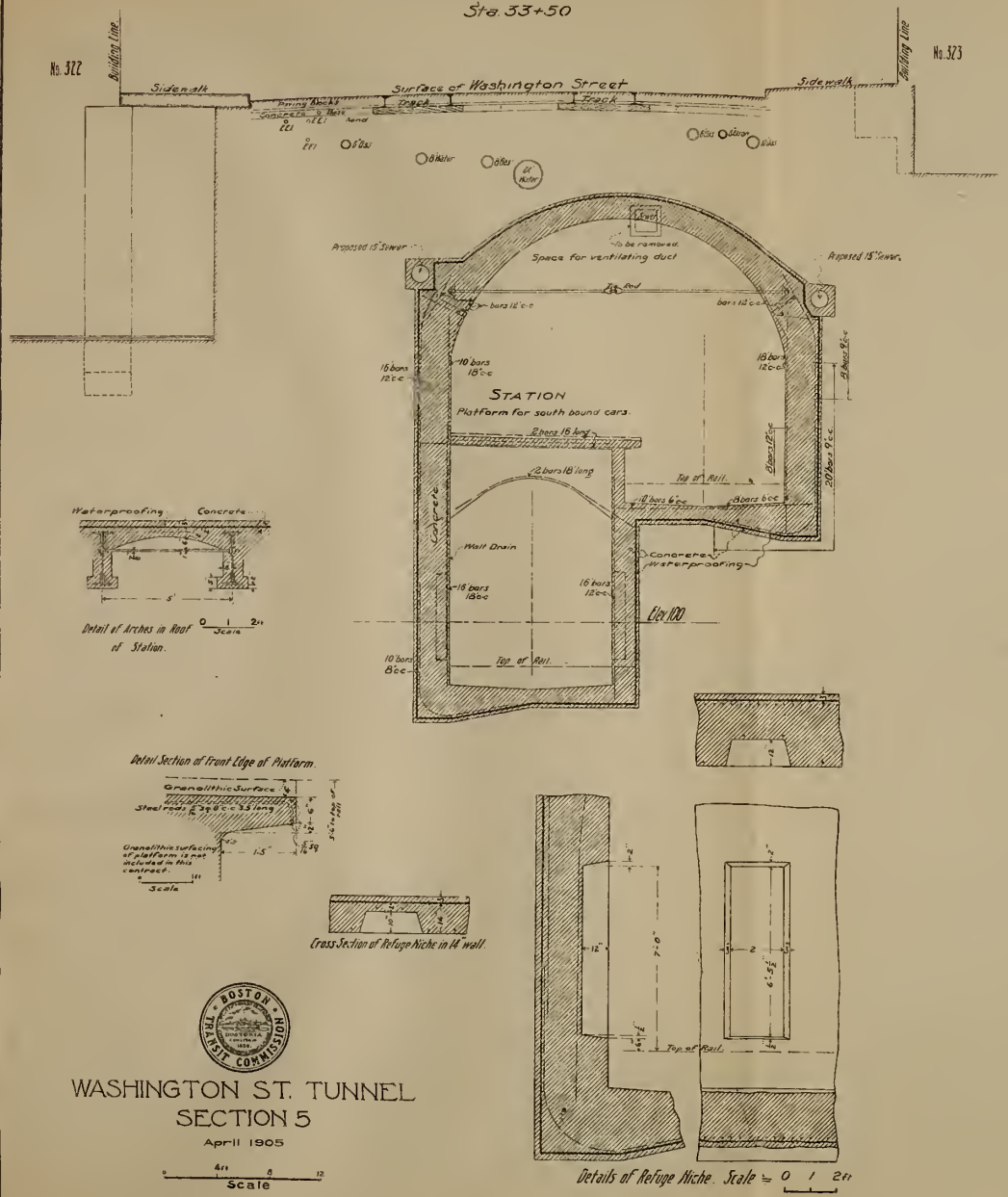
Storage Areas.—The mixing of concrete has been by machine, the plant being placed on Boston Common at the corner of Charles and Boylston streets. The contractor has also hired land at the Old Providence depot and also on the Boston Elevated property on Atlantic avenue, where excavated material and paving blocks are stored.

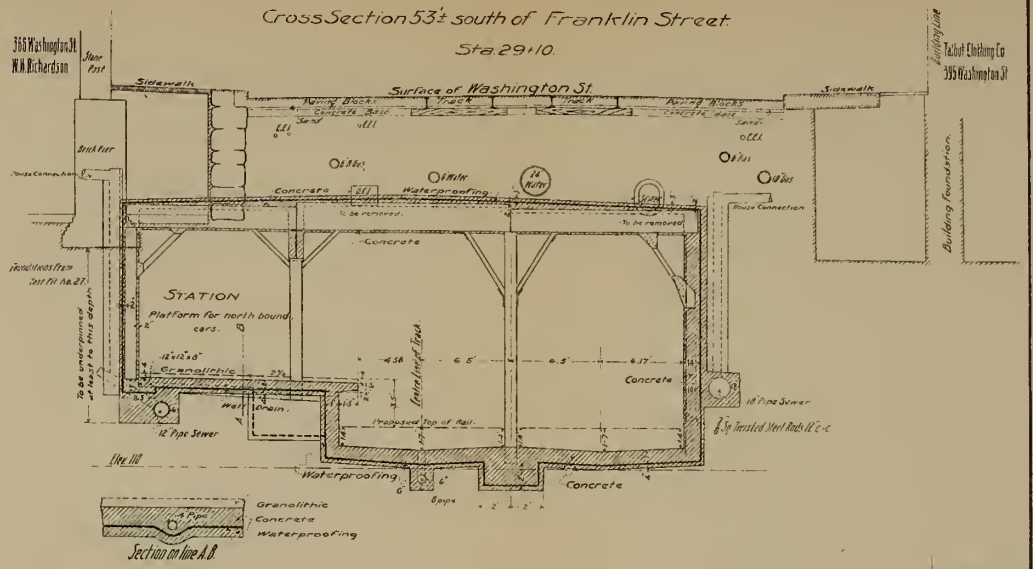
Section 5 of the Washington-Street Tunnel.

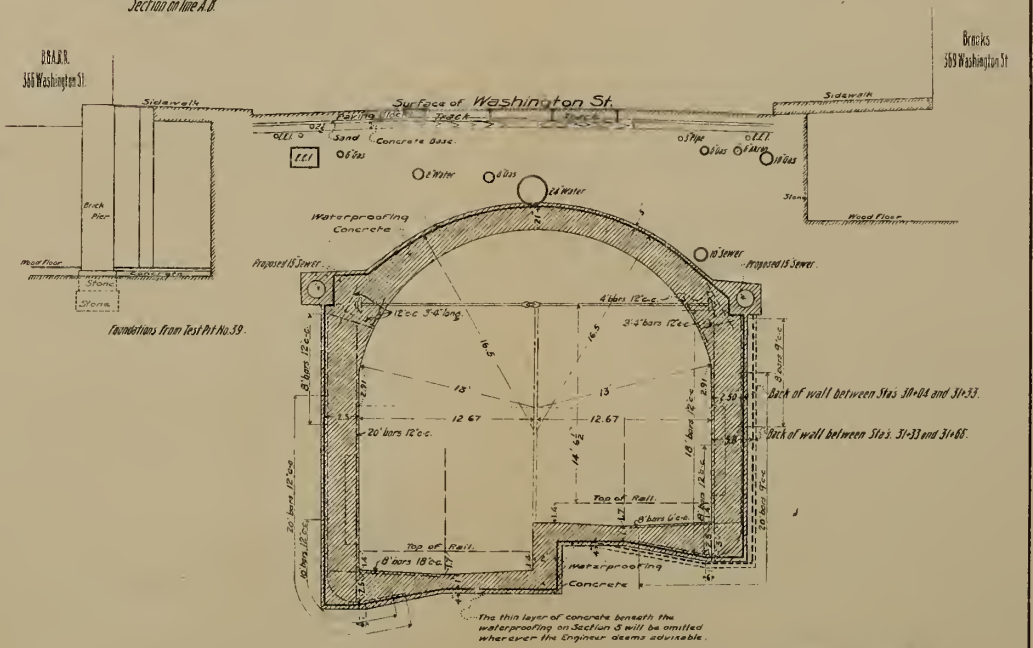
NOTE.—Considerable information in regard to this contract section will be found in the table on pages 44 to 47 and on plate 15.

General Description of Structure.—The structure will in general consist of concrete invert, side walls of reinforced concrete and an arch roof with tie rods. For a length of 100 feet south of and across Franklin street, however, the roof will be constructed of 20-inch and 24-inch I-beams imbedded in concrete and supported by girders carried on two lines of steel columns. Steel columns are also placed 5 feet apart in the easterly side wall the same as in the adjoining portion of Section 4.

Details of Construction.—The side walls between Franklin and Milk streets are now under construction, the







Cross Section 6± north of Bromfield St.
Sta. 31+00.

BOSTON TRANSIT COMMISSION

WASHINGTON ST. TUNNEL
SECTION 5
April 1905

Scale

H.H. Larsen Chief Engineer.

Heliotype Co., Boston.

work being carried on in lengths of about 16 feet. No excavation has as yet been done (June 30th) north of Milk street.

Section 5 is deeper than the preceding sections, the bottom being from 30 to 48 feet below the street. A feature of interest is that the track for north-bound cars from about 90 feet south of Milk street to the northerly end of the section is under the platform for south-bound cars and the passageway leading to the State street entrance to the tunnel. From the middle of the Herald building northerly for a distance of about 110 feet the westerly wall of the tunnel is under the front walls of buildings.

Relocation of Pipes.

In fixing the profile of the Washington-street Tunnel, a minimum depth of about 4 feet of earth over the roof was decided upon, to allow space for sub-surface structures in the street. The average depth between Kneeland and Franklin streets is 5 1-2 feet, with a minimum of 3 1-2 feet at Summer street and a maximum of 9 feet at Hayward place.

At most of the principal street intersections, and for the entire length of Section 2, the complete relocation of these underground structures has been necessary on account of the tunnel construction. Between these points, companies and city departments represented beneath the surface have asked that they be allowed to lay larger pipes and straighten their lines to conform to the necessary changes, and the Engineering Department has accordingly prepared precise plans showing a harmonious relocation of all of the principal underground structures in Washington street between Kneeland and Franklin streets. All new locations granted either by the Transit Commission or by the City authorities have been consistent with these plans. Plate 16 shows the proposed plan of relocation at the corner of Boylston and Washington streets.

The general method of ordering the removal of the old pipes and granting new locations is as follows:

Early in the work of each section, in order to give the companies time for preparation, the Commission orders by formal votes the removal of all the structures in the street not owned by the City which are shown by test pits to occupy space intended to be occupied by the tunnel or to otherwise interfere with its construction. New locations are granted at the same time which are shown approximately by plans

sent to the companies with the vote. Forty-six such plans have been prepared and sent during the last year.

As fast as conditions require, orders for specific removals are made by telephone or by letter, and are generally very promptly complied with. The gas company in this connection deserves especial commendation.

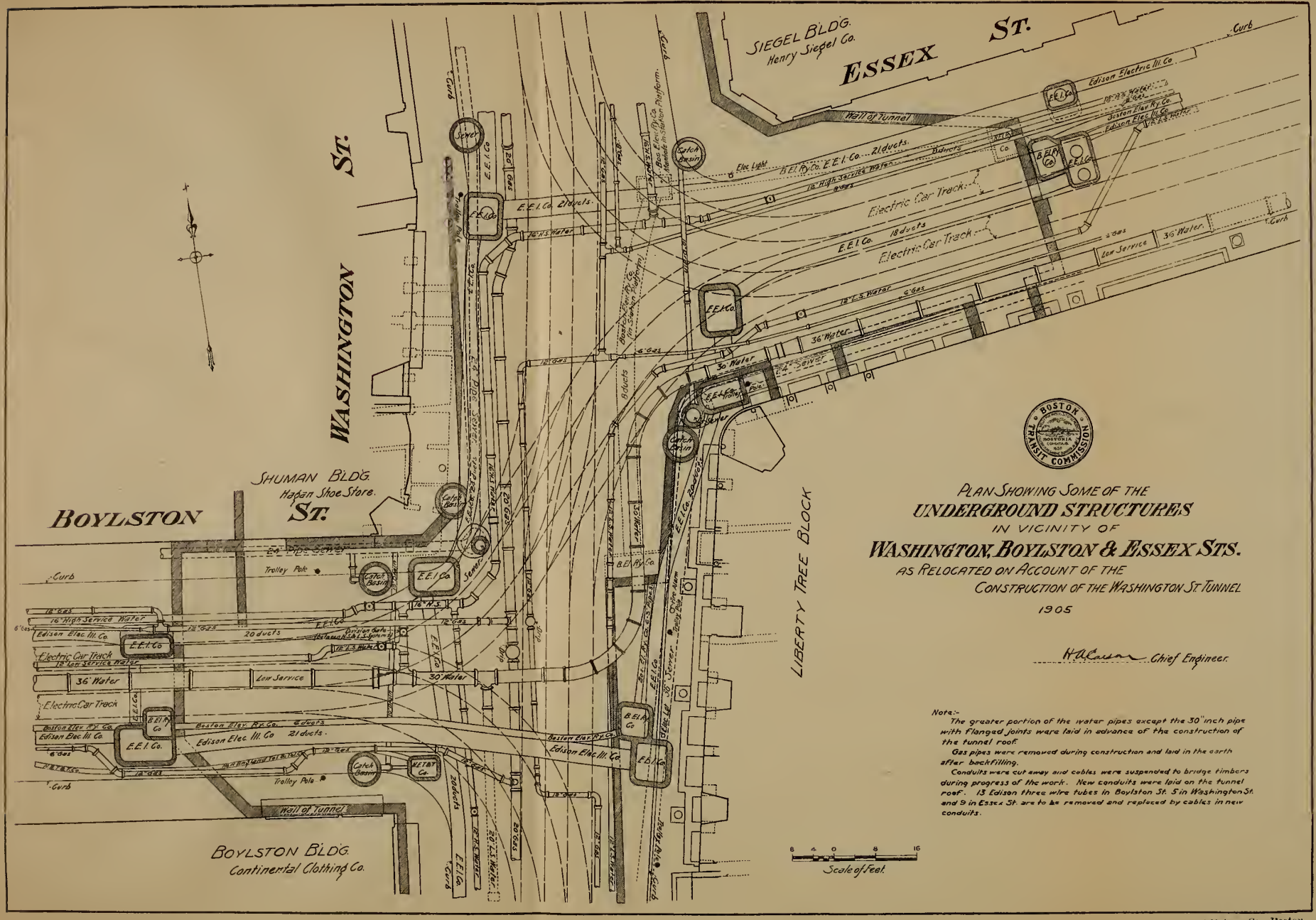
The new structures are laid in some respects under the direction of the Transit Commission engineers, who designate the precise location and the time of doing the work. In order not to incommode the public, much of the work of relocation is done under the planking which, during subway construction, forms the surface of the street, the contractor making the necessary changes in the timbering at the expense of the Commission.

The relocation of all Washington street sewers within the tunnel limits has been necessary and is described elsewhere.

The water pipes have been generally relocated in advance of the tunnel construction, the skilled labor only being furnished by the Water department. The pipes have been supported temporarily by timbers while work was going on and permanently by brick piers resting on the tunnel roof.

The laying of the 36 inch water pipe through Essex, Kingston, Otis, Devonshire, Franklin, Congress and Water streets, mentioned in the Tenth Annual Report, has been completed by the Water department, and water was turned into it on March 6, 1905. Since that time the service in the old 24 inch low-service pipe between Boylston and Water streets has been discontinued, and the pipe has been removed by the contractor as fast as uncovered. It was not deemed expedient to attempt to connect the new 36 inch pipe from Boylston street across Washington street into Essex street in advance of the construction of the roof of the tunnel, and service has been maintained through a temporary sixteen inch pipe laid in the ground with great difficulty in February, the greater part of which will eventually be utilized as a part of a new high-service main now being laid.

The gas pipes have been removed at once by the Gas Company on being uncovered, so as to avoid danger of explosion, and small pipes have been substituted where necessary to supply the buildings, either under the planking or through the basements between side streets. Over two miles of gas pipes have thus been removed between Harvard and Franklin streets, a distance of about 2,400 feet. The



BOSTON TRANSIT COMMISSION

PLAN SHOWING SOME OF THE
UNDERGROUND STRUCTURES
IN VICINITY OF
WASHINGTON, BOYLSTON & ESSEX STS.
AS RELOCATED ON ACCOUNT OF THE
CONSTRUCTION OF THE WASHINGTON ST. TUNNEL
1905

H. A. Carson Chief Engineer.

Note:-
The greater portion of the water pipes except the 30 inch pipe with flanged joints were laid in advance of the construction of the tunnel roof.
Gas pipes were removed during construction and laid in the earth after backfilling.
Conduits were cut away and cables were suspended to bridge timbers during progress of the work. New conduits were laid on the tunnel roof. 13 Edison three wire tubes in Boylston St. 5 in Washington St. and 9 in Essex St. are to be removed and replaced by cables in new conduits.

Heliotype Co., Boston.

permanent gas pipes have not been replaced in any locality until after the tunnel in such locality has been completed and the street backfilled.

The concrete of the electric conduits has generally been removed as soon as the tunnel excavation would allow and the cables hung or looped up out of the way. This with the removal of the gas pipes has given the contractors much additional space in which to work, and has greatly reduced the task of supporting the pipes. The new conduits have been laid for the most part on the tunnel roof under the planking before the street has been backfilled. The capacity of the electric light conduits has been materially increased and eventually all of the old Edison three-wire solid tube system over the tunnel will be removed and replaced by cables drawn through these conduits. The building connections will be made through pipes laid from the manholes. This change to a drawing-in system which permits repairs to be made without digging up the street will, doubtless, be appreciated after the pavement is permanently replaced.

The two 10-inch pneumatic mail tubes crossing the tunnel at Eliot and Kneeland streets were relaid in advance of the construction of the tunnel roof.

Washington street has been continuously patrolled by water, gas, and electric light inspectors, the Water Department men carrying a red flag by day and a blue light by night for identification, and despite the fact that bare electric light and power cables, water and gas pipes, pneumatic tubes, etc., have been carried on timbers in the open excavation where some settlement is inevitable, no accident at all serious to property or person has thus far resulted.

At the date of this report the work of pipe relocation has been substantially completed, as far north as Boylston street, and is under way over all the rest of the tunnel work under contract.

Bennet and Summer Street Sewers.

On page 64 of the Tenth Annual Report, reference is made to Bennet and Summer streets as affording outlets for the sewage on the westerly side of Washington street without siphoning.

The new Bennet street sewer and connecting sewers in Washington street, Harrison avenue and Harvard street were built by Patrick McGovern under contract of June 16,

1904, the work being completed August 8, 1904. Information about these sewers is given in the Report referred to.

The new Summer street sewer was built by Peter W. Hill under contract of July 23, 1904, from the existing overflow sewer in Dewey Square to about 190 feet easterly from Washington street, a distance of about 1600 feet. Through Dewey square for 208 feet the sewer was a circular brick structure 4′ 3″ in diameter, and the remainder of the way egg-shaped 3′-6″ by 5′-3″ and was also of brick. From considerations of economy of construction and in order to disturb street traffic as little as possible, the excavation was done by tunnelling, the positions for man-holes about 250 feet apart being used for shafts. The tunnel was mostly through hard blue clay, except in the portion westerly from Otis street, where it passed through a stratum of sand containing water, necessitating constant pumping. The work was begun July 26, 1904, and finished November 21, 1904.

EAST BOSTON TUNNEL.

Reference is made in the report of the Commission, on pages 14 to 20, to the opening of the Tunnel to public traffic and to various other matters of interest. Following is information in relation to ventilating apparatus, the Atlantic-avenue station and to pumping.

Ventilating Apparatus.

The contract for ventilating apparatus for the East Boston Tunnel, consisting of "Woodbridge" centrifugal fans direct connected to 580 volt D. C. motors was awarded to the American Blower Co. of Detroit, Mich., Nov. 12, 1904.

The apparatus installed by them is as follows:

Ventilating Chamber. Location of	Fans.	Normal Speed.	Maximum Speed.
Lewis St., near Webster St., East Boston	Two 8 ft. single inlet vertical	R.P.M. 175	185
Atlantic Avenue Station	Two 7 ft. double inlet horizontal	205	218
State Street, near India Street	Two 8 ft. single inlet vertical	76	90

The Holtzer-Cabot Electric Co. of Brookline, Mass., was the sub-contractor for the motors, and the Cutler-Hammer Mfg. Co. of Milwaukee, Wis., for the controllers.

The two fans in each ventilating chamber together give a maximum air delivery of about 45,000 cubic feet per minute. This quantity is sufficient to change the air in the section of the tunnel under the harbor every fifteen minutes, and in the section in State street every thirteen minutes. Smaller air deliveries for ordinary ventilation can be obtained by running the fans at slower speeds or by running only one fan at a time in each ventilating chamber. The speeds of the fans are raised from the normal to the maximum by weakening the motor fields.

The frictional resistance to the flow of air in the tunnel and ventilating duct was over-estimated, so that the original fan speeds called for in the specifications were afterwards reduced to those shown in the table, and the motors consequently run at less than their rated capacities.

The design for ventilating chambers and ducts and the general arrangement thereof was made by the Engineering Department. (See Plate 6 in the Eighth Annual Report and Plates 5, 6, 7 and 8 and pages 51, 53 and 55 of the Tenth Annual Report.) The calculations and designs for the ventilating machinery were made under the supervision of Professor S. Homer Woodbridge.

Bulkhead.

A temporary bulkhead has been built in the end of the East Boston Tunnel just west of the Court square station to shut off the excavated space between the present end of the tunnel and the old subway wall in Scollay square and so avoid or lessen the trouble which might occur from water getting into the tunnel in case a water pipe in this space should break.

Atlantic Avenue Station.

During the year the Whittier Machine Co., the contractor for the elevator plant, has put in the car and counterweight guides for the elevators and has nearly completed the installation of the hoisting machines and controllers in the machinery loft. One car frame has been put in place and run up and down, the results indicating that the special features of the plant have been successfully worked out, and that no noticeable shock or jar will be felt when the cars are

running at full speed (250 ft. per min.) on the curved portions of the guides.

The work below the street level in the Atlantic Avenue Station since the last report has included putting in interior walls and partitions, granolithic platforms, reinforced concrete and steel stairways, rib and glazed tile, etc. The contractors who did various parts of the work are as follows:

Reinforced concrete stairways,	THE SIMPSON BROS. CORP.
Concrete walls around elevator wells,	GOW & PALMER.
Rib and glazed tile,	WILLIAM H. SMITH.
Cutting out concrete at the foot of the elevator wells,	COLEMAN BROS.
Steel stairways,	L. M. HAM & CO.

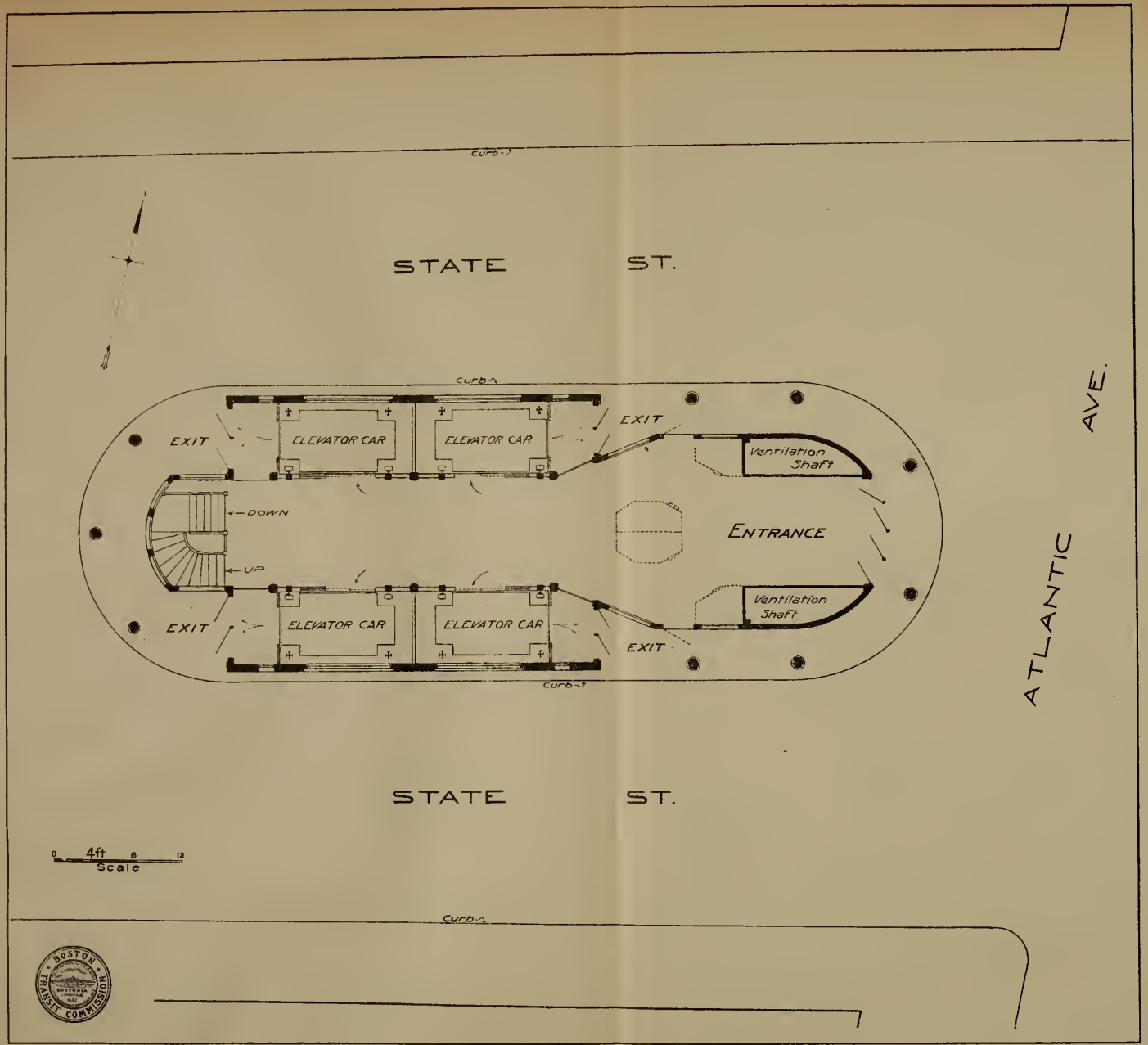
The contract for grilles, doors and screens for the openings in the elevator wells has been let to Oliver Whyte and Co.

Considerable miscellaneous work has been done by the Commission with day labor. The part of the station below the street is now about finished.

Entrances to Atlantic Avenue Station of the East Boston Tunnel.

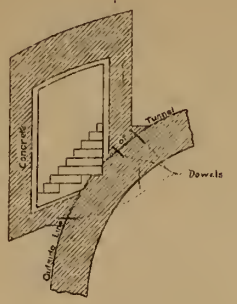
The contract for the 3-story building covering the easterly stairways and the elevators of the Atlantic avenue Station was made with the Woodbury & Leighton Company August 15, 1904. A canvass of bids is given in Appendix K-5. The plan of the street floor of this building is shown on plate 17. The structure is 84 feet long and 29 feet wide. The entrance is at the easterly end and the exits are at the sides and west end. There will be four elevators, two serving the eastbound platform and two the westbound. Each elevator can carry from 40 to 50 people at a time. For a description of these elevators see page 54 of the Tenth Annual Report. The second floor, about 13 1-2 feet above the street, is nearly identical in plan and arrangement with the street floor and is to be connected by a bridge with the State street Station of the elevated railway. The third floor contains the elevator machinery and is accessible from below by means of a stairway.

The building is constructed with a steel frame to which are attached an inside and outside covering of steel furring and wire lath covered with cement plaster, in most cases forming hollow walls. All steel is covered with cement mortar.

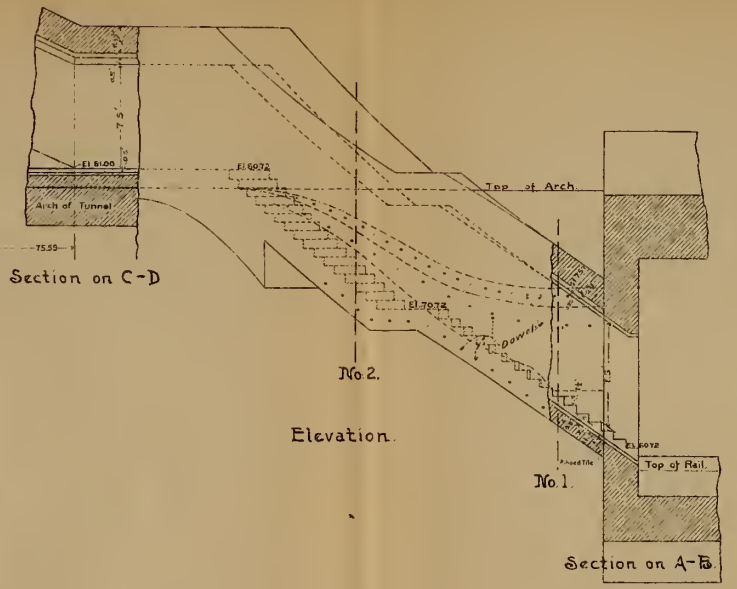


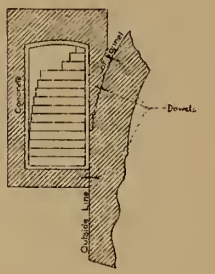
STREET LEVEL OF BUILDING FOR ELEVATORS AND STAIRWAYS
AT EAST END OF ATLANTIC AVENUE STATION,
EAST BOSTON TUNNEL.

Heliotype Co., Boston.

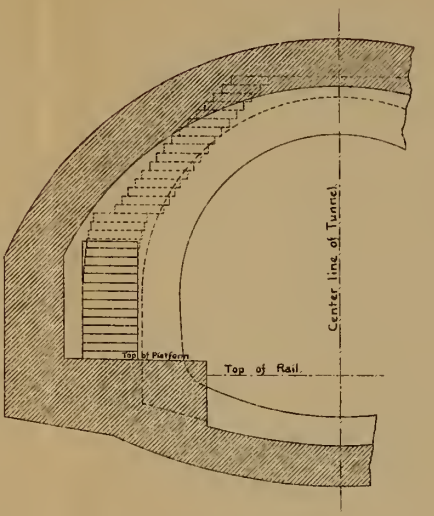


Section No. 2.

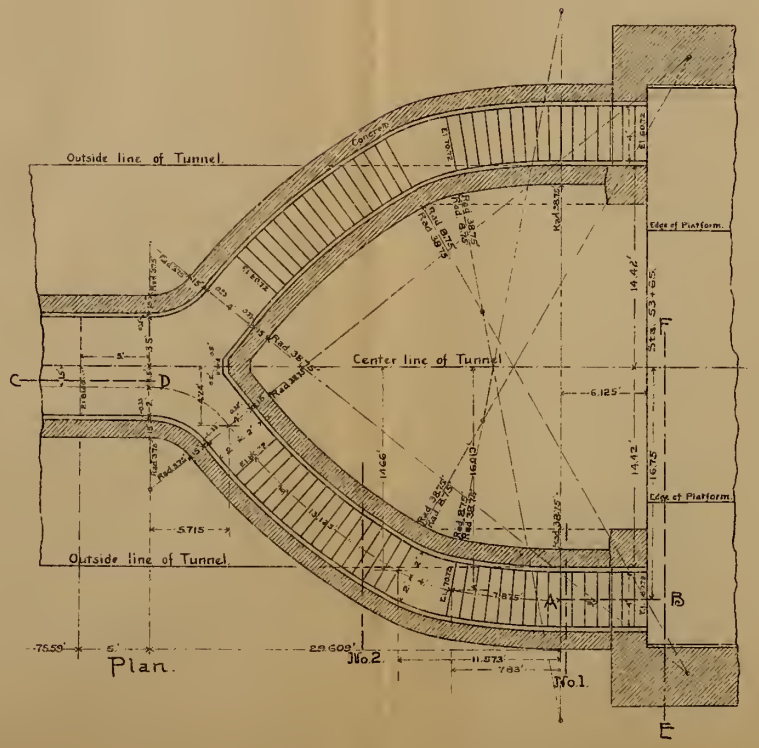




Section No. 1.



Section on E-F.



EAST BOSTON TUNNEL
STATE STREET.

Note: Elevations are referred to a datum about 100 Feet below mean low water of the sea.
The excavation to be paid for under Item (e) shall be the earth excavated above the bottom of the masonry with in vertical lines drawn four feet outside points of the side walls as shown in the plans.
The excavation under Item (f) shall be the displacement of the walls of the masonry as shown in the plans.

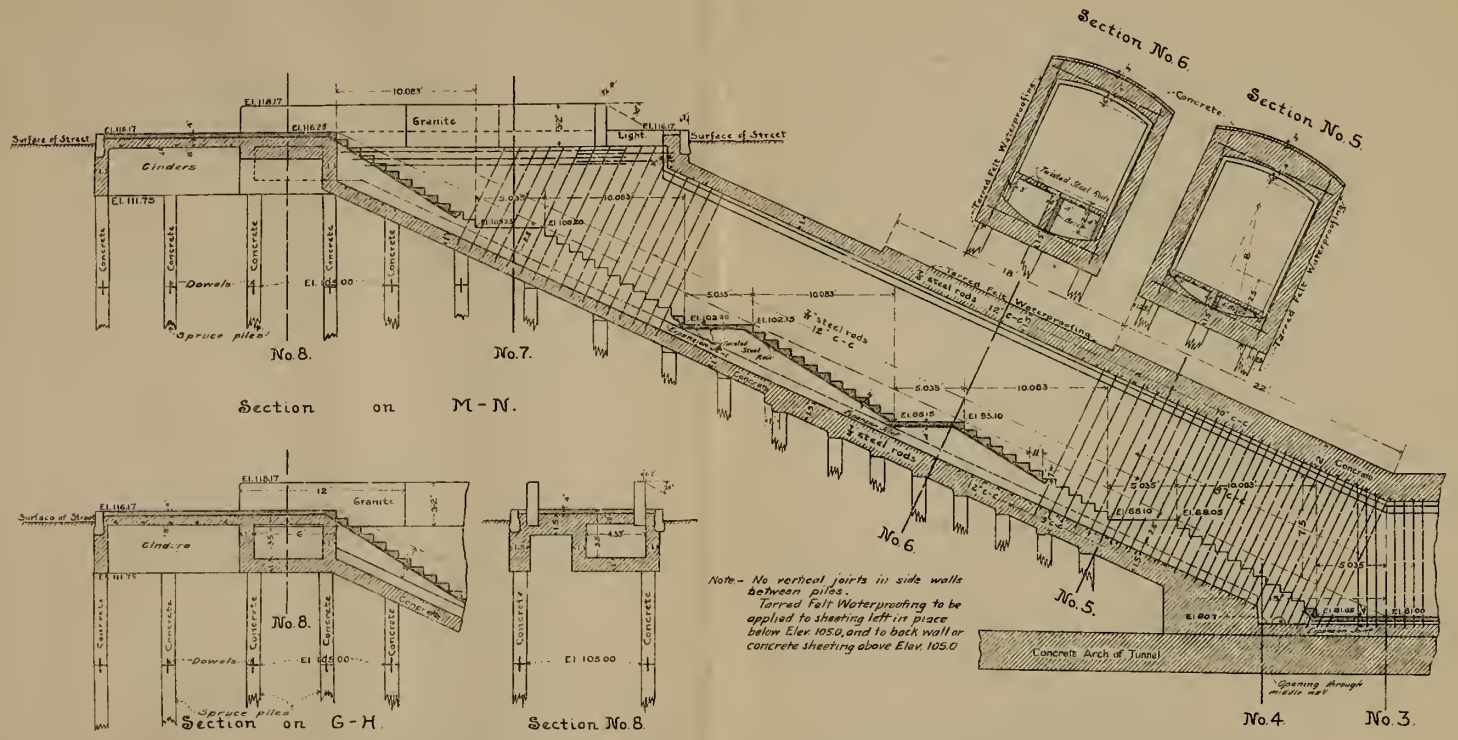
BOSTON TRANSIT COMMISSION

STAIRWAY AND INCLINE AT WESTERLY END OF ATLANTIC AVE. STATION.

H. A. Carson Chief Engineer.

0 4 8 12
Scale of Feet.

Heliotype Co., Boston.

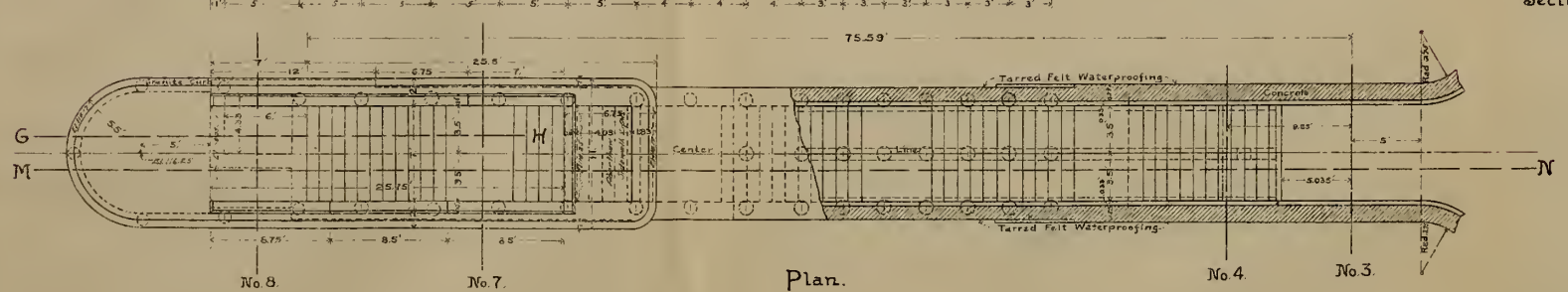


Section on M-N.

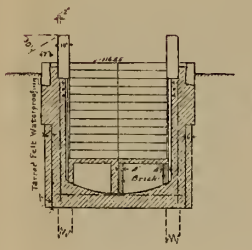
Section on G-H.

Section No. 8.

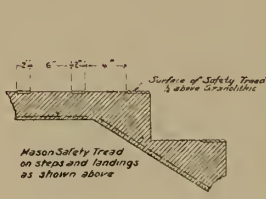
Note – No vertical joints in side walls between piles.
Tarred Felt Waterproofing to be applied to sheeting left in place below Elev. 105.0, and to back wall or concrete sheeting above Elev. 105.0



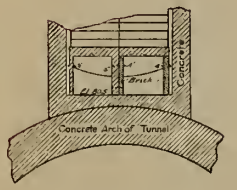
Plan.



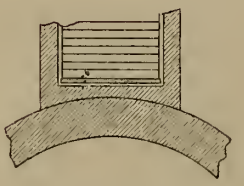
Section No. 7.



Detail of Steps.
Scale 1" = 8"



Section No. 4.



Section No. 3.

EAST BOSTON TUNNEL STATE STREET.

BOSTON TRANSIT COMMISSION

STAIRWAY AND INCLINE AT WESTERLY END OF ATLANTIC AVE. STATION.

H. A. Carson Chief Engineer.

Note. Elevations are referred to a datum about 100 feet below mean low water of the sea.
The excavation to be paid for under item (2a) shall be the earth excavated above the bottom of the masonry within vertical lines drawn from the extreme outside points of the side walls as shown in the plans.
The excavation under item (2b) shall be the displacement of the outside of the masonry as shown in the plans.

0 4 8 12
Scale of Feet.

Heliotype Co., Boston.

Building over stairway of emergency exit at westerly end of Atlantic Avenue Station, East Boston Tunnel. Walls of reinforced concrete ; roof of glass and metal.

PLATE 20

PLATE 21

Looking easterly in Devonshire Street Station of the East Boston Tunnel in State Street, under Old State House.
November 7, 1904.

APPENDIX K–14.

CANVASS OF BIDS FOR WASHINGTON STREET TUNNEL—STATION 8+00 TO STATION 13+25±, SECTION 2—. BIDS OPENED NOV. 17, 1904.

Section 2 from Near the Southerly Side of Eliot and Kneeland Sts., to Near the Northerly Side of Boylston St.

BIDDERS AND ADDRESSES.	20,000 Cu. Yds. Earth Excavation.	3,500 Cu. Yds. Concrete for all Purposes Except for Roof.	1,000 Cu. Yds. of Concrete for Roof.	50 Cu. Yds. Brick Masonry for Manholes, Piers for Water Pipes, etc.	Laying 100 Linear Ft. 24 In. Vitrified Pipe.	Laying 100 Linear Ft 18 In. and 15 In. Vitrified Pipe.	Laying 70 Linear Ft. 10 In. Vitrified Pipe.	Laying 30 Linear Ft. 8 In. Vitrified Pipe.	Laying 120 Linear Ft. 6 In. Vitrified Pipe.	Laying 230 Linear Ft. 4 In. Vitrified Pipe.	Setting and Securing 20 Tons Steel Weighing Less Than 6 Lbs. Per Linear Ft.	Setting and Securing 435 Tons Steel Weighing 6 Lbs. or More Per Linear Ft.	2,000 Sq. Yds. Coating of Portland Cement Mortar.	10 Cu. Yds. of Grout.	6,000 Sq. Yds. Waterproof Coating of Asphalt.	10,000 Sq. Yds. Tarred Felt.	Underpinning and Supporting and Protecting Buildings and Structures and all Other Work, etc.	TOTALS.
	a	b	c	d	e	ee	3e	4e	5	6e	f	ff	g	gg	h	i	k	
James J. Coughlan,	$4.90	$11.50	$12.50	$17.00	$1.50	$1.75	$1.50	$1.25	$1.25	$1.00	$16.00	$14.00	$0.30	$20.00	$0.40	$0.25	$6,000.00	
19 Worthington St., Boston	98,000.00	40,250.00	12,500.00	850.00	150.00	175.00	105.00	37.50	150.00	230.00	320.00	6,090.00	600.00	200.00	2,400.00	2,500.00	6,000.00	$170,557.50
Gow & Palmer,	4.50	11.00	12.50	18.00	.50	.50	.40	.40	.30	.20	10.00	15.00	.50	25.00	.50	.20	10,000.00	
50 Congress St., Boston	90,000.00	38,500.00	12,500.00	900.00	50.00	50.00	28.00	12.00	36.00	46.00	200.00	6,525.00	1,000.00	250.00	3,000.00	2,000.00	10,000.00	165,097.00
Charles F. Taylor & Co.,	4.00	11.00	12.00	16.00	2.00	1.50	1.00	.50	.50	.30	15 00	15.00	.75	20.00	.40	.30	5,000.00	
23 Lewis St., East Boston	80,000.00	38,500.00	12,000.00	800.00	200.00	150.00	70.00	15.00	60.00	69.00	300.00	6,525.00	1,500.00	200.00	2,400.00	3,000.00	5,000.00	150,789.00
E. W. Everson & Co.,	3.70	9.00	10.00	20.00	3.00	2.00	1.00	1.00	1.00	50.	20.00	15.00	.50	30.00	.50	.20	20,000.00	
Cor. Ward St. and Huntington Avenue, Boston	74,000.00	31,500.00	10,000.00	1,000.00	300.00	200.00	70.00	30.00	120.00	115.00	400.00	6,525.00	1,000.00	300.00	3,000.00	2,000.00	20,000.00	150,560.00
Manufacturers Contracting Co.,	4.42	9.50	10.25	16.00	1.00	1.00	.80	.50	.30	.20	10.00	15.00	.45	25.00	.40	.20	5,175.00	
1005 Market St., Wilmington, Del	88,400.00	33.250.00	10,250.00	800.00	100.00	100.00	56.00	15.00	36.00	46.00	200.00	6,525.00	900.00	250.00	2,400.00	2,000.00	5,175.00	150,503.00
Jones & Meehan,	3.90	9.00	11.00	20.00	2.00	1.50	1.20	1.00	.90	80.	10.00	12.00	.40	25.00	.40	.20	8,000.00	
1 Beacon St., Boston	78,000.00	31,500.00	11,000.00	1,000.00	200.00	150.00	84.00	30.00	108.00	184.00	200.00	5,220.00	800.00	250.00	2,400.00	2,000.00	8,000.00	141,126.00
Coleman Bros.,	3.80	9.50	9.50	20.00	1.50	1.00	1.00	1.00	.50	.50	15.00	8.00	.50	30.00	.30	.15	8,000.00	
15 Court Sq., Boston	76,000.00	33,250.00	9,500.00	1,000.00	150.00	100.00	70.00	30.00	60.00	115.00	300.00	3,480.00	1,000.00	300.00	1,800.00	1,500.00	8,000.00	136,655.00
H. P. Nawn,	3.00	8.50	13.00	15.00	.30	.30	.25	.25	.25	.10	6.00	15.00	.60	25.00	.30	.20	5.000.00	
82 Savin St., Boston	60,000.00	29,750.00	13,000.00	750.00	30.00	30.00	17.50	7.50	30.00	23.00	120.00	6,525.00	1,200.00	250.00	1,800.00	2,000.00	5,000.00	120,533.00
Patrick McGovern,	2.95	10.00	9.50	15.00	1.00	1.00	1.00	.50	.25	.15	12.00	5.00	.35	20.00	.25	.15	4,000.00	
6 Beacon St., Boston	59,000.00	35,000.00	9,500.00	750.00	100.00	100.00	70.00	15.00	30.00	34.50	240.00	2,175.00	700.00	200.00	1,500.00	1,500.00	4,000.00	114,914.50

The floors and roof are of concrete and wire or expanded metal except the part of the roof over the ends of the building which is of metal and glass. The copper panelling, etc., in all cases is laid on cement. The window openings on the first floor are only partially closed with glass, the space above being left open for air supply to tunnel.

At this date (June 30th) the plaster, copper work and elevator grilles are unfinished and painting has not been started.

The architectural work for this building and the supervision of the contractors who are constructing it has been under the direction of Charles Brigham and Willard P. Adden, architects.

The plan for the emergency stairway at the westerly ends of the platforms is illustrated on Plates 18 and 19. It was constructed by E. W. Everson & Company. (See Appendix K.) It comprises a stairway 4 feet wide from each platform joining on top of the tunnel arch a stairway 7 feet wide which with four intervening landings extends to the surface of the street. The construction is so arranged that a Reno inclined elevator or escalator can at any time be easily put in in place of half of the width of the 7-ft. stairway. The work was begun July 13, 1904, and completed Sept. 6, 1904.

A building made with concrete walls and glass and metal roof covering the top of the stairway is illustrated on Plate 20. This was built by The Aberthaw Construction Company. (See Appendix K-6.) It was begun Sept. 5, 1904, and completed Oct. 10, 1904.

Pumps.

On the night of September 8-9, 1904, considerable tide water came into the East Boston Tunnel at the Atlantic-avenue Station through nine ducts for wires, which ducts had been put in by the Boston Elevated Railway Company and left open. All the water which came in was taken care of by one of the two pumps described on page 53 of the Tenth Annual Report and the water did not get as high as the floor of the pump well. Although only one of these pumps was needed to take care of this water, and the pumps are ample for the leakage in the tunnel and rain water which may occasionally get in, it was thought that some unforeseen accident might happen which would make it desirable to have additional pumping plant, and accordingly an order has been

placed with the Lawrence Machine Co. of Lawrence, Mass., for a 2.5 inch two stage centrifugal pump, which will have a capacity sufficient to discharge 180 gallons per minute from the tunnel well through the discharge pipe which connects with a sewer in East Boston. This pump will be placed with the other pumps in the East Boston Tunnel pump chamber and will be used as a reserve and for emergency purposes.

The amount of leakage in the East Boston Tunnel is somewhat smaller than it was a year ago, the latest measurements giving less than seven gallons per minute.

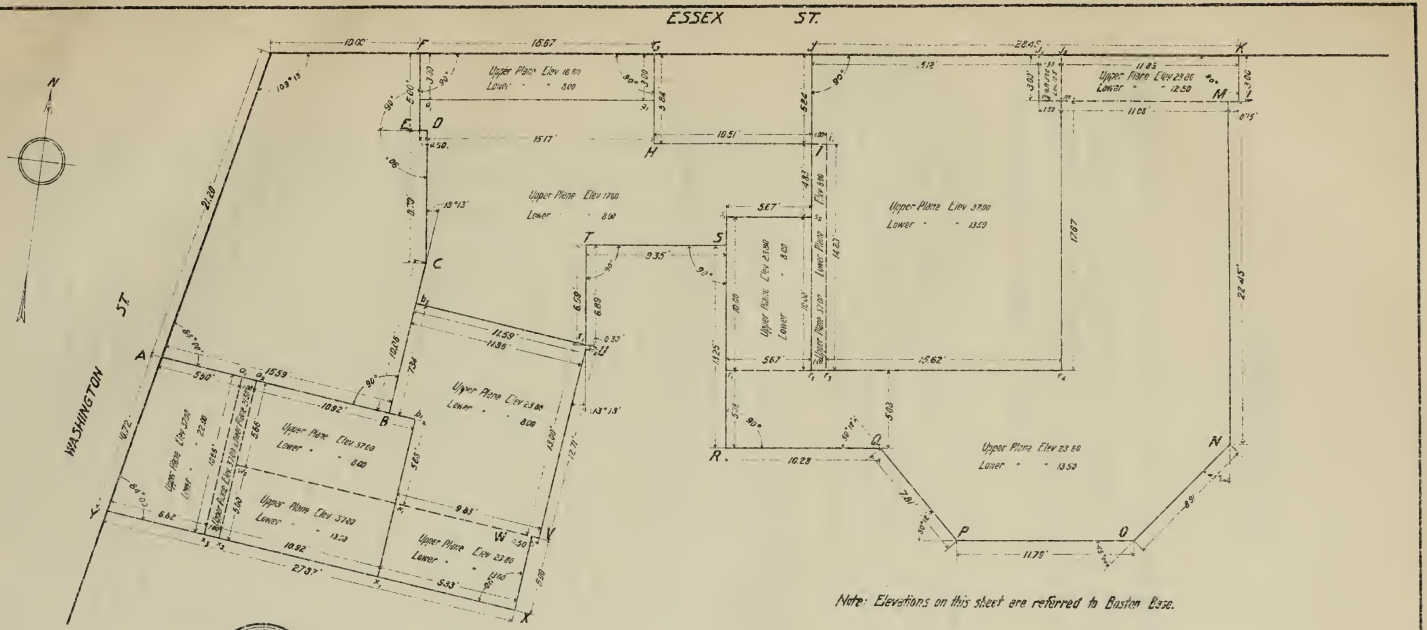
ASSISTANTS IN THE ENGINEERING DEPARTMENTS. — APPENDICES.

The names of all who have been employed in the Engineering Department for more than one month during the last year are given in Appendix G. These assistants, as a whole, have given zealous and intelligent service, and not a few have made valuable suggestions for our work.

Appendix H gives the names and addresses of contractors; Appendix I indicates the relation of fine grinding to the tensile strength of Portland cement; J gives some experiments as to the bearing power of earth at the bottom of a portion of the Washington-street Tunnel; K to K-24 give canvasses of bids; and L to L-6 give tables showing the relocation of conduits for electric wires, water pipes, sewers and various other underground structures.

Respectfully submitted,

H. A. CARSON,
Chief Engineer.



Note: Elevations on this sheet are referred to Boston Base.

BOSTON TRANSIT COMMISSION

PLAN SHOWING
EASEMENT TAKING
For a Portion of the
BOSTON TUNNEL & SUBWAY
May 31, 1905.

0 40ft. 8 12
Scale.

George G. Crocker
Charles H. Dalton
Thomas J. Gargan
George F. Swain
Horace G. Allen
Commissioners.

Howard A. Carson
Chief Engineer

PLATE 22.

HELIOTYPE CO., BOSTON

APPENDIX A.

INSTRUMENT OF TAKING OF AN EASEMENT FOR THE WASHINGTON STREET TUNNEL AT THE SOUTHEAST CORNER OF WASHINGTON AND ESSEX STREETS. *(Suffolk Registry of Deeds, Lib. 3047. Folio 70.)*

WHEREAS, George G. Crocker, Charles H. Dalton, Thomas J. Gargan, George F. Swain and Horace G. Allen, constitute the Boston Transit Commission, and said Commission at a regular meeting held this thirty-first day of May, 1905, at which meeting a quorum was present, by vote adopted the following motion:

"The Boston Transit Commission deems that it is necessary for the purposes set forth in chapter 534 of the acts of the Legislature of the Commonwealth of Massachusetts for the year 1902, being 'An act to provide for the construction of additional tunnels and subways in the city of Boston,' to take in fee simple for the city of Boston an easement for or right to the exclusive use of portions or sections bounded by vertical and horizontal planes of real estate in the city of Boston in said Commonwealth, as hereinafter described.

"The exterior vertical planes are those which contain the lines of a traverse hereinafter described and which are shown on plan entitled 'Plan showing easement taking for a portion of the Boston Tunnel & Subway', dated May 31, 1905, signed by a majority of the Commission, and H. A. Carson, the Chief Engineer of the Commission, numbered 7238, and to be recorded herewith in the Registry of Deeds for the County of Suffolk.

"The traverse is described as follows: Beginning at a point on the easterly line of Washington street distant twenty-one and twenty-one hundredths (21.20) feet southerly from the intersection of said easterly line of Washington street with the southerly line of Essex street; thence running easterly in the line A-B at an angle of eighty-four (84) degrees measured from the north toward the east with the outer face of the wall of the existing building to a point 'B', which point is distant fifteen and fiftynine-one hundredths (15.59) feet from said face of said wall; thence running northerly at right angles to said line A-B, ten and six-one hundredths (10.06) feet to a point 'C'; thence running still more northerly making an angle of thirteen (13) degrees, thirteen (13) minutes measured westerly from a continuation of said line B-C, eight and seventy-nineone hundredths (8.79) feet to a point 'D'; thence running westerly at right angles to said line C-D, fifty-one hundredths (.50) feet to a point 'E'; thence running northerly again at right

angles to said line D-E, five (5) feet to a point 'F' in said southerly line of Essex street, distance ten (10) feet easterly from the intersection of said easterly line of Washington street and said southerly line of Essex street, said line E-F being at right angles to said southerly line of Essex street; thence running easterly again along said southerly line of Essex street, fifteen and sixtyseven-one hundredths (15.67) feet to a point 'G'; thence running southerly at right angles to said line F-G, five and eightyfour-one hundredths (5.84) feet to a point 'H'; thence running easterly again at right angles to said line G-H, ten and fiftyone-one hundredths (10.51) feet to a point 'I'; thence running northerly again at right angles to said line H-I, five and eightyfour-one hundredths (5.84) feet to a point 'J' in said southerly line of Essex street; thence running easterly again along said southerly line of Essex street, twenty-eight and fortyfive-one hundredths (28.45) feet to a point 'K'; thence running southerly again at right angles to said southerly line of Essex street three (3) feet to a point 'L'; thence running westerly again at right angles to said line K-L, seventyfive-one hundredths (.75) feet to a point 'M'; thence running southerly again at right angles to said line L-M, twenty-two and fortyfive-one hundredths (22.45) feet to a point 'N'; thence running southwesterly making an angle of forty-five (45) degrees measured westerly from a continuation of said line M-N, eight and ninetyone-one hundredths (8.91) feet to a point 'O'; thence running westerly again making an angle of forty-five (45) degrees measured northerly from a continuation of said line N-O, eleven and seventynine-one hundredths (11.79) feet to a point 'P'; thence running northwesterly making an angle of fifty (50) degrees, twelve (12) minutes measured northerly from a continuation of said line O-P, seven and eightyone-one hundredths (7.81) feet to a point 'Q'; thence running westerly again making an angle of fifty (50) degrees, twelve (12) minutes measured southerly from a continuation of said line P-Q, ten and twentyeight-one hundredths (10.28) feet to a point 'R'; thence running northerly again at right angles to said line Q-R, thirteen and twentyfive-one hundredths (13.25) feet to a point 'S'; thence running westerly again at right angles to said line R-S, nine and thirtyfive-one hundredths (9.35) feet to a point 'T'; thence running southerly again at right angles to said line S-T, six and eightynine-one hundredths (6.89) feet to a point 'U'; thence running southerly again making an angle of thirteen (13) degrees, thirteen (13) minutes measured westerly from a continuation of said line T-U, twelve and seventyone-one hundredths (12.71) feet to a point 'V'; thence running westerly again at right angles to said line U-V, fifty-one hundredths (.50) feet to a point 'W'; thence running southerly again at right angles to said line V-W, five (5) feet to a point 'X'; thence running westerly again at right angles to said line W-X, twenty-seven and eightyseven-one hundredths (27.87) feet more or less, in the line X-Y to said easterly line of Washington street, and making an angle of eighty-four (84) degrees measured from the east to the north, with said outer face of said wall of said existing buliding; thence running northerly again along said easterly line of Washington street, ten and seventytwo-one hundredths (10.72) feet to the point of beginning.

"Within the said exterior vertical planes the respective

portions or sections are bounded by vertical planes containing the lines: a_1–x_3, a_2–x_2, b_1–x_1, w_2–w_1–W, b_2–t_1, e_1–g_1, I–s_2–r_2, i_1–r_3, j_1–m_2, j_2–m_1–r_4, m_2–m_1–M, r_1–r_2–r_3–r_4, s_1–s_2, s_1–S, as shown on said plan.

"Said respective portions or sections are confined between upper and lower horizontal planes whose respective boundaries and levels are shown on the following table, the elevation of the levels being referred to Boston base, so-called:

PRISM DESIGNATED BY	ELEVATION ABOVE BOSTON CITY BASE.	
	Lower Plane.	Upper Plane.
A–a_1–x_3–Y	22.00	37.00
a_1–a_2–x_2–x_3	21.50	37.00
a_2–B–b_1–w_1–w_2	8.00	37.00
w_2–w_1–x_1–x_2	13.00	37.00
w_1–W–X–x_1	13.00	23.80
B–b_2–t_1–U–V–W–w_1–b_1	8.00	23.80
b_2–C–D–E–e_1–g_1–H–I–s_2–s_1–S–T–t_1	8.00	17.60
e_1–F–G–g_1	8.00	18.60
S–s_1–s_2–r_2–r_1	8.00	23.80
I–i_1–r_3–r_2	8.00	37.00
I–J–j_1–m_2–m_1–r_4–r_3–i_1	13.50	37.00
j_1–j_2–m_1–m_2	12.50	37.00
j_2–K–L–M–m_1	12.50	23.80
M–N–O–P–Q–R–r_1–r_4–m_1	13.50	23.80

"Said Commission also deems that it is necessary for the purposes set forth in said act to take in fee simple an easement or right to a suitable support below said lower levels by the soil or otherwise of the structures which may be placed within said portions or sections except below the lower

levels of the two portions or sections first above described, being the prisms designated by $A-a_1-x_3-Y$ and $a_1-a_2-x_2-x_3$, but reserving to the owners of the premises within which this easement is taken, their heirs and assigns, the right to the support on the upper planes of said portions or sections as at present of the buildings on said premises, or the equivalent of such support to be furnished by said city, and also the right at any time or times to alter, strengthen and rebuild the present or any future building on said premises, and for the support thereof to use the structures which may be placed within the above described portions or sections, provided, that there shall be no obstruction or interference with the use of said portions or sections as herein taken, or injury to the structures which may be erected therein.

"The owners of the real estate in and through which said easements and rights are located are supposed to be: Frederick R. Sears, Francis I. Amory, Charles E. Cotting, and Herbert M. Sears, Trustees of the David Sears Real Estate Trust, under a declaration of trust, dated July 29, 1889, recorded in the Registry of Deeds for the County of Suffolk, Book 1894, Page 575.

"WHEREFORE, said easements and rights are hereby taken in fee simple for the City of Boston in part execution of the authority conferred by said chapter 534 of the acts of the year 1902 and of every other power and authority said Boston Transit Commission hereto enabling."

NOW, therefore, the Boston Transit Commission in accordance with the foregoing vote and pursuant to the act therein referred to hereby certifies and states that under and by virtue of the authority conferred by said act, and in part execution thereof, and for the reasons therein set forth, and by virtue of every other power and authority it hereto enabling, the easements and rights above described in and through the portions or sections of real estate above described are taken by it in fee simple for the city of Boston.

IN WITNESS WHEREOF WE, the undersigned, constituting a majority of the Boston Transit Commission hereto set our hands this thirty-first day of May in the year nineteen hundred and five.

(Signed)

GEORGE G. CROCKER,
THOMAS J. GARGAN,
GEO. F. SWAIN.
HORACE G. ALLEN.

Boston Transit Commission.

APPENDIX B.

[Chapter 460.]

Commonwealth of Massachusetts.

In the Year One Thousand Nine Hundred and Five.

AN ACT RELATIVE TO THE LOCATION OF THE TUNNEL IN THE CITY OF BOSTON PROVIDED FOR BY CHAPTER FIVE HUNDRED THIRTY-FOUR OF THE ACTS OF THE YEAR NINETEEN HUNDRED AND TWO.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows: —

Section 1. Chapter one hundred and sixty-seven of the acts of the year nineteen hundred and four is hereby amended by striking out section one and inserting in place thereof the following:— *Section 1.* The structure for the two tracks especially adapted for elevated cars or trains for which provision is made in chapter five hundred and thirty-four of the acts of the year nineteen hundred and two, therein called the tunnel, may be located and constructed by the Boston Transit Commission, northerly of the junction of Washington street and Adams square, in and through the existing subway or any part or parts thereof, or in public or private lands outside thereof. When such structure is so located the commission may make such changes in or additions to the subway, by enlargements thereof or branch structures, in Washington street or in other public or private lands northerly of a line drawn east and west through said junction, as may be necessary for the accommodation of subway traffic. In all action hereunder the commission shall have all the powers conferred by said act so far as necessary therefor, and shall be subject to the provisions of section thirteen thereof. In any case arising under said section thirteen the board shall have and may exercise any and all powers which might have been exercised by the commission. All expenses incurred hereunder, whether by way of compensation for the use of a part or parts of the subway, or for the taking of private lands for track or station purposes, or otherwise, shall be deemed a part of the cost of the tunnel under said act.

Section 2. This act shall take effect upon its passage. [*Approved May 25, 1905.*

APPENDIX C.

[Chapter 187.]

COMMONWEALTH OF MASSACHUSETTS.

In the Year One Thousand Nine Hundred and Five.

AN ACT TO AUTHORIZE THE CITY OF BOSTON TO PROVIDE FUNDS FOR THE COMPLETION OF THE EAST BOSTON TUNNEL.

Be it enacted by the Senate and House of Representatives in General Court assembled, by the authority of the same, as follows: —

SECTION 1. The treasurer of the city of Boston shall from time to time, at the request of the Boston transit commission, issue and sell at public or private sale bonds of said city, to the full amount authorized by chapter five hundred and forty-eight of the acts of the year eighteen hundred and ninety-four and chapter five hundred of the acts of the year eighteen hundred and ninety-seven, without the reduction provided for by chapter three hundred and forty-seven of the acts of the year eighteen hundred and ninety-seven, namely, to the amount of seven million five hundred thousand dollars, for the combined cost of the subway and of the East Boston tunnel. Such bonds shall be designated on their face, Rapid Transit Loan, shall be for the term of forty years, shall be registered or shall have coupons attached, and shall bear interest at a rate not exceeding four per cent per annum, payable semi-annually, as said treasurer shall determine, and shall not be included in determining the statutory limit of indebtedness of the city. Said treasurer shall apply the proceeds of said bonds to the payment of the cost and expenses of constructing the tunnel or tunnels to East Boston, as authorized by chapter five hundred of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof and in addition thereto; and, as required by said act, he shall keep a separate account of the bonds issued and of the cost and expenses incurred in the construction of said tunnel or tunnels.

SECTION 2. This act shall take effect upon its passage. [*Approved March 16, 1905.*

APPENDIX D.

LEASE BY THE CITY OF BOSTON TO THE BOSTON ELEVATED RAILWAY COMPANY OF THE EAST BOSTON TUNNEL.

Definition of terms:

City: city of Boston.
Commission: Boston Transit Commission.
Act: Chapter 500, Acts of 1897.
Company: Boston Elevated Railway Company.
Premises: tunnel and appurtenances.
Appurtenances: approaches, entrances, sidings, stations and connections therefor of the tunnel.
Board: Board of Railroad Commissioners.

The Boston Transit Commission, hereinafter called the commission, acting under and by virtue of an act of the Commonwealth of Massachusetts entitled "an Act to Promote Rapid Transit in the City of Boston and Vicinity," being chapter 500 of the acts of the year one thousand eight hundred and ninety-seven, hereinafter called the act, pursuant to the requirements of the act hereby executes this lease to the Boston Elevated Railway Company, hereinafter called the company, of the tunnel to East Boston with the approaches, entrances, sidings, stations and connections therefor, hereinafter called appurtenances, constructed under the authority of the act, which tunnel and appurtenances are hereinafter called the premises.

Term. The term is to begin when the use begins as hereinafter provided, and expires, as prescribed by the act, twenty-five years from the tenth day of June in the year one thousand eight hundred and ninety-seven.

The use of the premises is to begin on the thirtieth day of December, 1904.

Rental. The rental fixed by the act and hereby reserved is an annual rental equal to three-eighths of one per cent. of the gross receipts for each year, ending September thirtieth, of all lines owned, leased or operated by the company, to be paid to the city on or before the last day of November in each year, and at the same rate for fractional parts of a year.

The rental, as prescribed by the act, shall be in full compensation for the exclusive use of the premises by the company, its sub-lessees, successors or assigns, the company having the privilege to sub-let the premises, as therein prescribed.

As prescribed by the act, the company, as the agent of the city of Boston, hereinafter called the city, shall collect from each person passing through the tunnel in either direction a toll of one cent or such reduced toll as from time to time may lawfully be established, until such toll may lawfully be discontinued; and if such toll is reduced below the amount of one cent the company shall make provision for the sale of tickets, and the cash toll shall continue to be one cent; which

tolls shall be collected under such arrangements as shall be agreed upon by the city and the company, or in case of disagreement as shall be determined by the Board of Railroad Commissioners, hereinafter called the board.

If at any time during the continuance of the term hereof the company shall be deprived in whole or in part of the use of the premises by any cause growing out of the act of God, or public enemies, mobs or riots, works or excavations carried on or permitted by the city or other public authority, explosions or the bursting of pipes outside the premises, or the falling or settling of buildings; or growing out of the filling, caving in or other physical obstruction of the premises or any part thereof not due to any unlawful or negligent act of the company, or its agents, servants or licensees, in the use of the premises, or to any failure of the company to maintain the premises in good order and condition so far as it is herein required so to do; or growing out of leakage, or the location, maintenance or use of the wires or other apparatus which the city is herein authorized to maintain in the premises; then during such deprivation the rental or a just and reasonable part thereof, as agreed upon by the mayor of the city and the company or in case of difference as determined by arbitration as hereinafter provided, shall be abated.

Equipment.

The company shall suitably lay and maintain in first-class condition railway tracks in proper places in the premises, together with the appointments and apparatus necessary for the safe and convenient operation of the same and shall provide and maintain all wires, ducts, electrical or other apparatus or equipment necessary or convenient for the furnishing of power and light therein, and in general shall furnish all machinery, apparatus and furniture necessary or proper for the convenient maintenance and operation of a railway therein, and for the safety and accommodation of passengers, elevators and ventilating fans, however, being the subject of separate agreements of the parties; all of which so furnished shall remain the property of the company or its assigns so long as it or they continue to occupy and use the premises, and upon the termination of such use the same shall become the property of the city, which hereby agrees to pay for the same at its then fair value as agreed upon by the mayor of the city and the company or its assigns, or in case of difference as determined by arbitration as hereinafter provided, and the same shall be delivered to the city at such valuation.

Repairs.

The company shall maintain the premises, except as herein otherwise provided, in good order and condition as a complete structure adapted to the maintenance and use of lines of railway, and shall at all reasonable times be entitled to a permit to open the streets and other public grounds of the city for the purpose of making such repairs as it is under obligation to make, and when the right of the company or its assigns to use the premises shall terminate, they shall be restored to the city in good condition except as to repairs not obligatory upon the company or its assigns.

All repairs to the premises shall be at the sole cost and expense of the company except such repairs as are made necessary by any cause growing out of the act of God, or public enemies, mobs or riots, works or excavations carried on or permitted by the city or other public authority, explosions or the bursting of pipes outside the premises, or the falling or

settling of buildings; or growing out of the filling, caving in or other physical obstruction of the premises or any part thereof, not due to any unlawful or negligent act of the company, or its agents, servants or licensees, in the use of the premises, or to any failure of the company to maintain the premises in good order and condition so far as it is herein required so to do; or growing out of leakage, or the location, maintenance or use of the wires or other apparatus which the city is herein authorized to maintain in the premises. If repairs should be made necessary by any of said excepted causes, such repairs shall be made by the company and the reasonable cost and expense thereof shall be paid by the city at or before the time when the next payment of rental is made.

Liability for damages.

In the operation and use of the premises, or of the railways, machinery or apparatus therein, if the company has exercised due care, the city shall hold it harmless and indemnified for such injury to the company's corporeal property, and against such damages for injuries to persons or to the property of others, as may result from leakage, the location, maintenance or use of the wires or other apparatus which the city is herein authorized to maintain in the premises, works or excavations carried on or permitted by the city or other public authority, mobs or riots to the extent of the city's legal liability therefor, the falling or settling of buildings in consequence of the construction or use hereunder of the premises, the collection of tolls, which is the subject of a separate agreement, or from the bursting or leakage of the city's pipes outside the premises, or the filling or caving in or other physical obstruction of the premises or any part thereof, such bursting or leakage of the city's pipes outside the premises or such filling, caving in or obstruction not being due to the act of God or public enemies. The company shall hold the city harmless and indemnified against all other injuries or damages for injuries resulting to persons or property in such operation and use, except such as result from the act of God, public enemies, mobs or riots or from explosions or the bursting or leakage of pipes outside the premises.

Each party shall have the right, without prejudice to any other rights, to participate in the defence of any action or suit for any of the above causes.

Premises to be kept clean, lighted and ventilated.

The company shall keep the premises thoroughly clean and the approaches to stations clean and free from ice and snow, and when the premises are in use it shall suitably light the same in all parts, and shall keep in repair and operate to the best of its ability the ventilating apparatus.

Leakage.

In accordance with the provisions of the act, the city agrees that the premises shall be kept water tight or, in case of leakage, that the water shall be taken care of by it; and agrees to install and maintain, in such manner as not to interfere except unavoidably with the use of the premises by the company, or its assigns, all pumps, piping, wires and other appliances necessary therefor; and the company agrees to take care of and operate such appliances, as the agent of the city, to the best of its ability, and promptly to notify the city whenever it comes to its knowledge that new appliances or extraordinary repairs are needed, but otherwise assumes no obligation to see that such appliances are at any time without defects or sufficient for the purpose, or responsibility in relation to such appliances, or to leakage in the premises. The company's

compensation therefor as agreed upon by the mayor and the company or, in case or difference, determined by arbitration, as herein provided, shall be paid at or before the time when the next payment of rental is made.

Inspection by public officials.

The governor of the commonwealth, the mayor and engineer of the city, and the members of the board and of the commission, and their respective engineers shall at all times have free entry to the premises for the purpose of inspecting the same.

Additional uses.

To the extent of its lawful powers the company may make other incidental uses of the premises not impairing the use thereof for transportation of passengers, or diminishing or impairing the safety, accommodation, convenience or comfort of passengers; provided, however, that upon notice in writing at any time from the board that in its opinion any such incidental use impairs the use for transportation, or diminishes or impairs the safety, accommodation, convenience or comfort of passengers, it will forthwith, to the extent specified in the notice, discontinue such incidental use.

Wires and ducts.

If the company permits any other corporation or person to place or maintain wires, ducts or other structures within the premises, it shall be only to such extent as will not interfere with the safe and convenient operation of the railway and other apparatus which the company or the city is authorized to put therein, and the company agrees not to permit any gas pipes to be placed therein, or any water pipes except such as may be needed for fire protection and other uses therein.

Except as herein above provided the company shall not have the right to place in the premises or attach thereto any structures, machinery, merchandise, apparatus, advertisements or property of any sort which are not necessary or proper for the operation of its railway therein and the performance of its agreements herein contained.

The city may place in the premises such wires and apparatus as may be necessary for its police and fire-alarm service, to be used, however, exclusively for such service, and to be so located as not to interfere with the use of the premises which the company is hereby authorized to make, for which privilege the city shall allow such compensation as the mayor and the company may agree upon, or in case of difference as may be determined by arbitration as herein provided, to be paid at or before the time when the next payment of rental is made. The location, construction, maintenance and repair of such wires and apparatus shall be subject to such reasonable directions and regulations as the company may impose, or in case of any disagreement, as the board may determine.

Default and penalty.

In the event of the failure of the company or its assigns to pay the rental for three months after such rental shall have become due, or in the event of a failure to maintain and operate a railway within the premises, and if such failure shall have continued for three months, then in either of said events the city upon three months' notice, such default still continuing, shall have the right to terminate this contract and to reenter upon and repossess itself of the premises, unless such failure to maintain and operate grows out of the act of God, or public enemies, mobs or riots, works or excavations carried on or permitted by the city or other public authority, explosions or the bursting of pipes outside the premises, or the falling or settling of buildings; or grows out of the filling, caving in or other physical obstruction of the premises or any

part thereof not due to any unlawful or negligent act of the company, or its agents, servants or licensees, in the use of the premises, or to any failure of the company to maintain the premises in good order and condition so far as it is herein required so to do; or grows out of leakage, or the location, maintenance or use of the wires or other apparatus which the city is herein authorized to maintain in the premises. In case the right of reëntry and repossession above given shall be exercised, all the tracks, wires, ducts, apparatus, equipment and other property of the company or its assigns within the premises shall become the property of the city and shall be paid for by it at a valuation to be determined as herein provided upon termination of use.

Arbitration.

In case of difference between the city, acting by its mayor, and the company upon any matter as to which arbitration is herein provided for, the mater in dispute shall be left to the decision of three persons, one to be selected by the mayor of the city, one to be selected by the company and the third by the two thus chosen, the award of the majority of whom shall be binding upon the parties.

The company to be subject to law.

In respect of the equipment, use and operation of the railway to be located in the premises and transportation thereon, the company is to have all the powers and privileges and be subject to all the duties, liabilities, restrictions and provisions set forth in general and special laws which now are or hereafter may be in force applicable to it, so far as the same do not impair contract rights or privileges, acquired under any law or otherwise.

It is agreed that the recital or repetition in this contract of certain provisions of the act is not understood or intended either to extend or impair the operation or effect of such provisions, but is for convenience of reference, and that such recital or repetition shall convey no implication that any other provision of said act is not equally operative and effective.

In witness whereof the Boston Transit Commission has executed this instrument by the signature of a majority of its members pursuant to a vote of the commission, its members not being bound in their personal capacity, and the Boston Elevated Railway Company has caused its name and corporate seal to be affixed hereto by its president thereto duly authorized.

(Signed)

GEORGE G. CROCKER,
CHARLES H. DALTON,
THOMAS J. GARGAN,
GEORGE F. SWAIN,
HORACE G. ALLEN,
The Boston Transit Commission.

THE BOSTON ELEVATED RAILWAY COMPANY

BY

(Signed) WILLIAM A. BANCROFT,
President.

SEAL

Boston, December 24, 1904.

The following was passed at a meeting of the Boston Transit Commision held December 24, 1904:

"VOTED, that a lease of the East Boston tunnel, in the form as given in Document No. 5067, be executed by the Commission and, when the same has been signed also by the Boston Elevated Railway Company, that delivery of the same in exchange be made."

A true copy.

Attest:

(Signed) B. LEIGHTON BEAL,
Secretary.

I hereby certify that the accompanying lease is the document referred to in the foregoing vote as Document No. 5067.

(Signed) B. LEIGHTON BEAL,
Secretary.

BOSTON ELEVATED RAILWAY CO.
SECRETARY'S OFFICE
101 Milk street,
Boston, Mass.

Dec. 16th, 1904.

At a special meeting of the Directors of the Boston Elevated Railway Company duly called and held this day, the following vote was passed:

VOTED: That the President be authorized to execute with the Boston Transit Commission such lease of the East Boston Tunnel to this company as may be approved by the Executive Committee.

A true copy.

Attest:

(Signed) JOHN T. BURNETT,
Secretary.

Boston, Mass., Dec. 22nd, 1904.

At a special meeting of the Executive Committee of the Board of Directors of the Boston Elevated Railway Company duly called and held this day the following vote was passed:

VOTED: To approve the foregoing lease of the East Boston Tunnel to this company.

A true copy.

Attest:

(Signed) JOHN T. BURNETT,
Secretary.

APPENDIX E.

AGREEMENT BETWEEN THE CITY OF BOSTON AND THE BOSTON ELEVATED RAILWAY COMPANY FOR THE COLLECTION OF TOLLS IN THE EAST BOSTON TUNNEL.

The City of Boston, hereinafter called the City, and the Boston Elevated Railway Company, hereinafter called the Company, acting under section 17 of chapter 500 of the Acts of 1897, hereby agree upon the following arrangements for the collection of tolls by the Company as the agent of the City in the East Boston Tunnel as constructed under the Act.

1. The Company, as the agent of the City, shall collect a toll of one cent, or such reduced toll as from time to time may lawfully be established, in money or in money value represented by a toll ticket issued by the Company, from each person passing through the tunnel in either direction, namely, from the Tremont street subway at Scollay square, either in cars or otherwise, or from any entrance toll office at either of the Tunnel stations, or from East Boston; it being mutually agreed that "each person passing through said tunnel in either direction", in the sense of the statute and of this agreement, includes all persons passing in either direction through any part thereof, except employees of the Company on duty and employees of the City engaged in duties in the premises provided for by the lease thereof or by this agreemnt.

2. The collection of tolls shall be made by employees of the Company regularly employed as conductors or collectors in the ticket offices, or by such special toll-collectors as may necessarily be employed upon the cars or elsewhere.

3. For the service of collecting the tolls the Company shall use its best endeavors in selecting and procuring honest, competent and efficient employees; in instructing them as to their rights and duties; in overseeing their work and in preventing peculation or loss of tolls by negligence, dishonesty or otherwise.

4. The Company alone shall provide and issue toll tickets, if any are used, and shall not recognize or accept any other tickets; and it shall sell such tickets in such places and in such manner as may be convenient to the public and the Company.

5. The Company, through it Bureau of Audit, shall keep accurate and sufficient accounts of all tolls collected and of all toll tickets sold, and shall render such accounts monthly to the City, duly certified by the Auditor of the Company; and in the months of February, May, August and November in each year shall pay over to the city the sum due for the preceding quarter, being one cent for each toll collected in money and one cent for each toll ticket sold or such less sum as may be established as the toll if lawfully reduced.

6. The Company shall also keep proper and sufficient accounts of the cost of collecting such tolls, which shall include the reasonable compensation of all persons specially employed in or in connection with such collection, the necessary expense of printing and distrib-

uting toll tickets, if any are used, a fair proportion of the wages of persons whose duties are in part in or in connection with the collection of tolls, and the expense of heating and lighting any offices maintained exclusively for the purpose of collection of tolls, proper compensation for insuring the honesty and fidelity of the persons so employed and the reasonable cost of the necessary accounting.

7. The City shall reimburse the Company for its compensation and expenses incurred in the collection of tolls, as above provided, at the time of each payment of tolls to the City.

8. The City shall make no claim upon the Company for tolls evaded if the Company has used its best judgment and endeavors in the attempt to collect the same.

9. If any question arises between the parties as to the amounts received by the Company for tolls collected or for tickets sold, or the amounts due the Company for its compensation and expenses incurred in collection, as herein provided, the same shall be determined by a disinterested third person agreed on by the Mayor and the Company, whose decision shall be final, and whose compensation shall be paid by the Company if found in error, and otherwise by the City.

10. It is agreed that in all things relating to the collection of the tolls, the Company acts only as the agent of the City, under obligation of the statute, and that, as between the parties hereto, the acts of its employees therein shall be deemed the acts of the City and not of the Company; and the Company if it has complied with the provisions of paragraph three hereof shall not be liable or accountable in or for any suits, claims or damages arising out of the action of its employees in collecting or attempting to enforce the collection of the tolls, and the City in such case will hold the Company harmless and will indemnify it against all such suits, claims or damages, and will on notice assume the defence thereof.

This agreement shall take effect on the day when the tunnel is opened for traffic, and shall continue in force for the term of the East Boston Tunnel lease unless sooner modified or terminated by mutual agreement, or until the tolls are lawfully discontinued.

In witness whereof the City of Boston by its Mayor, and the Boston Elevated Railway Company by its President thereto duly authorized, hereto set their hands this twenty-fourth day of December in the year 1904.

THE CITY OF BOSTON

By (Signed) PATRICK A. COLLINS,
Mayor.

A. E. P.
B. L. B.

THE BOSTON ELEVATED RAILWAY COMPANY,

By (Signed) WILLIAM A. BANCROFT,
President.

{ SEAL }

APPENDIX F.

[Chapter 48.]

COMMONWEALTH OF MASSACHUSETTS.

In the Year One Thousand Nine Hundred and Five.

RESOLVE TO DIRECT THE BOSTON TRANSIT COMMISSION TO INQUIRE INTO THE SUBJECT OF THE FURTHER DEVELOPMENT OF THE SUBWAY SYSTEMS OF THE CITY OF BOSTON.

Resolved, That the Boston transit commission shall forthwith proceed to inquire into the subject of the further development of the subway systems of the city of Boston; the most advisable routes; whether further subways are necessary or desirable at the present time, or will be in the immediate future; whether the further construction of such subways will be likely to endanger the stability of any surface structures now erected or to be erected; and such other details as said commission may consider necessary and relevant; and shall submit a report covering the results of said inquiry to the next general court not later than the third Saturday in January. [*Approved April 13, 1905.*

APPENDIX G.

The names of all the assistants in the Engineering Department who have been employed for more than one month during the last year together with an indication of the work on which they have been engaged are given below: —

OFFICE ASSISTANTS, JUNE 30, 1905.

Assistant Engineers.

EDMUND S. DAVIS,	Oversight of office and field work.
WILLIAM W. LEWIS, WILLIAM O. WELLINGTON, HARRY S. R. MCCURDY,	Studies, preliminary estimates, designs for structures and contract plans.
GEORGE H. STEARNS, RUSSELL L. ELLIOT,	Designs and drawings for steel work* and concrete structures.
G. DANA EMERSON,	Miscellaneous work including designs for structures for ventilation, pumping, etc.

Draughtsmen, etc.

LEONARD B. HOWE, JOHN J. BURNS, WILBUR W. DAVIS, EDMUND A. RICE,	Plans for tunnel work and structures.
EDWIN L. REED,	Architectural work, designs for station entrances and changes in buildings.
EDWARD F. ATWOOD,	Plans for steel work and tunnel structures.
WALTER L. PERRY,	Lettering and tracing.
ERNEST M. CROWLEY,	Tracing, etc.
FREDERIC W. STILES,	Photographer and assistant for purchasing supplies.

PIPE CHANGES.

LAURENCE B. MANLEY,	Assistant Engineer, field and office work.
JOHN M. GLEN, Transitman,	Laying out and inspecting work in streets.
NORMAN C. MCNEIL, Transitman, WILLIAM E. WATKINS, Rodman,	Making plans in office for changes and laying out the work in streets.

* The plans for the steel for Sections 2 and 3 and for a portion of 4 were made in the office of Joseph R. Worcester, Consulting Engineer.

FIELD ASSISTANTS.

PATRICK F. O'BRIEN,	Assistant Engineer, Sections 1 and 5.
ROBERT B. FARWELL,	Assistant Engineer, Sections 2 and 3.
LEONARD L. STREET,	Assistant Engineer, Section 4.
CLIFFORD R. FANCY,	Transitman, Section 1.
CHARLES P. LOVELAND,	Transitman, Sections 2 and 3.
JAMES T. FRAME,	Transitman, Section 4.
RALPH H. STEARNS,	Transitman, Section 5.
JAMES B. FLAWS, RALPH C. MCPHERSON, DANIEL S. BELL, WILLIAM H. BELL, FRANCIS J. MURPHY,	Rodmen on line and grade work.
C. LEONARD BROWN, Section 1, AUSTIN E. JOYCE, Sections 2 and 3, WESLEY A. ROWELL, Section 3, ROY C. AIKEN, Section 4, FRANK J. EAGER, Section 4, ARTHUR E. LUCY, Section 5,	Transitmen whose duties have largely been inspecting construction work.
MOSES L. BROWN, FREDERICK W. FLETCHER, FREDERICK F. MURPHY, CHARLES J. RYCROFT, PETER J. RAFTUS, EDWIN H. DAVIS, HYMAN LEFTOVITH, JOHN J. HURLEY,	Rodmen whose duties have largely been inspecting various kinds of work on constrution.
THOMAS H. KEENAN,	Messenger.
CHARLES C. JOHNSON,	Chemist. Testing cement, pitch and other material, also superintending making of concrete sheeting, etc.
PAUL SWARTZ,	Chemist. Assisting on cement tests and other work.
A. W. PARKER,	Inspector of steel work.

CLERK, STENOGRAPHERS, ETC.

ARTHUR B. CARTER,	Clerk and stenographer. Correspondence and compilation of data.
ROSE A. MCMAHON,	Stenographer.
JEREMIAH L. MURPHY,	Messenger.
MICHAEL J. PENDERGAST,	Messenger and stenographer.
CHARLES E. FAY,	Messenger in draughting room, blueprinting, care of plans.

APPENDIX H.

SOME OF THE CONTRACTORS WHO HAVE DONE WORK FOR THE COMMISSION DURING THE YEAR ENDING JUNE 30, 1905.

NAME.	CONTRACT.
PETER W. HILL, Boston.	Sewer in Summer Street required on account of Washington St. Tunnel.
T. A. ELSTON & CO., Boston.	Taking down and removing buildings Nos. 11-21 Ash Street, Boston.
HARRY P. NAWN, Boston. Principal foreman : James McManus.	Retaining walls and roof for the Ash Street incline of the Washington Street Tunnel.
FALVEY & KELLY, Somerville, Mass.	Raising to grade about 200 linear feet of bluestone sidewalk, including sidewalk lights, at the Sherburne Building, Ash and Bennet Streets.
JOHN L. GRIFFIN & CO., Boston.	Changes in the Sherburne Building, Nos. 782-790 Washington Street.
NEW ENGLAND STRUCTURAL CO. Everett, Mass.	Structural steel for part of Section 1 of the Washington Street Tunnel.
PATRICK MCGOVERN, Boston. Principal foremen : Patrick Porter, John Colleran.	Section 1, Washington Street Tunnel.
ISAAC BLAIR & CO., Boston.	Shoring and underpinning Lyceum Theatre Building.
THE BOSTON BRIDGE WORKS, Boston.	Structural steel for part of Section 2 of the Washington Street Tunnel.
PATRICK MCGOVERN, Boston. Principal foremen : Patrick Porter, John Colleran.	Section 2 of the Washington Street Tunnel.

THE BOSTON BRIDGE WORKS, Boston.	Structural steel for Section 3 of the Washington Street Tunnel.
JONES & MEEHAN, Boston. Principal foreman : Michael Tallent.	Section 3 of the Washington Street Tunnel.
H. P. CONVERSE & CO., Boston.	Steel tie-rods and cast iron washers for section 4 of the Washington Street Tunnel.
LEWIS F. SHOEMAKER & CO., Philadelphia, Pa.	Structural steel for Section 4 of the Washington Street Tunnel.
HUGH NAWN CONTRACTING CO., Boston. Principal foremen : A. E. Weaving, James McManus.	Section 4 of the Washington Street Tunnel.
FRED A. HOUDLETTE & SON, Boston.	Steel for Section 5 of the Washington Street Tunnel.
COLEMAN BROTHERS, Boston. Engineer : John A. Starr. Principal foremen : John Colleran, Henry Strupney.	Section 5 of the Washington Street Tunnel.
WILLIAM H. SMITH, Boston.	Setting ribbed terra cotta tiling in Section B of the East Boston Tunnel.
WOODBURY & LEIGHTON CO., Boston.	Building over Atlantic Avenue Station, Section B, East Boston Tunnel.
SIMPSON BROS. CORPORATION, Boston.	Stairways and walls of re-inforced concrete at Atlantic-Avenue Station of the East Boston Tunnel.
E. W. EVERSON & CO., Providence, R. I.	Stairway and incline at westerly end of Atlantic Avenue Station of the East Boston Tunnel.
ABERTHAW CONSTRUCTION CO., Boston.	Stairway covering over westerly exit from Atlantic Avenue Station.
AMERICAN BLOWER CO., Detroit, Mich.	Three sets of ventilating apparatus in the East Boston Tunnel.

APPENDIX I.

TESTS TO SHOW THE EFFECT OF FINE GRINDING UPON THE TENSILE STRENGTH OF PORTLAND CEMENT BRIQUETTES.

Kind of Cement.	Proportions.	Age of Briquettes.	No. of Briquettes.	Average Tensile Strength.	Relative Strength in Percentages.	% Gain in Strength from the 7 to 28 Day Period.
* Vulcanite, as taken from bag	1 part cement 3 parts standard quartz sand, by weight.	7 days	3	343	100	..
" residue on No. 200 sieve		7 "	3	29	8.5	..
" that passed through No. 200 sieve		7 "	3	489	142.5	..
* " as taken from bag		28 "	3	460	100	34
" residue on No. 200 sieve		28 "	3	110	24	36
" that passed through No. 200 sieve		28 "	3	561	122	15

The No. 200 sieve contains approximately 40,000 meshes per square inch.

* 76 % of the cement passed through sieve No. 200.

APPENDIX J.

Experiments with Test Piles on Bearing Power of Earth at Bottom of Washington Street Tunnel.

Date, 1904.	KNEELAND STREET. Weight, in Lbs.	Load Per Sq. Ft., Lbs.	Daily Settlement, Feet.	Total Settlement, Feet.	Date, 1904.	HARVARD STREET. Weight, in Lbs.	Load Per Sq. Ft., Lbs.	Settlement, Feet.	Total Settlement, Feet.	Date, 1904.	BENNET STREET. Weight, in Lbs.	Load Per Sq. Ft., Lbs.	Daily Settlement, Feet.	Total Settlement, Feet.
Sept. 28	8,695	9,485			Sept. 18	4,727	5,194	.002	.002	Sept. 23	8,663	9,450		
29			.032	.032	18	6,794	7,703	.005	.007	24			.004	.004
30			.006	.038	18	9,247	10,484	.003	.010	25			.002	.006
Oct. 1			.001	.039	18	11,247	12,752	.006	.016	26			.003	.009
2			.000	.039	18	13,257	15,031	.011	.027	27			.000	.009
3			.000	.039	18	15,257	17,299	.003	.030	28			.000	.009
4			.000	.039	18	17,267	19,578	.007	.037	29			.000	.009
5	10,695	11,667	.014	.053	19	19,342	21,931	.012	.049	30	10,663	11,632	.003	.012
6			.040	.093	19			.007	.056	Oct. 1			.002	.014
7			.006	.099	19	21,382	24,244	.006	.062	2			.000	.014
8			.001	.100	20			.009	.071	3			.000	.014
9			.000	.100	21			.019	.090	4			.001	.015
10			.001	.101	22			.000	.090	5			.000	.015
11			.000	.101	23			.005	.095	6			.000	.015
12	12,695	13,849	.117	218	24			.000	.095	7	12,663	13,814	.000	.015
13			.017	.235	25			.000	.095	8			.009	.024
14			.001	.236	26			.000	.095	9			.000	.024
15			.002	.238	27			.000	.095	10			.000	.024
16			.014	.252	28			.001	.096	11			.000	.024
17			.004	.256	29			.000	.096	12			.000	.024
18			.002	.258	30			.000	.096	13			.000	.024
19	14,695	16,031	.049	.307	Oct. 1			.001	.097	14	14,663	15,996	.000	.024
20			.026	.333	2			.000	.097	15			.003	.027
21			.007	.340	3			.000	.097	16			.000	.027
22			.000	.340	4			.002	.099	17			.001	.028
23			.002	.342	5			.000	.099	18			.001	.029
24			.004	.346	6			.001	.100	19			.001	.030
25			.000	.346	7			.002	.102	20			.000	.030
26			.000	.346	8			.001	.103	21	16,663	18,451	.000	.030
27	16,695	18,212	.013	.359	9			.000	.103	22			.007	.037
28			.024	.383	10			.000	.103	23			.002	.039
29			.000	.383	11			.001	.104	24			.002	.041
30			.003	.386	12			.001	.105	25			.000	.041
31			.003	.389	13			.000	.105	26			.000	.041
Nov. 1			.002	.391	14			.000	.105	27			.000	.041
2			.002	.393	15			.000	.105	28	18,663	20,359	.005	.046
3			.000	.393	16			.000	.105	29			.007	.053
4			.000	.393	17			.000	.105	30			.003	.056
5			.000	.393	18			.000	.105	Nov. 1			.002	.058
6			.000	.393	19			.000	.105	2			.001	.059
7			.000	.393	20			.000	.105	3			.001	.060
8			.000	.393	21			.000	.105	4			.001	.061
9			.000	.393	22			.000	.105	5			.001	.062
10			.000	.393	23					6			.000	.062
					24					7			.000	.062
										8			.000	.062

Cross Section of Pile 132 sq. inches.
Clay—Quite Soft.

Cross Section of Pile 127 sq. inches.
Clay—Rather Soft.

Cross Section of Pile 132 sq. inches.
Clay—Hard.

The method of testing was as follows: A shaft 7 ft. x 9 ft. 3 in. was dug; an iron pipe 14 in. in diameter was then driven into the earth about 8 in. below the elevation of the footing of the pile; a wooden pile 12 in. square with its corners trimmed so as to fit inside the pipe without friction was next set on the undisturbed earth at the proposed grade of the bottom of the tunnel; a wooden box was then framed about the pile and loaded with paving stones. In the experiments for Kneeland and Bennet streets, levels on the piles were taken daily, the load being increased about a ton each week. In the case of Harvard street, the load was increased about a ton hourly during the first day and the settlement noted. After the second day the observations were taken daily but the load was not increased.

APPENDIX K.

CANVASS OF BIDS FOR STAIRWAY AND INCLINE AT WESTERLY END OF ATLANTIC AVENUE STATION OF THE EAST BOSTON TUNNEL. BIDS OPENED JULY 7, 1904.

BIDDERS AND ADDRESSES.	650 cu. yds. earth excavation by open cut.	250 cu. yds. earth excavation by tunnelling.	10 cu. yds. concrete masonry to be removed and disposed of.	300 cu. yds. concrete furnished and put in place.	23 tons steel rods set and secured.	60 cu. yds. coating Portland cement mortar.	100 sq. yds. waterproof coating of pitch or asphalt.	800 sq. yds. tarred felt pitch, etc.	700 lin. feet spruce piles.	Totals.	Time of Completion.
	a	2a	3a	b	f	g	h	i	j		
	$5 00	$10.00	$30.00	$15.00	$30.00	$1.00	$1.00	$0.30	$0.50		Oct. 10,
John J. Falvey & Co., Boston	3250.00	2500.00	300.00	4500.00	690.00	60.00	100.00	240.00	350.00	$11,990.00	1904
	5 00	10.25	25.00	15.00	25.00	.75	.75	.50	.50		Oct. 1,
Coleman Bros., Boston.....	3250.00	2500.00	250.00	4500.00	575.00	45.00	75.00	400.00	350.00	11,945.00	1904
	5.00	8.00	30.00	15.00	30.00	.50	.50	.30	.75		Oct. 15,
Patrick McGovern, Boston..	3250.00	2000.00	300.00	4500.00	690.00	30.00	50.00	240.00	525.00	11,585.00	1904
	4.00	8.00	30.00	15.00	30.00	1.00	.80	.50	.40		Sept. 20,
Jones & Meehan, Boston	2600.00	2000.00	300.00	4500.00	690.00	60.00	80.00	400.00	280.00	10,910.00	1904
	3.50	16.00	12.00	10.00	30.00	1 00	.75	.30	.50		Aug. 20,
E. W. Everson & Co., Boston	2275.00	4000.00	120 00	3000.00	690.00	60.00	75.00	240.00	350.00	10.810.00	1904

APPENDIX K–2.

Canvass of Bids for Sewer in Summer Street, Required on Account of Washington Street Tunnel. Bids Opened July 19, 1904.

Bidders and Addresses.	1,390 Lin. Ft. Excavation by Tunnelling for 3 Ft. 6 In. by 5 Ft. 3 In. Sewer.	1,390 Lin. Ft. Excavation by Open Cut for 3 Ft. 6 In. by 5 Ft. 3 In. Sewer.	210 Lin. Ft. Excavation by Open Cut for 4 Ft. 3 In. Sewer.	50 Lin. Ft. Excavation by Open Cut for 12 In. Pipe Sewer.	100 Cu. Yds. Excavation for Sewer in Trench Below Grade Line.	500 Cu. Yds. Brick Masonry in Tunnel for 3 Ft. 6 In. by 5 Ft. 3 In. Sewer.	500 Cu. Yds. Brick Masonry in Trench for 3 Ft. 6 In. by 5 Ft. 3 In. Sewer.	70 Cu. Yds. Brick Masonry in Trench for 4 Ft. 3 In. Sewer.	300 Cu. Yds. Concrete in Tunnel for 3 Ft. 6 In. by 5 Ft. 3 In. Sewer.	300 Cu. Yds. Concrete in Trench for 3 Ft. 6 In. by 5 Ft. 3 In. Sewer.	80 Cu. Yds. Concrete in Trench for 4 Ft. 3 In. and 12 In. Sewers.	Laying 50 Lin. Ft. 12 Inch Vitrified Pipe.	8 M. Ft. B. M. Lumber for Sheeting and Shoring in Open Trench.	4 M. Ft. B. M. Spruce Lumber for Permanent Use in Open Trench Other than for Sheeting and Shoring.	Laying 200 Lin. Ft. 8 In. Pipe for Underdrains in Trenches.	Placing 50 Pipe Branches in Sewers.	100 Cu. Yds. Gravel or Sand for Filling.	50 Cu. Yds. Grout in Tunnel.	Totals.		Time of Completion.
	a	aa	b	c	d	e	ee	f	g	gg	h	i	j	k	l	m	n	o	By Tunnel.	By Open Cut.	
H. P. Nawn, 82 Savin St., Roxbury.	$20.00 27,800.00	$24.00 33,360.00	$26.00 5,460.00	$5.00 250.00	$2.00 200.00	$22.00 11,000.00	$18.00 9,000.00	$18.00 1,260.00	$10.50 3,150.00	$8.00 2,400.00	$8.00 640.00	$1.00 50.00	$20.00 160.00	$35.00 140.00	$0.25 50.00	$0.25 12.50	$1.50 150.00	$10.50 525.00	$50,847.50	$53,132.50	Dec. 1, 1904.
John J. Falvey & Co., Somerville.	16.00 22,240.00	25.00 34,750.00	20.00 4,200.00	8.00 400.00	4.00 400.00	17.00 8,500.00	14.00 7,000.00	14.00 980.00	11.00 3,300.00	8.00 2,400.00	8.00 640.00	1.00 50.00	20.00 160.00	40.00 160.00	0.50 100.00	1.00 50.00	2.00 200.00	30.00 1,500.00	42,880.00	51,490.00	Nov. 1, 1904.
Dunfee, Shailer & Co.	12.00 16,680.00	20.00 27,800.00	25.00 5,250.00	25.00 1,250.00	4.00 400.00	18.00 9,000.00	18.00 9,000.00	18.00 1,260.00	12.00 3,600.00	12 00 3,600.00	12.00 960.00	1.00 50.00	25.00 200.00	25.00 100.00	0.50 100.00	0.50 25.00	1.50 150.00	20.00 1,000.00	40,025.00	50,145.00	Nov. 1, 1904.
James J. Coughlan. Roxbury.	13.75 19,112.50	19.00 26,410.00	17.50 3,675.00	4.00 200.00	3.00 300.00	17.00 8,500.00	13.00 6,500.00	16.00 1,120.00	13.00 3,900.00	12.00 3,600.00	11.50 920.00	2.00 100.00	30.00 240.00	40.00 160.00	0.25 50.00	3.00 150.00	1.50 150.00	25.00 1,250.00	39,827.50	43,575.00	Nov. 25, 1904.
Jones & Meehan, 1 Beacon St., Boston.	13.50 18,765.00	22.00 30,580.00	17.00 3,570.00	10.00 500.00	3.00 300.00	18.00 9,000.00	16.00 8,000.00	16.00 1,120.00	10.00 3,000.00	8.00 2,400.00	8.00 640.00	2.00 100.00	20.00 160.00	50.00 200.00	1.00 200.00	1.00 50.00	1.25 125.00	20.00 1,000.00	38,730.00	47,945.00	Sept. 20, 1904.
Patrick McGovern, 6 Beacon St., Boston.	13.50 18,765.00	18.00 25,020.00	16.00 3,360.00	6.00 300.00	4.00 400.00	16.00 8,000.00	14.00 7,000.00	14.00 980.00	13.00 3,900.00	12.00 3,600.00	12.00 960.00	2.00 100.00	25.00 200.00	30.00 120.00	0.30 60.00	2.00 100.00	1.00 100.00	20.00 1,000.00	38,345.00	42,300.00	Nov. 15, 1904.
E. W. Everson & Co., Ward St., Roxbury.	12.00 16,680.00	12.00 16,680.00	14.00 2,940.00	7.00 350.00	3.00 300.00	18.00 9,000.00	18.00 9,000.00	18.00 1,260.00	11.00 3,300.00	11.00 3,300.00	11.00 880.00	1.00 50.00	16.00 128.00	40.00 160.00	0.30 60.00	1.00 50.00	1.50 150.00	20.00 1,000.00	36,308.00	35,308.00	Sept. 10, 1904.
Gow & Palmer, 50 Congress St., Boston.	10.80 15,012.00	20.00 27,800.00	18 00 3,780.00	10.00 500.00	2.00 200.00	18.00 9,000.00	16.50 8,250.00	16.50 1,155.00	12.50 3,750.00	11.00 3,300.00	12.00 960.00	1.00 50.00	20.00 160.00	40.00 160.00	0.50 100.00	1.00 50.00	2.00 200.00	16.00 800.00	35,877.00	46,665.00	Nov. 1, 1904.
Peter W. Hill, Boston.	8.50 11,815.00	12.00 16,680.00	13.00 2,730.00	7.00 350.00	1.50 150.00	23.00 11,500.00	18.00 9,000.00	18.00 1,260.00	15.00 4,500.00	12.00 3,600.00	12.00 960.00	0.50 25.00	25.00 200.00	30.00 120.00	0.50 100.00	1.50 75.00	2.00 200.00	12.00 600.00	34,585.00	35,450.00	Oct. 30, 1904.

Items (*a*) and (*aa*) are in a measure alternatives of each other, and either of these items or a portion of either may be omitted by the Engineer.
Items (*e*) and (*ee*) are in a measure alternatives of each other, and either of these items or a portion of either may be omitted by the Engineer.
Items (*g*) and (*gg*) are in a measure alternatives of each other, and either of these items or a portion of either may be omitted by the Engineer.

APPENDIX K–3.

CANVASS OF BIDS FOR FURNISHING AND INSTALLING THREE SETS OF VENTILATING APPARATUS IN EAST BOSTON TUNNEL. BIDS OPENED JULY 26, 1904.

BIDDER.	Atlantic Avenue.	E. B. & Sec. C.	All.
Boston Blower Co., Boston	$3,800	$5,750	$9,550
B. F. Sturtevant Co. "	3,295	5,275	8,500
American Blower Co., Detroit	2,797	5,108	7,800

APPENDIX K–4.

CANVASS OF BIDS FOR SETTING RIBBED TERRA COTTA TILING IN SECTION B, EAST BOSTON TUNNEL. BIDS OPENED JULY 26, 1904.

BIDDERS.	Price.
Muir Brothers, Boston	6600 sq. yds. @ $2.05 = $13,530
Boston Tile & Mantel Co., Boston	6600 " " @ 1.95 = 12,870
Gow & Palmer, Boston	6600 " " @ 1.30 = 7,580
W. H. Smith, Boston	6600 " " @ 1.12 = 7,392

APPENDIX K–5.

Canvass of Bids for the Erection and Completion of Station over Atlantic Avenue Chambers, East Boston Tunnel. Bids Opened August 11, 1904.

Bidders and Addresses.	Price.	Remarks.
The Norcross Brothers Co., 73 Tremont St., Boston	$34,859	Add for alternative estimate for wood finish, $693. Deduct for copper grilles, $1229.
L. D. Willcutt & Son, 166 Devonshire St., Boston	29,875	Add $1186 for grilles and $475 for interior finish.
Woodbury & Leighton Co. 166 Devonshire St., Boston	28,877	Wood finish included without additional charge. Add for grilles, $1400.

APPENDIX K–6.

CANVASS OF BIDS FOR FURNISHING MATERIALS FOR AND CONSTRUCTING STAIRWAY COVERING, WEST END OF ATLANTIC AVENUE STATION. BIDS OPENED SEPTEMBER 1, 1904.

BIDDERS.	Price.	Time of Beginning Work.	Time of Completion.
Woodbury & Leighton, Boston	$2,865	Sept. 5, 1904	Dec. 1, 1904
E. R. Taylor & Co., Boston	2,784	" 6, 1904	Oct. 8, 1904
Aberthaw Construction Co., Boston .	2,247	" 5, 1904	.....

APPENDIX K–7.

Canvass of Bids for 41 Curved Posts and 135 Tie Rods for Boylston St. Station, Part of Section 2, Washington St. Tunnel. Sept 6, 1904.

Bidders and Addresses.	Price for Posts Per 100 Lbs.	Price for Tie Rods Per Lb.	Time of Delivery.
Belmont Iron Works, Phila., Pa.	$4.95	$0.03	60 days.
American Bridge Co., New York	4.75	.0475	56 days.
Cambria Steel Co., 101 Tremont St.	4.50	.045	Abt. 30 days.
Boston Bridge Works, 47 Winter St.	4.39	.0439	56 days.
Boston Steel & Iron Co., 101 Tremont St.	4.20	.042	60 days.
Eastern Bridge & Struct. Co., Worcester	4.20	.042	56 days.
Lewis F. Shoemaker & Co., Phila., Pa.	3.50	.035	56 days.
G. W. & F. Smith Iron Co., Gerard St., Rox.	3.50	.035	Abt. 30 days.
New England Struct. Co., Boston	3.03	.0303	35 days.

The contract was awarded to the New England Structural Co., who furnished 43,408 lbs. at $3.03 per hundred lbs. = $1,315.26.

APPENDIX K–8.

CANVASS OF BIDS FOR TAKING DOWN AND REMOVING BUILDINGS NO. 11 TO 21 ASH STREET, BOSTON. BIDS OPENED SEPT. 8, 1904.

BIDDERS.	Amount to be paid the Commission.	Time for Completion.
Frank Saggesse & Co.	$626.24	Nov. 15, 1904
Frederick T. Whitney	440.00	Nov. 1, 1904
T. A. Elston & Co.	175.00	30 days
Robert R. McNutt	105.00	Oct. 9, 1904
John J. Reagan	101.50	Oct. 8, 1904
A. A. Elston & Co.	50.00	8 weeks
Henry A. Slakin	50.00	Oct. 15, 1904

The contract was awarded to T. A. Elston & Co.

APPENDIX K–9.

CANVASS OF BIDS FOR FURNISHING STEEL AND IRON FOR SECTION 1, WASHINGTON ST. TUNNEL. BIDS OPENED SEPT. 8, 1904.

BIDDERS AND ADDRESSES.	400± tons Bid per Ton and Total Amt.	Time of Delivery.	
		1st Installment.	2nd Installment.
Fred A. Houdlette & Son, Boston	$55.75 22,300.00	Six Weeks	To follow as fast as required to complete work.
Passaic Steel Co., Patterson, N. J.	49.80 19,920.00	3 months	5 months
American Bridge Co., New York	48.40 19,360.00	Jan. 2, 1905	Jan. 20, 1905
Belmont Iron Works, Phila., Pa.	46.94 18,776.00	Nov. 15. 1904	Dec. 25, 1904
Phœnix Iron Co., Boston	46.80 18,720.00	Oct. 15, 1904	Nov. 15, 1904
Cambria Steel Co., Phila., Pa.	45.60 18,240.00	Oct. 24, 1904	Nov. 7, 1904
Boston Bridge Works, Boston	45.60 18,240.00	10 weeks	14 weeks
Lewis F. Shoemaker & Co., Phila., Pa.	44.35 17,740.00	Nov. 15, 1904	Dec. 15, 1904
New England Struct. Co., Boston	44.00 17,600.00	Oct. 22, 1904	Nov. 12, 1904

APPENDIX K–10.

CANVASS OF BIDS FOR RETAINING WALLS AND ROOF FOR THE ASH STREET INCLINE OF THE WASHINGTON STREET TUNNEL, SECTION 1.
BIDS OPENED OCTOBER 4, 1904.

BIDDERS AND ADDRESSES.	500 cu. yds. earth excavation.	Removing and disposing of 150 cu. yds. old masonry.	270 c.yds. reinforced concrete for retaining walls.	150 c.yds. reinforced concrete for roof.	Laying 300 lin. ft. 4-in. vitrified pipe.	Setting and securing 10 tons of steel weighing less than 6 lbs. per ft.	Setting and securing 2 tons of steel weighing more than 6 lbs. per ft.	Furnishing & put'g in place 100 c.yds. sand and gravel backfilling.	150 lin. ft. copper gutter and drain pipe.	Preparing and applying 100 sq.yds. of pitch or asphalt.	Totals.
	a	b	c	cc	d	e	ee	f	g	h	
Falvey & Kelley,	$3.50	$5.50	$12.00	$23.00	$0 25	$25.00	$25.00	$2.00	$2.00	$1.00	
Somerville	1750.00	825.00	3240 00	3450.00	75 00	250.00	50.00	200.00	300.00	160.00	$10,300.00
Gow & Palmer,	2.50	4.00	12.00	25.00	0.15	15.00	25.00	2.00	1.50	.60	
Boston	1250.00	600.00	3240.00	3750.00	45.00	150.00	50.00	200.00	225.00	96.00	9,606.00
Peter W. Hill,	3.00	7.00	14.00	12.00	.50	45.00	40.00	3.00	2.50	.50	
Boston	1500.00	1050.00	3780.00	1800.00	150 00	450.00	80.00	300.00	375 00	80.00	9,565.00
Chas. F. Taylor & Co.,	3.00	3.00	15.00	15.00	.50	15.00	15.00	2.00	1 00	.50	
Syracuse, N. Y.	1500.00	450.00	4050.00	2250.00	150.00	150.00	30.00	200.00	150.00	80.00	9,010.00
E. B. Roberts,	1 95	3 00	15 00	15.50	.25	10.00	10 00	1.60	.65	.25	
Swampscott, Mass.	975.00	450.00	4050.00	2325.00	75.00	100.00	20.00	160.00	97.50	40.00	8,292.50
Coleman Bros.,	2.50	4.00	12.00	14.00	.25	20.00	40.00	1.50	1.00	.40	
Everett, Mass.	1250 00	600.00	3240.00	2100.00	75.00	200.00	80.00	150.00	150.00	64.00	7,909.00
Manufacturers Cont. Co.,	1.95	2.40	11 35	18.68	.20	30.00	20.00	1.50	.50	.50	
Wilmington, Del.	975.00	360 00	3064.50	2802.00	60.00	300.00	40.00	150.00	75.00	80.00	7,906.50
Patrick McGovern,	1.50	3.00	11 00	18.00	.15	30.00	25.00	1.50	1.50	25	
Boston	750.00	450.00	2970.00	2700.00	45.00	300.00	50.00	150.00	225 00	40.00	7,680.00
E. W. Everson & Co.,	1.50	1.50	12.00	15.00	.20	30.00	30 00	1.75	1.00	.70	
Boston	750.00	225.00	3240.00	2250.00	60.00	300.00	60.00	175.00	150.00	112.00	7,322.00
W. A. & H. A. Root,	1.50	1.50	10 00	12.00	.07	9.50	40.00	2 25	1 25	.30	
Boston	750.00	225.00	2700.00	1800.00	21.00	95.00	80.00	225.00	187.50	48.00	6,131.50
H. P. Nawn,	2.50	2.00	9 00	11.00	.15	6 00	15.00	1.00	1.00	.30	
Boston	1250.00	300.00	2430.00	1650.00	45.00	60.00	30.00	100 00	150 00	48.00	6,063.00

APPENDIX K–11.

Canvass of Bids for Steel and Iron Work for Part of Section 2 of the Washington Street Tunnel. Bids Opened October 11, 1904.

Bidders and Addresses.	Price per Ton.	Cost for 435 Tons.
H. P. Converse & Co., 120 Milk St., Boston	$54 00	$23,490.00
Am. Bridge Co. of New York, 89 State St., Boston	53.41	23,233.35
Eastern Bridge & Structural Co., Worcester, Mass	50.00	21,750.00
Cambria Steel Company, of Phila., H. W. Hayes & Co., Sales Agent, 101 Tremont St., Boston	49.60	21,576.00
New Eng. Structural Co., 110 State St., Boston	49.00	21,315.00
The Boston Bridge Works Inc., 47 Winter St, Boston	48.30	21,010.50

APPENDIX K-12.

Canvass of Bids for Washington Street Tunnel—Station 2 + 39.5 to Station 7 + 82, Section 1. Bids Opened Oct. 27, 1904.

Bidders and Addresses.	12,000 Cu. Yds. Earth Excavation.	Removing and Disposing of 150 Cu. Yds. Old Masonry.	1400 Cu. Yds. Concrete.	2,400 Cu. Yds. Reinforced Concrete.	Laying 70 Lin. Ft. 12 In. Vitrified Pipe.	Laying 115 Lin. Ft. 8 In. Vitrified Pipe.	Laying 280 Lin. Ft. 15 In. Vitrified Channel Pipe.	Setting in Place and Securing 75 Tons of Steel Weighing Less than 6 lbs. per Lin. Ft.	Setting in Place and Securing 400 Tons of steel Weighing 6 Lbs. or More per Lin. Ft.	100 Cu. Yds. Brick Masonry for Walls and Piers Disturbed by Tunnel.	25 Cu. Yds. Brick Masonry for Manholes, Sewers, Piers for Pipes, etc.	3000 Sq. Yds. Pitch or Asphalt.	1,800 Sq. Yds. Portland Cement Mortar.	7,200 Sq. Yds. Tarred Felt.	Underpinning and Supporting and Protecting Buildings, etc.	10 Cu. Yds. Grout.	Totals.
	a	b	c	cc	d	dd	3d	e	ee	f	g	h	i	j	k	l	
Metropolitan Contracting Co., 95 Milk St., Boston	$7.50 90,000.00	$4.00 600.00	$9.75 13,650.00	$12.00 28,800.00	$1.50 105.00	$1.25 143.75	$2.00 560.00	$17.00 1,275.00	$18.00 7,200.00	$16.00 1,600.00	$16.00 400.00	$0.50 1,500.00	$0.50 900.00	$0.40 2,880.00	$23,000.00 23,000.00	$25.00 250.00	$172,863.75
E. W. Everson & Co., Cor. Ward St. and Huntington Ave., Boston	6.50 78,000.00	6.50 975.00	10.50 14,700.00	14.50 34,800.00	1.00 70.00	1.00 115.00	1.00 280.00	30.00 2,250.00	10.00 4,000.00	18.00 1,800.00	20.00 500.00	.50 1,500.00	.40 720.00	.20 1,440.00	18,000.00 18,000.00	30.00 300.00	159,450.00
Chas. F. Taylor & Co., 23 Lewis St., East Boston	4.00 48,000.00	5.00 750.00	14.00 19,600.00	16.00 38,400.00	.70 49.00	.40 46.00	1.00 280.00	20.00 1,500.00	25.00 10,000.00	20.00 2,000.00	20.00 500.00	.50 1,500.00	1.00 1,800.00	.50 3,600.00	25,000.00 25,000.00	20.00 200.00	153,225.00
James J. Coughlan, 19 Worthington St., Boston	4.90 58,800.00	9.00 1,350.00	11.50 16,100.00	12.50 30,000.00	.60 42.00	.55 63.25	.90 252.00	18.00 1,350.00	24.00 9,600.00	22.00 2,200.00	18.00 450.00	.35 1,050.00	.48 864.00	.48 3,456.00	21,753.00 21,753.00	20.00 200.00	147,530.25
Gow & Palmer, 50 Congress St., Boston	4.75 57,000.00	10.00 1,500.00	11.50 16,100.00	12.00 28,800.00	.50 35.00	.30 34.50	30 84.00	10.00 750.00	15.00 6,000.00	15.00 1,500.00	18.00 450.00	.50 1,500.00	.50 900.00	.20 1,440.00	28,000.00 28,000.00	25.00 250.00	144,343.50
Manufacturers Contracting Co., 1005 Market St., Wilmington, Del.	4.50 54,000.00	6.00 900.00	8.75 12,250.00	8.25 19,800.00	1.00 70.00	1.00 115.00	3.00 840.00	10.00 750.00	15.00 6,000.00	15.00 1,500.00	18.00 450.00	.40 1,200.00	.50 900.00	.23 1,656.00	22,715.00 22,715.00	20.00 200.00	123,346.00
H. P. Nawn, 82 Savin St., Boston	3.75 45,000.00	3.00 450.00	11.00 15,400.00	11.00 26,400.00	1.00 70.00	.50 57.50	.50 140.00	6.00 450.00	15.00 6,000 00	16.00 1,600.00	20.00 500.00	.30 900.00	.60 1,080.00	.20 1,440.00	18,000.00 18,000.00	30.00 300.00	117,787.50
Coleman Bros., 15 Court Sq., Boston	3.35 40,200.00	10.00 1,500.00	9.00 12,600.00	11.00 26,400.00	.50 35.00	.75 86.25	1.00 280.00	20.00 1,500.00	13.00 5,200.00	15.00 1,500.00	17.50 437.50	.25 750.00	.50 900.00	.15 1,080.00	21,000.00 21,000.00	30.00 300.00	113,768.75
Patrick McGovern 6 Beacon St., Boston	3.50 42,000.00	3.00 450.00	9.75 13,650.00	10.00 24,000.00	2.50 175.00	.60 69.00	1.75 490.00	14.50 1,087.50	6.00 2,400.00	14.00 1,400.00	14.50 362.50	.35 1,050.00	.30 540.00	.25 1,800.00	10,000.00 10,000.00	30.00 300.00	99,774.00
Jones & Meehan, 1 Beacon St., Boston	2.15 25,800.00	4.00 600.00	8.00 11,200.00	8.50 20,400.00	1.00 70.00	.80 92.00	1.20 336.00	10.00 750.00	10.00 4,000.00	16.00 1,600.00	16.00 400.00	.40 1,200.00	.40 720.00	.20 1,440.00	14,000.00 14,000.00	25.00 250.00	82,858.00

Note. — The contract was awarded to Patrick McGovern.

APPENDIX K–13.

CANVASS OF BIDS FOR SHORING AND UNDERPINNING LYCEUM THEATRE BUILDING. BIDS OPENED NOVEMBER 9, 1904.

BIDDER.	Price.	Time Required.
John Soley & Sons, 209 Maple Street, Chelsea, Mass.....	$4,900.00	
John Soley & Sons, 209 Maple Street, Chelsea, Mass.....	4,400.00 (excavation for underpinning front wall done by contractor for section 2.)	
The John Cavanagh & Son, Building Moving Co , 473 Dorchester Ave., S. Boston, Mass....	4,399.51	Begin in 24 hours and complete in 1 month.
Isaac Blair & Company, 444 Harrison Ave , Boston, Mass.....	3,631.00	Begin in 24 hours and complete in 6 weeks.

APPENDIX K–15.

Canvass of Bids for Steel and Iron Work, Section 3, Washington Street Tunnel. Bids Opened November 22, 1904.

Bidders and Addresses.	Price Bid Per Ton.	Cost for 500 Tons.
Pennsylvania Steel Co., 70 Kilby St., Boston	$64.40	$32,200
Eastern Bridge & Struct. Co., Worcester, Mass.	56.00	28,000
Berlin Construction Co., 131 State St., Boston	56.00	28,000
New England Structural Co., 110 State St., Boston	53.00	26,500
American Bridge Co., 89 State St., Boston	52.80	26,400
Louis F. Shoemaker & Co., Philadelphia, Pa.	50.60	25,300
Boston Bridge Works, 47 Winter St., Boston	48.25	24,125

APPENDIX K–16.

CANVASS OF BIDS FOR WASHINGTON STREET TUNNEL—STATION 13 + 25 + TO STATION 16 + 58.5, SECTION 3. BIDS OPENED DEC. 15, 1904.

BIDDERS AND ADDRESSES.	21,000 Cu. Yds. Earth Excavation.	Excavating for and Laying 170 Lin. Ft. 24 In. Sewer.		Excavating for and Laying 400 Lin. Ft. 18 In. Sewer.		3,000 Cu. Yds. Concrete for all Purposes Except Roof.	900 Cu. Yds. Concrete for Roof.	80 Cu. Yds. Brick Masonry for Manholes, Piers for Water Pipes, etc.	Laying 450 Lin. Ft. 24 In. Vitrified Pipe Side of or Above Tunnel Walls.	Laying 36 Lin. Ft. 24 In. Cast Iron Pipe for Sewer.	Laying 100 Lin. Ft. 6 In. Vitrified Pipe.	Laying 350 Lin. Ft. 4 In. Vitrified Pipe.	Setting and Securing 20 Tons Steel Weighing Less Than 6 Lbs. Per Linear Ft.	Setting and Securing 500 Tons Steel Weighing 6 Lbs. or More Per Linear Ft.	1,500 Sq. Yds. Coating of Portland Cement Mortar.	10 Cu. Yds. of Grout.	5,100 Sq. Yds. Waterproof Coating of Asphalt	9,000 Sq Yds. Tarred Felt, Pitch, etc.	Underpinning and Supporting and Protecting Buildings and Structures and all Other Work, Risks, etc.	TOTALS.	
	a	2a		3a		b	c	d	e	ee	3e	4e	f	ff	g	gg	h	i	k	Sewer by Open Cut.	Sewer by Tunnelling.
		Open Cut.	Tunnel.	Open Cut.	Tunnel.																
Manufacturers Contracting Co.,	$3.60	$9.50	$9.50	$9.50	$9.50	$9.25	$10.50	$16.00	$1.00	$3.00	$0.20	$0.10	$12.00	$14.00	$0.45	25.00	$0.40	$0.20	$28,000.00		
1005 Market St., Wilmington, Del.	75,600.00	1,615.00	1,615.00	3,800.00	3,800.00	27,750.00	9,450.00	1,280.00	450.00	108.00	20.00	35.00	240.00	7,000.00	675.00	250.00	2,040.00	1,800.00	28,000.00	$160,113.00	$160,113.00
Patrick McGovern,	3.75	9.00	10.00	11.00	12.00	10.50	12.50	14.00	1.50	2.00	.25	.25	12.00	7.00	.40	20.00	.20	.20	18,000.00		
6 Beacon St., Boston	78,750.00	1,530.00	1,700.00	4,400.00	4,800.00	31,500.00	11,250.00	1,120.00	675.00	72.00	25.00	87.50	240.00	3,500.00	600.00	200.00	1,020.00	1,800.00	18,000.00	154,769.50	155,339.50
Chas F. Taylor & Co.,	3.00	20.00	20.00	15.00	15.00	10 00	11.00	15.00	1.50	3.00	.50	.40	20.00	15.00	.50	20.00	.40	.30	23,000.00		
23 Lewis St., E. Boston	63,000.00	3,400.00	3,400.00	6,000.00	6,000.00	30,000.00	9,900.00	1,200.00	675.00	108.00	50.00	140.00	400.00	7,500.00	750.00	200.00	2,040.00	2,700.00	23,000.00	151,063.00	151,063.00
Coleman Bros.,	3.35	12.00	7.00	10.00	7.00	9.50	10.00	17.00	.75	1.50	.50	.25	15.00	7.00	.50	25.00	.25	.15	15,000.00		
15 Court Sq., Boston	70,350.00	2,040.00	1,190.00	4,000.00	2,800.00	28,500.00	9,000.00	1,360.00	337.50	54.00	50.00	87.50	300.00	3,500.00	750.00	250.00	1,275.00	1,350.00	15,000.00	138,204.00	136,154.00
Gow & Palmer,	3.00	8.50	6.50	7.00	6.50	10.00	12.00	18.00	1.00	2.00	.30	.20	15.00	10.00	.30	20.00	.30	.25	15,000.00		
50 Congress St., Boston	63,000.00	1,445.00	1,105.00	2,800.00	2,600.00	30,000.00	10,800.00	1,440.00	450.00	72.00	30.00	70.00	300.00	5,000.00	450.00	200.00	1,530.00	2,250.00	15,000.00	134,837.00	134,297.00
H. P. Nawn,	3.50	5.00	5.00	5.00	5.00	9.00	11.00	15.00	1.00	4.00	.50	.40	10.00	6.00	.60	25.00	.40	.15	11,000.00		
82 Savin St., Roxbury	73,500.00	850.00	850.00	2,000.00	2,000.00	27,000.00	9,900.00	1,200.00	450.00	144.00	50.00	140.00	200.00	3,000.00	900.00	250.00	2,040.00	1,350.00	11,000.00	133,974.00	133,974.00
Jones & Meehan,	2.95	8.00	6.30	8.00	6.30	9.00	10.00	20.00	1.00	2.00	.50	.40	10.00	12.00	.50	25.00	.50	.20	12,700.00		
1 Beacon St., Boston	61,950.00	1,360.00	1,071.00	3,200.00	2,520.00	27,000.00	9,000.00	1,600.00	450.00	72.00	50.00	140.00	200.00	6,000.00	750.00	250.00	2,550.00	1,800.00	12,700.00	129,072.00	128,103.00

APPENDIX K–17.

Canvass of Bids for Steel and Iron Work, Sec. 4, Washington St. Tunnel. Bids Opened January 28, 1905.

Bidders and Addresses.	Price Bid per Ton.	Cost for 440 Tons.
H. P. Converse & Co., 120 Milk St., Boston	$56.00	$24,640.00
The King Bridge Co., 277 Broadway, N. Y.	53.50	23,540.00
Belmont Iron Works, 22d St. & Washington Ave., Philadelphia, Pa.	53.46	23,522.40
West Virginia Bridge & Construction Co., Wheeling, W. Va.	52.20	22,968.00
Berlin Construction Co., 131 State St., Boston	52.00	22,880.00
Boston Bridge Works Inc., 47 Winter St., Boston	50.92	22,404.80
New England Struct. Co., 110 State St., Boston	50.80	22,352.00
American Bridge Co. of New York, 89 State St., Boston	49.60	21,824.00
American Struct. Steel Co., 1183 Broadway, N. Y.	48.95	21,538.00
Levering & Garrigues Co., 523 W. 23rd St, N. Y.	48.23	21,221.20
Lewis F. Shoemaker Co., Philadelphia, Pa.	47.90	21,076.00

APPENDIX K–18.

CANVASS OF BIDS FOR BUILDING STAIRWAYS AND WALLS OF REINFORCED CONCRETE, ATLANTIC AVENUE STATION, EAST BOSTON TUNNEL.
BIDS OPENED JANUARY 31, 1905.

BIDDERS AND ADDRESSES.	Item "A."	Item "B."	Totals.
	3½ Cu. Yds. Portland Cement Mortar 2½ In. Thick, Reinforced with Steel.	8½ Cu. Yds. Portland Cement Concrete Reinforced with Steel	
Aberthaw Construction Co., Boston	$210 00 735.00	$72.00 612.00	$1347.00
Eastern Expanded Metal Co., 101 Tremont St., Boston	132.00 462.00	46.00 391.00	853.00
Simpson Bros. Corp'n, Boston	95.00 332.50	45.00 382.50	715.00

APPENDIX K–19.

CANVASS OF BIDS FOR FURNISHING STEEL TIE RODS AND CAST IRON WASHERS, SECTION 4, WASHINGTON ST. TUNNEL.
BIDS OPENED FEBRUARY 2, 1905.

BIDDERS AND ADDRESSES.	Steel Tie Rods.		Cast Iron Washers.		Total Cost.
	Price Per Ton.	Cost for 40 Tons.	Price Per Ton.	Cost for 12½ Tons.	
New Eng. Bolt & Nut Co., 267 Atlantic Ave., Boston,	$70.00	$2800.00	$41.00	$512.50	$3312.50
G. W. & F. Smith Iron Co., Gerard St., Boston	65.25	2610.00	52.60	657.50	3267.50
Harrington, Robinson & Co., Boston.....	61.00	2440.00	43.25	540.63	2980.63
Lewis F. Shoemaker & Co., Harrison Bldg., Phila., Pa.	58.00	2320.00	44.00	550.00	2870 00
Cambria Steel Co., Arcade Bldg., Philadelphia, Pa.....	55.75	2230.00			2830.00
	Round Steel Rods 48.75	1950.00	48.00	600.00	2550.00
New Eng. Structural Co., 110 State St., Boston	56.00	2240.00	46.00	575.00	2815.00
The Sylvester Co., 70 Kilby St., Boston.....	54.00	2160.00	44.00	550.00	2710.00
Fred A. Houdlette & Son, 93 Broad St., Boston.....	2 in. Dia. Upset Ends 2½ in. 53.80	2152.00			2661.38
	2¼ in. Dia. no upsets 52.50	2100.00	40.75	509.38	2609.38
H. P. Converse & Co., 120 Milk St., Boston	52.20	2088.00	36.90	461.25	2549.25
The Sessions Foundry Co., Bristol, Conn.			39.80	497.50	
Osgood & Witherby, 3 Sherman St.,Ch's'n,Mass.			38.50	481.25	

APPENDIX K–20.

Canvass of Bids for Washington Street Tunnel—Station 16+58.5 to Station 29+10±, Section 4. Bids Opened Feb. 14, 1905.

Bidders and Addresses.	49,000 Cubic Yards Earth Excavation Including Backfilling.	200 Lin. Ft. Excavation by Tunnelling for Sewer in Summer St., Backfilling, etc.	8,500 Cubic Yards Concrete for all Purposes Except Item C.	1,500 Cubic Yards Concrete for Roof North of Sta. 23+11.	300 Cubic Yards Brick Masonry for Manholes, Sewers, Piers for Water-Pipes, etc.	Laying 200 Lin. Ft. 24 In. Vitrified Pipe for Sewer.	Laying 700 Lin. Ft. 18 In. Vitrified Pipe for Sewer.	Laying 760 Lin. Ft. 15 In. Vitrified Pipe for Sewer.	Laying 700 Lin. Ft. 8 In. Vitrified Pipe.	Laying 60 Lin. Ft. 6 In. Vitrified Pipe.	Laying 1,000 Lin. Ft. 3 In. and 4 In. Vitrified Pipe.	Setting and Securing 200 Tons Steel Weighing Less Than 6 Lbs. Per Lin. Ft.	Setting and Securing 500 Tons Steel Weighing 6 Lbs. or More Per Lin. Ft.	3,000 Sq. Yards Coating of Portland Cement Mortar.	10 Cubic Yards Grout. One Part Portland Cement to One Part Sand.	11,000 Sq. Yards Waterproof Coating, Pitch or Asphalt.	19,000 Sq. Yards, Tarred Felt, Pitch, etc.	Underpinning, Supporting and Protecting Buildings, Structures and all Other Work and Risks Not Otherwise Covered by Contract.	Totals.
	a	2a	b	c	d	e	ee	3e	4e	5e	6e	f	ff	g	gg	h	i	k	
Jones & Meehan,	$4.60	$15.00	$10.00	$12.00	$20.00	$2.00	$1.50	$1.20	$1.00	$0.90	$0.80	$14.00	$14.00	$0.50	$25.00	$0.50	$0.30		
1 Beacon St., Boston.....	225,400.00	3,000.00	85,000.00	18,000.00	6,000.00	400.00	1,050.00	912.00	700.00	54.00	800.00	2,800.00	7,000.00	1,500.00	250.00	5,500.00	5,700.00	$151,000.00	$515,066.00
Shailer & McCormick,	5.30	20.00	11.50	14.50	18.00	1.50	1.30	.80	.60	.50	.40	13.00	15.00	.60	28.00	.40	.15		
101 Tremont St., Boston.....	259,700.00	4,000.00	97,750.00	21,750.00	5,400.00	300.00	910.00	608.00	420.00	30.00	400.00	2,600.00	7,500.00	1,800.00	280.00	4,400.00	2,850.00	80,000.00	490,698.00
Gow & Palmer,	5.00	15.00	12.50	14.00	18.00	1.00	.70	.60	.30	.20	.15	12.00	15 00	.50	25.00	.50	.25		
50 Congress St., Boston.....	245,000.00	3,000.00	106,250.00	21,000.00	5,400.00	200.00	490.00	456.00	210.00	12.00	150.00	2,400.00	7,500.00	1,500.00	250.00	5,500.00	4,750.00	83,000.00	487,068.00
Coleman Bros.,	4.50	12.00	11.50	13.00	20.00	1.00	1.00	.75	.50	.40	.25	15.00	20.00	.75	50.00	.40	.20		
15 Court Sq., Boston.....	220,500.00	2,400.00	97,750.00	19,500.00	6,000.00	200.00	700.00	570.00	350.00	24 00	250.00	3,000.00	10,000.00	2,250.00	500.00	4,400.00	3,800.00	109,000.00	481,194.00
Seeley-Taylor Co.,	4.60	12.00	12.00	14.00	22.00	2.00	1.80	1.50	1.20	1.00	.80	25.00	25.00	1.00	25.00	.75	.50		
Tremont Building, Boston...	225,400.00	2,400.00	102,000.00	21,000.00	6,600.00	400.00	1,260.00	1,140.00	840.00	60.00	800.00	5,000.00	12,500.00	3,000.00	250.00	8,250.00	9,500.00	78,125.00	478,525.00
Patrick McGovern,	4.75	22.00	12.50	13.50	16.00	2.00	1.50	1.00	.75	.30	.15	15.00	20.00	.50	20.00	.40	.25		
6 Beacon St., Boston	232,750.00	4,400.00	106,250.00	20,250.00	4,800.00	400.00	1,050.00	760.00	525.00	18.00	150.00	3,000.00	10,000.00	1,500.00	200.00	4,400.00	4,750.00	74,000.00	469,203.00
Hugh Nawn Contracting Co,	5.00	17.00	11.00	15.00	17.00	1.25	1.00	.70	.60	.50	.30	12.00	15.00	.50	25.00	.30	.20		
82 Savin St., Boston.	245,000.00	3,400.00	93,500.00	22,500.00	5,100.00	250.00	700.00	532.00	420.00	30.00	300.00	2,400.00	7,500.00	1,500.00	250.00	3,300.00	3,800.00	76,000.00	466,482.00

APPENDIX K–21.

Canvass of Bids for Raising to Grade About 200 Linear Feet Bluestone Sidewalk, Including Sidewalk Lights, at Sherburne Building, Ash and Bennet Streets. Bids Opened April 25, 1905.

Bidder.	Price.	Time to Finish.
Patrick McGovern, Boston	$1,600.00	May 27, 1905
E. R. Taylor & Co., Boston	1,128.00	June 1, 1905
H. P. Converse & Co., Boston	1,080.00	In 12 Days
Falvey & Kelley, Somerville	600.00	In 9 Days

APPENDIX K--22.

CANVASS OF BIDS FOR FURNISHING STEEL WORK FOR SECTION 5, WASHINGTON ST. SUBWAY. BIDS OPENED MAY 11, 1905.
Time of Delivery as Called for by Specifications—1st Instalment July 1, 1905; 2nd Instalment August 15, 1905.

BIDDERS AND ADDRESSES.	108,000 Lbs. Steel Tie Rods.		290,000 Lbs. Structural Steel.		42,000 Lbs. Cast Iron.		8,500 Lbs. Turnbuckles.		Grand Total.	Time of Delivery.	
	Price Per Lb.	Total Price.	Price Per Lb.	Total Price.	Price Per Lb.	Total Price.	Price Per Lb.	Total Price.		1st Instal.	2nd Instal.
Boston Bridge Works, 47 Winter St., Boston	2.9 c.	$3,132.00	3.38 c.	$9,802.00	3.6 c.	$1,512.00	10 c.	$850.00	$15,296.00	Aug. 15, 1905	Aug. 25, 1905
H. P. Converse & Co., 120 Milk St., Boston	2.42 c.	2,613.60	3.4 c.	9,860.00	1.95 c.	819.00	9 c.	765.00	14,057.60	Aug. 1, 1905	Sept. 1, 1905
Lewis F. Shoemaker & Co., Harrison Bldg., Philadelphia	2.65 c.	2,862.00	3.25 c.	9,425.00	2.5 c.	1,050.00	6 c	510.00	13,847.00	July 1, 1905	Aug. 15, 1905
Belmont Iron Works, 22 Washington Ave., Phila.	2.6 c.	2,808.00	3.21 c.	9,309.00	1.875c.	787.50	8.75 c.	743.75	13,648.25	Aug. 1, 1905	Sept. 10, 1905
King Bridge Co., Cleveland, Ohio	2.2 c.	2,376.00	2.85 c.	8,265.00	4.5 c.	1,890.00	10.75c.	913.75	13,444.75	Sept. 15, 1905	Oct. 15, 1905
American Bridge Co., of New York, 89 State St., Boston	2.78 c.	3,002.40	2.89 c.	8,381.00	1.6 c.	672.00	9.75 c.	828.75	12,884.15	Aug. 15, 1905	Sept. 15, 1905
New England Structural Co., 110 State St., Boston	2.75 c.	2,970.00	2.875c.	8,337.50	2.5 c.	1,050.00	4 c.	340.00	12,697.50	All on or before Tie rods, cast iron and turnbuckles before	Aug. 15, 1905. Structural Steel during month of
F. A. Houdlette & Son, 93 Broad St., Boston	2.35 c.	2,538.00	2.64 c.	7,656.00	1.74 c	730.80	2.35 c.	199.75	11,124.55	July 15, 1905	August, 1905

APPENDIX K–23.

Canvass of Bids for Washington Street Tunnel—Station 29+10 to Station 39+23, Section 5. Bids Opened May 16, 1905.

Bidders and Addresses	52,000 Cu. Yds. of Excavation.	Furnishing, Hauling and Placing 11,000 Cu. Yds. of Concrete.	Hauling and Placing 11,000 Cu. Yds. of Concrete Furnished by Commission.	Furnishing, Hauling and Placing 500 Cu. Yds. of Concrete around Steel Beams.	Hauling and Placing around Steel Beams 500 Cu. Yds. of Concrete Furnished by Commission.	Furnishing and Laying 100 Cu. Yds. Brick Masonry.	Laying 540 Lin. Ft. 24 In. Vitrified Pipe.	Laying 170 Lin. Ft. 18 In. Vitrified Pipe.	Laying 1,050 Lin. Ft. 15 In. Vitrified Pipe.	Laying 400 Lin. Ft. 12 In. Vitrified Pipe.	Laying 400 Lin. Ft. 6 In. and 8 In. Vitrified Pipe.	Laying 300 Lin. Ft. 3 In. and 4 In. Vitrified Pipe.	Placing and Securing 300 Tons Steel and Iron Weighing Less than 6 Lbs. Per Lin. Ft.	Placing and Securing 250 Tons Steel and Iron Weighing 6 Lbs. or More Per Lin. Ft.	Furnishing, Preparing and Applying 3,000 Sq. Yds. of Coating of Portland Cement Mortar.	Furnishing, Preparing and Forcing into Void Spaces 100 Cu. Yds. Grout.	Preparing and Applying 5,000 Sq. Yds. Pitch or Asphalt.	Preparing and Applying 40,000 Sq. Yds. of Tarred Felt.	Underpinning, Supporting and Protecting Buildings and Structures on the Line of the Work, etc.	Total, Omitting Items bb and cc.	Total, Omitting Items b and c.
	a	b	bb	c	cc	d	e	ee	3e	4e	5e	6e	f	ff	g	gg	h	i	k		
The H. Gore Co.,	$6.50	$14.00	$9.00	$15.00	$10.00	$20.00	$0.75	$0.65	$0.50	$0.45	$0.20	$0.15	$20.00	$20.00	$0.75	$35.00	$0.40	$0.20			
54 Kilby St., Boston	338,000.00	154,000.00	99,000.00	7,500.00	5,000.00	2,000.00	405.00	110.50	525.00	180.00	80.00	45.00	6,000.00	5,000.00	2,250.00	3,500.00	2,000.00	8,000.00	$111,000.00	$640,595.50	$583,095.50
James J. Coughlan Construction Co.,	6.50	13.00	8.00	15.00	10.00	20.00	1.50	1.00	1.00	.50	.40	.40	20.00	18.00	.75	33.00	.50	.25			
19 Worthington St,, Boston	338,000.00	143,000.00	88,000.00	7,500.00	5,000.00	2,000.00	810.00	170.00	1,050.00	200.00	160.00	120.00	6,000.00	4,500.00	2,250.00	3,300.00	2,500.00	10,000.00	92,000.00	613.560.00	556,060.00
Gow & Palmer, Inc.,	6.00	14.50	9.00	16.00	11.00	18.00	1.00	.80	.60	.50	.30	.20	18.00	15.00	.75	25.00	.50	.25			
50 Congress St., Boston	312,000.00	159,500.00	99,000.00	8,000.00	5,500.00	1,800.00	540.00	136.00	630.00	200.00	120.00	60.00	5,400.00	3,750.00	2,250.00	2,500.00	2,500.00	10,000.00	55,000.00	564,386.00	501,386.00
Hugh Nawn Contracting Co.,	5.50	11.00	7.50	15.00	10.50	20.00	2.00	1.00	1.00	1.00	1.00	.70	12.00	15.00	.60	25.00	.30	.20			
82 Savin St., Boston	286,000.00	121,000.00	82,500.00	7,500.00	5,250.00	2,000.00	1,080.00	170.00	1,050.00	400.00	400.00	210.00	3,600.00	3,750.00	1,800.00	2,500.00	1,500.00	8,000.00	82,000.00	522,960.00	482,210.00
Manufacturers' Contracting Co.,	5.15	12.50	7.50	15.00	10.00	18.00	1.00	1.00	.75	.75	.30	.20	14.00	12.00	.45	25.00	.40	.20			
1005 Market St.. Wilmington, Del.	267,800.00	137,500.00	82,500.00	7,500.00	5,000.00	1,800.00	540.00	170.00	787.50	300.00	120.00	60.00	4,200.00	3,000.00	1,350 00	2,500.00	2,000.00	8,000.00	80,000.00	517,627.50	460,127.50
Metropolitan Contracting Co.,	4.95	10.90	6.25	15.00	7.00	15.00	1.50	1.50	1.50	1.50	1.50	1.00	15.00	18.00	.50	25.00	.50	.29			
95 Milk St., Boston	257,400.00	119,900.00	68,750.00	7,500.00	3,500.00	1,500.00	810.00	255.00	1,575.00	600.00	600.00	300.00	4,500.00	4,500.00	1,500.00	2,500.00	2,500.00	11,600.00	92,000.00	509,540.00	454,390.00
Coleman Bros.,	5.25	11.00	6.75	14.00	9.50	20.00	1.50	1.00	.75	.60	.40	.20	20.00	15.00	.50	25.00	.40	.20			
15 Court Sq., Boston	273,000.00	121,000.00	74,250.00	7,000.00	4,750.00	2,000 00	810.00	170.00	787.50	240.00	160.00	60.00	6,000.00	3,750.00	1,500.00	2,500.00	2,000.00	8,000.00	55,000.00	483,977.50	434,977.50

APPENDIX K–24.

Canvass of Bids for Making Changes in the Sherburne Building, Nos. 782-790 Washington Street. Bids Opened June 8, 1905.

Bidders and Addresses.	Price Bid.	Time of Completion.
John A. Rooney, 299 Temple St., W. Roxbury..	$2938.00	August 1, 1905.
C. A. Dodge & Co., 8 Beacon St.,Boston	2648.00	6 weeks after Signing of Contract.
Angus MacDonald, 161 Devonshire St., Boston ...	2496.00	30 Working Days after Award of Contract.
John Y. Mainland, 414 Albany St., Boston.....	2443.00	Before 5 Weeks After Notification.
Whitcomb & Kavanaugh, 6 Beacon St., Boston.....	2250.00	35 Days.
C. H. Belledeu, 5 Province Ct., Boston	2242.00	30 Working Days after Contract is Awarded.
Henry A. Root, Winthrop, Mass.	2139.00	30 Working Days.
John J. Flynn, 95 Milk St., Boston.....	1987.00	30 Days.
Martin Flynn, Jamaica Plain.....	1937.00	1 Month.
John F. Griffin & Co., 95 Milk St., Boston	1850.00	July 8, 1905.

APPENDIX L.

WASHINGTON STREET TUNNEL.

SUMMARY OF UNDERGROUND STRUCTURES RELOCATED IN CONNECTION WITH CONSTRUCTING THE WASHINGTON-STREET TUNNEL DURING THE YEAR ENDING JUNE 30, 1905.

	Linear Feet Removed.	Linear Feet Relaid.
Conduits for electric wires	5,679	3,987
Water pipes	5,659	7,508
Sewers	2,445	7,630
Gas pipes	11,697	1,062
Pneumatic mail pipes	194	220
Total	25,674	20,407

APPENDIX L—2.

WASHINGTON STREET TUNNEL.

ELECTRIC CONDUITS RELOCATED DURING THE YEAR ENDING JUNE 30, 1905.

COMPANY.	REMOVED.			RELAID.			
	Linear Feet, Conduit.	Duct Feet.	Manholes.	Linear Feet, Conduit.	Duct Feet.	Manholes.	
Boston Elevated Ry. Co.....	323	1,615	2	.....	.....	..	
Edison Electric Ill. Co..... ..	2,256	21,102	20	1,085	11,899	8	Relocated by order Trans. Com.
" " " "	.....	.....	..	427	5,979	3	Laid on permit from Wire Dept.
" " " "	2,056	2,056	..	1,540	1,540	..	Tubes, solid system.
Boston Low Tension Wire Ass'n.	407	1,714	5	416	1,766	5	
New England Tel. & Tel. Co.....	565	4,583	2	447	3,623	3	
Western Union Telegraph Co....	72	130	..	72	130	..	Iron pipe moved.
Total.....	5,679	31,200	29	3,987	24,937	19	

APPENDIX L–3.

WASHINGTON STREET TUNNEL.

WATER MAINS RELOCATED BY THE BOSTON TRANSIT COMMISSION DURING THE YEAR ENDING JUNE 30, 1905.

Size.	Feet Removed.	Feet Relaid.
2 inch	47	....
6 "	739	309
8 "	177	196
10 "	22	35
12 "	1,765	1,939
16 "	122	364
20 "	480	580
24 "	2,150	899
30 "	157	93
36 "	....	3,093
	5,659	7,508

NOTE. — This includes 3,093 feet of 36-inch pipe and 727 feet of 24-inch pipe together with some short lengths of smaller pipe relaid by the Water Department on account of removing the 24-inch pipe from Washington Street.

APPENDIX L–4.

WASHINGTON STREET TUNNEL.

SEWERS RELOCATED DURING YEAR ENDING JUNE 30, 1905.

SEWERS REMOVED.				RELAID.			
Size.	Shape.	Material.	Length.	Size.	Shape.	Material.	Length.
2′×2′	square	wood	230	4′–3″	circle	brick	243
17″×20″	square	wood	100	3′–6″×5′–3″	egg	"	1,598
2′×2′–6″	egg	brick	145	4′×3′	"	concrete	35
3′×2′	.....	"	325	4′×2′–8″	"	"	540
20″×30″	.....	"	150	3′	circle	"	526
24″	circle	"	775	3′	"	brick	378
20″	circle	"	250	2′–10″×4′–3″	egg	"	196
15″	.....	pipe	130	2′–6″×3′–9″	"	"	370
12″	.....	"	340	2′–9″×1′–6″	"	concrete	137
				2′×3′	"	"	154
				3′–6″×1′–3″	*	"	148
				2′–4″×3′–6″	egg	brick	435
				1′–8″×2′–6″	"	"	18
				24″		pipe	704
				20″		"	20
				18″		"	1,151
				15″		"	795
				12″		"	182
Total		.....	2,445	.....		.....	7,630

9 Catch basins built.
27 " " removed.

* Straight sides with semi-circle top and bottom.

APPENDIX L–5.

WASHINGTON STREET TUNNEL.

GAS MAINS RELOCATED DURING YEAR ENDING JUNE 30, 1905.

Size.	Linear Feet Removed.	Linear Feet Relaid.
3 inch.	20	....
4 "	411	40
6 "	5,885	456
8 "	1,140	....
10 "	2,251	....
12 "	1,910	296
20 "	80	270
Total.....	11,697	1,062

NOTE : This does not include about 2,600 feet of temporary 1½ inch, 2 inch and 3 inch wrought iron pipe laid in the street to supply the Company's customers while the street was open.

APPENDIX L 6.

EAST BOSTON TUNNEL.

WATER MAINS RELOCATED BY THE BOSTON TRANSIT COMMISSION DURING THE YEAR ENDING JUNE 30, 1905.

Size.	Feet Removed.	Feet Relaid
4 inch	....	38
12 "	22	16
16 "	120	117
Total	142	171