THE PORT OF NEW YORK AUTHORITY
111 EIGHTH AVENUE, NEW YORK, N. Y.

CROSS BAY UNION FREIGHT TUNNEL

1936 STUDY
BY
JOINT FACT FINDING COMMITTEE

December 1, 1936

THE PORT OF NEW YORK AUTHORITY

111 EIGHTH AVENUE, NEW YORK, N. Y.

CROSS BAY - UNION FREIGHT TUNNEL

Between Greenville, N. J. and Bay Ridge, N. Y.

New York Harbor

1936 STUDY BY JOINT FACT FINDING COMMITTEE

Consisting of Representatives of:

Pennsylvania Railroad

New Haven Railroad

Lehigh Valley Railroad

New Jersey Central Railroad

The Port of New York Authority

December 1, 1936

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New York, N. Y., April 8, 1937

Mr. M. W. Clement, *President*
Pennsylvania Railroad

Mr. E. E. Loomis, *President*
Lehigh Valley Railroad

Mr. H. S. Palmer, *President*
New York, New Haven & Hartford Railroad

Mr. E. W. Scheer, *President*
Central Railroad Co. of New Jersey

Commissioner Rudolph Reimer, *Chairman*
Special Committee on Cross Bay Union Freight Tunnel
The Port of New York Authority

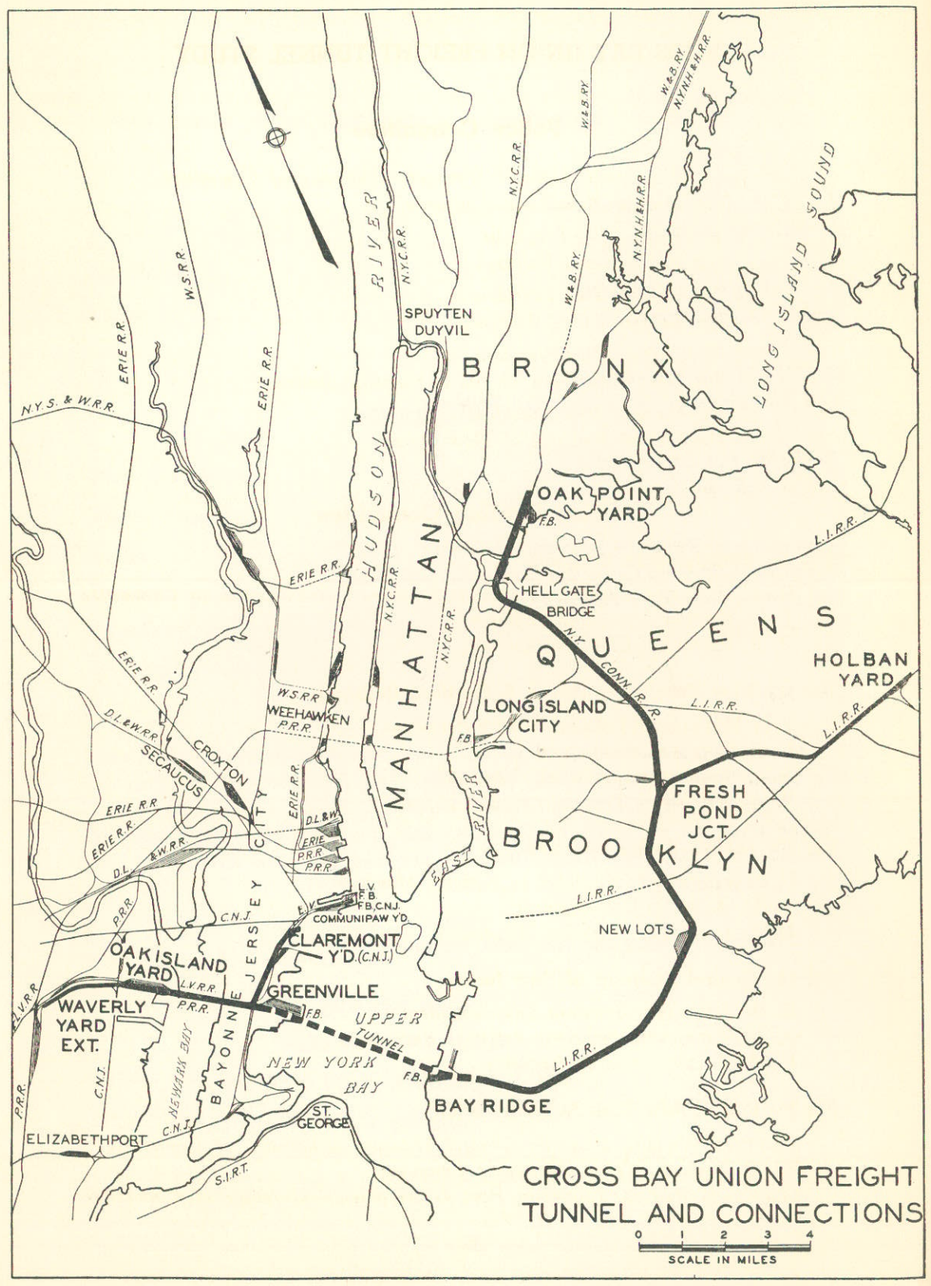
Dear Sirs:

I have been authorized and directed by the Policy Committee on the Cross Bay Union Freight Tunnel Study, consisting of representatives of The Port of New York Authority and those railroads herein addressed, to transmit to you a copy of a fact finding report on the Cross Bay Union Freight Tunnel between Greenville, N. J. and Bay Ridge, Brooklyn, prepared under the direction of the Policy Committee.

This report is being sent you under separate cover.

Yours very truly,
(*signed*) John E. Ramsey
Chairman, Policy Committee,
Cross Bay Union Freight Tunnel

EXHIBIT 1



CROSS BAY UNION FREIGHT TUNNEL STUDY

Policy Committee

JOHN E. RAMSEY, *General Manager—Chairman of Committee*
The Port of New York Authority

J. F. DEASY, *Vice-President*
The Pennsylvania Railroad

G. H. FOSTER, *Vice-President*
The Lehigh Valley Railroad

C. E. SMITH, *Vice-President*
The New York, New Haven & Hartford Railroad

R. W. BROWN, *Vice-President*
The Central Railroad of New Jersey

Fact Finding Committee

For the **Pennsylvania Railroad:**

G. F. WALTERS, *Supervisor, Freight Service—Vice-Chairman of Committee*
J. D. MOFFAT, *Assistant Engineer*
B. F. BRANDON, *Chief Accountant*

For the **New York, New Haven & Hartford Railroad:**

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L. E. GIFFORD, *Accountant*
A. C. E. MULLEN, *District Engineer*
W. P. KENNEDY, *Transportation Assistant*

For the **Lehigh Valley Railroad:**

F. HARTENSTIEN, *Assistant to General Manager*
A. M. KING, *Office Engineer*
H. F. LANDFEAR, *Division Accountant*

For the **Central Railroad of New Jersey:**

G. W. DEGRAFF, *Assistant Superintendent*
A. M. ZABRISKIE, *Principal Assistant Engineer*
P. M. KELLY, *Research Engineer*

For the **Port of New York Authority Staff:**

BILLINGS WILSON, *Assistant General Manager—Chairman of Committee*
W. P. HEDDEN, *Chief, Bureau of Commerce*
GLENN S. REEVES, *Engineer, Port Development—Secretary of Committee*

THE CROSS BAY UNION FREIGHT TUNNEL

(Greenville-Bay Ridge)

This report covers a joint study by the Staff of the Port Authority and representatives of the New Haven, Pennsylvania, New Jersey Central and Lehigh Valley Railroads of the economic practicability of constructing a single track, railroad freight tunnel betwen Greenville, Jersey City and Bay Ridge, Brooklyn, under upper New York Bay. This tunnel is part of Belt Line No. 1 of the statutory plan for the development of the Port of New York adopted by the States of New York and New Jersey in 1922 which the Port Authority is charged with effectuating.

Following a pubic hearing held by the Port Authority on September 10th, 1935, at which the railroads presented economic data on this subject differing from similar data in the possession of the Port Authority, conferences were held between the Port Authority staff and the four railroads which handle 88 per cent of the Cross Bay interchange. These led to the formation of a Policy Committee consisting of designated vice presidents of the aforementioned railroads and the General Manager of the Port Authority. The Policy Committee then created a Fact Finding Committee consisting of engineering, operating and accounting representatives of these four railroads and the Port Authority staff and instructed the Fact Finding Committee to make a new factual survey of the construction costs, general plan of operation and estimated economic savings from such a tunnel.

This tunnel is intended to replace the present carfloat method of interchanging freight cars between the southern group of New Jersey Railroads on the one hand and the Long Island and New Haven Railroads on the other, the latter also via the Hell Gate Bridge over the East River. The Port Authority believes that the tunnel would provide more dependable and expeditious handling of rail traffic across the harbor; eliminate carfloat delays occasioned by fogs, ice, storms and other interruptions to marine service; materially expedite the interchange of food, fuel, manufactured products and other freight, prevent delays that result in losses to shippers, consignees and railroads, release part of the New Jersey and Long Island waterfronts for steamship and industrial occupancy; improve the service to New England available to New Jersey shippers, and give the Boroughs of Brooklyn and Queens, having an aggregate population of 3,640,000 a dependable, all-rail, freight connection with the railroads of the United States lying west of the Hudson River.

To Mr. JOHN E. RAMSEY, *General Manager,*
The Port of New York Authority.

To Mr. J. F. DEASY, *Vice President,*
Pennsylvania Railroad.

To Mr. G. H. FOSTER, *Vice President,*
Lehigh Valley Railroad.

To Mr. C. E. SMITH, *Vice President,*
New York, New Haven & Hartford R.R.

To Mr. R. W. BROWN, *Vice President,*
Central Railroad of New Jersey.

} Policy Committee of the Cross Bay Union Freight Tunnel Study

Sirs:—

The Fact Finding Committee, of the Cross Bay (Greenville-Bay Ridge) Union Freight Tunnel Study, submits herewith a joint factual report of engineering costs, potential traffic and economic practicability of the proposed single track railroad freight tunnel under Upper New York Bay between Greenville, Jersey City, and Bay Ridge, Brooklyn.

Pursuant to program of study developed at your meeting of November 20, 1935, and communicated in letter of November 26, 1935, from Mr. J. E. Ramsey to other members of the Policy Committee, the Fact Finding Committee held its first meeting on December 2, 1935, in the office of the Port Authority. The Committee disregarded all previous studies of this project and made an entirely new approach to the whole problem. Also pursuant to instructions from the Policy Committee the study has been limited to the interchange traffic between the Pennsylvania, Lehigh Valley, and the New Jersey Central-B. & O. Railroads on the one hand and the New Haven and Long Island Railroads on the other, these railroads accounting for 88 per cent of the potential tunnel traffic.

The following constitutes a summary of our findings.

SUMMARY

Plan of Operation

The plan of operation proposed and subjected to economic analysis in this report was selected, after considering many possible plans, as being the most feasible and offering highest returns on the investment. Under this plan the present classification of interchange traffic would be continued using existing facilities with a minimum amount of new construction beyond the limits of the tunnel proper.

Electric locomotives would handle the traffic of the New Haven and Long Island Railroads to and from yards in New Jersey at Waverly, Greenville and Oak Island.

Other possible plans were considered but rejected as not justifying economic analysis.

Volume of Traffic and Tunnel Capacity

The actual interchange traffic between the railroads involved for the year 1935 amounting to 670,448 cars, has been used as the basis of this study. This traffic does not include any interchange from the northern group of New Jersey Railroads embracing the Erie Railroad, Lackawanna and West Shore Railroad.

The estimated daily capacity of the proposed single track tunnel may be considered as 5,000 cars or over twice the volume of traffic used in this study.

Engineering Plans and Estimates

The estimated cost of construction work and equipment necessary for the proposed plan of operation is as follows:

Tunnel including Approaches	$51,700,000
Changes and Additions at Greenville	1,800,000
Changes and Additions—Greenville to Claremont	81,000
Changes and Additions at Waverly and Oak Island	1,463,000
Changes and Additions at Fresh Pond	145,000
Sub-Total—Construction	$55,189,000
Electric Locomotives—thirteen	1,765,000
Total Construction and Equipment	$56,954,000

These costs are based on unit prices as of December 1935.

From an engineering standpoint the proposed tunnel presents no unusual construction problems and appears to be entirely feasible and can be constructed in 4½ to 5 years.

The top of the tunnel structure at the Brooklyn shore has been located a minimum of 57 feet below mean sea level. Even though the commerce of the port may require the deepening of the present channel another 5 feet, there would be a minimum of 10 feet of earth cover on top of the tunnel structure. The tunnel has been lengthened approximately one mile to reduce the ruling grades on the east approach from 1.77 per cent to 0.85 per cent. The latter grade, slightly above the 0.72 per cent eastbound grade of the Hell Gate Bridge, would not require the use of helper engines in the tunnel. The Committee considers the use of helper engines in this tunnel to be undesirable from a safety standpoint also because they would introduce light engine movements that would eliminate the reserve capacity of the tunnel needed for continuous operation.

Time Savings

The handling of interchange traffic via this tunnel, in lieu of carfloat, would expedite the movement, through the New York terminal zone on 68 per cent of the traffic, of which 29 per cent would be expedited 6 hours or more. This six hours saving is equivalent to 108,500 car days. If, to this is added some 14,100 car days due to elimination of fog and ice delays the total time savings on account of the tunnel is 122,600 car days. The reduction in time is most noteworthy in connection with the eastbound deliveries of the New Jersey Central and Lehigh Valley Railroads to the Long Island and the eastbound deliveries of the Lehigh Valley to the New Haven. The total time savings in car days if evaluated at $1.00 per day, amounts to $122,600 per year.

Indirect Benefits

In addition to the reduced car usage by reason of expedited operations in the New York district and elimination of fog and ice delays, there are a number of indirect savings which can be evaluated only in part. Taxes on labor payroll for social security and retirement purposes would be reduced by the net decrease in labor. Rerouting costs via the Poughkeepsie Bridge due to New York harbor fog and ice would be reduced. A partial evaluation of these items has been included in this report.

The Committee found it impossible to estimate in terms of dollars many of the advantages and benefits which would accrue from the tunnel project, including elimination of yard accumulations due to floating interruptions, reduction of harbor traffic and consequent lessening of hazard of collisions with shipping, stabilization of industry and tonnage on the lines of the carriers by providing all-rail connections across New York Harbor, enhancement of railroad business in competition with other forms of transportation on account of expedited service via tunnel, elimination of controversies and litigations over rate formulas involving float routes, advertising value of direct all-rail routes from the South and West into Long Island and New England, reduction in claims on account of lost markets, release of valuable waterfront property owned by the carriers and now occupied by floatbridges and yards for future development as shipping terminals and industrial property and general enhancement of good will through improved operation.

Net Operating and Other Economies

The operating savings have been calculated by comparing the increased train and car expenses under the proposed tunnel operation with reduced marine and yard expenses based on the judgment of the operating representatives of each railroad as to the number of tugs, floats, floatbridges or tug and switch engine crews that could be eliminated. A statement of these net operating savings, combined with such other economies as have been evaluated and the ratio of savings to new investment is shown below:—

Operating Savings	$ 2,097,901	
Added Expense	1,266,469	
Net Operating Savings	$ 831,432	
Indirect Savings	250,800	
Total Savings	$ 1,082,232	
Savings per Car (670,448 cars)	$ 1.61	
New Construction and Equipment		$ 56,954,000
Ratio of Savings to new investment ($56,954,000)		1.90%
Indirect Charges (Retirement of equipment and facilities and other expense incidental thereto)		$ 4,642,000

The Committee used operating costs, including maintenance, for the year 1935 in arriving at net savings.

The indirect charges represent sums which the railroads may wish to consider in calculating the economic benefits of the tunnel project but are not part of the new investment.

Analysis of maintenance costs over a period of years indicated a lower expenditure in 1935 per unit of operation than in predepression years, but the committee was unable to agree upon any evaluation of the extent to which 1935 maintenance is below normal. The Port Authority representatives believe that this amounts to a round figure of $85,000.

The margin of $833,000 between anticipated operating savings through discontinuance of the interchange of cars by floats and the present costs apportioned to this service is sufficiently large to indicate that substantial economies may be sought in the elimination of other elements of the marine and waterfront yard services as rapidly as possible. This difference represents charges which would be thrown upon other elements of the marine service such as pier station floating, lighterage and miscellaneous marine operations. The investigation of these features is outside this Committee's function.

The amount set forth as net savings applies to the project as a whole and does not measure the net effect on any individual road. No apportionment of ultimate cost to individual roads has been made for inter-railroad train service via the tunnel, service performed by one road for another or for operation, maintenance, rentals, and taxes on facilities, used jointly. Apportionment of such costs would be subject to agreement to be negotiated, of necessity, between the railroads affected.

General

It is recognized that the fundamental weakness of all economic studies of this character is the effort to deal with costs by deducting a few elements from an established whole and equating them to a theoretical cost under an assumed plan of operation.

The total cost of marine operation in New York harbor represents a very large sum. The Cross Bay interchange constitutes a very large part of the total cars or tonnage handled by the marine fleets but due to heavier loading of cars and floats, concentration of movement in off peak hours, and other factors, the proportion of total marine cost assignable to this service *on a performance basis is* considerably less than the ratio of the total marine traffic. The elimination of the Cross Bay interchange carfloating from the harbor waters would reduce by about one third the number of carloads of freight and empty cars given marine handling but the immediate results would be far less in reducing costs. Nevertheless, the shifting of the Cross Bay interchange from carfloats to tunnel route would be a long step forward in the progressive curtailment and coordination of all marine operations, which would achieve very great economies. It would also effect a very substantial reduction in the number of tug and carfloat movements in the harbor of New York, improving conditions for movement of other floating equipment. Therefore, it is essential that the proposal to substitute the tunnel for Cross Bay float interchange be looked upon merely as one step in a progressive scheme, and the immediate economies from the first step should be regarded as only partial.

The fairness of this point of view is emphasized by the finding in this report that there are $266,000 of marine costs and $567,000 of yard costs, $833,000 in all, which are now assigned or apportioned to the Cross Bay interchange but which

cannot be added to the $831,000 net operating savings, calculated by the Committee, because the equipment involved is used jointly in other services such as pier station floating and is required to take care of peak hour traffic demands in that or other services.

Important changes in present railroad operating methods, both in their terminal yards and line haul operations extending back to interior classification yards, would very likely result from the construction of this tunnel that would produce further economies. Based on practical experience with the new facility that cannot be foretold or measured at this time, it is conceivable, for example, that solid trains from points west of the Port District would in time be run through this tunnel to Long Island and to points in New England east of the Port District without any local yarding, and, in the case of the Pennsylvania Railroad, without even stopping to change engines.

No consideration has been given to the trend of Long Island and New Haven interchange traffic in future years as the railroad representatives on the committee are averse to making any such estimates. No attempt has been made to evaluate the effect of adding the Long Island interchange with the northern group of New Jersey Railroads to the tunnel route, this traffic in 1935 amounting to 93,245 cars. In this report it is proposed to continue to float this traffic, handling it through the present Bay Ridge yard of the Long Island Railroad. Floatbridge and yard operating expenses for this purpose have been allowed at Bay Ridge.

Respectfully submitted,

FACT FINDING COMMITTEE.

For the **Pennsylvania Railroad:**
Mr. G. F. Walter, *Supervisor, Freight Service—Vice Chairman of Committee.*
Mr. J. D. Moffat, *Assistant Engineer.*
Mr. B. F. Brandon, *Chief Accountant.*

For the **New York, New Haven & Hartford Railroad:**
Mr. J. O. Halliday, *Assistant to Vice President.*
Mr. L. E. Gifford, *Accountant.*
Mr. A. C. E. Mullen, *District Engineer.*
Mr. W. P. Kennedy, *Transportation Assistant.*

For the **Lehigh Valley Railroad:**
Mr. F. Hartenstien, *Assistant to General Manager.*
Mr. A. M. King, *Office Engineer.*
Mr. H. F. Landfear, *Division Accountant.*

For the **Central Railroad of New Jersey:**
Mr. G. W. DeGraff, *Assistant Superintendent.*
Mr. A. M. Zabriskie, *Principal Assistant Engineer.*
Mr. P. M. Kelly, *Research Engineer.*

For the **Port of New York Authority Staff:**
Mr. Billings Wilson, *Assistant General Manager—Chairman of Committee.*
Mr. W. P. Hedden, *Chief, Bureau of Commerce.*
Mr. Glenn S. Reeves, *Engineer Port Development—Secretary of Committee.*

SUPPLEMENTAL DATA

PLAN OF OPERATION

The purpose of constructing a railroad freight tunnel between Greenville, N. J., and Bay Ridge, Brooklyn, N. Y., is to provide an uninterrupted service the year round and quicken the movement through the New York gateway for interchange freight. It is practicable to operate through such a tunnel and use existing yard facilities with a decrease in the time required for the movement of interchange freight through the New York area by eliminating intermediate movements and yardings attendant to floating operations. The construction of the tunnel would have the effect of extending the New Haven and Long Island Railroad rail operation into New Jersey with connections to the Pennsylvania Railroad at Greenville, the Lehigh Valley Railroad at its Oak Island Yard and the New Jersey Central at Greenville.

Present Operations

At present, the New Haven-Pennsylvania Railroad freight is interchanged at Greenville, N. J., floated across the bay between Greenville and Bay Ridge by the New Haven Railroad, classified at, and dispatched from, Bay Ridge. Westbound freight is classified and dispatched from Greenville. The New Haven Railroad interchanges freight with the Lehigh Valley and New Jersey Central Railroads at Jersey City and moves it by float across the bay and East River between Jersey City and Oak Point where the eastbound freight is classified and dispatched in trains originating at Oak Point and Bay Ridge. Westbound freight for the New Jersey Central is classified and dispatched from Jersey City and the westbound freight for the Lehigh Valley is classified and dispatched at Jersey City and its Oak Island yard in Newark.

The interchange freight from the Pennsylvania, New Jersey Central and Lehigh Valley Railroads for the Long Island Railroad is delivered by float to the Long Island Railroad at Long Island City where it is classified and dispatched in trains to Long Island destinations. Westbound freight is floated from Long Island City to Greenville for the Pennsylvania and to Jersey City for the New Jersey Central and Lehigh Valley Railroads and dispatched along with freight from the New Haven and other points.

Proposed Operation

With the construction of the tunnel, the New Haven Railroad would receive its eastbound Pennsylvania freight at Waverly yard, its Lehigh Valley freight at Oak Island yard and the New Jersey Central freight at Greenville, and move it through the tunnel with New Haven motive power. On the westbound movements, the New Haven Railroad would deliver cars to the Pennsylvania and New Jersey Central at Greenville and to the Lehigh Valley at Oak Island yard.

The Long Island Railroad eastbound interchange freight, with the tunnel in operation, would be picked up at the three New Jersey yards already mentioned

and moved through the tunnel by Long Island motive power. Westbound, the Long Island would deliver interchange cars to the Pennsylvania and New Jersey Central at Greenville and to the Lehigh Valley at Oak Island.

Floating Operations

The present Cross Bay interchange floating operations for those railroads operating through the tunnel would be discontinued and a number of tugs, car floats, float bridges and float yards would be abandoned. The floatbridge operation at Greenville and at Long Island City would be entirely abandoned. The New Jersey Central and Lehigh Valley Railroads would curtail marine operations, maintaining only sufficient floating service as would be required for the New York pier station and other float interchange with the northern group of New Jersey Railroads. At Bay Ridge, the Long Island Railroad would abandon two of the four float bridges and receive there the interchange from the Erie, Lackawanna and New York Central Railroads instead of at Long Island City as at present.

Yard Operations

Operation through the tunnel would not materially change the present yard practices except the yards now used for float bridge operations, which would be curtailed or abandoned. The yard operations now performed at Bay Ridge for the Pennsylvania interchange would be transferred to the Waverly extension yard (P.R.R.) in New Jersey.

The Long Island City yard operations of the Long Island Railroad would be curtailed and these operations transferred to Holban Yard and Fresh Pond, on Long Island, and to Waverly Extension (P.R.R.) in New Jersey. The Long Island Railroad yard operations at Bay Ridge would provide for the handling of the interchange from the Erie, Lackawanna and New York Central Railroads now received at Long Island City.

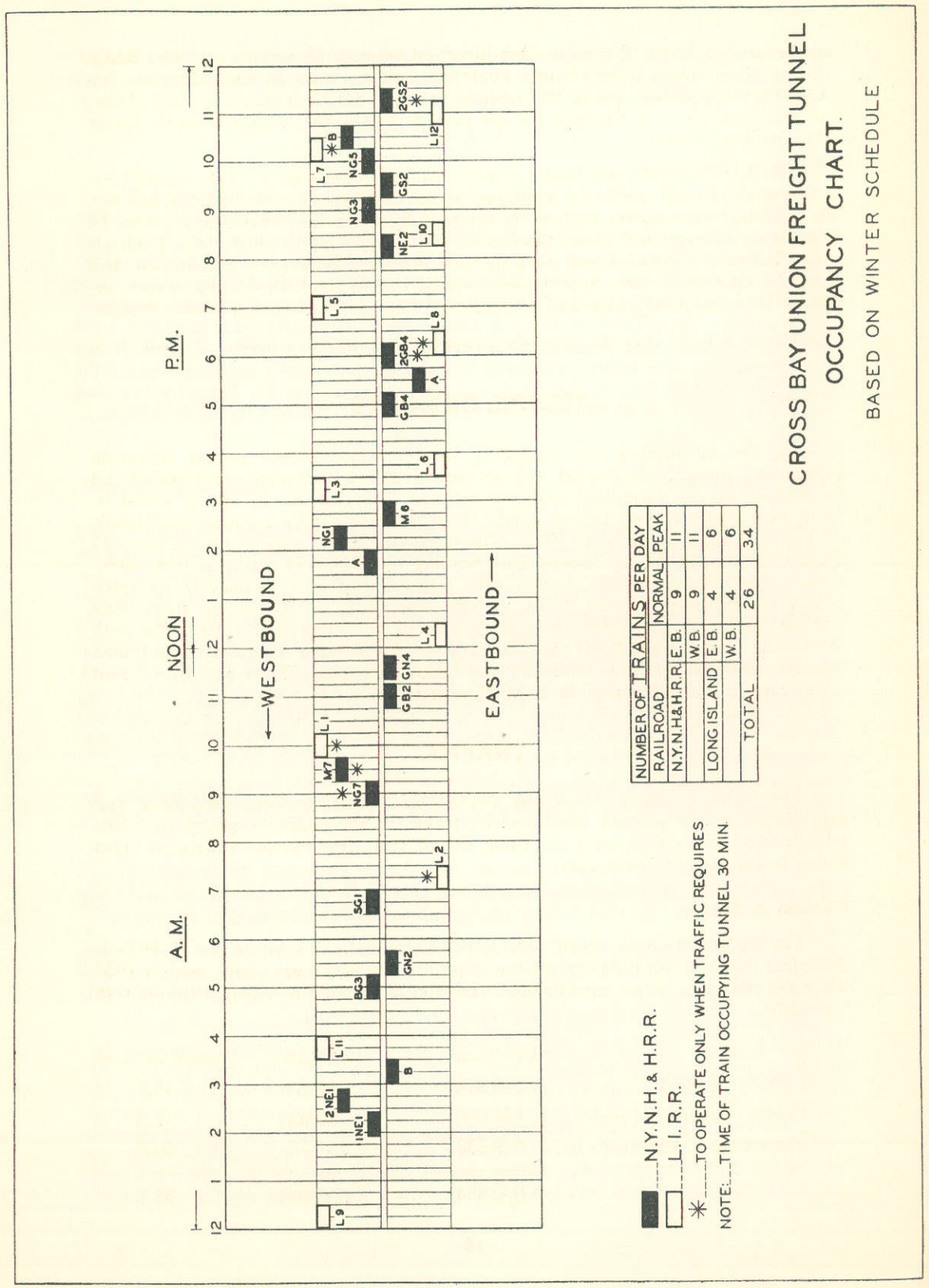
At Greenville, the float bridge yard operations would be discontinued but the westbound tunnel traffic for the Pennsylvania would be classified there as at present.

The Lehigh Valley yard operations at Jersey City would be curtailed due to the removal of the interchange floating to and from the New Haven and Long Island Railroads. Its Oak Island operations would be continued as at present.

A similar situation would hold at the Communipaw yard of the New Jersey Central, namely, curtailment of the float bridge yard operations, with no substantial change in other yard operations. A new transfer service for tunnel traffic would be operated between Communipaw and Greenville.

Tentative Schedule

To move the average New Haven interchange traffic, seven symbol train movements and two shuttle movements are necessary daily in each direction to and from the New Jersey yards. When peak traffic is moving two additional trips in each direction would be needed. These train movements replace the present



float service of 12 to 18 tows in each direction between Greenville and Bay Ridge for the New Haven-Pennsylvania interchange; four tows in each direction between the New Jersey Central at Communipaw and the New Haven at Oak Point; and four tows in each direction for the Lehigh Valley interchange between Jersey City and Oak Point.

The Long Island interchange would require a minimum of four round trips daily via the tunnel, with two additional round trips when peak traffic is moving. These tunnel movements replace the present float service consisting of 6 to 12 tows in each direction between Greenville and Long Island City for the Pennsylvania Railroad freight; three tows in each direction between Communipaw and Long Island City for the New Jersey Central freight, and three tows in each direction between Jersey City and Long Island City for the Lehigh Valley freight.

The scheduled train movements through the tunnel are shown on Exhibit 2.

TUNNEL CAPACITY

On the assumption that signalling in the tunnel would permit following movements through the tunnel and so spaced that a following train would not be stopped on the ascending grade, a total of 17 trains, 11 of which would be New Haven and 6 Long Island, would be required to handle the eastbound traffic on the peak days in the year 1935. The peak westbound movements requires 11 New Haven and 6 Long Island trains, making a total of 34 trains in both directions. The capacity of the tunnel with schedules as now tentatively indicated would be approximately 50 trains in both directions, or 50 percent more than required to handle the traffic on peak days in 1935. At present (1935) the peak movement ranges from 1,200 to 1,500 cars per day in each direction. The tunnel capacity based on tentative schedules and trains averaging 100 cars each, is about 2,500 cars in each direction in a 24 hour period.

TRAFFIC

The traffic assumed to use the Cross Bay Tunnel between Greenville and Bay Ridge, in the present study, is the traffic of the southern group of roads interchanged by carfloat with the Long Island and New Haven Railroads. This traffic in 1935 was 670,448 cars.

Decline in Traffic

The traffic which has been considered potential to this tunnel as of 1935 is 35% less than that in 1929, the post war peak. The minimum traffic was in 1933 when 636,468 cars were interchanged. Exhibit 3 shows the yearly variations in this traffic.

Railroad	1929 Traffic	1935 Traffic	Percent Decrease
C. N. J. & B. & O.....	249,818	135,676	45.7
Lehigh Valley Railroad.....	154,098	96,800	37.2
Pennsylvania Railroad	628,538	437,972	30.3
	1,032,454	670,448	35.1

EXHIBIT 3

CROSS BAY UNION FREIGHT TUNNEL

LOADED AND EMPTY CARS INTERCHANGED—EASTBOUND AND WESTBOUND

BY YEARS 1923—1935 INCLUSIVE

Year	New York, New Haven & Hartford Railroad With				Long Island Railroad With			Total L.I. & N.H. Railroads
	Penn RR.	C.N.J.	L.V. RR	Total	Penn RR	L.V. RR	CNJ-B&O	
1923	341,541	95,279	103,090	539,910	150,197	34,919	93,582	818,608
1924	345,053	94,543	117,302	556,898	142,435	34,611	93,783	827,727
1925	389,396	107,396	131,756	628,548	155,661	37,172	94,482	915,863
1926	415,153	123,025	142,199	680,377	182,605	38,179	104,140	1,005,301
1927	425,785	124,132	133,542	683,459	179,686	41,177	106,608	1,010,930
1928	431,360	143,041	122,063	696,464	176,989	43,618	108,972	1,026,043
1929	445,208	153,360	110,801	709,369	183,330	43,297	96,458	1,032,454
1930	413,061	136,677	95,287	645,025	193,466	39,434	91,619	969,544
1931	374,466	118,205	79,837	572,508	194,955	36,686	74,305	878,454
1932	282,994	83,398	66,614	433,006	155,483	28,660	58,651	675,800
1933	276,535	82,834	69,803	429,172	130,978	25,653	50,665	636,468
1934	286,973	91,294	73,959	452,226	132,067	26,683	51,975	662,951
1935	295,493	88,958	72,643	457,094	142,479	24,157	46,718	670,448

Interchange Traffic By Months

The monthly movement of cars, eastbound and westbound, interchanged with the Long Island and New Haven for 1935, follows:—

Month	New Haven R.R. with PRR, CNJ, LV	Long Island R.R. with PRR, CNJ-B&O, LV	Total Interchanged
	706*		706*
January	33,518	16,160	49,678
February	37,802	17,862	55,664
March	39,028	18,830	57,858
April	39,376	20,199	59,575
May	38,326	19,251	57,577
June	41,931	18,242	60,173
July	40,177	15,694	55,871
August	35,266	14,718	49,984
September	36,531	16,666	53,197
October	39,799	19,977	59,776
November	37,006	17,367	54,373
December	37,628	18,388	56,016
Total	457,094	213,354	670,448

(*)—Cars through Pennsylvania Railroad Station on account of floating ice in habor.

Average Daily and Peak Movement

The average movement per day together with the actual peak movement for a day in 1935 is shown in the following table:—

Eastbound	To New Haven Railroad		To Long Island Railroad		Total Cars		Percent
	Av.	Peak.**	Av.	Peak***	Av.	Combined Peak	Av.
Pennsylvania	393	514	198	247	591	761	65
New Jersey Central	118	199	64*	106*	182	305	20
Lehigh Valley	105	156	34	60	139	216	15
Total	616	869	296	413	912	1,282	100
Percent	68	—	32	—	—	—	100

Westbound	From New Haven Railroad		From Long Island Railroad		Total Cars		Percent
	Av.	Peak.**	Av.	Peak***	Av.	Combined Peak	Av.
Pennsylvania	417	791	192	282	609	1,073	66
New Jersey Central	126	273	64*	127*	190	400	20
Lehigh Valley	94	157	32	60	126	217	14
Total	637	1,221	288	469	925	1,690	100
Percent	69	—	31	—	—	—	100

(*) Includes Baltimore and Ohio interchange.
(**) February 10, 1935.
(***) April 19, 1935.

The average daily cars was determined by taking the total number of eastbound and westbound cars respectively for the year and dividing by 365.

ENGINEERING DATA

The construction of a tunnel between Greenville and Bay Ridge is feasible and presents no unusual problems of design or construction. The proposed project is a single-track freight tunnel connecting the Bay Ridge Branch of the Long Island Railroad in Brooklyn with the Pennsylvania Railroad tracks in New Jersey. The tunnel, with its eastbound ruling grade of 0.85 percent and 1.20 percent westbound, is 6.78 miles long from end to end of tunnel approach grades. From portal to portal, it is 5.52 miles long, of which 3.25 miles is under Upper New York Bay.

Routes In Brooklyn

Two locations were considered and are shown on Exhibit 4.

ROUTE A: Follow the right-of-way of the Bay Ridge Division of the Long Island Railroad eastwardly from the present Bay Ridge float bridges.

ROUTE B: Pass under the slips and piers of the U. S. Army Base to 61st Street, Brooklyn, continue under this street to Eighth Avenue and then follow eastwardly the right-of-way of the Bay Ridge Division of the Long Island Railroad.

Route B—Adopted

For the purpose of this study, Route B and an eastbound ruling grade of 0.85 per cent was adopted. The advantages of Route B over Route A are:—

1. Lesser cost by $200,000.00
2. Shorter length between portals by 330 feet
3. Less curvature by 42°
4. Better drainage conditions during construction
5. Less interference with Bay Ridge float bridges during construction.

Consideration in the selection of Route B has been given to the necessity of obtaining an easement under the U. S. Army Base and an authorization to place the tunnel under 61st Street, both of which appear feasible.

Route In Greenville

The New Jersey shore is low and flat, presenting no difficult problems. The route selected places the westerly end of the tunnel in the southerly portion of the Greenville Yard of the Pennsylvania Railroad, where connections can conveniently be made with the railroads using the tunnel.

Construction Methods

Consideration was given to practices and methods of tunnel construction which might be used for the Greenville-Bay Ridge location.

Due to the probability of encountering soil glacial in character; the necessary depth of tunnel to permit future channel dredging; the large portion of the tunnel

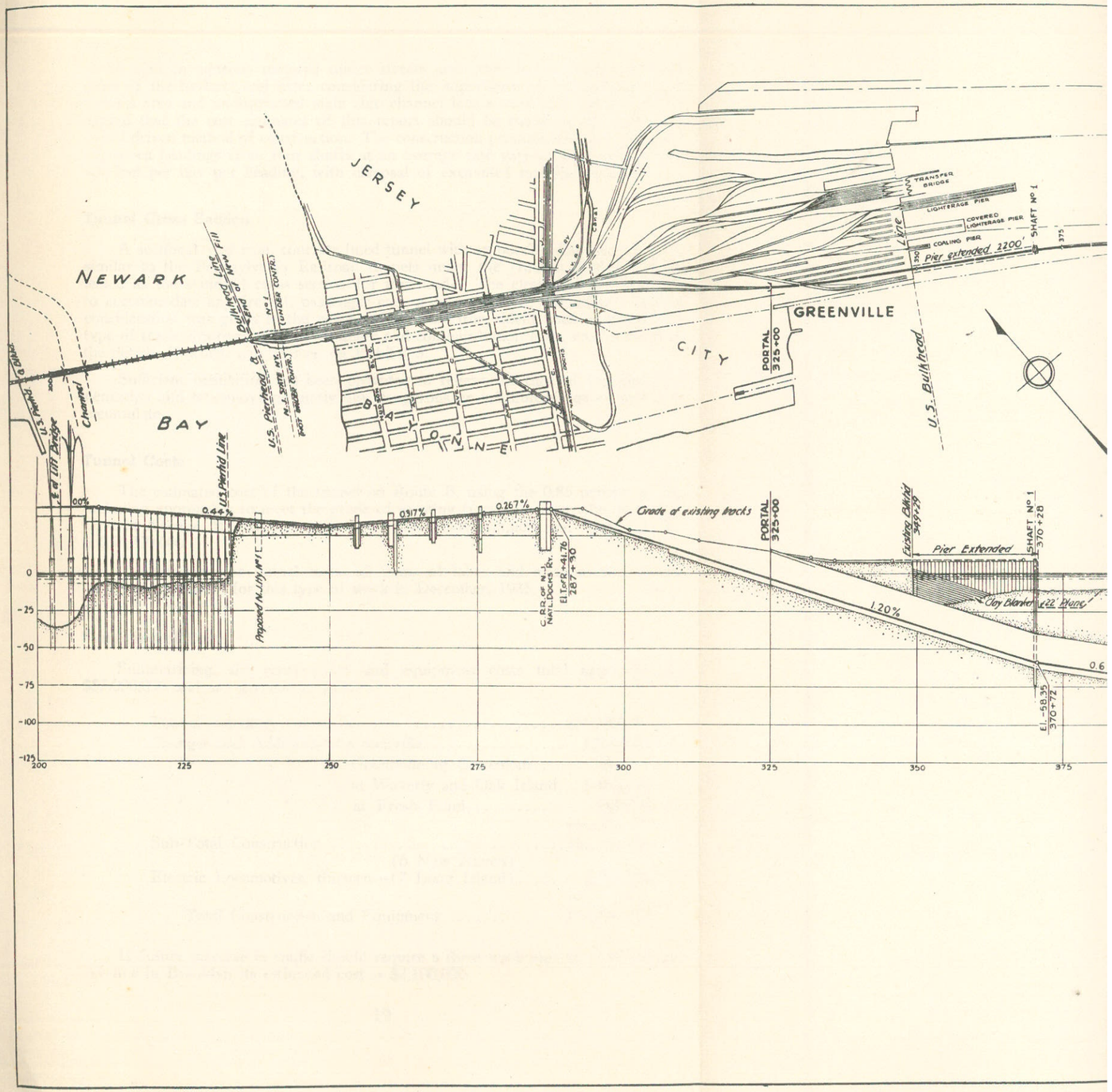
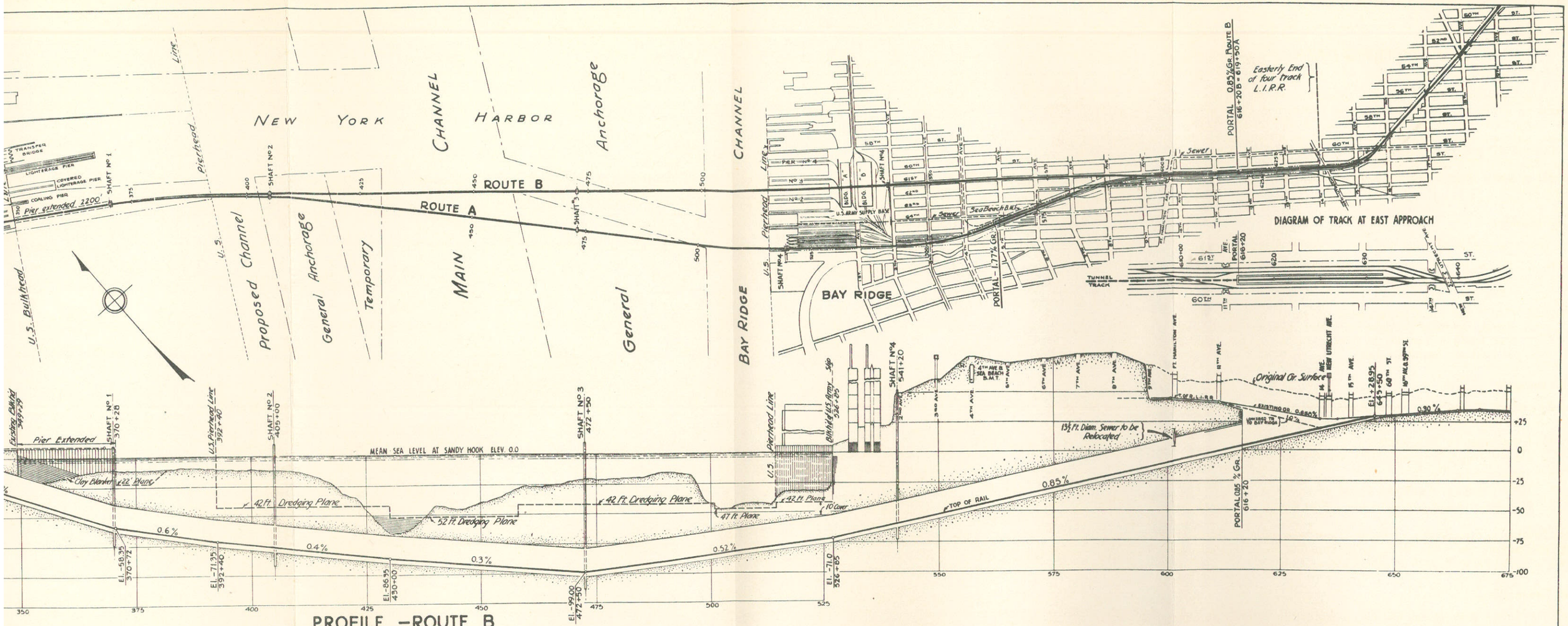


EXHIBIT 4



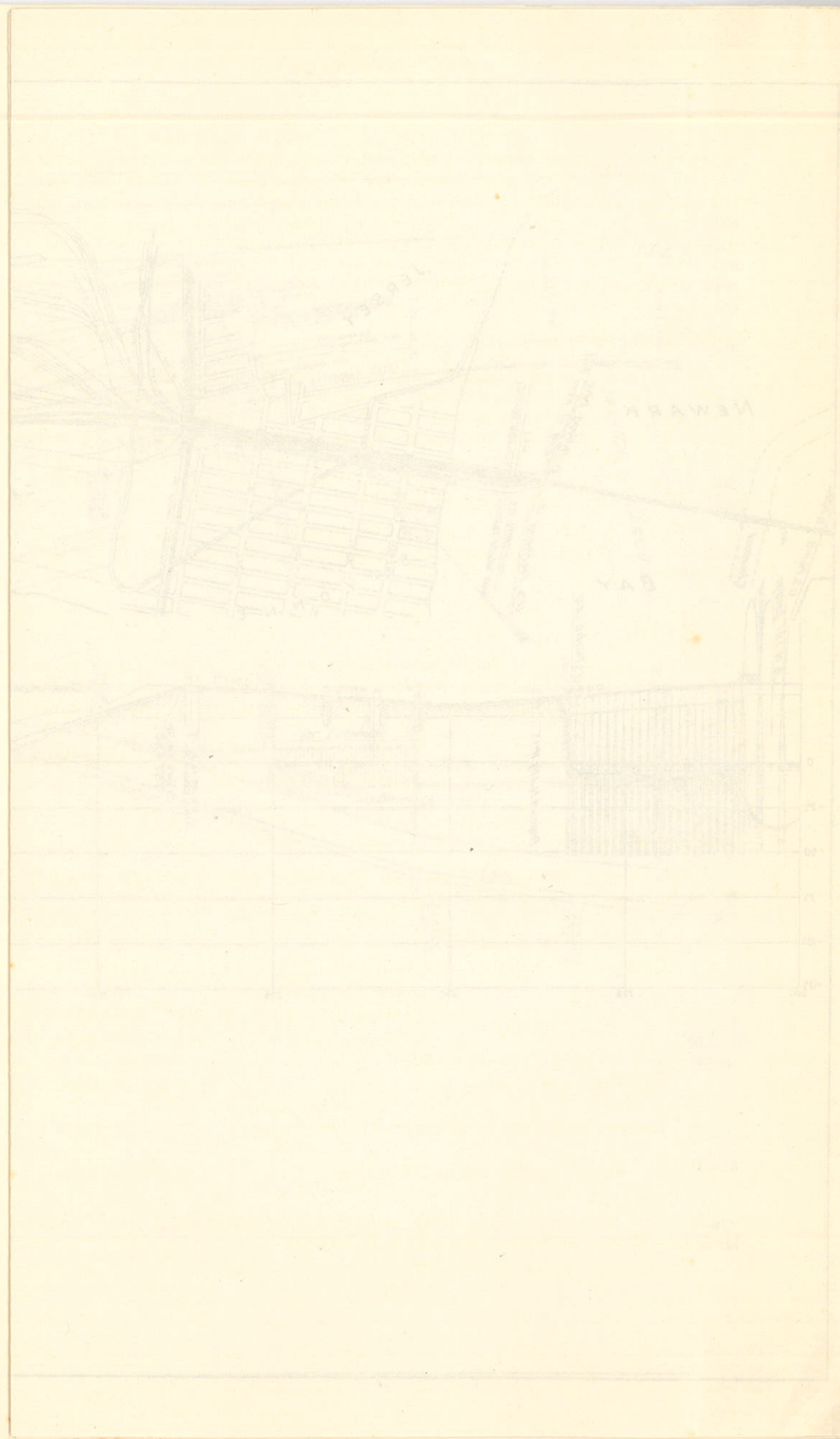
PROFILE – ROUTE B

DIAGRAM OF TRACK AT EAST APPROACH

CROSS BAY UNION FREIGHT TUNNEL
ROUTE A AND ROUTE B
GREENVILLE, N.J. TO BAY RIDGE, BROOKLYN

HORIZONTAL SCALE IN FEET 1000 0 1000 2000

VERTICAL SCALE IN FEET 25 0 25 50 75 100



to be built in aqueous material under streets and other improvements on both sides of the harbor; and after considering the importance of maintaining at all times a free and unobstructed main ship channel into a very busy harbor, it was agreed that the cost estimates of this report should be based on the shaft and shield driven method of construction. The construction program provides for driving seven headings from four shafts at an average rate varying between five and six feet per day per heading, with disposal of excavated material at sea.

Tunnel Cross Section

A sectional, cast iron, concrete lined tunnel with an outside diameter of 23′3″, similar to the Pennsylvania Railroad tunnels under the Hudson River, was selected as the standard cross section for this study. The clearances are adequate to accommodate any freight, passenger car, or locomotive in use today. Careful consideration was given to the weight of the cast iron shield, interior clearances, type of track, drainage, space for supply and communication lines, and ventilation, the details of which will be seen on Exhibit 5.

Sufficient ventilation has been provided to relieve the tube of fog and condensation and to remove promptly any dangerous or inflammable gases that may accumulate.

Tunnel Costs

The estimated cost of the tunnel on Route B, using the 0.85 percent grade, including approaches to meet the grade of existing tracks at Greenville, and New Utrecht Avenue, Brooklyn, a distance of 6.78 miles, complete and ready for use, is $51,700,000.

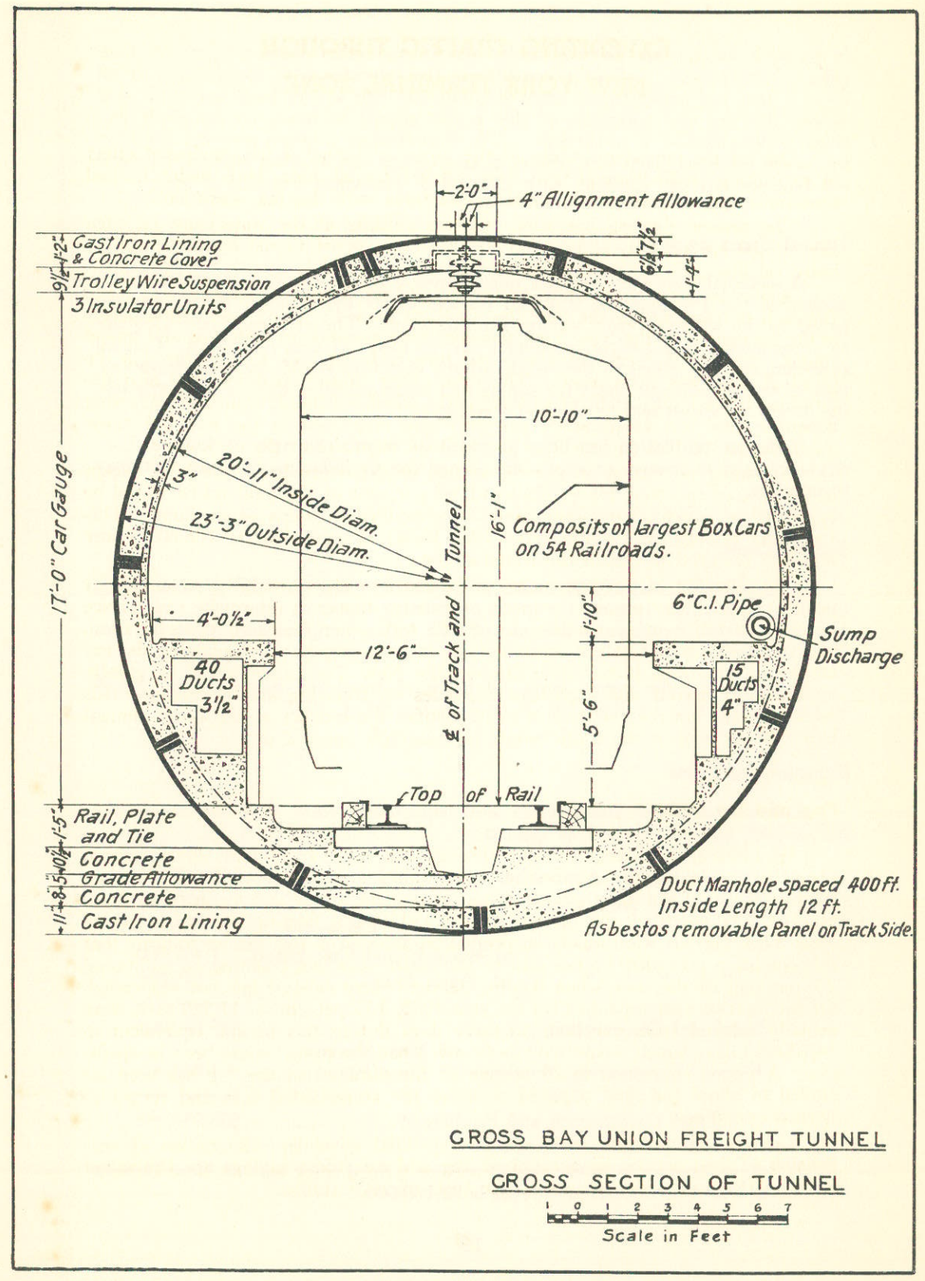
In estimating the tunnel costs, all items of labor and material were based on prices prevailing for this type of work in December, 1935.

Summary of Costs

Summarizing, the construction and equipment costs total approximately $57,000,000 and are divided as follows:

Tunnel including Approaches	$51,700,000
Changes and Additions at Greenville	1,800,000
" " " Greenville to Claremont	81,000
" " " at Waverly and Oak Island	1,463,000
" " " at Fresh Pond	145,000
Sub-Total Construction	$55,189,000
Electric Locomotives, thirteen—(6 New Haven) (7 Long Island)	1,765,000
Total Construction and Equipment	$56,954,000

If future increase in traffic should require a third track east of New Utrecht Avenue in Brooklyn its estimated cost is $2,100,000.



EXPEDITING TRAFFIC THROUGH NEW YORK TERMINAL ZONE

One of the important values of the proposed tunnel is its anticipated effect in expediting traffic through the New York terminal zone, both under normal conditions and at times when weather interferes with floating operations.

The present floating operation requires yarding at the waterfront on each side of the harbor. By eliminating floating in favor of tunnel operation one or more yardings are rendered unnecessary.

A one day time check of all eastbound and westbound loaded cars was made for each railroad, noting the time that each car passed selected observation points at the boundaries of the New York terminal zone, common to both float and tunnel routes. From this check day the actual time each car took to pass through the terminal zone was determined. The time under tunnel operation was also determined by assigning each car to a regularly scheduled tunnel train after allowing adequate time for classification, assembly and inspection in the terminal yards according to the best judgment of the railroad members of the committee.

Assuming no change in present arrival or departure train schedules except in the case of the New Haven Railroad, 68 per cent of the total traffic would be expedited of which 29 per cent would be expedited as much as six hours. This six hours savings on 194,430 cars (1935 basis) is equivalent to 108,500 fewer car days required to transit the terminal zone.

The speeding of car movement by six hours or more would be advantageous in many ways. Car usage is reduced, service to shipper is improved, rail service is more attractive in competition for traffic with other forms of transportation, and yards are cleared of car accumulations more promptly. Undoubtedly, the examples of improved transit time through the New York zone would be greatly multiplied if arrival and departure schedules on receiving and delivering roads were adjusted but the evidence in hand justifies the conclusion that on an annual basis, 29 per cent of the traffic would be materially speeded up.

Fog and Ice Delay

In addition to savings in time through the New York zone under normal operating conditions through the use of the tunnel route, there are instances when the tunnel would eliminate serious delays on account of fog and ice in New York Harbor. The check of the periods during 1935 when floating operations across New York Harbor were totally suspended on account of fog and ice indicate that this condition prevailed 2.3 per cent of the entire year, not counting an additional 2.7 per cent of the time when floating services were delayed but not suspended. Of the total cars interchanged for the year 1935, 1.72 percent, or 11,520 cars, were actually delayed from one hour to three days during this period, equivalent to 14,100 car days which would have been saved had the tunnel route been in operation. A period equivalent to 25 percent of the duration of the fog has been included to allow for time required to move the accumulated cars and return to normal operations.

Considering the time saved due to expedited schedules; elimination of suspension of float service on account of fog and ice; these savings are equivalent to 122,600 car days per annum on the basis of 1935 traffic.

ECONOMIC PRACTICABILITY OF TUNNEL PROJECT

The proposed tunnel project has been subjected to the economic test of comparing the increased costs of operating via the tunnel route with savings to be made through reductions in present marine, floatbridge and yard costs. The net savings are then calculated on a per car basis and as a percentage return on the new investment required.

Benefits

Operating economies, however, are not the sole benefits to be derived from the substitution of a tunnel for the present carfloat operation across New York Harbor. Decisions to construct large railroad engineering projects, have in the past been based in part upon anticipated results in expediting traffic, decreasing car usage, enhancing business, and in the case of bridges and tunnels, eliminating interruptions due to adverse weather conditions in New York Harbor. The same considerations apply to the Cross Bay Union Freight Tunnel Project.

Operating Savings

The investment cost, operating expenses, and net saving under the tunnel plan, are summarized below:—

New Construction and Equipment		$56,954,000
Savings		
Floating Equipment	$ 1,055,532	
Floatbridges	207,049	
Yard Operation and Maintenance	835,320	
	$ 2,097,901	
Increased Expenses		
Train and Car Expenses	$ 656,790	
Yard Expenses	314,893	
Signal Operation	32,900	
Maintenance	136,523	
Taxes—New investment outside tunnel	125,363	
	$ 1,266,469	
Net Savings from Operation	831,432	
Ratio of operating savings to investment in new construction and equipment ($56,954,000)		1.46 per cent
Operating Savings per car (670,448 cars)		$ 1.24

Indirect Economies

Other indirect economies and charges, resulting from the abandonment of the float routes, were considered and insofar as possible evaluated by the Committee. The indirect charges represent sums which the railroads may wish to consider in calculating the economic benefits of the tunnel project, but are not part of the new investment. The indirect savings and expenses are as follows:—

Indirect Savings (Per Annum)

Reduced car days per annum through expedited schedules if evaluated at $1.00 per car day	$ 108,500
Reduced car days through elimination of suspended marine service on account of weather conditions, if evaluated at $1.00 per car day	14,100
Elimination of present costs of re-routing freight on account of suspension of marine operations resulting from weather conditions.*	7,200
Port Authority estimate of increased savings per annum by adjustment of 1935 maintenance figures	85,000
Saving in security and retirement taxes account decreased labor payroll.**	36,000
Total Indirect Savings	$ 250,800
Net Operating Savings	831,432
Total Savings	$ 1,082,232
Savings per car (670,448 cars)	$ 1.61
Investment (New Construction and Equipment)	$56,954,000
Ratio of total savings to new investment ($56,954,000)	1.90%

(*) In the event of stoppage in the tunnel of considerable duration, the tunnel operation would be subject to similar cost.

(**) During the first 5 years, the total saving (at $36,000 per annum) of $180,000 would be partly offset by taxes on dismissal wage payments, amounting to $72,000, leaving a net for the 5-year period of $108,000 or $21,600 average per annum. After sixth year full savings of $36,000 per annum would accrue.

Indirect Charges

Profit and Loss Charge, account retirement of unamortized equipment and facilities	$ 3,102,000
Other expense incidental to retirement of equipment and facilities	$ 1,540,000
Total Indirect Charges	$ 4,642,000

Methods Used In Calculating Tunnel Economies

The calculation of reduced expenses on account of transferring Cross Bay interchange from the marine operation to the tunnel route was based upon estimates of the operating representatives of each railroad as to the number of complete physical units (i.e. tugs, floats, floatbridges, etc.) or complete crews (tug, switch engine, etc.) which could be eliminated, these units evaluated at going rates of wages, maintenance costs, etc.

Increased expenses for train and car operations were calculated by applying unit transportation costs to the added crews or cars, car miles, trains, train miles, etc. called for by the tunnel operating schedule.

Increased yard expenses were based upon engine crews and yard employees necessary to handle cars routed via the tunnel.

Signal operation and maintenance of tunnel, tracks, roadway, signals, electrification and taxes were computed on the basis of the best available experience.

All costs, including maintenance, are based upon the year 1935. It is the usual practice to compute maintenance costs over a period of three to five years in order to eliminate variations due to extraordinary change in a single year. In this instance, however, after examining maintenance figures for the past five years, it is concluded that 1935 is as representative as an average of those years, all of which were in the depression period.

Do 1935 Costs Represent Normal Maintenance?

Maintenance expenditures in 1935 (and the four years immediately preceding) were materially less per unit of operation than in pre-depression years (1924-1930). The Port Authority members of the Committee believe that the lower maintenance expenditures in recent years represent, in larger part, deferment of maintenance due to depression and, therefore, the 1935 figures are subnormal. The railroad members of the Committee, on the other hand, are of the opinion that the effect of subnormal maintenance, if any, cannot be appraised at this time.

Since more maintenance would be saved by abandonment of the float operation than will be incurred in the tunnel operation, the Port Authority members believe some weight should be given to the subnormal character of the 1935 figures. They have concluded, after a careful examination of all available evidence, that the 1935 maintenance costs are approximately one-third below normal and, therefore, the net 1935 maintenance savings (which are approximately $170,000) might reasonably be increased by 50 per cent, adding $85,000 to the savings indicated in the economic proof.

THE PORT OF NEW YORK AUTHORITY
111 EIGHTH AVENUE, NEW YORK, N. Y.

CROSS BAY UNION FREIGHT TUNNEL

1936 STUDY
BY
JOINT FACT FINDING COMMITTEE

December 1, 1936