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DELAWARE RIVER PORT AUTHORITY

REPORT TO

GOVERNOR DAVID L. LAWRENCE

AND

GOVERNOR ROBERT B. MEYNER

AND THE

LEGISLATURES OF PENNSYLVANIA AND NEW JERSEY

SOUTHERN NEW JERSEY RAPID TRANSIT SYSTEM

HADDONFIELD - KIRKWOOD LINE

New Jersey State Library

APRIL 1961

IN WITNESS WHEREOF, this _____ day of _____, 1961, DAVID L. LAWRENCE, has affixed his signature hereto as Governor of the Commonwealth of Pennsylvania and caused the great seal of the Commonwealth to be attached thereto.

_____

GOVERNOR
COMMONWEALTH OF PENNSYLVANIA

Attest:

_____

SECRETARY OF THE COMMONWEALTH

IN WITNESS WHEREOF, this _____ day of _____, 1961, ROBERT B. MEYNER, has affixed his signature hereto as Governor of the State of New Jersey and caused the great seal of the State to be attached thereto.

GOVERNOR
STATE OF NEW JERSEY

Attest:

SECRETARY OF STATE

DELAWARE RIVER PORT AUTHORITY
OF
PENNSYLVANIA AND NEW JERSEY
ADMINISTRATION BUILDING
BENJAMIN FRANKLIN BRIDGE PLAZA
CAMDEN 1, NEW JERSEY

April 19, 1961

TO THE HONORABLE:

Governor David L. Lawrence

Governor Robert B. Meyner

and the

Legislatures of the Commonwealth of Pennsylvania

and the

State of New Jersey

REPORT

In accordance with Article XII of the Agreement between the Commonwealth of Pennsylvania and the State of New Jersey, creating the Delaware River Port Authority, the said Delaware River Port Authority hereby respectfully reports that after investigation and study, this Authority has concluded plans with estimates of costs and means of financing for a new facility and project, for a purpose described in Article I, subdivision (j) of the Compact creating said Authority. This report in detail consists of the following:

1. This letter of transmittal, report and recommendation addressed to the Governor and Legislature of the Commonwealth of Pennsylvania and of the State of New Jersey.
2. Pertinent resolution of the Authority.
3. Report to the Authority by Simpson & Curtin, Engineers, on the engineering feasibility of the proposed Philadelphia—Camden—Haddonfield—Kirkwood Line, and exhibits thereto.
4. Report to the Authority by Drexel & Company on the financial feasibility of the proposed Philadelphia—Camden—Haddonfield—Kirkwood Line.

For almost a generation there has been a constant demand for a transportation system connecting Philadelphia and Camden and the nearby New Jersey suburbs which would provide a rapid, convenient and comfortable service, and attract sufficient patronage to decrease highway congestion.

Numerous reports concerning the feasibility of such a plan have been prepared by recognized consultants. In 1954 the Authority engaged the well-known firm of Parsons, Brinckerhoff, Hall and MacDonald to make a comprehensive study of the rapid transit possibilities in this area. Their report, submitted in January 1956, recommended construction of a three-corridor, conventional rail-type system, using existing rights-of-way from the present Camden-Broadway Station of the Pennsylvania-Reading Seashore Line, the construction of a tunnel under the Delaware River, and a new subway system under Arch Street, Philadelphia. The estimated cost of this total facility, at 1955 prices, was $242,000,000, exclusive of financing charges. The total cost of such a project was prohibitive.

The City of Philadelphia has, for many years, been concerned with commuter transportation within all of its suburban areas, including Camden and Southern New Jersey. The Philadelphia Urban Traffic and Transportation Board engaged the engineering firm of Louis T. Klauder & Associates to study the feasibility of a high speed transit system between Philadelphia, Camden and South Jersey suburbs, and on March 20th, 1959, that firm submitted their report entitled "Plan for a High Speed Mass Transit System between Philadelphia and Camden and South Jersey Suburbs." The Klauder recommendations differed from the Brinckerhoff report in that they contemplated using the existing rail line on the Benjamin Franklin Bridge and the present subway connection in Philadelphia. Estimated construction cost for a three-corridor system under the Klauder plan was, at 1960-1962 price level, $89,000,000.

Both the engineering and financial sections of this report are evaluations of a portion of the Klauder report, and pertain to the Philadelphia—Camden—Haddonfield—Kirkwood Line only.

After due consideration, this Authority made an exhaustive investigation and detailed study of the feasibility of the Philadelphia—Camden—Haddonfield—Kirkwood Line, as outlined by Klauder, and engaged the firm of Simpson & Curtin, traffic and transportation consultants, to evaluate that portion of the Klauder report and to submit its findings.

The Simpson & Curtin evaluation and report, received by the Authority in January of 1960, was immediately referred to its Transportation Committee for its study and recommendation.

The Simpson & Curtin report recommends a grade-separated facility using the existing Locust Street Subway in Philadelphia, and the existing Bridge Line to Broadway Station in Camden. At that point the line is to emerge from the subway and occupy a portion of the right-of-way of the Pennsylvania-Reading Seashore Line to the Kirkwood terminal. A single railroad track, permitting continued operation of specific services of the Pennsylvania-Reading Seashore Line, was to be retained by the railroad.

After more than a year of intensive study, including numerous committee conferences, meetings with governmental officials and other interested parties, the Transportation Committee recommended specific revisions to the Simpson & Curtin report, in order to meet either in whole or in part the suggestions of local authorities to the extent that they were financially feasible. These changes increased the costs of the proposed project by $5,420,000. The Transportation Committee's investigations included inspection tours of similar transit facilities located at Long Island, New York; Chicago, Illinois; Cleveland, Ohio; and Toronto, Ontario. The suggestions of the communities expected to patronize the facility were solicited and thoroughly investigated. Whenever these suggestions were found to be an improvement of the facility and within the area of financial feasibility, they were accepted and are included. It is the opinion of this Authority that it has done everything possible to develop a good rapid transit plan, and the plan here submitted is the best that can be undertaken within the framework of the Authority's financial resources.

In February of 1961 the Transportation Committee recommended to the Port Authority that it approve the construction and operation of the Philadelphia—Camden—Haddonfield—Kirkwood rapid transit line.

At its meeting on February 15, 1961, the Authority unanimously approved the report of its Transportation Committee, and directed that a detailed report be prepared.

The recommended Philadelphia—Camden—Haddonfield—Kirkwood Line will serve the most densely populated corridor of Camden County, and an area east of Haddonfield with a high growth potential. It will provide convenient transfers between other transportation facilities in New Jersey and Pennsylvania, as well as loading and parking areas at each of the New Jersey stations. It is but the first phase of an integrated area-wide transportation system for Southern New Jersey. The use made of this line by daily travelers will, to a large extent, control the development of subsequent extensions.

Only through the use of the existing rapid transit and rail facilities can modern high-speed rapid transit be established at reasonable costs and fares. The proposed facility will make maximum possible use of existing rapid transit and rail facilities in the area. The Authority believes that the public interest demands grade separation of rapid transit and railroad tracks from street and highway grade crossings. It therefore recommends the elevation of tracks above grade level where necessary.

The alternatives to elevating the tracks are (a) retaining all tracks at grade and raising or depressing all roads and streets crossing the tracks, or (b) depressing the tracks in an open-cut or subway type of construction. The first would cause major dislocation and property damage, and is not a satisfactory solution. The second is too costly, and presents many additional problems.

The presence of a railroad freight track in the right-of-way requires depressed sections as deep as 30 feet, and the construction of heavy retaining walls. Such sections would preclude the use of spur track service from the railroad freight line within the area of depression and would also make difficult the construction of suitable station facilities, parking areas, and the integrating of bus and rail service; and would necessitate additional use of adjacent highways for movement of vehicles.

The estimated net cost to the Delaware River Port Authority, for the construction of the proposed Philadelphia—Camden—Haddonfield—Kirkwood Line, is $44,600,000.

At its meeting of March 15, 1961, the Authority approved the recommendation of its Finance Committee, and engaged Drexel & Company to complete a report of financial feasibility of the project.

At its meeting on April 19, 1961, the Authority approved the financial feasibility report of Drexel & Company, and directed that a project report be submitted to the Governor and the Legislature of the Commonwealth of Pennsylvania and of the State of New Jersey as required by the Agreement between the said Commonwealth of Pennsylvania and the State of New Jersey.

The earnings of the line will not be sufficient to meet debt service cost and operating expenses. In order for the facility to be successfully financed, it will be necessary for the Authority to contribute a portion of its now available unencumbered funds.

After careful consideration, the Authority, at its meeting of April 19, 1961, adopted the recommendation of its financial consultants that a cash subsidy of

$25,000,000 should be provided. It is the desire of the Authority to make as large a contribution as prudently possible, in order that the feasibility of the line might be assured, and the cost of financing reduced. The financial advisers, after due consideration of the financial programs of the Authority, cautioned that a larger contribution would not be advisable. Financing of this facility may be either by public offering or private sale of bonds.

It is the opinion of the Delaware River Port Authority that the rapid transit line herein recommended is of sufficient importance to the orderly growth of the area to be served, that it warrants substantial financial support of the Authority in the way of a non-recoverable contribution. With the cash contribution, the revenues of the line will be sufficient to meet debt service and operating expenses, and the line will be economically feasible.

On the basis of the facts and recommendations in the evaluation and report of Simpson & Curtin (as revised) and the report of Drexel & Company as to financial feasibility, and the results of the studies by the Authority and the facts and reasons set forth herein, the Delaware River Port Authority respectfully requests the approval of His Excellency Governor David L. Lawrence and His Excellency Governor Robert B. Meyner to the construction and operation of a Philadelphia—Camden—Haddonfield—Kirkwood Rapid Transit Line as herein proposed, for the following reasons:

1. A modern high-speed rail rapid transit line is essential for the orderly growth of the Southern New Jersey area.
2. The system recommended will provide an excellent rapid transit system, both convenient and comfortable, which will attract sufficient patronage to decrease highway congestion.
3. Through no other means can a comparable system, rendering good, convenient and comfortable transportation, be as quickly and economically provided.
4. The Delaware River Port Authority is of the opinion that, if the proposed rapid transit line is constructed and put into operation, it will be patronized and supported generally, and will be the first step toward the solution of a problem of primary importance to the whole area.

Respectfully submitted,

DELAWARE RIVER PORT AUTHORITY
OF PENNSYLVANIA AND NEW JERSEY

John M. McCullough
Executive Director

Ralph Cornell
Chairman

RESOLUTION

Adopted by the Delaware River Port Authority at its regular meeting on April 19, 1961:

BE IT RESOLVED: That, the Authority accept and approve the detailed report to the Governor and Legislature of the Commonwealth of Pennsylvania and of the State of New Jersey for the construction and operation of the Haddonfield—Kirkwood Rapid Transit Line, connecting with the present Bridge Line, as submitted by the Officers of the Authority, included therein and made part thereof are the Reports of Simpson & Curtin, Engineers, and Drexel & Company, Financial Consultants, and

BE IT FURTHER RESOLVED: That, the Officers of the Authority are hereby directed to transmit this Report to the Governor and Legislature of the Commonwealth of Pennsylvania and of the State of New Jersey.

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ENGINEERING REPORT

An Evaluation of that portion of a report entitled

"Plan for a High Speed Mass Transit System

Between Philadelphia and Camden and South Jersey Suburbs",

prepared by Louis T. Klauder and Associates for the

Urban Traffic and Transportation Board of the City of Philadelphia

pertaining to the Haddonfield-Kirkwood Line only.

SIMPSON & CURTIN

1405 LOCUST STREET, PHILADELPHIA 2, PA. Kingsley 5-8000

Transportation Engineers

February 15, 1961

Delaware River Port Authority
Administration Building
Bridge Plaza
Camden 1, New Jersey

Gentlemen:

There is submitted herewith our revised report relating to a proposed Southern New Jersey Rapid Transit Line between Philadelphia, Pennsylvania and Kirkwood, New Jersey.

The initial study was authorized by Authority action on May 20, 1959 and reported upon January 20, 1960. Since that date, revisions and additions to the original proposal have been authorized, all of which are incorporated in this revised report.

Our assignment was to evaluate the plan prepared for the Urban Traffic and Transportation Board by Louis T. Klauder and Associates for a rapid transit line between the described terminals.

It is our finding that the Klauder proposal, modified and revised as herein indicated, is practical. The proposed rapid transit line can be operated on such a basis as to more than cover all operating expenses. There will be revenues in excess of operating expenses in a substantial amount which may be applied to service the equipment and construction debt.

We gratefully acknowledge the helpful cooperation of the staff of the Delaware River Port Authority and the many representatives of public bodies and private agencies with whom we conferred during the course of the study.

Respectfully submitted,

SIMPSON & CURTIN

Hawley S. Simpson

acknowledgements

We hereby acknowledge the generous assistance of the many agencies, public and private, which have aided us in the collection of factual material during the course of our study.

Among those which were of particular helpfulness are the following:

American Transit Association
Atlantic City Electric Company
Camden County Engineer's Office
City of Philadelphia
Department of Public Property
Division of Transit Operations
City Planning Commission
Urban Traffic and Transportation Board
Cleveland Transit System
General Electric Company
Grant Money-Meters Company
Hutchinson, Rivinus and Company
Louis T. Klauder and Associates
Metropolitan Toronto Planning Board
New Jersey State Highway Department
Ohio Brass Company
Parsons, Brinckerhoff, Quade and Douglas
Pennsylvania-Reading Seashore Lines
Philadelphia Transportation Company
Public Service Coordinated Transport
Public Service Electric and Gas Company
The Budd Company
The Pennsylvania Railroad Company
Toronto Transit Commission
Transit Research Corporation
Union Switch and Signal Division of
Westinghouse Air Brake Company
Urban Engineers, Inc.
Wallace & Warner

summary

During the past quarter of a century, numerous reports by recognized consultants have been submitted to public agencies in regard to the feasibility of a rapid transit system connecting Philadelphia with Camden and the nearby New Jersey suburbs.

In every instance, it was concluded that a comprehensive system of rapid transit in the area would be of marginal financial feasibility, and would require some form of public support, other than fare box revenue, to meet all operating costs and capital charges, at least in the development years.

The two most recent such reports are those by Parsons, Brinckerhoff, Hall and MacDonald, prepared for the Delaware River Port Authority,[1] and by Louis T. Klauder and Associates, prepared for the Urban Traffic and Transportation Board of the City of Philadelphia.[2]

This report deals solely with the feasibility of a rapid transit line from Philadelphia to Kirkwood, N. J., via the existing Bridge Line from Philadelphia to Camden, and thence along the right-of-way of the Pennsylvania-Reading Seashore Lines to Kirkwood This is the route recommended by Klauder and differs from the Brinckerhoff plan in two major essentials:

(a) The route is extended 2.0 miles from Ashland to a Kirkwood terminal near the White Horse Pike; and

(b) It uses the existing facilities for rapid transit from Camden to 16th and Locust Streets, Philadelphia, owned jointly by the Delaware River Port Authority and the City of Philadelphia, instead of constructing a subaqueous river crossing and a new subway tunnel under Arch Street in Philadelphia.

The New Jersey territory to be served by such a route is well developed, with a substantial density of population to Haddonfield and the prospect of relatively rapid growth in those areas south and east of Haddonfield. This area is strategically located with respect to the Philadelphia and Camden central business districts and other centers of employment and metropolitan area activity.

Anticipated growth, with consequent need for expanded transportation facilities, is such as to make it certain that unless adequate means of travel to Philadelphia

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1 *"Southern New Jersey Mass Transportation Survey"*, by Parsons, Brinckerhoff, Hall & MacDonald (hereafter referred to as the Brinckerhoff Report), January 1956.
2 *"Plan For A High Speed Mass Transit System Between Philadelphia And Camden And South Jersey Suburbs"*, by Louis T. Klauder and Associates (hereafter referred to as the Klauder Report), March 1959.

are created in the next two decades, the adjacent New Jersey area will be unable to take full advantage of its maximum growth potential.

Similarly, the maintenance of a strong Philadelphia central area, which is a prime objective of the City Administration, cannot be achieved without improvements in the traffic and transportation facilities that feed it.

There are two alternatives in the provision of added traffic facilities: either (a) more highways, river crossings and terminal facilities for surface vehicles, both private and public, or (b) a system of modern highways integrated with high-speed rail rapid transit.

If the trend in automobile use for commuter travel is continued and complete reliance in the future is to be on highways and bridges, large capital expenditures will be required with the expectation that little will be accomplished other than an intensification of the congestion which is typical of rush hours.

An integrated system of transportation, on the other hand, with appropriate emphasis on adequate rail rapid transit will result in a diversion of passengers from highway to public transit of such a magnitude as to reduce, materially, the need for expanded commuter highway facilities and river crossings, and the related center city terminal facilities necessary for private vehicle storage.

One of the prime advantages inherent in rail rapid transit, such as considered here, is that construction can be completed in a relatively short period of time, approximately two years from date of authorization, as compared with perhaps 10 years for a highway program of comparable capacity.

In an integrated system such as here visualized, much of the desire for travel in automobiles and buses to Center City would be lessened. Automobiles and buses can serve more effectively as feeders to high-speed, efficient mass transit for that portion of the trip which is now most congested, in contrast to their use as the principal medium for passenger travel.

Only by means of a fully integrated transportation system can the optimum cost of transportation and the maximum potential of the South Jersey area be fully realized.[3]

The requirements of a modern rapid transit system on the Haddonfield-Kirkwood route will be fully met by the type of facility here described.

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3 An excellent exposition of the need for an integrated system of transportation in Southern New Jersey is found in the Brinckerhoff Report, pp. I-III.

route

A completely grade-separated facility is provided from terminal to terminal, using the existing Locust Street Subway and Bridge Line to Broadway Station in Camden. At that point, the line would emerge from the tunnel and occupy the right-of-way of the Pennsylvania-Reading Seashore Lines to Kirkwood.

To permit continued operation of the Pennsylvania-Reading Seashore Lines, a single track adjacent to the rapid transit line would be provided at the new grade. This track will have no connection to the rapid transit tracks.

Control of trespassers will be provided by posting and fencing the right-of-way from end to end.

equipment

The equipment would consist of 82 modern, light-weight, high-speed cars with comfortable transverse seats for 80 to 88 passengers each, modern lighting, air-conditioning, powered for rapid acceleration and deceleration, with top running speeds of 65 miles per hour.

power

Power would be supplied by third rail. All substations would normally operate automatically with remote supervisory control.

signals and communication

Modern automatic signaling with train control would insure the ultimate in operating safety. Three-way communication between trains and supervisory personnel is provided.

fare structure

Fares would be charged on a three zone basis, with a basic first zone and intra-state fare of 25 cents, a two zone fare of 30 cents and the three zone fare of 40 cents.

Fare collection would be primarily automatic, using mechanical fare collectors.

stations

Stations would be functional and attractive, with escalators for all up movements. At Kirkwood, a Pennsylvania-Reading Seashore Lines transfer station

would be constructed at which passengers to and from points east and south would transfer from and to rapid transit. No Pennsylvania-Reading Seashore Lines passenger service would thereafter be provided between Kirkwood and Camden. Adequate parking facilities would be provided at all New Jersey stations (except City Hall in Camden). Approximately three-fourths of the parking area will be free; the remainder available at a daily charge of 25¢ per space.

operating schedules

Service is proposed from 5:30 A.M. to 1:00 A.M. Headways in the morning and evening rush hours would range between 4 and 5 minutes, using 6-car trains. Midday, between the two rush hours, and in early morning and evening and night hours, headways would range from 8 to 15 minutes, operating 1 and 2-car trains, as the traffic requires.

Scheduled time from the Kirkwood terminal to 8th and Market would be 22 minutes, at an average speed, including stops, of 36 miles per hour.

capital costs

The net cost of the Haddonfield-Kirkwood Line is $44,600,000 at current level prices.

revenues

Based upon the fare structure described in detail in the report, total operating revenues are estimated at $5,196,000 in 1962, rising to $5,671,000 in 1975. The year 1962 was selected because it was the year assumed by Brinckerhoff and Klauder as the first year of full operations.

operating costs

Operating costs, at 1962 levels, are estimated at $2,093,000 in 1962, increasing to $2,238,000 in 1975 as additional service is required for the higher passenger volumes of the later years.

debt service

The excess of revenues over operating expenses available for debt service rises from $3,103,000 in 1962 to $3,433,000 in 1975.

THE HADDONFIELD - KIRKWOOD LINE

The two most recent reports on rail rapid transit for Southern New Jersey are those of Parsons, Brinckerhoff, Hall and MacDonald (1956) and Louis T. Klauder and Associates (1959). These reports are referred to hereafter as the Brinckerhoff and Klauder Reports, respectively.

The Brinckerhoff Report was prepared in 1956 for the Delaware River Port Authority pursuant to legislation authorizing the Authority to undertake a study of a rapid transit system between Philadelphia and points in New Jersey within a 35 mile radius of Camden.

Brinckerhoff proposed a system of three routes occupying part of the right-of-way of the Pennsylvania-Reading Seashore Lines over most of the alignment in New Jersey between Broadway Station in Camden and terminals in Moorestown, Ashland and Woodbury Heights.

Between Camden and Philadelphia, a new trans-river tunnel to connect with a subway to be constructed under Arch Street to terminate in Philadelphia at Reyburn Plaza near the Pennsylvania Railroad Suburban Station was proposed.

This system was estimated to cost, at 1955 price levels, $242,000,000 as follows:

Trunk Line Between Philadelphia and Camden	76.6 million dollars
Moorestown Route	55.2
Haddonfield-Ashland Route	33.9
Woodbury Route	39.1
Yards and Shops	9.1
Equipment	28.1
Total	242.0 million dollars

To finance such a system, with interest during construction, an estimated $300,000,000 in bonds would be required.

It was estimated that this system, when in operation, would produce revenue in excess of maintenance and operating expense of $3,400,000 in 1962, rising to $6,700,000 in 1975, exclusive of debt service charges. When provision is made for interest on, and retirement of, debt and replacement of worn-out facilities, an annual deficit averaging $10,642,000 in the 35 years through 1997 was forecast.

Subsequent to the Brinckerhoff Report, the Urban Traffic and Transportation Board of Philadelphia, in June 1957, suggested that earlier proposals for linking the Locust Street Subway in Philadelphia by way of the Bridge Line across the Benjamin Franklin Bridge to a connection with railroad rights-of-way in New

Jersey be restudied, as an alternative to the Brinckerhoff plan. The firm of Louis T. Klauder and Associates was retained by the Urban Traffic and Transportation Board to conduct such a study. Reports were submitted to the Board by that firm in 1958 and 1959.

The Klauder plan adopts substantially the alignment of the three Brinckerhoff routes in New Jersey, with the exception that the Haddonfield Line is extended 2.0 miles from Ashland to a terminus at Kirkwood closely adjacent to the White Horse Pike. All routes would enter Philadelphia via the existing Bridge Line and the Locust Street Subway to a terminus at 16th and Locust Streets.

The system, as proposed by Klauder, is estimated to cost $89,000,000 at 1960-1962 price levels, distributed among the three routes as follows:

Moorestown Route	24.0 million dollars
Haddonfield-Kirkwood Route	36.0
Woodbury Route	29.0
Total	89.0 million dollars

These figures are total costs, including equipment, yards and shops.

The Klauder system was estimated to produce an excess of revenue over operating expenses of $4,538,000. After allowance for debt service charges, a deficit of $736,000 was anticipated. The Haddonfield Line, however, showed a slight profit. The gross increment of revenue over operating expense on the Haddonfield Line was estimated at $2,230,000, with a net profit of $42,000 after allowing for "carrying charges" of $2,188,000 annually.

The Haddonfield line as recommended by Klauder is single track from Haddonfield to Ashland, a distance of 5.2 miles, with numerous grade crossings.

A supplementary study by Klauder of a fully grade separated, double track line increased construction costs to 41 million dollars, and showed a deficit, after debt service, of $233,000 annually.

The major points of difference in the two reports are in the routings from Camden to Philadelphia. Brinckerhoff favored a new Arch Street Subway and opposed a connection with the Locust Street Subway on two principal grounds:

(a) The location of the Locust Street Subway does not provide for as effective passenger distribution as an Arch Street location; and

(b) The gradients and curvatures of the Bridge Line make it impossible to take advantage of the full capabilities of modern, high-speed transit equipment.

Klauder finds, in effect, that these objections are not so material as to warrant the expenditure of over $75,000,000 necessary to connect the Broadway Station in Camden with a terminal at Reyburn Plaza. We comment later on these two divergent points of view.

Scope of Study

In the light of these background facts, the Delaware River Port Authority has authorized this firm to evaluate the Klauder recommendations for a Haddonfield-Kirkwood Line.

Our review covered both the Brinckerhoff and Klauder plans to determine the validity of the differing recommendations. From this study emerges a plan patterned basically upon the Klauder plan, but with certain material revisions. In every instance where departures from the Klauder recommendations have been made, they have been in the direction of an upgrading.

It is obvious from our study of the Klauder Report that efforts were made to keep capital costs as low as possible in order to produce a system in which revenues and expenses would closely balance. In our judgment, the economies proposed by Klauder would have an adverse effect upon the ultimate success of the system. If mass transit in the Delaware Valley area is to assume the importance that it must, the standard of construction and operation should be the highest possible on the basis of current technology, but without undue extravagance.

The general plan of the route, station locations, and scheduled running times from New Jersey stations to 8th and Market Streets in Philadelphia are shown in Plate I.

In the Appendix, Plates IV to XIV inclusive, are reproductions of an aerial survey on which are superimposed the alignment of the route and the approximate location of stations and parking lots. Below each of the aerial photographs is the profile of the line showing the present and proposed track elevations and all present and proposed grade separations and pedestrian underpasses.

Alignment

Brinckerhoff terminated the line at Ashland; Klauder extended it 2.0 miles to Kirkwood. We recommend the Klauder route. The Kirkwood terminal has merit in that it is adjacent to the White Horse Pike and has obvious advantages as a collector of traffic from points south and east. Also, this area is expected to experience a rapid population growth, particularly if the rapid transit line is built. Thus, the extension can be fully supported.

Consideration of all factors related to the use of the Bridge Line-Locust Street route does not support the claim by Brinckerhoff that the Locust Street Subway is unsatisfactory as a Center City distributor.

Analysis of all person-trips between New Jersey and Center City, using the 1955 Brinckerhoff source data, shows 14,130 person-trips with destinations within 2/10ths mile of the three Arch Street Stations as proposed by Brinckerhoff; Independence Mall, 10th Street and the Terminal. A similar analysis of the person-trips adjacent to the Locust Street route shows 13,720 persons within 2/10ths mile of 8th and Market, and the 10th, 12th and 16th Street Stations on Locust. This is an insignificant differential.

As a further indication of the suitability of Locust Street as compared with Arch Street, an analysis of floor area in Center City now, and as anticipated for the future by the Philadelphia City Planning Commission, shows that the center of commercial and business activity is about ½ block south of Market Street, and thus almost exactly mid-way between Arch and Locust Streets.

An analysis of person-trips between New Jersey and Center City using the Brinckerhoff 1955 data, shows that the center of gravity of downtown destinations is at the same location.

The 1958 parking study by Wilbur Smith and Associates, prepared for the Philadelphia City Planning Commission, shows that the center of gravity of all persons using commercial parking facilities in the central area is between Chestnut and Sansom Streets.

Center City destinations do not, however, reflect the total importance of either of the routes as a traffic distributor. The most important station on the Locust Street route is 8th and Market Streets where the Bridge Line provides a direct connection to PTC elevated and subway lines; the Arch Street routing does not. The most important station on the Arch Street route, from the standpoint of passenger usage, was found by Brinckerhoff to be the Independence Mall Station at 5th and Arch Streets. This is less strategically located than the 8th and Market Street Station on the Bridge Line from the standpoint of city-wide distribution via PTC routes.

Estimates by PTC indicate that, of all the Jersey trips over the Bridge Line with final or intermediate origins or termini at 8th and Market Streets, 750,000 persons per year are within walking distance of the station; 1,900,000 make a paper transfer to or from PTC lines, either subway, elevated or surface, and another 1,500,000 make a direct transfer across the platform to or from the Ridge Subway.

On the matter of speed, Brinckerhoff indicates that schedule time between Broadway Station in Camden and the Arch Street Terminal at 15th Street would

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

PLATE I

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

SIMPSON AND CURTIN — PHILADELPHIA

Scale in Miles

0.5 0 1

MINUTES TO 8TH & MARKET ST. STATION VIA RAPID TRANSIT AS INDICATED

6 — 9½ — 12 — 14 — 15½ — 19½ — 22

FRANKFORD ELEVATED

MARKET STREET STATION

BENJAMIN FRANKLIN BRIDGE

8TH & MARKET STREET STATION

RIDGE AVE. SUBWAY

MARKET STREET SUBWAY

LOCUST STREET

15TH – 16TH STREET STATION

13TH STREET STATION

9TH – 10TH STREET STATION

BROAD STREET SUBWAY

CITY HALL STATION

BROADWAY STATION

BROADWAY

FERRY AVENUE

HADDON AVENUE

MT. EPHRAIM AVENUE

FERRY AVENUE STATION

CRESCENT BOULEVARD

COLLINGSWOOD STATION

COLLINGS AVENUE

CUTHBERT ROAD

CRYSTAL LAKE ROAD

WESTMONT STATION

HADDONFIELD STATION

NEW JERSEY TURNPIKE

HADDONFIELD

WOODCREST ROAD

BERLIN ROAD

ASHLAND STATION

WHITE HORSE PIKE

CHEWS LANDING ROAD

KINGS HIGHWAY

EVESHAM ROAD

KIRKWOOD STATION

BERLIN AVENUE

WALT WHITMAN BRIDGE

CRESCENT BOULEVARD

NORTH-SOUTH FREEWAY

BLACK HORSE PIKE

NEW JERSEY TURNPIKE

PLATE I

be five minutes. We estimate that, with modern equipment, the time from Broadway Station in Camden to the 16th Street terminus on the Locust Street Subway will be 9½ minutes. Part of the added time via Locust Street is due to the fact that there is one additional stop in Camden (City Hall) and one additional stop in Philadelphia.

While this time differential is of consequence, it must be weighed against the lack of direct connection to PTC if Arch Street were to be the distributor. The further fact that the Arch Street location would require an expenditure of over $75,000,000 for new facilities makes supportable the Klauder recommendation that the Bridge Line-Locust Street Subway be utilized.

Profile

The Pennsylvania-Reading Seashore Lines, which will be paralleled by rapid transit tracks, is presently elevated from Camden to a point just beyond Crescent Boulevard. Thereafter, all major crossings, except the New Jersey Turnpike are at grade.

The Brinckerhoff Report recommends that the entire route be grade-separated at all highway crossings.

Klauder proposed to construct grade separations at four locations south of Crescent Boulevard; at Browning Road, Cuthbert Road, Euclid Avenue and Kings Highway. All other crossings except three, which would be closed, would remain at grade, protected by automatic train-actuated gates.

A rapid transit system as contemplated, with highway crossings at grade, would not be in the public interest, either from the standpoint of safety or convenience.

The present standards of the U. S. Bureau of Public Roads[4] used in estimating needed improvements in the various road systems in connection with a recently conducted nationwide highway needs study support a completely grade-separated rapid transit operation. Under such standards, based upon estimated rapid transit movements and projected daily traffic, all crossings demand grade separations.

With relatively infrequent train operation, the New Jersey Board of Public Utility Commissioners has recorded 16 highway-rail grade crossing accidents in which six persons were killed and four were injured on this line between January 1945 and December 1958. With greatly increased frequency of rail service and the heavier traffic of the future, the potential hazard will increase proportionately and vehicular traffic will be further impeded.

4 *Instruction Manual For Estimating Needs of Various Road Systems For Use In Investigation Required Under Section 210 Of the Highway Revenue Act of 1956*, Bureau of Public Roads, March 1957.

Existing grade crossings may be eliminated by means of either grade separations or the closing of crossings to vehicular traffic.

To maintain present convenience of access to both sides of the track for both pedestrian and vehicular traffic, it is recommended that all existing crossings be grade separated. In addition, it is recommended that grade separations be provided at 3 new locations where crossings do not now exist, 2 of which will serve both vehicles as well as pedestrians and one for pedestrian use only.

Below are listed all of the present grade crossings on the line with their 1959 weekday, 24 hour traffic volume.

EXISTING CROSSINGS TO BE GRADE SEPARATED

Location	*1959 Average Weekday Traffic*	*Location*	*1959 Average Weekday Traffic*
Kings Highway	17,794	Redman Avenue	2,148
Cuthbert Road	16,014	Chews Landing Rd.	2,106
Collings Avenue	9,576	Irvin Avenue	1,909
Crystal Lake Rd.	8,375	Mt. Vernon Avenue	1,841
Euclid Avenue	5,174	Stoy Avenue	1,027
Browning Road	5,127	Zane Avenue	992
Evesham Avenue	4,280	Woodcrest Road	602
Lincoln Avenue	3,991	Glenwood Road	579
Lees Avenue	3,573		

NEW LOCATIONS FOR GRADE SEPARATIONS

Conard Avenue
Carlton Avenue
Chestnut Avenue—pedestrians only

The State of New Jersey, through legislative authority granted to the State Highway Department, has expressed a willingness to participate in the cost of these grade separations, in an amount equalling $3,000,000 to be expended over a three year period. Such monies, when appropriated, will be made available to the Delaware River Port Authority to be applied towards the construction of grade separations.

To provide access to the Kirkwood Rapid Transit Terminal and storage yard, and a PRSL transfer station adjacent to the White Horse Pike, it is necessary that the rapid transit tracks leave the PRSL right-of-way just south of the White Horse Road overpass and remain at grade to the terminal. To avoid a Berlin Road grade crossing it is recommended that Berlin Road be ended either side of the rapid transit tracks and provisions be made for alternative roadway connections to the White Horse Pike.

A completely grade separated route is provided by elevating the rapid transit tracks and the single railroad track above existing grade to provide adequate clearance at all highway underpasses with one exception. At Woodcrest Road the highway will overpass all tracks.

The alternative, of course, is an open cut or subway type of construction below ground level. Elevated construction is considerably less expensive than below-ground-level construction. A study of elevated track on embankment as compared to depressed track for a 3700 foot section through Haddonfield indicates a cost for open cut construction more than twice as great. A saving of nearly $2,000,000 for this section is realized by use of elevated construction on embankment. For elevated track on open structure in the same area, the saving in cost is approximately $1,000,000 compared with depressed construction.

To keep to a minimum the height of elevated structures, there has been introduced a gentle rolling profile, reaching existing grade, or as near to grade as practical, between rapid transit stations and highway grade separations and rising to the needed overhead clearance at grade separations. Thus, approximately 50% of the track between Collingswood and Kirkwood is not more than three feet above ground level. Much of the elevated section is only a few feet above grade, as may be seen from Plates IV to XIV. The grade of the remaining 50% is practically unchanged from its present ground level.

Elevating the tracks above highway crossings will enable improvement in existing roadway grades at the crossings. The exceptions are at the Mt. Vernon Avenue and Redman Avenue grade separations. To maintain operable railroad grades for PRSL trains on the Delair Branch, it is necessary to depress the roadway grades at these points below the present ground level.

Track

Brinckerhoff proposed double track from terminus to terminus. Klauder recommended double track to Haddonfield and single track from Haddonfield to the end of the line. The single track section is about five miles in length, with provision for passing trains only at Ashland.

Our operating schedules indicate that single track will not permit the headways required in this area. With a passing track only at Ashland Station the minimum spacing between trains is fixed at about 12 minutes. The operating limitations imposed by single track would adversely affect service to the public and the efficiency of the system.

Therefore, we adopt the Brinckerhoff recommendation for double track throughout; consistent with the philosophy that the line must be constructed to modern-day standards.

Track would have a weight of 132 lbs. per yard similar to that of the railroad tracks on the right-of-way. Running rails of this weight will provide return conductivity without the need for paralleling cable.

Rapid transit track crossovers would be constructed at every new station.

Equipment

Brinckerhoff recommended cars approximately 68 feet in length, weighing 1,000 lbs. per foot, powered by four 150 h.p. motors, with acceleration rates of about three miles per hour per second and a top running speed of 65 miles per hour. Cars would have two doors on each side and be fully air-conditioned. Transverse seats would be used throughout, two seats on each side of the aisle, with a total seating capacity of 74 to 76 passengers.

Klauder is not specific with respect to the type of equipment, but appears to have adopted the Brinckerhoff car except that he recommends three doors on each side and omits air-conditioning, but provides forced ventilation with provision for future air-conditioning.

The cars on which costs in this report are premised conform closely to the recommendations of Brinckerhoff, except that four 100 h.p. motors would be used instead of four 150 h.p. motors, and the number of seats is increased to an average of 84.

Klauder proposed to continue using the 26 existing Bridge Line cars for service between Camden and Philadelphia, after spending about $400,000 on their modernization. The performance characteristics of these old cars are considerably below those of modern, light-weight cars as recommended. In periods of maximum traffic, when all cars would be in operation, irregularity in headways and unsatisfactory passenger service and distribution between successive trains would result.

Therefore, the use of the existing equipment is impractical and our cost estimates contemplate new, high-speed, light-weight, air-conditioned cars exclusively.

Our traffic estimates indicate a need for 12 six-car trains. This will provide a full length train on a four to five minute headway between Philadelphia and Haddonfield in the peak half hour. Ten additional cars will be provided as spares, making a total requirement of 82 cars at the outset.

Power

Brinckerhoff proposed a third rail system; Klauder recommended overhead catenary.

It is our recommendation that third rail be used. Contact rail weighing 150 lbs. per yard and having electrical conductivity approaching three million circular mills of copper would be used as a conductor and contact medium without supplementary paralleling conductors. Its cost is approximately equivalent to that of overhead catenary of equivalent conductivity, is longer lived, would require less maintenance and is less prone to failure. Its use precludes the necessity of installing two types of current collection systems on the cars; both third rail shoes and pantographs. The latter would require complicated roof construction to obtain the necessary subway clearance.

Substations

Power is proposed to be delivered at 4 KV at six new sub-stations in territory served by Public Service Electric and Gas Company. At a seventh new substation in the territory of the Atlantic City Electric Company, power would be purchased at 34 KV, with provision for changeover to 69 KV when this voltage is available, as contemplated in the near future. Power would be transformed in all seven substations to 660 volts for propulsion purposes. To conserve construction cost, four of the substations would be located under the platform at passenger stations.

The three substations now serving the Locust Street Subway and Bridge Line will be continued in operation.

Signals and Communication

All lead cars will be equipped with cab signals. No wayside signals will be installed. Three-way communication between trains, dispatcher and station personnel would be provided.

Trains will be equipped with the most modern automatic control devices to assure maximum operating efficiency and the highest standard of safety.

Fare Structure and Collection

Brinckerhoff recommended a two-zone fare structure providing for a 20¢ fare on either side of the river, 20¢ between Philadelphia and Camden and a 40¢ fare for a ride between Philadelphia and any point beyond Broadway Station in Camden. Klauder recommended a six-zone fare system with a minimum fare of 15¢, rising to 40¢ in increments of 5¢.

While the zone fare system recommended by Klauder involves difficulties in the collection of fares that are avoided in the simple structure of the Brinckerhoff proposal, the advantages of a fare graduated according to the length of the ride

dictate the adoption of a variable fare zone structure as proposed by Klauder, although with a lesser number of zones and not in the same increments.

The schedule of fares proposed in this report provides for a basic minimum fare of 25¢ plus 5¢ for the second zone and 10¢ additional for the third zone.

The fare schedule used in revenue calculations is shown below.

PROPOSED SCHEDULE OF FARES
SOUTHERN NEW JERSEY RAPID TRANSIT
HADDONFIELD-KIRKWOOD LINE

Stations	Philadelphia Stations	Camden-City Hall	Camden-Broadway	Ferry Ave.	Collingswood	Westmont	Haddonfield	Ashland
Philadelphia Stations	25							
Camden-City Hall	25							
Camden-Broadway	25	25						
Ferry Avenue	30	25	25					
Collingswood	30	25	25	25				
Westmont	30	25	25	25	25			
Haddonfield	30	25	25	25	25	25		
Ashland	40	25	25	25	25	25	25	
Kirkwood	40	25	25	25	25	25	25	25

With the exception of the shorter rides, this schedule is substantially similar to the cash bus fares between Philadelphia and the New Jersey points served by the route, and lower than the combined Railroad and Bridge Line tariff.

To collect and account for the fares, mechanical fare collection devices are proposed which would reduce, to a minimum, the necessity for collector assign-

ments. Conventional zone fare systems depend upon the issuance of exit identification which indicates the amount of fare to be paid or the station to which the fare has been paid. At the point of exit, manual inspection of zone identification is required. This would be avoided under the plan proposed in this program. One cashier would be required in each station, for the purpose only of making change, and passing entering or exiting passengers who do not have the exact fare. To reduce as much as possible the number of cashier transactions, automatic coin changers would be installed in each station.

All stations would be controlled so that having once entered a station, no passenger could leave without the payment of cash and/or token fare and, always, in the precise amount applicable at that station for travel from any other station regardless of direction. This would be accomplished by the use of special identification tokens of varying dimensions, for deposit in exit turnstiles which would be actuated only by an appropriate token, cash, or cash and token, equivalent in value at least to the exit fare at the destination station.

In Philadelphia, certain modifications in station layout would be required because all entrances would be free and all passengers would deposit fare or token on exiting.

We have assumed that these needed minor modifications will be made by the City of Philadelphia, without cost to the rapid transit system as a part of the cost of general rehabilitation of the Broad-Ridge-Locust Subway system included in Philadelphia's Capital Program, Supplement of 1960-65.

Stations

Brinckerhoff's Report recommended stations with central tracks and two side platforms. Klauder recommended a single central platform. The central platform is more economical and is adaptable to a zone fare structure using the automatic fare collection devices which we propose.

The Klauder recommendation for center platform stations is adopted.

Klauder departs from Brinckerhoff's station locations by eliminating the Cuthbert Road station and introducing two stations, one in Collingswood south of Lees Avenue and one at Crystal Lake Road in Westmont. Greater passenger convenience is provided by the two station locations, although the capital cost is somewhat greater and rapid transit running time slightly increased. We approve two stations, one in Collingswood and one in Westmont, rather than a single station at Cuthbert Road.

At Kirkwood, a Pennsylvania-Reading Seashore Lines transfer station would be constructed at which passengers to and from points east and south would transfer from and to rapid transit. No Pennsylvania-Reading Seashore Lines passenger service would, thereafter, operate between Kirkwood and Camden.

The location of all stations is shown generally in Plate I, and more specifically in the Appendix in Plates IV to XIV inclusive.

Except as indicated later no physical modification of any existing Bridge Line stations is required (other than to adapt the stations to the proposed fare collection system), except at 8th and Market Streets.

Operation of the Haddonfield-Kirkwood line, with its increased volume of traffic and closer headways, will require a new track and platform exclusively for Ridge Avenue trains at 8th and Market Streets. This has been proposed by Klauder at an estimated cost of $3,000,000, with a recommendation that this be done as a part of the City's subway station improvement program. Funds for the improvement of the subway system are contained in the City's capital budget.

Modernized lighting in subway stations is needed, particularly at 8th and Market Street Station. Additionally, up escalation should be installed by the City at the 13th Street and the 15th Street Stations, at least from the concourse level to the street. The cost of such installations will approximate $150,000.

Similar modernization of the two Camden stations—City Hall and Broadway—should be undertaken by the Delaware River Port Authority.

DETERMINATION OF PATRONAGE

Studies of rapid transit patronage in Chicago, Toronto, Cleveland and Philadelphia indicate that riders who changed from other modes of travel to rapid transit did so primarily because of the time saving afforded by the superior facility. Other reasons given by those interviewed, but not in order of importance, are:

Lower cost
Parking difficulties in town
Traffic congestion
Greater convenience and comfort
Speed under all weather conditions
Lessened accident hazard

The following table summarizes the aforementioned studies, and shows that the largest percentage of rapid transit riders were former users of other forms of mass transportation. Former auto riders comprise varying percentages of the total persons diverted, ranging from 12.5% in Chicago to a high of 31.0% in Operation Northwest in Philadelphia.

FORMER MODES OF TRAVEL OF RAPID TRANSIT RIDERS

Former Mode	*Congress St. Rapid Transit (Chicago)*	*Yonge St. Subway (Toronto)*	*Operation Northwest (Philadelphia)*	*Shaker Heights Rapid Transit (Cleveland)*
Bus, rail	85.4%	86.2%	*	*
Auto	12.5%	12.9%	31.0%	20.0%
Other	2.1%	0.9%	*	*

*Information not available.

Studies of diversion to rapid transit facilities as well as to improved modern highways have resulted in a series of curves for estimating usage of such facilities based upon comparative techniques. Statistical tests of these curves and other factors such as cost savings, distance savings, household income, etc., demonstrated that time saving is the most reliable means of predicting potential users' behavior. Time saving techniques not only measure the amount of time saved by the superior facility but also indirectly reflect other influences such as greater convenience, traffic congestion, necessity for transfers, cost, and parking needs.

"Time ratio" diversion curves have long been used in the planning of express-

ways and major highway improvements. A time ratio is the total travel time via the new facility divided by the total travel time via the fastest alternate route.

A review of all of these curves indicates that for analogous use of a new facility, there is similarity in behavior regardless of the mode of travel. This similarity is shown below in a table which lists the percentages of total riders diverted to the facility when their time ratio is: 1.0 (neither saving nor loss in time via the new facility), 0.5 (new facility requires half the time of the old) and 1.5 (new facility requires a 50% increase in time compared to the old).

TRAFFIC DIVERSION TO NEW FACILITIES

Source	*Percent Traffic Diverted When Time Ratio Is:* 0.5	1.0	1.5	
For New Highway Facilities				
U. S. Bureau of Public Roads	99%	42%	0%	(Limited Access Highways)
American Association of State Highway Officials	93%	48%	4%	(Expressways)
	92%	35%	3%	(Major Streets)
For Rapid Transit Facilities				
Cook County Transportation Usage Study	*	42%	18%	(All Trips)
	85%	62%	35%	(Central City Trips Only)
Washington, D. C. Transportation Plan	100%	40%	0%	
Toronto Transit Commission Yonge Street Subway	*	30%	*	(Rush Hour)
	*	50%	*	(Mid-day and Evening)

*Information not available.

The percentages of diversion in the highway studies and the rapid transit studies are surprisingly close.

Based on these facts, a time ratio curve was developed for this study. This curve establishes the following percentages of traffic diverted at the three time ratios of the tabulations above:

Percent Traffic Diverted When Time Ratio Is: 0.5	1.0	1.5
91.5%	45.0%	1.0%

To evaluate previous estimates of passengers assigned to the then-proposed transit systems, the basic data of the 1955 origin and destination surveys by Parsons, Brinckerhoff, Hall and MacDonald were obtained.

The initial step in the analysis of these basic data was the determination of the areas between which traffic would be considered potential to the proposed rapid transit system. Person-trips considered potential are those trips whose travel is within the area of influence of, and generally parallel to, the rapid transit alignment, and of sufficient length to benefit by its use.

All potential trips were posted as to:

(1) The present mode of travel (auto, bus or rail).

(2) The time period during which the trip was made (commuter or non-commuter).

To apply the "time ratio" method of diversion outlined previously, the travel time between zones by auto, bus and the rapid transit facility were determined.

Auto travel times were established by conducting rush hour and mid-day field studies on major streets and highways in both New Jersey and Philadelphia; driving predetermined routes and recording the elapsed time at appropriate check points.

Bus travel times were measured by riding bus routes in the area of influence and recording the elapsed time at selected check points, in both A.M. and P.M. peak periods. Scheduled running time was used for the off-peak periods.

Rapid transit travel times are divided into two trip legs:

(1) Estimated running time between stations on the proposed rapid transit facility.

(2) Travel time to and from the rapid transit station including waiting and transfer time if a transfer in modes is involved.

The first was determined knowing the performance specifications of the recommended equipment. The second was determined by assigning traffic to proposed rapid transit stations using time, distance and convenience as the criteria for assignment. After assigning zonal movements to the stations, the travel time to the station was then measured. Thus, by summing the components, the total travel time via rapid transit is determined for any particular trip.

Knowing these data, the diversion percentages for each set of origins and destinations were computed and applied to the potential to determine the diverted passengers.

Having made a first estimate of the number of persons that would be diverted to rapid transit based exclusively on time differentials, the totals were then adjusted giving consideration to the fact that, even though time is saved, the resistance to transferring from mode to mode, i.e., auto or bus to rail transit, may act as a psychological depressant, particularly on relatively short intrastate trips. Additionally, a more restricted area of influence was established as a band paralleling the route and extending 2 miles on either side. Trips to and

from points outside this area, with the exception of the Merchantville-Pennsauken and the Gloucester City areas were eliminated, even though time might be saved by the use of rapid transit.

Through the application of these techniques, rapid transit patronage for the year 1962 was determined. That year was selected to enable direct comparisons with both the Brinckerhoff and Klauder passenger estimates.

The table following shows the estimated station to station passenger trips in both directions for an average 1962 workday.

STATION TO STATION PERSON TRIPS
AVERAGE WORKDAY – 1962

STATIONS	15th-16th Sts.	12th-13th Sts.	9th-10th Sts.	8th & Market Sts.	City Hall	Broadway	Ferry Ave.	Collingswood	Westmont	Haddonfield	Ashland	Kirkwood	
PHILADELPHIA													
15th-16th Sts.	—												
12th-13th Sts.	—	—											—
9th-10th Sts.	—	—	—										—
8th & Market Sts.	169	60	44	—									273
NEW JERSEY													
City Hall	207	422	174	2,960	—								3,763
Broadway	453	1,018	405	6,575	—	—							8,451
Ferry Ave.	604	1,331	436	6,394	—	—	—						8,765
Collingswood	366	553	270	2,071	784	436	—	—					4,480
Westmont	567	845	457	3,481	1,170	608	—	—	—				7,128
Haddonfield	498	639	229	3,023	2,172	971	137	—	—	—			7,669
Ashland	115	166	74	1,474	729	610	80	44	53	—	—		3,345
Kirkwood	895	884	488	6,598	2,214	722	111	307	369	785	—	—	13,373
TOTALS	3,874	5,918	2,577	32,576	7,069	3,347	328	351	422	785	—	—	57,247

Of the total of 57,247 daily passengers, 273 are estimated to be local passengers in Philadelphia between 8th and Market Street Station and stations on Locust Street; 44,672 are passengers between Philadelphia and points in New Jersey and the remaining 12,302 are local riders daily within New Jersey. All trips between adjacent stations in New Jersey have been arbitrarily deleted.

The 57,247 daily passenger trips were determined from a potential 138,000 daily automobile, bus and rail person-trips in the restricted area of influence of the proposed rapid transit system. The total diversion from all modes of transportation was 42%. It was assumed that all of the Bridge Line riders as of 1962 would continue to use rapid transit; 58% of the bus riders within the area of influence were estimated to be diverted to rapid transit and 25% of the person-trips by automobile were diverted.

The preceding table shows that the busiest station will be 8th and Market Streets, with an estimated 32,576 passengers boarding and alighting on an average workday. The importance of this station is due not alone to the business and commercial activity in the immediate vicinity of that station but primarily to the excellent transfer arrangements to Philadelphia Transportation Company lines. It is estimated that 24,921 passengers daily will transfer to or from PTC lines at this station.

From the station-to-station data of the previous table, the total passenger travel between stations may be computed. The results appear below.

PERSON-TRIPS BETWEEN STATIONS
AVERAGE WORKDAY – 1962

Between Stations	*Total Daily Person-Trips Both Directions*
15th-16th Sts. and 12th-13th Sts.	3,874
12th-13th Sts. and 9th-10th Sts.	9,792
9th-10th Sts. and 8th and Market Sts.	12,369
8th and Market Sts. and City Hall	44,672
City Hall and Broadway	47,978
Broadway and Ferry Ave.	42,874
Ferry Ave. and Collingswood	34,437
Collingswood and Westmont	30,308
Westmont and Haddonfield	23,602
Haddonfield and Ashland	16,718
Ashland and Kirkwood	13,373

The following table is a comparison of the estimated daily person-trips found in this study with those of Brinckerhoff and Klauder.

COMPARISON OF ESTIMATED PERSON-TRIPS
AVERAGE WORKDAY – 1962

	Simpson & Curtin	*Brinckerhoff*	*Klauder*
Philadelphia-Local	273	0	100
Philadelphia to and from New Jersey	44,672	56,073	36,886
New Jersey-Intrastate	12,302	6,533	12,215
	57,247	62,606	49,201

Our studies show a considerable reduction below the Brinckerhoff figures on trips between Philadelphia and New Jersey, even though the line here considered is extended two miles. The lesser volume is in part due to the fact that the use of the Bridge Line for Philadelphia delivery adds from 4 to 5 minutes to the total travel time to and from New Jersey points. Also, Brinckerhoff proposed an improbable condition: the closing of the Benjamin Franklin Bridge to all "locally originating" bus traffic which had the effect of considerably increasing the diversion to rapid transit. We have made no such assumption.

Our study shows a much greater traffic potential for New Jersey local trips than does Brinckerhoff. The basic traffic data show a very substantial movement by auto and bus between Camden and communities within the area of influence. The same diversion techniques which developed the cross-river trips via transit were used in the development of the New Jersey intrastate travel.

The total number of revenue passengers annually is estimated at 17,174,100.

Projection to 1975

The 1962 estimated transit patronage has been projected to 1975 by the application of zone-to-zone growth factors reflecting estimated population growth and changes in land use within the area affected.

The following table shows the 1975 patronage station by station. The increase from 57,247 passengers daily to 63,153 is 10.3%.

STATION TO STATION PERSON TRIPS
AVERAGE WORKDAY – 1975

STATIONS	15th-16th Sts.	12th-13th Sts.	9th-10th Sts.	8th & Market Sts.	City Hall	Broadway	Ferry Ave.	Collingswood	Westmont	Haddonfield	Ashland	Kirkwood	
PHILADELPHIA													
15th-16th Sts.	—												—
12th-13th Sts.	—	—											—
9th-10th Sts.	—	—	—										—
8th & Market Sts.	122	50	34	—									206
NEW JERSEY													
City Hall	234	527	206	2,960	—								3,927
Broadway	493	1,228	461	6,286	—	—							8,468
Ferry Ave.	689	1,674	519	6,439	—	—	—						9,321
Collingswood	375	632	290	1,849	1,023	550	—	—					4,719
Westmont	603	997	509	3,237	1,570	789	—	—	—				7,705
Haddonfield	565	800	271	3,026	3,071	1,330	195	—	—	—			9,258
Ashland	136	216	91	1,549	1,067	866	118	60	74	—	—		4,177
Kirkwood	1,001	1,092	570	6,499	3,093	977	156	396	490	1,098	—	—	15,372
TOTALS	4,218	7,216	2,951	31,845	9,824	4,512	469	456	564	1,098	—	—	63,153

Brinckerhoff estimated 1975 traffic 18.6% higher than the volume estimated when the system is first fully in operation.

Our estimates are based exclusively upon area growth projections. A transit growth factor representing increased use of rapid transit, because of increased traffic congestion and parking difficulties and costs has not been incorporated in the figures. Such a factor might well be applied.

TRENDS IN PERSON TRIPS ACROSS THE DELAWARE RIVER

Trends in total cross-river travel on the Benjamin Franklin and Walt Whitman Bridges since World War II have varied widely as to the three modes of transportation—auto, bus and rail.

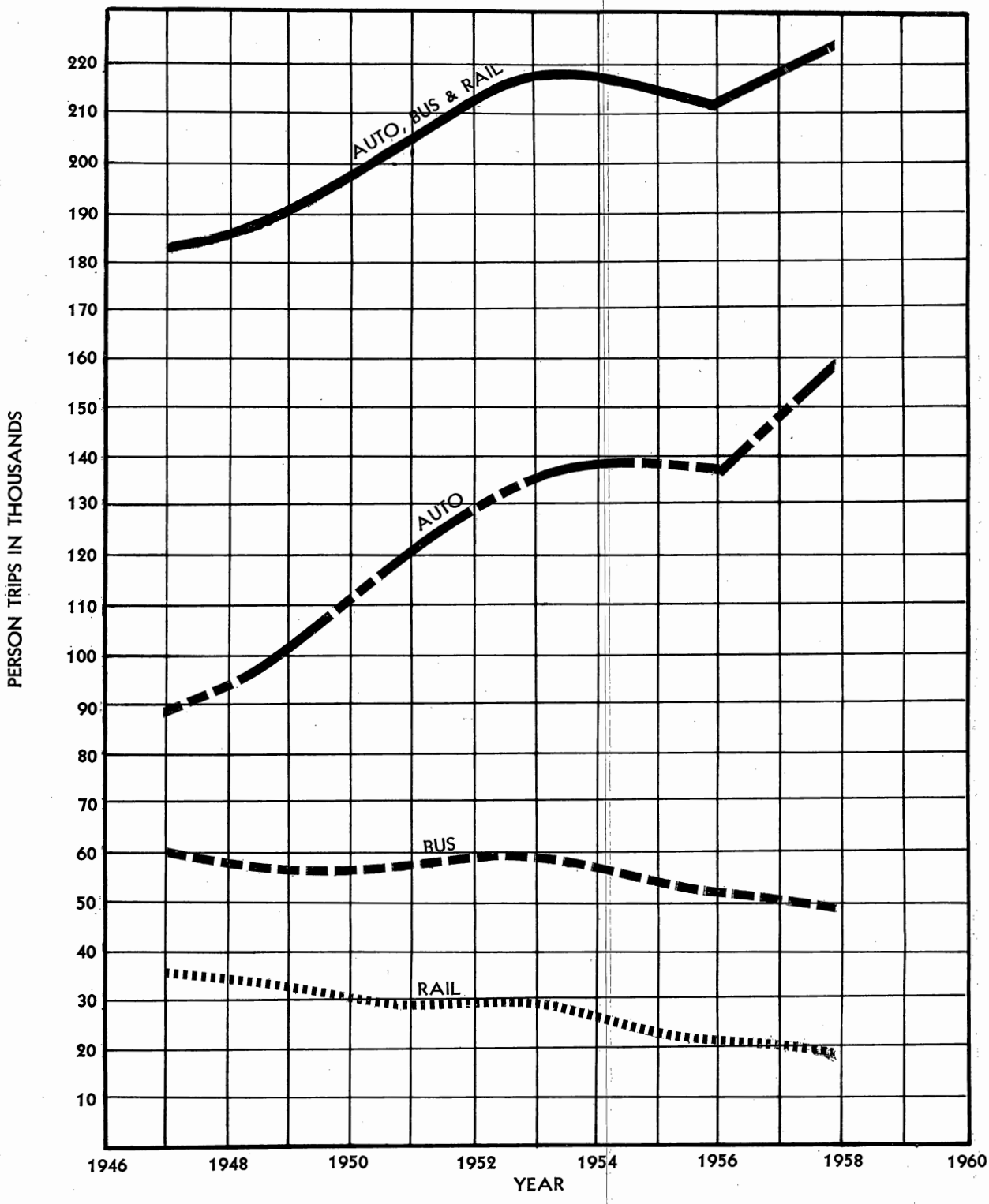
Plate II graphically illustrates the trend in average weekday travel by the several forms of transportation media from 1947 through 1958.

Plate III shows similar data limited to the commuter hours; defined as the four hours between 7:00 and 9:00 A.M. and 4:00 and 6:00 P.M.

The basic data in these two plates are from the Delaware River Port Authority, Philadelphia Transportation Company and Public Service Coordinated Transport.

The total number of persons crossing the two bridges has increased 22% during the eleven year period. Person trips by automobile during the same period have increased 76%; cross-river travel via buses has decreased 18% and rail passengers have decreased 47%. Although there is some slight fluctuation in the year to year trends for all means of travel, the upward trend by automobile and decreasing travel by public transportation are substantially constant throughout the period.

The decline in daily transit passengers (bus and rail combined) has been 29%. However, in the commuter period, the loss in transit traffic in the 11 years has been only 11.7%, at the rate of approximately 1% per year. It is significant that so much reliance is placed on public transportation, with all its present shortcomings. On the Benjamin Franklin Bridge 52% of all the person-trips in the commuter period are by bus and rail.



DAILY PERSON TRIPS

OVER THE

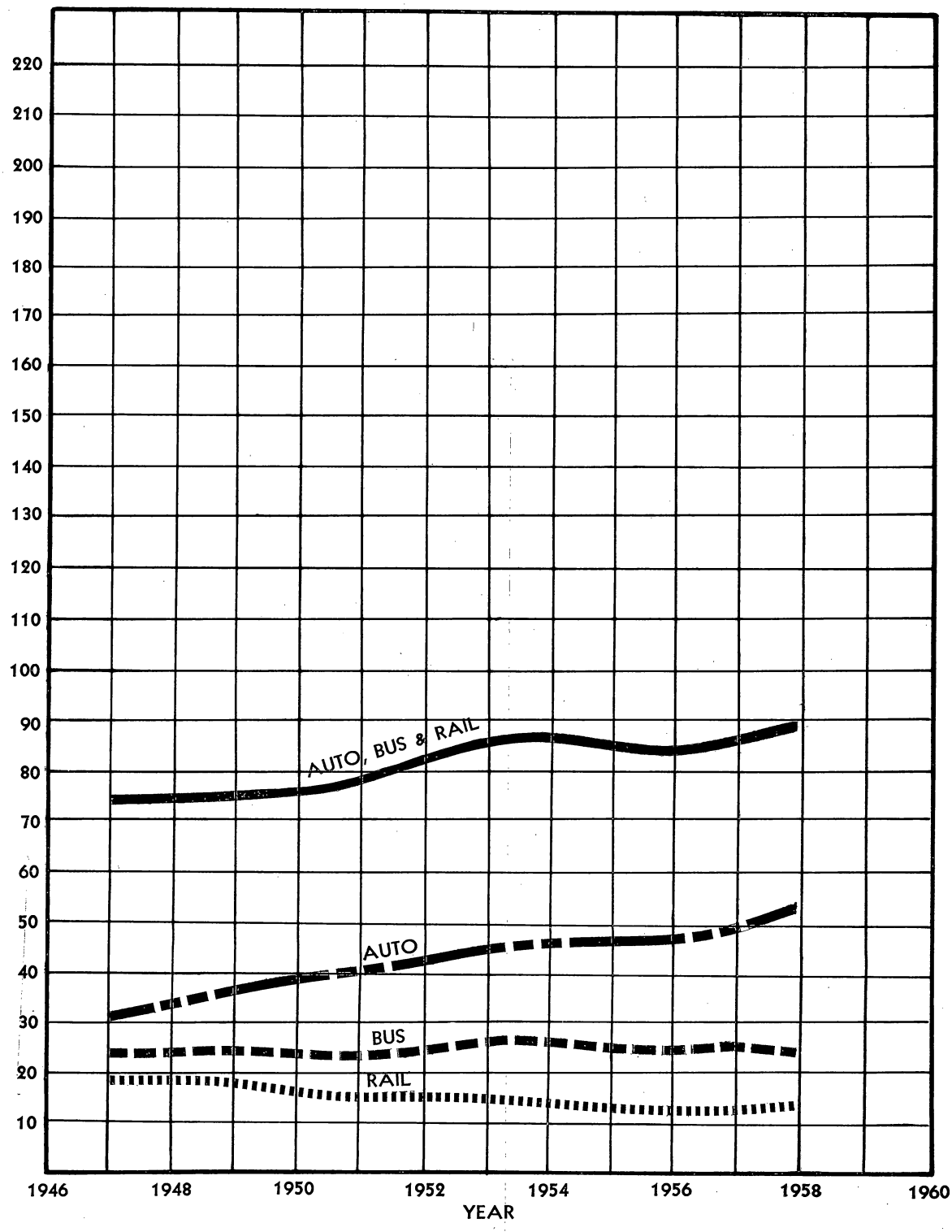
BENJAMIN FRANKLIN

AND

WALT WHITMAN BRIDGES

1947 THRU 1958

PLATE II



COMMUTER PERIOD PERSON TRIPS

OVER THE

BENJAMIN FRANKLIN

AND

WALT WHITMAN BRIDGES

1947 THRU 1958

PLATE III

TRAFFIC CAPACITY AND DEMAND BENJAMIN FRANKLIN AND WALT WHITMAN BRIDGES

During the maximum afternoon rush hour, approximately 21,700 persons cross the two bridges between Philadelphia and New Jersey. The demand, by 1975, will have increased about 25%, to 27,100.

The capacity of the two bridges, if the facilities of mass transportation were utilized to their maximum under existing conditions, is 38,300.

MAXIMUM HOURLY PERSON-TRIP CAPACITY AND DEMAND
BENJAMIN FRANKLIN AND WALT WHITMAN BRIDGES
EXISTING CONDITIONS

		Number of Person-Trips—One Direction—Maximum Hour					
Mode of Travel	*No. of Lanes*	*Capacity*		*1959 Demand*		*1975 Demand*	
Auto	7	13,900	36%	13,400	62%	19,800	73%
Bus	2	8,400	22%	5,300	24%	5,400	20%
Existing Rail Line	1	16,100	42%	3,000	14%	1,900	7%
		38,300	100%	21,700	100%	27,100	100%

The assumptions used in the above calculations are:

(1) Distribution of travel demand by modes projected to 1975 is based upon continuation of historical trends, adjusted for known changes in factors relating to traffic generation.

(2) Four lanes are assumed to be used by automobiles exclusively on the Benjamin Franklin Bridge and three lanes on the Walt Whitman Bridge in the direction of maximum traffic.

(3) The capacity of an auto lane on the Benjamin Franklin Bridge is assumed at 1,200 vehicles per hour, and on the Walt Whitman Bridge at 1,310 vehicles per hour with each vehicle carrying 1.59 persons in 1959.

(4) One lane on each bridge in each direction is assigned to buses, each carrying 42 seated passengers. With Market Street as the principal delivery route, and with existing terminal facilities, the total number of buses per hour cannot exceed 200 over both bridges.

(5) The capacity of the Bridge Line is based on 6-car trains operating on a 90 second headway, each car carrying 67 seated passengers.

As will be seen, while the total capacity of the bridges in person-trips is well beyond the 1975 demand, the present indications are that the trend away from public transportation of the type now offered is such that the demand imposed upon the two bridges by automobile traffic will considerably exceed—by over 40%—the bridges' combined capabilities.

It is significant that the existing rail line is carrying only 14% of the traffic on the two bridges in the rush hour, whereas it has a capacity of 42%. Based on past trends, the percentage of persons using the Bridge Line in 1975, assuming no improvement in facilities, will drop to as little as 7% of the total person-trips on both bridges.

It is obvious that improved transportation facilities must be provided before 1975 if the bridges are to handle the traffic demand imposed upon them.

If the Benjamin Franklin Bridge were converted to make maximum use of automobiles, with no rail transit, the total passenger capacity of the bridge would be substantially reduced. The calculations appear in the table below.

MAXIMUM HOURLY 1975 PERSON-TRIP CAPACITY AND DEMAND
BENJAMIN FRANKLIN AND WALT WHITMAN BRIDGES
ASSUMING RAIL LANES CONVERTED TO AUTOMOBILE USE

		Number of Person-Trips—One Direction—Maximum Hour			
Mode of Travel	*No. of Lanes*	*Capacity*		*1975 Demand*	
Auto	9	17,200	67%	19,800	73%
Bus	2	8,400	33%	7,300	27%
Rail	0	...	..	...	..
		25,600	100%	27,100	100%

In this calculation, it is assumed that, in the absence of the Bridge Line, the passengers that would have otherwise used rail facilities would avail themselves of bus service.

The large increase in automobiles and buses, if the Bridge Line were abandoned, would create severe problems of congestion unless substantial improvements in street and terminal facilities were undertaken.

The alternative to reliance exclusively upon bus and auto lies in the improvement of the rail line to make it more attractive to bus and automobile users.

The influence of improved rapid transit on the demand for travel by various modes is shown in the table following:

MAXIMUM HOURLY 1975 PERSON-TRIP CAPACITY AND DEMAND BENJAMIN FRANKLIN AND WALT WHITMAN BRIDGES ASSUMING CONSTRUCTION OF HADDONFIELD-KIRKWOOD RAPID TRANSIT LINE

Mode of Travel	*No. of Lanes*	*Number of Person-Trips—One Direction—Maximum Hour*			
		Capacity		*1975 Demand*	
Auto	7	13,900	33%	17,100	63%
Buses	2	8,400	20%	3,100	11%
Proposed Rapid Transit Line	1	20,200	47%	6,900	26%
		42,500	100%	27,100	100%

The only change in the capacity assumption is that the proposed rapid transit line would provide seats for 84 passengers in each car, instead of 67.

If the proposed rail line is established, it is estimated that it will attract 2,700 persons who would have used automobiles and 2,300 who would otherwise have been bus passengers in the maximum hour in 1975. This will reduce the demand in 1975 for automobile travel across the river from 19,800 person-trips in the rush hour to 17,100 person-trips.

The proposed rapid transit line would carry 26% of the total trips over the Bridges in 1975, compared with only 7% if the line is continued under existing conditions.

In the table above, the capabilities of buses and those of the proposed rapid transit line can be considerably expanded, if the need arises.

If an adequate bus terminal were built on the Philadelphia side of the bridge, with no traffic interference to and from the terminal, and if highway facilities on the New Jersey side were so designed as to enable buses to be collected and dispersed without traffic delays, the rush hour capacity for buses could be much increased. The New York Port Authority reports approximately 500 buses in the evening rush hour leaving the bus terminal and operating westbound through the Lincoln Tunnel. A central bus terminal in Philadelphia, with complete freedom from traffic interference on both sides of the River, should provide the same facility as in New York. Furthermore, it is possible that buses seating 50 passengers might be utilized.

Similarly, rapid transit maximum load capabilities could be expanded to more than 27,000 passengers by the use of 8-car trains.

REVENUES

Based upon the recommended schedule of fares, the annual passenger revenue in 1962 to be derived from the estimated 17,174,100 passengers is $5,101,125. The average fare per passenger is 29.7¢. The Brinckerhoff average fare for the three recommended routes is 31.89¢; the Klauder figure on the Haddonfield route is 24.5¢.

Since no definitive arrangement in regard to joint tariffs with Philadelphia Transportation Company and Public Service Coordinated Transport can be made at this time, our revenue figures assume that no such tariffs exist.

Brinckerhoff proposed no joint tariff.

Klauder proposed a joint tariff with Philadelphia Transportation Company by which PTC would carry transfer passengers for 10¢, under an arrangement whereby the rapid transit line would receive full fare for every passenger. He also proposed a joint tariff with Public Service Coordinated Transport which provided for a 10¢ fare reduction for bus passengers transferring at Broadway and City Hall stations and a 5¢ reduction for passengers transferring at other stations. This had the effect of reducing estimated rapid transit annual revenue by about 7% ($235,000).

Parking Revenue

Parking areas are provided at all of the stations beyond Broadway adequate to accommodate over 5,000 cars, as follows:

Ferry Avenue	1,000
Collingswood	500
Westmont	800
Haddonfield	1,000
Ashland	500
Kirkwood	1,500
	5,300

In estimating the number of cars for which parking should be provided it was assumed that 20% of those who use the rapid transit line will drive to the station and park; 60% will be driven, 15% will use buses, and 5% will walk.

Brinckerhoff proposed that parking be "free or at a nominal charge", Klauder recommended 6,790 car spaces, and a fee of 25¢ per day.

A parking fee of 25¢ per day would act as a traffic depressant, particularly affecting prospective patrons who now have free parking facilities at or near their destinations.

We recommend that one-quarter of each area be allocated to "Preferred Parking", consisting of those spaces located closest to the terminal. Parkers would be admitted to these areas through a parking gate upon payment of a 25¢ charge; all other spaces would be free.

Assuming the paid spaces to be 80% utilized on each workday, with reduced use on Saturdays, Sundays and holidays and with an allowance for collection costs, the resultant estimated net revenue is $70,000 annually.

Concession Revenue

Revenue from advertising and concessions is estimated at $25,000 annually.

Total Revenue

Revenue for 1962 is:

Passenger revenue	$5,101,000
Parking revenue (net)	70,000
Concessions and advertising (net)	25,000
	$5,196,000

Loss of Revenue to Bridges

Offsetting the revenues to be derived from a modern rapid transit line is the loss in revenue that is to be anticipated by the diversion of automobile riders and bus passengers to rapid transit.

For 1962 this is estimated at $705,000, computed as follows:

Reduction in automobile tolls	$555,000
Reduction in bus tolls	150,000
	$705,000

OPERATING SCHEDULES

As previously stated, the rapid transit passenger equipment will consist of modern, light-weight, air-conditioned cars, capable of maximum speeds of 65 miles per hour, with acceleration and deceleration rates exceeding that of present-day rail service now in operation in the Delaware Valley area.

With fast acceleration and high maximum speed capabilities coupled with the advantages of an exclusive right-of-way, rapid transit travel times would be considerably faster than by either auto or bus between common points of origin and destination.

The scheduled running time between rapid transit stations in New Jersey and the 8th and Market Street Station in Philadelphia is shown on the following table and also on Plate I.

TIMES AND AVERAGE SPEEDS
BETWEEN 8TH AND MARKET STREETS STATION
AND
ALL OTHER STATIONS

Stations	*Miles Between Stations*	*Minutes To 8th & Market Sts.*	*Average Speed To 8th & Market Sts.*
15th - 16th Sts.	–	3.4	20.5
12th - 13th Sts.	0.27	2.5	21.4
9th - 10th Sts.	0.29	1.6	22.5
8th and Market Sts.	0.60	–	–
City Hall	2.34	4.9	28.6
Broadway	0.27	5.9	26.5
Ferry Ave.	2.27	9.5	30.8
Collingswood	1.51	11.9	32.2
Westmont	0.81	13.9	31.1
Haddonfield	0.88	15.6	31.1
Ashland	3.19	19.5	34.7
Kirkwood	2.00	22.0	36.2

As 8th and Market Street is a focal point for cross-river trips, the running time inclusive of stop times is shown to that station rather than to the 15th - 16th Street Philadelphia terminal. To determine the running time from any station to 15th - 16th Street, it is merely necessary to compute the sum of the two appropriate running times indicated in the above table.

Although the average speed for the run from Kirkwood to 8th and Market

Streets is approximately 36 miles per hour, there are several occasions between Camden and Kirkwood when trains would operate between station stops at maximum speeds approaching or equaling 65 miles per hour.

A realistic determination of the time saving advantages of rapid transit versus auto and bus is indicated in the table immediately below. The time in minutes included in this table is determined from common New Jersey points, representative of the approximate population centers of the areas shown. The Philadelphia point is Broad and Chestnut Streets, the approximate center of Center City daytime activities.

COMPARATIVE TRAVEL TIME
RAPID TRANSIT VERSUS AUTO AND BUS

Between Broad and Chestnut Sts. and	*Time in Minutes*		
	Auto	*Bus*	*Rapid Transit**
Camden	13.7	16.2	12.5
Woodlynne	23.6	32.1	15.9
Collingswood	23.9	25.9	17.9
Audubon	29.9	40.3	23.2
Haddonfield	27.5	48.4	22.8
Ashland	31.4	52.1	24.4
Kirkwood	43.9	59.2	28.5

*Rapid Transit time is inclusive of travel time to and from the Rapid Transit station.

The auto and bus running times included in the above table represent actual congestion-free runs. There are, almost daily, occasions when auto and bus trips are delayed for considerable periods of time. If these delays had been pro-rated and included, they would increase considerably the over-all running times shown. Rapid transit times, on the other hand, can be consistently maintained because of the exclusive right-of-way and freedom from grade crossings.

Despite this conservatism, for runs beyond Camden, rapid transit reduces the over-all time to Broad and Chestnut Street from New Jersey points approximately ¼ to ½ below that for auto and bus respectively.

Frequency of Service

To provide attractive rapid transit service both from the standpoint of comfort as well as convenience, the operating schedule is based upon a load factor slightly higher than seated load between Camden and Philadelphia during the rush hours and a rapid transit seat for every passenger throughout the remainder of the day.

During the morning and evening commuter periods, there would be a train frequency of from 4 to 5 minutes. For the midday, early morning and night-time operations the headway will vary from 8 to 15 minutes. Service will be provided between 5:30 in the morning to 1:00 o'clock at night.

In order to provide the frequencies of service indicated, rush hour trains must comprise six cars, with midday and night-time trains of either one or two cars.

The total car miles operated for the year 1962 would equal 3,405,000 miles. It is estimated that the growth of traffic will require 3,642,000 miles annually by 1975.

OPERATING COSTS

The estimated cost of operation of the rapid transit line was established after a study of the costs of rapid transit operation of the Philadelphia Transportation Company and Cleveland Transit System. The latter system is municipally operated and its rapid transit line is closely comparable to that here proposed. Costs of those operations were adjusted, where required, because of differences in conditions which would affect the several cost elements.

Costs were classified in accordance with the Interstate Commerce Commission Uniform System of Accounts for Electric Railways and are presented in terms of costs per car-mile, a conventional method of stating unit transit costs.

The costs as classified are:

OPERATING COST PER MILE (1959 PRICES)

Account	*Cost in Cents per Car-Mile*
Way and Structures	7.83
Equipment	5.81
Power	11.48
Conducting Transportation	18.45
Traffic	0.63
General and Administrative	12.43
	56.63

These costs are increased by 8.5% to represent the probable operating cost per mile in 1962. This produces a cost of 61.44¢ per mile. The escalation factor of 8.5% is based upon the increase in operating costs per mile of large transit systems in the 3-year period 1955–1958.

Within the above costs there has been included an allowance for a management fee sufficient to permit the Authority to contract for the conduct of the operation either by an existing transit management in the area or by a new management group set up for this specific purpose within or outside the framework of the Authority. There is also included an allowance for rental to Pennsylvania-Reading Seashore Lines for the use of their right-of-way and the taxes thereon.

In all cost estimates, it is assumed that no rentals would be paid either to the Port Authority or the City of Philadelphia for the use of existing facilities, and that no taxes at any level of government would be levied on the system.

These estimated costs are compared with those of Brinckerhoff and Klauder, as shown here.

OPERATING COST IN CENTS PER MILE (1962 COSTS)
As Estimated by Simpson & Curtin, Brinckerhoff and Klauder

	Cost
Simpson & Curtin	61.44¢
Brinckerhoff	50.95
Klauder	55.25

Klauder does not classify as an element of operating costs: insurance, management fee or rental to Pennsylvania-Reading Seashore Lines; listing them within the category of "Carrying Charges". His totals for these three items, if included within operating costs would add 12.78¢ per car-mile.

CAPITAL COSTS

The capital costs of all work necessary to construct a modern, fully grade separated, double track rapid transit system to extend the present Bridge Line from Broadway station in Camden to Kirkwood, New Jersey are estimated at $44,600,000 at 1960-1961 prices. Klauder's estimate was $41,000,000 on the same basis. Brinckerhoff's estimate was $33,900,000 exclusive of the tunnel, the subway and equipment at 1955 price levels. That part of our costs which represents all construction, exclusive of equipment and land, totals $34,594,000.

Track and Structures

Within this category are included all costs to be incurred in construction of the transit trackage, grade separations, pedestrian underpasses, fencing of the right-of-way and the elevation and the reconstruction of the railroad track.

Electrification

Included are all costs of third-rail installation, bonding, insulation, substations and their equipment, and control devices.

Signals and Communication

All costs of automatic train control, signalling, dispatching and voice communication system are included, except cab signals which are included in the cost of the cars. The cost of reverse signalling necessary to the continued operation of the Pennsylvania-Reading Seashore Lines to Kirkwood on single track is also included.

Stations and Parking Areas

This item includes all costs to be incurred in the construction of the new stations, together with turnstiles, cashier booths, sanitary facilities, lighting, landscaping, the cost of grading and paving the parking lots and installation of control devices and fences on the paid parking areas. The cost of the Pennsylvania-Reading Seashore Line transfer station at Kirkwood is included.

Shops and Administration Building

This includes costs of building and equipment for the maintenance and cleaning of cars, and the necessary facilities for maintenance and operating personnel. An administration building is also provided, all to be located at the Kirkwood Terminal. Track, electrification, signals and land acquisition costs for the shop and yards are included in their respective classifications.

Equipment

This provides for the purchase of 82 passenger cars, 22 of which would be equipped

with controls for operation in either direction as single car trains; 16 would be semi-permanently coupled in pairs, and 44 cars would be semi-permanently coupled in quads. Cars will seat 80 to 88 passengers depending upon whether the car has one, two or no operator's cab. Cab signals and telephone equipment would be installed in the control end of all lead cars.

Land

Included within this item are all costs of land acquisition for right-of-way, grade crossings, stations and station parking areas, shop and car storage yards, together with demolition costs and damages to abutting property. No costs have been assigned to any of the public land required for rapid transit purposes.

Overheads

This item includes all legal and engineering fees and all other "make-ready" charges estimated at 1% of equipment costs and 10% of other capital costs.

Contingencies

This is estimated at 5% of equipment costs, and 10% of all other costs, including overheads.

Credits

The present cars owned by the Delaware River Port Authority, operating over the Bridge Line-Locust Street Subway, have been in service more than 25 years; they are therefore obsolete for high speed, modern rapid transit service. It is contemplated that these cars can be sold to an existing rapid transit service, not requiring high speed operation, for approximately 15% of present-day purchase prices.

A legislative grant to the Delaware River Port Authority of $3,000,000 from the State of New Jersey through the State Highway Department, towards grade separation costs, will be spread over a three-year period.

Total Costs

The estimated total cost of the proposed line at 1960-1961 prices is detailed in the table below. An escalation factor of 5% was applied to 1959 prices to represent the probable increase in costs to 1961.

ESTIMATED CAPITAL COSTS
SOUTHERN NEW JERSEY RAPID TRANSIT
HADDONFIELD-KIRKWOOD LINE
1960–1961 PRICES

Track and Structures		$16,075,000
Electrification		6,100,000
Signals and Communications		1,980,000
Stations and Parking Areas		3,490,000
Shops and Buildings		945,000
Equipment		11,000,000
Land		1,620,000
Total		$41,210,000
Overheads, Fees and Charges		$3,020,000
Contingencies		3,760,000
Total Cost		$47,990,000
Credits		
Allocation by N. J. Highway Department for Grade Separations	$3,000,000	
Sale of Old Cars	390,000	3,390,000
Total Cost Less Credits		$44,600,000

FINANCES

Annual operating costs, based upon the required annual car miles at the estimated cost of operation per mile, exclusive of debt service, will range from $2,093,000 in 1962 to $2,238,000 in 1975 at 1962 levels of cost.

The estimated excess of annual revenues over expenses will range from $3,103,000 in 1962 to $3,433,000 in 1975.

The table following sets out, for each year 1962 through 1975, the estimated annual total revenues, car miles, total expenses and excess of revenues over expenses.

ESTIMATED ANNUAL REVENUES AND OPERATING EXPENSES
HADDONFIELD-KIRKWOOD RAPID TRANSIT LINE
1962–1975
(Based on 1962 Costs and Fares)

Year	*Total Revenues*	*Car Miles*	*Operating Costs*	*Excess of Revenues Over Expenses*
1962	$5,196,000	3,405,000	$2,093,000	$3,103,000
1963	5,233,000	3,424,000	2,104,000	3,129,000
1964	5,269,000	3,442,000	2,115,000	3,154,000
1965	5,306,000	3,460,000	2,126,000	3,180,000
1966	5,342,000	3,478,000	2,137,000	3,205,000
1967	5,379,000	3,496,000	2,148,000	3,231,000
1968	5,415,000	3,514,000	2,159,000	3,256,000
1969	5,452,000	3,533,000	2,171,000	3,281,000
1970	5,488,000	3,551,000	2,182,000	3,306,000
1971	5,525,000	3,569,000	2,193,000	3,332,000
1972	5,561,000	3,587,000	2,204,000	3,357,000
1973	5,598,000	3,605,000	2,215,000	3,383,000
1974	5,634,000	3,623,000	2,226,000	3,408,000
1975	5,671,000	3,642,000	2,238,000	3,433,000

The excess of revenues over expenses, shown in the last column of the table, will be available to assist in servicing and retiring the debt incurred in the construction of the Line.

If the entire debt were to be financed by the issuance of bonds, the total issue would approximate $50,000,000. The difference between this figure and that of $44,600,000, the estimated construction cost, is accounted for by various fees and interest during the construction period.

Means by which this debt would be serviced and retired is a matter of policy to be determined by the Delaware River Port Authority in consultation with its staff and financial advisors.

FINANCIAL REPORT

DREXEL & CO.
1500 Walnut Street
Philadelphia 1

April 19, 1961

Delaware River Port Authority
Administration Building
Bridge Plaza
Camden 1, New Jersey

Dear Sirs:

In accordance with the authority contained in your letter of March 16, 1961, we have undertaken studies and submit herewith our report on the financial feasibility of the construction and operation by the Delaware River Port Authority of the proposed Rapid Transit facilities in Southern New Jersey.

The preparation of this report has been greatly facilitated by the co-operation afforded by the Executive Staff of the Authority, Mr. Bartholomew A. Sheehan, Chairman of the Finance Committee and other Authority officials. Also, we have benefited from the analysis of the General Bond Resolution, laws and other legal matters governing the financing and operation of the Authority provided by Messrs. Hawkins, Delafield & Wood, Bond Counsel.

We shall be glad to discuss this report in detail and prepare any supplements that may appear in order for your purpose.

Very truly yours,

Drexel + Co

I.
GENERAL

Under date of April 18, 1960, we submitted to the Transportation Committee of the Authority a report on financial feasibility of the proposed Southern New Jersey Rapid Transit System. That report was based on data contained in the Simpson & Curtin Report of January, 1960, as well as on statements and estimates supplied us by the Executive Staff of the Authority. We were further aided by various meetings and discussions with members of the Transportation Committee, Bond Counsel and others.

Subsequent to the submission of our April, 1960 report a number of changes in the program, as then contemplated, have been introduced. There have also been significant changes in the estimates of future net revenue and other pertinent data, as well as in the condition of the securities market. Such changes dictated the necessity of a reappraisal of the financial structure of the Authority and how it might be adapted to the financing, construction and operation of the projected Rapid Transit System. This report, therefore, comprises such reappraisal, demonstrates one method of financing and suggests a possible alternative for future consideration. Recommended procedure, looking toward implementation of a definitive financing plan following approval of the program, is also included.

It should be borne in mind that inasmuch as the future cost of money cannot be precisely predicted, the interest rates employed in the various calculations herein are conservative estimates of the cost of money under present conditions and are used solely for the purpose of demonstrating financial feasibility under such conditions.

II.
CONCLUSION

It is our conclusion, based upon information supplied us to date, that the Delaware River Port Authority can successfully finance the construction of and operate the proposed Rapid Transit System in substantially the manner set forth in this Report.

On the basis of estimates it appears that the Rapid Transit System will not produce sufficient revenues to pay its cost if such cost were financed entirely through a bond issue. Therefore, it is our firm opinion that to be successfully financed and operated, the use of presently available Authority funds to reduce the amount of financing and a secondary pledge of future unencumbered revenues of the Authority derived from operation of presently existing facilities to addi-

tionally secure a new bond issue are necessary and advisable. It also appears that financing of the program and operation of the system require the drafting of a new bond resolution separate from the present General Bond Resolution. While such primary and secondary pledges of revenue, together with the creation of a new and separate bond resolution, may appear to be a somewhat complex financing plan, we are confident that only under such procedure can the best results be obtained and that it will operate smoothly.

The extent to which presently available funds may be employed in reducing the amount of financing and the degree to which the net earnings of the Rapid Transit System alone and in combination with other revenue of the Authority may be expected to cover debt service on the bond issue suggested are demonstrated herein.

III.
PRESENT FINANCIAL STRUCTURE OF THE AUTHORITY

The Delaware River Port Authority at present enjoys a strong and healthy financial condition. Its revenues adequately cover the costs of operation, maintenance, and debt service; its reserves are substantial; the investments of the various funds are in accordance with the General Bond Resolution effective May 20, 1953; its bonded indebtedness in relation to revenue is conservative and is being retired at a satisfactory rate; its financial management is alert and efficient with very good savings effected in the handling of funds and the purchase of bonds in anticipation of Sinking Fund requirements.

As of February 28, 1961, the outstanding bonded indebtedness aggregates $90,931,000. (For details, see Exhibit A). Of this total, $476,000 par value is represented by refunding bonds issued in 1946. These bonds mature June 1, 1966, but are currently callable on any interest payment date at the premium set forth in the above-mentioned Exhibit. The bonds are the remainder of a total issue of $30,000,000. They bear interest at the very low rate of 1%, and substantial savings have been effected by retiring bonds of this issue through purchase in the open market at discounts rather than through call at a premium above par. Under the terms of the bond resolution securing the 1946 bonds, certain funds must be set aside for their benefit. The extent to which these funds have been accumulated is set forth in Exhibit B, and far exceeds the total par value of the outstanding 1946 bonds. The balance of the bonded indebtedness, $90,455,000, is represented by outstanding first series revenue bonds issued under the General Bond Resolution as supplemented by the First Series Supplemental Resolution effective May 20, 1953. (For details, see Exhibit A).

Revenues accruing to the Authority through operation of the Benjamin Franklin Bridge (including the High Speed Line located thereon) and the Walt Whitman Bridge are, after operation and maintenance charges, applied and distributed as required by the General Bond Resolution, but basically may be considered as pledged primarily to the support of the present debt. Operating revenues for the period 1957 through 1960 inclusive are set forth in Exhibit C. The High Speed Line providing rail transportation across the Benjamin Franklin Bridge is operated under contract by The Philadelphia Transportation Company. However, no revenue from that source has accrued to the Authority in recent years. The present contract expires July 1, 1961. In accordance with the terms of the General Bond Resolution and the First Supplemental Resolution, certain Sinking and Reserve Funds must be accumulated. These are discussed more fully in Section V. along with an explanation of the extent of their possible use in connection with financing the proposed Rapid Transit System.

The issuance of additional debt under the General Bond Resolution and the application of income from the existing Authority facilities are covered by various sections of that instrument. Of particular importance to the subject of this report, however, are: Section 102(38) which defines the "Projects" governed and covered by the Resolution and includes therein the High Speed Line but not the further lines and facilities needed for the proposed Rapid Transit System; Section 102(44) which defines as "Revenues" only the receipts of operation of the above-mentioned Projects, not the further lines constituting the Rapid Transit System; Section 102(31) which defines as "Operating Expenses" chargeable against such Revenues only the costs of operating and maintaining such Projects; Sections 405 to 410, inclusive, governing the issuance of additional parity bonds under the Resolution and, except for certain financing or reserve items, requiring deposit of all proceeds of additional Bonds in the Construction Fund under the Resolution; Section 411 limiting expenditure of additional Bond proceeds so deposited in the Construction Fund only for costs and expenses of the defined Projects; Section 502 which pledges the aforesaid Revenues or provides for their application only to Operating Expenses of the above Projects and payment of the existing Bonds; Section 556(1) and Section 402 of the First Series Supplemental Resolution which describe permitted use and transfers of General Reserve Fund monies under the 1946 Resolution, and Section 559 which deals with disposition of such monies and 1946 Bond Sinking Fund monies on retirement of the 1946 Bonds; and Sections 513 and 708 which describe the extent to which surplus amounts originally collected as Revenues aforesaid may on a subordinated basis be pledged or used for purposes other than payment of Bonds issued under the General Bond Resolution.

These provisions indicate clearly that indebtedness of the Authority for the purpose of financing the proposed Rapid Transit System cannot, under the

existing Bond Resolution, be created on a parity with the existing 1953 Bonds or other Bonds which the Authority may hereafter issue to finance one or more additional Delaware River crossings as a Project under that Resolution. It is equally clear, however, that there is no contractual or statutory limitation on the power of the Authority to otherwise finance the proposed System subject to the provisions of the Compact.

As relating to the High Speed Line which will be used by the proposed Rapid Transit System, these provisions of the General Bond Resolution may present some problem as to allocation of capital charges as well as Revenues and Operating Expenses as above mentioned. Bond Counsel and we have assumed that, in consultation with the Trustee and Engineering and Accounting experts, the Rapid Transit System, either in fact or in accordance with sound accounting practices, can be set up separately from the Bridges and High Speed Line terminating at Carman Street and Haddon Avenue in Camden, and a proper basis for allocations of revenue, expenses and other items regarding facilities in joint use can be arrived at, but definitive determinations have not as yet been attempted on these points. However, final decisions thereon will not materially affect the computations supporting our conclusions.

IV.
CONSTRUCTION COSTS

The cost of construction, as set forth in the Simpson & Curtin report, amounts to $44,600,000. (Exhibit D). Exhibit D shows the present break down of cost and reflects net after allowing for credit of $3,000,000 expected to be supplied by the New Jersey Highway Department in sharing the costs of grade separations and for the sale of old cars in the amount of $390,000—all credits aggregating $3,390,000. For purposes of this report, and in the interest of conservatism, a total cost figure of $50,000,000 has been used in considering financial feasibility.

The amount of financing necessary to cover this rounded cost may be substantially reduced by application of a portion of certain available reserve funds. While this subject is discussed more fully in Section V., it should be noted here that in the examples of financing used, we have assumed the use of an aggregate of $25,000,000 of such funds.

V.
SINKING AND OTHER FUNDS AND RESERVES

In Section III. of this Report reference has been made to the provisions of the existing Resolutions governing the use of the General Reserve Fund and other monies on hand in connection with financing facilities such as the proposed

Rapid Transit System. Exhibit B enumerates these funds and indicates a total as of February 28, 1961, of $33,390,000 as available for such purpose. Included in this total is the sum of $9,183,000 that will become available only after and if the outstanding 1946 bonds are called and redeemed.

In considering the extent to which these available funds could best be employed toward defraying the cost of construction, many factors and various points of view were considered. After weighing these, it is our conclusion that while use of these funds in lowering the amount of financing is highly desirable, sound financial procedure indicates that such use be limited so as to assure maintenance of reasonable reserves against future contingencies. To do otherwise might endanger the present financing and the future development of the Port.

Many developments in and around the Port area are being spoken of. These include: a new Delaware River crossing north of the present Benjamin Franklin Bridge; the new Delaware Expressway connecting the various facilities and increasing the traffic flow paralleling the River on the Pennsylvania side which conceivably could create new demands on the Authority; a possible new and widened approach artery to the Benjamin Franklin Bridge on the New Jersey side. All of these possibilities dictate the wisdom of avoiding complete or near exhaustion of available funds for present purposes.

In applying this reasoning, we have concluded that use of an aggregate of $25,000,000 of available funds would secure the advantage of reducing the amount of financing while avoiding the disadvantages of an exhausted or weakened reserve position. That the Authority is thus able to lend such substantial assistance to the construction of this important Transit System and at the same time maintain its finances in a sound healthy state is a most fortunate situation.

VI.
FINANCING

In approaching the question of the character or type of debt to be created to finance the proposed Rapid Transit System, we have been guided to a considerable extent by the restrictions on issuance of debt under the existing General Bond Resolution, by the purpose of issue, by "coverage", by expected market receptivity and other factors.

Debt for the purpose proposed cannot be incurred under or combined on a parity basis with indebtedness issued under the General Bond Resolution. Therefore, a new and separate Bond Resolution must be drawn, setting forth the nature of the obligation and the necessary covenants of the Authority.

The initial or primary security envisioned is that resulting solely from operation of the Rapid Transit System. However, because of the lack of favor accorded transit securities in general by capital markets today, as well as because of possible future developments that may affect the finances of the Authority, we deem it necessary and advisable to establish a "secondary" or "standby" pledge of funds other than those derived directly from operation of the Transit System. To accomplish this, the terms of the present General Bond Resolution permit the Authority, after satisfaction of all requirements thereunder, to use remaining "surplus" revenues for any lawful purpose.

The financing method detailed in this report, therefore, contemplates an issue of bonds secured by (i) a first lien on and pledge of earnings of the Rapid Transit System and (ii) a junior lien on and pledge of the net revenues of the Authority from its other facilities after providing all the debt payments and reserves required by the General Bond Resolution. Such a combined pledge should provide a highly satisfactory security and permit the sale of the bonds at an attractive rate of interest.

For demonstration we suggest that there be issued bonds in the amount of $29,500,000 (see Exhibit E); that they be term bonds with the benefit of a Sinking Fund and with a maturity of thirty years; that they be made callable for refunding after eight years but callable from monies in a Sinking Fund after four years; that there be a "fixed" Sinking Fund schedule setting forth the specific amount of bonds to be retired each year—such amounts so calculated that in the aggregate the full issue will be retired by the maturity date (Exhibit F). The new Bond Resolution would provide that while fixed Sinking Fund retirements are mandatory, failure to meet the specified annual retirement in whole or in part would not constitute an event of default.

The financing plan also contemplates that the Bond Resolution would be "open end" subject to reasonable earnings tests and restrictions so as to permit issuance of additional bonds in the future for possible expansion of the System and possibly for other undertakings. (See Section VIII. for discussion of Bond Resolution covenants).

An important and initial step in the suggested financing program is the retirement of the outstanding balance of $746,000 1946 bonds. (See Exhibit G). Such retirement will release some $9,000,000 of the reserve funds necessary for application to the over-all cost, and, therefore, lessen the amount of financing otherwise required.

In exploring financial feasibility, we have assumed employment of what (except for very large issues) is the most commonly used method of marketing state,

municipal and authority securities. This method is generally referred to as sale of a bond issue through "advertised sale" or "competitive bidding". Under this method the terms of the bond issue are determined by the Authority with the assistance of Bond Counsel, Engineers and Financing Consultants. A date is set on which bids for the issue will be received and advertising inviting such bids is placed in various appropriate newspapers and financial publications. Everything else being equal, the Authority in this way is assured of receiving the lowest rate of interest obtainable in the market.

While the method just described is used for demonstration purposes in this report, we feel we should point out that because of the somewhat unusual aspects of the situation now being considered, notably the subordinated and junior position of the bonds as regards payment from the Authority's existing and proven Revenues, there is an alternative method of financing that the Authority might under certain conditions deem more appropriate and advantageous, as the nature, extent and timing of the financing becomes more definite. This alternative method is sometimes referred to as "bank loan and private placement". Under this method funds required from time to time during the construction period are provided through a loan negotiated through a bank or group of banks. Such loan is extinguished at the end of the construction period by the issuance of bonds under a previously arranged contract with institutional or other purchasers. A further possible variation is a similar bond selling contract with such purchasers on a "forward-commitment" basis, with the bonds being delivered by the Authority only from time to time as construction funds are needed.

VII.
PROJECTED RESULTS OF OPERATION

The report of Messrs. Simpson & Curtin discusses the revenue anticipated from operation of the Rapid Transit System, as well as from incidental sources, such as parking fees, advertising concessions, etc. It also estimates the loss of revenue that may reasonably be anticipated as a result of diversion of automobile riders and bus passengers from the Bridges to Rapid Transit. The Engineers' Report further estimates the cost of operation and maintenance of the Rapid Transit System as well as incidental costs and charges. Accordingly, we are not in our report detailing these various items. Rather, there is included in our exposition of potential debt service coverage a projection of net revenues based on the Simpson & Curtin estimates and reflecting adjustments made by the Authority. (Exhibit H). This projection demonstrates the extent to which Transit System revenues remaining after cost of operation and maintenance may be expected to cover debt service for the first ten years of operation.

The secondary or surplus revenues from existing facilities referred to in Section VI. of this report have also been projected for the ten-year period, 1964–73. Such revenues constitute, under the program envisioned, a further pledge to the security of the proposed bonds. By adding this additional margin of protection, an overall coverage of from 3.59 to 3.69 times is obtained. This overall coverage, of course, might be lessened to some extent if in the future the Authority moves to finance projects under the existing General Bond Resolution, or if further financing is undertaken for the improvement or expansion of the Rapid Transit System or for other purposes under the new Bond Resolution.

The well recognized possible need for future development of the Port, additional crossings, expansion of the Rapid Transit System, or other undertakings required or authorized by the Compact Legislation between the Commonwealth of Pennsylvania and the State of New Jersey creating the Delaware River Port Authority, dictate the soundness of a generous initial margin of revenue over requirements.

VIII.
BOND RESOLUTION

The new and separate Bond Resolution referred to in this report would authorize the financing, define the security therefor, establish its terms, and govern the use of revenues of the Transit System, as well as the unencumbered surplus funds expected to become available under the General Bond Resolution.

To accomplish this, as well as other important matters in connection with the financial conduct of the Authority, various covenants must necessarily be made. These covenants would be arrived at after thorough discussion with the Authority, its Trustee, Bond Counsel, Engineers and Financing Consultants. Some of the topics to be covered by such covenants would include:

A. The imposition of adequate service rates on the new facilities.

B. The pledge of surplus revenues from present facilities.

C. The maintenance of adequate tolls on the present facilities.

D. The accumulation and maintenance of various funds for replacements, insurance, debt service, bond redemption, etc.

E. The terms of issuance in the future of pari passu bonds to provide extensions, betterments, additions, etc. to the Rapid Transit System.

F. Allocation of a portion of net revenue to a fund for possible future improvements so as to lessen the need for additional financing.

G. Proper provision for possible Port development and expansion.

H. Treatment of the High Speed Line.

I. Inasmuch as bonds issued under the new Bond Resolution would be junior to presently outstanding bonds as far as lien on revenues from facilities now in operation or authorized under the General Bond Resolution is concerned, it is necessary that adequate assurance be given holders of the junior lien bonds that their security will not be diluted beyond reasonable limits. This assurance would probably be in the nature of restrictions on the amount of debt which may at any one time be outstanding under the 1953 Bond Resolution.

IX.
RECOMMENDED PROCEDURE

Inasmuch as implementation of a financing program is probably some time away, the definitive amount of financing may well differ from that stated herein by reason of changes in the program itself, as well as by changes in the money market and other factors. When the program is clearly defined and financing is called for, we recommend the following procedure:

A. Determine the amount of financing, the method of financing, timing, etc.

B. Instruct Bond Counsel, Engineers and Financing Consultants to proceed to work closely with the Authority, its Trustee and members of its Executive Staff in implementing and carrying the program to completion. This, among other things, would include:

1. Writing of the Bond Resolution.
2. Writing of the Authority's Official Statement or Prospectus.
3. Assistance in the preparation of Sales Notices, advice on timing, information meetings, work with rating agencies, and other essential steps if the bonds are to be sold at advertised public sale.
4. Assistance in arranging for the bank loan and/or private placement of bonds, if that method of financing is determined upon.

X.
EXHIBITS

EXHIBIT A

OUTSTANDING BONDED INDEBTEDNESS
February 28, 1961
(000's Omitted)

REFUNDING BONDS, 1% dated June 1, 1946			
Original Issue		$30,000	
Less: Serial bonds matured and retired 6/1/46 to 6/1/54	$14,000		
Term bonds purchased and retired	15,524	29,524	
Bonds outstanding			$476(a)
FIRST SERIES REVENUE BONDS, dated May 15, 1953			
Original Issue		$100,000	
Less: Serial bonds matured and retired 12/15/57 to 12/15/60	$4,100		
Term bonds due 12/15/83 purchased or called and retired	5,445	9,545	
Bonds outstanding			$90,455 (b)
TOTAL BONDED INDEBTEDNESS			$90,931

(a) Refunding Bonds outstanding are all Term Bonds due June 1, 1966 and are callable on any interest payment date at 102% plus accrued interest.

(b) First Series Revenue Bonds outstanding are as follows:

Principal Amount	*Maturity Date*	*Interest Rate*
$1,600	12/15/61	3 %
1,800	12/15/62	3
2,000	12/15/63	3
2,200	12/15/64	3¼
2,400	12/15/65	3¼
2,700	12/15/66	3¼
2,900	12/15/67	3¼
$3,100	12/15/68	3¼%
3,300	12/15/69	3¼
3,400	12/15/70	3¼
3,500	12/15/71	3¼
3,500	12/15/72	3¼
3,500	12/15/73	3¼
54,555	12/15/83	3½
$90,455		

The bonds are callable, as a whole at any time, or in part on any interest payment date in inverse order of maturity, at 104% of the principal amount to and including December 15, 1962; thereafter at 103% to and including December 15, 1967; thereafter at 102% to and including December 15, 1972; thereafter at 101%to and including December 15, 1977; and thereafter at 100% plus accrued interest in each case.

EXHIBIT B

SOURCE AND AMOUNT OF UNENCUMBERED FUNDS AVAILABLE AS OF FEBRUARY 28, 1961
(000's Omitted)

Source	*Amount*
1946 Bond Sinking Fund	$ 9,183(a)
General Reserve Fund	10,519
General Fund	13,688
Total Amount Available	$33,390

(a) After deducting cost of redemption of $476,000 1% Bonds due 1966 @ 102 plus interest to June 1, 1961.

EXHIBIT C

OPERATING REVENUES AND EXPENSES FROM EXISTING FACILITIES
(000's Omitted)

	1957(a)	*1958*	*1959*	*1960*
Operating Revenues	$10,044	$10,631	$11,927	$12,669
Operating Expenses	2,387	3,071	3,112	3,497
Net Operating Revenues	$7,657	$7,560	$8,815	$9,172
Interest on Funded Debt	3,408	3,378	3,253	3,131
	$4,249	$4,182	$5,562	$6,041
Bond Amortization, Port Development Expense and Other Charges	2,270	2,715	3,006	3,602
Available Revenues (b)	$1,979	$1,467	$2,556	$2,439

(a) Walt Whitman Bridge opened for traffic May 16, 1957.

(b) From operations only. Accordingly interest earned on Reserve Funds ($1,282,000 in 1960) is excluded. To the extent that these Funds are employed as suggested in this Report such earnings will be reduced.

EXHIBIT D

ESTIMATED CONSTRUCTION COST
SOUTHERN NEW JERSEY RAPID TRANSIT SYSTEM
(000's Omitted)

Track and Structures		$16,075
Electrification		6,100
Signals and Communications		1,980
Stations and Parking Areas		3,490
Shops and Buildings		945
Equipment		11,000
Land		1,620
Total		$41,210
Overhead, Fees and Charges		3,020
Contingencies		3,760
Total Cost		$47,990
Credits		
Allocation by		
New Jersey Highway Dept. for Grade Separation	$3,000	
Sale of Old Cars	390	3,390
Total Cost Less Credits		$44,600
Adjustment (a)		5,400
Estimated Construction Cost		$50,000

(a) See Section IV. of Report.

EXHIBIT E

DETERMINATION OF AMOUNT OF BOND ISSUE
ASSUMING 30-YEAR 4¼% BONDS MATURING IN 1992
(000's Omitted)

Construction Cost (Exhibit D)	$50,000
Less Funds of the Authority to be made available	25,000
Balance to be Funded	$25,000
Interest during Construction, two years	2,508
Debt Service Reserve Fund (one year's debt service)	1,822
Discount at 1½%	443
Legal, Printing, Financial and Miscellaneous	352
	$30,125
Less Estimated Earnings on Construction Fund (a)	625
Bond Issue	$29,500

(a) Equivalent to 2½% per annum on Construction Fund for one year.

EXHIBIT F

$29,500,000 4¼% BONDS DUE 1992
SCHEDULE SHOWING SINKING FUND AND INTEREST REQUIREMENTS
(000's Omitted)

Calendar Year	*Sinking Fund*	*Interest*	*Total*
1962	$–	$1,254(a)	$1,254
1963	–	1,254(a)	1,254
1964	568	1,254	1,822
1965	592	1,230	1,822
1966	618	1,204	1,822
1967	644	1,178	1,822
1968	671	1,151	1,822
1969	700	1,122	1,822
1970	729	1,093	1,822
1971	760	1,062	1,822
1972	793	1,029	1,822
1973	826	996	1,822
1974	862	960	1,822
1975	898	924	1,822
1976	936	886	1,822
1977	976	846	1,822
1978	1,018	804	1,822
1979	1,061	761	1,822
1980	1,106	716	1,822
1981	1,153	669	1,822
1982	1,202	620	1,822
1983	1,253	569	1,822
1984	1,306	516	1,822
1985	1,362	460	1,822
1986	1,420	402	1,822
1987	1,480	342	1,822
1988	1,543	279	1,822
1989	1,609	213	1,822
1990	1,677	145	1,822
1991	1,737	74	1,811
	$29,500	$24,013	$53,513

(a) Under the Financing Plan presented in this Report interest for these years is capitalized.

EXHIBIT G

AMOUNT NECESSARY TO RETIRE THROUGH CALL ON JUNE 1, 1961 OUTSTANDING 1% BONDS DUE JUNE 1, 1966

Principal Amount Outstanding February 28, 1961	$476,000
Redemption Premium at $20 Per $1,000 Bond	9,520
Accrued Interest to June 1, 1961	2,380
Total	$487,900

EXHIBIT H

ESTIMATED REVENUES AND COVERAGE OF DEBT SERVICE ON $29,500,000 4¼% BONDS DUE 1992
(000's Omitted)

Calendar Years	*Estimated Available Revenues From Present Facilities*(a)	*Debt Service*(b)	*Coverage*	*Estimated Net Revenues From Rapid Transit*(c)	*Coverage*	*Total Revenues Available for Debt Service*	*Coverage*
1964	$3,625	$1,822	1.99	$3,103	1.70	$6,728	3.69
1965	3,541	1,822	1.94	3,129	1.72	6,670	3.66
1966	3,463	1,822	1.90	3,154	1.73	6,617	3.63
1967	3,427	1,822	1.88	3,180	1.75	6,607	3.63
1968	3,335	1,822	1.83	3,205	1.76	6,540	3.59
1969	3,350	1,822	1.84	3,231	1.77	6,581	3.61
1970	3,362	1,822	1.85	3,256	1.79	6,618	3.63
1971	3,370	1,822	1.85	3,281	1.80	6,651	3.65
1972	3,370	1,822	1.85	3,306	1.81	6,676	3.66
1973	3,366	1,822	1.85	3,332	1.83	6,698	3.68

(a) As estimated by the Authority, without providing for allocation of a portion of the revenues from the Rapid Transit System.

(b) Level debt service plan. Amount which will provide for payment of Sinking Fund and interest requirements in each year to maturity, retiring all bonds by maturity.

(c) Based on Simpson & Curtin Report and reflecting adjustments made by the Authority.

APPENDIX

INDEX TO
PLAN AND PROFILE PLATES

Plate No.	Plate Title
IV	Central Philadelphia Area
V	Independence Mall Area
VI	Benjamin Franklin Bridge
VII	Central Camden Area
VIII	Haddon Avenue Area—Camden
IX	Collingswood
X	Westmont
XI	Haddonfield
XII	Woodcrest
XIII	Ashland
XIV	Kirkwood

PROFILE LEGEND

Stations

Blue – Present and Proposed

Structures

Blue – Proposed

Black – Existing

Grade

Blue – Proposed rapid transit and railroad grade

Black (heavy)– Existing railroad grade

Note: Where proposed rapid transit grade is at existing railroad grade, only a blue line is shown.

Black (light) – Ground level

Note: Where existing railroad grade is at approximate ground level, only one black line is shown.

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE CENTRAL PHILADELPHIA AREA

PLATE IV

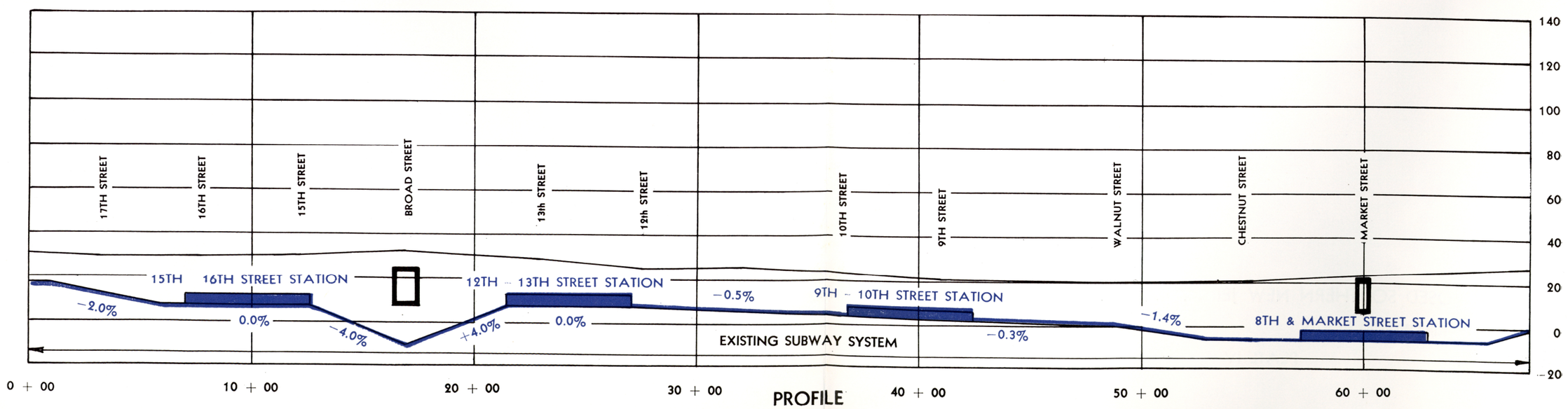
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE — CENTRAL PHILADELPHIA AREA

SIMPSON AND CURTIN — PHILADELPHIA



PLAN



PROFILE

PLATE IV

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

INDEPENDENCE MALL AREA

PLATE V

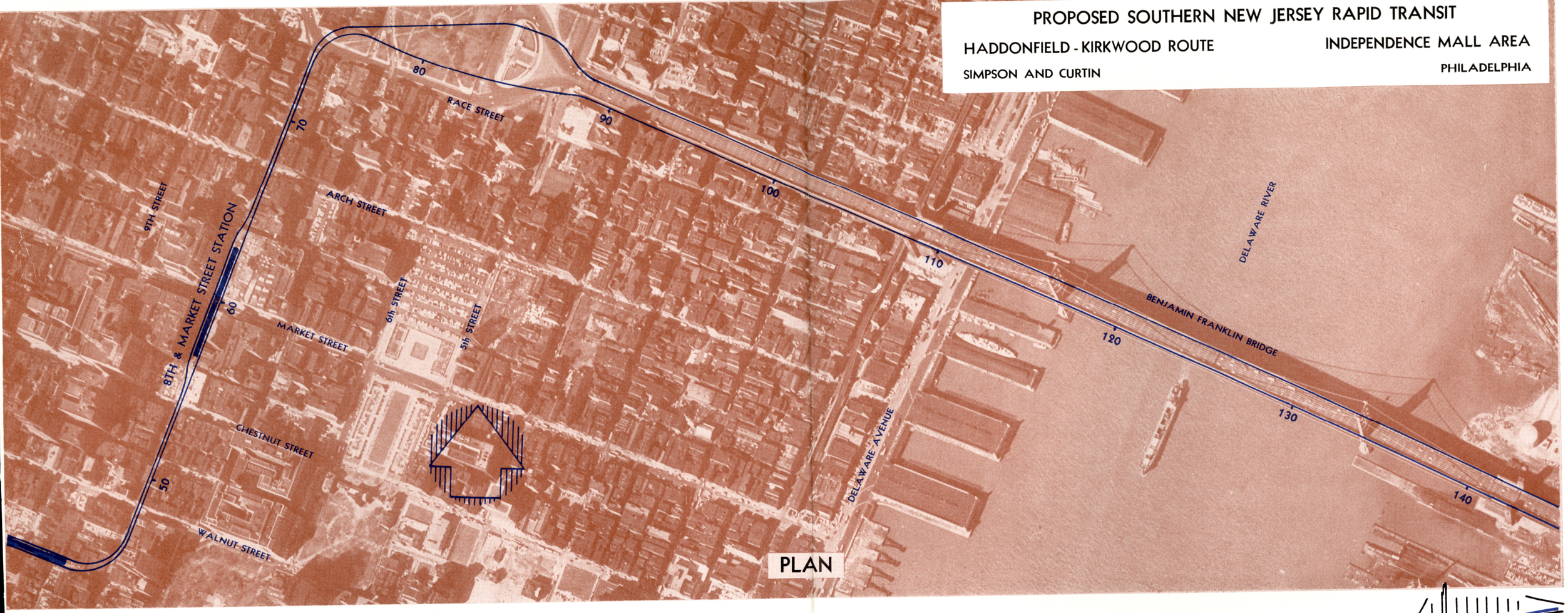
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

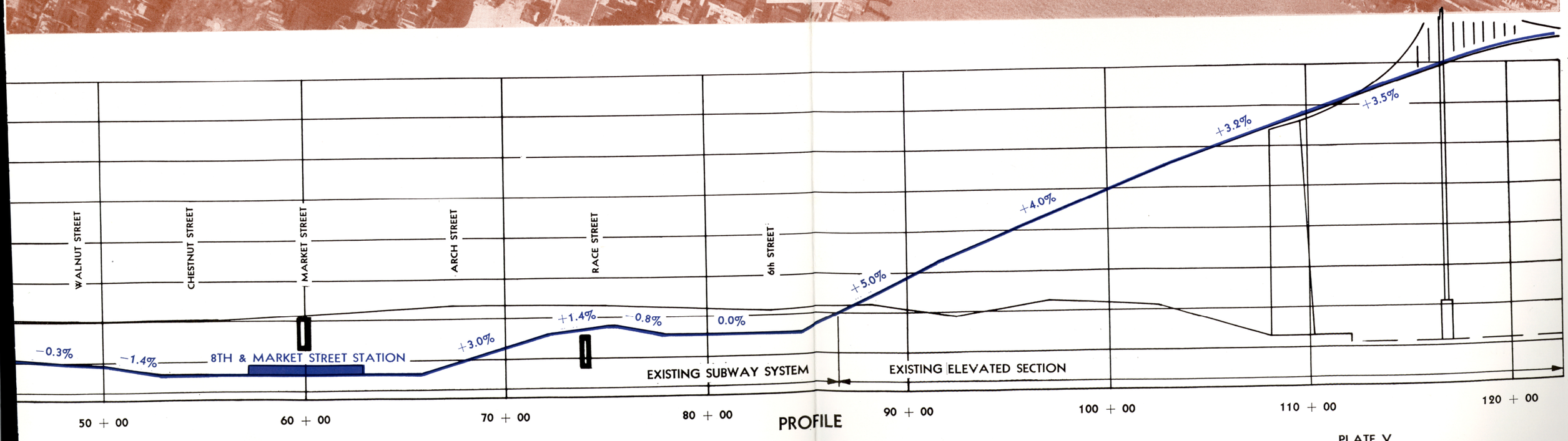
INDEPENDENCE MALL AREA

SIMPSON AND CURTIN

PHILADELPHIA



PLAN



PROFILE

PLATE V

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE BENJAMIN FRANKLIN BRIDGE

PLATE VI

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

BENJAMIN FRANKLIN BRIDGE

SIMPSON AND CURTIN

PHILADELPHIA

CITY OF PHILADELPHIA

VINE STREET

ELEVATED

DELAWARE RIVER

CITY OF CAMDEN

BENJAMIN FRANKLIN BRIDGE

90 100 110 120 130 140 150 160

RACE STREET

FRANKFORD

DELAWARE AVENUE

LINDEN STREET

6th STREET

5th STREET

ARCH STREET

PENN STREET

2nd STREET

COOPER STREET

MARKET STREET

PLAN

+5.0% +4.0% +3.2% +3.5% −3.5% −4.2% −4.3%

EXISTING ELEVATED SECTION

160 140 120 100 80 60 40 20 0

90 + 00 100 + 00 110 + 00 120 + 00 130 + 00 140 + 00 150 + 00 160 + 00

PROFILE

PLATE VI

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

CENTRAL CAMDEN AREA

PLATE VII

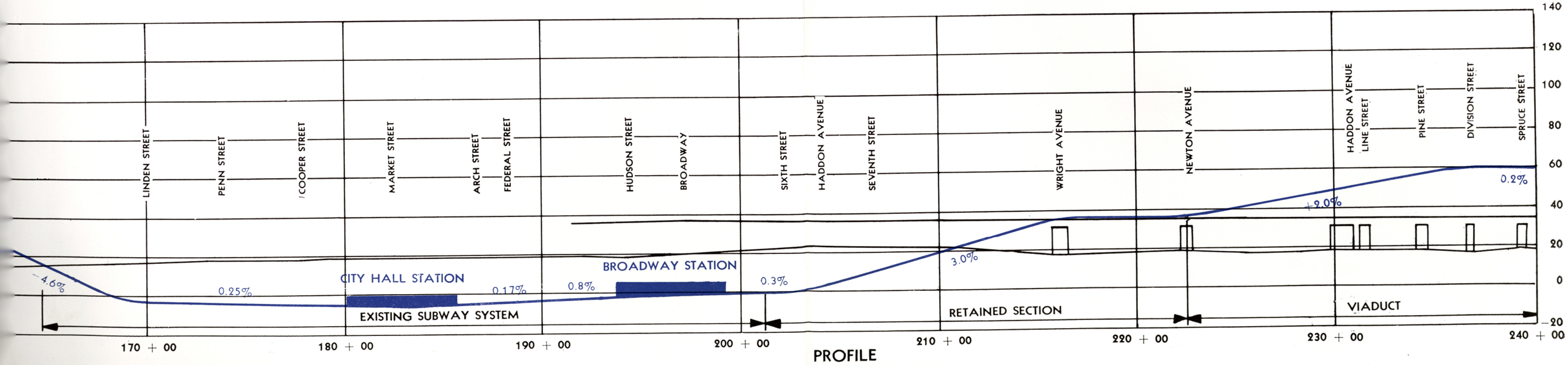
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE — CENTRAL CAMDEN AREA

SIMPSON AND CURTIN — PHILADELPHIA

MOORESTOWN BRANCH
WRIGHT AVENUE
HADDON AVENUE
NEWTON AVENUE
LINE STREET
PINE STREET
DIVISION STREET
SPRUCE STREET
WALNUT STREET
MT. VERNON STREET
CHESTNUT STREET
WOODBURY BRANCH
SYCAMORE STREET
MT. EPHRAIM AVENUE
SEVENTH STREET
SIXTH STREET
BROADWAY
PENN STREET
COOPER STREET
MARKET STREET
SECOND STREET
ARCH STREET
FEDERAL STREET
CITY HALL STATION
BROADWAY STATION
160
170
180
190
200
210
220
230
240
250

PLAN



PROFILE

PLATE VII

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE HADDON AVENUE AREA - CAMDEN

PLATE VIII

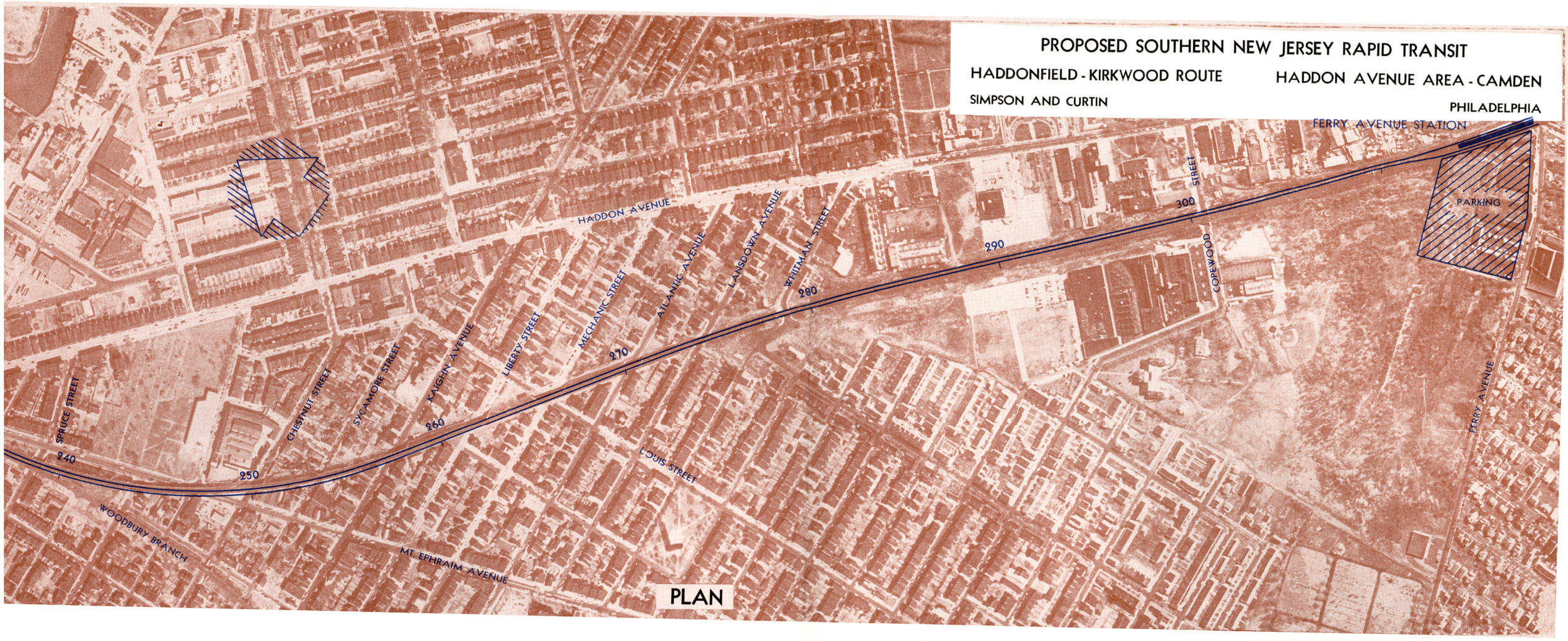
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

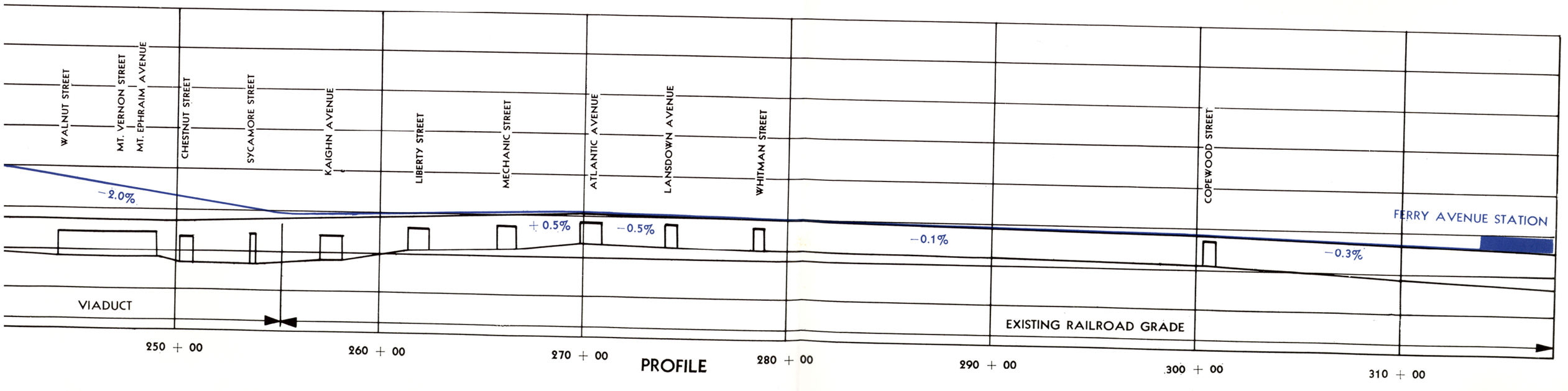
HADDON AVENUE AREA - CAMDEN

SIMPSON AND CURTIN

PHILADELPHIA



PLAN



PROFILE

PLATE VIII

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

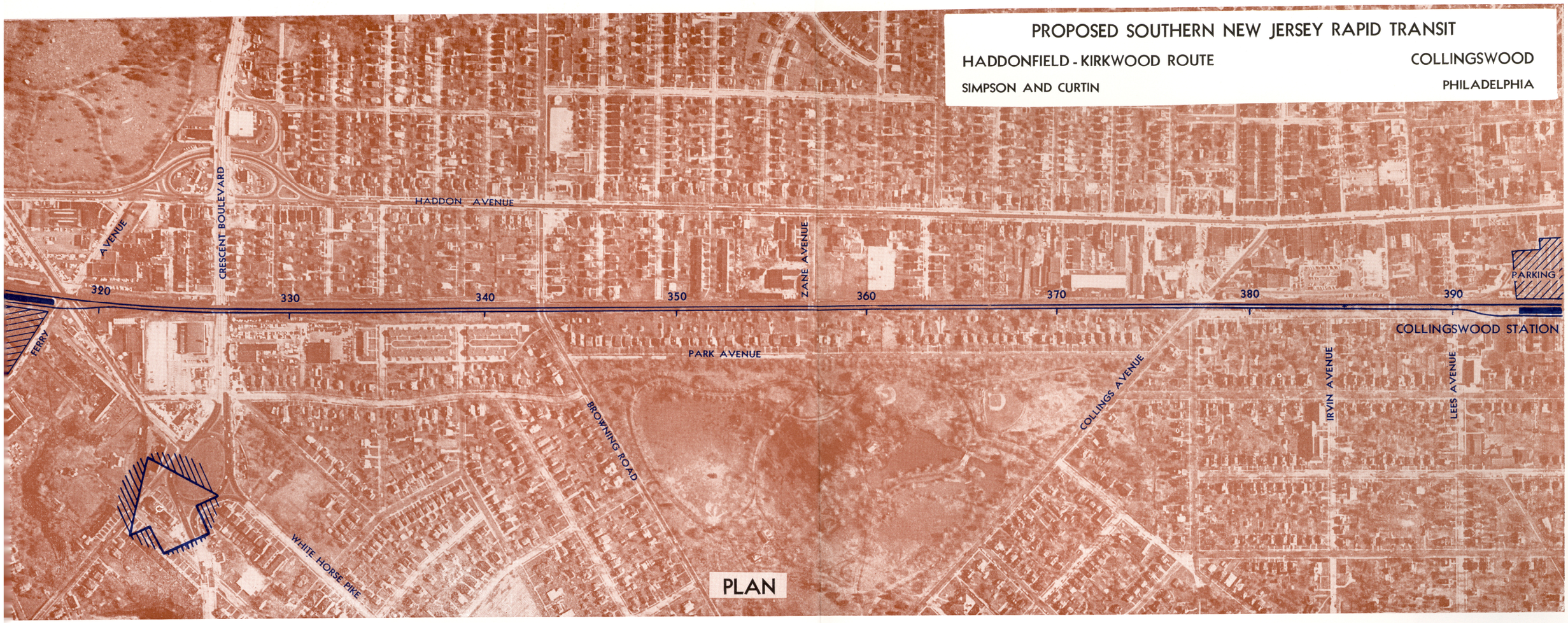
HADDONFIELD - KIRKWOOD ROUTE COLLINGSWOOD

PLATE IX

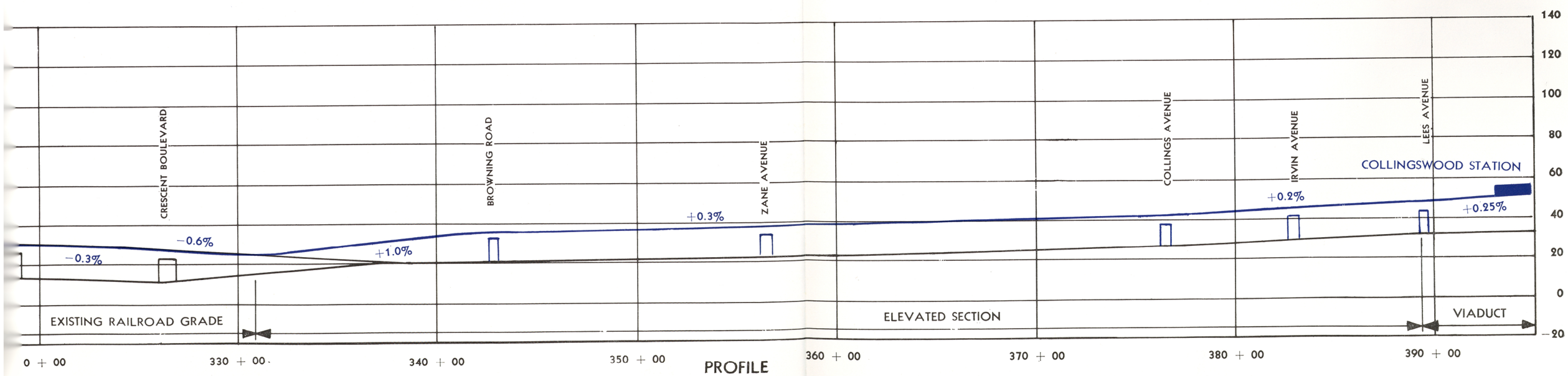
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE — COLLINGSWOOD

SIMPSON AND CURTIN — PHILADELPHIA



PLAN



PROFILE

PLATE IX

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

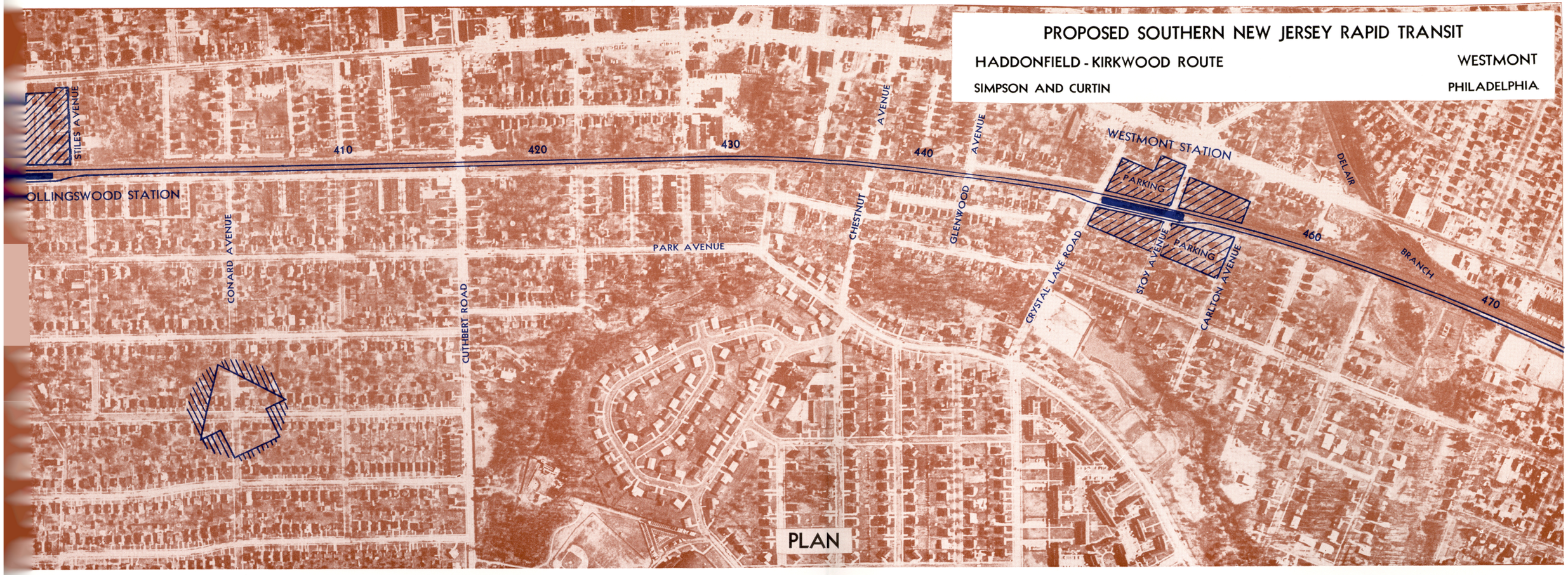
WESTMONT

PLATE X

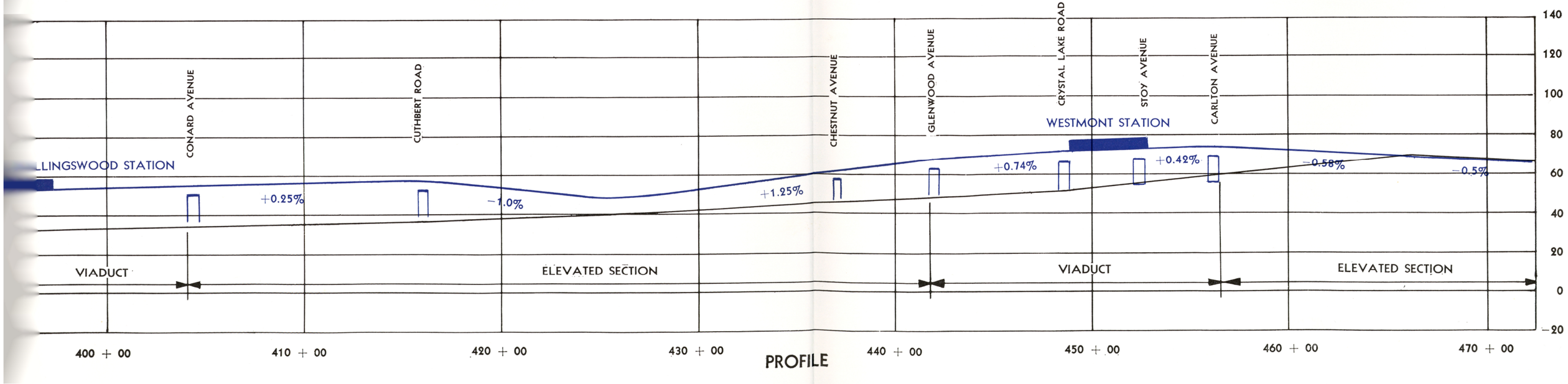
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE — WESTMONT

SIMPSON AND CURTIN — PHILADELPHIA



PLAN



PROFILE

PLATE X

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

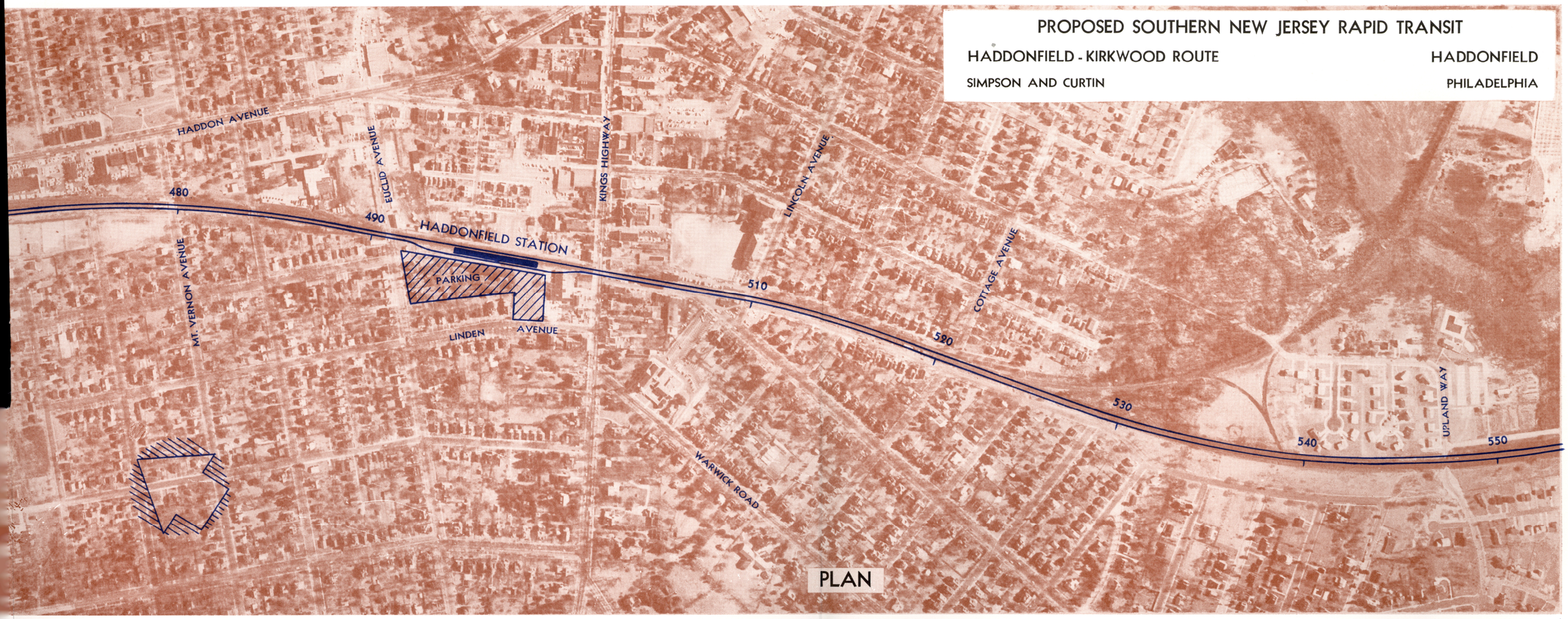
HADDONFIELD - KIRKWOOD ROUTE HADDONFIELD

PLATE XI

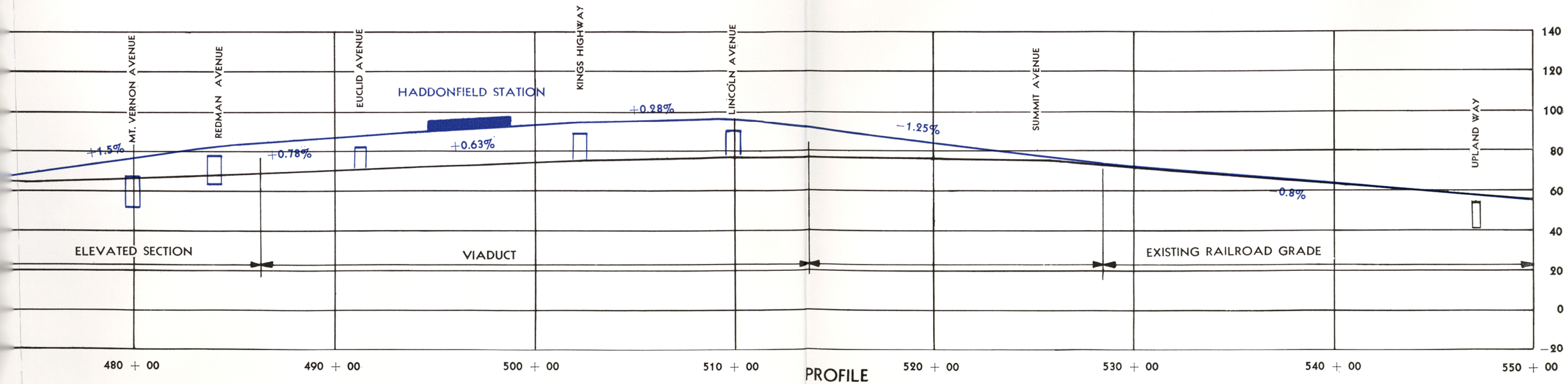
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE — HADDONFIELD

SIMPSON AND CURTIN — PHILADELPHIA



PLAN



PROFILE

PLATE XI

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

WOODCREST

PLATE XII

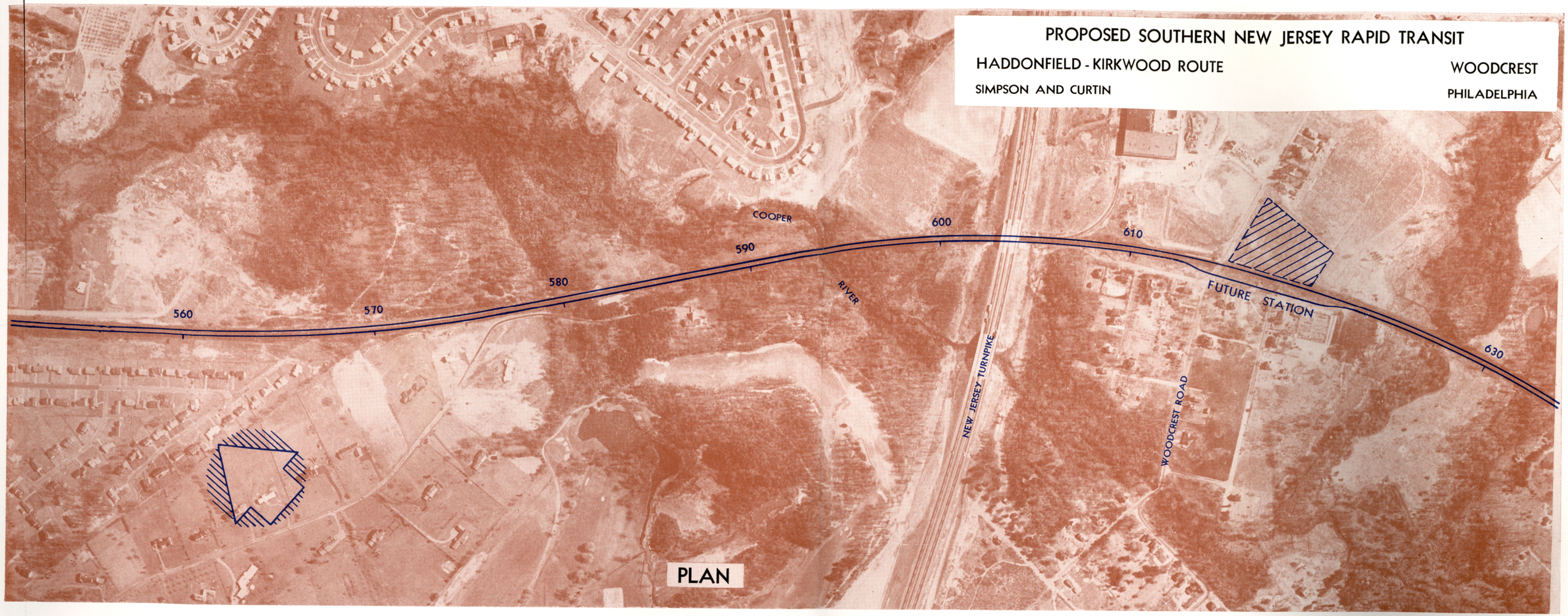
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

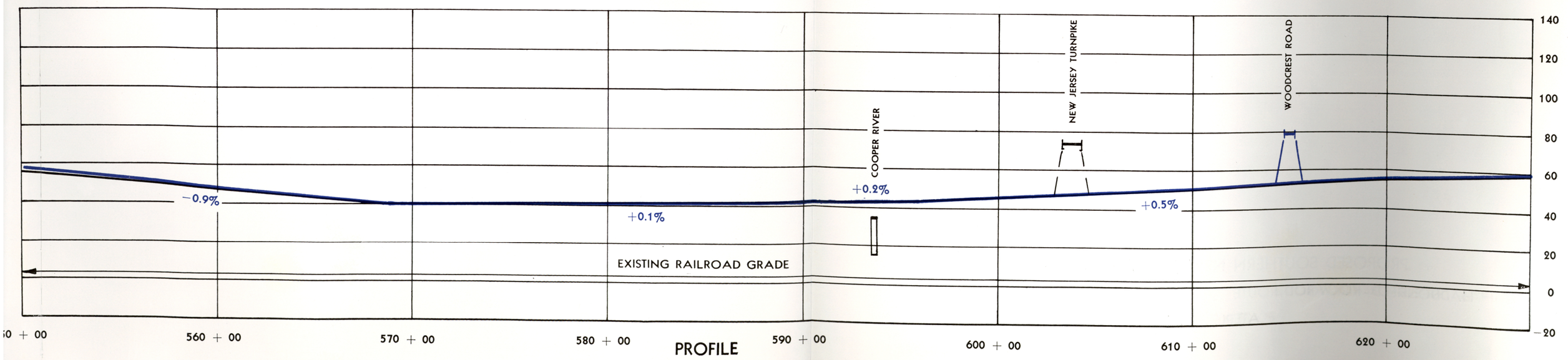
WOODCREST

SIMPSON AND CURTIN

PHILADELPHIA



PLAN



PROFILE

PLATE XII

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE ASHLAND

PLATE XIII

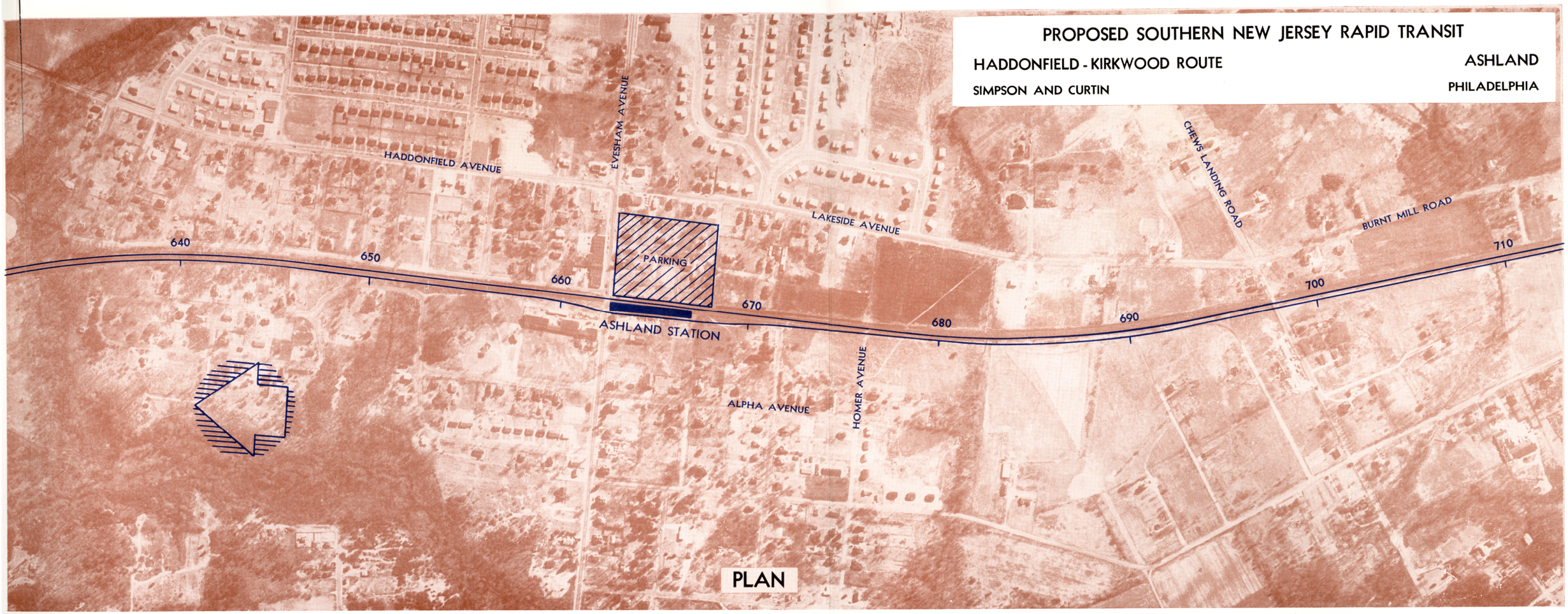
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

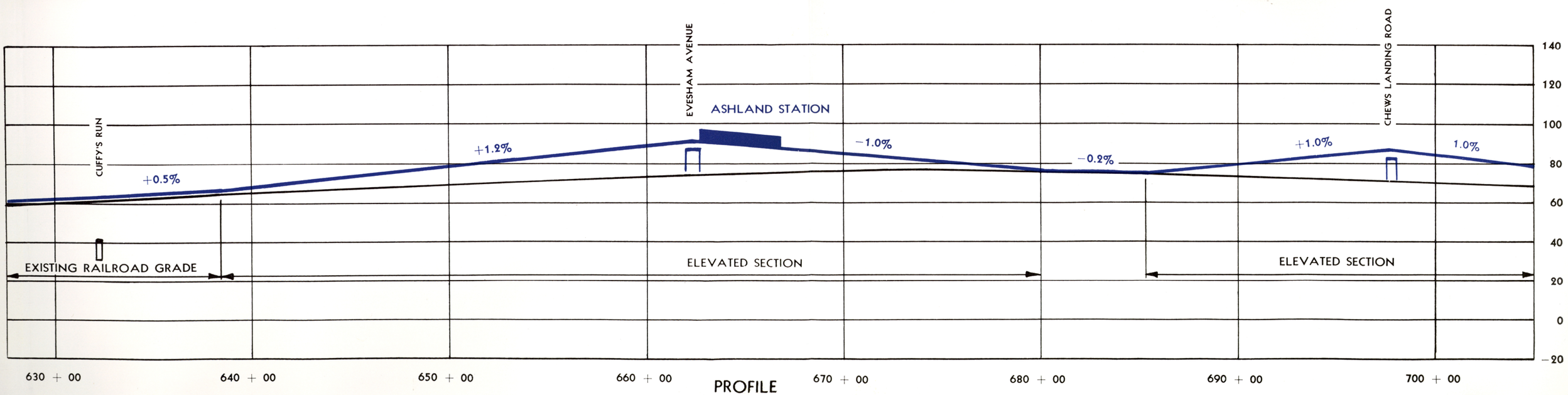
ASHLAND

SIMPSON AND CURTIN

PHILADELPHIA



PLAN



PROFILE

PLATE XIII

PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE

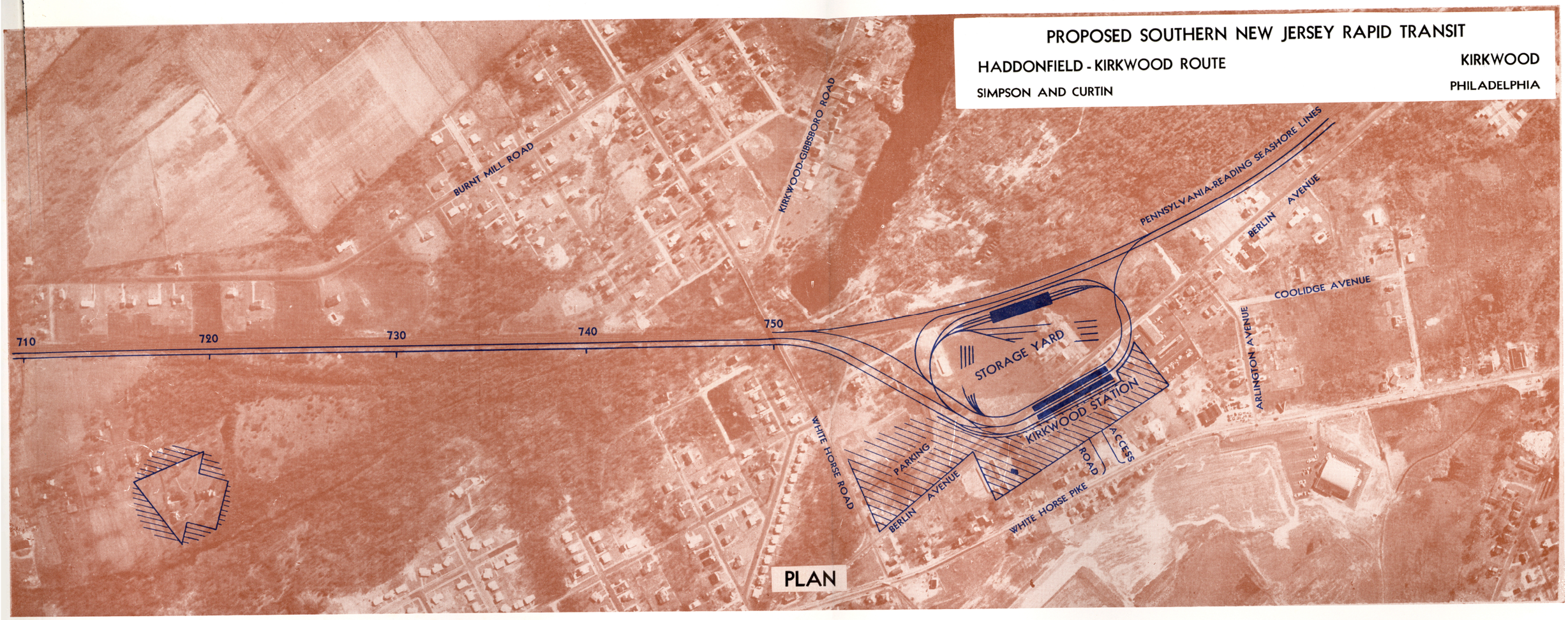
KIRKWOOD

PLATE XIV

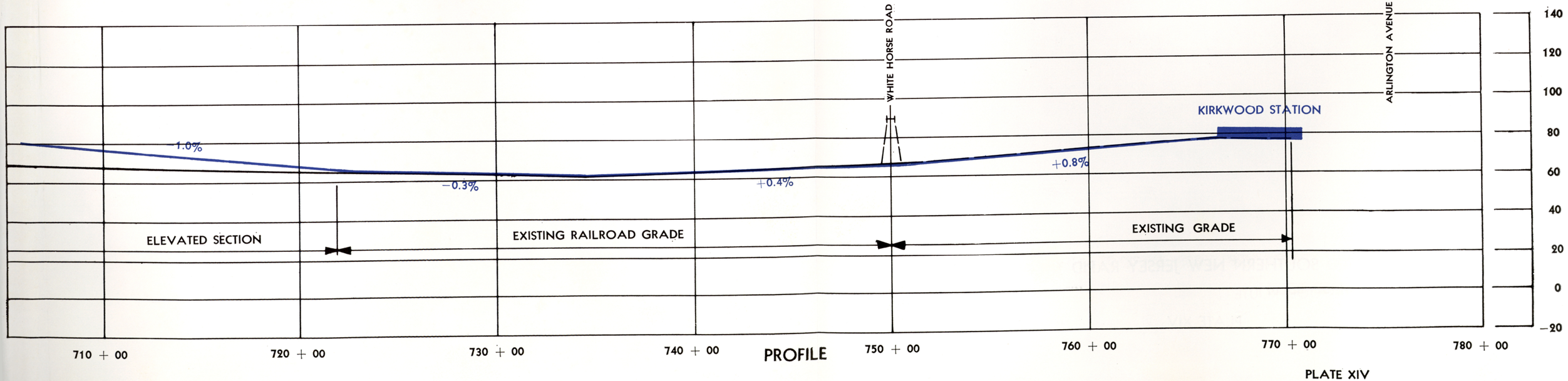
PROPOSED SOUTHERN NEW JERSEY RAPID TRANSIT

HADDONFIELD - KIRKWOOD ROUTE — KIRKWOOD

SIMPSON AND CURTIN — PHILADELPHIA



PLAN



PROFILE

PLATE XIV