SUPPLEMENTARY LISTING RECORD

NRIS Reference Number: 05000880 Date Listed: 8/12/2005

Property Name: Route 1 Extension County: Essex State: NJ

Multiple Name

This property is listed in the National Register of Historic Places in accordance with the attached nomination documentation subject to the following exceptions, exclusions, or amendments, notwithstanding the National Park Service certification included in the nomination documentation.

Patrick Andrus 8/12/2005

Signature of the Keeper Date of Action

Amended Items in Nomination:

The property is nominated under National Register Criteria A and C, but only one Area of Significance (Transportation) has been selected. Engineering is added as an Area of Significance to reflect the highway's importance in engineering history. The form is officially amended to add this additional Area of Significance.

DISTRIBUTION:

National Register property file
Nominating Authority (without nomination attachment)

880

NPS Form 10-900
(Rev. Aug. 2002) (Expires Jan. 2005)

OMB No. 1024-0018

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JUN 30 2005

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES REGISTRATION FORM

1. Name of Property

historic name: Route 1 Extension

other names/site number: Routes 1 & 9; US 1 & 9, State Route 25, State Rt. 139, Pulaski Skyway

2. Location

street & number: US 1 & 9 milepoint: 51.25-54.55, NJ 139 milepoint 0-1.45 ☐ not for publication
city or town: Newark, Jersey City, Kearney ☐vicinity
state: New Jersey code: NJ county: Essex, Hudson code: 013/017 zip code: 07105 (Newark); 07310, 07306 (Jersey City); 07032 (Kearny)

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this nomination meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☒ meets ☐ does not meet the National Register Criteria. I recommend that this property be considered significant ☐ nationally ☒ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

[signature] 6/13/05
Signature of certifying official Date

John S. Watson, Jr., Assistant Commissioner Natural & Historic Resources/DSHPO
State or Federal Agency or Tribal government

In my opinion, the property ☐meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of commenting or other official Date

State or Federal agency and bureau

4. National Park Service Certification

I, hereby certify that this property is: Signature of the Keeper Date of Action

☒ entered in the National Register Patrick W. Andrus 8/12/2005
☐ See continuation sheet.
☐ determined eligible for the National Register
☐ See continuation sheet.
☐ determined not eligible for the National Register
☐ removed from the National Register
☐ other (explain): ___________

5. Classification

Ownership of Property: Public-State

Category of Property: Structure

Number of Resources within Property

Contributing	Noncontributing	
		buildings
		sites
5		structures
		objects
5		Total

Number of contributing resources previously listed in the National Register 0

Name of related multiple property listing N/A

6. Function or Use

Historic Functions (Enter categories from instructions)
Cat: Transportation Sub: Road-Related

Current Functions (Enter categories from instructions)
Cat: Transportation Sub: Road-Related

7. Description

Architectural Classification (Enter categories from instructions)
N/A

Materials (Enter categories from instructions)
foundation N/A
roof N/A
walls N/A
other N/A

Narrative Description

See continuation sheet

8. Statement of Significance

Applicable National Register Criteria

_X_ A Property is associated with events that have made a significant contribution to the broad patterns of our history.
___ B Property is associated with the lives of persons significant in our past.
_X_ C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
___ D Property has yielded, or is likely to yield information important in prehistory or history.

Criteria Considerations: N/A

Areas of Significance: Transportation

Period of Significance: 1923-1932 Significant Dates: _____

Significant Person: N/A

Cultural Affiliation N/A Architect/Builder New Jersey State Highway Commission

Narrative Statement of Significance

See Continuation Sheet

9. Major Bibliographical References

See Continuation Sheet.

Previous documentation on file (NPS)

___ preliminary determination of individual listing (36 CFR 67) has been requested.
___ previously listed in the National Register
___ previously determined eligible by the National Register
___ designated a National Historic Landmark
___ recorded by Historic American Buildings Survey # ___
_X_ recorded by Historic American Engineering Record # NJ-9 (Pulaski Skyway)

Primary Location of Additional Data

___ State Historic Preservation Office
_X_ Other State agency
___ Federal agency
___ Local government
___ University
___ Other

Name of repository: NJ Department of Transportation; NJ State Archives

10. Geographical Data

Acreage of Property Approximately 62 acres.

UTM References (Place additional UTM references on a continuation sheet)

Elizabeth USGS Quad	Jersey City USGS Quad
Zone Easting Northing	Zone Easting Northing
A 18 573880 4509570	C 18 574080 4509500
B 18 573220 4509470	D 18 576780 4509580

X See continuation sheet.

Verbal Boundary Description

The boundary of Route 1 Extension is shown by the line on the accompanying map entitled: "Right-Of- Way Route 1 Extension Hudson/Essex Counties, NJ, 2003."

Boundary Justification: See Continuation Sheet

11. Form Prepared By

name/title Mary E. McCahon and Sandra G. Johnston

organization Lichtenstein Consulting Engineers, Inc. date December, 2003

street & number One Oxford Valley #818 telephone 215-752-2206

city or town Langhorne state PA zip code 08016

Property Owner

(Complete this item at the request of the SHPO or FPO.)

name ____________________

street & number ____________________ telephone ____________________

city or town ____________________ state_____ zip code __________

Narrative Description

The nominated portion of the 1923-1932 Route 1 Extension is the 5-mile-long eastern section of the 13.2-mile-long, limited-access, four-lane, approach road to the Holland Tunnel that is composed of a series of structures that are sequential or are linked by short sections of at-grade roadway (Figure 1).[1] It was designed and constructed between 1923 and 1932. The highway passes through Jersey City, which is crisscrossed by a myriad of 19th-century rail lines and yards servicing the Port of New York and a low, industrialized section through Kearny in Hudson County (Figure 2). It then passes into Newark (Essex County) north and east of Newark Airport. The highway traverses a highly industrialized and populated portion of northern New Jersey (photograph 1). The nominated portion of the resource is the contiguous eastern sections (original sections 1, 2, and 3) that retain their original design and thus the aspects of integrity. They survive largely as built despite the high volume of traffic serviced.

The nominated portion of the resource carries the highway from its eastern, at-grade terminus in lower Jersey City up to the level of Bergen Hill on an inclined viaduct and then into a covered cut through that trap rock ridge that divides the Hudson River from the valley of the Lower Hackensack and Passaic rivers. It then crosses the local streets, rail facilities, rivers and meadows on the west side of the ridge on a 3.5- mile-long high-level viaduct known as the Pulaski Skyway (photographs 2A, 2B, 3) with its pair of imposing through truss bridges over the rivers, and then down to grade again at US 1 & 9 milepoint 50.95 in Newark just north of the airport.

The highway west of that point, where it breaks into a barrier- and median-divided, eight-lane facility, has been so altered that its original appearance and design have been lost. Typical alterations west of milepoint 50.95 include widening of the original roadway and/or placement of parallel lanes and roadways, widening/replacement of some bridges, and removal of sections of the original balustrades. The difference

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[1] The nominated property is currently defined by the New Jersey Department of Transportation's route and milepoint designation as NJ 139 milepoint 0 through 1.5 and US 1 & 9 milepoint 50.95 through 54.55. The route designations change at Tonnele Circle, where US 1 & 9 continues north to the George Washington Bridge.

between the two sections of highway is so contrasting that the limit of the nominated portion is obvious and clearly discernible (photographs 4, 5).

General Design Characteristics

The entire limited-access, four-lane highway was originally built to general design characteristics. These include a 50'-wide roadway accommodating two, 10'-wide travel lanes in each direction, and concrete balustrades anchored to the superstructure and set atop a high concrete curb with a 2'-wide footway. Since the highway was designed for the economical service of traffic, all at-grade intersections (with both rail and vehicular traffic) were eliminated. A moderate maximum grade of 3.5% was used as was a minimum curve radius of 1000'. Because much of the eastern portion of the highway traverses either a congested portion of Jersey City or rivers and associated meadows, it is predominantly on structure (photographs 1, 2, 3). Most of the viaducts/bridges that either carry the highway itself or the overhead crossing streets are steel. With the exception of the Pulaski Skyway and other through truss spans, the steel was encased in concrete for future maintenance considerations. The original roadway consisted of a strong and durable reinforced concrete deck with a granite paver wearing surface, which was worn smooth and has been removed/replaced or resurfaced starting in 1955. There have been several bituminous and concrete wearing surfaces since then.

12th Street Viaduct

The easternmost 1,702'-long (.33 miles-long) section of the highway known as the 12th Street Viaduct extends west from grade at the west side of Jersey Avenue, the eastern terminus of the highway, to the Bergen Hill subway about Palisade Avenue. It is an inclined structure composed of 33 spans of various structure types and lengths. The 190'-long, easternmost section, which is not considered a span, is on fill held back by reinforced concrete retaining walls (photograph 6). The walls were replaced in kind in 2003. Spans 1 through 9 are a 154'-long, continuous, reinforced concrete, two-way structural slab supported on 22"-diameter, reinforced concrete mushroom columns with dropped capitals placed on a 14' by 18' grid (photograph 7). Spans 10 through 19 are simply supported, built up longitudinal beams (stringers) spaced about 5' center to center and framed into transverse girders. Spans 10 through 13 are 34'-long, and spans 14 to 19 are 51'-long (photograph 8). Each transverse girder is supported on three built up columns with built up knee braces. Spans 20 through 27 are composed of three lines of built up deck girders with deep, built up, open web floorbeams. They vary in span length from 66' to 72' (photograph 9). The same substructure with flexible columns at expansion points support the girders. Sway and lateral bracing has been added as needed to ensure stability for the increased length of the vertical members.

Spans 28 through 31, which cross former railroad lines, are the longest spans in the viaduct, and they are rivet connected, built up member, multiple Pratt deck truss spans supported on built up column bents. Span lengths vary from 78' for span 32 to 154' for span 28, which is supported at the west end on concrete piers rather than built up columns (photograph 10). Spans 30 and 31 were reconstructed in 1955 to accommodate the southbound turnpike extension, which passes under the spans. The spans were rebuilt/replaced in kind with shallower trusses in order to increase vertical clearance over the elevated section of new highway. Spans 32 and 33 are built up deck girders, and the westernmost end is supported on the rock ridge known as Bergen Hill (photograph 10).

Because of the concrete encasement, the decision was made to accommodate expansion by double flexible columns at roadway expansion joints. The twin built up columns are joined by plate at their bases and bearings and have a common footing. Movements developed in the superstructure due to temperature changes and live loads are accommodated by deflections of the flexible columns. This detail is typical of the highway and was used throughout in conjunction with all transverse girder/longitudinal beam superstructures (photograph 8). The viaduct, like all other spans with the superstructure beneath the roadway, is finished with cantilevered deck sections and substantial, reinforced concrete railings with rectangular openings and plain posts.

Ramps flanking the west end of the 12th Street Viaduct provide connections to the Jersey Heights streets at Palisade Avenue (a north-south street) for westbound traffic and tunnel access for eastbound traffic (photograph 1). The ramps have an approximately 4.5% grade. The westbound ramp on the north side of the viaduct is located on grade and is separated from the through portion of the highway by an unadorned, reinforced concrete retaining wall. The eastbound ramp on the south side of the viaduct is supported on a series of reinforced concrete deck arch spans that have graduated rise corresponding to the incline of the ramp (photograph 11). The arches have a 19' clear span. The arcaded ramp lends an air of monumentality to the design that is not present in other sections of the highway (photograph 10).

The 12th Street Viaduct appears largely as originally designed, but there have been some modifications. The most apparent one is the widening of the south side of spans 1 through 24 to accommodate the merging of the 1954-1956 eastbound New Jersey Turnpike Extension. The north side of spans 28 through 30 was widened slightly for the 1951 joining of the 14th Street Viaduct, which carries westbound traffic directly from the tunnel exit plaza (photograph 12). The 14th Street Viaduct is separated from the historic section of highway by an expansion joint, and after its opening, traffic on the 12th Street Viaduct from about span 25 east to the end was converted to one-way, eastbound traffic. The original railings have been removed at all sections where the viaduct has been widened and along Palisade Avenue. That work was done in 1968. The replacement railings are three rail high, extruded tubular railings (photograph 13). Safety shape median dividers were also placed in 1968, and they extend the length of the nominated portion. The encasement was largely removed on all spans except spans 32 and 33 in 2002-2003.

Hoboken Avenue Viaduct

The highway traverses Bergen Hill on a depressed roadway or subway that extends westward on a straight tangent from east of Palisade Avenue to the east end of the Conrail Viaduct near Collard Street in the heights part of Jersey City. The cut is covered by an approximately 3,380'-long structure known as the Hoboken Avenue Viaduct (photograph 13). The subway was constructed in a 60'-wide and 25'-deep cut through the rock with the roadway (Route 1 Extension) placed directly on the rock substrate. From that roadway level, the subway has the appearance of a tunnel because the local streets are carried overhead on structure (Figure 2). It has a 14' vertical clearance. This arrangement with the local streets overhead permits free communication of the pre-existing, local north-south streets in the Jersey Heights area (photograph 14). It also provided a new, multi-lane local thoroughfare known as State Highway from Oakland Avenue west to JFK (formerly Hudson) Boulevard. East of Oakland Avenue, the street is Hoboken Avenue, the historic road from Hoboken up the hill to the heights.

This 27'-wide upper roadway is carried on the typical, built up, 50'-wide and 5'-deep, transverse girders with closely spaced, framed in stringers spans. The girders are placed every 20', and they are supported on concrete columns on the south side and on the reinforced concrete retaining wall on the north side (photograph 15). Expansion joints are at every 4th or 5th girder, and twin flexible columns are used at the expansion joints. Long sections of the south side of the subway are open with the transverse beams supported on reinforced concrete columns. Elsewhere on the south side and all along the north side, the girders are supported on the retaining walls. Standard design concrete balustrades originally filled all the bays between the columns on the south side, but some sections were replaced with safety shape barrier in 1979. The center barrier median was also placed in 1979.

At the west end, as the lower level roadway curves south and diverges from the upper roadway, the south side of the upper roadway is carried on a 155' long, Warren with verticals deck truss. The truss is supported on rock on one end and on an outboard column on the south side of the lower level roadway (photograph 17). This design eliminated the need of columns in the median or near the edge of the lower roadway. The limit of the overhead portion of the viaduct is indicated by the expansion joint in State Highway near its intersection with Collard Street. All steel is fully encased in concrete.

The subway is naturally ventilated by the openings on the south side of the structure and by open ventilation bays located over the westbound travelway (photograph 16). The open ventilator bays extend the length, and they originally had open tops enclosed by the standard design concrete balustrades. The framed ventilation bays serve to separate eastbound traffic, completely supported on structure, from westbound traffic that is on grade. In 1979, the balustrades were replaced with safety shape barrier at the cross streets in order to improve sight lines, and steel open grid deck panels were placed over all the openings. Sections of the original balustrades remain at the middle of most blocks (photograph 14). They are not in good condition, and there is a great deal of in-kind replacement and repair.

As the highway emerges on the west side of the Bergen Hill, it returns, for the most part, to being carried on structure (photograph 17). With the exception of the great continuous-cantilever through truss bridges over the Hackensack and Passaic rivers and two railroad crossings, all superstructure west of the viaduct is below the roadway.

Conrail Viaduct

The highway crosses a 50'-deep, open railroad cut, on an eight-span, 485'-long structure known as the Conrail Viaduct (photograph 17). The east approach is composed of five, low rise, 28'-6"-long, stringer spans set on 2'-high concrete pedestals. The main span is three lines of 130'-long and 25'-deep, riveted Pratt trusses supported on massive concrete piers. The approach spans (one on each side of the truss span) consist of three lines of built up deck girder spans, 40' long on the west and 51'-4" long on the east. The outside ends of both girder spans are framed into the concrete walls at the respective tops of the cut. The inside end of the west girders bears on the upper chord of the trusses while the inside end of the east girders is supported on a steel column expansion bent that is founded on the concrete pier that also supports the trusses. The viaduct is fully encased in concrete (photographs 15, 16).

For the approximately 400'-long transition between the west end of the Conrail Viaduct and the east end of the Pulaski Skyway, the highway is carried at grade with the fill supporting the roadway held back by concrete retaining walls.

JFK Boulevard over Route 1 Extension

Other than the streets crossing the Hoboken Viaduct, the only local street carried over the nominated highway is JFK Boulevard. It crosses the highway at approximately the west end of the Conrail Viaduct at milepoint .3 of NJ 139. The overpass is 102' long and 93' wide and is composed of closely spaced, encased, built up stringers supported on concrete abutments that are integral with the retaining walls that parallel the highway. There are rolled section diaphragms between the beams. The overpass is finished with the standard design concrete balustrades, and a chain-link fence pedestrian enclosure has been added (photograph 19).

Pulaski Skyway

Starting at its eastern terminus at Tonnele Circle (milepoint 51 of US 1), the 18,495' or 3.5-mile-long viaduct known as the Pulaski Skyway crosses over Tonnele Circle and many local streets and railroads in Jersey City before rising over the Jersey meadowlands to span the Hackensack River. It then passes over local streets and industry in Kearny and again rises high over the Passaic River. Descending west of the Passaic, the viaduct crosses the New Jersey Turnpike and other streets and railroads in Newark as it transitions down to grade at milepoint 54.5 of US 1.

The 108 spans (spans are numbered sequentially from east to west) that make up the Pulaski Skyway vary in type and design. Most of the "low" section spans in Jersey City (east end) are the typical, built up, 50'-wide, transverse girders with closely spaced, framed in stringers or multi-girders with span lengths between 20' to 62' depending on local conditions. All spans are supported on built up columns and bents that vary in height from 15' to 35'. Twin flexible columns are used at the expansion joints at every second or third span, and the superstructures and substructures are fully encased in concrete (photograph 20).

Two spans of traditionally composed, riveted Pratt through trusses are used to cross the Erie Railroad just west of Tonnele Circle. The eastern span is 134' long, and the western one is 120' long. Two, 25'-deep, Pratt deck trusses are used to cross local streets and highways with the western one over Newark Avenue being 226' long and the one over Van Winkle Avenue being 176.5' long. A one span, 252'-long, Pratt through truss crosses the Pennsylvania RR and PATH at span 44, which is considered the end of the low portion of the viaduct. The truss spans are all supported on concrete piers, and they are not concrete encased.

The long-span portion of the viaduct is composed of two lines of continuous-cantilever design deck and through trusses (photographs 2A, 2B, 3). The truss lines increase in number between spans 53 and 57 and again between 70 and 75 to accommodate center ramps. There, through traffic is supported on 3 or 4 lines of trusses in order to provide the desired H 20 design loading. The truss spans are not encased in concrete. All trusses are riveted with heavily built, built up, box-section members and K truss lateral and sway bracing. The "land spans" are the Pratt deck truss spans from 175' to 350' in length and are generally 50' deep at the bearings and 25' deep at mid span. Panels are about 25' long (photographs 2A, 2B, 3). Even numbered spans do not have suspended sections while odd numbered spans have sections suspended from arms cantilevered from the fixed spans. The suspended sections have riveted connections at one end and pinned connections at the end post of the cantilevered arm at the other end. Expansion and contraction is accommodated by the pinned connections and by means of sliding plates on alternate chords. All bearing shoes are heavy steel castings with forged steel pins, and every other shoe is set on segmental rollers to allow for expansion and contraction (photograph 21).

The deck truss sections, like the rest of the highway where the superstructure is below the roadway, are finished with cantilevered deck sections on built up brackets and stout, built up, steel balustrades constructed with I beams that emulate the design of the reinforced concrete balustrades used elsewhere along the highway. The balustrades are placed behind a 16"-high and 2'-wide emergency footwalk framed into the flooring system to resist impact (photograph 22). The design was intended to prevent vehicles mounting it in case of accident. The viaduct has historically been painted black.

Because the desire was not to have the viaduct any higher than necessary, great 550'-long, continuous-cantilever, Baltimore through truss spans are used at the river crossings. The suspended section at the center of each river span is 350' long and is connected to the cantilever arms by pinned connections, which is a connection detail dating to the late 19th century. Its design deviated from the traditional design of through truss bridges with deck truss approach spans where there is an exact distinction between the two truss types. By designing anchor spans with curved chords, a visually pleasing transition between the through truss span and the shorter deck truss approach span was achieved (photographs 2A, 2B). The detail also makes the viaduct appear as a continuous structure from end to end, and it was done by the designers for aesthetic reasons.

The high-level viaduct is supported at each bearing on massive but graceful concrete piers with flared bases. Where needed for stability because of the height of the pier, built-up, steel lateral bracing is provided (photographs 2A, 2B). The bracing is fully encased in concrete and finished with reticulated panels. The piers are on foundations that were selected to address a variety of substrate conditions. The area between the two rivers and west of the Passaic River is swampy, and there the piers are on concrete caissons (a watertight box or casing used in founding structures) sunk by dredging and extending to rock. East of the Hackensack River, soil conditions permitted the use of concrete pile foundations.

To provide connections between the viaduct and surface streets, two center ramps with a 5.5% gradient were provided (photograph 21). The easternmost one provides an eastbound exit to Broadway and westbound access from Broadway on the west side of

Jersey City. This was intended as the interchange with the old Lincoln Highway (now designated US 1 & 9 Truck). The other center ramp services Kearny, which is located between the Hackensack and Passaic rivers, and it is located at Central Avenue in Kearny (photograph 23). It provides a westbound exit and eastbound entrance to the highway. Both ramps are 24' wide and accommodate two-directional traffic. The inclined ramps are suspended from the bottom chords of the overhead deck trusses until about the height of the piers. They change to about 140'-long, built up girder-floorbeam spans until close enough to the surface street where the roadway is supported on fill held by concrete retailing walls (photograph 24).

Westbound access to Raymond Boulevard in Newark is via an approximately 1000' long and 30'-wide ramp that breaks out from the main road at US 1 & 9 milepoint 51.5. The inclined ramp is carried on built up through girder-floorbeam spans with the same cantilevered deck sections and stout built up steel balustrades used on the viaduct itself. The roadway is curved; the girders themselves are not curved. The ramp is supported on built up steel bents.

West of the breakout for the Raymond Boulevard ramp, the viaduct curves southerly and transitions to grade. The transition is supported on built up girder-floorbeam spans supported on the same built up steel columns and flexible columns at the expansion joints used throughout the route. In 1959, the original center ramp at the west end of the Skyway was filled in and the roadway alignment was reconfigured to accommodate construction of the ramp merging southbound US 1 & 9 Truck with Route 1 Extension (photograph 4). Approximately 180' of the north side of the west end of the original Pulaski Skyway were widened in kind to accommodate the breakout (photograph 24). The south side of the Skyway was not altered.

Beyond the west end of the Pulaski Skyway, the scale, design, and character of the highway changes dramatically as it breaks out into an eight-lane facility that includes the merge with US 1 & 9 Truck and ramps from/to the New Jersey Turnpike (photograph 5). Other alterations include the placement of median dividers starting in 1955, and removal of the granite block pavers starting in 1945. Outside ramps were added to the Tonnele Circle interchange in the mid to late 1930s, and original ramps from the JFK Boulevard overpass to the circle and the central ramp at the approach road have been converted from two-way to one-directional traffic. The other central ramps at Central Avenue in Kearny and at Broadway in Jersey City have not been altered.

Statement of Significance

The easternmost 5 miles of Route 1 Extension in Hudson and Essex counties are historically and technologically significant under criteria A and C as a nearly intact section of America's first superhighway. The 13.2-mile Route 1 Extension from Bayway Circle at US 1 on the south side of Elizabeth to Jersey Avenue at Jersey City was planned, designed, and constructed by the New Jersey State Highway Commission between 1923 and 1932 to alleviate the tremendous volume of traffic that the 1927 Holland Tunnel introduced into an already congested region of metropolitan northern New Jersey. This approach road from the state's main north-south route integrated a high volume, through road with no grade crossings into fully developed urban settings. It was the first time in this country that economic theories of location and operation were applied to the planning and design of an unrestricted-use, vehicular highway, a concept that was not successfully repeated until the Pennsylvania Turnpike in the mid 1930s. It represents the transfer from railroads to highways the idea of a facility design based on safety, traffic service, and economic theory, particularly Wellington's Economic Theory of the Location of Railways. It reflects the thinking of the New Jersey State Highway Commission under the leadership of William G. Sloan, Chief Engineer, who more than any other individual was responsible for the design. The highway set the precedent and the standard for the planning and design of subsequent high speed, limited-access highways. Despite the fact that the tunnel approach road continues to serve a high volume of traffic, the east end, which includes the 3.5-mile long Pulaski Skyway viaduct with its pair of continuous-cantilever through-truss bridges soaring over the Hackensack and Passaic rivers and Jersey meadows, survives largely as originally designed.

The highway was built at a time when there were no vehicular precedents or models to emulate. The planning, design, and execution of Route 1 Extension were very much the products of a progressive governor, a state highway commission committed to solving New Jersey's already legion and looming traffic-congestion problems, and William G. Sloan, the state highway engineer appointed by the commission in 1923. It was through the genius of Sloan, a veteran railroad engineer, that the seemingly obvious link between trunk, or main railroad lines, and the new "through trunk highway" was made and implemented. The state used the proven theories of the economics of railroad location to justify the unprecedented cost and complicated design of the highway. A 1930 article in *Engineering News-Record* stated that "the whole enterprise

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[Route 1 Extension] is superhighway in the fullest meaning of the term," and "it is a credit to the state highway engineers and commissioners of New Jersey that in meeting the problem which confronted them they considered no solution less than the best."[1] In 1932, Thomas MacDonald, chief of the federal Bureau of Public Roads (predecessor of the Federal Highway Administration) referred to the Route 1 Extension as "the greatest highway project in the United States today,"[2] and truly it was.

The significance of the New Jersey State Highway Commission's accomplishment is enhanced when considered within the context of urban highways in the 1920s, where federal aid for roads was not permitted in cities with a population of more than 5,000. Even though the Route 1 Extension was this country's most expensive roadway project of the first third of the 20th century, the $40 million cost of its ambitious design and construction was borne entirely by the state of New Jersey. The state assumed responsibility for relieving its own urban traffic congestion, something that nearly all other cities and states generally avoided until a change in the federal funding laws in the late 1930s.

The limits of the nominated portion of the resource are consistent with the portion of the highway that was determined eligible for the National Register of Historic Places through interagency consultation among the New Jersey Department of Transportation, the New Jersey Division of Federal Highway Administration, and the New Jersey Historic Preservation Office (SHPO). That definition of the portion of the resource that retains the 1924-1932 aspects of integrity is based on TAMS Consultants, Inc.'s August, 1991 *Routes U.S. 1 & 9 Corridor Historic Engineering Survey Historical Narrative & Assessment of Significance and Integrity* and subsequent interagency consultation. Additional research and evaluation underlying this nomination confirmed the interagency determination. The nominated portion of the highway is located in Hudson and Essex counties and includes all road-related structures within the right-of-way that are associated with its original design from the west side of Jersey Avenue in Jersey City, the historic eastern terminus of the highway, westward through the Pulaski Skyway to a point where that viaduct transitions to a surface roadway. The original roadway itself, all structure supporting that roadway, overpass bridges, and ramps providing access or egress from the roadway are included, as are at-grade features such as balustrades that enclose ramps or ventilator bays. Modern sign bridges, lighting, median barriers, and deck and wearing surface material, which are replacement roadside appliances and roadways that change in accordance with continuously updated safety guidelines and policies, are excluded from the nominated property, even though they may be located within the original right of way. The highway west of the west end of the Pulaski Skyway at US 1 & 9 mile point 50.95 has been significantly altered many times and does not meet the aspects of integrity necessary to represent its significance and thus meet the criteria for evaluation. It is not part of the nominated property. Outside ramps added or altered at and near Tonnele Circle in the late 1930s and to the 12th Street Viaduct in the 1950s are only tangentially part of the highway, and since they are alterations of the original design, they are also excluded from the nominated portion of the property.

Port of New York and Jersey City

The Holland Tunnel approach road is located in a setting that once ranked as one of the most congested in the nation -- the Port of New York. In the 1910s and 1920s, New York handled one-fifth of the nation's foreign commerce. Only two other ports in the world, Hamburg and Rotterdam, came close to, but did not exceed, the Port of New York in tonnage handled. And neither city approached New York's chaotic complexity of railroad and marine coordination that, at least in peacetime, worked in spite of itself. The majority of the port was located in New York City, but most of the main line railroads' terminals were located in Jersey City on both sides of the Bergen Hill, a basaltic ridge that separates the Hudson River waterfront lowlands from the meadows on the west side of the ridge. This meant that a high percentage of the U.S. foreign commerce that went through the Port of New York went through Jersey City, which was crisscrossed by railroad tunnels, open cuts, yards, and at-grade tracks for both freight and passenger trains making their way to ferry slips and piers.[3]

The geography of metropolitan New York necessitated this convoluted system that relied on the railroads and a variety of vessels to function. From arrival in the New Jersey classification yards, freight would be sent through a maze of way points, including freight terminals, piers, side-spurs, changing from railroad to railroad, off-loading and loading onto ships, loading onto lighters or railroad car floats, which were then pushed by tugboat across the river if bound for Manhattan or out to sea if destined for other markets. If one of the transportation systems failed, it would diminish or nullify the functionality of the others. This absolute interdependence caused disaster during World War I. Prior to the war, the tangled web was already at capacity, limited by the number of lighters, amount of wharfage, available rolling stock, and cargo facilities.

While rising price levels, rising taxes, rising wages, labor laws limiting work days, and a short recession in the 1910s were contributing factors to the port's condition, most of its inefficiency woes could be blamed on neglect by the railroads themselves. Few improvements were made to the exceedingly antiquated port facilities during the late 1900s and early 1910s, yet, between 1915 and 1919, exports through the port doubled.[4]

Effects of World War I on Port of New York and Its Transportation Networks

Between 1914 (the outbreak of hostilities in Europe) and 1917 (when the United States entered the war), the ostensibly neutral U.S. was shipping supplies to the Allies. The Germans successfully combated U.S. shipping with a submarine campaign that crippled the Port of New York. No shipping lane was safe. Consequently, railroad cars arrived at the New Jersey Hudson River piers and waited to be unloaded onto ships that had been destroyed, had never arrived, or were reluctant to leave port.[5] As a result, the railroads were unable to get either long-haul freight or short-haul perishable goods, such as food, to their destinations in Manhattan or any place else in the world.

It was impossible to unload the railroad cars at the rate that they arrived at the port, and this prevented the rolling stock from being rotated back into use. The loss of cargo space paralyzed the port. A manpower shortage caused by the draft further complicated the unloading of cars, and by November of 1917, there were 180,000 railroad cars trapped in Eastern ports, unable to unload. The severity of this situation was exacerbated by mushrooming war industries and the passage of 1,321,000 troops through the port.[6] To make matters worse, the winter of 1917-1918 was one of the worst on record. Seven weeks of blizzards caused railroads to reassign an already overstretched workforce from railroad car repair to removing snow from tracks in order to keep at least some lines working. Human exhaustion, equipment failures, intolerable cold, and an influenza epidemic strained the railroads' human and physical resources and contributed to dramatic coal and food shortages, particularly in Manhattan, New York state, Pennsylvania, Ohio and New England. A solution to the bottleneck had to be devised. A permanent way for vehicles to cross the Hudson River was desperately needed.

Advent of Over-the-Road Trucking

World War I port congestion spawned the birth of the over-the-road trucking industry in America. In addition to the important contribution of moving supplies to the European front, trucks greatly ameliorated congestion at the Port of New York and demonstrated a versatility and reliability that would transform both passenger travel and goods shipments in the postwar era. As the railroad and port interdependency grew steadily worse, suppliers increasingly turned to trucks, which prior to 1917 had been used primarily for local deliveries. In December of 1917, the U. S. Army Quartermaster General started driving trucks intended for the European theater to their east coast port of embarkation over designated routes from Toledo through Ohio and Pennsylvania. The campaign highlighted the ability of the Pennsylvania Highway Department to keep the roads through the Allegheny Mountains open during the winter.[7] The exercise demonstrated that it was possible to keep long stretches of road open to traffic during severe winter weather and that dependable, interstate travel on highways was desirable, and even necessary.[8]

The Impetus for Route 1 Extension: The Holland Tunnel

After the World War I collapse of the Port of New York, various solutions to improve efficiency were proposed, including a loop railroad around the Manhattan and Brooklyn ports with a tunnel to New Jersey. But the railroads' recent history had been undependable. A bridge across the Hudson River was considered, but the cost was thought to be prohibitive. Consequently, a vehicular tunnel connecting New York and New Jersey was chosen in 1919 by the New Jersey Interstate Bridge and Tunnel Commission and the New York Board of Transportation and Commerce. A tunnel would significantly reduce vehicular congestion at the ferries and would also prevent the recurrence of shortages due to weather or labor-related interruption of ferrying and shipping. It would also free part of the waterfront now occupied by railroads or railroad car float and freight-lighter deliveries by promoting the use of trucks for hauling freight within the metropolitan region. A tunnel would also reduce the cost of handling freight in New York by eliminating waste due to delays in receiving and delivering freight to railroad terminals.[9]

The vehicular tunnel was the culmination of a decades-long series of charters and schemes to cross the mighty Hudson dating as far back as 1868. The Holland Tunnel was not the first tunnel under the river -- that distinction belongs to the Hudson & Manhattan Railway's subway tubes between Jersey City and lower Manhattan completed in 1908. The street railway tunnels were quickly followed in 1910 by the Pennsylvania Railroad's great New York Extension under the river to Pennsylvania Station. Neither of those tunnels, however, serviced horse-drawn conveyances, motor vehicles, or freight handling.[10]

In 1919, the joint interstate tunnel commission hired Charles M. Holland (1883-1924) as chief engineer. His shield-drive type, two-tube tunnel would be the first subaqueous tunnel in the world specifically designed for the requirements of vehicular traffic. Construction began on October 12, 1920, and the tunnel opened on November 13, 1927, connecting the lower west side of Manhattan with the north part of Jersey City where 75% of the Manhattan-bound traffic originated. Its location had the advantage of "low surface elevation at both sides of the river, resulting in the shortest possible approaches."[11] The Holland Tunnel solved the problems of ferrying, but it meant a dramatic increase in vehicular traffic in and through Jersey City, Newark, and Elizabeth. The Holland Tunnel was designated a National Historic Landmark in 1994.

Oh My, What Have We Done?

With the location of the west tunnel portal in Jersey City set in the vicinity of 12th Street, the next task was to determine how to accommodate the expected volume of vehicular traffic. The tunnel portals would concentrate an estimated 18 million vehicles annually on already heavily congested urban streets in Jersey City. There were no major highways through the area to channel the traffic. Instead, vehicles would zigzag through urban streets to reach their destination. Safety would be compromised, and the communities would become gridlocked, thus rendering the tunnel worthless.

Before the November, 1927 tunnel opening, all trans-river vehicular traffic between New York and New Jersey was carried by 15 different Hudson River ferries, five of which were concentrated in a two-mile long section of the Jersey City waterfront. In 1922, about 3,850,000 vehicles crossed the river on the five ferries, and traffic across the bridges over the Hackensack and Passaic rivers on the west side of Bergen Hill was even greater, totaling 4,600,000 vehicles. Local streets in Jersey City were already taxed beyond capacity, and monetary loss was being suffered by business concerns whose trucks were stalled by traffic. Travel time between Jersey City and

Elizabeth, some 15 miles away, could be up to two hours because of congestion and drawbridges over the Hackensack and Passaic rivers.[12] New Jersey's solution to the projected traffic congestion was to construct a limited-access, superhighway to channel traffic uninterrupted through the metropolitan region.

In 1921 as a response to concerns raised by Jersey City as to who was going to pay for the proposed arterial highway, the state legislature extended Route 1 to "begin at the entrance to the Vehicular (Holland) Tunnel ... thence through the City of Jersey City and the County of Hudson, to, through and beyond the City of Newark in the County of Essex, to and though the City of Elizabeth in the County of Union, to the point of beginning of said Route No. 1."[13] Then-Jersey City Mayor Frank Hague (head of the state's Democratic machine) and the city commission recognized that the "cost of such a highway, running up into the tens of millions of dollars, if settled upon the city, would have drained its financial resources." They concluded that this expenditure should not be borne by the city, but rather by the state at large. The mayor went before the state legislature and so vividly painted this picture that the legislature passed a bill creating a new state highway, the extension of Route 1, "... thus removing the enormous financial load from the City, and placing it on the state at large, where it rightfully belonged."[14] In 1922, New Jersey voters authorized a $40 million bond issue to pay for various highway improvement projects including the Route 1 Extension, which was to be the most expensive roadway ever built.[15]

As construction of the tunnel advanced and funding was in place to move ahead with the much-needed extension from Route 1 to the tunnel, the eight-man state highway commission did not act decisively. Deemed by many to be ineffective and mired in politics, the commission failed to move forward with plans for addressing the pending volumes of traffic introduced into the state from the tunnel, as well as the Delaware River Bridge between Camden and Philadelphia, which was also under construction.

The Visionaries

Six days after his January 1, 1923 inauguration as governor, George S. Silzer (1870-1940), a Middlesex County lawyer who was in the forefront of Democratic progressivism since his election to the state senate in 1906, announced to an astonished legislature that he had removed the ineffective state highway commission, which he considered subservient to political interests and incompetent.[16] In its stead, he nominated a four-man, bi-partisan commission of prominent citizens, several of whom were engineers. Silzer's concern for transportation reflected his correct assessment of the state's potential residential and commercial development. The automobile and truck would stimulate growth, and to facilitate this expansion, Silzer advocated for improved roads and bridges including a bridge at Fort Lee (George Washington Bridge), for which he authorized construction, and for incorporating the Holland Tunnel into the Port of New York facilities.

Silzer's appointments to the reconstituted state highway commission demonstrated a like-minded vision for solving a number of "problems of great magnitude, ... some of them of a pressing nature requiring immediate action in order to be prepared to meet conditions in 1926 [the projected completion date of for the Holland Tunnel],"[17]such as the situation at the entrance to the tunnel at Jersey City. The previous commission's provisions for handling the traffic were judged to be "absolutely inadequate."[18] Silzer's new commissioners, sworn in on March 13, 1923, took seriously their charge of hiring a state engineer with "the highest engineering skills" and who "was in entire harmony with the views of the Commission as to the importance of the problems which were to be solved, and the necessity of the greatest economy and the highest possible type of construction which should be employed in the work ... ."[19] Their selection was the eminently well qualified William G. Sloan (1876-1960), a Cornell-trained civil engineer with international leadership experience in the layout and construction of railroads, tunnels, bridges, steamship docks, and large manufacturing plants. During World War I he was commanding officer of a railroad-building army battalion, and he had been chief engineer for MacArthur Brothers, a major railroad construction company. A life member of the American Society of Civil Engineers, Sloan served as New Jersey State Highway Engineer from 1923 through 1929 and again from 1933 through 1937.[20]

From his initial report contained in the 1923 State Highway Commission Annual Report, it is clear that William G. Sloan had a clear and fully developed concept for a new arterial highway to the Holland Tunnel when he started as state highway engineer on April 11, 1923. Sloan foresaw the necessity of a highway to provide uninterrupted travel through the metropolitan region of the state, which included Jersey City, Newark, and Elizabeth, all important ports and manufacturing centers. He recognized that automobiles and trucks, rapidly increasing in both number and weight, were becoming as important as, and soon would be more important, than railroads. He also recognized that when the tunnel opened, the route through Jersey City, Newark, and Elizabeth would become the principal through-route for traffic between New York, Pennsylvania, and the western and southern regions of the country.[21]

In his unpublished memoir, Fred Lavis credits Sloan as

> ... one of the first engineers to really consider the effects of types of highway on costs of transportation ... . He believed that the highway should be designed from the point of view of its effect on the operation cost of the vehicles, elimination of delays being one important item in decreasing these costs.[22]

In his discourse on highway economics in the 1923 annual report, Sloan was already equating the "modern highway" with its railroad counterpart -- the main line or trunk railroad where a rapid increase in usage had necessitated "betterment work." In many places that betterment work meant complete reconstruction or realignment of tracks done at tremendous expense in order to keep the system functioning. The justification for the expenditure of enormous sums of money was economics of operation, studies of which supported the capital investment necessary to effect the improvements. Among the important considerations directly affecting the economics of railroads and their location were issues such as proper radius of curves, gradients, and elimination of all at-grade crossings. Sloan warned that he foresaw highways failing to meet projected usage demands unless those responsible for highway construction took advantage of the experience of the railroad companies and gave careful thought and consideration to the economics of highway construction and maintenance, and then laid out a comprehensive system of highways on the basis of the certain increases in traffic that were bound to occur. Sloan was taking and using actual, 24-hour traffic counts and statistical data on trucks to determine the maximum hour traffic. In his opinion, and what has come to be an accepted engineering principle, maximum hour traffic, percentage of truck traffic, and vehicle weight were the determining factors for deciding on the overall width of a highway, capacity of its related bridges, and the character of the pavement.[23]

New Jersey State Highway Commission Plans the Modern Highway

With the decision to build an arterial road on a new alignment already made by the state legislature in 1921, the New Jersey State Highway Commission under the leadership of Gen. Hugh L. Scott on May 11, 1923, appointed an Advisory Board composed of the county engineers from Bergen, Essex, and Hudson counties; the city engineers from Jersey City and Newark; Clifford M. Holland, chief engineer of the New Jersey Interstate Bridge and Tunnel Commission; and "special consulting engineer" Ernest Payne Goodrich, a highly experienced civil engineer and urban planner who had served as a consultant to the Regional Plan of New York. State Highway Engineer William G. Sloan was appointed its chair. The commission charged the Advisory Board with recommending a solution to the expeditious and economical handling of the volume of traffic associated with the tunnel and to give consideration to the probable character and amount of expected and future traffic. They were also asked to devise plans for handling such probable traffic and to recommend the location of routes and types of construction.[24]

While the board was structured to take advantage of regional expertise and experience, it was Sloan, the old railroad man, who was the "expert" on the panel and its dominant voice. The board's report, entitled *Report of the Advisory Board to the New Jersey State Highway Commission: Vehicular Tunnel Traffic Study,* was delivered less than three months later, and its contents far exceeded its somewhat restrictive title. The report presents remarkably farsighted, innovative, and fully developed recommendations for a limited-access, high capacity, superhighway the likes of which America had never seen. The recommendations about location and structure types were supported and justified with cost estimates and statistical data including analysis of grades (an important consideration of economical operation of heavy trucks), elimination of curvature, elimination of grade crossings, elimination of delays caused by draw bridges, and other considerations affecting the facility, such as the safety of travel. Generally speaking, the highway as constructed follows the route recommended by the Advisory Board. The principal deviations were east of the crest of Bergen Hill where the alignment was changed to a covered cut parallel to the Erie Railroad's Bergen Archways on account of difficulties in obtaining right of way on the board's recommended route, and in not using tunnels for the Hackensack and Passaic river crossings because of their high expense in comparison to bridges.[25]

The Advisory Board considered the entire route as a "comprehensive unit," and it weighed each component to achieve the "best solution of the whole problem with the goal of "handling this volume of traffic with a maximum of safety." Their specific and well-reasoned recommendations included bypassing Newark and Elizabeth by developing new alignments outside of their congested districts. While the Advisory

Board's effort did not produce any plans for the new through highway, it laid out the design criteria and thought process to support the actual layout and construction plans. Those design criteria include grades not exceeding 3.5%, a durable and strong roadway consisting of granite block pavers on a reinforced concrete base, a 150' turning radius, a 50' wide roadway to accommodate four lanes of moving traffic and space for disabled vehicles on all viaducts and subways, and a 60' wide roadway at all other points. The right of way itself should be 100' wide except in the congested part of Jersey City, where the ideal was not possible because of existing and planned future development. The board also recommended accommodation for transition to and from local streets at controlled points and with the new north-south road to the planned bridge at Fort Lee (George Washington Bridge authorized in 1923 and completed in 1931). The Advisory Board broke the highway into six different sections for the purposes of analysis and planning, and those section designations were carried through the construction phase.[26] Sections 1 through 3, those that are primarily on structure or subway through Jersey City and across the Hackensack and Passaic rivers to Newark, are addressed in this nomination.

Urban and Limited-Access Highways in the Early- to Mid-1920s

New Jersey's Route 1 Extension is all the more remarkable an achievement given the state of limited-access highway design in the early 1920s and the great expense of construction that was unhesitatingly borne entirely by the state. The federal government had partnered with the states to help fund construction of highways and bridges with passage of the Federal-Aid Act of 1916, but the legislation prohibited the use of federal money on roads in communities of more than 5,000 persons, a restriction that was not removed until 1936. That limitation reflected the ongoing competition between the proponents of long-distance, improved highways and those who wanted only to get the farmer out of the mud.[27] By 1916, most large cities had brick, block, or asphalt street surfaces, but most rural areas did not. Urban streets and highways such as the Route 1 Extension were held to be "local problems" that should be dealt with by the cities, not the federal government. By 1920, however and for the first time, the majority of Americans lived in cities, and the huge increase in the number of registered motor vehicles left city streets inadequate to the ever-increasing demand.[28] Federal participation literally stopped at the city limit leaving the motorist and state and local transportation officials to fend for themselves despite the fact that the route was an extension of a highway that was part of the federal-aid system.

Limited-access "superhighways" (defined by Maryland State Highway Commission head H. G. Shirley in 1918 as those with divided lanes on a separated grade; shallow, banked curves; hills of 3% to 5% grade)[29] in the early 1920s, when planning for the Route 1 Extension began, were few in number and were located in rural/suburban areas rather than in fully developed and congested urban settings. This country's earliest attempt at a "superhighway" appears to have been T. Coleman duPont's 1908 multi-modal, public highway extending across his native Delaware. It was to be the "straightest, widest, and best road in the country" unlike anything that had ever been built, and it was to have central lanes for high-speed automobiles, of which he was an enthusiast, and a series of flanking lanes separated by grass medians for trolleys, heavy motor freight, horse-drawn conveyances, and pedestrians within a 200' wide right of way. One of duPont's insights was incorporation of the railroad's concept of the urban bypass.[30] Towns were connected to the highway by spur roads. Construction started in 1911, and while not the limited-access, multi-modal road originally envisioned, and not even more than a 2-lane concrete highway in the earliest days, it represents period thinking about high-speed, through highways.[31]

The 1919-1925 Bronx River Parkway is perhaps the country's earliest designed, limited-access, dualized public highway of any length. It was built for automobiles; trucks were never allowed. The 15.5-mile-long road is located fully within the Bronx River Parkway Reservation, which was started in 1907 to eliminate pollution from the lower portion of the Bronx River valley. Part of the development of the reservation was to be a scenic parkway for pleasure use. The road was designed prior to 1916, but construction did not begin until 1919. The parkway features limited access, a smooth riding surface, dualized travelways with two, 10'-wide lanes in each direction, some use of grass medians, elimination of grade crossings, and grades and curvature to promote safe, high-speed use. The road was designed for speeds of 25 and 30 mph.[32] What is significant about the Bronx River Parkway from a highway engineering perspective is the fact that its designers applied some railroad theories such as controlling right of way, and thus access, and eliminated grade crossings to a motor car roadway of some length.

The other two 1920s urban expressways that received notice in the period literature were Wacker Drive in Chicago and Woodward Avenue between Detroit and Pontiac. Wacker Drive is an approximately one mile-long, two-level boulevard along the Chicago River that was built 1925-1927 to segregate classes of traffic and accommodate access to loading docks and a river promenade on the lower level. It was monumentally detailed and was more a City Beautiful civic amenity than a super highway.[33] Woodward Avenue is a wide boulevard that was constructed in sections between Detroit and Pontiac. Both the Chicago and Detroit expressways have intersecting streets and at-grade intersections, and represent upgrading of existing streets. Thus in comparison to what was being developed elsewhere in the nation, the Route 1 Extension was far ahead in scope and concept as a solution to urban traffic congestion.

Implementation of Advisory Board Recommendations

The Advisory Board's report was presented to the state highway commission on August 8, 1923. During the ensuing months, the commissioners questioned and considered the recommendations, particularly the one for tunnels under the Hackensack and Passaic rivers, which they believed might be too costly. The commissioners, however, did agree that work on the highway from the tunnel portal through Jersey City should begin at once, and work began in earnest July, 1924, when State Engineer Sloan hired Fred Lavis (1871-1950) to take charge of the detailed studies for the actual laying out of the route and the development of construction plans. Lavis was a consulting engineer with worldwide transportation industry experience including railroads in South and Central America, many railroads in this country, and the Pennsylvania Railroad's 1902-1910 New York Extension, which includes a tunnel through Bergen Hill. He remained with the Route 1 Extension project until 1928, and he was the head of the state highway commission's office at Jersey City. All studies, including the groundbreaking economic study that guided the location and design decisions, preparation of plans and specifications, and supervision of the construction were done under his direct supervision. Lavis won the American Society of Civil Engineers's (ASCE) Arthur M. Wellington Prize in 1930 for his work on the Route 1 Extension.[34]

Sigvald Johannesson (1878-1953) was in charge of all design details for the viaducts and structures including the Pulaski Skyway. A Dane educated at the University of Copenhagen, he too started with the state highway commission in 1924, and he went on to head their Division of Planning and Economics until his retirement in 1948. He previously worked on the London underground and with Lavis on the Pennsylvania Railroad's New York Extension.[35]

Design Based on Wellington's Economic Theory of Railway Location

Noted historian of both technology and the Port of New York, Carl W. Condit acknowledged in his seminal work American Building Art: The Twentieth Century that "it is necessary to note and explore the fact that many characteristics of the thoroughly engineered expressway of the present time originated with the railroad rather than the highway," but those concepts such as low grade, curvature, limited access, segregation of local and through/passenger and freight traffic, elimination of at-grade crossings [perhaps first used in this country by the Camden & Amboy Railroad at Bordentown ca. 1831], "did not appear in a systematic way on highways until the decade of the 1920s."[36] It may seem today that the laws of nature include an understanding that, for example, the steeper a grade, the more traffic would slow in climbing it, the more it would cost in gasoline, and the more wear and tear there would be on the vehicle. The early 1920s, however, was a time when the need for speed and economy had only been a consideration for railroads. There had not been enough automobiles, and painfully few highways, to demand a need for speed. Roadways were used to get from one property to another, were inherently slow, and were not through routes.

New Jersey's approach road to the Holland Tunnel marked the first time that the economic theory of railway location, and its resultant free, uninterrupted flow of through traffic without interference from local uses, was applied to a highway design. The road represents the transition to highways a design based on economic theory, safety, and traffic service. It was the genius of William Sloan and his staff of seasoned railroad men that made the seemingly obvious link between trunk railroad lines and the new "through trunk highway," and Arthur M. Wellington's The Economic Theory of the Location of Railways was used to justify the unprecedented cost and design of the Holland Tunnel approach road.[37]

Arthur M. Wellington's (1847-1895) influential work, The Economic Theory of the Location of Railways, was originally published in 1876 as a series of articles in Railroad Gazette and then in book form in 1877. There was practically nothing else in print to serve as a scientific guide to railway location. So complete and well reasoned was Wellington's work that it stood as the model for several generations of engineers. He revised and greatly expanded his theories for the second edition published in 1887. That edition's subtitle, "an analysis of the conditions controlling the laying out of railways to effect the most judicious use of capital," succinctly summarizes his theory, which compares the costs of operation for potential alignments and design features by estimating the cost of the improvement and then estimating the operation costs by considering the effect of variables. Variables included grade crossing delays to the safe, uninterrupted flow of heavy traffic, curvature, grade, alignment, number of tracks, and distance. Wellington determined the cost of operation per train mile, which he further broke down into units addressing all the factors in operating a train, such as coal and oil, wear and tear on rolling stock, and the weight of track itself. Using the train mile as a unit, it was then possible to calculate long-term, real costs over time and thus justify how a more expensive initial outlay was ultimately cost-effective.

Fred Lavis was an internationally experienced railroad man and an expert on Wellington's theory and tunnels. He had written prolifically on the subject of economics including Railroad, Location, Surveys and Estimates in 1906, Railway Estimates, Design, Quantities and Costs in 1917, and Instructions to Locating Engineers in 1919. Lavis insightfully reasoned that "highways (especially in fully developed, urban areas) must be developed to permit the same safe uninterrupted flow of heavy traffic as now obtains on a modern trunk-line railway, and the cost of operating these motor vehicles becomes an economic factor of importance."[38] He stated in his memoir:

> I was convinced that the highway should be designed just as the railways were designed, to produce the lowest ton-mile or passenger-mile costs of maintenance in relation to their effect on the operating costs of the vehicles.[39]

To that end, Lavis and his colleagues William Sloan and Sigvald Johannesson would be the first engineers to bring proven railroad economic theory to the building of highways by utilizing the principles of Wellington's The Economic Theory of the Location of Railways as a basis for computing, comparing, and evaluating costs associated with highway design, construction, and use.[40] Since one of the most important objectives was the passage of traffic with as little interruption or difficulty as possible, Lavis would use Wellington's theory to balance costs of construction with the savings in costs of operations to vehicles using the through highway as the justification for its location and design for the eastern section through already congested Jersey City. Its location and design would be based on a thorough study of the economic factors: costs of delays such as at-grade crossings or draw bridges, distance, curvature, rise and fall (grades), and costs of vehicle operation including fuel, driver wages, insurance, tires, and repairs.

Curvature (how the radius of curve would affect speed and safety), rise and fall (fuel consumption and speed going up hill), distance, and delays, all have economic value insofar as they may affect the cost of operation of the vehicles using the highway. Delays cost time, and time costs money. In adapting Wellington's principles for highway application, a car minute was set at 2 cents, and, using a 15 to 20 mile per hour speed, it was estimated that 54,000 vehicles per day or 18,360,000 per annum would pass over the east end of the highway. With these givens, the decision makers compared and evaluated various options by capitalizing the expense to the motoring public and then used that figure to support an appropriate capital cost for the design.

The economic factors were considered in light of what Lavis called "governing points." These included the practical considerations of topography, accommodation of the road within a built up section of Jersey City, the availability of desired right-of-way, much of which was owned by railroads, and mandated interchanges with existing and proposed roads, such as the north-south route to the new bridge being constructed over the Hudson River at 178th Street. The governing points influenced many design decisions, such as moving the location of the section from the tunnel portal to Bergen Hill (section 1) 50' north of the Erie Railroad's Bergen Archways rather than south of 12th Street. Another governing point influence meant not using an open cut through Bergen Hill, which was already traversed by numerous railroad open cuts. The open cut scheme had been recommended by the Advisory Board but was opposed by the community. In Newark there were many railroad property considerations and the airport under construction to be accommodated.

With the exception of the crossing of the Hackensack and Passaic rivers, which was not settled until the fall of 1929, the road was located and designed based on the economic factors and tempered by the governing points. Reiterating recommendations from the 1923 Advisory Board report, the actual design of the highway would be 50' wide when carried on viaduct or subway and 60' wide elsewhere. There would be no provision for pedestrian traffic. The roadway would have granite block paving on a 10" deep concrete base to accommodate 20-ton trucks, a maximum gradient of 3.5%, 1,000' curvature, and no conflicting intersections. It would be designed to accommodate a traffic volume of 5,500 vehicles per hour.[41]

Achieving Consensus on Final Design

In 1930, Fred Lavis provided a good summary description of the 13.2-mile-long highway:

> At its eastern end the Route 1 Extension connected with the Holland Vehicular Tunnel under the Hudson River. It then passed though Jersey City and over the trap dike which divides the Hudson River from the valley of the Lower Hackensack and Passaic Rivers, crosses this valley in the lower part of the Town of Kearny, then by passes the City of Newark, skirting the edge of the uplands and meadows, and finally, crosses the meadows to the City of Elizabeth, beyond which it connects with the main State Highway routes leading south.[42]

But achieving that route was no easy task. Theoretical mathematics aside, the highway was to be built through real communities and not in a vacuum. Local interests affected three parts of the final alignment; sections 1 and 2, which were considered by the designers as one section, and Section 3, now known as the Pulaski Skyway. The crossing of the Hackensack and Passaic Rivers became the most contentious section and caused delay of its completion until late in 1932. Construction on sections 1 and 2 began in the summer of 1925.

For the first two sections, the Advisory Board had suggested a 2,500'-long viaduct from grade at Jersey Avenue via an extension of 12th Street (east terminus of highway) up to the high ground and an open cut roadway extending from the end of that viaduct at Palisade Avenue to Tonnele Avenue with access ramps provided at Baldwin Avenue and Hudson (now JFK) Boulevard. The Erie Railroad, however, objected to another open cut paralleling its Bergen Archways because of the potential to interfere with any plans the Erie might have for widening their cut or removing the top of the earlier tunnel that laid below the cut. The railroad also objected to the 12th Street route from the tunnel portals to the top of the ridge because of warehouse expansion it was contemplating. They asked the state to move the viaduct to 13th Street, where a viaduct up the hill already existed, or to 14th Street.[43]

Jersey City officials also objected to another open cut. The Bergen Archways and Pennsylvania Railroad open cuts already divided their community and were an impediment to travel.[44] A compromise solution brokered by Governor Moore called for the highway to be in a covered cut on a trajectory along 12th Street and across the ridge on a line north of and parallel to the Erie Railroad's Bergen Archways. The depressed highway would be located underneath the surface streets. With this plan, the free communication of the north-south streets would be maintained, and a much-needed, east-west boulevard in the heights would be provided. The eastbound lanes of Hoboken Boulevard and the new boulevard called "State Highway," as well as the crossing streets would be carried on the roof of the covered cut while westbound traffic between Palisade Avenue and JFK Boulevard would be at-grade. The two directions of traffic were divided by the ventilator bays servicing the depressed roadway. By placing open bays over the eastbound lanes of the depressed highway and along the south side, the designers determined correctly that there was no need to provide mechanical ventilation in the subway.

It was recognized that, while the highway was designed largely for through traffic, there must be provisions for access to important points along the route. Where connections between the highway on structure and surface streets were to be made, it was decided that the highway would divide into two separate roadways to admit a central, inclined approach that was generally 24' wide to accommodate two-way traffic. Where local conditions did not permit this arrangement, such as at Palisade Avenue on the east side of Jersey City, the highway was carried through the center and the structure was widened on both sides to accommodate outside ramps flanking the highway and connecting to the surface streets. Since there were hardly any precedents for highway access ramps, the ramp system is one of the most significant design aspects of the highway.

In order to facilitate the interchange between the elevated highway and the at-grade north-south street (Tonnele Avenue) to the bridge at Fort Lee, as well as local Jersey City streets, Tonnele Avenue was improved with a traffic circle with separate radial approaches connecting the roads and ramps of the complicated intersection that included a ramp to the tunnel approach road. That center ramp served as the terminus of the east section of Route 1 Extension until the Skyway was completed in 1932, and it accommodated eastbound traffic entering and westbound traffic exiting to Tonnele Circle (Figure 3, Figure 4).[45]

The circle/interchange was almost immediately determined to be inadequate for the volume of traffic, due in part to existing conditions that limited the diameter of the circle and thus traffic flow through it, and the ramp from JFK Boulevard, which decreased the weaving distance for efficient use of the circle. Long outside ramps to accommodate both eastbound and westbound traffic were added as was a viaduct to directly link the westbound highway traffic with Route 1 & 9.[46] That 1938 viaduct, which crosses the circle, eliminated the at-grade westbound interchange between the two major highways. Once the outside ramps were in place, the original, two-way center ramp was converted to entering eastbound traffic from the circle only. An exit for westbound traffic to the circle was added by merging that ramp into the original ramp from JFK Boulevard to the circle.[47] All features communicating with the circle that are not part of the original design are considered as non-contributing because they are not part of the original highway and do not reflect the principles and theories that guided the original design.

Like all other aspects of the project, a great deal of consideration was given to every detail of the design, and decisions were based on economics that balanced construction costs and subsequent maintenance costs. They were applied to various alternatives for seemingly every span length, according to Sigvald Johannesson. All analysis also included certain, predetermined conditions such as the 50' roadway width, use of a high curb and heavy, reinforced concrete railing barriers anchored to the superstructure to prevent vehicles from "falling off the structures."[48] For maintenance considerations, most steel would be encased in concrete, but it was found uneconomical to encase the steel of the Pulaski Skyway truss spans because of the additional weight (dead load) that would have had to be supported on the foundations of the high level viaduct. And while most of the component steel stringer-multi-beam and truss spans were not technologically innovative from the structural perspective, a great deal of special attention was paid to design details, like the way to accommodate expansion within the structural design rather than by means of sliding plate expansion joints. Details like expansion joints and deck construction were changed from section to section as the results of experimentation and empirical study informed better details and were followed in period engineering publications.[49]

Construction of the highway was not sequential because of the controversy about how to cross the Passaic and Hackensack rivers, which was not resolved until the fall of 1929. But the other sections of the highway were constructed and opened as they were completed between 1926 and 1929. With the exception of the 3.5-mile-long Pulaski

Skyway section, the 13.2-mile-long highway was completed in strict accordance to the vision, planning, and design of William G. Sloan, Fred Lavis, and Sigvald Johannesson, despite the fact that Lavis left the commission in 1928 and Sloan left in June, 1929, only to return to his former position in 1933. Ironically, the last and most famous piece of the seminally important Route 1 Extension -- Pulaski Skyway -- did not strictly adhere to the economic factors that served as the basis for the design of the other sections of the highway. Its 135' vertical clearance over the rivers meant that the increased grade for the access ramps would make it impractical for truck usage, which were not allowed to use it after the mid 1930s. The high, unencased viaduct also increased maintenance costs.

Sections 3 Design Changes - The Pulaski Skyway Controversy

The controversy concerning the route and means of crossing the Hackensack and Passaic rivers began in 1925 with squabbles among the state and federal agencies granting permits for crossing navigable waterways. It was not resolved until 1929 and not completed until 1932. In the interim, traffic was routed on Route 1 between Tonnele Circle and Newark. This was a slow route, and there were numerous complaints until the high level viaduct opened to traffic in November, 1932. Governor A. Harry Moore designated the entire section as the General Pulaski Memorial Skyway on October 11, 1933 recognizing the young exile Polish Count Casimir Pulaski, who received a mortal wound at the Battle of Savannah in 1779 while fighting for American independence.[50] Having served with Washington since his arrival from Europe in August, 1777, Pulaski has always been recognized for his heroism and for the price he paid for American freedom.

The question of how to align the highway and cross the rivers in Section 3 was unsettled from the outset of planning the great highway. The August, 1923 Advisory Board report proffered both a recommendation and an alternate; one crossing the meadows and rivers in an economical straight line from Jersey City to Newark using tunnels at the rivers; the other using a longer route with movable bridges. While the board had considered the possibility of bridges across the rivers, it reasoned that drawbridge delays would cause traffic bottlenecks, thus defeating the purpose of everything else the highway had been designed for – namely high speed and economical vehicular traffic service. Because of this, the Advisory Board recommended construction of tunnels under both rivers, which would be an estimated

$8,334,000 more expensive than bridges. If the alternate of movable bridges were chosen by the state highway commission, the recommendation was for a vertical clearance of 40'. At some point in the planning process, the desired vertical clearance was reduced to 35',[51] which Sloan and Lavis believed would accommodate 85% of the river traffic. The other 15% could be accommodated at minimum traffic times. The state highway commission deliberated long and hard over this issue, and opted to pursue the less-expensive movable bridges rather than tunnels for the river crossings.

Coming to consensus and securing an alignment and a permit for construction of those bridges was marked by a series of indecisive and contradictory actions on the parts of the state and the federal War Department, which had jurisdiction over navigable waterways and permitting authority over all formations crossing them. The War Department did not want to increase the number of movable bridges over the Hackensack River, so it made the permit dependent on the state's removing the existing Lincoln Highway bridge when the bridge on Route 1 Extension was completed. State and local interests correctly realized that this action would significantly interfere with the efficient operation of both highways, so they did not agree with the stipulation. Still unresolved at the beginning of January, 1929, the state highway commission appointed a committee to objectively review all of the plans. William Sloan requested Colonel William J. Wilgus, Daniel Turner, and Thomas McDonald, chief of the Bureau of Public Roads, to serve on the committee with expediency.[52]

The three worked quickly, and by the end of January, they issued an opinion strongly recommending against the use of movable bridges, which they reasoned would "interfere so seriously with the vehicular traffic over the super-highway as to largely offset the advantages which have been gained by the elimination of all grade crossings along the superhighway in Jersey City and Newark."[53] They opined that a high-level viaduct on the most direct route would maintain the originally planned alignment and would be comparable in cost to the other alternatives considered. Their recommendation forced the state highway commission staff, now without Fred Lavis and soon to be without William G. Sloan (both of whom endorsed the 35' vertical clearance vertical lift bridges, for which plans were being developed, to rethink their approach to Section 3. In the fall of 1929, the commission and the War Department, as well as the Board of Commerce and Navigation, which had been pulled into the deliberations by the state, all approved the plan for the high level viaduct with a 135' vertical clearance over the Hackensack and Passaic rivers. In essence, the proponents for unrestricted marine traffic had won, and, as a consequence, Section 3 would be the only section of the highway not built in strict accordance with the economic approach advocated by Sloan and Lavis. But when opened to traffic on Thanksgiving Day, 1932, the 3.5-mile-long viaduct with its pair of 550'-long, cantilevered through truss bridges soaring over the meadowlands made it possible for motorists to cover in about five minutes a distance that formerly required from twenty minutes to two hours.[54]

The design of the high level viaduct, as it was originally known, was controlled by the need to achieve 135' vertical clearance over the rivers and the desire to maintain the 3.5% gradient. While it was possible to increase the grade and lower the viaduct on each side of the river crossings so that it would provide the 14' clearance over local streets, it was found that any savings in construction costs would have cost more in vehicle operation due to the rise and fall. The high elevation of the roadway and the great depth of suitable foundations in some locations such as the meadows between the two rivers and west of the Passaic River made long spans economical, with 300'-long spans being the most economical. Of course, span lengths were adjusted for existing conditions where longer through truss spans were used over railroad yards and lines where a 22' vertical clearance was needed.[55] The survey and design work for the Skyway and supervision of its construction was under the direction of H. W. Hudson and general supervision of Jacob L. Baur, state bridge engineer from 1930 until 1933.

Despite the emphasis on designing a facility based on servicing truck traffic, the 5.5% grade of the center ramps was too great for trucks to safely weave into higher-speed through traffic. There were several fatal accidents, and by the mid 1930s, Jersey City restricted trucks from using the Skyway. This meant that the improvements to Tonnele Circle were all the more needed as the circle is where trucks would enter and exit the tunnel approach road.

Changes and Integrity

The aspects of integrity vary from section to section of the highway with the contiguous easternmost sections of roadway retaining integrity. Beyond the Skyway and the nominated portion of the highway, there have been significant alterations including roadway widenings, additions of parallel roadways, changes to ramp geometry, bridge replacement, and replacement of original balustrades. The section of highway contiguous to the west end of the Pulaski Skyway is typical of alterations/improvements that began after World War II. The west terminus of the Skyway, where it transitions back to the roadway on grade, was originally divided to accommodate a center ramp for exiting eastbound traffic. In 1959, the center ramp and the three westernmost spans were filled in, and the roadway was reconfigured to accommodate construction of an at-grade ramp to merge southbound Route 1& 9 T with Route 1 Extension, which is now designated US Routes 1 & 9. At this point, the highway breaks out into an eight-lane facility with modern geometry and safety features. The original design and geometry of this and other sections of Route 1 Extension have been completely lost.

In contrast to the western portion of the highway, the changes to the east portion (from the Skyway east) are minor and generally do not compromise the aspects of integrity. Its integrity is due in large measure to the sheer size and structure type of the Pulaski Skyway and the fact that the Conrail, Hoboken, and 12th Street viaducts were threaded among the pre-existing factories, rail facilities, and warehouses that are Jersey City itself, thus precluding any prudent way to increase the roadway width of those structures. When increased roadway capacity was needed, an entirely new Holland Tunnel approach road, the New Jersey Turnpike's Hudson County Extension, was constructed on a new alignment in 1954-1955.

There have, however, been some changes to the east end of the approach road, particularly at Tonnele Circle and the 12th Street Viaduct. As previously discussed, the circle and highway approaches to it were modified to increase the efficiency of the complicated interchange among local streets and state highways. As originally planned, the 12th Street Viaduct, which is a straight projection from the tunnel approach plaza, carried two-directional traffic. The exit plaza, however, is along 14th Street, and from that portal, traffic had to navigate 1,750' of local surface streets and two, ninety degree turns to reach the 12th Street Viaduct. Turning movements were controlled by traffic signals, and this situation of mixing through traffic with traffic on local streets became intolerable. Planning for a through viaduct for westbound traffic along the14th Street alignment was undertaken by the Port Authority of New York and New Jersey in 1944, but its construction was not started until 1949 with completion in 1951. The 14th Street Viaduct merges with the 12th Street Viaduct east of the former Conrail Railroad, and the north elevation of three spans (spans 28 through 30) were widened slightly. Similarly, the south sides of spans 1 through 24 were widened slightly to accommodate the merge of eastbound tunnel traffic from the New Jersey Turnpike Newark Bay-Hudson County Extension that opened in September, 1956.

Selected sections of the original balustrades have also been replaced, and the concrete encasement on the 12th Street Viaduct was removed in 2002.

End Notes

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UTM References

Jersey City Quad

	Zone	Easting	Northing
E	18	578320	4510000
F	18	579140	4510020
G	18	579600	4509580
H	18	580140	4509125
I	18	580620	4509040
J	18	580620	4509060
K	18	579940	4509180
L	18	579280	4509940
M	18	578810	4510000
N	18	577420	4509720
O	18	575820	4509460
P	18	573900	4509425
Elizabeth Quad			
Q	18	573280	4509030

Boundary Justification

The boundary includes all structures (bridges, viaducts, ramps) and sections of roadway on grade or fill that comprise the original, pre-1933 alignment of the resource east of US Route 1 & 9 milepoint 51.25 to its historic terminus at grade at NJ 139 milepoint 1.45. Milepoints cited are derived from the New Jersey Department of Transportation's *New Jersey State Highway Straight Line Diagrams 1988.* These are the contiguous, original-construction sections of the highway that retain their original design and aspects of integrity. Since the nominated property is primarily a structure, the boundary is limited to the NJDOT-owned, developed portion of the right- of-way and is composed of the contiguous structures and related sections of roadway that carry the highway or local roadways over highway-carrying structures, including the Kennedy Boulevard overpass. The land under the highway-carrying structures, which in many instances is owned by others, is excluded from the boundary. None of the surroundings, including all at-grade, local streets are included in the boundary.

The structure portion of the nominated property has a typical overall right-of-way width of 55'-6", but it widens to as much as 120' at three points to accommodate central or side entrance ramps. The Raymond Avenue ramp had an overall width of 30'.

All modifications to the original, pre-1933 configuration of the highway, which have been added to the outside limits of the original highway alignment and were built after the 1923-1932 period of significance, are excluded from the boundary. These exclusions include the eastbound and westbound ramps from Tonnele Circle, the retaining walls constructed in the late 1930s to accommodate communication between the Kennedy Boulevard ramp and the westbound highway, the New Jersey Turnpike Extension added to the south side of spans 1 through 24 of the 12th Street Viaduct, and the 14th Street Viaduct, which is separated from the north side of spans 28-30 by expansion joints. The JKF Boulevard ramp connecting that local street with Tonnele Circle is contiguous to the north side of the highway. While it is an original feature, it was significantly altered as part of the construction of new ramps to and from the circle starting in the late 1930s. Because the JFK Boulevard ramp has been significantly altered and does not maintain its original design or the aspects of integrity, it is excluded from the boundary.

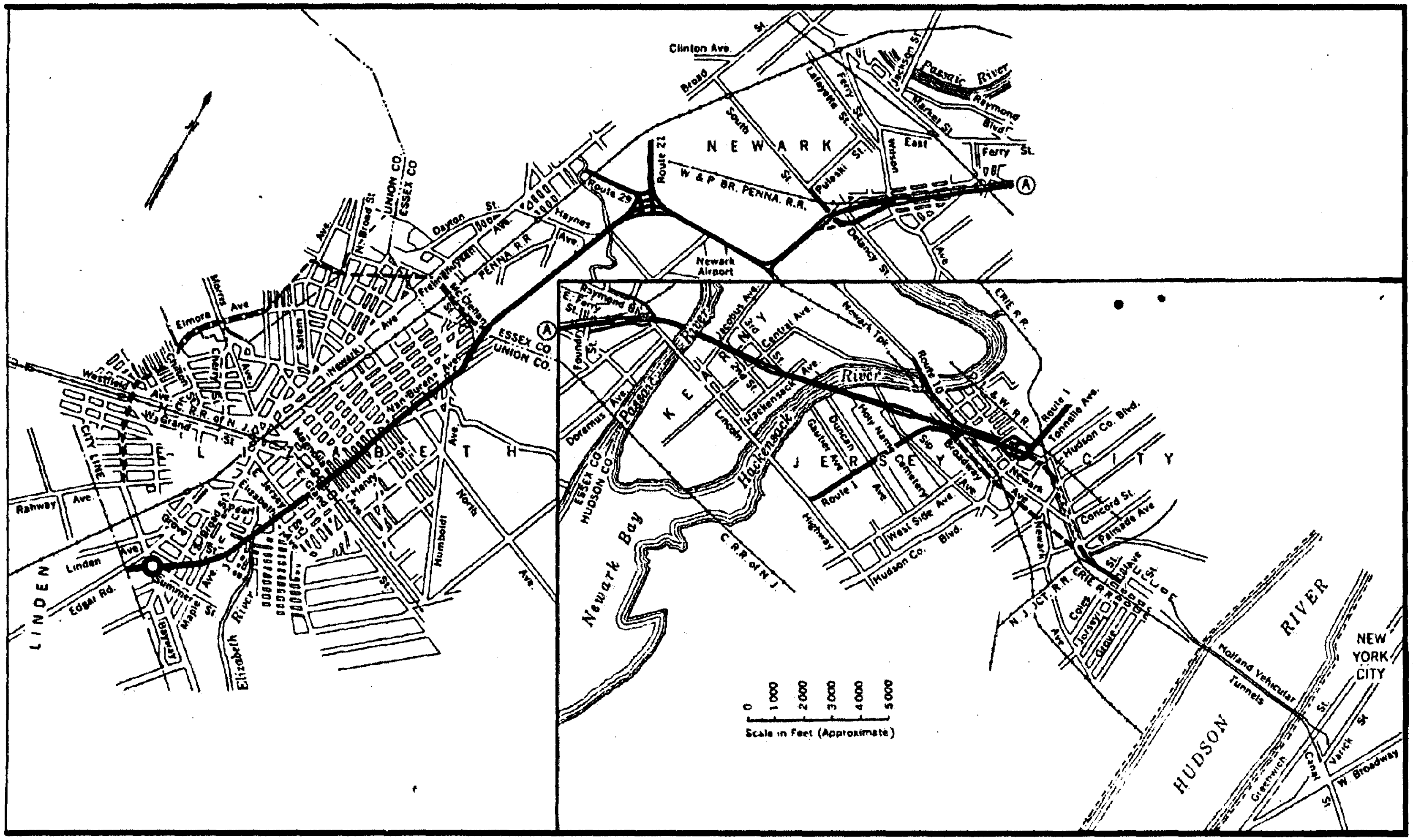
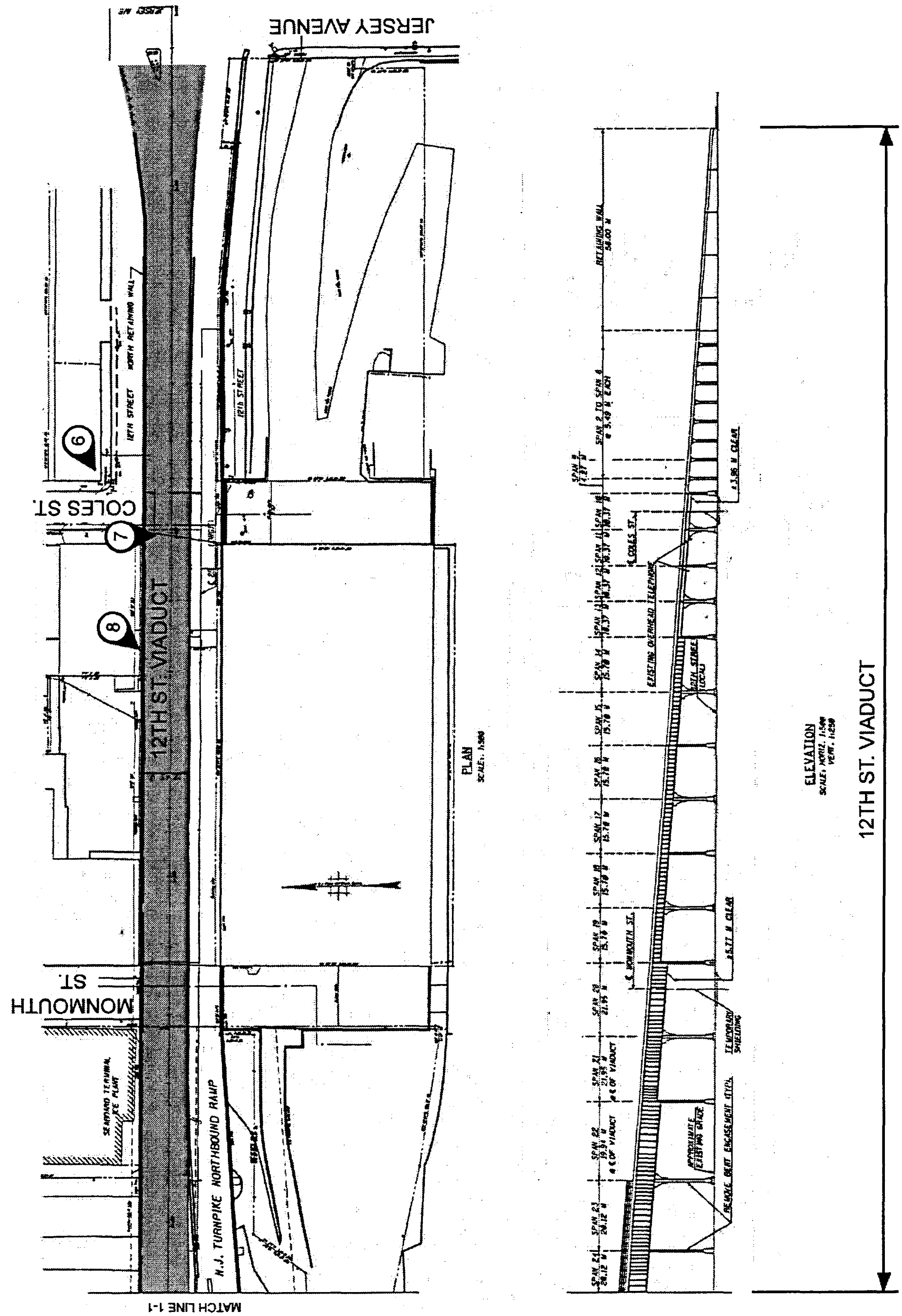


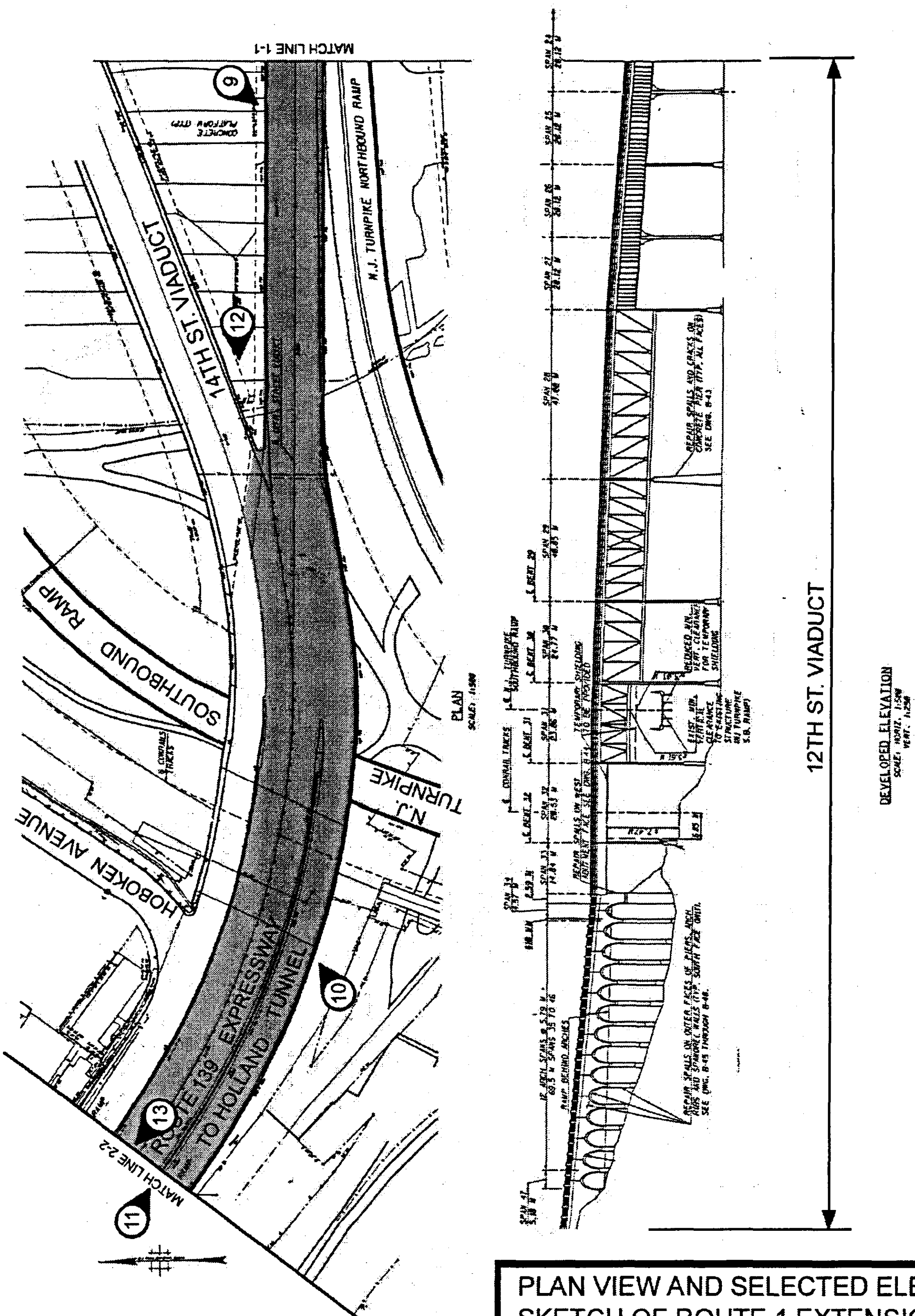
Figure 1. Alignment of Route 1 Extension through Jersey City, Newark, and Elizabeth, as illustrated in Sigvald Johannesson's 1933 article entitled "Lincoln Highway from Jersey City to Elizabeth, New Jersey" published in ASCE's *Transactions* in October, 1933.



PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

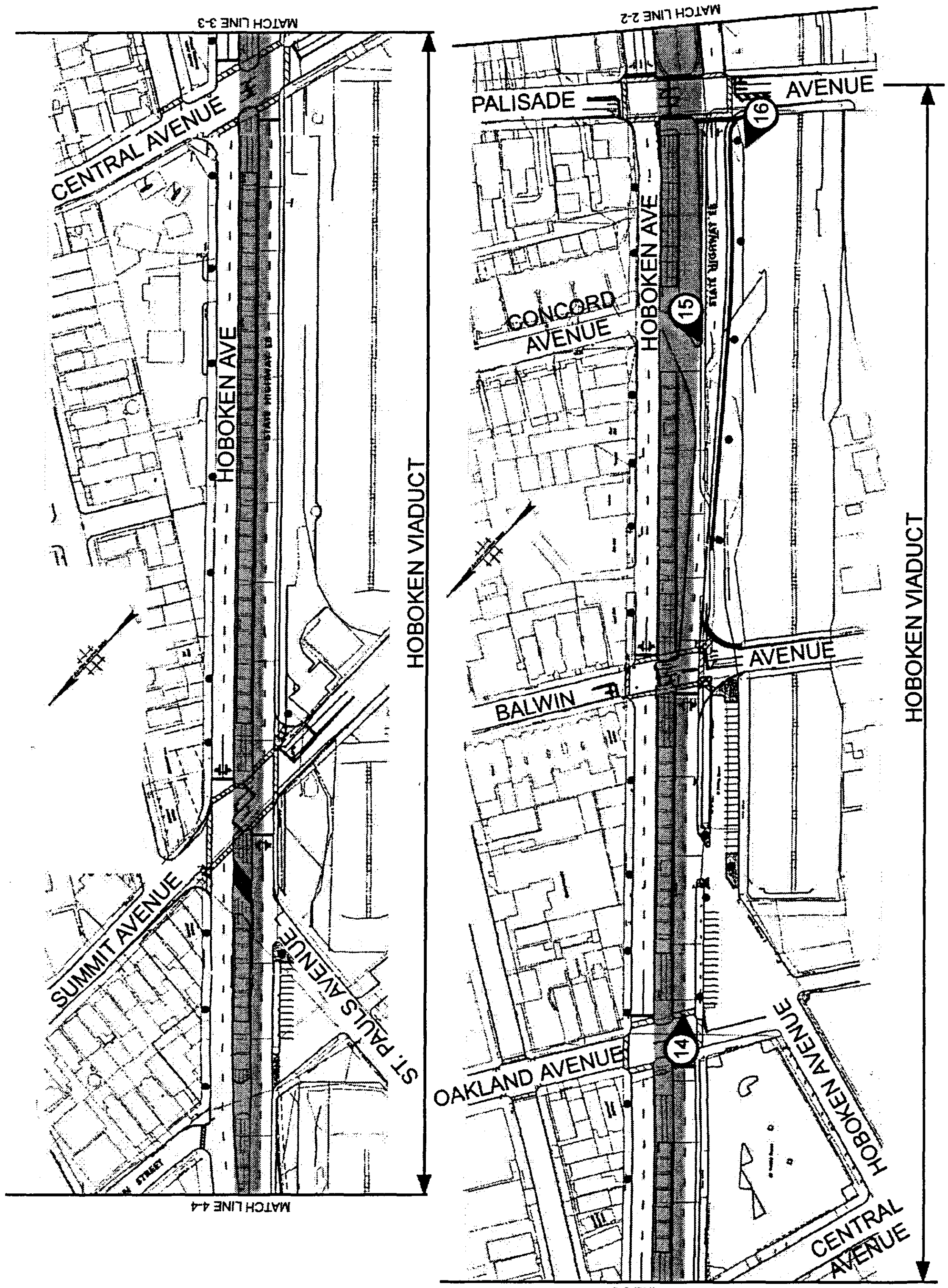
DATE 1/2004
SCALE APPROX. 1"=330'

FIGURE 2-1



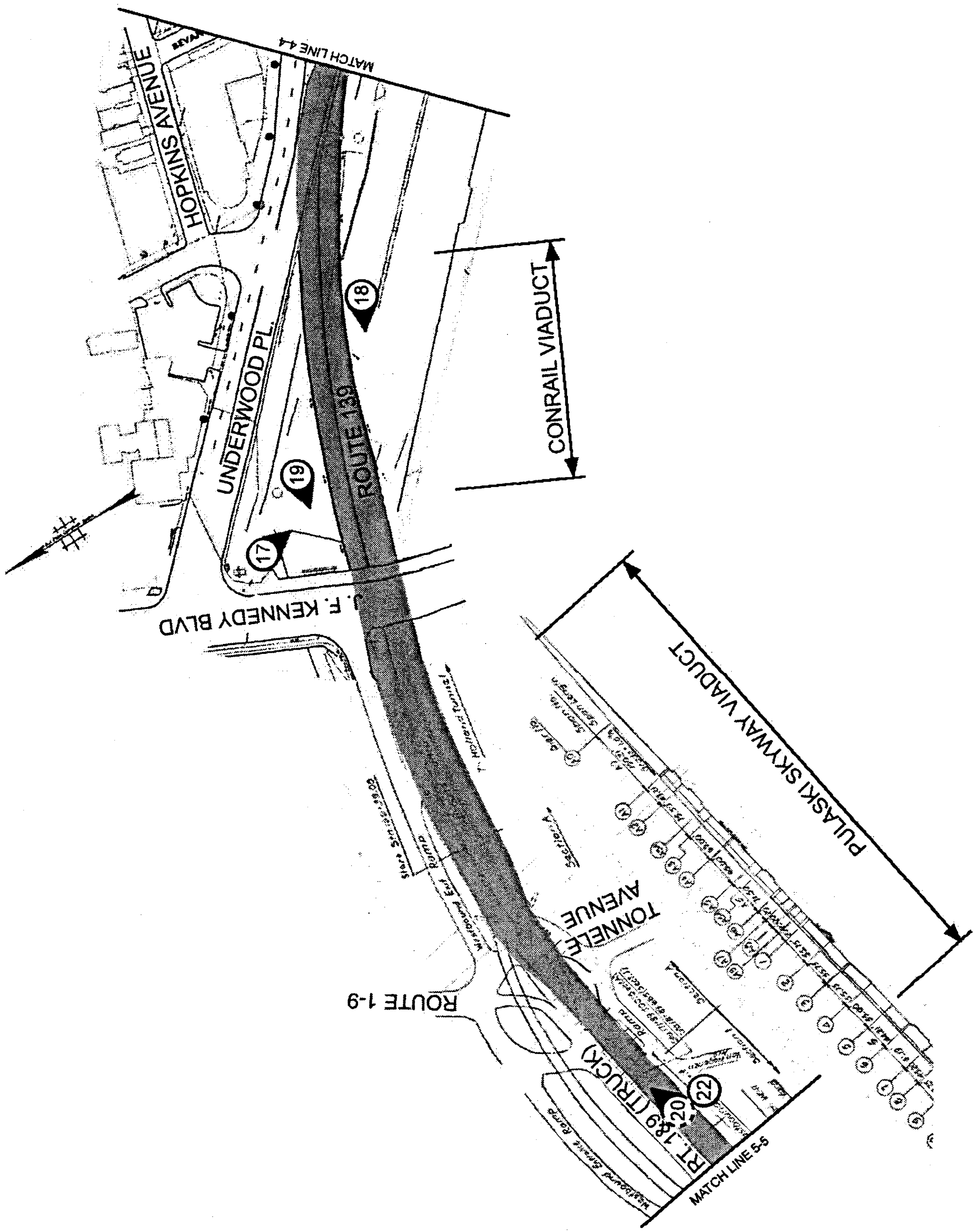
PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330'		FIGURE 2-2



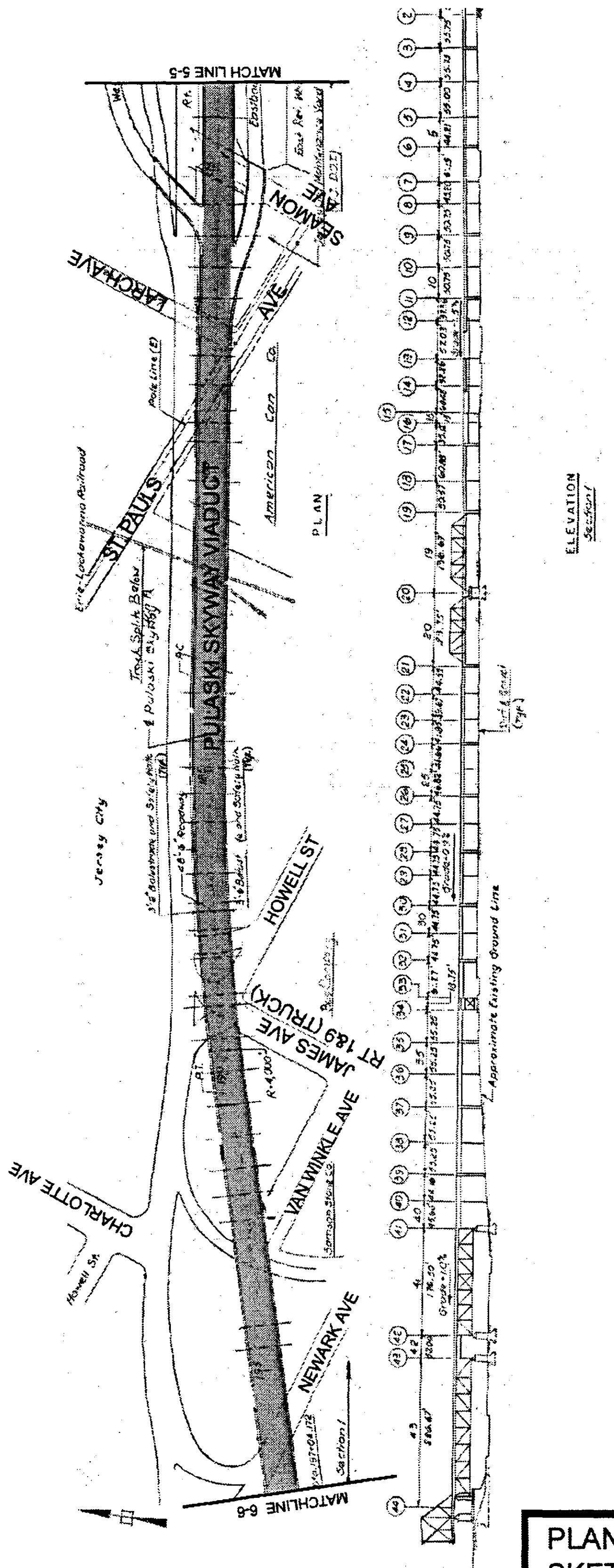
PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330'   FIGURE 2-3



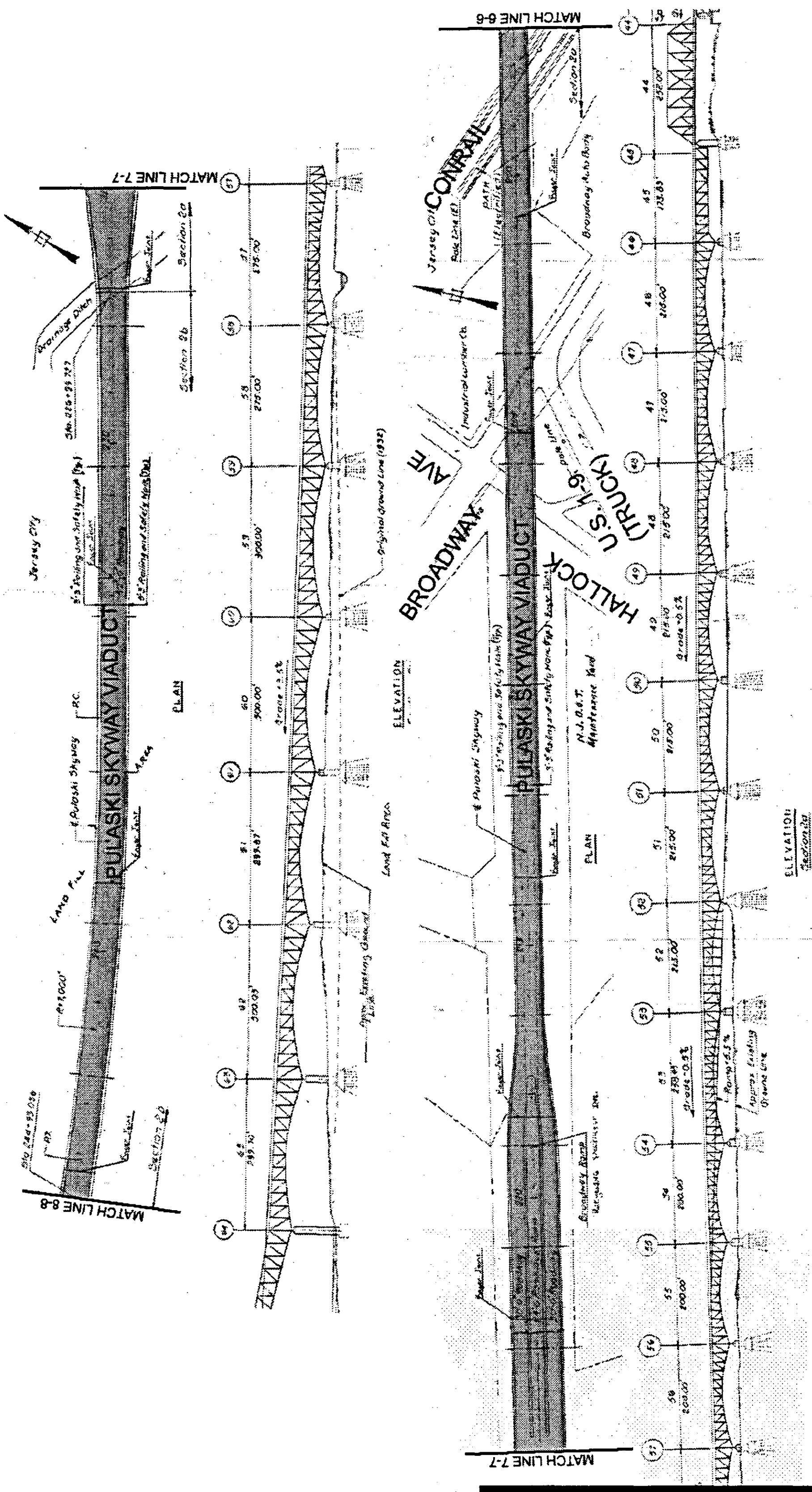
PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330' FIGURE 2-4



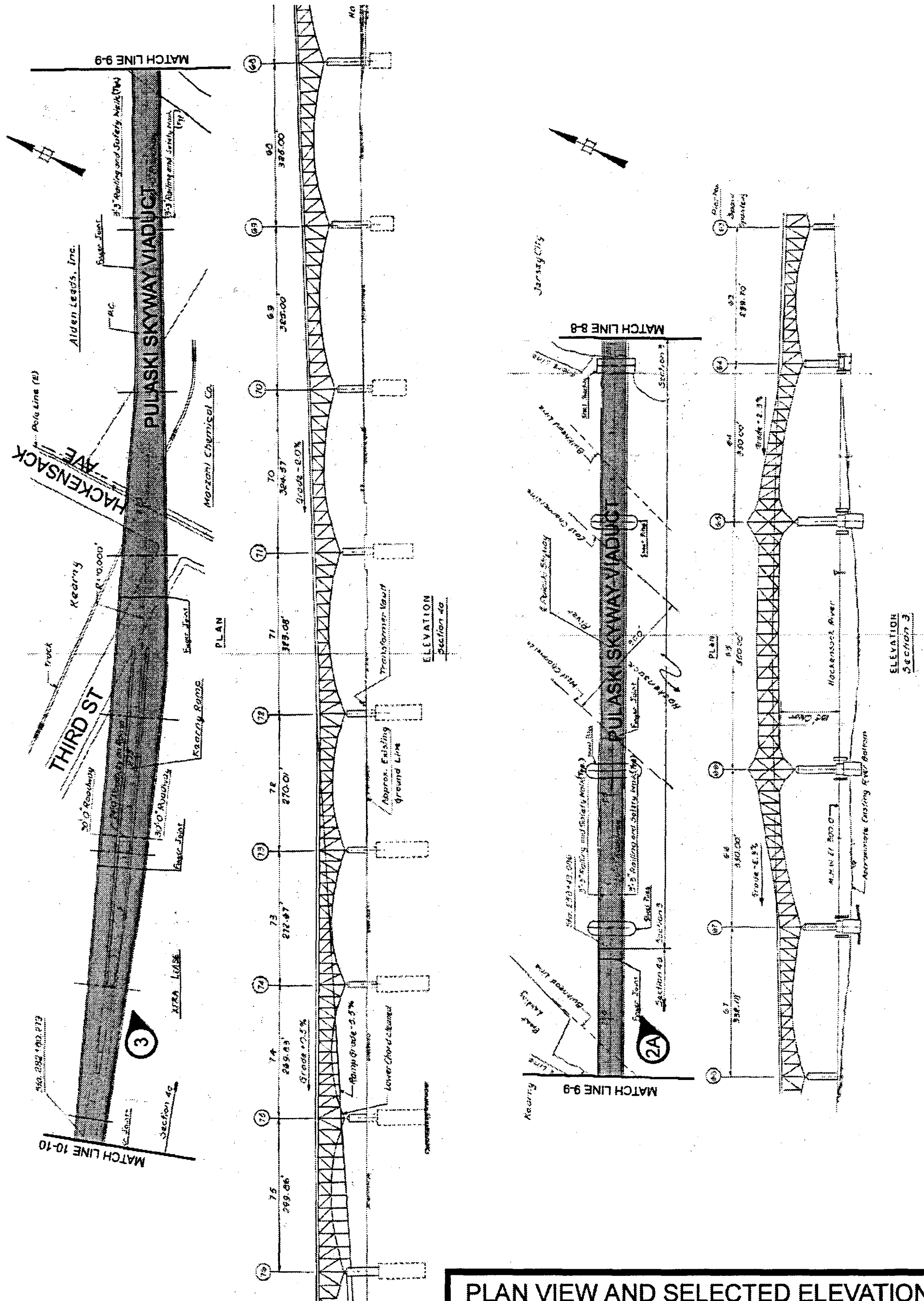
PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330'
FIGURE 2-5



PLAN VIEW AND SELECTED ELEVATIONS SKETCH OF ROUTE 1 EXTENSION

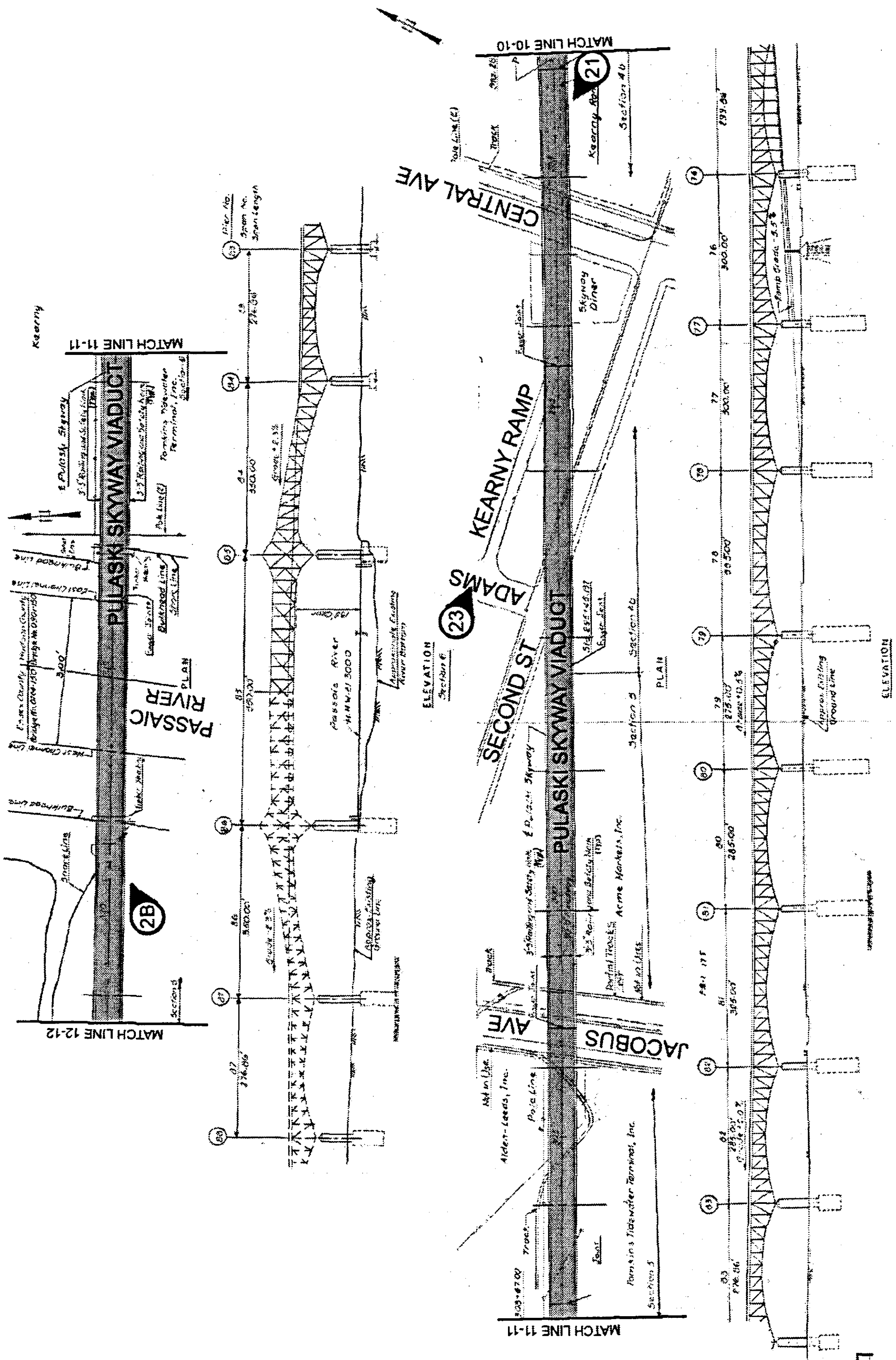
DATE 1/2004
SCALE APPROX. 1"=330' FIGURE 2-6



PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330'

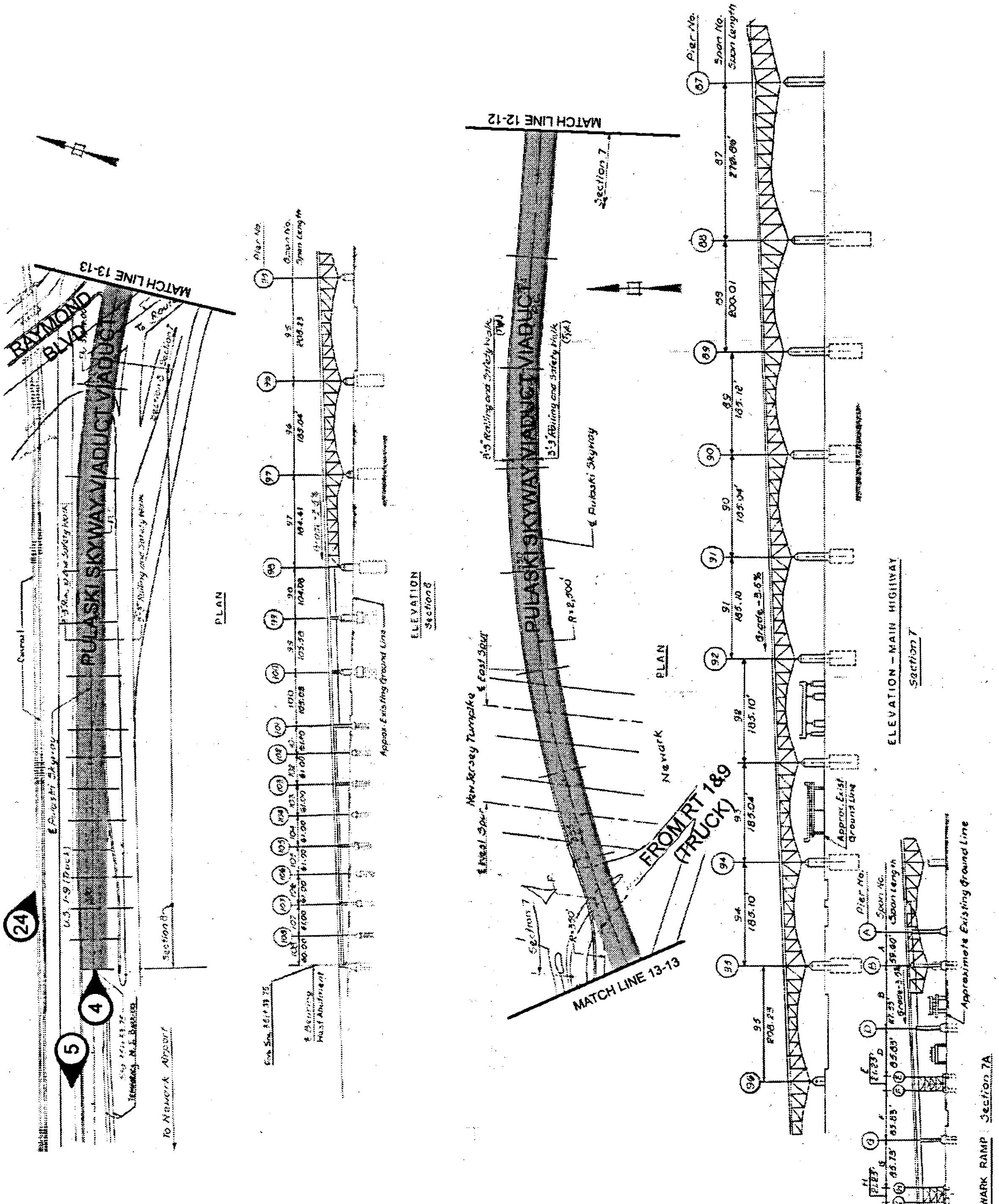
FIGURE 2-7



PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330'

FIGURE 2-8



PLAN VIEW AND SELECTED ELEVATIONS
SKETCH OF ROUTE 1 EXTENSION

DATE 1/2004
SCALE APPROX. 1"=330'

FIGURE 2-9

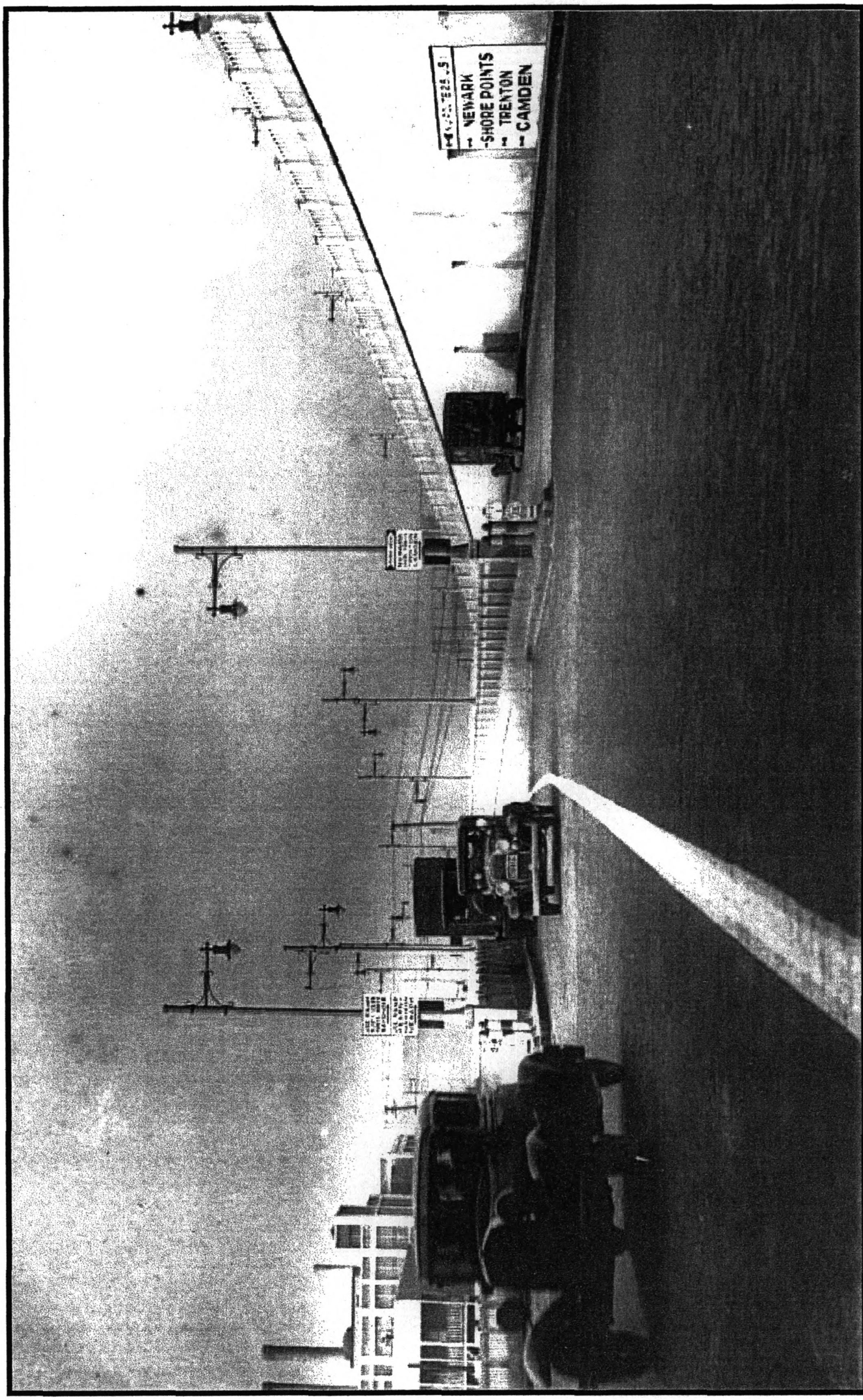


Figure 3. Dec. 1932 view looking west at center ramp to Tonnele Circle. This is where sections 1 and 2 of Route 1 Extension were accessed prior to completion of Pulaski Skyway. Courtesy of NJDOT/BEA Collection.

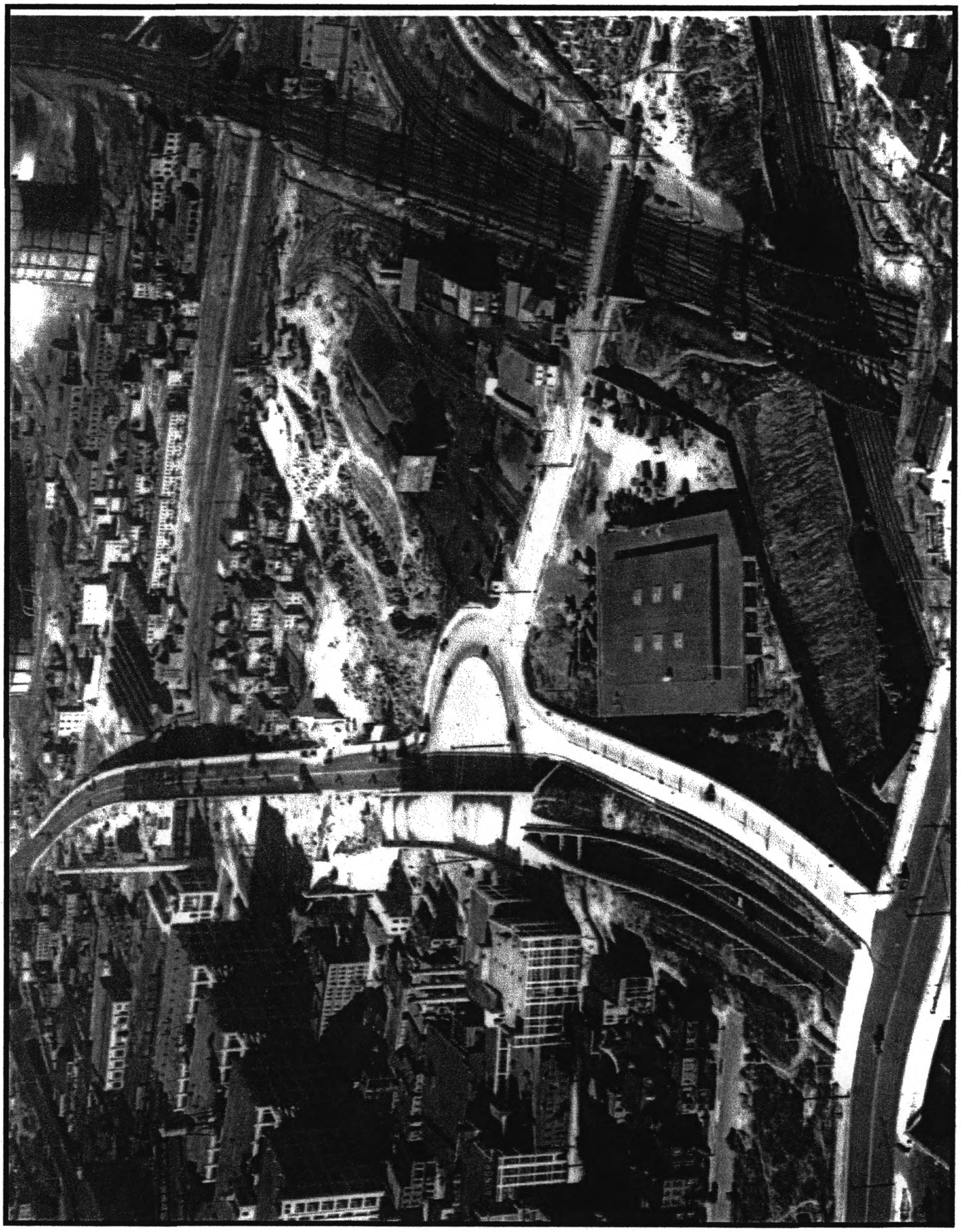
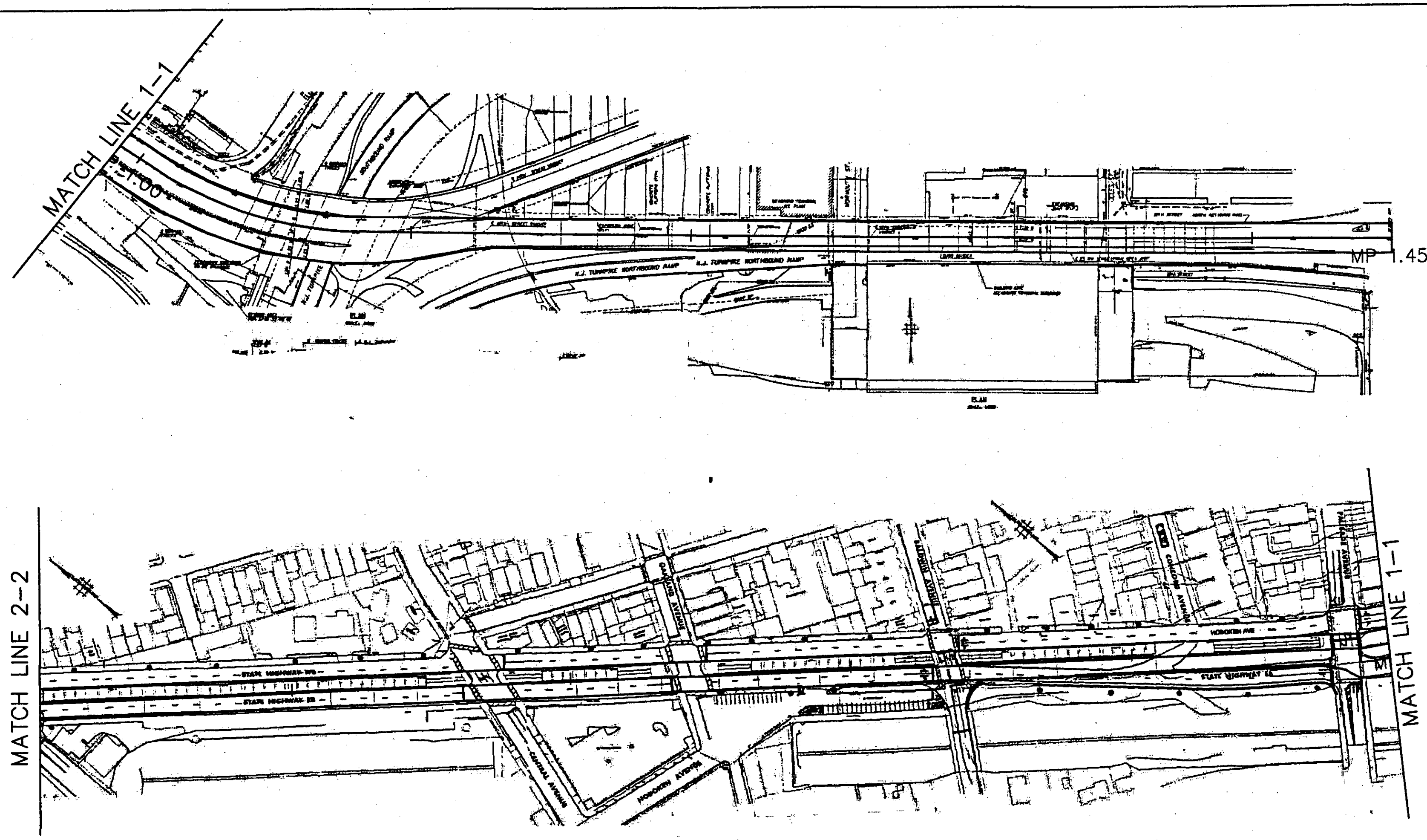


Figure 4. Ca. 1930 aerial view looking west at Tonnele Circle, west end of east section 2 of Route 1 Extension, and US Route 1. Overpass in foreground in JFK Boulevard. Courtesy of NJ Dept. of State: State Archives NJDOT Department of Transportation ca. 1920-1979 photographs filed by subject, Box 9, Jersey City Aerial Views folder.

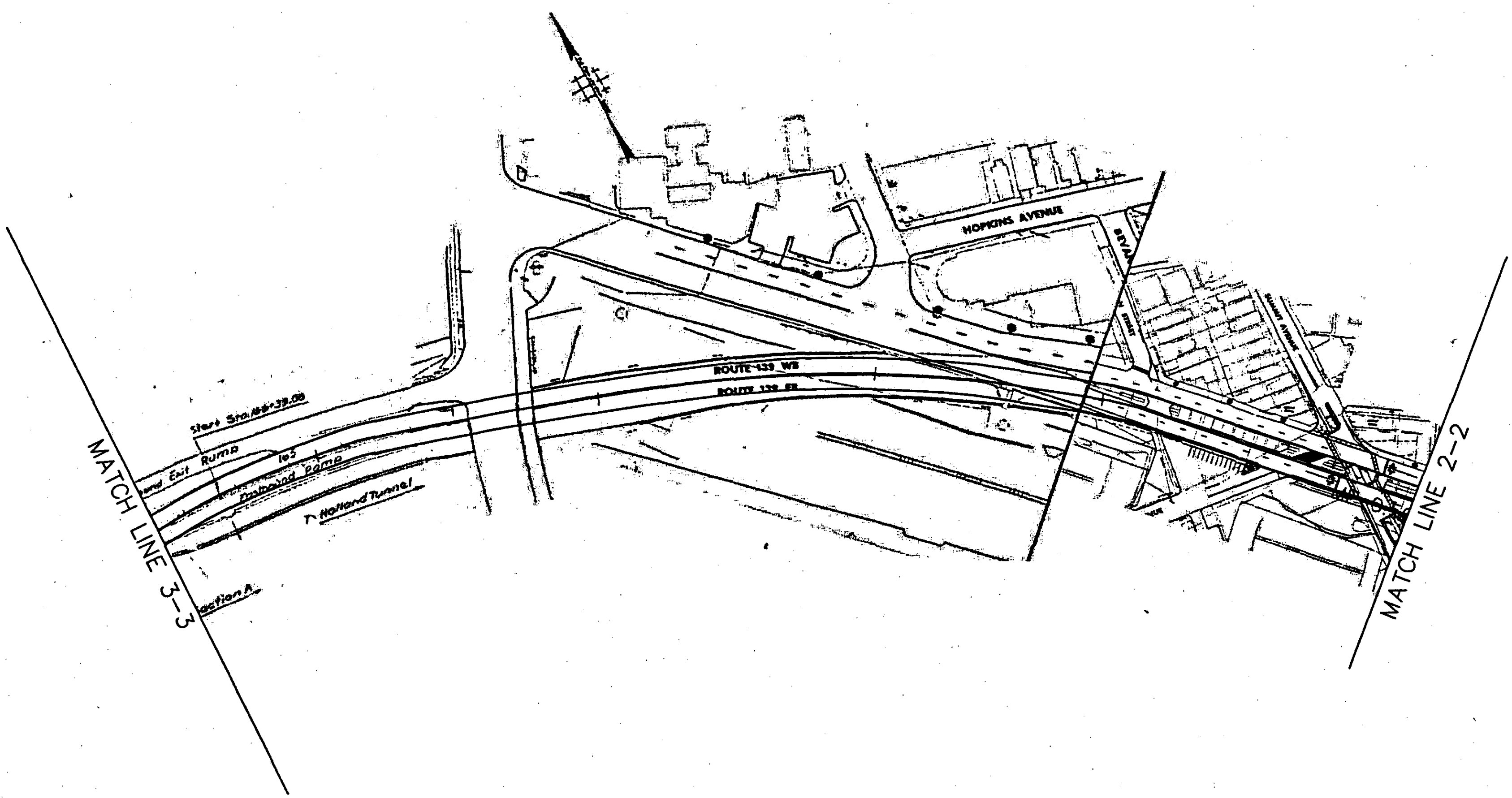


LEGEND

BOUNDARY

Right-Of-Way Route 1 Extension
Hudson/Essex Counties, New Jersey

SCALE: 1" = 200' PAGE 1 OF 6 DECEMBER 2003

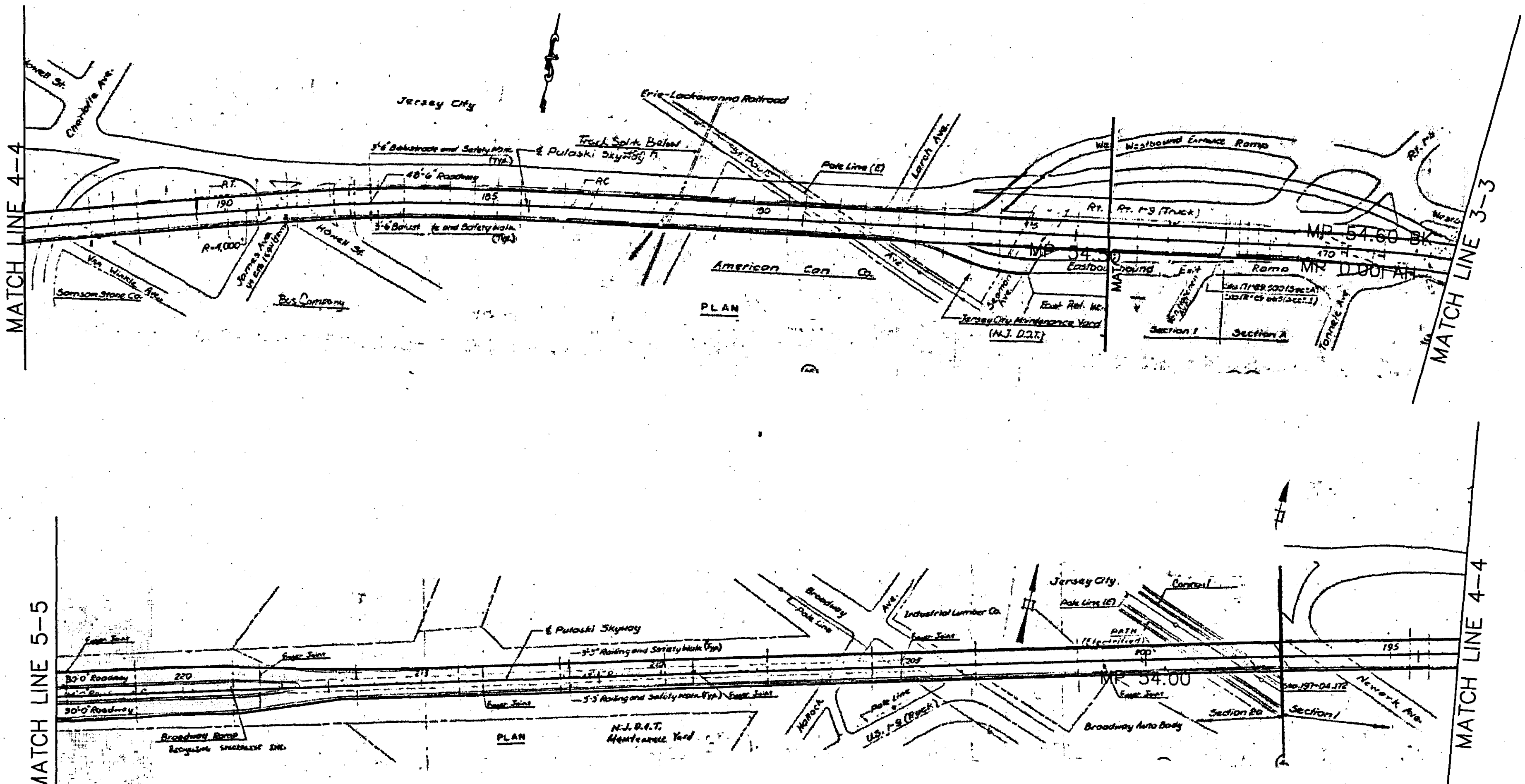


LEGEND

BOUNDARY

Right-Of-Way Route 1 Extension
Hudson/Essex Counties, New Jersey

SCALE: 1" = 200' PAGE 2 OF 6 DECEMBER 2003

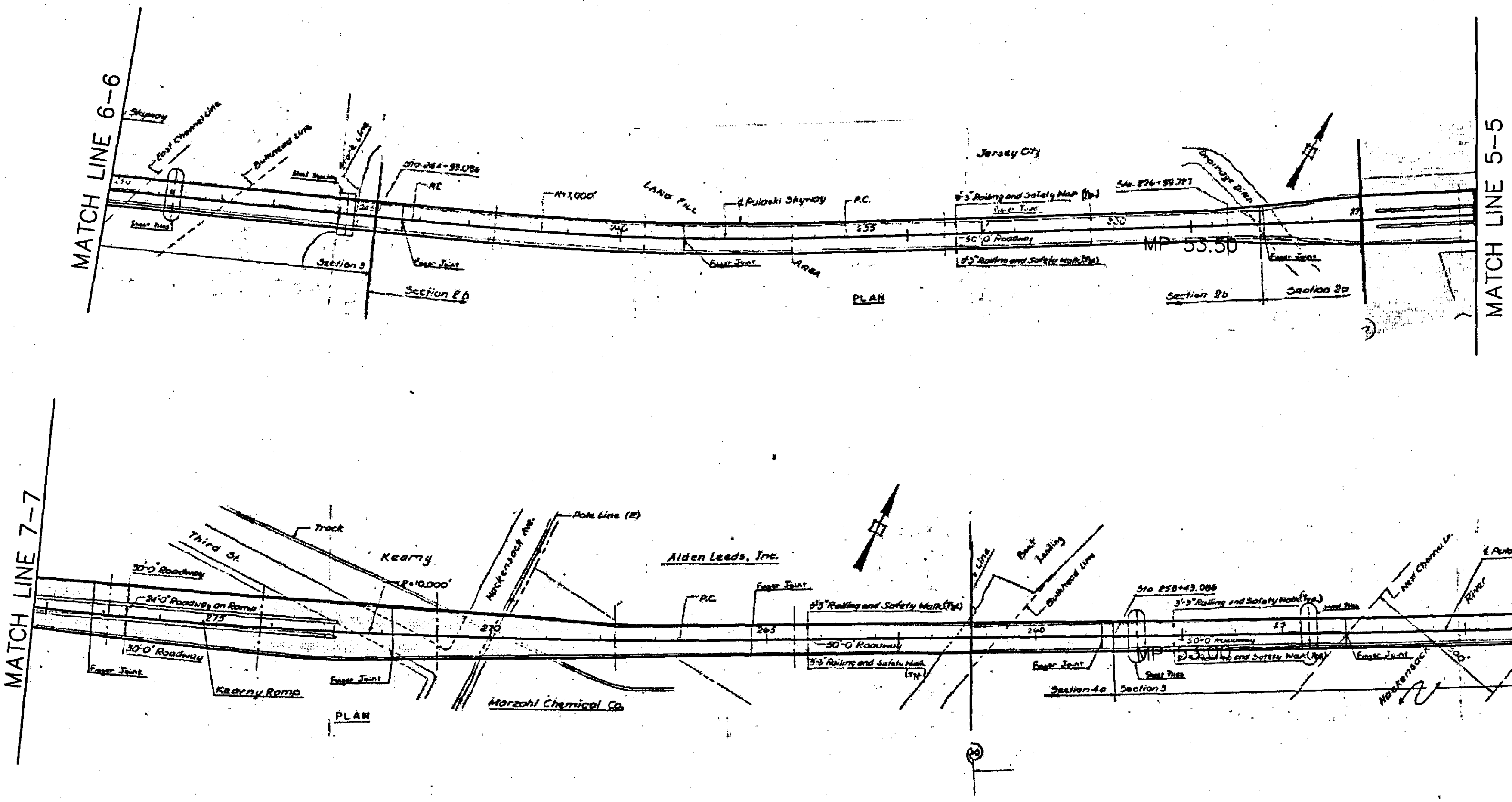


LEGEND

BOUNDARY

Right-Of-Way Route 1 Extension
Hudson/Essex Counties, New Jersey

SCALE: 1" = 200' PAGE 3 OF 6 DECEMBER 2003

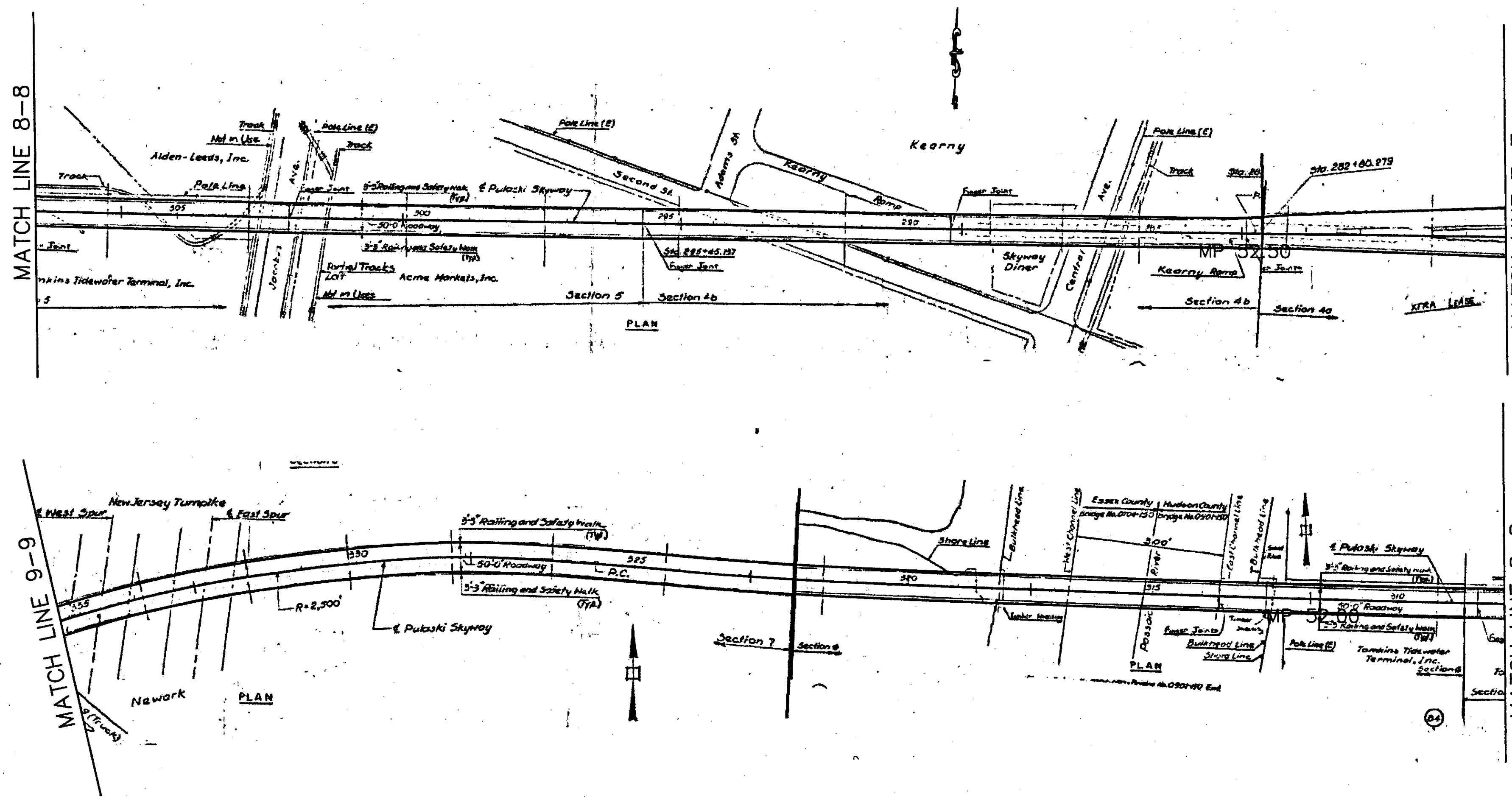


LEGEND

BOUNDARY

Right–Of–Way Route 1 Extension
Hudson/Essex Counties, New Jersey

SCALE: 1" = 200' PAGE 4 OF 6 DECEMBER 2003

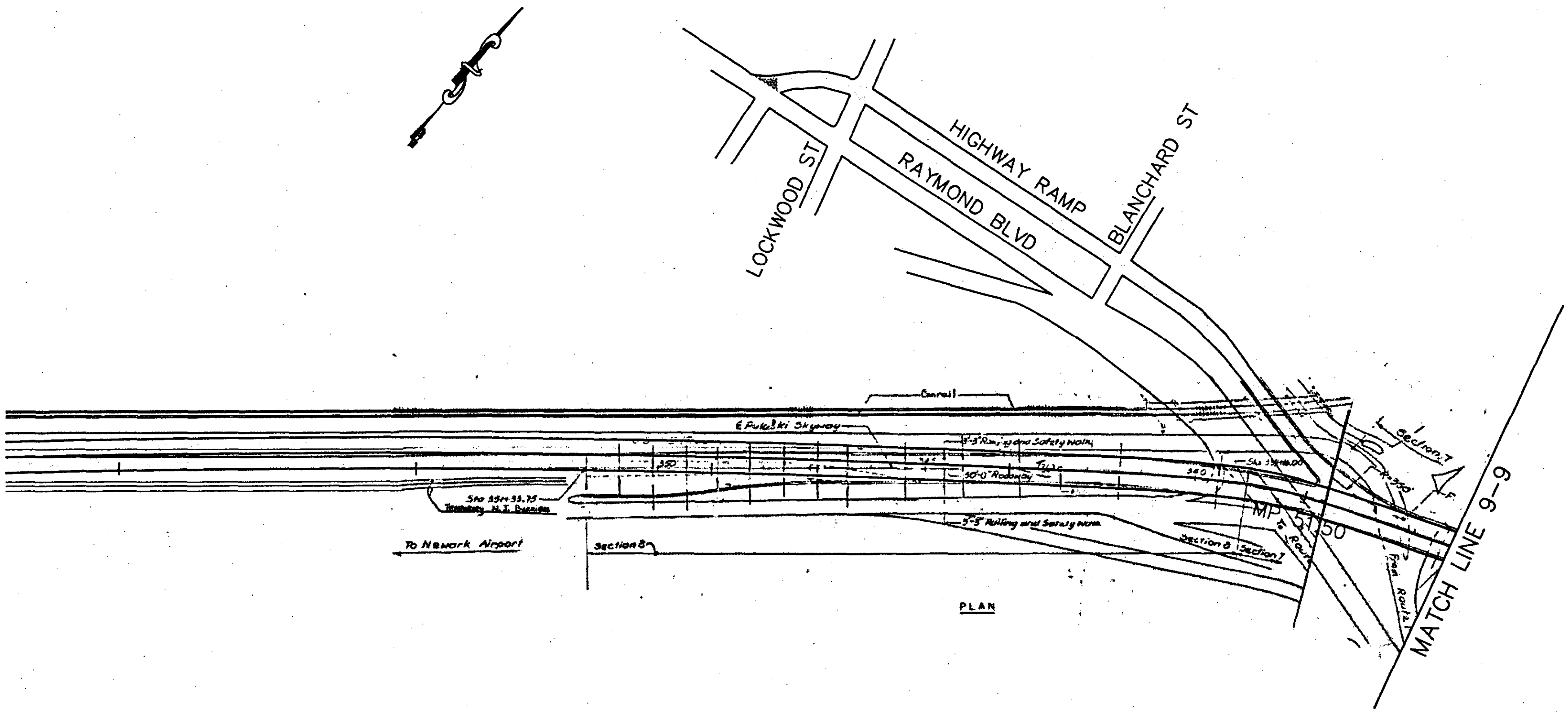


LEGEND

BOUNDARY

Right-Of-Way Route 1 Extension
Hudson/Essex Counties, New Jersey

SCALE: 1" = 200'   PAGE 5 OF 6   DECEMBER 2003



Right-Of-Way Route 1 Extension
Hudson/Essex Counties, New Jersey

SCALE: 1" = 200' PAGE 6 OF 6 DECEMBER 2003

LEGEND

BOUNDARY