

**Olivencia, Mildred**

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**Sent:** Friday, October 23, 2015 10:54 AM  
**To:** Olivencia, Mildred  
**Cc:** Torres-Rojas, Genara; Van Duyne, Sheree; Ng, Danny  
**Subject:** Freedom of Information Online Request Form

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List of specific record(s):

Access to the Regions Core Major Investment Study, or ARC MIS, completed in 1995. For my senior design project at Stevens, I am doing a study of alternatives to increase the trans-Hudson commuter capacity. I have done extensive research of the ARC project, but am unable to find a copy of the ARC MIS online. I request this document to see the long list of alternatives screened originally to see if a review can lead to a new result as conditions have changed in the 20 years since the report was completed. This was originally a public document, so there should be no issue re-releasing it for educational purposes. I can provide contact information to my faculty advisor if needed to verify my intentions. PDF format is preferred, but a hard copy is doable if that is all that is available. Thank you, Peirce Marston

**THE PORT AUTHORITY OF NY & NJ**

FOI Administrator

January 7, 2016

Mr. Haines Peirce Marston  
Stevens Institute of Technology

Re: Freedom of Information Reference No. 16426

Dear Mr. Marston:

This is in response to your October 23, 2015 request, which has been processed under the Port Authority's Freedom of Information Code (the "Code", copy enclosed) for a copy of the Access to the Regions Core Major Investment Study, or ARC MIS, completed in 1995.

Material responsive to your request and available under the Code can be found on the Port Authority's website at <http://www.panynj.gov/corporate-information/foi/16426-O.pdf>. Paper copies of the available records are available upon request.

Please refer to the above FOI reference number in any future correspondence relating to your request.

Very truly yours,



Danny Ng  
FOI Administrator

Enclosure

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# ACCESS TO THE REGION'S CORE

*Phases 1 and 2*

## Milestone Summary Report

*May, 1999*

Major Investment Study Sponsored by:





## Access To The Region's Core

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New York, NY 10048  
Tel. (212) 435-6898  
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*A joint venture of The Port Authority of NY & NJ, the Metropolitan Transportation Authority and NJ TRANSIT*

May, 1999

Dear Interested Citizen:

We are pleased to present the Milestone Summary Report for the Access to the Region's Core (ARC) Major Investment Study (MIS) Phases 1 and 2, sponsored by the Metropolitan Transportation Authority, NJ TRANSIT, and the Port Authority of New York and New Jersey. This study is being performed in accordance with Federal Transit Administration guidelines. During the course of the MIS work to date, the study team identified and analyzed difficulties that travelers originating outside Manhattan experience in accessing the region's core, Midtown Manhattan. The study confirmed that demand to access the core from the east and west will continue to grow. From the east, critical projects including the Queens Boulevard Connection and LIRR East Side Access are advancing. From the west, additional capacity is needed which directly impacts Penn Station New York and its access network.

Today Penn Station is nearing its capacity limit. Signal system and infrastructure improvements being made will accommodate short term service enhancements envisioned by the three railroads (Amtrak, NJ TRANSIT, and the LIRR) operating into Penn Station. But these improvements provide little margin for growth beyond 2002. Consequently, additional capacity expansion is necessary, to be staged so capacity can be added incrementally as growth requires. The ARC study team concluded that a commuter rail solution is the optimum approach and Alternative AA is the best candidate for meeting long term needs.

Alternative AA proposes to not only increase West of Hudson track capacity by virtue of a new tunnel and expansion of the track and platform complex at Penn Station, but also to build a connection between Penn Station and Grand Central Terminal, allowing the three commuter railroads in the region (Metro-North, NJ TRANSIT, and the LIRR) to access both of these facilities. Alternative AA has been configured to be compatible with the LIRR East Side Access project, as well as the Secaucus Transfer, where there is provision for an eventual connecting track to allow riders from Bergen, Rockland, and Orange counties "one seat ride access" to Midtown Manhattan.

No single project can remedy all the transportation deficiencies or capture all the opportunities that challenge the region. ARC and concurrent MIS transportation studies anticipate substantial growth in employment and economic activity throughout the metropolitan region. Together, these MIS efforts comprise the most comprehensive array of possible major improvements considered since the early decades of this century. ARC's scope and management reflect close coordination with these planning initiatives in both New York and New Jersey.

This Milestone Summary Report represents a transition from a broad-based investigation of Midtown Manhattan access needs and opportunities to the refinement of the most promising approach moving toward a recommended Locally Preferred Alternative. Phase 3 of ARC will (1) verify the constructibility and operability of Alternative AA with the aid of computer simulation, (2) identify and analyze long term variants to Alternative AA which may achieve the same aims more cost effectively and (3) identify and recommend nearer term solutions to meet the growth in demand at Penn Station. Phase 3 will include assessment of options for constructing the long term project in stages which would provide a continuum of improvements for commuter rail and Amtrak services converging on Midtown Manhattan.

We received many comments to our draft milestone report released in July, 1998 and thank you for your interest. We look forward to your continued participation in Phase 3.

Sincerely,

ARC Project Oversight Committee

Jack M. Kanarek  
NJ TRANSIT  
Corporation

Louis P. Venech  
The Port Authority of  
New York & New Jersey

William M. Wheeler  
Metropolitan Transportation  
Authority

## Table of Contents

<b>I. Introduction</b>	.1
A. Project History	.1
B. Project Goals	.1
C. Regional Transportation Facilities and Services	.1
1. Penn Station New York	.1
2. Grand Central Terminal	.2
3. Queens Subways	.2
4. Exclusive Bus Lane	.2
5. Projects Under Development and Construction	.2
<b>II. Regional Demographic Forecasts</b>	.4
A. 1990-2020 Regional Growth	.4
1. Population	.4
2. Labor Force and Employment	.4
<b>III. Penn Station: Need for Transportation Improvements</b>	.4
A. Trans-Hudson Near Term Capacity Issues	.5
B. East River Near Term Capacity Issues	.6
C. Near Term Capacity Relief for the Penn Station Network	.6
D. Long Island Rail Road East Side Access	.7
E. Longer Term Needs at Penn Station	.7
1. West of Hudson	.7
2. Long Island Rail Road	.8
3. Other Issues	.8
<b>IV. ARC Alternatives</b>	.10
A. Phase 1 - Initial Set of Build Alternatives	.10
B. Phase 2	.10
C. Evaluation of Phase 2 Alternatives	.14
1. No Build and Transportation System Management (TSM)	.14
2. Alternative B - Midtown Commuter Rail Connection	.14
3. Alternative CC - New Crosstown/Trans-Hudson Subway	.14
4. Alternative D - Crosstown Subway Extension-Palisades Bus/Truck Tunnel	.14

**V. Alternative AA - Penn Station-Grand Central Through Operation** .....16

    A. Description .....16

    B. Evaluation of Alternative AA .....16

        1. Constructibility .....17

        2. Operability .....18

        3. Rolling Stock .....18

        4. Capital Costs .....18

        5. Operating and Maintenance Costs .....21

        6. Ridership Forecast .....21

        7. Passenger Circulation at Penn Station .....21

        8. Passenger Circulation at Grand Central .....22

    C. Conclusions .....22

**VI. Next Steps** .....23

    A. ARC Phase 3 .....23

    B. Market Opportunities .....24

**List of Figures**

Figure 1: Penn Station .....5

Figure 2: West-of-Hudson AM Peak Hour Demand at Penn Station NY (PSNY) .....7

Figure 3: East-of-Hudson AM Peak Hour Demand at Penn Station NY (PSNY) .....8

Figure 4: Alternative A - PSNY/GCT Commuter Rail Through Operation .....11

Figure 5: Alternative B - Midtown Commuter Rail Connection .....11

Figure 6: Alternative C - Queens/Trans-Hudson Subway .....12

Figure 7: Alternative CC - Queens/New Jersey Rapid Transit Line .....13

Figure 8: Alternative D - Crosstown Subway Extension - Palisades Bus/Truck Tunnel .....13

Figure 9: Alternative AA - PSNY/GCT Commuter Rail Shared Facility .....16

Figure 10: Alternative AA - Grand Central Break Out at 42nd Street .....17

Figure 11: Alternative AA - Construction Costs (\$ Millions) .....19

Figure 12: Alternative AA - Property Acquisition and Easements (\$ Millions) .....19

Figure 13: Alternative AA - Total Capital Cost (\$ Millions) .....20

Figure 14: Alternative AA - Freight (\$ Millions) .....20

## I. Introduction

This Milestone Summary Report encompasses the work and findings of the Access to the Region's Core (ARC) study, Phases 1 and 2, an Option 1 Federal Transit Administration (FTA) Major Investment Study (MIS). It also establishes the basis to continue the MIS effort into Phase 3. This Milestone Summary Report draws on a series of Technical Reports of detailed analyses undertaken by the ARC project team. All work performed on this study was in conformance with FTA MIS guidelines.

### A. Project History

ARC is a planning partnership of the Port Authority of New York and New Jersey, the Metropolitan Transportation Authority, and NJ TRANSIT, known as the sponsoring agencies. The study is authorized by an Interagency Agreement, originally signed by the sponsoring agencies in March, 1994 as amended, and is governed by a Project Oversight Committee (POC) consisting of the transportation planning directors of the three agencies. The study area is a corridor extending from the Midtown Manhattan core, including Queens and Long Island to the east and counties in New Jersey and New York west of the Hudson River. The ARC study reflects ongoing consultation with federal, state and local authorities, and the participation of public officials and interested citizens.

### B. Project Goals

The ARC project inextricably links the New York-New Jersey metropolitan area's future economic well being with the need for improved regional commuter transit and freight movement. The three broad goals of the ARC project are: (1) to enhance the economic viability and productivity of the New York-New Jersey region; (2) to improve the quality of life in the region; and (3) to invest and use transportation resources productively, efficiently and effectively.

## C. Regional Transportation Facilities and Services

The Midtown Manhattan core is served by a variety of transit facilities and services including commuter rail, subway and PATH, express and commuter buses, and ferries. In the context of the overall regional network, transit is the dominant mode for both the New York (MTA) service territory and the West of Hudson market. With the vehicular crossings to Manhattan operating at capacity during peak periods, the region depends on the transit network to absorb most commutation to the Manhattan core. The major regional transit facilities and services for commuter markets to the east and west of Midtown Manhattan are briefly described below:

### 1. Penn Station New York

Penn Station New York plays a key role in linking the significant commuter markets — northern and central New Jersey, Long Island, and Queens — to Midtown Manhattan. It is the only point of direct access to Midtown Manhattan for the Long Island Rail Road (LIRR), NJ TRANSIT, and Amtrak intercity trains. With only 21 tracks and 11 platforms serving three railroads, Penn Station is the most heavily used railroad facility in the country, serving more than 310,000 arriving and departing rail trips on an average weekday. This includes 220,000 LIRR riders on about 415 trains, 66,000 NJ TRANSIT riders on about 195 trains, and 24,000 Amtrak riders on about 125 trains. More than 100,000 commuters, combined from both directions, arrive in the morning peak period, with a similar number of commuters departing in the evening peak period. About 50,000 commuters arrive in the morning peak (one) hour, between approximately 7:45 AM and 8:45 AM each weekday.

All three rail operators have implemented or are in the process of implementing improvements worth nearly a billion dollars to Penn Station and its operations. In addition to the successful Midtown Direct service, inaugurated in 1996, providing a direct one seat ride from NJ TRANSIT's Morris & Essex Lines to Penn Station, NJ TRANSIT plans to improve access to Penn Station from Hoboken Division trains via the Secaucus Transfer Station by 2002. The LIRR plans to introduce one seat ride trains from its non-electrified territory in 1999, including service on the Oyster Bay branch east of Mineola, the Port Jefferson branch east of Huntington, and the Montauk branch east of Babylon. Also in 1999, Amtrak plans to add high-speed Metroliner service from New York to Boston.

### 2. Grand Central Terminal

There are 44 active platform tracks at Grand Central Terminal, 28 on the upper level and 16 on the lower level. Metro-North Railroad is the sole operator at this facility, providing commuter service on three divisions — Harlem, Hudson, and New Haven — to the Bronx, Westchester, Putnam, and Dutchess Counties as well as southeastern Connecticut. On a typical day, approximately 175,000 arriving and departing riders use Grand Central on about 470 trains. The Long Island Rail Road East Side Access project is preparing an EIS and performing preliminary engineering in expectation of operating to Grand Central's lower level via the 63rd Street Tunnel lower level connecting Queens and Long Island to East Midtown.

### 3. Queens Subways

New York City Transit (NYCT) has several subway lines in Queens serving about 215,000 AM peak period commuters daily to Manhattan. The principal lines serving Midtown are the E and F Queens Boulevard express lines from Jamaica, the R Queens Boulevard local from Forest Hills, the #7 Flushing express and local, the N Astoria local, and the Q from Long Island City via the 63rd Street Tunnel upper level. The Queens Connection project, scheduled to open in 2001, will extend Q service via the Queens Boulevard express to Jamaica, while the F will become a Queens Boulevard local. All of these subway lines are fed by an extensive feeder bus network.

### 4. Exclusive Bus Lane

The Exclusive Bus Lane (XBL) is a single eastbound contra-flow lane on the westbound side of NJ-495, open in the AM peak period from 6:30 AM to 10:00 AM, extending for approximately 2½ miles from New Jersey Turnpike Interchanges 16E and 17 and from Route 3 to and through the center tube of the Lincoln Tunnel. NJ TRANSIT and private carrier buses using the lane enter the Port Authority Bus Terminal (PABT) in Midtown, while a small number of private carrier buses bypass the PABT and serve Manhattan streets directly. The XBL-Lincoln Tunnel-PABT bus system carries more trans-Hudson commuters than any other transit mode, serving about 70,000 commuters every morning on approximately 1,650 buses, with 32,000 of these commuters on about 675 buses in the peak (one) hour. There is no XBL in the PM peak period.

### 5. Projects Under Development and Construction

There are a number of strategic transit improvements recently completed or now underway in the Penn Station complex to avert excessive crowding and improve reliability in the short term which will alter the landscape of commuter access to Midtown Manhattan over the next few years. These improvements include:

- The LIRR's purchase of 23 dual mode (electric/diesel) locomotives and 134 bi-level coaches, with delivery scheduled to be completed by the end of 1999, will permit commuters in non-electrified territory to have a one seat ride directly to Penn Station. The LIRR envisions sending more service into Penn Station, and is developing "Schedule 99," a blueprint for increasing the number of trains entering Penn Station in the AM peak (one) hour from 36 at present to 42.
- Amtrak's high-speed Metroliner service to Penn Station will be expanded to include the New York to Boston corridor, scheduled to start in 1999.
- NJ TRANSIT's High Density Signaling (HDIS) and other improvements on the Northeast Corridor High Line will add to capacity from Secaucus to Penn Station from 20-21 train slots in the AM peak hour today to as many as 25 NJ TRANSIT/Amtrak trains per hour by 2002.
- NJ TRANSIT East End Concourse improvements with new stairs, escalators, and a mezzanine at Penn Station, scheduled to open in 2001, will improve vertical circulation and pedestrian amenity for NJ TRANSIT and Amtrak riders.

- The NJ TRANSIT Montclair Connection, opening in 2000 or 2001, will add Boonton Line and Montclair Branch trains to Midtown Direct Service to Penn Station. The Boonton Line will be electrified to Great Notch.
- The opening of the NJ TRANSIT Secaucus Transfer Station, scheduled for 2002, will allow Main/Bergen, Port Jervis, and Pascack Line riders from Bergen County and Passaic County in New Jersey and Rockland County and Orange County in New York to transfer to Penn Station bound trains.
- New links between the region's two busiest airports and the regional commuter rail network are moving forward: (1) the Port Authority's JFK International Airport light rail link to the LIRR Jamaica Station and to the NYCT Howard Beach A line subway station, and (2) extension of the Newark International Airport people mover by the Port Authority to a new station under construction on the NJ TRANSIT Northeast Corridor.
- The partial conversion of the Farley Post Office Building by the Penn Station Redevelopment Corporation into a rail station concourse and ticketing hall for use by Amtrak will give New York City an aesthetic, historically significant gateway, and provide separate Amtrak and NJ TRANSIT ticketing and passenger operations. Though this project does not add new track or platform capacity, it does add much needed vertical circulation to the western end of Penn Station's platforms.
- A recently completed project, extension of platform 11 (tracks 20 and 21) to accommodate 12 car LIRR trains including a connection to the Caemmerer West Side Yard has added flexibility to the LIRR operation.
- The "U" ladder connection, to be constructed in 1999, will link platform 7 (tracks 13 and 14) to the West Side Yard, providing greater operating flexibility and easing LIRR Penn Station congestion.
- The Queens Connection will link the upper level of 63rd Street subway tunnel to the Queens Boulevard express tracks in 2001 providing increased service of up to 15 additional trains per hour.

## II. Regional Demographic Forecasts

### A. 1990-2020 Regional Growth

#### 1. Population

The demographic forecasts used for the ARC study region are based upon forecasts developed for the New York Metropolitan Transportation Council. For the 30 year period (1990-2020) the region may anticipate a steady population growth based upon immigration and natural increase. By the year 2020, the population for the 31 counties in the study region is projected to reach about 22.8 million people, an increase of almost three million, or approximately 15 percent, over the 1990 figure of 19.8 million. Though the New York City population will grow during this period, the share of the region's population living in the suburban counties is expected to increase even more rapidly as the pace of growth shifts westward to New Jersey and the New York counties of Rockland and Orange, eastward to Long Island, and northward to Westchester and Connecticut.

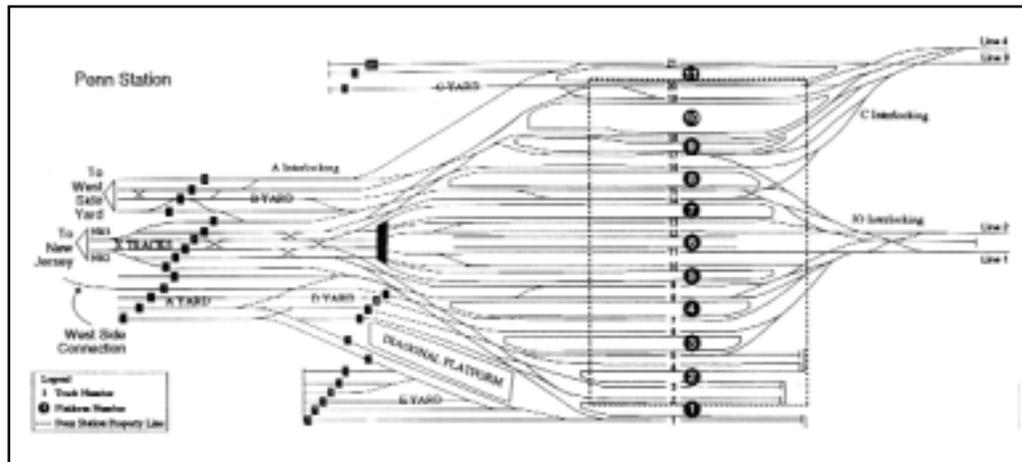
#### 2. Labor Force and Employment

The ARC study region is distinguished by Manhattan's central role as a destination for work trips. Considerably more journey-to-work trips end in Manhattan than in any other county in the region, and this pattern is expected to continue. While the Midtown Manhattan core will retain its employment dominance, suburbanization of the Manhattan labor force will continue. By 2020, Manhattan's employment will reach 2.7 million jobs, an increase of 246,000, or 10% over the 1990 level. Manhattan is expected to draw more heavily on the non-resident labor force because Manhattan employment is projected to grow faster than the Manhattan resident labor force. This is consistent with expectations that the suburban labor force growth rates will exceed the growth rates for available suburban jobs. Regional forecasts show continued growth of service industries; many of those firms are found in the Midtown Manhattan core. In addition, Manhattan's concentration of financial and corporate enterprises continues to perform competitively with other global centers. Consequently, Midtown Manhattan's preeminence as the economic engine of the region is expected to be sustained if required infrastructure, including transportation system renewal and expansion, is provided.

## III. Penn Station: Need for Transportation Improvements

The Penn Station complex must be viewed as the center of a far reaching network of tracks, tunnel structures, train storage yards, interlockings where tracks converge and diverge, signaling and communications systems, mechanical systems, traction power systems (third rail DC and overhead catenary AC) and passenger circulation facilities. The Penn Station complex is owned by Amtrak which has operating agreements with NJ TRANSIT and the LIRR for use of the facility and its network. It is as complicated a rail facility as can be found anywhere in the world. The ability of Penn Station to efficiently process trains and passengers is closely tied to the ability of its tracks, platforms, stairs, escalators pedestrian concourses, and yards to perform optimally.

Penn Station is also a strategically interrelated, closed system where changes in configurations or service disruptions anywhere in the system potentially have a ripple effect on all three railroads. The key facilities controlling the approaches to Penn Station are the two Hudson River tunnels and the "X" tracks through "A" Interlocking, and the four East River tunnels including "C" and "JO" Interlockings. The major signal system constraints today are experienced in the East River tunnels and along the High Line from Swift Interlocking East of Newark to the Hudson River tunnels. To the north of "A" Interlocking, four lead tracks connect the LIRR portion of Penn Station, to the West Side Storage Yard. To the south of "A" Interlocking, there is the single Empire Connection lead track that curves northward through a tunnel underneath the West Side Yard and links Penn Station with Amtrak's West Side line and then onto Metro-North's Hudson Line at Spuyten Duyvil for Amtrak Empire Service to Albany (Figure 1).



**Figure 1**  
**Penn Station**

The combination of changing regional demographics, continuing growth of Manhattan's business activities, and expanding rail transit services strongly point toward steady and substantial increases in commuter demand to Midtown Manhattan through 2020. This demand reflects both the region's competitive success and the attractiveness of its public transit network in supporting economic growth in the Midtown Manhattan core. These heavily utilized transit services, however, have only a limited capability to absorb anticipated passenger growth. Commuter demand for direct Penn Station service has grown steadily over a long period of time. ARC analysis shows Penn Station — both the station and its approach tunnels — will face a long term need for more capacity.

### A. Trans-Hudson Near Term Capacity Issues

Peak period operations into and out of Penn Station are constrained by track capacity and train maneuverability. From the west, there is little room to absorb all of the near term demand to be generated by planned increases in services, including the Secaucus Transfer Station, Montclair Connection, and Amtrak high-speed service. Two critical obstacles are: (1) short and stub end tracks 1-4 which limit their usefulness, and (2) limitations imposed by the crossover required at the "X" tracks at "A" Interlocking, west of Penn Station, for reverse moves in the AM peak period (Figure 1). Amtrak's new high-speed Metroliner service between Boston and New York, though approaching Penn Station from the east, will impact upon NJ TRANSIT service from the west by occupying longer length platforms in the center of Penn Station for extended periods of dwell time, further squeezing track and platform capacity.

The recently inaugurated Midtown Direct service that linked the Morris & Essex Lines via the Kearny Connection to Penn Station demonstrates the degree to which a new, attractive service will increase ridership. Since its June, 1996 opening, Midtown Direct has added nine AM peak period trains to Penn Station, and by mid-1998 there were 8,500 new daily Midtown Direct riders inbound to Penn Station, 6,000 in the AM peak period, and 3,500 in the AM peak hour, substantially more riders than was initially forecast.

What happens at Penn Station is critical to the entire the trans-Hudson system; expanding capacity or service in one facility or market provides breathing room in another. For example, in recent years the XBL has been moving closer to its maximum practical capacity of about 725-730 buses in the AM peak (one) hour. As the intensity of XBL usage increases, its reliability becomes increasingly vulnerable to operations disruptions. In 1998, the XBL averaged nearly 670 buses in the AM peak (one) hour, and on the heaviest days peak hour totals exceeded 700 buses. NJ TRANSIT surveys have shown that ridership from Morris and Essex Counties attracted to the Midtown Direct train service has offset the need for the equivalent of about 25 bus runs serving these communities in the AM (one) peak hour. Though the total number of

buses using the XBL/Lincoln Tunnel/PABT system has remained constant, this reflects continued robust growth in other segments of the West of Hudson market. Buses from these other corridors have replaced buses that used to operate from the Morris and Essex corridor. Thus, a ridership shift to a new Penn Station train service has provided both relief of another overstressed trans-Hudson system, i.e., buses in the XBL, and an opportunity for new buses to be absorbed into that system.

### B. East River Near Term Capacity Issues

Currently, the LIRR has high ridership on 36 inbound trains in the AM peak hour. With the Schedule 99 service adjustments to be implemented shortly, the LIRR will be able to provide new direct services from non-electrified territory through the introduction of dual mode locomotives and bi-level coaches, increasing the number of AM peak (one) hour LIRR trains to 42 at Penn Station.

After Schedule 99, the system of tracks, platforms, tunnels, and interlockings for services from east of Penn Station will be at or near capacity. With the limitations on the practical capacity at Penn Station, the LIRR will struggle to accommodate substantial further growth. There are LIRR conflicts at "C" Interlocking connecting to East River tunnel Lines 3 and 4, and at "JO" Interlocking connecting to East River tunnel Lines 1 and 2 where in the AM peak, inbound LIRR trains share a crossover with LIRR reverse peak and deadhead trains, NJ TRANSIT trains to Sunnyside Yard, and Amtrak revenue service to Boston and to Sunnyside Yard storage (Figure 1). This combination of scheduled revenue trains and equipment trains, which operate against the prevailing flow of commuter trains in the AM peak, reduces the tunnel capacity and introduces these crossover conflicts at "C" and "JO" interlockings. There are additional conflicts at Sunnyside Yard and at Harold Interlocking east of Sunnyside Yard where Amtrak and LIRR trains converge.

Amtrak's new high-speed Metroliner service between Boston and New York will also increase the East River tunnel congestion with one additional train in the peak (one) hour, since this train will use the same tunnels as the LIRR between Queens and Penn Station. In addition, the Port Authority has broken ground on a JFK Airport Access service that will connect to the LIRR's Jamaica Station. The Amtrak and JFK links will add relatively small ridership increments to Penn Station, but they underscore the importance of maintaining efficient use of the facility.

The subway system from Queens to Midtown Manhattan is overcrowded, but relief is on the horizon. The E and F Queens Boulevard expresses have been at the limit of capacity for some time, and with service already at the practical capacity of 30 trains in the AM peak hour, there is little or no room for growth, though there is some capacity on the R Queens Boulevard local. The Queens Connection, currently under construction and scheduled to open in 2001, will add up to 15 trains in a new Queens Boulevard service, the Sixth Avenue Q train via the 63rd Street Tunnel, and spread the Manhattan bound load among four lines rather than the three available today. Trains on the #7 Flushing express and local are currently operating within NYCT capacity guidelines and are forecast to remain within guidelines for the foreseeable future.

### C. Near Term Capacity Relief for the Penn Station Network

The Tri-Venture Railroads — Amtrak, LIRR, and NJ TRANSIT — undertook a comprehensive simulation and analysis of Penn Station with a short term focus, including the station, its approach tracks and interlockings, yards, and the entire rail network from Newark to Jamaica to New Rochelle. The July, 1997 Penn Station Capacity & Utilization - Future Operations report suggested short term remedies to provide enough track capacity for smooth operation of trains seeking to serve Penn Station in the next decade. These short term remedies include: (1) reconfiguration of "JO" Interlocking to ease conflicts and remove route restrictions, (2) platform swaps between NJ TRANSIT and other railroads with some related vertical circulation improvements, (3) signal modifications and upgrades in the East River tunnels and interlockings, and (4) reverse direction operation in East River tunnel Lines 1 and 2 during PM peak periods.

Only the proposed reconfiguration of "JO" Interlocking is being pursued by the railroads at this time. The other strategies are being analyzed further to understand their individual and synergistic benefits to maximize their effectiveness in providing short term relief, particularly in the PM peak. ARC Phase 3 will contribute to this continued evaluation by examining these effects as well as more complex solutions that may take longer to implement than those identified by the Tri-Venture railroads.

### D. Long Island Rail Road East Side Access

The Long Island Rail Road East Side Access project proposes to physically link the LIRR Main Line and Port Washington Branch to Grand Central Terminal. This project has entered the Preliminary Engineering/Environmental Impact Statement phase. It is estimated that significant numbers of LIRR riders will be attracted to Grand Central Terminal when this service opens, currently targeted for 2009. The LIRR will provide up to 24 trains in the AM peak (one) hour to Grand Central Terminal, saving customers up to 20 minutes per day in commuting time in each direction. With East Side Access, the LIRR anticipates that the number of LIRR trains to Penn Station will be reduced from planned 1999 levels of 42 trains per AM peak (one) hour.

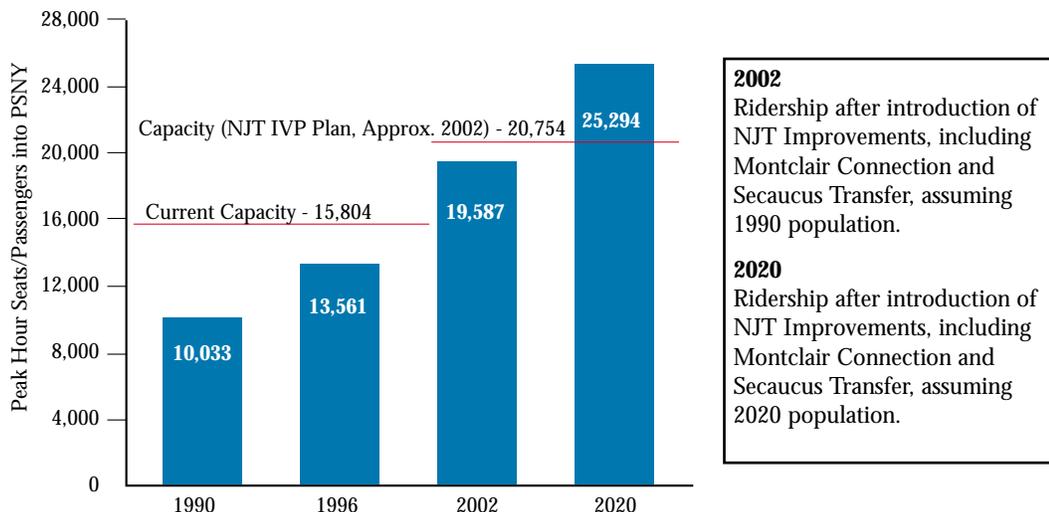
### E. Longer Term Needs at Penn Station

The near term initiatives at Penn Station will provide some capacity relief, but ongoing growth in demand is forecast to continue from both West of Hudson and Nassau/Suffolk/Queens markets which will consume the added capacity to Penn Station and its related facilities within a few years. This is demonstrated in ARC's No Build 2020 forecast which draws a picture of future conditions at Penn Station if no further actions are taken. This scenario, which does not include LIRR East Side Access, reflects the projected socioeconomic and demographic growth for the ARC study region, combined with the commuter rail network that is either in place, under construction, or funded for construction.

#### 1. West of Hudson

NJ TRANSIT's capacity improvements are sufficient to accommodate projected demand through 2002 and immediately thereafter, but continued growth in demand will outstrip this capacity in the longer term (Figure 2). The ARC ridership model forecasts 140,524 daily inbound and outbound trips crossing the Hudson River, including riders from New York's Rockland County and Orange County, to/from Penn Station for the No Build 2020. This is the equivalent of 25,294 one way inbound AM peak hour trips, 4,540 greater than Penn Station's expected capacity of 20,754 peak hour passengers. Thus, Penn Station will be incapable of handling the West of Hudson commuter rail ridership demand that can be expected under forecast conditions.

**Figure 2**  
**West-of-Hudson**  
**AM Peak Hour Demand at Penn Station**

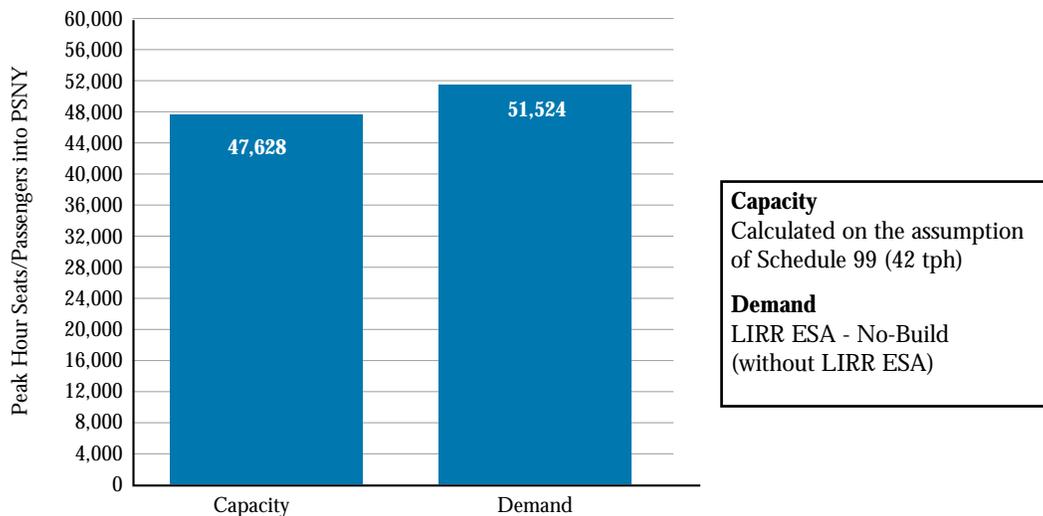


Source: ARC Ridership Model

## 2. Long Island Rail Road

The March, 1998 LIRR East Side Access project report, Major Investment Study for the Long Island Transportation Corridor, projects that 124,170 riders are expected to cross the East River into Penn Station during the AM peak period under No Build 2020 conditions. This is the equivalent of 51,524 inbound AM peak hour trips, 3,896 trips over the expected capacity of 47,628 peak hour passengers (Figure 3). This is the primary issue that the LIRR East Side Access project will solve. In addition, Metro-North Railroad is commencing a study which will explore entry for its customers into Penn Station after implementation of LIRR East Side Access, potentially adding to Penn Station demand.

**Figure 3**  
**Long Island Rail Road**  
**AM Peak Hour Demand at Penn Station**



Source: LIRR ESA MIS

## 3. Other Issues

Three other long term issues warrant acknowledgment in the context of Penn Station's future. These are: (1) dependence of regional economic development and growth on expansion of transportation infrastructure, (2) benefit of a one seat ride to East Midtown, and (3) freight service issues.

- Without some relief to this burgeoning Penn Station demand through expansion of the transportation infrastructure, passenger crowding and train delays will result, which could cause commuters to reallocate themselves to other modes, times, residences, or jobs, which may result in negative economic impacts for the metropolitan area.
- The sustained concentration of post World War II office construction east of Fifth Avenue has established East Midtown as Manhattan's primary commuter destination. Approximately 70% of all jobs in Midtown are within walking distance of Grand Central, while only 36% of jobs are within walking distance of Penn Station (there is some overlap, and some jobs are not within walking distance of either facility). Long Island Rail Road East Side Access addresses this issue by providing Queens/Long Island customers a one seat ride to East Midtown. New York and New Jersey residents from West of Hudson will continue to access Penn Station only, with the need to transfer to a subway or bus to reach their East Side destination.

- Freight service, though theoretically possible through the Penn Station system between New Jersey and Sunnyside Yard, has been routinely prohibited. The ARC analysis includes the concept of accommodating off peak freight service to yards in Queens or the Bronx as part of a potential expansion of Midtown Manhattan commuter rail facilities. This concept is also included among the alternatives identified for detailed analysis in the Cross Harbor Freight Movement Major Investment Study sponsored by the New York City Economic Development Corporation. Though shared commuter/freight facilities might limit freight opportunities, the incremental cost of such an approach could be less than the total cost of a dedicated freight only tunnel.

## IV. ARC Alternatives

### A. Phase 1 - Initial Set of Build Alternatives

During Phase 1 of ARC, 137 proposed alternatives were submitted for study, along with the MIS mandated “No Build” (do nothing other than what is already programmed and budgeted) and “Transportation System Management” (TSM) Alternatives. Evaluative screenings reduced this large number of proposals to 15, the “Initial Set of Build Alternatives” for technical analysis. These 15 proposed “Build” alternatives were distributed as follows:

- 1 Manhattan Rail Connection (Grand Central to Penn Station)
- 8 Commuter Rail
- 4 Rapid Transit (subway)
- 1 Combination (Commuter/Subway)
- 1 Joint Use Tunnel (Rail/Bus/Truck)

The 15 proposed “Build” alternatives were then evaluated on quantitative and qualitative criteria including: (1) support for regional economic and social development; (2) ridership; (3) quality of service; (4) effect on facility capacity; (5) fiscal impact; (6) cost effectiveness; (7) dependability; (8) constructibility; (9) institutional risk; (10) equity; (11) environmental issues, and (12) freight movement compatibility. The 15 proposed “Build” alternatives were further reduced to four for in depth technical analysis and conceptual planning during ARC Phase 2.

### B. Phase 2

The final four Phase 2 alternatives included two commuter rail alternatives, a rapid transit (subway) alternative, and an alternative with two geographically distinct components: a bus connection in New Jersey, and a subway extension in Manhattan. These were:

- Alternative A: Penn Station-Grand Central Commuter Rail Through Operation
- Alternative B: Midtown Commuter Rail Connection
- Alternative C: New Crosstown/Trans-Hudson Subway
- Alternative D: Crosstown Subway Extension-Palisades Bus/Truck Tunnel

Key elements of Alternative A, Penn Station-Grand Central Commuter Rail Through Operation (Figure 4), were: inclusion of Long Island Rail Road's East Side Access via 63rd Street Tunnel lower level, and entry into Grand Central's lower level center tracks; a new two track rail line including a tunnel under the Hudson River commencing at the Secaucus Transfer Station adjacent to the existing Amtrak tunnel into an expanded Penn Station and continuing to Grand Central Terminal; use of the 63rd Street Tunnel lower level for movement of NJ TRANSIT trains for turning and storage at Sunnyside Yard A; and the Secaucus Loop, providing a one seat ride from New Jersey's Bergen County and New York's Rockland County and Orange County to Penn Station.

Alternative A – PSNY/GCT Commuter Rail Through Operation

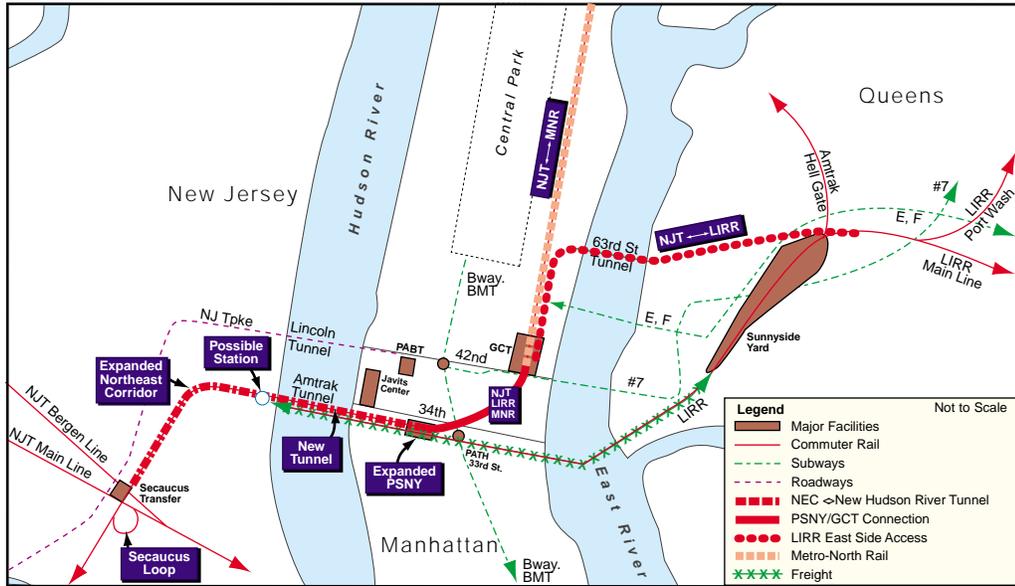


Figure 4

Alternative B, Midtown Commuter Rail Connection (Figure 5), was designed to create new NJ TRANSIT capacity across the Hudson River and a through operation with the LIRR across Midtown Manhattan. It proposed a new two track commuter rail line from the Secaucus Transfer, under the Palisades near Union City and via a new two track Hudson River tunnel into Manhattan at 49th or 50th Street. The line would continue up Third Avenue to the 63rd Street tunnel. Two new Manhattan stations were proposed for Seventh Avenue (Rockefeller Center West) and Park Avenue (Grand Central North). As in Alternative A, the Secaucus Loop would provide Rockland County, Orange County, and Bergen County commuters direct access to Midtown Manhattan.

Alternative B – Midtown Commuter Rail Connection

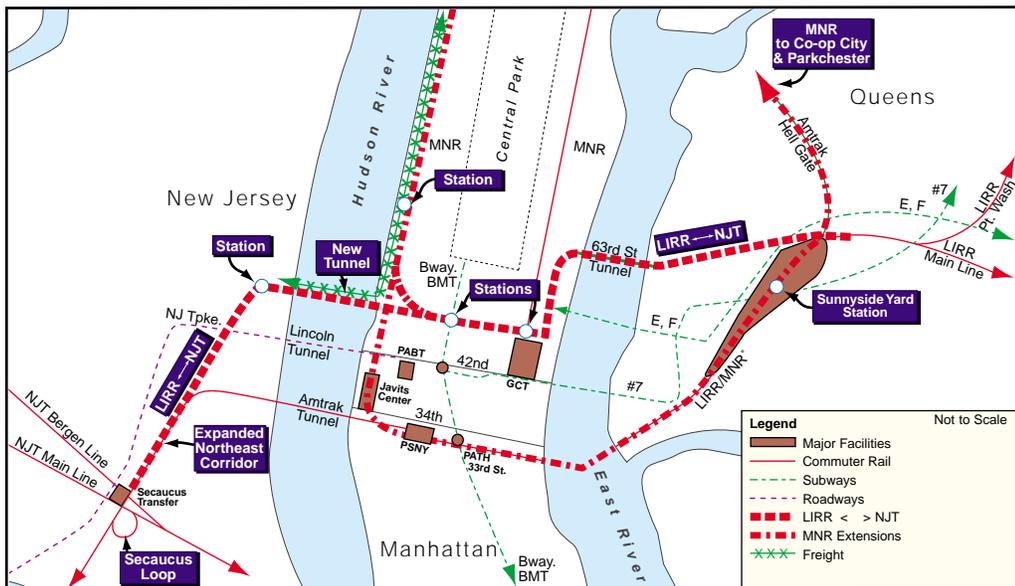


Figure 5

Alternative C - Queens/Trans-Hudson Subway

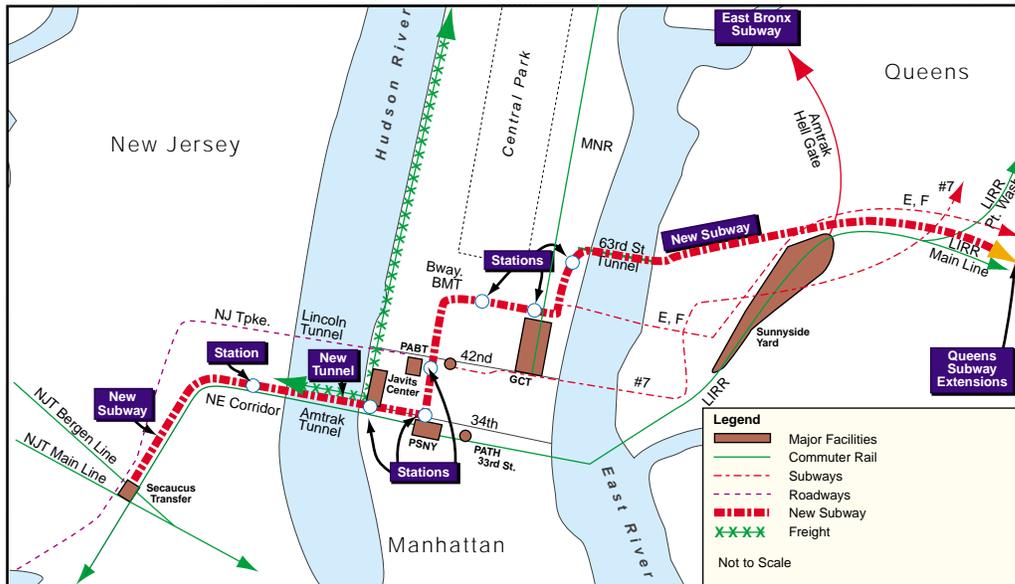


Figure 6

Alternative C, New Crosstown/Trans-Hudson Subway, (Figure 6) proposed a rapid transit line from the Secaucus Transfer to 33rd Street in Midtown Manhattan, with an intermediate station in northern Hudson County. This subway would continue from 33rd Street under Eighth Avenue, turning east at 49th Street. Stations would be placed at the Javits Convention Center, Penn Station, Port Authority Bus Terminal, Seventh Avenue/49th Street and Park Avenue/49th Street. The line would then turn north at Second Avenue and join the upper level of the 63rd Street subway tunnel, with a station on Second Avenue in the 50s. This alternative also included possible Queens Boulevard capacity expansion with a Queens Super Express Bypass and three possible subway extensions in eastern Queens. After a comprehensive analysis, Alternative C evolved into Alternative CC, Queens/New Jersey Rapid Transit Line. The modified routing realigned the Manhattan segment of the route straight across 49th Street from Second Avenue to the Hudson River (Figure 7).

Alternative D (Figure 8) consisted of two segments: (1) a Palisades Bus/Truck Tunnel and (2) a Crosstown Subway Extension. The proposed Palisades Bus/Truck Tunnel was a two lane roadway exclusively for buses and trucks, from the a new interchange for the New Jersey Turnpike near the Secaucus Transfer Station to the Lincoln Tunnel. The Crosstown Subway Extension of the #7 subway line from its current terminus at Times Square south and west via Eighth Avenue to Penn Station and the Javits Convention Center, would provide a transfer free subway connection between Penn Station and the Grand Central Terminal area compared to the two leg trip with a transfer at Times Square which is now required for travel between the two rail stations.

Alternative CC - Queens/New Jersey Rapid Transit Line

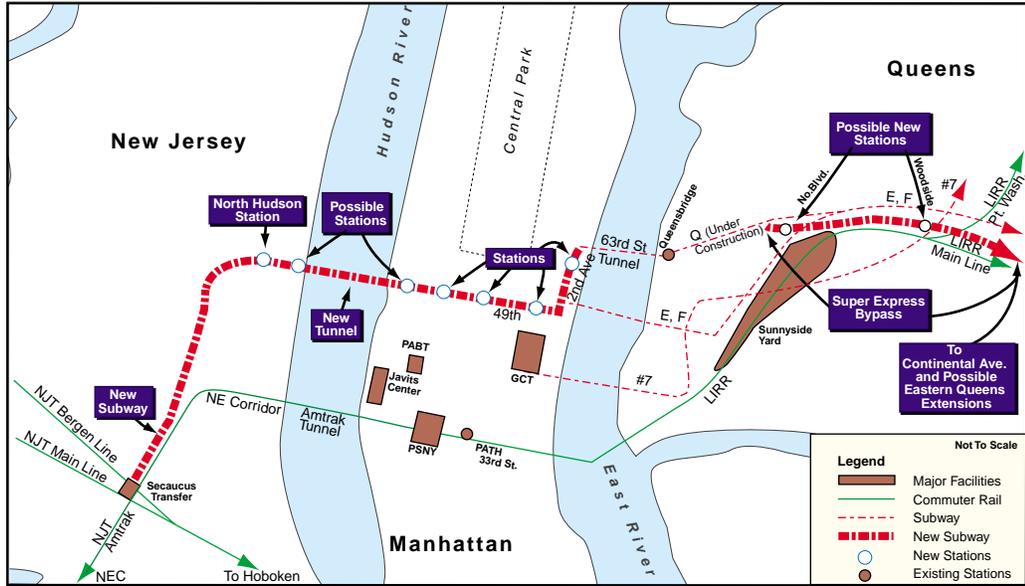


Figure 7

Alternative D - Crosstown Subway Extension - Palisades Bus/Truck Tunnel

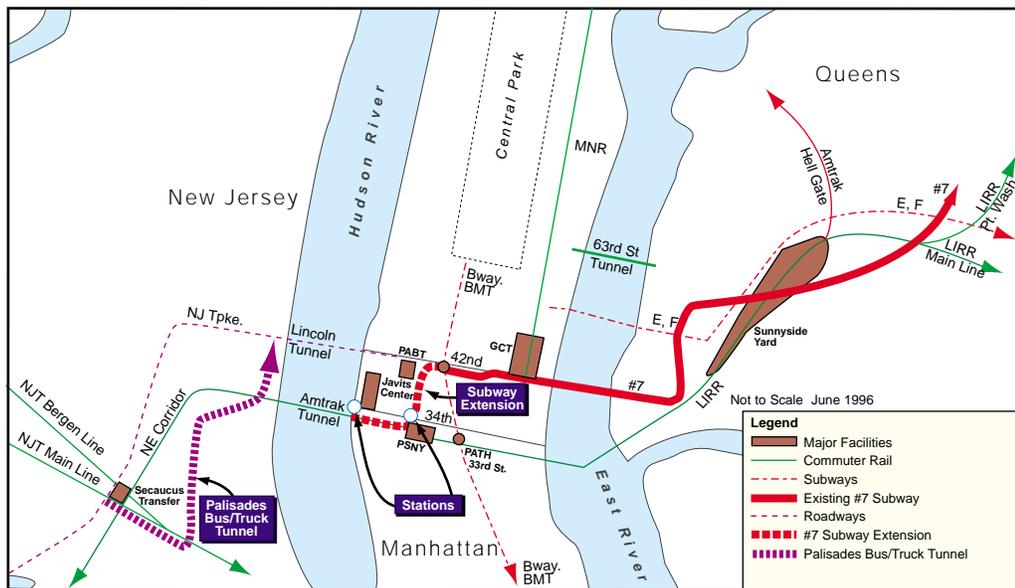


Figure 8

## C. Evaluation of Phase 2 Alternatives

### 1. No Build and Transportation System Management (TSM)

The analysis of the "No Build" Alternative concluded that projected Penn Station congestion, beginning in the early 2000s and growing to 2020, required some action to ameliorate a situation where future demand would far outstrip capacity. Therefore, doing nothing, i.e. adopting the "No Build" Alternative as the solution was not seen as a responsible course of action.

There were 16 Transportation System Management (TSM) elements originally analyzed by ARC in Phase 1, of which seven received more detailed consideration in Phase 2. Five of these seven proved to have merit, and ARC recommends their continued exploration. These were: (1) Expanded Use of Bi-level Electric Cars and Coaches by NJ TRANSIT, (2) Direct Bus Service Across the George Washington Bridge to East Midtown, (3) New Ferry Services (Hudson and East Rivers), (4) Unified Regional Fare System and Fare Media, and (5) Herald Square Pedestrian Passageway. The TSM elements were not modeled by ARC, however, the analysis concluded that each TSM did not provide meaningful capacity relief to the Hudson River tunnels and at Penn Station or demonstrate an ability to absorb a significant portion of the forecast growth in regional demand. This prompted the ARC sponsors to conclude that a major "Build" alternative needs to be explored.

### 2. Alternative B - Midtown Commuter Rail Connection

During the ARC Phase 2 evaluation of alternatives, the Long Island Rail Road East Side Access project to Grand Central via the 63rd Street Tunnel was advanced by the MTA as a major initiative of New York Governor Pataki's Master Links Program. As a result, in the ARC evaluation Alternatives A and B were examined in relation to the LIRR East Side Access Build Alternative to determine the best approach to East Side service from Queens/Long Island. In the ARC analysis, Alternative B was deemed inferior to Alternative A, and the ARC Project Oversight Committee eliminated Alternative B due to its operational and physical feasibility problems.

### 3. Alternative CC - New Crosstown/Trans-Hudson Subway

Alternative CC, which evolved from Alternative C, was not seen as an effective strategy for reducing the anticipated congestion problem at Penn Station and the Hudson River tunnel approaches to Penn Station. In the evaluation of Alternative CC, the ridership model forecast that it would carry significant New Jersey peak hour ridership, particularly from Hudson County. However, this alternative would not divert enough Midtown commuter rail trips to ease projected Hudson River tunnel and Penn Station overcrowding. On the Queens side, the initial ridership model forecast, which factored in operation of the Queens Connection, and concluded that the proposed service plan on the Queens Boulevard line could handle the projected ridership without exceeding MTA crowding standards. As a result, the ARC Project Oversight Committee decided to suspend further analysis of Alternative CC. Actual capacity relief delivered by the Queens Connection will be monitored by the MTA as the service plan is put into place, targeted for 2001.

### 4. Alternative D - Crosstown Subway Extension-Palisades Bus/Truck Tunnel

Analysis of the Palisades Bus/Truck Tunnel led to two critical findings: (1) though a diversion to a new exclusive roadway would reduce XBL congestion and improve travel conditions for bus riders and truckers, it would not solve a primary ARC objective of relieving capacity at Penn Station; and (2) construction of the surface/aerial alignment from the Palisades portal to the mouth of the Lincoln Tunnel would be in a subway/surface option which was found to be in conflict with NJ TRANSIT's Hudson-Bergen LRT project. Utilization of the bus network to absorb forecast growth would also require a greater share of Lincoln Tunnel capacity than is now available for bus priority treatment. This concept was eliminated from further consideration by the Project Oversight Committee.

The analysis of the westward extension of the #7 Flushing line also generated two key findings: (1) the construction of LIRR East Side Access to Grand Central would provide the Queens/Long Island market

with one seat access to East Midtown, diverting the largest single market for Penn Station to Grand Central trips, and thereby significantly diminishing the benefits of extending the #7 line to Penn Station; and (2) Underpinning the Eighth Avenue subway for this alignment from Times Square to Penn Station would complicate the constructibility of this strategy. Though the westward extension of the #7 Flushing line does not best meet ARC's regional transportation objectives, it may have merit and sufficient independent utility for crosstown and West Midtown access to warrant further analysis and consideration in other venues.

## V. Alternative AA - Penn Station-Grand Central Through Operation

### A. Description

ARC concluded that commuter rail was the best approach to resolving the future capacity needs of the Penn Station network, and that a modified Alternative A was the most promising alternative for detailed analysis. Alternative AA was developed as a refinement of Alternative A and designed to remedy the Alternative A deficiencies and to better interface with LIRR East Side Access (Figure 9).

Alternative AA – PSNY/GCT Commuter Rail Shared Facilities

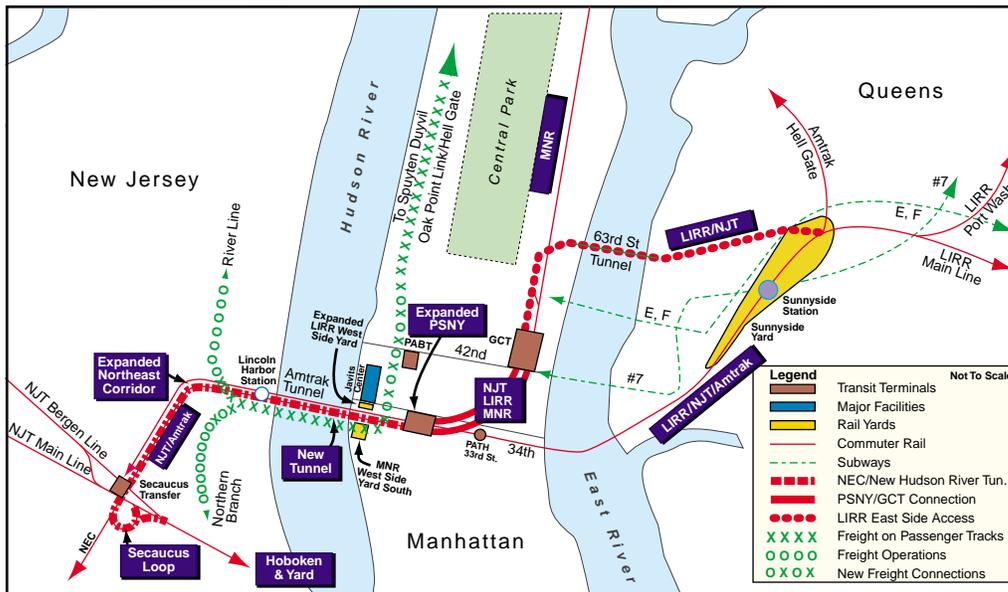


Figure 9

Alternative AA incorporated many key features from its Alternative A predecessor: (1) enhanced through operation for all three regional commuter railroads between Grand Central and Penn Station; (2) addition of two new tracks to the High Line from Secaucus and a new two track Hudson River tunnel to Penn Station; (3) the Secaucus Loop, including a fifth track at the Secaucus Transfer Station, providing a one seat ride from NJ TRANSIT's Main/Bergen, Port Jervis, and Pascack Valley lines to Manhattan; (4) expansion of Penn Station with the addition of a new two level station at 34th Street to be shared by the LIRR and Metro-North, (5) extended Penn Station tracks 1-6 and related platforms extensions for NJ TRANSIT; (6) an expanded West Side Yard North for LIRR storage (coordinated with any Javits Center expansion); (7) a new West Side Yard South, between 29th and 31st Streets west of Tenth Avenue, for midday Metro-North storage; (8) use of the 63rd Street Tunnel to access Yard A in Sunnyside by NJ TRANSIT for midday storage; and (9) a possible Hudson County station in Weehawken at Lincoln Harbor.

Additionally a major benefit of Alternative AA is its absorption of trans-Hudson growth, thus potentially relieving pressure on other trans-Hudson facilities including the XBL, Port Authority Bus Terminal, PATH, and the Lincoln Tunnel. Alternative AA also lends itself to optional freight accommodations, though the necessity to share tracks and tunnels with commuter rail trains limits freight operating latitude.

### B. Evaluation of Alternative AA

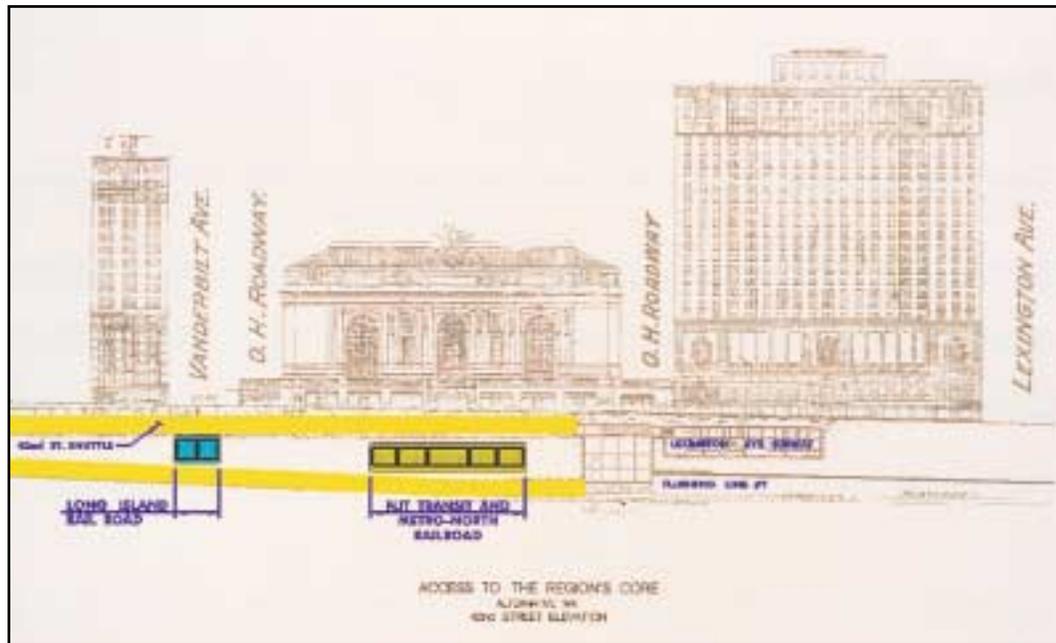
ARC determined that construction and operation of Alternative AA appears feasible. Detailed investigation and conceptual planning, including development of drawings indicating location of columns, eleva-

tions, and clearances demonstrated an initial determination of construction feasibility. In addition, a conceptual service plan has been developed that supports all three railroads gaining access to both Grand Central and Penn Station, although unique rolling stock would have to be developed and acquired by NJ TRANSIT (including equipment required to deliver the contract service for Metro-North customers on the Port Jervis and Pascack Valley Lines) to meet the operating requirement of Alternative AA. Capital and operating costs and ridership estimates have also been prepared.

### 1. Constructibility

Although there are many critical factors relating to the constructibility of Alternative AA such as building a Penn Station extension under 34th Street, extending Penn Station tracks 1-6 eastward, and constructing deep underground tunnels with two flyovers between Penn Station and Grand Central, the key issue remains whether it is possible to break out of the lower level of Grand Central without disrupting existing and planned commuter rail and subway operations. Two break outs of Grand Central are envisioned in Alternative AA: (1) tracks 105-112 in the center of the lower level for NJ TRANSIT access to Penn Station tracks 1-6 and Metro-North access to the new 34th Street Penn Station extension, and (2) LIRR East Side Access tracks 205-207 for a LIRR connection to the 34th Street Penn Station extension (Figure 10).

For Metro-North and NJ TRANSIT, new construction would extend southward from tracks 105-112, quickly merging these eight tracks into three tracks and severing the lower level loop tracks. The construction would continue south, under the pedestrian connection between the Times Square-Grand Central subway shuttle and the Lexington Avenue Line, and above the #7 Flushing Line tracks. The tracks would descend deep underground on the west side of Park Avenue and continue on to Penn Station.



**Figure 10**  
**Alternative AA**  
**Grand Central Break Out at 42nd Street**

A further requirement of the extension of Metro-North and NJ TRANSIT tracks below 42nd Street is that the southbound Lexington Avenue Line local track would have to be relocated horizontally a few feet eastward and vertically upward to provide sufficient space for the break out of the commuter lines. This would impact the connection between the southbound Lexington Avenue Line local and shuttle track 1, currently used for non-revenue subway moves, and require all future non-revenue subway moves to occur from track 4 of the existing Times Square shuttle connection to the Seventh Avenue subway northbound local track. A new connection from shuttle track 3 to shuttle track 4 would have to be built.

The proposed two track alignment for LIRR East Side Access tracks 205-207 would cross the severed lower level loop track under Vanderbilt Avenue at 42nd Street. It would travel under the north-south pedestrian passageway and tracks of the Times Square-Grand Central subway shuttle tracks as well as above the #7 Flushing Line tracks, and then continue underground on the south side of 42nd Street.

Detailed investigation and conceptual planning, including development of engineering drawings indicating location of columns, elevations, and clearances, demonstrated an initial determination of construction feasibility for both of these break outs. Further investigation is programmed in Phase 3 to confirm constructibility.

## 2. Operability

A conceptual service plan has been developed which supports all three railroads gaining access to both Grand Central and Penn Station. The preliminary analysis by the operating railroads indicates that it is a workable scheme. NJ TRANSIT would operate 22 trains through the new trans-Hudson River tunnel to tracks 1-6 in addition to the 20 to be operated in the existing tunnel to Penn Station in the AM peak (one) hour. Twenty trains would continue through to Grand Central. Upon discharge of passengers at Grand Central, nine of these trains would return to New Jersey via Penn Station, while 11 would continue via the lower level of the 63rd Street Tunnel for midday storage in Sunnyside Yard A.

Sixty-four Metro-North trains in the AM peak (one) hour would go to Grand Central, with 39 on the upper level and 25 to the lower level, of which 20 would continue to the new 34th Street Penn Station extension. Up to nine trains would return from Penn Station in revenue and non-revenue service northward through Grand Central, with the remainder storing in the new West Side Yard South.

The LIRR would operate 36 trains to Penn Station during the AM peak (one) hour, and 24 trains would go to Grand Central, as envisioned in the East Side Access study. Fourteen of the Grand Central trains would continue in non-revenue service through the 34th Street Penn Station extension to the expanded West Side Yard North, while six would return east from Grand Central in revenue service and four would be stored midday in Grand Central.

## 3. Rolling Stock

Unique rolling stock would have to be developed and acquired by NJ TRANSIT (including equipment required to deliver the contract service for Metro-North customers on the Port Jervis and Pascack Valley Lines) to meet the operating requirements of Alternative AA. This rolling stock would conform to the prohibition of diesel trains in tunnels, the low clearance of the 63rd Street Tunnel, and the historic incompatibility of the region's commuter railroads' propulsion systems. The types of rolling stock that would have to be utilized by NJ TRANSIT include: (1) low profile dual mode diesel/electric locomotives that can operate in diesel and third rail territory, and (2) low profile tri-voltage locomotives that can operate in three configurations: AC catenary (25HZ, 12.5 KV), AC catenary (60HZ, 25 KV), and DC third rail with flip third rail shoes. Locomotive manufacturers contacted by ARC have indicated that it would be possible to build such low profile locomotives. LIRR and Metro-North would continue to use their conventional rolling stock.

## 4. Capital Costs

Order of magnitude, conceptual planning level capital costs for Alternative AA have been developed differentiating: (1) construction, (2) property easements and acquisitions, (3) rolling stock, and (4) freight. In the construction cost estimate, a high contingency increment has been added to the unit cost for each

segment to reflect the rudimentary nature of the estimate, ranging from 20% to 50% for specific elements, depending on the detailed knowledge and degree of confidence in estimating that particular segment. A management and administrative add on between 21% and 38% was also added to every segment reflecting the variation in the type of activity and complexity of the support services needed to construct each segment. The end result is a range of low to high construction costs in 1997 dollars of the seven segments between Secaucus and Grand Central totaling from \$4.1 billion to \$4.6 billion, as itemized in Figure 11.

**Figure 11**  
**Alternative AA**  
**Construction Costs (\$ Millions)**

Segment	Low	High
Secaucus Transfer to 35th St.	\$1,612	\$1,802
35th St. to south of Grand Central	\$ 834	\$ 897
Tunnels & Station 34th St., 6th-10th Avenues	\$ 810	\$ 944
Grand Central work related to LIRR East Side Access	\$ 25	\$ 28
Grand Central North tunnels	\$ 289	\$ 321
West Side Yard North & leads (LIRR)	\$ 308	\$ 351
West Side Yard South & leads (Metro-North)	\$ 255	\$ 295
<b>Total</b>	<b>\$4,133</b>	<b>\$4,638</b>

There are four geographic areas where property easements and/or acquisitions are anticipated. Cost estimates are based on a percentage of assessed valuation as well as the projected purchase price of properties that would have to be acquired, and range between \$111 million and \$206 million in 1997 dollars as itemized in Figure 12.

**Figure 12**  
**Alternative AA**  
**Property Acquisition and Easements (\$ Millions)**

Segment	Low	High
Grand Central to Penn Station	\$ 93	\$188
West Side Yard North & leads (LIRR)	\$ 2	\$ 2
West Side Yard South & leads (Metro-North)	\$ 13	\$ 13
Secaucus wetlands area	\$ 3	\$ 3
<b>Total</b>	<b>\$111</b>	<b>\$206</b>

Rolling stock fleet estimates are based on a calculation of new rolling stock needed by NJ TRANSIT to meet its expanded operational requirements envisioned by Alternative AA. No additional rolling stock would be needed by Metro-North or the LIRR beyond rolling stock purchased to meet the operational requirements of the East Side Access project. The NJ TRANSIT rolling stock includes the cost of purchasing 33 new dual mode diesel/electric locomotives, 40 new tri-power electric locomotives, and a net cost for 262 additional passenger coaches (above and beyond the coaches that NJ TRANSIT would purchase to meet normal replacement and forecast growth to 2020). NJ TRANSIT would experience a simultaneous savings in costs for diesel and electric locomotives not acquired as a result of changes in operation due to direct Manhattan service in Alternative AA; these savings were subtracted from the rolling

stock estimate. The cost to NJ TRANSIT would be spread over many years and the increment in rolling stock would allow a major increase in service with a significant increase in ridership and revenue. A low to high range reflecting the variable unit costs as estimated by several rolling stock manufacturers ranges from \$581 million to \$765 million in 1997 dollars for NJ TRANSIT.

The total capital cost of Alternative AA including construction, property acquisition and easements, and purchase of new rolling stock ranges from \$4.8 billion to \$5.6 billion in 1997 dollars as detailed in Figure 13.

**Figure 13**  
**Alternative AA**  
**Total Capital Cost (\$ Millions)**

Segment	Low	High
Construction Costs	\$4,133	\$4,638
Property Acquisition and Easements	\$ 111	\$ 206
Rolling Stock	\$ 581	\$ 765
<b>Total</b>	<b>\$4,825</b>	<b>\$5,609</b>

Freight costs have been calculated in a manner similar to the calculation of construction costs, including contingencies and management and administrative charges, by isolating freight only segments and increments to reach a range of low to high costs. These costs, which are optional within the context of Alternative AA, range from \$649 to \$712 million in 1997 dollars and are listed in Figure 14. The Spuyten Duyvil connection includes triple tracking of the Metro-North Hudson Line from Spuyten Duyvil to Marble Hill. In addition, ARC Phase 3 will investigate the need for a dual connection to NYS&W freight track in New Jersey; eliminating the River Line connection would reduce the freight incremental cost by \$165 to \$185 million to a range of \$484 to \$527 million in 1997 dollars.

**Figure 14**  
**Alternative AA**  
**Freight (\$ Millions)**

Segment	Low	High
Hudson River tunnel cost difference to freight dimensions	\$ 56	\$ 60
West Side Line (Manh.) connection	\$224	\$245
Spuyten Duyvil connection	\$ 38	\$ 40
NJ connections (River Line/Northern Branch)	\$331	\$367
<b>Total</b>	<b>\$649</b>	<b>\$712</b>

## 5. Operating and Maintenance Costs

In order to have a consistent basis for developing operating and maintenance costs for each railroad, estimates were derived from FTA Section 15 Annual Reports. The four FTA mandated operating and maintenance costs elements were: (1) train operations, (2) rolling stock maintenance, (3) facilities maintenance, and (4) administration. The 2020 operating and maintenance costs for Alternative AA were then compared to the projected 2020 costs forecast for each railroad based upon each railroad's projected 2020 operating plan. The net increment of operating and maintenance costs for Alternative AA in 2020 was relatively large for NJ TRANSIT (including expenses required to deliver the contract service for Metro-North customers on the Port Jervis and Pascack Valley Lines) and comparatively modest for Metro-North and LIRR (exclusive of the cost of implementing East Side Access service to Grand Central). The incremental operating and maintenance cost to NJ TRANSIT would be paired with a major increase in service with a significant increase in ridership. Incremental revenues derived from Alternative AA service, generally about 45% of operating costs for NJ TRANSIT commuter rail, will offset a portion of the operating and maintenance costs; no revenue forecasts were performed by ARC.

Future calculations of operating and maintenance costs will be based upon actual operating plans, a more accurate methodology for predicting operating and maintenance costs. These results will then be subject to an iterative process of determining the optimum number of trains needed to meet demand, within the confines of defined capacity, based upon projected demand forecasts. This may result in a reduction of the number of trains required to meet demand, reducing 2020 operating and maintenance cost estimates.

## 6. Ridership Forecast

For Alternative AA, the ARC ridership model forecasts 182,022 daily inbound and outbound NJ TRANSIT commuter rail riders crossing the Hudson River screenline in 2020 to and from the West of Hudson markets to both Penn Station and Grand Central. This number is the equivalent of 32,764 one way AM peak hour trips, which is about 30% greater than the No Build 2020 level of 25,294. This ridership level exceeds the existing Hudson River tunnel capacity of 20,754 AM peak hour riders, but can be comfortably accommodated by Alternative AA because of the addition of a new tunnel which would increase trans-Hudson capacity to approximately 40,000 one way AM peak hour trips.

The model projects that daily riders who would cross the Hudson River divide between Penn Station and Grand Central in the ratio of approximately 69% to Penn Station and 31% to Grand Central. The ridership demand at Penn Station is forecast to be 124,914 daily two way trips, which is the equivalent of 22,485 one way AM peak (one) hour trips, while Grand Central is projected to capture 57,108 daily two way trips, which is the equivalent of 10,279 one way AM peak (one) hour trips. Although all NJ TRANSIT trains are scheduled to stop at Penn Station, passenger circulation at Penn Station remains within capacity as about a third of the riders continue to Grand Central. Congestion that might otherwise exist at Penn Station is thereby averted, and direct East Midtown access is provided for those West of Hudson commuters whose work destinations are in closer proximity to Grand Central.

ARC did not forecast commuter rail ridership from Nassau/Suffolk/Queens, however, the March, 1998 LIRR East Side Access project report, Major Investment Study for the Long Island Transportation Corridor, shows that under conditions of the LIRR East Side Access Build Alternative 134,577 daily two way riders are forecast to board and alight at the two Midtown terminals, Grand Central and Penn Station, during the morning peak period. This is the equivalent of 55,843 inbound AM (one) peak hour trips. These riders divide between Grand Central and Penn Station in the ratio of 54% and 46%, or 30,155 and 25,688 riders respectively. Neither ARC nor LIRR East Side Access forecast 2020 Metro-North ridership into Grand Central or Penn Station; Metro-North ridership will be forecast in ARC Phase 3.

## 7. Passenger Circulation at Penn Station

Two distinct analyses of passenger circulation were performed at Penn Station: emergency evacuation pursuant to NFPA 130 (National Fire Protection Association) guidelines, and daily platform and concourse use in regular service. This evaluation factored in the development of programmed "No Build"

projects such as construction of NJ TRANSIT's East End Concourse and the partial conversion of the Farley Post Office for use by Amtrak. In addition, NJ TRANSIT foresees the need to extend Penn Station's Central Concourse southward from platform 7 (tracks 13 and 14) to meet egress needs for growing ridership.

In the Alternative AA 2020 ridership forecast, a 15 minute pedestrian peak of the peak congestion was estimated to be about 22,000 passenger movements from all platforms in Penn Station. New capacity expansion necessitated by construction of Alternative AA, including extension of Penn Station platform 1 (tracks 1 and 2) eastward and platform 3 (tracks 5 and 6) westward as well as construction of a new 34th Street Penn Station extension for LIRR and Metro-North were assumed in this evaluation. Walk zones to the Seventh and Eighth Avenue subways were also analyzed. Based upon the preliminary findings of these analyses, Alternative AA could meet the requirements of both NFPA 130 and regular daily operations, though two passenger circulation improvements are seen as necessary in Penn Station: (1) extension of the LIRR/Farley West End Concourse to serve platform 1 (tracks 1 and 2) as well as additional 88 inch wide, double width staircases or one staircase and one escalator to both the West End and East End Concourses from platform 1, and (2) addition of one or two 44 inch staircases to the east side of the East End Concourse at platform 3 (tracks 5 and 6). Under Alternative AA, all new facilities will be designed to be compliant with the Americans with Disabilities Act (ADA).

### 8. Passenger Circulation at Grand Central

As with Penn Station, two distinct analyses of circulation were performed at Grand Central: emergency evacuation pursuant to NFPA 130, and issues relating to daily use in regular service. Grand Central today serves approximately 11,200 commuters in a 15 minute peak of the peak. This number is expected to grow to about 26,200 with the addition of the LIRR East Side Access project, and then to approximately 29,800 passengers with NJ TRANSIT riders added under Alternative AA. The issue of impact upon entrances to adjacent subways and on subway car crowding was also evaluated. Alternative AA will generate an additional 12% increment to the post LIRR East Side Access commuter rail transfers to the Lexington Avenue subway.

Additional passenger circulation improvements related to Alternative AA are needed to comply with NFPA 130 and to enhance circulation for Alternative AA. Improvements recommended by ARC may include: (1) adding a new cross passageway under 46th Street between the upper and lower level tracks, with direct access to the 47th Street cross passageway; (2) expanding the north side of 45th Street cross passageway into the baggage tunnel and additional stairs provided up to each platform; (3) replacing the existing staircases from the north side of the lower concourse to each platform with a pair of in line stairs or a stair and an escalator and widening the doorways to the platforms along the south side of the lower concourse, (4) building three new stairs from the lower concourse to the south end of each platform, and (5) adding new street exits located for the 46th and 47th Streets cross passageways. Under Alternative AA, all new facilities will be designed to be compliant with the Americans with Disabilities Act (ADA). Any improvements at Grand Central Terminal must also conform with New York City Landmarks Preservation Commission protections.

### C. Conclusions

Despite the initial determination that Alternative AA is feasible, there are several near term capacity issues and unknowns which must still be reconciled before this alternative may move forward into an Environmental Impact Study. In addition, the urgent problem of Penn Station capacity, as highlighted in the Tri-Venture Report, requires immediate attention. An incremental plan for expanding service and capacity in the near term future compatible with a long term build alternative should be developed. The unresolved details and questions regarding Alternative AA to be addressed will require the following action in Phase 3:

- A computer simulation of operating conditions of Alternative AA at Penn Station, Grand Central, and in between must be performed.

- A construction staging plan for Alternative AA needs to be developed.
- An intensified interest in how to deliver a one seat commuter rail ride into Manhattan from areas lacking such service in a shorter timeframe than Alternative AA can be built needs to be investigated.
- Constructibility of the Penn Station to Grand Central element of Alternative AA, covering such issues as realigning the Lexington Avenue southbound local track south of Grand Central and removal of the Times Square-Grand Central shuttle connection to this track requires detailed analysis.
- Pedestrian circulation under Alternative AA at Grand Central, especially platform F, needs additional investigation.
- A fuller picture of benefits to the railroads and their customers needs to be developed.

## VI. Next Steps

### A. ARC Phase 3

ARC Phase 3 will be a two year continuation of the study with the initial focus on identifying and analyzing solutions to near term (5-10 year) train congestion at Penn Station. The Tri-Venture railroads are now investigating some short term operations management strategies. ARC Phase 3 will contribute to the development and evaluation of these short term strategies in addition to developing near term and long term solutions.

Conclusions derived from the ARC and Tri-Venture studies determined that the service enhancements planned by the LIRR, NJ TRANSIT and Amtrak over the next few years should continue to be accompanied by additional improvements to the network of Penn Station tracks, platforms, and tunnels. As identified in the Tri-Venture research, coordinated investments to enhance Penn Station near term capacity are vitally important for the future economic well being of New York City and its suburban communities. In Phase 3, the ARC team will utilize the expertise of the Tri-Venture team of rail operations specialists from Amtrak, the LIRR, and NJ TRANSIT to evaluate these short term and near term solutions.

There will be a simultaneous ARC Phase 3 effort to begin to develop, screen, and investigate variants to Alternative AA, recognizing that the alignment from Secaucus to Penn Station, including the Secaucus Loop, and the LIRR East Side Access project are satisfactory components of a long term commuter rail capital expansion program, but that the segment between Penn Station and Grand Central presents operation and construction complexity. One or more variants will be selected for detailed evaluation, and these will be compared to Alternative AA in a benefit/cost analysis for all three commuter railroads, including the possibilities and benefits of phasing construction and developing an initial operating segment. As part of this analysis, ARC will reconsider the possibility of constructing a new East River tunnel which may provide other freight opportunities.

ARC will coordinate with many other regional studies in Phase 3, including:

- LIRR East Side Access preliminary engineering and Environmental Impact Statement;
- MTA Lower Manhattan Access Alternatives MIS/DEIS;
- Metro-North Penn Station Access MIS/DEIS;
- New York City Economic Development Corporation Cross Harbor Freight Movement MIS;
- NJ TRANSIT West Shore Region MIS/DEIS and other Urban Core projects related to capacity between Secaucus and Penn Station.

The result of ARC Phase 3 will be the selection of a Locally Preferred Alternative in conformance with FTA MIS guidelines. Depending upon the outcome of ARC Phase 3, the following step could be the development of an Environmental Impact Statement on one or more of the near term and longer term recommendations, as required to initiate the design and construction of the improvement(s).

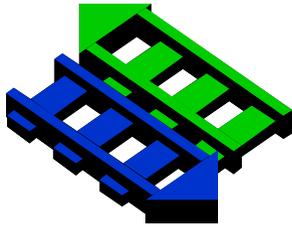
### B. Market Opportunities

The analyses completed in ARC Phases 1 and 2 also identified a number of other potential market opportunities, where coordination with existing services or new services planned or under study may be worthwhile. These will continue to be monitored by the ARC sponsors for possible future action, and are listed below:

- Extension of the #7 Flushing Line west from Times Square;
- Additional Queens Boulevard express service, after opening of the Queens Connection;
- Capacity for additional subway service in the upper level of the 63rd Street Tunnel;
- Congestion relief on Port Authority Midtown facilities: XBL, PABT, PATH uptown, and Lincoln Tunnel.



# ACCESS TO THE REGION'S CORE



## Summary Report 2003



Major Investment Study Sponsored by:



THE PORT AUTHORITY OF NY & NJ



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**ABSTRACT**

Access to the Region's Core (ARC) is a Major Investment Study (MIS) performed in accordance with Federal Transit Administration (FTA) guidelines, jointly sponsored by the Port Authority of New York and New Jersey (PANYNJ), the Metropolitan Transportation Authority (MTA), and NJ TRANSIT. The ARC MIS began in 1995 with three broad goals:

1. To enhance the economic viability and productivity of the New York-New Jersey region;
2. To improve the quality of life in the region; and
3. To invest and use transportation resources productively, efficiently, and effectively.

ARC Phases 1 and 2 identified and screened 137 alternatives representing a wide range of modal strategies, including bus, light rail, subway, PATH, commuter rail, ferry, new technologies, and auto. This analysis led to the finding that the commuter rail mode serving New York Pennsylvania Station (Penn Station) and Grand Central Terminal offered the best approach to meeting future capacity needs. Alternative AA, which provided a through operation for NJ TRANSIT, Long Island Rail Road (LIRR), and Metro-North Railroad between Penn Station and Grand Central Terminal, was selected as best meeting ARC's goals. Phases 1 and 2 are described in the May 1999 "Milestone Summary Report."

Phase 3 began in July 1999 with a specific mandate to:

- Develop and evaluate near-term improvements that could provide some capacity relief in 5-10 years, while a long-term build alternative was developed;
- Verify constructibility and operability of Alternative AA; and
- Develop and evaluate variants to Alternative AA in case it proved to be infeasible.

In Phase 3, three near-term capacity improvements were conceptualized and recommended:

1. Construction of a linear train storage yard under 31st Street linked to Penn Station Tracks 1-5;
2. Extension of tracks in "C" Yard to create new train storage linked to Penn Station Tracks 19-21; and
3. Construction of a new train storage yard west of Tenth Avenue and south of the existing LIRR West Side Yard, linked to Penn Station Tracks 1-9.

As work on Phase 3 progressed, Alternative AA was modified to create compatibility with changes in the LIRR East Side Access project. In addition, three variants, Alternatives G, P, and S, were selected and analyzed. Common elements of all build alternatives were: construction of a loop track at Secaucus to provide a direct link to Penn Station from Hoboken Division lines and two additional tracks on the Northeast Corridor between Secaucus and Penn Station, including a new trans-Hudson tunnel. Distinctive features of the four Phase 3 build alternatives were as follows:

- **Modified Alternative AA** would create rail links between Penn Station and Grand Central Terminal, serving NJ TRANSIT, LIRR, and Metro-North.

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## MIS SUMMARY REPORT

- ❑ **Alternative G** would create a rail link between Penn Station and the lower level of Grand Central Terminal shared by NJ TRANSIT and Metro-North.
- ❑ **Alternative P** would create new tracks and platforms located beneath existing Penn Station.
- ❑ **Alternative S** would create a new rail link to Penn Station, including a new East River tunnel, and train storage facilities at Sunnyside Yard in Queens.

Alternatives P and S and the near-term capacity improvements 1 and 3 are recommended for advancement into a Draft Environmental Impact Statement. These alternatives provide the highest levels of incremental train capacity, accommodate forecasted levels of ridership demand, and provide capacity relief to alternate travel modes. Other alternatives may emerge and be subject to analysis in the Draft Environmental Impact Statement. They also provide opportunities for possible future service to East Midtown. For more information, visit [www.accesstotheregionscore.com](http://www.accesstotheregionscore.com).

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Table of Contents**

<b>1.0. INTRODUCTION.....</b>	<b>0</b>
<b>1.1. THE METROPOLITAN REGION.....</b>	<b>0</b>
1.1.1. SOCIOECONOMIC TRENDS .....	0
1.1.2. TRANS-HUDSON COMMUTATION TO MANHATTAN.....	0
1.1.2.1. Penn Station—Current Conditions .....	5
1.1.2.2. Penn Station—Evolving Conditions.....	5
1.1.2.3. Penn Station—Future Capacity Issues .....	7
<b>1.2. PHASES 1 AND 2 .....</b>	<b>8</b>
1.2.1. PHASE 1—INITIAL SET OF BUILD ALTERNATIVES.....	8
1.2.2. PHASE 2—ANALYSIS OF SELECTED ALTERNATIVES .....	9
<b>1.3. NEAR-TERM IMPROVEMENTS .....</b>	<b>10</b>
<b>1.4. LONG-TERM BUILD ALTERNATIVES .....</b>	<b>13</b>
1.4.1. MODIFIED ALTERNATIVE AA.....	13
1.4.2. THREE ADDITIONAL BUILD ALTERNATIVES.....	14
1.4.2.1. Common Infrastructure.....	14
<b>1.5. ALTERNATIVE G .....</b>	<b>15</b>
1.5.1. PENN STATION MODIFICATIONS.....	15
1.5.2. GRAND CENTRAL TERMINAL MODIFICATIONS.....	16
1.5.3 MIDDAY TRAIN STORAGE .....	17
1.5.4. CONSTRUCTION COST ESTIMATE .....	18
1.5.5. OPERATIONS ANALYSIS .....	18
1.5.5.1. Fleet Requirements and Acquisition Costs .....	19
1.5.5.2. Operating and Maintenance Costs .....	19
<b>1.6. ALTERNATIVE P.....</b>	<b>20</b>
1.6.1. TAIL TRACKS .....	20
1.6.2. MIDDAY TRAIN STORAGE .....	22
1.6.3. CONSTRUCTION COST ESTIMATE .....	22
1.6.4. OPERATIONS ANALYSIS .....	22
1.6.4.1. Fleet Requirements and Acquisition Costs .....	22
1.6.4.2. Operating and Maintenance Costs .....	23
<b>1.7. ALTERNATIVE S.....</b>	<b>23</b>
1.7.1. PENN STATION MODIFICATIONS.....	24
1.7.2. SUNNYSIDE YARD APPROACH.....	24
1.7.3. MIDDAY TRAIN STORAGE AT SUNNYSIDE YARD.....	24
1.7.4. CONSTRUCTION COST ESTIMATE .....	25
1.7.5. OPERATIONS ANALYSIS .....	25

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

1.7.5.1. Fleet Requirements and Acquisition Costs .....	26
1.7.5.2. Operating and Maintenance Costs .....	26
<b>1.8. FREIGHT OPPORTUNITY.....</b>	<b>26</b>
<b>1.9. TRAVEL DEMAND RIDERSHIP FORECASTS.....</b>	<b>27</b>
1.9.1. ALTERNATIVE G .....	28
1.9.2. ALTERNATIVE P .....	29
1.9.3. ALTERNATIVE S .....	30
<b>1.10. COMPARATIVE SUMMARY OF RESULTS.....</b>	<b>31</b>
1.10.1. CAPITAL COSTS.....	31
1.10.2. OPERATING AND MAINTENANCE COSTS.....	32
1.10.3. TRANS-HUDSON CAPACITY INCREASE .....	32
1.10.3.1. Modal Diversions.....	33
<b>1.11. CONCLUSIONS AND RECOMMENDED NEXT STEPS .....</b>	<b>34</b>
1.11.1. ALTERNATIVE G CONCLUSIONS .....	34
1.11.2. ALTERNATIVE P CONCLUSIONS.....	35
1.11.3. ALTERNATIVE S CONCLUSIONS.....	35
1.11.4. BASELINE ALTERNATIVE CONCLUSIONS .....	36
1.11.5. RECOMMENDATIONS .....	36

**ACCESS TO THE REGION'S CORE**  
MIS SUMMARY REPORT

**List of Figures**

<b>Figure 1.1-1 Regional Rail Network.....</b>	<b>4</b>
<b>Figure 1.3-1 Near-Term Improvements.....</b>	<b>12</b>
<b>Figure 1.4-1 Modified Alternative AA .....</b>	<b>13</b>
<b>Figure 1.4-2 West-of-Hudson Common Infrastructure .....</b>	<b>14</b>
<b>Figure 1.5-1 Alternative G .....</b>	<b>15</b>
<b>Figure 1.5-2 Penn Station Key Infrastructure Changes.....</b>	<b>16</b>
<b>Figure 1.5-3 Grand Central Terminal Breakout .....</b>	<b>17</b>
<b>Figure 1.5-4 Boonton Yard.....</b>	<b>18</b>
<b>Figure 1.6-1 Alternative P .....</b>	<b>21</b>
<b>Figure 1.6-2 Alternative P – Flexed Approach.....</b>	<b>21</b>
<b>Figure 1.7-1 Alternative S .....</b>	<b>23</b>
<b>Figure 1.7-2 Sunnyside Yard .....</b>	<b>25</b>
<b>Figure 1.8-1 Freight Opportunity Alignment.....</b>	<b>27</b>

**List of Tables**

<b>Table 1.9-1 Alternative G Ridership Forecast – NJ TRANSIT.....</b>	<b>28</b>
<b>Table 1.9-2 Alternative G Ridership Forecast - Metro-North Railroad.....</b>	<b>29</b>
<b>Table 1.9-3 Alternative G Average Weekday Modal Diversions - NJ TRANSIT.....</b>	<b>29</b>
<b>Table 1.9-4 Alternative P Penn Station Ridership Forecast - NJ TRANSIT .....</b>	<b>30</b>
<b>Table 1.9-5 Alternative P Average Weekday Modal Diversions - NJ TRANSIT .....</b>	<b>30</b>
<b>Table 1.9-6 Alternative S Penn Station Ridership Forecast - NJ TRANSIT .....</b>	<b>31</b>
<b>Table 1.9-7 Alternative S Average Weekday Modal Diversions - NJ TRANSIT.....</b>	<b>31</b>
<b>Table 1.10-1 Estimated Capital Costs .....</b>	<b>32</b>
<b>Table 1.10-2 Estimated Annual Incremental Operating and Maintenance Costs.....</b>	<b>32</b>
<b>Table 1.10-3 Trans-Hudson 2020 Ridership Forecast – AM Peak Hour.....</b>	<b>33</b>
<b>Table 1.10-4 Average Weekday Modal Diversions - NJ TRANSIT .....</b>	<b>33</b>

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

## **1.0. INTRODUCTION**

Access to the Region's Core (ARC) is a planning partnership of the Port Authority of New York and New Jersey (the Port Authority), the New York Metropolitan Transportation Authority (MTA), and NJ TRANSIT, the sponsoring agencies. During the late 1980s and early 1990s, these agencies were exploring future travel demands and potential solutions to transportation capacity limitations. The MTA Long Island Rail Road (LIRR) conducted its "Network Strategy Study," with emphasis on new Midtown terminal capacity, which led to the LIRR East Side Access project. NJ TRANSIT completed its "Urban Core" planning work, resulting in Midtown Direct service and the Secaucus Transfer project. The Port Authority completed an "Interstate Network Analysis" examining trans-Hudson linkages and travel in three corridors, especially to the Midtown Manhattan business district.

Recognizing that a joint planning effort would be the most efficient means to examine new rail passenger capacity needs and solutions in relation to Midtown access, the three agencies formed the ARC planning partnership, and commenced this Major Investment Study (MIS) in 1995.

The work and findings of ARC Phases 1 and 2 were documented in the May 1999 "Milestone Summary Report." This Summary Report updates those previous findings and summarizes the third and final phase of the MIS work. It establishes the basis to continue the project into a Draft Environmental Impact Statement phase. All work performed has been in conformance with Federal Transit Administration (FTA) MIS guidelines in effect at the outset of Phase 3, in July 1999.

ARC inextricably links the New York-New Jersey metropolitan area's future economic well being with the need for improved accessibility to the region's largest concentration of employment, Midtown Manhattan. The three broad goals for ARC Phase 3 were to: (1) upgrade accessibility of the region's core; (2) utilize the region's existing transit infrastructure to the maximum extent possible; and (3) maintain and enhance the economic viability of the region. The Phases 1 and 2 Milestone Summary Report documented the need for additional trans-Hudson capacity and summarized a comparison of project concepts pointing toward expanded commuter rail service as the best solution for fulfilling those goals. The Phase 3 study focused primarily on trans-Hudson and New York Pennsylvania Station (Penn Station) capacity issues.

The final year of ARC's planning effort took place in the shadow of the September 11th terrorist attacks. That tragedy resulted not only in significant impacts for the existing regional transit network, especially for trans-Hudson commuters, but also spurred a reassessment of the need to maintain a secure, adequate and resilient transportation system that would minimize the vulnerability of the region's employment and economic base. The past year also presented new challenges for Amtrak, which owns the Penn Station complex and its existing tunnels beneath the Hudson and East rivers. As the federal government considers the policy issues and infrastructure financing requirements of the Amtrak intercity rail system, the region's passenger rail operators have a critical stake in continuing to cooperatively address the need to preserve and enhance this commuter rail facility.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

ARC factored these concerns into the findings and recommendation of next steps. In considering the options to be carried forward in the Environmental Impact Statement process, the ARC sponsoring agencies anticipated the need for continued flexibility in the midst of a major program of rebuilding, adapting, and upgrading the regional transportation network.

## **1.1. THE METROPOLITAN REGION**

Census data and forecasts of regional employment and population portray the 31-county tri-state region as a mature metropolitan area, with moderate but steady growth anticipated in population and employment to 2025.

### **1.1.1. Socioeconomic Trends**

The most recent forecast prepared for the New York Metropolitan Transportation Council (NYMTC) for the tri-state region shows population growing from approximately 21.5 million residents in 2000 to 24.0 million by 2025. Total employment for the same region is expected to increase from 11.6 million in 2000 to more than 13.5 million in 2025. Several long-term trends in population, employment, and regional development are expected to continue for the foreseeable future, including population and job growth in both older cities and suburban areas, with somewhat higher population growth in the least developed suburban counties.

These trends also show continuing momentum for employment growth in the Manhattan Central Business District (CBD), extending from 60th Street to the Battery. Manhattan accounted for 2.8 million jobs in 2000, with NYMTC forecasting the addition of nearly 200,000 new jobs by 2025. Midtown Manhattan would continue to serve as the pre-eminent concentration of employment.

Comparison of 1990 and 2000 Census data shows that the region's older urban communities demonstrated strong growth in population, especially in New York City and some urban areas in New Jersey, notably Hudson County. Employment grew in Midtown Manhattan, even as total regional employment continued a long-term trend of greater dispersion throughout the region. The past decade also saw strong performance by the region's public transportation services. NYMTC reported that the number of commuters who drove to work alone fell as transit services gained market share. This is a shift from the earlier trend of declining transit market share that followed the dispersal of jobs and population from the areas best served by public transit. By the late 1990s, many of the region's transit services, especially those serving Midtown Manhattan, were operating at capacity during peak periods.

### **1.1.2. Trans-Hudson Commutation To Manhattan**

These regional trends are especially evident on the system of transit and vehicular connections linking Manhattan with the West-of-Hudson portion of the region. Figures compiled by NJ TRANSIT show that, prior to September 11, 2001, approximately 236,000 inbound commuters crossed the Hudson River to destinations between 60th Street and the Battery from 6-10 AM on weekday mornings, 167,000 using Midtown crossings, and 69,000 entering Lower Manhattan.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

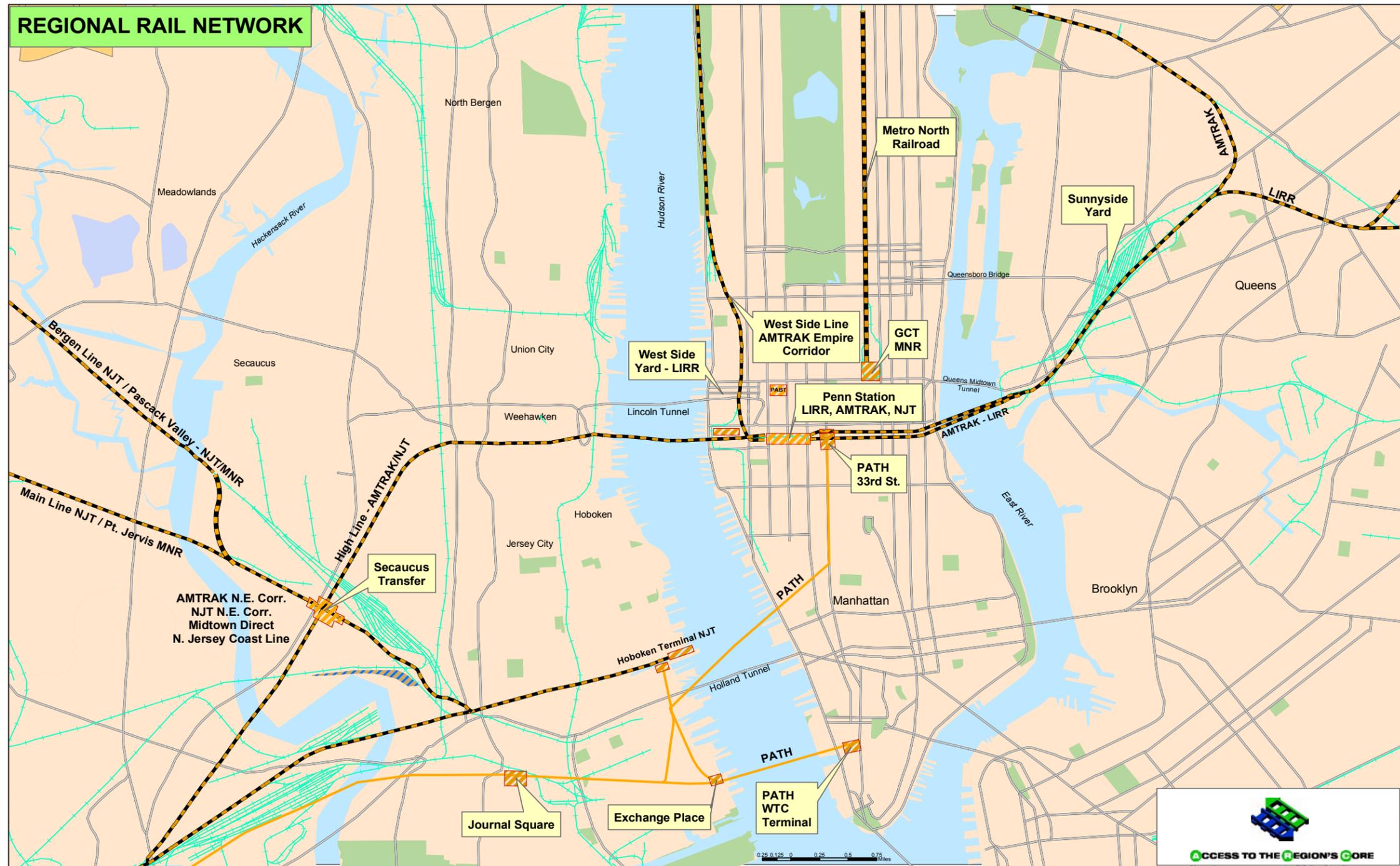
For Midtown, the primary transit connection is the Exclusive Bus Lane (XBL) system, providing preferential access for buses to the Lincoln Tunnel, most traveling directly into the Port Authority Bus Terminal. These buses carried more than 60,000 inbound passengers in the AM peak period. Rail service into Penn Station carried more than 33,700 riders, primarily on NJ TRANSIT. Lincoln Tunnel auto, private ferries with cross-town shuttle-bus connections, and PATH uptown service rounded out the Midtown access picture.

For Lower Manhattan, PATH service was the primary trans-Hudson mode, connecting with major NJ TRANSIT rail terminals and carrying more than 39,000 passengers into the World Trade Center terminal during the 4-hour morning peak. The September 11th attacks forced an extended interruption of PATH downtown service, and responses by transit operators and the commuter market they serve vividly illustrate the interrelationships and capacity pressures straining the trans-Hudson network. Midtown-bound ridership surged, dramatically increasing volumes on NJ TRANSIT trains bound for Penn Station in Midtown. This reflected both the loss of downtown PATH service for Lower Manhattan commuters and the primary choice of Midtown for business relocation, at least temporarily, from Lower Manhattan.

Major elements of the region's response to the September 11th disruption included greatly expanded ferry service (especially from Hoboken Terminal), reconfigured PATH service, acceleration of short-term efforts by NJ TRANSIT to improve conditions on rail service to Penn Station, and restrictions on single-occupant-auto entries through the Lincoln and Holland Tunnels during peak hours. Taken together, these measures have accommodated trans-Hudson commuter volumes that have rebounded to within a few percentage points overall of pre-September 11th totals. Many of these service adjustments are temporary. The expected return of PATH service to Lower Manhattan by late 2003 will ease pressure on alternative connections; however, this recovery phase for the trans-Hudson commuter network illustrates the lack of available capacity to absorb ridership growth or readily manage changes in commuter demand. It also demonstrates the interdependence across the West-of-Hudson transit network of the services that carry commuters to Midtown and Lower Manhattan.

In view of these socioeconomic trends, and the projected usage of the entire trans-Hudson transit network, ARC recognized that the commuter rail system, centered on Penn Station, offered the most effective approach to satisfying anticipated trans-Hudson travel demand. The regional rail network, including the Secaucus Transfer Station, is depicted in Figure 1.1-1.

**Figure 1.1-1**  
**Regional Rail Network**



**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**1.1.2.1. PENN STATION—CURRENT CONDITIONS**

The Penn Station facility consists of an integrated network of tracks, tunnel structures, equipment storage yards, interlockings, signaling and communications systems, platforms and passenger circulation facilities, and traction power systems positioned between New Jersey and Queens. This complex is owned by Amtrak and, through operating agreements, is also the only point of direct access to Midtown Manhattan for the LIRR and NJ TRANSIT. As such, it has a critical role in the region's public transportation network.

Penn Station is the most heavily used railroad facility in the country, serving more than 310,000 arriving and departing rail passengers (pre-September 11th) on nearly 800 train trips on an average day. Within the station are convenient links to the New York City subways operating along Eighth Avenue (A, C, E) and Seventh Avenue (1/9, 2, 3). The station is served directly by M4, M10, M16, M20, M34, and Q32 buses. Additional bus, subway, and PATH services are located within one block of the station.

East of Penn Station, four tracks handle LIRR and Amtrak train operations as well as NJ TRANSIT non-revenue trips to Sunnyside Yard in Queens for midday train storage and servicing. During the morning peak hour, 36 westbound LIRR trains (carrying about 40,000 passengers) and one Amtrak train arrive at Penn Station via these tracks. This level of activity is possible because of recent system improvements, including complete reconstruction of the LIRR passenger concourses. Trackage to the west of the station allows LIRR equipment to be moved to the West Side Yard for midday storage.

West of Penn Station, two trans-Hudson tracks accommodate Amtrak and NJ TRANSIT rail service. The eastbound peak-hour capacity is presently fully utilized by 17 NJ TRANSIT and 3 Amtrak trains. Peak-hour NJ TRANSIT and Amtrak commuter (clocker) ridership to Penn Station has grown from about 15,000 passengers in 2000 to nearly 20,000 in December 2001. The majority of this rapid change represents the temporary shift of commuters from PATH as a result of the events of September 11th, though a small portion is attributable to passengers from the Newark Liberty International Airport station (opened in October 2001). Much of this shift will revert back after the restoration of PATH service to Lower Manhattan. In the interim, the demand exceeds NJ TRANSIT's peak-hour seating capacity of about 18,100, resulting in overcrowded conditions on many trains (which were addressed via some train schedule and consist changes). The situation has also put added strain on the passenger circulation facilities at Penn Station.

The Empire Line emanates west from the station as a single track and travels north along the west side of Manhattan. At present, Amtrak operates 13 round trips to/from Albany on weekdays on this line, about half of which continue to/from other points further north or west.

**1.1.2.2. PENN STATION—EVOLVING CONDITIONS**

A series of ongoing capital improvements will open new markets, attracting additional riders on

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

trains to Penn Station, adding pressures to capacity and service reliability. Simultaneously, numerous projects are being pursued that will provide various measures of capacity expansion/relief, enabling the Penn Station infrastructure to keep pace with the growing passenger demand. Among the category of projects that will add pressures are:

- ❑ **Montclair Connection.** Introduced in September 2002, this project merged NJ TRANSIT's Boonton Line and Montclair Branch, allowing the introduction of Midtown Direct service to Penn Station on the combined line.
- ❑ **Secaucus Transfer Station.** This major station facility will allow passengers to transfer between trains on the Northeast Corridor and trains on the Main, Bergen County, Pascack Valley, and Port Jervis Lines. The present circuitous route to Midtown Manhattan via Hoboken will be avoided, producing substantial travel time savings and attracting new rail riders. The station is scheduled for opening in 2003. Service will be phased in gradually.
- ❑ **Newark Liberty International Airport Station.** Opened in late 2001, this station now serves about 2,500 daily riders.
- ❑ **JFK AirTrain.** The Port Authority is constructing a light rail link between JFK Airport and the LIRR Jamaica Station that will attract more riders between Penn Station and Jamaica Station.
- ❑ **Amtrak Acela Express Service.** Introduced in 2000, Amtrak's high-speed train on the Northeast Corridor between Boston and Washington has attracted new ridership and increased market share. As demand grows, Amtrak can be expected to increase its peak period service at Penn Station.

Projects that are expected to improve or expand operations, relieving pressures of demand, include:

- ❑ **Amtrak High-Density Signal Improvements.** This project will modify the signal system on the Northeast Corridor High Line between Secaucus and Penn Station, increasing the peak-hour train capacity up to 25 trains per hour. The project is being implemented in conjunction with the Secaucus Transfer and will be completed in 2003, prior to opening of the new station.
- ❑ **NJ TRANSIT Seventh Avenue Concourse.** Opened in September 2002, this new passenger facility in the southeast corner of Penn Station has improved vertical circulation for riders and provided added passenger amenities with the addition of a new passenger ticketing and waiting area. Also included are new stairs and escalators to/from platforms 1-12 and a soon-to-be-constructed new street exit/entry at the corner of Seventh Avenue and 31st Street.
- ❑ **JO Interlocking.** This project will realign the tracks of Lines 1 and 2 east of Penn Station, reducing crossover conflicts in the bi-directional flow of trains and increasing East River tunnel capacity. Combined with fleet upgrades and other changes, this is expected to increase the LIRR morning inbound capacity from 36 to 42 trains per hour.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

- ❑ ***Farley Post Office Building.*** Part of Farley Post Office building on Eighth Avenue to the west of Penn Station is to be converted by the Penn Station Redevelopment Corporation into a rail station concourse and ticketing area for use by Amtrak. While no new platform or track capacity will be added, the project will provide new stairways/escalators to improve vertical circulation at the western end of most platforms.
- ❑ ***Equipment Purchases.*** NJ TRANSIT has ordered new equipment that will increase average train passenger capacity into Penn Station. This includes 230 Comet V passenger coaches and 29 ALP-46 electric locomotives to augment NJ TRANSIT's existing fleet and replace cars scheduled for retirement. This will allow longer consists on some existing trains operating to Penn Station. Delivery started in 2002 and will be completed in 2003. NJ TRANSIT has completed development of specifications for a bi-level car that would seat in the range of 140 persons (the existing fleet averages about 120 seats per car). A contract for an initial order of 100 cars was approved in December 2002, with options to order over 200 additional cars.
- ❑ ***LIRR East Side Access Project.*** This capital investment will establish direct LIRR service to a new passenger facility beneath Grand Central Terminal via the 63rd Street Tunnel. This is expected to divert riders from Penn Station to Grand Central Terminal, relieving peak-period capacity constraints for LIRR service to and from Penn Station. The project is currently in design; construction is scheduled for completion in 2011.

### **1.1.2.3. PENN STATION—FUTURE CAPACITY ISSUES**

These programmed capacity improvements will not cumulatively satisfy future growth, particularly in the trans-Hudson market. Increase in demand will occur as a result of continued regional socioeconomic growth. Most of the increased trans-Hudson travel demand will fall on the commuter rail system serving Penn Station. The commuter rail mode will be most attractive due to congested conditions on alternative travel modes such as bus and automobile.

Further pressure on Penn Station will also be generated by public demand for rail system expansion proposals, both to increase one-seat ride opportunities and to serve new markets. A number of potential projects are under consideration by NJ TRANSIT. Also, the MTA/Metro-North Railroad is investigating the feasibility of operating service from some of its existing lines to Penn Station. These proposals would create added train and passenger activity at Penn Station, requiring expanded capacity.

After completion of the high-density signal system, the opening of the Secaucus Transfer Station, and the delivery of bi-level coaches, NJ TRANSIT and Amtrak will use all of the 25 peak-hour trans-Hudson train slots that will be available. NJ TRANSIT's capacity will be expanded to approximately 23,000-24,000 seats; however, ridership forecasts indicate that morning peak-hour passenger demand will begin to exceed that seated capacity at the end of this decade, and the shortfall would reach 4,000 to 5,000 by 2020 (or roughly 20% beyond capacity). This forecast does not include induced demand, i.e., new riders who might change their employment or residence as a result of new services. Nor does it account for displaced Lower Manhattan jobs that relocate permanently to Midtown, or additional development in the

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

westernmost portion of Midtown if New York City's proposed rezoning concepts are implemented.

It will be difficult to accommodate this excess demand. A small segment of rail trips might be accommodated through shifts in customer travel times to the less congested shoulders of the peak period. Other trips may be accomplished through tolerance of standing and crowding conditions, representing a degradation of service for passengers. Alternate travel modes are now at or near their peak capacities, and will continue to be so despite some short-term relief created by the various programmed commuter rail improvements. The magnitude of the unmet rail demand translates into as many as 105 additional peak-hour buses attempting to utilize the XBL/Lincoln Tunnel, creating a demand 15% over the peak-hour capacity of that facility. Alternately, the unmet demand equates to as much as 4,200 additional autos trying to pass through the trans-Hudson vehicular crossings during the peak hour, a figure requiring the equivalent of two additional highway lanes.

Meeting the region's mobility needs is critical to attaining the economic growth that is forecast and to maintaining Midtown Manhattan as a center of regional, national, and global importance. The potential inability to provide sufficient access to Midtown was recognized as a significant problem, leading to this project's major goal of developing both near-term (5-10 year) and longer-term capacity relief measures for the trans-Hudson transportation system. Ideally, these measures would be capable of increasing trans-Hudson service capacity up to 30 trains per hour (near-term) and substantially higher, up to 60 trains per hour (long-term).

## **1.2. PHASES 1 AND 2**

The initial phases of ARC consisted of analysis of current conditions and expected future needs, followed by exploration of candidate improvements to address those needs.

### **1.2.1. Phase 1—Initial Set of Build Alternatives**

In Phase 1, ARC identified 137 alternatives for initial screening, including commuter railroad, subway, PATH, bus, ferry, light rail, multimodal, new technology, and automobile strategies. Preliminary screenings reduced this to 15 build alternatives. Further quantitative and qualitative evaluation reduced this initial set to four build alternatives (Alternatives A, B, C, and D), which were advanced to Phase 2 for in-depth technical analysis and conceptual planning. These four alternatives were:

- ❑ **Alternative A** included a new railroad tunnel from the Secaucus Transfer Station, through Penn Station, into Grand Central Terminal's lower level center tracks and then to Sunnyside Yard in Queens via the existing 63rd Street Tunnel beneath the East River. This permitted NJ TRANSIT to reach Grand Central Terminal and Metro-North to reach Penn Station, while also allowing LIRR to have one train service to both terminals.
- ❑ **Alternative B** included a new two-track rail line between the Secaucus Transfer Station and Sunnyside Yard in Queens via a new Hudson River tunnel, 49th or 50th Street, Third

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

Avenue, and the 63rd Street Tunnel, to be used by LIRR and NJ TRANSIT for two-way through operation.

- ❑ **Alternative C** involved a new subway line from the Secaucus Transfer Station to Queens via 33rd Street, Eighth Avenue, 49th Street, Second Avenue, and the 63rd Street Tunnel. Alternative C evolved into Alternative CC, which realigned the Manhattan segment of the route straight across 49th Street from the Hudson River to Second Avenue.
- ❑ **Alternative D** consisted of two segments: a Palisades Bus/Truck Tunnel (a two-lane roadway starting from a new NJ Turnpike interchange near the Secaucus Transfer to the Lincoln Tunnel) and a Crosstown Subway Extension (lengthening the #7 subway line from Times Square south and west to Penn Station and the Javits Convention Center).

### **1.2.2. Phase 2—Analysis of Selected Alternatives**

In accordance with federal transit planning requirements in effect at the time, two additional alternatives were developed. The first was a No-Build alternative that involves nothing other than implementing those improvements that were already programmed and budgeted. The analysis of the No-Build alternative concluded that projected future demand for travel to Penn Station by 2020 would outstrip capacity and lead to congested conditions at the Penn Station complex. Adopting the No-Build alternative was not seen as a reasonable or responsible course of action.

The second was the Transportation System Management (TSM) alternative consisting of lower cost actions that achieve project goals through better management of the existing transit network. ARC investigated 16 TSM alternatives. Five of these proved to have merit with respect to improving the existing transit network. These were: (1) expanded use of higher capacity bi-level electric cars and coaches by NJ TRANSIT, (2) direct bus service across the George Washington Bridge to East Midtown, (3) new ferry services on the Hudson and East rivers, (4) introduction of a unified regional fare system and fare media, and (5) reopening the Herald Square pedestrian passageway under 32nd Street between Sixth and Seventh Avenues. The analysis concluded that they did not individually or collectively provide meaningful capacity relief to the Hudson River tunnels and Penn Station, or absorb a significant portion of the forecasted growth in regional demand to qualify as a reasonable or responsible alternative.

The ARC sponsoring agencies concluded that commuter rail was the best approach to resolving the future capacity needs of the Penn Station network, and that Alternative A's general concept of linking the railroads between Penn Station and Grand Central Terminal, combined with additional West-of-Hudson and Penn Station capacity, best met the ARC goals. To be consistent with the LIRR's East Side Access station at Grand Central Terminal, the Phase 2 planning process focused on a refined Alternative A, known as Alternative AA. Its key features were:

1. Through operation for all three regional commuter railroads (NJ TRANSIT, LIRR, and Metro-North) between Grand Central Terminal and Penn Station;

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

2. Addition of two new tracks to the Northeast Corridor High Line from Secaucus and a new two-track Hudson River Tunnel to Penn Station;
3. The Secaucus Loop, including a fifth track at the Secaucus Transfer Station, providing a one-seat ride from the NJ TRANSIT/Metro-North Main/Bergen, Port Jervis, and Pascack Valley lines to Manhattan;
4. Expansion of Penn Station with the addition of a new two-level station at 34th Street to be shared by the LIRR and Metro-North;
5. Extended Penn Station Tracks 1-6 and Platforms 1 and 3;
6. Expanded West Side Yard North for LIRR storage (coordinated with any Javits Center expansion);
7. New West Side Yard South, between 29th and 31st Streets west of Tenth Avenue, for midday Metro-North storage;
8. Use of the 63rd Street Tunnel by NJ TRANSIT to access Yard "A" in Sunnyside for midday storage; and
9. A possible freight alignment sharing the new Hudson River tunnel and Amtrak's West Side Line to Spuyten Duyvil, thence connecting via the Hell Gate Bridge to freight lines in Queens and points east, and the Bronx and points north.

Alternative B was found to have operational and physical feasibility problems and to be inconsistently aligned with the LIRR East Side Access project. Alternative C/CC was determined unable to ease projected Hudson River tunnel and Penn Station overcrowding. Analysis of Alternative D found that neither modal element would relieve congestion at Penn Station.

At the conclusion of Phase 2, Alternative AA had been developed to a conceptual level, and specific issues and concerns of constructibility and operability were still outstanding. The ARC sponsoring agencies initiated Phase 3 of ARC in July 1999, with the objective of verifying the constructibility and operability of Alternative AA, as well as identifying and analyzing variants to Alternative AA, in case it proved to be infeasible. Another Phase 3 objective was to identify and recommend near-term improvements to meet growing ridership demand prior to completion of a longer-term build alternative.

### **1.3. NEAR-TERM IMPROVEMENTS**

The ARC study team developed a set of 23 potential near-term improvements that could incrementally increase capacity in the Penn Station network in a 5- to 10-year time period. The value of near-term improvements would be to provide capacity enhancements until a long-term build alternative could be selected, designed, constructed, and placed into service. Three of these

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**MIS SUMMARY REPORT**

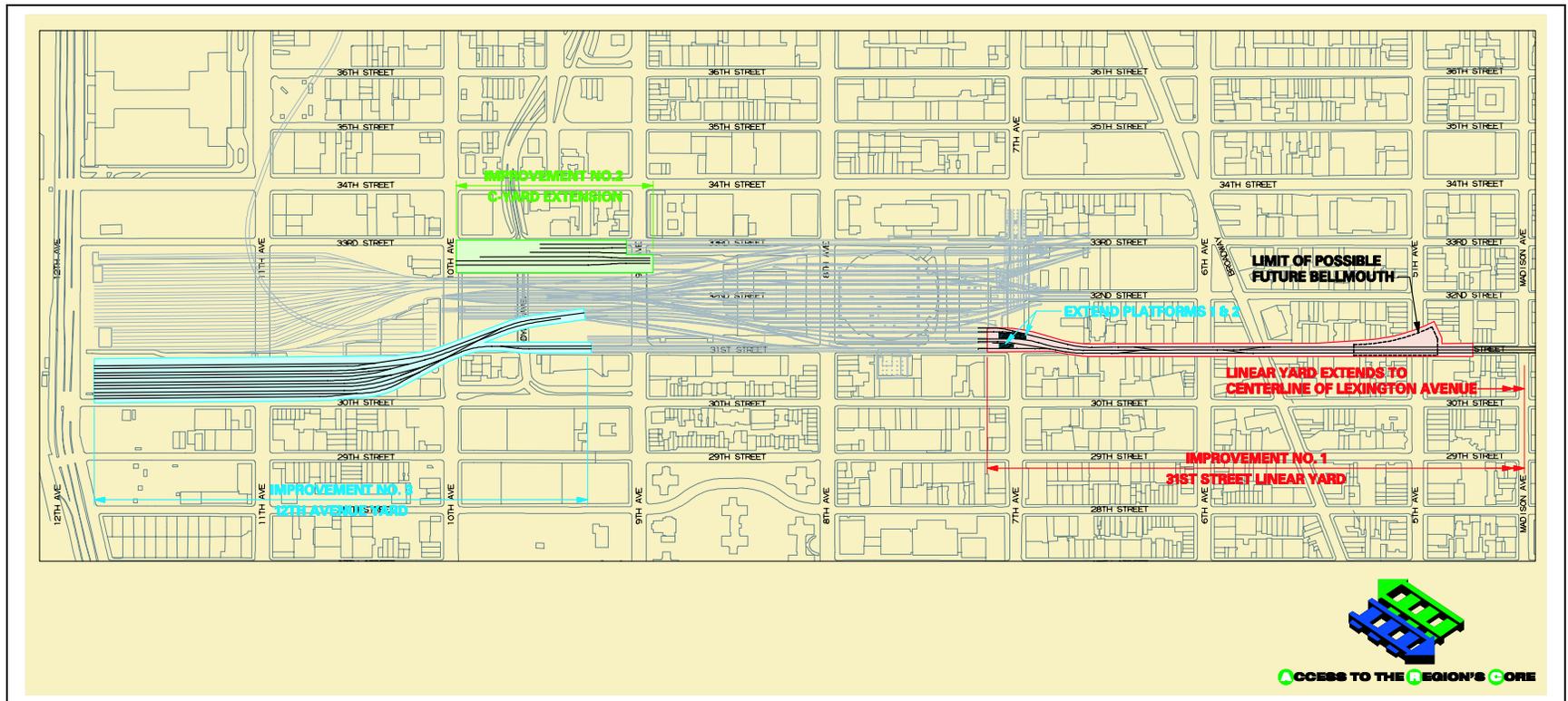
improvements (Figure 1.3-1) were selected for additional conceptual engineering studies, refinement of cost estimates, and identification of potential environmental impacts. These were:

1. ***31st Street Linear Yard.*** Breakthrough of the wall in the southeast corner of Penn Station and construction of a linear yard for NJ TRANSIT under 31st Street. Included is the easterly extension of Penn Station Tracks 1-5 to a three-track tunnel under 31st Street, providing a new storage yard for six 12-car NJ TRANSIT trains. Platforms 1 and 2 would be extended east under Seventh Avenue, and passenger connections to the street and the 34th Street station of the Seventh Avenue subway would be provided. The estimated construction cost, in 2000 dollars, not escalated to year of construction, is \$500 million.
2. ***“C” Yard Extension.*** Extension of “C” Yard Tracks 4, 5, 6, 8, 9, and 10, connected to LIRR Station Tracks 19-21, from their western ends at Ninth Avenue west to a new underground terminus that stub ends at Tenth Avenue. This would provide additional storage space for six 12-car LIRR trains north and east of the existing West Side Yard. The estimated construction cost, in 2000 dollars, not escalated to year of construction, is \$200 million.
3. ***Twelfth Avenue Yard.*** Construction of a new yard west of Tenth Avenue between 30th and 31st Streets with track access through Yard “A” from Penn Station Tracks 1-9, and Yard “E” from Penn Station Track 1. This new yard would be on MTA-owned property just south of the existing LIRR West Side Yard, and would be connected to Penn Station tracks used by NJ TRANSIT and Amtrak. It would contain 12 tracks, each able to store a 12-car train. The track layout would be similar to the existing LIRR yard, allowing space for the future placement of columns to support potential construction above the yard. The estimated construction cost, in 2000 dollars, not escalated to year of construction, is \$300 million.

Each of these three near-term improvements has independent utility and can be developed as a single improvement or in conjunction with one or both of the other improvements. Some are additionally compatible with the long-term build alternatives that were investigated during Phase 3. As service plan data was not available from the railroads at the time the near-term improvements were being developed, no operational analysis was performed to identify the associated extent of potential changes in service capacity. In addition, the feasibility of improvements 2 and 3 in relation to prospective redevelopment of the far West Side of Manhattan would have to be determined.

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MIS SUMMARY REPORT

Figure 1.3-1  
Near-Term Improvements



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**MIS SUMMARY REPORT**

**1.4. LONG-TERM BUILD ALTERNATIVES**

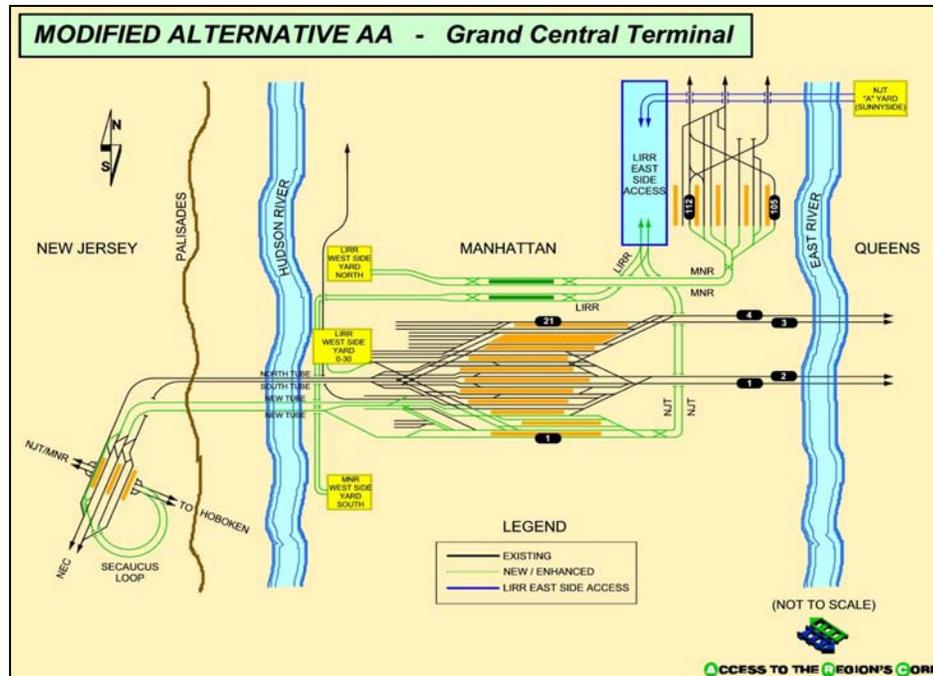
While the near-term improvements represent possible interim measures, a number of long-term build alternatives were also identified and evaluated during Phase 3.

**1.4.1. Modified Alternative AA**

Between ARC Phases 2 and 3, the location of the LIRR East Side Access terminal had been changed from the Madison Avenue Yard area adjacent to the existing Grand Central Terminal lower level to a deep site directly underneath the existing terminal, with a bi-level configuration. This required that modifications be made to the Grand Central Terminal configuration of ARC Alternative AA. In response, the ARC study team developed a “Modified Alternative AA” (Figure 1.4-1).

The East Side Access reconfiguration suggested a possible new ARC approach, linking NJ TRANSIT to the LIRR East Side Access deep station. Modified Alternative AA would extend NJ TRANSIT from Tracks 1-5 in Penn Station east to a tunnel under 31st Street, then north to the LIRR East Side Access station platform tracks. NJ TRANSIT would then continue via the new LIRR East Side Access tunnels to the lower level of the 63rd Street Tunnel under the East River and on to Yard “A” at Sunnyside. The LIRR would be extended south and then west of Grand Central Terminal in new tunnels to the lower level of a proposed 34th Street Station between Seventh and Eighth Avenues. It would be provided with a new 15-track West Side Yard North between 33rd and 34th Streets from Tenth Avenue to Twelfth Avenue.

**Figure 1.4-1**  
**Modified Alternative AA**



**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

Metro-North would gain access to the upper level of the new 34th Street Station by the construction of a breakthrough tunnel from its Grand Central Terminal Lower Level Tracks 105-112, running south and then west to the 34th Street Station. It would be provided with a new 20-track West Side Yard South between 29th and 31st Streets and between Tenth and Twelfth Avenues, with lead tracks running from the west end of the 34th Street Station.

After considerable conceptual engineering and operational and cost analyses, Modified Alternative AA was dropped from further consideration for reasons of higher construction complexity, operations risk, and costs.

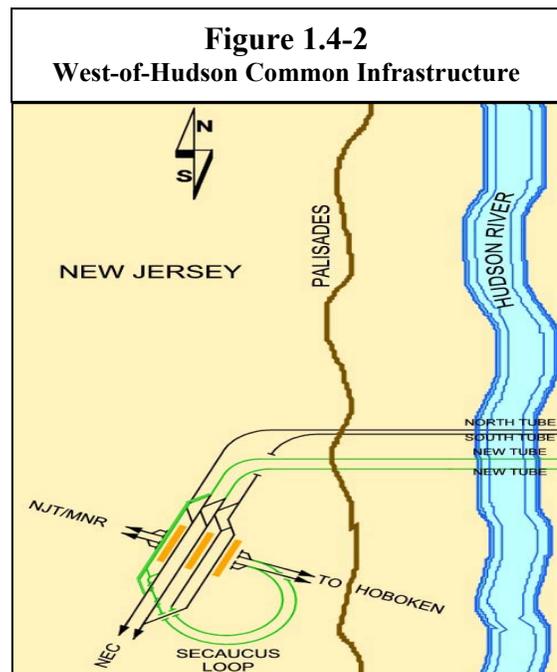
### 1.4.2. Three Additional Build Alternatives

Recognizing that Modified Alternative AA might prove to be infeasible, the ARC study team developed a list of 16 variants and subvariants at the outset of Phase 3. After consultation with LIRR, Metro-North, Amtrak, and NJ TRANSIT, these were screened down to three build alternatives (Alternatives G, P, and S) for further analysis.

#### 1.4.2.1. COMMON INFRASTRUCTURE

Alternatives G, P, and S have common infrastructure west of the Hudson River (Figure 1.4-2) from the Secaucus Transfer Station on the Northeast Corridor High Line to the new Hudson River Tunnel, including:

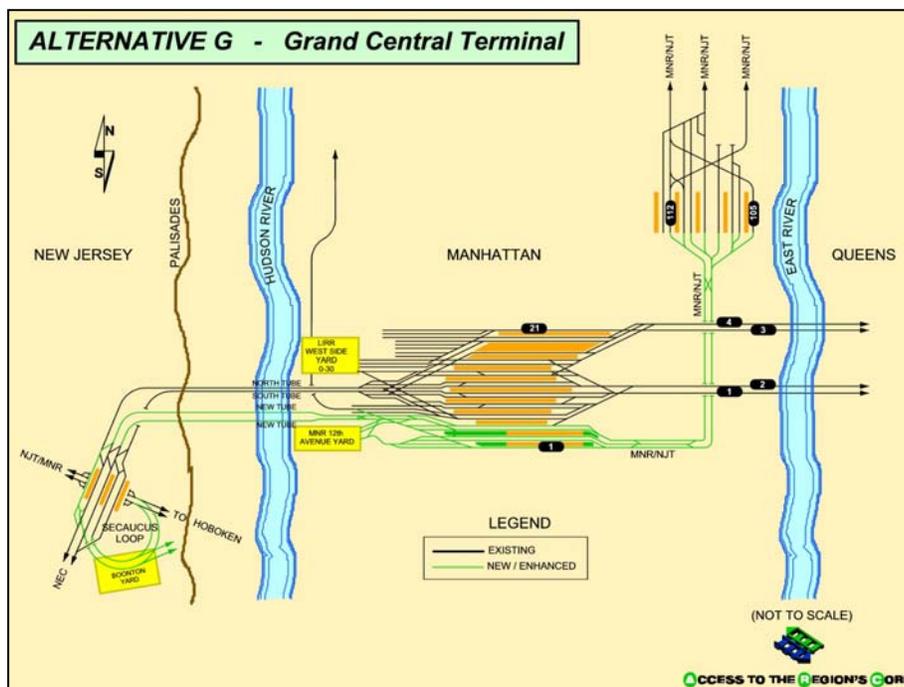
- ❑ Secaucus Loop tracks from the Main/ Bergen, Pascack Valley, and Port Jervis lines to the Northeast Corridor Line;
- ❑ Fifth track at the Secaucus Transfer Station;
- ❑ Two additional tracks on the Northeast Corridor High Line east of the Secaucus Transfer Station; and
- ❑ A two-track tunnel under the Palisades and Hudson River, located immediately south of the existing Hudson River tunnel.



### 1.5. ALTERNATIVE G

Alternative G would provide through bi-directional operation for NJ TRANSIT and Metro-North between Penn Station and Grand Central Terminal (Figure 1.5-1).

**Figure 1.5-1**  
**Alternative G**



#### 1.5.1. Penn Station Modifications

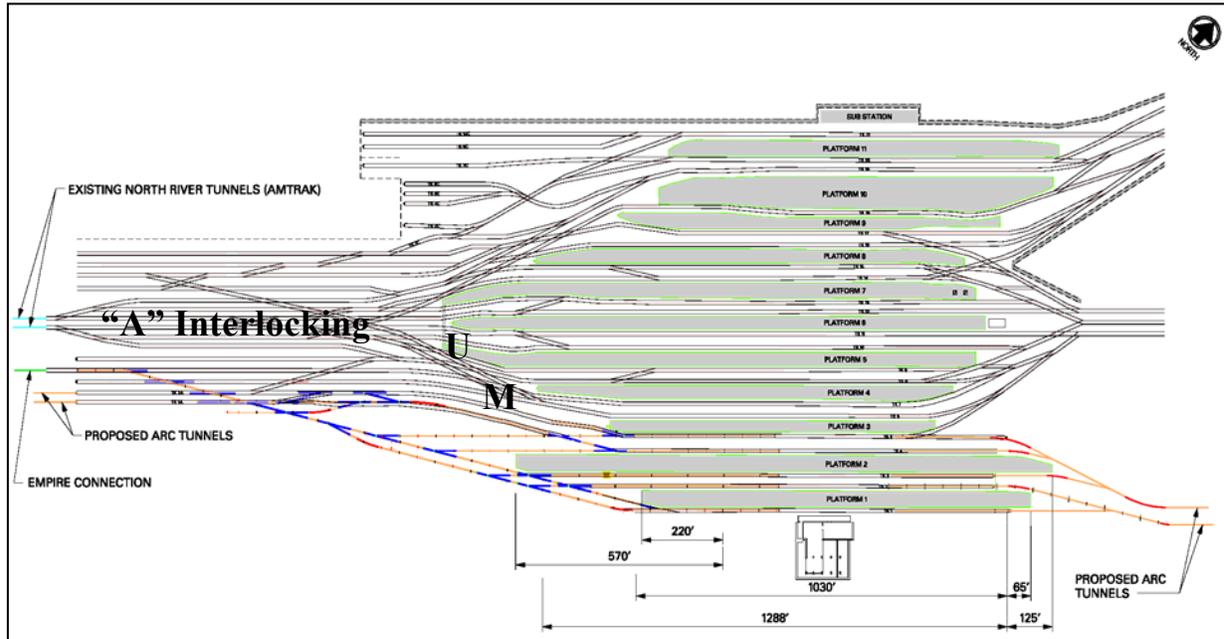
In Penn Station, trains arriving from the new Hudson River tunnels would be capable of accessing Tracks 1-9 using an expanded “A” Interlocking, though operation would be limited to Tracks 1-5 in peak service (Figure 1.5-2). To accommodate this connection, the “U” and “M” ladders would be truncated at Track 6. The existing Amtrak Mail Express (Diagonal) Platform and associated tracks would be removed to provide for a more efficient track alignment and to permit the extension of Platforms 1 and 2 westward to reach an extended West End Concourse.

The wall at the east end of Tracks 1-4 would be penetrated and a new tunnel from Tracks 1-5 extended eastward under the southwest corner of 11 Penn Plaza through a triangular easement area in the building basement to 31st Street. The foundations and subsurface structural elements of 11 Penn Plaza were constructed in the early 1920s to accommodate such a future easterly extension of the Penn Station tracks through its basement to an alignment under 31st Street. Track 5 would maintain its connection to East River Tunnel Lines 1 and 2 through “JO” Interlocking. If Near-Term Improvement No. 1, 31st Street Linear Yard (Section 1.3.), were

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

built with a bellmouth heading north, it would serve as a first step towards building the 31st Street alignment of Alternative G.

**Figure 1.5-2**  
**Penn Station Key Infrastructure Changes**



Platforms 1 and 2 would also be extended to the east, past the Seventh Avenue building line and directly below the 34th Street Station of the Seventh Avenue Subway. This would permit the construction of a direct passenger connection between the extended platforms and the subway mezzanine above.

### 1.5.2. Grand Central Terminal Modifications

Review of the Alternative AA (Phase 2) alignment at Grand Central Terminal identified design and construction concerns regarding the southward extension of Tracks 105-112. These concerns were studied in greater detail in Phase 3. A field survey was conducted to accurately identify the exact position of the underground structures, including the various subway tunnels in the vicinity. Historical construction documents were researched and compared to survey results. Using the new data and a three-dimensional computer model, the ARC study team concluded that it is physically feasible to break out of the lower level of Grand Central Terminal Tracks 105-112. However, such construction would impact the surrounding subways and buildings, as well as numerous important Grand Central Terminal support facilities located in the path of the proposed connection.

The Grand Central Terminal breakout would require relocation of the existing southbound Lexington Avenue Local track into the abandoned Shuttle Track 2, beginning at the southern end of the existing 42nd Street/Grand Central Terminal subway station (Figure 1.5-3). Construction

# ACCESS TO THE REGION'S CORE

## MIS SUMMARY REPORT

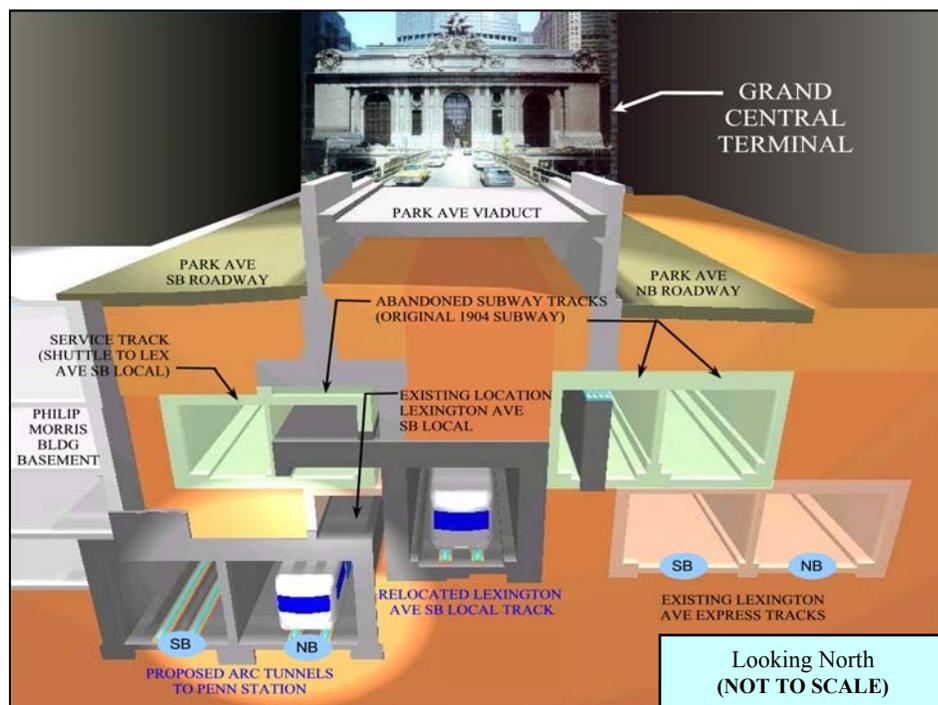
of this option would cause temporary service impacts to the Lexington Avenue Line, perhaps over an extended period of time.

### 1.5.3 Midday Train Storage

Alternative G requires space for midday storage of both NJ TRANSIT and Metro-North trains. Two primary yard locations have been identified: Twelfth Avenue Yard and Boonton Yard.

The Twelfth Avenue Yard would be identical to that described in Near-Term Improvement No. 3 (Section 1.3.) and would provide storage capacity for Metro-North trains exiting Penn Station. The ARC MIS assumed a track layout incorporating provisions for columns to support an “overbuild” recognizing the potential requirement for compatibility with proposals for West Side development.

**Figure 1.5-3**  
**Grand Central Terminal Breakout**



The Boonton Yard site is located in Secaucus south of the Northeast Corridor and the Secaucus Transfer Station (Figure 1.5-4). Access to the yard would be from the Northeast Corridor or the NJ TRANSIT Main Line via the proposed Secaucus Loop tracks as well as from Hoboken. The yard would provide space for 20-25 train sets, and be used by NJ TRANSIT and possibly Metro-North should capacity beyond that available in the Twelfth Avenue Yard be necessary.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

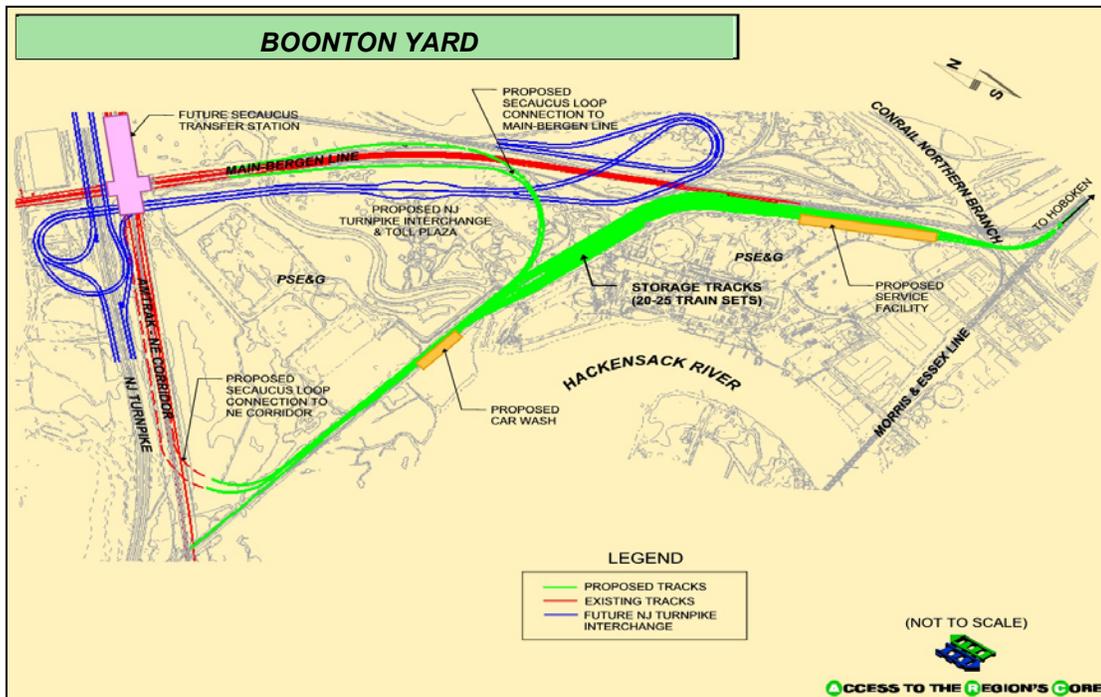
**1.5.4. Construction Cost Estimate**

The total estimated construction cost for Alternative G, including the Twelfth Avenue and Boonton Yards, is approximately \$2.9 to \$3.1 billion, in 2000 dollars, not escalated to year of construction. The cost estimates presented here, and for the following alternatives, are based on the conceptual planning performed to date, and may be modified as future engineering analyses are completed.

**1.5.5. Operations Analysis**

The Post-Secaucus Service Plan consists of schedules and service levels planned for Penn Station after completion of the Secaucus Transfer Project. These schedules, for the AM peak hour, projected 21 NJ TRANSIT trains plus two Amtrak trains (using four slots) to be moving eastbound through the existing Hudson River tunnels, for a total of 23 trains (25 slots). This included a shift of Clocker Service from Amtrak to NJ TRANSIT.

**Figure 1.5-4  
Boonton Yard**



The projected Metro-North 2020 service plan was used as a basis for future train movements into and out of Grand Central Terminal. This service plan included 11 trains in the AM peak hour arriving at the lower level of Grand Central Terminal. The combined Post-Secaucus Service Plan/Metro-North operating plan was the foundation for simulating train movements between the Secaucus Transfer Station, Penn Station, and Grand Central Terminal.

## **ACCESS TO THE REGION'S CORE**

### **MIS SUMMARY REPORT**

Detailed physical and operating characteristics of NJ TRANSIT, Amtrak, and Metro-North were used to simulate the functional, fully integrated rail network to be in place by 2020. The capacity analysis determined the maximum number of trains capable of operating in the AM peak hour in the key segments, Secaucus to Penn Station and Penn Station to Grand Central Terminal. The results yielded a conceptual service plan that indicated an increase of 13 additional NJ TRANSIT inbound trains (Secaucus to Penn Station) over the Post-Secaucus Service Plan during the AM peak hour, for an inbound total of 36 trains (34 NJ TRANSIT, two Amtrak) occupying 38 slots. Additional service beyond the 13 would make the entire operation unreliable.

During the AM peak hour, 20 NJ TRANSIT trains would travel from Penn Station to Grand Central Terminal. Of these, 13 would turn in Grand Central Terminal and head back south to Penn Station and points west. To allow NJ TRANSIT trains to enter Grand Central Terminal, the conceptual service plan requires that nine of the 11 Metro-North trains arriving at the lower level of Grand Central Terminal in the AM peak hour would continue through the new tunnels to Penn Station and thence to either the Twelfth Avenue Yard or the Boonton Yard for storage. The remaining two Metro-North trains and seven NJ TRANSIT trains would head north from the lower level of Grand Central Terminal in revenue and non-revenue service.

Circulation improvements would be needed at both Penn Station and Grand Central Terminal, the latter having certain landmark preservation considerations, to accommodate incremental pedestrian flows.

#### **1.5.5.1. FLEET REQUIREMENTS AND ACQUISITION COSTS**

New rolling stock, a combination of dual power locomotives, cab cars, and bi-level coaches, would have to be acquired by NJ TRANSIT to support the Alternative G service plan. It is estimated that NJ TRANSIT would have to obtain 13 additional train sets after redeployment of its current fleet, while Metro-North would not have to purchase any additional equipment.

As NJ TRANSIT and Metro-North trains will share the same tracks and tunnels between Penn Station and Grand Central Terminal and in operations north of Grand Central Terminal, NJ TRANSIT will have to purchase dual-power diesel/electric locomotives equipped with a transitional (flip) shoe to allow operation on Metro-North under-running third rail. These locomotives would also be able to operate on over-running third rail on Penn Station Tracks 5 and above.

Depending on the average consist of the added train sets, the estimated cost of this equipment is approximately \$186 to \$255 million in 2000 dollars, not escalated to year of purchase.

#### **1.5.5.2. OPERATING AND MAINTENANCE COSTS**

NJ TRANSIT's estimated annual operating and maintenance costs would increase under Alternative G by approximately \$43 to \$54 million, in 2000 dollars. Rail operating and maintenance costs would be partially offset by incremental fare revenue of approximately \$54 million to be generated from passengers attracted to Alternative G service. Thus, the net change

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

in estimated operating and maintenance costs is projected to either remain unchanged or decrease by up to \$13 million, in 2000 dollars. A fuller accounting would include incremental operating and maintenance costs and revenues associated with the extension of Metro-North Railroad service to Penn Station and storage sites on the West Side and in New Jersey. These figures were not developed.

## **1.6. ALTERNATIVE P**

Alternative P would provide a new terminal station underneath and operationally separate from the existing Penn Station. Figure 1.6-1 presents a cross-section of the revised Penn Station infrastructure at a point between Seventh and Eighth Avenues, looking west. The new station would be comprised of eight, 12-car tracks with four island platforms in two large caverns, each housing four tracks (two over two), two platforms (one over one) and a mezzanine above both levels. Significant new pedestrian spaces would be created to link the new mezzanine with the existing Penn Station and with local streets, providing adequate circulation. In Manhattan, a flexed approach was developed to transition from two tracks at the Hudson River bulkhead (indicated in yellow in Figure 1.6-2) to eight tracks at the new station area.

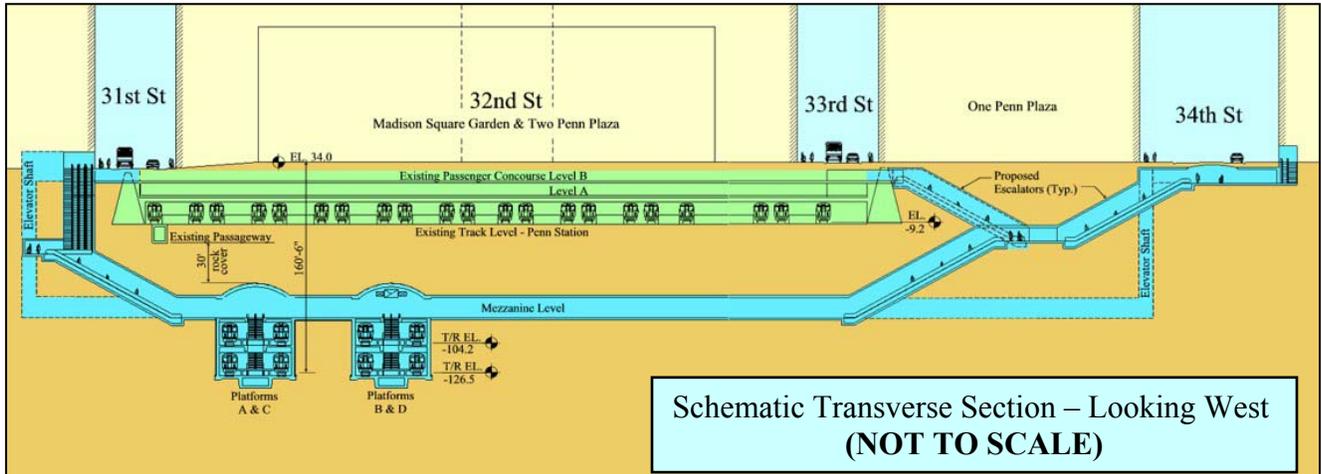
### **1.6.1. Tail Tracks**

The feasibility and benefits of an optional design feature was explored, extending eight, 12-car tail tracks east from the new lower level station terminus to Broadway, between 31st and 32nd Streets. The benefits of constructing tail tracks would include:

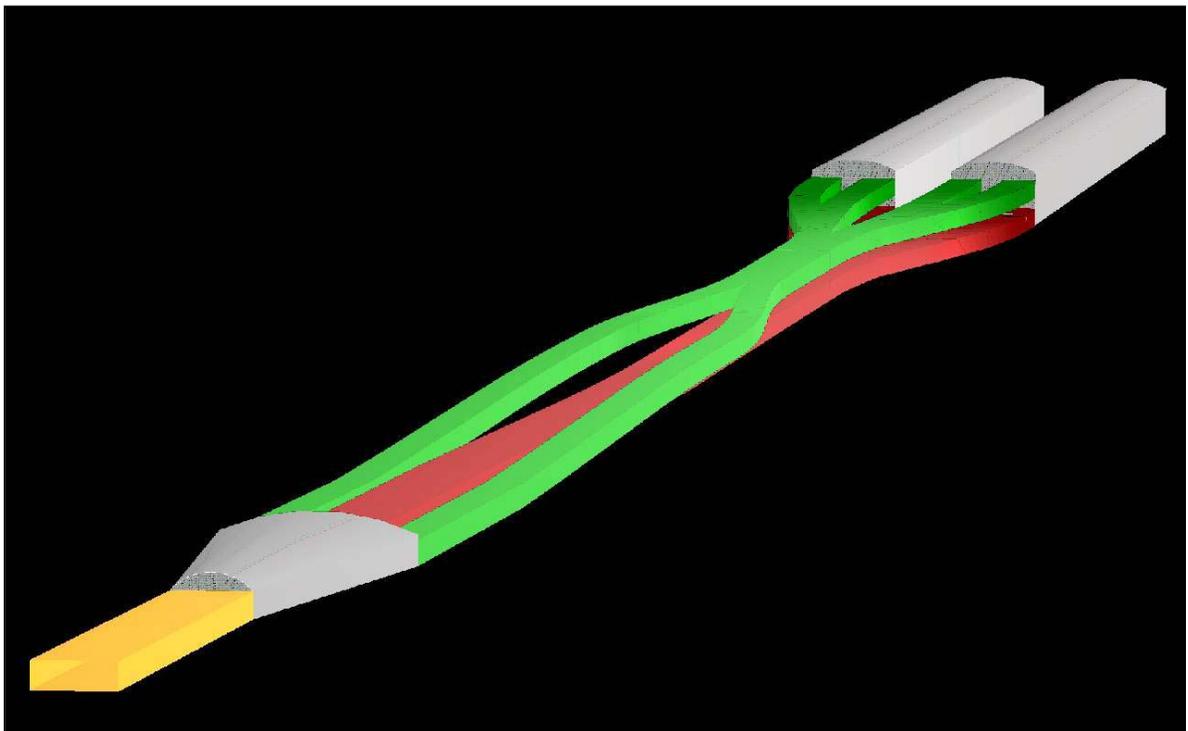
- ❑ Improved service performance and reliability,
- ❑ Means for disposing of disabled trains,
- ❑ Ability to stage trains for the afternoon peak, and
- ❑ First stage of possible future extension to either Sunnyside Yard or the vicinity of Grand Central Terminal.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Figure 1.6-1**  
**Alternative P**



**Figure 1.6-2**  
**Alternative P – Flexed Approach**



**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

### **1.6.2. Midday Train Storage**

Alternative P requires that approximately 20-25 NJ TRANSIT trains be stored during midday between the AM and PM peak periods. Boonton Yard (Section 1.5.3.), with a capacity of approximately 240 cars or 20-25 train sets, would accommodate this need.

### **1.6.3. Construction Cost Estimate**

The total estimated construction cost for Alternative P at this level of conceptual planning, including Boonton Yard, is approximately \$2.9 to \$3.2 billion, in 2000 dollars, not escalated to year of construction. The addition of eight tail tracks would add about \$350 to \$380 million to this cost estimate.

### **1.6.4. Operations Analysis**

The Post-Secaucus Service Plan was used as the basis for specifying future levels and frequencies of train movements between Secaucus and Penn Station. This analysis considered the Post-Secaucus Service Plan neutral to Alternative P operations, with the existing areas of Penn Station operating as they would have under the Post-Secaucus Service Plan. The baseline analysis was performed with eight tracks stub-ending at the eastern end of the new lower level station. A second analysis was performed assuming the addition of the optional eight tail tracks.

As the Alternative P station tracks would be on two levels, the dynamics of train operation are inherently different than those involving a station with a single-track level. The operational advantage of the bi-level concept for eight tracks is that four inbound and four outbound trains can be moving simultaneously: two trains to and from the upper level and two trains to and from the lower level. The resulting throughput optimizes train movements and, therefore, capacity using the new Hudson River tunnel.

Under the baseline stub-ended configuration, the conceptual service plan indicated that 21 additional NJ TRANSIT inbound trains could be operated during the AM peak hour, for a total of 44 trains (42 NJ TRANSIT, two Amtrak) using 46 train slots. Additional trains beyond the 44 would make the operation subject to delays and compromise reliability. Under the optional tail track configuration, terminal capacity could be increased by 29 trains in the AM peak hour for an inbound total of 52 trains (50 NJ TRANSIT, two Amtrak) using 54 train slots. In each case, the incremental train service would operate to the new station facility, separate from the existing facilities.

#### **1.6.4.1. FLEET REQUIREMENTS AND ACQUISITION COSTS**

In Alternative P, NJ TRANSIT will not share track or right-of-way between Secaucus and Penn Station with any other railroad, making it possible to utilize overhead catenary to supply propulsion power, and thus allowing use of NJ TRANSIT's locomotives, coaches, and electric multiple units (EMUs). Additional rolling stock would have to be acquired to support the

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

Alternative P service levels, including dual-powered locomotives to provide one-seat service on non-electrified line segments. The estimated number of additional train sets required after redeployment of its current fleet is 29 with the stub-ended tracks and 37 with the tail tracks. The estimated cost is approximately \$410 to \$563 million for the stub-end configuration. For the optional tail track configuration, the estimated cost is \$522 to \$716 million. These equipment cost estimates are in 2000 dollars, not escalated to year of purchase.

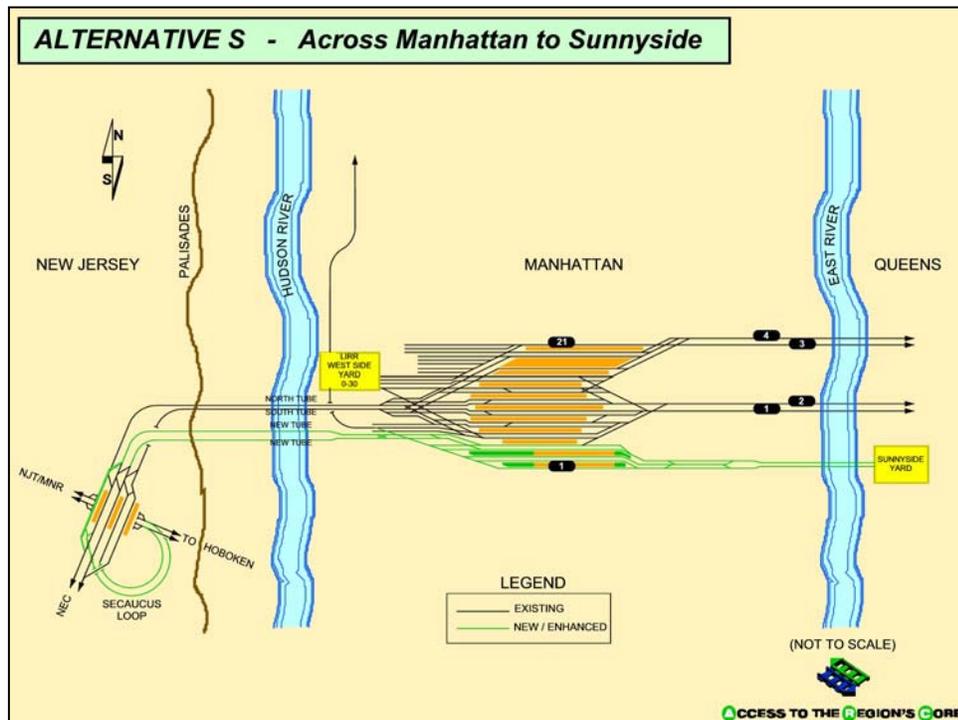
**1.6.4.2. OPERATING AND MAINTENANCE COSTS**

The annual estimated operating and maintenance costs would increase by approximately \$77 to \$94 million for the stub-end configuration and \$94 to \$115 million with tail tracks. Operating and maintenance costs would be partially offset by incremental fare revenues of approximately \$37 million (stub-end) or \$41 million (tail tracks). Thus, the net change in annual operating and maintenance costs for the stub-end operation is approximately \$40 to \$57 million in 2000 dollars. The net annual change for the tail track option is approximately \$53 to \$74 million. Operating and maintenance costs were estimated in 2000 dollars.

**1.7. ALTERNATIVE S**

Alternative S would provide added facilities for through operation at Penn Station, and for access to Sunnyside Yard for midday storage (Figure 1.7-1).

**Figure 1.7-1**  
**Alternative S**



**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**1.7.1. Penn Station Modifications**

The Alternative S alignment and modifications in and west of Penn Station are identical to those described in Alternative G (Section 1.5), and thus the associated challenges and benefits are similar. Should the three-track Linear Yard Near-Term Improvement (Section 1.3) be constructed in advance of Alternative S, two tracks would continue east of Lexington Avenue when Alternative S is implemented.

**1.7.2. Sunnyside Yard Approach**

In Queens, the new tunnel would be aligned under 54th Avenue to Vernon Boulevard, then curve north, beginning a gradual ascent to Sunnyside Yard. It would pass below the Pulaski Bridge, the Long Island Expressway elevated structure, and the Hunters Point Avenue Bridge. Within Sunnyside Yard, it would pass below the elevated LIRR Montauk Branch aerial structure and ascend to a tunnel portal just north of Newtown Creek.

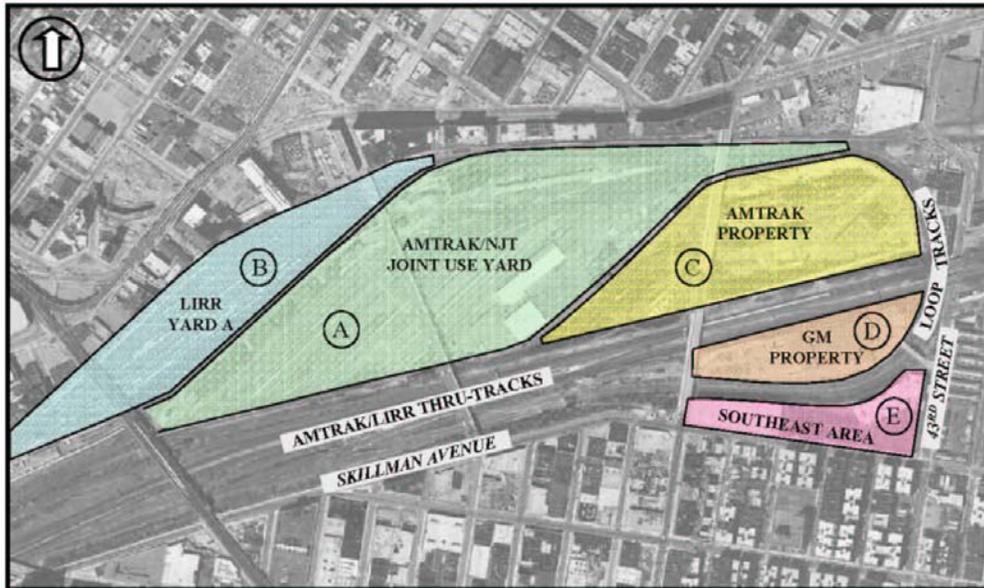
**1.7.3. Midday Train Storage at Sunnyside Yard**

Sunnyside Yard is a critical element of Alternative S. If the yard is incapable of storing additional NJ TRANSIT trains, Alternative S is infeasible. The Sunnyside Yard complex is divided into five distinct areas (Figure 1.7-2):

- A. The Joint Use Yard shared by Amtrak and NJ TRANSIT;
- B. LIRR's Yard A north and west of the Joint Use Yard;
- C. The Amtrak property south and west of the Joint Use Yard owned by Amtrak and not currently used for train storage;
- D. A built up parcel, known as the General Motors property between the LIRR Main Line and the Sunnyside Yard Loop Tracks; and
- E. The Southeast Properties outside of but adjacent to the Sunnyside Yard boundaries, bordered by the Loop Tracks on the north, 39th Street on the west, Skillman Avenue on the south, and 43rd Street on the east.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Figure 1.7-2**  
**Sunnyside Yard**



Each of these five areas was studied to determine the feasibility of developing a new midday train storage facility for use by NJ TRANSIT. These investigations concluded that the Amtrak property is the best option for use as a midday storage yard in Alternative S, assuming that MTA/New York City Transit (NYCT) does not purchase this site. Acquisition and development by NJ TRANSIT could nearly double the current storage capacity of the Joint Use Yard. The site would accommodate 35-38 train sets and the required support facilities and functions, including a car wash and a maintenance building. Negotiations for transfer of the unused Amtrak property from Amtrak to NYCT for use as a subway storage yard are ongoing, and thus the availability of that site for ARC purposes is uncertain. LIRR's Yard A is reserved for mid-day storage of East Side Access trains. No other viable space for midday storage of NJ TRANSIT trains east of Penn Station emerged from this analysis.

#### **1.7.4. Construction Cost Estimate**

The total estimated construction cost for Alternative S at this level of conceptual planning, including the Amtrak property at Sunnyside Yard, is approximately \$3.2 to \$3.4 billion in 2000 dollars, not escalated to year of construction.

#### **1.7.5. Operations Analysis**

The Alternative S conceptual service plan was developed in a manner similar to the service plans for Alternatives G and P. The capacity analysis indicated an increase of 17 additional NJ TRANSIT inbound trains (Secaucus to Penn Station) over the Post-Secaucus Service Plan during

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

the AM peak hour, for an inbound total of 40 trains (38 NJ TRANSIT, two Amtrak) occupying 42 slots. Additional service beyond this level would compromise the entire operation's reliability.

**1.7.5.1. FLEET REQUIREMENTS AND ACQUISITION COSTS**

NJ TRANSIT will not share track or right-of-way between Secaucus and Sunnyside Yard with any other railroad, and equipment procurements will conform to both the fleet specifications presently utilized and to dual-mode locomotives operable on electrified and non-electrified lines. The estimated number of additional train sets required after redeployment of its current fleet is 22. The estimated cost is approximately \$306 to \$410 million, in 2000 dollars, not escalated to year of purchase.

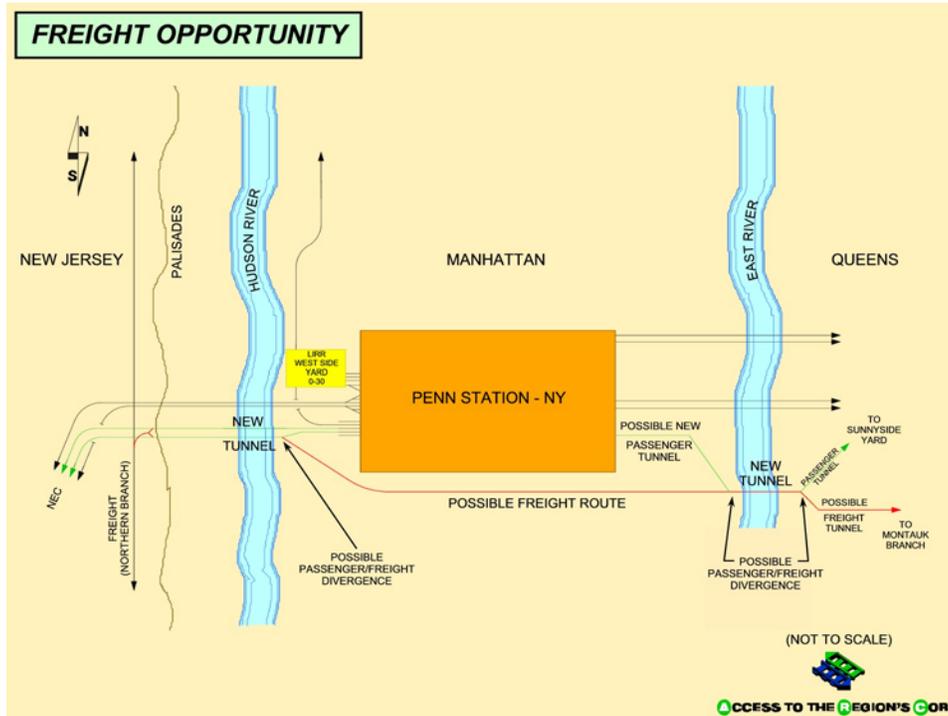
**1.7.5.2. OPERATING AND MAINTENANCE COSTS**

The estimated change in annual operating and maintenance costs would be approximately \$57 to \$71 million in 2000 dollars. These cost increases would be partially offset by increased fare revenue of approximately \$33 million generated from passengers attracted to the proposed Alternative S service. This would result in a net increase in annual operating and maintenance costs ranging from \$24 to \$38 million.

**1.8. FREIGHT OPPORTUNITY**

Although the ARC long-term build alternatives analyzed during Phase 3 provide only for passenger rail services, construction of a new Hudson River tunnel offers an opportunity to make provision for future freight service in addition to commuter rail service. A freight alignment capable of being implemented with all build alternatives was developed. It consists of a shared passenger/freight Hudson River tunnel and a dedicated cross-Manhattan freight tunnel deep under 31st Street connecting to a new East River tunnel (either dedicated freight or shared with passenger trains in Alternative S), and then connecting to the LIRR Montauk Branch in Queens (Figure 1.8-1). Because of the high density of commuter rail operations, freight service could not operate during peak hours and could be limited even during off-peak hours.

**Figure 1.8-1**  
**Freight Opportunity Alignment**



This freight opportunities analysis was coordinated with the sponsor of the NYC Economic Development Corporation’s Cross Harbor Freight MIS/DEIS and with the respective federal oversight agencies. ARC’s freight effort was limited to an examination of the physical modifications and incremental costs of constructing the new Hudson River tunnel to accommodate modern rail freight equipment, and to the development of a conceptual alignment, compatible with the ARC build alternatives, linking the new tunnel with available rail freight routes in New Jersey and Queens. The estimated incremental cost to modify the tunnel and track connections to handle freight traffic is in the range of \$146 to \$158 million in 2000 dollars.

**1.9. TRAVEL DEMAND RIDERSHIP FORECASTS**

As ARC is a bi-state study with overlapping jurisdictions, the ridership forecasts were developed based upon two travel demand models:

- ❑ The North Jersey Travel Demand Forecasting Model, which estimates future transit demand to Midtown Manhattan from areas west of the Hudson River; and
- ❑ The MTA Regional Transportation Forecasting Model, which estimates demand for areas east of the Hudson River.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

Adjustments to the models were made to avoid any double counting of Rockland and Orange County commuters.

A ridership demand of 28,500 trans-Hudson rail passengers from NJ TRANSIT and Metro-North market areas west of the Hudson River is forecast for the 2020 AM peak-hour No-Build condition. This figure reflects unconstrained trans-Hudson demand and is in excess of the 23,000-24,000 seats expected to be available to Penn Station. Therefore, this rail passenger demand could not be accommodated without new infrastructure.

The 2020 ridership forecasts of AM peak-hour trans-Hudson rail passengers for the build alternatives ranged from approximately 35,400 to 37,800, figures considered to be equivalent at this level of planning. Each of the build alternatives provides new infrastructure that cannot only accommodate the 2020 No-Build demand forecast, but can also meet growth in demand resulting from the new trans-Hudson tunnel and other investments.

**1.9.1. Alternative G**

In Alternative G, about 37,800 trans-Hudson passengers have been forecast for the 2020 AM peak hour. Of these passengers, more than 13,400, or 36%, would continue on to Grand Central Terminal (Table 1.9-1).

**Table 1.9-1  
Alternative G Ridership Forecast – NJ TRANSIT**

<b>AM Peak Hour</b>			
<b>Facility</b>	<b>1990 Base</b>	<b>2020 No-Build*</b>	<b>Alternative G</b>
Penn Station	11,436	28,539*	24,344
Grand Central Terminal	0	0	13,415
<b>Total</b>	11,436	28,539*	<b>37,759</b>
<b>*Unconstrained demand, Penn Station one hour capacity is approximately 23,000-24,000</b>			
<b>AM Peak Two Hours</b>			
<b>Facility</b>	<b>1990 Base</b>	<b>2020 No-Build</b>	<b>Alternative G</b>
Penn Station	15,414	40,457	34,244
Grand Central Terminal	0	0	18,870
<b>Total</b>	15,414	40,457	<b>53,114</b>

Alternative G also extends Metro-North service from Grand Central Terminal to Penn Station. This is estimated to attract nearly 2,600 Metro-North passengers (6% of the 44,300 total Metro-North passengers to Grand Central Terminal) in the AM peak-hour forecast to continue on to Penn Station (Table 1.9-2).

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Table 1.9-2**  
**Alternative G Ridership Forecast - Metro-North Railroad**

<b>AM Peak Hour</b>			
<b>Facility</b>	<b>1995 Base</b>	<b>2020 No-Build</b>	<b>Alternative G</b>
Grand Central Terminal	34,751	44,277	41,716
Penn Station	0	0	2,593
<b>Total</b>	<b>34,751</b>	<b>44,277</b>	<b>44,309</b>
<b>AM Peak Two Hours</b>			
<b>Facility</b>	<b>1995 Base</b>	<b>2020 No-Build</b>	<b>Alternative G</b>
Grand Central Terminal	55,585	71,165	67,049
Penn Station	0	0	4,157
<b>Total</b>	<b>55,585</b>	<b>71,165</b>	<b>71,206</b>

Compared to the ARC No-Build alternative, Alternative G will transfer approximately 9,400 daily auto trips to NJ TRANSIT commuter rail, and will also transfer approximately 27,000 more trans-Hudson trips to rail from all other transit modes (Table 1.9-3).

**Table 1.9-3**  
**Alternative G Average Weekday Modal Diversions - NJ TRANSIT**

<b>Mode</b>	<b>Alternative G</b>
<b>Total Auto</b>	<b>(9,402)</b>
<b>Total Transit</b>	<b>9,402</b>
Rail	36,204
PATH	(3,393)
Bus	(22,234)
Ferry	(1,175)

**1.9.2. Alternative P**

In Alternative P, about 35,800 NJ TRANSIT trans-Hudson railroad passengers are forecast in the 2020 AM peak hour for the stub-end configuration. The option with tail tracks, which permits up to eight more peak-hour trains to New York, would attract about 36,900 railroad passengers, or about 1,100 more than the stub-end operation (Table 1.9-4).

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Table 1.9-4**  
**Alternative P Penn Station Ridership Forecast - NJ TRANSIT**

<b>AM Peak Hour</b>					
	<b>1990 Base</b>	<b>2020 No-Build*</b>		<b>Alternative P</b>	
	<b>Passengers</b>	<b>Trains</b>	<b>Passengers</b>	<b>Trains</b>	<b>Passengers</b>
Stub-Ended	11,436	21	28,539*	42	35,804
Tail Tracks	11,436	21	28,539*	50	36,944
<b>*Unconstrained demand, Penn Station one hour capacity is approximately 23,000-24,000</b>					
<b>AM Peak Two Hours</b>					
	<b>1990 Base</b>	<b>2020 No-Build</b>		<b>Alternative P</b>	
	<b>Passengers</b>	<b>Trains</b>	<b>Passengers</b>	<b>Trains</b>	<b>Passengers</b>
Stub-Ended	15,414	40	40,457	77	50,378
Tail Tracks	15,414	40	40,457	85	51,983

Compared to the ARC No-Build alternative, Alternative P would attract approximately 4,600 (stub-ended) or 5,500 (optional tail tracks) daily trans-Hudson auto trips to transit, and will also transfer approximately 21,000 (stub-ended) or 24,000 (tail tracks) trans-Hudson trips from all modes to NJ TRANSIT commuter rail (Table 1.9-5).

**Table 1.9-5**  
**Alternative P Average Weekday Modal Diversions - NJ TRANSIT**

<b>Mode</b>	<b>Stub-Ended</b>	<b>Tail Tracks</b>
<b>Total Auto</b>	<b>(4,647)</b>	<b>(5,614)</b>
<b>Total Transit</b>	<b>4,647</b>	<b>5,614</b>
NJ TRANSIT Rail	21,339	24,321
PATH	(1,062)	(1,249)
Bus	(14,646)	(16,278)
Ferry	(984)	(1,180)

**1.9.3. Alternative S**

Alternative S is forecast to attract about 35,400 trans-Hudson passengers to Penn Station in the AM peak hour (Table 1.9-6).

**ACCESS TO THE REGION'S CORE**  
MIS SUMMARY REPORT

**Table 1.9-6**  
**Alternative S Penn Station Ridership Forecast - NJ TRANSIT**

AM Peak Hour				
1990 Base	2020 No-Build*		Alternative S	
Passengers	Trains	Passengers	Trains	Passengers
11,436	21	<b>28,539*</b>	38	35,353
<i>*Unconstrained demand, Penn Station one hour capacity is approximately 23,000-24,000</i>				
AM Peak Two Hours				
1990 Base	2020 No-Build		Alternative S	
Passengers	Trains	Passengers	Trains	Passengers
15,414	40	40,457	70	49,744

Compared to the ARC No-Build alternative, Alternative S would attract approximately 4,200 daily trans-Hudson auto trips to transit, and will also transfer approximately 19,000 daily trans-Hudson trips from all modes to NJ TRANSIT commuter rail (Table 1.9-7).

**Table 1.9-7**  
**Alternative S Average Weekday Modal Diversions - NJ TRANSIT**

Mode	Alternative S
<b>Total Auto</b>	<b>(4,192)</b>
<b>Total Transit</b>	<b>4,192</b>
NJ TRANSIT Rail	18,927
PATH	(828)
Bus	(13,172)
Ferry	(735)

## 1.10. COMPARATIVE SUMMARY OF RESULTS

The primary results of the rigorous quantitative analyses that were undertaken are summarized below.

### 1.10.1. Capital Costs

A comparison of the estimated capital costs for the build alternatives is presented in Table 1.10-1. These costs are estimated based on the conceptual-planning level of information developed in this phase of analysis, and are likely to change as further engineering, operations, and community impact analyses are undertaken. They provide a good basis for comparison among the ARC alternatives.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Table 1.10-1**  
**Estimated Capital Costs**  
**(2000\$)**

<b>Alternative</b>	<b>Construction Costs*</b>	<b>Equipment Costs**</b>	<b>Real Estate Costs***</b>
G	\$2.9-\$3.1 billion	\$186-\$255 million	Highest
P (Stub-ended)	\$2.9-\$3.2 billion	\$410-\$563 million	Lowest
P (Tail tracks)	\$3.3-\$3.6 billion	\$522-\$716 million	Middle
S	\$3.2-\$3.4 billion	\$306-\$410 million	Middle

\*In 2000 dollars, not escalated to year of construction.

\*\*Net cost after reallocation of NJT equipment from Hoboken Division.

\*\*\*Costs for real estate acquisitions and easements TBD in DEIS. Anticipated rankings shown.

### 1.10.2. Operating and Maintenance Costs

A comparison of the annual incremental operating and maintenance costs incurred by NJ TRANSIT for the build alternatives is presented in Table 1.10-2.

**Table 1.10-2**  
**Estimated Annual Incremental Operating and Maintenance Costs**  
**(2000\$)\***

<b>Alternative</b>	<b>Gross Operating Costs</b>	<b>Passenger Revenue</b>	<b>Net Operating Costs</b>
G**	\$43-\$54 million	\$54 million	(\$0-\$13 million)
P (Stub-ended)	\$77-\$94 million	\$37 million	\$40-\$57 million
P (Tail tracks)	\$94-\$115 million	\$41 million	\$53-\$74 million
S	\$57-\$71 million	\$33 million	\$24-\$38 million

\*In 2000 dollars, not escalated to year of implementation.

\*\*Alt. G figures do not include any changes in MNRR costs and revenues.

### 1.10.3. Trans-Hudson Capacity Increase

All of the build alternatives would provide the capacity to accommodate their respective forecast 2020 West-of-Hudson AM peak-hour railroad ridership demands. These demands are presented in Table 1.10-3.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**Table 1.10-3**  
**Trans-Hudson 2020 Ridership Forecast – AM Peak Hour**

<b>Alternative</b>	<b>Total Peak Hour Trains</b>	<b>1990 Base</b>	<b>2020 Total T-H Passengers</b>
G	34	11,436	37,759*
P (Stub-ended)	42	11,436	35,804
P (Tail tracks)	50	11,436	36,944
S	38	11,436	35,353

\*24,344 to Penn Station and 13,415 to Grand Central Terminal. In addition to trans-Hudson passengers, an additional 2,593 persons would travel to Penn Station via Metro-North trains from Grand Central Terminal.

**1.10.3.1. MODAL DIVERSIONS**

Compared to the ARC No-Build alternative, all build alternatives would transfer significant numbers of daily West-of-Hudson trips from auto, PATH, bus, and ferry to commuter rail (Table 1.10-4). This will free up capacity in the Lincoln and Holland tunnels, PATH, and trans-Hudson ferry operations, as well as on buses in the XBL to the Lincoln Tunnel and the Port Authority Bus Terminal.

**Table 1.10-4**  
**Average Weekday Modal Diversions - NJ TRANSIT**

<b>Mode</b>	<b>Alt. G</b>	<b>Alt. P (Stub)</b>	<b>Alt. P (Tail)</b>	<b>Alt. S</b>
<b>Total Auto</b>	<b>(9,402)</b>	<b>(4,647)</b>	<b>(5,614)</b>	<b>(4,192)</b>
<b>Total Transit</b>	<b>9,402</b>	<b>4,647</b>	<b>5,614</b>	<b>4,192</b>
Commuter Rail	36,204	21,339	24,321	18,927
PATH	(3,393)	(1,062)	(1,249)	(828)
Bus	(22,234)	(14,646)	(16,278)	(13,172)
Ferry	(1,175)	(984)	(1,180)	(735)

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

## **1.11. CONCLUSIONS AND RECOMMENDED NEXT STEPS**

The technical work of the ARC project has ranged from regional systems planning to conceptual design of three potential alignment alternatives. After concluding in Phases 1 and 2 that rail capacity at Penn Station should be expanded to serve growing demand, the primary aim of Phase 3 was to evaluate specific alignment alternatives and select one or more for advancement to the next phase of the project development process (i.e., preparation of a Draft Environmental Impact Statement). The work included the preparation of alignment configuration conceptual design plans, cost estimates, operations analyses, ridership forecasts and transportation and environmental impact analyses.

The results described in this report indicate that Alternatives G, P, and S would meet the key goal of ARC—providing increased rail capacity between Midtown Manhattan and points west of the Hudson River. The analyses demonstrated that each has attractive points as well as drawbacks. The results are summarized below.

### **1.11.1. Alternative G Conclusions**

Penn Station and Grand Central Terminal were both designed to be expandable to accommodate future operating changes. Penn Station was built to enable tracks 1-5 to be extended eastward into a future tunnel under 31st Street. Grand Central Terminal was designed to allow for a breakout from its lower level southward. Alternative G was configured to take advantage of these opportunities, accommodating in concept both Metro-North and NJ TRANSIT trains at both stations and providing one-seat service to both the east and west sides of Midtown Manhattan for their customers. As in Alternative S, the ARC trans-Hudson tunnel would permit off-peak closure (for maintenance) of one tunnel serving Penn Station while maintaining service in the other. Other benefits include provision of a direct pedestrian connection between Platforms 1 and 2 and the Seventh Avenue subway line (34th Street Station), and increased capacity at those platforms. Two of the near-term improvements (the 31st Street Linear Yard and the Twelfth Avenue Yard) could serve as preliminary phases of Alternative G.

Although the conversion of Metro-North and NJ TRANSIT operations from stub-end to flow-through movements was determined to be physically feasible, there would be impacts on NYCT subway structures and the operations support systems at Grand Central Terminal. Uncertainties over the extent to which these impacts could be mitigated could not be resolved satisfactorily during the Phase 3 effort. Alternative G would offer the smallest incremental increase in trans-Hudson train capacity among the alternatives and would create complex train operations that could affect the operational reliability of the respective railroads. Construction of Alternative G would require negotiation of easements or purchase of a large number of Manhattan properties. In addition, the physical impacts of construction on the ability to maintain existing operations appear to be significant.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**1.11.2. Alternative P Conclusions**

After considering and rejecting expansion of facilities to the immediate south of Penn Station, this alternative was designed to create a major new stub-ended station facility underneath the existing tracks and platforms to accommodate increased train operations. This concept avoids the problem of disturbing significant numbers of neighboring structures.

Alternative P would provide the largest service capacity increase of the build alternatives evaluated. The existing station and new deep station facilities would operate independently, allowing one operation to continue in the event of a major disruption to the other. Although not analyzed under ARC, it is conceptually possible that service from the new station to an East Midtown station or to Sunnyside Yard could be provided at a later time, if additional infrastructure were built.

Although the Alternative P configuration is feasible, the depth of the new trans-Hudson tunnel does not allow its tracks to connect with the existing tracks at Penn Station. Trains to either the existing or new tunnels would diverge east of the Secaucus Transfer Station. The drawback of this separate operation is that the new tracks would provide limited flexibility for daily operations, and would not allow for universal station operations during any tunnel closure for maintenance purposes. Passengers using the new station facility would need to traverse long distances from deep underground to reach the surface or subways, creating an inconvenience and requiring particular attention during design to ensure adequate emergency egress.

**1.11.3. Alternative S Conclusions**

As in Alternative G, Alternative S was designed to create a flow-through train operation to increase Penn Station capacity. Alternative S would likewise allow off-peak closure of one trans-Hudson tunnel while maintaining operations to most platforms in the other, and would create direct pedestrian links between the Seventh Avenue subway line (34th Street Station) and Platforms 1 and 2.

This alternative requires the construction of new tunnels eastward under 31st Street, the East River and western Queens to reach an expanded Sunnyside Yard for midday train storage, similar to NJ TRANSIT's current operating procedures. This significant new infrastructure would be constructed for the sole purpose of operating non-revenue trains and it would serve only Penn Station Tracks 1-5.

Concurrent with the planning for ARC, the MTA has been in negotiations with Amtrak for the use of the same area of Sunnyside Yard (for future subway train storage) that Alternative S proposes to use. To date, Amtrak, the owner of Sunnyside Yard, has not reached a decision on the use of this site. If it is not available for NJ TRANSIT use, then it is unlikely that Alternative S as currently defined will be viable.

**ACCESS TO THE REGION'S CORE**  
**MIS SUMMARY REPORT**

**1.11.4. Baseline Alternative Conclusions**

New FTA procedures mandate that project sponsors identify a baseline improvement condition that does not include the build alternative, so that the incremental costs and benefits of the build alternative can be quantified above the baseline condition. Based on the Phase 1 and 2 investigations of TSM options (Section 1.2.2), the ARC sponsoring agencies found that there are no strategies short of the build options that would meet the ARC project goals and needs. Therefore, it is proposed that the ARC baseline alternative be the No-Build alternative.

**1.11.5. Recommendations**

This study has established the need for new trans-Hudson rail capacity to Midtown Manhattan. It is recommended that, of the three alternatives evaluated in the final study phase, options P and S be advanced to the Draft Environmental Impact Statement phase for further analysis toward the ultimate implementation of a capital solution.

The drawbacks related to Alternative G (concerning the risks surrounding construction and operations) indicate that the alternative, as devised, is not acceptable for implementation. As a result, Alternative G is not recommended for further development in the Draft Environmental Impact Statement. Although both Alternatives P and S also have some deficiencies, the findings indicate that these options, or perhaps variations of them, have potential to acceptably meet the goal of expanding Penn Station train capacity for increased trans-Hudson rail service.

In the Draft Environmental Impact Statement, these alternatives and variants should be further refined with the goal of defining a specific project for continued advancement toward implementation. Based on issues raised earlier in this report, the new work should focus on such issues as train operating flexibility, while continuing to focus on the overall need to provide added trans-Hudson rail capacity in a timely manner.

By definition, the ultimate capital solution will take many years to implement and, as stated earlier in the report, it would be advantageous if smaller scale improvements that begin to address the larger capacity need could be developed in the meantime. For this reason, it is also recommended that the 31st Street Linear Yard and the Twelfth Avenue Storage Yard alternatives be further evaluated.

**ACCESS TO THE REGION’S CORE  
DRAFT ENVIRONMENTAL IMPACT STATEMENT**

**Alternatives Considered in the MIS – West of Hudson Connections**

<b>Mode</b>	<b>Alignment</b>
1. Commuter Rail – 34 <sup>th</sup> Street Corridor	<ul style="list-style-type: none"> <li>• Expanded NEC to PSNY</li> <li>• Expanded NEC to PSNY &amp; GCT</li> <li>• Expanded NEC to PSNY &amp; new east side terminal</li> <li>• Expanded NEC to PSNY &amp; GCT to SSY via 63<sup>rd</sup> St. Tunnel</li> <li>• Expanded NEC to PSNY &amp; GCT to Hell Gate Line to Bronx &amp; Westchester via 63<sup>rd</sup> St. Tunnel</li> <li>• Expanded NEC to PSNY &amp; new east side station to Hell Gate Line to Bronx &amp; Westchester via 63<sup>rd</sup> St. Tunnel</li> <li>• Expanded NEC to PSNY &amp; GCT to LIRR via 63<sup>rd</sup> St. Tunnel</li> <li>• Expanded NEC to PSNY &amp; new east side station to LIRR via 63<sup>rd</sup> St. Tunnel</li> </ul>
2. Commuter Rail – Palisades Corridor at 43 <sup>rd</sup> – 50 <sup>th</sup> Street	<ul style="list-style-type: none"> <li>• Expanded NEC to crossing to new west side terminal</li> <li>• Expanded NEC to crossing to new east side terminal</li> <li>• Expanded NEC to crossing to new west side station and east side terminal</li> <li>• Expanded NEC to crossing to new station at north end of GCT then via 63<sup>rd</sup> St. tunnel to SSY, Bronx, or LIRR</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new west side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new east side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new west side station and east side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new station at north end of GCT then via 63<sup>rd</sup> St. tunnel to SSY, Bronx, or LIRR</li> </ul>
3. Commuter Rail – Palisades North Corridor at 57 <sup>th</sup> – 59 <sup>th</sup> Street	<ul style="list-style-type: none"> <li>• Expanded NEC to new west side terminal</li> <li>• Expanded NEC to new east side terminal</li> <li>• Expanded NEC to new west side station and east side terminal</li> <li>• Expanded NEC to crossing to new station at north end of GCT then via 63<sup>rd</sup> St. tunnel to SSY, Bronx, or LIRR</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new west side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new east side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new west side station and east side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new station at north end of GCT then via 63<sup>rd</sup> St. tunnel to SSY, Bronx, or LIRR</li> </ul>

**ACCESS TO THE REGION'S CORE  
DRAFT ENVIRONMENTAL IMPACT STATEMENT**

<p>4. Commuter Rail – Edgewater Corridor at 96<sup>th</sup> –110th Street</p>	<ul style="list-style-type: none"> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to GCT via Park Avenue Tunnel</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new west side terminal</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new stations in Manhattan terminating at GCT</li> <li>• Main/Bergen/Pascack/NYS&amp;W/West Shore to new stations in Manhattan then via 63<sup>rd</sup> Street Tunnel to SSY, Bronx/Westchester via Hell Gate Bridge, or LIRR</li> </ul>
<p>5. Commuter Rail – North Hudson Corridor</p>	<ul style="list-style-type: none"> <li>• Pascack/Port Jervis via new Tappan Zee Corridor crossing and MNR Hudson Line to GCT</li> </ul>
<p>6. Subway - #7 Extension</p>	<ul style="list-style-type: none"> <li>• Via 41<sup>st</sup> Street Corridor to Secaucus Transfer</li> <li>• Via 41<sup>st</sup> Street Corridor to Sports Complex</li> <li>• Via 41<sup>st</sup> Street Corridor to north Hudson communities</li> <li>• Via Eighth Avenue &amp; 33<sup>rd</sup> Street/PSNY to Secaucus Transfer</li> <li>• Via Eighth Avenue &amp; 33<sup>rd</sup> Street/PSNY to Sports Complex</li> <li>• Via Eighth Avenue &amp; 33<sup>rd</sup> Street/PSNY to north Hudson communities</li> </ul>
<p>7. Subway – GCT/ Times Square Shuttle Extension</p>	<ul style="list-style-type: none"> <li>• Via 41<sup>st</sup> Street Corridor to Secaucus Transfer</li> <li>• Via 41<sup>st</sup> Street Corridor to Sports Complex</li> <li>• Via 41<sup>st</sup> Street Corridor to north Hudson communities</li> <li>• Via Eighth Avenue &amp; 33<sup>rd</sup> Street/PSNY to Secaucus Transfer</li> <li>• Via Eighth Avenue &amp; 33<sup>rd</sup> Street/PSNY to Sports Complex</li> <li>• Via Eighth Avenue &amp; 33<sup>rd</sup> Street/PSNY to north Hudson communities</li> </ul>
<p>8. Subway – IND/53<sup>rd</sup> Street Corridor (A,B,C,D,E,F)</p>	<ul style="list-style-type: none"> <li>• Via 53<sup>rd</sup> Street to Secaucus Transfer</li> <li>• Via 53<sup>rd</sup> Street to Sports Complex</li> <li>• Via 53<sup>rd</sup> Street to north Hudson communities</li> </ul>
<p>9. Subway – 63rd Street Corridor</p>	<ul style="list-style-type: none"> <li>• Via new crosstown line in 40s or 50s to Secaucus Transfer</li> <li>• Via new crosstown line in 40s or 50s to Sports Complex</li> <li>• Via new crosstown line in 40s or 50s to north Hudson communities</li> </ul>
<p>10. Subway – Extension of BMT from 57<sup>th</sup> Street &amp; Seventh Avenue</p>	<ul style="list-style-type: none"> <li>• Under Central Park to new tunnel in West 60s or 70s to Secaucus Transfer</li> <li>• Under Central Park to new tunnel in West 60s or 70s to Sports Complex</li> <li>• Under Central Park to new tunnel in West 60s or 70s to north Hudson communities</li> </ul>
<p>11. Subway – Extension of 8th Avenue (A) Line from 168<sup>th</sup> St.</p>	<ul style="list-style-type: none"> <li>• Via lower level of GWB to Sports Complex</li> </ul>

**ACCESS TO THE REGION'S CORE  
DRAFT ENVIRONMENTAL IMPACT STATEMENT**

12. Subway – New Line	<ul style="list-style-type: none"> <li>• Secaucus Transfer to new tunnel at 49<sup>th</sup> – 50<sup>th</sup> Street, then via Second Avenue subway and 63<sup>rd</sup> Street tunnel to new Queens Blvd bypass tracks to Forest Hills</li> </ul>
13. Bus – New bus Terminal (PABT West)	<ul style="list-style-type: none"> <li>• New bus terminal in vicinity of Meadowlands Sports Complex to intercept Manhattan bound buses with transfer to one of the rail lines listed above</li> </ul>
14. PATH	<ul style="list-style-type: none"> <li>• Extend tunnel from 33<sup>rd</sup> Street &amp; Sixth Avenue to Times Square</li> <li>• Extend tunnel from 33<sup>rd</sup> Street &amp; Sixth Avenue to GCT</li> <li>• Extend tunnel from 33<sup>rd</sup> Street &amp; Sixth Avenue to #7 subway</li> <li>• Extend tunnel from 33<sup>rd</sup> Street &amp; Sixth Avenue to BMT subway at Herald Square</li> <li>• Extend tunnel from 33<sup>rd</sup> Street &amp; Sixth Avenue to IND subway at Herald Square</li> <li>• Connect to BMT subway in vicinity of 8<sup>th</sup> Street</li> <li>• Connect to IND subway in vicinity of 23<sup>rd</sup> Street</li> <li>• Connect to IRT#1/9 subway in vicinity of Christopher Street</li> </ul>
15. Combined Commuter Rail/ Subway	<ul style="list-style-type: none"> <li>• Combined 2<sup>nd</sup> Avenue/63<sup>rd</sup> Street subway or LIRR across 43<sup>rd</sup> Street to lower level GCT and then new tunnel across Hudson to Secaucus Transfer</li> <li>• Combined 2<sup>nd</sup> Avenue/63<sup>rd</sup> Street subway or LIRR across 43<sup>rd</sup> Street to lower level GCT and then new tunnel across Hudson to Meadowlands Sports Complex</li> <li>• Combined 2<sup>nd</sup> Avenue/63<sup>rd</sup> Street subway or LIRR across 43<sup>rd</sup> Street to lower level GCT and then new tunnel across Hudson to north Hudson communities</li> </ul>
16. Combined LRT/ Subway	<ul style="list-style-type: none"> <li>• HBLRT via new tunnel to Manhattan connecting to #7</li> <li>• HBLRT via new tunnel to Manhattan connecting to Times Square/GCT Shuttle</li> <li>• HBLRT via new tunnel to Manhattan connecting to BMT at 57<sup>th</sup> Street &amp; Seventh Avenue</li> <li>• HBLRT via new tunnel to Manhattan connecting to IND at 53<sup>rd</sup> Street</li> </ul>
17. Combined Commuter Rail/ Freight	<ul style="list-style-type: none"> <li>• NEC/Main/Bergen/Pascack with freight via new Hudson River tunnel – Passenger service to Penn Station – freight to West Side Line</li> </ul>
18. Combined Commuter Rail/ Freight	<ul style="list-style-type: none"> <li>• NEC/Main/Bergen/Pascack with freight via new Hudson River tunnel – Passenger service to Penn Station – freight via 31<sup>st</sup> Street bypass to new East River tunnel to Queens</li> </ul>

**ACCESS TO THE REGION'S CORE  
DRAFT ENVIRONMENTAL IMPACT STATEMENT**

19. LRT	<ul style="list-style-type: none"> <li>• HBLRT to proposed 42<sup>nd</sup> Street LRT</li> <li>• HBLRT via two lanes of Lincoln tunnel converted to light rail use</li> <li>• HBLRT to PATH 33<sup>rd</sup> Street tunnel for joint use with PATH with possible extension to GCT</li> <li>• HBLRT to Broadway BMT</li> </ul>
20. Multi-modal – Combined Rubber Tire and Rail	<ul style="list-style-type: none"> <li>• Chunnel type facility for trains and autos, trucks, buses from Meadowlands Sports complex to SSY</li> <li>• Chunnel type facility for freight trains and trucks only</li> <li>• Chunnel type facility for passenger trains to PSNY with possible connection to GCT and trucks to new East River tunnel</li> </ul>
21. Rubber Tire Crossings	<ul style="list-style-type: none"> <li>• Motor Vehicle Tunnel - New Jersey to Queens</li> <li>• Motor Vehicle Bridge and Roadway - New Jersey to Queens</li> <li>• Bus/truck tunnel across Hudson from NJ Turnpike</li> </ul>
22. Ferries	<ul style="list-style-type: none"> <li>• Various routes considered with expanded feeder bus networks, channeled to TSM</li> <li>• Bus Ferries</li> <li>• LRT Ferries</li> </ul>
23. New Technologies	<ul style="list-style-type: none"> <li>• Monorail, AGT, PRT, etc.</li> <li>• No specific alignment defined</li> </ul>



# *Access To The Region's Core*

*A joint venture of the Port Authority of NY & NJ, the Metropolitan Transportation Authority and NJ Transit*

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## **15 BUILD ALTERNATIVES**

**December, 95**



## *Access To The Region's Core*

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*A joint venture of the Port Authority of NY & NJ, the Metropolitan Transportation Authority and NJ Transit*

### **15 BUILD ALTERNATIVES**

December, 95

Glossary of Acronyms

**3:1** - 3 tracks in peak direction and 1 track in off peak direction on Queens Boulevard line (E, F, G, R)

**AHS** - Automated Highway System: A series of highway improvements that increase speed and allow greater vehicular volumes

**BMT** - Brooklyn Manhattan Transit: The name of the company that operated many of the subway lines between Brooklyn and Manhattan

**FTA** - Federal Transit Administration: The federal agency that monitors ISTEA

**GCT** - Grand Central Terminal: The end of the line for MNR trains

**GWBBS**- George Washington Bridge Bus Station: the bus terminal in upper Manhattan at the end of the George Washington Bridge

**HBLRT** - Hudson-Bergen Light Rail Transit System: A new light rail transit line currently under design between Bayonne and the Vince Lombardi park-and-ride

**IND** - Independent Subway System: The name of the subway lines built by New York City in the 1920s and 1930s

**IRT** - Interborough Rapid Transit: the name of the company that operated the original subway system (distinguished today as numbered lines)

**ISTEA**-Intermodal Surface Transportation Efficiency Act: The current transportation statute governing federal funding of transportation projects, studies, and operations

**ITS** - Intelligent Transportation System (formerly IVHS): A series of transportation improvements that provide highway and transit users with more real time information about travel options

**IVHS** - See ITS

**LIE** - Long Island Expressway: I-495 and NY 495 in Queens and Long Island

**LIRR** - Long Island Rail Road: The MTA commuter railroad serving Long Island and Queens

**LRT** - Light Rail Transit (sometimes referred to as trolley)

**MIS** - Major Investment Study: A type of study dealing with substantial transportation improvements using ISTEA funds, that must follow specific planning guidelines and criteria

**MNR** - Metro-North Railroad: The MTA commuter railroad serving the Bronx, Westchester County, and Connecticut

**MTA** - Metropolitan Transportation Authority: The transit and bridge and tunnel operator in New York City and its suburbs

**NEC** - Northeast Corridor: The line extending from Boston through PSNY to Washington used by Amtrak; NJT operates over the segment between PSNY and Trenton

**NJT** - NJ TRANSIT: The transit operator in the State of New Jersey

**NYCT** -New York City Transit (formerly Authority): The operator of subways and buses in New York City

**NYS&W**- New York Susquehanna & Western: A freight rail corridor being investigated by NJT for possible future commuter rail operation

**PABT** - Port Authority Bus Terminal: The terminal for New Jersey commuter buses and the XBL

**PANYNJ**- The Port Authority of New York and New Jersey

**PSNY** -Penn Station New York: Station used by Amtrak, LIRR, and NJT

**SSY** - Sunnyside Yard: A rail facility in western Queens used primarily for commuter and intercity train storage and staging

**TDM** - Transportation Demand Management: A series of measures that aim to reduce the demand for transportation

**TSM** - Transportation Systems Management: A series of measures that are intended to improve the efficiency and operation of the existing transportation system at low capital cost

**XBL** - Exclusive Bus Lane: A contraflow lane on NJ 495 in New Jersey to the Lincoln Tunnel and into the PABT

# *ACCESS TO THE REGION'S CORE*

## **NO BUILD**

### **New Jersey Transit**

1. Kearny Connection
2. Secaucus Transfer Station
3. Montclair Connection
4. New Initiatives Support Projects
  - NEC Highline Signaling
  - PSNY East End Concourse
  - Traction System Upgrade
5. Hudson/Bergen LRT
6. Hunter Connection (NEC to Raritan Valley Line, operating speed improvements)
7. Intermediate Volume Plan (IVP)
8. Hamilton Township Park-Ride

### **Metropolitan Transportation Authority**

1. Queens Boulevard Line Connection, 63rd Street Tunnel, upper level (NYCTA)
2. LIRR:
  - Replacement of diesel fleet with regular and dual mode locomotives, bi-level cars (2x2 seating)
  - Track Connection, West Side Yard to PSNY Tracks 14 and Below (5X/6X or "U" Ladder)
  - Platform 11 Extension (Under Construction)
3. North End Access, GCT
4. MNR Harlem Line Third Track, Mt. Vernon to Crestwood
5. MNR Harlem Line Extension to Wassaic
6. MNR Service with Existing Fleet Plus Rolling Stock (Purchased under currently funded MTA Capital Plan)
7. MNR Hudson Line, Cortlandt Station replaces Crugers and Montrose Stations; Parking at Cortlandt Station
8. Full Manhattan Bridge Upgrade

# *ACCESS TO THE REGION'S CORE*

## **NO BUILD**

### **Port Authority of New York & New Jersey**

1. Extension of Newark Airport People Mover to Haynes Avenue NEC
2. Airport Access to NYC Airport(s) - to be recommended by Port Authority

### **Amtrak**

NEC High Speed Rail Project

### **New Jersey Turnpike Authority**

HOV Lanes, Interchanges 11-14

### **New York City Department of Transportation**

New Ferry Service, Staten Island to W. 38th Street

### **New York State Department of Transportation**

Long Island Expressway HOV Lanes, Exit 30 - 49 and 57 - 64 (Nassau & Suffolk Counties)

### **NY Waterway**

Hoboken, NJ - W. 38th Street ferry



**ACCESS TO THE REGION'S CORE**

**LEGEND**

**EXISTING**

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

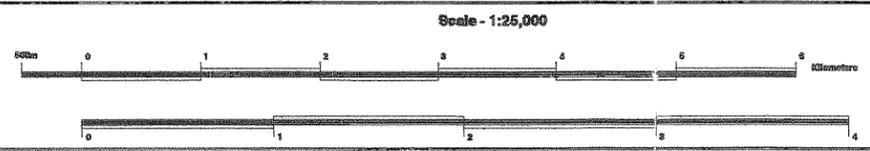
**PROPOSED**

- ALTERNATIVE BY ARC
- - - RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS



**STUDY AREA MAP**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY    METROPOLITAN TRANSPORTATION AUTHORITY    NEW JERSEY TRANSIT



DATE 12/04/95

## Alternative 1a

### Multi-Link Connection

#### Midtown Transit Connection (via LRT)

##### Features

##### Manhattan

- A surface LRT loop connecting PSNY, GCT, Javits Center, and West 38th Street Ferry Terminal
  - ⇒ LRT loop on 42nd Street, Park Avenue, 12th Avenue, and 34th Street with multiple stops
  - ⇒ Possible use of shuttle tracks between GCT and Times Square and Park Avenue underpass between 33rd and 40th Street for LRT use instead of surface operation

##### Queens

- Sunnyside Multimodal Transportation Hub (to be based on final recommendation of MTA "Long Island City Transportation Needs and Opportunities" study, and modeled by LIRR "East Side Access" study) including:
  - ⇒ New LIRR station on Hunterspoint tracks
  - ⇒ Extension of NJT revenue service to new station
  - ⇒ Pedestrian transfer to E, F, and R at Queens Plaza Station
  - ⇒ Possible subway connection of 63rd Street Tunnel upper level to G line
  - ⇒ Possible rerouting of #7 and N lines to new station (and closure of Queensboro Plaza elevated station)
- Use of existing tunnels only; no LIRR service to GCT via 63rd Street Tunnel or new East River tunnel

##### Long Island

- Improved access from PSNY to east Midtown via LRT Loop
- Use of existing tunnels only; no LIRR service to GCT via 63rd Street Tunnel or new East River tunnel

##### New Jersey/Rockland/Orange

- Improved access from PSNY to east Midtown via LRT Loop
- Use of existing Penn Tunnel; no new Hudson River tunnel

ACCESS TO THE REGION'S CORE

LEGEND

EXISTING

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

PROPOSED

- ALTERNATIVE BY ARC
- RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS



1A

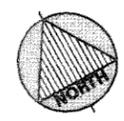
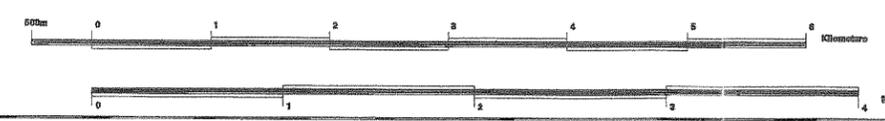


1A

MIDTOWN TRANSIT CONNECTION

PORT AUTHORITY OF NEW YORK AND NEW JERSEY METROPOLITAN TRANSPORTATION AUTHORITY NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 1b

### Multi-Link Connection

#### Midtown Transit Connection (via subway)

##### Features

##### Manhattan

- An extension of the #7 (Flushing) subway from Times Square to PSNY via Eighth Avenue (to be evaluated with Alternative 10b)

##### Queens

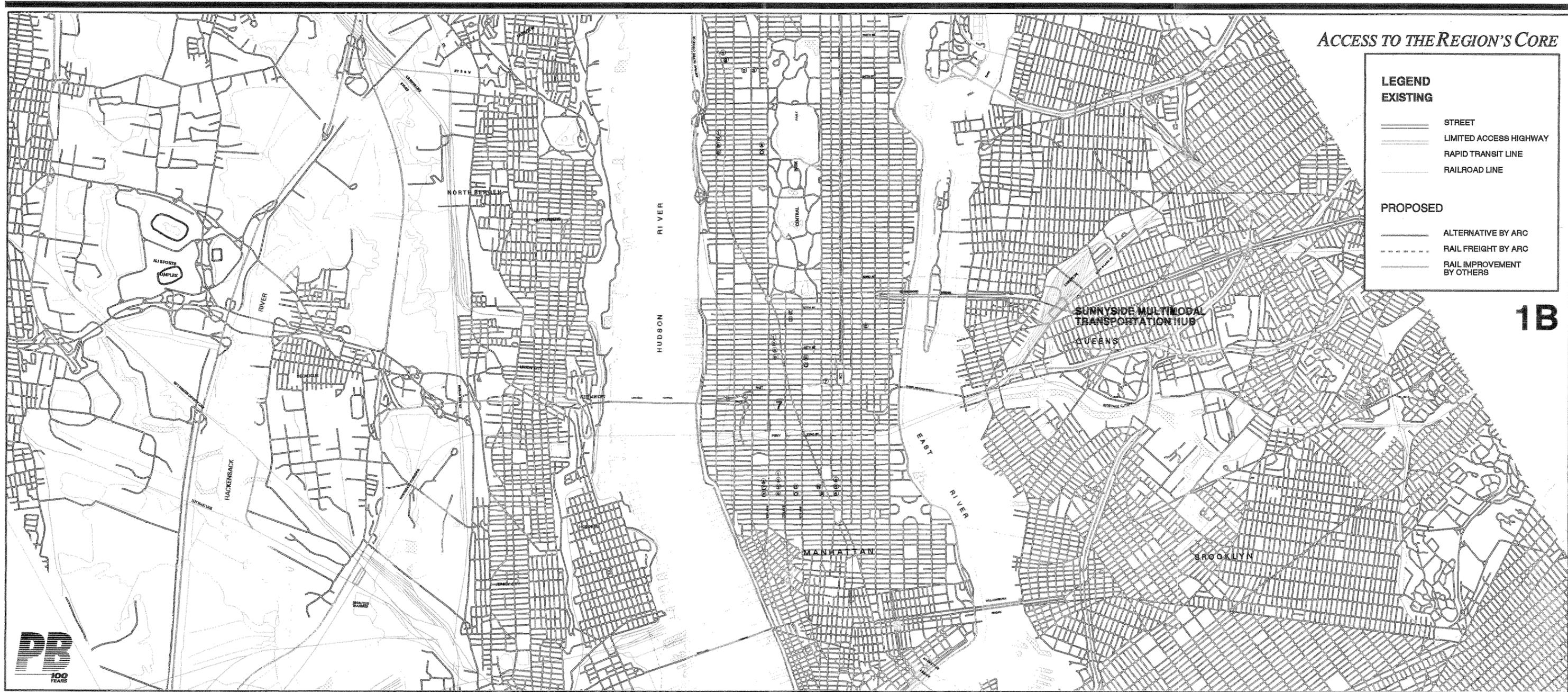
- Sunnyside Multimodal Transportation Hub (to be based on final recommendation of MTA "Long Island City Transportation Needs and Opportunities" study, and modeled by LIRR "East Side Access" study) including:
  - ⇒ New LIRR station on Hunterspoint tracks
  - ⇒ Extension of NJT revenue service to new station
  - ⇒ Pedestrian transfer to E, F, and R at Queens Plaza Station
  - ⇒ Possible subway connection of 63rd Street Tunnel upper level to G line
  - ⇒ Possible rerouting of #7 and N lines to new station (and closure of Queensboro Plaza elevated station)
- Use of existing tunnels only; no LIRR service to GCT via 63rd Street Tunnel or new East River tunnel

##### Long Island

- Improved access from PSNY to east Midtown via extended #7 subway
- Use of existing tunnels only; no LIRR service to GCT via 63rd Street Tunnel or new East River tunnel

##### New Jersey/Rockland/Orange

- Improved access from PSNY to east Midtown via extended #7 subway
- Use of existing Penn Tunnel; no new Hudson River tunnel



**1B**

**MIDTOWN TRANSIT CONNECTION**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY

METROPOLITAN TRANSPORTATION AUTHORITY

NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 2

### Multi-Link Connection

#### Midtown Access

##### Features

##### Long Island

- LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### New Jersey/Rockland/Orange

- Palisades Tunnel Bus/Truckway from proposed New Jersey Turnpike Interchange at Allied Junction to Lincoln Tunnel approach in New Jersey (no new roadway extension into Lincoln Tunnel or Manhattan)
  - ⇒ The use of the busway by trucks and service delivery vehicles during off peak hours will be explored
- Use of existing Penn Tunnel; no new Hudson River tunnel
  - ⇒ Potential for additional capacity in PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY

##### Manhattan

- Proposed NYCDOT 42nd Street LRT from Javits Center to United Nations

##### Queens

- LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

ACCESS TO THE REGION'S CORE

LEGEND

- EXISTING**
- STREET
  - LIMITED ACCESS HIGHWAY
  - RAPID TRANSIT LINE
  - RAILROAD LINE
- PROPOSED**
- ALTERNATIVE BY ARC
  - - - RAIL FREIGHT BY ARC
  - RAIL IMPROVEMENT BY OTHERS

2

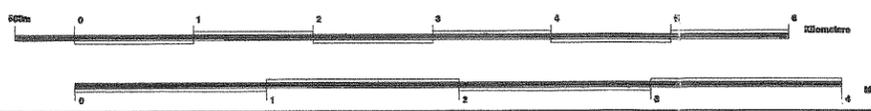


2

MIDTOWN ACCESS

PORT AUTHORITY OF NEW YORK AND NEW JERSEY METROPOLITAN TRANSPORTATION AUTHORITY NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 3

### Commuter Rail

#### Commuter Terminal Connection

##### Features

##### Manhattan

- Direct commuter rail connection from PSNY to GCT or vicinity via 32nd Street and Madison (or Third) Avenue
- Tracks 1 to 4 of PSNY extended east (and then north) from existing stub end track
- Three possible commuter rail operation scenarios within existing GCT or vicinity:
  - a) NJT/LIRR connected at GCT and service extended from New Jersey through 63rd St. Tunnel lower level to Queens/Long Island; no change to MNR service
  - b) NJT/MNR connected at GCT and service extended from New Jersey through Park Avenue Tunnel to Westchester/Connecticut; LIRR at GCT
  - c) NJT, MNR, and LIRR at separate terminal areas in or near GCT

##### Long Island

- All three scenarios include LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Queens

- All three scenarios include LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### New Jersey/Rockland/Orange

- Use of existing Penn Tunnel; no new Hudson River tunnel
- Improved access from PSNY to east Midtown via commuter rail connection from PSNY to GCT
  - ⇒ Potential limited expansion of capacity to PSNY

##### General

- Specially designed dual power locomotive may be required for through running operation in Scenario (a)

ACCESS TO THE REGION'S CORE

LEGEND

EXISTING

-  STREET
-  LIMITED ACCESS HIGHWAY
-  RAPID TRANSIT LINE
-  RAILROAD LINE

PROPOSED

-  ALTERNATIVE BY ARC
-  RAIL FREIGHT BY ARC
-  RAIL IMPROVEMENT BY OTHERS



3

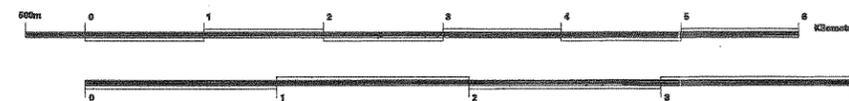
COMMUTER TERMINAL CONNECTION

PORT AUTHORITY OF NEW YORK AND NEW JERSEY

METROPOLITAN TRANSPORTATION AUTHORITY

NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 4

Commuter Rail**Hudson/Terminal Connection**FeaturesNew Jersey/Rockland/Orange

- New Hudson River tunnel (one or two tracks) connecting to expanded PSNY with additional tracks and platforms from 33rd to 34th Street
- Bus to West Shore line commuter rail at Meadowlands Sports Complex (no commuter parking)
- Transfer from Main/Bergen/Port Jervis/Pascack Valley lines, New York Susquehanna & Western, and West Shore line (via Sports Complex) at Secaucus Transfer Station

Manhattan

- Direct commuter rail connection from PSNY to GCT or vicinity via 34th Street and Madison (or Third) Avenue
- Three possible commuter rail operation scenarios within existing GCT or vicinity:
  - a) NJT/LIRR connected at GCT and service extended from New Jersey through 63rd St. Tunnel lower level to Queens/Long Island; no change to MNR service
  - b) NJT/MNR connected at GCT and service extended from New Jersey through Park Avenue Tunnel to Westchester/Connecticut; LIRR at GCT
  - c) NJT, MNR, and LIRR at separate terminal areas in or near GCT

Long Island

- All three scenarios include LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

Queens/Bronx

- All three scenarios include LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties
- Sunnyside Multimodal Transportation Hub (to be based on final recommendation of MTA "Long Island City Transportation Needs and Opportunities" study, and modeled by LIRR "East Side Access" study) including:
  - ⇒ New LIRR station on Main Line tracks
  - ⇒ Extension of NJT revenue service to new station
  - ⇒ Pedestrian transfer to E, F, and R at Queens Plaza Station
  - ⇒ Possible subway connection of 63rd Street Tunnel upper level to G line
  - ⇒ Possible rerouting of #7 and N lines to new station (and closure of Queensboro Plaza elevated station)
  - ⇒ MNR New Haven line via Hell Gate Bridge to PSNY with Bronx stations at Co-op City and Parkchester (this component to be modeled by ARC study)

General

- Specially designed dual power locomotive may be required for through running operation in Scenario (a)

Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island

ACCESS TO THE REGION'S CORE

LEGEND

- EXISTING**
- STREET
  - LIMITED ACCESS HIGHWAY
  - RAPID TRANSIT LINE
  - RAILROAD LINE

- PROPOSED**
- ALTERNATIVE BY ARC
  - - - RAIL FREIGHT BY ARC
  - RAIL IMPROVEMENT BY OTHERS

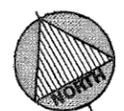
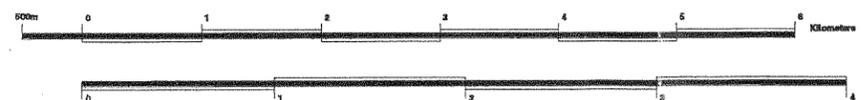


4

**HUDSON/TERMINAL CONNECTION**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY METROPOLITAN TRANSPORTATION AUTHORITY NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 5

### Commuter Rail

#### Penn Through Corridor

##### Features

##### New Jersey/Rockland/Orange

- New Hudson River tunnel (one or two tracks) linking Secaucus Transfer Station and expanded PSNY

##### Manhattan

- PSNY expanded with additional tracks and platforms at south end of station; Tracks 1 to 4 of PSNY extended east from existing stub ends
- Alignment across 31st Street with new station at Park Avenue and transfer to #6 (IRT local)

##### Long Island

- New East River tunnel linking Sunnyside Yard and PSNY
- Increased LIRR service to expanded PSNY
- Transfer at new Park Avenue station for #6 (IRT local) subway service to east Midtown

##### Queens

- New East River tunnel linking Sunnyside Yard and PSNY
- Increased LIRR service to expanded PSNY with possible new Queens stations and expanded Queens service

##### Freight

- Rail freight directly across Manhattan from Conrail River Line and New York Susquehanna & Western in New Jersey to LIRR at Sunnyside Yard, with connections to New England via Hell Gate Bridge

**LEGEND**  
**EXISTING**

-  STREET
-  LIMITED ACCESS HIGHWAY
-  RAPID TRANSIT LINE
-  RAILROAD LINE

**PROPOSED**

-  ALTERNATIVE BY ARC
-  RAIL FREIGHT BY ARC
-  RAIL IMPROVEMENT BY OTHERS



**5**

# PENN THROUGH CORRIDOR

PORT AUTHORITY OF NEW YORK AND NEW JERSEY

METROPOLITAN TRANSPORTATION AUTHORITY

NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 6

### Commuter Rail

#### GCT Super Terminal

##### Features

##### New Jersey/Rockland/Orange

- New (two track) tunnel from Secaucus Transfer Station under north Hudson Palisades and Hudson River to West 58th Street and GCT
  - ⇒ Construction of Secaucus Loop with direct connection to Manhattan from Main/Bergen/Port Jervis/Pascack Valley lines, New York Susquehanna & Western, and West Shore line (via Sports Complex), with a stop at Secaucus Transfer Station; possible NJT Boonton line extension via Lackawanna Cutoff to Pennsylvania
  - ⇒ New Palisades station with transfer to Hudson-Bergen Light Rail Transit system

##### Manhattan

- GCT Super Terminal with side by side operation for NJT, MNR, and LIRR; no through running
  - ⇒ Use of existing GCT or expansion to Madison Avenue or Third Avenue terminal, if necessary
- New West Side Station at Coliseum Site (West 58th Street/Eighth to Ninth Avenue) which may serve as first stage terminal for NJT

##### Long Island

- LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Queens

- LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island

ACCESS TO THE REGION'S CORE

LEGEND

EXISTING

-  STREET
-  LIMITED ACCESS HIGHWAY
-  RAPID TRANSIT LINE
-  RAILROAD LINE

PROPOSED

-  ALTERNATIVE BY ARC
-  RAIL FREIGHT BY ARC
-  RAIL IMPROVEMENT BY OTHERS



**PA**  
100  
TO LASKAWANNA  
CUTOFF

SECAUCUS  
LOOP

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# GCT SUPER TERMINAL

PORT AUTHORITY OF NEW YORK AND NEW JERSEY

METROPOLITAN TRANSPORTATION AUTHORITY

NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 7

Commuter Rail

## NJ/ 63rd Street Connection

FeaturesNew Jersey/Rockland/Orange

- New (two track) tunnel from Secaucus Transfer Station under north Hudson Palisades and Hudson River to West 49th Street and GCT
  - ⇒ Construction of Secaucus Loop with direct connection to Manhattan from Main/Bergen/Port Jervis/Pascack Valley lines, New York Susquehanna & Western, and West Shore line (via Sports Complex), with a stop at Secaucus Transfer Station; possible NJT Boonton line extension via Lackawanna Cutoff to Pennsylvania
  - ⇒ New Palisades station with transfer to Hudson-Bergen Light Rail Transit system

Manhattan

- Commuter rail east-west alignment on 49th Street and north-south on Third Avenue with through running of NJT and LIRR
- Two stations at Sixth to Eighth Avenue and Third to Park Avenue (GCT North End Access) connecting to all five north-south subway lines

Long Island

- LIRR via 63rd Street Tunnel lower level, Third Avenue and 49th Street to New Jersey
  - ⇒ Two Manhattan stations at Sixth to Eighth Avenue and Third to Park Avenue (GCT North End Access) connecting to all five north-south subway lines
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

Queens

- LIRR via 63rd Street Tunnel lower level, Third Avenue and 49th Street to New Jersey with new Queens stations and expanded Queens service
  - ⇒ Two Manhattan stations at Sixth to Eighth Avenue and Third to Park Avenue (GCT North End Access) connecting to all five north-south subway lines
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR through service with reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

Bronx/Westchester

- MNR New Haven line via Hell Gate Bridge and 63rd Street Tunnel lower level, Third Avenue and 49th Street to New Jersey (with possible connection to Pascack Valley and Port Jervis lines via Secaucus Loop), and new stations at Co-op City and Parkchester
- MNR via Hudson line (Amtrak Empire corridor) from Spuyten Duyvil to PSNY

General

- Specially designed dual power locomotive may be required for through running operation

Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island

LEGEND

EXISTING

-  STREET
-  LIMITED ACCESS HIGHWAY
-  RAPID TRANSIT LINE
-  RAILROAD LINE

PROPOSED

-  ALTERNATIVE BY ARC
-  RAIL FREIGHT BY ARC
-  RAIL IMPROVEMENT BY OTHERS



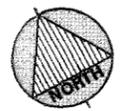
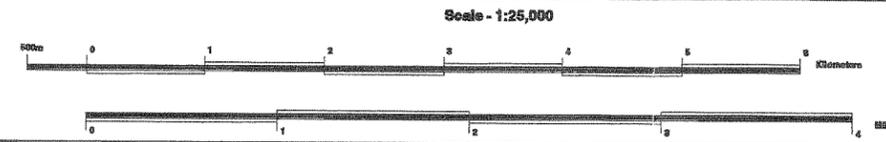
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# NJ/63rd STREET CONNECTION

PORT AUTHORITY OF NEW YORK AND NEW JERSEY    METROPOLITAN TRANSPORTATION AUTHORITY    NEW JERSEY TRANSIT



DATE 12/04/95

## Alternative 8

### Commuter Rail

#### Midtown Through Corridor

##### Features

##### New Jersey/Rockland/Orange

- New (two track) tunnel from Secaucus Transfer Station under North Hudson Palisades and Hudson River to West 49th Street
  - ⇒ New Palisades station with transfer to Hudson-Bergen Light Rail Transit system

##### Manhattan

- Two stations at Sixth to Eighth Avenue and Third to Park (GCT North End Access) connecting to all five north-south subway lines

##### Long Island

- LIRR via new East River tunnel from Sunnyside Yard across 49th Street to New Jersey
  - ⇒ Two Manhattan stations at Sixth to Eighth Avenue and Third to Park (GCT North End Access) connecting to all five north-south subway lines
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Queens

- LIRR via new East River tunnel from Sunnyside Yard across 49th Street to New Jersey with new Queens stations and expanded Queens service
  - ⇒ Two Manhattan stations at Sixth to Eighth Avenue and Third to Park (GCT North End Access) connecting to all five north-south subway lines
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR through service with reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### General

- Specially designed dual mode locomotive may be required for through running operation

##### Freight

- Rail freight directly across Manhattan from Conrail River Line and New York Susquehanna & Western in New Jersey to LIRR at Sunnyside Yard, with connections to New England via Hell Gate Bridge



**LEGEND**

**EXISTING**

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

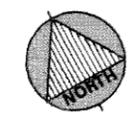
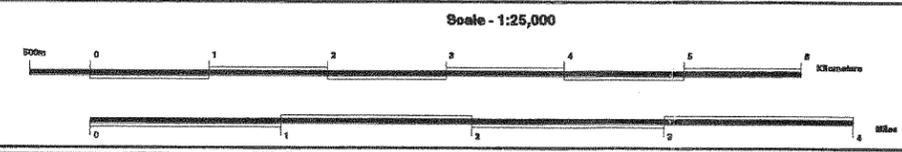
**PROPOSED**

- ALTERNATIVE BY ARC
- - - RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS



# MIDTOWN THROUGH CORRIDOR

PORT AUTHORITY OF NEW YORK AND NEW JERSEY METROPOLITAN TRANSPORTATION AUTHORITY NEW JERSEY TRANSIT



## Alternative 9

### Commuter Rail

#### Tappan Zee

##### Features

##### Rockland/Orange/Northern Bergen County

- MNR Port Jervis line extension from Suffern along I-287 in Rockland County to new Hudson River tunnel or bridge connection in vicinity of Tappan Zee Bridge to Hudson line to GCT (modified alternative #2 from MNR "Trans-Hudson Crossing" study)

##### Long Island

- LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Queens

- LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### Bronx/Westchester

- MNR New Haven line via Hell Gate Bridge and 63rd Street Tunnel lower level to GCT with new stations at Co-op City and Parkchester

##### New Jersey

- NJT Waterfront Connection (Phases 2 and 3) between Newark and Hoboken with transfers to PATH Uptown line and West 38th Street ferry service from Hoboken

##### Freight

- Rail freight via new Hudson River tunnel or bridge, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island

ACCESS TO THE REGION'S CORE

LEGEND

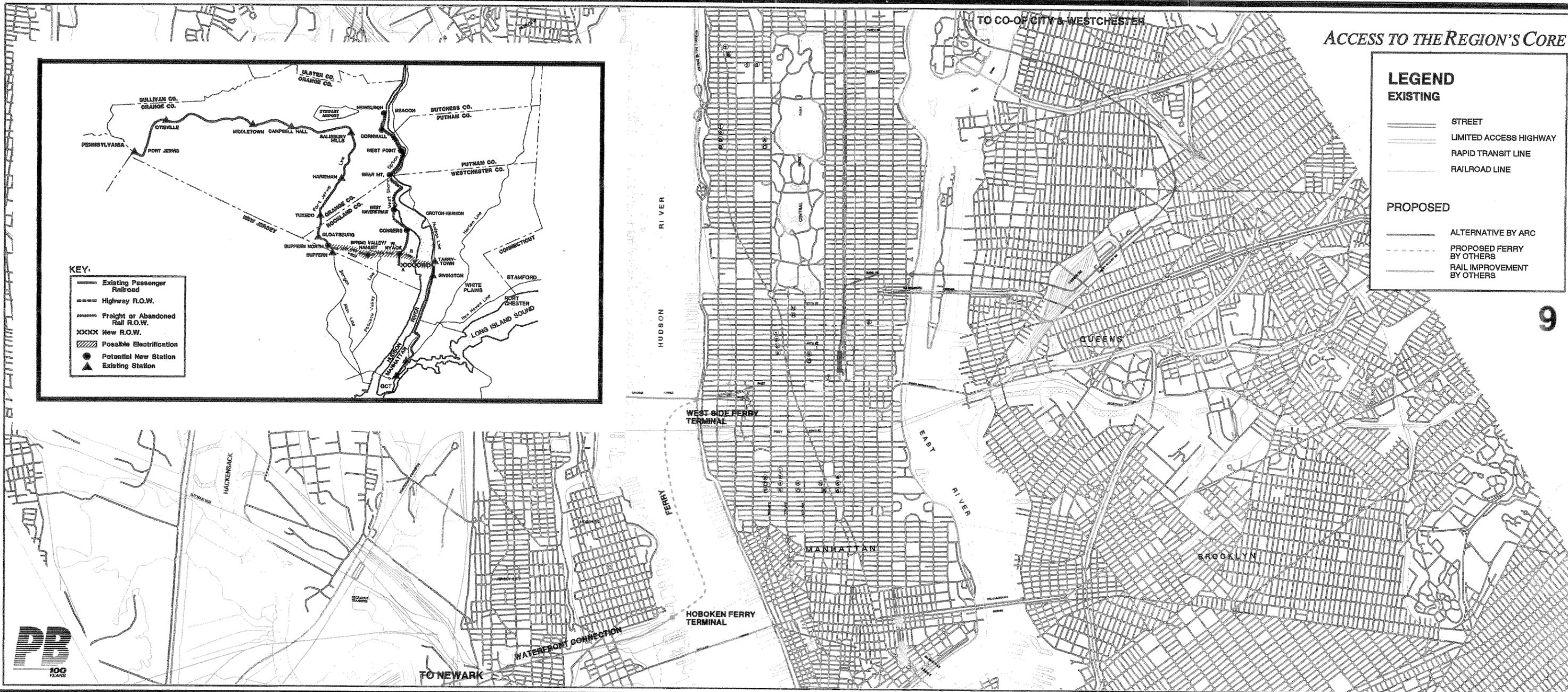
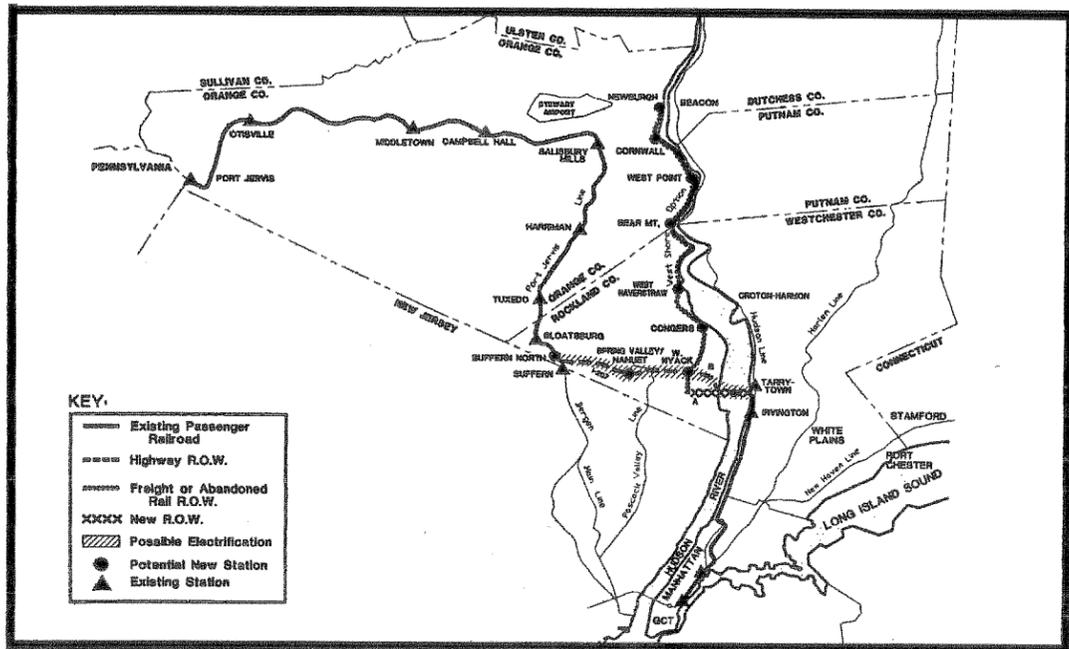
EXISTING

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

PROPOSED

- ALTERNATIVE BY ARC
- - - PROPOSED FERRY BY OTHERS
- RAIL IMPROVEMENT BY OTHERS

9



9

TAPPAN ZEE

PORT AUTHORITY OF NEW YORK AND NEW JERSEY

METROPOLITAN TRANSPORTATION AUTHORITY

NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 10

### Rapid Rail Transit

#### Flushing (#7) Extension

##### Features

##### Manhattan

- Extension of #7 (Flushing) subway from current terminus at Times Square via new two track Hudson River tunnel to New Jersey:
  - a) Via 41st Street to new Hudson River Tunnel
  - b) Via Eighth Avenue and 33rd Street to new Hudson River tunnel with stations at PSNY and Javits Center
  - c) Same as (b)
- Relocation of existing West Side Ferry Terminal to 34th Street to be served by Javits Center station in Scenarios (b) and (c)

##### New Jersey/Rockland/Orange

- Two new termini in New Jersey: the Secaucus Transfer Station and the Meadowlands Sports Complex
- Scenario (b) includes bus intercept for all suburban commuter buses (in vicinity of North Bergen park-and-ride)
- Commuter park-and-ride at Meadowlands Sports Complex
  - ⇒ Bus to subway and West Shore line commuter rail to subway transfer
- Transfer from Main/Bergen/Port Jervis/Pascack Valley lines, New York Susquehanna & Western, and Northeast Corridor lines at Secaucus Transfer Station; possible NJT Boonton line extension via Lackawanna Cutoff to Pennsylvania
- Harmon Meadows, Palisades, and Waterfront subway stations
  - ⇒ Transfer to Hudson-Bergen Light Rail Transit system at Palisades station

##### Queens/Bronx

- Scenario (b) includes extension of 63rd Street Tunnel upper level subway via Hell Gate Bridge to Co-op City and five intermediate Bronx stations with transfer to Queens Boulevard local (G, R) at Northern Boulevard
- Scenario (c) includes Queens Boulevard line Super Express Bypass between Forest Hills (71st/Continental) and 63rd Street Tunnel upper level with stations at Woodside (transfer to LIRR and #7) and 21st Street/Long Island City
- Scenario (c) also includes eastern Queens subway extensions from Queens Boulevard line in three corridors:
  - ⇒ Via Long Island Expressway from Woodhaven Boulevard to Fresh Meadows with four intermediate stations
  - ⇒ Via Hillside Avenue extension from 179th Street terminal to Springfield Boulevard with three intermediate stations
  - ⇒ Via conversion of LIRR Atlantic Branch to subway from Jamaica Center/Parsons/Archer terminal to Springfield Boulevard with three intermediate stations

##### General

- Investigation to be conducted of possible upgrading of #7 to Division B (IND/BMT) standards including determination if larger Division B subway cars can fit in Steinway (42nd Street) Tunnel

##### Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island

LEGEND

EXISTING

-  STREET
-  LIMITED ACCESS HIGHWAY
-  RAPID TRANSIT LINE
-  RAILROAD LINE

PROPOSED

-  ALTERNATIVE BY ARC
-  RAIL FREIGHT BY ARC
-  RAIL IMPROVEMENT BY OTHERS



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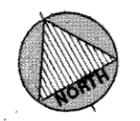
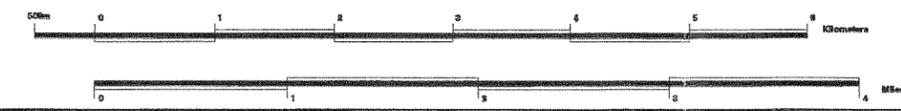
**PR**  
100 YEARS  
TO LACKAWANNA  
CUTOFF

10

# FLUSHING # 7 EXTENSION

PORT AUTHORITY OF NEW YORK AND NEW JERSEY    METROPOLITAN TRANSPORTATION AUTHORITY    NEW JERSEY TRANSIT

Scale - 1:25,000



DATE 12/04/95

## Alternative 11

### Rapid Rail Transit

#### Broadway BMT Extension

##### Features

##### Manhattan

- Extension of Broadway BMT subway from 57th Street and Seventh Avenue under Central Park, across West 66th Street to New Jersey via new two track Hudson River tunnel
  - ⇒ New station at Lincoln Center
  - ⇒ Subway transfers to east Midtown and Queens at 57th and 42nd Streets

##### New Jersey/Rockland/Orange

- New two track tunnel from Manhattan to the Meadowlands Sports Complex
  - ⇒ Bus to rail transfer at Meadowlands Sports Complex (no commuter parking)
  - ⇒ West Shore line transfer to subway at Meadowlands Sports Complex
- Harmon Meadows and Palisades subway stations
  - ⇒ Transfer to Hudson-Bergen Light Rail Transit system at Palisades station
- Subway transfers to east Midtown and Queens at 57th and 42nd Streets
  - ⇒ Additional access via Broadway BMT to Herald Square, Union Square, City Hall, and Brooklyn

##### Long Island

- LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Queens

- LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island



**LEGEND**

**EXISTING**

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

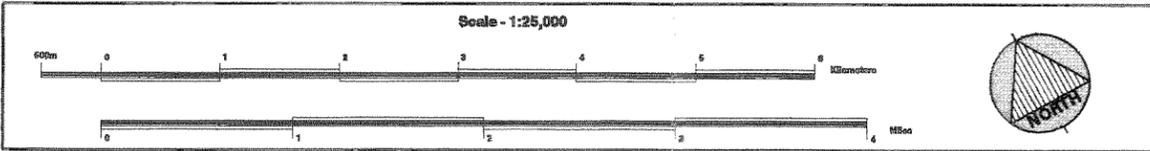
**PROPOSED**

- ALTERNATIVE BY ARC
- - - RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS



**BROADWAY BMT EXTENSION**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY    METROPOLITAN TRANSPORTATION AUTHORITY    NEW JERSEY TRANSIT



**Alternative 12**

**Rapid Rail Transit**

**New Crosstown Subway**

Features

Manhattan

- New two track crosstown subway with alignment under 49th Street from Hudson River to Second Avenue and via Second Avenue to 63rd Street Tunnel upper level
  - ⇒ Four Manhattan stations: Seventh to Eighth Avenue; Rockefeller Center; Park Avenue (GCT North End Access); and 55th Street and Second Avenue
- Hudson River tunnel shared with Hudson-Bergen Light Rail Transit system extension; LRT stub ends at 49th Street and Eighth Avenue

New Jersey/Rockland/Orange

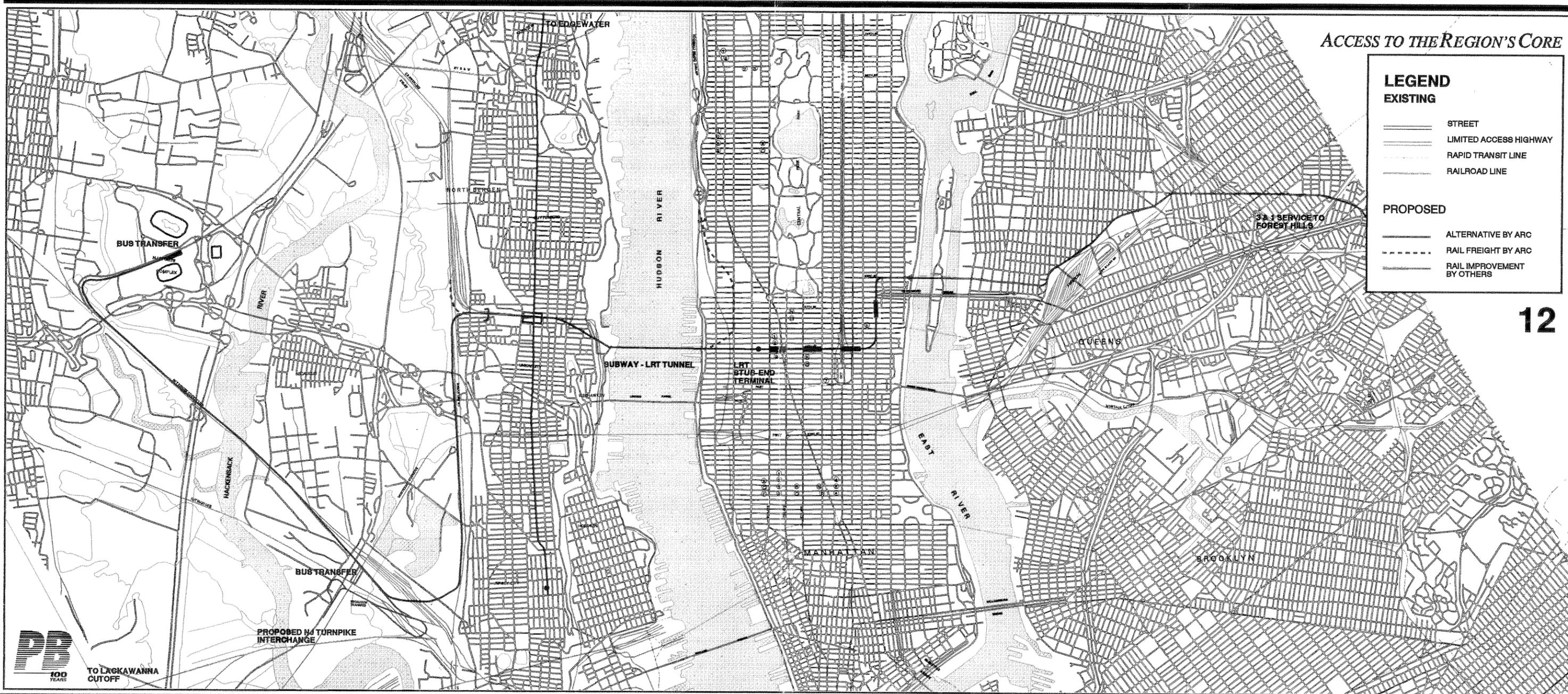
- From Hudson River west via Secaucus Transfer Station and north to Meadowlands Sports Complex Terminal
  - ⇒ Bus to rail transfer at Meadowlands Sports Complex (no commuter parking)
  - ⇒ West Shore line transfer to subway at Meadowlands Sports Complex
- Hudson River tunnel shared with Hudson-Bergen Light Rail Transit system extension to Manhattan; LRT stub ends at 49th Street and Eighth Avenue
- New Palisades subway station with transfer to Hudson-Bergen Light Rail Transit system
- Possible north-south subway extensions to Jersey City Heights and/or Fort Lee under Bergenline (or parallel) Avenue
- Transfer from Main/Bergen/Port Jervis/Pascack Valley lines, New York Susquehanna & Western, and Northeast Corridor lines at Secaucus Transfer Station; possible NJT Boonton line extension via Lackawanna Cutoff to Pennsylvania

Queens

- From 63rd Street Tunnel upper level to Queens Plaza/Sunnyside Yard area via bellmouth extension
- Queens Boulevard 3 and 1 peak direction express service between Queens Plaza and Forest Hills (71st/Continental)

Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island



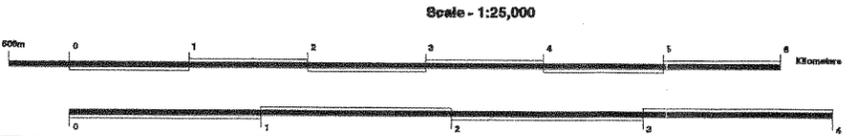
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12

**NEW CROSSTOWN SUBWAY**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY METROPOLITAN TRANSPORTATION AUTHORITY NEW JERSEY TRANSIT



DATE 12/04/95

## Alternative 13

### Rapid Rail Transit

#### Sixth/Eighth Avenue IND Extension

##### Features

##### Manhattan

- Extension of Sixth/Eighth Avenue IND subway lines to New Jersey via new two track Hudson River tunnel:
  - a) From 53rd Street and Seventh Avenue west via 53rd Street;
  - b) From PSNY west via 33rd Street with a station at Javits Center
- Hudson River tunnel shared with Hudson-Bergen Light Rail Transit system extension; LRT connects to proposed NYCDOT 42nd Street LRT via 11th Avenue
- Relocation of existing West Side Ferry Terminal to 34th Street to be served by Javits Center station

##### New Jersey/Rockland/Orange

- New two track tunnel from Manhattan to the Meadowlands Sports Complex
  - ⇒ Bus to rail transfer at Meadowlands Sports Complex (no commuter parking)
  - ⇒ West Shore line transfer to subway at Meadowlands Sports Complex
- Harmon Meadows and Palisades subway stations
  - ⇒ Transfer to Hudson-Bergen Light Rail Transit system at Palisades station
- Hudson River tunnel shared with Hudson-Bergen Light Rail Transit system extension to Manhattan; LRT connects to proposed NYCDOT 42nd Street LRT via 11th Avenue

##### Long Island

- LIRR via 63rd Street Tunnel lower level into GCT (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Queens

- LIRR via 63rd Street Tunnel lower level into GCT with possible new Queens stations and expanded Queens service (to be modeled by LIRR "East Side Access" study)
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island

ACCESS TO THE REGION'S CORE



**LEGEND**

**EXISTING**

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

**PROPOSED**

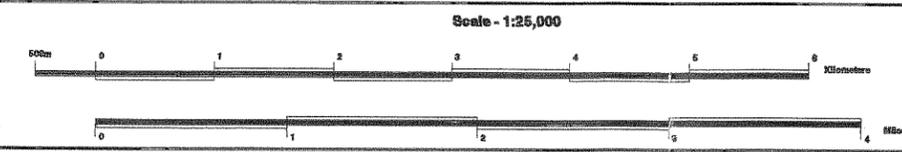
- ALTERNATIVE BY ARC
- - - RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS

13



**13 IND EXTENSION**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY METROPOLITAN TRANSPORTATION AUTHORITY NEW JERSEY TRANSIT



DATE 12/04/95

## Alternative 14

### Modal Combination

#### Port Washington Combination

##### Features

##### Long Island

- LIRR Port Washington line via subway operation to upper level of 63rd Street Tunnel
- LIRR Main line via 63rd Street Tunnel lower level into GCT
  - ⇒ Potential for additional capacity by dual mode operations to PSNY for diesel lines as well as for improved service on electrified lines

##### Manhattan

- New two track subway south on Second Avenue, east on 43rd Street to new station on third level under GCT, and into new two track Hudson River tunnel to New Jersey
  - ⇒ Four stations in Manhattan: Far West Side; Times Square; GCT; and 55th Street and Second Avenue
  - ⇒ A first phase would consider use of the Broadway BMT express tracks to west Midtown and lower Manhattan

##### New Jersey/Rockland/Orange

- Two new termini in New Jersey: the Secaucus Transfer Station and the Meadowlands Sports Complex
  - ⇒ Bus to subway and West Shore line commuter rail to subway transfer at Meadowlands Sports Complex (no commuter parking)
- Harmon Meadows, Palisades, and Waterfront subway stations
  - ⇒ Transfer to Hudson-Bergen Light Rail Transit system at Palisades station
- Transfer from Main/Bergen/Port Jervis/Pascack Valley lines, New York Susquehanna & Western, and Northeast Corridor lines at Secaucus Transfer Station; possible NJT Boonton line extension via Lackawanna Cutoff to Pennsylvania

##### Queens

- LIRR Port Washington line via subway operation to upper level of 63rd Street Tunnel
- LIRR Main line via 63rd Street Tunnel lower level into GCT
  - ⇒ Potential for increased LIRR service to PSNY from implementation of LIRR "East Side Access" through reduction in number of LIRR trains to PSNY from Nassau and Suffolk Counties

##### Freight

- Rail freight via new Hudson River tunnel, West Side Line, Spuyten Duyvil connection, MNR Hudson line, and Oak Point link to New England and, via Hell Gate Bridge, to Sunnyside Yard and Long Island



**LEGEND**

**EXISTING**

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

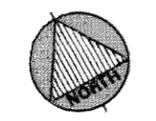
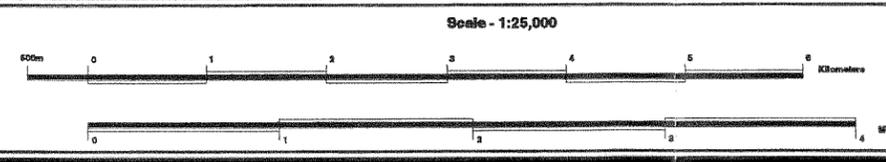
**PROPOSED**

- ALTERNATIVE BY ARC
- RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS



# PORT WASHINGTON COMBINATION

PORT AUTHORITY OF NEW YORK AND NEW JERSEY    METROPOLITAN TRANSPORTATION AUTHORITY    NEW JERSEY TRANSIT



## Alternative 15

### Joint Use Tunnel

### Joint Use Tunnel

#### Features

#### Manhattan

- New restricted use vehicular/rail tunnel from New Jersey to Queens to accommodate buses, trucks, commercial vans, and rail freight via 49th/50th Streets in Manhattan
  - ⇒ Two lanes for daytime use by buses, trucks, and commercial vans
  - ⇒ One center track for overnight rail freight
- Bus passengers would reach surface in Manhattan via elevators
- Trucks would not stop in Manhattan
- Rail freight trains would not stop in Manhattan

#### New Jersey/Rockland/Orange

- Buses, trucks, and commercial vans connect to and from New Jersey Turnpike Interchange 16E/Route 3
- Rail freight to and from Conrail River line and New York Susquehanna & Western
- Bus to bus staging facilities in New Jersey with both shuttle and through buses in tunnel
- New bus storage areas New Jersey will be required

#### Queens/Long Island

- Buses, trucks, and commercial vans connect to and from Long Island Expressway at Van Dam Street
- Rail freight to and from LIRR at Sunnyside Yard
- Bus to bus staging facilities in Queens with both shuttle and through buses in tunnel
- New bus storage areas in Queens will be required

ACCESS TO THE REGION'S CORE



**LEGEND**

**EXISTING**

- STREET
- LIMITED ACCESS HIGHWAY
- RAPID TRANSIT LINE
- RAILROAD LINE

**PROPOSED**

- ALTERNATIVE BY ARC
- - - RAIL FREIGHT BY ARC
- RAIL IMPROVEMENT BY OTHERS

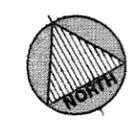
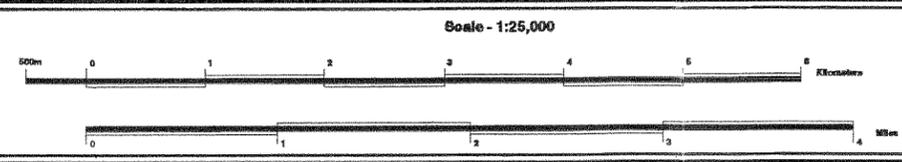
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15

**JOINT USE TUNNEL**

PORT AUTHORITY OF NEW YORK AND NEW JERSEY      METROPOLITAN TRANSPORTATION AUTHORITY      NEW JERSEY TRANSIT



DATE 12/04/95