

# RARITAN VALLEY LINE ONE-SEAT RIDE SERVICE TO MANHATTAN

---

## STUDY REPORT

JULY 10, 2020



---

# TABLE OF CONTENTS

<b>Executive Summary</b> .....	<b>iv</b>
<b>1.0 Introduction</b> .....	<b>1</b>
<b>2.0 Organization of Study Report</b> .....	<b>3</b>
<b>3.0 Background</b> .....	<b>4</b>
3.1 RVL History.....	4
3.2 RVL Infrastructure and Train Service .....	4
3.3 North Jersey Rail Lines and RVL Ridership .....	7
3.4 The Northeast Corridor .....	7
3.5 NJ TRANSIT Planning for Trans-Hudson Capacity Expansion and the RVL .....	12
<b>4.0 Raritan Valley Line One-Seat Ride Options Analysis</b> .....	<b>15</b>
4.1 Alternatives Analysis Structure and Process .....	15
4.2 Baseline Operating Service Plan .....	16
4.3 Train Slot Availability Analysis .....	18
4.4 Scenarios Analysis and Results .....	18
4.5 Short-Term Direct Rail Service Scenarios .....	19
4.6 Medium-Term Direct Rail Service Scenarios .....	23
4.7 Long-Term Scenario E .....	26

---

<b>5.0 Future Planning Process .....</b>	<b>29</b>
<b>6.0 Conclusions .....</b>	<b>30</b>
<b>Appendices .....</b>	<b>32</b>
Appendix A .....	32
Appendix B .....	40
Appendix C .....	47
Appendix D .....	50
Appendix E .....	57
Appendix F .....	63
Appendix G .....	66
Appendix H .....	75
Appendix I .....	86

---

# EXECUTIVE SUMMARY

On January 13, 2020, Governor Murphy signed legislation enacted by the New Jersey State Legislature that directs NJ TRANSIT to “conduct a study on the feasibility of providing rail service on the Raritan Valley Line (RVL) that offers full-time direct rail service to New York City,” that is defined as “a one-seat ride to and from its termini and that operates on weekdays and weekends, during peak hours and non-peak hours.” The RVL schedule in effect prior to Covid-19 included direct rail service via the Northeast Corridor (NEC) to Penn Station New York (PSNY) during the weekday midday and weekday evening off-peak periods, but not during the weekday morning and evening peak periods and during weekends.

In compliance with this legislation, NJ TRANSIT reviewed RVL, NEC and PSNY operating conditions and alternatives for providing full-time RVL one-seat ride service that would be feasible in the context of physical infrastructure investments and capital and operating funding circumstances. This study provides the methodology and results of the aforementioned review and analysis.

Several scenarios for implementing RVL one seat ride service in the peak hours were developed. Some scenarios include substitution of existing NEC and/or NJCL trains with RVL trains. The displaced NEC and/or NJCL trains would terminate at Newark Penn Station (NPS), requiring PSNY-bound passengers to transfer. The scenarios which re-allocate NEC / PSNY capacity to the RVL would have negative customer impacts, as they reduce both rail system ridership and carrying capacity to PSNY, are estimated to result in overcrowding at NPS and Secaucus Junction, and would potentially degrade on

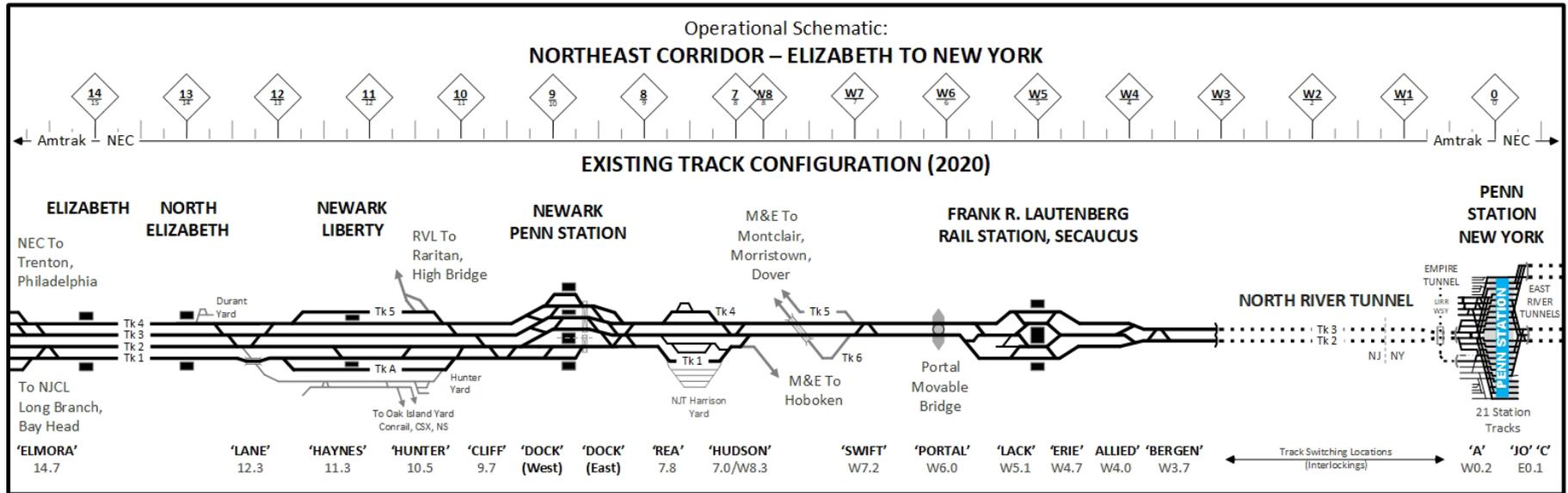
time performance. The proposed peak hour RVL PSNY trains would provide a one-seat ride but would not markedly reduce travel times for RVL riders since these one-seat ride trains would no longer operate with a skip stop pattern but would stop at all RVL stations due to the limited available train slots. Each of the scenarios would require increased annual funding for operation and maintenance and significant capital investment. The study determined that full-time direct rail service to Manhattan will be best achieved by expanding trans-Hudson and PSNY infrastructure capacity based on the overall Gateway Program, which would benefit riders on all of NJ TRANSIT’s northern New Jersey rail services, including the RVL.

## STUDY PROCESS & STRUCTURE

This study analyzed, in detail, weekday morning and weekend one-seat ride services on the NEC, between Newark and PSNY (Figure ES-1). The study reconfirmed previous analyses that concluded that the NEC and PSNY are at capacity during the peak hours of the morning peak period and on weekends. Therefore, to operate full-time one-seat ride RVL trains to PSNY it would be necessary to re-allocate NEC / PSNY train capacity that is used by other NJ TRANSIT rail service lines or expand system capacity. This study reviewed both approaches and considered short, medium and long-term scenarios.

The weekday morning peak period (6:00 am to 10:00 am) was studied in detail to evaluate potential operating concepts since ridership is more concentrated in the morning than during the

**FIGURE ES-1 – NORTHEAST CORRIDOR**



evening peak period (4:00 pm to 8:00 pm). For evening RVL one-seat ride service it is expected that the operations, (especially slot reallocation), infrastructure and rail rolling stock assumptions for the morning peak period will be applicable to support comparable evening one-seat ride operations. A fuller operational analysis of rail system scheduling would need to be performed to advance any of the Study’s scenarios.

## ANALYSIS & RESULTS

For the planning of RVL one-seat ride service to PSNY, it is important to recognize that NJ TRANSIT’s train operations on the NEC are integrated into the network of services along the 457-mile NEC between Boston and Washington, D.C., and its connecting rail corridors. The NEC segment utilized by NJ TRANSIT between Newark, New Jersey and PSNY and Sunnyside Yard in Queens, NY,

which is owned by Amtrak, is the most intensely used segment of railroad in the United States. During the peak hours of the weekday morning and evening peak periods this segment of the NEC is used to capacity by Amtrak, Long Island Rail Road (LIRR) and NJ TRANSIT. Additionally, due to essential tunnel maintenance activities, one of the two tracks under the Hudson River (known as the North River Tunnel) is removed from service during weekends, and the remaining single track is used to capacity.

Further complicating the capacity constraints is the complex railroad configuration which involves weaving together a diverse group of Amtrak, NJ TRANSIT and LIRR train services over 60 miles of tracks that merge and diverge at very complex junctions. Even small schedule adjustments must be fully coordinated among all parties to avert what could otherwise be large-scale impacts to all operations. In addition, NJ TRANSIT rail lines have

**TABLE ES-1 – RVL STUDY SCENARIOS**

Scenario	Potential Rail Service	Forecasted Net Peak Period Ridership Change*	Capital Improvements and Estimated Capital Cost	Annual Operation & Maintenance Costs (2020\$)	Implementation
<b>Short-Term: Scenario A</b>	3 existing RVL trains extended to PSNY in the shoulders of the morning peak period (arriving at PSNY before 7:00 am or after 9:20 am)	No significant change in ridership	Multi-level cars and dual mode locomotives needed to fulfill morning schedules not covered by extended trains and to provide longer trains for PSNY service; Raritan yard expansion  <b>\$125 Million</b>	<b>\$4.6 Million</b>	Six Years
<b>Short-Term: Scenario B</b>	3 NEC trains terminate at NPS and 3 existing RVL trains use their slots to operate to PSNY in peak 2 hours (arriving at PSNY between 7:00 am and 9:20 am)	Ridership declines modestly	Same as Scenario A and station improvements to lengthen platforms to improve compatibility with longer trains  <b>\$346-704 Million</b>	<b>\$6.7 Million</b>	Seven Years+
<b>Medium-Term: Scenario C</b>	2 NEC & 2 NJCL trains terminate at NPS and 4 existing RVL trains use their slots to operate to PSNY in peak 2 hours (arriving at PSNY between 7:00 am and 9:20 am)	Ridership declines	Similar to Scenario B, plus additional multi-level cars and RVL station platform improvements, NPS passenger circulation upgrades, and Hunter Flyover  <b>\$1.6 Billion</b>	<b>\$6.7 Million</b>	Eleven Years
<b>Medium-Term: Scenario D</b>	Same morning peak service as Scenario C and weekend service	Ridership declines on weekdays, grows on weekends	Same as Scenario C and Hudson River Tunnel Project  <b>\$15 Billion**</b>	Gateway Program	Eleven Years
<b>Long-term: Scenario E</b>	Full-time direct service to PSNY	Significant ridership growth associated with full Gateway Program	Gateway Program Projects  <b>\$30+ Billion**</b>	Gateway Program	Undefined

\* Additional impacts not covered in table. See Section 4.0, Raritan Valley Line One-Seat Ride Options Analysis, for additional information.

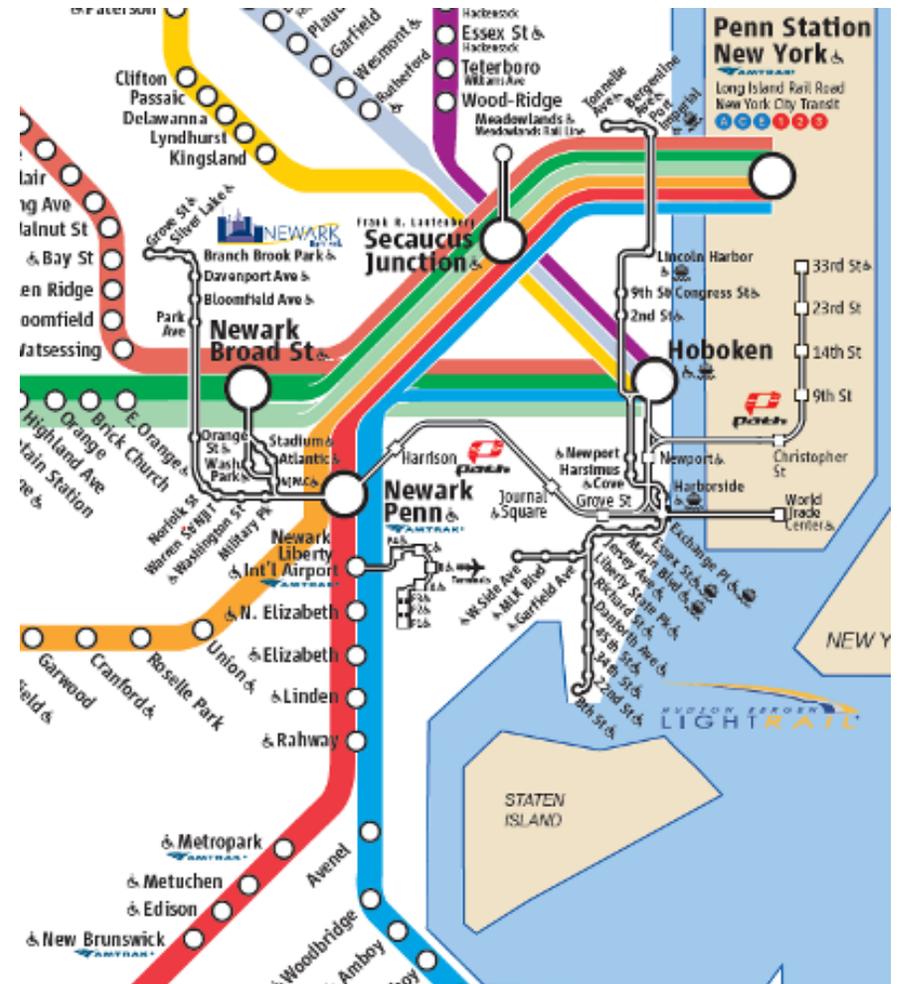
\*\*The full \$15-30 Billion capital cost for Gateway Program improvements is not attributable only to RVL but to the entire NJ TRANSIT commuter rail system and Amtrak.

an interdependent operation as lines merge with the NEC and train capacity must be planned to accommodate high volumes of passengers on trains and their movement on and off trains at Newark Penn Station (NPS), Secaucus Junction and PSNY (Figure ES-2).

The full capacity utilization makes the system very sensitive to any occurrence that disrupts the scheduled operation of trains. When train movement is disturbed, the impact can cascade through the system and negatively affect travel for thousands of customers. In addition, the RVL is subject to congested operating conditions on the Conrail-owned segment of the RVL, known as the Lehigh Line, where RVL trains share the line – the busiest freight operation in New Jersey – with Conrail, CSX Transportation and Norfolk Southern Railway freight trains. As with service over the NEC, even simple service changes planned by NJ TRANSIT requires significant coordination among these railroads.

Based on the evaluation of the train operations, concepts for re-allocation of capacity and plans for the expansion of NEC and PSNY train capacity were explored and categorized as short, medium and long-term scenarios, considering the estimated timing that would be required for implementation (Table ES-1). Short-Term scenarios A and B and Medium-Term scenario C would extend RVL trains to PSNY. Scenario A accomplishes this goal by extending existing peak period RVL trains to PSNY arriving prior to 7:00 am and after 9:20 am. Scenarios B and C would extend existing RVL trains to PSNY by displacing NEC and North Jersey Coast Line (NJCL) trains during the busiest times of the peak period. For each of these scenarios additional dual mode locomotives and multi-level cars will be needed. The RVL trains that would be extended to PSNY would not be available to fulfill their later morning schedules and so additional rail equipment would be needed to cover those schedules. Furthermore, longer RVL trains with dual mode locomotives would

**FIGURE ES-2 – NEC STATIONS AND CONNECTING NJ TRANSIT RAIL LINES**



be needed to accommodate ridership between Newark and New York.

After detailed review of train operations, the NEC and NJCL trains that could potentially be displaced within the intricate pattern of NJ TRANSIT and Amtrak train services were identified. These displaced

---

trains would terminate revenue service at NPS, where passengers would transfer to other trains (NJ TRANSIT or PATH) for travel to Manhattan, increasing their travel time. The RVL substitution trains would not markedly reduce travel time to PSNY for RVL riders since these one-seat ride trains would no longer operate with a skip stop pattern but would stop at all RVL stations due to the limited available train slots.

The one-seat ride RVL trains would provide less overall capacity for passengers boarding at NPS and at Secaucus Junction than the displaced trains because RVL train lengths are limited by the configuration of the track connection to the NEC for Scenario B and by the train length limitation of the dual mode locomotive for Scenario C. Additionally, the Scenario B configuration, which requires cross track operation as trains approach NPS, would have greater potential for delayed service to PSNY. These operations characteristics would exacerbate overcrowding conditions on trains to PSNY and increase the potential for degraded on-time performance.

Each of the scenarios would require increased annual funding for operation and maintenance and significant capital investment, including the purchase of new rail vehicles and construction of infrastructure needed to support the operation of the peak period PSNY rail service. Capital investments would range from \$125 million for Scenario A to \$1.6 billion for Scenario C and would require about six to eleven years from program initiation to implementation, respectively. Medium-Term Scenario C would be made possible by construction of an important NEC congestion relief project at the confluence of the RVL with the NEC, known as the Hunter Flyover; estimated to cost almost \$400 million.

Planning for expansion of rail system capacity has been under development for the last twenty-five years and is now being

advanced through the Gateway Program. Phase I of the Gateway Program includes construction of a new Hudson River Tunnel and rehabilitation of the existing rail tunnel (the North River Tunnel) when funding is made available. Although it would not add weekday capacity to the rail system, construction of the Hudson River Tunnel Project would remove the single-track weekend constraint that is necessary for tunnel maintenance. This would present an opportunity for NJ TRANSIT to operate weekend RVL one-seat ride service. This option, designated as Medium-Term Scenario D, includes the Scenario C rail service concept, and would cost approximately \$15 Billion. Long-Term Scenario E includes the Gateway Program's PSNY expansion and other capacity expansion projects necessary to increase trans-Hudson rail service capacity. Implementation of those projects, together with NJ TRANSIT system and RVL improvements would support the potential of full-time direct service for the RVL and all other North Jersey routes without the re-allocation of NEC / PSNY train capacity.

## CONCLUSIONS

The study determined that full-time direct rail service to Manhattan will be best achieved by expanding trans-Hudson and PSNY infrastructure capacity (Scenario E). While it may be possible to achieve full-time direct rail service to PSNY as described in Scenario D, several risks and impacts have been identified and would need to be addressed.

The study's operations analyses and development of the study scenarios provide an understanding of the complex railroad operating environment, needed capital investments, and on-going operations and maintenance costs and challenges that NJ TRANSIT must consider as it works to improve service for each of its rail lines. For the RVL, significant capital investments and operations

---

modifications would be needed to transform the line from one that operates peak period service only to Newark, to a larger-scale model that can operate to and from PSNY. This change includes not only the length of the trains (seat capacity) operated but the supporting maintenance and infrastructure necessary to sustain the operation. The railroad fleet must be expanded by procuring new multi-level car trains with dual mode locomotives, additional overnight train storage yard tracks and servicing facilities must be constructed, and increased operations and maintenance funding would be needed.

All scenarios involve significant expense, but Scenarios B and C, which would re-allocate NEC / PSNY capacity to the RVL, would also have negative customer impacts. Even with significant investment, these scenarios reduce both rail system ridership and carrying capacity to PSNY, are expected to result in overcrowding at NPS and Secaucus Junction, and would potentially degrade on-time performance. Medium-Term Scenario D includes the concepts in Scenario C, but the weekend service could be implemented independently without the Scenario C service changes. Long-Term Scenario E would be part of NJ TRANSIT's system-wide program to expand service to and from PSNY and would provide full-time direct service for RVL customers without displacing NEC or NJCL customers.

In contrast to the short and Medium-Term train substitution scenarios, Long-Term Scenario E, based on the overall Gateway Program, would implement a comprehensive set of improvements that will be integrated into the complex NEC / PSNY operating environment, benefiting riders on all of NJ TRANSIT's northern New Jersey rail services, including the RVL. Each rail line would operate to PSNY and trains would accommodate the line's passengers, minimizing transfers at NPS and Secaucus Junction.

Along with development and implementation of the Gateway

capacity expansion program, incremental improvement of the RVL will position the line for future operation of direct service to Manhattan when additional trans-Hudson capacity comes on-line. Projects that will facilitate improved service for RVL riders and one-seat ride service include: the Hunter Flyover; RVL station platform improvements; acquisition of additional multi-level rail cars and dual mode locomotives; and construction of additional train storage yard capacity. Furthermore, as NEC / PSNY capacity is expanded the construction of additional tracks along the NJ TRANSIT-owned segment of the RVL and along the Conrail-owned Lehigh Line would support the operation of additional RVL service, including more frequent peak period train service, and potentially for future extension to the west and/or along the West Trenton Line. The additional capacity provided by these projects would enable more frequent express service and would preserve reasonable travel times.

In conclusion, this study determined that Short-Term substitution of NEC/NJCL trains with RVL trains would reduce system ridership and capacity and risk degrading system on time performance. It also affirmed that by advancing the Hunter Flyover, and supporting and participating in the project development work for the Hudson Tunnel Project and the Gateway Program expansion of trans-Hudson capacity, the State of New Jersey is on the path to providing improved rail service for all of NJ TRANSIT's northern New Jersey rail lines and for the implementation of RVL direct service to Manhattan.

---

# 1.0 INTRODUCTION

On January 13, 2020, Governor Murphy signed legislation enacted by the New Jersey State Legislature that requires New Jersey Transit Corporation (NJ TRANSIT) to

**“conduct a study on the feasibility of providing rail service on the Raritan Valley Line (RVL) that offers full-time direct rail service to New York City. The report shall include findings concerning why direct service was initially suspended, historical and expected ridership for the direct rail service to New York City, actions that the corporation is required to take in order to provide fulltime direct service to New York City, the amount of time those actions are expected to take, the cost to provide the service, and any factors that may delay or increase the cost of providing the service.”**

The legislation states that “full-time direct rail service” equates to rail service that provides a one-seat ride to and from its termini, and that operates on weekdays and weekends, during peak hours and non-peak hours.

NJ TRANSIT provides RVL direct rail service via the Amtrak Northeast Corridor (NEC) to Penn Station New York (PSNY) during the weekday midday and weekday evening off-peak periods. The direct rail service was initiated in 2014 utilizing the then new ALP-45DP dual mode locomotive, which is designed to propel trains on diesel lines, such as the RVL, and then with electric power on the NEC, a requirement to operate in the existing trans-Hudson Tunnel (known as the North River Tunnel) and in PSNY.

In June 2018, RVL direct rail service was discontinued as rail vehicles were taken out of service for the installation of the Positive Train Control (PTC) system that the federal government has mandated and because of a shortage of train engineers. The direct rail service was restored in November 2019, except for one late evening train in each direction. It was NJ TRANSIT’s intention to restore that train after the completion of the PTC project.

However, beginning on Monday, March 23, 2020, the RVL direct rail service was again discontinued as NJ TRANSIT rail services began operating on a modified schedule due to the coronavirus (COVID-19). The timing for restoration of systemwide full weekday service, including the prior RVL direct rail service is not known as of the completion of this study.

The State’s directive to undertake and complete this study occurred before the Covid-19 pandemic, which has brought about immense economic, social and transportation disruptions to the New Jersey / New York metropolitan region, as well as throughout the United States. Studies of this type are based on analysis of transportation system user preferences and forecasts for future population growth, housing and employment conditions. The impact of Covid-19 on future economic, transportation and financial conditions and activity are largely unknown, and therefore, cannot be fully predicted at this time. After past disruptions to economic conditions and NJ TRANSIT’s infrastructure and ridership, the system re-emerged and continued to be a critical element of the region’s economic backbone due to the dedication of NJ TRANSIT employees and leadership.

---

Since it is too early to understand how the Covid-19 pandemic will impact public transit ridership and financial conditions, this study was prepared using pre-Covid-19 transportation preferences and assumes that housing and job conditions are consistent with regional long-term models and planning forecasts, and growth will continue at some point as anticipated prior to the pandemic.

---

# 2.0 ORGANIZATION OF STUDY REPORT

The report consists of the following sections.

## BACKGROUND

This section provides a short history of the RVL and a description of its infrastructure and train service. It also contains ridership data for the RVL and NJ TRANSIT's other northern New Jersey rail lines. Additionally, this section describes the Northeast Corridor (NEC) and NJ TRANSIT planning for trans-Hudson capacity expansion and the relationship to the RVL.

## RVL ONE SEAT RIDE OPTIONS ANALYSIS

This section describes the NEC capacity analysis and the evaluation of potential scenarios for implementing RVL one-seat ride service.

## APPENDICES

Technical sections provide detailed information and analysis that support the work of the study.

# 3.0 BACKGROUND

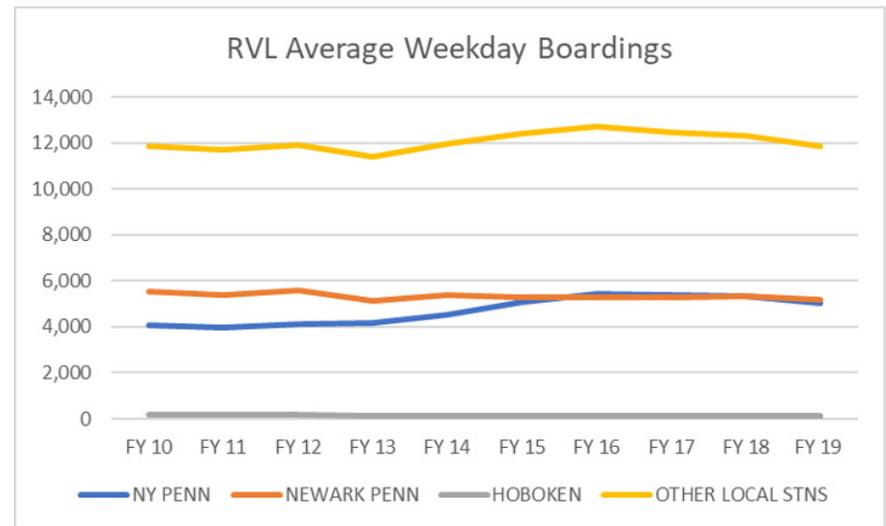
## 3.1 RVL HISTORY

The RVL's configuration is the result of efforts by the State of New Jersey to maintain commuter rail passenger service and reduce costs as the Central Railroad of New Jersey (CNJ), also known as the Jersey Central, was failing during the late 1950s and 1960s. At that time the CNJ provided commuter rail service in New Jersey to communities between Hampton and the CNJ's terminals in Jersey City and Newark (on Broad Street). The Jersey City Terminal, on the Hudson River waterfront (now within Liberty State Park), provided access to Manhattan via ferry service. The plan for reconfiguration of the CNJ, known as the Aldene Plan, involved rerouting the diesel propelled commuter rail service via the Lehigh Valley Railroad (LV) and the Pennsylvania Railroad (PRR) to Newark Penn Station (NPS), the line's new eastern terminal, where passengers could access Newark and transfer to commuter and PATH trains to Manhattan. The RVL, as a diesel line, could not continue to PSNY since only electric trains are permitted to operate through the North River Tunnel under the Hudson River to Penn Station New York (PSNY). The Aldene Plan, completed in 1967, reduced the cost of operating commuter rail service and it eliminated the cost of operating the Jersey City Terminal and the ferry service to Manhattan. The Aldene Plan also was the first of the State of New Jersey's efforts to expand the use of the NEC's access to PSNY in midtown Manhattan for the State's commuter rail network.

As a result of the Aldene Plan, the RVL service operates on a combination of segments of the former CNJ (now owned by NJ

TRANSIT), the former LV (now owned by Conrail), and the former PRR, now the Northeast Corridor (NEC) owned Amtrak (Figure 2 and Figure 1 and Figure 2).

**FIGURE 1 – HISTORICAL AVERAGE WEEKDAY RVL BOARDINGS**

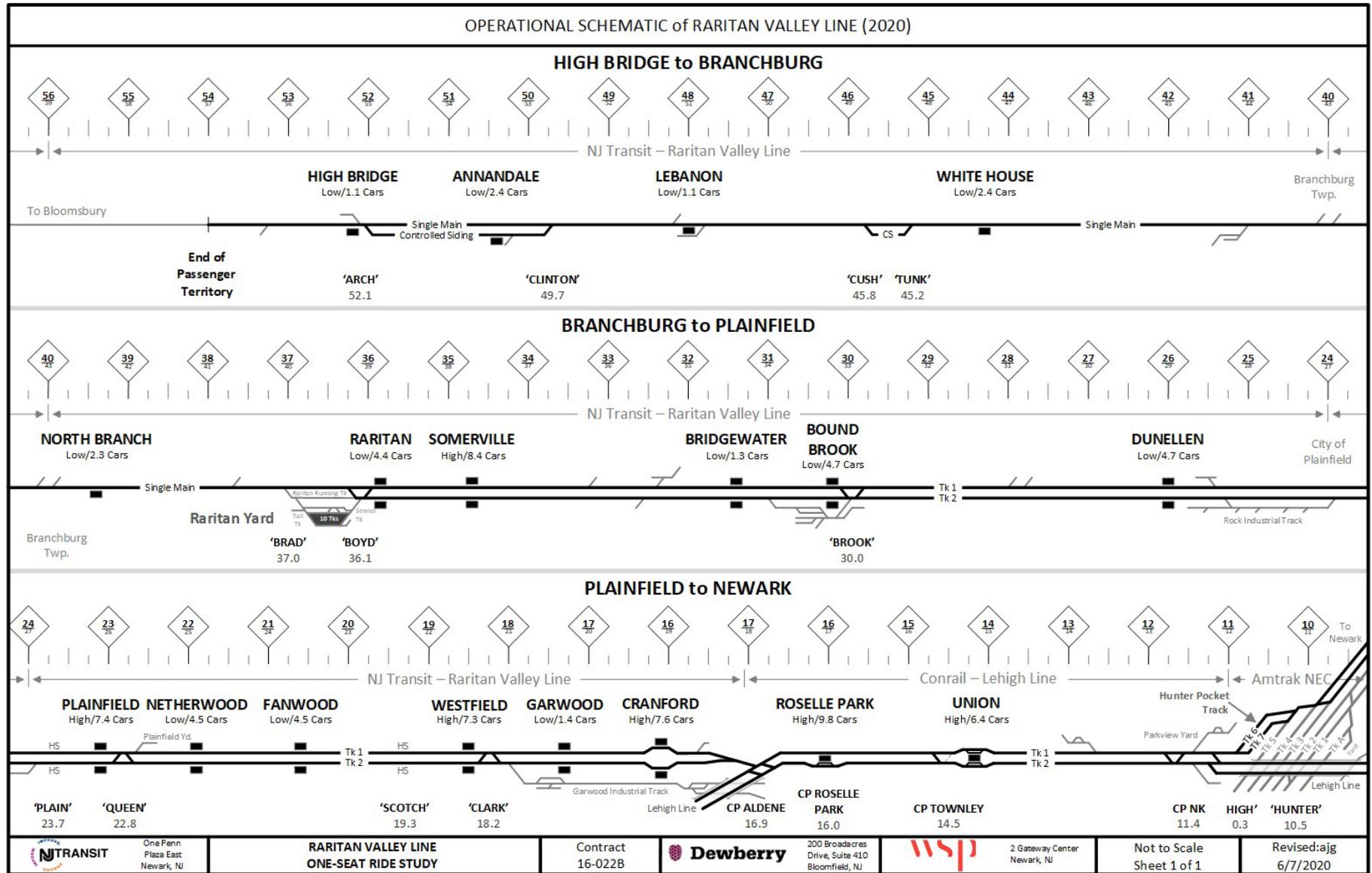


FY Years 2010 to 2019 (Other Local Stations are those between Union and High Bridge; and the Boardings include trips between stations.)

## 3.2 RVL INFRASTRUCTURE AND TRAIN SERVICE

The RVL is approximately 45 miles in length from High Bridge Station to NPS. The western segment of the RVL, the 37-mile long

**FIGURE 2 – SCHEMATIC SHOWING RARITAN VALLEY LINE, 2020**



---

former CNJ segment of the line between High Bridge and Cranford stations, is owned and controlled by NJ TRANSIT. West of Raritan, it consists of a single-track with one passing siding, and it has two main line tracks between Raritan and Cranford stations.

East of the Cranford station the single track Aldene connection links the former CNJ tracks to the 6-mile long Lehigh Valley Railroad segment, now known as the Lehigh Line. Conrail, which is owned by the Norfolk Southern Railway (NS) and CSX Transportation (CSX) as a shared asset on behalf of its owners, controls freight and passenger train operations on the Lehigh Line. The Roselle Park and Union stations are on this segment of the RVL.

The Lehigh Line carries long distance freight railroad services for both NS and CSX. The line extends from Newark to Phillipsburg and continues westward across the Delaware River into Pennsylvania. West of Manville, NJ the NS owns the Lehigh Line, which is the sole access point in NS' 20,000 mile system to the New York metropolitan area. In Manville the CSX-owned Trenton Line (which was formerly used for West Trenton Line commuter rail service) diverges from the Lehigh Line and runs to Ewing Township (location of SEPTA's West Trenton Station), and then across the Delaware River into Pennsylvania. This part of CSX's 21,000 mile network is a segment of its I-95 corridor which extends from south Florida to Boston.

The six mile long shared segment of the Lehigh Line utilized by Conrail, NS, CSX, and NJ TRANSIT train is the busiest freight rail line in the State of New Jersey. Depending on freight train scheduling a combined total of about 100 freight and RVL trains a day share the two tracks of the Lehigh Line. Scheduling of RVL trains, which constitute about 60% of the Lehigh Line train movements on an average weekday, is coordinated with Conrail, whose dispatchers control the movement of trains on the Lehigh Line. **Conrail must**

**approve any schedule changes proposed by NJ TRANSIT for its RVL service.**

The RVL connects to the NEC in Newark via a single track known as the Hunter Connection. The Hunter Connection has a second track, or "passing siding", known as the Hunter Pocket Track. The pocket track will accommodate a train of up eight coaches and one locomotive in length, making it possible for trains to pass each other on the Connection. RVL trains operate on the NEC for about two miles to NPS where passenger service terminates, except for midday and evening off-peak period trains that continue to operate to PSNY.

Approaching NPS, eastbound RVL trains either cross over the NEC and board/discharge predominantly on Track 1 Platform B or do not crossover the NEC and board/discharge from Platform E Track 5 on weekdays. On weekends, all RVL trains utilize Platform E Track 5. Some of the RVL trains that terminate at NPS "turn around" to operate in westbound revenue service back to the RVL, and others operate eastward with no passengers to connecting tracks in Harrison, NJ to access NJ TRANSIT's Meadows Maintenance Complex or operate elsewhere on the rail system.

RVL trains initiate service from High Bridge, Raritan and Plainfield. Service patterns are local or express. The entire line is served by a single storage yard at Raritan, where trains are parked, and minor servicing is performed. The line is not electrified, thus only diesel locomotives and dual mode locomotives in diesel mode operate on the line. Train sets in operation include both single level coaches and multilevel coaches, and peak period trains consist of six, seven or eight cars plus a locomotive.

Currently there are 18 stations (excluding NPS and PSNY) on the RVL. Six stations have high level boarding, 12 stations have low

---

level boarding. Platform lengths vary from approximately 100 feet to nearly 900 feet; the length that is compatible with a ten-car train. Automobile parking is available at all stations with some operated by NJ TRANSIT and some operated by other parties. RVL parking capacity is 4,682 spaces and in 2018 occupancy was at about 74%, with varying levels of use by station.

### 3.3 NORTH JERSEY RAIL LINES AND RVL RIDERSHIP

Several regional and local variables impact ridership on public transportation systems and individual routes, including travel times, convenience and attractiveness of transit services, alternative modes, demographics, economic conditions, job availability, housing availability and costs. In addition, development and redevelopment adjacent to stations that creates more transit-friendly conditions and attracts people to use transit services can have an impact on transit utilization.

Major drivers of ridership on NJ TRANSIT's northern New Jersey rail system have historically been job conditions in Manhattan and the availability of housing in New Jersey. Since the great recession of 2008, average weekday ridership on NJ TRANSIT's northern New Jersey rail lines increased 5% in total over the period between fiscal year 2009 and 2019, but some lines experienced larger positive and negative changes. During this eleven year period RVL ridership has been steady with modest variation from year to year. The net change was a decrease of 1%. The NEC saw a 5% increase, shown in Table 1. The Montclair-Boonton Line ridership increase was 20%. The Pascack Valley Line saw a 20% increase and the Main and Bergen County lines increased by 18%. The latter two lines, like the RVL, require passengers to transfer (at Secaucus Junction) to access

PSNY trains. The North Jersey Coast Line (NJCL) experienced a 25% drop in the first five years of the eleven-year period (also affected by Superstorm Sandy), and since then ridership has remained relatively steady.

Total RVL ridership (see Figure 1 and Table 2) was relatively constant during the last decade, although travel to PSNY increased after the weekday midday and evening off-peak one-seat ride service was inaugurated in 2014. Daily weekday ridership along the RVL varied from fewer than 100 at several stations to about 2,700 at Westfield.

The RVL is among the several rail lines where new housing has been developed and projects are being advanced to continue that trend. Cranford was in the forefront of supporting and developing transit-oriented development (TOD), but recently TOD has occurred and is proposed for other RVL stations, including Union, Garwood, Fanwood, Plainfield, Dunellen, Bound Brook, Somerville and Raritan. The RVL is not unique, as TOD has been implemented and is being advanced along many other NJ TRANSIT lines.

### 3.4 THE NORTHEAST CORRIDOR

NJ TRANSIT's train operations on the NEC are integrated into the network of services along the 457-mile NEC operating between Boston, MA and Washington, D.C., and its connecting rail corridors. According to the Northeast Corridor FUTURE Tier 1 Final Environmental Impact Statement Summary (December 2016), the NEC is:

**...the most heavily utilized rail network in the United States. The NEC ranks among the busiest rail corridors in the world,**

**TABLE 1 – HISTORICAL AVERAGE WEEKDAY TRIPS (BY FISCAL YEAR) ON NJ TRANSIT’S NORTHERN NEW JERSEY RAIL LINES**

Rail Line		Eastern Terminal	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	% Change for Period from 2009 to 2019	Notes
Northeast Corridor	NEC	PSNY	116,500	115,700	110,800	113,700	114,450	118,600	121,950	124,150	121,350	120,750	122,650	5	Between Rahway and North Elizabeth passengers can board NEC or NJCL trains
North Jersey Coast Line	NJCL	PSNY & Hoboken	29,950	27,850	25,000	24,900	22,250	23,350	24,150	24,150	23,150	22,500	22,800	-24	Ridership does not include boardings between Rahway and North Elizabeth.
Raritan Valley Line	RVL	Newark Penn	22,550	21,550	21,250	21,800	20,850	22,000	22,950	23,550	23,250	23,150	22,200	-1	Between 2014 & 2018 midday and evening off-peak trains operated to PSNY
Morris & Essex	M&E	PSNY & Hoboken	53,300	52,850	52,300	54,100	51,600	56,050	58,800	60,500	59,500	58,000	59,900	12	
Montclair - Boonton	M-B	PSNY & Hoboken	15,700	14,750	15,000	15,750	14,850	16,300	17,600	18,300	18,200	18,400	18,800	20	
Main Line Bergen County	MLBC	Hoboken with transfer at Secaucus Junction	26,600	25,850	25,750	26,950	25,600	28,150	30,150	30,950	29,900	30,100	31,450	18	Includes riders transferring at Secaucus Junction to / from PSNY trains
Pascack Valley	PVL	Hoboken with transfer at Secaucus Junction	7,100	6,950	6,750	7,150	6,850	7,650	8,250	8,500	8,000	8,000	8,550	20	Includes riders transferring at Secaucus Junction to / from PSNY trains
<b>Total</b>			<b>271,700</b>	<b>265,500</b>	<b>256,850</b>	<b>264,350</b>	<b>256,450</b>	<b>272,100</b>	<b>283,850</b>	<b>290,100</b>	<b>283,350</b>	<b>280,900</b>	<b>286,350</b>	<b>5</b>	

Note: FY 2019 ridership may have been impacted as rail service was modified due to removal of trains for installation of PTC equipment and train engineer shortage.

**TABLE 2 – HISTORICAL AVERAGE WEEKDAY RVL BOARDINGS BY STATION**

Station	Average Weekday Passenger Boardings										
	FY 2009	FY 2010	FY 2011	FY 2012	FY 2012	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Penn Station NY	4,254	4,060	3,991	4,124	4,169	4,520	5,098	5,414	5,386	5,321	5,043
Newark Penn	5,744	5,521	5,409	5,594	5,158	5,365	5,268	5,277	5,273	5,348	5,171
Hoboken	165	180	163	158	135	146	147	150	139	141	137
Other Local Stations	12,386	11,837	11,686	11,922	11,385	11,967	12,436	12,707	12,451	12,340	11,848
<b>Total RVL</b>	<b>22,548</b>	<b>21,598</b>	<b>21,249</b>	<b>21,798</b>	<b>20,847</b>	<b>21,998</b>	<b>22,949</b>	<b>23,548</b>	<b>23,249</b>	<b>23,150</b>	<b>22,199</b>
Secaucus	13	13	12	13	11	13	17	21	20	24	24
Union	1,230	1,196	1,265	1,355	1,288	1,371	1,480	1,517	1,470	1,473	1,433
Roselle Park	901	865	864	845	813	858	892	891	908	957	922
Cranford	1,189	1,175	1,189	1,264	1,254	1,351	1,412	1,510	1,500	1,505	1,432
Garwood	85	90	101	83	94	103	118	126	126	124	122
Westfield	2,321	2,286	2,300	2,376	2,327	2,496	2,638	2,727	2,722	2,701	2,567
Fanwood	917	913	966	974	940	969	1,053	1,093	1,087	1,065	1,030
Netherwood	603	559	534	546	501	520	516	513	490	451	444
Plainfield	1,044	968	897	893	858	862	845	817	764	727	697
Dunellen	1,041	1,001	948	945	852	908	924	940	904	872	835
Bound Brook	748	681	620	622	613	616	614	599	571	557	544
Bridgewater	417	344	338	336	299	309	315	333	346	344	310
Somerville	711	630	651	677	656	695	711	725	685	675	683
Raritan	731	672	622	638	579	580	580	591	577	586	551
No Branch	95	100	80	72	66	67	67	56	48	48	43
White House	109	121	120	110	91	99	103	106	96	95	83
Lebanon	25	30	28	21	19	20	22	23	21	24	20
Annandale	125	117	78	82	65	68	71	68	65	65	63
High Bridge	80	76	73	72	58	64	56	53	50	47	46

By Fiscal Year (FY) (NJ TRANSIT FY: July 1 to June 30). Weekday midday and evening off-peak PSNY one-seat ride service offered between March 2014 to September 2018. Weekday midday and evening off-peak PSNY one-seat ride service resumed from October 2019 (FY 2020).

**moving more than 750,000 passengers every day on 2,200 trains. Freight operators share the NEC with passenger railroads and are responsible for the movement of over 350,000 car loads of freight per year on the NEC. This volume of traffic and diversity of service today operates on an NEC with capacity constraints that require scheduled and real-time trade-offs in frequency, speed, and performance of passenger and freight services. The congestion caused by these capacity constraints limits operations and opportunities to improve or expand passenger rail services. The NEC's aging infrastructure further limits operations and constrains the ability to improve and expand services. This infrastructure, in many cases built over 100 years ago, does not provide the resiliency or redundancy necessary to respond to unanticipated natural disasters or other disruptive events.<sup>1</sup>**

The NEC between Newark, New Jersey and Sunnyside Yard in Queens, NY, which includes the two single-track tunnels under the Hudson River, a single-track tunnel in Manhattan serving New York State's Empire Service, PSNY, and four single-track tunnels under the East River, is the most intensely used segment of the NEC. Amtrak has agreements with the New York State Department of Transportation, the Long Island Rail Road and NJ TRANSIT regarding the operations of trains and the use of PSNY's 21 tracks and 11 platforms (Figure 3). Pre-construction efforts are also underway to introduce Metro-North Railroad commuter service to PSNY from New Rochelle, NY and points east to New Haven, CT, starting by 2025. The operations of each of the railroads is unique and based on the configuration of the railroad infrastructure and train services that they provide.

<sup>1</sup> Federal Railroad Administration, 2016, Northeast Corridor FUTURE Tier 1 Final Environmental Impact Statement Volume 1 (Preferred Alternative) Summary, page S-5.

The movement of RVL trains along each segment of railroad (Figure 3) that it operates on, in the eastbound and westbound directions, is controlled by the right-of-way owners, as follows:

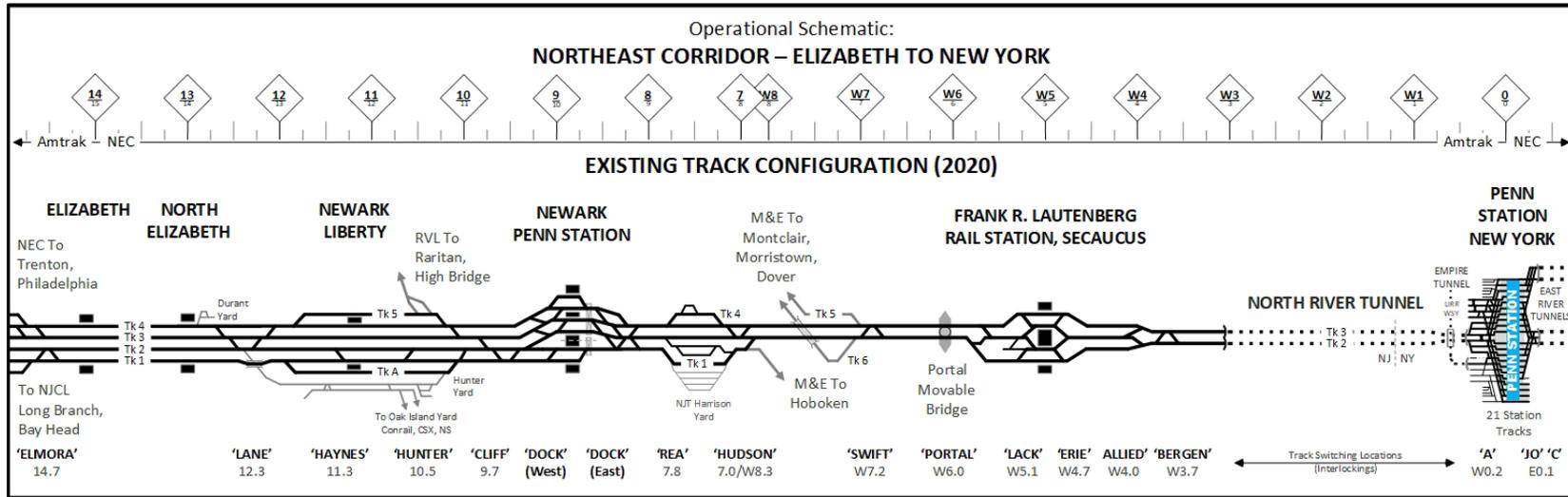
- NJ TRANSIT, along the former CNJ right of way,
- Conrail, along the Lehigh Line,
- Amtrak, along the Hunter Connection and NEC.

As trains move from one segment to the next, control is transferred from railroad dispatcher to railroad dispatcher. **The day-to-day operation of trains involves weaving together the movement of numerous trains, and if delays occur to one or more trains the impacts can cascade to other trains and services.** Furthermore, the planning of schedules must be done in the context of the extensive network of train operations of each railroad in New Jersey and elsewhere. **Considering this larger system, planning for modifying NJ TRANSIT's rail services, and specifically the RVL, requires evaluation of the infrastructure and capacity of the interconnected, multi-railroad system and approval of the two host railroads (Amtrak and Conrail).** The result is that RVL train operations are often confined to narrow windows or slots, within which trains can be scheduled, limiting the flexibility of scheduling.

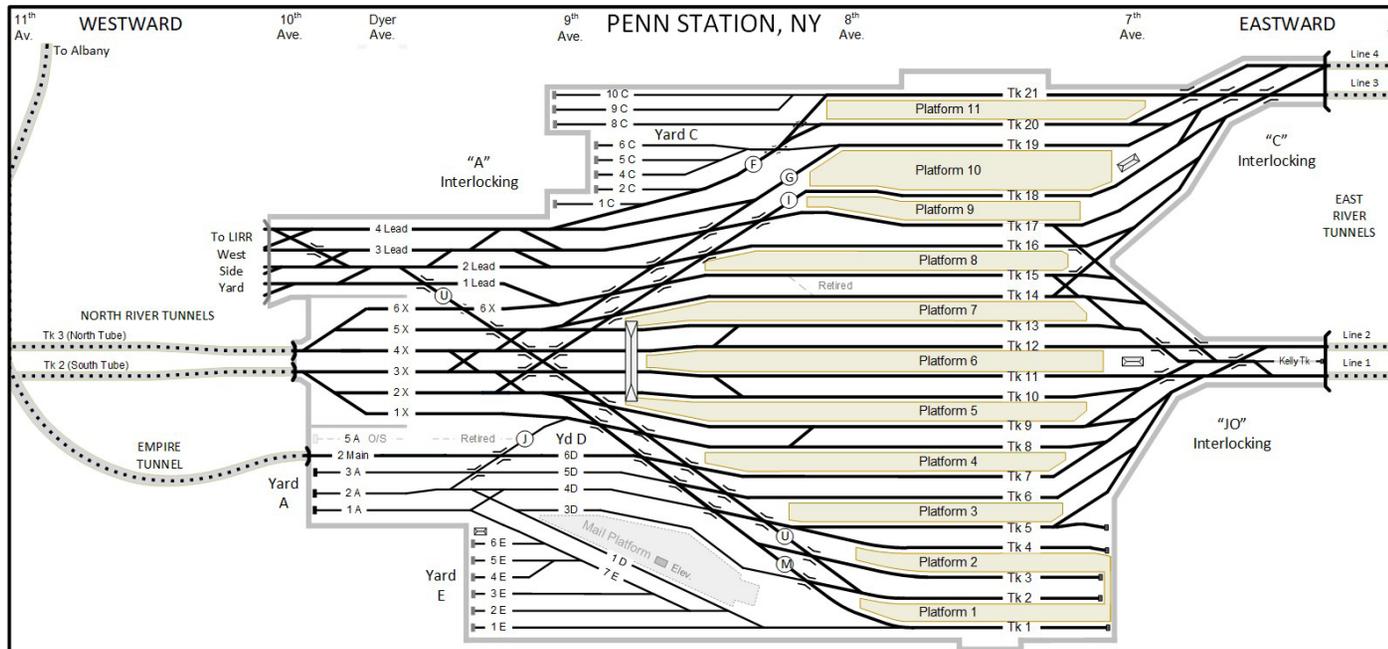
Infrastructure renewal is a daily activity along the NEC. Major projects like the East River Tunnel Renewal project and the Sawtooth Bridge Replacement project are in the pipeline. Amtrak is enhancing NEC infrastructure and purchasing next-generation rail vehicles to allow for additional Amtrak train service.

During the 1980s, after NJ TRANSIT was created, plans were developed to improve commuter rail access to PSNY. During the 1990s NJ TRANSIT invested in projects, including signal system and electric power supply improvements, that increased NEC peak

**FIGURE 3 – SCHEMATIC OF NORTHEAST CORRIDOR, 2020**



**FIGURE 4 – SCHEMATIC SHOWING PENN STATION NEW YORK, 2018**



---

period capacity between Newark and PSNY to accommodate the operation of more electric trains and transferring passengers from the diesel rail lines. The increased capacity made it possible to accommodate growing ridership on the electrified NEC and NJCL, and from the RVL's diesel trains. The increased capacity also facilitated construction of connecting tracks to the NEC from the electrified Morristown Line that facilitated PSNY train service from the electrified Morris & Essex Lines (Midtown Direct service, 1996) and from the Montclair – Boonton Line (Montclair Connection, 2002). The added signal capacity, along with special high-speed track switches and “overtake” tracks, also made it possible to construct the Frank R. Lautenberg Secaucus Junction (opened in 2003), which provides a transfer to trains serving PSNY from the diesel propelled trains on the Main, Bergen County, Pascack Valley, and Port Jervis lines.

### 3.5 NJ TRANSIT PLANNING FOR TRANS- HUDSON CAPACITY EXPANSION AND THE RVL

During the last twenty-five years plans were developed for increasing NJ TRANSIT train service capacity between NJ TRANSIT's northern New Jersey rail lines and PSNY to accommodate forecasted ridership growth. The expanded capacity would support increased service on the electrified rail lines that operate to PSNY and would make it possible to implement full-time direct rail service to PSNY for the RVL service and for NJ TRANSIT's other diesel (non-electrified) lines. The plans were developed recognizing that PSNY's peak of the peak period train capacity is fully utilized and that additional tunnel and station capacity in New York City would be needed to accommodate trains from other rail lines.

In the late 1990s, even before the projects that expanded PSNY rail

services were completed, NJ TRANSIT anticipated that passenger demand would exceed capacity in the future and that one-seat ride service would be desired by commuter rail passengers. NJ TRANSIT initiated work on the Access to the Region's Core Project (ARC), and by 2010 environmental studies had been completed and engineering design was at the point that the project had moved into construction. ARC proposed to construct railroad infrastructure that would approximately double peak period train capacity for NJ TRANSIT to and from a new station adjacent to and north of PSNY. Project elements included a new tunnel under Hudson River and additional tracks and passenger platforms adjacent to PSNY under West 34th Street, with a cost estimated at greater than \$10 billion. Prior to beginning major construction, the project was terminated.

**The ARC project, combined with the purchase of dual mode diesel-electric locomotives, if completed, would have enabled the operation of peak period one-seat ride service for the RVL and for other NJ TRANSIT northern New Jersey diesel rail lines.**

The dual mode locomotives (designated as ALP-45DP locomotives) can operate in diesel mode on rail lines that are not electrified, and then switch to electric mode for operations on electrified lines, including in the North River Tunnel and in PSNY, where diesel locomotive propulsion for passenger trains is prohibited. When ARC was cancelled in 2010 the purchase of the dual mode locomotives was well underway and as a result those locomotives are now a part of NJ TRANSIT's fleet of rail vehicles. The availability of the ALP-45DP has made it possible to provide the RVL one-seat ride service in the midday and evening weekday off-peak periods.

Prior to the cancellation of ARC, planning for additional infrastructure required for implementation of one-seat service for the RVL was initiated. The planning efforts included a draft feasibility analysis for improving the RVL's connection to the NEC at Hunter

---

Interlocking, the location containing switches and signals allowing RVL trains to enter and exit the NEC. The project, known as the Hunter Flyover, would construct a single-track bridge over the NEC tracks at Hunter to enable eastbound RVL trains to merge onto NEC Track 1, used for eastbound service to NPS and toward PSNY. This project would substantially reduce delays currently experienced by eastbound RVL trains which must wait for passing NEC traffic to clear before being able to cross the four track NEC main line to reach the eastbound “side” of the NEC. NJ TRANSIT is currently working to initiate a project to bring the Hunter Flyover to a 10% design level.

More recently NJ TRANSIT also analyzed the feasibility of adding one or more main tracks on the segment of the Lehigh Line used by RVL trains. This capacity-constrained freight line precludes NJ TRANSIT from being able to increase the number of trains operating on the RVL. In addition, NJ TRANSIT reviewed options for increasing peak period train frequency on the NJ TRANSIT controlled segment of the RVL through the addition of a third main track along critical sections of the line.

The Hunter Flyover and Lehigh Line and RVL track projects would accommodate the increase of peak period train frequency for the RVL and reduce conflicts with other train services operating on the NEC and Lehigh Line and along the RVL itself.

Since the cancellation of ARC, the Federal Railroad Administration (FRA) and Amtrak have pursued planning and preliminary design work for expanded PSNY train service. Amtrak proposed the Gateway Program, which includes projects like many of those that NJ TRANSIT had developed to increase NJ TRANSIT PSNY train service. The FRA completed the NEC FUTURE Environmental Impact Statement which proposes rail service and infrastructure improvements for the full length of the NEC, including the expansion

of rail capacity comparable to the Gateway Program.

After the existing North River Tunnel was flooded by Superstorm Sandy in October 2012, it was recognized that the tunnel was in deteriorating condition and would need major rehabilitation work to maintain rail services. It was determined that a new tunnel as proposed in the Gateway Program should be constructed so that the existing tunnel could be taken out of service for repairs. The new tunnel design would be compatible with required future infrastructure investments needed for expansion of PSNY and more frequent peak period Amtrak and NJ TRANSIT train service. It is important to note that these additional capacity investments will be required in order to increase peak hour rail service to and from PSNY. The Tunnel Project, while critical to maintaining existing service levels, by itself does not permit service to be increased.

The Gateway Program planning is underway by Amtrak with NJ TRANSIT’s involvement. It proposes to construct a new tunnel, expand PSNY, and implement other improvements that would support increased Amtrak and NJ TRANSIT rail services. One component of the first phase of the Gateway Program, the Hudson Tunnel Project, proposes to construct a new tunnel and rehabilitate the North River Tunnel, severely damaged by Superstorm Sandy flooding.

In addition to the Hudson Tunnel Project, Phase 1 of the Gateway Program consists of the Portal North Bridge project. Improvements to increase capacity are part of Phase 2 of the Program, including the construction of additional tracks and passenger platforms in PSNY to provide peak period capacity for additional trains. Potentially, this could include RVL full time direct rail service and provide capacity for a westward extension of the RVL and restoration of the West Trenton Line. Advancement of a PSNY expansion project awaits development of a detailed plan, completion

---

of environmental studies, and most significantly, identification of funding.

NJ TRANSIT and Amtrak undertook the necessary environmental studies and related engineering for the construction of the new tunnel and rehabilitation of the flooded tunnel (Gateway Phase 1). In June 2017 the Hudson Tunnel Draft Environmental Impact Statement was distributed for public review. The draft project schedule anticipated construction of the new tunnel and repair of the existing tunnel within about twelve years from issuance of a Record of Decision by the FRA. The Record of Decision has not yet been issued and funding is not in place for construction of the project. Considering this, **for the foreseeable future NJ TRANSIT operations to PSNY will, at best, be restricted to the existing capacity and may be subject to being cut back in the future if the tunnel condition deteriorates and requires outages for repairs.**

As this study is being prepared, the timing for implementation is not known for construction and completion of the Gateway Program projects that would be needed to facilitate expanded NJ TRANSIT operations to PSNY from its northern New Jersey rail lines.

# 4.0 RARITAN VALLEY LINE ONE-SEAT RIDE OPTIONS ANALYSIS

## 4.1 ALTERNATIVES ANALYSIS STRUCTURE AND PROCESS

While other regional planning efforts are considering long-term capacity enhancements for service into Manhattan, such as the Gateway Program which will provide for increased Amtrak and NJ TRANSIT rail service, this study focused on the viability and feasibility of Short or Medium-Term possibilities to provide additional direct rail service to Manhattan on the RVL (Table 3). The scenarios for RVL one seat ride service to Manhattan are presented such that they could be incrementally implemented over time, ultimately achieving full time direct rail service to Manhattan.

**TABLE 3 – DAILY TIME PERIODS CONSTITUTING FULL TIME DIRECT RAIL SERVICE**

Service Period Description	Service Status
Weekday Morning Pre-Peak Period	Existing Service Pre-PTC
Weekday Morning Peak Period	Analyzed in Study
Weekday Afternoon	Existing Service Pre-PTC
Weekday Evening Peak Period	Addressed in Study
Weekday Post Evening Peak Period	Existing Service Pre- PTC
Weekend All Day	Analyzed in Study

The study includes evaluation of the northern New Jersey rail system’s existing infrastructure, ridership, operations and capacity, and identified and analyzed potential rail system operation modifications and infrastructure improvements to implement a potentially feasible RVL one-seat ride. The analysis was performed with the assumption that any adjustments to NJ TRANSIT operating plans would not impact Amtrak service or Conrail operations. Also, the analysis and results in the study presents the maximum number of RVL one-seat ride trains that can be scheduled, without impacting existing Amtrak service or Conrail operations, while providing a reasonable frequency of one-seat ride trains to PSNY. Thus, for several scenarios presented, a lesser amount of RVL one-seat ride trains could be studied further. These multiple combinations of operating plans were not analyzed.

The study evaluates, in detail, the weekday morning peak period, eastbound direction, between the hours of 6:00 am and 10:00 am as well as the potential for weekend service. In addition to the evening peak period, these are currently the periods that RVL direct rail service is not provided. It is important to note that the analysis of the morning peak period is a significant focus of this study since ridership and service are most concentrated during this peak period. While PM peak period train service was not analyzed in detail, issues, challenges and costs associated with implementing

---

eastbound morning peak period one-seat ride service can also be expected for PM peak period service implementation.

The study begins with analysis of the availability of rail line capacity, referred to as train slots, between the point at which the RVL meets the NEC almost 2 miles west of NPS to PSNY, as well as within PSNY.

Knowing that, at this time, train capacity may be fully utilized during certain periods of the day, a strategy that some supporters of RVL one-seat ride service have suggested is modifying the allocation of PSNY train capacity so that RVL trains can operate to PSNY during the peak period. This study includes an analysis of that suggested approach, which conceptually, would remove certain direct NEC or NJCL morning peak period trains between NPS and PSNY in order to provide direct morning peak period RVL service to PSNY.

**Critical to the analysis is recognition that the implementation of full-time direct rail service to Manhattan for the RVL must be planned in a way that considers the impact to the complex network of passenger and freight railroad operations within which RVL service is operated.**

## 4.2 BASELINE OPERATING SERVICE PLAN

The train service plan utilized for all analyses and the development of alternative scenarios was the plan in effect in October 2017 (Table 4). That timetable was selected primarily since it was the maximum level of service that NJ TRANSIT has been able to operate, it was integrated with Amtrak service and acceptable to Amtrak at that time, it was in place before rail service was affected by the removal of rail vehicles for installation of Positive Train Control equipment, and it is NJ TRANSIT's goal to resume that service level. This service plan was used for both weekday and weekend analysis.

As shown in the October 2017 Timetable, trains initiate service from High Bridge, Raritan and Plainfield, with most RVL trains originating and terminating at Raritan. Morning peak period service consists of local trains and incorporates a skip-stop pattern during the busiest times, with trains serving selected stops scheduled in pairs. With only a single track available for peak direction service, this schedule strategy reduces trip times and balances passenger loads between trains for the current frequency of service. In the future, for the operation of more frequent peak period train service, the construction of an additional track will enable limited-stop express trains to pass local trains. Except for two westbound High Bridge express trains, afternoon peak period service patterns are local, as passenger demand is spread over a longer period of time.

The weekday morning eastbound (peak direction) peak period (start of service to approximately 10:00 am) timetable, reflecting the full service from October 2017, is shown in Table 4. The first RVL train operating directly to PSNY is train #5126 which arrives PSNY at 10:09 am.

The RVL connects to the NEC at Hunter Interlocking where the RVL connecting track joins NEC Track 4, which is the NEC's westbound (or outbound) track, used by trains bound for NEC and NJCL stations. Some eastbound RVL morning peak period trains are able to operate on track 4 to NPS Track 5, where they disembark passengers. These are the RVL trains that are scheduled to "turn back" at NPS and operate westbound back to the RVL. Other RVL morning peak period trains must crossover three or four of the very busy NEC tracks at Hunter to reach Track 1; from which they can operate eastward to NPS Track 1 / Platform B where passengers have the opportunity for a same platform transfer to PATH or NJ TRANSIT trains to PSNY, or they descend to the station concourse.

Entering NPS, trains may operate on any track, but the predominant

**TABLE 4 – OCTOBER 2017 MORNING PEAK PERIOD RVL RAIL SERVICE TIMETABLE**

October 2017, AM Weekday RVL Eastbound Service													
Train ID	5404	2406	5408	5710	5412	5714	5416	5718	5420	5422	5902	5126	
Equipment	7ML+ALP45	6ML+ALP45	6ML+ALP45	6ML+ALP45	6ML+ALP45	8SL+PL42	8SL+PL42	7ML+ALP45	7ML+ALP45	7ML+ALP45	8SL+ALP45	6ML+ALP45	
Station/Layover	High Bridge			5:51 A		6:17 A		6:41 A					
	Annandale			5:55 A		6:21 A		6:45 A					
	Lebanon			5:59 A		6:25 A		6:49 A					
	White House			6:05 A		6:31 A		6:55 A					
	North Branch			6:12 A		6:38 A		7:02 A					
	Raritan	4:31 A	5:07 A	5:52 A	6:20 A	6:31 A	6:47 A	6:53 A	7:11 A	7:17 A	7:37 A		8:43 A
	Somerville	4:34 A	5:10 A	5:55 A	6:23 A	6:34 A	6:50 A	6:56 A	7:14 A	7:20 A	7:40 A		8:46 A
	Bridgewater	4:38 A	5:15 A	6:00 A	...	6:39 A	...	7:01 A	7:19 A	7:25 A	7:45 A		8:51 A
	Bound Brook	4:42 A	5:18 A	6:03 A	6:30 A	...	6:56 A	7:04 A	7:22 A	7:28 A	7:48 A		8:54 A
	Dunellen	4:48 A	5:24 A	6:09 A	6:36 A	...	7:03 A	7:11 A	7:29 A	7:34 A	7:54 A		9:00 A
	Plainfield	4:53 A	5:29 A	6:14 A	...	6:49 A	...	7:16 A	...	7:39 A	7:59 A	8:32 A	9:05 A
	Netherwood	4:56 A	5:32 A	6:17 A	...	6:52 A	...	7:19 A	...	7:42 A	8:03 A	8:35 A	9:08 A
	Fanwood	4:59 A	5:35 A	6:20 A	...	6:56 A	...	7:23 A	...	7:46 A	8:07 A	8:38 A	9:12 A
	Westfield	5:04 A	5:40 A	6:25 A	6:47 A	...	7:14 A	...	7:39 A	7:52 A	8:12 A	8:43 A	9:16 A
	Garwood	...	5:43 A	6:29 A	...	7:01 A	...	...	...	7:55 A	...	...	9:20 A
	Cranford	5:08 A	5:46 A	6:32 A	6:52 A	...	7:19 A	7:29 A	...	7:58 A	8:17 A	8:48 A	9:23 A
	Roselle Park	5:14 A	5:52 A	6:38 A	...	7:09 A	...	7:36 A	...	8:04 A	8:22 A	8:53 A	9:29 A
	Union	5:18 A	5:56 A	6:42 A	...	7:13 A	...	7:41 A	...	8:09 A	8:26 A	8:58 A	9:33 A
	Newark Penn	5:29 A	6:08 A	6:55 A	7:10 A	7:26 A	7:40 A	7:54 A	8:03 A	8:22 A	8:38 A	9:09 A	9:46 A
	Hudson Yd/ MMC	5:37 A			7:42 A			8:27 A	8:35 A		9:08 A	9:40 A	
Secaucus												9:55 A	
Hoboken		6:29 A											
Penn Station NY												10:09 A	
	Peak Shoulder (Before 7A @ PSNY)		Peak of the Peak (7A – 9:20A @ PSNY)								Peak Shoulder (After 9:20 A @ PSNY)		
AM Peak													

---

operation is either to cross over three of the four NEC tracks and board/discharge from Platform B Track 1 or occupy only the northernmost track of the NEC and board/discharge from Platform E Track 5 on weekdays. On weekends, all RVL trains utilize Track 5.

## 4.3 TRAIN SLOT AVAILABILITY ANALYSIS

Weekday morning peak period train slot availability within PSNY was assessed, with the goal to find available slots that could be utilized by a new train that originated along the RVL. The study focused on the weekday morning, from 6:00 am to 10:00 am, since ridership is more concentrated in the morning than during the afternoon peak period, from 4:00 pm to 8:00 pm. Therefore, providing weekday full-time, one-seat ride service depends on defining a feasible plan for the morning peak period. The analysis of PSNY slots determined that there were two peak period slots available before 7:00 am and one peak period slot available after 9:20 am, the “shoulders of the peak” period. No slots were available between the hours of 7:00 am and 9:20 am, the “peak of the peak”.

Weekend all day slot availability within PSNY as well as North River Tunnel slot availability was reviewed. PSNY slots are available but North River Tunnel slots are not available for additional NJ TRANSIT trains during weekends. **Amtrak shuts down one of the two North River tubes over weekends for vital maintenance, thus limiting the number of trains for the two carriers into and out of PSNY as the one tube handles operations in both directions. The result is that NJ TRANSIT can operate no more than four trains per hour in each direction. The heavy passenger volumes on the existing NEC and NJCL trains, which are accommodated by 10 car trains or longer, provide no feasible opportunity to reallocate weekend capacity to the RVL since the Hudson Pocket Track limits RVL train length to eight coaches plus a locomotive. Operating service**

**into Manhattan with only eight coaches would cause significant overcrowding.** In addition, historic weekend ridership on the NEC and NJCL are far greater than the RVL. The RVL weekend ridership is only 8% of the NEC weekend ridership and less than 50% of the NJCL ridership. Not only do the NEC trains serve the NEC stations, but the NJCL trains also serve the NEC stations between Rahway and Elizabeth. Furthermore, the NJCL trains serve the significant summer season Jersey Shore market. Based on these factors, the operation of RVL weekend direct rail service will only be possible when train capacity is increased with at least two trans-Hudson tracks in service. See Appendix A for more details.

## 4.4 SCENARIOS ANALYSIS AND RESULTS

For the weekday morning peak period, potential train operating scenarios were outlined based on the train slot availability analysis. The scenarios include using the slots available during the shoulders of the morning peak period and consider the concept of re-allocating operating slots, as suggested by supporters for peak of the peak period one-seat ride service to Manhattan. The potential operating scenarios were defined considering operating factors between the Hunter Connection, NPS and PSNY and tested against existing infrastructure capacity and rail equipment availability during the morning peak period. The intricate pattern of train operations between the Hunter Connection and NPS of RVL, NEC, NJCL and Amtrak trains was a determinant in identifying RVL trains that could be extended to PSNY and NEC and NJCL trains that could be displaced.

If construction of new infrastructure was necessary for an operating scenario to work, that new infrastructure was identified. The infrastructure considered both existing and new and includes Raritan train storage yard, RVL station platforms, additional tracks

---

on the RVL and Lehigh Line, Hunter Pocket track, NEC Hunter Interlocking, Hunter Flyover, NPS platforms and vertical circulation, NEC High Line, Portal Bridge North, North River Tunnel, PSNY platforms and track, East River Tunnels, and Sunnyside Yard. In addition, if additional train equipment would be needed for a scenario to be feasible, the approximate numbers of vehicles were identified.

The analysis assumes that the size and mix of the rail fleet is that which existed in late 2017, with the exception of the acquisition that is now underway of new multi-level electric multiple unit (EMU) vehicles; which will replace the single level Arrow III electric vehicles (EMU's) that will be retired.

If any of the scenarios presented below are considered for advancement, additional rail service planning would be required for full-day operations, including the afternoon peak period as well as other lines impacted by the operational changes.

Five potential scenarios that could be operationally feasible were progressed and categorized for short, medium, and long-term time periods. For the Short-Term (mid-to late 2020s) and Medium-Term (early-mid 2030s) time periods ridership estimates were developed using NJ TRANSIT's forecasting model. In addition, order of magnitude capital and operating costs were defined, including cost escalation.

Scenarios analyzed include:

- **Short-Term Scenario A:** 3 RVL trains operate to PSNY in the shoulders of the morning peak period
- **Short-Term Scenario B:** Shoulders of the peak service and in AM peak 2 hours, 3 NEC trains terminate at NPS, and 3 RVL trains use their slots to operate to PSNY

- **Medium-Term Scenario C:** Shoulders of the peak service and in AM peak 2 hours, 2 NEC & 2 NJCL trains terminate at NPS, and 4 RVL trains use their slots to operate to PSNY
- **Medium-Term Scenario D:** Scenario C plus all day weekend service for full-time direct rail service to PSNY
- **Long-term Scenario E:** Significant capacity expansion for full-time direct rail service to PSNY

See Appendix B for more detail on each scenario and Table 5 which lists the service plan, capital equipment and capital infrastructure for each scenario.

**TABLE 5 – COMPARISON OF EACH SCENARIO FOR OPERATIONS, CAPITAL INFRASTRUCTURE AND ROLLING STOCK INVESTMENTS**

Raritan Valley Line (RVL) One-Seat Ride to Penn Station New York (PSNY) Summary										
			Baseline (October 2017)	Short-Term (Scenarios A & B)		Medium-Term (Scenarios C & D)		Long-Term (Scenario E)		
Service Plan	AM Early Shoulder of the Peak (~Until 6:40 am at Newark or Until 7:00 am at Hoboken/ PSNY)	RVL terminate Newark	1	2 frequencies	0	2 frequencies	0	2 frequencies	0	3 frequencies
		RVL terminate Hoboken	1		0		0			
		RVL terminate PSNY	0		2		2			
	AM Peak of the Peak (~6:40 to 9:00 am at Newark or 7:00 to 9:20 am at Hoboken/ PSNY)	RVL terminate Newark	8	8 frequencies	5	8 frequencies	4	8 frequencies	0	16 frequencies
		RVL terminate Hoboken	0		0		0			
		RVL terminate PSNY	0		3		4			
	AM Late Shoulder of the Peak (~9:00 to 10:00 am at Newark or 9:20 to 10:20 am at Hoboken/ PSNY)	RVL terminate Newark	1	2 frequencies	0	2 frequencies	0	2 frequencies	0	3 frequencies
		RVL terminate Hoboken	0		0		0			
		RVL terminate PSNY	1		2		2			
	Trains Substituted** (PSNY-bound trains terminated at Newark/ Hoboken) in favor of RVL train extended to PSNY in AM Peak of the Peak	NEC-PSNY Substitution	None	0 frequencies	3	3 frequencies	2	4 frequencies	None	0 frequencies
		NJCL-PSNY Substitution	None		None		2		None	
		M&E-PSNY Substitution	None		None		None		None	
MoBo-PSNY Substitution		None	None		None		None			
Capital Equipment	Needed to Operate Service	Multi-Level Cars: ML	51 ML	10 train sets	96 ML	12 train sets (each of 8 ML)	120 ML	12 train sets (each of 10 ML)	TBD ML	TBD train sets
		Single-level Cars: SL	16 SL		0 SL		0 SL		0 SL	
		Dual Powered Loco: DM	8 DM		12 DM		12 DM		TBD ML	
		Diesel Loco: DL	2 DL		0 DL		0 DL		0 DL	
	Change from 2017 Baseline + 20% Spares (apportioned to the Change only)	Multi-Level Cars: ML	N/A	N/A	+45 ML & +9 ML (Spares)	+2 train sets	+69 ML & +14 ML (Spares)	+2 train sets	TBD ML	TBD train sets
		Single-level Cars: SL	N/A		-16 SL		-16 SL		-16 SL	
		Dual Powered Loco: DM	N/A		+4 DM & +1 DM (Spare)		+4 DM & +1 DM (Spares)		TBD DM	
		Diesel Loco: DL	N/A		-2 DL		-2 DL		-2 DL	
Capital Infrastructure			Existing	Existing Plus	Short-Term Plus	Medium-Term Plus				
				2 train set storage addition at Raritan Yard Pedestal & Wash Track, Tower at Raritan Yard <b>Platform &amp; ADA improvements at stations on RVL</b>	Hunter Flyover Newark Penn Station Track A platform extension Newark Penn Station mobility improvements Platform & ADA improvements at stations on RVL <b>Gateway Program Phase 1: Hudson River Tunnel Project</b> <b>Gateway Program Phase 1: Portal North Bridge Project</b> <b>Gateway Program Phase 1: Fourth Track Hudson to Dock</b>	Gateway Program Future PSNY Expansion Project & other projects Additional Train storage on RVL Additional tracks on Conrail Lehigh Line Third track on RVL Westbound Waterfront Connection – System Improvement				

\*\*No substitution required for RVL One-Seat ride during Peak Shoulders (Early/ Prior to 7 AM and Late/ after 9:20 AM). Substitution of train slots required if providing One-Seat ride during Peak of the Peak (7:00 AM – 9:20 AM).

---

## 4.5 SHORT-TERM DIRECT RAIL SERVICE SCENARIOS

### 4.5.1 SHORT-TERM SCENARIO A

#### OPERATING PLAN

##### Weekday Morning Shoulders of the Peak Period

Two existing RVL trains originating at Raritan would be extended to PSNY, Train No. 5404 and Train No. 2406. They would stop at all stations, and each would arrive at PSNY before 7:00 am. In addition, one existing train originating at Raritan, Train No. 5902, would be extended to PSNY, stopping at all stations, and arriving at PSNY after 9:20 am and before the end of the morning peak period at 10:00 am. The three extended RVL trains would perform cross over moves at Hunter Interlocking to correctly position for continued operation to PSNY.

#### RIDERSHIP

Ridership forecasts for this scenario were not developed. Riders may gravitate to the new one seat ride trains, but not significantly due to the early and late morning peak period schedules.

#### INFRASTRUCTURE AND RAIL EQUIPMENT IMPROVEMENTS

This scenario can operate on existing infrastructure except that Raritan Yard would need to expand to accommodate two additional train sets, each consisting of an ALP-45DP and a maximum of eight multi-level coaches. An additional two ALP-45DP locomotives and 19 multi-level coaches are required.

#### EVALUATION

##### RVL Impacts

- RVL customers on the three peak period shoulder trains would avoid transferring to NEC or NJCL trains at NPS. It should be noted that these three trains currently utilize NPS Platform B, Track 1, thus the transfer is relatively convenient since it is a same platform transfer.
- This scenario would not provide weekday peak of the peak period or weekend service.
- Travel time savings for these three one-seat trains from Raritan in shoulder of the peak period would be approximately 5 minutes since they will make all stops and could experience longer total travel time with eight multi-level cars train set propelled in diesel mode along the RVL.

##### NEC Impacts

- No significant impacts to NEC or NJCL operations.

##### Rail System Impact

- This scenario would expand the rail vehicle fleet requiring maintenance. Also, the addition of a late morning train must be coordinated with Amtrak's planned service expansion including high-speed service.

##### Ridership Changes

- One-seat ride service that is not in the peak of the peak period would not result in a significant increase of RVL ridership

See Appendix D for more details.

---

## 4.5.2 SHORT-TERM SCENARIO B

### OPERATING PLAN

#### Weekday Morning Shoulders of the Peak (Scenario A) plus Peak of the Peak Service

In addition to extended trains discussed in Scenario A for shoulders of the peak period, this scenario would extend up to three peak of the peak RVL trains, Train Nos. 5710, 5714, 5718, that currently terminate revenue service at NPS, to PSNY during peak of the peak period (7:00 am to 9:20 am), and terminate revenue service on three NJ TRANSIT NEC trains at NPS, Train Nos. 3918, 3122, 3924. Customers on these three NEC trains would disembark at NPS and transfer to either the three extended RVL trains or other trains arriving at NPS that continue to PSNY or transfer to PATH. This scenario is limited to three peak of the peak RVL extended trains due to the availability of crossover slots at Hunter Interlocking, from Track 5 to Tracks 1 or 2. The remaining five RVL trains in peak of the peak continue to terminate at NPS. The extended RVL trains will make all station stops along the RVL. The six extended RVL trains would perform at-grade cross over moves east of NPS to correctly position for continued operation to PSNY. During the peak of the peak period only three RVL trains can cross over the NEC tracks and be in position to operate into NPS and then to PSNY. As noted below in Scenario C, the construction of the Hunter Flyover would make it possible for a fourth RVL train to substitute for another train.

The three RVL trains to be extended to PSNY currently enter NPS very close to the time that the three NEC trains are scheduled to arrive at NPS. Continuing with the premise that minimal disruption to the Baseline Schedule is critical, these NEC trains would be candidates for displacement. NJCL trains do not arrive at NPS proximate to RVL trains.

### RIDERSHIP

Forecast results show that during the peak two hours, ridership along the RVL would experience an increase of 180 riders. Along the NEC, there would be a **loss of 430 riders**, along the NJCL there would be an increase of 180 riders, and **cumulative changes for all three lines would be a decrease of 70 riders**.

### INFRASTRUCTURE AND RAIL EQUIPMENT IMPROVEMENTS

This scenario would preferably include providing longer high level RVL platforms at certain station locations since many platform lengths do not readily accommodate eight coaches and thus could increase dwell times. As with the first scenario, Raritan Yard would need to be improved and expanded to accommodate two additional train sets each consisting of an ALP-45DP and a maximum of eight multi-level coaches. A total of five additional ALP-45DP locomotives and 54 multi-level coaches are required.

### EVALUATION

#### RVL Impacts

- Morning one-seat ride service to PSNY would consist of three all stop shoulder of the peak trains and three all stop peak of the peak period trains. The existing skip stop service pattern would be eliminated since train slots are not available for additional trains that would be needed to provide reasonable headway from all RVL stations.
- Five morning all stop trains would terminate at NPS in the peak of the peak period.
- No weekend one-seat ride service would be provided.
- Travel time savings for the six one-seat trains would be minimal since trains will experience longer total travel time with eight

---

multi-level cars and operating as all stop local trains. The longer trains are heavier and therefore require more time to accelerate and brake, increasing the total travel time. Currently, morning RVL Service incorporates a skip-stop pattern, with trains serving selected stops scheduled in pairs. This is a method used where only a single track is available for peak direction service to reduce trip times and balances passenger loads between trains. With the exception of two High Bridge express trains, evening service patterns are local, as passenger demand is spread over a longer period.

## NEC Impacts

- The three NEC trains that would be displaced by RVL trains and would no longer operate to PSNY, would terminate service at NPS. Passengers on these trains bound for PSNY would need to transfer at Newark to other trains to PSNY or to PATH.
- The NEC trains being terminated at Newark (or diverted to Hoboken), instead of their usual trip to PSNY, will require cancellations of their return trip in the westbound direction from PSNY to destinations on the NEC, NJCL and M&E. While those westbound trips can be theoretically made from Newark (or Hoboken), those trips will no longer serve the sizeable volume of customers from PSNY wanting to go to destinations on all zones of NEC as well as the inner zone of the NJCL and M&E. The morning reverse peak market from PSNY consists of workers, college students and airport travelers. The six RVL trains that would operate to PSNY would operate westbound, but only to Newark. Westbound NEC customers would need to change trains in Newark.
- While theoretical cross over capacity west of NPS exists, the new RVL train crossover moves will create increased potential for service delays.

- There will be an impact on NEC operating capacity to PSNY serving NPS and Secaucus Junction. The three peak of the peak extended RVL trains will consist of eight multi-level cars (the maximum length allowed due to constraint of Hunter Pocket track) with a dual mode locomotive. Each eight-car multi-level train can provide 1,088 seats. All three displaced NEC trains consist of 10-car multi-level cars. **Each 10-car multi-level train currently provides 1,360 seats. Thus, with the operation of the RVL there would be a net loss of 816 seats to PSNY and less overall capacity for passengers boarding at NPS, including those from the displaced trains, and at Secaucus Junction.** These operations characteristics would exacerbate overcrowding conditions on trains to PSNY and increase the potential for degraded on-time performance.

## Ridership Changes

- The RVL peak period ridership increases 3%, while the rail system loses 70 riders (0%) and 120 divert to auto driving

## Rail System Impact

- This scenario would expand the rail vehicle fleet requiring maintenance and necessitate system timetable modifications, especially along the RVL.
- The RVL cross track operation between the Hunter Connection to NPS and the reduced passenger capacity on trains to PSNY would risk degrading system on time performance.

See Appendix D for more details.

---

## 4.6 MEDIUM-TERM DIRECT RAIL SERVICE SCENARIOS

### 4.6.1 MEDIUM-TERM SCENARIO C

#### OPERATING PLAN

##### **Weekday Morning Shoulders (Scenario A) plus Peak of the Peak Service**

In addition to extended trains discussed in Scenario A for Shoulders of the Peak period, extend up to four RVL trains that currently terminate revenue service at Newark Penn, Train Nos. 5408, 5412, 5416, 5420, to PSNY during peak of the peak period (7:00 am to 9:20 am), which would require terminating revenue service on two NJ TRANSIT NEC trains and two NJCL trains at Newark Penn Station, Train Nos. 3312, 3318, 3124, 3926. Customers on these four NEC / NJCL trains would have the choice at NPS of transferring to either the four extended RVL trains or other trains arriving at NPS that continue to PSNY, or transfer to PATH. The completion of the Hunter Flyover under this scenario would enable up to four RVL trains to operate via the grade separated “flyover” to Track 1 and be in position to displace trains that operate to PSNY. This scenario is limited to four RVL extended trains due to limited availability of NEC slots on Tracks 1 between Hunter and NPS. The four RVL trains that would be extended to PSNY currently enter NPS very close to the time that two NEC and two NJCL trains are scheduled to arrive at NPS. Continuing with the premise that minimal disruption to the Baseline Schedule is critical, these NEC and NJCL trains would be displaced.

Extended RVL trains make all station stops along the RVL.

#### RIDERSHIP

Ridership forecast results show that during the peak two hours, ridership along the RVL would experience an increase of 150 riders. Along the NEC, there would be a negligible change, along the NJCL **there would be a reduction in ridership of 870, and cumulative changes for all three lines would be a net reduction of 670 riders.**

#### INFRASTRUCTURE AND RAIL EQUIPMENT IMPROVEMENTS

This scenario requires construction of the Hunter Flyover, renewal and expansion of NPS Platform A, lengthening some RVL platforms to accommodate eight coaches and converting low level platforms to high level. Raritan Yard would need to be improved and expanded to accommodate two additional train sets each consisting of an ALP 45 and a maximum of ten multi-level coaches. A total of five additional ALP 45 locomotives and 83 multi-level coaches are required. The Hunter Flyover, a one-track bridge over the NEC, would enable RVL trains to avoid at-grade cross track movement on the NEC at Hunter Interlocking, providing flexibility for scheduling of eastbound RVL trains, and would allow RVL trains to merge onto NEC Track 1, facilitating operations to PSNY. In addition, it would allow for the operation of 10-car multi-level trains - as the eight-car limitation on the Hunter Connection would no longer be a constraint. Construction of longer platforms at RVL stations is needed to accommodate the train lengths required for this scenario. The lengthening of platforms will trigger Americans with Disabilities Act of 1990 (ADA) regulations which require that if station platforms are improved level boarding is necessary, which would be provided by high level platforms. The improvement of NPS Platform A is needed because it is currently used as a last resort during the morning peak period since the vertical circulation elements have inadequate capacity for peak period operations. The displacement of NEC and NJCL trains by RVL trains would increase the use of the platform

---

and the volume of transferring passengers.

## EVALUATION

### RVL Impacts

- Morning one-seat ride service to PSNY would consist of three all stop shoulder of the peak trains and four all stop peak of the peak period trains. The existing skip stop service pattern would be eliminated since train slots are not available for additional trains that would be needed to provide reasonable headway from all RVL stations.
- Four morning all-stop trains would terminate at NPS in the peak of the peak period.
- No weekend one-seat ride service would be provided.
- Travel time savings for the seven one-seat trains would be minimal since trains will experience longer total travel time with train consists of eight or more multi-level cars and operating as all stop local trains. The longer trains are heavier and therefore require more time to accelerate and brake, increasing the total travel time. Currently, morning RVL service incorporates a skip-stop pattern, with trains serving selected stops scheduled in pairs. This is a method used where only a single track is available for peak direction service to reduce trip times and balances passenger loads between trains. With the exception of two High Bridge express trains, evening service patterns are local, as passenger demand is spread over a longer period.
- The four RVL trains that would be extended would require some schedule adjustments throughout the RVL so that they arrive in time to use the available operating slot at the merge point at Hunter Interlocking.

### NEC and NJCL Impacts

- The four NEC/NJCL trains that would be displaced by RVL trains would no longer operate to PSNY and would terminate service at NPS. Larger numbers of passengers are carried on the displaced NEC and NJCL trains than on the substitute RVL trains. Passengers on the NEC / NJCL trains bound for PSNY would need to transfer at Newark to other trains to PSNY or to PATH.
- The NEC/NJCL trains being terminated at Newark (or diverted to Hoboken), instead of their usual trip to PSNY, will require cancellations of their return trip in westbound direction from PSNY to destinations on the NEC, NJCL and M&E. While those westbound trips can be theoretically made from Newark (or Hoboken), those trips will no longer serve the customers from PSNY wanting to go to destinations on all zones of NEC as well as the inner zone of the NJCL and M&E. The morning reverse peak market from PSNY consists of workers, college students and airport travelers. The six RVL trains that would operate to PSNY would operate westbound, but only to Newark. Westbound NEC customers would need to change trains in Newark.
- There might not be an immediate impact on NEC operating capacity to PSNY serving NPS and Secaucus Junction. The four peak of the peak extended RVL trains will consist of 10 multi-level cars. All four displaced NEC/NJCL trains have the potential to operate consists of 10 multi-level cars. Each 10-car multi-level train currently provides 1,360 seats. The practical limit of an ALP-45DP operating in diesel mode is 10 multi-level cars. However, the capacity of those trains may be exceeded by ridership increases on the Main, Bergen County, Pascack Valley and Port Jervis lines that transfer at Secaucus Junction to PSNY bound trains. **The use of new electric multi-level cars in 12-car trains operating on the NEC would then be needed to accommodate the transferring passengers at Secaucus Junction.**

---

## Ridership Changes

- The RVL peak period ridership increases 2%, while the rail system loses 2% ridership, and 90 divert to PATH and 260 divert to auto driving

## Rail System Impact

- This scenario would expand the rail vehicle fleet requiring maintenance and necessitate significant system timetable modifications.

See Appendix E for more details.

## 4.6.2 MEDIUM-TERM SCENARIO D

### OPERATING PLAN

**Same as Scenario C plus All Day Weekend Service**

**Extend all weekend RVL trains that terminate revenue service at NPS to PSNY.**

### RIDERSHIP

No forecasts were developed for this scenario. Ridership would be similar to those in Scenario C since most of the systemwide ridership occurs on weekdays.

### INFRASTRUCTURE AND RAIL EQUIPMENT IMPROVEMENTS

This scenario is based on the construction of the proposed Gateway Program's Hudson Tunnel Project, which consists of constructing two new Hudson Tunnel Tubes and rehabilitating the two North River Tunnel Tubes. Currently one of the two North River Tunnel tracks between New Jersey and PSNY is in service, and used to capacity, during weekends. The other track is taken out of service

for essential tunnel maintenance activities. The completion of this project will provide four trans-Hudson tracks and thereby eliminate the single-track constraint, making it possible to increase NJ TRANSIT weekend service, including for the RVL. Additional trains might be required depending on the frequency of RVL direct service. The cost of additional trains was not included. The four trans-Hudson tracks that would be in place would expand tunnel capacity, but additional tracks and platforms in Manhattan would be needed to expand peak period capacity.

## EVALUATION

### RVL Impacts

- For weekend service, no major impacts – trains will likely operate their normal weekend schedule on the RVL.
- Impacts for weekday service would be as described for Scenario C

### NEC Impacts

- No major impacts on the NEC, but the extension of weekend RVL trains will require coordination with Amtrak for dispatching of trains east of Newark to PSNY.
- Impacts for weekday service would be as described for Scenario C

### Ridership Changes

- Forecasts were not prepared for weekend service
- Forecasts for weekday service as described for Scenario C

### System Impact

- Scenario requires construction of (Gateway) Hudson Tunnel

Project

- Gateway Program Phase 1 will benefit the RVL and be part of the larger program to expand NJ TRANSIT rail system PSNY service.
- The Gateway Program Phase 1 Projects will be critical to maintaining trans-Hudson rail service for New Jersey, New York and the entire Northeast Corridor region.

See Appendix E for more details.

## 4.7 LONG-TERM SCENARIO E

### CONSTRUCTION OF GATEWAY PROGRAM PROJECTS THAT WOULD INCREASE NEC AND PSNY PEAK PERIOD CAPACITY

#### OPERATING PLAN

##### Weekday and Weekend All Day

**The Gateway Program would expand PSNY capacity for NJ TRANSIT rail service, including providing capacity for RVL full-time direct service to PSNY during weekday peak periods and on weekends.**

#### RIDERSHIP

No forecasts were developed for this scenario. The ARC project and the Gateway Program have generated ridership forecasts for this scenario.

#### INFRASTRUCTURE AND RAIL EQUIPMENT IMPROVEMENTS

Essentially this scenario requires the full Gateway Program buildout

including the expansion of PSNY train and passenger capacity. In addition, to support more frequent RVL service this scenario requires additional tracks on the Conrail Lehigh Line as well as on RVL and other improvements. The two-track Lehigh Line, shared by the RVL with Conrail, CSX and Norfolk Southern freight train services, is near capacity and requires one or two additional tracks to support more frequent RVL peak period service. Furthermore, the two-track segment of the RVL west of Cranford requires an additional track to make it possible to provide increased peak period frequency and a zoned service pattern to optimize travel time. RVL station platform improvements would also be needed to minimize station dwell time and improve passenger convenience and ADA access.

#### EVALUATION

The Gateway Program's PSNY expansion and other capacity expansion projects necessary to increase trans-Hudson rail service capacity, together with NJ TRANSIT system and RVL improvements, would support the potential of full-time direct service for the RVL and all other North Jersey routes without the re-allocation of NEC / PSNY train capacity.

See Appendix F for more details.

#### SCENARIO CAPITAL COSTS, OPERATING COSTS, RIDERSHIP AND TIMELINES

See Table 6 for rough order of magnitude cost estimates and implementation durations for each scenario.

See Appendix G for more details.

**TABLE 6 – SCENARIO SUMMARY RESULTS**

<b>Scenario Name</b>	<b>Operating Plan Modification</b>	<b>Net Peak Period Ridership Change</b>	<b>Capital Cost</b>	<b>O&amp;M Cost</b>	<b>Implementation</b>
<b>Short-Term Scenario A</b>	3 RVL trains operate to PSNY in the shoulders of the morning peak period	Minimal change	\$ 125 Million	\$ 4.6 Million per year	Six Years
<b>Short-Term Scenario B</b>	In peak 2 hours, 3 NEC trains terminate at NPS, and 3 RVL trains use their slots to operate to PSNY	-70	\$ 346 -704* Million	\$ 6.7 Million per year	Seven Years+
<b>Medium-Term Scenario C</b>	In peak 2 hours, 2 NEC & 2 NJCL trains terminate at NPS, and 4 RVL trains use their slots to operate to PSNY	-670	\$ 1.6 Billion	\$ 6.7 Million per year	Eleven Years
<b>Medium-Term Scenario D</b>	Same morning peak service as Scenario C and weekend service	TBD	\$ 15 Billion**	Gateway Program	Eleven Years
<b>Long-term Scenario E</b>	Full-time direct service to PSNY	TBD	\$30+ Billion**	Gateway Program	Undefined

\*Scenario B cost of \$686 Million includes RVL station platform improvements

\*\*The full \$15-30 Billion capital cost is not attributable only to RVL but to the entire NJ TRANSIT commuter rail system and Amtrak

---

# 5.0 FUTURE PLANNING PROCESS

**This study analyzed weekday morning and weekend one seat ride services only. The weekday morning peak period was studied to evaluate potential operating concepts since ridership is more concentrated in the morning than during the evening peak period (4:00 pm to 8:00 pm). For evening RVL one-seat ride service it is expected that the operations, (especially slot reallocation), infrastructure and rail rolling stock assumptions for the morning peak period will be applicable to comparable evening one-seat ride operations.**

In the development of the potential scenarios, criteria were utilized regarding slot reallocation, RVL train stopping patterns, RVL station platform improvements, rail fleet size and mix, peak period train capacity and deployment of operational personnel among others. The application of these criteria affects the results of ridership forecasts, capital costs, operating costs and thus would require further analysis to refine the results of this study and to more clearly understand implementation risks, for both morning and evening service.

As previously noted, the NJ TRANSIT rail system is complex. Amtrak and Conrail own portion of the right-of-way on which the RVL operates and they must approve schedule changes. Ridership on PATH may be affected and would need to be consulted to discuss the interactions of their respective future operating plans with any modifications to NJ TRANSIT operating plans.

Beyond the basic operating, infrastructure and rail equipment

elements related to implementing moderate or significant operating improvements, NJ TRANSIT has traditionally followed a rigorous planning process either because it is required by statute or it is just good practice. Planning of most projects and / or substantial service changes include public outreach either formally through federal NEPA or New Jersey State EO-215, or in compliance with P.L. 2018, CHAPTER 162 (An Act Concerning Reforms of the New Jersey Transit Corporation approved December 20, 2018), and / or Title VI equity analysis requirements. Public hearings are most likely required, or are beneficial for significant rail service changes, for construction of new infrastructure, and for stakeholder and customer feedback

When NJ TRANSIT implements projects, service or fare changes that meet specified thresholds it must pursue actions that are specified by the State of New Jersey or the federal government. Among those requirements are the NJ TRANSIT Reform Legislation and the FTA mandated Title VI Program requirements that are described below in Appendix I. This study has identified a range of potential rail service and infrastructure improvements that may be subjected to requirements of either or both. For Scenarios A, B, C and D a potential implementation schedule, and related cost, was defined that would include “administrative” efforts for development of the study scenario. The efforts to comply with the NJ TRANSIT Reform Legislation and Title VI would be included in the administrative program.

---

# 6.0 CONCLUSIONS

During the last twenty-five years various studies were performed for implementing incremental full-time direct rail service to PSNY for the RVL service and for NJ TRANSIT's other diesel (not electrified) lines, most significantly the ARC and subsequent Gateway Programs. The plans were developed recognizing that PSNY's peak of the peak period train capacity is fully utilized and that additional rail, tunnel and PSNY station capacity between Newark and New York City would be needed to accommodate additional trains. These plans were defined considering forecasts that anticipate continued significant growth in demand for access to Manhattan from New Jersey.

To respond to the State legislation directing NJ TRANSIT to study the feasibility of full-time direct rail service to New York City for the RVL, this study analyzed weekday morning peak period and weekend operations, rail system infrastructure and rolling stock. The study identified and evaluated five alternative approaches for peak period one seat ride service to PSNY.

The study determined that full-time direct rail service to Manhattan will be best achieved by expanding trans-Hudson and PSNY infrastructure capacity (Scenario E). While it may be possible to achieve full-time direct rail service to PSNY as described in Scenario D, several risks and impacts have been identified and would need to be addressed.

The study's operations analyses and development of the study scenarios provide an understanding of the complex railroad

operating environment, needed capital investments, and on-going operations and maintenance costs and challenges that NJ TRANSIT must consider as it works to improve service for each of its rail lines. For the RVL, significant capital investments and operations modifications would be needed to transform the line from one that operates peak period service only to Newark, to a larger-scale model that can operate to and from PSNY. This change includes not only the length of the trains (seat capacity) operated but the supporting maintenance and infrastructure necessary to sustain the operation. The railroad fleet must be expanded by procuring new multi-level car trains with dual mode locomotives, additional overnight train storage yard tracks and servicing facilities must be constructed, and increased operations and maintenance funding would be needed.

All scenarios involve significant expense, but Scenarios B and C, which would re-allocate NEC / PSNY capacity to the RVL, would also have negative customer impacts, even with significant investment, as they reduce both rail system ridership and carrying capacity to PSNY, are estimated to result in overcrowding at NPS and Secaucus Junction, and would potentially degrade on time performance. Medium-Term Scenario D includes the concepts in Scenario C, but the weekend service could be implemented independently without the Scenario C service changes. Long-Term Scenario E would be part of NJ TRANSIT's system-wide program to expand service to and from PSNY and would provide full-time direct service for RVL customers without displacing NEC or NJCL customers.

In contrast to the Short and Medium-Term train substitution

---

scenarios, Long-Term Scenario E, based on the overall Gateway Program, would implement a comprehensive set of improvements that will be integrated into the complex NEC / PSNY operating environment and planned to benefit riders on all of NJ TRANSIT's northern New Jersey rail services, including the RVL. Each rail line would operate to PSNY and trains would accommodate the line's passengers, minimizing transfers at NPS and Secaucus Junction.

Along with development and implementation of the Gateway capacity expansion program, incremental improvements of the RVL will position the line for future operation of direct service to Manhattan when additional trans-Hudson capacity comes on-line. Projects that will facilitate improved service for RVL riders and one-seat ride service include: the Hunter Flyover, RVL station platform improvements; acquisition of additional multi-level rail cars and dual mode locomotives, and construction of additional train storage yard capacity. Furthermore, as NEC / PSNY capacity is expanded the construction of additional tracks along the NJ TRANSIT-owned segment of the RVL and along the Conrail-owned Lehigh Line would support the operation of additional RVL service, including more frequent peak period train service, and potentially for future extension to the west and/or along the West Trenton Line. The additional capacity provided by these projects would enable more frequent express service and would preserve reasonable travel times.

**In conclusion, this study determined that Short-Term substitution of NEC/NJCL trains with RVL trains would reduce system ridership and capacity and risk degrading system on time performance. It also affirmed that by advancing the Hunter Flyover, and supporting and participating in the project development work for the Hudson Tunnel Project and the Gateway Program expansion of trans-Hudson capacity, the State of New Jersey is on the path to**

**providing improved rail service for all of NJ TRANSIT's northern New Jersey rail lines and for the implementation of RVL direct service to Manhattan.**

---

# APPENDIX A

## TRAIN SLOT AND INFRASTRUCTURE CAPACITY ANALYSIS

### NEC / PSNY WEEKDAY MORNING PEAK PERIOD CAPACITY ANALYSIS

Anticipating that NEC and PSNY physical infrastructure can be maintained at the existing level of service in peak periods, the NEC's morning peak period (6:00 am to 10:00 am arrival at PSNY) capacity was analyzed to determine if capacity is available to extend RVL trains to PSNY. The study focused on the weekday morning, from 6:00 am to 10:00 am, initially since ridership is more concentrated in the morning than during the afternoon peak period, from 4:00 pm to 8:00 pm.

The NEC segments that impact capacity are the RVL connection to the NEC at Hunter Interlocking; NPS; Secaucus Junction; the North River Tunnel; PSNY; and the East River Tunnel. The following describes the results of the evaluation:

#### HUNTER INTERLOCKING

The RVL connects to the NEC at Hunter Interlocking where the RVL connecting track (referred to as the Hunter Connection) joins NEC Track 4, which is the NEC's westbound (or outbound) track, used by trains bound for NEC and NJCL stations. Some eastbound RVL morning peak period trains are able to operate on Track 4 to NPS Track

5, where they disembark passengers. These are the RVL trains that are scheduled to "turn back" at NPS and operate westbound back to the RVL. Other RVL morning peak period trains must crossover three or four of the very busy NEC tracks at Hunter to reach Track 1; from which they can operate eastward towards NPS. After stopping at NPS and unloading all passengers those trains continue eastward to operate to NJ TRANSIT's Meadows Maintenance Complex or to other NJ TRANSIT points, like Hoboken.

Due to the at-grade crossing of tracks, when any RVL train crosses to reach NEC Track 1, all NEC rail traffic in both directions is held to a stop on either side of Hunter interlocking. Because of the high peak period NEC train volumes, RVL trains require a window of opportunity, or "slot", to be able to cross all four NEC main tracks. This study performed a detailed evaluation of the interlocking and determined that only limited train slots are available for RVL trains to cross over to Track 1 since Amtrak and NJ TRANSIT trains operate in both directions on the four NEC tracks (see Figure 5). During the peak of the peak period (arrival at PSNY between 7:00 am and 9:20 am), aside from the RVL trains that are currently able to cross at Hunter and reach NEC Track 1, there are no available operating slots for any of the trains that currently use NEC track #4 and turn back at NPS to instead cross over to NEC track #1 for operation toward PSNY. However, the analysis determined that during the early and late shoulders of the peak period, before PSNY arrival 7:00 am and after 9:20 am, there are a limited number of slots available to route trains across Hunter Interlocking to Track 1 towards PSNY.

---

## **NEWARK PENN STATION**

All NJ TRANSIT NEC, NJCL and RVL trains stop at NPS. In peak periods, sections of the passenger platforms and vertical circulation elements are heavily crowded, impacting passenger movement. Currently in the morning peak period all eastbound RVL passengers must alight, and nearly half of the passengers transfer to trains to PSNY, while others transfer to PATH, other transit services or proceed to Newark area destinations. NPS is also a transfer station for passengers on NEC and NJCL trains. About 20% of NEC passengers and 25% of NJCL passengers alight. This provides capacity on trains for RVL and other passengers boarding in NPS, and also provides capacity for passengers to board the PSNY trains that stop at Secaucus Junction. Schedules of some RVL shoulder trains that terminated on Track 5 in 2017 were subsequently adjusted to operate to Track 1 to allow same platform transfer at NPS. As shown in Figure 6, Tracks 1 through 5 of NPS have a high utilization in AM Weekday Peak period. Track A is of limited use due to inadequate length as well as inadequate vertical circulation (stairs, elevators, escalators) and connections to other tracks of the station. RVL trains are highlighted as well as the trains that offer connection for PSNY.

## **NEC HIGH LINE AND SECAUCUS JUNCTION**

The segment of the NEC east of Harrison, containing Secaucus Junction, is known as the High Line since it is mostly an elevated railroad right of way. Swift Interlocking, located west of Secaucus Junction along the High Line, consists of the connecting tracks to the NJ TRANSIT Morris & Essex Lines (M&E). Trains from the Morristown Line, Gladstone Branch and the Montclair – Boonton Line merge onto the NEC to reach PSNY. Trains merging at Swift from NJ TRANSIT's M&E Lines and NEC, and Amtrak's intercity services fully utilize the NEC capacity during the peak hours. The

High Line uses High Density Interlocking Signaling (HDIS) system which enables up to 24 trains per hour (TPH) practical capacity. Trains are scheduled to operate on a headway (spacing of time between trains) on an average of 2.5 minutes – typically alternating between two minutes and three minutes apart.

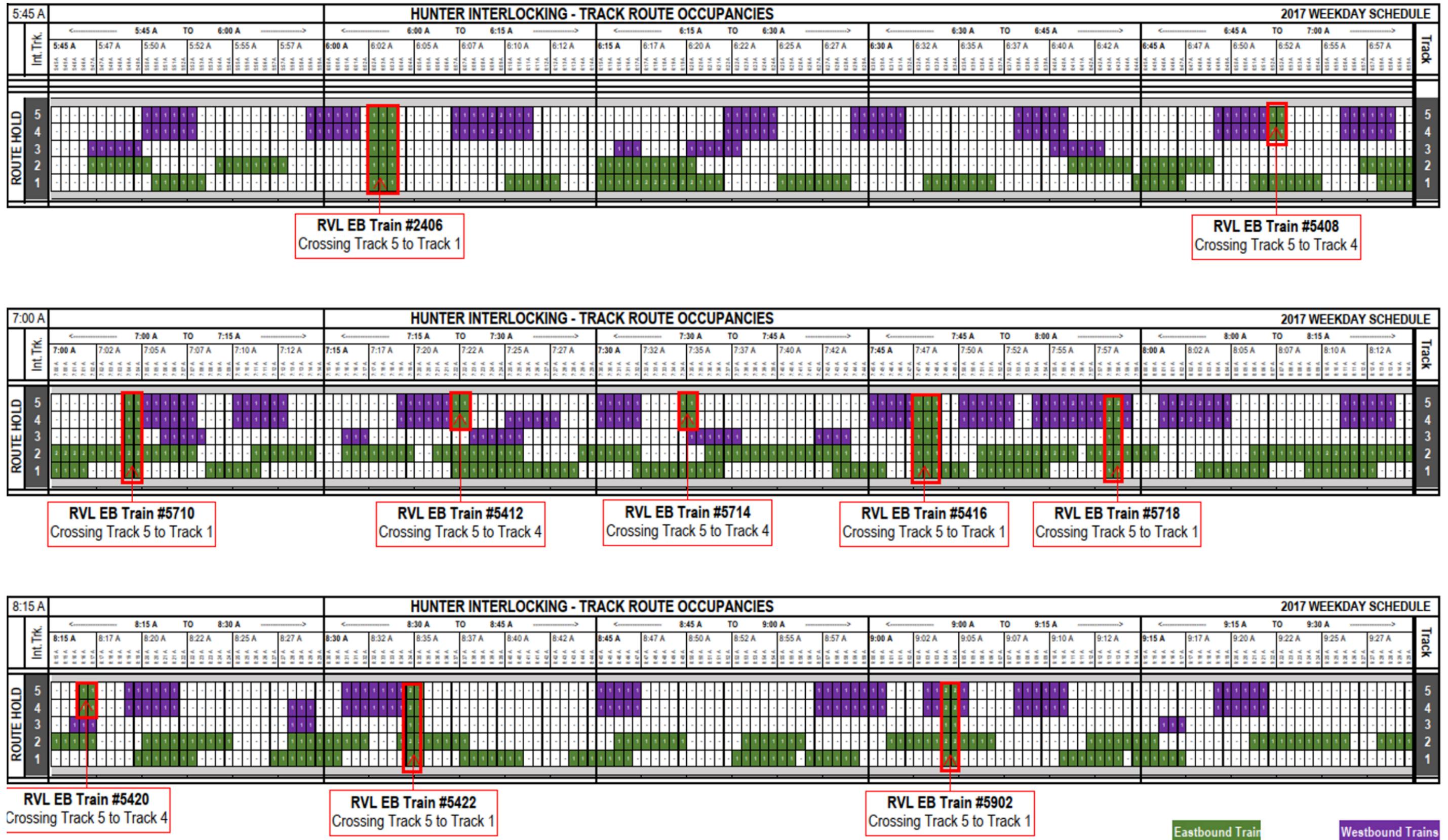
Secaucus Junction was developed to connect NJ TRANSIT's northern New Jersey rail lines enabling passengers on Main, Bergen County, Pascack Valley and Port Jervis line trains to transfer to and from PSNY trains, or onto westbound trains. The station's track configuration makes it possible for some PSNY bound NJ TRANSIT trains to stop and others to operate non-stop through the station in the morning peak period. All Amtrak and designated NJ TRANSIT M&E trains, usually with high load factors, bypass the station.

Passenger movement off and on trains at NPS and Secaucus Junction, respectively, provides the capacity needed to accommodate the large volumes of passengers that board PSNY bound trains at Secaucus Junction. At NPS, significant numbers of passengers alight from NEC and NJCL trains, and even as passengers board, most trains leave NPS with fewer passengers than they had arriving at NPS. This leaves capacity for passengers to board at Secaucus Junction for the trip to PSNY. Train consists are planned to accommodate NEC and NJCL demand and to ensure that adequate capacity is available for passengers to board at Secaucus Junction. This operation provides efficient utilization of train capacity through the North River Tunnel and into PSNY. Currently, 21 out of 23 NEC and NJCL trains that arrive at PSNY between 7:00 am and 9:20 am stop at Secaucus Junction.

## **NORTH RIVER TUNNEL**

The North River Tunnels use HDIS system which enables up to 24 trains per hour (TPH) practical capacity. Trains are scheduled

FIGURE 5 – HUNTER INTERLOCKING OCCUPANCY: AM WEEKDAY PERIOD (5:45 AM TO 9:30 AM)





---

to operate on a headway (spacing of time between trains) of 2.5 minutes on average – typically alternating between two minutes and three minutes apart. Informed by previous studies that evaluated the utilization of the tunnel and review of recent train operations, this study confirmed that during the peak of the morning peak period, between 7:00 am and 9:20 am arrivals at PSNY, NJ TRANSIT and Amtrak fully utilize all available train slots for eastbound service through the tunnel. However, in the early morning peak period between 6:00 am and 7:00 am and after 9:20 am (arrivals) at PSNY there is some limited available capacity for additional trains in the tunnel.

## **PENN STATION NEW YORK**

Amtrak, NYSDOT, LIRR and NJ TRANSIT share PSNY and agreements are in place governing the use of tracks and platforms. During AM Peak Period (6:00 am to 10:00 am), Tracks 13 to 21 are for exclusive use of LIRR whereas Tracks 5 to 12 are used jointly by Amtrak and NJ TRANSIT. Tracks 1 to 4 are exclusive for NJ TRANSIT use during AM Peak period. Informed by previous studies that evaluated the utilization of PSNY and review of recent operations, track and platform utilization based on standard dwell times for Amtrak and NJ TRANSIT trains, this study concluded that during the peak of the morning peak period, between 7:00 am and 9:20 am, NJ TRANSIT and Amtrak fully utilize all available train slots and there is no available capacity to add new trains without removing/ substituting existing trains. However, in the early morning peak period between 6:00 am and 7:00 am and after 9:20 am there is some limited available capacity for additional trains in to operate to PSNY.

## **EAST RIVER TUNNEL**

The four track East River Tunnel is shared by Amtrak, NYSDOT, LIRR,

and NJ TRANSIT. LIRR operates the largest number of trains in and out of PSNY and has exclusive use of two of the four tracks and shares the other two with Amtrak and NJ TRANSIT. NJ TRANSIT uses the East River Tunnel to operate trains without passengers to and from Sunnyside Yard; which provides a through operation so that other trains can sequentially utilize PSNY platforms. As with the North River Tunnel and PSNY, a review of train operations, as well as previous studies that evaluated the utilization of the tunnel this study concluded that during the peak of the morning peak period, between 7:00 am and 9:20 am, NJ TRANSIT and Amtrak fully utilize the available train slots.

Figures 7 and 8 show the utilization of North River Tunnels, Penn Station New York and East River Tunnels for the AM Weekday period. The diagrams depict the utilization of each of the tunnels and the station platform tracks for time that the trains pass by (tunnels) or dwell (station) on the tracks. Based on the evaluation of each of the NEC segments the study has concluded that there are no additional slots available for RVL trains to operate to PSNY during the 7:00 am to 9:20 am peak of the peak period at PSNY on weekdays. However, there is limited capacity available during the shoulders of the weekday morning peak period prior to 7:00 am and after 9:20 am.

## **NEC / PSNY WEEKEND CAPACITY ANALYSIS**

The existing two track North River Tunnel has been in use for 110 years and has required on-going maintenance and improvements requiring track outages to perform the required work. Adding to this challenge is the fact that the tunnel's condition was compromised by the damage to tunnel components, caused by seawater inundation during Superstorm Sandy in October 2012. To maintain the tunnel in useable condition Amtrak takes one tunnel track out of service

---

during weekends. As a result, train scheduling is based on the use of a single track to accommodate trains in both directions. Typically, a fleet of trains are operated in one direction and then in the other direction each hour.

NJ TRANSIT uses four train slots per hour in each direction on weekends. NJ TRANSIT's service consists of two trains per hour for the NEC, one for the NJCL, and one for the Morristown Line. The NJCL trains also serve the NEC stations between Rahway and North Elizabeth. The Morristown Line trains serve the stations on that line and provide PSNY access for the Gladstone Branch and Montclair-Boonton Line. NJ TRANSIT weekend trains carry passengers who transfer at Secaucus Junction to and from Main, Bergen, Pascack Valley and Port Jervis and RVL passengers who transfer at NPS.

Weekend trains are very often full and at peak times they carry standees. During the Summer season NEC and NJCL weekend trains are used to capacity, particularly the NJCL trains as they carry beachgoers and travelers to other destinations.

The annual weekend ridership on the lines that operate to PSNY in FY 2019 was:

- NEC: 6,001,100
- NJCL: 1,074,700
- M&E: 1,674,900

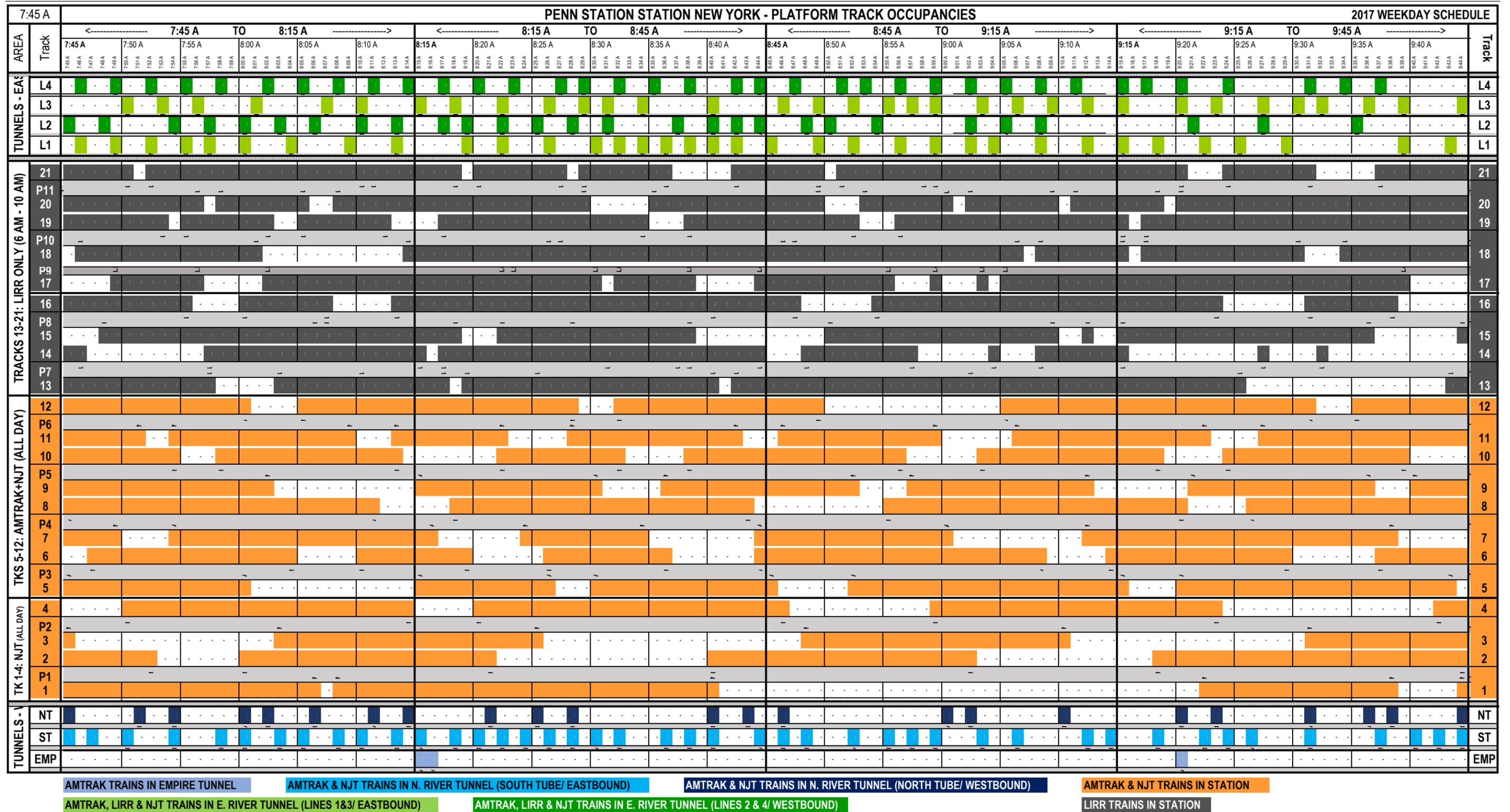
In comparison, RVL weekend ridership was 504,100, half the number of NJCL trips, less than a third of M&E trips, and about 8% of the NEC trips.

Considering the historic use of weekend trains and the full use of the available slots to and from PSNY, it is not feasible to substitute RVL trains for other existing services. In the future, when at least two

tunnel tracks are in full-time service on weekends on a permanent basis, extension of RVL trains to PSNY is expected to be feasible.



FIGURE 8 – NORTH RIVER TUNNELS, PENN STATION NEW YORK AND EAST RIVER TUNNELS OCCUPANCY: AM WEEKDAY PERIOD (7:45 AM TO 9:45 AM)



AMTRAK TRAINS IN EMPIRE TUNNEL
AMTRAK & NJT TRAINS IN N. RIVER TUNNEL (SOUTH TUBE/ EASTBOUND)
AMTRAK & NJT TRAINS IN N. RIVER TUNNEL (NORTH TUBE/ WESTBOUND)
AMTRAK & NJT TRAINS IN STATION  
AMTRAK, LIRR & NJT TRAINS IN E. RIVER TUNNEL (LINES 1&3/ EASTBOUND)
AMTRAK, LIRR & NJT TRAINS IN E. RIVER TUNNEL (LINES 2 & 4/ WESTBOUND)
LIRR TRAINS IN STATION

---

# APPENDIX B

## DIRECT RAIL SERVICE SCENARIOS

Having determined that there is no train slot capacity available during the peak of the morning weekday peak period (7:00 am to 9:20 am) for adding RVL trains, two strategies were considered: expanding capacity and reallocating existing capacity. As previously stated, the expansion of NEC and PSNY capacity is the goal of the Gateway Program, which proposes to facilitate the operation of more frequent service for all of NJ TRANSIT's northern New Jersey rail lines, including the provision of one-seat ride service for the RVL and NJ TRANSIT's other diesel services. The Gateway Program is expected to be advanced over the long-term considering the complexity and substantial cost of the program. Therefore, the expansion of capacity is the long-term scenario for this study.

The other strategy, reallocation of existing capacity during the peak of the peak period, would require substituting RVL trains for existing PSNY bound trains. Any displaced trains would need to terminate passenger service at NPS, and their passengers bound for PSNY would need to transfer to other trains. In the development of short, medium and long-term scenarios it was recognized that the RVL operations, rail vehicles and supporting infrastructure are compatible with operations to Newark Penn Station, but would require modifications and improvements to support the operation peak period service to PSNY.

Two scenarios (A & B) were developed for the Short-Term:

- Short-Term Scenario A would provide service during shoulders of the peak period without substituting for trains from other lines.
- Short-Term Scenario B, in addition to providing service during shoulders of the peak period, would provide service during peak of the peak period using the substitution concept.

The Short-Term scenario would require capital projects on NJ TRANSIT property that could potentially be implemented in the near-term, assuming that with further analysis the supporting projects are determined to be feasible, and that funding will be available within NJ TRANSIT's capital planning priorities.

Medium-Term scenarios would consist of the Short-Term scenario projects and would also require other, larger scale capital improvements, including the construction of the Hunter Flyover project, which, as described above would improve the connection to the NEC at Hunter. The Flyover, a relatively high-cost project, would involve complex construction work on Amtrak and Conrail property that is anticipated to require an extended period of time to design, fund and construct. Two scenarios (C & D) were developed for the Medium-Term:

- Medium-Term Scenario C would provide service during the shoulders of the peak and would provide service during the peak of the peak period using the substitution concept.
- Medium-Term Scenario D would provide the same weekday

---

service as Scenario C and would also include weekend RVL service to PSNY. This scenario would be made possible by the completion of the Phase 1 projects of the Gateway Program. Specifically, the new Hudson River Tunnel project, which includes rehabilitation of the North River Tunnel, would alleviate the weekend trans-Hudson tunnel constraint; making it possible for NJ TRANSIT to operate additional weekend service.

In developing the train substitution concepts for the Short and Medium-Term scenarios, a key factor that was identified is the service pattern that exists on the NEC between Secaucus Junction and PSNY during the weekday morning peak period. The existing NEC and NJCL peak period trains are coordinated and scheduled to provide capacity for passengers boarding at both NPS and Secaucus Junction. Trains arriving at NPS are typically close to capacity. At NPS some passengers alight and others board. Typically, more passengers alight than board as significant numbers of passengers transfer to PATH to travel to Jersey City and lower Manhattan. That leaves capacity on trains that is then filled at Secaucus Junction, where passengers transfer from the Main, Bergen County, Pascack Valley, and Port Jervis lines board for the trip to PSNY. When trains operate on schedule passenger loads are balanced, which is important on this capacity-constrained segment of the railroad system. For this operation to work, trains to PSNY must have adequate capacity to accommodate people boarding at Secaucus Junction. There is virtually no remaining capacity on PSNY bound peak of the peak trains once they leave Secaucus Junction, and in fact trains are often filled well beyond seated capacity. As a result, in planning for RVL one-seat service, for any RVL train proposed to operate in peak service to PSNY it would be necessary to operate trains consisting of eight to ten multi-level cars to accommodate these volumes.

The Long-Term Scenario E would involve increasing NEC and PSNY capacity as proposed by the Gateway Program Future Phase. In addition, the Long-Term scenario would require investment in other projects within NJ TRANSIT territory that would facilitate the operation of one-seat ride service and an expanded schedule of RVL trains; and the related increased passenger ridership.

Figures 9-12 show side-by-side comparison of infrastructure required for each of the five scenarios. These are not to scale and for illustrative purposes only. The exact configuration will be finalized when these projects have undergone detailed engineering and design. Table 7 summarizes the needed operations, rail vehicles and infrastructure investments and changes necessary to provide one-seat ride for Raritan Valley Line to PSNY for each scenario.

Infrastructure investments necessary for the study scenarios include projects that have independent utility that would provide benefit to the NJ TRANSIT rail system. The replacement of low-level platforms with high level platforms at RVL stations would not only provide accessibility for people with disabilities but would improve convenience for all passengers and reduce train dwell time at stations. The improvement of NPS platform A and other station circulation improvements would upgrade the functionality of the station for passengers and for train operations for all rail lines serving the station. The Hunter Flyover, which benefits the RVL, would also reduce congestion on the NEC, benefitting NJ TRANSIT's NEC and NJCL, and Amtrak train movement.

For Short-Term Scenario B and for Medium-Term Scenario C, the study scenarios that would substitute RVL trains for NEC and NJCL trains, ridership changes from the future no build were estimated. Appendix C describes the ridership forecasting results.

FIGURE 9 – CAPITAL INFRASTRUCTURE INVESTMENTS FOR VARIOUS SCENARIOS (HIGH BRIDGE TO NORTH BRANCH)

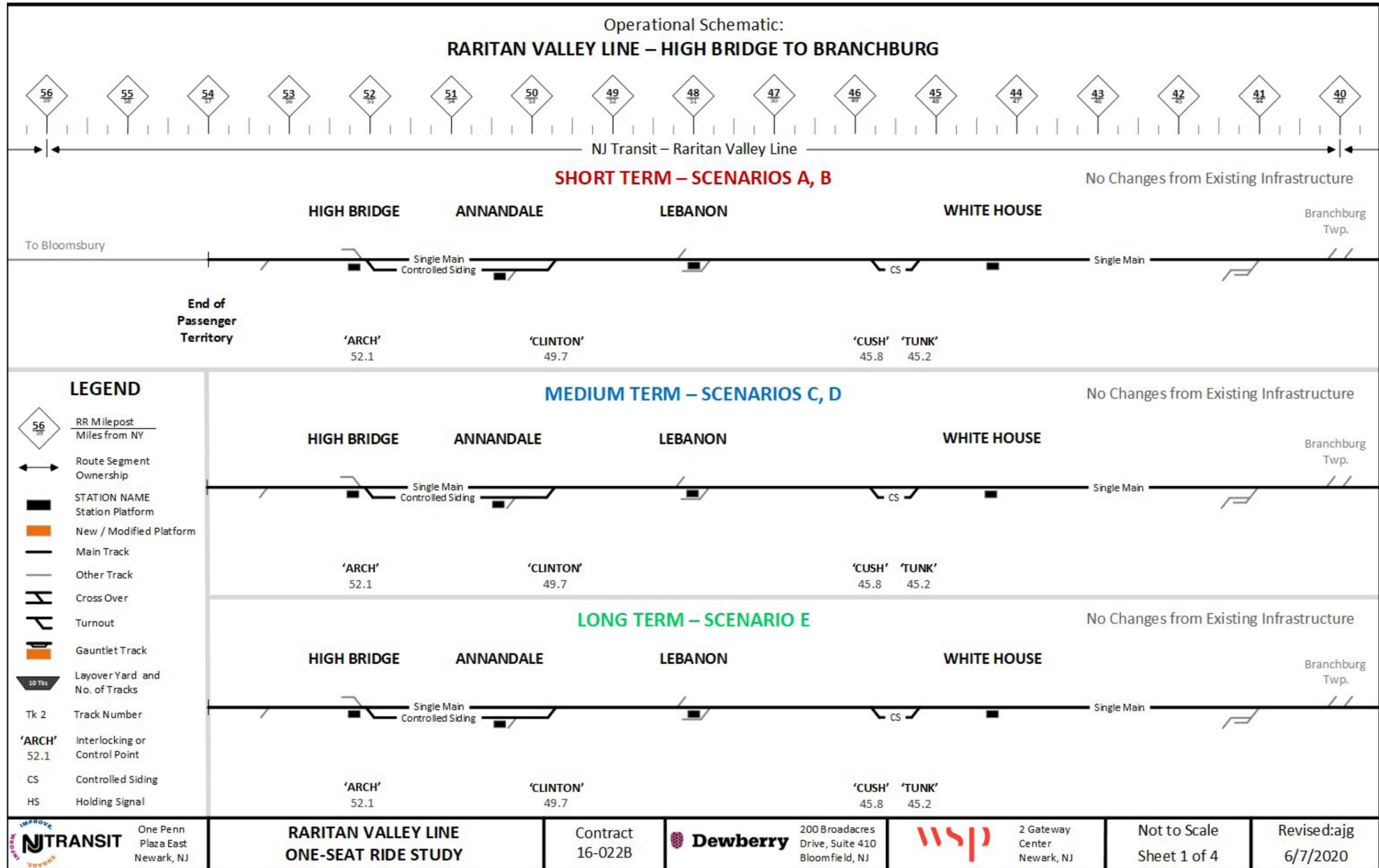


FIGURE 10 – CAPITAL INFRASTRUCTURE INVESTMENTS FOR VARIOUS SCENARIOS (NORTH BRANCH TO PLAINFIELD)

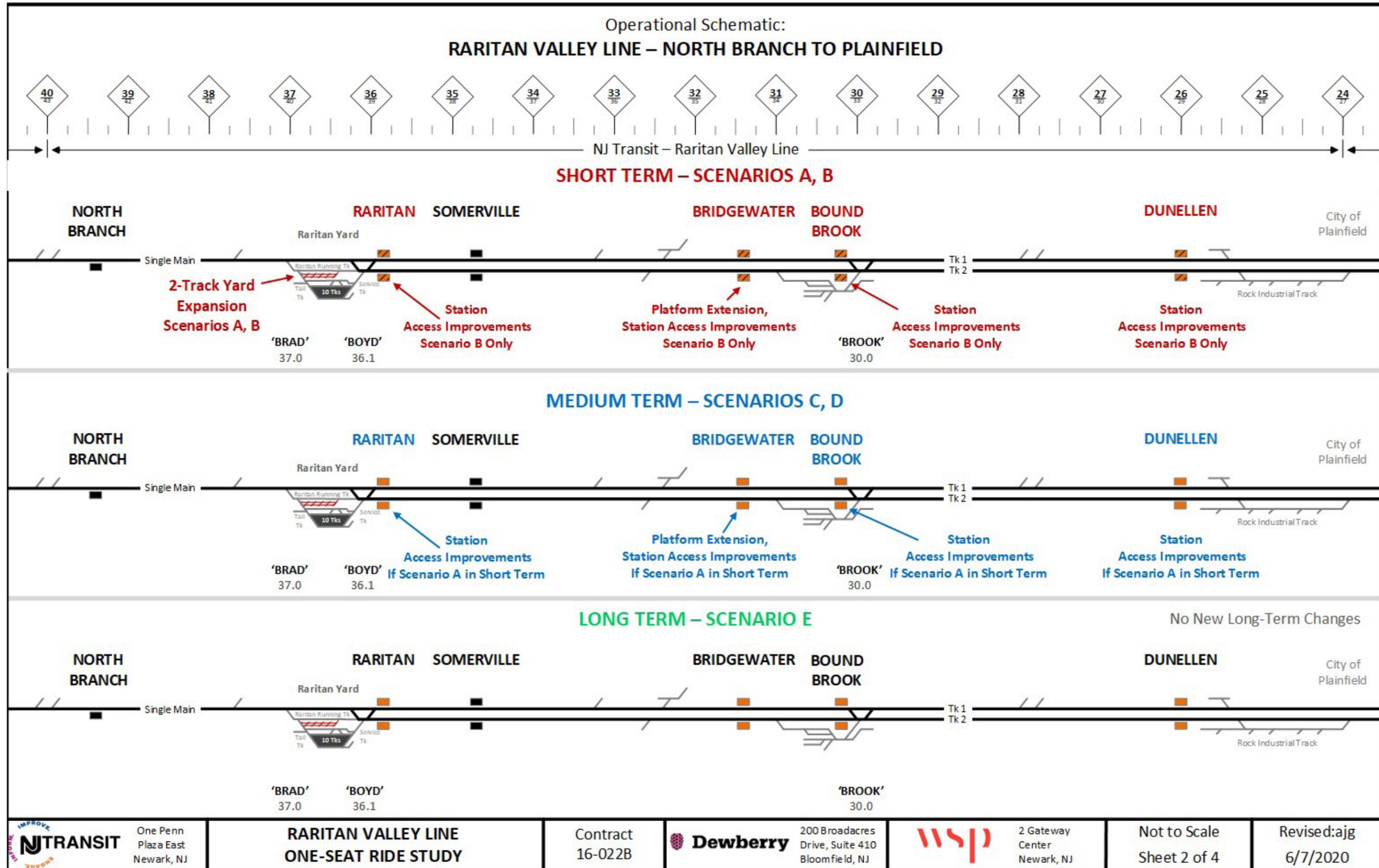


FIGURE 11 – CAPITAL INFRASTRUCTURE INVESTMENTS FOR VARIOUS SCENARIOS (PLAINFIELD TO CONNECTION WITH NEC AT HUNTER INTERLOCKING)

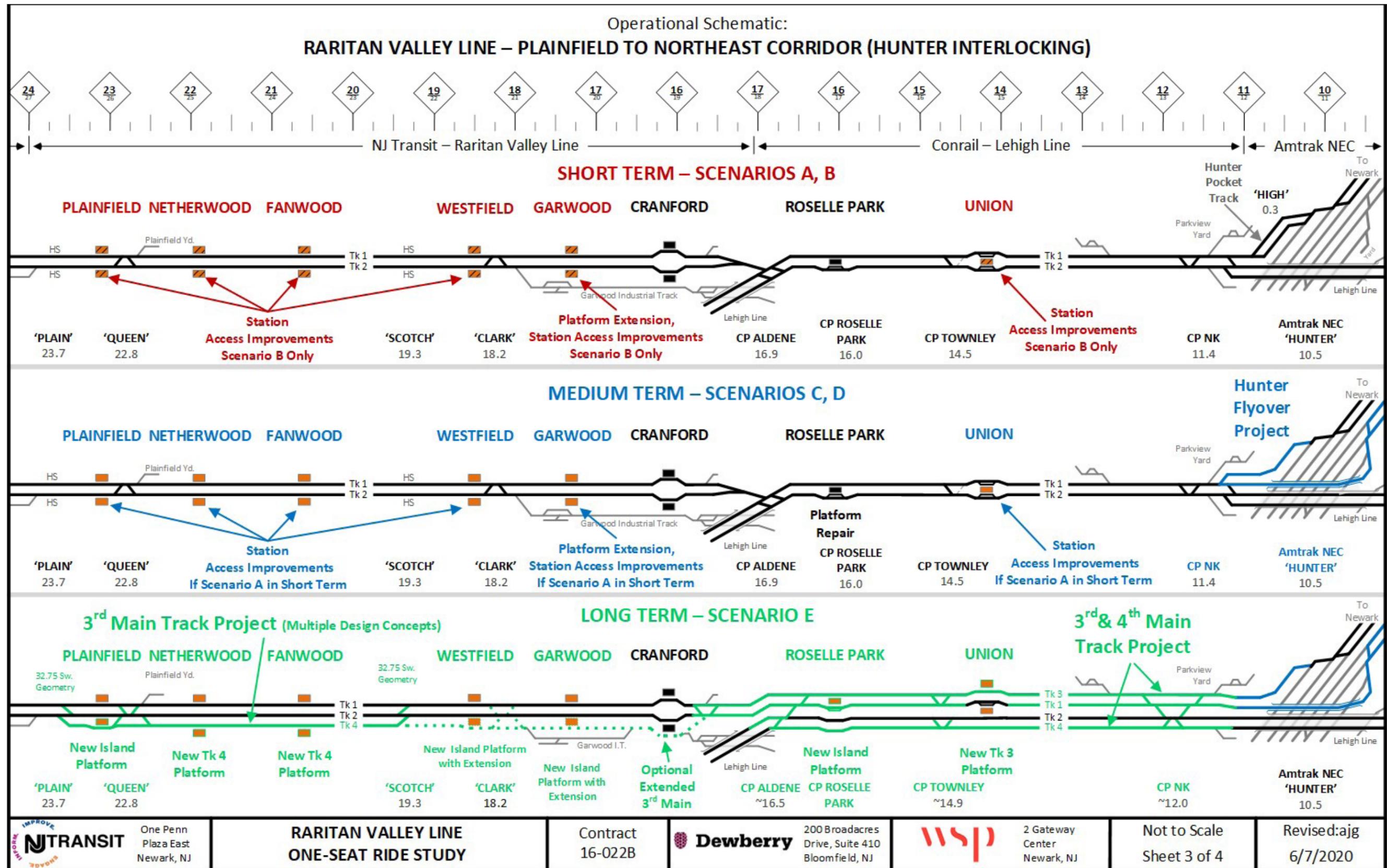
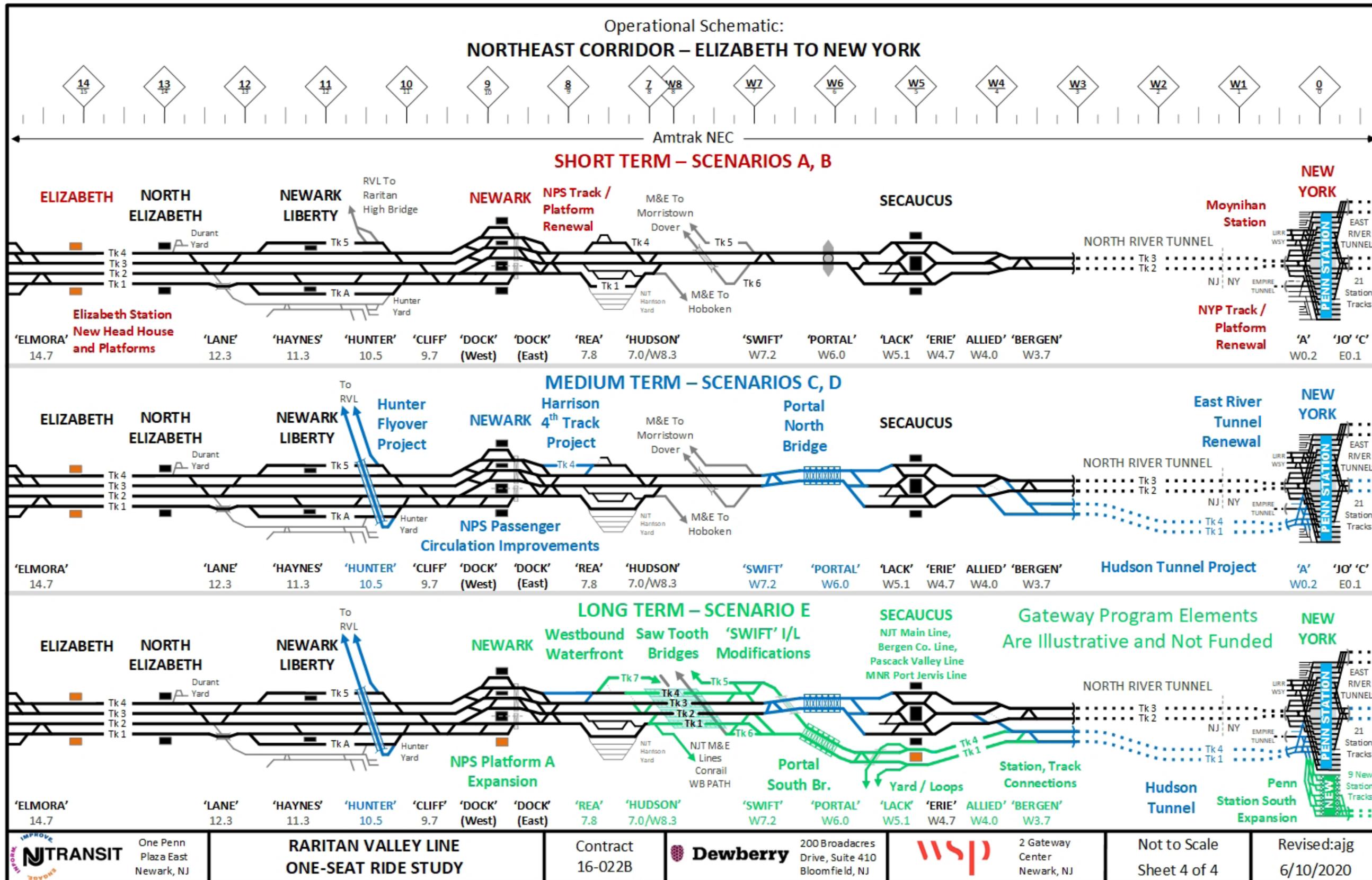


FIGURE 12 – CAPITAL INFRASTRUCTURE INVESTMENTS FOR VARIOUS SCENARIOS (NEC FROM ELIZABETH TO HUNTER INTERLOCKING TO PENN STATION NEW YORK)



**TABLE 7 – COMPARISON OF EACH SCENARIO FOR OPERATIONS, CAPITAL INFRASTRUCTURE AND ROLLING STOCK INVESTMENTS**

Raritan Valley Line (RVL) One-Seat Ride to Penn Station New York (PSNY) Summary										
			Baseline (October 2017)	Short-Term (Scenarios A & B)		Medium-Term (Scenarios C & D)		Long-Term (Scenario E)		
Service Plan	AM Early Shoulder of the Peak (~Until 6:40 am at Newark or Until 7:00 am at Hoboken/ PSNY)	RVL terminate Newark	1	2 frequencies	0	2 frequencies	0	2 frequencies	0	3 frequencies
		RVL terminate Hoboken	1		0		0		0	
		RVL terminate PSNY	0		2		2		3	
	AM Peak of the Peak (~6:40 am to 9:00 am at Newark or 7:00 am to 9:20 am at Hoboken/ PSNY)	RVL terminate Newark	8	8 frequencies	5	8 frequencies	4	8 frequencies	0	16 frequencies
		RVL terminate Hoboken	0		0		0		8	
		RVL terminate PSNY	0		3		4		8	
	AM Late Shoulder of the Peak (~9:00 am to 10:00 am at Newark or 9:20 am to 10:20 am at Hoboken/ PSNY)	RVL terminate Newark	1	2 frequencies	0	2 frequencies	0	2 frequencies	0	3 frequencies
		RVL terminate Hoboken	0		0		0		0	
		RVL terminate PSNY	1		2		2		3	
	Trains Substituted** (PSNY-bound trains terminated at Newark/ Hoboken) in favor of RVL train extended to PSNY in AM Peak of the Peak	NEC-PSNY Substitution	None	0 frequencies	3	3 frequencies	2	4 frequencies	None	0 frequencies
		NJCL-PSNY Substitution	None		None		2		None	
		M&E-PSNY Substitution	None		None		None		None	
MoBo-PSNY Substitution		None	None		None		None			
Capital Equipment	Needed to Operate Service	Multi-Level Cars: ML	51 ML	10 train sets	96 ML	12 train sets (each of 8 ML)	120 ML	12 train sets (each of 10 ML)	TBD ML	TBD train sets
		Single-level Cars: SL	16 SL		0 SL		0 SL		0 SL	
		Dual Powered Loco: DM	8 DM		12 DM		12 DM		TBD ML	
		Diesel Loco: DL	2 DL		0 DL		0 DL		0 DL	
	Change from 2017 Baseline + 20% Spares (apportioned to the Change only)	Multi-Level Cars: ML	N/A	N/A	+45 ML & +9 ML (Spares)	+2 train sets	+69 ML & +14 ML (Spares)	+2 train sets	TBD ML	TBD train sets
		Single-level Cars: SL	N/A		-16 SL		-16 SL		-16 SL	
		Dual Powered Loco: DM	N/A		+4 DM & +1 DM (Spare)		+4 DM & +1 DM (Spares)		TBD DM	
		Diesel Loco: DL	N/A		-2 DL		-2 DL		-2 DL	
Capital Infrastructure			Existing	Existing Plus		Short-Term Plus		Medium-Term Plus		
				2 train set storage addition at Raritan Yard Pedestal & Wash Track, Tower at Raritan Yard <b>Platform &amp; ADA improvements at stations on RVL</b>		Hunter Flyover Newark Penn Station Track A platform extension Newark Penn Station mobility improvements Platform & ADA improvements at stations on RVL <b>Gateway Program Phase 1: Hudson River Tunnel Project</b> <b>Gateway Program Phase 1: Portal North Bridge Project</b> <b>Gateway Program Phase 1: Fourth Track Hudson to Dock</b>		Gateway Program Future PSNY Expansion Project & other projects Additional Train storage on RVL Additional tracks on Conrail Lehigh Line Third track on RVL Westbound Waterfront Connection – System Improvement		

\*\*No substitution required for RVL One-Seat ride during Peak Shoulders (Early/ Prior to 7 AM and Late/ after 9:20 AM). Substitution of train slots required if providing One-Seat ride during Peak of the Peak (7: 00 am – 9:20 am).

# APPENDIX C

## RIDERSHIP FORECASTS

One of the factors that contributes to increased ridership is transit-oriented development (TOD) which locates more jobs, housing, and other activities near rail stations. New housing has been developed in the vicinity of many stations in northern New Jersey. The RVL is among the lines where new housing has been developed and projects are being advanced to continue that trend. Cranford was in the forefront of supporting and developing TOD, but recently TOD has occurred and is proposed for other RVL stations, including Union, Garwood, Fanwood, Plainfield, Dunellen, Bound Brook, Somerville and Raritan. The RVL is not unique as TOD has been implemented and is being advanced along many other NJ TRANSIT lines. The following are some of the stations at which TODs have been developed or are advancing:

- NEC stations: Elizabeth, Linden, Rahway, Metuchen, New Brunswick, Princeton Junction, Hamilton, future North Brunswick Station
- NJCL stations: Avenel, Woodbridge, South Amboy, Aberdeen-Matawan, Red Bank, Asbury Park, Belmar, Bradley Beach
- Morris & Essex lines stations: Newark, East Orange, Brick Church, Orange, South Orange, Maplewood, Summit, Morristown
- Montclair-Boonton stations: Watsessing, Bloomfield, Bay Street-Montclair
- Main & Bergen County stations: new Wesmont Station, Radburn-Fair Lawn, Waldwick, Rutherford

- Pascack Valley stations: Essex St. Hackensack, Montvale, Park Ridge

Utilizing regional demographic information NJ TRANSIT has prepared ridership forecasts for its rail lines for the next 25 years (Table 8). Those forecasts assume that the rail system will continue to provide a consistent level of service, as now available. All rail lines are expected to experience increasing passenger demand. The forecasted ridership growth rates anticipate housing and job development, but they may not include recent proposals for TOD. It

**TABLE 8 – FORECASTED AVERAGE WEEKDAY BOARDING RIDERSHIP GROWTH RATES FOR NJ TRANSIT’S NORTHERN NEW JERSEY RAIL LINES**

Northern New Jersey Rail Line	Forecasted Growth Rates From 2015 to 2025	Forecasted Growth Rates From 2025 and 2035
Main / Bergen County	11%	13%
Pascack Valley	3%	14%
Montclair- Boonton	12%	8%
M&E	12%	8%
RVL	15%	11%
NJCL	13%	11%
NEC	3%	14%
Total	8%	11%

(Forecasts assume that 2015 / 2017 Rail Service)

---

is possible that new TOD proposals could result in higher ridership increases than forecasted. However, since TOD is being advanced along most of NJ TRANSIT's northern New Jersey rail lines, for the purposes of this study as rail services are being compared, the current forecasts were utilized.

## **RIDERSHIP FORECASTS FOR SHORT AND MEDIUM-TERM SCENARIOS**

Ridership forecasts were prepared using NJ TRANSIT's North Jersey Transit Demand Forecasting Model. The demographic forecasts in the model are consistent with the regional forecasts being used by the North Jersey Transportation Planning Authority. The model utilizes a base year of 2015, which contained a rail service for that year. This rail service planning analysis in this study uses the October 2017 rail service timetable, which was almost the same for the rail lines that are the focus of this study.

Ridership forecasts were prepared for the study scenarios that would modify rail service frequency and travel times during the peak two hours of the morning peak period. The two study scenarios for which ridership forecasts were prepared were Short-Term Scenario B and Medium-Term Scenario C.

Table 9 provides estimated ridership changes from the no build condition for the morning peak period for the forecast year for each scenario.

For Short-Term Scenario B RVL ridership would increase about 3%, the NEC would decrease by about the same percentage and the NJCL would increase 2%. The net change for the three lines is 70 fewer riders. In addition, 120 would divert to auto driving.

For Medium-Term Scenario C RVL ridership would increase 2%, the NEC would be unchanged, and the NJCL would decrease 10%. NEC ridership is unchanged because ridership losses are replaced by riders diverted by the reduced frequency on the NJCL (primarily to the Metropark Station, which is convenient to the NJCL corridor via the Garden State Parkway). **The net change for the three lines is a decrease of 670 riders. In addition, 90 would be diverted to PATH and 260 would divert to auto driving.**

**TABLE 9 – RIDERSHIP FORECASTS FOR WEEKDAY MORNING PEAK PERIOD FOR SHORT AND MEDIUM-TERM SCENARIOS**

Study Scenario	Weekday Morning Peak Period			
	Boarding Ridership Change for Line from No Build	Diversions to PATH (Does not include transfers from NJ TRANSIT trains to PATH)	Diversions to Bus	Diversions to Auto
<b>Short-Term Scenario B (2025 Forecast):</b> In peak 2 hours, 3 NEC trains terminate at NPS, and 3 RVL trains use their slots to operate to PSNY				
<b>RVL</b>	180 (3%)			
<b>NEC</b>	-430 (-3%)			
<b>NJCL</b>	180 (2%)			
<b>Net Change for Three Lines</b>	-70 (0%)			
Diversions from NJ TRANSIT Rail System		0	20 (0%)	120 (0%)
<b>Medium-Term Scenario C (2035 Forecast):</b> In peak 2 hours, 2 NEC & 2 NJCL trains terminate at NPS & 4 RVL trains use their slots to operate to PSNY				
<b>RVL</b>	150 (2%)			
<b>NEC</b>	50 (0%)*			
<b>NJCL</b>	-870 (-10%)			
<b>Net Change for Three Lines</b>	-670 (2%)			
<b>Diversions from NJ TRANSIT Rail system</b>		90 (0%)	400 (0%)	260 (0%)

\*NEC ridership is unchanged because ridership losses are replaced by riders diverted by the reduced frequency on the NJCL.

---

# APPENDIX D

## SHORT-TERM SCENARIOS

For the Short-Term, the study explored the concept of extending up to six existing RVL trains to PSNY in the morning peak period between 6:00 am and 10:00 am. In this scenario three of these trains could be extended during the shoulders of the peak period, which are before 7:00 am and after 9:20 am, and do not require substitution of any NEC or NJCL trains. A constraint related to substitution operation in the in the 7:00 am to 9:20 am peak of the peak period in the Short-Term Scenarios is the Hunter Pocket Track length, which would limit trains to a consist of only up to eight cars and a locomotive. The trains bound for PSNY that would be displaced have longer consists to accommodate passengers boarding at NPS and Secaucus Junction.

The following describes the Short-Term scenario A (Table 10), which would involve extension of up to three shoulder of the peak period trains, (two of them before 7:00 am and one after 9:20 am arrival at PSNY; all three without any substitution). Also described below is Short-Term scenario B, which would involve extension of up to six trains (two of them before 7:00 am without any substitution, three between 7:00 am and 9:20 am, with substitution and one after 9:20 am without any substitution).

## SHORT-TERM SCENARIO A - WEEKDAY MORNING PEAK PERIOD SHOULDERS ONE-SEAT RIDE SERVICE

### OPERATIONS

- Two early morning RVL trains would be extended to PSNY, arriving at PSNY before 7:00 am
- One late peak period train would be extended to PSNY, arriving at PSNY between 9:20 am and 10:00 am, just prior to the first existing RVL midday off-peak period train
- The extension of these trains to PSNY would change the pattern of train operations, including the existing operation of trains for outbound trips and second inbound trips. As a result, two additional train sets would be required for the RVL.
- No NEC or NJCL trains will be displaced in Short-Term scenario A.

### RAIL VEHICLES

- This scenario would modify the existing RVL operations pattern and would require additional passenger cars and dual power locomotives because the extended trains to PSNY would not be available to return to Raritan Yard for another eastbound run.
  - Sixteen (16) new multi-level (ML) rail cars and three spare cars (20% spares vehicles required for vehicle servicing and maintenance) for a total of 19 cars
  - Two (2) ALP-45DP dual power locomotives

TABLE 10 – SCENARIO A SERVICE PATTERN AND EQUIPMENT

Tested AM Weekday RVL Eastbound Service Pattern: Short-Term Scenario A												
Train ID	5404	2406	5408	5710	5412	5714	5416	5718	5420	5422	5902	5126
Equipment	8ML+ALP45	8ML+ALP45	6ML+ALP45	6ML+ALP45	6ML+ALP45	8SL+PL42	8SL+PL42	7ML+ALP45	7ML+ALP45	7ML+ALP45	8ML+ALP45	8ML+ALP45
Extended to PSNY?	Yes	Yes	No	No	No	No	No	No	No	No	Yes	Already does
Change on RVL?	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No
Swaps Slot of Train?	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A
Station/Layover	High Bridge			X		X		X				
	Annandale			X		X		X				
	Lebanon			X		X		X				
	White House			X		X		X				
	North Branch			X		X		X				
	Raritan	X	X	X	X	X	X	X	X	X	X	X
	Somerville	X	X	X	X	X	X	X	X	X	X	X
	Bridgewater	X	X	X	...	X	...	X	X	X	X	X
	Bound Brook	X	X	X	X	...	X	X	X	X	X	X
	Dunellen	X	X	X	X	...	X	X	X	X	X	X
	Plainfield	X	X	X	...	X	...	X	...	X	X	X
	Netherwood	X	X	X	...	X	...	X	...	X	X	X
	Fanwood	X	X	X	...	X	...	X	...	X	X	X
	Westfield	X	X	X	X	...	X	...	X	X	X	X
	Garwood	X	X	X	...	X	...	...	...	X	...	X
	Cranford	X	X	X	X	...	X	X	...	X	X	X
	Roselle Park	X	X	X	...	X	...	X	...	X	X	X
	Union	X	X	X	...	X	...	X	...	X	X	X
	Newark Penn	X	X	X	X	X	X	X	X	X	X	X
	Hudson Yd/ MMC				X			X	X		X	
Secaucus	X	X									X	
Hoboken												
Penn Station NY	X	X									X	
	Peak Shoulder (6:00 am - 7:00 am @ PSNY)			Peak of the Peak (7:00 am - 9:20 am @ PSNY)						Peak Shoulder (after 9:20 am @ PSNY)		
AM Peak												

## INFRASTRUCTURE

Two additional storage tracks would need to be constructed at Raritan Yard to accommodate two additional trains.

## RIDERSHIP

- New PSNY-bound train service during the early morning and late shoulder of the peak period is not expected to attract a measurable number of new riders.
- Existing RVL riders traveling to PSNY, would experience a reduced travel time of about five minutes and avoid the need to transfer between trains at NPS.

## COST AND SCHEDULE

Short-Term Scenario A – Weekday Morning

**TABLE 11 – SCENARIO A COST AND SCHEDULE SUMMARY**

Scenario A	Capital Cost	Operating Cost	Implementation
Infrastructure	\$ 11 Million		
Platforms	\$ 0 Million		
Rolling Stock	\$ 107 Million		
Administrative	\$ 7 Million		
<b>Total</b>	\$ 125 Million	\$ 4.6 Million per year	Six Years

## SHORT-TERM SCENARIO B – SHOULDERS AND PEAK OF THE PEAK ONE-SEAT RIDE SERVICE

### OPERATIONS

- Same as Scenario A for shoulder of the peak (before 7:00 am and after 9:20 am) service which requires no substitution of trains

from other lines.

- The study team explored extension of up to three RVL trains in peak of the peak period (7:00 am to 9:20 am) to PSNY. Those trains now operate across Hunter Interlocking to Track 1, putting them in position to be extended to PSNY. No other slots are available during the time period for operating to Track 1 at Hunter Interlocking since it operates at capacity during the 7:00 am to 9:20 am peak period.
- The three RVL trains (Table 12) that are available to be extended operate very close in time to three existing NEC trains. Therefore, the RVL trains would displace PSNY-bound NJ TRANSIT NEC trains east of Newark. RVL trains are in closer proximity to NJ TRANSIT NEC trains than they are to NJCL trains at Newark because of the NEC service interaction with Amtrak and its Boston-PSNY-DC service timetable and the use of available slots on NEC Track 2 by NEC Outer Zone Express and NJCL Express train schedules. Timing of NJCL Expresses determine the timing of NJCL locals, which primarily serve the inner zone of NEC (Rahway, Linden, Elizabeth, North Elizabeth and Newark Airport), and in turn the timing of the NEC Middle Zone Express trains. RVL service at Hunter interlocking, and M&E service at Swift interlocking, go into the gaps that are left at those key junctions by differences in speed or stopping pattern of trains coming up from west to east on the NEC.
- Targeting NJCL Express trains specifically does not fit into this structure. Trains providing NJ TRANSIT NEC service represent a much higher overall volume than NJCL Express or Local, so the train in closest proximity to an RVL train is, in every instance, the one providing NJ TRANSIT NEC service.
- Going out of slot at Hunter interlocking to make RVL/NJCL Express train swaps means that the substituted NJCL Express train gets cancelled entirely, rather than being able to continue

TABLE 12 – SCENARIO B SERVICE PATTERN AND EQUIPMENT

Tested AM Weekday RVL Eastbound Service Pattern: Short-Term Scenario B												
Train ID	5404	2406	5408	5710	5412	5714	5416	5718	5420	5422	5902	5126
Equipment	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45	8ML+ALP45
Extended to PSNY?	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No	Yes	Already does
Change on RVL?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Swaps Slot of Train?	No	No	N/A	Yes; NEC	N/A	Yes; NEC	N/A	Yes; NEC	N/A	N/A	No	N/A
Station/Layover	High Bridge			X		X		X				
	Annandale			X		X		X				
	Lebanon			X		X		X				
	White House			X		X		X				
	North Branch			X		X		X				
	Raritan	X	X	X	X	X	X	X	X	X	X	X
	Somerville	X	X	X	X	X	X	X	X	X	X	X
	Bridgewater	X	X	X	X	X	X	X	X	X	X	X
	Bound Brook	X	X	X	X	X	X	X	X	X	X	X
	Dunellen	X	X	X	X	X	X	X	X	X	X	X
	Plainfield	X	X	X	X	X	X	X	X	X	X	X
	Netherwood	X	X	X	X	X	X	X	X	X	X	X
	Fanwood	X	X	X	X	X	X	X	X	X	X	X
	Westfield	X	X	X	X	X	X	X	X	X	X	X
	Garwood	X	X	X	X	X	X	X	X	X	...	X
	Cranford	X	X	X	X	X	X	X	X	X	X	X
	Roselle Park	X	X	X	X	X	X	X	X	X	X	X
	Union	X	X	X	X	X	X	X	X	X	X	X
	<b>Newark Penn</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
	Hudson Yd/ MMC							X			X	
Secaucus	X	X		X		X		X			X	
Hoboken												
<b>Penn Station NY</b>	<b>X</b>	<b>X</b>		<b>X</b>		<b>X</b>		<b>X</b>			<b>X</b>	
	Peak Shoulder (6A - 7A @ PSNY)		Peak of the Peak (7A - 9:20A @ PSNY)					Peak Shoulder (after 9:20A @ PSNY)				
<b>AM Peak</b>												

operation as far as Newark, because there is no other slot for the substituted train to operate on NJCL between South Amboy through the junction with Amtrak near Rahway (Union interlocking) to Hunter interlocking.

- Alternately, if this NJCL Express train is not cancelled but rather re-timed, it would cause cancellation of the NJCL Local train that serves all stops between South Amboy to PSNY including the inner zone stations of NEC.

**TABLE 13 – SCENARIO B NEC SERVICE MODIFICATION AND EQUIPMENT**

<b>AM Weekday NEC Eastbound Service Shortened to Newark: Short-Term Scenario B</b>				
<b>NEC Train ID</b>	<b>3918</b>	<b>3122</b>	<b>3924</b>	
<b>Equipment</b>	<b>10ML+ALP46A</b>	<b>10ML+ALP46A</b>	<b>10ML+ALP46A</b>	
<b>Change on NEC?</b>	No	No	No	
<b>Station/Layover</b>	Trenton	6:23 A	...	7:12 A
	Hamilton	6:30 A	...	7:19 A
	Princeton Jct	6:37 A	...	7:27 A
	Jersey Ave	...	...	...
	New Brunswick	...	7:06 A	...
	Edison	...	7:11 A	...
	Metuchen	...	7:17 A	...
	Metropark	...	7:22 A	...
	Rahway	...	...	...
	Linden	...	...	...
	Elizabeth	...	...	...
	North Elizabeth	...	...	...
	Newark Airport	...	...	...
	<b>Newark Penn</b>	<b>7:12 A</b>	<b>7:40 A</b>	<b>8:06 A</b>
	Secaucus	Train formerly to PSNY (Arr. 7:34 AM).	Train formerly to PSNY (Arr. 8:03 AM).	Train formerly to PSNY (Arr. 8:28 AM).
	Hoboken	Cut-back to Newark; No change to stops	Cut-back to Newark; No change to stops	Cut-back to Newark; No change to stops
<b>Penn Station NY</b>	on NEC	on NEC	on NEC	

- This is a critical issue and unresolvable since the RVL merges at Hunter interlocking with the NEC on a “flat” junction. The RVL merging slots, under this infrastructure constraint, are therefore not alterable and, thus, the RVL/NJCL Express swap is not possible in Short-Term scenario B.

Table 13 shows the three modified NEC trains and their station stops. Under RVL One-Seat Ride Short-Term Scenario B, these three trains will no longer travel to PSNY but instead will be terminated at NPS.

The NEC, NJ TRANSIT’s highest ridership line, has geographic zones of service that are served by several patterns of train service to accommodate the ridership during the peak periods. The baseline (October 2017) service plan has the following NEC train patterns and volumes. Pursuant to terminating four of those trains at Newark (from their original destination of PSNY), Table 14 identifies the net changes.

## RAIL VEHICLES

- This scenario would significantly modify the existing RVL

operations pattern and would require two additional trains as needed for Short-Term Scenario A.

- The operation of peak of the peak period RVL trains to PSNY would require increased capacity on each train to accommodate passenger boardings at Secaucus Junction which are accommodated by the NEC trains that would be displaced.
- The extension to PSNY will require a uniform fleet of 12 RVL trains, each consisting of eight-car ML coaches and ALP-45DP dual power locomotives.
- This will require additional rail vehicles:
  - 45 ML coaches and nine ML spares = 54 ML
    - 16 single level cars are expected to be retired or redeployed elsewhere on the NJ TRANSIT rail system
  - Four ALP-45DP locomotives and one spare = 5 ALP-45DP
    - 2 diesel locomotives will be retired or redeployed

## INFRASTRUCTURE

**TABLE 14 – SCENARIO B NEC SERVICE MODIFICATION IMPACT**

NEC Train Service Pattern	Eastbound Arrivals between 7:00 AM – 9:20 AM at PSNY		
	Baseline (October 2017)	Short-Term Scenario B	Change
Trenton – PSNY (Local)	2	2	-
Trenton – PSNY (Express from Princeton Jct.)	7	5	-2
Trenton – Newark (Express from Princeton Jct)	0	2	+2
Trenton/ Jersey Ave/ New Brunswick – PSNY (Express from Metropark)	10	9	-1
Trenton/ Jersey Ave/ New Brunswick – Newark (Express from Metropark)	0	1	+1

- Same as Scenario A, Raritan Yard will require construction of two additional storage tracks to accommodate a total of 12 train sets.
- Due to loss of access for the peak of the peak period trains to Meadows Maintenance Complex (MMC), Raritan Yard will need to have one pedestal / pit track and one wash track to accommodate servicing and inspection functions that are currently conducted at the MMC for RVL trains. In addition, a yard tower to manage effective train movement will be needed.
- Seven low level platform stations are proposed to be improved to provide high level platforms with a length of a minimum of six coaches. Consider constructing to accommodate eight coaches in anticipation of Medium-Term scenario D to minimize train dwell time and overall trip time. (See Appendix H - RVL Platform Assessment)

## RIDERSHIP

- Estimated ridership gains and losses for Short-Term Scenario B
- Peak period boarding ridership changes for each line:
  - RVL increases modestly, by 180; a 3% increase
  - The NEC decrease by 430; a 3% decrease
  - The NJCL increases 180, a 2% increase. Metropark’s frequent service to PSNY and location along the Garden State Parkway attracts passengers from the NJCL corridor. The reduced PSNY service at Metropark in this scenario would divert NEC riders from Metropark to NJCL stations.
  - The rail system would decrease by 60 riders
- Diversion to PATH = 0
- Diversion to auto driving = 120

## COST AND SCHEDULE

TABLE 15 – SCENARIO B COST AND SCHEDULE SUMMARY

Scenario B	Capital Cost	Operating Cost	Implementation
Infrastructure	\$ 26 Million		
Platforms	\$ 358 Million *		
Rolling Stock	\$ 309 Million		
Administrative	\$ 12 Million		
<b>Total</b>	\$ 704 Million	\$ 6.7 Million per year	Seven Years

\*All platforms Raritan and east would be modified to accommodate six-car trains

# APPENDIX E

## MEDIUM-TERM SCENARIO ANALYSIS WEEKDAY AND WEEKEND

### MEDIUM-TERM SCENARIO C – WEEKDAY MORNING SHOULDERS AND PEAK OF THE PEAK ONE-SEAT RIDE SERVICE

For the Medium-Term, the study identified the potential to extend up to seven existing RVL trains to PSNY in the morning peak period between 6:00 am and 10:00 am (Table 16). Three of these trains could be extended during the shoulders of the peak period as described for Short-Term scenario A, before 7:00 am and after 9:20 am, and four could be extended during the peak of the peak period between 7:00 am and 9:20 am if the RVL trains substitute for other trains. This scenario includes construction of the Hunter Flyover, a one-track bridge over the NEC, that would enable RVL trains to avoid cross track movement on the NEC at Hunter Interlocking, providing flexibility for scheduling of eastbound RVL trains, and would allow RVL trains to merge onto NEC Track 1, facilitating operations to PSNY. In addition, it would allow for the operation of 10-car ML trains - as the eight-car limitation on the Hunter Connection would no longer be a constraint – if needed to accommodate transfers at Secaucus Junction. The following description assumes that the Short-Term Scenario is not implemented first:

### OPERATIONS

- Same as Short-Term Scenario A for shoulder of the peak service (before 7:00 am and after 9:20 am)
- The Medium-Term scenario includes the critical capital investment of Hunter Flyover. Analysis of 7:00 am to 9:20 am peak period operations through NPS determined that up to four RVL trains could be extended to PSNY if they substitute for two NEC and two NJCL trains
- The displaced NEC trains would operate to NPS and NJCL trains would operate to Hoboken (via NPS), where passengers would transfer to other trains to Manhattan, including NJ TRANSIT to PSNY or PATH to WTC

Table 17 shows the two NEC and two NJCL trains and their station stops. Under RVL One-Seat Ride Medium-Term Scenario C, these four trains will no longer travel to PSNY but instead will be terminated at NPS.

The NEC and NJCL have geographic zones of service that are served by several patterns of train service to accommodate the ridership during the peak periods. The baseline (October 2017) service plan has the following NEC and NJCL train patterns and volumes. Pursuant to terminating four of those trains at NPS (from their original destination of PSNY), Table 18 identifies the net changes.

TABLE 16 – SCENARIO C RVL SERVICE PATTERN AND EQUIPMENT

Tested AM Weekday RVL Eastbound Service Pattern: Medium-Term Scenario C													
Train ID	5404	2406	5408	5710	5412	5714	5416	5718	5420	5422	5902	5126	
Equipment	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+ALP45	10ML+	
Extended to PSNY?	ALP45	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Already does	
Change on RVL?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Swaps Slot of Train?	No	No	Yes; NJCL	N/A	Yes; NJCL	N/A	Yes; NEC	N/A	Yes; NEC	No	No	N/A	
Station/Layover	High Bridge			X		X		X					
	Annandale			X		X		X					
	Lebanon			X		X		X					
	White House			X		X		X					
	North Branch			X		X		X					
	Raritan	X	X	X	X	X	X	X	X	X	X	X	
	Somerville	X	X	X	X	X	X	X	X	X	X	X	
	Bridgewater	X	X	X	X	X	X	X	X	X	X	X	
	Bound Brook	X	X	X	X	X	X	X	X	X	X	X	
	Dunellen	X	X	X	X	X	X	X	X	X	X	X	
	Plainfield	X	X	X	X	X	X	X	X	X	X	X	
	Netherwood	X	X	X	...	X	...	X	...	X	X	X	
	Fanwood	X	X	X	...	X	...	X	...	X	X	X	
	Westfield	X	X	X	...	X	...	X	...	X	X	X	
	Garwood	X	X	X	...	X	...	X	...	X	...	X	
	Cranford	X	X	X	...	X	...	X	...	X	X	X	
	Roselle Park	X	X	X	...	X	...	X	...	X	X	X	
	Union	X	X	X	...	X	...	X	...	X	X	X	
	<b>Newark Penn</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
	Hudson Yd/ MMC										X		
Secaucus	X	X	X		X		X		X		X	X	
Hoboken													
<b>Penn Station NY</b>	<b>X</b>	<b>X</b>	<b>X</b>		<b>X</b>		<b>X</b>		<b>X</b>		<b>X</b>	<b>X</b>	
	Peak Shoulder (6:00 am- 7:00 am @ PSNY)		Peak of the Peak (7:00 am - 9:20 am @ PSNY)						Peak Shoulder (after 9:20 am @ PSNY)				
<b>AM Peak</b>													

## RAIL VEHICLES

- This scenario would significantly modify the existing RVL operations pattern and would require two additional trains as needed for Short-Term scenario A
- The operation of peak of the peak period RVL trains to PSNY would require increased capacity on each train to accommodate passenger boardings at Secaucus Junction
- The extension to PSNY will require a uniform fleet of 12 10-car ML trains, each propelled by ALP-45DP dual power locomotives
  - This will require additional rail vehicles (assumes the Short-Term Scenario is not implemented):
    - 45 ML and nine ML spares = 54 ML or 69 ML and 14 ML spares = 83 ML
    - 16 single level cars are expected to be retired or redeployed elsewhere on the NJ TRANSIT rail system
  - Four ALP-45DP locomotives and one spare = five ALP-45DP
    - two diesel locomotives will be retired or redeployed

**TABLE 17 – SCENARIO C NEC/NJCL SERVICE MODIFICATION IMPACT**

NEC/NJCL Train Service Pattern	Eastbound Arrivals between 7 AM – 9:20 AM at PSNY/ Hoboken		
	Baseline (October 2017)	Medium-Term Scenario C	Change
Trenton – PSNY (Local)	2	2	-
Trenton – PSNY (Express from Princeton Jct.)	7	6	-1
Trenton – Newark (Express from Princeton Jct)	0	1	+1
Trenton/ Jersey Ave/ New Brunswick – PSNY (Express from Metropark)	10	9	-1
Trenton/ Jersey Ave/ New Brunswick – Newark (Express from Metropark)	0	1	+1
Bay Head – PSNY (Express)	3	1	-2
Bay Head – Newark/ Hoboken (Express)	0	2	+2
Long Branch – PSNY (Express)	3	3	-
Long Branch – Hoboken (Express)	3	3	-
Long Branch – PSNY (Local)	1	1	-
Long Branch – Hoboken (Local)	0	0	-
South Amboy – PSNY (Local)	3	3	-

TABLE 18 – SCENARIO C NEC/NJCL SERVICE PATTERN AND EQUIPMENT

AM Weekday NEC/NJCL Eastbound Service Shortened to Newark: Medium-Term Scenario C				
NEC/ NJCL Train ID	3312	3318	3124	3926
Equipment	8SL & ALP45DP	8ML & ALP45DP	8ML & ALP45DP	9ML & ALP46
Cut-back to Newark?	Yes	Yes	Yes	Yes
Change on NEC/NJCL?	No	No	No	No
Station/Layover	Trenton			7:31 A
	Hamilton			7:38 A
	Princeton Jct			7:45 A
	Jersey Ave			...
	New Brunswick			7:16 A
	Edison			7:21 A
	Metuchen			7:27 A
	Metropark			7:33 A
	Bay Head	5:06 A	5:44 A	
	Point Pleasant	5:10 A	5:48 A	
	Manasquan	5:15 A	5:53 A	
	Spring Lake	5:19 A	5:57 A	
	Belmar	5:23 A	6:01 A	
	Bradley Beach	5:27 A	6:05 A	
	Asbury Park	5:31 A	6:09 A	
	Ellenhurst	5:35 A	6:13 A	
	Alberon	5:39 A	6:17 A	
	Long Branch	5:44 A	6:23 A	
	Little Silver	5:51 A	6:29 A	
	Red Bank	5:55 A	6:33 A	
	Middletown	6:01 A	6:39 A	
	Hazlet	6:07 A	6:45 A	
	Aberdeen-Matawan	6:11 A	6:50 A	
	South Amboy	6:21 A	...	
Perth Amboy	...	...		
Woodbridge	6:31 A	...		

AM Weekday NEC/NJCL Eastbound Service Shortened to Newark: Medium-Term Scenario C					
NEC/ NJCL Train ID	3312	3318	3124	3926	
Equipment	8SL & ALP45DP	8ML & ALP45DP	8ML & ALP45DP	9ML & ALP46	
Cut-back to Newark?	Yes	Yes	Yes	Yes	
Change on NEC/NJCL?	No	No	No	No	
Station/Layover	Avenel	...	↓	↓	
	<b>Rahway</b>	...	...	...	
	Linden	...	...	...	
	Elizabeth	...	...	...	
	North Elizabeth	...	...	...	
	Newark Airport	...	...	...	
	<b>Newark Penn</b>	<b>6:53 A</b>	<b>7:24 A</b>	<b>7:55 A</b>	<b>8:22 A</b>
	Secaucus	Train formerly to PSNY (Arr. 7:14 AM). Cut-back to Newark; No change to stops on NJCL	Train formerly to PSNY (Arr. 7:47 AM). Cut-back to Newark; No change to stops on NJCL	Train formerly to PSNY (Arr. 8:18 AM). Cut-back to Newark; No change to stops on NEC	Train formerly to PSNY (Arr. 8:46:00 am). Cut-back to Newark; No change to stops on NEC
	Hoboken				
	<b>Penn Station NY</b>				

## INFRASTRUCTURE

- Same as the Short-Term Scenario B, Raritan Yard will need capacity for 12 train sets along with a pit or pedestal track, car wash and yard tower.
- Construction of Hunter Flyover
- Newark Penn Station improvements
- Since consists would be ten cars, all platforms east of Raritan should be high level and with a minimum of accommodation of eight coaches. Assuming Short-Term platform modifications are implemented, 10 high level platforms would be extended from six to eight coaches. (Appendix H - RVL Platform Improvement Assessment)

## RIDERSHIP

- Estimated ridership gains and losses for Short-Term Scenario C
  - Peak period boarding ridership changes for each line:
    - » RVL increases by 150; a 2% increase
    - » The NEC sees a negligible change
    - » The NJCL decreases 870, a 10% reduction
    - » The rail system loses 670 riders
- Diversion to PATH = 90
- Diversion to auto driving = 260

## COST AND SCHEDULE

**TABLE 19 – SCENARIO C COST AND SCHEDULE SUMMARY**

Scenario C	Capital Cost	Operating Cost	Implementation
Infrastructure	\$ 503 Million		
Platforms	\$ 563 Million *		
Rolling Stock	\$ 456 Million		
Administrative	\$ 25 Million		
<b>Total</b>	<b>\$ 1.55 Billion</b>	<b>\$ 6.7 Million per year</b>	<b>11 Years</b>

\*All platforms Raritan and east would accommodate 8 train cars

## MEDIUM-TERM SCENARIO D – DIRECT RAIL SERVICE ON WEEKENDS

Medium-Term Scenario D can, theoretically, function independently of other scenarios. However, this study has assumed that this scenario would provide the same weekday service as Scenario C and would also include weekend RVL service to PSNY. This scenario would be made possible by the completion of the Phase 1 projects of the Gateway Program. Specifically, the new Hudson River Tunnel Project, which includes rehabilitation of the North River Tunnel, would alleviate the weekend trans-Hudson tunnel constraint; making it possible for NJ TRANSIT to operate additional weekend service. The Gateway Program, including the Hudson Tunnel Project, will be of benefit to all NJ TRANSIT northern New Jersey rail lines as well as Amtrak.

## OPERATIONS

- All weekend RVL trains terminating at Newark Penn Station could be extended to PSNY
- Weekday peak period service as proposed by Scenario C

---

## RAIL VEHICLES

- The weekend service would utilize the existing train sets on the RVL being used for weekday off-peak service. As a result, no additional train sets or cars would be required for additional weekend service
- Weekday service would require the rail vehicles specified for Scenario C

## INFRASTRUCTURE

- The weekend service would be made possible by the completion of the Hudson River Tunnel Project
- Weekday service would require the infrastructure specified for Scenario C

## RIDERSHIP

- A ridership forecast was not developed for this study.

## COST AND SCHEDULE

**TABLE 20 – SCENARIO D COST AND SCHEDULE SUMMARY**

Scenario D	Capital Cost	Operating Cost	Implementation
Infrastructure	\$ 503 Million		
Platforms	\$ 563 Million		
Rolling Stock	\$ 456 Million		
Administrative	\$ 27 Million		
<b>Total</b>	<b>\$ 1.55 Billion *</b>	Gateway Program	11 Years

\*Includes Scenario C costs. Excludes Gateway Tunnel and Portal Bridge North costs.

Portal Bridge North approximate cost: \$1.8 billion  
Hudson Tunnel Project approximate cost: \$13.0 billion

# APPENDIX F

## LONG-TERM SCENARIO E

### **GATEWAY PROGRAM FUTURE PHASE PROJECTS AND OTHER MAJOR INVESTMENTS FACILITATING EXPANDED TRANS-HUDSON RAIL SERVICE TO PSNY FOR ALL RAIL LINES, INCLUDING RVL**

The future phase projects of the Gateway Program and other major investments in NJ would facilitate expanded trans-Hudson rail service to PSNY for all rail lines, including RVL. A key component of Gateway Program Phase 2 is the expansion of PSNY to provide additional tracks and platforms for NJ TRANSIT trains. The phasing of the implementation of the Gateway Program and other major investments is not known at this time. The following describes the potential operations (Table 21) and infrastructure that would support full-time direct access for the RVL and would also provide improved service for NJ TRANSIT's entire northern New Jersey rail system.

#### **OPERATIONS**

- Potential RVL service plan:
  - Two to three RVL trains in the early shoulder peak period (prior to 7:00 am) to PSNY
  - 7:00 am to 9:00 am peak of the peak period:
    - » Four RVL trains per hour to PSNY and three to four trains

per hour to Hoboken (requires Westbound Waterfront Connection) for a total of up to 16 trains for the two-hour period between 7:00 am to 9:00 am.

- » The proposed one-seat ride service plan would consist of more frequent peak period service, which would require expanded track capacity which would be provided by additional tracks on the Conrail Lehigh Line and a third track on NJ TRANSIT's segment of the RVL. If funding is not available for those projects when NEC / PSNY capacity is made available NJ TRANSIT could consider an alternative in which the current trains are extended to PSNY during the two-hour peak period and only investments necessary for that level of service would be required. As funding is made available and additional RVL track capacity is implemented RVL service could be expanded.
- Three RVL trains in the 9:00 to 10:00 am late shoulder peak period to PSNY

TABLE 21 – SCENARIO E RVL SERVICE PATTERN

Tested AM Weekday RVL Eastbound Service Pattern: Long-Term Scenario E																				
Train ID	5402	5404	5706	2408	5910	2912	5714	2916	5918	5720	2422	5924	2926	5728	2930	5932	5734	5936	5438	
High Bridge			X				X			X				X			X			
Annandale			X				X			X				X			X			
Lebanon			X				X			X				X			X			
White House			X				X			X				X			X			
North Branch			X				X			X				X			X			
Raritan	X	X	X	X			X			X	X			X			X		X	
Somerville	X	X	X	X			X			X	X			X			X		X	
Bridgewater	X	X	X	X			X			X	X			X			X		X	
Bound Brook	X	X	X	X			X			X	X			X			X		X	
Dunellen	X	X	X	X			X			X	X			X			X		X	
Plainfield	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Netherwood	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
Fanwood	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
Westfield	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
Garwood	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
Cranford	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
Roselle Park	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
Union	X	X		X	X	X		X	X		X	X	X		X	X		X	X	
<b>Newark Penn</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	
Hudson Yd/ MMC																				
Secaucus	X	X	X		X		X		X	X		X		X		X	X	X	X	
Hoboken				X		X		X			X		X		X					
<b>Penn Station NY</b>	<b>X</b>	<b>X</b>	<b>X</b>		<b>X</b>		<b>X</b>		<b>X</b>	<b>X</b>		<b>X</b>		<b>X</b>		<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	
	Peak Shoulder (6:00 am - 7:00 am @ PSNY)			Peak of the Peak (7:00 am - 9:00 am @ PSNY)												Peak Shoulder (9:00 am - 10:00 am @ PSNY)				
<b>AM Peak</b>																				

## RAIL VEHICLES

- ALP-45DP locomotives and multi-levels. If alternative approach for incremental service is used, the rail fleet listed for the Medium-Term Scenario C could suffice

## INFRASTRUCTURE

NEC / PSNY Infrastructure improvements generally based on Gateway Program, expected to include:

- PSNY track / platform expansion increasing train slots with related concourse, waiting areas, and street/subway connections
- Four-track High Line, which would include Portal South Bridge (assumes previous construction of Portal North and Sawtooth bridges improvements)
- PSNY daytime storage yard for increased service to PSNY, including for RVL
- Westbound Waterfront Connection for RVL or other trains operating to Hoboken or Hudson Yard/MMC. This is because the train volumes on the High Line would not permit “at-grade” crossing of westward trains from Hoboken or MMC/ Hudson Yard in westbound direction.
- Additional tracks on Conrail Lehigh Line as well as third track on RVL will be necessary to operate nearly double the train volumes during the same peak of the peak time period. This infrastructure wouldn’t be needed under the alternative approach for incremental service.
- Rail rolling stock would be acquired commensurate with rail service plan and related ridership

## RIDERSHIP

- No ridership forecasts were developed. As funding and the implementation schedule for the Gateway Program is defined it will be possible to prepare ridership forecasts.

## COST AND SCHEDULE

**TABLE 22 – SCENARIO E COST AND SCHEDULE SUMMARY**

Scenario E	Capital Cost	Operating Cost	Implementation
Infrastructure	\$ 2,452 Million		
Platforms	\$ 563 Million		
Rolling Stock	\$ TBD Million		
Administrative	\$ TBD Million		
<b>Total</b>	\$ TBD Million *	Gateway Program	Undefined

\* Includes Scenario C costs plus other RVL specific improvements. Excludes Gateway Tunnel, Portal Bridge North, PSNY Expansion, and other system-wide costs.

The full \$15-30 billion Gateway capital cost is not attributable only to RVL but to the entire NJ TRANSIT commuter rail system and Amtrak.

---

# APPENDIX G

## CAPITAL COST, OPERATING COSTS AND SCHEDULE

### CAPITAL COSTS

Capital scope and costs were developed from a variety of sources such as prior NJ TRANSIT studies and newly developed for this RVL Study.

Development of both costs and timelines assumed that, in the year 2021, there would be a rigorous commencement of a formal NJ TRANSIT program that works towards implementation of full time direct RVL service to New York Penn Station (PSNY) for one of the Scenarios A, B, or C. Note that an initial selection of Scenario A only for advancement would delay implementation of Scenario B and C since a new administrative process would be required for Scenario B or C. Scenario D and E cost and timelines are more related to, and dependent on NJ TRANSIT system-wide improvements and the Gateway Program that are being progressed on separate timelines.

Table 23 presents a summary of the capital costs for each scenario in Year of Expenditure Dollars. It also indicates assumed Revenue Service dates. For each scenario, infrastructure projects, rail equipment and administrative efforts required to support the scenarios are listed. Details of the Platform Improvement scope and costs can be found in Appendix H.

## SCENARIO SCOPE, CAPITAL COST, OPERATING COST AND SCHEDULE

### SHORT-TERM SCENARIO A

#### Rail Vehicle Purchase

This scenario would modify the existing RVL operations pattern and would require additional passenger cars and dual mode locomotives. The RVL trains that would be extended to PSNY would not be available to fulfill their later morning schedules and so additional rail equipment would be needed to cover those schedules.

- 16 new multi-level (ML) rail cars and three spare cars for a total of 19 cars
- Two ALP-45DP dual power locomotives

#### Infrastructure Improvements

Two additional storage tracks to be constructed at Raritan Yard to accommodate the two additional trains and one pedestal track.

#### Capital Cost

- Rail Vehicles cost: \$106 million consisting of:
  - 16 Multi-level cars plus three spares, total of 19 coaches at \$3.5 million each (2020 dollars)
  - Two ALP-45DP locomotives at \$ 11.5 million each (2020 dollars)

**TABLE 23 – SUMMARY OF SCENARIO CAPITAL COSTS**

	Short-Term		Medium-Term		Long-term
	Scenario A \$M (YOE)	Scenario B \$M (YOE)	Scenario C \$M (YOE)	Scenario D \$M (YOE)	Scenario E \$M (YOE)
Revenue Service Year	2027	2028	2032	2031	2040
<b>Infrastructure</b>					
Raritan Yard Two Tracks	8.1	8.1	8.1	8.1	8.1
Raritan Yard Pedestal Track	2.8	2.8	2.8	2.8	2.8
Raritan Yard Train Wash		6.4	6.4	6.4	6.4
Raritan Yard Tower		8.1	8.1	8.1	8.1
Hunter Flyover			391.4	391.4	391.4
Newark Penn Station Track A Platform			70.4	70.4	70.4
Newark Penn Station Mobility			15.4	15.4	15.4
Gateway Phase 1A - Portal North				System Improvement	
Gateway Phase 1B - New Tunnels				System Improvement	
Gateway Phase 2 - NY Penn South +					System Improvement
Lehigh 3rd and 4th Tracks					309.9
RVL 3rd Track					842.7
RVL 2nd Yard plus Track to Yard					396.7
RVL Road and Parking Improvements					
RVL Platform Improvement Costs	-	357.7	563.4	563.4	563.4
<b>Subtotal Infrastructure Scenario Costs</b>	<b>10.9</b>	<b>383.1</b>	<b>1,066.1</b>	<b>1,066.1</b>	<b>3,015.6</b>
<b>Rail Rolling Stock</b>					
ALP 45 Locomotive	26.6	70.6	70.6	70.6	TBD
Multi Level Coach	77.1	232.4	379.0	379.0	TBD
Administrative	3.0	6.0	6.0	6.0	TBD
<b>Subtotal Rolling Stock</b>	<b>106.7</b>	<b>309.0</b>	<b>455.6</b>	<b>455.6</b>	<b>TBD</b>
<b>General Administrative</b>					
Hearings, Title VI, Planning	7.0	12.0	25.0	27.0	
<b>Total Scenario Capital Cost</b>	<b>124.6</b>	<b>704.1</b>	<b>1,546.7</b>	<b>1,548.7</b>	<b>TBD</b>

- Rail yard expansion estimated cost: \$ 11 million
- Administrative Cost: \$7 million. Programmatic efforts, environmental, hearings, outreach, local interface, concept design, other.
- **Total cost: \$125 million (Year of Expenditure Dollars)**
- Operations and Maintenance Costs \$4.6 Million per year

## Schedule

- The estimated duration for the Administrative Process would be three years to procure consultant services, develop conceptual layout plans for Raritan Yard expansion, negotiate the acquisition of additional train sets, negotiate with Amtrak and Conrail for use of their property, public outreach, public hearings, environmental documentation, and procure detailed design services
- The duration for the design, procurement and construction of the Raritan Yard improvements is estimated at three years. If contract options exist for ALP 45's and multilevel coaches, then these would not be on the critical path
- Total duration for Scenario A is six years

## SHORT-TERM SCENARIO B

### Rail Vehicle Purchase

This scenario would significantly modify the existing RVL operations pattern and would require two additional trains as needed for Short-Term scenario A. The operation of peak of the peak period RVL trains to PSNY would require increased capacity on each train to accommodate passenger boardings at Secaucus Junction. The extension to PSNY will require a uniform fleet of 12 RVL trains, each consisting of eight-car ML coaches and ALP-45DP dual power locomotives.

- This will require additional rail vehicles :
  - 45 ML coaches and 9 ML spares = 54 ML
  - 16 single level cars are expected to be retired or redeployed elsewhere on the NJ TRANSIT rail system
    - » Four ALP-45DP locomotives and one spare = five ALP-45DP
    - » two diesel locomotives will be retired or redeployed

### Infrastructure Improvements

The same as scenario A, Raritan Yard will require construction of two additional storage tracks to accommodate a total of 12 train sets. **The existing yard configuration can accommodate increasing the train set lengths to ten coaches for all train sets.**

Due to loss of access for the peak of the peak period trains to Meadows Maintenance Complex (MMC), Raritan Yard will need to have one pedestal track and one wash track to accommodate servicing and inspection functions that are currently conducted at MMC for RVL trains as well as a yard tower for effective train movement.

Seven low level platforms to be changed to high level and lengthened to accommodate six coaches minimum. Consider constructing to accommodate eight coaches in anticipation of Medium-Term scenario.

### Capital Cost

- Rail Vehicles cost: \$309 million consisting of:
  - 54 Multi-level cars at \$3.5 million each (2020 dollars)
  - 5 ALP-45DP locomotives at \$11.5 million each (2020 dollars)

- Rail yard expansion estimated cost: \$26 million
- Cost to construct extended, high level platforms at seven stations: \$357 million
- Administrative Costs: \$12 million. Programmatic efforts, environmental, hearings, outreach, local interface, concept design, other.
- **Total cost: \$704 million (Year of Expenditure Dollars)**
- Operation and Maintenance Costs \$6.7 Million per year

## Schedule

The estimated duration for the Administrative Process would be three years to procure consultant services, develop conceptual layout plans for Raritan Yard expansion, extend up to seven RVL platform lengths to accommodate a minimum of six coaches and replace low level platforms with high level platforms, negotiate the acquisition of additional train sets, negotiate with Amtrak and Conrail for use of their property, public outreach, public hearings, environmental documentation, and procure detailed design services.

The duration for the design, procurement and construction of the Raritan Yard improvements and critical platform extensions is estimated at four years. If contract options exist for ALP 45's and multilevel coaches, then these would not be on the critical path. The addition of the most critical of the seven high level platform extensions to the scope would be constructed concurrent with the yard improvements. Other platform construction would continue beyond the commencement of one seat ride revenue service.

Total duration of Operating Scenario B is seven years.

## MEDIUM-TERM SCENARIO C

### Rail Vehicle Purchase

This scenario would significantly modify the existing RVL operations pattern and would require two additional trains as needed for Short-Term scenario A. The operation of peak of the peak period RVL trains to PSNY would require increased capacity on each train to accommodate passenger boardings at Secaucus Junction. The extension to PSNY will require a uniform fleet of 12 10-car ML trains, each propelled by ALP-45DP dual power locomotives.

- This will require additional rail vehicles (assumes Short-Term Scenario is not implemented):
  - 45 ML and nine ML spares = 54 ML or 69 ML and 14 ML spares = 83 ML
    - » 16 single level cars are expected to be retired or redeployed elsewhere on the NJ TRANSIT rail system
  - Four ALP-45DP locomotives and one spare = five ALP-45DP
    - » Two diesel locomotives will be retired or redeployed

### Infrastructure improvements

Same as the Short-Term Scenario B, Raritan Yard will need capacity for 12 train sets along with Pedestal track, Wash Track and Yard Tower.

- Construction of Hunter Flyover
- Construction of NPS platform and mobility improvements

Since consists would be ten cars, all platforms east of Raritan should be high level and with a minimum of accommodation of eight coaches. Assuming Short-Term platform modifications are

---

implemented, 10 high level platforms would be extended from six to eight coaches and Roselle Park's platform would be repaired.

## Capital Costs

- Rail Vehicles cost: \$456 million consisting of:
  - » Five Multi-level cars at \$3.5 million each (2020 dollars)
  - » Five ALP-45DP locomotives at \$11.5 million each (2020 dollars)
- Rail yard expansion estimated cost: \$ 26 million
- Cost to construct extended, high level platforms at 10 stations: \$563 million
- Hunter flyover cost estimate = \$391 million
- Newark Penn Station Passenger Circulation Improvements: \$70 million
- Additional improvements that would be desirable to implement: \$15 million
- Administrative Costs: \$25 million
- **Total cost: \$1.546 billion (Year of Expenditure Dollars)**
- Operation and Maintenance Costs - \$6.7 Million per year

## Schedule

The estimated duration for the Administrative Process would be four years to procure consultant services, develop conceptual layout plans for Raritan Yard expansion, ten high level platform extensions, Hunter Flyover and NPS improvements, negotiate the acquisition of additional train sets, negotiate with Amtrak and Conrail for use of their property, public outreach, public hearings, environmental

documentation, and procure detailed design services.

The duration for the design, procurement and construction of the Raritan Yard improvements, RVL platform extensions, Hunter Flyover, Newark Penn Station Platform A and mobility improvements is estimated at seven years.

Total duration of Operating Scenario C is 11 years.

## MEDIUM-TERM SCENARIO D

This Scenario includes the substitution concepts in Scenario C, but the weekend service could be implemented independently without the Scenario C service changes. At a minimum, Scenario D requires the construction of the Hudson River Tunnel Project at a cost of approximately \$13 billion. However, further review of required infrastructure and rail vehicles would be appropriate if this scenario is advanced, which could include additional ALP 45's and multi-level coaches, as well as Raritan Yard expansion to accommodate extra train sets.

### Rail Vehicle Purchase

This scenario would utilize the existing train sets on RVL being used for weekday off-peak service. Since no substitution is made from trains of other lines and since the weekend service is less pronounced than weekday peak period service, no additional train sets or coaches would be required.

### Infrastructure Improvements

Medium-Term Scenario D can, theoretically, function independently of other scenarios. The key requirement for this scenario to be possible is the new Hudson River Tunnels.

## Capital Costs

- Minimum requirements – Gateway Tunnel- two new North Tubes and rehab existing: \$13.0 billion.

The following costs are assuming that Scenario C will be implemented concurrent with the Gateway Tunnel project.

- Rail Vehicles cost:\$456 million consisting of:
  - 83 Multi-level cars at \$3.5 million each (2020 dollars)
  - Five ALP-45DP locomotives at \$11.5 million each (2020 dollars)
- Raritan Rail Yard expansion estimated cost: \$ 26 million
- Cost to construct extended, high level platforms at 10 stations: \$563 million
- Hunter Flyover cost: \$391 million
- Newark Penn Station Passenger Circulation Improvements: \$70 million
- Additional improvements that would be desirable to implement: \$15 million
- Administrative Costs: \$27 million
- **Subtotal cost: \$1.548 billion (Year of Expenditure Dollars)**
- Portal Bridge North cost: \$1.8 billion additional
- Operation and Maintenance Costs – TBD by Gateway Program

## Schedule

Current estimated completion of the Portal Bridge North and Gateway Tunnels is 2032.

## LONG-TERM SCENARIO E

### Rail Vehicle Purchase

ALP-45DP locomotives and multi-levels would be consistent with the ARC plan or the Gateway Program

### Infrastructure improvements

NEC / PSNY Infrastructure improvements generally based on Gateway Program, expected to include:

- PSNY track / platform expansion increasing train slots with related concourse, waiting areas, and street/subway connections
- Four track High Line, which would include Portal South Bridge (assumes previous construction of Portal North and Sawtooth bridges improvements)
- PSNY daytime storage yard for increased service to PSNY, including for RVL
- Westbound Waterfront Connection for RVL or other trains operate to Hoboken or Hudson Yard/MMC. This is because the train volumes on the High Line would not permit “at-grade” crossing of westward trains from Hoboken or MMC/ Hudson Yard in westbound direction.

Additional tracks on Conrail Lehigh Line as well as third track on RVL will be necessary to operate nearly double the train volumes during the same peak of the peak time period.

### Capital Costs

The Gateway Program is projected to cost over \$30 billion (year of expenditure dollars) plus RVL related improvements.

---

## Schedule

The Gateway Program completion date has not been determined.

# INFRASTRUCTURE IMPROVEMENT PROJECT DESCRIPTIONS

## PROPOSED NEWARK PENN STATION (NPS) IMPROVEMENTS FOR SCENARIO C, D, E

Currently NPS experiences significant passenger congestion in peak periods on platforms and in vertical circulation from platform level to the Main Concourse, and from PATH outbound Platform H to Platform D (Tracks 3 and 4). In addition, Track A is used sparingly since it has substandard widths in some areas and only 10 cars in length. To mitigate congestion, delays, and to provide operational flexibility, NJ TRANSIT has defined a program of vertical circulation and platform level improvements for all NPS platforms. It would be desirable to implement all improvements to accommodate increasing ridership on all rail lines serving NPS. However, if RVL trains substitute for NEC or NJCL trains to PSNY, and if funding is limited, selected improvements would be desirable to accommodate the greater volume of transferring passengers who utilize the NEC and NJCL trains.

It is not expected that funding will be available for the NPS circulation improvements in the Short-Term infrastructure plan, and as a result it is recommended that at a minimum the following improvements should be included in the Medium-Term infrastructure plan:

## NEW PLATFORM A (TRACK A) VERTICAL CIRCULATION CORE AND PLATFORM EXTENSION TO THE WEST

Platform A is used as a last resort during the morning peak period since the two stairs to the main station have inadequate capacity for the volume of passengers descending to the station concourse as they move to other NJ TRANSIT trains, PATH trains, or other destinations. In addition, if trains bound for PSNY are placed on Track A, congestion is further exacerbated as passengers climb the stairs against the downward flow of passengers. Expanded vertical circulation capacity as recommended would alleviate congestion, particularly if the platform is used more frequently due to operation of RVL trains to PSNY and displacement of NEC and/or NJCL trains.

Currently Platform A can accommodate only 10-car trains. Since many trains are as long as 12-cars, extending the platform will provide access to all cars and avoid delays if a train longer than 10 cars is operated on Track A.

## NEW VERTICAL CIRCULATION ELEMENT STAIR D4

Expands capacity for passenger movement in afternoon peak period between trains on Platform D (Tracks 3 and 4) and Platform E (Track 5) to:

- Alleviate congestion on the western part of Platform D where existing VCE's to the main concourse are located, and which is the most severely congested area on Platform D
- Alleviate congestion on VCE Stair D1 to the main concourse, which is the most congested VCE in the station during the evening peak period
- This improvement would benefit transfers among trains on Tracks 3 or 4 from PSNY to trains that start their westbound operation on Track 5. Currently RVL trains begin their run on Track

5, but if NEC or NJCL trains start their trips from NPS, then they may be placed on Track 5.

### **ADDITIONAL IMPROVEMENTS THAT WOULD BE DESIRABLE TO IMPLEMENT IF FUNDING IS AVAILABLE:**

- New VCE Stair C3 and Waiting Room C3 and Stair B4
  - For RVL trains that continue to operate to Track 5 during the morning peak period, this VCE would provide an additional route between Track 5 and Tracks 1 and 2 and PATH using the North Concourse for access to NJ TRANSIT PSNY bound trains and PATH.
- New VCE Stair/Ramp DH6
  - Redirecting a portion of transfers from outbound PATH to Track 3 and 4 to the eastern portion of Platform D will alleviate congestion at the bottom of the existing ramp DH5. Similar to New VCE Stair D4, it will also alleviate congestion on VCE Stair D1. Linking this VCE with new Stair D4 provides a secondary benefit in that an alternate route between Platform H and the main concourse is provided and would alleviate congestion on existing VCE escalator/stair E3 and E4.
- Extend elevator E4 to platform H, replace existing platform level waiting room doors on all platforms.

## **RARITAN YARD EXPANSION PROJECT SCENARIO A,B,C,D,E**

The potential expansion of the yard would be located between the existing yard tracks to the south, and the RVL main line to the north as illustrated by sketch plan below.

A preliminary cost estimate for the two tracks is listed in Table 24. Additional costs would be incurred to fund a pit / pedestal track, train washer, and yard tower.

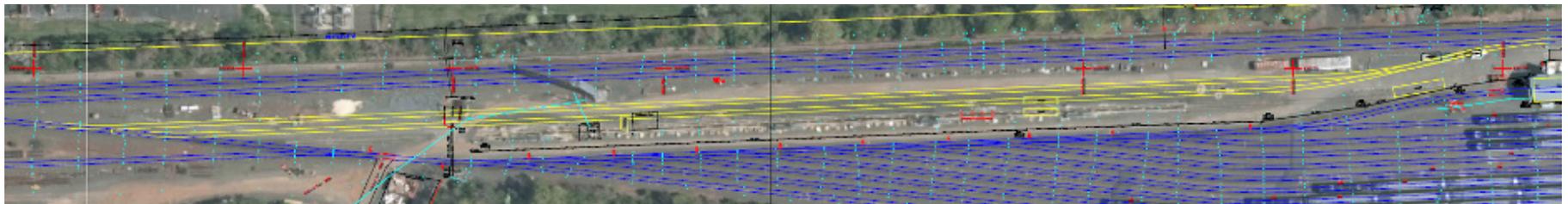
## **HUNTER FLYOVER PROJECT FOR SCENARIO C,D,E**

The major elements of the Hunter Flyover project include the following elements:

- New bridge over Frelinghuysen Ave. for Hunter Connecting Track, which becomes the westbound track
- Single track bridge over the six NEC tracks connecting to eastbound NEC track A and Track 1
- Interlocking modifications for both Lehigh Line and NEC

The estimated year 2020 cost is \$300 million. Estimated cost to mid-point of construction is \$391 million.

**FIGURE 13 – RARITAN YARD EXPANSION SKETCH PLAN**



**TABLE 24 – RARITAN YARD IMPROVEMENTS EAST OPTION PRELIMINARY COST ESTIMATE**

<b>Items</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Extended Amount</b>
<b>Sitework</b>				
Clearing Site	Lump Sum	Lump Sum	\$75,000.00	\$75,000.00
Soil Erosion and Sediment Controls	Lump Sum	Lump Sum	\$10,000.00	\$10,000.00
6' High Chain Link Fence	L.F.	200	\$40.00	\$8,000.00
Miscellaneous Utility/Shed/Radio Tower Relocations	Lump Sum	Lump Sum	\$450,000.00	\$450,000.00
Miscellaneous Grading and Drainage Work	Lump Sum	Lump Sum	\$125,000.00	\$125,000.00
Landscaping/Site Restoration as Needed	Lump Sum	Lump Sum	\$25,000.00	\$25,000.00
Electric Lock, Signal Revision as Needed	Lump Sum	Lump Sum	\$400,000.00	\$400,000.00
Miscellaneous Driveway and Safety Improvements as needed	Lump Sum	Lump Sum	\$40,000.00	\$40,000.00
<b>Sitework Subtotal</b>				<b>\$1,333,000.00</b>
<b>New Rail Track</b>				
Track include 4 #10 Turnouts and approximately 2675' of track*	Lump Sum	1	\$2,204,000.00	\$2,204,000.00
<b>Rail Yard Subtotal</b>				<b>\$2,204,000.00</b>
<b>Construction Cost Total</b>				<b>\$3,337,000.00</b>
<b>NJ Transit Cost Factors (% of Construction Cost)</b>				
Environmental (5%)				\$166,850.00
Planning (4%)				\$133,480.00
Design (12%)				\$400,440.00
In-House Project Administration (2%)				\$66,740.00
Construction Management (10%)				\$333,700.00
Flagging (10%)				\$333,700.00
Insurance (\$5,50 per \$1,000, or 0.55%)				\$18,353.50
<b>Subtotal, all costs</b>				<b>\$4,790,263.50</b>
<b>Contingency @ 50% of all costs</b>				<b>\$2,295,131.75</b>
<b>Total Project Cost</b>				<b>\$7,200,000.00</b>

---

# APPENDIX H

## RVL PLATFORM ASSESSMENT

### INTRODUCTION

RVL platform lengths and platform accessibility were reviewed for each of the 18 stations along the RVL in order to assess the potential need for platform improvements related to full time RVL direct service to PSNY.

The assessment considered platform length, ADA accessibility, ridership, and the number of coaches in a train set that would be operating as the criteria for assessing the potential need for platform improvements.

Ridership information was reviewed, which lead to viewing RVL station locations as two geographical segments:

- **West Stations** which include High Bridge, North Branch, Whitehouse, Lebanon, and Annandale
- **East Stations** which include Raritan Somerville, Bridgewater, Bound Brook, Dunellen, Plainfield, Netherwood, Fanwood, Westfield, Garwood, Cranford, Roselle Park, and Union

The assessment utilized information from the 2015 Commuter Rail Station GS Manual, and the 2015 Draft Rail Stations Assessment RVL Report as references.

## EXISTING STATION CONFIGURATION

### WEST STATIONS

- All five stations are 200 feet in length or shorter and can accommodate boarding a maximum of two coaches, except High Bridge which can only accommodate one coach
- All five stations are low level boarding
- All five stations have a single side platform

### EAST STATIONS

#### Platforms Accommodating at least One Coach

- **Garwood** - two low level side platforms, inbound platform is 200 feet long that can accommodate a maximum boarding of two coaches, outbound platform is 121 feet long that can accommodate boarding a maximum of one coach
- **Bridgewater** - two low level side platforms, inbound platform is 200 feet long that can accommodate a maximum boarding of two coaches, outbound platform is 113 feet long that can accommodate boarding a maximum of one coach

#### Platforms Accommodating at least Four Coaches

- **Bound Brook** - two low level side platforms, inbound platform is 400 feet long that can accommodate a maximum boarding of four coaches, outbound platform is 400 feet long that can accommodate boarding a maximum of four coaches

- **Dunellen** - two low level side platforms, inbound platform is 398 feet long that can accommodate a maximum boarding of four coaches, outbound platform is 399 feet long that can accommodate boarding a maximum of four coaches
- **Netherwood** - two low level side platforms, inbound platform is 383 feet long that can accommodate a maximum boarding of four coaches, outbound platform is 381 feet long that can accommodate boarding a maximum of four coaches
- **Fanwood** - two low level side platforms, inbound platform is 383 feet long that can accommodate a maximum boarding of four coaches, outbound platform is 381 feet long that can accommodate boarding a maximum of four coaches
- **Raritan** - two low level side platforms, inbound platform is 393 feet long that can accommodate a maximum boarding of four coaches, outbound platform is 377 feet long that can accommodate boarding a maximum of four coaches

#### Platforms Accommodating at least Six Coaches

- **Roselle Park** – one high level center platform, 834 feet long that can accommodate a maximum boarding of nine coaches. Approximately 150 feet of platform is currently out of service for repairs. No elevator to platform exists at this station.
- **Somerville** - two high level side platforms, inbound platform is 710 feet long that can accommodate a maximum boarding of eight coaches, outbound platform is 710 feet long that can accommodate boarding a maximum of eight coaches. ADA accessible.
- **Westfield** - two high level side platforms, inbound platform is 623 feet long that can accommodate a maximum boarding of seven coaches, outbound platform is 624 feet long that can

accommodate boarding a maximum of seven coaches. ADA accessible

- **Cranford** - two high level side platforms, inbound platform is 645 feet long that can accommodate a maximum boarding of seven coaches, outbound platform is 666 feet long that can accommodate boarding a maximum of seven coaches. ADA accessible
- **Plainfield** - two high level side platforms, inbound platform is 632 feet long that can accommodate a maximum boarding of seven coaches, outbound platform is 626 feet long that can accommodate boarding a maximum of seven coaches. ADA accessible.
- **Union** – one high level center platform, 546 feet long that can accommodate a maximum boarding of six coaches. ADA accessible.

## CURRENT OPERATING TRAIN LENGTHS

The October 2017 Baseline Timetable indicates that during the morning peak period three single level, eight-coach consists operated, three multilevel seven-coach consists operated and five six coach consists operated (Table 25). All single-level consists were powered by diesel locomotives and the all multilevel consists were powered by dual powered locomotives (ALP 45).

## DIRECT RAIL SERVICE PLATFORM IMPROVEMENTS

NJ TRANSIT has created a comprehensive Commuter Rail Station Guidelines and Standards Manual, published in 2015. The manual establishes standards in many design areas such as platforms, station buildings and access. Section 7.2.3 of the manual references Appendix F, Territory-Based Platform Lengths, which contains a

**TABLE 25 – CURRENT RVL TRAIN OPERATIONS AND EQUIPMENT**

<b>Train #</b>	<b># of Coaches</b>	<b>Train Type</b>	<b>Station Origin</b>
5404	7	ML-DP	Raritan
2406	6	ML-DP	Raritan
5408	6	ML-DP	Raritan
5710	6	ML-DP	High Bridge
5412	6	ML-DP	Raritan
5714	8	SL-Diesel	High Bridge
5416	8	SL-Diesel	Raritan
5718	7	ML-DP	High Bridge
5420	7	ML-DP	Raritan
5902	8	SL-Diesel	Plainfield
5126 to PSNY	6	ML-DP	Raritan

table that identifies the desired number of cars to be platformed at each station. NJ TRANSIT developed these values after considering ridership and consist length on the given line. The platform length selected for a given station should consider available area, potential parking expansions, and other site conditions, in addition to the recommended length based on prevailing consist service. Therefore, the actual length of the train platform may differ from the recommended length based on these factors.

Appendix F states that three approaches were considered for determining the recommended platform length: ridership, consist (train length) based, and territory-based.

Below is an explanation of each approach and the rationale for using the territory-based approach. All approaches are approved by Rail Operations.

## THREE APPROACHES TO DETERMINING PLATFORM LENGTH

### 1. Ridership

Length determined by peak ridership boardings. This methodology was used in previous standards manuals when ridership and resulting train lengths were less than current and future requirements.

### 2. Consist-based

Platform lengths at all stations on a line, if feasible, are the length of the maximum-sized consist.

### 3. Territory-based

Combining the goals of the ridership and consist-based approaches, territory-based platform lengths will be uniform based on the typical ridership within a given line segment. Longer, uniform platform lengths (longer consists) are recommended in the higher ridership segments of a line. Shorter, uniform platform lengths (shorter consists) are recommended in line segments where ridership is lower. Programmatic planning, design, and construction within a territory should be ordered to minimize operational impacts.

## SELECTED APPROACH

### Territory-Based, Using Prevailing Ridership Demand Forecasts

Although the consist-based approach would be desirable, the territory-based approach has been selected to allow NJ TRANSIT to limit the cost per station in areas where ridership is relatively low, and train crews can manage operations with shorter than train-length platforms.

---

## DESIGN EXCEPTION

As designs for platforms are advanced emergent conditions including funding, geometric, operations, and land use constraints may require a design of a shorter or longer platform length that does not meet the territory-based guidelines. These design exceptions are subject to the approval of both the Senior Vice President, Capital Programs and Senior Vice President & General Manager, Rail Operations.

Guideline Table F-1 (Table 26), which displays the boarding/alighting tracks, the platform type (high-level “H”, mini-high “M” or low-level “L”), the platform lengths, and line operating consist lengths for NJ TRANSIT trains at each commuter rail station.

## SCENARIO PLATFORM IMPROVEMENTS

While the October 2017 RVL train sets operated with six, seven, and eight-coach train sets, stopping at platforms that were shorter than the train set length, it would be desirable to upgrade platform lengths and heights to improve safety with level boarding, decrease dwell times with increased train doors on platforms, improve ADA accessibility with level boarding, and generally enhancing the RVL customer experience. These goals would be achieved by implementing the Territory Based platform lengths as recommended in the 2015 Station Manual. But as stated in the manual, conditions may not justify, or may not permit meeting the platform length goals. Platform improvements identified for each operating scenario were developed in such a way as to get as close to the Territory Based goals as reasonably possible.

In addition, the assumption is made that if a low-level platform is extended, then it would be converted to a high-level platform as required by regulation.

## SHORT-TERM SCENARIO A – SHOULDER OF THE PEAK PERIOD DIRECT RAIL SERVICE

Two existing early morning trains and one late morning train would be extended with service to PSNY. Inherent ridership may grow. With the operation of one seat service, customers may gravitate to the RVL for these new one seat ride trains but it may not result in a significant ridership increase. Therefore, no improvements would be made to existing platforms. No ridership forecast was generated for this scenario.

## SHORT-TERM SCENARIO B – PEAK OF THE PEAK PERIOD DIRECT RAIL SERVICE

Three Scenario A trains and three additional existing RVL trains would be extended with service to PSNY, for a total of six RVL trains out of 11. Train sets would consist of eight multi-level coaches and one ALP 45 to maximize the number of seats, to the greatest extent possible, to accommodate transfers from the NEC “substitution” trains. An eight-coach maximum train set is dictated by RVL Hunter Pocket Track configuration. Ridership forecasts were performed for this scenario and indicate some, but not significant ridership growth on the RVL. Considering that the Guidelines (Table 26) is recommending eight-car platform lengths for the Horizon Year 2040, customer experience would be enhanced, and NJ TRANSIT would show progress toward greater accessibility, there is incentive for platform improvements. For any of the scenarios presented, West Stations would not be improved.

Improvement options are:

1. No platform improvements
2. Improvements to platforms that can now only accommodate 2 or less coaches, those being Garwood and Bridgewater

**TABLE 26 – PLATFORM SIZE RECOMMENDATIONS FROM NJ TRANSIT GUIDELINES**

Line	LC	Station	Track	Platform Type H - High Level L - Low Level M - Mini-High	Platform Length (Cars)	2015 Longest Consist (Cars)	2040 Territory Based Length (Cars)	Notes
RV	1	High Bridge	S	L	2	8	4	
RV	2	Annandale	S	L	2	8	4	
RV	3	Lebanon	S	L	1	8	4	
RV	4	White House	S	L	2	8	4	
RV	5	North Branch	S	L	2	8	4	
RV	6	Raritan	2 /1	L	5 /4	8	8	
RV	7	Somerville	2 /1	H	8	8	8	
RV	8	Bridgewater	2 /1	L	2	8	8	
RV	9	Bound Brook	2 /1	L	5	8	8	
RV	10	Dunellen	2 /1	L	5	8	8	
RV	11	Plainfield	2 /1	H	7	8	8	
RV	12	Netherwood	2 /1	L	5	8	8	
RV	13	Fanwood	2 /1	L	5	8	8	
RV	14	Westfield	2 /1	H	7	8	8	
RV	15	Garwood	2 /1	L	2	8	8	
RV	16	Cranford	2 /1	H	7	8	8	
RV	17	Roselle Park	2 /1	H*	9	8	8	*No ADA
RV	18	Union	2 /1	H	6	8	8	

3. Improvements to platforms that can only accommodate four coaches, those being Garwood, Bridgewater, Bound Brook, Dunellen, Fanwood, Netherwood, and Raritan. Improvements would consist of converting low level to high level and extending to accommodate a six-coach train set.

### **MEDIUM-TERM SCENARIO C – PEAK OF THE PEAK PERIOD DIRECT RAIL SERVICE**

Three Scenario A trains and four additional existing RVL trains would be extended with service to PSNY, for a total of seven RVL trains out of 11. Train sets would consist of eight to 10 ML coaches and one ALP 45 to maximize the number of seats, to the greatest extent possible, to accommodate transfers from the NEC and NJCL “substitution” trains. A 10-coach train set can be utilized with the construction of the required Hunter Flyover. Ridership forecasts were performed for this scenario and indicate some, but not significant ridership growth on the RVL. Considering that Appendix F is recommending eight-car platform lengths for the Horizon Year 2040, longer platforms would enhance customer experience, and NJ TRANSIT would show progress toward greater accessibility, there is incentive for platform improvements. For any option, West Stations would not be improved.

Improvement options are:

1. No platform improvements
2. Improvements to platforms that can only accommodate 2 or less coaches, those being Garwood and Bridgewater
3. Improvements to platforms that can only accommodate four coaches, those being Garwood, Bridgewater, Bound Brook, Dunellen, Fanwood, Netherwood, and Raritan
4. Improvement to all East Stations. Improvements would consist

of converting low level to high level and reconstructing or extending to accommodate an eight-coach train set.

### **MEDIUM-TERM SCENARIO D – WEEKEND DIRECT RAIL SERVICE**

If this service is implemented without implementing Scenarios B or C, then no platform improvements would be required.

### **LONG-TERM SCENARIO E – FULL TIME DIRECT RAIL SERVICE**

Platforms would need to be configured consistent with the needs of an ARC or Gateway full buildout, which generally would require a minimum accommodation of an 8-coach train set.

Table 27 presents the existing platform configurations as well as average station ridership for Fiscal Year 2018. The table also summarizes the improvement options described for Scenario B, Option 3 and Scenario C, Option 4 when applicable.

### **CAPITAL COSTS FOR PLATFORM IMPROVEMENTS**

The NJ TRANSIT 2015 Draft Rail Station Assessment was utilized for scope and pricing. The 2015 Assessment identified platform improvements that are generally consistent with Scenario B which includes all East Stations accommodating a 6-coach train set.

The only station in the 2015 Assessment not consistent with Scenario B was Raritan, which did not include extension to accommodate six cars. For Scenario B, Raritan was priced for a six-coach platform using costs from other similar platforms. In addition, 2015 Draft Assessment included costs for platform improvements at the five West Stations. As indicated previously, no improvements to these station platforms were included in this RVL study.

**TABLE 27 – RVL PLATFORM IMPROVEMENT**

	Existing Platform	Track 1	Track 2	Track 1	Track 2	FY 2018 Weekday Ridership		Short-Term Scenario B	Medium-Term Scenario C
Station	Type	Length (ft.)	Length (ft.)	Cars	Cars			Platform Improvement	Platform Improvement
Union	High	546		6.4		1,473	6.4%	None	8
Roselle Park	High	834		9.8		957	4.1%	None	None
Cranford	High	645	666	7.6	7.8	1,505	6.5%	None	None
Garwood	Low	200	121	2.4	1.4	124	0.5%	6	8
Westfield	High	623	624	7.3	7.3	2,701	11.7%	None	8
Fanwood	Low	383	381	4.5	4.5	1,065	4.6%	6	8
Netherwood	Low	383	381	4.5	4.5	451	1.9%	6	8
Plainfield	High	632	626	7.4	7.4	727	3.1%	None	8
Dunellen	Low	398	399	4.7	4.7	872	3.8%	6	8
Bound Brook	Low	400	400	4.7	4.7	557	2.4%	6	8
Bridgewater	Low	113	113	1.3	1.3	344	1.5%	6	8
Somerville	High	710	710	8.4	8.4	675	2.9%	None	None
Raritan	Low	393	377	4.6	4.4	586	2.5%	6	8
North Branch	Low	192		2.3		48	0.2%	None	None
Whitehouse	Low	201		2.4		95	0.4%	None	None
Lebanon	Low	97		1.1		24	0.1%	None	None
Annandale	Low	203		2.4		65	0.3%	None	None
High Bridge	Low	97		1.1		47	0.2%	None	None

---

Scenario C assumes all East Station platforms will be improved to accommodate an eight-coach train set. Cost associated with extending a platform from six-coach (Scenario B) to eight-coach (Scenario C) were estimated and added.

The individual station costs include costs for engineering, project management, construction, rail force account, contingency and other station specific costs. Beyond those station specific costs, administrative costs were added to Scenarios B and C to account for platform improvement programmatic cost. The implementation of this very significant platform improvement program will require additional resources in order to properly manage the program and coordinate internally and with external stakeholders.

Table 28 indicates the capital cost of platform improvements. These improvement costs are based on Scenario B and Scenario C which would represent a level of improvement most consistent with Table 25, the NJ TRANSIT Guidelines. The costs are escalated to Year of Expenditure Dollars.

The scope and cost from the 2015 Draft Assessment is listed below were utilized to price Scenario B (six-coach train set). Additional costs were applied to these as appropriate in developing Scenario C (8-coach train set).

## **UNION**

Accessibility Improvements: \$0 – Station is accessible

## **ROSELLE PARK**

Accessibility Improvements: \$8.5M

- Platform repair/upgrade
- New stairs and elevators

- New canopy
- Pedestrian tunnel repair

## **CRANFORD**

Accessibility Improvements: \$0 – Station is accessible

## **GARWOOD**

Accessibility Improvements: \$29.9M (2015 Dollars)

- 540' (six-car) HLP WB side platform w 100' canopy
- 370' (four-car) HLP EB side platform w 200' canopy
- Elevators, stairs to repaired underpass
- Emergency ramps

## **WESTFIELD**

Accessibility Improvements: \$0 – Station is accessible

## **FANWOOD**

Accessibility Improvements: \$37.1M (2015 Dollars)

- 540' (six-car expandable to 710') HLP WB side platform with 100' canopy
- WB track grading to facilitate level boarding on WB side
- 540' (four-car, expandable to 710') HLP EB side platform with 200' canopy
- Pedestrian overpass with stair tower & double elevators
- Relocation/removal of EB station building
- Restriped parking

**TABLE 28 – RVL PLATFORM IMPROVEMENT COST SUMMARY**

<b>Station</b>	<b>Short-Term Scenario A \$M</b>	<b>Short-Term Scenario B \$M</b>	<b>Short-Term Scenario C \$M</b>	<b>Short-Term Scenario D \$M</b>	<b>Short-Term Scenario E \$M</b>	<b>Cost Source/Notes</b>
<b>Revenue Service Year</b>	<b>2027</b>	<b>2028</b>	<b>2032</b>	<b>2032</b>	<b>2040</b>	<b>Full Station Program Start - 2021</b>
Union (center) 6 to 8 Car		NA	19.6	19.6	19.6	Estimate
Roselle Park (center) (Repair)		29.1	29.1	29.1	29.1	Estimate
Cranford (center)		NA	NA	NA	NA	N/A
Garwood 6 Car Initial		40.2	59.8	59.8	59.8	Draft Rail Station Assessment 2015
Westfield (2 sides) 6 Car to 8 Car		NA	19.6	19.6	19.6	Estimate
Fanwood 6 Car Initial		49.9	69.4	69.4	69.4	Draft Rail Station Assessment 2015
Netherwood 6 Car Initial		43.3	62.8	62.8	62.8	Draft Rail Station Assessment 2015
Plainfield (center) 6 Car to 8 Car		NA	19.6	19.6	19.6	Estimate
Dunellen 6 Car Initial		49.1	68.6	68.6	68.6	Draft Rail Station Assessment 2015
Bound Brook 6 Car Initial		42.1	61.6	61.6	61.6	Draft Rail Station Assessment 2015
Bridgewater 6 Car Initial		43.8	63.4	63.4	63.4	Draft Rail Station Assessment 2015
Somerville		NA	NA	NA	NA	Estimate
Raritan 6 Car initial		40.3	59.9	59.9	59.9	Draft Rail Station Assessment 2015 (adjusted)
North Branch		NA	NA	NA	NA	
Whitehouse		NA	NA	NA	NA	
Lebanon		NA	NA	NA	NA	
Annandale		NA	NA	NA	NA	
High Bridge		NA	NA	NA	NA	
Platform Program Admin Costs		20.0	30.0	30.0	30.0	Estimate
<b>Total RVL Platforms</b>		<b>357.7</b>	<b>563.4</b>	<b>563.4</b>	<b>563.4</b>	

- 
- Emergency ramps and safety fencing

## **NETHERWOOD**

Accessibility Improvements: \$32.2M (2015 Dollars)

- 540' (six-car expandable to 710') HLP WB side platform with 100' canopy
- 370' (four-car, expandable to 710') HLP EB side platform with 200' canopy
- Stair towers & double elevators to pedestrian tunnel
- Emergency ramps

## **PLAINFIELD**

Accessibility Improvements: \$0 – Station is accessible

## **DUNELLEN**

Accessibility Improvements: \$36.6M (2015 Dollars)

- 540' (six-car expandable to 710') HLP WB side platform with 100' canopy
- Stair towers at each end of WB platform, to street
- Emergency ramps at each end of WB platform
- 540' (six-car, expandable to 710') HLP EB side platform with 200' canopy
- Stair towers & double elevators to pedestrian tunnel
- Partial to full demolition of station building
- Sheltered waiting area with radiant heat, EB side

## **BOUND BROOK**

Accessibility Improvements: \$31.3M - \$39.7M (2015 Dollars)

- 540' (six-car, expandable to 710') HLP WB side platform w 100' canopy
- Two eastbound platform options:
  - 370' center island HLP, 25' wide; or
  - 370' side platform HLP
- Elements common to both eastbound options
  - Expandable to 540'
  - 200' canopy
  - Pedestrian overpass, stair tower & elevators
  - Emergency ramps

## **BRIDGEWATER**

Accessibility Improvements: \$32.6M (2015 Dollars)

- 540' (six-car, expandable to 710') HLP WB side platform w 100' canopy
- 370' (four-car, expandable to 710') HLP EB side platform w 200' canopy
- Pedestrian overpass with stair towers & double elevators
- Emergency ramps
- Restriped parking

---

## **SOMERVILLE**

Accessibility Improvements: \$0 – Station is accessible

## **RARITAN**

Accessibility Improvements: \$17.8M (2015 Dollars) (Note: additional cost was added for 540' long platforms)

- 350' side platforms HLP, both sides, with end stairways and central ADA ramp (not expandable)
- WB shelter, 100' EB canopy
- Restriped, shifted parking

## **ASSESSMENT ASSUMPTIONS**

- Platform extensions and conversion of low-level platforms to high-level platforms is physically feasible.
- Only the extension and/or conversion is priced. No station building improvements or new station facilities are included unless otherwise noted.
- Parking improvements are not included.
- Improvements beyond the platform footprint is not included unless otherwise noted.
- Some station locations may need significant reconfiguration or relocation if a third track is added to the RVL. No costs are included for that reconfiguration or relocation. Thus, any Short-Term scenario improvements might need to be discarded.

---

# APPENDIX I

## LEGISLATIVE AND TITLE VI CONSIDERATIONS

### NJ TRANSIT REFORM LEGISLATION

State of New Jersey legislation P.L. 2018, CHAPTER 162, approved December 20, 2018 defines requirements for public hearings for service and fare changes that meet specified thresholds. Section 8 (d.) (1) states that “Before implementing the substantial curtailment or abandonment of rail passenger services, the corporation shall hold at least two public hearings in the area affected, as close as possible to the highest trafficked stop on the route. At least one of the two hearings shall take place on a State working day. One hearing shall take place for at least two hours between the hours of 9:00 a.m. and 5:00 p.m., and the other hearing shall take place for at least two hours between the hours of 6:00 p.m. and 10:00 p.m. Each public hearing required pursuant to this paragraph shall be attended by at least two members of the corporation’s board of directors.”

The legislation also states that “substantial curtailment” “shall mean a change in service that: (5) reduces service on a rail line in a way that reduces the amount of total service on the line by more than 25 percent or reduces service on a rail line during peak hours in a way that reduces the total number of daily trips provided during peak hours.”

Short-Term Scenario B and Medium-Term Scenario C would both involve reducing the total number of daily trips provided during peak hours to PSNY. Under those scenarios, trains that operate to PSNY

would no longer provide trips to PSNY and would instead operate only to NPS and would require passengers to transfer to other trains for trips to PSNY. Under Short-Term Scenario B three fewer NEC trains would operate to PSNY and under Medium-Term Scenario C two fewer NEC trains and two fewer NJCL trains would operate to PSNY during the peak hours.

Since the rail service changes related to Short-Term Scenario B and Medium-Term Scenario C would reduce the total number of daily trips provided during peak hours it would be necessary to hold at least two public hearings in the area affected. Short-Term Scenario B would require at least two public hearings along the NEC and Medium-Term Scenario C would require two public hearings along the NEC and two along the NJCL.

### TITLE VI PROGRAM

Title VI of the Civil Rights Act of 1964 seeks to ensure that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

To demonstrate that NJ TRANSIT is complying with Title VI requirements, FTA requires NJ TRANSIT to prepare and submit a Title VI Program every three years. NJ TRANSITs Board of Directors has adopted a Title VI Program, in conformance with FTA guidelines.

---

NJ TRANSIT's policy and procedures for Title VI, requires an equity analysis for all projects that involve a "Major Service Change". For the purposes of this project, it is assumed that a "Major Service Change" occurs when NJ TRANSIT proposes to discontinue (abandon) all service on a portion of a rail line that represents more than 25% of the route or line's miles, or when it proposes to increase the length of a rail line by more than 25% of the route or line's miles. A "Major Service Change" may also occur when NJ TRANSIT proposes to substantially curtail or substantially increase the amount of service on any rail line. "Substantial" for this purpose is defined to mean a considerable reduction or increase in service on a particular rail line; it is recognized that the determination of what is a considerable reduction or increase in service will depend on the particular characteristics of the rail line in question. However, NJ TRANSIT generally considers this to include any service reduction or increase on a rail line that reduces or increases the amount of service on the line by more than 25% or any service reduction or increase that would change the span of service by two hours or more.

This study has reviewed rail service changes for the weekday morning peak period for Short-Term Scenarios A and B, and Medium-Term Scenarios C and D, but the study has not defined full day service plans for each scenario. If any of the scenarios are advanced for further study a comprehensive rail service plan will be developed and at that time it can be determined if the service reduction or increase will involve a "Major Service Change."

Assuming a "Major Service Change" occurs, an equity analysis is required to determine whether or not there is a disparate impact or disproportionate burden (DI/DB) on identified Title VI populations. Title VI populations are defined as minority populations as well as low-income populations.

## DATA COLLECTION

Initially, rider survey data are used for analyses that might affect current riders. NJ TRANSIT has rider survey data for each route (family of routes) or rail line within each market; this data includes information on the number of riders that are minorities or low income. This data is used to estimate the percentage of riders on a particular route or line that are minority or low income and what percentage may be affected by a service change to the route or line.

For analyses that might affect potential riders in an area (such as a service expansion), NJ TRANSIT relies on the American Community Survey (currently 2014-2018) to provide data on overall population, minorities, and low income individuals (Census definition).

NJ TRANSIT may need to utilize demographic data to perform equity analyses for service expansions or new routes/services. In these cases NJ TRANSIT will use minority and low income population data at the Census block group level from the American Community Survey (currently 2008-2012). NJ TRANSIT completes demographic analyses and mapping, using GIS, in house. The number of riders impacted by the proposed service change will be determined using GIS. NJ TRANSIT staff will map each route proposed for a service change, including all stop locations, and create buffers around each stop along the impacted route segments. It is assumed for this project a one-mile buffer for each station would be utilized. These buffers represent the service area in which passengers can access the stops. The buffers for a single service change will be merged into a combined impact buffer. Census block groups at least partially contained within the buffers to identify the population impacted by the service change will be selected.

---

## EQUITY ANALYSIS

To conduct the service equity analysis the following eight steps as identified in the NJ TRANSIT policy are necessary.

Ranges for the market by type including, but not limited to, span of service, frequency of service, and discontinuation or new service. Separate the service reductions and service increases.

Identify the numbers and percentages of overall, minority, and low income riders impacted by each service change.

Sum the total numbers of overall, minority, and low income riders adversely impacted by service reductions and positively impacted by service increases separately. Determine the percentages of minority and low income riders impacted for each.

Determine the market's percentages of minority ridership and low income ridership.

Calculate the absolute difference between the percentage of total adversely impacted minority riders and the percentage of minority riders in the market. Do the same for the adversely impacted low income riders.

Apply the DI/DB thresholds (10-point difference) to determine if the adverse service changes will result in a disparate impact on minority riders or a disproportionate burden on low income riders.

Repeat steps 5 and 6 for the total positively impacted minority and low income riders.

Examine the net impacted riders (number of total positively impacted riders minus number of total adversely impacted riders) for overall, minority, and low income riders. The results provide additional evidence as to whether minority and low income riders

constitute a notable share of overall riders that experience net adverse or positive impacts from the service changes combined.

If a DI/DB is identified for either minority or low income riders, alternatives and mitigation measures should be considered. If potential disparate impacts on minority riders are found, NJ TRANSIT will analyze alternatives to determine if any exist that would serve legitimate program goals, but with less of a disparate effect based on race, color, or national origin. If potential disproportionate burdens on low income riders are found, NJ TRANSIT will take steps to avoid, minimize, or mitigate impacts where practicable, including describing available alternatives. The analysis of alternatives may include the impacts of minor service changes (those that did not meet the "major service change" definition, but are proposed as part of the same service change package).

## PUBLIC PARTICIPATION

NJ TRANSIT engages the public on all fare and/or major service changes in accordance with the governing statute N.J.S.A. 27:25-8(d) which states in part:

"Before implementing any fare increase for any motorbus regular route or rail passenger services, or any curtailment or abandonment of those services, the corporation shall hold a public hearing in the area affected during evening hours... Notice of the hearing shall be given by the corporation at least 15 days prior to the hearing...; the notice shall also be posted at least 15 days prior to the hearing in prominent places on the railroad cars and buses serving the routes to be affected."

Before implementing the substantial curtailment or abandonment of rail passenger services, the corporation shall hold at least two public

---

hearings in the area affected, as close as possible to the highest trafficked stop on the route. At least one of the two hearings shall take place on a State working day. One hearing shall take place for at least two hours between the hours of 9:00 am and 5:00 pm, and the other hearing shall take place for at least two hours between the hours of 6:00 pm and 10:00 pm.