Paterson-Newark Transit Market Study

Final Report
June 2020

Prepared for

NJTPA
NORTH JERSEY TRANSPORTATION PLANNING AUTHORITY

Prepared by

FITZGERALD & HALLIDAY, INC.
Innovative Planning, Better Communities

Study Partners and Organization

This report has been prepared as part of the North Jersey Transportation Planning Authority's (NJTPA) Subregional Studies Program with financing by the Federal Transit Administration and the Federal Highway Administration of the U.S. Department of Transportation. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The NJTPA is solely responsible for its contents.

The study was managed by Passaic County in partnership with Essex County. Additional guidance was generously provided by a Technical Advisory Committee, including members from each of the study area municipalities, NJ TRANSIT, New Jersey Department of Transportation (NJDOT), the NJTPA, and local stakeholders such as the Newark Alliance. Studies funded under the NJTPA's Subregional Studies Program conduct planning-level analysis.

Technical memoranda, additional reference documents, and a matrix of recommendations, timeframes, and responsible parties are housed at the NJTPA, Passaic County, and Essex County.

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Sobers Consulting, llc

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Executive Summary

The Paterson-Newark Transit Market Study is the first step in determining the feasibility and scope of implementing new, high-quality transit service between Paterson and Newark along the existing Newark Industrial Track (NIT) freight rail corridor. The goal of the study was to determine the market potential of such transit service in Passaic and Essex Counties. The objectives of the study were to:

- Provide an assessment of community characteristics, environmental justice concerns, existing infrastructure and transit service, and environmental constraints
- Identify potential station stops and alignment options connecting Paterson and Newark that serve key employment and activity centers
- Prepare projections of potential ridership (number of boardings on a train or bus), capacity, and preliminary capital/construction costs
- Provide a preliminary environmental screening and assessment
- Demonstrate economic development and value capture potential
- Integrate multimodal (bus/rail along with bicycle access) facility and travel opportunities
- Identify project development and funding opportunities

Study Area

The study area is defined as a travel corridor between Paterson and Clifton in Passaic County and Nutley, Belleville, and Newark in Essex County. The study focuses on the area surrounding the NIT, an underused freight rail corridor,

Study Area

and envisions the potential for eventual regional connections beyond the immediate area.

Study Findings

The Paterson-Newark Transit Market Study demonstrates the potential benefits of a range of concepts for new, high-quality transit systems linking Paterson and Clifton in Passaic County to Nutley, Belleville, and Newark in Essex County. Transit systems such as bus rapid transit and light rail have the potential to affect mode shift from auto trips to transit and compare well with regional bus routes and commuter rail line ridership. Intersections with a wide array of multimodal travel options throughout the corridor underscore the importance of this north-south corridor and the opportunity to open up more regional travel options to a substantial ridership market.

Three conceptual alternatives were tested in NJ TRANSIT's Transit Demand Forecast Model, including two light rail (Options A and B) and Bus Rapid Transit (BRT). Technical study and ongoing conversations with partner agencies, municipalities, stakeholders, and the public provided the following takeaways:

- NJ TRANSIT's Demand Forecast Model reveals strong performance for each alternative
- Light rail and bus alternatives show ridership potential exceeding some regional rail lines
- Faster, more reliable transit between Paterson and Newark could improve travel times, job access, and regional connectivity
- The three modeled alternatives show potential to divert more than 3,000 daily automobile trips to transit by creating attractive, competitive service options
- Diverting auto trips to transit can reduce roadway and highway maintenance costs, reduce personal travel costs, mitigate regional congestion and environmental impacts
- The alternatives herein stand to benefit environmental justice and traditionally disadvantaged populations in the corridor almost uniformly; no one alternative risks significantly higher impacts, nor do any alternatives fail to provide comparable opportunities for enhanced mobility
- Regional models such as Hudson-Bergen Light Rail, River LINE, and CTfastrak demonstrate potential for economic development and value capture surrounding transit stations
- Members of the public generally expressed support for enhanced transit options between Paterson and Newark, with a preference for light rail options over bus and desire for mixed-use, transit-supportive development along the corridor.

Recommendations

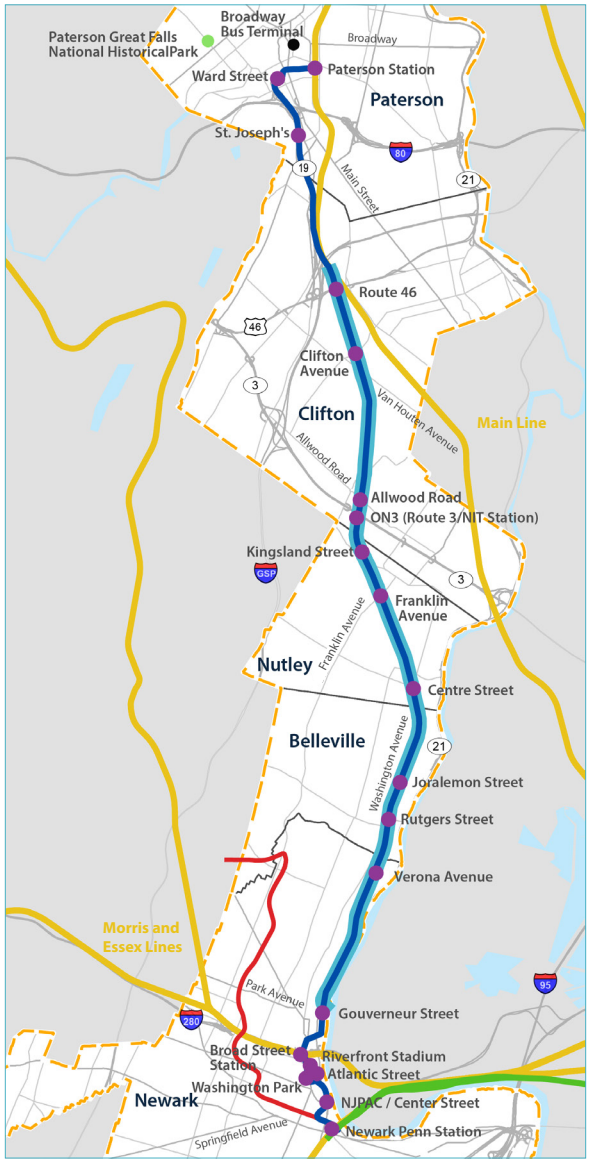
1 Preserve Rights-of-Way

A critical element to developing enhanced transit options in the corridor is the preservation of key right-of-way components, including the Newark Industrial Track (NIT), NJ Route 19, and local streets in Paterson and Newark in particular. Each of these rights-of-way offers the potential to prioritize transit, separate transit from general roadway congestion, and improve travel times for more cost-effective and customer-friendly service. Action should be taken now to ensure their potential use, through concerted local government and agency partnerships to plan for the next generation of transit systems.

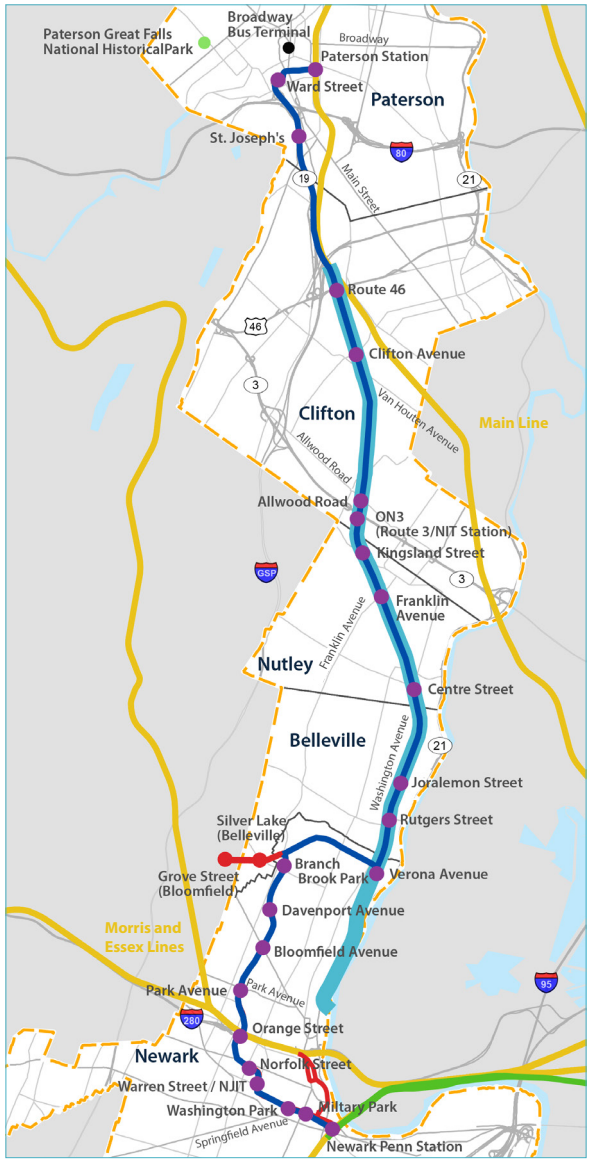
2 Advance to Detailed Study

This market study confirms the viability and market potential of a high-quality transit connection between Paterson and Newark. It does not

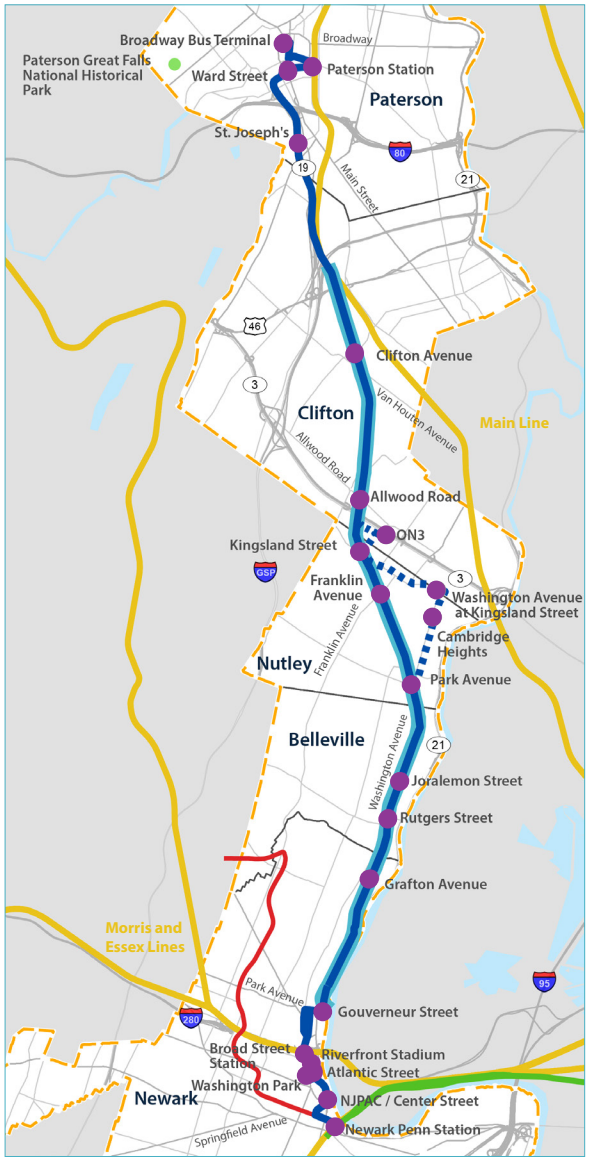
Light Rail A



Light Rail B



Bus Rapid Transit



Legend

Alternative Alignment
Hybrid BRT Alignment with diversion
Newark Industrial Track
Potential Stations
Newark Light Rail
NJ TRANSIT Commuter Rail
PATH
Study Area
0 0.5 1 Miles

provide detailed technical study of the many components of such a project. Therefore, establishing champions and a project lead to advance to more detailed technical assessments and concept development are the next steps towards advancing the concepts initially explored in this study. Detailed technical study would include:

- Alignments
- Mode choice and specification
- Station location and design
- Bicycle/pedestrian trails and greenway compatibility
- Service plan
- Maintenance and operation
- Capital and operating cost estimates
- Environmental review
- Funding and financing

3 Refine Demand Forecasts

As demand estimates are critical to demonstrating project potential, considerations for further enhancing ridership forecasts in future study phases include more specific station locations, parking supply and pricing, transit fares, and potential model enhancements to reflect BRT performance in other systems.

4 Phase Implementation

While full build of any new transit system will require significant planning, funding, and time for implementation,, initiative can be taken in the interim to expand transit connectivity and improve the performance of the existing network. Transit signal priority and bus service enhancements are two important early actions to lay the groundwork for this project and improve regional transit travel.

5 Leverage Regional and Local Initiatives

The value of each individual transportation project is increased when demonstrably linked to other efforts, underway or planned, such as NJ TRANSIT's Passaic Bergen Hudson Transit Project. Transit-supportive zoning and land use at the local level sets the stage for sustainable transportation options, while local enhancements such as sidewalk network improvements provide complementary benefits including walk access to transit and increased safety and connectivity within communities.

6 Engage and Listen

Throughout the planning and design process (e.g., alternatives analysis, preliminary design studies, and environmental review), project partners will continue to engage the public, stakeholders, and elected officials to foster an inclusive, equitable, and beneficial investment program for local communities and the region.

Public and Stakeholder Engagement

Thoughtful and effective engagement with the public, municipal and agency officials, and elected representatives is vital to creating a foundation of communication and trust in any planning project. Throughout the public engagement process, community members consistently expressed desire for faster, more direct transit options between Paterson and Newark and more reliable local bus service. The multi-pronged outreach effort included the following:

- **A Technical Advisory Committee** (TAC) comprised of municipal and county officials, the NJTPA, NJ TRANSIT, NJDOT, and organizations

including Newark Alliance and EZ Ride

- **Stakeholder meetings** offered opportunities for detailed technical discussions and sharing of local perspectives on the opportunities and potential concerns related to the study and associated mode and alignment options.
- **In-person public engagement** occurred early in the study. The project team held two rounds of pop-up outreach events in the vicinity of Newark Broad Street Station and Paterson City Hall in October 2019. Study team members held brief, informal conversations with transit users (and non-users) and administered a bilingual survey (English and Spanish).
- Passaic County created a **project website** with links to project materials such as summary presentations, TAC presentations, an e-survey and fact sheets. A comment box and contact information were included for public feedback.
- An **e-survey** identifying barriers and opportunities for transit in the corridor was administered from October 2019 until the conclusion of the study, including during pop-up events.
- In response to the COVID-19 pandemic, two in-person public meetings scheduled were replaced with a **virtual presentation** posted to the project website in May 2020. The presentation was available with English and Spanish subtitles. Public comments and questions were accepted for two weeks following the posting of the presentation by email, telephone, and the website comment box.

Public and Stakeholder Comments

Members of the public and key stakeholders, including NJ TRANSIT and the Tri-State Transportation Campaign, submitted comments in response to the virtual presentation. Comments generally showed enthusiastic support for advancing one or more of the options and were consistent with project planning principles, if not necessarily the purview of this market study.

NJ TRANSIT indicated a preference for the Hybrid BRT Option, noted potentially high costs associated with light rail, and suggested that commuter rail be eliminated from consideration. Members of the public, however, preferred light rail options (especially Light Rail Option B) over bus options. Development potential near light rail stations was frequently mentioned by the public and stakeholders, and commenters suggested new development could help pay for and support new transit service.

Stakeholders and the public expressed expectations of continued engagement in the course of additional studies. Concerns were also raised about increased vehicular traffic around park and rides, with support voiced for bicycle/pedestrian paths alongside the transit alignment.

Methodology

The study assessed current conditions (demographics, infrastructure, environment, and existing transit) developed a range of conceptual transit alternatives (light rail, commuter rail, bus), and screened these options to test market potential through NJ TRANSIT's demand forecast model. The study intent was not to identify a specific, locally preferred alternative, instead developing strong conceptual alternatives as a starting point for more detailed analysis and design.

Key data points from the model output included: year 2040 projected daily ridership by alternative (including existing and new transit segments), auto and transit trip diversions to new services, and access mode to stations. The NJ TRANSIT model produced ridership estimates for four scenarios, including the three selected alternatives and a 2040 No Build condition. The No Build is defined as future ridership on existing transit systems (bus and rail) without new transit service from Paterson to Newark. This study focused on the performance of the three modeled alternatives, with qualitative discussion of regional effects.

The following outputs are evaluated based on NJ TRANSIT's demand forecasting results:

Ridership by Alternative (Average Daily Boardings)

Option	2040 No Build	2040 Light Rail A	2040 Light Rail B	2040 Bus Rapid Transit
Existing Segments	20,340	27,100	23,740	N/A
New Segments	N/A	10,600	8,760	11,460
Total Daily Boardings	**20,340**	**37,700**	**32,500**	**11,460**

- Total ridership on proposed mode, including station estimates where appropriate
- Changes in total transit ridership in the corridor
- Shifts in mode, particularly auto trip diversions to transit
- Improved mobility in the corridor, including effects on environmental justice communities
- Throughout this study, attention was paid to potential impacts to environmental justice communities. All three transit alternatives would improve access to employment, education, and other key trip destinations in similar measure for existing environmental justice populations.

Ridership by Alternative

Ridership is defined as passenger boardings, i.e., each time a person boards a transit vehicle. For each alternative, ridership is broken out by existing segments (in the case of the two light rail alternatives), new segments, and total daily ridership. Emphasizing the new segments associated with the three alternatives (i.e., excluding existing Newark Light Rail ridership), the three options perform comparably, and BRT exhibits the greatest new system ridership, as it does not explicitly include existing bus ridership in the corridor.

The increased ridership associated with each alternative relative to the 2040 No Build condition indicates the potential to increase overall transit usage in the corridor and to enhance ridership at existing stations on the Newark Light Rail system. Ridership includes diversions from existing transit and automobile trips, each of which offers opportunities to reallocate existing operating and maintenance resources and mitigate new project costs. The Newark Light Rail has its own well-established market base, yet stands to increase in utility as new connections are created.

Next Steps

The study's intent was not to recommend a specific transit project, instead developing strong conceptual alternatives as a starting point for more detailed analysis and design. Passaic and Essex Counties, along with state, regional and local partners, are encouraged to pursue an alternatives analysis to further explore design and operational considerations, impacts, and benefits of a new high-capacity transit service connecting study area municipalities. Open and ongoing engagement with the public and stakeholders is paramount.

Introduction

Economic development and mobility are intrinsically linked, and, in a region as dense and diverse as northern New Jersey, opportunities to create bold, new linkages between established communities do not present themselves often. As municipalities of all sizes grapple with issues including increasing costs of living, traffic congestion, and challenges to access healthcare, education, and employment, fostering dynamic and sustainable public transportation is paramount.

However, ridership forecasts alone are inconclusive as a determinant to select one alternative above another. At the corridor level, these conclusions set the stage for further evaluation of these alternatives and other potential transit enhancements.

The Paterson-Newark Transit Market Study finds that concepts for a variety of new, high-quality transit systems linking Paterson and Clifton in Passaic County to Nutley, Belleville, and Newark in Essex County show strong ridership potential. Furthermore, this study shows that such new transit systems have the potential to affect mode shift from auto trips to transit and compare well with regional bus routes and commuter rail lines regarding ridership.

This study does not recommend a locally preferred mode or alignment. The preliminary alignment options developed in this study are a starting point for initial stakeholder and public feedback. Passaic and Essex Counties, along with state, regional and local partners, are encouraged to pursue an alternatives analysis to further explore design and operational considerations, impacts, and benefits of a new high-capacity transit service connecting study area municipalities.

Study Purpose and Objectives

The Paterson-Newark Transit Market Study is the first phase in determining the feasibility and scope of implementing new transit service from Paterson to Newark along the existing Newark Industrial Track (NIT) owned and operated by Norfolk Southern. The goal of the study was to determine the market feasibility of such transit service in Passaic and Essex Counties. The objectives of the study were to:

- Provide an assessment of community characteristics, environmental justice concerns, existing infrastructure and transit service, and environmental constraints
- Identify potential station stops and alignment options connecting Paterson and Newark that serve key employment and activity centers
- Prepare projections of potential ridership, capacity, and preliminary capital costs
- Provide a preliminary environmental screening and assessment
- Demonstrate economic development and value capture potential
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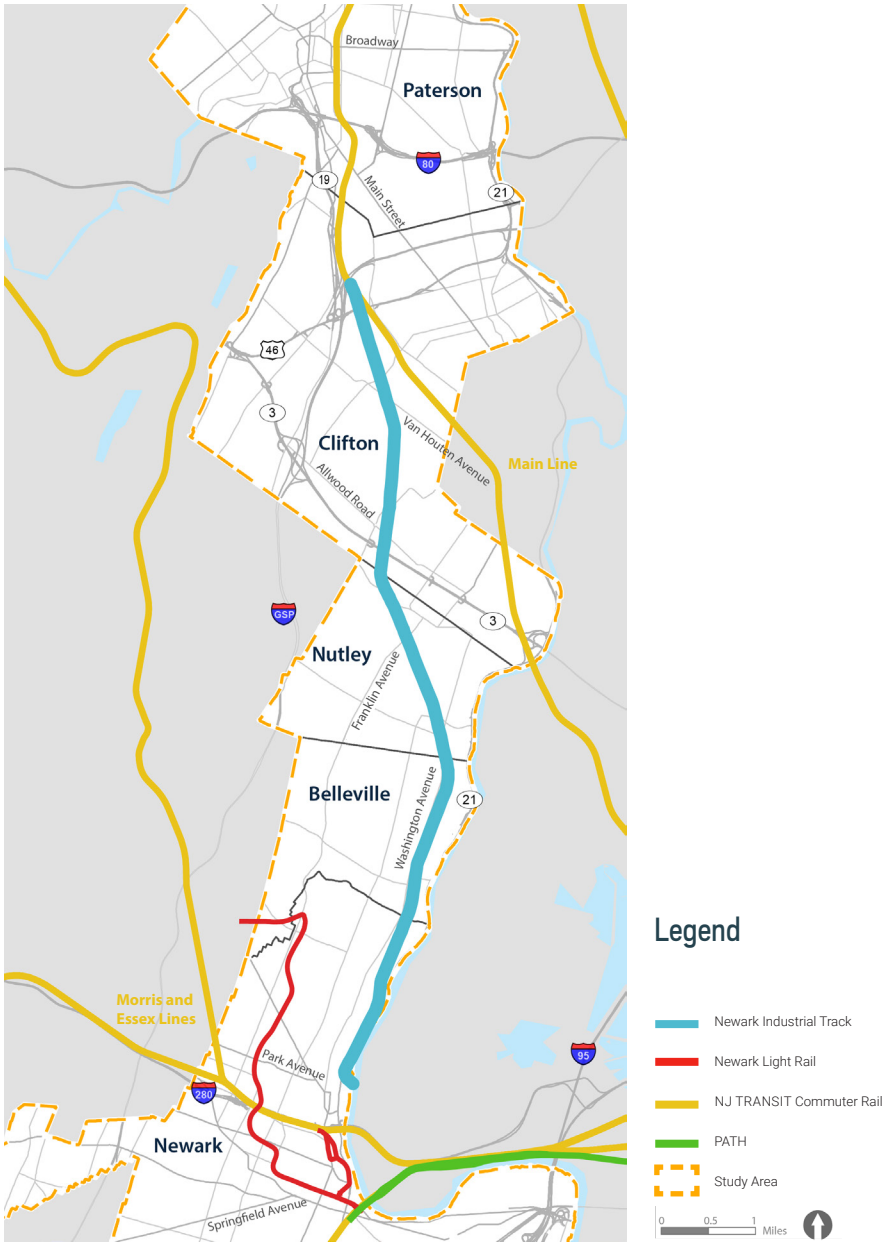
Study Area

The study area is defined as a travel corridor between Paterson and Clifton in Passaic County and Nutley, Belleville, and Newark in Essex County. The study focuses on the area surrounding the NIT, an underused freight rail corridor, and envisions the potential for eventual regional connections beyond the immediate area.

Figure 1. Study Area



Public and Stakeholder Engagement

Thoughtful and effective engagement with the public, municipal and agency officials, and elected representatives is vital to creating a foundation of communication and trust in any planning project. Throughout the public engagement process, community members consistently expressed desire for faster, more direct transit options between Paterson and Newark and more reliable local bus service. The multi-pronged outreach effort included the following:

- A **Technical Advisory Committee (TAC)** shared visions for public transportation in the corridor, provided technical information, offered local community and agency perspective and feedback, and assisted in decision-making at major milestones such as the development and selection of mode and alignment options to be explored. Three TAC meetings were convened over the course of the study, corresponding with project milestones and key decision points.

Technical Advisory Committee

NJTPA	City of Newark	NJ TRANSIT
Passaic County	City of Clifton	NJDOT
Essex County	Township of Nutley	Newark Alliance
City of Paterson	Township of Belleville	EZ Ride

- **Stakeholder meetings** offered opportunities for detailed technical discussions and sharing of local perspectives on the opportunities and potential concerns related to the study and associated mode and alignment options. Stakeholders included: NJ TRANSIT, Prism Capital Partners, LLC (developers of the ON3 site), and municipalities in the study area.

- **In-person public engagement** occurred early in the study. The project team held two rounds of pop-up outreach events in the vicinity of Newark Broad Street Station and Paterson City Hall in October 2019. This was during the data collection phase of the study that sought to assess broad travel needs, barriers, and opportunities in the corridor. At these events, study team members held brief, informal conversations with transit users (and non-users) and administered a bilingual survey (English and Spanish). Study team members interacted with approximately 60 community members.

- Passaic County created a **project website** with links to project materials such as summary presentations, TAC presentations, an e-survey and fact sheets. A comment box and contact information were included for public feedback.

Photo: Fitzgerald & Halliday, Inc. (FHI)

- An e-survey identifying barriers and opportunities for transit in the corridor was administered from October 2019 until the conclusion of the study, including during pop-up events.
- Due to the COVID-19 pandemic, two in-person public meetings scheduled near the conclusion of the study were replaced with a **virtual presentation** posted to the project website in May 2020. The presentation was available with English and Spanish subtitles. Public comments and questions were accepted for two weeks following the posting of the presentation, from May 11 through May 25. Comments and questions were also accepted via email throughout the study via project email addresses and the website comment box.

Summaries of comments received form public, non-profit, and agency reviewers are included in the Key Findings section of this document.

Photo: Fitzgerald & Halliday, Inc. (FHI)

Current Conditions

Community Characteristics

Anchored by the two major cities of Newark and Paterson, with Belleville, Nutley, and Clifton in between, the study corridor includes mixed densities and development types and demographic characteristics.

Population

An estimated 582,112 people live within the five-community study area.[1] They represent roughly 44 percent of Essex and Passaic Counties' combined population. Newark is the largest city in the state, with an estimated 282,803 residents — comprising nearly 35 percent of Essex County's total population — and Paterson is the third largest city in the state, comprising roughly 29 percent of Passaic County's population. With such a large percentage of the population, residents of the study area communities, particularly Newark and Paterson, resemble the make-up of the counties overall.

Table 1. Study Area Population (Current and Forecast)

	Newark	Belleville	Nutley	Clifton	Paterson
Year 2017	282,803	36,383	28,829	86,207	147,890
Year 2045	328,809	41,246	33,531	104,208	178,907
Change	16%	13%	16%	21%	21%

2017: American Community Survey Five-year Estimates (2017)
2045: NJTPA Demographic and Employment forecast Model (DEFM)

1 ACS Demographic and Housing Estimates, 2013-2017 5-year estimates, DP05

Although all five municipalities saw a loss of residents in the 1970s and 1980s, the municipalities have all seen one to two percent growth in recent years. Clifton specifically has seen noteworthy population gains since 1990. Forecasted growth in 2045 ranges from 16 to 21 percent in the five municipalities.

Environmental Justice

To ensure that potential transportation improvements are considered through a lens of equity, thus avoiding disproportionate impacts to vulnerable populations while ensuring equal benefits, an environmental justice analysis was conducted for the five study area communities based on six demographic factors:

- People with a disability
- Minority population
- Households with no vehicle
- Households with limited English proficiency
- Households below the poverty level
- People over 65 years old

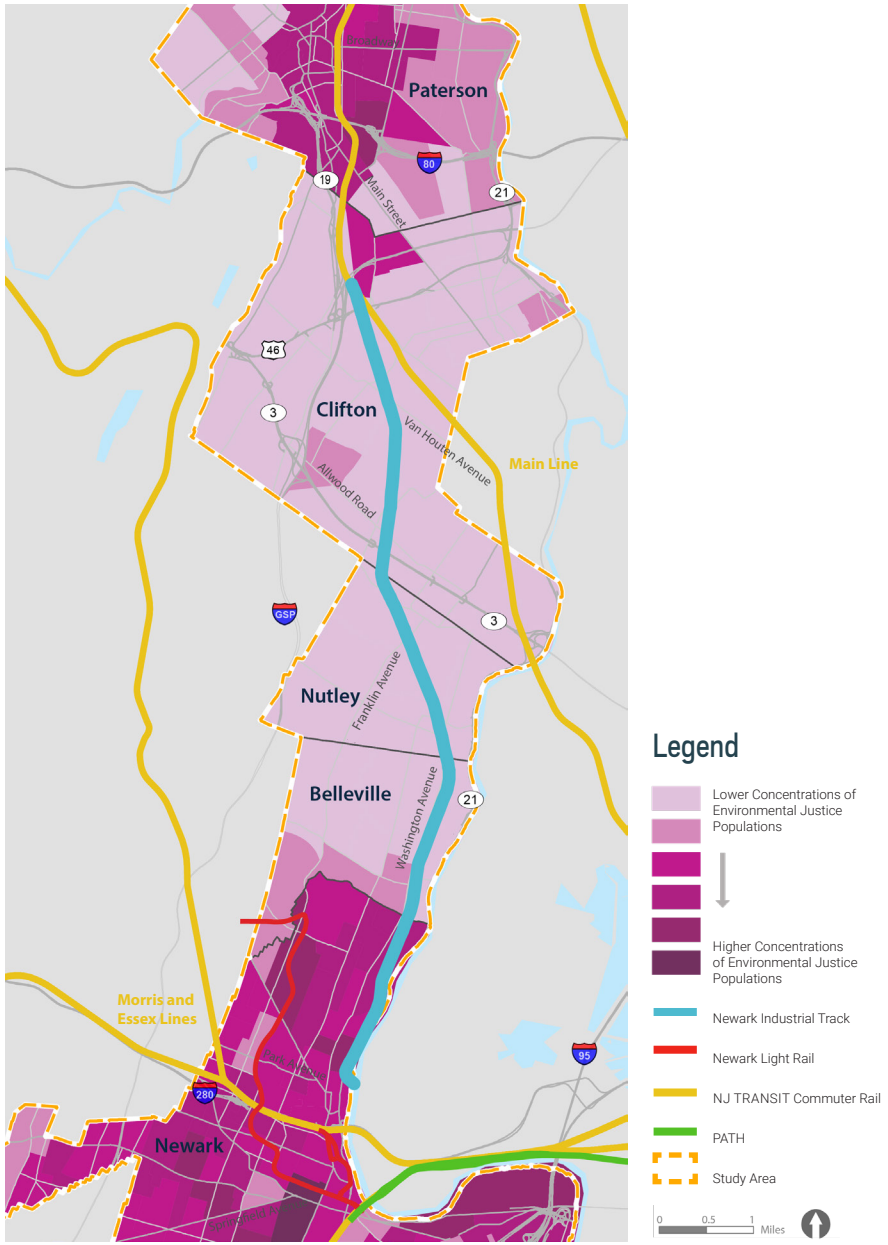
Environmental justice populations within the study area are concentrated in, but not limited to, the cities of Paterson and Newark. This is demonstrated by the composite map (Figure 2) reflecting the overlay of these six demographic groups (at Census Tract or Block Group level), which provides a geographic representation of the concentrations of environmental justice populations.

These communities were also evaluated independently. The conclusions from this analysis include:

- **People with a disability.** Census Tracts with a high concentration of people with a disability are fairly uniform throughout the study area (<20%). Concentration of this population are most prevalent in Newark, where Census Tracts above 25 percent or higher are prevalent.
- **Minority population.** Block Groups with concentrations of minority residents (>30%) are located throughout the corridor. Newark and Paterson have numerous Block Groups with minority residents exceeding 75 percent of the population and the largest minority populations within the study area and the study corridor (i.e., northern Newark and central Paterson).
- **Households with no vehicle.** More than 30 percent of households in Newark and Paterson are identified as zero-car households. In pockets of these cities, it is common for this rate to exceed 50 percent. Belleville, Clifton, and Nutley typically have rates below 20 percent.
- **Households with limited English proficiency.** In areas of Newark and Paterson, limited English proficiency households are common, with rates about 20 percent. These rates are lower in the other study area municipalities.
- **Households below poverty level.** In Newark and Paterson, rates of higher than 25 percent for households living below poverty level are common. The Springfield/Belmont neighborhood of Newark as well as locations in central Paterson have numerous Block Groups with over 40 percent of households living below the poverty level.
- **People over 65 years old.** People 65 years or older make up less than 20 percent of residents in most Block Groups along the corridor.

The transit options developed in this study offer opportunities for enhanced mobility for traditionally disadvantaged populations and do so in roughly equal measure. Because alignments are centered on the NIT and generally

Figure 2. Environmental Justice Communities



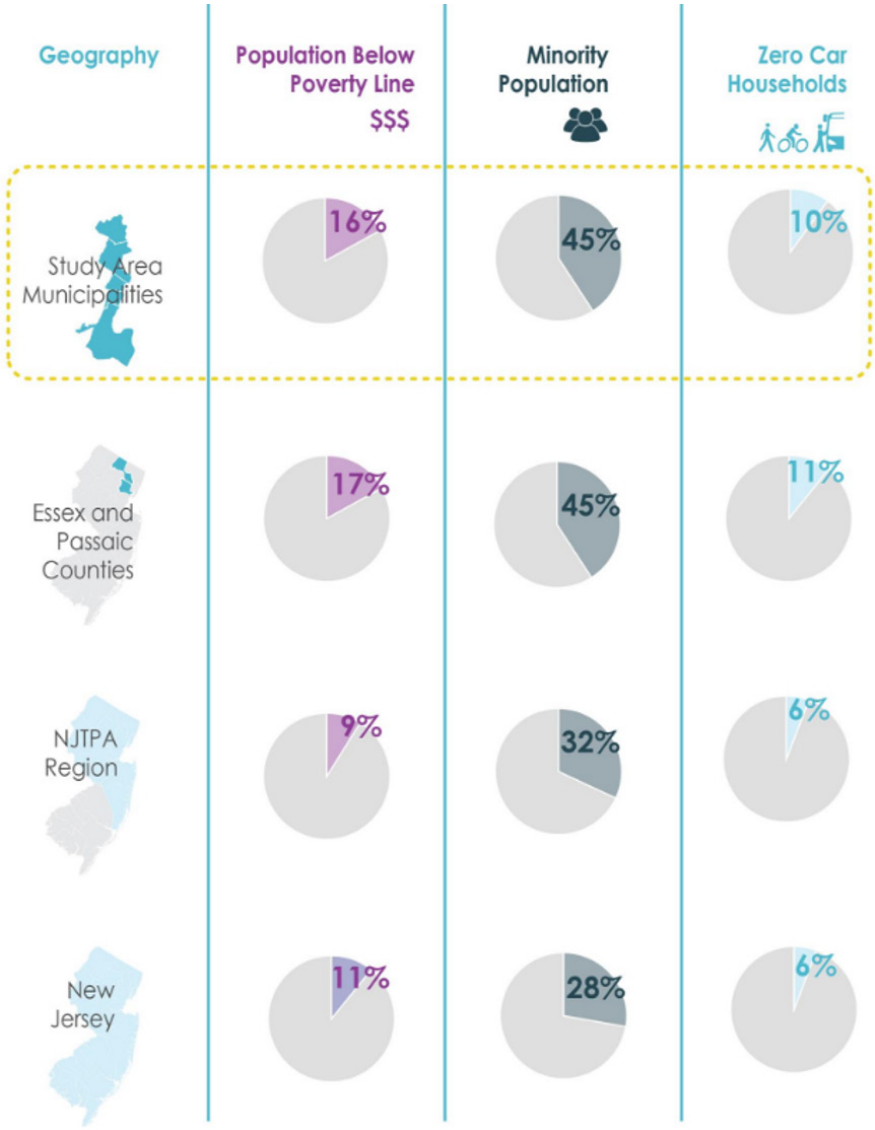
consistent across the alternatives discussed later in this report, potential impacts and benefits would be similar in relationship to the environmental justice populations in each community. The study area contains a greater percentage of environmental justice communities than the NJTPA region and the state of New Jersey (Figure 3).

When considering modifications to infrastructure and associated policies, it is important to consider how environmental justice and vulnerable user groups will be impacted by the modifications. Considerations include, but are not limited to:

- The need for people with disabilities to travel safely throughout the study area municipalities, which requires universal access principals including, but not limited to: ADA-accessible ramps, unobstructed sidewalks, and audible pedestrian signals
- Multimodal access allows people without access to personal vehicles to reach jobs, medical appointments, schools, recreational opportunities, shopping, and other regional destinations on foot, by bike, or by affordable public transit.
- Households below the poverty level benefit from affordable transportation options and alternatives to car ownership.
- Senior citizens and younger adults alike also benefit from transportation options and alternatives to reliance on automobiles and car ownership.

Concentrations of such populations, particularly in central Paterson and northern Newark, stand to benefit directly from investment in high-quality transit that links these centers with major job markets. Developers of significant sites such as ON3 have stated a strong desire to draw from a regional workforce in a variety of sectors, and to facilitate and encourage commuting and travel by modes other than private automobiles. Quality transit options support the traveling public and the institutions and businesses seeking to attract regional talent.

Figure 3. Environmental Justice Communities by Geography



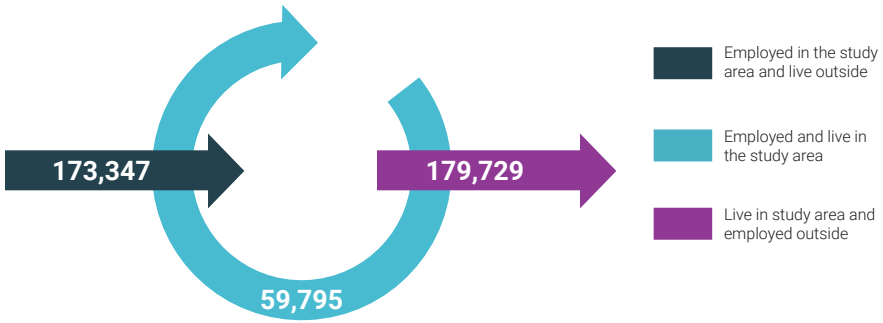
American Community Survey Five-year Estimates (2017)

Employment and Commuting Patterns

Approximately 64 percent of the study areas residents work within a 10-mile commute of home, with an additional 26 percent commuting within 24 miles. Only about four percent work a significant distance (50+ miles) from home. Additionally, 87 percent of study area residents have one-way commute times under one hour. The numbers of workers commuting into and out of the study area for work daily is similar (173,347 entering and 179,728 existing), while nearly 60,000 workers both live and work within the study area. The cities of Newark and Paterson are the most common commute destinations for study area residents, presenting a strong transit market with significant activity centers anchoring the corridor.

The prevalence of relatively short commutes and significant employment trip flow within the study area (and to/from nearby communities) underscores the opportunity for more competitive transit within the region to complement the New York-focused network. Efficient, direct transit options have the potential to be more competitive with automobile travel so long as journey times are not significantly longer than driving, whereas driving is typically more attractive for shorter trips and to destinations without significant parking costs or constraints such as congestion.

Figure 4. Study Area Commuting Patterns (2017, All Jobs)



Census Bureau LEHD Origin-Destination Employment Statistics (2017)

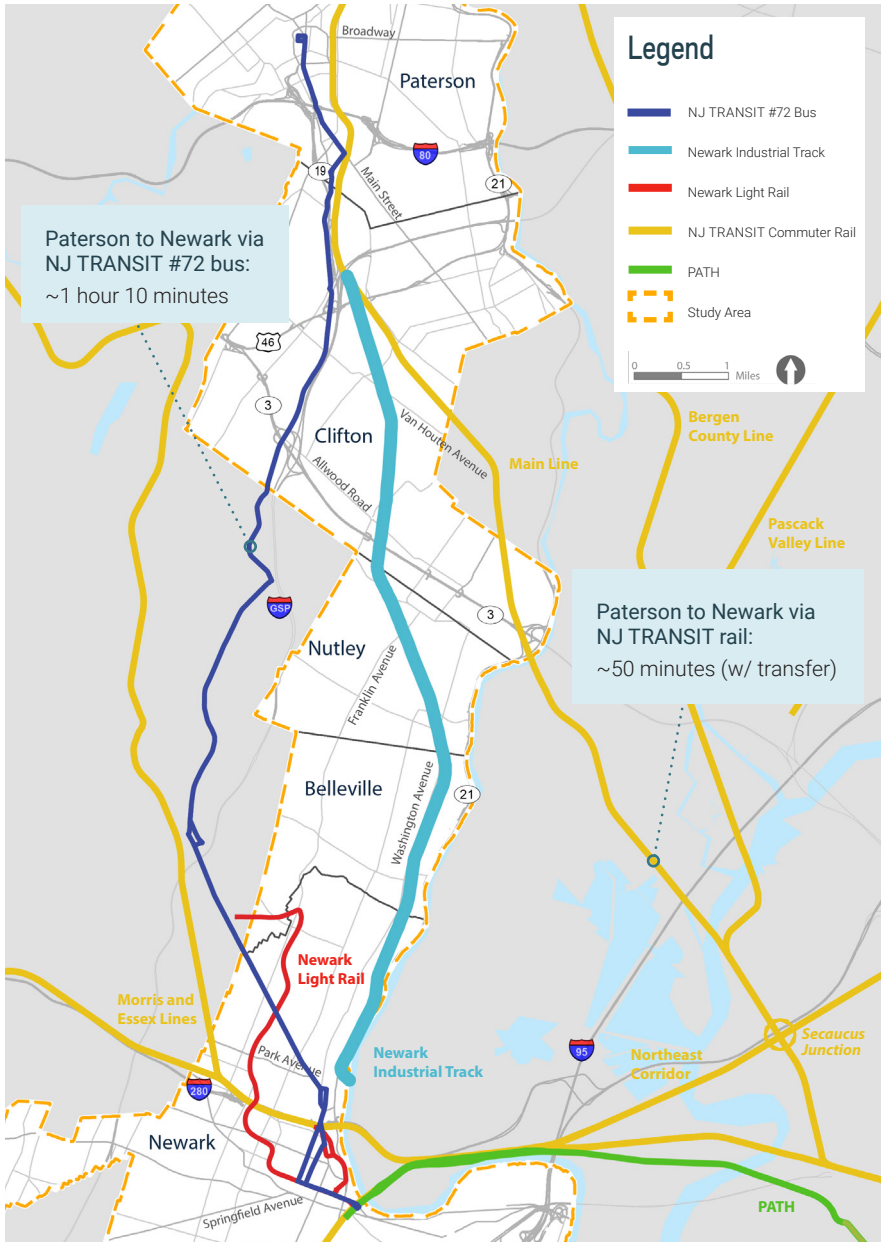
Photo: Fitzgerald & Halliday, Inc. (FHI)

Employment and population density are two primary contributors to the potential for transit ridership. In addition to high job density in Paterson and downtown Newark, moderate density is seen along the NIT, particularly in Clifton, while the ON3 development in Clifton and Nutley will continue to expand employment in the middle of the corridor. Existing and proposed developments, paired with commuting data, provide evidence that there is a market for commuters who could be better served by enhanced public transit options.

Existing Transit Services

The public transportation network in northern New Jersey is extensive, with a variety of modes and operators. NJ TRANSIT provides the most transit transit service in the region, including commuter rail, light rail, and interstate, regional, and local buses. The Port Authority of NY & NJ operates the PATH rail system. While the northern New Jersey transit network is expansive, it

Figure 5. Existing Transit Service



is highly focused on commuter travel to and from New York City, including key portals such as Newark and Hoboken. As a result, intrastate travel by rail or bus may present challenges, as service is often indirect, infrequent, and time-consuming. Local bus routes often have long travel times.

Private carrier commuter buses to New York City are operated by DeCamp Bus Lines and private "jitney" buses are operated by Spanish Transportation and some smaller carriers (Genesis, 3CM) from Main Street and Broadway in Paterson to the Port Authority Bus Terminal (PABT) and George Washington Bridge Bus Station (GWBBS) in Manhattan. Jitney services operating along NJ Route 4 make some intermediate stops, including Garden State Plaza in Paramus. Saddle River Tours, another private bus company, ceased operations of its Route 55 from Bloomfield to New York City in January 2020.

The primary transit links between Paterson and Newark are NJ TRANSIT's #72 bus service, serving Newark, Belleville, Bloomfield, Clifton and Paterson, and NJ TRANSIT rail via the Northeast Corridor and Main Line, with a necessary transfer at Secaucus Junction. Bus travel times between these two cities are often an hour or more, while rail service can achieve the trip in 50-60 minutes but with lower frequency on the Main Line at certain times of day. Neither presents an optimal connection between these two urban centers, located just 12 miles apart, as the crow flies. Travel time and access to transportation play an enormous role in community equity and often reveal disconnects between regional prosperity and local economic realities.

The existing NIT right-of-way offers potential travel enhancements between Paterson and Newark and numerous interfaces with significant intra- and interstate travel corridors, including the robust NJ Route 3 bus corridor. Intermodal opportunities exist throughout the study corridor, with developing nodes such as the ON3 development offering modern, mixed use activity hubs. The NIT is the last true remaining north-south, grade-separated corridor that could be developed exclusively for public transit use. If use of the corridor is not considered, or the right-of-way is compromised, such an opportunity may not present itself again.

Road Network

Local and regional traffic congestion is a concern frequently cited by stakeholders, including TAC members and the developers of ON3. Several projects are either in the planning stages or under construction to mitigate these issues, including Contract B Route 3/Route 46 Interchange. Based on observations and traffic conditions inventoried as part of this study, the street network experiences significant congestion, particularly in downtown Newark and downtown Paterson. In addition, NJ Routes 3 and 21 experience traffic delays particularly during typical commuter peak periods. Increased options for transit represent a fundamental strategy to mitigate continued congestion and capacity concerns on roads. Examples of key nodes and corridors cited by TAC members and project stakeholders as being problematic from a traffic standpoint include:

- NJ Route 3 (including pedestrian-bus accessibility limitations)
- NJ Route 7 (Broadway/Washington Avenue in Newark and Belleville)
- NJ Route 21
- Kingsland Road and various Nutley Township intersections
- Downtown Paterson
- Downtown Newark

Conversely, NJ Route 19 is a highway asset with excess capacity, ripe for opportunity for other uses. It contrasts with NJ Route 3, which experiences regular congestion. The region will benefit from transit investment that mitigates existing congestion and takes advantage of network links with excess capacity and available right-of-way.

The study area around the corridor presents limited right-of-way capacity; however, existing underused space such as empty parcels and industrial lots may be considered for use to support transit operations, including station stops and new or shared parking areas.

Infrastructure

The existing corridor infrastructure provides opportunities for enhanced network connectivity, with the following considerations:

Traffic operations: Observations and travel time data collected along the study area corridor indicate recurring congestion particularly during peak hours in the Paterson and Newark city centers as well as other signalized corridors. Priority treatments such as transit signal priority (TSP) should be implemented before any new transit service operates on the NIT or exclusive right-of-way. Taking advantage of excess capacity on NJ Route 19 represents an important opportunity to create provide dedicated transit running ways.

Bridge crossings: Given age and/or condition, six bridge structures along the NIT would likely require rehabilitation or replacement to support a new transit alignment. These include bridges over:

- Second River (Newark, Nutley)
- Mill Street (Belleville)
- Park Avenue (Nutley)
- Passaic Avenue (Nutley)
- Franklin Avenue (Nutley)
- Weasel Brook (Clifton)

The rehabilitation of the NIT bridge over Passaic Avenue would likely come at a significant cost and is currently only wide enough to serve a single travel lane/track.

Pavement conditions: These ranged from good to very poor. Pockets of deterioration, fatigue, and repair patching were evident throughout the corridor. More in-depth pavement evaluation is recommended to review questionable locations to identify the potential for segments to accommodate increased/heavier traffic.

Signal equipment: Traffic signals, including pedestrian signals (majority of which do not have countdown display) generally conform with National Electrical Manufacturers Association (NEMA) TS-1 specifications. Busy corridors in Paterson and Newark could benefit from a transit signal priority system to reduce transit delays.

Pedestrian accommodations: Pedestrian accommodations are intermittently available throughout the study area with pedestrian signals, sidewalks, Americans with Disabilities Act compliant curb ramps and crosswalks provided but generally do not provide connectivity through the corridor. New transit options can facilitate improved access to existing parks and active transportation networks, including potential trail and greenway components along the transit right-of-way and links to regional resources such as the Morris Canal Greenway. Importantly, emphasizing multi-modal facilities within the primary transit corridor can link regional facilities and open up additional project funding opportunities.

Environment

An environmental screening was conducted for the study corridor using a 300-foot buffer of the proposed route segments. Environmental Geographic Information System (GIS) data layers provided by the NJTPA and New Jersey Department of Environmental Protection (NJDEP) open data portals were used for this screening. The environmental constraints screened and revealed included:

- Hazardous waste (Classification Exception Areas [CEAs], Known Contaminated Site List [KCSL] properties, deed-noticed properties, and brownfield development areas)
- Cultural resources (historic districts, historic properties, and archeological sites)
- Natural resources (designated open space and Green Acres encumbered properties, threatened and endangered [T&E] species, 100-year flood zones, and NJDEP-mapped and U.S. Fish and Wildlife Services [USFWS] National Wetland Inventory [NWI]-mapped wetlands)

A range of issues was identified that would require further analysis for the advancement of a transit project, examples of which are shown on the accompanying map. However, the environmental concerns that were identified did not appear to present fatal flaws for a future project.

Reference documents for additional detail: Community Characteristics Technical Memorandum, Infrastructure Assessment Technical Memorandum.

Infrastructure

Paterson

Local street modifications required to provide dedicated transit rights-of-way.

Clifton

Right-of-way transition required to transition from NIT to NJ Route 19 or local streets.

Bridge rehabilitation required at Weasel Brook.

Nutley

Bridge rehabilitation required at Franklin, Park, and Passaic Avenues.

Belleville

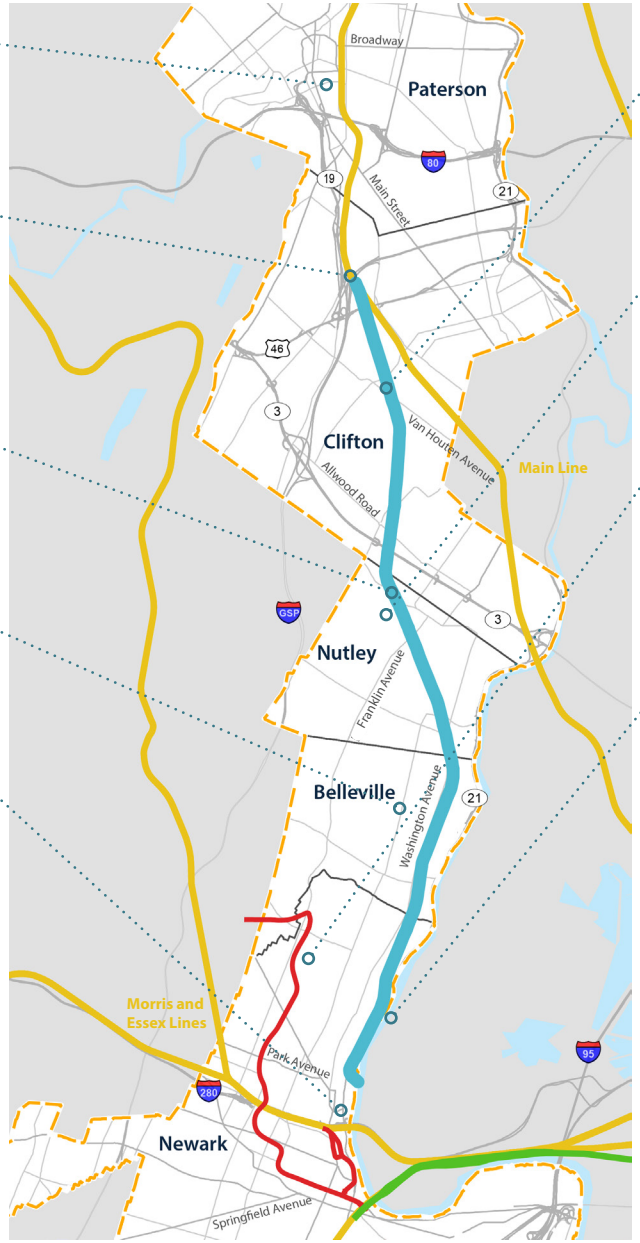
Bridge rehabilitation required at Mill Street.

Newark

Local street modifications required to provide dedicated transit rights-of-way and connections to Newark Light Rail.

Bridge rehabilitation required at Second River.

Figure 6. Study Area Considerations



Environment

Clifton

Four historic districts and associated contributing properties, one individually-listed historic property.

Nutley

One historic district and several individually-listed historic properties are located along the southern portion of the ROW.

Newark

Branch Brook Park is a historic district and Green Acres encumbered property located on either side of the westernmost end of the Orange Branch ROW.

Newark

The NIT line crosses the regulated floodplain of the Second River. The southern end of the alignment runs for approximately one mile parallel to and just west of the Passaic River and has portions within the Passaic River 100-year floodplain.

Mode & Alignment Options

Transit Modes Considered

Enhanced Bus & Bus Rapid Transit (BRT)

The Federal Transit Administration (FTA) defines BRT as a high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms and enhanced stations. Elements may be applied throughout, or in selective measure, and may be expanded as systems evolve. Enhanced bus would be similar to NJ TRANSIT's existing Go Bus service but may have modified transit signal priority or queue jump lanes that allow buses to bypass automobile traffic.

Commuter Rail

In the context of this study, the commuter rail option refers to a train that does not have overhead wires and can run on the NJ TRANSIT Main Line. As opposed to NJ TRANSIT Main Line service, however, this commuter rail may have fewer cars and look similar to trains on NJ TRANSIT's River LINE, a diesel light rail system. Dallas Area Rapid Transit's (DART) Cotton Belt Regional Rail vehicles are one such example.

Light Rail

Light rail often has a lower capacity than commuter rail, though in the context of this study both options would be relatively similar in passenger capacity. Light rail can operate in mixed traffic or in separate rights-of-way. This would be useful when connecting the existing Newark Light Rail to the NIT. Light rail

NJ TRANSIT's Go Bus

NJ TRANSIT

Connecticut's CTfastrak Bus Rapid Transit

Wikimedia Commons user Pi.1415926535

Dallas Area Rapid Transit's Cotton Belt Regional Rail

Dallas Area Rapid Transit

NJ TRANSIT's Newark Light Rail

NJ TRANSIT

vehicles are usually electric, so overhead wires would be required, or vehicle technology capable of operating underground at Newark Penn Station.

Conceptual Transit Alignments

The study team developed six initial mode and alignment options for consideration in the study corridor, which considered existing transit modes and services, right-of-way opportunities, and a range of complexity and anticipated cost. When developing the alternatives, the project team focused on the following objectives:

- Integration with existing transit services
- Multimodal connections
- Service to major regional trip generators (e.g., ON3, St. Joseph's Regional Medical Center)
- Opportunities for travel time improvements
- Station spacing appropriate to mode types (e.g., closer for enhanced bus)
- Potential for phased implementation

Potential station locations were developed, for the purpose of modeling, with many of the same considerations as the alignments including population centers, high employment locations, and potential transfers between existing transit services (e.g., NJ TRANSIT bus, light rail and commuter rail). Station locations were primarily envisioned for walkability and local community access, with some park & ride opportunities included at regional nodes. Capital investments such as rail and dedicated BRT rights-of-way provide a more predictable service for customers, a greater commitment to investment and service delivery, and attract developers more than traditional local bus.

Alignments developed herein were defined with enough specificity to inform the demand forecasting process. Each alternative includes important potential for extended alignments and connections to regional points of interest, including the Great Falls National Historic Park in Paterson and Newark Liberty International Airport, either directly or through coordinated transit links.

Alignment Options Summary

Alignment options were vetted and refined through an iterative process among Passaic County, Essex County, the NJTPA, NJ TRANSIT, and the consultant team. Once approved by these stakeholders, the project team presented and discussed alternatives with the TAC, which resulted in a new option (Hybrid BRT). The subsequent sections discussing the alignment options in greater detail are organized by mode: rail options first followed by bus options. Key summary statistics of the seven alignments are shown in Table 2.

Table 2. Alignment Options with Summary Statistics

Option	Number of Stations	Average Distance Between Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Minutes)
Light Rail A	19	0.8	Yes	48
Light Rail B	23	0.7	Yes	51
Commuter Rail ‡	21	0.7	No	47
Bus Rapid Transit A	18	0.9	Yes	41
Bus Rapid Transit B	18	0.9	Yes	52
Hybrid BRT § (with/without local diversion)	20/18	0.8/0.9	Yes	48/41
Enhanced Bus	19	0.8	Yes	65

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

‡ The Commuter Rail option assumes no wait time to transfer between light rail vehicles to the commuter rail vehicles

§ Developed following TAC discussion.

Light Rail Option A (via Broad Street)

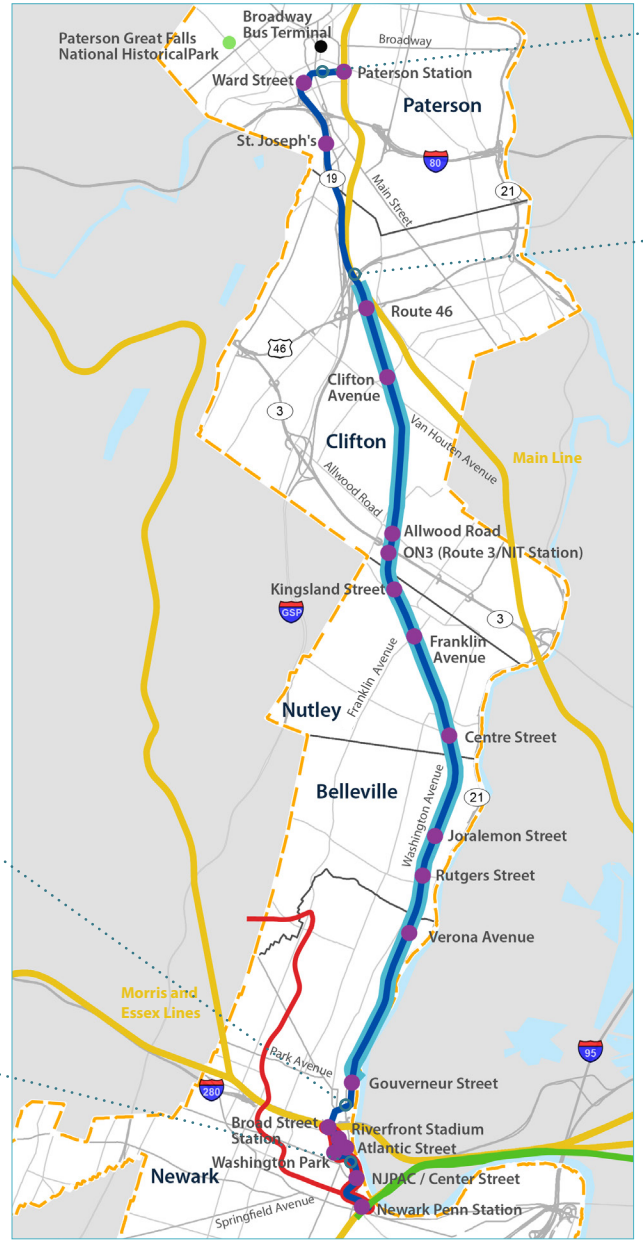
Light Rail Option A connects Newark Penn Station to Paterson Station. The new service would share Newark Light Rail tracks between Newark Penn Station and Broad Street station, extending north via on-street rights-of-way in Newark to connect with the NIT at 3rd Avenue. The alignment uses the full length of the NIT, transitioning to NJ Route 19 at the NIT's northern terminus, taking advantage of dedicated transit space along NJ Route 19, and entering Paterson via Ward Street.[2]

This option would also require the use of the NIT bridge over Passaic Avenue in Nutley, which could be a significant capital investment. A major benefit to this option is the 48-minute runtime (no transfers required) between Newark and Paterson, making it one of the fastest options. Additionally, this option would be fully integrated into the existing Newark Light Rail system, making for a seamless regional rail network.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
19	0.8	Yes	48

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

Figure 7. LRT A Alignment & Stations



2 It is assumed that an existing travel lane in each direction on NJ Route 19 would be converted to a transit-only lane. Municipal stakeholders suggested that Route NJ 19 has excess capacity, so no expansion of NJ Route 19 is anticipated for any of the alternatives.

Figure 8. LRT A - Paterson Detail

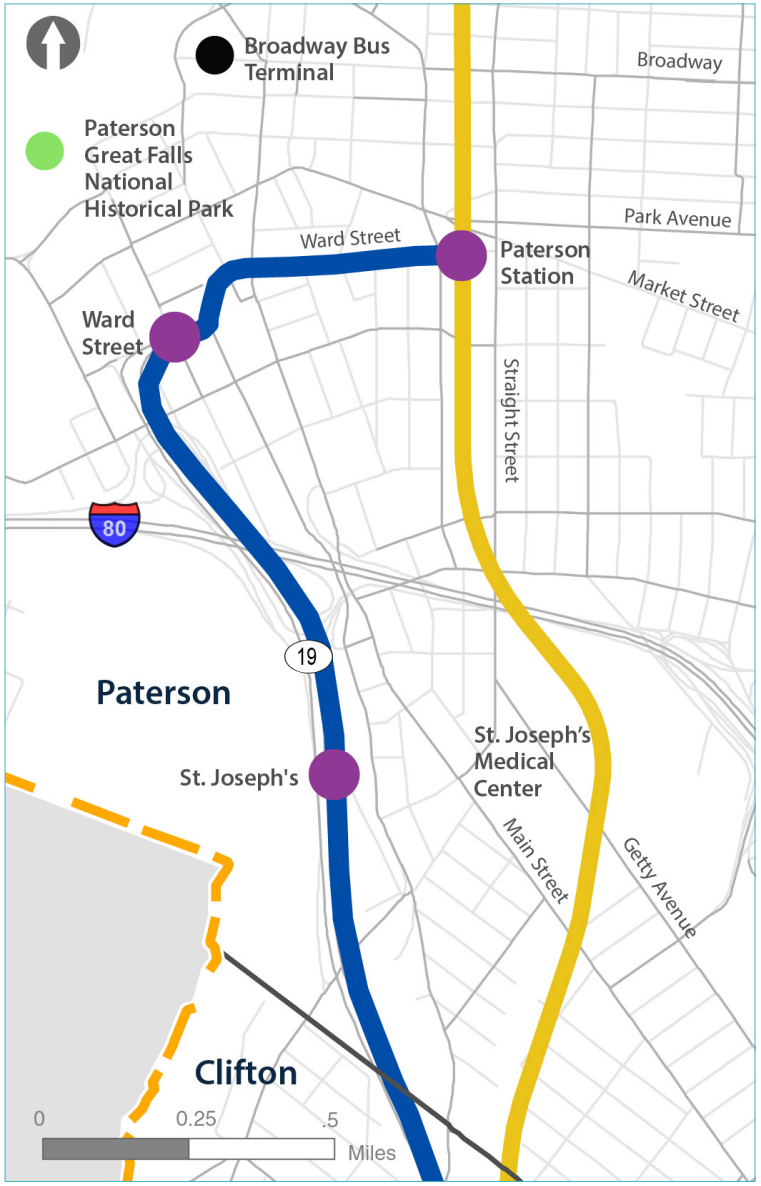
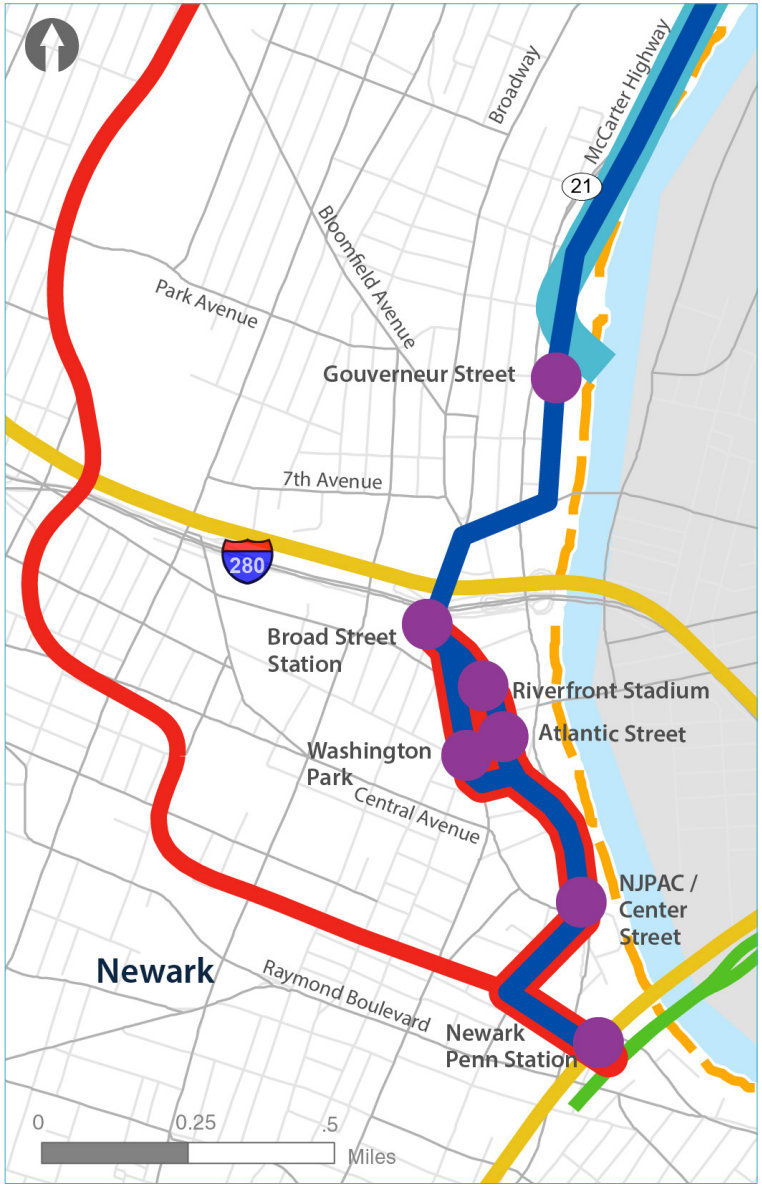
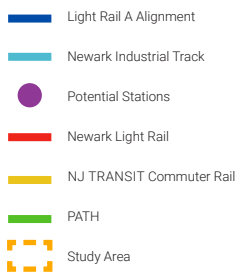


Figure 9. LRT A - Newark Detail





Light Rail Option B (via Branch Brook Park)

Light Rail Option B runs from Newark Penn Station to Paterson Station. It uses the existing Newark Light Rail alignment to Grove Street. Rather than terminating at Grove Street, the light rail would head east toward the NIT using the existing Boonton Line right-of-way until connecting to the NIT. At this point, rail cars would head north along the NIT until its terminus near the Garden State Parkway, transitioning to NJ Route 19 and entering Paterson from Ward Street.

Considering most of the alignments of Light Rail Options A and B are identical, Light Rail Option B has many of the same opportunities and challenges as Light Rail Option A. Opportunities include full integration with the Newark Light Rail system and additional multi-modal opportunities that may arise with greenway components along the transit right-of-way, such as connections to Branch Brook Park and the proposed Morris Canal Greenway (which crosses the Orange Branch right-of-way in Newark). End-to-end travel time is only slightly longer than Light Rail A. Construction costs via the Boonton Line right-of-way may be lower than the longer on-street alignments for Light Rail A in Newark.

The end-to-end runtime of 51 minutes is an estimated three minutes longer than Light Rail Option A because of the longer routing on the Newark Light Rail to Grove Street. Challenges include the relatively high cost of rail investment and addressing the NIT bridge in Nutley.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
23	0.7	Yes	51

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

Figure 10. LRT B Alignment & Stations

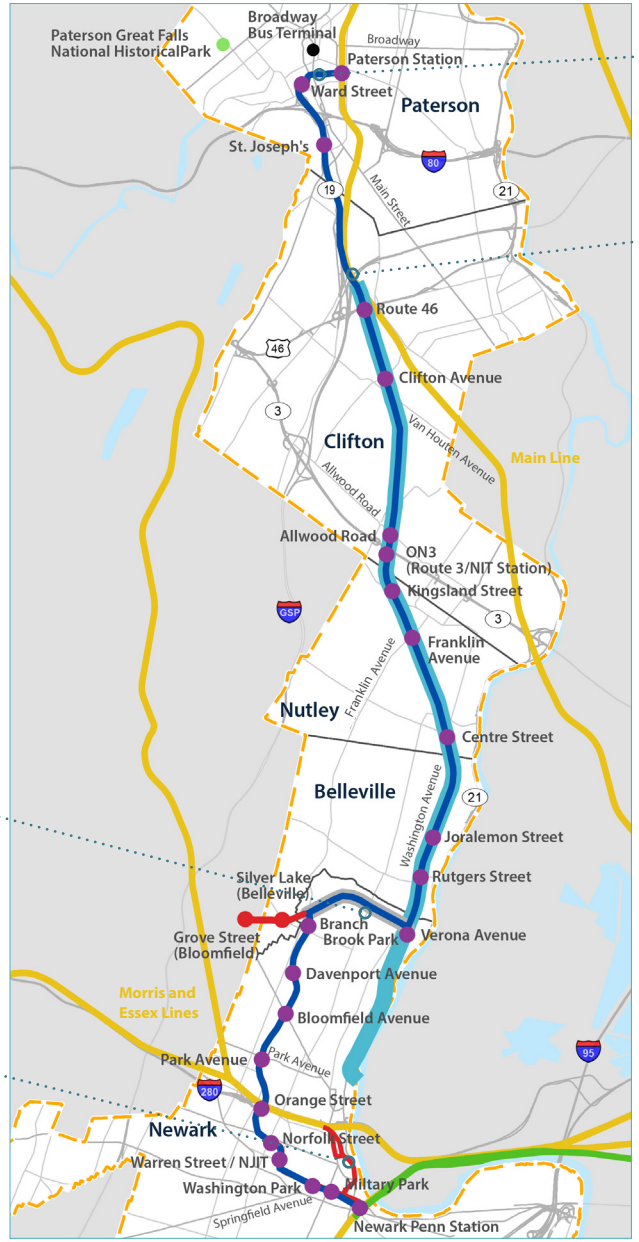
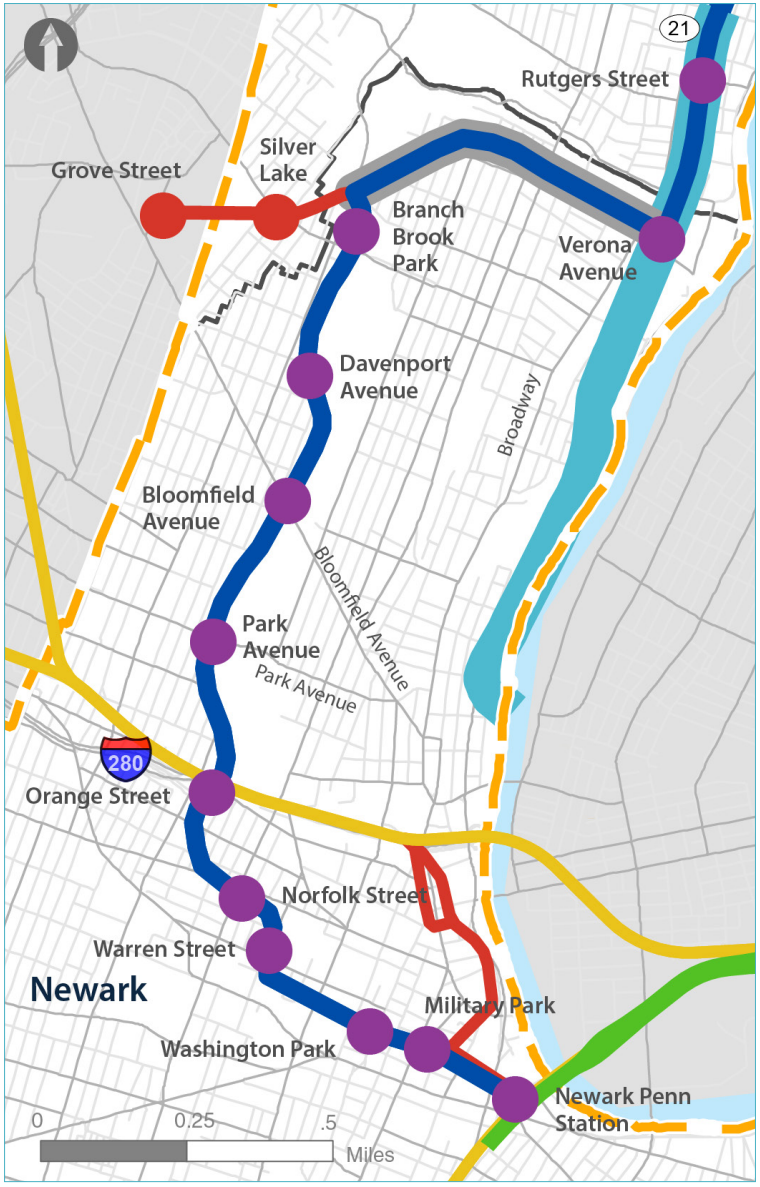


Figure 11. LRT B - Paterson Detail

Figure 12. LRT B - Newark Detail



Legend

- Light Rail B Alignment
- Newark Industrial Track
- Boonton Line Orange Branch ROW
- Potential Stations
- Newark Light Rail
- NJ TRANSIT Commuter Rail
- PATH
- Study Area

Commuter Rail

The Commuter Rail Option connects Newark Penn Station to Paterson Station but requires a transfer between the new alignment and the Newark Light Rail system. Commuter rail would require a new, eastward extension of the Newark Light Rail alignment from Branch Brook Park station toward the southern end of the NIT using the old Boonton Line Orange Branch right-of-way. This would be a two-seat ride for passengers, requiring a transfer from the light rail to commuter rail at Verona Avenue in Newark. The commuter rail alignment would begin at Verona Avenue and continue north along the NIT until it connects at the NJ TRANSIT Main Line near the Garden State Parkway in Clifton. Trains may terminate at the existing Paterson Station or continue north on the Main Line.

For the purposes of modeling, a 47-minute travel time was estimated, including the transfer between commuter rail and light rail; however, passenger journey times may be longer between Newark and Paterson depending on service frequencies of each line. This concept envisioned smaller trainsets than traditional commuter rail. The feasibility of integrating this line into the larger NJ TRANSIT rail network requires further technical study. This option would not allow for a stop at St. Joseph's Regional Medical Center, which was previously studied by NJ TRANSIT and deemed infeasible at the time due to spatial and capital cost constraints.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
21	0.7	No	47

The Commuter Rail option assumes no wait time to transfer between light rail vehicles to the commuter rail vehicles

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

Newark Light Rail extension necessary to allow transfer at Verona Avenue

Figure 13. Commuter Rail Alignment & Stations

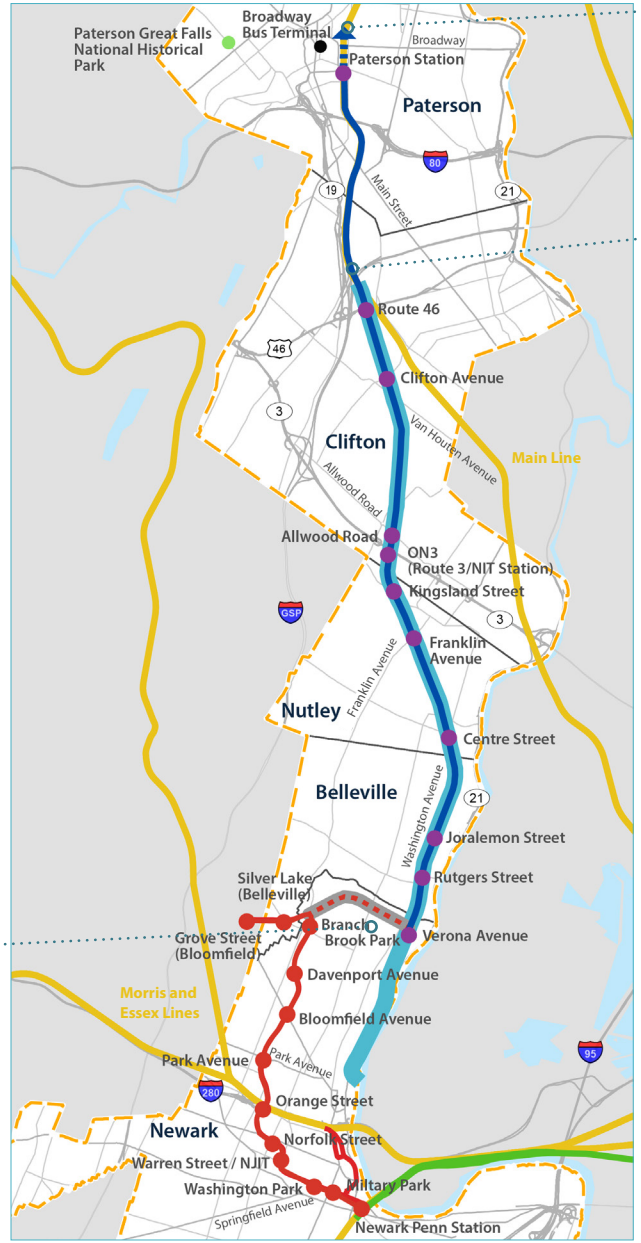
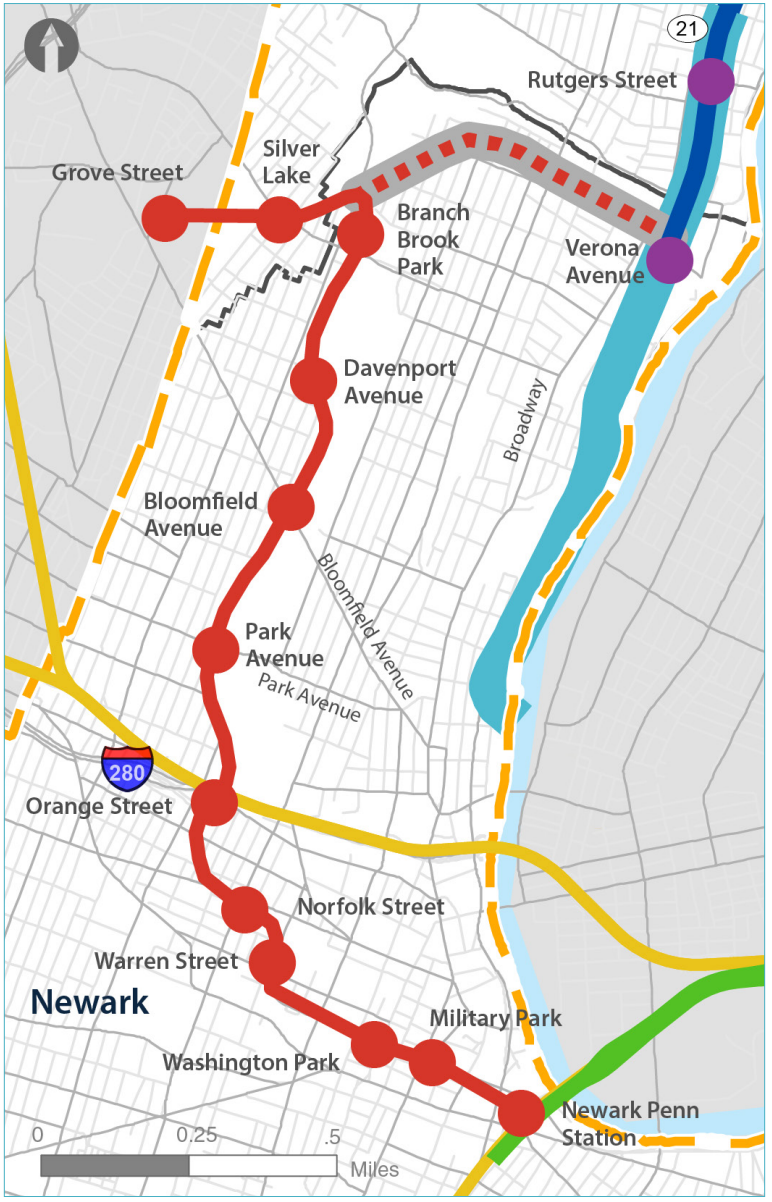


Figure 14. Commuter Rail - Paterson Detail

Figure 15. Commuter Rail - Newark Detail



Bus Rapid Transit Option A

BRT Option A connects Newark Penn Station to Broadway Bus Terminal in Paterson. Similar to Light Rail Option A, it shares the Newark Light Rail Broad Street Extension right-of-way between Newark Penn and Broad Street Stations before an on-street transition to the NIT.[3] Vehicles leaving the northern end of the NIT would continue along NJ Route 19 via a dedicated bus lane [4] and enter Paterson via Ward Street, with bus priority treatments and connections to other services at the Broadway Bus Terminal. The estimated runtime of this route is about 40 minutes end-to-end.

Buses using the full NIT would see fewer unexpected delays, while the Newark Light Rail right-of-way and dedicated bus lanes on NJ Route 19 further improve performance into the urban centers. Significant infrastructure investments include the reconstruction of the NIT bridge in Nutley and on/off ramps to transition vehicles between the NIT and NJ Route 19.

Benefits include the ability for other regional bus services to use some or all of the dedicated busways. Similarly, busways offer valuable opportunities for emergency service vehicles to avoid local congestion when responding to calls and the potential for complementary greenway and active transportation facilities in the corridor.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
18	0.9	Yes	41

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

3 Use of the Newark Light Rail alignment for buses is technically feasible, though this option would need to be explored further because it may prove costly to adapt the existing infrastructure. This exercise is for demand forecast modeling purposes and not a detailed study of infrastructure. A more detailed study of infrastructure would be required if any options move forward with implementation.

4 It is assumed that an existing travel lane in each direction on NJ Route 19 would be converted to a transit-only lane. Municipal stakeholders suggested that NJ Route 19 has excess capacity, so no expansion of NJ Route 19 is anticipated for any of the alternatives.

Figure 16. BRT A Alignment & Stations

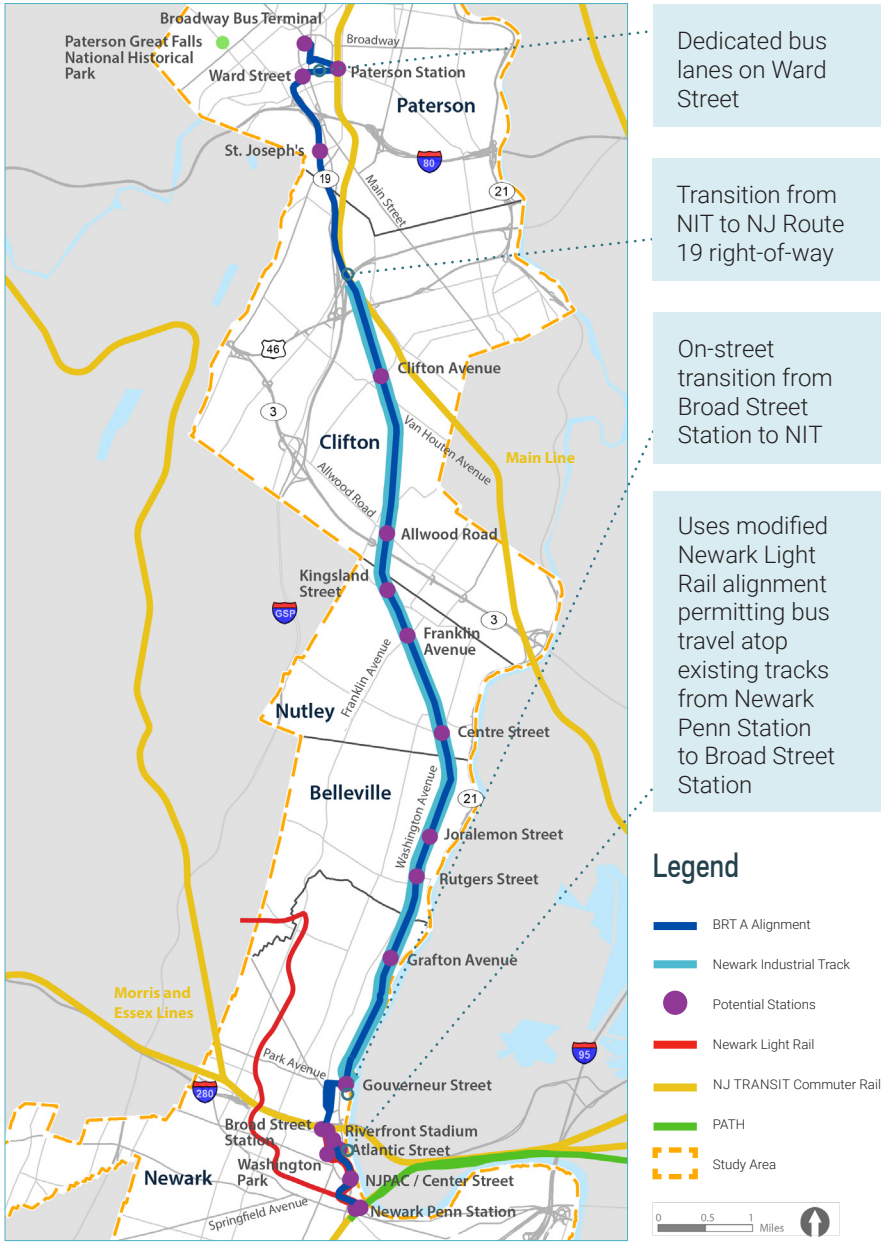
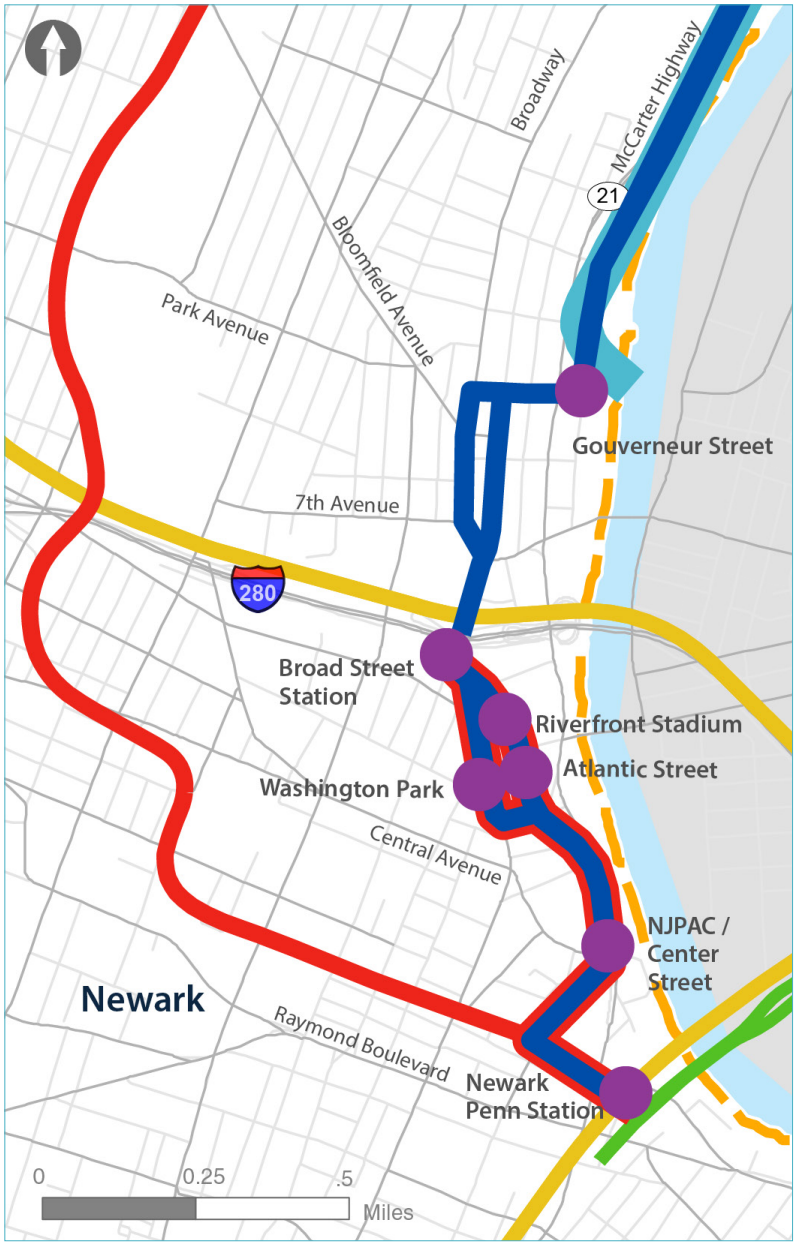


Figure 17. BRT A - Paterson Detail

Figure 18. BRT A - Newark Detail



Bus Rapid Transit Option B

BRT Option B runs from Newark Penn Station to Broadway Bus Terminal. It uses existing, mixed-traffic bus route alignments in Newark to reach the southern terminus of the NIT, then follows the NIT until it crosses Washington Avenue in Nutley. At this point, buses would travel along Washington Avenue north and turn at Kingsland Street, passing through the ON3 development before re-joining the NIT. Vehicles would exit the northern terminus of the NIT via Kuller Road. The buses would use Straight Street to run from St. Joseph's Regional Medical Center to downtown Paterson.

Unlike BRT Option A, this alignment avoids the NIT bridge in Nutley and provides direct access to ON3 and St. Joseph's Regional Medical Center. The northern terminus may be less capital-intensive because an at-grade crossing of the NJ TRANSIT Main Line onto Kuller Road may be feasible. However, there option poses an increased potential for delay in Newark, Nutley, and Paterson due to the use of mixed-traffic roadways. Overall, this alignment results in an estimated runtime of 52 minutes, about 10 minutes longer than BRT Option A. Potential active transportation and multi-modal components are applicable along dedicated rights-of-way.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
18	0.9	Yes	52

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

Figure 19. BRT B Alignment & Stations

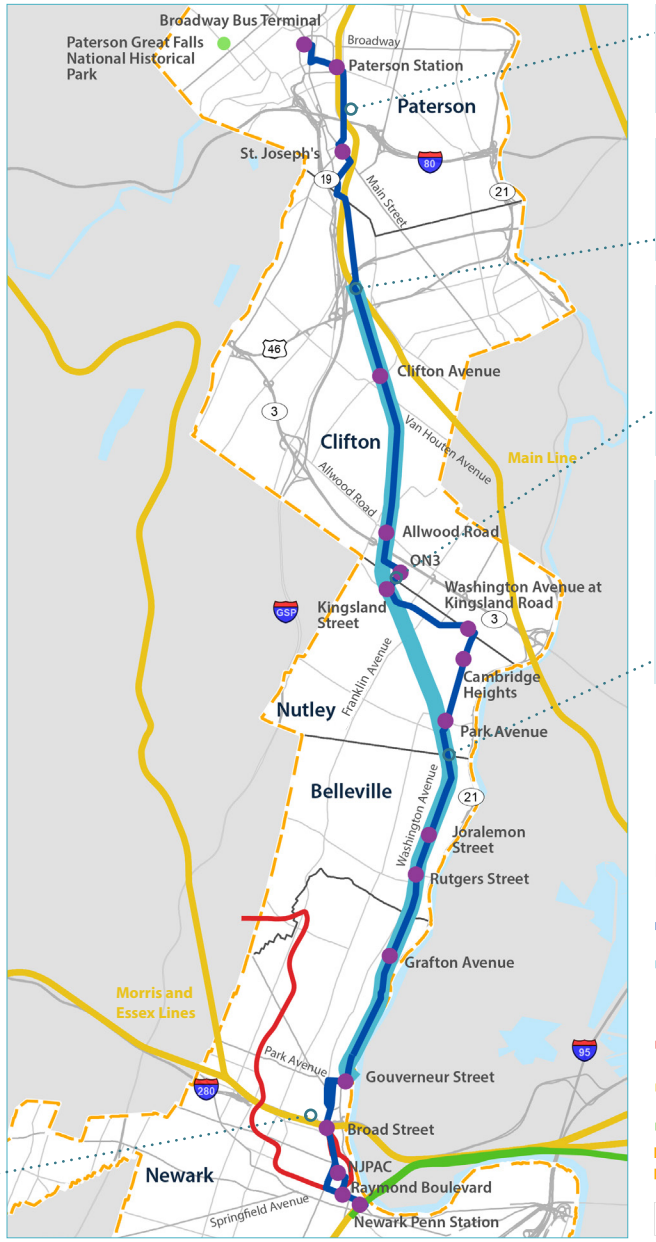
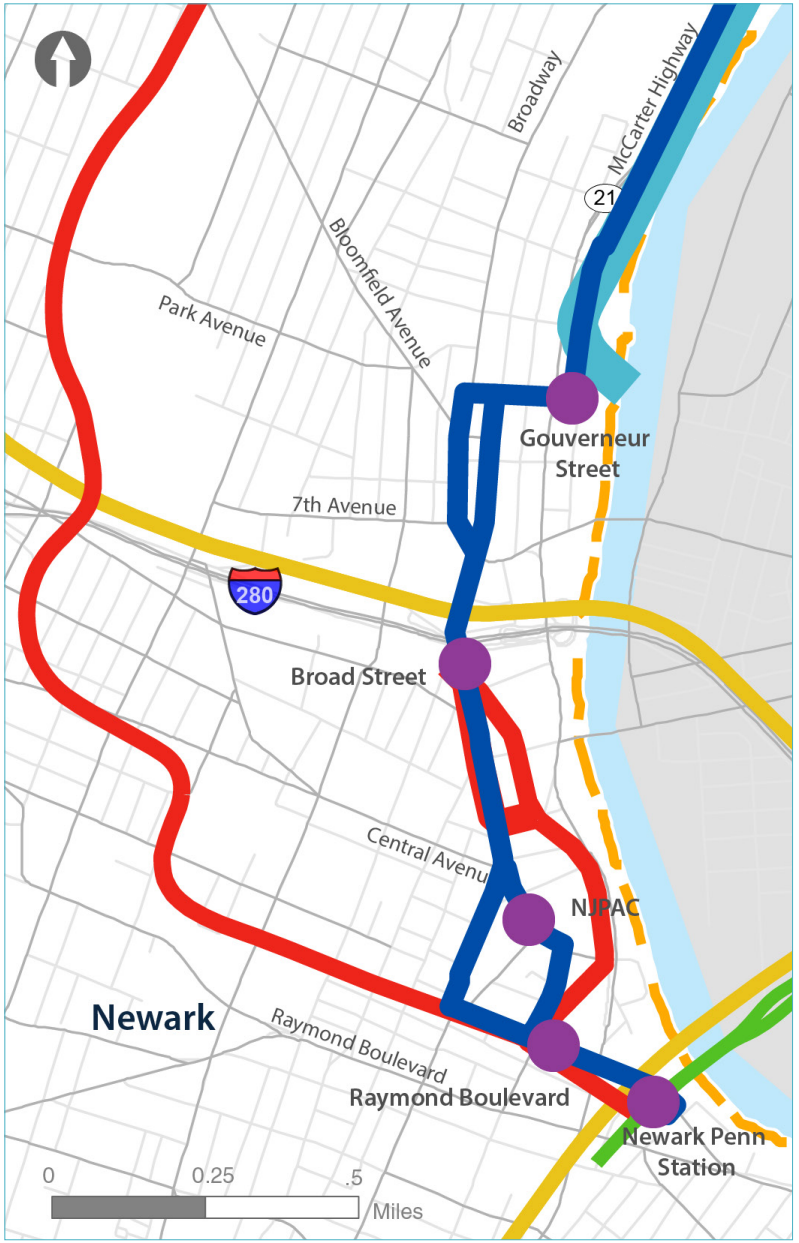


Figure 20. BRT B - Paterson Detail

Figure 21. BRT B - Newark Detail



Hybrid BRT Option

Following discussion and feedback from the study TAC, a hybrid BRT option was developed, incorporating elements of BRT A and BRT B. In this hybrid, buses would use the existing Newark Light Rail alignment and stations from Newark Penn Station to Broad Street,[5] transitioning to local streets to reach the southern terminus of the NIT near 3rd Avenue in Newark. For the purposes of modeling and flexibility, the hybrid BRT would operate a split service pattern through Nutley.

Trips alternate between a direct path through Nutley on the NIT and an on-street diversion via Washington Avenue, Kingsland Street, and the interior of ON3 before rejoining the NIT. After the northern end of the NIT, all BRT trips would continue along NJ Route 19 via a dedicated bus lane and enter Paterson via Ward Street to serve Paterson Station and the Broadway Bus Terminal.[6]

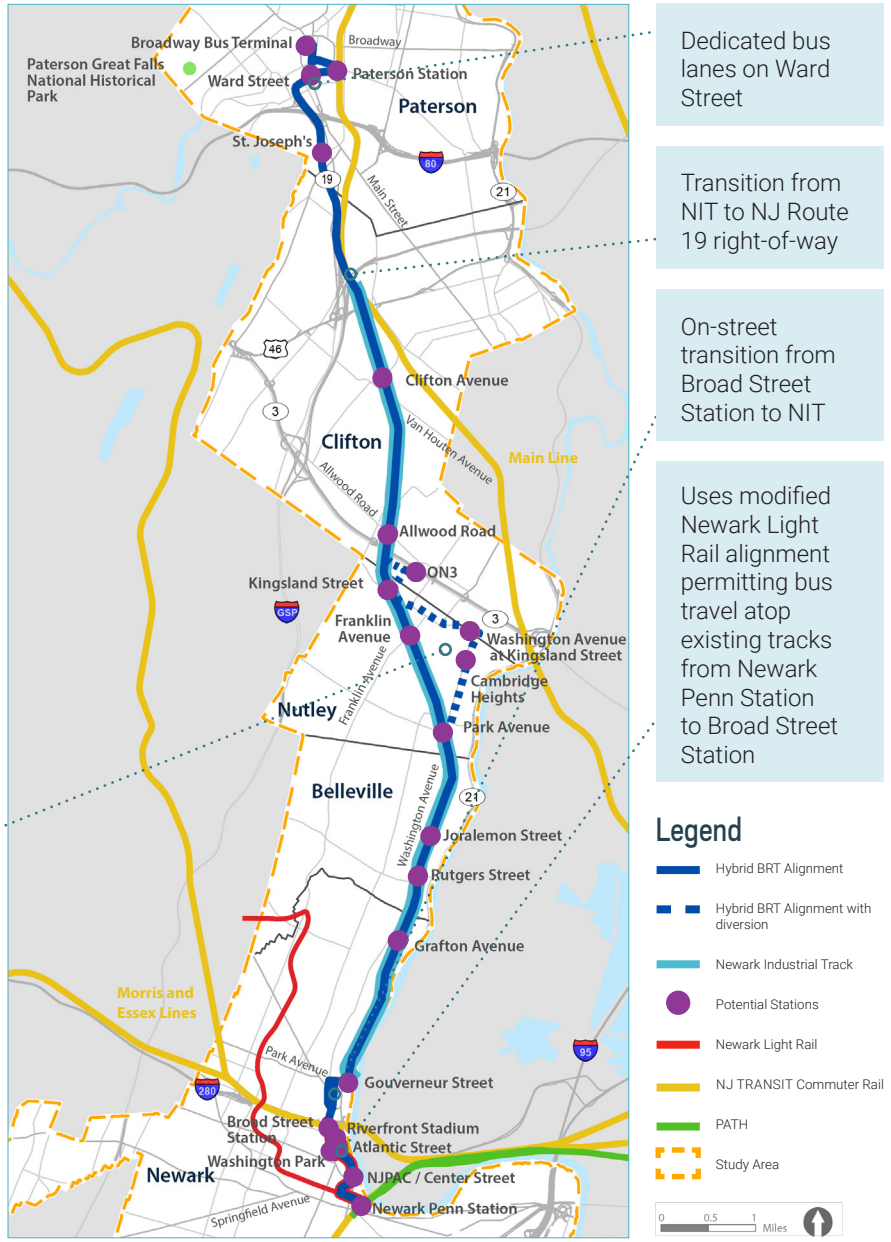
On-street segments add seven minutes of runtime relative to the NIT; however, this hybrid option demonstrates the flexibility of BRT and the ability to transition more frequently between dedicated rights-of-way and local streets. BRT treatments offer opportunities to enhance existing bicycle and pedestrian linkages, while the dedicated rights-of-way may offer more significant, regional multi-modal links.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
20/18	0.8/0.9	Yes	48/41

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

Alternating service pattern via NIT and local streets through Nutley

Figure 22. Hybrid BRT Alignment & Stations

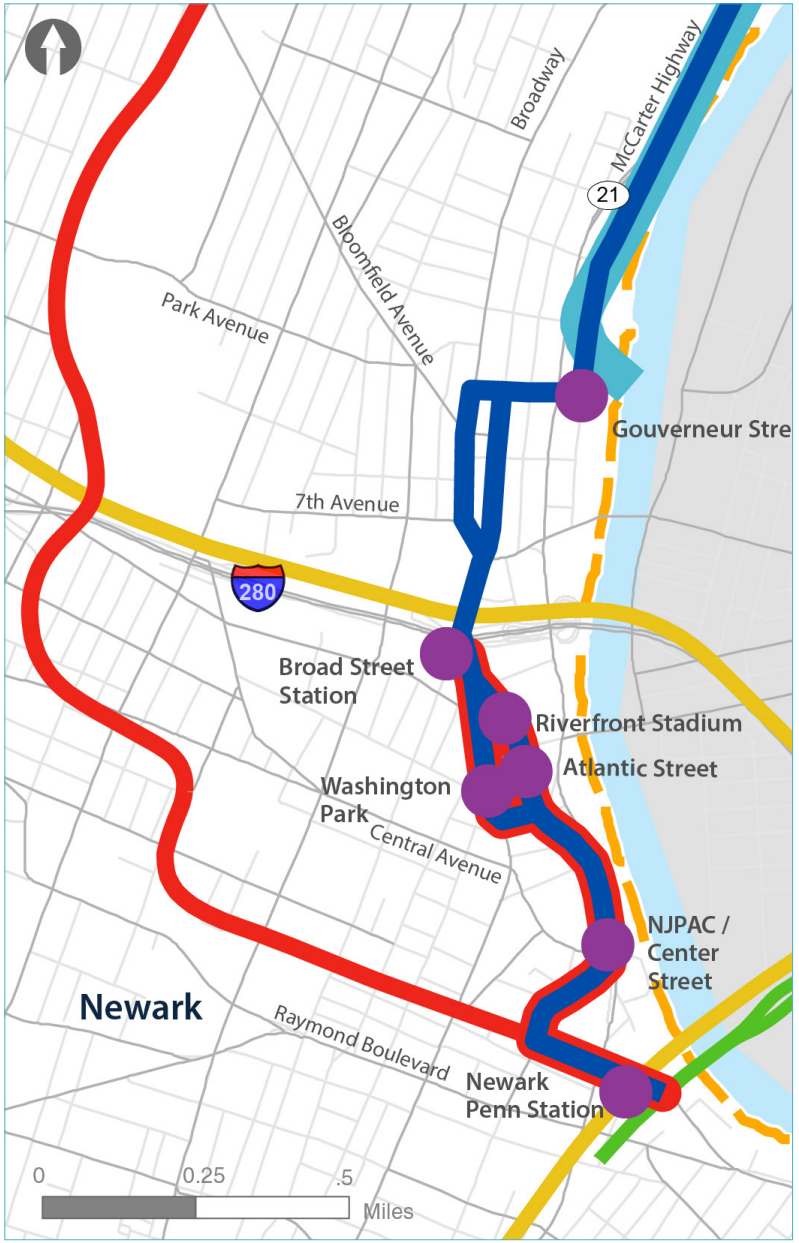


5 Use of the Newark Light Rail alignment for buses is technically feasible, though this option would need to be explored further because it may prove costly to adapt the existing infrastructure. This exercise is for demand forecast modeling purposes and not a detailed study of infrastructure. A more detailed study of infrastructure would be required if any options move forward with implementation.

6 It is assumed that an existing travel lane in each direction on NJ Route 19 would be converted to a transit-only lane. Municipal stakeholders suggested that NJ Route 19 has excess capacity, so no expansion of NJ Route 19 is anticipated for any of the alternatives.

Figure 23. Hybrid BRT - Paterson Detail

Figure 24. Hybrid BRT - Newark Detail



Enhanced Bus

The Enhanced Bus Option connects Newark Penn Station to the Broadway Bus Terminal in Paterson without any dedicated rights-of-way, following the Broad Street/Broadway/Washington Avenue/Kingsland Street corridors in Newark, Belleville, and Nutley. The proposed route passes through ON3 in Nutley and Clifton and directly serves St. Joseph's Regional Medical Center in Paterson before reaching Paterson Station and the Broadway Bus Terminal.

Because it does not use the NIT, the Enhanced Bus alignment is more flexible and requires minimal capital investment. It is assumed that this option would incorporate a modified transit signal priority system to allow for faster, more reliable travel than the existing network provides. Transit-only lanes or queue jump lanes may be explored at strategic locations to mitigate traffic delay.

Coordination between NJ TRANSIT and NJTDOT and other regional agencies could yield pilot intelligent transportation system (ITS) projects to improve traffic flow on and around the NJ Route 3 corridor would offer state-of-the art transit and traffic management potential around the ON3 development, with benefits extending to one of the state's busiest bus corridors.

The lack of dedicated rights-of-way results in the slowest running time. While faster than NJ TRANSIT Route #72's scheduled runtime of 75 minutes, Enhanced Bus would not be as competitive with private auto trips as other alternatives. However, this option offers an early action for phased implementation of more robust transit improvements.

# of Stations	Avg. Distance Btwn. Stations (Miles)	One-Seat Ride*	End-to-End Runtime (Mins)
19	0.8	Yes	65

* Travel on alignment from Newark Penn Station to northern terminus in Paterson without a required transfer

Figure 25. Enhanced Bus Alignment & Stations

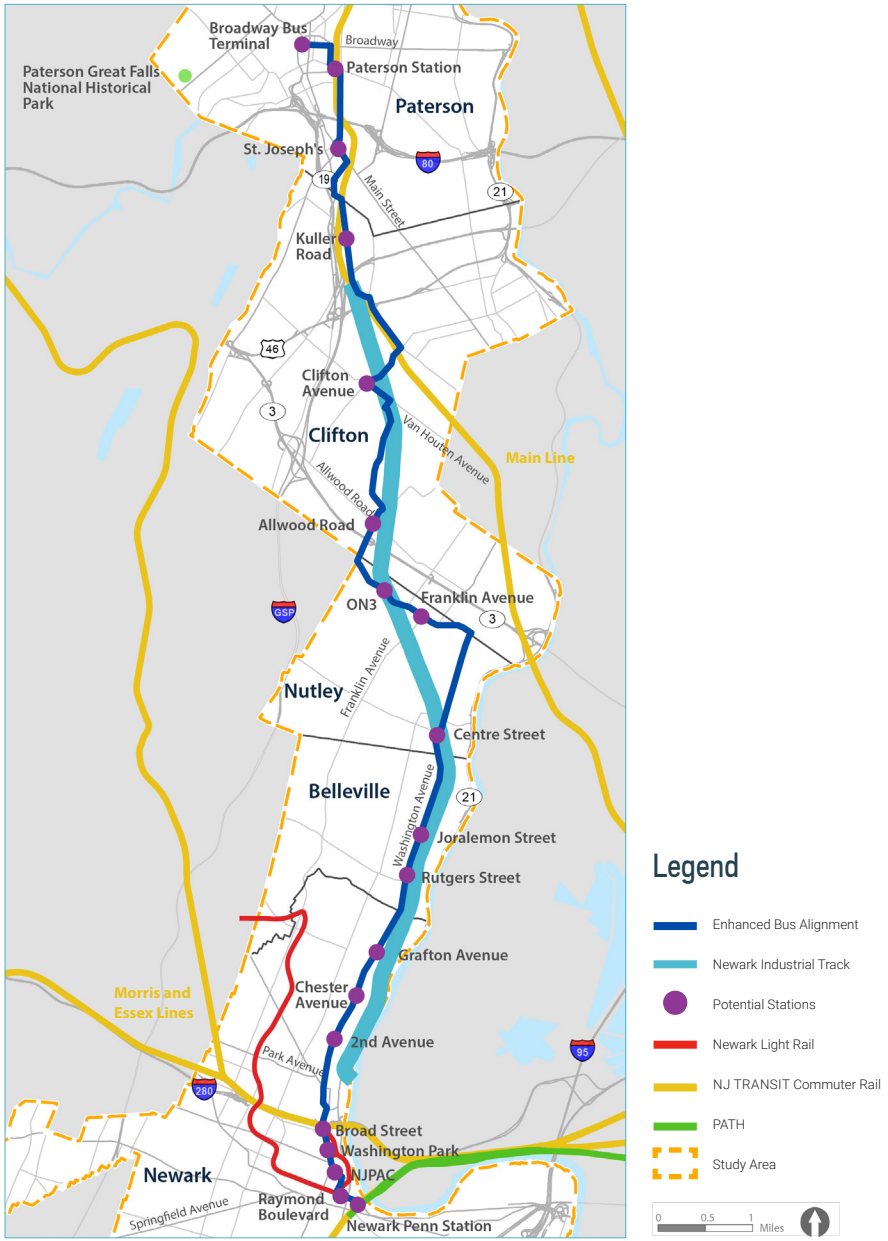
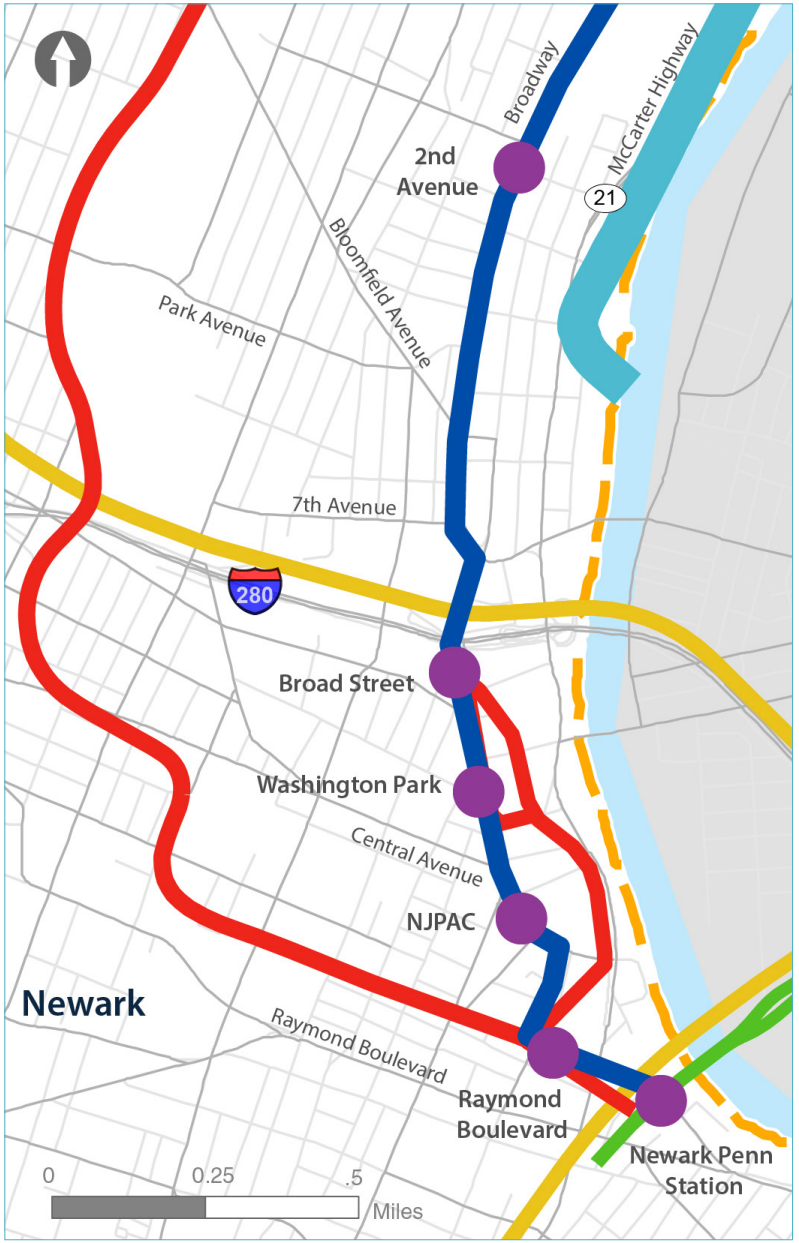


Figure 26. Enhanced Bus - Paterson Detail

Figure 27. Enhanced Bus - Newark Detail



Demand Forecast Model Selection

Screening by the study team, NJ TRANSIT, and the TAC resulted in the selection of three options for further analysis using NJ TRANSIT's demand forecast model: Light Rail A, Light Rail B, and the Hybrid BRT. These three options served as the basis for the study's market assessment to validate ridership potential, potential trip diversions from automobiles, and related attributes. The selection for modeling is summarized in the following table, including decision factors for selection.

Reference document for additional detail: Alignment Selection & Demand Forecast Input Technical Memorandum

Table 3. Alternative Selection for Demand Forecast Model

Option	Selected for Modeling?	Notes
Light Rail A	**Yes**	• **Seamless connection with existing Newark Light Rail** • **Direct, efficient travel path between Newark and Paterson** • **Serves major corridor destinations, including ON3 and St. Joseph's Regional Medical Center** • **Connections to NJ TRANSIT rail at Newark Penn Station and Broad Street Station**
Light Rail B	**Yes**	• **Seamless connection with existing Newark Light Rail** • **Additional destinations served in downtown Newark** • **Boonton Line Orange Branch ROW may cost less than on-street connection to NIT** • **Serves major corridor destinations, including ON3 and St. Joseph's Regional Medical Center** • **Connections to NJ TRANSIT rail at Newark Penn Station and Broad Street Station**
Hybrid BRT	**Yes**	• **BRT elements offer similar performance and connectivity as light rail** • **Flexibility of mode allow for potential use of dedicated rights-of-way by other bus services** • **TAC and community interest in evaluation of NIT and local street options in Nutley** • **Capital and operating costs expected to be lower than light rail**
Commuter Rail	No	• NJ TRANSIT Main Line operational constraints • Inability to connect to Newark Penn Station requires customer transfer to Newark Light Rail • Newark Light Rail extension also required to meet commuter rail at NIT terminus
Bus Rapid Transit A	No	• Elements combined with BRT B to create Hybrid BRT
Bus Rapid Transit B	No	• Elements combined with BRT A to create Hybrid BRT • On-street alignment between Newark Penn Station and Broad Street Station may be applied to Hybrid BRT
Enhanced Bus	No	• Longer travel times relative to rail and BRT • Lack of dedicated rights-of-way subject mode to local traffic congestion • Enhanced Bus remains a viable interim step in path to light rail or BRT implementation

Market Assessment

The ridership forecasts conducted for this study demonstrate strong market potential for new transit service from Paterson to Newark and validate the conceptual alignment alternatives developed. At the corridor level, these conclusions set the stage for further evaluation of these alternatives and other potential transit enhancements. The model analysis requires definition of station locations, parking capacity, and other attributes; however, this study does not put forth such details as recommendations. Instead, these details should be pursued in subsequent alternatives analysis, EIS, and preliminary design.

The forecast results described herein indicate a positive response to the new modes and alignments, underscore the potential to affect mode shift from auto trips to transit, and compare well with key bus routes and/or nearby commuter rail performance. Ridership forecasts alone are inconclusive as a determinant to select one alternative above another and ridership is emphasized at the segment level rather than by station.

Complementary perspectives, including desires for enhanced transit options from local communities, developers (e.g., ON3), and transit riders demonstrate holistic value for a project in this corridor. The ability to link two major urban job markets, better serve residential and commercial development along the corridor, and improve regional transit connections to New York City, Bergen, Hudson, and Union Counties is an exciting prospect. The ability to create a new service in this corridor, home to significant environmental justice populations in central Paterson and northern Newark, underscores the market potential. Greenway and active transportation components along the transit right-of-way can provide additional benefit to residents and businesses throughout the corridor.

Methodology and Assumptions

The study team collaborated with NJ TRANSIT to conduct the requisite transportation demand modeling which was at the core of this study's transit market analysis. NJ TRANSIT used its Transit Demand Forecast Model (NJTDFM) for the analysis, which is a robust model that includes northern New Jersey's full transportation network as well as regional links to New York City, the lower Hudson Valley, western Long Island, and eastern Pennsylvania.

The model is calibrated with NJTPA's 2040 regional growth forecast, which accounts for known and approved development. It does not account for induced growth related to future development opportunities, such as transit-oriented development (TOD) that may be spurred by new transit service from Paterson to Newark. As a result, additional ridership and economic and social benefits are possible, but not reflected in the results. To inform the modeling process, each alternative included the following attributes:

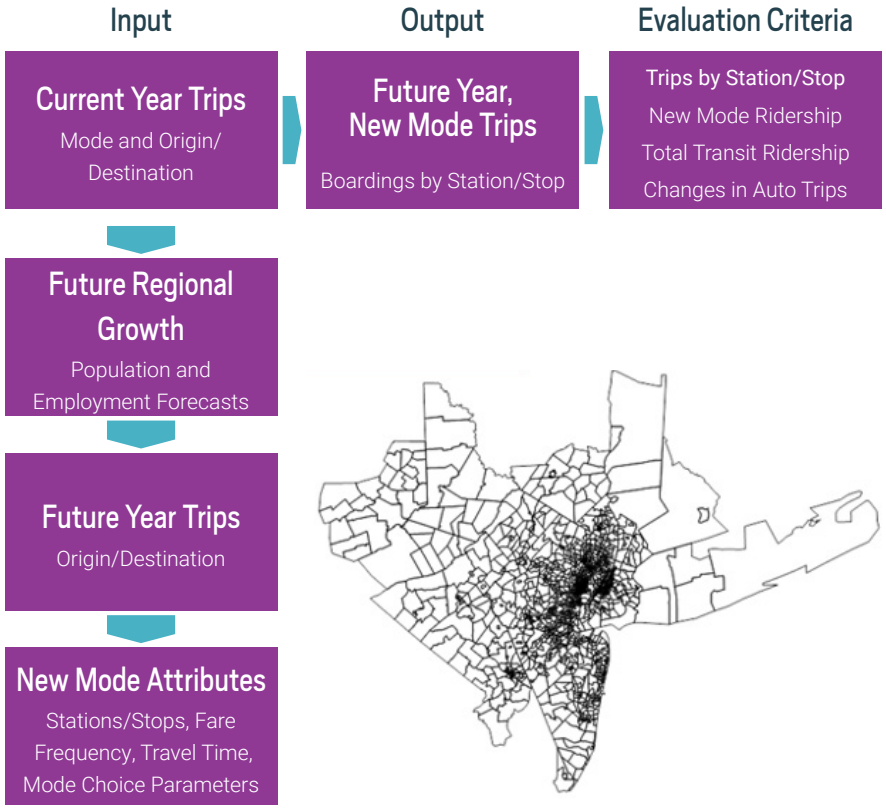
- Station/stop locations
- Access points
- Transit travel time
- Fares
- Service frequency

For this effort, the study team coordinated with NJ TRANSIT in the development of model inputs to ensure effective modeling of key locations such as the ON3 development in Nutley and Clifton. Baseline assumptions

concerning development and population growth were reviewed and updated to properly reflect the project context, with input from Passaic and Essex counties and NJTPA.

The model process takes a series of inputs, including demographic and employment data, future year trip origins and destinations, and new mode attributes, and tests each new alignment within the context of the regional network. A series of outputs provide a picture of alternative performance in terms of ridership (boardings by station/stop) and related impacts such as new mode ridership, total transit ridership, and diversions from existing transit and automobile trips.

Figure 28. Model Process Summary



Demand Forecast Model Results

The NJ TRANSIT model produced ridership estimates for four scenarios, including the three selected alternatives and a 2040 No Build condition. The No Build is defined as future ridership on existing transit systems (bus and rail) without new transit service from Paterson to Newark. Projected 2040 ridership was also produced for each of the three mode and alignment alternatives, including existing transit services and segments (e.g., Newark Light Rail) and new segments associated with this project. This study focuses on the performance of the three modeled alternatives, with qualitative discussion of regional effects.

The following outputs are evaluated based on NJ TRANSIT's demand forecasting results:

- Total ridership on proposed mode, including station estimates where appropriate
- Changes in total transit ridership in the corridor
- Shifts in mode, particularly auto trip diversions to transit
- Improved mobility in the corridor, including effects on environmental justice communities

Throughout this study, attention was paid to potential impacts to environmental justice communities. All three transit alternatives would improve access to employment, education, and other key trip destinations in similar measure for existing environmental justice populations.

Ridership by Alternative

Ridership is defined as passenger boardings, i.e., each time a person boards a transit vehicle. For each alternative, ridership is broken out by existing segments (in the case of the two light rail alternatives), new segments, and total daily ridership. Emphasizing the new segments associated with

Figure 29. Alternative Segments (New and Existing)

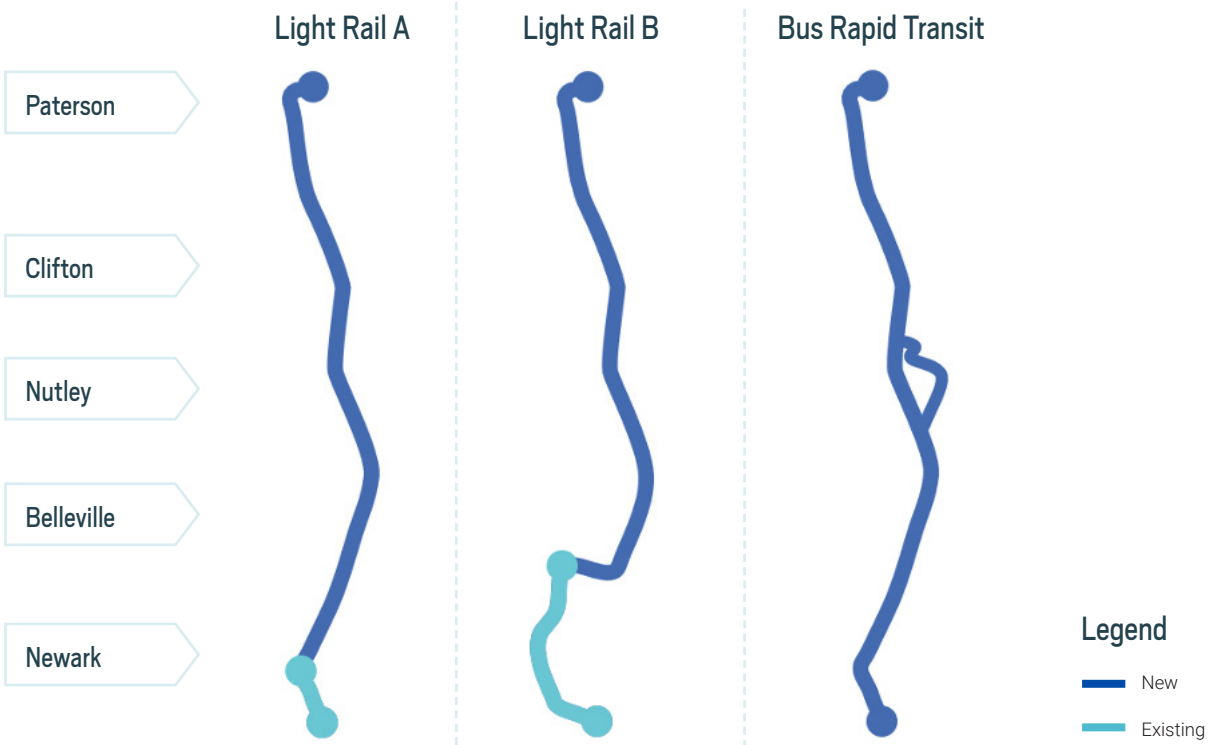


Table 4. Ridership by Alternative (Average Daily Boardings)

	2040 - No Build	2040 - Light Rail A	2040 - Light Rail B	2040 - Bus Rapid Transit
Existing Segments	20,340	27,100	23,740	
New Segments	N/A	10,600	8,760	11,460
Total Daily Boardings	**20,340**	**37,700**	**32,500**	**11,460**

Emphasis on new segment comparison

Table 5. Changes from No Build (Change in Average Daily Boardings)

	2040 - No Build	2040 - Light Rail A	2040 - Light Rail B	2040 - Bus Rapid Transit
Existing Segments	N/A	6,760	3,400	
New Segments	N/A	10,600	8,760	11,460*
Total Daily Boardings	N/A	**17,360**	**12,160**	**11,460**

Ridership gains of existing Newark Light Rail

Total ridership growth from no-build

* Bus Rapid Transit shares the Newark Light Rail alignment and stations from Newark Penn Station to Broad Street Station. Only new BRT-specific ridership is shown here.

the three alternatives (i.e., setting aside existing ridership on the Newark Light Rail system), the three options perform comparably. BRT exhibits the greatest new system ridership, while not explicitly distinguishing new and existing bus ridership in the corridor (e.g., NJ TRANSIT #72). Existing bus ridership is factored into transit trip diversions.

Performance in Regional Context

The overall performance of the three alternatives is strong individually and compared to the No Build. An overall increase in transit usage in the corridor due to the addition of service in the network. For comparison, the following table relates total ridership for each alternative (new and existing segments) relative to projected 2040 ridership on some representative NJ TRANSIT services. Projected 2040 ridership for other NJ TRANSIT services reflects the network changes associated implementation of with each new alternative.

Light rail ridership (Light Rail A and B) is presented as new ridership and total Newark Light Rail system ridership upon implementation of either alternative, which would see growth on existing segments as well as the new alignment to Paterson. The BRT concept has the greatest flexibility and ability for other existing bus services to benefit from using portions of the dedicated right-of-way. While existing services such as NJ TRANSIT's #72 and #74 buses may be reconfigured as feeder or modified local services to complement the new alternatives, they would likely continue to operate as they do not align entirely with the NIT. However, this impact was not included in these ridership forecasts, which were devised to test specific point-to point service concepts in the study corridor but not broad network service changes. Additional study is required to further explore additional service design and ridership implications.

Ridership by Municipality

Ridership potential, while not equal in each community, is well distributed and indicates potential value for the entire corridor. Each municipality hosting the new transit connection would share in the benefits associated with its use. Factors affecting ridership at the local level include density of population, employment, and commercial development, existing employment trip flows, and opportunities to capitalize on other existing transit services. Ridership numbers represent projected daily passenger boardings at new stations within each municipality, as such, ridership associated with existing Newark Light Rail stations is not included.

Table 6. Ridership in Regional Context

	No Build	Light Rail A	Light Rail B	Bus Rapid Transit
PROJECT ALTERNATIVES				
Existing Segments	20,340	27,100	23,740	N/A
New Segments	N/A	10,600	8,760	11,460
Total Daily Ridership	**20,340**	**37,700**	**32,500**	**11,460**
OTHER TRANSIT SERVICES				
Hudson Bergen Light Rail	61,140	60,860	61,000	61,100
Main/Bergen/Port Jervis Lines	54,480	52,000	52,640	53,940
NJ Ferries to Manhattan	30,460	30,400	30,440	30,440
Pascack Valley Line	11,980	11,980	11,980	11,980

Table 7. 2040 Daily Ridership by Municipality – New Segments (Average Daily Boardings)

	2040 - No Build	2040 - Light Rail A	2040 - Light Rail B	2040 - Bus Rapid Transit
Paterson	N/A	1,770	2,110	1,910
Clifton	N/A	2,900	2,170	1,190
Nutley	N/A	**2,740**	**2,040**	**2,220**
Belleville	N/A	1,780	1,440	1,240
Newark	N/A	1,410	1,000	4,900*
Total	N/A	**10,600**	**8,760**	**11,460**

* Bus Rapid Transit shares the Newark Light Rail alignment and stations from Newark Penn Station to Broad Street Station. Only new BRT-specific ridership is shown here.

Mode Shift

An important consideration of each alternative is its impact on existing transit services as well as its potential to divert a significant number of automobile trips to transit, in this case between 3,800 and 5,700 daily car trips. Benefits associated with trip diversions to high quality transit service include:

- Reduced traffic congestion
- Reduced highway repair costs
- Efficient allocation of transit resources
- Funding opportunities related to air quality

Transit diversions are indicative of travel behavior changes associated with new options offering access to new destinations, improved travel times or frequency or other factors. Transit fares coded in the model are consistent with existing light rail fares. Parking is assumed to be free to the user. Transit diversions are quantified by service type (e.g., bus, rail, other) and represent diversions from across the network.

Most diversions from existing transit to the new alternatives correspond to shifts from NJ TRANSIT's bus services and the Main Line commuter rail between Hawthorne and Kingsland stations, which most closely parallel the proposed corridor. It is important to note that overall growth in existing ridership relative to the No Build alternative demonstrates the added value of the proposed new services this corridor and factors in only existing land use, not potential new infill and TOD. Transit trip diversions do not indicate negative network impacts; rather, they demonstrate the value of improved transit service and offer opportunities to reallocate resources and update service design, particularly for local bus.

Light rail and BRT alternatives impact the corridor and network differently. Future analysis may refine the modeling and further consider additional induced demand from planned land use development.

Table 8. Daily Trip Diversions

	2040 - Light Rail A	2040 - Light Rail B	2040 - Bus Rapid Transit
Automobile	5,700	3,960	3,830
Bus	**8,340**	**5,560**	**5,780**
NJ TRANSIT Rail	1,950	1,910	720
Other (PATH, Ferry, Light Rail)	1,370	730	1,130
Total Trip Diversions*	**17,360**	**12,160**	**11,460**

* Matches total new trips relative to No Build

Access to Stations

Station locations differ in terms of parking and the potential to offer transfer opportunities with the existing transit network. Many stations identified in the model inputs are envisioned as primarily walk-up stations, with limited or no new parking created and in support of broader goals to reduce auto traffic congestion in the region. At the same time, select stations with the potential to serve as regional intercept park & rides performed well with driver access from beyond the study area.

While access modes vary across the alternatives, the BRT option clearly reveals a higher walk access and lower transfer rate. The combination of walk and transfer access for all alternatives reinforces the overall goal of minimizing auto trips associated with (or potentially in competition with) the transit concepts.

Table 9. Changes from No Build

	No Build	Light Rail A	Light Rail B	Bus Rapid Transit
Transfer	51%	41%	43%	27%
Walk	44%	46%	50%	63%
Drive	5%	13%	7%	10%

* Bus Rapid Transit shares the Newark Light Rail alignment and stations from Newark Penn Station to Broad Street Station. Only new BRT-specific ridership is shown here.

Reference document for additional detail: Demand Forecast Results and Recommendations Technical Memorandum

Cost Estimation

High-level cost estimates for the three modeled alternatives follow guidance contained in the FTA Standard Cost Categories for Capital Projects. Unit costs are based on the NJDOT Cost estimating Guide as well as recent experience and review of prior studies which included the design and cost estimating of capital cost elements on other similar projects. Costs were escalated to 2020 dollars. Right-of-way acquisition costs were not included in the cost estimation and would be included in subsequent analyses.

These cost estimates are intended to provide informative, order-of-magnitude reference to potential project funding requirements. Cost estimation will be refined significantly in future studies such as alternatives analysis and preliminary design efforts.

Operating plans were developed only to provide service span and frequency inputs to the demand forecast model and not to inform cost estimation. Operating costs would be developed at an appropriate level in a subsequent alternatives analysis, including assumptions of associated ridership and farebox return. As a general rule, light rail operating costs (on an hourly, unit cost basis) are higher than BRT, although as BRT service quality approaches that of rail (including dedicated rights-of-way, station elements, etc.), the gap between these hourly costs narrows.

Table 10. Estimated Capital Costs in Millions (2020 Dollars)

Cost Item	Light Rail A	Light Rail B	Bus Rapid Transit
Guideway and track	$400	$270	$100
Stations, stops, terminals, intermodal centers	$150	$140	$30
Yards, shop administration buildings	$50	$50	*
Site work and special conditions	$80	$80	$20
Systems	$150	$150	$20
Vehicles	$180	$180	$10
Professional services	$160	$160	$30
Subtotal	**$1,170**	**$1,030**	**$210**
Contingency	$150	$150	$40
Finance charges	TBD	TBD	TBD
Total Project Cost	**$1,320**	**$1,180**	**$250**

* Assumes completion of planned NJ TRANSIT Northern Bus Garage in advance of project implementation

Economic Development Opportunity

Implementation of light rail and bus rapid transit systems have documented positive impacts on real estate and economic development nationally and particularly in New Jersey. The impacts are numerous, including increased property values (assessed and sale values), increased local property tax revenues, residential property creation (including single-family, rental and affordable housing), commercial development, brownfield reclamation, and current or proposed real estate and redevelopment projects.

The Hudson-Bergen Light Rail (HBLR) is a prime example of the impact that high-quality transit investment can have in a region. Over several decades, significant population and employment growth has occurred within the immediate catchment area of HBLR stations. Over two-thirds of the riders indicate that the system was a key driver in their residential location choice, and over 80 percent of trips are for work purposes[7]. A secondary measure of the system's impact is that riders frequent area businesses within ½ mile of the stations, which has been estimated to generate over $40 million in economic activity (e.g., purchases, services) annually.

The River LINE light rail system provides additional perspectives on the impact of the transportation investment. The River LINE has had positive impacts in some of the small cities and towns it serves, exemplified by Florence and Cinnaminson. Developers from New York and northern New Jersey became interested in towns along the riverfront and a significant number of housing units have also attracted big box stores and supporting retail businesses. Zoning policies supporting development along the River LINE attracted some developers to turn abandoned warehouses and factories into new, high-density residential projects.

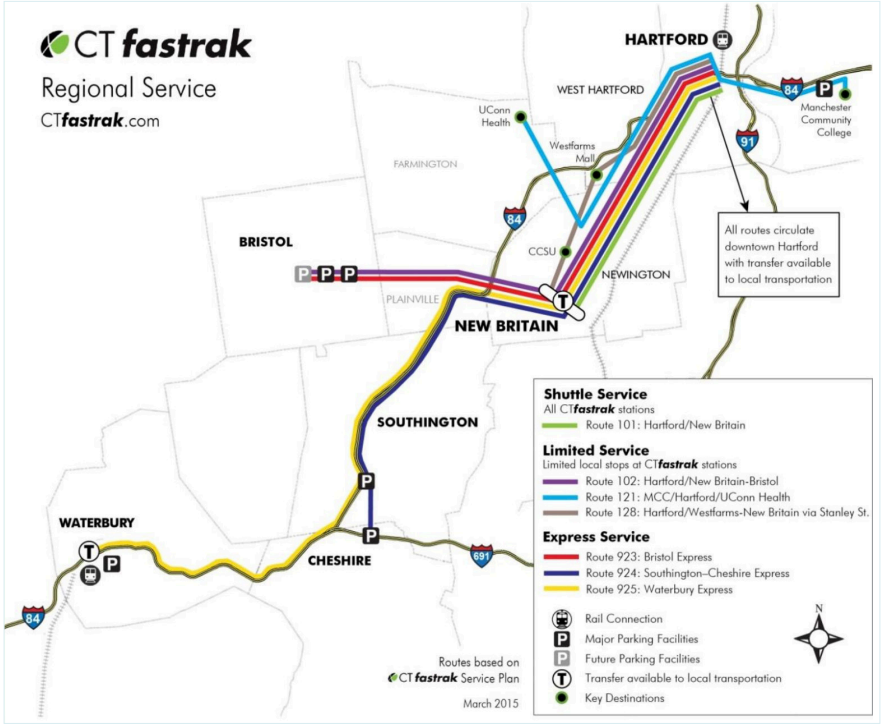
7 Defining the Hudson Bergen Light Rail Catchment Area, January 2019, New Jersey Department of Transportation Bureau of Research

Regional Success Story: CTfastrak

CTfastrak, which opened in 2015, is Connecticut's first Bus Rapid Transit (BRT) system. CTfastrak stations are located along a dedicated 9.5 mile guideway that spans New Britain, Newington, West Hartford, and Hartford, but the system extends through a much larger region, offering connections to local transit routes and rail service in Hartford and Waterbury, 22 miles away. CTfastrak serves the state's capital and provides links between major anchor institutions, such as Aetna, The Hartford, Central Connecticut University, Westfarms Mall, UConn Health Center, and Manchester Community College.

This transit investment has spurred significant economic growth due to extensive transit-oriented, mixed-use development and redevelopment in an old industrial brownfield corridor. Currently, it is estimated that CTfastrak has generated approximately $225 million in economic development. Approximately 650 residential units have been constructed or planned, and approximately 110,000 sf of commercial/office space has been constructed or planned, including:

Hartford	1429 Park St	reSET, Hog River Brewing Company
	1477 Park St	Parkville Sounds
	1400 Park St	Parkville Food Hall
West Hartford	616 New Park Ave	54 residential units
	485 New Park Ave	New Park Brewing
	637 New Park Ave	GastroPark
New Britain	125 Columbus Blvd	160 residential units
	1 Herald Sq	Multi-tenant medical building
	57 Court St	24 residential units



System Map: CTfastrak.com

Funding and Value Capture

Numerous strategies can be used to support the implementation of a rapid transit system, shaped to the size and scale of the investment. The light rail options in this study have estimated costs ranging between $1.1 and $1.3 billion. The bus rapid transit option is estimated at $250 million.

Rapid transit systems can be funded in a variety of ways and typically employ a combination of state and federal resources. The most common federal source is the FTA's Capital Investment Grants (CIG) program, a discretionary grant program that funds transit capital investments including heavy rail, commuter rail, light rail, streetcars, and BRT. The program includes New Starts funding for projects over $300 million or Small Starts funding for projects less than $300 million. Projects are rated by FTA at various points in the process according to criteria evaluating project justification and local financial commitment. This funding program does require local match and projects with strong local support are rated favorably.

Federal formula funding allocated to the state can be used as part of a funding program. Federal Highway Administration (FHWA) funds have flexible funding provisions that enable transfers for transit projects. In addition, projects that are part of a bus rapid transit system, like signal automation and pre-emption can be funded with Congestion Mitigation and Air Quality (CMAQ) funds. Other CMAQ opportunities include complementary active transportation or greenway opportunities, marketing, and start-up costs. Various special discretionary grant programs at state and federal levels may be available for capital costs such as electric bus purchases. . Benefits used to justify transit funding include changes in travel costs, changes in mode choice, environmental remediation, changes in emissions, changes in noise, and positive impacts on health and safety.

Finally, USDOT has a Center for Innovative Finance Support, with programs designed to enhance the effective grant management techniques and bridge investment gaps between available resources and infrastructure needs. The programs include federal fund management tools, federal aid matching strategies, federal debt financing tools, and federal credit assistance tools.

Value capture typically occurs through Tax Increment Financing (TIF), enabled through local authorization. Another strategy is to invite developers to submit proposals for developing state and/or locally owned properties at transit stations. NJ TRANSIT released such a solicitation for development proposals on the River LINE in October 2019. This type of TOD can result in negotiated financial contributions or payments over time.

Planning and Design

Looking to the near-term actions to advance the alternatives in this study, the CIG program requires either Project Development and Engineering (New Starts) or Project Development (Small Starts) phases of work. These feature a complete environmental review process including developing and evaluating alternatives, providing detailed ridership forecasts, completing preliminary engineering (typically), selecting a locally preferred alternative (LPA), and adopting the project in a long-range transportation plan. An Environmental Impact Statement (EIS) can typically take 1-2 years and costs in the range of $3-5 million, depending on the project. Design and engineering costs sufficient to support a CIG program review are typically about 10 percent of estimated construction costs.

Recommendations

1 Preserve Rights-of-Way

A critical element to developing enhanced transit options in the corridor is the preservation of key right-of-way components, including the NIT, NJ Route 19, and local streets in Paterson and Newark in particular. Each of these rights-of-way offers the potential to prioritize transit, separate transit from general roadway congestion, and improve travel times for more cost-effective and customer-friendly service.

Action should be taken now to ensure their potential use, through concerted local government and agency partnerships to plan for the next generation of transit systems. Other local right-of-way enhancements, such as bus priority treatments in major transit corridors, should be pursued as complementary and near-term actions.

2 Advance to Further Study

This market study confirms the viability and market potential of a high-quality transit connection between Paterson and Newark. It does not provide detailed technical study of the many components of such a project. Therefore, establishing champions and a project lead to advance to more detailed technical assessments and concept development are the next steps towards advancing the concepts initially explored in this study. Detailed technical study would include:

- Alignments
- Mode choice and specification
- Station location and design
- Bicycle/pedestrian trails and greenway compatibility
- Service plan
- Maintenance and operation
- Capital and operating cost estimates
- Environmental review
- Funding and financing

3 Refine Demand Forecasts

As demand estimates are critical to demonstrating project potential, considerations for further enhancing ridership forecasts in future study phases include:

- More specific station locations
- Detailed parking locations
- Considerations of fare and/or parking pricing options
- Existing bus network system changes to feed the BRT and/or utilize the dedicated right-of-way
- Updated development plans and local zoning changes
- Induced demand based on potential transit investments

4 Phase Implementation

While full build of any new transit system will require significant planning, funding, and time, initiative can be taken in the interim to expand transit connectivity and improve the performance of the existing network.

Transit signal priority: significant bus service levels and ridership, particularly in Paterson and Newark, warrant continued pursuit of transit priority measures on local streets to increase bus speeds, make better use of transit resources, and improve the customer experience. Priority treatments would afford benefits to ridership in this and other major corridors.

Enhanced bus service: initiatives such as NJ TRANSIT's Go Bus program offer opportunities to create limited stop, high-frequency bus connections between Paterson and Newark without significant capital expenditures. Such improvements may be pursued as an interim measure and serve as a stepping-stone to build the corridor market in advance of light rail or significant bus rapid transit investments.

Other ongoing improvement opportunities include upgrades to bus stops/shelters, real-time bus arrival information at major bus stops, investment in electric vehicles, and targeted marketing in the Paterson-Newark corridor.

5 Leverage Regional & Local Initiatives

The value of each individual transportation project is increased when demonstrably linked to other efforts, underway or planned. Parallel regional efforts such as the Passaic Bergen Hudson Transit Project, conducted by NJ TRANSIT, offer potential tie-ins to this study corridor and together would even further enhance regional mobility. Transit-supportive zoning and land use at the local level sets the stage for sustainable transportation options, while local enhancements such as sidewalk network improvements provide complementary benefits including walk access to transit and increased safety and connectivity within communities.

6 Engage and Listen

Throughout the future planning and design process (e.g., alternatives analysis, preliminary design studies, and environmental review), project partners will continue to engage the public, stakeholders, and elected officials to foster an inclusive, equitable, and beneficial investment program for local communities and the region.

Reference document for additional detail: Recommendations Matrix (Timeframes, Responsible Parties)

Photo: Fitzgerald & Halliday, Inc. (FHI)

Key Findings

The study originally envisioned a selection of two alternatives based on demand forecast model results. However, all three alternatives modeled perform favorably, have unique attributes, and remain worthy of further consideration. Technical study conducted throughout the effort and ongoing conversations with partner agencies, municipalities, stakeholders, and the public revealed the following takeaways:

- NJ TRANSIT's Demand Forecast Model reveals strong performance for each alternative
- Light rail and bus alternatives show ridership potential exceeding some regional rail lines
- Faster, more reliable transit between Paterson and Newark could improve travel times, job access, and regional connectivity
- The three modeled alternatives show potential to divert more than 3,000 daily automobile trips to transit by creating attractive, competitive service options in a congested north-south corridor
- The alternatives herein stand to benefit environmental justice populations in the corridor almost uniformly; no one alternative risks significantly higher impacts, nor do any alternatives fail to provide comparable opportunities for enhanced mobility
- Regional models such as Hudson-Bergen Light Rail, River LINE, and CTfastrak demonstrate potential for economic development and value capture surrounding transit stations

Public and Stakeholder Comments

Members of the public and key stakeholders, including NJ TRANSIT and the Tri-State Transportation Campaign, submitted comments in response to the virtual presentation. Comments generally showed enthusiastic support for advancing one or more of the options and were consistent with project planning principles, if not necessarily the purview of this market study.

NJ TRANSIT indicated a preference for the Hybrid BRT Option, followed by Light Rail Option B, and suggested that commuter rail be eliminated from consideration. Staff also thought that extending the Newark Light Rail at Broad Street may have some major cost and environmental justice challenges. Additionally, station platforms would need to be long enough to support multiple unit transit vehicles where possible.

Members of the public, however, preferred light rail options (especially Light Rail Option B) over bus options. Development potential near light rail stations was frequently mentioned by the public and stakeholders, and commenters suggested new development could help pay for and support new transit service. A member of the Belleville Planning Board suggested that the extension of light rail beyond the current alignment would coordinate with Belleville's current zoning that allows for mixed-use, transit-supportive land uses.

As for concerns, stakeholders and the public hoped to see additional outreach, particularly in Nutley and in environmental justice communities that may not have access to information online. They said engagement should continue through the course of additional studies. Concerns were also raised about increased vehicular traffic around park and rides. The Tri-State Transportation Campaign requested that the project support the electrification of the bus fleet. One member of the public suggested considering bicycle and pedestrian paths alongside the transit alignment.

Conclusion

The Paterson-Newark Transit Market Study demonstrates the potential benefits of a range of concepts for new, high-quality transit systems linking Paterson and Clifton in Passaic County to Nutley, Belleville, and Newark in Essex County. Transit systems such as bus rapid transit and light rail have the potential to affect mode shift from auto trips to transit and compare well with regional bus routes and commuter rail lines regarding ridership. Intersections with a wide array of multimodal travel options throughout the corridor underscore the importance of this north-south corridor and the opportunity to open more regional travel options to a substantial ridership market.

The study's intent was not to identify a specific, locally preferred alternative, instead developing strong conceptual alternatives as a starting point for more detailed analysis and design. Passaic and Essex Counties, along with state, regional and local partners, are encouraged to pursue an alternatives analysis to further explore design and operational considerations, impacts, and benefits of a new high-capacity transit service connecting study area municipalities. Open, ongoing engagement with the public and stakeholders is paramount.

The study team thanks all who participated and offered insights throughout this effort.